ARI Research Note 86-12

How To Remotely And Automatically Score TRAINFIRE Record Fire And Field Fire Ranges

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U. S. Army

Research Institute for the Behavioral and Social Sciences

January 1986

U. S. ARMY RESEARCH INSTITUTE
FOR THE BEHAVIORAL AND SOCIAL SCIENCES

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: Research Note 86-12	2. GOVT ACCESSION NO.: AD-A167954
3. RECIPIENT'S CATALOG NUMBER:	
4. TITLE (and Subtitle): HOW TO REMOTELY AND AUTOMATICALLY SCORE TRAINFIRE RECORD FIRE AND FIELD FIRE RANGES	5. TYPE OF REPORT & PERIOD COVERED: January 1979 - September 1979
	6. PERFORMING ORG. REPORT NUMBER:
7. AUTHOR(s): Seward Smith	8. CONTRACT OR GRANT NUMBER(s): - -
9. PERFORMING ORGANIZATION NAME AND ADDRESS: US Army Research Institute Fort Benning Field Unit, P.O. Box 2086 Fort Benning, GA 31905-0686	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 2Q263743A773 2Q263731A773
11. CONTROLLING OFFICE NAME AND ADDRESS: US Army Research Institute for the Behavioral and Social Sciences, 5001 Eisenhower Avenue Alexandria, VA 22333-5600	12. REPORT DATE: September 1985
	13. NUMBER OF PAGES: 10
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): - -	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

- -

18. SUPPLEMENTARY NOTES

- -

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

M16A1 Rifle,
~~Rifle Marksmanship~~
Marksmanship Ranges,
Marksmanship Targets,
Knowledge of Results,
Automated Scoring,
M31A1 Target Holding Mechanism.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A major finding of recent rifle marksmanship research is that, in order to improve learning, the firer needs feedback about his shot-by-shot performance. Many efforts are underway to build more effective feedback into the instructional programs. One way to aid this process is the automation of various ranges (e.g., Record Fire). The purpose of this paper is to detail how such automation could be carried out using the current M31A1 TRAINFIRE Target Holding Mechanism. A simple modification of the mechanism, the addition of a hit indicating wire per target or lane, and a control panel, that includes hit

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Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Research Note 86-12

20. ABSTRACT (con't)

registering capability, will permit automatic scoring. Various pieces of equipment could probably be adapted for the control system. Although not covered in the paper, an inexpensive microcomputer with a suitable interface could easily be utilized for control and scoring. Keywords:

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HOW TO REMOTELY AND AUTOMATICALLY SCORE TRAINFIRE
RECORD FIRE AND FIELD FIRE RANGES

Using currently available equipment it is possible to score small arms marksmanship hit performance remotely and automatically. TRAINFIRE ranges utilize the M31A1 Target Holding Mechanism (shown in Figure 1).

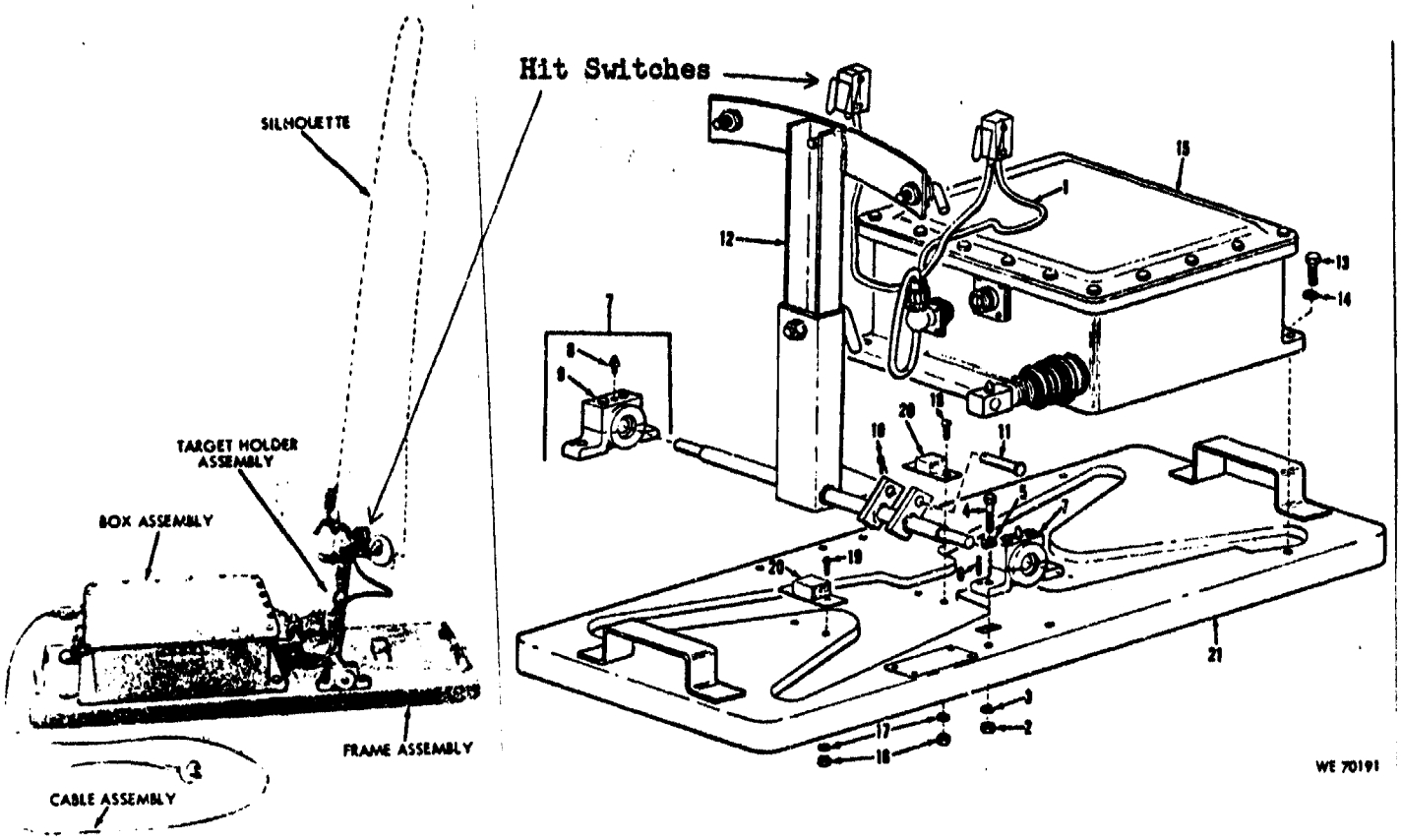

Figure 1. M31A1 TRAINFIRE Target Holding Mechanism

This device holds either a Type E (kneeling) or Type F (prone) silhouette target. The silhouette can be electrically raised or lowered remotely (e.g., from the control tower) by closing up or down switches. There are

two hit sensing microswitches clipped to the base of the silhouette (shown in Figure 1). Impact on the target causes one or both of these "kill" switches to open momentarily which in turn activates the drive motor to lower the target.

Typically hits on these targets have been scored by observer/scorers. For several years counters have been in the Army's inventory for use in sensing hits, but they have received only limited use. One available unit is the M40 Night Firing Target Mechanism (see Figure 2). Unfortunately the

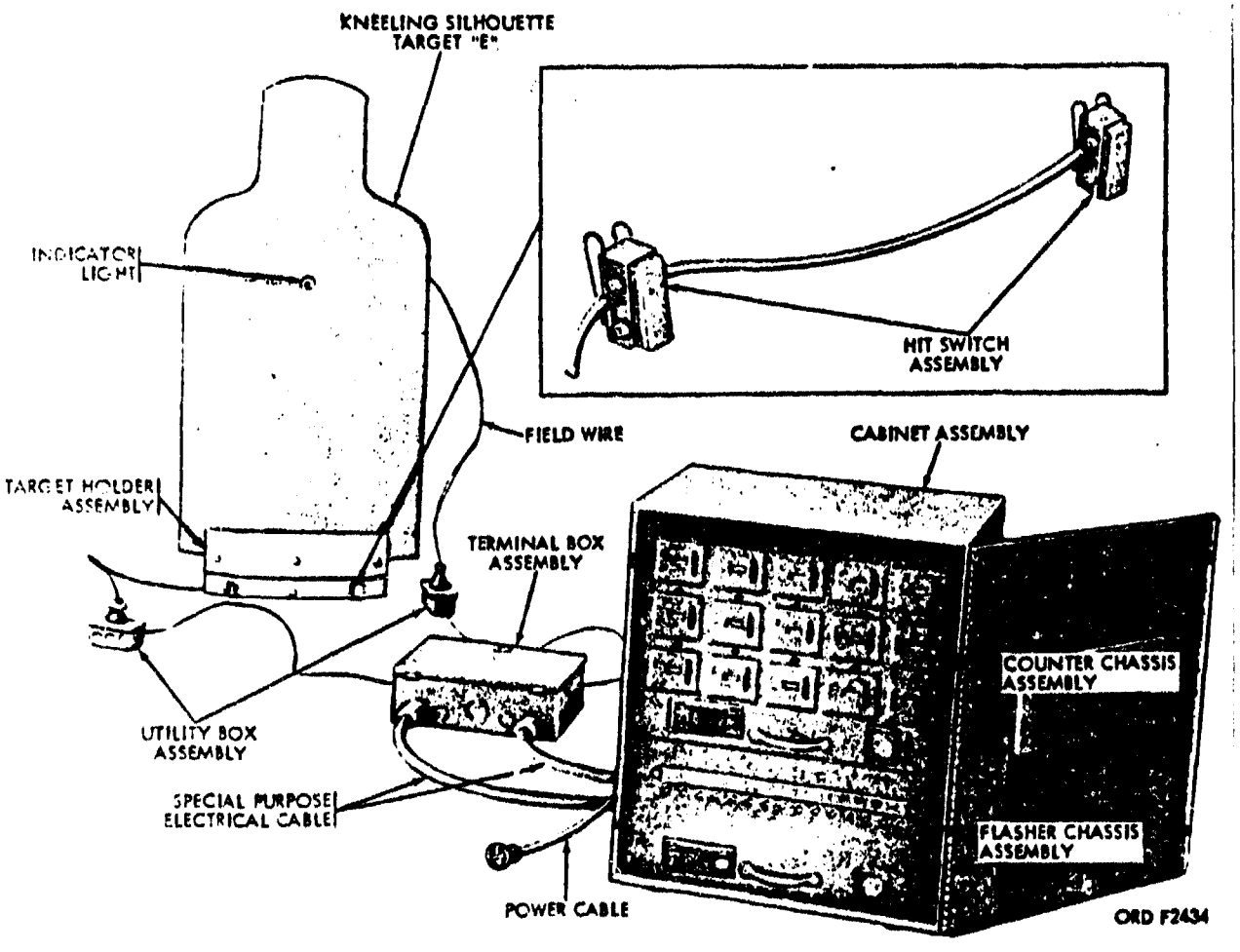

Figure 2. M40 Night Firing Target Mechanism showing use of hit switches with a stationary target. It can also be used with the M31A1 "killable" target.

counting system using M31A1 mechanisms records all target lowerings, whether caused by a bullet hit or by closure of the "down" switch in the tower.

The purpose of this paper is to show how to count only target hits. This would make it possible to score Record Fire centrally and automatically. It requires only simple circuit modifications and one "hit" indicator wire coming from each target mechanism.

The largest relay inside the M31A1 target can be used to sense target hits. If there are jumper wires connected as shown in the picture on the left in Figure 3 they should be removed. New wires should be connected as shown in the picture on the right in Figure 3. In current use of the M31A1 targets three wires run from each target to the control tower (a common, an up and a down). To send hit information to the tower requires a new wire to be laid on the range for each target mechanism. The same common wire used for up and down functions can be used by the new hit circuit.

The hit indicator counter panel (see Figure 4) would be located back at the control center.

Figure 5 is the circuit diagram of the counting system, modified by additions at the upper left to count hits but not operator controlled target lowerings. A relay would be added to the down switch for each target bank controlled in the tower. This relay (marked 3K MFD on the circuit diagram) closes whenever the down switch is operated. It holds closed until all targets in the bank have had time to fall from view. Contacts on that holding relay interrupt the common wire to all counters preventing their operation for about two seconds after the switch closure.

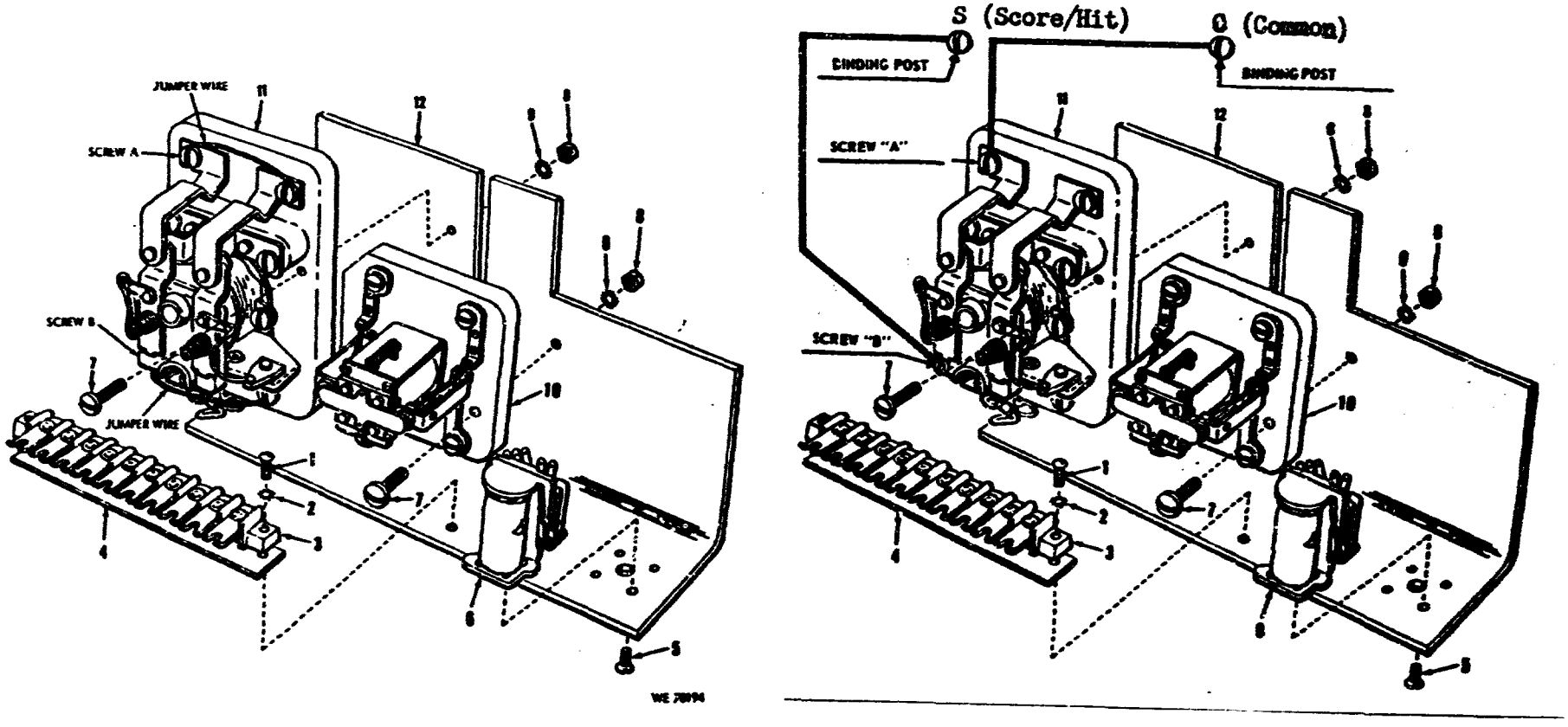

Figure 3. Circuit modifications required at the M31A1 target device.

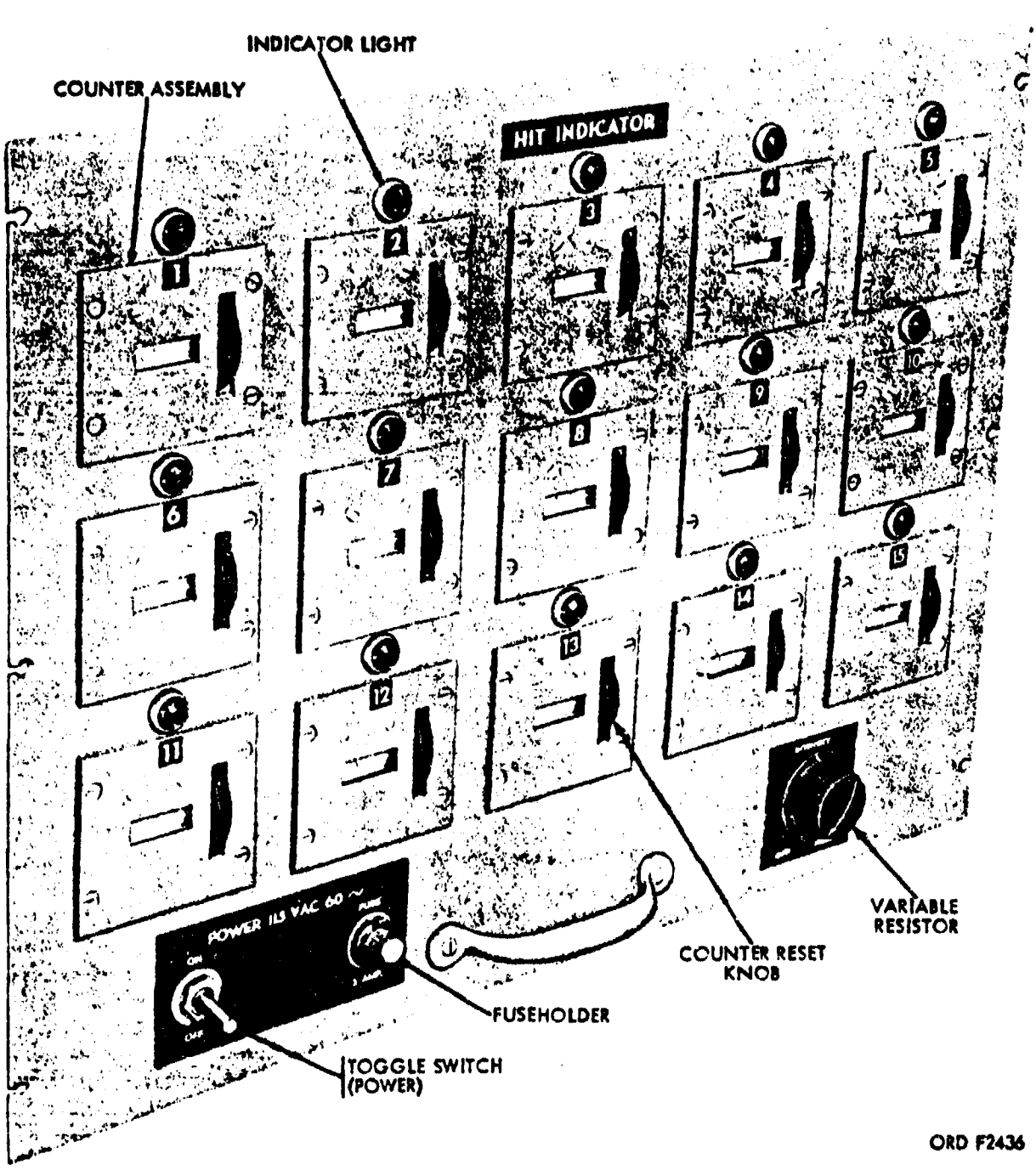

Figure 4. Counter chassis assembly.

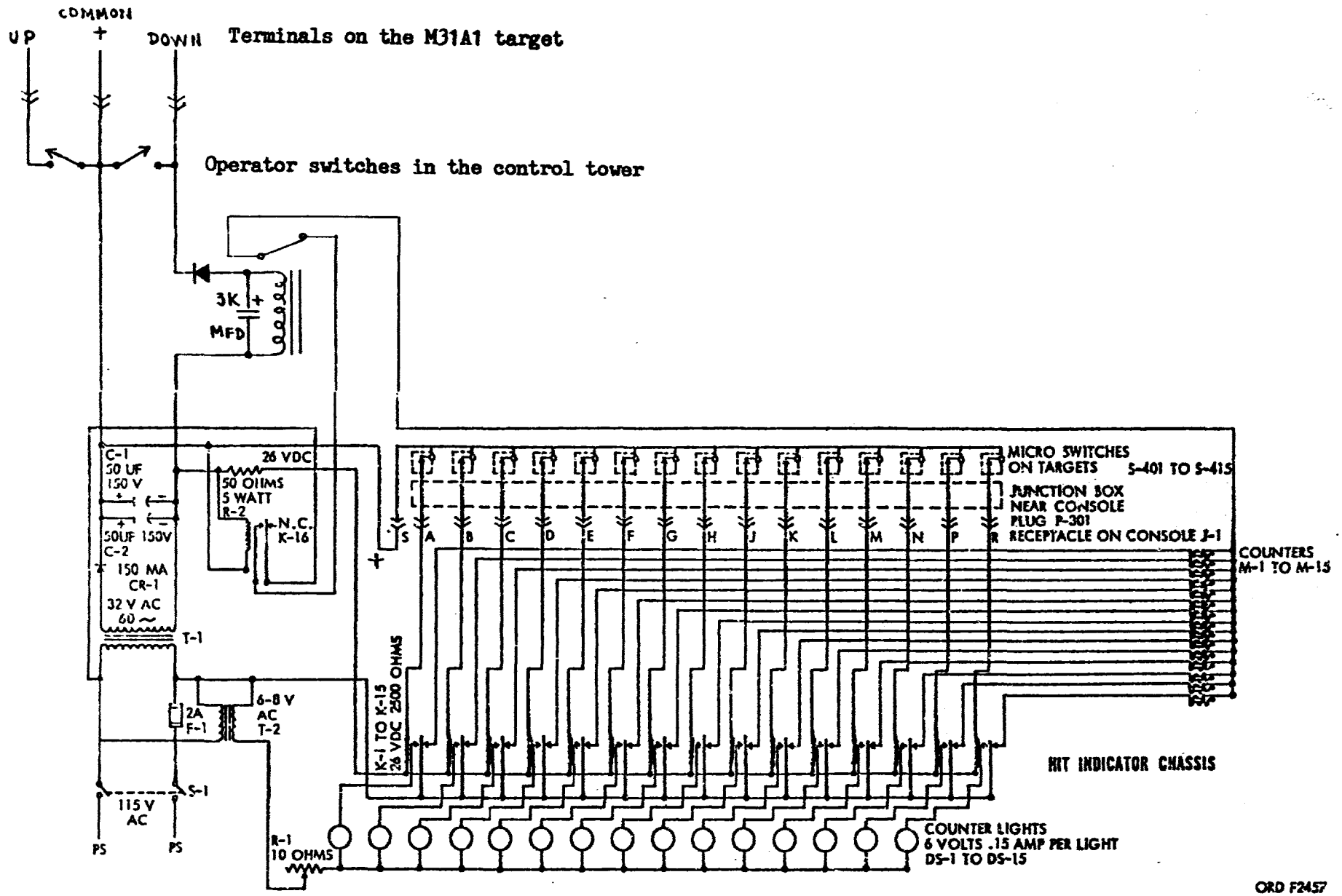

Figure 5. Counter chassis assembly - schematic diagram.

Counters could be connected in many different ways per lane as desired. Ideally for record fire there should be a total of seven counters per lane, one counter recording all hits and one each for the six ranges (50, 100, 150, 200, 250 and 300 meters). This arrangement permits an operator to record the foxhole firing total per lane after the 20th round of the record fire test. At the end of record fire the 40 round hit total would be recorded. This score minus the foxhole total gives the prone firing total. The operator could then record hit totals per range per lane. These six counters per lane when summed give a cross check for the totals counter. They also give information about number of hits at the various ranges. This would be useful information for diagnosis of shooter difficulties, to determine training effectiveness, and to aid in early detection of target malfunctions.

Why Switch to Automatic Scoring?

A major reason for recommending automatic range scoring is to obtain accuracy and consistency in the scoring of shooting performances. Another advantage is reduction in the required labor force to operate the range. Currently, scoring requires an observer/scorer for each of the 16 record fire lanes. With counter banks in the control tower only a single scorer would be required.

Simplification of scoring procedures would also result. The tower operator currently raises a target bank and later sounds a whistle before he presses the down switch so that scorers know when to disregard further hits. In the automatic system the target appears and disappears and a hit counts if it occurs prior to the closing of the down switch.

What is the Cost of the Conversion?

The major cost is the price and installation of an additional wire per target device. Assuming the availability of counter assemblies from M40 Night Firing Mechanisms, no new costs for count circuit counters and relays would be required. The few relays used in the circuit modifications are standard for use in M31A1 Target Holders. No other costs are anticipated.

One option would be to construct a console for the control tower to place the counters in a more convenient lane by range configuration. This too could be inexpensively accomplished especially if parts could be removed and used from M40 Night Firing Mechanisms.