CHAPTER 12
PREPARATION OF FIRE CONTROL EQUIPMENT

Three types of firing charts can be constructed on the M16/M19 plotting board: the observed firing chart, the modified-observed firing chart, and the surveyed firing chart. This chapter discusses methods of constructing all three charts.

12-1. OBSERVED FIRING CHARTS

The mobile nature of modern combat often requires mortars to provide accurate and responsive indirect fire support before survey information is available. The observed firing chart provides this ability.

a. **Pivot-Point Method Without Use of Range Arms**. The observed firing chart (pivot point) is the simplest and fastest way to plot. The mortars are plotted at the pivot point. This allows the computer to use the vertical centerline to ensure that the mortar position and plot are parallel and to measure range faster.

(1) *Preparation of the plotting board*. Two items are needed to set up the plotting board for operation: a direction (azimuth) and a range from the mortar position to the target. The azimuth and range from the mortar position to the target are usually obtained from a map by plotting each position and then determining the grid azimuth and range. That information is then transferred to the plotting board (Figure 12-1). For example, the computer determines the initial direction (azimuth) between the mortar position and target is 3220, and the range is 2,600 meters.

(2) *Determination of mounting azimuth*. To determine the mounting azimuth (MAZ) from the DOF, the computer rounds off the DOF to the nearest 50 mils. (Round-off rule for obtaining the mounting azimuth: 0 to 24, round to 00; 25 to 74, round to 50; 75 to 99, round to 100.) The aiming circle operator uses the mounting azimuth to lay the section, and the computer uses it to prepare the M16/M19 plotting board. This gives the computer a starting point for superimposing the referred deflection scale at a longer graduation.

EXAMPLES

DOF 3200 = MAZ 3200
DOF 1625 = MAZ 1650
DOF 3150 = MAZ 3150

(DOF 3150 is already at the nearest 50 mils; there is no need to round off.)

(3) *Referred deflection*. The aiming circle operator gives the referred deflection to the FDC after the section is laid. The referred deflection can be any 100-mil deflection from 0 to 6300, as long as all of the mortars can place out their aiming posts on the same deflection. Normally, the referred deflection used is 2800 to the front or 0700 to the rear.

NOTE: Use only 2800 + 0700 to avoid sight block.

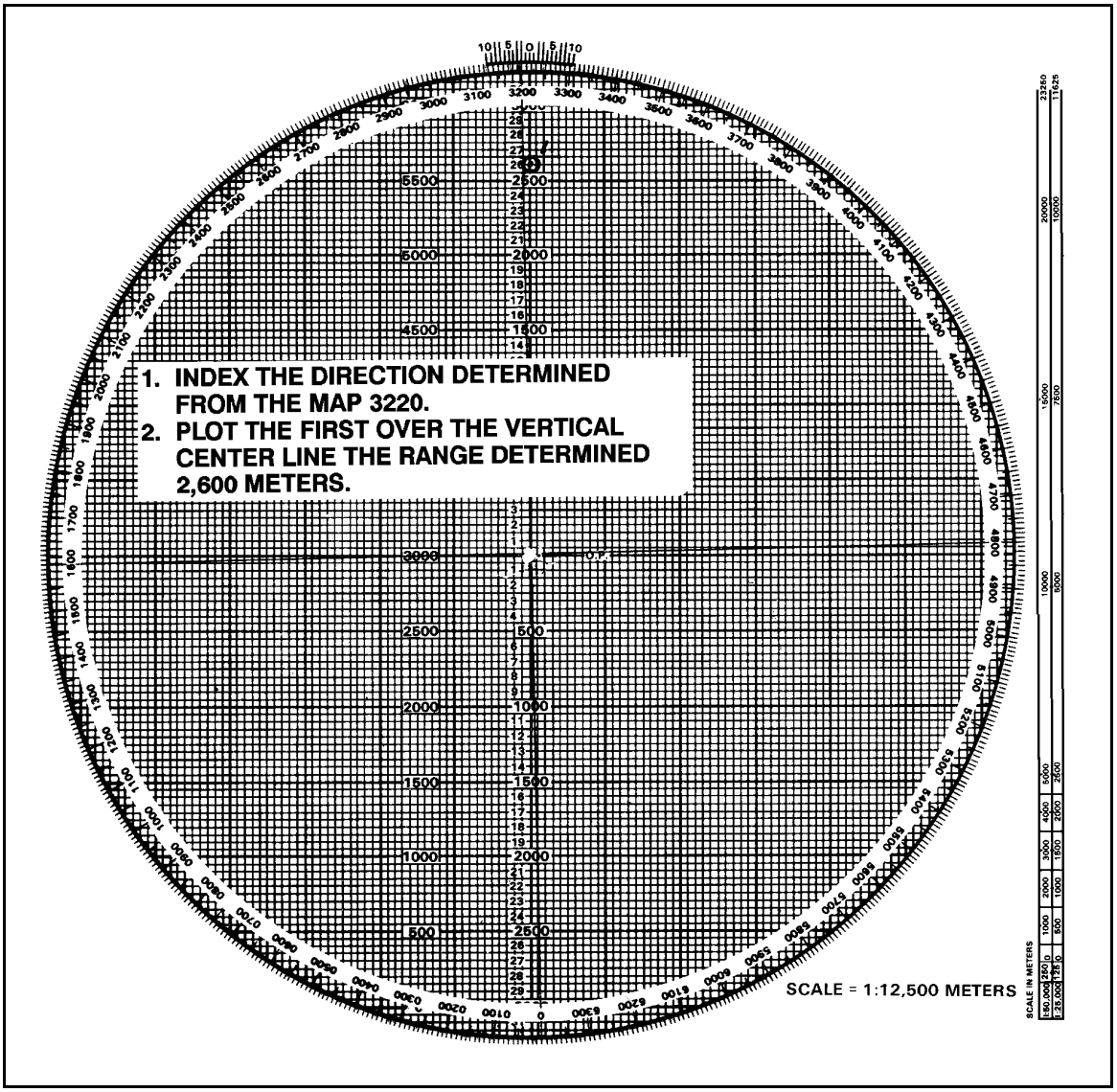


Figure 12-1. Preparation of the plotting board.

(4) *Superimposition of referred deflection.* The referred deflection is superimposed (written) on the azimuth disk under the mounting azimuth using the LARS (left add, right subtract) rule. The disk is normally numbered 400 mils left and right of the referred deflection (Figure 12-2), which is usually enough to cover the area of operation. However, if needed, the deflection scale can be superimposed all the way around the azimuth disk.

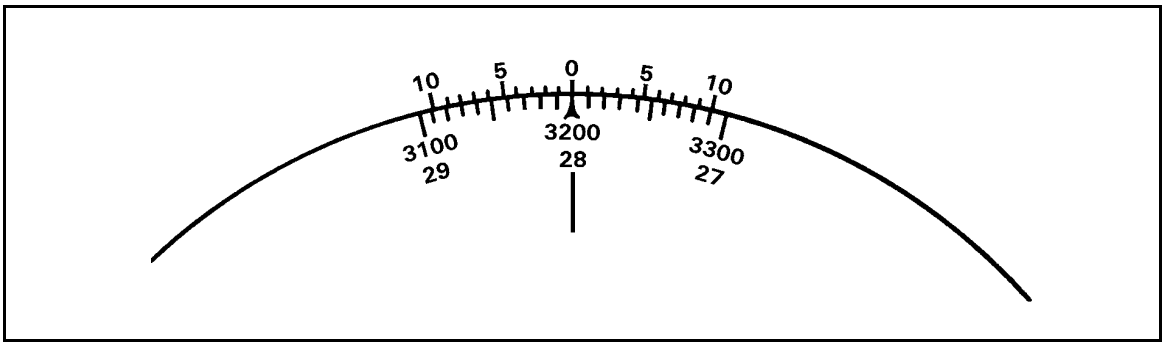


Figure 12-2. Superimposition of referred deflection scale under the mounting azimuth.

(5) *Determination of firing data*. After plotting the first round on the DOF at the determined range and superimposing the deflection scale, the computer rotates the azimuth disk until the first round is over the vertical centerline. He determines the deflection to fire the first round by using the deflection scale and the left portion of the vernier scale (Figure 12-3).

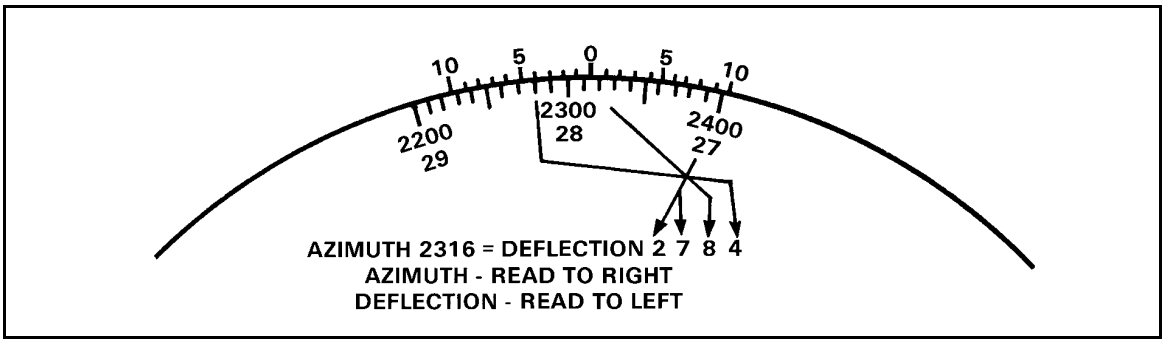


Figure 12-3. Determination of the deflection.

(a) Read the first two digits from the deflection scale. Since deflections increase to the left, read the first number (100-mil indicator) to the right of the index mark. In this example, it is 27.

(b) Read the third digit from the 10-mil graduations between deflection scale numbers 27 and 28 (100-mil indicators). Count the 10-mil graduations on the azimuth disk (from 27 to the index mark) to find that the index mark is between the eighth and ninth 10-mil graduations, making the third digit 8.

(c) Read the fourth digit at the vernier scale. For deflections, use the left half of the vernier scale. Count the 1-mil graduations, starting at the 0, to the left until one of the 1-mil graduations of the vernier scale and one of the 10-mil graduations on the azimuth disk are aligned. In this example, the fourth 1-mil graduation is aligned, making the fourth digit 4.

(d) Determine the range by rotating the plot over the vertical centerline and reading the range to the nearest 25 meters. Enter the firing table (such as FT 81-AI-3) and determine the charge as follows: Open the FT at TAB "PART ONE" and turn back one page (page XXXIX). This page is the charge-vs-range chart (Figure 12-4). It can be used to

determine the lowest charge to engage the target. To use the chart, find the range to the target using the range bar at the bottom of the chart. The range bar is numbered every 500 meters from 0 to 5,000 meters. Since the range to the target was determined to be 2,600 meters, estimate the 2,600 meters on the range bar. After determining the 2,600-meter point on the range bar, place a straightedge at the point so that it crosses the charge lines (Figure 12-5). The first charge line the straightedge crosses is the lowest charge possible to engage the target.

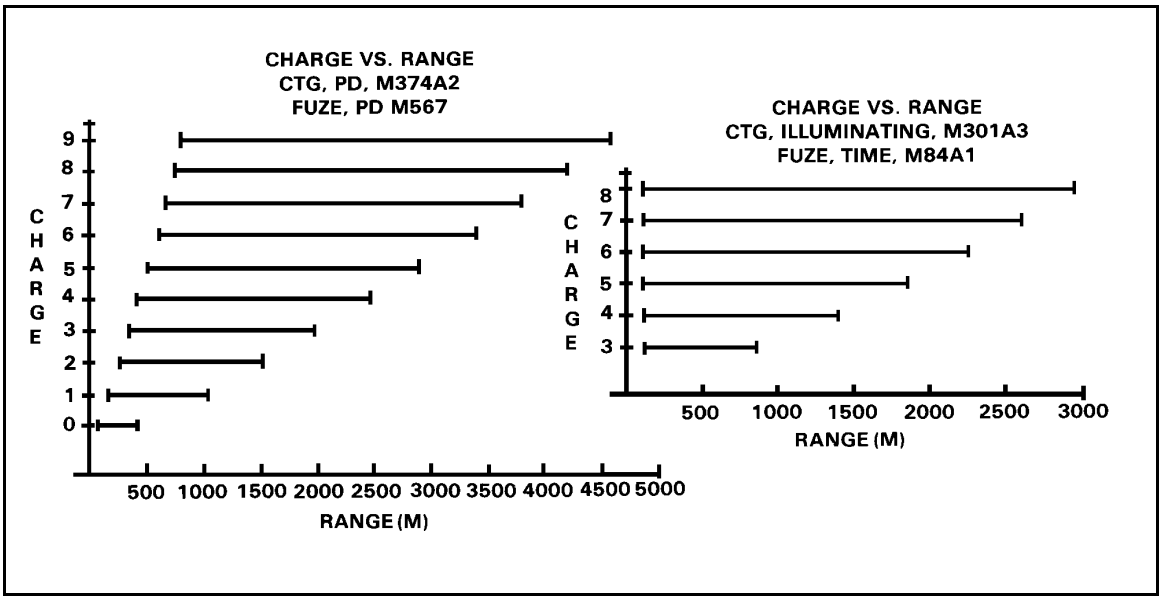


Figure 12-4. Charge-vs-range chart.

PART 1			PART 2		
CARTRIDGE, HE, M374A2 AND WP, M375A2			CARTRIDGE, ILLUMINATING, M301A3		
PART 1-0	CHARGE 0	70 - 401	PART 2-3	CHARGE 3	100-850
PART 1-1	CHARGE 1	181 - 1037	PART 2-4	CHARGE 4	100-1400
PART 1-2	CHARGE 2	263-1508	PART 2-5	CHARGE 5	100-1850
PART 1-3	CHARGE 3	348-1991	PART 2-6	CHARGE 6	100-2250
PART 1-4	CHARGE 4	432-2466	PART 2-7	CHARGE 7	100-2600
PART 1-5	CHARGE 5	513-2929	PART 2-8	CHARGE 8	100-2950
PART 1-6	CHARGE 6	592-3374	PART 209	FUZE SETTING CORRECTIONS	
PART 1-7	CHARGE 7	668-3802			
PART 1-8	CHARGE 8	741-4209			
PART 1-9	CHARGE 9	811-4595			

Figure 12-5. Determination of charge.

(e) Another method that can be used is to turn to page II in the FT. There is a listing of charges for M374A2 (HE) and M375A2 (WP) from charge 0 through charge 9. Below that listing is the charge listing for M301A3 illumination (illum) from charge 0 through charge 8. Write in after each charge the minimum and the maximum ranges that

each charge zone covers (Figure 12-6). By looking at the maximum range, the correct charge to use can easily be determined.

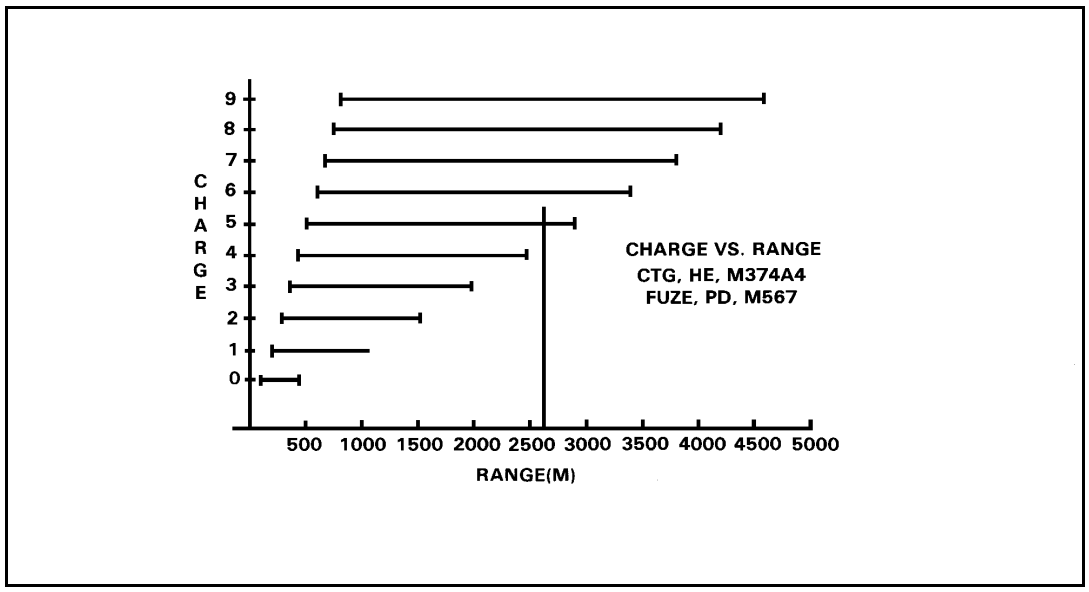


Figure 12-6. Charge zone and range.

(6) *Plotting of observer corrections*. To plot the FO's corrections, the computer first indexes the FO's direction to the target. That OT direction is given in the call-for-fire or with the first correction. Going from the last round, he applies the FO's corrections.

(a) For example, assume that the OT direction is 3050, and the FO sends these corrections: RIGHT 50, DROP 200. Ensuring that OT direction is indexed, make these corrections from the first plot (Figure 12-7).

(b) To do this, move to the right one small square (50 meters), then straight down the board four small squares (200 meters). Then, make a small plot, circle it, and label it "No. 2." To determine the firing data, rotate the disk until the No. 2 plot is over the vertical centerline. Then, read the deflection and range (Figure 12-8). Using the FT, determine the charge and elevation to fire the round, and compute the subsequent fire command.

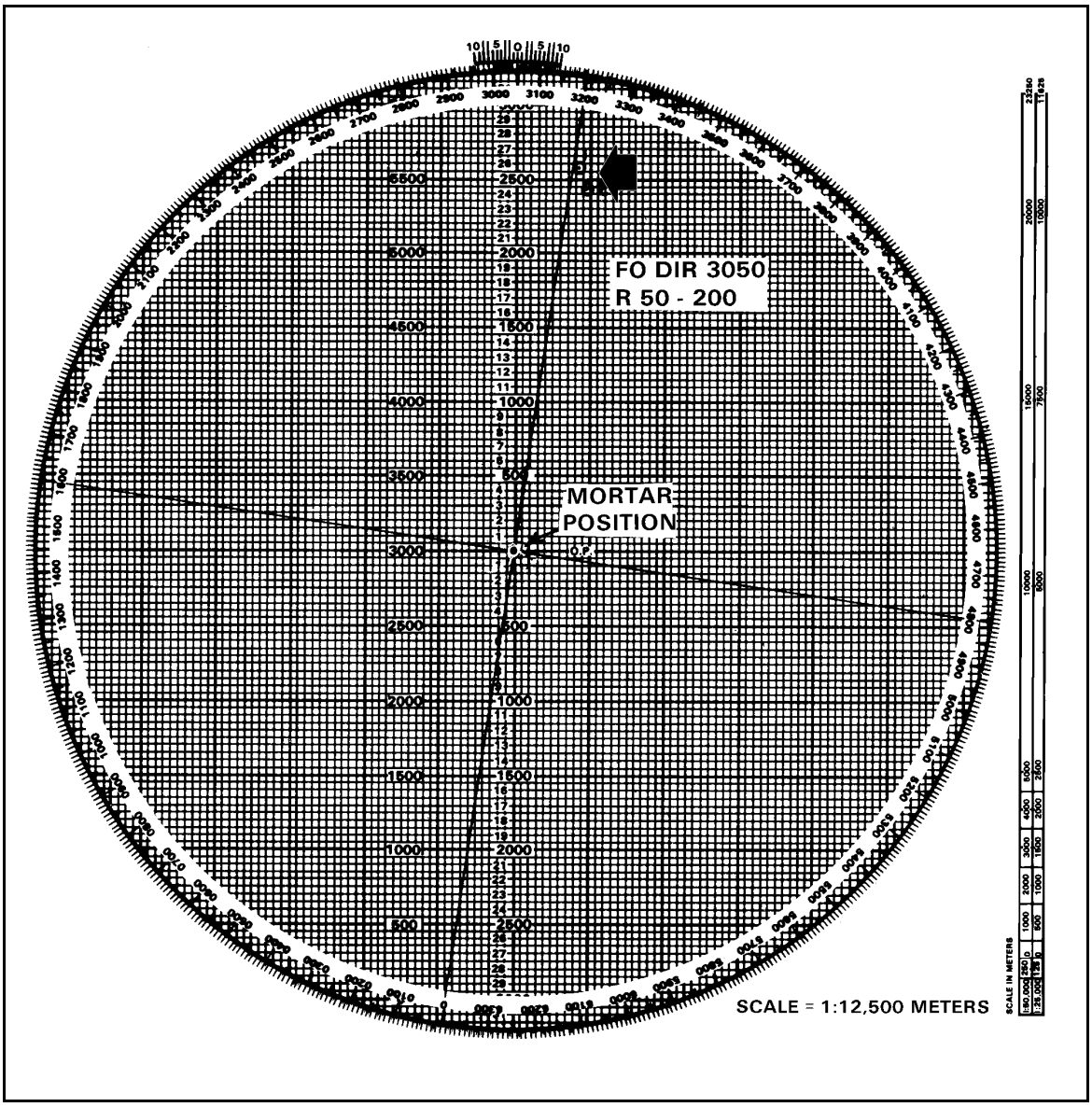


Figure 12-7. Plotting of observer's correction.

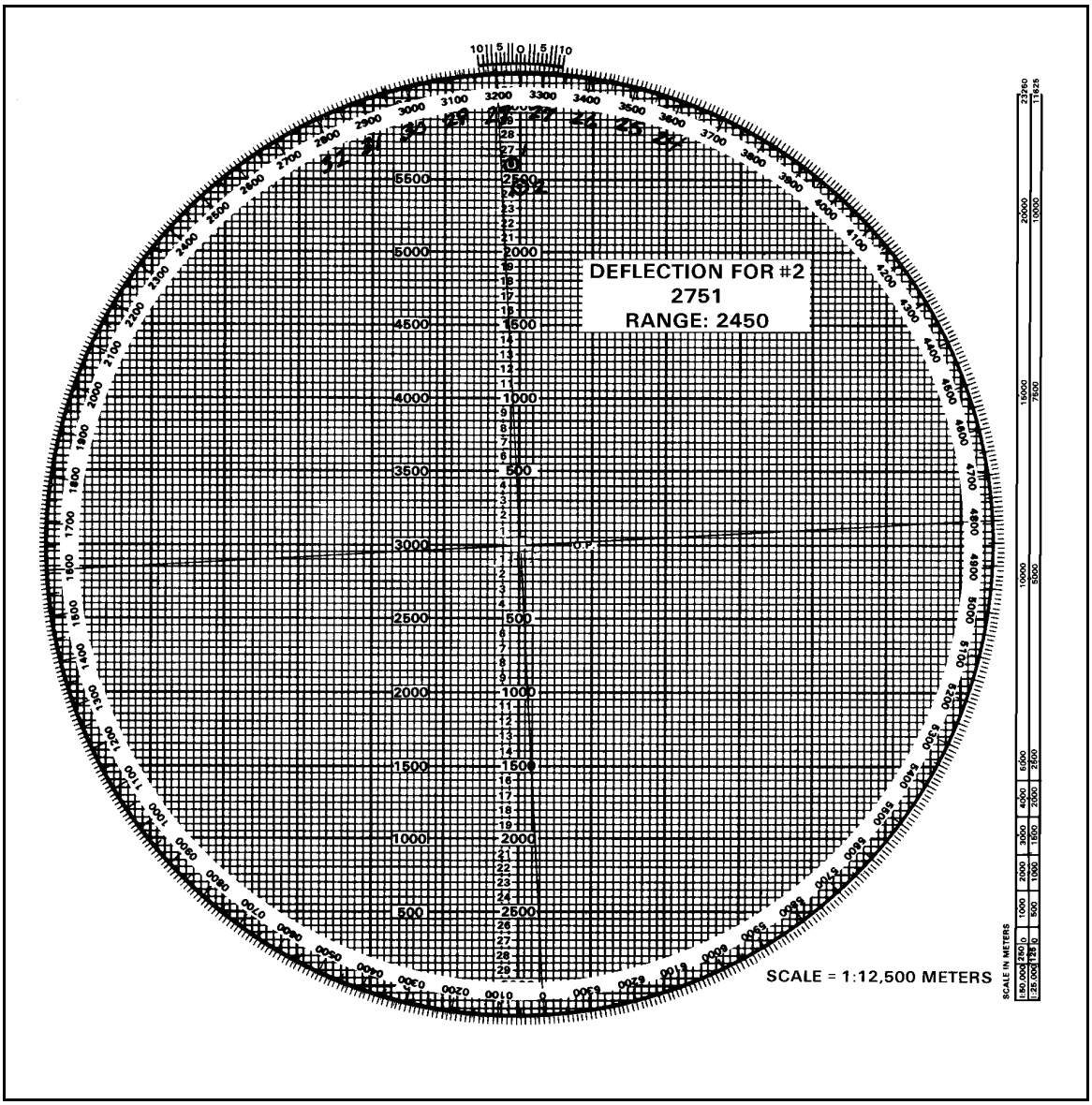


Figure 12-8. Determination of deflection and range.

(c) Once the end of mission (EOM) has been given, update the M16/M19 plotting board (Figure 12-9). To do this, erase all the plots except the final plot. Then enclose that plot with a hollow cross and number it with the target number (Figure 12-10).

(7) *Engagement of other targets*. To fire other targets on this chart, the computer must perform the following actions:

(a) Grid. Go back to the map, plot the target location, and determine the range and direction.

(b) Shift. Index the FO's direction to the target and apply the correction from the known point, which must be plotted on the chart.

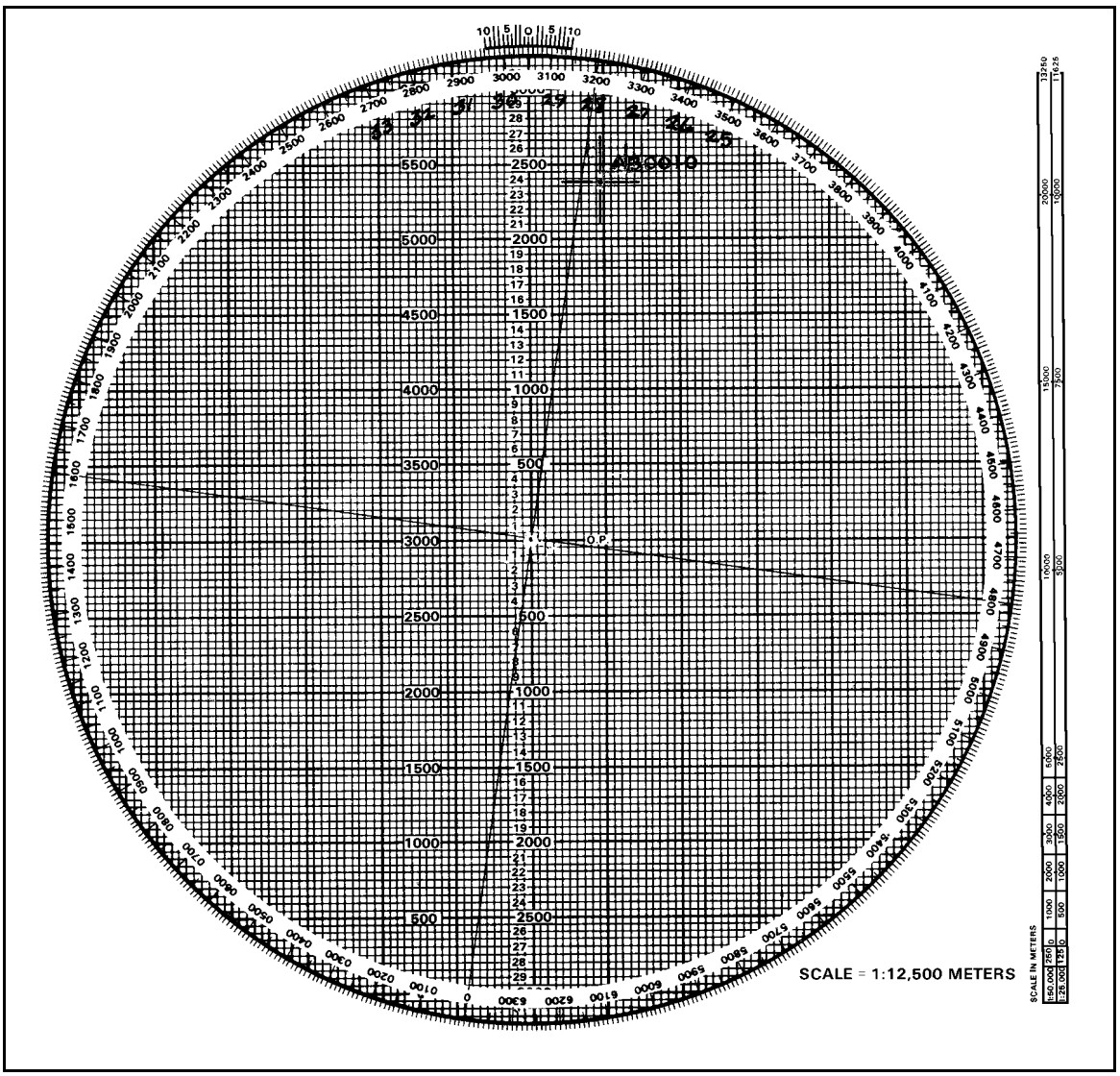


Figure 12-9. Board updated.

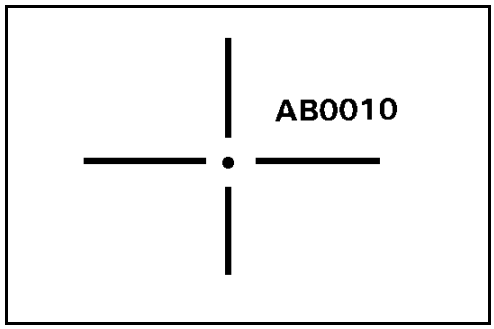


Figure 12-10. Hollow cross with target number.

b. **Below Pivot-Point Method**. The observed firing chart (with mortars plotted below pivot point) is used when the ranges to the targets being engaged are over 3,200 meters. (When the initial range to the target is 2,900 meters or more, mortars are always plotted below the pivot point.)

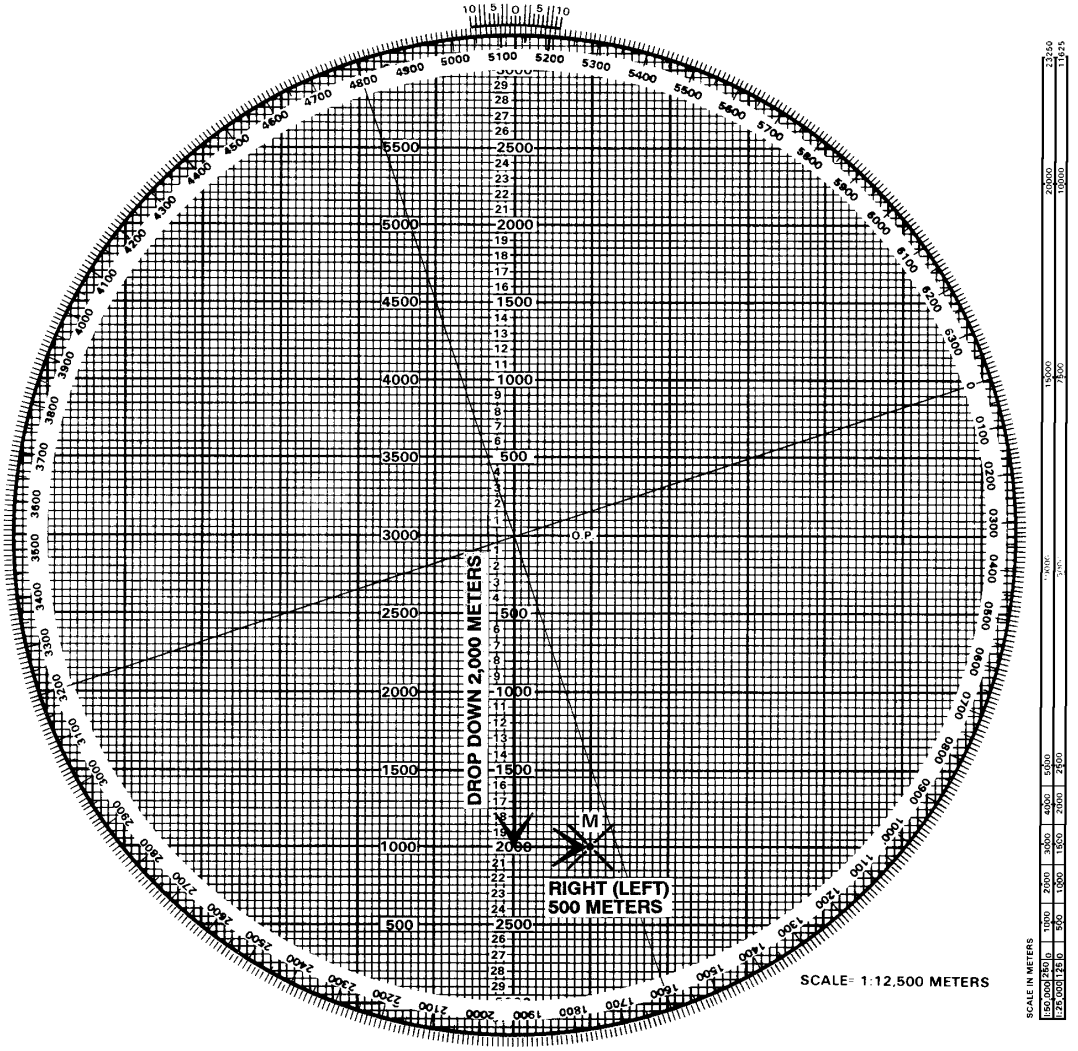
(1) Two items are needed to set up the board for operation: a gun-target azimuth and a range from the mortar position to the target. To construct the chart—

(a) Index the gun-target azimuth.

(b) Drop below the pivot point 1,000 meters for 60-mm mortars, 2,000 meters for the 81-mm mortars, and 3,000 meters for the 4.2-inch and 120-mm mortars.

NOTE: When firing 800-series ammunition with the 81-mm mortar, drop 3,000 meters below the pivot point to accommodate the extended range.

(c) Plot the mortar position 500 meters left or right of the vertical centerline (Figure 12-11).



INITIAL SETUP BELOW THE PIVOT POINT DOF 5130. REFERRED REFLECTION 2800.

Figure 12-11. Plotting of mortar position.

(2) Once these actions have been taken, ensure that the azimuth disk is still indexed on the gun target azimuth. Then, from the mortar position, plot the first round at the range determined using the parallel-line method of plotting (Figure 12-12). Determine the mounting azimuth and referred deflection the same way as with the pivot-point method.

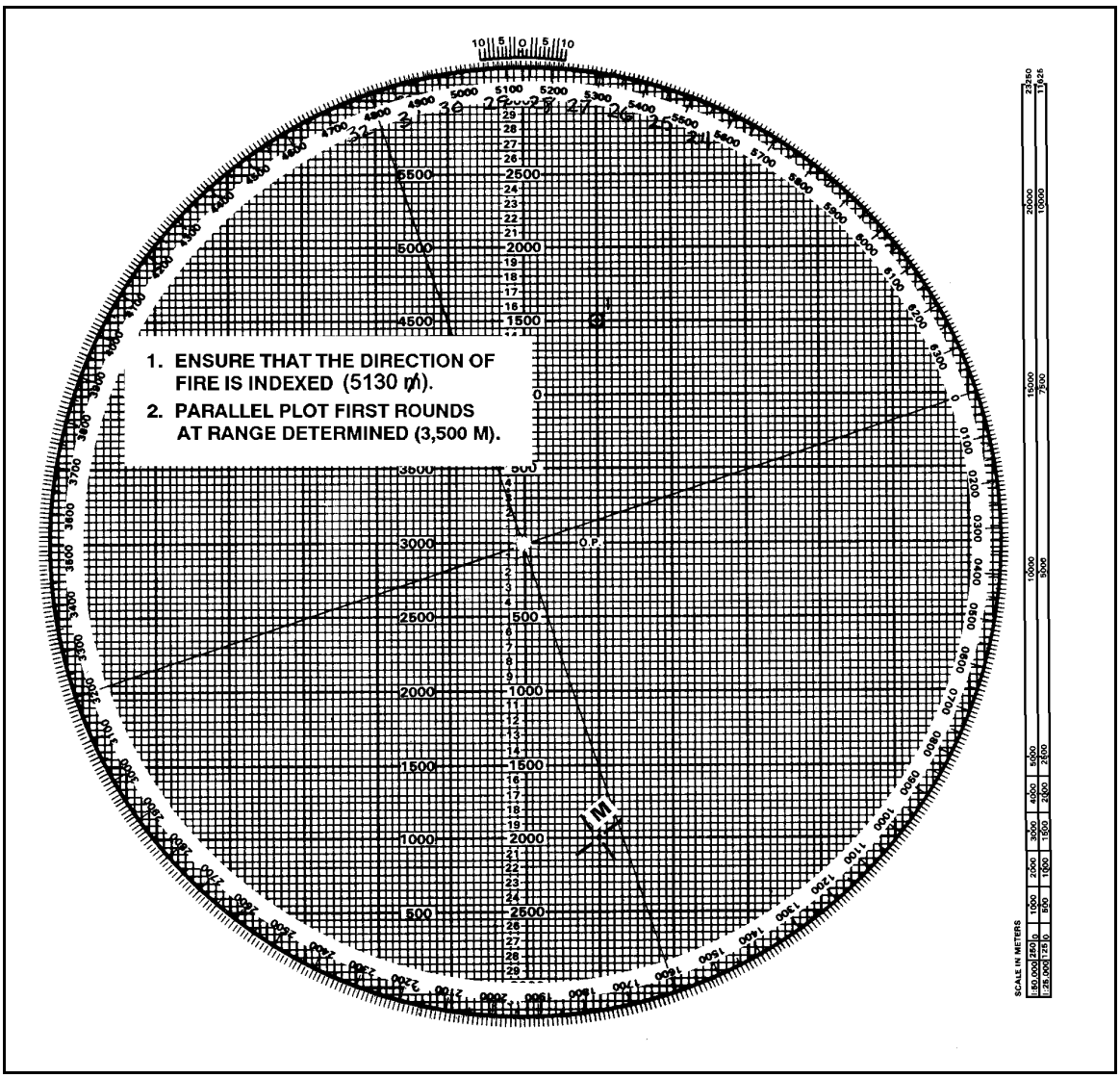


Figure 12-12. Plotting of first round.

(3) To determine the firing data to send to the mortar, align the mortar position below the target being engaged using the parallel-line method of plotting. Then read the deflection using the azimuth disk and vernier scale and measure the range between the mortars and target. To align the mortar position and target, since the mortar position is being plotted away from the pivot point, use the parallel-line method of plotting. With the mortar position and target plotted, rotate the disk until the mortar position and the target are an equal distance from, or on, the same vertical line (Figure 12-13).

NOTE: All directions are read from bottom to top.

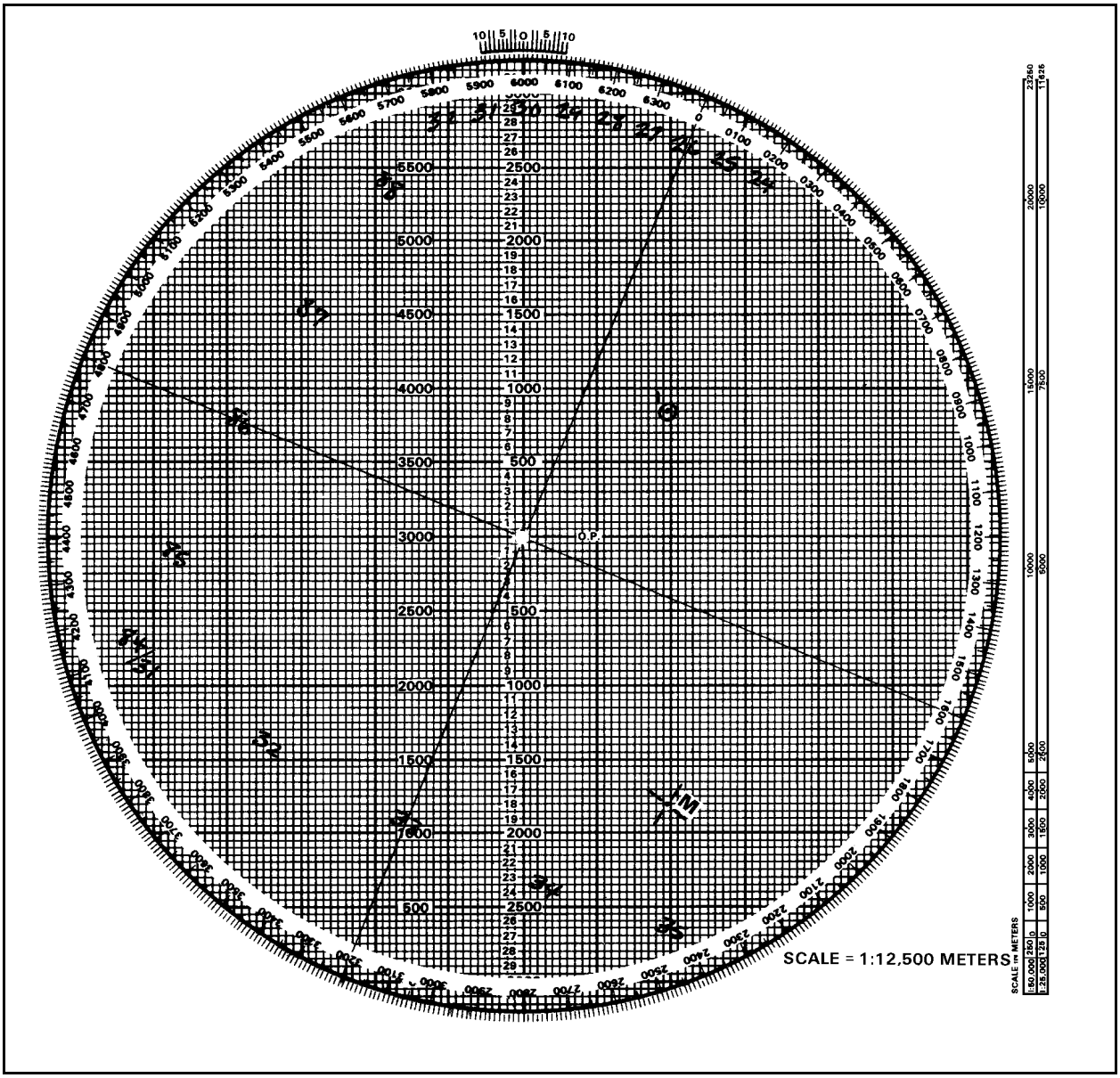


Figure 12-13. Parallel-line plotting.

(4) Now determine ranges differently than with the mortar position plotted at the pivot point. Count each of the 50-meter squares from the mortar position to the target or place the edge of the computer's record alongside the two plots on the plotting board (mortar and target). Then make a tick mark on the edge of the computer's record at each plot. Using the alternate range scale to the left of the pivot point, lay the computer's record along this scale with the mortar tick mark at 0 and read the range (Figure 12-14).

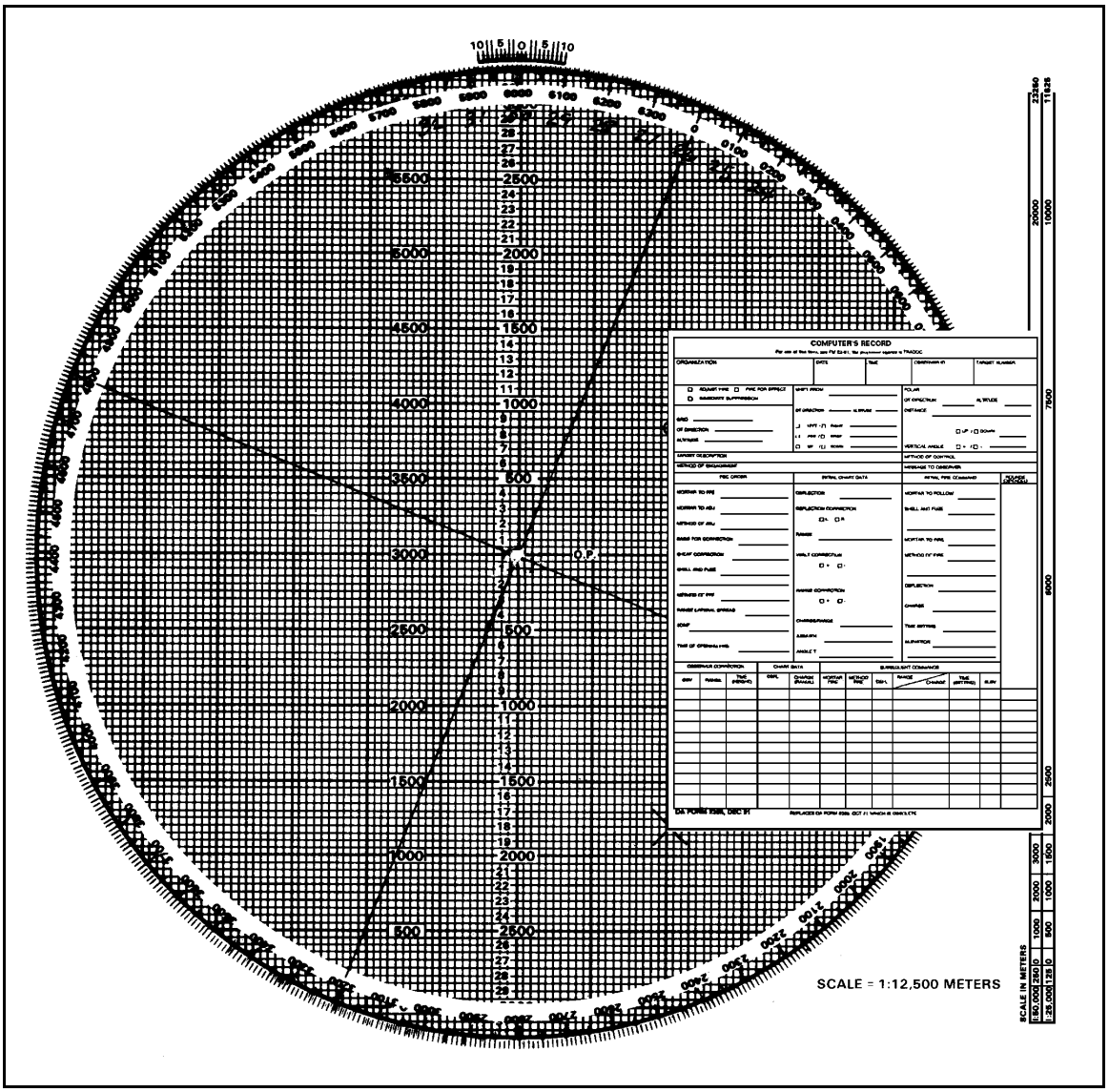


Figure 12-14. Determination of range with edge of Computer's Record.

(5) To update the board after the EOM is given or to engage other targets, use the same method as with the pivot-point method.

NOTE: When operating the M16 plotting board as an observed firing chart (pivot-point or below-pivot-point methods), no correction factors are applied to the data.

c. **Mortars Plotted at Pivot Point**. With the pivot pin inserted in the pivot point of the plotting board, the computer can use the range scale arm the same as with the range arm to determine deflections and range to both the initial and subsequent rounds.

(1) Determine the range and direction to the center of the sector from a map or by visual observation. Round off the azimuth to the initial round or direction of fire (DOF) to the nearest 50 mils to determine a mounting azimuth, and superimpose a deflection scale on the azimuth disk.

(2) Make the initial plot by indexing the DOF (or initial azimuth) to the initial round at the index mark. This may be different from the mounting azimuth because of the round-off rule. Use the scale on the vertical centerline to make the initial plot at the correct range.

(3) When the FO calls in a target direction (the OT azimuth), index the azimuth disk on the M16/M19 plotting board at the OT azimuth. It remains indexed on that azimuth until the mission is completed. Plot corrections from the FO IAW procedures. Once a correction has been plotted, rotate the range arm until the right edge of the range arm is over the new plot. Determine the range to the nearest 25 meters, and read the deflection to the nearest mil using the vernier scale.

(4) Plot additional corrections, and use the range scale arm to determine range and deflection. Once the azimuth disk is indexed on the OT azimuth, the disk does not have to be rotated to determine ranges or deflections.

d. **Mortars Plotted Below Pivot Point**. With the pivot pin inserted in the pivot point, the computer can use the left edge of the range scale arm to plot the initial round. The mounting azimuth and azimuth to the initial round are determined as for mortars plotted at pivot point. The computer indexes the azimuth disk on the DOF and aligns the right edge of the range scale arm on the vertical centerline. Next, he makes a small plot at the zero range on the left edge of the range scale arm. Then, still using the left edge, he makes a small plot at the range for the initial round. The mortar position plot must be marked with a hollow cross to further identify its position. Once the initial round is fired, the range scale arm is removed, and the left edge is used as a range scale.

e. **Care and Cleaning of Plotting Boards**. Plotting boards must be handled with care to prevent bending, scratching, or chipping. They must be kept away from excessive heat or prolonged exposure to the sun, which may cause them to warp. When storing a board, it is placed in its carrying case, base down, on a horizontal surface. It is not placed on edge or have other equipment stored on it. The plotting board can normally be cleaned with a nongritty (art gum) eraser. If the board is excessively dirty, a damp cloth is used. The contact surface of the disk and base are cleaned often. The disk is removed by pushing a blunt instrument through the pivot point hole from the back of the base.

12-2. MODIFIED-OBSERVED FIRING CHART

The modified-observed firing chart can be constructed on the M16 plotting board. It is constructed when the mortar position or target is known to survey accuracy. The three basic items needed to construct a modified observed chart are: : a DOF (usually to the center of the platoon area of responsibility), one point (mortar position, target, or reference point) that must be known to surveyed accuracy (eight-digit grid coordinates), and a grid intersection to represent the pivot point.

NOTE: See survey firing chart in Chapter 14.

a. **Determination of Direction of Fire**. The section sergeant usually determines DOF. In most cases, it is to the center of sector. The mortar location can be surveyed by map inspection, terrain inspection, or pacing from a known point on an azimuth, as long as the position of the base gun is known to a valid eight digits.

(1) For the 60-mm and 81-mm mortars, the grid intersection representing the pivot point (Figure 12-15) is between 1,500 and 2,000 meters forward of the mortar location. This allows the full range of the mortar to be used.

NOTE: When using the M16 plotting board with the 4.2-inch mortar, the section sergeant selects the grid intersection to be 2,000 to 2,500 meters forward of the mortar position. With the 120-mm mortar, the grid intersection should be 3,000 to 4,000 meters forward of the mortar position.

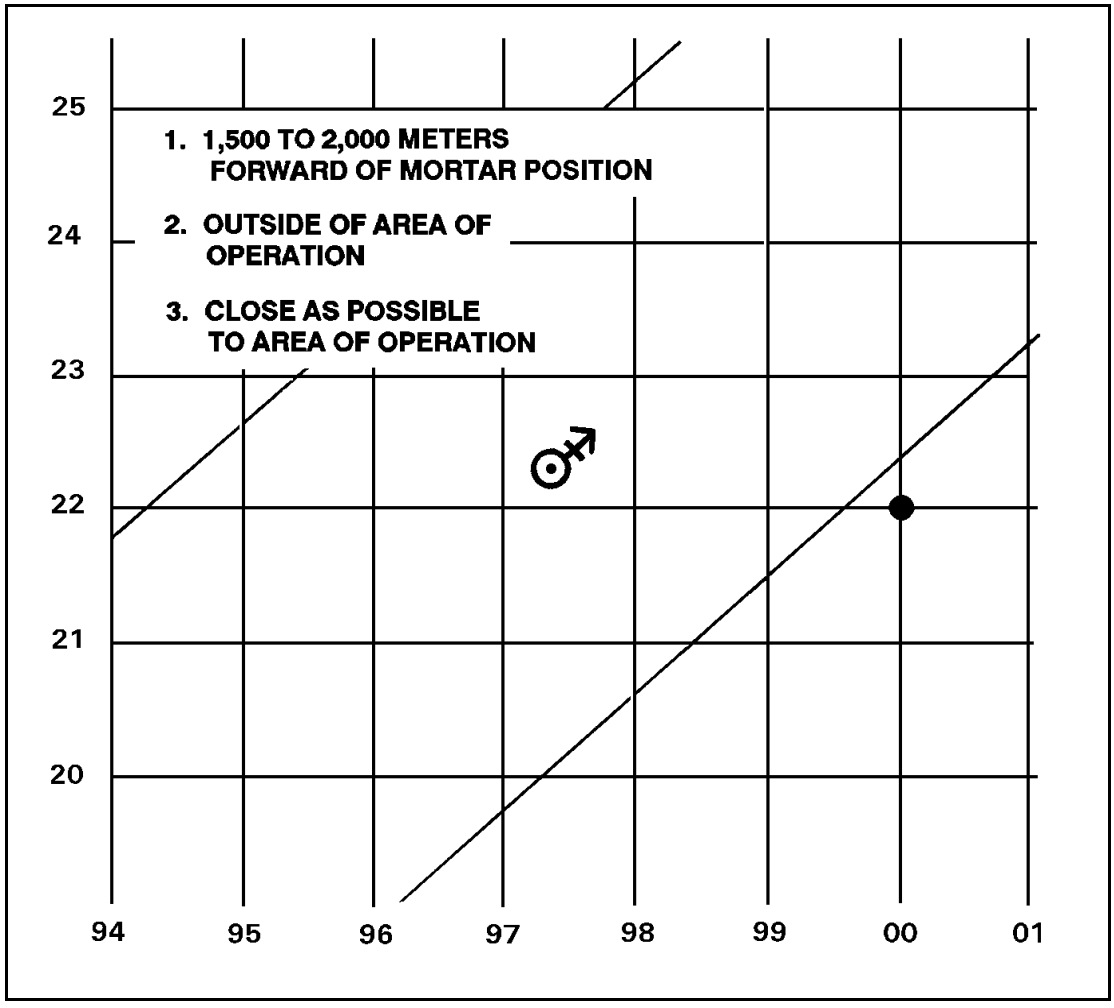


Figure 12-15. Grid intersection to represent pivot point.

(2) The grid intersection should be outside the area of responsibility. This ensures that the pivot point does not interfere with plotting targets or corrections. The grid

intersection is also as close as possible to the area of responsibility. This ensures that as much of the area of responsibility as possible will be on the plotting board.

b. **Superimposition of Grid System on Plotting Board**. Once the grid intersection has been determined, the computer indexes "0" on the azimuth disk. He then drops down 2,000 meters below the pivot point and writes in the east/west indicator on the vertical centerline at the 2,000-meter mark. Next, he goes 2,000 meters to the left of the pivot point on the heavy center horizontal line and writes the north/south indicator. To complete the grid system, the computer writes in the other north/south, east/west grid numbers as though looking at a map. By numbering every other heavy dark line (two large squares) on the plotting board, he retains a scale of 1:12,500 on the board (Figure 12-16).

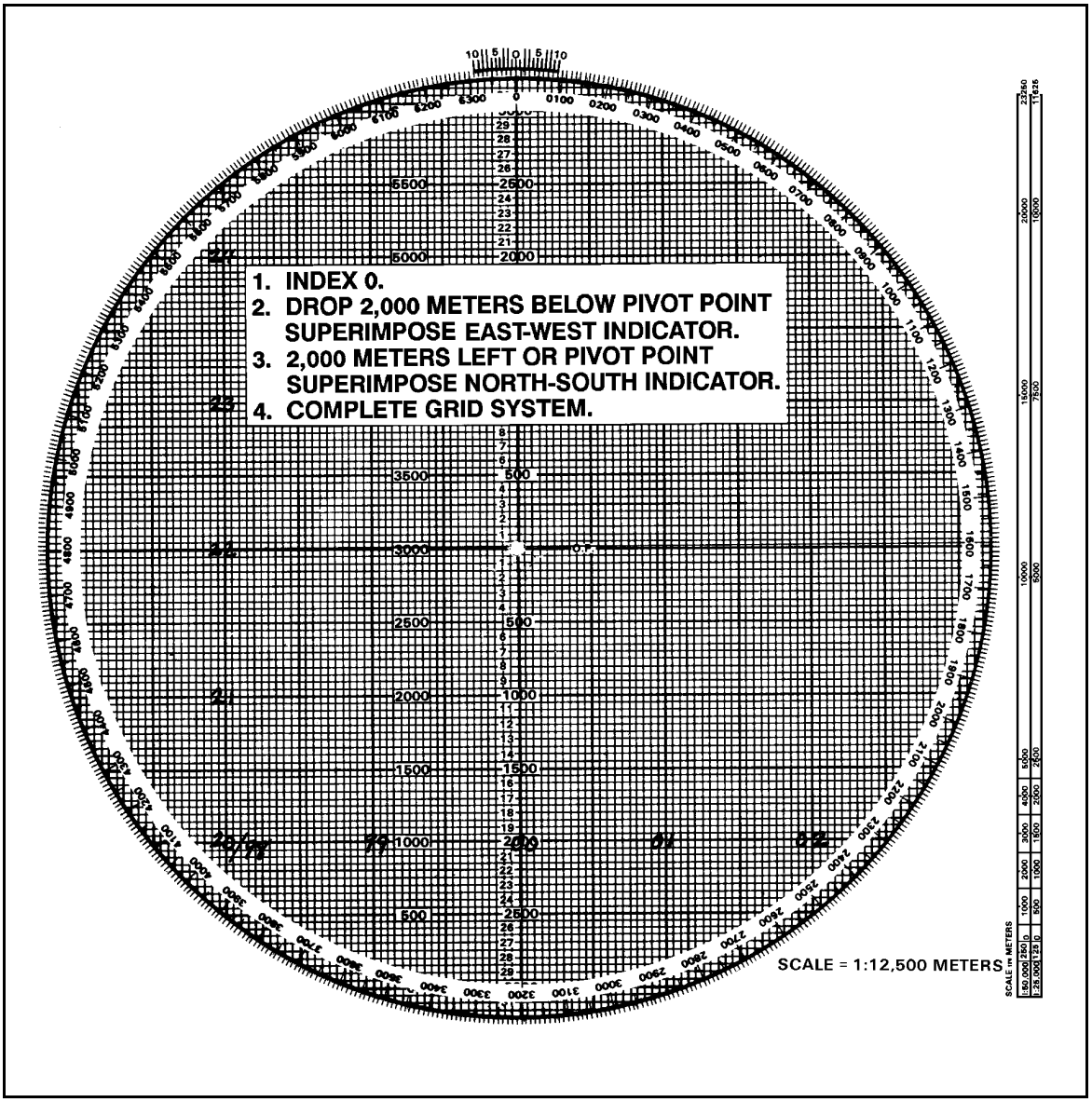


Figure 12-16. Superimposition of the grid.

c. **Plotting of Mortar Position**. Now that a grid system is on the board, the computer can plot any grid coordinates. To do this, he must—

(1) Ensure that the azimuth disk is indexed at 0.

(2) Read like a map: RIGHT and UP.

(3) Remember that the scale is 1:12,500 (each small square is 50 meters by 50 meters) (Figure 12-17).

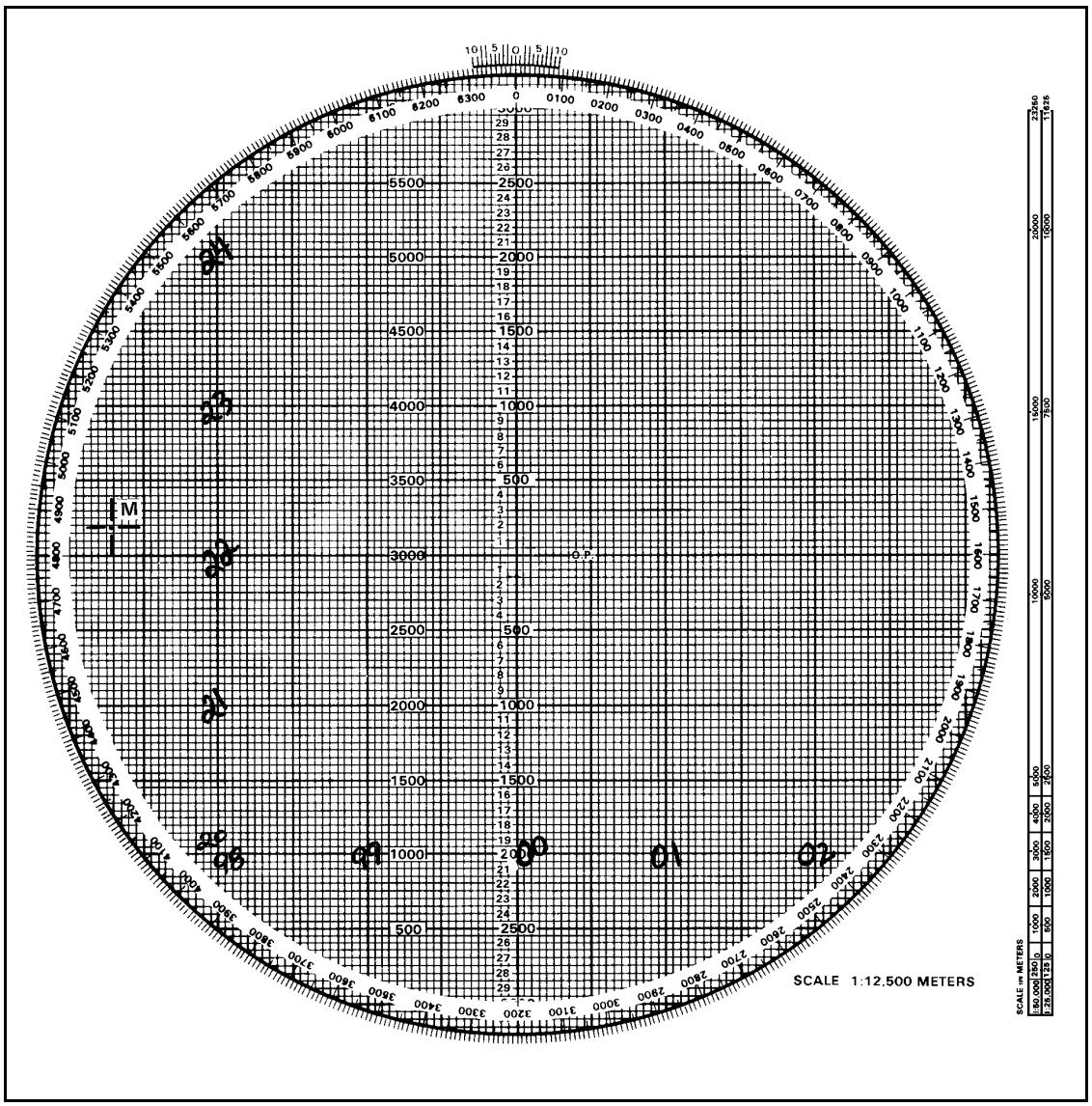


Figure 12-17. Plotting of a mortar position.

To superimpose the deflection scale, the computer writes the referred deflection on the board the same way as with the observed chart. Firing data are determined by using the parallel-line method of plotting.

d. **Field-Expedient Method for Construction**. If the grid coordinates of the mortar position are known but a map is not available for determining the grid intersection to represent the pivot point, the computer can construct the modified-observed firing chart by using the following procedures:

(1) Index the DOF.

(2) Drop below the pivot point on the vertical centerline 2,000 to 2,500 meters.

(3) Go 500 to 1,000 meters left or right of the vertical centerline and make a plot (Figure 12-18).

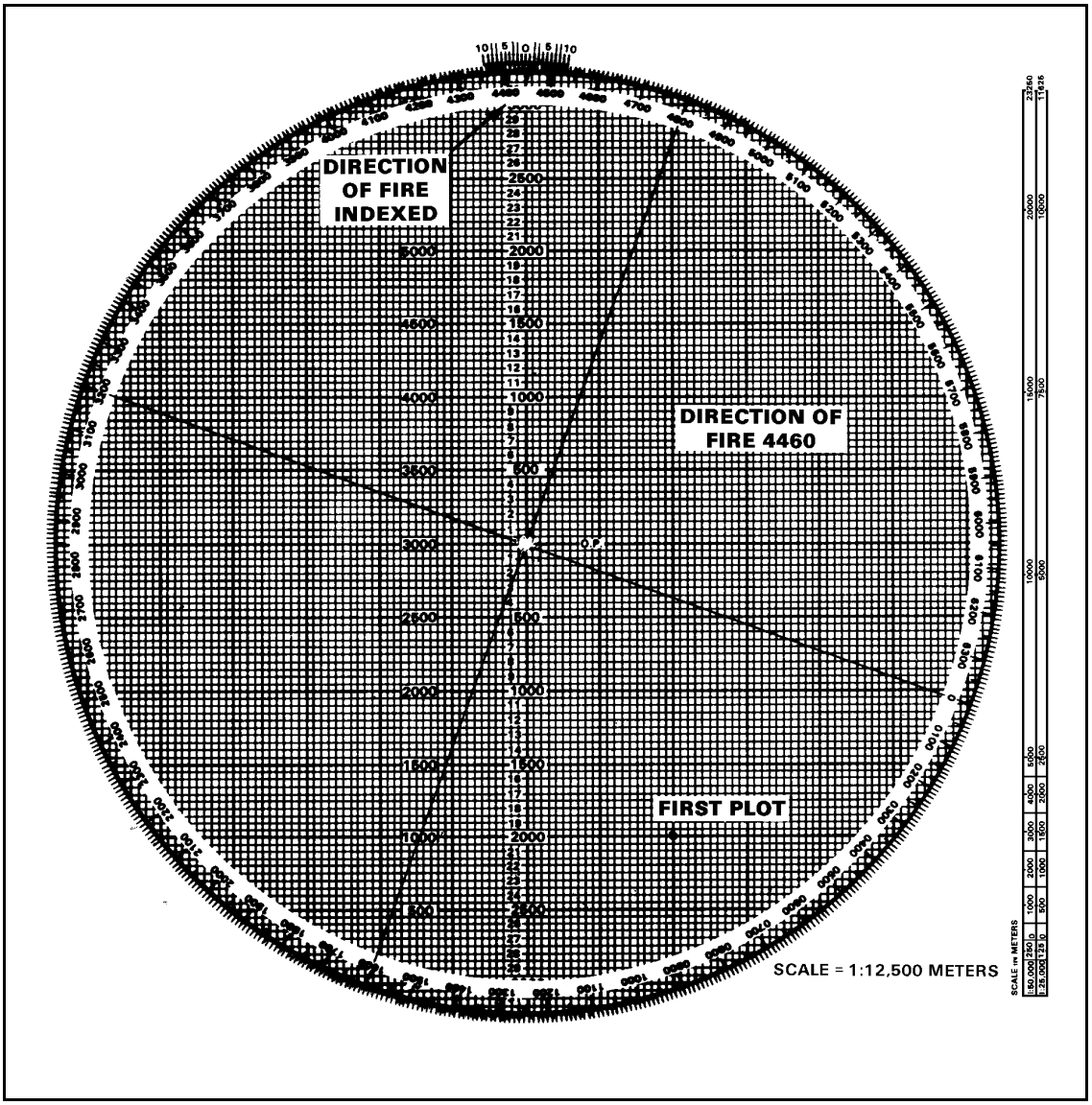


Figure 12-18. First plot.

(4) Rotate the azimuth disk and index "0."

(5) Determine the 1,000-meter grid that contains the mortars (Figure 12-19). The first, second, fifth, and sixth numbers of the mortar grid give the 1,000-meter grid square.

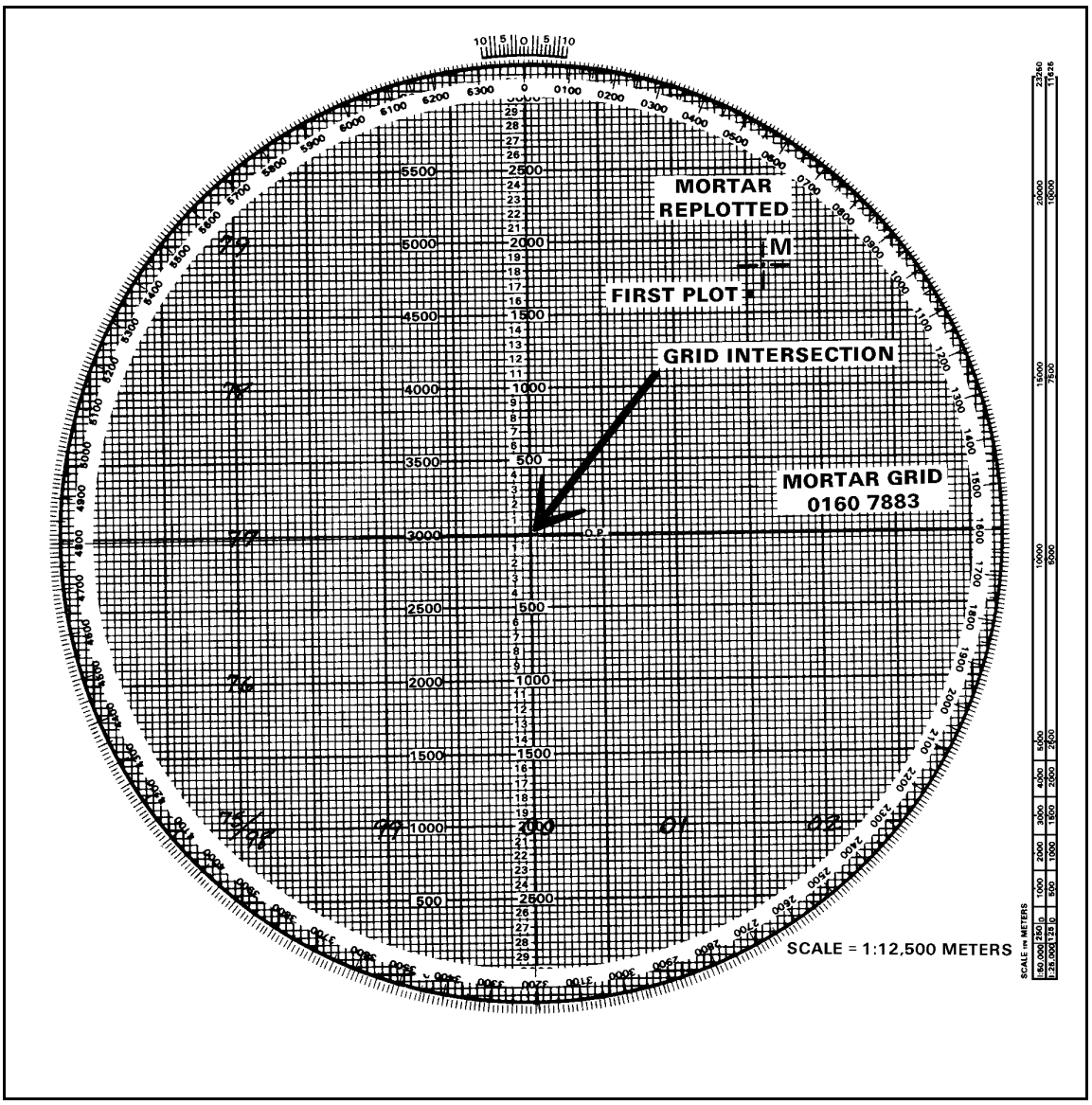


Figure 12-19. Replotting of mortar location.

(6) Superimpose the grid system.
(7) Replot the mortar location to the surveyed grid.

12-3. TRANSFER OF TARGETS

Transfer is the process of transferring a target from the observed chart to the modified-observed chart, or from the modified-observed chart to the surveyed chart, as more information becomes available. This occurs since the targets transferred are known points to the FO and FDC, and these points may be used in future missions. Transfer is always done using chart data (deflection and range to the final plot).

EXAMPLE

Assume that the mortar section is at grid 939756 (six digits: observed chart) and two targets have been fired on (Figure 12-20). The platoon leader determines that the eight-digit grid to the mortar position is 93937563 (modified-observed chart) and designates the grid intersection to represent the pivot point. The computer constructs the chart and transfers the targets from the observed chart (Figure 12-21).

NOTE: No firing corrections are used with the observed chart. Once transferred to the modified-observed chart, the altitude of the target is assumed to be the same as that of the mortar position.

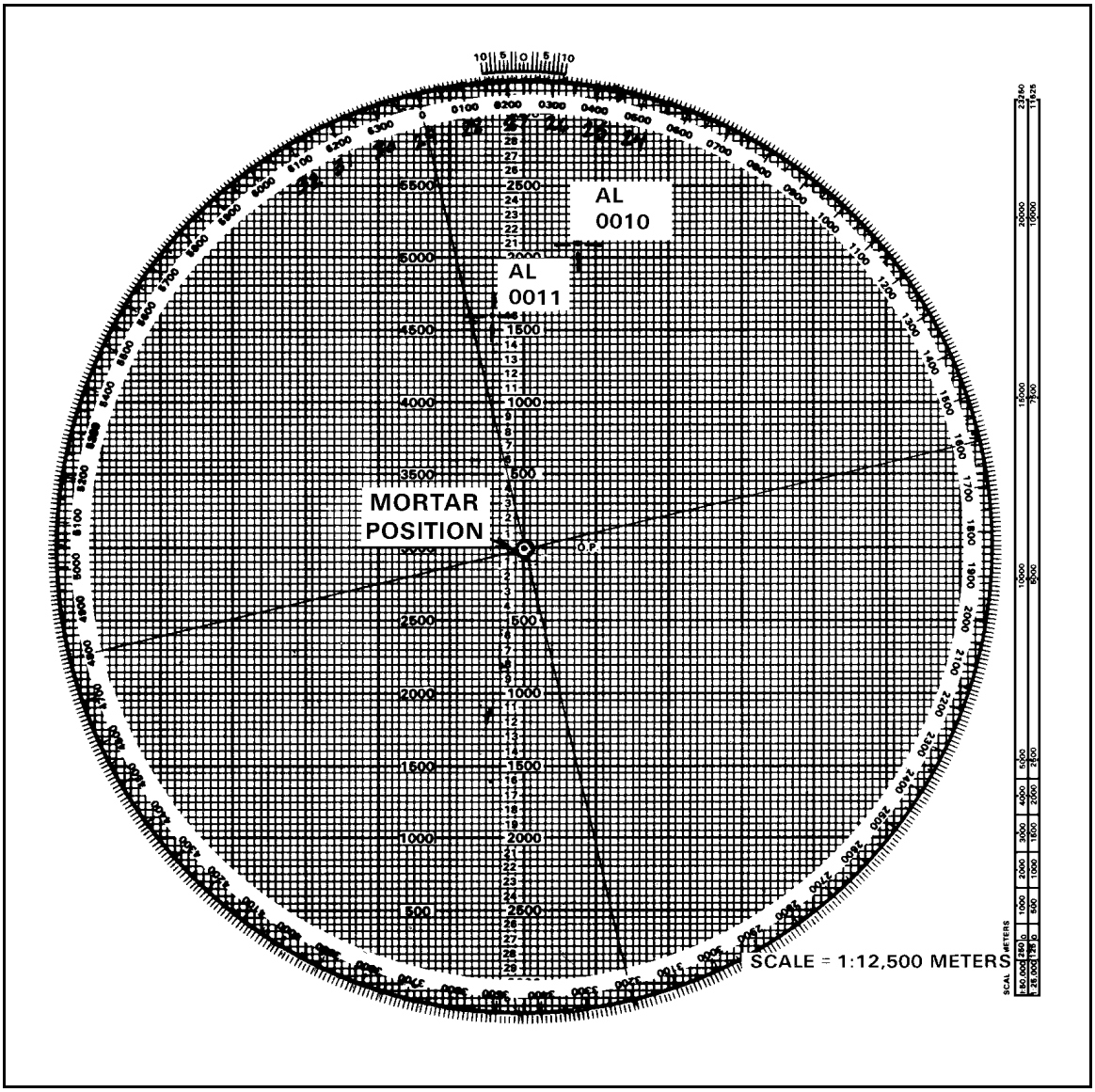


Figure 12-20. Observed chart.

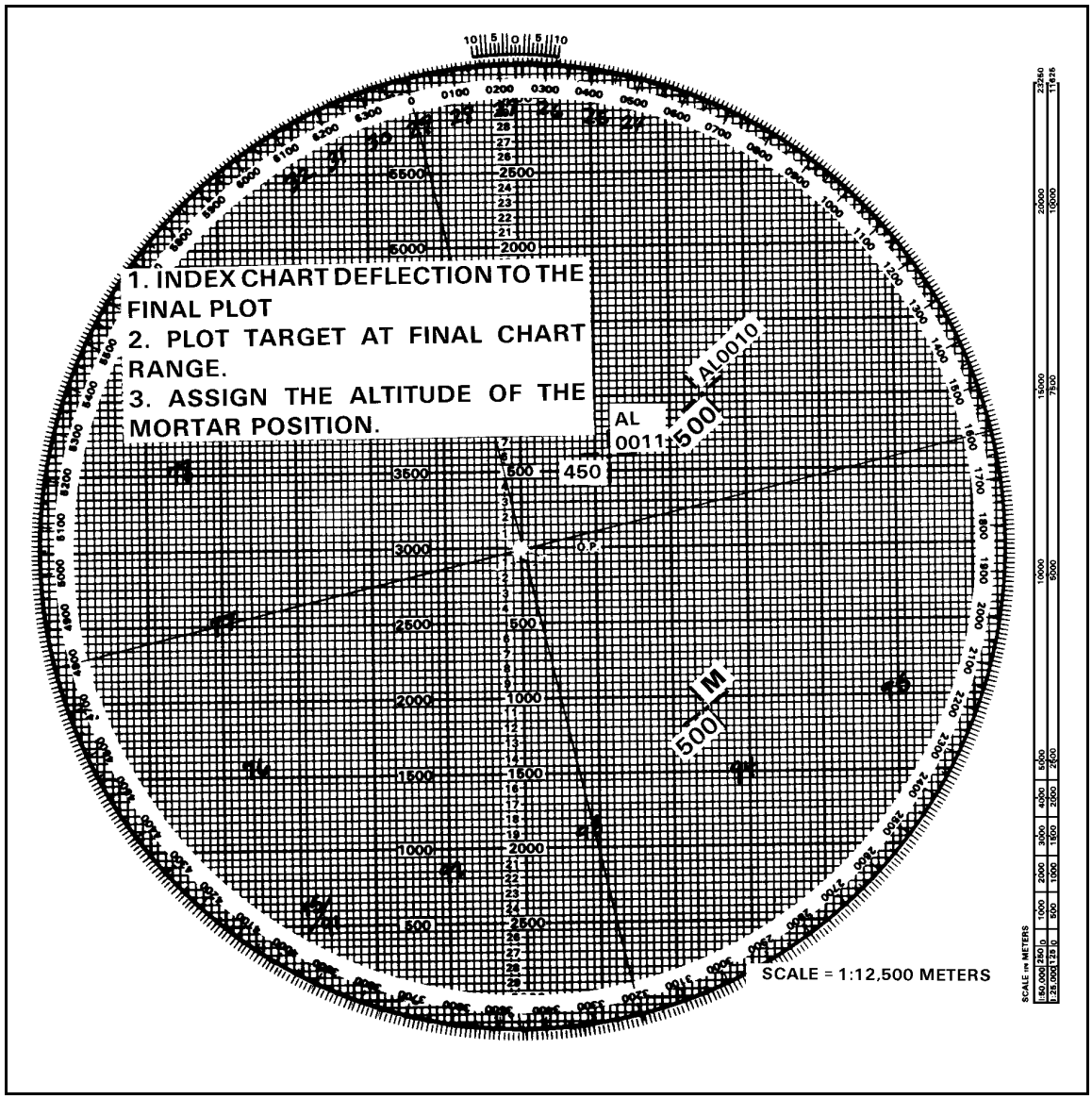


Figure 12-21. Forward plotting target to modified-observed chart from the observed chart.

a. **Target Plotting**. After transfer, through coordination with the FO, an RP or target may be identified to valid eight-digit coordinates. The plotting board is then reconstructed as a surveyed chart. When the situation permits, a registration mission should be conducted on the point for which the valid eight-digit coordinates were determined. Then firing corrections are computed.

(1) When transferring targets from one type of chart to another, remember that the target plots on the observed chart are plotted at the data it takes to hit the target. This is not always the locations of the targets.

(2) The same holds true for the modified-observed chart, except that with some targets, altitude correction (VI) may have been used. When replotting the target at the end of the mission, strip this altitude correction from the command range and plot the target using

this range. Using this procedure gives a more accurate picture of the exact location of the target than the observed chart; however, it is not always the actual location of the target.

b. **Plotting of Previously Fired Targets**. At the completion of the surveyed registration mission and the computation of the firing corrections, previously fired targets plotted on the plotting board must be forward plotted. Since the surveyed chart is the most accurate chart to use, all information on it should be the most accurate possible.

EXAMPLE

When targets AL0010 and AL0011 (Table 12-1) were fired before the surveyed registration, the data and the plots included all firing corrections, even though they may have been unknown at the time of firing. To forward plot these targets, the computer strips the firing correction from the range and deflection to plot them at their actual location.

NOTE: To strip out the corrections, the signs must be reversed.

COMMAND DATA	FIRING CORRECTIONS	COMPUTATIONS	CHART DATA FOR REPLOT
TARGET AL0010			
DEFLECTION 2786 RANGE 1825	DEFLECTION R12 RCF - 18 ALTITUDE CORRECTION +25	2786 + L12 = 2798 +18 X 1.8 = +32 1825 + 32 - 25 = 1832	 DEFLECTION 2798 RANGE 1825
TARGET AL0011			
DEFLECTION 3115 RANGE 2850	DEFLECTION R12 RCF - 18 ALTITIUDE CORRECTION +25	3115 + L12 = 3127 +18 X 2.9 = +52 2850 + 52 - 25 = 2877	 DEFLECTION 3127 RANGE 2875

Table 12-1. Replotting of previously fired targets.

12-4. DEFLECTION CONVERSION TABLE

When an adjustment is made to a sheaf, such as after the completion of the registration, the sheaf is paralleled or converged if engaging a point-type target, or opened when engaging a wider target. In these situations, the computer must determine the new data and convert the deviation corrections required into mils. He can use the deflection conversion table (Figure 12-22) or the mil-relation formula.

NOTE: If the target has been mechanically surveyed, enter the DCT at the initial range plot. If the target is nonsurveyed (even if it is an eight-digit grid), enter the DCT at the final range plot.

a. To use the DCT, first round off the range at which the section is firing to the nearest 100 meters. This is required because the ranges on the table are divided into 100-meter increments. Next, go down the range column to find the range. The deflection is in meters across the top of the card.

b. Using the number of meters the FO requested to move the strike of the round, find that number of meters and go straight down that column until it intersects with the range. That number is the number of mils that would have to be applied to the mortar sight to move the strike of the round the required meters. If the range is greater than 4,000 meters, divide the range and mil correction by two.

RANGE IN METERS	DEFLECTION IN METERS														
	1	10	20	30	40	50	75	100	125	150	175	200	300	400	500
500	3.0	20	41	61	81	102	152	201	250	297	34	388	550	687	800
600	1.7	17	34	51	68	85	127	168	209	250	289	328	472	599	708
700	1.5	15	29	44	58	73	109	145	180	215	250	284	412	529	632
800	1.3	13	25	33	51	64	95	127	158	189	219	250	365	472	569
900	1.1	11	22	34	45	57	85	113	141	168	195	223	328	426	517
1000	1.0	10	20	31	41	51	76	102	127	152	176	201	297	388	473
1100	.93	9	18	28	37	46	69	92	115	138	161	183	271	355	435
1200	.85	8	17	25	34	42	64	85	106	127	148	168	249	328	402
1300	.79	8	16	23	31	39	59	78	98	117	136	155	231	304	374
1400	.73	7	15	22	29	36	55	73	91	109	127	145	215	283	349
1500	.68	7	14	20	27	34	51	68	85	102	118	135	201	265	328
1600	.63	6	13	19	25	32	48	64	80	95	111	127	189	250	309
1700	.60	6	12	18	24	30	45	60	75	90	104	119	178	235	291
1800	.57	6	11	17	23	28	42	57	71	85	99	113	168	223	276
1900	.54	5	11	16	21	27	40	54	67	80	94	107	160	211	262
2000	.51	5	10	15	20	25	38	51	64	76	89	102	152	201	250
2100	.49	5	10	15	19	24	36	48	61	73	85	97	145	192	238
2200	.46	5	9	14	19	23	35	46	58	69	81	92	138	183	228
2300	.44	4	9	13	18	22	33	44	55	66	77	88	132	175	218
2400	.43	4	8	13	17	21	32	42	53	63	74	85	127	168	209
2500	.41	4	8	12	16	20	31	41	51	61	71	81	122	162	201
2600	.39	4	8	12	16	20	29	39	49	59	68	78	117	155	194
2700	.38	4	8	11	15	19	28	38	47	57	66	75	113	150	187
2800	.37	4	7	11	15	18	27	36	45	55	64	73	109	145	180
2900	.35	4	7	11	14	18	26	35	44	53	61	70	105	140	174
3000	.34	3	7	10	14	17	25	34	42	51	59	68	102	135	168
3100	.33	3	7	10	13	16	25	33	41	49	57	66	98	131	163
3200	.32	3	6	10	13	16	24	32	40	48	56	64	95	127	158
3300	.31	3	6	9	12	15	23	31	39	46	54	62	92	123	153
3400	.30	3	6	9	12	15	22	30	37	45	52	60	90	119	149
3500	.30	3	6	9	12	15	22	29	36	44	51	58	87	116	145
3600	.29	3	6	8	11	14	21	28	35	42	49	57	85	113	141
3700	.28	3	6	8	11	14	21	28	34	41	48	55	82	110	137
3800	.27	3	5	8	11	13	20	27	33	40	47	54	80	107	133
3900	.27	3	5	8	10	13	20	26	33	39	46	52	78	104	130
4000	.26	3	5	8	10	13	19	26	32	38	45	51	76	102	127

Figure 12-22. Deflection conversion table.

EXAMPLE

The mortar section has completed a registration mission and is prepared to adjust the sheaf. The final adjusted range for the RP is 2,750 meters. The No. 1 and No. 3 mortars fire one round each. The FO sends the following corrections: NUMBER 3, R30; NUMBER 1, L20; END OF MISSION, SHEAF ADJUSTED. Any corrections of 50 meters or more must be refired.

For this example, the last deflection fired from No. 1 and No. 3 was 2931 mils. Using the DCT, round off the range to the nearest 100 meters (2,800). Find 2,800 meters in the range column and, using the FO's corrections, find 30 and 20 in the deflection-in-meters column. Go across and down those columns to where they intersect. The table shows that the requirements are 11 mils for 30 meters and 7 mils for 20 meters.

Using this information, use the previous deflection fired, which was 2931 mils. Since the FO's correction for the No. 3 mortar was R30, which equals R11 mils (using the LARS rule), subtract 11 mils from 2931 mils. This gives a new deflection of 2920 mils. The correction for No. 1 mortar was L20, which equals L7 mils. Using the LARS rule for deflection, add 7 mils to 2931, which gives a new deflection of 2938 mils.

If there is no deflection conversion table available, use the mil-relation formula (W/R x M) to convert the corrections from meters to mils. To use the formula for the same FO's corrections of R30 and L20 used in the example cited, cover the item needed (in this case M [mils]). The remainder of the formula states: divide W (width in meters) by R (range in thousandths).

W/R = 20/2.8 = M	7.1 = 7 mils	10.7 = 11 mils
	28./200.0	28./300.0
	196	28
W/R = 30/2.8 = M	40	200
	28	196
	120	4

These are exactly the same figures determined by using the DCT.

12-5. GRID MISSION

For an observed chart, the grid coordinates of the target must be plotted on the map, and a direction and distance determined from the mortar location to the target. For modified and surveyed charts, index "0" and plot the target using the grid coordinates.

NOTE: Corrections for VI can be used on the modified and surveyed charts.

12-6. SHIFT MISSION

For an observed chart, the known point must be plotted on the firing chart. This may be a fired-in target or a mark-center-of-sector round. The OT azimuth is indexed, and the

correction applied is sent in the call for fire. For modified and surveyed charts, the same procedure is used as for the observed chart.

12-7. POLAR MISSION

The FO's location must be plotted on the plotting board before a polar mission can be fired. For an observed chart, the location can be plotted in three ways: by resection, by direction and distance, or by range and azimuth from a known point.

a. **Resection** (Figure 12-23). Plot two known points on the plotting board. Then index the azimuths the FO sends from these two points, and draw lines from the known points toward the bottom of the board. The intersection of these lines is the FO's location.

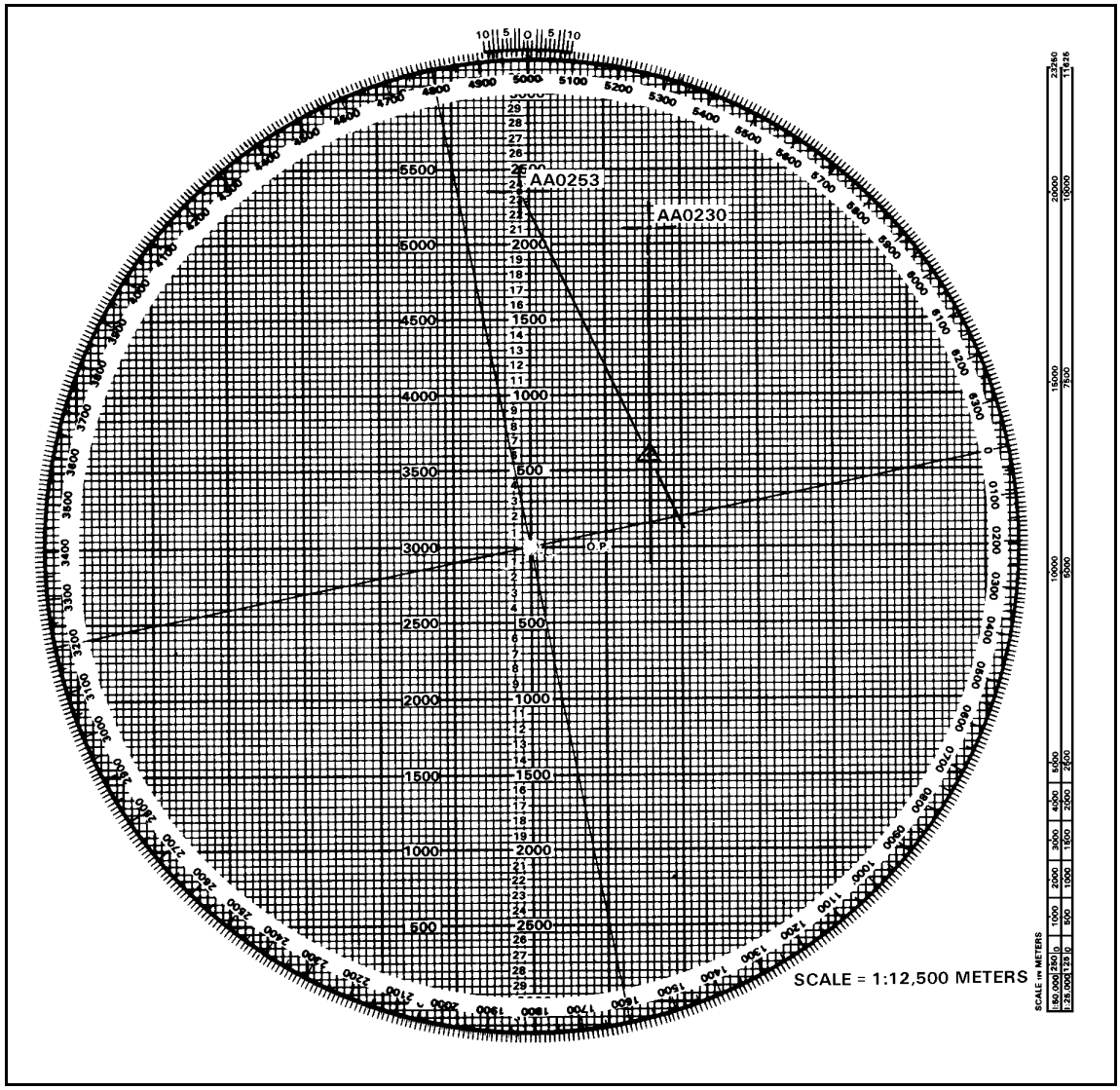


Figure 12-23. Resection.

b. **Direction and Distance** (Figure 12-24). The FO sends the computer the grid to the FO position. The computer then plots the grid on the map, determines the direction and distance from the mortar position to that grid, transfers the direction and distance to the plotting board, and plots the FO's location.

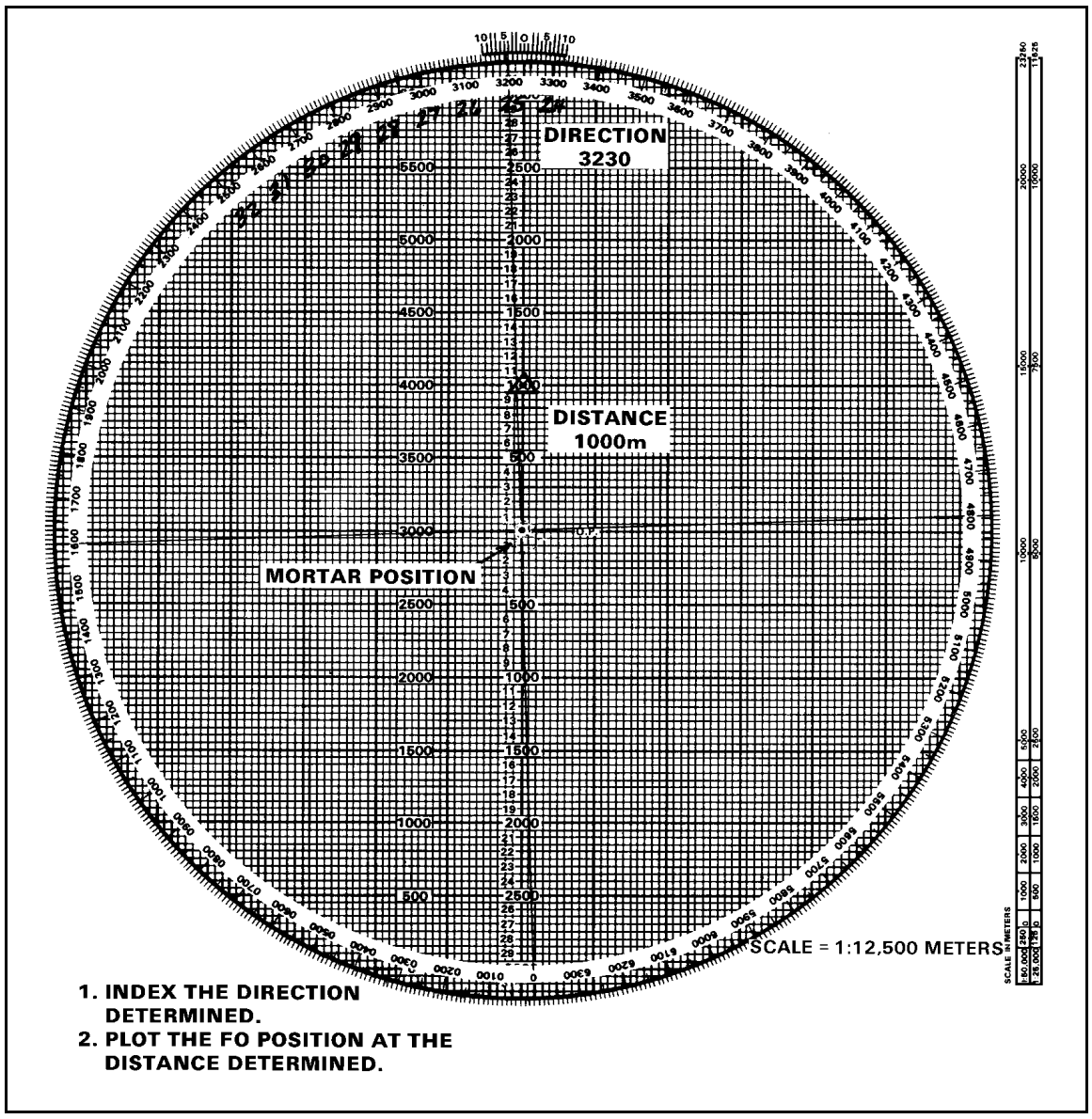


Figure 12-24. Direction and distance.

c. **Range and Azimuth from a Known Point.** The FO must send the range from the known point and the azimuth on which that point is seen. Once that is known, the computer can index the azimuth, drop below the known point the range given, and plot the FO's location (Figure 12-25). For modified and surveyed charts, the FO's location can be plotted if the grid of the FO is known, by indexing "0" and plotting the FO grid. If the grid is not known, then the computer can use resection, direction and distance, or range and azimuth from a known point.

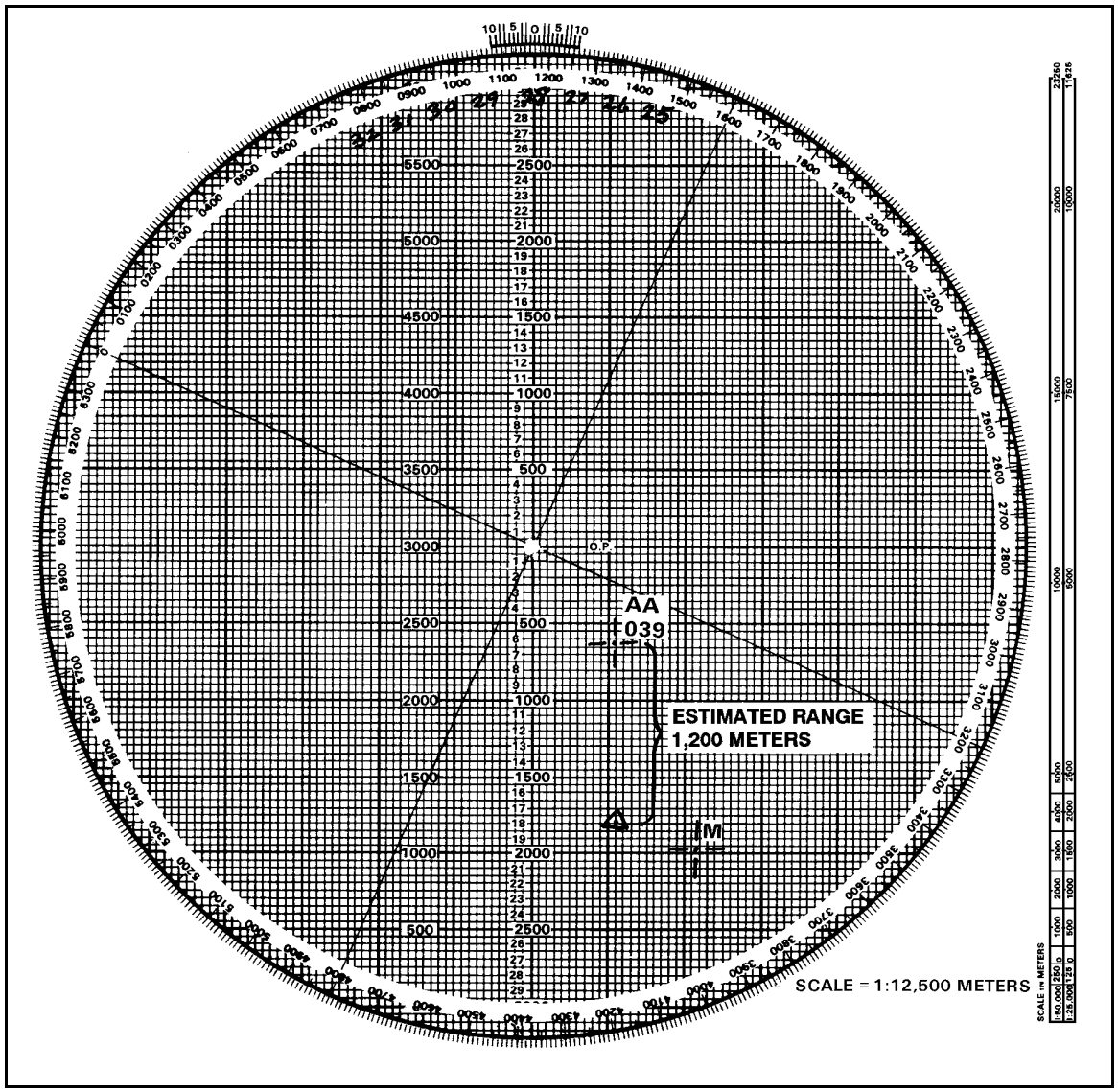


Figure 12-25. Estimate of range from reference point of FO's location.