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DSTS-4A MAINTENANCE MANUAL

Serial numbers 973-XXXXXXX and up

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The part number for this manual is 700-096

1.0 INTRODUCTION

The purpose of this manual is to enable trained technicians to repair and calibrate the DSTS-4A digital depth sounder test set. Because the DSTS-4A is microprocessor controlled, it is difficult to troubleshoot, and at times appears to defy the most elemental rules of logic. As a diagnostic aid, extensive use of oscilloscope waveforms at all important nodes is used. Please read the theory of operation and study the schematics and block diagram before proceeding to repair a DSTS-4A. Calibration of a working unit is much easier, and may be done without reference to the theory, block diagram, or schematics.

1.1 RELATED DOCUMENTS

The technician should read the operator's manual. This document is called the "DSTS-4A OPERATORS MANUAL". This is the standard manual that is included with the DSTS-4A. Please read over this document to obtain a working knowledge of the DSTS-4A depth sounder test set. Although this service manual is written as a stand-alone manual, the additional knowledge gained by reading the operator's manual will be of significant help in servicing the unit.

1.2 DEFINITIONS AND ABBREVIATIONS USED IN THIS MANUAL

1.2.1 DEFINITION OF "PULSE" AS USED IN THIS DOCUMENT

The word "pulse" means the envelope containing the entire number of cycles that come from the output of a depth sounder. It does not refer to a portion of the sine wave burst. There are some exceptions, as when the trigger pulse is mentioned. These are readily differentiated by the context "pulse" is used in, and by the wave forms included in this document.

1.2.2 DUT

The abbreviation, DUT, means "Depthsounder Under Test" in this document. To aid in diagnosing malfunctions in the DSTS-4A, the DUT should be a working depth sounder.

1.2.3 DSTS

The abbreviation, DSTS, stands for "Depth Sounder Test Set", and refers to the DSTS-4A, hardware revision 3 throughout this manual.

2.0 THEORY OF OPERATION

The DSTS is designed to test depth sounders. To do this, the electrical pulse transmitted by the sounder under test is measured, and the peak-to-peak voltage, the frequency, the width, and the repetition rate are calculated by the microprocessor. The user selects the depth and reply amplitude . After a delay that is determined by the depth, the reply echo is transmitted from the DSTS back to the DUT. The DUT should

display the echo at the appropriate depth. The DSTS is divided into two printed circuit boards; the front panel board, and the main board. The front panel board is mostly analog circuitry and the main board is mostly digital.

2.1 FRONT PANEL BOARD

The front panel board receives and transmits the signals from and to the DUT. These signals connect to J104, the IN/OUT BNC connector located on the front panel. J104 connects to the wiper of the load switch. This switch, S1B , selects one of the three internal loads, or the external load. Output signals from the front panel board to the main board are the pulse cycle sample, and the detected pulse voltage. Inputs to the front panel board from the main board are the reply pulse, and scope trigger pulse.

2.1.1 PULSE LED OPERATION

The input signal at J104 also goes through voltage divider resistors R110, R111, and R112 to the input of U101A. Resistor R113 and diode D105 protect the input of U101A from excessive voltages. The output of U101A sends the pulse cycle sample to the main board. This output also drives the input of U103B which in turn drives the pulse detector, D104 and C105. The voltage across C105 drives the pulse LED through U103C and U103D. A pulse of just a few microseconds is stretched and will show as a bright flash on the LED. Note that the pulse LED circuitry is separate from the rest of the DSTS circuit. The significance is that the pulse LED will still work even if the microprocessor is locked or dead. The pulse LED is a sure indicator of the presence of a pulse at the DSTS input. If the pulse LED does not light, the problem is most likely a bad cable or DUT, or possibly a bad part in the pulse LED circuit. If no input pulse is present, the DSTS will do nothing but display "WAITING FOR A PULSE" until it receives one.

2.1.2 PULSE VOLTAGE MEASUREMENT

R101 through R104 form a voltage divider. The voltage across R104 is applied to the peak-to-peak detector diodes D101 and D102. The two amplifiers, U103A and U103B make up a peak hold detector. The output voltage of U103B pin 7 goes to the analog-to-digital converter chip (U13 pin 6) on the main board. Calibration of the voltage reading is set by the offset voltage at U103D pin 14 that goes to the analog-to-digital converter (U13 pin 7) on the main board. This offset voltage is set by the pot R145, located on the back of the front panel board. The voltage difference between the two input pins (6 and 7) of the analog-to-digital converter chip is converted to a digital value following the end of the input pulse from the DUT. This value is read by the microprocessor and displayed on the LCD as the peak-to-peak pulse input voltage.

2.1.3 REPLY PULSE SIGNAL

The reply echo pulse is generated on the main board by U8B. The output of this IC is a frequency burst with an amplitude of about 4.5 to 5 volts peak-to peak that goes through buffer U2F to J3 pin 8. A jumper cable from J3 on the main board carries

this signal to J103 pin 8 on the front panel board. The signal is buffered by U101E and U101F. U101 gets its supply voltage from U104, pin3. U104 is a precision 5 volt regulator with a maximum error of 1 percent. U101 is a CMOS inverting buffer with an output voltage swing equal to the supply voltage. Thus, the output from U101F will always be 5V peak-to-peak within 1 percent. The output of U101F goes though R133 to the attenuator made up of resistors R122 through R132. The attenuator switch, SW2, selects the tap point, and therefore, the reply voltage level. Buffer amplifier, U105A presents a very high impedance to the attenuator, minimizing any inaccuracy due to loading. The output of U105A goes to the reply level vernier control, R146. Calibration adjustment, R139, sets the maximum resistance of R146 to 700 ohms. The lower end of R146 is grounded through R141, a 350 ohm 1% resistor. The correct adjustment of R139 insures the output at the wiper of R146 will vary over a 3 to 1 range. Buffer amplifier U105B, a unity gain amplifier, provides a low output impedance for the reply echo. The output of this amplifier is DC decoupled by C108 and then goes through the voltage divider resistors, R149 and R137. The actual reply voltage sent back to the DUT is developed across R137. With the attenuator set to the 50 millivolt range and the reply amplitude vernier set to the CAL position, the reply pulse voltage across R137 will be about 111 millivolts peak-to-peak. The impedance at the high end of R137 is about 22 ohms. This is low enough so there is no appreciable error induced with a change in the load resistance.

2.1.4 FIVE VOLT PRECISION SUPPLY REGULATOR

The 5 volt supply regulator, U104, is a precision, low drop-out voltage regulator. It will continue to regulate accurately as long as the input voltage to pin 1 is greater than 5.2 volts. The output voltage specification is 5 Volts, ±1%. The reply voltage and the voltmeter calibration will be inaccurate if the precision regulator is not within specifications. This regulator supplies buffer U101 and operational amplifiers U103 and U105. A 1.7 volt bias voltage is developed by R117 and R118. This is buffered by U103C and serves as the "ground" reference for U105.

2.2 FRONT PANEL TO MAIN BOARD CABLING

Three ribbon cable jumpers connect the front panel board to the main board.

2.2.1 24 CONDUCTOR RIBBON CABLE

A 24 conductor cable carries power, digital power ground, and the toggle switch connections. It plugs into J102 on the front panel board and into J2 on the main board.

2.2.2 16 CONDUCTOR RIBBON CABLE

The 16 conductor cable carries the detected pulse voltage, pulse cycle sample, trigger, reply pulse, and analog ground for the A/D converter, U13. This cable plugs into J103 on the front panel board and J3 on the main board.

2.2.3 14 CONDUCTOR RIBBON CABLE

The 14 conductor cable carries the power, ground, and data for the LCD display. It is dedicated to the LCD and carries no signals to the panel board circuits. The cable connects to J101 on the panel board to J1 on the main board.

2.3 MAIN BOARD

The main board contains all the digital circuits for processing the pulse and generating the reply. Power supply, charging, and protective circuits are also on the main board. Refer to the schematic and block diagram for this discussion.

2.3.1 POWER SUPPLY

The 12 volt AC or DC current enters the board at J6. It passes through the fuse on the rear panel via J5. D5 rectifies the current if it is AC, or passes it on if it is DC. D7 is a reverse polarity and overvoltage protection diode. D4 is the battery switch-over diode. The cathode of D5 connects to the power switch. The other side of the power switch feeds the voltage regulator IC's (U12 and U14) on the main board, and U104 on the front panel board.

2.3.2 ANALOG TO DIGITAL CONVERTER

The output of the peak-to-peak voltage detector on the front panel board connects to the analog to digital converter chip, U13, on the main board. The DC voltage across the input (pins 6 and 7) of U13 is converted to a digital word and read by the microprocessor just after the end of the input pulse. The digital word is converted and scaled to read peak-to-peak voltage. This voltage is displayed on the LCD display.

2.3.3 PULSE INPUT

The pulse cycle sample input connects to U1. U1 doubles the pulse frequency by delaying the pulse at U1 pin 10 as compared to pin 9. As a result, twice the input frequency appears at pin 11 of U1. This gives the input pulse processing circuitry twice the number of input cycles for a given input pulse and therefore increases the accuracy of the DSTS.

2.3.4 INPUT PULSE PROCESSING

The pulse at the output of U1 connects to the inputs of seven independant 16-bit counters. The integrated circuits U4, U5, and U11 each contain three counters numbered 0-2. U4's counter 0 is used to gate out the first two cycles of the input pulse, counter 1 totalizes the input cycles, and counter 2 sets up a measurement gate. U5's Counter 2 measures the period between the input pulses, counter 0 detects the end of the input pulse, and counter 1 counts the number of 10 Mhz clocks that occur over the duration of the input gate generated by U4. The input pulse width is measured by counter 1 of U11. The pulse frequency, width, and period are calculated based on the values contained in the above seven counters. The software accounts for the doubled frequency input from U1, and the readout displays the true frequency.

2.3.4.1PULSE PERIOD MEASUREMENT TRIGGER

The microprocessor generates a trigger pulse for U9, which is the period counter circuit. The output of this circuit is a pulse that tracks the time between the input pulses from the DUT. The trigger, applied to pin 4 of U9, primes the flip-flop. The duration between the next two pulses (pin 11 of U9) following the trigger appears at pin 9 of U9. It goes from there to pin 16 of U5, the pulse period counter's gate input. This trigger pulse must be present for the period measurement circuit to work.

2.3.5 REPLY PULSE PROCESSING

The reply pulse processing is done with a series of counters. Two counters run the phase locked loop (PLL), another sets the delay or depth, and another sets the reply width. Since the input pulse frequency is doubled by U1, the output frequency of the PLL runs at the same frequency, which is twice that of the input. This also increases the resolution of the PLL circuit and gives another important advantage. To get the correct reply frequency, the output of the PLL is divided by 2 with a gated counter. This way, when the output pulse is off, no signal is generated at the reply frequency. This is important because any residual signal at the DUT's receiver could cause improper operation or receiver calibration errors.

2.3.5.1 REPLY DEPTH GENERATION

The depth of the reply echo is set by the value loaded into the bottom depth one-shot counter, U6, and by the frequency of the depth clock divider output. One of the three counters in U7 generates the depth clock. The frequency of the depth clock depends on the current depth mode the DSTS is set to. The depth mode is the selection of feet, meters, or fathoms. The approximate frequencies for the depth clock are 156,250 Hz for feet, 26,041 Hz for fathoms, and 49019 Hz for meters. The depth clock connects to the clock input of the bottom depth one-shot counter, U6. This counter is loaded with the calculated value for the desired depth of the reply echo. A second echo one-shot (U11) is active when the fish echo function is used. The output of the depth one-shots go to the input of the reply width counter, also configured as a one-shot. Normally, this counter is automatically loaded with a pulse length that tracks the incoming pulse width. The DSTS operator can also manually load a value of reply width.

2.3.5.2 PLL OPERATION

The operation of the PLL is straight forward. A reference frequency is generated by the PLL reference divider, U11, and the divide-by-n counter is loaded with the correct number to produce the desired output frequency. To get the desired frequency resolution of 100 Hz, both the reference and the divide-by-n counters' values must be calculated and loaded for each frequency change. Due to round-off errors, the frequency will only be exact at frequency outputs that are at 500 Hz intervals. Very small errors will be observed at other frequencies. For example, setting up a frequency of 508.3 Khz actually results in a frequency of 508.305 Khz. The difference is too small to be of importance, but is mentioned here for trouble shooting purposes.

When checking the frequency for calibration purposes, please use an even frequency such as 100 Khz.

2.3.6 AUTOPULSE OPERATION

When the DSTS is operated in the auto pulse mode, it generates a series of output pulses without any input pulse from a depth sounder applied. This is done by using the microprocessor, U15, to generate a series of triggers to drive the reply width counter, U6. A pulse width of 500 uSec is loaded into this counter by the microprocessor software. The repetition rate is governed by software and is approximately 50 mSec.

2.4 INTERNAL REFERENCE FREQUENCIES

In addition to the depth clock and PLL reference frequencies, there are two other counters that generate one megahertz and one kilohertz reference frequencies. Two of the counters from the U7 chip are used to do this. These reference frequencies are used to drive the reply width counter, the autopulse generator, U11, and the pulse period counter U5.

2.5 CONTROLLER SECTION

The 8032 microprocessor controls the operation of the DSTS by implementing the software contained in the external EPROM (U21). A peripheral interface port with 24 in/out lines (U3) is used to expand the number of ports used by the micro processor. This IC (U3) reads the panel switches and drives the LCD display. The optional RS-232 interface hardware is also associated in the controller section. To implement the RS-232 output option, the interface IC(U16) and the RS-232 EPROM must be installed. An additional RAM socket is included on the board for future expansion if required.

3.0 OPENING THE DSTS

Any time you open the DSTS, you should be working on a static mat. The integrated circuits used in the DSTS are very sensitive to static discharge. Please exercise all due caution. Unplug the power cord from the DSTS and remove the four rubber stick-on feet by peeling them off with your fingers. Remove the four screws recessed in the plastic feet, and remove the feet and plastic bail. Set the DSTS upright and carefully lift off the top half of the case, including the black band. Make sure that the back panel **DOES NOT** lift up as you do this. If the back panel lifts, the voltage regulator may be torn from the main board. The front panel should also stay with the bottom part of the case.

3.1 REMOVING THE FRONT PANEL.

To remove the front panel , unplug the ribbon cables from the back of the front panel PCB. Note the orientation of each cable so it can be replaced correctly. The red wire in the ribbon cable identifies pin one. To prevent the pins from accidental bending, insert them into a small rectangle of styrofoam or anti-static material if

available.

3.2 REMOVING THE FRONT PANEL PCB.

Separate the front panel PCB from the front panel by first removing all knobs from the panel. Remove the nuts holding the controls and switches. Using a soldering iron and solder removal tool, clear all solder from the five holes connecting the BNC, ground lug, and external load jacks to the front panel PCB. Do not attempt to remove the BNC connectors or external load jacks from the panel. Note the position of the remaining nuts and lock washers that are between the front panel and the switches. These nuts control the spacing of the PCB from the front panel, and re-assembly is easier if they are not moved. Verify that the five connections to the jacks are free of solder and gently separate the PCB from the panel by pulling it from the edges. Save the plastic window that is wedged between the display and panel. The LCD surface is sensitive to scratching, so protect it carefully while handling.

3.3 REPLACING THE FRONT PANEL PCB.

Replacement is the reverse of the removal procedure in section 3.2. The toggle switches all have nuts and lock washers on the inside of the panel. The rotary switches have nuts on the inside and flat washers on the outside. The position of the nuts on the switch bushings determines the spacing of the PCB and the LCD display from the panel. The nuts should be adjusted so the display is in contact with the plastic window on the front panel. The nuts must be adjusted so that neither the PCB or the front panel shows any sign of bowing or warping. This is critical and if too much pressure is placed on the LCD display, it will be damaged.

After securing the PCB to the panel by tightening the nuts on the outside of the panel, solder the connections to the front panel jacks and the ground lug. A total of five connections must be soldered.

3.4 REMOVING THE MAIN PCB.

To remove the main PCB, first remove the three plugs with the ribbon connectors. Note the position of the red stripes on the cables as they identify the end of the plug with pin one. Remove the 4-40 screw, lock washer and nut holding the voltage regulator (U14) to the rear panel. Unsolder the two wires from the fuse post on the rear panel. Remove the five 6-32 screws that hold the main PCB to the bottom case half. Use caution in handling the main PCB. The voltage regulator (IC14) is unsupported and is easily bent or broken off.

3.5 REPLACING THE MAIN PCB.

Replacement is the reverse of the removal procedure in section 3.4. Attach the

IDENTIFYING TOP AND BOTTOM CASE-HALVES.
The top case-half has aluminum studs near each corner.
The bottom case has a screw hole near each corner that penetrates the case.

main PCB to the bottom case half. The beveled corners go at the louvered end of the bottom case half. The bottom case half has a through-hole near each corner. Slide the rear panel into the groves near the louvered end of the case. Be sure to fasten the voltage regulator (IC14) to the back panel after mounting the main PCB on the case.

3.6 ASSEMBLING THE DSTS

When assembling the DSTS, dress the ribbon cables close to the main board and keep them behind the aluminum shield. Place the top back on the case and attach the feet. Do not over-tighten the screws for the feet or you may crack the plastic case. Place the rubber feet over the screw holes.

4.0 TROUBLESHOOTING THE DSTS

The DSTS is a microprocessor controlled instrument. Because of this it is much harder to troubleshoot than analog instruments. The best approach is to isolate the faulty section and then make use of the extensive waveforms included in section 7.0 to narrow the search down to the faulty component.

4.1 REQUIRED TEST EQUIPMENT

A 3½ digit multimeter, a digital scope similar to a LeCroy LS140, the EDI DSTS CALIBRATOR, and a working depthsounder are required to successfully troubleshoot the DSTS.

4.2 ISOLATING THE PROBLEM

Before in-depth troubleshooting starts, the area in which to look for the problem should be isolated.

4.2.1 POWER SUPPLY

Check the power supplies. There are three 5-volt regulators, two on the main board, and one on the panel board. Check the outputs of U14, U12, and U104 for a +5VDC output. If the voltage is low and the regulator is hot, then suspect a short. The power supplies must all be working before any further tests are performed.

4.2.2 CLOCK OPERATION

Check the 10 Mhz oscillator, Y1 for a 4 V P-P 10 Mhz output. Also check the 10 Mhz outputs at U2 pin 10, and U2 pin 6. If these are present, then check for 1 Mhz at U7 pin 13 and 1 Khz at U7 pin10. Refer to waveforms WF051 and WF052. Next, check for a clock frequency of 11.052 Mhz at pin 18 and 19 of U15. Refer to waveforms WF017 and WF018.

4.2.3 INPUT PULSE PATH

Refer to the schematic. Hook up a known good depth sounder to the DSTS. Check the pulse LED. It should be flashing or on continuously when the DUT is on. Check to see if the display is correctly reading the input pulse. If not, then follow the path of the input pulse. Waveforms WF001 through WF009 are useful here. Follow

the signal through to the main board. Check the signals at U1, referring to waveforms WF022 through WF027 and WF030 and WF031. All signals described so far do not depend on the microprocessor's correct operation.

4.2.4 CW OUTPUT CHECK

To check the output signal path, put the DSTS into the FACTORY TEST MODE. Press both the FREQ and MODE switches down and release them simultanously. This puts the DSTS in the AUTO PULSE mode and the message "Auto Pulse Mode" appears on the LCD. To get the CW output, momentarily lift the WIDTH switch up. The message "FACTORY TEST MODE" should appear. Set the REPLY LEVEL switch for 50 mV output, and the LOAD switch to the LOW position. Turn the AMPL VERNIER max CCW. An 111 mV peak-to-peak signal should appear at the IN/OUT switch. If not, start at the main board with the PLL circuit. Waveforms WF041, WF043, WF054 will be helpfull. Check for signal at the input and output of the gated divide-by-2 counter, U8. Also check the buffer U2F. If the signal is present here, then check for a bad 16 conductor jumper cable. Check the signal path through the front panel board. Waveforms WF010 through WF016 shoud prove helpful for this. The output (reply) signal does depend on the proper operation of the microprocessor and many of the IC's on the main pcb.

4.3 MICROPROCESSOR TESTS

If the DSTS has proper power and clock signals and still does not work, it is possible that the microprocessor section is defective. The usual symptoms of a bad processor are garbage on the display and/or erratic operation. Use a scope to check waveforms WF017 through WF021. Also check all bus and address lines with a scope to see if any of them are shorted. If this doesn't work, replace the processor (U15) and the periphial chip (U3).

4.4 MAIN BOARD COUNTER TESTS

Check waveforms WF028 through WF060. These waveforms show the signals at the counter IC's inputs and outputs. Other important nodes in the signal path are also covered. Use the block diagram in conjunction with the schematic to follow the signal paths. Substitute socketed parts if they are suspect. The counters are especially difficult because some have no visible output. The output is data to the processor. Again, use common sense, the waveforms, and part substitution if nescessary.

5.0 CALIBRATION OF THE DSTS

The DSTS has only two calibration adjustments. R139 calibrates the attenuator, and R145 calibrates the voltmeter. Adjustments to R145 should only be made if the A/D converter (U13) is replaced. Do not adjust R139 unless the reply vernier level pot (R146) is replaced.

5.1 REQUIRED TEST EQUIPMENT

A 3½ digit multimeter, a digital scope similar to a LeCroy LS140, the EDI DSTS CALIBRATOR, and a working depthsounder are required to successfully troubleshoot the DSTS.

5.1.0 THE EDI DSTS CALIBRATOR

The EDI DSTS CALIBRATOR is a specialized pulse generator. It is designed to generate a calibrated, high voltage pulse for the DSTS. The pulse frequency is 204.8 Khz, width is 312.5 usec, period is 80 msec, and the voltage is 400V p-p with < 1% overshoot. If a substitute pulse generator is used in place of the EDI DSTS CALIBRATOR, monitor the pulse at the input of the DSTS during calibration to verify that it meets the pulse parameters outlined in this paragraph.

5.2 PRELIMINARY OPERATIONAL TEST

Connect power to the DSTS and turn the power switch on. Observe the LCD for the power-up message "WAITING FOR A PULSE". If this message appears, connect an operational depth sounder to the IN/OUT connector. The DSTS should read the input pulse and generate a reply echo. If so, **remove the power cord** and proceed to the next step. If not, repair the DSTS before attempting the calibration procedure.

5.3 DSTS/3 FACTORY CALIBRATION PROCEDURE

Record the following data:

DATE_____ DSTS SERIAL#_____

EPROM VERS_____ OPTIONS: Bat Pk__ RS-232__ OTHER____

_____

5.3.0 VERNIER ATTENUATOR CALIBRATION

DO NOT use an ohmmeter with more than 100 mV at the probe tips measured across 1KΩ.

Remove all power and other connections to the DSTS. Set the AMPL VERNIER control max CCW. Set the ohmmeter to the 2000 ohm range. Connect the ohmmeter leads to the two outside legs of the AMPL VERNIER pot. Set R139 for a reading of 700 ± 7 ohms. Record reading _____ .

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5.3.1 ATTENUATOR TEST

Measure the resistance from the attenuator switch tap to ground. The readings (from .01 mV to 50 mV) should be: 1.0, 2.0, 5.1, 10, 20, 50, 100, 200, 500, 1000, 1990, and 4980. The tolerance is +/- 5%, +/- 0.1 ohm. Check if ok_____.

5.3.2 LOAD RESISTOR TEST

Connect an ohmmeter between the IN/OUT center pin and shell. The readings (from LOW to EXT LOAD) should be: 360, 590, 2170, and 57,000 ohms. Tolerance is ± 10%. Check if ok_____.

Plug the power cord in and turn the power on before proceeding.

5.3.3 5-VOLT CHECK

Connect a meter between ground and pin1 of U101. The voltage should be between 4.95 and 5.05 volts. Record the voltage _____VDC.
Record voltage at pin 40 of U15 (main PCB). _____VDC.

5.3.4 OSCILLATOR CHECKS

Processor clock. Check U15, pin 18, for 11.06 ±.01 MHz. _____MHz
System clock. Check U2, pin 9 for 10.000 ± .001 MHz. _____MHz.

5.3.5 REPLY VOLTAGE CHECK

Turn the DSTS power on. Set the REPLY LEVEL to 50 mV. Set the AMPL VERNIER to the max CCW (CAL) position. Set the LOAD to LOW. Connect the scope to the IN/OUT connector through a short BNC-BNC cable. Press the FREQ and MODE switches down at the same time and release them. The message "Auto Pulse Mode" will be displayed. Raise the WIDTH and DEPTH switches up at the same time. The message "FACTORY TEST MODE" will appear. The oscilloscope should read 106 to 116 P-P millivolt at 100 Khz. Record this voltage_____millivolts.

5.3.6 VOLT METER CALIBRATION.

Connect the power cord and turn the DSTS on. Connect the **EDI DSTS CALIBRATOR** to the IN/OUT jack. Turn the **EDI DSTS CALIBRATOR** power on. Reset the DSTS by raising the MODE switch momentarily. Allow the voltage reading to stabilize for 30 seconds. Adjust R145 which is on the back of the front panel PCB behind the power switch for a reading of 400 volts. This reading may occasionally show 390 or 410 volts, but should read 400 most of the time.

Record the reading _____volts.

5.3.7 FREQUENCY, WIDTH, AND PERIOD VERIFICATION

Record the following information from the top line of the display:

FREQ_____ Limit: ± 100 Hz, or 204.7 to 204.9 KHz
WIDTH_____ Limit: ± 4 uSec or 308 to 310 uSec.
PERIOD_____ Limit: 78 to 80 mSec.

Turn the EDI DSTS TESTER power off **before** disconnecting the EDI DSTS TESTER.

5.3.8 OPERATIONAL TEST

Set the LOAD to MED. Connect known good depth sounder to the DSTS. Record the brand and model of the depth sounder _____. Turn the power on and allow 60 seconds for readings to stabilize. Record the following from the top line of the display:

Frequency _____
Width _____
Period _____
Voltage _____

Reduce the REPLY level until the depthsounder loses the echo. Record the lowest voltage that the results in a steady an echo. _____millivolts. Record the indicated depth on the depth sounder. _____feet. Are the above readings within a reasonable range for the sounder used? _____. Check the fish echo and any other software options for proper function. Fish OK? _____. RS-232 OK? _____. Auto Fish OK? _____.

5.3.8.1 OPTIONAL BATTERY PACK TEST

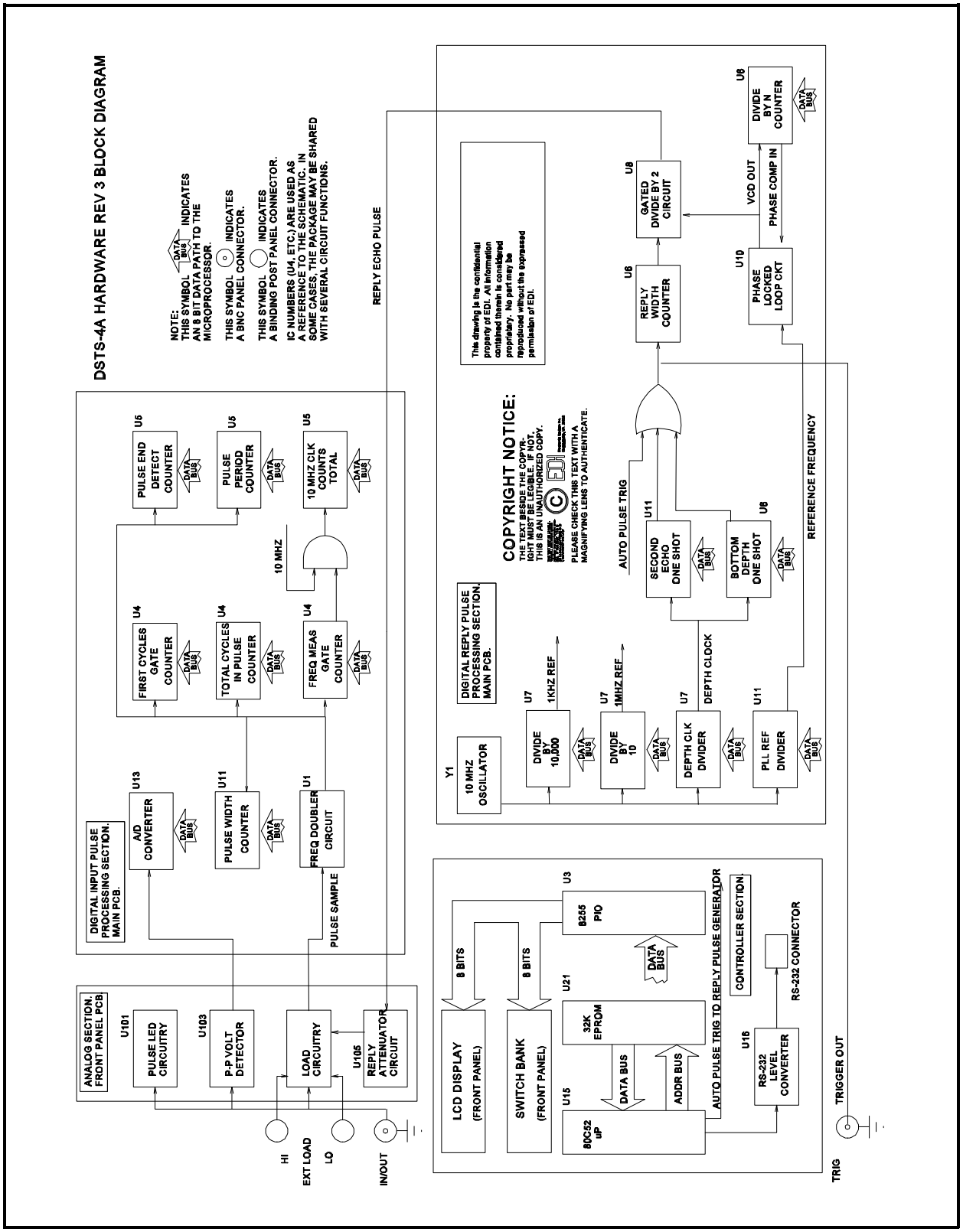
Charge the DSTS internal battery pack for 24 hours using the factory supplied wall transformer. The power switch to the DSTS can be on or off, it does not matter as long as the correct power supply is used and working. After the 24 hour charge period, remove the power and turn the DSTS on and record the time. The battery pack must run the DSTS for a minimum of three hours continously. Batt OK?_____

5.3.9 TEST CERTIFICATION

Date: _____ Ser#: _____
Tested by: _____
Company: _____
Address: _____
City, State, Zip: _____

Phone: _____ FAX: _____

6.0 BLOCK DIAGRAM



7.0 LIST OF SCHEMATICS

	DESCRIPTION	DOCUMENT NUMBER
1)	FRONT PANEL BOARD SCHEMATIC	DSTS4A3-1
2)	MAIN BOARD MICROPROCESSOR	DSTS4A3-2
3)	MAIN BOARD PULSE RECEIVER	DSTS4A3-3
4)	MAIN BOARD PULSE TRANSMITTER	DSTS4A3-4

7.1 COPYRIGHT PROTECTION OF DRAWINGS AND MANUAL

The schematics are copyrighted, as is the rest of this manual, and it is illegal to distribute copies of this manual. Please do not copy these drawings or this manual without first obtaining permission in writing from EDI. This schematic is printed with a high resolution laser printer. The copyright notice contains details that will not properly reproduce on a copier. Therefore, any copies are obvious and easily confirmed.

7.2 FRONT PANEL BOARD SCHEMATIC.

The front panel schematic is complete on one sheet of paper. All board-mounted components are shown. Comments are made on the drawing regarding components external to the board. For more specific details about a component, please check the relevant parts list in section 9 of this manual.

7.3 MAIN BOARD MICROPROCESSOR

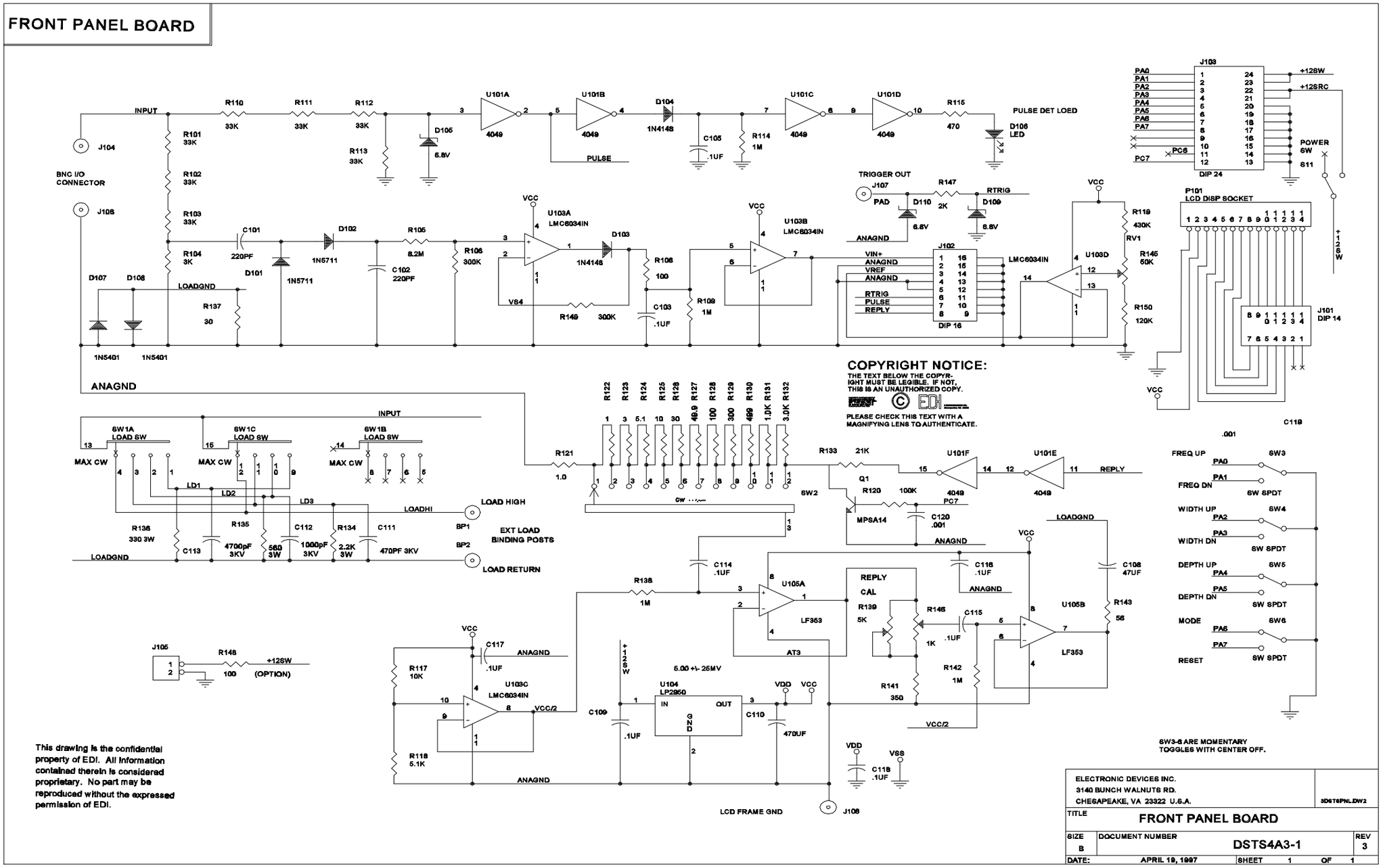
The microprocessor schematic covers the microprocessor section of the main board. Signal flow between the drawing sheets is indicated by labels. All board-mounted components are shown. This schematic is copyrighted, as is the rest of this manual, and It is illegal to distribute copies of this document.

7.4 MAIN BOARD PULSE RECEIVER

This section covers the pulse input section of the main board. Signal flow between the drawing sheets is indicated by labels. All board-mounted components are shown. This schematic is copyrighted, as is the rest of this manual, and it is illegal to distribute copies of this document.

7.5 MAIN BOARD PULSE TRANSMITTER

This section covers the reply pulse generator circuitry of the main board. Signal flow between the drawing sheets is indicated by labels. All board-mounted components are shown. This schematic is copyrighted, as is the rest of this manual, and it is illegal to distribute copies of this document.


FRONT PANEL BOARD
INPUT
BNC I/O CONNECTOR
PULSE DET LOED
PULSE
TRIGGER OUT
LOADGND
ANAGND
VCC
VIN+
VREF
RTRIG
PULSE
REPLY
LMC6034IN
DIP 16
DIP 24
LCD DISP SOCKET
POWER SW
SW1A LOAD SW
SW1B LOAD SW
SW1C LOAD SW
MAX CW
LOAD HIGH
LOAD RETURN
EXT LOAD BINDING POSTS
LF353
LP2950
REPLY
CAL
AT3
5.00 +\- 25MV
VCC/2
LCD FRAME GND
FREQ UP
FREQ DN
WIDTH UP
WIDTH DN
DEPTH UP
DEPTH DN
MODE
RESET
SW 8PDT
SW3-6 ARE MOMENTARY TOGGLES WITH CENTER OFF.
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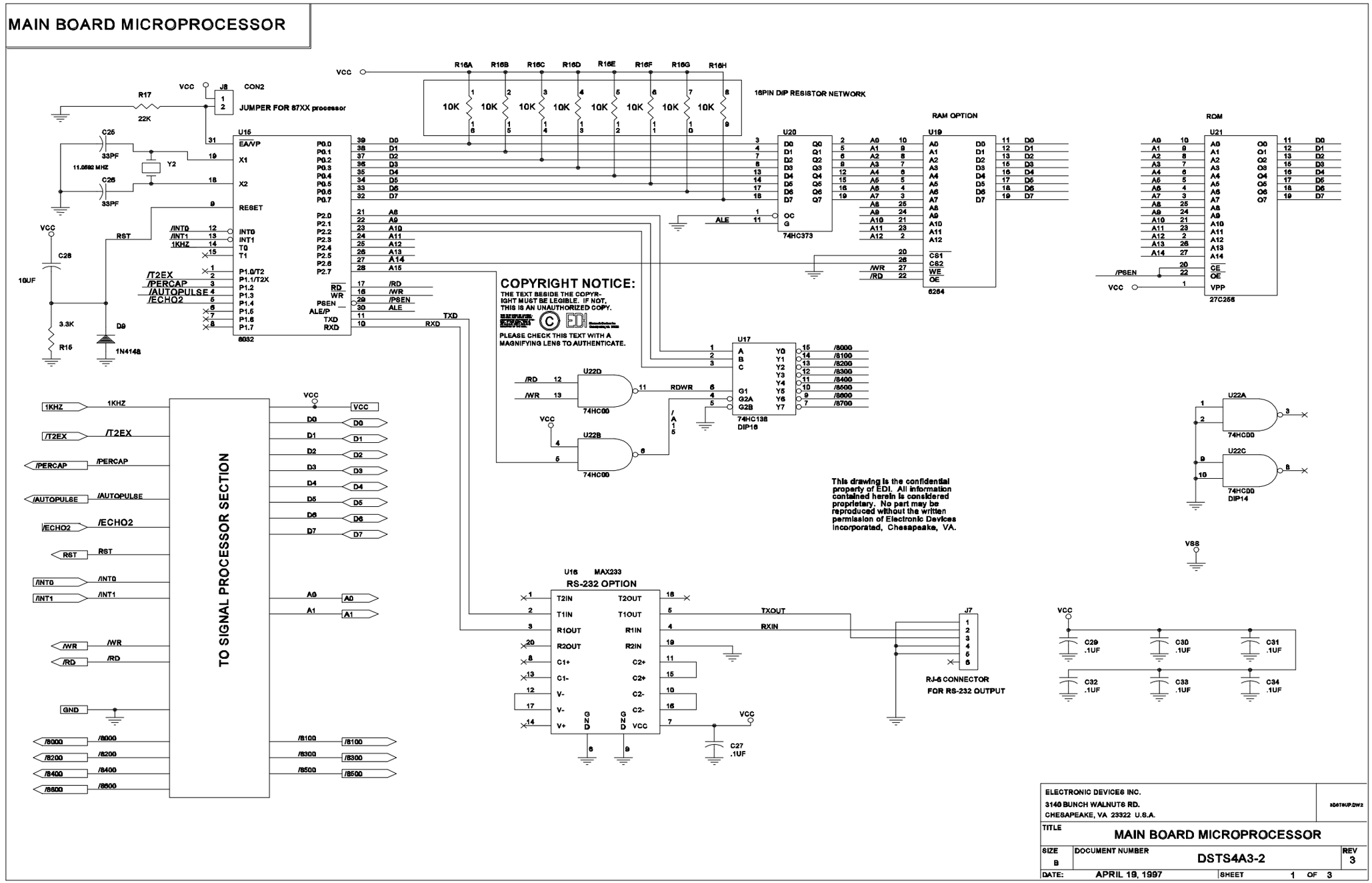
ELECTRONIC DEVICES INC.
3140 BUNCH WALNUTS RD.
CHESAPEAKE, VA 23322 U.S.A.
3DSTSPNL.DW2
TITLE
FRONT PANEL BOARD
SIZE B
DOCUMENT NUMBER
DSTS4A3-1
REV 3
DATE: APRIL 19, 1997
SHEET 1 OF 1


MAIN BOARD MICROPROCESSOR
JUMPER FOR 87XX processor
16PIN DIP RESISTOR NETWORK
RAM OPTION
ROM
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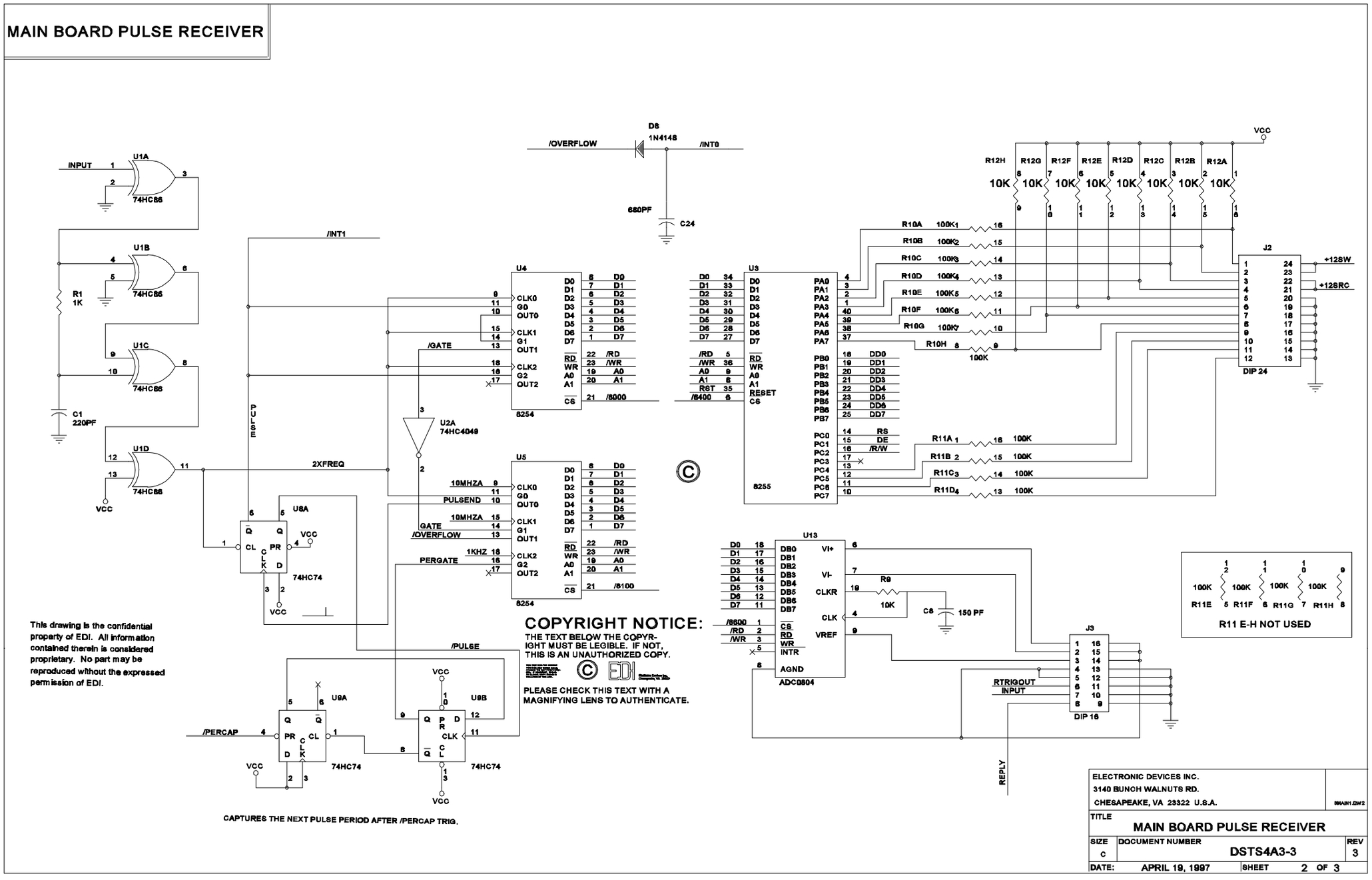
TO SIGNAL PROCESSOR SECTION
RS-232 OPTION
RJ-6 CONNECTOR FOR RS-232 OUTPUT
ELECTRONIC DEVICES INC.
3140 BUNCH WALNUTS RD.
CHESAPEAKE, VA 23322 U.S.A.
TITLE
MAIN BOARD MICROPROCESSOR
SIZE B
DOCUMENT NUMBER DSTS4A3-2
REV 3
DATE: APRIL 19, 1997
SHEET 1 OF 3


MAIN BOARD PULSE RECEIVER
INPUT
U1A
74HC86
U1B
R1
1K
U1C
C1
220PF
U1D
VCC
/INT1
2XFREQ
/PULSE
D8
1N4148
/OVERFLOW
/INT0
680PF
C24
U4
8254
/GATE
U2A
74HC4049
U5
10MHZA
PULSEND
GATE
/OVERFLOW
1KHZ
PERGATE
U3
8255
/8400
/8000
/8100
/RD
/WR
RESET
U8A
U8B
74HC74
/PERCAP
U13
ADC0804
R9
10K
C8
150 PF
CLKR
CLK
VREF
AGND
INTR
R10A 100K
R10B 100K
R10C 100K
R10D 100K
R10E 100K
R10F 100K
R10G 100K
R10H 100K
R12H 10K
R12G 10K
R12F 10K
R12E 10K
R12D 10K
R12C 10K
R12B 10K
R12A 10K
J2
DIP 24
+12SW
+12SRC
R11A 100K
R11B 100K
R11C 100K
R11D 100K
R11E 100K
R11F 100K
R11G 100K
R11H 100K
R11 E-H NOT USED
J3
DIP 16
RTRIGOUT
INPUT
REPLY
CAPTURES THE NEXT PULSE PERIOD AFTER /PERCAP TRIG.
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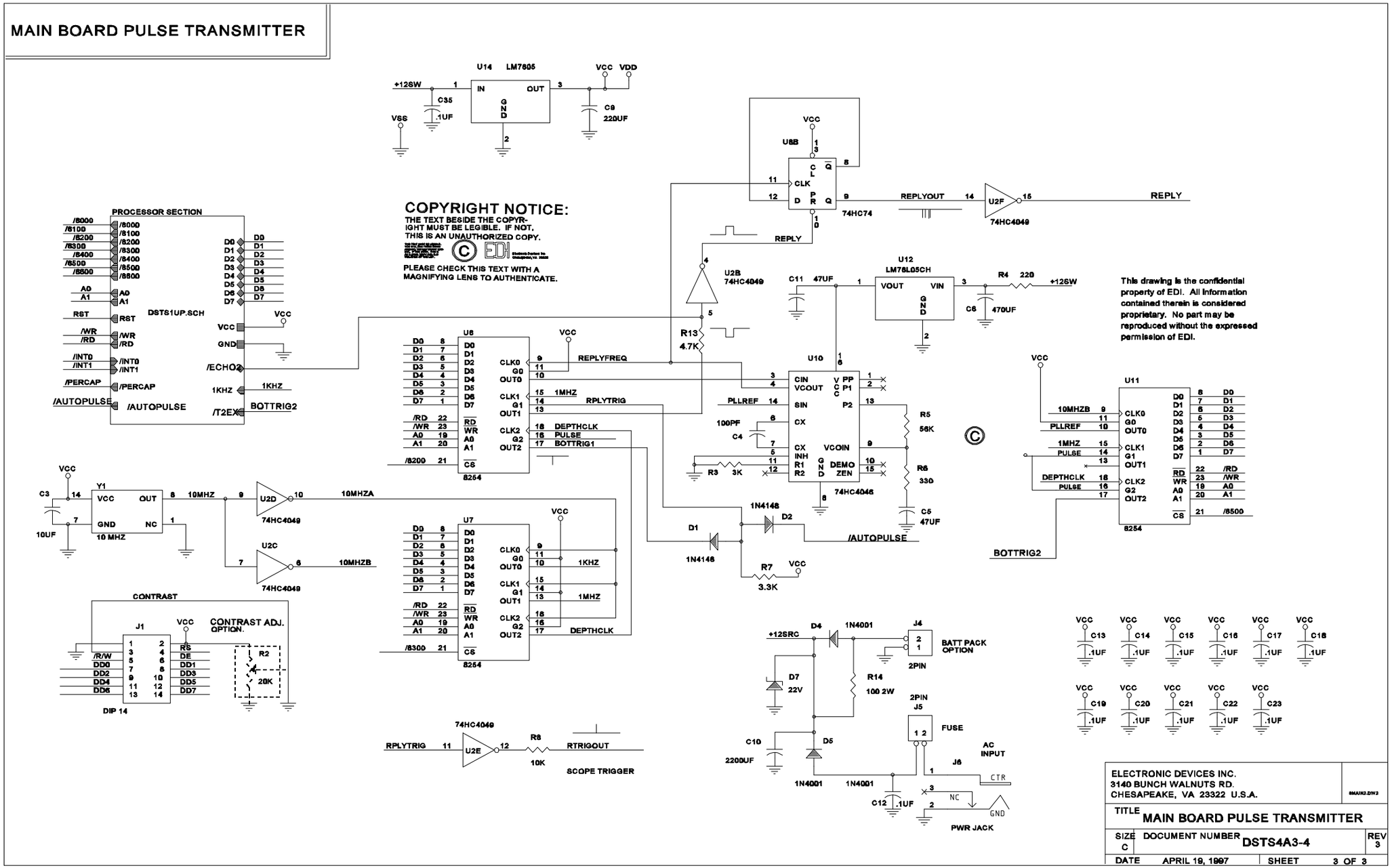
ELECTRONIC DEVICES INC.
3140 BUNCH WALNUTS RD.
CHESAPEAKE, VA 23322 U.S.A.
98AIN1.DW2
TITLE
MAIN BOARD PULSE RECEIVER
SIZE C
DOCUMENT NUMBER DSTS4A3-3
REV 3
DATE: APRIL 19, 1997
SHEET 2 OF 3


MAIN BOARD PULSE TRANSMITTER
U14 LM7805
+12SW
VSS
C35 .1UF
C9 220UF
VCC VDD
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PROCESSOR SECTION
DSTS1UP.SCH
/8000
/8100
/8200
/8300
/8400
/8500
/8600
A0
A1
RST
/WR
/RD
/INT0
/INT1
/PERCAP
/AUTOPULSE
D0
D1
D2
D3
D4
D5
D6
D7
VCC
GND
/ECHO2
1KHZ
/T2EX
BOTTRIG2
U8B
74HC74
REPLY
REPLYOUT
U2F
74HC4049
U2B
74HC4049
R13
4.7K
U12
LM78L05CH
VOUT
VIN
C11 47UF
R4 220
C6 470UF
+12SW
U8
8254
REPLYFREQ
1MHZ
RPLYTRIG
DEPTHCLK
PULSE
BOTTRIG1
/8200
U10
PLLREF
100PF
C4
R3 3K
R5 56K
R6 330
C5 47UF
/AUTOPULSE
1N4148
D1
D2
R7 3.3K
U11
10MHZB
PLLREF
1MHZ
PULSE
DEPTHCLK
BOTTRIG2
/8500
Y1
C3
10UF
10 MHZ
10MHZ
U2D
74HC4049
10MHZA
U2C
10MHZB
U7
1KHZ
DEPTHCLK
/8300
CONTRAST
J1
CONTRAST ADJ. OPTION.
R2 20K
DIP 14
RPLYTRIG
U2E
R8 10K
RTRIGOUT
SCOPE TRIGGER
+12SRC
D4 1N4001
J4
BATT PACK OPTION
2PIN
D7 22V
R14 100 2W
C10 2200UF
D5
J5
FUSE
AC INPUT
J6
CTR
NC
GND
PWR JACK
C12 .1UF
C13 C14 C15 C16 C17 C18
C19 C20 C21 C22 C23
.1UF
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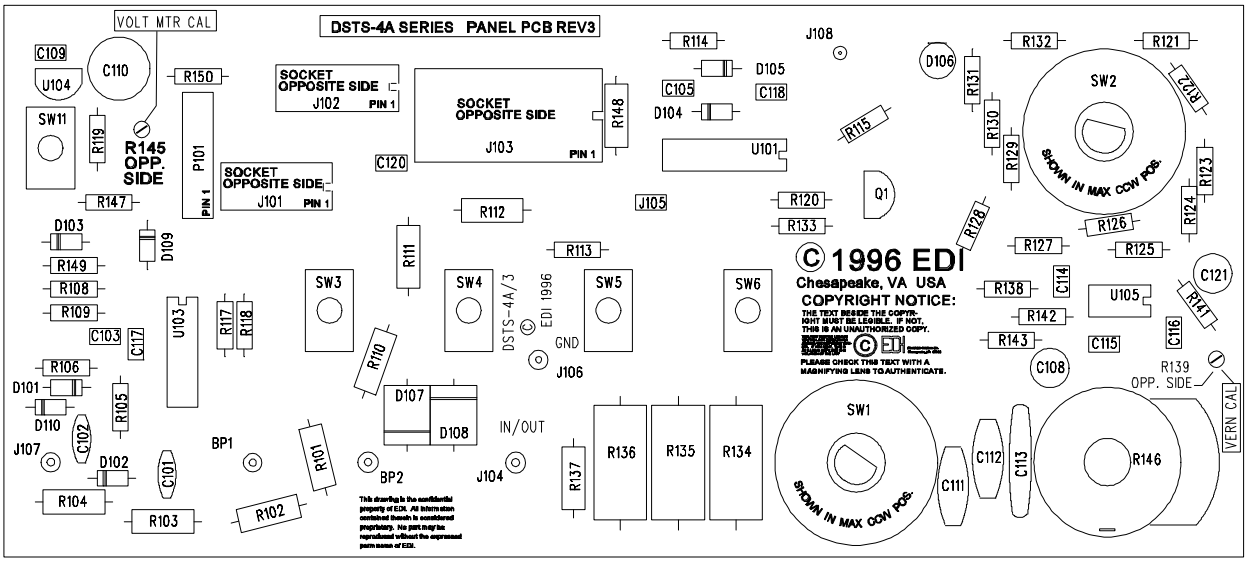
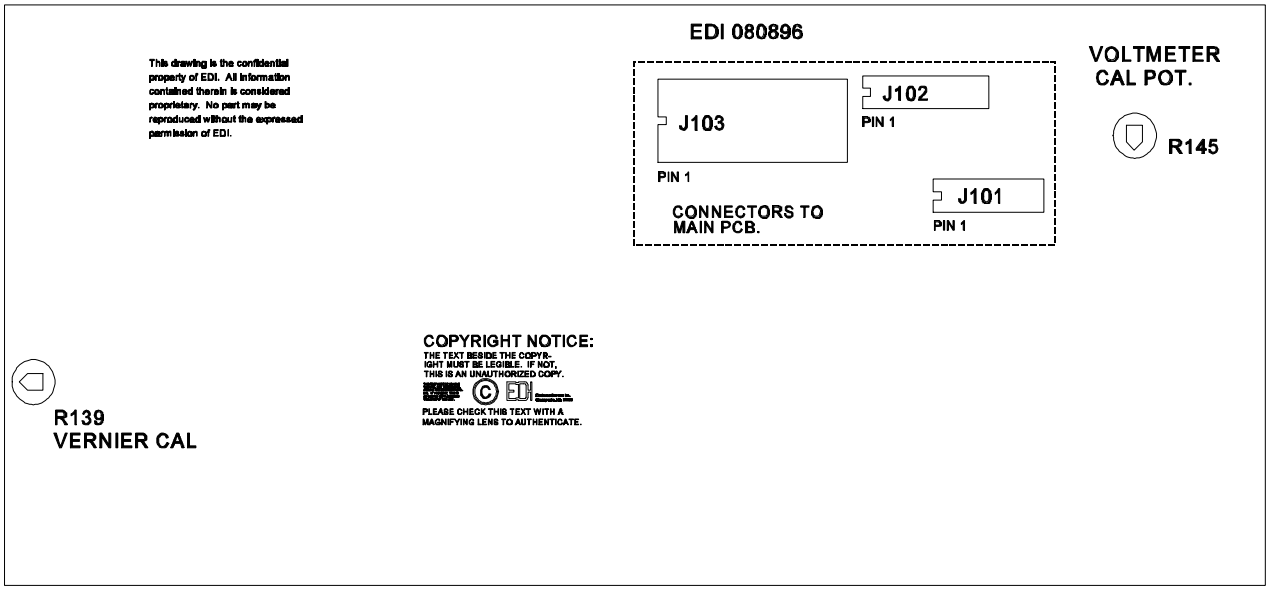
ELECTRONIC DEVICES INC.
3140 BUNCH WALNUTS RD.
CHESAPEAKE, VA 23322 U.S.A.
8MAIN3.DW3
TITLE MAIN BOARD PULSE TRANSMITTER
SIZE C
DOCUMENT NUMBER DSTS4A3-4
REV 3
DATE APRIL 19, 1997
SHEET 3 OF 3

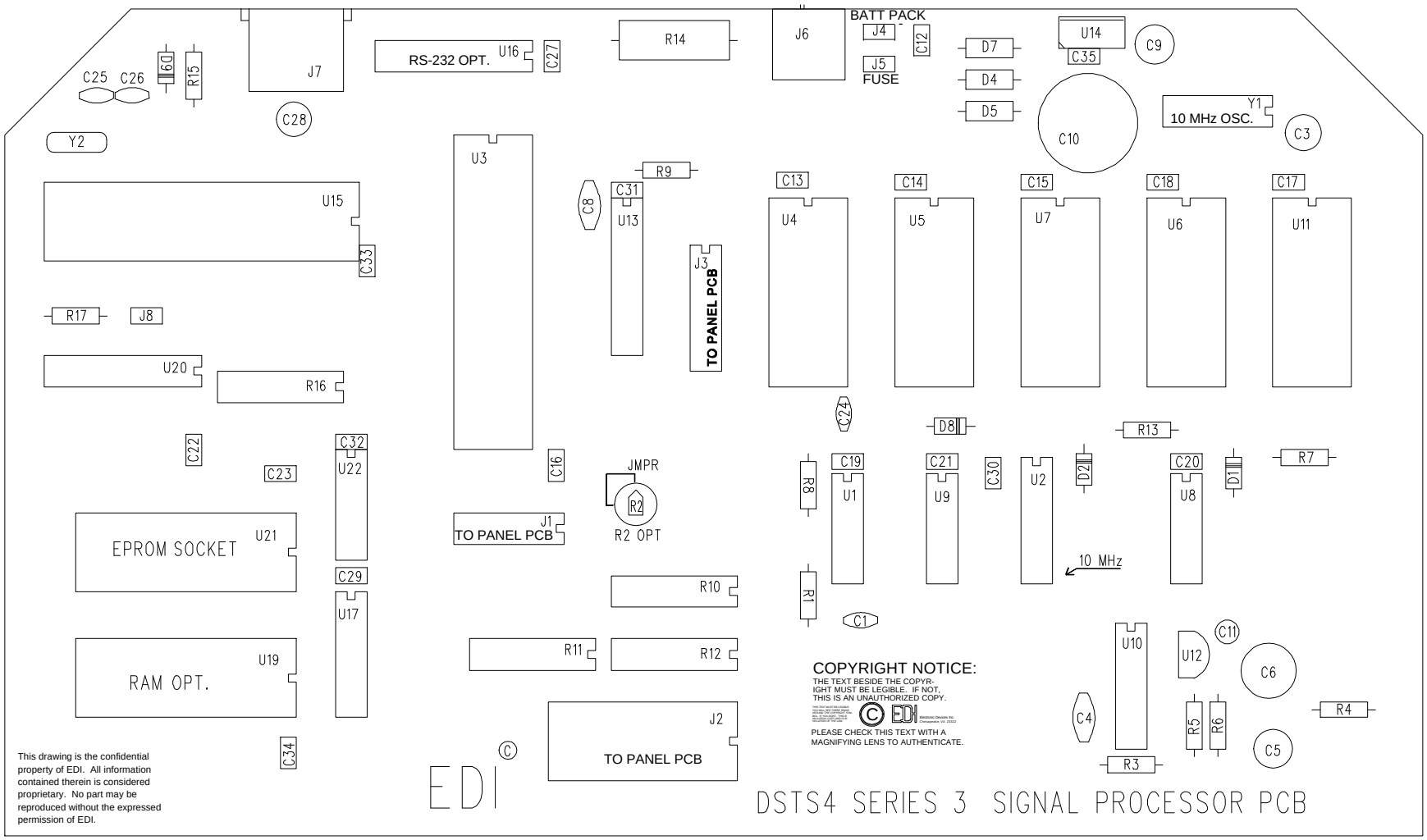
The panel board has parts on both sides. Section 8.1 shows the top (what you see from the front panel) and section 8.2 shows the bottom of the panel board. The main board has parts on one side only. Section 8.3 shows the parts located on the main board as viewed from the top.

8.1 PANEL BOARD FRONT VIEW



8.2 PANEL BOARD REAR VIEW




BATT PACK
J6
J4
J5
FUSE
C12
D7
D4
D5
U14
C35
C9
C10
Y1
10 MHz OSC.
C3
RS-232 OPT.
U16
C27
R14
J7
C28
C25
C26
D9
R15
Y2
U3
R9
C8
C31
U13
J3
TO PANEL PCB
U15
C33
R17
J8
U20
R16
C22
C23
C32
U22
C16
JMPR
R2
R2 OPT
J1
TO PANEL PCB
EPROM SOCKET
U21
C29
U17
R10
RAM OPT.
U19
R11
R12
J2
TO PANEL PCB
C34
C13
C14
C15
C18
C17
U4
U5
U7
U6
U11
C24
D8
R13
R8
C19
U1
C21
U9
C30
U2
D2
C20
U8
D1
R7
10 MHz
R1
C1
U10
U12
C11
C6
C4
R5
R6
R4
C5
R3
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EDI ©
DSTS4 SERIES 3 SIGNAL PROCESSOR PCB

9.0 WAVEFORMS

Many waveforms have been reproduced in the following ten pages. The waveforms were acquired using a LeCroy LS-140 digital oscilloscope. These waveforms are numbered WF001 through WF059. The point of connection is listed to the right of the waveform number. For instance, "WF046 U6.13" means that waveform WF046 was taken at pin 13 of IC U6. Additional information regarding DSTS operating modes or control settings may be included on the same line.

9.1 SCOPE SETUP FOR WAVEFORMS

The waveforms were captured with the DSTS connected to an EDI DSTS TESTER. This is a pulse generator that supplies a regulated 400V P-P pulse at a frequency of 204.8 KHz, a width of 312.5 uSecs, and a period of 80 mSecs. If an EDI DSTS TESTER is not available, use a known good depth sounder. A simple analog type of sounder is preferred because the period is very steady. Digital depth sounders commonly have a very erratic period and also randomly change pulse widths with time.

9.2 TRIGGER SETUP

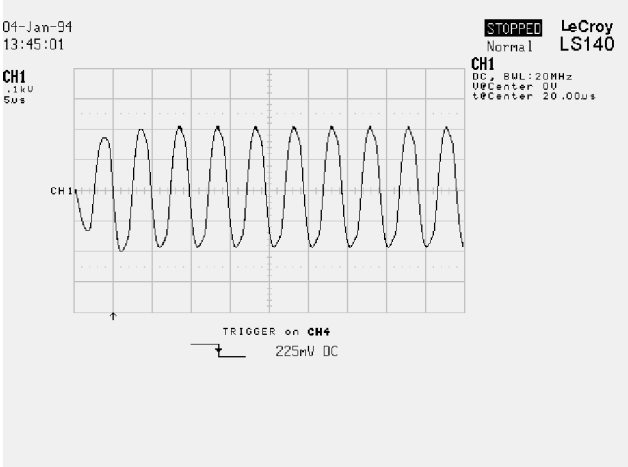
The oscilloscope is triggered on the edge of the first cycle of the input pulse to the DSTS. Data relating to the voltage and time-base appears in the upper left area of the waveform. Trigger delays are shown at the upper right portion.

9.3 VERTICAL SETUP

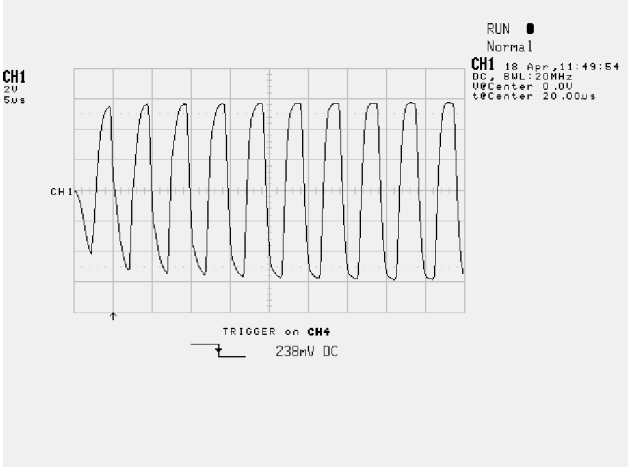
Digital scopes, by their nature, show a very noisy waveform. If your scope has a vertical bandwidth limiting function, use it. The bandwidth may be set as low as 2 megahertz. If a digital scope is not available, a good analog scope may be used, but the waveforms will be harder to see. The vertical sensitivity and time base can be read off the upper left and upper right sides of the waveforms.

9.4 DSTS-4A CONTROL SETUP

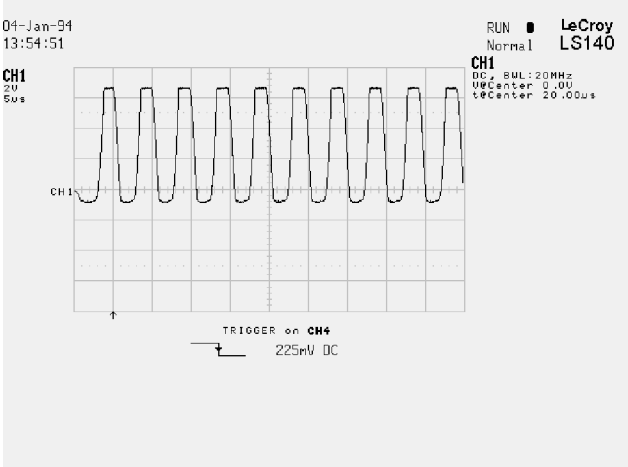
The LOAD switch is set to the low position, the REPLY LEVEL is set to 50 mV, and the AMPL VERNIER is set to the maximum CCW position. Additional information regarding DSTS operating modes or control settings may be noted in the waveform captions.



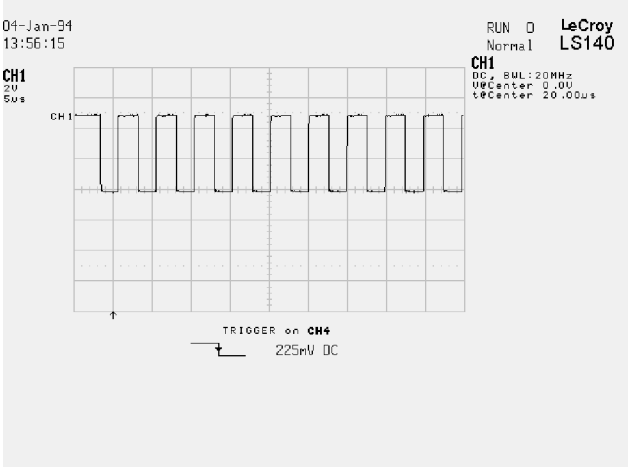
WF001 J104



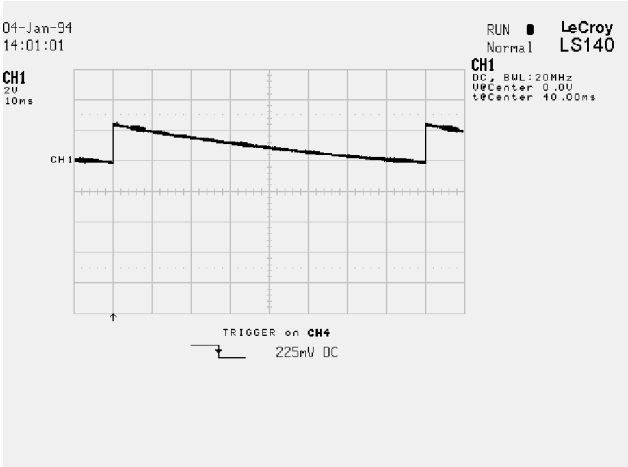
WF002 R103-R104



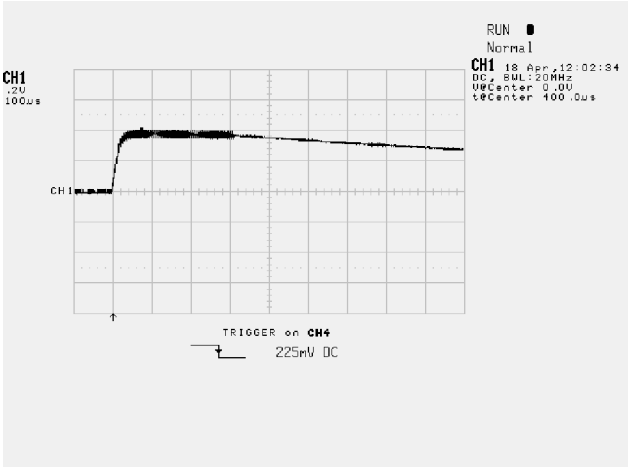
WF003 U101.3



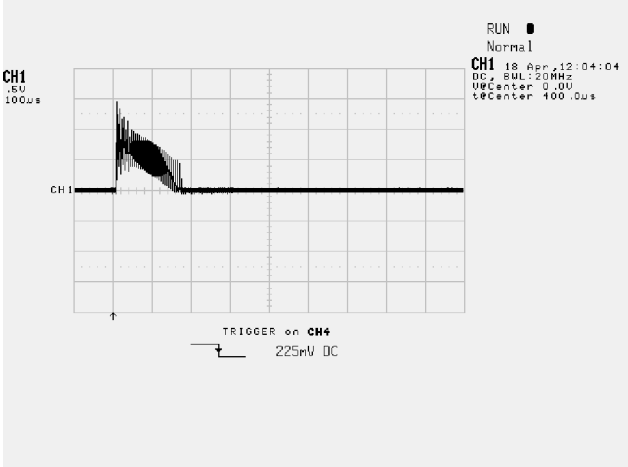
WF004 U101.2



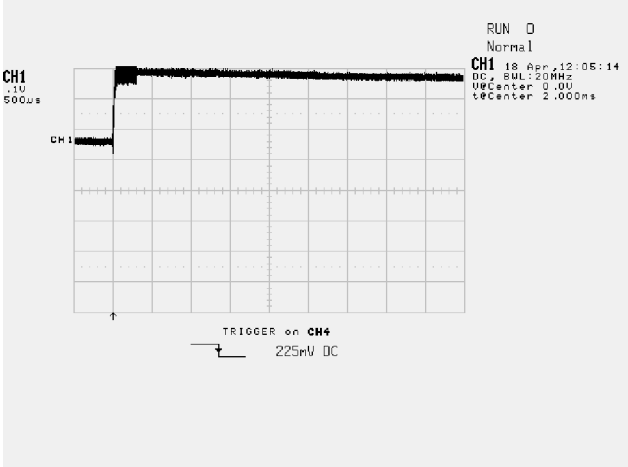
WF005 U101.7



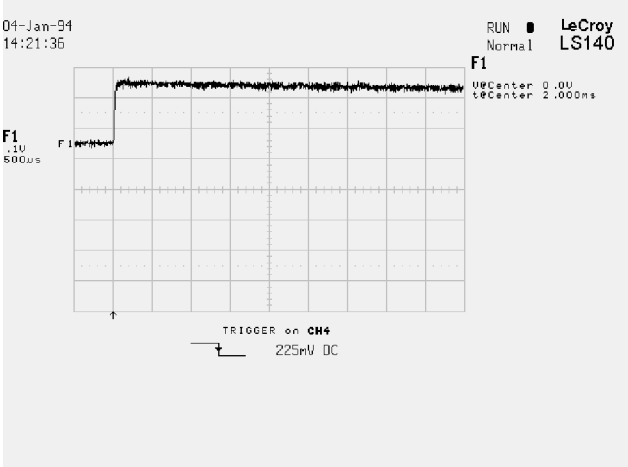
WF006 U103.3



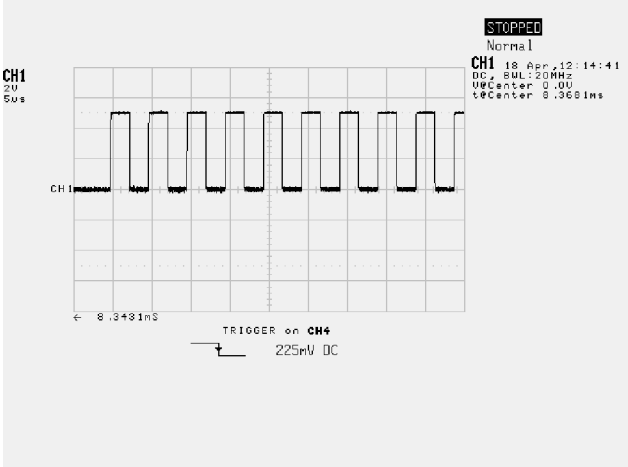
WF007 U103.1



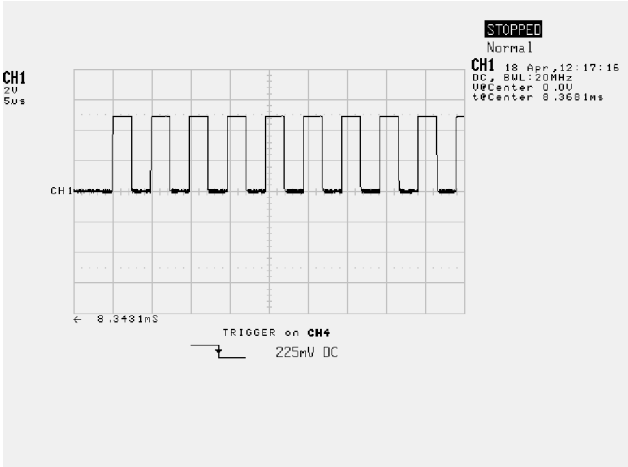
WF008 U103.5



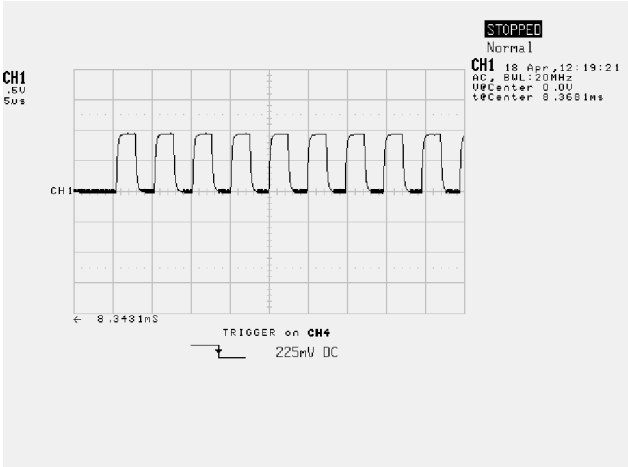
WF009 U103.7



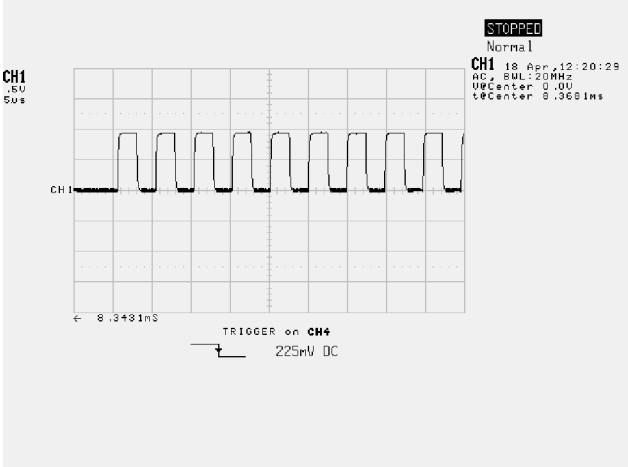
WF010 U101.11



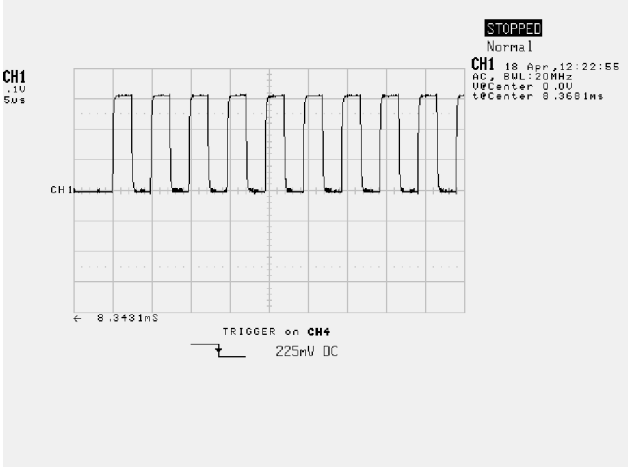
WF011 U101.15



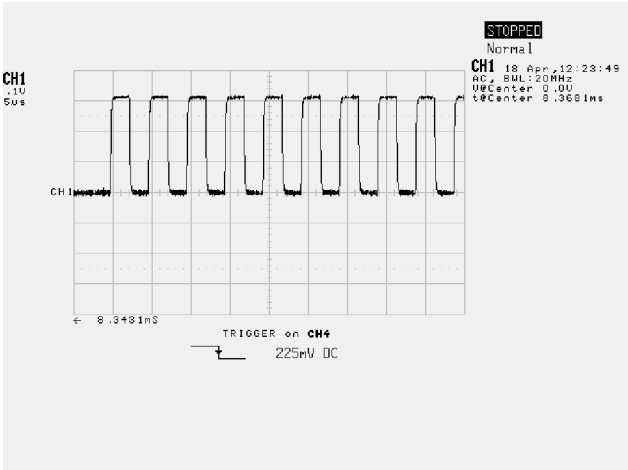
WF012 U105.3



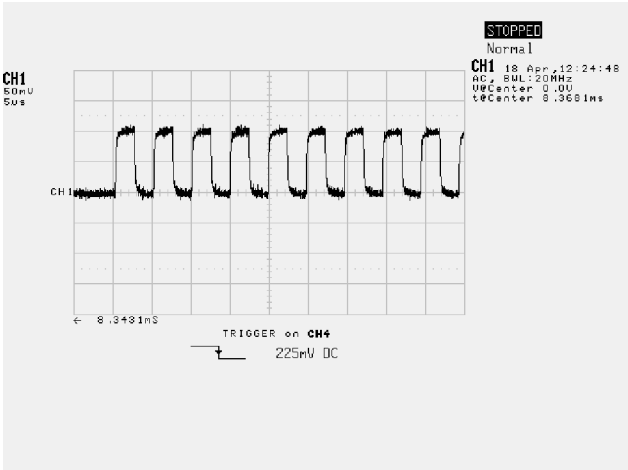
WF013 U105.1



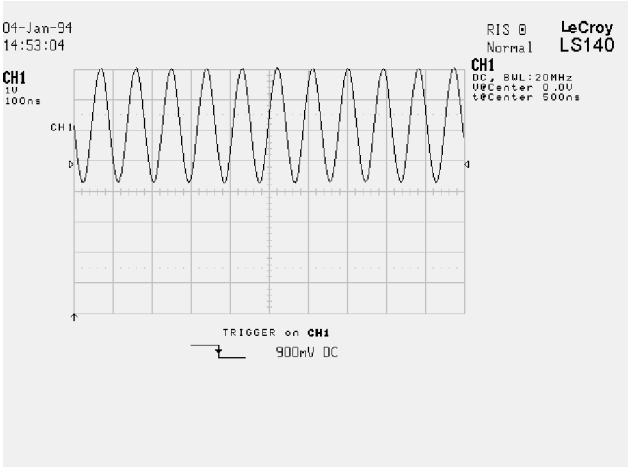
WF014 U105.5



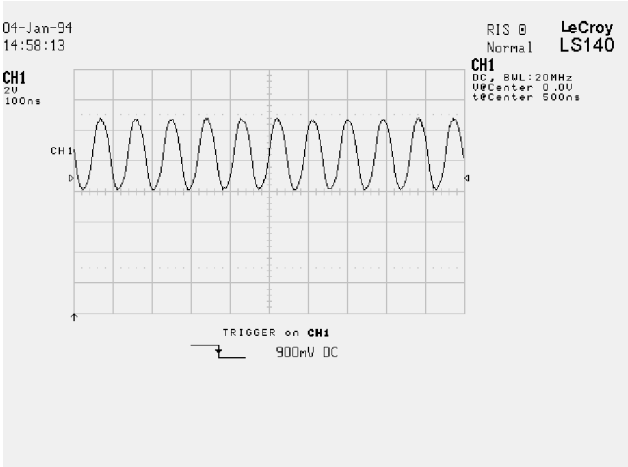
WF015 U105.7



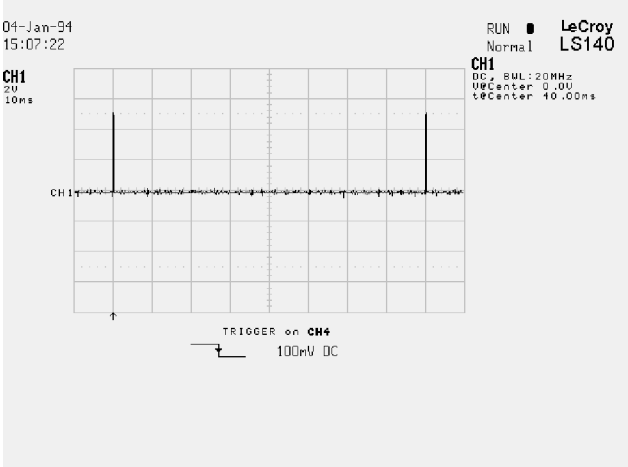
WF016 D107 CATHODE



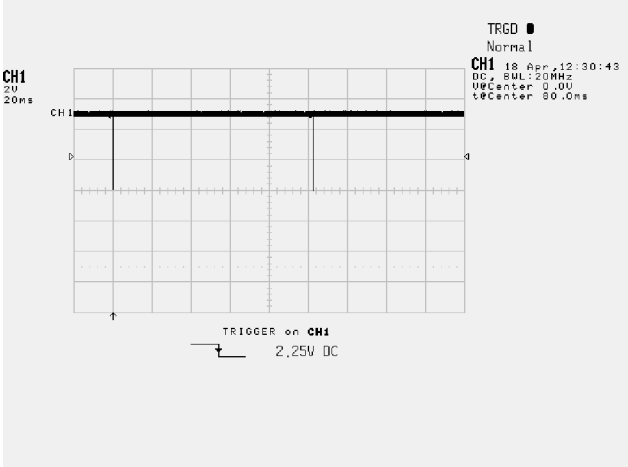
WF017 U15.19



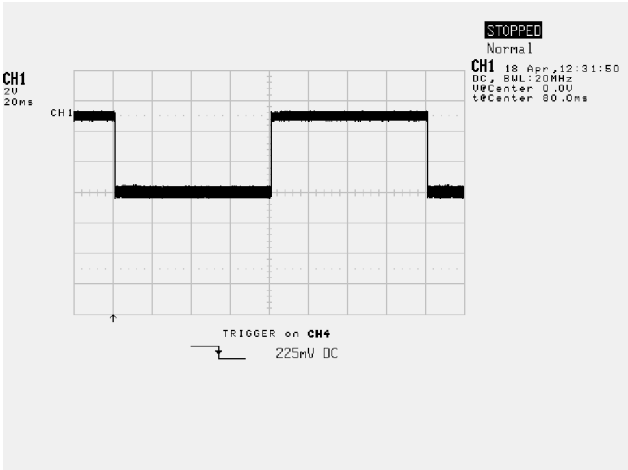
WF018 U15.18



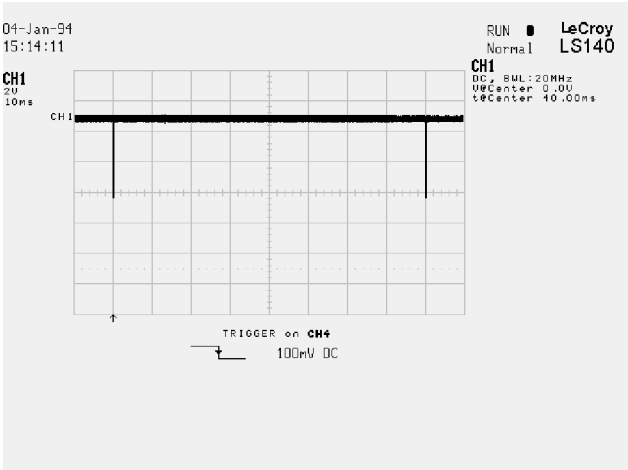
WF019 U15.13



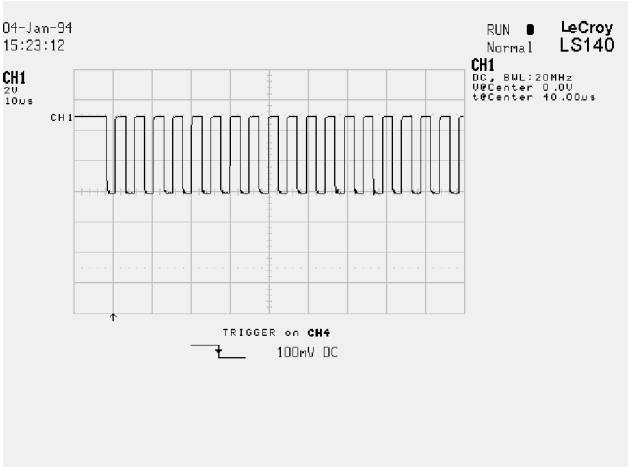
WF020 U15.1 AUTO PULSE MODE



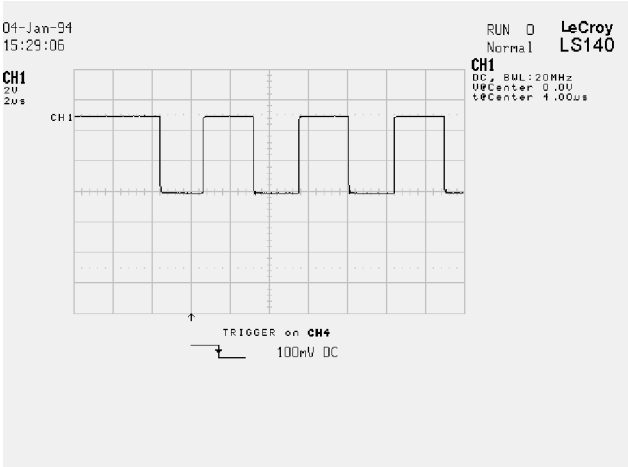
WF021 U15.3



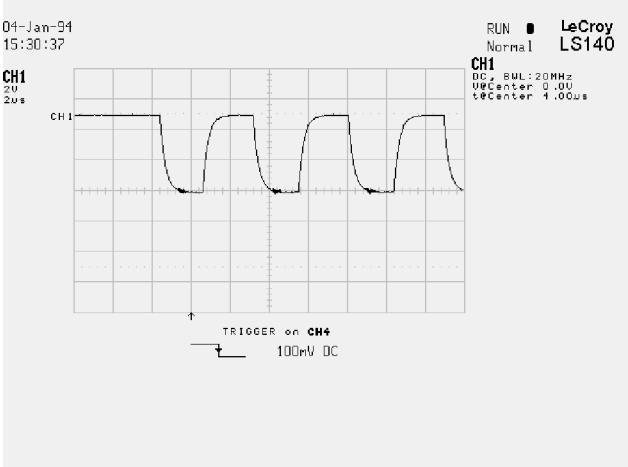
WF022 U1.1



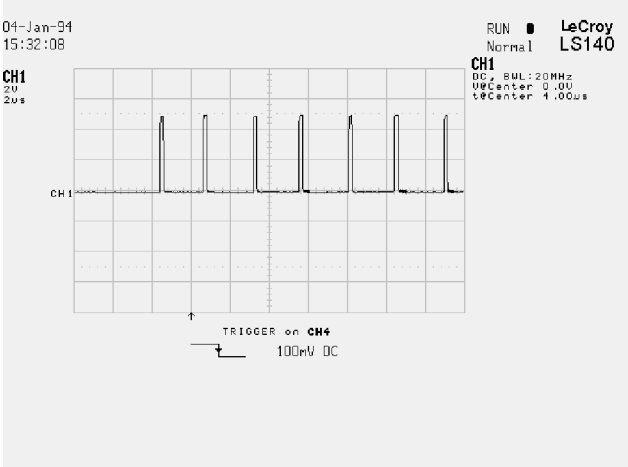
WF023 U1.4



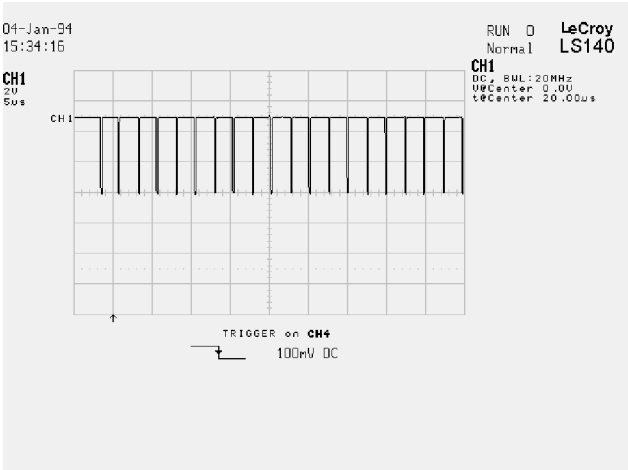
WF024 U1.6



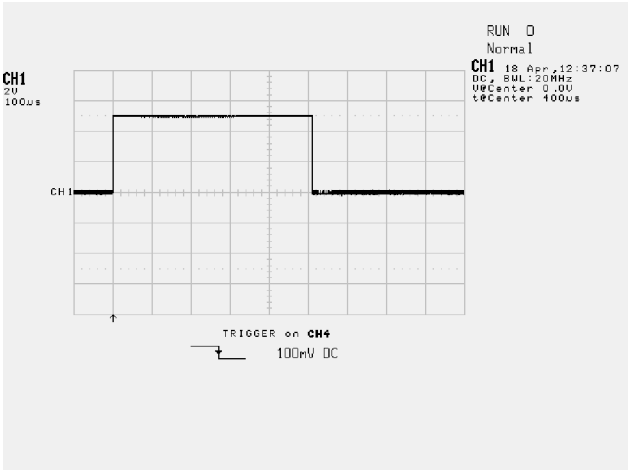
WF025 U1.10



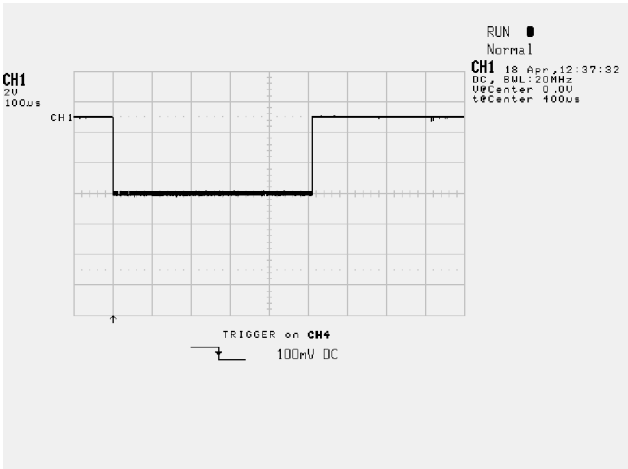
WFO26 U1.8



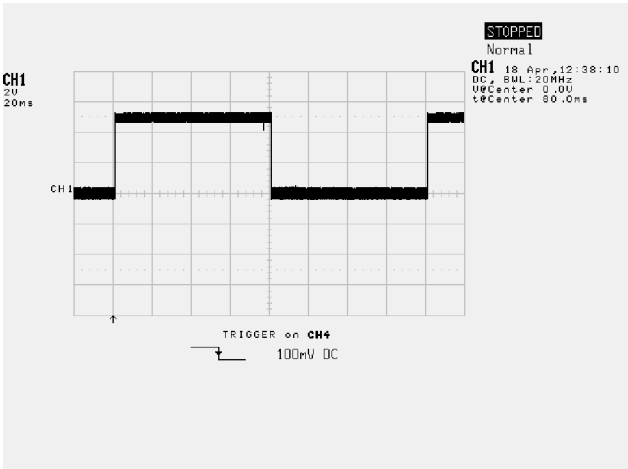
WF027 U1.11



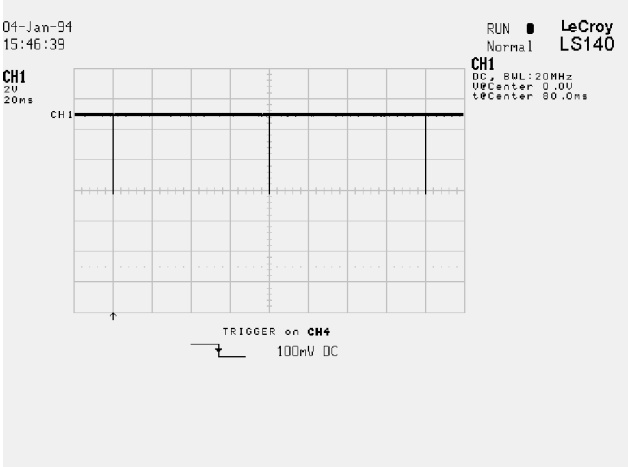
WFO28 U8.6



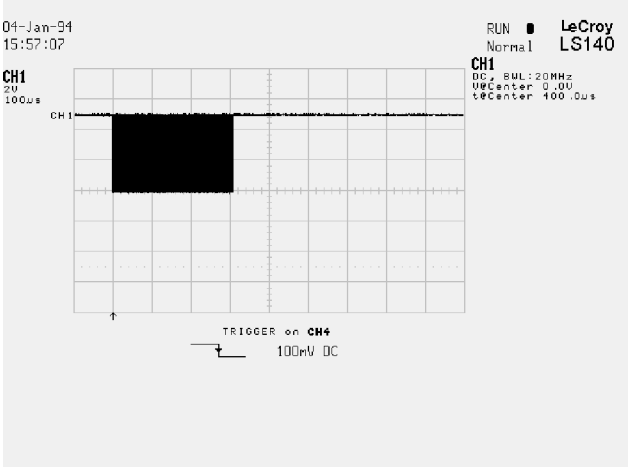
WFO29 U8.3



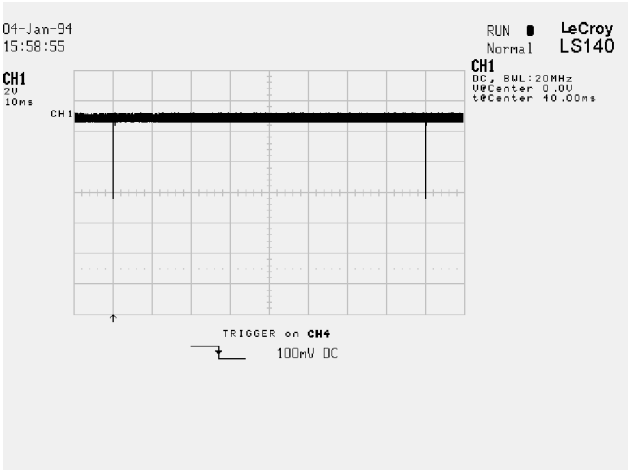
WF030 U9.4



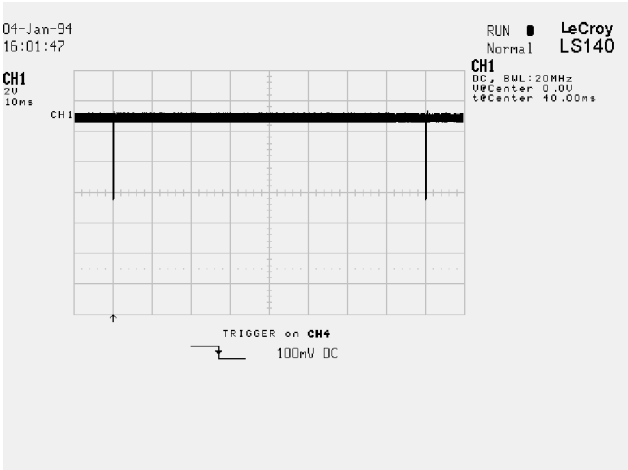
WFO31 U9.11



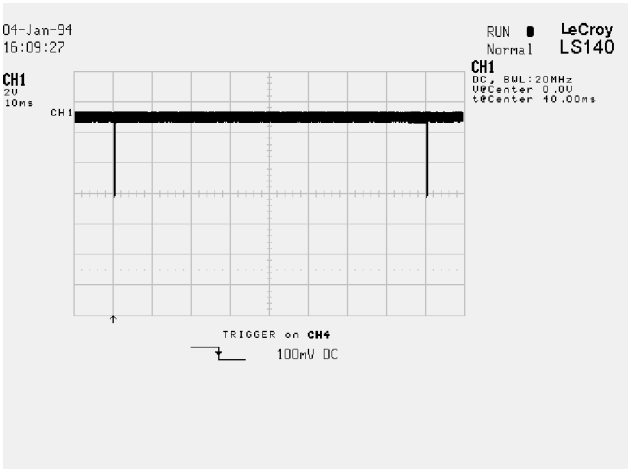
WF032 U4.9



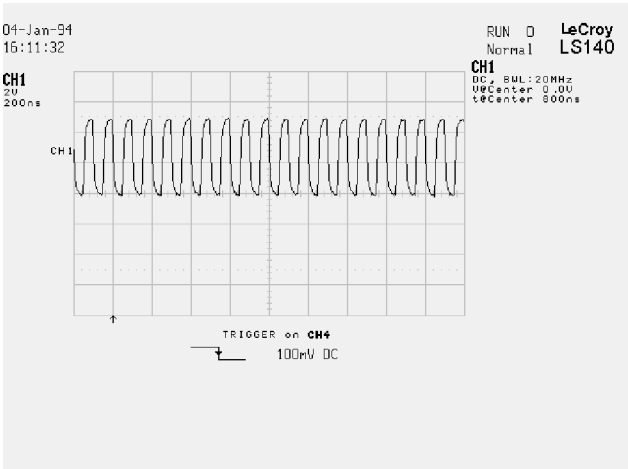
WF033 U4.10



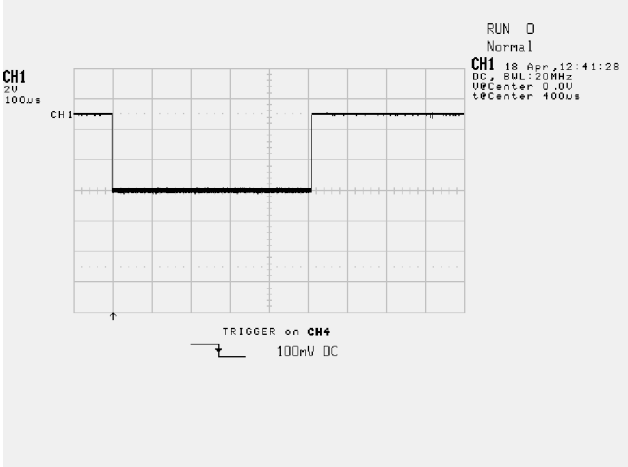
WF034 U4.13



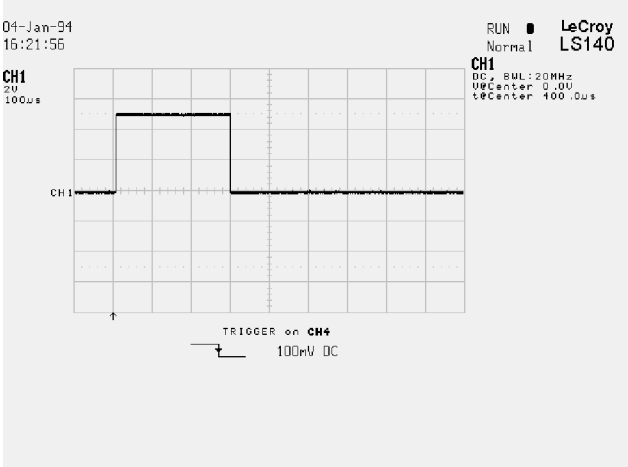
WF035 U4.21



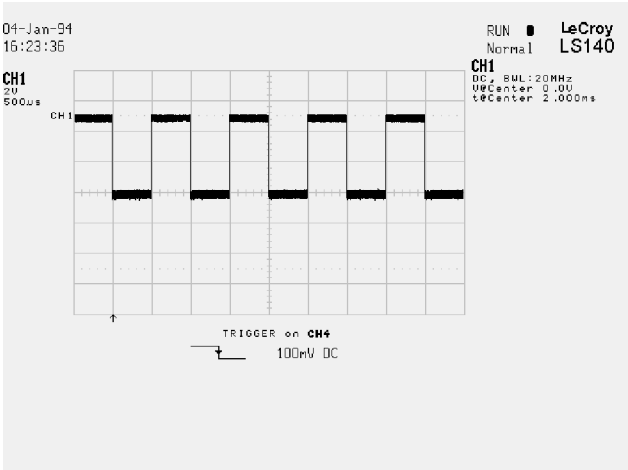
WFO36 U5.9



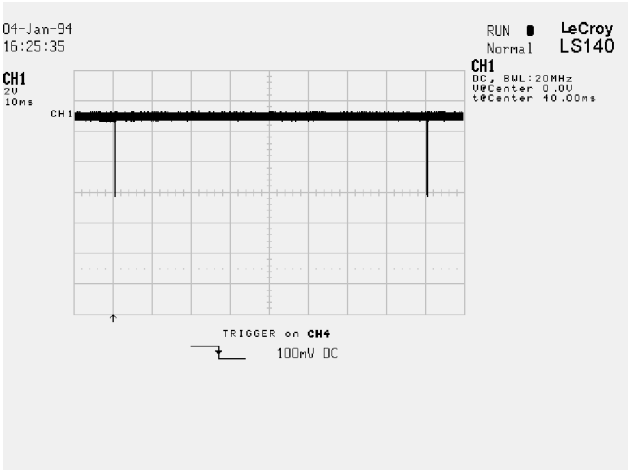
WF037 U5.10



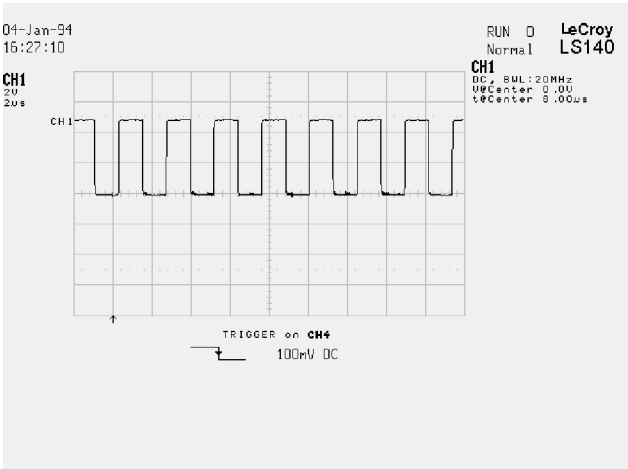
WF038 U5.14



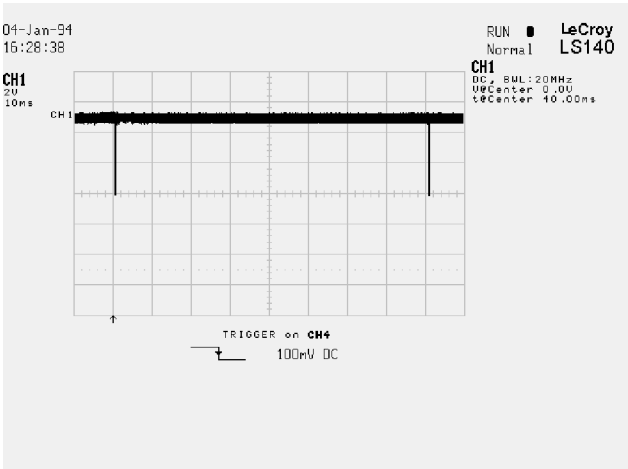
WF039 U5.18



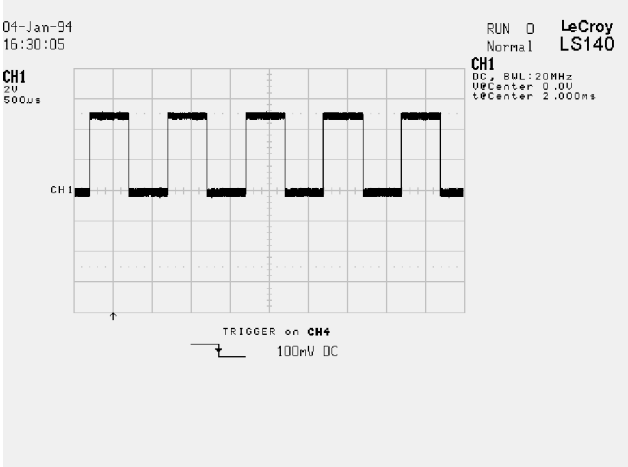
WF040 U5.21



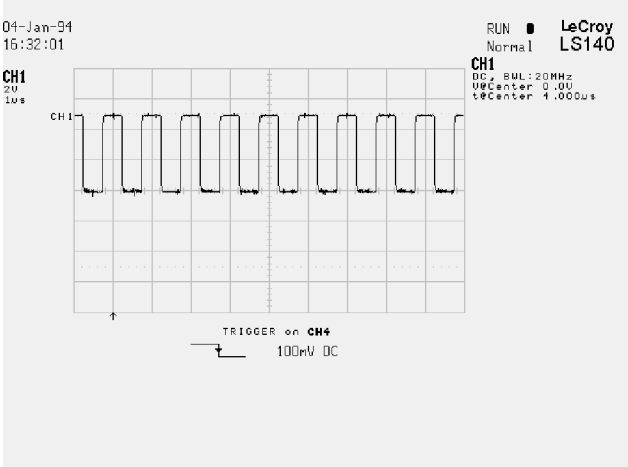
WFO41 U6.9



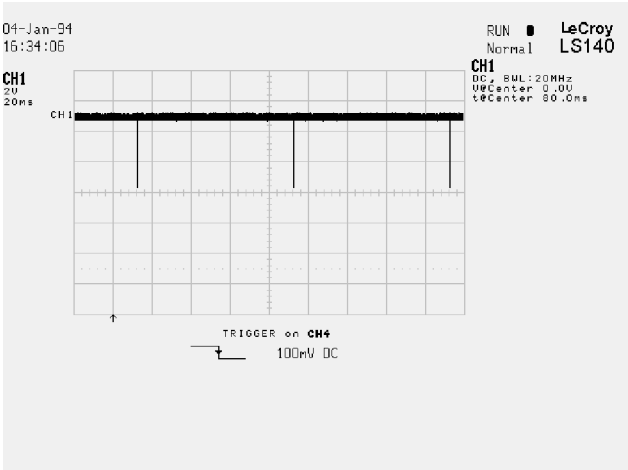
WFO42 U6.21



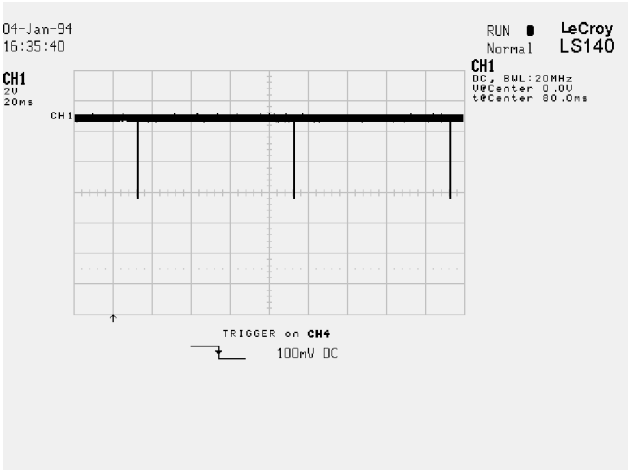
WF043 U6.10



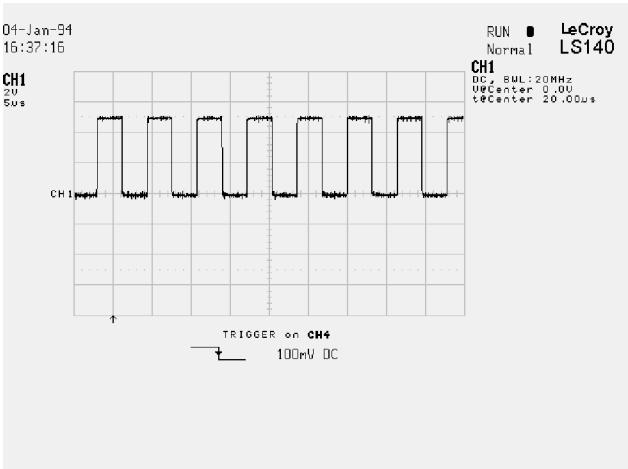
WF044 U6.15



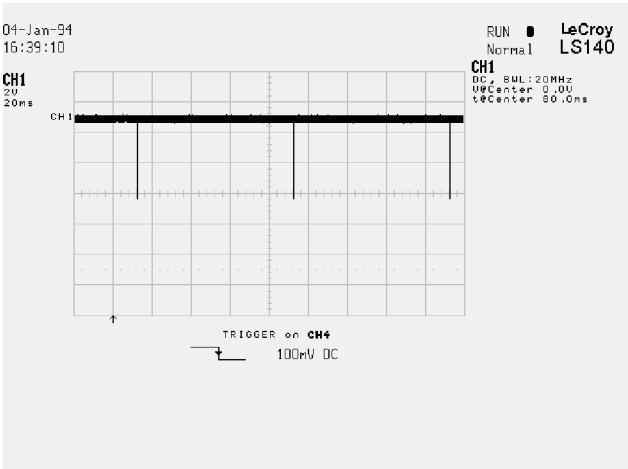
WF045 U6.14



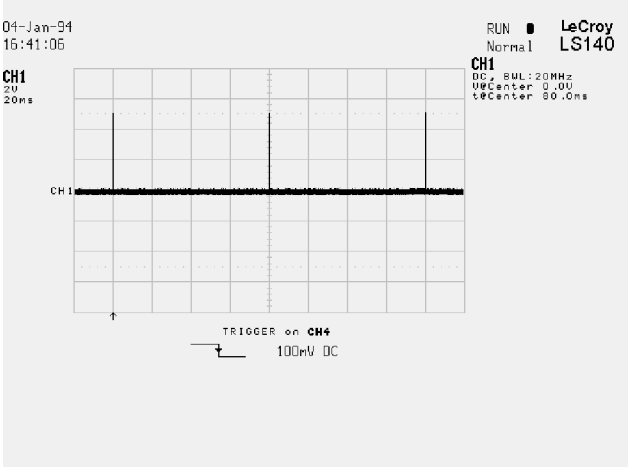
WF046 U6.13



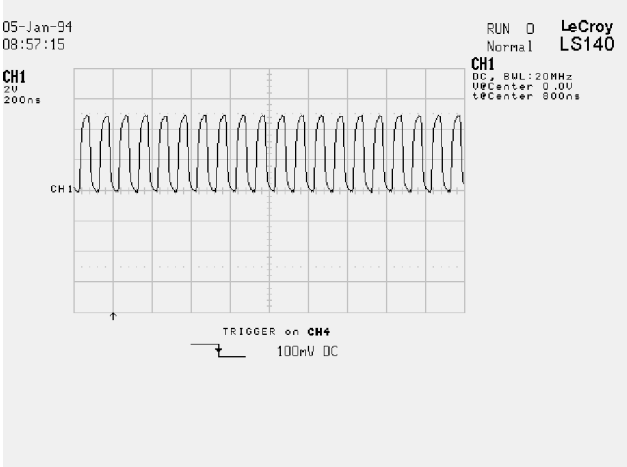
WF047 U6.18



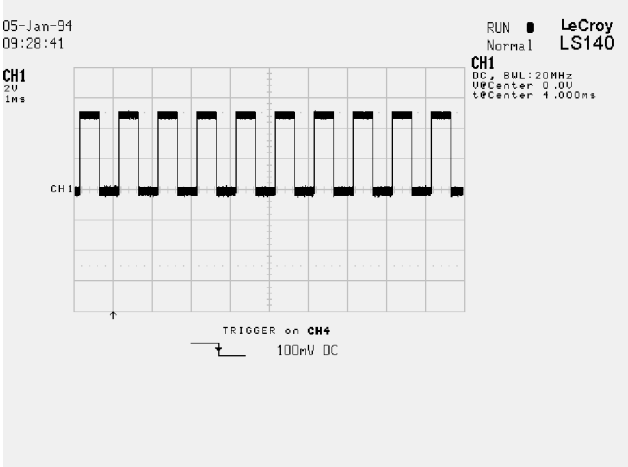
WF048 U6.17



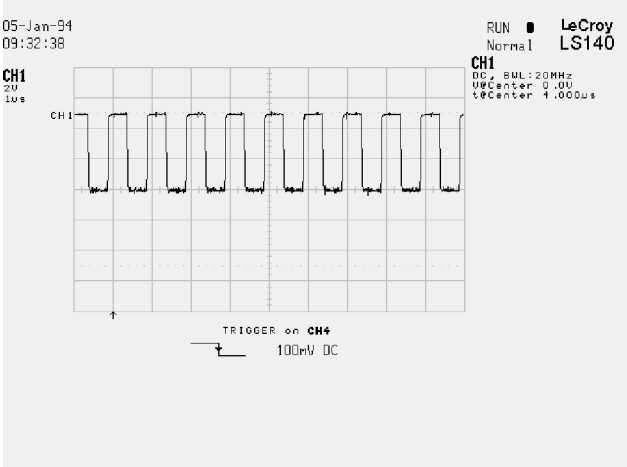
WF049 U6.16



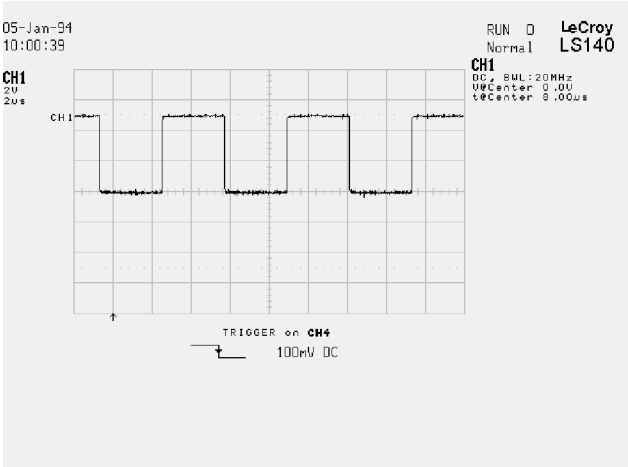
WF050 U7.9



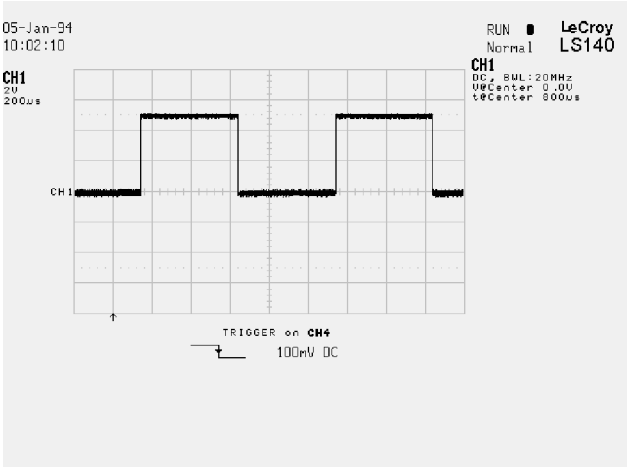
WF051 U7.10



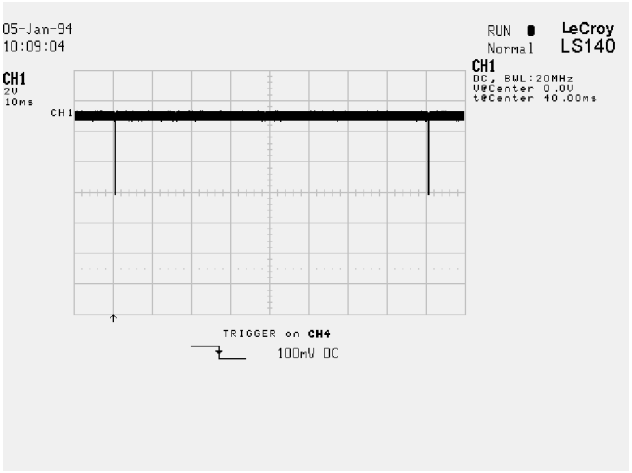
WF052 U7.13



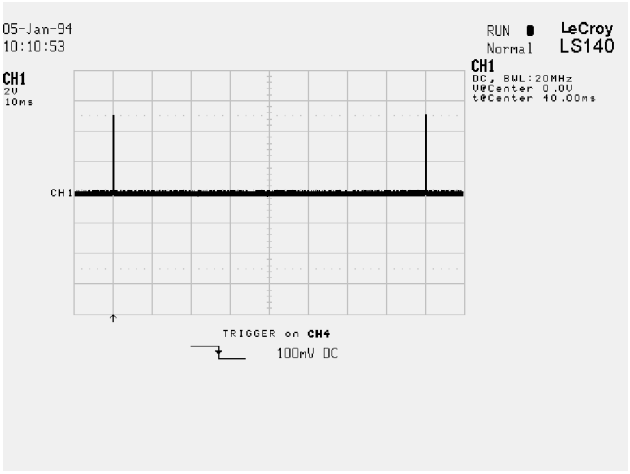
WF053 U7.17



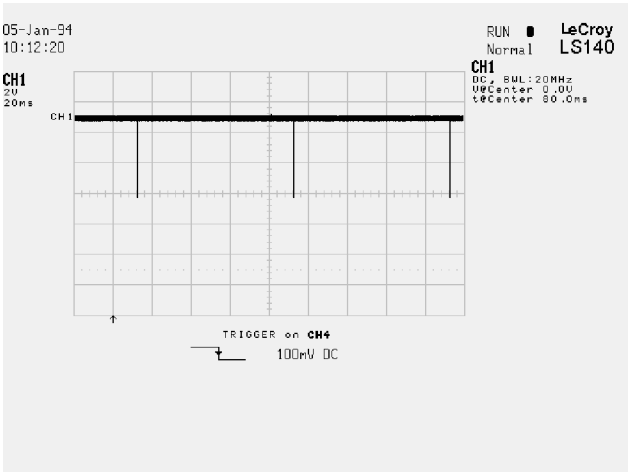
WF054 U11.10



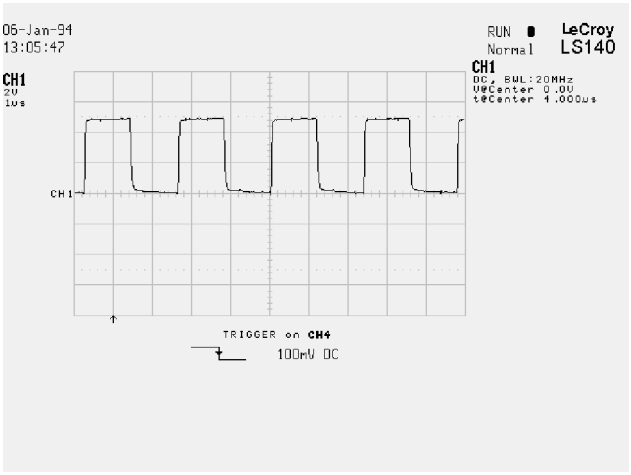
WF055 U11.21



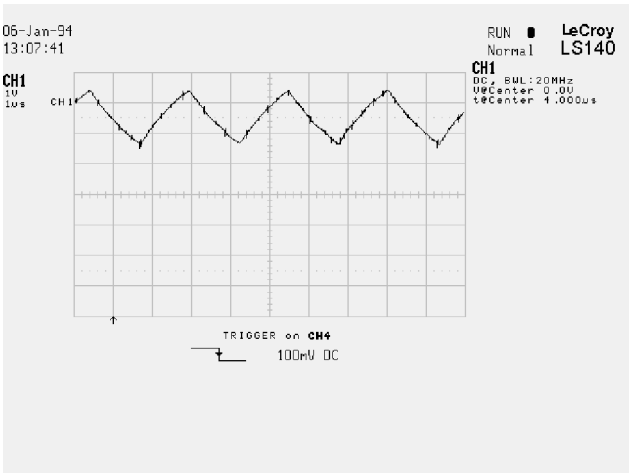
WF056 U11.16



WF057 U11.17 FISH ECHO MODE



WF058 U13.19



WF059 U13.4

9.0 DSTS FRONT PANEL PARTS LIST

DSTS4A PANEL PCB REV3. PCB# DSTS4A3PN-080896. Revised: April 18, 1996 Code Qty Ref Description Catalog number Vendor					
600-028	2	C101	220pF	P4104	DIGI-KEY
		C102	220pF	P4104	DIGI-KEY
602-009	8	C103	.1uF 100V 10%	C320C104K1R5CA	STERLING
		C105	.1uF 100V 10%	C320C104K1R5CA	STERLING
		C109	.1uF 100V 10%	C320C104K1R5CA	STERLING
		C114	.1uF 100V 10%	C320C104K1R5CA	STERLING
		C115	.1uF 100V 10%	C320C104K1R5CA	STERLING
		C116	.1uF 100V 10%	C320C104K1R5CA	STERLING
		C117	.1uF 100V 10%	C320C104K1R5CA	STERLING
		C118	.1uF 100V 10%	C320C104K1R5CA	STERLING
601-025	2	C108	47uF 10V	P5216	DIGI-KEY
		C121	47uF 10V	P5216	DIGI-KEY
601-022	1	C110	470uF 16V	P5234	DIGI-KEY
600-010	1	C111	470pF 3KV	539-HT471M	MOUSER
600-009	1	C112	1000pF 3KV	539-HT102M	MOUSER
600-011	1	C113	4700pF 3KV	539-HT472M	MOUSER
607-003	1	C120	.001	212-2112-102K	MOUSER
620-010	2	D102	1N5711/5082-2800	1N5711/5082-2800	PENSTOCK
		D101	1N5711/5082-2800	1N5711/5082-2800	PENSTOCK
620-003	2	D103	1N4148	1N4148	DIGI-KEY
		D104	1N4148	1N4148	DIGI-KEY
620-014	2	D109	6.8V	1N5235BCT-ND	DIGI-KEY
		D105	6.8V	1N5235BCT-ND	DIGI-KEY
659-011	1	D106	LED	HLMP-D101	ARROW
620-005	2	D107	1N5401	1N5401	DIGI-KEY
		D108	1N5401	1N5401	DIGI-KEY
620-009	1	D110	6.8V	1N4736A	DIGI-KEY
110-003	1	J101	DIP 14	A9314	DIGI-KEY
110-013	1	J102	DIP 16	A9316	DIGI-KEY
110-001	1	SO105	DIP 8	AE8908	DIGI-KEY
110-008	1	J103	DIP 24	A9324	DIGI-KEY

DSTS4A PANEL PCB REV3. PCB# DSTS4A3PN-080896. Revised: April 18, 1996 Code Qty Ref Description Catalog number Vendor					
524-013	1	P101	LCD DISP SOCKET	929975-01-36-ND	DIGI-KEY
620-006	1	Q1	2N3904	2N3904	DIGI-KEY
638-001	6	R101	33K 1/2W 1%	29MF500-33K	MOUSER
		R102	33K 1/2W 1%	29MF500-33K	MOUSER
		R103	33K 1/2W 1%	29MF500-33K	MOUSER
		R110	33K 1/2W 1%	29MF500-33K	MOUSER
		R111	33K 1/2W 1%	29MF500-33K	MOUSER
		R112	33K 1/2W 1%	29MF500-33K	MOUSER
638-003	1	R104	3K	29MF500-3K	MOUSER
632-083	1	R105	8.2M	29SJ250-8.2M	MOUSER
632-096	2	R106	300K	29SJ250-300K	MOUSER
632-056	1	R113	33K	29SJ250-33K	MOUSER
632-096		R149	300K	29SJ250-300K	MOUSER
632-014	1	R108	100	29SJ250-100	MOUSER
632-079	4	R109	1M	29SJ250-1M	MOUSER
		R114	1M	29SJ250-1M	MOUSER
		R138	1M	29SJ250-1M	MOUSER
		R142	1M	29SJ250-1M	MOUSER
632-097	1	R115	470	29SJ250-470	MOUSER
632-045	1	R117	10K	29SJ250-10K	MOUSER
632-039	1	R118	5.1K	29SJ250-5.1K	MOUSER
632-101	1	R119	430K	29SJ250-430K	MOUSER
632-067	1	R120	100K	29SJ250-100K	MOUSER
632-002	2	R121	1.0	29SJ250-1	MOUSER
		R122	1.0	29SJ250-1	MOUSER
632-004	1	R123	3	29SJ250-3	MOUSER
632-005	1	R124	5.1	29SJ250-5.1	MOUSER
631-012	1	R125	10	ME271-10	MOUSER
631-013	1	R126	30	ME271-30	MOUSER
631-014	1	R127	49.9	ME271-49.9	MOUSER
631-004	1	R128	100	ME271-100	MOUSER
631-020	1	R129	300	ME271-300	MOUSER

DSTS4A PANEL PCB REV3. PCB# DSTS4A3PN-080896. Revised: April 18, 1996 Code Qty Ref Description Catalog number Vendor					
631-015	1	R130	499	ME271-499	MOUSER
631-016	1	R131	1.0k	ME271-1K	MOUSER
631-017	1	R132	3.0k	ME271-3K	MOUSER
631-023	1	R133	21K	ME271-21K	MOUSER
637-001	1	R134	2.2K 3W	28PR002-2.2K	MOUSER
637-006	1	R135	560 5W	28PR004-560	MOUSER
637-003	1	R136	330 3W	28PR002-330	MOUSER
638-002	1	R137	30	29MF500-30	MOUSER
640-004	1	R139	5K	36C53	DIGI-KEY
631-024	1	R141	350	ME271-350	MOUSER
631-051	1	R143	53.6	ME271-53.6	MOUSER
640-019	1	R145	50K	36C54	DIGI-KEY
640-013	1	R146	1K	31VQ301	MOUSER
632-032	1	R147	2K	29SJ250-2K	MOUSER
		R148	100	NOT USED	
632-068	1	R150	120K	29SJ250-120K	MOUSER
510-019	1	SW1	LOAD SW	10WA136	MOUSER
510-018	1	SW2	12 POS	10WA134	MOUSER
510-016	4	SW3	SW SPDT	3TF106G	TOCOS
		SW4	SW SPDT	3TF106G	TOCOS
		SW5	SW SPDT	3TF106G	TOCOS
		SW6	SW SPDT	3TF106G	TOCOS
510-017	1	SW11	SW SPDT	3TF101D	TOCOS
100-051	1	U101	4049	74HC4049	DIGI-KEY
100-054	1	U103	LMC6484IN	LMC6484IN	AVNET
625-001	1	U104	LP2950	LP2950ACZ-5.0	HAMILTON
100-067	1	U105	LT1630CN8	LT1630CN8	DIGI-KEY
670-017-REV3	1	PCB	DSTS4A-3 FP PCB	DSTS4A-3 FP PCB	EDI
110-003	1	U103	DIP 14	A9314	DIGI-KEY
110-013	1	U101	DIP 16	A9316	DIGI-KEY
524-012	1	H101	DUAL 72 PIN HEADER	S2012-36-ND	DIGI-KEY

DSTS4A PANEL PCB REV3. PCB# DSTS4A3PN-080896. Revised: April 18, 1996 Code Qty Ref Description Catalog number Vendor					
679-007	1	JC1	14 PIN JUMPER CABLE	2X14ID1T-4"	AXIS
679-008	1	JC2	16 PIN JUMPER CABLE	2X16IDP1T-6"	AXIS
679-009	1	JC3	24 PIN JUMPER CABLE	2X24IDP1T-4"	AXIS
660-002	1	LCD101	LCD DISPLAY/OPTREX	OP224NB-ND	DIGI-KEY

END OF THE FRONT PANEL BOARD PARTS LIST.

9.1 DSTS MAIN BOARD PARTS LIST

DSTS4A MAIN PCB REV3. PCB# DSTS4A3PN-071196-03. Revised: April 17, 1997 Code Qty Ref Description Catalog number Vendor					
600-019	1	C1	220pF 50V DISC CAP	140-CD50S5-221J	MOUSER
601-001	2	C3	10uF 16V ELECT CAP	P807	DIGI-KEY
		C28	10uF 16V ELECT CAP	P807	DIGI-KEY
600-007	1	C4	100pF 50V DISC CAP	140-CD50S5-101J	MOUSER
601-003	2	C5	47uF 10V ELECT CAP	P6737	DIGI-KEY
		C11	47uF 10V ELECT CAP	P6737	DIGI-KEY
601-022	1	C6	470uF 16V ELECT CAP	P5234	DIGI-KEY
600-021	1	C8	150pF 50v DISC CAP	140-CD50S5-151J	MOUSER
601-026	1	C9	220uF 10V ELECT CAP	P1202	DIGI-KEY
601-023	1	C10	2200uF 25V HFS CAP	P1226	DIGI-KEY
602-009	20	C12	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C13	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C14	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C15	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C16	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C17	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C18	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C19	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C20	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING

DSTS4A MAIN PCB REV3. PCB# DSTS4A3PN-071196-03. Revised: April 17, 1997 Code Qty Ref Description Catalog number Vendor					
		C21	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C22	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C23	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C27	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C29	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C30	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C31	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C32	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C33	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C34	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
		C35	.1uF 50V MYLAR CAP	C320C104K1R5CA	STERLING
600-027	1	C24	680pF 100V DISC CAP	P4183	DIGI-KEY
600-017	2	C25	33pF 50V DISC CAP	140-CD50S2-033J	MOUSER
		C26	33pF 50V DISC CAP	140-CD50S2-033J	MOUSER
620-003	4	D1	1N4148 DIODE	1N4148	DIGI-KEY
		D2	IN4148 DIODE	IN4148	DIGI=KEY
		D8	IN4148 DIODE	IN4148	DIGI-KEY
		D9	IN4148 DIODE	IN4148	DIGI-KEY
620-001	2	D4	1N4001 1 AMP 50 PIV	IN4001	DIGI-KEY
		D5	IN4001 1 AMP 50 PIV	IN4001	DIGI-KEY
620-004	1	D7	1N4747A DIODE	IN4747A	DIGI-KEY
110-003	1	J1	14 PIN DIP SOCKET TIN	A9314-ND	DIGI=KEY
110-008	1	J2	24 PIN DIP SOCKET TIN	A9324-ND	DIGI-KEY
110-013	1	J3	16 PIN DIP SOCKET TIN	A9316-ND	DIGI-KEY
NOTUSED	2	J4	2 PIN SIP\2P\P	NOT USED	
		J5	2 PIN SIP\2P\P	NOT USED	
521-008	1	J6	POWER JACK	16PJ093	MOUSER
521-009	1	J7	TELEPHONE JACK	TM2REA-0606	SCHUSTER
NOTUSED	2	J8	CON2 SIP\2P	NOT USED	
632-028	1	R1	1K	29SJ250-1K	MOUSER

DSTS4A MAIN PCB REV3. PCB# DSTS4A3PN-071196-03. Revised: April 17, 1997 Code Qty Ref Description Catalog number Vendor					
NOTUSED	1	R2	USE JUMPER WIRE AS ON MAIN BOARD LAYOUT	NOT USED	
632-035	1	R3	3K	29SJ250-3K	MOUSER
632-018	1	R4	220	20SJ259-220	MOUSER
632-061	1	R5	56K	29SJ250-56K	MOUSER
632-036	2	R7	3.3K	29SJ250-3.3K	MOUSER
		R15	3.3K	29SJ250-3.3K	MOUSER
632-045	2	R9	10K	29SJ250-10K	MOUSER
		R8	10K	29SJ250-10K	MOUSER
632-021	1	R6	330	29SJ250-330	MOUSER
629-001	2	RN10	100K DIP 16 RN	761-3-R100K	DIGI-KEY
		RN11	100K DIP 16 RN	761-3-R100K	DIGI-KEY
632-038	1	R13	4.7K	29SJ250-4.7K	MOUSER
628-001	1	R14	100 2W 5% RESISTOR	ME262-100	MOUSER
629-003	2	RN16	10K DIP 16 RN	761-3-R10K	DIGI-KEY
		RN12	10K DIP 16 RN	761-3-R10K	DIGI-KEY
632-052	1	R17	22K	29SJ250-22K	MOUSER
100-060	1	U1	CD74HC86 IC	CD74HC86	HAMILTON
100-051	1	U2	74HC4049 IC	74HC4049	DIGI-KEY
100-041	1	U3	P8255A/USE 40 PIN SOCKET A9340-ND 110-007	P8255A	ADC
100-055	5	U4	MSM82C54-2RS IC	MSM82C54-2RS	STERLING
		U5	MSM82C54-2RS IC	MSM82C54-2RS	STERLING
		U6	MSM82C54-2RS IC	MSM82C54-2RS	STERLING
		U7	MSM82C54-2RS IC	MSM82C54-2RS	STERLING
		U11	MSM82C54-2RS IC	MSM82C54-2RS	STERLING
100-027	2	U8	SN74HC74N DIP 14 IC	SN74HC74N	DIGI-KEY
		U9	SN74HC74N DIP 14 IS	SN74HC74N	DIGI-KEY
100-056	1	U10	74HC4046 DIP 16 IC	74HC4046	DIGI-KEY
610-005	1	U12	UA78LO5ACLP	UA78L05ALP	ARROW
100-061	1	U13	ADC0804LCN/DIP 20 IC USE 20 PIN SOCKET A9320-ND 110-014	ADC0804LCN	BELL

DSTS4A MAIN PCB REV3. PCB# DSTS4A3PN-071196-03. Revised: April 17, 1997 Code Qty Ref Description Catalog number Vendor					
100-003	1	U14	LM7805/LM340T-5	LM7805	DIGI-KEY
100-062	1	U15	P80C32/DIP 40 USE 40 PIN SOCKET A9340-ND 110-007	P80C32	WYLE LAB
100-064	1	U16	USED WITH RS-232 OPTION MAX233CPP DIP 20	MAX233CPP	AXIS
100-029	1	U17	74HC138N DIP 16 IC	74HC138N	DIGI-KEY
OPTION	1	U19	62128 RAM OPTION USE A9328-ND 28 PIN SOCKET 110-006		DIGI-KEY
100-057	1	U20	74HC373 DIP 20 IC	74HC373	DIGI-KEY
100-070	1	U21	TMS27C56-12JL IC USE 28 PIN SOCKET A9328-ND 110-006	TMS27C256-12JL	ARROW
100-059	1	U22	MM74HC00N DIP 14 IC	MM74HC00N	DIGI-KEY
655-003	1	Y1	X114/10MHZ DIP 14 CRYSTAL	X114	DIGI-KEY
650-008	1	Y2	CTX078/11.0592MHZ XTAL HC49/U	CTX078	DIGI-KEY
670-018-REV3	1	PCB	DSTS-4A-3 MAIN PCB	DSTS-4A-3	EDI
651-001	1	CM1	470-035 CRYSTAL MOUNT BIVAR	470-035	PETRICKO
700-006	1	MAN	DSTS-4A-3 OPERATORS MANUAL	DSTS-4A-3 OPERATORS MAN	EDI
110-003	6	J1	DIP 14	A9314	DIGI-KEY
		Y1	DIP 14	A9314	DIGI-KEY
		U1	DIP 14	A9314	DIGI-KEY
		U8	DIP 14	A9314	DIGI-KEY
		U9	DIP 14	A9314	DIGI-KEY
		U22	DIP 14	A9314	DIGI-KEY
110-013	6	J3	DIP 16	A9316	DIGI-KEY
		RN10	DIP 16	A9316	DIGI-KEY
		RN11	DIP 16	A9316	DIGI-KEY
		U2	DIP 16	A9316	DIGI-KEY
		U10	DIP 16	A9316	DIGI-KEY
		U17	DIP 16	A9316	DIGI-KEY

DSTS4A MAIN PCB REV3. PCB# DSTS4A3PN-071196-03. Revised: April 17, 1997 Code Qty Ref Description Catalog number Vendor					
110-014	3	U13	DIP 20	A9320	DIGI-KEY
		U16	DIP 20	A9320	DIGI-KEY
		U20	DIP 20	A9320	DIGI-KEY
110-006	2	U19	DIP 28	A9328	DIGI-KEY
		U21	DIP 28	A9328	DIGI-KEY
110-008	6	J2	DIP 24	A9324	DIGI-KEY
		U4	DIP 24	A9324	DIGI-KEY
		U5	DIP 24	A9324	DIGI-KEY
		U6	DIP 24	A9324	DIGI-KEY
		U7	DIP 24	A9324	DIGI-KEY
		U11	DIP 24	A9324	DIGI-KEY
110-007	2	U3	DIP 40	A9340	DIGI-KEY
		U15	DIP 40	A9340	DIGI-KEY

END OF THE MAIN BOARD PARTS LIST.

9.2 DSTS CHASIS PART LIST

DSTS4A-3 CHASIS PART LIST. RIVISED: APRIL 18, 1997 Code Qty Ref Description Catalog number Vendor					
522-015	1	BP1	CONN. RED	J151-ND	DIGI-KEY
522-016	1	BP2	CONN. BLUE	J155-ND	DIGI-KEY
522-002	2	J104	BNC CONN.	10-2000	PROFESS
		J107	BNC CONN.	10-2000	PROFESS
530-005	3	KN1	KNOB	ME450-2036	MOUSER
		KN2	KNOB	ME450-2036	MOUSER
		KN3	KNOB	ME450-2036	MOUSER
500-015	1	FP1	4A-3 FRONT PANEL	4A-3 FRONT PANEL	SERVICE METALS
500-016	1	RP1	4A-3 REAR PANEL	4A-3 REAR PANEL	SERVICE METALS
505-004	1	CASE	DSTS-4A-3 CASE	DSTS-4A-3 CASE	GLOBAL SPECIALITY
537-001	1	PW1	4A CLEAR PLASTIC WIN	4A CLEAR PLASTIC WIN	EDI

DSTS4A-3 CHASIS PART LIST. RIVISED: APRIL 18, 1997 Code Qty Ref Description Catalog number Vendor					
540-001	1	FH1	FUSEHOLDER	44FH-112	MOUSER
542-001	1	F101	1 AMP FUSE 3AG	44FP-049	MOUSER
532-005	2	HW2	3/8" IN'T LOCKWASHER	3/8" IN'T LOCKWASHER	EDI
		HW2	3/8" IN'T LOCKWASHER	3/8" IN'T LOCKWASHER	EDI
200-001	1	HW3	POWER TRANSFORMER	T506-ND	DIGI-KEY
531-006	2	HW4	#10 MM HEX NUT	48AN010	MOUSER
			#10 MM HEX NUT	48AN010	MOUSER
522-003	1	HW5	BNC GRD LUG	50N454	NEWARK
531-004	1	HW6	4-40 HEX NUT	H216-ND	DIGI-KEY
532-003	1	HW7	#4 INT. TOOTH L/W	H236-ND	DIGI-KEY
535-003	1	HW8	4-40 X 1/4 MS	H142	DIGI-KEY
535-006	5	HW9	6-32 X 1/4 P/HD/MS	H154	DIGI-KEY
		HW9	6-32 X 1/4 P/HD/MS	H154	DIGI-KEY
		HW9	6-32 X 1/4 P/HD/MS	H154	DIGI-KEY
		HW9	6-32 X 1/4 P/HD/MS	H154	DIGI-KEY
		HW9	6-32 X 1/4 P/HD/MS	H154	DIGI-KEY
538-001	1	HW10	WHT LUSTRE CAP 3/8 ID	LC9375-2/WHT	ACCUARTE
538-002	1	HW11	BLK LUSTRE CAP 3/8 ID	LC9375-1/BLK	ACCURATE
505-004-TC	1	TOP CASE	TOP CASE HALF	TOP CASE HALF	EDI
505-004-BC	1	BOTTOM CASE	BOTTOM CASE HALF	BOTTOM CASE HALF	EDI
505-004-SR	2	SIDE RAILS	SIDE RAILS/EXTENDERS	SIDE RAILS/EXTENDERS	EDI
		SIDE RAILS	SIDE RAILS/EXTENDERS	SIDE RAILS/EXTENDERS	EDI
505-004-RFT	4	RUBBER FEET	RUBBER FEET	RUBBER FEET	EDI
505-004-STOF	8	STAND OFFS	STANDOFFS (1 1/4")	STANDOFFS (1 1/4")	EDI
505-004-CS	4	CASE SCREWS	CASE SCREWS	CASE SCREWS	EDI
505-004-TB	1	TILT BAIL	TILT BAIL	TILT BAIL	EDI

DSTS4A-3 CHASIS PART LIST. RIVISED: APRIL 18, 1997 Code Qty Ref Description Catalog number Vendor					
505-004PF	4	PLASTIC FEET	PLASTIC FEET	PLASTIC FEET	EDI
505-004-T	4	THREADED INSERT	THREADED INSERT	THREADED INSERT	EDI
505-005-PW	4	PLASTIC WASHER	PLASTIC WASHER	PLASTIC WASHER	EDI

END OF THE CHASSIS PARTS LIST.

9.3 VENDOR ADDRESS/PHONE NUMBERS

1- DIGI-KEY CORP. 800-344-4539
701 Brooks Ave. South
Thief River Falls, MN. 56701-0677

2- MOUSER ELECTRONICS 800-346-6873
P.O. Box 714
Mansfield, TX. 76068

3- ARROW ELECTRONICS 800-932-7769
1860 Smithtown Ave.
Ronkonkoma, NY. 11779

4- BELL INDUSTRIES-MRY 800-274-6953
Edd-Maryland
P.0. Box 13418
Newark, NJ. 07188-0418

5- AXIS ELECTRONICS, INC. 800-368-2815
22 Cessna Court
Gathersburg, MD. 20879

6- PENSTOCK 408-730-0300
P.O. Box 100181
Pasadena, CA. 91189-0181

7- HAMILTON/HALLMARK 800-332-8638
10240 Old Columbia Rd.
Columbia, MD. 21046

WARNING. Do not install the battery pack fuse until after all wiring has been completed and checked.

8-	TOCOS AMERICA, INC. 1177 E. Tower Road Schaumburg, IL. 60173	708-884-6664
9-	SCHUSTER ELECTRONICS, INC. DEPT. L-1005 Columbus, OH. 43260	800-877-6875
10-	Sterling Electronics 711 Moorefield Park Dr. Richmond, VA. 23236	804-226-2190
11-	PETRICKO SALES, INC. 12211 Distribution Place Beltsville, MD. 20705	800-333-5292
12-	EDI. Electronic Devices Inc POB 15037, Chesapeake, VA 23328	804-421-2968

END OF THE VENDORS LIST

10.0 ACCESSORIES

The accessories currently available for the DSTS include an internal, rechargeable battery pack, and a RS-232 interface. Refer to section 3 for information on how to dissassemble the DSTS.

10.1 INTERNAL RECHARGEABLE BATTERY PACK.

The internal battery pack mounts in the rear portion of the top case-half. It is fastened in place with seven 6-32 by 3/8" pan head screws. The battery pack is oriented so the batteries are placed next to the cover, and the fuse is accessible from the bottom of the PCB. When installing the battery pack, do not over tighten the mounting screws. Tighten them just enough to hold the batteries against the cover, but not so much that the PCB is badly warped. The 24" long twisted pair of wires from the battery pack PCB connect to the main PCB. The connection point is J4, located on the rear edge of the main PCB next to the external power connector, J6. The positive (red wire) connects to the pad nearest the power jack, J6. The negative (black wire) connects to the pad nearest the marking "J4". When the battery pack is wired correctly to the main board, install the 3AG one-ampere fuse. The batteries will recharge in about 20 -30 hours, and a fully charged battery pack will provide over three hours of continuous operation.

10.1.1 BATTERY PACK PARTS LIST

QTY	REFERENCE	EDI P/N	DESCRIPTION

1	BATT PCB	670-014	BATT PACK PCB
1	F201	542-002	1 AMP 3AG FUSE
8	BA201	300-001	.6AH AA NICAD BATT
7	HW201	535-007	6-32 by 3/8" PHMS
2	FC201	541-001	FUSE CLIP

10.2 RS-232 OPTION.

Installation of the RS-232 option involves changing the EPROM, U21, and the installation of an IC in the socket, U16. Remove the top of the DSTS as described in section 3. Remove the EPROM from socket U21 and replace it with the supplied RS-232 EPROM. Instert the MAX233 chip in socket U10. Replace the cover and connect it to the power supply. The data connection to the computer is made through the supplied cable and adapter. To test the RS-232 option, connect the DSTS to a terminal. Consult the software manual included with the RS-232 option for details on operating the DSTS via a terminal program. A suitable cable is included with the RS-232 option kit. The next section covers the cable wiring.

10.2.1 RS-232 CABLE WIRING

The RS-232 package includes a 6-conductor cable with R-J6 telephone modular connectors on each end. A DB-9 adapter is furnished to connect this cable to the serial port of your computer or terminal. See figure 1 on the next page for wiring details if the cable is damaged or lost.

10.2.3 RS-232 OPTION PARTS LIST

QTY	REFERENCE	EDI P/N	DESCRIPTION
1	U21	100-008/P	EPROM WITH RS-232 SOFTWARE. EDI
1	U16	100-064	MAX233CPP DRIVER CHIP HAMILTON/HALLMARK
1	CA201	678-010	6 FT RJ-6 INTERCONNECT CABLE. EDI
1	AD201	521-010	RJ6 FEMALE TO DB-9 FEMALE ADAPTER. 046-0003-ND DIGIKEY
1	RS-232 MANUAL	RS-232/MAN	OPERATORS AND PROGRAMMERS MANUAL FOR RS-232 INTERFACE.

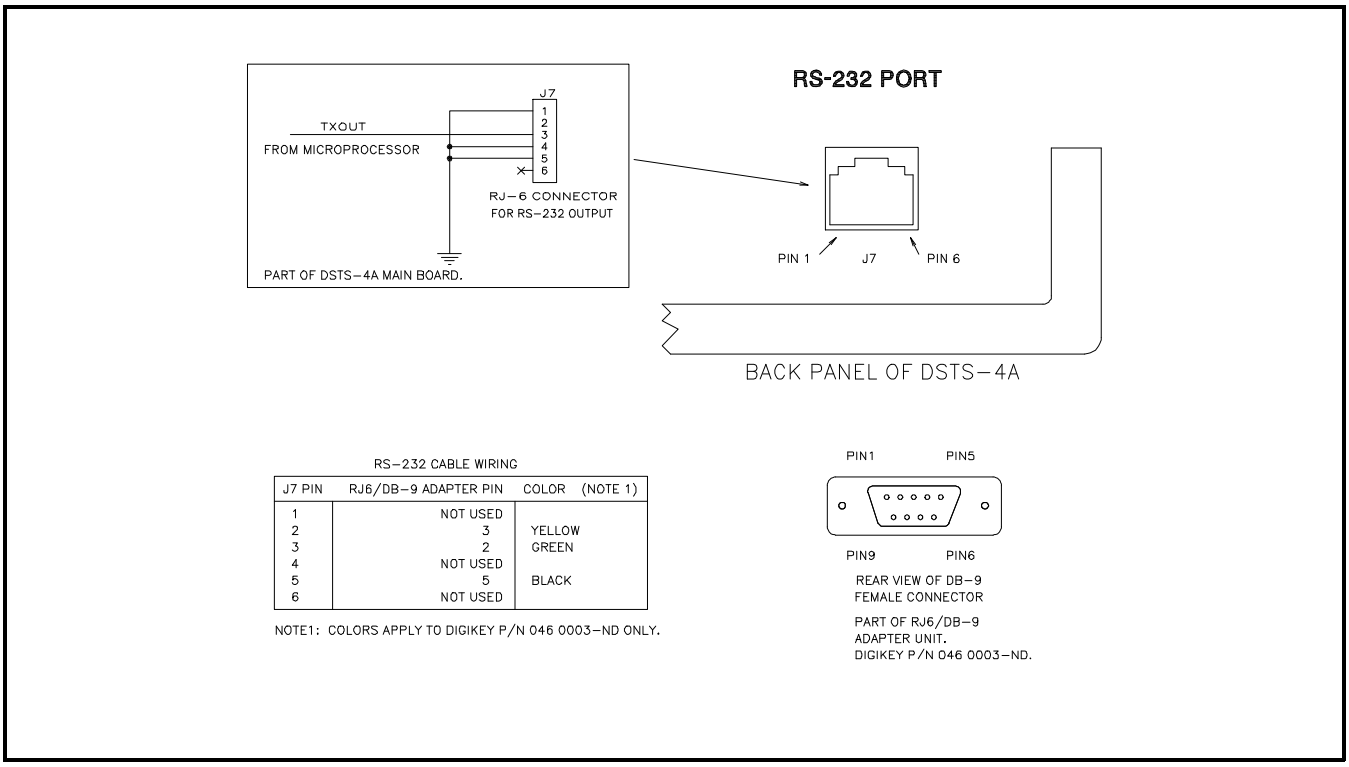


Figure 1 RS-232 connector wiring.

11.0 SPECIFICATIONS OF THE DSTS-4A REV3 DEPTH SOUNDER TEST SET

Parameter	**Range**	**Resolution**	**Accuracy**
Input frequency	3 to 650 Khz	100 Hz	±.02% ±100 Hz[1]
Input width	50 to 20,000 uS[2]	1 uS	±.02% ±2 cycles
Input period	10 to 9999 mS	1 mS	±.02% ±100 uS
Input amplitude	50 to 2500 Vp-p	10 Vp-p	±5% ±10 Vp-p
Min input level[3]	35 Vp-p at 50KHz	N/A	N/A
Output frequency	3 to 650 KHz	100 Hz	±.02%
Output width	10 to 20,000 uS	100 uSec	±.02%
Output depth	1 to 999.9 ft/mt	.1 unit	±.02%
Output level	10 to 350,000 uV	VERNIER	±1.5 dB
Power requirements:	6-15 VAC or 8-18 VDC @ 200 mA maximum.		
Size and Weight:	10" W by 7"D by 4.5"H. Shipping Wt. 6 Lbs.		

[1] For pulse widths > 99 uS. Typically ± 200 Hz at 50 uS width.

[2] The input pulse must contain 6 or more cycles.

[3] Increases with frequency. Approximately 100 V p-p at 500KHz.