

PART THREE MORTAR BALLISTIC COMPUTER

CHAPTER 6 INTRODUCTION

This chapter describes the characteristics, capabilities, and memory storage of the mortar ballistic computer.

6-1. DESCRIPTION

The M23 MBC is handheld, lightweight, and battery powered. It is used for automated computations, digital communications, and displaying mortar-related information (Figure 6-1). The MBC weighs 7 pounds (including battery) or 8 pounds (including battery and case assembly). It is highly portable, can be used in all-weather operations, and has built-in self-test circuits. The MBC requires fire mission data input to compute fire commands needed to effectively execute a mortar fire mission. When the MBC is connected to an external communication device (digital message device), the FO fire mission inputs are automatically entered and may be reviewed and edited by the MBC operator. When the MBC is not connected to an external communication device, all fire mission data are entered manually by the MBC operator. The fire commands are then relayed to the gun line IAW unit SOP.

a. **Initialization Switches** (Figure 6-2). These switches include the following:

(1) *SET UP—1*. Starts the menu for entry of setup data: timeout, target prefix and block number range, audio alarm, minimum easting and northing coordinates, location grid declination, latitude, listen only mode, message transmission rate, transmitter warm-up delay time, single or double message block mode, and owner identification.

(2) *WPN DATA—2*. Starts menus for entry of weapon data or review of weapon data for each unit: selection of up to three firing sections; grid location of the basepieces (normally the registering gun) for each of these sections; up to six individual gun locations for each section; and weapon type, carrier- or ground-mounted, altitude, azimuth of fire, and referred deflection being used.

NOTE: At this time, the MBC revision III/A does not allow entries with the same identifier. (For example, when using B02, the number 02 cannot be used again.)

(3) *FO LOC—3*. Starts menus for entry of data: FO number (12 maximum), grid location, and altitude.

(4) *REG DATA—4*. Starts menus for manually entering a registration data file for registration points (RP) or review of RP data: RP number, location, altitude, weapon unit and number; elevation for 107-mm or charge for the 60-/81-/120-mm; and type of MET data used when the RP was fired to include the range and deflection correction factors.

(5) *BRT—5*. Selects the level of brightness for the display area. Controls the background lighting for the keyboard. The MBC can be operated in total darkness if the brightness is set at LOW. When set at LOW, the background (keyboard) is lit.

(6) *ON/OFF*—6. Turns the MBC on or off. When turned on, the display temporarily shows POWERUP TEST, then shows READY.

(7) *FIRE ZONES*—7. Starts menus for entry of or review of fire zone/fire line boundaries: location points for fire lines, zone numbers, number of points for fire zone (no-fire area), and location points for fire zone boundaries.

(8) *MET*—8. Starts menus for entry of nonstandard MET: MET station data and location; and entry of nine lines of MET data including wind direction, speed, temperature, and pressure for each line of MET data.

(9) *KNPT/TGT*—9. Starts menus for data entry of known points or target reference points: known point or target number, grid location, and altitude.

(10) *AMMO DATA*—10. Starts menus for entry of ammunition data for each caliber weapon in use: ammunition types, powder temperature change, and correction factors for projectile weight.

(11) *TEST*—11. Manually starts self-test of microprocessor (ROM, RAM, and instruction set) for all switches and keys, display (character generation), modem (communication device), software revision number, and communications (transmit test message).

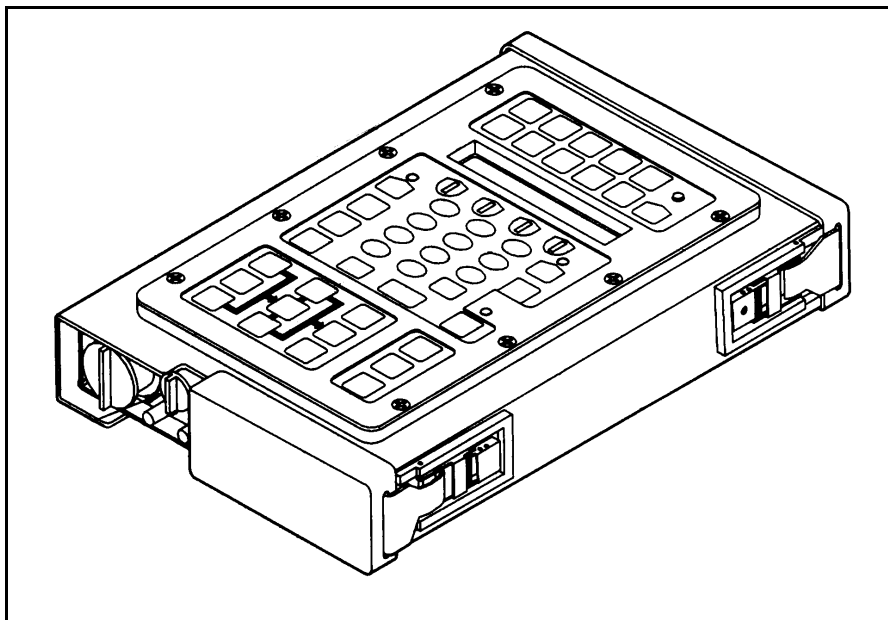


Figure 6-1. The mortar ballistic computer.

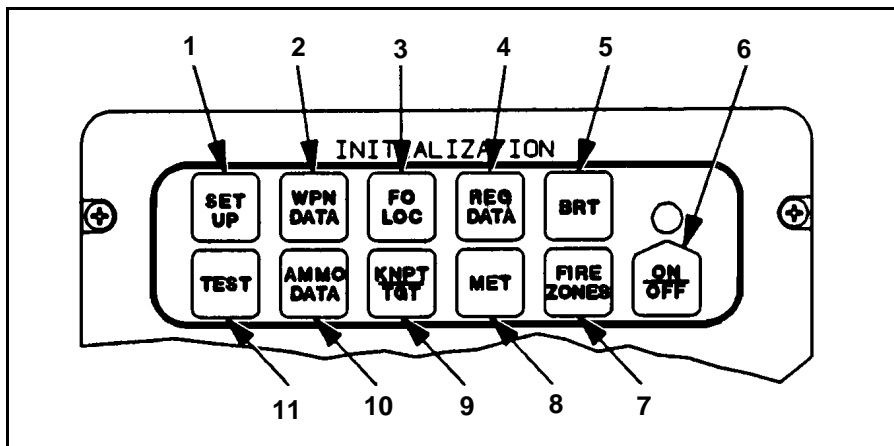


Figure 6-2. Initialization switches.

b. **Action Switches** (Figure 6-3). These switches include the following:

(1) *MSG—1*. Displays first line of a message transmitted by a digital message device (DMD).

(2) *SEQ—2*. Displays next line of menu to allow viewing or entry of data. Data entered from keyboard is not stored in memory until the SEQ switch is pressed.

(3) *BACK—3*. Displays previous menu line to allow reviewing or data changes (reverse-sequence through data).

(4) *XMIT—4*. Starts message to observer (MTO) menus or command message to observer (CMD) menus for entry and transmission of firing information to the observer.

(5) *CLEAR ENTRY—5*. Removes last (rightmost) character from a data field. Allows re-keying for an entry.

(6) *COMPUTE—6*. Starts computation of fire mission data, survey data, registration data, and adjustments.

(7) *EOM—7*. Starts menus for manual entry of end-of-mission instructions to delete all mission data or end the active mission and to store the final target grid location in the target file.

(8) *MSN—8*. Starts menus to review current fire mission data and to assign a mission number (making the mission operational). This allows changing to mission buffers and applying corrections to a subsequent mission.

(9) *SURV—9*. Starts menus for manual entry of survey data for computation. Survey types are resection, intersection, and traverse. Data entries are horizontal and vertical angles, and distances. Computed answer may be stored as a known point, target, FO location, or base mortar location.

(10) *REVIEW—10*. Returns display to first line of a message or to main menu currently in use.

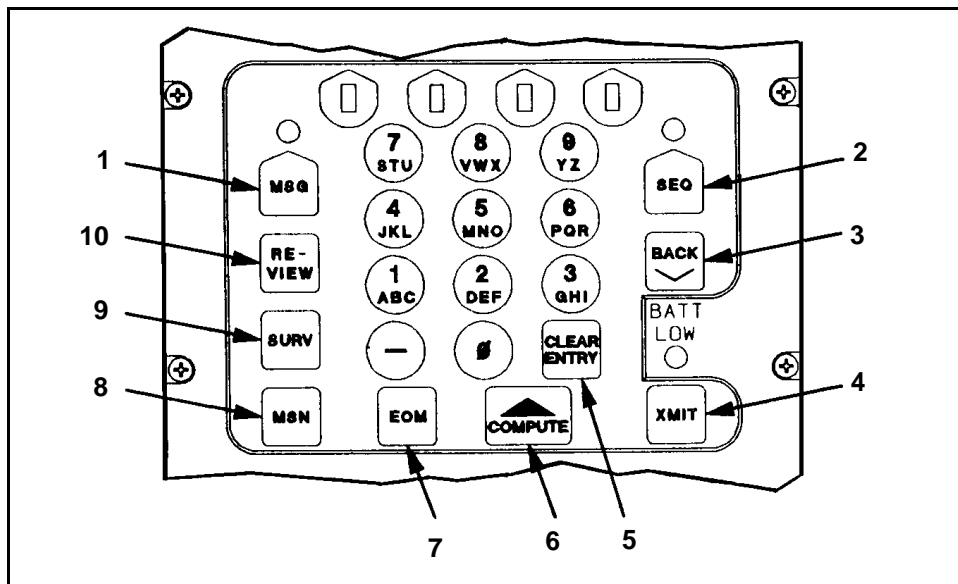


Figure 6-3. Action switches.

c. **Keys** (Figure 6-4). Eleven keys are used to enter alphabetical (alpha) or numerical (numeric) characters and minus sign. Alpha or numeric selection for combination keys is either automatic or menu-selectable.

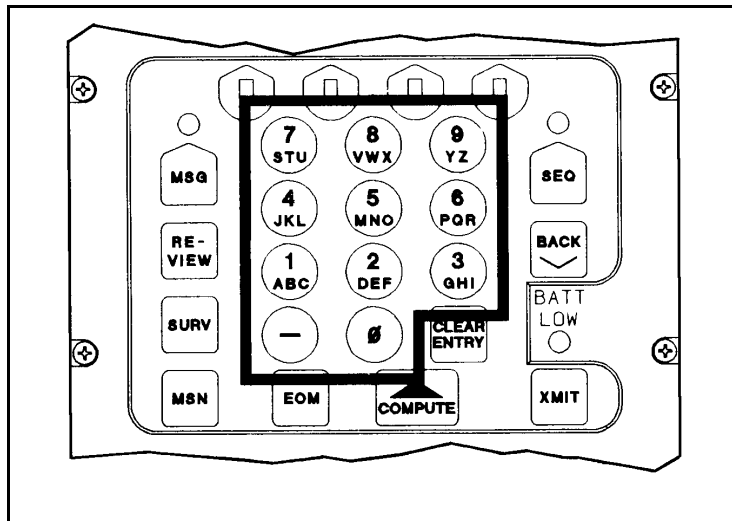


Figure 6-4. Alphanumeric and minus sign keys.

d. **Fire Missions** (Figure 6-5). The operator starts a fire mission menu by pressing the grid, shift, or polar keys.

(1) **GRID—I**. For manual entry of grid fire mission data when target location is identified by grid coordinates. Entries are: FO ID number, FO direction to target, target location, and altitude when known.

(2) *ADJ*—2. For manual entry of fire mission adjustment data (corrections) from the FO. By menu selection, use registration point data or MET data. Correction entries are: left or right deviations, plus or minus range, and up or down height.

(3) *REG*—3. For review of registration data, and computation and storage of registration point correction factors. Displayed output from computation includes range correction factor and deflection correction amount. (To review registration data, use REG DATA key.)

(3) *TFC*—4. For manual entry of technical firing data. Use to enter or change information for sheaf, method of control, and weapons to fire. Use registration point data or type of MET data.

(5) *FPF*—5. For manual entry of FPF line data, safety fan, and minimum/maximum charge. Entries are: FPF location, target altitude, target width, and attitude.

(6) *WPN/AMMO*—6. For manual entry or to change the weapon or ammunition data for a fire mission. Entries are: weapon unit and number (A section, No. 3 gun), shell and fuze combination, elevation (107-mm mortar) or charge (60-mm/81-mm mortar).

NOTE: When the 120-mm mortar data becomes available, the computer must be updated.

(7) *BURST*—7. For manual entry of burst location data (corrections) supplied by a laser-equipped FO. Entries, from laser to burst are: direction, distance, and vertical angle.

(8) *POLAR*—8. For manual entry of either a normal or laser-designated polar fire mission using polar plot data. A normal polar mission target is identified by direction, distance, and up/down height from an FO. A laser polar mission target is identified by laser direction, laser distance, and laser vertical angle.

(9) *SHIFT*—9. For manual entry of shift fire mission data when a target location is identified by a shift from an existing known-point target. Entries are: FO ID, known/target number FO direction to target, direction, and amount of shift.

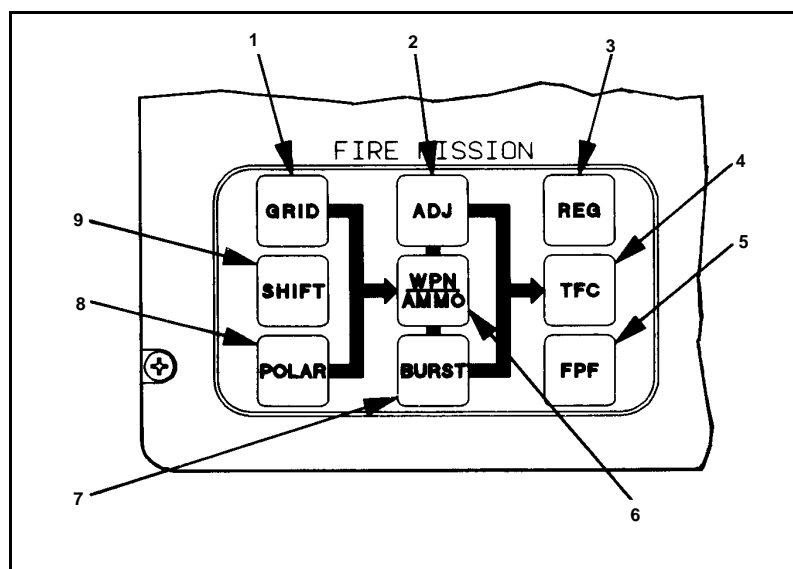


Figure 6-5. Fire mission switches.

e. **Output Switches** (Figure 6-6). These switches include the following:

(1) *FIRE DATA*—1. For reviewing existing fire commands of active fire missions. Data are the same as the COMPUTE switch output.

(2) *SFTY DATA*—2. Data menus for active fire missions to review safety factors. Enter boundaries for a safe firing area or a minimum and maximum charge for the safety area.

(3) *RELOT*—3. To review target replot data and to increase target location accuracy. Enter new target altitude then press RELOT switch to compute a new grid location.

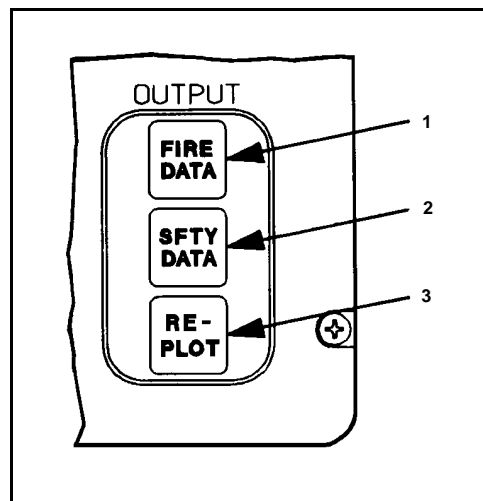


Figure 6-6. Output switches.

f. **Display Switches** (Figure 6-7). The display area displays up to 16 alphanumeric characters. The flashing character blocks signal a need for an operator action. To respond, the operator presses the display switch below the flashing block or the SEQ switch. Any combination of blocks (or none) may flash. If no block is flashing, there is no action required, and the operator cannot change what is shown on the display.

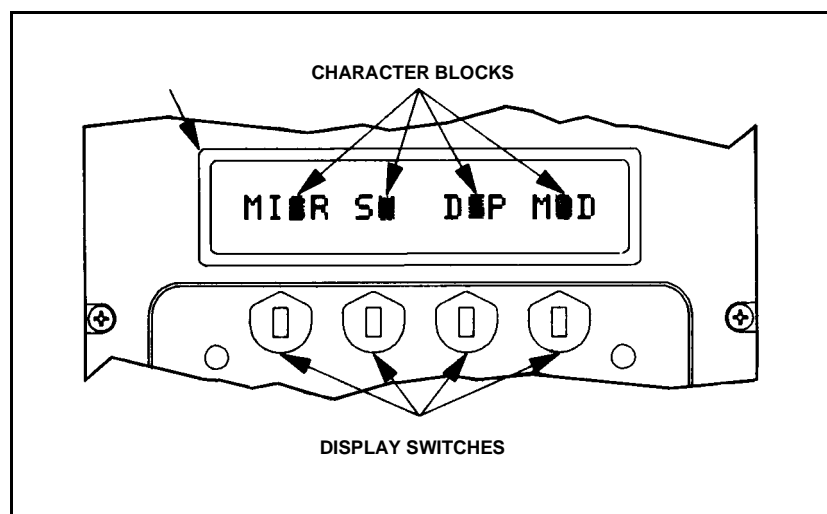


Figure 6-7. Display switches.

g. **LED Indicators** (Figure 6-8). LED indicators include the following:

(1) *Standby Indicator*—1. Indicates (when flashing) that the display timeout period has expired. Flashes once every 6 seconds while the display is "time out." To bring the last display back on, press any key once.

NOTE: It is recommended not to use the FIRE MISSION keys to bring the display back ON. Some of these keys are highly sensitive and a fire mission can be initiated accidentally. The safest key to use is the sequence key.

(2) *Sequence Indicator*—2. Indicates (when flashing) that more data are available for the current menu or display.

(3) *BATT LOW Indicator*—3. Indicates (when flashing) that the internal 12-volt battery is low. This indicator starts flashing when the battery output reaches 11 volts. The MBC shuts off at 10 volts. If the BATT LOW indicator starts flashing in the middle of a fire mission, continue with the mission, and change the battery as soon as possible.

(4) *Message Indicator*—4. Indicates (when flashing) that the MBC has received one or more digital messages. The flash rate increases with the number of messages received.

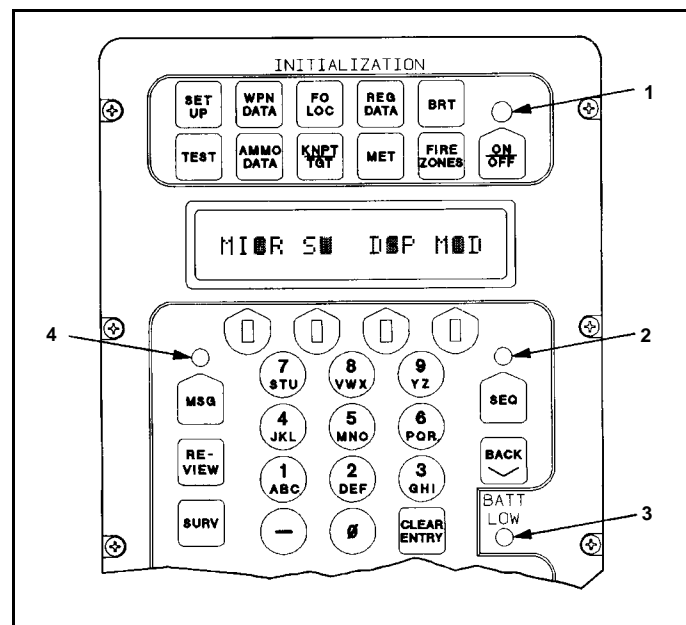


Figure 6-8. LED indicators.

Flash Rates: 1.25 times per second = one message
 2.5 times per second = two or more messages
 5 times per second = one or more FO command (CMD) messages

6-2. AUDIO ALARM

The internal audio alarm beeps continuously when digital messages are received. The beep rate for an FO CMD message is noticeably faster than the rate for other message types. To turn off the beeping alarm, the operator presses any switch or key. The alarm OFF/ON function is menu-selectable in the SET UP switch function.

6-3. CAPABILITIES

The MBC performs the following functions:

a. Communicates with the digital message device (DMD). Incoming messages are of two types: fire request messages and information only messages. When the message indicator is lit or the audio alarm sounds and the MSG switch is pressed, the first line of the first message received is displayed. When the message is a fire mission, the MBC automatically assigns a mission and target number, unless three active fire missions are in progress. Therefore, the MBC displays NO AVAIL MSN and discards the message.

b. Handles a full range of mortar ammunition. The ammunition file in the MBC contains the following ammunition for each mortar system. The first round listed by type is the MBC "default" ammunition.

(1) *M224, 60-mm mortar.*

High explosive: *M720; M49A4; (X)M888

White phosphorus: *M302A1; #M302A2; M722

Illumination: *M83A3; M721

(2) *M252 and M29, 81-mm mortars.*

High explosive: *M374; M374A2; M374A3; M821; M889; #M889A1; #M821A1

White phosphorus: M375; *M375A2; M375A3

Illumination: *M301A3; M853A1

Training/Practice: *M1; M68; M879; #M880 (TP ammunition must be ground-mounted mode only)

Red phosphorus: M819

(3) *M30, 107-mm mortar.*

High explosive: *M329A1; M329A2

White phosphorus: *M328A1

Illumination: M335A2

Tactical CS: (X)M630

(4) *120-mm mortar.*

High explosive: M933; *M934; **M57

White phosphorus: **M68; *M929

Illumination: **M91; *M930

(5) *M303 insert, 120-mm mortar.*

High explosive: *M374; M374A2; M374A3

White phosphorus: M375; *M375A2; M375A3

Illumination: M301A3

Training/Practice: M880

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*Default ammunition.

**NDI ammunition.

#Revision III/A.

c. Computes and applies registration corrections.

d. Computes and applies MET corrections.

e. Computes firing data for all fire mission types.

- f. Allows mortar dispersion up to 999 meters from the basepiece.

6-4. MEMORY STORAGE

The memory storage specifications of the MBC are as follows:

- Active fire missions (3).
- Messages in the message buffer (3).
- Weapon systems; three sections/platoons with up to six mortars each (up to 18).
- FO locations with their call signs (12).

NOTE: At this time, the MBC revision III does not allow entries with the same identifier (for example, when using B02, the 02 cannot be used again).

- Known points/targets (50).
- Registration points (16).
- Firing sections (3).
- No-fire zones; must have a minimum of 3 points; 80 total points are available (10). All zones share 80-point pool.
- Points for each no-fire zone (8).
- FPFs files; one for each section/platoon (3).
- Safety fans; one for each section/platoon (3) with each diagram capable of having ten fans (0 to 9).
- One no-fire line.

6-5. ERROR MESSAGES

The following messages are error messages the might appear. Also after the error message, there is an explanation along with the action to be taken.

@ = Alpha character
 # = Numeric character
 \$ = Alpha or numeric character

ERROR MESSAGE	EXPLANATION/ACTION
@@ * RANGE ERR *	Target location cannot be precisely achieved by ballistic calculations. Following menu indicates error magnitude. ACTION: Verify all initialization and input data. Check error magnitude in following menu. If error is excessive, use alternate weapon or ammunition type.
ERROR MESSAGE	EXPLANATION/ACTION
@# ACTIVE, MSN #	Weapon selected (@#) is now activated for mission #. ACTION: Choose an alternate weapon not now in use, or terminate mission #.

@# IS BP When entering WPN BATA, basepiece number entered as alternate piece.

ACTION: Enter correct weapon number.

@# MISSED: ##### Follows *RANGE ERR* message. Indicates error magnitude as distance in meters from target.

ACTION: Verify all initialization and input entries. If error is excessive, select an alternate charge, weapon, or ammunition type.

@# NOT FOUND No WPN DATA entered for this weapon.

ACTION: Enter WPN DATA for this weapon or choose an alternate weapon.

@#:@# DANGER WARNING: Friendly weapon is positioned at or near computed target location. First @# is firing weapon ID. Second @# is endangered weapon position ID.

ACTION: Verify target and FO location entries. If locations are correct and endangered FO is still in place, verify mission.

@#:@/## DANGER WARNING: Friendly FO is positioned at or near computed target location. The @# is firing weapon ID. The @/## is endangered FO ID.

ACTION: Verify target and FO location entries. If locations are correct and endangered FO is still in place, verify mission.

^ AZ TOO BIG Difference between safety fan LLAZ and RLAZ entries is 3200 mils or more.

ACTION: Change safety fan LLAZ and RLAZ entries to get delta azimuth of less than 3200 mils.

^ AZ TOO SMALL Difference between safety fan LLAZ and RLAZ entry is less than 400 mils.

ERROR MESSAGE

EXPLANATION/ACTION

ACTION: Change safety fan LLAZ and RLAZ entry to get delta azimuth of at least 400 mils.

^ RANGE TOO SMALL Difference between safety fan MIN RN and MAX RN entries is less than 200 meters.

ACTION: Change SFTY DATA MIN RN and MAX RN entry to get delta range of 200 meter meters or greater.

ADJ COMPLETE All weapons in sheaf are already adjusted.

ACTION: No further adjustments are possible within current mission.

BAD AIR DENSITY Temperature and pressure entries will not yield ballistics solution.

ACTION: Verify temperature and pressure values. If correct for given MET, data are not usable in MBC.

BAD CHARGE ZONE SFTY DATA, MIN CHG entry is greater than MAX CHG entry.

ACTION: Change MIN CHG and MAX CHG entries so that MIN CHG is less than or equal to MAX CHG.

BAD FO:@/## FR Fire request message received from FO for which no initialization was entered. Corrections cannot be computed.

ACTION: If action is required, enter FO LOC initialization data.

BAD HEIGHT Absolute altitude or delta height is outside the range-400 meters to 10,000 meters.

ACTION: Verify all altitude, height, or vertical angle entries. If all values are correct, given mission cannot be computed.

BAD KNPT:## SHFT Upon receipt of FR SHIFT message, known point message is not stored in KNPT buffer.

ERROR MESSAGE EXPLANATION/ACTION

ACTION: If known point is valid, enter KNPT data. If known point number is in error, orally request retransmission of corrected message.

BAD POWER UP Hardware malfunction; memory probably corrupted.

ACTION: Power down and back up several times. If this or another power-up error occurs, check battery or power supply. If error still occurs, return MBC to next higher maintenance level.

BAD ^ HEIGHT

Similar to BAD HEIGHT error. Computed delta height exceeds acceptable limits.

ACTION: Verify all altitude, height, and vertical angle entries. If all values are correct, given mission cannot be computed.

BAD ^ WIND ##-##

Direction and velocity entries in consecutive MET datum planes yield easting and northing wind components that differ by more than 29 knots. The ##-## indicates MET datum planes in error.

ACTION: Verify direction and velocity entries for stated MET datum planes. If correct for given MET, data are not usable in MBC.

BANK:FAIL

Memory bank switching hardware failure.

ACTION: Return MBC to next higher maintenance level.

BAT @ NOT FOUND

Initialization data not yet entered for this battery.

ACTION: Enter initialization data for this battery or select weapon from another battery.

CHARGE VIOLATION

Illegal cartridge-fuze-charge combination entry, such as:

- 81-mm, with VT fuze, at charge 0.
- 107-mm, with VT fuze, and charge less than 10.
- 107-mm, carrier mounted, at an elevation of 1065 mils, and a charge greater than 32.

ERROR MESSAGE**EXPLANATION/ACTION**

ACTION: Make alternate WPN/AMMO entries to avoid the above illegal combinations.

CHG TOO BIG

Minimum range for user-selected charge is greater than range to target.

ACTION: Leave charge field blank (MBC selects optimum charge) or enter valid smaller alternate charge. If valid charge

	cannot be found for these WPN/AMMO entries, make alternate WPN/AMMO entries.
CHG TOO LOW	<p>User-selected charge maximum range is less than the range to target.</p> <p>ACTION: Leave the charge field blank (MBC selects optimum charge) or enter valid larger alternate charge. If valid charge cannot be found for these WPN/AMMO entries, make alternate WPN/AMMO entries.</p>
DEFL TOO BIG	<p>Required deflection exceeds maximum left or right traverse limitations for carrier-mounted 107-mm mortars.</p> <p>ACTION: Select alternate weapon for which limitations are not exceeded.</p>
DISP \$\$\$ MEM \$\$\$	<p>Follows REV NO. FAILURE error message. Indicates revision numbers for display/processor and memory respectively.</p> <p>ACTION: Return MBC to next higher maintenance level.</p>
DUPLICATE WPNS	<p>Same weapon number entered two or more times into TFC, GUNS selection for multiple weapon missions.</p> <p>ACTION: Delete duplicate entries.</p>
E TOO BIG	<p>Computed delta easting exceeds 32767.</p> <p>ACTION: Verify all entries affecting delta easting. Also verify that MIN E and MIN N entries in the SET UP data are appropriate for mission coordinates.</p>
ERROR MESSAGE	EXPLANATION/ACTION
ENTRY NOT FND	<p>Required FO, KNPT, or TGT initialization data not yet entered into the appropriate memory file.</p> <p>ACTION: Enter initialization data for required FO, KNPT, or TGT, or choose alternate course of action not requiring this data.</p>
EXCESSIVE WIND	Wind deviations exceed stability limitations of MBC.

	ACTION: Verify MET entries. If correct, this MET is unusable.
FATAL ERR, REINIT	Mission data have been corrupted. ACTION: End mission with EOM and restart mission from beginning.
FILE EMPTY	No data in initialization data buffer. ACTION: Verify the initialization function selection under review and enter the required initialization data.
FILE FULL	No more initialization data storage space available in buffer. ACTION: Delete unneeded data to make space for new initialization data entries.
FO TOO CLOSE	FO is too close to target to perform MPI mission (within 10 meters). ACTION: Verify FO and target coordinate entries.
FORMAT ERROR	All valid data not entered into blank menu fields. ACTION: Enter all required data into blank menu fields or select alternate menu sequence using appropriate action switch.
FPF LN EMPTY	Selected FPF line is now unused. ACTION: Select appropriate FPF line having stored data.
GUN IS ADJUSTED	Adjustments have already been completed for this weapon.
ERROR MESSAGE	EXPLANATION/ACTION ACTION: Select new weapon to ADJust only after all adjustments have been completed for the current weapon. Once new weapon is selected, previous adjustments are fixed and further adjustment is not permitted for weapon now in use.
ID ASSIGNED	This KNPT number or TGT number entry has already been used.

	ACTION: Choose alternate number for data storage, or delete stored data before storing new data.
ILL ENTRY	Illegal value entered into blank field of data entry menu. ACTION: Determine proper value range for data and change data entry accordingly.
ILLEGAL CHARGE	Manually entered charge is invalid for selected ammunition. ACTION: Leave charge field blank (MBC selects optimum charge) or enter valid alternate charge.
ILLEGAL SWITCH	Invalid keypress. ACTION: Check entry. Make only valid entries.
ILLEGAL TGT NUM	Target number is within target number block range assigned in SET UP. ACTION: Manually enter a target number outside range defined in SET UP, or notify sender to retransmit valid target number.
INST:FAIL	Processor failure. ACTION: Return MBC to next higher maintenance level.
LN ALREADY INIT	FPF line is already in use (initialized). ACTION: Select alternate FPF line or clear line to reinitialize.
MAX NOT GREATER	MAX fire line is closer than MIN fire line. ACTION: Verify MIN and MAX fire line entries.
ERROR MESSAGE	EXPLANATION/ACTION
MODEM:FAIL	Modem CCA failure. ACTION: Return MBC to next higher maintenance level.
MSG BUFFER EMPTY	No messages are stored in message buffers. ACTION: DO NOT press MSG switch unless message lamp is blinking.

MSN # UNASSIGNED	Unassigned mission selected for activation. ACTION: Activate an alternate mission when operating on a previously initiated mission.
MSN ERROR	Probable MBC software fault. ACTION: End mission and reenter. Compute mission. If error reoccurs, return MBC to next higher maintenance level.
N TOO BIG	Computed delta northing exceeds 32767. ACTION: Verify all entries affecting delta northing. Also, verify that MIN E and MIN N entries in SET UP data are appropriate for mission coordinates.
NO ACTIVE MSN	No missions are stored in mission buffers or no mission is presently activated. ACTION: Initiate new mission using GRID, SHIFT, or POLAR switch or fire request message; or select a stored mission using MSN switch and appropriate display switch.
NO ADJUST DATA	All required ADJust data have not been entered. ACTION: Do not press COMPUTE switch for an ADJ before viewing ADJ data entry field (DEV).
NO AVAIL MSN	Mission buffers are full (three missions stored). ACTION: Terminate one stored mission by selecting EOM, EOMRAT, or EOMFPF. Then initiate new mission.

ERROR MESSAGE**EXPLANATION/ACTION**

NO CURRENT MET	Current MET has not been initialized. ACTION: Enter or review appropriate NEW MET data and initialize CURR MET by pressing UPDATE*, or select STD MET.
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NO FO ENTERED	<p>No FO entry in mission input data.</p> <p>ACTION: When sending digital response to manual input mission, enter FO ID when beginning mission. FO ID is entered automatically in BMD-supported missions.</p>
NO MAP MOD	<p>Computation (such as computing gun orders) requires MIN E and MIN N coordinates, and none were assigned in SET UP data entry.</p> <p>ACTION: Completely initialize SET UP data.</p>
NO OUTPUT DATA	<p>Review of FIRE DATA or SFTY DATA or other operation (such as ADJ, REG, or REPLOT) requires existing output data.</p> <p>ACTION: Press COMPUTE switch after properly entering appropriate mission input data.</p>
NO SHEAF DATA	<p>SPECIAL sheaf selected but without width or direction entry.</p> <p>ACTION: Enter all sheaf data before pressing COMPUTE switch.</p>
NO TGT DATA	<p>Insufficient target location data.</p> <p>ACTION: Press MSN switch, then sequence through mission input data menus. Enter all input data on all entry menus.</p>
NO TGT NUM	<p>Target numbers not yet assigned for target block definition in SET UP data.</p> <p>ACTION: Assign new block of target numbers using SET UP initialization menu sequence.</p>
ERROR MESSAGE	EXPLANATION/ACTION
NO TRIANGLE	<p>Line segments in SURV INT or RES problem do not converge.</p> <p>ACTION: Verify input angle and coordinate data entries.</p>
NO WPN DATA	<p>Weapon not yet selected using WPN/AMMO switch.</p> <p>ACTION: Enter weapon on WPN select menu before pressing COMPUTE switch.</p>

POWER FAILURE MBC Powered down by means other than ON/OFF switch, such as by removing battery or external power.

ACTION: Turn power off using ON/OFF switch before disconnecting power source.

PTS AVAIL:## Remaining number of points available in fire zone storage buffer when new fire zone entry contains too many points.

ACTION: Define new fire zone with fewer points or delete unused fire zones to provide additional buffer storage space.

RAM:FAIL @## IMICRO test random access memory failure.

ACTION: Return MBC to next higher maintenance level.

RANGE TOO SMALL Range to target is zero, or when entering FIRE ZONES data, distance between points is less than 10 meters.

ACTION: Verify mission input entry or FIRE ZONES data entry.

REG TOO BIG Range corrections exceed 999 meters when computing a REGistration.

ACTION: Register target only when range corrections are 999 meters or less (usually much less).

REV NO. FAILURE Memory CCA and display/processor CCA have incompatible revision numbers.

ACTION: Return MBC to next higher maintenance level.

ERROR MESSAGE	EXPLANATION/ACTION
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RANGE TOO BIG	Entered or computed range is too large.
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ACTION: Change distance or coordinate entries to reduce range to acceptable value.
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ROM:FAIL A##	MICRO test read-only-memory failure.
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ACTION: Return MBC to next higher maintenance level.
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SAFETY VIOLATION	Impact point is outside defined safety fan boundaries.
	ACTION: Verify target location and safety data entries. Reenter, if necessary. No further action can be taken.
SINGLE WPN ONLY	More than one weapon is designated on TFC sequence GUNS: @# _____ menu but selected TFC CONTROL allows only one weapon.
	ACTION: Select TFC CONTROL function allowing multiple weapons, or DO NOT enter additional weapons.
SPC SHEAF ERROR	Weapon registration is illegal while in TFC CONTROL (SPECIAL SHEAF).
	ACTION: To perform a registration, change TFC CONTROL selection.
SUPERSONIC	Calculated shell velocity exceeds mach 1.
	ACTION: Prevailing nonstandard conditions Provide inaccurate MBC calculations. Verify all nonstandard initialization entries including AMMO powder TEMP, AMMO weight corrections, all MET data, and target and weapon ALT.
TEMP OUT OF RANGE	Powder temperature entry outside range (-70 to 140).
	ACTION: Verify that powder temperature entry is within allowable range.

ERROR MESSAGE**EXPLANATION/ACTION**

TEMP TOO LOW	MBC cannot compute gun orders for 107-mm mortars with extension when powder temperature is below -30 degrees.
	ACTION: Mission cannot be fired under given conditions verify ammunition powder temperature and target location entries.
TEMP TOO LOW	Air temperature in MET data is below 1536 (153.6 degrees Kelvin or -183.2 degrees Fahrenheit)-
	ACTION: Verify that air temperature entry is 1536 or above.

TGT HIGH/RN BIG Target is beyond maximum range or maximum altitude at maximum allowable safe charge, and charge has not been manually entered.

ACTION: Mission cannot be fired under given conditions. Verify WPN/AMMO and target location entries.

TGT LOW/RN SMALL Target is below minimum range or minimum altitude at minimum allowable safe charge, and charge has not been manually entered.

ACTION: Mission cannot be fired under given conditions. Verify WPN/AMMO and target location entries.

TGT TOO HIGH Target altitude is greater than 90 percent of MAX ORD of computed flight trajectory. Reliable results cannot be obtained.

ACTION: Increase charge or elevation entries, if possible.