NBSIR 73-236 (R)

Field Service Test Model: Computer-Controlled U System. Manual for Test Unit.

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and Technology

July 11, 1973

Instruction Manual

Prepared for

Department of the Air Force
HQ USAF (AFTAC/TAP)
Patrick A.F.B., Florida 32925

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U. S. DEPARTMENT OF COMMERCE, Frederick B. Dent, Secretary
NATIONAL BUREAU OF STANDARDS, Richard W. Roberts, Director

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ILLUSTRATIONS

FIELD SERVICE TEST MODEL: COMPUTER-CONTROLLED U SYSTEM MANUAL FOR TEST UNIT

by
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1. INTRODUCTION

The Field Service Test Model uses a computer to control the operation of from 1 to 15 EECO 881 receivers for unattended operation. Each receiver is connected to the computer by an ADACS Interface Chassis, which provides the necessary decoding and conversion for communications between the receiver and the computer.

The Test Unit is a self-contained device to test the operation of the receiver and the ADACS Interface Chassis.

When testing the receiver, the Test Unit is connected directly to the receiver in place of the ADACS chassis. It performs the functions of both the ADACS chassis and the computer (see figures 1 and 2).

When testing the ADACS chassis, the Test Unit is connected to the ADACS chassis in place of the computer, where it performs the functions of the computer (see figures 3 and 4).

It is assumed that the reader is thoroughly familiar with the operation of the receiver and with the contents of the Manual for Receiver and ADACS Interface Chassis.

2. EQUIPMENT NEEDED WITH TEST UNIT

Receiver and ADACS Interface Chassis being tested.
U Similator (generates VLF radio signal with variable amplitude and frequency).
Oscilloscope to observe 3-microsecond, 5-volt pulse.

3. TEST UNIT OPERATION WITH RECEIVER ONLY

This section of the manual contains a general description of the operation of the Test Unit when it is used to test just the receiver. The details of these tests are given in section 5 of this manual.

The receiver is tested with the Test Unit connected as shown in figure 1. The Test Unit performs the functions of both the computer and the ADACS Interface Chassis. For this reason, the ADACS Gain-Tracking-Phase card and Blanking & INE card are included in the Test

Unit, so that they may perform the functions that would normally be performed by their counterparts in the ADACS chassis.

Figure 2 shows an overview of the operation of the Test Unit when used to test just the receiver. Figures 5 through 10 show the detailed logic of the Test Unit. The circuitry on the cards is shown in figures 12 through 16, and the integrated circuits used on the cards are shown in figures 17 through 22. The front and back panels of the Test Unit are shown in figures 24 and 26.

3.1 RF GAIN

The RF Gain controls in the receiver are tested by setting the RF Gain switches on the Test Unit front panel (figure 24) to a particular value and determining what signal amplitude from the U Simulator is necessary for the Amplitude (AGC) level from the receiver to indicate a particular value (0 dB) on the DVM (digital voltmeter).

The RF Gain switches (figure 8) are used both to drive the LED's (light emitting diodes) that are above the switches and as inputs to the Gain-Tracking-Phase card (figures 9 and 13). (The switch outputs to connector J2 are not used in this configuration.) The Gain-Tracking-Phase card decodes the binary switch settings into signals to activate the proper relays in the receiver (see figure 11 for a chart of the decoding). The decoded relay signals are sent to the receiver via connector J1.

The Amplitude level from the receiver is connected to the DVM by the Function switch (figure 5).

3.2 PHASE

The phase shift controls are tested by observing the Phase Difference level from the receiver on the DVM in response to phase shift commands by the Test Unit.

The phase is shifted in the receiver when it gets a Phase Pulse from the Test Unit. To generate a Phase Pulse, the Phase bit switch on the front panel of the Test Unit (figure 8) is set to the on position. This will cause the LED above the switch to go on and will enable the one shot on the Gain-Tracking-Phase card (figure 9). Then the operator presses the Phase Change pushbutton (figure 5), which causes the one shot on the LED Driver card (figure 6) to send a Phase Change Pulse to the Gain-Tracking-Phase card. The Gain-Tracking-Phase card uses the two inputs to generate the Phase Pulse to send via connector J1 to the receiver.

The Phase Difference level from the receiver is connected by the Function switch (figure 5) to the DVM, permitting the operator to see its value.

3.3 TRACKING RATE

The tracking rate controls in the receiver are tested using the Tracking Rate switches on the Test Unit front panel to select a particular tracking rate and observing the time required for the receiver Phase Difference level to respond by a given amount to a phase shift.

The Tracking Rate switches (figure 8) are set to a tracking rate. This tracking rate is indicated in the LED's above the switches and is sent to the Gain-Tracking-Phase card (figure 9). The Gain-Tracking-Phase card decodes the binary switch settings into signals to activate the proper relays in the receiver (see figure 11 for a chart of the decoding). The decoded signals are sent to the receiver via connector J1.

The Phase Difference level from the receiver is connected by the Function switch (figure 5) to the DVM.

3.4 BLANKING LEVEL

The blanking level controls in the receiver are tested by setting the Blanking Level switches on the front panel of the Test Unit to particular values and observing the resulting Percent Blanking on the DVM.

The Blanking Level switches (figure 8) are used both to drive the LED's that are above the switches and as inputs to the Blanking & INE card (figure 10). The Blanking & INE card converts the binary switch settings into an analog voltage level that is sent to the receiver via connector J8. It may also be observed on the DVM by setting the Function switch to the Blanking Level position. The conversion from digital-to-analog also involves the use of a non-linear network for more precise definition of small levels (see figure 15 for the card circuitry).

The Blanking Pulses from the receiver enter the Test Unit via J6. The Blanking Pulses are brought to a front panel connector where they may be viewed on an oscilloscope and to the Blanking & INE card. The Blanking & INE card contains circuitry that converts the Blanking Pulses into an analog level, called Percent Blanking, which is connected via the Function switch to the DVM.

3.5 FREQUENCY AND CARDIOID

The frequency bits from the receiver and the bits from the cardioid (if used) are indicated on the front panel of the Test Unit to determine if the computer would be getting the correct bits.

The frequency bits from the receiver enter the Test Unit via connector J3 and the bits from the cardioid via connector J4. Both go to the LED Driver card (figure 6). The outputs from the LED Driver card go to the LED's (figure 7). See figure 12 for a schematic of the LED Driver card.

3.6 INE AND INTERRUPT

The INE (Invalid Data Equipment sensed) is used by the computer program to indicate that the receiver or its ADACS Interface Chassis is inoperative.

The INE signal from the receiver enters the Test Unit via connector J3 (figure 6) and goes to the Blanking & INE card (figure 10). The circuitry on the Blanking & INE card generates an INE output if there is either an INE input from the receiver or INE conditions within the Test Unit, such as, an incorrect power supply voltage level. (The Maintenance switch input to the Blanking & INE card is grounded, so that it will not cause an INE condition.) One of the INE output lines from the Blanking & INE card goes to a front panel connector (figure 5) and the other goes to an LED (figure 7).

The interrupt circuitry in the ADACS Interface Chassis will cause an interrupt to the computer if there is any change in the status of the Maintenance switch, the Manual switch or the INE status since the last interrupt. The Manual switch output (figure 5) is used to light the LED above the switch (figure 7), to go to the receiver via connector J1 (figure 9), and to be monitored by the interrupt circuit on the Blanking & INE card (figures 10 and 16). The Maintenance switch input is grounded, so that it cannot change status. The output of the interrupt circuit goes to the LED Driver card (figure 6), which contains a one-shot circuit that causes the Interrupt LED (figure 7) to flash. The output also goes to a front panel connector (figure 5).

4. TEST UNIT OPERATION WITH ADACS INTERFACE CHASSIS AND RECEIVER

This section of the manual contains a general description of the operation of the Test Unit when it is used to test the ADACS chassis. The details of these tests are given in section 6 of this manual.

The receiver must be tested prior to testing the ADACS chassis, as it is used with the ADACS chassis in the testing of the latter. The Test Unit is connected to the ADACS chassis and the receiver as shown in figure 3, with the Test Unit performing the functions of the computer.

Figure 4 shows an overview of the operation of the Test Unit when it is used to test the ADACS chassis. Figures 5 through 10 show the detailed logic of the Test Unit. The circuitry on the cards is shown in figures 12 through 16, and the integrated circuits used on the cards are shown in figures 17 through 22.

The Gain-Tracking-Phase card is not used in this test configuration, as an identical card in the ADACS chassis is used instead. The Blanking & INE card in the Test Unit is used only for testing the INE circuitry in the ADACS chassis.

4.1 RF GAIN

The RF Gain control circuitry in the ADACS chassis is tested using the RF Gain switches on the front panel of the Test Unit and determining what signal amplitude from the U Simulator is necessary for the Amplitude (AGC) level from the receiver to indicate a particular value on the DVM.

The RF Gain switches (figure 8) are used both to drive the LED's that are above the switches and as outputs to connector J2 to the ADACS chassis (figure 9). (The Gain-Tracking-Phase card is not used.) The ADACS chassis uses its Gain-Tracking-Phase card to decode the bits from the switches and activate the proper relays in the receiver. It is this circuitry that is to be tested by the Test Unit.

The Amplitude level from the receiver is connected to the DVM by the Function switch (figure 5). Figure 11 contains a chart of the decoding.

4.2 PHASE

The phase shift controls in the receiver are checked with the Test Unit connected directly to the receiver. The only ADACS circuitry involved is the one-shot circuit on the Gain-Tracking-Phase card in the ADACS and it is checked when the tracking rate controls are tested.

4.3 TRACKING RATE

The tracking rate controls in the ADACS chassis are tested by using the Tracking Rate switches on the front panel of the Test Unit and observing the time required for the receiver Phase Difference level to respond by a given amount to a phase shift.

The Tracking Rate switches (figure 8) are set to a tracking rate. This tracking rate is indicated in the LED's above the switches and is sent to the ADACS chassis via connector J2 (figure 9). The ADACS chassis uses its Gain-Tracking-Phase card to decode the bits from the switches and activate the proper relays in the receiver. It is this circuitry that is tested by the Test Unit.

The Phase Difference level from the receiver is connected by the Function switch (figure 5) to the DVM. Figure 11 contains a chart of the decoding.

4.4 BLANKING LEVEL

The conversion of the blanking level bits into an analog blanking voltage level by the digital-to-analog converter on the Blanking & INE card in the ADACS chassis is tested by setting the Blanking Level switches (figure 8). The outputs of these switches are used both to drive the LED's that are above the switches and as outputs to the connector J2 (figure 9). The Blanking & INE card in the ADACS chassis converts the bits into an analog voltage which goes to the receiver via ADACS connector J8. A BNC tee connector is used on J8 and a coax line is connected to the External input to the Test Unit (figure 5). The External input is connected to the DVM by the Function switch. The DVM indicates the voltage level from the digital-to-analog converter, which is then compared to the value set in the Blanking Level switches.

The conversion of the Blanking Pulses from the receiver to a Percent Blanking level by the circuitry on the Blanking & INE card in the ADACS chassis is tested by connecting the output of that card, ADACS connector J7, to the External input to the Test Unit. The External input is connected to the DVM by the Function switch (figure 5). By varying the setting of the Blanking Level switches to produce known Blanking Pulses conditions, the correct operation of the conversion may be verified.

4.5 FREQUENCY AND CARDIOID

The ADACS chassis merely wires the frequency bits it receives from the receiver directly through to the computer, so the only testing needed is to verify the correct wiring of this connection.

The cardioid bits do not come from the ADACS chassis.

4.6 INE AND INTERRUPT

The INE circuitry in the ADACS chassis is tested by causing INE conditions in the ADACS chassis and observing the INE indicator on the front panel of the Test Unit. The INE signal from the ADACS chassis comes into the Test Unit via J3 (figure 6) and goes to the Blanking & INE card (figure 10) of the Test Unit. The output of the card goes both to the front panel INE connector of the Test Unit (figure 5) and to INE LED indicator (figure 7).

Interrupts from the ADACS chassis are not tested.

5. TEST PLAN FOR RECEIVER

The test plan consists of a number of tests on the receiver that should be done in the sequence given as the tests build on the results of the previous tests. In each test the settings of all equipment controls, a test procedure, and conclusions which may be drawn from a successful result are given.

In general all numbers in the tests are decimal, the exceptions being that of the switch settings for the Test Unit which are given in binary. The toggle switch handle should be up for a "one". In the case of the LED (light emitting diode) indicators, a "one" is indicated by the light being on.

The tests are in three groups: adjustments to the S1001 card (which are also described in 4.6.1.2 of the Manual for Receiver and ADACS Interface Chassis; NBSIR73-227), tests made with the receiver in manual mode, and tests made with the receiver in automatic (computer-controlled) mode.

5.1 ADJUSTMENTS TO THE S1001 CARD

There are four adjustments to be made to the S1001 card in the receiver. Two of these adjustments compensate for offset in the zero output and two provide full-scale (gain) adjustment.

5.1.1 AMPLITUDE CHANNEL

Switch the receiver to manual control (using the switch on the ADACS chassis) and switch the receiver's Servo switch to Track. Examine the Amplitude output with the DVM of the Test Unit. With the receiver tuned to a moderately strong station, or to the Simulator output, adjust the receiver RF Gain control until the front panel Signal Strength meter reads exactly "-20 dB". Now adjust R28 on the card for zero Amplitude output as indicated on the DVM in the Test Unit. Readjust the receiver RF Gain control until its Signal Strength meter reads exactly "+20 dB". Now adjust R31 on the card until the DVM reads +10.00 volts.

5.1.2 PHASE CHANNEL

With the receiver still on manual control and the Signal Strength meter indicating mid-scale, set the Servo switch to Negative Slew and the Tracking Rate control to 0.3 microseconds per second. Observe the Phase output of the receiver with the DVM in the Test Unit. As the value indicated on the DVM approaches zero, adjust R38 on the card to keep the DVM indicating zero. When the phase jumps from 0 to 360 degrees, stop turning R38. To confirm that zero degrees is represented by zero volts, switch to Positive Slew and observe that just after jumping from 360 degrees to zero degrees, the DVM reads essentially zero. The full scale adjustment R41 is made with Positive Slew as the phase approaches 360 degrees in a like manner, keeping the DVM indicating 7.816 volts. This completes the adjustments to the S1001 card.

5.2 RECEIVER IN MANUAL MODE

Before the receiver can be tested for automatic (computer-controlled) operation it is necessary to verify its operation in manual mode. The following tests should be performed in sequence.

5.2.1 SUBJECT OF TEST: MANUAL OPERATION OF RECEIVER - TUNING AND TRACKING

Configuration tested (see figure 1):

Fixed control settings:

Receiver: RF Gain: to obtain midscale on signal level meter
Blanking: 5
Tracking Rate: 1.0
Servo: track, unless noted
Frequency: see test procedure
AC Power: see test procedure

ADACS: Maintenance:, Manual:, Power: NOT USED

Simulator: Frequency: see test procedure
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factors: 0.2
Signal Phase Shift Control: Step: μs : OFF
Ramp: μs/s: OFF
Attenuation, S+N Control: Signal: 40 dB
Gaussian Noise: OFF
Impulse Noise: OFF

Test Unit: Manual: Manual
DVM: Amplitude
Switch Register: Gain:, Tracking Rate:, Blanking:, Phase change: DON'T CARE

Test procedure: Set the tuning to 10.0 kHz. Turn AC power to ON. Observe that TUNING lamp blinks and eventually goes out. The INE lamp on the Test Unit should be lit when the TUNING light is lit. After the TUNING lamp goes out, the DISABLE lamp may light. When tracking and signal strength are acceptable, the DISABLE lamp will be out. Change the tuning at the Synthesizer and then the Receiver to 27.7 kHz. Observe that the above pattern of lamp actions is repeated. Now switch the Servo switch to all of its positions. The DISABLE and INE lamps should be continuously lit in all except the TRACK and INT BAL positions.

Conclusions:

The local oscillator synthesizer works. Portions of the INE Circuit are operable.

5.2.2 SUBJECT OF TEST: MANUAL OPERATION OF RECEIVER - RF GAIN CONTROL

Configuration tested (see figure 1):

Fixed control settings:

Receiver: RF Gain: see test procedure
Blanking: 5
Tracking Rate: 0.1
Servo: Track
Frequency: 19.9
AC Power: ON

ADACS: Maintenance:, Manual:, Power: NOT USED

Simulator: Frequency: 19.90
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: μs : OFF
Ramp: μs/s: OFF
Attenuation, S + N Control: Signal: see test procedure
Gaussian Noise: OFF
Impulse Noise: OFF

Test Unit: Manual: Manual
DVM: Amplitude
Switch Register: Gain:, Tracking Rate:, Blanking:, Phase change: DON'T CARE

Test procedure: Set the Simulator signal attenuator to 0 dB. Find the Receiver RF Gain setting that results in a midscale reading on the Signal Level meter. This setting should be about 2. Set the Simulator attenuator to 50 dB and again determine the RF GAIN setting for midscale reading. This setting should be about 8. The DVM on the Test Unit should read 5 ± .10 V. Set the Simulator Signal attenuator to 70 dB and observe that the DVM reads 0 ± .10 Volts, while the Signal Level meter reads - 20 dB.

Conclusions:

The RF Gain can be adjusted to accommodate the range of input signals and the Amplitude output indicates correctly.

5.2.3 SUBJECT OF TEST: MANUAL OPERATION OF RECEIVER - BLANKING

Configuration tested (see figure 1):

Fixed control settings:

Receiver: RF Gain: to obtain midscale on signal level meter
Blanking: see test procedure
Tracking Rate: 1.0
Servo:
Frequency: 19.9
AC Power: ON

ADACS: Maintenance:
Manual: NOT USED
Power:

Simulator: Frequency: 19.90
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: μs : OFF
Ramp: μs/s: OFF
Attenuation, S+N Control: Signal: 50 dB
Gaussian Noise: 0 dB
Impulse Noise: OFF

Test Unit: Manual: Manual
DVM: Percent Blanked
Switch Register: Gain:
Tracking Rate: DON'T CARE
Blanking:
Phase change:

Test procedure: This is a test of the manual blanking level control. These tests also verify (to some extent) proper operation of the percent blanking-to-analog-voltage circuit in the Test Unit. Disconnect the Blanking Pulses cable from J6 of the Test Unit. The DVM should read 0 ± .10 V. With J6 shorted the DVM should read 10 V within 0.25 V. Reconnect the cable to J6. Vary the Blanking control and observe that for settings below 5 the BLANKING lamp does not flash and the DVM indicates 0 ± .10 V. Rotate the Blanking control clockwise until the BLANKING lamp appears to be continuously illuminated. The DVM should indicate at least 3.00 V (indicating 30% blanking). Further clockwise motion of the Blanking control should allow a DVM reading of at least 9.5 V to be obtained.

Conclusions: The internal blanking circuits operate properly and the Percent Blanking portion of the Test Unit operates.

5.2.4 SUBJECT OF TEST: MANUAL OPERATION OF RECEIVER - TRACKING RATE

Configuration tested (see figure 1):

Fixed control settings:

Receiver: RF Gain: to obtain midscale reading on Signal Level meter
Blanking: 5
Tracking Rate: see test procedure
Servo: TRACK
Frequency: 19.9
AC Power: ON

ADACS: Maintenance:, Manual:, Power: NOT USED

Simulator: Frequency: 19.90
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: µs : see test
Ramp: µs/s: procedure
Attenuation, S+N Control: Signal: 50 dB
Gaussian Noise: OFF
Impulse Noise: OFF

Test Unit: Manual: Manual
DVM: Phase
Switch Register: Gain:, Tracking Rate:, Blanking:, Phase Change: DON'T CARE

Test procedure: The tracking rate will be roughly checked by causing a phase step in the signal and observing the response time of the phase output of the receiver, using the DVM as an indicator. Place the Tracking Rate Switch at 5 µs/s. Place the RAMP switch on the Simulator in the ADV or RET position and press the step push button until the DVM reads about 4 V. Write down the voltage step corresponding to a 10 µs phase step. For each of the following settings of the Receiver Tracking Rate control observe that the DVM takes the listed time to change by 62% of the voltage step measured above.

Tracking Rate setting	µs/s	5	1	0.5	0.1
Time for 62% of step	s	2	10	20	100

Allow the reading to fully settle between each test. In order to keep on scale, the Simulator RAMP switch should be reserved after each test.

Conclusions: Achievement of the above results indicates that the Receiver tracking rate circuits are functioning satisfactorily.

5.2.5 SUBJECT OF TEST: CORRECT FULL-SCALE RANGE ON PHASE OUTPUT: 50 μs SHIFT

Configuration tested (see figure 1):

Fixed control settings:

Receiver: RG Gain: to obtain midscale reading on Signal Level meter
Blanking: 5
Tracking Rate: 0.1
Servo: see test procedure
Frequency: 19.9
AC Power: ON

ADACS: Maintenance: / Manual: / Power: } NOT USED

Simulator: Frequency: 19.9
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: μs : OFF
Ramp: μs/s: OFF
Attenuation, S+N Control: Signal: 50 dB
Gaussian Noise: OFF
Impulse Noise: OFF

Test Unit: Manual: Manual
DVM: Phase
Switch Register: Gain: / Tracking Rate: / Blanking: } DON'T CARE
Phase change: see test procedure

Test procedure: The analog output of the receiver that is used to indicate phase will be examined to determine if its amplifier gain and zero are set correctly. The test method involves use of the 50 μs Phase Change system, which results in exactly a half-scale change in the phase output each time the phase is changed by 50 μs. First the operation of the phase changer must be checked. Set the SERVO switch to TRACK. Set the Phase switch on the Test Unit to 0, then push the Phase Change button. The DVM reading should not appreciably change. Now set the Phase switch to 1 and press the button again. The DVM reading should change exactly 3.908 V each time the button is pressed, alternately positively and negatively. Any error in this value indicates that the phase amplifier on the S1001 card in the receiver is set for the incorrect gain. An error of 0.05 V is acceptable.

To observe the zero adjustment of the Phase channel, switch the Servo control to the NEG SLEW position and observe the DVM readings. They will progressively decrease and then jump to about 7.816 V and slowly decrease again. The value just before

5.2.5 (Cont'd)

the jump to full-scale is the "zero". This should be within 0.05 V of zero.

Conclusions: The phase output signal is correct and the 50 μs phase shift system works.

5.2.6 SUBJECT OF TEST: MANUAL OPERATION OF RECEIVER - REMOTE FREQUENCY INDICATION

Configuration tested (see figure 1):

<u>Fixed control settings</u>:

Receiver: RF Gain: 5
Blanking: 5
Tracking Rate: 1.0
Servo: TRACK
Frequency: see test procedure
AC Power: ON

ADACS: Maintenance: }
Manual: } NOT USED
Power: }

Simulator: Frequency:
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: μs : OFF
Ramp: μs/s: OFF
Attenuation, S+N Control: Signal:
Gaussian Noise: OFF
Impulse Noise: OFF

Test Unit: Manual: Manual
DVM: DON'T CARE
Switch Register: Gain: }
Tracking Rate: } DON'T CARE
Blanking: }
Phase change: }

<u>Test procedure</u>: Proper operation of the remote frequency indicating system will be determined by setting each frequency dial to the useful values and observing the remote indication on the lamps of the Test Box. The frequency is indicated in nine's complement, binary coded decimal; i.e.

dial	lamps
0	1001
1	1000
2	0111
3	0110
etc	
8	0001
9	0000

5.2.6 (Cont'd)

The frequency should always lie in the range of 10.0 and 29.9 kHz. Set the tenths dial successively to all its values and observe that the correct lamps are lit. Do the same for the units dial. Set the tens dial to 1, and 2 and observe that the Test Unit lamps indicate only the last two bits of the correct number.

Conclusions: The remote frequency indicating system is operating correctly.

5.3 RECEIVER IN AUTOMATIC MODE

The following tests verify that the receiver works correctly when under automatic (computer-controlled) operation.

5.3.1 SUBJECT OF TEST: REMOTE OPERATION OF RECEIVER - GAIN CONTROL

Configuration tested (see figure 1):

Fixed control settings:

Receiver: RF Gain: any, is also varied during test
Blanking: any
Tracking Rate: any
Servo: any
Frequency: 19.9
AC Power: ON

ADACS: Maintenance: } NOT USED
Manual:
Power:

Simulator: Frequency: 19.90
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: μs : OFF
Ramp: μs/s: OFF
Attenuation, S+N Control: Signal: 50 dB
Gaussian Noise: OFF
Impulse Noise: OFF

Test Unit: Manual: Automatic
DVM: amplitude
Switch Register: Gain: see test procedure
Tracking Rate: 0000
Blanking: 110000
Phase change: 0

Test procedure: This test determines correct remote control of RF gain. The procedure is to set the Receiver gain by remote control to each of the possible values and determine the Simulator output amplitude setting that results in a 0 dB reading on the Signal Level meter. There should be smooth relationship between gain and required signal. Any steps differing by more than 2 dB from the smooth curve indicate malfunction. Lowest gain occurs with a switch setting of 00000. Highest gain occurs with a switch setting of 11000. Any higher switch settings results in uncontrolled higher gain and improper operation. To make the measurement, set the Test Unit gain switches to 01000, and record the Simulator output setting S1 required to obtain a 0 dB reading on the Receiver Signal Level meter. Now set the Test Unit gain switches to 11000, and again record the Simulator output setting required to obtain a 0 dB reading on the Receiver Signal Level meter. These Simulator levels should be about 0 and 50 dB respectively. Rotate the Receiver RF Gain

5.3.1 (Cont'd)

control and observe that there is no effect on the signal level meter reading. Now calculate the ratio (S2-S1)/16. This gives the average Receiver gain step size in dB. Verify that all gain steps are within 2 dB of being correct.

Conclusions: The remote control of the Receiver gain operates correctly.

5.3.2 SUBJECT OF TEST: REMOTE OPERATION OF BLANKING LEVEL CONTROL

Configuration tested (see figure 1):

<u>Fixed control settings</u>:

Receiver: RF Gain: any
Blanking: (changed during test)
Tracking Rate: any
Servo: any
Frequency: 19.9
AC Power: ON

ADACS: Maintenance: }
Manual: } NOT USED
Power: }

Simulator: Frequency: 19.90
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: μs : OFF
Ramp: μs/s: OFF
Attenuation, S+N Control: Signal: 50 dB
Gaussian Noise: 10 dB
Impulse Noise: OFF

Test Unit: Manual: Automatic
DVM: see test procedure
Switch Register: Gain: to obtain midscale reading on Signal Level
Tracking Rate: 0000
Blanking: see test procedure
Phase change: 0

<u>Test procedure</u>: This is a test of the remote blanking level control. These tests verify (to some extent) proper operation of the Blanking Control and percent-blanked-to-analog-voltage portions of the Test Unit. Set the DVM to Blanking Voltage. Set the Blanking control switches to 000000. The DVM should read 0 V within 50 mV. Set the switches to 010000, the DVM should read -.50V within 0.05V. Set the switches to 1000000, the DVM should read -2V within 0.2V. Set the switches to 110000, the DVM should be -6V within 0.6V. Set the switches to 111111, the DVM should read greater than -10V. Now switch the DVM to the Percent Blanked position for the rest of this test. Set the Blanking switches of the Test Box until the DVM reads 1.00V (10% blanking). The switches should be 011000 within 000010. Now change these switches to obtain a DVM reading or 3.0V. The switch combination should be 010011 within

5.3.2 (Cont'd)

000010. Rotate the Receiver Blanking control over its range and observe that there is no change in the DVM reading.

Conclusions: Remote control of blanking level is possible and the Blanking Control portion of the Test Unit also operates.

5.3.3 SUBJECT OF TEST: REMOTE CONTROL OF RECEIVER - TRACKING RATE

Configuration tested (see figure 1):

Fixed control settings:

Receiver: RF Gain: any
Blanking: any
Tracking Rate: any
Servo: any
Frequency: 19.9
AC Power: ON

ADACS: Maintenance: } NOT USED
Manual:
Power:

Simulator: Frequency: 19.90
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: μs : see test
Ramp: μs/s: procedure
Attenuation, S+N Control: Signal: 50 dB
Gaussian Noise: OFF
Impulse Noise: OFF

Test procedure: The tracking rate will be roughly checked by causing a phase step in the signal and observing the response time of the phase output of the receiver using the DVM as an indicator. Place the Test Unit Tracking Rate switches in the fastest rate 1001 (7 μs/s). Place the RAMP switch of the Simulator in the ADV or RET position and press the step push button until the DVM reads about 4 V. For each of the following settings of the Test Box Tracking Rate switches, observe that the DVM takes approximately the listed time to change by 62% of the value measured for a 10 μs step in the test "Manual operation of receiver - tracking rate".

Tracking Rate switches	1000	0101	0100	0000
Time for 62% of step	2	10	20	160 seconds

Allowing the reading to settle between each test. In order to keep on scale, the Simulator RAMP switch should be reversed after each test.

Conclusions: Correct operation of the tracking rate remote control and the associated decoder in the Test Unit is determined by this test.

5.3.4 SUBJECT OF TEST: INE OPERATION

Configuration tested (see figure 1):

Fixed control settings:

Receiver: RF Gain: any
Blanking: any
Tracking Rate: any
Servo: see test procedure
Frequency: see test procedure
AC Power: ON, is turned off during test

ADACS: Maintenance: } NOT USED
Manual:
Power:

Simulator: Frequency: 19.90
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: μs : OFF
Ramp: μs/s: OFF
Attenuation, S+N Control: Signal: 50 dB
Gaussian Noise: OFF
Impulse Noise: OFF

Test Unit: Manual: Automatic
DVM: any
Switch Register: Gain: to obtain midscale on Signal Level meter
Tracking Rate: 0000
Blanking: 110000
Phase change: 0

Test procedure: This test is to determine proper operation of the INE circuits in the modified receiver when in the Automatic mode. The first portion of the test determines that the SERVO switch has no effect in Automatic. Observe the INE lamp while rotating the Servo switch. It should not light in any position. Reset the Simulator to 20.1 kHz and wait for the Signal Level meter to go below -20 dB. The INE should not light. Reset the Simulator to 19.9 kHz. Turn Receiver AC POWER switch off. Note that the INE lamp remains on. After waiting a few seconds, turn the AC POWER back on. The INE will blink until the TUNING lamp on the Receiver goes out.

Conclusions: The Receiver portion of the INE circuit operates.

6. TEST PLAN FOR THE ADACS INTERFACE CHASSIS

Testing of the ADACS chassis includes both the adjustment of zero and full scale settings of a circuit on the Blanking & INE card, and a series of tests on the unit.

The receiver must be tested prior to testing the ADACS chassis, as it is used with the ADACS chassis in the testing of the latter.

6.1 ADJUSTMENTS TO THE BLANKING & INE CARD

The circuit on this card for converting the Blanking Pulses into an analog Percent Blanking voltage has both a zero setting and a full scale setting. The zero setting uses a fixed resistor and the full scale setting uses an adjustable pot.

Remove the cable to J6, connect a coax cable from J7 to the External input connector on the front panel of the Test Unit, and set the Function switch of the Test Unit to External. The voltage indicated on the DVM (digital voltmeter) in the Test Unit should be zero, plus or minus 50 millivolts. If not, a new value for R17 is needed. Use a higher value of resistance if the voltage is negative.

With the cable to J6 still disconnected, connect a shorting cap to J6. The DVM voltage should be adjusted with R18A on the card to give a reading of +10.00 volts.

6.2 ADACS TESTS

The test plan consists of a number of tests using the receiver and the ADACS chassis connected as shown in figure 3. The tests should be done in the sequence given. In each test the settings of all equipment controls, a test procedure, and conclusions which may be drawn from a successful result are given.

In general all numbers are decimal, the exception being that of the switch settings for the Test Unit which are given in binary. The toggle switch handle should be up for a "one".

The tests are performed using the Test Unit to simulate computer commands. In almost all cases the actions may be commanded from the operator console when using the receiver/ADACS chassis under computer control. All tests made in this section of the manual should be repeated using the computer to establish the conditions and observe the results.

6.2.1 SUBJECT OF TEST: OPERATION OF PERCENT BLANKING PORTION OF ADACS

Configuration tested (see figure 3):

Fixed control settings:

Receiver: RF Gain: / Blanking: / Tracking Rate: / Servo: / Frequency: — DON'T CARE
AC Power: ON

ADACS: Maintenance: either
Manual: either
Power: ON

Simulator: Frequency:
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: μs : OFF
Ramp: μs/s: OFF
Attenuation, S+N Control: Signal:
Gaussian Noise: OFF
Impulse Noise: OFF

Test Unit: Manual: either
DVM: PERCENT BLANKING
Switch Register: Gain: / Tracking Rate: / Blanking: / Phase change: — DON'T CARE

Test procedure: This test determines the 0% and 100% blanking readings of the Percent Blanking portion of the ADACS. The test is conducted with the normal wire to J6 of the ADACS disconnected. With this wire disconnected, the DVM should read 0 V within 100 mV. With the center terminal of J6 shorted to its shell, the DVM should read 10.00 V within .25 V. Percent blanking is directly read by moving the DVM decimal place one place to the right. A reading of 1.00 V means 10.0% blanking.

Conclusions: The percent blanking circuit in the ADACS is operating properly.

6.2.2 SUBJECT OF TEST: OPERATION OF RECEIVER THROUGH ADACS - FREQUENCY INDICATION

Configuration tested (see figure 3):

<u>Fixed control settings</u>:

Receiver: RF Gain: any
Blanking: any
Tracking Rate: any
Servo: TRACK
Frequency: see test procedure
AC Power: ON

ADACS: Maintenance: NORMAL
Manual: MANUAL
Power: ON

Simulator: Frequency:
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: μs : OFF
Ramp: μs/s: OFF
Attenuation, S+N Control: Signal:
Gaussian Noise: OFF
Impulse Noise: OFF

Test Unit: Manual: either
DVM: any
Switch Register: Gain: } DON'T CARE
Tracking Rate:
Blanking:
Phase change:

<u>Test procedure</u>: Proper operation of the remote frequency indicating system will be determined by setting each frequency dial to the useful values and observing the remote indication on the lamps of the Test Box. The frequency is indicated in nine's complement, binary coded decimal; i.e.

dial	lamps
0	1001
1	1000
2	0111
3	0110
etc.	
8	0001
9	0000

6.2.2 (Cont'd)

The frequency should always lie in the range of 10.0 and 29.9 kHz. Set the tenths dial successively to all its values and observe that the correct lamps are lit. Do the same for the units dial. Set the tens dial to 1 and 2 and observe that the Test Unit lamps indicate only the last two bits of the correct number.

Conclusions: The remote frequency indicating system is operating correctly.

6.2.3 SUBJECT OF TEST: REMOTE CONTROL OF RECEIVER ADACS-GAIN CONTROL

Configuration tested (see figure 3):

Fixed control settings:

Receiver: RF Gain: any
Blanking: any
Tracking Rate: any
Servo: any
Frequency: 19.9
AC Power: ON

ADACS: Maintenance: NORMAL
Manual: AUTOMATIC
Power: ON

Simulator: Frequency: 19.90
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: μs : OFF
Ramp: μs/s: OFF
Attenuation, S+N Control: Signal:
Gaussian Noise: OFF
Impulse Noise: OFF

Test Unit: Manual: either
DVM: Amplitude
Switch Register: Gain: see test procedure
Tracking Rate: 0000
Blanking: 110000
Phase change: 0

Test procedure: This test determines correct remote control of RF gain through the ADACS. A previous test has determined that the gain control card in the Receiver operates. This test is to assure that the decoder and wiring in ADACS are correct. The procedure is to set the Receiver gain by remote control to each of the possible values and determine the Simulator output amplitude required to obtain a 0 dB reading on the Receiver Signal Level meter. There should be a smooth relationship between gain and required signal. Any steps differing from the smooth curve by more than 2 dB indicate a malfunction. A gain-per-step value for each receiver is determined in the test "Remote operator of receiver - gain control". Using this value, go through all gain steps and determine the associated Simulator output required. Verify that all steps are within the 2 dB tolerance.

6.2.3 (Cont'd)

Conclusions: The remote control of Receiver gain using the decoder in the ADACS unit operates correctly.

6.2.4 SUBJECT OF TEST: OPERATION OF RECEIVER THROUGH ADACS - BLANKING LEVEL CONTROL

Configuration tested (see figure 3):

Fixed control settings:

Receiver: RF Gain: any
Blanking: any
Tracking Rate: any
Servo: any
Frequency: 19.9
AC Power: ON

ADACS: Maintenance: NORMAL
Manual: AUTOMATIC
Power: ON

Simulator: Frequency: 19.90
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: μs : OFF
Ramp: μs/s: OFF
Attenuation, S+N Control: Signal:
Gaussian Noise: OFF
Impulse Noise: OFF

Test Unit: Manual: either
DVM: EXTERNAL, changed during test
Switch Register: Gain: to obtain midscale reading on Signal Level
Tracking Rate: 0000
Blanking: see test procedure
Phase change: 0

Test procedure: This is a test of remote control of blanking using the Blanking Control card in ADACS. A previous test has determined that blanking level of the receiver can be remotely controlled. The first step in this test is to determine the correct operation of the digital-to-analog converter in ADACS which produces the Blanking Control Voltage. The external voltage input for the DVM on the Test Unit is connected by a tee to the Blanking Control Voltage output on the ADACS. Set the blanking switches and read the DVM voltages. Compare with this table.

6.2.4 (Cont'd)

Switches	Lowest Voltage	Highest Voltage
000000	-0.05	0.05
010000	-5.5	-4.5
100000	-2.2	-1.8
110000	-6.6	-5.4
111111	no limit	-10.0

Connect the cable from the External input of the Test Unit to the Percent Blanking output of the ADACS. Adjust the Blanking Control Switches so that the Blanking light never lights. The DVM should read 0.0 V within 100 mV. Now change the Blanking control switches until the DVM reads 2.00 V as closely as possible. This is the voltage produced by the ADACS. A similar circuit is contained in the Test Unit. Its voltage should be read by switching the DVM to the PERCENT BLANKING position. The two values should agree within 100 mV.

Conclusions: The Blanking circuitry of the ADACS operates.

6.2.5 SUBJECT OF TEST: OPERATION OF RECEIVER THROUGH ADACS - TRACKING RATE

Configuration tested (see figure 3):

Fixed control settings:

Receiver: RF Gain: any
Blanking: any
Tracking Rate: any
Servo: any
Frequency: 19.9
AC Power: ON

ADACS: Maintenance: NORMAL
Manual: AUTOMATIC
Power: ON

Simulator: Frequency: 19.9
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: μs : OFF
Ramp: μs/s: OFF
Attenuation, S+N Control: Signal:
Gaussian Noise: OFF
Impulse Noise: OFF

Test Unit: Manual: either
DVM: PHASE
Switch Register: Gain: to obtain midscale reading of Signal Level
Tracking Rate: see test procedure
Blanking: 110000
Phase change: 0

Test procedure: The tracking rate will be roughly checked by causing a phase step in the signal and observing the response time of the phase output of the receiver using the DVM as an indicator. Place the Test Unit Tracking Rate switches in the fastest rate 1001 (7 μs/s). Place the RAMP switch of the Simulator in the ADV or RET position and press the step push button until the DVM reads about 4 V. For each of the following settings of the Test Unit Tracking Rate switches, observe that the DVM takes approximately the listed time to change by 62% of the value measured for a 10 μs step in the test "Manual operation of receiver - tracking rate".

Tracking Rate switches	1000	0101	0100	0000	
Time for 62% of step	2	10	20	100	seconds

6.2.5 (Cont'd)

Allow the reading to settle between each test. In order to keep on scale, the Simulator RAMP switch should be reversed after each test.

Conclusions: Correct operation of the tracking rate remote control and the associated decoder in the ADACS chassis is determined by this test.

6.2.6 SUBJECT OF TEST: INE OPERATION OF RECEIVER AND ADACS

Configuration tested (see figure 3):

Fixed control settings:

Receiver: RF Gain: 5
Blanking: 5
Tracking Rate: 0.1
Servo: TRACK, varied during test
Frequency: 19.9, will be varied during test
AC Power: ON, varied during test

ADACS: Maintenance: NORMAL, changed during test
Manual: AUTOMATIC, changed during test
Power: ON, changed during test

Simulator: Frequency: 19.90
Signal Generator Control: Continuous Carrier
Square Wave
Keyed CW
Duty Factor: 0.2
Signal Phase Shift Control: Step: μs : OFF
Ramp: μs/s: OFF
Attenuation, S+N Control: Signal:
Gaussian Noise: OFF
Impulse Noise: OFF

Test Unit: Manual: either
DVM: any
Switch Register: Gain: to obtain midscale on Signal Level meter
Tracking Rate: 0000
Blanking: 110000
Phase change: 0

Test procedure: Operation of the INE system will be verified. The Receiver parts of the system have been tested before. The Interrupt lamp on the Test Unit is not connected to the Interrupt output on the ADACS. The INE lamp in the Test Box will indicate INE conditions in the ADACS, but the Interrupt lamp is meaningless. Observe the interrupt pulse with an oscilloscope connected to either Interrupt BNC connector on the rear of ADACS.

Let the system stabilize with the INE lamp extinguished. Suddenly change the Receiver tuning to 29.9 kHz. The TUNING lamp of the receiver will blink resulting in a blink of the INE lamp and an interrupt. When the tuning is reset to 19.9 the same sequence of events should occur. Turn the Receiver AC POWER switch off. There should be an interrupt and the INE lamp should remain lit. When the AC POWER is turned on there should

6.2.6 (Cont'd)

be another interrupt and the INE should eventually go out. Turn the Maintenance switch to MAINTENANCE; there should be an interrupt and the INE lamp should remain lit. After a few seconds return this switch to NORMAL; there should be another interrupt and the INE lamp should extinguish. Turn the INE Manual switch to MANUAL; there should be an interrupt but the INE lamp should NOT light. Return this switch to AUTOMATIC; there should be another interrupt but no INE light. Turn the ADACS OFF and observe that there is an interrupt.

Conclusions: The INE system has been tested when this and the previous tests are complete.

7. FAILURE DIAGNOSIS

The following service advice may be of assistance in the diagnosis of system failures. The use of the Test Unit in the diagnosis is assumed.

7.1 NO AC POWER AT THE RECEIVER AND ADACS

a) The computer must be running a program which pulses the Time-Out circuit at least once each second.

b) Reset the Time-Out circuit.

c) Check that the correct AC power source is available and connected.

d) Check all fuses.

7.2 INCORRECT FREQUENCY INDICATION

a) Determine that the Zener-regulated voltages on the S1001 (Latch) card in the receiver are correct.

b) Determine that the load pulse for the latches on the S1001 card (pin 10 of U3 and U4) is entirely within the duration of the Frequency Input pulse (pin 12 of U1).

c) Determine that the Frequency Input pulse (pin 12 of U1) occurs at a 100 Hertz rate.

d) If only selected bits of the frequency are failing to change as the receiver is tuned through its range, the trouble may be a defective latch (U3 or U4) on the S1001 card or in the wiring.

7.3 TUNING LIGHT FAILS TO GO OUT

a) Follow advice in receiver manual.

b) Unplug the connector from P1 of the S1001 (Latch) card in the receiver to determine if this card is affecting the receiver's frequency synthesizer. If the tuning light goes out, the fault is on the card, as the output functions of the receiver are disabled with this card removed.

7.4 NO AMPLITUDE OUTPUT TO COMPUTER

If the receiver appears to work properly, but there is no signal on the Amplitude output to the computer, J31:

a) Observe the input and output signals to AR2 and AR4 on the S1001 (Latch) card in the receiver. The gains should be 0.25 for AR2 and 10 for AR4.

b) If there is an appropriate signal at the output of AR4, but no signal at J31, there is a wiring fault.

7.5 NO PHASE OUTPUT TO COMPUTER

If the receiver appears to work properly, but there is no signal on the Phase output to the computer, J26:

a) Observe the input and output signals to AR1 and AR3 on the S1001 (Latch) card in the receiver. The gains should be 1 for AR1 and 2 for AR3.

b) If there is an appropriate signal at the output of AR3, but no signal at J26, there is a wiring fault.

7.6 RF GAIN UNCONTROLLED IN AUTOMATIC

a) Using the chart in figure 11, try to identify if one or more relays on the S3001 card in the receiver are sticking or otherwise malfunctioning.

b) Determine that the decoder (Gain-Tracking-Phase card in the ADACS chassis) is operating correctly to drive the proper relays for each RF gain step.

c) Alternatively, repeat the tests in 5.3.1 and 6.2.3.

7.7 TRACKING RATE UNCONTROLLED IN AUTOMATIC

a) Observe the operation of the tracking rate controls in the receiver by repeating 5.3.3. A failure of one of the relays is the most likely cause of trouble.

b) Observe the operation of the decoder card in the ADACS chassis by repeating 6.2.5.

7.8 BLANKING LEVEL UNCONTROLLED IN AUTOMATIC

a) Observe that the Blanking Level voltage can be made to cover its entire range by digital command. This voltage is produced in the digital-to-analog converter on the Blanking & INE card in the ADACS chassis. If the voltage is not correct, disconnect the cable from J8 of the ADACS chassis and measure the voltage again, as there may be an excessive loading of the signal by a malfunction in the receiver.

b) If the voltage is correct, the trouble may be in the relay K15 on the S3001 card in the receiver.

c) If the voltage is incorrect, the trouble may be in the digital-to-analog converter on the Blanking & INE card or in the wiring to it.

7.9 PERCENT BLANKING INCORRECT

a) If the Percent Blanking output is always close to zero volts, there is probably a break in the wire bringing Blanking Pulses from the receiver.

b) If the Blanking Level is changed so that the Blanking light on the receiver seems to be continuously lit, the output voltage for Percent Blanking should be over 1 volt.

c) If the Percent Blanking output is always about 10 volts, the input signal at J6 is grounded, perhaps by a short.

8. TEST UNIT CONSTRUCTION

The Test Unit is constructed using a custom-modified cabinet containing three printed circuit cards and numerous front panel switches and indicators. The Test Unit contains the same circuit functions as the ADACS Interface Chassis, whose functions it performs in one mode of operation, plus the circuitry and switches necessary to perform the functions of the computer.

The three cards in the Test Unit are: the Blanking & INE card (S4001), the Gain-Tracking-Phase card, and the LED Driver card. The first two are also used in the ADACS Interface Chassis. The LED Driver card is used only in the Test Unit.

8.1 BLANKING & INE CARD

8.1.1 CONSTRUCTION AND PARTS LIST

The construction of this card and its parts list are contained in sections 5.2.1 and 5.2.3, respectively, of the Manual for Receiver and ADACS Interface Chassis (NBSIR 73-227).

8.1.2 ADJUSTMENT

The circuit on this card for converting the Blanking Pulses into an analog Percent Blanking voltage has both a zero setting and a full scale setting. The zero setting uses a fixed resistor and the full scale setting uses an adjustable pot.

Remove the cable (if any) to connector J6 and set the Function switch to Percent Blanking. The voltage indicated on the DVM (digital voltmeter) should be zero, plus or minus 50 millivolts. If not, a new value for R17 on the card is needed. Use a higher value of resistance if the voltage is negative.

Connect a shorting cap to J6. Adjust R18A on the card to give a DVM reading of +10.00 volts.

8.2 GAIN-TRACKING-PHASE CARD

The construction of this card and its parts list are contained in sections 5.1.1 and 5.1.2, respectively, of NBIR73-227. There are no adjustments to be made on this card.

8.3 LED DRIVER CARD

8.3.1 CONSTRUCTION

This card (figure 12) contains drivers to interface incoming signal lines with the LED's on the front panel of the Test Unit, and two one-shot circuits for the Phase-Change Pulse and Interrupt signals. There are no special precautions to observe in the construction of this card and the components may be assembled in any order.

8.3.2 PARTS LIST (LED DRIVER CARD)

Designator	Quantity	Description	Manufacturer	Part Number
LED Driver	1	Printed circuit card	Divelpro	-
A, B, C	3	Hex inverter, open collector, high current, TTL	Texas Instruments	SN7406N
F	1	Quad 2-input, positive NAND gates, TTL	Texas Instruments	SN7400N
D, E	2	Integrated circuit, one shot	Fairchild	F9601
R1	18	Resistor, 240 ohms, 1/2 watt, $\pm 5\%$	-	-
R3, R4, R6	3	Resistor, 5100 ohms, 1/2 watt, $\pm 5\%$	-	-
R2	1	Resistor, 33K ohms, 1/2 watt, $\pm 2\%$	-	-
R5	1	Resistor, 39K ohms, 1/2 watt, $\pm 2\%$	-	-
C1	1	Capacitor, 0.01 micro-farad, $\pm 10\%$	Sprague	Pacer Filmite
C2	1	Capacitor, 100. microfarad, $\pm 10\%$ electolytic, 25 WVDC	Sprague	TE 1211
C3	1	Capacitor, 0.001 microfarad, $\pm 10\%$	Sprague	Pacer Filmite

8.4 CHASSIS

8.4.1 CONSTRUCTION

The chassis for the Test Unit is a commercially available cabinet that is drilled and labelled for the mounting of the necessary components. The front panel is drilled (figure 23) and labelled (figure 24) for the mounting of switches, LED's (light emitting diodes), and the DVM (digital voltmeter). The back panel is drilled (figure 25) and labelled (figure 26) for the mounting of connectors. The floor of the chassis is drilled (figure 27) for the mounting of the printed circuit cards and power supplies.

The components are installed on the front panel as shown in figure 28 and on the back panel as shown in figure 29. The resistors for the LED's are soldered directly to the LED holders. Check each of the multi-pin connectors for a well-secured nut in the center of the connector to hold the plug, as some of the connectors have been delivered with a loose nut that later became a nuisance whenever cables were changed.

The printed circuit cards are mounted in sockets attached to the floor of the chassis by angle brackets (figure 30). The Gain-Tracking-Phase card is mounted on top of the LED Driver card using straightened-out angle brackets between the card sockets. The ends of the cards are kept off the floor of the chassis and separated from each other by spacers. (Do not mount the card sockets until later.)

It is quite difficult to tighten the screws to the terminal strip on the 5-volt power supply when it is installed in the chassis, so it is desirable to do some of the wiring of the supplies with them on the work bench. Position the power supplies on the bench as they will be in the chassis. Connect all of the input wiring to both supplies (see figure 10). Connect a single red wire to the +5 volt output and a single black wire to the output common. The red and black wires should be number 16 gauge and about 24 inches long. (The excess will be cut off later.)

Mount the power supplies using the correct spacers for each supply (see figure 30). Both power supplies use 3/4-inch long spacers, but one uses spacers with holes for number 6 screws and the other for number 8 screws. Do not tighten the screws until all screws have been started.

8.4.2 WIRING

While the electrical performance of the Test Unit is not (except for the grounding) affected by the manner in which it is wired, the appearance of the finished wiring is dependent upon the techniques used.

When the card sockets are wired, put each socket in a bench vise and solder the wires to each of the pins, observing the color code. (It is much neater to make up the cable harnesses this way than when the sockets are already mounted.) Use shrink tubing about 1/8 inch in diameter over each of the pins. Use excess wire length, which will later be cut back to the proper length when the sockets are mounted. It is more convenient to use cable ties to group wires going to different connectors on the back panel.

The grounding technique used has all of the ground wires connected directly to a single point on the chassis. The point used is a long solder lug attached under the mounting screw for one of the card sockets. (Typically, the mounting screw for the Blanking & INE card nearest to the other card, as this is a convenient place.) All ground wires are connected directly to this lug, so some care must be used to conserve space on the lug, as it may become a bit crowded. When mounting the card sockets, scrape off the anodizing on the chassis around where the ground lug will go and use appropriate lock washers (with teeth) to ensure a good ground to the chassis.

The two terminal strips are used for mounting the resistor and capacitor for the Manual switch. They should be mounted near the card sockets.

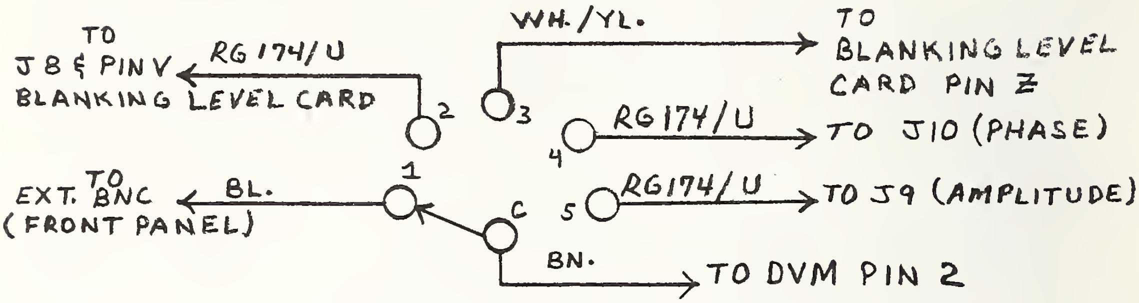
Dress each group of wires going from adjacent card socket pins to a particular back panel connector for a neat, equal length appearance and cut to length. There is no need to seek minimum length or to separate wires, as there are no electrical problems. Attach the crimp pins and insert into the appropriate slots of the connectors. The remaining wires may be cut to length and soldered. Additional wires on the wiring diagram that are not yet soldered should be installed now. The a.c. power wiring should be installed with shrink tubing over component contacts to reduce the chance of accidental electrical shock. When using the coax from the BNC connectors, care should be taken in stripping them back and in soldering. (The amount of heat required to solder the ground straps to ground lug can easily melt the insulator and cause a short.) Use cable ties as needed.

Before turning on a.c. power, check out the a.c. power path visually. Then test with a.c. power, but without the cards. Check for the correct voltage at the card pins. Adjust the d.c. level with the power supply adjustment pots, if necessary. It is desirable to check out the wiring from the cards to the back panel connectors using an ohmmeter.

Mount the cards in the chassis using the 1/2 inch spacers to keep the ends of the cards off the bottom of the chassis, and to keep the cards tightly into the sockets.

Certain commercial equipment and materials are identified in this paper in order to adequately specify the components used. In no case does such identification imply recommendation or endorsement by the National Bureau of Standards, nor does it imply that the material or equipment identified is necessarily the best available for the purpose.

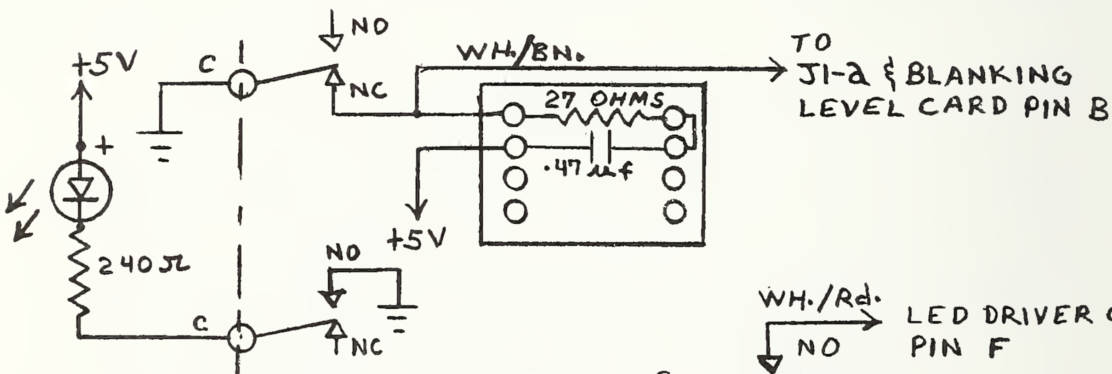
TEST UNIT WIRING



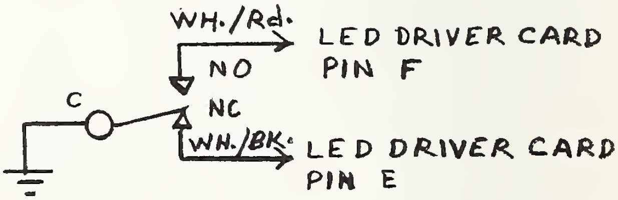
FUNCTION SWITCH

FRONT PANEL BNC'S

BLANKING	– BLANKING LEVEL CARD PIN X & J6	RG174/U
INE	– BLANKING LEVEL CARD PIN E	WH./VI
INTERRUPT	– BLANKING LEVEL CARD PIN 4 & LED DRIVER CARD PIN N	WH./BL.



AUTO/MANUAL

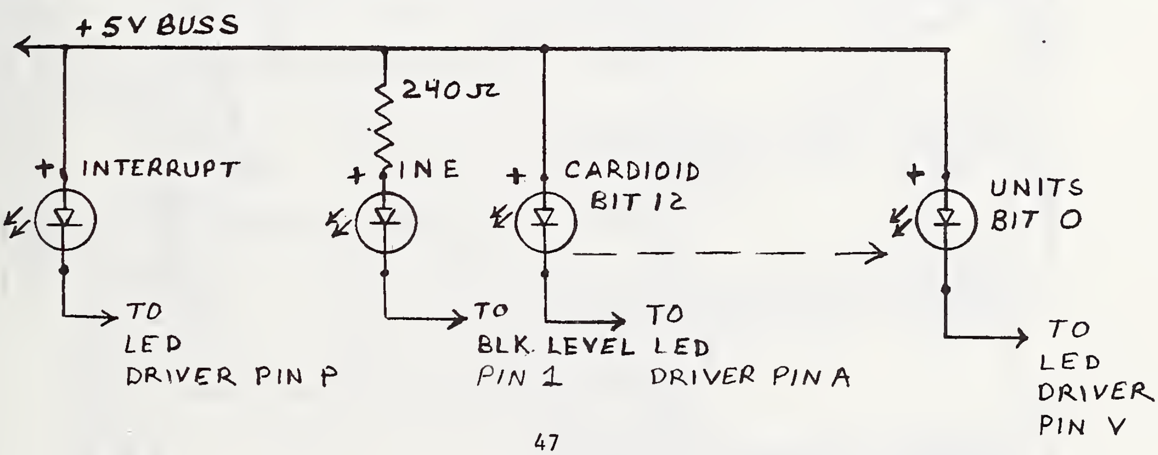


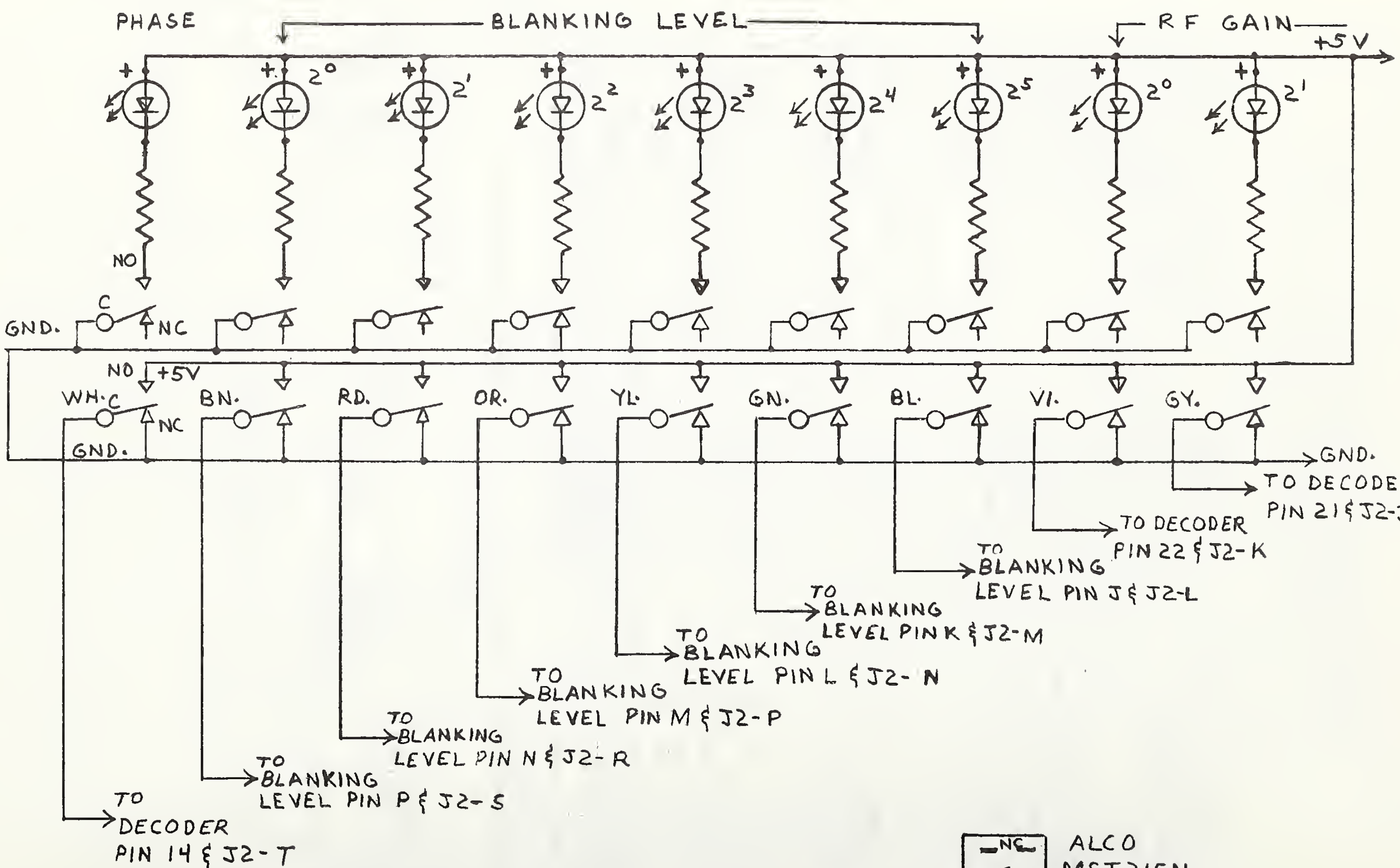
PHASE CHANGE

TEST UNIT WIRING

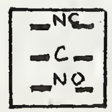
TOP ROW LED's FROM PIN B

FROM	TO	PIN NO.	COLOR
INTERRUPT	LED DRIVER	P	BROWN
INE	BLANKING LEVEL	1	RED
BIT 12 CARDIOID #1	LED DRIVER	A	ORANGE
BIT 11 CARDIOID #2	LED DRIVER	B	YELLOW
BIT 10 CARDIOID # 3	LED DRIVER	C	GREEN
BIT 9 TENTHS # 1	LED DRIVER	D	BLUE
BIT 8 TENTHS # 2	LED DRIVER	J	VIOLET
BIT 7 TENTHS # 3	LED DRIVER	K	GRAY
BIT 6 TENTHS # 4	LED DRIVER	L	BROWN
BIT 5 UNITS # 1	LED DRIVER	M	RED
BIT 4 UNITS # 2	LED DRIVER	R	ORANGE
BIT 3 UNITS # 3	LED DRIVER	S	YELLOW
BIT 2 UNITS # 4	LED DRIVER	T	GREEN
BIT 1 TENS # 1	LED DRIVER	U	BLUE
BIT 0 TENS # 2	LED DRIVER	V	VIOLET



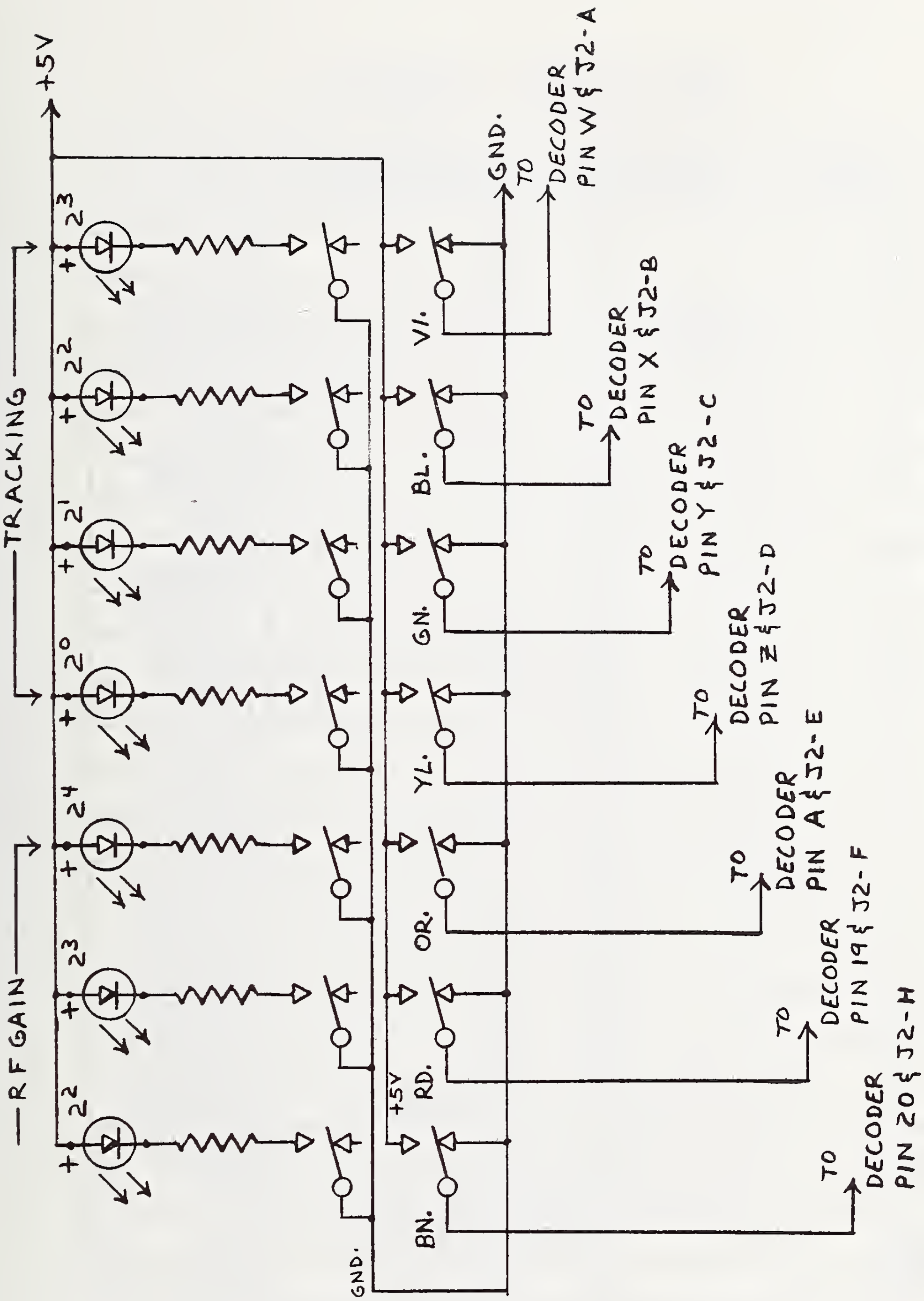


TEST UNIT WIRING



ALCO
MST215N

SWITCH DETAIL



TEST UNIT WIRING

TEST UNIT WIRING

FROM J1	TO DECODER BOARD	COLOR
A	17	BROWN
B	16	RED
C	18	ORANGE
D	V	YELLOW
E	U	GREEN
F	T	BLUE
H	B	BROWN
J	2	RED
K	F	ORANGE
L	J	YELLOW
M	E	GREEN
N	C	BLUE
P	D	VIOLET
R	9	GRAY
S	8	WHITE
T	L	BLACK
U	3	WH./BN.
V	K	WH./Rd.
W	H	WH./OR.
X	M	WH./YL.
Y	15 & J2-U	WH./GN.
* Z	GND.	BLACK
a	SEE PAGE 1	
** b	+5 VOLTS & J4-H	RED
* c	GND.	BLACK

* JUMPER Z TO c TO GND.
** JUMPER b TO J4-H TO +5 VOLTS

TEST UNIT WIRING

FROM	TO	COLOR
J2-A		
J2-B		
J2-C		
J2-D		
J2-E		
J2-F		
J2-H		
J2-K		
J2-L		
J2-M		
J2-N		
J2-P		
J2-R		
J2-S		
J2-T		
J2-U		
J2-V	J2-X	BLACK
J2-W		
J2-X	GND.	BLACK

NOTE:
WIRING FROM J2-A THRU J2-V SEE PAGES 3, 4 & 5

TEST UNIT WIRING

FROM	TO	COLOR
J3-A	LED DRIVER 18	BLACK
J3-B	LED DRIVER 17	BROWN
J3-C	LED DRIVER 16	RED
J3-D	LED DRIVER 15	ORANGE
J3-E	LED DRIVER 14	YELLOW
J3-F	LED DRIVER 13	GREEN
J3-H	LED DRIVER 12	BLUE
J3-J	LED DRIVER 11	VIOLET
J3-K	LED DRIVER 10	GRAY
J3-L	LED DRIVER 9	WHITE
J3-M	BLANKING LEVEL 5	WH./BN.
J3-N	J3-V	BLACK
J3-P		
J3-S		
J3-T		
J3-U		
J3-V	J3-X	BLACK
J3-W		
J3-X	GND.	BLACK

TEST UNIT WIRING

FROM	TO	COLOR
J4-A	LED DRIVER 7	WH./BK.
J4-B	LED DRIVER 3	WH./BN.
J4-D	LED DRIVER 2	WH./Rd.
J4-E	GND.	BLACK
*J4-H	+5VOLTS	RED

* SEE PAGE 5

TEST UNIT WIRING

BLANKING LEVEL CARD

FROM	TO	TO	TO	TO	COLOR
A	D	R	S	GND.	BLACK
* 4	LED DRIVER N				WH./BL.
6	+5 VOLTS				RED
F	+15 VOLTS				ORANGE
H	-15 VOLTS				BLUE
U	GND.				BLACK
X	J6				RG174/U

* SEE PAGE 1

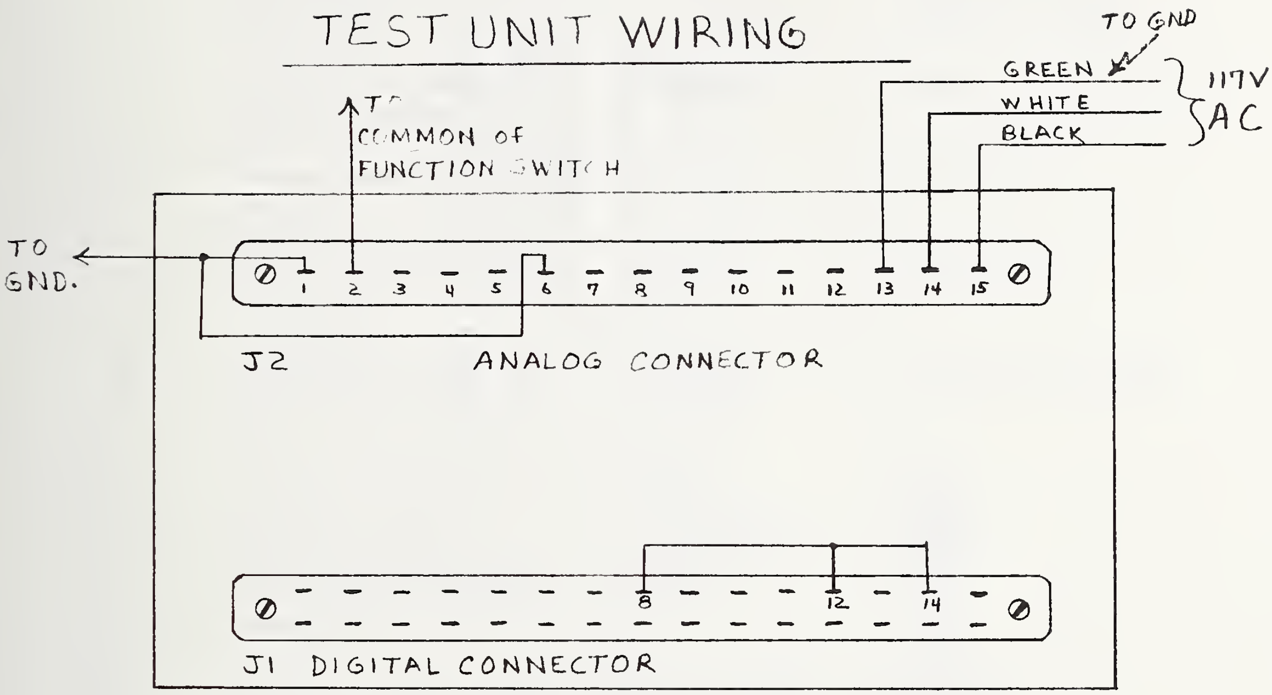
DECODER CARD

FROM	TO	COLOR
1	+5 VOLTS	RED
4	GND.	BLACK
S	LED DRIVER H	WH./GN.

LED DRIVER

FROM	TO	COLOR
1	+5 VOLTS	RED
4	GND.	BLACK

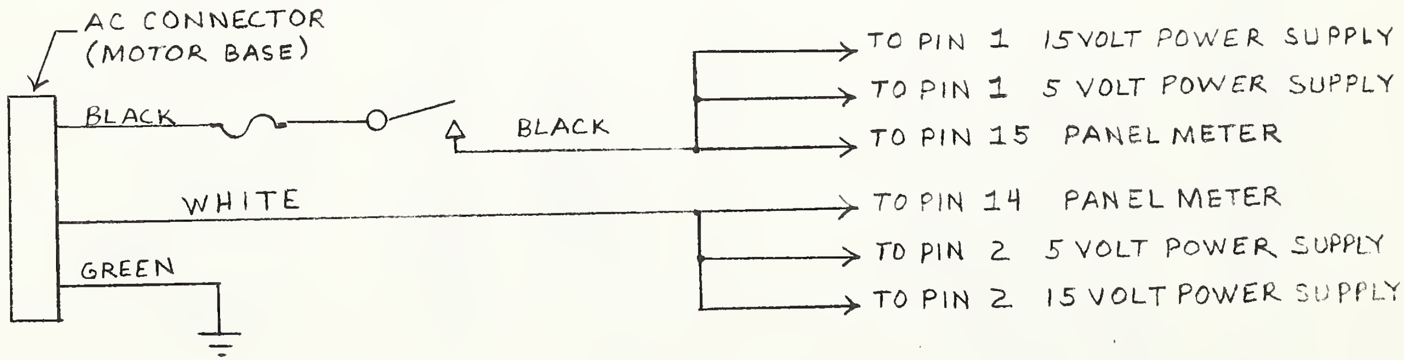
TEST UNIT WIRING



REAR VIEW

DIGITAL PANEL METER

TEST UNIT WIRING



8.4.3 PARTS LIST (CHASSIS)

Quantity	Description	Manufacturer	Part Number
1	Chassis with front and back panels drilled and labelled.	Optima	K-051716HT Gray No. 26440 Trim No. 26152
1	Digital voltmeter for panel mounting	Newport	200A with option A3
1	Power supply ±15 volts 400 mA	Lambda	LXD-3-152
1	Power supply +5 volts 4 amperes	Lambda	LXS-A-5-OV
32	Indicator, light emitting diode	Dialight	249-7868-3331-504
1	Toggle switch	J-B-T	ST22N
1	Rotary switch, 5 position, 1 pole, non-shorting, steatite	Centralab	PA2001
17	Toggles switch, DPDT	Alcoswitch	MST215N
1	Flush motor plug (a.c. power)	Amphenol	160-5-N
8	BNC connectors	Amphenol	31-221
1	5 pin connector	Amphenol	126-010
3	44 pin card sockets	Amphenol	225-22221-101
1	56 pin connector	ELCO	00-8016-056-000-001
3	20 pin connector	ELCO	00-8016-020-000-707
72	contacts for connectors	ELCO	60-8017-0313
1	Extension cord	Belden	17461
6	Angle brackets	H.H.Smith	1476
5	Spacers, 1/2 inch high, no. 6 hole	H.H. Smith	2112

8.4.3 (Cont'd)

Quantity	Description	Manufacturer	Part Number
4	Spacers, 3/4 inch high, no. 6 hole	H.H.Smith	2113
4	Spacers, 3/4 inch high, no. 8 hole	H.H.Smith	2118

8.4.3 PARTS LIST (CHASSIS) (Cont'd)

Quantity	Description	Manufacturer	Part Number
1	Capacitor, 0.47 microfarad	Spague	Pacer Filmite
1	Resistor, 27 ohm, 1/2 watt, 2 percent	-	-
18	Resistor, 240 ohms, 1/4 watt, 5 percent	-	-
1	Feedthrough lug to be used as ground lug	Vernitron	14301
1	Fuse holder, 3AG extractor post	Littlefuse	342012A
1	Fuse, 1/2 ampere, slow blow 3AG	Littlefuse	313.500
2	Tie down terminals, used as terminal strips	H.H.Smith	863

Quantity	Thread	Description
12	2-56	5/8 inch long fillister head brass machine screw
12	2	washer, cadmium plated steel, internal teeth
12	2-56	brass hexagon nut
6	4-40	1/2 inch long fillister head brass machine screw
4	4-40	1/2 inch long round head brass machine screw
4	4	washer, cadmium plated steel, round flat
8	4	washer, cadmium plated steel, internal teeth
8	4-40	brass hexagon nut
2	6-32	1 and 3/4 inch long flat head brass machine screw
5	6-32	one inch long flat head brass machine screw
4	6-32	3/8 inch long flat head brass machine screw
3	6	washer, cadmium plated steel, round flat

8.4.3 (Cont'd)

Quantity	Thread	Description
7	6	washer, cadmium plated steel, internal teeth
7	6-32	brass hexagon nut
4	8-32	one inch long flat head brass machine screw

Certain commercial equipment and materials are identified in this paper in order to adequately specify the components used. In no case does such identification imply recommendation or endorsement by the National Bureau of Standards, nor d es it imply that the material or equipment identified is necessarily the best available for the purpose.

ORIGINAL DATE OF DRAWING 5-1-73

REVISIONS			
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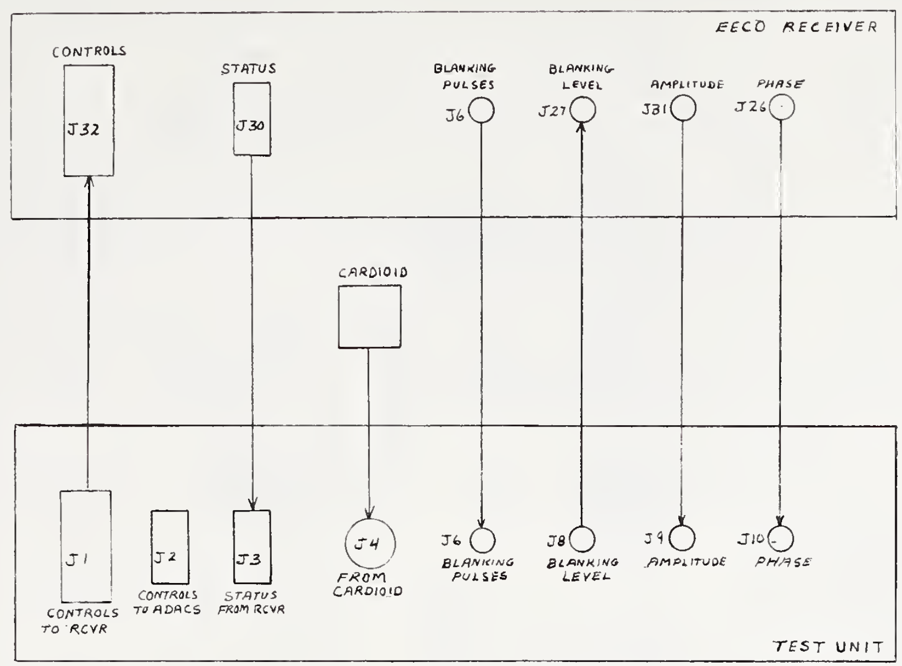

TO TEST RECEIVER ONLY

TEST UNIT CABLING TO RECEIVER (ONLY)
FIGURE 1

PIECE NO	NOMENCLATURE	NO. REQ'D

NATIONAL BUREAU OF STANDARDS
WASHINGTON, D.C. 20234

TEST UNIT CABLING TO RECEIVER (ONLY)
FOR

MODEL	TYPE	SCALE
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TOLERANCES (Unless otherwise specified)	PROJECT ENGR	PROJECT ENGR
DECIMALS ±.005 FRACTIONS ±.015 ANGLES ±½°	SUBMITTED BY	CHIEF, SEC.
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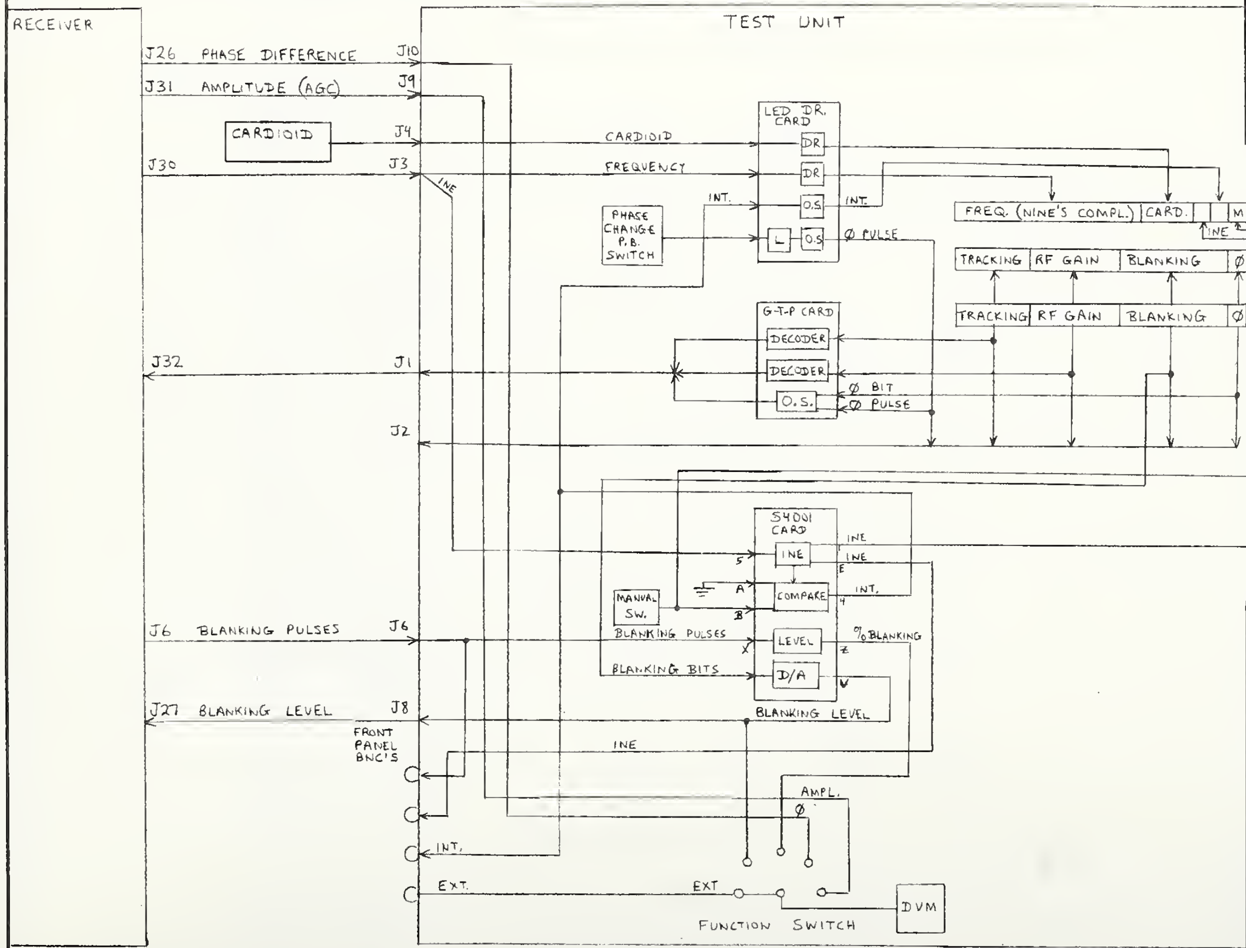

TEST UNIT WITH RECEIVER (ONLY)

FIGURE 2

ORIGINAL DATE OF DRAWING 5-1-73			
REVISIONS			
NO	E C N	CHANGE	DATE
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PIECE NO	NOMENCLATURE	NO REQ'D

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TEST UNIT WITH RECEIVER (ONLY)

FOR

MODEL	TYPE	SCALE
DIMENSIONS IN INCHES (Unless otherwise specified)	DRAFTSMAN	CHECKER
TOLERANCES (Unless otherwise specified)	PROJECT ENGR	PROJECT ENGR
DECIMALS ±.005 FRACTIONS ±.015 ANGLES ±½°	SUBMITTED BY	CHIEF, SEC.
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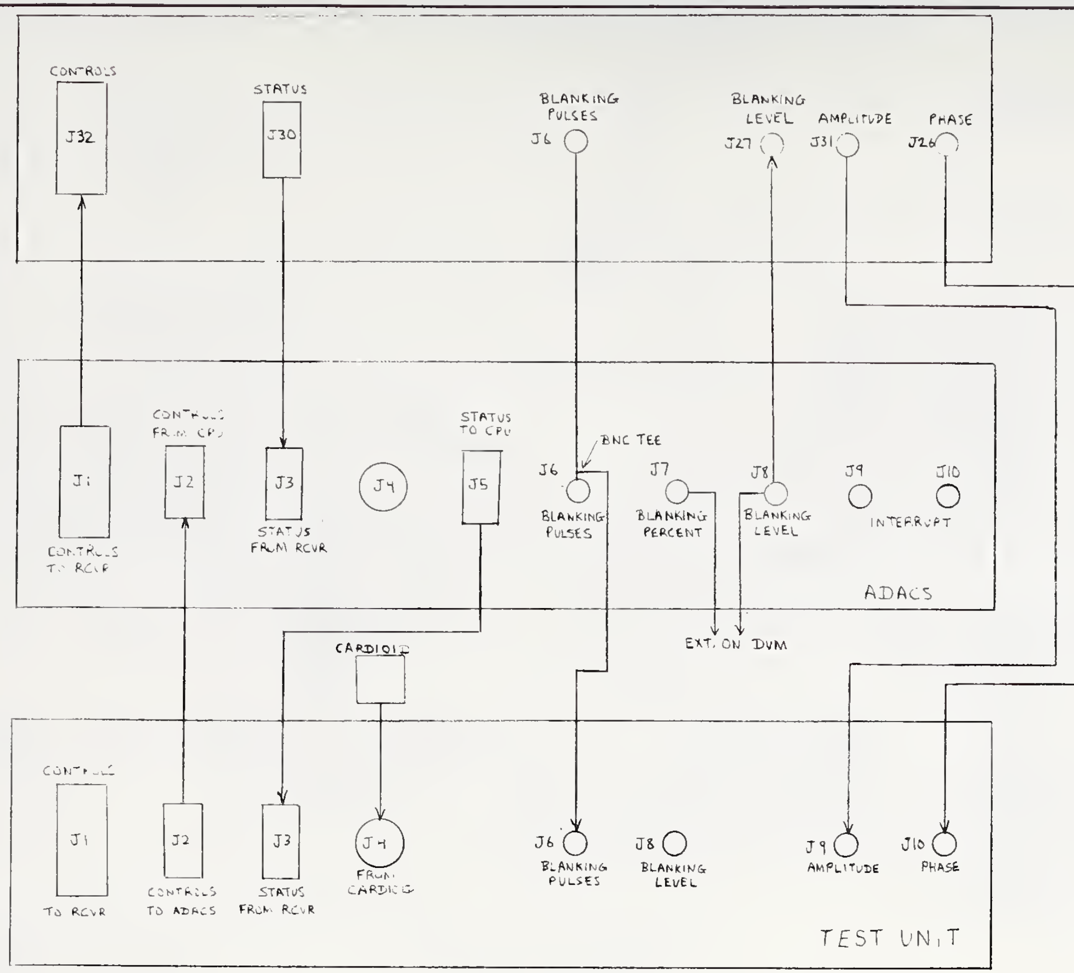

TEST UNIT CABLING TO RECEIVER AND ADACS

FIGURE 3

ORIGINAL DATE OF DRAWING

REVISIONS			
NO	E C N	CHANGE	DATE
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PIECE NO | NOMENCLATURE | NO REQ'D

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WASHINGTON, D. C. 20234

TEST UNIT CABLING TO RECEIVER & ADACS

FOR

MODEL | TYPE | SCALE

DIMENSIONS IN INCHES (Unless otherwise specified)

TOLERANCES (Unless otherwise specified)

DECIMALS ±.005
FRACTIONS ±.016
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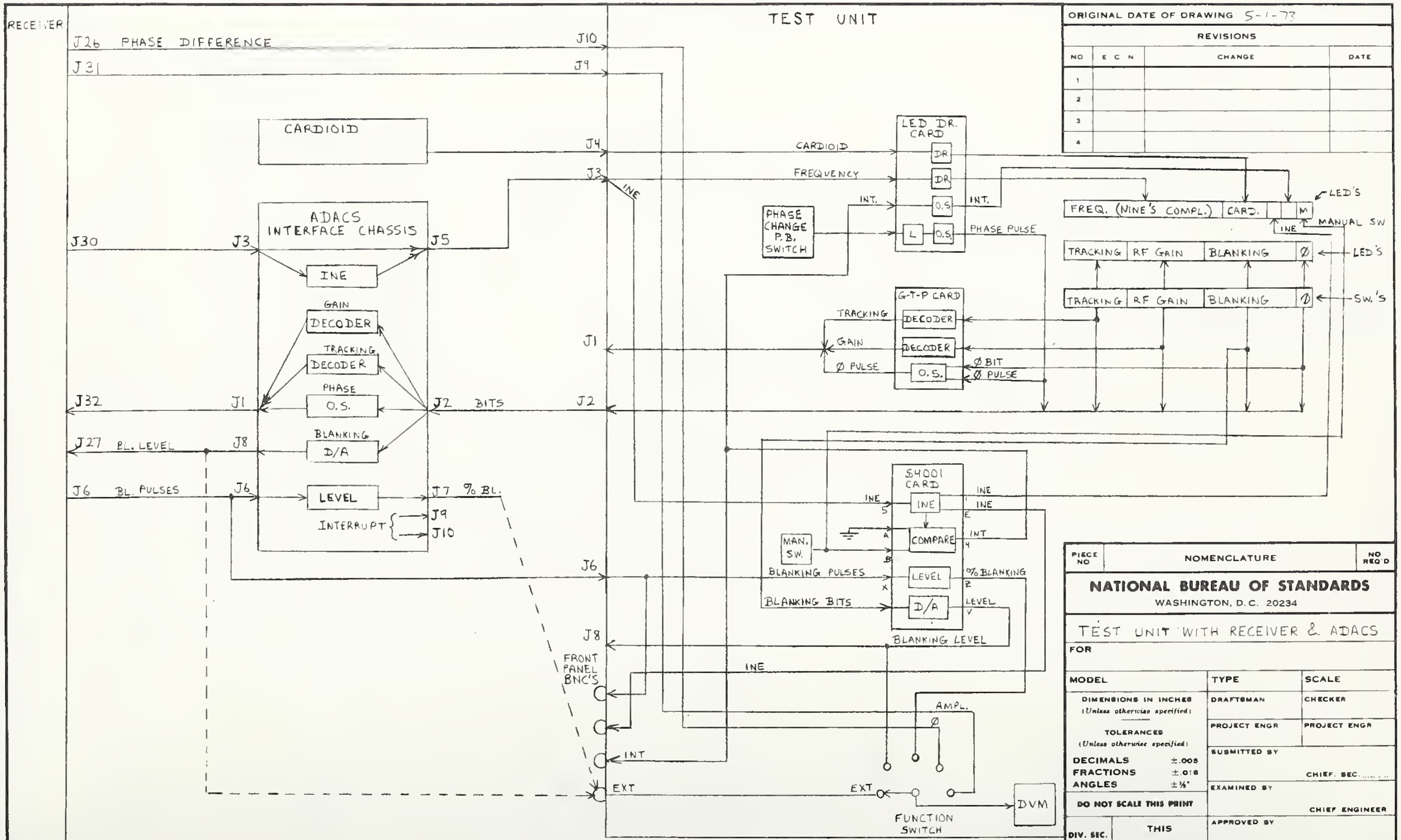
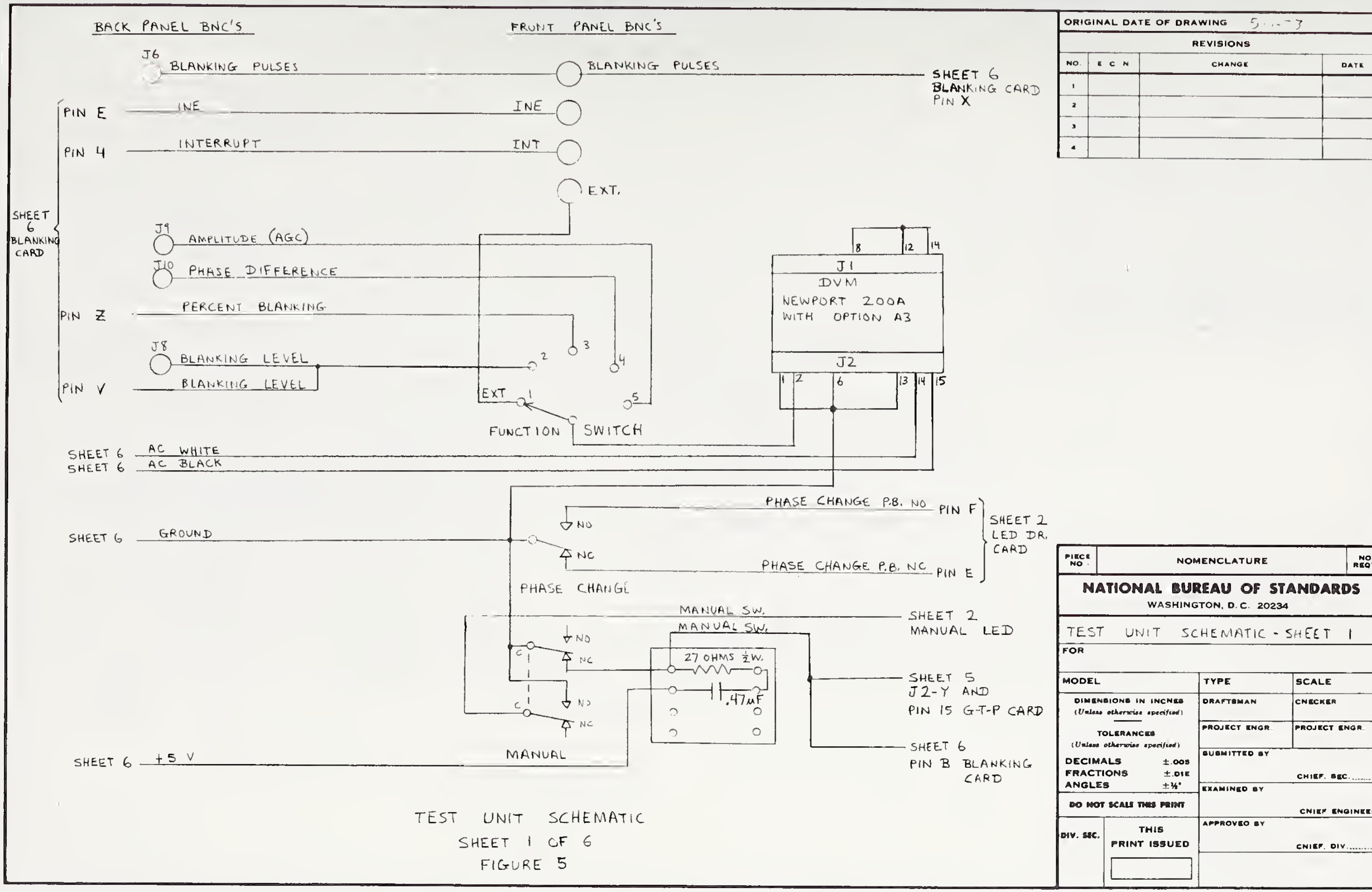
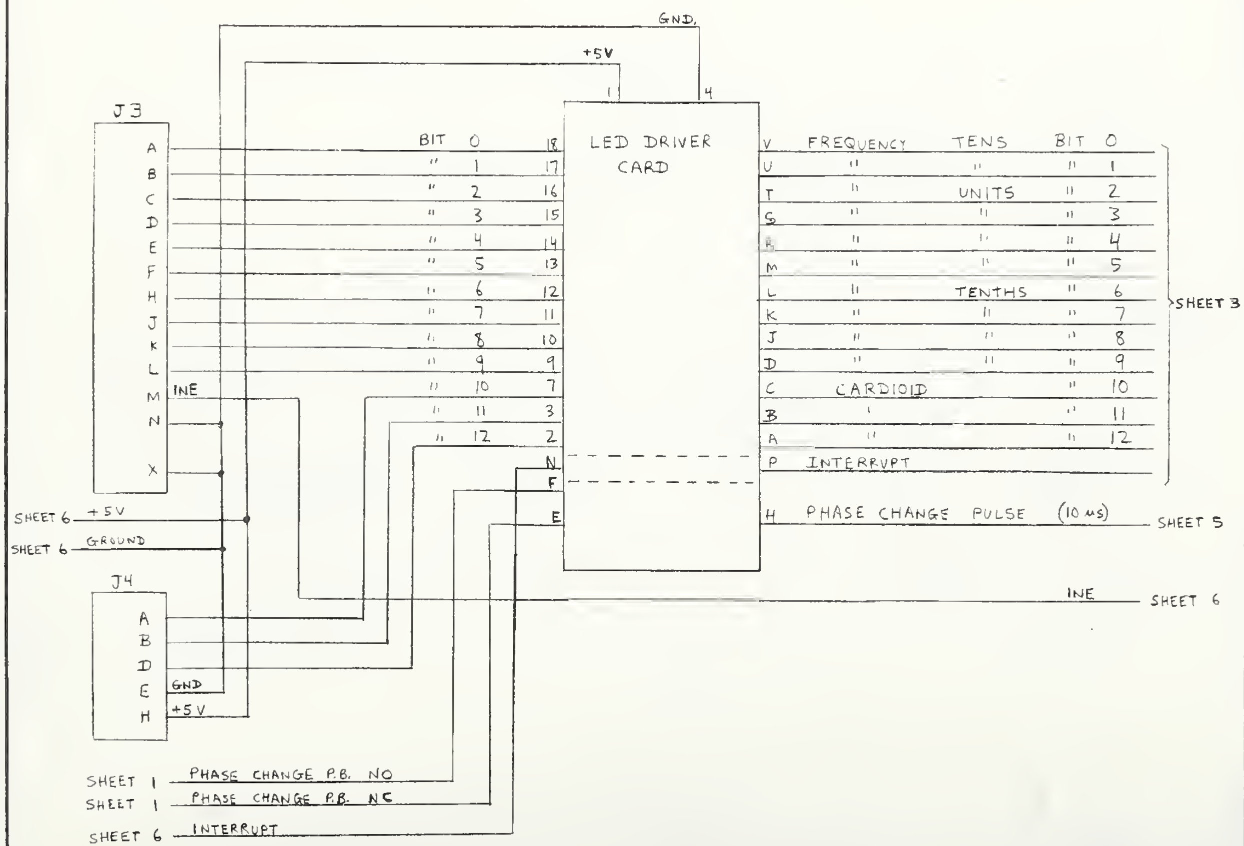


TEST UNIT WITH RECEIVER AND ADACS
FIGURE 4



TEST UNIT SCHEMATIC
SHEET 1 OF 6
FIGURE 5



TEST UNIT SCHEMATIC
SHEET 2 OF 6
FIGURE 6

ORIGINAL DATE OF DRAWING 5-1-73			
REVISIONS			
NO	E C N	CHANGE	DATE
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PIECE NO	NOMENCLATURE	NO REQ'D
	NATIONAL BUREAU OF STANDARDS WASHINGTON, D.C. 20234	
	TEST UNIT SCHEMATIC - SHEET 2	
	FOR	

MODEL	TYPE	SCALE
DIMENSIONS IN INCHES (Unless otherwise specified)	DRAFTSMAN	CHECKER
TOLERANCES (Unless otherwise specified)	PROJECT ENGR	PROJECT ENGR
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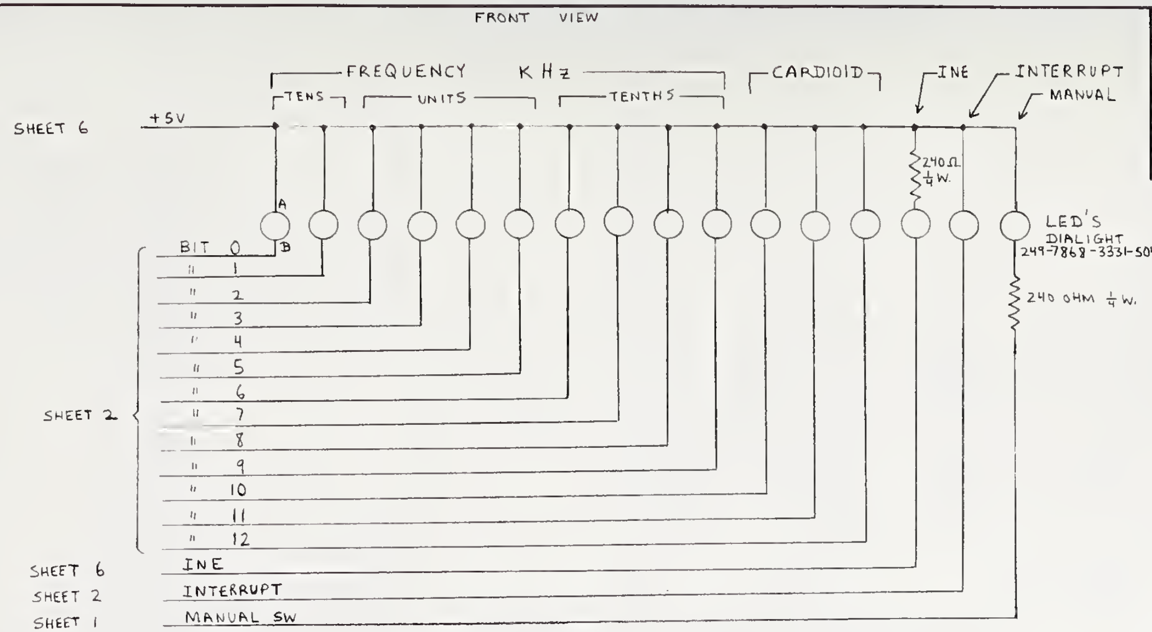

ORIGINAL DATE OF DRAWING 5-1-73

REVISIONS

NO	E C N	CHANGE	DATE
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PIECE NO.	NOMENCLATURE	NO REQ'D

NATIONAL BUREAU OF STANDARDS
WASHINGTON, D. C. 20234

TEST UNIT SCHEMATIC - SHEET 3

FOR

MODEL	TYPE	SCALE
DIMENSIONS IN INCHES (Unless otherwise specified)	DRAFTSMAN	CHECKER
TOLERANCES (Unless otherwise specified)	PROJECT ENGR	PROJECT ENGR
DECIMALS ±.008 FRACTIONS ±.018 ANGLES ±½°	SUBMITTED BY CHIEF, SEC	
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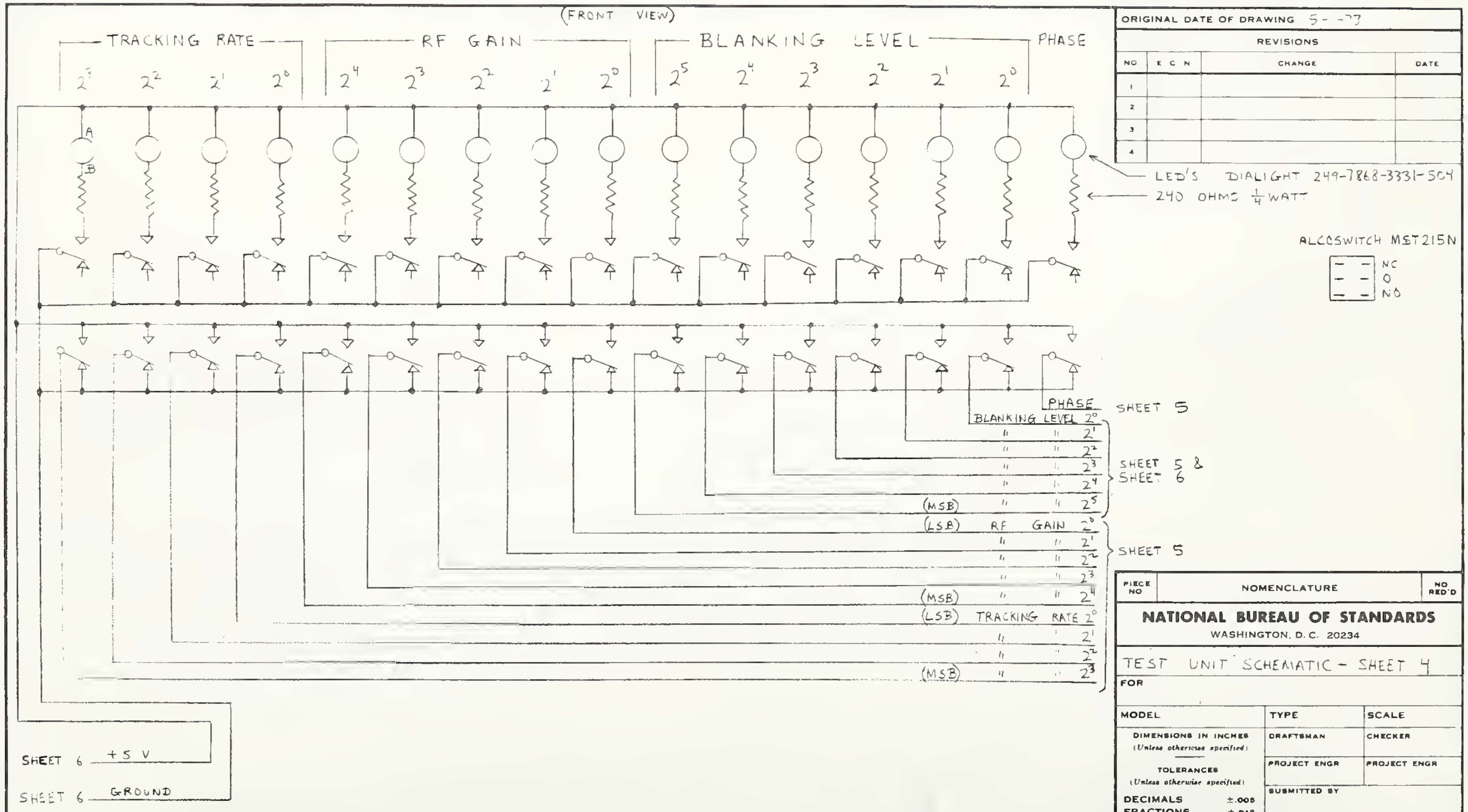
TEST UNIT SCHEMATIC
SHEET 3 OF 6
FIGURE 7



ORIGINAL DATE OF DRAWING 5- -77		
REVISIONS		

NO	E C N	CHANGE	DATE
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PIECE NO	NOMENCLATURE	NO REQ'D

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TEST UNIT SCHEMATIC – SHEET 4
FOR

MODEL	TYPE	SCALE
DIMENSIONS IN INCHES (Unless otherwise specified)	DRAFTSMAN	CHECKER
TOLERANCES (Unless otherwise specified)	PROJECT ENGR	PROJECT ENGR
DECIMALS ±.005 FRACTIONS ±.015 ANGLES ±½°	SUBMITTED BY	CHIEF, SEC ......
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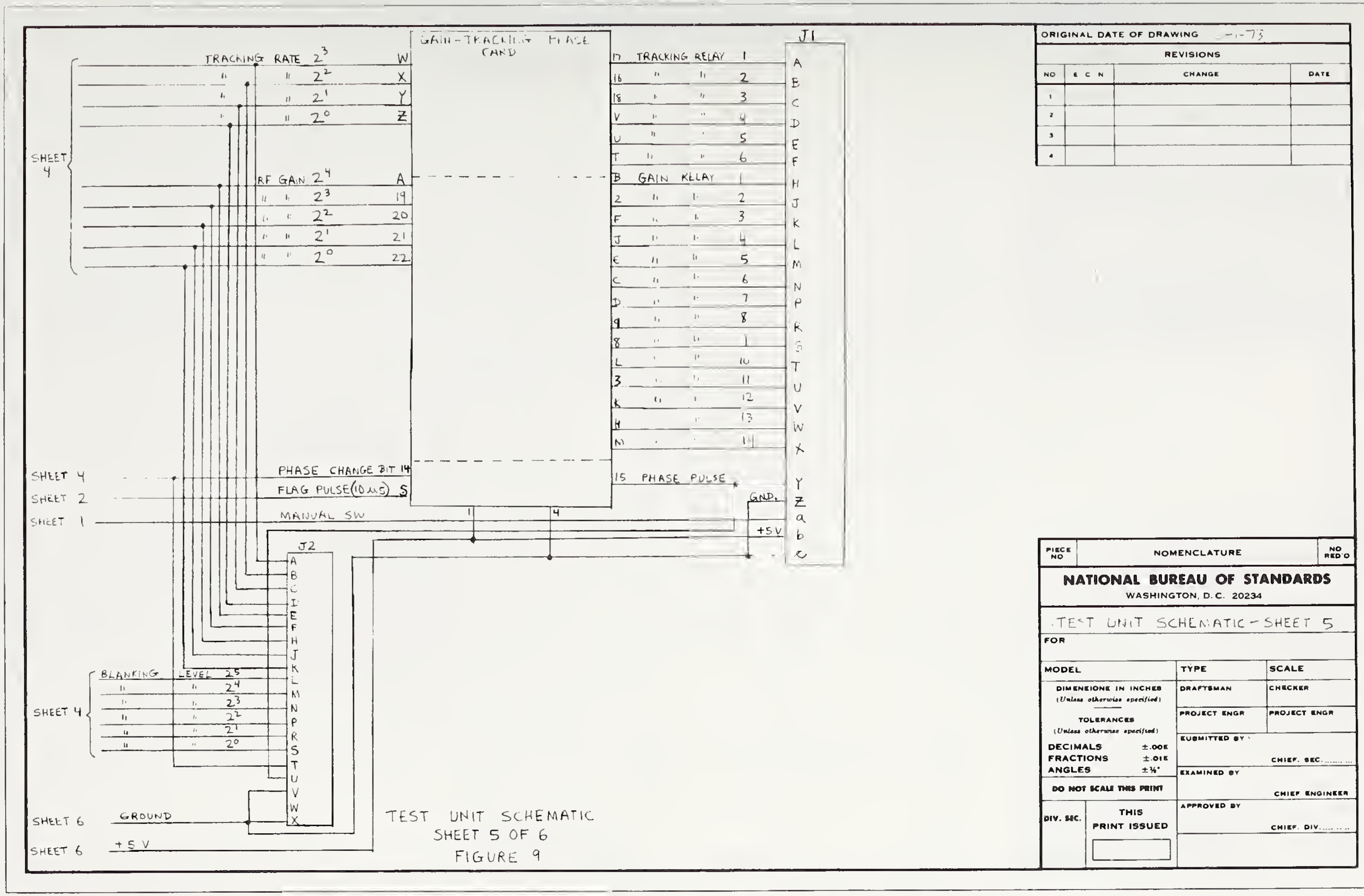
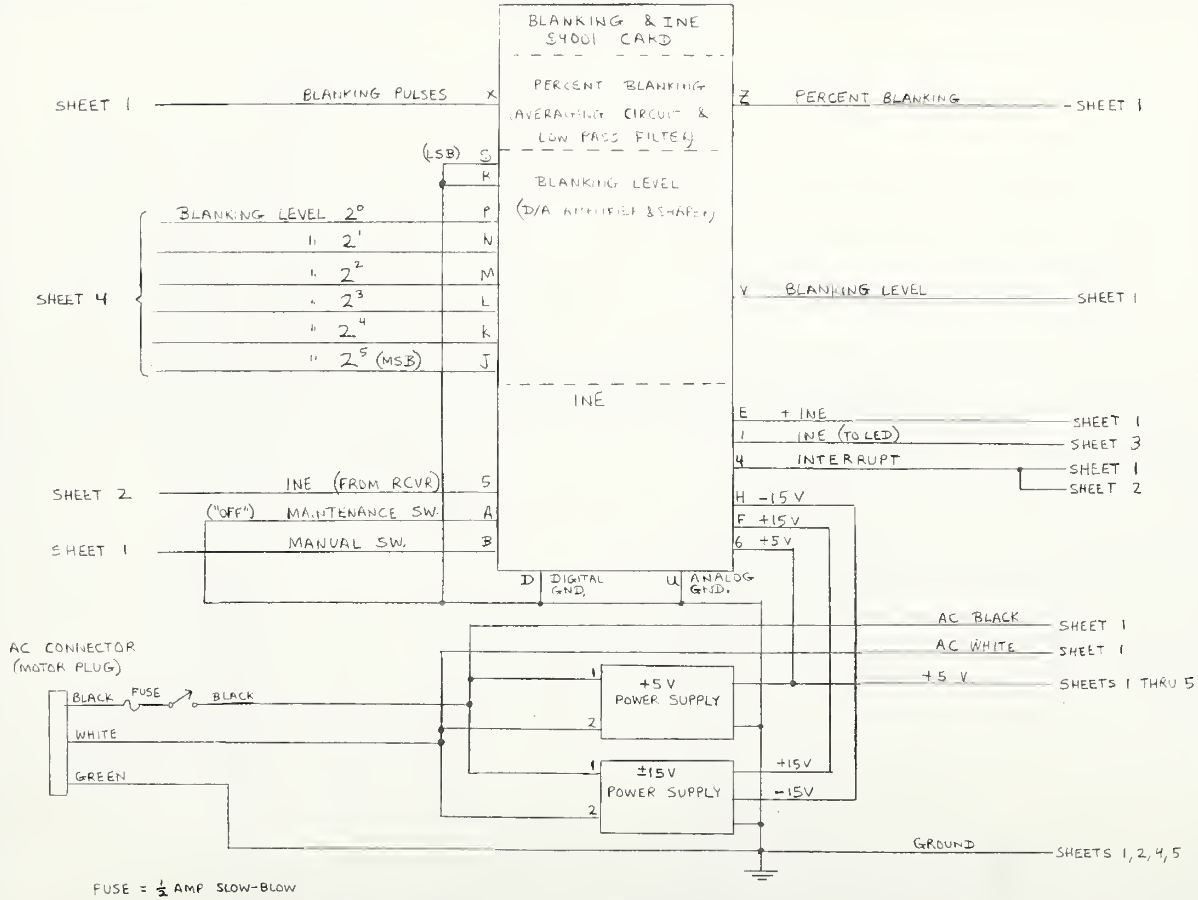
TEST UNIT SCHEMATIC
SHEET 4 OF 6
FIGURE 8



TEST UNIT SCHEMATIC
SHEET 5 OF 6
FIGURE 9



TEST UNIT SCHEMATIC
SHEET 6 OF 6
FIGURE 10

ORIGINAL DATE OF DRAWING 5 - 73

REVISIONS

NO	E C N	CHANGE	DATE
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TEST UNIT SCHEMATIC – SHEET 6

FOR

MODEL	TYPE	SCALE
DIMENSIONS IN INCHES (Unless otherwise specified)	DRAFTSMAN	CHECKER
TOLERANCES (Unless otherwise specified)	PROJECT ENGR	PROJECT ENGR
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TRACKING

STEP	CODE	RELAYS	TRACKING
1	0000	1 & 6	0.1
2	0001	2 & 6	0.15
3	0010	3 & 6	0.3
4	0011	4 & 6	0.5
5	0100	5 & 6	0.7
6	0101	1	1.0
7	0110	2	1.5
8	0111	3	3.0
9	1000	4	5.0
10	1001	5	7.0

GAIN

STEP	CODE	RELAYS	dB GAIN
1	00000	1	0
2	00001	2 & 3	5.
3	00010	2	6.
4	00011	3 & 4	10.
5	00100	3	12.
6	00101	4 & 5	15.
7	00110	4	18.
8	00111	5 & 6	21.
9	01000	5	24.
10	01001	6 & 7	27.
11	01010	6	30.
12	01011	7 & 8	33.
13	01100	7	36.
14	01101	8 & 9	39.
15	01110	8	42.
16	01111	9 & 10	45.
17	10000	9	48
18	10001	10 & 11	51.
19	10010	10	54.
20	10011	11 & 12	57.
21	10100	11	60.
22	10101	12 & 13	63.
23	10110	12	66.
24	10111	13 & 14	69.
25	11000	13	72.

TRACKING & GAIN CHART

FIGURE 11

ORIGINAL DATE OF DRAWING 5-1-73

REVISIONS

NO.	E C N	CHANGE	DATE
1			
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TRACKING AND GAIN CHART

FOR

MODEL | TYPE | SCALE

DIMENSIONS IN INCHES (Unless otherwise specified)

TOLERANCES (Unless otherwise specified)
DECIMALS ±.005
FRACTIONS ±.016
ANGLES ±½°

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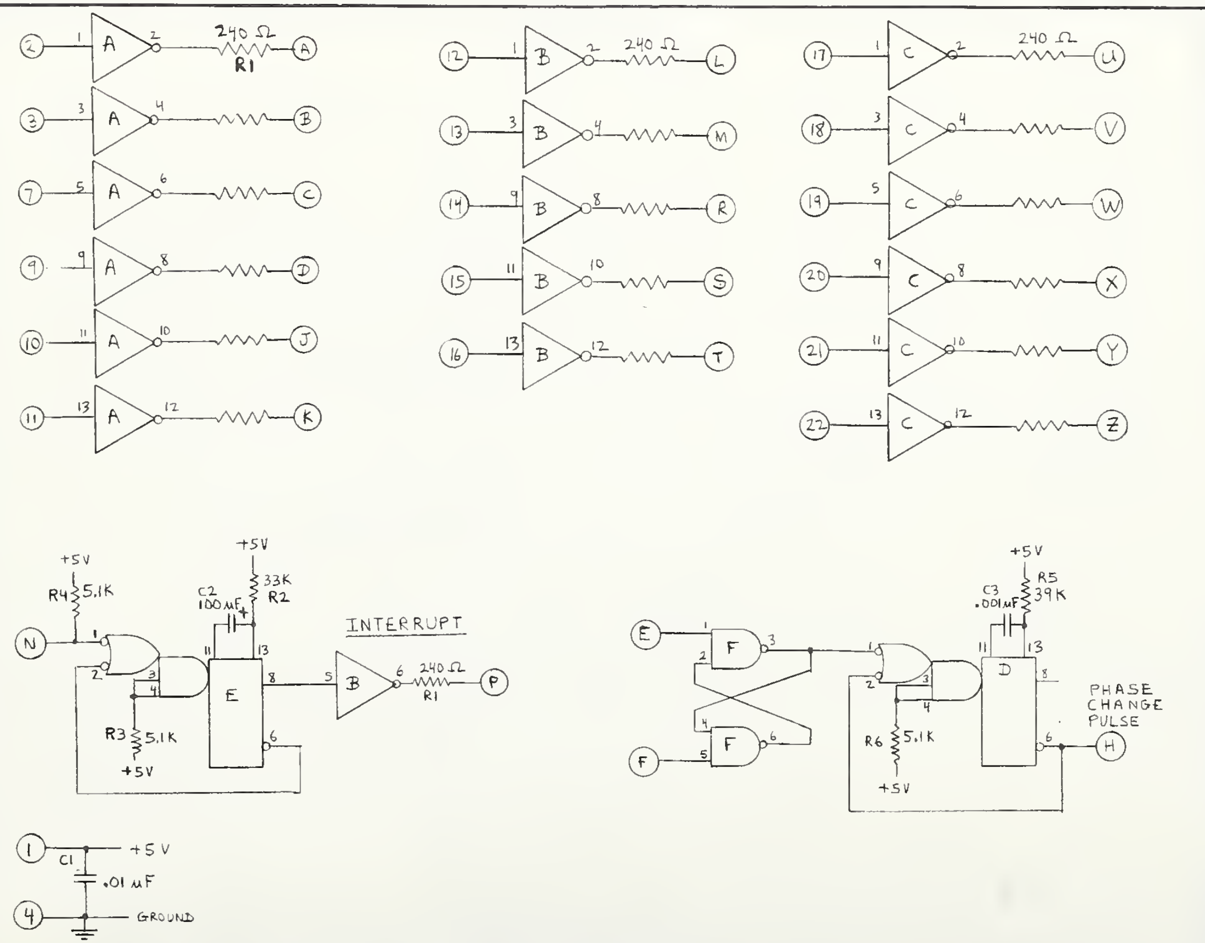

LED DRIVER CARD
FIGURE 12

ORIGINAL DATE OF DRAWING 5-73

REVISIONS

NO	E C N	CHANGE	DATE
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4			

A, B, C } SN7406N

D, E } F9601 ONE SHOT IC (FAIRCHILD)

F SN7400N

ALL RESISTORS ½ WATT

PIECE NO	NOMENCLATURE	NO REQ'D

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LED DRIVER CARD

FOR

MODEL	TYPE	SCALE
DIMENSIONS IN INCHES (Unless otherwise specified)	DRAFTSMAN	CHECKER
TOLERANCES (Unless otherwise specified)	PROJECT ENGR	PROJECT ENGR
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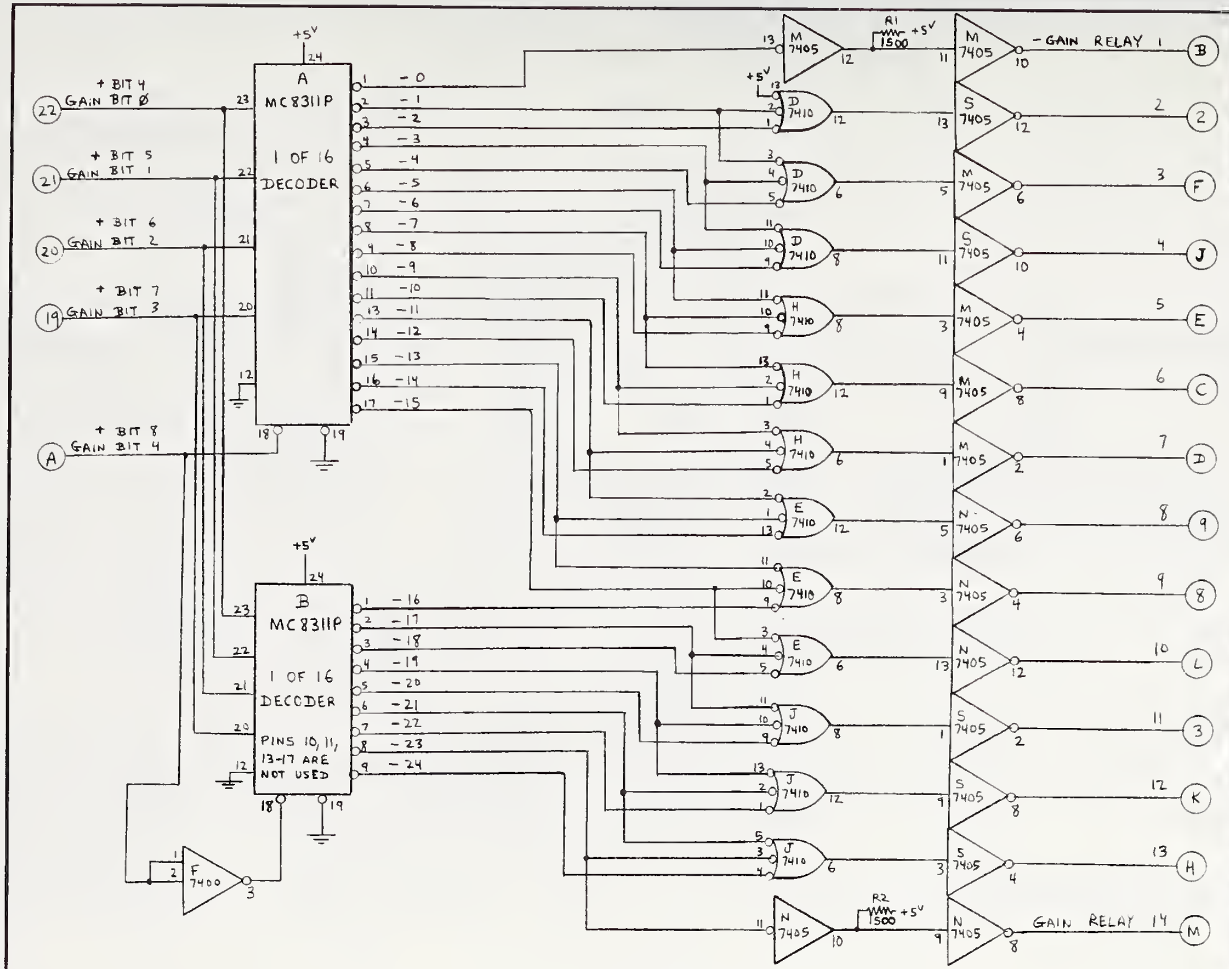

GAIN-TRACKING - PHASE CARD CIRCUITRY
SHEET 1 OF 2
FIGURE 13

ORIGINAL DATE OF DRAWING 5-1-73

REVISIONS

NO	E C N	CHANGE	DATE
1			
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4			

PIECE NO | NOMENCLATURE | NO REQ'D

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GAIN-TRACKING-PHASE CARD 1 OF 2

FOR

MODEL | TYPE | SCALE

DIMENSIONS IN INCHES (Unless otherwise specified)

TOLERANCES (Unless otherwise specified)

DECIMALS ±.005
FRACTIONS ±.015
ANGLES ±½°

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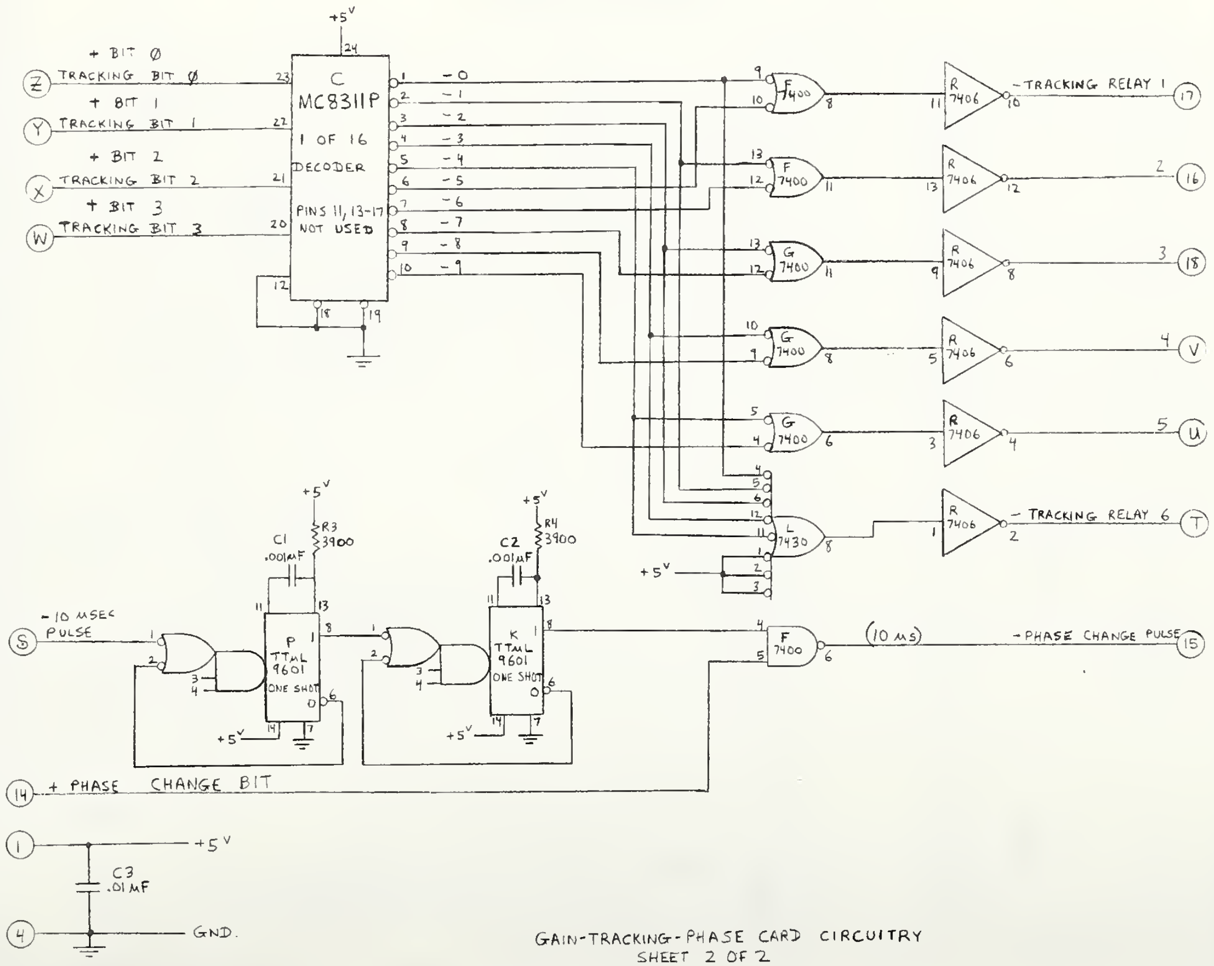

GAIN-TRACKING-PHASE CARD CIRCUITRY
SHEET 2 OF 2
FIGURE 14

ORIGINAL DATE OF DRAWING 5-1-73

REVISIONS			
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PIECE NO	NOMENCLATURE	NO REQ'D

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GAIN-TRACKING-PHASE CARD 2 OF 2
FOR

MODEL	TYPE	SCALE
DIMENSIONS IN INCHES (Unless otherwise specified)	DRAFTSMAN	CHECKER
TOLERANCES (Unless otherwise specified)	PROJECT ENGR	PROJECT ENGR
DECIMALS ±.002 FRACTIONS ±.016 ANGLES ±½°	SUBMITTED BY CHIEF, SEC.	
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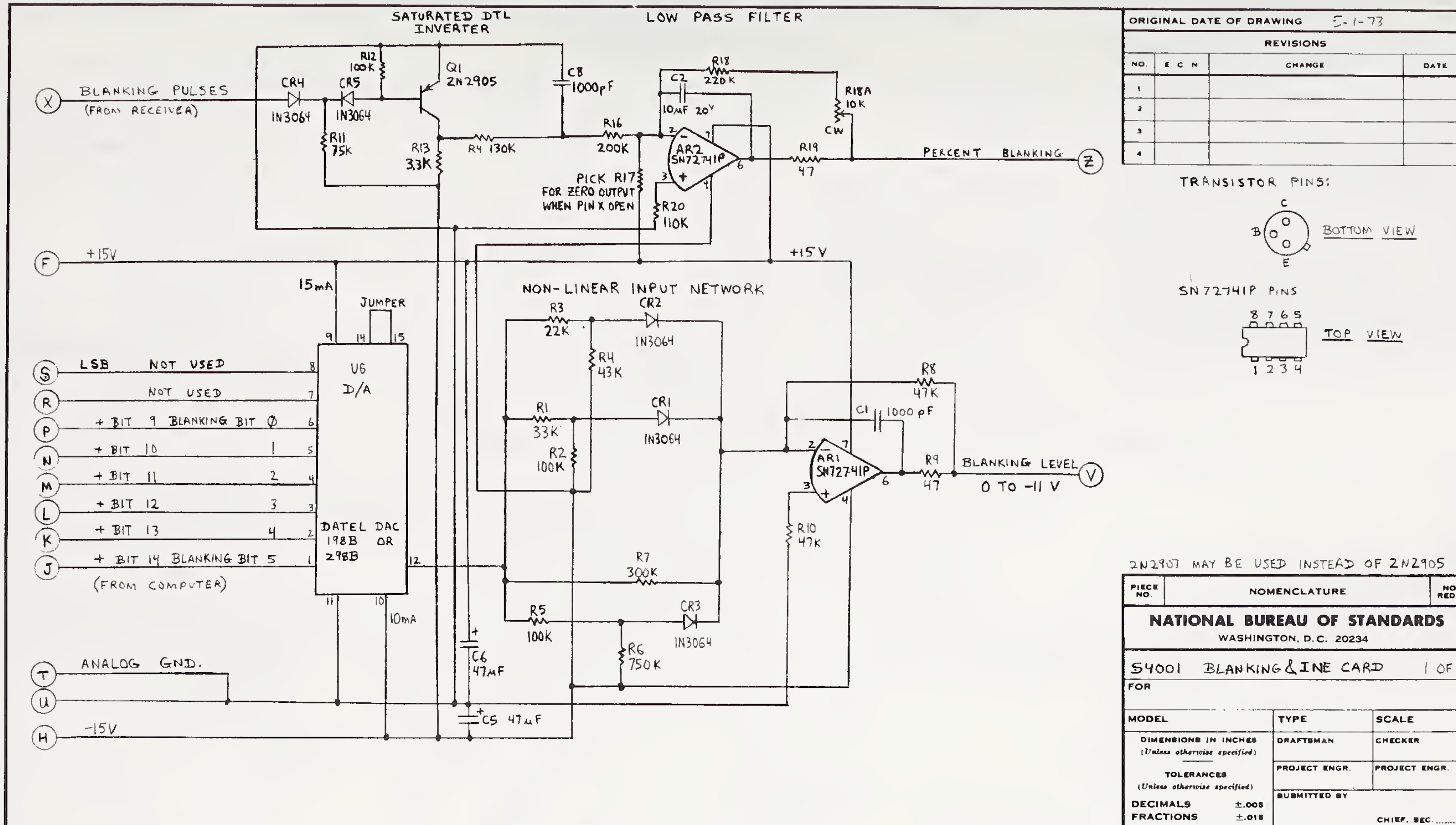
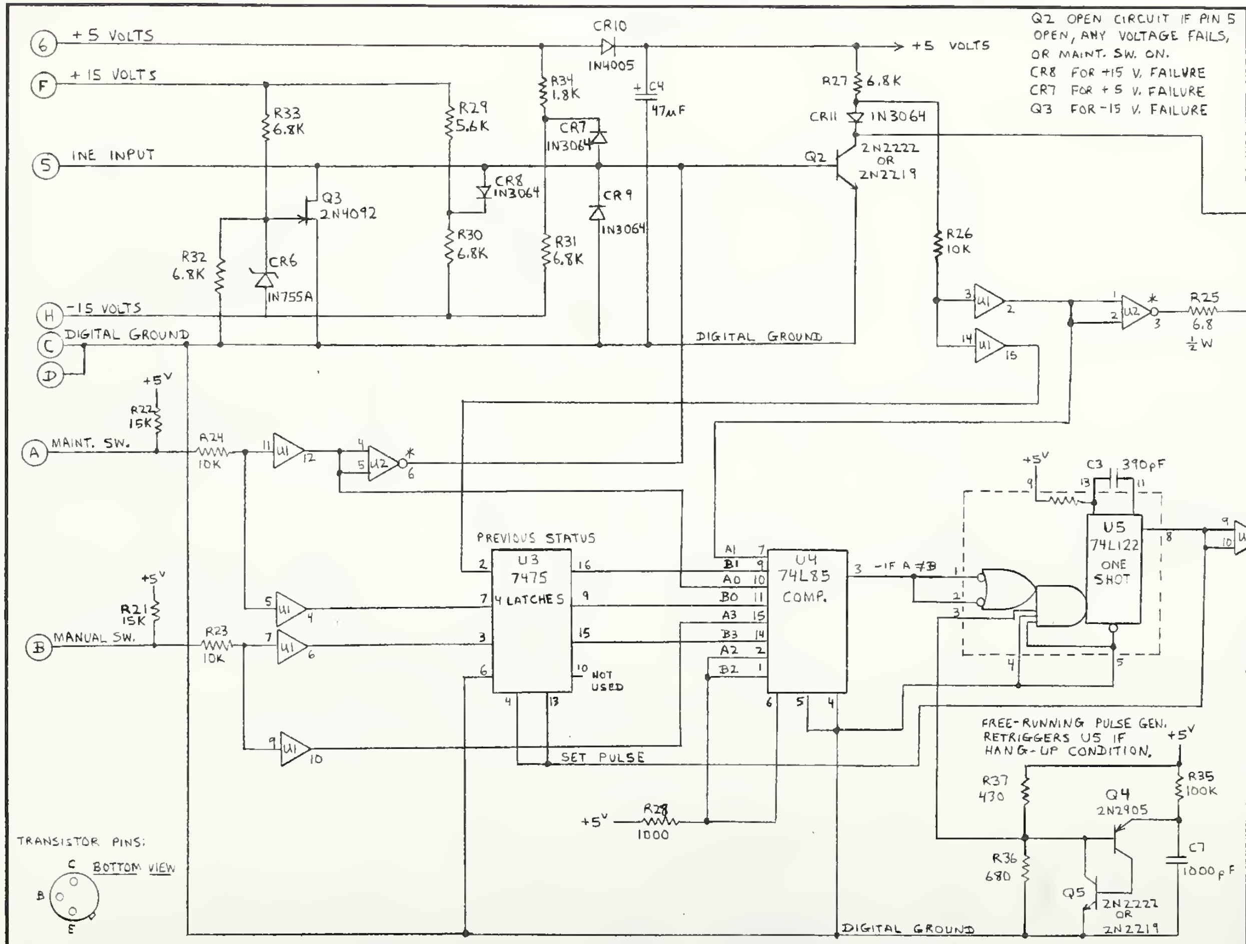


S4001
BLANKING & INE CARD CIRCUITRY
SHEET 1 OF 2
FIGURE 15



S4001
BLANKING & INE CARD CIRCUITRY
SHEET 2 OF 2
FIGURE 16

ORIGINAL DATE OF DRAWING	5-1-73		
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PIECE NO	NOMENCLATURE	NO. REQ'D

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S4001 BLANKING & INE CARD 2 OF 2

FOR

MODEL	TYPE	SCALE
DIMENSIONS IN INCHES (Unless otherwise specified)	DRAFTSMAN	CHECKER
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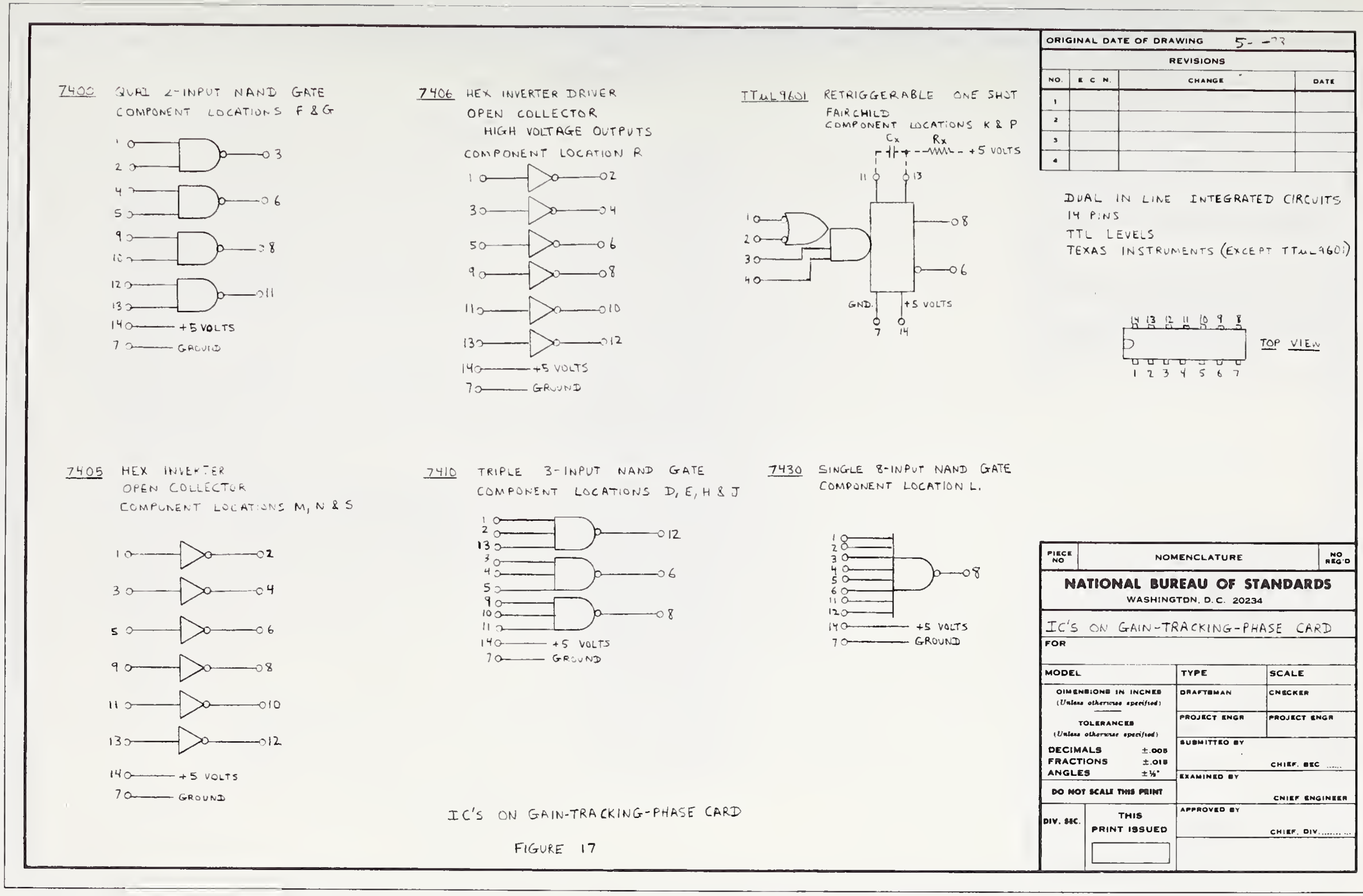
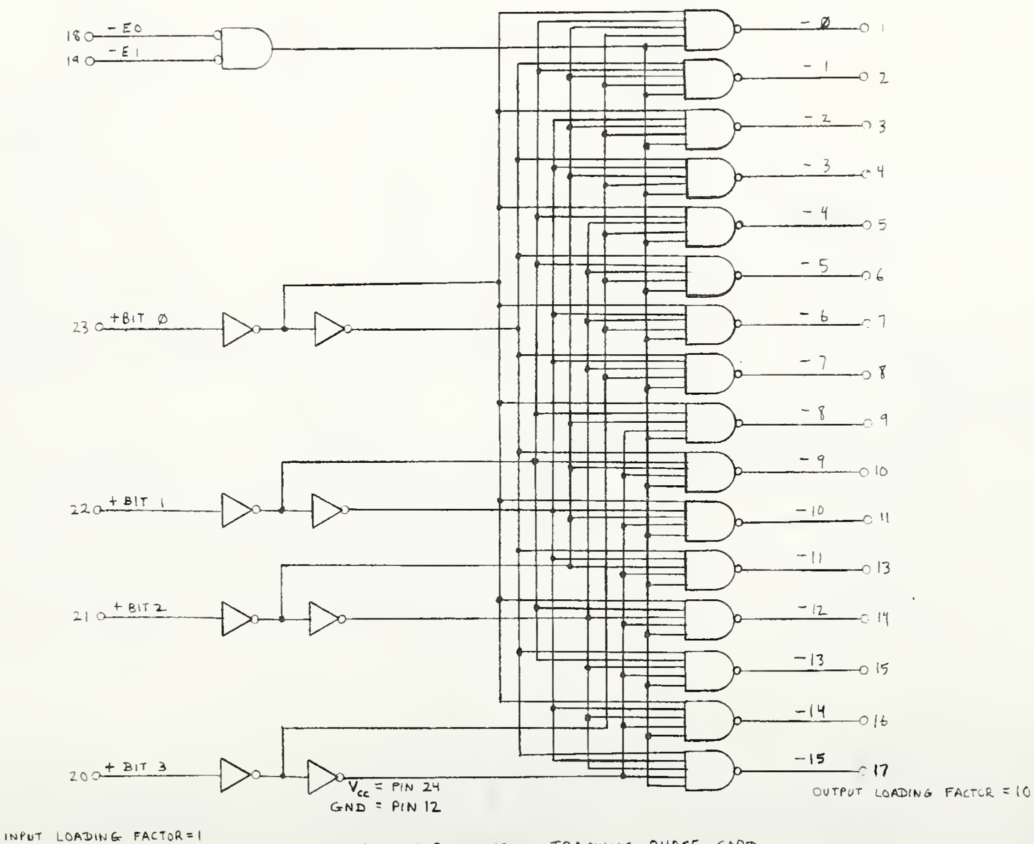


IC'S ON GAIN-TRACKING-PHASE CARD

FIGURE 17



MC8311P ON GAIN-TRACKING-PHASE CARD
SHEET 1 OF 2
FIGURE 18

MOTOROLA MC8311P
TTL LEVELS
175 MW. POWER DISSIPATION

GAIN-TRACKING-PHASE CARD
COMPONENT LOCATIONS A, B & C.

ORIGINAL DATE OF DRAWING 5-1-73

REVISIONS			
NO	E C N	CHANGE	DATE
1			
2			
3			
4			

PIECE NO	NOMENCLATURE	NO REQ'D

NATIONAL BUREAU OF STANDARDS
WASHINGTON, D. C. 20234

MC8311P ON GAIN-TRACKING-PHASE CARD

FOR

MODEL	TYPE	SCALE
DIMENSIONS IN INCHES (Unless otherwise specified)	DRAFTSMAN	CHECKER
TOLERANCES (Unless otherwise specified)	PROJECT ENGR	PROJECT ENGR
DECIMALS ±.005 FRACTIONS ±.01E ANGLES ±½°	SUBMITTED BY CHIEF, SEC.	
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INPUT					OUTPUT															
EI	D	C	B	A	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
0	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
0	1	0	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
0	1	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
0	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
0	1	1	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
0	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
0	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

0 = GROUND

1 = +V

MC 8311P ON GAIN-TRACKING-PHASE CARD
SHEET 2 OF 2

FIGURE 19

ORIGINAL DATE OF DRAWING 5-1-73

REVISIONS			
NO	E C N	CHANGE	DATE
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4			

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NATIONAL BUREAU OF STANDARDS
WASHINGTON, D.C. 20234

MC 8311P ON GAIN-TRACKING-PHASE CARD

FOR

MODEL | TYPE | SCALE

DIMENSIONS IN INCHES (Unless otherwise specified)
TOLERANCES (Unless otherwise specified)
DECIMALS ±.005
FRACTIONS ±.015
ANGLES ±½°

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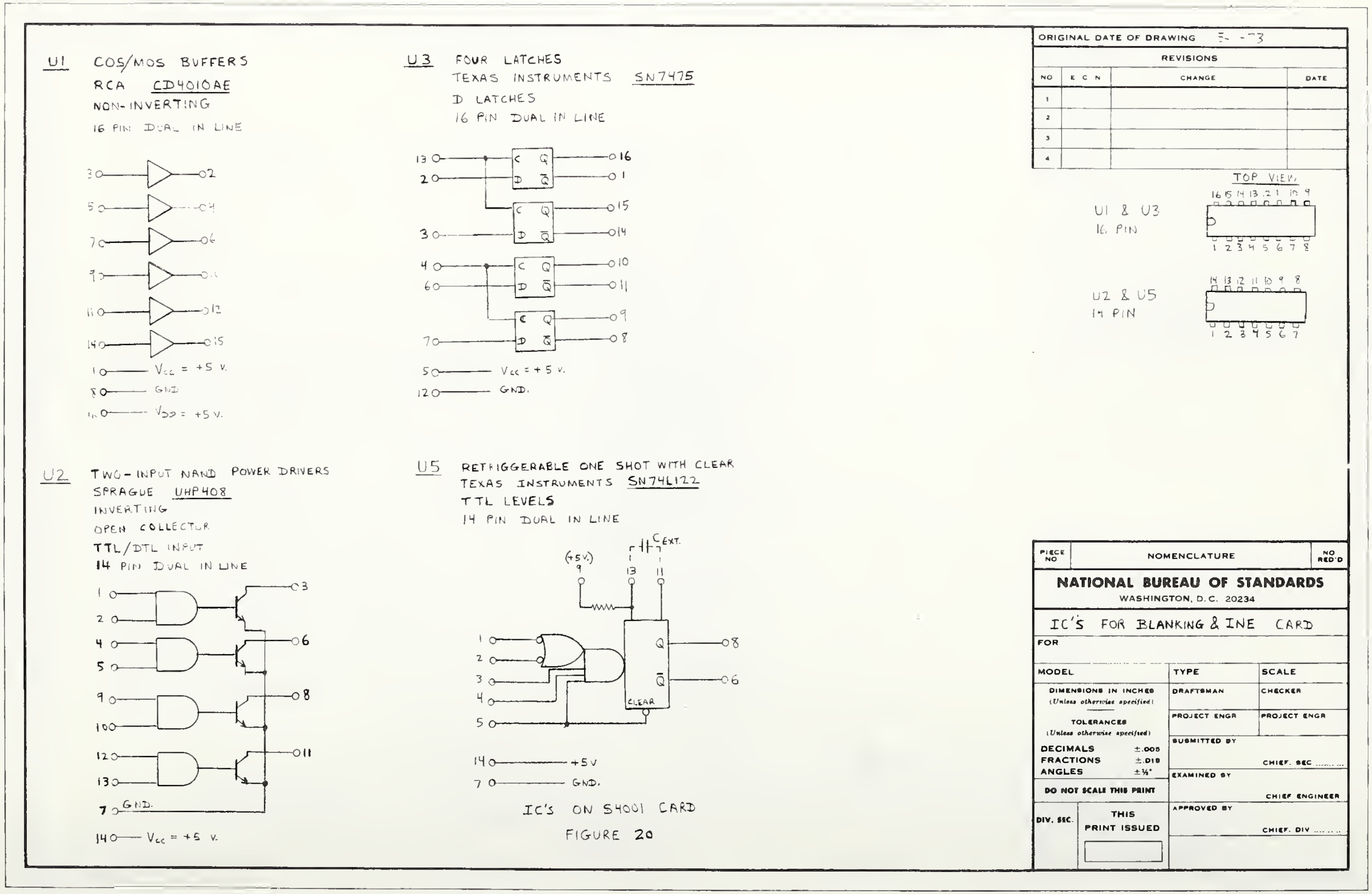
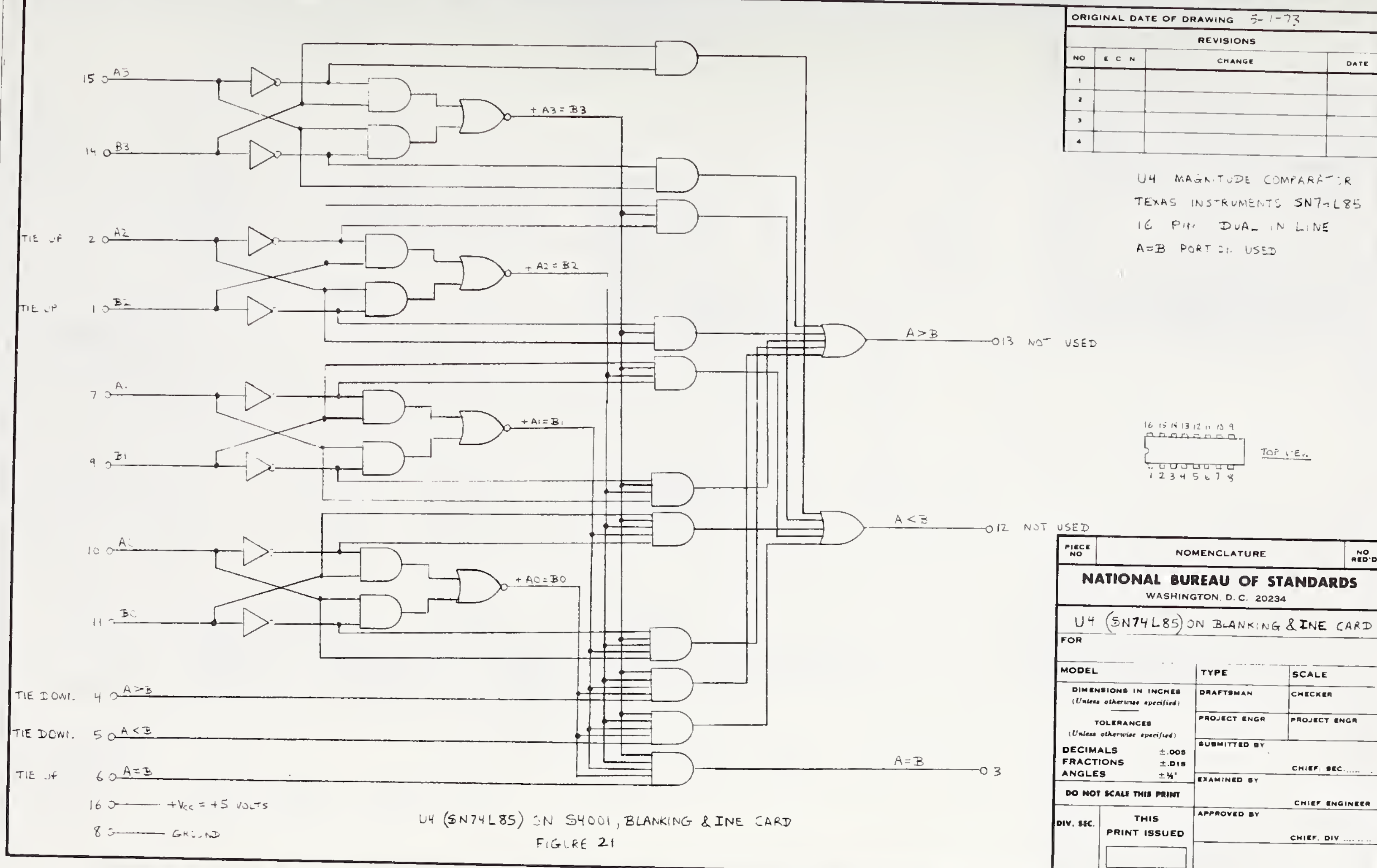


IC'S ON S4001 CARD

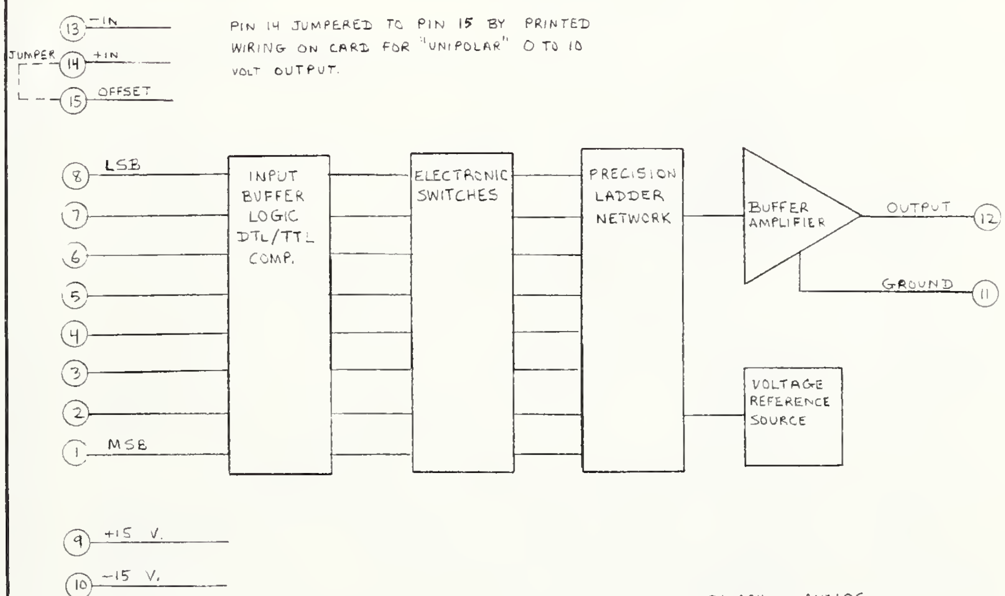
FIGURE 20

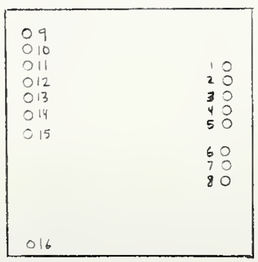


U4 (SN74L85) ON S4001, BLANKING & INE CARD

FIGURE 21

PIN 14 JUMPERED TO PIN 15 BY PRINTED WIRING ON CARD FOR "UNIPOLAR" 0 TO 10 VOLT OUTPUT.





BINARY INPUT	ANALOG OUTPUT
1111 1111	+9.96 VOLTS
1110 0000	+8.7
1100 0000	+7.5
1000 0000	+5.0
0100 0000	+2.5
0010 0000	+1.2
0000 0000	0.0

U6 ON S4001 CARD

FIGURE 22

ORIGINAL DATE OF DRAWING 5-\-73

REVISIONS

NO	E C N	CHANGE	DATE
1			
2			
3			
4			

DIGITAL TO ANALOG CONVERTER - 8 BITS
DATEL DAC 198B OR 298B BINARY
OUTPUT SETTLING TIME 20 μSEC. TO ±0.2%
DTL/TTL LOGIC LEVELS FOR INPUT
OUTPUT 0 TO 10 VOLTS @ 5 MA
POWER INPUT ±15 VOLTS @ ±20 MA.
SIZE 2"×2"×0.4"

PIECE NO | NOMENCLATURE | NO REQ'D

NATIONAL BUREAU OF STANDARDS
WASHINGTON, D.C. 20234

U6 ON BLANKING & INE CARD

FOR

MODEL | TYPE | SCALE

DIMENSIONS IN INCHES (Unless otherwise specified)

TOLERANCES (Unless otherwise specified)
DECIMALS ±.005
FRACTIONS ±.015
ANGLES ±½°

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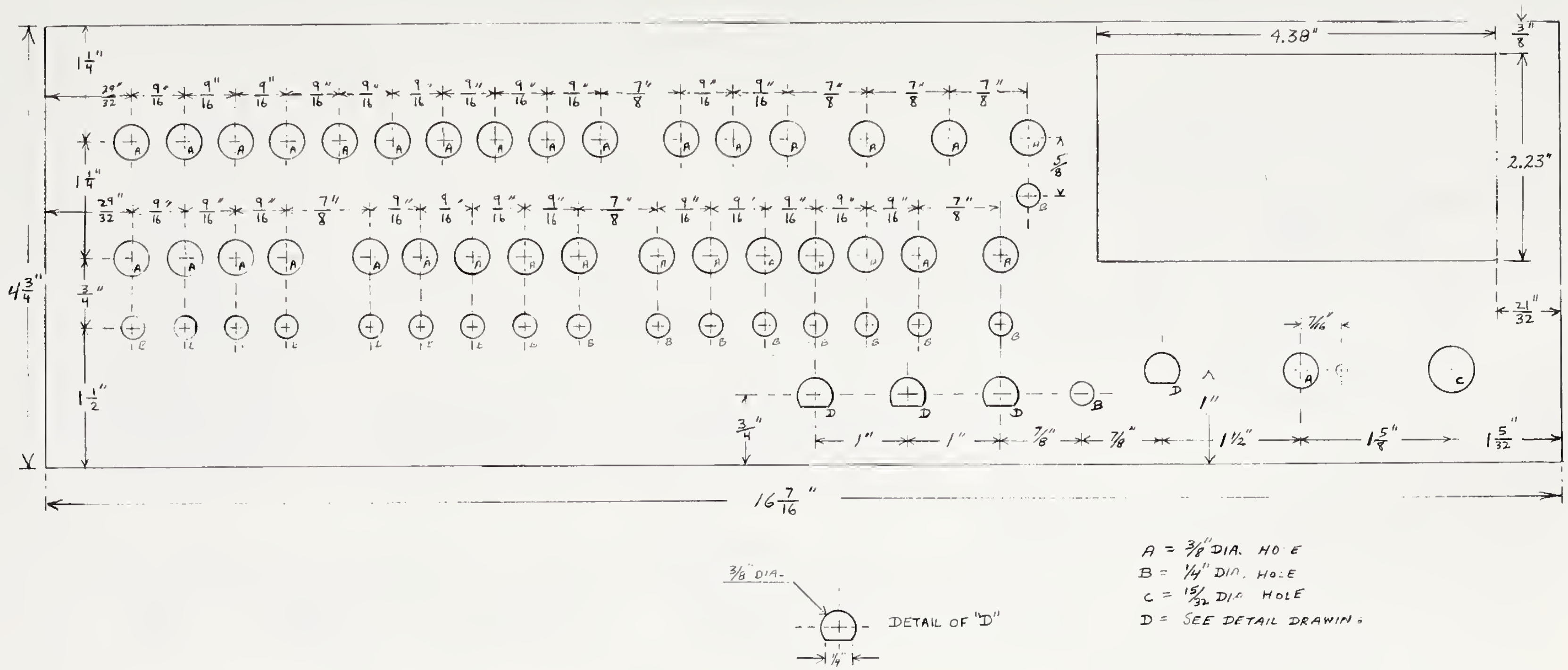
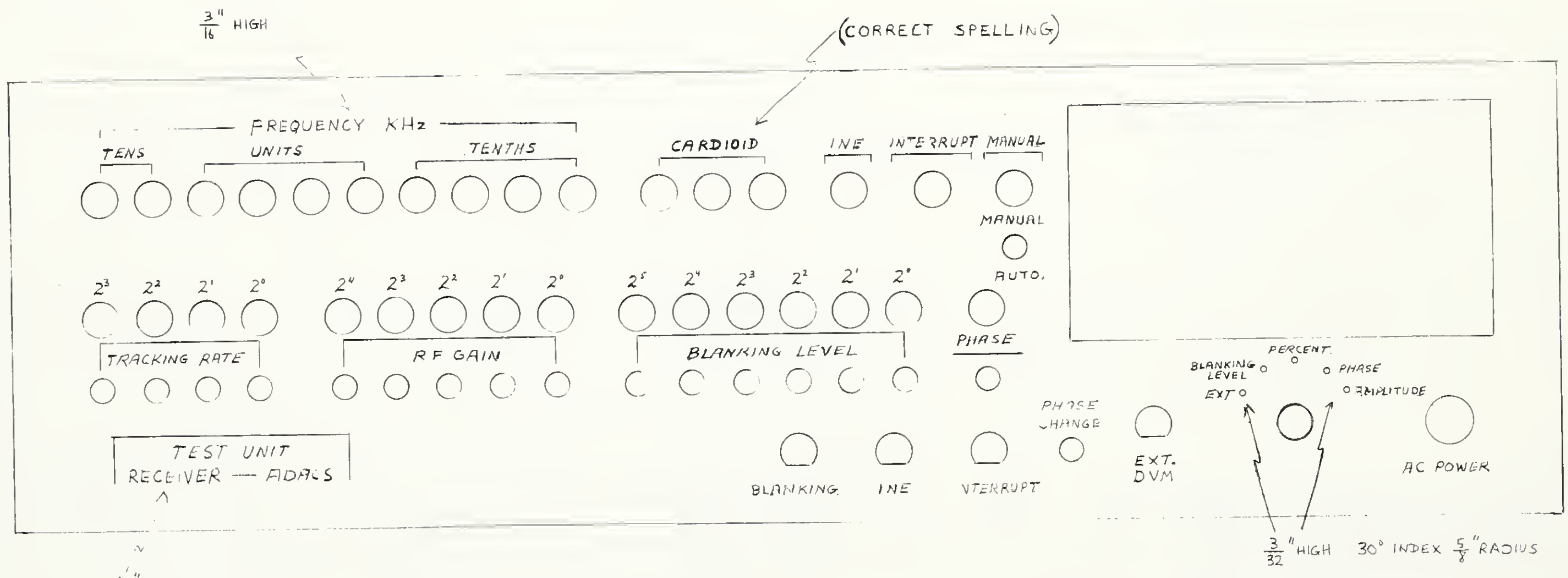


TEST UNIT FRONT PANEL - HOLES

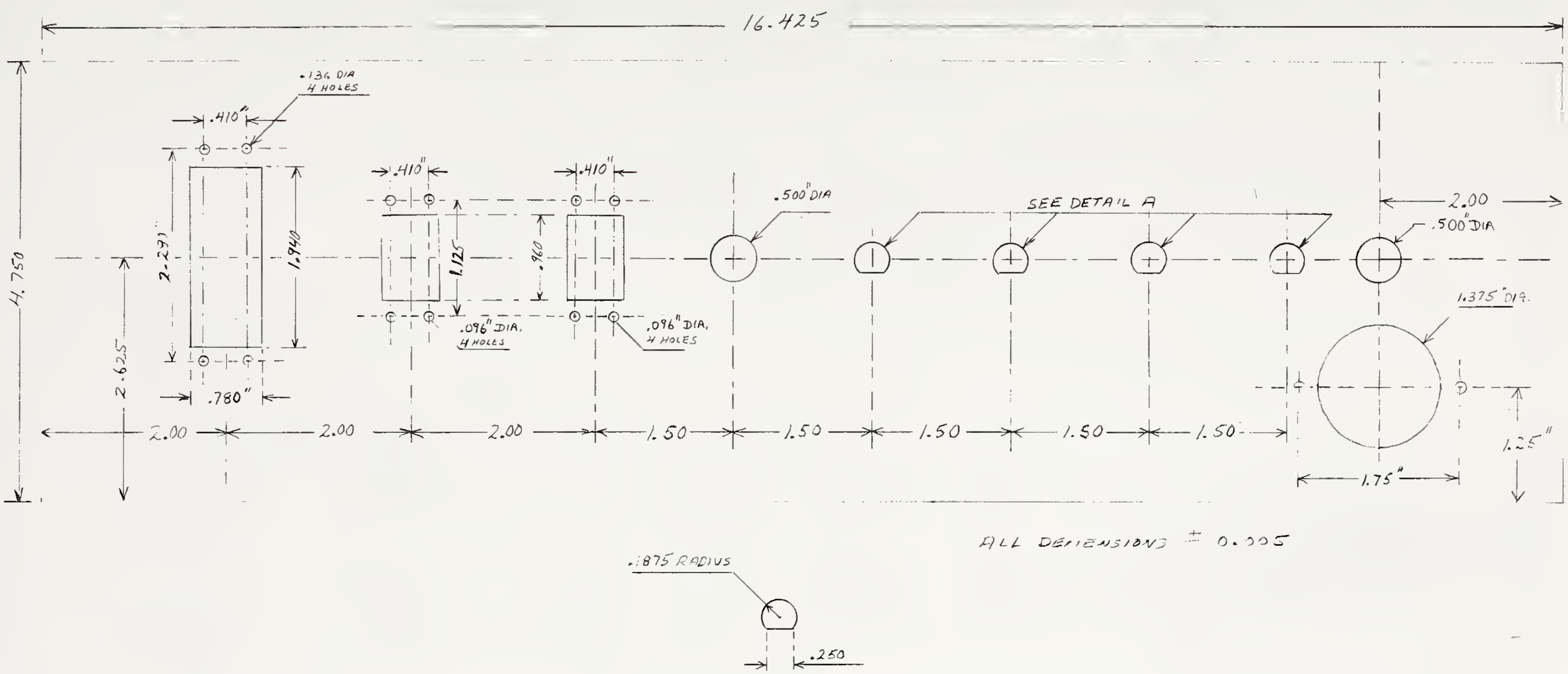
FIGURE 23



ALL LETTERING BLACK.
ALL LETTERING 1/8" HIGH EXCEPT AS NOTED.

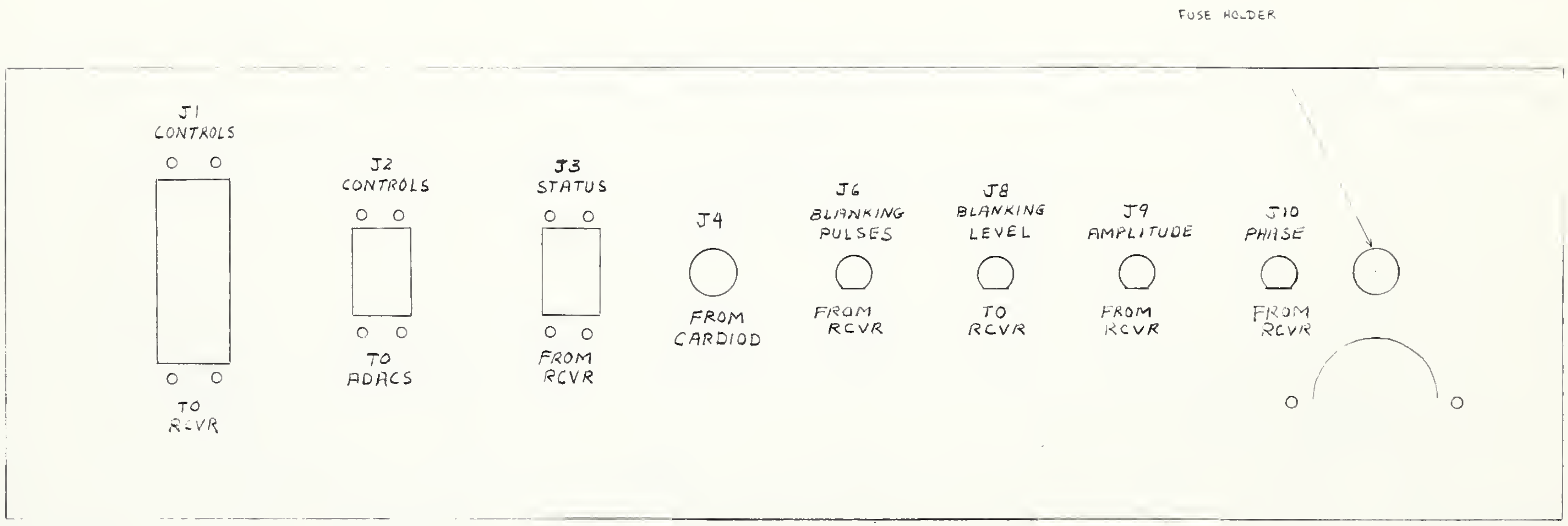
TEST UNIT FRONT PANEL – LETTERING

FIGURE 24



TEST UNIT BACK PANEL - HOLES

FIGURE 25



ALL LETTERING BLACK; $\frac{1}{8}''$ HIGH; CENTERED $\frac{3}{16}''$ ABOVE/BELOW CIRCULAR HOLES AND CENTERED $\frac{3}{8}''$ ABOVE/BELOW RECTANGULAR HOLES.

TEST UNIT BACK PANEL - LETTERING

FIGURE 26

ORIGINAL DATE OF DRAWING			
REVISIONS			
NO	E C N	CHANGE	DATE
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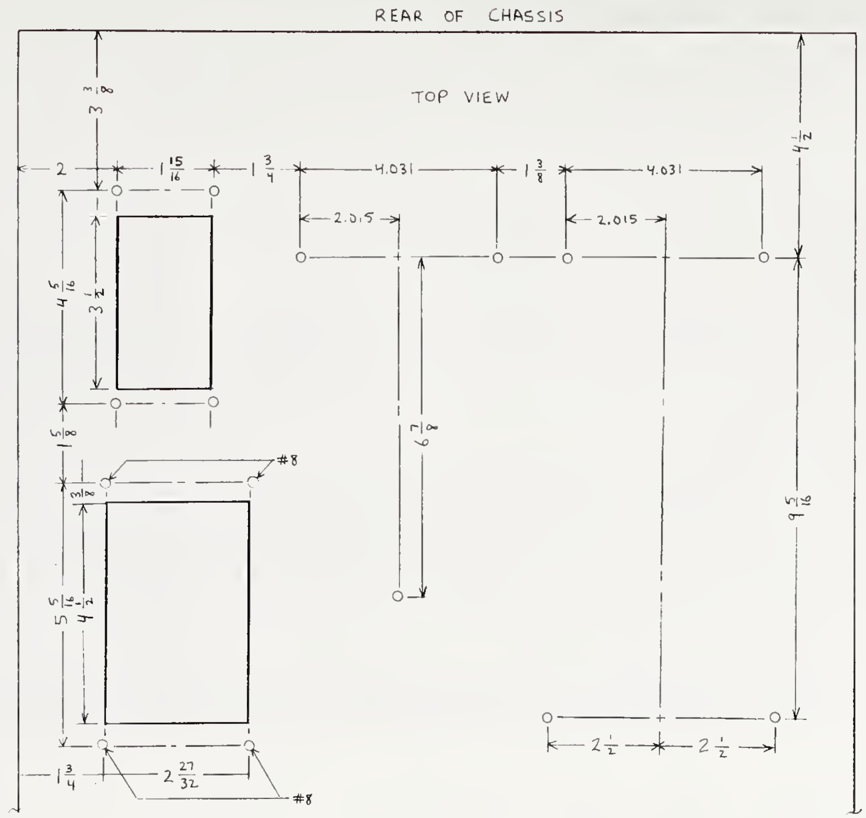

CUT TWO RECTANGULAR HOLES AS SHOWN.
ALL ROUND HOLES DRILLED FOR #6 SCREW EXCEPT AS NOTED.
COUNTERSINK ALL ROUND HOLES FOR FLAT HEAD SCREWS.
ALL DIMENSIONS IN INCHES. MEASURE FROM OUTSIDE OF CHASSIS.

TEST UNIT CHASSIS

FIGURE 27

PIECE NO	NOMENCLATURE	NO REQ'D
	NATIONAL BUREAU OF STANDARDS WASHINGTON, D.C. 20234	
	TEST UNIT CHASSIS	
FOR		

MODEL	TYPE	SCALE
DIMENSIONS IN INCHES (Unless otherwise specified)	DRAFTSMAN	CHECKER
TOLERANCES (Unless otherwise specified)	PROJECT ENGR.	PROJECT ENGR
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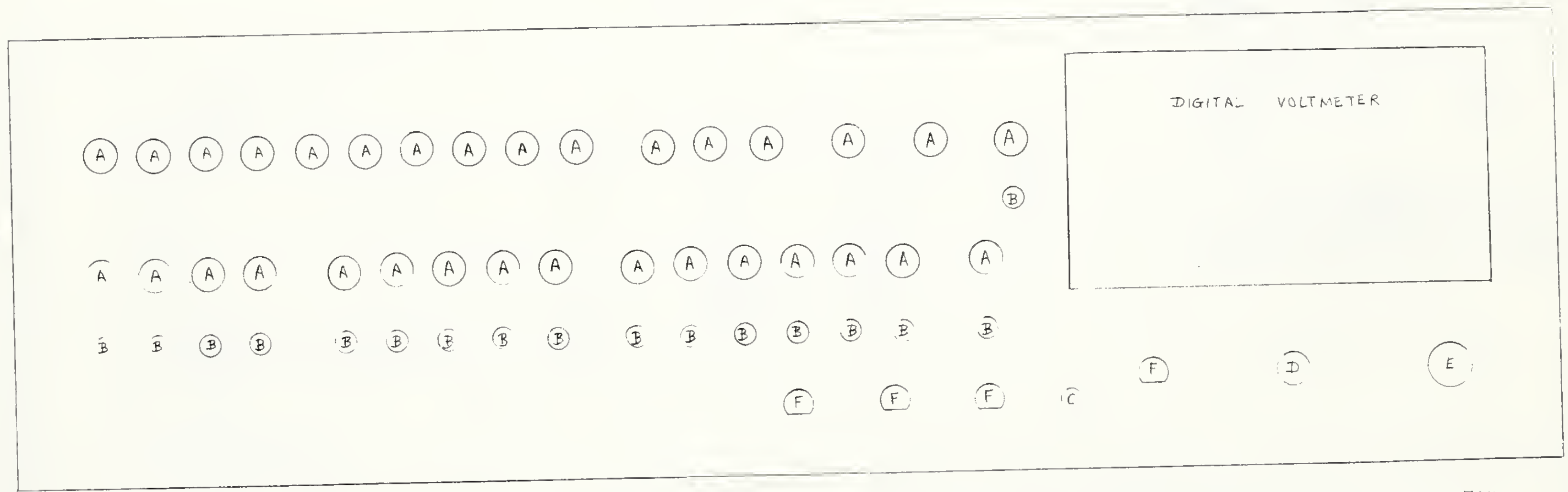
FRONT VIEW

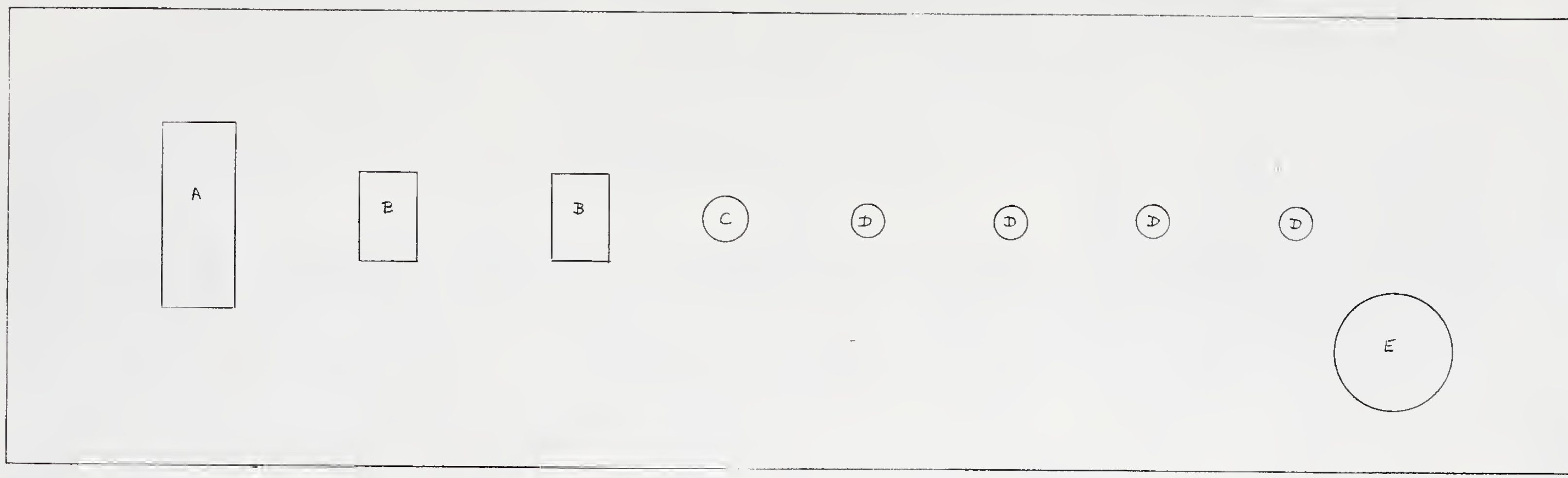


A LIGHT EMITTING DIODE, DIALIGHT 249-7868-3331-504
B ALCOSWITCH MST-205N
C MICROSWITCH 2PBII-T2
D CENTRALAB. PA2001 5 POSITION, 1 POLE, NON-SHORTING
E J-B-T ST22N TOGGLE SWITCH
F AMPHENOL 31-221 BNC CONNECTORS

TEST UNIT FRONT PANEL - COMPONENTS

FIGURE 28

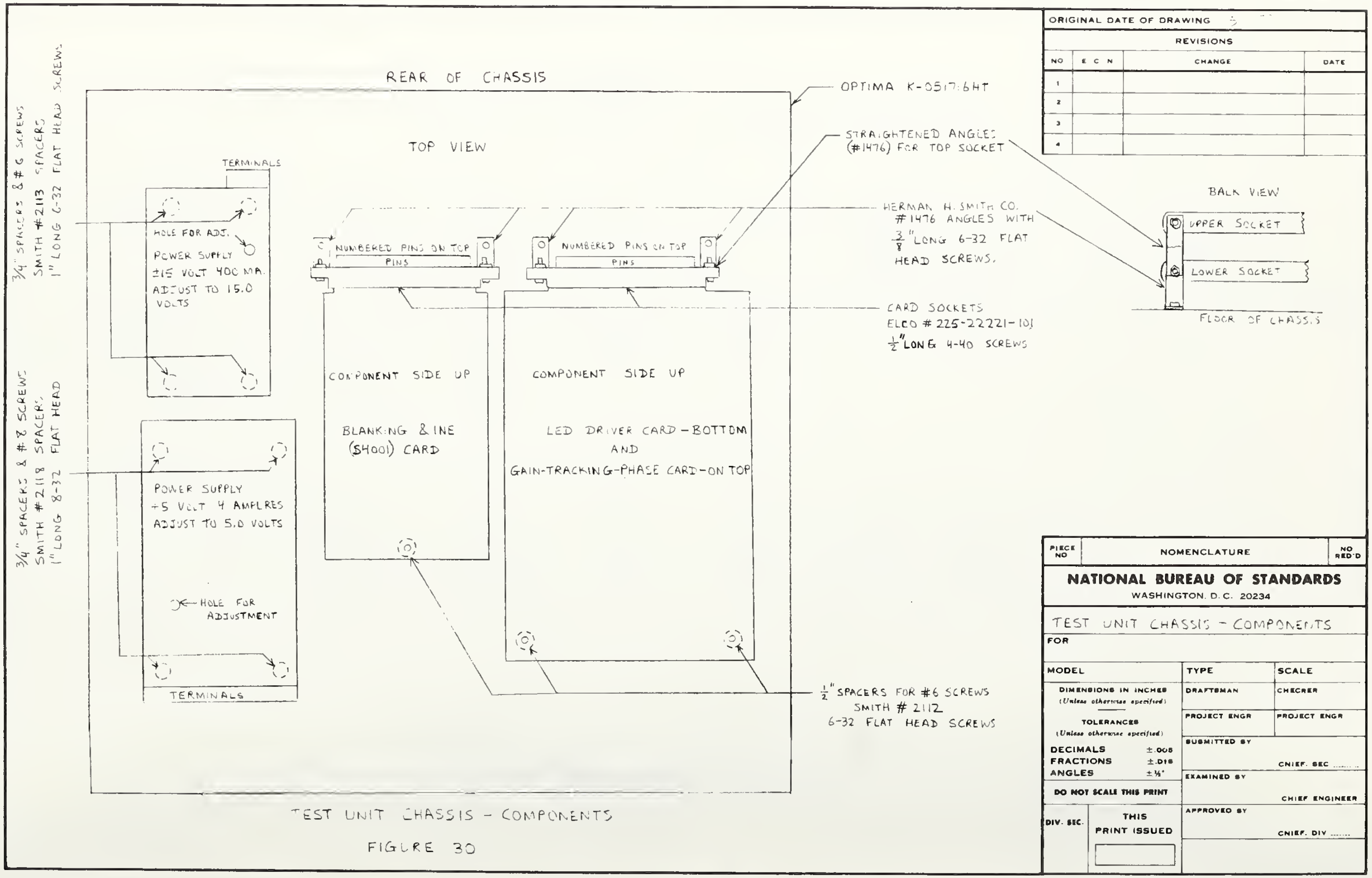
BACK VIEW



A	ELCO	00-8016-056-000-001	56-PIN CONNECTOR
B	ELCO	00-8016-020-000-707	20-PIN CONNECTOR
C	AMPHENOL	126-010	5-PIN SOCKET
D	AMPHENOL	33-221	BNC CONNECTORS
E	AMPHENOL	160-5-N	FLUSH MOTOR PLUG (AC POWER)

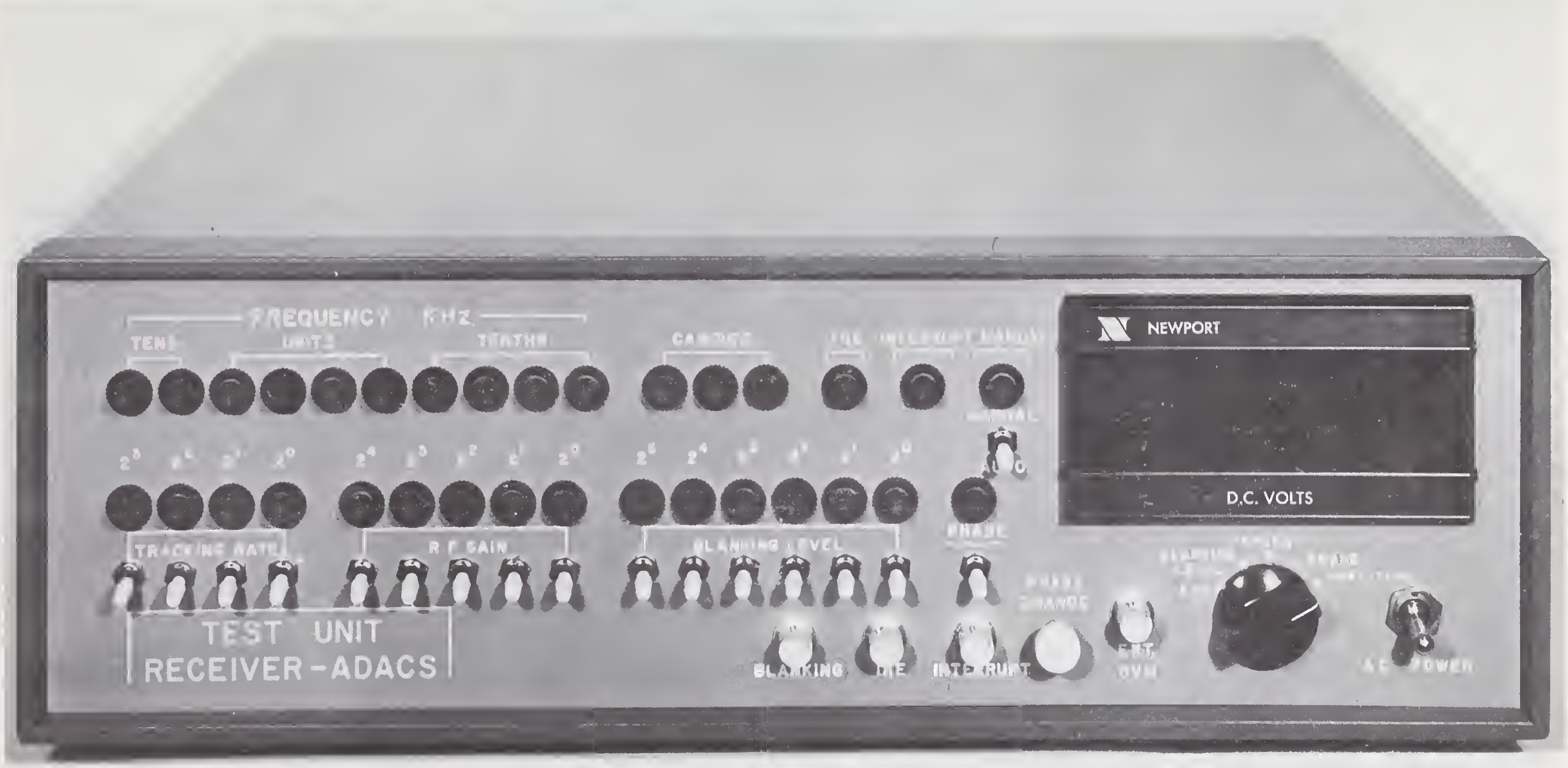
TEST UNIT BACK PANEL - COMPONENTS

FIGURE 29



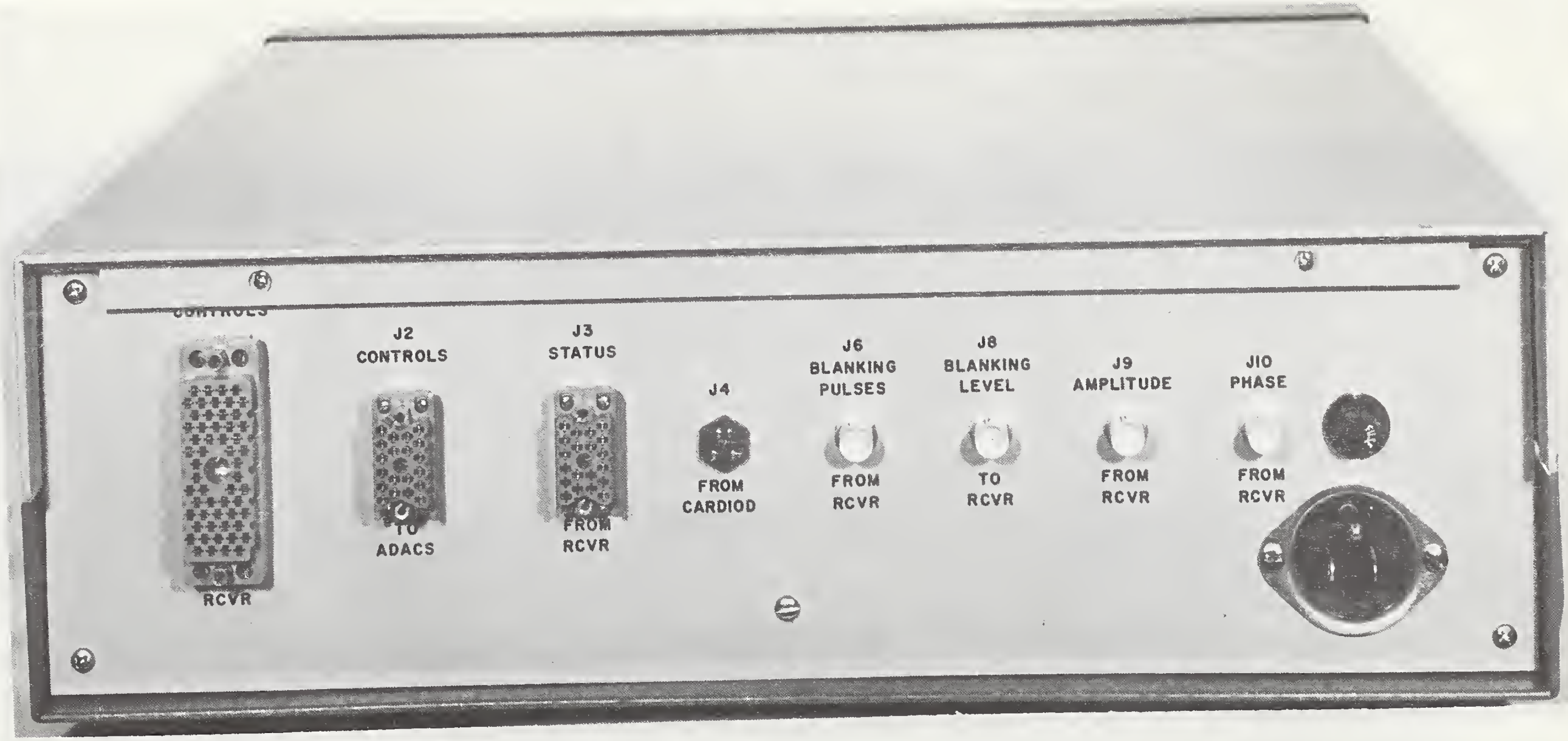
TEST UNIT CHASSIS - COMPONENTS

FIGURE 30



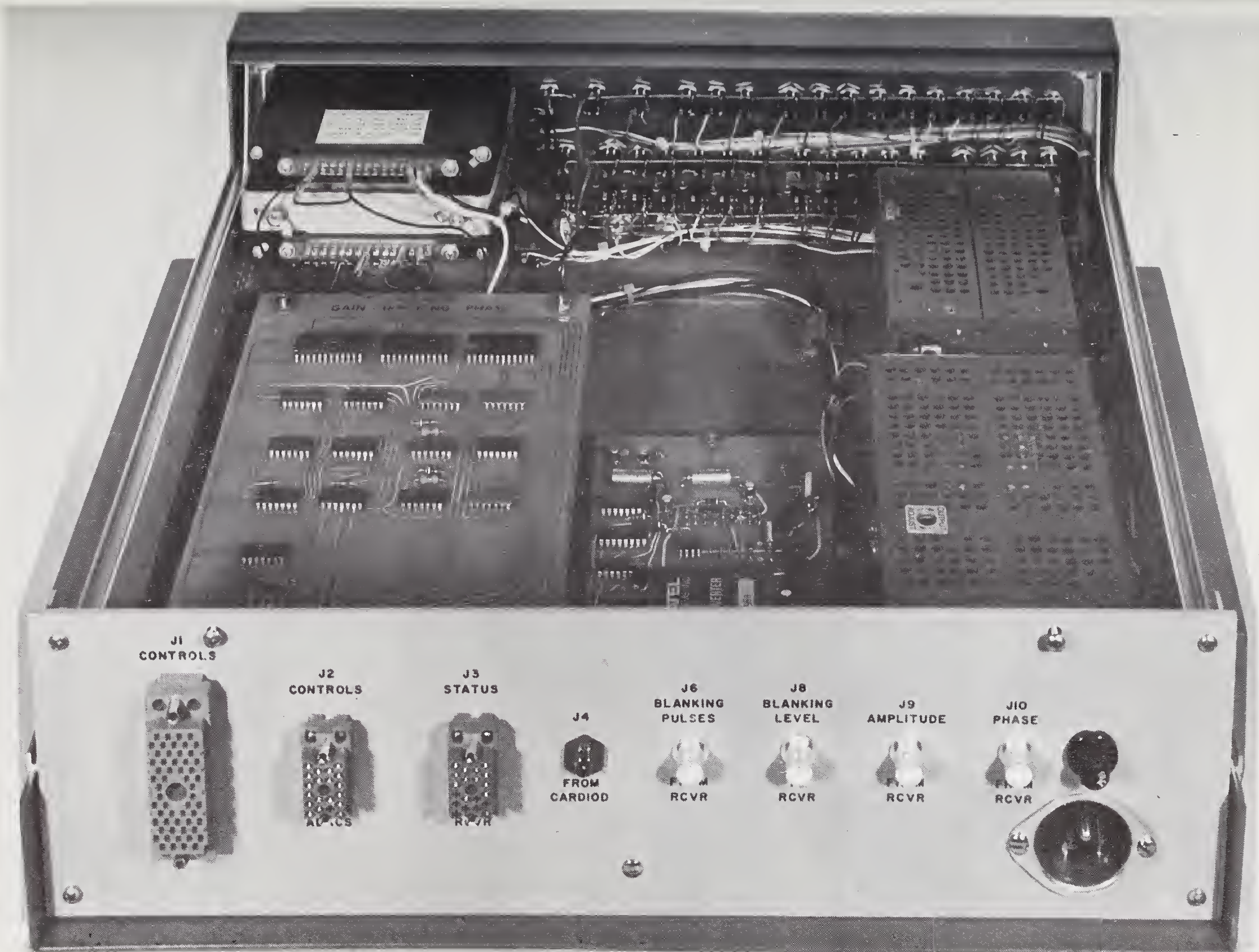
TEST UNIT FRONT VIEW

FIGURE 31



TEST UNIT BACK VIEW

FIGURE 32



TEST UNIT TOP VIEW

FIGURE 33

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4. TITLE AND SUBTITLE

FIELD SERVICE TEST MODEL: COMPUTER-CONTROLLED U SYSTEM
MANUAL FOR TEST UNIT

5. Publication Date
July 11, 1973

6. Performing Organization Code

7. AUTHOR(S) R. J. Carpenter, K. M. Gray
D. S. Grubb and L. J. Palombo

8. Performing Organization
NBSIR 73-236

9. PERFORMING ORGANIZATION NAME AND ADDRESS

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20234

10. Project/Task/Work Unit No.
6505413

11. Contract/Grant No.
AFTAC T/2301/U/NBS

12. Sponsoring Organization Name and Address

Department of the Air Force
HQ USAF (AFTAC/TAP)
Patrick A.F.B., Florida 32925

13. Type of Report & Period Covered
Instruction Manual

14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

This manual describes the construction and use of a highly specialized test unit for use with certain computer-controlled very low frequency receivers and their associated interface (ADACS) units.

17. KEY WORDS (Alphabetical order, separated by semicolons)
ADACS interface chassis; computer-controlled VLF receivers; test unit; U system

18. AVAILABILITY STATEMENT	19. SECURITY CLASS (THIS REPORT)	21. NO. OF PAGES
[ ] UNLIMITED.	UNCLASSIFIED	
18. (cont.) [X] FOR OFFICIAL DISTRIBUTION. DO NOT RELEASE TO NTIS.	20. SECURITY CLASS (THIS PAGE) UNCLASSIFIED	22. Price

USCOMM-DC 66244-P71