

THE EFFECT OF LINE VOLTAGE VARIATIONS ON THE MODEL DAB DIRECTION-FINDING EQUIPMENTS

During final tests and calibration of a recent DAB installation, it was necessary to consider line voltage fluctuation as a possible source of trouble. In cases where difficult operation of DAB equipment is noted, this possibility should not be overlooked.

Experience has shown that any rapid change of a-c line voltage in excess of 5 percent is detrimental to operation of the DAB during the period of change, but that very gradual variations up to 20 percent can be tolerated. The equipment was designed to operate from a 105-120 volt line whose regulation does not vary beyond ± 10 percent.

If rapid variations in excess of 5 percent occur, indicator traces from a given signal will fade completely out, necessitating a constant retuning of the equipment. The reasons for this fading are that the high-frequency oscillator varies in frequency and the injection amplifier varies in output. Where such conditions exist, the installation of an automatic voltage regulating transformer is recommended. The Bureau is arranging the procurement of a suitable voltage-regulating transformer which will be assigned a Navy model number. These will be distributed to the main distribution points, Navy Yards New York and Mare Island, from which Radio Material Officer activities may obtain their requirements.

DISCRIMINATING FILTERS AND NEW COMMUTATORS FOR MODEL DAB DIRECTION-FINDING EQUIPMENTS

A self-contained discriminating filter (Collins type 115K-3) has been designed for use with the model DAB series equipments. The new filter unit is essentially a low-pass 1000-cycle cut-off filter. When inserted in the circuit, it effects an increase in the signal strength of approximately 5 db in the pass band, due to two stages of audio amplification incorporated in it. The filter increases both the selectivity and the sensitivity of the direction-finding unit as a whole and thus performs a helpful function in the taking of accurate bearings. The filter is contained in a case and requires no modification of the DAB equipment for installation. Switches are provided to facilitate using the DAB with or without the filter unit, as desired. Filter units have been ordered for DAB series equipments at all supplementary radio stations under Contract NXsr-67990.

A new improved type of commutator has been developed for the model DAB radio direction-finding equipment. Replacement commutators have already been shipped to all stations using model DAB equipment with the old type commutators. Slight alignment adjustments and returning of the loops may be found necessary after installation of the new commutator. Beginning with model DAB-3, serial no. 18 on Contract NXs-17111, the new commutators have been installed prior to shipment.

Supplemental equipment spares, in addition to equipment spares already delivered, have been ordered for all DAB equipments.

MODIFICATION OF THE MODEL DAE DIRECTION-FINDING EQUIPMENTS

Difficulties similar to the following example regarding the proper operation of the model DAE direction-finding equipment have been encountered at the various Navy yards:

Bearings were taken on eight frequencies from 248 to 1400 kcs. Although the minima were sharp, uncorrected bearings were noticed on opposite sides of the loop instead of an average ambiguity of $\pm 5.5^\circ$ and a maximum of $\pm 10^\circ$. The abnormal ambiguity disappeared when the sense antenna was disconnected, indicating that an undesirable non-directional voltage component was being coupled with the first r-f amplifier grid.

The faulty operation of the model DAE direction-finding equipment has been traced to the S-105 capacitor switch. It was noticed that stray in-phase voltage components were being introduced through the sense balance circuit and causing an unbalance to the loop circuit.

This fault has been corrected by installing a 15-micromicrofarad variable capacitor and a 20,000-ohm $\frac{1}{2}$ -watt resistor between the antenna and the tuning capacitor forming a balanced bridge circuit (see Figure 1). The stray in-phase component produced by the capacitance between the antenna and the sense resistor R-101 through

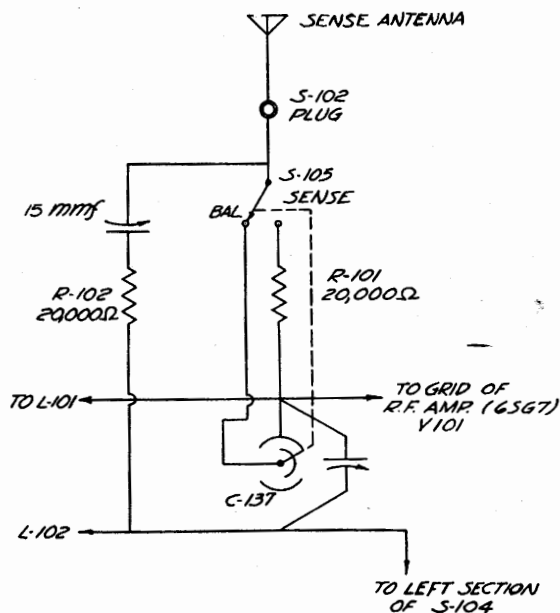


FIGURE 1.—Schematic of circuit.

switch S-105 is opposed by the potential introduced by the 15-mmfd. variable capacitor and the 20,000-ohm resistor, causing these potentials to cancel. This in turn balances the loop circuit. It should be noticed in Figure 1 that R-102 must be of the same value as R-101 in order for the circuit to balance.

The 15-mmfd. variable capacitor and the 20,000-ohm $\frac{1}{2}$ -watt resistor should be mounted on an insulator pedestal as shown in Figure 2 and

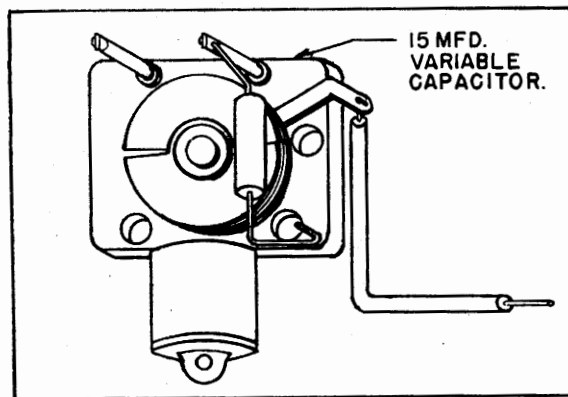


FIGURE 2.—Mounting position.

should be mounted approximately three inches back of the front panel of the case on the top side of the chassis midway between the balance capacitor and the tuning capacitor as shown in Figure 3. The rotor is connected to the antenna terminal of the sense balance switch and the free end of

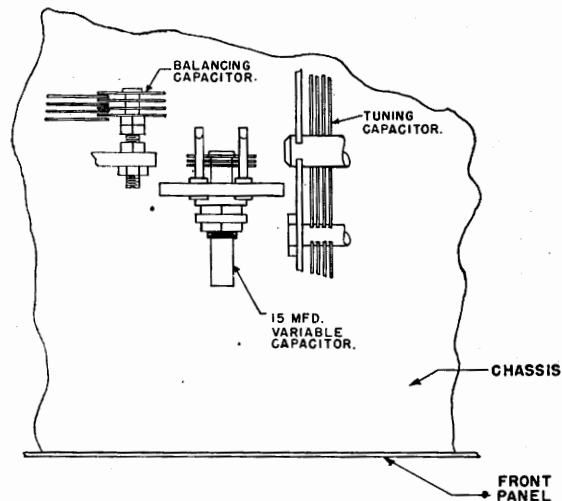


FIGURE 3.—Mounting position.

the resistor is soldered to the forward side of the forward section of the balance capacitor stator.

justed to cause the reciprocal bearings to be exactly 180° apart. After this capacitor has been initially adjusted it needs no further adjusting.

In operation, the 15-mmfd. condenser is ad-

MODEL DAE SERIES TROUBLE SHOOTING NOTES

DIFFICULTY ENCOUNTERED	CAUSE AND REMEDY
Intermittent operation.	Short in the 5-foot shielded r-f cable caused by the insulated segments pulling apart enough to permit the braided shield to enter between the segments and short out the loop conductors. Correction can be made as follows: Remove end fitting, outer rubber cover, cloth cover and shield. Pull each segment apart slightly and make sure no broken wires from the shield are lodged between the segments. Put a drop of solder just large enough to retain the segment at one end of the cable. Hold the opposite end of the cable and force the segments together with moderate pressure and then put a drop of solder on each wire to hold the segment at that end. Now lay on a flat surface and wrap with transparent scotch tape, keeping the tape at approximately a 45° angle. Cover with a new piece of copper braid (3/8" wide when flat). If exposed to weather, wrap with friction tape and paint.— <i>A.O.B., NOB Key West</i>
Primary of output transformer T-101 burnt out. No spares on hand.	An emergency repair was made by installing a 15,000-ohm 2-watt resistor in the plate circuit of the 6J5 final audio amplifier and a .01-mfd. mica condenser in series with the earphones.— <i>U. S. S. PS-549</i>

LUBRICATION OF THE ABI UNIT OF MODEL DAK SERIES EQUIPMENTS

It has come to the attention of the Bureau that many ships are either failing to lubricate or over-lubricating the rotating assembly in the ABI unit. Neither condition is desirable and may cause defects in the operation of the equipment.

There are two lubrication points in the ABI unit and these are clearly indicated in Figure 85 on page 94 of the model DAK-2 instruction book. Both the front and the rear bearings should be lubricated once a week. It has been determined that the Navy type OS-1113-D oil is a satisfactory substitute for Standard Oil Company "Univis #40" oil, generally specified in the instruction books. No other type oils except the aforementioned ones are suitable for lubricating the ABI unit in the Navy models DAK, DAQ, DAU, DAJ and DAH direction-finding equipments. Navy type oil is preferred to commercial type oil and should be used when available. If Navy type OS-1113-D is not available aboard ship, the oil should be requisitioned through regular supply channels.

Attention is invited to the fact that the front bearing is made of "Oilite" which is a porous material containing in its structure approximately 25 percent oil by volume. In addition, it has a felt-packed oil well at the bottom of the bearing structure to act as an additional reservoir. Due to the porosity of the bearing it is not necessary that oil, when added, be applied to bearing surfaces. A channel is provided from the oil hole at the top of the bearing around the inside of the bearing cap to the oil reservoir at the bottom. It is not intended that oil be applied directly to bearing surfaces. Under no circumstances should the bearing be drilled to provide an oil hole. The rear bearing is of the ball bearing type and is lubricated through the snap cap on the lower bearing.

Attention is invited to the fact that the ABI unit must be kept scrupulously clean and free from excessive oil, copper dust and carbon dust.

DEFECTS IN MODEL DAQ ANTENNA INSTALLATIONS

In several installations of the old type DAQ antenna, it has been found that corrosive action has set in between the counterpoise rods and their base. This corrosion has introduced a resistance anywhere from 1000 ohms to infinity between the counterpoise rods and the sense rod. With this condition existing, balancer action was nullified. After the rods were cleaned and reinstalled, it was possible to balance the dummy loop and thus obtain good sense conditions.

From records of balancer curves on the USS ———, it was definitely apparent that sense conditions of the DAQ were incorrect. Upon checking the external condenser C-305 at the crossed loop assembly, it was found that there was a definite resistance of the condenser itself to ground of 100,000 ohms. Upon replacing with a new C-305 condenser having a resistance value of infinity, balancer action was again established. The balancer curve for this loop maintained the same characteristics from 6 April 1944 to 28 September 1944, at which date a slight change was apparent. On 16 November 1944 there was a definite change, but sense was still fairly good. On 26 December 1944, the last availability, the sense change became too poor for the equipment to operate efficiently.

It was determined that the resistance introduced into the C-305 condenser was caused by absorption of moisture. After a day of drying in a warm dry place the condenser was normal. There was also a definite resistance of 5000 ohms from the sense connection at the dummy loop, with C-305 disconnected, to ground, whereas this value should be infinity.

EFFECT OF DEMOUNTABLE WHIP ANTENNAS ON MODEL DAQ AND MODEL DAU OPERATION

On some type destroyer-escorts and destroyers, the emergency transmitter uses a demountable whip antenna. Instructions are that this antenna shall be carried unshipped.

On ships with an auxiliary mainmast installation of model DAQ or DAU direction-finding equipments this is particularly important. If last calibrated with the whip up, no change should be made until immediately prior to the next calibration when it shall be stowed.

It is important to realize that performance of the DAQ or DAU with and without the whip antenna in position will be different. With the whip in operating position unusual deviations are common.

DAQ/DAU DIRECTION-FINDING EQUIPMENT

FIELD CHANGE NO. 1

INSTALLATION OF IMPROVED LOOP ANTENNA

Equipments affected.—Model DAQ and DAU series equipment.

Purpose.—To replace the present loop antennas with an improved type.

General.—Several reports have been received stating that the counterpoise ground rods of the old type antenna have been snapping off at the butt. This has been caused by excessive vibration due to height and construction.

A quantity of new loops is being procured on contracts NXsr-96333 and N5sr-9553 for use with both the DAQ and DAU equipments. New loops are designated CFT-69083B. Instructions for the installation of the new loop antennas are included with each kit. These instructions should be kept with the equipment which has been modified.

Vessels are requested to contact an Electronics Officer at the earliest opportunity for the installation of the new antenna. Record of completion of this change should be made on ship's Radio Equipment Log, NAVSHIPS 900,039.

Completion of this change should be reported on NBS (383) forms. 1/1/46

→ DAK DIRECTION-FINDING EQUIPMENT FIELD CHANGE NO. 1

MODULATOR TUBE BALANCER KIT

Equipments affected.—Models DAK-1, DAK-2 and DAK-3 series direction-finding equipment.

Purpose.—To permit proper balancing of the modulator.

Action required.—This kit permits placing the modulator balance control R-127, a control which needs frequent adjustment, on the front panel, replacing the goniometer gain control R-117 (a control used much less frequently). It places the goniometer gain control R-117 in the position inside the chassis at present occupied by the balance control R-127.

Material required.—The kit contains one RF 3445-3 harness assembly and one RF 3958-1 escutcheon.

General.—A sufficient quantity of kits to accomplish this change has been procured on contract NXsr-97674. The kits are labelled "Modification Kits for DAH & DAK." Vessels should contact an Electronics Officer at the earliest opportunity for this kit. The change is within the scope of the ship's force.

Complete and detailed instructions which are included with the kit should be kept with the instruction book for the modified equipment. The instruction book should be corrected accordingly. A record of completion of this change should be made on the ship's "Radio Equipment Log," NAVSHIPS 900,039. Completion of this change should be reported on the NBS-383 card. 3/1/46 ←

MODELS DAK/DAQ SERIES TROUBLE SHOOTING NOTES

DIFFICULTY ENCOUNTERED	CAUSE AND REMEDY
All pilot and dial lamps out.	Failure of a-c power supply. Blown fuse. Faulty OFF-ON switch. Break in continuity of power cables, probably at plugs or in the vicinity of a sharp bend. Plugs must be seated firmly in their sockets and coupling rings on plugs must be tight. Failure of filament circuit due to open or short.
No signal, weak signal, or incorrect indication.	Failure of plate supply due to burned out or weak rectifier, poor contact at tube socket, break in continuity of power cable, shorted filter or bypass condenser in plate or screen circuit. Faulty antenna connection. Check contact at plugs in connecting cables. Ground or open circuit in junction box, goniometer, or interconnecting cables. Weak or burnt out vacuum tubes, especially type 6SH7 in DAQ. Dirty contact in band switch. Contacts may be temporarily cleaned by rotating switch back and forth several times. Grease and dust may be removed with carbon tetrachloride. Incorrect cable connection. Shorted trimming or tuning condenser.
Noisy or intermittent reception.	Noise pickup by antenna system. Check by removing antenna (both sense and loops) and noting if noise is eliminated. Poor joint in cable. Worn gain control. Defective contact in wave switch. Poor contact at vacuum tube socket. "Noisy" tube due to loose weld. Check by lightly tapping each tube with finger or pencil. Poor solder joint (rosin joint). Leaky bypass or coupling condenser. Poor ground on shields.
Fading.	Reception of sky-wave signals. Defective bypass or coupling condenser. "Thermostatic" heater in vacuum tube, i.e. heater warms up then breaks and remakes connection after cooling.
All sense indication reversed in one pair of quadrants.	Transmission lines incorrectly connected at loop or junction box.
Indicator pattern satisfactory with "SEARCH — INSTANT BEARING — SENSE" switch on "INSTANT BEARING" but no pattern on "SENSE" or vice versa.	Open directional or sense deflection coils in ABI units. Remove power and check continuity between slip rings and replace defective coil. Brush not making proper contact or pigtail broken. Check by visual inspection and/or ohmmeter check. Replace defective brush.
All sense indications reversed.	Deflection coil assembly rotated 180° with respect to goniometer. Loosen locking screw and turn coupling adjustment until graduated ring has turned 180°.
Receiver tunes signal satisfactorily and circle on ABI is satisfactory but no bearings can be obtained.	Cable number 12 open. No receiver indicator channel output. Check receiver indicator channel output with deflection amplifier connected and indicator goniometer rotating. Required voltage is approximately 4 volts DC. If no voltage, check circuits for defect.

Saw tooth or jiggly pattern on ABI.	Intermittent or poor contact at slip rings due to pitting of slip rings or low brush spring tension. Check adjustment of spring tension and clean slip rings. Loose slip rings. Tighten slip ring retainer.
Pattern oscillates on ABI.	Defective goniometer coupling. Loose rivets holding spindle on rotating unit. Leather coupling stretched out of shape. High-voltage transformer leads 3 and 4 reversed. Excessive beat frequency oscillator injection. In DAK-2 dress leads to S-201 and C-224 as far from each other as possible. In DAQ dress leads to V-105. Also coupling condenser C-221 in DAK not properly set. Adjust C-221 so that CW overload at 1000 cycles occurs at 25 milliwatts. Defective bearings in rotating unit or motor. Check for freedom of movement and replace defective bearings as required. The a-c leads not properly located near the cathode-ray tube. Twist a-c leads and locate them away from tube.
ABI reciprocal bearings off.	Rotating shaft axes askew. Parts of indicator assembly magnetized. Demagnetize in accordance with instructions in instruction book.
ABI pattern blanks out at 90° and 270°.	Type 5BPI cathode-ray tube used instead of 5NPI tube. Use only type 5NPI.
ABI pattern in error by 45°.	Brush holders shorted across bakelite. Clean or replace.
ABI pattern shifts with time.	Coupling in ABI unit loose. Readjust and tighten, inserting spacer if necessary.
No pattern on ABI.	Defective high-voltage transformer. Blown fuse. Defective 2X2 rectifier tube. Defective cathode-ray tube or tube improperly placed in socket.
Rounded nulls on ABI pattern.	Deflection sense control set too close to maximum. Set control as close to maximum as will give sharp points on pattern. Excessive quadrature voltage pickup on antenna system. Low transconductance in 6AC7 deflection amplifier tube. Defective 6H6 indicator detector tube.
ABI pattern gives circle at center with no signal input.	Parts of indicator magnetized. Demagnetize as per instructions in instruction book. Deflection sensitivity control set back too far from maximum.
Poor sense indication in wet weather on DAQ.	Leakage of moisture into antenna. Dry out thoroughly and coat all cable connections, leads to dummy loop and dummy loop insulators with glyptol.
Low leakage resistance in DAQ antenna on megger check.	Condensation of moisture in antenna and on terminal blocks. Dry out thoroughly and coat with glyptol.

Poor sense pattern.	Unmatched transmission line. Coils in sense input stage of DAQ improperly adjusted. Sense coils should resonate above operating frequency of band. Sense balancing condenser C-305 improperly adjusted. Readjust. Improper alignment of input stages in DAK. Realign in accordance with procedure outlined in instruction book. Improper setting of goniometer gain control in DAK.
Indicator tracks backwards.	Transmission lines or interconnecting cable interchanged or lead reversed.
Sense input stage will not align in DAK.	One side of sense input cable grounded.
Directional input stage will not align in DAK.	One side of cable to directional input stage through junction box shorted to ground. Check lead to J-109.
Reciprocal bearing in error on DAK manual indicator.	Balanced modulator tubes unbalanced. Readjust R-127 as described on page 77 of DAK-2 instruction book. Leakage of signal between sense and directional input channels. Axes of goniometer and dial shaft askew.
One line on manual indicator in DAK disappears.	Balanced modulator tubes unbalanced. One tube of balanced modulator defective. Replace <i>both</i> tubes and rebalance.
Blanking circuit of DAK manual indicator inoperative.	Blanking switch open. Bias supply voltage to cathode-ray tube low. Defective cable 18. Defective type 6SN7 tube (V-212). Defective type 6AC7 tube (V-108 or V-109).
Fuse good but holder caused open circuit.	Repaired by securing tightly the locknuts holding fuse holder in place.—U. S. S. <i>Howard D. Crow</i>
Lower bearing of ABI unit damaged due to copper dust from slip rings.	Emergency repair may be made by using SKF bearing 1202, item 195 in equipment spares for model SL radar.—U. S. S. <i>Mika</i>
Excessive oil, copper shavings and dust in the ABI unit.	Follow lubrication and preventive maintenance schedule.
DAK.—Receiver lost sensitivity.	Found plate filter capacitor C-106 to be shorted and R-104 to have burned out. Replaced these two components and set operated normally.—U. S. S. <i>Lovelace</i> (DE198)
DAK-1.—Loss of sense determination.	Found loose connection in base of sense antenna between the sense antenna and sense cable.—U. S. S. <i>Rampart</i> (AM282)
DAK-2.—Intermittent operation of automatic bearing indicator. Signals would appear and disappear leaving only a dot on the oscilloscope.	Pin "E" on plug J-502 and pin "D" on plug J-403 were not electrically or mechanically connected to the cable. The leads were just touching the pins and no permanent connection had been made. This failure had apparently been caused by the operator's knee hitting the cable resulting in intermittent contact of pin and leads. Pin "E" is the high voltage return through the deflection coils and pin "D" is the common ground connection between the two units.

DIFFICULTY ENCOUNTERED	CAUSE AND REMEDY
DAK-2.—Intermittent operation of ABI unit with signals appearing and disappearing leaving no trace on cathode-ray tube.	Found poor solder joint at pin E on J-502 and pin D on J-403 with leads from cable just touching connectors.—U. S. S. <i>Pittsburgh</i> (CA-72)
→ DAK-2.—Failure of R-133.	The short wire lead between R-132 and R-133 shorted to ground causing an excessive current to be drawn through R-133 burning this resistor out. The wire was shorted to ground by being squeezed between the terminal board which holds R-132 and the metal support for the terminal board.—U. S. S. <i>La Prade</i> (DE-409).
DAQ.—Tracing on ABI unit became very broad and could not be focused.	Found to be due to R-255 becoming partially opened.—U. S. S. <i>Cincinnati</i> (CL-6). ←

DEFECTIVE MODEL DAS-1 RECEIVER COUNTER-TEST JACKS

The Radio Material Officer, Navy Yard, Philadelphia, has reported that several model DAS-1 receivers have had defective ("open") counter-test jacks. The equipments apparently operated normally and strong signals were observed—although the jacks were open and the output of the detector was supposedly not connected to the following amplifier. It is believed that sufficient pickup is obtained in the lead from the jack to the grid resistor to give apparently normal operation. When the open jack is repaired, the amplitude of the signals increases about 100 percent.

A routine test for open jacks is to observe the signals while inserting the counter-test lead into the jack. If the amplitude of the signals decreases about 50 percent, it may normally be concluded the jack is in good operating condition. If the amplitude of the signals is unchanged, it may be concluded that the jack is defective and therefore open.

Similar trouble should be expected with LRN-1, LRN-1A and DAS-3 equipments.

REPLACEMENT LEVER-TYPE SWITCHES FOR MODELS DAS-1, DAS-3, LRN-1, AND LRN-1A EQUIPMENTS

A quantity of the lever-type switches used for "receiver", "framing", and "phase-shift" in DAS-1, DAS-3, LRN-1 and LRN-1A equipments have been procured from Fada Radio & Electric Co. under contract NXsr-79949. These will be distributed to Radio Material Officers in the near future. Fada part No. 45.163M replaces S4 and S6 in DAS-1, LRN-1 and LRN-1A and S104 and S106 in DAS-3. Fada part No. 45.223M replaces S5 in DAS-1, LRN-1 and LRN-1A and S105 in DAS-3. Ships having LRN-1, LRN-1A and DAS-1 are authorized to draw one of each part to be used as an equipment spare. One of each part is supplied in the equipment spares for DAS-3, but switches may be drawn to replace spares which are expended.

INSTALLATION OF LORAN ANTENNAS AND LOADING COILS ON MODELS LRN AND DAS SERIES EQUIPMENTS

Numerous instances of improper antenna installation have been reported, including the following:

(1) Improper adjustment of the loading coil. In many instances the entire number of coil turns is used (from tap 1 to tap 10), and no attempt has been made to adjust the number of turns (by selecting appropriate taps) for maximum signal strength. The loading coil should be connected so that it is in series with the antenna lead-in and the center conductor of the coaxial cable. The active number of turns is the number between the two taps to which the two flexible leads (one from the antenna, one from the coaxial cable center conductor) connect. The tap arrangement is somewhat peculiar, as shown in Figure 1, and should be carefully noted.

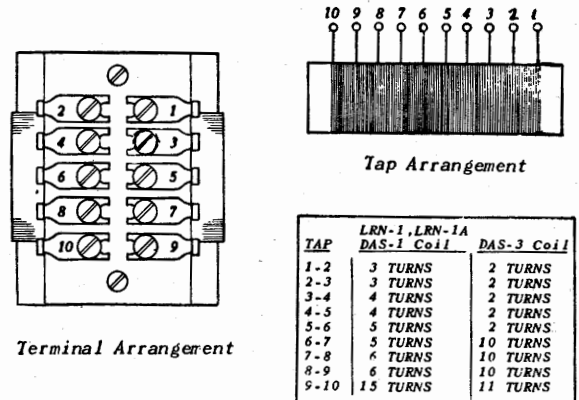


FIGURE 1.—Terminal and top arrangement of loading coil.

(2) Improper location of the loading coil. The coil should be located as close to the base of the antenna as possible. LRN-1, LRN-1A, DAS-1, and DAS-3 loading coils should be located just inside the weather bulkhead within a few inches of the entrance insulator. Coaxial cable between antenna and loading coil will greatly reduce signal strength; therefore the antenna and entrance insulator should be so arranged that such cable is not necessary. Model DAS-4 and all later models will have a thoroughly weatherproof loading coil box suitable for outside mounting. If necessary, installing activities are authorized to

remove the coils supplied with LRN-1, LRN-1A, DAS-1, and DAS-3 equipments from the box furnished, and to place them in a thoroughly weatherproof box.

(3) Poor choice of antenna location. If necessary, the antenna should deviate from the vertical plane, if a marked increase in clearance from superstructure, decrease in length of coaxial lead-in or improved location of the antenna loading coil can be obtained thereby.

There is some interaction between the best "ANT" screw adjustment in the receiver and the best loading coil adjustment. Therefore the "ANT" tuning should be checked for several different numbers of loading coil turns in the vicinity of the apparently correct number and the best combination found. Where several channels are to be used, a compromise adjustment of the loading coil must be made. This may best be accomplished by tuning up a channel with a frequency near the center of the band in accordance with the above procedure, then with that selected number of loading coil turns, tune the other channel "ANT" screws for maximum signal response on the respective channels.

Where it is not possible to use normal signals for tuning purposes, signals radiated from any modulated signal generator covering the correct frequency range or signals radiated from a type CME-60069 or CME-60069A loran signal generator may be used. The generator should be connected to another antenna near the antenna being tuned, and adjusted to radiate signals of the appropriate frequencies for tuning each channel. A special portable test set TS-251/UP, now

under procurement and scheduled for delivery during the spring and summer of 1945, will be ideal for this purpose as well as for general receiver and indicator alignment checking.

Where possible the antenna should be checked for directional effects in accordance with the procedure given on page 23 of "The Loran Handbook for Shipboard Operators."

LORAN TEST SET MODEL TS-251/UP

Model TS-251/UP is a portable test set which produces simulated loran signals for testing and alignment of shipboard and aircraft loran receiving equipments (including model LRN series, DAS series, DBS, DBE, AN/APN-4 and AN/APN-9). By means of switches any of four loran radio frequencies can be selected at any of three standard output levels. The signals are suitable for all indicator and receiver testing requiring the use of actual signals but are not suited for the training of operators, signal generators Navy type CME-60069 or CME-60069-A being used for that purpose. The test set, including connecting cables and adapters for all models of loran receiving equipment, is housed in a weather-resistant carrying case and the complete set weighs 18 pounds. The set operates from 80/115/230 volts AC at any frequency from 50 to 1600 cycles per second and consumes less than 25 watts. It is shown in Figure 1.

The test set is intended for loran installation and maintenance activities and not for ships having only one loran receiving equipment



FIGURE 1.—Test set TS-251/UP.

aboard. Therefore, as rapidly as equipments are available, distribution will be made as follows:

3 to NYNYK	1 each to AG73-78
3 to NYNOR	3 to NYPS
2 to DISH #32	2 to 8th N. D.
6 to FRAY #32	3 to 11th N. D.
3 to DOTI #32'	1 to RMS at NRL
4 to NYMI	1 to RMS at Treasure
2 to NYPHIL	Island
2 to NYCHARL	1 to 7th N. D.
1 to Casco Bay	3 to ULOD #32
2 to NYBOS	2 to HODE #32
5 to DUVA #32	2 to KESO #32

Approximately 90 sets are yet to be assigned. Requests from other activities will be placed upon commitments until such time as the Army is in a position to accept delivery destinations, since this equipment is being procured from the Army. The above activities after receiving and inspecting their equipments may address requests for additional equipments to the Bureau of Ships, attention Code 955, copy to Code 982A. Such requests should indicate the approximate number of men engaged in loran installation and maintenance and the approximate number of equipments serviced. Other activities servicing shipboard loran equipment may make similar requests if their work is in line with the above. Distribution to maintenance activities servicing aircraft loran equipment exclusively is being made by the Bureau of Aeronautics.

Individual equipment spare part sets for the TS-251/UP are being procured for the equipments under the cognizance of the Bureau of Ships from the Airplane and Marine Instruments Company under contract NXsr-91901 and will be furnished separately when available.

REMOVING MODELS DAS-1, DAS-3, DAS-4, LRN-1, LRN-1A EQUIPMENT FROM ITS CASE

The U. S. S. *Ahrens* (DE-575) has reported to the Bureau that oscillator coil L-1 is subject to frequent failure due to the location of the coil

in a position vulnerable to damage when the equipment is removed from the case for servicing.

Maintenance personnel should exercise caution when removing or installing equipment from the case to avoid catching the coil on the case, breaking the coil form or damaging the leads thereto.

→ LORAN RECEIVING EQUIPMENT—MODEL LRN-SERIES AND DAS-SERIES

GENERAL

There has been some confusion caused by the various model LRN-series and DAS-series equipments because some are interchangeable and some are not. Also there has been some confusion about field changes (modifications) and kits because no definite field change numbers were assigned. It is the purpose of this article to clear up these matters.

There are really two distinct varieties of the LRN- and DAS-series of equipments:

- (1) The "FADA" variety—models LRN-1, LRN-1A, DAS-1, DAS-3 and DAS-4. (See Figure 1.) The LRN-1 and LRN-1A are predecessors of the DAS-1, but are mechanically interchangeable and electrically very similar despite the great difference in model letters. Each succeeding model of this variety has improved workmanship and components, and in some cases new operating features which must be incorporated into earlier models by field changes. However, all models of this variety are mechanically interchangeable and operate from a 115-volt 50/60-cycle power supply. The contractor for all these models is the Fada Radio and Electric Company.
- (2) The "GENERAL ELECTRIC" variety—models DAS and DAS-2. (See Figure 2.) These two models are not mechanically interchangeable with equipments of the Fada variety despite the similarity in model letters. The circuits while basically similar are entirely different in detail, and almost none of the special components of the General Electric variety are interchangeable

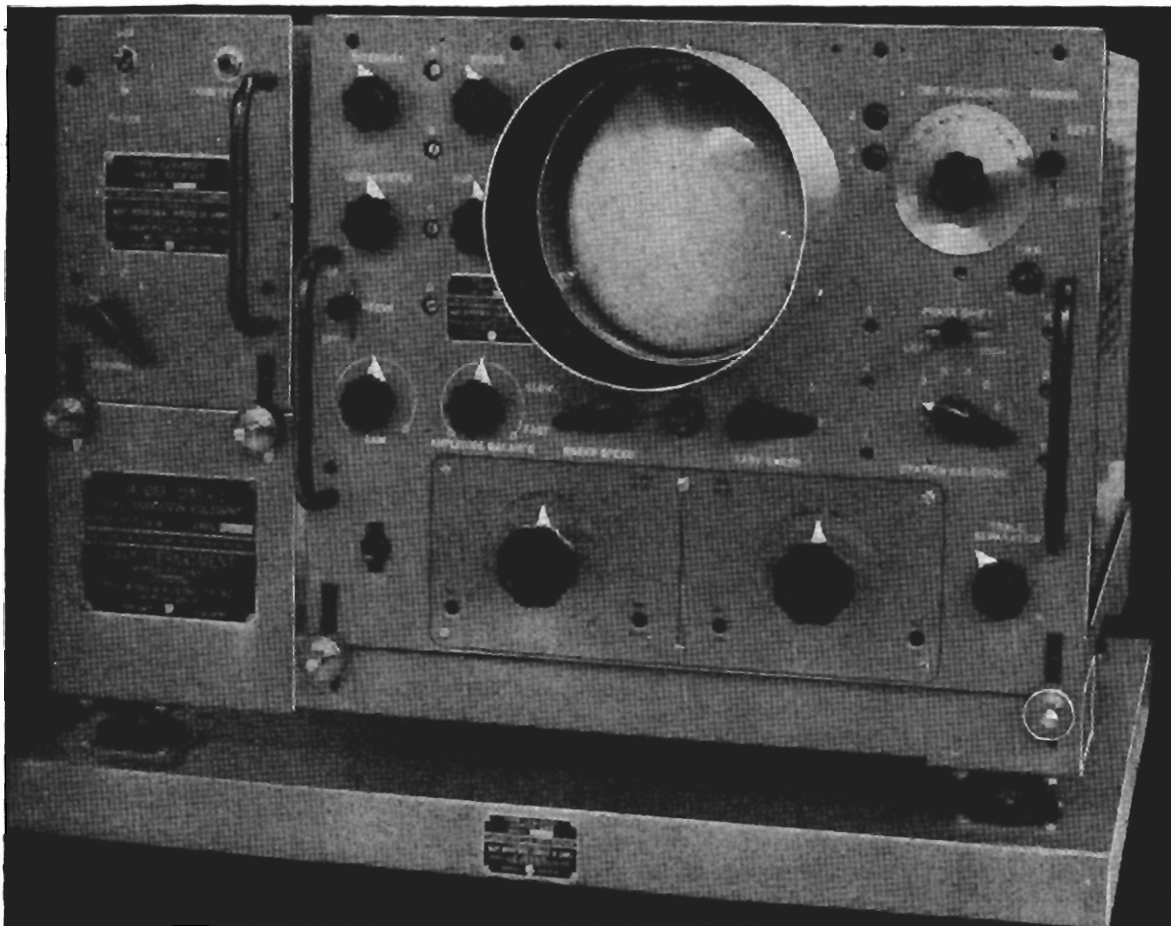


Figure 1.—Model DAS-3. LRN-1A, DAS : 1 and DAS : 4 are similar. LRN is similar except for its mounting base, which makes its overall height less.

with components of the Fada variety. Models DAS and DAS-2 operate from a 115/230-volt 50/60-cycle power supply and, after suitable field changes, the DAS and DAS-2 are electrically and mechanically identical. The contractor is the General Electric Co. Only one DAS and no DAS-2 have been installed on U. S. Navy ships; their main use has been on British ships and at loran transmitter monitor stations, principally operated by the Coast Guard.

The DAS-series equipments are called "Radio Navigation Equipment" on the name plates but it is permissible to refer to them as "Loran Receiving Equipment".

In addition to the above, several other models of loran receiving equipment have been

or will shortly be available. These include the model AN/APN-9, model DBS and model DBE.

Thus, it will be seen that :

(1) "DAS-series" should not be used when just any model of loran receiving equipment is meant.

(2) "DAS-series" should not be used when reference to a particular model of the series is meant.

(3) "DAS" should not be used when DAS-1, DAS-2, DAS-3, or DAS-4, etc. is meant.

(4) "Model DAS-series Loran Equipment" in the *Electronic Type Allowance Booklet* should be interpreted as models LRN-1, LRN-1A, DAS-1, DAS-3 or DAS-4 and not as DAS or DAS-2. (LRN-1, LRN-1A and DAS-1

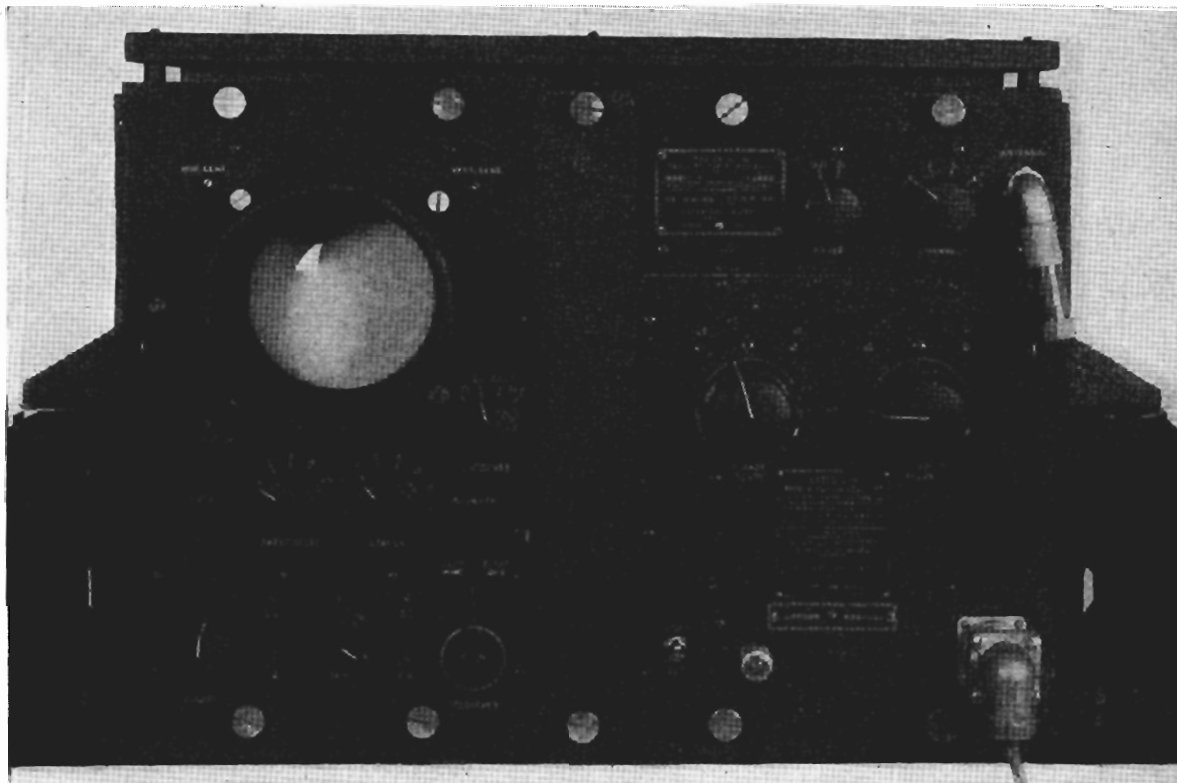


Figure 2.—Model DAS. DAS : 2 is similar.

shall be modified to LRN-1b, LRN-1Ab, and DAS-1b; DAS and DAS-2 shall be modified to DAS-b and DAS-2b, but still will not be used on U. S. Navy Ships.)

The contracts under which the various equipments were manufactured do not always list the exact model designation but sometimes only call for "DAS-series". The equipments and correct contracts are as follows:

- DAS—NX_{ss}-26190
- DAS-2—NX_{ss}-35364
- DAS-1—NX_{ss}-26792 and NX_{sr}-33791
(Shipping priorities 1-140)
- DAS-3—NX_{sr}-33791 (Shipping priorities
141-1920)
- DAS-4—NX_{sr}-33791 and NX_{sr}-83379
(shipping priorities 1921-1941)

FIELD CHANGES

A number of modifications of the various equipments have been described in the CEMB and RIB, and a number of modification kits

have been distributed. These modification kits have each been identified by various names and some by numbers also. *In order to clarify the situation, all changes have now been assigned Navy field change numbers and titles, as follows:*

(1) LRN-1/LRN-1A Field Changes:

- | Change No. | Title |
|------------|--|
| 1 | ADD PRR SWITCH |
| 1A | PRR ADJUSTMENT IF KIT FOR CHANGE 1 NOT AVAILABLE (NO KIT) |
| 2 | CHANGE TO LRN-1M, LRN-1AM (MODIFY COILS FOR 2 MEDIUM FREQ. CHANNELS) (CHANGE IS OBSOLETE; MAKE CHANGE 2A ALSO OR INSTEAD). |
| 2A | CHANGE TO LRN-1b, LRN-1Ab (MODIFY COILS FOR 4 MEDIUM FREQUENCY CHANNELS—USING KIT FOR DAS-1 FIELD CHANGE NO. 2). |

<i>Change No.</i>	<i>Title</i>	<i>Change No.</i>	<i>Title</i>
3	CHANGE INTERCONNECTING CABLE (NO KIT).	5	CHANGE FEEDBACK CAPACITOR C220. (NO KIT).
4	CHANGE CRT INTENSIFIER. (NO KIT).	(4)	DAS/DAS-2 Field Changes:
5	ADD RESISTOR TO STABILIZE SQUARE WAVE GEN. (NO KIT).	1	RELOCATE STATION SELECTOR TRIMMERS
6	SAME AS DAS-1/DAS-3 FIELD CHANGE NO. 3.	2A	CHANGE TIME CORRECTOR CIRCUIT (NO KIT)
7	SAME AS DAS-1/DAS-3 FIELD CHANGE NO. 5.	2B	SLOW SWEEP LENGTH (NO KIT)
8	SAME AS DAS-1/DAS-3 FIELD CHANGE NO. 6.	3	CHANGE DAS TO DAS-a (CHANGE PULSE RATE AND IMPROVE CATHODE-RAY-TUBE FOCUS)
9	SAME AS DAS-1/DAS-3 FIELD CHANGE NO. 8.	4	REMOVE FILAMENT GROUND IN INDICATOR (NO KIT)
10	SAME AS DAS-1/DAS-3 FIELD CHANGE NO. 9.	5	IMPROVE BALANCE GAIN CONTROL CIRCUITS
(2)	DAS-1/DAS-3 Field Changes:	6	CHANGE GAIN AND FINE DELAY CONTROLS
1	CHANGE DAS-1 to DAS-1a (ADD PRR SWITCH).	7	ADD RESISTOR R285 (NO KIT)
1A	PRR ADJUSTMENT IF KIT FOR CHANGE 1 NOT AVAILABLE. (NO KIT).	8	ADJUST B+ TO 280 VOLTS INSTEAD OF 300 (NO KIT)
2	CHANGE DAS-1a to DAS-1b (MODIFY RECEIVER COILS FOR 4 MEDIUM FREQUENCY CHANNELS).	9	CHANGE DAS-a TO DAS-b, DAS-2 to DAS-b (MODIFY COILS FOR 4 MEDIUM FREQUENCY CHANNELS)
3	CONNECT RECEIVER DIODE. (NO KIT).	10	ADD TWO MICROSECOND MARKERS FOR MONITORING
4	CHANGE NAMEPLATES. (NO KIT).	11	CHANGE AMPL. BALANCE TO R-F AMPLIFIER (NO KIT) (To be published shortly)
5	CHANGE GROUNDING. (NO KIT).		
6	INSULATE CAPACITOR C107/C207. (NO KIT).		
7	CHANGE SLOW SWEEP RESISTOR R167/R267. (NO KIT).		
8	CHANGE CAPACITOR C37/C137. (NO KIT).		
9	ADD RESISTOR R31 IN RECEIVER. (NO KIT).		
(3)	DAS-4 Field Changes:		
1	WATERPROOF ANTENNA LOADING COIL. (NO KIT).		
2	CHANGE FEEDBACK CAPACITOR C219. (NO KIT).		
3	CHANGE CRYSTAL OSCILLATOR COIL L101. (NO KIT).		
4	CHANGE SLOW SWEEP CIRCUIT RESISTOR R269. (NO KIT).		

A description of each field change follows this article. Table 1 (published herewith) is a cross-index of field change kits which gives the field change number with which the kit will henceforth be identified and all of the various names which that same kit has been called in the contracts, shipping papers, instruction books, kit instructions, CEMB, and RIB.

The instruction book for model DAS and DAS-2 radio navigation equipment (SHIPS 225A contains information of DAS/DAS-2 field changes 1 through 7, but it should be noted that the *kit numbers listed on pages 1-3 and 1-4 of that publication are not the same as the field change numbers, and these old kit numbers are not to be used in the future.* The field change numbers do agree with the equipment change numbers listed in that publication.

The instruction book for model DAS-1/DAS-3 (NAVSHIPS 900,752), now being

TABLE 1
 CHART OF LORAN FIELD CHANGE KITS
 MODEL DAS AND DAS-2 FIELD CHANGE KITS

Navy field change number	Equipment affected	Model designation after change	Contract reference	Contractors shipping paper reference as	Equipment instruction book (Ships 225A) references as:		Kit instruction reference as:
					Section I	Section V	
Kit for DAS Field Change No. 1	DAS (Serial Nos. 1-5 only)	No Change	NXsr-26190 G. E. Co. Lot 3, Item 3aaa; Modification Kit for Item 3a	DAS Trimmer Kit for Equipments Serial Nos. 1-5	Kit No. 1 (For equipment change No. 1)	Loran Shipboard Modification Kit	Trimmer Assembly Kit
Kit for DAS Field Change No. 3#	All DAS (Serial Nos. 1-200)	DAS-a	NXsr-26190 G. E. Co. Lot 1 1/4, Item 1b and Lot 2 1/4, Item 2b; Modification Kit for DAS	Pulse Rate Change and Cathode Ray Tube Focus Kit for DAS	Kit No. 2# (For equipment change No. 3)	Rate Change and Cathode Ray Tube Adapter Kit.	
Kit for DAS/DAS-2 Field Change No. 5 and 6#	All DAS (Serial Nos. 1-200) DAS-2 (Serial Nos. 201-580) (DAS and DAS-2 Kits are interchangeable)	No Change	NXsr-26190 G. E. Co. Lot 1 1/4, Item 1c and Lot 2 1/4, Item 2c; Balance Gain Control Modification Kit for DAS.	Balance Gain Control Modification Kit for DAS	Kit No. 3# (For equipment change Nos. 2, 4, 5 and 6)	Control Modification Kit	Kit for Improving Operating Characteristics of Model DAS and DAS-2
Kit for DAS/DAS-2 Field Change No. 9	All DAS and DAS-2 (DAS and DAS-2 Kits are interchangeable)	DAS-b DAS-2b	NXsr-35384 G. E. Co. No Lot Number Nor Item Number; Balance Gain Control Modification Kit for DAS-2.	Balance Gain Control Modification Kit for DAS-2	Kit for Changing Receiver Channels		Coil Modification Kit for DAS and DAS-2
Kit for DAS/DAS-2 Field Change No. 10	DAS and DAS-2 At Loran Transmitter Monitoring Stations NOT FOR GENERAL SHIPBOARD USE.	DAS-aM DAS-bM DAS-2M DAS-2bM	NXsr-69004 G. E. Co. Lot 1, Item 1a and Lot 2, Item 2a; Coil Modification Kit for DAS NXsr-35384 G. E. Co. Lot 1 1/4, Item 1e; Coil Modification Kit for DAS-2 S and A Order No. 22515 OSRD (Radiation Laboratory) Lot 1, Item 1a and Lot 2, Item 2a; Microsecond Marker Modification kit for DAS and DAS-2	Coil Modification Kit for DAS Coil Modification Kit for DAS-2 Two Microsecond Marker Kits for DAS and DAS-2 Equipments			Modification Kit M for DAS and DAS-2

*NOTE: Navy Field Change Number Does Not Agree With Kit Number in Section I of Instruction Book (SHIPS 225A).
 *No change.

TABLE 1—Continued
CHART OF LORAN FIELD CHANGE KITS—Continued

MODEL DAS-1 FIELD CHANGE KITS

Navy field change number	Equipment affected	Model designation after change	Contract reference	Contractors shipping paper and final instructions (NAVSHIPS 900,752) reference as:	Radio installation bulletin and communication equipment maintenance bulletin reference as:	Kit instruction reference as:
Kit for DAS-1 Field Change No. 1	DAS-1, LRN-1, LRN-1A (Kit is interchangeable with Kit for LRN-1/LRN-1A Field Change No. 1)	DAS-1a LRN-1* LRN-1A*	NXsr-26792 and NXsr93791 Fada Radio & Electric Co.; No Lot nor Item Numbers; Model DAS-1 Receiver Indicator Modification Kits NXsr-93961 Fada Radio & Electric Co. Lot 2, Item 2b; Pulse Repetition Rate Modification Kit	PRR Modification Kit for DAS-1	Switch Modification Kit for DAS-1	Modification of DAS-1 Navigation Equipment (Subtitle Inside: Modification of Pulse Repetition Rate of DAS-1 Indicator)
Kit for DAS-1 Field Change No. 2	DAS-1, LRN-1, LRN-1A (Even if Previously Modified to LRN-1 or LRN-1AM by Kit for LRN-1/LRN-1A Field Change No. 2)	DAS-1b LRN-1b LRN-1AE	NXsr-77867 Fada Radio & Electric Co. Lot 1, Item 1; Coil Modification Kit for DAS-1 NXsr-93961 Fada Radio & Electric Co. Lot 1; Item 1a and Lot 2, Item 2a; Coil Modification Kit	Coil Modification Kit for DAS-1	Coil Modification Kit for DAS-1	Modification Kit No. 2 for Radio Receiver CFE-48216 Part of Model DAS-1

MODEL LRN-1/LRN-1A FIELD CHANGE KITS

Navy field change Number	Equipment affected	Model designation after change	Contract reference	Contractors shipping paper reference as:	Radio installation bulletin and communication equipment maintenance bulletin reference as:	Kit instruction reference as:
Kit for LRN-1/LRN-1A Field Change No. 1	LRN-1, LRN-1A and DAS-1 (Kit is interchangeable with Kit for DAS-1 Field Change No. 1)	LRN-1* LRN-1A* DAS-1a	NXsr-60989 Fada Radio & Electric Co. Lot 1 Item 1; Repetition Rate Switch Assembly Kits	Repetition Rate Modifications Kits for Model LRN-1A	Switch Modification Kit or PRR Switch Modification Kit for LRN-1/LRN-1A	Modification of LRN-1A Navigation Equipment (Subtitle Inside: Modification of Pulse Repetition Rate of LRN-1A (Indicator))
Kit for LRN-1/LRN-1A Field Change No. 2	OBsolete Use Kit for DAS-1 Field Change No. 2 For LRN-1 and LRN-1A Also (even if Previously Modified to LRN-1M or LRN-1AM by Kit for LRN-1/LRN-1A Field Change No. 2)	LRN-1M LRN-1AM	NXsr-60989 Fada Radio & Electric Co. Lot 1, Item 2; Modification Tuning Coil Kits for LRN-1 and LRN-1A Receivers	Modification Tuning Coil Kit for LRN-1 and LRN-1A Receivers	Coil Modification Kit for LRN-1/LRN-1A	Modification of LRN-1A Navigation Equipment (Subtitle Inside: Modification of LRN-1A Receiver to Cover Revised Operating Frequencies)

*No change.

printed, will contain information on DAS-1/DAS-3 field changes 1 through 8.

Certain changes have been required because of changes of pulse recurrence rates and radio-frequency channels of the loran transmitting stations. In this respect the following equipments meet all of the latest requirements:

- LRN-1b (LRN-1 with field changes 1 and 2A)
 - LRN-1Ab (LRN-1A with field changes 1 and 2A)
 - DAS-b (DAS with field changes 3 and 9)
 - DAS-1b (DAS-1 with field changes 1 and 2)
 - DAS-2b (DAS-2 with field change 9)
 - DAS-3
 - DAS-4
- (Also AN/APN-9, DBS and DBE)

A log of modifications and changes should be made for each equipment, and the field changes which have been made should be entered. Form NAVSHIPS 2390 may be used, but the word "Radar" should be crossed out, since loran is considered to be radio equipment. A NAVSHIPS NBS-383 Revised (Failure Report—Electronic Equipment) card should be sent to the Bureau to indicate which field changes have been made. Fill out the top half of the card and under "remarks" note "Navy field changes no. ——— made".

SPARE PARTS

Each model of the DAS-series has been furnished with an appropriate set of equipment spare parts for that model. Equipment spare parts for models LRN-1 and LRN-1A were furnished retroactively.

Many LRN-1, LRN-1A, DAS-1, DAS-3 and DAS-4 parts are interchangeable. (Circuit symbol numbers are generally similar also, if 100 is added to LRN-1, LRN-1A and DAS-1 indicator symbol numbers, and 300 is added to LRN-1, LRN-1A and DAS-1 receiver symbol numbers). All DAS and DAS-2 parts are interchangeable, and circuit symbol numbers are the same. Therefore stock and tender spare parts have been grouped in many instances to reduce the number of different types of spare part sets.

DAS-1 and DAS-3 tender and stock spare parts have been grouped into DAS-1/DAS-3 series tender spare parts and DAS-1/DAS-3 series stock spare parts. Such a set contains parts to service both DAS-1 and DAS-3. Only supplementary tender and stock spares for DAS-4 have been procured. These contain only DAS-4 parts which are different from DAS-1 or DAS-3 parts: DAS-1/DAS-3 spares must be used for parts which are similar.

DAS and DAS-2 tender and stock spares have been similarly grouped into DAS/DAS-2 series tender and stock spares.

The following is a summary of spare parts contract numbers.

- (1) Equipment spare parts (in addition to those on contracts for equipments also)
 - LRN-1/LRN-1A Some made up by Radiation Laboratory and NYd Bos (no contract number).¹
 - LRN-1A NXss-29646¹
 - DAS/DAS-2 NXsr-45458
 - DAS-1 NXsr(LL)-62374
 - NXsr(LL)-77873
- (2) DAS-1/DAS-3 series tender spares
 - NXsr-33791
 - NXsr-43414
 - NXsr-83379
 - NXsr-90755
- (3) DAS-4 supplementary tender spares
 - NXsr-87734
 - NXsr-83379
 - NXsr-90755
- (4) DAS-1 stock spares
 - NXss-26792¹
 - NXsr-33791¹
- (5) DAS-1/DAS-3 series stock spares
 - NXsr-33791
 - NXsr-83379
- (6) DAS-4 supplementary stock spares
 - NXsr-87734
 - NXsr-83379
- (7) DAS/DAS-2 series tender spares
 - NXsr-45458
- (8) DAS stock spares
 - NXsr-26190¹
- (9) DAS/DAS-2 series stock spares
 - NXsr-45458

¹ Spares on contracts so marked, and equipment spaces furnished with DAS-1 and DAS were in accordance with old specifications (RE 13A 554D) and not as complete as other spare parts sets.

INSTRUCTION BOOKS

<i>Model</i>	<i>Furnished with Equipment</i>	<i>Replacements</i>
LRN-1	(1) Loran Indicator and Receiver ² Model LRN-1 Maintenance Instructions.	(³)
	(2) Loran Indicator and Receiver ² Model LRN-1 Operation Instructions.	
LRN-1A	(1) Loran System Receiver-Indicator ² LRN-1A Operation and Maintenance Instructions.	(³)
	(2) Loran System Receiver-Indicator ² LRN-1A Installation, alignment and manipulation.	
DAS-1	Preliminary Instruction Book Model ² DAS-1 Loran System Receiver Indicator (NAVSHIPS 929-1).	Instruction Book for Models DAS-1 and DAS-3 Radio Navigation Equipment (NAVSHIPS 900,752) (Distributed by Oct. 1945). ⁴
DAS-3	(1) Temporary Instruction Book for Model DAS-3 Radio Navigation Equipment (NAVSHIPS 900,254IB) (with early equipments).	
	(2) Preliminary Instruction Book for Model DAS-3 Radio Navigation Equipment (SHIPS-263) (with later equipments; also bulk distribution to field to replace temporary book).	
DAS-and DAS-2	Preliminary Instruction Book for Navy Model DAS and DAS-2 Radio Navigation Equipment (SHIPS 225).	Instruction Book for Model DAS and Model DAS-2 Radio Navigation Equipment (SHIPS 225A).

—11/1/45.

NAVY FIELD CHANGES⁵ FOR MODELS LRN-1 AND LRN-1A

NAVY FIELD CHANGE NO. 1—ADD PRR SWITCH

Purpose: To provide for both L (25 per sec.) and H ($33\frac{1}{3}$ per sec.) basic pulse recurrence rates by addition of PRR switch.

Material Required: Kit for LRN-1/LRN-1A field change no. 1 or Kit for DAS-1 field change no. 1. In addition, for LRN-1, a small 25-mmfd. variable air capacitor is required.

Equipments affected: LRN-1: all; LRN-1A: all.

The change in model LRN-1A is made in accordance with the instructions contained in the kit, and with the following precautions: The wires from the PRR switch to the new 200,000-

ohm resistor R183 should be twisted together and run from the switch down the rear of the subpanel supporting the feedback capacitors (between the panel and the station selector switch) then over to the vertical wall formed by the upper subchassis and along the corner formed by the vertical wall and the main chassis deck, then down through the hole between V33 and V34 to R183. Shielded wire should not be used.

In the LRN-1, the new potentiometer and new 47,000-ohm resistor are not installed, but the 25-mmfd. capacitor (not furnished with kit) is connected in series with the PRR switch and pins 5 of V6 and pins 4 and 5 of V9.

No change in model designation of the LRN-1 or LRN-1A is made after this change.

² Not packed with equipments—supplied to Electronics officers separately.

³ DAS-3 preliminary book (SHIPS 263) or DAS-1/DAS-3 final book (NAVSHIPS 900752) contains much information applicable to models LRN-1 and LRN-1A, and copies may be obtained by holders of LRN-1 and LRN-1A equipments.

⁴ DAS-3 preliminary book (SHIPS 263) contains much information applicable to model DAS-1, and is much more complete than NAVSHIPS 929-1. Copies may be obtained by holders of DAS-1 equipment until the final book NAVSHIPS 900,752 is available.

⁵ No field changes are to be made to equipment on inactive ships.

NAVY FIELD CHANGE NO. 1A—PRR ADJUSTMENT (IF KIT FOR FIELD CHANGE NO. 1 IS NOT AVAILABLE)

Purpose: Same as for change no. 1, except PRR switch not added.

Material required: LRN-1—small mica capacitor (if needed). LRN-1A—39,000-ohm ½-watt composition resistor (if needed).

Equipments affected: LRN-1: all; LRN-1A: all.

If a kit for field change no. 1 is not available or if operation at H PRR is necessary pending installation of field change 1, adjustment of screw "D" on the front panel of model LRN-1A or screw "4" in the top of model LRN-1 should be set to produce a 3-4 test pattern of *six groups of five steps on each trace*. It may be necessary to change R23 in the LRN-1A indicator from 47,000 ohms to 39,000 ohms, and it may be necessary in the LRN-1 to add a small mica capacitor (selected to allow adjustment to both six and eight groups of steps) between pin 5 of V6 and pins 4-5 of V9. As a further refinement, the two positions of the screw driver slot corresponding to L and H may be indicated by marks adjacent to the screw head.

NAVY FIELD CHANGE NO. 2—CHANGE LRN-1 TO LRN-1M, LRN-1A TO LRN-1AM (MODIFY COILS FOR 2 MEDIUM FREQUENCY CHANNELS)

Purpose: To change the receiver coils to provide two instead of one channel covering the range of 1.7 to 2.0 mc.

Material required: Kit for LRN-1/LRN-1A field change no. 2.

Special tools required: Model LP signal generator.

Equipments affected: Originally all LRN-1 or LRN-1A but *change is now obsolete, and if not already made, make change no. 2A instead.*

The instructions with the kit for change no. 2 called for stamping "M" after the type No. CFE-46216 of the receiver. This statement is in error, as the designation CFE-46216 applies only to the model DAS-1 receiver. Therefore, equipments with this change should have the letter "M" stamped after the model designation to make LRN-1M or LRN-1AM. The instructions with the kit also called for the stenciling of the word "Modified" on the receiver unit under the nameplate.

NAVY FIELD CHANGE NO. 2A—CHANGE TO LRN-1b AND LRN-1Ab (MODIFY COILS FOR 4 MEDIUM FREQUENCY CHANNELS)

Purpose: To provide 4 medium frequency channels covering range of 1.7 to 2.0 mc.

Material required: Kit for DAS-1 field change No. 2.

Special tool required: Model LP signal generator.

Equipments affected: All LRN-1 and LRN-1A, even if previously modified by LRN-1/LRN-1A field change no. 2.

Instructions for making the change are furnished with the kit. After the modification the model letters on both the receiver and indicator should be changed to LRN-1b and LRN-1Ab. Note that these new designations indicate that both changes no. 1 and 2A have been made. If the kit for change no. 1 is not available when change no. 2A has been made, the log of modifications and changes for the equipment should so indicate. Removed parts may be destroyed.

NAVY FIELD CHANGE NO. 3—CHANGE INTERCONNECTING CABLE

Purpose: Reduce distortion of signals.

Material required: Modified receiver-indicator interconnecting cable, with separately shielded conductor for video. (These were supplied to field by Radiation Laboratory.)

Time required: 5 minutes.

Equipments affected: About first 75 LRN-1A.

If the video lead from receiver to indicator is not separately shielded in the interconnecting cable, distortion of the pulse signal may occur because of coupling between the two leads, and erroneous readings may result. The replacement cable should be used to eliminate this trouble. If a replacement cable was not received, a cable can be made up in the field, or obtained from DAS-1/DAS-3 tender or stock spares. (This change was originally published as a supplement to the LRN-1A instruction book.)

NAVY FIELD CHANGE NO. 4—CHANGE CRT INTENSIFIER CIRCUIT

Purpose: To eliminate bright spots on CRT on fast sweeps.

Material required: 1 approx. 30,000-ohm 1/2-watt resistor (27,000±10 or 33,000±10% available in spare parts).

Time required: Approx. 1 hour.

Equipment affected: LRN-1A, only if trouble encountered.

The purpose of the change is to provide a CRT grid driver circuit which is not adversely affected by cathode-ray-tubes with large grid leakage current.

The fundamental difficulty with the original design when used with tubes having excessive grid leakage is that the intensifier voltage which would normally be maintained below cut-off except during the operation of the pedestal generator, leaks up into the conducting range before the fast sweep is triggered and thereby creates the bright spots at the beginning of the traces. The problem, then, is to drive the intensifier down so far during the off period that even with leakages up to 50 microamperes it won't be able to drift up past cut-off before the next positive kick from the pedestal generator.

In order to drive the intensifier voltage below the present level which is satisfactory with good cathode-ray-tubes, a low impedance driver is

necessary in place of the original drive from the "on" tube of the pedestal generator delay multivibrator. The cathode follower, terminals 4, 5, and 6 of V-20, which normally serves to apply the pedestal-creating voltage to the vertical plates, is admirably suited to this purpose and is not necessary during the fast sweeps. Therefore, this design modification simply involves borrowing this cathode follower for an intensifier driver during the fast sweeps. Extra connections to existing switches are used, one existing resistor (R116) is shorted out, and one new resistor is needed (30K, 1/2-watt) to replace R104.

Referring to the accompanying diagram (Figure 1), the five steps necessary to accomplish this modification are as follows:

- (1) Disconnect the wire at the junction of R110 and C97 that runs from the pedestal generator V-19 to switch S1A, and connect it to pin 6 of V-20, the cathode follower.
- (2) Disconnect the wire at the junction of R109 and R110 which runs through R105 to pin 4 of V-20, and connect it to the junction of R110 and C97.

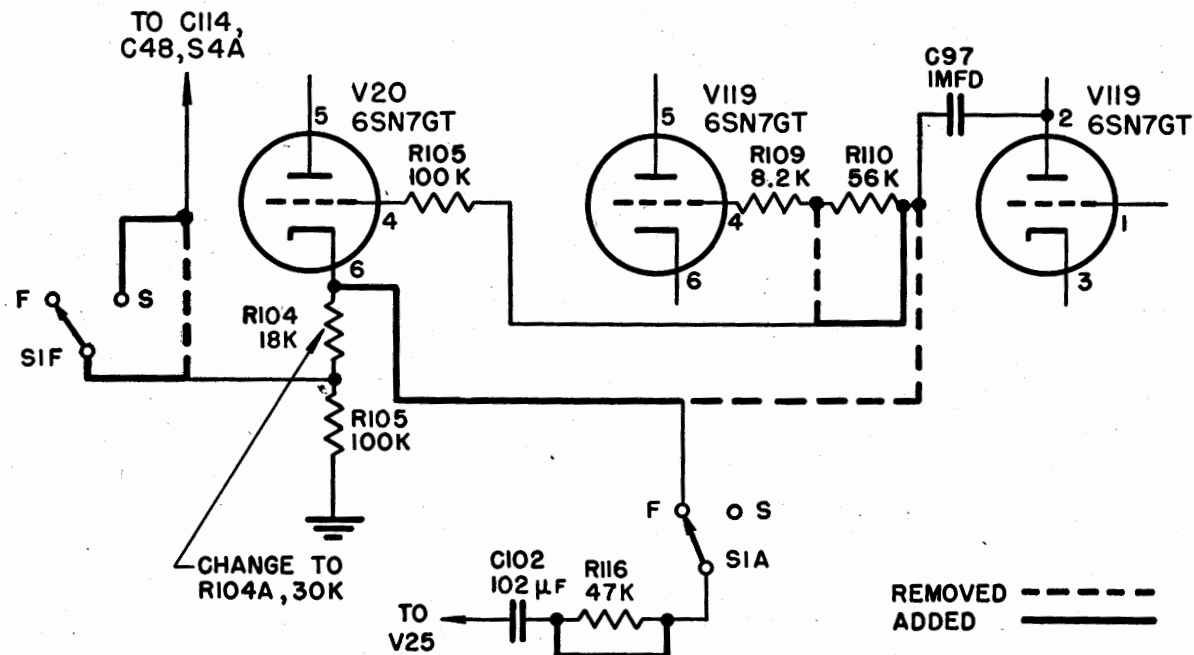


Figure 1.—Schematic for field change no. 4 for LRN-1A.

- (3) Short circuit R116.
- (4) Replace R104 with a 30K 1/2-watt resistor, R104A.
- (5) From the junction of R103 and R104A connect to an unused section of S1 (the slow-fast sweep switch) in such a way that the circuit will be closed back to C114 in the slow sweep position and open during the fast sweeps.

An emergency cure for the bright spots can be effected by connecting a resistor of 2 to 5 megohms from pin 5 of V-35 to the junction of C-77 and R-120 in the negative high voltage power supply. By increasing the negative bias on the grid in this way, the tube will remain cut off during the part of the cycle when the fast sweep is not sweeping, and the bright spots will be eliminated, but the changes above are preferable. (This change was originally published as a supplement to the LRN-1A instruction book.—11/1/45.)

NAVY FIELD CHANGES¹ FOR MODELS DAS-1 AND DAS-3

NAVY FIELD CHANGE NO. 1—CHANGE DAS-1 TO DAS-1a (ADD PRR SWITCH)

Purpose: To provide for both L (25 per second) and H (33 1/3 per second) basic pulse recurrence rates by addition of PRR switch.

Material required: All necessary parts are furnished in kit for DAS-1 field change no. 1 or LRN-1/LRN-1A field change no. 1 (kits are interchangeable.)

List of parts furnished in the above kits is as follows:

		LRN-1/ DAS-1 LRN-1A
Kit	Kit	
2 ¹	1	D. P. S. T. toggle switch, 5/8" long shank, Arrow—H&H #20902 Mod. Navy type CHH-24322.
2 ¹	1	100,000-ohm ±20% carbon potentiometer screwdriver adjusted—Clarostat Type 37. Navy type CMC-632121-20%.

		LRN-1/ DAS-1 LRN-1A
Kit	Kit	
1	1	47,000-ohm, 1/2-watt carbon resistor. Navy type RC21AE473K.
1	1	220,000-ohm, 1/2-watt carbon resistor. Navy type RC21AE224K.
1	1	Tie lug—Cinch #1531.
2 ¹	1	Nameplate (for toggle switch) marked: "H-L" corresponding to left and right positions of the switch and "PRR" beneath H-L.

¹ One of each of these items is supplied for equipment spare parts.

Time required: 2 hours.

Equipments affected: DAS-1: All.

DAS-3: None (Incorporated in all equipments at factory).

Instructions for making the change are included with each kit. In addition, the following instructions are pertinent: The wires from the PRR switch to the new 200,000-ohm resistor R183 should be twisted together and run from the switch down the rear of the subpanel supporting the feed-back capacitors (between the panel and the station selector switch) then over to the vertical wall formed by the upper sub chassis and along the corner formed by the vertical wall and the main chassis deck, then down through the hole between V33 and V34 to R183. Shielded wire should not be used.

After making the change the type number of the DAS-1 indicator unit is changed from CFE-55118 to CFE-55118-A, and the model letters of the equipment are changed to DAS-1a by stamping the nameplates.

NAVY FIELD CHANGE NO. 1A—PRR ADJUSTMENT (IF FIELD CHANGE NO. 1 IS NOT AVAILABLE)

Purpose: Same as for change no. 1, except PRR switch not added.

Materials required: 1—39,000-ohm 1/2-watt carbon resistor (if needed).

Equipments affected: DAS-1: All.

DAS-3: None.

¹ No field changes are to be made to equipment on inactive ships.

If field change no. 1 is not available or if operation at H basic pulse repetition rate is necessary pending installation of field change no. 1, adjustment screw "D" on the front panel of the equipment can be turned to the center of the stable region where the pattern of six group of steps on each trace is obtained.

It may be necessary to change the value of R23 from 47,000 ohms to 39,000 ohms to achieve this adjustment. As a further refinement, the two positions of the screw driver slot corresponding to L and H can be indicated by marks on the panel.

NAVY FIELD CHANGE NO. 2—CHANGE DAS-1a TO DAS-1b (MODIFY RECEIVER COILS FOR 4 MEDIUM FREQUENCY CHANNELS)

Purpose: Change receiver coils to provide four medium frequency channels covering 1.7 to 2.0 mc.

Material required: All necessary parts and instructions are supplied with the kit for DAS-1 field change no. 2. List of material furnished in the kit is as follows:

- 2 Coil Assemblies Antenna, L1, L2, 13, 14. Navy Type No. CFE-47553.
- 2 Coil Assemblies, mixer, L1, 12, 13, 14. Navy Type No. CFE-47553.
- 2 Coil Assemblies, oscillator, L7, L8, 19, L10. Navy Type No. CFE-47554.

Each of the above coil assemblies consists of four coils, single wound on $\frac{1}{2}$ " bakelite tube in shielded aluminum case $2\frac{1}{16}$ " x $2\frac{1}{16}$ " x $3\frac{1}{16}$ " high. The antenna and mixer coils are identical except for marking. One of each assembly is for equipment spare parts.

Time required: 2 hours.

Special tools required: Model LP signal generator.

Equipments affected: DAS-1: All.
DAS-3: None.

After modification, the DAS-1 receiver unit type number is changed from CFE-46216 to CFE-46216B, and the model letters of the DAS-1 are changed to DAS-1b. Note that the designation DAS-1b indicates that both field changes nos. 1 and 2 have been made. There is no model designation to indicate that only field

change no. 2 has been made. If the kit for change no. 1 is not available when change no. 2 is made, the log of modifications and changes for the equipment should so indicate. Removed parts may be destroyed.

NAVY FIELD CHANGE NO. 3—RECEIVER DIODE CONNECTION

Purpose: Reduce receiver overload.

Material required: Several inches of wire.

Time required: 5 minutes.

Equipments affected: DAS-1: All.

DAS-3: None (some-
what similar
change incor-
porated in
equipments at
factory).

It has been determined that the effects of overloading the receiver on strong signals can be greatly reduced by connecting the unused diode half of V6 as a limiter to prevent the control grid of V7 (the video amplifier) from going positive. This is accomplished by grounding pin 8 (cathode) of V6 and connecting pin 5 (plate) of V6 to the end of R-30 that connects to the test jack. (R-30 is connected between the test jack and pin 4 (control grid) of V7). This modification greatly stabilizes the traces and minimizes jumping caused by strong drifting signals and by static crashes.

NAVY FIELD CHANGE NO. 4—NAMEPLATE CHANGE

Purpose: Replace nameplates (new serial numbers).

Material required: New nameplate supplied by contractor to activities receiving affected equipments.

Time required: 5 minutes.

Equipments affected: DAS-1: serial nos. 1 to 140 on contract NX88-33791 only.

Serial numbers of the above mentioned equipments have been advanced a basic five hundred numbers. Cognizant activities should replace the nameplates on equipments bearing serial nos. 1 to 140, with new nameplates serial nos. 501 to 640 inclusive. If the new nameplates have not been received, make the change by stamping the present nameplate.

NAVY FIELD CHANGE NO. 5—GROUNDING CHANGE

Purpose: Reduce counter instability.

Material required: Approximately 1 ft. wire.

Equipments affected: DAS-1: All.

DAS-3: Serial nos. 1-234 except 165, 213, 223, 228, 229, 230, 232 (others changed at factory).

In all DAS-1 and in the DAS-3 equipments indicated above, counter circuit instability in the form of signals jumping to right or left when the RECEIVER switch is operated, can be reduced by disconnecting the ground to the chassis from S4B in DAS-1 or S104B in DAS-3 and running an insulated ground lead from S4B to the ground lug on socket X17 in DAS-1 or X117 in DAS-3.

NAVY FIELD CHANGE NO. 6—INSULATE CAPACITOR C107/C207

Purpose: Improve test pattern.

Material required: Small piece at insulating board per drawing.

Time required: 1 hour.

Equipments affected: DAS-1: All.

DAS-3: Serial Numbers 1-420, 423, 424, 427, 435, 437, 445, 460, 461, 468, 470-473, 475-477, 496, 503, 504, 507, 509, 517, 518 (others changed at factory).

Indistinctness of the upper left dot in the #2 test jack pattern may occur if C107 in DAS-1 or C207 in DAS-3 has a high capacity to ground. Different makes of capacitors vary greatly in this respect. The difficulty can be completely eliminated by insulating the case of C107 or C207 from ground by means of a mounting board of bakelite or other non-conducting material. As a convenience both C107 or C207 and C111 or C211 should be mounted on the board as shown in diagram of Figure 1 but only C107 or

C207 is to be insulated from ground. The spacers may be of any convenient material, either metal or non-conducting and the dimensions are not critical. The result of these changes is to reduce the slow sweep retrace time so that the dot formerly partially lost in the retrace can be clearly seen.

NAVY FIELD CHANGE NO. 7—CHANGE SLOW SWEEP RESISTOR R167/R267

Purpose: Improve stability of slow sweep generator.

Material required: 3300-ohm $\pm 10\%$, 2-watt composition resistor (if needed).

Time required: 1/2 hour.

Equipments affected: DAS-1: All.

DAS-3: Serial numbers 1-524 (others changed at factory).

Where instability of the operation of V122 in DAS-3 or V22 in DAS-1 (slow sweep generator) is experienced, selection of tubes may be necessary, or R267 in DAS-3 or R167 in DAS-1 can be changed from 4700 ohms to 3300 ohms. The instability is particularly evident as a horizontal jitter.

NAVY FIELD CHANGE NO. 8—CHANGE CAPACITOR C37/C137

Purpose: Improve "A" pedestal stability.

Material required: 30 micromicrofarad capacitor (available in spare parts).

Time required: 1/2 hour.

Equipments affected: DAS-1: All.

DAS-3: 1-541 except 496, 524, 532, 538, 539 (others changed at factory).

If "A" pedestal jitter is encountered, changing the coupling capacitor C37 in DAS-1 or C137 in DAS-3 from 25 to 30 micromicrofarads may cure the trouble.

NAVY FIELD CHANGE NO. 9—ADD RESISTOR R31 IN RECEIVER

Purpose: Improve receiver sensitivity.

Material required: 15,000-ohm, 1/2-watt resistor (available in spare parts).

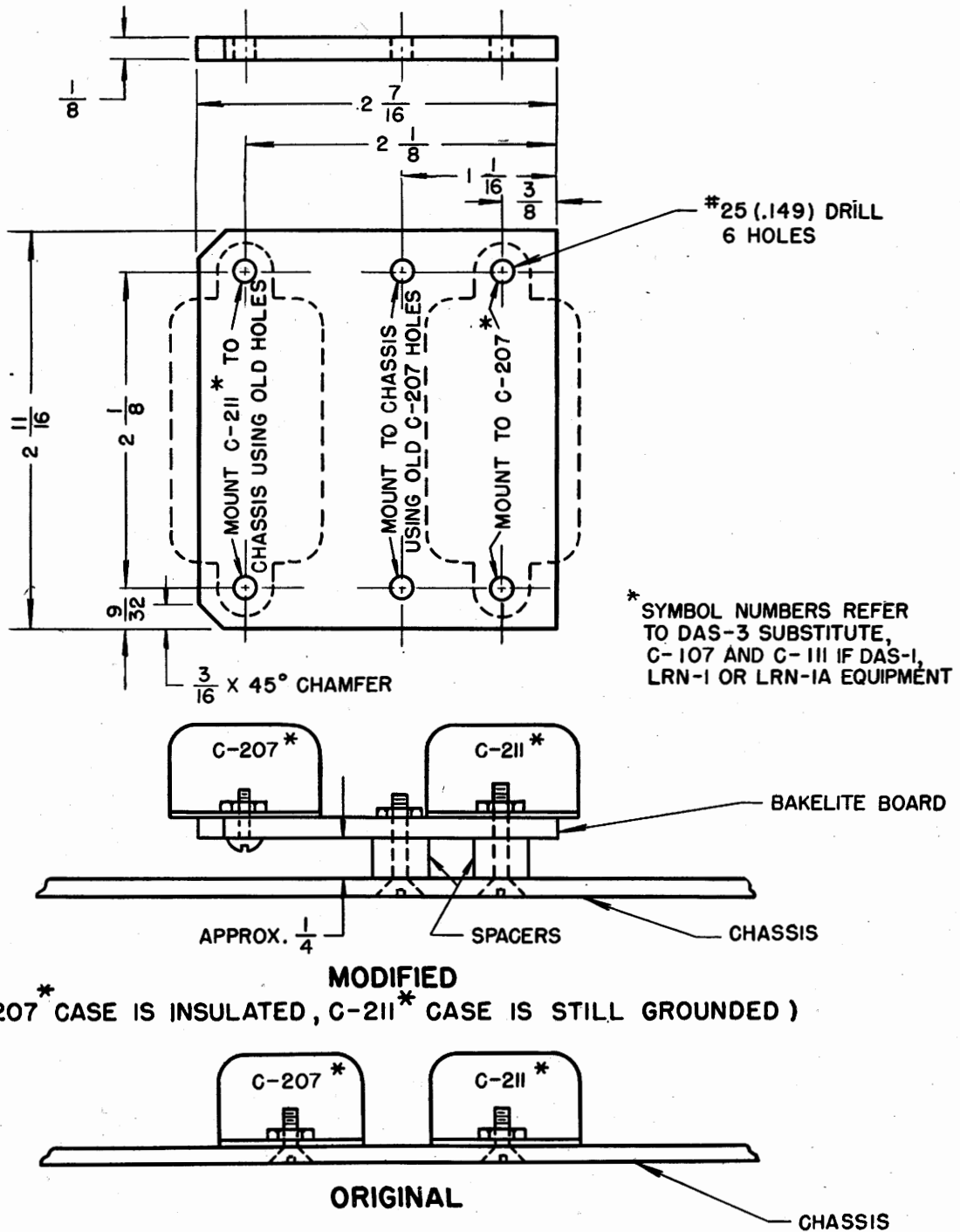


FIGURE 1.—Installation of a mounting board.

Time required: ¼ hour.

Equipments affected: DAS-1: All, after modification to DAS-1b by field change no. 2.

DAS-3: None.

After modification of DAS-1 to DAS-1b by field change no. 2, the receiver sensitivity can be considerably improved by adding a new 15,000-ohm ½-watt resistor, designated R31, from the contact arm of S1C in the receiver and ground. The resistor then shunts C36 and C37. This resistor reduces the local oscillator output and increases the convertor efficiency. The resistor should be mounted on the rear wafer of S1 (channel switch), between the switch lug which contacts the movable contact in all switch positions, and the grounded lug on the switch wafer. A similar resistor, R331 is installed in DAS-3 equipments at the factory. This change was suggested by Navy Yard, New York, and has not been previously published.—11/1/45

NAVY FIELD CHANGES¹ FOR MODEL DAS-4

NAVY FIELD CHANGE NO. 1—WATER PROOF ANTENNA LOADING COIL

Purpose: To prevent water leakage into coils which are mounted in exposed locations.

Material required: Small amount of glyptol, rubber cement or other similar sealing compound.

Equipments affected: DAS-4 serial no. 1-177. (Others corrected by contractor.)

It has been discovered that there is a tendency for the Navy type CG-47335 antenna loading coil unit to leak around the central through-bolt in the ceramic entrance insulator. This condition should be remedied by removing the external nut and washer and pouring the sealing compound into the small space around the feed through bolt, and then replacing the external washer and nut.

(The Type CG-47335 loading coils supplied with models DAS and DAS-2 require a similar change. The loading coils supplied under

NXsr-83412 for use with AN/APN-9 and those supplied with models X-DBS and DBS have been corrected by the contractor.)

NAVY FIELD CHANGE NO. 2—CHANGE FEEDBACK CAPACITOR C219

Purpose: To provide a better range of adjustment for station selector adjustment no. 6.

Material required: One Navy Type CM20C121J 120 micromicrofarad mica capacitor.

Equipments affected: DAS-4 serial nos. 1-97 except 76, 88, 89, 90, 91, 92, 95 and 96. (*Only if trouble encountered*) (others corrected at factory).

This change should be made only if trouble in obtaining the correct adjustment is encountered. In that case, change C219 from 130 to 120 mmfd., and correct the instruction book as follows:

Page 4-9—Figure 4-16 change value of C219 to 120 mmfd.; 6-11—change value of C219 to 120 mmfd.; Navy type no. to CM-20C1215; MFR drawing and part no. to 15.374.

Page 7-19—Figure 7-18 (indicator schematic) and loose drawing figure 7-18 also, change value of C219 to 120 mmfd.

NAVY FIELD CHANGE NO. 3—REDUCE INDUCTANCE OF L101

Purpose: To provide a greater range of drift control at temperature extremes.

Material required: None.

Special tools required: Navy model OJ impedance bridge.

Equipments affected: DAS-4 serial no. 1-508 and 512-516, 519-526, 528, 529, 531, 536, 543, 545, 548, 550, 551, 556, 562, 564, 570, 577 and 585. (*Only if trouble encountered.*) (Others corrected at factory).

In order to provide a greater range of DRIFT control at extremely low temperatures, less than 0° C. (32° F.), L101 was reduced from 55 millihenries to 44.5 ±2% millihenries to 100 cycles and the iron core was eliminated in equipments not affected by this field change. L314 in the output of the video amplifier was changed at the same time to keep the two parts interchangeable.

¹No field changes are to be made to equipments on inactive ships

able, since the value of L314 is not critical. Unless a model DAS-4 is operated under extremely low temperature conditions and unless certain components in the oscillator circuit are replaced because of failure, trouble will not be encountered and no change should be made.

If trouble is encountered in stopping the drift of signals, first try the spare crystal and make sure that all circuits are properly aligned, and then as a last resort reduce the inductance of L101 by removing turns, leaving the iron core in place. Measure the inductance with the model OJ impedance bridge if one is available. Otherwise, adjust by timing the drift of actual loran signals. At normal room temperatures the DRIFT control should vary the crystal frequency at least 250 parts per million when in the extreme clockwise or counterclockwise positions. This means that a loran signal should drift 10,000 microseconds in less than 40 seconds when the DRIFT control is in its extreme position. This amount of drift control at normal room temperatures will allow full correction for crystal oscillator drift at temperature extremes.

If the equipment has been changed at the factory, or if this field change is made, the instruction book should be corrected in the following places:

Page 4-4—Fig. 4-4 change L101.

Page 6-23—If fixed at factory change number of turns to "approximately 2,408 and delete reference to iron core and change inductance to 46.7 mh. $\pm 2\%$ in air (can removed) and 44.5 mh. in can. If coil modified in field, change inductance only.

Page 7-17—(and loose drawing) change L413 to delete iron core (only if fixed at factory).

Page 7-18—(and loose drawing) change L101.

NAVY FIELD CHANGE NO. 4—CHANGE SLOW SWEEP CIRCUIT RESISTOR R269

Purpose: To produce a clearer station selector "test" pattern by reducing the slow sweep retrace time.

Material required: One 270-ohm $\pm 10\%$ 1/2-watt carbon resistor, Navy type RC20BE271K.

Equipments affected: DAS-4 serial numbers 1-585 (only if trouble is encountered). (Other equipment corrected at factory.)

Some trouble has been experienced in making the right number of dots appear in the first column of the test pattern. On station selector position ZERO there should be eight clear dots. If the top dot is not clear, making this field change will help this situation. The change consists merely of changing R269 to 270 ohms.

If the equipment has been changed at the factory, or if this field change is made, change the instruction book (SHIPS 322) as follows:

Page 4-11—Figure 4-19 change R269 to 270 ohms.

Page 6-46—change R269 to 270 ohms, change Navy type no. to RC20BE271K, change mfgr dwg no. and part no. to 30.684, delete asterisks in tender and stock spare parts columns and add 1A-3, 1A-5. Delete resistor R323 from "all symbol designations involved."

Page 6-49—under R323 delete reference to R269 and change other columns to make similar to old R269 listing.

Page 7-19 (and loose drawing)—change value of R269 to 270 ohms.

NAVY FIELD CHANGE NO. 5—CHANGE FEEDBACK CAPACITORS C220

Purpose: To provide a better range of adjustment for station selection adjustment number 7.

Material required: One 130-micromicrofarad $\pm 5\%$ mica capacitor Navy type number CM-20C131J. (Available in spare parts as C219—before field change number 2.)

Equipments affected: DAS-4 serial numbers 1-585 (only if trouble is encountered) (other equipments corrected at factory).

This change should be made only if trouble is encountered in making the correct adjustment. In that case change C220 from 150 to 130 micromicrofarads, and correct the instruction book as follows:

Page 4-9—Fig. 4-16 change value of C220.

Page 6-11—delete reference to C164 in description column of C220 and add "Ca-

pacitor fixed mica 130 mmfd. $\pm 5\%$ 500 v; add Navy type No. CM20C131J and mfr. part No. 15.296. Under spare parts insert 2-1, 1A-1, 1A-1 in columns from left to right add C220 in "all symbol designations involved" and .15 under invoice price.

Page 6-6—under C164 delete C220 in all symbol designations involved.

Page 7-19 (and loose drawing)—change value of C220.—11/1/45

NAVY FIELD CHANGES¹ FOR MODELS DAS AND DAS-2

NAVY FIELD CHANGE NO. 1—RELOCATE STATION SELECTOR TRIMMERS

Purpose: To provide better access for adjustment.

Material required: Kit for model DAS field change no. 1.

Equipments affected: DAS serial no. 1-5. (Others changed at factory.) Instructions are furnished with kit and in SHIPS 225A, section V.

NAVY FIELD CHANGE NO. 2A—CHANGE TIME CORRECTOR CIRCUIT

Purpose: To provide less critical adjustment at the circuit.

Material required: None.

Equipments affected: DAS serial nos. 1-106. (Others changed at factory.)

Instructions for the change are furnished in SHIPS 225A section V as "change 2". (Also published as Group 1A change in Supplement E to preliminary instruction book.)

NAVY CHANGE NO. 2B—INCREASE SLOW SWEEP LENGTH

Purpose: To make the traces on the fast sweeps longer, if they tend to be too short.

Material required: 3 feet of insulated hook-up wire.

Equipments affected: DAS serial no. 1-106 (only if trouble is encountered).

This change was published as Group 1-B change in Supplement E to the preliminary in-

struction book for DAS/DAS-2, but was left out of the final instruction book SHIPS 225A. The circuit diagrams in SHIPS 225A show the circuits after the change. Detailed instructions for the change follow.

(1) Remove the indicator unit from the cabinet and place it upside down on a table or on top of the cabinet. Remove the bottom plate from the chassis.

(2) Face the rear of the unit and locate terminal board TB107. This terminal board is normally above the rear deck of the unit, and may now be seen directly under the socket for the cathode-ray-tube.

(3) Still facing the rear of the unit, count over to the fourth terminal from your left on TB107. This should be labeled C175. Directly behind C175 (toward the front of the indicator) is R272. It may be difficult to see the label for this resistor, but it is the 3.9-megohm resistor between the fourth pair of terminals from your left in the back row.

(4) From the end of R272 nearest to you a lead runs to pin no. 3 of X114. This is the 300-volt supply. Unsolder the lead from the terminal of R272 and solder it to the terminal of R273 farthest from you. R273 is in the front row on the terminal board, and to the right of C175. The proper terminal is the one which is also connected to the resistor R271.

(5) Loosen the six screws holding the terminal board to the chassis, and raise it enough to see the underside. On the underside is a jumper between the terminal of R272 nearest to you, and the terminal of R273 farthest away. Cut the jumper at both ends and remove it. Replace the terminal board.

(6) Cut an insulated piece of wire about three feet long, and solder one end to the terminal of R272 where the lead was removed in step (4).

(7) Lace the other end of the new lead through the cabled leads on your left, up the side of the rear panel to the grommet through the main chassis. This grommet is directly behind the trace separation potentiometer R148. Draw the lead through the grommet, and along

¹No field changes are to be made to equipments on inactive ships.

beside the wires on your extreme left, toward the front panel of the unit.

(8) Locate R198 and R199 on terminal board TB104. As you face the rear of the unit, these resistors are between the seventh and eighth pairs of terminals from the front panel, on the terminal board on your extreme left. Bring the end of the new lead up to these resistors and connect to either one of the top two terminals. These two terminals are the ones which are tied together by a jumper.

**NAVY FIELD CHANGE NO. 3—CHANGE DAS TO DAS-a
(CHANGE PULSE RATE AND IMPROVE CATHODE-RAY-TUBE FOCUS)**

Purpose: (1) to add PRR switch to allow reception of stations with both H ($33\frac{1}{3}$ per sec.) and L (25 per sec.) basic pulse recurrence rates.

(2) to improve cathode-ray-tube focus.

Material required: Kit model for DAS field change no. 3.

Equipments affected: All DAS (Serial no. 1-200).

Instructions for making change are included with kit and also in section V of SHIPS 225A. In addition to the model letter change, the receiver-indicator unit type number is changed from CG-46210 to CG-46210A.

NAVY FIELD CHANGE NO. 4—REMOVE FILAMENT GROUND IN INDICATOR

Purpose: To reduce signal pulse flutter by removing a-c ground currents from gain balance voltage.

Material required: None.

Equipments affected: DAS serial nos. 1-200, DAS-2 serial nos. 201-375 (others fixed at factory).

Instructions for making the change are contained in SHIPS 225A, section V. (Also published as Group II change in Supplement E to the preliminary instruction book.)

NAVY FIELD CHANGE NO. 5—IMPROVE BALANCE GAIN CONTROL CIRCUITS

Purpose: To increase the range of the amplitude balance control and decrease distortion of the signals.

Material required: Kit for DAS/DAS-2 field change nos. 5 and 6. (Change no. 5 only may also be made from the equipment spare parts.)

Equipments affected: DAS serial nos. 1-200; DAS-2 serial nos. 201-408, except 405 and 406. (Other changed at factory.)

Instructions for making the change are furnished with the kit and also in SHIPS 225A, section V. (Also published as Group III change in Supplement E to the preliminary instruction book.)

NAVY FIELD CHANGE NO. 6—CHANGE GAIN AND FINE DELAYS CONTROLS

Purpose: To obtain smoother control action.

Material required: Kit for DAS/DAS-2 field changes no. 5 and 6.

Equipments affected: DAS serial nos. 1-200; DAS-2 serial nos. 201-580. (Others changed at factory.)

Instructions for making the change are included in the kit and also in SHIPS 225A. (Also published partially as Group IV change in Supplement E to the preliminary instruction book.) The diagrams and parts list in SHIPS 225A include the change, but the following corrections are required in the parts lists:

Page 6-21—R214 receiver gain control, *potentiometer wire-wound* 2000-ohms $\pm 10\%$ 4 w., *non-linear taper* with fastest resistance change near counterclockwise end. Navy type no. 632028-10.

Page 6-28—R338 fine delay control potentiometer, carbon 10,000-ohm $\pm 10\%$ $\frac{1}{2}$ -watt. Navy type no. 632029-10.

NAVY FIELD CHANGE NO. 7—ADD RESISTOR R285 (NO KIT)

Purpose: To provide a better range of control for the fourth counter adjustments C4 (or C4A) and C4B.

Material required: One 3900-ohm $\pm 5\%$ 1-watt composition resistor (available in spare parts as replacement for R190).

Equipments affected: DAS: serial nos. 1-200; DAS-2; serial nos. 200-770. (Others changed at factory).

Instructions for making the change are contained in the final instruction book for models DAS/DAS-2 (SHIPS 225A), section V.

NAVY FIELD CHANGE NO. 8—ADJUST B+ TO 280 VOLTS INSTEAD OF 300

Purpose: To prevent interaction of AMPL BALANCE and FINE DELAY controls, and to reduce horizontal trace jitter.

Material required: None.

Equipments affected: All DAS and DAS-2.

Faulty adjustment of the voltage regulator circuits can cause several undesirable operating conditions. This is especially true after field change no. 5 has been made. The undesirable operating conditions are:

(1) Introduction of a slight horizontal jitter on the lower trace on sweeps 4 and 5.

(2) Variation in position of the markers on the lower trace on sweep 4 and 5, by movement of the balance control and to a lesser extent the gain control.

The variation in the position of the markers on the lower trace and consequent change in the reading, as mentioned above, will not cause an error in the reading provided the gain and balance controls are not moved to change the amount of shift after signals have been matched but may cause errors in using homing technique if not carefully watched. Therefore, operators should be instructed:

(1) To get in the habit of not changing the gain and balance controls after matching signals and before reading, and to carefully check readings when homing.

(2) To check for movement of the markers on the lower trace of sweep speed 4 with variation in the position of the gain and balance controls, and to report this to proper maintenance men for correction at an early opportunity. However, note that even with this movement the equipment is entirely usable.

The faulty performance mentioned above can be minimized by adjustment of the voltage regulator (R309) to produce a regulated B+ voltage of 280 volts rather than 300 volts, and by checking that the voltage regulator is actually

operating. Make a note on page 5-3 of SHIPS 225A.

NAVY FIELD CHANGE NO. 9—CHANGE DAS-a TO DAS-b, DAS-2 TO DAS-2b (MODIFY COILS FOR 4 MEDIUM FREQUENCY CHANNELS)

Purpose: To make channels 3 and 4 cover the same tuning range as channels 1 and 2 (1.7 to 2.0 mc.).

Material required: Kit for DAS/DAS-2 field change no. 9.

Equipments affected: DAS: all; DAS-2: all.

Instructions for making the change are included with the kit. After the change the channels are to be tuned as follows:

- (1)—1950 kc.
- (2)—1850 kc.
- (3)—1900 kc.
- (4)—1750 kc.

In addition to the model letter changes, the receiver-indicator type number is changed from CG-46210A to CG-46210B, and for DAS-2 only the receiver unit type number is also changed from CG-46244 to CH-46244A.

NAVY FIELD CHANGE NO. 10—ADD TWO MICROSECOND MARKERS FOR MONITORING

Purpose: To slightly increase the accuracy with which time-difference readings may be interpolated by providing two-microsecond markers.

Material required: Kit for field change no. 10.

Equipments affected: DAS and DAS-2 used for monitoring loran transmissions. *not for general shipboard use.*

The relative complexity of this field change makes it unsuitable for general use. Therefore it is restricted to use at monitoring stations, where the highest possible degree of accuracy is desired. Complete instructions for making the change are furnished with the kit. After this change the following changes in model designations and type designations are made:

(1) DAS-a (DAS with PRR switch) becomes DAS-aM and receiver-indicator CG-46210-A becomes CG-46210-C.

(2) DAS-b (DAS-a with 4 medium frequency channels) becomes DAS-bM and re-

ceiver-indicator CG-46210-B becomes CG-46210-D.

(3) DAS-2 becomes DAS-2M, CG-46210-A becomes CG-46210-C, and indicator CG-55147 becomes CG-55147-A.

(4) DAS-2b (DAS-2 with 4 medium frequency channels) becomes DAS-2bM, CG-46210-B becomes CG-46210-D, and CG-55147 becomes CG-55147-A.

NAVY FIELD CHANGE NO. 11—CHANGE AMPL. BALANCE TO R-F AMPLIFIER

(To be published shortly.)—11/1/45

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→ ADJUSTMENT OF DRIVE MECHANISM FOR OSC. FREQUENCY CONTROL KNOB OF DAS SERIES EQUIPMENT

Slipping, excessive backlash or other erratic action of the drive mechanism for the OSC. FREQUENCY control knob can often be cured

by loosening the tangential screw in the split collar, and then turning either of the two circular end pieces which are threaded into the collar. This changes the pressure on the ball-bearings of the planetary drive in the mechanism. A notch is provided on the end pieces for a spanner wrench, but sufficient torque can be obtained from the point of a screw driver inserted in the notch. In models DAS and DAS-2, the adjustment can be most readily made by removal of the knob and dial of the control. Models DAS-1 and DAS-3 require loosening the front panel and removal of the mechanism for adjustment. In extreme cases the mechanism can be readily disassembled for cleaning by unscrewing either of the threaded end pieces. After adjustment, the tangential screw in the split collar should be tightened to hold the adjustment. 3/1/46 ←

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MODEL DAS SERIES TROUBLE SHOOTING NOTES

DIFFICULTY ENCOUNTERED	CAUSE AND REMEDY
LRN-1A.—Indicator unit. Too many pedestals appeared. Five on each trace.	Condenser C-97 . . . was shorted . . . Short would not show up until 150 volts were applied across condenser. Replacement was made with an exact duplicate found in SL radar spares.—U. S. S. <i>Austin</i>
LRN-1A.—Indicator. No pedestal on either trace.	Condenser C-97 was later found to have over 800 mmfd. capacitance from either condenser terminal to its case. Capacity bridge tests showed 1.0 mfd. at 600 volts, and negligible leakage, but it would not operate in this circuit. Replacement of this condenser corrected trouble.—U. S. S. <i>Austin</i>
LRN-1A.—Indicator. Trace disrupted. Also previously, signals interchanged on traces, jumping back and forth.	Due to arc in potentiometer R-13. As new part was not available, the arm was filed off a little at the point where arc was occurring. This did not prevent arcing, but with careful adjustment of the counters it was possible to set this adjustment at a point where the arc would not occur. Replacement will be made whenever a spare can be obtained as the adjustment is now set right at the edge of the place at which arcing occurs.—U. S. S. <i>Austin</i>
LRN-1.—Indication changed when equipment was jarred.	Found oscillator coil for band 1 loose in mounting. Normal operation restored when tightened.— <i>Coast Guard Unit #21, 1st N. D.</i>
Crystal Y-1 oscillator at wrong frequency or not oscillating at all. By removing crystal, signals can be stopped momentarily. With crystal in place, signals cannot be stopped.	Usually due to crystal slipping out of place in holder. Can be repaired by disassembly of holder, cleaning crystal and holder with carbon tetrachloride and reassembly.—U. S. S. <i>Kirkpatrick</i>
"500" markers varied in amplitude.	C-171 is mounted on a panel insulating it from ground. A large washer on a bolt holding the insulating panel in place made intermittent contact with metal case of the capacitor. Cured by using smaller washer.— <i>Radio Lab., Boston Navy Yard</i>
DAS-1A.—Frequent blowing of fuse for no apparent reason.	Finally traced to insulation breakdown. The lead from terminal 17 on power transformer was run too close to terminal #14. The insulation on the wire occasionally broke down, causing fuse to blow.—U. S. S. <i>Bayfield</i>
DAS-3.—Equipment inoperative.	Found that nameplate screw had shorted the wire behind the nameplate.—U. S. S. <i>E. G. Chase (DE-16)</i>
Oscillation in receiver.	Found wave traps L5, L6, and L15 improperly adjusted.—U. S. S. <i>Raton</i>
DAS-1.—Very erratic operation of V-12 delay multivibrator, giving sudden jumps.	By testing with a vacuum-tube-voltmeter, it was discovered that pin #1 of V-12 tended to go positive when the delay jumped. Found C-40 to have intermittent leakage. Replaced.—U. S. S. <i>Cushing (DD-797)</i>

NOTE: LRN-1, LRN-1A, DAS-1, DAS-3, and DAS-4 have generally similar circuits and symbols. Add 100 to LRN-1, LRN-1A, and DAS-1 indicator symbols to get corresponding DAS-3 and DAS-4 symbols. Add 300 to LRN-1, LRN-1A, and DAS-1 receiver symbols to get corresponding DAS-3 and DAS-4 symbols. DAS and DAS-2 have identical circuits and symbols (after field changes).

DIFFICULTY ENCOUNTERED	CAUSE AND REMEDY
DAS-1.—Erratic operation of V-14 coarse delay circuit.	Found C-61 to have high resistance leakage. Replaced.—U. S. S. <i>Cushing</i> (DD-797)
DAS-3.—Sweep wavy—signals intermittent, OK when received but would stop and start when equipment was jarred.	Trouble traced to third i-f coil. Replaced but still bad trace. Finally found to be due to the calibration jack failing to short when plug was removed due to bent jack springs.—U. S. S. <i>Windsor</i> (APA-55)
DAS-3.—Intermittent operation of gear.	Found to be caused by defect in the mixer section of the channel switch S-301B and S-301E. The plating had worn off to make an intermittent short circuit between contacts. Cured by cleaning the gear with compressed air.— <i>RMO, NYBOS</i>
DAS-1.—Unable to focus image on scope.	Found that R-132 had increased in value considerably.—U. S. S. <i>Montpelier</i> (CL-57)
DAS-2.—Delay control did not work with pedestals; sweeps distorted. No fast sweep in #4 and #5 positions.	This was found to be caused by the arm of S-103C shorting to the arm of S-103D, thus overloading and locking the pedestal generator circuit.— <i>U. S. C. G. Unit #207</i>
→ DAS.—Signals jumped or drifted suddenly on fast sweeps.	Contacts of switch S-101A and S-101B had worn, giving light and intermittent connection.— <i>U. S. C. G. Unit #207</i>
DAS-3.—Coarse delay control inoperative due to binding of shaft and freezing of control.	Found to be due to oil or grease on the bakelite shaft causing distortion and binding of the shaft. Repaired by sanding down the shaft.—U. S. S. <i>Roe</i> (DD-418)
LRN-1A.—Unable to get proper delay on B pedestal.	Found resistors changed values as follows: R-61 increased from 22K to 30K, R-75 increased from 100K to 300K. Replaced.—U. S. S. <i>Gillette</i> (DE-681) ←

NOTE: LRN-1, LRN-1A, DAS-1, DAS-3, and DAS-4 have generally similar circuits and symbols. Add 100 to LRN-1, LRN-1A, and DAS-1 indicator symbols to get corresponding DAS-3 and DAS-4 symbols. Add 300 to LRN-1, LRN-1A, and DAS-1 receiver symbols to get corresponding DAS-3 and DAS-4 symbols. DAS and DAS-2 have identical circuits and symbols (after field changes).

DIFFICULTY ENCOUNTERED	CAUSE AND REMEDY
DAS-3.—No 10-microsecond markers.	Defective V-116, a 6SL7. Replaced.— <i>Ind. Com. USNRB</i>
DAS-4.—On stations 5, 6, and 7 the double trace was lost.	"Q" slightly off adjustment.— <i>Ind. Com. USNRB</i>
DAS-4.—Channels 1 and 2 very weak.	Antenna coils for channels 1 and 2 burned out. These were rewound and replaced, there being no spares available.— <i>Ind. Com. USNRB</i>
DAS-3.—No gain and no grass.	Rectifier tube V-309, a 5Y3G, burned out.— <i>Ind. Com. USNRB</i>
DAS-3.—Some grass, but no signals.	Detector-oscillator V-302, a 6AC7, weak.— <i>Ind. Com. USNRB</i>
DAS-3.—Upper pedestal flickers when COURSE DELAY is turned toward maximum, station selector is on 4, 5, 6, or 7, and PRR is on "H".	Replaced the pedestal generator V-119, a 6SN7.— <i>Ind. Com. USNRB</i>
DAS-3.—Loss of one trace on scope.	Found feedback capacitors 4 and 5 shorted.— <i>Ind. Com. USNRB</i>
DAS-3.—No focus control.	Potentiometer shaft severed. Replaced R-243 and restored operation to normal.— <i>Ind. Com. USNRB</i>
DAS-1.—Intermittent signals.	Found an open circuit in interconnecting cable.— <i>Ind. Com. USNRB</i>
DAS-3.—No high pulse recurrent rate.	S-108 shorted.— <i>Ind. Com. USNRB</i>
DAS-3.—Fuse blew whenever indicator was jarred.	Spaghetti on wire from R-184 to R-186 had worn through and was shorting out on case.— <i>Ind. Com. USNRB</i> ←

NOTE: LRN-1, LRN-1A, DAS-1, DAS-3, and DAS-4 have generally similar circuits and symbols. Add 100 to LRN-1, LRN-1A, and DAS-1 indicator symbols to get corresponding DAS-3 and DAS-4 symbols. Add 300 to LRN-1, LRN-1A, and DAS-1 receiver symbols to get corresponding DAS-3 and DAS-4 symbols. DAS and DAS-2 have identical circuits and symbols (after field changes).

**EFFECT OF DEMOUNTABLE WHIP ANTENNAS
ON DAU OPERATION**

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See the article entitled "Effect of Demountable Whip Antennas on DAQ and DAU Operation," page DAK/DAQ:1.

**DAU DIRECTION-FINDING
EQUIPMENT****FIELD CHANGE NO. 1****INSTALLATION OF IMPROVED LOOP ANTENNA**

See the article entitled "DAQ/DAU Direction-Finding Equipment—Field Change No. 1—Installation of Improved Loop Antenna" on page DAK/DAQ:2

1/1/46

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MODEL DAU SERIES TROUBLE SHOOTING NOTES**DIFFICULTY ENCOUNTERED****CAUSE AND REMEDY**

On SCAN signals were unstable and impossible to read.

Tests showed contactor ring in type CFT-55146 automatic bearing indicator "bouncing" excessively in mount. Installed new ring and operation again became normal.—U. S. S. *Bostwick*

Arcing and sparking at brushes in ABI unit making bearings impossible.

Traced to small piece of copper wire which fell behind slip ring and caused a ground. Cleared trouble by blowing out ABI unit with dry compressed air.—U. S. S. *Otter (DE-210)*

→ **DBM RADAR DIRECTION-FINDING
EQUIPMENT**

FIELD CHANGE NO. 1

CHANGING WIRING OF S-107

Equipments affected.—Model DBM-1 radar direction-finding equipment, serials no. 1 through no. 100.

Purpose.—To eliminate oscillation of the true bearing dial when the selector switch is in the relative bearing position, and to standardize zeroing connections on the 5CT selsyn, G-101.

General.—These kits, each containing the necessary material and detailed instructions, will be shipped to maintenance activities. A $\frac{3}{8}$ " socket wrench must be provided by the activity making the change.

Vessels should contact an Electronics Officer for the kit. The change is within the scope of the ship's force and should be accomplished at the earliest opportunity.

The modification instructions should be kept with the instruction book of the modified equipment. The instruction book NAVSHIPS 900,587 should be corrected accordingly. A record of completion of this change should be made on the "Radar Log of Modifications and Changes". Completion of this change should be reported on the NBS-383 card. 4/1/46

**DBM RADAR DIRECTION-FINDING
EQUIPMENT**

FIELD CHANGE NO. 2

CHANGING SCANNING CAPACITOR COUPLING

Equipments affected.—Model DBM-1 radar direction-finding equipment, serials no. 1 through no. 100.

Purpose.—To relieve the loading on the selsyn, B-101, by eliminating the binding in the coupling to the scanning capacitor, C-142.

General.—This change is being made to eliminate binding in the coupling, and so reduce mechanical loading on the selsyn B-101. Any loading on the selsyn B-101 causes a lag which introduces bearing error. The new type coupling reduces the mechanical load on selsyn B-101 to a minimum, and so improves bearing accuracy.

These kits, each containing the material and detailed instructions will be shipped to maintenance activities. Vessels should contact an

Electronics Officer for the kit. The change is within the scope of the ship's force and should be accomplished at the earliest opportunity.

The modification instructions should be kept with the instruction book of the modified equipment. A record of completion of this change should be made on the "Radar Log of Modifications and Changes". Completion of this change should be reported on the NBS-383 card. 4/1/46

**DBM RADAR DIRECTION-FINDING
EQUIPMENT**

FIELD CHANGE NO. 3

CHANGING BULLET IN ANTENNA R-F ROTARY JOINT

Equipments affected.—Model DBM-1 radar direction-finding equipment, serials no. 1 through no. 252.

Purpose.—To eliminate noise and signal attenuation caused by uneven wear in the rotary joint of the antenna.

General.—The steel pin in the rotary joint of the antenna is in contact with a beryllium copper cup and the relative hardness of the two metals is so close that they wear unevenly. The surface contact of the pin and cup is reduced by the uneven wear, causing considerable noise in the receivers. Replacing the pin with a silver plated, soft brass pin will reduce the tendency toward uneven wearing of the two parts.

These kits, each containing 6 rotary joint bullet pins and detailed replacement instructions, will be shipped to maintenance activities.

Note that before reassembly after the new pins are installed the rotating joint cavity should be filled with grease. Lubrication instructions are stamped on the base plate of the right angle connector.

Vessels should contact an Electronics Officer for this kit. This change is within the scope of the ship's force and should be accomplished at the earliest opportunity.

The modification instructions should be kept with the instruction book of the modified equipment. The parts lists should be corrected accordingly. A record of completion of this change should be made on the "Radar Log of Modifications and Changes". Completion of this change should be reported on the NBS-383 card. 4/1/46

SECTION 4. DIRECTION-FINDING EQUIPMENT

REDUCTION OF OSCILLATOR RADIATION IN MODEL DP EQUIPMENTS

The Radio and Sound Laboratory, San Diego, has found that substantial reduction in radiation from the local oscillator in the model DP series direction finder may be accomplished by this procedure: Tighten the bolts which secure the tuning condenser frame to the chassis. Make sure that lock washers are used under each nut. Install a short heavy copper braid bond from approximately the center of the tuning condenser casting to the chassis. By these means the rotor of the tuning condenser is made more nearly at chassis potential.

The DP series direction finders has been tested and found to be within the safety limits prescribed by the Chief of Naval Operations, provided the equipment is left in its original condition and the tuning condenser is grounded as above.

FAULTY SHIELD CONTINUITY IN MODEL DP EQUIPMENTS

The following paragraph is quoted from a laboratory report following an investigation of the installation and performance of a model DP series equipment in a heavy cruiser.

“Faulty shield continuity was observed at the plug connection of the antenna and loop circuits on the receiver top. It was observed that the r-f input plug assembly consists of components assembled after painting, and a resistance of about ten ohms was found between the plug assembly plate and its screw connection to the receiver case. This is a common fault in these equipments and is capable of causing serious error. It appears that insufficient attention has been paid to such details in the manufacture of these equipments. The effect was made more noticeable by the absence of a ground on the receiver case, although such is required by the installation instructions.”

All model DP series installations should be checked to determine if the above-mentioned condition exists and, if so, proper corrective action should be taken.

MODEL DP SERIES TROUBLE SHOOTING NOTES

DIFFICULTY ENCOUNTERED	CAUSE AND REMEDY
"Frozen" tuning dial.	Smoothed burred shaft between dial and ganged condenser with sandpaper and file.—U. S. S. <i>Beale</i>
Loop drive cable slipped off drums.	Opened trunk, replaced cable and tightened turnbuckles. Secured a stop bolt through handwheel so drums can only be rotated through 360°.—U. S. S. <i>Ranger</i>
Fuse burning out whenever ship's guns were fired.	The cause of this was eventually traced to one of the line filter chokes on the primary side of the power transformer. Upon examination of the choke, it was found that the nut and washer had come off the adjusting screw in the powdered iron core. This nut and washer were shorting from one of the a-c lead lugs to the coil mounting stud. These nuts and washers cannot be seen without removing the coil mounting from the choke coil.—U. S. S. <i>Omaha</i>
Output section inoperative.	Tests showed equipment to be operating properly up to transformer. No output beyond that point. Output transformer T-104 had a shorted primary winding. Replaced.—U. S. S. <i>Baltimore</i>
Poor or uncertain bearings, noisy operation.	Check grounding between receiver case and loop connection plug. Often paint will be found on the grounding screw. Clean contact surfaces with file or sandpaper and retighten grounding screw. Check with low range ohmmeter for continuity.
→ DP-7.—Weak signals.	Found antenna banana plugs worked loose due to gunfire. Repaired by tightening up connections.—U. S. S. <i>Portland (CA-33)</i>
DP-12.—Intermittent operation due to loss of a-c power.	Found "rosin" solder joint in fuse holder.—U. S. S. <i>Barrier (AM-150)</i>

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