



# *Model FM Power Supply*

I N S T R U C T I O N M A N U A L



SONICS



Sonics & Materials, Inc.

# WARNING

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## ***SAFETY PRECAUTIONS READ BEFORE INSTALLING OR USING THE EQUIPMENT***

This system has been designed to assure maximum operator safety. However, no design can completely protect against improper usage. For maximum safety and equipment protection, observe the following warnings at all times and read the instruction manual carefully before you attempt to operate the equipment.

- High voltage is present in the equipment. Disconnect plug before removing cover or servicing.
- Make sure equipment is properly grounded with a 3-prong plug. Before plugging in equipment, test outlet for proper earth grounding.
- Ultrasonic welders operate above normal audibility for most people. Ear protection is recommended.

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# TABLE OF CONTENTS

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<b>IMPORTANT SERVICE LITERATURE</b> .....	4
Manual Change Information .....	4
<b>UNPACKING AND INSPECTION</b> .....	5
Visible Loss or Damage .....	5
Concealed Loss or Damage .....	5
<b>INTRODUCTION</b> .....	6
<b>OVERVIEW OF ULTRASONIC PLASTICS ASSEMBLY</b> .....	6
What is Ultrasonics? .....	6
Principal of Ultrasonic Assembly .....	6
Ultrasonic Assembly Systems .....	6
<b>GLOSSARY OF ULTRASONIC TERMS</b> .....	8
<b>INSTALLATION</b> .....	9
Electrical Power Requirements .....	9
Setting Up .....	9
Electrical Connections .....	10
Cable Connections .....	11
Available Converters .....	12
<b>OPERATING PROCEDURES</b> .....	13
Front Panel Controls and Indicators .....	13
<b>OPERATIONAL SIGNALS</b> .....	15
Operational Features .....	15
Starting up the Power Supply .....	15
Initial Operation .....	16
<b>BASIC MODES OF OPERATION</b> .....	17
Time-Based Modes .....	17
Energy-Based Modes .....	17
Mode Codes Display .....	18
<b>TIME-BASED MODES</b> .....	19
Selecting and Setting Timers in a Time-Based Cycle .....	19
Selecting and Setting the Afterpulse Timer .....	20
Selecting and Setting Process Control Tolerance Limits in a Time-based Cycle .....	21
Selecting and Adjusting Variable Force Trigger Actuation in a Time-Based Cycle .....	21

<b>ENERGY-BASED MODES</b> .....	23
Constant Energy-Based Cycle with Time Delay Triggering . . . .	23
Constant Energy-Based Cycle with Variable Force Triggering . .	24
Timer 5 .....	24
Selecting and Setting the Maximum Weld Time .....	24
<b>OVERVIEW OF OPERATIONS AND LCD DISPLAYS</b> .....	25
<b>OVERVIEW OF SET-UP PROCEDURES AND DISPLAYS</b> .....	27
<b>ADDITIONAL FEATURES AND FUNCTIONS</b> .....	29
Program Version Designation .....	29
Cancel Number of Welds .....	29
Cancel Number of Rejects .....	29
Job Storage .....	29
Job Sequence .....	31
Cal Pulse .....	32
<b>KEYPAD SECURITY</b> .....	33
<b>PRINTER INTERFACE AND OPERATION</b> .....	34
Printer Operation .....	34
Printout of the Weld Energy Curve .....	34
Printer Displays .....	35
Graph Header .....	37
Reject Printouts .....	38
<b>SYSTEM STATUS TESTS AND FUNCTIONS</b> .....	39
Power Supply Test and Display .....	39
Operation Sequence Display .....	39
System Status Tests and Miscellaneous Functions .....	39
Printer Test .....	40
Coupling Force Measurement .....	41
Clear Parameters .....	41
<b>SYSTEM STATUS TESTS</b> .....	42
System Status Tests and Miscellaneous Functions .....	42
Overload Protection .....	43
<b>MAINTENANCE</b> .....	44
General .....	44
Repairs / Service .....	44
<b>WARRANTY</b> .....	45
Limitation of Warranty .....	45
<b>APPENDIX</b> .....	46

# IMPORTANT SERVICE LITERATURE

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**NOTE:** Please read carefully before operating the equipment, then forward to your service department.

The system supplied with this instruction manual is constructed of the finest material and the workmanship meets the highest manufacturing standards. It has been thoroughly tested and inspected before leaving the factory and when used in accordance with the procedures outlined in this manual, will provide you with many years of safe and dependable service.

## **MANUAL CHANGE INFORMATION**

We continually strive to be at the forefront of the latest electronic developments by adding circuit and component improvements to our equipment as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we cannot incorporate these changes immediately into printed manuals. Hence, your manual may contain new change information. Change information, if any, is located in the Appendix.

We reserve the right to make any changes in the design or construction of our equipment at any time, without incurring any obligation to make any change whatsoever in units previously delivered.

The technical data and schematics in the manual are for informational purposes only and may not reflect the current configuration being shipped from our factory. Upon formal request, complete and up-to-date information can be provided from the factory free of charge.

# UNPACKING AND INSPECTION



**NOTE:** We recommend keeping all carton(s) and packing material in case it might be necessary to move the equipment, or to ship it for repair.

Before unpacking the equipment, check the shipping carton for any visible damage. If you see any, be sure to follow the procedures described below under “Visible Loss or Damage.” Otherwise, proceed to remove the equipment from the carton. Before storing any packing material, check it carefully for small parts. Then perform a visual inspection of the equipment to detect any evidence of damage which might have occurred during shipment. Check the following:

1. all components against the enclosed packing list,
2. all module plug-in units,
3. all wire plug-in connections.

The equipment was carefully packed and thoroughly inspected before leaving our factory. All units are tested and checked for problems prior to shipping. It is asked that when a problem does occur that all parts and components be inspected for damage (especially when the unit is not in working order when received). Responsibility for safe delivery was assumed by the carrier upon acceptance of the shipment. Claims for loss of damage sustained in transit must therefore be made upon the carrier, as follows:

## **VISIBLE LOSS OR DAMAGE**

Any external evidence of loss or damage must be noted on the freight bill or express receipt, and signed by the carrier’s agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier’s refusal to honor a damage claim. The form required to file such a claim will be supplied by the carrier.

## **CONCEALED LOSS OR DAMAGE**

Concealed loss or damage means loss or damage which does not become apparent until the merchandise has been unpacked. The contents might have been damaged in transit due to rough handling even though the container may not show external damage. When the damage is discovered upon unpacking, make a written request for inspection by the carrier’s agent within 48 hours of the delivery date. Then file a claim with the carrier since such damage is the carrier’s responsibility. The form required to file such a claim will be supplied by the carrier. Do not destroy packing materials, or move material from one location to another before the carrier makes their inspection.

If the system or any unit is damaged, notify “Sonics.” “Sonics” will arrange for repair or replacement of damaged equipment without waiting for the claim against the carrier to be settled, provided a new purchase order is issued to cover the repair or replacement costs. Should any damage, shortage or discrepancy exist, please notify us immediately.

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# INTRODUCTION

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The FM model power supply is an auto-tuned ultrasonic generator with a built-in Microprocessor that allows time and energy-based control. The Microprocessor is programmed with a multi-function keypad and information is displayed on the back-lit liquid crystal display (LCD). This power supply can be used with a pneumatic actuator or with a stand-alone converter.

## OVERVIEW OF ULTRASONIC PLASTICS ASSEMBLY

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### *WHAT IS ULTRASONICS?*

Ultrasonics refers to vibrational waves with a frequency above the human audible range which is usually above 18,000 cycles per second (Hz).

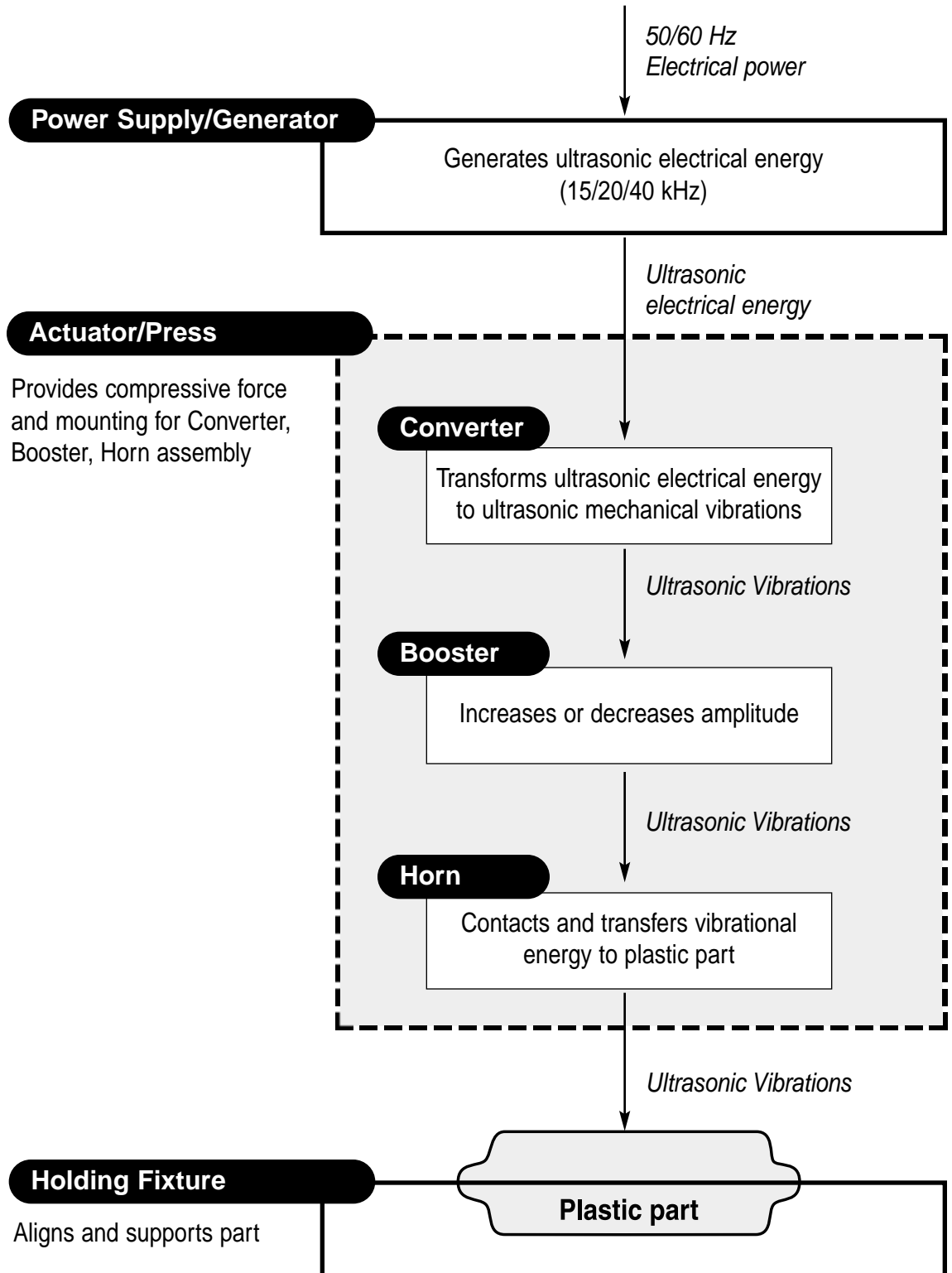
### *PRINCIPLE OF ULTRASONIC ASSEMBLY*

The basic principle of ultrasonic assembly involves conversion of high frequency electrical energy to high frequency mechanical energy in the form of reciprocating vertical motion which, when applied to a thermoplastic, generates frictional heat at the plastic/plastic or plastic/metal interface. In ultrasonic welding, this frictional heat melts the plastic, allowing the two surfaces to fuse together; in ultrasonic staking or insertion, the controlled flow of molten plastic is used to capture or lock another material in place (staking) or encapsulate a metal insert (insertion).

### *ULTRASONIC ASSEMBLY SYSTEMS*

“Sonics” ultrasonic assembly systems are generally composed of the following major elements: a power supply, converter, booster, horn, pneumatic press and holding fixture, as detailed in the diagram on the next page. A review of this diagram will help you understand the basic elements involved in the assembly process and their relation to each other.

**“SONICS” ULTRASONIC ASSEMBLY SYSTEMS**





# GLOSSARY OF ULTRASONIC TERMS

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**POWER SUPPLY/GENERATOR** – The solid state power supply converts standard 50/60 Hz electrical energy to 15,000 Hz, 20,000 Hz or 40,000 Hz (15/20/40 kHz) electrical energy.

**ACTUATOR/WELDING PRESS** – The pneumatic actuator provides compressive force and mounting for the converter, booster and horn assembly. The tabletop press consists of a base assembly, column and actuator (head).

**CONVERTER** – The converter changes the high frequency electrical energy supplied by the power supply to high frequency mechanical vibrations.

**BOOSTER** – Successful ultrasonic welding often depends on having the right amplitude at the horn face. Often it is not possible to design a horn which has both the necessary shape and required gain (ratios of input amplitude to output amplitude). In such cases, a booster is placed between the converter and the horn to either increase or decrease the amplitude of the horn. In addition to changing/maintaining the amplitude, the booster provides support and alignment in the welding system.

**HORN** – The horn is a tuned component of the system which comes in contact with the parts to be assembled. The horn 1) transfers the ultrasonic vibrations produced from the converter to the parts being welded, and 2) applies necessary force to the assembly while the material resolidifies.

**HOLDING FIXTURE** – The holding fixture or nest assures proper alignment and support of the parts being assembled.

# INSTALLATION



## WARNING

The line cord of the controller/power supply is equipped with a 3-prong, grounding plug. Do not, under any circumstances, remove the ground prong. The plug must be plugged into a mating 3-prong, grounding type outlet.

## ELECTRICAL POWER REQUIREMENTS

The power supply requires a fused, single-phase, standard 3-terminal grounding type receptacle capable of supplying the requisite voltage and current. Refer to the table below for power specification.

### POWER SPECIFICATIONS

Model	Power Rating	115 vac	230 vac
FM740	700w	15 amps	10 amps
FM1020	1000w	15 amps	10 amps
FM1520	1500w	N/A	15 amps
FM2020	2000w	N/A	20 amps

## SETTING UP

The power supply is a free-standing assembly. It should be installed in a clear, uncluttered location that is free from excessive dirt, dust, corrosive fumes, and temperature and humidity extremes. The selected installation site should be near the electrical power source and away from equipment that generates abnormally high electrical transients. Observe the following additional instructions when installing the equipment:

- Allow at least 6 inches (152.4mm) at the rear of the power supply for cable connections.
- Position the power supply so that the front panel controls are visible and readily accessible.
- The power supply is air cooled; allow sufficient space around the assembly to ensure adequate ventilation. If the power supply must be housed in a confined space, forced air cooling may be necessary to keep surrounding air within acceptable ambient temperature limits. Periodically check the ventilation grille and clean as necessary.



**NOTE:** If power supply is to be run continuously, air cooling of the converter and horn is required. Use clean, dry compressed air filtered down to 5 microns (supplied to converter fitting – see page 12).



**NOTE:** Do not plug the power supply into an electrical outlet until all other connections have been made.

## **ELECTRICAL CONNECTIONS**

The standard cable supplied with a “Sonics” press is 10 feet. Optional extension cables are available up to 15 feet without modification.

When making the initial electrical connections, make sure the power is disconnected and follow these precautions.

1. Do not strain or kink the cables. When going around corners, allow as wide a bend as possible. Do not run the cables parallel to any power line within a distance of less than 1 foot (305mm).
2. To prevent the possibility of an electrical shock, ensure that the power supply line cord is properly grounded. Also make sure that the voltage rating of the electrical power source matches the power supply requirement (refer to the “Power Specifications” table on preceding page).
3. Check with your electrician if you have any wiring questions.



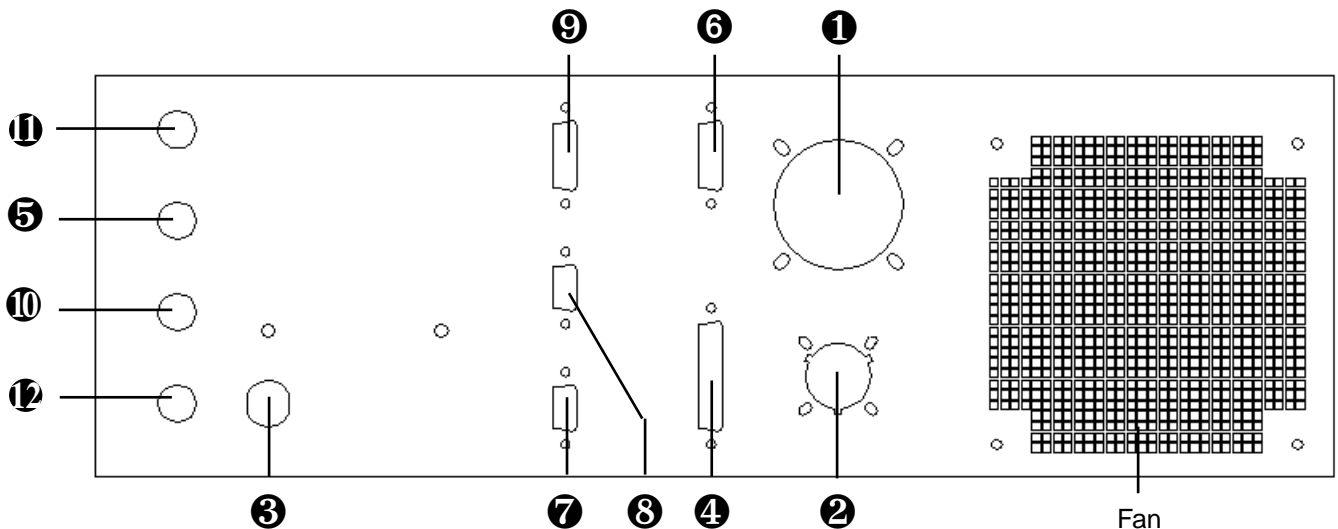
**NOTE:** Detailed wiring diagrams are supplied in the Appendix at the back of this manual.

### CABLE CONNECTIONS:

Located at the rear of the power supply are the cable connections as illustrated below. (The interconnecting cables will be supplied with your system.)

1. J1, a round, 12-pin RF cable that connects the welding press or converter to the power supply.
2. J2, an actuation cable that connects the power supply to a trigger source (refer to wiring diagrams in Appendix).
3. The power line cord that plugs into the appropriate electrical outlet.

Once these connections have been made, the power supply is ready for operation. If applicable, be sure to consult your welding press instruction manual to insure that all connections on the press side are correct, and that the press is ready for operation.



Also located at the rear of the power supply are the following:

4. J3 Printer Output
5. fuse (based on requirements listed in "Power Specifications" table, p. 9),
6. J6 Rotary Table Output (see wiring diagrams in Appendix),
7. J7 I/O (see wiring diagrams in Appendix),
8. J8 I/O (see wiring diagrams in Appendix),
9. J9 Reject Output
10. fuse (based on requirements listed in "Power Specifications" table, p. 9),
11. fuse (fixed 0.5 amp),
12. fuse, not optional (based on requirements listed in "Power Specifications" table, p. 9)



**NOTE:** To see a list of converters that can be connected to the power supply, see the table on the following page.

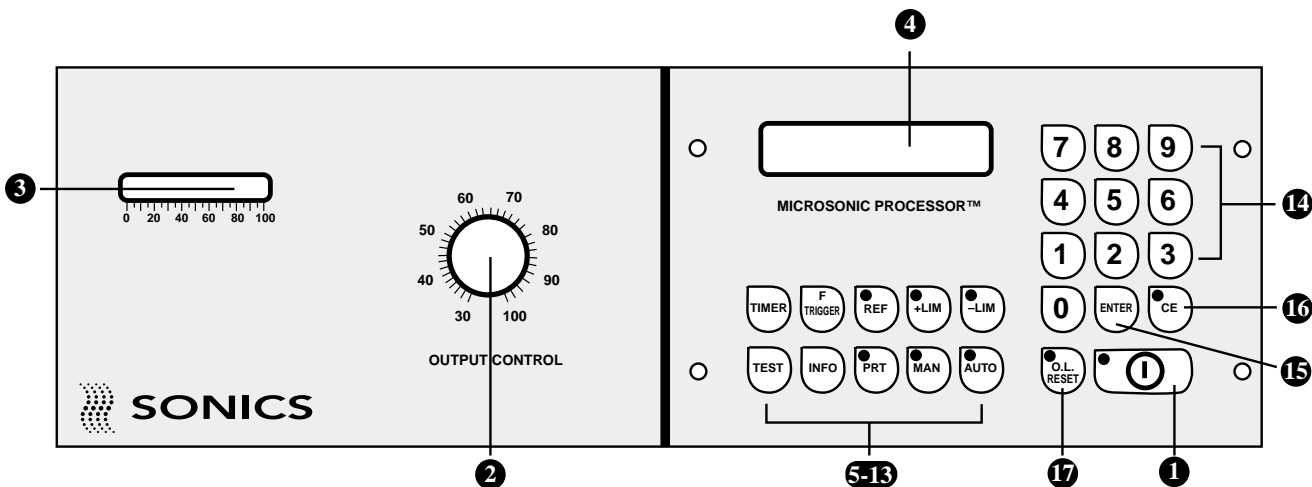
### AVAILABLE CONVERTERS

Item No.	Description
CV00015	20 kHz with Button connector
CV00151	20 kHz with Lemo connector
CV00154	20 kHz with Lemo connector and fitting for air cooling
CV00157	20 kHz with Button connector and fitting for air cooling
CV00158	20 kHz Hand Gun with handles and cables
CV00331	20 kHz with Fischer connector
CV00334	20 kHz with Fischer connector and fitting for air cooling
CV00023	40 kHz with Button connector
CV00231	40 kHz with Lemo connector
CV00232	40 kHz with SHV connector side mounted
CV00234	40 kHz with Lemo connector and fitting for air cooling
CV00238	40 kHz Hand Gun with trigger switch and cable

# OPERATING PROCEDURES

## FRONT PANEL CONTROLS AND INDICATORS

Located on the front panel of the power supply are the following controls and indicators:



### WARNING

The RESET button is a built-in safety feature. When the power supply is connected to a press, be sure the press head actuation signals are not activated (or closed). If they are activated, the press head will descend immediately when the RESET button is depressed.

1. ON/OFF key which turns the unit on and off. Red LED in upper left corner indicates unit is ON.
2. OUTPUT CONTROL DIAL which controls *fine* adjustment of the amplitude of the system's high-frequency vibrations over the full operating range. (*Major* adjustments of amplitude are made through the use of different boosters – consult your press manual for further information.)
3. LED LOAD METER which indicates the power level of ultrasonics that is being delivered to the welding press.
4. LCD SCREEN which displays various settings, parameters and prompts as detailed in the following pages.
5. TIMER key which selects and displays timer settings and permits adjustment of timer duration in .01 second increments (from 0.00 to 9.99 seconds) for five timers as follows:
  - T1: Delay Timer (for normal delay triggering or pre-triggering).
  - T2: Weld Timer (in time-based operation).
  - T3: Hold Timer (in both time- and energy-based operation).
  - T4: Afterpulse Timer (to release assemblies adhering to horn).
  - T5: Abort Cycle Timer (limits maximum weld time permitted for an assembly).
6. F-TRIGGER key which displays and permits adjustment of triggering force as a percentage of maximum force. When used in conjunction with Head Advance Control (1098 Model only) actual horn coupling force can be displayed.

7. REF key which displays energy in Watt Seconds (Ws) when the constant energy mode has been selected, and permits adjustment of the set value in .1 Ws increments. Green LED in the upper left corner indicates completion of an acceptable process cycle.
8. +LIM / -LIM keys which display and establish upper and lower quality control tolerance limits in time (sec.) when energy mode is selected and in energy (Ws) when time mode is selected. Red LEDs in upper left corner indicate when rejects occur because either time or energy is above or below set limits.
9. TEST key which can be used to test ultrasonic operation and displays idle losses of converter/booster/horn as a percentage of maximum power when key is depressed.
10. INFO key which displays data (or parameters) on the LCD screen. Can be pressed up to eight times to display the following data (in the order shown):
  - *Number of cycles*
  - *Number of rejects*
  - *Rated output power of system*
  - *Mode Codes (functions selected)*
  - *Length of Graph Time Axis when printed out on optional printer*
  - *SAVE RECALL OTHER options*
  - *Job Sequencing*
  - *Calibration Pulse (activation or deactivation).*
11. PRT key which permits display of parameters and dynamic process conditions when optional CRT monitor or printer is used. Green LED in upper left corner indicates when data is being transmitted to a peripheral accessory.
12. MAN key which is only used with rotary table operation to select normal single cycle indexing (the default mode).
13. AUTO key which is only used with rotary table operation to select continuous cycling.
14. 0-9 Numeric key pad which allows input of numeric data or numeric selection options by pressing the keys.
15. ENTER key which enters data into the system as keyed in with numerical keys and displayed on the LCD screen.
16. CE key which cancels a prior parameter value when a new value is to be entered. Red LED in upper left corner indicates key is functional and will cancel a value displayed when depressed.
17. O.L. RESET key which resets the power supply following an overload condition. Red LED in upper left corner indicates an overload condition exists.

# OPERATIONAL SIGNALS

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Valid parameter entries and/or selections are verified by an audible signal of short duration. Invalid entries and/or selections (fault conditions) are signaled by an audible signal of longer duration.

## **OPERATIONAL FEATURES**

- Adjustable Afterpulse Timer to separate parts from horn.
- Adjustable tolerance limits in energy (Ws) or time (sec) with visual and audible alarms.
- Information displays including: number of assemblies, number of rejects, power supply rated output, Mode Codes (functions selected) and length of time axis for optional power curve printout.
- Fault displays: CHECK PRESS, CHECK PRESSURE OR b8, FORCE MISSING, PRESS VALVE FAILURE.
- Keypad security to prevent unauthorized adjustment of parameters.
- Self diagnostic input test.
- Display of coupling force measurement (Model 1098 only).
- Storage capabilities of up to 9 programs.
- Job sequence of up to 9 programs.
- Deactivation of calibration pulse (i.e., when utilizing vacuum horns).
- Variable weld time in constant energy mode.
- Printer/CRT monitor interface permits connection to an optional CRT and/or printer or computer.

## **STARTING UP THE POWER SUPPLY**

Press the ON/OFF key to turn the power supply on. The red LED will light up indicating the unit is on.

The LCD screen will briefly display “Sonics & Materials.” If a printer or CRT is not connected to the system, the following message will also be displayed briefly:

\* \* \* NO PRINTER! \* \* \*

Then the LCD screen will display “READY.”



## INITIAL OPERATION

After the power supply is turned on (as described above), follow these steps:

1. Make sure that all necessary preparations have been made with regard to the ultrasonic system and tooling, and that the items to be welded are in position.
2. Press and hold the TEST button. While depressing the TEST button, check the LCD reading. Make sure the reading on the LCD display (see example below) does not exceed 10%.

US-TEST = 05%

- a) If the display is above 10%, contact Sonics immediately for further instructions before proceeding.
- b) If the display is below 10%, you can proceed with operation.

During the testing process, keep in mind that the ultrasonics are only activated as long as the TEST button is depressed – once you release the TEST button, ultrasonics is terminated.

3. The power supply is now ready for operation.



**NOTE:** The TEST and Load Meter check should always be done for all cold start-ups, and for any start-up after the system has been idle for 20 minutes or more.

# BASIC MODES OF OPERATION

---

The FM power supply's built-in microprocessor allows the use of either time-based or energy-based cycles in four basic modes, as follows:

1. Time-based cycle with time delay triggering or pre-triggering.
2. Time-based cycle with variable force triggering.
3. Constant energy-based cycle with time delay triggering or pre-triggering.
4. Constant energy-based cycle with variable force triggering.

## ***TIME-BASED MODES***

In a ***Time-Based Cycle with Time Delay Triggering***, the Weld and Hold timers are actuated following the termination of a pre-determined delay period. This delay period is initiated when the horn contacts the part to be welded.

In a ***Time-Based Cycle with Variable Force Triggering***, the Weld and Hold Timers are actuated after a pre-determined coupling force is exerted on the components.

For both of these time-based modes of operation, upper and lower tolerance limits in energy (Ws) can be adjusted.

## ***ENERGY-BASED MODES***

In a ***Constant Energy-Based Cycle with Time Delay Triggering***, the weld cycle follows the termination of a pre-determined delay period. The weld cycle continues until a pre-selected amount of energy in Watt seconds (Ws) is delivered to the components. The duration of the weld cycle may vary, but the energy delivered is constant.

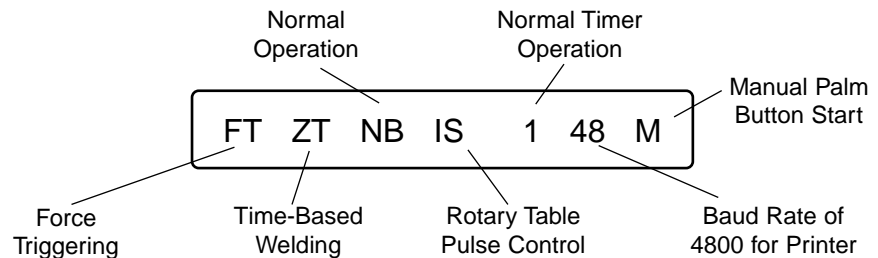
In a ***Constant Energy-Based Cycle with Variable Force Triggering***, the Weld cycle is initiated after a pre-selected Trigger Force is reached. Once again, the duration of the weld cycle is dependent upon the pre-selected amount of energy delivered to the components.

In the case of energy-based modes of operation, the upper and lower tolerance limits are adjustable in time (seconds).

## MODE CODES DISPLAY

The power supply is shipped with blank programs, so all data and parameters must be input by the customer. On initial start-up, the default mode selected is the Time-Based cycle. Press the INFO key four times and the following "Mode Codes" display will appear on the LCD screen:

## DEFAULT SETTINGS



## MODE CODES: FUNCTION ABBREVIATIONS

Following is a complete list of mode code abbreviations that will appear in eight positions on the LCD display and their corresponding meanings.

*1st Position* T1 = Ultrasonics are turned on following termination of delay time or pre-trigger

or

FT = Ultrasonics actuated when trigger force has been reached

---

*2nd Position* ZT = Time-based welding

or

EN = Constant energy welding

---

*3rd Position* NB = Normal operation (no rotary table)

or

RT = Rotary table control and operation provided by microprocessor

---

*4th Position* IS = Rotary table pulse control

or

DS = Rotary table continuous signal control with acknowledgement

---

*5th Position* U = Afterpulse Timer (T4) operational (Not a default)

or

blank

---

*6th Position* 1 = Normal Timer operation

---

*7th Position* 48 = Baud rate of 4800 for optional printer

---

*8th Position* M = Manual, dual palm switch actuation

or

A = Automatic impulse actuation

# TIME-BASED MODES



**NOTE:** When the Time-Based mode is in effect, the percentage of maximum power and energy (Ws) used are displayed on the LCD immediately following completion of the process cycle.

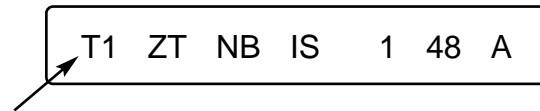
## SELECTING AND SETTING TIMERS IN A TIME-BASED CYCLE (with delay triggering)

As described on the previous pages, the default mode is the Time-Based cycle. Pressing the INFO key four times would display the following codes on the LCD Screen:



The mode code “ZT” would be displayed in the second position, indicating time-based operation.

To change from Force Triggering (FT) to Time Delay Triggering (T1), press numerical key 1. The following display will appear:



As mentioned previously, the five timers are:

Timer		Timer Number (NR)	Mode Code
Delay Timer	=	Timer 1	= T1
Weld Timer	=	Timer 2	= ZT
Hold Timer	=	Timer 3	= T3
Afterpulse Timer	=	Timer 4	= U
Abort Timer	=	Timer 5	=

Press the TIMER key and the following display will appear:



Press the appropriate numerical key to select a timer value to be displayed or set; i.e., press key 1 to display the set-value of the Delay Timer (T1); key 2, to display the set-value of the Weld Timer (T2); and so on.

Once a timer number has been selected, the red LED in the upper corner of the CE key will light up, indicating that the CE key is functional and must be depressed to enter a new time value, regardless of whether or not a previously established value is displayed. After depressing the CE key, which cancels the prior time value, key in a new value using the numeric keys and press the ENTER key to set the value, or wait thirty seconds and the value will be automatically accepted.



**NOTE:** If you do not press the ENTER key to enter in new data within 30 seconds, the new data will be automatically entered in by the system.



**NOTE:** T1 should be selected and set at 0.00 seconds only when pre-triggering is required. Pre-triggering during normal welding operations can result in surface marking.

Pre-triggering is accomplished by setting T1 to 0.00 sec, thus continuing the calibration pulse until T2 is actuated by the horn contacting the workpiece.

The Delay Timer (T1) can only be set or changed when Delay Timer Triggering (T1) has been selected. The Delay Timer is not operational when the Force Triggering function (FT) has been selected. Attempts to access T1 when the Force Trigger function has been selected will result in the following display:

TIMER 1 MODE IS OFF!

The Weld Timer (T2) can only be set or changed when Time-Based operation (ZT) has been selected. The Weld Timer is not operational when the Constant Energy function (EN) has been selected. Attempts to access T2 when the Constant Energy function has been selected will result in the following display:

US-TIME MODE IS OFF!

If no timer values are to be changed, press the ENTER key twice (providing that a time value is displayed) to return to system status READY.

### **SELECTING AND SETTING THE ATERPULSE TIMER**

In some applications involving staking, spot welding, or a vacuum horn, the completed assembly may remain attached to the horn. In such instances, the Afterpulse Timer (T4) can be used to actuate the ultrasonics briefly to release the assembly as the press retracts to rest position.

To use the Afterpulse Timer (T4), press the INFO key four times to display the current Mode Codes, for example, T1 ZT NB IS 1 48 M. Press the numerical key 5 and the letter "U" will appear in the fifth position of the LCD display between "IS" and "1," indicating that the Afterpulse Timer (T4) is operational. The new display will now appear as follows:

FT EN NB IS 1 48 A

Once the Afterpulse Timer is operational, parameters for it may be entered in the same manner as for all timers: press the Timer key and when prompted, press the corresponding numerical key (4); then use the CE and numerical keys to select the value desired.

To cancel operation of the Afterpulse Timer (T4), follow the same procedure described above to select the function. (The numerical key 5 acts as a toggle



**NOTE:** If the Afterpulse Timer is not in use, (which is the case if the Mode Code function "U" is not displayed), T4 should be cleared so that the displayed value is 0.00 sec. Although the Afterpulse Timer is not operational, any value set for T4 will extend the Hold Timer (T3) duration by that value.

key to activate and cancel the Afterpulse function.) When the Afterpulse Timer is cancelled, the function letter “U” will no longer appear in the Mode Codes display.

### **SELECTING AND SETTING PROCESS CONTROL TOLERANCE LIMITS IN A TIME-BASED CYCLE**

The process control tolerance limits are established in energy (Ws) when the Time-Based mode (ZT) is in effect.

If tolerance reject limits have not previously been set, or if all parameters have been cleared, the system will automatically display the default limits. For example, at 1500 watts, the display will show 0 Ws and 14,985.0 Ws for the lower and upper limits respectively.

Press the – LIM key to display the lower limit value on the LCD. The red LED on the CE key will light up indicating that the CE key is functional and must be depressed if a new lower limit value is to be entered.

Press the CE key to clear the displayed value, key in the new value with the numeric keys and set it by pressing the ENTER key. (If the ENTER key is not depressed, the value is accepted automatically after 30 seconds.)

Selection and adjustment of the upper tolerance limit is accomplished in the same manner once the + LIM key is pressed.

If entry of an improper limit value is attempted, i.e., a lower limit value that exceeds the upper limit value, the following display will appear on the LCD screen.

+ LIMIT < -LIMIT!

### **SELECTING AND ADJUSTING VARIABLE FORCE TRIGGER ACTUATION IN A TIME-BASED CYCLE**

Press the INFO key four times to view the Mode Codes display. If FT is not displayed as the first setting, press the numerical key 1 to change the setting to Force Triggering.

Then, press the ENTER key to return to the READY display. Press the F TRIGGER key to display the existing Force Trigger value on the LCD. A red LED will indicate that the CE key is operational and must be depressed if a new Force Trigger value is to be entered.

Press the CE key to clear the display and key in the desired Force Trigger value. The force value can be established from 1% to 99% of the maximum press force (100% = 50 PSIG). A force of 0% cannot be entered.

Press the ENTER key or any other key to enter the new Force Trigger set value, or wait 30 seconds for automatic acceptance.

The Force Trigger (FT) value can only be set or changed when the Force Triggering (FT) mode is in effect. It is not operational when the Time Delay Triggering function (T1) has been selected. Attempts to access FT by depressing the F Trigger Key when the Time Delay Triggering (T1) function is in effect will result in this display:

FORCE-TRIG. MODE OFF

If the required coupling force is not reached because air pressure is not sufficient, the head will retract after five seconds and the following message will be displayed:

FORCE MISSING

An assembly cycle can be completed only when the fault has been corrected, either by increasing gauge pressure or decreasing the Force Trigger value.

The actual horn coupling force can be determined (Model 1098 only) by following the procedures explained on page 41.

# ENERGY-BASED MODES

## **CONSTANT ENERGY-BASED CYCLE WITH TIME DELAY TRIGGERING**

When the CONSTANT ENERGY function (EN) has been selected, the weld cycle follows the termination of a predetermined delay period (T1) and continues until a pre-selected amount of energy (Ws) has been delivered to the components being assembled. When the Constant Energy function is in effect, the percentage of maximum power used and actual weld cycle duration are displayed on the LCD immediately following completion of the cycle.

To change from Time-based operation to the Constant Energy mode (EN), first press the INFO key four times to display the current Mode Codes. Press the numerical key 2 to change the Constant Time mode (ZT) to the alternate Constant Energy function (EN). To return to the READY display, press the ENTER key. Press the REF key to display any previously entered energy value on the LCD. A red LED will indicate that the CE key is functional and must be pressed in order to enter a new energy value.

Press the CE key to clear the current display values and use the numerical keys to set the new energy value. Press the ENTER key, or wait 30 seconds for automatic acceptance.

The REF value in (Ws) can only be set or changed when Constant Energy (EN) is in effect. It is not operational when the Time Based function (ZT) is in effect. Pressing the REF key when the Time Based function (ZT) is in use will result in the following display:

ENERGY MODE IS OFF

If the selected energy level is not reached within 10 seconds as a result of low coupling force or the absence of components in the part holding fixture, the cycle is terminated automatically and the following message will be displayed:

(X)%Pmax 0.00 sec

### **Quality Control Tolerance Limits**

When the Constant Energy mode (EN) is in effect, the quality control tolerance limits are measured in time (sec).

If tolerance reject limits have not previously been set, or if all parameters have been cleared, the power supply will automatically display the default values of 0.00 sec and 9.99 sec for the lower and upper limits respectively.



### **CONSTANT ENERGY-BASED CYCLE WITH VARIABLE FORCE TRIGGERING (Refer to page 27 for keystroke sequence guide.)**

This mode of operation utilizes both the Force Trigger (FT) and Constant Energy (EN) functions to assure consistent triggering and energy delivery.

To change from Time-based operation, press the INFO key four times to display the current Mode Codes, i.e., T1 ZT NB IS 1 48 A. Press the numerical keys 1 and 2 to select the alternate functions FT and EN. The new mode codes (in the first and second positions of the LSD display) will now appear as follows:

T1	ZT	NB	IS	U	1	48	A
----	----	----	----	---	---	----	---

The Delay Timer (T1) and Weld Timer (T2) are not active in this mode (because triggering is initiated by the piezoelectric load cell and weld cycle duration is determined by the pre-selected level of energy delivered to the components being assembled). The Hold Timer (T3) is active and can be set in the usual manner.

Force Trigger (FT) and the quality control tolerance limits (+LIM/-LIM) are also active in this mode and can be set in the usual manner.

#### **TIMER 5**

Timer #5 is an abort cycle timer that can override the hard coded value of 9.99 seconds as an absolute time out when in the Energy mode.

Timer 5 is set in the same manner as the other timers 1 through 4. If the abort cycle feature is not to be used, Timer 5 should be set to 9.99 sec. If Timer 5 were set to zero (0), then welding in the Energy mode could not occur because the counters start simultaneously. The weld cycle will be terminated by whichever applicable time limit is reached first. Again, timer 5 can only be used when welding in the Energy mode. Timer 2 and Timer 5 cannot be utilized simultaneously.

#### **SELECTING AND SETTING THE MAXIMUM WELD TIME (in Constant Energy Mode)**

In the Constant Energy Mode, the Abort timer (T5) overrides the actual weld cycle time and can therefore limit the maximum ultrasonic weld time permitted for an assembly. That is, if the value set for the Abort timer (T5) is reached before the programmed energy value is met, sonics will be terminated and the hold cycle will be initiated.

# OVERVIEW OF OPERATIONS AND LCD DISPLAYS

## MICROSONIC PROCESSOR™ OPERATING INSTRUCTIONS


	FUNCTION	DISPLAY BEFORE	KEY OPERATION SEQUENCE	DISPLAY AFTER
<b>START-UP</b>	Start power supply and Microsonic Processor™	—		SONICS AND MATERIALS •••• NO PRINTER •••• READY
<b>TEST</b>	Test for idle losses in air	READY	TEST	US - TEST = 5%
<b>TIMER</b>	Select Timer Function Select Timer ex: Delay Trigger Timer Set Timer 1 ex: 0.25 sec. Enter set value	READY TIMER NR = (1-5)? TIMER 1 = 0.00 sec TIMER 1 = 0.25 sec	TIMER 1 CE 2 5 ENTER	TIMER NR = (1-5)? TIMER 1 = 0.00 sec TIMER 1 = 0.25 sec TIMER NR = (1-5)?
<b>LIMIT</b>	Select Upper Limit Cancel Value Set Upper Limit ex: 115.0 Ws Enter set value	READY + LIM = 14985.0 Ws + LIM = 00000.0 Ws + LIM = 115.0 Ws	+ LIM CE 1 1 5 0 ENTER	+ LIM = 14985.0 Ws + LIM = 00000.0 Ws + LIM = 115.0 Ws READY
<b>WELDS</b>	Display number of welds completed Display number of rejects Display rated power Display Mode Codes	READY READY READY READY	INFO INFO INFO INFO INFO INFO INFO INFO INFO INFO INFO	WELD CYCLES = 0 REJECTS = 0 RATED POWER = 1500W
<b>DELAY TIMES</b>	Select either Delay Timer Triggering or Force Triggering Functions If Delay Triggering (T1): If Force Triggering (FT):	T1 ZT NB IS 1 48 M FT ZT NB IS 1 48 M	1	FT ZT NB IS 1 48 M T1 ZT NB IS 1 48 M
<b>ENERGY</b>	Select either Time Based function or Constant Energy Function If Time Based (ZT): If Constant Energy (EN):	T1 ZT NB IS 1 48 M T1 EN NB IS 1 48 M	2	T1 EN NB IS 1 48 M T1 ZT NB IS 1 48 M

	FUNCTION	DISPLAY BEFORE	KEY OPERATION SEQUENCE	DISPLAY AFTER
<b>AFTERPULSE</b>	Select Afterpulse Timer (T4) or cancel Afterpulse Timer (T4).	T1 ZT NB IS 1 48 M	5	FT ZT NB IS 1 48 M
<b>TRIGGER FORCE</b>	Select Trigger Force Set Trigger Force ex: 25% Enter set value	READY TRIGGER (F) = 1% TRIGGER (F) = 25%	F TRIGGER CE 2 5 ENTER	TRIGGER (F) = 1% TRIGGER (F) = 25% READY
<b>REF</b>	Select and clear energy (REF) set value Set REF value ex: 100.0 Ws Enter REF Value	READY REF = 00000.0 Ws REF = 100.0 Ws	REF CE 1 0 0 0 ENTER	REF = 00000.0 Ws REF = 100.0 Ws READY
<b>SECURITY</b>	Secure keypad to prevent unauthorized adjustment of parameters. Release keypad security	T1 ZT NB IS 1 48 M	0 7	READY
<b>PRINT</b>	Continuous sequential display or printout of dynamic operating conditions on optional CRT or printer	READY	PRT	READY
	Printout of weld curve by optional printer	READY	ENTER Depress and hold for two seconds	* DATA TO PRINTER * READY

# OVERVIEW OF SET-UP PROCEDURES AND DISPLAYS

## CONSTANT ENERGY WITH VARIABLE FORCE TRIGGERING

	FUNCTION	DISPLAY BEFORE	KEY OPERATION SEQUENCE	DISPLAY AFTER
<b>START-UP</b>	Start power supply	—	①	SONICS AND MATERIALS •••• NO PRINTER •••• READY
<b>TEST</b>	Test for idle losses in air	READY	TEST	US - TEST = 5%
<b>FORCE TRIGGER</b>	Determine whether Force Trigger function has been selected  If not:	READY  T1 EN NB IS 1 48 M	INFO INFO INFO INFO  1	FT EN NB IS 1 48 M  FT EN NB IS 1 48 M
<b>CONSTANT ENERGY</b>	Determine whether Constant Energy function has been selected  If not:	READY  FT ZT NB IS 1 48 M	INFO INFO INFO INFO  2	FT EN NB IS 1 48 M  FT EN NB IS 1 48 M
<b>TRIGGER FORCE</b>	Select Trigger Force  Set Trigger Force ex: 25%  Enter set-value	READY  TRIGGER (F) = 00%  TRIGGER (F) = 25%	F TRIGGER CE 2 5 ENTER	TRIGGER (F) = 00%  TRIGGER (F) = 25%  READY
<b>REF</b>	Select and clear energy set value  Set REF value ex: 100.0 Ws  Enter REF value	READY  REF = 00000.0 WS  REF = 1000 WS	REF CE  1 0 0 0 ENTER	REF = 00000.0 W  REF = 1000 W  READY
<b>TIMERS</b>	Select Timer Function  Select Hold Timer (T3)  Set Hold Timer ex: 25 sec.  Enter set-value (T3)	READY  TIMER NR = (1-5)?  TIMER 3 = 0.00 sec  TIMER 3 = 0.25 sec	TIMER  3 CE 2 5 ENTER	TIMER NR = (1-5)?  TIMER 3 = 0.00 sec  TIMER 3 = 0.25 sec  TIMER NR = (1-5)?
<b>AFTERPULSE</b>	Cancel Afterpulse Timer (T4)	TIMER NR = (1-5)?	4 CE ENTER	TIMER NR = (1-5)?

	FUNCTION	DISPLAY BEFORE	KEY OPERATION SEQUENCE	DISPLAY AFTER
<b>UPPER LIMIT</b>	Select Upper Limit function	READY	+ LIM CE	+ LIM = 0.00 sec
	Set Upper Limit ex: 0.90 sec.	+ LIM = 0.00 sec	9 0	+ LIM = 0.90 sec
	Enter set-value	+ LIM = 0.90 sec	ENTER	READY
<b>LOWER LIMIT</b>	Select Lower Limit function	READY	- LIM CE	- LIM = 0.00 sec
	Set Lower Limit ex: 0.60 sec.	- LIM = 0.00 sec	6 0	- LIM = 0.60 sec
	Enter set-value	- LIM = 0.60 sec	ENTER	READY
<b>OFF</b>	Turn off power supply and Microsonic Processor™	READY  (Or any other display when power supply is ON.)		*** OFF ***  —

# ADDITIONAL FEATURES AND FUNCTIONS

## ***PROGRAM VERSION DESIGNATION***

To review the program version number, press and hold the TEST and REF keys simultaneously when "SONICS & MATERIALS" appears on the LCD DISPLAY at start-up. The display will then show the program version number i.e., V2.6 845-19 1500W. To return to system status READY, simply release the TEST and REF keys.

## ***CLEAR WELD COUNTER***

As described earlier, the number of welds or process cycles can be displayed by pressing the INFO key once when the system status READY is displayed. To clear the displayed value at the end of a shift or when otherwise required, press the CE key once. The LCD screen display will change to "DELETE = CE?" Press the CE key once to clear the number of welds display and change to the number of rejects display, i.e., "REJECTS = 5."

## ***CLEAR REJECT COUNTER***

Also as described earlier, the number of rejects can be displayed by pressing the INFO key twice, when the system status READY is displayed, (or by using the procedure described directly above to Clear the Weld Counter.

To clear the displayed value of rejects when required, press the CE key twice. The LCD screen display will change to "DELETE = CE?" Press the CE key once to cancel the number of rejects display and return to the system status READY display.

## ***JOB STORAGE***

Up to 9 different jobs may be stored and recalled or changed upon demand. Typical information stored includes timers (T1-T5), Force Trigger, Energy Reference, +/-Limits, Booster Gain, Horn Number, Air Pressure (reference only), and Cal Pulse ON/OFF.

### ***Save***

To use the job storage feature, press the INFO key six times. The LCD screen display will show the following message:

SAVE RECALL OTHER

From this display, jobs can be saved or recalled. To save a job, press numerical key 1 (as "SAVE" is in the first display position). A new display will appear:

JOB NUMBER: \_\_

Saved jobs will be numbered 1 through 9. Use the numerical keys to enter in the desired job number (1 - 9). Once the job number is keyed in, press the ENTER key. The following message will be displayed on the LCD screen:

SAVE O.K.! \_\_

All the parameters for that job will be saved under the number keyed in. To return to system status READY, press the ENTER key.

### **Recall**

To recall a job that has been saved, first access the "SAVE RECALL OTHER" display (by pressing the INFO key 6 times). Then, press numerical key 2 (since recall is in the second display position). The following message will appear on the LCD screen display:

JOB NUMBER: \_\_

Use the numerical keys to enter in the number (1 through 9) of the job to be recalled. Once the number is keyed in, press the ENTER key. The LCD screen will display:

RECALL O.K.! \_\_

The system will not respond if there is no job saved under a number corresponding to the numerical key pressed.

### **Other**

The "OTHER" option in the "SAVE RECALL OTHER" display allows the storage of Pressure, Booster Gain and Horn Number parameters. To record these values, press the numerical key 3 on the keypad. The display will change to:

PRESSURE 000.00 Psig

To record a pressure, first press the CE key. This will clear out the current entry.



**NOTE:** Pressure is reference only, this does not change the actual air pressure.

PRESSURE 0.00 Psig

Use the numerical keys to enter in the new pressure value. When the desired pressure is displayed on the LCD screen, press the ENTER key. The LCD screen display will show the following:

BOOSTER GAIN = 0.00 \_\_

To set a new Booster Gain ratio, use the CE and numerical keys in the same manner described above for recording the Pressure value. Upon completion, press the ENTER key and the LCD display will change to:

HORN NUMBER: 000000 \_\_

To record a new Horn Number, follow the same procedures as for recording Pressure and Booster Gain.

### **JOB SEQUENCE**

Once jobs have been stored, they can be sequenced in accordance with application requirements. Saved jobs can be sequenced in any order and may be repeated in the sequence up to a maximum of 9 steps. Each job in the sequence is considered one step, with a maximum of 9 steps in a sequence before the sequence is repeated. The weld line report to the printer/CRT will include the step number in the sequence. The LCD screen display will indicate the step in the sequence that will be performed in the next weld operation.

To use the job sequence feature, press the INFO key 7 times (from the READY 1 mode). The LCD display will show the following:

SEQUENCE OFF

To sequence, first press the CE key. The LCD display will change to:

SEQUENCE

Use the numerical keypad to enter in the numbers corresponding to the sequence of stored jobs to be utilized. For example, a display of "SEQUENCE 1324182" will sequence Job 1, then Job 3, Job 2, and so on. If the system does not respond to (and display) an entry, it is because there is no job saved under that number.



The following is an example where four jobs are to be sequenced and one set of parameters (Job 1) is to occur twice in the sequence. The sequence is as follows:

SEQUENCE 1 2 1 5

The LCD screen will show the following displays as the jobs are sequenced:

<i>Display for</i>	first cycle	READY 1	STEP #1
	second cycle	READY 2	STEP #2
	third cycle	READY 1	STEP #3
	fourth cycle	READY 5	STEP #4

**NOTE:** Sequence repeats, going back to first cycle.

### ***CAL PULSE***

The microprocessor controlled welder calibrates itself prior to each weld cycle. The use of the calibrator (cal) pulse enables the machine to automatically monitor the idle losses in the converter/ booster/horn assembly just as the head begins its descent to the part. The system adds the energy necessary to vibrate the horn in air, to the total energy programmed to weld a part. The cal pulse is utilized only in the Constant Energy mode, although it is activated during all modes of operation. Occasionally, it is necessary to turn the cal pulse off. For example, in order to place a part into the horn prior to welding (i.e.; vacuum horns), the cal pulse can be turned on and off from the front panel.

Press the INFO key 8 times from the READY 1 mode. The display will read either "CAL PULSE IS ON" or CAL PULSE IS OFF." Press the CE key, (which will act as a toggle) and the cal pulse will be either turned on or turned off. The system will acknowledge by showing the new (on or off) setting on the LCD display.

# KEYPAD SECURITY

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The keypad can be “locked” so that all operating parameters that are selected and set with the keypad are locked in, preventing unauthorized cancellation or adjustment.

To activate the security feature, first press the INFO key 4 times to display the current Mode Codes (i.e., T1 ZT NB IS 1 48 M, or other variation). Then, press the numerical keys 0 and 7 in sequence within one second to lock the keypad. When the keypad is secured in this manner, all parameter values can still be displayed, but the CE key is not functional (the red LED will not light up and parameters cannot be cancelled or changed). Any attempt to change or enter parameters with the CE key will result in the following message being displayed on the LCD screen:

KEYBOARD IS LOCKED

To return to normal operation and unlock the keypad, repeat the lock procedure - press the numerical keys 0 and 7 (within one second) while the Mode Codes are displayed. The red LED in the upper corner of the CE key will be illuminated again to prompt and permit cancellation.

# PRINTER INTERFACE AND OPERATION



**NOTE:** Use of a printer causes the cycle to be extended by approximately 200 ms.

## **PRINTER OPERATION**

If a printer is to be used for documentation of the dynamic process conditions, it must have an RS232 serial port interface, a buffer of 2K bytes and be capable of accepting a transmission rate of 4800 Baud. Following completion of an assembly cycle, the assembly number, percentage of maximum power used, energy level, weld cycle duration and reject status can be printed.

When the number of welds or number of rejects is displayed on the LCD, as a result of pressing the INFO key the requisite number of times, that same information can be printed.

The green LED in the upper corner of the PRT key must be illuminated for a printout of process conditions to occur. Press the PRT key to obtain a printout. Refer to the printer displays shown on the next pages for examples.

## **PRINTOUT OF THE WELD ENERGY CURVE**

A graphic display of the actual weld curve can also be printed out if a printer with a serial port interface and a buffer of 2K bytes, such as an Epson Model LX-810 or comparable, unit is used.

The printout of the weld curve plots the actual pattern of instantaneous loading as a function of time. The vertical line at the beginning of the printout indicates the idle losses of the converter, booster and horn in air; and the area under the curve corresponds to the energy delivered throughout the cycle. (Refer to the sample printer displays on the next page for examples.)

The printout of the weld curve is initiated by pressing the ENTER key for approximately 1 second until an audible alarm sounds and the following message appears on the LCD screen:

\* DATA TO PRINTER \*

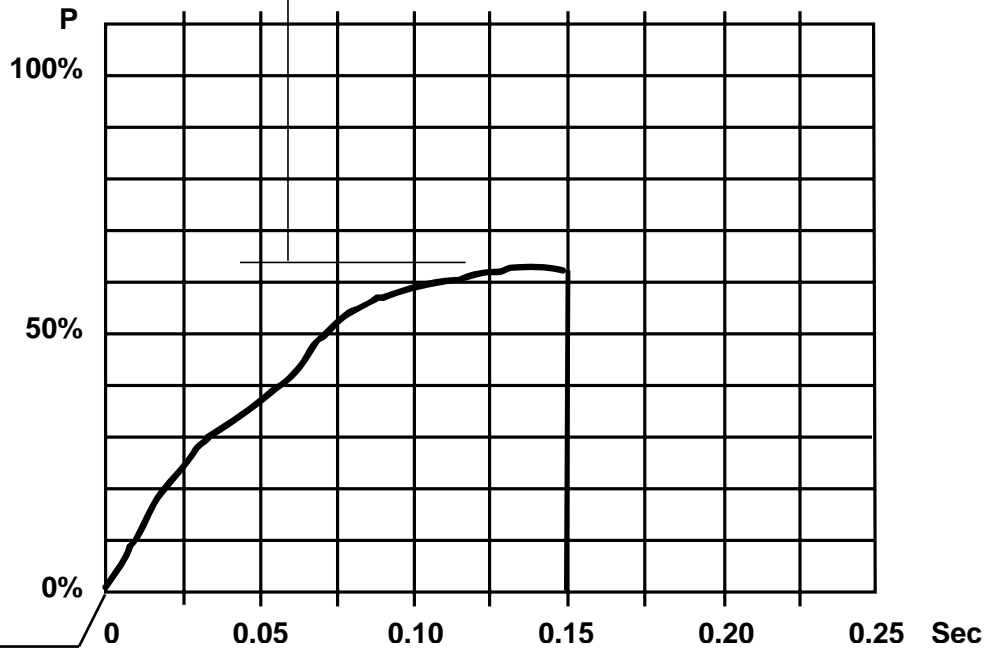
The printout requires approximately 70 seconds to complete, with a Baud rate of 4800.

## PRINTER DISPLAYS

### Time Based mode with delay timer triggering

<b>SONICS AND MATERIALS</b>	Program Version	Power Supply Output Rating	Mode Codes
	V3.0 845-73	1500W	T1 ZT NB IS 1 48 M
Delay Timer — Timer 1 = 0.25 sec	+ LIM = 105.0 Ws	Upper tolerance limit (energy)	
Weld Timer — Timer 2 = 0.15 sec	- LIM = 90.0 Ws	Lower tolerance limit (energy)	
Hold Timer — Timer 3 = 0.25 sec	CAL PULSE = ON		
Afterpulse Timer — Timer 4 = 0.00 sec	BOOSTER GAIN = 1.50	HORN NUMBER: 123	
Timer 5 = 0.00 sec	0.15 sec	Predetermined Weld Cycle	
Pressure 30.00 Psig	90.8 Ws	Actual energy delivered	
Assembly Number — 98			

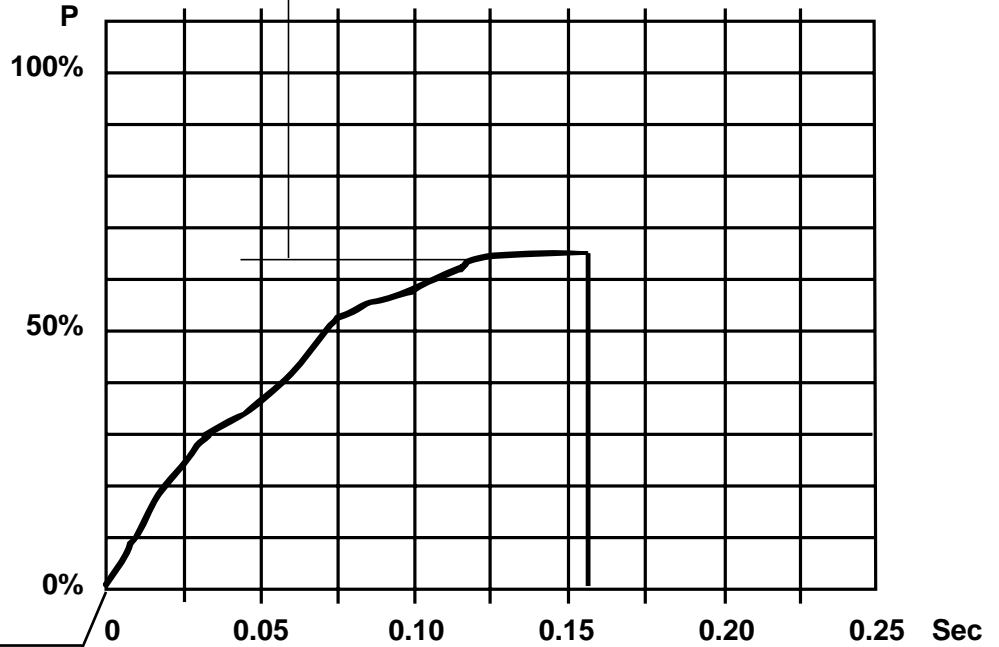
Percentage of available power used — 64%P max



### Constant energy mode with variable force triggering

<b>SONICS AND MATERIALS</b>	Program Version	Power Supply Output Rating	Mode Codes
	V3.0 845-73	1500W	FT EN NB IS 1 48 M
Trigger Force	Trigger (F) = 2%	+ LIM = 0.20 sec	Upper Limit (Time)
Energy Set-Value	REF = 91.0 Ws	- LIM = 0.10 sec	Lower Limit (Time)
Hold Timer	Timer 3 = 0.25 sec	CAL PULSE = ON	
Afterpulse Timer	Timer 4 = 0.00 sec	BOOSTER GAIN = 1.50	HORN NUMBER: 123
	Timer 5 = 0.25 sec	0.17 sec	Actual Weld Cycle Duration
	Pressure 30.00 Psig	91.2 Ws	Actual energy delivered
Assembly Number	100		

Percentage of available power used — 65%P max



Idle Losses For Converter, Booster and Horn

The keypad is not functional during the time a printout is being made until a short audible tone is heard and the LCD returns to system status "READY." Printing can be stopped at any time by pressing any key. The printer will continue printing, however, until the data stored in the buffer has been printed.

Time axis plot lengths of 250 ms, 500 ms, 1 second, 5 seconds and 10 seconds are available for printout. The time axis desired must be specified prior to the assembly cycle, as follows.

Press the INFO key five times until the following display appears on the LCD screen:

GRAPH TIME AXIS

The red LED in the corner of the CE key indicates that it is functional and therefore, the displayed value can be cancelled and changed.

Press the CE key and then key in the appropriate numerical code (see below) for the Time Axis Plot Length desired. Acknowledge the entry by pressing the ENTER key or wait 30 seconds for automatic acceptance.

CODE	TIME AXIS LENGTH
02	250ms
05	500ms
10	1 sec
50	5 sec
99	10 sec

### **GRAPH HEADER**

In addition to cycle parameters, the printout will also include readings for Air Pressure, Cal Pulse, Booster Gain and Horn Number. These values may be entered through the keypad. The printout readings are reference values only; i.e., if the gauge pressure setting reads 45 psig and the printout reads "PRESSURE 20 PSIG", the parts will be welded with 45 psig. The same applies for "Booster Gain" and "Horn Number."

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### ***REJECT PRINTOUTS***

The reason for a reject, such as  $\pm$  LIM or T5, will be printed out for each weld. If the Timer 5 limit is exceeded, then the printout will read as follows:

25 76/o 176.6 ws 0.40 sec. \*\*\*\* Reject T5

For the example above, the printout indicates that this cycle was rejected because the Timer 5 setting (0.40 sec.) was exceeded. In this case, the red LED's in the corners of both the +LIM and -Lim keys will be illuminated.

# SYSTEM STATUS TESTS AND FUNCTIONS

## **POWER SUPPLY TEST AND DISPLAY**

The ultrasonic power supply can be actuated briefly and tested by pressing and holding the TEST key. The value displayed on the LCD screen should not exceed 10% or 20% on the LED bar graph.

## **OPERATION SEQUENCE DISPLAY**

The operation sequence, which includes the trigger, time and energy functions in use during a process cycle, can be displayed on the LCD screen during subsequent cycles. To display the sequence, press the numerical key 4 when the Mode Codes are displayed.

Each function abbreviation is displayed as it is actuated, and all function abbreviations are retained in display until the cycle is completed, i.e., T1 T2 T3, T1 T2 T3 T4, T1 T2 T3 T4+ US, FT T2 T3, FT EN T3 and other variations.

The power supply can be returned to the system status READY display during the process cycle by repeating the procedure used above to select the operation sequence display (press the numerical key 4 when the Mode Codes are displayed).



**NOTE:** Refer to page 42 for an overview of system status tests displays.

## **SYSTEM STATUS TESTS AND MISCELLANEOUS FUNCTIONS**

In addition to the basic modes and functions described in the preceding sections, the power supply provides additional testing and operating functions, as listed below.

### **Input Test**

To display the status of the various system inputs, press the TEST and AUTO keys simultaneously when "SONICS & MATERIALS" appears on the LCD screen at start-up. The display will change to "INPUT TEST." When the TEST and AUTO keys are released, the status of the various inputs will be displayed in an alphabetical code. From left to right, the inputs are as follows (see next page):



Input No.	Function	Alphabetical Status Codes	
1.	Emergency stop/converter door interlock	A = ON	a = OFF
2.	Not used at present time	B = ON	b = OFF
3.	Stop timer 2	C = OFF	c = ON
4.	Not used at present time	D = OFF	d = ON
5.	Stop timer 3	E = OFF	e = ON
6.	Stop timer 4	F = OFF	f = ON
7.	Rotary table valve monitoring	G = Missing	g = OK
8.	Press valve monitoring	H = Missing	h = OK
9.	Head advance control	I = OFF	i = ON
10.	External Start	J = OFF	j = ON
11.	L H Palm Switch	K = OFF	k = ON
12.	R H Palm Switch	L = OFF	l = ON
13.	Rotary table acknowledgement 1	M = OFF	m = ON
14.	Rotary table acknowledgement 2	N = OFF	n = ON
15.	Press upper limit switch	O = OPEN	o = CLOSED
16.	Horn contact acknowledgement	P = OFF	p = ON

To terminate the test and clear the display, press the ON/OFF key.

### ***PRINTER TEST (only with Optional Peripherals)***

To access the Printer Test feature, first ensure that the optional printer is "ON." Then, press the TEST and PRINT keys simultaneously when "SONICS AND MATERIALS" appears on the LCD screen at start-up. The display will change to "PRINTER TEST" and a test sample will be printed on the printer.

To terminate the test, press the ON/OFF key.



## **WARNING**

*The F TRIGGER key must be depressed before the horn makes contact or an invalid force measurement, or the value “0%,” will be displayed.*

### **COUPLING FORCE MEASUREMENT (Model 1098 only)**

To measure the actual horn coupling force, turn the head down key switch clockwise. Then, as the head is descending, press the F TRIGGER key and keep it depressed until the horn contacts the parts.

The coupling force will be displayed on the LCD screen as a percentage of the maximum available force. (100% = 50 Psig = 245 lbs. = 1,090 Newtons)

Release the head advance control(s) to terminate measurement.

Because of the characteristics of the piezoelectric load cell, the display will be accurate only if the temperature remains constant and the period of measurement does not exceed 30 seconds. If a 30 second duration is exceeded, release the head advance control and repeat the procedure above.

### **CLEAR PARAMETERS**

To cancel all variable parameters and release keypad security, press the INFO and F TRIGGER keys simultaneously when “SONICS & MATERIALS” appears on the LCD screen at start-up. The power supply will return to normal Force Trigger Operation with Delay Triggering mode.

All keypad LED's will light up and stay illuminated until the INFO and F TRIGGER keys are released and the unit is turned Off.

# SYSTEM STATUS TESTS

## SYSTEM STATUS TESTS AND MISCELLANEOUS FUNCTIONS

FUNCTION	DISPLAY BEFORE	KEY OPERATION SEQUENCE	DISPLAY AFTER
Input Test	SONICS AND MATERIALS	TEST + AUTO	INPUT TEST ABCDEFGHIJKLMNoP
CRT Monitor/Printer Test	SONICS AND MATERIALS	INFO + PRT	** PRINTER TEST **
Cancel Parameters	SONICS AND MATERIALS	INFO + F TRIGGER	**** OFF ****
Program Version Designation	SONICS AND MATERIALS	TEST + REF	V2.6 845-19 1500W Typical Display
Cancel Number of Welds	READY WELD CYCLES = 100 DELETE = CE?	INFO CE CE	WELD CYCLES = 100 DELETE = CE? REJECTS = 5
Cancel Number of Rejects	READY REJECTS = 5 DELETE = CE?	INFO INFO CE CE	REJECTS = 5 DELETE = CE? READY
Select Time Axis Length (power curve) Set Plot Length ex: 500 ms. Enter Plot Length	READY GRAPH-TIME-AXIS: 02 GRAPH-TIME-AXIS: 05	INFO INFO INFO INFO INFO CE 5 ENTER	GRAPH-TIME-AXIS: 02 GRAPH-TIME-AXIS: 05 READY
Advance Head For Set-Up	READY	Depress Head Advance Control	*** ADJUST ***
Force Measurement	*** ADJUST ***	F TRIGGER	TRIGGER TEST = 15%

## OVERLOAD PROTECTION

The overload protection circuit will terminate sonics when the system is operated under adverse conditions, i.e., improper tuning, excessive power supply loading, loose or failed horn or booster, thereby protecting the power supply and other system components. When an overload condition exists, the RESET button will illuminate and remain lit until the button is pressed (regardless of whether the condition is corrected or not). If a repeated overload condition exists, resolve the problem before a failure of the power supply occurs.



**NOTE:** System will still cycle even though the power supply is in overload condition, but sonics will not be delivered.

If an overload condition exists, try the following:

- decrease horn force
- decrease amplitude (change booster or decrease output control)
- decrease downspeed
- check for loose or broken studs
- check the coupling surfaces between horn/booster and booster/converter
- check for cracked horn or booster
- check to see if the load meter exceeds 100% during weld process (if so, a higher powered unit is needed)

If you cannot remedy the situation, contact Sonics' Service Department at 1-800-745-1105.

# MAINTENANCE

---

## **GENERAL**

1. Always make sure the power supply has adequate ventilation by keeping sufficient space around the assembly.
2. Periodically check the ventilation grilles and clean as necessary.

## **REPAIRS / SERVICE**

If problems are encountered, contact our Service Department at 1-800-745-1105.

It is suggested that a system in need of repair be sent back to the factory with a written description pertaining to the nature of the problem.

**Always contact the factory for return authorization** before shipping any instrument. Include date of purchase, model number, and serial number. For units not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay. Care should be exercised to provide adequate packing to insure against possible damage in shipment. The system should be sent with all transportation charges prepaid and return method of shipment indicated.



**NOTE:** *If packing unit for return shipment, DO NOT use styrofoam "peanuts."*

# WARRANTY

---

Sonics & Materials, Inc., hereinafter referred to as “Sonics,” warrants its products for a period of one year from the date of shipment against defect in material and workmanship under normal installation, use, and maintenance as described in the operating instructions which accompany such equipment. During the warranty period, “Sonics” will, at its option, as the exclusive remedy, either repair or replace without charge for material and labor, the part(s) which prove upon our examination to be defective, provided the defective unit is returned to us properly packed with all transportation charges prepaid.

## **LIMITATION OF WARRANTY**

This warranty is in lieu of any other warranties, either express, implied, or statutory. “Sonics” neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with the sale of its products. “Sonics” hereby disclaims any warranty or merchantability or fitness for a particular purpose. No person or company is authorized to change, modify, or amend the terms of this warranty in any manner or fashion whatsoever. Under no circumstances shall “Sonics” be liable to the purchaser or to any other person for any incidental or consequential damages or loss of profit or product resulting from any malfunction or failure of this “Sonics” product.

This warranty does not apply to equipment which has been subject to unauthorized repair, misuse, abuse, negligence or accident. Equipment which, in our judgment, shows evidence of having been used in violation of operating instructions, or which has had the serial number altered or removed, will be ineligible for service under this warranty.

No liability is assumed for expenses or damages resulting from interruptions in operation of the product or damages to material in process.

“Sonics” equipment is designed for maximum operator safety and incorporates built-in safety devices. Any modifications to these safety features will void the warranty. “Sonics” assumes no responsibilities for consequential damages incurred due to modifications to the said equipment.

“Sonics” reserves the right not to warrant horns of unusual or experimental design which in our judgment are more likely to fail in use.

Data supplied in the instruction manual has been verified and validated and is believed adequate for the intended use of the equipment. If the equipment or procedures are used for purposes other than those specified herein, confirmation of their validity and suitability should be obtained in writing from “Sonics.”

# APPENDIX

## DIP SWITCH DEFAULT SETTINGS

SWITCH	POS. OFF	POS. ON	DEFAULT
DIP-1	Force Trigger Mode (FT)	T1 (ZT) Model	OFF
DIP-2	Weld by Timer 2 (T2)	Weld by Energy (EN)	OFF
DIP-3	Normal mode without Rotary table	Rotary table mode to DIP-4	OFF
DIP-4	Rotary table mode with pulse control	Rotary table mode with continuous control and ackn.	OFF
DIP-5	Timer 4 adds to hold time	Timer 4 as shake off pulse during press return	OFF
DIP-6	N/A	N/A	OFF
DIP-7	Printer output 1,200 Baud	Printer output 4,800 Baud	ON
DIP-8	Alternate start method	Two-hand start only	ON

Refer to p. 18 for function abbreviations.

# APPENDIX

## EQUIPMENT WIRING DIAGRAMS AND ASSOCIATED I/O

Model	Wiring Diagram	Actuation J2	I/O J3	I/O J6	I/O J7	I/O J8	I/O J9
FM	E-2952	E-2703	E-2480	E-2483	E-3014	E-3013	E-2902

Drawing	Description
E-2480	Printer Cable
E-2483	Rotary Table Cable
E-2703	Impulse Actuation Cable
E-2902	Good Part/Bad Part and Abort Cable. Special*
E-2952	FM Wiring Diagram
E-3013	F-Series General I/O
E-3014	F-Series General I/O

\*Pin 3 has 24 vdc for the reject output and pin 2 has a switched return on standard machines. Good part/Bad part and Abort is a special modification.

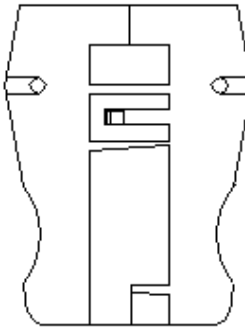


# APPENDIX

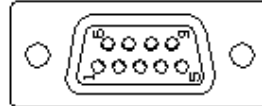
**NOTES:**

- ONE 1/4" DIA. X 3 3/4" LONG HEAT SHRINK TUBING AND ONE 3/8" DIA. X 3 3/4" LONG HEAT SHRINK TUBING UNDER FERRITE.
- TWO 3/8" DIA. X 1" LONG HEAT SHRINK ON CABLE SIDE OF FERRITE.
- CUT OFF WIRES NOT USED: (COLORS: BLUE, AND WHITE)

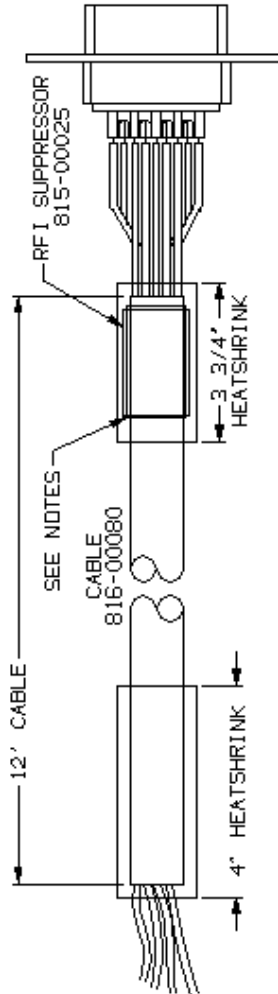
HOOD  
821-00136



NOTE: JUMP PIN 9 TO PIN 6



REAR VIEW  
CONNECTOR  
821-00132



**OUTPUT DEFINITIONS**

PIN	COLOR-GA	FDL	FM	F0	FC
1	CABLE SHIELD	SHIELD GND	SHIELD GND	SHIELD GND	SHIELD GND
2	RED 24 GA	Hz/10	Hz/10	Hz/10	Hz/10
3	BLK 24 GA	TUNE LOCK IND.	TUNE LOCK IND.	TUNE LOCK IND.	TUNE LOCK IND.
4	BRN 24 GA	SMP8 READY	SMP8 READY	SMP8 READY	SMP8 READY
5	YEL 24 GA	D.L. RESET	D.L. RESET	D.L. RESET	D.L. RESET
6	DRG 24 GA	MC	MC	MC	MC
7	V10 24 GA	D.L. IND.	D.L. IND.	D.L. IND.	D.L. IND.
8	GRY 24 GA	15VDC RETURN	15VDC RETURN	15VDC RETURN	15VDC RETURN
9	GRN 24 GA	COMMON EMITTER	COMMON EMITTER	COMMON EMITTER	COMMON EMITTER

201-0206

NO.	DESCRIPTION	BY	DATE
1	ADDED NOTES	JAC	10-28-88
2	ADDED CIRCUIT CHART	JAC	10-28-88
3			
4			
5			

**SONICS** 25 OLMOND AVE., BOSTON, MA 02118

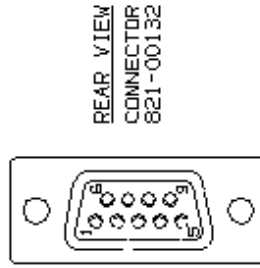
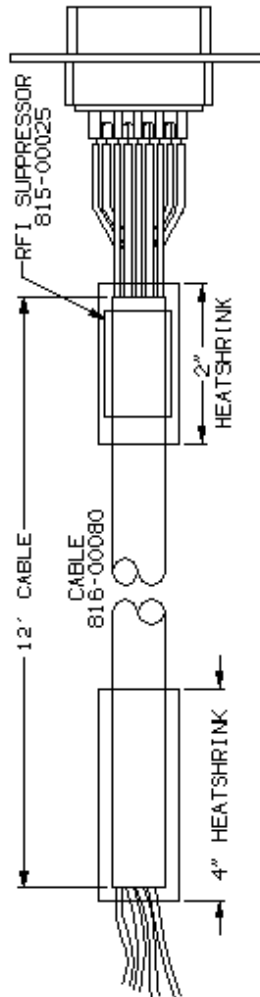
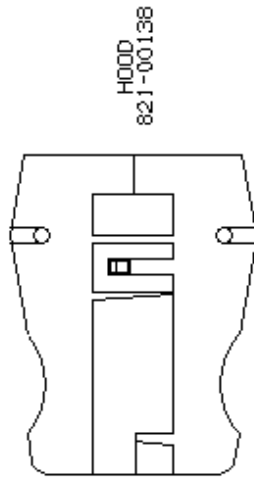
F-SERIES CONTROL CABLE I/O CONNECTIONS (P8)

DRAWN BY	YAB	SCALE	DATE	3-14-97	OFFICE NO.	E-3013
CHK'D BY						
APPROVED						

TOLERANCES (UNLESS OTHERWISE SPECIFIED):  
FRACTIONAL: \* 1/64  
DECIMAL: .25 ± .030  
DIMENSIONS: .005 ± .005

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# APPENDIX



OUTPUT DEFINITIONS

PIN	COLOR-GA	FDL	FM	F0	FC
1	BRN 24 GA	PART MISLIGNED	NC	NC	NC
2	BLK 24 GA	PART MISSING	NC	NC	NC
3	VIO 24 GA	UNDER HELD	NC	NC	NC
4	YEL 24 GA	OVER HELD	NC	NC	NC
5	WHT 24 GA	5 VDC RETURN	NC	NC	+10VDC
6	RED 24 GA	EXT. AMPL. CONTROL	EXT. AMPL. CONTROL	EXT. AMPL. CONTROL	EXT. AMPL. CONTROL
7	GRN 24 GA	GROUND	GROUND	GROUND	GROUND
8	BLU 24 GA	0-10VDC (WATTS)	0-10VDC (WATTS)	0-10VDC (WATTS)	0-10VDC (WATTS)
9	CABLE SHIELD	SHIELD	SHIELD	SHIELD	SHIELD

201-0207

NO.	REVISED OUTPUT DEFINITION SHEET	DATE	BY
1		10-28-88	

**SONICS** CHARTER HULL, INC. WATERBURY, CT 06406

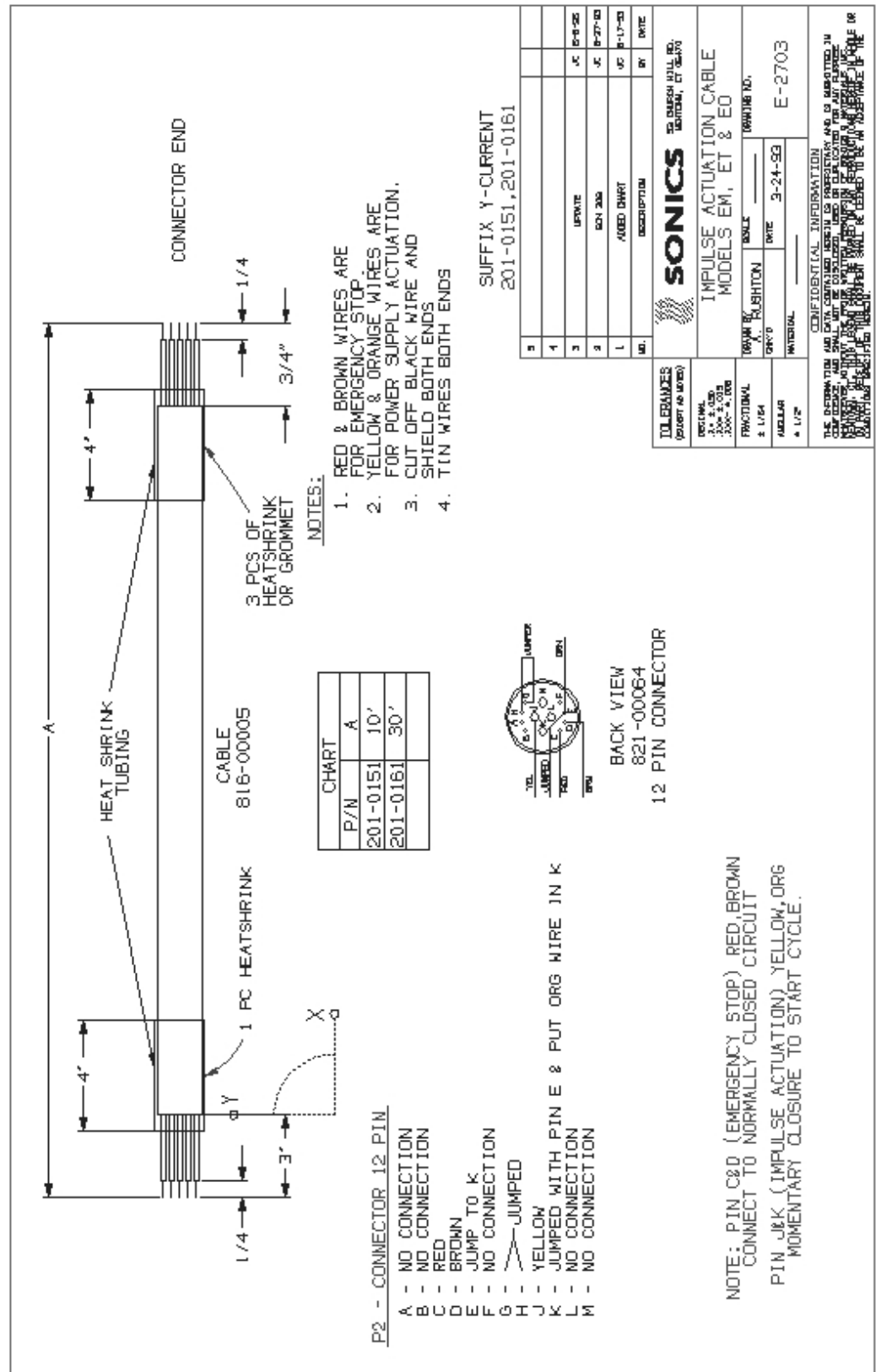
F-SERIES CONTROL CABLE I/O CONNECTIONS (P7)

DRAWN BY	DATE	SCALE	BY	DATE
VAB	3-14-97	----		

INTERNAL: E-3014

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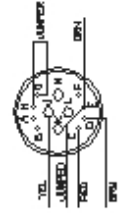
P2 - CONNECTOR 12 PIN

- A - NO CONNECTION
- B - NO CONNECTION
- C - RED
- D - BROWN
- E - JUMP TO K
- F - NO CONNECTION
- G - JUMPED
- H - JUMPED WITH PIN E & PUT ORG WIRE IN K
- J - NO CONNECTION
- K - NO CONNECTION
- L - NO CONNECTION
- M - NO CONNECTION

P/N	A
201-0151	10'
201-0161	30'

**NOTES:**

1. RED & BROWN WIRES ARE FOR EMERGENCY STOP FOR POWER SUPPLY ACTUATION.
2. YELLOW & ORANGE WIRES ARE FOR POWER SUPPLY ACTUATION.
3. CUT OFF BLACK WIRE AND SHIELD BOTH ENDS
4. TIN WIRES BOTH ENDS



BACK VIEW  
821-00064  
12 PIN CONNECTOR

NOTE: PIN C&D (EMERGENCY STOP) RED, BROWN CONNECT TO NORMALLY CLOSED CIRCUIT  
PIN J&K (IMPULSE ACTUATION) YELLOW, ORG MOMENTARY CLOSURE TO START CYCLE.

SUFFIX Y-CURRENT  
201-0151, 201-0161

NO.	DATE	BY
2		
3	12-18-52	JC
4	12-27-52	JC
5	12-27-52	JC
6	12-27-52	JC
7	12-27-52	JC
8	12-27-52	JC
9	12-27-52	JC
10	12-27-52	JC
11	12-27-52	JC
12	12-27-52	JC

**SONICS** TO ORDER HULL NO. 12101, 12102, 12103

IMPULSE ACTUATION CABLE  
MODELS EM, ET & EO

DESIGNED BY: A. RUSHTON  
DATE: 3-24-53  
DRAWING NO. \_\_\_\_\_

MATERIAL: \_\_\_\_\_  
SCALE: \_\_\_\_\_

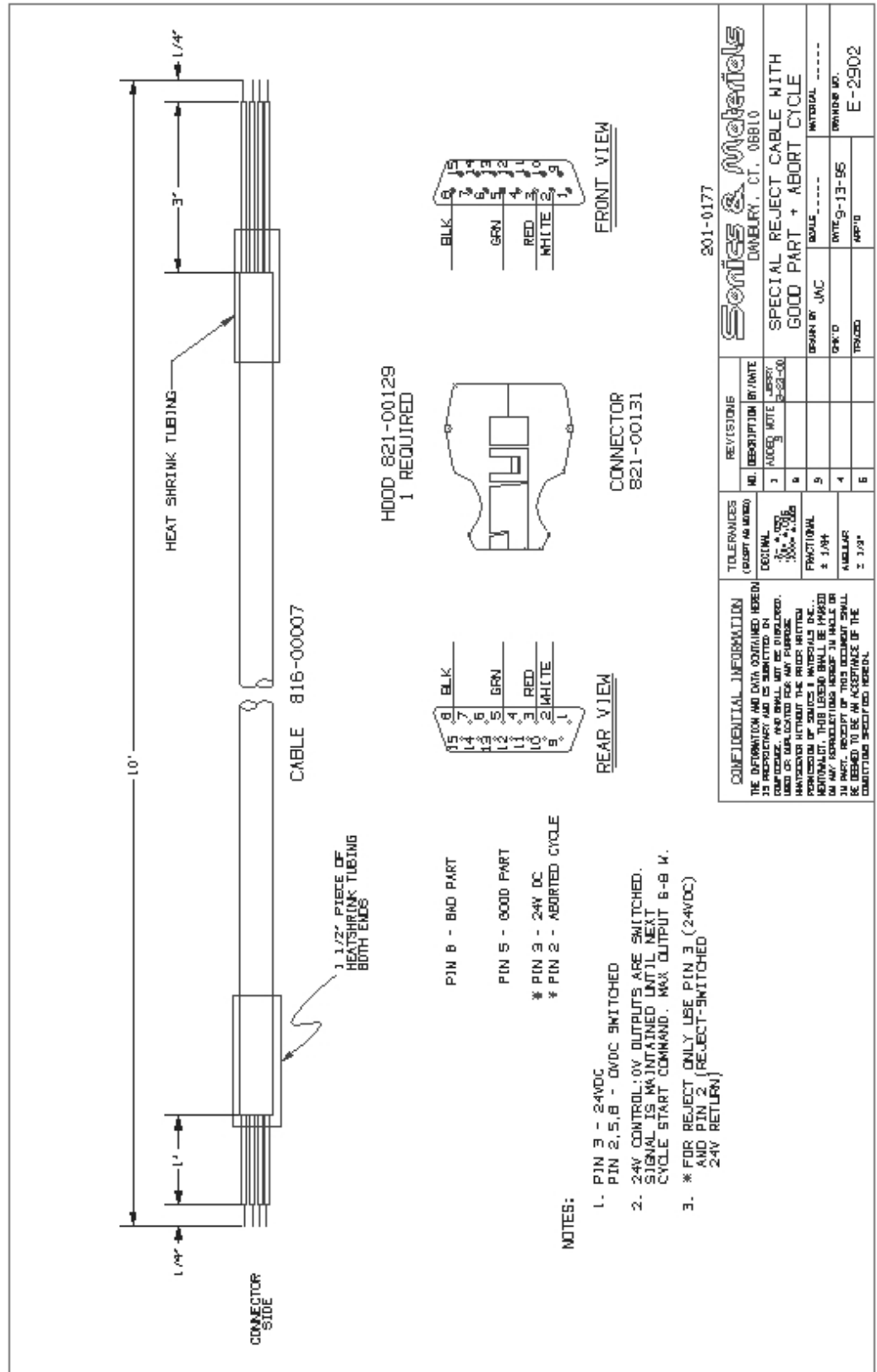
**TELEGRAMS** (EXCEPT AS NOTED)  
SONICS  
300 S. 10th St.  
MILWAUKEE 2, WIS.  
FACSIMILE 4 1/4"

**SONICS**  
12101, 12102, 12103

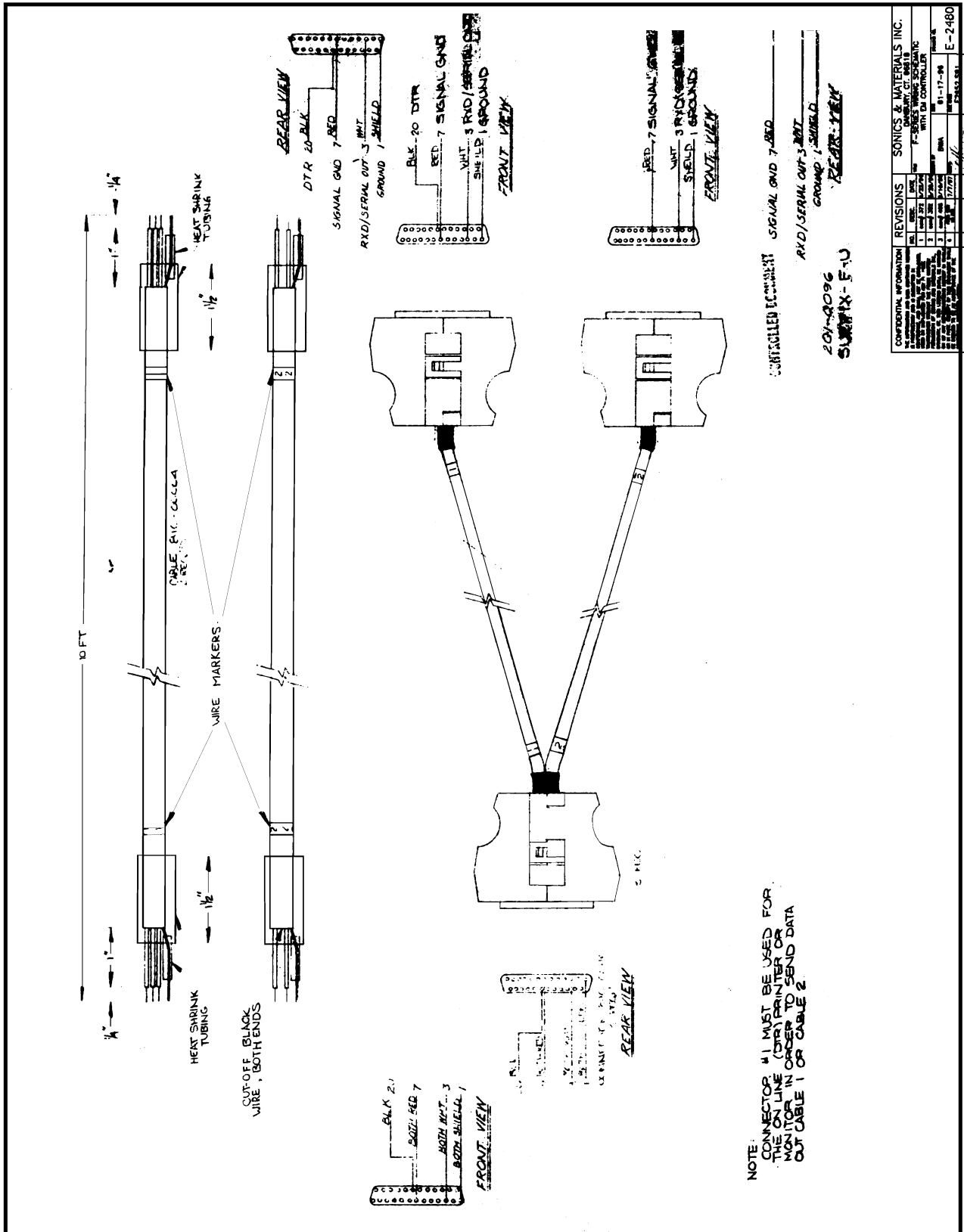
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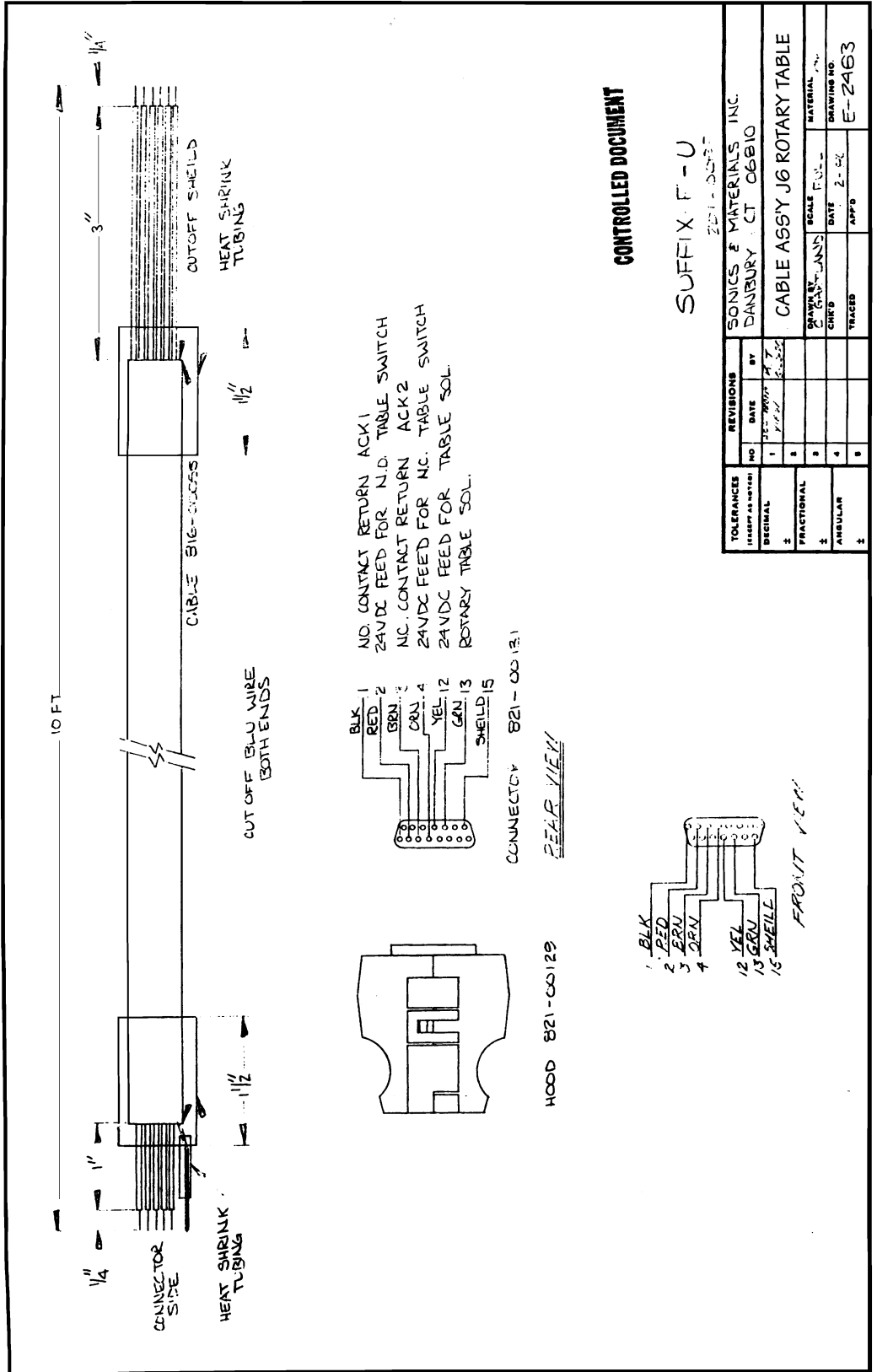
# APPENDIX



# APPENDIX



# APPENDIX



CONTROLLED DOCUMENT

SUFFIX F-U  
821-00129

TOLERANCES (UNLESS OTHERWISE SPECIFIED)	REVISIONS		
	NO.	DATE	BY
DECIMAL	1	11-11-77	AK 2
FRACTIONAL	2	11-11-77	AK 2
ANGULAR	3		
	4		
	5		

DRAWN BY		SCALE		MATERIAL	
C. BASSMAN		FUS		DRAWING NO.	
DATE		APPRO		E-2463	
2-88					

SONICS & MATERIALS INC.	
DANBURY CT 06810	
CABLE ASSY J6 ROTARY TABLE	



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