SERVICE TEST MANUAL

FOR

SIGNAL EQUIPMENT SE-7-T1

(FOR SMALL UNITS OF MECHANIZED FORCES)

RESTRICTED

PREPARED AT

SIGNAL CORPS LABORATORIES

FORT MONMOUTH, NEW JERSEY

SEPTEMBER 15, 1936

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R E S T R I C T E D

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PART ONE

INFORMATION FOR USING ARM BOARDS

SECTION I. GENERAL

1. The purpose of this manual is to outline a program of test in accordance with par. 11b, AR 850-25 and to provide engineering characteristics and data called for in par. 12a(1), AR 850-25.

2. Signal Equipment SE-7-T1 is an experimental type of equipment submitted for comment by the using arms preliminary to the design of a service-test type.

SECTION II. MILITARY CHARACTERISTICS

3. The military characteristics of a signaling device for small units of mechanized forces, designated "Signal Equipment SE-7" are recommended in paragraph 2a, Minutes, Signal Corps Technical Committee, Meeting No. 112, December 11, 1933 and approved by the Secretary of War per 1st Ind., A.G., 413.77 (1-6-34) (Misc.) D, January 15, 1934 to CSigO. They are as follows:

a. Operation must be positive both at the halt and during movement and be capable of transmitting at least 15 distinct signals, both day and night.

b. Each signal must be capable of instantaneous transmission and reception.

c. It should add no height, or at least a minimum height, to the overall height of the car.

d. It should be of the least practical bulk and weight so as not to seriously encumber the limited compartment of the car.

e. It should not interfere with observation from the car, nor the operation of the armament of the car.

f. It should have an effective range of at least 400 yards.

g. If a manually-operated device, provision should be made so that the signal can be exposed correctly by the operator who, from his position inside the car, cannot see his own signal.

h. If a manually-operated visual device, it should be capable of directional signaling through 360 degrees to other cars or ground troops and if practicable it should be capable of signaling to airplanes in flight.

4. This signal equipment is a new type to be developed for use by mechanized-force platoon commanders in leading and controlling the individual cars of their platoons. No equipment is now issued for this use. With reference to its use by Infantry, the Chief of Infantry in 3rd Ind., C.I., 537.3/7884-B (7-11-33) Aug. 17, 1933 to CSigO, comments as follows:

> "The Chief of Infantry recognizes the need for communication between the tank platoon commander and the crews of the other tanks in the platoon and is interested in any system of signalling which will facilitate the control of fast tanks.
>
> "The Chief of Infantry, frankly, doubts the practicability of any visual signalling device which permanently projects from the top of a tank. Such a device will be subject to damage by underbrush, overhanging branches and enemy fire. However, if the proposed signalling device is developed for the Cavalry, it is recommended that The Infantry Board be given an opportunity to test it, as a possible means of controlling the maneuvering of tanks and tank units."

SECTION III. RESUME OF DEVELOPMENT

5. Development was initiated with a study of the means available to accomplish the object sought. Radio was eliminated because of intricacy of equipment and power requirement. Sound was eliminated as impractical on account of interfering noises of the vehicle and of gunfire. Of the possible visual means, external mechanical shapes or surfaces were eliminated because of the necessary frailty and bulk of the external structure. Smoke, vapor, flame and pyrotechnic means were considered and rejected. Although such means might add no external structure to the vehicle, the bulk, pressure or inflammability of the internal supply of liquid fuel, gas or pyrotechnic powder was considered undesirable. The use of concentrated light projectors, either singly or in groups appeared to offer the most practicable line of attack. However, to provide an instantaneous signal or "picture" in fifteen forms, as required by the military characteristics, would necessitate four simultaneously visible projectors spaced several inches apart. This appeared to call for too much external structure as well as to admit too much chance of false signals through the failure of one or more of the projectors.

It was decided to propose to the using arms a cyclic flashing signal with a frequency of from one to three seconds per cycle. One design was proposed utilizing two parallel projectors in a signal turret, flashing in rotation "dots" of white and red. This was laid aside on the assumption that an all-around projection of the signal was preferable to a uni-directional beam. For all-around projection with two projectors it becomes necessary to mount one projector above the other to avoid eclipse of one by the other at certain azimuths. As this would double the height above the turret required for one projector and make the upper one quite inaccessible, it was decided to use a single white projector, flashing cyclic signals made up of standard Morse dots and dashes. An alternative proposal to make a self-contained single or double-barreled hand projector for pointing through pistol ports or the turret hatch was passed over upon the criticism by Cavalry representatives that it would require handling by an operator whose hands should be free for other work.

SECTION IV. PROGRAM OF TEST

6. It is desired that tests be conducted with a view to comment in report of test upon the following points:

a. Is the principle employed to provide 15 distinct positive signals under the conditions specified in military characteristics a (paragraph 3 above) satisfactory (i.e., automatically-keyed, Morse-code flashing white light)?

b. With reference to characteristic b, is the substitution of a repetitive signal with a frequency of a few seconds per cycle a satisfactory substitute for the instantaneous signal specified?

c. Does the model submitted come reasonably within characteristic c?

d. Does it appear that the model submitted can be refined into reasonable compliance with characteristic d?

e. Is characteristic e satisfactorily covered?

f. Is characteristic f satisfactorily covered?

g. Is the monitoring arrangement for checking the outgoing signal from within the car satisfactory in principle?

h. Is the 360-degree horizontal signal provided more or less satisfactory than the selective directional signal specified in characteristic h? If less satisfactory, is it a permissible substitute?

i. Is the provision of a top lens to render the signal visible to aircraft considered desirable?

j. Are the 15 signals provided by the six-circuit selector satisfactory?

k. Is the keying rate (2.5 seconds) satisfactory?

l. Is the addition of a key for manual Morse-code signaling considered desirable?

m. Does the plan to place the selector, or the complete keying unit behind the dashboard appear practical?

n. Is the service life of the incandescent lamps satisfactory?

o. What difficulties not indicated above appeared in operation or maintenance of the model submitted?

p. Is any amendment of the military characteristics recommended?

q. Should models of a service-test type be produced, based on the model submitted?

PART TWO

TECHNICAL INSTRUCTIONS

SECTION I. DESCRIPTION

1. Signal Equipment SE-7-T1 consists of a sturdy signal lamp for mounting above a combat vehicle for the projection of signals visible at all times through 360 degrees of azimuth. The signal lamp is supplied with power from the vehicle battery through an automatic keying assembly designed to repeat continuously any one of fifteen distinctive signals. The automatic keyer consists of a selector for setting up the desired signal and a distributor for continuous transmission of the signal selected. In the current model, a ballast lamp is connected between the keyer and the signal lamp, as an expedient to control the current to a standard incandescent lamp designed for a different purpose. In any later model of this general type, the ballast lamp would be eliminated by the development of a lamp designed for direct operation from the vehicle battery.

2. The signal lamp, shown in Fig. 1, consists of an incandescent lamp designed for signaling, mounted at the focus of a cylindrical Fresnel lens, which concentrates the light from the filament into a horizontal zone extending in azimuth through 360 degrees and having a vertical spread of about 4 degrees. The lens is mounted in a frame with four protecting fins designed to divert underbrush or wire encountered during motion of the vehicle, regardless of the position of the turret. The frame is designed to mount on an armored-car turret and communicates with the interior by means of a hollow shaft inserted through a hole in the turret. The hollow shaft is provided with an interrupted-screw "breech-block" plug carrying the lamp socket and permitting replacement

of the lamp from within the vehicle. Monitoring of outgoing signals is provided for by means of a lens conducting light from the lamp chamber through a small hole to the base of the breech block, where the signal may be observed from within the vehicle. In a finished model it is proposed to design the hollow shaft for a minimum diameter which will permit removal of the lamp, to design the fins and lens cap with a smooth contour without shoulders or indentations to catch obstacles, and to arrange the outer ends of the fins so as to bear firmly against the armor plate without fastening other than by an internal collar on the hollow shaft. If it is considered desirable, a window or lens may be recessed into the top of the signal lamp so as to throw a vertical beam for signaling to aircraft.

3. The distributor, which comprises the left-hand portion of the assembly, shown in Fig. 2, consists of a twelve-volt motor which drives through a reduction gear a brush sweeping a ten-segment commutator once every 2-1/2 seconds. Each sweep transmits one signal at a rate corresponding to a Morse-code speed of five words per minute. Three successive segments of the commutator are dead, in order to transmit a "space" signal representing the minimum space between letters in Morse code. The fourth segment connects directly to the lamp to provide the initial "mark" or "lamp-on" phase of the signal to be sent. The remaining six segments connect to the selector, which by permutations of these six connections provides fifteen distinctive combinations. Ten appears to be the minimum number of equal divisions of the time cycle which will provide the fifteen signals demanded by the military characteristics.

4. The selector, which comprises the right-hand portion of Fig. 2, consists of a selector dial which may be set at any one of sixteen positions as indicated on its face, and a toggle switch for starting and stopping the distributor. The selector dial drives a shaft carrying six cam switches which may be made to set up "mark" or "space" signals on their respective six segments of the commutator, thus setting up the character corresponding to that indicated on the selector dial. In a finished model it is proposed to mount the selector dial on the instrument board of the vehicle, with the distributor behind the board at the nearest convenient point. If it is considered desirable, a telegraph key for ordinary manual Morse signaling can be provided for use in addition to the automatic keying arrangement.

5. The incandescent lamp being furnished in the signal lamp is Lamp LM-16 rated at 6 volts, 2 amperes. Since the battery supply is 12 volts, or higher, it is necessary to connect in series with this a resistor that will furnish a voltage drop of 6 volts. For this purpose a second lamp socket and Lamp LM-16 is being furnished as a "ballast lamp." A lamp is the only type of resistor which can be connected in series with a signaling lamp which will not appreciably alter the rapid incandescence and nigrescence required for clear-cut signals. The Lamp LM-16 is being furnished at this time because (1) the light output is sufficient, (2) it has the required characteristic for rapid signaling and (3) a suitable 12-volt lamp cannot be secured without a special order to lamp manufacturers.

6. The signal equipment requires a current of about 2 amperes in the distributor motor circuit and an intermittent current of 2 amperes in the signal-lamp circuit, or a peak load of 4 amperes. With the substitution of a 12-volt signal lamp and elimination of the ballast lamp, the peak load should not exceed 3 amperes.

SECTION II. EMPLOYMENT

7. For purposes of test it should suffice to mount the signal lamp on top of the turret of an armored car in an improvised manner not necessitating any modification of the structure of the vehicle. It is suggested that the turret hatch of an Armored Car M1 may be fully opened and the installation made on a thin wooden panel clamped over the opening in lieu of the hatch cover. The automatic-keying assembly may be secured in any convenient place inside the vehicle and connected as indicated in the diagram shown in Fig. 3; that is, the plug on the end of the cord furnished is plugged into the receptacle in the keyer, the free end is connected to the binding posts on the breech block of the signal lamp, and a two-conductor lamp cord connected from the binding posts on the keyer to the most convenient source of 12-volt supply from the vehicle battery. These leads should be not less than No. 16 A.W.G. A Lamp LM-16 should be inserted in the breech block and in the ballast lamp socket on the keyer. The breech block is then inserted in the signal lamp and locked with a quarter-turn clockwise rotation. It may be desirable to cover the ballast lamp with a hood of some non-inflammable material.

8. To operate the equipment, first set up the desired signal by rotating the selector dial in either direction until the proper indicating mark clicks into place opposite the index. Second, throw the toggle switch to "on" position, thus starting the distributor. Third, glance at the monitor in the base of the breech block and check the outgoing signal. It is suggested that the BAR or seven-unit dash be used to indicate "Stand by for signals" and that the signal be repeated until acknowledged by repetition of the same signal by the receiving station. This is to be followed by transmission of other code signals each to be transmitted until acknowledged by an identical repeat-back. Each signal is terminated by throwing the toggle switch on the selector to "off."

9. The signal equipment should require little maintenance care during the period of test other than to see that the selector "click ring," which appears between the forward-switch cam and the back of the selector dial, is kept lightly lubricated with vaseline or soft grease. In a finished model it is proposed to provide a click ring which will not require special care.

SECTION III. REPAIR

10. Parts of a nature to enable maintenance of the equipment by using troops during the period of test should be requested by the accountable officer directly from the Signal Property Officer, Signal Corps Laboratories, Fort Monmouth, New Jersey.

11. In the event of a breakdown requiring the machining of parts or other trouble not readily remedied with local facilities, report should be made direct to the Director, Signal Corps Laboratories, requesting instructions.

SECTION IV. PARTS LIST

12. Signal Equipment SE-7-T1 consists of:

Item	1	1 ea.	Signal Lamp, cylindrical Fresnel (no code)
"	2	1 ea.	Keyer (no code), consisting of a distributor and a selector assembled on a common base
"	3	4 ea.	Lamp LM-16, modified by stripping of metallized surface (2 in use, 2 spare)
"	4	1 ea.	Cord, keyer to signal lamp (no code)
"	5	20 ft.	Wire, 2-conductor, No. 16 A.W.G. lamp cord
"	6	3 ea.	Instruction Book, Service Test Manual for Signal Equipment SE-7-T1

NOTE: Items 3, 5 and 6 are expendable per par. 1a(4) AR 35-6620

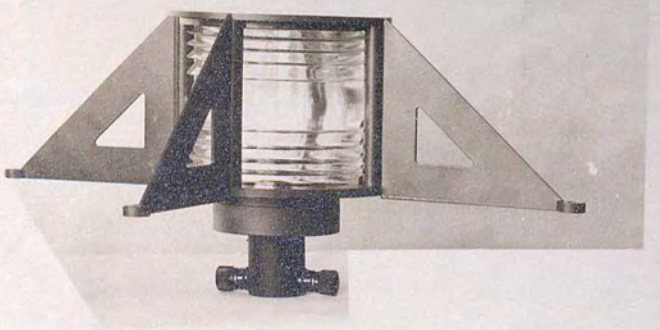

Fig. 1 - Signal Lamp, Part of Signal Equipment SE-7-T1

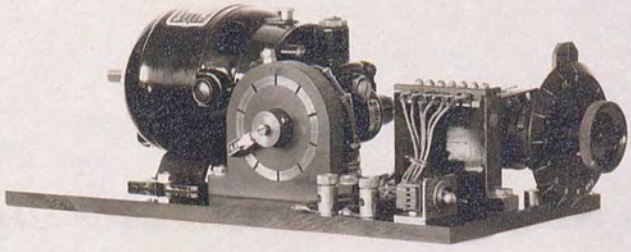

Fig. 2 - Distributor and Selector for Keying Signal Equipment SE-7-T1

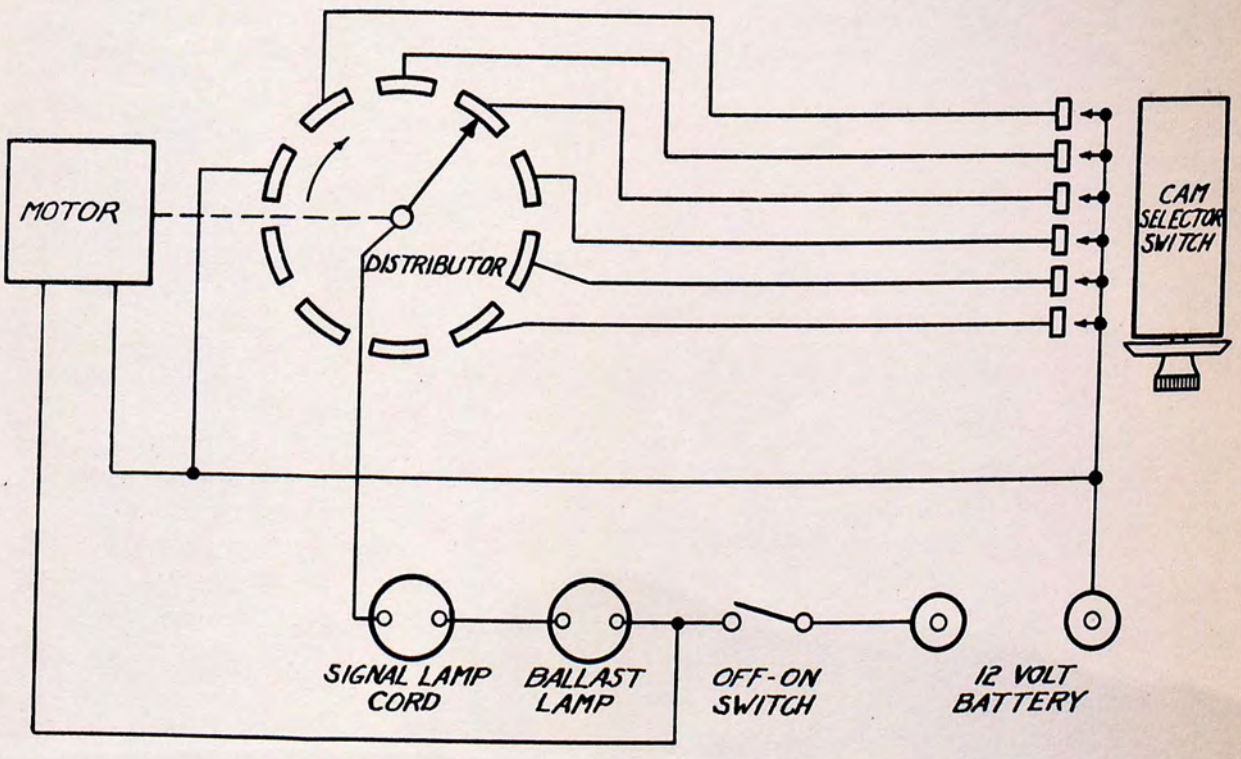

Fig. 3 - Schematic Wiring Diagram of Signal Equipment SE-7-T1