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Sep 81

COMPUTER SET FIELD ARTILLERY GENERAL CANNON GUNNERY APPLICATIONS

REFERENCE NOTE

U.S. ARMY
FIELD ARTILLERY SCHOOL
Gunnery Department
Fort Sill, Oklahoma

*Supersedes RN GD05HC, Jan 81.

Gunnery Department, US Army Field Artillery School, is the proponent agency for the Hand-Held Calculator Cannon Artillery Applications. Questions concerning the operation of the calculator or related gunnery procedures should be addressed to:

Commandant
US Army Field Artillery School
Gunnery Department
ATTN: ATSF-G-RA
Fort Sill, Ok 73503

or telephone AV 639-6108/3901.

Civilian Area code 405-351-6108/3901

Questions concerning the operation of JMEM's application should be addressed to:

Commandant, US Army Field Artillery School
Directorate of Combat Developmnnts
ATTN: ATSF-CD-MDD
Fort Sill, Oklahoma 73503

telephone: AV 639-3669/2807
CIV 405-351-3669/2807

TABLE OF CONTENTS

PART 1. GENERAL INFORMATION

	Page
Introduction	1-A
Programed Capabilities	5-A
Limitations	6-A
Computation Principles	7-A
Flag Card	10-A
Keyboard Overlay	12-A
Cue Cards	13-A
Care and Maintenance	13-A
Field Charging Systems	15-A
Vehicle Power Connections	16-A
Trouble Shooting	21-A

PART 2. OPERATOR PROCEDURES/JOB AIDS

Flag Cards	1-B
Memory Map (Gunnery & HB/MPI Program)	6-B
Prepare for Action	8-B
Program Set Up	10-B
Battery Set Up	11-B
Firing Over 00 Grid Lines	12-B
Determining and Applying Registration Corrections	13-B
Grid Mission	15-B
Polar Mission	16-B
Shift from a Known Point	17-B
Subsequent Correction	18-B
HB/MPI	19-B
Precision Registration	22-B
DPICM	24-B
FASCAM	26-B
M692/M731 (ADAM) Projectile	27-B
M718/M741 (RAAM) Projectile	29-B
Special Situations	30-B
TGPC/SPEC CORR	32-B
Concurrent MET	36-B
Subsequent MET	42-B
Linear Interpolation	47-B
JMEM/SS	49-B
8-Inch K-Transfer Nuclear Mission	55-B
8-Inch MET + VE Nuclear Mission	58-B
155 K-Transfer Nuclear Mission	60-B

PART 3. SAMPLE PROBLEMS

Grid AF MSN	1-C
Polar AF MSN	3-C
Shift AF MSN	4-C
HB/MPI	6-C
Computation of GFT Setting from HB/MPI	8-C
M101A1	11-C
M102	12-C
M114A1	13-C
M114A2/M109	14-C

Table of contents cont.

	Page
M109A1	15-C
M110A2	16-C
Polar FFE	17-C
Grid FFE MSN, High Angle	18-C
Precision Registration	19-C
Computation of GFT Setting from Precision Registration M101A1	21-C
M102	22-C
M114A1	22-C
M109/M114A2	22-C
M109A1	22-C
M110A2	23-C
Grid FFE MSN (Shell WP)	24-C
Shift FFE MSN (Shell APICM M444/M449/M404)	25-C
Grid AF MSN (Shell DPICM M483A1)	27-C
Grid AF MSN (Shell ADAM M692/M731)	30-C
TGPC	32-C
Concurrent/Subsequent MET M101A1	36-C
M102	41-C
M114A1	46-C
M109/M114A2	51-C
M109A1	56-C
M110A2	61-C
K-Transfer Nuclear Mission 155M	66-C
8-Inch	69-C
MET + VE Nuclear Missions 8-Inch	73-C

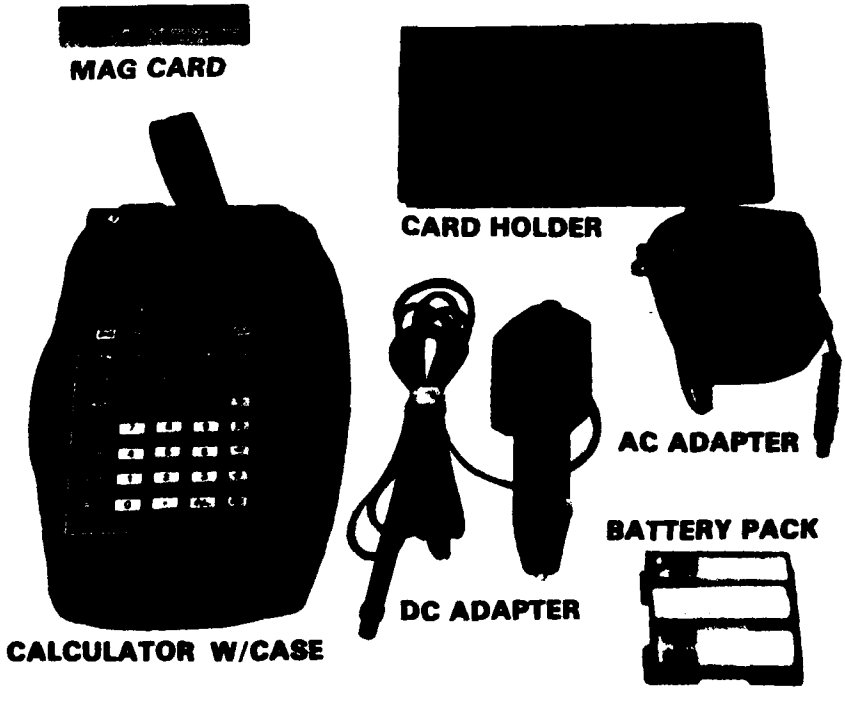


FIGURE 1. COMPUTER SET, FIELD ARTILLERY, GENERAL

PART I

1. REFERENCES.

FM 6-40, Field Artillery Cannon Gunnery (Dec 78) and TM 9-1220-242-12&P (Nov 79).

2. GENERAL.

The Computer Set Field Artillery, General, supplements the existing FADAC/Manual fire direction system, by simplifying gunnery computational procedures. During periods of FADAC nonavailability/inoperability (i.e., movement, lone gun operations, hip shoots), the calculator can provide the primary source of firing data. It also expedites and simplifies HB/MPI registration procedures and concurrent/subsequent MET applications. Upon fielding of the battery computer system (BCS), the Computer Set Field Artillery, General, will comprise the major component part of the manual emergency FDC kit. The capability to fire artillery independent of BCS/TACFIRE computer systems must be maintained.

3. OBJECTIVE.

This reference note is a comprehensive introductory and training manual for the cannon gunnery applications of the Computer Set Field Artillery, General. It is organized into three major parts: Introductory Information, Operator Procedures/Job Aids, and Sample Problems.

-READ THE INTRODUCTORY SECTION PRIOR TO OPERATING THE CALCULATOR.
-READ THE INSTRUCTIONS GIVEN AT THE BEGINNING OF PARTS 2 AND 3.
-SOLVE THE SERIES OF SAMPLE PROBLEMS USING THE JOB AIDS AS YOUR PRIMARY REFERENCE.

4. INTRODUCTION.

a. The Computer Set Field Artillery General (fig 1) is a militarily adapted commercial calculator programmed for cannon gunnery applications. The TI-59 calculator uses preprogrammed memory modules. It is powered by an internal, rechargeable battery pack. Chargers, adapters, and connectors, are provided for attachment to external power sources for extended operations. Light emitting diodes display ten numeric digits, a minus sign, and a decimal point.

b. End Item Description. The component parts are shown in figure 1. The following parts comprise the Computer Set, Field Artillery, General:

CALCULATOR - A commercial TI-59, hand-held programmable calculator with carrying case.

BPiA BATTERY PACK - Rechargeable, internal power supply.

CARD HOLDER - Wallet for storage of cue cards, keyboard overlays, modules and diagnostic/blank magnetic cards.

DC CHARGER-ADAPTER - Converts 12/15-volts DC to 5.5 volts DC.

120/240-VOLTS AC CHARGER-ADAPTER - Converts 120/240 volts AC to 8.4 volts AC.

CONNECTOR, PLUG ELECTRICAL - Power source connector for BA4386 battery (fig 15, pg 9-A).

CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL - Vehicle 12-volt battery cable, assembly (fig 15, pg 9-A).

TM 9-1220-242-12&P - Operator's Maintenance Manual

The connector and cable assembly are used to connect the calculator to the external power sources illustrated on pages 15-A to 20-A. TM 9-1220-242-12&P contains the maintenance procedures for all component parts of the computer set.

c. Associated End Item. Artillery program applications are required to accomplish gunnery related calculations. The programs are stored on 5000-step memory modules, called Firmware Modules. The memory module is the primary component part of the Program kit, Computer Set, Field Artillery, General. Keyboard overlays and operator cue cards are associated with the program kit applications. Two modules (weapon system and special situation) per weapon system, are required to accomplish all the gunnery applications:

(1) The Weapon System Modules are programmed for low/high angle fire gunnery, HB/MPI registration procedures, and are weapon system related.

(a) Program Kits are available for the following weapon systems:

M101A1/M102 (same module)	NSN 1220-01-082-1624
M114A2/M109 (same module)	NSN 1220-01-082-1623
M114A1	NSN 1220-01-082-1625
M109A1	NSN 1220-01-082-1617
M110A2	NSN 1220-01-082-1618

(b) The M198 weapon system program kit will be developed when fire control information is available. In the interim the M109A1 module can be utilized for the M198 system following the conduct of a registration and application of registration corrections (residuals).

(c) The M110A2 module was programmed based on the M110A1 TFT muzzle velocities. Fire control information for the M110A2 parallels the M110A1 with the exception of minor muzzle velocity variances. Application of registration corrections will compensate for the muzzle velocity variations.

(d) The component parts of the Program Kit, Computer Set, Field Artillery, _____ (weapon system) (fig 2) are:

MODULE:	5000-step, Read Only memory module containing gunnery and HB/MPI programs.
KEYBOARD OVERLAY:	Gunnery and HB/MPI applications (reversible).
CUE CARD:	Gunnery and HB/MPI application cue card (reversible), defines functions of control keys A through E.
REFERENCE NOTE:	GD05HC (not shown).

(2) The Special Situation Module (NSN 1220-01-082-1628) is not weapon system peculiar.

(a) It is designed and programmed for the following applications:

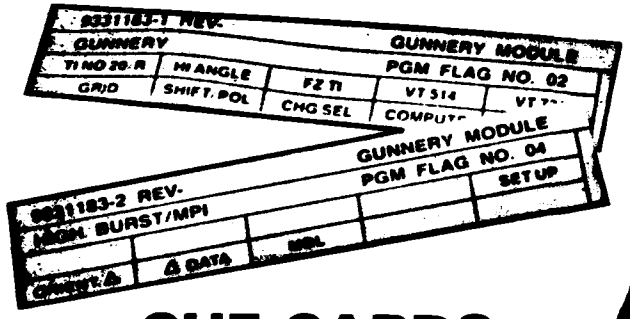
-Concurrent/subsequent MET mathematics.
-Terrain gun position/special correction mathematics.
-M549A1 rocket assisted projectile (RAP) gunnery (M109/M109A1 systems only).
-14.5, M31 trainer.
-Joint munition effectiveness, surface to surface (JMEM/SS).
-Linear interpolation.

(b) The component parts of the Program Kit, Computer Set, Field Artillery, Special Situation (fig 3) are:

MODULE:	5000-step, Read Only memory module containing MET, TGPC/SPEC CORR, 14.5 trainer, RAP, JMEM/SS, and linear interpolation programs.
KEYBOARD OVERLAY:	MET and TGPC/SPEC CORR applications (reversible).
CUE CARD:	Concurrent and subsequent MET applications (reversible), defines functions of control keys A through E.
CUE CARD:	TGPC/SPEC CORR application and Linear Interpolation routine (reversible), defines control keys A - E.
REFERENCE NOTE:	GD05HC (not shown).

WEAPON SYSTEM MODULE

KEYBOARD OVERLAYS



CUE CARDS

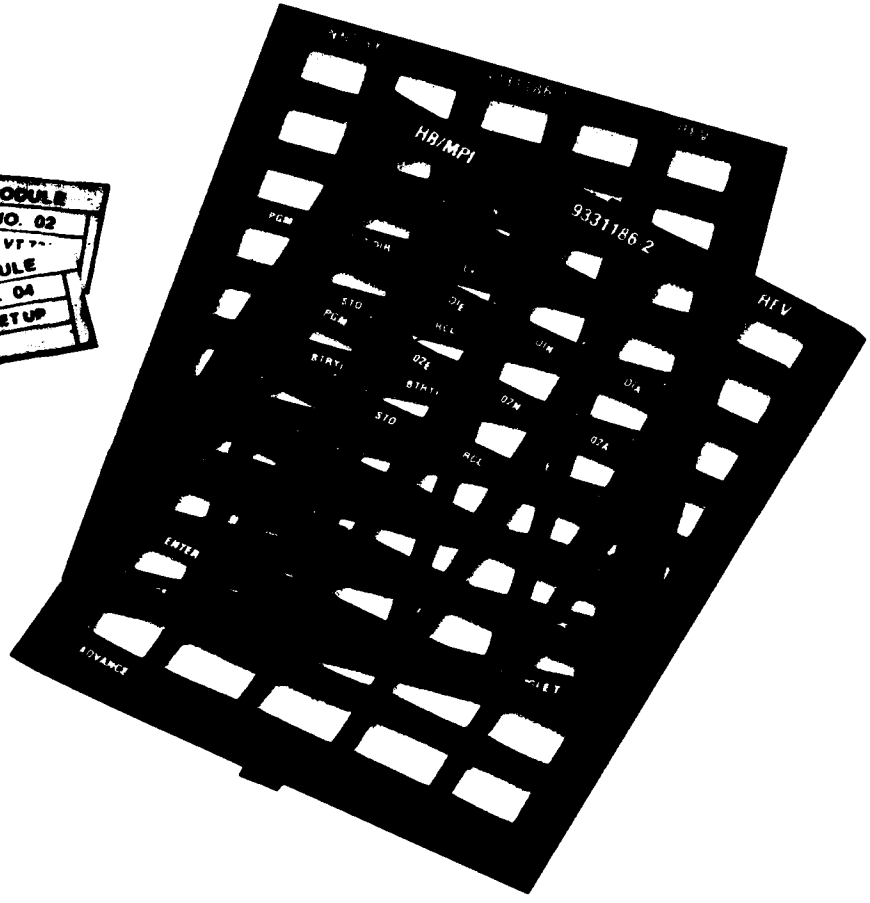
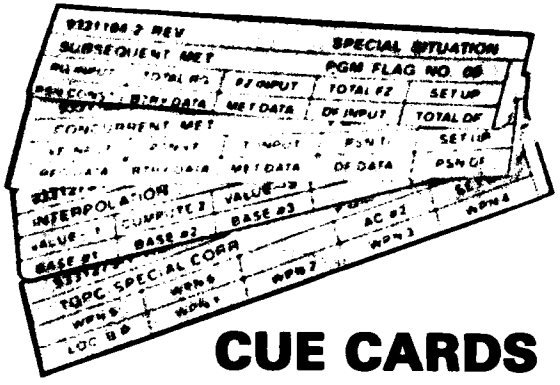


FIGURE 2, PROGRAM KIT, COMPUTER SET, FIELD ARTILLERY, M109A1

SPECIAL SITUATION MODULE

KEYBOARD OVERLAYS



CUE CARDS

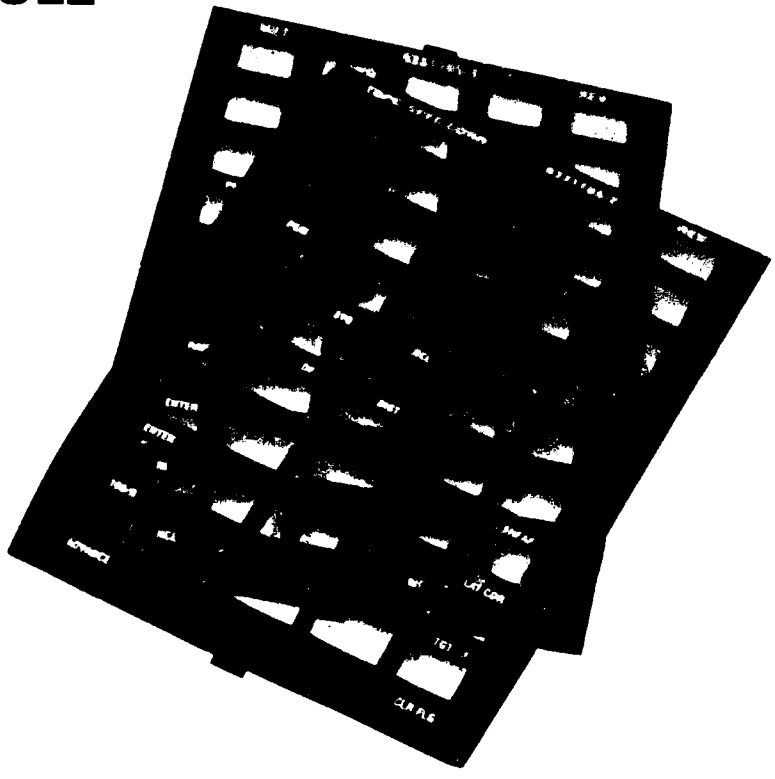


FIGURE 3, PROGRAM KIT, COMPUTER SET, FIELD ARTILLERY, SPECIAL SITUATION

5. PROGRAMMED CAPABILITIES.

a. Weapon System Module. The exact capabilities vary by weapon system. Each system's flag card lists its exact charge/projectile capabilities. The following capabilities are common to all the weapon system modules:

(1) Cannon gunnery application.

(a) Determines direction (gun-target-azimuth) and range to targets, located by grid, shifts from a known point or polar method of target location.

(b) Computes M564 fuze settings for HE, low angle fire and time of flight for HE, high angle fire.

(c) Computes chart deflection, applies drift and the GFT deflection correction and displays deflection to fire.

(d) Computes elevation (low and high angle), applies angle of site (low angle only), registration corrections, and 20/R (when overridden) and displays quadrant to fire.

(e) Selects the lowest charge to fire of the group of charges recalled.

(f) Applies subsequent corrections for range and deviation and computes subsequent firing data. Fuze setting height of burst adjustment must be done manually using Δ FS.

(g) Stores and applies registration corrections by charge (range K, GFT deflection correction, and fuze K) for the four charges recalled.

(h) Provides the tabular firing table/graphical firing table entry arguments for computation of firing data for projectiles illumination, APICM, DPICM, and FASCAM.

(i) Stores and recalls seven target locations.

(j) Computes angle T.

(k) Indicates some common operator errors (see flag card and para 8c).

(2) High burst/mean-point-of impact registration application.

(a) Determines observer's orienting data (direction and vertical angle) to the HB/MPI orienting point.

(b) Averages observer's measured directions/vertical angles and computes mean burst location grid and altitude.

b. Special Situation Module. It is programmed to perform the gunnery functions of the weapon system module for the 14.5 and 549A1 (RAP) projectiles (excluding HB/MPI functions), and the following applications:

(1) Terrain gun position/special corrections.

(a) Performs the M17 plotting board functions and assists with mathematical computation of TGPC/SPEC CORR.

(b) Computes piece displacement using laid deflection and distance (hasty traverse).

(c) Computes lateral corrections to assigned sheaf burst lines.

(d) Assists with the computation of right/left sector TGPC.

(2) Concurrent MET. Computes position deflection correction, position velocity error, and position fuze correction for all weapon systems and projectiles (including shell HES).

(3) Subsequent MET/MET + VE). Computes total deflection correction, total range correction, and total fuze correction for all weapon sy tems and projectiles (including shell nuclear).

(4) Linear interpolation. Computes the unknown (X) value of an interpolation problem.

(5) JMEM/SS.

(a) Computes fractional damage based on projectile and number of volleys.

(b) Computes number of volleys for a specified projectile based on the desired fractional damage.

6. LIMITATIONS.

a. Volatile Memory. Whenever the calculator is turned off or power is lost, all data in the 100 working registers is erased. This necessitates reentry of data and reactivation of the desired programs. Data stored on the module is not affected by a power loss. Power source connectors and adapters are used to continuously charge the internal battery pack. When connected to an external power source, the calculator can be operated for extended periods of time.

b. Accuracy: Is limited to range curve-fit intervals. See paragraph 7 for detailed discussion of accuracy and curve-fit intervals.

c. Charges: Only four charges can be recalled at one time. The flag card (para 8) outlines the charge/projectile groups.

d. Transfer Limits: Registration corrections/residuals are applied without consideration of deflection transfer limits. Paragraph 5-37, FM 6-40, transfer limits apply.

e. Target Store: Seven storage locations are available.

f. Height of burst adjustment for fuze time: Must be done manually with Δ FS obtained from the TFT/GFT.

g. Tabular Firing Tables/Graphical Firing Tables (TFT/GFT's): Are required for computation of firing data for ILLUM, APICM, DPICM, FASCAM, WP, SMK, and Chemical Projectiles.

h. Multiple Missions: Require more than one calculator.

i. The Calculator cannot:

-Store fire support coordination measures (FSCM).
-Derive muzzle velocities.
-Compute chronograph/velocimeter reduction.
-Replot.
-Compute maximum ordinate.
-Compute complementary angle of site.

7. COMPUTATION PRINCIPLES.

a. The calculator, cannon-gunnery program computations yield tabular firing table (TFT) data under standard conditions. The solution is a curve-fit solution, using second degree polynomials, fit to TFT data by the method of least squares. The Ballistic Research Laboratory, Aberdeen Proving Ground, Maryland produced the polynomial coefficients, called constants, for the gunnery program equations. Constants are associated by weapon system, low/high angle fire, charge, and projectile family. Each weapon system's flag card (para 8) identifies its grouping of constants which are activated in charge groups of four.

b. To compute firing data, the correct group of constants must be recalled by the operator from the memory module. These constants are then available for use by the gunnery program to compute the curve-fit solution (firing data). Under standard conditions, the curve-fit solution will normally agree with the TFT, but may vary as much as:

+/- 3m/l elevation
+/- 1m/l deflection (low angle)
+/- 3m/l deflection (high angle)
+/- .1 fuze setting (FS) increment
+/- .1 time of flight in seconds

c. This accuracy requirement is met within certain range intervals of each charge, called the CURVE-FIT INTERVAL. The flag cards list the curve-fit intervals by charge and projectile. The above specified accuracy is attained whenever computing at adjusted ranges (chart range multiplied by range K) which falls within the curve-fit interval. To override the curve fit interval error indicator type: CLR, ADVANCE. To determine another charge when the curve fit interval error indicator is flashing, type: CLR, C.

WARNING: WHEN THE ADJUSTED RANGE FALLS OUTSIDE THE CURVE-FIT INTERVAL, SIGNIFICANTLY LARGE ERRORS MAY OCCUR.

To alert the operator to curve-fit violations, the calculator will display a flashing 4 (error indicator). When a range curve-fit interval violation is indicated (flashing 4), the operator should consult the flag card and override a charge that falls within the range curve-fit interval. If operational constraints prohibit changing charges, the error indicator can be overridden and firing data computed. The magnitude of the error introduced by firing outside the established curve-fit interval depends on the type of fire, the distance outside the interval, and the change in range per 1 mil change in elevation (col 5, Tbl F, TFT) corresponding to the adjusted range

d. Charge selection routine:

(1) Selection of the charge to fire is based upon the chart range to the target. The calculator will select the lowest charge (based on chart range) of the group recalled, falling within the range curve-fit interval. The operator may override at his discretion a specific charge. To override the selected charge, press: CLR, (charge # to fire), ADVANCE.

(2) If the chart range is less than the lowest charge's curve-fit minimum range, the calculator will select the lowest charge of the charge group recalled.

Note. Range curve-fit violations are based on adjusted range (CHT RG times RG K), and are checked during the compute mode.

It is possible to receive an error indicator (flashing 4) when firing a charge selected by the calculator, if the adjusted range falls outside the curve-fit interval. The range curve-fit intervals on the flag card should be consulted during firing.

(3) If the chart range exceeds the maximum curve-fit range of the higest charge recalled, the calculator will select the highest charge (see note, above).

(4) If the chart range exceeds the maximum TFT range of the highest charge of the group recalled, the calculator will flash a #2 (error indicator).

e. Registration Correction/Residuals. Registration corrections are applied through the input of range K, fuze K and the GFT deflection correction. Residuals are computed from a GFT setting constructed from a registration or derived from FADAC. Residual validity is dependent on the GFT setting's validity, FM 6-40 registration transfer limits apply. The calculator applies registration corrections regardless of transfer limits.

(1) RANGE K: Is a factional representation of the total range correction. Range K is determined by dividing the range corresponding to elevation plus complementary angle of site (QE - angle of site), by the chart range to the registration point. This value when entered into the calculator as a residual is multiplied by the chart range to determine the corrected range for each mission. As chart range increases/decreases from the registering range, the range K factor proportionally increases/decreases the mission's total range correction.

RANGE ~ ELEVATION + CAS, ÷, CHART RANGE = RANGE K

(2) FUZE K: Is also a fractional multiplier similar to range K. It applies a total fuze correction to all fuze time/VT missions. Fuze K is determined by dividing the adjusted time (from registration) by the time corresponding to elevation + CAS.

ADJUSTED TIME, ÷, TIME ~ ELEVATION + CAS = FUZE K

(3) GFT DEFLECTION CORRECTION: Is the total deflection correction minus drift. When the GFT deflection correction is entered into the calculator, it is automatically applied to drift corresponding to elevation for each mission's deflection correction.

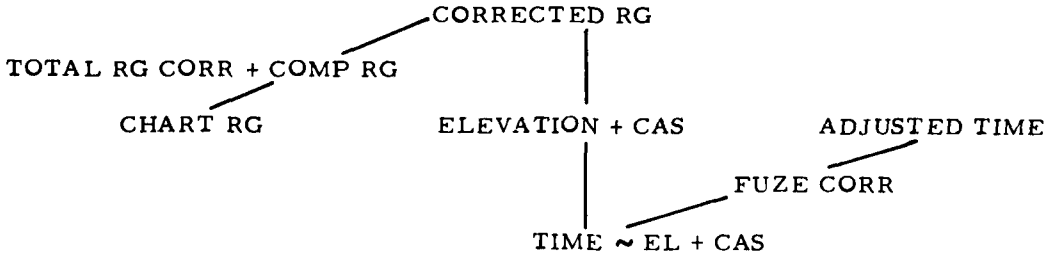
TOTAL - DRIFT = GFT DF CORR

(4) RESIDUALS: Can be stored by charge for each charge of the constants recalled (total of 4). If no residuals are entered, the calculator will default to standard values of range K "1.0", GFT DF CORR "0", fuze K "1.0". Whenever a group of charge constants are recalled the residuals are automatically set to the standard values.

f. Complementary Angle of Site (CAS). Without the application of residuals the firing data quardant (QE) routine does not apply CAS when computing QE to fire.

ELEVATION + ANGLE OF SITE = QUADRANT ELEVATION

The first round data error introduced by ignoring CAS is small when consideration is given to the many variable errors involved (observer location error, a target location error, muzzle velocity errors, etc.). If residuals are computed and applied as specified in the residual section of the Job Aids (pg 13-B and 14-B), the registration mission's CAS (comp range) is reflected in the range K residual. By determining the range corresponding to elevation + CAS (corrected range) complementary range is included in the total range correction and the resulting range K residual.



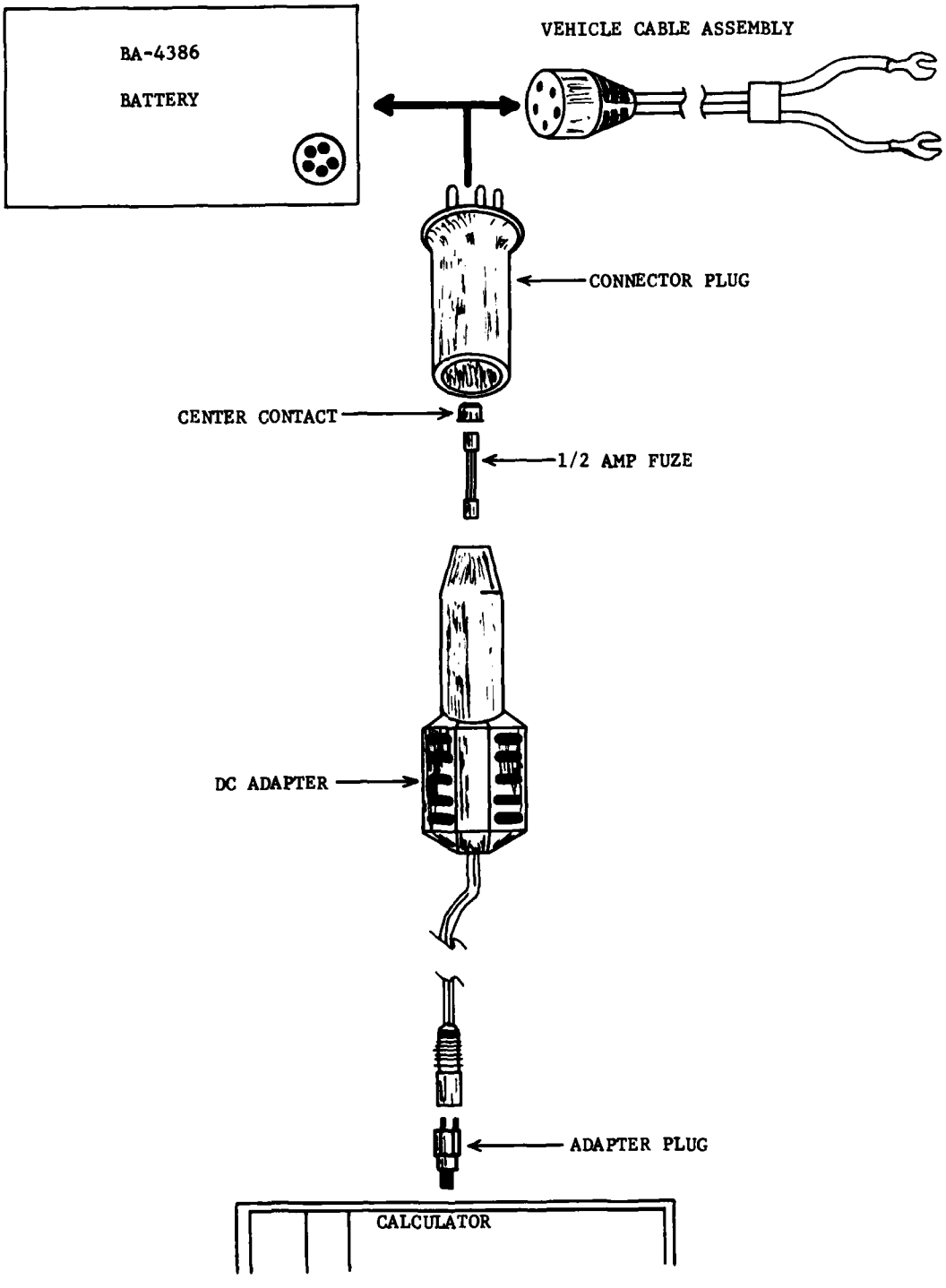


Figure 15. Field charging systems.

8. FLAG CARD

Flag cards are comprehensive listings of frequently used information--Program/Constant flag numbers, Error Indicators, Fuze Overrides, and Curve Fit Intervals. Each weapon system has an associated flag card (pages 1-B Through 5-B). The flag card on page 11-A was extracted to assist explanation of the flag card's information.

a. Weapon System Module: Contains the program applications and associated program flag numbers. The program flag number is the number used to recall the desired program. The weapon system module has two major programs (gunnery and HB/MPI), and numerous constants grouped by charge, projectile, and method of fire. The interior identification program flag number is used to verify the weapon system module upon initial receipt (see Prepare for Action).

b. Special Situation Module: Contains the program applications and associated program flag numbers. The program flag number is the number used to recall the desired program. The special situation module has six major programs (gunnery, TGPC/SPEC CORR, concurrent MET, subsequent MET, interpolation, JMEM/SS) and constants for the 14.5, M31 trainer, and RAP(M549A1) for the 155mm systems. The interior identification program is used to verify the special situation module upon initial receipt (see Prepare for Action).

c. Error Indicator: The calculator is programmed to detect some operator errors, and alert the operator by flashing numbers 1 through 5 or by displaying numbers 7 or 77.

FLASHING 1 - indicates that no observer target direction has been entered. The calculator must have an OT direction before applying any subsequent correction. Any change after the computation of initial firing data constitutes a subsequent correction. For observer target DIR 0, 6400 must be used.

FLASHING 2 - indicates that the chart range to target is greater than the maximum tabular firing table range of the highest charge recalled.

FLASHING 3 - indicates that a charge was overridden with a charge which is not a member of the charge group recalled.

FLASHING 4 - indicates that the adjusted range (CHT RG X RG K) falls outside the charge's range curve-fit interval.

FLASHING 5 - indicates that a number other than 1 through 7 was used to store or recall a target (ONLY #1 thru #7 can be used).

DISPLAYED 7 or 77 - indicates that the program pointer in the calculator is at the end of the gunnery program(7), or at the end of any other program (77). When the ADVANCE key is pressed out of sequence or at random, the program pointer will go to the last step in the program and display 7 or 77. This precludes some data input storage errors and prohibits the execution of program subroutines out of sequence.

CAUTION: Random successive pressing of the ADVANCE key must be avoided. It will cause program and data errors which may cause erroneous computations.

d. Override: Fuze quick is the programmed standard fuze. If a fuze setting/time of flight is required, the correct override flag must be set. The gunnery application matrix and the flag card identify the key-flag relationships. Basically, the setting of override flags:

(1) Provide a graze burst fuze setting/TOF.

(2) Apply or omit 20/R to quadrant for fuzes, Time and VT.

(3) Round down fuze setting/TOF for fuze VT.

(4) Enable high angle computations.

FLAG CARD (ILLUSTRATION) - M114A1 CANNON ARTILLERY PROGRAMS

M114A1 Weapon System Module:

PROGRAMS	PGM FLAG #
Interior Identification	01
Cannon Gunnery	02
HB/MPI	04

CONSTANTS	PGM FLAG #
Shell HE (M107)	
Low Angle, CHG 1-2 GB & 3-4 WB	05
Low Angle, CHG 4-7 WB	06
High Angle, CHG 1-2 GB & 3-4 WB	07
High Angle, CHG 4-7 WB	08

ERROR INDICATORS:

Flashing:
1 - No observer target direction.
2 - Beyond maximum range of highest charge recalled.
3 - Constants not available in recalled charge group.
4 - Outside curve-fit interval.
5 - Invalid target STORE/RECALL number.

Displayed:
7 - END of gunnery program
77 - END of all other programs.

Special Situation Module:

PROGRAMS	PGM FLAG #
Interior Identification	01
Cannon Gunnery	02
14.5, M31 Trainer Constants	04
M109A1 RAP (M549A1) Constants	
Low Angle, CHG 7R & 8R	05
M114A2/M109 RAP (M549A1) Constants	
Low Angle, CHG 7R	06
TGPC/SPEC CORR	07
Concurrent MET Math	08
Subsequent MET Math	09
Interpolation Linear	10
JMEM/SS	11

OVERRIDES:

2ND, A: Computes TOF/MTSQ fuze setting without 20/R.
2ND, B: Enable high angle computations.
2ND, C: Computes MTSQ fuze setting with 20/R.
2ND, D: Computes VT fuze setting with 20/R.
2ND, E: Computes VT fuze setting without 20/R.

Fuze setting curve-fit coefficients are based on:

HE (M107)
Low Angle = M564 FZ
High Angle = TOF

RAP (M549A1)
Low Angle = TOF

14.5 (M31)
Low Angle = TOF

RANGE CURVE-FIT INTERVALS

Shell HE (M107)

CHG	Low Angle RANGE	High Angle RANGE
1G	1700-3700	2900-3900
2G	2100-4700	3700-4800
3W	2800-6100	4800-6300
4W	3600-7800	6100-8000
5W	4400-9400	7500-9700
6W	5700-11600	9400-12000
7W	7500-14100	11600-14600

M109A1 RAP (M549A1)

CHG	Low Angle
7R	12300-19200
8R	15300-23000

M109/M114A2 RAP (M549A1)

CHG	Low Angle RANGE
7R	12100-19000

M31 (14.5 Trainer)

CHG	Low Angle RANGE
1	3600-7200

e. Fuze flags can only be set in the following progression:

Fz Q to Fz Ti to Fz VT_{514} to Fz VT_{732}

$Q \longrightarrow Ti \longrightarrow VT_{514} \longrightarrow VT_{732}$

The operator cannot set a flag for Fz Ti or either Fz VT's and then go to Fz Q without pressing the end of mission (EOM) key, E. The operator cannot set the flag for either Fz VT's and then go to Fz Ti without pressing the EOM key. The operator cannot set a flag for Fz VT_{732} and then go to Fz VT_{514} without pressing the EOM key. Also the operator cannot go from "Ti NO 20R" to either Fz Ti or Fz VT_{514} without pressing the EOM key. If it is necessary to accomplish any of these mentioned operators without ending the mission, the procedure is as follows:

(1) Store the present grid location as a target (see pg 15-B, para 1d).

(2) Press the EOM key, E.

(3) Recall the stored grid location (see pg 15-B para 1e).

(4) Set the appropriate flag (Fz Q is the default, no flag set).

(5) Proceed with the mission.

f. The operator can go from low angle to high angle without pressing the EOM key provided the appropriate high angle constants are recalled. The operator cannot go from high angle to low angle without pression the EOM key. If it is necessary to go from high angle to low angle without ending the mission, the procedure is as follows:

(1) Store the present grid location (see pg 15-B, para 1d).

(2) Press the EOM key, E.

(3) Recall the stored grid location (see pg 15-B para 1e).

(4) Recall the appropriate low angle constants.

(5) Recall the gunnery program (2nd PGM, 02).

(6) Continue as usual.

g. Fuze setting curve-fit coefficients are based on the following:

(1) Low angle fire fuze settings (all weapons systems) are based on graze bursts for M564 fuze. High angle fire fuze settings are based on time-of-flight. Fuze VT is the preferred fuze for high angle fire.

(2) Fuze settings for low and high angle fire for DPICM (M483A1) are based on graze bursts for fuze M577 (155 systems). The calculator program computes self-registering mode data only. TFT fuze HOB corrections or GFT conversion scales are used to correct S-R mode data to FFE DPICM firing data.

(3) Fuze settings for RAP (M549A1) and the M31 (14.5 trainer) are based on time-of-flight.

(4) Fuze settings for low and high angle fire for high explosion spotter (HES) M424A1 (M110A2 system) are based on graze bursts for fuze M591.

h. Range Curve-Fit Intervals: This section lists the curve-fit interval ranges by charge and projectile. The curve-fit intervals have been violated whenever a flashing 4 is displayed (see para 7c and 8c).

9. KEYBOARD OVERLAYS.

Each application's overlay identifies the gunnery programed function labeled below each key on the overlay. With the exception of 2ND, CLR, STO, RCL, 0-9 numeric, and the ÷, X, -, +, =, +/- mathematic keys, the Texas Instrument labeled key functions are not used. A one-key, one-function relationship applies for all keys except the mathematic keys. They perform the math function, as well as, the assigned gunnery function. The overlays were developed to facilitate man-machine interaction, simplify and expedite training, and enhance retention of operator skills. To prepare the keyboard for operation, the Texas Instrument key labelings (circled below) should be concealed with small pieces of black tape. When this is accomplished, place the gunnery overlay on the keyboard and compare it to figure 7. The RCL and STO keys need not be concealed.

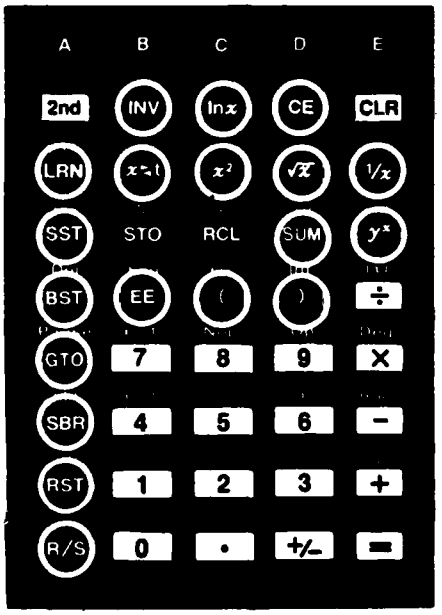


Figure 4. TI-59 keyboard preparation.

10. CUE CARDS

Each major application has an associated cue card labeled for that particular application. Cue cards identify the functions of the control keys (A thru E, fig 5, below). Each control key is capable of performing two functions: The pressing of the key alone accomplished the primary function listed above it on the first line of the cue card (i.e., to compute firing data, PRESS: D). To execute the second function, the 2ND key is pressed before pressing the lettered control key (i.e., to override fuze time, PRESS: 2ND, C).

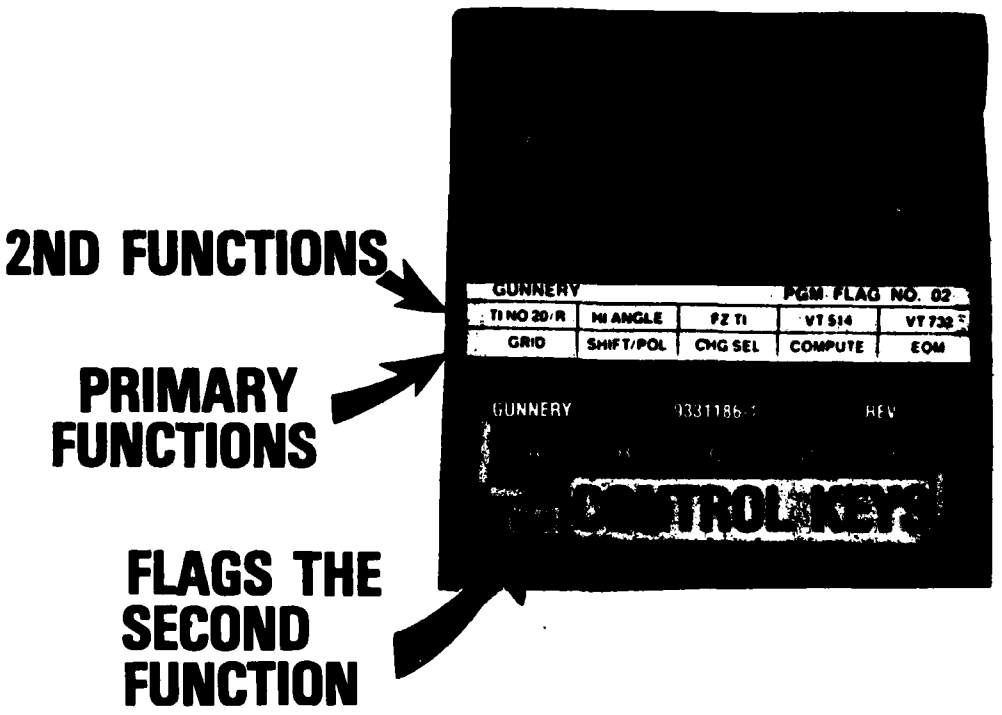


Figure 5. Cue card/Control keys.

11. CARE AND MAINTENANCE

a. The Computer Set, Field Artillery, General, is not militarily hardened.

HANDLE IT WITH CARE AND PROTECT IT FROM THE WEATHER

TM 9-1220-242-12 & P, The Organizational Maintenance Manual for the computer set, contains some operation and maintenance instructions. Become thoroughly familiar with the contents of the TM as well as this RN, prior to attempting operation of the calculator. The drawings on pages 15-A through 20-A in this reference note, illustrate the correct way to connect the charging system to various 12-volt vehicle sources.

THE CALCULATOR MAY BE DAMAGED IF THE CHARGING SYSTEM IS IMPROPERLY CONNECTED.

b. Figure 6 is a design drawing of a Dispatch Case (NSN 8460-00-782-6726/cost $10.50) modified to carry the computer (while charging) and its associated equipment-TFT addendums, BA-4386 battery and connectors. Modifications must be done by the unit or the local training aid support organization. The computer set should be inventoried frequently to insure accountability of the many small component parts.

12. FIELD CHARGING SYSTEMS

a. The charging systems (fig 15, pg 9-A) are negative ground, 12-15 volt DC systems. The designed power sources are BA-4386 batteries or 12-volt vehicle batteries.

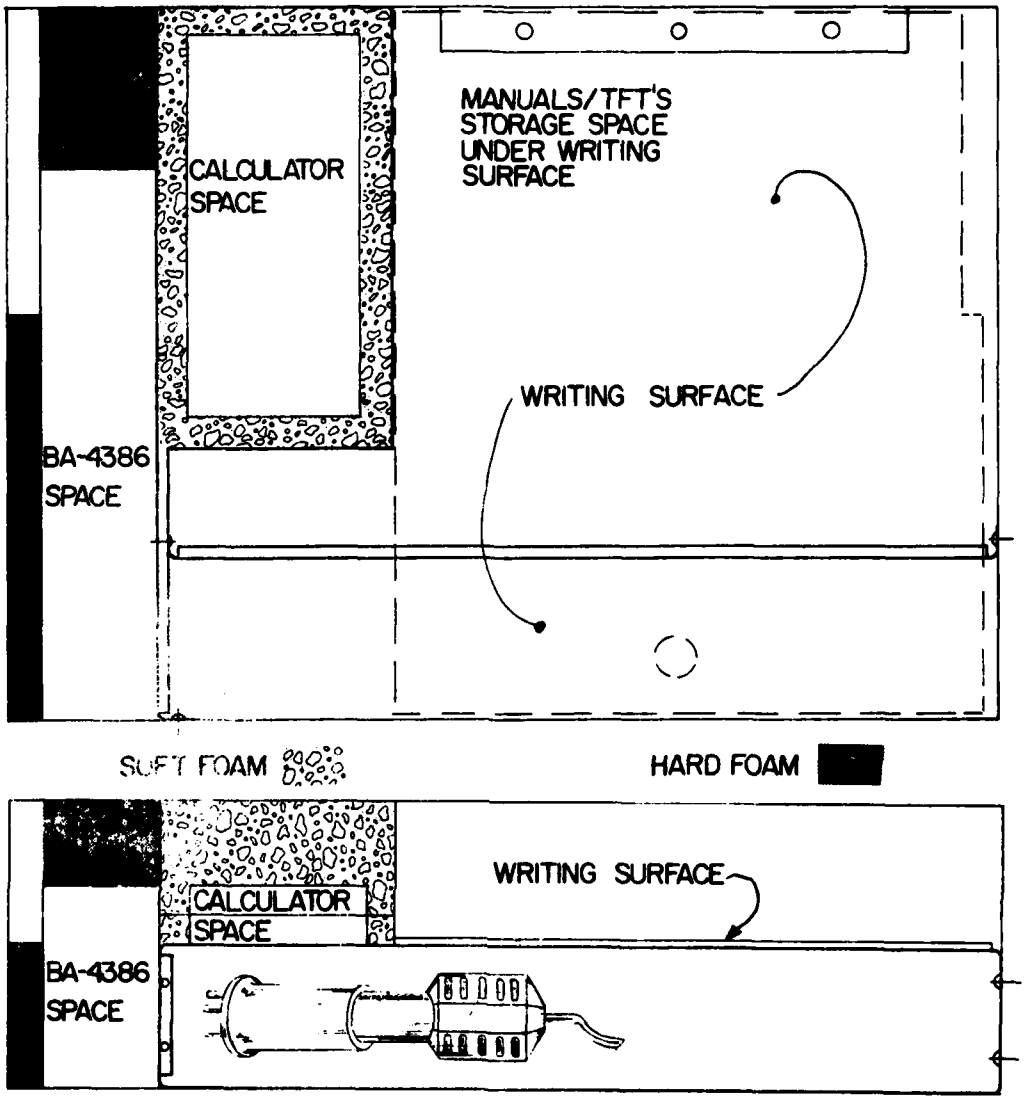


Figure 6. Carrying case for computer set, FA general.

WARNING: BATTERIES CONNECTED IN SERIES PRODUCE 24-VOLTS. INSURE THAT THE CONNECTION OF THE VEHICLE BATTERY IS AS PRESCRIBED ON PAGES 16A THROUGH 20A.

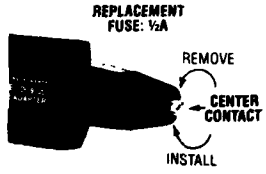
If the cable assembly is connected to a positive ground system the DC adapter will become very hot (uncomfortable to touch). Disconnect the calculator and take corrective action.

b. The DC adapter contains a 1/2-amp fuze for overload protection. If a charging problem is encountered, check to insure that the fuze is not blown.

(1) To remove the fuze, press the center contact into the housing and rotate 1/4 turn counterclock wise.

CAUTION! THE FUZE IS SPRINGLOADED.

(2) To replace the fuze, reverse the above procedures.



c. If the charging system fails to charge the calculator and the apparent source of the problem is not the charging system, connect the calculator to the 120/240 AC adapter/charger. If the AC adapter charges the calculator, the charging system is at fault. If the AC adapter fails to charge the calculator, change battery packs. If still unsuccessful follow procedures outlined in TM 9-1220-242-12&P.

d. The following illustrations depict the correct way to connect the vehicle cable to 12-volt batteries to attain a 12-volt output. Refer to the figure for the type of vehicle being used.

THE CONNECTION TO A 12-VOLT VEHICLE BATTERY SHOULD BE PERFORMED BY A QUALIFIED SUPERVISOR.

Once the connection is properly made, leave the cable assembly attached to the battery. During March Order or vehicle starting, remove the DC adapter from the connector plug.

ONE QUARTER TON TRUCK

STEP

1 Insure that the battery pack is installed in the calculator.

2 Turn off the calculator.

3 ATTACH THE SPADE LUG OF THE ALL BLACK (NEGATIVE) WIRE of the cable assembly to the minus (negative) terminal shown below.

4 ATTACH THE SPADE LUG OF THE BLACK-WITH-WHITE STRIPE (POSITIVE) WIRE of the cable assembly to the plus (positive) terminal as shown below.

CAUTION! IF THERE IS ANY DOUBT ABOUT WHICH BATTERY TO CONNECT TO, USE A MULTIMETER AND MEASURE THE VOLTAGE BETWEEN THE POSITIVE AND NEGATIVE TERMINALS. A 12-VOLT OUTPUT IS REQUIRED.

THE POSITIVE AND NEGATIVE WIRES MUST BE ATTACHED TO THE SAME BATTERY TO PRECLUDE A 24-VOLT OUTPUT.

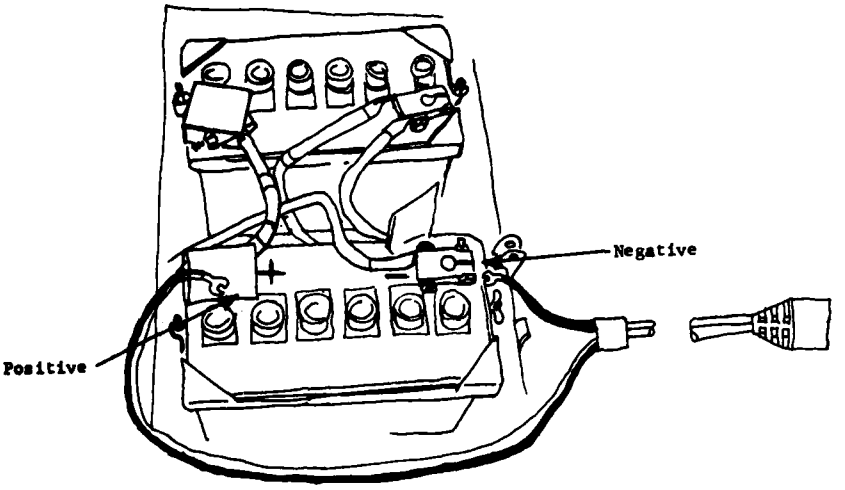


Figure 16. One quarter tone truck.

M109 SERIES HOWITZERS AND M577 COMMAND POST VEHICLES

STEP

1 Insure that the battery pack is installed in the calculator.

2 Turn off the calculator.

3 ATTACH THE SPADE LUG OF THE ALL BLACK (NEGATIVE) WIRE of the cable assembly to the minus (negative) terminal shown below.

4 ATTACH THE SPADE LUG OF THE BLACK-WITH-WHITE STRIPE (POSITIVE) WIRE of the cable assembly to the plus (positive) terminal as shown below.

CAUTION! IF THERE IS ANY DOUBT ABOUT WHICH BATTERY TO CONNECT TO, USE A MULTIMETER AND MEASURE THE VOLTAGE BETWEEN THE POSITIVE AND NEGATIVE TERMINALS. A 12-VOLT OUTPUT IS REQUIRED. THE POSITIVE AND NEGATIVE WIRES MUST BE ATTACHED TO THE SAME BATTERY TO PRECLUDE A 24-VOLT OUTPUT.

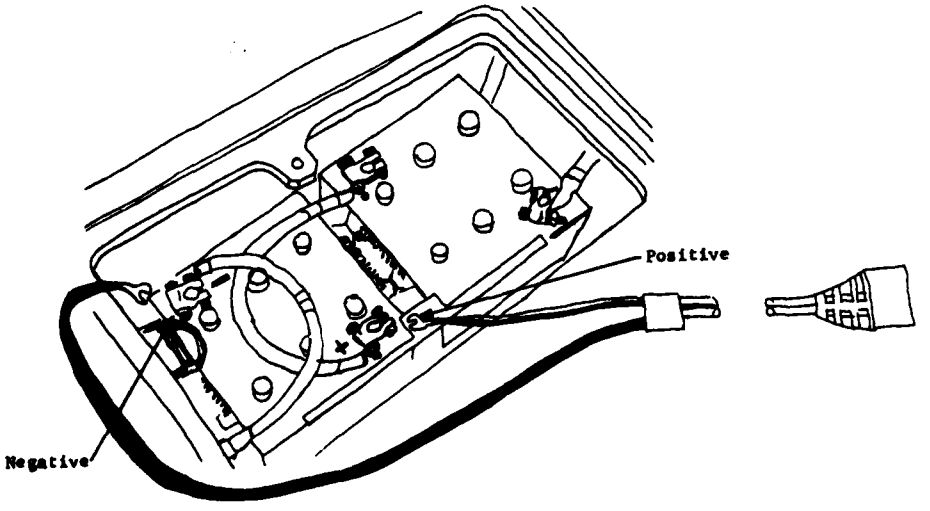


Figure 17. M109 series howitzers and M577 command post vehicles.

TWO AND ONE-HALF, AND FIVE TON TRUCKS

STEP

1 Insure that the battery pack is installed in the calculator.

2 Turn off the calculator.

3 ATTACH THE SPADE LUG OF THE ALL BLACK (NEGATIVE) WIRE of the cable assembly to the minus (negative) terminal shown below.

4 ATTACH THE SPADE LUG OF THE BLACK-WITH-WHITE STRIPE (POSITIVE) WIRE of the cable assembly to the plus (positive) terminal as shown below.

CAUTION! IF THERE IS ANY DOUBT ABOUT WHICH BATTERY TO CONNECT TO, USE A MULTIMETER AND MEASURE THE VOLTAGE BETWEEN THE POSITIVE AND NEGATIVE TERMINALS. A 12-VOLT OUTPUT IS REQUIRED.

THE POSITIVE AND NEGATIVE WIRES MUST BE ATTACHED TO THE SAME BATTERY TO PRECLUDE A 24-VOLT OUTPUT.

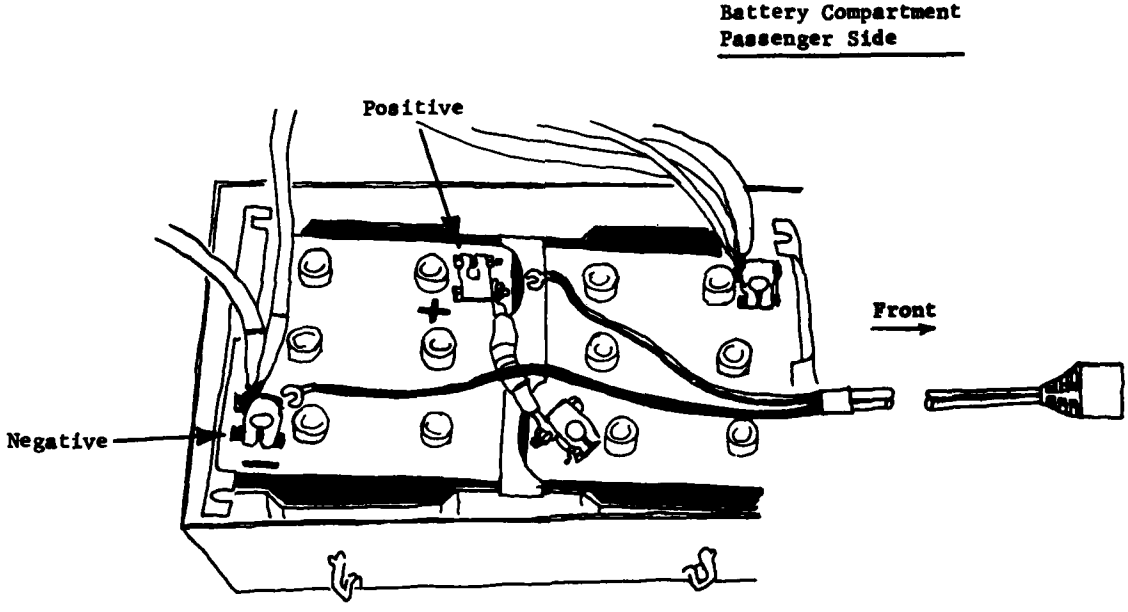


Figure 18. Two and one-half, and five ton trucks

M110 SERIES HOWITZERS 12-VOLT VEHICLE POWER CONNECTION

STEP

1 Insure that the battery pack is installed in the calculator.

2 Turn off the calculator.

3 ATTACH THE SPADE LUG OF THE ALL BLACK (NEGATIVE) WIRE of the cable assembly to the minus (negative) terminal shown below.

4 ATTACH THE SPADE LUG OF THE BLACK-WITH-WHITE STRIPE (POSITIVE) WIRE of the cable assembly to the plus (positive) terminal as shown below.

CAUTION! IF THERE IS ANY DOUBT ABOUT WHICH BATTERY TO CONNECT TO, USE A MULTIMETER AND MEASURE THE VOLTAGE BETWEEN THE POSITIVE AND NEGATIVE TERMINALS. A 12-VOLT OUTPUT IS REQUIRED.

THE POSITIVE AND NEGATIVE WIRES MUST BE ATTACHED TO THE SAME BATTERY TO PRECLUDE A 24-VOLT OUTPUT.

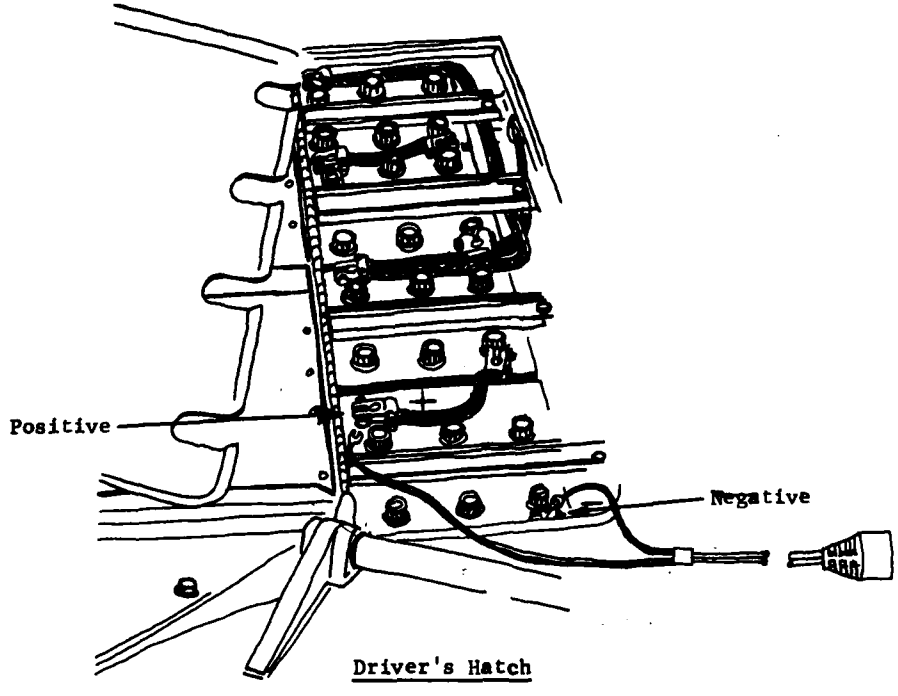


Figure 19. M110 series howitzers 12-volt vehicle power connection.

GAMMA GOAT

STEP

1 Insure that the battery pack is installed in the calculator.

2 Turn off the calculator.

3 ATTACH THE SPADE LUG OF THE ALL BLACK (NEGATIVE) WIRE of the cable assembly to the minus (negative) terminal shown below.

4 ATTACH THE SPADE LUG OF THE BLACK-WITH-WHITE STRIPE (POSITIVE) WIRE of the cable assembly to the plus (positive) terminal as shown below.

CAUTION! IF THERE IS ANY DOUBT ABOUT WHICH BATTERY TO CONNECT TO, USE A MULTIMETER AND MEASURE THE VOLTAGE BETWEEN THE POSITIVE AND NEGATIVE TERMINALS. A 12-VOLT OUTPUT IS REQUIRED.

THE POSITIVE AND NEGATIVE WIRES MUST BE ATTACHED TO THE SAME BATTERY TO PRECLUDE A 24-VOLT OUTPUT.

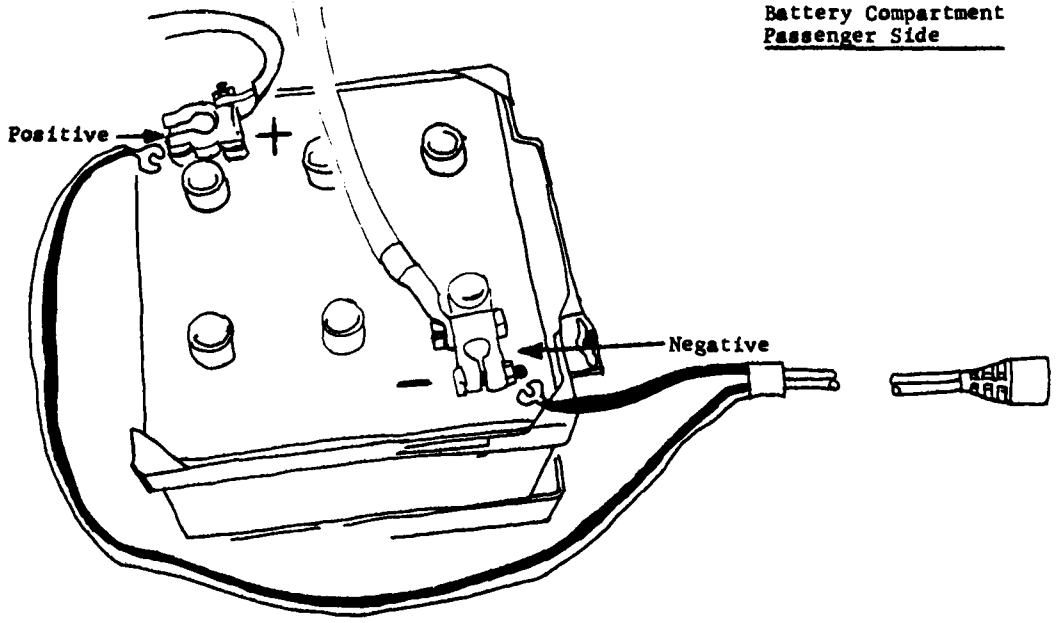


Figure 20. Gamma goat.

12. TROUBLE SHOOTING

If problems are encountered during the operation of the calculator, checks must be made to isolate and identify the source of the problem. The problem may be caused by equipment malfunction, loss of power, or operator procedural error.

a. Equipment Malfunction. Table 5-1, TM 9-1220-242-12&P addresses some of the common equipment malfunctions and should be consulted when equipment problems are suspected. In some cases, the TM's corrective actions require keyboard operation using the manufacturer's (TI) designated key symbols. Some of the key symbols may be covered with tape. If the required key is covered, refer to figure 4, page 12-A to determine which key to press. The manufacturer's designed key functions are always present. The gunnery programs temporarily redefines the key's function for accomplishment of the gunnery related calculations.

b. Loss of Power. Power problems are usually indicated by a dim, fading display or no display at all. The internal battery pack's life must be extended by charging it with external power sources. Figure 15 (pg 9-A) illustrates the charging systems. Pages 15-A through 20-A illustrate the correct way to connect the connector plug assembly to the different types of vehicles.

CARE MUST BE EXERCISED TO INSURE THAT THE CABLES ARE CONNECTED TO PROVIDE ONLY 12-VOLTS.

If power problems are suspected, take the following corrective actions:

-CHECK TO INSURE that the lug bolts which connect the connector plug assembly to the 12-volt vehicle battery are properly connected.

-CHECK THE DC ADAPTER and insure that the fuze has not been blown (fig 15).

-CHECK ALL CABLES (WIRES) AND CONNECTORS in the system and insure that they are not broken or loosely connected.

-CHECK THE POWER SOURCE (BA-4386 or 12-volt vehicle battery) and insure that it has not been completely discharged.

-CHECK THE INTERNAL BATTERY PACK and insure that it is properly installed and charged.

c. Procedural Errors/Operator Errors. The procedures outlined in the Job Aid section must be followed to preclude procedural errors.

(1) If the operator enters erroneous data while operating the gunnery program, it can be corrected by reentering the correct data.

(2) If an input error is made during the execution of a sequential subroutine, MET, HB/MPI:

-PRESS the last pressed control key (A thru E)

-ENTER ALL DATA in that subroutine again

(3) During the operation of the gunnery program, if the control key fails to return the calculator to the desired subroutine location:

-RECALL the charge constants.

- RECALL the gunnery program.

-START the mission again following the Job Aid procedures.

(4) If the PGM key is pressed without first pressing the 2ND key, the calculator will be placed into the learn (programming) mode and will display 000 00,. To return to the operator mode:

-PRESS PGM again

WARNING: WHEN ENTERING DATA, PRESSING THE KEYS WITHOUT FIRST PRESSING THE ENTER KEY EXECUTES THE MANUFACTURER'S DESIGNED FUNCTION. RANDOM PRESSING OF THE KEYS MUST BE AVOIDED.

(5) The pressing of the TGT RCL key, without first pressing the ENTER key, removes the program pointer from the module; which in turn, restricts gunnery operations. Subsequent key presses will result in flashing displays. To return the pointer to the module:

-RECALL the gunnery program: 2ND, PGM,02

-FOLLOW the Job Aid TGT RCL procedures.

(6) Pressing gunnery labeled keys without first pressing the ENTER key will cause BOGUS displays. To correct the error:

-PRESS CLR, twice.

-PRESS the ENTER key prior to pressing the applicable gunnery key.

(7) If all else fails and the nature of the problem cannot be isolated, take the following corrective actions:

-TURN THE CALCULATOR OFF

-TURN IT ON - this clears the calculator

-SET UP THE CALCULATOR following the procedures prescribed in the reference note for the desired application.

PART 2

OPERATOR PROCEDURES/JOB AIDS

This section contains program flag cards, detailed operator procedures and keyboard/cue card matrices for all programmed applications. During the initial training phase, the operator should read and follow the procedures outlined for each application. Trained personnel need not use the job aids unless difficulty is experienced. Total reliance on the job aids should be avoided with the exception of the MET, TGPC/SPEC CORR and JMEM/SS programs. For these applications the job aids must be used to insure that the correct sequence is followed.

-UNDERLINED WORDS indicate numeric values

-EACH KEY STROKE is separated by a comma (,)

-NOTES identify exceptions or variations to procedures

FLAG CARD - M101A1/M102 CANNON ARTILLERY PROGRAMS

M101A1/M102 Weapon System Module:

PROGRAMS	PGM FLAG #
Interior Identification	01
Cannon Gunnery	02
HB/MPI	04
CONSTANTS	
M101A1 Shell HE (M1)	
Low Angle, CHG 1-4	05
Low Angle, CHG 4-7	06
High Angle, CHG 1-4	07
High Angle, CHG 4-7	08
M102 Shell HE (M1)	
Low Angle, CHG 1-4	09
Low Angle, CHG 4-7	10
High Angle, CHG 1-4	11
High Angle, CHG 4-7	12

ERROR INDICATORS:

Flashing:
1 - No observer target direction.
2 - Beyond maximum range of highest charge recalled.
3 - Constants are not available in recalled charge group.
4 - Outside curve-fit interval.
5 - Invalid target STORE/RECALL number.

Displayed:
7 - END of gunnery program.
77 - END of all other programs.

Special Situation Module:

PROGRAMS	PGM FLAG #
Interior Identification	01
Cannon Gunnery	02
14.5, M31 Trainer Constants	04
M109A1 RAP(M549A1) Constants	
Low Angle, CHG 7R & 8R	05
M114A2/M109 RAP(M549A1) Constants	
Low Angle, CHG 7R	06
TGPC/SPEC CORR	07
Concurrent MET Math	08
Subsequent MET Math	09
Interpolation Linear	10
JMEM/SS	11

OVERRIDES:

2ND, A : Computes TOF/MTSQ fuze setting without 20/R.
2ND B : Enables high angle computations.
2ND, C : Computes MTSQ fuze setting with 20/R
2ND, D : Computes VT fuze setting with 20/R.
2ND, E : Computes VT fuze setting without 20/R.

Fuze setting curve-fit coefficients are based on:

HE(M1)
Low Angle = M564 FZ
High Angle = TOF

RAP(M549A1)
Low Angle = TOF

14.5(M31)
Low Angle = TOF

RANGE CURVE-FIT INTERVALS

M101A1 System
Shell HE(M1)

CHG	Low Angle RANGE	High Angle RANGE
1	1500-3300	2200-3200
2	1700-3800	2600-3700
3	2000-4500	3100-4400
4	2500-5500	3800-5400
5	3300-7000	4500-6800
6	4100-8800	6000-8600
7	5300-10600	7300-10500

M102 System
Shell HE(M1)

CHG	Low Angle RANGE	High Angle RANGE
1	1600-3600	2000-3500
2	1900-4200	2900-4100
3	2300-5000	3400-4900
4	2800-6200	4200-6000
5	3700-7900	5200-7700
6	4400-9300	6200-9100
7	5700-11200	7500-11000

M109A1 RAP(M549A1)

CHG	Low Angle RANGE
7R	12300-19200
8R	15300-23000

M109/M114A2 RAP(M549A1)

CHG	Low Angle RANGE
7R	12100-19000

M31(14.5 TRAINER)

CHG	Low Angle RANGE
1	3600-7200

FLAG CARD - M114A1 CANNON ARTILLERY PROGRAMS

M114A1 Weapon System Module:

PROGRAMS	PGM FLAG #
Interior Identification	01
Cannon Gunnery	02
HB/MPI	04
CONSTANTS	
Shell HE(M107)	
Low Angle, CHG 1-2 GB & 3-4 WB	05
Low Angle, CHG 4-7 WB	06
High Angle, CHG 1-2 GB & 3-4 WB	07
High Angle, CHG 4-7 WB	08

ERROR INDICATORS:

Flashing:
1 - No observer target direction.
2 - Beyond maximum range of highest charge recalled.
3 - Constants not available in recalled charge group.
4 - Outside curve-fit interval.
5 - Invalid target STORE/RECALL number.

Displayed:
7 - END of gunnery program.
77 - END of all other programs.

Special Situation Module:

PROGRAMS	PGM FLAG #
Interior Identification	01
Cannon Gunnery	02
14.5, M31 Trainer Constants	04
M109A1 RAP(M549A1) Constants	
Low Angle, CHG 7R & 8R	05
M114A2/M109 RAP(M549A1) Constants	
Low Angle, CHG 7R	06
TGPC/SPEC CORR	07
Concurrent MET Math	08
Subsequent MET Math	09
Interpolation Linear	10
JMEM/SS	11

OVERRIDES:

2ND, A : Computes TOF/MTSQ fuze setting without 20/R.
2ND, B : Enables high angle computations.
2ND, C : Computes MTSQ fuze setting with 20/R.
2ND, D : Computes VT fuze setting with 20/R.
2ND, E : Computes VT fuze setting without 20/R.

Fuze setting curve-fit coefficients are based on:

HE(M107)
Low Angle = M564 FZ
High Angle = TOF

RAP(M549A1)
Low Angle = TOF

14.5(M31)
Low Angle = TOF

RANGE CURVE-FIT INTERVALS

Shell HE(M107)

	Low Angle	High Angle
CHG	RANGE	RANGE
1G	1700-3700	2900-3900
2G	2100-4700	3700-4800
3W	2800-6100	4800-6300
4W	3600-7800	6100-8000
5W	4400-9400	7500-9700
6W	5700-11600	9400-12000
7W	7500-14100	11600-14600

M109A1 RAP(M549A1)

Low Angle	
CHG	RANGE
7R	12300-19200
8R	15300-23000

M109/M114A2 RAP(M549A1)

Low Angle	
CHG	RANGE
7R	12100-19000

M31(14.5 Trainer)

Low Angle	
CHG	RANGE
1	3600-7200

FLAG CARD - M109/M114A2 CANNON ARTILLERY PROGRAMS

M109/M114A2 Weapon System Module:

PROGRAMS	PGM FLAG #
Interior Identification	01
Cannon Gunnery	02
HB/MPI	04
CONSTANTS	
Shell HE(M107)	
Low Angle, CHG 2-5 GB	05
Low Angle, CHG 4-7 WB	06
High Angle, CHG 2-5 GB	07
High Angle, CHG 4-7 WB	08
Shell DPICM(M483A1)	
Low Angle, CHG 2-5 GB	09
Low Angle, CHG 4-7 WB	10
High Angle, CHG 2-5 GB	11
High Angle, CHG 4-7 WB	12

ERROR INDICATORS:

Flashing:
1 - No observer target direction.
2 - Beyond maximum range of highest charge recalled.
3 - Constants are not available in recalled charge group.
4 - Outside curve-fit interval.
5 - Invalid target STORE/RECALL number.

Displayed:
7 - END of gunnery program.
77 - END of all other programs.

Special Situation Module:

PROGRAMS	PGM FLAG #
Interior Identification	01
Cannon Gunnery	02
14.5, M31 Trainer Constants	04
M109A1 RAP(M549A1) Constants	
Low Angle, CHG 7R & 8R	05
M114A2/M109 RAP(M549A1) Constants	
Low Angle, CHG 7R	06
TGPC/SPEC CORR	07
Concurrent MET Math	08
Subsequent MET Math	09
Interpolation Linear	10
JMEM/SS	11

OVERRIDES:

2ND, A : Computes TOF/MTSQ fuze setting without 20/R.
2ND, B : Enables high angle computations.
2ND, C : Computes MTSQ fuze setting with 20/R.
2ND, D : Computes VT fuze setting with 20/R.
2ND, E : Computes VT fuze setting without 20/R.

Fuze setting curve-fit coefficients are based on:

HE(M107)	DPICM(M483A1)
Low Angle = M564 FZ	Low Angle = M577 FZ
High Angle = TOF	High Angle = M577 FZ

RAP(M549A1)	14.5(M31)
Low Angle = TOF	Low Angle = TOF

RANGE CURVE-FIT INTERVALS

Shell HE(M107)

CHG	Low Angle RANGE	High Angle RANGE
2G	2100-4700	3200-4700
3G	2800-6300	4200-6100
4G	3600-7900	5400-7800
5G	4400-9500	6500-9300
4W	3600-7800	5300-7700
5W	4300-9400	6500-9300
6W	5700-11600	8500-11300
7W	7400-14000	10900-13800

Shell DPICM(M483A1)

CHG	Low Angle RANGE	High Angle RANGE
2G	1900-4200	2900-4100
3G	2500-5500	3800-5300
4G	3200-7000	4800-6900
5G	4100-8800	6100-8700
4W	3300-7200	5000-7100
5W	4200-9000	6300-8900
6W	5500-11100	8300-10900
7W	7800-13600	10700-13400

M109A1 RAP(M549A1)
Low Angle

CHG	RANGE
7R	12300-19200
8R	15300-23000

M109/M114A2 RAP(M549A1)
Low Angle

CHG	RANGE
7R	12100-19000

M31(14.5 Trainer)
Low Angle

CHG	RANGE
1	3600-7200

FLAG CARD - M109A1 CANNON ARTILLERY PROGRAMS

M109A1 Weapon System Module:

PROGRAMS	PGM FLAG #
Interior Identification	01
Cannon Gunnery	02
HB/MPI	04
CONSTANTS	
Shell HE(M107)	
Low Angle, CHG 2-5 GB	05
Low Angle, CHG 5-8 WB	06
High Angle, CHG 2-5 GB	07
High Angle, CHG 5-8 WB	08
Shell DPICM(M483A1)	
Low Angle, CHG 3-5 GB	09
Low Angle, CHG 5-8 WB	10
High Angle, CHG 3-5 GB	11
High Angle, CHG 5-8 WB	12

ERROR INDICATORS:

Flashing:
1 - No observer target direction.
2 - Beyond maximum range of highest charge recalled.
3 - Constants are not available in recalled charge group.
4 - Outside curve-fit interval.
5 - Invalid target STORE/RECALL number.

Displayed:
7 - END of gunnery program.
77 - END of all other programs.

Special Situation Module:

PROGRAMS	PGM FLAG #
Interior Identification	01
Cannon Gunnery	02
14.5, M31 Trainer Constants	04
M109A1 RAP(M549A1) Constants	
Low Angle, CHG 7R & 8R	05
M114A2/M109 RAP(M549A1) Constants	
Low Angle, CHG 7R	06
TGPC/SPEC CORR	07
Concurrent MET Math	08
Subsequent MET Math	09
Interpolation Linear	10
JMEM/SS	11

OVERRIDES:

2ND, A : Computes TOF/MTSQ fuze setting without 20/R.
2ND, B : Enables high angle computations.
2ND, C : Computes MTSQ fuze setting with 20/R.
2ND, D : Computes VT fuze setting with 20/R.
2ND, E : Computes VT fuze setting without 20/R.

Fuze setting curve-fit coefficients are based on:

HE(M107)	DPICM(M483A1)
Low Angle = M564 FZ	Low Angle = M577 FZ
High Angle = TOF	High Angle = M577 FZ

RAP(M549A1)	14.5(M31)
Low Angle = TOF	Low Angle = TOF

RANGE CURVE-FIT INTERVALS

Shell HE(M107)

CHG	Low Angle RANGE	High Angle RANGE
2G	2200-4800	3200-4700
3G	2900-6300	4200-6200
4G	3700-8000	5400-7800
5G	4400-9500	6500-9400
5W	4600-9900	6800-9800
6W	5900-11900	8200-11500
7W	7600-14300	10400-13800
8W	11100-17400	13500-16900

Shell DPICM(M483A1)

CHG	Low Angle RANGE	High Angle RANGE
3G	2600-5700	3700-5500
4G	3700-7300	5000-7100
5G	4200-8900	6200-8800
5W	4600-9600	6700-9300
6W	5800-11600	8200-11400
7W	8500-13900	9900-13600
8W	11300-16800	12100-16700

M109A1 RAP(M549A1) Low Angle

CHG	RANGE
7R	12300-19200
8R	15300-23000

M109/M114A2 RAP(M549A1) Low Angle

CHG	RANGE
7R	12100-19000

M31(14.5 Trainer) Low Angle

CHG	RANGE
1	3600-7200

FLAG CARD - M110A2 CANNON ARTILLERY PROGRAMS

M110A2 Weapon System Module:

PROGRAMS	PGM FLAG #
Interior Identification	01
Cannon Gunnery	02
HB/MPI	04
CONSTANTS	
Shell HE(M106)	
Low Angle, CHG 2-5 GB	05
Low Angle, CHG 5-8 WB	06
Low Angle, CHG 9 (M188E1)	07
High Angle, CHG 2-5 GB	08
High Angle, CHG 5-8 WB	09
High Angle, CHG 9 (M188E1)	10
Shell HES(M424A1)	
Low Angle, Zone 1-3 & 8	11
High Angle, Zone 1-3 & 8	12

ERROR INDICATORS:

Flashing: 1 - No observer target direction.
2 - Beyond maximum range of highest charge recalled.
3 - Constants are not available in recalled charge group.
4 - Outside curve-fit interval.
5 - Invalid target STORE/RECALL number.

Displayed: 7 - END of gunnery program.
77 - END of all other programs.

Special Situation Module:

PROGRAMS	PGM FLAG #
Interior Identification	01
Cannon Gunnery	02
14.5, M31 Trainer Constants	04
M109A1 RAP(M549A1) Constants	
Low Angle, CHG 7R & 8R	05
M114A2/M109 RAP(M549A1) Constants	
Low Angle, CHG 7R	06
TGPC/SPEC CORR	07
Concurrent MET Math	08
Subsequent MET Math	09
Interpolation Linear	10
JMEM/SS	11

OVERRIDES:

2ND, A : Computes TOF/MTSQ fuze setting without 20/R.
2ND, B : Enables high angle computations.
2ND, C : Computes MTSQ fuze setting with 20/R.
2ND, D : Computes VT fuze setting with 20/R
2ND, E : Computes VT fuze setting without 20/R.

Fuze setting curve-fit coefficients are based on:

HE(M106)	HES(M424A1)
Low Angle = M564 FZ	Low Angle = M591 FZ
High Angle = TOF	High Angle = M591 FZ

RAP(M549A1)	14.5(M31)
Low Angle = TOF	Low Angle = TOF

RANGE CURVE-FIT INTERVALS

Shell HE(M106)

CHG	Low Angle RANGE	High Angle RANGE
2G	2900-6600	4500-6500
3G	3500-8000	5400-7800
4G	5100-9500	6600-9400
5G	7100-11400	8000-11400
5W	7600-12000	8400-12000
6W	9200-14000	10500-14100
7W	11200-16500	12400-16200
8W	13700-19600	15800-19500
9	14900-21700	18700-22500

Shell HES(M424A1)

ZONE	Low Angle RANGE	High Angle RANGE
1	2600-5600	4000-5800
2	4500-9500	5800-8800
3	8900-14400	8800-12500
8	12200-17300	12500-17000

M109A1 RAP(M549A1)

CHG	Low Angle RANGE
7R	12300-19000
8R	15300-23000

M109/M114A2 RAP(M549A1)

CHG	Low Angle RANGE
7R	12100-19000

M31(14.5 Trainer)

CHG	Low Angle RANGE
1	3600-7200

OPERATOR'S MEMORY MAP: GUNNERY PROGRAM

Data Register Allocation

Data Register	Contents
00	Battery Easting
01	Battery Northing
02	Battery Azimuth of Lay
03	Battery Altitude
04	Range K (For CHG Selected)
05	Deflection Correction (For CHG Selected)
06	Fuze K (For CHG Selected)
07	Chart Range to Target
08	Chart Azimuth to Target
09	Control Register
10	Target Easting
11	Target Northing
12	OT Direction
13	Target Altitude
14	Lateral Deviation
15	Range Shift/OT Distance
16	Quadrant Elevation
17	Deflection
18	Fuze Setting/Time of Flight
19	Adjusted Range
20	Range K 1st Charge
21	DF CORR 1st Charge
22	Fuze K 1st Charge
23	Range K 2nd Charge
24	DF CORR 2nd Charge
25	Fuze K 2nd Charge
26	Range K 3rd Charge
27	DF CORR 3rd Charge
28	Fuze K 3rd Charge
29	Range K 4th Charge
30	DF CORR 4th Charge
31	Fuze K 4th Charge
32	TGT 1, EAsting-Northing
33	TGT 1, Altitude
34	TGT 2, Easting-Northing
35	TGT 2, Altitude
36	TGT 3, Easting-Northing
37	TGT 3, Altitude
38	TGT 4, Easting-Northing
39	TGT 4, Altitude
40	TGT 5, Easting-Northing
41	TGT 5, Altitude
42	TGT 6, Easting-Northing
43	TGT 6, Altitude
44	TGT 7, Easting-Northing
45	TGT 7, Altitude

CONSTANTS

Data Register	Contents
46	Elevation Constant A_2 1st CHG
47	Elevation Constant A_1 1st CHG
48	Elevation Constant A_0 1st CHG
49	Elevation Constant A_2 2nd CHG
50	Elevation Constant A_1 2nd CHG
52	Elevation Constant A_2 3rd CHG
53	Elevation Constant A_1 3rd CHG
54	Elevation Constant A_0 3rd CHG
55	Elevation Constant A_2 4th CHG
56	Elevation Constant A_1 4th CHG
57	Elevation Constant A_0 4th CHG
58	Drift Constants B_2 1st CHG
59	Drift Constants B_1 1st CHG
60	Drift Constants B_0 1st CHG
61	Drift Constants B_2 2nd CHG
62	Drift Constants B_1 2nd CHG
63	Drift Constants B_0 2nd CHG
64	Drift Constants B_2 3rd CHG
65	Drift Constants B_1 3rd CHG
66	Drift Constants B_0 3rd CHG
67	Drift Constants B_2 4th CHG
68	Drift Constants B_1 4th CHG
69	Drift Constants B_0 4th CHG
70	Fuze/TOF Constants C_2 1st CHG
71	Fuze/TOF Constants C_1 1st CHG
72	Fuze/TOF Constants C_0 1st CHG
73	Fuze/TOF Constants C_2 2nd CHG
74	Fuze/TOF Constants C_1 2nd CHG
75	Fuze/TOF Constants C_0 2nd CHG
76	Fuze/TOF Constants C_2 3rd CHG
77	Fuze/TOF Constants C_1 3rd CHG
78	Fuze/TOF Constants C_0 3rd CHG
79	Fuze/TOF Constants C_2 4th CHG
80	Fuze/TOF Constants C_1 4th CHG
81	Fuze/TOF Constants C_0 4th CHG
82	6400
83	Common Deflection
84	100
85	1st CHG Value
86	2nd CHG Value
87	3rd CHG Value
88	4th CHG Value
89	Minimum Curve-Fit Range 1st CHG
90	Minimum Curve-Fit Range 2nd CHG
91	Minimum Curve-Fit Range 3rd CHG
92	Minimum Curve-Fit Range 4th CHG

OPERATOR'S MEMORY MAP: GUNNERY PROGRAM (cont'd)

Data Register Allocation

Data Register	Contents
93	Maximum Curve-Fit Range 1st CHG
94	Maximum Curve-Fit Range 2nd CHG
95	Maximum Curve-Fit Range 3rd CHG
96	Maximum Curve-Fit Range 4th CHG
97	Maximum TFT Range 4th CHG
98	Charge Value Being Fired
99	Control Register
51	Elevation Constant A_0 2ND CHG

OPERATOR'S MEMORY MAP: HB/MPI PROGRAM

Data Register Allocation

Data Register	Contents
10	Mean Burst Location EASTING
11	Mean Burst Location NORTHING
13	Mean Burst Location ALTITUDE
46	01 EASTING
47	01 NORTHING
48	01 ALTITUDE
49	02 EASTING
50	02 NORTHING
51	02 ALTITUDE
56	01 AVERAGE DIRECTION
57	01 AVERAGE VA
58	02 AVERAGE DIRECTION

GUNNERY APPLICATION

CUE CARD PRIMARY FUNCTIONS

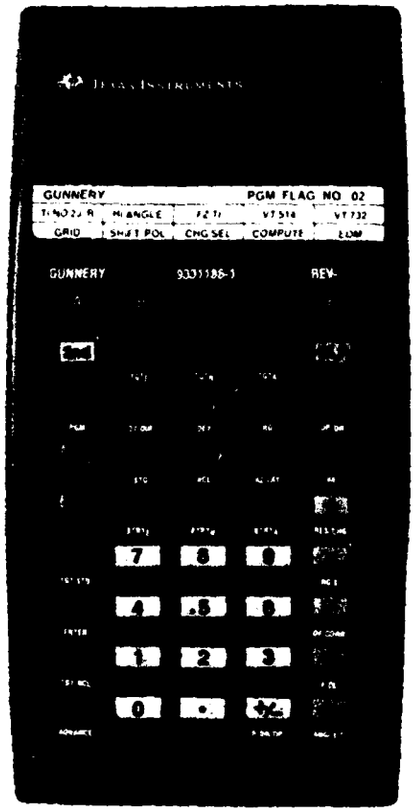
GRID : COMPUTES INITIAL GUN-TARGET AZIMUTH AND RANGE FOR GRID MISSIONS

SHIFT/POL : COMPUTES INITIAL GUN-TARGET AZIMUTH AND RANGE FOR SHIFT FROM KNOWN POINT AND POLAR MISSIONS

CHG SEL : BASED ON RANGE: SELECTS LOWEST CHARGE TO FIRE

COMPUTE : COMPUTES FIRING DATA: TIME, DEFLECTION, QUADRANT

EOM : END OF MISSION: CLEARS FLAGS AND WORKING REGISTERS.



CUE CARD SECONDARY FUNCTIONS

TI NO 20/R : FLAGS FUZE SETTING WITH-OUT 20/R APPLIED TO QUADRANT.

HI ANGLE : FLAGS HIGH ANGLE FIRE.

FZ TI : FLAGS FUZE SETTING WITH 20/R APPLIED TO QUADRANT.

VT 514 : FLAGS FUZE VT WITH 20/R APPLIED TO QUADRANT.

VT 732 : FLAGS FUZE VT WITHOUT 20/R APPLIED TO QUADRANT.

KEYBOARD DEFINITIONS

2ND : SECOND
TGT_E : TARGET EASTING
TGT_N : TARGET NORTHING
TGT_A : TARGET ALTITUDE
CLR : CLEAR
PGM : PROGRAM
OT DIR : OBSERVER TARGET DIRECTION
DEV : DEVIATION (LEFT/RIGHT)
RG : RANGE (ADD/DROP)
UP/DN : UP/DOWN (ALTITUDE) (SHIFT)
STO : STORE
RCL : RECALL
AZ LAY : BTRY AZIMUTH OF LAY
VA : OBSERVER VERTICAL ANGLE
$BTRY_E$: BATTERY EASTING
$BTRY_N$: BATTERY NORTHING
$BTRY_A$: BATTERY ALTITUDE

KEYBOARD DEFINITIONS

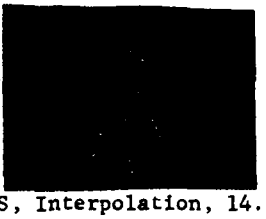
RES/CHG : RESIDUAL/CHARGE
RG K : RANGE K
DF CORR : GFT DEFLECTION CORRECTION
FZ K : FUZE K
ANGLE T : GUN-TARGET-OBSERVER ANGLE
R/DN/DP : RIGHT/DOWN/DROP
TGT STO : TARGET STORE
ENTER : ENTER
TGT RCL : TARGET RECALL
ADVANCE : ADVANCE

FIGURE 7, GUNNERY MATRIX

PREPARE FOR ACTION

1. Insure ON/OFF switch is off.

2. Place the module in the calculator for the desired applications.



   a. Weapon system module - gunnery and HB/MPI.

   b. Special situation module - MET, TGPC/SPEC CORR, RAP, JMEM/SS, Interpolation, 14.5.

3. Connect external power connectors to BA-4386 (PRC 77 battery) or 12-volt vehicle battery as required. Refer to Field Charging Systems, page 15-A.

4. Slide ON/OFF switch to ON, 0 displayed.

5. Verify that all light emitting diodes in the display light by typing:

   Decimal point (.), +/-, and the number 8, ten times

6. Verify that the module is programmed for your weapon system or for special situations.

   TYPE: 2ND, PGM, 01, E

Display identifies the version and the weapon system interior identification code as shown below:

WEAPON SYSTEM INTERIOR IDENTIFICATION

	Version/Weapon System
M101A1/M102	1.001010102
M114A1	1.000000114
*M109/M114A2	1.001090114
M109A1	1.000000109
M110A2	1.000001102
Special Situation	1.000000001

7. *M109/M114A2: The M109and M114A2 common deflections vary (M109-3200, M114A2-2400) The operator must specify the weapon system.

   M109 system Type: 109,ADVANCE: 3200 displayed

   M114A2 system Type: 114,ADVANCE: 2400 displayed

8. Prepare the calculator for operation as indicated on page 12-A, paragraph 9.

9. Install the applicable keyboard overlay and cue card.

10. Go to Program Set Up.

NARRATIVE.

The memory modules contain permanently stored constants and programs. The cannon artillery program flag cards are weapon system related and contain the flag number associated with each program or set of constants. Constants are charge, projectile, and type of fire related and are recalled in groups. To compute firing data, the correct set of constants and the gunnery program must be recalled. For other program applications, only the applicable program is recalled. Refer to the program's section and follow the instructions given. For cannon gunnery follow the steps listed below:

CANNON GUNNERY PROGRAM SET-UP FOR FIRING DATA COMPUTATIONS.

1. Manually determine shell, charge, and type of fire,(low/high angle)desired.

2. Refer to the weapon system program flag card and determine the program flag number corresponding to step 1.

3. Recall the program constants for the program determined in step 2 by typing:

2ND, PGM _____, A :
(PGM FLAG #)

The calculator will display the projectile nomenclature and constant program flag number separated by a decimal point (i.e., 107.05). The M101A1 and M102 weapon system module's display will contain the system designation 101 or 102, instead of the projectile nomenclature. Projectiles and their associated displays are:

155 WEAPON SYSTEMS

Shell	Display
HE(M107)	107.__(PGM FLAG #)
DPICM(M483A1)	483.__(PGM FLAG #)
M109A1 system RAP(M549A1)	1090549
M109/M114A2 system RAP(M549A1)	1140109549
14.5(M31) Trainer	14.5

8"(M203) SYSTEM

Shell	Display
HE(M106)	106.__(PGM FLAG #)
HES (M424A1)	424.__(PGM FLAG #)

105 WEAPON SYSTEMS

Weapon	Display
M101A1	101.__(PGM FLAG #)
M102	102.__(PGM FLAG #)

4. Clear display: PRESS CLR.

5. Recall the gunnery program: Type: 2ND,PGM,02

Note: Each time constants are recalled, the gunnery program must be recalled (2ND, PGM,02) to position the pointer in the correct location. Follow the sequence shown in steps 3 through 5 above.

6 Go to BATTERY SETUP.

BATTERY SET UP

1. Enter battery location (5-digit Easting/Northing)

   a. EASTING,ENTER,$BTRY_E$

   b. NORTHING,ENTER,$BTRY_N$

   c. ALTITUDE*,ENTER,$BTRY_A$

   Note. Enter altitudes below sea level as minus values (press R/DN/DP key prior to enter).

2. Enter azimuth of lay.

   AZIMUTH,ENTER,AZ LAY*

   CAUTION! IF NO AZIMUTH OF LAY IS ENTERED, THE CALCULATOR WILL USE DIRECTION 0 AS THE AZIMUTH OF LAY.

3. Determine and store registration corrections, if applicable (see page 13-B).

   Note. The computer can store one set of residuals for each charge of the constants recalled. If no residuals are entered, the calculator will automatically use the following standard values:

   RANGE K: 1.0 GFT DF CORR: 0 FUZE K: 1.0

   Whenever constants are recalled the residuals are automatically set to standard.

4. Go to grid, shift or polar mission section.

   Note. To recall battery data, the storage register number must be known. Refer to the gunnery application memory map for all storage registers.

TYPE	DISPLAY
RCL, 00	Battery EASTING
RCL, 01	Battery NORTHING
RCL, 03	Battery ALTITUDE
RCL, 02	AZIMUTH OF LAY

*Note. M109/M114A2 Units insure that your system has been designated (see Prepare for Action, step 7).

FIRING OVER 00 GRID LINES

NARRATIVE.

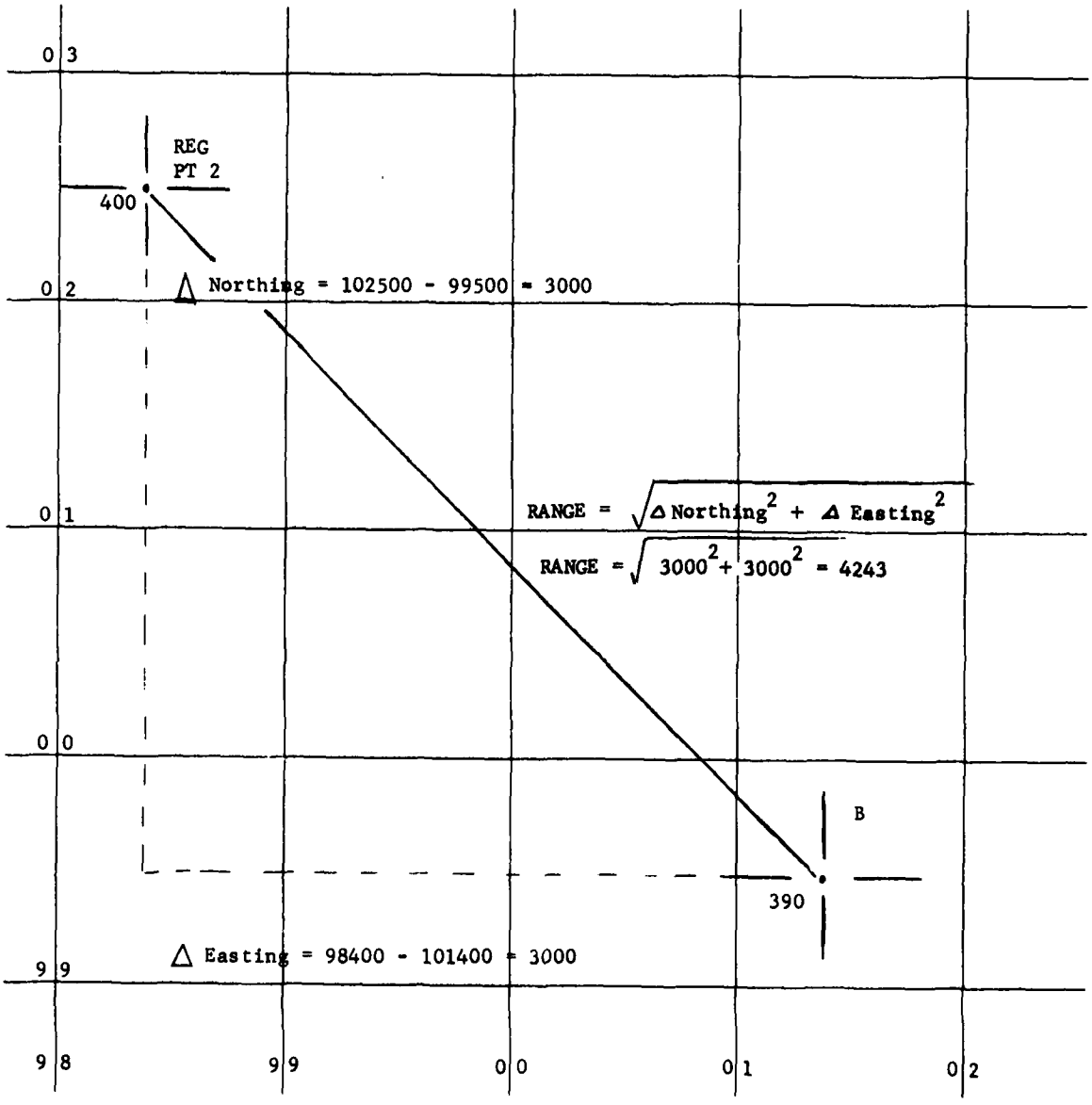
Five digit Easting and Northing grids must always be used, with one exception: When firing over 00 EASTING or 00 NORTHING grid lines a leading one (1) must be applied to grids to the RIGHT of the 00 EASTING line, and/or above the 00 NORTHING line. The calculator determines differences in BATTERY-TARGET, EASTING and NORTHING mathematically.

Δ EASTING = $TGT_E - BTRY_E$

Δ NORTHING = $TGT_N - BTRY_N$

CHART RANGE = $\sqrt{\Delta \text{ NORTHING}^2 + \Delta \text{ EASTING}^2}$

If the leading 1's is(are) not applied extremely large and erroneous chart ranges will be computed.



DETERMINING AND APPLYING REGISTRATION CORRECTIONS

NARRATIVE.

The calculator applies registration corrections called RESIDUALS, through the input of range K, fuze K, and deflection corrections. Residuals can be stored by charge, for each charge of the group recalled (total of 4). If no residuals are entered, the calculator will automatically use standard values of range K 1.0, GFT DF CORR 0, fuze K 1.0. Whenever a group of charge constants are recalled, the residuals are automatically set to the STANDARD VALUES. **A specific charge's residuals can be zeroed by entering the standard values.**

RANGE K is a fractional representation of the total range correction. As chart range increases/decreases from the registering range, the range K factor proportionally increases/decreases the mission's total range correction. Range K is determined by dividing the range corresponding to elevation + CAS (QE - ∡site) by the chart range to the registration point. This value when entered into the calculator as a residual, is multiplied by the chart range to determine the corrected range for each mission. The registration mission's complementary angle of site is reflected in the range K factor (see para 7f, pg 8-A).

$$\text{DIVIDE: } \frac{\text{RANGE} \sim \text{ELEVATION + CAS}}{\text{CHART RG}} = \text{RANGE K}$$

FUZE K is also a fractional multiplier similar in nature to range K. Fuze K is determined by dividing the adjusted TI (from registration) by the TI corresponding to elevation + CAS.

$$\text{DIVIDE: } \frac{\text{ADJUSTED TIME}}{\text{TIME} \sim \text{ELEVATION + CAS}} = \text{FUZE K}$$

THE GFT DEFLECTION CORRECTION is the total deflection correction minus drift.

CHART TO ADJUSTED = TOTAL
TOTAL - DRIFT = GFT DF CORR

The GFT DF CORR is entered into the calculator and is automatically added to the drift corresponding to elevation for each mission's deflection correction. To determine residuals, a registration is conducted and/or a one-plot GFT setting is derived from FADAC. DO NOT AVERAGE RESIDUALS from a two-plot derived GFT setting, the accuracy is unpredictable. The M109A1 example computations (below) are provided to identify procedures and terminology.

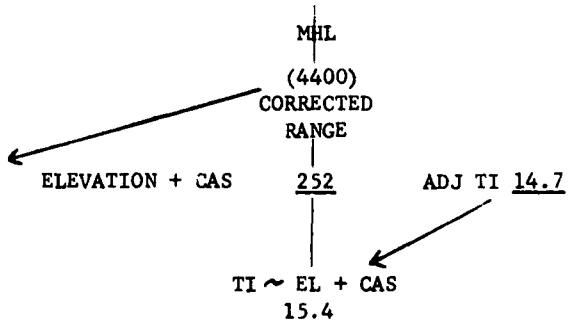
M109A1 EXAMPLE:

ADJUSTED QE : 260
− ANGLE OF SITE : +8
ELEVATION + CAS 252

GFT B, CHG 4 GB, LOT XY, CHART RG 4200

GFT DF CORR L4

TOTAL DF CORR L9



Type: 4400, ÷, 4200 = 1.047619048 = Range K value

Type: 14.7, ÷, 15.4 = .9545454545 = Fuze K value

TOTAL DF CORR L9 - DRIFT L5 = GFT L4

DETERMINING REGISTRATION CORRECTIONS/RESIDUALS

RANGE K

1. Manually construct the GFT setting from the registration or derive one with FADAC and determine chart range and range ~ to elevation + CAS (use TFT or GFT).

   Note. The calculator is programmed to display whole numbers, with the exception of fuze settings. To display the range K and fuze K residuals, the fixed decimal mode must be overridden by typing Texas Instruments key actions: INV, 2ND, FIX which equates to: TGT_E, 2ND, $BTRY_N$.

2. Override fixed decimal mode: type: TGT_E, 2ND, $BTRY_N$

3 With the calculator divide: RANGE~ ELEVATION + CAS ÷ CHART RANGE = Range K

4. Enter displayed range K value by typing: ENTER, RG K

DF CORR

1. Manually determine the GFT DF CORR: CHART DF TO ADJ DF = TOT DF CORR
   TOTAL DF CORR - DRIFT = GFT DF CORR

2. Enter computed GFT DF CORR by typing: GFT DF CORR*, ENTER, DF CORR

   *Note. If GFT DF CORR is RIGHT, the R/DN/DP key must be PRESSED prior to ENTER.

FUZE K

1. Determine time ~ to elevation + CAS and adjusted time.

2. With the calculator divide: ADJUSTED TIME ÷ TI ~ ELEVATION + CAS = Fuze K

3. Enter displayed FZ K value by typing: ENTER, FZ K

TO APPLY REGISTRATION CORRECTIONS/RESIDUALS

The residuals determined above have been stored in the calculator. To apply these residuals, they must be associated with the registering charge.

1. To apply residuals, type: CHG, ENTER, RES/CHG

   DISPLAY will flash: RG K GFT DF CORR FZ K

   Note. The calculator programs will express and display residuals to two decimal places. It automatically returns the decimal mode to whole numbers and displays the fuze K value as a whole number.

2. Residuals can be applied for each charge of the four recalled charges.

   CAUTION! TI-59 RESIDUALS ARE NOT THE SAME AS FADAC RESIDUALS. THE PROCEDURES OUTLINED ABOVE MUST BE FOLLOWED.

GRID MISSION FIRING DATA

1. Enter target location. (5-digit Easting/Northing)
   Type:

   a. EASTING, ENTER, TGT_E

   b. NORTHING, ENTER, TGT_N

   c. ALTITUDE, ENTER, TGT_A

   d. To store as a target type: (If required) Use numbers 1 through 7.

      TGT #, ENTER, TGT STO: DISPLAY = 0

   e. *To recall a stored target type: (If required)

      TGT #, ENTER, TGT RCL, DISPLAY = 0

      *Note. The stored target data is transferred from storage to the working TGT_E, TGT_N, TGT_A registers. To display the data, recall by register numbers:

      TGT_E: RCL,10 TGT_N: RCL,11 TGT_A: RCL,13

2. To determine azimuth and range: Depress A, AZIMUTH flashed, RANGE displayed.

3. Charge selection: Depress C: Display = lowest charge based on range curve-fit intervals. To change the charge type: CLR, CHG, ADVANCE.

4. Enter overrides: (refer to flag card).

5. Compute firing data: Depress D: TIME displayed (if applicable)
   Advance: DEFLECTION displayed.
   Advance: QUADRANT displayed.

   Note. Any change after the computation of initial firing data (step 5), constitutes a subsequent correction. An observer target direction must be entered or a flashing 1, error indicator, will be displayed.

POLAR MISSION

1. Enter observer location as a target. (5-digit Easting/Northing)
   Type:
   a. EASTING, ENTER, TGT_E
   b. NORTHING, ENTER, TGT_N
   c. ALTITUDE, ENTER, TGT_A
   d. To store an observer as a target, type: (If required) Use numbers 1 through 7.

      TGT #, ENTER, TGT STO, DISPLAY = 0

   e. *To recall a stored observer, type: (If required)

      TGT #, ENTER, TGT RCL, DISPLAY = 0

      Note. When a stored observer is recalled, it is placed into the TGT_E, TGT_N, TGT_A working registers. To verify the data, you must recall it by register numbers:

      TGT_E: RCL,10 TGT_N: RCL,11 TGT_A: RCL,13

2. Enter observer direction: *OT DIRECTION, ENTER, OT DIR.

   *Note. 6400 must be used for direction 0.

3. Distance: DISTANCE, ENTER, RG.

4. Altitude changes:

   a. Vertical angle: VERTICAL ANGLE, *ENTER, VA

      *Note. If VA is negative, press R/DN/DP key prior to ENTER.

   b. Vertical shift: SHIFT, *ENTER, UP/DN.

      *Note. If shift is down, press R/DN/DP key prior to ENTER.

5. Polar plot target: Press B: AZIMUTH flashed, RANGE displayed.

6. Charge selection: Press C, display equals lowest charge based on range curve-fit interval. To change the charge, type: CLR, CHG, ADVANCE.

7. Enter overrides (refer to flag card).

8. Compute firing data: Press D, TIME displayed (if applicable).
   Advance, DEFLECTION displayed
   Advance, QUADRANT displayed

9. Determine angle T: ENTER, ∠ T.

10. Go to subsequent corrections.

SHIFT FROM A KNOWN POINT MISSION

1. Enter known point location as a target. (5-digit Easting/Northing)
   Type:
   a. EASTING, ENTER, TGT_E.

   b. NORTHING, ENTER, TGT_N.

   c. ALTITUDE, ENTER, TGT_A.

   d. To store as target: (If required) Use numbers 1 through 7.

      TGT #, ENTER, TGT STO: DISPLAY = 0

   e. *To recall a stored target: (If required)

      TGT #, ENTER, TGT RCL: DISPLAY = 0

   *Note. Following step 1e, the stored target data is transferred from storage to the working target registers. To display the data, recall by register numbers:

   TGT_E: RCL,10 TGT_N: RCL,11 TGT_A: RCL,13

2. Enter observer target direction:

   *OT DIRECTION, ENTER, OT DIR

   *Note. 6400 must be used for direction 0.

3. Lateral shift:

   *SHIFT, ENTER, DEV

   *Note. If shift is right, press R/DN/DP key prior to ENTER.

4. Range shift:

   *SHIFT, ENTER, RG

   *Note. If range shift is a drop, press the R/DN/DP key prior to ENTER.

5. Vertical shift:

   SHIFT, *ENTER, UP/DN.

   *Note. If vertical shift is down, press R/DN/DP key prior to ENTER.

6. Locate target: Press B, AZIMUTH flashed, RANGE displayed.

7. Charge selection: Press C, display equals lowest charge based on range curve-fit interval. To change the charge, type:

   CLR, CHG, ADVANCE

8. Enter overrides (refer to flag card).

9. Compute firing data: Press D, TIME displayed (if applicable).
   Advance, DEFLECTION displayed
   Advance, QUADRANT displayed

10. Determine angle T: ENTER, ∠ T.

11. Go to subsequent corrections.

SUBSEQUENT CORRECTIONS

NARRATIVE.

Any override change following the computation of firing data is considered a subsequent correction by the computer. Therefore, an observer target direction must be entered to permit computations of override changes and subsequent corrections. A FLASHING 1 indicates that no OT DIRECTION has been entered. For OT DIRECTION ZERO, 6400 must be used. The program considers an ADD, RANGE SHIFT and a LEFT, DEVIATION SHIFT as positive values. Whenever the observer's corrections are DROP(range) or RIGHT(deviation) negative values must be entered (press R/DN/DP key prior to ENTER). Fuze time height-of-burst adjustment must be done manually using ΔFS obtained from the TFT (table F, col 4) or the GFT. The UP/DN key on the keyboard only changes target altitude, not fuze setting.

SUBSEQUENT CORRECTIONS.

1. Enter OT direction:

   *DIRECTION, ENTER, OT DIR

   *Note. Direction 0 is entered as 6400.

2. Determine Angle T:

LEFT is PLUS RIGHT is NEGATIVE

   ENTER, ± T.

3. Deviation shift:

   SHIFT, *ENTER, DEV

   *Note. If shift is right, press R/DN/DP key prior to ENTER.

4. Range shift:

   SHIFT, *ENTER, RG

   *Note. If shift is drop, press R/DN/DP key prior to ENTER.

5. Compute firing data: Press D, TIME displayed (if applicable).
   Advance, DEFLECTION displayed
   Advance, QUADRANT displayed

6. Repeat steps 3-5 for additional subsequent corrections.

7. Fuze HOB adjustment must be done manually, using ΔFS obtained from GFT/TFT (Table F, col 4).

8. End of mission: Press E.

Note. Fuze PD is the standard calculator fuze which is set when END OF MISSION is given. Once a fuze override flag (2ND,A thru E) is set, it cannot be changed without giving the calculator END OF MISSION.

HIGH BURST/MEAN POINT OF IMPACT APPLICATION

CUE CARD PRIMARY FUNCTIONS

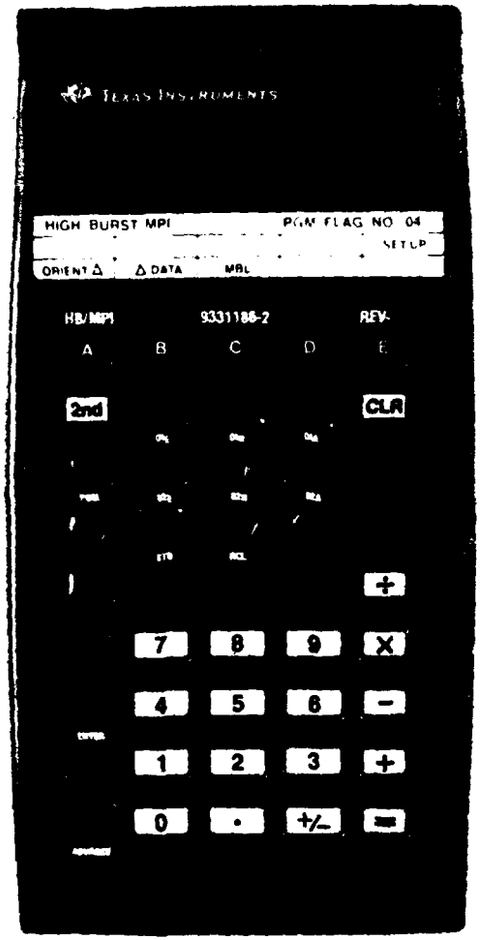
ORIENT : COMPUTES OBSERVERS DIRECTION AND VERTICAL ANGLE TO ORIENTING POINT GRID.

△- DATA : SETS-UP SEQUENCE FOR INPUT OF OBSERVERS REPORTED DIRECTIONS AND VERTICAL ANGLE FOR EACH ROUND FIRED.

MBL : COMPUTES MEAN BURST LOCATION, GRID AND ALTITUDE.

KEYBOARD DEFINITIONS

2ND : SECOND
01_E : OBSERVER 01 EASTING
01_N : OBSERVER 01 NORTHING
01_A : OBSERVER 01 ALTITUDE
PMG : PROGRAM
CLR : CLEAR
02_E : OBSERVER 02 EASTING
02_N : OBSERVER 02 NORTHING
02_A : OBSERVER 02 ALTITUDE
STO : STORE
RCL : RECALL
ENTER : ENTER
ADVANCE : ADVANCE
+/— : CHANGES SIGN OF DISPLAY.



CUE CARD SECONDARY FUNCTION

SET-UP : SETS-UP HB/MPI PROGRAM AND CLEARS WORKING REGISTERS.

FIGURE 8, HB/MPI MATRIX

HB/MPI REGISTRATION

NARRATIVE.

The conduct of a HB/MPI registration with the computer parallels manual procedures with one exception. Firing data must be computed prior to setting up the HB/MPI program because of data register assignments and program routines. DA Form 4201 should be used for recording the critical HB/MPI information. The gunnery overlay and cue card are used for computation of firing data. The HB/MPI overlay and cue card must be used to orient the observers and subsequently determine the mean burst location (MBL). The changing of templates/cue cards, does not affect the stored orienting point grid, nor the MBL grid. The input of observers reported directions and VA (step 5b) must be in sequence. Flag numbers are provided to identify the next data input register. The computer sums the observers spottings and then divides the sum by the number of usable rounds (step 5d(1)). To delete an unusable round, enter the unusable rounds observer directions as negative values and 01's VA with an opposite signed value. Following the computation of the MBL, chart range and deflection must be determined with the gunnery program for computation of registration corrections/residuals and GFT setting.

STEPS:

1. Select orienting point.
2. Compute firing data to orienting point (use gunnery template and cue card). Note. For high burst use fuze override 2ND, A. This precludes adding 20/R to quadrant. (Record firing data: Adjusted Time, Deflection and Quadrant.)
3. Orient observers: (use HB/MPI template and cue card).
   a. Recall HB/MPI program: 2ND, PGM, 04
   b. Set up routine: 2ND, E
   c. Input observer location:
      (1) 01 location: 01 EASTING, ENTER, 01_E
      01 NORTHING, ENTER, 01_N
      01 ALT ____, ENTER, 01_A
      (2) 02 location: 02 EASTING, ENTER, 02_E
      02 NORTHING, ENTER, 02_N
      02 ALT ____, ENTER, 02_A
   d. Determine orienting data:
      (1) Press A, display = 01 DIR
      (2) Advance, display = 01 VA
      (3) Advance, display = 02 DIR
      (4) Advance, display = 02 VA
4. Fire HB/MPI.

STEPS (continued)

5. Determine mean burst location:

a. Set up MBL routine: Depress B : display = 0

b. Input observers measured directions and VA.

(1) 01 AZ, ADVANCE, display = 1

(2) 01 VA, ADVANCE, display = 2

(3) 02 AZ, ADVANCE, display = 0

Note: The displays of 0, 1, and 2, indicate data registers for the next data input: 0 = 01 DIR, 1 = 01 VA, 2 = 02 DIR

Note. If an error is made PRESS B and input observer directions and vertical angle again.

c. Repeat steps 5b for each round fired.

Note. Delete an unusable round by entering in negative values for directions and opposite signed VA of the unusable round. All three values must be entered as negative inputs to preclude sequence violations.

d. Determine mean burst location (MBL):

(1) Number usable rounds fired, DEPRESS C: display = MBL EASTING
ADVANCE: display = MBL NORTHING
ADVANCE: display = MBL ALTITUDE

6. Determine the GFT setting (use gunnery overlay and cue card).

a. Compute chart range to MBL:

(1) Recall constants for registering charge:

2ND, PGM, _____, A
PGM FLAG #

(2) Recall gunnery program:

2ND, PGM, 02

(3) Depress A: Azimuth to MBL flashed.
Chart range to MBL displayed.

(4) Record displayed range. This is the GFT setting chart range.

b. Compute chart deflection to MBL:

(1) Depress D; IGNORE displayed fuze setting.

(2) Advance: Displayed deflection has drift applied.

(3) Manually compute chart deflection by subtracting drift from the deflection computed in step 6b(2).

c. Determine registration corrections/residuals. Refer to page 13-B instructions. Construct the GFT setting and compute residuals for the computer.

Note. In some cases a 1 mil chart deflection error may be introduced if drift corresponding to elevation differs from drift corresponding to ELEVATION + CAS.

PRECISION REGISTRATION

NARRATIVE

Fire direction procedures for the impact portion of a precision registration are identical to those of an adjust fire mission. Paragraph 5-6, FM 6-40, explains manual registration gunnery procedures. The calculator applies drift to all computed deflections. Therefore drift must be subtracted from the initial deflection fired to determine chart deflection.

IMPACT PHASE OF REGISTRATION

1. Recall constants for the registering charge,

   Type: 2ND, PGM _____, A
   PGM FLAG #

2. Recall gunnery program,

   Type: 2ND, PGM 02

3. Enter registration point grid as a target, or recall from TGT STORE (see GRID MISSION).

4. Determine chart range and azimuth to registration point,

   PRESS: A: AZIMUTH flashed
   CHART RANGE displayed (record chart range)

5. Charge Selection: PRESS: C; OVERRIDE for registering charge (if required).

   Type: CLR, Charge, ADVANCE

6. Compute initial firing data.

   PRESS D: Deflection to fire displayed (record)
   ADVANCE: Quadrant displayed.

   Note. To determine chart deflection, subtract drift from initial deflection.

7. Fire the impact portion of the registration:

   a. Follow subsequent correction procedures.

   b. Apply observer's impact refinement.

      Note. DO NOT OVERRIDE FUZE TIME.

   c. Compute adjusted deflection and quadrant.

      PRESS: D: Adjusted deflection displayed (record)
      ADVANCE: Adjusted quadrant displayed (record)

TIME PHASE OF REGISTRATION

8. OVERRIDE FZ TIME, PRESS: 2ND, C
   Compute firing data, PRESS: D: Time displayed.
   ADVANCE: Deflection displayed.
   ADVANCE: Quadrant displayed.

9. Fire the time registration.

   Note. Fuze setting height of burst adjustments must be done manually using Δ FS (TFT/GFT).

10. Construct the GFT setting (refer to determination/application of registration corrections).

    a. CHART RANGE - determined in step 4, is the GFT setting range.

    b. ADJUSTED QUADRANT (step 7c) - Angle of site = Elevation + CAS.

       Note. Angle of site = Vertical Interval ÷ Chart Range/1000

    c. Determine range ~ to Elevation + CAS (use GFT/TFT).

    d. ADJUSTED TIME = Time fired plus/minus time refinement.

    e. TOTAL DEFLECTION CORRECTION : compare chart deflection (step 6) to adjusted deflection (step 7).

    f. TOTAL DF CORR - Drift ~ EL + CAS = GFT DF CORR.

    g. Go to Determination/Application of Registration Corrections.

DUAL PURPOSE IMPROVED CONVENTIONAL MUNITION
(DPICM M483A1)

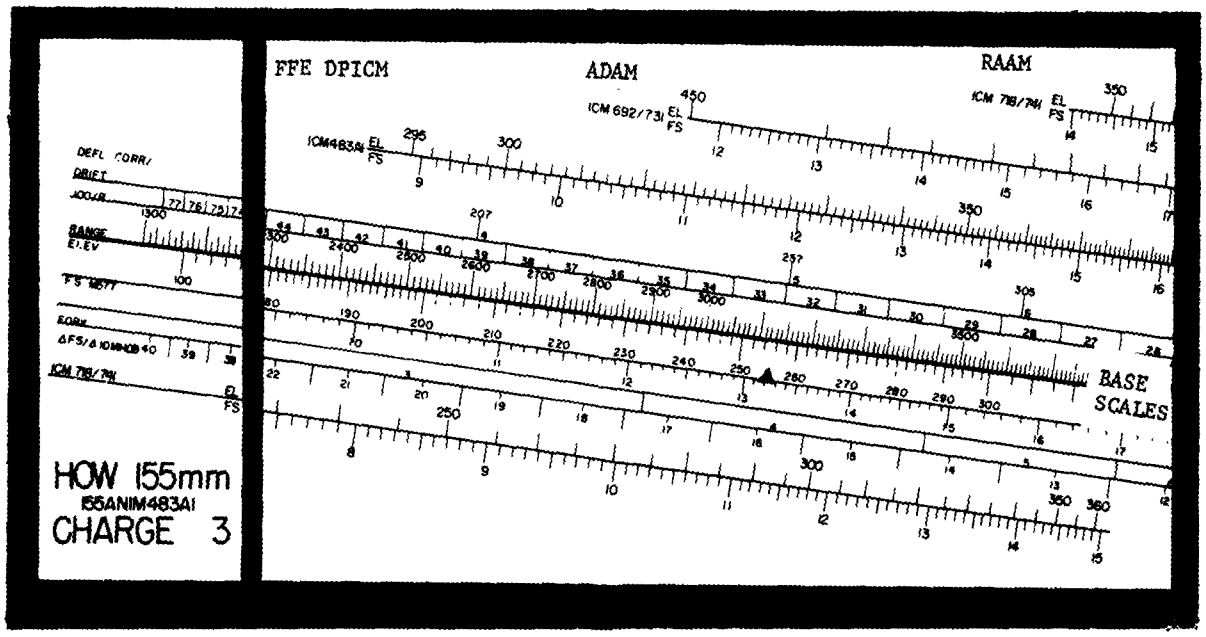
NARRATIVE.

a. The DPICM projectile (M483A1) is not ballistically similar to the high explosive (M107) projectile. This necessitated the creation of a new projectile family, titled, The M483A1 Family. The weapon systems' TFT's, GFT's, and GST's are used to compute manual firing data for the DPICM projectile. The base scales on the TFT's/GFT's represent the M483A1 data for the SELF-REGISTRATION MODE (Graze Burst). To compute fire-for-effect data, the self-registration mode data must be corrected to DPICM FFE MODE data. Corrections for fuze setting and quadrant elevation can be determined from the TFT addendums, or from the ICM 483A1 scale on the GFT's. Refer to the example 155AN-1 GFT below.

b. The calculator is programmed to compute M483A1 self-registration (S-R) mode firing data. Refer to the program flag card for charge groups and PGM FLAG #'s. The S-R mode data (fuze setting and quadrant elevation) must be corrected to FFE DPICM data. The tabular firing table addendums or the graphical firing tables are used to determine/apply the corrections. For S-R Mode Fuze Setting, change Time (Δ Time) to 98.0.

WEAPON SYSTEM	M483A1 BASE TFT	M483A1 ADDENDUM
M109A1	FT-155 AN-1	FT-155 ADD-J-1
M109/M114A2	FT-155 AK-2	FT-155 ADD-G-2

EXAMPLE.



SET UP

STEP

1 Determine M483A1 charge group and method of fire desired, refer to flag card and recall the program constants,

Type: 2ND, PGM, _____, A
PGM FLAG #

Note. Projectile and PGM FLAG # displayed; i.e., 483.___(PGM #).

2 Clear display: PRESS: CLR
3 Recall gunnery program: PRESS: 2ND, PGM 02
4 Enter battery data and DPICM registration corrections (if available).

SELF-REGISTRATION (S-R MODE)

STEP

5 Enter target location (follow steps for method of target location).
6 Determine azimuth and range to target: PRESS: A or B
7 Select charge: PRESS: C
To change charge, type: CLR, CHARGE, ADVANCE
8 OVERRIDE FZ TIME NO 20/R : PRESS: 2ND, A
9 Compute S-R mode firing data: PRESS D : Time Displayed (Δ Time 98.0)
ADVANCE : Deflection Displayed
ADVANCE : Quadrant Displayed

Note. This is the data to fire for DPICM registration/adjustment and FASCAM adjustment.

DPICM FIRE-FOR-EFFECT FIRING DATA

STEP

10

Firing Table Addendum Method	Using GFT Method
a. Enter Table B (FT Addendum) with the S-R mode fuze setting. Extract and apply the correction to fuze setting.	a. Place manufacturer's hair line (MHL) over the S-R mode fuze setting on the base scale - read FFE fuze setting under MHL on ICM 483A1 scale.
b. Enter Table A (FT Addendum) with S-R mode quadrant. Extract and apply correction to quadrant elevation.	b. Place MHL over S-R quadrant on the base scale - read FFE quadrant under MHL on ICM 483A1 scale.
c. The S-R mode deflection is the deflection to fire.	c. The S-R mode deflection is the deflection to fire.

SUBSEQUENT CORRECTIONS

STEP

11 For deviation and range shifts - Enter the shift corrections (see subsequent corrections)
- Recompute S-R mode data.
- Correct S-R mode data to FFE data (step 10)

12 For HOB adjustments: Use column 3, Tables A and B, and correct QE and fuze setting by 50m HOB increments.

13 END OF MISSION: PRESS: 2ND, E

FAMILY OF SCATTERABLE MUNITIONS (FASCAM)

NARRATIVE.

a. The DPICM (M483A1) projectile fired in the self-registration (S-R) mode is also the base round for the FASCAM projectiles:

M692/M731 ADAM (Area Denial Artillery Munitions)
M718/M741 RAAM (Remotely Activated Anti-Tank Mines)

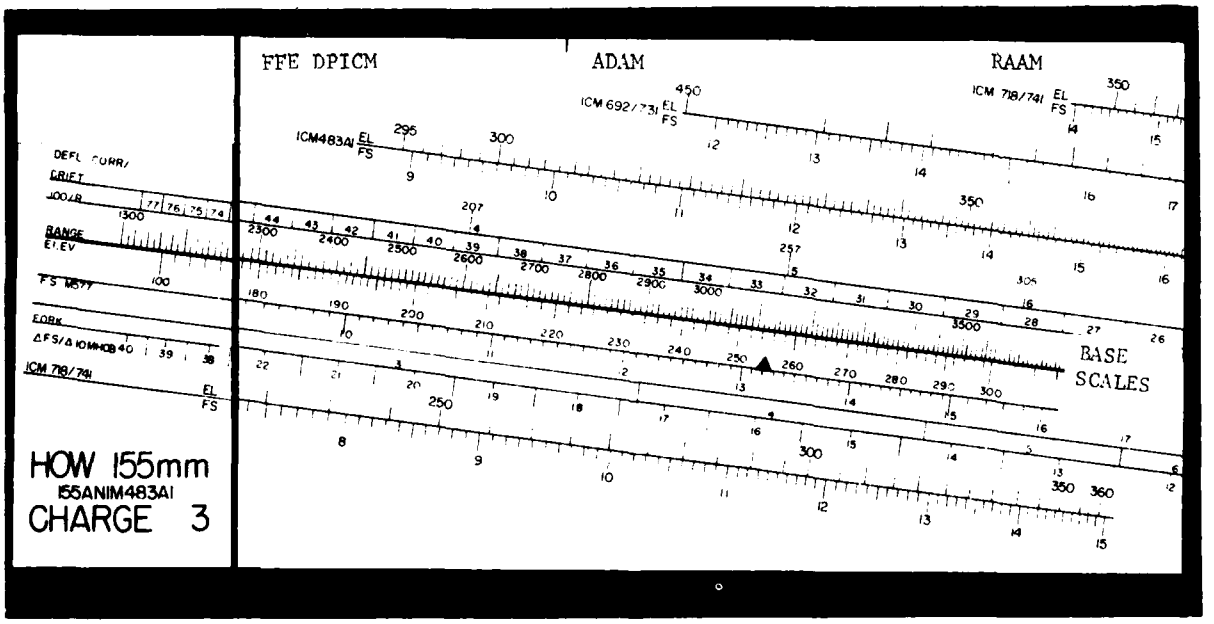
The different model numbers identify the mine's long/short self-destruct times (actual times are classified). The DPICM projectile is fired to locate the adjusting point for FASCAM (FFE) employment. DPICM S-R mode firing data is converted to the applicable FASCAM data by applying fuze setting and QE HOB corrections from TFT addendums or by using the FASCAM scales on the weapon system's M483A1 GFT.

b. Six hundred meters is the computed HOB for the ADAM projectile. This large HOB necessitates application of low level wind corrections for the ADAM rounds only.

c. The calculator is programmed to compute M483A1 S-R mode firing data. Refer to the program flag card for charge groups and PGM FLAG #'s. The S-R mode data (fuze setting and quadrant elevation) must be corrected to FFE DPICM data. The tabular firing table addendums or the GFT is used to determine/apply the corrections. ADAM low level wind corrections are applied prior to converting S-R mode data to FFE DPICM data.

		ADDENDUMS	
Weapon System	M483A1 Base TFT	ADAM	RAAM
M109A1	FT 155-AN-1	FT 155-ADD-L-1	FT 155-ADD-N-1
M109/M114A2	FT 155-AK-2	FT 155-ADD-M-1	(Not Available)

EXAMPLE.



SET UP

STEP

1 Determine M483A1 charge group and method of fire desired, refer to flag card and recall the program constants,

Type: 2ND, PGM, _____, A
PGM FLAG #

Note. Projectile and PGM FLAG # displayed; i.e. 483.___(PGM #).

2 Clear display: PRESS: CLR
3 Recall gunnery program: PRESS: 2ND PGM 02
4 Enter battery data and DPICM registration corrections (if available).

SELF-REGISTRATION (S-R MODE)

STEP

5 Enter target location (follow steps for method of target location).
6 Determine azimuth and range to target: PRESS: A or B
7 Select charge: PRESS: C
To change charge, type: CLR, CHARGE, ADVANCE
8 OVERRIDE FZ TIME NO 20/R : PRESS: 2ND, A
9 Compute S-R mode firing data: PRESS D : Time Displayed(Δ Time 98.0)
ADVANCE : Deflection Displayed
ADVANCE : Quadrant Displayed

Note. This is the S-R DPICM data to locate the ADAM adjusting point.

ADAM M692/M731 FIRE-FOR-EFFECT FIRING DATA

STEP

10 Determine the wind displaced aim point (low level wind corrections, para 11-6, FM 6-40).

a. Enter Table A (ADAM FT Addendum) with DPICM S-R mode QE

b. Extract one knot correction factor from column 5.

c. Multiply correction factor by the windspeed taken from line 02 of most current MET message.

d. Enter the wind direction (line 02 MET MSG) as the OT direction,

type: Wind Direction, ENTER, OT DIR

e. Enter the wind correction determined in step 10c, as an ADD range correction

type: RANGE CORR, ENTER, RG

11 Compute S-R mode DPICM data to the wind displaced aim point.

STEP

12 Convert S-R mode DPICM data to ADAM FFE data:

Firing Table Addendum Method	GFT Method
a. Enter Table B (ADAM FT Addendum) with the corrected S-R mode fuze setting. Extract and apply the correction to fuze setting.	a. Place manufacturer's hairline (MHL) over the corrected S-R mode fuze setting on the base scale - read FFE fuze setting under MHL on M692/M731 scale.
b. Enter Table A (ADAM FT Addendum) with the corrected S-R mode quadrant. Extract and apply correction to quadrant elevation.	b. Place MHL over corrected S-R quadrant on the base scale - read FFE quadrant under MHL on M692/731 scale.
c. The S-R mode deflection is the deflection to fire.	c. The S-R mode deflection is the deflection to fire.

Note. The ADAM projectiles are only fired in effect. All adjustments are fired with DPICM S-R mode.

SET UP

STEP	
1	Determine M483A1 charge group and method of fire desired, refer to flag card and recall the program constants,

Type: 2ND, PGM, _____, A
PGM FLAG #

Note. Projectile and PGM FLAG # displayed; i.e., 483.___(PGM #).

2	Clear display: PRESS: CLR
3	Recall gunnery program: PRESS: 2ND, PGM 02
4	Enter battery data and DPICM registration corrections (if available).

SELF-REGISTRATION (S-R MODE)

STEP	
5	Enter target location (follow steps for method of target location).
6	Determine azimuth and range to target: PRESS: A or B
7	Select charge: PRESS: C To change charge, type: CLR, CHARGE, ADVANCE
8	OVERRIDE FZ TIME NO 20/R : PRESS: 2ND, A
9	Compute S-R mode firing data: PRESS D : Time Displayed (Δ Time 98.0) ADVANCE : Deflection Displayed ADVANCE : Quadrant Displayed

Note. This is the S-R mode DPICM data fired to locate the RAAM adjusting point.

RAAM M718/M741 FIRE-FOR-EFFECT FIRING DATA

STEP	Firing Table Addendum Method	GFT Method
10	a. Enter Table B (RAAM FT Addendum) with the S-R mode fuze setting. Extract and apply the correction to fuze setting.	a. Place manufacturer's hairline (MHL) over the S-R mode fuze setting on the base scale - read FFE fuze setting under MHL on M718/M741 scale.
	b. Enter Table A (RAAM FT Addendum) with S-R mode quadrant. Extract and apply correction to quadrant elevation.	b. Place MHL over S-R quadrant on the base scale - read FFE quadrant under MHL on M718/M741 scale.
	c. The S-R mode deflection is the deflection to fire.	c. The S-R mode deflection is the deflection to fire.

Note. The RAAM projectiles are only fired in effect. All adjustments are fired with DPICM S-R mode.

SPECIAL SITUATIONS

ANTI-PERSONNEL IMPROVED CONVENTIONAL MUNITIONS (APICM), M444/M449/M404

All weapon systems APICM projectiles are ballistically similar to the system's base HE projectile (M1/M107/M106). TFT addendums or GFT conversion scales are used to convert HE data to FFE APICM data. The calculator provides the HE projectile solution. When computing firing data for AF/FFE APICM missions, override fuze time NO 20/R (2ND, A), ignore the displayed fuze setting during HE adjustment. When HE FFE data is computed the displayed fuze setting is the HE FFE fuze setting. Convert HE FFE fuze setting and quadrant to APICM data with the ICM addendum or GFT conversion scales (para 11-2, FM 6-40).

HIGH ANGLE

High angle firing data solutions are computed when high angle program constants are recalled and high angle (2ND, B) is overridden. High angle computations ignore site and 20/R HOB corrections. Fuze settings are based on time of flight curve-fits. Variable time (VT) is the preferred fuze.

CAUTION: If high angle is overridden (2ND, B) without high angle constants recalled, the calculator will compute erroneous firing data.

WHITE PHOSPHORUS (WP)

The WP projectile is a member of the HE family. Weight corrections are applied to compensate for the difference in projectile [5] weights. To compute WP firing data, enter Table F, TFT with initial chart range, and extract the range correction factor for an increase/decrease of 1 [0] . Multiply the correction factor by the difference in [5] weight between the HE and WP projectiles. This range correction is applied to the HE FFE range prior to computing WP FFE data (para 11-14, FM 6-40). With the calculator this range correction is applied by entering in the gun target azimuth as the observer target direction, apply the ADD/DROP range correction shift, and compute firing data for WP. The input of the weight correction as a range shift on the GT line changes the calculator's target grid.

CHEMICAL PROJECTILE

The manual solution incorporates the use of the GFT and the TFT to determine firing data for the weight correction of the chemical projectiles. The TFT solution provides corrections to the range to compensate for the weight difference. When fire for effect is to be fired with a chemical projectile, the adjustment phase is normally conducted with HE, fuze quick. Determination/application of projectile weight corrections procedures parallel those for a WP mission. If firing the (VX) agent, a variable time (proximity) fuze is used. Override the model number of the VT fuze fired. GB agents are fired with a PD fuze (para 11-21, FM 6-40).

SMOKE

HC (white) smoke is a base-ejection projectile fired with mechanical time fuze, (M501A1) and is used to screen friendly movements from the enemy or to obscure the enemy's vision. It produces no casualty effect. Firing data for shell smoke (HC) is HE data with 2.0 fuze setting increments subtracted from M564 fuze setting. Override 2ND, A prior to computing (para 11-17, FM 6-40).

ROCKET ASSIST PROJECTILE (M549A1)

Rocket assist projectile (M549A1) programs are available on the special situation module for the M109A1 and M109/M114A2 systems. The RAP round's extended range capability is obtained from a built-in rocket motor. The rocket-on mode for the projectile is selected by removing the rocket-off cap prior to chambering the round. Removal of the cap exposes a pyrotechnic delay assembly in the base of the rocket motor. At launch the high temperatures generated by the propellant ignites the delay which burns for approximately seven seconds before igniting the rocket motor propellant. Manual procedures for computing firing data for the RAP are identical to those for the M107 with one exception; during computation of met corrections a correction for the nonstandard temperature of the rocket propellant must be made. Since no method for measuring actual rocket motor propellant temperature is available, it is assumed to be the same as the powder temperature. The GFT/GST's for the M549A1 projectile are read in the same manner as those for conventional HE with the exception that fuze setting scales are not included. When firing RAP the VT fuze setting is determined by overriding VT fuze (2ND, E). Fuze settings are based on time of flight.

Note. For the M114A2 system only. Input the system's common deflection.
Type: 2400,STO,83

ILLUMINATION

The calculator is not programmed to compute illumination firing data. However, it can perform the firing chart functions, determine range and deflection for use with the illumination TFT/GFT. Paragraph 11-9, FM 6-40 procedures are then followed for the manual solution of illumination firing data. To determine chart range:

a. Recall the applicable low angle HE charge constants program.

Type: 2ND, PGM_____, A
(PGM FLAG #)

b. Recall gunnery program.

Type: 2ND, PGM, 02

c. Input target location and PRESS A: AZIMUTH flashed
RANGE displayed (record range/set-off on illum GFT)

d. Charge selection, PRESS C : to change charge:

Type: CLR, CHG, ADVANCE

e. Compute deflection to target: PRESS D: DEFLECTION displayed

Note. This is the deflection to fire for one/two gun illumination and illumination, range spread missions. For lateral spread and range and lateral spread missions. apply 500/R corrections to the center deflection.

f. Determine fuze setting and quadrant with the GFT/TFT.

TGPC/SPEC CORR APPLICATION

CUE CARD PRIMARY FUNCTIONS

LOC BP : LOCATES BASE PIECE WITH RESPECT TO AIMING CIRCLE'S LOCATION AND AZIMUTH OF LAY. BASE PIECE IS THEN ESTABLISHED AS THE BATTERY CENTER.

WPN #1 : COMPUTES WEAPON #1 DISPLACEMENT FROM BASE PIECE AND LATERAL CORRECTION TO ASSIGNED BURST LINE.

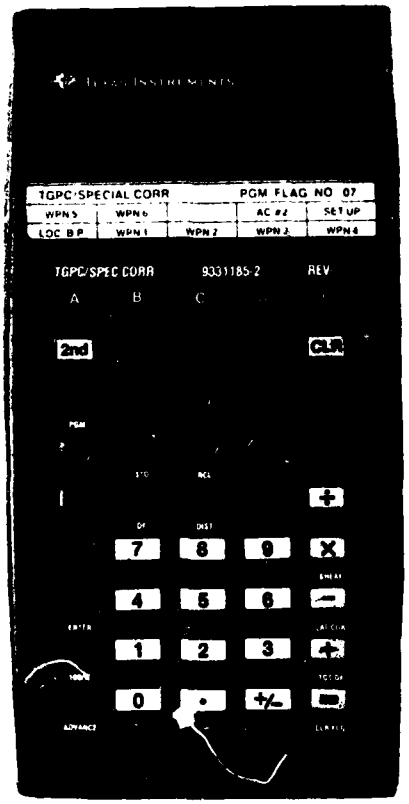
WPN #2 : COMPUTES WEAPON #2 DISPLACEMENT FROM BASE PIECE AND LATERAL CORRECTION TO ASSIGNED BURST LINE.

WPN #3 : COMPUTES WEAPON #3 DISPLACEMENT FROM BASE PIECE AND LATERAL CORRECTION TO ASSIGNED BURST LINE.

WPN #4 : COMPUTES WEAPON #4 DISPLACEMENT FROM BASE PIECE AND LATERAL CORRECTION TO ASSIGNED BURST LINE .

KEYBOARD DEFINITIONS

2ND	: SECOND
CLR	: CLEAR
PGM	: PROGRAM
STO	: STORE
RCL	: RECALL
DF	: LAID DEFLECTION
DIST	: DISTANCE FROM AC
ENTER	: ENTER
100/R	: 100/R
ADVANCE	: ADVANCE
SHEAF	: SHEAF (BURST PATTERN)
LAT CORR	: LATERAL CORRECTION
TGT DF	: CENTER SECTOR /TGT DEFLECTION
CLR FLG	: CLEAR FLAG
+/—	: CHANGES SIGN OF DISPLAY.



CUE CARD SECONDARY FUNCTIONS

WPN #5 : COMPUTES WEAPON #5 DISPLACEMENT FROM BASE PIECE AND LATERAL CORRECTION TO ASSIGNED BURST LINE.

WPN #6 : COMPUTES WEAPON #6 DISPLACEMENT FROM BASE PIECE AND LATERAL CORRECTION TO ASSIGNED BURST LINE.

AC #2 : SETS UP HASTY TRAVERSE PROGRAM FOR INPUT OF DEFLECTION AND DISTANCE FROM THE SECOND AIMING CIRCLE. USED ONLY WHEN THE BATTERY WAS LAID BY TWO AIMING CIRCLES.

SET UP : SETS UP PROGRAM AND CLEARS WORKING REGISTERS.

FIGURE 9, TGPC/SPEC CORRECTION MATRIX

TERRAIN GUN POSITION CORRECTIONS (TGPC)

NARRATIVE.

The calculator can perform the M17 plotting board function and aid with the math solution of TGPC/SPEC CORR computations. Use the back of the Record of Fire for computations. Hasty traverse procedures are used to determine piece displacement. Hasty traverse must precede TGPC or SPEC CORR computations because the position range correction determined during hasty traverse is stored and used for the computation of TGPC/SPEC CORR. The desired sheaf (the weapon system's standard for TGPC, Table 1) must be entered into the calculator much the same way burst lines are constructed on the M17 plotting board. Once the desired sheaf is entered, each weapon is assigned to a burst line. The burst line assignment is determined by ordering the weapons by the lateral displacement magnitude from right to left. The weapon with the largest right lateral displacement corrects to burst line #1. The weapon with the largest left lateral displacement will correct to burst line #6. Toward and away from battery center is indicated by: 1 = Toward battery center, -1 = Away from battery center. The program is set up to compute primary sector TGPC. Right and left sectors can also be computed by changing the target deflection and recomputing the piece displacements and burst line assignments.

SPECIAL CORRECTIONS.

Computation of special corrections for a converge sheaf are accomplished by:

-Entering the DF to the target (step 12). DF____,ENTER,TGT DF

-Designating the sheaf (step 9). 0,ENTER,SHEAF This automatically places 0 in all burst line registers.

HASTY TRAVERSE/DETERMINING PIECE DISPLACEMENT.

STEPS

1 Obtain deflection and distance from aiming circle to each weapon.

2 Recall TGPC program: 2ND,PGM,07

3 Set up TGPC routine (Primary Sector): 2ND,E

4 Determine base piece (BP) location:

a. BP LAID DEFLECTION,ENTER,DF

b. DISTANCE,ENTER,DIST

c. PRESS A : DISPLAY: 0

Note. Base piece is assumed to be over battery center.

5 Determine location of weapons #1 with respect to base piece:

a. WPN #1 LAID DEFLECTION,ENTER,DF

b. WPN #1 DISTANCE,ENTER,DIST

c. PRESS B : WPN #1's LATERAL DISPLACEMENT displayed.
ADVANCE : WPN #1's RANGE DISPLACEMENT displayed.

Note. MINUS = RIGHT/FORWARD OF BP PLUS = LEFT/BACK OF BP

d. Record WPN #1's lateral and range displacement prior to continuing.

6 Repeat step 5a and 5b and press the applicable weapon key for the remaining weapons.

TERRAIN GUN POSITION CORRECTIONS

STEPS (continued)

7. Order the weapons from right to left based on the magnitude of their lateral displacements determined in step 5 and 6. See example:

EXAMPLE:

Weapon	Lateral Displacement	Corrects to Burst Line
1	R79	1
2	R62	2
3	0(BP)	3
4	L28	4
6	L56	5
5	L74	6

8. Assign weapons to burst lines as ordered in step 7. The rightmost piece corrects to burst line #1.

a. Record assignment on Record of Fire (ROF).

b. Record range displacement (determined in step 5) in column 7 on ROF.

9. Input standard sheaf intervals from right to left (Table 1).

Burst #1, ENTER, SHEAF, Burst #2, ADVANCE

Burst #3, ADVANCE, Burst #4, ADVANCE

Burst #5, ADVANCE, Burst #6, ADVANCE

Note. For converge sheaf: 0,ENTER,SHEAF

Table 1. TGPC Standard Sheaf Burst Location

CALIBER	BURST LINE NUMBER					
	6	5	4	3	2	1
105	50(L)	30(L)	10(L)	-10(R)	-30(R)	-50(R)
155	100(L)	60(L)	20(L)	-20(R)	-60(R)	-100(R)
8" (6-Gun)	150(L)	90(L)	30(L)	-30(R)	-90(R)	-150(R)
155 (4-Gun)			60(L)	20(L)	-20(R)	-60(R)
8" (4-Gun)			90(L)	30(L)	-30(R)	-90(R)

Note. Burst line values must be entered in sequence starting with burst #1.

LEFT is plus (+) RIGHT is minus (-)

Input only six burst lines.

10. Determine position lateral correction to assigned burst line.

a. Set up the subroutine: Press CLR, ENTER, LTRL CORR

b. Press weapon button assigned to burst line #1 (step 8).

(1) Display 1 or -1: 1 = Toward battery center
-1 = Away from battery center

(2) Press: ADVANCE.
Display: Position weapon's lateral correction
Record on Record of Fire in column 1.

c. Repeat step 10b for each burst line as ordered in step 7.

STEPS (continued)

11. Follow the steps on the Record of Fire and complete TGPC computations. The calculator should be used for mathematic computations.

    a. To determine 100/R value, type: RANGE, ENTER, 100/R

    b. Display = 100/R

LEFT/RIGHT SECTOR TGPC

STEPS (continued)

12. Designate the sector and locate base piece.

    a. Type: Sector Center Deflection, ENTER, TGT DF

    Note. For converge sheaf: DF TO TGT, ENTER, TGT DF

    b. Press A : Display is 0

13. Weapon displacement computation.

    a. Press weapon button: Display = LATERAL DISPLACEMENT
    Advance, Display = RANGE DISPLACEMENT

    c. Repeat steps 13a and b for each weapon and record lateral and range displacement.

14. Order the weapons from right to left, based on their lateral displacement, assign corresponding burst lines, and repeat steps 7-11.

OPERATOR'S MEMORY MAP: TGPC PROGRAM

Data Register Allocation

Data Register	Contents	Data Register	Contents
10	Burst Line #1	32	Weapon #4 DF from AC
11	Burst Line #2	33	Weapon #4 Distance from AC
12	Burst Line #3	34	Weapon #4 Displacement(R/L)
13	Burst Line #4	35	Weapon #4 Displacement (F/B)
14	Burst Line #5	36	Weapon #5 DF from AC
15	Burst Line #6	37	Weapon #5 Distance from AC
16	Base Piece Deflection from Aiming Circle	38	Weapon #5 Displacement (R/L)
		39	Weapon #5 Displacement (F/B)
17	Base Piece Distance from AC	40	Weapon #6 DF from AC
18	BP Displacement from AC (R/L)	41	Weapon #6 Distance from AC
19	BP Displacement from AC (F/B)	42	Weapon #6 Displacement (R/L)
20	Weapon #1 Deflection from AC	43	Weapon #6 Displacement (F/B)
21	Weapon #1 Distance from AC	46	Burst Line Lat Corr Weapon #1
22	Weapon #1 Displacement (R/L)	47	Burst Line Lat Corr Weapon #2
23	Weapon #1 Displacement (F/B)	48	Burst Line Lat Corr Weapon #3
24	Weapon #2 DF from AC	49	Burst Line Lat Corr Weapon #4
25	Weapon #2 Distance from AC	50	Burst Line Lat Corr Weapon #5
26	Weapon #2 Displacement (R/L)	51	Burst Line Lat Corr Weapon #6
27	Weapon #2 Displacement (F/B)	52	AC #2 Deflection from AC #1
28	Weapon #3 DF from AC	53	AC #2 Distance from AC #1
29	Weapon #3 Distance from AC	54	AC #2 Displacement from AC #1 (R/L)
30	Weapon #3 Displacement (R/L)	55	AC #2 Displacement from AC #1 (F/B)
31	Weapon #3 Displacement (F/B)		

CONCURRENT MET APPLICATION

CUE CARD PRIMARY FUNCTIONS

REG DATA : SETS UP SEQUENCE FOR REG-ISTRATION DATA INPUT

BTRY DATA : SETS UP SEQUENCE FOR BATTERY DATA INPUT.

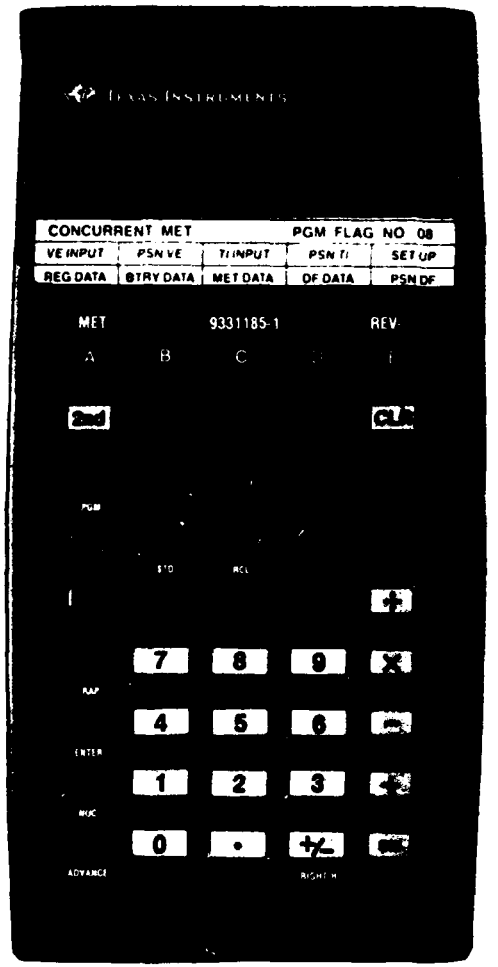
MET DATA : SETS UP SEQUENCE FOR MET MESSAGE DATA INPUT.

DF DATA : SETS UP SEQUENCE FOR DE-FLECTION CORRECTION INPUTS AND COMPUTES MET DEFLECT-ION CORRECTION.

PSN DF : COMPUTES POSITION DE-FLECTION CORRECTION.

KEYBOARD DEFINITIONS

2ND : SECOND
CLR : CLEAR
PGM : PROGRAM
STO : STORE
RCL : RECALL
RAP : ROCKET ASSISTED PROJECTILE: SETS UP TABLE E.1 CORRECTION ENTRY.
ENTER : ENTER
NUC : NUCLEAR: ENABLES CONSIDERATION OF COMPLIMENTARY RANGE FOR SUBSEQUENT MET
ADVANCE : ADVANCE
RIGHT/H : RIGHT /HEADWIND



CUE CARD SECONDARY FUNCTIONS

VE INPUT : SETS UP SEQUENCE FOR VELOCITY ERROR COR-RECTION INPUT, AND COMPUTES MET RANGE CORRECTION

PSN VE : COMPUTES POSITION VEL-OCITY ERROR CORRECTION

TI INPUT : SET UP SEQUENCE FOR FUZE CORRECTION INPUTS AND COMPUTES MET FUZE CORRECTION.

SET UP : SETS UP PROGRAM AND CLEARS WORKING REGISTERS.

FIGURE 10, CONCURRENT MET MATRIX

CONCURRENT MET MATHEMATICS

NARRATIVE.

The concurrent MET program parallels the MET DATA CORRECTION sheet (DA Form 4200) format and FM 6-40 solution of a concurrent MET sequence. The calculator automates the manual MET computations and frees the operator from slow and error prone mathematics. The program is universal for all weapon systems and projectiles. MET procedures remain constant between systems, only the tabular firing table inputs change. Sequence notes identify projectile peculiar inputs and procedures. Both increase/decrease TFT correction factors are entered. The calculator selects and applies the correct correction factor. Calculator inputs are sequential. If the sequence is not followed, computation errors will incur. The solution sequence is divided into four major sections:

-Known Data Input.
-Position Deflection Correction.
-Position Velocity Error.
-Position Fuze Correction.

If an error is made while entering data, it can be corrected by pressing the last pressed control key. This allows the operator to start that section over again. Refer to the concurrent MET application matrix for the keyboard overlay and cue card functions (fig 10).

1. RECALL THE CONCURRENT MET PROGRAM.

   Type: 2ND,PGM,08

2. SET UP MET ROUTINE.

   Type: 2ND,E

   Note. For M549A1 RAP, type: ENTER,RAP

3. KNOWN DATA.

   a. Registration data: PRESS A.

   INPUT:

1	Chart range,	ADVANCE
2	Adjusted range,	ADVANCE
3	Adjusted elevation,	ADVANCE
4	*Time ~ adjusted elevation,	ADVANCE
5	*Adjusted time,	ADVANCE

   *Note. For impact registration input zero for input 4 and 5.

6	Chart deflection,	ADVANCE
7	Adjusted deflection,	ADVANCE

   b. Battery data: PRESS B.

   INPUT:

1	Battery altitude,	ADVANCE
2	*Altitude of burst,	ADVANCE

   *Note. TGT ALT + HOB = ALT OF BURST

3	*Angle of site,	ADVANCE

   *Note. ALT OF BURST - ALT OF BTRY = VERTICAL INTERVAL
   VERTICAL INTERVAL ÷ CHART RANGE IN THOUSANDS = ANGLE OF SITE

INPUT (continued)

4 Direction of fire, ADVANCE

5 Projectile ⊡ *weight, ADVANCE

6 Standard projectile ⊡ *weight, ADVANCE

*Note. For 8" HES and 155 NUC, use pound weights of projectiles.

7 Propellant temperature, ADVANCE

c. MET data: PRESS C. (displays Table A, entry argument). Determine MET line number.

INPUT

1 Altitude MDP, ADVANCE

2 MDP pressure, ADVANCE

3 Wind direction, ADVANCE

4 Wind speed, ADVANCE

5 Air temperature, ADVANCE

6 Air density, ADVANCE

Note. Values extracted from the ballistic MET message form (DA Form 3675) must be converted to actual MET data correction sheet data prior to input.

4. POSITION DEFLECTION CORRECTION COMPUTATION.

a. Press D, displays Table B, entry arguments, range and vertical interval seperated by a decimal point. Minus sign indicates a negative VI (i.e., -5000.100 is read: RANGE 5000, VI -100).

INPUT

1 Comp range, ADVANCE (Display = Table C, entry argument: CHART DIRECTION OF WIND)

2 *Crosswind comp, ADVANCE

*Note. RIGHT = Minus (-) LEFT = Plus (+)

3 *Range wind comp, ADVANCE (Display = Table F, entry argument: RANGE)

*Note. HEAD = Minus (-) TAIL = Plus (+)

4 Drift, ADVANCE

5 Crosswind CORR, ADVANCE (Display = Table I, entry argument: RANGE and AZIMUTH TO TARGET e.g, 5100.0800 is read: RANGE 5000, AZ 800).

Note. Express range to 500 meters. Use correct latitude.

6. Azimuth rotation CORR, ADVANCE* (Display = MET DEFLECTION CORRECTION)

*Note. If calculator does not compute after input of azimuth rotation correction, ADVANCE, you have made an input error. PRESS D and input all values in paragraph 4a again.

b. PRESS E: (Display = POSITION DEFLECTION CORRECTION.)

5. POSITION VELOCITY CORRECTION COMPUTATIONS.

a. Press 2ND, A (Displays Table D, entry argument: Δ h)

+, battery above MDP
-, battery below MDP

INPUT

1 Temperature correction, ADVANCE

2 Density correction, ADVANCE (Displays Table E, entry argument: propellant temperature)

3 Propellant temperature correction, ADVANCE (Displays Table F entry argument: range)

Notes:

1. If required, use Interpolation routine. To return to this program type:
   2ND, PGM, 08
   2ND, A
   Then input all paragraph 5a data.
   DO NOT TYPE: 2ND, E (MET SET UP)

2. If firing RAP, display = Table E.1 entry argument; RANGE . PROPELLANT TEMP.
   INPUT: RKT MTR TEMP RG CORR, ADVANCE (Displays Table F, entry argument: RANGE.)

4 MV decrease, ADVANCE

5 MV increase, ADVANCE

6 Range wind head, ADVANCE

7 Range wind tail, ADVANCE

8 Air temp decrease, ADVANCE

9 Air temp increase, ADVANCE

10 Air density decrease, ADVANCE

11 Air density increase, ADVANCE

12 Proj weight decrease, ADVANCE

13 Proj weight increase, ADVANCE (Display = Table H, entry argument: RANGE . AZIMUTH TO TARGET (express range to 500 meters).

14 Range rotation correction, ADVANCE

15 Latitude correction, ADVANCE (Display = MET RANGE CORR.)

Note. If calculator does not compute MET RANGE CORR after input of latitude correction, ADVANCE, you have made an input error. PRESS 2ND . A and then input all values in paragraph 5a again.

b. PRESS 2ND, B: (Display = POSITION VELOCITY ERROR)

Note: The calculator's computed met position constants and total corrections may deviate from manually computed values slightly. This is due to the increased computational accuracy with the calculator.

6. POSITION FUZE CORRECTION COMPUTATIONS

a. Press 2ND, C (Display = Table J, entry argument fuze setting).

INPUT:

1	MV decrease correction, ADVANCE
2	MV increase correction, ADVANCE
3	Range wind head, ADVANCE
4	Range wind tail, ADVANCE
5	Air temp decrease, ADVANCE
6	Air temp increase, ADVANCE
7	Air density decrease, ADVANCE
8	Air density increase, ADVANCE
9	Proj weight decrease, ADVANCE
10	Proj weight increase, ADVANCE (Displays MET FUZE CORR)

Note. If calculator does not compute after input of PROJ WT INC, ADVANCE, you have made an input error. PRESS 2ND, C, and input all values in paragraph 6a again.

b. PRESS 2ND, D: (Display = POSITION FUZE CORRECTION)

OPERATOR'S MEMORY MAP: CONCURRENT MET PROGRAM

Data Register Allocation

Data Register	Contents
30	Standard Projo Wt
REGISTRATION DATA	
40	Chart Range
41	Adjusted Range
42	Adjusted Elevation
43	TI ~ Adjusted Elevation
44	Adjusted TI
45	Chart Deflection
46	Adjusted Deflection
BATTERY DATA	
47	Battery Altitude
48	Altitude of Burst
49	✗ Site
50	Direction of Fire
51	Actual Projo Wt
52	Propellant Temperature
MET DATA	
53	Altitude of MDP
54	Air Pressure
55	Wind Direction
56	Wind Speed
57	Air Temperature
58	Air Density
59	MV Decrease
60	MV Increase
61	RG Wind H
62	TG Wind T
63	Air Temp Decrease
64	Air Temp Increase
65	Air Density Decrease
66	Air Density Increase
67	Projo Wt Decrease
68	Projo Wt Increase
69	MV Decrease
70	MV Increase
71	RG Wind H
72	RG Wind T
73	Air Temp Decrease
74	Air Temp Increase
75	Air Density Decrease
76	Air Density Increase
77	Projo Wt Decrease
78	Projo Wt Increase
79	Corrected Air Temp
80	Corrected Air Density
81	Met Deflection Correction
82	Not Used
83	Not Used
84	Not Used
85	RG Component of Wind Speed
86	Met Fuze Correction
87	Not Used
88	Δ V
89	Working Register
90	CW Correction to Deflection
91	Δ MV Due to Propellant Temp
92	Δ RG Due to Rocket Motor Temp (RAP RD ONLY)
93	Met Range Correction
94	Δ V Range Correction
95	Chart Range in 100's
96	Control Register
POSITION CONSTANTS	
97	PSN DF Correction
98	PSN VE Correction
99	PSN TI Correction

SUBSEQUENT MET/MET+VE APPLICATION

CUE CARD PRIMARY FUNCTIONS

PSN CONST : SETS UP SEQUENCE FOR INPUT OF POSITION CONSTANTS (POSITION DEFLECTION CORRECTION, POSITION VELOCITY ERROR CORRECTION, POSITION FUZE CORRECTION).

BTRY DATA : SETS UP SEQUENCE FOR BATTERY DATA INPUT

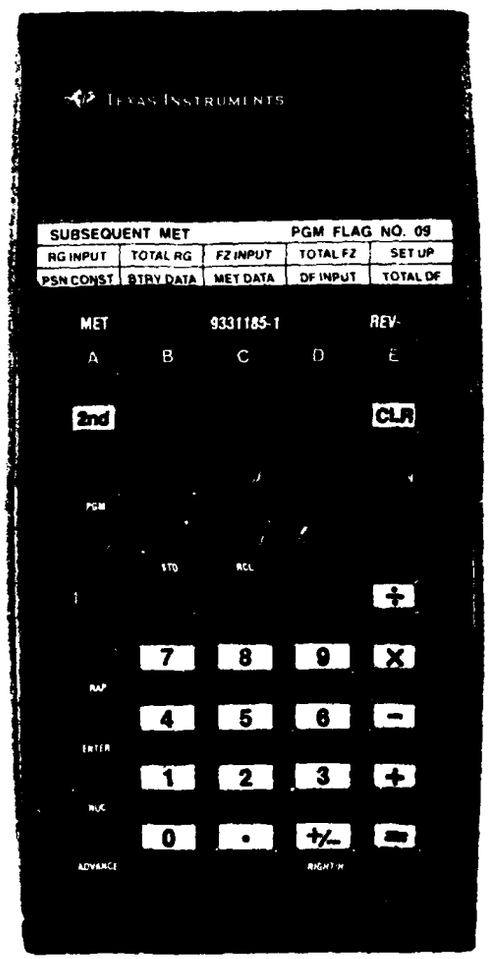
MET DATA : SETS UP SEQUENCE FOR MET MESSAGE DATA INPUT.

DF INPUT : SETS UP SEQUENCE FOR DEFLECTION CORRECTION INPUTS, AND COMPUTES MET DEFLECTION CORRECTION.

TOTAL DF : COMPUTES TOTAL DEFLECTION CORRECTION.

KEYBOARD DEFINITIONS

2ND : SECOND
CLR : CLEAR
PGM : PROGRAM
STO : STORE
RCL : RECALL
RAP : ROCKET ASSISTED PROJECTILE: SETS UP TABLE E.1 CORRECTION ENTRY.
ENTER : ENTER
NUC : NUCLEAR: ENABLES CONSIDERATION OF COMPLIMENTARY RANGE.
ADVANCE : ADVANCE
RIGHT/H : RIGHT/HEADWIND



CUE CARD SECONDARY FUNCTIONS

RG INPUT : SETS UP SEQUENCE FOR VELOCITY ERROR CORRECTION INPUT AND COMPUTES MET RANGE CORRECTION

TOTAL RG : COMPUTES TOTAL RANGE CORRECTION.

FZ INPUT : SETS UP SEQUENCE FOR FUZE CORRECTION INPUTS AND COMPUTES MET FUZE CORRECTION.

TOTAL FZ : COMPUTES TOTAL FUZE CORRECTION.

SET UP : SETS UP PROGRAM AND CLEARS WORKING REGISTERS.

FIGURE 11, SUBSEQUENT MET MATRIX

SUBSEQUENT MET/MET + VE MATHEMATICS

NARRATIVE.

The concurrent MET narrative also applies to the subsequent MET application. The end results of subsequent MET's are total corrections for deflection, range, and fuze setting. The MET keyboard overlay is used with the subsequent MET cue card. Refer to the subsequent MET application matrix for the overlay and cue card functions.

1. RECALL SUBSEQUENT MET PROGRAM.

   Type: 2ND, PGM, 09

2. SET UP MET ROUTINE.

   Type: 2ND, E

   Note. For 8" HES and 155 NUC MET TO TGT, type: ENTER, NUC
   For M549A1 (RAP), type: ENTER, RAP

3. INPUT KNOWN DATA.

   a. Position constants: PRESS A.

      INPUT:
      1 Position DF CORR, ADVANCE
      2 Position VE CORR, ADVANCE
      3 Position FZ CORR, ADVANCE

      Note. For MET + VE GFT setting use average position constants for VE and fuze CORR and POS DF CORR of 0 (para 6-10b, FM 6-40).

   b. Battery data: PRESS B.

      INPUT:
      1 Chart range, ADVANCE
      2 Chart deflection, ADVANCE
      3 Battery altitude, ADVANCE
      4 *Altitude of burst, ADVANCE

      *Note. TGT ALT + HOB = ALT OF BURST

      5 Direction of fire, ADVANCE
      6 Projectile * [f] weight, ADVANCE
      7 Standard * [f] weight, ADVANCE

      *Note. For 8" HES and 155 NUC, use pound weight of projectile.

      8 Propellant temperature, ADVANCE

Note. If an error is made while entering data, it can be corrected by pressing the last pressed control key. This allows the operator to start that section over again.

c. MET data: PRESS C*

*Note. For MET + VE GFT setting use concurrent MET line number. For MET TO TGT, enter Table B with range and VI, and determine MET line number.

INPUT:

1 Altitude MDP, ADVANCE
2 MDP pressure, ADVANCE
3 Wind direction, ADVANCE
4 Wind speed, ADVANCE
5 Air temperature, ADVANCE
6 Air density, ADVANCE

Note. Values extracted from the ballistic MET message form (DA Form 3675) must be converted to actual MET data correction sheet data prior to input.

4. TOTAL DEFLECTION CORRECTION COMPUTATION.

a. Press D; displays Table B, entry arguments, range and vertical interval, separated by a decimal point. Minus sign indicates a negative VI (e.g., -5000.100 is read: RANGE 5000, VI -100)

INPUT:

1 Comp range, ADVANCE (Display = Table C, entry argument: CHART DIRECTION OF WIND)
2 *Crosswind comp, ADVANCE

*Note. LEFT = Plus (+) RIGHT = Minus (-)

3 *Rangewind comp, ADVANCE (Display = Table F, entry argument: RANGE)

*Note. HEAD = Minus (-) TAIL = Plus (+)

4 Drift, ADVANCE
5 Crosswind CORR, ADVANCE (Display = Table I, entry argument: *RANGE . AZIMUTH TO TARGET (e.g., 5100.0800 is read: RANGE 5000, AZ 800).

*Note. Express displayed range to 500M. Use correct latitude.

6 *Azimuth rotation CORR, ADVANCE (Display = MET DEFLECTION CORRECTION)

*Note. If calculator does not compute after input of azimuth rotation correction, ADVANCE, you have made an input error. PRESS D and input all values in paragraph 4a again.

b. PRESS E: (Display = TOTAL DEFLECTION CORRECTION.)

5. TOTAL RANGE CORRECTION COMPUTATION.

a. PRESS 2ND, A (Displays Table D, entry argument Δh:)

+, battery above MDP
-, battery below MDP

INPUT:

1 DT TEMP CORR, ADVANCE

2 DD DENSITY CORR, ADVANCE (Displays Table E, entry argument: PROPELLANT TEMPERATURE)

3 Propellant Temp CORR, ADVANCE (Displays Table F, entry argument: RANGE)

Notes:

1. If required, use interpolation routine. To return to this program type:

   2ND, PGM, 09
   2ND, A

   Then input all paragraph 5a data.
   DO NOT TYPE: 2ND, E (MET SET UP)

2. For RAP (M549A1) display is Table E.1, entry argument: RANGE . PROPELLANT TEMP.
   INPUT: RKT MTR TEMP RG CORR, ADVANCE (Displays Table F, entry argument: RANGE.)

4 MV decrease, ADVANCE

5 MV increase, ADVANCE

6 Range wind head, ADVANCE

7 Range wind tail, ADVANCE

8 Air temp decrease, ADVANCE

9 Air temp increase, ADVANCE

10 Air density decrease, ADVANCE

11 Air density increase, ADVANCE

12 Proj weight decrease, ADVANCE

13 Proj weight increase, ADVANCE (Displays Table H, entry argument: RANGE . AZIMUTH TO TARGET (express range to 500 meters).)

14 Range rotation CORR, ADVANCE

15 Latitude CORR, ADVANCE (Display = MET RANGE CORR.)

Note. If calculator does not compute MET RANGE CORR after input of latitude correction, ADVANCE, you have made an input error. PRESS 2ND . A and input all values in paragraph 5a again.

b. PRESS 2ND, B: (Display = TOTAL RANGE CORRECTION)

6. TOTAL FUZE CORRECTION COMPUTATION.

a. PRESS 2ND, C (Displays corrected range: CHART RANGE + TOTAL RANGE CORRECTION.) If shell NUC is flagged, CORRECTED RANGE = CHART RANGE + COMPLEMENTARY RANGE + TOTAL RANGE CORRECTION. Determine adjusted elevation and fuze setting corresponding to corrected range (use TFT or GFT). Construct lazy Z GFT setting diagram.

Note. If required, use interpolation routine. To return to this program, type:

2ND, PGM, 09
2ND, C

Then input all paragraph 6a data, DO NOT TYPE: 2ND, E: MET SET UP

INPUT:

1 Time ~ adjusted elevation, ADVANCE (Displays Table J, entry argument: FUZE SETTING)
2 MV decrease CORR, ADVANCE
3 MV increase CORR, ADVANCE
4 Range wind head, ADVANCE
5 Range wind tail, ADVANCE
6 Air temp decrease, ADVANCE
7 Air temp increase, ADVANCE
8 Air density decrease, ADVANCE
9 Air density increase, ADVANCE
10 Proj weight decrease, ADVANCE
11 Proj weight increase, ADVANCE (Display = MET FUZE CORR)

Note. If calculator does not compute after input of PROJ WT INC, ADVANCE, you have made an input error. PRESS 2ND, C, and input all values in paragraph 6a again.

b. PRESS 2ND, D: (Display = TOTAL FUZE CORRECTION)

OPERATOR'S MEMORY MAP: SUBSEQUENT MET PROGRAM

Data Register Allocation

Data Register	Contents	Data Register	Contents
00	TI ~ Adjusted Elevation/Range	71	Range Wind (HEAD)
28	Height of Target Above Gun	72	Range Wind (TAIL)
29	Chart Range + Comp Range	73	Air Temp Decrease
30	Standard Projo Weight	74	Air Temp Increase
40	Chart Range	75	Air Density Decrease
45	Chart Deflection	76	Air Density Increase
47	Battery Altitude	77	Projo Weight Decrease
48	Altitude of Burst	78	Projo Weight Increase
50	Direction of Fire	79	Corrected Air Temp
51	Actual Projo Weight	80	Corrected Air Density
52	Propellant Temp	81	Met Deflection Correction
53	Altitude of MDP	82	Not Used
54	Air Pressure	83	Position Deflection Correction
55	Wind Direction	84	Position Time Correction
56	Wind Speed	85	Range Component of Windspeed
57	Air Temperature	86	Met Fuze Correction
58	Air Density	87	Position VE Correction
59	MV Decrease	88	Δ V
60	MV Increase	89	Working Register
61	Range Wind (HEAD)	90	CW Deflection Correction
62	Range Wind (TAIL)	91	Δ MV Due to Propellant Temp
63	Air Temp Decrease	92	Δ Range Due to Rocket Motor
64	Air Temp Increase		Δ Temp (RAP RD ONLY)
65	Air Density Decrease	93	Met Range Correction
66	Air Density Increase	94	Δ V Range Correction
67	Projo Weight Decrease	95	Chart Range in 100's
68	Projo Weight Increase	96	Control Register
69	MV Decrease	97	Total Deflection Correction
70	MV Increase	98	Total Range Correction
		99	Total Fuze Correction

INTERPOLATION APPLICATION

CUE CARD PRIMARY FUNCTIONS

BASE #1 : FIRST KNOWN VALUE INPUT
BASE #2 : SECOND KNOWN VALUE INPUT
BASE #3 : THIRD KNOWN VALUE INPUT

CUE CARD SECONDARY FUNCTIONS

VAULE ~ 1 : TABULAR FIRING TABLE VALUE CORRESPONDING TO BASE#1.

COMPUTE 2 : COMPUTES TABULAR FIRING TABLE VALUE CORRESPONDING TO BASE#2.

VALUE ~ 3 : TABULAR FIRING TABLE VALUE CORRESPONDING TO BASE#3.

SET UP : SETS UP ROUTINE

KEYBOARD DEFINITIONS

NOTE: NO SPECIAL KEYBOARD OVERLAY IS REQUIRED. THE ROUTINE USES CONTROL KEY FUNCTIONS.

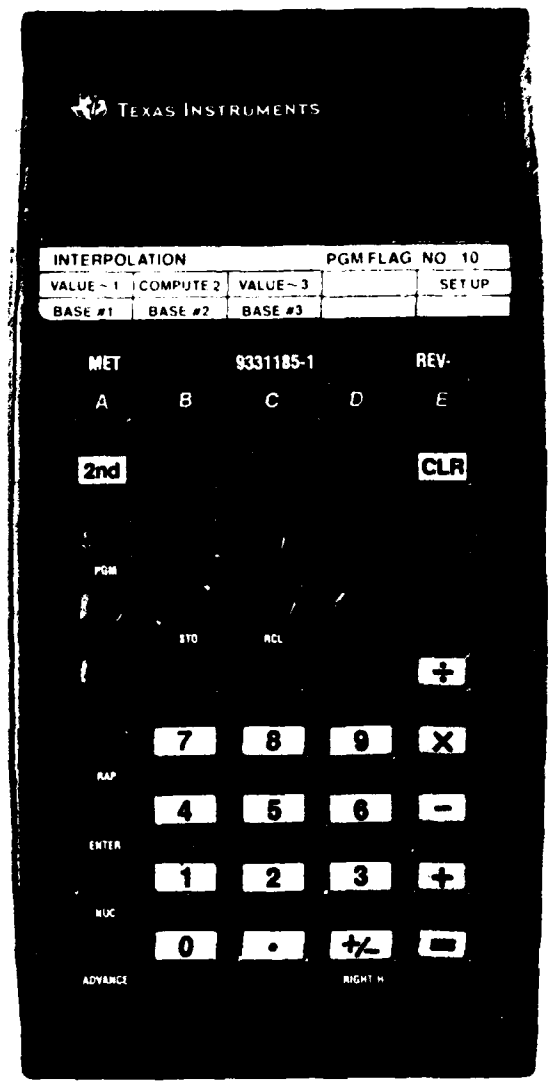


FIGURE 12, INTERPOLATION MATRIX

LINEAR INTERPOLATION

NARRATIVE.

The special situation module contains an interpolation program. No t[illegible]olate is required. The interpolation cue card is used to solve interpolation problems. Th[illegible]e values are the three known values used to set up manually an interpolation problem ([illegible] example). Values corresponding to the base values are determined with the TFT. Inputs must follow the prescribed sequence. The interpolation routine can be used in conjunction with other programs. It uses dedicated registers which do not interfere with other ongoing programs. To return to a program from the interpolation routine, recall the program, and cue the desired subroutine, but DO NOT SET UP THE PROGRAM. SET UP clears the data registers and would necessitate re-input of all data.

STEPS

1 Recall the interpolation program, type: 2ND, PGM, 10

2 Set up routine, type: 2ND, E

3 Input base values:

BASE #1, Press A
BASE #2, Press B
BASE #3, Press C

4 Input values corresponding to base values:

VALUE ~ #1, 2ND, A
VALUE ~ #3, 2ND, C

5. Determine value corresponding to base value #2:

PRESS: 2ND, B

6 Interpolation program data register allocation:

Data Register	Contents
00	Base Value #1
01	Base Value #3
02	Base Value #2
03	Value Corresponding to Base Value #1
04	Value Corresponding to Base Value #1
05	Computed Value Corresponding to Base Value #2

EXAMPLE

INTERPOLATION

155AM1, HE M107, CHG 7

BASE #	BASE VALUES ELEVATION	VALUE ~ BASE RANGE
1	424.5	11,800
2	419.0	X (X = 11,717)
3	417.9	11,700

SPECIAL SITUATION				
JMEM/SS		PGM FLAG NO. 11		
PRINT				SET UP
HE NV→FD	ICM NV→FD	HE FD→NV	ICM FD→NV	DATA RCL

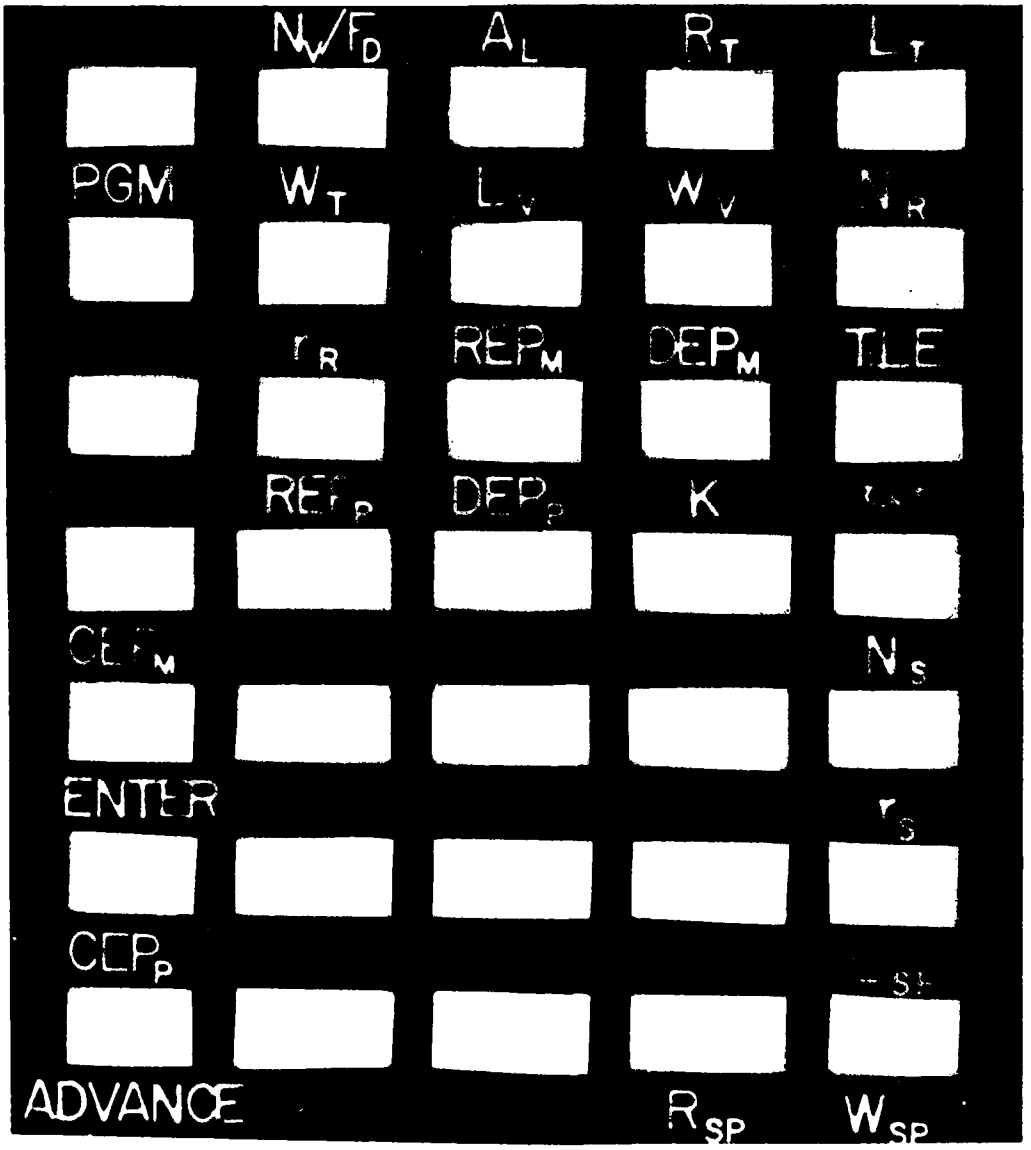


Figure 13. JMEM/SS application matrix.

JOINT MUNITION EFFECTIVENESS MANUAL/SURFACE TO SURFACE (JMEM/SS)

NARRATIVE.

The JMEM/SS program has little or no battery level application. It is provided to assist staff officers with fire planning. In order to use this program, the operator must be familiar with JMEM/SS manuals and the basic effectiveness manual, FM 101-60-17 (Confidential). The JMEM/SS program computes expected fractional damage, based on nature of target, munition and volume of fire. It will also predict the number of volleys per munition required to attain a desired fractional damage. Values from FM 101-60-17 must be entered into the calculator. An asterisk by the sequence step indicates FM 101-60-17 inputs. The JMEM/SS overlay and cue card are not part of the program kit. They must be fabricated locally. The overlay and cue card on page are to scale. Reproduce it and cut out the key slots. The key labeling and cue card functions are addressed below:

CUE CARD PRIMARY FUNCTIONS

HE Nv→ FD : Compute fractional damage based on number of volleys (HE)

ICM Nv→ FD : Compute fractional damage based on number of volleys (ICM)

HE FD→ Nv Compute number of volleys for desired fractional damage (HE)

ICM FD→ Nv Compute number of volleys for desired fractional damage (ICM)

DATA RCL : Alternate way of entering/ changing data

CUE CARD SECONDARY FUNCTIONS

Print: Print input/output data

Set Up: Initialize program

KEYBOARD OVERLAY LABEL

A_L The lethal area for the single round or submunition.

CEP_M The mean point of impact circular error probable (excluding target location error).

CEP_P The precision circular error probable.

EC The expected fractional coverage of the target by the weapon pattern

DEP_M The mean point of impact probable error in deflection (excluding target location error).

DEP_P The precision probable error in deflection.

F_D The desired or expected fractional damage.

K The pattern adjustment factor.

L_{SP} The single round submunition pattern dimension in the range direction (for ICM's only).

L_T The dimension of the target area in the range direction.

L_V The dimension of the volley pattern in the range direction.

N_R The number of rounds in each volley.

N_S The number of submunitions in each round (for ICM's only).

N_V The number of volleys.

KEYBOARD OVERLAY LABEL (continued)

r_R The reliability of the round.

R_T The radius of the target area.

R_{SP} The single round submunition pattern radius (for ICM's only).

r_S The reliability of the submunition (for ICM's only).

REP_M The mean point of impact probable error in range (excluding target location error).

REP_P The precision probable error in range.

TLE The target location error (in circular errors probable).

W_{SP} The single round submunition pattern dimension in the deflection direction (for ICM's only).

W_T The dimension of the target area in the deflection direction.

W_V The dimension of the volley pattern in the deflection direction.

PROGRAM EXECUTION

1 Recall the JMEM/SS program:

Type: 2ND, PGM, 11

2 Set up JMEM/SS routine:

2ND, E

3 Enter the input data (use the JMEM/SS keyboard overlay/cue card).

DATA INPUT

1 Number of volleys, ENTER, N_V/F_D

(If number of volleys is needed as output, type in fractional damage as input at this step).

2* Lethal area, ENTER, A_L

3 Target radius, ENTER, R_T

(If target area is described in length and width, skip step 3 and execute steps 4 and 5. If step 3 is executed, skip steps 4 and 5).

4 Target length, ENTER, L_T

5 Target width, ENTER, W_T

6 Length of volley, ENTER, L_V

7 Width of volley, ENTER, W_V

8 Number of rounds per volley, ENTER, N_R

9* Round reliability, ENTER, r_R

10* MPI probable error in range, ENTER, REP_M

PROGRAM EXECUTION (continued)

DATA INPUT

11* MPI probable error in deflection, ENTER, DEP_M

(If MPI error is given as a circular error probable skip steps 10 and 11 and execute step 12. If MPI error is given as range and deflection probable errors, execute steps 10 and 11 and skip step 12).

12* MPI circular error probable, ENTER, CEP_M

13 Target location error, ENTER, TLE

14* Precision probable error in range, ENTER, REP_P

15* Precision probable error in deflection, ENTER, DEP_P

(If precision error is given as a circular error probable, skip steps 14 and 15 and execute step 16. If precision error is given as range and deflection probable errors, execute steps 14 and 15 and skip step 16).

16* Precision circular error probable, ENTER, CEP_P

17* Adjustment factor, ENTER, K

18* (HE only) Angle of fall, ENTER, ω

19* (ICM only) Number of submunitions, ENTER, N_S

20* (ICM only) Reliability of submunition, ENTER, r_S

21* (ICM only) Submunition pattern radius, ENTER, R_{SP}

(skip step 21 if pattern is given as length and width and execute steps 22 and 23 instead).

22* (ICM only) Submunition pattern length, ENTER, L_{SP}

23* (ICM only) Submunition pattern width, ENTER, W_{SP}

(Skip steps 22 and 23 if step 21 was executed)

*Note. This data is obtained from the JMEM/SS Basic Effectiveness Manual (FM 101-60-17, Confidential).

4 Compute effects data:

PRESS: Appropriate control key (display = output value)

Note.

CONTROL KEY	OUTPUT
A	The expected fractional damage for HE round when number of volleys fired entered.
B	The expected fractional damage for ICM round when number of volleys fired entered.
C	The number of HE volleys to fire to attain a specified level of fractional damage.
D	The number of ICM volleys to fire to attain a specified level of fractional damage.

OPERATOR'S MEMORY MAP: JMEM/SS PROGRAM

Data Register Allocation

Data Register	Contents	
05	F_D/N_V	Fractional Damage/Number of Volleys
06	EC	Expected Coverage
07	W_{SP}/ZERO	Submunition Pattern Width/Submunition Pattern Radius
08	L_{SP}/R_{SP}	Submunition Pattern Length
09	R_S	Submunition Reliability
10	N_S	Number of Submunitions
11	K	Adjustment Factor
12	DEP_P/ZERO	Precision Error in Deflection
13	REP_P/CEP_P	Precision Error in Range
14	TLE	Target Location Error
15	DEP_M/ZERO	MPI Error in Deflection
16	REP_M/CEP_M	MPI Error in Range
17	R_R	Round Reliability
18	N_R	Number of Rounds
19	W_V	Width of Volley
20	L_V	Length of Volley
21	W_T/ZERO	Width of Target
22	L_T/R_T	Length of Target/Radius of Target
23	A_L	Lethal Area
24	N_V/F_D	Number of Volleys/Fractural Damage

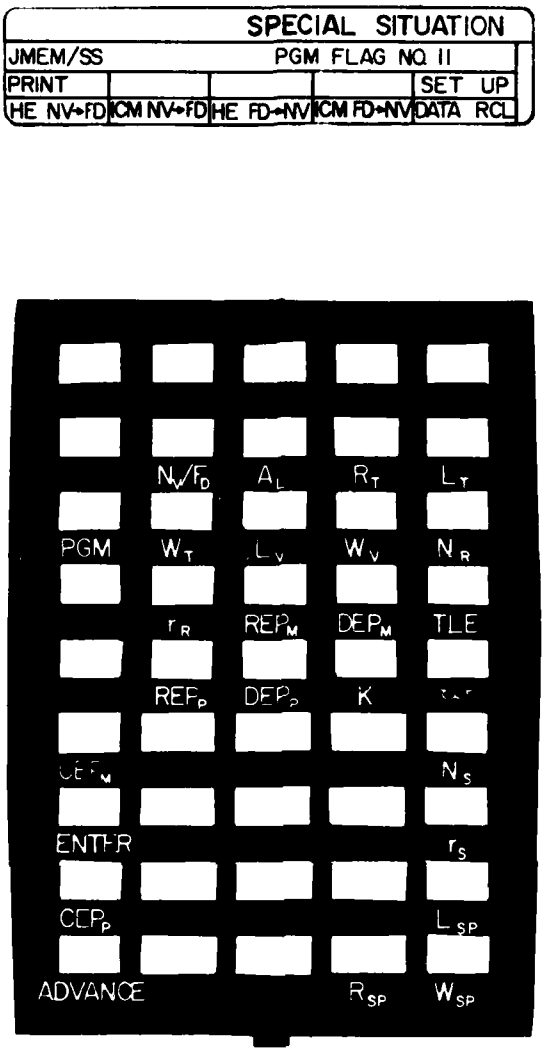
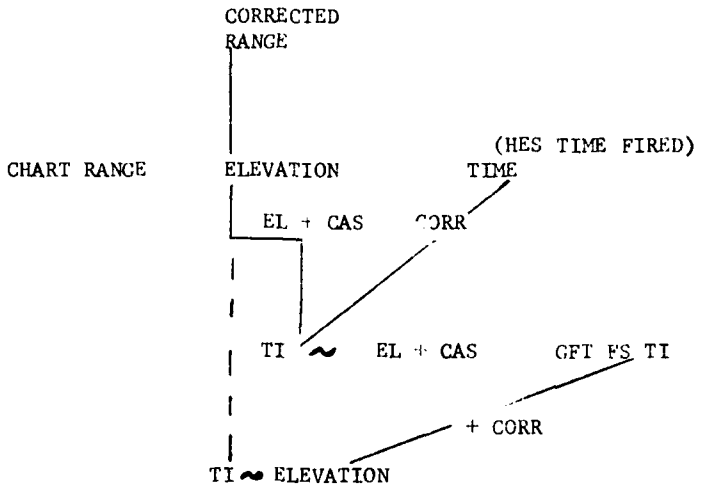


Figure 14. Keyboard overlay and cue card (actual size)

NARRATIVE

The M110A2 weapon system module is programmed to compute High Explosive Spotter (HES) firing data. Operator procedures for the HES are identical to those used for the conventional projectiles with the exception of registration correction determination. Due to the large vertical intervals associated with 8-inch nuclear firings, the effects of complementary angle of site on fuze setting and quadrant must be considered. For the K-transfer technique, the HES GFT setting is constructed as outlined in paragraph 13-3, FM 6-40.



To compute range K, divide corrected range by chart range. To compute fuze K, divide the GFT fuze setting time by time ~ to elevation. These procedures eliminate the effects of the HES' registration comp site from the residuals. The actual comp site (CAS) of the nuclear mission is added as a range correction during the solution of the gunnery problem (steps 10 & 11 below).

HES, K-TRANSFER TECHNIOUE

STEPS

1 Program Set Up

a. Recall HES constants

2ND, PGM,_____,A
(PGM FLAG #)

b. Recall gunnery program

2ND, PGM, 02

2 Set Up Weapon as a Battery

WPN Easting,ENTER,$BTRY_E$
WPN Northing,ENTER,$BTRY_N$
WPN Altitude,ENTER,$BTRY_A$
AZ OF LAY,ENTER,AZ LAY

STEPS

3 Determine and apply HES Residuals from the HB Registration or derived from FADAC.

a. Fix display format: PRESS TGT_E,2ND,$BTRY_N$

b. Range K = CORRECTED RG ÷ CHART RG,=
ENTER,RG K

c. DF CORR = GFT DF CORR,ENTER,DF CORR

d. Fuze K = GFT FZ TI ÷ TI ~ EL,=
ENTER,FZ K

e. Apply to registering charge: CHG,ENTER,RES/CHG

4 Enter Target Location. Type:

EASTING,ENTER,TGT_E
NORTHING,ENTER,TGT_N
ALTITUDE,ENTER,TGT_A
HEIGHT OF BURST,ENTER,UP/DN

5 Compute azimuth and chart range to target (record chart range on line 6, DA Form 4207).

PRESS A

6 Compute height of burst above gun (VI)

	ALT OF BURST	(stored in register 13)
-	BTRY ALT	(stored in register 03)
=	HOB ABOVE GUN	(record on line 5, DA Form 4207)

7 Compute/extract comp range to a one meter VI accuracy from Table B, TFT.

8 Add comp range to chart range and determine Table F entry range. Record on line 8, DA Form 4207.

9 Compute projectile weight and temperature corrections HES → NUC. Follow the instructions given on lines 9 through 18, DA Form 4207.

10 Total all corrections:

	COMP RG CORR _____
	PROP TEMP CORR _____
	PROJ WT CORR _____
=	RG CORR

Note. CAS is applied to OE & FS by adding COMP RG.

11 Enter the total range corrections as a range shift on the gun target azimuth.

a. RG CORR,ENTER,RG

b. GUN TGT AZ,ENTER,OT DIR

12 Charge Selection: PRESS C
To override charge: PRESS CLR,CHG,ADVANCE

13 Override Fuze Time NO 20/R

PRESS 2ND,A

STEPS

14 Compute corrected range: PRESS B Record corrected range on line 19, DA Form 4207.

15 Compute HES fuze setting corresponding to EL + COMP SITE. PRESS D
Record on line 25, DA Form 4207.

16 Compute HES adjusted deflection: PRESS:ADVANCE
Record on line 28, DA Form 4207.

Note. This is not CHT DF, DRIFT and the GFT DF CORR have been applied to the displayed DF. (Skip line 29, DA Form 4207.)

17 Compute HES quadrant: PRESS:ADVANCE Record QE on line 32, DA Form 4207.

18 Refer to Table M, determine and apply HES ballistic corrections and convert HES data to nuclear firing data. Complete computations shown on lines 25 through 34, DA Form 4207.

19 END OF MISSION E

8-INCH NUCLEAR MET + VE TECHNIQUE

STEPS

1 Solve a MET to the target, using the special situation module and determine:

TOT RG CORR
TOT DF CORR
TOT FZ CORR

2 Using the weapon system module, set up the program:

a. Recall HES constants:

2ND,PGM,_____,A
(PGM FLAG #)

b. Recall gunnery program:

2ND,PGM,02

3 Set up the weapon as a battery:

WPN #1 EASTING,ENTER,$BTRY_E$
WPN #1 NORTHING,ENTER,$BTRY_N$
WPN #1 ALTITUDE,ENTER,$BTRY_A$
AZ OF LAY,ENTER,AZ LAY

4 Enter target data:

EASTING,ENTER,TGT_E
NORTHING,ENTER,TGT_N
ALTITUDE,ENTER,TGT_A
HOB,ENTER,UP/DN

5 Compute azimuth and chart range: PRESS: A Record CHT RG on line 2, DA Form 4207.

6 Add the total range correction and comp range (from MET Form).

7 Enter the total range correction + comp range as a range shift.

RG CORR,ENTER,RG

8 Enter gun target direction as OT DIR.

AZIMUTH,ENTER,OT DIR

9 Compute corrected range: PRESS: B Record on line 4, DA Form 4207.

10 Override fuze time NO 20/R: PRESS: 2ND,A

11 Charge Selection: PRESS: C

Note. DO NOT APPLY residuals.

12 Compute FS ~ EL + COMP SITE, PRESS: D Record on line 10, DA Form 4207.

STEPS

13 Compute deflection: PRESS: ADVANCE

Determine Drift ~ to Corrected Range (Ln 4). Subtract Drift from the displayed Deflection and record Chart Deflection on Line 15, DA Form 4207.

14 Compute quadrant for spotter: PRESS: ADVANCE Record on line 19, DA Form 4207.

15 Record the total deflection correction and total fuze correction on lines 16 and 11 respectively.

16 Refer to Table M (TFT 8-R-1) and determine and record ballistic corrections for the HES firing data on lines 13, 17, and 20.

17 Complete steps 10 through 21 on DA Form 4207 and determine nuclear firing data.

18 END OF MISSION E

155 CALIBER NUCLEAR DELIVERY
(M114A1/M114A2/M109/M109A1)

NARRATIVE

The weapon system's module is used to solve K-transfer nuclear computations. HE firing data is computed using HE residuals. This data is then corrected for the ballistic differences of the nuclear projectile (sec 2, chap 13, FM 6-40). The MET + VE technique uses the special situation module. A MET to a target is solved (using TFT-AJ-2) to provide a total range, deflection, and fuze setting correction. Nuclear firing data is then computed by completing DA Form 4505.

155 NUCLEAR K-TRANSFER TECHNIQUE

STEPS

1 Program Set Up.

a. Determine HE charge-to-NUC charge correlation.

M109A1,M109,M114A1	M109,M114A1	M109A1
HE,M107 PROPELLANTS	NUCLEAR PROJ,M454 PROPELLANTS	NUCLEAR PROJ,M454 PROPELLANTS
CHARGE	CHARGE	CHARGE
4, 5 (GB) or (WB)	1 (M206)	1 (M206)
	2 (M206)	2 (M206)
7 (WB)	3 (M207)	3 (M197)

b. Verify module/system:

2ND,PGM,01,E

Note. M114A2 designate system: 114,ADVANCE
M109 designate system: 109,ADVANCE

c. Recall charge constants:

2ND,PGM,_____,A
(PGM FLAG #)

d. Recall gunnery program:

2ND,PGM,02

2 Set Up Weapon as a Battery:

WPN EASTING,ENTER,BTRY$_E$
WPN NORTHING,ENTER,BTRY$_N$
WPN ALTITUDE,ENTER,BTRY$_A$
AZ OF LAY,ENTER,AZ LAY

STEPS

3 Determine and Apply HE Residuals

a. Fix display format: PRESS TGT_E, 2ND, $BTRY_N$

b. Range K: RG ~ EL + CAS ÷ CHT RG, =
ENTER, RG K

c. GFT DF CORR: GFT DF CORR, ENTER, DF CORR

d. FUZE K: ADJ TI ÷ TI ~ EL + CAS, =
ENTER, FZ K

e. Apply to registering charge (CHG), ENTER, RES/CHG

4 Enter Target Data

EASTING, ENTER, TGT_E
NORTHING, ENTER, TGT_N
ALTITUDE, ENTER, TGT_A
HOB, ENTER, UP/DN

5 Compute azimuth and range: PRESS A

6 Charge Selection: PRESS C
To override: PRESS: CLR, _____, ADVANCE
(CHG)

7 Override FZ TI NO 20/R: PRESS 2ND, A

8 Compute HE Firing Data

D HE FS
ADVANCE, HE DF
ADVANCE, HE QE

9 Convert HE data to nuclear data by applying ballistic corrections and timer temperature corrections (chap 13, sec 2, FM 6-40).

a. Fuze setting:
HE Time
+ Timer Setting Correction (Tbl O)
= Intermediate Timer Setting
+ Timer Temperature Correction (Tbl K)
= Corrected Timer Setting (FZ TI fuze setting to fire)
Fuze VT back-off Time (Tbl L)
= Timer Setting to Fire for Fuze VT Option

b. Deflection:
HE Deflection
+ Ballistic Deflection Correction (Tbl O)
= Deflection to Fire

c. Quadrant Elevation:
HE Quadrant
+ Ballistic Quadrant Correction (Tbl O)
= Quadrant to Fire

10 END OF MISSION: PRESS E

PART 3

SAMPLE PROBLEMS

This section contains a chronological series of missions with solutions for all calibers. The Job Aids Section (Part 2) contains the detailed logic and procedures for the sample problems. Refer to the Job Aids Section during the conduct of the sample problems for each application.

INSTRUCTIONS:

-Prepare the calculator for operation as indicated on page 12-A.

-Read the applicable section of the Job Aid for the task to be performed.

-Locate the sample task problem and perform the operation.

-If difficulty is experienced, refer to the Job Aid Section and verify that the correct procedures are being followed.

-For Trouble Shooting procedures, refer to page 21-A ,

-Underlined words in the Job Aids Section represent numeric data inputs.

-The Remarks column identifies weapon system peculiar operations.

-The battery location and azimuth of lay remains the same for all problems.

PREPARE FOR ACTION

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Turn-off calculator	Slide ON/OFF Switch to left		
2	Place weapon system module in calculator			
3	Connect external power as required			
4	Turn-on calculator	Slide ON/OFF Switch to right	0	
5	Verify light emitting diodes	.,+/-,8888888888	-.8888888888	
6	Verify module system	2ND,PGM,01,E	1.001010102	M101A1/M102
			1.000000114	M114A1
			1.001090114	M109/M114A2
			1.000000109	M109A1
			1.000001102	M110A2
			1.000000001	Special Situation
7	For M109/M114A2 only, designate system.			
	M109, Type:	109,ADVANCE	3200	M109 common deflection
	M114A2, Type:	114,ADVANCE	2400	M114A2 common deflection

FIRE ORDER STANDARDS	
ELEMENT	CURRENT STANDARD
UNIT TO FIRE	BATTERY
ADJUSTING ELEMENT/METHOD OF FIRE OF ADJUSTING ELEMENT	#3 ①
BASIS FOR CORRECTIONS	FASTEST METHOD
DISTRIBUTION	Parallel Sheaf
PROJECTILE	HE
AMMUNITION LOT AND CHARGE	Lot XY/
FUZE	Q
NUMBER OF ROUNDS	1
RANGE SPREAD, LATERAL SPREAD, ZONE FIRE, OR SWEEP FIRE	Center range and deflection
TIME OF OPENING FIRE	When ready

PROGRAM SET UP

STEP 1
Manually Determine Shell/ Charge/Method of fire (Establish standard FO)

PROJECTILE LOTS
LOT I: M483A1 (DPICM)
LOT T: Shell WP
LOT X: Shell HE

PROPELLANT LOTS
LOT Y: Green Bag
LOT W: White Bag

STEP 2
Refer to flag card and determine constant PGM Flag # ~ to charge groups assigned.

		CONSTANTS FLAG #
M101A1/M102	CHG 1-4 GB	05 09
M114A1	CHG 1-2 GB,3-4 WB	05
M109/M114A2	CHG 2-3 GB	05
M109A1	CHG 2-5 GB	05
M110A2	CHG 2-5 GB	05

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
3	Recall constants	2ND,PGM 05,A	101.05	M101A1
		(M102) 2ND,PGM,09,A	102.09	M102
			107.05	M114A1
			107.05	M109/M114A2
			107.05	M109A1
			106.05	M110A2
4	Clear display	CLR	0	
5	Recall gunnery program	2ND, PGM, 02	0	

Note. Constants must be recalled first then the gunnery program.

BATTERY SET UP

GIVEN: Battery Location 60858 32640 ALT 352
Azimuth of Lay 6350

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	BTRY Easting	60858,ENTER,$BTRY_E$	60858	
2	BTRY Northing	32640,ENTER,$BTRY_N$	32640	
3	BTRY Altitude	352,ENTER,$BTRY_A$	352	
4	AZ OF LAY	6350,ENTER,AZ LAY	6350	

ADJUST FIRE MISSION GRID

RECORD OF FIRE

CALL FOR FIRE

Observer H24 (AF) FFE/IS/S _____ Tgt _____

Grid 606377

Polar: Dir _____ Dis _____ U/D _____ VA ± _____

Shift _____ Dir _____ L/R _____ +/- _____ U/D _____

Troops with overhead cover

TGT ALT 375
OT DIR 600

∢ Si÷10 | 10m Si

FIRE ORDER CHG Computer, (3) rounds i/c | Df Corr

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	TGT Easting	60600,ENTER,TGT_E	60600	
2	TGT Northing	37700,ENTER,TGT_N	37700	
3	TGT Altitude	375,ENTER,TGT_A	375	
4	Azimuth/ Range	A	6348 5067	Azimuth flashed Range displayed
5	Charge Selection	C	4 3 3 3 2	M101A1/M102 M114A1 M109/M114A2 M109A1 M110A2
	Note. Fire Computer's Charge			Fire computer's charge
6	Compute firing data	D/ADVANCE	2812/523 3210/435 2412/442 2411 429 3211 429 3212/421 3210/401	M101A1 DF QE M102 DF QE M114A1 DF QE M114A2 DF QE M109 DF QE M109A1 DF QE M110A2 DF QE
7	Enter OT DIR	600,ENTER,OT DIR	600	
8	Determine ∢ T	ENTER,∢ T	652	ANNOUNCE to observer

SUBSEQUENT CORRECTIONS

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
9	LEFT 180	180,ENTER,DEV	180	
10	ADD 400	400,ENTER,RG	400	
11	COMPUTE	D/ADVANCE	2797/626	M101A1 DF/QE
			3195/497	M102 DF/QE
			2397/505	M114A1 DF/QE
			2395/487	M114A2 DF/QE
			3195/487	M109 DF/QE
			3197/477	M109A1 DF/QE
			3194/451	M110A2 DF/QE
12	DROP 200	200,R/DN/DP,ENTER,RG	-200	
13	COMPUTE	D/ADVANCE	2818/582	M101A1 DF/QE
			3216/472	M102 DF/QE
			2418/480	M114A1 DF/QE
			2417/464	M114A2 DF/QE
			3217/464	M109 DF/QE
			3218/455	M109A1 DF/QE
			3216/432	M110A2 DF/QE
14	ADD 100	100,ENTER, RG	100	
15	COMPUTE	D/ADVANCE	2807/602	M101A1 DF/QE
			3205/484	M102 DF/QE
			2407/492	M114A1 DF/QE
			2406/475	M114A2 DF/QE
			3206/475	M109 DF/QE
			3207/466	M109A1 DF/QE
			3205/441	M110A2 DF/QE
16	RIGHT 50	50,R/DN/DP,ENTER,DEV	-50	
17	DROP 50 FFE	50,R/DN/DP,ENTER,RG	-50	
18	COMPUTE	D/ADVANCE	2805/584	M101A1 DF/QE
			3203/473	M102 DF/QE
			2405/482	M114A1 DF/QE
			2404/465	M114A2 DF/QE
			3204/465	M109 DF/QE
			3205/456	M109A1 DF/QE
			3203/433	M110A2 DF/QE
19	END OF MISSION	E	0	

ADJUST FIRE MISSION POLAR

RECORD OF FIRE

CALL FOR FIRE

Observer H30 (AF) FFE/IS/S _____ Tgt _____

Grid: _____

(Polar) Dir 6400 Dis 3000 U/D 20 VA ± _____

Shift _____ Dir _____ L/R _____ +/- _____ U/D _____

Troops in open ICM i/e

H30 Location:
62213 34190 ALT 404

+Si÷10 | 10m Si

FIRE ORDER CHG 4, (M110A2: CHG 3) (3) TI i/e | Df Corr

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	OBS Easting	62213, ENTER, TGT_E	62213	
2	OBS Northing	34190,ENTER,TGT_N	34190	
3	OBS Altitude	404,ENTER,TGT_A	404	
4	DIR 6400	6400,ENTER,OT DIR	6400	
5	DIST 3000	3000,ENTER,RG	3000	
6	DOWN 20	20,R/DP/DN,ENTER, UP/DN	-20	
7	POLAR PLOT	B	295	Azimuth flashed
			4747	Range displayed
8	CHG Selection	C	4	M101A1
			3	M102
			3	M114A1
			3	M114A2
			3	M109
			2	M109A1
			2	M110A2
9	Change CHG	CLR,4,ADVANCE	4	All except M110A2
		(M110A2) CLR,3, ADVANCE	3	M110A2
10	COMPUTE	D/ADVANCE	2463/469	M101A1 DF/QE
			2863/397	M102 DF/QE
			2062/292	M114A1 DF/QE
			2061/288	M114A2 DF/QE
			2861/288	M109 DF/QE
			2861/283	M109A1 DF/QE
			2860/292	M110A2 DF/QE
11	COMPUTE ∢ T	ENTER, ∢ T	295	
12	ADD 400	400,ENTER,RG	400	
13	COMPUTE DATA	D/ADVANCE	2488/538	M101A1 DF/QE
			2886/445	M102 DF/QE
			2085/321	M114A1 DF/QE
			2084/316	M114A2 DF/QE
			2884/316	M109 DF/QE
			2884/311	M109A1 DF/QE
			2883/321	M110A2 DF/QE
14	RIGHT 50	50,R/DN/DP,ENTER,DEV	-50	
15	DROP 100	100,R/DN/DP,ENTER,RG	-100	
16	COMPUTE DATA	D/ADVANCE	2472/521	M101A1 DF/QE
			2871/434	M102 DF/QE
			2070/315	M114A1 DF/QE
			2069/310	M114A2 DF/QE
			2869/310	M109 DF/QE
			2869/305	M109A1 DF/QE
			2868/314	M110A2 DF/QE
17	FZ TI	2ND, C		Override FZ TI
18	LEFT 30	30,ENTER,DEV	30	
19	DROP 50	50,R/DN/DP,ENTER,RG	-50	
20	COMPUTE	D/ADVANCE/ADVANCE	24.3/2475/515	M101A1 TI/DF/QE
			21.8/2874/431	M102 TI/DF/QE
			18.2/2073/314	M114A1 TI/DF/QE
			18.0/2072/310	M114A2 TI/DF/QE
			18.0/2872/310	M109 TI/DF/QE
			17.8/2872/304	M109A1 TI/DF/QE
			17.9/2871/314	M110A2 TI/DF/QE

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
21	Manually determine Δ FS corresponding to fuze setting fired (use TFT/GFT)			M101A1 Δ FS = .09 M102 Δ FS = .10 M114A1 Δ FS = .12 M114A2 Δ FS = .12 M109 Δ FS = .12 M109A1 Δ FS = .12 M110A2 Δ FS = .11
22	DOWN 20 FFE Manually Compute HOB Correction Note. Deflection and Ouadrant do not change.			Δ FS Computations M101A1: .09 X 2.0 = .18 M102: .10 X 2.0 = .20 M114A1/M114A2/M109/ M109A1: .12 X 2.0 = .24 M110A2: .11 X 2.0 = .22 FFE Fuze Settings M101A1 24.5 M102 22.0 M114A1 18.4 M114A2/M109 18.2 M109A1 18.0 M110A2 18.1
23	END OF MISSION	E	0	

ADJUST FIRE MISSION SHIFT FROM A KNOWN POINT

RECORD OF FIRE

CALL FOR FIRE

Observer M69 (AF) FFE/IS/S _____ Tgt _____

Grid: _____

Polar: Dir _____ Dis _____ U/D _____ VA ± _____

(Shift) REG PT 1 : Dir 660 L/(R) 300 +/(−) 400 U/D _____

Company digging in ICM i/e

REG PT 1 Location
60553 37465, ALT 385
STORE AS TGT #1

→ Si÷10 | 10↑ Si

FIRE ORDER CHG4 (M110A2, CHG 3), (2) VT i/e (M514 SERIES) | Df Corr

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	REG PT Easting	60553,ENTER,TGT_E	60553	
2	REG PT Northing	37465,ENTER,TGT_N	37465	
3	REG PT Altitude	385,ENTER,TGT_A	385	
4	STORE AS TGT #1	1,ENTER,TGT STO,	0	
5	OT DIR	660,ENTER,OT DIR	660	
6	RIGHT 300	300,R/DN/DP,ENTER,DEV	-300	
7	DROP 400	400,R/DN/DP,ENTER,RG	-400	
8	PLOT TARGET	B	6328 4336	Azimuth flashed Range displayed
9	CHG Selection	C	3 2 2 2 2	M101A1/M102 M114A1 M109/M114A2 M109A1 M110A2
10	Change CHG	CLR,4,ADVANCE (110A2) CLR,3,ADVANCE	4 3	

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
11	COMPUTE	D/ADVANCE	2829/408	M101A1 DF/OE
			3228/351	M102 DF/OE
			2428/262	M114A1 DF/OE
			2427/259	M114A2 DF/OE
			3227/259	M109 DF/OE
			3227/255	M109A1 DF/OE
			3227/264	M110A2 DF/OE
12	COMPUTE ✈ T	ENTER, ✈ T	732	ANNOUNCE to observer
13	LEFT 30	30,ENTER,DEV	30	
14	ADD 400	400,ENTER,RG	400	
15	COMPUTE	D/ADVANCE	2778/456	M101A1 DF/OE
			3177/387	M102 DF/OE
			2376/286	M114A1 DF/OE
			2375/282	M114A2 DF/OE
			3175/282	M109 DF/OE
			3175/277	M109A1 DF/OE
			3174/286	M110A1 DF/OE
16	DROP 200	200,R/DN/DP,ENTER,RG	-200	
17	COMPUTE	D/ADVANCE	2805/432	M101A1 DF/OE
			3204/370	M102 DF/OE
			2404/274	M114A1 DF/OE
			2403/271	M114A2 DF/OE
			3203/271	M109 DF/OE
			3203/266	M109A1 DF/OE
			3202/275	M110A2 DF/OE
18	ADD 100	100 ENTER,RG	100	
19	COMPUTE	D/ADVANCE	2791/444	M101A1 DF/OE
			3190/378	M102 DF/OE
			2390/280	M114A1 DF/OE
			2389/276	M114A2 DF/OE
			3189/276	M109 DF/OE
			3189/272	M109A1 DF/OE
			3188/281	M110A1 DF/OE
20	DROP 50 FFE	50,R/DN/DP,ENTER,RG	-50	
21	Override FZ VT	2ND,D	-50	
22	COMPUTE	D/ADVANCE/ADVANCE	21.0/2798/442	M101A1 TI/DF/OE
			19.0/3197/378	M102 TI/DF/OE
			16.0/2397/282	M114A1 TI/DF/OE
			16.0/2396/278	M114A2 TI/DF/OE
			16.0/3196/278	M109 TI/DF/OE
			15.0/3196/273	M109A1 TI/DF/OE
			16.0/3195/283	M110A2 TI/DF/OE
23	END OF MISSION	E	0	

HIGH BURST REGISTRATION

RECORD OF FIRE

CALL FOR FIRE

Observer _____ AF/FFE/IS/S _____ Tgt _____

Grid: _____

Polar: Dir _____ Dis _____ U/D _____ VA ± _____

Shift _____ Dir _____ L/R _____ +/- _____ U/D ___

	GRID	ALT
01	59748 33872	370
02	62213 34190	391

→ Si÷10 | 10m Si

FIRE ORDER HB REG,GRID 6237,ALT 373,HOB +30,CHG 5(M101A1/M102) FZ TI, AMC | Df Corr

CHG 4(155 Calibers)
CHG 3(M110A2)

DETERMINE FIRING DATA

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Recall registration charge constants	2ND,PGM,06	101.06	M101A1
		2ND,PGM,10	102.1	M102
		2ND,PGM,05	107.05	All 155 calibers
		2ND,PGM,05	106.05	M110A2
2	Recall gunnery program	2ND,PGM,02		Previous display
3	Orienting PT Easting	62000,ENTER,TGT_E	62000	
4	Orienting PT Northing	37000,ENTER,TGT_N	37000	
5	Orienting PT Altitude	403,ENTER,TGT_A	403	373 +30 HOB = 403
6	Determine AZ and RG	A	261	Azimuth
			4507	Range
7	CHG Selection	C	4	M101A1
			4	M102
			2	M114A1
			2	M109/M114A2
			2	M109A1
			2	M110A1
8	Change Charge to registering Charge	CLR,5,ADVANCE	5	M101A1/M102
		CLR,4,ADVANCE	4	All 155 calibers
		CLR,3,ADVANCE	3	M110A2
9	Override FZ TI NO 20/R	2ND,A		Previous display
10	Compute Firing Data	D/ADVANCE/ ADVANCE	17.2/2494/310	M101A1 TI/DF/QE
			16.1/2893/272	M102 TI/DF/QE
			16.1/2095/278	M114A1 TI/DF/QE
			15.9/2094/275	M114A2 TI/DF/QE
			15.9/2894/275	M109 TI/DF/QE
			15.8/2894/270	M109A1 TI/DF/QE
			15.9/2894/279	M110A2 TI/DF/QE

ORIENT OBSERVERS (USE HB/MPI OVERLAY AND CUE CARD)

HIGH BURST (MEAN POINT OF IMPACT) REGISTRATION
For use of this form, see FM 6-40; the proponent agency is US Army Training and Doctrine Command.

COMPUTATION OF HB (MPI) LOCATION

Message to Observers	Dis 01 → 02	Az 01 → 02	
OBSERVE HB REG 01 DIR ____, VA ____ Measure the VA 02 DIR ____, VA ____ Report when ready to observe		±	3200

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
11	Recall HB/MPI program	2ND,PGM,04	(disregard display)	Use HB/MPI template and cue card
12	Set up Routine	2ND,E	0	
13	01 Easting	59748,ENTER,01_E	59748	
14	01 Northing	33872,ENTER,01_N	33872	
15	01 Altitude	370,ENTER,01_A	370	
16	02 Easting	62213,ENTER,02_E	62213	
17	02 Northing	34190,ENTER,02_N	34190	
18	02 Altitude	391,ENTER,02_A	391	
19	Determine 01 DIR to OP	A	636	
20	Determine 01 VA to OP	ADVANCE	9	
21	Determine 02 DIR to OP	ADVANCE	6323	
22	Determine 02 VA to OP	ADVANCE	4	
23	Send MTO and FIRE THE HIGH BURST			

Message to Observers

OBSERVE HB REG
01 DIR 636, VA +9
MEASURE THE VA
02 DIR 6323, VA +4

REPORT WHEN READY TO OBSERVER

24 Record Observers Directions and Vertical Angles on DA Form 4201

Observer Readings			
Rd No	01 Az	VA	02 Az
1	625	+13	6381
2	627	+13	6380
3	624	+11	6382
4	623	+11	6380
5	626	+12	6379
6	650	+11	6350
7			
8			

25	Set up Mean Burst Location routine	B	0	
26	Input OBS measured direction and VA (as received)	625,ADVANCE	1	Display identifies the next input data register: 0 = 01 DIR 1 = 01 VA 2 = 02 DIR
		13,ADVANCE	2	
		6381,ADVANCE	0	
		627,ADVANCE	1	
		13,ADVANCE	2	
		6380,ADVANCE	0	
		624,ADVANCE	1	
		11,ADVANCE	2	
		6382,ADVANCE	0	
		623,ADVANCE	1	
		11,ADVANCE	2	
		6380,ADVANCE	0	
		626,ADVANCE	1	
		12,ADVANCE	2	
		6379,ADVANCE	0	
		650,ADVANCE	1	
		11,ADVANCE	2	
		6350,ADVANCE	0	

STEP		
27	FDO inspected observer readings for unusable rounds and throw out #6.	

Observer Readings			
Rd No	O1 Az	VA	O2 Az
1	625	13	6381
2	627	13	6380
3	624	11	6382
4	623	11	6380
5	626	12	6379
~~6~~	~~650~~	~~11~~	~~6350~~

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
28	FDO inspected the readings and eliminated #6 from the average by entering negative values.	650,+/-,ADVANCE 11,+/-,ADVANCE 6350,+/-,ADVANCE	1 2 0	Subtract the unusable rounds
29	Round #7 was fired and VA reported and entered.	625,ADVANCE 11,ADVANCE 6378,ADVANCE	1 2 0	
30	To determine mean burst location input # of usable rounds.	6,C ADVANCE ADVANCE	62152 37286 419	Easting Northing Altitude — Record

7	625	11	6378

Location of HB (MPI)	E		N		H	
COMPUTATION OF GFT SETTING						
Alt HB (MPI)		QE fired		Chart data to HB (MPI) location Deflection ____ ø Range ____ M GFT "____" Charge ____ Lot ____ Range ____ Elevation ____ Time ____		Df corr
−Alt Btry		− Site VI/HB (MPI) Rg				
VI	+ −	Adj Elev				

COMPUTATION OF GFT SETTING (USE GUNNERY OVERLAY/CUE CARD)

31	Recall constants for registering charge	2ND,PGM,06,A 2ND,PGM,10,A 2ND,PGM,05,A	101.06 102.1 107.05 107.05 106.05	M101A1 M102 M109/M109A1 M114A1/M114A2 M110A2
32	Recall gunnery program	2ND,PGM,02		
	Compute Azimuth, Chart Range to MBL	A	277 4820	Azimuth flashed CHT RG displayed (Record on DA Form 4201)

Location of HB (MPI)	E	62	152	N	37	286	H	419
COMPUTATION OF GFT SETTING								
Alt HB (MPI)	419	QE fired		Chart data to HB (MPI) location Deflection ____ ø Range 4820 M GFT "4820" Charge ____ Lot ____ Range ____ Elevation ____ Time ____			Df corr	
−Alt Btry	352	− Site VI/HB (MPI) Rg						
VI	± 67	Adj Elev						

DA FORM 1 JAN 74 4201 REPLACES DA FORM 6-55 1 NOV 67 WHICH IS OBSOLETE

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
33	Compute Chart Deflection to MBL (Ignore Fuze Setting)	D/ADVANCE	2479	M101A1 CHT DF & DRIFT
			2878	M102 CHT DF & DRIFT
			2080	M114A1 CHT DF & DRIFT
			2079	M114A2 CHT DF & DRIFT
			2879	M109 CHT DF & DRIFT
			2879	M109A1 CHT DF & DRIFT
			2878	M110A2 CHT DF & DRIFT
34	Complete lower portion of DA Form 4201			
35	Set Display Format	TGT_E, 2ND, $BTRY_N$		Will not change display from step 33.

M101A1

STEP 1 Compute Elevation plus CAS: ANGLE OF SITE: 67, ÷ 4.820 = 13.89176861 ≈ +14

COMPUTATION OF GFT SETTING					
Alt HB (MPI)	419	QE fired	310	Chart data to HB (MPI) location Deflection 2474 ᵐ Range 4820 M	Df corr L20
−Alt Btry	352	− Site VI/HB (MPI) Rg	+14	GFT ° Charge 5 Lot XX	L5
VI	± 67	Adj Elev + CAS	296	Range 4823 Elevation 296 Time 17.2	L15

TOTAL DRIFT GFT

2 Compute Chart Deflection by subtracting DRIFT ~ to ELEVATION + CAS

The deflection computed in step 33.

DEFLECTION 2479
-DRIFT L5
CHART DEFLECTION 2474

CHART → ADJ = TOTAL DF CORR
2474 → 2494 = L20

3 Construct the GFT setting. Determine Corrected Range and Time ~ to EL + CAS:

4472
|
CHART RG 4820, EL + CAS 296 TIME 17.2
GFT DF CORR L15 |
17.1

4 Determine and Enter Residuals:

RANGE K	4472 ÷, 4820, =	.9272237197
	ENTER, RG K	.9272237197
GFT DF CORR	15, ENTER, DF CORR 15	
FUZE K	17.2, ÷, 17.1, =	1.005847953
	ENTER, FZ K	1.005847953
5 Apply to CHG 5	5, ENTER, RES/CHG	.93
		15
		1.01
		1
END OF MISSION	E	0

M102

STEP

1 Compute Elevation plus CAS. ANGLE OF SITE: $67 \div 4.820 = 13.89176861 \approx +14$

COMPUTATION OF GFT SETTING					
Alt HB (MPI)	419	QE fired	272	Chart data to HB (MPI) location Deflection 2874 M Range 4820 M	Df corr L19
−Alt Btry	352	Site VI/HB (MPI) Rg	+14	GFT ° 0 ' Charge 5 Lot XX Range 4820 Elevation 258 Time 16.1	L4
VI	+ −67	Adj Elev +CAS	258		L15

TOTAL DRIFT GFT

2 Compute Chart Deflection by subtracting Drift ~ to EL + CAS from the deflection computed in step 33.

DEFLECTION	2878
DRIFT	L4
CHART DEFLECTION	2874

CHART → ADJ = TOT DF CORR
2874 → 2893 = L19

3 Construct the GFT setting and determine Corrected Range and Time ~ to EL + CAS.

CHART RG 4820, EL + CAS 4465 / 258 TIME 16.1 / 15.9

GFT DF CORR: L15

4 Determine and Enter Residuals:

RANGE K	4465, ÷, 4820, =	.9263485477
	ENTER, RG K	.9263485477
GFT DF CORR	15, ENTER, DF CORR	15
FUZE K	16.1, ÷, 15.9, =	1.012578616
	ENTER, FZ K	1.012578616
5 Apply to CHG 5	5, ENTER, RES/CHG	.93 15 1.01 1
6 END OF MISSION	E	0

M114A1

STEP

1 Compute Elevation plus CAS. ANGLE OR SITE: 67, ÷, 4.820 - 13.89176861 ≈ +14

COMPUTATION OF GFT SETTING					
Alt HB (MPI)	419	QE fired	278	Chart data to HB (MPI) location Deflection 2074 Range 4820 M	Df corr L21
−Alt Btry	352	± Site VI/HB (MPI) Rg	+14	GFT 0 Charge 4 Lot XX Range 4820 Elevation 264 Time 16.1	L6
VI	± 67	Adj Elev ± CAS	264		L15

TOTAL DRIFT GFT

2 Compute Chart Deflection by subtracting DRIFT ~ to ELEVATION + CAS from the deflection computed in step 33.

DEFLECTION 2080
- DRIFT L6
CHART DEFLECTION 2074

CHART → ADJ = TOTAL DF CORR
2074 → 2095 = L21

3 Construct the GFT setting and determine Corrected Range and Time ~ to EL + CAS.

CHART RG 4820, EL + CAS — 4464 / 264 / 16.0 — TIME 16.1

GFT DF CORR L15

4 Determine and Enter Residuals:

RANGE K	4464, ÷, 4820, =	.925565001
	ENTER, RG K	.925565001
GFT DF CORR	15, ENTER DF CORR	15
FUZE K	16.1, ÷, 16.0	1.00625
	ENTER, FZ K	1.00625
5 Apply to CHG 4	4, ENTER, RES/CHG	.93
		15
		1.01
		1
6 END OF MISSION	E	0

M114A2/M109 SYSTEM

STEP

1 Compute Elevation plus CAS: ANGLE OF SITE: 67, ÷, 4.820 = 13.89176861 ≈ +14.

COMPUTATION OF GFT SETTING					
Alt HB (MPI)	419	QE fired	275	Chart data to HB (MPI) location Deflection 2074 mil Range 4820 M	Df corr L20
−Alt Btry	352	* Site VI/HB (MPI) Rg	+14	GFT "_____" Charge 4 Lot XX Range 4820 Elevation 261 Time 15.9	L5
VI	± 67	Adj Elev CAS	261		L15

TOTAL DRIFT GFT

2 Compute Chart Deflection by subtracting Drift ~ to Elevation + CAS from the deflection computed in step 33:

M114A2		M109	
DEFLECTION	2079	DEFLECTION	2879
- DRIFT	L5	- DRIFT	L5
CHART DEFLECTION	2074	CHART DEFLECTION	2874

CHART → ADJ = TOT DF CORR
2074 → 2094 = L20

CHART → ADJ = TOT DF CORR
2874 → 2894 = L20

3 Construct the GFT setting and determine Corrected Range and Time ~ to EL + CAS.

4474
|
CHT RG 4820, EL + CAS 261, TIME 15.9
|
GFT DF CORR L15
|
15.8

4 Determine and Enter Residuals:

RANGE K	4474, ÷, 4823, =	.9276383993
	ENTER, RG K	.9276383993
GFT DF CORR	15, ENTER, DF CORR	15
FUZE K	15.9, ÷, 15.8 =	1.006329114
	ENTER, FZ K	1.006329114
5 Apply to CHG 4	4, ENTER, RES/CHG	.93
		15
		1.01
		1
6 END OF MISSION	E	0

M109A1

STEP

1 Compute Elevation plus CAS: ANGLE OF SITE: 67, ÷, 4.820 = 13.89176861 ≈ + 14

COMPUTATION OF GFT SETTING					
Alt HB (MPI)	419	QE fired	270	Chart data to HB (MPI) location Deflection 2874 ds Range 4820 M	Df corr L20
−Alt Stry	352	Site VI/HB (MPI) Rg	14	GFT " " Charge 4GB Lot XY	
VI	± 67	Adj Elev +CAS	256	Range 4820 Elevation 256 Time 15.8	L5 L15

TOTAL DRIFT GFT

2 Compute Chart Deflection by subtracting DRIFT ~ to ELEVATION + CAS from the deflection computed in step 33.

	DEFLECTION	2879
	- DRIFT	L5
CHART	DEFLECTION	2874

CHART → ADJ = TOTAL DF CORR
2874 → 2894 = L20

3 Construct the GFT setting. Determine Corrected Range and Time ~ to EL + CAS:

4462
|
CHART RG 4820, EL + CAS 256 TIME 15.8
|
GFT DF CORR L15 15.6

4 Determine and Enter Residuals:

RANGE K	4462, ÷, 4823, =	.9251503214
	ENTER, RG K	.9251503214
GFT DF CORR	15, ENTER, DF CORR	15
FUZE K	15.8, ÷ 15.6, =	1.012820513
	ENTER, FZ K	1.012820513

5 Apply to CHG 4 4

.93
15
1.01
1

6 END OF MISSION E

0

M110A2

STEP

1 Compute Elevation plus CAS: ANGLE OF SITE: 67, ÷, 4.820 = 13.89176861 ≈ + 14

COMPUTATION OF GFT SETTING					
Alt HB (MPI)	419	QE fired	279	Chart data to HB (MPI) location Deflection 2874 mil Range 4820 M	Df corr L21
−Alt Btry	352	Site VI/HB (MPI) Rg	14	GFT " " Charge 3 Lot XM Range 4820 Elevation 265 Time 15.9	L5
VI	± 67	Adj Elev + CAS	265		L16

TOTAL DRIFT GFT

2 Compute Chart Deflection by subtracting DRIFT ~ to ELEVATION + CAS from the deflection computed in step 33.

DEFLECTION	2878
- DRIFT	L5
CHART DEFLECTION	2873

CHART → ADJ = TOTAL DF CORR
2873 → 2894 = L21

3 Construct the GFT setting. Determine Corrected Range and Time ~ to EL + CAS:

4459
|
CHART RG 4820, EL + CAS 265 TIME 15.9
|
GFT DF CORR L16 15.7

4 Determine and Enter Residuals:

RANGE K	4459, ÷, 4820, =	.9245283019
	ENTER, RG K	.9245283019
GFT DF CORR	16, ENTER, DF CORR	16
FUZE K	15.9, ÷, 15.7, =	1.012738854
	ENTER, RG K	1.012738854

5 Apply to CHG 3 — 3, ENTER, RES/CHG

.92
16
1.01
1

6 END OF MISSION — E — 0

FIRE FOR EFFECT FZ VT

RECORD OF FIRE

CALL FOR FIRE

Observer T30 AF (FFE) IS/S _____ Tgt _____

Grid: _____

(Polar) Dir 6400 Dis 3400 U/D _____ VA (-) 10

Shift _____ Dir _____ L/R _____ +/- _____ U/D _____

BMP WITH INFANTRY DPICM

T30 LOCATION 62213 34190 ALT 404

RESIDUALS FROM HB/MPI REGISTRATION ARE APPLIED

∠ Si÷10 | 10 m Si

FIRE ORDER FFE, CHG 5 (M101A1/M102), FZ VT (M732) (3)
CHG 4 (155 calibers)
CHG 3 (M110A2)

Df Corr

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Observer Easting	62213,ENTER,TGT_E	62213	
2	Observer Northing	34190,ENTER,TGT_N	34190	
3	Observer Altitude	404,ENTER,TGT_A	404	
4	Direction 6400	6400,ENTER,OT DIR	6400	
5	Distance 3400	3400,ENTER,RG	3400	
6	Vertical Angle -10	10,R/DN/DP,ENTER,VA	-33	Displays Vertical Interval
7	Polar Plot Target	B	272	Azimuth
			5132	Range
8	Charge Selection	C	4	M101A1
			4	M102
			3	M114A1/M114A2
			3	M109/M109A1
			2	M110A2
9	Override Charge	CLR,5,ADVANCE	5	M101A1/M102
		CLR,4,ADVANCE	4	All 155 Systems
		CLR,3,ADVANCE	3	M110A2
10	Override Fuze VT	2ND,E		Previous Display
11	Compute FFE Firing Data	D/ADVANCE/ADVANCE	18.0/2498/325	M101A1 TI/DF/OE
			17.0/2898/283	M102 TI/DF/OE
			17.0/2099/289	M114A1 TI/DF/OE
			17.0/2099/285	M114A2 TI/DF/OE
			17.0/2899/285	M109 TI/DF/OE
			16.0/2899/280	M109A1 TI/DF/OE
			17.0/2899/289	M110A2 TI/DF/OE
12	Compute ∠ T	ENTER, ∠ T	272	
13	END OF MISSION	E	0	

HIGH ANGLE, FFE

RECORD OF FIRE

CALL FOR FIRE

Observer N27 AF (FFE) IS/S _____ Tgt _____

Grid: REG PT 1

Polar: Dir _____ Dis _____ U/D _____ VA ± _____

Shift _____ : Dir _____ L/R _____ +/- _____ U/D _____

TROOPS IN TRENCHES, VT

REG PT 1
60553 37465, ALT 385

÷Si÷10 | 10m Si

FIRE ORDER FFE, HIGH ANGLE, (COMPUTER'S CHG) FZ (M514) VT 2 | Df Corr

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Recall PGM constants for Shell HE, High Angle	2ND,PGM,07,A	101.07	M101A1
		(M102) 2ND,PGM,11,A	102.11	M102
		(M110A2) 2ND,PGM,08,A	107.07	M114A1
			107.07	M114A2/M109
			107.07	M109A1
			106.08	M110A2
2	Clear Display	CLR	0	
3	Recall Gunnery Program	2ND,PGM,02	0	
4	Override High Angle	2ND,B	0	
5	Override Fuze VT	2ND,D	0	
6	Recall Registration PT 1 (previously stored as TGT #1)	1,ENTER,TGT RCL	0	
7	Compute AZ & RG	A	6336	AZ Flashed
			4835	RG Displayed
8	Charge Selection	C	4	M101A1
			3	M102
	(Fire Computer's Charge)		3	M114A1
			3	M114A2
			3	M109
			3	M109A1
			2	M110A2
9	Compute Firing Data	D /ADVANCE/ADVANCE	43.0/2851/1076	M101A1 TI/DF/QE
			39.0/3250/975	M102 TI/DF/QE
			48.0/2464/1159	M114A1 TI/DF/QE
			48.0/2479/1160	M114A2 TI/DF/QE
			48.0/3279/1160	M109 TI/DF/QE
			48.0/3289/1164	M109A1 TI/DF/QE
			50.0/3284/1191	M110A2 TI/DF/QE
10	OT DIR 1100	1100,ENTER,OT DIR	1100	
11	Determine Angle T	ENTER, ∡ T	1164	
12	RIGHT 50	50,R/DN/DP,ENTER, DEV	-50	
13	ADD 200, REPEAT	200,ENTER,RG	200	
14	Compute Firing Data	D /ADVANCE/ADVANCE	43.0/2808/1069	M101A1 TI/DF/QE
			39.0/3207/964	M102 TI/DF/QE
			48.0/2421/1153	M114A1 TI/DF/QE
			48.0/2435/1155	M114A2 TI/DF/QE
			48.0/3235/1155	M109 TI/DF/QE
			48.0/3245/1160	M109A1 TI/DF/QE
			50.0/3240/1187	M110A2 TI/DF/QE
15	END OF MISSION	E	0	

PRECISION REGISTRATION

RECORD OF FIRE

CALL FOR FIRE

Observer _____ AF/FFE/IS/S _____ Tgt _____

Grid: _____

Polar: Dir _____ Dis _____ U/D _____ VA ± _____

Shift DIRECTION 6210 : Dir _____ L/R _____ +/- _____ U/D _____

REG PT 2 LOCATION
64651 39695 ALT 420

∠ Si ÷ 10 | 10 m Si

FIRE ORDER PREC REG ON REG PT 2, LOT XW, CHG 6 (M110A2, CHG 5WB), Q +TI | Df Corr

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Send Message to Observer			Observer reports DIR 6210
2	Recall Constants for Registering Charge	2ND,PGM,06,A (M102) 2ND,PGM,10,A	101.06 102.10 107.06 107.06 106.06	M101A1 M102 M114A1/M114A2 M109/M109A1 M110A2
3	Recall Gunnery Program	2ND,PGM,02		(Previous Display)
4	REG PT Easting	64651,ENTER,TGT_E	64651	
5	REG PT Northing	39695,ENTER,TGT_N	39695	
6	REG PT Altitude	420,ENTER,TGT_A	420	
7	Store As TGT 2	2,ENTER,TGT STO	0	
8	Compute Azimuth and Range	A	502 8010	Azimuth Range
9	Charge Selection	C	6 6 5 5 5 5	M101A1 M102 M114A1 M109/M114A2 M109A1 M110A2
10	Override Charge	CLR 6,ADVANCE (M110A2) CLR,5, ADVANCE	6 5	
11	Compute Initial Firing Data	D/ADVANCE	2257/522 2657/475 1855/335 1857/338 2657/338 2657/320 2655/335	M101A1 DF/QE M102 DF/QE M114A1 DF/QE M114A2 DF/QE M109 DF/QE M109A1 DF/QE M110A2 DF/QE
12	Manually determine chart deflection: Deflection Fired - Drift ~ to Elevation (QE - ∠ Site = Elevation) = Chart Deflection Compute ∠ of Site: REG PT ALT 420 − BTRY ALT 352 Vertical Interval 68 ÷ 8.010 = ∠ of Site (8)			
13	Enter OT DIR	6210,ENTER,OT DIR	6210	
14	Compute T	ENTER, ∠ T	692	
SUBSEQUENT CORRECTIONS				
15	LEFT 40	40,ENTER,DEV	40	
16	ADD 200	200,ENTER,RG	200	

SUBSEQUENT CORRECTIONS (cont'd)

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
17	Compute Firing Data	D/ADVANCE	2277/539	M101A1 DF/QE
			2677/488	M102 DF/QE
			1875/343	M114A1 DF/QE
			2676/346	M109 DF/QE
			1876/346	M114A2 DF/QE
			2677/327	M109A1 DF/QE
			2675/342	M110A2 DF/QE
18	-100	100,R/DN/DP,ENTER,RG	-100	
19	Compute Firing Data	D/ADVANCE	2269/529	M101A1 DF/QE
			2669/480	M102 DF/QE
			1867/338	M114A1 DF/QE
			2668/341	M109 DF/QE
			1868/341	M114A2 DF/QE
			2669/323	M109A1 DF/QE
			2667/338	M110A2 DF/QE
20	ADD 50	50,ENTER,RG	50	
21	Compute Firing Data	D/ADVANCE	2273/534	M101A1 DF/QE
			2673/484	M102 DF/QE
			1871/341	M114A1 DF/QE
			2672/344	M109 DF/QE
			1872/344	M114A2 DF/QE
			2673/325	M109A1 DF/QE
			2671/340	M110A2 DF/QE
22	(2) +25	25,ENTER,RG	25	
23	Compute Firing Data	D/ADVANCE	2275/536	M101A1 DF/QE
			2675/486	M102 DF/QE
			1873/342	M114A1 DF/QE
			2674/345	M109 DF/QE
			1874/345	M114A2 DF/QE
			2675/326	M109A1 DF/QE
			2673/341	M110A2 DF/QE
24	(1) -25	25,R/DN/DP,ENTER,RG	-25	
25	Compute Firing Data	D/ADVANCE	2273/534	M101A1 DF/QE
			2673/484	M102 DF/QE
			1871/341	M114A1 DF/QE
			2672/344	M109 DF/QE
			1872/344	M114A2 DF/QE
			2673/325	M109A1 DF/QE
			2671/340	M110A2 DF/QE
26	R20 +10 Record as REG PT 2, Time Repeat	20/R/DN/DP,ENTER,DEV 10,ENTER,RG	-20 10	
27	Compute Adjusted DF & QE and Record	D/ADVANCE	2272/536	M101A1 ADJ DF/QE
			2672/486	M102 ADJ DF/QE
			1870/342	M114A1 ADJ DF/QE
			1871/345	M114A2 ADJ DF/QE
			2671/345	M109 ADJ DF/QE
			2672/326	M109A1 ADJ DF/QE
			2670/341	M110A2 ADJ DF/QE
28	Override Fuze Time	2ND, C		Previous Display

SUBSEQUENT CORRECTIONS (cont'd)

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
29	Compute Initial Time Firing Data	D/ADVANCE/ADVANCE	32.7/2272/539	M101A1 TI/DF/OE
			31.2/2672/489	M102 TI/DF/OE
			25.4/1870/344	M114A1 TI/DF/OE
			25.6/1871/347	M114A2 TI/DF/OE
			25.6/2671/347	M109 TI/DF/OE
			24.9/2672/329	M109A1 TI/DF/OE
			25.0/2670/344	M110A2 TI/DF/OE

30 Using the TFT/GFT determine ▲ FS corresponding to the initial fuze setting and apply subsequent HOB correction of UP40.

	FS		UP40		Fuze Setting Correction	Time Fired	Time to Fire
M101A1	0.07	X	4.0	=	.28 ≈ -0.3	32.7	32.4
M102	0.07	X	4.0	=	.28 ≈ -0.3	31.2	30.9
M114A1	0.08	X	4.0	=	.32 ≈ -0.3	25.4	25.1
M114A2	0.08	X	4.0	=	.32 ≈ -0.3	25.6	25.3
M109	0.08	X	4.0	=	.32 ≈ -0.3	25.6	25.3
M109A1	0.08	X	4.0	=	.32 ≈ -0.3	24.9	24.6
M110A2	0.08	X	4.0	=	.32 ≈ -0.3	25.0	24.7

31 ③ Repeat

32 U10 record as Time Registration Point 2. END OF MISSION

33 Determine Adjusted Time:

	FS		UP10		Fuze Setting Correction	Time Fired	Adjusted Time
M101A1	0.07	X	1.0	=	.07 ≈ -0.1	32.4	32.3
M102	0.07	X	1.0	=	.07 ≈ -0.1	30.9	30.8
M114A1	0.08	X	1.0	=	.08 ≈ -0.1	25.1	25.0
M114A2	0.08	X	1.0	=	.08 ≈ -0.1	25.3	25.2
M109	0.08	X	1.0	=	.08 ≈ -0.1	25.3	25.2
M109A1	0.08	X	1.0	=	.08 ≈ -0.1	24.6	24.5
M110A2	0.08	X	1.0	=	.08 ≈ -0.1	24.7	24.6

34 Determine GFT setting, compute and apply residuals for the registering charge.

M101A1

RG 8130

CHG 6, RG 8010, EL + CAS 528, TI 32.3

TI 32.8

CHT (2247) → ADJ (2272) = TOTAL (L25)
TOTAL (L25) - DRIFT (L10) = GFT (L15)

RG K: 8130 ÷ 8010 = 1.014981273
FZ K: 32.3 ÷ 32.8 = .9847560976

M114A1

RG 8130

CHG 6, RG 8010, EL + CAS 334, TI 25.0

25.4

CHT (1847) → ADJ (1870) = TOTAL (L23)
TOTAL (L23) - DRIFT (L8) = GFT (L15)

RG K: 8130 ÷ 8010 = 1.014981273
FZ K: 25.0 ÷ 25.4 = .9842519685

M102

RG 8130

CHG 6, LOT XY, RG 8010, EL + CAS 478, TI 30.8

31.2

CHT (2647) → ADJ (2672) = TOTAL (L25)
TOTAL (L25) - DRIFT (L10) = GFT (L15)

RG K: 8130 ÷ 8010 = 1.014981273
FZ K: 30.8 ÷ 31.2 = .9871794872

M109/M114A2

RG 8130

CHG 6, RG 8010, EL + CAS 337, TI 25.2

25.7

CHT (2648/1848) → ADJ (2671/1871) = TOTAL (L23)
TOTAL (L23) - DRIFT (L9) = GFT (L14)

RG K: 8130 ÷ 8010 = 1.014981273
FZ K: 25.2 ÷ 25.7 = .9805447471

M109A1

RG 8120

CHG 6, RG 8010, EL + CAS 318, TI 24.5

24.9

CHT (2647) → ADJ (2672) = TOTAL (L25)
TOTAL (L25) - DRIFT (L10) = GFT (L15)

RG K: 8120 ÷ 8010 = 1.013732834
FZ K: 24.5 ÷ 24.9 = .983935743

M110A2

RG 8130

CHG 5, RG 8010, EL + CAS 333, TI 24.6

TI 25.0

CHT (2647)→ADJ (2670) = TOTAL (L23)
TOTAL (L23) - DRIFT (L8) = GFT (L15)

RG K: 8130 ÷ 8010 = 1.014981273
FZ K: 24.6 ÷ 25.0 = 0.984

35 END OF MISSION E 0

SHELL WP FFE MISSION

Precision Registration Residuals Applied.

RECORD OF FIRE

CALL FOR FIRE

Observer M10 AF (FFE) IS/S _____ Tgt _____

Grid: 6324 4069

Polar: Dir _____ Dis _____ U/D _____ VA ± _____

Shift _____ : Dir _____ L/R _____ +/- _____ U/D _____

POL DUMP WP

(TGT ALT 316) M102 & M101A1

HE = 4 2

WP = 7 5

Si÷10 10m Si

FIRE ORDER FFE, SHELL WP, LOT RW, CHG 6 (M110A2, CHG 5WB), ③ Df Corr

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	TGT Easting	63240, ENTER, TGT_E	63240	Precision registration residuals are applied.
2	TGT Northing	40690, ENTER, TGT_N	40690	
3	TGT Altitude	316, ENTER, TGT_A	316	
4	Azimuth/Range	A	293	Azimuth flashed
			8395	Range displayed
5	Charge Selection	C	6	M101A1
			6	M102
			5	M114A1
			5	M109/M114A2
			5	M109A1
			5	M110A2
6	Override Charge	CLR, 6, ADVANCE (M110A2 Fire CHG 5)	6	155 calibers only

7 Manually compute WP weight correction:

ENTER Table F (TFT) with range to target.
EXTRACT Inc ⊡ correction factor.
MULTIPLY correction factor X difference in HE and WP ⊡ weights.

	INC 1 ⊡		⊡ Weight Difference		Range Correction
M101A1	1	X	3	=	3
M102	-9	X	3	=	-27
M114A1	13	X	3	=	39
M109/M114A2	13	X	3	=	39
M109A1	20	X	3	=	60
M110A2	23	X	3	=	69

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
8	ENTER Gun - Target Azimuth as OT Direction	293, ENTER, OT DIR	293	
9	Apply WP RG CORR	3, ENTER, RG	3	M101A1
		27, R/DN/DP, ENTER, RG	-27	M102
		39, ENTER, RG	39	M114A1
		39, ENTER, RG	39	M114A2/M109
		60, ENTER, RG	60	M109A1
		69, ENTER, RG	69	M110A2
10	Apply WP RG CORR	B	293/8398	M101A1
			293/8368	M102
			293/8434	M114A1
			293/8434	M114A2/M109
			293/8455	M109A1
			293/8464	M110A2

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
11	Compute WP FFE data	D/ADVANCE	2484/583	M101A1 DF/QE
			2883/515	M102 DF/QE
			2080/357	M114A1 DF/QE
			2881/360	M109 DF/QE
			2081/360	M114A2 DF/QE
			2882/340	M109A1 DF/QE
			2880/356	M110A2 DF/QE
12	END OF MISSION	E	0	

SHELL APICM (M444/M449/M404)

RECORD OF FIRE

CALL FOR FIRE

Observer L98 AF/(FFE)/IS/S _____ Tgt _____

Grid: _____

Polcr: Dir _____ Dis _____ U/D _____ VA ± _____

(Shift) REG PT 2 : Dir 1540 L (R) 160 (A) - 200 (U/D) 20

INFANTRY PLATOON IN OPEN ICM

Precision Registration
Residuals Applied
REG PT 2
64651 39695, ALT 420

÷Si÷10 | 10m Si

FIRE ORDER FFE, SHELL ICM, LOT TW, CHG 6, (M110A2,CHG 5WB)FZ TI, (3) | Df Corr

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Recall REG PT 2	2,ENTER,TGT RCL	0	
2	OT Direction	1540,ENTER,OT DIR	1540	
3	RIGHT 160	160,R/DN/DP,ENTER, DEV	-160	
4	ADD 200	200,ENTER,RG	200	
5	UP 20	20,ENTER,UP/DN	20	
6	Locate Target	B	535 7983	Azimuth flashed Range displayed
7	Charge Selection	C	6 6 5 5 5 5	M101A1 M102 M114A1 M109/M114A2 M109A1 M110A2
8	Override Charge	CLR,6,ADVANCE (M110A2 Fire CHG 5)	6	(155 calibers only)
9	Override FZ TI,NO 20/R	2ND,A		Previous Display
10	Compute HE Firing Data	D/ADVANCE/ADVANCE	32.1/2240/536 30.7/2640/487 24.9/1838/343 25.1/2638/346 25.1/1838/346 24.3/2640/327 24.5/2638/343	M101A1 TI/DF/OE M102 TI/DF/OE M114A1 TI/DF/OE M109 TI/DF/OE M114A2 TI/DF/OE M109A1 TI/DF/OE M110A2 TI/DF/OE

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS

11 Convert HE Data to ICM Data:

TFT METHOD

M101A1	Time (HE)	32.1		Quadrant (HE)	536	
	Table B	-0.5		Table A	37	
	Time to Fire	31.6	Deflection 2240	Quadrant to Fire	573	
M102	Time (HE)	30.7		Quadrant (HE)	487	
	Table B	-0.7		Table A	33	
	Time to Fire	30.0	Deflection 2640	Quadrant to Fire	520	
M114A1	Time (HE)	24.9		Quadrant (HE)	343	
	Table B	-1.1		Table A	32	
	Time to Fire	23.8	Deflection 1838	Quadrant to Fire	375	
M109/ M114A2	Time (HE)	25.1		Quadrant (HE)	346	
	Table B	-1.4		Table A	+25	
	Time to Fire	23.7	Deflection 2638/ 1838	Quadrant to Fire	371	
M109A1	Time (HE)	24.3		Quadrant (HE)	327	
	Table B	-1.2		Table A	30	
	Time to Fire	23.1	Deflection 2640	Quadrant to Fire	357	

M110A2 - M404 TFT addendum for the M110A2 is not available. The M110 weapon system firing table addendum A-1 is authorized for M110A2 (M404) COMBAT EMERGENCY FIRINGS ONLY. Table A and B corrections compensate for HE-ICM ballistic differences. Height of burst corrections must also be applied to compute the desired 600 meter HOB. The addendum corrections compute data for a 300 meter HOB. The additional 300 meter fuze and OE corrections are computed using the 50 meter change in height of burst correction factors from column 3 of tables A and B.

BALLISTIC CORRECTIONS

Fuze setting correction (Tbl B) -0.7
Quadrant correction (Tbl A) +28

HOB CORRECTION (+300)

Fuze setting correction (Tbl B, Col 3) +0.1 X 6 = +0.6
Quadrant correction (Tbl A, Col 3) +7.4 X 6 = +44

HE Time	24.5		HE Quadrant	343	
Ballistic Correction	-0.7		Ballistic Correction	+28	
HOB Correction	+0.6		HOB Correction	+44	
Time to Fire	24.4	Deflection 2601	Quadrant to Fire	415	

GFT METHOD - GFT's with ICM scales are available for all calibers. The GFT method is the preferred method. Paragraph 11-2, FM 6-40, outlines the manual solution using the GFT.

12 END OF MISSION E 0

M109A1 DPICM AF MISSION

GIVEN: M483A1 GFT Setting:

GFT B, CHG 4, LOT IY, RG $\frac{4370}{4240}$ EL + CAS $\frac{279}{16.5}$ TI 16.8

GFT DF CORR L4

RECORD OF FIRE

CALL FOR FIRE

Observer M64 (AF) FFE/IS/S _____ Tgt _____

Grid: 6124 3791

Polar: Dir _____ Dis _____ U/D _____ VA ± _____

Shift _____ : Dir _____ L/R _____ +/- _____ U/D _____

T-62 TANK INBOUNDING OVER WATCH, DPICM i/e

TGT ALT 301

± Si ÷ 10 | 10 m Si

FIRE ORDER SHELL DP-SR, LOT IY, CHG 4 (2) DPICM i/e | Df Corr

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Recall DPICM, PGM, Constants	2ND, PGM, 09, A	483.09	
2	Clear display	CLR	0	
3	Recall gunnery PGM	2ND, PGM, 02	0	

ENTER DPICM RESIDUALS

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
4	Fix Display Format	TGT_E, 2ND, $BTRY_N$	0	
5	Range K	4370, ÷, 4240, =	1.030660377	
		ENTER, RG K	1.030660377	
6	GFT DF CORR	4, ENTER, DF CORR	4	
7	Fuze K	16.8 ÷ 16.5, =	1.018181818	
		ENTER, FZ K	1.018181818	
8	Apply to CHG 4	4, ENTER, RES/CHG	1.03	Range K
			4.	GFT DF CORR
			1.02	Fuze K
			1	Displayed
9	TGT Easting	61240, ENTER, TGT_E	61240	
10	TGT Northing	37910, ENTER, TGT_N	37910	
11	TGT Altitude	301, ENTER, TGT_A	301	
12	Compute AZIMUTH and RG to TGT	A	74	Azimuth flashed
			5284	Range displayed
13	CHG Selection	C	3	Override CHG 4
		CLR, 4, ADVANCE	4	
14	Override FZ TI NO 20/R	2ND, A	4	
15	Compute Self Registering Mode Firing Data (S-R)	D/ADVANCE/ADVANCE	22.0/3087/364	TI/DF/QE
16	S-R Mode Fuze Setting is announced as Δ Time		98.0	

Subsequent Corrections: DIR 250, LEFT 200, DROP 400 FFE

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
17	OT DIR 250	250,ENTER,OT DIR	250	
18	LEFT 200	200,ENTER,DEV	200	
19	DROP 400, FFE	400,R/DN/DP,ENTER,RG	-400	
20	Compute S-R Mode Data	D/ADVANCE/ADVANCE	20.2/3141/329	TI/DF/QE

21 Convert S-R Mode Data to FFE DPICM firing data using TFT Addendum J-1 or the CHG 4 M483A1 GFT (Chap 11, FM 6-40).

Fuze Setting to Fire:	S-R Time	20.2
	ADD: Table B CORR	-1.2
	Time to Fire	19.0
Deflection to Fire:	3141 (S-R DF)	
Quadrant to Fire:	S-R QE	329
	Table A	+41
	QE to Fire	370

22	END OF MISSION	E	0

M114A2/M109 DPICM AF MISSION

GIVEN: GFT B, CHG 4GB, LOT IY, RG 4240, EL + CAS 4370 / 292 / 16.9 TI 16.6

GFT DF CORR R4

RECORD OF FIRE

Observer M64 CALL FOR FIRE (AF) FFE/IS/S _____ Tgt _____

Grid: 6124 3791

Polar: Dir _____ Dis _____ U/D _____ VA ± _____

Shift _____ : Dir _____ L/R _____ +/- _____ U/D _____

BRDM WITH INFANTRY, DPICM i/e

TGT ALT 301

÷Si÷10 | 10m Si

FIRE ORDER SHELL DP-SR LOT IY, CHG 4 (3), DPICM i/e

Df Corr

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Recall M483A1 Constants for CHG 4	2ND, PGM,09,A	483.09	
2	Clear Display	CLR	0	
3	Recall Gunnery PGM	2ND,PGM,02	0	

ENTER DPICM RESIDUALS

4	Fix Display Format	TGT_E,2ND,$BTRY_N$	0	
5	Range K	4370, ÷ ,4240, =	1.030660377	
		ENTER, RG K	1.030660377	
6	GFT DF CORR	4,R/DN/DP,ENTER DF CORR	-4	

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
7	Fuze K	16.6, ÷ ,16.9, = ENTER,FZ K	.9822485207 : .9822485207	
8	Apply to Registering CHG 4	4,ENTER,RES/CHG	1.03 -4. .98 1.	Range K GFT DF CORR Fuze K Displayed
9	TGT Easting	61240,ENTER,TGT_E	61240	
10	TGT Northing	37910,ENTER,TGT_N	37910	
11	TGT Altitude	301,ENTER,TGT_A	301	
12	Compute Azimuth and Range to TGT	A	74 5284	Azimuth flashed Range displayed
13	CHG Selection	C	3	Override CHG 4
14		CLR,4,ADVANCE	4	
14	Override FZ TI NO 20/R	2ND,A	4	
15	Compute S-R Mode Firing Data	D/ADVANCE/ADVANCE	21.9/2280/384 21.9/3080/384	M114A2 TI/DF/QE M109 TI/DF/QE
16	S-R Mode Fuze Setting is Announced as ▲ Time		98.0	

SUBSEQUENT CORRECTIONS: DIR 250, LEFT 200, DROP 400 FFE

17	OT DIR 250	250,ENTER,OT DIR	250	
18	LEFT 200	200,ENTER,DEV,	200	
19	DROP 400 FFE	400,R/DN/DP,ENTER,RG	-400	
20	Compute S-R Mode Data	D/ADVANCE/ADVANCE	20.0/2334/346 20.0/3134/346	M114A2 TI/DF/QE M109 TI/DF/QE
21	Manually convert S-R Mode Data to FFE DPICM firing data using TFT Addendum G-2 or CHG 4, M483A1 GFT. (Chap 11, FM 6-40).			

TFT METHOD

Fuze Setting to Fire: S-R Mode Time 20.0
Table B CORR -1.1
18.9

Deflection to Fire: 3134/2334 (M109/M114A2)

Quadrant to Fire: S-R QE 346
Table A CORR +41
QE to Fire 387

22	END OF MISSION	E	0

M114A2/M109/M109A1 ADAM (M692/M731) MISSION

RECORD OF FIRE

Observer B29(Bde FSO) CALL FOR FIRE (AF)/FFE/IS/S _____ Tgt _____

Grid: 629 371

Polar: Dir _____ Dis _____ U/D _____ VA ± _____

Shift _____ : Dir _____ L/R _____ +/- _____ U/D _____

ADAM Short, PLUG 150 X 150 GAP IN MINE FIELD

TGT ALT 383
DPICM Residuals Applied

→Si÷10 | 10 m Si

FIRE ORDER #4,DP-SR, LOT IY, CHG 4, FZ TI (2) ADAM-S, LOT VY i/e | Df Corr

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	TGT Easting	62900,ENTER,TGT_E	62900	
2	TGT Northing	37100,ENTER,TGT_N	37100	
3	TGT Altitude	383,ENTER,TGT_A	383	
4	Compute Azimuth and Range to TGT	A	437 4905	Azimuth Range
5	Charge Selection	C CLR,4,ADVANCE	3 4	Override CHG 4
6	Override FZ TI NO 20/R	2ND,A	4	
7	Compute S-R Mode Firing Data	D/ADVANCE/ADVANCE	19.8/1915/360 19.8/2715/360 20.0/2723/343	M114A2 TI/DF/OE M109 TI/DF/OE M109A1 TI/DF/OE
8	S-R Mode Fuze Setting is announced as △ Time 98.0			

SUBSEQUENT CORRECTIONS:

9	DIR 310	310,ENTER,OT DIR	310	
10	LEFT 60	60,ENTER,DEV	60	
11	DROP 100 FFE	100,R/DN/DP,ENTER,RG	-100	
12	Compute S-R Mode Data	D/ADVANCE/ADVANCE	19.3/1925/350 19.3/2725/350 19.5/2733/334	M114A2 TI/DF/OE M109 TI/DF/OE M109A1 TI/DF/OE

CONTINUED ON FOLLOWING PAGE

BALLISTIC MET MESSAGE

For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE	TIME (GMT)	DURATION (HOURS)	STATION HEIGHT (10's M)	MDP PRESSURE % OF STD
METB	K	Q			YY	$G_oG_oG_o$	G	hhh	PPP
METB	3	1	395	330	29	025	0	025	001

ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) ΔΔΔ
SURFACE	00	21	7	052	904
200	01	20	9	049	906
500	02	23	11	047	908
1000	03	25	13	046	910
1500	04				

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
13	Manually determine the wind displaced aim point.			
	(M114A2/M109) 1 Knot Corr Factor 9.2 X 11 (LN 02 windspeed) = 101 meters			
	(M109A1) 1 Knot Corr Factor 9.3 X 11 (LN 02 windspeed) = 102 meters			
14	Wind Direction (LN 02)	2300,ENTER,OT DIR	2300	
15	Wind Correction	101,ENTER,RG	101	M114A2/M109
		102,ENTER,RG	102	M109A1
16	Compute S-R Mode Data to Wind Displaced Aim Point	D/ADVANCE/ADVANCE	19.2/1904/347	M114A2 TI/DF/QE
			19.2/2704/347	M109 TI/DF/QE
			19.4/2711/331	M109A1 TI/DF/QE

17 Manually convert S-R Mode Data to FFE ADAM firing data using TFT addendum or CHG 4 M483A1 GFT:

TFT METHOD

M109/M114A2

Fuze Setting to Fire:

S-R Mode Time	19.2
Table B Correction	-0.3
Time to Fire	18.9

Deflection to Fire: 1904 (M114A1)
2704 (M109)

Quadrant to Fire:

S-R Mode Quadrant	347
Table A Correction	+122
Quadrant to Fire	469

M109A1

Fuze Setting to Fire:

S-R Mode Time	19.4
Table B Correction	-0.4
Time to Fire	19.0

QE to Fire:

S-R Quadrant	331
Table A Corr	+120
QE to Fire	451

Deflection to Fire: 2711

18 END OF MISSION E

TERRAIN GUN POSITION CORRECTION (TGPC)(All Weapon Systems)

GIVEN: M109A1 Battery

Note. Procedures are the same for all calibers with the exception of Sheaf designation.

Laid deflection and distances from the aiming circle to each weapon.

	Weapon	Deflection	Distance
	1	1657	320
	2	1833	250
	3	2110	260
(Base Piece)	4	2052	195
	5	2658	160
	6	3091	175

TGPC/SPEC CORR Cue Card and Overlay

HASTY TRAVERSE

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Recall TGPC Program	2ND,PGM,07		
2	Set up Routine	2ND,E	0.	
3	Enter BP	2052,ENTER,DF	2052	
	Location	195,ENTER,DIST	195	
		A	0.	BP is over BTRY CTR
4	Determine Location of	1657,ENTER,DF	1657	
	WPN #1 with respect to BP	320,ENTER,DIST	320	
		B	-143	WPN #1 LAT DISP (143R)
		ADVANCE	-66	WPN #1 RG DISP (66F)
5	Determine Location of	1833,ENTER,DF	1833	
	WPN #2 with respect to BP	250,ENTER,DIST	250	
		C	-67	WPN #2 LAT DISP (67R)
		ADVANCE	-27	WPN #2 RG DISP (27F)
6	Determine location of	2110,ENTER,DF	2110	
	WPN #3 with respect to BP	260,ENTER,DIST	260	
		D	-52	WPN #3 LAT DISP (52R)
		ADVANCE	41	WPN #3 RG DISP (41B)
7	Determine Location of	2052,ENTER,DF	2052	WPN #4 is Base Piece
	WPN #4 with respect to BP	195,ENTER,DIST	195	
		E	0	
		ADVANCE	0	
8	Determine Location of	2658,ENTER,DF	2658	
	WPN #5 with respect to BP	160,ENTER DIST	160	
		2ND,A	95	WPN #5 LAT DISP (95L)
		ADVANCE	54	WPN #5 RG DISP (54B)
9	Determine Location of	3091,ENTER,DF	3091	
	WPN #6 with respect to BP	175,ENTER,DIST	175	
		2ND,B	157	WPN #6 LAT DISP (157L)
		ADVANCE	90	WPN #6 RG DISP (90B)

Note. Record range displacement on Record of Fire, column 7.

TGPC COMPUTATIONS

Assign a weapon to a burst line based on lateral displacement magnitude.

Weapon	Lateral Displacement	Correction to Burst Line
1	R143	1
2	R67	2
3	R52	3
4	0 (BP)	4
5	L95	5
6	L157	6

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
10	Input STD SHEAF intervals	100,+/-,ENTER,SHEAF	-100	Burst #1
		60,+/-,ADVANCE	-60	Burst #2
		20,+/-,ADVANCE	-20	Burst #3
		20,ADVANCE	20	Burst #4
		60,ADVANCE	60	Burst #5
		100,ADVANCE	100	Burst #6
	Note. All calibers. For initial training use the 155 Sheaf Intervals. For actual TGPC computation use your caliber's Sheaf Intervals. (See TGPC section in the Job Aid.)			
11	Set up LAT CORR subroutine	CLR,ENTER,LAT CORR	0	
12	Determine LAT CORR for weapons assigned to burst lines in order.	B	1	Toward BTRY CTR
		ADVANCE	43	WPN #1 LAT CORR to Burst #1
		C	1	Toward BTRY CTR
		ADVANCE	7	WPN #2 LAT CORR to Burst #2
		D	1	Toward BTRY CTR
		ADVANCE	32	WPN #3 LAT CORR TO Burst #3
		E	-1	Away from BTRY CTR
		ADVANCE	20	WPN #4 LAT CORR to Burst #4
		2ND,A	1	Toward BTRY CTR
		ADVANCE	-35	WPN #5 LAT CORR TO Burst #5
		2ND,B	1	Toward BTRY CTR
		ADVANCE	-57	WPN #6 LAT CORR to Burst #6
13	Record Position Lateral Corrections (col 1,ROF). Record Position Range Corrections dete mined during Hasty Traverse computations in column 7. Complete TGPC computations following procedures outlined on back of ROF.			
14	Compute 100/R: MIN RG	3000,ENTER,100/R	34*	*For TGPC 100/R value never exceeds 25
	MAX RG	7000,ENTER,100/R	15	

CONTINUED ON NEXT PAGE

TERRAIN GUN POSITION CORRECTION
RECORD OF FIRE

TERRAIN GUN POSITION / SPECIAL CORRECTIONS

L/P/R Sector **TRANSFER LIMITS** Chg ____

		LEFT	CENTER	RIGHT		
CEN DF - 400pt	DF				DF	CEN DF-400pt
CEN RG-2000M	RG	(Min)		(Max)	RG	CEN RG+2000M

Gun	Corr To Burst Line	Dir Of Corr Toward -BC — Away -BC —	① Pos Lateral Corr (L/R)	② 100/R GFT * T ___ Min Rg A ___ Max Rg	③ Pos Df Corr (L/R) ① × ② / 100 =	④ Btry Comp VE (I/D)	⑤ MV Unit Corr Fac (Tbl F) D+___ I-___	⑥ MV Rg Corr ④ × ⑤	⑦ Pos Rg Corr (F= -) (B= +)	⑧ Total Rg Corr ⑥ + ⑦ =	⑨ Pos El Corr ⑧ -DR Per 1pt D El (Tbl F) (___)	⑩ Corr Rg ⑧ ≈ 10M Plus CEN Rg * (___)	⑪ Fs - ⑩	⑫ Pos Ti Corr ⑪ Minus Fs-CEN Rg (___)	Gun
#	#	T/A	5M	1pt	1pt	0.1M/S	0.1 M	1M	5M	1M	1pt	10M	0.1	0.1	#
1	1	T	L45						-65						1
2	2	T	L5						-30						2
3	3	T	L30						+40						3
4	4	A	L20						0						4
5		T	R35						+55						5
6		T	R60						+90						6

DA FORM 1 OCT 78 **4757**

FOR USE OF THIS FORM, SEE FM 6-40.
THE PROPONENT AGENCY IS TRADOC.

* FOR SPECIAL CORR USE CHART RANGE TO TARGET

RIGHT SECTOR TGPC

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
15	Designate the sector	2400,ENTER,TGT DF		R SEC CTR DF
16	Locate BP	A	0	
17	Determine WPN DISP based on Left SEC DF	B	-55	WPN #1 LAT DISP
		ADVANCE	-148	RG DISP
		C	-29	WPN #2 LAT DISP
		ADVANCE	-67	RG DISP
		D	-66	WPN #3 LAT DISP
		ADVANCE	-8	RG DISP
		E	0	WPN #4 LAT DISP
		ADVANCE	0	RG DISP
		2ND,A	29	WPN #5 LAT DISP
		ADVANCE	105	RG DISP
		2ND,B	47	WPN #6 LAT DISP
		ADVANCE	175	RG DISP

18 Order Weapons and assign burst lines. (Record range displacement, col 7, ROF.)

Weapon	Lateral Displacement	Correction to Burst Line
3	R66	1
1	R55	2
2	R29	3
4	0	4
5	L29	5
6	L47	6

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
19	Input STD SHEAF Interval (Skip this step if sheaf has been designated.)	100,+/-,ENTER,SHEAF	-100	Burst #1
		60,+/-,ADVANCE	-60	Burst #2
		20,+/-,ADVANCE	-20	Burst #3
		20,ADVANCE	20	Burst #4
		60,ADVANCE	60	Burst #5
		100,ADVANCE	100	Burst #6

20	Set up LAT CORR subroutine	CLR,ENTER,LAT CORR	0	
21	Determine LAT CORR for	D	-1	Away from BTRY CTR
	WPNS assigned to burst line	ADVANCE	-34	POS LAT CORR
		B	-1	Away from BTRY CTR
		ADVANCE	-5	POS LAT CORR
		C	1	Toward BTRY CTR
		ADVANCE	9	POS LAT CORR
		E	-1	Away from BTRY CTR
		ADVANCE	20	POS LAT CORR
		2ND,A	-1	Away from BTRY CTR
		ADVANCE	31	POS LAT CORR
		2ND,B	-1	Away from BTRY CTR
		ADVANCE	53	POS LAT CORR
22	Record POS LAT CORR (col 1, ROF).			
	Record POS RG CORR (col 7, ROF)			
	Complete computations following procedures outlined on Record of Fire.			
23	Compute 100/R MIN RG	3500,ENTER,100/R	29*	*For TGPC 100R values
	MAX RG	7500,ENTER,100/R	14	never exceeds 25.

RIGHT SECTOR TGPC RECORD OF FIRE

TERRAIN GUN POSITION / SPECIAL CORRECTIONS															
L/P/R Sector			TRANSFER LIMITS											Chg ____	
											LEFT	CENTER	RIGHT		
											CEN DF+400pt	DF		DF	CEN DF-400pt
											CEN RG-2000M	RG	(Min)	RG	CEN RG+2000M
			①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	
Gun	Corr To Burst Line	Dir Of Corr Toward –BC— Away –BC—	Pos Lateral Corr (L/R)	100/R GFT * T ____ Min Rg A ____ Max Rg	Pos Df Corr (L/R) ① × ② / 100 =	Btry Comp VE (I/D)	MV Unit Corr Fac (Tbl F) D+____ I–____	MV Rg Corr ④ × ⑤	Pos Rg Corr (F = –) (B = +)	Total Rg Corr ⑥ + ⑦ =	Pos El Corr ① ÷ DR Per Ipf D El (Tbl F) (____)	Corr Rg ⑧ ≈ 10M Plus CEN Rg * (____)	Fs – ⑩	Pos Ti Corr ⑪ Minus Fs–CEN Rg (____)	Gun
#	#	T/A	5M	1pf	1pf	0.1M/S	0.1 M	1M	5M	1M	1pf	10M	0.1	0.1	#
1	2	A	R5						–150						1
2	3	T	L10						–70						2
3	1	A	R35						–10						3
4	4	A	L20						0						4
5	5	A	L30						+105						5
6	6	A	L55						+175						6

DA FORM 1 OCT 78 4757

FOR USE OF THIS FORM, SEE FM 6-40; THE PROPONENT AGENCY IS TRADOC.

* FOR SPECIAL CORR USE CHART RANGE TO TARGET

M101A1 CONCURRENT MET

GIVEN:

Registration Data: GFT B, CHG 4, LOT X, RG 4060, EL 4120 / 372 / 18.5 TI 18.2

CHT DF	2770
ADJ DF	2783
ADJ OE	387
DIR OF FIRE	6070
↓ SI = +15	

Battery Data:

BTRY ALT	516
REG PT 4 ALT	578
PROJ WT	3
PROP TEMP	+82°
LAT	34°N

MET Data

BALLISTIC MET MESSAGE

For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE	TIME (GMT)	DURATION (HOURS)	STATION HEIGHT (10's M)	MDP PRESSURE % OF STD
METB	K	Q			YY	$G_oG_oG_o$	G	hhh	PPP
METB	3	1	344	985	27	095	37	037	991

ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) ΔΔΔ
SURFACE	00	21	06	050	940
200	01	22	07	040	943
500	02	23	09	033	945
1000	03	22	11	026	956
1500	04	20	14	024	962

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Turn off Calculator	Slide ON/OFF Switch to left		
2	Place Special Situation Module in Calculator. Use MET overlay and concurrent MET cue card.			
3	Connect external power as required.			
4	Turn on Calculator	Slide ON/OFF Switch to right	0	
5	Verify light emitting diodes	.,+/-,8888888888	-.8888888888	
6	Verify Module	2ND,PGM,01,E	1.000000001	Special Situation

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
7	Recall Concurrent MET Program	2ND,PGM,08	1.00000001	
8	Set up MET Routine	2ND,E	0	
9	Input Registration Data	A,4060,ADVANCE	4060	CHT RG
		4120,ADVANCE	4120	ADJ RG ~ ADJ EL
		372,ADVANCE	372	ADJ EL
		18.5,ADVANCE	18.5	TI ~ ADJ EL
		18.2,ADVANCE	18.2	ADJ TI
		2770,ADVANCE	2770	CHT DF
		2783,ADVANCE	2783	ADJ DF
10	Input Battery Data	B,516,ADVANCE	516	BTRY ALT
		578,ADVANCE	578	ALT OF BURST
		15,ADVANCE	15	∠ OF SITE
		6070,ADVANCE	6070	DIR OF FIRE
		3,ADVANCE	3	PROJ ⊡ WT
		2,ADVANCE	2	STD PROJ ⊡ WT
		82,ADVANCE	82	PROP TEMP
11	Input MET Data	C	387	ADJ OE/TBL A use MET line #02
		370,ADVANCE	370	ALT MDP
		99.1,ADVANCE	99.1	MDP PRESS
		2300,ADVANCE	2300	WIND DIR
		9,ADVANCE	9	WIND SPEED
		103.3,ADVANCE	103.3	AIR TEMP
		94.5,ADVANCE	94.5	AIR DEN
12	Compute PSN DF CORR	D	4100.100	TBL B (RG.VI)
		36,ADVANCE	2600	COMP RG/TBL C
		.56,+/-,ADVANCE	-5	CROSSWIND COMP
		.83,ADVANCE	4100	RG WIND COMP/ TBL F
		6.3,ADVANCE	6.3	DRIFT
		.22,ADVANCE	4100.6000	CROSSWIND CORR/ TBL I (RG AZ)
		.5,ADVANCE	5.7	AZ ROT CORR/ MET DF CORR
		E	7	PSN DF CORR
13	Compute PSN VE	2ND,A	150	TBL D
		.3,+/-,ADVANCE	103	TEMP CORR
		1.5,+/-,ADVANCE	82	DEN CORR/TBL E
	Interpolation)	2ND,PGM,10	82	Recall Interpolation PGM
		2ND,E	0	Set Up Routine
		80,A	80	Base Value #1
		82,B	82	Base Value #2
		90,C	90	Base Value #3
		0.7,2ND,A	0.7	Value ~ #1
		1.5,2ND,C	1.5	Value ~ #3
		2ND,B	.86	Value ~ #2
	(Return to CONC MET PGM)	2ND,PGM,08	.86	
		2ND,A	150	Re-Input all PSN VE data/ TBL D
		.3,+/-,ADVANCE	103	TEMP CORR
		1.5,+/-,ADVANCE	82	DEN CORR/TBL E
		.86,ADVANCE	4100	PROP TEMP CORR/ TBL F
		29.6,ADVANCE	29.6	MV DEC
		26.9,+/-,ADVANCE	-26.9	MV INC
		1.7,ADVANCE	1.7	RG WIND HEAD

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
13	(cont'd)	1.6,+/-,ADVANCE	-1.6	RG WIND TAIL
		0.8,+/-,ADVANCE	-0.8	AIR TEMP DEC
		0.7,ADVANCE	0.7	AIR TEMP INC
		4.9,+/-,ADVANCE	-4.9	AIR DEN DEC
		5.0,ADVANCE	5.	AIR DEN INC
		41,+/-,ADVANCE	-41	PROJ WT DEC
		42,ADVANCE	4100.6000	PROJ WT INC/ TBL H (RG.AZ)
		8,ADVANCE	8.0000	RG ROT CORR
		.87,ADVANCE	4.8	LAT CORR/ MET RG CORR
		2ND,B	-2.7	PSN VEL ERROR
14	Compute PSN FZ CORR	2ND,C	19	TBL J
		.071,+/-,ADVANCE	-0.071	MV DEC CORR
		.070,ADVANCE	0.07	MV INC CORR
		.001,+/-,ADVANCE	-0.001	RG WIND HEAD
		.001,ADVANCE	0.001	RG WIND TAIL
		.001,ADVANCE	0.001	AIR TEMP DEC
		.001,+/-,ADVANCE	-0.001	AIR TEMP INC
		.006,ADVANCE	0.006	AIR DEN DEC
		.006,+/-,ADVANCE	-0.006	AIR DEN INC
		.114,ADVANCE	0.114	PROJ WT DEC
		.115,+/-,ADVANCE	-0.2	PROJ WT INC/ MET FZ CORR
		2ND,D	-0.1	PSN FZ CORR
15	Record Position Constants			
16	Clear Display	CLR	0	

M101A1 SUBSEQUENT MET

Given:

POS Constants:

PSN DF CORR	L7
PSN VE CORR	-2.7
PSN FZ CORR	-0.1

BTRY Data:

BTRY ALT	516
RG PT 4 ALT	578
DIR OF FIRE	6070
LAT	34° N
CHT RG	4060
CHT DF	2770
PROJ WT	3
PROP TEMP	+85° F

MET Data

BALLISTIC MET MESSAGE

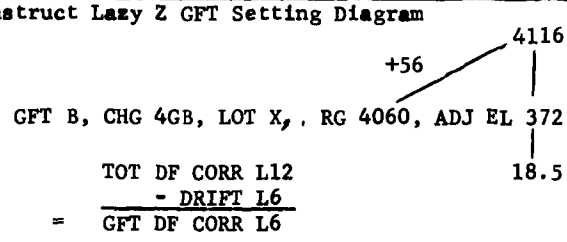
For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE	TIME (GMT)	DURATION (HOURS)	STATION HEIGHT (10's M)	MDP PRESSURE % OF STD
METB	K	Q			YY	$G_oG_oG_o$	G	hhh	PPP
METB	3	1	344	985	27	115	0	037	990

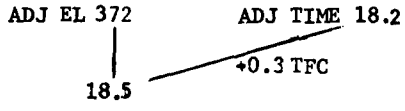
ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) ΔΔΔ
SURFACE	00	19	7	054	940
200	01	19	10	051	947
500	02	20	12	045	952
1000	03	21	14	043	957
1500	04	22	16	040	960

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Recall Subsequent MET PGM	2ND,PGM,09	0	Use MET overlay & SUBS cue cards
2	Set Up Routine	2ND,E	0	
3	Inpute PSN Constants	A,7,ADVANCE	7.0	PSN DF CORR
		-2.7,+/-,ADVANCE	-2.7	PSN VE CORR
		0.1,+/-,ADVANCE	-0.1	PSN FZ CORR
4	Inpute BTRY Data	B,	0.0	
		4060,ADVANCE	4060	CHT RG
		2770,ADVANCE	2770	CHT DF
		516,ADVANCE	516	BTRY ALT
		578,ADVANCE	578	ALT OF BURST
		6070,ADVANCE	6070	DIR OF FIRE
		3,ADVANCE	3	PROJ ∩ WT
		2,ADVANCE	2	STD PROJ ∩ WT
		85,ADVANCE	85	PROP TEMP
5	Inpute MET Data	C,	0.0	
		370,ADVANCE	370	ALT MDP
		99.0,ADVANCE	99	MDP PRESS
		2000,ADVANCE	2000	WIND DIR
		12,ADVANCE	12	WIND SPEED
		104.5,ADVANCE	104.5	AIR TEMP
		95.2,ADVANCE	95.2	AIR DEN
6	Compute Total DF CORR	D,	4100.100	TBL B (RG.VI)
		36,ADVANCE	2300	COMP RG/TBL C
		.77,+/-,ADVANCE	-9	CROSSWIND COMP
		.63,ADVANCE	4100	RG WIND COMP/ TBL F
		6.3,ADVANCE	6	DRIFT
		.22,ADVANCE	4100.6000	CROSSWIND CORR/ TBL I (RG.AZ)
		.5,ADVANCE	4.8	AZ ROT CORR/ MET DF CORR
		E,	12	TOT DF CORR
7	Compute Total RG CORR	2ND,A	150	TBL D
		.3,+/-,ADVANCE	104.2	DT TEMP CORR
		1.5,+/-,ADVANCE	85	DD DENS CORR/ TBL E
		1.1,ADVANCE	4100	PROP TEMP CORR/ TBL F
		29.6,ADVANCE	29.6	MV DEC
		26.9,+/-,ADVANCE	-26.9	MV INC
		1.7,ADVANCE	1.7	RG WIND HEAD
		1.6,+/-,ADVANCE	-1.6	RG WIND TAIL
		0.8,+/-,ADVANCE	-0.8	AIR TEMP DEC
		0.7,ADVANCE	0.7	AIR TEMP INC
		4.9,+/-,ADVANCE	-4.9	AIR DEN DEC
		5.0,ADVANCE	5.	AIR DEN INC
		41,+/-,ADVANCE	-41	PROJ WT DEC
		42,ADVANCE	4100.6000	PROJ WT INC/ TBL H (RG.AZ)
		8,ADVANCE	8.0000	RG ROT CORR
		.87,ADVANCE	8.9	LAT CORR/ MET RG CORR
		2ND,B	56	TOT RG CORR
8	Compute Corrected RG	2ND,C	4116	CORR RG

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
9	Construct Lazy Z GFT Setting Diagram			



10	Compute Total FZ CORR	18.5,ADVANCE	19	TI ~ ADJ EL/ TBL J
		.071,+/-,ADVANCE	-0.071	MV DEC CORR
		.07 ,ADVANCE	0.07	MV INC CORR
		.001,+/-,ADVANCE	-0.001	RG WIND HEAD
		.001,ADVANCE	0.001	RG WIND TAIL
		.001,ADVANCE	0.001	AIR TEMP DEC
		.001,+/-,ADVANCE	-0.001	AIR TEMP INC
		.006,ADVANCE	0.006	AIR DEN DEC
		.006,+/-,ADVANCE	-0.006	AIR DEN INC
		.114,ADVANCE	0.114	PROJ α WT DEC
		.115+/-,ADVANCE	-0.2	PROJ σ WT INC/ MET FZ CORR
		2ND,D	-0.3	TOT FZ CORR
11	Complete Lazy Z GFT Setting Diagram			



12 Refer to Residual Section, insert the weapon system module, and determine/apply residuals.

M102 CONCURRENT MET

GIVEN:

Registration Data: GFT B, CHG 4GB, LOT X, RG 4460, EL 366 (4540 / 11.2) TI 11.3

CHT DF	3170
ADJ DF	3183
ADJ OE	380
DIR OF FIRE	6070 ∠ SI = +14

Battery Data:

BTRY ALT	516
REG PT 4 ALT	578
PROJ WT	3 ⊡
PROP TEMP	+82°F
LAT	34°N

MET Data

BALLISTIC MET MESSAGE

For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE	TIME (GMT)	DURATION (HOURS)	STATION HEIGHT (10's M)	MDP PRESSURE % OF STD
METB	K	Q			YY	$G_oG_oG_o$	G	hhh	PPP
METB	3	1	344	985	27	095	37	037	991

ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) ΔΔΔ
SURFACE	00	21	06	050	940
200	01	22	07	040	943
500	02	23	09	033	954
1000	03	22	11	026	956
1500	04	20	14	024	962

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Turn off Calculator	Slide ON/OFF Switch to left		
2	Place Special Situation Module in Calculator. Use MET overlay and concurrent MET cue card.			
3	Connect external power as required.			
4	Turn on calculator	Slide ON/OFF Switch to right	0	
5	Verify light emitting diodes	.,+/-,8888888888	-.8888888888	
6	Verify Module	2ND,PGM,01,E	1.000000001	Special Situation
7	Recall Concurrent MET Program	2ND,PGM,08	1.000000001	

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
8	Set up MET Routine	2ND,E	0	
9	Input Registration Data	A,4460,ADVANCE	4460	CHT RG
		4540,ADVANCE	4540	ADJ RG ~ ADJ EL
		366,ADVANCE	366	ADJ EL
		11.2,ADVANCE	11.2	TI ~ ADJ EL
		11.3,ADVANCE	11.3	ADJ TI
		3170,ADVANCE	3170	CHT DF
		3183,ADVANCE	3183	ADJ DF
10	Input Battery Data	B,516,ADVANCE	516	BTRY ALT
		578,ADVANCE	578	ALT OF BURST
		14,ADVANCE	14	∠ OF SITE
		6070,ADVANCE	6070	DIR OF FIRE
		3,ADVANCE	3	PROJ □ WT
		2,ADVANCE	2	STD PROJ □ WT
		82,ADVANCE	82	PROP TEMP
11	Inpute MET Data	C	380	ADJ OE/TBL A use MET line #02
		370,ADVANCE	370	ALT MDP
		99.1,ADVANCE	99.1	MDP PRESS
		2300,ADVANCE	2300	WIND DIR
		9,ADVANCE	9	WIND SPEED
		103.3,ADVANCE	103.3	AIR TEMP
		95.4,ADVANCE	95.4	AIR DEN
12	Compute PSN DF CORR	D	4500.100	TBL B (RG.VI)
		35,ADVANCE	2600	COMP RG/TBL C
		.56,+/-,ADVANCE	-5	CROSSWIND COMP
		.83,ADVANCE	4500	RG WIND COMP/ TBL F
		6.7,ADVANCE	6.7	DRIFT
		.20,ADVANCE	4500.6000	CROSSWIND CORR/ TBL I (RG AZ)
		.5,ADVANCE	6.2	AZ ROT CORR/ MET DF CORR
		E	7	PSN DF CORR
13	Compute PSN VE	2ND,A	150	TBL D
		.3,+/-,ADVANCE	103	TEMP CORR
		1.5,+/-,ADVANCE	82	DEN CORR/TBL E
	(Interpolation)	2ND,PGM,10	82	Recall Interpolation PGM
		2ND,E	0	Set Up Routine
		80,A	80	Base Value #1
		82,B	82	Base Value #2
		90,C	90	Base Value #3
		0.8,2ND,A	0.8	Value ~ #1
		1.8,2ND,C	1.8	Value ~ #3
		2ND,B	1.	Value ~ #2
	(Return to CONC MET PGM)	2ND,PGM,08	1.	Re-Input all
		2ND,A	150	PSN VE data/ TBL D
		.3,+/-,ADVANCE	103	TEMP CORR
		1.5,+/-,ADVANCE	82	DEN CORR/TBL E
		1.0,ADVANCE	4500	PROP TEMP CORR/ TBL F
		29.8,ADVANCE	29.8	MV DEC
		26.7,+/-,ADVANCE	-26.7	MV INC
		2.6,ADVANCE	2.6	RG WIND HEAD
		1.8,+/-,ADVANCE	-1.8	RG WIND TAIL
		1.0,ADVANCE	1.	AIR TEMP DEC
		0.2,+/-,ADVANCE	-0.2	AIR TEMP INC

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
13	(cont'd)	5.4,+/-,ADVANCE	-5.4	AIR DEN DEC
		5.5,ADVANCE	5.5	AIR DEN INC
		41,+/-,ADVANCE	-41	PROJ WT DEC
		43,ADVANCE	4500.6000	PROJ WT INC/ TBL H (RG.AZ)
		5,ADVANCE	5.0000	RG ROT CORR
		.87,ADVANCE	.4	LAT CORR/ MET RG CORR
		2ND,B	-3.7	PSN VEL ERROR
14	Compute PSN FZ CORR	2ND,C	11	TBL B
		.038,+/-,ADVANCE	-0.038	MV DEC CORR
		.038,ADVANCE	0.038	MV INC CORR
		.001,+/-,ADVANCE	-0.001	RG WIND HEAD
		.001,ADVANCE	0.001	RG WIND TAIL
		.001,+/-,ADVANCE	-0.001	AIR TEMP DEC
		.000,ADVANCE	0	AIR TEMP INC
		.002,ADVANCE	0.002	AIR DEN DEC
		.002,+/-,ADVANCE	-0.002	AIR DEN INC
		.064,ADVANCE	0.064	PROJ WT DEC
		.065,+/-,ADVANCE	-0.1	PROJ WT INC/ MET FZ CORR
		2ND,D	+0.2	PSN FZ CORR
15	Record Position Constants			
16	Clear Display	CLR	0	

M102 SUBSEQUENT MET

GIVEN:

POS Constants:

PSN DF CORR	L7
PSN VE CORR	-3.7
PSN FZ CORR	+0.2

BTRY Data:

BTRY ALT	516
RG PT 4 ALT	578
DIR OF FIRE	6070
LAT	34°N
CHT RG	4460
CHT DF	3170
PROJ WT	3□
PROP TEMP	+85°F

MET Data

BALLISTIC MET MESSAGE

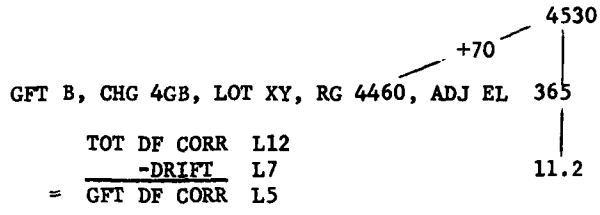
For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE	TIME (GMT)	DURATION (HOURS)	STATION HEIGHT (10's M)	MDP PRESSURE % OF STD
METB	K	Q			YY	$G_oG_oG_o$	G	hhh	PPP
METB	3	1	344	985	27	115	0	037	990

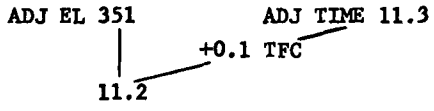
ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) △△△
SURFACE	00	19	7	054	940
200	01	19	10	051	947
500	02	20	12	045	952
1000	03	21	14	043	957
1500	04	22	16	040	960

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Recall Subsequent MET PGM	2ND,PGM,09	0	Use MET overlay and SUBS cue cards
2	Set Up Routine	2ND,E	0	
3	Inpute PSN Constants	A,7,ADVANCE	7.0	PSN DF CORR
		3.7,+/-,ADVANCE	-3.7	PSN VE CORR
		0.2,ADVANCE	0.2	PSN FZ CORR
4	Input BTRY Data	B,	0.0	
		4460,ADVANCE	4460	CHT RG
		3170,ADVANCE	3170	CHT DF
		516,ADVANCE	516	BTRY ALT
		578,ADVANCE	578	ALT OF BURST
		6070,ADVANCE	6070	DIR OF FIRE
		3,ADVANCE	3	PROJ ⊡ WT
		2,ADVANCE	2	STD PROJ ⊡ WT
		85,ADVANCE	85	PROP TEMP
5	Inpute MET Data	C,	0.0	
		370,ADVANCE	370	ALT MDP
		99.0,ADVANCE	99.	MDP PRESS
		2000,ADVANCE	2000	WIND DIR
		12,ADVANCE	12	WIND SPEED
		104.5,ADVANCE	104.5	AIR TEMP
		95.2,ADVANCE	95.2	AIR DEN
6	Compute Total DF CORR	D,	4500.100	TBL B (RG.VI)
		35,ADVANCE	2300	COMP RG/TBL C
		.77,+/-,ADVANCE	-9	CROSSWIND COMP
		.63,ADVANCE	4500	RG WIND COMP/ TBL F
		6.7,ADVANCE	7	DRIFT
		.20,ADVANCE	4500.6000	CROSSWIND CORR/ TBL I (RG.AZ)
		.5,ADVANCE	5.4	AZ ROT CORR/ MET DF CORR
		E,	12	TOT DF CORR
7	Compute Total RG CORR	2ND,A	150	TBL D
		.3,+/-,ADVANCE	104.2	DT TEMP CORR
		1.5,+/-,ADVANCE	85	DD DENS CORR/ TBL E
		1.3,ADVANCE	4500	PROP TEMP CORR/ TBL F
		29.8,ADVANCE	29.8	MV DEC
		26.7,+/-,ADVANCE	-26.7	MV INC
		2.6,ADVANCE	2.6	RG WIND HEAD
		1.8,+/-,ADVANCE	-1.8	RG WIND TAIL
		1.0,ADVANCE	1.	AIR TEMP DEC
		0.2,+/-,ADVANCE	-0.2	AIR TEMP INC
		5.4,+/-,ADVANCE	-5.4	AIR DEN DEC
		5.5,ADVANCE	5.5	AIR DEN INC
		41,+/-,ADVANCE	-41	PROJ WT DEC
		43,ADVANCE	4500.6000	PROJ WT INC/ TBL H (RG.AZ)
		5,ADVANCE	5.0000	RG ROT CORR
		.87.ADVANCE	-1.1	LAT CORR/ MET RG CORR
		2ND,B	70	TOT RG CORR
8	Compute Corrected RG	2ND,C	4530	

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
9	Construct Lazy Z GFT Setting Diagram			



10	Compute Total FZ CORR	11.2,ADVANCE	11	TI ~ ADJ EL/ TBL J
		.038,+/-,ADVANCE	-0.038	MV DEC CORR
		.038,ADVANCE	0.038	MV INC CORR
		.001,+/-,ADVANCE	-0.001	RG WIND HEAD
		.001,ADVANCE	0.001	RG WIND TAIL
		.001,+/-,ADVANCE	-0.001	AIR TEMP DEC
		.000,ADVANCE	0	AIR TEMP INC
		.002,ADVANCE	0.002	AIR DEN DEC
		.002,+/-,ADVANCE	-0.002	AIR DEN INC
		.064,ADVANCE	0.064	PROJ @ WT DEC
		.065,+/-,ADVANCE	-0.1	PROJ @ WT INC/ MET FZ CORR
		2ND,D	0.1	TOT FZ CORR
11	Complete Lazy Z GFT Setting Diagram			



12 Refer to Residual Section and determine/apply residuals.

M114A1 CONCURRENT MET

GIVEN:

Registration Data: GFT B, CHG 4GB, LOT XY, RG 5660, EL 5730 / 382 / 22.1 TI 22.4

CHT DF	2370
ADJ DF	2383
ADJ OE	393
DIR OF FIRE	6070, ∠ S1 = +11

Battery Data:

BTRY ALT	516
REG PT 4 ALT	578
PROJ ⊡ WT	5 ⊡
PROP TEMP	+82°F
LAT	34°N

MET Data

BALLISTIC MET MESSAGE

For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE	TIME (GMT)	DURATION (HOURS)	STATION HEIGHT (10's M)	MDP PRESSURE % OF STD
METB	K	Q	xxx	xxx	YY	$G_oG_oG_o$	G	hhh	PPP
METB	3	1	344	985	27	095	37	037	991

ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) ΔΔΔ
SURFACE	00	21	06	050	940
200	01	22	07	040	943
500	02	23	09	033	954
1000	03	22	11	026	956
1500	04	20	14	024	962

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Turn off Calculator	Slide ON/OFF Switch to Left		
2	Place Special Situation Module in Calculator. Use MET Overlay and Concurrent MET Cue Card.			
3	Connect External Power as required.			
4	Turn on Calculator	Slide ON/OFF Switch to Right	0	
5	Verify Light Emitting diodes	.,+/-,8888888888	-,8888888888	
6	Verify Module	2ND,PGM,01,E	1.000000001	Special Situation

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
7	Recall Concurrent MET Program	2ND,PGM,08	1.000000001	
8	Set up MET routine	2ND,E	0	
9	Inpute Registration Data	A,5660,ADVANCE	5660	CHT RG
		5730,ADVANCE	5730	ADJ RG ~ ADJ EL
		382,ADVANCE	382	ADJ EL
		22.1,ADVANCE	22.1	TI ~ ADJ EL
		22.4,ADVANCE	22.4	ADJ TI
		2370,ADVANCE	2370	CHT DF
		2383,ADVANCE	2383	ADJ DF
10	Input Battery Data	B,516,ADVANCE	516	BTRY ALT
		578,ADVANCE	578	ALT OF BURST
		11,ADVANCE	11	∡ OF SITE
		6070,ADVANCE	6070	DIR OF FIRE
		5,ADVANCE	5	PROJ ⧈ WT
		4,ADVANCE	4	STD PROJ ⧈ WT
		82,ADVANCE	82	PROP TEMP
11	Input MET Data	C,	393	ADJ OE/TBL A use MET line #02
		370,ADVANCE	370	ALT MDP
		99.1,ADVANCE	99.1	MDP PRESS
		2300,ADVANCE	2300	WIND DIR
		9,ADVANCE	9	WIND SPEED
		103.3,ADVANCE	103.3	AIR TEMP
		95.4,ADVANCE	95.4	AIR DEN
12	Compute PSN DF CORR	D,	5700.100	TBL B (RG.VI)
		35,ADVANCE	2600	COMP RG/TBL C
		.56,+/-,ADVANCE	-5	CROSSWIND COMP
		.83,ADVANCE	5700	RG WIND COMP/ TBL F
		9.0,ADVANCE	9	DRIFT
		.24,ADVANCE	5700.6000	CROSSWIND CORR/ TBL I (RG AZ)
		.6,ADVANCE	8.4	AZ ROT CORR/ MET DF CORR
		E,	5	PSN DF CORR
13	Compute PSN VE	2ND,A	150	TBL D
		.3,+/-,ADVANCE	103	TEMP CORR
		1.5,+/-,ADVANCE	82	DEN CORR/TBL E
	(Interpolation)	2ND,PGM,10		Recall Inter-polation PGM
		2ND,E	0	Set Up Routine
		80,A	80	Base Value #1
		82.B	82	Base Value #2
		90.C	90	Base Value #3
		0.5,2ND,A	0.5	Value ~ #1
		0.9,2ND,C	0.9	Value ~ #3
		2ND,B	0.58	Value ~ #2
	(Return to CONC MET PGM)	2ND,PGM,08		
		2ND,A	150	Re-Input all PSN VE data/ TBL D
		.3,+/-,ADVANCE	103	TEMP CORR
		1.5,+/-,ADVANCE	82	DEN CORR/TBL E
		.58,ADVANCE	5700	PROP TEMP CORR/ TBL F
		33.6,ADVANCE	33.6	MV DEC
		27.3,+/-,ADVANCE	-27.3	MV INC
		5.1,ADVANCE	5.1	RG WIND HEAD

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
13	(cont'd)	2.4,+/-,ADVANCE	-2.4	RG WIND TAIL
		4.7,ADVANCE	4.7	AIR TEMP DEC
		0.1,+/-,ADVANCE	-0.1	AIR TEMP INC
		8.0,+/-,ADVANCE	-8.	AIR DEN DEC
		8.2,ADVANCE	8.2	AIR DEN INC
		41,+/-,ADVANCE	-41.0	PROJ WT DEC
		43,ADVANCE	5700.6000	PROJ WT INC/ TBL H (RG.AZ)
		7,ADVANCE	7.0000	RG ROT CORR
		.87,ADVANCE	-17.9	LAT CORR/ MET RG CORR
		2ND,B	-3.2	PSN VEL ERROR
14	Compute PSN FZ CORR	2ND,C	22	TBL B
		.065,+/-,ADVANCE	-0.065	MV DEC CORR
		.061,ADVANCE	0.061	MV INC CORR
		.006,+/-,ADVANCE	-0.006	RG WIND HEAD
		.001,ADVANCE	0.001	RG WIND TAIL
		.009,+/-,ADVANCE	-0.009	AIR TEMP DEC
		.000,ADVANCE	0.	AIR TEMP INC
		.009,ADVANCE	0.009	AIR DEN DEC
		.009,+/-,ADVANCE	-0.009	AIR DEN INC
		.095,ADVANCE	0.095	PROJ WT DEC
		.098,+/-,ADVANCE	-0.2	PROJ WT INC/ MET FZ CORR
		2ND,D	0.5	PSN FZ CORR
15	Record Position Constants			
16	Clear Display	CLR	0	

M114A1 SUBSEQUENT MET

GIVEN:

POS Constants:
- PSN DF CORR L5
- PSN VE CORR -3.2
- PSN FZ CORR +0.5

BTRY Data:
- BTRY ALT 516
- REG PT 4 ALT 578
- DIR OF FIRE 6070
- LAT 34°N
- CHT RG 5660
- CHT DF 2370
- PROJ WT 3 (7)
- PROP TEMP +85°F

BALLISTIC MET MESSAGE

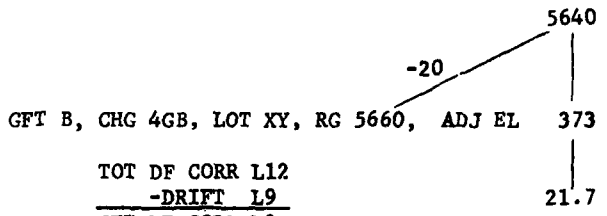
For use of this form, see FM 6-15; the proponent agency is TRADOC.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE YY	TIME (GMT) $G_oG_oG_o$	DURATION (HOURS) G	STATION HEIGHT (10's M) hhh	MDP PRESSURE % OF STD PPP
METB	K	Q							
METB	3	1	344	985	27	115	0	037	990

ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) ΔΔΔ
SURFACE	00	19	7	054	940
200	01	19	10	051	947
500	02	20	12	045	952
1000	03	21	14	043	957
1500	04	22	16	040	960

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Recall Subsequent MET PGM	2ND,PGM,09	0	Use MET Overlay and SUBS
2	Set Up Routine	2ND,E	0	Cue Cards
3	Input PSN Constants	A,5,ADVANCE	5.0	PSN DF CORR
		3.2,+/-,ADVANCE	-3.2	PSN VE CORR
		0.5,ADVANCE	0.5	PSN FZ CORR
4	Input BTRY Data	B,	0.0	
		5660,ADVANCE	5660	CHT RG
		2370,ADVANCE	2370	CHT DF
		516,ADVANCE	516	BTRY ALT
		578,ADVANCE	578	ALT OF BURST
		6070,ADVANCE	6070	DIR OF FIRE
		3,ADVANCE	3	PROJ □ WT
		4,ADVANCE	4	STD PROJ □ WT
		85,ADVANCE	85	PROP TEMP
5	Inpute MET Data	C,	0.0	
		370,ADVANCE	370	ALT MDP
		99.0,ADVANCE	99.	MDP PRESS
		2000,ADVANCE	2000	WIND DIR
		12,ADVANCE	12.	WIND SPEED
		104.5,ADVANCE	104.5	AIR TEMP
		95.2,ADVANCE	95.2	AIR DEN
6	Compute Total DF CORR	D,	5700.100	TBL B (RG.VI)
		35,ADVANCE	2300	COMP RG/TBL C
		.77,+/-,ADVANCE	-9	CROSSWIND COMP
		.63,ADVANCE	5700.	RG WIND COMP/ TBL F
		9.0,ADVANCE	9	DRIFT
		.24,ADVANCE	5700.6000	CROSSWIND CORR/ TBL I (RG.AZ)
		.6,ADVANCE	7.4	AZ ROT CORR/ MET DF CORR
		E,	12	TOT DF CORR
7	Compute Total RG CORR	2ND,A	150	TBL D
		.3,+/-,ADVANCE	104.2	DT TEMP CORR
		1.5,+/-,ADVANCE	85	DD DENS CORR/ TBL E
		0.7,ADVANCE	5700	PROP TEMP CORR/ TBL F
		33.6,ADVANCE	33.6	MV DEC
		27.3,+/-,ADVANCE	-27.3	MV INC
		5.1,ADVANCE	5.1	RG WIND HEAD
		2.4,+/-,ADVANCE	-2.4	RG WIND TAIL
		4.7,ADVANCE	4.7	AIR TEMP DEC
		0.1,+/-,ADVANCE	-0.1	AIR TEMP INC
		8.0,+/-,ADVANCE	-8.	AIR DEN DEC
		8.2,ADVANCE	8.2	AIR DEN INC
		41,+/-,ADVANCE	-41	PROJ WT DEC
		43,ADVANCE	5700.6000	PROJ WT INC/ TBL H (RG.AZ)
		7,ADVANCE	7.000	RG ROT CORR
		.87,ADVANCE	-103.9	LAT CORR/ MET RG CORR
		2ND,B	-20	TOT RG CORR
8	Compute Corrected RG	2ND,C	5640	CORR RG

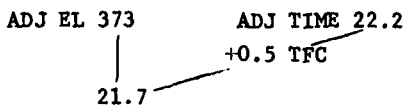
STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
9	Construct Lazy Z GFT Setting Diagram			



TOT DF CORR L12
-DRIFT L9
= GFT DF CORR L3

10	Compute Total FZ CORR	21.7,ADVANCE	22	TI ~ ADJ EL/ TBL J
		.065,+/-,ADVANCE	-0.065	MV DEC CORR
		.061,ADVANCE	0.061	MV INC CORR
		.006,+/-,ADVANCE	-0.006	RG WIND HEAD
		.001,ADVANCE	0.001	RG WIND TAIL
		.009,+/-,ADVANCE	-0.009	AIR TEMP DEC
		.000,ADVANCE	0.	AIR TEMP INC
		.009,ADVANCE	0.009	AIR DEN DEC
		.009,+/-,ADVANCE	-0.009	AIR DEN INC
		.095,ADVANCE	0.095	PROJ ⍓ WT DEC
		.098,+/-,ADVANCE	0.0	PROJ ⍓ WT INC/ MET FZ CORR
		2ND,D	0.5	TOT FZ CORR

11 Complete Lazy Z GFT Setting Diagram



12 Refer to Residuals Section and determine/apply residuals.

M109/M114A2 CONCURRENT MET

GIVEN:

5720

Registration Data: GFT B, CHG 4GB, LOT XY, RG 5660, EL 358 TI 21.5

21.3

CHT DF	3170/2370
ADJ DF	3183/2383
ADJ QE	369
DIR OF FIRE	6070, ∠ SI = +11

Battery Data:

BTRY ALT	516
REG PT 4 ALT	578
PROJ WT	5
PROP TEMP	+82°F
LAT	34°N

MET Data

BALLISTIC MET MESSAGE

For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE	TIME (GMT)	DURATION (HOURS)	STATION HEIGHT (10's M)	MDP PRESSURE % OF STD
METB	K	Q			YY	$G_oG_oG_o$	G	hhh	PPP
METB	3	1	344	985	27	095	37	037	991

ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) ΔΔΔ
SURFACE	00	21	06	050	940
200	01	22	07	040	943
500	02	23	09	033	954
1000	03	22	11	026	956
1500	04	20	14	024	962

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Turn off Calculator	Slide ON/OFF Switch to Left		
2	Place Special Situation Module in Calculator. Use MET Overlay and Concurrent MET Cue Card.			
3	Connect External Power as required.			
4	Turn on Calculator	Slide ON/OFF Switch to Right	0	
5	Verify Light Emitting Diodes	.,+/-,8888888888	-.8888888888	
6	Verify Module	2ND,PGM,01,E	1.000000001	Special Situation.

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
7	Recall Concurrent MET Program	2ND,PGM,08	0	
8	Set up MET routine	2ND,E	0	
9	Input Registration Data	A,5660,ADVANCE	5660	CHT RG
		5720,ADVANCE	5720	ADJ RG ~ ADJ EL
		358,ADVANCE	358	ADJ EL
		21.3,ADVANCE	21.3	TI ~ ADJ EL
		21.5,ADVANCE	21.5	ADJ TI
		3170/2370,ADVANCE	3170/2370	CHT DF
		3183/2383,ADVANCE	3183/2383	ADJ DF
10	Input Battery Data	B,516,ADVANCE	516	BTRY ALT
		578,ADVANCE	578	ALT OF BURST
		11,ADVANCE	11	∠ OF SITE
		6070,ADVANCE	6070	DIR OF FIRE
		5,ADVANCE	5	PROJ □ WT
		4,ADVANCE	4	STD PROJ □ WT
		82,ADVANCE	82	PROP TEMP
11	Input MET Data	C	369	ADJ QE,TBL A use MET line #02
		370,ADVANCE	370	ALT MDP
		99.1,ADVANCE	99.1	MDP PRESS
		2300,ADVANCE	2300	WIND DIR
		9,ADVANCE	9	WIND SPEED
		103.3,ADVANCE	103.3	AIR TEMP
		95.4,ADVANCE	95.4	AIR DEN
12	Compute PSN DF CORR	D	5700.100	TBL B (RG.VI)
		32,ADVANCE	2600	COMP RG/TBL C
		.56,+/-,ADVANCE	-5	CROSSWIND COMP
		.83,ADVANCE	5700	RG WIND COMP/ TBL F
		7.6,ADVANCE	7.6	DIRFT
		.20,ADVANCE	5700.6000	CROSSWIND CORR/ TBL I (RG AZ)
		.6,ADVANCE	7.2	AZ ROT CORR/ MET DF CORR
		E	6	PSN DF CORR
13	Compute PSN VE	2ND,A	150	TBL D
		.3,+/-,ADVANCE	103	TEMP CORR
		1.5,+/-,ADVANCE	82	DEN CORR/TBL E
	(Interpolation)	2ND,PGM,10		Recall Interpolation PGM
		2ND,E		Set up Routine
		80,A	80	Base Value #1
		82,B	82	Base Value #2
		90,C	90	Base Value #3
		0.6,2ND,A	0.6	Value ~ #1
		1.1,2ND,C	1.1	Value ~ #3
		2ND,B	0.7	Value ~ #2
	(Return to CONC MET PGM)	2ND,PGM,08		
		2ND,A	150	Re-Input all PSN VE data/ Tbl D
		.3,+/-,ADVANCE	103	TEMP CORR
		1.5,+/-,ADVANCE	82	DEN CORR/TBL E
		0.7,ADVANCE	5700	PROP TEMP CORR/ TBL F
		31.2,ADVANCE	31.2	MV DEC
		24.7,+/-,ADVANCE	-24.7	MV INC

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
13	(cont'd)	7.2,ADVANCE	7.2	RG WIND HEAD
		2.6,+/-,ADVANCE	-2.6	RG WIND TAIL
		12.2,ADVANCE	12.2	AIR TEMP DEC
		1.7,+/-,ADVANCE	-1.7	AIR TEMP INC
		7.5,+/-,ADVANCE	-7.5	AIR DEN DEC
		7.7,ADVANCE	7.7	AIR DEN INC
		38,+/-,ADVANCE	-38	PROJ WT DEC
		42,ADVANCE	5700.6000	PROJ WT INC/ TBL H (RG.AZ)
		12,ADVANCE	12.0000	RG ROT CORR
		.87,ADVANCE	-17.8	LAT CORR/ MET RG CORR
		2ND,B	-3.2	PSN VEL ERROR
14	Compute PSN FZ CORR	2ND,C	21	T8L B
		.060,+/-,ADVANCE	-0.06	MV DEC CORR
		.052,ADVANCE	0.052	MV INC CORR
		.009,+/-,ADVANCE	0.009	RG WIND HEAD
		.002,ADVANCE	0.002	RG WIND TAIL
		.023,+/-,ADVANCE	-0.023	AIR TEMP DEC
		.003,ADVANCE	0.003	AIR TEMP INC
		.008,ADVANCE	0.008	AIR DEN DEC
		.008,+/-,ADVANCE	-0.008	AIR DEN INC
		.086,ADVANCE	0.086	PROJ WT DEC
		.093,+/-,ADVANCE	-0.2	PROJ WT INC/ MET FZ CORR
		2ND,D	0.4	PSN FZ CORR
15	Record Position Constants			
16	Clear Display	CLR	0	

M109/M114A2 SUBSEQUENT MET

GIVEN:

POS Constants: PSN DF CORR L6
PSN VE CORR -3.2
PSN VZ CORR +0.4

BTRY Data: BTRY ALT 516
REG PT 4 ALT 578
DIR OF FIRE 6070
LAT 34° N
CHT RG 5660
CHT DF 3170/2370
PROJ WT 3 ☐
PROP TEMP +85° F

BALLISTIC MET MESSAGE

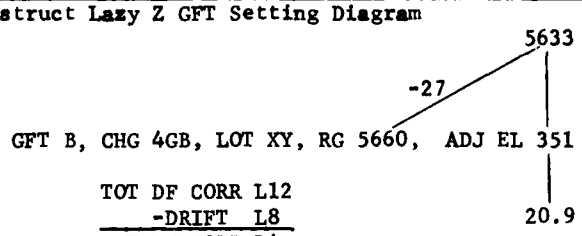
For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE	TIME (GMT)	DURATION (HOURS)	STATION HEIGHT (10's M)	MDP PRESSURE % OF STD
METB	K	Q			YY	$G_oG_oG_o$	G	hhh	PPP
METB	3	1	344	.985	27	115	0	037	990

ZONE HEIGHT (METERS)	LINE NUMBER	BALLISTIC WINDS		BALLISTIC AIR	
		DIRECTION (100's MILS)	SPEED (KNOTS)	TEMPERATURE (% OF STD)	DENSITY (% OF STD)
	ZZ	dd	FF	TTT	ΔΔΔ
SURFACE	00	19	7	054	940
200	01	19	10	051	947
500	02	20	12	045	952
1000	03	21	14	043	957
1500	04	22	16	040	960

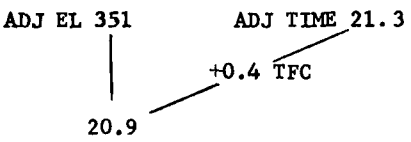
STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Recall Subsequent MET PGM	2ND,PGM,09	0	Use MET Overlay and SUBS Cue Cards
2	Set Up Routine	2ND,E	0	
3	Input PSN Constants	A,6,ADVANCE	6.0	PSN DF CORR
		3.2,+/-,ADVANCE	-3.2	PSN VE CORR
		.4,ADVANCE	0.4	PSN FZ CORR
4	Input BTRY Data	B,	0.0	
		5660,ADVANCE	5660	CHT RG
		3170/2370,ADVANCE	3170/2370	CHT DF
		516,ADVANCE	516	BTRY ALT
		578,ADVANCE	578	ALT OF BURST
		6070,ADVANCE	6070	DIR OF FIRE
		3,ADVANCE	3	PROJ WT
		4,ADVANCE	4	ST PROJ WT
		85,ADVANCE	85	PROP TEMP
5	Input MET Data	C,	0.0	
		370,ADVANCE	370	ALT MDP
		99.0,ADVANCE	99	MDP PRESS
		2000,ADVANCE	2000	WIND DIR
		12,ADVANCE	12	WIND SPEED
		104.5,ADVANCE	104.5	AIR TEMP
		95.2,ADVANCE	95.2	AIR DEN
6	Compute Total DF CORR	D,	5700.100	TBL B (RG.VI)
		32,ADVANCE	2300	COMP RG/TBL C
		.77,+/-,ADVANCE	-9	CROSSWIND COMP
		.63,ADVANCE	5700	RG WIND COMP/ TBL F
		7.6,ADVANCE	8	DRIFT
		.20,ADVANCE	5700.6000	CROSSWIND CORR/ TBL I (RG.AZ)
		.6,ADVANCE	6.4	AZ ROT CORR/ MET DF CORR
		E,	12	TOT DF CORR
7	Compute Total RG CORR	2ND,A	150	TBL D
		.3,+/-,ADVANCE	104.2	DT TEMP CORR
		1.5,+/-,ADVANCE	85	DD DENS CORR/ TBL E
		0.8,ADVANCE	5700	PROP TEMP CORR/ TBL F
		31.2,ADVANCE	31.2	MV DEC
		24.7,+/-,ADVANCE	-24.7	MV INC
		7.2,ADVANCE	7.2	RG WIND HEAD
		2.6,+/-,ADVANCE	-2.6	RG WIND TAIL
		12.2,ADVANCE	12.2	AIR TEMP DEC
		1.7,+/-,ADVANCE	-1.7	AIR TEMP INC
		7.5,+/-,ADVANCE	-7.5	AIR DEN DEC
		7.7,ADVANCE	7.7	AIR DEN INC
		38,+/-,ADVANCE	-38	PROJ WT DEC
		42,ADVANCE	5700.6000	PROJ WT INC/ TBL H (RG.AZ)
		12,ADVANCE	12.000	RG ROT CORR
		.87,ADVANCE	-101.6	LAT CORR/ MET RG CORR
		2ND,B	-27	TOT RG CORR
8	Compute Corrected RG	2ND,C	5633	CORR RG

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
9	Construct Lazy Z GFT Setting Diagram			



TOT DF CORR L12
-DRIFT L8
= GFT DF CORR L4

10	Compute Total FZ CORR	20.9 ,ADVANCE	21	TI ~ ADJ EL/ TBL J
		.060,+/-,ADVANCE	-0.06	MV DEC CORR
		.052,ADVANCE	0.052	MV INC CORR
		.009,+/-,ADVANCE	-0.009	RG WIND HEAD
		.002,ADVANCE	0.002	RG WIND TAIL
		.023,+/-,ADVANCE	-0.023	AIR TEMP DEC
		.003,ADVANCE	0.003	AIR TEMP INC
		.008,ADVANCE	0.008	AIR DEN DEC
		.008,+/-,ADVANCE	-0.008	AIR DEN INC
		.086,ADVANCE	0.085	PROJ WT DEC
		.093,+/-,ADVANCE	-0.0	PROJ WT INC/ MET FZ CORR
		2ND,D	0.4	TOT FZ CORR
11	Complete Lazy Z GFT Setting Diagram			



12 Refer to Residual Section and determine/apply residuals.

M109A1 CONCURRENT MET

GIVEN:

5790

Registration Data: GFT B, CHT 4GB, LOT XY, RG 5660, EL 358 TI 21.5

Chart DF	3170	
Adjusted DF	3183	
Adjusted QE	369	21.4
Direction of Fire	6070	

Battery Data:

Battery Altitude	516
Registration Pt 4 ALT	578
Projectile Weight	5
Propellant Temperature	+82°F
Latitude	34°N
Angle of Site	+11

MET Data:

BALLISTIC MET MESSAGE

For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE	TIME (GMT)	DURATION (HOURS)	STATION HEIGHT (10's M)	MDP PRESSURE % OF STD
METB	K	Q			YY	$G_oG_oG_o$	G	hhh	PPP
METB	3	1	344	985	27	095	37	037	991

		BALLISTIC WINDS		BALLISTIC AIR	
ZONE HEIGHT (METERS)	LINE NUMBER ZZ	DIRECTION (100's MILS) dd	SPEED (KNOTS) FF	TEMPERATURE (% OF STD) TTT	DENSITY (% OF STD) ΔΔΔ
SURFACE	00	21	06	050	940
200	01	22	07	040	943
500	02	23	09	033	954
1000	03	22	11	026	956
1500	04	20	14	024	962

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Turn off calculator	Slide ON/OFF Switch to left		
2	Place Special Situation module in calculator. Use MET overlay and concurrent MET cue card.			
3	Connect external power as required.			
4	Turn on calculator	Slide ON/OFF Switch to right	0	
5	Verify light emitting diodes	.,+/-,8888888888	-.8888888888	
6	Verify module	2ND,PGM,01,E	1.000000001	Special Situation

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
7	Recall Concurrent MET Program	2ND,PGM,08	0	
8	Set up MET Routine	2ND,E	0	
9	Input Registration Data	A,5660,ADVANCE	5660	Chart Range
		5790,ADVANCE	5790	ADJ RG ~ ADJ EL
		358,ADVANCE	358	Adjusted EL
		21.4,ADVANCE	21.4	Time ~ ADJ EL
		21.5,ADVANCE	21.5	Adjusted Time
		3170,ADVANCE	3170	CHT DF
		3183,ADVANCE	3183	ADJ DF
10	Input Battery Data	B,516,ADVANCE	516	BTRY ALT
		578,ADVANCE	578	ALT of Burst
		11,ADVANCE	11	∠ of Site
		6070,ADVANCE	6070	DIR of Fire
		5,ADVANCE	5	PROJ ⊡ WT
		4,ADVANCE	4	STD PROJ ⊡ WT
		82,ADVANCE	82	PROP TEMP
11	Input MET Data	C	369	ADJ QE/TBL A use MET line #02
		370,ADVANCE	370	ALT MDP
		99.1,ADVANCE	99.1	MDP PRESS
		2300,ADVANCE	2300	Wind DIR
		9,ADVANCE	9	Wind Speed
		103.3,ADVANCE	103.3	AIR TEMP
		95.4,ADVANCE	95.4	Air Density
12	Compute PSN DF CORR	D	5700.100	TBL B (RG.VI)
		32,ADVANCE	2600	COMP RG/TBL C
		.56,+/-,ADVANCE	-5.	Crosswind COMP
		.83,ADVANCE	5700	RG Wind COMP/ TBL F
		7.5,ADVANCE	7.5	Drift
		.19,ADVANCE	5700.6000	Crosswind CORR/ TBL I (RG AZ)
		.6,ADVANCE	7.1	AZ ROT CORR/ MET DF CORR
		E	6.	PSN DF CORR
13	Compute PSN VE	2ND,A	150.	TBL D
		.3,+/-,ADVANCE	103.	TEMP CORR
		1.5,+/-,ADVANCE	82.	DEN CORR/TBL E
	(Interpolation)	2ND,PGM,10	82	Recall Interpolation PGM
		2ND,E	0	Set Up Routine
		80,A	80.	Base Value #1
		82,B	82.	Base Value #2
		90,C	90.	Base Value #3
		0.6,2ND,A	0.6	Value ~ #1
		1.1,2ND,C	1.1	Value ~ #3
		2ND,B	0.7	Value ~ #2
	(Return to CONC MET PGM)	2ND,PGM,08		
		2ND,A	150	Re-Input all PSN VE data/ TBL D
		.3,+/-,ADVANCE	103	TEMP CORR
		1.5,+/-,ADVANCE	82	DEN CORR/TBL E
		0.7,ADVANCE	5700	PROP TEMP CORR/ TBL F
		30.9,ADVANCE	30.9	MV DEC
		24.1,+/-,ADVANCE	-24.1	MV INC
		7.4,ADVANCE	7.4	RG WIND HEAD

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
13	(cont/d)	2.5,+/-,ADVANCE	-2.5	RG WIND TAIL
		13.4,ADVANCE	13.4	AIR TEMP DEC
		2.0,+/-,ADVANCE	-2.	AIR TEMP INC
		7.2,+/-,ADVANCE	-7.2	AIR DEN DEC
		7.4,ADVANCE	7.4	AIR DEN INC
		37,+/-,ADVANCE	-37	PROJ WT DEC
		41,ADVANCE	5700.6000	PRJ WT INC/ TBL H (RG.AZ)
		12,ADVANCE	12.0000	RG ROT CORR
		.87,ADVANCE	-17.2	LAT CORR/ MET RG CORR
		2ND,B	-5.5	PSN VEL ERROR
14	Compute PSN FZ CORR	2ND,C	21.	Table B
		.059,+/-,ADVANCE	-0.059	MV DEC CORR
		.050,ADVANCE	0.05	MV INC CORR
		.010,+/-,ADVANCE	-0.01	RG WIND HEAD
		.002,ADVANCE	0.002	RG WIND TAIL
		.025,+/-,ADVANCE	-0.025	AIR TEMP DEC
		.004,ADVANCE	0.004	AIR TEMP INC
		.008,ADVANCE	0.008	AIR DEN DEC
		.008,+/-,ADVANCE	-0.008	AIR DEN INC
		.085,ADVANCE	0.085	PROJ WT DEC
		.090,+/-,ADVANCE	-0.3	PROJ WT INC/ MET FZ CORR
		2ND,D	0.4	PSN FZ CORR
15	Record POS Constants			
16	Clear Display	CLR	0	

M109A1 SUBSEQUENT MET

GIVEN:

Position Constants:

PSN DF CORR	L6
PSN VE CORR	-5.5
PSN FZ CORR	+0.4

Battery Data:

BTRY ALT	516
RG PT 4 ALT	578
DIR OF FIRE	6070
LAT	34°N
CHT RG	5660
CHT DF	3170
PROJ □ WT	3 □
PROP TEMP	+85°F

CONTINUED ON NEXT PAGE

MET Data:

BALLISTIC MET MESSAGE

For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

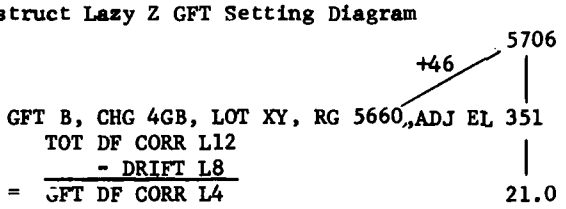
IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE	TIME (GMT)	DURATION (HOURS)	STATION HEIGHT (10's M)	MDP PRESSURE % OF STD
METB	K	Q			YY	$G_oG_oG_o$	G	hhh	PPP
METB	3	1	344	985	27	115	0	037	990

ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) ΔΔΔ
SURFACE	00	19	7	054	940
200	01	19	10	051	947
500	02	20	12	045	952
1000	03	21	14	043	957
1500	04	22	16	040	960

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Recall Subsequent MET PGM	2ND,PGM,09	0	Use MET overlay and SUBS
2	Set Up Routine	2ND,E	0	cue cards
3	Input PSN Constants	A,6,ADVANCE	6.0	PSN DF CORR
		5.5,+/-,ADVANCE	-5.5	PSN VE CORR
		.4,ADVANCE	0.4	PSN FZ CORR
4	Input BTRY Data	B,	0.0	
		5660,ADVANCE	5660	CHT RG
		3170,ADVANCE	3170	CHT DF
		516,ADVANCE	516	BTRY ALT
		578,ADVANCE	578	ALT OF BURST
		6070,ADVANCE	6070	DIR OF FIRE
		3,ADVANCE	3	PROJ ◻ WT
		4,ADVANCE	4	STD PROJ ◻ WT
		85,ADVANCE	85	PROP TEMP
5	Input MET Data	C,	0.0	
		370,ADVANCE	370	ALT MDP
		99.0,ADVANCE	99.	MDP PRESS
		2000,ADVANCE	2000	WIND DIR
		12,ADVANCE	12.	WIND SPEED
		104.5,ADVANCE	104.5	AIR TEMP
		95.2,ADVANCE	95.2	AIR DEN
6	Compute Total DF CORR	D,	5700.100	TBL B (RG.VI)
		32,ADVANCE	2300	COMP RG/TBL C
		.77,+/-,ADVANCE	-9	Crosswind COMP
		.63,ADVANCE	5700.	RG WIND COMP/ TBL F
		7.5,ADVANCE	8.	Drift
		.19,ADVANCE	5700.6000	Crosswind CORR/ TBL I (RG.AZ)
		.6,ADVANCE	6.3	AZ ROT CORR/ MET DF CORR
		E,	12	Total DF CORR

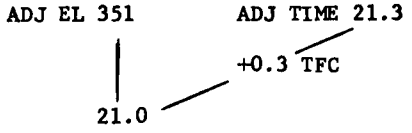
STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
7	Compute Total RG CORR	2ND,A	150	Table D
		.3,+/-,ADVANCE	104.2	DT TEMP CORR
		1.5,+/-,ADVANCE	85	DD DENS CORR/ TBL E
		0.8,ADVANCE	5700.	PROP TEMP CORR/ TBL F
		30.9,ADVANCE	30.9	MV DEC
		24.1,+/-,ADVANCE	-24.1	MV INC
		7.4,ADVANCE	7.4	RG WIND HEAD
		2.5,+/-,ADVANCE	-2.5	RG WIND TAIL
		13.4,ADVANCE	13.4	AIR TEMP DEC
		2.0,+/-,ADVANCE	-2.	AIR TEMP INC
		7.2,+/-,ADVANCE	-7.2	AIR DEN DEC
		7.4,ADVANCE	7.4	AIR DEN INC
		37,+/-,ADVANCE	-37	PROJ WT DEC
		41,ADVANCE	5700.6000	PROJ WT INC/ TBL H (RG,AZ)
		12,ADVANCE	12.000	RG ROT CORR
		.87,ADVANCE	-99.2	LAT CORR/ MET RG CORR
		2ND,B	46	TOT RG CORR
8	Compute Corrected RG	2ND,C	5706	CORR RG

9 Construct Lazy Z GFT Setting Diagram



10	Compute Total FZ CORR	21.0,ADVANCE	21.	TI ~ ADJ EL/ TBL J
		.059,+/-,ADVANCE	-0.059	MV DEC CORR
		.050,ADVANCE	0.05	MV INC CORR
		.010,+/-,ADVANCE	-0.01	RG WIND HEAD
		.002,ADVANCE	0.002	RG WIND TAIL
		.025,+/-,ADVANCE	0.025	AIR TEMP DEC
		.004,ADVANCE	0.004	AIR TEMP INC
		.008,ADVANCE	0.008	AIR DEN DEC
		.008,+/-,ADVANCE	-0.008	AIR DEN INC
		.085,ADVANCE	0.085	PROJ □ WT DEC
		.090,+/-,ADVANCE	-0.1	PROJ □ WT INC/ MET FZ CORR
		2ND,D	0.3	TOT FZ CORR

11 Complete Lazy Z GFT Setting Diagram



12. Refer to Residual Section and determine/apply residuals.

M110A2 CONCURRENT MET

GIVEN:

5980

Registration Data: GFT B, CHG 4GB, LOT XY, RG 6130, EL 309 TI 19.7
CHT DF 3170
ADJ DF 3183 19.9
ADJ QE 319
DIR OF FIRE 6070
∠ SI = +10

Battery Data:
BTRY ALT 516
REG PT 4 ALT 578
PROJ WT 5
PROP TEMP +82°F
LAT 34°N

MET Data:

BALLISTIC MET MESSAGE

For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE YY	TIME (GMT) $G_oG_oG_o$	DURATION (HOURS) G	STATION HEIGHT (10's M) hhh	MDP PRESSURE % OF STD PPP
METB	K	Q							
METB	3	1	344	985	27	095	37	037	991

ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) ΔΔΔ
SURFACE	00	21	06	055	940
200	01	22	07	040	943
500	02	23	09	033	954
1000	03	22	11	026	956
1500	04	20	14	024	962

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Turn off Calculator	Slide ON/OFF Switch to Left		
2	Place Special Situation Module in Calculator. Use MET overlay and concurrent MET cue card.			
3	Connect external power as required.			
4	Turn on Calculator	Slide ON/OFF Switch to Right	0	
5	Verify light emitting diodes	.,+/-,8888888888	-.8888888888	
6	Verify module	2ND,PGM,01,E	1.000000001	Special Situation

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
7	Recall Concurrent MET Program	2ND,PGM,08	0	
8	Set Up MET Routine	2ND,E	0	
9	Input Registration Data	A,6130,ADVANCE	6130	CHT RG
		5980,ADVANCE	5980	ADJ RG ~ ADJ EL
		309,ADVANCE	309	ADJ EL
		19.9,ADVANCE	19.9	TI ~ ADJ EL
		19.7,ADVANCE	19.7	ADJ TI
		3170,ADVANCE	3170	CHT DF
		3183,ADVANCE	3183	ADJ DF
10	Input Battery Data	B,516,ADVANCE	516	BTRY ALT
		578,ADVANCE	578	ALT OF BURST
		10,ADVANCE	10	∠ OF SITE
		6070,ADVANCE	6070	DIR OF FIRE
		5,ADVANCE	5	PROJ □ WT
		4,ADVANCE	4	STD PROJ ▱ WT
		82,ADVANCE	82	PROP TEMP
11	Input MET Data	C	319	ADJ OE/TBL A use MET line #02
		370,ADVANCE	370	ALT MDP
		99.1,ADVANCE	99.1	MDP PRESS
		2300,ADVANCE	2300	WIND DIR
		9,ADVANCE	9	WIND SPEED
		103.3,ADVANCE	103.3	AIR TEMP
		95.4,ADVANCE	95.4	AIR DEN
12	Compute PSN DF CORR	D	6100.100	TBL B (RG.VI)
		23,ADVANCE	2600	COMP RG/TBL C
		.56,+/-,ADVANCE	-5	CROSSWIND COMP
		.83,ADVANCE	6200	RG WIND COMP/ TBL F
		5.7,ADVANCE	5.7	DRIFT
		.21,ADVANCE	6200.6000	CROSSWIND CORR/ TBL I (RG AZ)
		.6,ADVANCE	5.2	AZ ROT CORR/ MET DF CORR
		E	8.	PSN DF CORR
13	Compute PSN VE	2ND,A	150.	TBL D
		.3,+/-,ADVANCE	103.	TEMP CORR
		1.5,+/-,ADVANCE	82.	DEN CORR/TBL E
	(Interpolation)	2ND,PGM,10	82	Recall Interpolation PGM
		2ND,E	0	Set Up Routine
		80,A	80.	Base Value #1
		82,B	82.	Base Value #2
		90,C	90.	Base Value #3
		0.5,2ND,A	0.5	Value ~ #1
		1.0,2ND,C	1	Value ~ #3
		2ND,B	0.6	Value ~ #2
	(Return to CONC MET PGM)	2ND,PGM,08	0.6	Re-Input all
		2ND,A	150	PSN VE Data/ TBL D
		.3,+/-,ADVANCE	103	TEMP CORR
		1.5,+/-,ADVANCE	82	DEN CORR/TBL E
		0.6,ADVANCE	6200	PROP TEMP CORR/ TBL F
		16.8,ADVANCE	16.8	MV DEC
		15.8,+/-,ADVANCE	-15.8	MV INC
		10.6,ADVANCE	10.6	RG WIND HEAD

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
13	(cont'd)	8.7,+/-,ADVANCE	-8.7	RG WIND TAIL
		26.9,ADVANCE	26.9	AIR TEMP DEC
		24.0,+/-,ADVANCE	- 24.	AIR TEMP INC
		7.8,+/-,ADVANCE	- 7.8	AIR DEN DEC
		7.6,ADVANCE	7.6	AIR DEN INC
		24,+/-,ADVANCE	-24	PROJ WT DEC
		24,ADVANCE	6200.6000	PROJ WT INC/ TBL H(RG.AZ)
		9,ADVANCE	9.0000	RG ROT CORR
		.87,ADVANCE	-152.7	LAT CORR/ MET RG CORR
		2ND,B	-0.8	PSN VEL ERROR
14	Compute PSN FZ CORR	2ND,C	20	TBL J
		.031,+/-,ADVANCE	-0.031	MV DEC CORR
		.031,ADVANCE	0.031	MV INC CORR
		.011,+/-,ADVANCE	-0.011	RG WIND HEAD
		.012,ADVANCE	0.012	RG WIND TAIL
		.036,+/-,ADVANCE	-0.036	AIR TEMP DEC
		.037,ADVANCE	0.037	AIR TEMP INC
		.009,ADVANCE	0.009	AIR DEN DEC
		.008,+/-,ADVANCE	-0.008	AIR DEN INC
		.055,ADVANCE	0.055	PROJ WT DEC
		.055,+/-,ADVANCE	0.2	PROJ WT INC/ MET FZ CORR
		2ND,D	-0.4	PSN FZ CORR
15	Record Position Constants			
16	Clear Display	CLR	0	

M110A2 SUBSEQUENT MET

GIVEN:

POS Constants:
- PSN DF CORR L8
- PSN VE CORR -0.8
- PSN FZ CORR -0.4

BTRY Data:
- BTRY ALT 516
- RG PT 4 ALT 578
- DIR OF FIRE 6070
- LAT 34°N
- CHT RG 6130
- CHT DF 3170
- PROJ WT 3 a
- PROP TEMP +85°F

MET Data

BALLISTIC MET MESSAGE

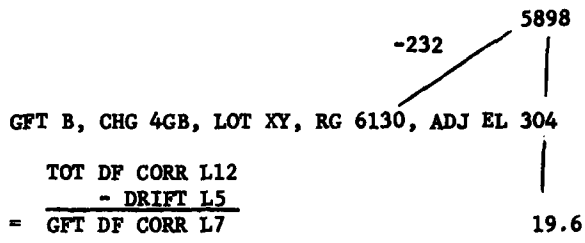
For use of this form, see FM 6-15; the proponent agency is United States Continental Army Command.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE YY	TIME (GMT) $G_oG_oG_o$	DURATION (HOURS) G	STATION HEIGHT (10's M) hhh	MDP PRESSURE % OF STD PPP
METB	K	Q							
METB	3	1	344	985	27	115	0	037	990

ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD) ΔΔΔ
SURFACE	00	19	7	054	940
200	01	19	10	051	947
500	02	20	12	045	952
1000	03	21	14	043	957
1500	04	22	16	040	960

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Recall Subsequent MET PGM	2ND,PGM,09	0.	Use MET overlay and SUBS
2	Set Up Routine	2ND,E	0	cue card
3	Input PSN Constants	A,8,ADVANCE	8.0	PSN DF CORR
		0.8,+/-,ADVANCE	-0.8	PSN VE CORR
		0.4,+/-,ADVANCE	-0.4	PSN FZ CORR
4	Input BTRY Data	B,	0.0	
		6130,ADVANCE	6130.	CHT RG
		3170,ADVANCE	3170	CHT DF
		516,ADVANCE	516	BTRY ALT
		578,ADVANCE	578	ALT OF BURST
		6070,ADVANCE	6070	DIR OF FIRE
		3,ADVANCE	3	PROJ ◻ WT
		4,ADVANCE	4	STD PROJ ◻ WT
		85,ADVANCE	85	PROP TEMP
5	Input MET Data	C,	0.0	
		370,ADVANCE	370	ALT MDP
		99.0,ADVANCE	99.	MDP PRESS
		2000,ADVANCE	2000	WIND DIR
		12,ADVANCE	12.	WIND SPEED
		104.5,ADVANCE	104.5	AIR TEMP
		95.2,ADVANCE	95.2	AIR DEN
6	Compute Total DF CORR	D,	6100.100	TBL B(RG.VI)
		23,ADVANCE	2300	COMP RG/TBL C
		.77,+/-,ADVANCE	-9	CROSSWIND COMP
		.63,ADVANCE	6200	RG WIND COMP/ TBL F
		5.7,ADVANCE	6	DRIFT
		.21,ADVANCE	6200.6000	CROSSWIND CORR/ TBL I (RG.AZ)
		.6,ADVANCE	4.4	AZ ROT CORR/ MET DF CORR
		E,	12	TOT DF CORR
7	Compute Total RG CORR	2ND,A	150	TBL D
		.3,+/-,ADVANCE	104.2	DT TEMP CORR
		1.5,+/-,ADVANCE	85	DD DENS CORR/ TBL E
		0.8,ADVANCE	6200	PROP TEMP CORR/ TBL F
		16.8,ADVANCE	16.8	MV DEC
		15.8,+/-,ADVANCE	-15.8	MV INC
		10.6,ADVANCE	10.6	RG WIND HEAD
		8.7,+/-,ADVANCE	-8.7	RG WIND TAIL
		26.9,ADVANCE	26.9	AIR TEMP DEC
		24.0,+/-,ADVANCE	-24.	AIR TEMP INC
		7.8,+/-,ADVANCE	-7.8	AIR DEN DEC
		7.6,ADVANCE	7.6	AIR DEN INC
		24,+/-,ADVANCE	-24	PROJ WT DEC
		24,ADVANCE	6200.6000	PROJ WT INC/ TBL H (RG.AZ)
		9,ADVANCE	9.000	RG ROT CORR
		.87,ADVANCE	-231.9	LAT CORR/ MET RG CORR
		2ND,B	-232	TOT RG CORR
8	Compute Corrected RG	2ND,C	5898	CORR RG

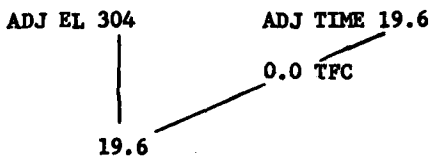
STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
9	Construct Lazy Z GFT Setting Diagram			



TOT DF CORR L12
- DRIFT L5
= GFT DF CORR L7

10	Compute Total FZ CORR	19.6,ADVANCE	20	TI ~ ADJ EL/ TBL J
		.031,+/-,ADVANCE	-0.031	MV DEC CORR
		.031,ADVANCE	0.031	MV INC CORR
		.011,+/-,ADVANCE	-0.011	RG WIND HEAD
		.012,ADVANCE	0.012	RG WIND TAIL
		.036,+/-,ADVANCE	-0.036	AIR TEMP DEC
		.037,ADVANCE	0.037	AIR TEMP INC
		.009,ADVANCE	0.009	AIR DEN DEC
		.008,+/-,ADVANCE	-0.008	AIR DEN INC
		.055,ADVANCE	0.055	PROJ ◻ WT DEC
		.055,+/-,ADVANCE	0.4	PROJ ◻ WT INC/ MET FZ CORR
		2ND,D	0.0	TOT FZ CORR

11 Complete Lazy Z GFT Setting Diagram



12 Refer to Residual Section, insert the weapon system module, and determine/apply residuals.

M114A1/M114A2/M109/M109A1 K-TRANSFER NUCLEAR MISSION

Weapon #1 Location: 60890, 32615 ALT 352
AZ OF LAY 6350
SHELL NUC POWD TEMP +25

GIVEN: HE (M107) GFT Setting

7360

GFT B, CHG 5WB, LOT XY, RG 7510, EL + CAS 371, TI 24.7

GFT DF CORR L2 25.0

RECORD OF FIRE

CALL FOR FIRE

Observer FROM HIGHER HQ AF/FFE/IS/S _____ Tgt _____

Grid: 60259 40648 ALT 327

Polar: Dir _____ Dis _____ U/D _____ VA ± _____

Shift _____ : Dir _____ L/R _____ +/- _____ U/D _____

OSHELL NUC, FZ VT HIGH, HOB +80 → Si÷10 | 10 mil Si

FIRE ORDER #1, USE GFT, SHELL NUC, LOT TZ, CHG2, FZ VT, HIGH ⓘ HOB +80 AT MY COMMAND | Df Corr

PREPARE FOR ACTION

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Turn-off calculator	Slide ON/OFF Switch to left		
2	Place weapon system module in calculator			
3	Connect external power as required			
4	Turn-on calculator			
5	Verify light emitting diodes	.,+/-,8888888888	-.8888888888	
6	Verify module system	2ND,PGM,01,E	1.001010102	M101A1/M102
			1.000000114	M114A1
			*1.001090114	M109/M114A2
			1.000000109	M109A1
			1.000001102	M110A2
			1.000000001	Special Situatfon
	Note. For M109/M114A2 only, designate system.			
	M109,Type:	109,ADVANCE	3200	M109common DF
	M114A2,Type:	114,ADVANCE	2400	M114A2common DF

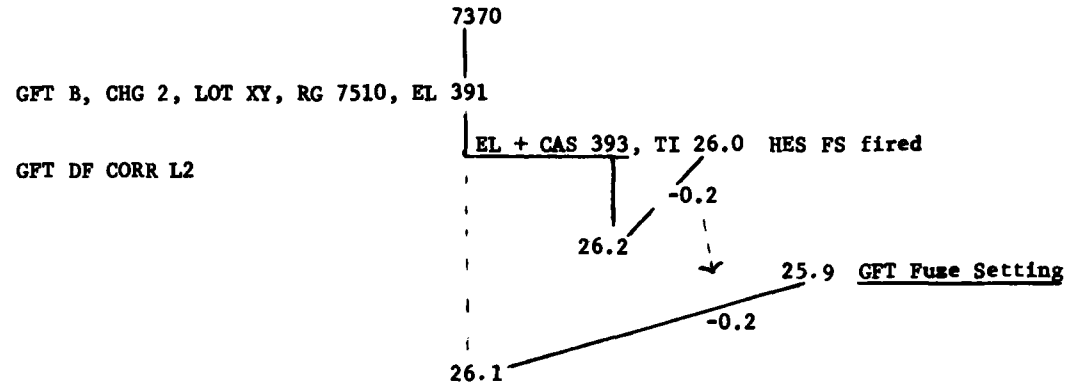
PROGRAM SET UP

7	Recall CHG 5WB constants	2ND PGM,06,A	107.06	
8	Clear display	CLR	0	
9	Recall gunnery program	2ND,PGM,02	0	

M110A2 K-TRANSFER NUCLEAR MISSION

GIVEN:

Weapon #1 Location: 60890 32615 ALT 352 AZ OF LAY 6350
Projectile Weights: HES 225 NUC 223
Powder Temperature: HES 30 NUC 20
TFT-8-R-1
High Explosive Spotter (M424A1) GFT Setting



RECORD OF FIRE

CALL FOR FIRE

Observer HIGHER HQ AF/FFE/IS/S Tgt

Grid: 60259 40648 ALT 327

Polar: Dir Dis U/D VA ±

Shift: Dir L/R +/- U/D

① SHELL NUC, FZ TI, HOB +200

Si÷10 10m S

FIRE ORDER #1, USE GFT SHELL NUC, LOT TZ, CHG 2, FZ TI, ①, HOB +200, AT MY COMMAND

Df Corr

PREPARE FOR ACTION

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Turn-off calculator	Slide ON/OFF Switch to left		
2	Place weapon system module in calculator			
3	Connect external power as required.			
4	Turn-on calculator	Slide ON/OFF Switch to right	0	
5	Verify light emitting diodes	.,+/-,8888888888	-.8888888888	
6	Verify module system	2ND,PGM,01,E	1.000001102	M110A2

PROGRAM SET UP

7	Recall HES low angle constants	2ND,PGM,11,A	424.11	
8	Clear display	CLR	0	
9	Recall gunnery program	2ND,PGM,02	0	

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
	SET UP WEAPON #1 AS A BATTERY			
10	WPN #1 Easting	60890,ENTER,$BTRY_E$	60890	
11	WPN #1 Northing	32615,ENTER,$BTRY_N$	32615	
12	WPN #1 Altitude	352,ENTER,$BTRY_A$	352	
13	Azimuth of Lay	6350,ENTER,AZ LAY	6350	
	DETERMINE AND APPLY SHELL HES, CHG 2 RESIDUALS			
14	Fix Display format	TGT_E,2ND,$BTRY_N$	6350	
15	Range K	7370, ÷ ,7510,=	.9813581891	
16		ENTER,RG K	.9813581891	
16	GFT Deflection Correction	2,ENTER,DF CORR	2	
17	Fuze K	25.9, ÷ ,26.1,=	.9923371648	
		ENTER,FZ K	.9923371648	
18	Apply to Charge 2	2,ENTER,RES/CHG	.98	Range K
			2	GFT DF CORR
			.99	Fuze K
			1	Displayed
	ENTER TARGET DATA			
19	TGT Easting	60259,ENTER,TGT_E	60259	
20	TGT Northing	40648,ENTER,TGT_N	40648	
21	TGT Altitude	327,ENTER,TGT_A	327	
22	Height of Burst	200,ENTER,UP/DN	200	
23	Compute Azimuth and Range	A	6320	Azimuth flashed
			8058	Range displayed
24	Record Chart Range on line 6 of DA Form 4207			

8-INCH NUCLEAR COMPUTATION

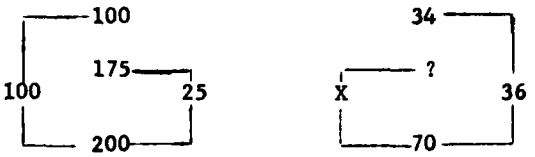
K-TRANSFER

1	Alt of Tgt	(1M)	
2	HOB Above Tgt	(1M)	
3	Alt of Burst (1 plus 2)	(1M)	
4	Alt of Btry	(1M)	
5	HOB Above Gun (3 minus 4)	(1M)	
6	Chart Rg to Tgt	~~(10M)~~	8058
7	Comp Rg (Tbl B)	(1M)	
8	Entry Rg (6 plus 7) [(1m)] ≈	(100M)	

25	Compute HOB above Gun and record on line 5	RCL,13	527	ALT OF BURST
		RCL,03	352	- BTRY ALT
		527,-,352,=	175	= HOB above gun

5	HOB Above Gun (3 minus 4)	(1M)	175

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
26	Compute Comp Range (Tbl B) and record on line 7. (Interpolate Comp RG to 1M VI accuracy)	VI	COMP RG	



$\frac{25}{100} = \frac{X}{36}$

$100X = 900$

$X = 9$

70 -9 = 61 COMP RG

27 Comp RG + CHT RG = TBL F ENTRY RG

5	HOB Above Gun (3 minus 4)	(1M)	175
6	Chart Rg to Tgt	~~(10M)~~	8058
7	Comp Rg (Tbl B)	(1M)	+61
8	Entry Rg (6 plus 7) [8119 (1m)] ≈ (100M)		8100

28 Compute Projectile Weight and Temperature Corrections by completing lines 9 through 18.

6	Chart Rg to Tgt	~~(10M)~~	8058	
7	Comp Rg (Tbl B)	(1M)	+61	*
8	Entry Rg (6 plus 7) [(1m)] ≈ (100M)		8100	
9	△ MV (Tbl E) [NUC PT (20 °F)]	(0.1M/S)	-4.8	
10	△ MV (Tbl E) [Spot PT (30 °F)]	(0.1M/S)	-3.8	
11	Difference (9 minus 10)	(0.1) D/I	1.0	
12	Unit Corr (Tbl F, Col 10/11)	(0.1)	-21.1	
13	Corr for Prop Temp (11 X 12)	(1M)	-21	*
14	NUC Wt	(1Lb)	223	
15	Spotter Wt	(1Lb)	225	
16	Difference (14 minus 15)	(1Lb) D/I	2	
17	Unit Corr (Tbl F, Col 18/19)	(1.0)	-7	
18	Corr for Proj Wt (16 X 17)	(1M)	-14	*

29 Total all corrections:

	COMP RG CORR	+61 (line 7)
	PROP TEMP CORR	-21 (line 13)
	PROJ WT CORR	-14 (line 18)
=	RG CORR	26

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
30	Enter Range Correction	26,ENTER,RG	26	COMP RG, WT & TEMP RG CORR
31	Enter Gun Target Azimuth as OT DIR	6320,ENTER,OT DIR	6320	
32	Charge Selection	C	2	
33	Override Fuse Time NO 20/R	2ND,A	2	

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
34	Compute corrected range, Record on line 19.	B	6320 8084	Azimuth flashed Corrected range displayed

19	Corrected Rg (6+(13+18))	8084	(1m) ≈ (10M)	

35	Compute FS ~ EL + COMP SITE, Record on line 25	D	28.8

25	FS ~ 24 (HES GFT Setting)	(0.1)	28.8

36	Compute HES ADJ DF, Record on line 28.	ADVANCE	3241	This is ADJ DF

28	~~Gnt DF to Tgt~~ ADJ DF	(1ρ)	3241
29	DF Corr [GFT Df _____ + Drift ~ El 20 _____]		NA

37	Compute HES Quadrant Record on line 32	ADVANCE	461	

32	QE for Spotter, 22	(1ρ)	461

38 Refer to Table M, CHG 2 (TFT 8-R-1), determine and apply ballistic corrections.

25	FS ~ 24 (HES GFT Setting)	(0.1)	28.8	
26	Bal Fz Corr for NUC (Tbl M)	(0.1)	+0.2	
27	FS to Fire (25 plus 26)	(0.1)	29.0	Nuclear Timer Setting
28	~~Gnt DF to Tgt~~ ADJ DF	(1ρ)	3241	
29	DF Corr [GFT Df _____ + Drift ~ El 20 _____]		—	
30	Bal Df Corr for NUC (Tbl M) [R0 70ρ] ≈	(1ρ)	R1	
31	DF to Fire (28+29+30)	(1ρ)	3240	Nuclear Deflection
32	QE for Spotter, 22	(1ρ)	461	
33	Bal QE Corr for NUC (Tbl M)	(1ρ)	+4	
34	QE to Fire (32+33)	(1ρ)	465	Nuclear Quadrant

DA FORM 1 OCT 78 4207 REPLACES DA FORM 4207 (JAN 74) A (JAN 74), WHICH ARE OBSOLETE.

39	END OF MISSION	E	0

M110A2 MET + VE NUCLEAR MISSION

GIVEN: WPN DATA
TFT 8-R-1
WPN #1 LOC 60890 32615 ALT 352
AZ OF LAY 6350

TGT DATA

RECORD OF FIRE

CALL FOR FIRE

Observer HIGHER HQ AF/FFE/IS/S _____ Tgt _____

Grid: 61520 44657 ALT 410

Polar: Dir _____ Dis _____ U/D _____ VA ± _____

Shift _____ : Dir _____ L/R _____ +/- _____ U/D _____

① SHELL NUC, FZ TI, HOB +140 | ∠Si÷10 | 10 m Si

FIRE ORDER #1,USE TFT,SHELL NUC,LOT TZ,CHG 3,FZ TI, ① HOB+140,AT MY COMMAND | Df Corr

MET TO TARGET DATA (SUBSEQUENT MET)

A MET to the target was solved (using the special situation module). Extracts of the completed DA Form 4200 are shown below:

HEIGHT OF TARGET (burst) ABOVE GUN (ft)	+198	COMP RG	+40	CHART RG	12058	ENTRY RG	12098		12100

COMPUTATION OF VE

PROP TEMP °F	VE	M/S		TOTAL RANGE CORRECTION		
	CHANGE TO MV FOR PROP TEMP	M/S		MET RANGE CORRECTION	+148	
	ΔV	M/S	MV UNIT CORRECTION	ΔV RANGE CORRECTION	+64	
				TOTAL RANGE CORRECTION	+212	+212

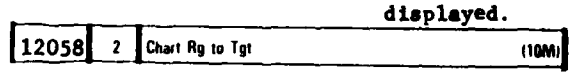
OLD VE _____ + NEW VE _____ = _____ ÷ 2 = AVG VE _____ M/S

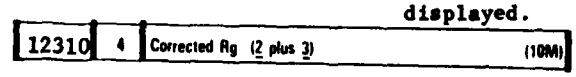
MET FUZE CORRECTION

	VARIATION FROM STANDARD	UNIT CORRECTION	PLUS	MINUS		
ΔV	D / I					
RANGE WIND	T / H					
AIR TEMP	D / I					
AIR DENSITY	D / I					
PROJ WEIGHT	D / I				TOTAL FUZE CORRECTION	
					MET FUZE CORRECTION	+0.1
					FUZE CORRECTION	-0.2
MET FUZE CORR					TOTAL FUZE CORRECTION	-0.1	-0.1

PREPARE FOR ACTION

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
1	Turn-off calculator	Slide ON/OFF Switch to left		
2	Place weapon system module in calculator			
3	Connect external power as required.			
4	Turn-on calculator	Slide ON/OFF Switch to right	0	
5	Verify light emitting diodes	.,+/-,8888888888	-.8888888888	
6	Verify module system	2ND,PGM,01,E	1.000001102	M110A2
	PROGRAM SET UP			
7	Recall HES low angle constants	2ND,PGM,11,A	424.11	
8	Clear display	CLR	0	
9	Recall gunnery program	2ND,PGM,02	0	
	SET UP WPN #1 AS A BATTERY			
10	WPN #1 Easting	60890,ENTER,$BTRY_E$	60890	
11	WPN #1 Northing	32615,ENTER,$BTRY_N$	32615	
12	WPN #1 Altitude	352,ENTER,$BTRY_A$	352	
13	Azimuth of Lay	6350,ENTER,AZ LAY	6350	
	ENTER TARGET DATA			
14	TGT Easting	61520,ENTER,TGT_E	61520	
15	TGT Northing	44657,ENTER,TGT_N	44657	
16	TGT Altitude	410,ENTER,TGT_A	410	
17	Height of Burst	140,ENTER,UP/DN	140	
18	Compute Azimuth and Range Record Chart Range on line 2	A	53 12058	Azimuth flashed Chart Range displayed.
19	Add the TOT RG CORR and COMP RG (from MET Form)	212,+,40,=	252	
20	Enter as a range shift	252,ENTER,RG	252	
21	Enter gun target direction as OT DIR	53,ENTER,OT DIR	53	
22	Compute corrected range. Record on line 4.	B	53 12310	Azimuth flashed Corrected range displayed.
23	Override Fuze TI NO 20/R	2ND,A	12310	
24	Charge Selection	C	3	





Note. No residuals are applied.

STEP	MISSION	KEYBOARD	DISPLAY	REMARKS
25	Compute Fuze Setting ~ EL + COMP SITE. Record on line 10.	D	38.3	

38.3	10	FS ~ 9 (Use MHL)	(0.1)

26	Compute Deflection	ADVANCE	3107	CHT DF + DRIFT
27	Determine drift ~ to corrected range (Ln 4) and subtract from displayed deflection.		3107 L10 3097	

3097	15	Cht Df to Tgt	(1mil)

28	Compute Quadrant for Spotter. Record on line 19.	ADVANCE	460	

460	19	QE for Spotter 7	(1mil)

29 Record the total fuze correction from the MET Form on line 11.

-0.1	11	Total Fz Corr (from met form)	(0.1)

30 Record the TOT DF CORR from MET Form on line 16.

L11	16	Total DF Corr (from met form)	(1mil)

31 Refer to Table M, CHG 3, TFT 8-R-1, and determine ballistic corrections for TI,DF, and QE. (Entry argument is HES, QE, and VI)

QE 3.3 (record on line 20)
FS 0.2 (record on line 13)
DF R0.7 (record on line 17)

32 Complete DA Form 4207 and apply the ballistic corrections to the HES spotter data.

	38.3	10	FS ~ 9 (Use MHL)	(0.1)
	-0.1	11	Total Fz Corr (from met form)	(0.1)
	38.2	12	FS for Spotter (10 plus 11)	(0.1)
	+0.2	13	Bal Fz Corr for NUC (Tbl M)	(0.1)
Nuclear Deflection	38.4	14	FS to Fire (12 plus 13)	(0.1)
	3097	15	Cht Df to Tgt	(1mil)
	L9	16	Total DF Corr (from met form)	(1mil)
	R1	17	Bal Df Corr for NUC (Tbl M) [__(Dkpl)] ≈	(1mil)
Nuclear Fuze Setting	3105	18	Df to Fire (15+16+17)	(1mil)
	460	19	QE for Spotter 7	(1mil)
	3	20	Bal QE Corr for NUC (Tbl M)	(1mil)
Nuclear Quadrant	463	21	QE to Fire (19+20)	(1mil)

33 END OF MISSION E 0