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**TECHNICAL MANUAL**

for use of

**AN/FGQ-1 with AN/UGC-6A and TT-47E/UG**

**EQUIPPED WITH AGH FUNCTION BOX**

Prepared by

**U.S. NAVAL SECURITY ENGINEERING FACILITY**

Washington 25, D.C.

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For

**THE DEPARTMENT OF THE NAVY  
BUREAU OF SHIPS**

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LIST OF EFFECTIVE PAGES

PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
Title Page ii to v 1-0 to 1-1 2-0 to 2-2 3-1 4-0 to 4-2 5-0	Original Original Original Original Original Original		

**DEPARTMENT OF THE NAVY  
Bureau of Ships  
Washington 25, D. C.**

**From: Chief, Bureau of Ships**

**To: All Activities concerned with the Installation, Operation  
and Maintenance of the Subject Equipment**

**Subj: Technical Manual for use of AN/FGQ-1 with AN/UGC-6A  
and TT-47E/UG equipped with AGH Function Box.**

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CHANGE NO.	DATE	FIELD CHANGE NO.	SIGNATURE

## TABLE OF CONTENTS

## SECTION 1--GENERAL INFORMATION

Paragraph	Page
1-1. Functional Description	1-0
1-2. Field Changes	1-0
1-3. Material Required	1-0
1-4. Publications Required	1-1

## SECTION 2--INSTALLATION

2-1. Installation Layout	2-0
2-2. Modifications	2-0
a. Modifications Required for all AN/FGQ-1 Repeater Mixer Units	2-0
b. Modifications Required for all New AN/FGQ-1 Installations only	2-0
2-3. Interconnections	2-1

## SECTION 3--OPERATOR'S SECTION

3-1. Functional Operation	3-1
3-2. Operating Procedures	3-1
3-3. Test Procedures	3-1

## SECTION 4--THEORY OF OPERATION

4-1. Technical Information	4-0
4-2. Sequential Selection of a Function	4-0
4-3. Control of AN/FGQ-1	4-1

## SECTION 5--PARTS LIST

5-1. Parts List	5-0
-----------------	-----

## LIST OF ILLUSTRATIONS

## Figure Number

2-1. Interconnecting Block Diagram
2-2. AN/UGC-6 Modification
2-3. AN/UGC-5 and AN/UGC 6 Wiring Diagram (Modified)
2-4. AN/FGQ-1 Wiring Modification for Remote Cipher-Plain Switching
4-1. AN/FGQ-1 Adaptor Assembly Parts

SECTION 1

GENERAL INFORMATION

1-1. FUNCTIONAL DESCRIPTION.

The AN/FGQ-1 Repeater Mixer Unit in conjunction with a cryptographic unit provides a synchronous teletypewriter security system. During intervals between transmissions, electrical noise or other interference on the signal path, causes a loss of synchronization between terminal equipments. The C-2272/UG Control was developed to overcome this deficiency by providing TEXT-CIPHER switching from local or remote stations. However, the C-2272/UG Control is limited in application to the (Teletype Model 15) AN/FGC-9, AN/FGC-10, TT-6/FG, TT-7/FG series of Teletypewriter equipments.

The AN/UGC-5, AN/UGC-6, TT-47( )/UG or the TT-69( )/UG Teletypewriter equipments, when equipped with the AGH Function Box, together with the CE-180044 Modification Kit will provide the TEXT-CIPHER switching function for the AN/FGQ-1 terminal equipments which was previously provided by the C-2272/UG Control Unit. This modification to the AGH Function Box equipped, AN/UGC-5, AN/UGC-6, TT-47( )/UG or the TT-69( )/UG and the AN/FGQ-1 provides a terminal facility which is compatible with a terminal composed of an AN/FGC-9, AN/FGC-10, TT-6/FG or TT-7/FG and AN/FGQ-1 with a C-2272/UG Control Unit.

1-2. FIELD CHANGES.

a. The following Field Changes to the AN/FGQ-1 Repeater Mixer Unit must be completed before this installation is accomplished.

(1) CHANGE NO. 1: CE-10600 (RE-121/UG). See current edition of CSPM-1A or KAG-14/TSEC for Modification No. 1 to AN/FGQ-1 Repeater Mixer Unit.

(2) CHANGE No. 2: Filter modification to PP-748/U Power Supply (K.S. 5988 rectifier). See current edition of CSPM-1A or KAG-14/TSEC for Modification No. 2 to AN/FGQ-1 Repeater Mixer Unit.

(3) CHANGE NO. 3: On-Line protective device. See NAVSHIPS 93522, Technical Manual for C-2192/UG Control, Teletypewriter and CSPM-1, 1-34 Modification No. 10.

1-3. MATERIAL REQUIRED.

a. The following kits, supplied through BuShips, are for adapting AN/FGQ-1 installation for use with the AGH Function Box:

(1) Kit CE-180045 (for converting AN/FGQ-1 installations currently using the C-2272/UG):

- 1 Cable assembly, (W-1)
- 1 Switch assembly, 157095
- 1 Wire, WHITE, 15 inches long AWG #20.

(2) Kit CE-180044 (for new installations only):

- 1 Cable assembly, (W-1)
- 1 Switch assembly, 157095
- 1 Wire, WHITE, 15 inches long, AWG #20
- 1 each, adapter, AN/FGQ-1: receptacle, cable, brackets, dummy plug assembly
- 4 each, #6 self tapping screw for mounting AN/FGQ-1 adaptor assembly
- 4 each, #6 lock washers
- 1 each, lock, CIPHER-LOCAL TEST-TEXT switch.

1-4. PUBLICATIONS REQUIRED.

- a. NAVSHIPS 93534, Technical Manual for AN/UGC-5, AN/UGC-6, AN/UGC-7 and AN/UGC-8 Teletypewriters.
- b. NAVSHIPS 93241, Technical Manual for TT-47( )/UG and TT-69( )/UG Teletypewriters.
- c. TM11-2209, Teletypewriter Set 131B2.

SECTION 2  
INSTALLATION

2-1. INSTALLATION LAYOUT.

Locate the AN/FGQ-1 Repeater Mixer and companion Teletypewriter for maximum operator convenience in available space.

2-2. MODIFICATIONS.

a. MODIFICATIONS REQUIRED FOR ALL AN/FGQ-1 REPEATER MIXER UNITS.

Inspect AN/FGQ-1 and verify completion of Field Changes indicated in Section 1, paragraph 1-2. These Field Changes must be accomplished before proceeding further.

b. MODIFICATIONS REQUIRED FOR ALL NEW AN/FGQ-1 INSTALLATIONS.

**IMPORTANT:** Verify completion of these modifications, (previously effected by Kit CE-180045) in those installations currently using the C-2272/UG. For new installations, proceed as indicated.

- (1) Remove front and rear metal grills from the AN/FGQ-1 table.
- (2) Disconnect and remove the PP-748/U rectifier from the rear of the AN/FGQ-1 table.
- (3) Take the 14 pin AN connector, bracket, dummy plug, and cable (W-1) assembly from Kit CE-180044.
- (4) Place connector assembly directly to the right of the TX relay and centrally locate on the rear panel of the AN/FGQ-1 table.
- (5) Using drilled holes in bracket as a template, mark and center punch four holes to be drilled in AN/FGQ-1 panel. Drill the four holes with a #36 drill.
- (6) Drill one 3/8 inch hole, centrally located, between the four holes just drilled. Remove all burrs.
- (7) Draw the WHITE and WHITE/BLACK leads in cable (W-1) around to the right of bracket. Draw the BROWN and VIOLET leads around to the left of bracket. Tape the ten remaining wires with electrical tape from the connector to a point approximately two inches along the cable, and then draw them through the 3/8 inch hole. With the KEY WAY on the AN connector in the UP position, mount the bracket with four #6 self tapping screws, provided.



NOTE

In the following steps, 8 through 24, the lengths of the wires should be shortened to make a neat installation. Form and lace interconnecting leads to existing cables.

(8) Draw WHITE and WHITE/BLACK leads up through BX connector into power box on right hand side of AN/FGQ-1 table.

(9) Connect WHITE lead to terminal 3 on terminal block.

(10) Connect WHITE/BLACK lead to terminal 4 on terminal block.

(11) Disconnect BLACK lead from terminal 11 on B block.

(12) Splice, solder and tape the VIOLET lead from terminal F on J-1 to BLACK lead just removed.

(13) Connect BROWN lead to terminal 11 on B block.

(14) Connect the ORANGE wire to terminal 1 on C block.

(15) Connect the WHITE/YELLOW wire to terminal 5 on C block.

(16) Disconnect the BROWN wire from terminal 3 on A block.

(17) Splice, solder and tape the YELLOW wire in cable (W-1) to BROWN wire removed from terminal 3.

(18) Connect GREY wire to terminal 3 on A block.

(19) Connect the WHITE/RED wire to bottom terminal 10 of TX relay.

(20) Connect the WHITE/BLUE wire to bottom terminal 11 of TX relay.

(21) Connect the WHITE/BROWN wire to bottom terminal 4 of CP relay.

(22) Connect the WHITE/GREEN wire to bottom terminal 5 of CP relay.

(23) Connect the RED wire to the front terminal of the AC resistor.

(24) Connect the BLACK wire to the front terminal of the AD resistor.

(25) Throw the CIPHER-LOCAL TEST-TEXT switch on the AN/FGQ-1 table to CIPHER position. Remove knob from CIPHER-LOCAL TEST-TEXT switch. Place mounting hole end of switch lock, provided, over switch and secure with knob so that switch is locked in CIPHER position.

2-3. PROCEDURE FOR INTERCONNECTING THE AN/FGQ-1 REPEATER MIXER WITH THE AN/UGC-5, AN/UGC-6, TT-47( )/UG or TT-69( )/UG TELETYPEWRITER.

a. Refer to figure 2-1. Remove plug P-1 from receptacle J-1 and remove the C-2272/UG Control Unit from the AN/FGQ-1 table.

b. Refer to figure 2-2.

(1) Remove the typing unit.

(2) Unsolder the RED and the BLACK wires from the Function Box switch assembly (S-1402) and solder to the terminals of the new switch assembly provided. (See figure 2-2)

(3) Connect the WHITE wire from the installation kit to the remaining terminal of the new switch assembly.

(4) Replace switch assembly 157072 with switch assembly 157095. The mounting screws are to be placed in the 9th and 10th holes from the left end of the function switch mounting (when facing the rear of the typing unit).

(5) Feed the WHITE wire through the plastic sleeving to typing receptacle J-1301 and solder to pin 16.

NOTE

TB-4255 and TB-800, in the AN/UGC-5 and AN/UGC-6 equipment, correspond respectively to TB-702 and TB-1105 in the TT-47( )/UG and TT-69( )/UG equipments.

(6) On terminal board TB-4255 (TB-702) remove the jumper between terminal 33 and 35. Remove and tape WHITE wire on terminal 33.

(7) Remove and tape PURPLE wire from terminal 32 which goes to terminal board TB-800 (TB-1105).

(8) Remove and tape BLUE wire from terminal 32.

c. Run the lugged end of cable assembly (W-1) up through the middle holes in lower and upper shelves of the AN/UGC-6 or AN/UGC-5, and along the shelf under terminal board TB-4255 (TB-702) to terminals 28, 32, and 33. Connect cable (W-1) to terminal board TB-4255 (TB-702) as follows:

(1) BLACK lead to terminal 32.

(2) RED lead to terminal 33.

(3) WHITE lead to terminal 28.

d. Replace typing unit.

e. Connect the plug end P-1 of cable W-1 to receptacle J-1 of the AN/FGQ-1 Repeater Mixer Unit.

SECTION 3

OPERATOR'S SECTION

3-1. FUNCTION OPERATION.

The AGH Function Box permits keyboard control of AN/FGQ-1 CIPHER-TEXT switching. Special code bars contained in the AGH Function Box respond to a sequence of four 'C's' and actuate a switch. This switch, in turn, shifts the AN/FGQ-1 from TEXT to CIPHER condition. Similarly, the Function Box effects CIPHER to PLAIN shift upon receiving four consecutive 'H's'. For detailed theory of operation, refer to Section 4, THEORY OF OPERATION.

3-2. OPERATING PROCEDURES.

Assume the AN/FGQ-1 station to be idle, and in the PLAIN condition. In this state, the TEXT (Red) indicator lamp on the AN/FGQ-1 table and the PLAIN (Red) indicator lamp on the C-2192/UG Control Teletypewriter (protective device) will glow.

It is now desired to send classified traffic over the circuits. To shift the AN/FGQ-1 to CIPHER condition the operator must hold the C-2192/UG Knee Switch depressed and hit the SEND key, the LETTERS key, and four 'C's' in sequence. While the knee switch is depressed, the PLAIN SEND (Amber) lamp on the C-2192/UG Control Unit will glow. After the 4th 'C', both the transmitting and receiving equipments will shift to CIPHER. In the CIPHER condition, the CIPHER indicator lamps on both the AN/FGQ-1 table (Amber or Green) and C-2192/UG (Green) will glow. The operator may now release the knee switch and proceed to transmit his traffic in the normal manner.

After completion of the transmission, the operator enters four 'H's' in sequence. This returns both transmitting and receiving stations to the PLAIN condition.

3-3. TEST PROCEDURES.

a. With the equipment energized and the C-2192/UG Knee Switch held operated, depress the SEND key and the LETTERS key, then operate the letter 'C' four (4) times. The CIPHER indicator (Green) on the C-2192/UG Control Unit glows and the cipher device motor starts running.

b. Release the C-2192/UG Knee Switch. Depress the letter 'H' four (4) times. The TEXT indicator (Red) on the AN/FGQ-1 glows, the TEXT indicator (Red) on the C-2192/UG Control Unit glows and the cipher device motor stops running.

SECTION 4

THEORY OF OPERATION

4-1. TECHNICAL INFORMATION.

a. The Automatic Typewriter with the "/AGH" suffix contains a Function Box which allows the Printer to be used for controlling CIPHER-TEXT switching of AN/FGQ-1 equipment. The Function Box, located directly behind the code bar unit, can be readily removed and replaced. The Function Box has 42 slots, each of which will accommodate a function bar and its associated mechanism. These function bar mechanisms, in conjunction with the code bars, are employed to initiate CIPHER-TEXT switching on the AN/FGQ-1 equipment by means of an electrical switch mounted on the Function Box.

b. The code bars in the Printer contain an identical pattern of notches at the rear. They are moved toward the left in response to a marking impulse and to the right in response to a spacing impulse. The front of the function bars contains a series of tines which are bent toward the left or right according to the marking or spacing pattern of the Baudot code combination represented by the particular function bar. By this arrangement the function bar becomes the variable and the code bars need never be changed. The location of the Function Box in its relation to the code bar assembly is shown in NAVSHIPS Manual 93534, figure 1-5, and figure 1-7.

c. Approximately ten function bar mechanisms are employed to control such normal functions as "Carriage Return", "Line Feed", etc., required in a Page Printer. The remaining 32 slots are available for other purposes. Such an operation performed by the Function Box is described herein.

4-2. SEQUENTIAL SELECTION OF A FUNCTION.

a. Selection of a function is accomplished on a sequential basis by using a sequence of code combinations. In this case, it is desired to perform a particular function, TEXT to CIPHER shift, only upon receipt of four 'C's' in sequence. Similarly, CIPHER to TEXT shift, is desired only upon receipt of four 'H's' in sequence. To perform these special functions, 'C' and 'H' function bar mechanisms must be provided in addition to the mechanisms required for regular functions. Except for a difference in the 'C' and 'H' function levers, the components of the mechanisms are the same. Both the 'C' and 'H' function levers have two additional projections: One for latching each lever, and the other for blocking the following 'C' (or 'H') function bars. Also, a function lever latch is substituted in place of the function lever spring plate.

b. All sequential functions operate in a left to right direction as viewed from the rear of the Printer. Selection of the function on a four 'C' sequence is initiated in the same manner as described in NAVSHIPS 93534 for the selection of line feed. The 'C' code is set up in the code bars, the function bars feel for an opening, and only the first 'C' function bars (there are now four in the Function Box) find an opening in the code bars. The 'C' printing function operates in the regular manner and we are no longer concerned with it. The first 'C' function bar associated with four 'C' sequence, upon entering the code bars, allows its associated function pawl to fall into engagement with the function bar. When the function bar is operated by the bale, the function pawl

actuates the function lever causing this lever to become latched up on its associated latch. When the first 'C' function lever is in its latched position the projection which otherwise locks the second 'C' function bar is out of the way and, upon reception of the second 'C' in the code bars, the second 'C' function bar moves into the code bars and picks up its associated pawl. When the second 'C' function lever is in its latched position the projection which otherwise locks the third 'C' function bar is out of the way and, upon reception of the third 'C' in the code bars, the third 'C' function bar moves into the code bars and picks up its associated pawl. When the third 'C' function lever is in its latched position the projection which otherwise locks the fourth 'C' function bar is out of the way and upon reception of the fourth 'C' in the code bars, the fourth 'C' function bar moves into the code bars and picks up its associated pawl.

c. The operation of the four 'H' sequence is similar to the four 'C' sequence except that after selection of the fourth 'H', the stripper blade moves in a downward direction and engages a projection on the 'C' function lever latches thus unlatching the 'C' function levers. On the return cycle of the 'C' function bars, the 'H' pawls are operated which in turn actuates the 'H' lever and the desired operation is performed. When the stripper blade returns to its upward (normal) position, the 'H' function pawls are stripped off the function bar and the action is completed. Return of the 'H' function lever to normal blocks subsequent operation of the 'H' function bar.

d. In effect, the first function bar mechanism of a sequence opens a gate for the function bar mechanism to the right (as viewed from the rear) for the following cycle only and then immediately closes the gate unless the next function bar takes advantage of the opening. Therefore, unless the sequence is selected in the exact order, the desired operation will not be performed.

#### 4-3. CONTROL OF AN/FGQ-1.

a. LOCAL and CIPHER-PLAIN switching of the AN/FGQ-1 is accomplished by the addition of an electrical switch to the function box. This switch is assembled in a molded plastic block. The switch contains an arm, contacts, and a spring. Electrical contact is completed between the arm and the contacts. Wiring connection is made to the contacts and to the spring.

b. The switch mechanism is controlled by the top of a function lever. Operation of a function lever associated with the switch arm transfers power from one circuit to another. The electrical switch may be locked either closed or opened.

c. When the switch is locked in its operated position it may be unlocked and returned to normal by a sequence of codes. Assume that it is desired to switch the AN/FGQ-1 from PLAIN to CIPHER condition upon reception of a four sequence code consisting of 'C', 'C', 'C', 'C'. Further assume that it is desired to switch the AN/FGQ-1 from CIPHER to PLAIN condition upon reception of 'H', 'H', 'H', 'H'. For this job it is necessary to equip the Function Box with twelve function bar mechanisms and one switch mechanism. Obviously, four function bar mechanisms are required to switch to CIPHER condition. However, for a reason which will be explained later, two sets of 'H' sequence mechanisms must be used to switch to PLAIN condition. These mechanisms must be assembled in the following order (from left to right as viewed from the rear):

<u>Left to Right Order</u>	<u>Slot #</u>	<u>Function Bar Code</u>
1	13	'H'
2	14	'H'
3	15	'H'
4	16	'H'
5	17	'C'
6	18	'C'
7	19	'C'
8	20	'C'
9	21	'H'
10	22	'H'
11	23	'H'
12	24	'H'

d. The switching to CIPHER condition is started by the selection of the first member of the calling sequence. This is the number 17 function bar mechanism which is coded 'C'. Operation of the number 17 mechanism opens the gate for the operation of the number 18 function bar mechanism which is also coded 'C'. Operation of the number 18 mechanism in turn opens the gate for the number 19 function bar mechanism which is also coded 'C'. Operation of the number 19 mechanism opens the gate for the operation of the number 20 function bar mechanism which is also coded 'C'. The switch mechanism is associated with the fourth 'C' function mechanism and when the function lever operates, the switch operates and thus switches the AN/FGQ-1 to CIPHER condition. The latch lever associated with the fourth 'C' function bar mechanism differs in that it is not equipped with an unlatching projection but is equipped instead with a release projection. Absence of the unlatching projection causes the function lever associated with the 'H' function bar to remain latched and consequently the CIPHER remains. The CIPHER condition is changed to PLAIN condition by the four 'H' sequence. This action is initiated by selection of the number 13 and number 21 function bar mechanisms, both of which are coded 'H'. Operation of these mechanisms opens the gate for operation of the number 14 and number 22 function bar mechanisms which are coded 'H', and the gate opening process is repeated for the number 15 and number 23 function bar mechanisms that are coded 'H'. The two function levers (numbers 16 and 24) associated with the fourth 'H' function bar mechanisms differ from any previously described function levers in that they are equipped with extensions for mounting a rod to form a bale between the two levers. This bale is called the latch release bale. The reason for two sets of 'H' mechanisms now becomes apparent. When the two function levers operate in unison, the bale operates the function lever associated with the 'H' function bar mechanism, releases the function lever and shifts the circuit to PLAIN condition.

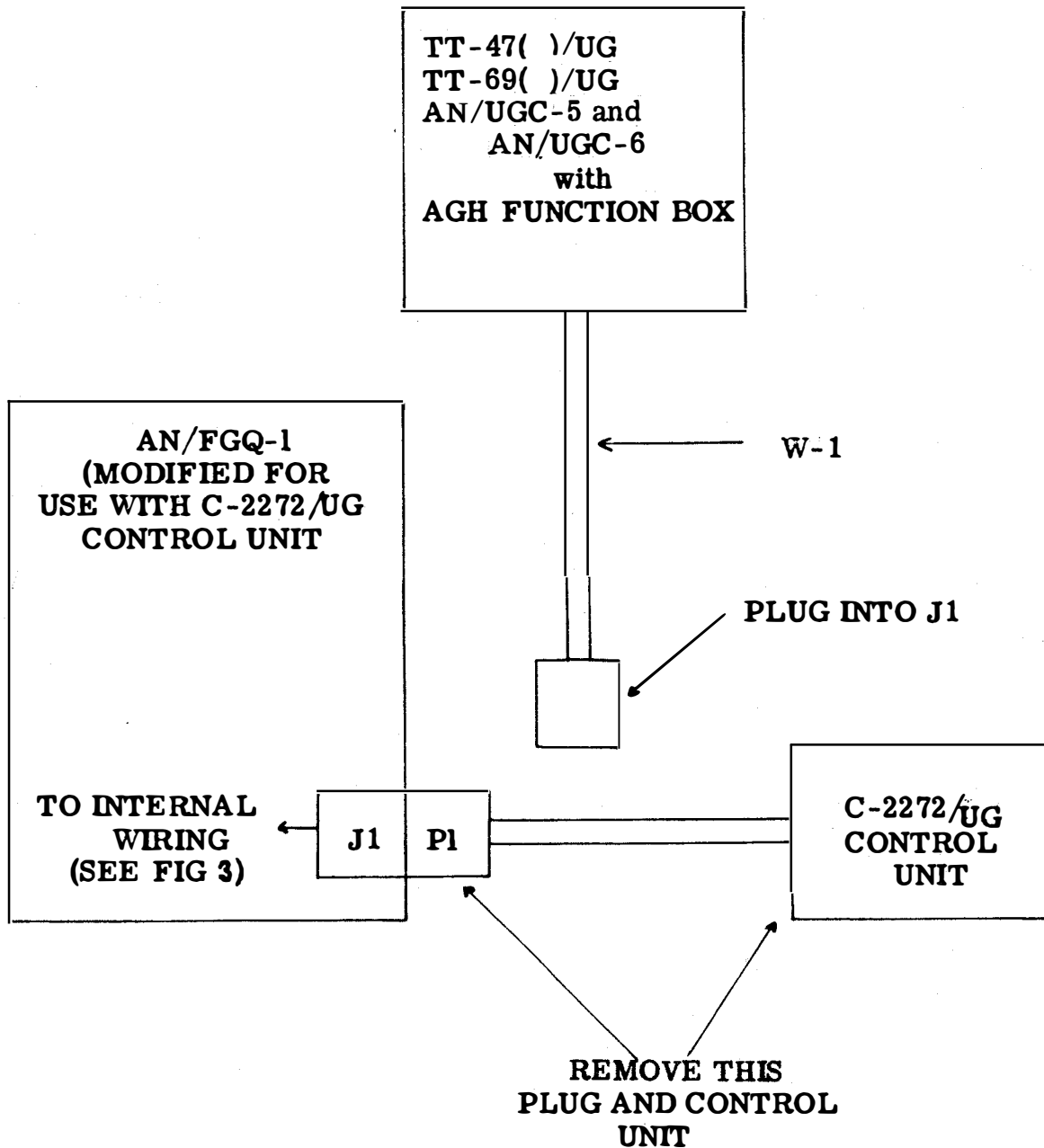
e. Operation of the AN/FGQ-1 is not changed by this modification except for the manner in which CIPHER-PLAIN switching is performed. In this case the manual switch on the front of the AN/FGQ-1 cabinet is locked in the CIPHER position and switching is performed by the function-operated switch on the teletypewriter.

SECTION 5

PARTS LIST

5-1. Parts List.

REF DESIG	FIGURE	NAME OF PART AND DESCRIPTION	FEDERAL STOCK NUMBER	OTHER STOCK NUMBER	QTY REQ.
		Cable Assembly (W-1)			1
H-1	4-1	Cap, Electrical (for receptacle); 7/16" x 1-7/16" Dia	NC5935- 187-4291	Amphenol #9760-20	1
H-2	4-1	Chain, (included with H-1) 4-5/8"			
H-3	4-1	Screw, Machine; slotted pan head; #4-40, 3/8" L	G5305- 043-6640		4
H-4	4-1	Nut, plain, hexagon; #4-40	G5310- 271-4642		4
H-5	4-1	Washer, lock; internal toothed #6	G5310- 527-3290		4
H-6	4-1	Mounting bracket			1
H-7	4-1	Screw, tapping, thread forming slotted round head #6, 3/8" L	G5305- 227-1084		4
H-8	4-1	Washer, lock; internal toothed, #6	G5310- 595-7235		4
	Not Shown	Adapter, cable to connector; 3/4" cable opening	NS5935- 223-0572		1
	Not Shown	Switch lock (cipher-local test- text)			1
J-1	4-1	Connector, receptacle; female 14 contact, 1.344" L x 1-1/2" x 1-1/2" H	NF5935- 149-3237		1
P-1	2-1	Connector, plug, male, 14 contact, 2-3/16" x 1-15/32 Dia	NF-5935- 259-0071		2
S-1	2-2, 2-3	Function Box Switch- Single Pole Double Throw  White wire, AWG #20		TTY NO. 157095	1  12"



INTERCONNECTING  
 BLOCK DIAGRAM  
 FIGURE 2-1



AN/UGC-6 MODIFICATION

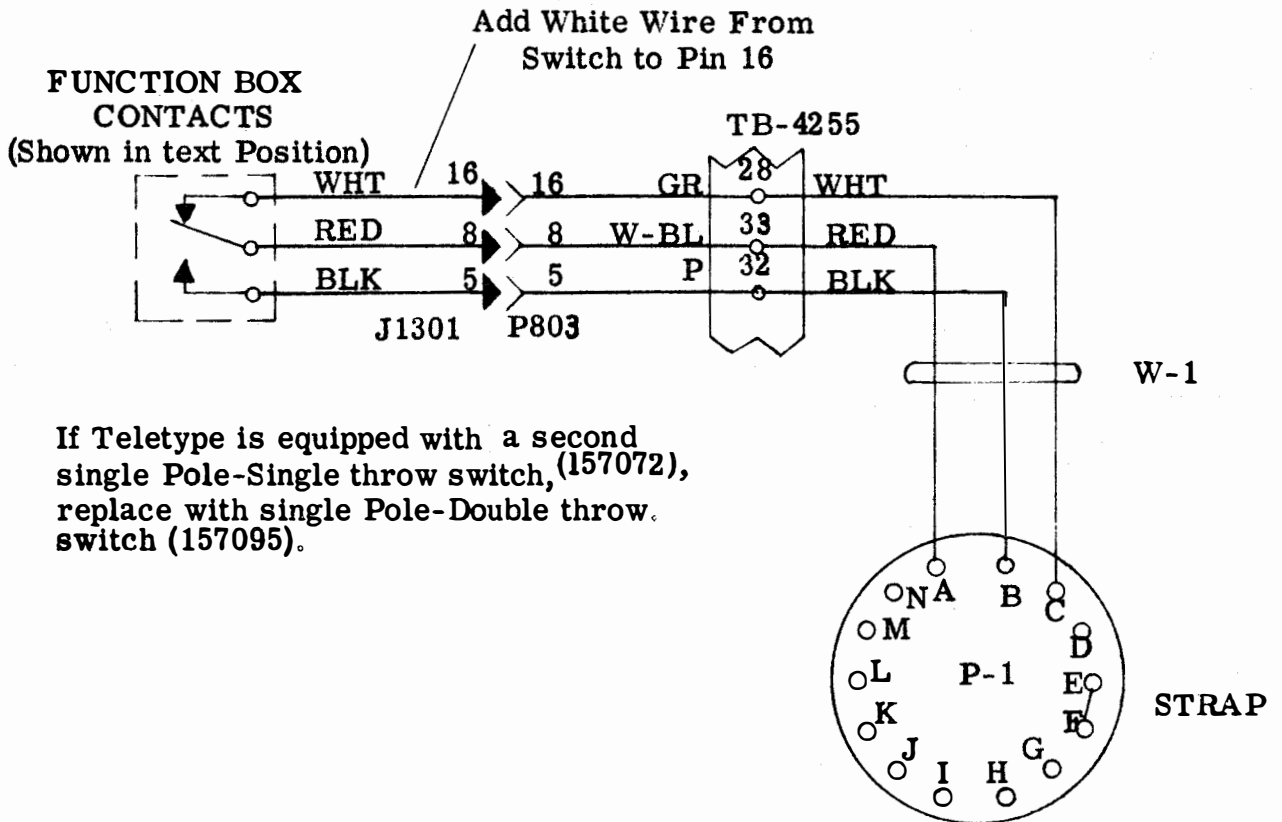
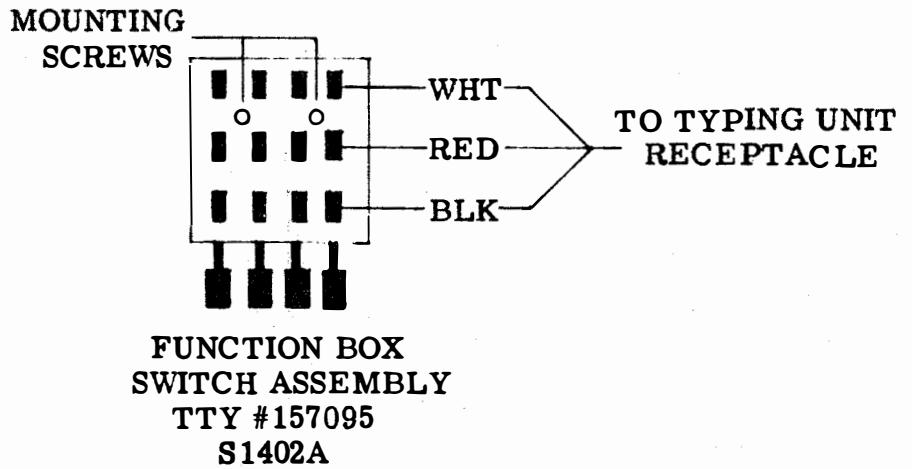


FIGURE 2-2

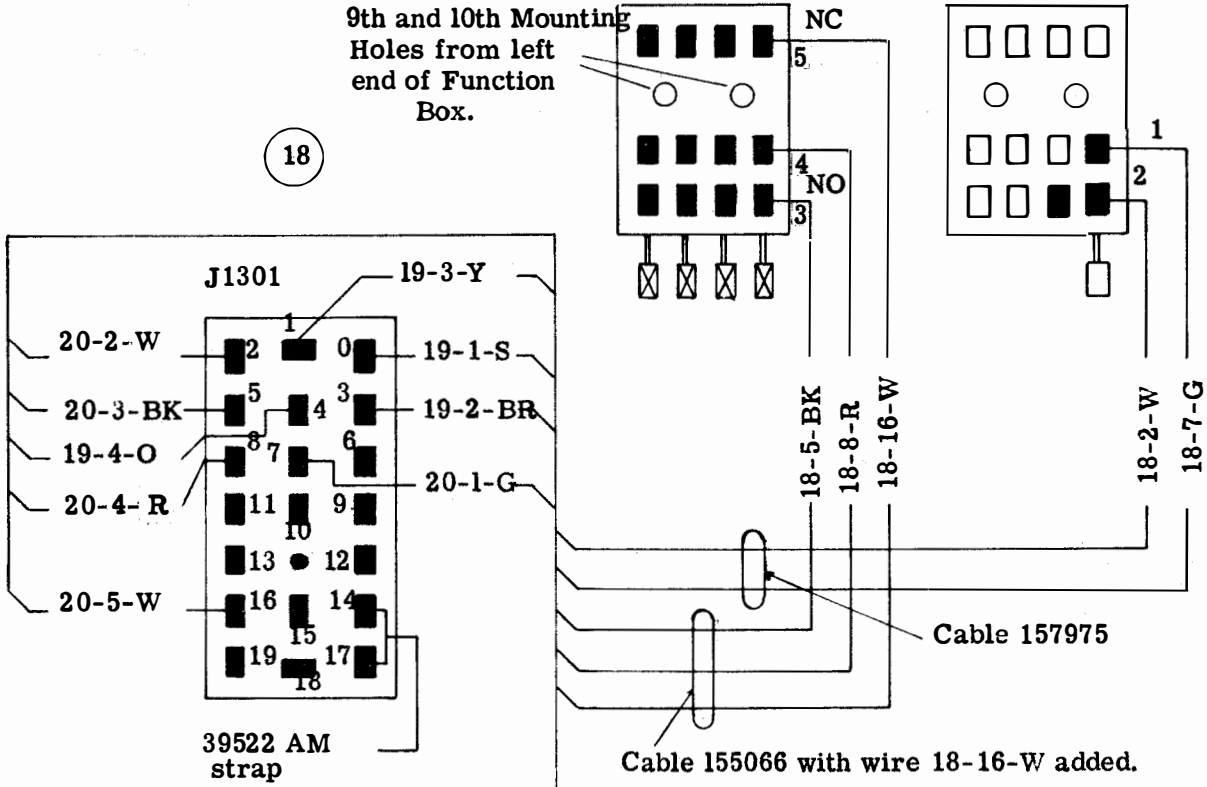
S-1402 A  
(157095)  
SW. ASSM

20

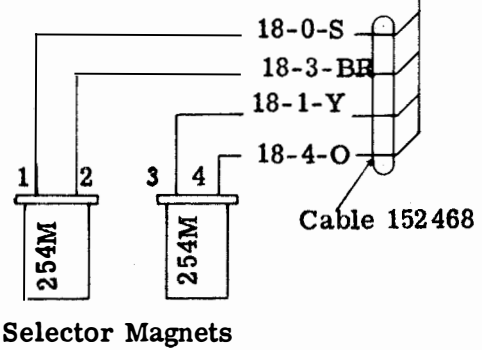
S-1401  
(157072)  
SW. ASSM.

9th and 10th Mounting  
Holes from left  
end of Function  
Box.

18



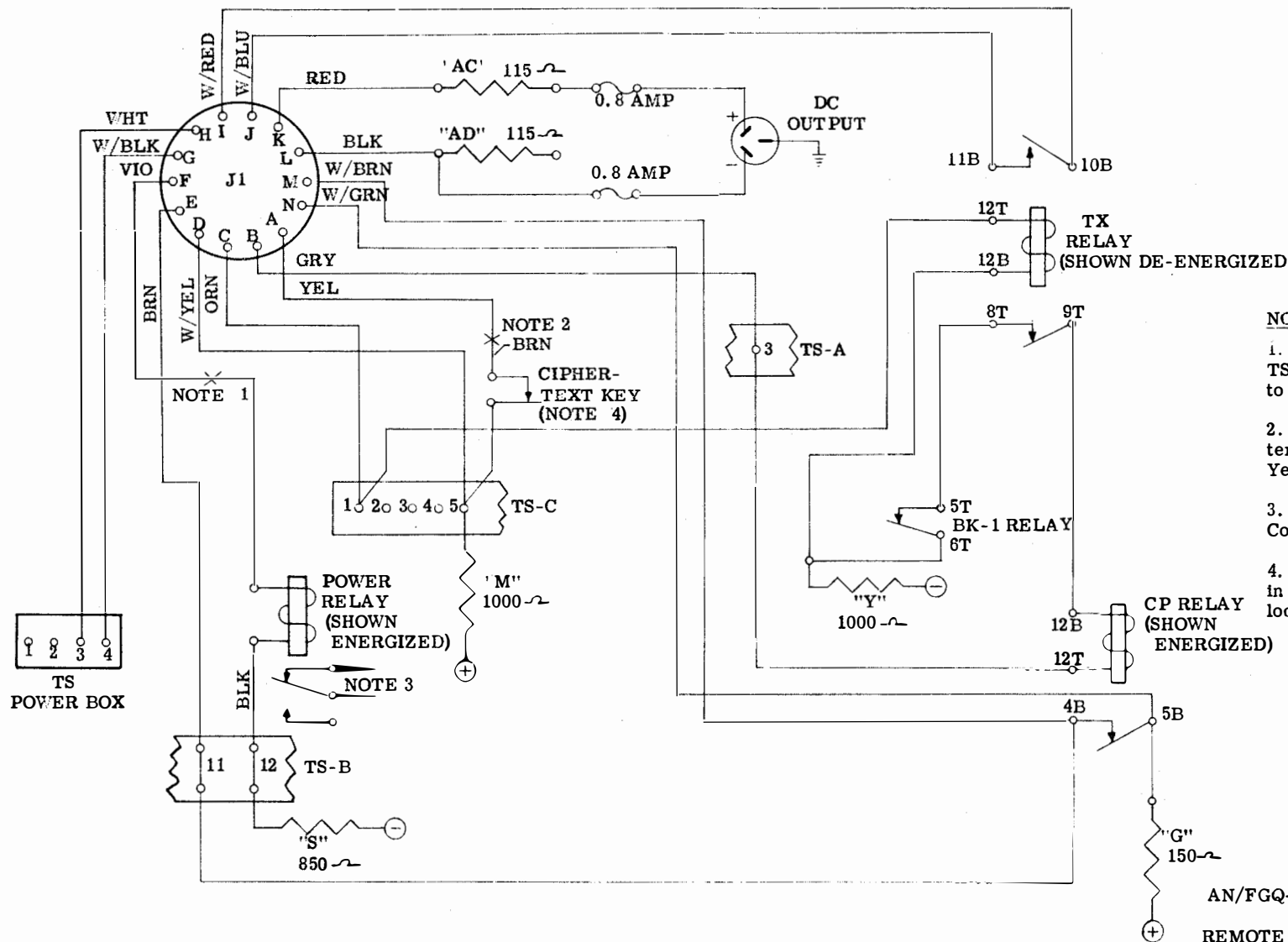
19



This wiring diagram supersedes Sections  
18, 19 and 20, FIG. 6-270 of NAVSHIPS 93534  
and Sections 21 and 22, FIG 6-145 of NAVSHIPS  
93241

**WIRING DIAGRAM  
FOR  
AGH FUNCTION BOX  
EQUIPPED AN/UGC-5  
and AN/UGC-6**

**FIGURE 2-3**

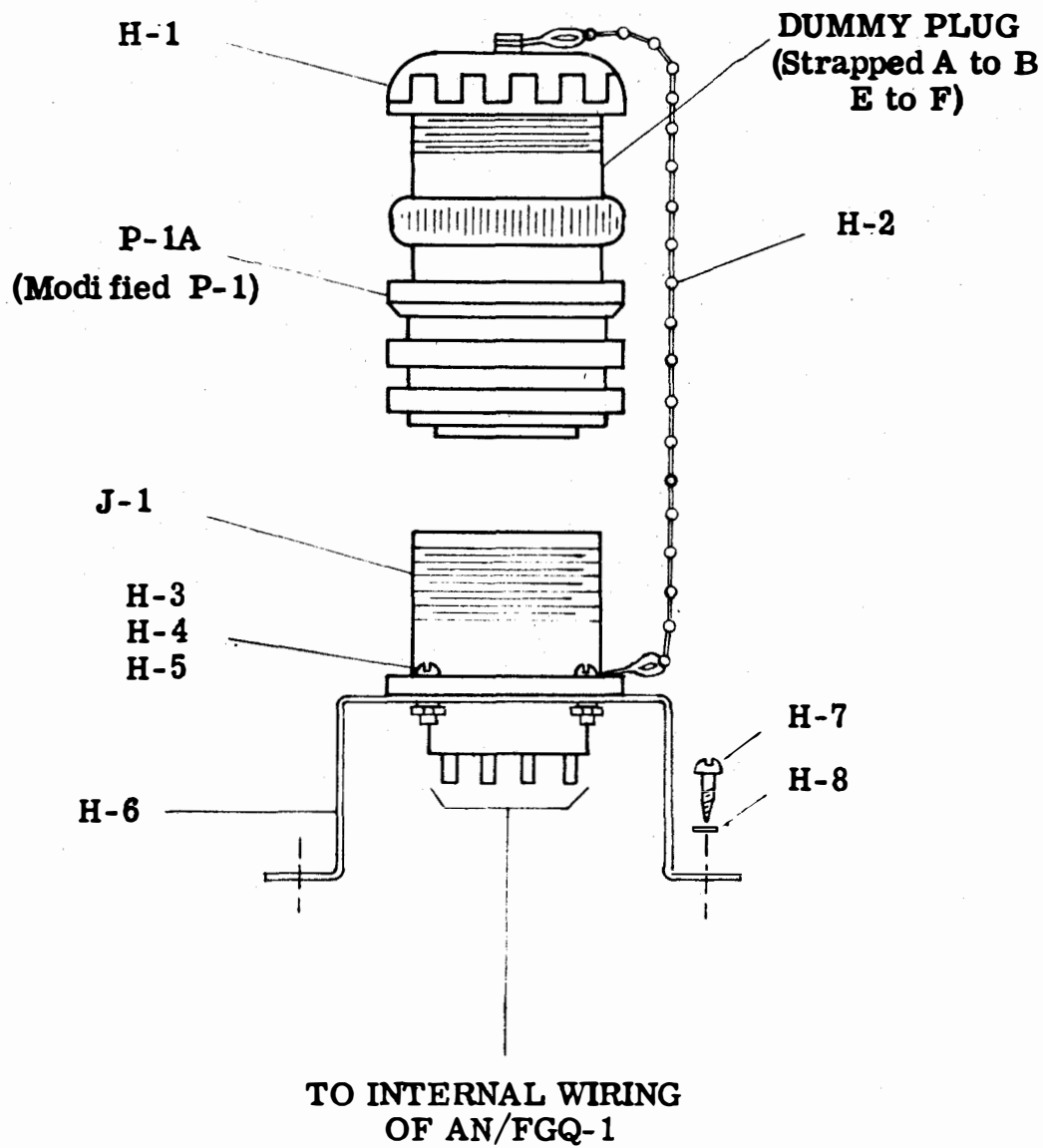


**NOTES**

1. Remove Black Wire from TS-B-Terminal 11 and splice to Violet wire.
2. Remove Brown wire from terminal "A"-3 and splice to Yellow wire.
3. AC to Cipher Device Motor Control.
4. CIPHER-TEXT key locked in Cipher Position with Switch lock.

AN/FGQ-1 WIRING MODIFICATION  
FOR  
REMOTE CIPHER-PLAIN SWITCHING

FIGURE 2-4



AN/FGQ-1 ADAPTOR ASSEMBLY PARTS

FIGURE 4-1