TM 9-1240-369-34

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT

MAINTENANCE MANUAL

FOR

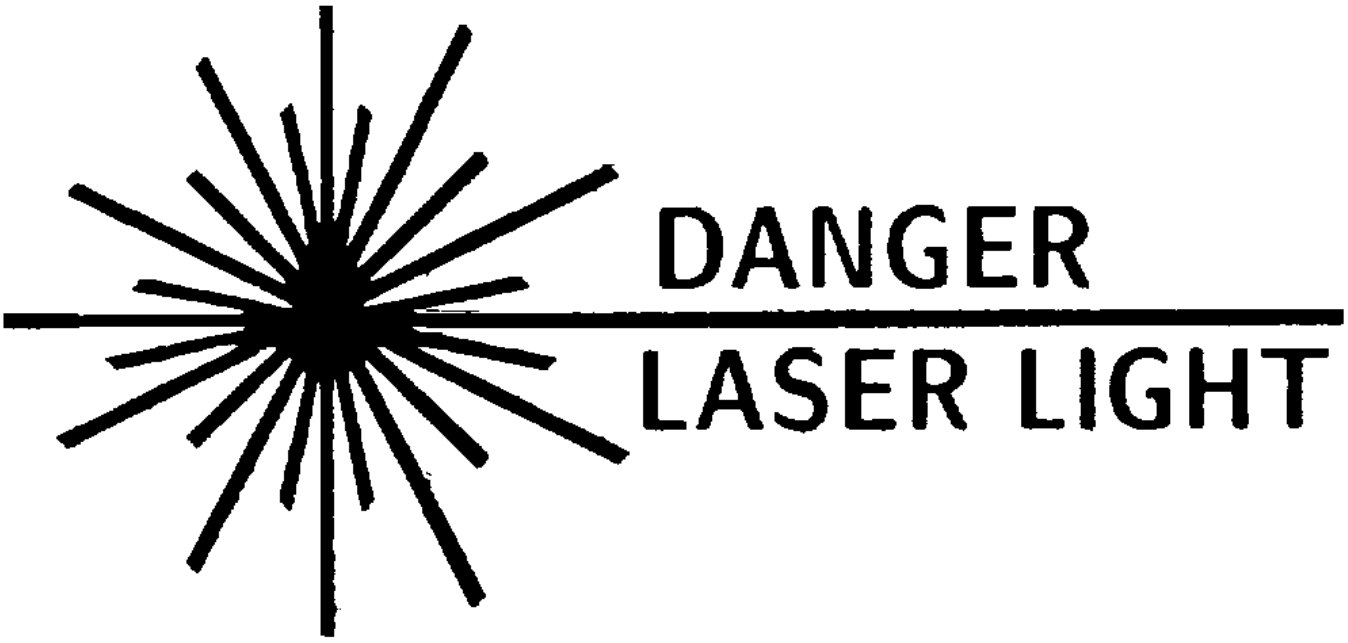
RANGE FINDER, FIRE CONTROL:

(LASER) AN/VVG-1 (1240-00-470-2156)

This copy is a reprint which includes current pages from Change 1

HEADQUARTERS, DEPARTMENT OF THE ARMY
FEBRUARY 1974

WARNING



AR402234

The laser beam is dangerous and can cause blindness if it enters the eye either directly or reflected from a shiny surface. Before pressing the RANGE switch (firing the laser), the operator should take adequate precautions to ensure maximum safety for friendly personnel within 20° of the laser line-of-sight. When using the R/T tester in a checkout area, ensure that it is securely clamped to the receiver-transmitter unit before setting the R/T tester switch to FIRE. Laser light leakage due to improper mounting may cause injury to eyes. Ensure that the light seal on the tester adapter and R/T tester are correctly mated and that the screws are secured. This procedure will prevent light leakage between the interface of the R/T tester, the receiver-transmitter unit, and the tester adapter. Post warning signs "WARNING-LASER LIGHT" and use a countdown procedure if the laser is fired without being covered by the tester as in optical alinement.

The pulse forming network (PFN) may retain high-voltage charges from the 1200 volts developed in the PFN charge power supply if the dump relay fails. Before working within the transmitter area of the receiver-transmitter unit, allow 20 seconds after turn-off, then momentarily ground the terminal of the high voltage lead to the housing with a shorting bar having an insulated handle. If the PFN charge power supply extender cable is used, ground the COIL terminal of the PFN.

The storage battery A78B1 can supply enough short circuit current to generate temperatures high enough to cause metal to fuse together and also cause severe burns. When handling the battery assembly remove all rings from fingers and do not insert metal objects into the immediate area of the battery assembly.

Ensure that ballistic dust cover is closed and secured by its latch to prevent light leakage which may cause injury to eyes.

Ensure that power is off when installing or removing units in hot mock-up or installing or removing components or assemblies in units.

WARNING

Whenever it is desired to real the events counter on the receiver-transmitter unit, ensure that system power is off prior to opening the casting latch. This will prevent inadvertent firing of the laser which could cause injury to personnel.

Personnel routinely performing maintenance at the GS and depot level are required to receive eye examinations in accordance with AR 4046.

DANGEROUS CHEMICALS

Toluol solvent is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged or repeated breathing of the vapor. Avoid prolonged or repeated contact with the skin.

Isopropyl alcohol is flammable. Keep all flammable cleaning material away from open flames. Failure to do so could result in injury or death.

Paints and primers are toxic and flammable. Keep all flammable material away from open flares. Use only in a well-ventilated area. Avoid prolonged or repeated contact with the skin.

Methyl ethyl ketone is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged or repeated breathing of vapor. Avoid prolonged or repeated contact with the skin. Keep away from heat or open flames.

CHANGE

No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, *22 September 1975*

Direct Support and General Support
Maintenance Manual
RANGE FINDER, FIRE CONTROL (LASER) AN/VVG-1
(1240-00-470-2156)

TM 9-1240-36934, 13 February 1974, is changed as follows:

1. Delete old page and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page. Added or revised illustrations are indicated by a vertical bar adjacent to the identification number.

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To be distributed in accordance with DA Form 1241, (qty rqr block No. 186) Direct and General Support Maintenance requirements for Range Finder, Fire Control, Laser AN/VVG-1.

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DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL RANGE FINDER, FIRE CONTROL (LASER) AN/VVG-1 (1240-00-470-2156)

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

a. The instructions in this manual are in accordance with the maintenance allocation chart (MAC) and are published for the use of direct support and general support maintenance personnel for the repair of Fire Control Range Finder. (Laser) AN/VVG-1, hereinafter referred to as the laser range finder.

b. Refer to TM 9-2350-230-10 and TM 9-2350-230-20 for operator and organizational maintenance.

1-2. Forms and Records.

a. Maintenance Forms and Records. Maintenance forms, records, and reports which are to be used by personnel and maintenance levels are listed in and prescribed by TM 38-750.

b. Reports of Accidents. The necessary reports are prescribed in AR 358-40.

c. Reporting of Equipment Publication Improvements. Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028, Recommended Changes to DA Publications, and forwarded directly to Commanding Officer, Frankford Arsenal. ATTN: SARFA-MA, Philadelphia, PA 19137.

Section II. DESCRIPTION AND DATA

1-3. Description.

The laser range finder is a component of the fire control system used in conjunction with the M551A1 Armored Reconnaissance/Airborne Assault Vehicle; hereinafter referred to as the Sheridan vehicle. The function of the laser range finder is to improve the first-round-hit capability of the primary weapon of the Sheridan vehicle. This function is accomplished by transmitting a pulse of laser light, receiving reflected light from the target, and converting the time from transmission to reception into range data. The range data is numerically indicated in meters and provides accurate range information for the weapon crew. Figure 1-1 illustrates the units of the laser range finder.

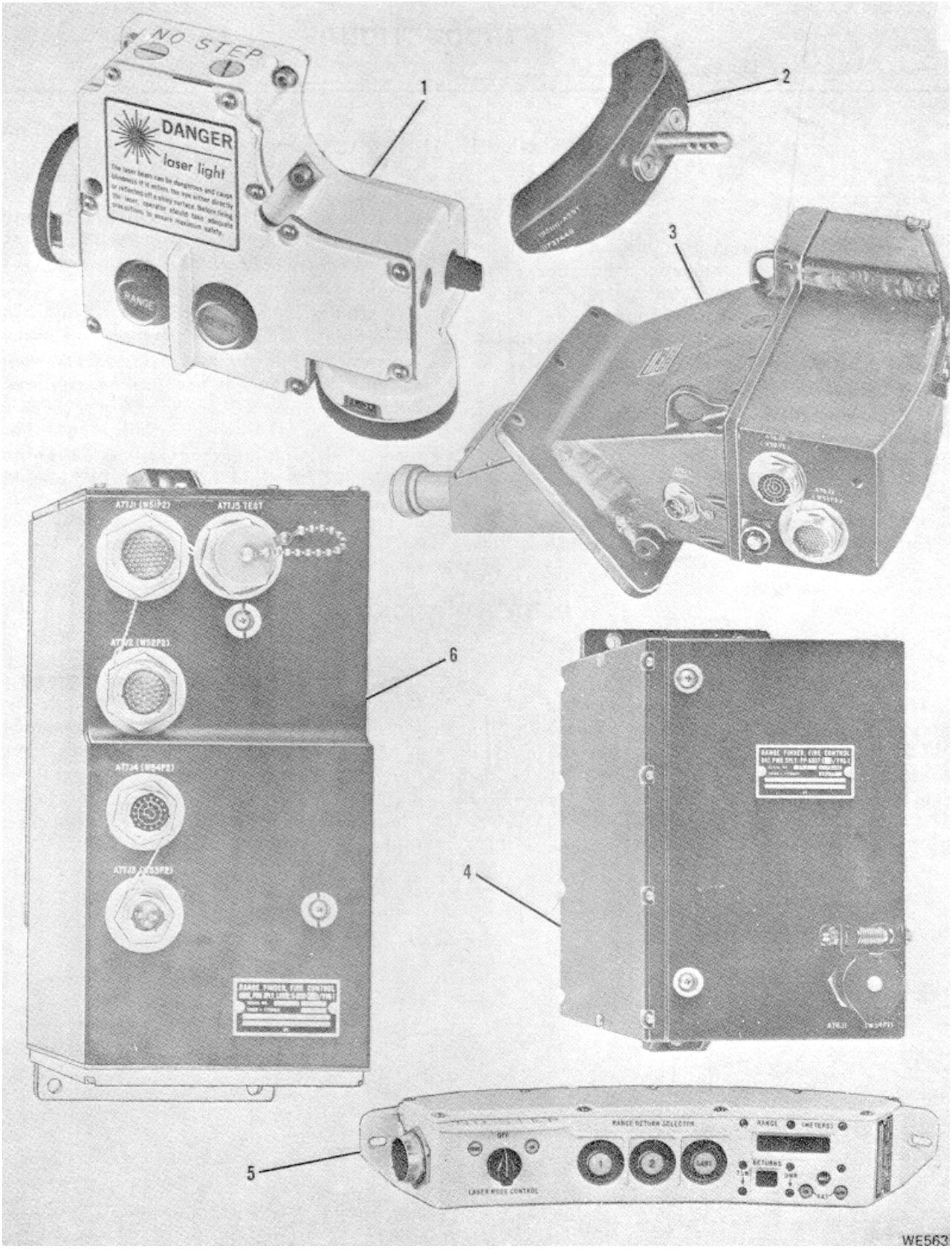


Figure 1-1. Fire Control Range Finder, (Laser). AN/ VVG-1.

KEY to figure 1-1:

1. R/T Control C-8728/VVG-1(A75)-11738851
2. Headrest Assembly-117349
3. Laser Receiver-Transmitter R/T-1021/VVG-1(A76)-11738821
4. Battery Power Supply PP-6607/VVG-1(A78)-11738841
5. Laser Ranging Commander's Control C-135/VVG-1(A77)-11738831
6. Laser Power Supply Control C-9135/VVG-1(A77)-11738831

1-4. Tabulated Data.

Refer to TM 9-2320-230-10-2-3 for physical and system performance characteristics of the laser range finder.

Section III. THEORY OF OPERATION

1-5. Scope.

This section contains the overall system functional description and functional theory of the laser range finder. Paragraph 1-6 defines the purpose of this section. Paragraph 1-7 contains the system functional description and system functional block diagrams. Paragraph 1-8 contains the system self test functional theory with each self test discussed separately.

1-6. Purpose.

The purpose of this section is to familiarize personnel with the function of the laser range finder and its units. The information presented provides both a basic and a detailed understanding of the laser range finder and aids in the troubleshooting and repair of the system.

1-7. System Functional Description.

a. General.

NOTE

Signal nomenclature on all block and functional diagrams and schematics expresses the "high" (true) state of the signal. For example, reset indicates that the signal level is "high" when the condition is NOT reset-that is, when the RESET switch has not been pressed.

As shown in the block diagram (fig. 1-2) the laser range finder operates upon control signals generated by the commander's control and R/T control units. The commander operates the laser range finder by using the RANGE and RESET switches. and the azimuth and elevation controls on the R/T control unit. In addition, a RTCL ILLUM control on the R/T control unit provides control of reticle lighting for operations in low light conditions. On the commander's control unit, the LASER MODE CONTROL switch, RANGE RETURN SELECTOR switches, test switch (TSW), and dimmer (DMR) switch are used. The laser range finder contains a transmitter that develops and transmits the laser pulses, a receiver for receiving and converting the reflected light from the target to electrical signals, data processing circuits and built-in test circuitry. In addition to the laser and processing circuits. the system contains a R/T control unit which provides control over the receiver-transmitter unit. and a commander's control unit which controls the system and provides displays for the operator and a battery power supply unit which provides additional power for operating the system. As depicted by figure 1-2, all of the commander's controls are located on the commander's control and R/T control units. The laser range finder has four functions; control and display, power control and generation, transmitting-receiving and data processing. The control and display function comprises all circuitry in the commander's control and R/T control units. The control and display function consists of the operator controls and indicators and the malfunction logic which assists in isolating malfunctions that might occur in the system. The power control and generation function comprises the battery power supply unit, preregulator, and two printed circuit cards in the power supply control unit. These circuits generate -1600 V for the photomultiplier tube (PMT), + 10 v for the light emitting diodes (readout display), + 15V for biasing and lights, + 5 V and -5 V for logic circuits, and +29 V for the automatic gain control (agc) circuitry. Either the tank power or the battery in the battery power supply unit supplies the +24 V Q-switch motor power, depending upon which has the higher voltage. The transmitting-receiving function develops the laser pulse and converts the reflected light from the target into a video signal. The pulse forming network (PFN) charge power supply charges the PFN so that it can provide the large energy requirement of the flashtube when it is fired. The PFN charge power supply applies the fire signal to the transmitter logic circuit card assembly. The transmitter logic develops SCR trigger and reset signals and, under control of the Q-switch magnetic pickup, drives the Q-switch in the transmitter component assembly. The

transmitter component assembly contains the ruby rod and its flashtube. the transmitter optics (relay prisms, folding prisms, resonant reflector, and porro prism), and the recollimating telescope. A rotating relay prism on the Q-switch actually controls development of the single "giant" laser pulse, by creating for an instant an optical resonant cavity (hence, by analogy to a magnetron cavity, the "Q" term) while the flashtube is "pumping" the ruby rod. The resulting laser pulse is transmitted through two transfer prisms and the scan prism to the target. The returning pulses from the target are detected by a photomultiplier tube and processed by the video amplifier. The data processing function stores range data for up to three targets that might be detected. Timing is provided by the A-trigger sensor assembly and the A-trigger reply utilizes a phototransistor that samples the laser flash to start the counters. The malfunction 3/buffer logic printed circuit card provides driving circuits for the A-trigger and video signals and generates a malfunction 3 signal. The interface circuits provide line receivers for the test range signal and line drivers for the A-trigger and video signals. An EVENTS counter in the receiver-transmitter unit counts each time the laser flashtube is fired. Data processing is shared among four printed circuit cards located in the power supply unit: reply gating, select logic, counter, and an interface card. The reply gating card counts the replies, gates the video in response to minimum and maximum range citeria, and provides range timing by means of a crystal oscillator and three counters. The reply gating card contains nearly all circuitry for self-test, including a test oscillator for development of continuous simulated A-trigger, video. and reset pulses to enable oscilloscope checks. These circuits (without the test oscillator) are used in test mode operation to obtain simulated ranges for readout by repeatedly pressing the RANGE switch to fill tile counter. The select logic card controls the three counters. The counters card contains three identical counter, each of which consists of three decade counters for storing binary coded decimal (BCD) ranges in thousands, hundreds. and tens. A counter is not required for the units readout indicator, because it registers only 0 or 5. The counters card also develops overrange and 9995 (counter full) signals used by the select logic and reply gating. Test circuits within the power supply unit monitor signals and produce malfunction signals which are displayed on the RANGE (METERS) indicator when a malfunction occurs.

b. Receiver-transmitter Unit, Power Supply Control Unit and Battery Power Supply Unit Functional Operation. Figure 1-3 is a functional block diagram of the receiver-transmitter unit power supply unit and battery power supply unit.

(1) *Power supply control unit*. The power supply unit consists of the following circuits; PFN charge power supply, low voltage power supply, --1600 V power supply. reply gating, select logic, counters, interface circuits, preregulator, and a pulse forming network. Each circuit is explained in the following paragraphs.

(a) *PFA charge power supply module*. The PFN charge power supply is a plug-in module which draws a constant current from the power source during the PFN charge cycle and, after the energy storage capacitors in the PFN are charged, provides a repeaking operation to maintain the voltage until the laser is fired. The charging cycle is controlled by a linear amplifying charging sense circuit that includes a multivibrator and four amplifiers. This circuit develops a pulsating, rather than a continuous. recharging cycle. PFN voltage adjust (R 10) enables field adjustment of the PFN voltage and, consequently, the energy that may be stored in the PFN. If R10 is set for too high an energy level. the laser flash can be intense enough to severely damage the transmitting optics; if set too low, insufficient energy will be directed on the target to permit detection by the receiver. A thermistor is provided in this circuit to correct the PFN voltage for laser temperature changes. A high voltage DC to AC converter functions as a regenerative oscillator. developing a square-wave output that turns two power transistors on and off to provide a constant current PFN charging and repeaking function. The PFN, consisting of capacitors and inductors is charged to about + 1200 V. It provides the current and voltage to maintain the desired duration of flashtube firing. Power supply protection is provided by a circuit that utilizes a differential amplifier and silicon controlled rectifier to prevent excessive current in the power drive by turning it off before the end of half cycle. or in the event of a short in the PFN. The circuit also detects high overvoltage transients and cuts off the power drive to prevent excessive collector voltage buildup. Further protection is provided by a differential amplifier that senses overvoltage and acts through the PFN control logic circuit to cause the SCR to cut off the power drive. .A dump relay forms a discharge path for the PFN when power is removed from the receiver/transmitter unit. to eliminate the safety hazard of a residual charge. Activation of the RANGE switch on the R/T control unit initiates the firing of the laser. The range signal is applied to the fire logic circuit. which contains a flip-flop driven by the multivibrator in the charging sense circuit. and a gate to determine that the PFN is charged, the system has been manually reset, and the RANGE switch is being pressed. The gate also ensures the system is not in the test mode, because it is not desired that the laser actually be fired during routine testing. If these conditions are all met, the fire signal is developed. The fire logic applies a turnoff signal to the PFN control logic to inhibit PFN charging during the time the laser is fired, and a charged signal to the range light flasher logic. Prior to firing, the reset flip-flop causes that logic circuit to apply range light signals to the red RANGE backlights so that they are continuously on. When the charged signal is applied with the manual reset signal, it opens a gate for the range light oscillator so that the backlights will flash. This indicates that the laser is ready to fire. After firing, a reset signal developed in the transmitter logic circuit card assembly resets the charge logic flip-flop. It cannot operate subsequently until the reset flip-flop has been reset by the SCR trigger signal, generated with the firing of the flashtube, so that it can accept the manual reset signal generated by pressing the RESET switch, or the manual reset that occurs when the system is turned on. The PFN charge power supply also develops +400 V from the + 1600 V supply for the flashtube trigger circuit.

(b) *Bias power supply cards.* A DC to DC converter in the preregulator converts the prime power from the battery power supply unit to + 15 V. The + 1.5 V is then applied to a regulator whose output is + 10 V. A DC to DC converter in the low voltage power supply utilizes a square-loop oscillator to develop + 5, --5. and + 29 V from the + 15 V output to the preregulator. Only the +5 V output of the low voltage power supply is regulated. The -1600 V power supply converts the + 15 V regulated voltage to -1600 V required for the photomultiplier tube (PMT) bias network. DC to DC conversion. with a driven squarewave generator and full-wave rectification, develops these voltages.

(c) *Reply gating card (test circuits).* Data processing begins in the reply gating circuit card assembly. Some of the circuitry on this card is devoted exclusively to test circuits. With the LASER MODE CONTROL switch set to TEST, the laser cannot be fired. Built-in test circuits in the reply gating card allow simulated range signals to be processed to verify the various logic elements. Pressing the R/T control unit RANGE switch in test mode simulates firing and processing of one, two, three, or four replies, which are displayed on the commander's unit RANGE (METERS) and RETURNS indicators. The simulation logic test circuitry on the reply gating card develops simulated video, simulated A-trigger, and simulated reset signals

for this purpose. The range-counter generates one step count each time the RANGE switch is pressed. and resets itself after the fourth range signal. The video inhibit circuit contains coincidence circuits to monitor the range counter output. and generates a signal to inhibit the maximum range circuits when the number of replies processed agrees with the number of times the RANGE switch has been pressed. The test oscillator is not used in the test mode normally; it is turned on when the power supply unit cover is removed, thus closing a pressure-sensitive interlock switch. The oscillator then generates a pulse train at 1000 prf so that an oscilloscope can be used for troubleshooting.

(d) *Reply gating card (operational circuits).* The operational circuitry of the reply gating card includes an oscillator, counters, logic and gating circuits. Initial resetting of all circuits connected to the reset signal bus is accomplished by a delay circuit, the turn-on reset OR gate (shared with simulated reset signal and an inverter. The 10 km monostable multivibrator generates a turn-off signal for the maximum range gate. At the end of a time period corresponding to the full capacity of the counters, it resets the maximum range flip-flop to the inhibit state, preventing any further video replies from being processed. It also provides an enabling signal to the select enable logic. The maximum range flip-flop and gate circuit is in the normal inhibited state at the start of any ranging sequence. It is enabled by the A-trigger signal gated by the output of the reset and malfunction 7 logic, which is on briefly when the reset signal occurs due to flashtube triggering. Subsequently, it may be inhibited either by the 10 km gate, or by the 9995 signal (the "counter full' signal developed in the counters circuit card assembly), or by an inhibit signal applied by the replies counter when the eight reply has been received. The minimum range flip-flop and gate circuit is enabled by the reset pulse gating of the A-trigger signal. However, it is immediately set to the inhibit state by the video pulse that is generated by leakage of light back into the receiver from the transmitter at the time of transmission, and it remains in the inhibited state long enough to prevent video generated from backscattered light from entering the counter start-stop flip-flops. At the end of the minimum-range period, the minimum range signal from the counters card changes the state back to enabled. The enabling minimum range gate and maximum range gate signals are applied to the video gate, a four-input NAND gate. One of the inputs is used only during test to simulate a fourth reply by briefly interrupting the third video. The fourth input is the video signal itself (or the simulated video signal if the laser is in the test model). If the video gate is enabled, video pulses are passed to the start-stop and binary flip-flop circuit. This circuit includes three high-speed binary counters, each controlled by a start-stop flip-flop. The counting sequence is started by the leading edge of the leakage video pulse that corresponds to A-trigger development, not by the A-trigger signal, which simply sets the start-stop flip-flops to a state of readiness to begin the counting. This introduces the delay encountered in the video amplifier and gating system into the counters. in order to avoid having to compensate for that delay so that fictitiously long ranges will not be read out. The three counters count high-frequency pulses generated by a crystal controlled oscillator. and fed continuously to the clock pulse inputs of the binary flip-flops. The outputs of the binary flip-flops are buffered and applied to the counter card.

(e) *Select logic card*. The select logic circuit card assembly contains logic for counter selection. The reply select logic circuit produces outputs representing various combinations of the reply count. which are applied to the select control logic circuit. First, second. or last signals are applied from the RANGE RETURN SELECTOR pushbuttons on the commander's control unit to the select control logic circuit, and compared to the other inputs to generate a select 1, select 2, or select 3 signal. thus determining which return will be displayed on the RANGE (METERS) indicator.

(f) *Counters card*. The counters circuit card assembly contains the circuitry that counts the clock pulses during the interval between transmission of the laser pulse and detection of the reflected replies. The card contains three identical decade counter circuits with buffer gates. The three inputs, counter 1, counter 2, and counter 3 are applied to the correspondingly numbered counter, causing the counter to count as long as input pulses are applied. The signals on the three input lines are terminated in sequence, under control of the counter gating logic. The outputs of each counter are applied in BCD form to the commander's control unit for display on the RANGE (METERS) indicator. Counter 3 contains a DTL integrated circuit that processes the outputs for the fourth (units) readout indicator which indicates the minimum 5-meter increment and therefore needs only two-state capability (0 and 5). Counter 3 also provides information for the minimum and overrange logic circuitry, which generates three outputs used to inhibit circuits in the reply gating and select logic cards. These outputs are the overrange signal, developed when the

range to the target exceeds the systems capacity, the 9995 signal, developed when the counters are full and the min range signal, developed for a period immediately after laser pulse transmission in order to close the video gate to spurious nearby backscattered returns from surface objects. The test range gate circuit applies a test range signal to the video amplifier during the test mode. The reset and malfunction 8 logic circuitry contains a flip-flop that is set to the malfunction state by the reset signal, and reset to the nonmalfunction state by inputs from 100-meter signals from each counter. Thus, failure of any of the three counters to count results in generation of a malfunction 8 signal for application to the digital indicator.

(g) *Interface circuit card*. The interface circuit card serves as an interface between the power supply control unit and the receiver-transmitter unit. The interface circuit buffers and inverts the A-trigger, video min range inhibit and test range signals; generates the malfunction 2 and 4 signals; and generates a +15 V interlock to prevent the PEN from charging in the test mode. The interface circuit receives the A-trigger and video signals from the malfunction 3/buffer logic card and sends the A-trigger and video signals to the reply gating circuit. The interface card also receives the reset signal from the R/T control unit and sends the reset (1) signal to the counters and reply gating circuits. The reset (2) signal is sent from the interface card to the PEN charge power supply.

When the system is operating in the test mode the test signal comes through transistor Q2 and inhibits the generation of a +15 V interlock which in turn prevents the PEN from charging in the test mode.

Malfunction 2 is generated from malfunction 7 and malfunction 8. Malfunction 7 and malfunction 8 are OR'd together and when either is low, this causes the commander's control unit MALF light to illuminate and a "2" readout to be seen on the RANGE (METERS) indicator showing that a malfunction has occurred in either the reply gating or counters circuits. Malfunction 4 is generated as a result of fault in the PEN circuit. When the RANGE switch is activated. the fire signal should come through and clear the flip-flop circuit (Z, 5). If the fire signal is not generated, the flip-flop will go high and cause the MALF light to illuminate, and a "4" readout to be seen on the RANGE (METERS) indicator.

The test range signal comes in and is buffered and sent to the malfunction 3 / buffer logic circuit.

(2) *Receiver-transmitter unit*. The receiver-transmitter unit consists of the following circuits or assemblies, transmitter logic, transmitter logic components, boresight and field stop assembly photomultiplier, video amplifiers, A-trigger assemblies, and a malfunction 3/buffer logic card.

(a) *Transmitter logic and transmitter logic component cards.* The transmitter logic circuit card assembly performs these functions: switching for the Q-switch assembly senses the speed of the Q-switch motor to provide triggering for the flashtube, and it generates the SCR-trigger signal for the reset flip-flop and the reset signal for the fire logic circuit in the PFN charge power supply. The transmitter logic component assembly contains the trigger transformer for firing the flashtube. When the fire signal is applied to the Q-switch power switch circuit, a return path for the motor is closed and the motor starts. The motor coasts to a stop when the fire signal is removed. The Q-switch timing circuit acts in conjunction with the Q-switch speed sensing circuit to determine when the motor has increased to the speed required before firing of the laser can occur. These circuits compare the fixed-length pulse of a monostable multivibrator with the time interval of magnetic pickup pulses from the Q-switch. A linear ramp is generated in the Q-switch timing circuit, and at the end of the timing cycle the SCR trigger timing logic circuit, if the Q-switch speed is high enough, generates a signal that is inverted and applied to the flashtube trigger SCR. The SCR trigger timing logic simultaneously generates the SCR trigger signal.

(b) *Transmitter component assembly*. The transmitter component assembly contains the recollimating transmitter telescope, the Q-switch assembly, the flashtube and ruby rod, and associated optics. The flashtube requires two voltages: a high voltage to fire it and a sustained voltage. Upon firing, the flashtube trigger SCR dumps + 400 volts stored in a capacitor through the primary of a transformer. A pulse of about + 10 kv developed in the secondary in series with the + 1200 V from the PFN ionizes the gas in the flashtube and the stored energy in the PFN dumps into the flashtube sustaining its output until the laser pulse is generated. An elliptical reflector directs the light from the flashtube into the ruby rod. which forms an optical resonant cavity with a reflective porro prism at one end. two relay prisms with 4.5 degree hypotenuse angles to fold the beam 180 degrees, and a resonant reflector that is partially reflective and partially transmissive at the output end. One of the relay prisms is mounted on the Q-switch assembly. It is rotated at a specific speed to govern the precise time of development of the laser pulse; it serves as a "Q-spoiling" device except for a brief instant when it is alined to form a resonant optical

cavity. At this time, in conjunction flashtube firing, a "giant" pulse of laser energy is emitted through the resonant reflector and the recollimating transmitter telescope.

(c) *Boresight/field Stop Assembly*. Laser returns are focused by the objective lens into the penta prism. This prism folds the laser return into the dichroic beam splitter. A small portion of the laser return is reflected by the beam splitter through a 0.75 milliradian field stop and the recollimating lens. This beam is then folded through the 40 A bandpass filter and enhancement prism to the PMT. Most of the visible light return passes straight through the dichroic beam splitter, reticle, and field lens. This beam then goes through the derotation prism, and is folded through the safety filter and into the eyepiece of the boresight telescope.

(d) *Photomultiplier chassis*. The photomtultiplier chassis assembly consists of a PMT assembly and a bias network circuit card assembly. The PMT assembly includes an enhancement prism that, by reflecting part of the light among several surfaces, has the effect of distributing the light over a large portion of the photosensitive surface of the PMT. The PMT bias network provides the necessary PMT dynode biasing and supplies the interface for adding time programmed gain (tpg) and agc to control the amplification characteristics of the PMT. Bias voltages as high as -1600 V are applied to the PMT.

(e) *Video Amplifier*. The video amplifier amplifies the small signals from the PMT to the level needed to drive the logic circuitry in the data processing function. The video amplifier circuit consists of four linear amplifier stages with feedback circuitry. These are followed by a threshold circuit and output driver stage. An agc sensing circuit applies the agc detected signal to the age control circuit in the photomultiplier chassis. The video signal is applied to the reply gating circuit card assembly. A portion of the transmitted laser beam is scattered by the scanning prism, through the receiver optics. to the PMT. The PMT amplifies the light and applies a signal to the video amplifier. The video amplifier amplifies the signal to form the A-trigger reply signal. The A-trigger reply signal establishes zero time for the range logic.

(f) *A-trigger assembly*. Data processing requires that an instant before zero-time, when the laser transmission pulse is emitted, a signal be generated to set the counting circuits and enable various gates. This is done by the A-trigger signal, which is developed by the A-trigger sensor assembly and the A-trigger component assembly. The former consists only of a phototransistor mounted on the A-trigger sensor assembly and is positioned directly above the space between the resonant reflector and the transmitter telescope, where the phototransistor detects a portion of sidescattered light from the beam when firing occurs. The latter assembly contains an amplifying stage. The A-trigger signal is applied to an OR gate shared with the simulated A-trigger signal in the reply gating circuit card assembly located in the power supply unit.

(g) *Malfunction 3/buffer logic*. The malfunction 3/buffer logic consists of signal drivers, buffers, and the malfunction 3 fault detection circuit. The malfunction 3/buffer logic includes drivers for the A-trigger and video signals enroute to the interface circuit in the power supply unit, receives the test range signal, and also buffers the reset signal. The malfunction 3 circuit consists of a flip-flop which is preset by the fire signal when the laser is fired. When the laser is fired, the flip-flop receives the A-trigger signal at the K input and the video signal at the T input. If the A-trigger and video signals do not appear, the Q ouput (O) of the flip-flop stays low and causes the malf 3 signal to be generated. The manual reset signal clears the flip-flop so the MALF indicator and the number "3" on the RANGE (METERS) indicator goes off.

(3) *Battery power supply unit*. The battery power supply unit contains a nickel-cadmium battery supply for use as a backup to the prime power source during emergency conditions. A fully charged battery supply alone can provide the capability of 30 ranging pulses at 70 ± 15°F and 10 ranging pulses down to a -20°F temperature. Depending on the temperature the battery is subjected to during the charging process, charging to capacity times will vary. At -25° F the charging circuitry is deactivated by a temperature sensing transducer (thermostatic switch) and the battery will not receive a charge. This is done to protect the nickel-cadmium cell from damage. To charge the battery whenever this -25°F low temperature condition exists for extended periods of time, the battery power supply unit must be removed and allowed to temperature stabilize above -25°F before being charged.

NOTE

The manufacture recommendation as to the number of complete charge-discharge cycles permissible for this battery is approximately 100 life cycles. Battery power supply unit batteries approaching this limit may exhibit some signs of deterioration by not holding a full charge for their nominal between-charge time.

In operation this battery power source takes over when tank voltage falls below the + 18.0 V minimum

required for operation of the laser system. Such drops in voltage may occur in operation because of heavy transient loads. The battery power supply unit consists of a power control circuit, a low voltage transient control circuit, the battery, the battery charge sensing circuit, a battery charger circuit, and a battery charger malfunction circuit. The power control circuit receives the +24.0 v prime power from the tank via relay K1. The battery consists of 24 cells which supply + 29.0 volts to the system. The battery is charged by the battery charger circuit whenever vehicle power is applied to the system. The low voltage transient control circuit detects when the battery power supply unit should be switched in as the primary power source for the laser range finder. Vehicle battery voltage below approximately + 22.0 V is insufficient to bring the Q-switch in the transmitter component assembly to full speed. Therefore, the + 24.0 V Q-switch line is connected through diodes in the power supply control circuit to both the battery and the vehicle power line, so that the source with the higher voltage always drives the Q-switch.

The BAT LOW lamp on the front of the commander's control unit indicates (lights) when the battery voltage drops below approximately +24.0 V. Momentary high current loads, such as charging the PFN, can cause the BAT LOW lamp to light. As soon as the battery voltage recovers to a voltage above approximately + 24.0 V. The BAT LOW lamp goes out. If the condition is allowed to continue, it can reduce the battery life and negate the emergency capability of the battery power supply unit. However, when operating at below 0°F temperatures and the BAT LOW lamp lights, it is permissible to range 10 times prior to recharging. The BAT LOW indication does not mean that the system will not function properly. However, it is recommended that the battery be charged at the first opportune time. The MALF 1 indication shows that the battery charging circuit is not operating properly or that the battery temperature has fallen below -25° F. The battery charging circuit malfunction circuit Q3 and Q5 detects a malfunction either in the battery charging circuit or as a temperature indication and causes the MALF lamp to light. The BAT DR lamp warns that the laser range finder battery power supply unit battery is supplying the power to operate the system. Continued use of the system with the BAT DR lamp lighted will negate the emergency capability of the battery power supply unit.

(c) *Commanders Control Unit and R/T Control Unit Functional* Operations. The commander's control and R/T control units functional diagram is illustrated in figure 1-4.

(1) *Commander's control unit.* The commander's control unit consists of the following circuits or assemblies logic circuit card, readout circuitry assembly and an electronic component assembly. The commander's control unit provides the display status for the operator.

(a) *Logic circuit*. The logic circuit card consist of the circuitry for the RANGE RETURN SELECTOR switches, the MALF indicator and test (TSW) switch. Then one of the RANGE RETURN SELECTOR switches is activated, this generates the appropriate range select signal. For example. if the RANGE RETURN SELECTOR 1 switch is activated, the first signal is generated and sent to the select logic in the power supply unit. The RANGE RETURN SELECTOR 1 switch is illuminated indicating which switch was activated. The RANGE RETURN SELECTOR switches are momentary pushbutton type and each has lamp drivers with a latching circuit. The malfunction logic consists of hex inverters which displays the appropriate malfunction number (1, 2, 3 or 4) on the RANGE (METERS) indicator depending on what malfunction has occurred. The logic circuit also contains the circuitry for the TSW switch which tests to see if the indicators on the front panel are functioning properly (see table 2-1).

(b) *Readout circuit*. The BCD ranges are applied to the readout circuit (Z1 thru Z8). Also, the range returns are applied to this circuit. The readout circuit consists of the decoder/driver circuits and numerical readouts. There is a decoder/driver circuit and an numeric display for each readout on the RANGE (METERS) indicator and also for the RETURNS indicator. There are tour indicators (units, tens, hundreds and thousands) for the RANGE (METERS) indicator and one indicator for the RETURNS indicator. The numeric display has seven segments, each segment consisting of several diodes. Each display is a red numeric display (0 thru 9). The decoder/driver circuit provides the appropriate input code for the display desired. The decoder/driver circuit contains seven drivers suitable for driving the readout. The drivers are controlled by a BCD decoding network which receives and processes the range and return signals and displays them on the indicators.

(c) *Commander's control unit outputs*. The outputs from the commander's control unit are the following signals: test, manual reset, manual reset select, first, second. and last. The test and test signals set logic circuits for the selected mode of operation. The

reset signals are split in two; the latter, manual reset select, is applied only to the set logic card. The last three signals (first, second. and last) control the counter selection logic circuits.

(2) *R/T control unit.* The R/T control unit consists of two switches. RANGE and RESET, with backlighted indicators. The RANGE switch is a pushbtutton type switch which fires the laser. The RESET switch is also a pushbutton type switch that resets the system prior to the next ranging sequence after any ranging operation. The RESET switch has to be activated before the transmitter canbe fired after the initial firing allowing system turn-on. The R/T control unit also has two control knobs, azimuth and elevation. These controls are used to center the telescope on the target. A RTCL ILLUM control is provided to light the telescope reticle for low light operations.

1-8. System Self-Test Function Theory.

a. General. The laser range finder contains two categories of self-test circuitry. Malfunctions in four specific area of the system are monitored during the operational mode --ON-- to provide indications of trouble to the vehicle crew, and general clues to the trouble area to the turret mechanic as well as the crew. The malfunction circuitry provides the capability to isolate problems which occur in the system. Certain malfunctions are automatically detected. Then the MALF light is illuminated the type of malfunction will be indicated on the last numeral of the range (meters) indicator. Malfunction indications and probable troubles are assigned as follows:

MALF 4 (Power Supply Control Unit)	PFN Over charge PMT High Voltage PFN Charge (fire signal)
MALF 3 (receiver-transmitter unit)	A-Trigger and A-Trigger Reply
MALF 2 (Iower Supply control Unit)	Reply gating and Counters
MALF 1 (Battery power supply unit)	Battery charger

(after lasing MALF 1 will not be present until RESET switch on R/T control unit is pressed)

The second category of self-test circuitry is used in the test mode of operation; to provide comprehensive simulation of firing the laser and receiving up to four replies without actually transmitting a laser beam.

CHAPTER 2

DIRECT SUPPORT AND GENERAL SUPPORT

MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS AND TEST EQUIPMENT

2-1. General.

Repair parts, special tools and test equipment are listed in TM 9-1240-369-34P.

2-2. Standard Tolls and Test Equipment.

Special tools and test equipment having general application to the laser range finder are authorized for issue by tables of allowances (TA) and tables of organization and equipment (TOE) and are listed in table 2-4.

2-3. Special Tools and Test Equipment.

Special tools and test equipment are provided for maintenance of the laser range finder at direct support (DS) and general support (GS) maintenance. Special tools and test equipment which are necessary to perform operations described in this manual are listed in tables 2-1 thru 2-3 and illustrated in figures 2-1 thru 2-4. The units of the laser range finder are also needed for DS/GS level maintenance and are illustrated in figure 1-1. These equipments, along with a prime power source. form a complete system hot mock-up for testing, troubleshooting, and alining faulty units of the laser range finder.

Table 2-1. Direct Support Special Tools and Test Equipment (10559658)

Item No.	Item	NSN or reference	Reference Fig No.	Reference Item No.	Function
1	Tester, R/T	10559600	2-1	6	To measure receiver sensitivity and transmitter output energy of the receiver transmitter unit(A76).
2	Cable, extender PFN charge power	10559664	2-1	5	To provide test points for designated circuit card assemblies located in the power supply control unit (A77) and battery power supply unit (A78) during troubleshooting.
3	Extender card, counters	10559508	2-1	4	
4	Extender card, reply gating	10559516	2-1	3	
5	Extender card, select logic	10559518	2-1	1	
6	Extender card, 1600 power supply	10559517	2-1	2	
7	Puller. circuit card	11737838	2-1	14	To remove circuit card assemblies from power supply control unit (A77) housing.
8	Wrench, ball (0.035)	11737812-1	2-1	19	Used to loosen and tighten various socket head cap screws during repair of unit.
9	Wrench, ball (3/32)	11737812-2	2-1	18	
10	Wrench, ball (7/64)	11737812-3	2-1	17	
11	Wrench, ball (9/ 641	11737812-4	2-1	16	
12	Wrench, ball (5/32)	11737812-5	2-1	15	
13	Wrench, connector (10.875)	11737480-5	2-1	7	Used to loosen and tighten various connector nuts during repair of units.
14	Wrench, connector (1.062)	11 37480-8	2-1	9	
15	Wrench, connector (1.187)	11737480-10	2-1	11	
16	Wrench, connector (1.312)	11737480-12	2-1	13	
17	Wrench, connector (1.437)	11737480-14	2-1	8	
18	Wrench, connector (1.562)	11737480-16	2-1	10	
19	Wrench, connector (1.687)	11737480-18	2-1	12	
20	Case, carrying	1174;5643	2-1	20	To carry and store special tools and test equipment for the laser range finder.

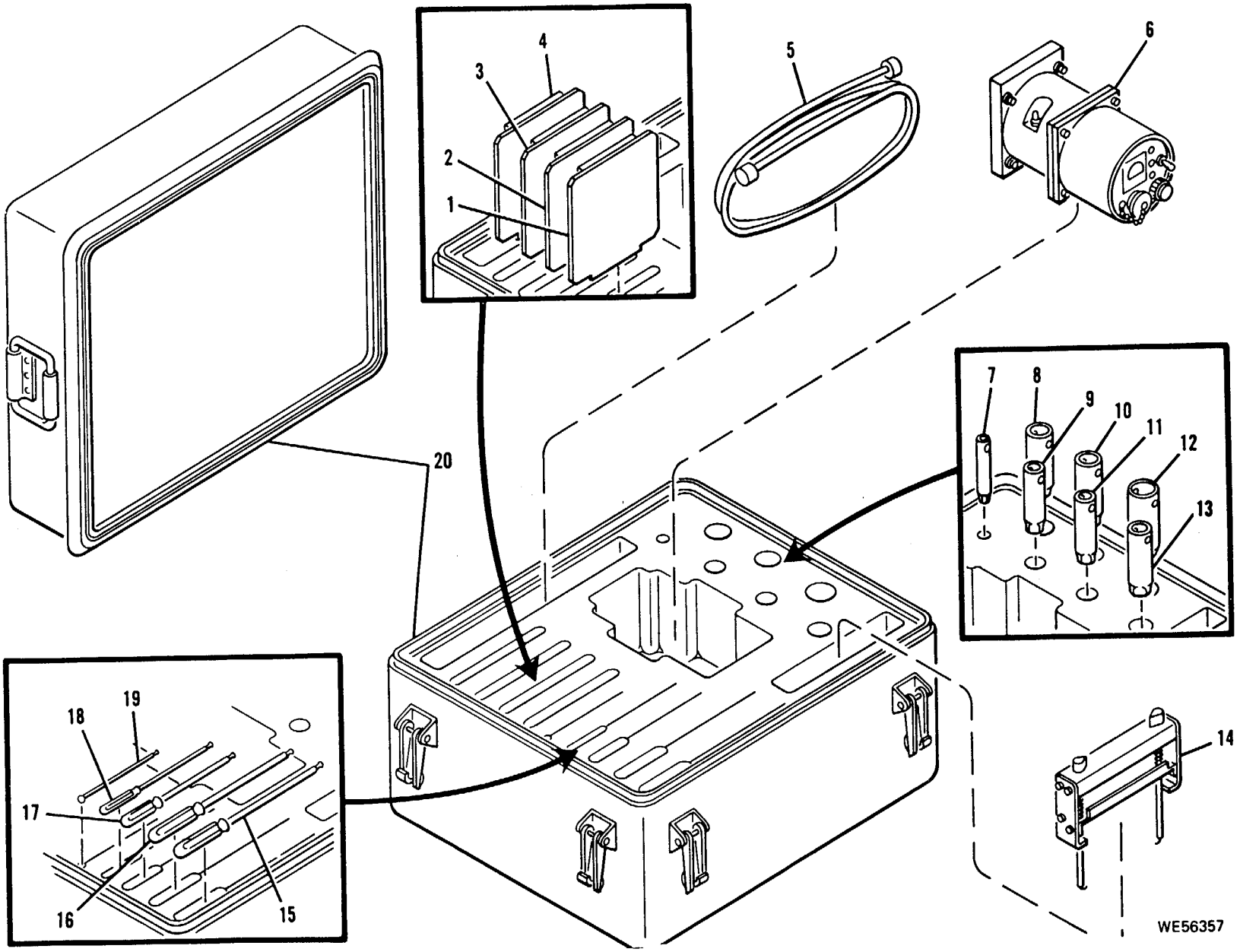


Figure 2-1. Direct support special tools and test equipment (10559658).

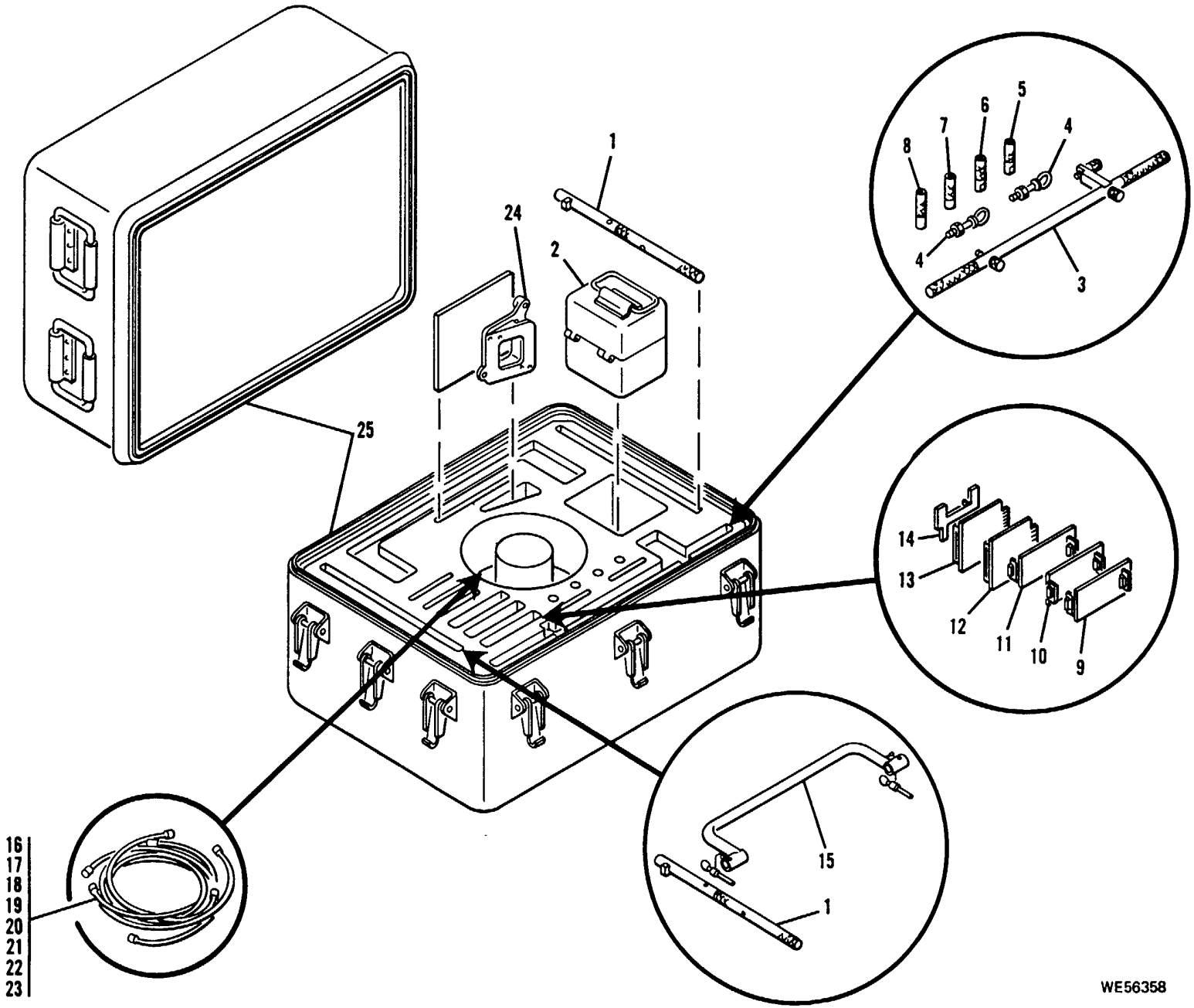


Figure 2-2. Direct support special tools and test equipment (11738864).

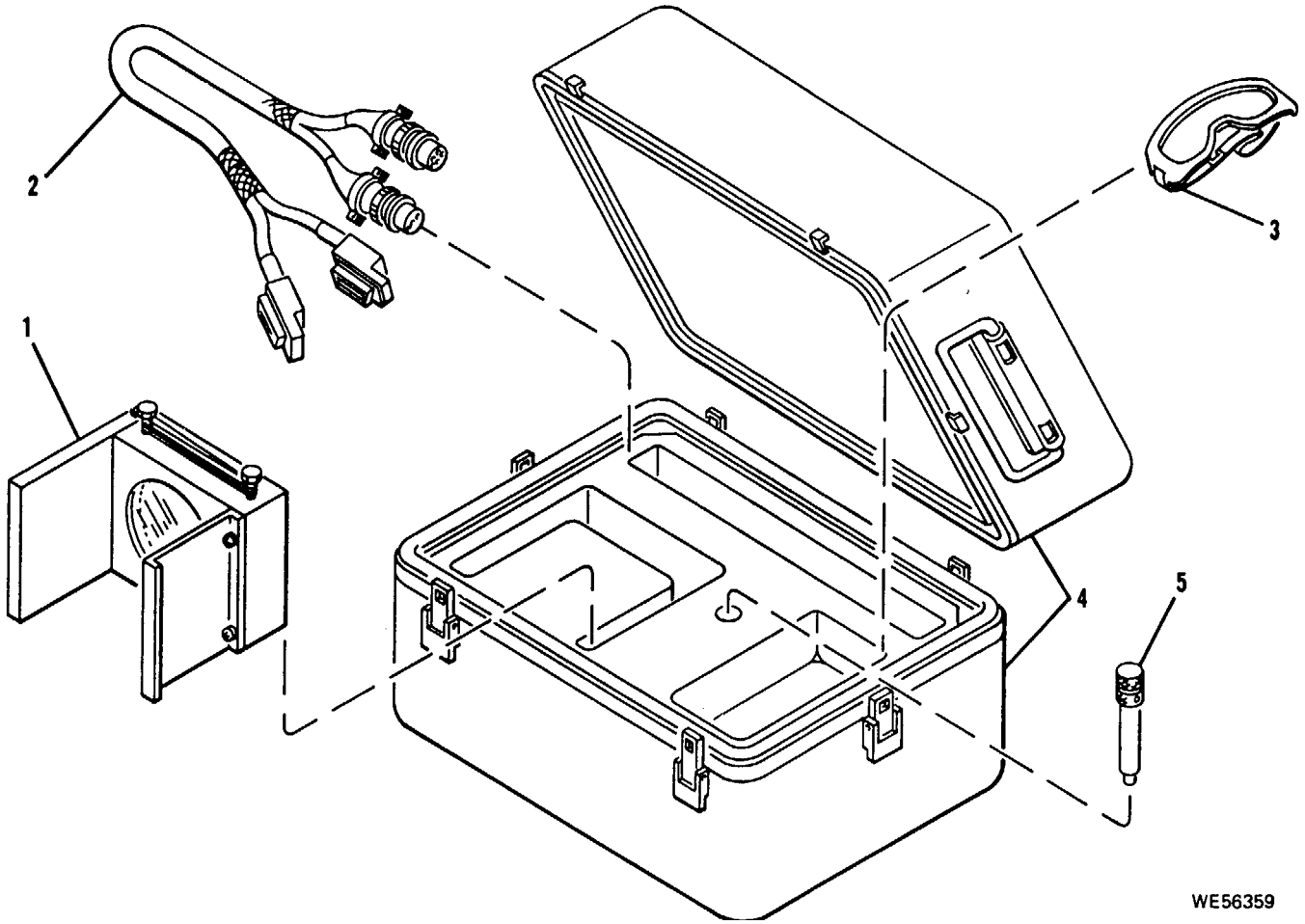


Figure 2-3. General support alignment kit (11738863).

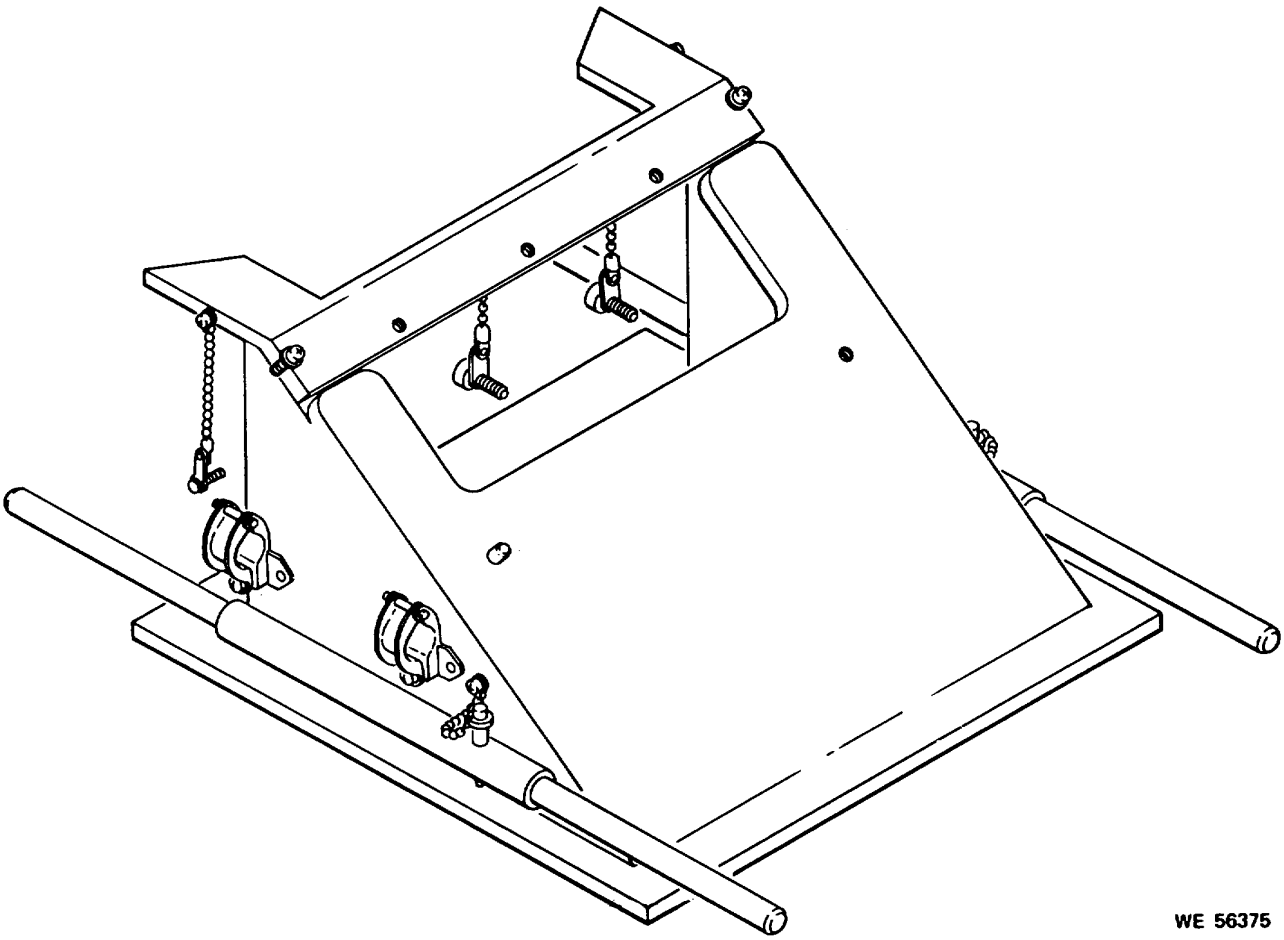


Figure 2-4. R/T holding fixture (11738862).

Table 2-2. Direct Support Special Tools and Test Equipment (11738864)

Item No.	Item	NSN or reference	Reference Fig No.	Reference Item No.	Function
1	Adapter, Tester	11737814	2-2	24	To mount R/T tester to receiver transmitter unit (A761).
2	Animeter, PFN-charge	11737824	2-2	2	To determine the PFN current setting after adjustment using the R/T tester.
3	Cable, ammeter PFN charge	11745327	2-2	16	To interconnect PFN charge ammeter to power supply control unit (A77).
4	Cable, tester A7 /A77	11737815	2-2	17	To interconnect the R/T tester to the power supply control unit (A77).
5	Cable, test A75/A79 (W50)	11737821	2-2	18	To interconnect the designated units during troubleshooting.
6	Cable, test A76/ A77 (W51)	11737817	2-2	19	
7	Cable, test A76/A77 (W52)	11737818	2-2	20	
8	Cable, test A76/ A78 (W53)	11737819	2-2	21	
9	Cable, test A77/A78 (W54)	11737816	2-2	22	To interconnect the designated units during troubleshooting.
10	Cable, test A75/A76	11737820	2-2	23	
11	Extender card, interface	11737822	2-2	12	To provide test points for designated circuit card assemblies located in If the power supply control unit (A77) and the battery power supply unit (A78) during troubleshooting.
12	Extender card, low-voltage power supply	10559515	2-2	13	
13	Extender card, battery charge sensor	11737823	2-2	9	
14	Extender card, charge control	11737845	2-2	10	
15	Extender card, power control	11737851	2-2	11	

Table 2-2. Direct Support Special Tools and Test Equipment (11738864)—Continued

Item No.	Item	NSN or reference	Reference Fig No.	Reference Item No.	Function
16	Eyebolt (2 each)	NAS1053-5-17	2-2	4	To facilitate use of receiver-transmitter handles with a mechanic hoist or similar device.
17	Gage, depth-connector. cover/housing	11737471	2-2	14	To determine clearance on connectors W1J3 and WIJS of receiver transmitter unit (A76).
18	Handle assembly, ballistic cover	11741606	2-2	3	To facilitate handling of the ballistic cover
19	Handle, receiver-transmitter (2 each)	11737942	2-2	1	To facilitate handling of the receiver transmitter unit (A76).
20	Tie rod assembly, handle-receiver-transmitter	11737945	2-2	15	
21	Tool, removal-boot	11737451	2-2	7	To remove switch boots (switch lens seals) from R/T control unit (A75). And commander's control unit (A79).
22	Wrench, spanner-nut	11745619-1	2-2	5	To remove spanner nuts from switches on R/T control unit (A75) and commander's control unit (A79).
23	Wrench, spanner-nut	11745619-2	2-2	6	
24	Wrench, spanner-switch	11737810	2-2	8	
25	Case, carrying	11737835	2-2	25	To carry and store special tools and test equipment for the laser range finder.

Table 2-3. General Support Alignment Kit (11738863)

Item No.	Item	NSN or reference	Reference Fig No.	Reference Item No.	Function
1	Cable, branched	11741597	2-3	2	To provide power to receiver transmitter unit (A76) when the ballistic cover is removed.
2	Case, carrying	11737981	2-3	4	To carry and store all items of the alignment kit special tools and test equipment.
3	Goggles, laser safety	GFE	2-3	3	To provide eye protection during receiver-transmitter unit (A76) alignment.
4	Lens assembly, alinement	11741599	2-3	1	To permit alinement of eyepiece reticle with transmitter laser beam.
5	Tool, boresight adjustment	11741598	2-3	5	To adjust screws which aline transfer prism.

Table 2-4. Standard Tools and Test Equipment

Item	National Stock No.	Use
Kit, Purging	4931-00-065-1110	Purge units
Multimeter, Simpson 260 or equivalent		General testing
Nitrogen, Technical (Tank)	6830-00-656-1596	
Oscilloscope, Tektronix, model 545 or equiv.	.....	General testing
Tool Kit, Fire Control Instrument Repairman	4931-00-947-8243	General installation and maintenance
Tool Kit, Turret Mechanic	4910-00-695-1039	

2-4. Hot Mock-up Interconnection Diagram.

a. A hot mock-up is to be set up to verify a fault in the unit(s) of the laser range finder and adjust the pulse forming network (PFN). Set up the hot mock-up as illustrated in figure 2-5 using the laser range finder units, the test cables (or system cables if available), and a prime power source. The test cables are part of the laser range finder special tools and test equipment. The receive-transmitter tester (hereinafter referred to as R/T tester) and PFN charge ammeter, special equipment, are used in conjunction with the hot mock-up to perform receiver sensitivity and transmitter output tests.

b. The PFN can be adjusted at direct support. Troubleshooting and repair of the receiver-transmitter is limited to general support.

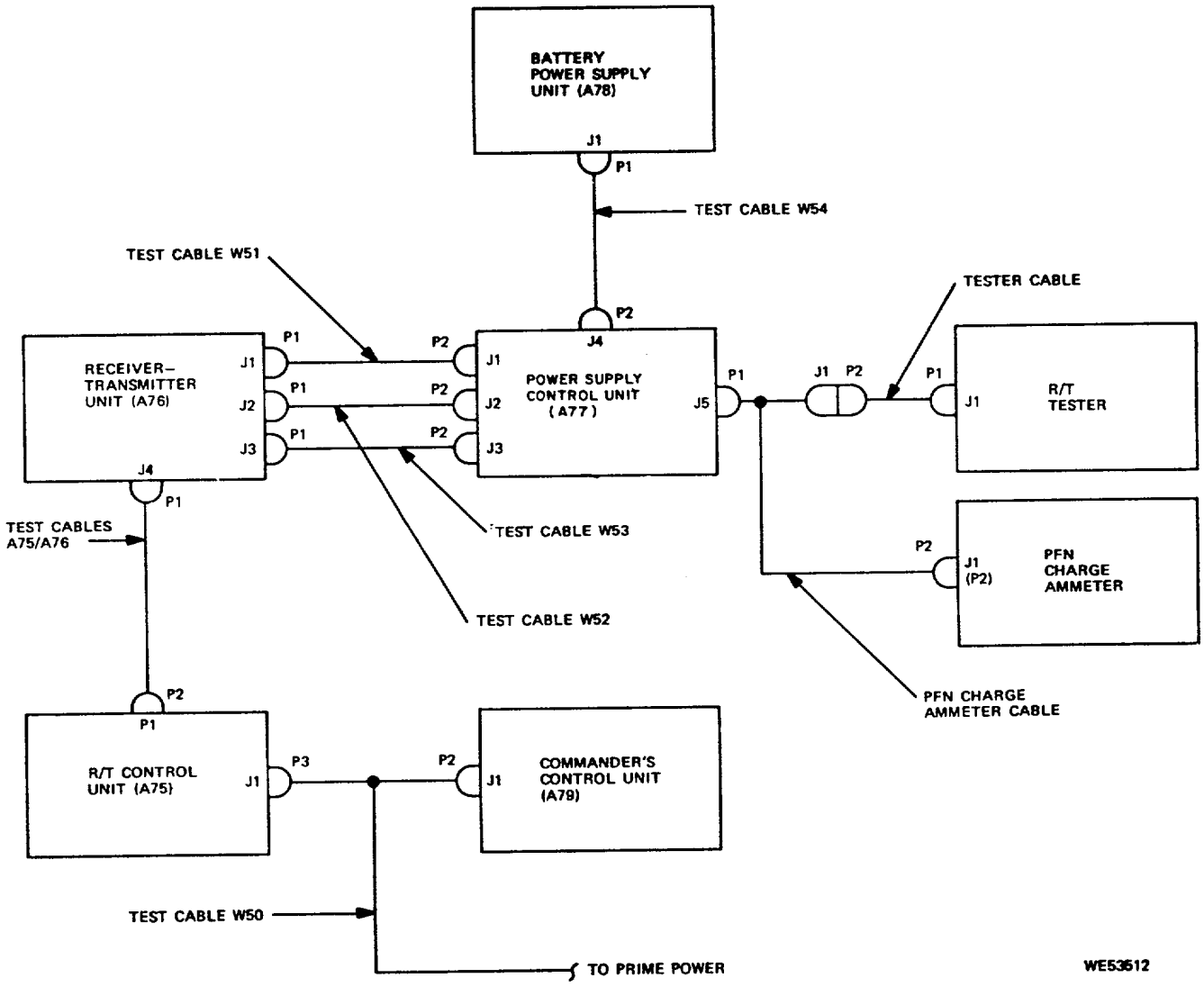


Figure 2-5. Hot mock-up interconnection diagram.

Section II. TROUBLESHOOTING

2-5. General.

The troubleshooting procedures described in this section consist of fault isolation within the major units to modules, printed circuit cards and assemblies, and their replacements. All troubleshooting procedures in the section may be performed at direct support with the exception of troubleshooting the receiver-transmitter unit (para 2-11) which is to be performed at general support only. Also included as part of the direct and general support maintenance function is the PFN adjustment. Because of this adjustment, it is required that the receiver-transmitter unit and power supply control unit be replaced as a pair. Schematic and wiring diagrams for the units of the laser range finder and their components are contained in figures 2-7 thru 2-37 to aid in troubleshooting. Extender cards and test cables which are provided as part of special tools and test equipment are used to fault isolate down to the replaceable item.

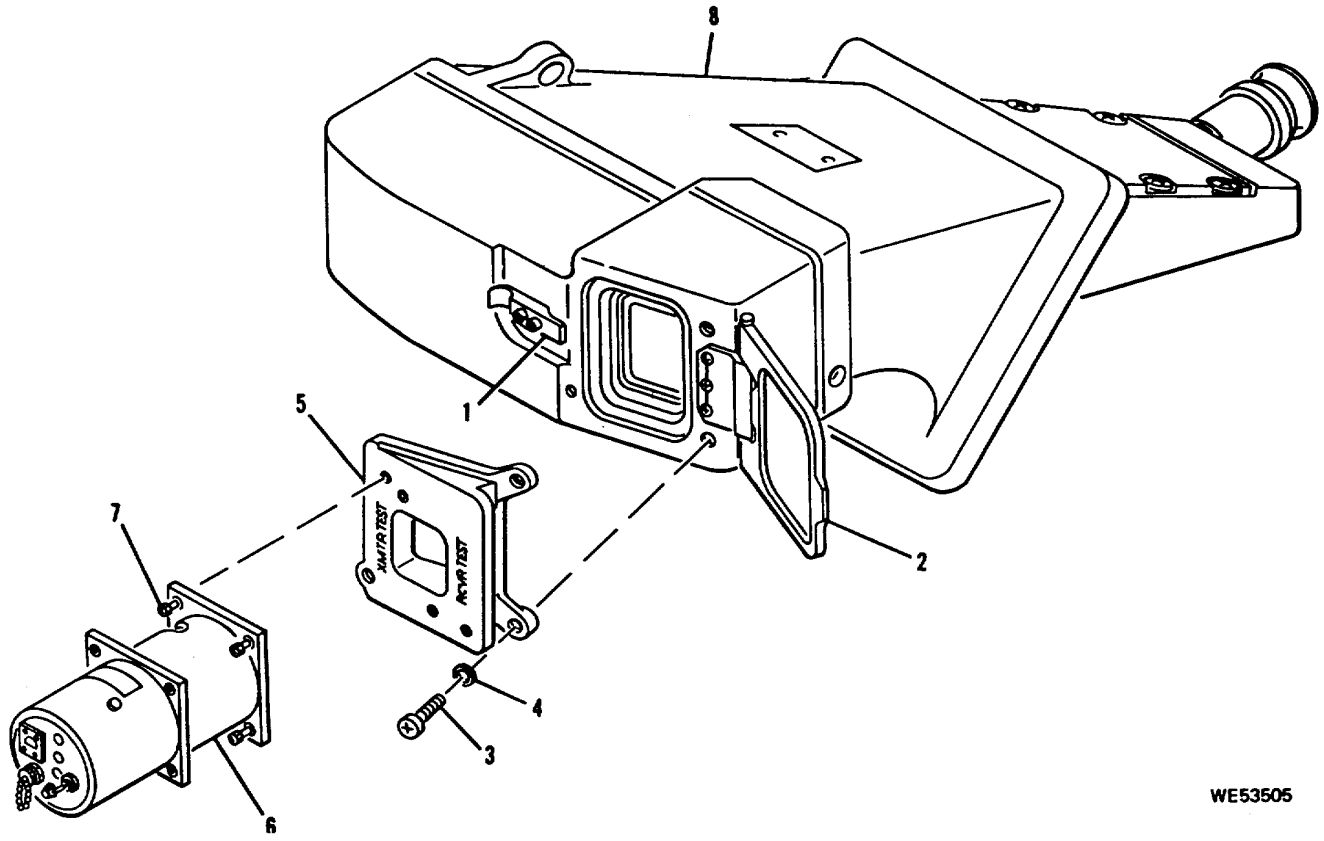
2-6. Receiver-Transmitter Check and Adjustment.

CAUTION

Adjustment tool inserted into PFN ADJ access port shall be of an electrically insulating material to prevent possible damage to equipment resulting from tool contacting exposed voltage point. Excessive transmitter energy density may damage the coating on the receiver-transmitter unit optical elements.

a. *General.* The transmitter energy, which may be altered by adjusting the PFN current, is to be checked every 5,000 rangings. In addition, whenever there is a requirement that the receiver-transmitter unit or the power supply control unit be replaced or repaired, the PFN current must be adjusted to produce the proper transmitter energy. The R/T tester and the PFN charge ammeter check the transmitter energy, receiver sensitivity, and the PFN current. The following procedure is to be performed by securing the tester adapter and R/T tester to the receiver-transmitter unit and interconnecting the PFN charge ammeter, and R/T tester to the power supply control unit.

b. PFN Adjustment Procedure. The following procedure is used to prepare the R/T tester for use (fig. 2-6).



1. Latch—11737964
2. Cover assembly—11737870
3. Screw (3)—NAS1351C3LE6P
4. Washer (3)—NAS1598C3R
5. Tester adapter—11737814
6. R/T tester—10559600
7. Screw (2)—part of item 6
8. Receiver-transmitter unit—11738821

Figure 2-6. R/T tester installation.

NOTE

The R/T tester and the PFN charge ammeter may he used by DS level maintenance personnel on the Sheridan vehicle as well as in the hot mockup. When the R /T tester and the PFN charge ammeter are used on the Sheridan vehicle, the vehicle must be located in an area which is sheltered from the weather. The vehicle, receiver-transmitter unit and R/T tester must be allowed to temperature stabilize for 12 hours to a temperature of 75 ± 10° F. If the R/T tester and the PFN charge ammeter are used on the Sheridan vehicle perform steps (1) thru (33). If the R/T tester and the PFN charge ammeter are to be used in the hot mock-up. perform steps (2) thru (32).

(1) Remove ballistic connector cover, power supple control unit cover and power supply control unit as described in TM 9-2350-230-20.

(2) Slide latch (1) to the left and open cover assembly (2).

WARNING

Laser light leakage due to improper mounting may cause injury to eyes. Ensure that the light seal on the tester adapter and the R/T tester are correctly mated and that the screws are secured. This procedure will prevent light leakage between the interface of the R/T tester, the receiver-transmitter unit and the tester adapter.

(3) Remove three screws (3) and three washers (4) from front of the receiver-transmitter unit.

(4) Secure tester adapter (5) to the receiver-transmitter unit with three screws (3) and three washers (4).

(5) Secure R/T tester (6) to the tester adapter with two captive screws (7). Mount the R/T tester such that RCVR TEST on the tester adapter is exposed.

(6) Connect hot mock-up as illustrated in figure 2-5.

(7) Set power supply control unit to 24 nominal.

(8) Set LASER MODE CONTROL switch on the commander's control unit to ON.

(9) Turn MODE SELECT switch on the R/T tester clockwise to the position that lights white RCVR indicator lamp.

(10) Adjust the prism steering mechanism the azimuth and elevation controls on the R/T control unit) to achieve maximum signal output on RCVR-XMTR STATUS meter as follows:

(a) Adjust the azimuth control to obtain peak indication on the R/T tester RCVR-XMTR STATUS meter. Record setting as observed in the azimuth position window on the azimuth control.

(b) If required, turn the azimuth control to reduce indication on RCVR-XMTR STATUS meter to midscale.

(c) Adjust the elevation control to obtain peak indication on the RCVR-XMTR STATUS meter. Record setting as observed in the elevation position window on the elevation control.

(d) Turn the azimuth control to the position marked in (a) above.

(11) Observe the indication on RCVR-XMTR STATUS meter; the meter indicates in the white band when the receiver sensitivity is within acceptable limits. If meter indication is below the white band, the receiver gain is low and the receiver-transmitter unit and the power supply control unit must be replaced. Go to step (24).

NOTE

If the above malfunction is observed at general support, replace the photomultiplier chassis (89, fig. 3-6) assembly and repeat this procedure.

(12) Set MODE SELECT switch on the R/T tester to the position that lights OFF lamp. Do not disturb the setting of the prism steering mechanism.

(13) Set LASER MODE CONTROL switch on the commander's control unit to OFF.

WARNING

Laser light leakage due to improper mounting may cause injury to eyes. Ensure that the light seal on the tester adapter and the R/T tester are correctly mated and that the screws are secured. This procedure will prevent light leakage from occurring at the interface of the R/T tester, the receiver-transmitter unit, and the tester adapter.

(14) Move the R/T tester from the RCVR test position on the tester adapter to the XMTR TEST position.

(15) Set LASER MODE CONTROL switch on the commander's control unit to ON.

(16) Turn MODE SELECT switch on the R/T tester counterclockwise to the position that lights red XMTR indicator lamp.

(17) Set RESET-FIRE switch on the R/T tester to RESET and release.

(18) Pull out and set RESET-FIRE switch on the R/T tester to FIRE and release.

(19) Observe the indication on RCVR-XMTR STATUS meter; meter indicates in the red band when the transmitter output energy is within acceptable limits. Press PFN charge ammeter PRESS TO TEST switch. The maximum indication should be no more than 82 microamps. If the indication is not in the red band, remove PFN ADJ screw (1A, fig. 3-2) (permits access to

PFN voltage control) on the power supply control unit and adjust (10) the PFN voltage control in the power supply control unit as described in the subsequent steps.

CAUTION

Do not turn PFN voltage control too high as damage to the laser optics might occur. Turning R10 clockwise increases the energy output of the laser range finder, causing the meter needle to move to the right. If it is necessary to increase the laser energy output, do so in steps not greater than one full clockwise turn at a time, to avoid damage to the optics.

(20) Turn the PFN voltage control a maximum of one full clockwise turn and observe the indication on the RCVR-XMTR STATUS meter.

(21) Press PRESS TO TEST switch on PFN charge ammeter. If the PFN charge ammeter indicates more than 82 microamperes when the R/T tester indicates in the red band return the receiver-transmitter unit and power supply unit to GS maintenance for repair.

(22) Repeat step 20 until RCVR-XMTR STATUS meter indicates in the red. If adjustment cannot be accomplished, the receiver-transmitter unit must be replaced. Go to step (24).

NOTE

If the above malfunction is observed at general support, replace the transmitter component assembly (71, fig. 3-6) and repeat this procedure.

(23) Release PRESS TO TEST switch on the PFN charge ammeter.

(24) Set LASER MODE CONTROL switch in the commander's control unit to OFF.

(25) Disconnect PFN charge ammeter cable from PFN charge ammeter and power supply unit.

(20) Disconnect the tester cable from the R/T tester and the PFN charge ammeter cable.

(27) Loosen the four screws (7) that secure the R/T tester to the tester adapter.

(28) Remove the three screws (3) and three washers (4) that secure the tester adapter to the receiver-transmitter unit.

(29) Lubricate screw (3) with grease, MIL-G4343.

(30) Install the three screws (3) and three washers (4) on the front of the receiver-transmitter unit (8).

(31) Install PFN ADJ screw on power supply control unit.

(32) Close cover assembly (2) and latch (1).

(33) Install power supply control unit, power supply control unit ballistic connector cover, and power supply control unit cover as described in TM 9-23-230-12.

2-7. Troubleshooting of R / T Control C-8728/VVG-1 (A75)

a. *Test Setup*. Set up hot mock-up as described in paragraph 2-4.

b. *Troubleshooting Procedures*. All troubleshooting procedures for the R/T control unit are contained in table 2-5. This table is to be used after organizational maintenance has determined the malfunction exists in the R/T control unit.

Table 2-5. Troubleshooting of R/T Control C-8728/VVG-1 (A75)

Item No.	Malfunction	Probable cause	Corrective action
		WARNING	
	Ensure that power is off when installing or removing units in hot mock-up, or installing or removing components or assemblies in units.		
		NOTE	
	Unless otherwise specified, all controls, switches, and indicators are on the A75 unit and lamp illumination is adjusted for maximum brightness. Extender card test points are connected to corresponding circuit card pin numbers.		
1	RESET or RANGE lamp does not illuminate.	Defective lamp, defective switch, or A75 unit	1. Install failed unit in hot mock-up. 2. Perform portion of checkout (para 4-2a or 4-2b) which will duplicate malfunction. 3. Replace lamp associated with malfunction (para 3-3c) 4. Perform step 2. If malfunction is corrected, remove unit from hot mock-up. If malfunction is not corrected, continue with step 5.

Table 2-5. Troubleshooting of R/T Control C-8728/VVG-1 (A75)-Continued

Item No.	Malfunction	Probable cause	Corrective action
1	RESET or RANGE lamp does not illuminate-continued		5. Remove unit cover assembly and cover seal (para 3-3a). 6. Using multimeter, measure voltage at terminal 1 of malfunctioning switch. If multimeter indicates +15.0 ± 0.7 V. continue with step 7. If multimeter does not indicate +15.0 ± 0.7 V. return unit to depot for repair. 7. Set LASER MODE CONTROL switch on commander's control unit to OFF. 8. Using multimeter, check continuity as follows: RESET switch, terminal 2 to ground; RANGE switch, terminal 2 to pin N of connector J1. If continuity exists, continue with step 9. If continuity does not exist, return unit to depot for repair. 9. Replace malfunctioning switch (para 3-3d). 10. Perform step 2 and continue with step 11. 11. Remove unit from hot mock-up. 12. Replace cover seal and unit cover assembly (para 3-3a). 13. Install unit shipping cover (para 3-3f) and purge unit (TM 92350-230-12).
2	Azimuth or elevation control does move the scan prism smoothly.	Azimuth and/or elevation control	Return unit to depot for repair.
3	Reticle lamp illumination in receiver-transmitter unit is not varied by RTCL ILLUM control.	RTCL ILLUM control, or A75 unit.	1. Install failed unit in hot mock-up. 2. Perform portion of BIT (para 4-2a) which will duplicate malfunction. 3. Remove unit cover assembly and cover seal (para 3-3a). 4. Using multimeter, measure voltage at terminal 2 of pot. R1 (15, fig. 3-1) while adjusting RTCL ILLUM control. If voltage varies between +15.0 ± 0.7 V and +0.2:± 0.2 V return unit to depot for repair. If multimeter does not vary between + 15.0 ± 0.7 V and + 0.2 ± .2 V, continue with step 5. 5. Using multimeter, measure voltage at terminal 3 of R1. If multimeter indicates +15.0 ± .0.7 V. continue with step 6. If multimeter does not indicate +15.0 ± 0.7 V, return unit to depot for repair. 6. Set LASER MODE CONTROL switch on commander's control unit to OFF.

Table 2-5. Troubleshooting of R/T Control C-8728/VVG-1 (A 75) - Continued

Item No .	Malfunction	Probable cause	Corrective action
3	Reticle lamp illumination in receiver- transmitter unit is not varied by RTCL ILLUM control-		7. Using multimeter, check continuity between terminal1 of R1 and ground. If continuity exists, continue with step 8. If continuity does not exist return unit to depot for repair. 8. Replace RTCL ILLUM potentiometer (para 3-3e) 9. Perform step 2 and continue with step 10. 10. Remove unit from hot mock-up. 11. Replace cover seal and unit cover assembly (para 3-3a). 12. Install unit shipping cover (para 3-3f) and purge unit (TM 9-2350-230-12).

2-8. Troubleshooting of Laser Power Supply Control C9135/VVG-1 (A77)

a. Test Setup. Set up hot mock-up as described in paragraph 2-4.

b. Troubleshooting Procedures. All troubleshooting procedures for the power supply control unit are contained in table 2-6. This table is to be used after organizational maintenance has determined the malfunction exists in the power supply control unit. A circuit card puller (6, table 2-1) is provided in the special tools and test equipment to facilitate removal of the A77 circuit card assemblies.

Table 2-6. Troubleshooting of Laser Power Supply Control C-9135/VVG-1 (A77)

Item No.	Malfunction	Probable cause	Corrective action
	WARNING **Ensure that power is off when installing or removing units in hot mock-up, or installing or removing components or assemblies in units.** **NOTE** **It is assumed that the access cover assembly of the power supply control unit is removed throughout this table. Enable switch S1 under access cover by pulling lever outward and switch S2 on chassis, located adjacent to PFN A777Z1, by pressing down on its lever. Disable the switches by releasing the levers. For location of PFN, refer to figure 3-2. Extender card test points are connected to corresponding circuit card pin numbers.**		
1	PFN charge power supply A77A9, or PFN A77Z1.	Or RANGE lamp does not flash (unit A75).	1. Install failed unit in hot mock-up. 2. Enable interlock switch S1 on chassis. 3. Perform portion of (para 4-2a) which will duplicate malfunction. 4. Using multimeter, measure voltage at pin 2-7 of interface circuit card assembly A77A7. If multimeter indicates + 15.0 $\pm$ 1.0 V. continue with step 5. If multimeter does not indicate +15.0 $\pm$ 1.0 V. perform steps 20 thru 26 in "Corrective action" column for item No. 2. 5. Press PRESS TO TEST switch on PFN charge ammeter. Observe that meter does not indicate more than 82 microamperes when RCVR-XMTR STATUS

Table 2-6. Troubleshooting of Laser Power Supply Control C-9135/VVG-1 (A77) - Continued

Item No.	Malfunction	Probable cause	Corrective action
	RANGE lamp does not flash (unit A75)-continued		meter on R/T tester indicates near center of red band. If this indication is obtained, continue with step 18. If the RCVR-XMTR status meter indicates outside the red band, continue with step 6. 6. Disable interlock switch S1 on chassis. 7. Remove A77A9 module (para 3-5d). 8. Using a ground rod, ground coil (high-voltage terminal of PFN A77Z1 for 5 seconds. 9. Using multimeter, measure resistance from PFN A77Z1 coil terminal to ground. If resistance is greater than 1 megohm. Continue with step 12. If resistance is less than 1 megohm, continue with step 10. 10 Replace PFN A77Z1 (para 3-5 g). 11. Perform steps 14 thru 18. 12. Replace A77A9 module (para 3-5 d). 13. Adjust PFN voltage control A77, A9R10 six turns counter-clockwise. 14. Enable interlock switch S1 on chassis. 15. Using R/T tester, adjust A77, A9R10 for proper transmitter output energy (para 2-6). 16. Disable interlock switch S1 on chassis. 17. Remove unit from hot mockup. 18. Replace gasket and unit cover assembly (para 3-5a). 19 Purge unit (TM 9-2350-230-12).
2	RANGE(METERS) indicator (unit A79) does not display correct readout.	Counters circuit card assembly, A77A5: reply gating circuit card Assembly A77A4, low voltage Interface power supply A77A2. Interface circuit card assembly A77A7 or A77 unit.	1. Install failed unit in hot mock-up. 2. Enable interlock switch S1 on chassis. 3. Perform portion of Checkout (para 4-2a, 4-2b), which will duplicate malfunction. 4. Disable interlock switch S1 on chassis. 5. Remove A77A4 card (para 3-5c). 6. Install extender card (4, table 2-1). 7. Insert A77A4 card into extender card connector. 8. Enable interlock switch S1 on chassis. 9. Perform step 3 and continue with step 10. 10. Enable switch S1 on A77A4 card. 11 Using oscilloscope, measure signals at pins 24, 25, and 26 of A-7A4 card. If signals compare

Table 2-6. Troubleshooting of Laser Power Supply Control C-9135/VVG-1 (A77)--Continued

Item No.	Malfunction	Probable cause	Corrective action
2	RANGE (METERS) indicator (unit A79) does not display correct readout-continued.		with figure 2-7. continue with step 12. If signals do not compare with figure 2-7. continue with step 20. 12. Disable interlock switch S1 on chassis. 13. Remove A77A5 card para 3-5c). 14. Install extender card (3, table 2-1). 15. Using multimeter, check continuity between pin 31 of A77A4 card and pin 28 of A77A5 extender card; pin 27 of A77A4 card and pin 27 of A77A5 extender card: pin 26 of A77A5 card and pin 26 of A77A5 card; pin 25 of A77A4 card and pin 25 of A77A5 extender card: pin 24 of A77A4 card and pin 24 of A77A5 extender card. If continuity exists. continue with step 16. If continuity does not exist, return A77 unit to depot for repair. 16. Remove cable from A77J1 connector. 17. Using multimeter, check continuity between pin 13 of A77A5 extender card and pin H of A77J1connector; pin 12 of A77A5 extender card and pin J of A77J1 connector; pin 11 of A77A5 extender card and pin K of A77J1 connector; pin 10 of A77A5 extender card and pin L of A77J1 connector; pin 9 of A77A5 extender card and pin M of A77J1 connector, pin 8 of A77A5 extender card and pin N of A77J1 connector; pin 7 of A77A5 extender card and pin P of A77J1 connector; pin 6 of A77A5 extender card and pin R of A77J1 connector; pin 5 of A77A5 extender card and pin S of A77J1 connector; pin 4 of A77A5 extender card and pin T of A77J1 connector; pin 3 of A77A5 extender card and pin U of A77J1 connector: pin 2 of A77A5 extender card and pin V of A77J1 connector; pin 1 of A77A5 extender card and pin W of A77J1 connector. If continuity exists, replace A77A5 card and continue with step 18. If continuity does not exist, return A77 unit to depot for repair. 18. Remove extender cards. 19. Install A77A4 and A77A5 cards (para 3-5c), and continue with steps 61 thru 63.

Table 2-6. Troubleshooting o/ Laser Power Supply Control C-9135/VVG-1 (A77)-Continued

Item No.	Malfunction	Probable cause	Corrective action
2	RANGE (METERS) indicator unit A79 does not display correct readout-continued-		20. Using multimeter, measure voltage at pins 14 and 15 of A77A4 card. If multimeter indicates +15.0 ±.0.7 V and +4.0 ± 1.5 V. respectively, continue with step 30. If multimeter does not indicate +15.0 ± 0.7 V and +4.0 ±.1.5 V respectively, continue with step 21. 21. Disable interlock switch S1 on chassis. 22. Remove A7 A2 card (para 3-5c). 23. Install extender card (12, table 2-2). 24. Insert A; A2 card into extender card connector. 25. Enable interlock switch S1 on chassis. 26. Using multimeter. Measure voltage at pins 14 and 15 of A77A2 card. If multimeter indicates + 15.0 ± 0.7 V and +4.0 ± 1.5V, respectively, return A77 unit to depot for repair. If multimeter does not indicate +15.0 ± 0.7 V and +4.0 ± 1.5 V respectively replace AT A2 card and continue with step 27. 27 Disable switch S1 on chassis. 28. Remove extender cards. 29. Install A77A2 and A77A4 cards (para 3-5c) and continue with step 61. 30. (Conditions of step 10, MODE switch in TEST, and S1 on A77A4 card enabled, should exist at this time). Using oscilloscope measure signal at pin 6 of A77A4 card. If signal compares with figure 2-8, continue with step 35. If signal does not compare with figure 2-8, continue with step 31. 31 Using oscilloscope, measure signal at pin 29 of A77A4 card. If signal compares with figure 2-9, continue with step 35. If signal does not compare with figure 2-9, continue with step 32. 32. Using oscilloscope, measure signal at pin 7 of A77A4 card. If signal compares with figure 2-10, continue with step 35. If signal does not compare with figure 2-10, continue with step 33. 33. Using multimeter, measure voltage at pin34 of A77A4 card. If multimeter indicates +0.2 ± 0.2 V, continue with step 34. If multimeter does not indicate

Table 2-6. Troubleshooting of Laser Power Supply Control C-9135/VVG-1 (A77)-Continued

Item No.	Malfunction	Probable cause	Corrective action
2	RANGE (METERS)indicator unit A79 does not display correct readout-continued		+0.2:0.2 V, return A77 unit to depot for repair 34. Using multimeter, measure voltage at pins 14 and 15 of A77A4 card. If multimeter indicates 15.0±1.0 V and + 4.0 ±1.5 respectively, replace A77A4 card and perform steps 27 thru 29, and 61 thru 63.If multimeter does not indicate +15.0 ± 1.0 V and 4.0 ± 1.5 V, respectively, perform steps 21 thru 26. 35. Using oscilloscope, measure signal at pin 27 of A77A4 card. If signal compares with figure 2-11,continue with step 36. If signal does not compare with figure 2-11, continue with step 13. 36. Using oscilloscope, measure signal at pin 12 of A77A4 card. If signal compares with figure 2-12, continue with step 50. If signal does not compare with figure 2-12. continue with step 37. 37. Perform step 32. If signal compares with figure 2-10, Continue with step 38. If signal does not compare with figure 2-10. continue with step 33. 38. Using multimeter, measure voltage at pin 10 of A77A4 card. If multimeter indicates +4.0 ± 1.5 .V replace A77A4 card and perform steps 27 and 28. If multimeter does not indicate +4.0±1..5 V, continue with step 39. 39. Using multimeter, measure voltage at pin 9 of A77A4 card. If multimeter indicates +5.0 ± 0.5V, replace A.77A4 card and perform steps 27 and 28. If multimeter does not indicate +5.0 ± 0.5V. continue with step 40. 40. Disable interlock switch S1 on chassis. 41. Remove A77A7 card para 3-7c). 42. Install extender card (11, table 2-2). 43. Insert A7TAT card into extender card connector. 44. Enable interlock switch S1 on chassis. 45 Using multimeter. Measure voltage at pin 10 of A77A7 card. If multimeter indicates+5.0 ± 0.5V. return A77 unit to depot for repair. If multimeter does not indicate +4.0 ± 1.5 V, continue with step 46.

Table 2-6. Troubleshooting of Laser Power Supply Control C-9135/VVG-1 (A 77)-Continued

Item No.	Malfunction	Probable cause	Corrective action
2	RANGE (METERS)indicator unit A79 does not display correct readout--continued.		46. Using multimeter measure voltage at pin 11 and 12 of A77A7card. If multimeter indicates + 0.2 ± 0.2V and +4.0 ± 1.5 V. respectively. replace A77A7 card and continue with step 47 If multimeter does not indicate +0.2 ± 0.2 V and + 4.0 ±1.5 V re-spectively. return A77 unit to depot for repair. 47. Perform steps 27 and 28, and continue with step 48. 48. Install A77A4 and A77A7 cards (para 3-5c) and continue with step 6 1. 49. Enable interlock switch S1 on chassis. 50. Perform step 33. If multimeter indicates +0.2 ± 0.2 V, continue with step 51. If multimeter does not indicate +0.2 ± 0.2 V. Return A77 unit to depot for repair. 51. Perform step 38. If multimeter indicates +4.0 ± 1.5 V, continue with step 52. If multimeter does not indicate +4.0 ± 1.5V,perform steps 41 thru 46. 52. Using multimeter, measure voltage at pin 9 of A77A4 card. If multimeter indicates +4.0 ± 1.5 V. continue with step 57. If multimeter does not indicate + 4.0 ± 1.5 V. continue with step 53. 53. Perform steps 41 thru 44. 54. Using multimeter. Measure voltage at pin 10 of A77A7 card. If multimeter indicates + 4.0 ± 1.5 V. return A77 unit to depot for repair. If multimeter does not indicate +4.0 ± 1.5 V. continue with step 55. 55. Using multimeter measure voltage at pins 11 and 12 of A77A7 card. If multimeter indicates + 0.2 ± 0.2 V and +4.0 ± 1.5 V, respectively. replace A77A7 card and continue with step 56. If multimeter does not indicate +0.2 ± 0.2 V and +4.0 ± 1.5 V, respectively. return A77 unit to depot for repair. 56. Perform steps 27, 28,48 and 49. 57 Using oscilloscope. Measure signal at pin 7 of A77A4 card. If signal compares with figure 2-10, continue with step 60. If signal does not compare with figure 2-10 continue with step 58.

Table 2-6. Troubleshooting of Laser Power Supply Control C-9135/VVG-1 (A771) - Continued

Item No.	Malfunction	Probable cause	Corrective action
2	RANGE(METERS) indicator unit A79 does not display correct readout--continued.		58. Using multimeter. Measure voltage at pins 14 and 15 of A7TA4 card If voltmeter indicates15.0.±1.0 V and +5.0 ± 0.5V respectively, replace A77A4 card and continue. with step 27 If voltmeter does not indicate +15.0 ± 1.0 V and +5.0± 0.5 V, respectively continue with step 59). 59. Perform steps 21 thru 29. 60 Using oscilloscope, measure signal at pin 31 of A77A4 card. If signal compares with figure 2-13, replace A77A4 card and continue with step 27. If signal does not compare with figure 2-13, continue with step 13. 61. Replace gasket and unit cover assembly (para 3-5a). 62. Remove units from hot mock-up. 63. Purge unit (TM 9-2350-230-12).
3	RANGE (METERS) indicator A79 is incorrect. MALF indicator (unit A79) lights WHEN range switch (unit A75) is pressed.	Low voltage power supply circuit. card assembly A77A2, reply gating circuit card assembly A77A4, counters circuit card assembly A77A5, interface circuit card assembly A77A7 PFN charge power supply A77A9 or A77 unit	1. Install failed units into hot mock-up. 2. If malfunction occurred during actual ranging operation, utilize R/T tester (para 2-6) to check receiver sensitivity and transmitter output energy. If receiver sensitivity is not within tolerance, perform procedure in "Corrective action" column for item No 8. If transmitter output energy is not within tolerance perform steps 13 thru 15 in "Corrective action" column for item No.1. 3. Perform procedure in "Corrective action" column for item No.2.
4	A "2" is displayed on the right hand RANGE(METERS) indicator (unit A79).	Counters circuit card assembly A7A5, Reply gating circuit card Assembly A77A4, low voltage power supply A77A2, interface circuit card assembly A77A7 or A77 unit.	1. Install failed unit into hot mock-up. 2. Enable switch S1 on A77A4 card, and interlock switch S2 on, or chassis. 3. Perform portion of BIT (para 4-2a) which will duplicate malfunction. 4. Disable switch S1on A77A4 card, and interlock switch S2 on chassis . 5. Remove A77A4 card para 3-5c). 6. Install extender card (4, table 2-1). 7. Insert A77A4 card into extender card connector. 8. Enable switch S1on A77A4 card and interlock switch S2 on chassis.

Table 2-6. Troubleshooting of Laser Power Supply Control C-9135/VVG-1 (A77) - Continued

Item No.	Malfunction	Probable cause	Corrective action
4	A ''2" is displayed on the right. hand 'RANGE (METERS) indicator unit (A79)-- continued.		9. Perform step 3 and continue with step 10. 10. Using multimeter, measure voltage at pin 5A of A77A4 card. If multimeter indicates + 0.2±0.2 V. continue with step 16. If multimeter indicates +5.0 ± 0.5 V. Continue with step 11. 11. Using multimeter measure voltage at pin 5 on A7T7A7 card. If multimeter indicates +4.0 ± 1.5 V. continue with step 12. If multimeter indicates +0.2 ± 0.2 V return A77 unit to depot. 12. Using multimeter measure voltage at pin 31 on A77A7 card. If voltmeter indicates +4.0 ± 1.5 V. Replace AT7A7 card and continue with step .21. If multimeter indicates +0.2 ± 0.2 V, continue with step13. 13. Disable switch S1 on A77A4 card. And interlock switch S2 on chassis. 14. Remove A77A5 card (para 3-5c). 15. Install extender card (3, table 2-1) connector. 16. Insert A77A5 card into extender card connector. 17. Enable switch S1 on A77A4 card, and interlock switch S2 on chassis. 18. Perform step 3 and continue with step 19. 19. Using multimeter, measure voltage at pin A77A5 card. If multimeter indicates +3.5 ± 1.5 V, return A77 unit to depot for repair. If multimeter indicates +0.2 ± 0.2 V, continue with step 20. 20. Perform steps 11 thru 63 in "Corrective action" column for item No. 2. 21. Disable switch S1 on A77A4 card and switch S2 on chassis. 22. Remove extender cards. 23. Install A77A4 and A77A7 cards (para 3-5 c). 24. Remove unit from hot mock-up. 25. Purge unit (TM 9-2350-230-12).
5	A "4" is displayed on the right hand RANGE(METERS) indicator (unit A79) before RANGE switch(unit A75) is pressed.	-1600 V power supply circuit card assemblyA77A1, low voltage power supply A77A2, or A77 unit.	1. Install failed units into hot mock-up. 2. Enable switch S1 on A77A4 card, and interlock switch S1 on chassis. 3. Perform portion of Checkout (para 4-2a or 4-2b) which will duplicate malfunction.

Table 2-6. Troubleshooting of Laser Power Supply Control C-9135/VVG-1 (A77) - Continued

Item No.	Malfunction	Probable cause	Corrective action
5	A "4" is displayed on the right hand RANGE(METERS) indicator unit A79 before RANGE switch (unit A75) is pressed-continued.		4. Disable switch S1 on A77A4 card, and interlock switch S1 on chassis. 5. Remove A77A1card (para 3-5c). 6. Install extender card (6, table 2-1) 7. Insert A7 AI card into extender card. 8. Enable switch S1 on A77A4 card and interlock switch S1 on chassis. 9. Perform step 3 and continue with step10. **WARNING** **The following step requires measurement of dangerous potential(-1900 ± 200 V). Exercise extreme caution when taking this measurement.** 10. Using multimeter, measure voltage at pin 29 of A77A1 card. If multimeter indicates -1900 ± 20 V, continue with step 11. If multimeter does not indicate -1900 ± 200 V, continue with step 12. 11 Using multimeter, measure voltage at pin 8 of A77A9 card. If multimeter indicates +4.0 ± 1.5 V. Continue with item 6 "Corrective action". If multimeter indicates +0.2 ± 0.2 V. continue with step 12. 12. Using oscilloscope, measure signals at pins 5 and 14 of A77A1 card. If signals compare with figure 2-14. continue with step 13. If signals do not compare continue with step 16. 13. Using multimeter, measure voltage at pin 7A of A77A1 card. If multimeter indicates +15.0 ± 1.0 V replace A77A1 card and continue with step 14. If signals do not compare with figure 2-14. Continue with steps14 and 15. 14. Disable switch S1 on A77A4 card. and interlock switch S1 on chassis. 15 Remove extender card and continue with step 25. 16. Remove A77A2 card para 3-5c). 17. Install extender card (12, table 2-2). 18. Insert ATTA2 card into extender card connector.

Table 2-6. Troubleshooting of Laser Power Supply Control C-9135/VVG-1 (A77) - Continued

Item No.	Malfunction	Probable cause	Corrective action
5	A "4" is displayed on the right hand RANGE(METERS) indicator (unit A79 before RANGE switch(unit A75) is pressed-continued		19 Enable switch S1 on A77A4 card. and interlock switch S2 on chassis. 20 Perform step 2 and continue with step 21. 21. Using oscilloscope, measure signals at pins 5 and 10 of A77A2 card. If signals compare with figure 2-14, return A77 unit to depot for repair. If signals do not compare with figure 2-14, replace A77A2 card and continue with step 22. 22. Disable switch S1 on A77A4 card, and interlock switch S1 on chassis. 23. Remove extender cards. 24. Replace A77A1 and A77A2 cards (para 3-5c), and continue It, with step 26. 25. Install AT7AI card (para 3-5c) 26 Remove unit from hot mock-up. 27 Purge unit (TM 9-2350-230-12)
6	A "4" is displayed on the right hand RANGE (METERS) indicator (unit A79) after RANGE switch is pressed.	PFN charge power supply AT77A9, or interface circuit card assembly	1. Install failed units into hot mock-up. 2. Replace A77A9 module (para 3-5 d). 3. Perform steps 13 thru 19 in "Corrective action" column for item No.1.
7	With the system operating on power provided by batteries in A78 unit, a "4" is displayed on the right hand RANGE (METERS) indicator after range switch is pressed	PFN change power supply A77A9, or interface circuit card assembly A77A7.	Perform procedure in "Corrective action" column for item No.6.
8.	Improper readout on RANGE (METERS) indicator when RANGE RETURN SELECTOR 1 or 2 (unit A79) is selected.	Select logic circuit card assembly A77A3 counters circuit card assembly A77A5, or A77unit.	1. Install failed unit into hot mock-up. 2. Enable switch S1 on card A77A4, and interlock switch S1 on chassis. 3. Perform portion of Checkout (para 4-2a or 4-2b) which will duplicate malfunction. 4. Disable switch S1 on card A77A4, and interlock switch S1 on chassis. 5. Remove ATT A3 card (para 3-5c). 6. Install extender card (5, table 2-1) 7. Insert AT A3 card into extender card connector. 8. Enable switch S1 on card A77A4 and interlock switch S1 on chassis. 9. Perform step 3 and continue with step 10. 10. Using multimeter, measure voltage at pin 20, 21, or 22, of A77A3 card. If multimeter

Table 2-6. Troubleshooting of Laser Power Supply Control C-9135/VVG-1 (A77) - Continued

Item No.	Malfunction	Probable cause	Corrective action
8	Improper readout on RANGE RANGE (METERS) indicator when RANGE RETURN is selected continued		indicates +0.2 ± 0.2 V with proper range selection. continue with step 11. If multimeter indicates+4.0 ± 1.5 V, with proper range selection. continue with step 22. 11. Using multimeter measure voltage at pin 5,6, or 8 of A77A3 card. If multimeter indicates +4.0 ± 1.5 V, with proper range selection. replace A77A3 card and continue with step 17. If multimeter indicates +0.2 ± 0.2 V with proper range selection return A77 unit to depot for repair. 12. Disable switch S1and interlock switch S1 on chassis. 13. Remove A77A5 card (para 3-5c). 14. Install extender card 13, table 2-1) 15. Insert A77A5 card into extender card connector. 16. Enable switch S1 and interlock switch S1 on chassis. 17. Perform step 3 and continue with step 18. 18. Using multimeter, measure voltage at pin 20, 21, or 22 of A77A5. card. If multimeter indicates +0.2 ± 0.2 V with proper range selection, replace A77A5 card and continue with step 19. If multimeter does not indicate +0.2 ± 0.2 V with proper range return selection, return A77 unit to depot for repair. 19. Disable switch S1 and interlock switch S1 on chassis. 20. Remove extender cards. 21. Install A77A3 and A77A5 cards (para 3-5c) and continue with step 24. 22. Remove extender card. 23. Install A77A3 card (para 3-5c) 24. Remove unit from hot mock-up. 25. Purge unit (TM 9-2350-230-12).

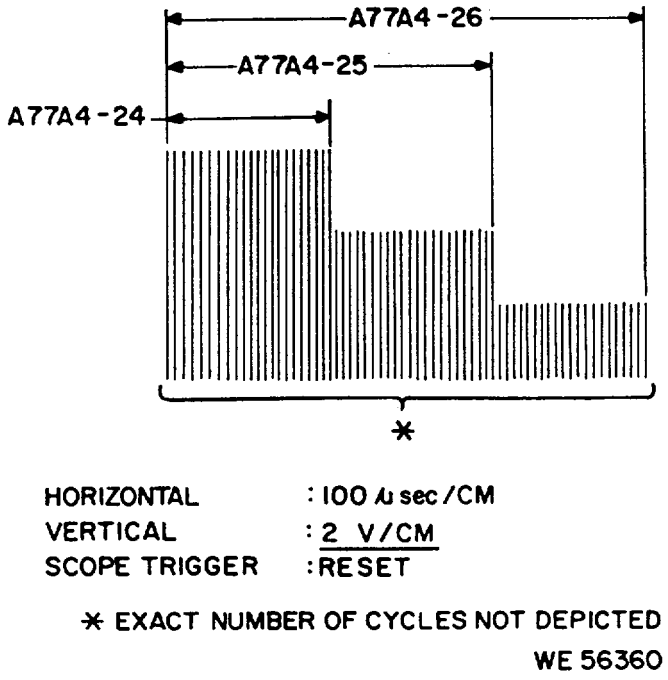


Figure 2-7. Counter input signal.

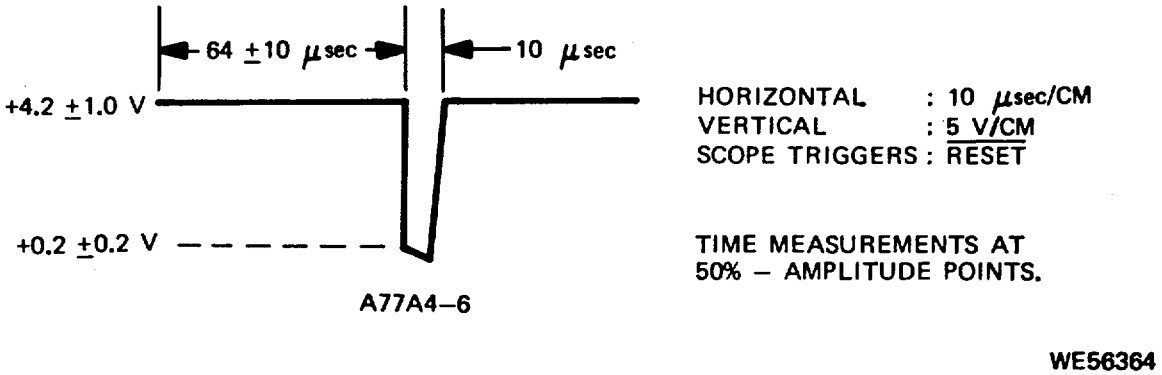


Figure 2-8. Minimum range inhibit signal.

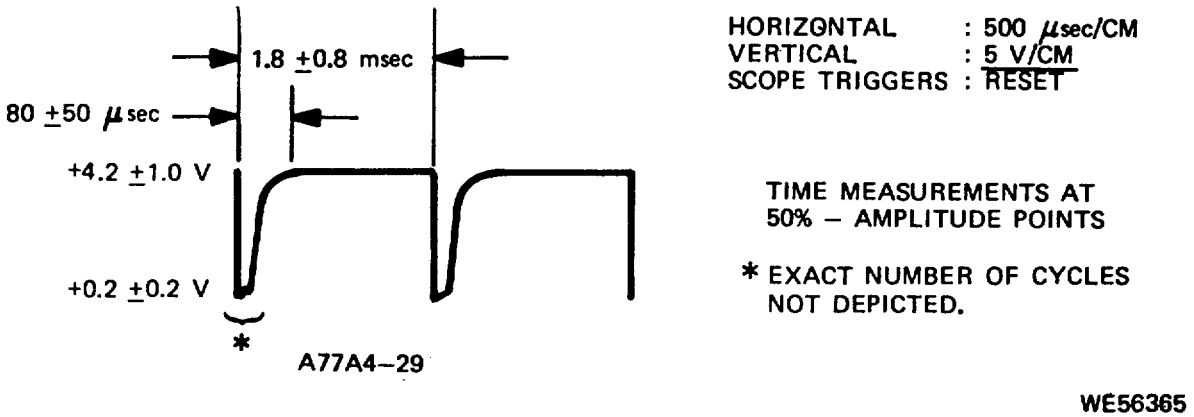


Figure 2-9. Reset Signal.

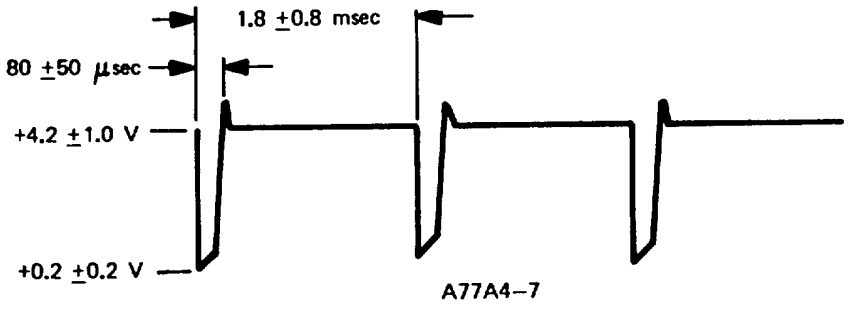


Figure 2-10. Manual reset select signal.

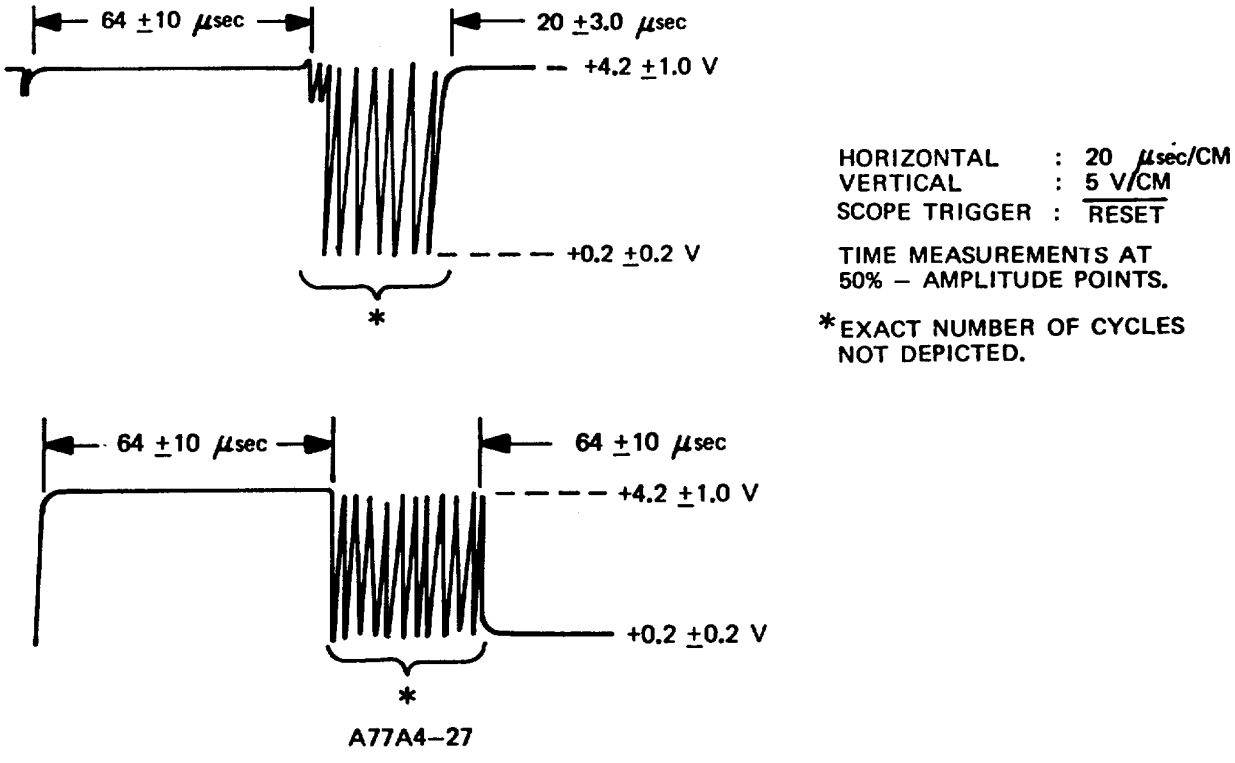


Figure 2-11. Minimum range signal.

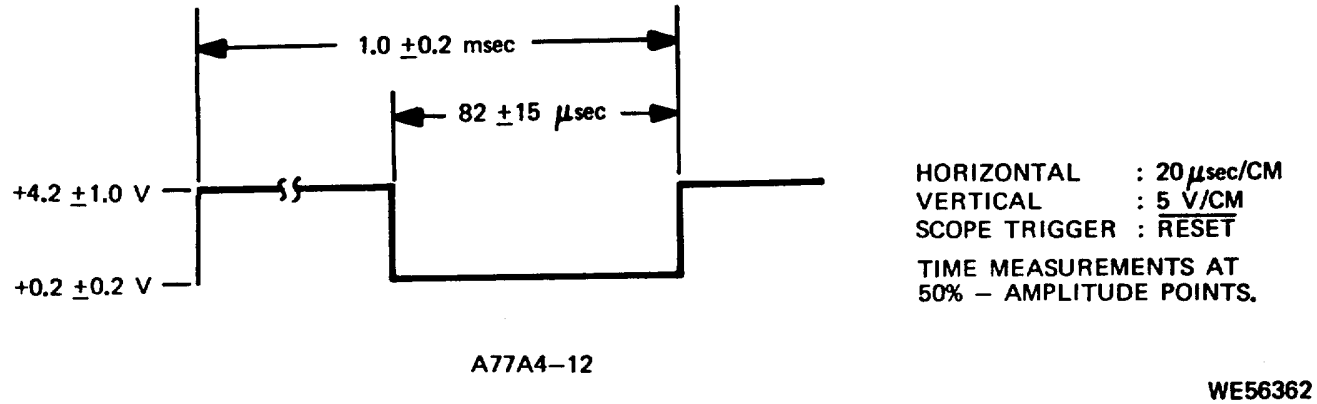
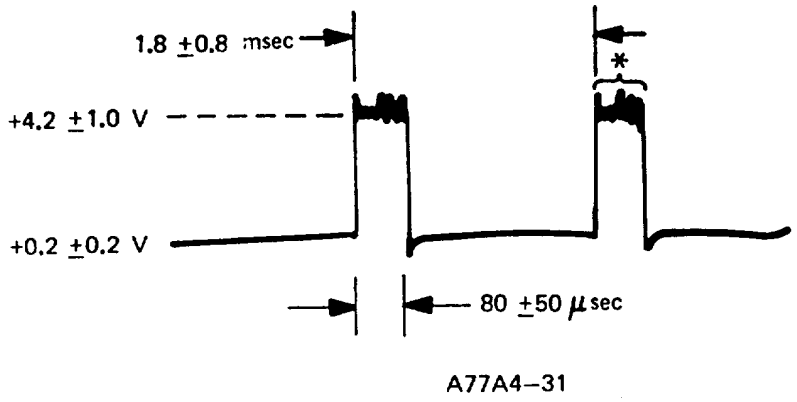


Figure 2-12. 10 km gate signal.



HORIZONTAL : 50 µsec/CM
VERTICAL : 5 V/CM
SCOPE TRIGGERS : $\overline{\text{RESET}}$

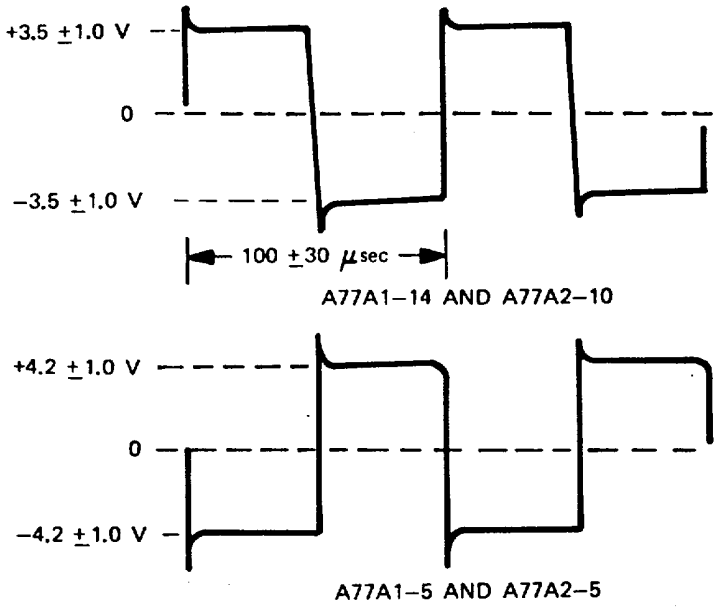
TIME MEASUREMENTS AT 50% – AMPLITUDE POINTS.

BASED ON EXACT INSTANT OF MEASUREMENT, A GROUND SIGNAL OR SIGNAL SHOWN ON ILLUSTRATION MAY BE DISPLAYED.

* EXACT NUMBER OF CYCLES NOT DEPICTED.

WE56366

Figure 2-13. 9995 signal.



HORIZONTAL : 20 µsec/CM
VERTICAL : 5 V/CM
SCOPE TRIGGER : SYNC SIGNAL A

TIME MEASUREMENTS AT 50% – AMPLITUDE POINTS.

WE56367

Figure 2-14. Sync signals A and B (power supply control unit).

2-9. Troubleshooting of Battery Power Supply PP-6607/VVG-1 A78).

a. Test Setup. Set up hot mock-up as described in paragraph 2-5

b. Troubleshooting Procedures. All troubleshooting procedures for the battery power supply unit are contained in table 2-7. This table is to be used after organizational maintenance has determined the malfunction exists in the battery power supply unit.

Table 2-7. Troubleshooting of Battery Power Supply PP-6607/VVG-1 (A78)

Item No.	Malfunction	Probable cause	Corrective action
	WARNING **Ensure that power is off when installing or removing units in hot-mock-up, or installing or removing components or assemblies in units. The storage battery assembly A78B1 can supply enough short-circuit current to generate temperatures high enough to cause metal to fuse together, and also cause severe burns to the human body. When handling the battery assembly remove all rings front fingers and do not insert metal objects into the immediate area of the battery assembly.**		
	NOTE **Extender card test points are connected to corresponding circuit card pin numbers.**		
1	When LASER MODE CONTROL switch (unit A79) is turned to TEST or ON position, no switches or indicators (unit A75, or A79) illuminate.	Power control electronic component. assembly card A78A2. Or A78 unit	1. Install failed unit in hot mock-up. 2. Perform portion of Checkout (para 4-2a or 4-2b) which will duplicate malfunction 3. Remove A78A2 card (para 3-7b). 4. Install extender card (15, table 2-2). 5. Insert A78A2 card into extender card connector. 6. Perform step 2 and continue with step 7. 7. Using multimeter, measure voltage at pin 17 of A78A2 card. If multimeter indicates +24.0 ± 1.0 V, return A78 unit to depot for repair. If multimeter does not indicate +24.0 ± 1.0 V, continue with step 8. 8. Using multimeter, measure voltage at pin 25 of A78A2 card. If multimeter indicates +24.0 ± 1.0 V, replace A78A2 card and continue with step 9. If multimeter indicates +0.2 ± 0.2 V, return A78 unit to depot for repair. 9. Remove extender card. 10. Install A78A2 card (para 3-7b). 11. Remove unit from hot mock-up. 12. Purge unit (TM 9-2350-230-12).
2	A "1"' is displayed on the right hand RANGE (METERS) indicator (unit A79).	Battery charge sensor circuit card assembly A78A3, charge control circuit card assembly A78A4 power control circuit card assembly A78A2, or A78	1. Install failed unit into hot mock-up. 2. Perform portion of BIT (para 4-2a) unit which will duplicate malfunction. 3. Remove A78A3 card (para 3-7b) 4. install extender card (13, table 2-2). 5. Insert A78A3 card into extender card connector. 6. Perform step 2 and continue with step 7.

Table 2-7. Troubleshooting of Battery Power Supply PP-6607/VVG-1 (A78) - Continued

Item No.	Malfunction	Probable cause	Corrective action
2	A "1" is displayed on the right hand RANGE.(METERS) indicator (unit A79)--continued.		7. Using a multimeter, measure voltage at pins 6 and 20 of A78A3 card If voltage difference is greater than 1.0 V, replace A78A3 card and continue with step 25. If voltage difference is not greater than 1.0 V, continue with step 8. 8. Using oscilloscope measure signal at pins 17 and 18 of A78A3 card. If signals compare with figure 2-15, continue with step 10. If signals do not compare with figure 2-15, continue with step 9. 9. Using multimeter, measure voltage at pins 2 and 12 of A78A3 card. If multimeter indicates +15 ± 0.7 V and +5.0 ± 0.2 V, respectively, replace A78A3 card and continue with step 25. If multimeter does not indicate +15.0 ± 0.7 V and +5.0 ± 0.2 V, respectively, return A78 unit to depot for repair. 10 Using multimeter. Measure voltage at pin 14 of A78A3 card. If multimeter indicates +5.0 ± 0.7 V, return A78 unit to depot for repair. If multimeter indicates +0.2 ± 0.2 V, continue with step 11. 11. With battery fully charged, within a +28±:5 V range, and using multimeter measure voltage at pin 20 of A78A3 card. The multimeter should indicate the charged battery voltage. If multimeter indicates within this range, continue with step 18. If multimeter does not indicate within this range, continue with step 12. 12. Remove A78A4 card (para 3-7b). 13. Install extender card (14, table 2-2) 14. Insert AT8A4 card into extender card connector. 15. Perform step 2 and continue with step 16. 16. Using multimeter, measure voltage at pin 8 of A78A4 card. If multimeter indicates the same voltage as for step 10, return A78 unit to depot for repair. If multimeter does not indicate the same voltage as for step 10, continue with step 17. 17. Using oscilloscope, measure

Table 2-7. Troubleshooting of Battery Power Supply PP-6607/VVG-1 (A78) - Continued

Item No.	Malfunction	Probable cause	Corrective action
			signals at pins 6 and 5 of A78A4 card. If signals compare with figure 2-15, replace A78A4 card and continue with step 25. If signals do not compare with figure 2-15, return unit to depot for repair. 18. Using multimeter, measure voltage at pin 6 of A78A3 card. If multimeter indicates the same voltage as for step 10, replace A78A3 card, and continue with step 25. If multimeter does not indicate the same voltage as for step 10, continue with step 19. 19. Remove A78A2 card (para 3-7b). 20. Install extender card (15, table 2-2). 21. Insert A78A2 card into extender card connector. 22. Perform step 2 and continue with step 23. 23. Using multimeter, measure voltage at pin 8 of A78A2 card. If multimeter indicates the same voltage as for step 10, return A78 unit to depot for repair. If multimeter does not indicate the same voltage as for step 10, continue with step 24. 24. Using multimeter, measure voltage at pins 21 and 22 of A78A2 card. If multimeter indicates the same voltage as for step 10), replace A78A2 card and continue with step 25. If multimeter does not indicate the same voltage as for step 10, return unit to depot for repair. 25. Remove extender cards. 26. Install cards (para 3-7b). 27. Remove unit from hot mock-up. 28. Purge unit (TM 9-2350-230-12).
3	BAT LOW indicator illuminates (unit A79).	Storage battery assembly A78B1, or battery charge sensor circuit card assembly A78A3.	1 Install failed unit in hot mock-up. 2. Charge storage battery assembly (para 2-13) If malfunction is corrected continue with step 15. If malfunction is not corrected continue with step 3. 3. Replace storage battery assembly (para 3-7 c). 4. Perform portion of BIT (para 4-2a) which will duplicate malfunction. If malfunction is corrected, continue with step 12. If malfunction is not corrected continue with step 8. 5. Remove A78A3 card (para 3-7b). 6. Install extender card (13. table 2-2).

Table 2-7. Troubleshooting of Battery Power Supply PP-6607/VVG-1 (A78) - Continued

Item No.	Malfunction	Probable cause	Corrective action
3	BAT LOW indicator illuminates (unit A79)-- continued.		7. Insert A78A3 card into extender card connector. 8. Perform step 4 and continue with step 9. 9. Using multimeter, measure voltage at pin 11 of A78A3 card. If multimeter indicates +0.2 ± 0.2 V, replace A78A3 card and continue with step 10. 10. Remove extender card. 11. Install A78A3 card (para 3-7b). 12. Remove unit from hot mock-up. 13. Install gasket and unit cover (para 3-7a). 14. Purge unit (TM 9-2350-230-12).
4	BAT DR indicator illuminates (unit A75) when system operates on vehicular power.	Battery charge sensor circuit card assembly A78A3, or A78 unit.	1. Install failed unit in hot mock-up. 2. Perform portion of BIT per (para 4-2 a) which will duplicate malfunction. 3. Remove A78A3 card (para 3-7b). 4. Install extender card (13, table 2-2). 5. Insert A78A3 card into extender card connector. 6. Perform step 2 and continue with step 7 7. Using a multimeter. Verify voltage at pin 15 of A78A3 card indicates +0.9 ± 0.5 V. 8. Using multimeter ,measure voltage at pin 15 of A78A3 card. If multimeter indicates greater than + 24 V, replace A78A3 card and continue with step 9. If multimeter indicates +0.2 ± 0.2 V, return A78 unit to depot for repair. 9. Remove extender card. 10. Install A78A3 card para 3-7b). 11. Remove unit from hot mock-up. 12 Purge unit (TM 9-2350-230-12).

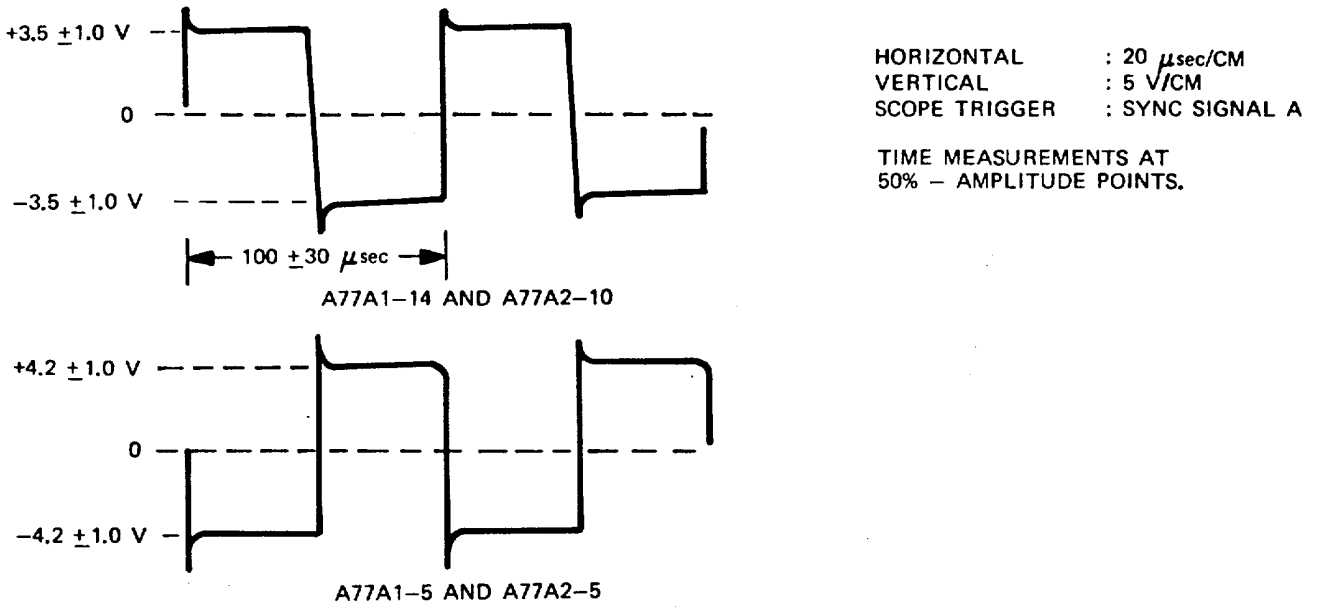


Figure 2-15. Sync signals A and B (battery power supply unit).

2-10. Troubleshooting of Laser Ranging Commander's Control C-9134/VVG-1 A79).

a. Test Setup. set up riot mock-up as described in paragraph 2-5.

b. Troubleshooting Procedures All troubleshooting procedures for the commander's control unit are contained in table 2-8. This table is to be used after organizational maintenance has determined the malfunction to exist in the commander's control unit.

Table 2-8. Troubleshooting of Laser Ranging Commander's Control C-9134/VVG-1 (A79)

Item No.	Malfunction	Probable cause	Corrective action
	WARNING **Ensure that power is off when installing or removing units in hot mock-up, or installing or removing components or assemblies in units.**		
	NOTE **Unless otherwise specified, all switches, indicators, and test points are on the A79 unit.**		
1	When TSW switch is pressed, one or more do not illuminate.	Defective lamp, TSW switch, or logic circuit card A79A1.	1. Install failed unit in hot mock-up. 2. Perform portion of checkout (para 4-2a or 4-2b) which will duplicate malfunction. 3. Replace lamp associated with malfunction (para 3-9f). 4. Perform step 2. If malfunction is not corrected, continue to step 5. 5. Remove unit access cover (para 3-9a). 6. Using multimeter, measure voltage at TP7 on A79A1 card

Table 2-8. Troubleshooting of Laser Ranging Commander's Control C-9134/VVG-1 (A79)-Continued

Item No.	Malfunction	Probable cause	Corrective action
1	When TSW switch is pressed one or more do not illuminate-continued.		with TSW pressed. If multimeter indicates +0.8±0.8 V. continue with step 7. If multimeter does not indicate +0.8 ± 0.8 V return unit to depot for repair. 7. Using multimeter, measure TP8 thru TP10 ,TP15 thru TP19. And voltage at TP28. If multimeter does not indicate 1.5 ± 0.5 V. At TP8 thru TP10. And and +0.8 ± 0.8 V at the other test points, replace A79A1card (para 3-9b) and continue with step 8. 8. Perform step 2 and continue with step 9. 9. Remove unit from hot mock-up. 10. Replace unit access cover (para 3-9a) 11. Purge unit (TM 9-2350-230-12)
2	When DMR switch is pressed, The indicators do not dim or brighten	A79 unit	Return unit to depot for repair.
3	MALF lamp does not illuminate when a system malfunction is detected.	Defective lamp or logic circuit card A79A1.	1. Install failed unit in hot mock-up. 2. Perform portion of checkout (para 4-2a or 4-2b) which will duplicate malfunction. 3. Remove unit access cover (para 3-9 a). 4. Using a multimeter, measure voltage at TP19 on A79A1 card with RANGE switch pressed. If multimeter indicates +0.2 ± 0.2 V, return unit to depot for repair. If multimeter indicates +15.0 ± 0.7 V, proceed to step 5. 5. Using multimeter, measure voltages at TP24, TP25, TP26, and TP32 on AQ9A1 card. If multimeter indicates +0.2 ± 0.2 v at any test point, replace A79A1 card (para 3-9b) and continue to step 6. If multimeter does not indicate +0.22 ± 0.2 V at any test point, return unit to depot for repair. 6. Perform step 2 and continue to step 7. 7. Remove unit from hot mock-up. 8. Replace unit access cover (para 3-9a). 9. Purge unit (TM 9-2350-230-12).
4	Incorrect indication on RANGE (METERS) or RETURNS indicators.	Readout circuit card assembly A79A2.	1. Install failed unit in hot mock-up. 2. Remove unit access cover (para 3-9a). 3. Perform portion of checkout (para 4-2a or 4-2b) which will duplicate malfunction. 4. Using a multimeter, measure voltage at TP22 on A-79A2 card. If multimeter indicates

Table 2-8. Troubleshooting of Laser Ranging Commander's Control C-9134/VVG-1 (A79)-Continued

Item No.	Malfunction	Probable cause	Corrective action
			+0.2 ± 0.2 V with TSW switch pressed, continue with step 5. If multimeter does not indicate +0.2 ± 0.2 V with TSW switch pressed, return unit to depot for repair. 5. Using a multimeter, measure for +0.2 ± 0.2 V at TP4 thru TP11, TP13, TP14, TP16 thru TP21 and TP23 thru TP25 (depending upon which numerical indicator is incorrect). (See fig. 2-37 to correlate numerical indication with test point. If multimeter indication is correct, return A79 unit to depot for repair. If multimeter indication is incorrect, replace A79A2 card (para 3-9c) and continue with step 6. 6. Perform step 3 and continue with step 7. 7. Remove unit from hot mock-up. 8. Replace unit access cover (para 3-9a). 9. Purge unit TM 9-2350-230-12).
5	LAST lamp does not light when RESET switch (unit A75) is pressed.	Logic circuit card assembly A79A1.	1. Install failed unit in hot mock-up. 2. Remove unit access cover (para 3-9a). 3. Perform portion of BIT (para 4-2a) which will duplicate malfunction. 4. Using multimeter, measure voltage at TP12 on A79A1 card with RESET switch pressed. If multimeter indicates +0.2 ± 0.2 V, return unit to depot for repair. If multimeter indicates +4.0 ± 1.5 V, continue with step 5. 5. Measure voltage at TP8 on A79A1 card with RESET switch pressed. If multimeter indicates +0.2 ± 0.2 V, replace A79A1 card (para 3-9b), and continue with step 6. If multimeter does not indicate +0.2 ± 0.2 V, return unit to depot for repair. 6. Perform step 3 and continue with step 7. 7. Remove unit from hot mock-up. 8. Replace unit access cover (para 3-9a). 9. Purge unit TM 9-2350-230-201.
6	RANGE (METERS) and RETURNS indicators do not blank when RANGE switch unit A75) is pressed.	Logic circuit card. A79A1: or Readout Circuit Assembly, A79A2.	1. Install failed unit in hot mock-up. 2. Remove unit access cover para 3-9a). 3. Perform portion of checkout (para 4-2a or 4-2b) which will duplicate malfunction.

Table 2-8. Troubleshooting of Laser Ranging Commander's Control C-9134/VVG-1 (A79)-Continued

Item No.	Malfunction	Probable cause	Corrective action
6	(RANGE (METERS) and RETURNS indicators do not blank when RANGE switch (unit A75 is pressed-continued.		4. Using multimeter, measure voltage at TP22 on A79AI card with RANGE switch pressed. If signal momentarily goes high, continue with step 5. If signal does not momentarily go high, continue with step 6. 5. Use multimeter to measure voltage at TP15 of A79A2 card with RANGE switch pressed. If signal momentarily goes high, replace AT9A2 card (para 3-9c), and continue with step 7. If multimeter indication does not momentarily go high, return unit to depot for repair. 6. Using multimeter, measure voltage at TP23 of A79A1 card with RANGE switch pressed. If multimeter indicates +0.2 ± 0.2 V. replace AT9A1 card (para 3-9b) and perform steps 7 and 8. If multimeter indicates +5.0 ± 0.1 V return unit to depot for repair. 7. Perform step 3 and continue with step 8. 8. Remove unit from hot mock-up. 9. Replace unit access cover (para 3-9a). 10. Purge unit (TM 9-2350-230-12).
7	RANGE RETURN SELECTOR 1 or 2 lamp does not illuminate.	Logic Circuit card assembly A79A1.	1. Install failed unit in hot mock-up 2. Remove unit access cover (para 3-9a). 3. Perform portion of checkout (para 4-2a or 4-2b) which will duplicate malfunction. 4. Using multimeter, measure voltage at TP6 on A79A1 card after 1 switch has been pressed, or at TP4 on A79A1 card after 2 switch has been pressed. If multimeter indicates +0.9 ± 0.5 V, return unit to depot for repair. If multimeter indicates +15.0 ± 0.7 V, continue with step 5. 5. Using multimeter, measure voltage at TP8 on A79A1 card with 1 switch pressed, or at TP9 on A79A1 card with 2 switch pressed. If multimeter indicates +0.2 ± 0.2 V, replace AT9A1 card (para 3-9b) and continue with step 6. If multimeter does not indicate +0.2 ± 0.2 V, return unit to depot for repair. 6. Perform step 3 and continue with step 7. 7. Remove unit from hot mock-up. 8. Replace unit access cover (para 3-9a).

Table 2-8. Troubleshooting of Laser Ranging Commander's Control C-9134/VVG-1 (A79)-Continued

Item No.	Malfunction	Probable cause	Corrective action
7	RANGE RETURN SELECTOR 1 or 2 lamp does not illuminate-continued.		9. Purge unit (TM 9-2350-230-12).
8	System does not operate.	LASER MODE CONTROL switch.	1. Install failed unit in hot mock-up. 2. Perform portion of checkout (para 4-2a or 4-2b) which will duplicate malfunction. 3. Remove unit from hot mock-up. 4. Return unit to depot for repair.

2-11. Troubleshooting of Laser Receiver-Transmitter RT-1021/VVG-1 (A76).

a. Test Setup. Set up hot mock-up as described in paragraph 2-5.

b. Troubleshooting Procedures. All troubleshooting procedures for the receiver-transmitter unit are contained in table 2-9. This table is to be used at general support maintenance level after organizational maintenance has determined the malfunction exists in the receiver-transmitter unit.

Table 2-9. Troubleshooting of Laser Receiver-Transmitter RT-1021/VVG-1 (A76)

Item No.	Malfunction	Probable cause	Corrective action
		WARNING	
	Ensure that power is off when installing or removing units in hot mock-up, or installing or removing components or assemblies in units.		
1	A "3" is displayed on the right RANGE (METERS) indicator (unit A79).	PFN current adjustment; malfunction 3/buffer logic circuit card A76A1, PMT chassis assembly A76A6, or flashtube V1.	1. Install failed units in hot mock-up. 2. Perform portion of checkout (para 4-2a or 4-2b) which will duplicate malfunction. 3. Using R/T tester (para 2-6) check receiver sensitivity and transmitter output energy. If receiver sensitivity is not within tolerance. continue with step 4. If transmitter output energy is not within tolerance, continue with step 7. If receiver sensitivity and transmitter output energy are within tolerance and malfunction exists. continue with step 9. 4. Remove R/T tester. 5. Replace PMT chassis assembly A76A6 (para 3-12l). 6. Perform step 3 and continue with step 11. 7. Replace flashtube V1 (para 3-12h). 8. Perform step 11. 9. Replace A76A1 card (para 3-12e). 10. Perform step 3 and continue with step 11. 11. Perform receiver-transmitter unit alinement (para 3-12c).

Table 2-9. Troubleshooting of Laser Receiver-Transmitter Rt-1021/VVG-1(A76) - Continued

Item No.	Malfunction	Probable cause	Corrective action
2	Reticle lamps do not illuminate.	Defective lamp: "A"-trigger circuit card assembly. A76A2: or A76 unit.	1. Install failed unit into hot mock-up. 2. Replace reticle lamps (para 3-12p). If malfunction is corrected, continue with step 4. If malfunction is not corrected, continue with step 3. 3. Replace A76A2 card (para 3-12f). If malfunction is corrected, continue with step 4. If malfunction is not corrected return A76 unit to depot for repair. 4. Perform receiver-transmitter unit alinement (para 3-12c).
3	Improper display on RANGE (METERS) indicators (unit A79).	Video amplifier assembly. A76A7. malfunction 3/buffer logic circuit card, A76A1, or A76 unit.	1. Install failed unit into hot mock-up. 2. Perform portion of checkout (para 4-2a or 4-2b) which will duplicate malfunction. 3. Replace A, 6A7 assembly (para 3-12m) and perform step 2. If malfunction is corrected, continue with step 5. If malfunction is not corrected, replace A76A1 card per (para 3-12e), install original A76A7 assembly and perform step 4. 4. Perform step 2. If malfunction is not corrected, return A76 unit to depot for repair. If malfunction is corrected. continue with step 5. 5. Perform receiver-transmitter unit alinement (para 3-12c).
4	Q-switch motor-operates when power is applied to system.	Transmitter logic circuit card assembly A76A4, transmitter component assembly A76A3, or A76 unit.	1. Install failed unit into hot mock-up. 2. Perform portion of BIT (para 4-2a) which will duplicate malfunction. 3. Using multimeter, measure voltage at pin 4c of terminal board WITB1. If voltage is +4 $\pm$ 1.5 V, continue with step 4. If voltage is +0.2 $\pm$ 0.2 V, return A76 unit to depot for repair. 4. Replace A76A4 card (para 3-12j). 5. Perform step 2. If malfunction is corrected continue with step 8. If malfunction is not corrected continue with step 6. 6. Replace A76A3 assy (para 3-12g) and install original A76A4 card. 7. Perform step 2. If malfunction is not corrected, return A76 unit to depot for repair. If malfunction is corrected perform step 8. 8. Perform receiver-transmitter unit alinement (para 3-12c).

Table 2-9. Troubleshooting of Laser Receiver-Transmitter Rt-1021/VVG-1(A76) - Continued

Item No.	Malfunction	Probable cause	Corrective action
5	Flashtube V1 does not flash. A "3" is displayed on right hand RANGE (METERS) indicator (unit A79).	Flashtube V1, transmitter component assembly A76A3, transmitter logic component assembly A76A5, or A76 unit.	1. Install failed unit into hot mock-up. 2. Perform portion of checkout (para 4-2a or 4-2b) which will duplicate malfunction. 3. Replace flashtube V1 (para 3-12h). 4. Perform step 2. If malfunction is corrected, continue with step 10. If malfunction is not corrected continue with step 5. 5. Replace A76A3 assembly (para 3-12g) and install original flashtube in original A76A3 assy. 6. Perform step 2. If malfunction is corrected, perform step 10. If malfunction is not corrected, perform step 7. **WARNING** **The following step requires measurement of dangerous potential (+400 V). Exercise extreme caution when taking this measurement.** 7. Using multimeter, measure voltage at pin 24 of A76A5 connector WIJ3. If multimeter indicates + 400 V, perform step 8. If multimeter does not indicate +400 V, return A76 unit to depot for repair. 8. Replace A76A5 assembly (para 3-12k), and install original A76A3 assembly. 9. Perform step 2. If malfunction is corrected, perform step 10. If malfunction is not corrected, return A76 unit to depot for repair. 10. Perform receiver-transmitter unit Receiver sensitivity is not within FN current adjustment alinement (para 3-12c).
6	Receiver sensitivity is not within tolerance.	PFN current adjustment: malfunction 3/buffer logic circuit card A76A1. PMT chassis assembly A76A6, or flashtube V1.	Perform procedure in "Corrective action" column for item No. 1.
7	PFN voltage control can not be adjusted.	PFN current adjustment: malfunction 3/ buffer logic circuit card A76A1. PMT chassis assembly A76A6, or flashtube V1.	Perform procedure in "Corrective action" column for item No. 1.
8	Transmitter energy is not within tolerance.	PFN current adjustment: malfunction 3/buffer logic circuit card A76A1. PMT chassis assembly A76A6, or flashtube V1.	Perform procedure in "Corrective action" column for item No. 1.

Section III. GENERAL MAINTENANCE

2-12. Maintenance Services.

a. General. Maintenance services include cleaning. inspection, and paint touch-up. This maintenance is performed to detect and correct conditions which may cause the equipment to deteriorate and degrade field performance or cause a field failure. Refer to table 2-10 for required materials.

b. General Cleaning Instruction. The laser range finder should always be kept reasonably clean. System performance may be degraded, and relatively obvious defects that would be noted in a visual inspection may be hidden by dust, grease, or other foreign matter. Cleaning which may be performed by DS and GS maintenance personnel is the same as that performed by organizational maintenance personnel prior to touch-up paintings. Cleaning of internal optics is performed at GS only.

WARNING

Toluol solvent is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged or repeated breathing of the vapor. Avoid prolonged or repeated contact with the skin.

Keep all inflammable cleaning materials away from open flames. Failure to do so could result in injury or death.

(1) *Metal parts.* Use dry, clean wiping rags to remove dust, dirt, grease, moisture, or other foreign matter from metal parts. If the foreign matter cannot be removed using dry wiping rags, dampen a rag with alcohol or solvent and gently wipe the area.

(2) *Rubber parts.* Clean rubber parts using a mild detergent and .warm water. Then dry the parts using a (clean, absorbent wiping rang.

(3) *Glass.*

CAUTION

The optical elements of the laser range finder are coated. Do not clean glass surfaces of the laser range finder with rags or other material that might scratch the coated surfaces and thereby degrade system performance.

Table 2-10. Maintenance Materials Required

Item No.	Item Name	Specification	FSC
	WARNING **Ethyl alcohol is flammable. When using it for cleaning, keep it and all flammable cleaning materials away from open flames.** **Toluol solvent is toxic and flammable. Use only in well ventilated area. Avoid prolonged or repeated breathing of the vapor. Avoid prolonged or repeated contact with the skin.**		
1	Braid, Wire (Copper, tin-coated, Tubular) 1/2 in. ID. No. 36 AWG	FED QQ-B-575	6145
2	Brush, Artists	.....	8020
3	Cotton, Flannel, Cotton (wiping rag)	FED CCC-C-458	8305
4	Ethyl Alcohol, Liquid	FED O-C-265	6810
5	GIycerin-Water Mixture	MIL-G-18694	6810
6	Grease, Pneumatic Systems	MIL-G-4343	9150
7	Insulation, Sleeving, Electrical Heat Shrinkable (white .877/.093 dia)	MIL-1-23053 / 5	5970
8	Paint, White (Color 227875)	FED-STD-595	8010
9	Paper, Lens Tissue	FED-NNN-P-40	6640
10	Primer Coating, Epoxy Polyamide, Chemical and Solvent	MIL-P-23377	8010
11	Sealant	RTV 3145 (Dow Corning)	.....
12	Sealing Compound Adhesive, Curing (Polysulfide Base)	MIL-S-11031	8030
13	Sealing Compound Non-Curing Polysulfide Base	MIL-S-11030	8030
14	Sealing, Locking and Retaining Compounds Single component (Grade CV)	MIL-S-22473	8030
15	Tape, Antiseize Tetrafluoroethylene with Dispenser	MIL-T-27730	8030
16	Tape, Lacing and Tying	MIL-T-43435	4020
17	Toluol, Cleaning Solvent	T324 (Fisher Scientific Co.)	6810

Use a camel hair brush to remove loose particles of dust and lint from glass surfaces. Then. wipe the surface in a circular motion using lens tissue-either dry or moistened with methyl or ethyl alcohol. If dirt, lint. or smears remain on the glass, wrap a piece of lens tissue around the end of an orange stick (or equivalent) to form a swab. Beginning at the center of the surface, swab with a (circular motion while applying a light downward pressure. Gradually increase the radius of the area being cleaned until the entire surface has been covered. If necessary, use a rubber syringe to blow off any remaining dust or lint.

(4) *Other.* Use a dry rag to remove loose dirt, dust or debris. Flush off caked mud using clean water.

c. Cleaning Procedures for Cold Weather Operation.

(1) If the temperature is below 320 F, add glycerin to cleaning water. This will prevent it from freezing on the part being cleaned and possibly preventing normal operation of the laser system.

(2) Alcohol, applied with a lens tissue, may be used to clean glass surfaces if dry lens tissue does not work satisfactorily.

CAUTION

The optical elements of the laser range finder are coated. Do not rub glass surfaces with rags or other materials that might scratch the coated surfaces and thereby degrade system performance.

(3) If moisture has frozen on glass surfaces, apply deicer or place the unit in a warm area until the ice melts. Then pat dry the surface with clean absorbent wiping rag. Clean with lens tissue when the surface is dry.

d. Inspection.

(1) Conduct a visual inspection of unit housings and attaching hardware to make sure that all units are in good condition. Ensure that no moisture is trapped around the area of the window and ballistic dust cover on the receiver-transmitter unit.

(2) Replacement units should be substitute for those found to be damaged or worn near or beyond serviceable limits. Dirt, grease, and foreign matter should be removed from all inspected surfaces. Preservatives and foreign matter should be removed from electrical connectors. Areas in which the paint is scratched, chipped, or worn should be repainted. Maintenance tasks which are not authorized for the DS and GS maintenance personnel should be referred to the responsible maintenance activity.

(3) During the visual inspection, the laser range finder is completely assembled and checked for its mechanical operating capability. After completion of the visual inspection. the system self-test is performed to insure the serviceability of the entire system.

(4) The complete inspection is performed for an initially received laser range finder system to insure that it is not damaged. This inspection, including the system self-test, is also performed weekly to make sure the system is maintained in a state of operational readiness.

e. General Painting Instructions. Visually inspect unit housings and attaching hardware for rust or corrosion and missing, chipped or blistered paint. Small areas of damaged paint may be touched lip as part of user preventive maintenance. When painting with a brush, apply the paint as issued or after thinning with not more than 5 percent by volume of thinner.

CAUTION

Optical elements, bearings, rubber, or other components which might be damaged by cleaning, masking or paint must be removed from the units before proceeding.

(1) Smooth surface and feather edges of affected area with fine abrasive paper.

WARNING

Toluol solvent is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged or repeated breathing of the vapor. Avoid prolonged or repeated contact with the skin.

(2) Clean area with wiping rag dampened with toluol cleaning solvent.

CAUTION

Use masking tape to insure that no paint is applied to the following: countersinks, counterbores, bolt holes, bearing surfaces, attached surfaces, o-ring grooves, and those areas treated with solid film lubricant.

(3) Apply primer and paint to the affected area according to instructions cited on the paint containers. Air dry primer for 1/2 hour minimum. Within 2 hours after application of primer, apply one coat of paint.

f. Lubrication.

CAUTION

Lubricant should never be applied to exposed surfaces because dust is likely

to collect and wear away the parts (it acts as an abrasive).

Lubrication for the laser range finder is limited to the lubrication as discussed in chapter 3.

g. Nitrogen Purging and Charging. Refer to TM 9-2350-230-12.

2-13. Charging of Storage Battery Assembly A78B1.

Refer to TM 9-2350-230-12 for charging of storage battery assembly within the battery power supply unit.

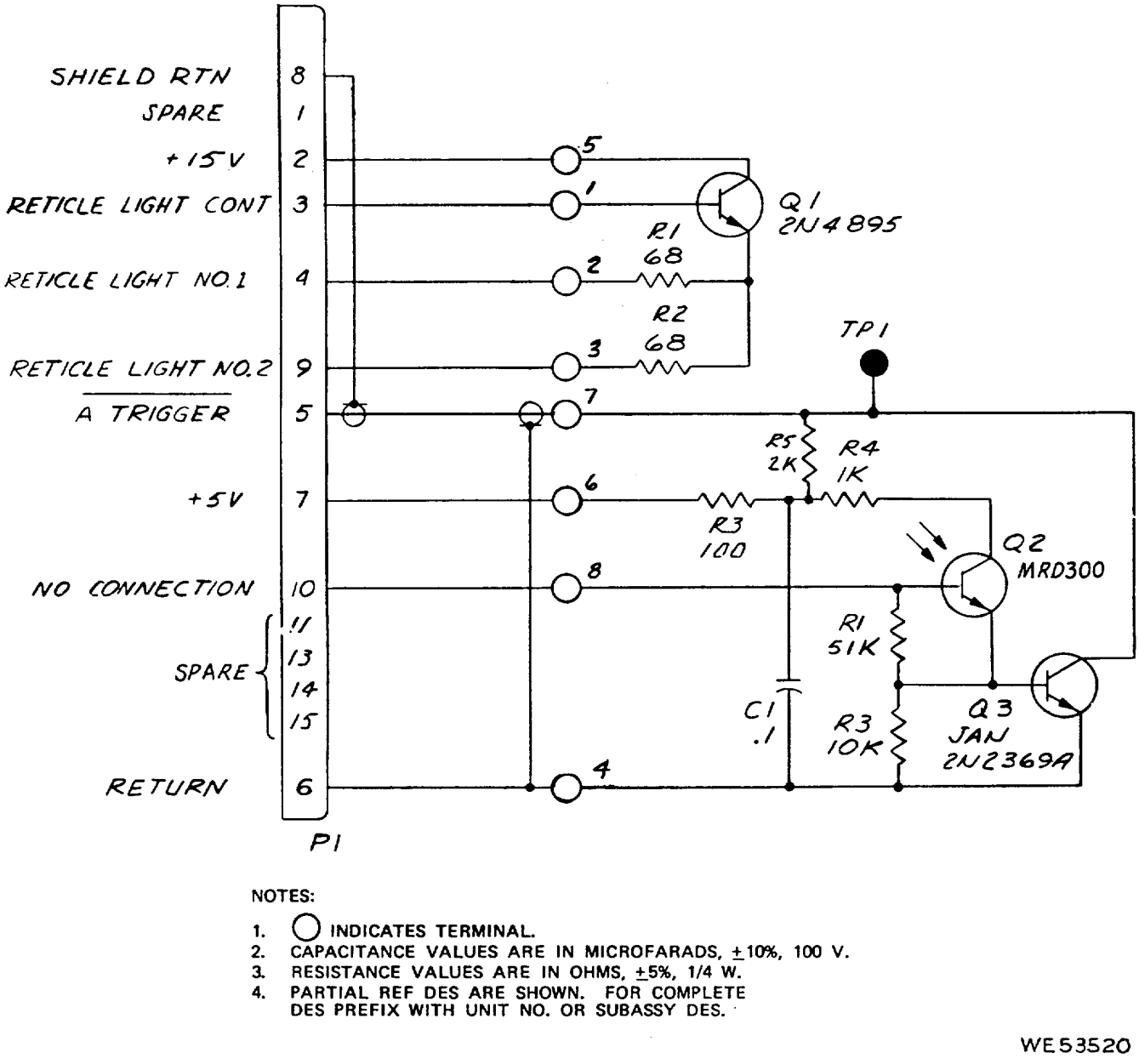
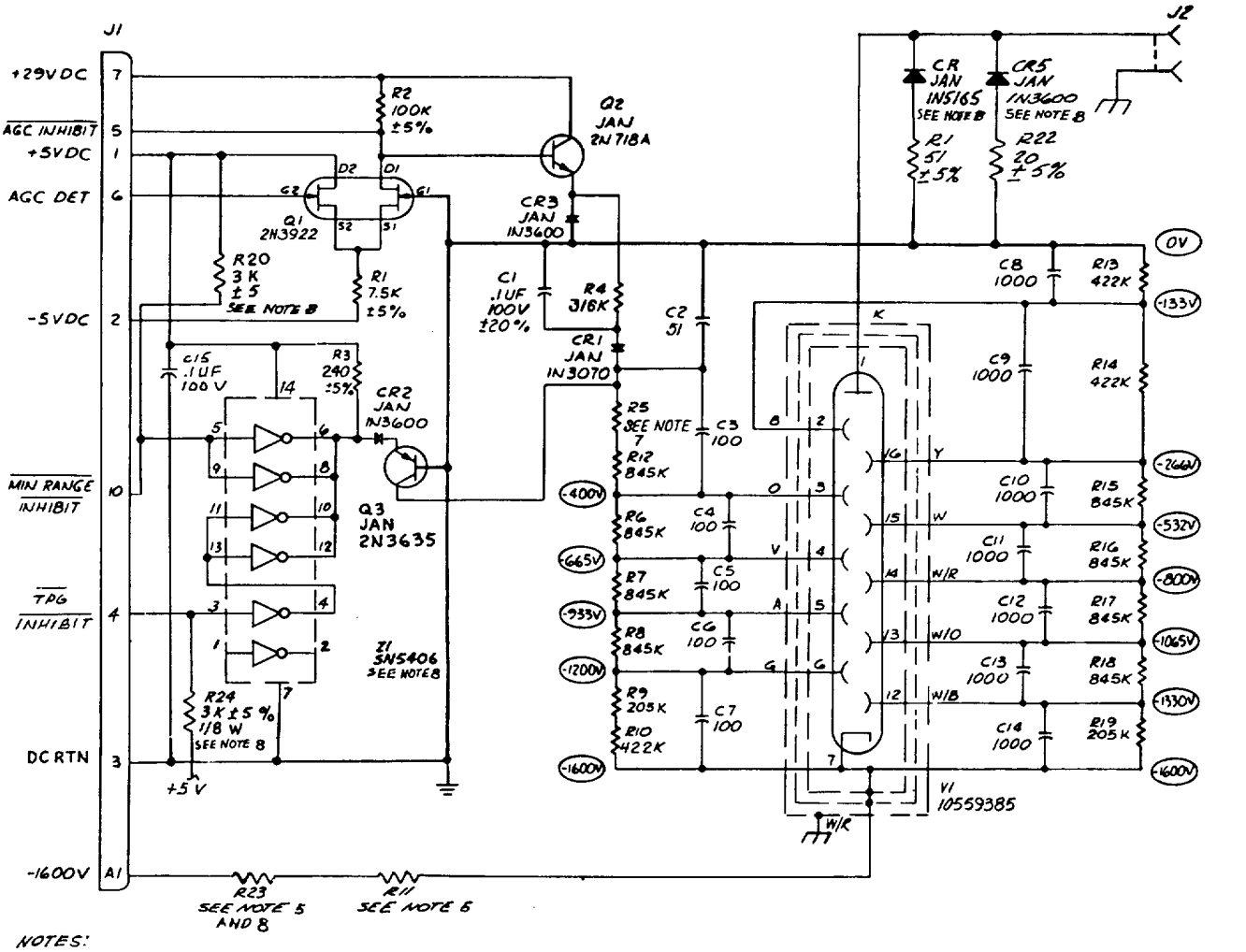


Figure 2-20. "A" trigger (A76A2) schematic diagram.



NOTES:

1. PARTIAL REF DES ARE SHOWN FOR COMPLETE DES PREFIX WITH UNIT NO. OR SUBASSY DES
2. RESISTANCE VALUES ARE IN OHMS, ±1%, 1/4W EXCEPT AS NOTED
3. CAPACITANCE VALUES ARE IN PICOFARADS, ±5%, 500V EXCEPT AS NOTED FOR SERIAL NO.'S 949 AND BELOW CAPACITOR VALUES ARE ±10% OF INDICATED VALUE EXCEPT C1 IS ±20%
4. SELECTED RESISTOR RANGE 499K ±1%, 1/4W THRU 499K ±1%, 1/4W, RANGE 500K ±2%, 1W THRU 1.0 MEG ±2% 1W PER MIL-S-14875
5. ◯ INDICATES NOMINAL VALUES MEASURED WITH VTVM
6. SELECTED RESISTOR RANGE 10K TO 402K PER MIL-S-14875
7. FOLLOWING COMPONENTS AND REF DES ARE NOT USED ON SERIAL NO. 949 AND BELOW CR4, CR5, R20 THRU R24, AND 21

WE53519

Figure 2-22. Phototube bias network (A76A6) schematic diagram.

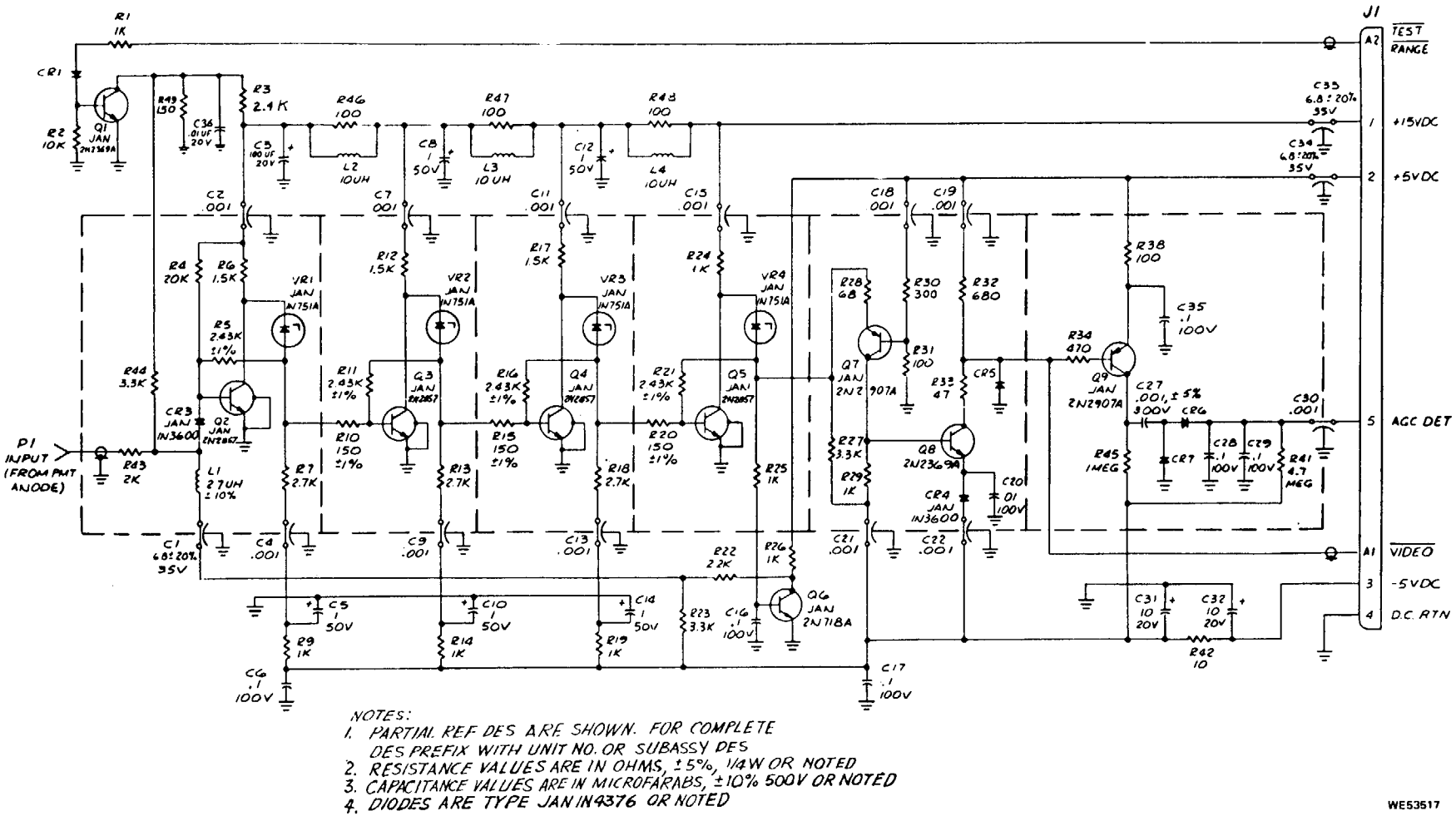
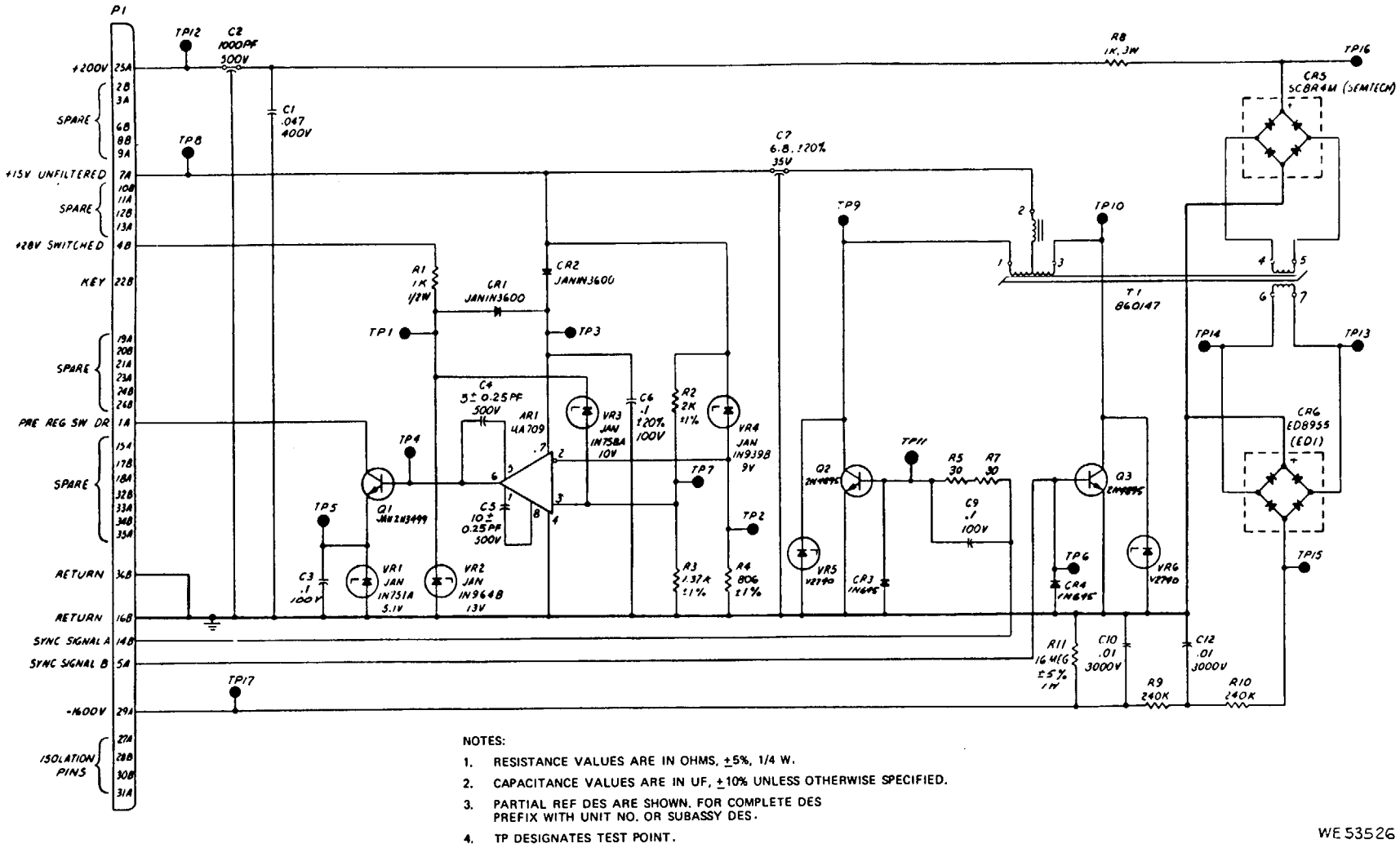


Figure 2-23. Video amplifier (A76A7) schematic diagram.

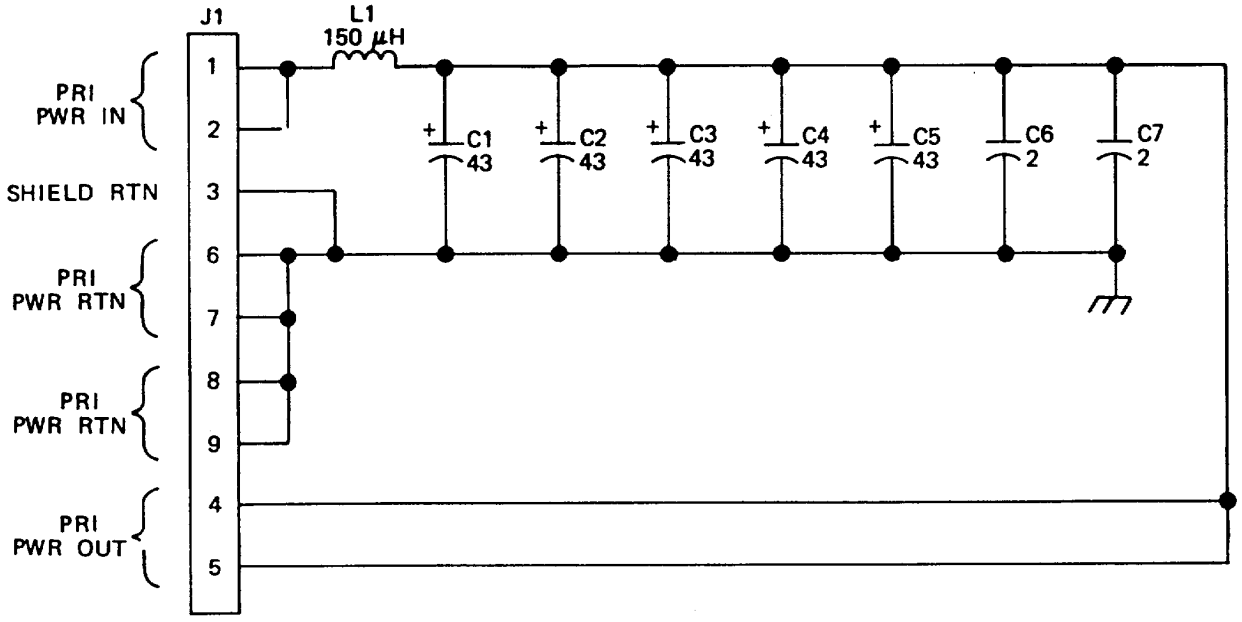


NOTES:

1. RESISTANCE VALUES ARE IN OHMS, ±5%, 1/4 W.
2. CAPACITANCE VALUES ARE IN UF, ±10% UNLESS OTHERWISE SPECIFIED.
3. PARTIAL REF DES ARE SHOWN. FOR COMPLETE DES PREFIX WITH UNIT NO. OR SUBASSY DES.
4. TP DESIGNATES TEST POINT.

WE 53526

Figure 2-25. -1600 V power supply (A77A1) schematic diagram.



NOTES:

1. PARTIAL REF DES ARE SHOWN. FOR COMPLETE DES PREFIX WITH UNIT NO. AND SUBASSY DES.
2. REF DES ARE FOR REF ONLY AND DO NOT APPEAR ON COMPONENTS.
3. CAPACITANCE VALUES ARE IN MICROFARADS ±20%, 100 V.

WE56369

Figure 2-31. Electronic filter component assembly (A77A8) schematic diagram.

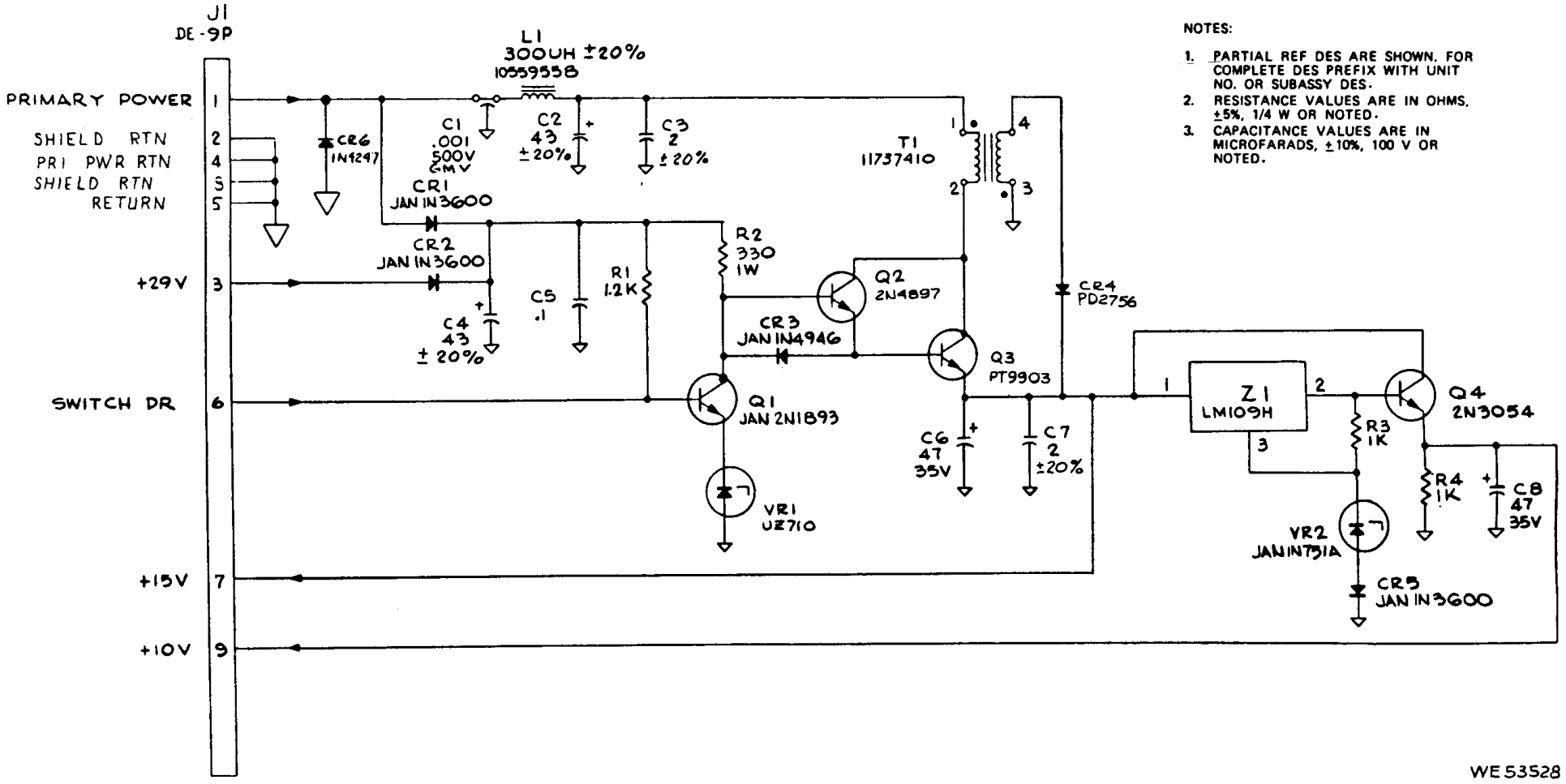


Figure 2-33. Preregulator (A77A10) schematic diagram.

CHAPTER 3

REPAIR INSTRUCTIONS

Section I. GENERAL

3-1. Scope.

This chapter contains detailed instructions for the repair of the laser range finder. Repair instructions consists of step-by-step procedures for replacement of faulty components within the laser range finder units. Sections II thru IV are DS and sections VII and VIII are GS repair instructions. The requirement for component replacement is indicated by visual inspection and/or troubleshooting.

3-2. Parts Replacement.

In subsequent paragraphs authorized parts damaged beyond repair are to be replaced.

Section II. REPAIR OF R/T CONTROL C-8728/VVG-1 (A75)

3-3. Disassembly of R/T Control unit (A75).

The R/T control unit is to be disassembled only to the point where the damaged component can be removed and replaced. During disassembly, it is recommended that disassembled items be indexed in order of removal. Assembly can then be accomplished by replacing items in reverse index order. After any repair. the R/T control unit must b)e purged with dry nitrogen gas in accordance with TM 9-2350-230-12.

a. Replacement of Cover Seal (see fig. 3-1).

CAUTION

There are wire connections between the housing and the switches on the cover assembly. Remove cover assembly away from the housing carefully.

(1) Remove nine screws (1), nine washers (2) and carefully ease cover assembly (3) from the housing.

(2) Rotate cover seal (4) so that the seal can be removed by sliding over the cover assembly (3) and wire connections.

(3) Lubricate new cover seal (4) by applying a thin, uniform, film of grease, MIL-G-4343 to the high point on the bead of the cover seal. Do not apply so much grease that it fills the grooves on either side of the bead. Apply by hand to both sides of the cover seal.

(4) Install new cover seal (4) by performing steps (1) and (2) in reverse order.

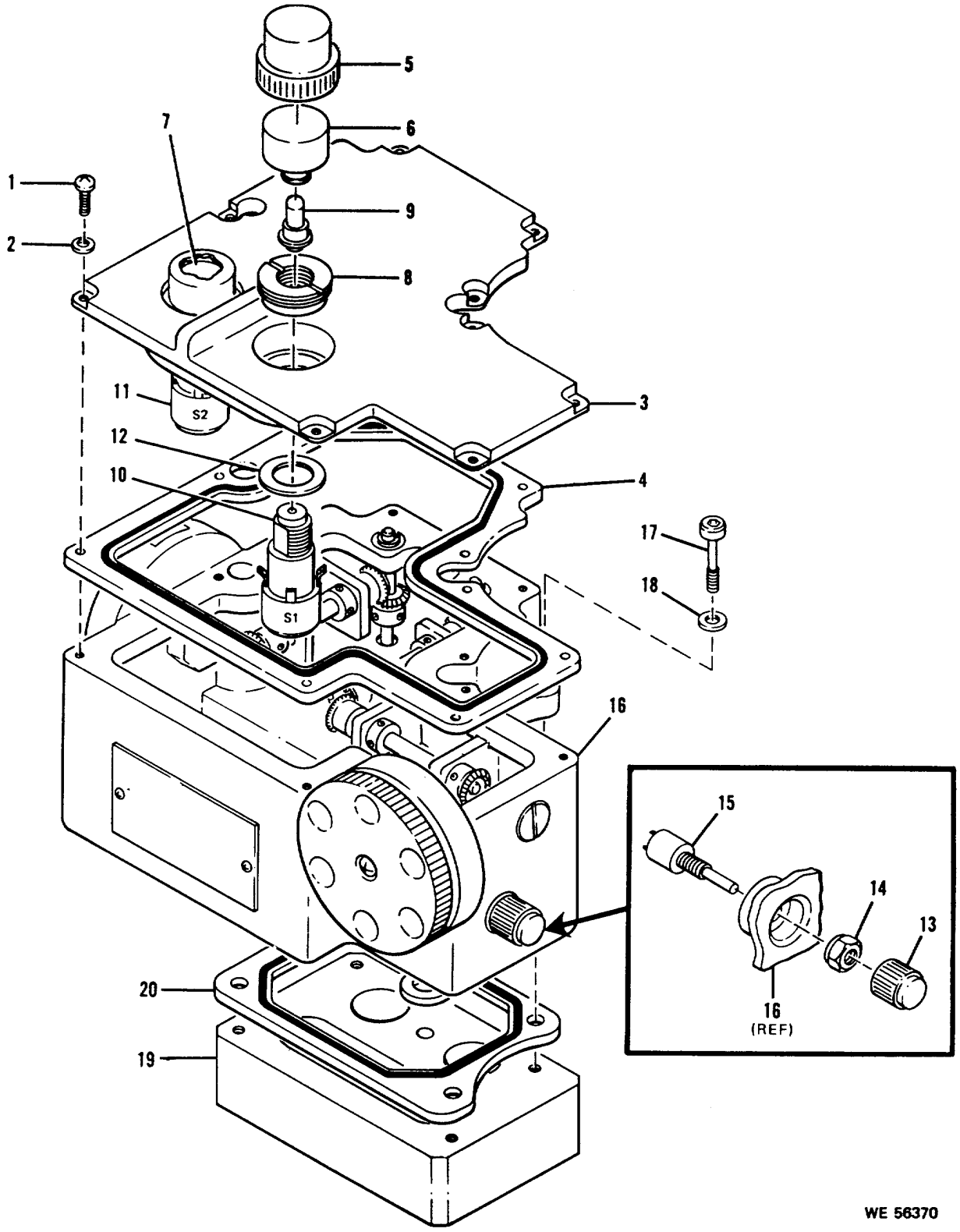


Figure 3-1. Disassembly of R/T Control C-8728/ VVG-1 (A75).

KEY to fig. 3-1:

1. Screw-NAS1635-04-6
2. Washer-AN960C4
3:. Cover assembly-11737915
4. Cover seal-11738857
5. Switch lens seaI-1173799-2
6. Switch lens-11741549-2
7. Switch lens-11741549-1
8. Switch boot adapter-11737539
9. Lamp-11738097
10. RESET switch S1-11737454
11. RANGE switch S2-11737454
12. Sealing washer-NAS1598D8Y
13. Knob-MS91528-OC1B
14. Boot- M5423/09-03
15. RTCL ILLUM potentiometer-11737448
16.. Housing-11738855
17. Screw-11737922
18. Washer-NAS620C10L
19. Shipping cover-11737928
20. Gasket-11737356

b. Replacement of Switch Lens Seal (see fig. 3-1).

(1) Unscrew and remove switch lens seal (5) with boot removal tool (21, table 2-2) from cover assembly (3).

(2) Install new switch lens seal (5) with boot removal tool (21. table 2-2).

c. Replacement of Lamps (see fig. 3-1). The following steps are applicable to replacement of lamp in push button switches S1 and S2.

(1) Unscrew and remove applicable switch lens seal (5) with boot removal tool (21, table 2-2) from cover assembly (3).

(2) Pull applicable switch lens (6 or 7) straight out from cover assembly.

(3) Remove lamp (9) from switch lens (6 -or 7).

(4) Install new lamp (9).

(5) Push applicable switch lens (6 or 7) back onto plunger of switch.

(6) Install switch lens seal with boot removal tool (21, table 2-2).

d. Replacement of Switches S1 and S2 (see fig.3-1).

(1) Remove cover assembly and cover seal as instructed in paragraph 3-6 *a.* steps (1) and (2).

(2) Record where the four color-coded wires are connected, then unsolder from RESET switch S1 (10).

(3) Record where the four color-coded wires are connected, then unsolder from RANGE switch S2 (11).

(4) Unscrew and remove applicable switch lens seal (5) with boot removal tool (21, table 2-2) from cover assembly (3).

(5) Pull applicable switch lens (6 or 7) straight out from cover assembly (3).

(6) Unscrew and remove switch boot adapter (8) with switch spanner wrench (24, table 2-2).

(7) Remove switch S1 or S2 (10 or 11) and sealing washer (12) from cover assembly (3).

(8) Lubricate sealing washer (12) by applying a thin, uniform film of grease MIL-G-4343.

(9) Install new switch S1 or S2 (10 or 11) an. sealing washer (12) to cover assembly (31.

(10) Install switch boot adapter (8) with switch spanner wrench (24, table 2-2). Seal adapter with sealant MIL-S-22473.

(11) Push applicable switch lens (6 or 7) back onto plunger of switch S1 or S2.

(12) Install switch lens seal (5) with boot removal tool (21, table 2-2).

(14) Solder four color-coded wires to the terminals on RANGE switch S2 (11).

(15) Install cover seal and cover assembly as described in paragraph 3-3 *a.* steps (3) and (4).

e. Replacement of RTCL ILLUM Potentiometer.

(1) Remove cover assembly and cover seal as instructed in paragraph 3-3 *a*, steps (1) and 12).

(2) Loosen two setscrews on the knob (13) and remove knob. Unscrew and remove boot (14) from shaft of RTCL ILLUM potentiometer (15).

(3) Remove RTCL ILLUM potentiometer from R/T control unit housing (16).

(4) Note where the three color-coded wires are connected; then unsolder from RTCL ILLUM potentiometer (15).

(5) Solder three color-coded wires to new RTCL ILLUM potentiometer.

(6) Install RTCL ILLUM potentiometer to R/T control unit housing (16). Rotate potentiometer to engage tang in slot provided in housing.

(7) Lubricate boot (14) by applying a thin, uniform, film of grease, MIL-G-4343. Apply by hand.

(8) Install boot (14) and knob (13) to RTCL ILLUM potentiometer.

(9) Install cover seal and cover assembly as instructed in paragraph 3-3 a. steps (3) and (4).

f. Removal and Installation of R/T Control Unit Shipping Cover (see fig. 3-1).

(1) Loosen four screws (17) and four washers (18).

(2) Removing shipping cover (19) and retain gasket (20) with R/T control unit.

(3) Lubricate gasket (20) by applying a thin uniform, film of grease, MIL-G-4343, to the high point on the bead of the gasket. Do not apply so much grease that it fills the grooves on either side of the bead. Apply by hand to both sides of the gasket.

(4) Install shipping cover (19) by performing steps (1) and (21 in reverse order.

3-4. Inspection of R/T Control Unit (A75)

a. Inspect the general condition of all par Check for wear or other conditions indicating deterioration.

b. Inspect switches, controls, gears, bearings, and screws for corrosion; check switches, controls, gears and bearings for proper mechanical operation; check machined surfaces for conditions that may prevent alinement with mating parts.

c. Check electrical wiring for chafed or broken wires and bad solder connections.

d. Inspect machined sealing surfaces for scratches, debris or excessive lubricant that may prevent proper sealing.

Section III. REPAIR OF LASER POWER SUPPLY CONTROL C-9135/VVG-1 (A77)

3-5. Disassembly of Power Supply Control Unit (A77).

The power supply control unit is to be disassembled only to the point where the damaged components can be removed and replaced. During disassembly, it is recommended that disassembled items be indexed in order of removal. Assembly can then be accomplished by replacing items in reverse index order. After any repair. the power supply control unit must be purged with dry nitrogen gas in accordance with TM 9-2350-230-12.

a. Replacement of Access Cover Gasket (see fig. 3-2).

(1) Remove six screws (1), six washers (2), power supply control unit access cover assembly (3), and access cover gasket (4). Inspect screws and washers for damage and replace as necessary.

(2) Lubricate new access cover gasket (4) by applying a thin, uniform film of grease, MIL-G4343, to the high point on the head of the gasket. Do not apply so much grease that it fills the grooves on either side of the bead. Apply by hand to both sides of the gasket.

(3) Install new access cover gasket by performing step (1) in reverse order.

KEY to fig. 3-2:

1. Screw-N AS 1635-08-12
1a. Screw--PFN access screw
2. Washer-AN960C8
3. Access cover assembly-11737860
4. Access cover gasket-11738892
5. Screw-NAS1635-06-8
6. Washer-NAS620C6
7. Preregulator cover-11738839
8. Screw locking assembly-1139036
9. Connector P2-M24308/1-1
10. Preregulator electronic component assembly A77A10-11737807
11. Preregulator gasket-11738840
12. Screw-NAS1635-06-5
13. Washer-NAS620C6
14. -1600 V power supply circuit card assembly A77A1-10559335.
15. Low voltage power supply circuit card assembly A 77A2-10559325
16. Shield board-10559309
17. Select logic circuit card assembly A-77A3-10559285
18. Interface circuit card assembly A77A3-11737802
19. Reply gating circuit card assembly A77A4-10559295
20. Counters circuit card assembly A77A5-10559305
21. Screw-NAS1635-06-8
22. PFN charge power supply A77A9-10559345
23. Nut-part of item 29
24. Lockwasher-part of item 29
25. Terminal lug-MS25036-154
26. Washer-part of item 29
27. Terminal-part of item 29
28. Screw-MS16997-20
29. PFN A77Z1-10559361
30. PFN gasket-11737801
31. Screw-NAS1635-06-5
:12. Washer-NAS620C6
33. Electronic filter component assembly A77A8-11737811
34. Screw locking assembly-11739036
35. Connector P1-M24308/1-1
36. Housing-11738835

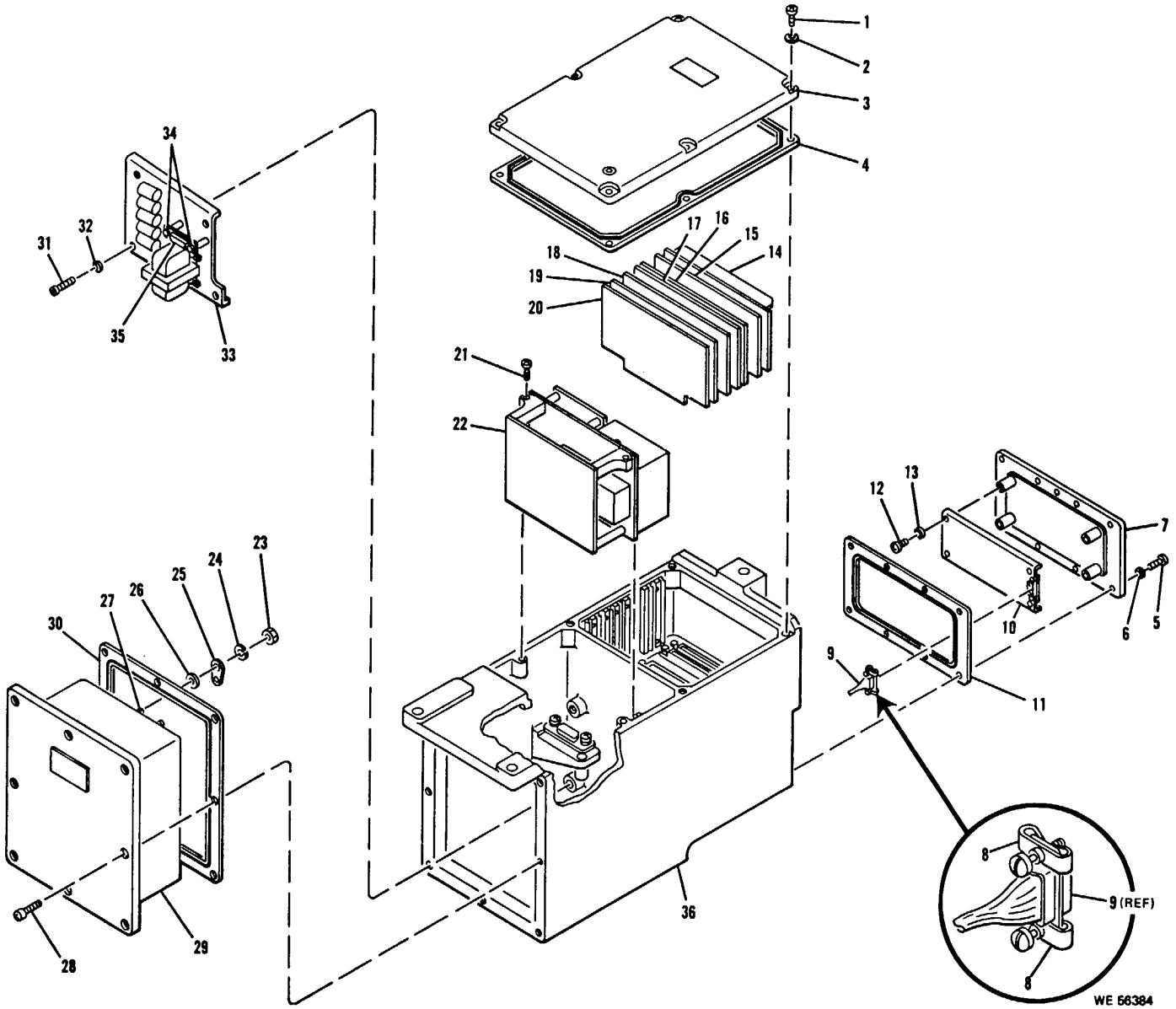


Figure 3-2. Disassembly of Laser Power Supply Control C-9135/VVG-1 (A77).

b. Replacement of Preregulator Electronic Component Assembly and Preregulator Gasket (see fig. 3-2).

(1) Remove eight screws (5) eight washer (6) and partially remove preregulator cover (7) from the power supply unit.

(2) Loosen two captive screws on the connector screw locking assembly (8), and disconnect cable harness connector P2 (9) from connector J1 on the preregulator electronic component assembly (10).

(3) Remove preregulator gasket (11).

(4) Remove four screws (12), four washers (13), and preregulator electronic component assembly (10).

(5) Lubricate preregulator gasket (11) by applying a thin. Uniform, film of grease, MIL-G-4343, to the high point on the bead of the gasket. Do not apply so much grease that it fills the grooves on either side of the bead. Apply by hand to both sides of the gasket.

(6) Install new preregulator electronic component assembly and/or preregulator gasket by performing steps (1) thru (4) in reverse order. Note orientation of preregulator gasket and preregulator electronic component assembly to ensure dowel pin hole in both parts engage dowel pin in housing (36).

c. Replacement of Printed Circuit Cards A77A1 thru A77A5 and A77A7 (see fig. 3-2).

(1) Remove access cover assembly as instructed in paragraph 3-5 *a*.

(2) Remove the desired printed circuit card assemblies (14) thru (20) from the power supply unit. Remove desired printed circuit card assembly with circuit card puller (7), table 2-1).

(3) Install new printed cards by performing steps (1) and (2) in reverse order. Do not use the circuit card puller when installing the printed circuit cards.

d. Replacement of PFN Charge Power Supply A77A9 (see fig. .3-2).

(1) Remove access cover assembly as instructed in paragraph 3-5 *a*.

(2) Remove two screws (21) and PFN charge power supply A77A9 (22). Inspect screws for damage and replace as necessary. No special instructions are required for removal or replacement or the PFN charge power supply.

(3) Install new PFN charge power supply by performing steps (1) and (2) in reverse order.

e. Replacement of Electronic Filter Component Assembly A77A8 (see fig. 3-2).

(1) Remove PFN charge power supply A77A9 (22) as instructed in paragraph 3-5*d*.

(2) Remove two nuts (23), two lockwashers (24), two terminal lugs (25) and two washers (26) from terminals (27) on the PFN (209).

(3) Remove eight screws (28), PFN A77Z1 (29) and PFN gasket (30).

(4) Loosen two captive screws on screw locking assembly (34), and disconnect cable harness connector P1 (35) from J1 on electronic filter component assembly (33).

(5) Remove four screws (31) four washers (32), and electronic filter component assembly A77A8 (33).

(6) To lubricate PFN gasket (30) by applying a thin, uniform, film of grease, MIL-G-4343. Apply by hand to both sides of the rubber portion of the gasket.

(7) Install new electronic filter component assembly by performing steps (1) thru (5) in reverse order.

f. Replacement of Switch S1 on Reply Gating Circuit Card Assembly A77A4 (see fig. 3-2).

(1) Remove access cover assembly as instructed in paragraph 3-5 a.

(2) Remove reply gating circuit card assembly A77A4 (19) as instructed in paragraph 3-5 *c*.

(3) Tag the leads to the terminals on switch S1 for identification. Unsolder the leads.

(4) Remove two nuts, two lockwashers, two washers, actuator switch adapter, and switch S1 from component side of the card assembly.

(5) Remove two screws and two nonmetallic washers from the opposite side of the card assembly. Inspect the washers for damage and replace as necessary.

CAUTION

When installing switch S1, ensure that its actuator switch adapter is not installed too high reply gating circuit card assembly A77A4 or it may be damaged when the access over assembly is installed.

(6) Install new switch S1 by performing steps (1) thru (5) in reverse order. During installation switch S1, ensure that when the reply gating circuit card assembly A77A4 is seated in the housing, switch S1 is adjusted to a height where the access cover will adjust barely activate switch S1 (an audible click can be heard).

g. Replacement of PFN A77Z1 (see fig. 3-2).

(1) Remove PFN charge power supply A77A9 (22) as described in Paragraph 3-5*d*.

(2) Remove two nuts (23), two lockwashers (24), two terminal lugs (25) and two washers (26) from terminals (27) on PFN A77Z1 (29).

(3) Remove eight screws (28), PFN A77Z1 (29)and PFN gasket 130).

(4) Lubricate PFN gasket (30) by applying a thin. Uniform, film of grease. MIL-G-4343, to the high point on the bead of the gasket. Do not apply so much grease that it fills the grooves on either side of the bead. Apply by hand to both sides of the gasket.

(5) Install new PFN by performing steps (1) thru (3) in reverse order.

3-6. Inspection of Power Supply Control Unit (A77).

a. Inspect the general condition of all parts. Check for wear or other conditions indicating deterioration.

b. Inspect for PFN all circuit cards, and all modules for corrosion; check all screws for worn threads check all gaskets for deterioration; and check all machined surfaces for conditions that may prevent alinement with mating parts.

c. Check electrical wiring for chafed electrical wiring for chafed or broken wires and bad solder connections.

d. Inspect machined sealing surfaces for surfaces for debris or excessive lubricant that may prevent proper sealing.

Section IV. REPAIR OF BATTERY POWER SUPPLY PP-6607/ VVG-1 (A78)

3-7. Disassembly of Battery Power Supply Unit (A78)

The battery power supply unit is to be disassembled only to the point where the damaged components can be removed and replaced. During disassembly. it is recommended that disassembled items be indexed in order of removal. Assembly can then be accomplished by replacing items in reverse index order. After any repair. the battery power supply unit must be purged with dry nitrogen gas in accordance with TM 9-2350-230-12.

a. Replacement of Gasket (see fig. 3-3).

(1) Remove 10 screws (1), 10 washers (2), access cover (3) and gasket (4). Inspect screws and washers for damage and replace as necessary.

(2) Lubricate new gasket (41 by applying a thin, uniform, film of grease. MIL-G-4343, to the high point on the bead of the gasket. Do not apply so much grease that it fills the grooves on either side of the bead. Apply by hand to rubber insert on both sides of gasket.

(3) Install new gasket in the reverse order of step (1).

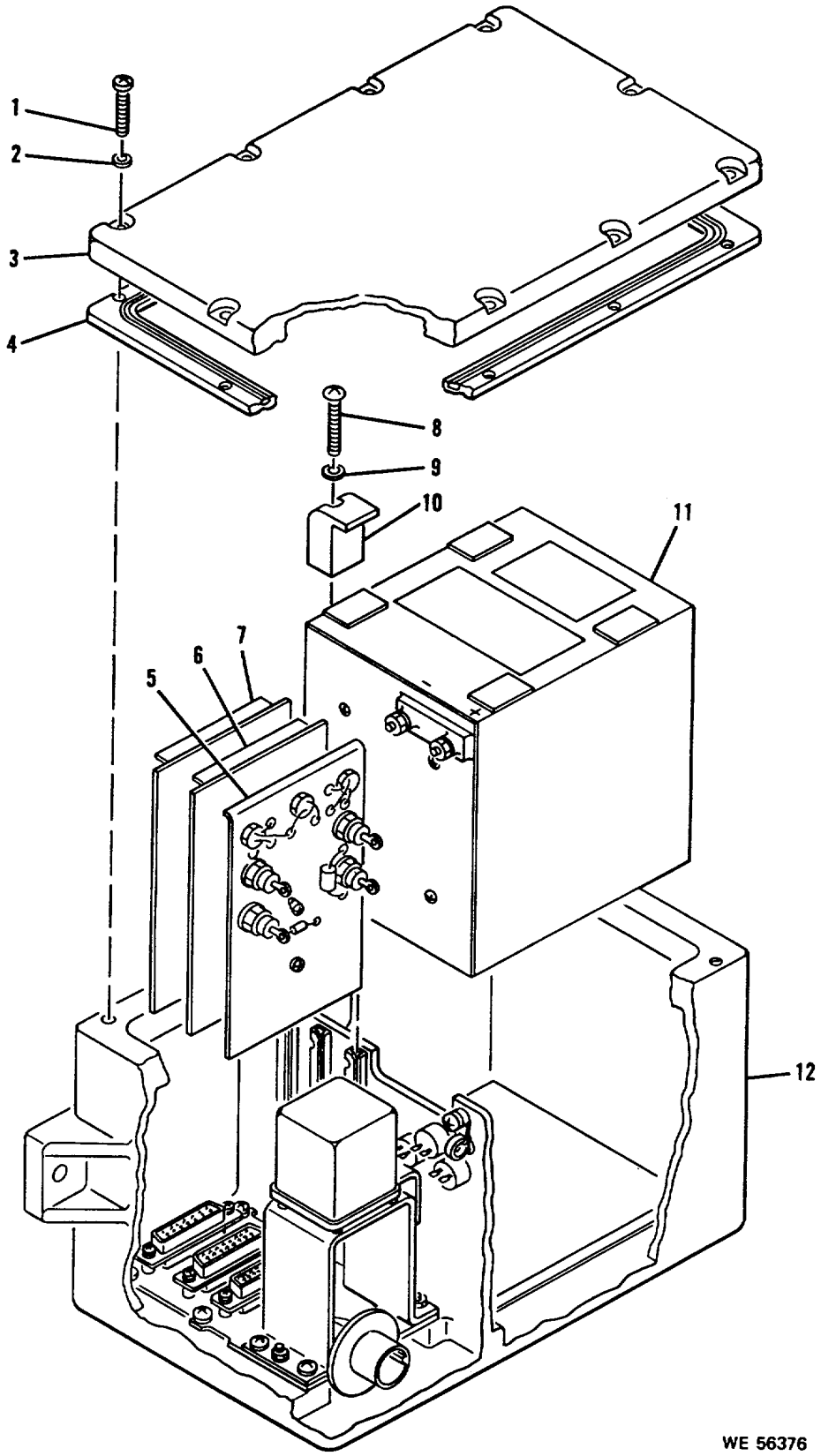


Figure 3-3. Disassembly of Battery Power Supply PP-6607/VVG-1 (A78).

KEY to fig. 3-3:

1. Screw--MS51957-30
2. Washer-NAS620C6L
3. Access cover--11737865
4. Gasket- 11638849
5. Power control electronic component assembly A78A2--11738850
6. Battery charge sensor circuit card assembly A78A3--11738808
7. Charge control circuit card assembly A78A4--11738818
8. Screw--MS51957-46
9. Washer—NAS620C8
10. Battery retainer--11737834
11. Storage battery assembly--11737972
12. Housing assembly--11738845

b. Replacement of Electronic Component Assembly A78A2 and Circuit Card Assemblies A78A3 and A78A4 (see, fig. 3-3).

(1) Remove access cover as instructed in paragraph 3-7 *a* step (1).

WARNING

The power control electronic component assembly (5) is adjacent to the terminals on the storage battery assembly (11). The storage battery assembly can supply enough short circuit current to generate temperature high enough to cause metal to fuse together, and also cause severe burns to the human body. Remove all rings from fingers and do not insert metal objects into immediate area of the battery assembly.

(2) Remove the desired electronic component assembly (5) or circuit card assembly (6 or 7). No special instructions are required for removal or replacement.

(3) Install new assemblies by performing steps (1) and (2) in reverse order.

c. Replacement of Storage Battery Assembly A78B1 (see fig. 3-3.

(1) Remove access (cover as instructed in paragraph 3-7 *a*.

(2) Remove screws (8), four washers (9), and four battery retainers (10).

WARNING

The storage battery assembly A78B1 can supply enough short circuit current to generate temperatures high enough to cause metal to fuse together, and also cause severe burns to the human body. When handling the battery assembly, remove all rings from fingers and do not insert metal objects into the immediate area of the battery assembly.

(3) Disconnect battery leads from storage battery assembly terminal and lift out.

CAUTION

When installing replacement storage battery assembly, ensure that terminal on the black battery lead is connected to the negative terminal of A78B1, and the red battery lead is connected to the positive terminal of A78B1.

(4) Install replacement storage battery assembly by performing steps (1) thru (3) in reverse order.

3-8. Inspection of Battery Power Supply Unit (A78)

a. Inspect the general condition of all parts. Check for wear or other conditions indicating deterioration.

b. Inspect storage battery assembly, battery pack retainer, and screws for corrosion. Check gasket for deterioration and machined surfaces for conditions that might prevent alinement with mating parts.

c. Check electrical wiring for chafed or broken wires and bad solder connections.

d. Charge batteries in battery power supply unit and verify condition before replacing with new parts.

e. Inspect machined sealing surfaces for scratches. debris or excessive lubricant that may prevent proper sealing.

Section V. REPAIR OF LASER RANGING COMMANDER'S CONTROL C-9134/VVG-1 (A79)

3-9. Disassembly of Commander's Control Unit (A79).

The commander's control unit is to be disassembled only to the point where the damaged items can be removed and replaced. During disassembly, it is recommended that the disassembled items be indexed in order of removal. Assembly can then be accomplished by replacing items in reverse index order. After any repair, the commander's control unit must be purged with dry nitrogen gas in accordance with TM 9-2350-230-12.

a. Replacement of Access Cover (see fig. 3-4).

(1) Remove nine screws (1), nine washers (2) and access cover (3). Inspect screws and washers for damage and replace as necessary.

(2) Lubricate the seal on the access cover by applying a thin, uniform, film of grease. MIL-G-4343, to the high point on the bead of the seal. Do not apply so much grease that it fills the grooves on either side of the bead. Apply by hand.

(3) Install new access cover in the reverse order of step (1).

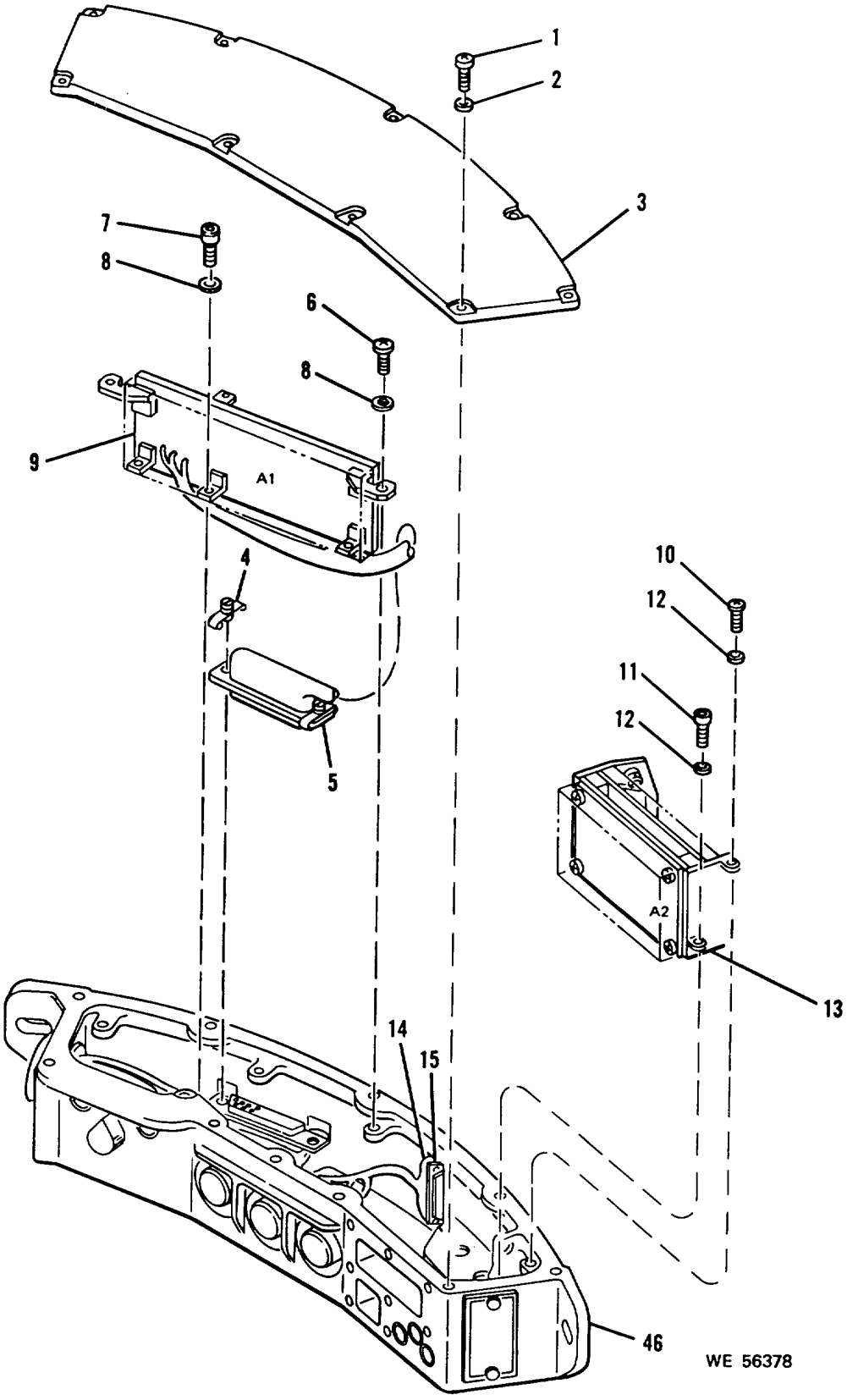


Figure 3-4. Disassembly of Laser Ranging Commander's Control C-9134/VVG-1 (A79) (Sheet 1 of 2 sheets).

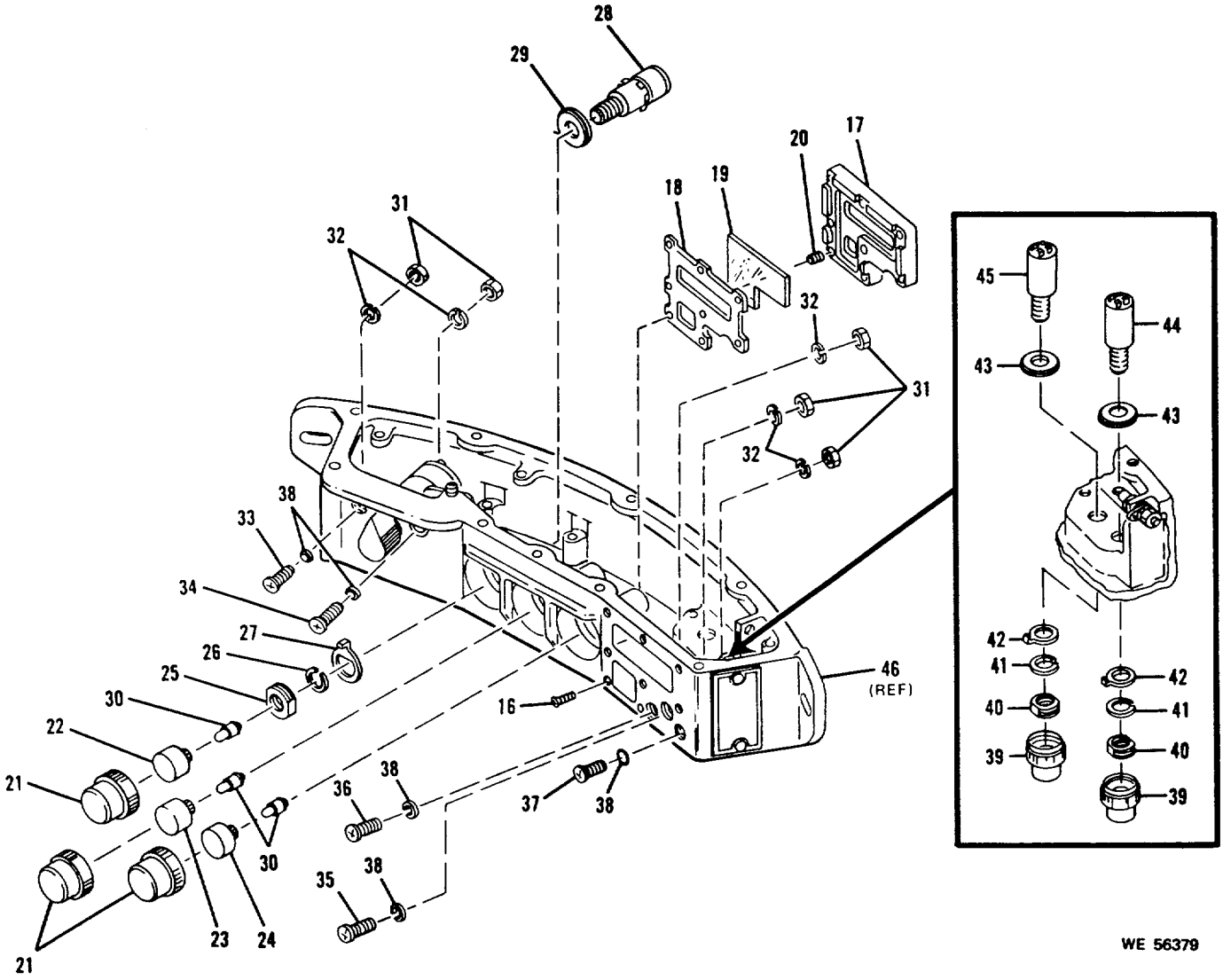


Figure 3-4. Disassembly of Laser Ranging Commander's Control C-9134/VVG-1 (A79) (Sheet 2 of 2 sheets).

KEY to fig. 3-4:

1. Screw—NAS163-06-6
2. Washer—NAS620C6L
3. Access cover--11738817
4. Screw locking assembly--11739036
5. Connector A1P1--M24308/3-4
6. Screw--NAS1635-04-4
7. Screw--NAS1352-04-4
8. Washer-AN960C4
9. Logic circuit card assembly A79A1-11737334
10. Screw--NAS1635-04-4
11. Screw—NAS1352-04-4
12. Washer--NAS620C4
13. Readout circuit assembly A79A2-11737350
14. Screw locking assembly--11739036
15. Connector W1P1--M24308/1-3
16. Screw--MS3213-7
17. Lens bracket--11737330
18. Lens gasket--11737331
19. Filter lens--1737329
20. Insert-MS21209C0415.
21. Switch lens seal--11745629
22. Switch lens--11741527-1
23. Switch lens--11741527-2
21. Switch lens--11741527-3
25. Seal adapter--11737385
26. Lockwasher--part of item 28
27. Key washer--part of item 28
28. Switch S4 thru S6--11745600
29. Preformed packing--NAS1523AA7Y
33. Lamp--11738097
31. Nut--part of items 28 thru 32
32. Lockwasher-MS35338-138
33. Indicator light DA5--11737364-1
34. Indicator light DS4--11737364-2
35. Indicator light DS6--11737364-3
36. Indicator light DS8--11737364-5
37. Indicator light DS7--11737364-4
38. Preformed packing--MS28775-009
39. Switch lens seal--11737499-1
40. Seal adapter--10737544
41. Lockwasher--part of items 39 or 40
42. Key washer--11745580
43. Preformed packing--NAS1523AA7Y
44. DMR switch S1--MIL-S-8805/99-004
45. TSW switch S2--MIL-S-8805/99-032
46. Housing--11738815

b. Replacement of Logic Circuit Card Assembly A79A1 (see fig.3-4).

(1) Remove access cover as instructed in paragraph 3-9 a step (1).

(2) Remove three screws (6), three screws (7), and six washers (8) that secure the logic circuit card assembly (9) to housing.

(3) Loosen two screws on screw locking assembly (4) and disconnect connector A1P1 (5) from harness connector W1J1.

(4) Remove the logic circuit card assembly.

(5) Install new logic circuit card assembly by performing steps (2) thru (4) in reverse order.

(6) Install access cover as instructed in paragraph 3-9 a steps (2) and (3).

c. Replacement of Readout Circuit Assembly A79A2 (see fig. 3-4).

(1) Remove access cover as instructed in paragraph 3-9 a step (1).

(2) Remove screw (10), three screws (11), four washers (12) and readout circuit assembly A79A2 (13).

(3) Loosen two screws on screw locking assembly (14) and disconnect harness connector W1P1 (15) from connector A2J 1 on readout circuit assembly A79A2 (13).

(4) Install new readout circuit assembly A79A2 (13) by performing steps (2) and (3) in reverse order.

(5) Install access cover as instructed in paragraph 3-9a step (2) and (3).

d. Replacement of Lens Gasket and Lens Filter (see fig. 3-4).

(1) Remove access cover as instructed in paragraph 3-9 a step (1).

(2) Remove readout circuit assembly A79A2 as described in paragraph 3-9 c.

(3) Remove eight screws (16), lens bracket (17) lens gasket (18), and filter lens (19). Inspect screws. washers and inserts (20) for damage and replace as necessary.

(4) Before installing lens gasket, lubricate by applying thin uniform film of grease, MIL-G-4343. Apply by hand to both surfaces of the lens gasket.

(5) Install new lens gasket or filter lens by performing steps (2) and (3) in the reverse order.

(6) Reinstall access cover as instructed in paragraph 3-9a steps (2) and (3).

e. Replacement of RANGE RETURN SELECTOR switches S4 thru S6 and Switch Lens Seals (21) (see fig. 3-4). The following steps are applicable to each indicator S4 thru S6 and its switch lens seal (21).

(1) Remove access cover as instructed in paragraph 3-9 a step (1).

(2) Unscrew applicable switch lens seal (21) from housing with boot removal tool (21, table 2-2).

(3) Pull applicable switch lens (22, 23 or 24) straight out from housing.

(4) Tag all leads to applicable switch for identification. Unsolder leads.

(5) Remove applicable seal adapter (25) lockwasher (26), key washer (27), switch S4 thru S6 (28) and preformed packing (29) from housing.

(6) Lubricate preformed packing (29) by applying a thin, uniform, film of grease, MIL-G-4343.

(7) Install new switch lens seal and switch by performing steps (1) thru (5) in reverse order. Install switch lens seal with boot removal tool (21, table 2-2).

(8) Install access over as instructed in paragraph 3-9 *a* steps (2) and (3).

f. Replacement of Lamps (see fig. 3-4). The following steps are applicable to replacement of lamps in pushbutton switches S4 thru S6.

(1) Unscrew and remove switch lens seal (21) from housing.

(2) Pull application switch lens (22, 23, or 24) straight out from switch.

(3) Remove lamp (30).

(4) Install new lamp (30), and applicable switch lens (22, 23, or 24).

(5) Install switch lens seal (21) to housing.

g. Replacement of Indicator Lights DS4 thru DS8 and Preformed Packings (see fig. 3-4). The following steps are applicable to each indicator light (33 thru 37) and performed packings

(1) Remove access cover as instructed in paragraph :3-9 *a* step (1).

NOTE

Readout indicator assembly (13) must be removed only when replacing indicator lights (30, 31, and 32).

(2) Remove readout circuit assembly (13) as described in paragraph :3-9 c.

(3) Tag all leads to the switch for identification. Unsolder respective indicator light leads.

(4) Remove nut (31) and lockwasher (32) from back of faulty, indicator light.

(5) Push fault indicator light (33 thru 37) out through front panel. Retain preformed packing (38).

(6) Lubricate preformed packing (38) by applying a thin, uniform film of grease, MIL-G4-4343. Apply hand to entire surface of the preformed packing.

(7) Install new indicator light by performing steps (2) thru (5) in reverse order.

(8) Install access cover as instructed in paragraph 3-9 *a* steps (2) and (3).

h. Replacement of DMR Switch S1, TSW Switch S2, and Switch Lens Seal (39) (see fig. 3-1). The following steps are applicable to either switch and switch lens seal (39).

(1) Remove access cover as instructed in paragraph 3-9 *a*.

(2) Unscrew and remove switch lens seal (39) from housing.

(3) Tag all leads to the switch for identification. Unsolder the leads.

(4) Remove seal adapter (40), lockwasher (41), key washer (42) and preformed packing (43) from switch S1 (44) or switch S2 (45).

(5) Lubricate preformed packing (43) by applying a thin, Uniform, film of grease, MIL-G-4343.

(6) Install new switch lens seal and switch by performing steps (2) thru (4) in reverse order.

(7) Install access cover as instructed in paragraph 3-9d steps (2) and (3).

3-10. Inspection of Commander's Control Unit (A79).

a. Inspect the general condition of all parts. Check for wear or other conditions indicating deterioration.

b. Inspect lens filter. indicators, switches, and screws for corrosion; check machine surfaces for conditions that may prevent alinement with mating parts: check lens filter for scratches and all switch lens seals for holes or tears.

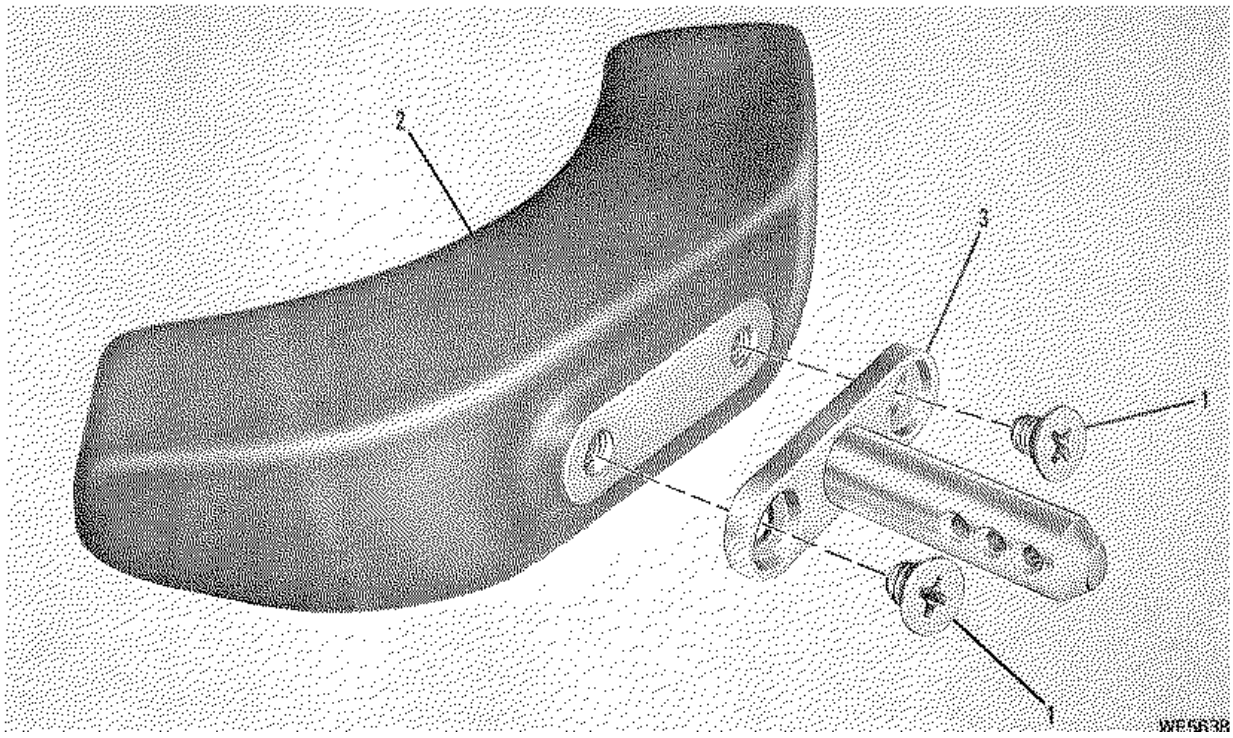
c. Check electrical wiring for chafed or broken wires and bad solder connections.

d. Inspect machined sealing surfaces for scratches. debris or excessive lubricant that may prevent proper sealing.

Section VI. REPAIR OF HEADREST ASSEMBLY

3-11. Disassembly of Headrest Assembly (See fig. 3-5).

The repair of the headrest assembly is limited to replacing the headrest. The headrest is replaced by removing two screws (1) which secure headrest (2) to support (3). When installing new headrest, secure headrest to support with two screws. Seal the screws with sealing compound, MIL-S-11031, and torque to 50 inch-pounds.



1. Screw –MS51960-80
2. Headrest --10553476
3. Support--8624705

Figure 3-5. Disassembly of headrest assembly.

Section VII. REPAIR OF LASER RECEIVER-TRANSMITTER RT-1021/VVG-1 (A76)

3-12. Disassembly of Receiver-transmitter Unit (A76).

The receiver-transmitter unit is to be disassembled at GS only to the point where the damaged items can be removed and replaced. During disassembly, it is recommended that disassembled items be indexed in order of removal. Assembly can then be accomplished by replacing items in reverse index order. After any repair the receiver-transmitter unit must be purged and charged with dry nitrogen gas in accordance with TM 9-2350-230-12.

CAUTION

The entire disassembly and assembly of the receiver-transmitter unit is to be performed under controlled environmental conditions. Dust and humidity will create unacceptable units. Utmost care should be taken to ensure cleanliness of area where repair is to be performed.

a. Replacement of Ballistic Cover Gasket (see fig. 3-6).

CAUTION

When removing ballistic cover assembly (5) which weighs approximately 70 pounds, great care is required to prevent optical damage. Remove the cover assembly in a straight line away from the mating assembly.

(1) Remove screw (1) and washer (2) just above the window in front of the receiver transmitter unit.

(2) Secure one end of ballistic cover handle assembly (18, table 2-2) in the hole where the screw and washer in step (1) was removed.

(3) Secure the other end of the ballistic cover handle assembly in the hole just to the right of connector A76J2.

(4) Remove 19 screws (3) 19 washers (4), ballistic cover assembly (5) and ballistic cover gasket (6). Discard screws (3).

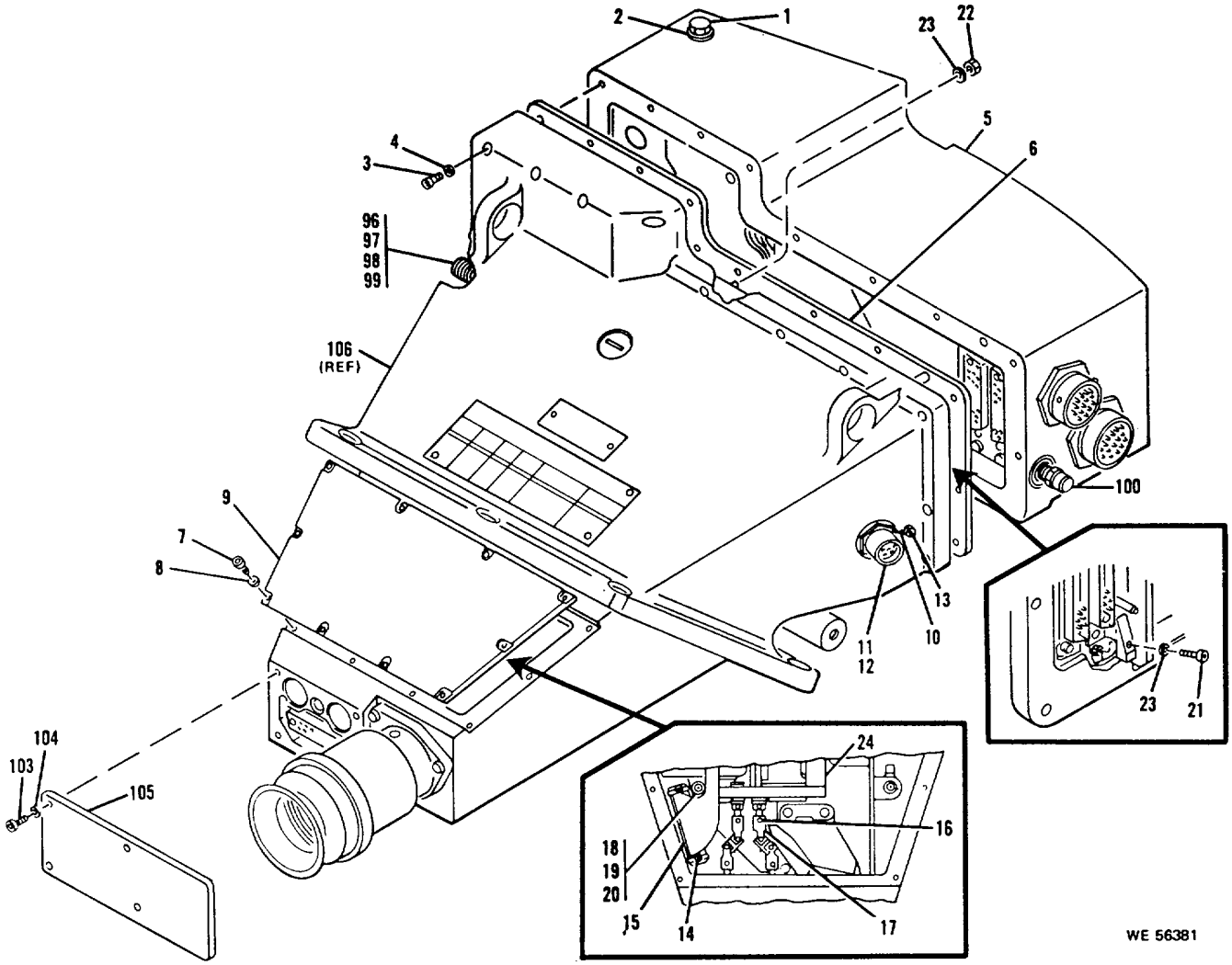


Figure 3-6. Disassembly of Laser Receiver-Transmitter RT-1021/VVG-1 (A76) (Sheet 1 of 3 sheets).

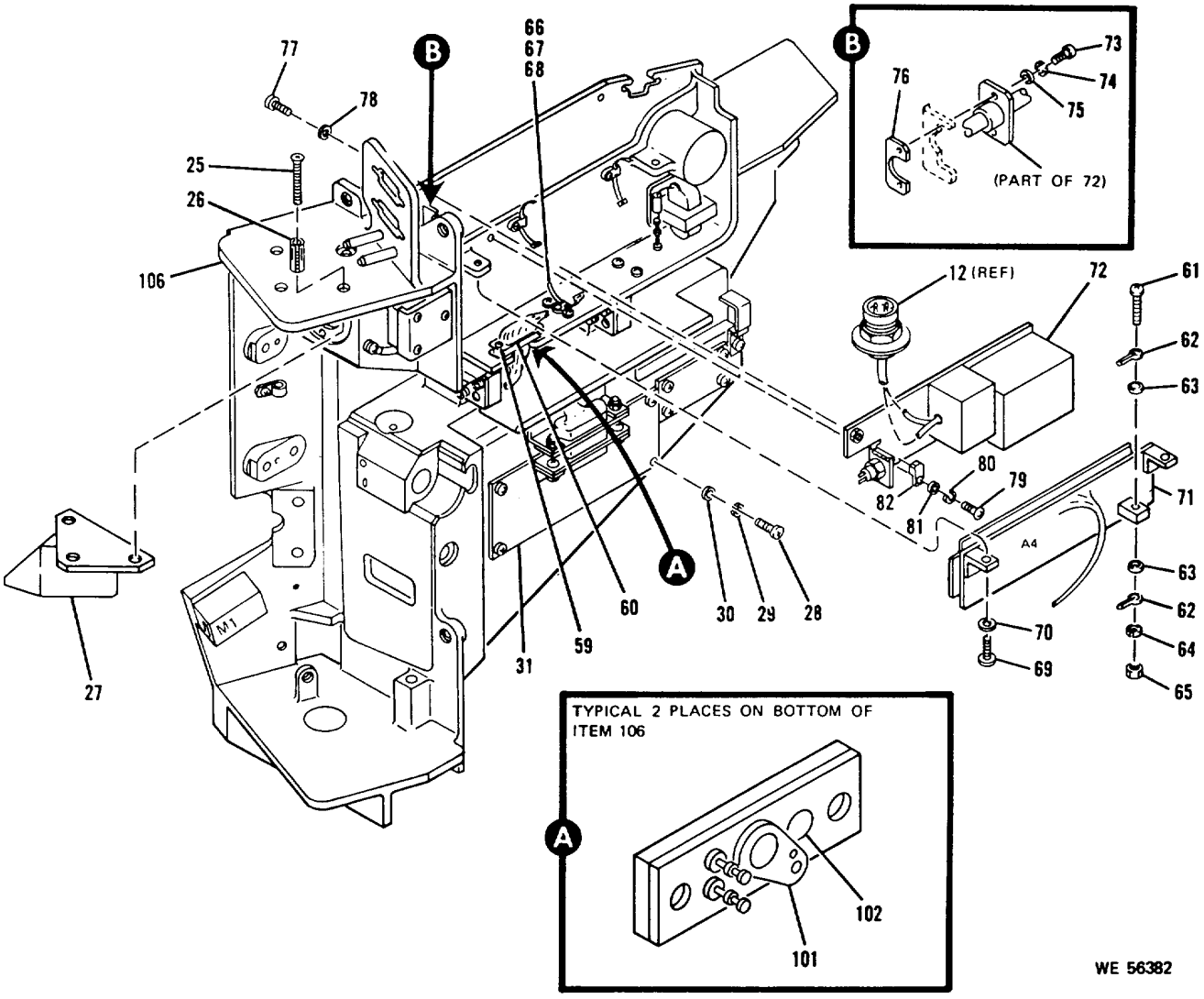


Figure 3-6. Disassembly of Laser Receiver-Transmitter RT-1021/VVG-1 (A76) (Sheet 2 of 3 sheets).

KEY to fig. 3-6:

1. Screw--NAS1226C1
2. Washer—NAS1598C6R
3. Screw--NAS1351-3LL12P
4. Washer—NAS620C10
5. Ballistic cover assembly--11737395
6. Ballistic cover gasket--11738871
7. Screw—NAS1635C06LE4
8. Washer-NAS620C6L
9. Access cover--11737369
10. Lockwire--MS20995C32
11. Retaining nut-part of item 12
12. Connector A76J3--11737533
13. Screw--NAS1352C064
14. Screw locking assembly--11739036
15. Connector A76W1P3—M24308/3-5.
16. Setscrew—NAS1081-04A2
17. Universal joint--11737528
18. Screw—NAS1351-3LL12P
19. Washer--MS35338-157
20. Washer—NAS620C10
21. Screw--NAS1291C3
22. Nut--NAS1291C3
23. Washer—NAS620C10
24. Optical bench assembly--11737374
25. Expander screw--11737396
26. Adjustment screw--11737397
27. Transfer prism assembly No. 1-11737439
28. Screw—MS51957-14
29. Lockwasher--MS35338-135
30. Washer-AN960C4
31. Malfunction 3/buffer logic circuit card assembly A76A1 11738803
32. Screw locking assembly--11739036
33. Connector A2P1--MS24308/3-2
34. Screw--MS51957-13
35. Lockwasher--MS35338-135
36. Washer-AN960C4
37. A-trigger circuit card assembly A76A2-11737477
38. Screw—NAS1635-04LL-5
39. Washer--NAS62014L
40. Transmitter cover assembly--11741541
41. Connector P1I--11738974
42. Setscrew--NAS1081C02D4L
43. Flashtube high voltage holder-10559472
44.. Screw-MS51957-16
45. Lockwasher--MS35338-135
46. Washer—NAS620C4
47. Transmitter component assembly A76A3-10559479
48. Screw--11737540-2
49. Valve Stem--11739028
50. Screw—NAS135C04LE-10
51. Telescope--10559415
52. Screw--NAS1352C04-4
53. Elliptical reflector retainer--10559362
54. Transmitter reflector assembly--10559447
55. Screw—MS519573-16
56. Flashtube heat sink holder--10559471
57. Screw—MS51957-16
58. Flashtube V1--10559659
59. Screw locking assembly--11739036
60. Connector A4P1—M24308/3-2
61. Screw—MS51957-8
62. Terminal--MS35431-1
63. Washer—AN960C3
64. Lockwasher-MS35338-134
65. Nut—NAS671C2
66. Strap-11741522
67. Screw-MS24693C1
68. Clamp--11741321
69. Screw—NAS1352C04LE6
70. Washer—AN960C4
71. Transmitter logic circuit card assembly A76A4-10559425
72. Transmitter logic component assembly A76A3-10559404
73. Screw—MS31957-4
74. Lockwasher-MN35338-134
75. Washer-AN960C3
76. Nutplate--11741534

76A. Screw

76B. Cover

77. Screw—MS51957-18
78. Washer—AN960C4
79. Screw--MS1957-14
80. Lockwasher-MS35338-135
81. Washer—AN960C4
82. Holddown clamp--11737338
83. Coaxial lead A7W1--10559475
84. Screw locking assembly--11739036
85. Connector A76W1P1--11738916
86. Screw--MS51957-28
87. Lockwasher-MS35338-136
88. Washer-NAS620C6
89. PMT chassis assembly A76A6-10559435
90. Screw locking assembly--11739036
91. Connector A76W1P2--11738912
92. Screw--MS51957-29
93. Lockwasher--MS35338-136
94. Washer--NAS620C6
95. Video amplifier A76A7--10559445
96. Cap--8200055
97. Stem--11739028
98. Core--11739003
99. Strap--10516567
100. Relief valve--10516717
101. Contact--11737879
102. Lamp--11738021
103. Screw--NAS1351-3LL8P
104. Washer-NAS620C100
105. Shipping cover-11737963
106. Main housing assembly-11737390

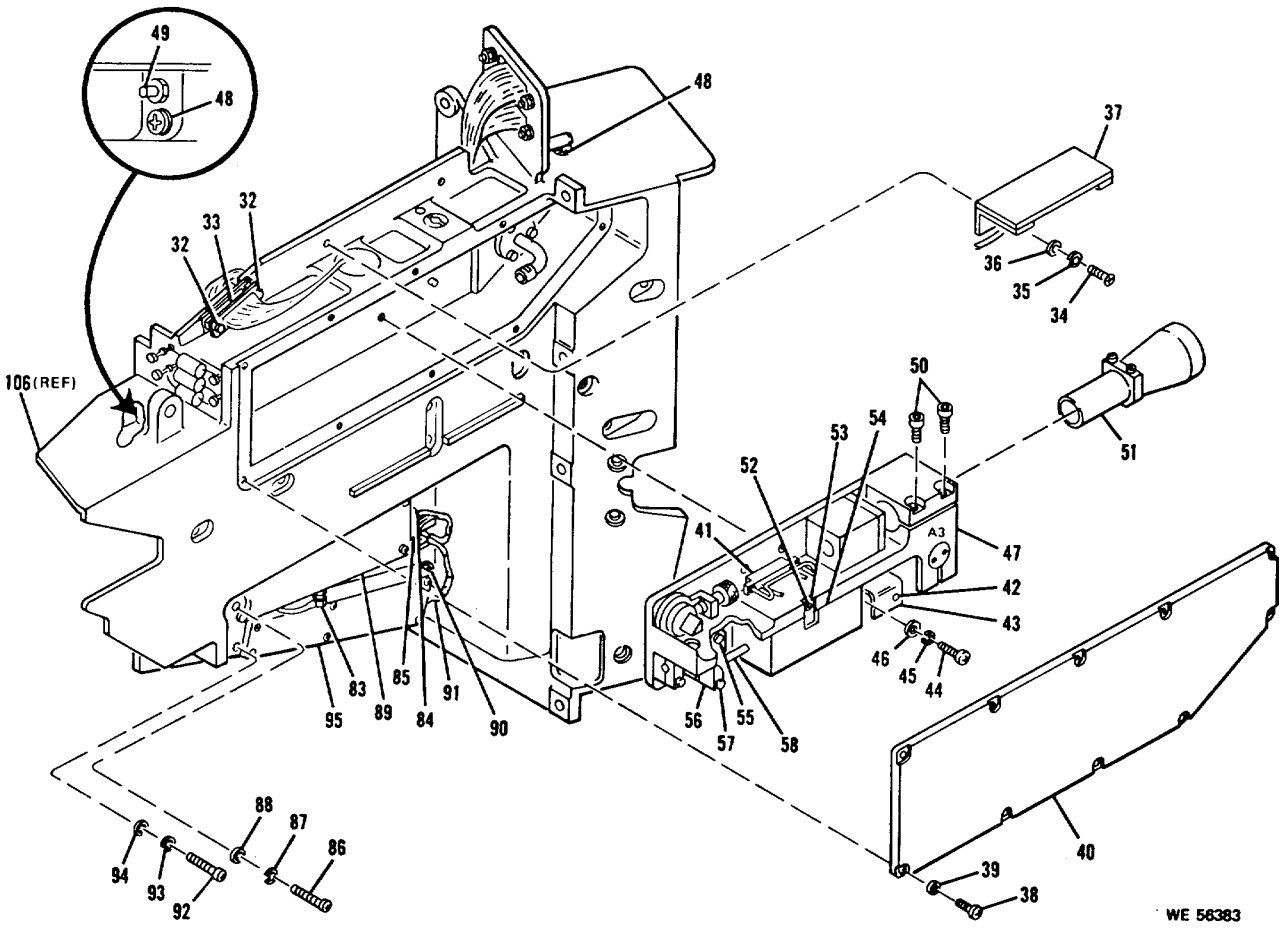


Figure 3-6. Disassembly of Laser Receiver-Transmitter RT-1021/VVG-1 (A76) (Sheet 3 of 3 sheets).

(5) Lubricate new ballistic cover gasket (6) by applying a thin, uniform, film of grease, MIL-G4343, to the high point on the bead of the gasket. Do not apply so much grease that it fills the grooves on either side of the bead. Apply by hand to the inserts on both sides of the ballistic cover gasket.

(6) Install new ballistic cover gasket (6) by performing step (4) in reverse order. Use new screws (31 and torque to 45 to 50 inch-pounds.

b. Removal and Installation of Optical Bench Assembly (see fig. 3-6).

NOTE

The optical bench assembly as a whole is not a replaceable assembly. This assembly must be removed from the main housing assembly in accordance with the following procedure in order to replace the components that are replaceable on the optical bench assembly.

(1) Remove ballistic cover assembly and ballistic cover gasket as instructed in paragraph 3-12 a, steps (1) thru (4).

(2) Remove 10 screws (7), 10 washers (8), and access cover (9).

(3) Cut lockwire (10) between retaining nut (11) on connector A76J3 (12) and screw (13).

(4) Remove retaining nut (11) which secures connector A76J3 to housing assembly (106) with connector wrench (15, table 2-1).

(5) Loosen two captive screws on screw locking assembly (14) and disconnect connector A76W1P3 (15).

WARNING

Ethyl alcohol is flammable. When using it for cleaning, keep it and all flammable cleaning materials away from open flames.

(6) Apply ethyl alcohol, O-C-265, to soften sealant on setscrew. Loosen two setscrews (16) on each shaft and slide two universal joints (17) to the rear in order to disengage from coupling shaft on optical bench assembly (24).

(7) Remove two screws (18), two washers (19) and two washers (20). Discard screws (18). Remove screws with ball wrench (12, table 2-1).

(8) Remove 6 screws (21), nut (22), and seven washers (23). Discard screws (21). Remove screws with ball wrench (12, table 2-1).

CAUTION

Use extreme care in performing the following step in order to prevent damage to the optical bench assembly.

(9) Carefully slide optical bench assembly (24) from main housing assembly (106). Use extreme care to avoid hitting the sides of the housing assembly. Carefully guide harness connector A76J3 (12) during removal.

CAUTION

When placing the optical bench assembly on a work bench, ensure that all optical components are not damaged. If necessary, place the assembly on blocks.

(10) Make necessary repair on optical bench assembly

CAUTION

Use extreme care in performing the following step in order to prevent damage to the optical bench assembly. Ensure cleanliness of all optical surface before installing optical bench assembly into housing

(11) Carefully, slide optical bench assembly (24) into main housing assembly (106). Ensure that connector A76J3 can be positioned in its proper place when the optical bench assembly (24) is finally secured to the main housing assembly.

(12) Install six new screws (21) nut (22), and seven washers (23). Torque screws to 45 to 50 inch-pounds. (13) Install two new screws (18), two washers (19) and two washers (23). Torque screws to 45 to 50 inch-pounds.

(14) Slip two universal joints (17) on their respective coupling shaft on optical bench assembly (24). Ensure all setscrews (16) contact a flat on each shaft. Seal threads of setscrews (16) with sealant. MIL-S-22473, and torque to 42 to 54 inch-ounces.

(15) Connect connector A76W1P3 (15) to connector A76W2J5 on main housing assembly (106). Seal threads of screws on screw locking assembly ( ) with sealant, MIL-S-22473, and tighten.

(16) Slip connector A76J3 (12) to the proper opening on the side of main housing assembly (106) and secure with retaining nut (11). Use connector wrench (15, table 2-1) to secure nut.

(17) Install lockwire (10) from retaining nut (11) to screw (13) per MS33540.

(18) Lubricate seal around access cover (9) by applying a thin, uniform, film of grease, MIL-G-43413, to the high point on the bead of the seal. Do not apply so much grease that it fills the grooves on either side of the bead. Apply by hand.

(19) Install access cover (9) with 10 screws (7) and (10) washers (8).

(20) Perform receiver-transmitter unit alinement procedure as described in paragraph 3-12 *c.*

c. Receiver-Transmitter Unit, Alinement Procedure.

(1) Remove balistic cover assembly per paragraph 3-12 a.

(2) Connect receiver-transmitter unit into hot mock-up as described in paragraph 2-4 except for the change shown in figure 3-7; which illustrates the use of branched cable (1, table 2-3).

(3) Secure alinement lens assembly (4, table 2-3) in front of the receiver-transmitter aperture with four screws.

(4) Place a sheet of thermal chart paper (Graphic (Controls Corp., P/N 651-54 or GFE) inches in front of the alinement lens assembly. The length of the cord on the alinement lens assembly is 70 inches.

(5) Set control knobs on the R/T control unit to zero.

(6) View chart paper through the receiver-transmitter unit eyepiece and adjust the distance between the lens assembly and chart paper until no parallax is apparent between the reticle seen in the eyepiece and the image of the chart paper.

WARNING

The laser ca be dangerous and cause blindness if it enters the eyes either directly or reflected from a shiny surface. Before pressing the RANGE switch (firing the laser), take adequate precautions to assure maximum safety for adjacent maintenance personnel in or near the laser line-of-sight, Wear safety goggles.

(7) Turn LASER MODE CONTROL switch on the commander's control unit ON.

(8) Press and release RANGE switch on the R/T control unit. The laser will fire through the lens assembly causing a burn spot on the chart paper.

If the receiver is alined to the transmitter, the burn spot will be coincident with the reticle when viewed through the eyepiece. If receiver is aline(d to the' transmitter. proceed with step (14). If receiver is not alined to the transmitter, continue with step ()1.

NOTE

The receiver-transmitter unit alignment is accomplished by adjusting screws on transfer prism assembly No. 1 (see fig. 3-7).

(9) Loosen the tipper and lower left expander screws using boresight tool (5, table 2-3).

CAUTION

Do not loosen or adjust lower right screws which act as a pivot point.

(10) Adjust direction of the transmitter beam by turning the tipper and lower left adjustment screws as required to make the burn spot coincident with the reticle seen in the eyepiece. Turning the upper adjustment screw clockwise directs the burn spot downward. Turning the lower left adjustment screw clockwise directs the burn spot to the left.

(11) Tighten expander screws.

(12) Perform steps (7) thru (11) until alinement is accomplished.

(13) Tighten expander screws to 10 to 12 inch-pounds. Apply blue Glyptal to the adjustment screws.

(14) Remove four screws and lens assembly.

(15) Install ballistic cover assembly as described in paragraph 3-12a.

(16) Remove receiver-transmitter unit from hot mock-tip.

(17) Purge receiver-transmitter unit in accordance with TM 9-2350-230-12.

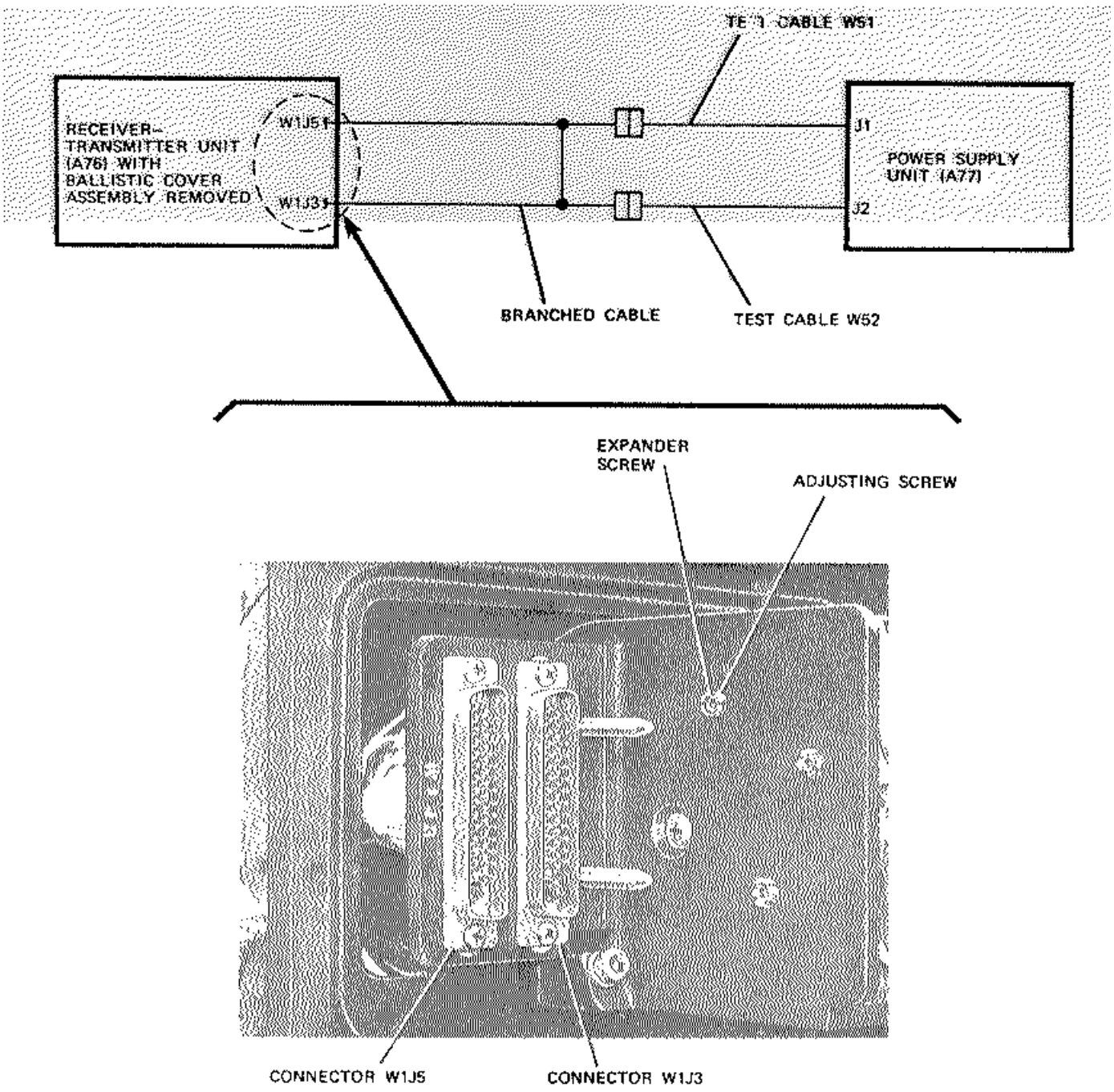


Figure 3-7. Receiver-transmitter unit alignment.

d. Replacement of Transfer Prism Assembly No. 1 (see fig. 3-6).

(1) Remove optical bench assembly as described in paragraph 3-12 *b*.

(2) Loosen three expander screws (25), turn three adjustment screws (26) clockwise, and remove transfer prism assembly No. 1 (27).

(3) Install new transfer prism assembly No. 1 by performing steps (1) and (2) in reverse order.

(4) Install optical bench assembly as instructed in paragraph 3-12 b.

e. Replacement of Malfunction 3/Buffer Logic Circuit Card Assembly A76A1 (see fig. 3-6).

(1) Remove optical bench assembly as described in paragraph 3-2 b).

(2) Remove four screws (28), four lockwashers (29), four washers (30).

(3) Remove malfunction 3/buffer logic circuit card assembly AT6A1 (31) disconnecting connector W1J1 in the same motion.

(4) Install new malfunction 3/buffer logic circuit card assembly by performing steps (1) thru (3) in reverse order.

(5) Install optical bench assembly as instructed in paragraph 3-12 *b*.

f. Replacement of A-Trigger Circuit Card Assembly A76A2 (see fig. 3-6).

(1) Remove optical bench assembly as described in paragraph 3-12 *b*.

(2) Loosen two captive screws on screw locking assembly (32) and disconnect connector A2P1 (33) from harness connector W1J2.

(3) Remove two screws (34), two lockwashers (35). two washers (36),.and A-Trigger circuit card assembly A76A2 (37).

(4) Install new A-trigger circuit card assembly by performing steps (1) thru (3) in reverse order.

(5) Install optical bench assembly as instructed in paragraph 3-12 *b*.

g. Replacement of Transmitter Component Assembly A76A3 (see fig. 3-6).

(1) Remove optical bench assembly as described in paragraph 3-12 b.

(2) Remove 10 screws (38), 10 washers (39), and transmitter cover assembly (40).

(3) Disconnect connector P1 (41).

(4) Loosen setscrew (42) and pull out high voltage cable lead from flashtube high voltage holder (43). Use ball wrench (9, table 2-1) to loosen setscrews.

(5) Remove four screws (44), four lockwashers 145), tour washers (46), and transmitter component assembly A76A3 (47).

(6) Clean transmitter telescope as instructed in paragraph 2-12 *b*. step (3).

(7) Install new transmitter component assembly by performing steps (2) thru f6) in reverse order.

(8) Remove two screws (48).

(9) Purge transmitter component assembly housing at valve stem (49) in accordance with TM 9-2350-230-12. Set final pressure to 0.5 psig.

(10) Install optical bench assembly as instructed in paragraph 3-12 *b*. Do not install receiver-transmitter cover.

h. Replacement of Flashtube V1 on Transmitter Component Assembly A76A3 (see fig. 3-6).

(1) Remove optical bench assembly as described in paragraph 3-12 b.

(2) Remove 10 screws (38), 10 washers (39), and transmitter cover assembly (40).

(3) Remove screw (52) elliptical reflector retainer (53), and transmitter reflector assembly (54).

(4) Loosen setscrew (42) and pull high voltage cable lead from flashtube high voltage holder (43). Use ball wrench (9, table 2-1) to loosen setscrews.

(5) Loosen two screws (55) which secure flashtube heat sink holder (56) and slide towards the rear for tube removal clearance.

(6) Loosen screw (57) which clamps the cathode electrode and remove flashtube V1 (58).

CAUTION

Ensure that new flashtube and cavity are free of foreign material and fingerprints.

(7) Clean new flashtube and cavity as instructed in paragraph 2-12 *b*: step (3).

(8) Install flashtube V1 (58) in flashtube heat sink holder (56) so that the anode electrode (marked with red paint or "+" symbol) is at the forward end (or end with high voltage cable lead) of the cavity. Do not tighten clamping screw (57).

(9) Position flashtube in flashtube high voltage holder (43). Position flashtube heat sink holder (56) so that the internal flashtube cathode and anode are centered on the ruby rod clamp.

(10) Rotate flashtube and adjust position of heat sink so that anode (as viewed through glass envelope of flashtube) is centered in high voltage holder (43).

(11) Tighten screw (57) and two screws (55) securing flashtube heat sink holder (56).

CAUTION

High voltage cable lead must slip freely over flashtube anode without bending flashtube.

(12) Insert high voltage cable lead into flashtube high voltage holder (43). Aline the clearance hole in the terminal so that it is in line with setscrew (421 and tighten setscrew.

(13) Install transmitter reflector assembly 1541 and elliptical reflector retainer (53) and secure with screw (52).

(14) Install transmitter cover assembly (40) and secure with 10 screws (38) and 10 washers (39).

(15) Purge and charge transmitter component assembly housing in accordance with TM 9-2350230-12. Set final pressure to be 3.5 ±0.5 psig.

(16) Install optical bench assembly as instructed in paragraph 3-12 b.

i. Replacement of Transmitter Logic Circuit Card Assembly A76A4 (see fig. 3-6).

(1) Remove optical bench assembly as described in paragraph 3-12 b).

(2) Loosen two captive screws on screw looking assembly (59) and disconnect connector A4P1 (60) from harness connector W1J4.

(3) Remove screw (61), two terminals (62), two washers (63), lockwasher (64), and nut (65) from transformer T2 on transmitter logic circuit card assembly (17).

(4) Cut strap (66) and remove screw (67) and clamp (68).

(5) Remove two screws (69), two washers (70), and transmitter logic circuit card assembly A76A4 (71).

(6) Obtain new clamp (68).

(7) Install new transmitter logic circuit card assembly by performing steps (1) thru (5) in reverse order.

(8) Install optical bench assembly as instructed in paragraph 3-12 *b*.

j. Replacement of Transmitter Logic Component Assembly A76A5 (see fig. 3-6).

(1) Remove optical bench assembly as described in paragraph 3-12 *b*).

WARNING

The PFN may retain high voltage charges from this 1200 volts developed in the PFN charge power supply. Before proceeding use a suitable shorting rod with an insulated handle to ensure that the PFN is fully discharged. While grounding the shorting rod to the housing, touch the rod to the high voltage terminal at the forward end of the flashtube.

(2) Remove three screws (76A) from high voltage terminal cover (76B), remove cover and unsolder high voltage cable at contact.

(3) Unsolder wires from transmitter logic component assembly (72) terminals 7, 8, and 10, and tag for later installation of new transmitter logic component assembly.

(4) Remove potting material from around connector A76J3 (12), pin A, and unsolder wire from pin A.

(5) Remove two screws (73), two lockwashers (74), two washers (75) and nut-plate (76) and gently pull high voltage lead free.

(6) Remove two screws (77), two washers (78), one screw (79), lockwasher (80), washer (81), holddown clamp (82) and remove transmitter logic component assembly A76A5 (72).

(7) Install a new transmitter logic component assembly by performing steps (1) thru (6) in reverse order. During installation of new transmitter logic component assembly A76A5, twist brown lead going to transformer T2 of transmitter logic circuit card assembly A76A4 with high voltage lead from A76A5. Install protective sleeving over high voltage lead and tie in place using lacing tape, MIL-T-43435. Install braid (1, table 2-10) and insulation sleeving, MIL-I-23053/5, over wire from card A76A5, terminal 1, to connector A76J3, pin A, and pot with sealant, RTV 3145.

(8) Install optical bench assembly as instructed in paragraph 3-12 *b*.

k. Replacement of PMT chassis Assembly ,A76A6 (see fig. 3-6).

(1) Remove optical bench -assembly as described in paragraph 3-12 *b*).

(2) Disconnect coaxial lead A7WI (83) from connector J2.

(3) Loosen two captive screws in screw locking assembly (84) and disconnect connector A76W1P1.

(4) Remove two screws (86), two lockwashers (87), two washers (88), and PMT chassis assembly (89)

(5) Install a new PMT chassis assembly by performing steps (1) thru (4) in reverse order. Seal screws 1841 with sealant, MIL-S-22473.

(6) Reinstall optical bench assembly as instructed in paragraph 3-12 *b*).

I. Replacement of Video Amplifier A76A7 (see fig. 3-6).

(1) Remove optical bench assembly as described in paragraph 3-12 *b*.

(2) Loosen two captive screws on screw locking assembly (90) and disconnect connector A76W1P2 (91).

(3) Disconnect coaxial lead A7W1 (831)from connector J2 on PMT chassis assembly (89).

(4) Remove three screws (92), three lock-washers (93). three washers (94), and video amplifier A76A7 (95).

(5) Install new video amplifier by performing steps (1) thru (4) in reverse order. Seal screw (90) with sealant. MIIL-S-22473.

(6) Install optical bench assembly as instructed in paragraph 3-12 *b*.

m. Replacement of Fill Valve (see fig. 3-6).

(1) Remove cal, (96) from fill valve stem (97)

(2) Remove fill valve stem (97) from main housing assembly (106).

(3) Remove fill valve core (98) and strap (99) from stem (97).

(4) Install new fill valve by performing steps (1) and (3) in reverse order. Before installing, seal threads of stem (97) using sealing compound, MIL-S-11030.

n. Replacement of Relief Valve (see fig. 3-6).

(1) Remove relief valve (100) from ballistic (cover assembly (5).

(2) Install new relief valve (100). Before installing, seal threads of relief valve (100) with sealant, MIL-S-22473.

o. Replacement of Reticle Lamps (see fig. 3-6).

(1) Remove optical bench assembly as described in paragraph 3-12 *b*.

(2) Turn the contacts (101) to one side from their pivotal point and pull faulty reticle lamp (102) out of its slot.

(3) Install new reticle lamp (102) into its slot and perform steps (1) and (2) in reverse order.

(4) Install optical bench assembly as instructed in paragraph 3-12 *b*).

p. Removal and Installation of R/T Unit Shipping Cover see fig.3-6).

(1) Remove four screws. (103) and four washers (104).

(2) Remove shipping cover (105).

(3) Install shipping cover by performing steps (1) and (2) in reverse order.

3-13. Inspection of Receiver-Transmitter Unit (A76).

a. Inspect the general condition of all parts. Check for wear or other conditions indicating deterioration.

b. Inspect all circuit cards and all modules for corrosion; check all screws for worn threads, check all seals for deterioration, and check all machined surfaces for conditions that may prevent alinement with mating parts. Check all gears, shafts, and bearings for free operation.

c. Check electrical wiring for chafed or broken wires and bad solder connections.

d. Check all optical elements for cleanliness and freedom from surface scratches.

e. Inspect machined sealing surfaces for scratches. debris or excessive lubricant that may prevent proper sealing.

Section VIII. REPAIR OF CABLE ASSEMBLIES

3-14. General.

The system cable assemblies W50 through W54 are replaced at organizational level and are to be sent directly to depot for any maintenance. The only exception is to cable assembly W50. The terminal lugs may be replaced at GS level maintenance. No special instructions are required for the replacement of the terminal lugs. Any other repair of interconnecting cable W50 will be performed at depot.

3-15. Inspection of Cable Assembly W50.

a. Inspect the general condition of all parts. Check for wear or other conditions indicating deterioration. Check connectors for bent pins and presence or o-ring inside connector around base of pins.

b. Check electrical wiring for chafed or broken wires and bad solder connections.

c. Install cable assembly W50 in hot mock-up and perform BIT (para 4-2a).

CHAPTER 4

FINAL INSPECTION

4-1. Scope.

Final inspection is performed after repair has been completed to insure serviceability of the laser range finder according to established standards. Any items containing defects disclosed by the final inspection will be returned to the maintenance shop for repair and adjustment.

4-2. Checkout.

Using the test cables from the special tools and test equipment, make proper interconnection of the individual units of the laser range finder as instructed in paragraph 2-4. Then, follow the procedures in a below for checkout to verify proper operation of the units within the laser range finder system.

a. Built-in Test. The laser range finder contains a built-in test (BIT) capability which traces faults to the lowest line replaceable unit. The test consists of manipulating the laser range finder controls in a prescribed sequence while observing that certain lamps light and certain ranges appear on the readout. Although the laser will not be fired while the LASER MODE CONTROL switch on the commander's control unit is in the TEST position, the ballistic dust cover should be closed. This will prevent the exposed optics from contamination and any eye injury in case the LASER MODE CONTROL switch is inadvertently turned to the ON position.

NOTE

Unless otherwise specified, all switches, lamps., and readouts mentioned in the following procedure are on the commander's control unit (A79).

(1) Apply external power to the hot mock-up as described in paragraph 2-4. Adjust voltage to 24 $\pm$1 V.

(2) Set LASER MODE CONTROL switch to TEST position and observe the following:

(a) LASER MODE CONTROL TEST lamp lights.

(b) RANGE RETURN SELECTOR LAST lamp lights.

(c) RANGE (METERS) and RETURNS indicators display 0000 and 0, respectively.

(d) RESET lamp on the R/T control unit lights.

(e) RANGE lamp on the R/T control unit lights but does not flash on and off.

(3) Press and hold the TSW switch and observe the following:

(a) All lamps on the commander's control unit and R/T unit light.

(b) RANGE (METERS) and RETURNS indicators display 8888 and 8, respectively.

(4) While pressing the TSW switch, press and release DMR switch twice and observe the following:

(a) All lamps on the commander's control unit alternately dim and brighten.

(b) RANG(E (METERS) and RETURNS indicators maintain the same brightness.

(5) Release the TSW switch. The status of the switch lamps will be that of step 2.

(6) Adjust RTCL ILLUM control on the R/T control unit and observe that the reticle illumination in the receiver-transmitter unit varies.

(7) Press and release the RANGE switch on R/T control unit and observe the following:

(a) RANGE RETURN SELECTOR LAST lamp remains lit.

(b) RANGE (METERS) indicator displays 84.5 $\pm$15.

(c) RETURNS indicator displays 1.

(8) Press and release RANGE RETURN SELECTOR 1 switch and observe the following:

(a) RANGE RETURN SELECTOR 1 lamp lights.

(b) RANGE RETURN SELECTOR LAST lamp goes out.

(c) RANGE (METERS) indicator displays 845 $\pm$15.

(9) Press and release RANGE RETURN SELECTOR 2 switch and observe the following:

(a) RANGE RETURN SELECTOR 1 lamp goes out.

(b) RANGE RETURN SELECTOR 2 lamp lights.

(c) RANGE (METERS) indicator displays 9995, 9990, or 000.

(10) Press and release RANGE RETURN SELECTOR LAST switch and observe the following:

(a) RANGE RETURN SELECTOR 2 lamp goes out.

(b) RANGE RETURN SELECTOR LAST lamp lights.

(c) RANGE METERS indicator displays 845 $\pm$ 15.

(11) Press and release RANGE switch on the R/T control unit a second time and observe the following:

(a) RANGE RETURN SELECTOR LAST lamp remains lit.

(b) RANGE (METERS) indicator displays 1845 ±15

(c) RETURNS indicator displays 2.

(12) Press and release RANGE switch on the R/T control unit a third time and observe the following:

(a) RANGE RETURN SELECTOR LAST lamp remains lit.

(b) RANGE (METERS) indicator displays 2845 ±15.

(c) RETURNS readout displays 3.

(13) Press and release RANGE switch on the R/T control unit a fourth time and observe the following:

(a) RANGE RETURN SELECTOR LAST lamp remains lit.

(b) RANGE (METERS) indicator displays 2845 ±15.

(c) RETURNS readout displays 3.

(14) Press and release RANGE RETURN SELECTOR switch and observe the following:

(a) RANGE RETURN SELECTOR LAST lamp goes out.

(b) RANGE RETURN SELECTOR 1 lamp goes out

(c) RANGE (METERS) indicator displays 845 ±15.

(15) Press and release RANGE RETURN SELECTOR 2 switch and observe the following:

(a) RANGE, RETURN SELECTOR 1 lamp goes out.

(b) RANGE RETURN SELECTOR 2 lamp lights.

(c) RANGE (METERS) indicator displays 1845 ±15.

(d) RETURNS indicator displays 4.

(16) Press and release RESET switch on R/T control unit and observe the following:

(a) RANGE RETURN SELECTOR 2 lamp goes out.

(b) RANGE RETURN SELECTOR LAST lamp lights.

(c) RANGE (METERS) and RETURNS indicators display 0000 and 0, respectively.

(d) RANGE lamp on the R/T control unit lights.

(e) RESET lamp on the R/T control unit lights.

(17) Press and hold RANGE switch on the R/T control unit and observe the following:

(a) MALF lamp lights.

(b) RANGE (METERS) indicator displays 0002.

(c) RETURNS indicator displays 0.

(18) Release RANGE switch on R/T control unit.

(19) Press and release RESET switch and observe the following:

(a) RANGE RETURN SELECTOR LAST lamp lights.

(b) RANGE lamp on the R/T control unit lights.

(c) RESET lamp on the R/T control unit lights.

(d) RANGE (METERS) and RETURNS indicators display 0000 and 0 respectively.

(20) Turn external power off and observe the following:

(a) RANGE (METERS) and RETURS indicator displays 0001.

(b) MALF and BAT DR lamps light.

NOTE

If the battery in the battery power supply unit is low, the BAT LOW lamp will also light.

(21) Turn external power on and observe the following:

(a) RANGE (METERS) indicator displays 0000.

(b) MALF and BAT DR lamps go out.

WARNING

When reading the events counter on receiver-transmitter unit, ensure that system power is off prior to opening ballistic dust cover. This will prevent inadvertent firing of the laser which could cause injury to personnel.

(22) Set LASER MODE CONTROL switch to OFF position: open ballistic dust cover, and read and record events counter reading: Close and latch ballistic dust cover.

b. Closed Cover Test.

(1) Set LASER MODE CONTROL switch to ON position and observe the following:

(a) LASER MODE CONTROL ON lamp lights.

(b) RANGE RETURN SELECTOR LAST lamp lights.

(c) RANGE (METERS) and RETURNS indicators display 0000 and 0, respectively.

(d) RANGE lamp on the R/T control unit is flashing.

(e) RESET lamp on the R/T control unit lights.

WARNING

Ensure ballistic dust cover is closed and secured by its latch to prevent leakage which may cause injury to eyes.

(2) Press and release RANGE switch on the R/T control unit and observe the following:

(a) RANGE METERS indicator has an indication.

(b) RETURNS indicator displays 0.

(3) Set LASER MODE CONTROL switch to OFF position. All lamps and indicators will go out.

(4) Open ballistic dust cover and verify events counter advanced one shot. Close and latch)ballistic dust cover.

(5) Turn external power off.

(6) Remove unit being inspected from hot mock-up.

APPENDIX A

REFERENCES

A-1. Safety.

Control of Hazards to Health from Laser Radiation..... TB MED 279

A-2. Supply Catalogs.

The following Department of the Army Supply Catalogs pertain to repair and overhaul of this materiel:

Brushes, Paints, Sealers and Adhesives C8000-IL-A
Fire Control Maintenance and Repair Shop Specialized Equipment Tool Set, DS, GS, and Depot Maintenance: General Purpose Tools (4931-574-6433).....SC 4931-95-CL-J51
Fire Control Maintenance and Repair Shop Specialized Equipment Wrench Set. Spanner DS, GS, and Depot Maintenance: Tubr, Dble-End Concave Inserted Blade; Set of 76 Wrenches (4931-580-0012) .....SC 4931-95-CL-J52
Miscellaneous Hardware .....C5340-IL-A, Vols 1, 2, 3
Oils and Greases: Cutting. Lubricating and Hydraulic C9100-IL
Purging Kit, Fire Control: Organizational Maintenance FSN 4931-065-1110.....SC4931-95-CL-J54
Shop Set. Instrument and Fire Control, Field Maintenance: Basic (4931-754-0740)..... SC4931-95-CL-A07
Tool Kit. Fire Control Instrument Repairman 14931-947-82431 ..... SC4931-95-CL-A09

A-3. Other Publications.

a. General.

Accident Reporting and Records.....AR 385-40
First Aid for Soldiers .....FM 21-11
Recommended Changes to Publications ..... DA FORM 2028
The Army Maintenance Management Systems (TAMMS .....TM 38-750

b. Maintenance.

General Maintenance Procedures For Fire Control Material TM 9-254
Operator and Organizational Maintenance Manual Armored Reconnaissance/Airborne Assault Vehicle Full-Tracked, 152-MM, M551 (2350-873-5408) and M551A1 (2350-140-5151) ..... TM 9-2350-230-12
Operator's Manual (Turret Operation) AR/AAV M551A1 (Sheridan) (W/Laser Range Finder) (2350-140-5151) .....TM 9-2350-230-10/ 2-3

c. Operations.

Northern Operations.....FM 31-71
Operation and Maintenance of Army Materiel in Extreme Cold Weather 0^{o} to -65^{o} F.....TM 9-207

d. Shipment and Storage.

Paper Lens Tissue Anti-Tarnish Wrapping MIL-P-13988
Part, Equipment and Tools for Army Material, Packaging of MIL-P-14232/P11738801
Preservation, Methods of MIL-P-116
Preservation, Packaging and Packing .....AR 700-15

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General, United States Army
Chief of Staff

Official:

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*U.S. GOVERNMENT PRINTING OFFICE: 1990 - 276-914/21055

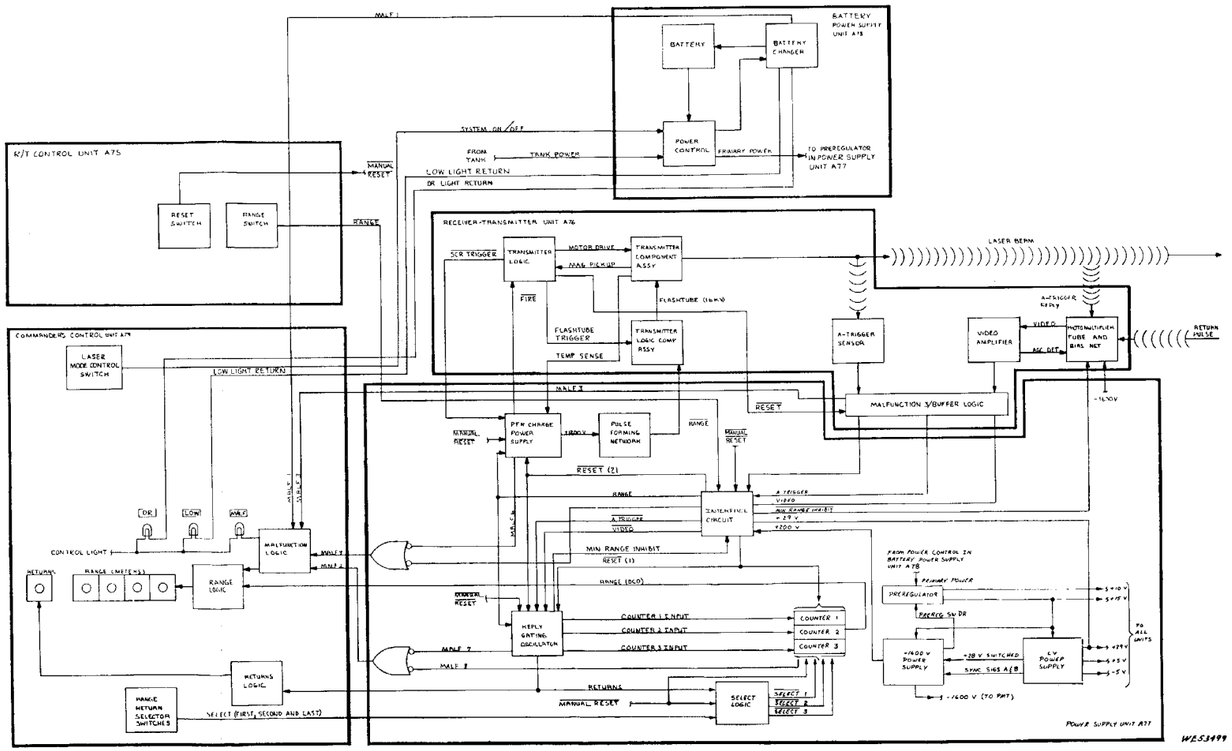


Figure 1-2. Laser range finder block diagram.

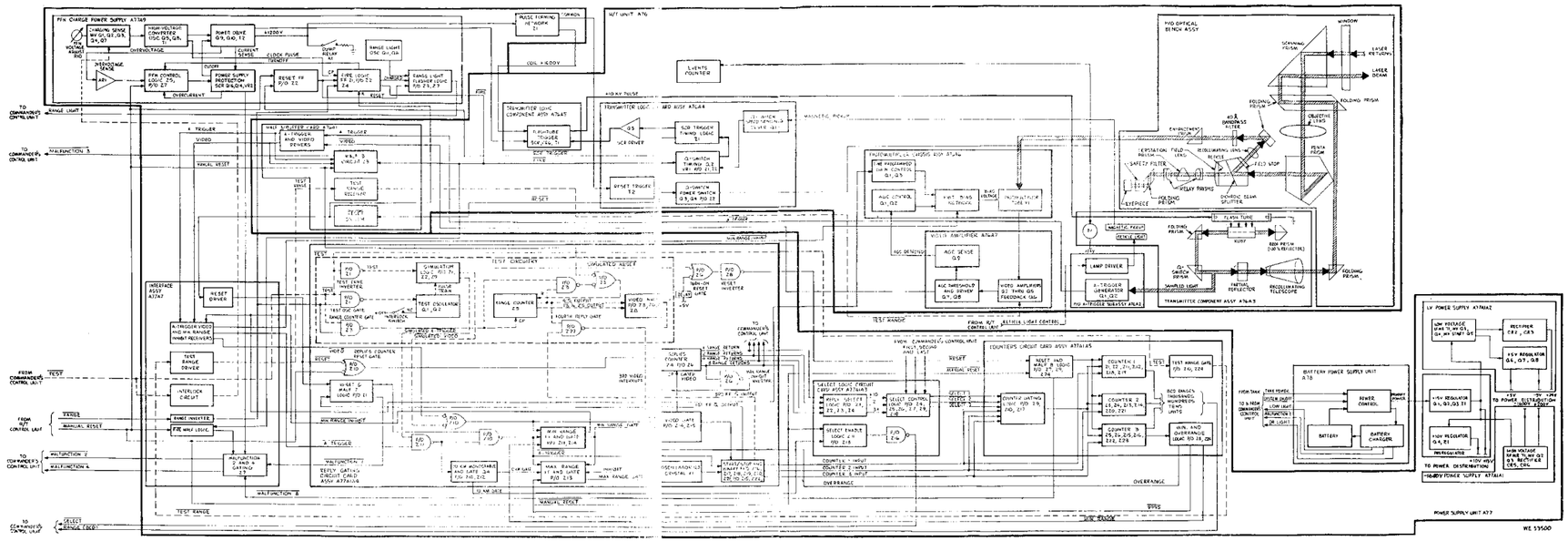


Figure 1-3. Receiver-transmitter unit, power supply control unit, and battery power supply unit functional block diagram.

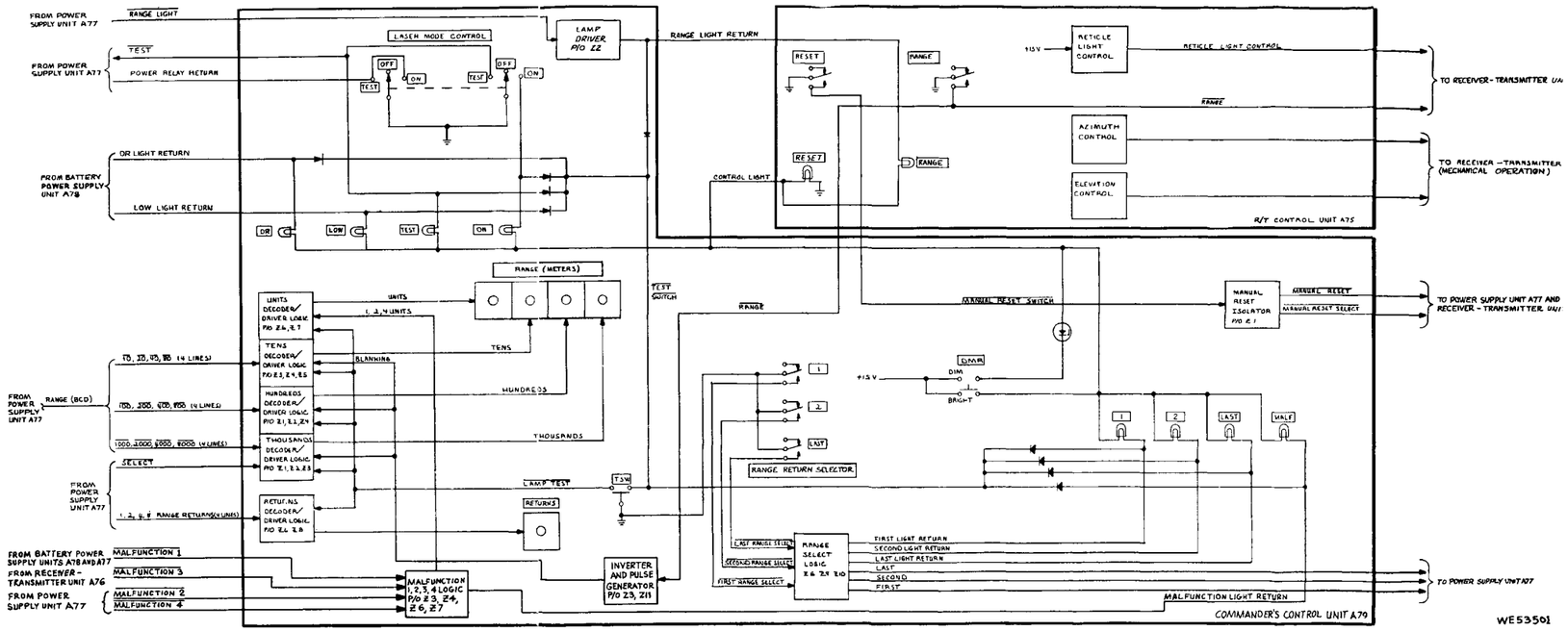


Figure 1-4. Commander's control unit and R/T control unit functional block diagram.

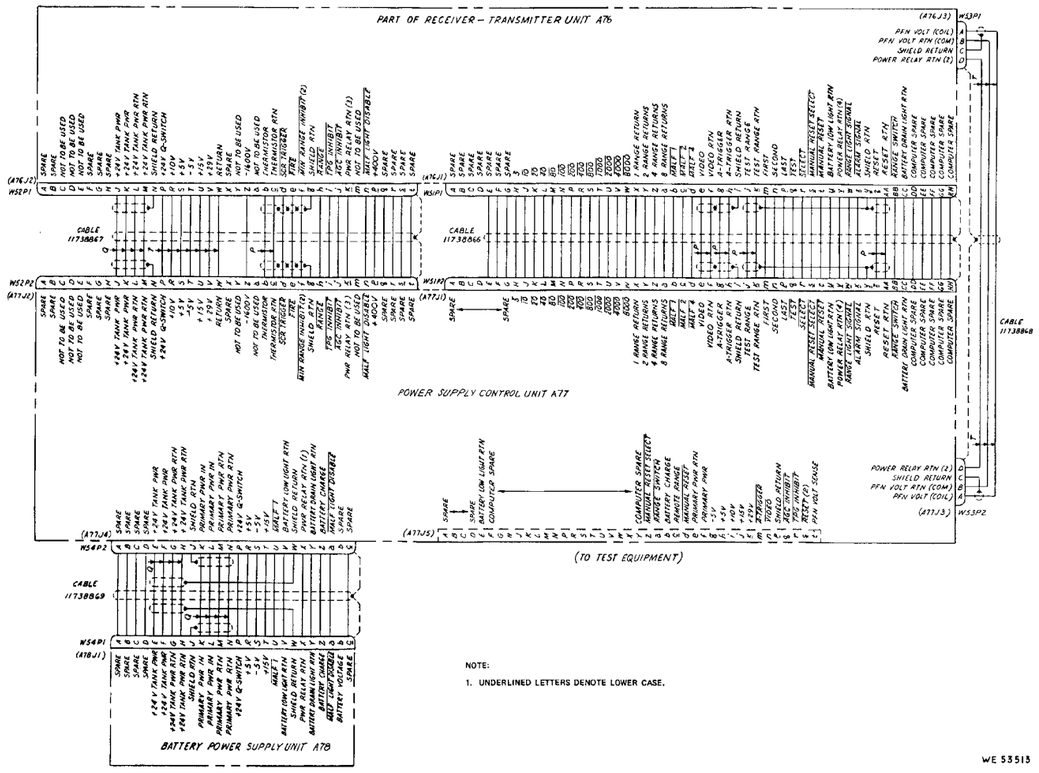
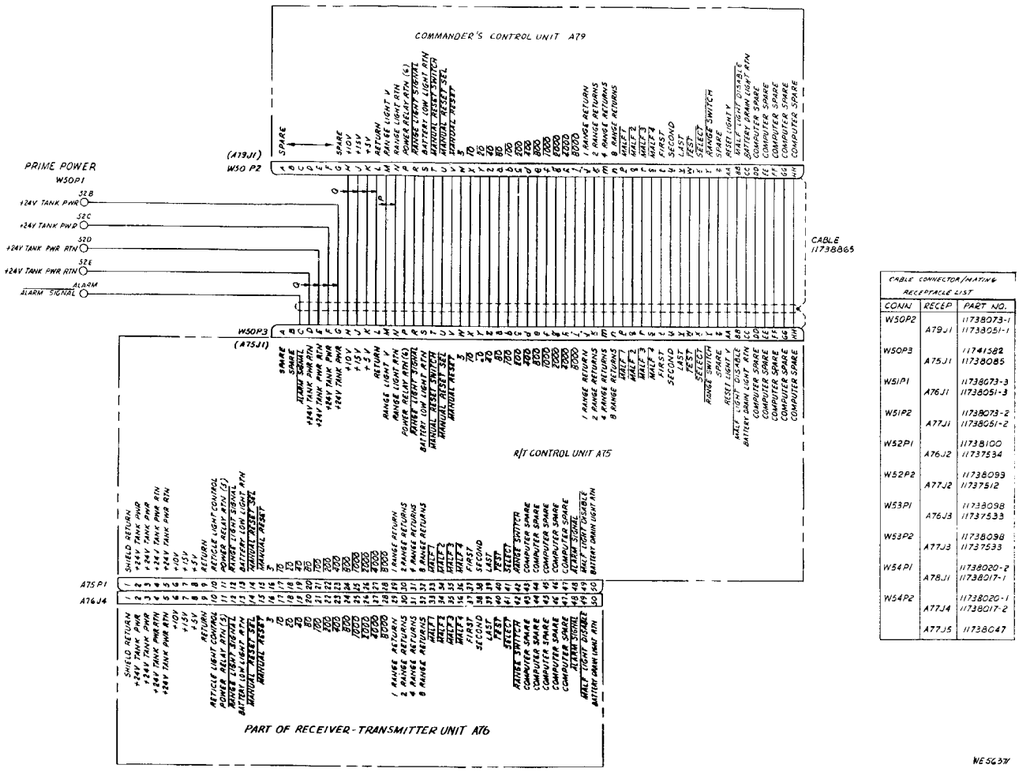


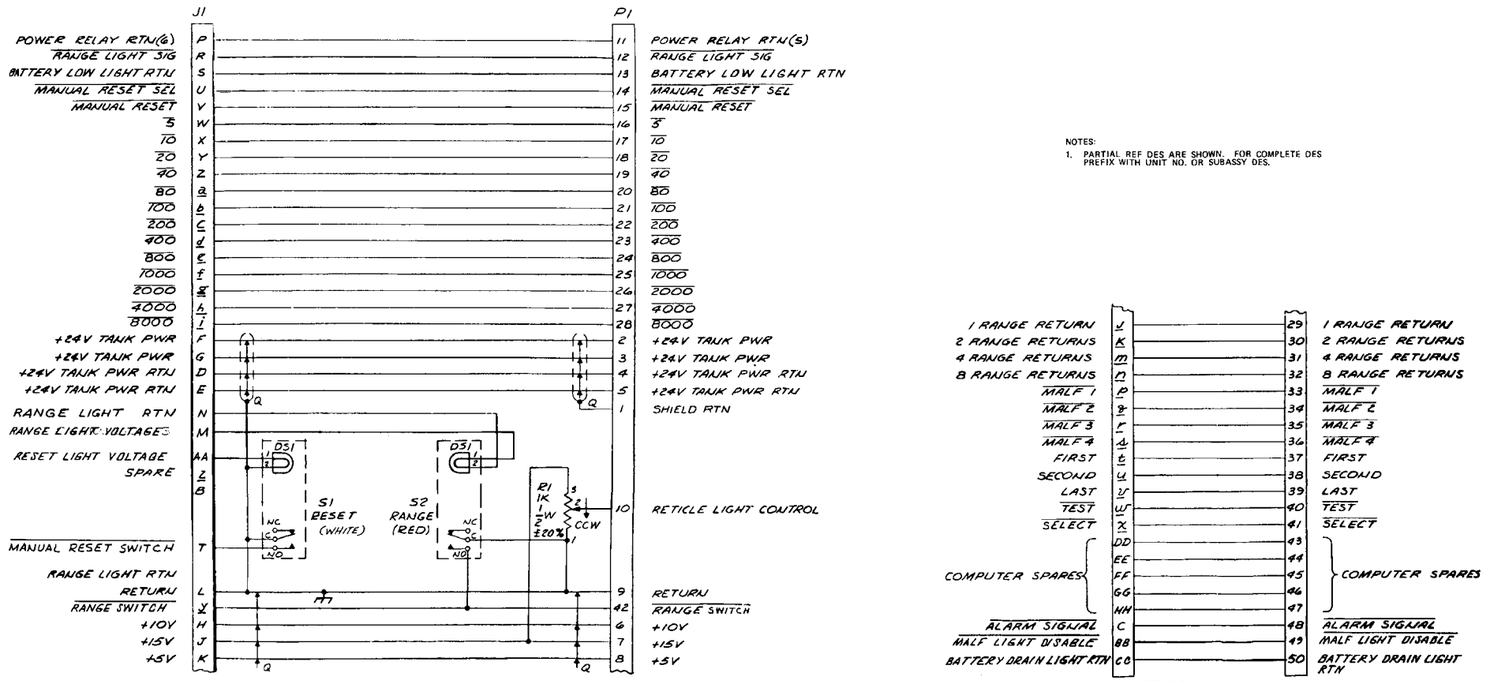
Figure 2-16. Laser range finder interconnection schematic diagram (Sheet 1 of 2 sheets).



CABLE CONNECTOR/MATING RECEPTACLE LIST

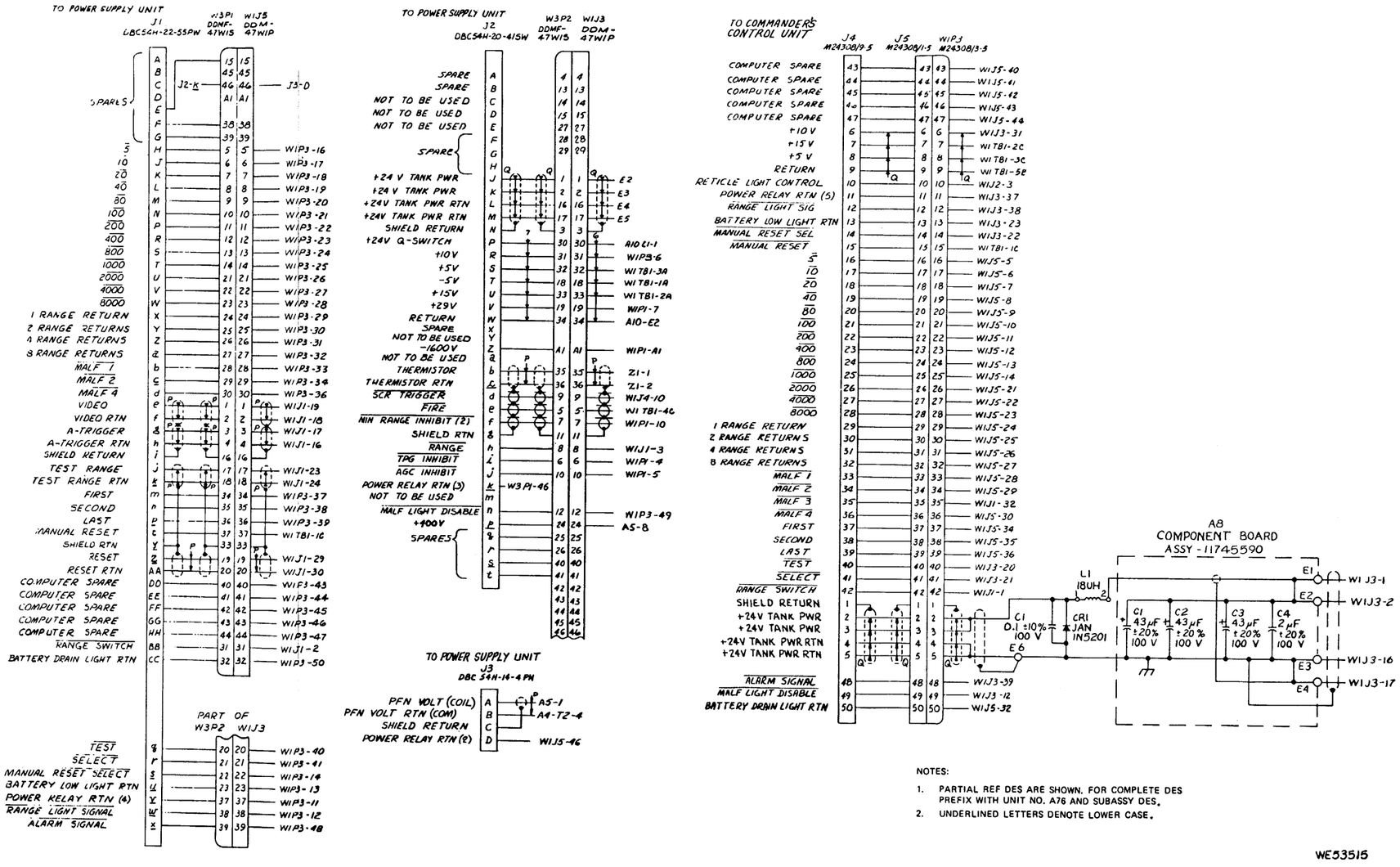
CONN	RECEP	PART NO.
W50P2		11738073-1
	A79J1	11738051-1
W50P3		11741382
	A75J1	11738085
W51P1		11738073-3
	A76J1	11738051-3
W51P2		11738073-2
	A77J1	11738051-2
W52P1		11738100
	A76J2	11737534
W52P2		11738093
	A77J2	11737512
W53P1		11738098
	A76J3	11737533
W53P2		11738098
	A77J3	11737533
W54P1		11738020-2
	A76J1	11738017-1
W54P2		11738020-1
	A77J4	11738017-2
	A77J5	11738047

Figure 2-16. Laser range finder interconnection schematic diagram (Sheet 2 of 2 sheets).



NOTES:
1. PARTIAL REF DES ARE SHOWN. FOR COMPLETE DES PREFIX WITH UNIT NO. OR SUBASSY DES.

Figure 2-17. R/T control unit (A75) schematic diagram.



NOTES:

1. PARTIAL REF DES ARE SHOWN. FOR COMPLETE DES PREFIX WITH UNIT NO. A76 AND SUBASSY DES.
2. UNDERLINED LETTERS DENOTE LOWER CASE.

WE53515

Figure 2-18. Receiver-transmitter unit (A76) schematic diagram (Sheet 1 of 2 sheets).

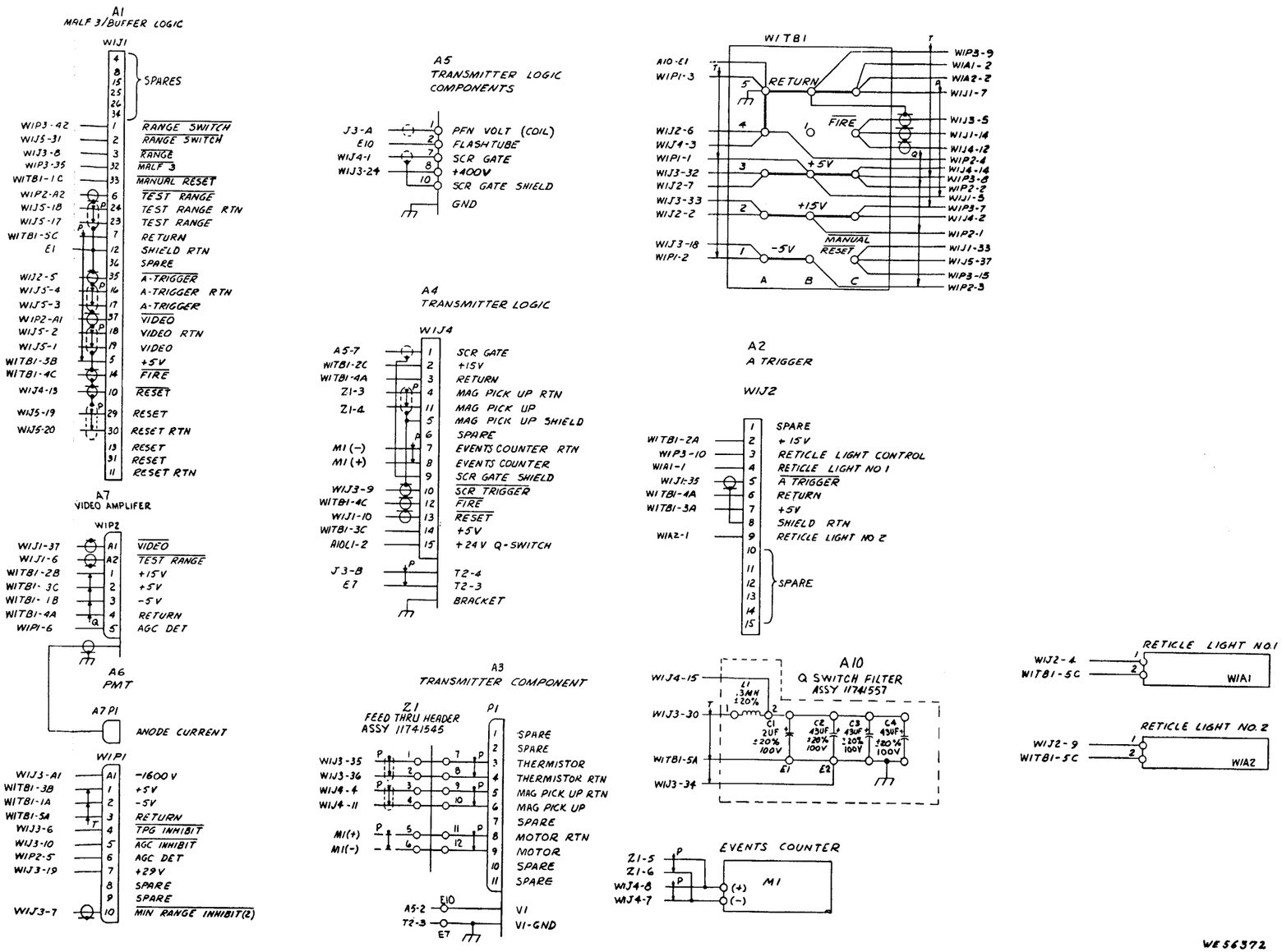


Figure 2-18. Receiver-transmitter unit (A76) schematic diagram (Sheet 2 of 2 sheets).

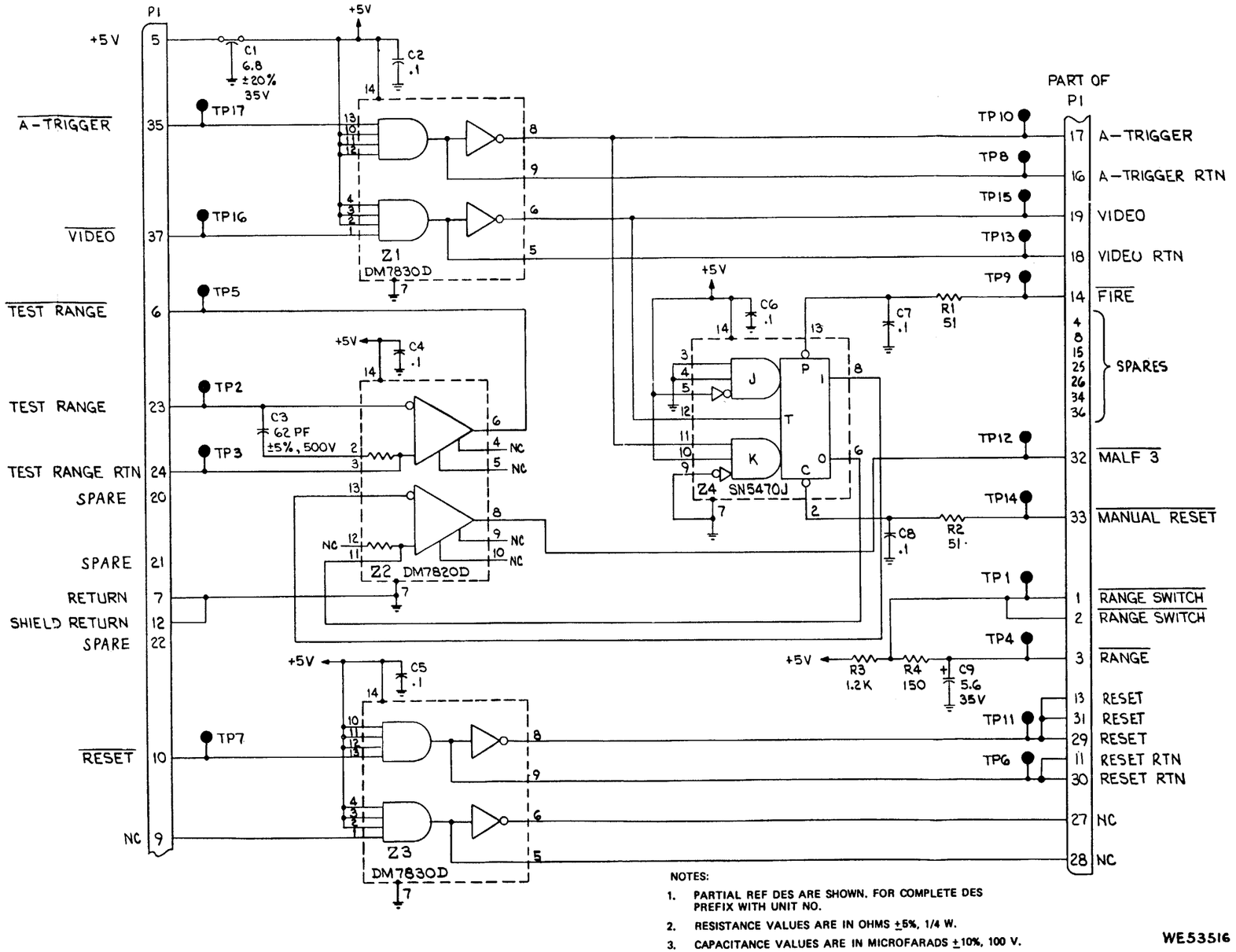
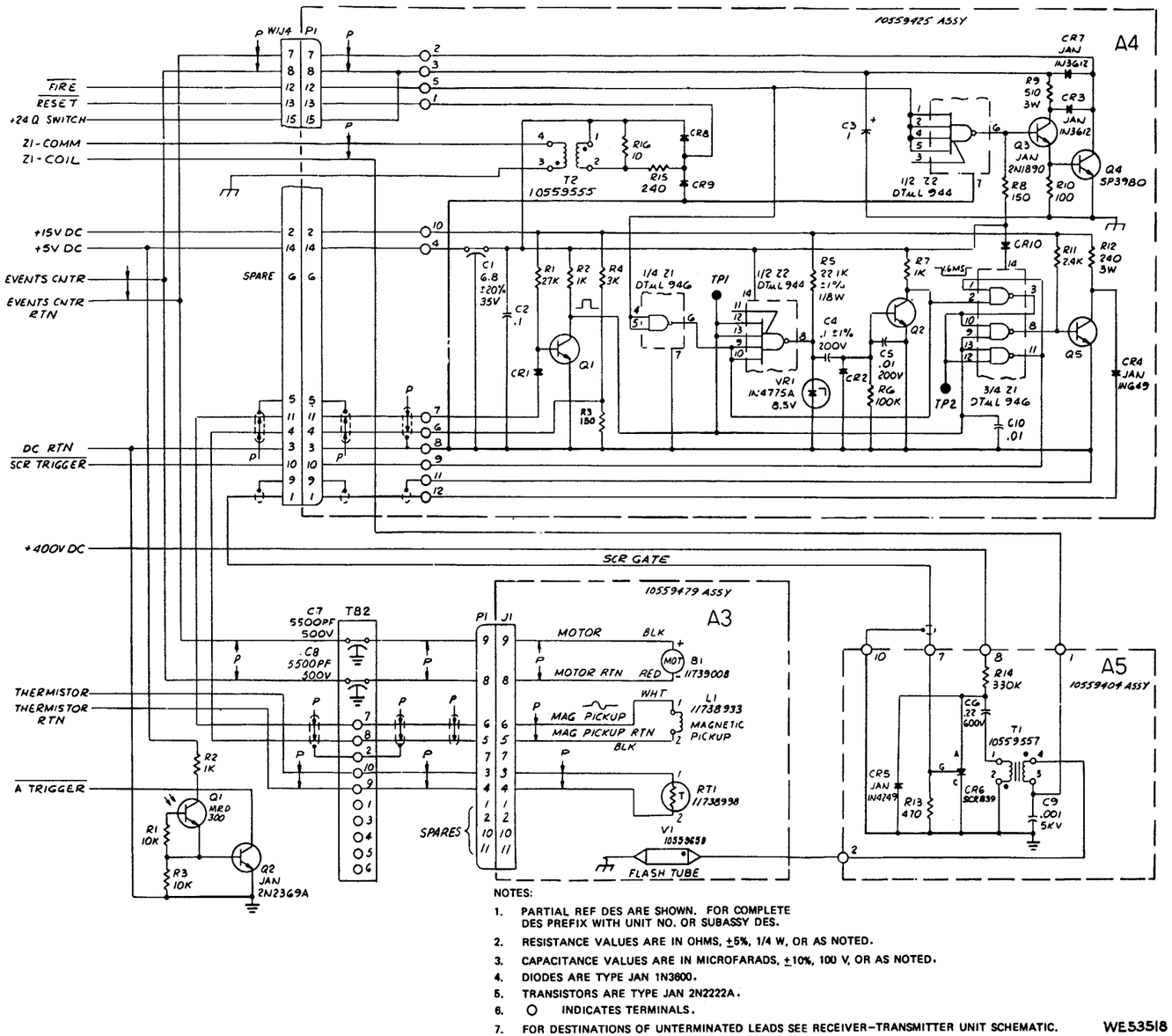


Figure 2-19. Malfunction 3 / buffer logic (A76A1) schematic diagram.



NOTES:

1. PARTIAL REF DES ARE SHOWN. FOR COMPLETE DES PREFIX WITH UNIT NO. OR SUBASSY DES.
2. RESISTANCE VALUES ARE IN OHMS, ±5%, 1/4 W, OR AS NOTED.
3. CAPACITANCE VALUES ARE IN MICROFARADS, ±10%, 100 V, OR AS NOTED.
4. DIODES ARE TYPE JAN 1N3600.
5. TRANSISTORS ARE TYPE JAN 2N2222A.
6. ○ INDICATES TERMINALS.
7. FOR DESTINATIONS OF UNTERMINATED LEADS SEE RECEIVER–TRANSMITTER UNIT SCHEMATIC.

WE53518

Figure 2-21. Transmitter (A76A3, A76A4, A76A5) schematic diagram.

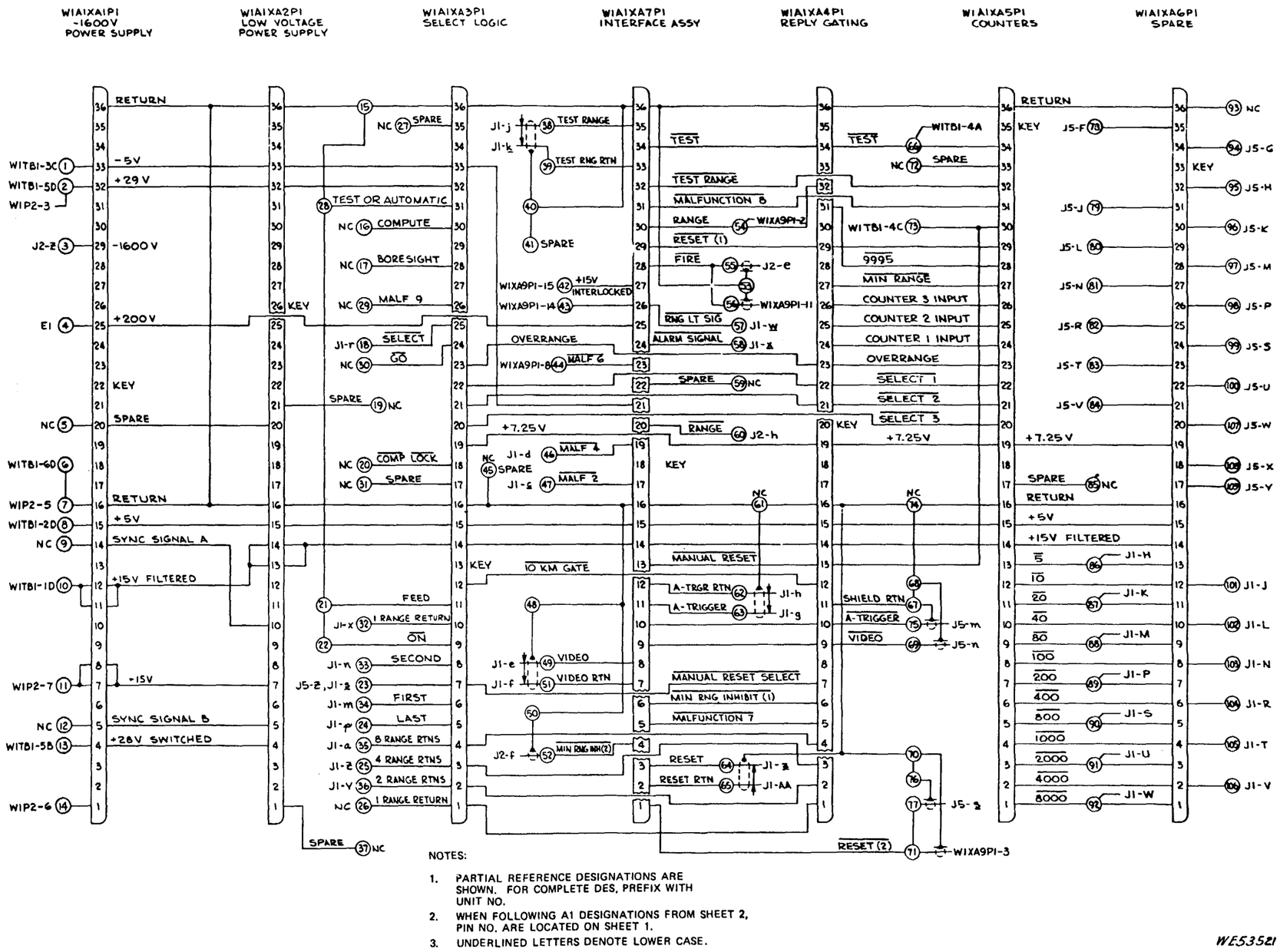


Figure 2-24. Power supply control unit (A77) schematic diagram (Sheet 1 of 2 sheets).

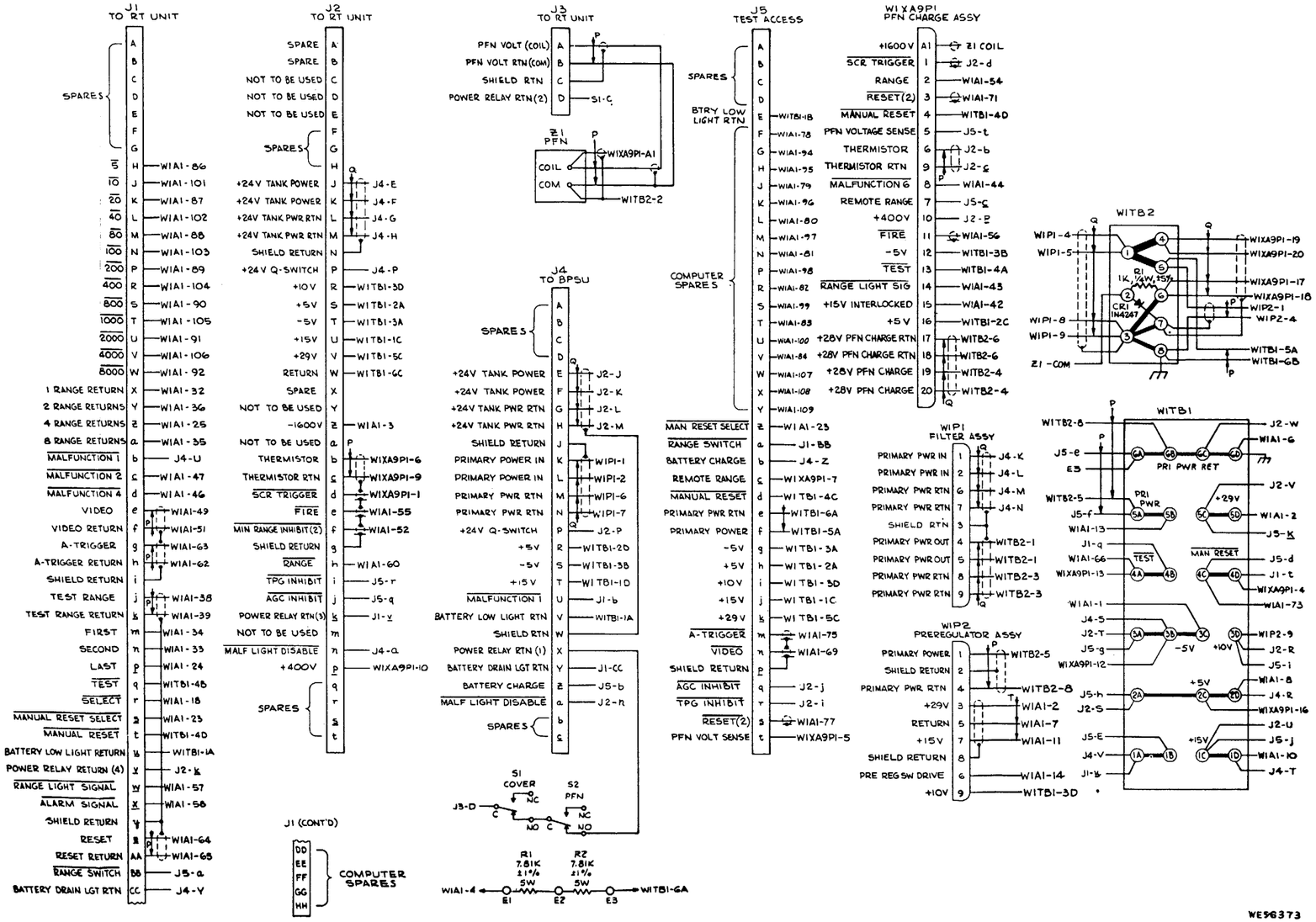
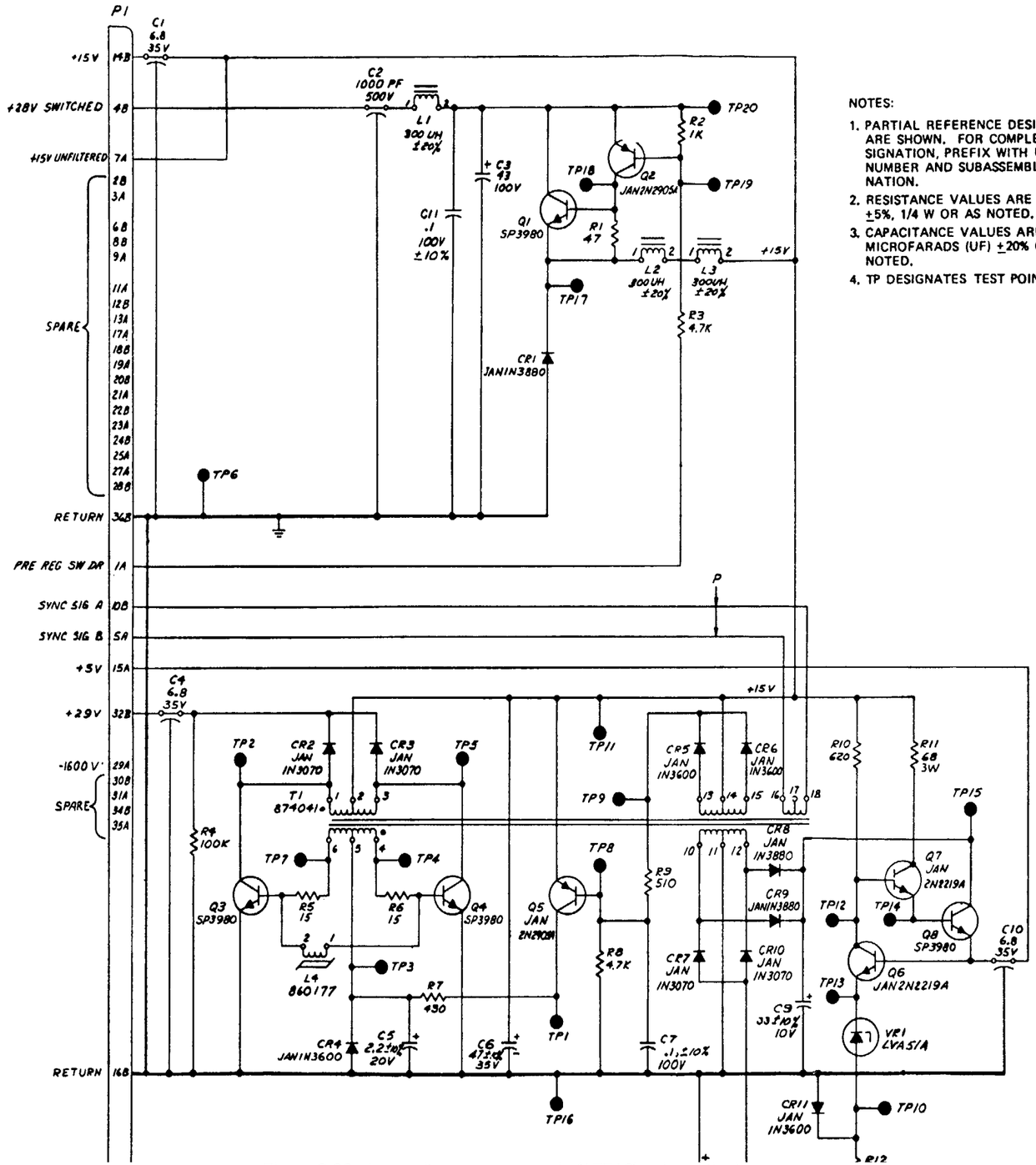


Figure 2-24. Power supply control unit (A77) schematic diagram (Sheet 2 of 2 sheets).



NOTES:

1. PARTIAL REFERENCE DESIGNA ARE SHOWN. FOR COMPLETE D SIGNATION, PREFIX WITH UNIT NUMBER AND SUBASSEMBLY DI NATION.
2. RESISTANCE VALUES ARE IN O ±5%, 1/4 W OR AS NOTED.
3. CAPACITANCE VALUES ARE IN MICROFARADS (UF) ±20% OR A NOTED.
4. TP DESIGNATES TEST POINT.

Figure 2-26. Low voltage power supply (A77A2) schematic diagram.

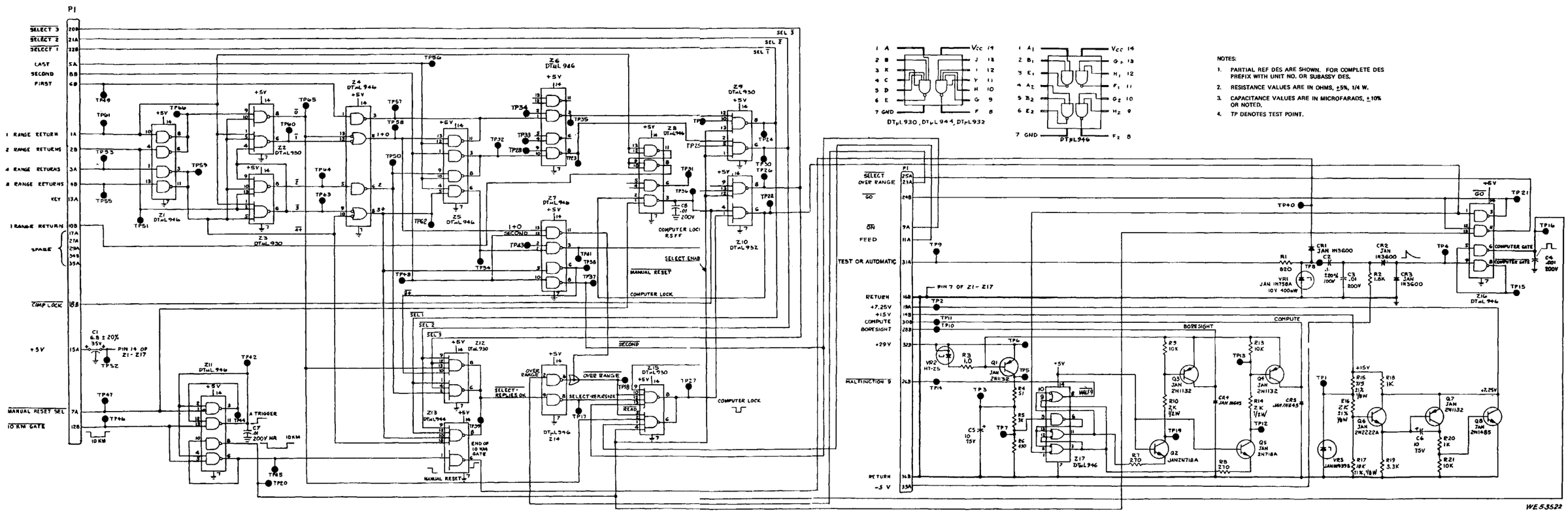
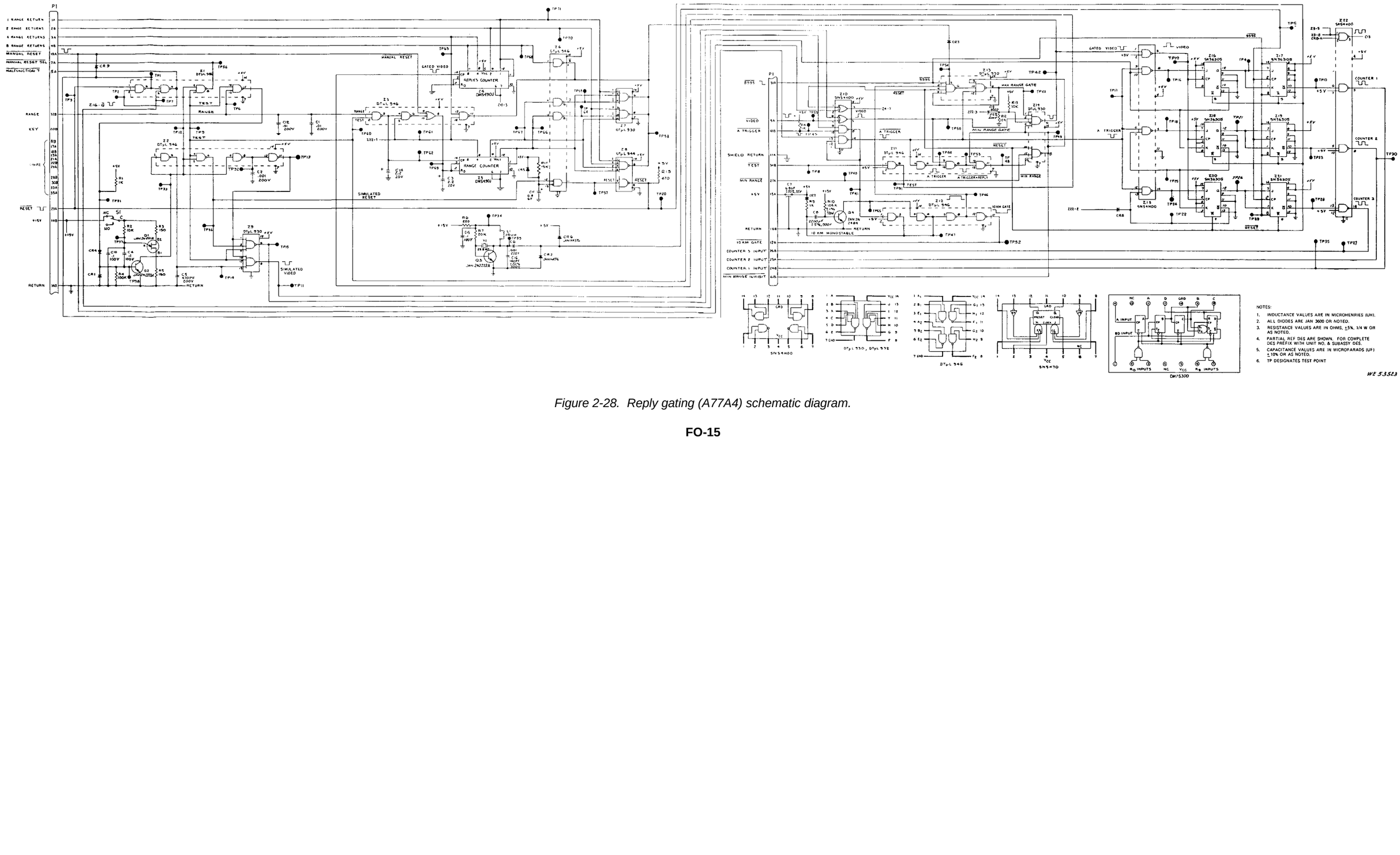


Figure 2-27. Select logic (A77A3) schematic diagram.



NOTES:

1. INDUCTANCE VALUES ARE IN MICROHENRIES (UH).
2. ALL DIODES ARE JAN 3600 OR NOTED.
3. RESISTANCE VALUES ARE IN OHMS, ±5%, 1/4 W OR AS NOTED.
4. PARTIAL REF DES ARE SHOWN. FOR COMPLETE DES PREFIX WITH UNIT NO. & SUBASSY DES.
5. CAPACITANCE VALUES ARE IN MICROFARADS (UF) ±10% OR AS NOTED.
6. TP DESIGNATES TEST POINT

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Figure 2-28. Reply gating (A77A4) schematic diagram.

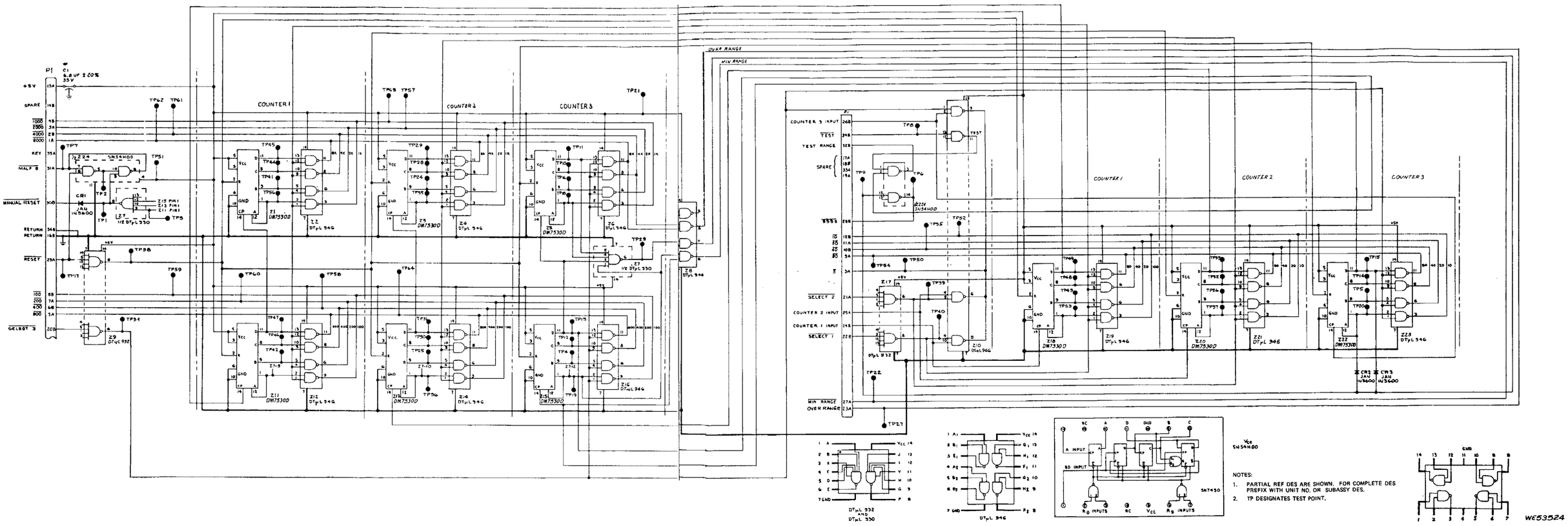


Figure 2-29. Counters (A77A5) schematic diagram.

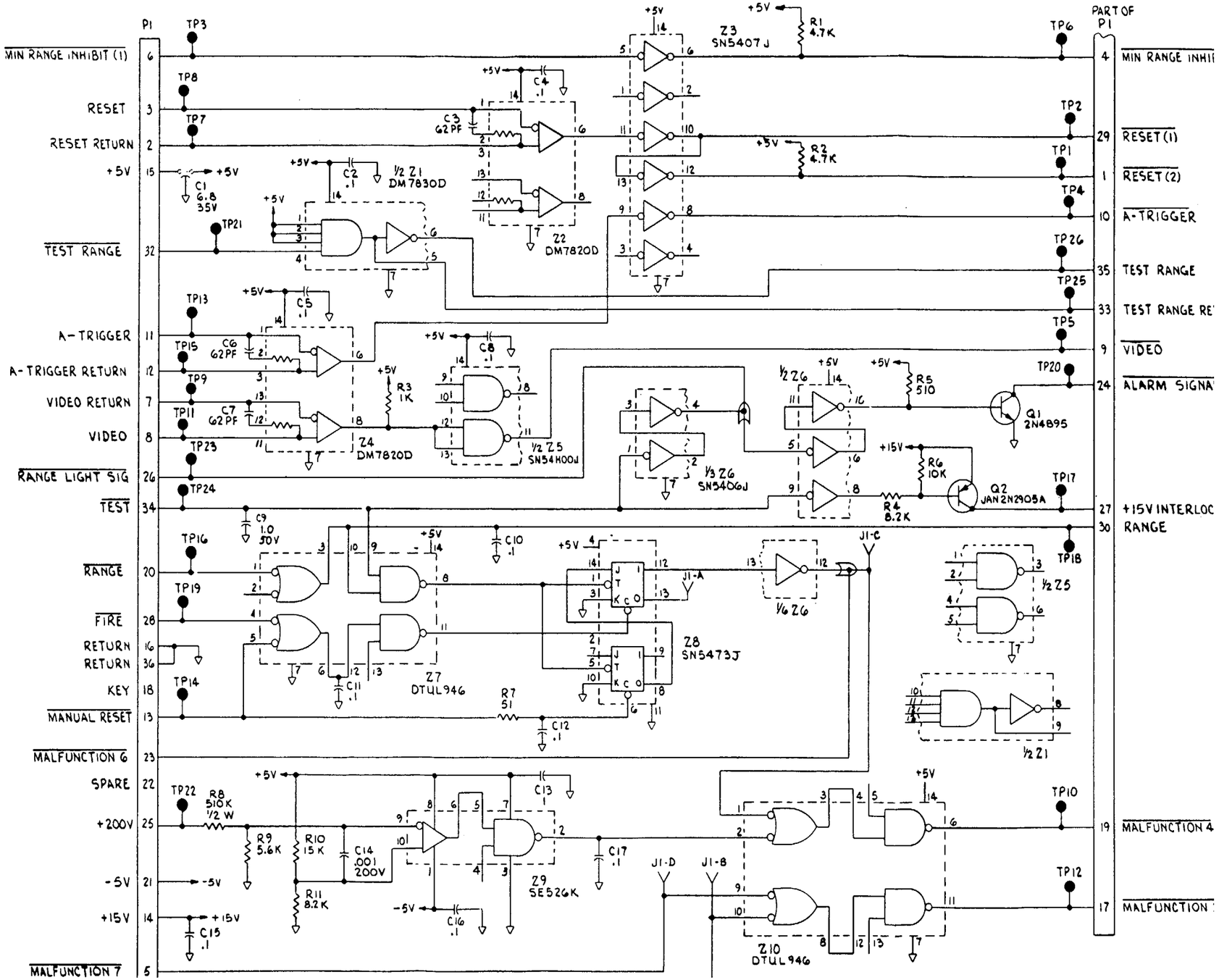


Figure 2-30. Interface circuit card (A77A7) schematic diagram.

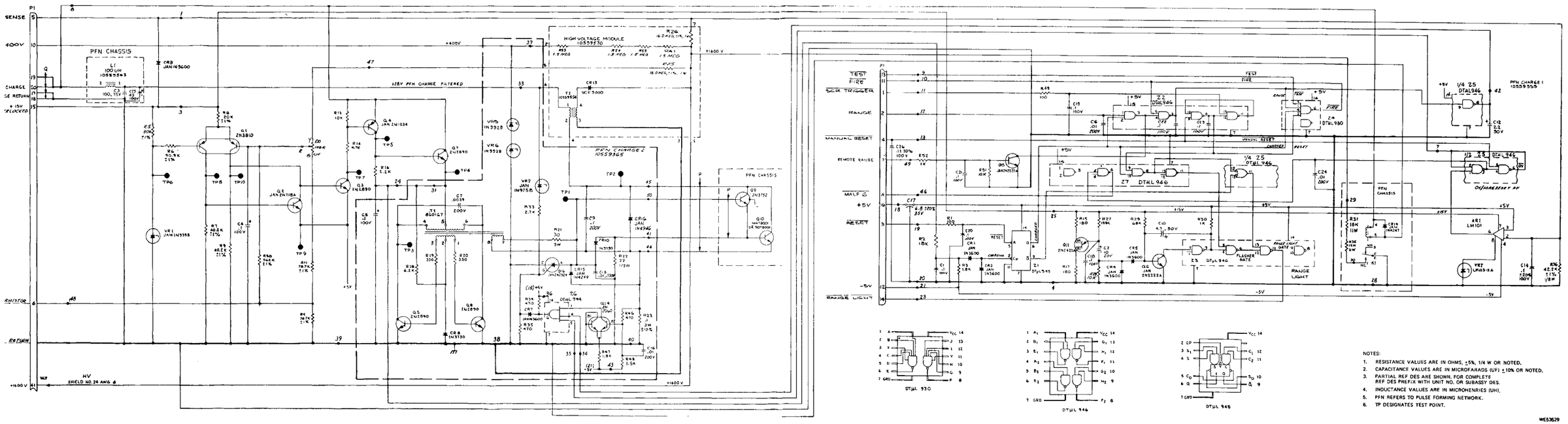


Figure 2-32. PFN charge power supply (A77A9) schematic diagram.

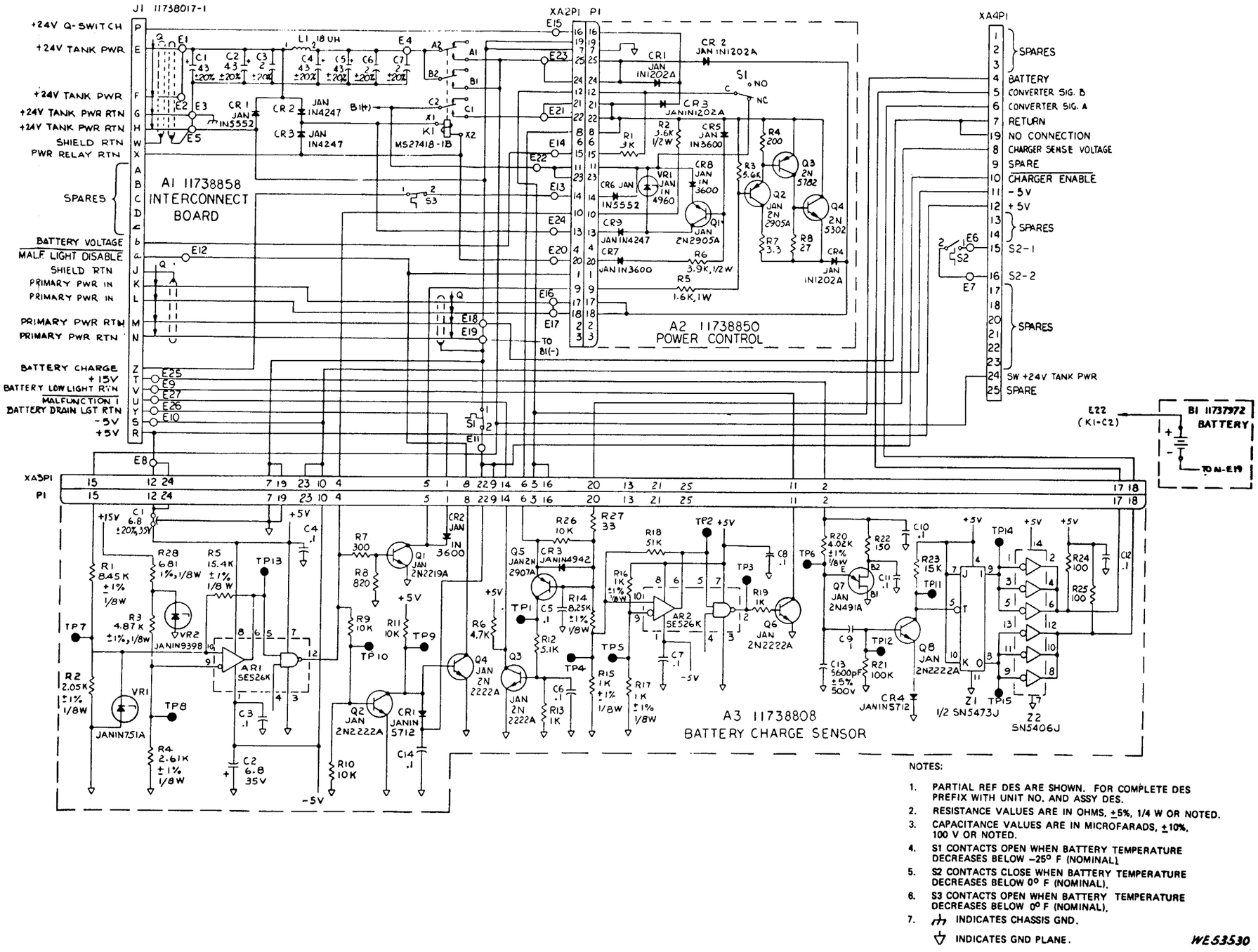


Figure 2-34. Battery power supply unit (A78) schematic diagram (Sheet 1 of 2 sheets).

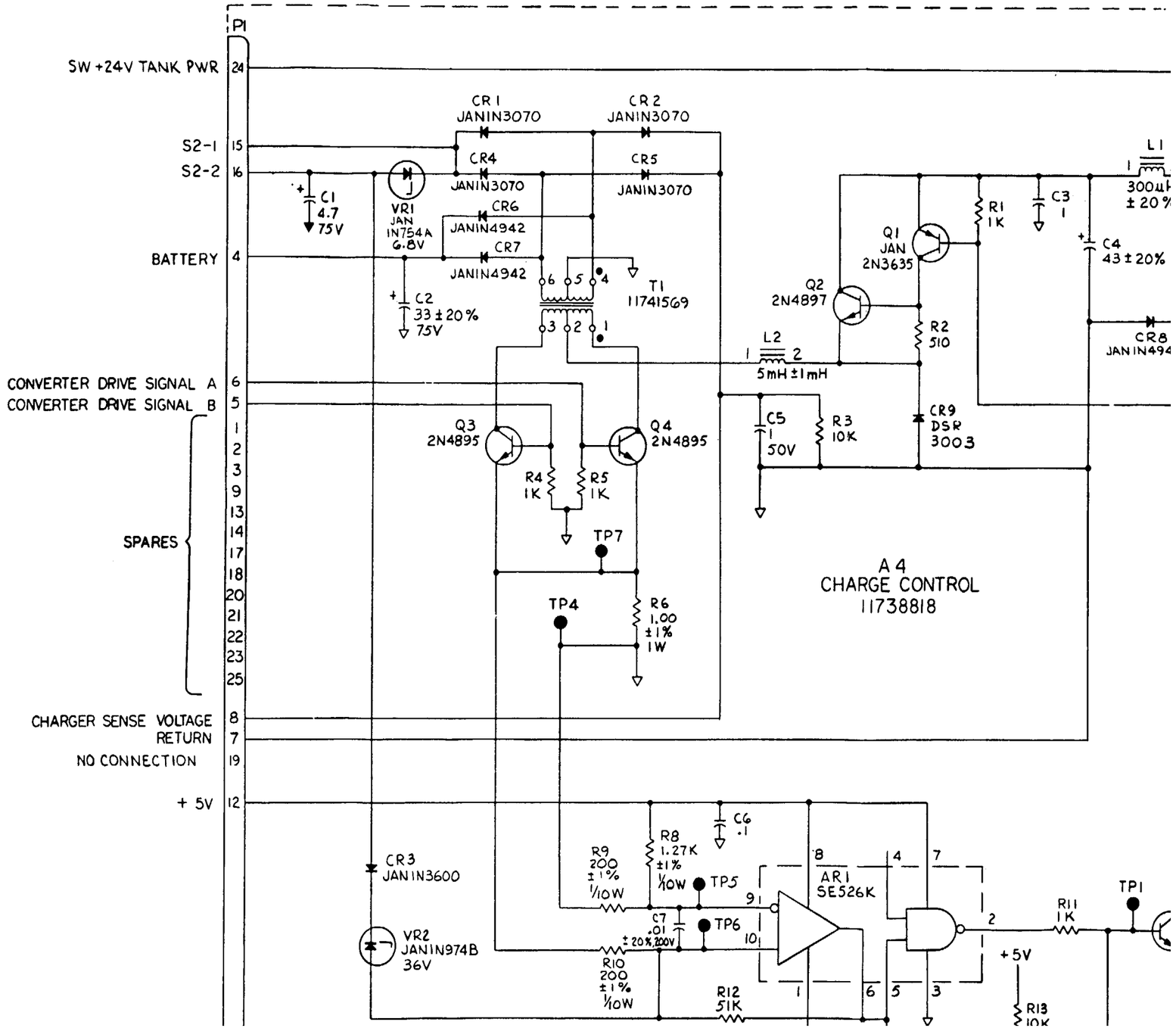
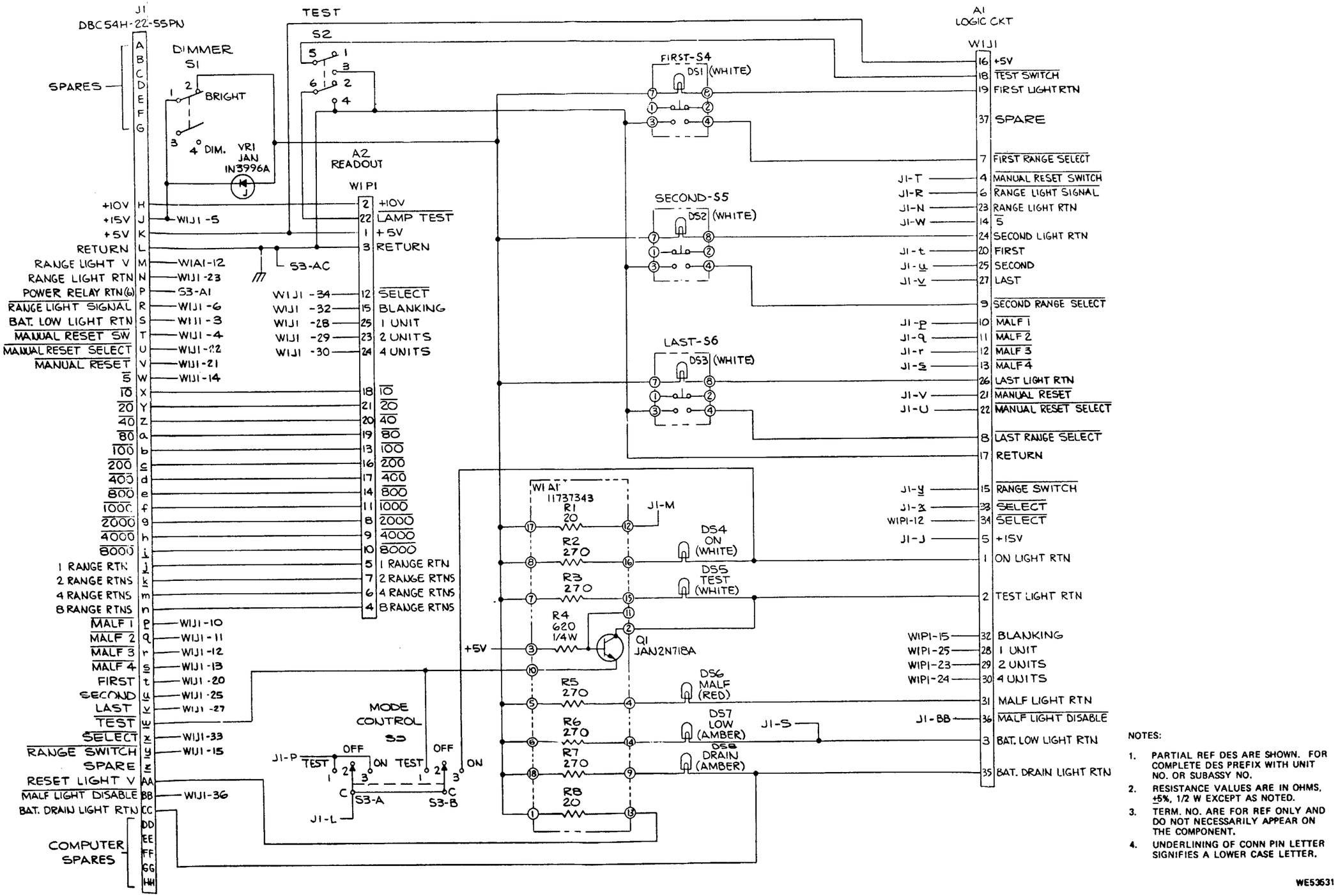


Figure 2-34. Battery power supply (A78) schematic diagram (Sheet 2 of 2 sheets)

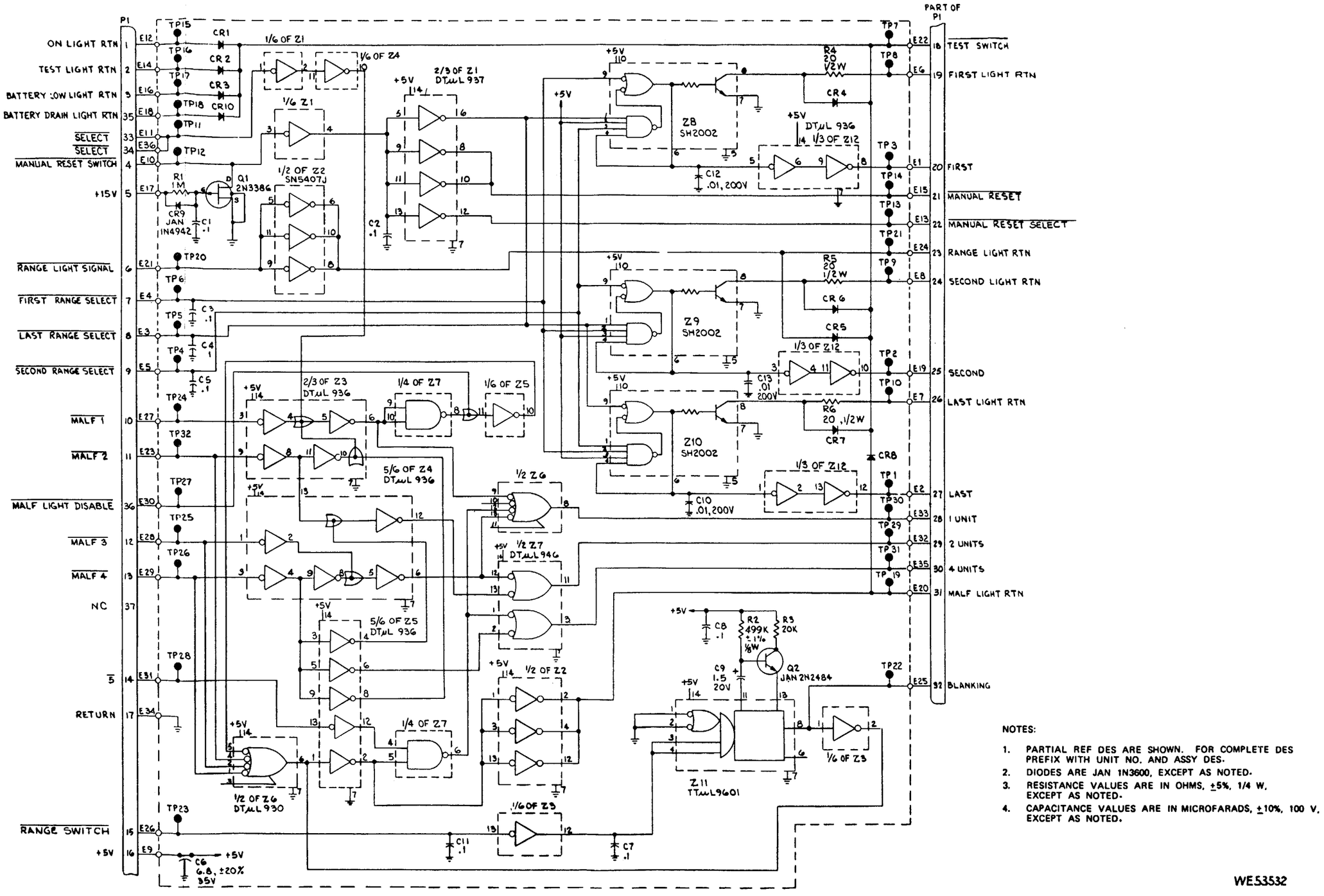


NOTES:

1. PARTIAL REF DES ARE SHOWN. FOR COMPLETE DES PREFIX WITH UNIT NO. OR SUBASSY NO.
2. RESISTANCE VALUES ARE IN OHMS, ±5%, 1/2 W EXCEPT AS NOTED.
3. TERM. NO. ARE FOR REF ONLY AND DO NOT NECESSARILY APPEAR ON THE COMPONENT.
4. UNDERLINING OF CONN PIN LETTER SIGNIFIES A LOWER CASE LETTER.

WE53631

Figure 2-35. Commander's control unit (A79) schematic diagram.



NOTES:

1. PARTIAL REF DES ARE SHOWN. FOR COMPLETE DES PREFIX WITH UNIT NO. AND ASSY DES.
2. DIODES ARE JAN 1N3600, EXCEPT AS NOTED.
3. RESISTANCE VALUES ARE IN OHMS, ±5%, 1/4 W, EXCEPT AS NOTED.
4. CAPACITANCE VALUES ARE IN MICROFARADS, ±10%, 100 V, EXCEPT AS NOTED.

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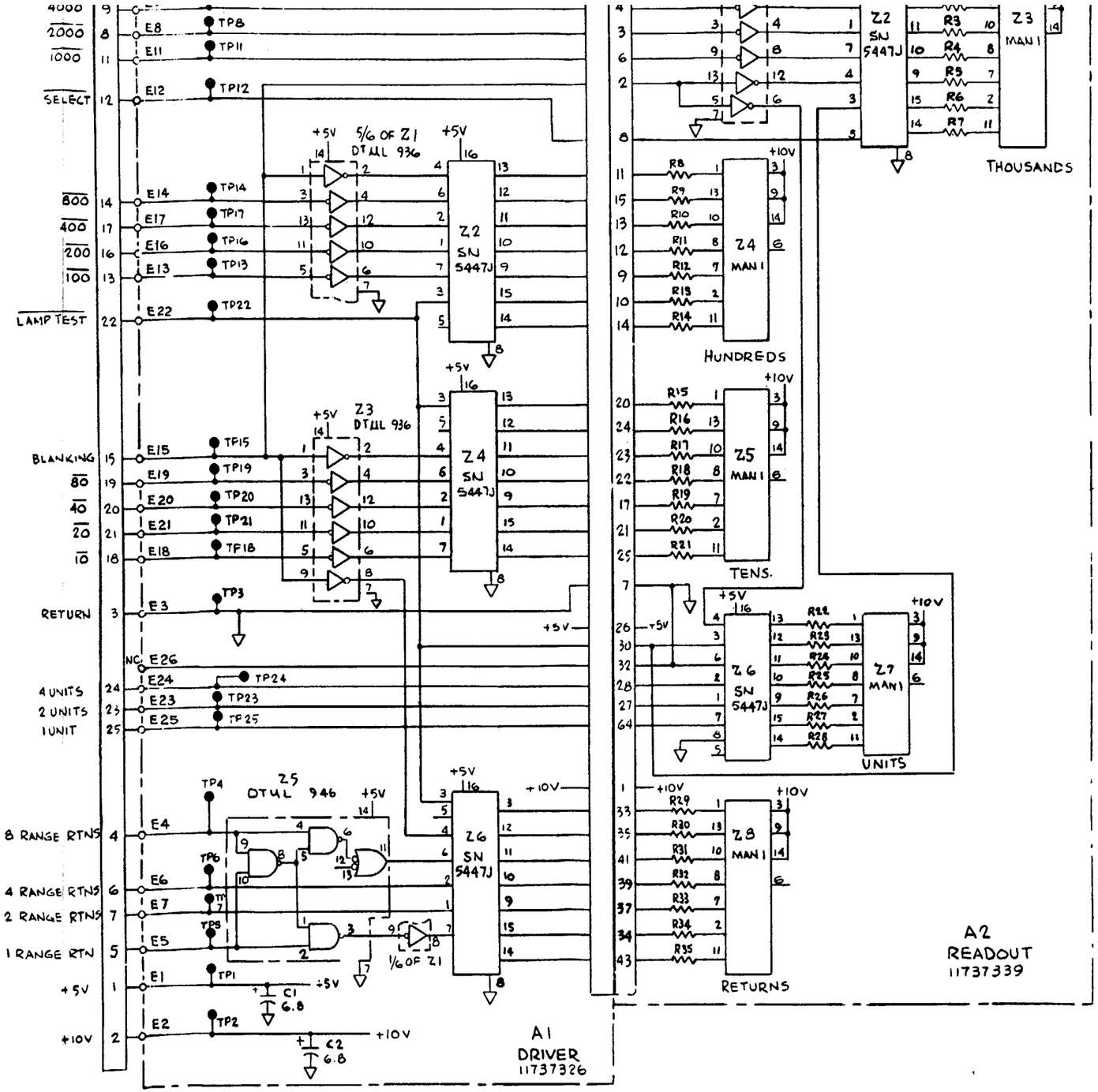
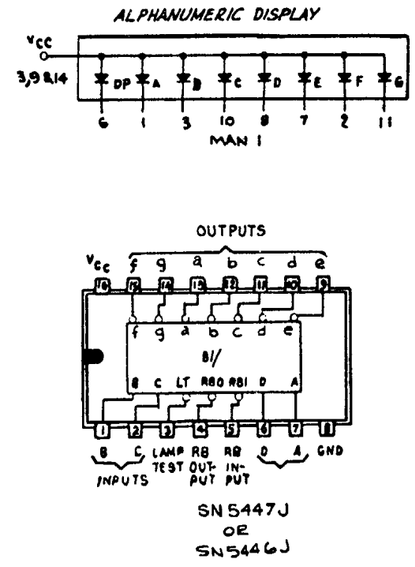
Figure 2-36. Logic circuit card (A79A1) schematic diagram.





NOTES:

1. TP DESIGNATES TEST POINT.
2. CAPACITANCE VALUES IN MICROFARADS ±10%, 35
3. RESISTOR VALUES ARE 620 OHMS ±5%, 1/8 W.
4. PARTIAL REF DES ARE SHOWN. FOR COMPLETE D PREFIX WITH UNIT NO. AND SUBASSY DES.

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Figure 2-37. Readout circuit assembly (A79A2) schematic diagram.

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