TR 1230-1

TECHNICAL REGULATIONS No. 1230-1

WAR DEPARTMENT, WASHINGTON, April 8, 1936.

TELEGRAPH SET

SUPERSEDED Date: 22 Ly Prepared under direction of the Chief Signal Officer

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SECTION I

GENERAL USE AND DESCRIPTION

Paragraph General use. General description.

1. General use.—The telegraph set TG-5 is an open-circuit field telegraph set designed for use on field lines within the division, or in any situation requiring the use the use of portable telegraph equipment for short distances and with very few intermed. intermediate or way stations. It can be used on either complete metallic or on ground ground return circuits, but normally it will be used over simple execution with circuits and will employ a ground return. It cannot be used in connection with a standard closed-circuit telegraph system. Using its self-contained batteries it ordinated closed-circuit telegraph system. it ordinarily should operate over field circuits of any length likely to be encountered with tered within the infantry division. The range may be still further increased by adding the still further increased by adding additional line battery in series externally where exceptionally long lines or high or high resistance grounds are encountered. (See par. 18 f.) Several sets may be operated. be operated in series if desired, although ordinarily not more than 3 or 4 should be required. be required to work together on one circuit.

2. General description.—a. The set in its aluminum alloy case weighs 5 unds in the set in its aluminum alloy case weighs 5 pounds including batteries, and is provided with a canvas and leather carrying case CS 40 case CS-49, weighing 1 pound. Figure 1 shows the telegraph set with its component, and the set ready for conponent parts including its carrying case. Figure 2 shows the set ready for connection to nection to a line circuit. Figure 3 shows a rear view of the set and the manner in which the set and the manner and which the set are set as a set of the set and the manner in which the set are set of the set and the manner in which the set are set of the set and the manner in which the set are set of the set and the manner in which the set are set of the set and the manner in which the set are set of the set and the manner in which the set are set of the set are set of the set and the manner in which the set are set of the set of the set are set of the set of in which the local circuit batteries are installed. Figure 4 shows schematically the work. the working parts of the set, their terminals, the color scheme of the wires connecting the necting them together, and the effect on the line relay of moving the external

pointers when making relay adjustments.

b. The adjustable line relay in each set operates on a low direct current to control a local circuit in the set. If two sets are connected and the key of one is one is operated, it closes the line circuit, sending direct current over the line and through the control of the circuit, sending direct current over the line and through the circuit, sending direct current over the line and through the circuit, sending direct current over the line and through the circuit is a circuit in the set. and through the line relays of both sets, operating them. (See fig. 5.) The battery battery which supplies this line current is furnished only by the set which is transmitting. transmitting, no battery being supplied to the line by the receiving set. line battery is normally a 22½-volt dry battery contained in the set.

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c. Each line relay when operated closes the local circuit in its set. If the head series with the first the first series with the fi set is not plugged in to the jack, this local circuit in its set. If the in series with a small bell. In this local circuit contains a 3-volt dry batter. in series with a small bell. In this condition operating the key in either set called



FIGURE 1.—Component parts of telegraph set TG-5. (See fig. 5.) However, if the headset is plugged in to the idease the bell out of the out of the bell out of t the bell to ring. the jack contacts cut the bell out of the circuit and place an interrupter of the however, if the headset is plugged in to the however, type in series with the 2 with the circuit and place an interrupter the interrupter that the circuit and place an interrupter the interrupter that the circuit and place an interrupter the interrupter that the circuit and place an interrupter that the circuit and place and circuit and c "howler" type in series with the 3-volt battery. In this condition, operating the



Figure 2.—Telegraph set TG-5 ready for use. TL-1562

key in either set causes the interrupter to send a 1,000-cycle tone into the

d. Thus, by removing the plug of the headest for the headset from the jack, a set may be left in the be left in the stand-by position by that its call bell may be runs by operating operating the key at either station.

Or, by insert. Or, by inserting the plug in the jack, a set may be a set may be put in the operating position position so that 1,000-cycle signals will be bewill be heard in the receiver when the key of the key at either station is operated.

e. When

e. When more than two stations are connected in one circuit, operation in ting station is similar. The transmits ting station sends current from its line battern. line battery through the line relays of all station of all stations in the circuit causing their local their local circuits to operate in the manner of manner described above. (See fg. 8)

f. Power for the line circuit is fur e local given by

nished by a 22½-volt battery BA-2 and for the local circuit by two 1½-volt but for attention is made for attention.

The battery BA-2 and for the local circuit by two 1½-volt but proving the set, 2, and 3.) sion is made for attaching batteries are contained within the set, 2, and 3) sin series. The batteries are contained within the set, 2, and 3) sin series. The batteries are contained within the set, 2, and 3) sin series.

TELEGRAPH SET TG-5

A station in a circuit uses no line battery except when the key of that set is operated, and no local battery except when its own plug is inserted in the jack or when the key of some set in the circuit is operated.

SECTION II

Casa	DETAILED DESCRIPTION OF PARTS	Paragraph
Case	and the second of the first subject to the street of the second of	3
Relay BK-7	M. 65 18 19 19 19 19 19 19 19 19 19 19 19 19 19	4
E-5		5
Rey J-41		6
apacitor CA ore		The state of the s
Bell, Edwards no. 13		8
ack. Wort-		
Binding Electric	no. 226-A	10
Batton Posts TM-150		11
		12
Ciarries BA-30	AND A MILL SUSPENDENCE AND A SECOND RESIDENCE OF THE S	13
Circuits		14
0 -		11

3. Case.—a. The aluminum alloy case is hinged in such a manner that the top, front, and a part of the back may be opened. The top is hinged along the back

edgeso it may be raised, after pressing the latch button on the front, to expose the compartments for the headset HS-20 and battery BA-2. The front is hinged along the base and lowers to a horizontal plane with the key J-41 mounted in the proper position for After the front is lowered, the binding posts TM-150, relay BK-7, interrupter BZ-5, Edwards no. 13 bell, and Western Electric no. 226-A jack are exposed. The small door in the back may be opened by turning the catch one quarter turn with a screw driver, exposing a compartment for two batteries BA-30. The case is painted olive drab. is fitted on the top. A name plate gram is cemented inside the top. The circuit dia-



FIGURE 3.—Rear view of telegraph set TG-5 showing local circuit batteries.

b. The carrying case CS-49 is of heavy canvas with its bottom reinforced by ather leather. Its top is sewed to the case at one side to form a hinge, and fastens with a snap when the case at one side to form a hinge, and fastens with

a snap when closed. An adjustable web-carrying strap is attached to the case.

4. Relation to the case at one side to form a fingle, and the case. 4. Relay BK-7.—The relay is contained in a black bakelite housing with two interes. pointers mounted on the front side for adjusting the spring tension on the armature and the pointers armature and the air gap between the armature and core ends. The pointers are designated the air gap between the armature and core ends. are designated SPRING and GAP, respectively, and move over graduated scales from 0 to 20 may be adjusted to operate on as low a current as 1.5 milliamperes. Five terminals at one of the break-make contacts. minals at one end provide connection to the winding and the break-make contacts.

The contact The contact adjusting screws are properly set and sealed at the factory and should not require adjusting screws are properly set and sealed at the factory and should not require adjustment. An opening in the top of the relay housing permits cleaning of cleaning of the relay contacts by the operating personnel. Another opening in the bottom contacts by the operating personnel. in the bottom of the housing exposes the armature tension spring and thread.

5. Intermediate the housing exposes the armature tension spring and thread.

button mounted against the diaphragm of a telephone receiver. (See fig. 4.)
Battery (3 volts) connected in the receiver. Battery (3 volts) connected in series with one carbon button and the receiver winding causes the interpret winding causes the interrupter to howl continuously at a frequency of approximately 1,000 cycles per second. mately 1,000 cycles per second. The interrupter operates in the vertical position only, due to the position of the only, due to the position of the carbon button. The output of the interrupter is 6. Key J.41 (The carbon button. The curve.

6. Key J-41.—The open-circuit operating key is of the usual lever type ounted on a molded balkalit operating key is of the usual lever type mounted on a molded bakelite base. When receiving, the back contact is in series with the line relevant. series with the line relay and line, but not with the line battery of the set.

When receiving, the 'make' when transmitting, the 'make' and line, but not with the line battery of the set in transmitting, the "make" contact places the line battery (22½ volts) of the set in series with the line relay and line. series with the line relay and line. Three knurled binding posts provide connections to the key. The key is

tions to the key. The key is easily adjustable to suit the operator. 7. Capacitor CA-210.—The capacitor consists of two 0.25-mf units inclosed a metal can with four family a series in a metal can with four flexible 6-inch leads. One unit is connected in series

Binding Posts TM-150 34 22v HILL E 8430 BA-2 Capacitor CA-210

FIGURE 4.—Working parts and wiring of telegraph set TG-5. TL-1564

with the headset to prevent the flow of direct current through the receiver windings. other unit is connected across the "make" contacts of the key to eliminate key clicks.

8. Headset HS-20. The headset consists of a receiver R-3 with web head band, plug PL-55, and a 4-foot flexible cord The receiver is of the standard watchcase type and has a resistance of 80 ohms.

The plug is of the simple tip-sleeve type with black shell. The cord has two tinsel, rubber, and braid covered conductors twisted together.

9. Bell, Edwards No. 13.—The bell is of the small vibrator type, and is fitted tha 1-inch gong. The bell is of the small vibrator type, signal before with a 1-inch gong. The bell is of the small vibrator type, and 18 the plug is inserted in the inch the plug is inserted in the jack. (See fig. 5.)

10. Jack, Western Electric No. 226-A.—The jack is of the standard tip spring. sleeve type with an extra set of transfer contacts operated by the tip spring. The bell is normally in series with The bell is normally in series with the battery and relay contact before the plug is inserted. After the plug is inserted. After the plug is inserted. is inserted. After the plug is inserted, the battery and relay contact before the rand the receiver is connected to the stery is transferred to the interrupter and the receiver is connected to the stery is transferred to the interrupter and the receiver is connected to the stery is transferred to the interrupter and the receiver is connected to the stery is transferred to the interrupter and the receiver is connected to the stery is transferred to the interrupter and the receiver is connected to the stery is transferred to the interrupter and the receiver is connected to the stery is transferred to the interrupter and the receiver is connected to the stery is transferred to the interrupter and the receiver is connected to the stery is transferred to the interrupter and the receiver is connected to the stery is transferred to the interrupter and the receiver is connected to the stery is transferred to the interrupter and the receiver is connected to the stery is transferred to the interrupter and the receiver is connected to the stery is transferred t

and the receiver is connected to the relay and series capacitor. (See fig. 6.)

11. Binding posts TM-150 11. Binding posts TM-150.—The binding posts have knurled metal heads V are for connecting the line and heads posts have knurled metal heads as for connecting the line and heads are for and a slot for connecting the line and battery leads. The binding posts have knurled metal at 3 V are for emergency connections of the line and battery leads. The binding posts designated BA-30 are not when batteries 3 V are for emergency connections of an external local battery when batteries BA-30 are not available. The BA-30 are not available. The + binding post is common to the 3-volt and 12. Battery. The line binding

22-volt circuits. The line binding post is common 12. Battery RA-2 That is posts are designated L₁ and L₂. 12. Battery BA-2.—The line battery is a standard 22½-volt battery with inch flexible leads. The red and battery is a standard 22½-volt battery ated to the 6-inch flexible leads. The line battery is a standard 22½-volt battery and — 22-volt binding posts, respectively. and 22-volt binding posts, respectively. A sponge-rubber pad fastened to the top of the case serves to hold the battern and the pattern and th top of the case serves to hold the battery firmly in its compartment. If necessary additional batteries may be placed and firmly in its compartment. additional batteries may be placed adjacent to the telegraph set and connected in series with the battery in the set in series with the battery in the set.

13. Batteries BA-30.—These batteries are of the same size as standard commercial flashlight batteries. Two are used in series for the 3-volt bell and interrupter circuits. The lid of the rear compartment is properly marked for polarity of the batteries. A spiral spring in the — end of the compartment connects to the base of one battery and a flat spring contact in the + end connects to the top of the other battery. It is important that the two batteries BA-30 be properly connected in series; that is, the top of one battery making contact with the base of the other. If one of the batteries should be reversed the local circuit will not operate.

14. Circuits.—Figure 4 shows the circuit diagram and wiring of the set. Figure 5 is a schematic diagram of only the calling circuit when one station is calling another. Figure 6 illustrates the sending and receiving circuits of two stations installed with a telegraph line wire and ground return when one station is transmitting to another. Figures 7 and 8 illustrate the same for a 2- and a 3-station circuit respectively but over simplexed telephone circuits with ground

SECTION III

INSTALLATION AND OPERATION

Prepart	Paragraph
Preparing the set for installation Testing the celling	15
Testing the calling circuit	16
Testing the sending circuit— Methods of connecting and receiving circuit—	17
Methods of connecting into a telegraph line circuit Ground connecting into a telegraph line circuit	18
Ground connecting into a telegraph line circuit.	19
Adjustment of the line relay	20

15. Preparing the set for installation.—Open the telegraph set and see at the control of the set for installation.—Open the telegraph set and see that the line battery and local circuit batteries are properly installed.

figs. 2 and 3.) In case batteries BA-2 and BA-30 are not available, any batteries of the proper voltage may be connected externally, care being exercised to connect them with polarities as indicated in figures 2 and 4. Remove the headset from its compartment but do not insert the plug in the jack. Adjust the key as desired, being careful not to screw the back contact down so far that both front and back contacts "make" at the same time, since this will short-circuit

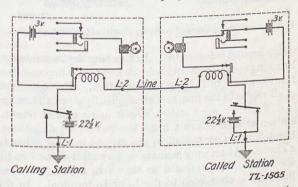


FIGURE 5.—Calling circuit of a telegraph line circuit using telegraph set TG-5.

the line battery.

16. Testing the calling circuit.—Test the calling circuit by temporarily ort-circuit. short-circuiting the line binding-posts L₁ and L₂, and at the same time pressing the key. the key. The bell should ring. If it does not, adjust the relay as in paragraph 20 b and

17. Testing the sending and receiving circuit.—Test the sending and receiving circuit by inserting the plug of the headset in the jack. The interrupter (howler) should be faintly (howler) should operate continuously and its 1,000-cycle tone should be faintly audible, but not in the receiver. Adjust the receiver to the ear, again temporarily short-circuit the line binding posts L₁ and L₂, and at the same time press the key. A strong signal should be heard in the receiver when the key is depressed. If a constant signal is heard in the receiver when the key is depressed, or if no signal is heard when the key is depressed, adjust the relay as in paragraph 20 b and c.

18. Methods of conversion.

18. Methods of connecting into a telegraph line circuit.—a. Two-station circuit using telegraph line wire and ground return.—Two stations connected together in a ground return circuit, the single line wire of which is used exclusively for telegraph, are shown in figure 6. This method is used when there is a separate line wire available exclusively for the single line wire available exclusively for the single line when there is a separate line wire available exclusively for the single line when there is a separate line wire available exclusively for the single line wire available exclusively for the single line when there is a separate line wire available exclusively for the single line wire available exclusively available exclusively exclusively available exclusively exclusively exclusively exclusively exclusively exclusively exclusively exclusively exclusive

b. Two-station circuit using simplexed telephone circuit and ground return.—When there is no separate line wire available exclusively for telegraph communication, the usual case in a military wire system, a simplexed telephone circuit serves as the line wire as shown in figure 7. In this case both telephone wires together make up the telegraph line wire, and the single wire from the mid-point of the

Transmitting Station

Receiving Station

FIGURE 6.—Transmitting and receiving circuits of telegraph set TG-5.

line side of the repeating coil provides the line connection to the telegraph

instrument.

c. Line and ground connections, two-station circuit.—In both cases a good ground connection good ground connection should be made to one of the line terminals of the set and the line should be connected to the other. It makes no difference to which of the two line terminals L₁ and L₂ the line

or the ground is connected. In breaking the transmission from another station, the breaking operator should hold his key partly depressed so that neither the back nor front contacts of the key make contact. This opens the line, stops the operation of all relays in the line, and contact. This opens the line, stops of all sets.

of all relays in the line, and consequently stops all headset or bell signals of all sets.

d. Three or more station circuit using ground return.—With a three or more station ground return circuit, the two terminal stations should have one of their line terminals connected to the ground and the other to the line as described in c above. At an intermediate or way station the two line wires are connected to the L₁ and L₂ terminals, as shown in figure 8. It makes no difference which line wire is connected to the L₁ or L₂ terminal. In this particular example the telegraph line circuit is simplered.

telegraph line circuit is simplexed around an intermediate telephone switchboard. With a circuit of three or more stations, each of the idle stations will hear all transmissions between any other stations working together in the circuit. These signals will be heard as bell signals unless the headset is plugged in, in which case the idle operator must remain close enough to his set to hear in the receiver any call for his station. Breaking transmission is accomplished in the same

e. All metallic telegraph circuits.—When any consideration makes a ground return circuit impracticable, a metallic return may be used instead. In this case both line terminals may be connected to line wires reserved for telegraph use only, both may be connected to the telegraph legs from the line sides of the repeating coils in simplexed telephone circuits (the more usual case), or one may

be connected to a wire reserved for the telegraph and the other to a simplexed telephone circuit. Intermediate stations must make certain that their sets are connected in series with the line circuit and not across it.

f. Additional line battery.—When long lines, high resistance grounds, or leaky lines in wet weather reduce the current through the relay at the receiving station

so that it fails to operate, additional battery may be connected in series with the battery BA-2 in each set in the line circuit. In any case it is advisable to employ at each set a line battery with approximately the same voltage. Although the relay winding will stand a constant current of approximately 300 milliamperes without injury, nevertheless the line current should be kept below 30 milliamperes, if possible, since the relay works much better at

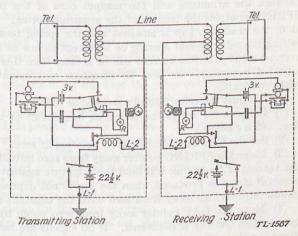


FIGURE 7.—Two-station circuit of telegraph set TG-5 operating over a simplexed telephone circuit.

the lower current value, interference troubles are less, and interception is more difficult. However, before adding external battery, care should be taken each time to adjust the relay for minimum current operation (see par. 20 b and c), and additional battery should be added only if the relay still fails to function.

19. Ground connections.—When ground return circuits are used, which will usually be the case, a good ground connection (i. e., one of low resistance)

Line

Terminal

Tansmitting

Intermediate

Receiving

Station

TL:1568

FIGURE 8.—Three-station circuit of telegraph set TG-5 operating over simplexed telephone circuits.

is necessary not only to insure sufficient operating current, but also to prevent interference with neighboring telegraph circuits. A metal ground rod about 2 feet in length driven well into the ground where it is moist, or where a good contact is made with the ground by wetting it, should provide a satisfactory ground. Where difficulty is experienced in obtaining a satisfactory ground connection,

and when interference with other telegraph circuits is noted, the difficulty may be reduced by using separate grounds placed at some distance from each other for each instrument, and with the ground moistened and packed around each ground

rod. If it is found impossible to obtain a satisfactory ground, it will be advisable to eliminate the necessity for a ground by using a metallic return. (See par. 18 e.)

20. Adjustment of the line relay.—a. The two pointers on the front of the set marked GAP and SPRING are for adjusting the line relay to obtain good signals. (See fig. 4.) The one marked GAP controls the length of the air gap between the armature and the magnet core of the relay. The one marked SPRING controls the tension of the armature spring. When both pointers are at 0, the armature gap is smallest and the spring tension is least. With this setting the relay should operate on a current as low as 1.5 milliamperes. However, as a rule, the line current will be greater than this and the relay should be adjusted accordingly so that its armature will operate and release properly without sticking.

b. To adjust the relay initially proceed as follows:

(1) Connect the set to the telegraph line circuit or to an artificial telegraph line. (See c below.)

(2) Set the GAP and the SPRING pointers at zero.

(3) Move the SPRING pointer away from zero initially about 5 points so that the tension of the spring will hold the armature against the back contact. If a constant signal is produced when the key is not depressed, move the SPRING pointer still farther away from zero until the constant signal ceases.

(4) Move the GAP pointer away from zero notch by notch until signals are heard when the key is depressed. If no signals are heard upon depressing the key after the pointer has been moved to the other end of the scale, the spring tension is probably too great; the SPRING pointer must be moved back toward zero and the GAP pointer again moved away from zero until signals are heard when the key is depressed.

(5) Move the GAP pointer still farther away from zero until the signals disappear.

(6) Now move the GAP pointer back toward zero until the signals are heard again.

(7) Make minor adjustments with the SPRING pointer until the best signals are heard.

(8) Thereafter, while the instrument is connected into the same circuit, make adjustments with the GAP pointer until the best signals are obtained. When once the tension of the armature spring is properly adjusted, it seldom will be necessary to change it while operating on the same telegraph circuit.

c. When it is desired to make certain that a set is in good operating condition, in a repair shop, or before the set is connected into a working telegraph circuit, it may be tested as in b above, after bridging a resistance of about 2,000 ohms (such as a radio headset P-11, if available) across the line binding posts so as to produce an artificial line. However, the final adjustment of the relay must always be made while the set is connected into the telegraph circuit in which it is to operate. This adjustment of the relay should be made on signals transmitted from the most distant station on the circuit, although generally a satisfactory adjustment can be made while an operator is listening to the signals of his own set while it is connected into the line circuit.

d. Often it will be found necessary to have different relay adjustments when working with different stations on the circuit. These minor adjustments are made at the time an operator is ready to work with a particular station in the circuit. They generally will consist only in making minor changes in the setting of the GAP pointer.

SECTION IV

TATE TATE

MAINTENANCE	Paragrap
Care and repair	2
Removal from service	2

21. Care and repair.—a. The contact adjusting screws of the relay are adjusted and scaled at the factory and should not be changed except when repairs are being made at a regularly established repair shop for signal equipment. An opening in the top of the relay housing permits cleaning of the relay contacts. This opening is reached by removing the four small screws in the bottom of the case of the set which hold the relay housing in place, and then pulling the relay housing forward until the opening in its top over the relay contacts is exposed. To clean the relay contacts, a burnishing tool, if available, otherwise a piece of smooth steel, or a piece of bond or other similar paper should be drawn between the contacts while they are held pressed slightly together. The paper used should be unglazed, and one that will not leave lint on the contacts. The tracing paper in the back of the message book M-105 would be satisfactory to use.

b. The interrupter is adjusted and sealed at the factory and no attempt should be made to adjust or repair it in the field.

c. The bell, jack, and key contacts should be kept clean and in adjustment in the manner described in a above for the relay contacts.

d. After the line wires are connected to the set, the top and back compartments should be closed to protect the instrument.

e. When no traffic is being handled remove the plug from the jack to conserve the local 3-volt battery. The bell then serves as a calling signal for the operator. With the plug in the jack the bell will not ring, but the battery will be used up by the continuous operation of the howler.

22. Removal from service.—When removing the set from service, all bat-

teries should be disconnected and removed from their compartments.

[A. G. 062.12 (11-4-35).]

BY ORDER OF THE SECRETARY OF WAR:

MALIN CRAIG, Chief of Staff.

OFFICIAL:

E. T. CONLEY,

Major General,

The Adjutant General.