INSTRUCTION MANUAL

700203D

EN1701 SERIES CONTROLS

MICROPROCESSOR BASED
Weld Sequence Controls

Wiring Diagram 421484 “T” Cabinet

Intended for use with firmware version 1.09

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ENTRON Controls, LLC.

MICROPROCESSOR BASED WELDING CONTROLS

INSTALLATION AND OPERATION MANUAL FOR:
Model Series EN1701

! CAUTION !
READ THIS MANUAL COMPLETELY BEFORE ATTEMPTING TO INSTALL OR OPERATE THIS CONTROL

ENTRON Controls, LLC., reserves the right to alter the contents of this manual without previous notice.

ENTRON Controls, LLC.
Greer, South Carolina 29650

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1.0 INTRODUCTION AND OVERVIEW

This manual details the features of the EN1701 Control and shows how to program the system using the RPP1 programmer.

The EN1701 Control is an integrated timer/controller/inverter system for MF resistance welding. The control section is housed in a bookcase type casing, which simply mounts onto the power pack for ease of maintenance.

A programming pendant (type RPP1) is available and provides a large multi-line display, making programming easy.

A powerful built-in logic sequencer program provides the EN1701 with a flexible means of fully controlling small machines or tooling arrangements, without the need for additional hardware.

A RS232 Connector provides a connection from a PC running ENLINK 1701 software to one EN1701 control for programming and monitoring purposes.

An optional 10/100BASE-T Ethernet card is available for networking multiple EN1701 controls with ENLINK 1701.

Figure 1-1. *Programming pendant (RPP1)*

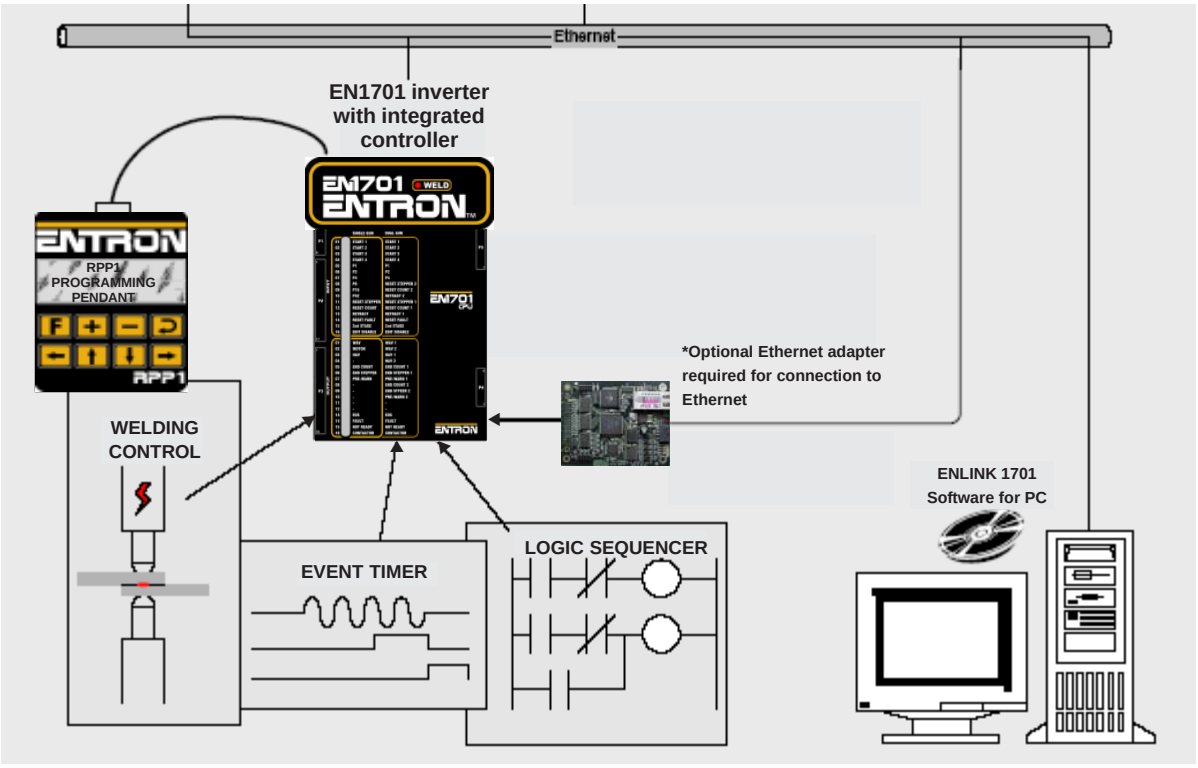


Figure 1-2. *EN1701 System*

1.1 FUNCTIONS

- Spot / Repeat / Roll-spot / Seam (dual heat) / Seam (pre-heat) welding
- Single or dual gun operation
- Dual weld intervals plus pulsation, upslope and downslope
- Constant current regulation
- Up to 64 programs (internal or external selection)
- Current (high/low/pre limits), programmable blocking
- Measurements log keeps history of recent welds
- Proportional valve controller (0 to 10V or 4 to 20 mA)
- Up to 3 analog inputs (2 x 0 to 10V plus 1 x 0 to 10V / 4 to 20 mA)
- Pressure monitoring (high/low limits)
- Programmable outputs (events)
- Machine sequencer logic
- Welding programs may be linked together for multiple spot sequences
- Retract/high-lift control
- Contactor timer
- Head-lock function
- Electrode management functions, including stepping, counting, tip-dressing and preset curves
- All inputs and outputs 24 VDC
- Coil/Toroid and PV calibration functions
- Coil/Toroid test function
- Program lockout (keyswitch) function
- External plug-in programming pendant with large backlit 4x20 LCD display and data backup facility (RPP1)
- RS232 port for PC communications
- Expandable via optional plug-in Ethernet card
- Operation Mode (Program Lockout and Weld/No Weld)

1.2 GLOBAL PARAMETERS

Configuration

- Sequence: Spot / Roll-spot / Seam (dual heat) / Seam (pre-heat)
- Regulation: Primary / Secondary
- Single gun / Dual gun
- Retract (x2): Simple / Hi-lift+ / Hi-lift-
- Program select: Binary / 1-of-4
- Contactor time: 0 to 200 s
- Blanking: On / Off
- Coil/Toroid test: On / Off
- On Fault: Continue / Stop / Head-lock / EOS / No EOS
- Sequencer: On / Off
- Coil/Toroid attenuation factor: 1 to 4
- Sync counter with log: On / Off
- Pressure units (kN/lbf)

Calibration (x2)

- Coil/Toroid sensitivity (100 to 2000 mV/kA)
- Maximum primary current (0 to 600A)
- S/P ratio (1:1 to 199:1)
- Inverter (2 points, kA / %heat)
- Pressure (2 points, kN/lbf)

Counter (x2)

- Actual count (0 to 9999)
- Terminal count (0 to 9999)
- Stop/continue at end
- Tip-dressing (On/Off)
- Maximum dressings (0 to 9999)
- Dressings done (0 to 9999)
- Reset stepper to (0 to 99999)

Stepper (x2)

- Stepper on/off
- Stop/continue at end
- Curve (10 point, interpolated)

Output Map

- Normal/Event/Sequencer

Input Map

- Normal/Sequencer (x16)

Sequencer

- Up to 250 statements

1.3 PROGRAM PARAMETERS (x64)

Weld program

- Pre-squeeze (0 to 999 ms)
- Squeeze (0 to 999 ms)
- Weld1 (0 to 999 ms)
- Cool1 (0 to 999 ms)
- Weld2 (0 to 999 ms)
- Cool2 (0 to 999 ms)
- Pulses (0 to 9)
- Hold (0 to 999 ms)
- Off (0 to 999 ms)
- Upslope (0 to 999 ms)
- Downslope (0 to 999 ms)
- Pressure (0 to 100%)
- Heat 1 (0 to 99.9%)
- Heat 2 (0 to 99.9%)
- Current 1 (0 to 60kA)
- Current 2 (0 to 60kA)
- Balance (seam only)
- Normal/Link program
- Mode 1 (P/W, CCu, CCC)
- Mode 2 (P/W, CCu, CCC)

Monitor limits

- Current monitor On/Off
- Low limit, weld1 (0 to 99%)
- High limit, weld1 (0 to 99%)
- Pre-limit, weld1 (0 to 99%)
- Low limit, weld2 (0 to 99%)
- High limit, weld2 (0 to 99%)
- Pre-limit, weld2 (0 to 99%)
- Pre-limit count (0 to 99)
- Pressure monitor On/Off
- Wait for pressure On/Off
- Pressure low limit (0 to 99%)
- Pressure high limit (0 to 99%)

Events

- 4 x 4 trigger points

2.0 MOUNTING DIAGRAMS

2.1 BRACKET MOUNTING POSITION OPTION 1

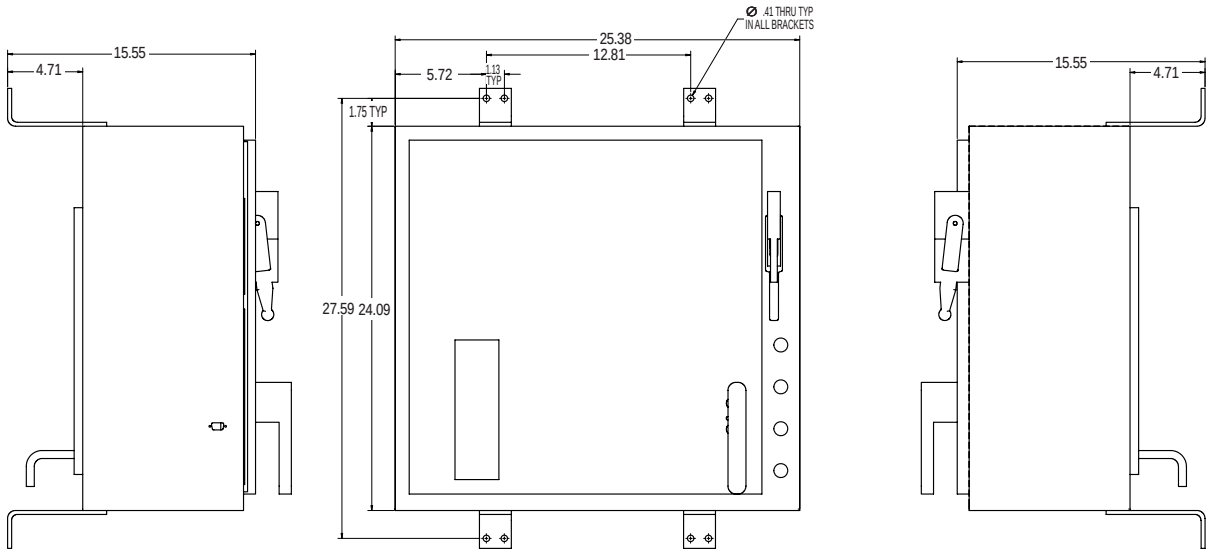


Figure 2-1. *Bracket mounting position option 1*

2.2 BRACKET MOUNTING POSITION OPTION 2

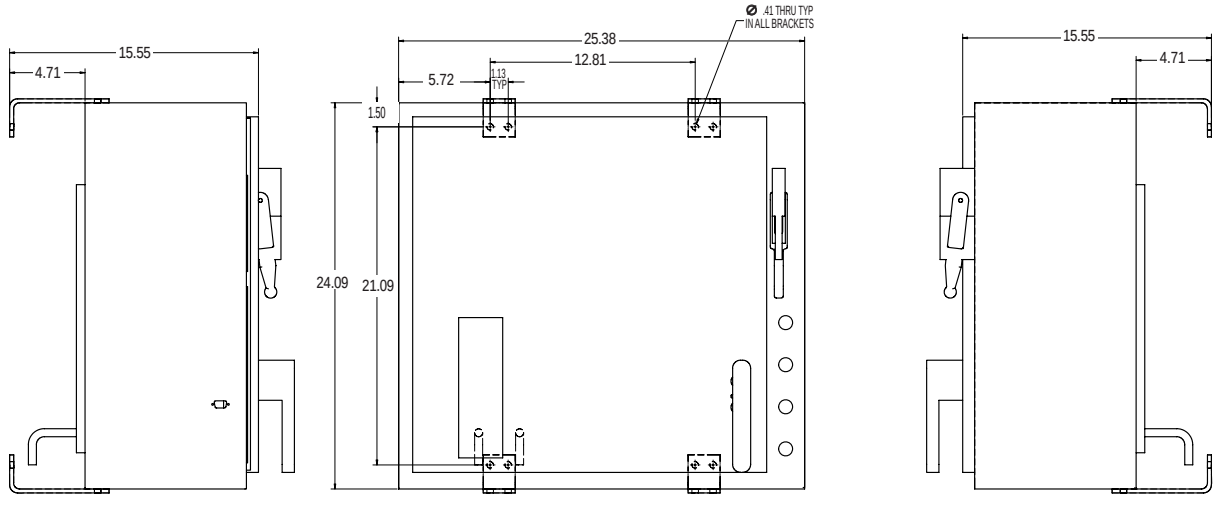


Figure 2-2. *Bracket mounting position option 2*

2.3 BRACKET MOUNTING POSITION OPTION 3

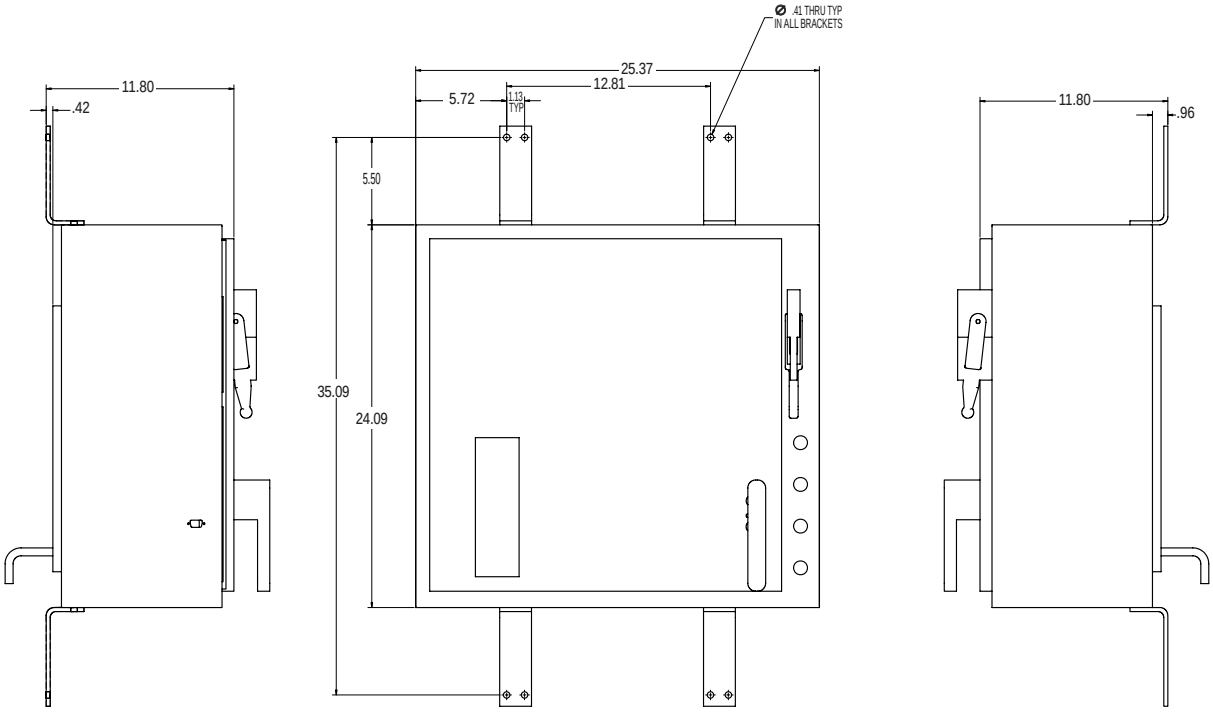


Figure 2-3. *Bracket mounting position option 3*

2.4 BRACKET MOUNTING POSITION OPTION 4

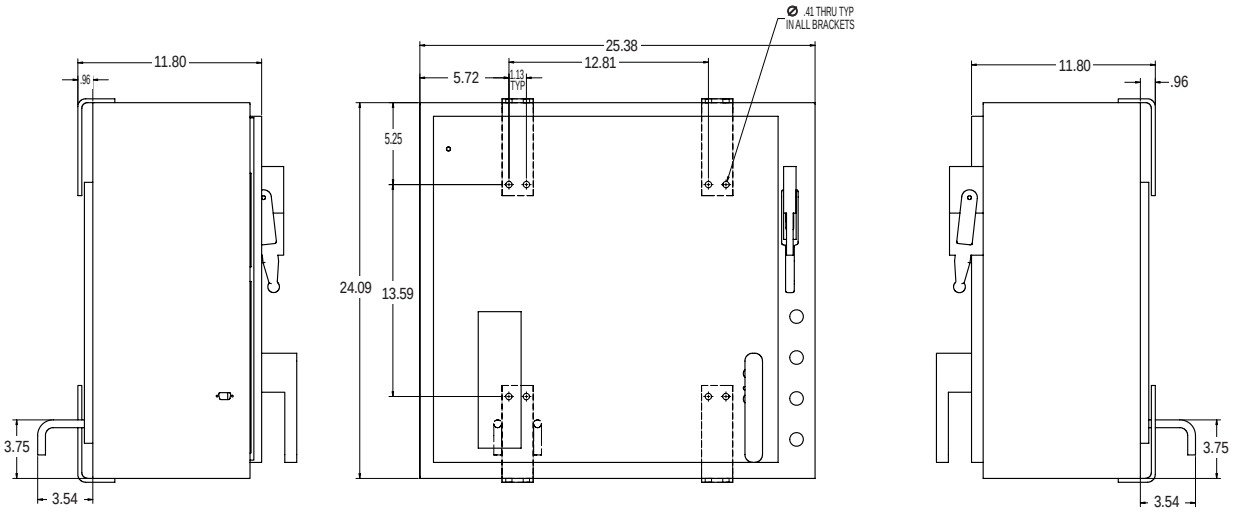


Figure 2-4. *Bracket mounting position option 4*

2.5 BRACKET MOUNTING POSITION OPTION 5

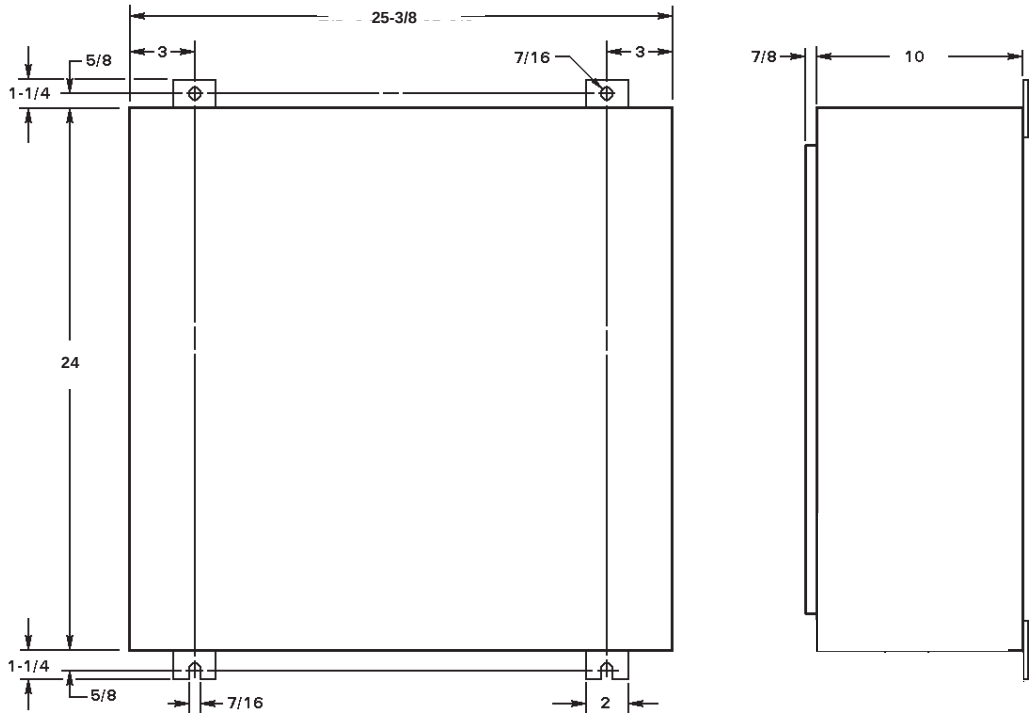


Figure 2-5. *Bracket mounting position option 5*

3.0 GENERAL OPERATING REQUIREMENTS

3.1 OPERATING VOLTAGE

To insure the control will operate properly, it must be properly grounded. Proper grounding is not only a safety precaution, it will lessen the possibility of electrical interference being introduced into the control. Ground the control at the ground lug on the cabinet.

! CAUTION !
THIS WELDING CONTROL OPERATES ON THREE PHASE 380 VAC OR 480 VAC. When the welding control and/or welding machine is shipped, the voltage at which it was set is marked on the tag attached to the control terminal block.

! WARNING !
THIS WELDING CONTROL IS A DUAL-VOLTAGE UNIT. IF THE CONTROL IS USED ON A VOLTAGE OTHER THAN THE ONE FOR WHICH IT IS WIRED, SERIOUS DAMAGE CAN RESULT.

NOTICE
NO CALIBRATION OR CHANGE REQUIRED FOR OPERATION ON EITHER 50 OR 60 Hz.

3.2 ISOLATION CIRCUITRY DESCRIPTION

The EN1701 Series Controls are microprocessor-based resistance welding controls that incorporate circuitry designed to prevent weld valve outputs from the control due to spurious or unexpected or false conditions or failure of circuit components. The intent of this section is to explain how the circuitry accomplishes this isolation.

3.2.1 24 VDC OUTPUTS

The isolation is provided by electro-mechanical control relay contacts that are in series with the solenoid valve voltage supply for Gun 1 and Gun 2 valve outputs (WAV1 and WAV2). In a non-initiated state, the relay contacts are open and no output from these circuits are possible. When the control is initiated by the physical closure of a normally open set of external contacts (commonly a foot switch) across the initiation circuit, the relays are energized and their contacts close and complete the circuits to the solenoid valves. The outputs are not actually energized, however, until the microprocessor reaches the point in the sequence at which the valves are to be activated. Typical output circuitry can be seen in Figure 3-1.

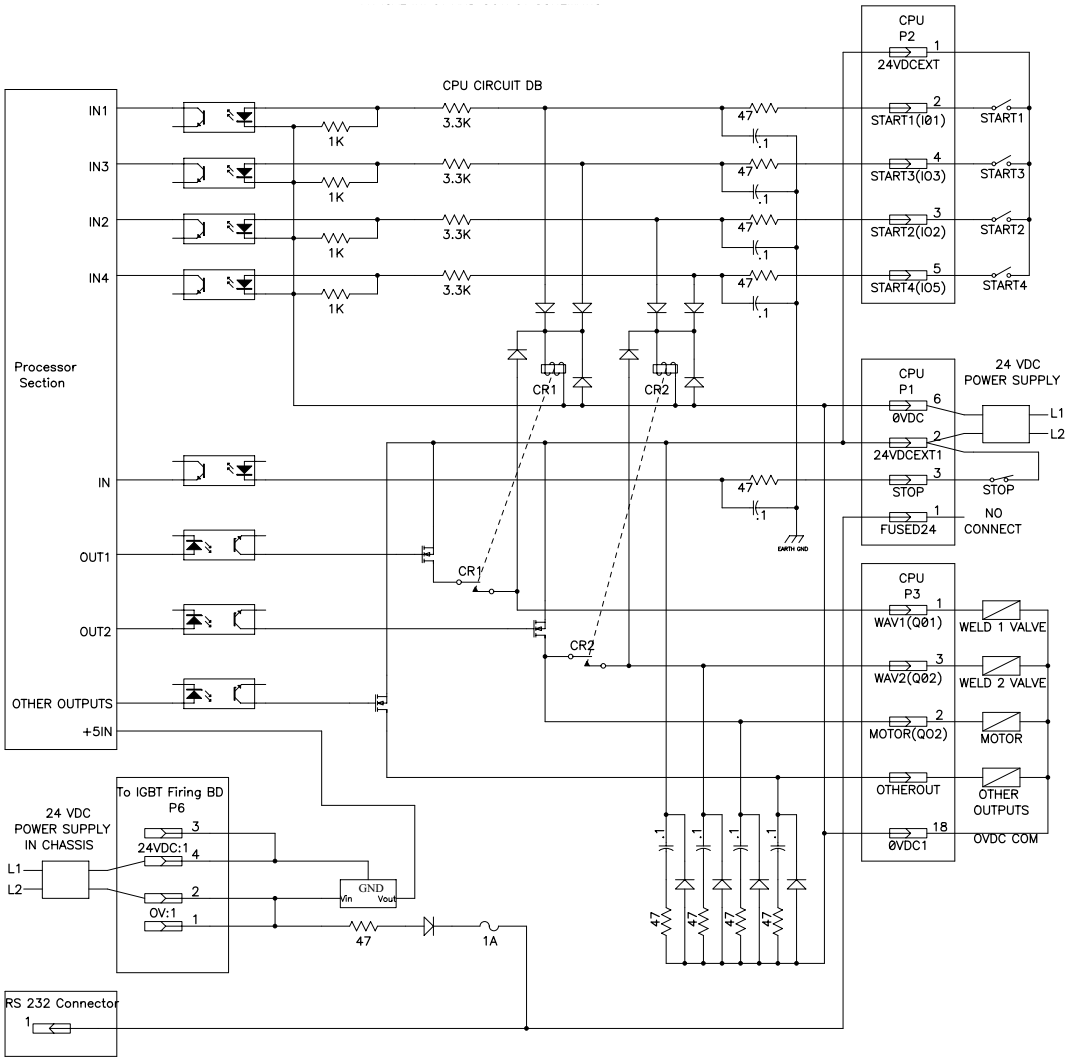


Figure 3-1. *Typical input and output schematic*

3.2.1 24 VDC OUTPUTS (cont.)

There is no way to guarantee that any control circuit will be free of any component failure. It is always necessary to take personal safety precautions when operating any machinery. The system is designed so that it would take two non-associated circuits to fail before an unexpected output could occur.

In addition to the relay contacts mentioned above, there are other levels of isolation. The valve outputs are further isolated by the use of optically isolated transistor (solid state) outputs.

NOTICE

The control is not monitoring the status of the contacts on the control relays CR1 and CR2. Therefore, if these contacts fail closed, relay isolation of Gun 1 and Gun 2 (WAV1 and WAV2) may be comprised.

NOTICE

Note also that all other outputs are not isolated through CR1 or CR2.

3.2.2 24 VDC INPUTS

The initiation signals first pass through a circuit comprised of opto-isolators before being passed to the input circuitry of the microprocessor.

NOTICE

The stop input is only an input to the processor (typical input circuitry can be seen in Figure 3-1). It will not remove output voltages in the case of some control failures.

NOTICE

The stop input is not an Emergency Stop input; therefore, sequences will resume if start inputs are present when the stop is energized.

NOTICE

If start inputs are present at power on, a weld sequence will start.

For added security, the stop input can be wired per Figure 3-2 so that the 24 VDC is switched by the stop switch that then powers the 24 VDC outputs.

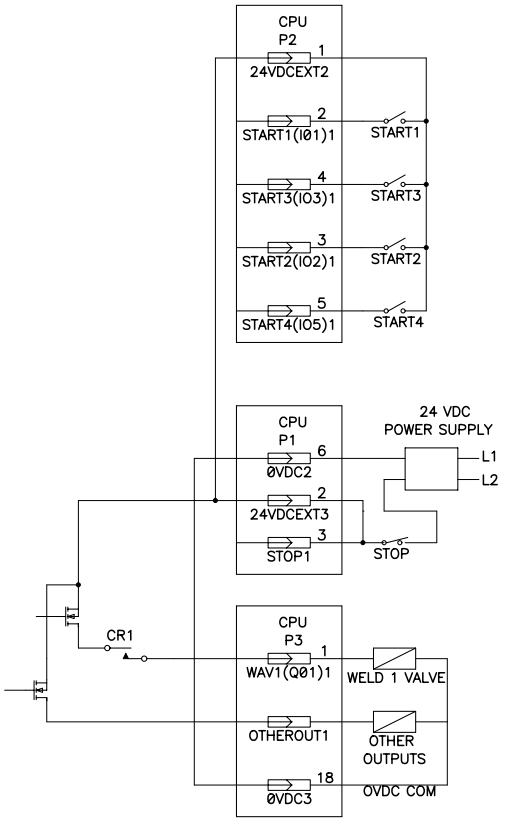


Figure 3-2. *Stop powering input and output*

3.2.3 INVERTER OUTPUT

Inverter output is not isolated through any control relay outputs. Even when FPI4 option is installed, the contactor driver is not protected. If control relay isolation is required, the driver relay can be operated by the protected output Gun 1 valve (WAV1). Note: SQUEEZE time must be long enough so contacts close before weld current passes.

3.2.4 POWER SUPPLIES

An isolated power supply (self-contained in the inverter chassis) supplies power to all functions of the CPU except input and output functions.

Power for input and output functions is supplied by an external 24 VDC 2 A power supply. This is an isolated power supply used only for the I/O functions of the control. Since this power supply is isolated, the 0 VDC terminal may be chassis grounded if required. Also when this control is integrated into larger systems, the 0 VDC terminal may be connected to the 0 VDC bus of the larger system. When needed, this power supply can be removed or disconnected and the power supply from the larger system can be used to power the input and output functions of the control.

NOTICE

Do not use P1-1 to power the I/O functions of the control. This is meant to be an isolated power supply to power the microprocessor logic inside the CPU of the weld control. Also note that this same power supply provides power to the RPP1 through the RS232 Connector Pin 1. Do not use the RPP1 cable (Harness A/N 322548) to connect to your computer.

! CAUTION !

Use of incorrect cables from weld control to computer inputs can allow 24 VDC to be applied incorrectly to connected devices.

3.2.5 LOAD CALCULATIONS

Q01-Q04 (WAV and HAV) outputs are rated to switch 500 mA at 24 VDC. All other outputs are rated to switch 100 mA at 24 VDC.

The standard external power supply for the EN1701 Control will supply 2.0 amps continously.

Be certain the summation of all loads to the power supply will not exceed the alloted 2 A. When calculating this load, note that, since this power supply also supplies input circuits, the input circuits will add a worst-case load of 200 mA when all inputs are turned on. P1 inputs consume 7 mA and P2 inputs consume 11 mA.

3.2.6 INTERNAL CONNECTOR CONNECTIONS

As can be seen from Figure 3-1 and Connection Diagram 5.3.2, please note the following:

P1-2 24 VDC is internally connected to P2-1
P1-6 0 VDC is internally connected to P3-18

3.2.7 P4 ISOLATED POWER SUPPLY

When using P4 for proportional valves and sensors, another/different power supply must be added and connected to P4-1 and 2.

3.2.8 EL – EARTH LEAKAGE

The EN1701 comes with the EL (earth leakage) feature in all controls. It is not an option. The function of this feature is to account for currents in the control and be certain they are flowing from line-to-line and not line-to-ground. The circuitry in its simplest description sums current from the incoming line powering the control and subtracts current used by the control and load (weld transformer). If the result is greater than 100 mA, the circuit breaker is electronically tripped. This feature assists the control over-current protection circuits in cases where the weld transformer primary shorts to ground. It also limits damage to the control in case of SCR, IGBT, or capacitor failure.

! DANGER !

THIS CIRCUITRY ALONE SHOULD NEVER BE USED FOR OPERATOR PROTECTION AS TRIP LEVELS ARE TOO HIGH TO PROTECT PERSONNEL.

To understand the operation of this feature with more detail, please see EN1701 Wiring Diagram 421484. All incoming power to the control is passed by CB1 (circuit breaker 1) through T6 (transformer/coil). T6 provides a voltage when currents through its core do not sum to zero. This voltage is fed to CR4 (Earth Leakage Circuit Board) where this voltage is monitored. When this voltage reaches the trip point (100 mA), the board closes an on-board relay. The normally open contacts of this relay pass 120 VAC, developed from the primary windings of PS1 (power supply 1), to the ST (shunt trip) on CB1, thus disconnecting power to the control at currents over 100 mA. Note that SW1 (push-to-test switch) supplies a test current through T6 large enough to create a fault for test purposes.

3.2.9 GF – GROUND FAULT OPTION (HAND-HELD TRANSGUN)

The design of the optional GF (Ground Fault) circuit is meant to fulfill the recommended requirements of RWMA's Bulletin 5-015.68.04 (Figure 3-3). The recommended standard is typically called out to protect operators in hand-held transgun applications.

To understand the operation in more detail, see Wiring Diagram 421484 and the Weldsafe 5100 manual in Appendix A. Since CR1 (Weldsafe 5100) operation is discussed in Appendix A, its design will not be discussed further. Operation of the GF option is similar to that of the standardly equipped EL. When the GF option is used, it is used in conjunction with the EL circuit. The GF option monitors specifically the transformer load and the ground connection to it.

BULLETIN 5-015
SAFETY STANDARDS FOR CONSTRUCTION AND GUIDE FOR INSTALLATION AND OPERATION

BUL 5-015.68 GROUNDED CIRCUITS AND EQUIPMENT GROUNDING

.04 Special considerations for Portable Transguns

(a) *Portable Transguns* – shall be grounded per *Article 250 of the National Electrical Code* and require the use of (1),(2) and (3) listed below:

NOTE— Conduit or Raceways shall not be used as the grounding conductor.

NOTE— The intention of these requirements is to ensure that the grounding conductor to the transgun is sized correctly to allow sufficient ground fault current to flow for a time long enough to trip an upstream circuit breaker or other protection device. As a general guideline, the resistance of a grounding conductor should be maintained at a value to ensure the continuous and unrestricted flow of available ground fault short circuit current until the circuit protection device removes voltage from the equipment.

(1) *Grounding Integrity* – The welding gun transformer case and secondary shall be grounded and protected by fail safe circuitry designed to immediately disconnect line voltage from the transgun via a circuit breaker with shunt trip or a circuit breaker with undervoltage trip. The combined clearing time shall not exceed 60 mS. A sensed value of grounding conductor resistance in excess of one ohm by the ground integrity monitor would be considered an inadequate ground [referred to in paragraph 5-015.68.04(a)(2)]. A push-to-test circuit providing a 1 ohm resistance between the sense lead and ground will be included to verify the operation of the ground integrity circuit.

NOTE— The ground integrity monitor operation shall not depend on a programmable device.

(2) *Ground Fault Current Relay* – A sensitive, fail safe, ground fault relay with a maximum trip point of 15mA must be used to provide protection against differential ground fault leakage currents. The ground fault relay must immediately disconnect line voltage from the Portable Transgun via a circuit breaker with shunt trip or a circuit breaker with undervoltage trip. The combined clearing time shall not exceed 60 mS.

A push-to-test circuit supplying a test fault current, through the sense coil of 20mA maximum will be included to verify the operation of the ground fault relay.

Only three wires are allowed to pass through the ground fault relay current pickup transformer: two welding transformer primary conductors and the push-to-test circuit.

NOTE— The ground fault current relay operation shall not depend on a programmable device.

NOTE— If an Isolation Contactor is used, ground fault current will only be detected when this Isolation Contactor is closed.

NOTE— In (1) and (2) above, combined clearing time is the reaction time of the ground fault relay plus the clearing time of the shunt trip or undervoltage trip of circuit breaker.

(3) *Ground shielded cable* – The weld transformer primary cable conductors between the weld control and the Portable Transgun must be surrounded by grounded shield. This shield must be tied to an appropriate ground lug at the control. In addition to the two primary conductors, ground conductor and shield, a ground sense wire must be included with the cable.

NOTE— The grounded shield provides a current path should a metallic component cut through the shield to a power conductor within the cable. This current path will then cause the ground fault current relay to trip.

Reproduced from RWMA Bulletin 5 – Resistance Welding Control Standards, October 1995.

Figure 3-3. *RWMA recommended standards for grounded circuits*

3.2.9 GF – GROUND FAULT OPTION (HAND-HELD TRANSGUN) (cont.)

GROUND FAULT DETAILS

Weld transformer primary wires are passed through T5 (transformer/coil). Current will be summed by T5 and the difference sent to CR1. CR1 will monitor this current and will close a contact at the RWMA specification of 15 mA. These contacts pass 120 VAC, developed on the primary of PS1 (power supply 1), to the ST (shunt trip) on CB1 (circuit breaker 1). When the voltage is applied, the contacts of the breaker will open. Timing of this action will be within the RWMA recommendation of 60 ms.

A push-to-test circuit is composed of SW2 (push button switch 2) and R81 (10k resistor). When SW2 is closed, a current is developed from the primary voltage windings (120 VAC) of PS1, through R81 (approximately 20 mA), and is passed through T5.

GROUND DETECTOR

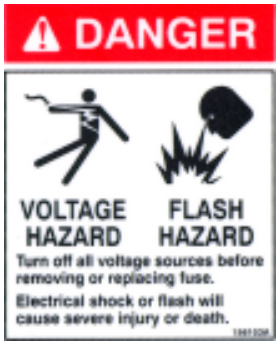
It is important that the control and gun be well grounded in the case of a high current fault to ground. This low impedance will allow properly designed upstream breakers to open before the voltage on the gun gets over 48 VAC. To insure a low resistance connection between the gun and control, CR1 (Weldsafe 5100) monitors the connection between the gun case and control ground via TS1-17. The detect wire is routed from the gun case through the transgun cable to TS17-1. From there, the signal is passed through SW4 and on to CR1. SW 4 is a push-to-test switch for the GND detection circuit. When pressed, R83 (1 ohm resistor) is inserted in series with this detect lead to perform the push-to-test feature.

When the CR1 measures 1 ohm or greater in the ground path, a separate set of contacts in CR1 relay will close. These contacts are in parallel with the EL and GF contacts and will pass 120 VAC from the primary windings of PS1 to the ST of the CB1 and remove voltage to the control within 60 ms.

4.0 PRECAUTIONARY LABELING

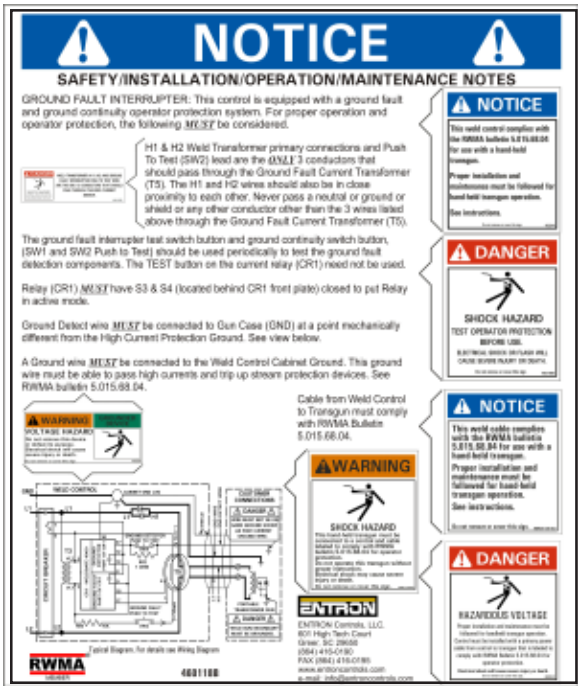
Observe the **WARNING, DANGER** and **CAUTION** labels affixed to the control to maintain safe operation.

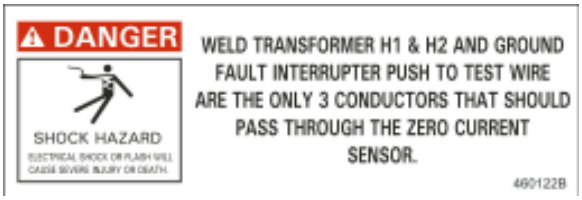
4.1 HAZARDOUS VOLTAGES



4.2 INVERTER SPECIFIC

4.3 TRANSGUN





4.4 PROGRAMMING

5.0 WIRING

5.1 CONNECTORS (CONTROL)

Connectors P1, P2, P3, P4 and P5 are two-part terminals, for use with wires up to 1mm^2.

Connector P6 is used internally to connect to the inverter power pack, and is not used for user connections.

Connector P7 is the RS232 port, for the connection of the RPP1 programming pendant or a PC. A ribbon cable assembly is available for converting to the standard 9-pin D-sub style of connector.

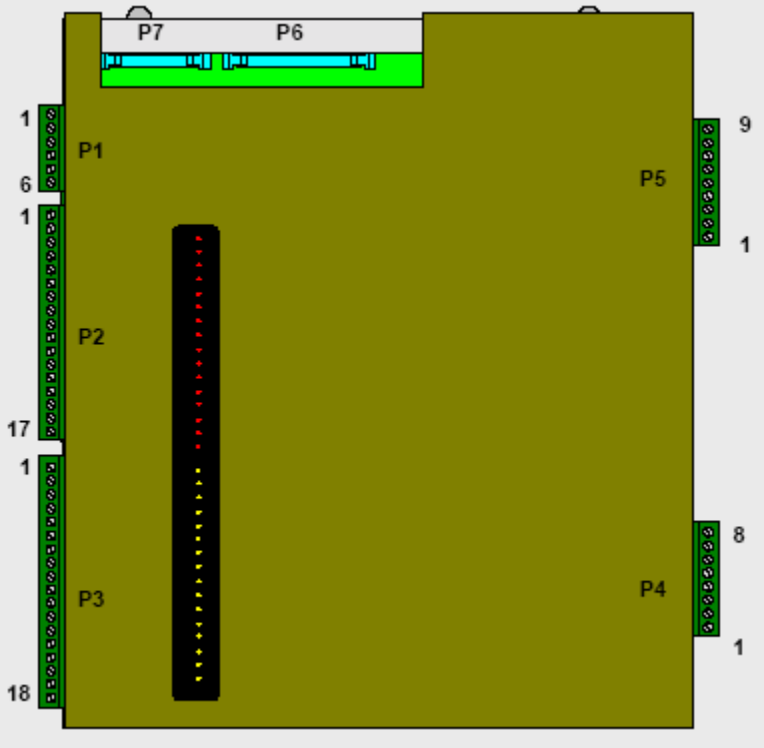


Figure 5-1. *Control connectors*

5.2 CONNECTORS (POWER)

A 3-phase supply, via a suitable protective device (such as a circuit breaker), should be connected to the inverter as shown (Terminals L1, L2, L3, PE).

A suitable MF welding transformer/rectifier should be connected to the inverter at terminals H1 and H2. The transformer MUST also be connected to the protective earth (PE).

Additional earthing and/or a protective device is required for the secondary circuit, depending on the application.

! CAUTION !
THESE TASKS MUST ONLY BE CARRIED OUT BY QUALIFIED PERSONNEL.

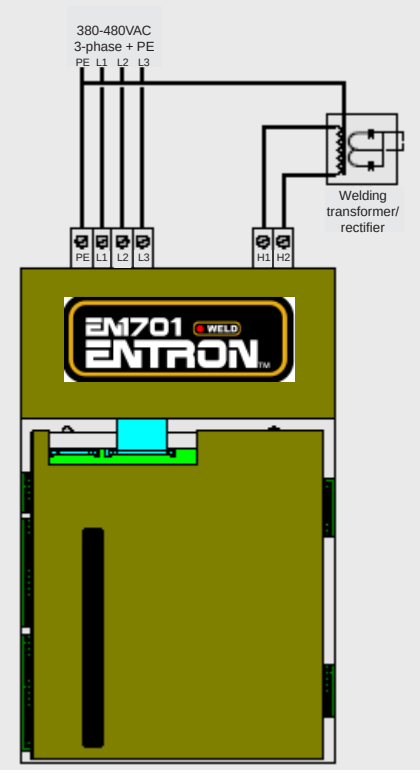
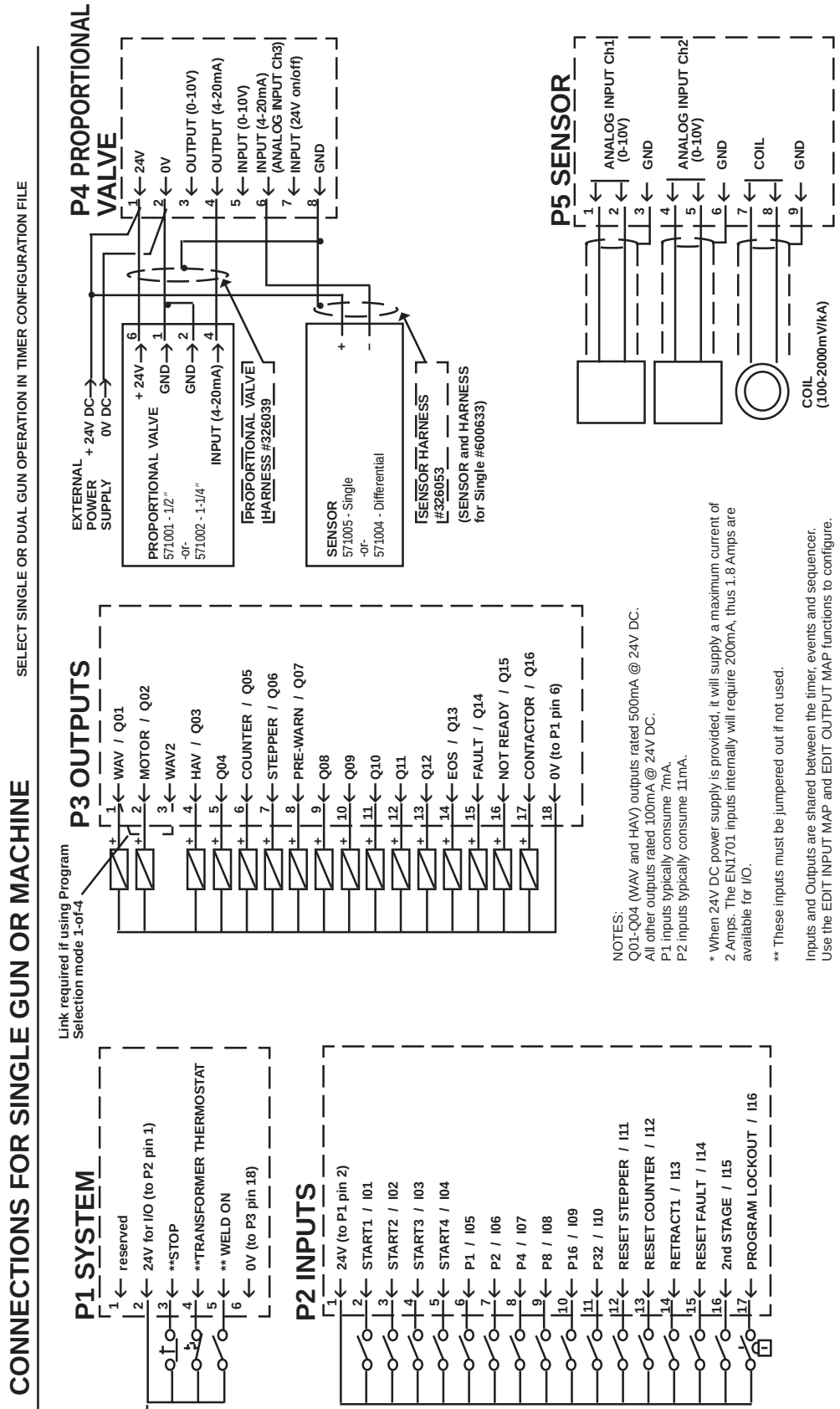


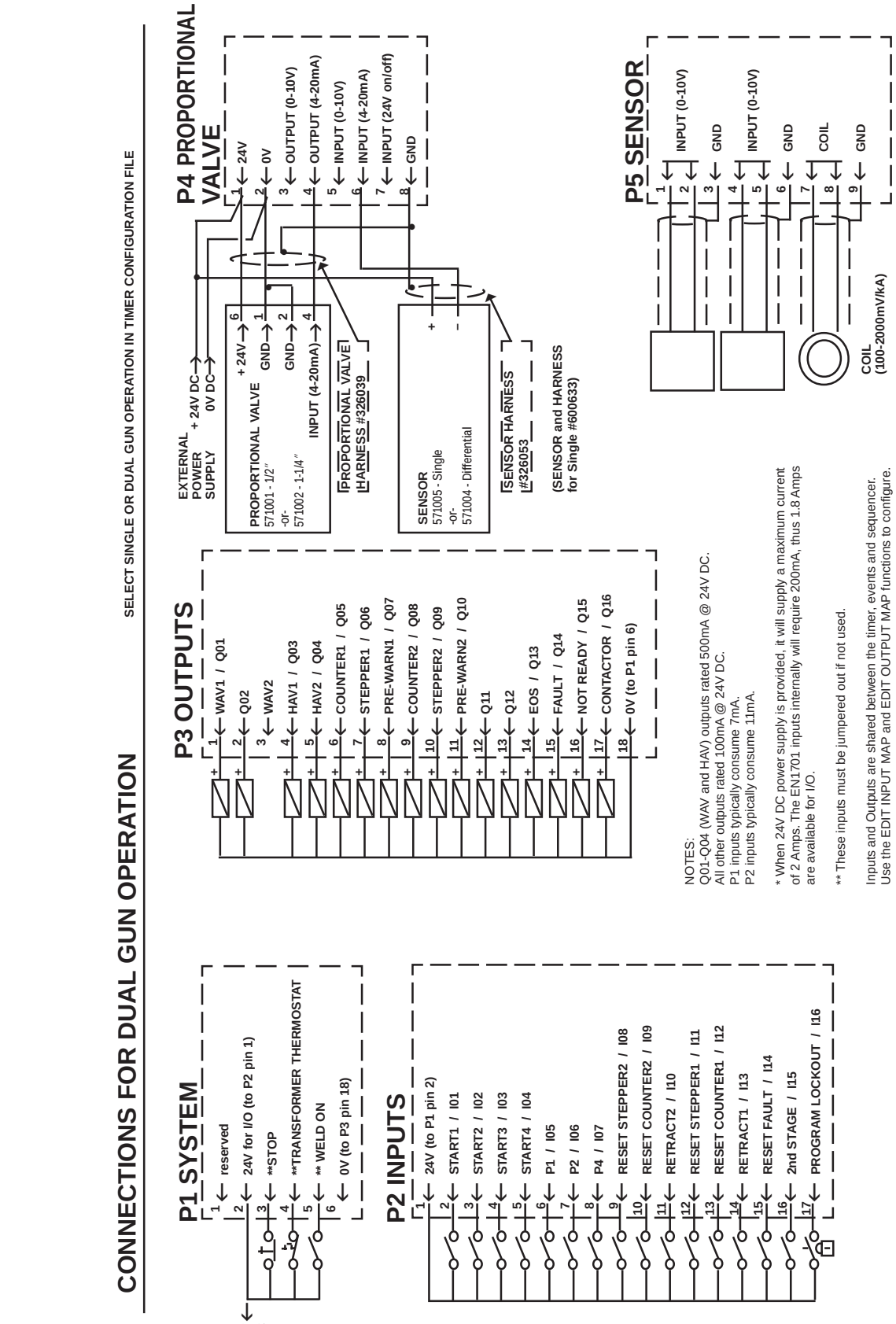
Figure 5-2. *Power connectors*

5.3 USER CONNECTIONS

5.3.1 USER CONNECTIONS FOR SINGLE GUN OR MACHINE



5.3.2 USER CONNECTIONS FOR DUAL GUN OPERATION



5.3.3 GLOBAL INPUTS – NON-PROGRAMMABLE

STOP (P1-3) – input for normally closed stop switch, connected to +24VDC, halts program in its place, however will not open control relays, and as a result will not remove output voltages. When open, it outputs an error on the main screen of the RPP1 and an error message to ENLINK1701 status screen. If STOP is opened while a program is executing, when STOP switch is closed and if START is still closed, the control will not restart or continue the welding sequence until START is opened and closed again.

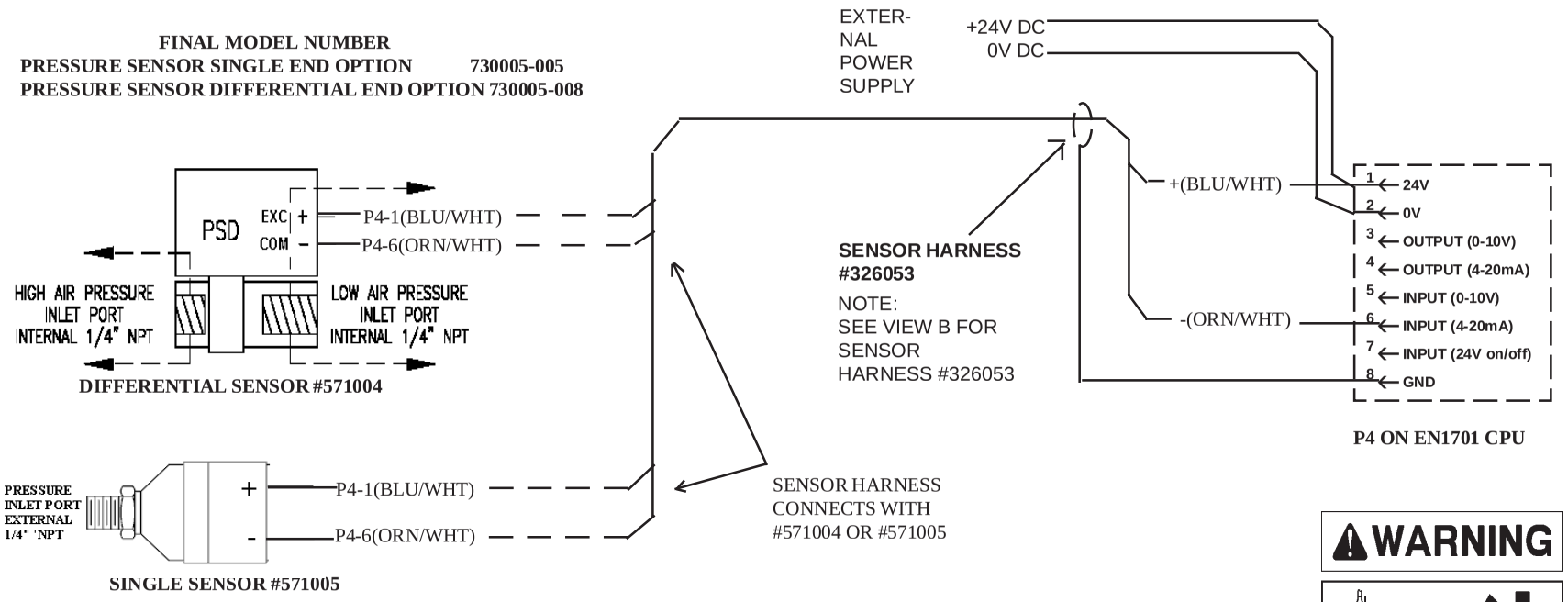
TRANSFORMER THERMOSTAT (P1-4) – input for normally closed Temperature Limit Switch, connection to +24VDC, used to prevent initiation when welding transformer is too hot. When open, it outputs an error on the main screen of the RPP1 and an error message to ENLINK1701 status screen.

WELD ON (P1-5) – input for a toggle switch or normally closed switch to +24VDC. Open to run program without current, close to run program with current. When open, it displays message “WELD OFF” on the main screen of the RPP1 and status screen of ENLINK1701.

5.4 PRESSURE SENSE & PRESSURE CONTROL

5.4.1 DETAILED PRESSURE SENSE DRAWING

FINAL MODEL NUMBER
PRESSURE SENSOR SINGLE END OPTION 730005-005
PRESSURE SENSOR DIFFERENTIAL END OPTION 730005-008

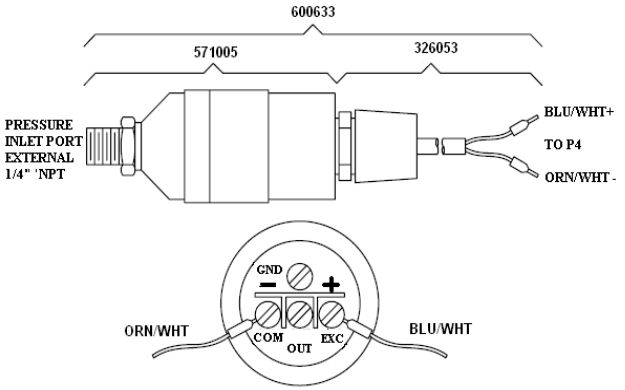


DIFFERENTIAL SENSOR #571004

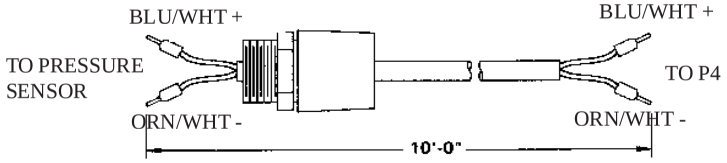
P4 ON EN1701 CPU

SINGLE SENSOR #571005

May be supplied as an one piece assembly with the harness integral to the Sensor Unit or as a separate Sensor/Harnes Unit which must be assembled in the field per the drawing below.



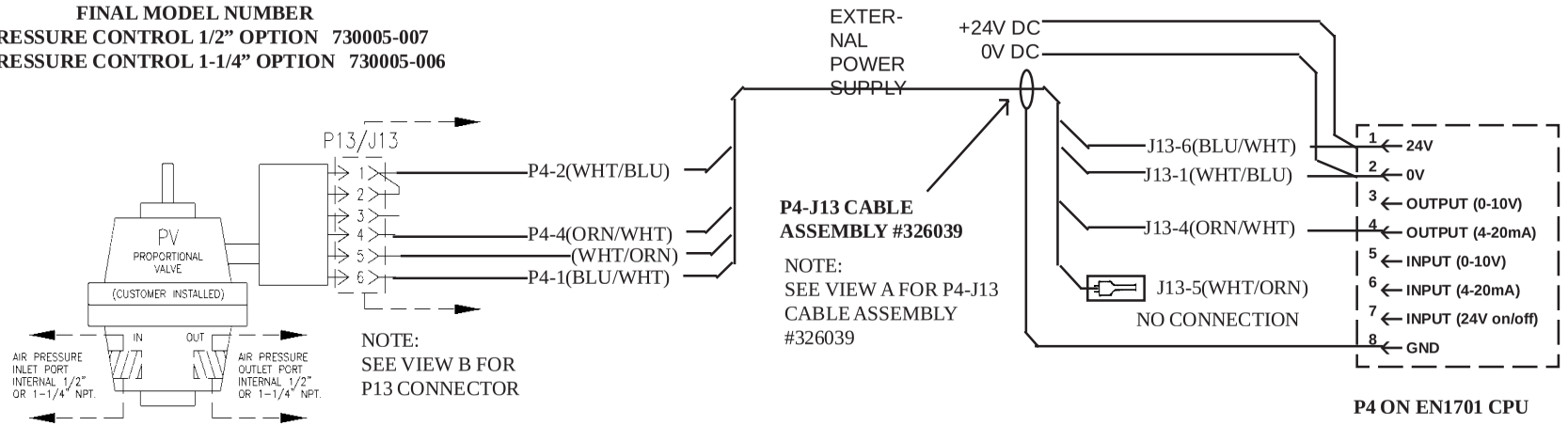
VIEW A: PRESSURE SENSOR ASSEMBELY #600633



VIEW B: SENSOR HARNESS #326053
USED WITH #571004 OR USED IN #600633
(CONSISTS OF #571005 + #326053)

PRESSURE SENSOR WIRING DIAGRAM
11/30/06

FINAL MODEL NUMBER
PRESSURE CONTROL 1/2" OPTION 730005-007
PRESSURE CONTROL 1-1/4" OPTION 730005-006

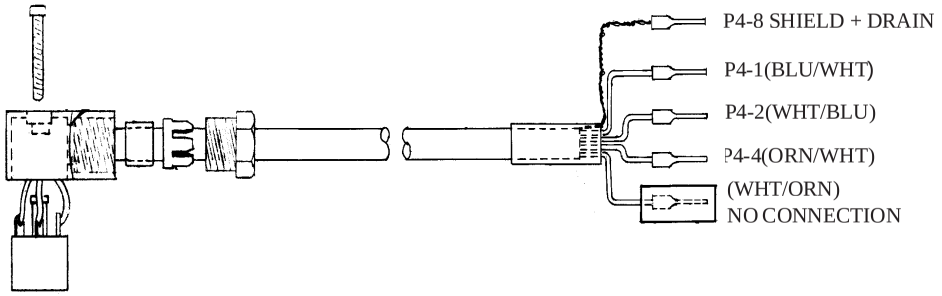


NOTE:
SEE VIEW A FOR P4-J13
CABLE ASSEMBLY
#326039

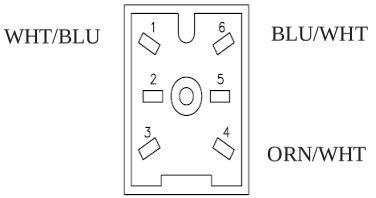
NOTE:
SEE VIEW B FOR
P13 CONNECTOR

P4 ON EN1701 CPU

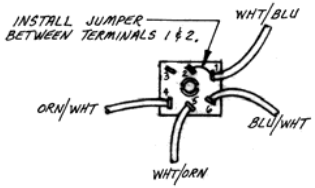
PROPORTIONAL VALVE
571001 - 1/2" or 571002 - 1-1/4"



VIEW A: P4-J13 CABLE ASSEMBLY
HARNESS #326039



VIEW B: P13 CONNECTOR
(PART OF PROPORTIONAL VALVE)



PRESSURE CONTROL WIRING DIAGRAM
11/30/06

5.5 MULTIPLE TWO-STAGE FOOT SWITCHES

The first STAGE control signal START1–START4 (pin 2–pin 5 of connector P2) and the second STAGE signal (pin 16 of connector P2) can be wired paralleled to allow initiations by means of multiple two-stage foot switches. To setup the EN1701 to work in two-stage welding mode, three steps are required:

1. Connect the switches to the control
   The foot switches are connected to the connector P2 of control as shown in Figure 5.3. One to 4 two-stage foot switches can be used. Activating the foot switches SW1 through SW4 will initiate the welding sequence in the schedule associated with the activated switch.

2. Set up the **PROG.SELECT** configuration of control
   The **PROG.SELECT** configuration must be set up as **1-of-4** mode via RPP1 programming pendant as explained in Section 6.5.1 Edit Configuration. For convenience, the instructions to program this feature are as follows:
   a) To access the Configuration menu, select the **VERSION** line on the Main menu (last line), hold down ↵ key, then press **F** key.
   b) Scroll down the menu using ↓ key to **PROG.SELECT** and press ↵ key.
   c) Check if the configuration of **PROG.SELECT** is **1-of-4** mode. If not, use **+** or **–** key to change it.
   d) Reset the EN1701 for the change to take effect.

3. Associate the welding schedules with the switches
   To set the schedule that initiates with the first two-stage switch, set the **USE PROGRAM** setting to the program desired (program *N*) in the Main menu. If more than one two-stage switch is being used, the second switch will automatically be assigned to program *N*+1, the third switch will automatically be assigned to program *N*+2, and the fourth switch will be assigned to program *N*+3.

   For example, if **USE PROGRAM** is set to 6, the first switch will initiate program 6; the second, program 7; the third, program 8; and the fourth, program 9.

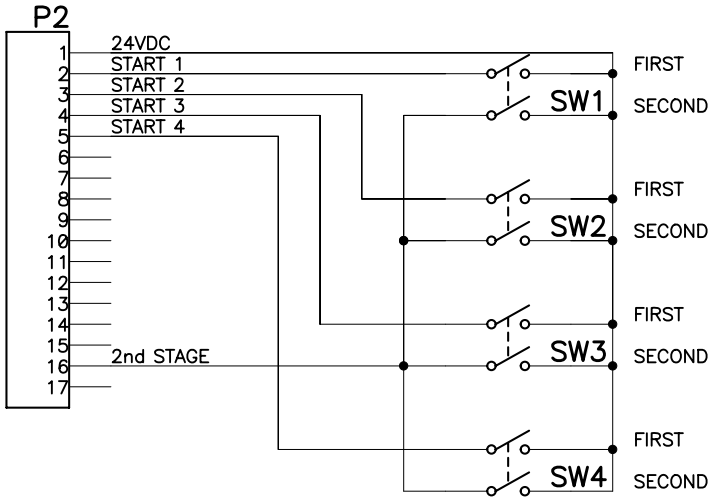


Figure 5-3. *Multiple two-stage foot switches connection diagram*

5.6 WIRING DIAGRAMS

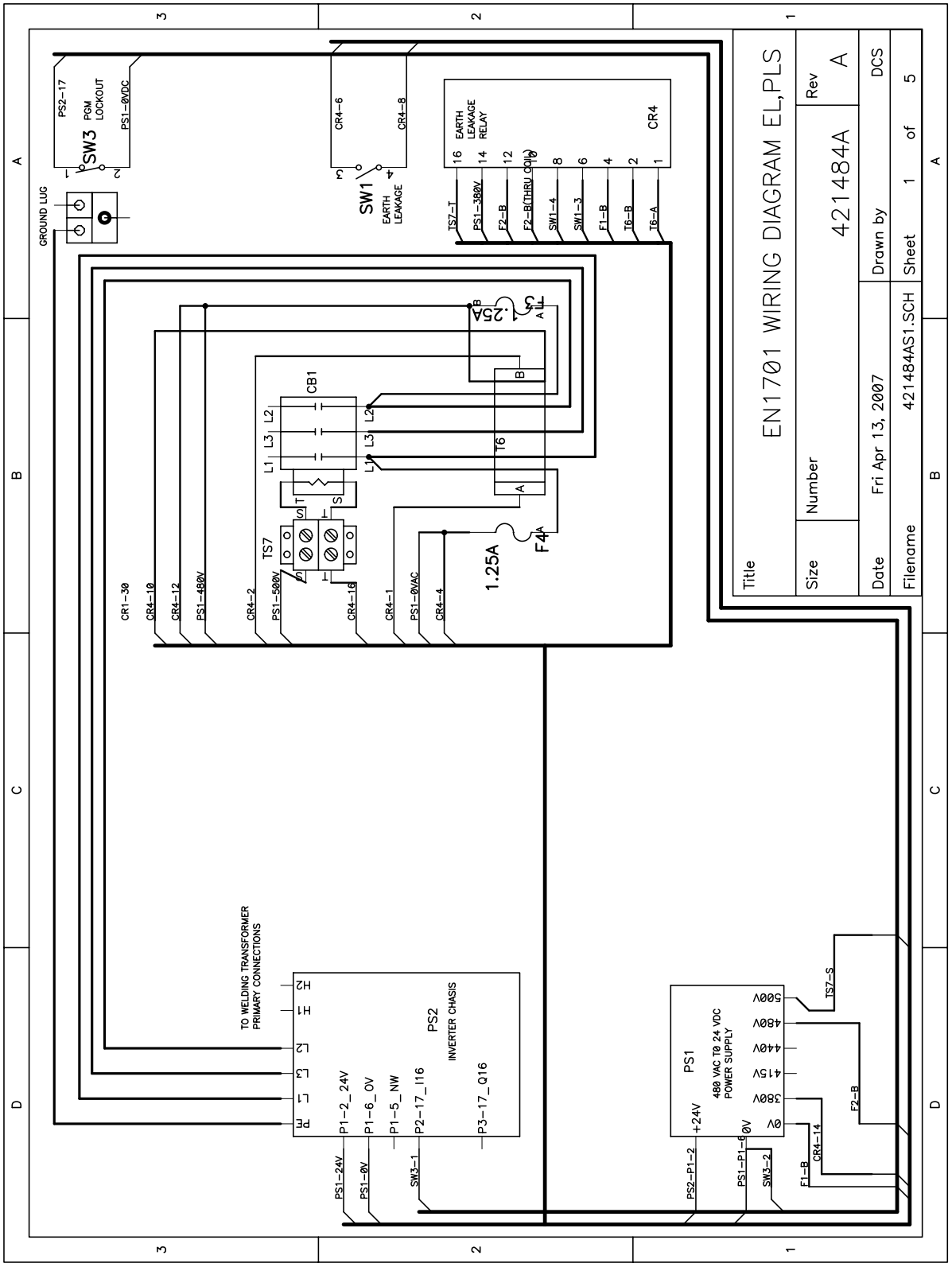
5.6.1 BILL OF MATERIALS

QTY	PART NO.	DESCRIPTION	DESIGNATION
•	600733	Assem, Remote Programming Pendant 1, RPP1	
❖◆	600730	Assem, EN1701 CPU (Part of: 600729 or 600728)	PS2
❖	600729	Assem, EN1701 600A Chassis w/CPU	PS2
◆	600728	Assem, EN1701 360A Chassis w/CPU	PS2
2	566027	Hose Connector, M16 to 3/8 Hose Barb 90°	
4	530041	MTG, Bracket, Foot, EN1701, 'T' Cab.	
▫	410372	PCB Assem, EN1701 Ethernet PCB	PS2
4	346015	Lug, Screw 1/4" Bolt to Dual 2/0 AWG Consists of: 314054, 346011, 600649	TS2
1	338021	Gasket, for 338020 (Polycarbonate Window)	
1	338020	Polycarbonate Window	
1	331445	Connector, 6 Pin Screw Term. Plug	P1
1	331162	Connector, 18 Pin Screw Term. Plug	P3
1	331161	Connector, 17 Pin Screw Term. Plug	P2
1	331160	Connector, 9 Pin Screw Term. Plug	P5
1	331159	Connector, 8 Pin Screw Term. Plug	P4
•	322548	Harness Assem, 25', 9 Pin to 9 Pin RPP1 To RS232 Jack	
■	322547	Harness Assem, 9 pin to 9 pin RS232 to Computer	
1	322546	Harness Assem, 10 pin to 9 pin CPU to RS232 Jack	
1	318031	Assem, Power Supply, 480VAC to 24VDC, 75VA	PS1
‡	314064	Surge Suppressor for ABB 600V Contactors	CR2
‡	314063	Transient Suppressor Module for 314063	CR3
‡	314062	Relay, Mechanic Industrial Control, 2 Pole, 24VDC	CR3
‡	314061	Relay, Isolation Contactor 3 Pole 480 Coil	CR2
*	313020	Current Sense Coil 12" Flex Torid 1KΩ, 200mV/1000A	
*	313019	Current Sense Coil 6" Flex Torid 1KΩ, 200mV/1000A	
*	313018	Current Sense Coil 3" Flex Torid 1KΩ, 200mV/1000A	
1	309520	Assem, Earth Leakage, PCB Assem	CR4
1	309519	Assem, Earth Leakage, Current Transformer	T6
◀	309518	Ground Fault Relay, 1000Hz, Weldsafe 5100	PS2
◀	309514	Ground Fault Current Coil	T5
❖	309057-002	CIR BRKR w/Shunt Trip, 3 Pole, 100A, 110VAC, Square D	CB
◆	309034-002	CIR BRKR w/Shunt Trip, 3 Pole, 200A, 110VAC, Square D	CB
1	309018-002	Flange Operator, C/B, 200A Square D	CB
2	308010	Fuse Holder, One Pole (Single BAF Fuse)	F1, F2
2	307025	Fuse, 1 1/4A, Time Delay, 13/32 x 1 1/2, 600A, Mini Cartridge	F1, F2
†	302028	Spare/Replacement Keys (2) for 302018, 302026, Key #445	SW3, 5, 6
▲	302027	Switch Assem Oil Tight, Key Lock, 22mm 3 position Consists of: 302026, 302019, 302020	OMS SW3, 5, 6
▼	302025	Switch Assem, Oil Tight, Push Button, Red, N/C, 22mm Consists of: 302020, 302023, 302019	GF SW4
◀	302024	Switch Assem, Oil Tight, Push Button, Red N/O 22mm Consists of: 302022, 302023, 302019	SW2 GF SW1 EL
◀▼	302023	Switch Assem, Oil Tight, Push Button, Red Section, 22mm	SW2GF, SW1EL, SW4GF
◀	302022	Switch Assem, N/O Contact Section, 22mm	SW2 GF, SW1 EL
▶	302021	Switch Assem, Oil Tight, Key Lock, N/C 22mm Consists of: 302018, 302019, 302020	SW2 GF, SW1 EL
▶▼	302020	Switch Assem, N/C Contact Section, 22mm	SW4 GF, SW3 PLS, SW3,5,6 OMS
▲▶▼◀	302019	Switch Assem, Mounting Base Section, 22mm	SW1-6
▶	302018	Switch Assem, Oil Tight, Key Lock Section, 22mm 2 Position	SW3 PLS

•	RPP1	■	Ethernet	▶	PLS
❖	600AMP Unit	‡	FPI 3 Option	▼	GF
◆	300AMP Unit	†	Spare Key	◀	EL/GF
▫	Ethernet Option	▲	OMS	*	As Application Demands

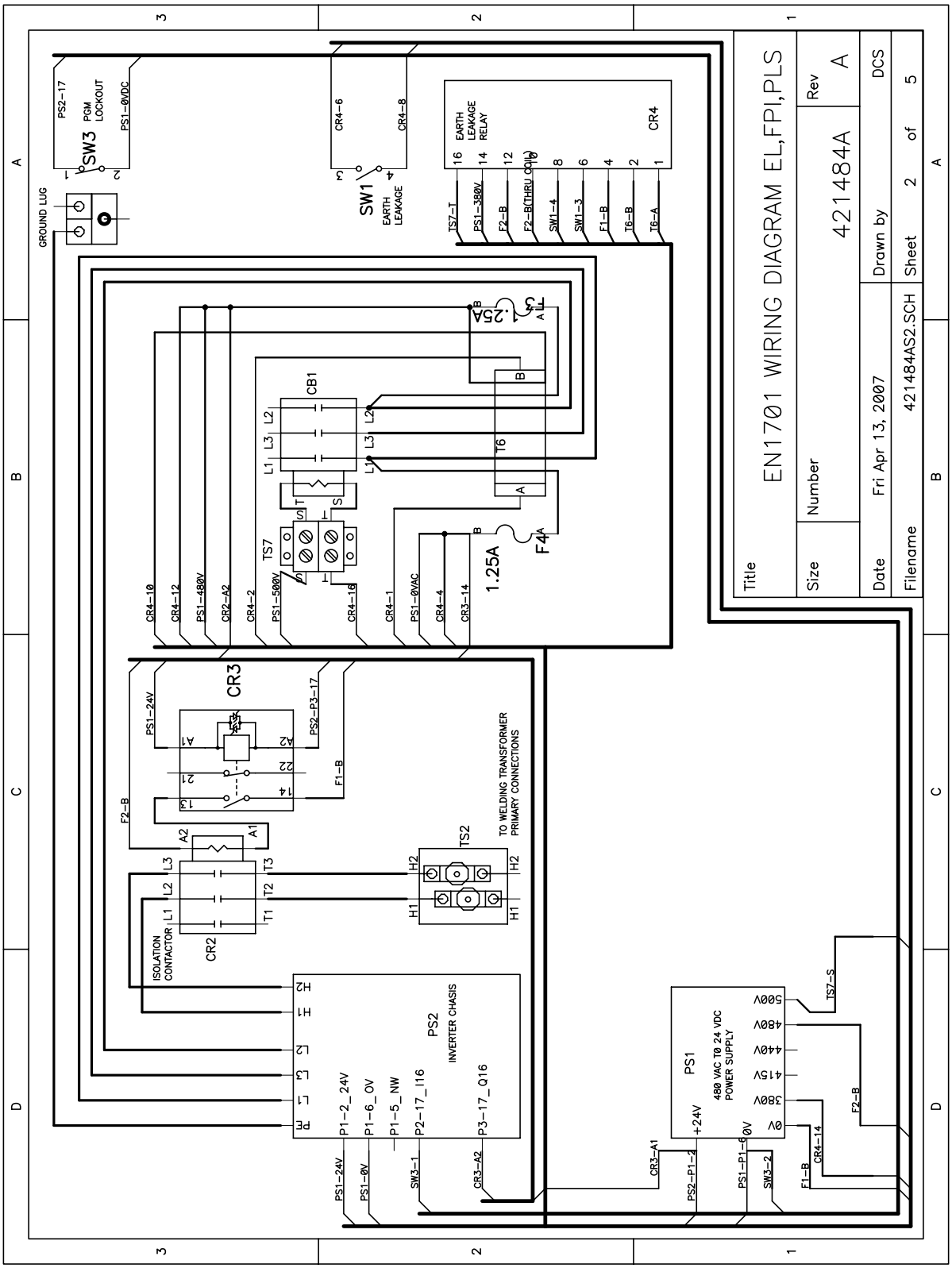
5.6 WIRING DIAGRAMS

5.6.2 NO OPTIONS



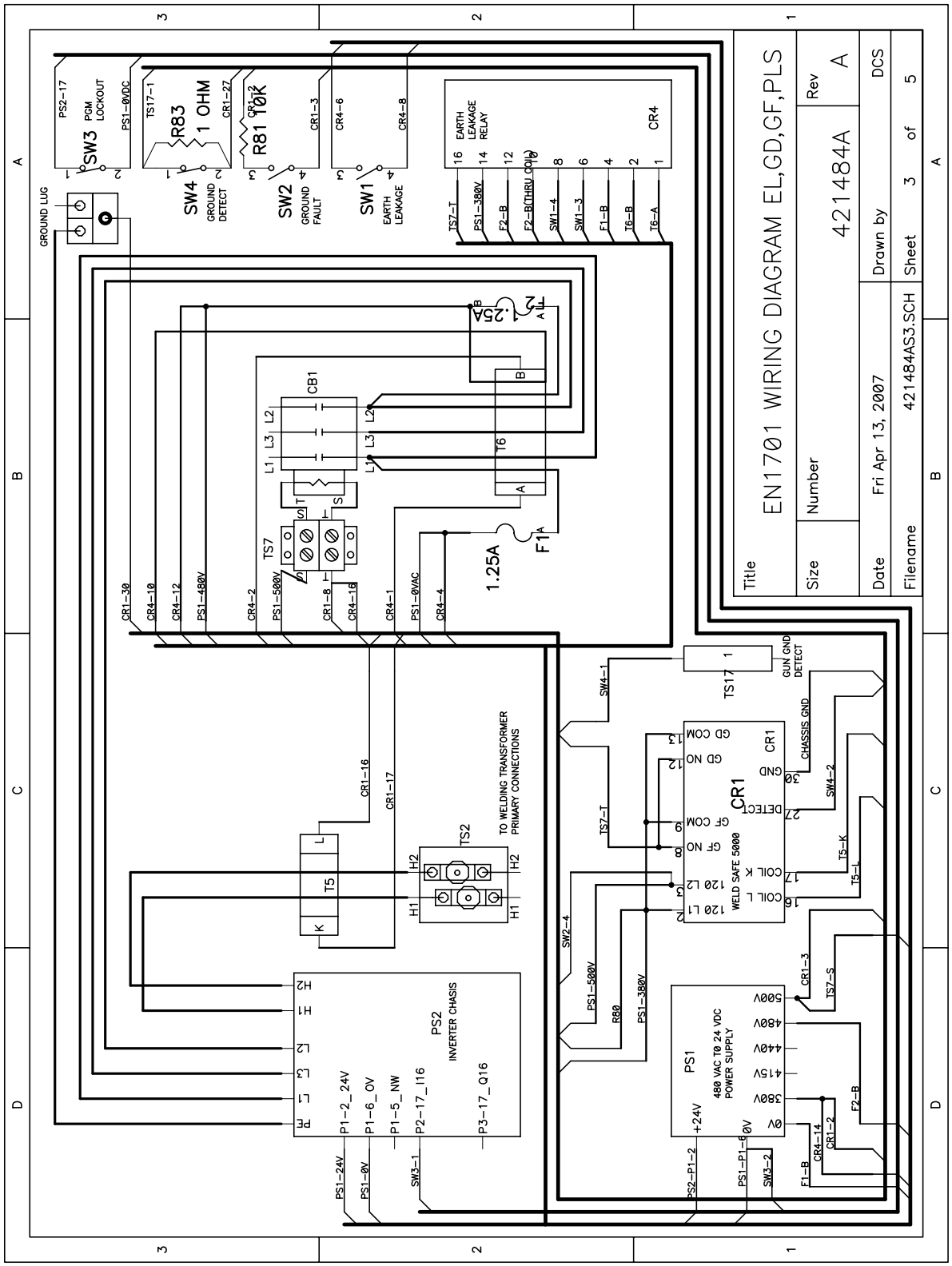
5.6 WIRING DIAGRAMS (cont.)

5.6.3 WITH FPI



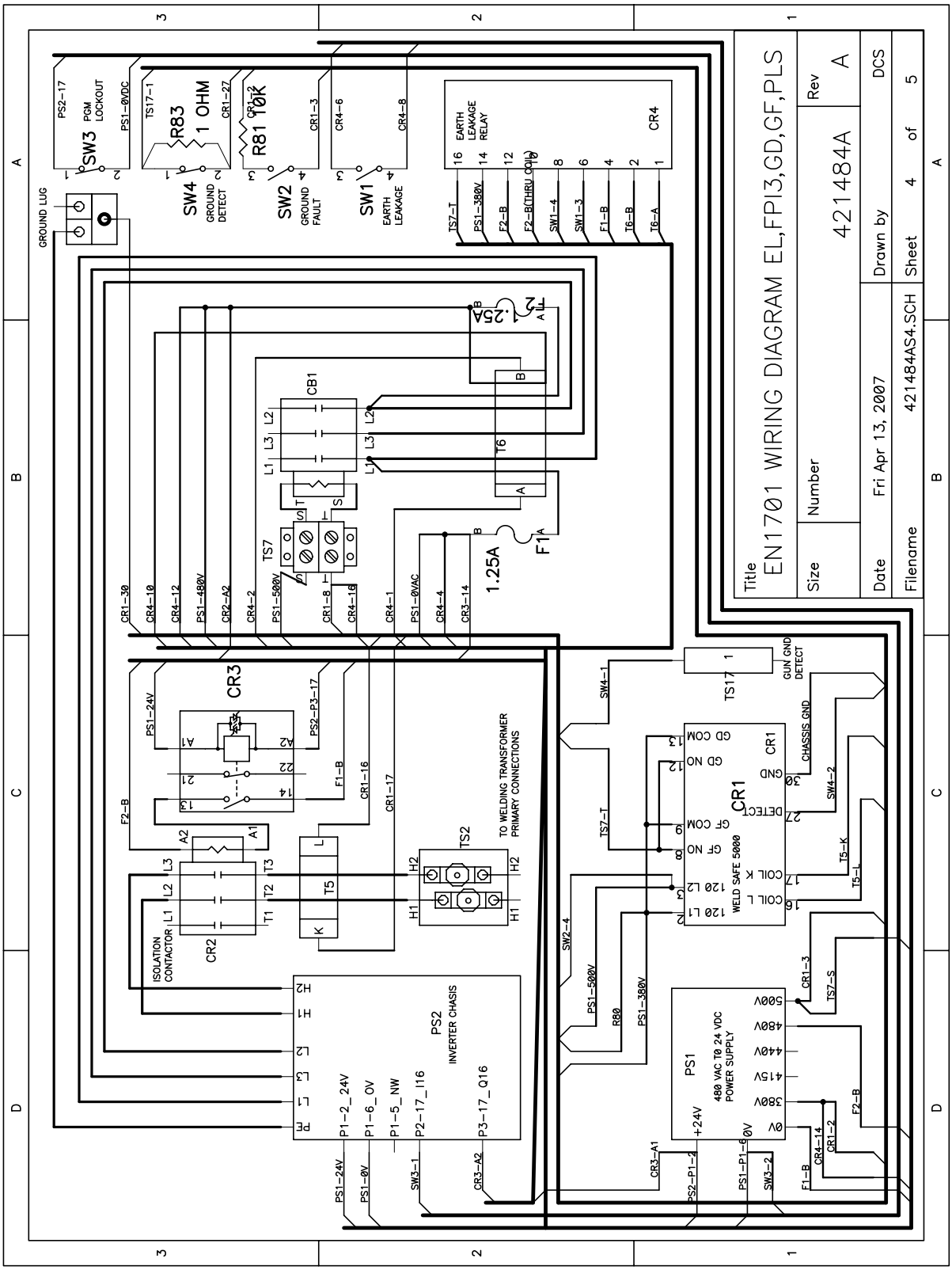
5.6 WIRING DIAGRAMS (cont.)

5.6.4 WITH GF



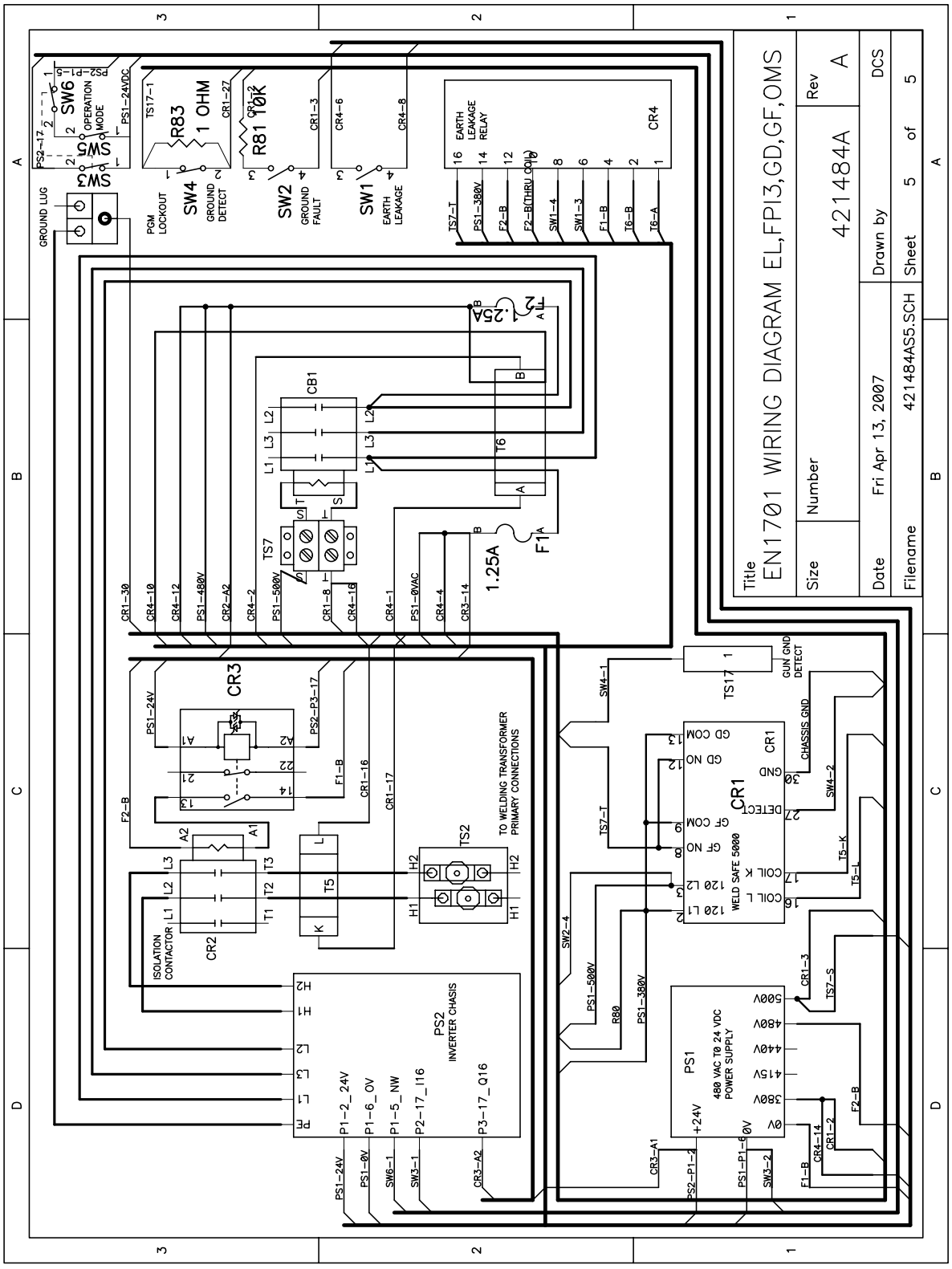
5.6 WIRING DIAGRAMS (cont.)

5.6.5 WITH FPI & GF



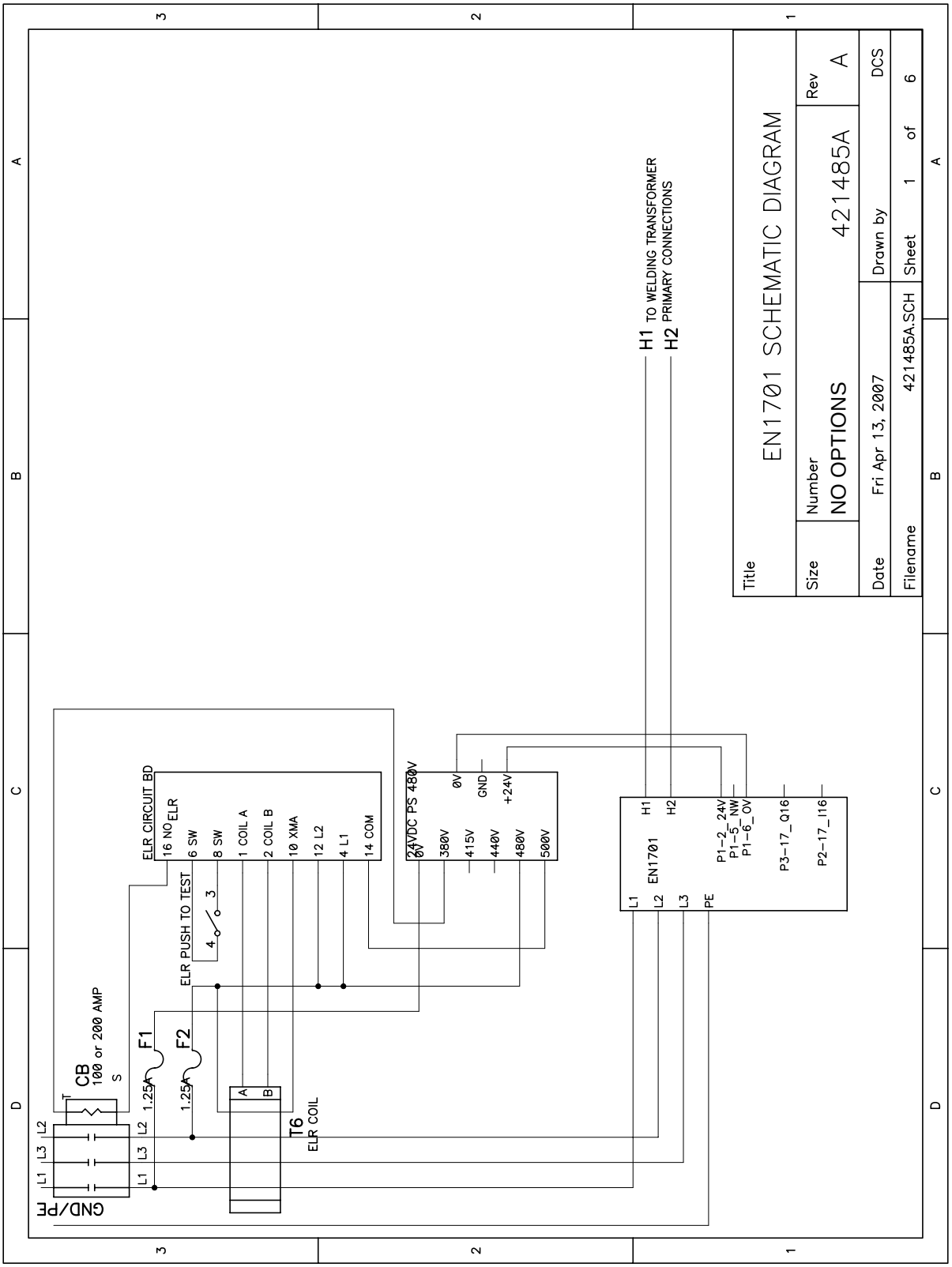
5.6 WIRING DIAGRAMS (cont.)

5.6.6 WITH FPI, GF & OMS



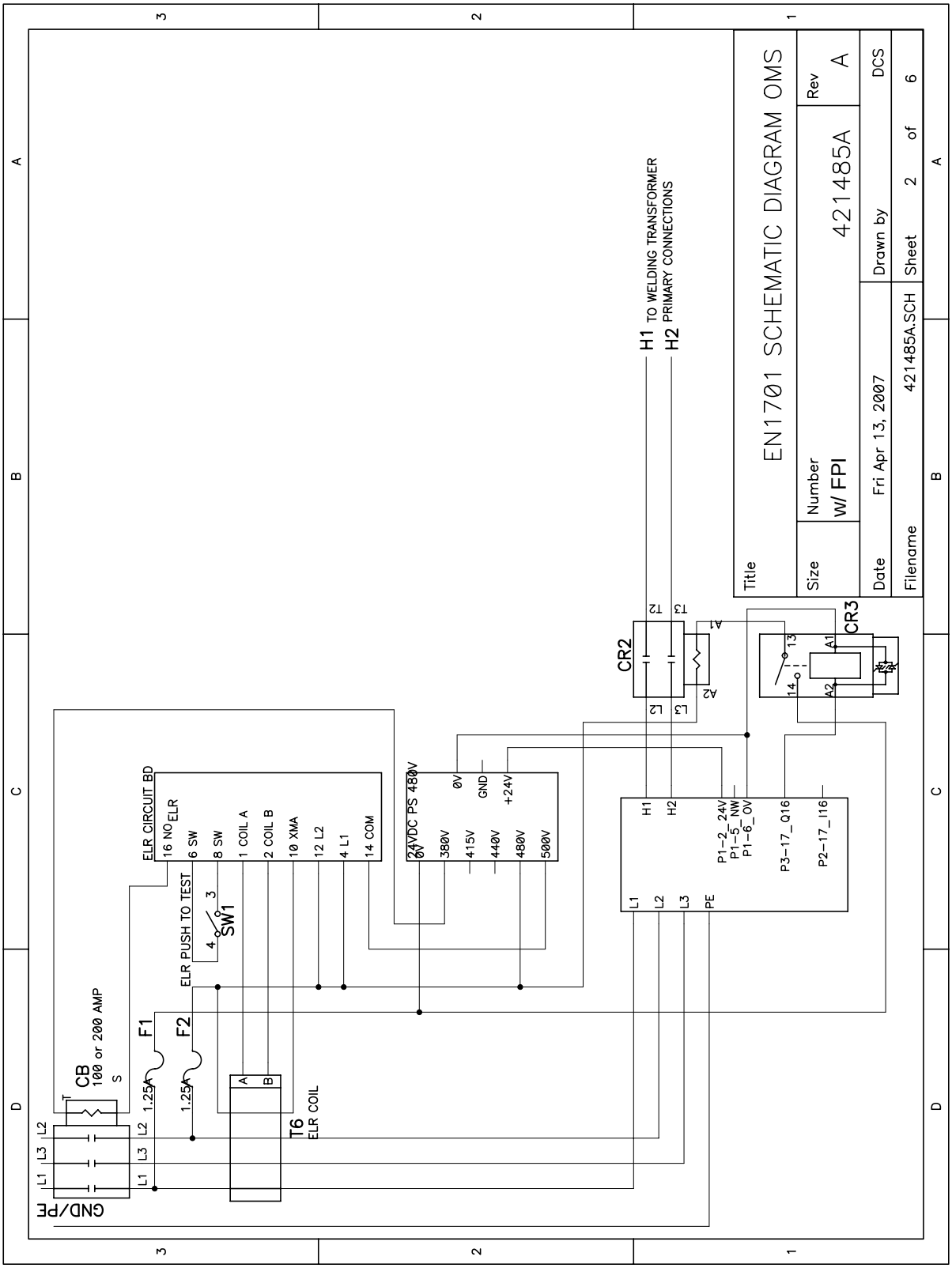
5.7 SCHEMATIC DIAGRAMS

5.7.1 NO OPTIONS



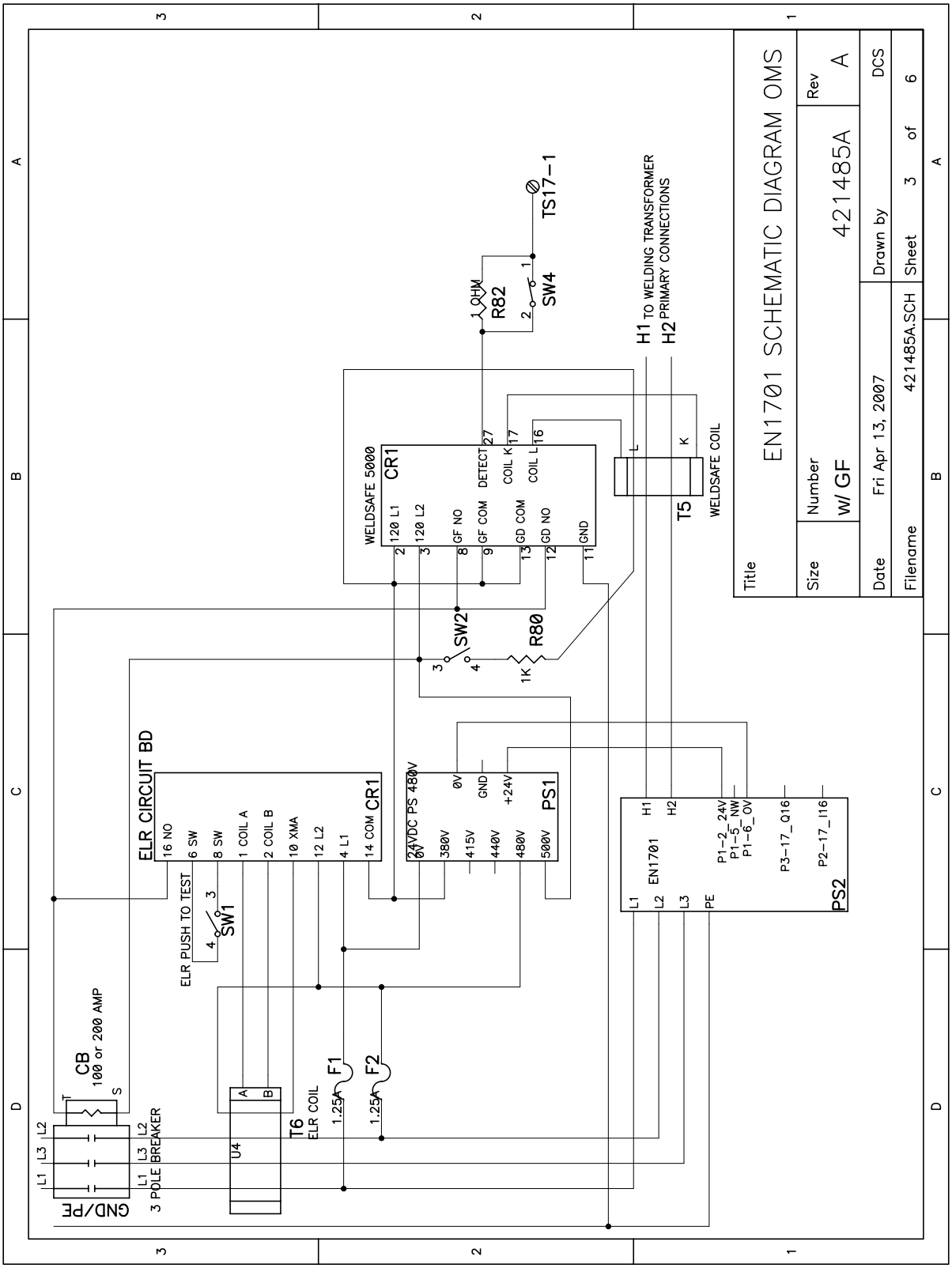
5.7 SCHEMATIC DIAGRAMS (cont.)

5.7.2 WITH FPI



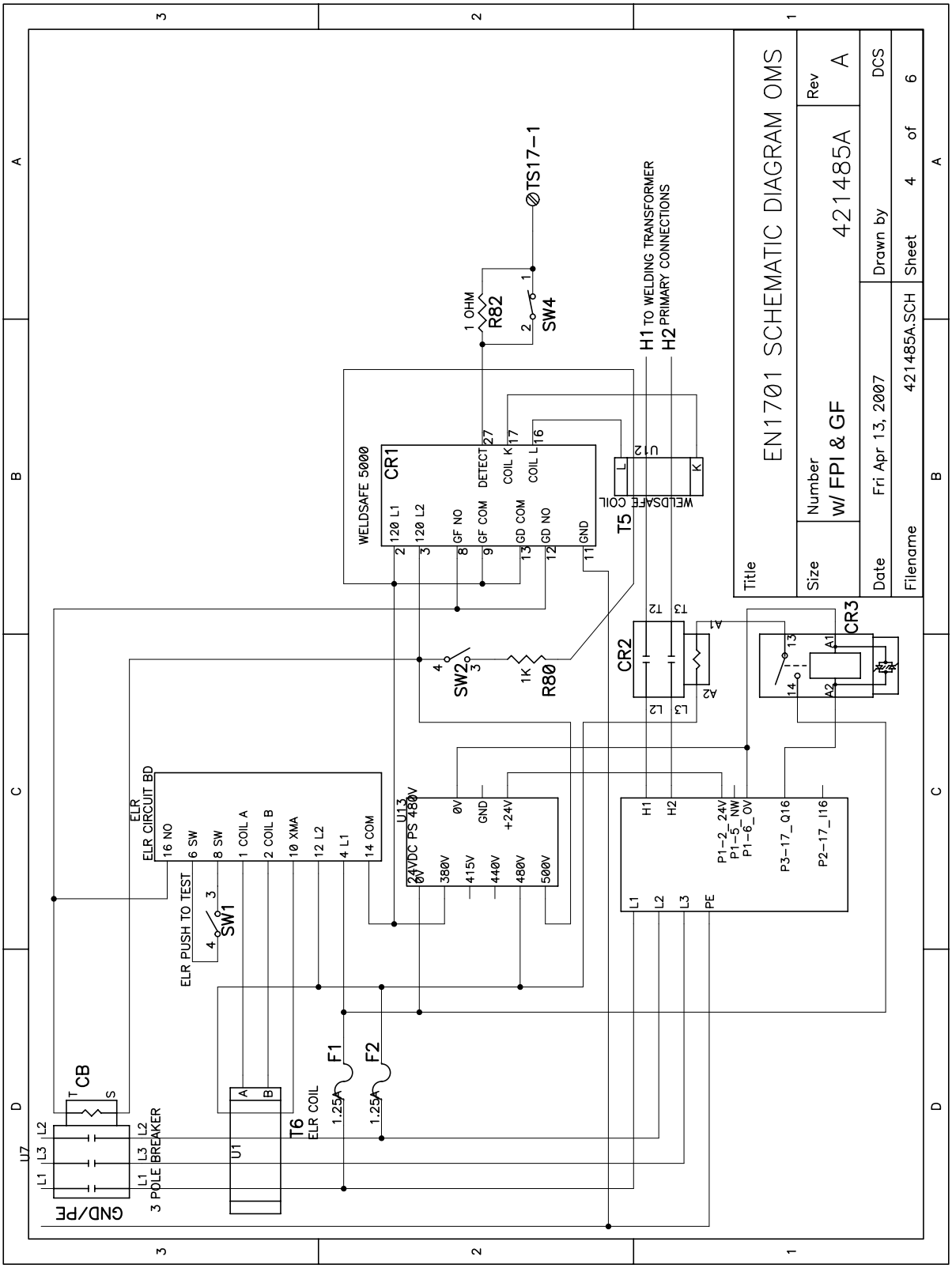
5.7 SCHEMATIC DIAGRAMS (cont.)

5.7.3 WITH GF



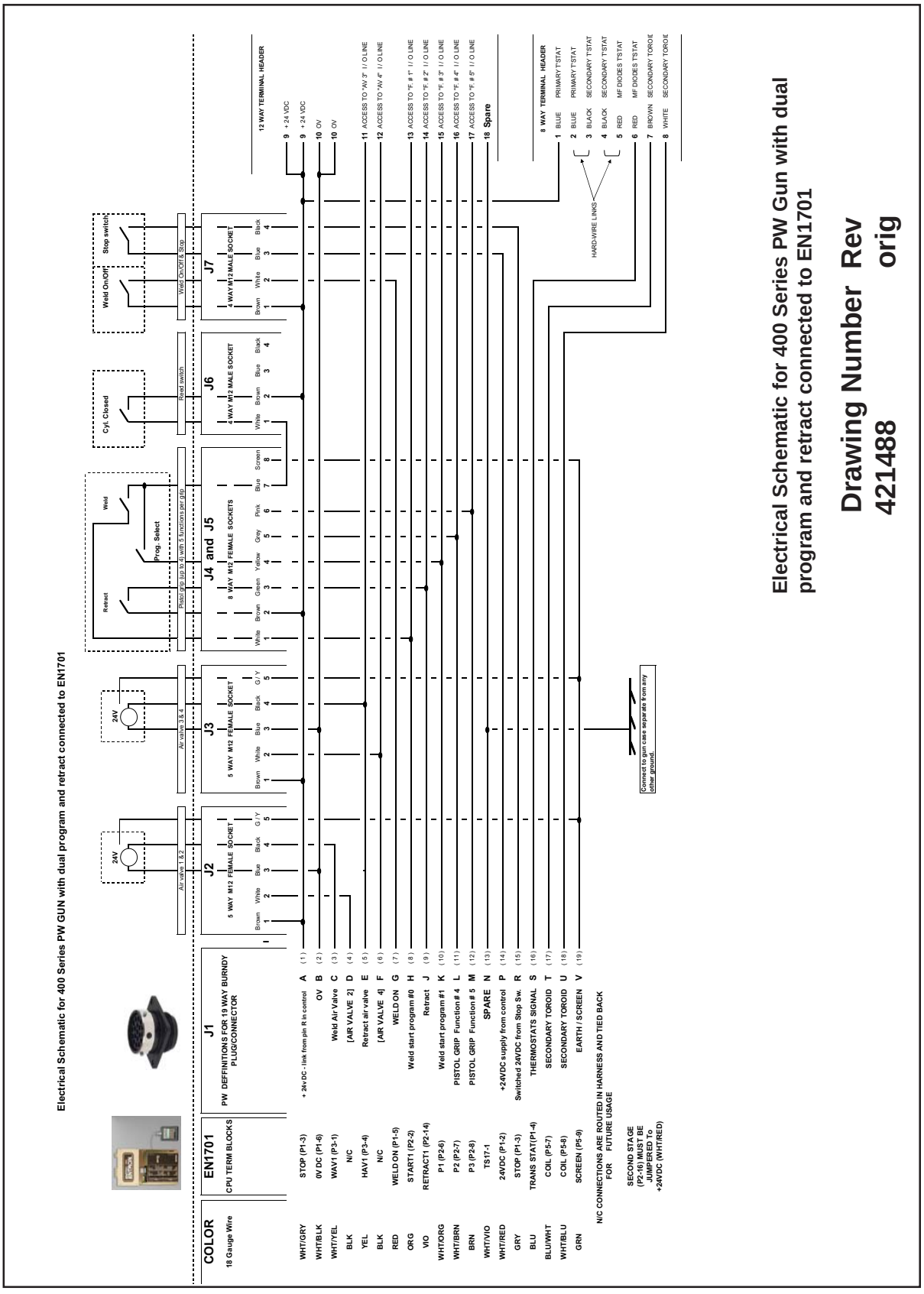
5.7 SCHEMATIC DIAGRAMS (cont.)

5.7.4 WITH FPI & GF



5.7 SCHEMATIC DIAGRAMS (cont.)

5.7.5 PW GUN CONNECTED TO EN1701



5.8 GETTING STARTED

1. Make the basic connections as shown here. You may need additional connections (see Section 5.3 User Connections), depending on your installation requirements, but the connections shown here are the most basic which are required in order to run the equipment.

2. Make sure that you have sufficient air pressure and cooling water where necessary.

3. Switch on, then use the INITIALIZE function to clear the EN1701's memory (see Section 6.5.7). If necessary, use the ERASE SEQUENCE function to clear SEQUENCER (see Section 6.6.6).

4. Edit the Configuration menu to set REGULATION=PRIMARY and BLANKING=On (see Section 6.5.1 Edit Configuration).

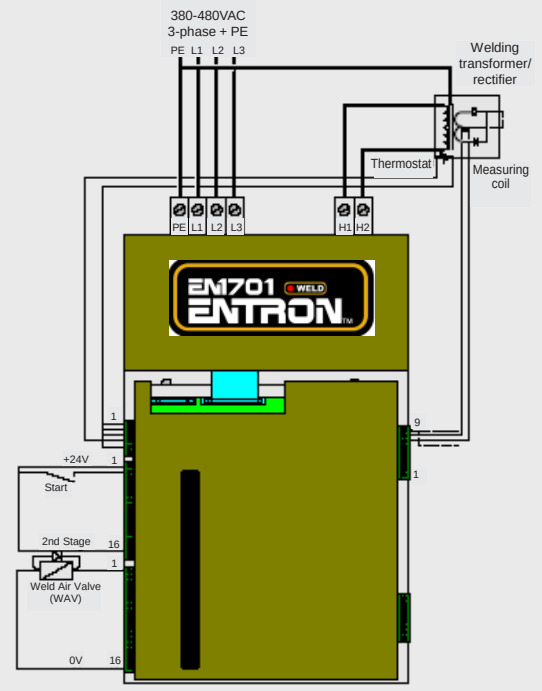


Figure 5-4. *Basic connections*

5. Edit the Calibration menu to set MAX. PRIMARY.AMPS and S/P RATIO parameters to suit your equipment (see Section 6.5.2 Edit Calibration).

6. Edit program 0 to set up a basic weld sequence (e.g., SQZ=500ms, W2=200ms, CCu mode, HLD=500ms, Pulses=1, all other intervals=0).

7. You should now be able to perform a welding operation. Begin by using the gun short-circuit (i.e., without metal to be welded). The timer should report the measured current on the diagnostic display.

8. Perform the calibration operation for coil sensitivity. Observe the current with an external meter. Set the program heat to give a typical value of welding current on the meter. Adjust coil sensitivity (in the Calibration menu) until EN1701 measurement agrees with the meter.

9. Perform the calibration operation for the inverter current (see Section 6.5.2 Edit Calibration).

10. You can now proceed to make any other adjustments which may be required, and to set up programs for welding.

5.9 PROGRAM SELECTION AND I/O VARIATIONS

Programs can be selected in a variety of different ways, depending on the settings used. Table 5-1 shows how program selection works in every mode of operation, whether it be SINGLE or DUAL GUN; BINARY or 1-OF-4; INTERNAL or EXTERNAL program select. The variable ***N*** refers to the USE PROGRAM setting on the RPP1 or in ENLINK1701. The variable ***P*** refers to EXTERNAL BINARY selection. Table 5-2 describes how EXTERNAL BINARY program selection works. Use the given formula to determine which binary configuration will result in the desired program. Standard binary conversion can be used as well.

Table 5-1. *Program selection options*

Single/ Dual	Binary/ 1-of-4	Use program/ EXT selection	START inputs	Program selected	Gun used
	Binary	N = 0–63 (Section 5.9.1)	1	*N*	1
		P = 0–63 (Section 5.9.2)	1	*P*	1
Single	1-of-4	N = 0–15 (Section 5.9.3)	1	*N*	1
			3	*N*+16	1
			2	*N*+32	1
			4	*N*+48	1
		P = 0–15 (Section 5.9.4)	1	*P*	1
			3	*P*+16	1
			2	*P*+32	1
			4	*P*+48	1
	Binary	N = 0–31 (Section 5.9.5)	1	*N*	1
			2	*N*+32	2
		P = 0–7 (Section 5.9.6)	1	*P*	1
			2	*P*+32	2
Dual	1of4	N = 0–15 (Section 5.9.7)	1	*N*	1
			3	*N*+16	1
			2	*N*+32	2
			4	*N*+48	2
		P = 0–7 (Section 5.9.8)	1	*P*	1
			3	*P*+16	1
			2	*P*+32	2
			4	*P*+48	2

Table 5-2. *External Binary selection*

Input	Open (0) Value	Closed (1) Value
P1	P1=0	P1=1
P2	P2=0	P2=2
P4	P4=0	P4=4
P8	P8=0	P8=8
P16	P16=0	P16=16
P32	P32=0	P32=32

Selected program:
P = P1+P2+P4+P8+P16+P32

Example:

Input	Status	Value
P1	1	P1=1
P2	0	P2=0
P4	1	P4=4
P8	1	P8=8
P16	0	P16=0
P32	1	P32=32

Selected program:
P = P1+P2+P4+P8+P16+P32
P = 1 + 0 + 4 + 8 + 0 + 32
P = 45

5.9 PROGRAM SELECTION & I/O VARIATIONS (cont.)

Each mode of operation has its own configuration for the I/O of the EN1701. The following sections describe in detail the variations for the I/O depending on what mode of operation and selection are chosen.

5.9.1 SINGLE GUN OPERATION – INTERNAL PROGRAM SELECT MODE

INPUTS (I) (see Section 5.3.1)

I01 START1 – normally open; when closed to +24VDC, it closes control relays and initiates program set in USE PROGRAM setting (***N***); must remain closed through SQUEEZE time in order to completely execute the weld.
I02 START2 – not defined *
I03 START3 – not defined *
I04 START4 – not defined *
I05 P1 – not defined *
I06 P2 – not defined *
I07 P4 – not defined *
I08 P8 – not defined *
I09 P16 – not defined *
I10 P32 – not defined *
I11 RESET STEPPER – normally open; close to +24VDC to reset STEPPER count to zero; required if control is set to STOP AT END of STEPPER (see Section 6.6.5).*
I12 RESET COUNT – normally open; close to +24VDC to reset COUNTER to zero; required if control is set to STOP AT END of COUNTER (see Section 6.6.5).*
I13 RETRACT – normally open; close to +24VDC; depending on RETRACTION mode, switch is used to open and close the arms of welder to semi-open position (see Section 6.5.1).*
I14 RESET FAULT – normally open; if control is set to STOP ON FAULT, close this switch to +24VDC; after error is cleared, used to return control to normal operation (see Section 6.5.1).*
I15 2nd STAGE – connected to 2nd stage of dual stage foot switch; after initiating START, close to +24VDC to continue weld when parts are in place and ready to complete the weld. If not required for application, this input must be tied to +24VDC, as execution of a weld will not occur without closing this input to +24VDC.*
I16 EDIT DISABLE – normally open; close to +24VDC to disable programming from the RPP1 pendant (see Section 5.10).*

OUTPUTS (Q) (see Section 5.3.1)

Q01 WAV (WELD AIR VALVE) – +24VDC, 500mA maximum load; used to activate valve to close electrodes; is active for SQUEEZE, WELD, and HOLD time (see Section 7.0 for timing diagrams).*+
Q02 MOTOR – +24VDC, 500mA maximum load; used in SEAM mode to activate motor for seam welding application (see Section 7.0).*+
Q03 HAV (HI-LIFT AIR VALVE) – +24VDC, 500mA maximum load; used for retraction to close weld arms to semi-open position (see Sections 7.0 and 6.5.1).*+
Q04 not defined; +24VDC, 500mA maximum load *+
Q05 END COUNT – +24VDC, 100mA maximum load; indicates that COUNTER has completed (see Section 6.6.5).*+

* denotes additional function with SEQUENCER (see Section 6.6.6)
+ denotes additional function with EVENTS (see Section 6.6.4)

5.9.1 SINGLE GUN OPERATION – INTERNAL PROGRAM SELECT (cont.)

Q06 END STEPPER – +24VDC, 100mA maximum load; indicates that STEPPER has completed (see Section 6.6.5).*+

Q07 PRE-WARN – +24VDC, 100mA maximum load; indicates that WELD count/ STEPPER count is getting close to completion (see Section 6.6.5).*+

Q08 not defined; +24VDC, 100mA maximum load *+

Q09 not defined; +24VDC, 100mA maximum load *+

Q10 not defined; +24VDC, 100mA maximum load *+

Q11 not defined; +24VDC, 100mA maximum load *+

Q12 not defined; +24VDC, 100mA maximum load *+

Q13 EOS (END OF SEQUENCE) – +24VDC, 100mA maximum load; indicates END OF SEQUENCE when weld program has completely executed.*+

Q14 FAULT – +24VDC, 100mA maximum load; indicates FAULT/ERROR has occurred.*+

Q15 NOT READY – +24VDC, 100mA maximum load; indicates that control is not ready to weld and will not initiate.*+

Q16 CONTACTOR – +24VDC, 100mA maximum load; used to energize an isolation contactor; turns on at SQUEEZE time and remains on through welding sequence plus time programmed into CONTACTOR TIME in the Configuration menu (see Section 6.5.1). This output is not protected by control relay contacts.*+

5.9.2 SINGLE GUN OPERATION – EXTERNAL BINARY PROGRAM SELECT MODE

INPUTS (I) (see Section 5.3.1)

I01 START1 – normally open; when closed to +24VDC, it closes control relays and initiates externally selected program (***P***); must remain closed through SQUEEZE time in order to completely execute the weld.

I02 START2 – not defined *

I03 START3 – not defined *

I04 START4 – not defined *

I05 P1 – normally open; when closed to +24VDC, it adds 1 to the total program select (see Section 5.9).*

I06 P2 – normally open; when closed to +24VDC, it adds 2 to the total program select (see Section 5.9).*

I07 P4 – normally open; when closed to +24VDC, it adds 4 to the total program select (see Section 5.9).*

I08 P8 – normally open; when closed to +24VDC, it adds 8 to the total program select (see Section 5.9).*

I09 P16 – normally open; when closed to +24VDC, it adds 16 to the total program select (see Section 5.9).*

I10 P32 – normally open; when closed to +24VDC, it adds 32 to the total program select (see Section 5.9).*

I11 RESET STEPPER – normally open; close to +24VDC to reset STEPPER count to zero; required if control is set to STOP AT END of STEPPER (see Section 6.6.5).*

I12 RESET COUNT – normally open; close to +24VDC to reset COUNTER to zero; required if control is set to STOP AT END of COUNTER (see Section 6.6.5).*

I13 RETRACT – normally open; close to +24VDC; depending on RETRACTION mode, switch used to open and close the arms of welder to semi-open position (see Section 6.5.1).*

I14 RESET FAULT – normally open; if control is set to STOP ON FAULT, close this switch to +24VDC; after error is cleared, used to return control to normal operation (see Section 6.5.1).*

I15 2nd STAGE – connected to 2nd stage of dual stage foot switch; after initiating START, close to +24VDC to continue weld when parts are in place and ready to complete the weld. If not required for application, this input must be tied to +24VDC, as execution of a weld will not occur without closing this input to +24VDC.*

I16 EDIT DISABLE – normally open; close to +24VDC to disable programming from the RPP1 pendant (see Section 5.10).*

OUTPUTS (Q) (see Section 5.3.1)

Q01 WAV (WELD AIR VALVE) – +24VDC, 500mA maximum load; used to activate valve to close electrodes; is active for SQUEEZE, WELD, and HOLD time (see Section 7.0 for timing diagrams).*+

Q02 MOTOR – +24VDC, 500mA maximum load; used in SEAM mode to activate motor for seam welding application (see Section 7.0).*+

Q03 HAV (HI-LIFT AIR VALVE) – +24VDC, 500mA maximum load; used for retraction to close weld arms to semi-open position (see Sections 7.0 and 6.5.1).*+

Q04 not defined; +24VDC, 500mA maximum load *+

Q05 END COUNT – +24VDC, 100mA maximum load; indicates that COUNTER has completed (see Section 6.6.5).*+

Q06 END STEPPER – +24VDC, 100mA maximum load; indicates that STEPPER has completed (see Section 6.6.5).*+

Q07 PRE-WARN – +24VDC, 100mA maximum load; indicates that WELD count/ STEPPER count is getting close to completion (see Section 6.6.5).*+

Q08 not defined; +24VDC, 100mA maximum load *+

Q09 not defined; +24VDC, 100mA maximum load *+

Q10 not defined; +24VDC, 100mA maximum load *+

Q11 not defined; +24VDC, 100mA maximum load *+

Q12 not defined; +24VDC, 100mA maximum load *+

Q13 EOS (END OF SEQUENCE) – +24VDC, 100mA maximum load; indicates END OF SEQUENCE when weld program has completely executed.*+

Q14 FAULT – +24VDC, 100mA maximum load; indicates FAULT/ERROR has occurred.*+

Q15 NOT READY – +24VDC, 100mA maximum load; indicates that control is not ready to weld and will not initiate.*+

Q16 CONTACTOR – +24VDC, 100mA maximum load; used to energize an isolation contactor; turns on at SQUEEZE time and remains on through welding sequence plus time programmed into CONTACTER TIME in the Configuration menu (see Section 6.5.1). This output is not protected by control relay contacts.*+

* denotes additional function with SEQUENCER (see Section 6.6.6)
+ denotes additional function with EVENTS (see Section 6.6.4)

5.9.3 SINGLE GUN OPERATION – INTERNAL 1-OF-4 PROGRAM SELECT MODE

INPUTS (I) (see Section 5.3.1)

I01 START1 – normally open; when closed to +24VDC, it closes control relays and initiates program set in USE PROGRAM setting (***N***); must remain closed through SQUEEZE time in order to completely execute the weld.

I02 START2 – normally open; when closed to +24VDC, it closes control relays and initiates program set in USE PROGRAM setting plus 32 (***N*+32**); must remain closed through SQUEEZE time in order to completely execute the weld.*

I03 START3 – normally open; when closed to +24VDC, it closes control relays and initiates program set in USE PROGRAM setting plus 16 (***N*+16**); must remain closed through SQUEEZE time in order to completely execute the weld.*

I04 START4 – normally open; when closed to +24VDC, it closes control relays and initiates program set in USE PROGRAM setting plus 48 (***N*+48**); must remain closed through SQUEEZE time in order to completely execute the weld.*

I05 P1 – not defined *

I06 P2 – not defined *

I07 P4 – not defined *

I08 P8 – not defined *

I09 P16 – not defined *

I10 P32 – not defined *

I11 RESET STEPPER – normally open; close to +24VDC to reset STEPPER count to zero; required if control is set to STOP AT END of STEPPER (see Section 6.6.5).*

I12 RESET COUNT – normally open; close to +24VDC to reset COUNTER to zero; required if control is set to STOP AT END of COUNTER (see Section 6.6.5).*

I13 RETRACT – normally open; close to +24VDC; depending on RETRACTION mode, switch used to open and close the arms of welder to semi-open position (see Section 6.5.1).*

I14 RESET FAULT – normally open; if control is set to STOP AT FAULT, close this switch to +24VDC; after error is cleared, used to return control to normal operation (see Section 6.5.1).*

I15 2nd STAGE – connected to 2nd stage of dual stage foot switch; after initiating START, close to +24VDC to continue weld when parts are in place and ready to complete the weld. If not required for application, this input must be tied to +24VDC, as execution of a weld will not occur without closing this input to +24VDC.*

I16 EDIT DISABLE – normally open; close to +24VDC to disable programming from the RPP1 pendant (see Section 5.10).*

OUTPUTS (Q) (see Section 5.3.1)

Q01 WAV (WELD AIR VALVE) – +24VDC, 500mA maximum load; used to activate valve to close electrodes; is active for SQUEEZE, WELD, and HOLD time (see Section 7.0 for timing diagrams).*+

Q02 MOTOR – +24VDC, 500mA maximum load; used in SEAM mode to activate motor for seam welding application (see Section 7.0).*+

Q03 HAV (HI-LIFT AIR VALVE) – +24VDC, 500mA maximum load; used for retraction to close weld arms to semi-open position (see Sections 7.0 and 6.5.1).*+

Q04 not defined; +24VDC, 500mA maximum load *+

Q05 END COUNT – +24VDC, 100mA maximum load; indicates that COUNTER has completed (see Section 6.6.5).*+

5.9.3 SINGLE GUN OPERATION – INTERNAL 1-OF-4 PROGRAM SELECT (cont.)

Q06 END STEPPER – +24VDC, 100mA maximum load; indicates that STEPPER has completed (see Section 6.6.5).*+

Q07 PRE-WARN – +24VDC, 100mA maximum load; indicates that WELD count/ STEPPER count is getting close to completion (see Section 6.6.5).*+

Q08 not defined; +24VDC, 100mA maximum load *+

Q09 not defined; +24VDC, 100mA maximum load *+

Q10 not defined; +24VDC, 100mA maximum load *+

Q11 not defined; +24VDC, 100mA maximum load *+

Q12 not defined; +24VDC, 100mA maximum load *+

Q13 EOS (END OF SEQUENCE) – +24VDC, 100mA maximum load; indicates END OF SEQUENCE when weld program has completely executed.*+

Q14 FAULT – +24VDC, 100mA maximum load; indicates FAULT/ERROR has occurred.*+

Q15 NOT READY – +24VDC, 100mA maximum load; indicates that control is not ready to weld and will not initiate.*+

Q16 CONTACTOR – +24VDC, 100mA maximum load; used to energize an isolation contactor; turns on at SQUEEZE time and remains on through welding sequence plus time programmed into CONTACTOR TIME in the Configuration menu (see Section 6.5.1). This output is not protected by control relay contacts.*+

5.9.4 SINGLE GUN OPERATION – EXTERNAL BINARY 1-OF-4 PROGRAM SELECT

INPUTS (I) (see Section 5.3.1)

I01 START1 – normally open; when closed to +24VDC, it closes control relays and initiates externally selected program (***P***); must remain closed through SQUEEZE time in order to completely execute the weld.

I02 START2 – normally open; when closed to +24VDC, it closes control relays and initiates externally selected program plus 32 (***P*+32**); must remain closed through SQUEEZE time in order to completely execute the weld.*

I03 START3 – normally open; when closed to +24VDC, it closes control relays and initiates externally selected program plus 16 (***P*+16**); must remain closed through SQUEEZE time in order to completely execute the weld.*

I04 START4 – normally open; when closed to +24VDC, it closes control relays and initiates externally selected program plus 48 (***P*+48**); must remain closed through SQUEEZE time in order to completely execute the weld.*

I05 P1 – normally open; when closed to +24VDC, it adds 1 to the total program select (see Section 5.9).*

I06 P2 – normally open; when closed to +24VDC, it adds 2 to the total program select (see Section 5.9).*

I07 P4 – normally open; when closed to +24VDC, it adds 4 to the total program select (see Section 5.9).*

I08 P8 – normally open; when closed to +24VDC, it adds 8 to the total program select (see Section 5.9).*

I09 P16 – not defined *

I10 P32 – not defined *

I11 RESET STEPPER – normally open; close to +24VDC to reset STEPPER count to zero; required if control is set to STOP AT END of STEPPER (see Section 6.6.5).*

* denotes additional function with SEQUENCER (see Section 6.6.6)
+ denotes additional function with EVENTS (see Section 6.6.4)

5.9.4 SINGLE GUN – EXTERNAL BINARY 1-OF-4 PROGRAM SELECT (cont.)

I12 RESET COUNT – normally open; close to +24VDC to reset COUNTER to zero; required if control is set to STOP AT END of COUNTER (see Section 6.6.5).*

I13 RETRACT – normally open; close to +24VDC; depending on RETRACTION mode, switch used to open and close the arms of welder to semi-open position (see Section 6.5.1).*

I14 RESET FAULT – normally open; if control is set to STOP ON FAULT, close this switch to +24VDC; after error is cleared, used to return control to normal operation (see Section 6.5.1).*

I15 2nd STAGE – connected to 2nd stage of dual stage foot switch; after initiating START, close to +24VDC to continue weld when parts are in place and ready to complete the weld. If not required for application, this input must be tied to +24VDC, as execution of a weld will not occur without closing this input to +24VDC.*

I16 EDIT DISABLE – normally open; close to +24VDC to disable programming from the RPP1 pendant (see Section 5.10).*

OUTPUTS (Q) (see Section 5.3.1)

Q01 WAV (WELD AIR VALVE) – +24VDC, 500mA maximum load; used to activate valve to close electrodes; is active for SQUEEZE, WELD, and HOLD time (see Section 7.0 for timing diagrams).*+

Q02 MOTOR – +24VDC, 500mA maximum load; used in SEAM mode to activate motor for seam welding application (see Section 7.0).*+

Q03 HAV (HI-LIFT AIR VALVE) – +24VDC, 500mA maximum load; used for retraction to close weld arms to semi-open position (see Sections 7.0 and 6.5.1).*+

Q04 not defined; +24VDC, 500mA maximum load *+

Q05 END COUNT – +24VDC, 100mA maximum load; indicates that COUNTER has completed (see Section 6.6.5).*+

Q06 END STEPPER – +24VDC, 100mA maximum load; indicates that STEPPER has completed (see Section 6.6.5).*+

Q07 PRE-WARN – +24VDC, 100mA maximum load; indicates that WELD count/ STEPPER count is getting close to completion (see Section 6.6.5).*+

Q08 not defined; +24VDC, 100mA maximum load *+

Q09 not defined; +24VDC, 100mA maximum load *+

Q10 not defined; +24VDC, 100mA maximum load *+

Q11 not defined; +24VDC, 100mA maximum load *+

Q12 not defined; +24VDC, 100mA maximum load *+

Q13 EOS (END OF SEQUENCE) – +24VDC, 100mA maximum load; indicates END OF SEQUENCE when weld program has completely executed.*+

Q14 FAULT – +24VDC, 100mA maximum load; indicates FAULT/ERROR has occurred.*+

Q15 NOT READY – +24VDC, 100mA maximum load; indicates that control is not ready to weld and will not initiate.*+

Q16 CONTACTOR – +24VDC, 100mA maximum load; used to energize an isolation contactor; turns on at SQUEEZE time and remains on through welding sequence plus time programmed into CONTACTOR TIME in the Configuration menu (see Section 6.5.1). This output is not protected by control relay contacts.*+

5.9.5 DUAL GUN OPERATION – INTERNAL PROGRAM SELECT MODE

INPUTS (I) (see Section 5.3.2)

I01 START1 – normally open; when closed to +24VDC, it closes control relays and initiates program set in USE PROGRAM setting (***N***) for gun 1; must remain closed through SQUEEZE time in order to completely execute the weld.

I02 START2 – normally open; when closed to +24VDC, it closes control relays and initiates program set in USE PROGRAM setting plus 32 (***N*+32**) for gun 2; must remain closed through SQUEEZE time in order to completely execute the weld.*

I03 START3 – not defined *

I04 START4 – not defined *

I05 P1 – not defined *

I06 P2 – not defined *

I07 P4 – not defined *

I08 RESET STEPPER2 – normally open; close to +24VDC to reset STEPPER count for gun 2 to zero; required if control is set to STOP AT END of STEPPER (see Section 6.6.5).*

I09 RESET COUNT2 – normally open; close to +24VDC to reset COUNTER for gun 2 to zero; required if control is set to STOP AT END of COUNTER (see Section 6.6.5).*

I10 RETRACT2 – normally open; close to +24VDC; depending on RETRACTION mode, switch used to open and close the arms of gun 2 to semi-open position (see Section 6.5.1).*

I11 RESET STEPPER1 – normally open; close to +24VDC to reset STEPPER count for gun 1 to zero; required if control is set to STOP AT END of STEPPER (see Section 6.6.5).*

I12 RESET COUNT1 – normally open; close to +24VDC to reset COUNTER for gun 1 to zero; required if control is set to STOP AT END of COUNTER (see Section 6.6.5).*

I13 RETRACT1 – normally open; close to +24VDC; depending on RETRACTION mode, switch used to open and close the arms of gun 1 to semi-open position (see Section 6.5.1).*

I14 RESET FAULT – normally open; if control is set to STOP AT FAULT, close this switch to +24VDC; after error is cleared, used to return control to normal operation (see Section 6.5.1).*

I15 2nd STAGE – connected to 2nd stage of dual stage foot switch; after initiating START, close to +24VDC to continue weld when parts are in place and ready to complete the weld. If not required for application, this input must be tied to +24VDC, as execution of a weld will not occur without closing this input to +24VDC.*

I16 EDIT DISABLE – normally open; close to +24VDC to disable programming from the RPP1 pendant (see Section 5.10).*

OUTPUTS (Q) (see Section 5.3.2)

Q01 WAV1 (WELD AIR VALVE) – +24VDC, 500mA maximum load; used to activate valve to close electrodes for gun 1; is active for SQUEEZE, WELD, and HOLD time (see Section 7.0 for timing diagrams).*+

Q02 WAV2 (WELD AIR VALVE) – +24VDC, 500mA maximum load; used to activate valve to close electrodes for gun 2; is active for SQUEEZE, WELD, and HOLD time (see Section 7.0 for timing diagrams).*+

* denotes additional function with SEQUENCER (see Section 6.6.6)
+ denotes additional function with EVENTS (see Section 6.6.4)

5.9.5 DUAL GUN OPERATION – INTERNAL PROGRAM SELECT (cont.)

Q03 HAV1 (HI-LIFT AIR VALVE) – +24VDC, 500mA maximum load; used for retraction to close weld arms of gun 1 to semi-open position (see Sections 7.0 and 6.5.1).*+

Q04 HAV2 (HI-LIFT AIR VALVE) – +24VDC, 500mA maximum load; used for retraction to close weld arms of gun 2 to semi-open position (see Sections 7.0 and 6.5.1).*+

Q05 END COUNT1 – +24VDC, 100mA maximum load; indicates that COUNTER1 has completed (see Section 6.6.5).*+

Q06 END STEPPER1 – +24VDC, 100mA maximum load; indicates that STEPPER1 has completed (see Section 6.6.5).*+

Q07 PRE-WARN1 – +24VDC, 100mA maximum load; indicates that WELD count for STEPPER1 is getting close to completion (see Section 6.6.5).*+

Q08 END COUNT2 – +24VDC, 100mA maximum load; indicates that COUNTER2 has completed (see Section 6.6.5).*+

Q09 END STEPPER2 – +24VDC, 100mA maximum load; indicates that STEPPER2 has completed (see Section 6.6.5).*+

Q10 PRE-WARN2 – +24VDC, 100mA maximum load; indicates that WELD count for STEPPER2 is getting close to completion (see Section 6.6.5).*+

Q11 not defined; +24VDC, 100mA maximum load *+

Q12 not defined; +24VDC, 100mA maximum load *+

Q13 EOS (END OF SEQUENCE) – +24VDC, 100mA maximum load; indicates END OF SEQUENCE when weld program has completely executed.*+

Q14 FAULT – +24VDC, 100mA maximum load; indicates FAULT/ERROR has occurred.*+

Q15 NOT READY – +24VDC, 100mA maximum load; indicates that control is not ready to weld and will not initiate.*+

Q16 CONTACTOR – +24VDC, 100mA maximum load; used to energize an isolation contactor; turns on at SQUEEZE time and remains on through welding sequence plus time programmed into CONTACTOR TIME in the Configuration menu (see Section 6.5.1). This output is not protected by control relay contacts.*+

5.9.6 DUAL GUN OPERATION – EXTERNAL BINARY PROGRAM SELECT MODE

INPUTS (I) (see Section 5.3.2)

I01 START1 – normally open; when closed to +24VDC, it closes control relays and initiates externally selected program (***P***) for gun 1; must remain closed through SQUEEZE time in order to completely execute the weld.

I02 START2 – normally open; when closed to +24VDC, it closes control relays and initiates externally selected program plus 32 (***P*+32**) for gun 2; must remain closed through SQUEEZE time in order to completely execute the weld.*

I03 START3 – not defined *

I04 START4 – not defined *

I05 P1 – normally open; when closed to +24VDC, it adds 1 to the total program select (see Section 5.9).*

I06 P2 – normally open; when closed to +24VDC, it adds 2 to the total program select (see Section 5.9).*

I07 P4 – normally open; when closed to +24VDC, it adds 4 to the total program select (see Section 5.9).*

I08 RESET STEPPER2 – normally open; close to +24VDC to reset STEPPER count for gun 2 to zero; required if control is set to STOP AT END of STEPPER (see Section 6.6.5).*

I09 RESET COUNT2 – normally open; close to +24VDC to reset COUNTER for gun 2 to zero; required if control is set to STOP AT END of COUNTER (see Section 6.6.5).*

I10 RETRACT2 – normally open; close to +24VDC; depending on RETRACTION mode, switch used to open and close the arms of gun 2 to semi-open position (see Section 6.5.1).*

I11 RESET STEPPER1 – normally open; close to +24VDC to reset STEPPER count for gun 1 to zero; required if control is set to STOP AT END of STEPPER (see Section 6.6.5).*

I12 RESET COUNT1 – normally open; close to +24VDC to reset COUNTER for gun 1 to zero; required if control is set to STOP AT END of COUNTER (see Section 6.6.5).*

I13 RETRACT1 – normally open; close to +24VDC; depending on RETRACTION mode, switch used to open and close the arms of gun 1 to semi-open position (see Section 6.5.1).*

I14 RESET FAULT – normally open; if control is set to STOP ON FAULT, close this switch to +24VDC; after error is cleared, used to return control to normal operation (see Section 6.5.1).*

I15 2nd STAGE – connected to 2nd stage of dual stage foot switch; after initiating START, close to +24VDC to continue weld when parts are in place and ready to complete the weld. If not required for application, this input must be tied to +24VDC, as execution of a weld will not occur without closing this input to +24VDC.*

I16 EDIT DISABLE – normally open; close to +24VDC to disable programming from the RPP1 pendant (see Section 5.10).*

OUTPUTS (Q) (see Section 5.3.2)

Q01 WAV1 (WELD AIR VALVE) – +24VDC, 500mA maximum load; used to activate valve to close electrodes for gun 1; is active for SQUEEZE, WELD, and HOLD time (see Section 7.0 for timing diagrams).*+

Q02 WAV2 (WELD AIR VALVE) – +24VDC, 500mA maximum load; used to activate valve to close electrodes for gun 2; is active for SQUEEZE, WELD, and HOLD time (see Section 7.0 for timing diagrams).*+

Q03 HAV1 (HI-LIFT AIR VALVE) – +24VDC, 500mA maximum load; used for retraction to close weld arms of gun 1 to semi-open position (see Sections 7.0 and 6.5.1).*+

Q04 HAV2 (HI-LIFT AIR VALVE) – +24VDC, 500mA maximum load; used for retraction to close weld arms of gun 2 to semi-open position (see Sections 7.0 and 6.5.1).*+

Q05 END COUNT1 – +24VDC, 100mA maximum load; indicates that COUNTER1 has completed (see Section 6.6.5).*+

Q06 END STEPPER1 – +24VDC, 100mA maximum load; indicates that STEPPER1 has completed (see Section 6.6.5).*+

Q07 PRE-WARN1 – +24VDC, 100mA maximum load; indicates that WELD count for STEPPER1 is getting close to completion (see Section 6.6.5).*+

Q08 END COUNT2 – +24VDC, 100mA maximum load; indicates that COUNTER2 has completed (see Section 6.6.5).*+

* denotes additional function with SEQUENCER (see Section 6.6.6)
+ denotes additional function with EVENTS (see Section 6.6.4)

5.9.6 DUAL GUN OPERATION – EXTERNAL BINARY PROGRAM SELECT (cont.)

Q09 END STEPPER2 – +24VDC, 100mA maximum load; indicates that STEPPER2 has completed (see Section 6.6.5).*+

Q10 PRE-WARN2 – +24VDC, 100mA maximum load; indicates that WELD count for STEPPER2 is getting close to completion (see Section 6.6.5).*+

Q11 not defined; +24VDC, 100mA maximum load *+

Q12 not defined; +24VDC, 100mA maximum load *+

Q13 EOS (END OF SEQUENCE) – +24VDC, 100mA maximum load; indicates END OF SEQUENCE when weld program has completely executed.*+

Q14 FAULT – +24VDC, 100mA maximum load; indicates FAULT/ERROR has occurred.*+

Q15 NOT READY – +24VDC, 100mA maximum load; indicates that control is not ready to weld and will not initiate.*+

Q16 CONTACTOR – +24VDC, 100mA maximum load; used to energize an isolation contactor; turns on at SQUEEZE time and remains on through welding sequence plus time programmed into CONTACTOR TIME in the Configuration menu (see Section 6.5.1). This output is not protected by control relay contacts.*+

5.9.7 DUAL GUN OPERATION – INTERNAL 1-OF-4 PROGRAM SELECT MODE

INPUTS (I) (see Section 5.3.2)

I01 START1 – normally open; when closed to +24VDC, it closes control relays and initiates program set in USE PROGRAM setting (***N***) for gun 1; must remain closed through SQUEEZE time in order to completely execute the weld.

I02 START2 – normally open; when closed to +24VDC, it closes control relays and initiates program set in USE PROGRAM setting plus 32 (***N*+32**) for gun 2; must remain closed through SQUEEZE time in order to completely execute the weld.*

I03 START3 – normally open; when closed to +24VDC, it closes control relays and initiates program set in USE PROGRAM setting plus 16 (***N*+16**) for gun 1; must remain closed through SQUEEZE time in order to completely execute the weld.*

I04 START4 – normally open; when closed to +24VDC, it closes control relays and initiates program set in USE PROGRAM setting plus 48 (***N*+48**) for gun 2; must remain closed through SQUEEZE time in order to completely execute the weld.*

I05 P1 – not defined *

I06 P2 – not defined *

I07 P4 – not defined *

I08 RESET STEPPER2 – normally open; close to +24VDC to reset STEPPER count for gun 2 to zero; required if control is set to STOP AT END of STEPPER (see Section 6.6.5).*

I09 RESET COUNT2 – normally open; close to +24VDC to reset COUNTER for gun 2 to zero; required if control is set to STOP AT END of COUNTER (see Section 6.6.5).*

I10 RETRACT2 – normally open; close to +24VDC; depending on RETRACTION mode, switch used to open and close the arms of gun 2 to semi-open position (see Section 6.5.1).*

I11 RESET STEPPER1 – normally open; close to +24VDC to reset STEPPER count for gun 1 to zero; required if control is set to STOP AT END of STEPPER (see Section 6.6.5).*

I12 RESET COUNT1 – normally open; close to +24VDC to reset COUNTER for gun 1 to zero; required if control is set to STOP AT END of COUNTER (see Section 6.6.5).*

I13 RETRACT1 – normally open; close to +24VDC; depending on RETRACTION mode, switch used to open and close the arms of gun 1 to semi-open position (see Section 6.5.1).*

I14 RESET FAULT – normally open; if control is set to STOP ON FAULT, close this switch to +24VDC; after error is cleared, used to return control to normal operation (see Section 6.5.1).*

I15 2nd STAGE – connected to 2nd stage of dual stage foot switch; after initiating START, close to +24VDC to continue weld when parts are in place and ready to complete the weld. If not required for application, this input must be tied to +24VDC, as execution of a weld will not occur without closing this input to +24VDC.*

I16 EDIT DISABLE – normally open; close to +24VDC to disable programming from the RPP1 pendant (see Section 5.10).*

OUTPUTS (Q) (see Section 5.3.2)

Q01 WAV1 (WELD AIR VALVE) – +24VDC, 500mA maximum load; used to activate valve to close electrodes for gun 1; is active for SQUEEZE, WELD, and HOLD time (see Section 7.0 for timing diagrams).*+

Q02 WAV2 (WELD AIR VALVE) – +24VDC, 500mA maximum load; used to activate valve to close electrodes for gun 2; is active for SQUEEZE, WELD, and HOLD time (see Section 7.0 for timing diagrams).*+

Q03 HAV1 (HI-LIFT AIR VALVE) – +24VDC, 500mA maximum load; used for retraction to close weld arms of gun 1 to semi-open position (see Sections 7.0 and 6.5.1).*+

Q04 HAV2 (HI-LIFT AIR VALVE) – +24VDC, 500mA maximum load; used for retraction to close weld arms of gun 2 to semi-open position (see Sections 7.0 and 6.5.1).*+

Q05 END COUNT1 – +24VDC, 100mA maximum load; indicates that COUNTER1 has completed (see Section 6.6.5).*+

Q06 END STEPPER1 – +24VDC, 100mA maximum load; indicates that STEPPER1 has completed (see Section 6.6.5).*+

Q07 PRE-WARN1 – +24VDC, 100mA maximum load; indicates that WELD count for STEPPER1 is getting close to completion (see Section 6.6.5).*+

Q08 END COUNT2 – +24VDC, 100mA maximum load; indicates that COUNTER2 has completed (see Section 6.6.5).*+

Q09 END STEPPER2 – +24VDC, 100mA maximum load; indicates that STEPPER2 has completed (see Section 6.6.5).*+

Q10 PRE-WARN2 – +24VDC, 100mA maximum load; indicates that WELD count for STEPPER2 is getting close to completion (see Section 6.6.5).*+

Q11 not defined; +24VDC, 100mA maximum load *+

Q12 not defined; +24VDC, 100mA maximum load *+

Q13 EOS (END OF SEQUENCE) – +24VDC, 100mA maximum load; indicates END OF SEQUENCE when weld program has completely executed.*+

Q14 FAULT – +24VDC, 100mA maximum load; indicates FAULT/ERROR has occurred.*+

Q15 NOT READY – +24VDC, 100mA maximum load; indicates that control is not ready to weld and will not initiate.*+

* denotes additional function with SEQUENCER (see Section 6.6.6)
+ denotes additional function with EVENTS (see Section 6.6.4)

5.9.7 DUAL GUN OPERATION – INTERNAL 1-OF-4 PROGRAM SELECT (cont.)

Q16 CONTACTOR – +24VDC, 100mA maximum load; used to energize an isolation contactor; turns on at SQUEEZE time and remains on through welding sequence plus time programmed into CONTACTOR TIME in the Configuration menu (see Section 6.5.1). This output is not protected by control relay contacts.*+

5.9.8 DUAL GUN OPERATON – EXTERNAL BINARY 1-OF-4 PROGRAM SELECT

INPUTS (I) (see Section 5.3.2)

I01 START1 – normally open; when closed to +24VDC, it closes control relays and initiates externally selected program (***P***) for gun 1; must remain closed through SQUEEZE time in order to completely execute the weld.

I02 START2 – normally open; when closed to +24VDC, it closes control relays and initiates externally selected program plus 32 (***P*+32**) for gun 2, must remain closed through SQUEEZE time in order to completely execute the weld.*

I03 START3 – normally open; when closed to +24VDC, it closes control relays and initiates externally selected program plus 16 (***P*+16**) for gun 1; must remain closed through SQUEEZE time in order to completely execute the weld.*

I04 START4 – normally open; when closed to +24VDC, it closes control relays and initiates externally selected program plus 48 (***P*+48**) for gun 2; must remain closed through SQUEEZE time in order to completely execute the weld.*

I05 P1 – normally open; when closed to +24VDC, it adds 1 to the total program select (see Section 5.9).*

I06 P2 – normally open; when closed to +24VDC, it adds 2 to the total program select (see Section 5.9).*

I07 P4 – normally open; when closed to +24VDC, it adds 4 to the total program select (see Section 5.9).*

I08 RESET STEPPER2 – normally open; close to +24VDC to reset STEPPER count for gun 2 to zero; required if control is set to STOP AT END of STEPPER (see Section 6.6.5).*

I09 RESET COUNT2 – normally open; close to +24VDC to reset COUNTER for gun 2 to zero; required if control is set to STOP AT END of COUNTER (see Section 6.6.5).*

I10 RETRACT2 – normally open; close to +24VDC, depending on RETRACTION mode, switch used to open and close the arms of gun 2 to semi-open position (see Section 6.5.1).*

I11 RESET STEPPER1 – normally open; close to +24VDC to reset STEPPER count for gun 1 to zero; required if control is set to STOP AT END of STEPPER (see Section 6.6.5).*

I12 RESET COUNT1 – normally open; close to +24VDC to reset COUNTER for gun 1 to zero; required if control is set to STOP AT END of COUNTER (see Section 6.6.5).*

I13 RETRACT1 – normally open; close to +24VDC; depending on RETRACTION mode, switch used to open and close the arms of gun 1 to semi-open position (see Section 6.5.1).*

I14 RESET FAULT – normally open; if control is set to STOP AT FAULT, close this switch to +24VDC; after error is cleared, used to return control to normal operation (see Section 6.5.1).*

I15 2nd STAGE – connected to 2nd stage of dual stage foot switch; after initiating START, close to +24VDC to continue weld when parts are in place and ready to complete the weld. If not required for application, this input must be tied to +24VDC, as execution of a weld will not occur without closing this input to +24VDC.*

I16 EDIT DISABLE – normally open; close to +24VDC to disable programming from the RPP1 pendant (see Section 5.10).*

OUTPUTS (Q) (see Section 5.3.2)

Q01 WAV1 (WELD AIR VALVE) – +24VDC, 500mA maximum load; used to activate valve to close electrodes for gun 1; is active for SQUEEZE, WELD, and HOLD time (see Section 7.0 for timing diagrams).*+

Q02 WAV2 (WELD AIR VALVE) – +24VDC, 500mA maximum load; used to activate valve to close electrodes for gun 2; is active for SQUEEZE, WELD, and HOLD time (see Section 7.0 for timing diagrams).*+

Q03 HAV1 (HI-LIFT AIR VALVE) – +24VDC, 500mA maximum load; used for retraction to close weld arms of gun 1 to semi-open position (see Sections 7.0 and 6.5.1).*+

Q04 HAV2 (HI-LIFT AIR VALVE) – +24VDC, 500mA maximum load; used for retraction to close weld arms of gun 2 to semi-open position (see Sections 7.0 and 6.5.1).*+

Q05 END COUNT1 – +24VDC, 100mA maximum load; indicates that COUNTER1 has completed (see Section 6.6.5).*+

Q06 END STEPPER1 – +24VDC, 100mA maximum load; indicates that STEPPER1 has completed (see Section 6.6.5).*+

Q07 PRE-WARN1 – +24VDC, 100mA maximum load; indicates that WELD count for STEPPER1 is getting close to completion (see Section 6.6.5).*+

Q08 END COUNT2 – +24VDC, 100mA maximum load; indicates that COUNTER2 has completed (see Section 6.6.5).*+

Q09 END STEPPER2 – +24VDC, 100mA maximum load; indicates that STEPPER2 has completed (see Section 6.6.5).*+

Q10 PRE-WARN2 – +24VDC, 100mA maximum load; indicates that weld count for STEPPER2 is getting close to completion (see Section 6.6.5).*+

Q11 not defined; +24VDC, 100mA maximum load *+

Q12 not defined; +24VDC, 100mA maximum load *+

Q13 EOS (END OF SEQUENCE) – +24VDC, 100mA maximum load; indicates END OF SEQUENCE when weld program has completely executed.*+

Q14 FAULT – +24VDC, 100mA maximum load; indicates FAULT/ERROR has occurred.*+

Q15 NOT READY – +24VDC, 100mA maximum load; indicates that control is not ready to weld and will not initiate.*+

Q16 CONTACTOR – +24VDC, 100mA maximum load; used to energize an isolation contactor; turns on at SQUEZZE time and remains on through welding sequence plus time programmed into CONTACTOR TIME in the Configuration menu (see Section 6.5.1). This output is not protected by control relay contacts.*+

* denotes additional function with SEQUENCER (see Section 6.6.6)
+ denotes additional function with EVENTS (see Section 6.6.4)

5.10 PROGRAM LOCKOUT (PLS)

Normally, a user can access the parameters via the keypad on the RPP1 programming pendant, and make any changes as required. Under some circumstances, it may be desirable to prevent such general access.

The EN1701 provides an input called PROGRAM LOCKOUT, which can be used to block all parameter edits. With this input on, it will still be possible to view parameters, but no changes are permitted via the keypad. If edits are attempted, the display will briefly show **** EDITS DISABLED **** and the edit will be blocked.

It is suggested that this input is controlled via a key switch, such that only the key-holder is able to open the switch, and thus be able to edit parameters.

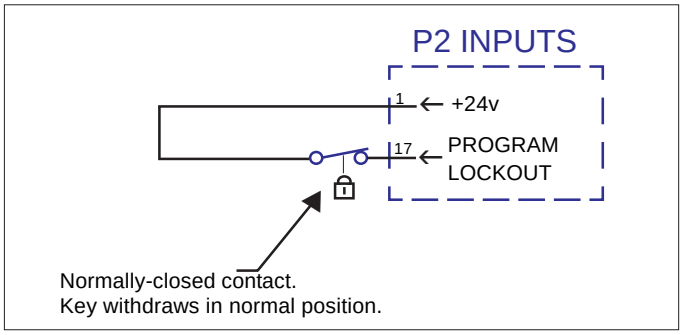


Figure 5-5. *PLS connections*

Figure 5-6. *PLS*

If this feature is not required, simply leave this input unconnected.

Weld controls can be ordered with this switch by ordering Program Lockout Switch (PLS) option.

5.11 OPERATION MODE SWITCH (OMS) (PROGRAM LOCKOUT AND WELD/NO WELD)

Normally, a user can access the parameters via the keypad on the RPP1 programming pendant, and make any changes as required. Under some circumstances, it may be desirable to prevent such general access. Also it is sometimes desirable to initiate a sequence as programmed without weld current for setup purposes.

The EN1701 provides an input called PROGRAM LOCKOUT, which can be used to block all parameter edits. With this input on, it will still be possible to view parameters, but no changes are permitted via the keypad. If edits are attempted, the display will briefly show **** EDITS DISABLED **** and the edit will be blocked.

Figure 5-7. *OMS*

5.11 OPERATION MODE SWITCH (OMS) (cont.)

The EN1701 also provides an input for WELD ON. P1-5 must be connected to +24 VDC for a weld to be made in a sequence.

It is suggested that this input is controlled via a key switch, such that only the key-holder is able to open the switch, and thus be able to edit parameters.

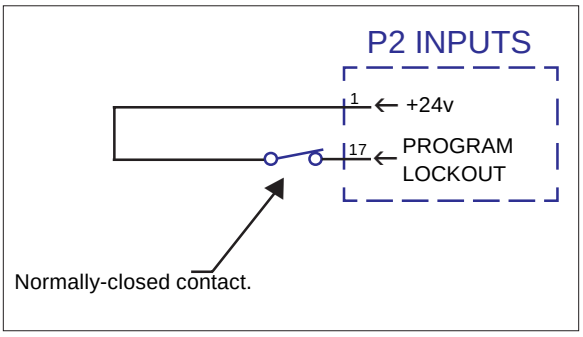


Figure 5-8. *OMS P2 connections*

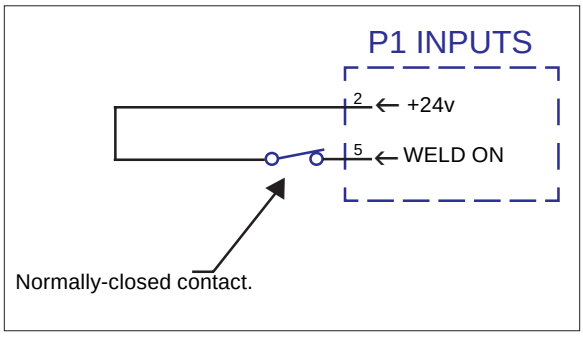


Figure 5-9. *OMS P1 connections*

When PROGRAM LOCKOUT is not required, simply leave this input unconnected. When WELD ON is not required, simply jumper P1-5 (WELD ON) to P1-2 (+24v).

Weld controls can be ordered with this option by ordering the Operation Mode Switch (OMS) option.

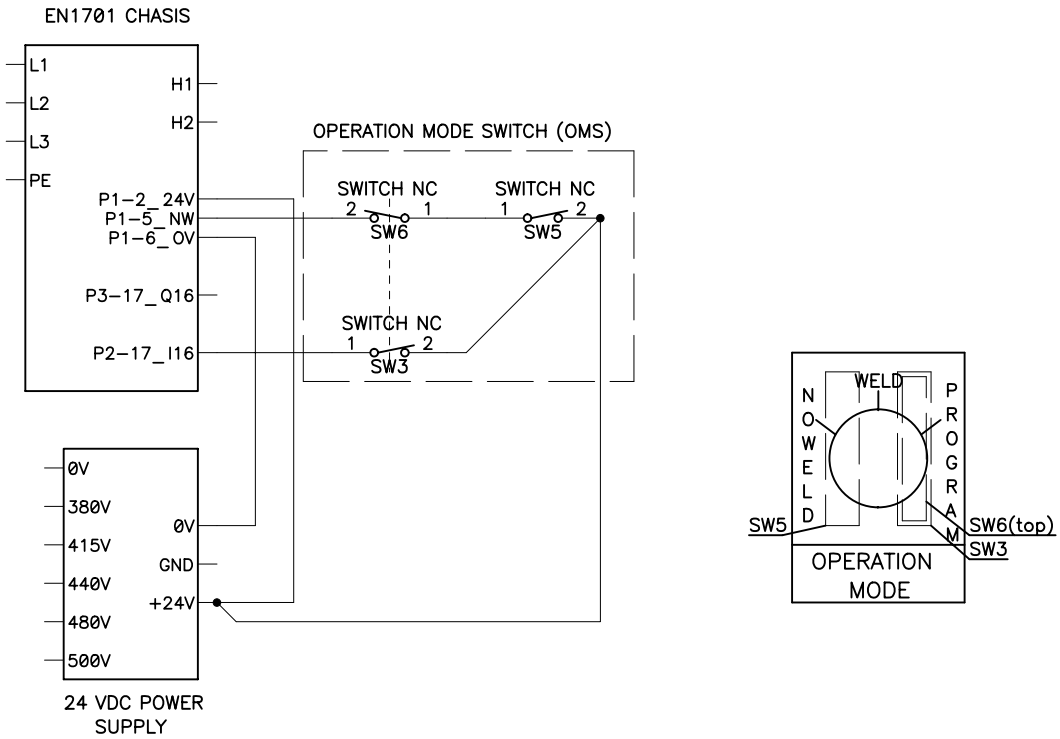


Figure 5-10. *Operation Mode Switch (OMS) schematic*

6.0 PROGRAMMING

6.1 KEYPAD

Using the keypad

- Press the **F** (function) key to return to the previous screen, or to move between menu screens (see Section 6.2 Menus).
- The selected function or parameter will flash.
- Use the ←, ↑, ↓, or → keys to select a different function or parameter. The visible window will scroll when required.
- Press the ↵ key to access the selected function.
- Press the **+** or **-** key to change the selected parameter. Press **+** and **-** keys together to set a parameter to 0 or its minimum value.
- On some screens, certain keys can have a special function. These are noted in the section describing that screen.

Figure 6-1. *RPP1 keypad*

6.2 MENUS

The various functions of the EN1701 are arranged into a set of menus and screens. This diagram shows how these are organized and accessed:

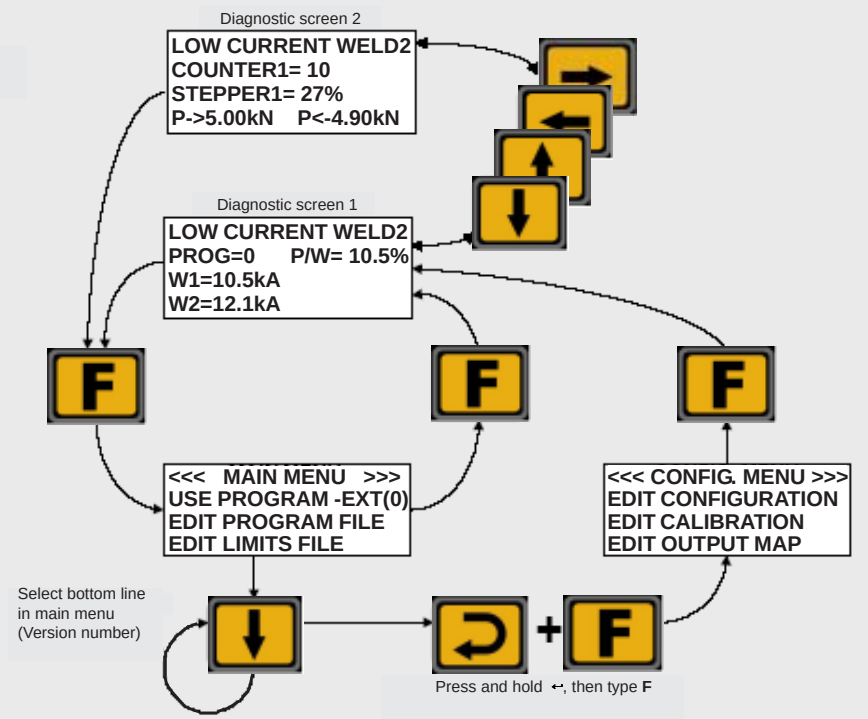


Figure 6-2. *Menu access*

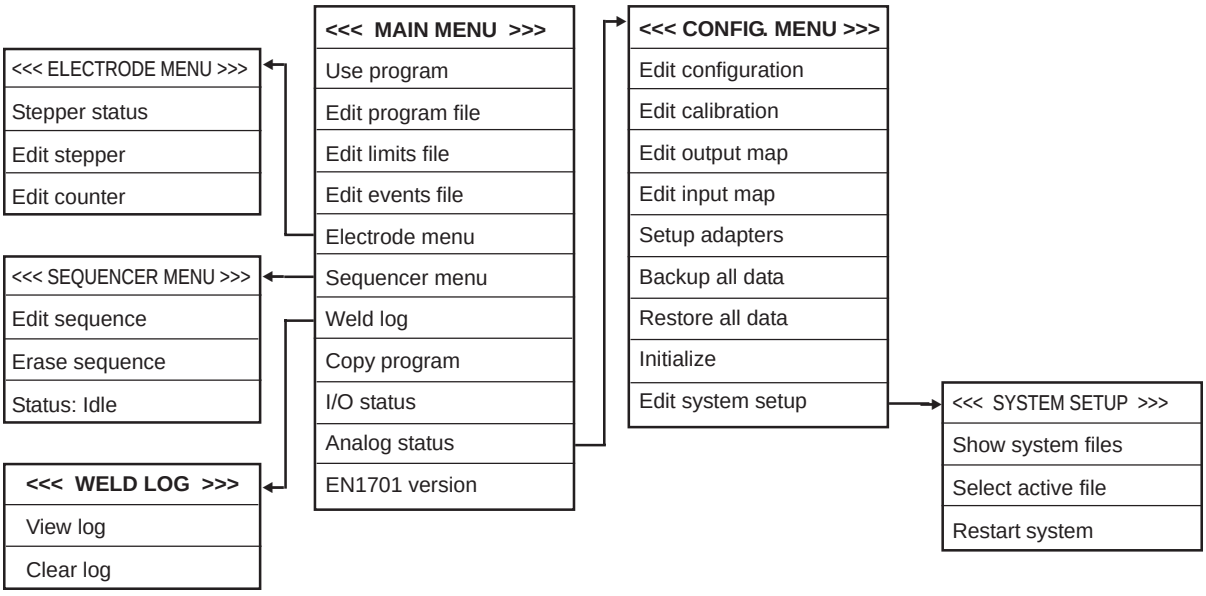
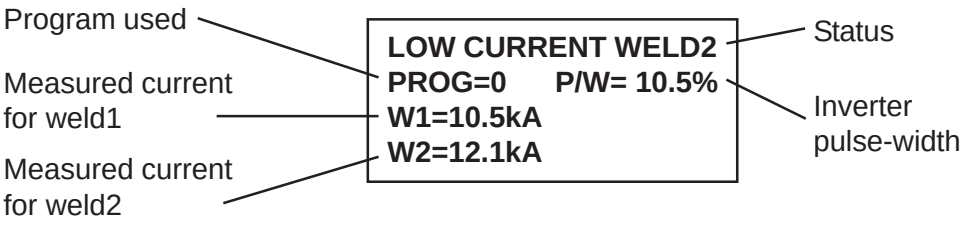


Figure 6-3. *Menu organization*

6.3 DIAGNOSTIC SCREEN 1



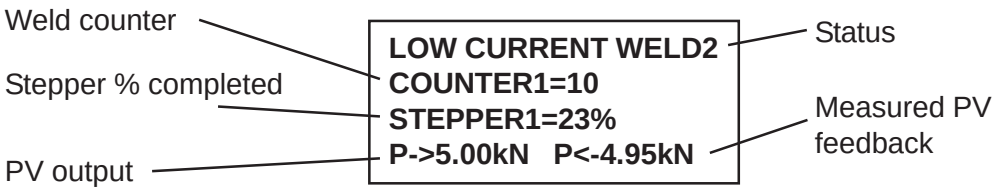
NOTICE

Some elements may not be visible, if that feature is not being used.

Status: Diagnostic error messages. If more than one exists, these are flashed sequentially.
Program used: This is the program number that was last used.
Pulse-width: The inverter output pulse-width, as a percentage of maximum, measured during the last weld.
Measured current: The RMS current measured during the last weld.

- Press ↵key to reset faults (same action as external input). The counters will also be reset if they have reached the end of count.
- Press ↑, ↓, ← or → key to change to Diagnostic screen 2.

6.4 DIAGNOSTIC SCREEN 2



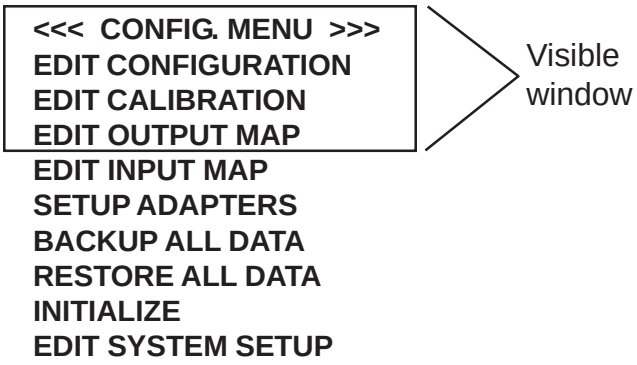
NOTICE

Some elements may not be visible, if that feature is not being used.

Status: Diagnostic error messages. If more than one exists, these are flashed sequentially.
Weld counter: The present value in the counter (updates after each weld).
Stepper % complete: Shows the progress along the stepping curve.
PV output: The output from the PV controller is determined by the pressure parameter in the selected program.
Measured PV feedback: The dynamic value measured from the feedback channel.

- Press ↵key to reset faults (same action as external input). The counters will also be reset if they have reached the end of count.
- Press ↑, ↓, ← or → key to change to Diagnostic screen 1.

6.5 CONFIGURATION MENU



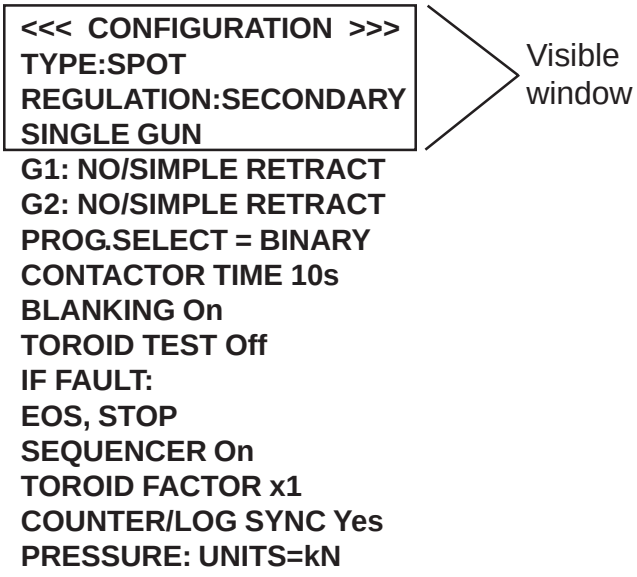
NOTICE

After changing the configuration, you must restart the EN1701 before your changes will take effect.

You can restart the control by cycling the power or via the System Setup menu.

To access the Configuration menu, select the **VERSION** line on the Main menu (last line), hold down the ↵ key, then press the **F** key.

6.5.1 EDIT CONFIGURATION



NOTICE

After changing the configuration, you must restart the EN1701 before your changes will take effect.

The diagnostic message CONFIG. CHANGED will appear, and further welding will not be permitted until the control is restarted.

You can restart the control by cycling the power or via the System Setup menu.

6.5.1 EDIT CONFIGURATION (cont.)

- SEQUENCE TYPE: **SPOT / ROLL-SPOT / SEAM (DUAL HEAT) / SEAM (PRE-HEAT)**.

- REGULATION **(PRIMARY/SECONDARY)**: Specifies where the inverter closed loop control feedback is obtained from.

- **SINGLE GUN / DUAL GUN**: The number/type of welding guns to be controlled.

- RETRACT: **SIMPLE / HI-LIFT+ / HI-LIFT-**. Set to **SIMPLE** if not required. One independent setting for each gun.

- PROGRAM SELECT: **BINARY / 1-OF-4**. Sets the method of program selection.

NOTICE
When operating in SEAM mode, **only** BINARY program selection can be used.

- CONTACTOR TIME (**0 to 200 s**): This is the delay (in seconds) after a weld, before the contactor output is turned off. Set to 0 if not required.

- BLANKING (**On/Off**): When set to **On**, the first 50 ms of weld current will be excluded from the measurement and limit testing process.

- COIL/TOROID TEST (**On/Off**): When set to **On**, the resistance of the coil/toriod is tested while the EN1701 is idle. The resistance must lie between 10 and 300 Ohms. Values outside this range will prevent the control from starting.

- IF FAULT **(CONTINUE/STOP/HEAD-LOCK/EOS/NO EOS)**: If **HEAD-LOCK** is selected, then when a weld fault is detected, the weld airvalve signal is held on and no further welds are permitted, until a fault reset is given. If **STOP** is selected, then when a weld fault is detected, the weld airvalve opens as normal, but no further welds are permitted, until a fault reset is given. If **CONTINUE** is selected, then further welds will be permitted, regardless of the status of the previous weld. If **EOS** is selected, then the EOS signal is always given. If **NO EOS** is selected, then no EOS signal is given when there is a weld fault.

- SEQUENCER **(On/Off)**: If **On** is selected, then the sequencer is active, and welds are started via sequencer statements. If **Off** is selected, then the sequencer is disabled, and welds can be started via the START input.

- COIL/TOROID FACTOR: The ratio of the external attenuator which is required to measure currents>60 kA.

- COUNTER/LOG SYNC: If set to **Yes**, then the log will be cleared when a counter is reset. If set to **No**, then the log and counters are independent.

- PRESSURE UNITS (kN/lbf): This selects the units for all pressure related functions.

6.5.2 EDIT CALIBRATION

```
<<< CALIBRATION 1 >>>
TOROID: 150 mV/kA
MAX.PRI.AMPS 600 A
S/P RATIO 50:1
Pt1: 15.1kA
    @80.0% [AUTO LOAD]
Pt2: 5.40kA
    @20.0% [AUTO LOAD]
PRESSURE:
Pt1: 10.0kN @ 100%
Pt2: 0.00kN @ 0/0%
```

Visible window

NOTICE

There are separate calibration menus for each gun in a dual-gun system.

- **COIL/TOROID:** Sensitivity of the measuring coil, expressed in mV/kA. **Important:** When calibrating coil sensitivity, configure for primary regulation and use CCu mode for welding.
- **MAX.PRI.AMPS:** This must be set to the maximum transformer primary current or maximum inverter current, whichever is the smaller.
- **S/P RATIO:** This must be set equal to the turns-ratio of the welding transformer.
- **PT1/PT2:** The relationship between the %heat output and actual current is expressed by entering two "test" point values, which then define straight-line relationships. PT1 and PT2 will be the lower and upper pressure limits.
- **PRESSURE:** Relationship between the PV controller output and actual tip force. This is expressed by entering two "test" point values, which then define a straight-line relationship.

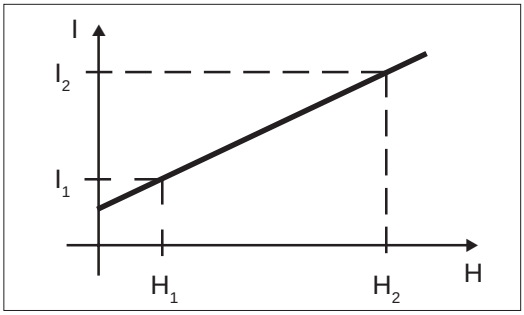


Figure 6-4. *Calibration set points*

EN1701 current calibration includes secondary current measure calibration and current regulation accuracy calibration.

SECONDARY CURRENT MEASURE CALIBRATION

If coil sensitivity is available, do the following:

1. Attach secondary coil as described in Section 5.3 and power up EN1701.
2. Using RPP1, go to **CONGIF.MENU** by depressing **F** key to get to the Main menu; then, on either the top or bottom line of the menu, hold down ↵ key and depress **F** key.
3. Go to **EDIT CONFIGURATION** by scrolling to it and pressing ↵ key.
4. Go to **TOROID** by scrolling and set coil sensitivity (mV/kA).

6.5.2 EDIT CALIBRATION (cont.)

If coil sensitivity is not available, calibrate the inverter as follows:

1. Before calibration, check and make sure **BLANKING** setting is the same as standard current meter or weld scope setting. Program a weld schedule which sets inverter working on **CCu** mode, high percentage current (recommend 80%, 200mS).
2. Attach secondary coil as described in Section 5.3 and power up EN1701.
3. Using RPP1, go to **CONGIF.MENU** by depressing **F** key to get to the Main menu; then, on either the top or bottom line of the menu, hold down ↵ key and depress **F** key.
4. Go to **EDIT CONFIGURATION** by scrolling to it and pressing ↵ key.
5. Go to **MAX.PRI.AMPS** by scrolling and set the maximum primary current.
6. Go to **S/P RATIO** by scrolling and set transformer turns ratio.
7. Go to **TOROID** by scrolling and set initial value for coil sensitivity (mV/kA).
8. Do a weld and compare the current readings from standard current meter and Pop-up Meter on the RPP1. If reading from RPP1 is higher than reading from standard current meter, increase the value of coil sensitivity. If reading from RPP1 is lower than reading from standard current meter, decrease the value of coil sensitivity.
9. Repeat step 8 until RPP1 reading agrees with reading from standard current meter.

NOTICE

The EN1701 coil input circuitry can operate with a maximum of 9 volts. CALIBRATION ERROR message will be displayed if the coil generates and sends a voltage signal greater than 9 volts. Coil maximum output can be calculated by the following formula:

Coil maximum output = Maximum primary current x Transformer's turns ratio x Coil sensitivity

If the maximum primary current, transformer's turns ratio and coil sensitivity settings lead to coil maximum output exceeding the limit value, a weld program will not be triggered and CALIBRATION ERROR message will be displayed.

CURRENT REGULATION ACCURACY CALIBRATION

To calibrate the current regulation accuracy, do the following:

1. Before calibration, check and make sure **BLANKING** setting is the same as standard current meter or weld scope setting. Also make sure **MAX.PRI.AMPS, S/P RATIO** and **TOROID** sensitivity have been set to the correct values.
2. Do a weld at a low heat (H1) in **CCu** mode (recommend 20%, 200mS). The EN1701 measures the secondary current (I1). This value can be observed on Diagnostic screen or via Pop-up Meter window.
3. Select [**AUTO LOAD**] for point 1 (**Pt1**) on the Calibration screen, then press the ↵ key. This will automatically load the measured values into the Calibration menu.
4. Do a weld at a high heat (H2) in **CCu** mode (recommend 80%, 200mS). The EN1701 measures the secondary current (I2). This value can be observed on Diagnostic screen or via Pop-up Meter window.
5. Select [**AUTO LOAD**] for point 2 (**Pt2**) on the Calibration screen, then press the ↵ key. This will automatically load the measured values into the Calibration menu.

6.5.3 EDIT OUTPUT MAP

<<< OUTPUT MAP >>>
Q01: WAV1
Q02: MOTOR
Q03: HAV1
Q04: Reserved
Q05: COUNTER1
Q06: STEPPER1
Q07: PRE-WARN1
Q08: Reserved
Q09: Reserved
Q10: Reserved
Q11: EVENT
Q12: SEQUENCER
Q13: EOS
Q14: FAULT
Q15: SEQUENCER
Q16: CONTACTOR

Each output may be independently set up as ***either***:

the standard function assigned (see Section 5.3),
or as an EVENT output,
or as a SEQUENCER output.

When an output is mapped to EVENT, it may be programmed to operate at any point in the welding sequence, via an EVENT program.

When an output is mapped to SEQUENCER, it may be programmed to operate under the control of the SEQUENCER program.

6.5.4 EDIT INPUT MAP

<<< INPUT MAP >>>
I01: START1
I02: START2
I03: START3
I04: START4
I05: P1
I06: P2
I07: P4
I08: P8
I09: P16
I10: P32
I11: RESET STEP.1
I12: RESET COUNT1
I13: RETRACT
I14: RESET FAULT
I15: 2nd STAGE
I16: EDIT DISABLE

Each input may be independently set up as ***either***:

the standard function assigned (see Section 5.3)
or as a SEQUENCER input.

When an input is mapped to SEQUENCER, it may be used as part of the SEQUENCER program.

Note that input I01 has a special function and may only be mapped to standard.

6.5.5 SETUP ADAPTERS

```
<<< ADAPTERS >>>
SLOT 1    Ethernet 1.01
SLOT 2
```

The EN1701 CPU can be configured with up to two adapter cards, to provide additional functions.

These are installed into two positions, referred to as Slot 1 and Slot 2.

This screen can be used to:

- Show what type of adapter cards are fitted.
- Access any parameters required by that adapter.

NOTICE

Some adapters do not require any parameters.

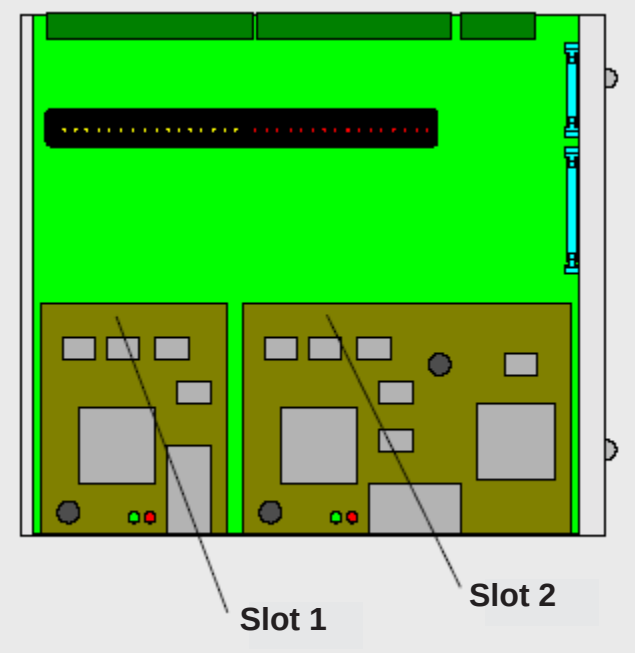


Figure 6-5. *View of CPU with cover removed and two adapter cards installed*

6.5.6 BACKUP/RESTORE

The **BACKUP** and **RESTORE** functions provide a convenient means of transferring all of your settings from one EN1701 control to another.

BACKUP: Use this function to make a copy of all of your data. The copy is held within the RPP1 pendant. No data in the EN1701 is changed. Note that only one backup can be stored in the RPP1, and that this is overwritten each time the BACKUP function is used.

RESTORE: Use this function to restore all of your data in the EN1701 from a backup stored in the RPP1 pendant. Note that this operation will overwrite all data which was previously stored in the EN1701. After the RESTORE operation, the backup remains in the RPP1.

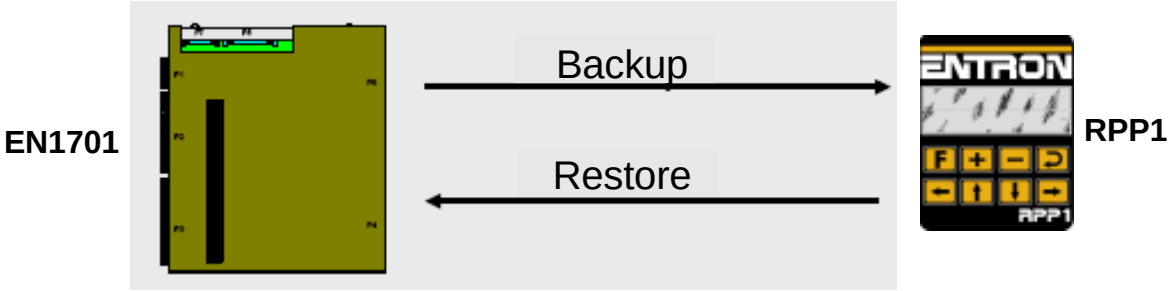


Figure 6-6. *BACKUP and RESTORE functions*

6.5.7 INITIALIZE

The **INITIALIZE** function provides a convenient means of setting all of the data in the EN1701 to a known initial state. This can be useful when first setting up a system.

! CAUTION !
When you use the **INITIALIZE** function, you will lose all previously stored data in the EN1701.

NOTICE
Sequence data is not cleared with INITIALIZE function (see Section 6.6.6)

After an INITIALIZE operation, you should edit the Configuration menus (Configuration, Calibration, Mapping, etc.) to suit your installation. You will then need to set up any welding programs, etc., which you wish to use.

6.5.8 SYSTEM SETUP MENU

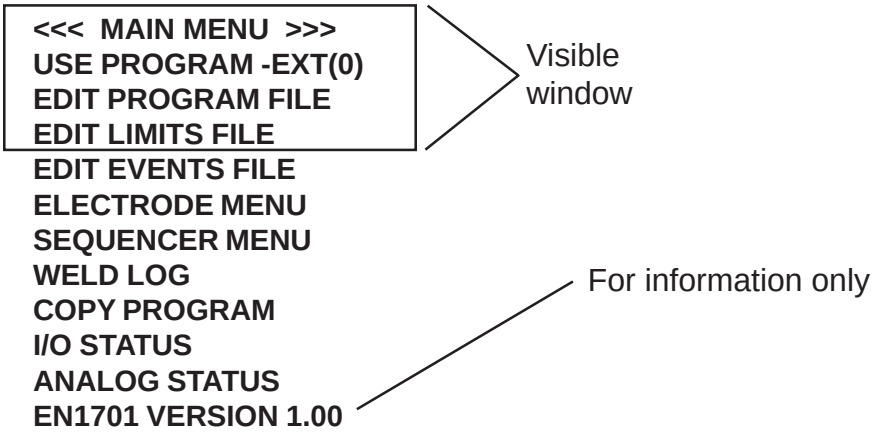
```
<<< SYSTEM SETUP >>>
SHOW SYSTEM FILES
SELECT ACTIVE FILE
RESTART SYSTEM
```

The EN1701 CPU is equipped with two memories, which can be used to store two versions of the operating firmware files. The Edit System Setup menu provides a number of functions for examining and selecting these files.

! CAUTION !
These functions should only be used by trained and experienced personnel, as improper use could render the EN1701 inoperable.

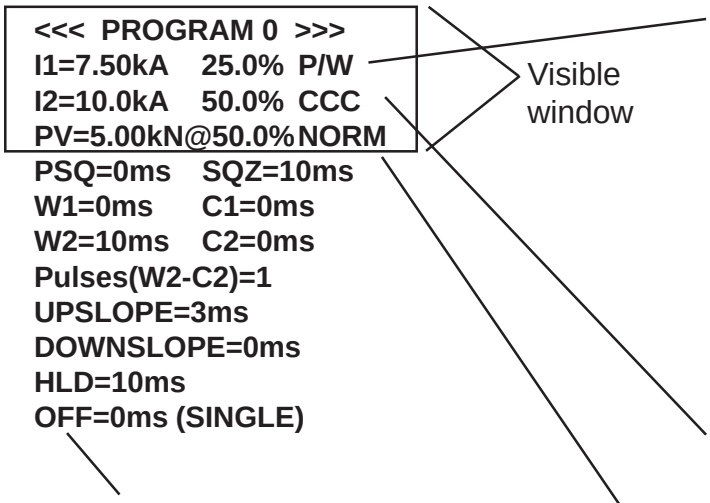
NOTICE
The EN1701 will not operate while this menu is selected.

6.6 MAIN MENU



To access the Configuration menu, select the **VERSION** line on the Main menu (last line), hold down the ↵ key, then press the **F** key.

6.6.1 EDIT PROGRAM



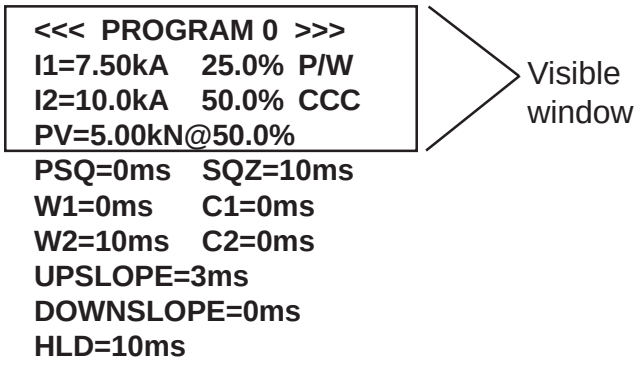
P/W=Constant **P**ulse-**W**idth mode. The current and heat parameters are independently adjustable. The inverter pulse-width is fixed. The current parameter is used for monitoring only.
CCu=**C**onstant **C**urrent **u**ncalibrated mode. The current and heat parameters are independently adjustable. Actual current is determined by the inverter. The current parameter is used for monitoring only.
CCC=**C**onstant **C**urrent **C**alibrated mode. The current parameter (in kA) is adjustable, but the heat is automatically determined by the EN1701 from the calibration data.
NORM = **NORM**al spot weld operation.
LINK = **LINK**ed spot operation.

NOTICE

Set ***OFF*** time to 0 for SINGLE SPOT operation.
If ***OFF*** time>0, then REPEAT operation will occur.

LINKed operation provides a means of chaining programs together so that a single start signal generates a sequence of programs. At the end of a linked program, the next program (numerically ascending) is automatically selected and run, and so on, until either a program set to **NORM**al, or the last program (63) is reached.

6.6.2 EDIT PROGRAM (SEAM)

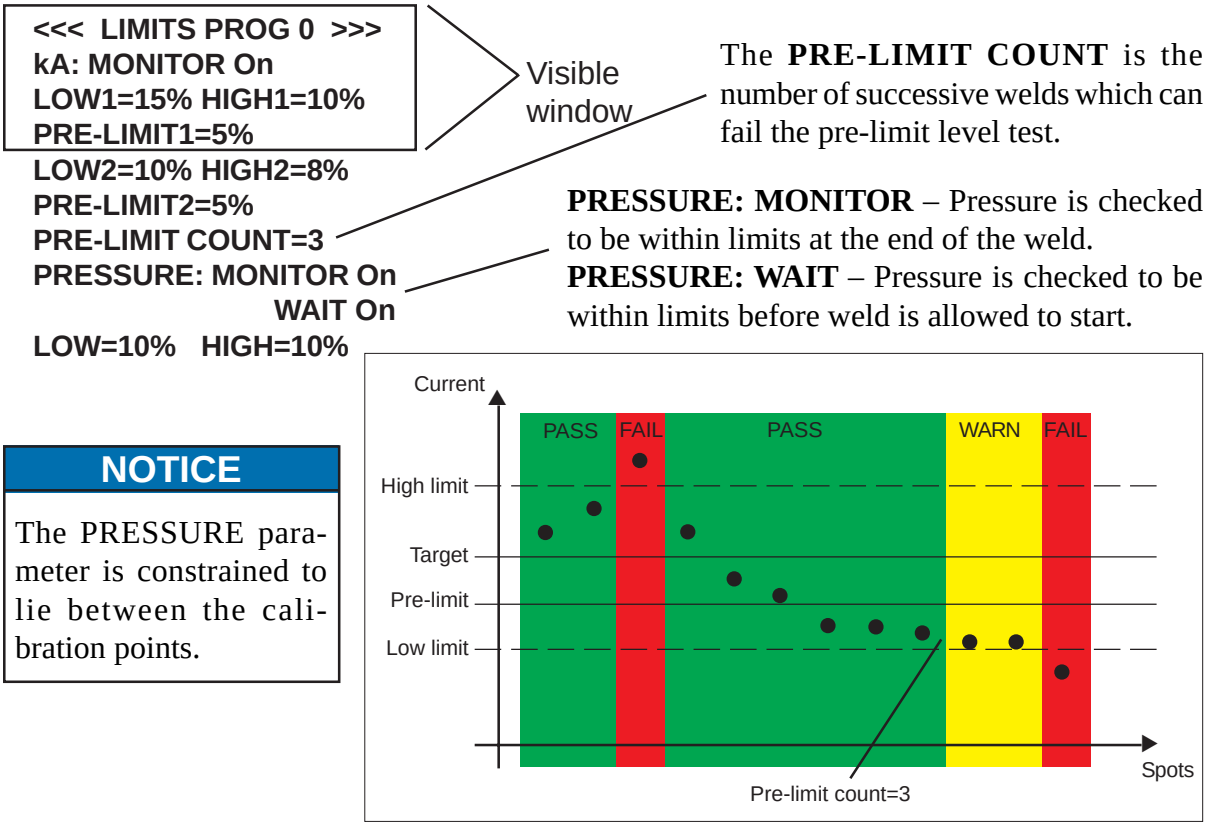


If the EN1701 is configured for seam welding, then the program screen changes as shown, in order to present only the relevant parameters.

! CAUTION !

When using a MF system for seam welding, the duty is effectively 100%.
Make sure that the transformer/rectifier are correctly specified for this duty.

6.6.3 EDIT LIMITS

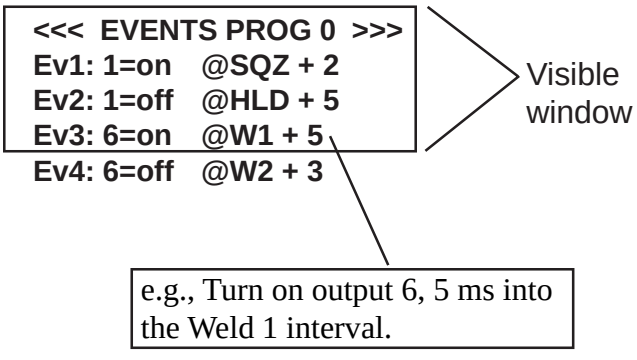


NOTICE

The PRESSURE parameter is constrained to lie between the calibration points.

Figure 6-7. *Limits*

6.6.4 EDIT EVENTS



- Each welding program may have up to 4 EVENTS defined.
- Each EVENT can turn one output on or off.
- To disable an EVENT, set its output to "?."

NOTICE

The outputs used must be mapped to EVENT for correct operation (see Section 6.5.3 Edit Output Map).

6.6.5 ELECTRODE MENU

```
<<< ELECTRODE MENU >>>
ELECTRODE STATUS
EDIT STEPPER
EDIT COUNTER
```

Electrode management is provided via a combination of STEPPER and COUNTER functions.

The STEPPER provides a means of gradually increasing the current, to compensate for electrode wear. Two STEPPERS are provided, one per gun.

A STEPPER is programmed by means of a curve which will provide values of heat and current increments related to the number of spots done. The curve is defined by a set of 10 points. The EN1701 provides interpolation between these points.

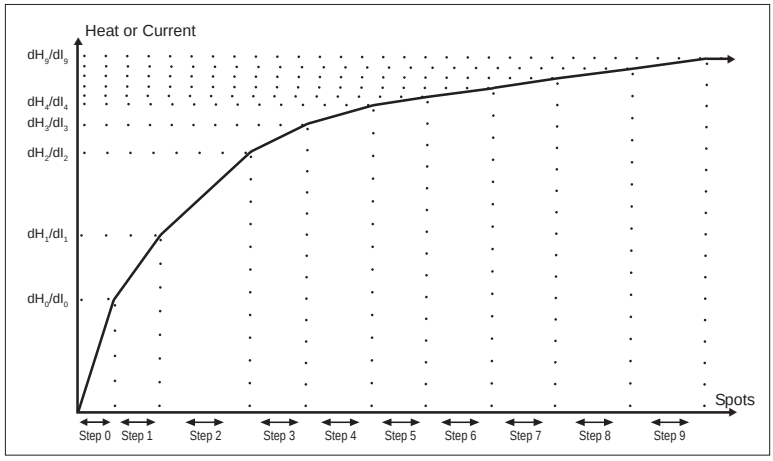


Figure 6-8. *Stepper curve*

ELECTRODE STATUS

```
< STATUS ELECTRODE 1 >
SPOTS = 45 (12%)
[RESET]
dH=2.5%
dI=500A
```

Select 1 for gun 1, or 2 for gun 2 (dual-gun mode only).

Visible window

The percentage done of the total number of spots, also shown as a bar graph.

The number of spots made since the last reset. This may be changed to alter the working position on the curve.

Select this field and press ↵ to reset this STEPPER (same function as external input).

dH=additional %heat being applied (+HEAT from table).

dI=additional current being applied (+A from table).

Outputs:

Output “End of stepper” comes on at the end of the last step.

Output “Prewarn” comes on during the last step.

If tip-dressing is on, then the outputs behave differently (see Edit Counter on page 71).

6.6.5 ELECTRODE MENU (cont.)

EDIT STEPPER

```
<<< STEPPER 1 on >>>
CONTINUE AT END
SPOTS    +HEAT   +A
0:   10   1.0%    100 A
1:   50   1.5%    200 A
2:   100  2.0%    300 A
3:   100  2.5%    400 A
4:   100  3.0%    500 A
5:   100  3.5%    600 A
6:   100  4.0%    700 A
7:   100  4.5%    800 A
8:   150  5.0%    900 A
9:   200  5.5%    1000 A
[PRESET #3]
```

Visible window

Enable or disable the STEPPER.

If **CONTINUE AT END** is selected, then at the end of the last step, further welding can take place as normal, but the STEPPER output will remain on. There is no further increase in current.

If **STOP AT END** is selected, then no further welding may take place until a STEPPER reset is given.

NOTICE

P/W and CCu modes will make use of both the +HEAT(dH) and +AMPS(dI) parameters. CCC mode uses only the +A(dI) parameter, as the heat is self-adjusting.

QUICK SET-UP: Enter values in step 9 only, to define the finishing point, select the PRESET field, edit the preset number (see STEPPER Presets below), and then press ↵ to load this STEPPER with a preset curve.

STEPPER PRESETS

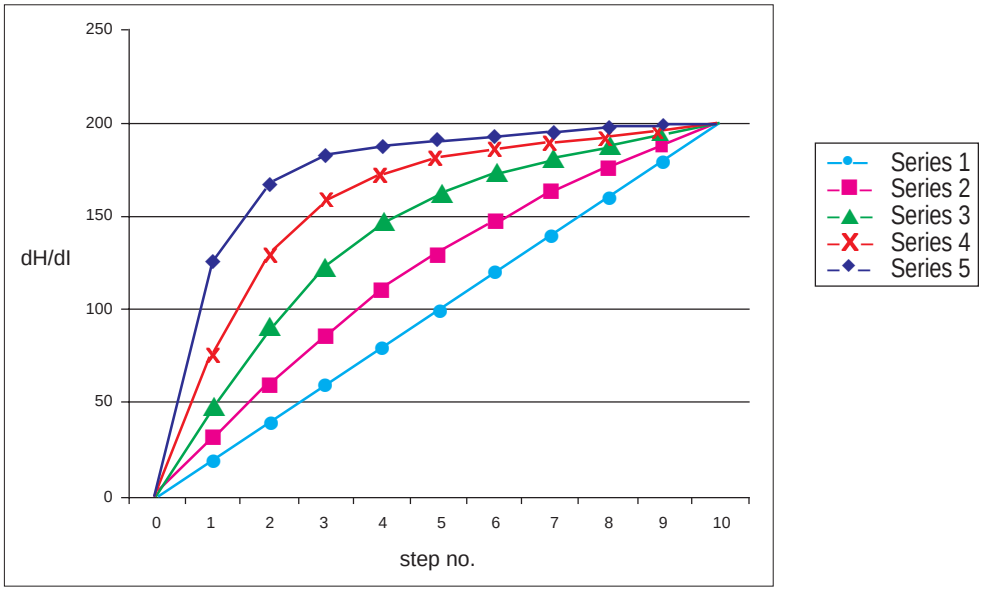


Figure 6-9. *Stepper curve variations*

When a preset curve is loaded, the data is obtained from a table which holds the 5 curves shown. The step sizes (spots) are all made the same as for step 9, and the +HEAT(dH) and +A(dI) parameters are obtained by applying the values in step 9 to the curve as a scaling factor.

6.6.5 ELECTRODE MENU (cont.)

EDIT COUNTER

```
<<<  COUNTER 1  >>>
COUNT NOW = 431
COUNT UP TO 500
STOP AT END
TIP DRESSING On
MAX.DRESSINGS=10
DRESSINGS DONE=2
@RESET,STEPPER=100
```

Visible window

NOTICE

Counter 1 is used by gun 1.
Counter 2 is used by gun 2.

COUNT NOW is incremented after every weld. When **COUNT UP TO** is reached, the COUNTER output is activated.

If **STOP AT END** is selected, then no further welding may take place until a COUNTER reset is given.

Set **COUNT UP TO** = 0 to disable a COUNTER.

If **CONTINUE AT END** is selected, then further welding can take place as normal, but the COUNTER output will remain on.

COUNT NOW is reset to zero by activating the COUNTER reset input.

EDIT COUNTER (TIP DRESSING)

```
<<<  COUNTER 1  >>>
COUNT NOW = 431
COUNT UP TO 500
STOP AT END
SYNC. WITH LOG Yes
TIP DRESSING On
MAX.DRESSINGS=10
DRESSINGS DONE=2
@RESET,STEPPER=100
```

Visible window

The COUNTER can be used to control tip-dressing by setting the parameter **TIP DRESSING** to "On."

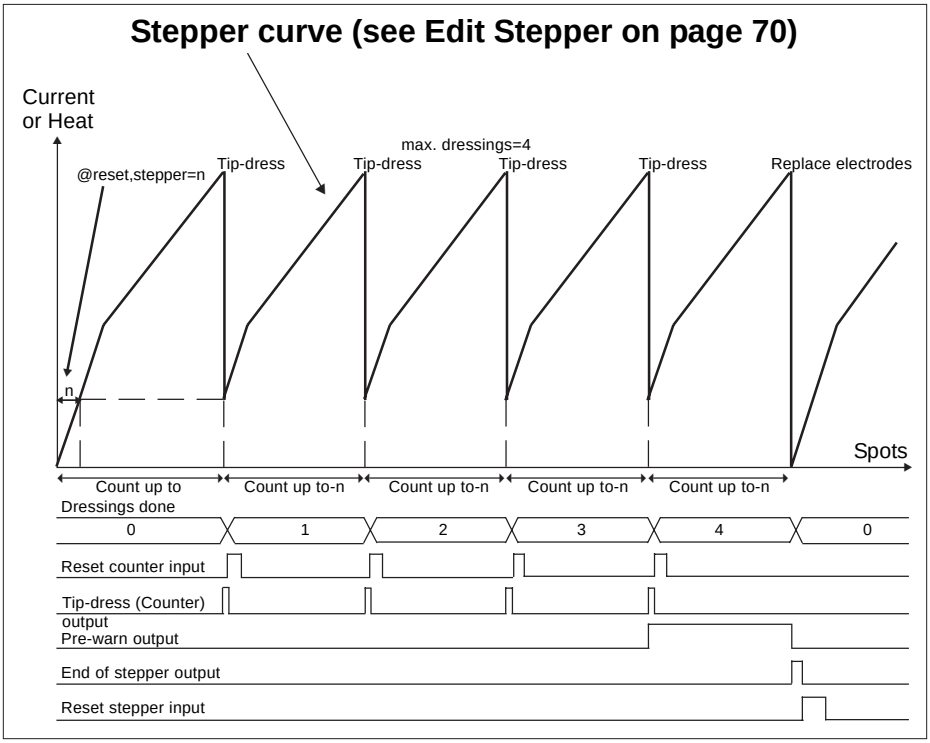


Figure 6-10. *Stepper tip dress*

6.6.6 SEQUENCER

The SEQUENCER provides a means of controlling a small machine via a series of logic statements. The statements are executed sequentially in the order in which they appear.

The START1 input is used to trigger execution of the sequence and must be maintained. On release of the START1 signal, the sequence is reset.

With the SEQUENCER configured (see Section 6.5.1 Edit Configuration), the START1 signal cannot be used to start a weld. Instead, welds are started via statements within the sequence.

The functions available consist of various input, output, memory, delay, counter and weld operations. It is also possible to program subroutines up to 8 levels deep.

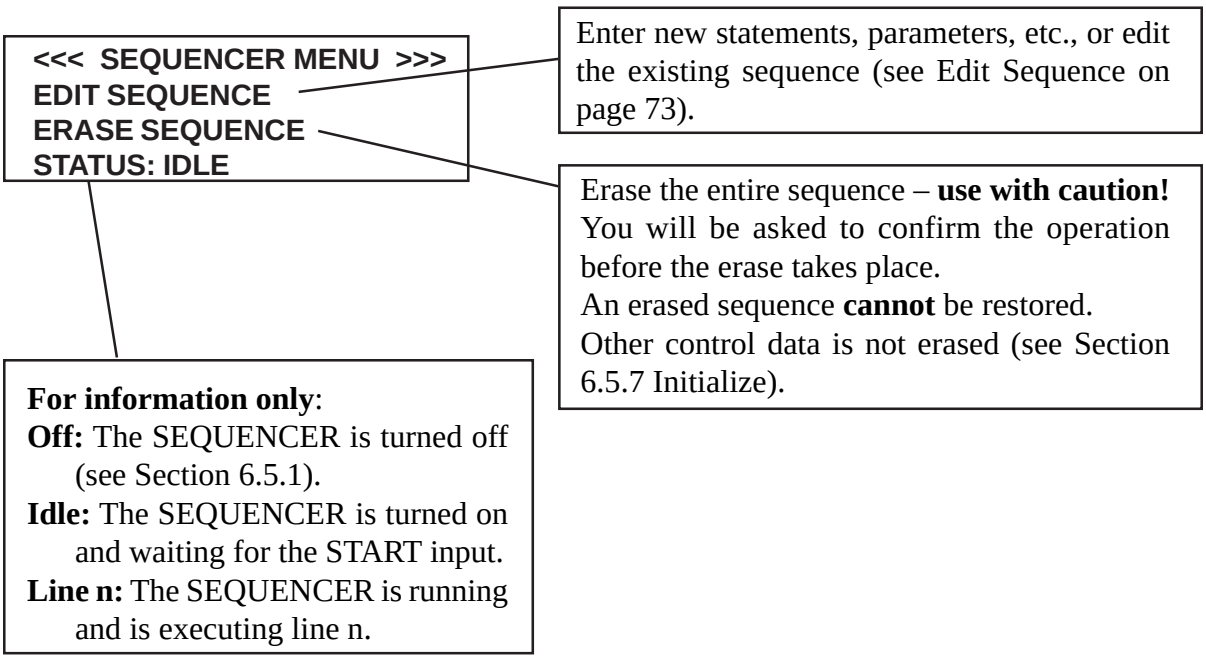
The following resources are available:

Statements (lines)		Up to 249 max.
Outputs	16	Q01 to Q16
Inputs	16	I01 to I16
Memory	8	M1 to M8 (non-volatile)
Counters	8	C1 to C8 (non-volatile)
Analog inputs	3	A1 to A3

NOTICE

Non-volatile values are retained, even if power is lost.
The inputs and outputs are shared with the welding controller and event timer (see Section 6.5.4 Edit Input Map and Section 6.5.3 Edit Output Map).

SEQUENCER MENU



6.6.6 SEQUENCER (cont.)

EDIT SEQUENCE

On the Edit Sequence screen, the keys have the following functions.

At any time:

- Press the ↑ or ↓ key to change the selected line. The entire line will flash. The screen will scroll when required.
- Press the ↵ key to insert a new (blank) line. The line number will be shown.
- Press the **F** key to return to the Sequencer menu screen.

When entire line is flashing:

- Press **+** and **-** keys together to delete the selected line.
- Press the **+** or **-** key to change the selected statement type.
- Press the ← key to momentarily see the selected line number.
- Press the ← or → key to select a parameter (parameter only will flash).

When parameter only is flashing:

- Press the **+** or **-** key to change the selected parameter.
- Press **+** and **-** keys together to set 0 or minimum value.

The following table lists the available logic statement types:

STATEMENT	RANGE	FUNCTION
Line nnn	1 to 249	Line number within sequencer file (has no effect)
— STEP nnn —	1 to 999	Has no effect, but serves as the target for a JUMP or GOSUB statement, or as a logical divider in the program
AWAIT INPUT Inn ON	1 to 14	Waits for Input nn to be ON
AWAIT INPUT Inn OFF	1 to 14	Waits for Input nn to be OFF
OUTPUT Qn ON	1 to 12	Turns ON Output n
OUTPUT Qn OFF	1 to 12	Turns OFF Output n
MEMORY Mn ON	1 to 8	Sets Memory bit n (non-volatile)
MEMORY Mn OFF	1 to 8	Clears Memory bit n (non-volatile)
DELAY nn.n s	0.1 to 99.9 s	Waits for specified time
JUMP nnn	1 to 999	Program continues at specified STEP number
GOSUB nnn	1 to 999	Program continues with the subroutine at the specified STEP number (maximum of 8 nesting levels)
RETURN		Return from subroutine
COUNTER Cn = xxx	n=1-8, x=1-999	Loads Counter n with the value xxx (non-volatile)
DECREMENT COUNTER Cn	1 to 8	The value in Counter n is reduced by 1 (non-volatile)
IF Cn>ZERO, JUMP xxx	n=1-8, x=1-999	If the value in Counter n is not zero, then continue at STEP xxx If the value in Counter n is zero, then continue at the next statement
IF Qn ON, JUMP xxx	n=1-12, x=1-999	If Output Qn is ON, then continue at STEP xxx If Output Qn is OFF, then continue at the next statement
IF Qn OFF, JUMP xxx	n=1-12, x=1-999	If Output Qn is OFF, then continue at STEP xxx If Output Qn is ON, then continue at the next statement
IF Mn ON, JUMP xxx	n=1-8, x=1-999	If Memory Mn is ON, then continue at STEP xxx If Memory Mn is OFF, then continue at the next statement
IF Mn OFF, JUMP xxx	n=1-8, x=1-999	If Memory Mn is OFF, then continue at STEP xxx If Memory Mn is ON, then continue at the next statement
IF Inn ON, JUMP xxx	n=1-14, x=1-999	If Input Inn is ON, then continue at STEP xxx If Input Inn is OFF, then continue at the next statement
IF Inn OFF, JUMP xxx	n=1-14, x=1-999	If Input Inn is OFF then continue at STEP xxx If Input Inn is ON, then continue at the next statement
WELD (Prog=nn)	nn=0-63,EXT	Execute weld sequence using program nn. If nn=EXT, read the program number from the external inputs. The sequencer will wait until the weld reaches “End of sequence,” before continuing with the next statement.
AWAIT ANALOG n<mm V	n=1-3, 0.0≤mm≤10.0	Waits for Analog input n to be less than mm Volts
AWAIT ANALOG n>mm V	n=1-3, 0.0≤mm≤10.0	Waits for Analog input n to be greater than mm Volts
IF ANALOG n<mm V, JUMP xxx	n=1-3, 0.0≤mm≤10.0	If Analog input n is less than mm Volts, then continue at STEP xxx, otherwise continue with next statement
IF ANALOG n>mm V, JUMP xxx	n=1-3, 0.0≤mm≤10.0	If Analog input n is greater than mm Volts, then continue at STEP xxx, otherwise continue with next statement

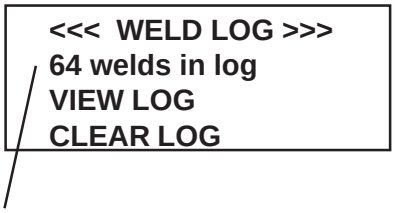
6.6.6 SEQUENCER (cont.)

EDIT SEQUENCE (cont.)

A short example sequence:

— STEP 1 —	
AWAIT INPUT I03 ON	Part detector
— STEP 2 —	
OUTPUT Q8 ON	Clamp ON
DELAY 0.5	Pause
— STEP 3 —	
WELD (PROG=01)	Weld operation using program #1
OUTPUT Q8 OFF	Clamp off
— STEP 4 —	
OUTPUT Q7 ON	Signal job done by flashing output until START released
DELAY 0.4	Flash “On” time
OUTPUT Q7 OFF	
DELAY 0.2	Flash “Off” time
JUMP 4	Loop back to create flashing effect

6.6.7 WELD LOG



The number of welds presently held in the LOG.

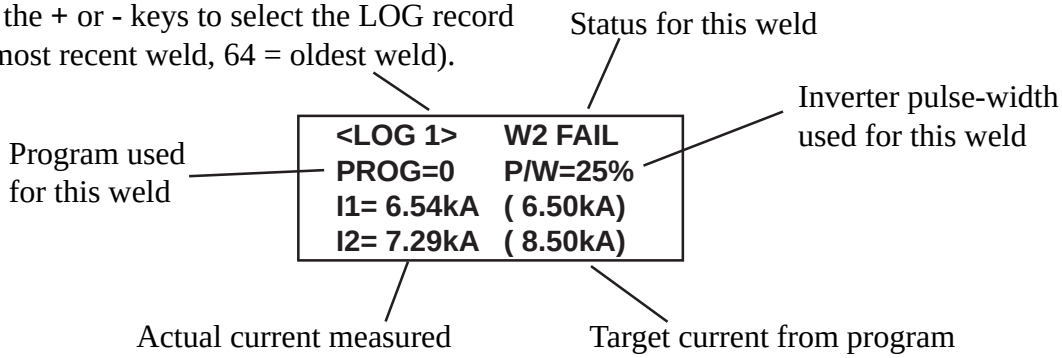
The EN1701 records the measurements from each weld into the WELD LOG. The LOG can hold information from up to 64 welds (after this, the oldest record will be discarded).

To see the information for each weld, select the **VIEW LOG** function.

The LOG can be cleared (emptied) by using the **CLEAR LOG** function.

VIEW LOG SCREEN 1

Press the + or - keys to select the LOG record (1 = most recent weld, 64 = oldest weld).



NOTICE

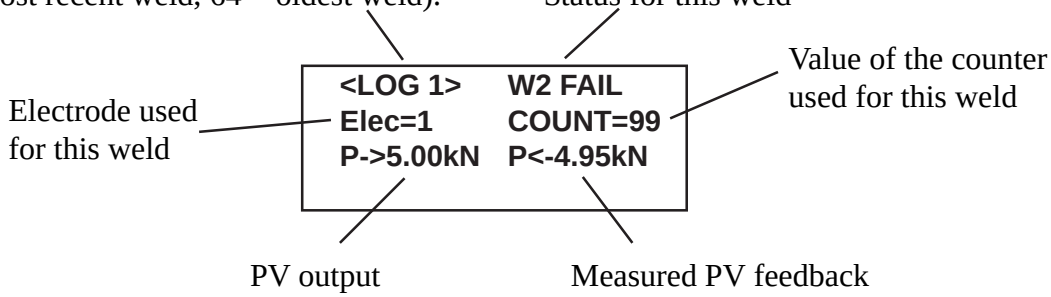
If either of I1 or I2 are not shown, then that interval was not used.

Press ↑, ↓, ← or → key to change to LOG screen 2.

6.6.7 WELD LOG (cont.)

VIEW LOG SCREEN 2

Press the + or - keys to select the LOG record
(1 = most recent weld, 64 = oldest weld).



Press ↑, ↓, ← or → key to change to LOG screen 1.

6.6.8 COPY PROGRAM

```
<<< COPY PROGRAM >>>
FROM: 0
TO: 1
GO
```

COPY a program (and associated limit and event files) to any other program or to all other programs.

- The **TO** parameter can be set to **ALL** if required (i.e., copy one program to all others).
- Select the last line (**GO**), then press the ↵ key to execute the COPY function. This line will briefly show **COPY DONE**, when the function is complete.

6.6.9 I/O STATUS

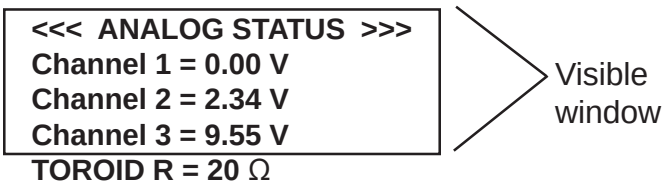
```
<<< I/O STATUS >>>
I01:START1      Off
I02:START2      On
I03:START1      Off
I04:START1      Off
I05:P1          Off
I06:P2          Off
...
...
etc.
```

Visible window

This screen can be used to observe the status of the discrete inputs and outputs.

Each input or output is labeled to show how it is mapped (i.e., standard function / event / sequencer; see Section 6.5.4 Edit Input Map and Section 6.5.3 Edit Output Map).

6.6.10 ANALOG STATUS



This screen can be used to observe the status of the analog inputs.

Analog input channels 1, 2 and 3: The dynamic voltage at each of the analog inputs. This is shown for test calibration purposes only and does not need to be adjusted by the user.

Coil/Toroid resistance: The result of the coil/toriod test, in Ohms. If a measurement>750 Ohms is obtained, then the ∞ symbol is shown. If the coil/toroid test is off, then "???" is shown.

6.6.11 POP-UP METER

The EN1701 will measure the current on both the weld1 and weld2 intervals, and this is displayed on the diagnostic screen.

Often, when programming the EN1701, you will need to refer to these measurements. In order to avoid having to switch between screens, there is a convenient Pop-up Meter window, which allows you to view the measurements without leaving the screen you are on.

The Pop-up Meter is activated by pressing the ↵ key. To close the Pop-up window, press the ↵ key again.

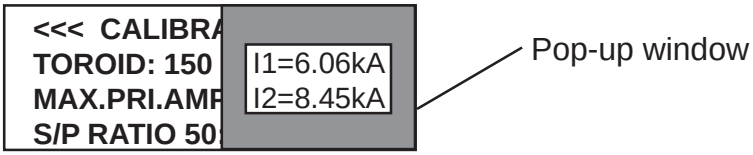


Figure 6-11. *Pop-up Meter*

NOTICE

The window may not show both weld1 and weld2, if either interval was not used. Some screens use the ↵key for another purpose (such as selecting an item from a list). In this case, the Pop-up Meter is not available from that screen.

7.0 OPERATION TIMING CHARTS

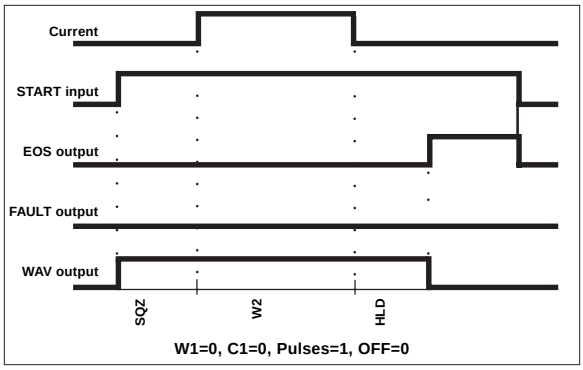


Figure 7-1. *Basic Spot Weld—No Weld Faults*

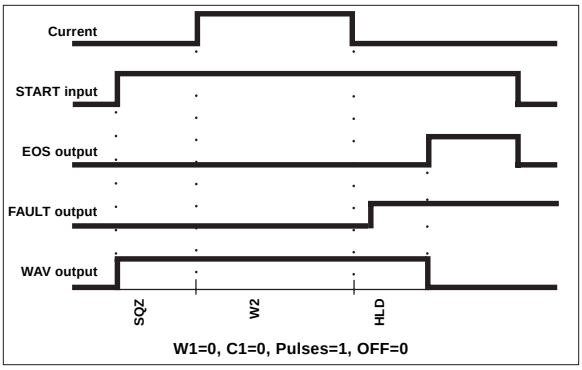


Figure 7-2. *Basic Spot Weld—Weld Fault*

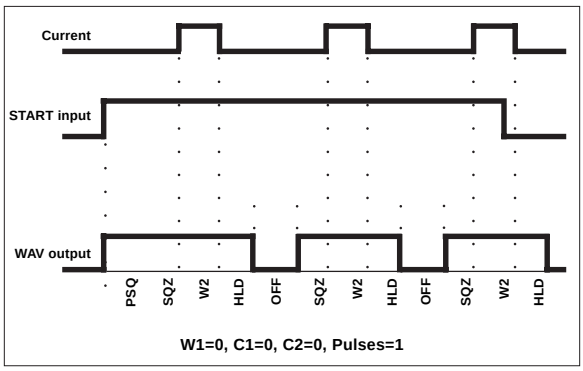


Figure 7-3. *Repeat Spot Weld*

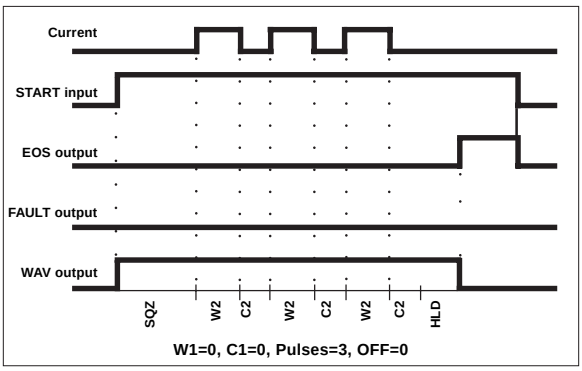


Figure 7-4. *Pulsation Spot Weld*

UPSLOPE AND DOWNSLOPE

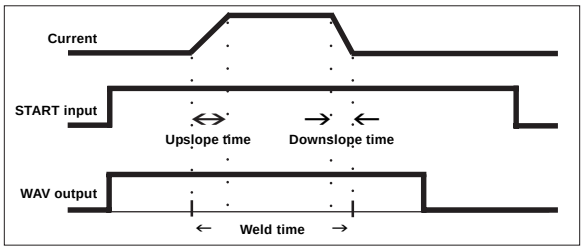


Figure 7-5. *Spot Weld*

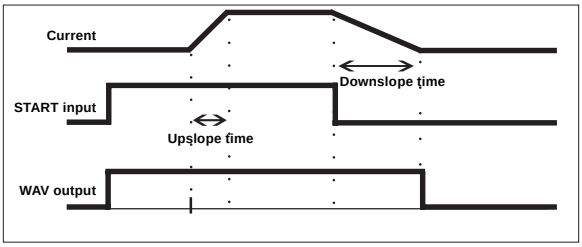


Figure 7-6. *Seam Weld*

The upslope and downslope times are part of the overall weld time – they **do not** add to the weld time.

For seam welds, the downslope time begins when the initiation input turns off.

7.0 OPERATION TIMING CHARTS (cont.)

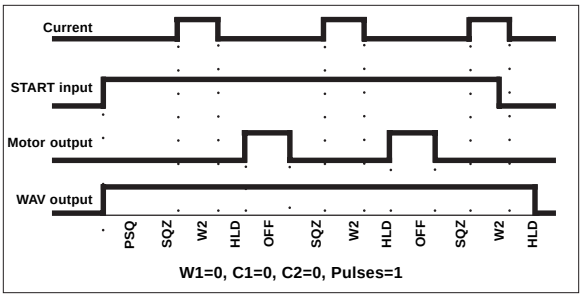


Figure 7-7. *Roll-spot Welding*

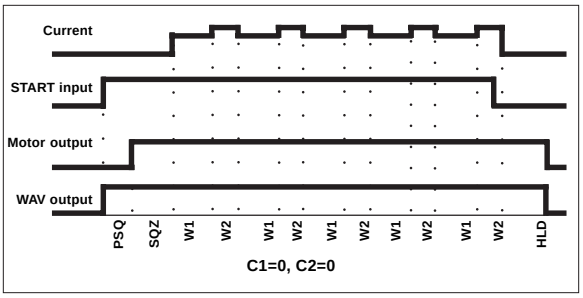


Figure 7-8. *Seam Welding (Dual Heat)*

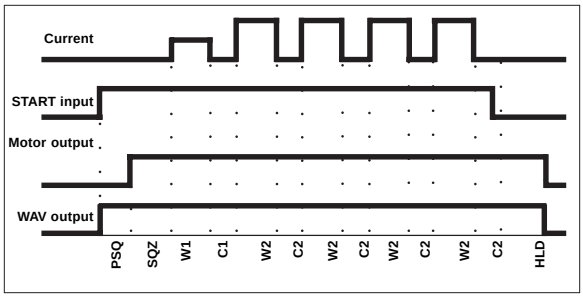


Figure 7-9. *Seam Welding (Pre-heat)*

EOS SIGNAL

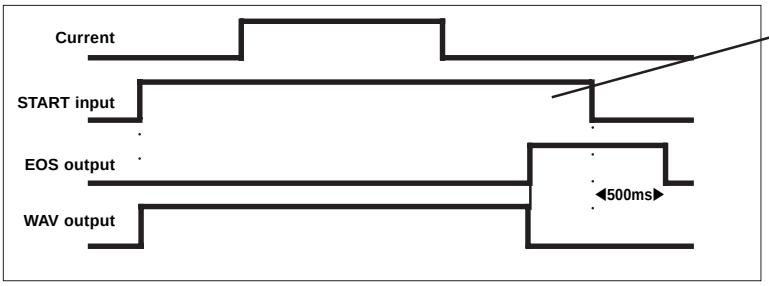


Figure 7-10. *EOS signal – Handshake mode*

HANDSHAKE mode: The start signal remains on until EOS is given. When start is removed, EOS goes off, after 500ms. This is the recommended method of operation for automatic systems.

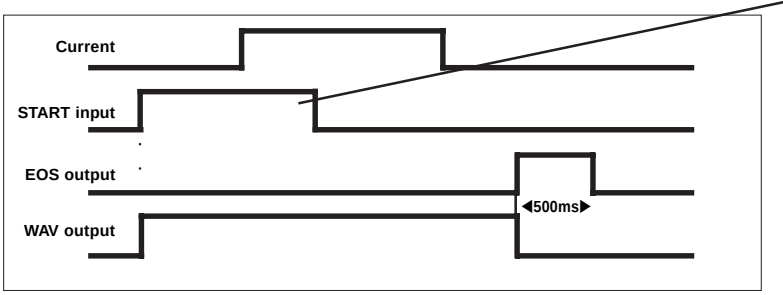


Figure 7-11. *EOS signal – Pulsed mode*

PULSED mode: The start signal goes off before the end of the hold time. The EOS signal is a fixed pulse of 500ms.

In either mode, if a new start signal is given during the EOS pulse, then EOS will go off and a new sequence will start.

7.0 OPERATION TIMING CHARTS (cont.)

The RETRACT operating mode (***SIMPLE/HI-LIFT+/HI-LIFT-***) is set in the Configuration file.

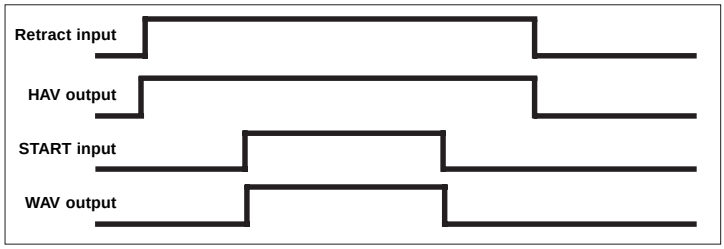


Figure 7-12. *SIMPLE*

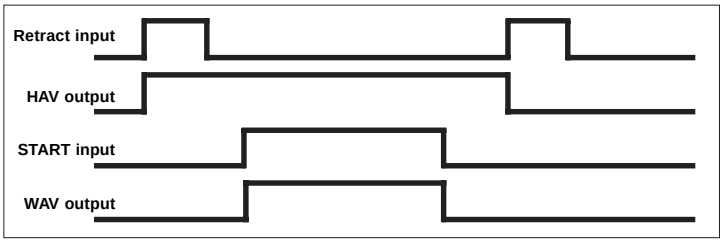


Figure 7-13. *HI-LIFT+*

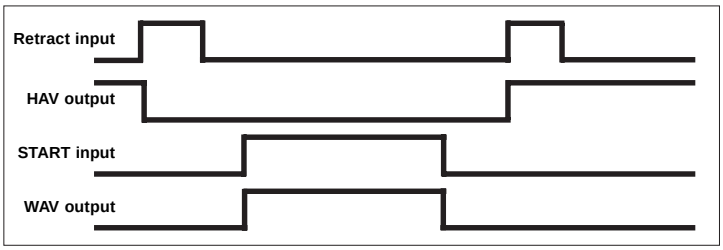


Figure 7-14. *HI-LIFT–*

8.0 ENLINK 1701 SOFTWARE

ENLINK 1701 software is available for use with the EN1701. This offers the user the ability to program and monitor the welding control and to backup all of the programmed data on a PC.

The EN1701 may be connected to the PC via RS232 (one control only) or via Ethernet (multiple controls on a network).

ENLINK 1701 is available on CDROM, and works with all versions of Microsoft Windows™ (98 onwards). Contact factory for more details.

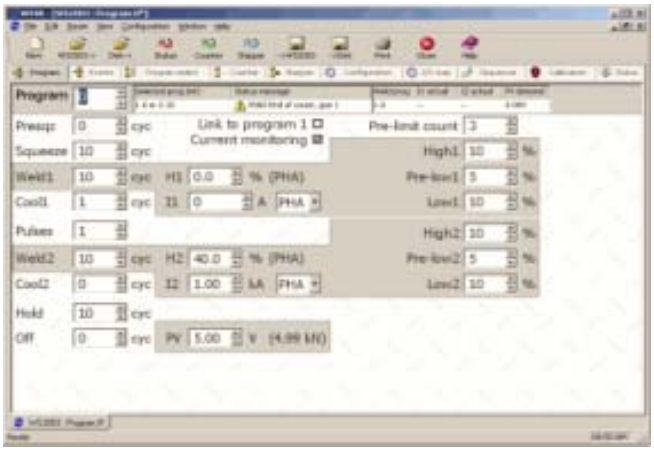


Figure 8-1. *ENLINK 1701 software*

9.0 APPLICATIONS AND PROGRAMMING EXAMPLES

9.1 MULTIPLE VALVE (EVENT)

One application of the EVENT function is multiple valve control. The following example describes how to control four valves to use four guns with the EVENT function.

! WARNING !

Only WAV1 output is protected via control relay contacts. All other outputs are not protected and should be considered during application design. See Section 3.2.

For this example, each gun will be programmed for the following sequence:

SQUEEZE for 500 ms
WELD for 200 ms with 1 kA on CCC mode
HOLD for 800 ms

To perform the above function, follow these steps:

1. Connect initiation switch SW1 to connector P2 as shown in Figure 9-1.
2. Connect four valves associated with Guns 1-4 to connector P3 as shown in Figure 9-2.

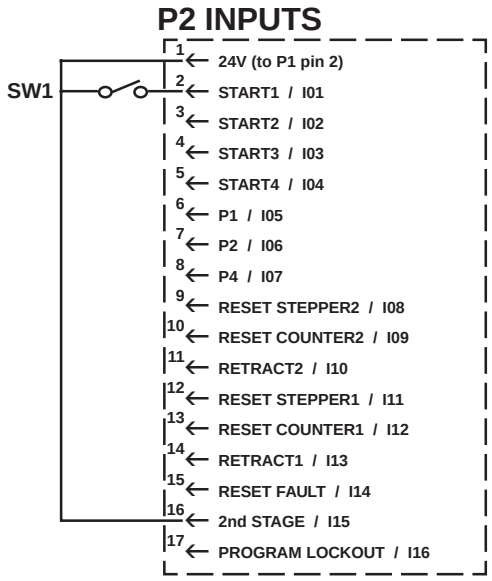


Figure 9-1. *Initiation switch connection*

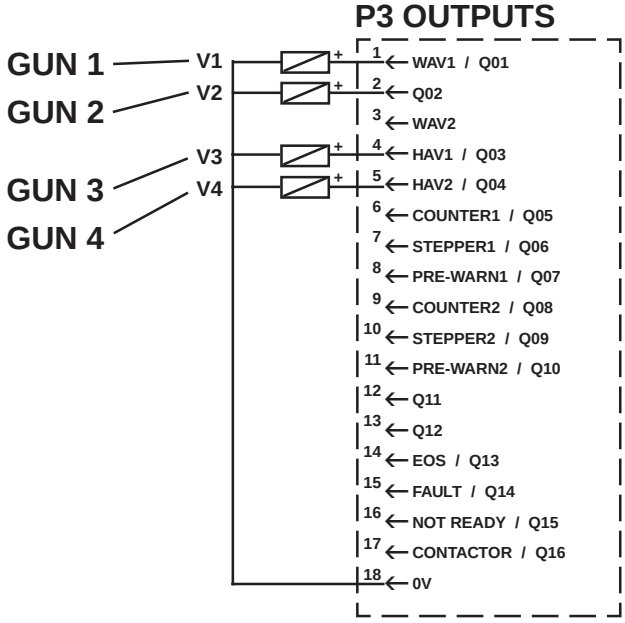
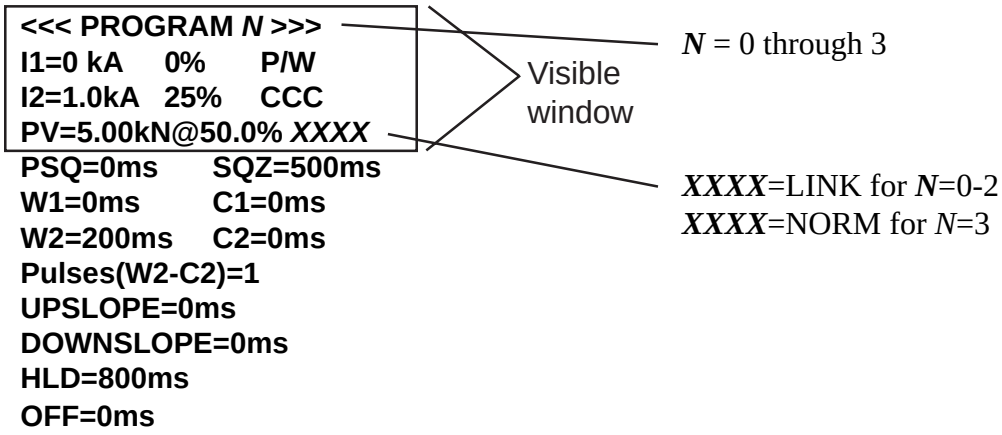


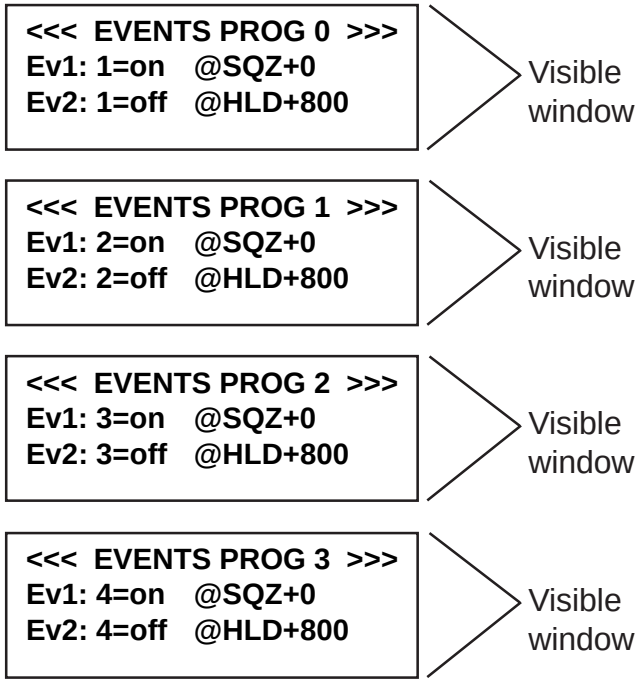
Figure 9-2. *Multiple valve connection*

9.1 MULTIPLE VALVE (EVENT) (cont.)

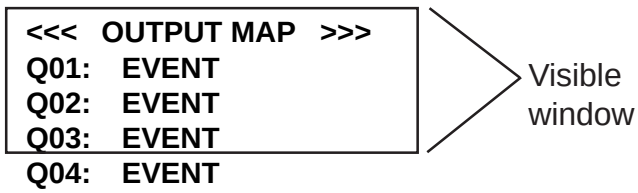
3. Edit programs 0 through 3 as follows (see Section 6.6.1 Edit Program):



4. Edit EVENTS using the following parameters:



5. Map Output 1 through 4 to EVENT (see Section 6.5.3 Edit Output Map).



6. Initiate a weld with initiation switch SW1 on P2 – PIN 2 (START1).

9.2 DUAL PALM BUTTON CONTROL (SEQUENCER)

The following application shows how to use the SEQUENCER to accomplish a dual palm button control function.

! WARNING !

This programming of the internal SEQUENCER for dual palm button control is an example only. Please note that industrial products designed for requirements such as this include many more safeguards to ensure correct operation. Please review designs carefully to ensure that failures do not cause undesirable results!

For this example, switches PB1 and PB2 are used as initiation switches; RELAY1 on output port Q10 is used to indicate fault when one initiation switch is closed and the other switch is not closed within 0.5 seconds; RELAY2 on output port Q12 is used to indicate END OF SEQUENCE.

This function requires both PB1 and PB2 be closed within 0.5 seconds of each other before the weld sequence will start. Two relay outputs indicate status of the sequence and are not required.

To perform this function, follow these steps:

1. Connect the initiation switches PB1 and PB2 to connector P2 as shown in Figure 9-3.
2. Connect diodes to P2 as shown in Figure 9-3.
3. Connect the indication relays RELAY1 and RELAY2 to connector P3 as shown in Figure 9-4 (if required).

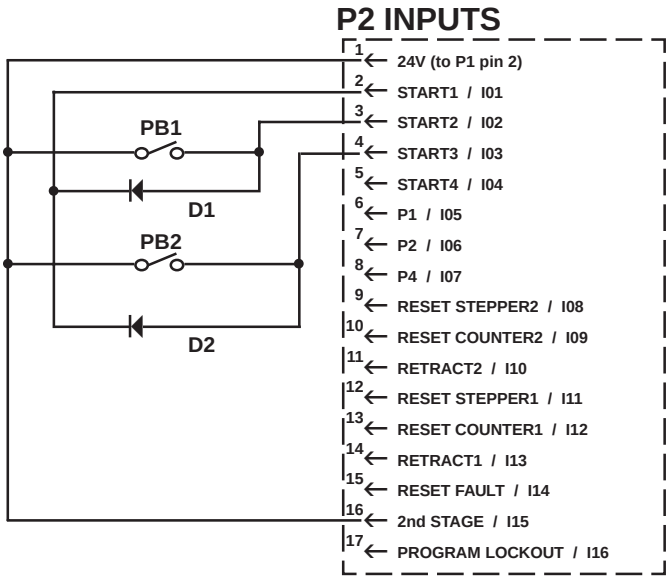


Figure 9-3. *Initiation switches connection*

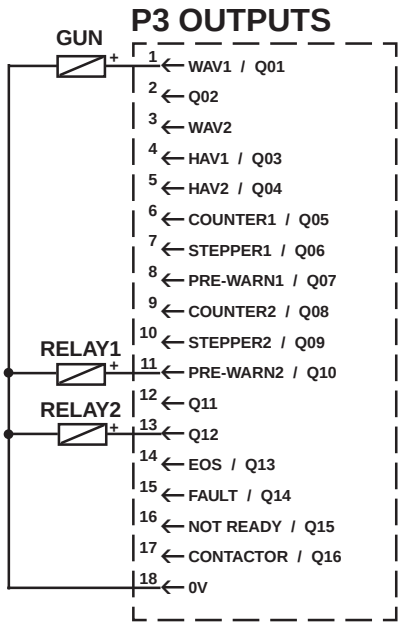


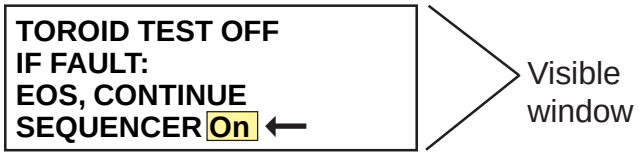
Figure 9-4.
Indication relays connection

9.2 DUAL PALM BUTTON CONTROL (SEQUENCER) (cont.)

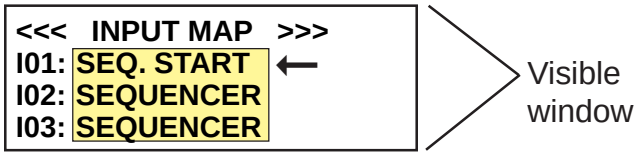
4. Program parameters on the EN1701, using either RPP1 or ENLINK.

If using RPP1:

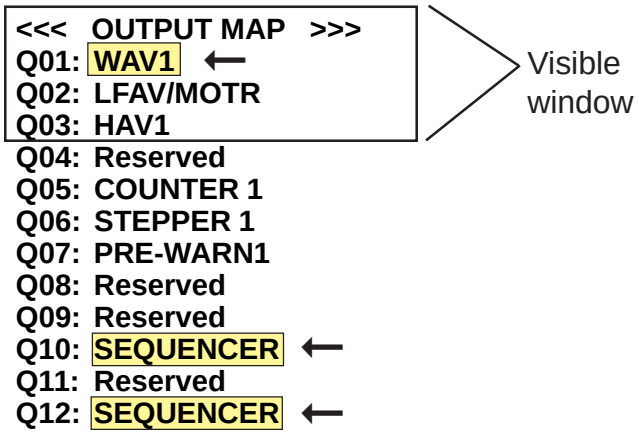
A. Enable the SEQUENCER function in Configuration menu (see Section 6.5.1 Edit Configuration).



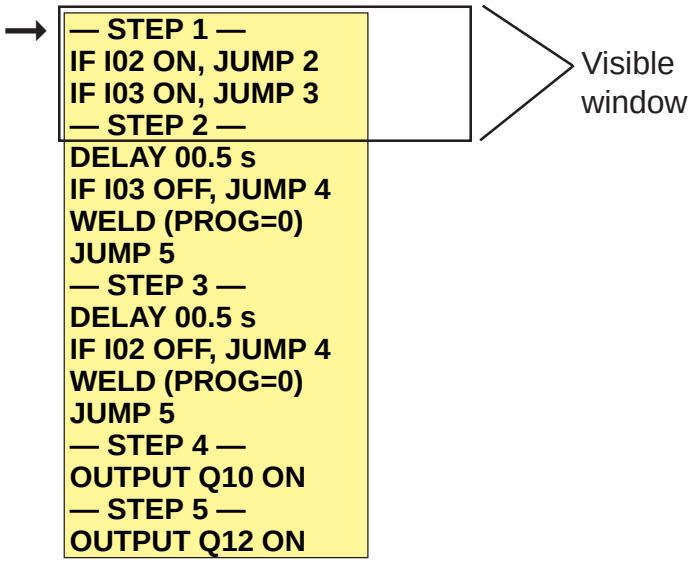
B. Map input ports in Edit Input Map menu (see Section 6.5.4 Edit Input Map).



C. Map output ports in Edit Output Map menu (see Section 6.5.3 Edit Output Map).



D. Enter sequence program in Sequencer menu (see Section 6.6.6 Sequencer).



9.2 DUAL PALM BUTTON CONTROL (SEQUENCER) (cont.)

If using ENLINK:

A. Enable SEQUENCER function on Configuration page.

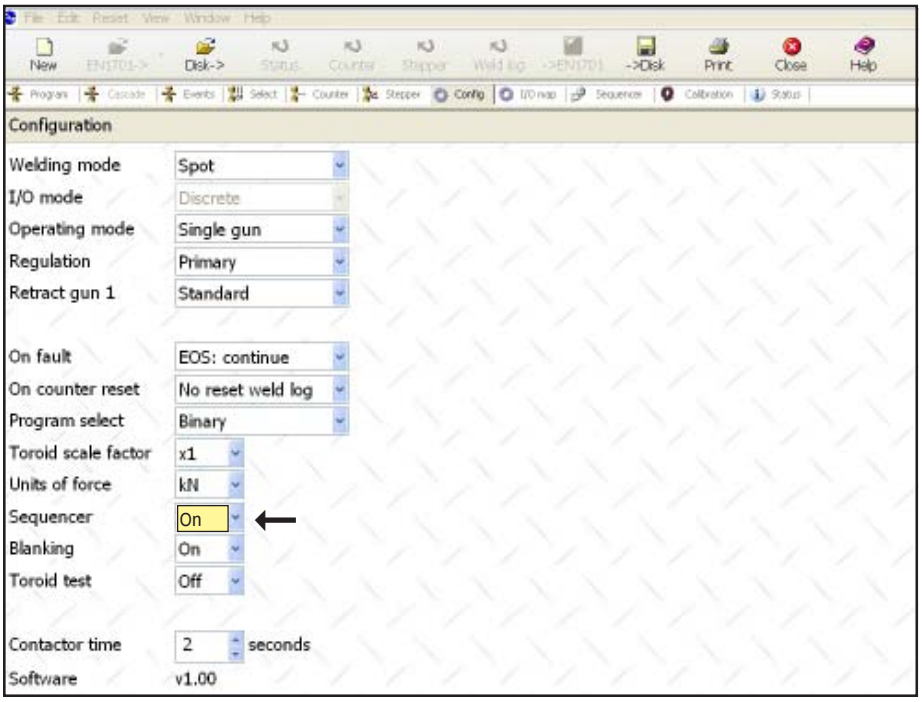


Figure 9-5. *Configuration page*

B. Map input and output ports on I/O map page.

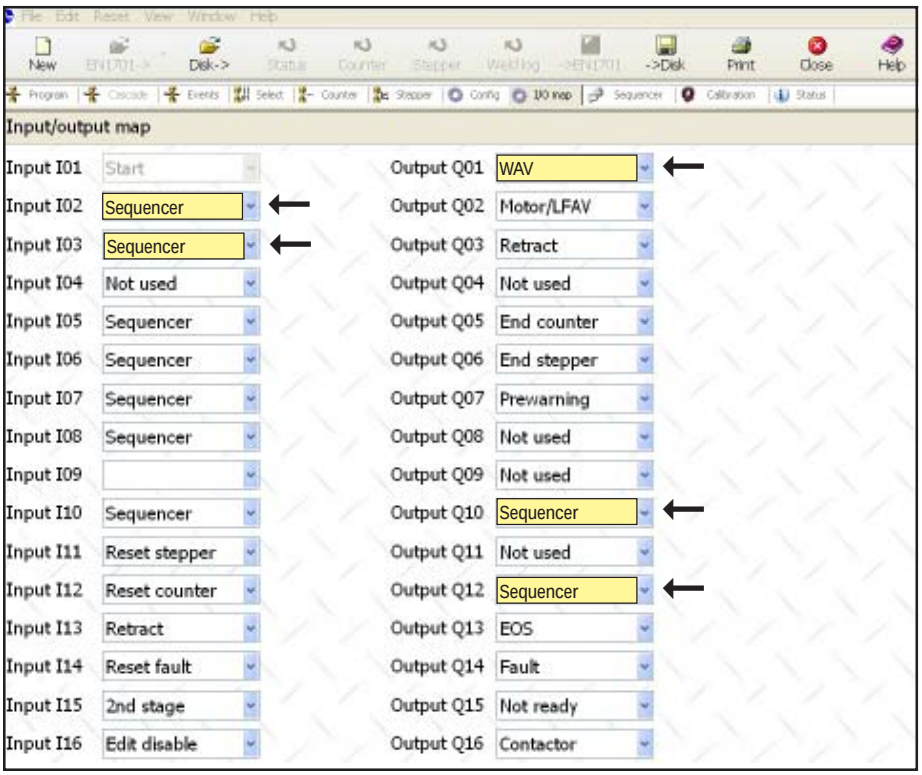


Figure 9-6. *I/O map page*

9.2 DUAL PALM BUTTON CONTROL (SEQUENCER) (cont.)

C. Enter sequence program on Sequencer page.

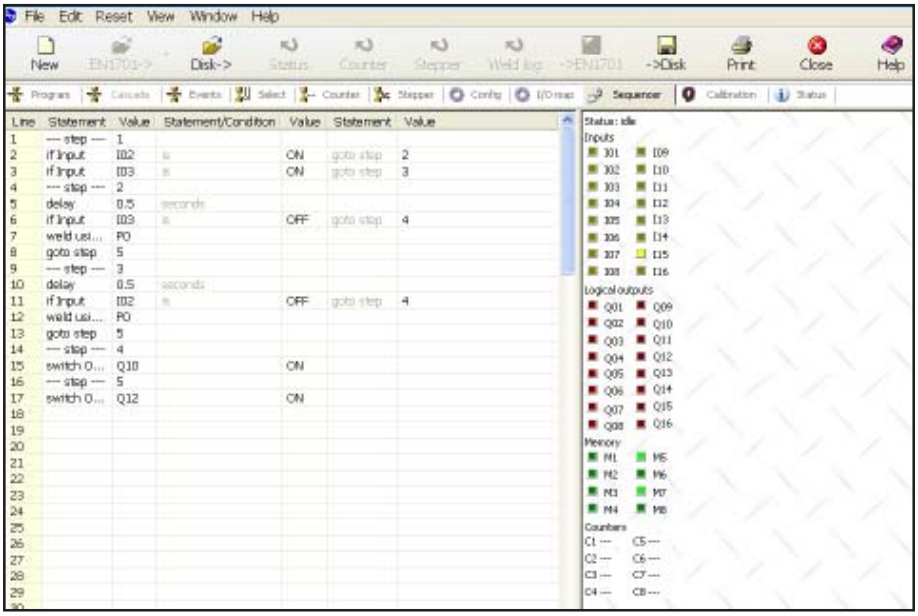


Figure 9-7. *Sequencer page*

5. Initiate the weld with switches PB1 and PB2.

10.0 STATUS/ERROR CODES

The description (abbreviated) appears on the top line of the Diagnostic screen.

ERROR CODE	DESCRIPTION	REMEDY
0	No errors	
1	Configuration error	Edit the Configuration menu
2	Calibration error	Check parameters in Calibration menu
6	Retract not ready	Operate retract input
7	Data error	Edit program
8	Weld off	Close Weld-on switch
9	No current (weld 1)	Check secondary circuit / check coil connection
10	No current (weld 2)	Check secondary circuit / check coil connection
11	Low current (weld 1)	Check secondary circuit or adjust parameters
12	Low current (weld 2)	Check secondary circuit or adjust parameters
13	Pre-alarm (weld 1)	Check secondary circuit or adjust parameters
14	Pre-alarm (weld 2)	Check secondary circuit or adjust parameters
15	High current (weld 1)	Check secondary circuit or adjust parameters
16	High current (weld 2)	Check secondary circuit or adjust parameters
17	Config. Changed	Restart the timer (power off/on)
18	No 2nd stage	Check the 2nd stage input
19	Toroid overrange	Reduce current, or use an external signal attenuator
20	Toroid open circuit	Inspect coil/toroid connection
21	Toroid short circuit	Inspect coil/toroid connection
25	Sequencer error	Edit sequencer program
26	Heatsink hot	Check inverter cooling (air/water) / Reduce duty
27	No 24V supply	Check fuse in timer
30	Headlocked	Operate reset fault input
31	No adapter	Fit adapter or change configuration
41	Low pressure	Check operation of PV / Check inlet pressure
42	High pressure	Check operation of PV / Check inlet pressure
43	Transformer hot	Check water flow to welding transformer / Reduce duty
44	Stop	Close the external Stop circuit
45	Fan fail	Check inverter fans
46	Waiting for pressure	Check operation of PV / Check inlet pressure
48	No current (weld off)	Close Weld-on switch
49	Max. pulse-width	Check secondary circuit / Reduce heat/current
50	Max. primary current	Check secondary circuit / Reduce heat/current
51	Short circuit	Check cables from inverter to welding transformer / Check transformer
52	Earth fault	Check cables from inverter to welding transformer / Check transformer
53	Inverter voltage error	Check incoming line to inverter
54	Inverter disabled	Check control connections to inverter
65	Stepper 1 end	Reset stepper 1
66	Stepper 2 end	Reset stepper 2
73	Stepper 1 prewarn	
74	Stepper 2 prewarn	
81	Counter 1 end	Reset counter 1
82	Counter 2 end	Reset counter 2
89	Tip dress 1	Dress gun 1 and activate reset counter input
90	Tip dress 2	Dress gun 2 and activate reset counter input

11.0 ENTRON LIMITED WARRANTY AND FACTORY SERVICE

ENTRON Controls, LLC., warrants that all ENTRON control panels, **EXCEPT** silicon controlled rectifiers (SCRs) and SCR and IGBT assemblies, circuit breakers and electro-mechanical contactors are free of defects for a period of **ONE YEAR** from the date of original purchase and, in the event of a manufacturing defect, ENTRON will repair or replace, at its discretion, the defective part without any cost for parts or labor.

All silicon controlled rectifiers, SCR and IGBT assemblies, and circuit breakers in ENTRON control panels are covered by a limited warranty from the original manufacturer (other than ENTRON). If these parts fail because of a manufacturing defect, they will not be repaired or replaced by ENTRON, but will be returned by ENTRON to the original manufacturer in accordance with said manufacturer's warranty.

To obtain repairs or replacement parts under this warranty, the defective parts must be returned to ENTRON Controls, LLC., 601 High Tech Court, Greer, SC 29650. Please send your repair to the attention of "service" with a description of the problem you are experiencing, contact person, and phone number.

EXCLUSIONS: This warranty does not cover damage by accident, misuse, unauthorized repair or modification to any control assembly by the customer.

IMPORTANT NOTE: The warranty period is considered from the date of shipment and is tracked by a serial number code.

USE OF "OUT OF WARRANTY" REPAIR SERVICE:
To obtain service for any printed circuit board assembly after one year from the date of purchase, send the assembly, prepaid, to ENTRON Controls, LLC., and ENTRON will repair the printed circuit board assembly and return it to you without further warranty on its part. Additional service charges will be invoiced at time of shipment.

Your ENTRON Controls, LLC., representative is always available to assist you with your control or welding problems. Our sales representatives, Original Equipment Manufacturers, Dealers and Distributors are always supported by direct factory assistance. Do not hesitate to call for prompt, professional assistance – 864-416-0190. There is no charge for this assistance.

APPENDIX A

Weldsafe 5100

combination ground fault sensing and ground checking relay for AC 1000 Hz manual transgun applications

Weldsafe 5100 Features

- **10 mA trip point setting for ground fault sensing**
- **C.T. loop monitoring**
- **1 Ω single trip point for ground checking**
- **Voltage Build-up Detection**
- **Optional End-of-Line Resistor for crush fault detection**
- **Harmonic filtering**

The Weldsafe 5100 combination ground fault current and ground check relay has been designed to provide sensitive ground fault protection and continuous ground checking for ac, 1000 Hz manual transguns in accordance with RWMA Bulletin 5 standards.

Weldsafe 5100 Operation

Ground Fault Sensing Operation

The Weldsafe 5100 protects operators and equipment from dangerous leakage currents that may occur when a circuit is energized. The device has harmonic filtering to prevent nuisance tripping and an inverse reaction time that corresponds to IEC 470-1 safety curves.

- **Ground Fault Protection**

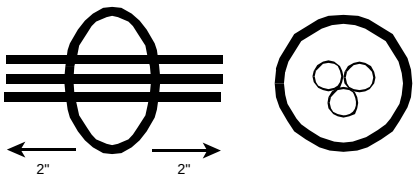
The Weldsafe 5100 ground fault function has two ground fault settings which will typically correspond to the size of the manual transgun. Setting 1 is the factory setting. This setting should always be used whenever practicable. Generally, Setting 1 will work for transguns smaller than 100 KVA. For manual guns larger than 100 KVA or with very high amperages (>40,000A), Setting 2 can be selected. All settings exceed current RWMA recommendations. To determine which setting is correct, consult with your service operator.

- **C.T. Loop Monitoring**

The Weldsafe 5100 also continuously monitors the connection to the current transformer to ensure proper functioning of the ground fault sensing. If this connection is broken, the unit will immediately operate.

- **CT600/.../WKE Series Current Transformers**

The ground fault protection function of the Weldsafe 5100 operates together with a CT600 series current transformer. There are different sizes available ranging from 1” to 5-1/8” depending upon the size of the load conductors passing through window. The C.T. is connected across terminals 16 and 17. Only the load carrying conductors pass through the C.T. The ground wire must remain outside the C.T. core. It is also important that the cables passing through the C.T. be as straight as possible (see diagram) to minimize the possibility of core saturation.



CT600/60/2 for High Current Applications

In applications where very high current is present, as in the case of a very large hand-held welding gun (>100KVA, 40,000A), this high current may influence the operation of the CT and cause nuisance tripping. The mounting and location of the CT within the control panel is very important. In order to get optimum results from the CT, it is recommended that the CT be mounted on the output side. This reduces the influence of any internal leakage caused by components in the welding control. For systems above 100 KVA, it is advisable to use either coaxial cable or order the CT600/60/2. This CT has been specifically designed with a 6" metal core insert and provides the same shielding from the high current as the coaxial cable.

Ground Checking Operation

The Weldsafe 5100 has several protective methods to ensure proper grounding of fixed or portable equipment. If the unit senses any one of the following conditions, it activates the alarm relay (K2).

- **Pilot Wire Ground Integrity Check**

The Weldsafe 5100 monitors the resistance of the return path to ground via a ground connection from terminal 30 and a standard loop pilot wire going to the equipment from terminal 27. The unit continuously sends a measuring

signal around the ground loop circuit. This circuit comprises the main equipment grounding conductor, a section of the equipment casing and a pilot conductor return path. When the Weldsafe 5100 detects a loop resistance in excess of 1 Ω, it will activate the output alarm relay (K2). The response time will vary depending upon the actual loop resistance value. A time delay of up to 2 S can occur for values less than 2 Ω. The Weldsafe will react in < 30 mS for values approaching “open circuit” (see Table 1).

- **Earth Voltage Build-up**

The Weldsafe 5100 can also detect large ground fault currents that may cause unsafe voltage build-up on the ground path. If the unit senses a voltage >30 V ac on the ground path, it will immediately react to this condition.

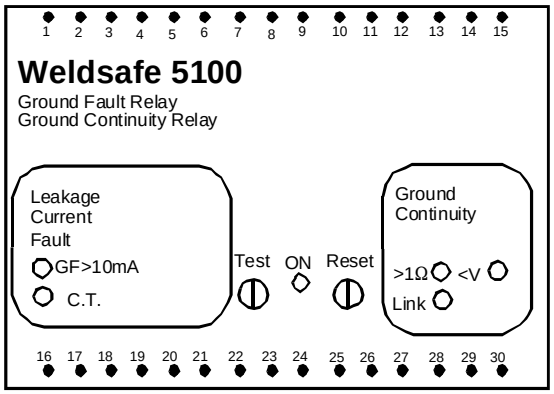
- **Optional End-of-Line Resistor (EOL)**

The Weldsafe 5100 ground checking operation has an additional protection feature. The unit can detect crush or parallel faults. This situation occurs when the cable ground wire becomes unintentionally connected to the equipment pilot wire. To sense this fault, a grounding resistor is connected at the end of the pilot wire from terminal 29. In this configuration, the Weldsafe 5100 will alarm if the ground wire ever comes into contact with the equipment pilot wire. This grounding resistor must have a value of 49.9 ohms with a high tolerance of +/- 0.1% to ensure proper function of the Weldsafe 5100. Circuit Savers can supply this resistor on request. *Please note: this end-of-line (EOL) will not affect the operation of the earth voltage build-up function.*

Weldsafe 5100 Technical Information

Mounting and Wiring

The Weldsafe 5100 can be either DIN rail mounted (35mm) or screw-mounted by the 2 holes at the corners of the device. Terminals are clearly marked for connection.



Input Power Supply

The Weldsafe 5100 requires an auxiliary power supply of either 24 V ac or 120 V ac, 50-60 Hz. Customer must specify.

Trip/Alarm Output Relays

Two sets of changeover trip/alarm contacts (one for ground fault, one for ground check) are provided rated at 250 V, 5 A. These two relays can be set for tripping or remote indication. They can be configured for either failsafe or active operation, manual or auto reset. Factory settings are Failsafe and Auto Reset. To adjust relay for Failsafe/Active operation for either ground fault or ground check, open front cover. There is a small blue button in the left and right lower areas. The switch on the left changes the ground fault, the one on the right changes the ground check. For Hand reset close contacts between 18-19, open for Auto.

LEDs

In addition to the trip relays there are six LED indicators on the front cover. The green LED indicates POWER ON. There are two red LEDs for the ground fault function:

- “GF” indicates leakage in excess of preset trip level
- “C.T.” indicates C.T. connection broken

There are three LEDs indicating different conditions on the ground check function:

- “1Ω” indicates ground loop resistance in excess of 1 ohm
- “Link” indicates ground wire connected to pilot wire
- “>V” indicates voltage build-up in excess of 30 V ac

Test/Reset

The test facilities on the Weldsafe 5100 may be operated locally or remotely. They test both the ground fault sensing and the ground checking circuits. The test button, S1 is used to simulate a ground fault condition internally as a means of testing the relay function. An external test button can also be used to perform the same function test.

CT600 Current Transformers

CT600/25/WKE	1” internal diameter
CT600/60/WKE	2 1/3” internal diameter
CT600/95/WKE	3 3/4” internal diameter
CT600/130/WKE	5 1/8” internal diameter
CT/600/60/2	2 1/3" internal diameter for high current applications, 6" metal insert

Technical Data

Nominal AC insulation voltage ..... 500 V ac
Insulation group to UL 1053
and VDE 0110(01.83) ..... Dirty group 2
Test voltage ..... 3000 V ac
Operation class ..... Continuous
Input supply voltage .... 24 V ac or 120 V ac, 50-60 Hz
Working range ..... +/- 15%
Maximum self-consumption ..... 10 VA
Alarm relay contacts ..... Volt-free NO/NC
Switching capacity ..... 1100 VA
Rated contact voltage 250V
Continuous current 5A
Breaking capacity .....
At: 240V ac, P.F.=0.4 ..... 3A
At: 110V dc, @L/R=0 ..... 0.3A
Adjustable function ..... Failsafe/Active
Relay alarm memory ..... Manual/Auto reset
Factory settings ..... Failsafe/Auto
Operating ambient temperature ..... -10° to +60° C
Storage ambient temperature ..... -40° to +70° C

Mounting
Terminal ..... M 2.5
Terminal capacity ..... 0.5 to 4 mm2
Torque Force ..... 0.8 Nm

Ground fault function
Trip level
Setting 1 ..... factory setting
S8 closed ..... 10 mA, +0%/-15%, ac 50-60 Hz
Response time ..... 20 –25 mS Response time
Setting 2
S8 open ..... 10 mA, +0%/-15%, ac 50-60 Hz
Response time ..... Inverse time::current, see below
Current transformer .... CT600/…/WKE or CT600/60/2
Sizes ..... 1” – 5-1/8” internal diameter

Ground check function
Loop resistance measuring current ..... DC 20 mA
Trip Level ..... 1Ω, +/-15%
Stray voltage
(terminals 30-27 or 30-29) ..... Max. 300 V ac (<5 sec)
Response time ..... inverse 21mS-1.8S, see Table 1

Hysteresis ..... Approx. 2%
Voltage response ..... > 30 V ac

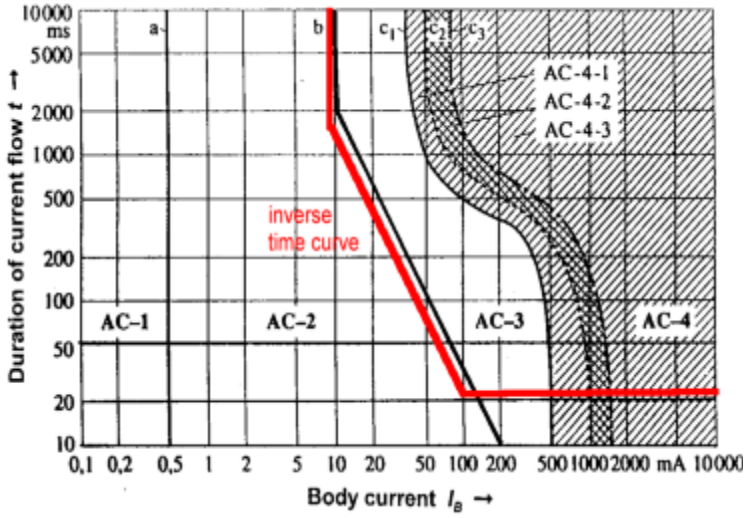
Weight ..... 575 g
Dimensions ..... 2.96"H x 3.94"W x 4.33"D

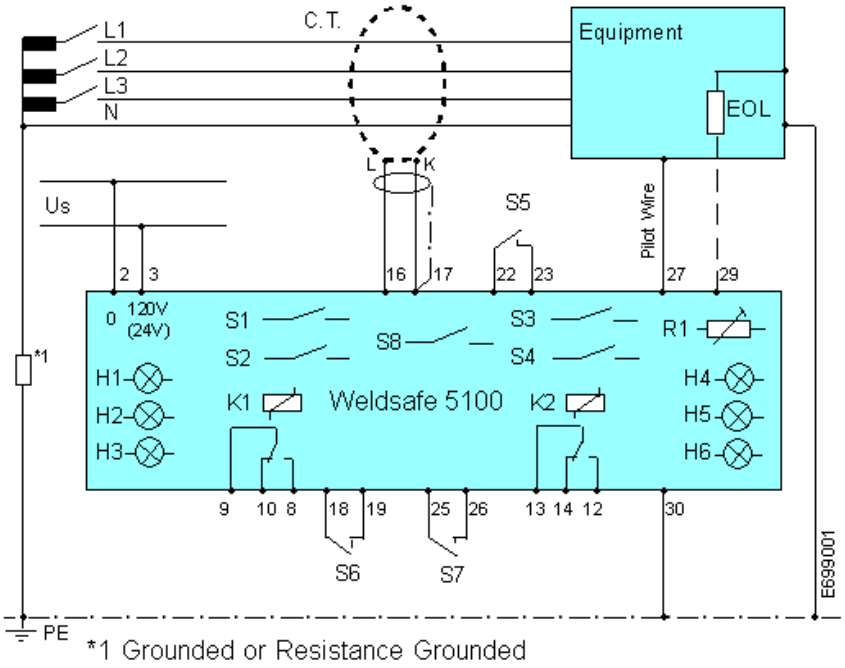
Industry Standards ..... RWMA 5-015.68.04
..... in accordance with UL Class B

Table 1

Response Time for Ground Loop value change 0.5 Ω to R Ω	
0.5 Ω - 2 Ω	≈1.8 S
0.5 Ω - 5 Ω	≈1.8 S
0.5 Ω - 8 Ω	≈1.8 S
0.5 Ω - 10 Ω	≈1.8 S
0.5 Ω - 20 Ω	≈310 mS
0.5 Ω - 50 Ω	≈100 mS
0.5 Ω - 100 Ω	≈60 mS
0.5 Ω - 200 Ω	≈42 mS
0.5 Ω - Open	≈21 mS

Inverse Response Time Curve for Setting 2





PLEASE NOTE:
TO CHECK UNIT FUNCTION DURING COMMISSIONING, WE RECOMMEND TESTING THE Weldsafe 5100 UNDER TRUE FAULT CONDITIONS. FOR THE GROUND FAULT FUNCTION, A SMALL RESISTOR, (e.g. 30 KΩ AT 480V WILL GENERATE APPROX. 16 mA) CAN BE USED TO CREATE THIS CONDITION. FOR THE GROUND CHECKING FUNCTION, OPEN THE PILOT WIRE.

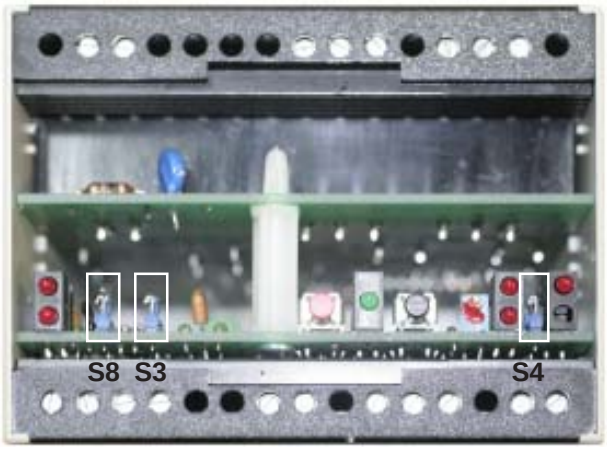
Legend

H1	LED green POWER ON
H2	LED red GROUND FAULT
H3	LED red CT FAULT
H4	LED red LOOP RESISTANCE > 1Ω
H5	LED red CRUSH FAULT
H6	LED red VOLTAGE BUILD-UP
K1	Ground fault alarm relay
K2	Ground check alarm relay
S1	Internal test button
S2	Internal reset button
S3	Switch for ground fault Failsafe/Active (behind front cover) Closed=active Open=failsafe
S4	Switch for ground check Failsafe/Active (behind front cover) Closed=active Open=failsafe
S5	External test button
S6	External reset button for ground fault sensing
S7	External reset button for ground checking
S8	Trip level adjustment (behind front cover) Closed = 10 mA fixed, factory setting Open = 10 mA inverse response
**R1	Loop resistance adjustment - see instructions ☞

Terminals

2-3	Input power supply 120V ac or 24 V ac +/-15%
8-9-10	Contact for K1 alarm relay – ground fault
12-13-14	Contact for K2 alarm relay – ground check
16-17	C.T. connection
18-19	Ground fault external reset, Hand=closed Auto=open
22-23	External test button (optional)
25-26	Ground check external reset, Hand=closed Auto=open
27	Pilot wire if using standard ground check monitoring
29	Pilot wire if using EOL monitoring
30	Ground connection
EOL	End-of-line resistor, 49.9Ω, +/-0.1

☞ **R1 Loop Resistance Adjustment
This is an internal adjustment that must made when cable length is very long and the loop resistance is high (0.5..0.8Ω). Please check with manufacturer about your specific application.



WELDSAFE 5100 MODIFICATION NOTES