

(c) If either or both of the requirements specified in (a) and (b) above are not met, the machine shall be turned over to the Equipment Maintenance Force for further tests.

(c) If a bias set is not normally available at the point involved then follow the procedure specified in 2.07.

### 3.04 Test of Keyboard

(a) If a 118 type telegraph transmission measuring set is available, use the testing procedure specified in Paragraph 2.08(a), otherwise use the procedure specified in 2.09(a).

\* (b) The Test Requirements to be met by keyboards at either 60 or 75 speed should be 8% or less.

(c) If the Test Requirements specified in (b) above are not met, the machine shall be turned over to the Equipment Maintenance Force for further tests.

American Telephone and Telegraph Company

BELL SYSTEM PRACTICES  
Teletypewriter and Manual  
Telegraph Station and PBX  
Installation and Maintenance

ADDENDUM P35.613  
Issue C, 2-1-56  
Long Lines Department  
(Telegraph)  
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MONITORING TELETYPEWRITERS - 14 TYPE

REQUIREMENTS AND PROCEDURES

1. GENERAL

1.01 This addendum supplements Section P35.613 to specify the transmission tests, adjustments and limits for 60 and 75 speed monitoring teletypewriters which are also to be used for transmission measuring purposes. Teletypewriters are not recommended for measuring the quality of 100 speed telegraph transmission. This issue replaces Issue B of the addendum.

1.02 The information contained in this section is intended for use by both the Equipment Maintenance Forces and Telegraph Test Room Attendants and is issued as Section E35.901 also.

1.03 Part 2 covers "Readjust Requirements, Adjustments and Tests." It is to be applied both when performing initial lineups on monitoring teletypewriters and when readjusting them after they have been turned down because of failure to meet the "Test Requirements."

1.04 Part 3 covers "Test Requirements", which are to be applied by Telegraph Test Room Attendants in order to determine if the monitoring teletypewriters are in correct adjustment. The making of these tests is primarily the responsibility of the Telegraph Repeater Force.

1.05 Any set failing to meet the "Test Requirements" shall be adjusted to meet the "Readjust Requirements" specified in Part 2.

1.06 Monitoring teletypewriters which are used only for purposes of obtaining copy may be maintained in accordance with the instructions covering the transmission maintenance and adjustment of a customer machine at the end of a short loop.

1.07 A sufficient number of monitoring teletypewriters suitable for transmission measuring purposes, suitably designated, should be maintained at any one office to insure against shortage of transmission measuring apparatus due to trouble in other transmission measuring equipment.

1.08 A suggested designation arrangement is to insert in the 87693M name plate a red card marked "MONIT. ONLY" for those machines used only for monitoring, and a red card marked "MEASURING" for those machines used for measuring and monitoring. These cards should be stenciled in black india ink or typed in capitals. In addition to the above card on the monitoring only machine, it is suggested that the range scale crank and the end scales be removed.

Note: If not so equipped the covers should be provided with 87693M name plates. These are secured with four 78484M screws requiring a 2-56 tap or 34-11M nuts.

## 2. READJUST REQUIREMENTS, ADJUSTMENTS AND TESTS

2.01 The procedures and limits here specified are intended for use by the Equipment Maintenance Force both when performing initial lineups on monitoring teletypewriters and when lining up the machines which have failed to meet the "Test Requirements" specified in Part 3.

2.02 Dual speed machines shall be lined up for the higher speed at which they are intended to operate. If such machines are fitted with zero end scales, the scales shall be adjusted for measuring at the higher speed at which the machines are intended to operate.

2.03 The following items shall be checked before applying the transmission adjustments:

- (a) In the case of initial lineup, all mechanical requirements and tolerances must be checked. The machine must be clean, properly lubricated and in good condition.
- (b) In the case of lineup after turndown, only those mechanical features requiring attention or suspected of requiring it need be checked.
- (c) Check the speed of the motor and adjust if necessary. In the case of a dual speed machine check both motor speeds.

2.04 Test Setup for Testing the Receiving Mechanism - Bias Set Available

- (a) Set up a 60 mil TLT and drive it with polar signals obtained by connecting the polar output of the bias set to Drop 1 if the bias set has a polar output. If the bias set does not have a polar output then drive the TLT with the neutral output of the bias set by connecting it to Looping 1 of the TLT.
- (b) Connect the teletypewriter under test to Looping 2 of the TLT.
- (c) Drive the bias set with automatic signals of the proper speed and check these signals to be sure that they are free of distortion.

2.05 Determination of Bias Index and Skew Index of Monitoring Teletypewriter - Bias Set Available

- (a) Transmit to the typing unit under test, miscellaneous signals (test sentence), at the proper speed, biased 25% marking and determine the range. Record the upper limit as "H" and the lower limit as "L".



(b) Determine the range similarly, using 25% spacing bias except that in this case the upper limit should be recorded as "h" and the lower limit as "l"

(c) Record the readings as follows:

|   |   |
|---|---|
| h | H |
| l | L |

The readings are recorded in this manner as an aid to the memory; notice that each of the values appears in the same relative position with respect to the others as would be the case if an actual parallelogram were drawn and the readings then marked on the parallelogram at the points which they determine.

(d) The next step is to determine "X" and "Y" as indicated below, and then under "Y" record "X - Y", and under "X - Y" record X + Y.

|       |   |              |
|-------|---|--------------|
| h - H | = | X            |
| l - L | = | Y            |
|       |   | <u>X - Y</u> |
|       |   | X + Y        |

The purpose of this somewhat mechanical procedure is to simplify the computation. The quantity "X - Y" is the "bias index" and it is merely twice the internal bias of the machine. The "bias index" automatically comes out positive if the internal bias is marking, and negative if the internal bias is spacing. The quantity "X + Y" is the "skew index"; it is 50 plus twice the internal skew of the machine. If the internal skew is positive, the skew index is greater than 50 and if the internal skew is negative, the skew index is less than 50. There is no point in determining the actual internal bias and skew in order to adjust the machine, however, because the limits are given in terms of the "bias index" and the "skew index" which are easier to determine.

- (e) As an example, suppose a machine was measured and the following results were obtained:

$$\begin{array}{rcl} h & = & 85 \\ l & = & 39 \end{array} \qquad \begin{array}{rcl} H & = & 62 \\ L & = & 10 \end{array}$$

The computations would be made as follows:

$$\begin{array}{rcl} 85 & - & 62 & = & 23 \\ 39 & - & 10 & = & 29 \\ \hline & & & & -6 & = & \text{bias index} \\ & & & & 52 & = & \text{skew index} \end{array}$$

As a matter of interest it might be stated that the internal bias is 3% spacing and the internal skew is 1% positive.

- (f) The following is a sample computation on a machine with zero internal bias and zero skew:

$$\begin{array}{rcl} 85 & - & 60 & = & 25 \\ 35 & - & 10 & = & 25 \\ \hline & & & & 0 & = & \text{bias index} \\ & & & & 50 & = & \text{skew index} \end{array}$$

## 2.06 Adjustment of Receiving Mechanism Based on Measurements Using a Bias Set

(a) If the skew index is outside the limits of 48 to 52 as measured in Paragraph 2.05, adjust it to within these limits. The skew index may be adjusted by varying the armature spring tension. Increasing the tension increases the skew index and vice versa. Machines differ but at 60 speed one full turn of the armature spring tension adjusting screw will change the skew index about 2 points. The final spring tension, based on these measurements, should be within the limits of 160 to 210 grams or 5-5/8 to 7-3/8 ounces for 60 speed. For 75 speed, experience indicates the final spring tension should be within the limits of 190 to 220 grams or 6-3/4 to 8-1/4 ounces.

- (b) Measure the bias index and skew index again. The skew index should now be within limits; if not, make a suitable readjustment and repeat the measurements.
- (c) Notice that the bias index of the machine will vary while the skew index is being adjusted. It may, in fact, become somewhat worse than it was when initially measured.
- (d) When the skew index is finally within limits, proceed to remove the bias last measured. Do this by adjusting the armature air gap. Remove positive bias by increasing the armature air gap and negative bias by decreasing the armature air gap. Machines differ but at 60 speed, .001 inch change in the air gap will change the bias index about 5%. The final mean armature air gap setting should be within the limits of .002 to .008 inch based on this method of adjustment for 60 speed. For 75 speed, experience indicates the final mean armature air gap setting should be within the limits of .002 to .004 inch.
- (e) Repeat adjustments of the air gap and measurements of the bias index and the skew index until the bias index is within the limits of plus 2 to minus 2 per cent. The skew index should not change much while the air gap is being adjusted; in fact, this is the basis of the whole procedure.
- (f) In order to facilitate armature air gap adjustments all monitoring teletypewriters should be fitted with armature air gap adjusting brackets.
- (g) If the machine has zero end scales, adjust the bias set for zero bias and determine the upper and lower points of failure. Set the zeros of the zero end scales to coincide with these points. The receiving mechanism is now ready for service.

(h) If the machine does not have zero end scales, set the bias box for zero bias and determine the upper and lower points of failure. These should be recorded and turned over to the telegraph test room attendant when the machine is turned up for service. The receiving mechanism is now ready for service.

(i) In the case of a dual speed machine with zero end scales, set the scales for the higher speed and report the local range on the lower speed when the machine is turned up for service.

(j) In the case of a dual speed machine without zero end scales report the local range at both speeds when the machine is turned up for service.

2.07 Monitoring teletypewriters intended to be used for measuring purposes can not be adjusted satisfactorily without some means of introducing predetermined amounts of bias into the test signals; therefore, if such machines are located at a point where a bias set is not normally available, arrangements shall be made to ship in a portable bias set at periodically established test intervals in order to test and adjust the monitoring teletypewriters, provided a source of reversals is available at the point for use in calibrating the bias set. Whenever a bias set is shipped to such a point the procedures specified in Paragraphs 2.02 through 2.06 shall be applied to all the monitoring teletypewriters at the point.

2.08 Keyboard Adjustment - 118 Type Telegraph  
Transmission Measuring Set Available

(a) Set up a 60 mil test TLT, patch the measuring set into Looping 1 and the teletypewriter into Looping 2. Transmit the test sentence twice (or an equivalent number of letters) at a speed just sufficient to crowd the keyboard. The total distortion should not exceed 7% at 60 speed or 9% at 75 speed.



(b) If the distortion does exceed the limits shown above, the mechanical adjustments should be checked and readjusted as necessary to reduce the distortion. Anti-distortion detents may be applied if available.

2.09 Keyboard Adjustment - 118 Type Telegraph Measuring Set Not Available

(a) Set up a 60 mil test TLT, patch another monitoring teletypewriter known to be in good adjustment into Looping 1; patch the teletypewriter with the keyboard under test into Looping 2. Set the range arm of the measuring machine the required number of per cent below its upper failure point on local signals and transmit the test sentence twice (or an equivalent number of letters) from the keyboard under test at a speed just sufficient to crowd it. Repeat this procedure with the range arm of the measuring machine set to the required number of per cent above its lower failure point on local signals. No errors should be received on the measuring machine.

\*(b) The readjust requirements for keyboards at 60 or 75 speed should be 7% or less.

(c) If the distortion limits are exceeded, the mechanical adjustments should be checked and readjusted as necessary to reduce the distortion. Anti-distortion detents may be applied if available.

2.10 A monitoring teletypewriter may be turned up for service only when both its receiving mechanism and keyboard meet the specified readjust requirements.

2.11 Whenever a monitoring teletypewriter is turned over to the Equipment Department because either its keyboard or receiving mechanism failed to

meet the test requirements, then both the keyboard and the receiving mechanism shall be adjusted to meet the readjust requirements.

### 3. TEST REQUIREMENTS

3.01 The procedures and limits specified under "Test Requirements" are designed to indicate whether the set is in satisfactory operating condition. They are not as severe as the "Readjust Requirements" specified in Part 2 but provide ample margin for satisfactory operation.

3.02 Any set which fails to meet the "Test Requirements" shall be readjusted to meet the more severe "Readjust Requirements"

#### 3.03 Test of Receiving Mechanism

(a) Use the same setup specified in 2.04. Send miscellaneous signals biased 10% marking and determine the upper point of failure. The indicated reduction in range at the upper end should be between 7% and 11%.

Note: When making this test if the lower point of failure is measured, it may be as much as 3 points below or one point above the zero setting of the lower zero end scale due to the permissible amounts of bias and skew which may be present.

(b) Now send miscellaneous signals biased 10% spacing and determine the lower point of failure. The indicated reduction in range at the lower end should be between 7% and 11%.

Note: When making this test if the upper point of failure is measured, it may be as much as 3 points above or one point below the zero setting of the upper zero end scale due to the permissible amounts of bias and skew which may be present.

**BELL SYSTEM PRACTICES**  
**Teletypewriter and Manual**  
**Telegraph Station and P.B.X.**  
**Installation and Maintenance**

**SECTION P35.613**  
**Issue 1, May, 1935**  
**AT&T Co. Standard**

# **MONITORING TELETYPEWRITER**

## **14 TYPE**

### **REQUIREMENTS AND PROCEDURES**

#### **1. GENERAL**

1.01 This section covers supplementary requirements and procedures which apply in connection with 14-type teletypewriters used for monitoring purposes.

1.02 For requirements and procedures other than those specifically covered in this section, see the sections in the "P" series which cover respectively the lubrication and the requirements and procedures for 14-type typing unit and base, and for line relays.

#### **2. ADJUSTMENT FOR ZERO INTERNAL BIAS**

2.01 The adjustment of a monitoring teletypewriter so that it is free from internal bias is essential in all cases.

2.02 The theory of signal reception in teletypewriters is covered in Section E45.521 of Bell System Practices and the requirements and procedures outlined below are based on the considerations discussed in that section.

2.03 A teletypewriter can be tested for internal bias by comparing the orientation range on signals having zero bias with those obtained using signals which have first some marking bias and then some spacing bias. If the upper limit is raised by the reception of signals having spacing bias, the teletypewriter has an internal bias which is marking. Conversely, if the lower limit is lowered by the reception of signals having marking bias, the teletypewriter has an internal bias which is spacing.

2.04 The internal bias of the teletypewriter is dependent on the line relay used and changing the line relay will change the bias of a machine.



2.05 Bias can usually be eliminated from the teletypewriter by making an appropriate adjustment as described later. However, in some machines it may not be possible because of manufacturing variations to remove it to within the required limit of 2%. Selection of machines for monitoring purposes may therefore be required.

### **Source of Biased Signals**

2.06 Any device which provides signals having no distortion other than marking or spacing bias as desired, may be used in making the test. It is not essential that the exact amount of bias introduced into the signals be known, nor is there any definite requirement regarding the amount of bias introduced, except that the introduced bias should be between 10 and 35 per cent.

2.07 Where no source of biased signals for testing purposes is already available a test set made locally may be used as shown in Figs. 1 and 2. As shown in Fig. 1, this set consists of a 60-milliampere "dummy" circuit with arrangements for inserting a retardation coil to produce spacing bias and for bridging a spark-killer across the sending contacts or distributor to produce marking bias. The amount of bias produced will depend upon the adjustment of the line relay of the teletypewriter and will ordinarily be between 10 and 20 per cent. for both marking (positive) and spacing (negative) bias.

(a) To set up the operating condition a + 130 volt (120 ohm) battery tap is patched to the jack labeled "+ 130 V.," ground to the jack labeled "G," a source of substantially perfect signals to the jack labeled "SIG" and the teletypewriter to the jack labeled "TTY". With the key in the normal position signals will be unbiased. To obtain signals with marking or spacing bias the key is operated to either the "+" or "-" position. An equipment assembly suitable for mounting in a box is shown in Fig. 2. If desired the equipment may be assembled on a panel for mounting on a relay rack.

### **2.08 Adjustment Procedure**

(a) Check the speeds of the teletypewriter as outlined in Part 4 and readjust if necessary.

(b) Check the adjustment of the line relay in accordance with the requirements and procedures covering line relays and readjust if necessary. Where a relay test panel or test table is available, the relay should be checked and, if necessary, readjusted using this apparatus.

(c) With the teletypewriter operating at 60 speed, obtain orientation range limits as outlined in the section cov-



ering requirements and procedures for the 14-type typing unit using substantially perfect signals having zero bias.

Note: Range should be minimum 70 per cent.

(d) Obtain orientation range limits as in (c) using signals having spacing bias in measuring the upper limit and marking bias in measuring the lower limit, the signals to be obtained from a source as described in paragraph 2.06.

Note: If upper limit obtained in (d) is greater than that obtained in (c), the teletypewriter has internal marking bias. If lower limit obtained in (d) is lower than that obtained in (c) the teletypewriter has internal spacing bias.

(e) Remove marking bias by increasing the armature air-gap and armature spring tension, and remove spacing bias by decreasing the air-gap and spring tension keeping the adjustment of these parts within the limits specified in the section covering the requirements and procedures for the 14-type typing unit.

Note: If in any case the internal bias cannot be removed to within one or two per cent. using the above procedure, it may be necessary to readjust some other part of the typing unit affecting the orientation range or as a final resort it may be necessary to replace the typing unit. The parts whose adjustments affect the orientation range are:

- Selector Armature
- Selector Armature Bracket
- Selector Armature Bracket Link
- Selector Clutch Spring
- Armature Locking Wedge
- Armature Trip-Off Eccentric Screw
- Magnet Bracket

### **3. ADJUSTMENT OF 83562(M) 14-TYPE MONITORING RANGE SCALE ASSEMBLY (CRANK OPERATED)**

3.01 The stop lever eccentric screw on the range scale sector, the stop lever spring tension and the trip latch spring tension should be in accordance with the requirements and procedures for the 14-type typing unit.

3.02 Worm shaft should have some end play, not more than .004", and be so located that there will be just perceptible radial play between the worm and gear sector at the closest point in their rotation.

(a) Gauge by eye and feel, holding detent spring away from ratchet wheel.

(b) To adjust, reposition shaft rear bearing bracket.

**3.03 Scale pointer** shall line up with range scale division 60 when the detent spring roller is directly above the centerline of the worm shaft and in the space between two worm shaft ratchet wheel detents.

(a) Gauge by eye.

(b) To adjust, reposition detent spring.

**3.04 Detent spring tension** shall be Min. 24 ozs. (680 gms.), Max. 32 ozs. (900 gms.) measured at the detent spring roller stud as the roller starts to move.

(a) Gauge with a 138-58(M) scale.

(b) To adjust, bend detent spring.

**3.05 End zero scales** shall be located so that the zero scale division coincides with the extremities of the teletypewriter orientation range as determined on substantially perfect signals received with zero bias.

(a) Gauge by eye when measuring orientation range.

(b) To position, remove end zero scale mounting screws and reposition scales as required. Reinsert mounting screws with flat and spring washers under head of screw. Tighten screws.

Note: It is not possible to set these end zero scales on a teletypewriter having an orientation range of less than 70 divisions because each end zero scale extends from its zero point for a distance of 35 divisions.

#### 4. ADJUSTMENTS FOR TWO-SPEED GOVERNOR

**4.01 Governor contacts, adjusting wheels and brushes** shall be adjusted as specified for edge-contacting type single speed governors (see section covering requirements and procedures for 14-type typing unit).

**4.02 Speed.** The free speed of receiving shaft in revolutions per minute corresponding to operations per minute is:

| <u>Speed</u> | <u>Operations per Min.</u> | <u>Words per Min.</u> | <u>Target</u> | <u>Black Target Spots</u> | <u>Free Speed Rec. Shaft in R.P.M.</u> |
|--------------|----------------------------|-----------------------|---------------|---------------------------|--|
| Low          | 240.0                      | 40.0                  | 1J            | 23                        | 274.3                                  |
| High         | 368.0                      | 61.3                  | 1G            | 10                        | 420.6                                  |

(a) Check speed as outlined in the section covering speed regulation, checking and adjusting the 40 speed governor before checking 60 speed.

Note: Governor switch should be in "LO" position while checking and adjusting the 40 speed governor

and in "HI" position while checking and adjusting the 60 speed governor.

(b) Adjust speed using the right governor contacting spring adjusting thumb wheel (side of governor adjacent to motor) for adjusting the 40 speed governor and the left thumb wheel for adjusting the 60 speed governor. Turn the thumb screws as indicated by letters "S" and "F" to decrease and increase the speed respectively.

Note: 40 speed governor must be checked and adjusted before 60 speed governor.

## **5. LUBRICATION OF 83562(M) 14-TYPE MONITORING RANGE SCALE ASSEMBLY (CRANK OPERATED)**

5.01 The oils and grease referred to herein are those specified in the section on Teletypewriter Apparatus—Lubrication—General Requirements.

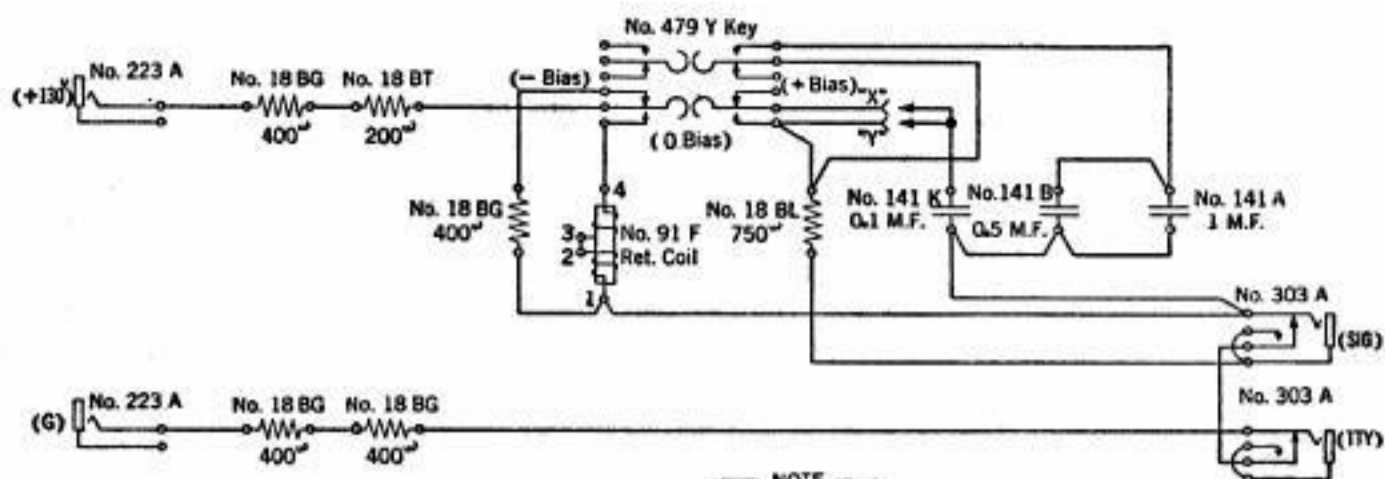
5.02 The following parts should be lubricated sparingly with oil:

- Front and rear shaft bearings.
- Detent roller bearing.
- Pointer shoulder screw.
- Trip plunger.
- Trip bell crank pivot.
- Stop pawl latch pivot.
- Stop pawl shoulder screw.

5.03 The following parts shall be sparingly lubricated with grease:

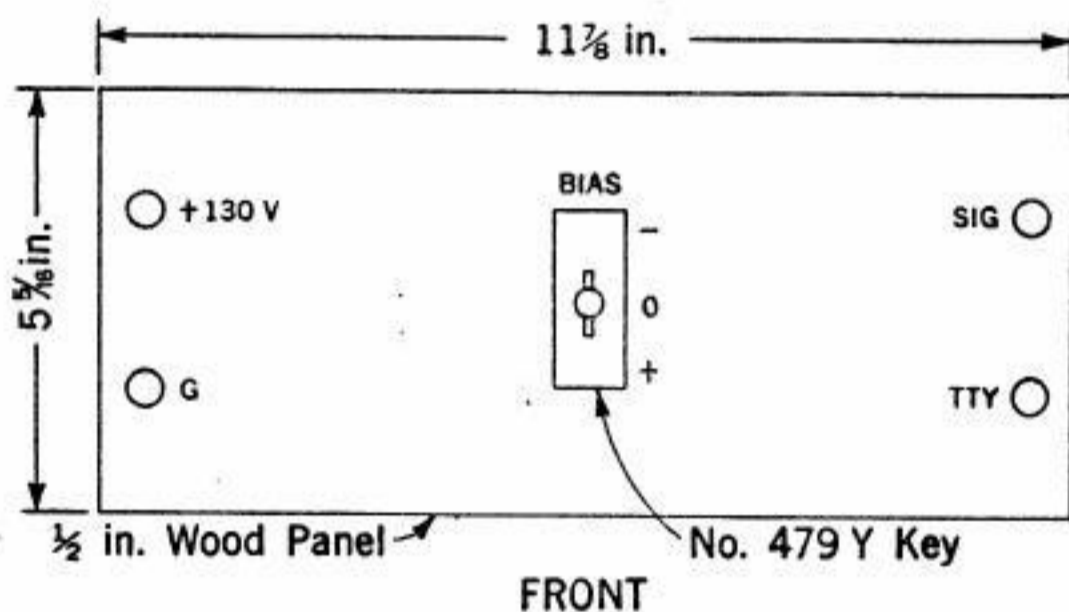
- Worm and sector teeth.
- Detent star wheel.
- Sliding surfaces of pointer extension and main bracket.
- Sliding surfaces of sector and main bracket.





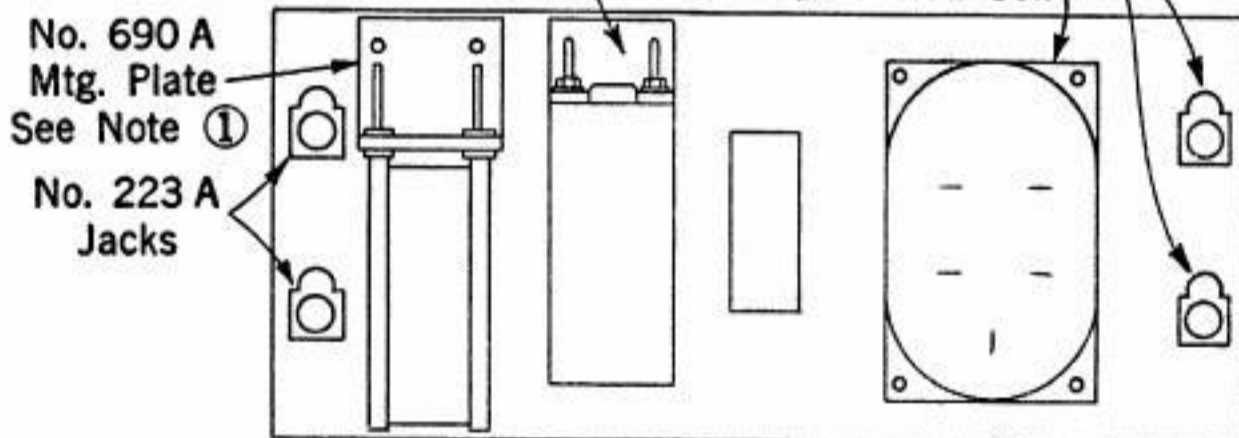
NOTE  
Use "X" wiring for signals from Brush Distributor  
and "Y" wiring for multiple sender signals.

Fig. 1



No. 27-B Bracket with No. 141-A,  
141-B and 141-K Conds.

No. 303 A Jacks  
No. 91 F Ret. Coil



REAR

NOTE

① Drilled in Pos. 1 - 6 for No. 18 type resistances.

Fig. 2