



ULTRASONIC POWER LOGICON

OPERATING MANUAL

MODEL 5C-11 POWER LOGICON

MODEL _____ ULTRASONIC TRANSDUCER

**UTHE TECHNOLOGY INC.
UTHE TECHNOLOGY INTERNATIONAL**

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SECTION I

INTRODUCTION

The purpose of this manual is to provide pertinent installation, operating, and maintenance data with respect to the particular ultrasonic equipment described in Sections II and III.

Since UTI manufactures many types of ultrasonic power supplies and transducers, please note that the detailed data presented herein may be appropriate only to those devices carrying the serial numbers listed on the cover page of this manual.

Since several products presently manufactured incorporate special features, it has been found convenient to describe these features and the appropriate design modifications in Section III.

Section IV presents installation instructions and Section V the recommended operating procedures.

The use of the Power Logicon for diagnostic testing of a complete ultrasonic system is described in Section VI.

Detailed circuit and troubleshooting information is presented in Section VII.

UTi

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5 WATT ULTRASONIC POWER LOGICON MODEL 5C

UTi MODEL 5C ULTRASONIC POWER LOGICON



FEATURES

- All Solid State
- 5 Watts into 22 Ohms
- 2 Channels
- 55 to 65 kHz
- Built-In Phase Comparator, Impedance Tracking and Diagnostics
- Stable to 5 Hz in 60,000 Hz

DESCRIPTION

The C series of UTi power supplies incorporate all the advancements learned in the development of the successful Model 10B, 15B, 16B, 17B, and 18B Power Logicons.

The Model 5C has been specifically developed as a low-cost replacement for older tube-type power supplies where greater stability, precision, and reliability is desired. In addition, the Model 5C will be especially appropriate for use in those areas of micro-processing which do not require the greater power capabilities of the Model 10C and 20C Power Logicons.

If used in wire bonding, 4 mil wire is the maximum size that should be used with the Model 5C.

The Model 5C is designed for use with magnetostrictive transducers; in particular, UTi ceramic transducers. Its electronic diagnostic and phase comparator sub-systems permit rapid tuning and interfacing with external transducers.

In addition, this same circuitry can be used to determine the basic health of a complete ultrasonic system in a matter of seconds.

SPECIFICATIONS

POWER: 5 watts into a 22 ohm resistive load. Power continuously variable from each of two channels from 10 milliwatts to 5 watts. Output impedance of power amplifier approximately 1 ohm and nonreactive with load.

Power amplifier automatically controlled by transducer impedance tracking feedback system and electronically programmed to prevent microfracturing of semiconductor devices when used in ultrasonic bonding.

Output stability . . . 0.1 percent into pure resistive load of 22 ohms.

2 power ranges . . . 0 to 1 watt and 0 to 5 watts.

Overload electronically protected.

Line voltage 110-130 volts AC, 50-60 Hz.
220-240 volts AC, 50-60 Hz.

TIME: Solid-state timer for each channel. Timer range: 10 ms to 300 ms.

Timer Stability . . . 0.5 percent at 100 ms. Linear control continuously variable.

OSCILLATOR: Continuously variable from 55 kHz to 65 kHz. Stabilized to ± 5 Hz at power supply output over temperature range of 60°F to 100°F after 10 minute warmup.

LOGIC: All solid-state internal logic. Solid-state interrupt logic for external motor or solenoid control.

Manual or automatic control of either channel.

TUNING: Tuning to transducer in less than 15 seconds. Once tuned, no further tuning is required until tooling is changed.

Wide-band oscillator and electronic phase comparator permits rapid power supply and transducer checkout. Work-piece and transducer troubles easily diagnosed. Panel meter indicates "go-no-go" condition. Phase comparator permits precision tuning to ± 5 Hz.

GENERAL: Every attempt has been made to provide the Model 5C with great reliability, stability, and precision. All DC power supplies are series regulated and zener controlled for isolation from AC line transients. All outputs are short-circuit protected and power supply will automatically current-limit in the event the power amplifier is overloaded.

SIZE: 9" x 3" x 6" (23 cm x 8 cm x 16 cm)

WEIGHT: 8 pounds (3.6 kg)

WARRANTY: All UTI instruments are warranted against defective materials and workmanship for one year. UTI will repair or replace products which prove to be defective during the warranty period. No other warranty is expressed or implied. We are not liable for consequential damages.

CERTIFICATION: Uthe Technology, Inc., certifies that all instruments are thoroughly tested and inspected and found to exceed published specifications when shipped from the factory. We further certify that its calibration measurements are traceable to the U.S. National Bureau of Standards, through the Hewlett-Packard, Tektronix and John Fluke companies, to the extent allowed by the technology and the capability of the Bureau's calibration facility. Further, all power supplies, when used with UTI ultrasonic transducers, are certified to be in full compliance with the FCC Rules and Regulations in effect on 1 January 1968.

APPLICATIONS ASSISTANCE: UTI provides applications assistance and aftersale backup at no cost to the customer within the United States, Canada, Mexico, Eastern Asia, and Western Europe.

OPTIONS: (1) Channel indicator lights.
(2) 10-turn potentiometers for control of power and time.
(3) 8 different logic configurations for interfacing with various assembly machine models.

MODEL 5C ULTRASONIC POWER LOGICON

INTERNATIONAL SALES AND SERVICE:

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998 Toa Payoh North
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Kan Electronics Company, Ltd.
Shoei Bldg., 7th Floor
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Chuo-ku, Tokyo 104, Japan
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Bazelmans Products International, C.V.
Westervelden 11
Veldhoven, The Netherlands
Telex: 51717

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SECTION IV

INSTALLATION:

Transducer: The ultrasonic transducer is normally installed in a holding fixture prior to use. For precise positioning and effective operation, the transducer collar should be securely attached, via a clamp, to the holding fixture.

While installing, do not strike, tap or hammer the transducer. Never strike, tap or hammer the ferrite element.

When mounted in a suitable holder which does not permit introduction of sudden motion or shock into the collar, the transducer is rugged and reliable. However, the ferrite may fracture if the collar is shocked or permitted to move due to hammering or tapping of the transducer.

Following installation of the transducer into its holder, the lead wires of the transducer should be soldered to pins 1 and 3 of the supplied 4-pin connector.

Before the transducer can be effectively used, a workpiece must be mounted in the end of the ultrasonic horn. If the alignment of the transducer with respect to its holder is critical, the workpiece is often installed before the transducer is rigidly clamped.

If possible, the length and placement of the workpiece should be as recommended in Section II. If it is necessary, for mechanical reasons, to use a workpiece which is longer than that recommended or which must be placed such that its extension is outside of the recommended tolerance band, acoustic effectiveness can be ascertained by employing the diagnostic procedures discussed in Section VI.

It is good practice to thoroughly clean the workpiece before installation and to not handle the workpiece with ungloved hands. The workpiece should be clean and free of moisture and lubricants at time of installation. The recommended workpiece material for use at the high frequencies involved is tungsten carbide.

Power Logicon: The installation of the Power Logicon is very straightforward and proceeds as follows:

1. Turn off power switch.
2. Turn all power and time controls to zero.
3. If a UTI type transducer is to be driven, place the **TRANSDUCER** switch mounted on the rear of the chassis in the UTI position. If a Sonobond type transducer is to be employed, place the **TRANSDUCER** switch in the **OTHER** position.

4. It is common practice to use the UTI Power Logicon in conjunction with some "external control device. This external control device may be as simple as a footswitch or as complex as an automatic die bonder. In any event, for successful remote control of the Power Logicon it is necessary that the switching logic of the controlling device be consistent with the internal solid-state logic of the Power Logicon.

In general, two types of control logic are normally employed in the semiconductor industry. We have chosen to denote one type of logic as -1 (dash 1) and the other as -2 (dash 2):

Each type can be explained in terms of the operating function and interrelationship of each of the pins of the 5-pin connector mounted on the rear of the chassis.

For the Dash 1 version, the control logic is as follows:

When Pin A is shorted to Pin B, Channel 2 will be triggered. Power and Time will be controlled by the Power Logicon in accordance with settings of the Channel 2 Power and Time controls.

When Pin A is shorted to Pin C, Channel 1 will be triggered. Power and Time will be controlled by the Power Logicon in accordance with settings of the Channel 1 Power and Time controls.

For the Dash 2 series, the control logic is as follows:

When Pin A is connected to Pin B, Channel 2 will be the operative channel.

When Pin A is open with respect to Pin B, Channel 1 will be the operative channel.

When Pin D is shorted to Pin E, the appropriate channel will be triggered.

Pin C is not used.

The type of control logic originally supplied with the Power Logicon can be determined from the identification tag on the rear of the chassis. If there exists a -1 following the model number, Dash 1 logic was initially supplied. Correspondingly, if a -2 follows the model number designation, Dash 2 logic was originally incorporated.

If there should be any question as regards the type of logic presently incorporated, this can be resolved by inspecting the plug-in PC board mounted internally. The plug-in board will be marked with a -1 or -2 depending upon its logic configuration.

The control logic of the Power Logicon covered by this manual can be easily converted from one type to the other. This is accomplished by removing the plug-in PC board and replacing it with its alternate. Logic boards can be purchased from the factory for a nominal price.

Following the inspection and verification of logic compatibility, the 5-pin connectors should be mated.

5. The 2-pin control connector mounted on the rear of the chassis can be used to disengage 110 Vac equipment during the activation of the transducer by the Power Logicon. The connector should be considered as a **series** switch and under no circumstances should **both** sides of a 110 Vac line be connected to the two pins of the connector.

The maximum current rating of the solid-state motor control is 2.5 amps.

If it is desired to use this AC control switch, solder the appropriate wires to the supplied female connector and plug wired connector into mounted 2-pin connector.

6. Connect the transducer cable to the 4-pin transducer connector previously installed.
7. Connect the AC cord to a nearby 110 Vac receptacle.
8. Installation is now complete. Operation of the installed ultrasonic system is discussed in the next section.

SECTION V

OPERATING INSTRUCTIONS

Assuming that the ultrasonic equipment has been installed in accordance with the procedures described in Section IV, the system can now be operated.

The front panel controls of the Power Logicon are shown in Fig. (1). Figures 2 and 3 give representative time and power values as a function of control knob settings.

It is recommended that initial operation proceed as follows:

1. Activate Power switch. Indicator lamp should light.
2. Turn thumbscrew (tuning coil) mounted on the rear of the chassis full **counterclockwise**.
3. Set Hi-Lo switch to the **H_i** position.
4. Set Channel 1 and Channel 2 Power Controls to 5.0.
5. Activate Channel Test Switch by moving toggle either to the right or left. Observe Test Meter while depressing switch.
6. Test Meter should indicate more than half-scale.
7. Ten minutes after the Power Switch has been activated, the Power Logicon is ready for final tuning. This is accomplished by slowly turning the Turning Coil thumbscrew clockwise while activating the Channel Test Switch and observing the Test Meter.
8. The system is tuned when the test meter indicates a **minimum**. In the tuned condition, the meter should indicate a value of less than 0.2. (See Section VI.) Once tuned, no further tuning will be required until the ultrasonic system is modified.

If Maximum power conversion efficiency is required, it is recommended that the system be tuned with the workpiece under load. It is not suggested that this tuning practice be employed unless it appears that the demands of the process are exceeding the power capabilities of the Power Logicon.

9. Following tuning, the ultrasonic system is ready for useful work. Initial power and time settings can be determined from Fig. (2) and Fig. (3). The Hi-Lo Switch and control knobs can be adjusted accordingly.

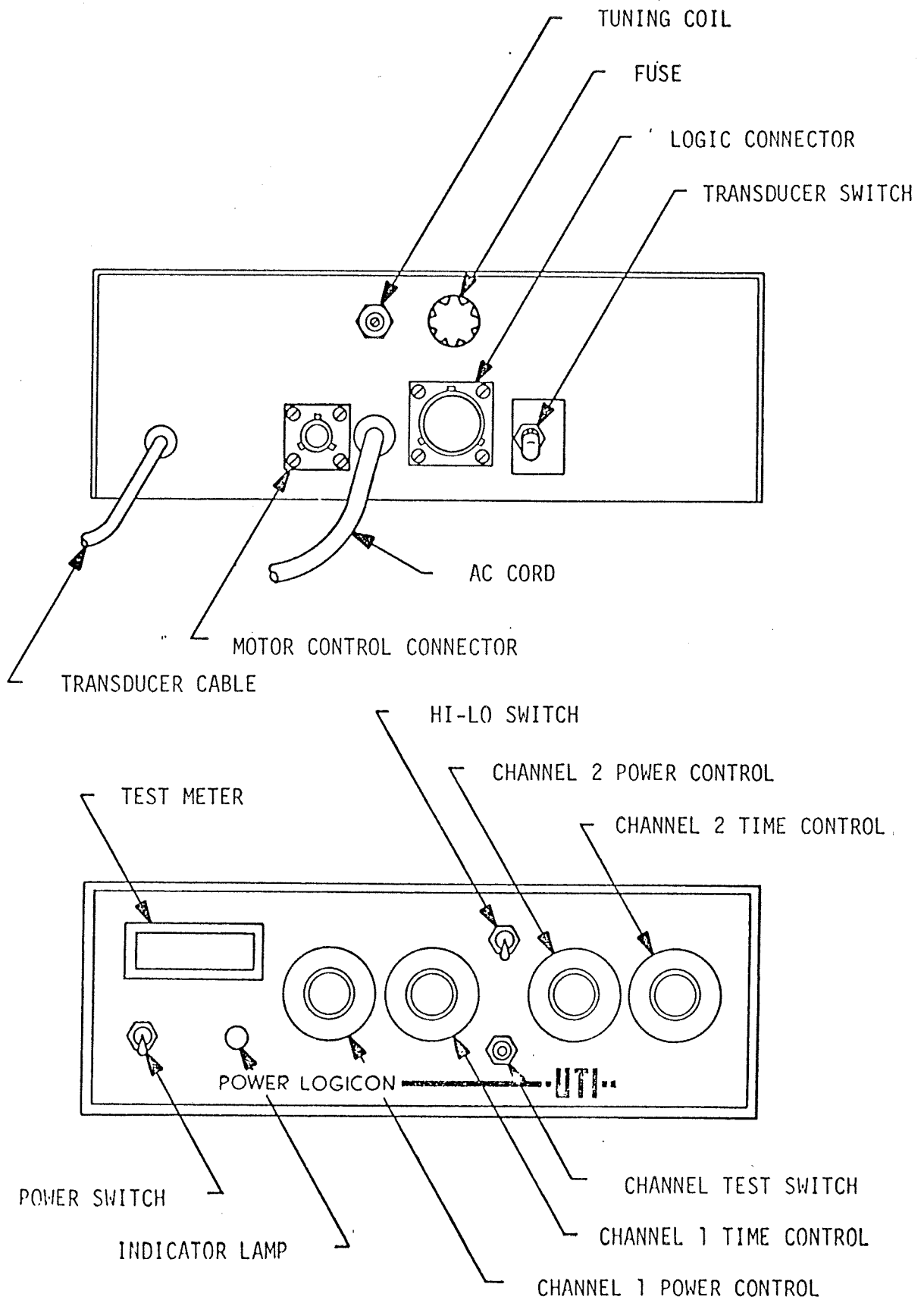


FIGURE 1

MODEL 5C FRONT AND REAR SCHEMATICS

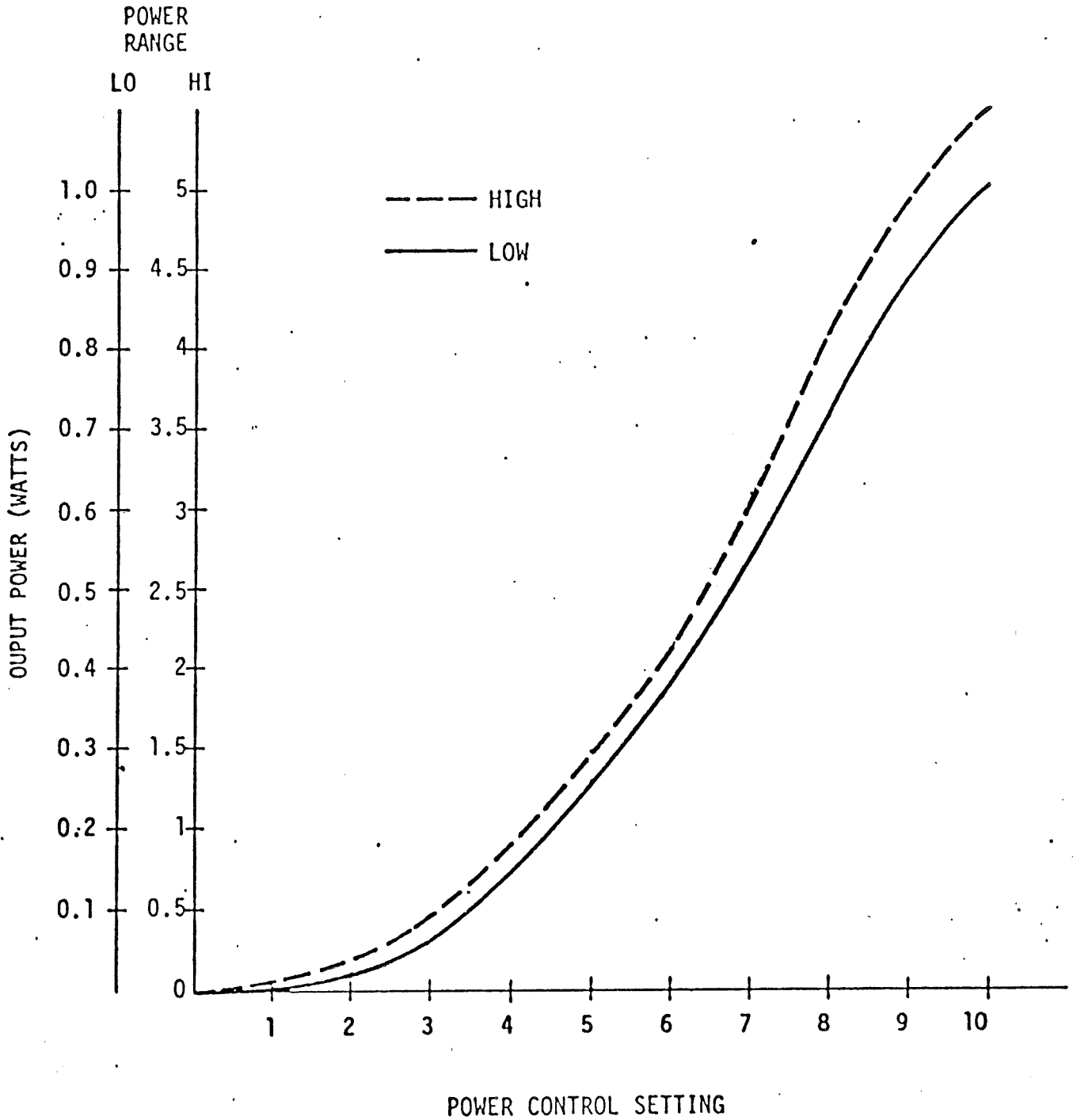


FIGURE 2

OUTPUT POWER VS POWER CONTROL SETTING

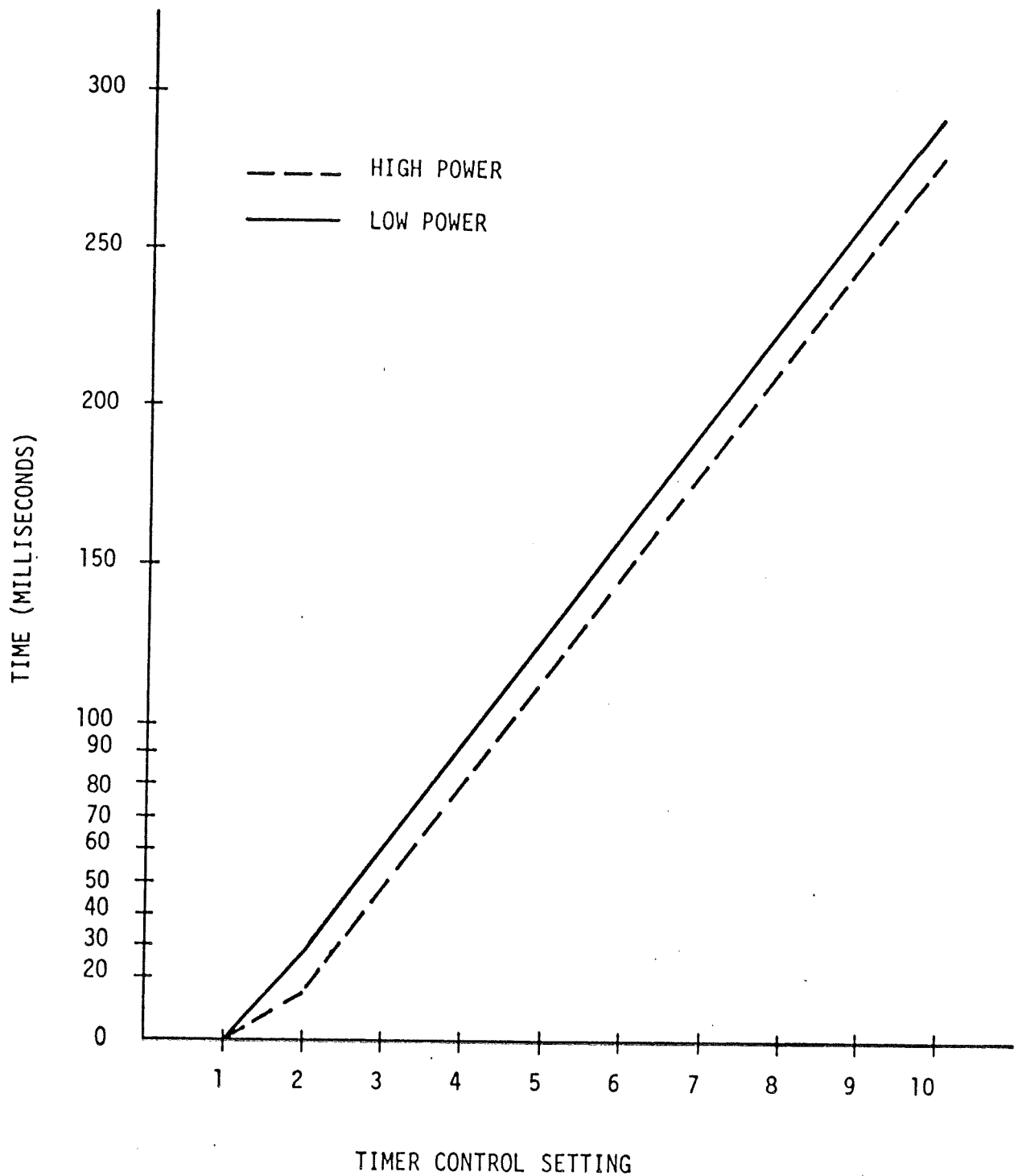


FIGURE 3

TIME VS TIMER CONTROL SETTING

SECTION VI

DIAGNOSTIC TESTING

The electronic diagnostic and phrase comparator sub-systems built into the Power Logicon can be used to determine the basic health of a complete ultrasonic system in a matter of seconds.

Since these tests are so easy to accomplish, it is recommended that they be accomplished prior to troubleshooting the machine or process on which the UTI ultrasonic system is being used.

The "Go-No-Go" ultrasonic tests proceed as follows:

1. Inspect system to insure that all necessary connections have been accomplished. Note that the indicator Lamp is lit. If not, see Section VII.
2. Inspect transducer and note that it is firmly mounted in its holding fixture. Check the Transducer Switch mounted on rear of Power Logicon to insure that it is in the proper position.
3. If motor control circuit in Power Logicon is used, turn Power Logicon off and activate Channel Test Switch for approximately 5 seconds.
4. Attempt to operate machine. If the motor or solenoid being controlled by the Power Logicon remains operable, then the motor control circuit is either shorted, or an error has been made in installing the ultrasonic system. See Sections IV and VII for detailed installation and circuit test data.
5. Assuming that tests 1 through 4 have been successfully passed, reactivate Power Logicon Power Switch and note that the Indicator Lamp lights.
6. Turn thumbscrew (tuning coil) mounted on the rear of the chassis full **counterclockwise**.
7. Set Hi-Lo Switch to the **H** position.
8. Set Channel 1 and Channel 2 Power Controls to 5.0.
9. Activate Channel Test Switch by moving toggle either to the right or left. Observe Test Meter while depressing switch.
10. The Test Meter should indicate more than half-scale. If not, disconnect transducer and reactivate Channel Test Switch. If the Test Meter again indicates less than half-scale, the Power Logicon is defective (see Section VII). If the meter now indicates more than half-scale, a short-circuit exists in the transducer electrical circuit.

If no short-circuit can be found in the transducer wiring, return the transducer to the appropriate manufacturer for repair. Please do not attempt to repair the transducer without first checking with the manufacturer.

11. Set timer controls on the front panel to 10 and remotely fire the Power Logicon in normal sequence. The Test Meter should momentarily indicate more than half-scale when the unit has been triggered by the machine or footswitch and should have zero deflection at all other times. If this does not occur, remove the 5-pin logic connector from the rear of the chassis and manually fire the Power Logicon in interconnecting the appropriate pins with a short piece of wire. Two wires will be required in the event a Dash 2 type Power Logicon is being tested.

If half-scale movement of the Test Meter does not momentarily occur when the appropriate triggering pins are shorted together, the Power Logicon is defective and can be further tested as described in Section VII. If proper meter motion does occur, there exists a problem in the remote triggering device.

12. Following the successful conclusion of Test 11, slowly turn the Tuning Coil thumbscrew clockwise while activating the Channel Test Switch and observing the Test Meter.
13. The Test Meter should dip below 0.4 only once and during this single dip should indicate less than 0.2 at minimum deflection. If this occurs, skip to Step 15. If not, read on.

If the meter indicates more than one dip below a reading of 0.4, remove the workpiece and repeat. If multiple dips again occur, check for a loose transducer horn. If the horn is found to be tight, the conclusion is that the transducer is defective and must be replaced.

If multiple dips do not occur when the workpiece is removed, than the workpiece is dirty, improperly positioned, of improper length or shape, or is internally fractured.

If the installed workpiece is longer than that recommended in Section II, reposition workpiece until the meter dip test can be passed.

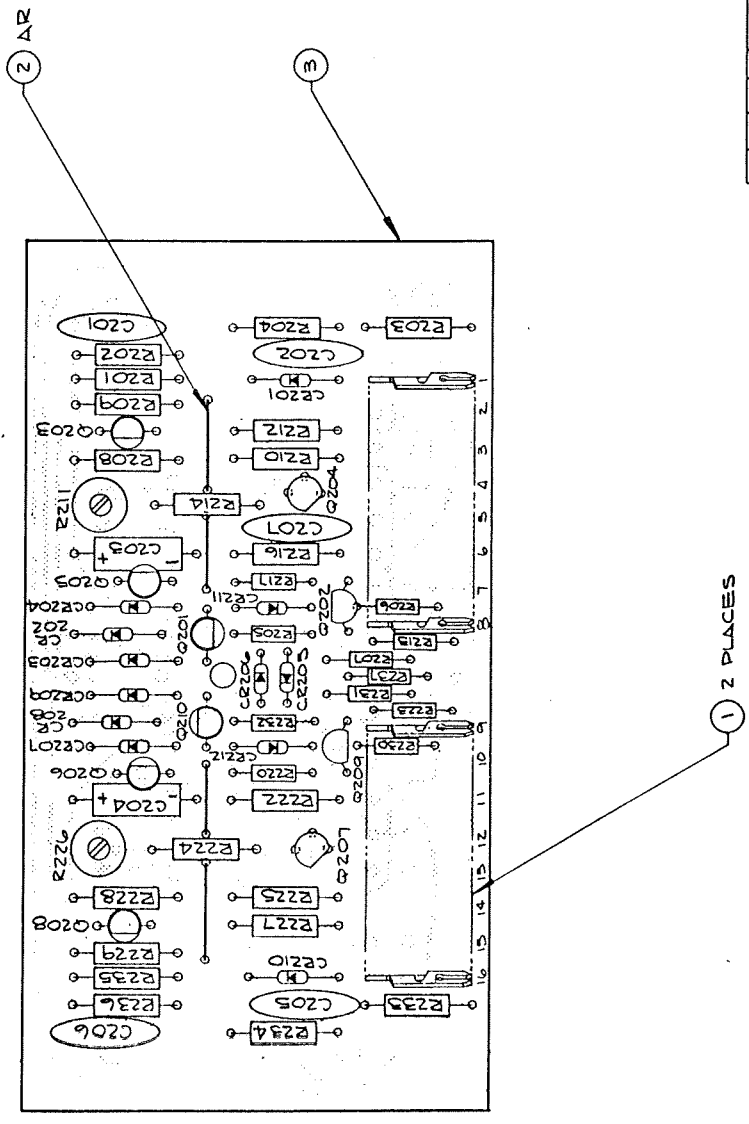
If the quality of the workpiece is suspect, change workpieces and retest. If strong multiple dips are again experienced, the shank of the workpieces are dirty or contaminated with lubricant or the workpiece hole in the ultrasonic horn is contaminated. The corrective procedure is to clean and dry the workpiece and hole.

14. If, while performing Step 12 no significant dip is seen on the meter, examine the transducer to insure that it is connected to the Power Logicon. This is accomplished by measuring the DC resistance across Pins 1 and 3 of the transducer connector with the Power Logicon disconnected. The measured resistance should be less than 1 ohm. If not, the transducer or its wiring is defective. If no error has been made in installing the transducer, the transducer is defective and must be returned to the manufacturer for repair.
15. If the foregoing tests are successfully passed, the ultrasonic system is most probably in good working order.

With very little practice, the qualification of a UTI ultrasonic system can be accomplished in less than 30 seconds. For this reason, it is suggested that the ultrasonic system be first examined when processing problems occur. Normally the results of the ultrasonic "Go-No-Go" tests indicate that the ultrasonic system is in proper working order and one of the major process parameters, the ultrasonic system, can be eliminated from further consideration. This can save considerable time in isolating and solving complex processing problems.

REVISIONS		
SYN	DESCRIPTION	APPROVAL
A	Q204 & Q207 WAS TO SCHEMATIC REMOVED R218 & R219 ADDED R231, C207, R211 & R212	3-3-67 [Signature]
B		9-9-65 mtd.

NOTES:
 1. FOR ELECTRONIC COMPONENTS,
 SEE BILL OF MATL B/M/OZ17
 2. REF: SCHEMATIC DIAGRAM-COZ15

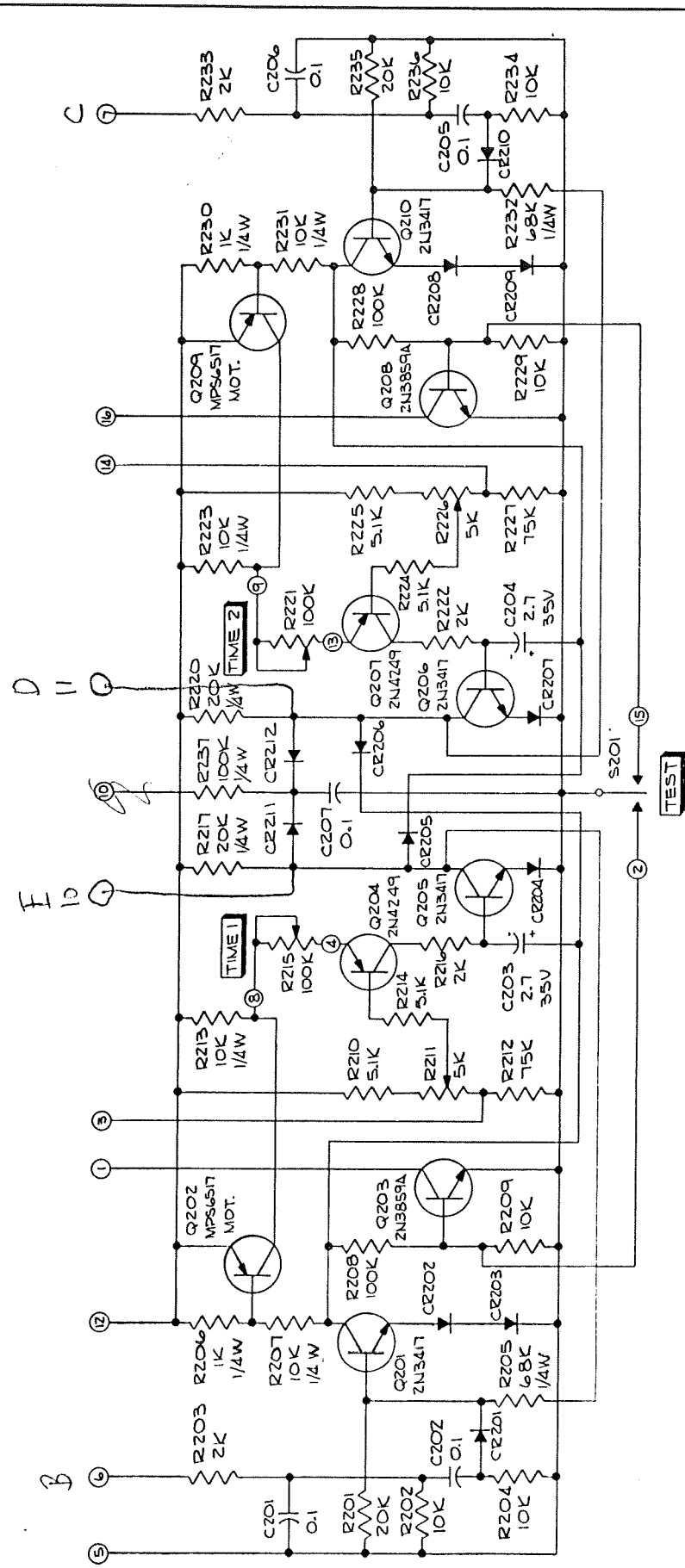


1	B	O232	TIMER BD	(TBOZ00)
	AR	2	BUSS WIRE, #20AWG	
		2	02008-1111-5000 CONTACT, P.C. EDGE TYPE ELCO	
QTY	QTY	ITEM	DESCRIPTION - MATERIAL - SIZE	SOURCE NUMBER
1	1	1		

W D NO	ASSEMBLY NO	QTY
UNIT'S OTHERWISE SPECIFIED	DATE	
DIMENSIONS ARE IN INCHES	V. JEWELST 3/10/68	
UTILIZES	APPROVALS	
WHOLESALE PARTS	3/28/68	
REWORK PARTS		
UP TO 10% INCREASE IN PRICE		

UTL UTI TECHNOLOGY, INC.	
TITLE	COMPONENT BD
SCALE	2/1
SIZE	OZ17
NUMBER	B

SYM	DESCRIPTION	APPROVAL
A	ALL RESISTORS WERE 10% Q204 & Q207 WAS 2N4314	46/
B	REMOVED R218 & R219, ADDED R237, C207, CR211 & CR212	mg



- NOTES:
1. UNLESS OTHERWISE SPECIFIED:
ALL RESISTORS ARE 1/2W, 5%.
ALL CAPACITANCE IS IN MICROFARADS.
 2. ALL UNMARKED DIODES ARE IN4154.
 3. ALL 0.1UF CAPACITORS ARE TSVDC.
 4. ALL CIRCLED NUMBERS ARE PIN CONNECTIONS FOR POWER SUPPLY BD.

QTY	ITEM	PART NUMBER	DESCRIPTION - MATERIAL - SMT	SOURCE NUMBER												
TOTAL P. (MILL)																
MATERIAL																
TREATMENT																
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONAL DECIMAL EXP. : 01 . 005 . 1/16																
ANGLES SURFACE FINISH UNLESS OTHERWISE SPECIFIED																
DO NOT SCALE FROM DRAWING																
<table border="1"> <tr> <td>DATE</td> <td>APPROVED</td> <td>SCALE</td> <td>FILE</td> </tr> <tr> <td>7/1/68</td> <td>V.J. GARDNER</td> <td>1/16"</td> <td>SCHEMATIC-TIMING CIRCUIT</td> </tr> <tr> <td></td> <td></td> <td></td> <td>UTHE TECHNOLOGY, INC.</td> </tr> </table>					DATE	APPROVED	SCALE	FILE	7/1/68	V.J. GARDNER	1/16"	SCHEMATIC-TIMING CIRCUIT				UTHE TECHNOLOGY, INC.
DATE	APPROVED	SCALE	FILE													
7/1/68	V.J. GARDNER	1/16"	SCHEMATIC-TIMING CIRCUIT													
			UTHE TECHNOLOGY, INC.													

LAST REFERENCE DESIGNATIONS USED

R237
CR212
Q210

REF DESIGNATIONS NOT USED

R218
R219

UTHE TECHNOLOGY, INC.

SECTION VII

CIRCUIT DATA

Presented in this section are circuit schematics, circuit layouts, and operating test voltages. Sufficient data is included for fully testing a Power Logicon with commonly available test equipment. The minimum equipment required is a quality oscilloscope (1 megohm input impedance and time base amplifier) and a 22 ohm, 10 watt resistor.

Model 5C Test Points and Voltages are as follows. All test points are referenced to system common.

1. Power Supplies

- a. 45 VDC at collector of Q-111 (adjustable by R-108).
- b. 32 VDC \pm 5% at Q-105 Emitter.
- c. 9 VDC \pm 15% at Q-114 Emitter with S-102 open.

2. Amplifier Test Voltages

All tests taken with the 22 ohm resistor connected across pins 1 and 3 of the transducer connector and power 1 set at 10 on Hi.

CHANNEL TEST SWITCH
CHANNEL 1

	OFF		ON	
Q-115 Emitter	16 VDC	18 VAC P.P.	16 VDC	18 VAC P.P.
Q-116 Emitter	17 VDC	12 VAC P.P.*	17 VDC	12 VAC P.P.
Q-117 Collector	30 VDC	0	0 VDC	0 VAC P.P.
Q-121 Source #2 Pin 6	32 VDC	0	29 VDC	3 VAC P.P.
Q-107 Emitter	2 VDC	0	2 VDC	.2 VAC P.P.
Q-108 Collector	24 VDC	0	24 VDC	35 VAC P.P.
Q-112 Collector	25 VDC	0	25 VDC	35 VAC P.P.
Q-106 Collector	27 VDC	\pm 2V		

* AC adjustable by R-138

3. Timers

All measurements taken with oscilloscope. Two measurements should be taken where applicable. Turn timer controls to 10.

- a. Time 1 Adjustable with (R-211) or (R311).
 -1 Logic (J-101A to J-101C.)
 -2 Logic (J-101D to J-101E with J-101A to J-101B open.)

	QUIESCENT	TRIGGERED
Q-(201) (302) Collector	28 VDC	2 VDC
Q-(203) (304) Collector	0 VDC	.7 VDC
Q-(205) (306) Collector	1.4 VDC	22 VDC

- b. Time 2 Adjustable with (R-226) or (R-326).
 -1 Logic (J-101A to J-101B)
 -2 Logic (J-101D to J-101E with J-101A to J-101B shorted.)

	QUIESCENT	TRIGGERED
Q-(210) (311) Collector	28 VDC	2 VDC
Q-(208) (309) Collector	0 VDC	.7 VDC
Q-(206) (307) Collector	1.4 VDC	22 VDC

- c. Motor Control (operated by both timers)

	QUIESCENT	TRIGGERED
Q-119 Collector	1.4 VDC 3 VAC P.P.	0 VDC 0 VAC
Q-120 Collector	13 VDC 35 VAC P.P.	32 VDC 0 VAC