

# INSTRUCTION MANUAL

700200H

## WELDER INTERLOCK

MICROPROCESSOR BASED  
Welder Interlock Control

Wiring Diagram      420721    NEMA 1 Cabinet

**ENTRON**

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# ENTRON Controls, LLC.

MICROPROCESSOR BASED WELDER INTERLOCK CONTROL

INSTALLATION AND OPERATION MANUAL FOR:  
WELDER INTERLOCK

<b>!</b> <b>CAUTION</b> <b>!</b>
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 GENERAL DESCRIPTION

The Welder Interlock is designed for applications with more than one NEMA S2H welding control (with valve output and interlocking pressure switch) connected on the same power line. The main purpose is to allow only one welder to weld at a time, when more than one welder is initiated on the same power bus that cannot support the demands of more than one control.

As of June 2007, EN1000 and EN1001 Controls with PROM firmware version 619016-002**BB** and higher have a special **P.O. 20** added for use with welder interlock. **P.O. 20** removes delays associated with SQUEEZE and HOLD times (see Instruction Manual 700120, Section 5.4.7). Use of this PROCESS OUTPUT significantly decreases wait times for interlocked welders.

As of August 2003, priority operation has been revised. A new microprocessor based Control Board A/N 410358 has been designed to replace the previous TTL board A/N 410256. Besides the base version of the A/N 410358 board, which is made for 2 to 8 welders, other variations are possible for controlling up to a total of 24 welders, using only one Welder Interlock Control Board in one cabinet. Two or more Welder Interlock Controls can be interconnected or cascaded, as described in Section 2.3.

The Welder Interlock consists of a Control Board, a Relay Rack Board, a Control Transformer and harnesses. Figure 1-1 is the 2-4 Welder Interlock and Figure 1-2 is the 2-8 Welder Interlock.



**Figure 1-1.** 2-4 Welder Interlock



**Figure 1-2.** 2-8 Welder Interlock

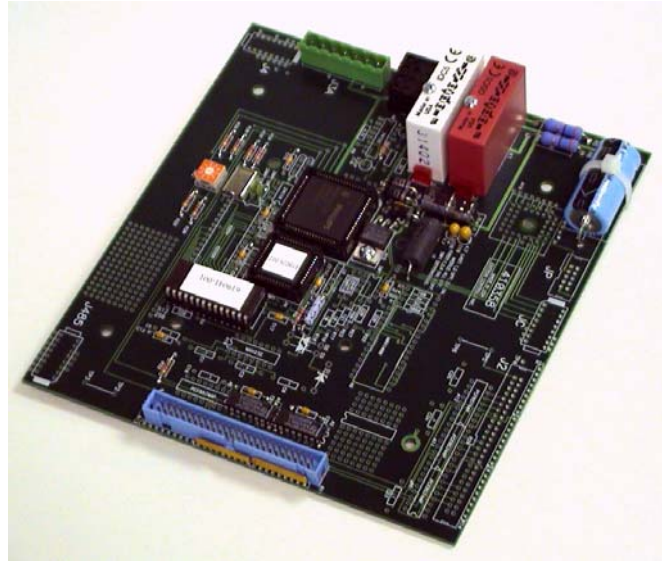
## 1.0 GENERAL DESCRIPTION (cont.)

The Welder Interlock 2-8 Control Board (A/N 410358) is shown in Figure 1-3. In addition to other components on the board, there are two relays which are used for welder interlock cascading:

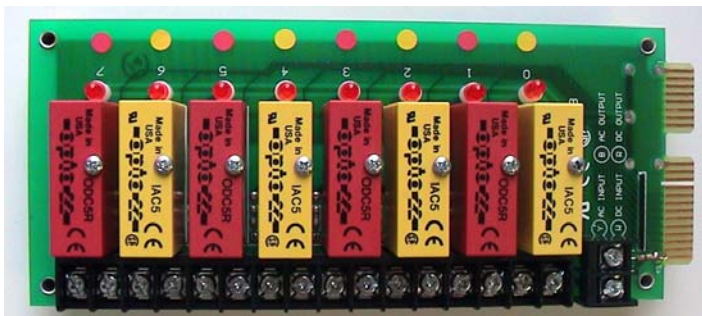
- DC Input relay (white), and
- DC Output relay (red).

Connector J1 is used to connect the Control Board to the Relay Rack Board. Connector J3 (P3) or J3A is used to connect the Control Board to the power supply (Control Transformer) and to provide access to three terminals on TS1.

With PROM firmware version 619041-001 **ORIG**, rotary switch SW2 is used to enable and select priority. In addition, as of October 2013, with PROM firmware version 619041-001**A** and higher, rotary switch is also used to set the Welder Interlock Board to Master Board working mode or Slave Board working mode (see Section 5.0 and Section 6.0).



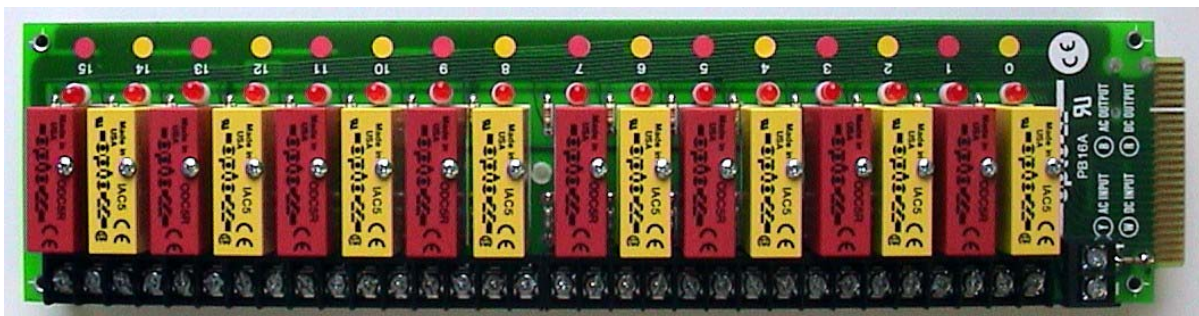
**Figure 1-3.** Welder Interlock 2-8 Control Board



**Figure 1-4.** Relay Rack Board PB8 for PCB2 410254

Board PCB2 A/N 410254 – 2-4 Welder Interlock, with I/O relays is shown in Figure 1-4.

Board PCB2 A/N 410255 – 2-8 (or 5-8) Welder Interlock, with I/O relays is shown in Figure 1-5.

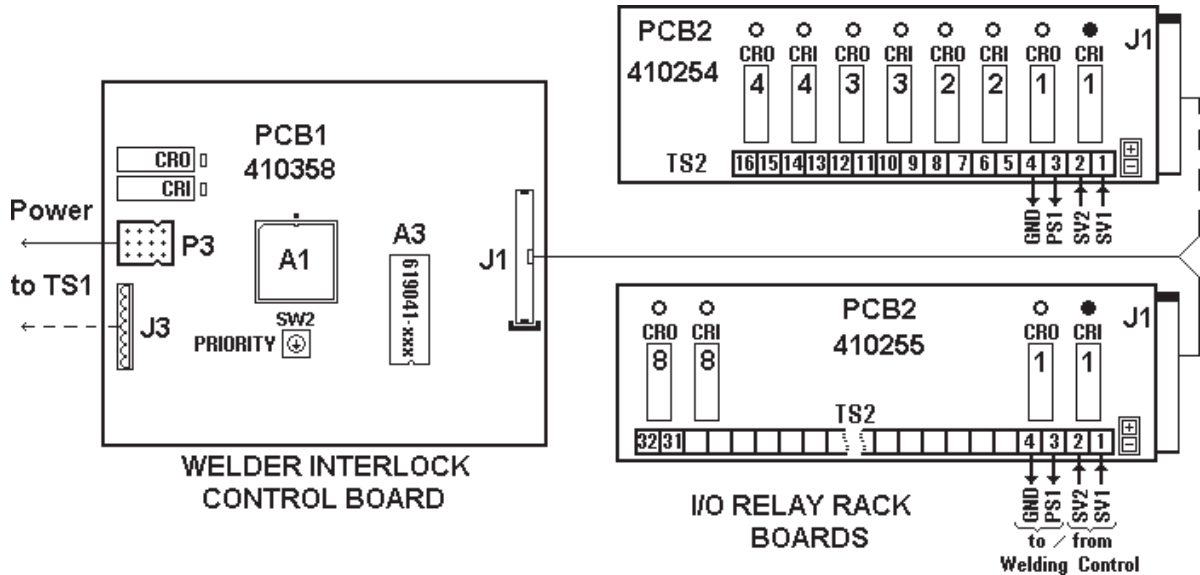


**Figure 1-5.** Relay Rack Board PB16 for PCB2 410255

## 2.0 INSTALLATION

### 2.1 INSTALLATION DIAGRAMS

The block diagram for the Control Board connection to the Relay Rack Boards (2-4 or 2-8 Welder Interlock) is shown in Figure 2-1. For detailed information about wiring, refer to Wiring Diagram 420721 (Figure 2-3) for 2-8 Welder Interlock.



**Figure 2-1.** Connection of Welder Interlock Board to Relay Rack Board

Input relays: Terminals on PCB2-TS2 marked SV1-x and SV2-x denote connections to solenoid valve output terminals located in the welding controls being interlocked.

Output relays: Terminals on PCB2-TS2 marked PS1-x and PS2-x denote connections to pressure switch terminals located in the welding controls being interlocked. The PS2 connections are normally connected to TS1-GND.

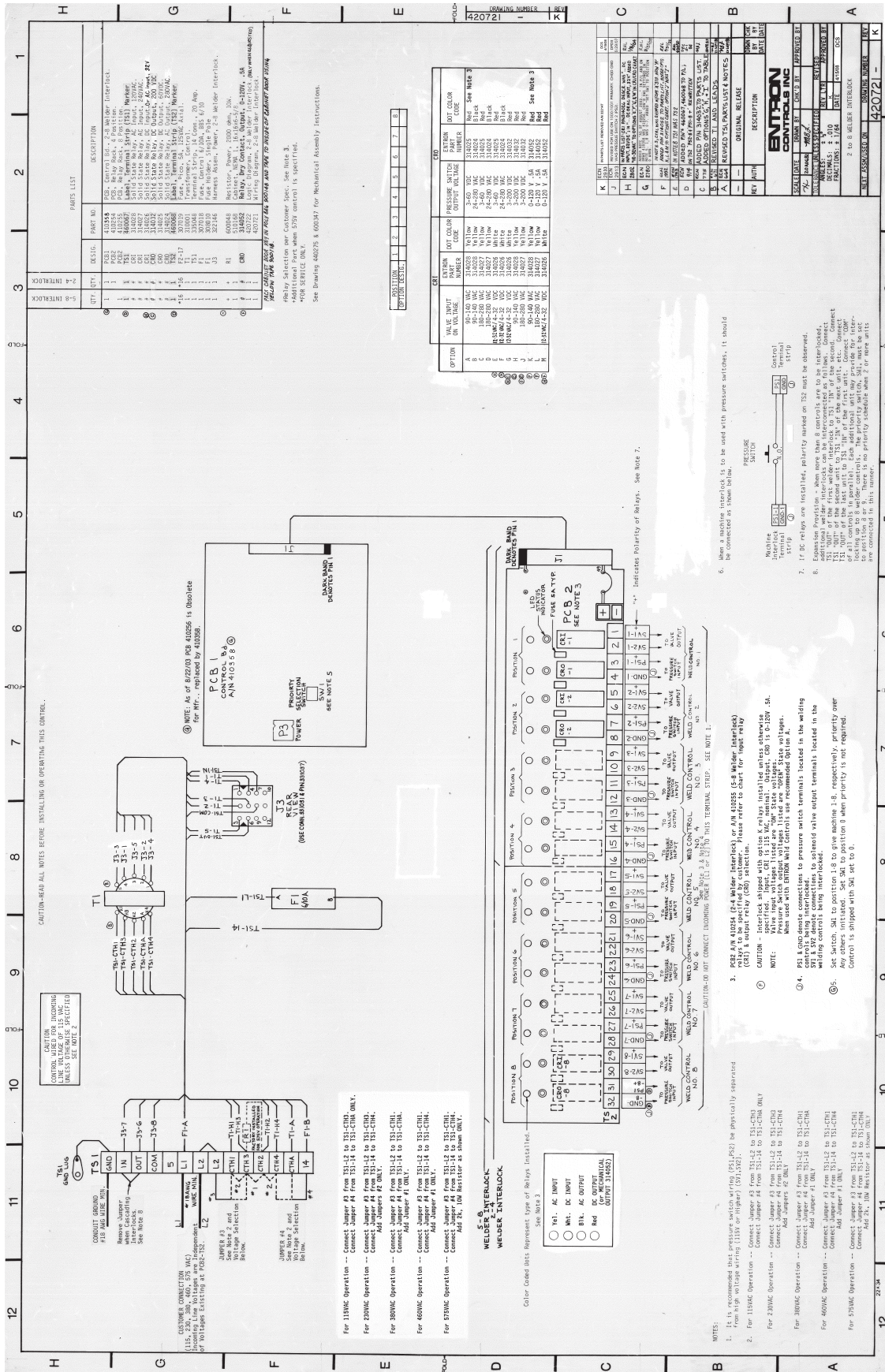
Figure 2-2 shows the detailed board and harness layout inside the cabinet of a 2-4 Welder Interlock.



**Figure 2-2.** Detailed board and harness layout



# 2.2 WIRING & CABINET DIAGRAMS



**Figure 2-3. Welder Interlock Wiring Diagram**

## 2.2 WIRING & CABINET DIAGRAMS (cont.)

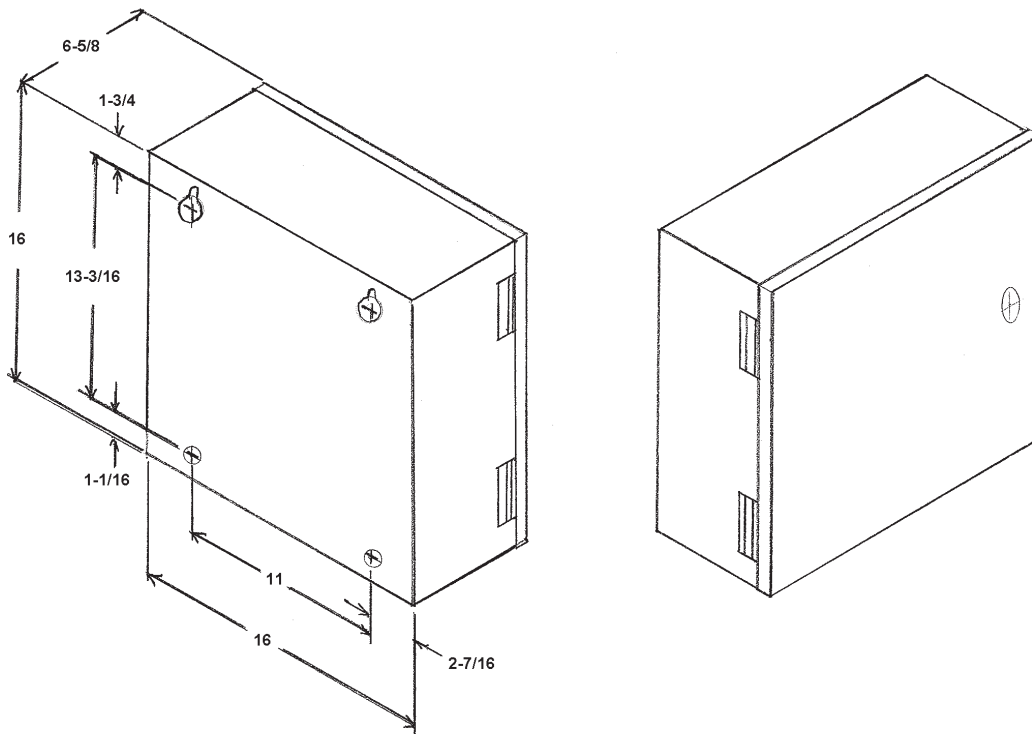


Figure 2-4. Welder Interlock Cabinet dimensions

## 2.3 WELDER INTERLOCK INTERCONNECTION (CASCADING)

When more than 8 (or more than 24) controls are to be interlocked, additional Welder Interlocks can be interconnected as shown in Figure 2-5. Connect TS1-OUT of the first Welder Interlock to TS1-IN on the second. Connect TS1-OUT on the second unit to TS1-IN of the next unit, etc. Connect TS1-OUT of the last unit to TS1-IN of the first one. Connect TS1-COM of all controls in parallel. Detailed Welder Interlock operation is described in Section 5.0.

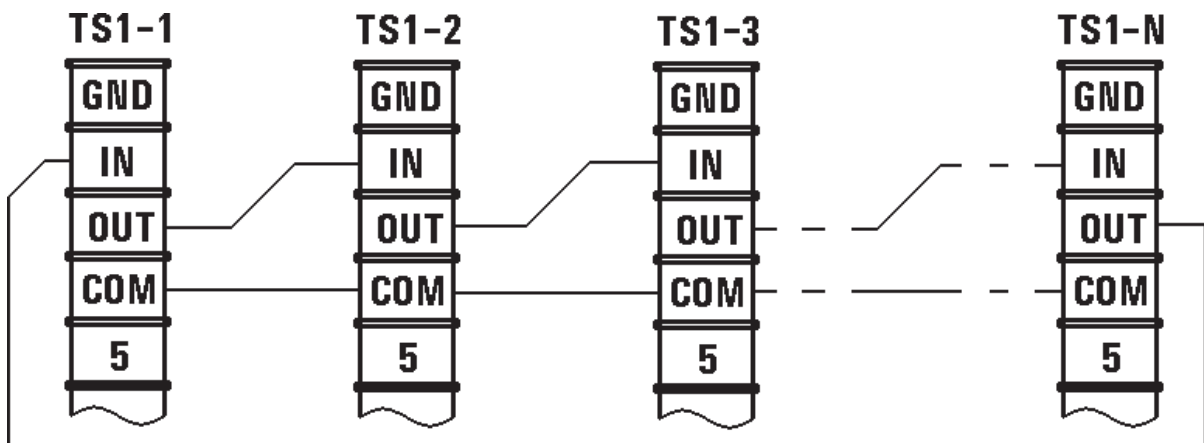


Figure 2-5. Interconnection of multiple Welder Interlocks



## 2.4 USING WELDER INTERLOCKS IN 3-PHASE SYSTEMS

When more controls are to be interlocked in 3-phase systems, the configuration can be used as shown in Figure 2-6. Three groups of the welding controls are connected to L1-L2, L2-L3, and L3-L1, respectively. It is not necessary for three Welder Interlocks to be interconnected, as described in previous section, although it is possible (contact factory for details).



**Figure 2-6.** *Interconnection of Welder Interlocks in a 3-phase system*

## 3.0 GENERAL OPERATING REQUIREMENTS

### 3.1 OPERATING VOLTAGE

The Welder Interlock can operate at 120, 240, 380, 480, and 575 VAC. When a 380 or 575 VAC main is desired, please consult the factory. When control is converted from one line voltage to another, only rearranging jumpers on TS1 is required, shown in Figure 3-1 and Table 3-1.

<b>! WARNING !</b>
THIS CONTROL IS A MULTI-VOLTAGE UNIT WHICH CAN BE CHANGED FROM ONE VOLTAGE TO ANOTHER BY RE-ARRANGING JUMPERS ON TERMINAL STRIP TS1 INSIDE THE UNIT. IF CONTROL IS USED WITH A VOLTAGE OTHER THAN THE ONE FOR WHICH IT IS WIRED, SERIOUS DAMAGE CAN RESULT.

Incoming line voltages on L1-L2 are independent of voltages existing at PCB2-TS2.

### 3.1 OPERATING VOLTAGE (cont.)

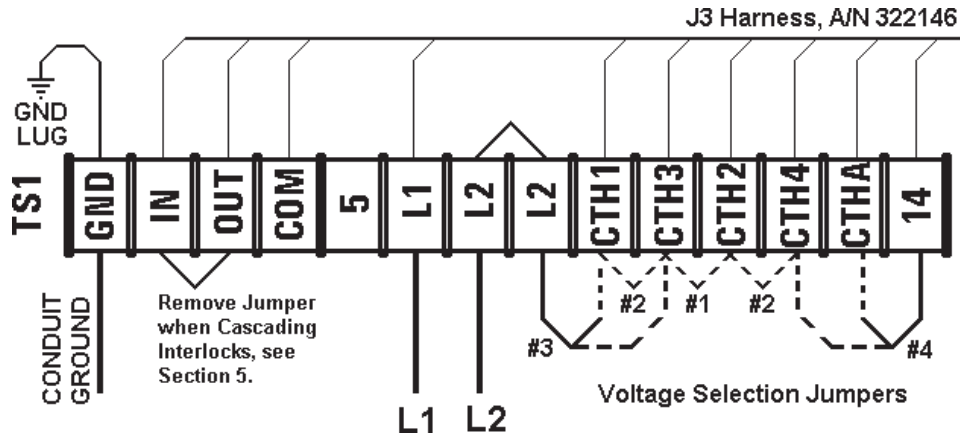


Figure 3-1. TS1 Connections and Voltage Selection Jumpers settings

Table 3-1. Voltage Selection Jumpers settings

Voltage [VAC]	120	240	380	480	575
Jumpers	<b>Jumper #3</b> TS1-L2 to TS1-CTH3	<b>Jumper #3</b> TS1-L2 to TS1-CTH3	<b>Jumper #3</b> TS1-L2 to TS1-CTH1	<b>Jumper #3</b> TS1-L2 to TS1-CTH1	<b>Jumper #3</b> TS1-L2 to TS1-CTH1
	<b>Jumper #4</b> TS1-14 to TS1-CTHA	<b>Jumper #4</b> TS1-14 to TS1-CTH4	<b>Jumper #4</b> TS1-14 to TS1-CTHA	<b>Jumper #4</b> TS1-14 to TS1-CTH4	<b>Jumper #4</b> TS1-14 to TS1-CTH4
		Add Jumper #2	Add Jumper #1	Add Jumper #1	Add 2KS, 10W instead of Jumper #1

#### NOTICE

For 575 VAC voltage operation, add **2k Ohm, 10W** resistor (A/N 600048) between TS1-CTH3 and TS1-CTH2, instead of Jumper #1.

#### NOTICE

Unless specified at the time of order, control is shipped with 120 VAC jumper settings.

### 3.2 FUSING AND SAFE OPERATION

**CONTROL FUSE** This fuse, a 1/4 A, is used to protect the control circuits. The fuse holder is located within the cabinet, upper left section.

#### ! CAUTION !

INSTALL PROPERLY SIZED FUSES IN SERVICE DISCONNECT SWITCH.  
CHECK WELDING MACHINE MANUFACTURER'S RECOMMENDATIONS.

#### ! DANGER !

**VOLTAGES PRESENT IN THIS CONTROL CAN CAUSE SEVERE OR FATAL INJURY. DO NOT SERVICE ANY COMPONENT WITH POWER ON. USE ONLY THE FUSE TYPE SPECIFIED TO MAINTAIN SAFE OPERATION.**

### 3.2 FUSING AND SAFE OPERATION (cont.)

Observe the hazard labels affixed to the control to maintain safe operation. Some of them are shown in Figure 3-2.



**Figure 3-2.** *Danger, Warning and Notice labels*







## 4.0 I/O RELAYS SPECIFICATIONS

The Welder Interlock Control is shipped with **Option K** relays installed, unless otherwise specified. See Table 4-1 and Table 4-2 for ENTRON Part Numbers and more information about available relays.

**Table 4-1.** I/O Relays Options with factory P/Ns

OPTION	CRI			CRO		
	VALVE INPUT VOLTAGE	P/N	COLOR	PS OUTPUT VOLTAGE	P/N	COLOR
A	90 - 140 VAC	314028	Yellow	3 - 60 VDC	314025	Red
B	90 - 140 VAC	314028	Yellow	24 - 280 VAC	314024	Black
C	180 - 280 VAC	314027	Yellow	3 - 60 VDC	314025	Red
D	180 - 280 VAC	314027	Yellow	24 - 280 VAC	314024	Black
E	12 - 32 VAC / 4 - 32 VDC	314026	White	3 - 60 VDC	314025	Red
F	12 - 32 VAC / 4 - 32 VDC	314026	White	24 - 280 VAC	314024	Black
G	12 - 32 VAC / 4 - 32 VDC	314026	White	3 - 200 VDC	314032	Red
H	90 - 140 VAC	314028	Yellow	3 - 200 VDC	314032	Red
J	180 - 280 VAC	314027	Yellow	3 - 200 VDC	314032	Red
<b>K</b>	90 - 140 VAC	314028	Yellow	0 - 120 VDC, 0.5A	314052	Red
L	180 - 280 VAC	314027	Yellow	0 - 120 VDC, 0.5A	314052	Red
M	12 - 32 VAC / 4 - 32 VDC	314026	White	0 - 120 VDC, 0.5A	314052	Red

**Table 4-2.** I/O Relays

INPUT - DC / AC 314026	INPUT - AC 314027/314028	OUTPUT - DC 314025/314032/314052	OUTPUT - AC 314024
			
<b>WHITE</b>	<b>YELLOW</b>	<b>RED</b>	<b>BLACK</b>

Contact factory for other available options and versions of Welder Interlock Control Board A/N 410358 and Relay Rack Boards for up to 24 welders per single Interlock Board in one cabinet without cascading. See Section 2.3 for more information about cascading Interlocks.

## 5.0 OPERATION

Full operation of the Welder Interlock Control Board may be summarized as follows:

1. The Welder Interlock will cyclically scan all relay inputs until an input relay (on PCB2 Board, terminals SV1-SV2) is found energized. The Welder Interlock will activate the associated output relay (on PCB2 Board, terminals PS1-GND) and it will stop cyclic scanning.
2. After that relay input is de-energized, the Welder Interlock will deactivate the output relay and continue to cyclically scan the next inputs until another input activation is detected.
3. At the end of each scan loop (24 steps), the Welder Interlock sends an output pulse (18 VDC) from CRO on the Control Board to TS1-OUT. The Welder Interlock pauses and waits until a pulse (18 VDC) is received at relay CRI on the Control Board, via TS1-IN. The scan of all relay inputs (maximum 24 per Welder Interlock) will then resume. See Section 6.0 for more information about priority.

### **For PROM firmware version 619041-001A and higher:**

As of October 2013, in order for cascading interlock to work more reliably, Master Board working mode and Slave Board working mode have been introduced with PROM firmware version 619041-001A and higher.

If multiple Interlock Boards are cascading connected together as a loop system, one Interlock Board must be set to Master Board working mode and other Interlock Boards must be set to Slave Board working mode.

When Interlock Board is set to Master Board working mode, for every processing cycle, board will scan its input ports, process all the welding request(s) and pass the priority signal out to the Slave Interlock Board(s). Once the Master Interlock Board receives a return priority signal back from Slave Interlock Board(s), a new processing cycle will start.

When Interlock Board is set to Slave Board working mode, for every processing cycle, board will wait for the priority signal from its Master Interlock Board. Once priority signal is received, the Slave Interlock Board will scan its input ports, process all the welding request(s) and pass the priority signal out to next Slave Interlock Board or Master Interlock Board. Once the priority signal has been passed out, the Slave Interlock Board will wait for a new priority input signal to start a new processing cycle.

The Master/Slave Board working modes are set through rotary switch SW2 (see Section 6.0).

### **NOTICE**

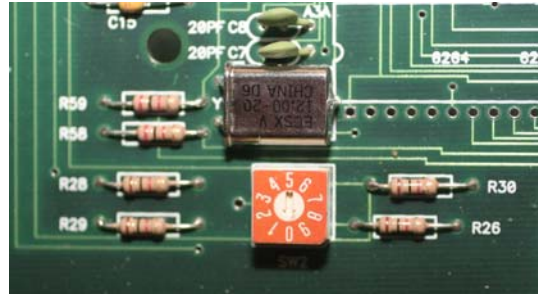
1. If only one Interlock Board is used in entire Interlock system, that board must be set to Master Board working mode.
2. If multiple Interlock Boards are used and cascading connected in entire Interlock system, one of the boards must be set to Master Board working mode and the other Interlock Board(s) must be set to Slave Board working mode.
3. If multiple Interlock Boards are used and cascading connected in entire Interlock system, all the boards should use the same PROM firmware version.

## 6.0 PRIORITY

As of August 2003, priority operation has been revised.

With PROM firmware version 619041-001 **ORIG**, using rotary switch SW2 (see Figure 6-1), priority may be enabled and selected:

- set SW2 to 0 to disable priority if priority is not required;
- set SW2 to any number from 1 to 8 to enable priority and select corresponding welder #1 to #8, respectively, as the welder with highest priority.
- set SW2 to 9 to enable priority on welder #9 only on Welder Interlock Control Boards for more than 8 welders.



**Figure 6-1.** Priority switch SW2

As of October 2013, with PROM firmware version 619041-001A and higher, using rotary switch SW2, the Master/Slave Board working mode and priority may be enabled and selected:

- set SW2 to 0 to set Interlock Board to Master Board working mode and disable priority.
- set SW2 to any number from 1 to 4 to set Interlock Board to Master Board working mode, enable priority and select corresponding welder #1 to #4, respectively, as the welder with highest priority.
- set SW2 to any number from 5 to 8 to set Interlock Board to Slave Board working mode, enable priority and select corresponding welder #5 to #8, respectively, as the welder with highest priority.
- set SW2 to 9 to set Interlock Board to Slave Board working mode and disable priority.

If priority is enabled, the control always checks the corresponding welder input and it will activate its output each time after any other welder is done with its welding sequence.

In the case where multiple and/or all welder inputs are presented at the same time, the priority control will be first and then other initiated controls will be allowed to weld, beginning with the lowest order welder.

### **NOTICE**

Priority switch is set to 0 (factory default setting) when Welder Interlock is shipped.

Following is an example of how priority operation works with eight welders:

Priority switch SW2 is set to 5 to enable and set priority for welder #5 over any other welder initiated. All other welder relay inputs are active. After power-up, the control will activate relay output for welder #5, since priority for that welder is set. After welder #5 is done, the control will activate the output of welder #1, and when this one is done, it will activate welder #5 again (only if its input is active again). After #5 is done, the control will activate welder #2 and again after this one is done, it will go back to #5, and sequence will continue in this order:

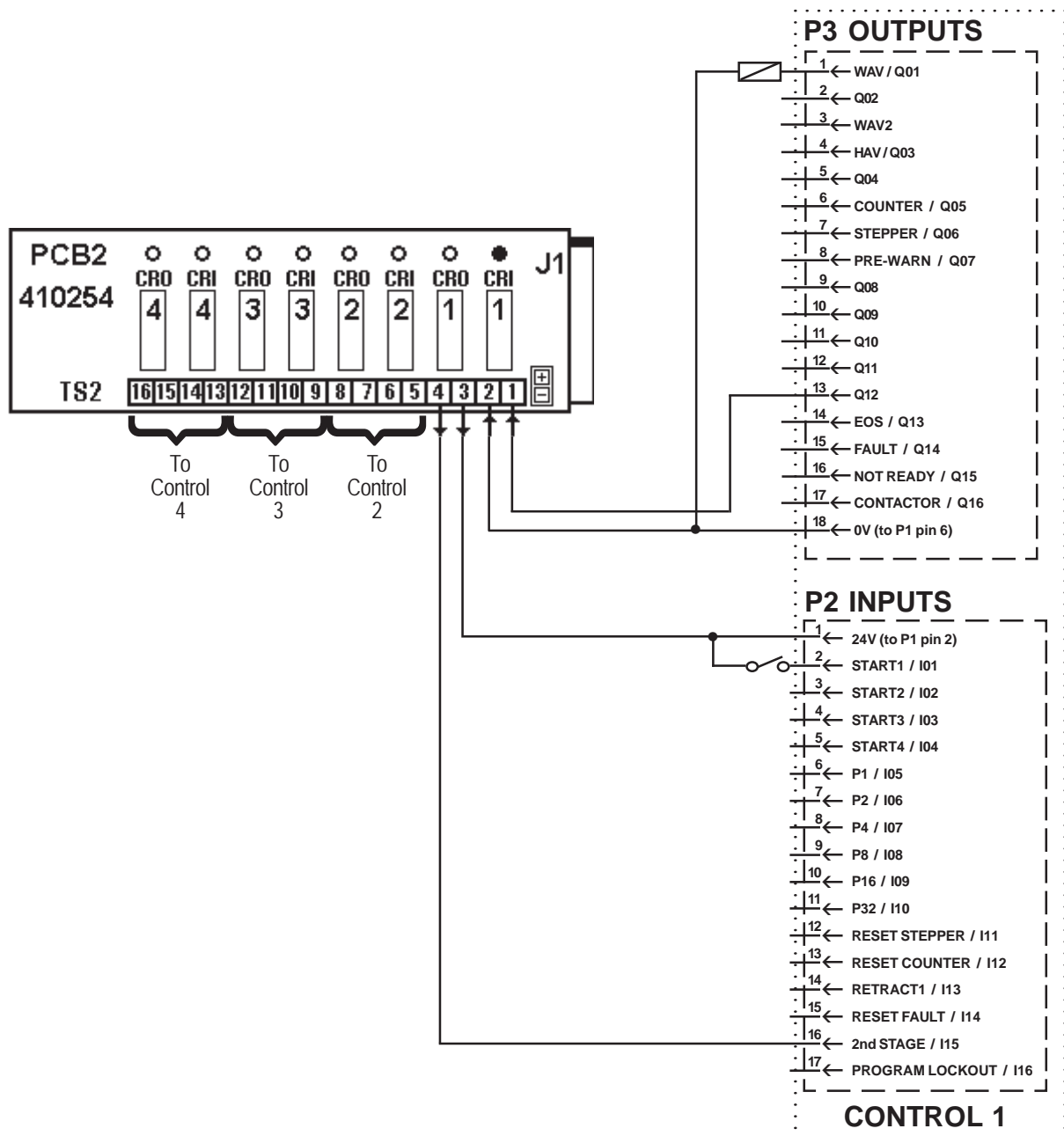
5 - 1 - 5 - 2 - 5 - 3 - 5 - 4 - 5 - 6 - 5 - 7 - 5 - 8.

## 7.0 APPLICATIONS AND PROGRAMMING EXAMPLES

### 7.1 WELDER INTERLOCK USED WITH EN1701 CONTROLS

The following application shows how to use the Welder Interlock with multiple EN1701 Controls (see Instruction Manual 700203 for control details). The Relay Rack should use Option E shown on Wiring Diagram 420721 or Section 4.0. The input relays should be white IDC5 relays (P/N 314026). The output relays should be red ODC5 relays (P/N 314025). Refer to Wiring Diagram 420721 for Welder Interlock connection and operation details.

For this example, connections should be made as shown in Figure 7-1. Subsequent controls should be connected as Control 1, but on next available pair of relays.

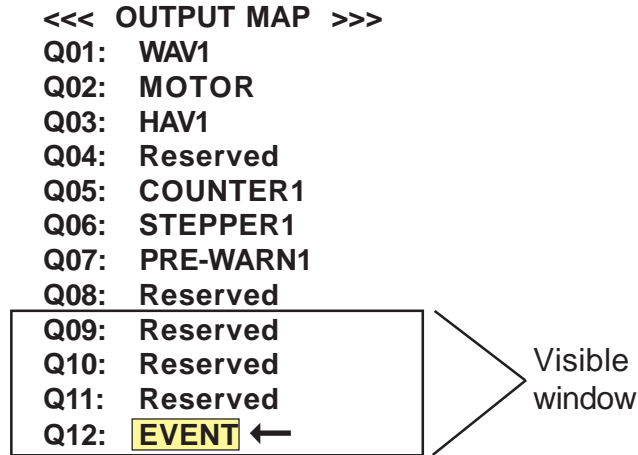


**Figure 7-1.** EN1701 and Welder Interlock connections

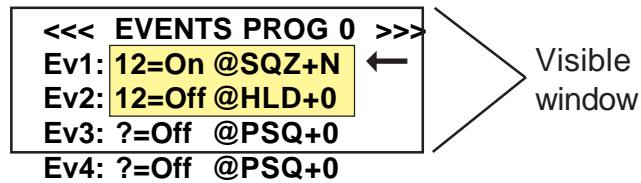
## 7.1 WELDER INTERLOCK USED WITH EN1701 CONTROLS (cont.)

Programming can be done using either RPP1 or ENLINK. Program weld parameters as desired on all welders.

In Output Map, map Output Q12 to **EVENT**.



In Events menu, program an EVENT as follows:

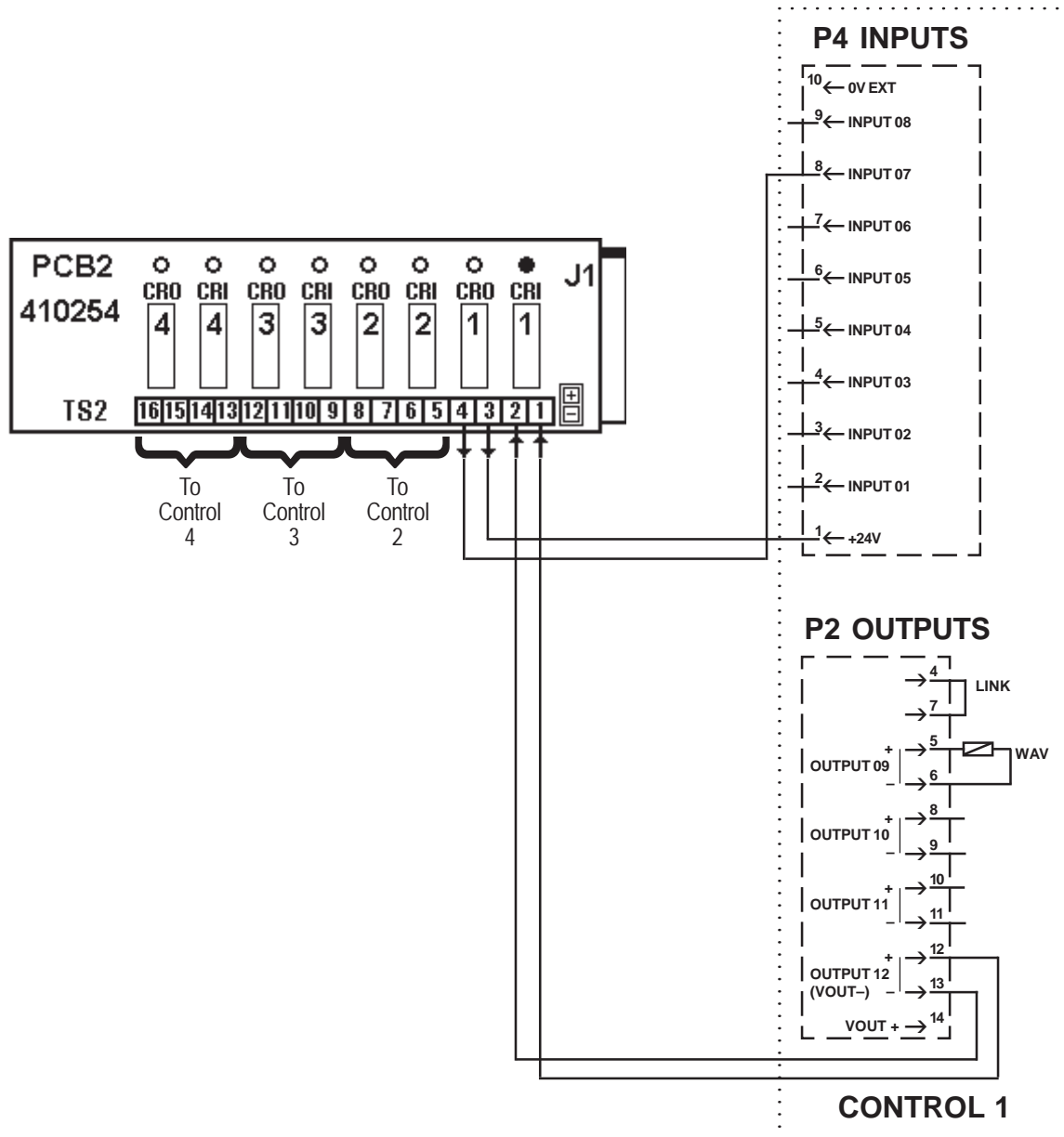


Value of *N* is the programmed SQUEEZE time minus one.

## 7.2 WELDER INTERLOCK USED WITH EN1721 CONTROLS

The following application shows how to use the Welder Interlock with multiple EN1721 Controls (see Instruction Manual 700211 for control details). The Relay Rack should use Option E shown on Wiring Diagram 420721 or Section 4.0. The input relays should be white IDC5 relays (P/N 314026). The output relays should be red ODC5 relays (P/N 314025). Refer to Wiring Diagram 420721 for Welder Interlock connection and operation details.

For this example, connections should be made as shown in Figure 7-2. Subsequent controls should be connected as Control 1, but on next available pair of relays.

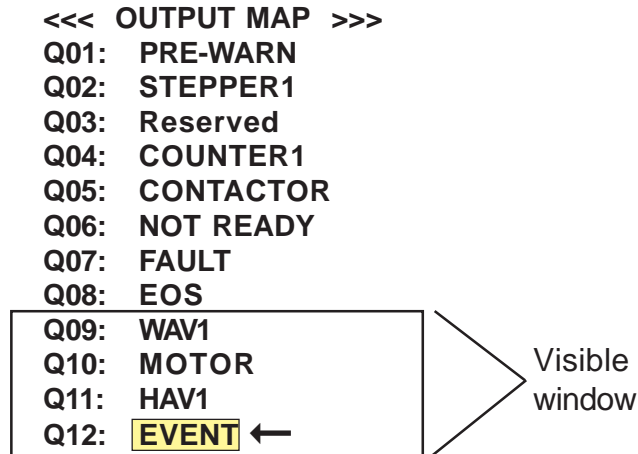


**Figure 7-2.** EN1721 and Welder Interlock connections

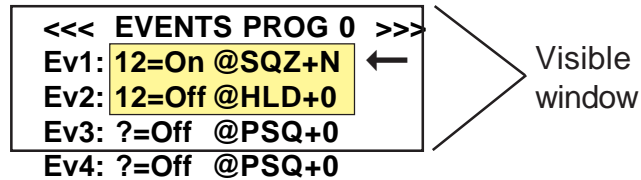
## 7.2 WELDER INTERLOCK USED WITH EN1721 CONTROLS (cont.)

Programming can be done using either RPP1 or ENLINK. Program weld parameters as desired on all welders.

In Output Map, map Output Q12 to **EVENT**.



In Events menu, program an EVENT as follows:



Value of *N* is the programmed SQUEEZE time minus one.

## 8.0 ENTRON LIMITED WARRANTY AND FACTORY SERVICE

ENTRON Controls, LLC., warrants that all ENTRON control panels, **EXCEPT** Mid-frequency Inverter controls, silicon controlled rectifiers (SCRs), insulated gate bipolar transistors (IGBTs), SCR and IGBT assemblies, circuit breakers, and electro-mechanical contactors, are free of manufacturing defects for a period of **TWO YEARS** 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, circuit breakers and electro-mechanical contactors in ENTRON control panels are covered by a **limited warranty from the original manufacturer**. 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.

ENTRON Controls, LLC., warrants that all Mid-frequency Inverter controls are free of manufacturing 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.

To obtain repairs or replacement parts under this warranty, the defective part must be returned, prepaid, to ENTRON Controls, LLC., 1402 S. Batesville Road, 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 or 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 or welding control after the warranty period, send the assembly or control, prepaid, to ENTRON Controls, LLC., and ENTRON will repair the printed circuit board assembly or control and return it to you without further warranty. Additional service charges will be invoiced at time of shipment.

**Your ENTRON Controls, LLC., Original Equipment Manufacturers (OEMs), Dealers and Distributors are your first response contact to secure technical assistance on control or welding problems. Should they be unable to assist you, please contact your ENTRON sales representative or the factory directly. Contact the factory at 864-416-0190.**