# 11-000 Work Station Attachment

**CONTENTS**



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## 11-010 INTRODUCTION

The work station attachment on each System/34 controls up to eight work stations (16 work stations with expansion feature B); a work station being one of the following:

- 5251 Display Station (Model 1 or 11)
- 5252 Dual Display Station
- 5255 Display Station
- 5224 Matrix Line Printer
- 5225 Matrix Line Printer
- 5256 Matrix Printer

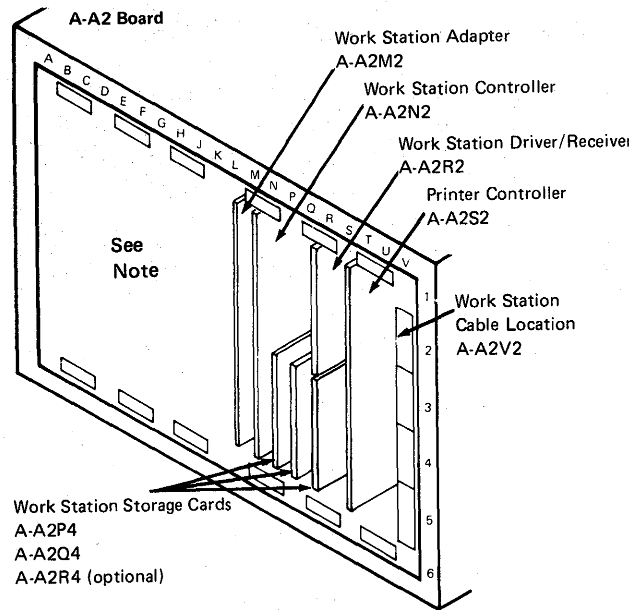
The primary display station (the system console) must be one of the following:

- 5251 Display Station (Model 1 or 11)
- 5252 Dual Display Station
- 5255 Display Station

See Figure 11-4 for several examples on how work stations can be attached to System/34.

## 11-100 LOCATIONS

All parts for the work station attachment are located on the A-gate, A2 board. As Figure 11-1 shows, the parts include six cards (A-A2R4 is optional), four top card connectors, and one cable. For a description of the top card connectors, see paragraph 11-300.




*Note:* The top card connectors are not shown.

**Figure 11-1. Work Station Attachment Card Locations**

The location of the six cards and the hardware on each card are:

- Work Station Controller Card (A-A2N2)
  - 4-bit ALU
  - 4-bit A and B registers
  - 16 4-bit data address registers
  - 16 4-bit primary work registers
  - 16 4-bit auxiliary work registers
  - 16-bit op register
  - 16-bit storage address register (The SAR bits are numbered XSAR 0 through 3 and SAR 0 through 11.)
  - 16-bit instruction address register
  - 2K bytes of controller random access storage
  - Control logic: Includes controller load logic, controller interrupt logic, and miscellaneous control lines between the controller and adapter cards.

- Work Station Adapter Card (A-A2M2)

  Since all commands and data must pass through the adapter card, there are three important functions to the adapter card. These functions and the hardware for each are:
  - Channel
    - Data bus out (DBO), data bus in (DBI), command bus out (CBO), command bus in (CBI)
    - Base cycle steal
    - Interrupt level 4 generation
    - I/O instruction decode
  - Controller
    - Controller data bus out (CDBO), controller data bus in (CDBI), and controller command bus out (CCBO)
    - Controller status and control latches
    - Controller I/O instruction decode
  - Driver/receiver controls
    - SERDES and SERDES controls
    - Modulator/demodulator
    - Cable address register (driver/receiver selection)

- Driver/receiver card (A-A2R2)
  The driver/receiver card can drive up to eight work stations. This card has the following functions:
  - Driver/receiver circuits
  - Driver/receiver activity register
  - Cable selection decode
  - Controller 16-MHz oscillator
  - Receive clock generation

- Storage cards (A-A2P4 and A-A2Q4)
  These cards are needed on each system; they contain additional controller storage. An optional type A-A2Q4 card is available; it contains additional storage.

- Feature storage card (A-A2R4)
  This card is needed on systems having any work station controller features.

## 11-200 MAINTENANCE

Because of the parts (cards, top card connectors, and cable) that make up the work station attachment, there are no adjustment, removal, or replacement procedures. Any maintenance performed on the attachment needs a failing part exchanged. For locations of all the parts, see Figures 11-1 through 11-3.

*Line Quality*

There is a service check that should be performed if the quality of the line signal is in question. To perform this service check, see *Cable Quality Check*, paragraph 11-500.

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*Work Stations*

For maintenance information on the work stations, see the following manuals:

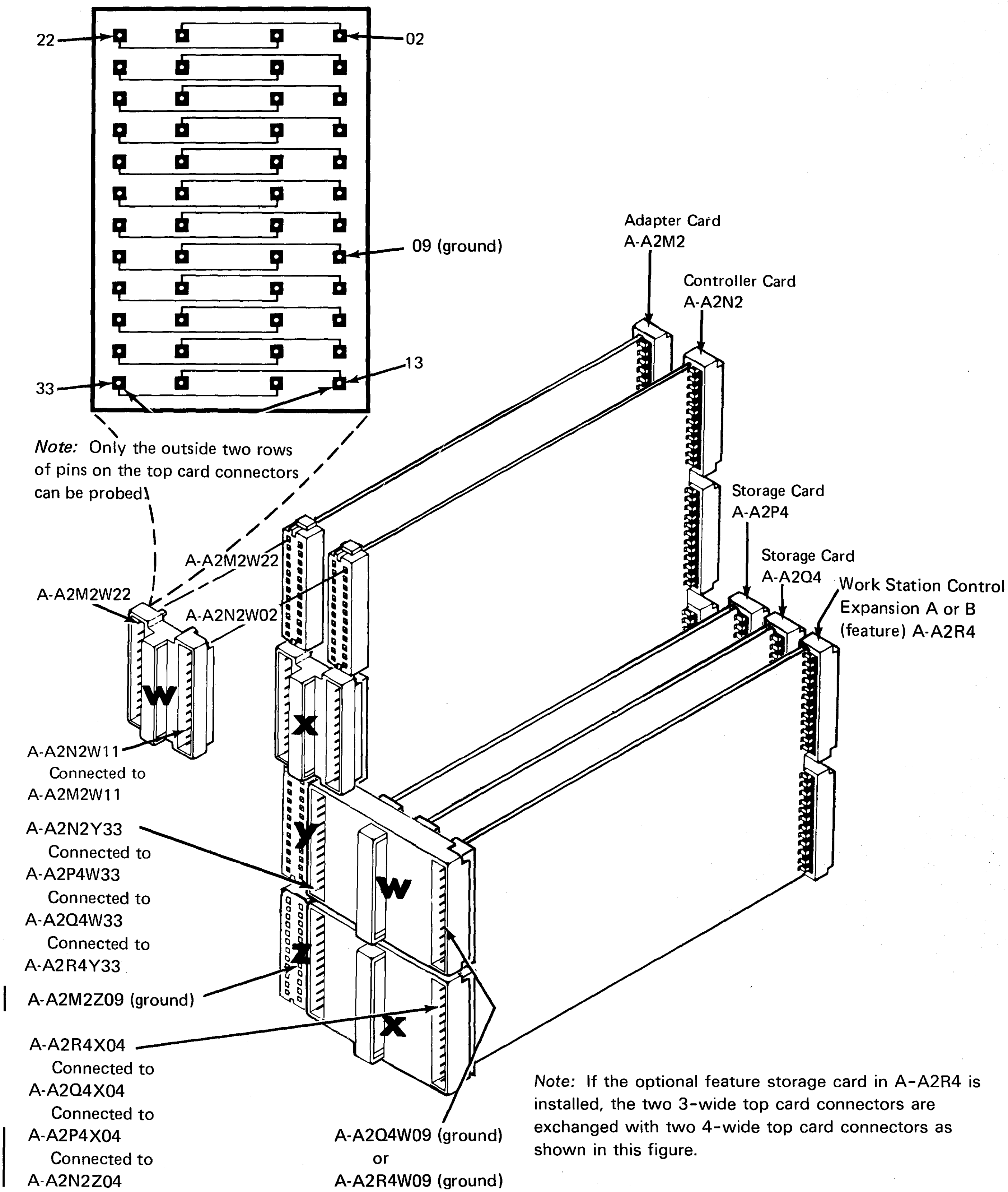
- *IBM 5224 Printer Models 1 and 2 Maintenance Information Manual*, SY34-0095
- *IBM 5224 Printer Model 12 Maintenance Information Manual (Ideographic)*, SY34-0096
- *IBM 5225 Printer Models 1, 2, 3, and 4 Maintenance Information Manual*, SY34-0060
- *IBM 5225 Printer Models 11 and 12 Maintenance Information Manual (Ideographic)*, SY34-0094
- *IBM 5251 Display Station Models 1 and 11 Maintenance Information and Maintenance Analysis Procedures Manual*, SY31-0461
- *IBM 5252 Dual Display Station Maintenance Information and Maintenance Analysis Procedures Manual*, SY31-0492
- *IBM 5255 Display Station Model 1 Maintenance Information Manual*, SY09-1011
- *IBM 5255 Display Station Model 2 Maintenance Information Manual*, SY09-1013
- *IBM 5256 Printer Maintenance Information Manual*, SY31-0462

## 11-300 TOP CARD CONNECTORS

Figure 11-2 shows the location of all top card connectors on the work station attachment cards. Notice that the 3-wide connectors (on the N2, P4, and Q4 cards) are marked W and X on the P4 and Q4 cards but the same connectors are marked Y and Z, respectively, on the N2 card. (Card connectors are always marked W, X, Y, and Z for 4-wide cards; they are marked W and X for 2-wide cards.)

Also notice that only some of the pins on the top card connectors are accessible for scope probing. These pins are on the outside two rows of the 2-wide and 3-wide connectors. The row of pins on the right side of the connector is numbered 02 through 13; the pins on the left side of the connector are numbered 22 through 33.

As an aid for identifying pin locations on each card connector, several pin locations are shown in Figure 11-2.




*Note:* If the optional feature storage card in A-A2R4 is installed, the two 3-wide top card connectors are exchanged with two 4-wide top card connectors as shown in this figure.

**Figure 11-2. Work Station Attachment Top Card Connectors**

## 11-400 CABLES

A cable is needed to attach the work stations to the A-A2 board on System/34; it is connected from the A-A2V2 socket to the work station cable entry tower. Another cable (twinaxial cable) is connected from the cable entry tower to the work stations. The ports on the cable entry tower are numbered 0 through 3. Port 0 is *always* used for the system console *only*. Ports 1 through 3 are used to attach a total of seven (a total of 15 if work station control expansion B is installed) additional work stations to System/34. Figure 11-4 shows two ways in which work stations can be attached to the system.

*Note:* Seven work stations can be attached to any of the ports 1 through 3 for systems without work station control expansion B.

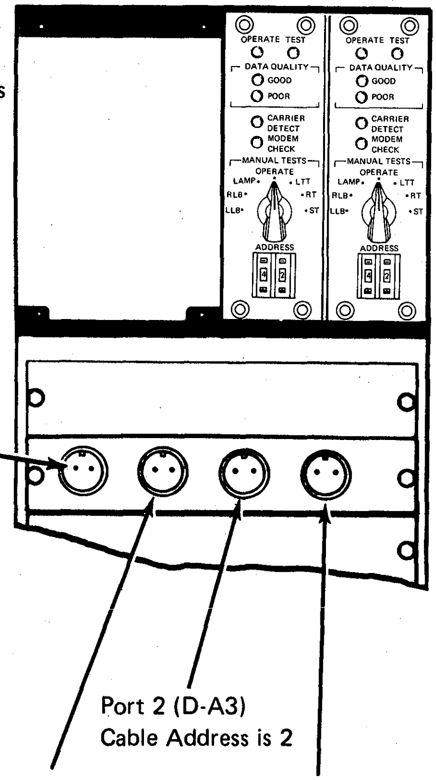



**Figure 11-3. Cable Entry Tower**

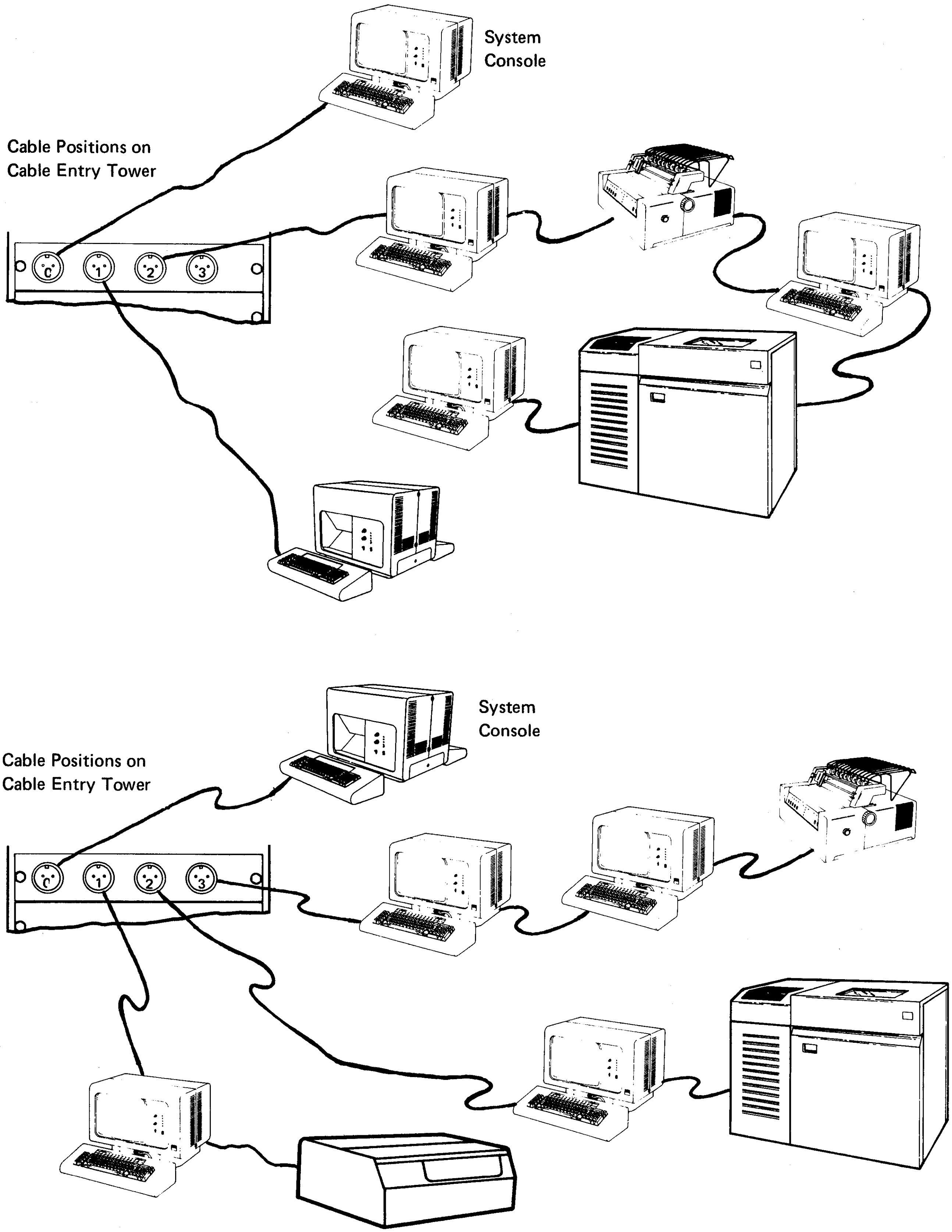



**Figure 11-4. Work Station Configurations**

## 11-500 CABLE QUALITY CHECK

A cable continuity check that does not need an oscilloscope is available in MAPs 1181 through 1184. Use these MAPs before using the cable quality check.

The following paragraphs aid you in determining if there is a problem in a cable, a cable connection, or an attached work station. The information will also help you determine where the problem is. The most common problems are open circuit cables, short circuit cables, or poor cable connections.

To make this cable quality check, you will need the following (or similar):

- Tektronix[1] 453 or 454 oscilloscope
- BNC T-connector
- Coaxial cable with BNC ends
- Times-1 (X1) probe with ground lead and two alligator clips
- Resistor assembly (part 7362344). This resistor assembly is needed only if the end of the cable being checked is not terminated at a work station.

*Note:* Do not use this test procedure to check the quality of any work done by a customer.

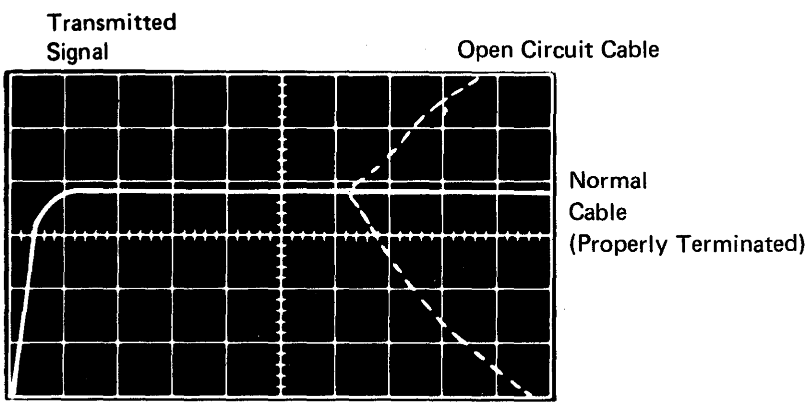
[1]Trademark of Tektronix, Inc.

## 11-510 Cable Checking Introduction

If you understand the cable quality check, go to paragraph 11-520 and perform the check. However, if you do not understand this check, it is important that you carefully read all of the information through paragraph 11-515. You can use this information as an introduction to cable checking with the use of an oscilloscope. Additional information can be found in *An Oscilloscope Measurement Procedure for Twisted and Coax Cables*, S226-3913.

### *11-513 Typical Signals*

When you use the oscilloscope to make the cable quality check, you will probably see a scope display similar to the following figure. This figure shows the transmitted signal for a normal cable, and the change in signal level that occurs if a cable has an open or short circuit.




Notice that for an open circuit cable the transmitted signal moves upward; for a shorted circuit cable the transmitted signal moves downward. However, for a good cable, there is usually a small change in the transmitted signal level, or no change at all. Small changes (less than 10 percent of the transmitted signal level) are normal and they are probably caused by a cable-to-cable connection or by a connector on a work station.

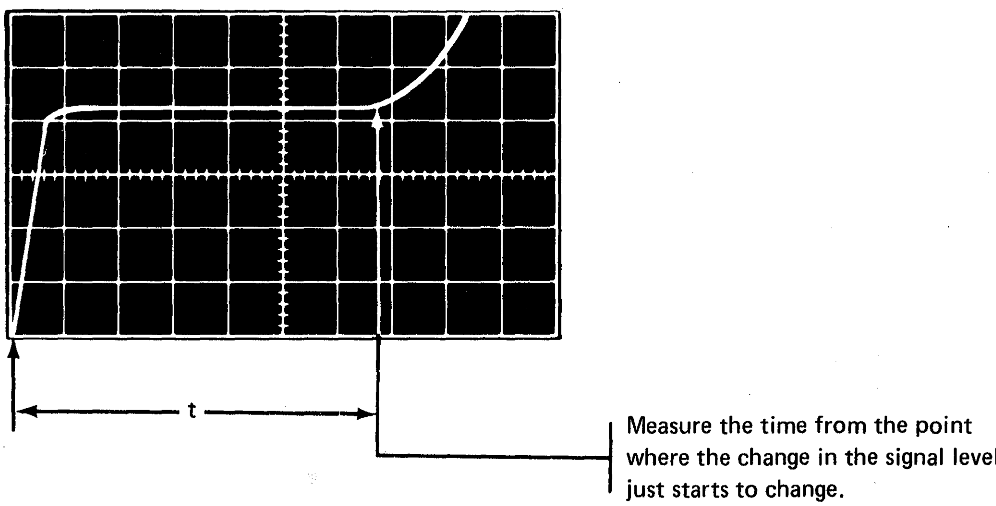
*Note:* A change of more than 10 percent of the transmitted signal level usually indicates a cable problem.

## *11-515 Calculating Distance to Cable Problem*

You can determine the distance to a cable problem from the end of the cable that you are checking by using the calculations as described in Figure 11-5.

In making the calculations, it is *important* that you:

- Calculate the distance accurately.
- Measure the time in microseconds as indicated by the pointer in Figure 11-5.
- Determine the time (t) by multiplying the B time base by the number of scope divisions.




**Calculations for determining distance in feet and meters are:**

$D_f$ = t (µs) X 324.7 feet
$D_m$ = t (µs) X 99 meters

$D_f$ = distance in feet
$D_m$ = distance in meters
t = time in microseconds. To find t, multiply the B time base setting by the number of scope divisions.

The following calculation is set for the transmitted signal above (assuming that the B time base is set for 0.2 µs).

t = 6.8 divisions X 0.2 µs = 1.36 µs

1.36 µs X 324.7 feet = 441.6 feet

**Figure 11-5. Calculating Distance to Bad Cable**

## 11-520 Cable Quality Check Procedure

If you understand the information in paragraphs 11-500 through 11-515, you should now perform the cable quality check. Set the knobs and switches on the oscilloscope as shown in Figure 11-6. Then see Figure 11-7 and do the following:

1. Connect the T-connector to the B gate on the side panel of the oscilloscope. (The output of the B gate transmits a signal on the cable.)

2. Connect the coaxial cable from the channel 1 input to one side of the T-connector. If you have a probe-tip-to-BNC-adapter (part 453199), use a times-1 (X1) probe.

3. Connect a times-1 (X1) probe with a ground lead and alligator clips to the other side of the T-connector.

4. Connect the alligator clips to the end of the cable being checked as follows:

   - Ground lead to shield

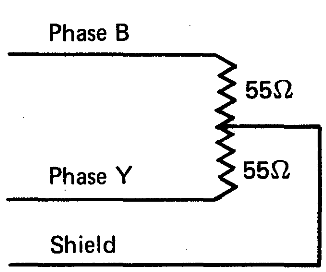
   - Signal lead to phase Y

5. Ensure that the other end of the cable being checked is terminated. To do this do one of the following:

   - Verify that a work station without the Cable Thru feature is attached (cable is automatically terminated),
     or

   - Set the work station terminator switch to 1 on work stations with the Cable Thru feature,
     or

   - Terminate the end of the cable with a resistor assembly (part 7362344) as shown here:




6. If the oscilloscope is connected as instructed, you should now see a signal. If the signal shows that the cable is good (no change in the signal level), you may be checking only the first 91 meters (300 feet) of a longer cable. Therefore, change the B time base from 0.1 microseconds to 0.2 microseconds, to 0.5 microseconds, and so on up to 2 microseconds. The 2 microsecond setting checks the maximum length cable of 1524 meters (5000 feet), so it is not necessary to increase the B time base to 5 microseconds.

   If the transmitted signal changes at any of the B time base settings, go to step 9.

7. If you see no change in the signal level when the B time base is set to 2 microseconds, leave the B time base on 2 microseconds and move the alligator clips as follows:

   - Ground lead to shield

   - Signal lead to phase B

   If the transmitted signal changes, go to step 9.

8. If you see no change in the signal level when the B time base is set to 2 microseconds, leave the B time base on 2 microseconds and move the alligator clips as follows:

   - Ground lead to phase Y

   - Signal lead to phase B

   If the transmitted signal changes, go to step 9. After you have checked all three possible combinations (shield to phase Y, shield to phase B, and phase Y to phase B) and there is still no change of the transmitted signal, the cable is good.

9. If there is a change of the transmitted signal, move the B time base to a setting that will let you calculate the distance to the bad cable. Use Figure 11-5 as an aid in calculating the distance, and Figure 11-8 as a reference.

   *Note:* If for some reason you want to check the length of a good cable, disconnect the cable from the other end. The transmitted signal will show an open circuit as shown in C or D of Figure 11-8.

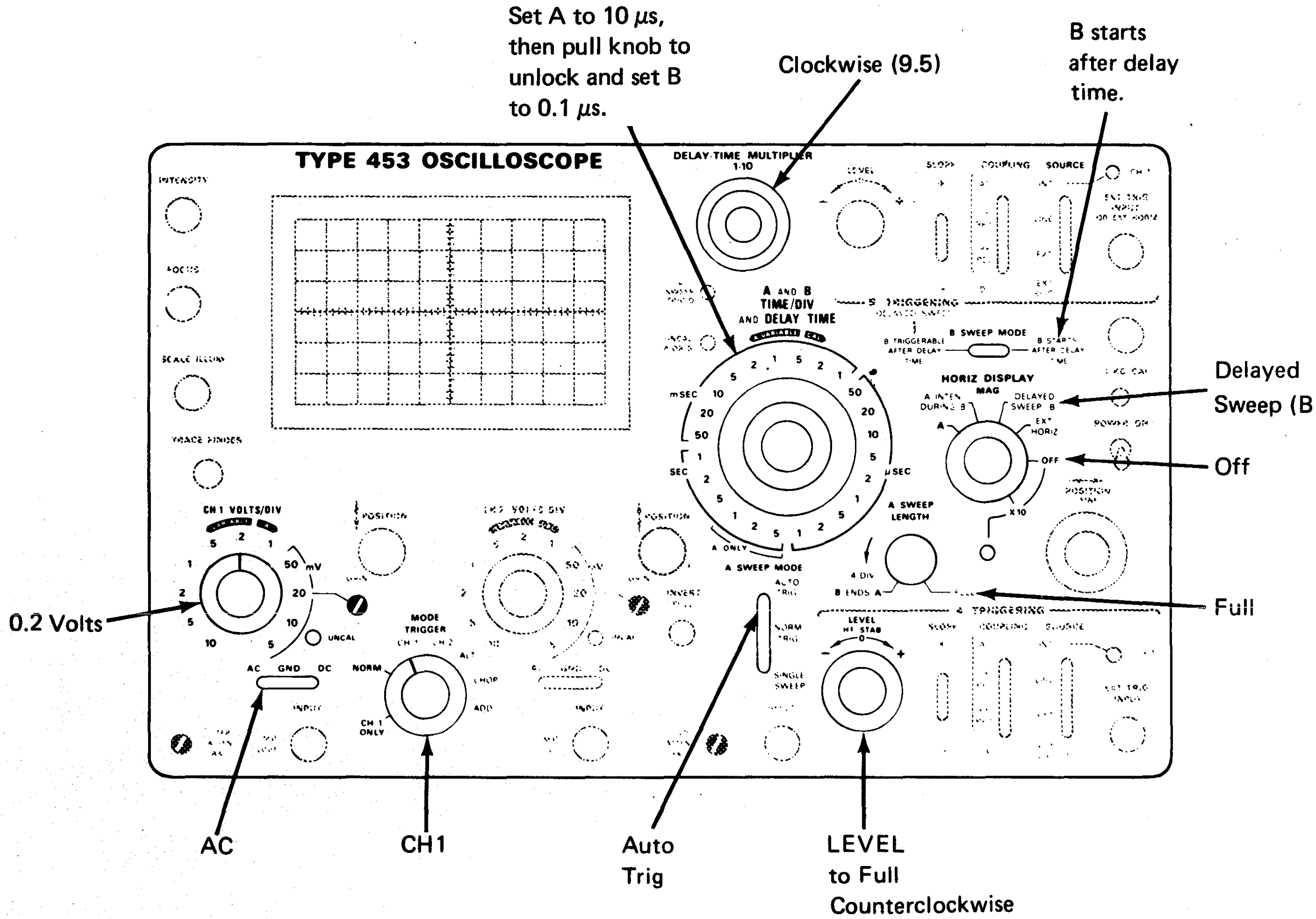



**Figure 11-6. Setting Oscilloscope Switches**

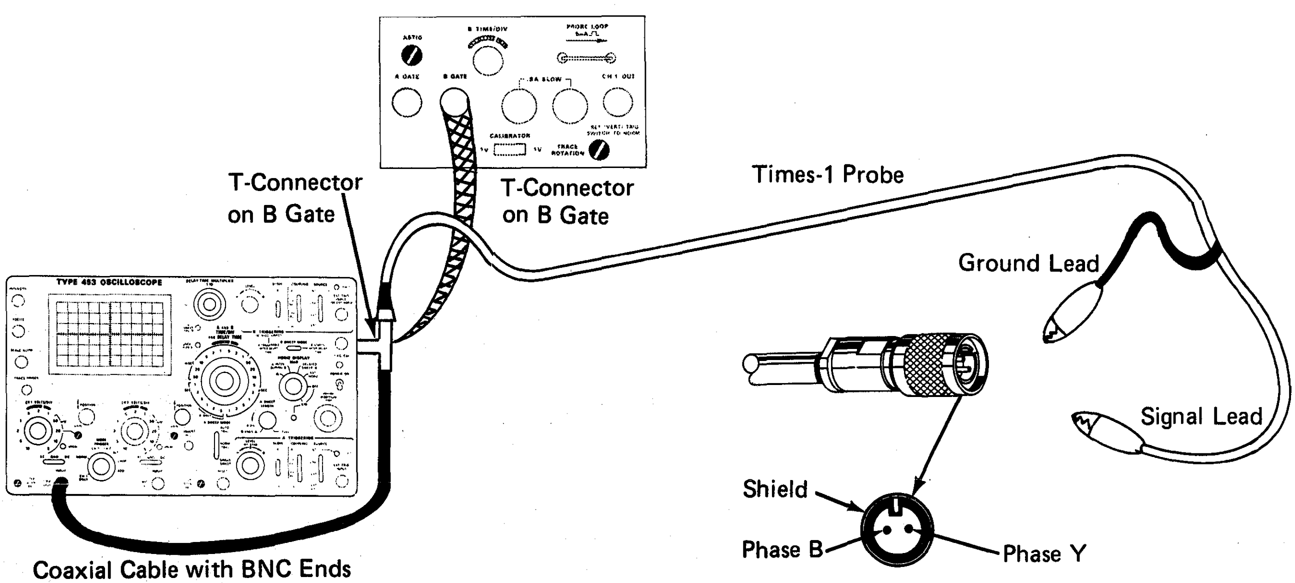
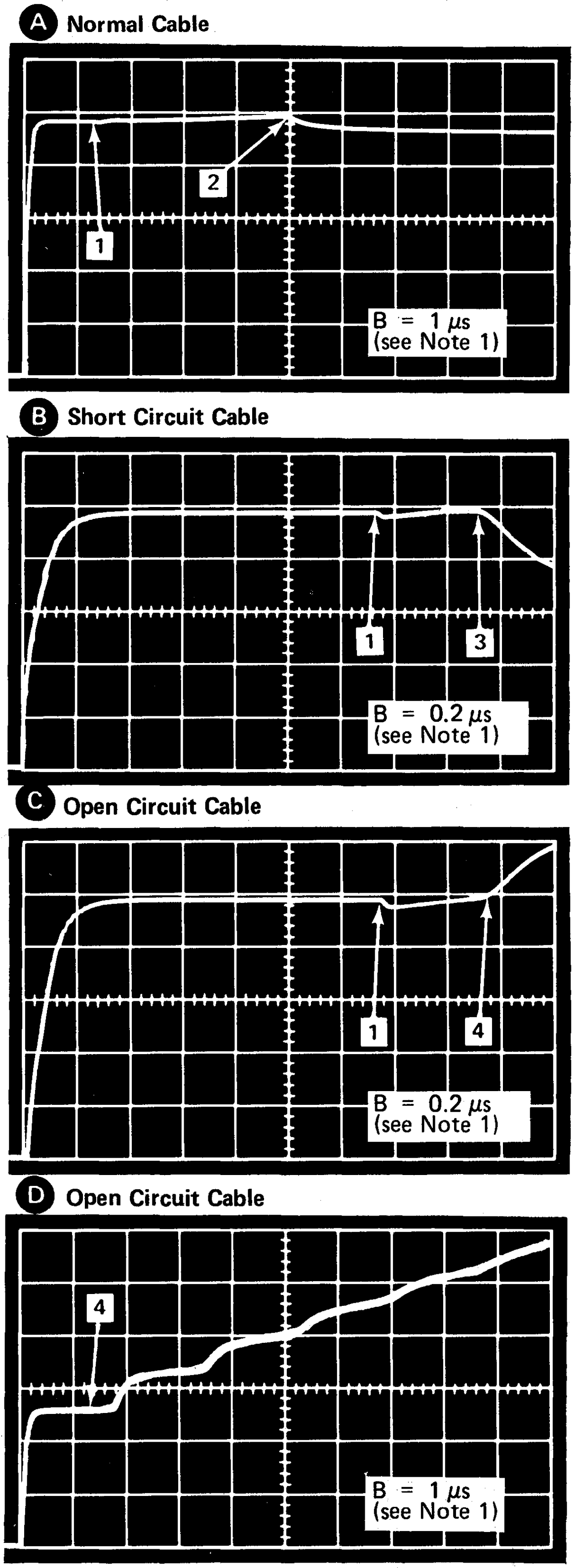



**Figure 11-7. Connecting the Oscilloscope**




[1] A small change in the signal level caused from a terminal (with the Cable Thru feature) 131 meters (430 feet) from the end of the cable being checked. The change at [1] is also shown in (B) and (C).

[2] A change in the signal level caused from the last terminal on the cable 495 meters (1625 feet) from the end of the cable being checked.

*Note:* A change in the signal level of more than 10 percent usually indicates a problem.

[1] Same as [1] in (A) but with the B time base now set to 0.2 μs.

[3] A change in the signal level caused by a short circuit cable 170 meters (560 feet) from the end of the cable being checked.

1.72 μs X 99 meters = 170 meters
or
1.72 μs X 324.7 feet = 560 feet } (see Note 2)

[1] Same as [1] in (B).

[4] A change in the signal level caused by an open circuit cable 170 meters (560 feet) from the end of the cable being checked.

1.72 μs X 99 meters = 170 meters
or
1.72 μs X 324.7 feet = 560 feet } (see Note 2)

[4] Same as [4] in (C) but with the B time base set at 1 μs.

*Note:* Always change the B time base to show only one change in the signal level so that you can more easily determine the time on your oscilloscope.

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*Notes:*

1. The A time base is always set for 10 μs and Channel 1 is always set for 0.2 volts/division.
2. The reflection for the shorted cable and for the open cable occurs at 8.6 divisions. Therefore, t is equal to 1.72 μs (8.6 x 0.2).

**Figure 11-8. Sample Oscilloscope Signals**