CLOCK DISTRIBUTION UNIT
INSTALLATION AND MAINTENANCE PROCEDURES

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1. INTRODUCTION

1.01 This practice provides a general description along with procedures for installation and maintenance procedures of the J98726Z-1 Clock Distribution Unit (CDU). Broad schematic coverage is given in application schematic SD-7C389-02. The plug-in equipment is coded AHG1, AHG4, AHG16, AHG25, AHG26, and AHG27.

1.02 This practice is being reissued to reflect design and operational improvements. The major changes are as follows:

- Addition of the AHG26 Timing Distributor (TD) plug-in unit.
- Addition of the AHG27 Timing Interface (TI) plug-in unit.
- Addition of procedure for CDU maintenance and troubleshooting.

1.03 The objective of the CDU is to provide the highest quality timing with maximum reliability. The CDU is a distributor of

synchronization from either high quality DS-1 signals, a 5ESS or DACS-1 BITS clock, or the Stratum II system clock of the 4ESS or DACS machines. The CDU provides a variety of synchronized signals including: all ones DS-1, 2.048 MHz, 512 kHz or 64 kHz sine waves. Typical applications are shown in Fig. 1.

1.04 The CDU's output, with an AHG25 TD, will supply signals that may be used to synchronize equipment requiring all ones DS-1 timing signals with either D4 or extended superframe framing format. The CDU's output, with an AHG4 TD will provide synchronization signals for timing a Primary Frequency Supply PFS-2 (J68857M) or PFS-2B (J68857AC). The CDU's output, with an AHG26 TD, will provide synchronization signals for timing a Distribution Hybrid Tree (SD-51498-01) or an Office Master Frequency Supply (J-50802-01).

1.05 The system architecture of the CDU consists of separate A and B sides which derive their timing separately from the A and B timing inputs (Fig. 2). There is no switching between these inputs. One half of the total outputs are derived from input A and the other half from input B. If there is a failure of one of the inputs, then all outputs derived from that input will be inhibited. The outputs of the CDU's A and B outputs may be fed into external switching and distribution machines. These machines perform phase build-out necessary for hitless switches between the A and B sides of the CDU.

1.06 The CDU's output signals are made available at the SDE A and SDE B terminal blocks above the shelf assembly. The Side A and Side B timing signals are divided between the SDE ( ) terminal blocks. ***The first ten output taps on SDE A and SDE B terminal blocks provide outputs from side A (TD-1 and TD-3 respectively). The second ten output taps on SDE A and SDE B terminal blocks provide outputs from side B (TD-2 and TD-4 respectively).***

1.07 Careful placement of the CDU is needed to achieve high reliability timing. The input signal level and transmission characteristics require that a few simple guidelines be observed when installing the CDU. The CDU should not be placed in an electrically noisy environment or highly active area. Care should be taken when running power and signal cables so that the input signal cables are kept away from output cables. Good frame ground connections should be checked to ensure optimum shielding from external electrical noise. Finally, all cables connecting to the CDU should be dressed such that unshielded lengths are kept as short as possible. Shield connections between the CDU to equipment located within a switching area should be made in accordance with AT&T Practice 803-500-410.

1.08 Connection of the CDU to the output from the DACS (2.048 MHz sine wave) should be made in accordance with information from SD-96658-01, CAD 169. One of the DACS outputs should come from 0TLI1, and the other output from 1TLI1. The 2.048 MHz input should be cabled with 22BF or equivalent cable only. The shield should be connected at the DACS end (hard ground) and at the CDU end at the shield designation (capacitive ground). The CDU should be mounted in the DACS area as required.

1.09 Connection of the CDU to the output signal from the 4ESS (16.384 MHz CTS) should be done in accordance with information from SD-4A014-02: Sheet B1GB, Note 1; Sheet D7, Note 307. Each 16.384 MHz CTS signal should be buffered with a 100 ohm to 75 ohm isolation transformer (NE01489-31G1 or equivalent). Connection to the isolation transformer should be made with Sealectro 51-151-000 connector or equivalent.

1.10 The DS-1 framed input signal should be cabled with 22BF or equivalent cable only. The cable's shield should be connected to the shield designation on the CDU (capacitive ground). The DS-1 signals must be cabled from the DS-X and not exceed 655 feet in length. Input levels to the CDU may be either standard (6 volts p-p) or monitor level (.6 volts p-p). If the monitor level is chosen, bridging resistors (two 432 ohm resistors) must be added at the DS-X.

1.11 The 16.384 MHz CTS input should be cabled with 728A or equivalent coaxial cable only. The cable should be connected so that the cable's tip and shield are connected to the tip and ring designations on the CDU. The coaxial cable's shield should also be connected to the shield designation on the CDU (capacitive ground). The CDU should be mounted as close to the 4ESS area as possible.

1.12 When the CDU is operating properly, the following indications are provided:

- All lamps on the fuse and alarm panel (F & A Panel) are extinguished.
- Pressing the MEM button extinguishes all LEDs on the AHG1 TA.
- The IN SCE and DUPLEX LEDs will light on each TI.
- The TDs in positions 1 and 3 will light the TI A OUTPUT IN USE LEDs.
- The TDs in positions 2 and 4 will light the TI B OUTPUT IN USE LEDs.

2. APPARATUS

2.01 Equipment required to perform the installation and maintenance tests includes the following:

- Digital multimeter
- Dual-trace oscilloscope with differential input capability
- A 133 ohm resistor termination and 133 ohm termination mini-clip EA end or slip-on
- R-4987 antistatic wrist strap
- A KS-21838 extractor tool for white option plugs or a long-nose pliers
- Frequency counter able to measure to 2.048 MHz with input impedance of 1 Meg-ohm
- Cords as required.

3. INSTALLATION OF CDU PANEL

A. Description

3.01 The CDU is attached to the equipment bay using brackets on either side of the shelf. These brackets are reversible and allow both front and rear mounting without any additional hardware. This arrangement is shown in Fig. 3.

3.02 The –48 volt battery is cabled to TS 1 located at the rear of the Fuse and Alarm panel. Provision is made for three separate –48 volt battery feeds (–48 A, –48 B, and –48 ABS). Since the CDU is capable of operating with a single blown fuse or damaged power feed, these feeds should be kept separate and individually fused to ensure true power redundancy.

3.03 Input signals are cabled to TS 2 located at the rear of the CDU beside the Fuse and Alarm panel. There is provision for two input signals, one per TI circuit pack. The 16.384 MHz inputs must be cabled with 728A or equivalent coaxial cable. The 2.048 MHz inputs must be cabled with 22BF or equivalent cable. All unshielded wire at TS 2 should be kept as short as possible. Pig-tail shield wires should also be kept short.

3.04 Alarm output connections are cabled to backplane "E" terminals located at the rear of the CDU, beside the Fuse and Alarm panel.

3.05 The TD backplane connector pins are wired to the two center terminal blocks above the CDU panel (Fig. 4). The outputs of TDs 1 and 2 go to the SDE A terminal block; those for TDs 3 and 4 go to SDE B terminal block. Terminal access is thereby provided for the 40 separate output timing taps. Output tap cabling is connected directly to the SDE A and SDE B terminal blocks (Fig. 5).

3.06 The CDU shelf assembly is installed and wired by the AT&T Technologies installation forces or the local central office installation group. The plug-in units are installed after the wiring and cabling is completed. The plug-in units should be installed as shown in Fig. 6.

4. PROVISIONING AND OPERATION PROCEDURES

A. General

4.01 The provisioning and operation procedures include the following:

- Verifying fusing, powering, and alarming
- Verifying continuity
- Verifying input and output signals
- Replacing circuit packs
- Increasing output capability using the auxiliary panel expansion option.

B. Verifying Fusing, Powering, and Alarming

4.02 Chart 1 gives the procedures for verifying fusing and powering.

C. Verifying Continuity

4.03 Chart 2 gives the procedures for verifying continuity.

D. Verifying Input and Output Signals

4.04 The input signal waveforms that will be observed may either be two 16.384 MHz composite timing signal (CTS) two 2.048 MHz sine wave timing signals, one 16.384 MHz CTS and one 2.048 MHz sine wave timing signal, or two DS-1 input signals.

4.05 The input signal waveforms that will be observed may either be two 16.384 MHz composite timing signal (CTS) or two 2.048 MHz sine wave timing signal, or one 16.384 MHz CTS and one 2.048 MHz sine wave timing signal.

4.06 The input and output signals that will be measured in this procedure will vary from those shown in input waveform figures due to cable length and parasitic capacitance. Chart 3 gives the procedures for verifying input and output signals.

E. Replacing Circuit Packs

4.07 Chart 4 contains information for the in-service replacement of all CDU circuit packs. The circuit packs include: AHG1, AHG4, AHG16, AHG25, AHG26, and AHG27.

F. Auxiliary Panel Expansion Option

4.08 Chart 5 contains information for the expansion of the output capacity using auxiliary panels. The auxiliary panels must be located within six feet from the main panel.

4.09 Chart 6 contains information for checking the operation of an in-service CDU. Input, output, and backplane signals are evaluated to determine the source of any operational problems.

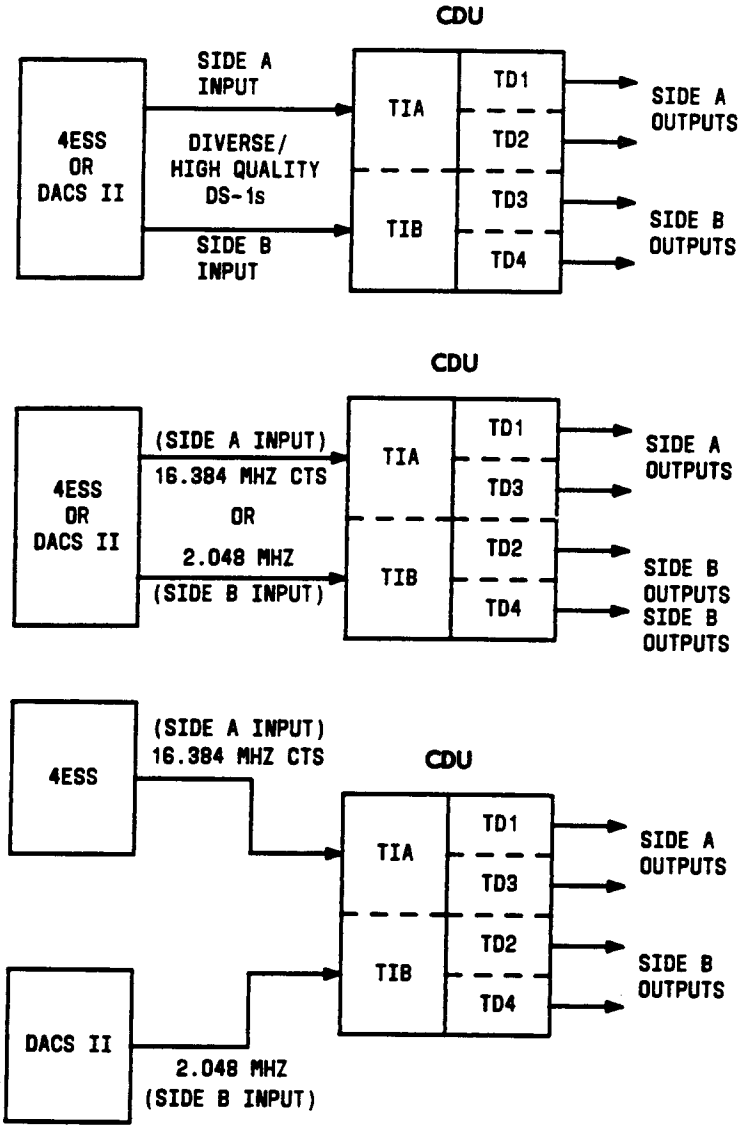


Fig. 1 - Clock Distribution Unit Applications

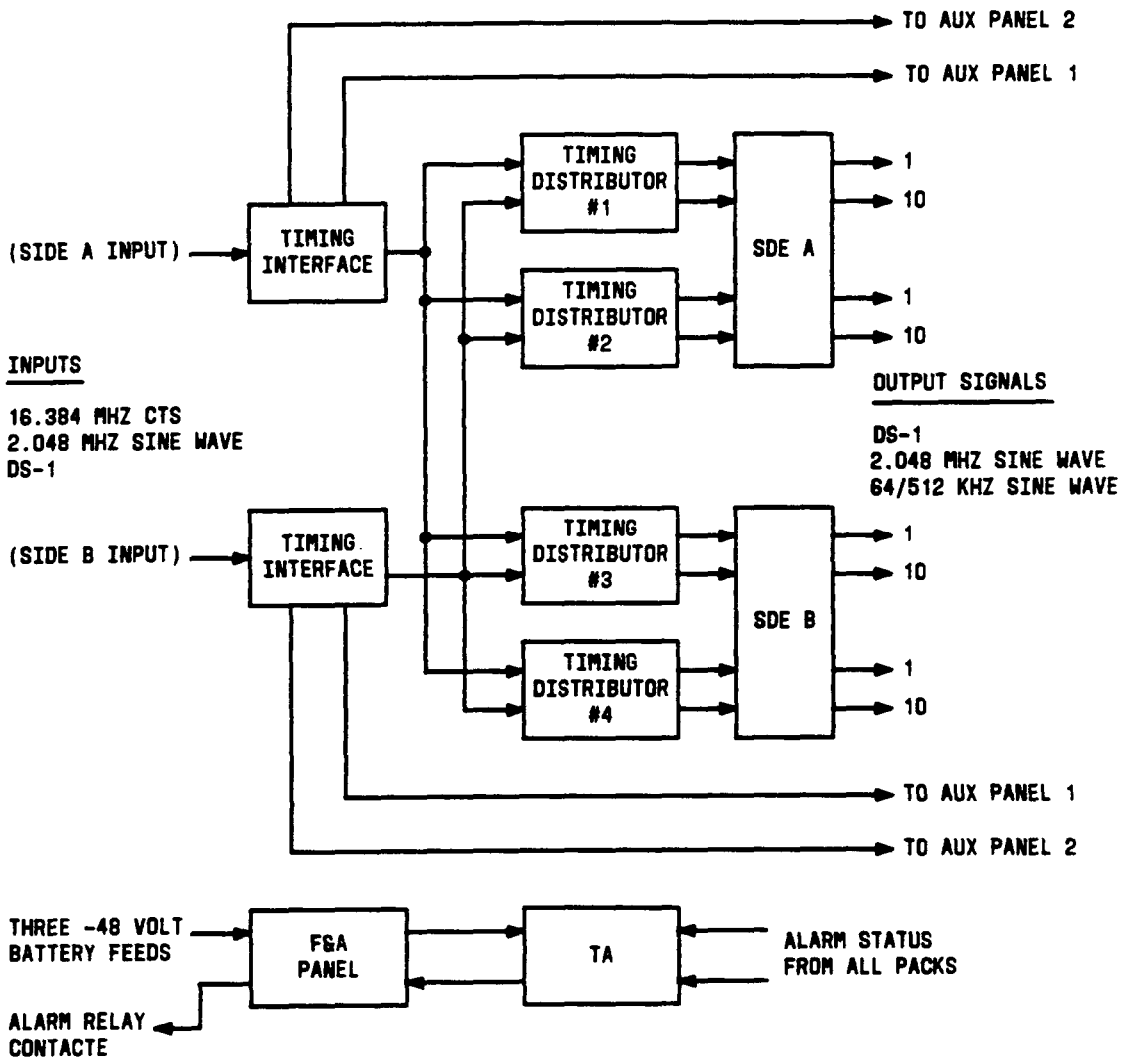
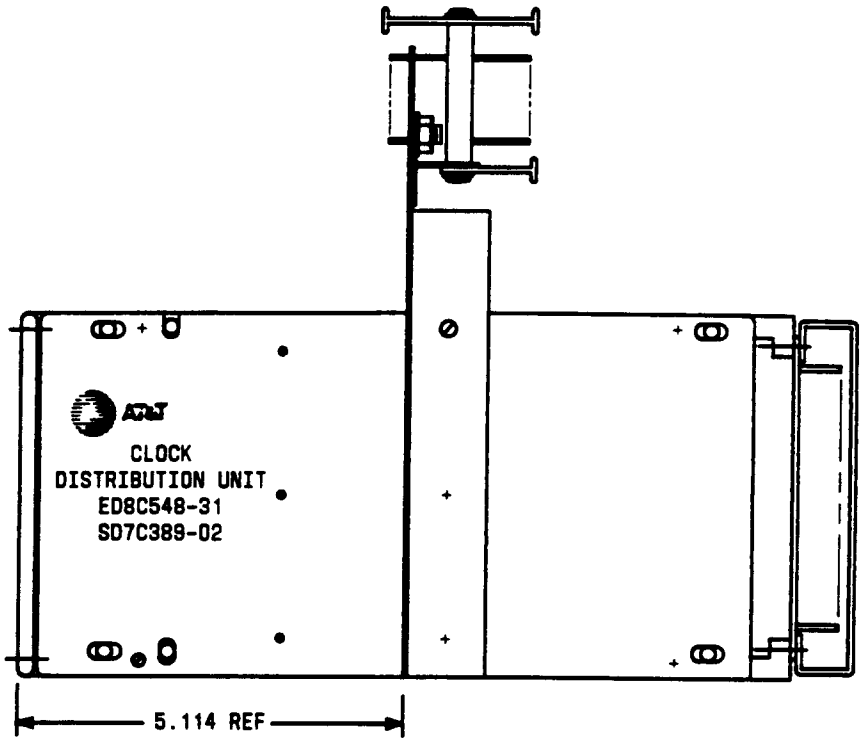


Fig. 2 - Clock Distribution Block Diagram



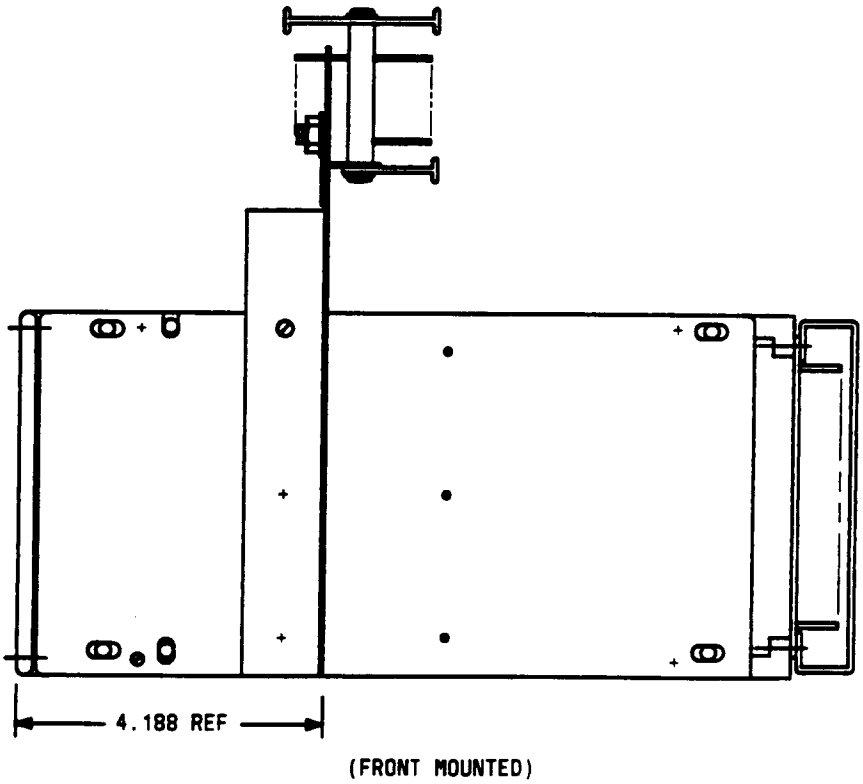


Fig. 3 - Bracket Location for Front and Rear Mounted CDU

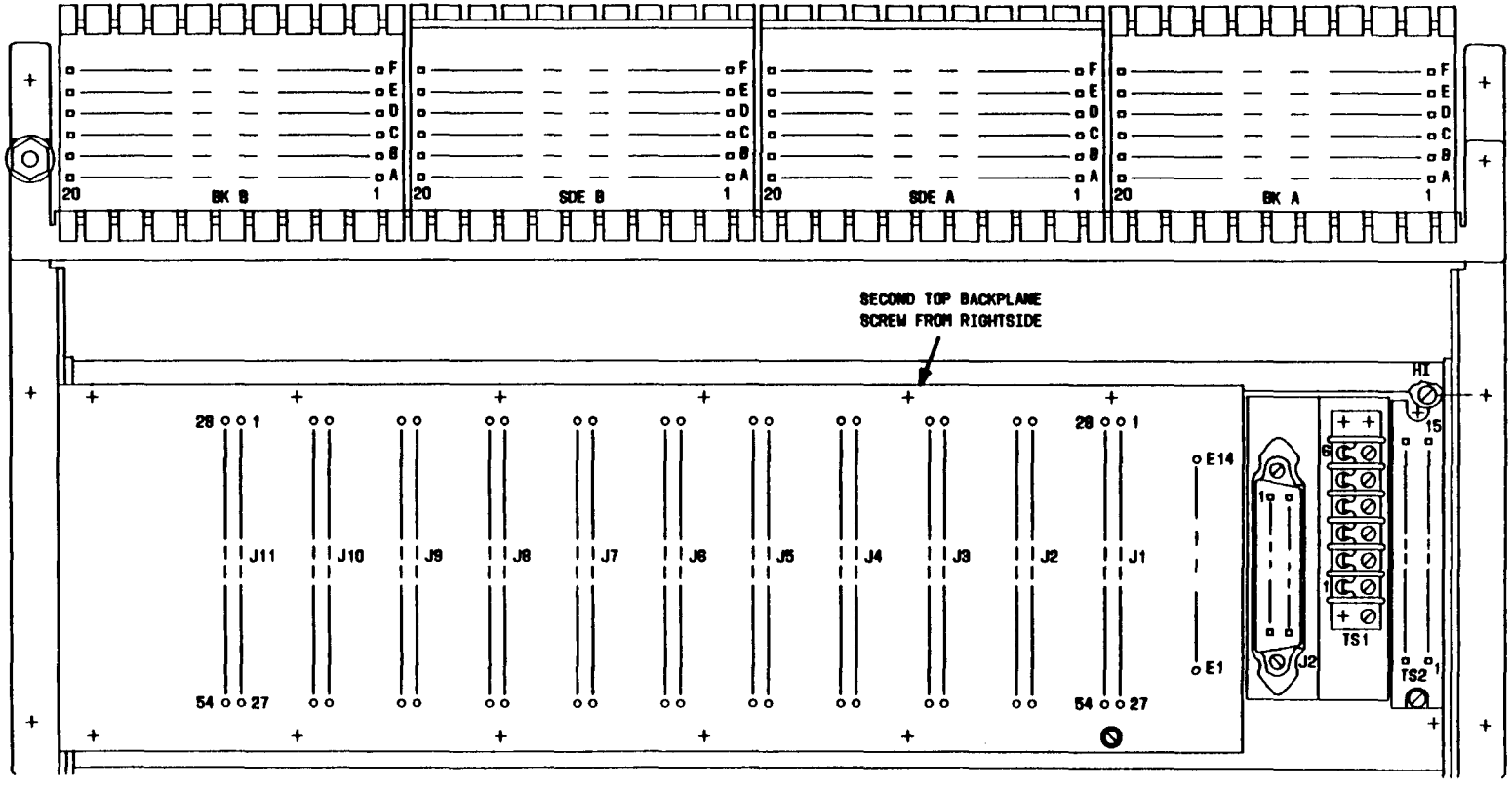


Fig. 4 - J98726Z-1 Rear View

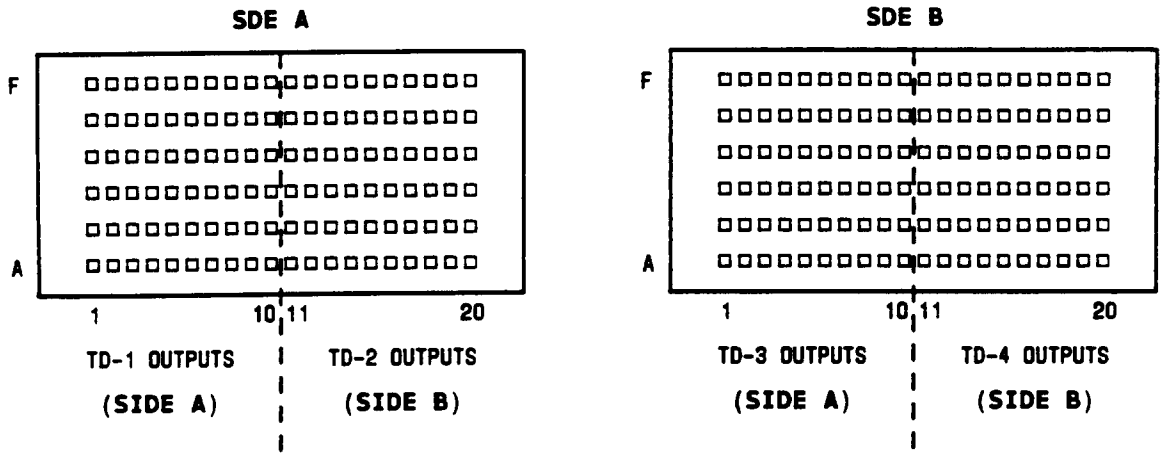
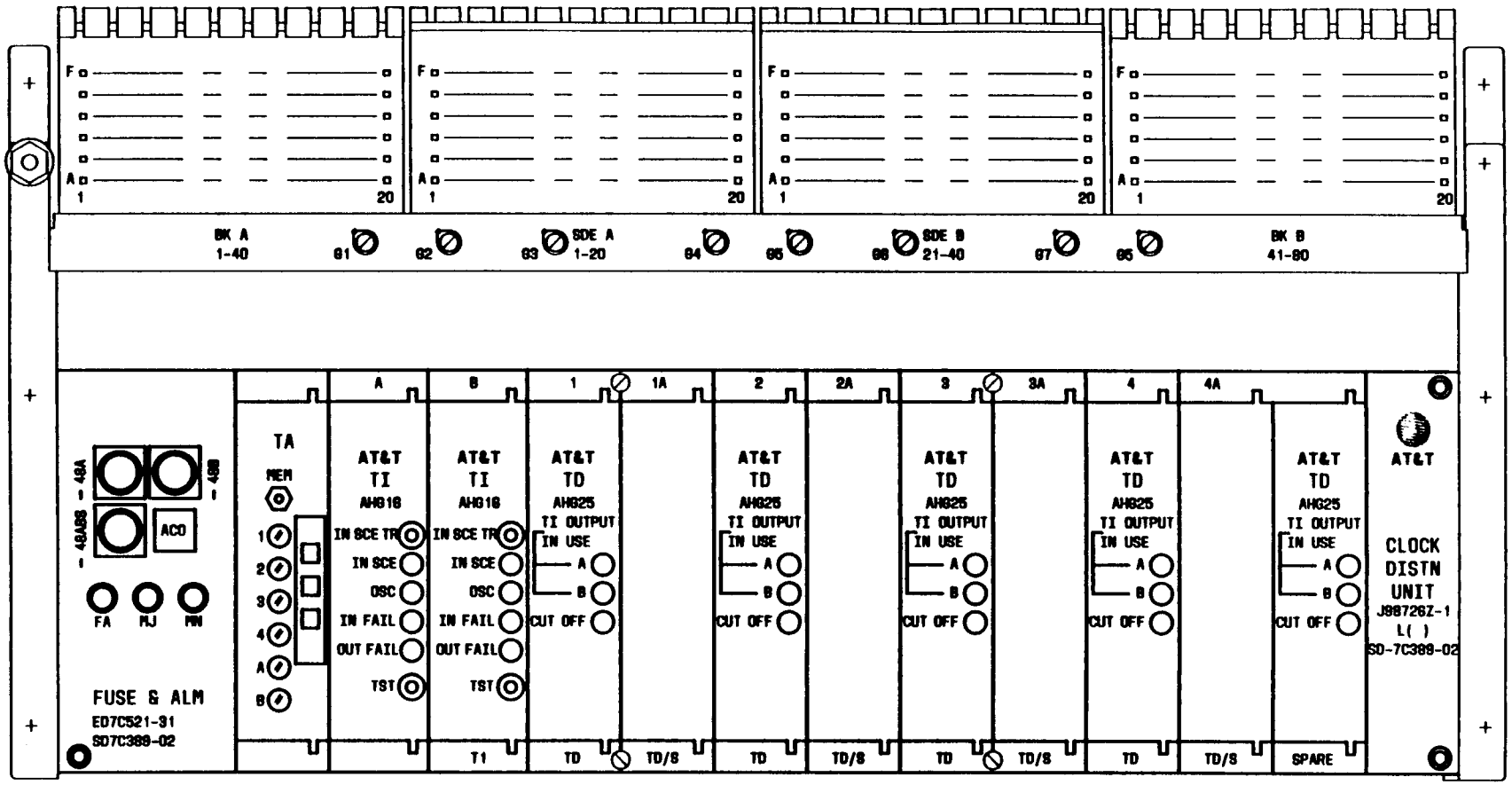


Fig. 5 - SDE ( ) Terminal Block Assignments for DS-1 Outputs



FRONT VIEW

Fig. 6 - J98726Z-1 Front View

5. PROCEDURES

5.01 The following charts provide installation and maintenance information.

A. CHART 1 — VERIFYING FUSING, POWERING, and ALARMING

STEP	PROCEDURE
1	Verify that the TS 1 terminals 2, 4, and 6 on the CDU panel are free from ground before installing the 1-1/3 ampere office feeder fuses associated with the CDU.
2	Remove the –48A (F2), –48B (F3), and the –48 ABS (F1) fuses from their fuse holders at the front of the panel.
3	Install the 1 1/3 ampere office feeder fuses. ***Requirement:*** The FA lamp will light.
4	Using the VOM (volt-ohm-milliammeter), verify that –48 volts exists at TS 1 between terminals 1 and 2, 3 and 4, and 5 and 6. (Terminals 1, 3, and 5 are GRD.)
5	Reinstall the –48A (F2), –48B (F3) and –48ABS (F1) fuses. ***Requirement:*** The MN and MJ lamps will light and remain on. The FA lamp is off.
6	If the ACO lamp is not lit, depress the ACO switch. ***Requirement:*** Audible alarm is cut off.
7	Remove the –48A (F2) fuse. ***Requirement:*** The MN, MJ, and FA lamps will light and remain on.
8	Replace the –48A (F2) fuse. ***Requirement:*** Only the MN and MJ lamps will light.
9	Remove the –48B (F3) fuse. ***Requirement:*** The MN, MJ, and FA lamps will light and remain on.
10	Replace the –48B (F3) fuse. ***Requirement:*** Only the MN and MJ lamps will light.
11	Remove the –48ABS (F1) fuse.

STEP	PROCEDURE
	Requirement: Only the FA lamp will light.
12	Replace the –48ABS (F3) fuse. ***Requirement:*** The MN and MJ lamps will light and remain on.
13	Depress the ACO switch to extinguish the ACO lamp. ***Requirement:*** The audible alarm is enabled.
14	With the VOM on the RX1 scale, verify that a short exists between the following pairs of backplane E terminals. • E3 and E4 • E5 and E6 • E7 and E8 • E9 and E10 • E11 and E12 • E13 and E14.
15	Depress the ACO switch to light the ACO lamp. ***Requirement:*** An open exists between backplane E terminals: E3-E4 and E9-E10. A short exists between backplane terminals E5-E6, E7-E8, E11-E12, and E13-E14.
16	Depress the ACO switch. ***Requirement:*** The ACO lamp will extinguish.
17	Apply a short between the backplane E terminals E1 and E2. ***Requirement:*** An open exists between the backplane E terminals E3-E4 and E9-E10.

B. CHART 2 — VERIFYING CONTINUITY

STEP	PROCEDURE
1	Check all leads that are run by the installer for continuity. *Note:* There are four possible input cabling options. Perform only the verification for the configuration that is being used.
2	Verify that the 16.384 MHz CTS timing sources are connected to TS 2 with 728A coaxial cable or equivalent. Verify that the 2.048 MHz timing sources are connected to TS 2 with 22BF twisted shielded cable or equivalent. Verify that the DS-1 timing sources are connected to TS 2 with 22BF twisted shielded cable or equivalent. **Two 16.384 MHz Composite Timing Signals (CTS)** • 16.384 MHz CTS T — Side A TS 2 Terminal 5 • Shield* — Side A TS 2 Terminal 4 • Shield* — Side A TS 2 Terminal 3 • 16.384 MHz CTS T — Side B TS 2 Terminal 10 • Shield* — Side B TS 2 Terminal 9 • Shield* — Side B TS 2 Terminal 8 **Two 2.048 MHz Sine Wave Timing Sources** • 2.048 MHz R — Side A TS 2 Terminal 5 • 2.048 MHz T — Side A TS 2 Terminal 4 • Shield* — Side A TS 2 Terminal 3 • 2.048 MHz R — Side B TS 2 Terminal 10 • 2.048 MHz T — Side B TS 2 Terminal 9 • Shield* — Side B TS 2 Terminal 8

* Capacitive ground is presented by CDU.

STEP	PROCEDURE

16.384 MHz CTS and 2.048 MHz Sine Wave Timing Sources

• 16.384 MHz CTS T	Side A TS 2 Terminal 5
• Shield*	Side A TS 2 Terminal 4
• Shield*	Side A TS 2 Terminal 3
• 2.048 MHz R	Side B TS 2 Terminal 10
• 2.048 MHz T	Side B TS 2 Terminal 9
• Shield*	Side B TS 2 Terminal 8
OR	
• 2.048 MHz R	Side A TS 2 Terminal 5
• 2.048 MHz T	Side A TS 2 Terminal 4
• Shield*	Side A TS 2 Terminal 3
• 16.384 MHz CTS T	Side B TS 2 Terminal 10
• Shield*	Side B TS 2 Terminal 9
• Shield*	Side B TS 2 Terminal 8

Two DS-1 Timing Signals

• DS-1 T	Side A TS 2 Terminal 1
• DS-1 R	Side A TS 2 Terminal 2
• Shield*	Side A TS 2 Terminal 3
• DS-1 T	Side B TS 2 Terminal 6
• DS-1 R	Side B TS 2 Terminal 7
• Shield*	Side B TS 2 Terminal 8

Note: DS-1 inputs shall only be from a 4ESS, 5ESS, or DACS. DS-1 facilities may not provide suitable inputs because of excess jitter.

* Capacitive ground is presented by CDU.

C. CHART 3 — VERIFYING INPUT AND OUTPUT SIGNALS

STEP	PROCEDURE

Note 1: Input measurements must be taken across a 75 ohm terminating resistor unless the corresponding TI is present.

Note 2: DS-1 input and output measurements must be taken across a 100 ohm terminating resistor unless the corresponding TI is present.

Note 3: The 64 kHz or 512 kHz output measurements must be taken across a 133 ohm terminating resistor.

Note 4: Waveforms of input signals may vary due to cable length and parasitic capacitance.

Note 5: The CDU's output signals are made available at the SDE A and SDE B terminal blocks above the shelf assembly. The side A and side B timing signals are divided between the SDE () terminal blocks. The first ten output taps on SDE A and SDE B terminal blocks provide outputs from side A (TD-1 and TD-3 respectively). The second ten output taps on SDE A and SDE B terminal blocks provide outputs from side B (TD-2 and TD-4 respectively).

1 Set up a dual-trace oscilloscope for differential measurements with Channel 2 added and inverted using an internal trigger or 2V/DIV (DS-1 NORM).

- Set Channels 1 and 2 to .5V/DIV (All except DS-1 NORM).
- Set Time Base to 50ns/DIV (16.384 MHz CTS input) or 500ns/DIV (2.048 MHz input) or 1 μs/DIV (DS-1).

2 Connect the probes of the dual-trace oscilloscope across the input points of TS 2, ensuring that the measurement is being taken across the appropriate resistor with ground leads of the probes connected to frame ground.

Requirement: The oscilloscope trace should match the waveform shown in Fig. 7 (16.384 MHz CTS input), Fig. 8 (2.048 MHz input), Fig. 9 (DS-1 normal level), or Fig. 10 (DS-1 monitor level).

3 Remove termination.

4 Prior to installation, set all of the white option plugs on the AHG1 (TA) circuit pack to the "out" position (Fig. 11 and Table A).

5 Install the AHG1 TA into the TA card slot.

Requirement: All LEDs (light emitting diodes) on the faceplate will light.

STEP	PROCEDURE

6 Prior to installation the options should be set on the two AHG16 or AHG27 TI circuit packs. The placement and listing of these options is presented on Fig. 12, Table B (for the AHG16 TI) and Fig. 13, Table C (for the AHG27 TI).

7 Install a pair of AHG16 or a pair of AHG27 (TI) circuit packs into the TI A and TI B card slots.

Requirement: The IN FAIL and OUT FAIL LEDs will light.

8 Wait approximately 10 seconds after inserting the last TI and press the MEM button on the TA.

Requirement: All red LEDs on the TIs will extinguish. All yellow LEDs on the TA will extinguish. Only the red LEDs on the TA and the green IN SCE and DUPLEX LEDs on the TIs will light.

9 For the AHG16 TI circuit packs, use a frequency counter to measure the 5 volt peak frequency at the TST faceplate jack on each TI. Use a pin jack to connect the tip of the frequency counter's probe. Connect the ground lead to the faceplate latch.

Requirement: The frequency is 2.048 MHz.

Note 1: Each TI supplies input timing signals to only two TD positions. TI A supplies output signals to TD positions 1 and 3; TI B supplies output signals to TD positions 2 and 4. This TD arrangement is referred to as a "duplex" configuration.

Note 2: Both the AHG4 or AHG26 TD are not used in pairs. Therefore, for these two TDs, the complementary TD slot should be left vacant.

Note 3: TD installation is contained in Steps 10 through 26. If installing an AHG25 TD, refer to Steps 10 through 16. If installing an AHG4 TD, refer to Steps 17 through 22. If installing an AHG26 TD, refer to Steps 23 thorough 26.

10 Prior to installation, options should be set on the two AHG25 TD circuit packs. The placement and listing of these options is shown in Fig. 14 and Table D.

11 Install the AHG25 TD circuit packs. One of the packs should be in an even numbered TD slot (2,4) and the other pack should be in an odd numbered TD slot (1,3).

Requirement: Only one TI OUTPUT IN USE LED will light on each TD. The TDs in slots 1 and 3 will have the TI A IN USE LEDs lit. The TDs in slots 2 and 4 will have the TI B IN USE LEDs lit.

STEP	PROCEDURE

12 In each TD position (except position 1) where a TD is used, the corresponding white option plug on the AHG1 TA should be placed in the "IN" position. The white option plugs allow the AHG1 to report alarm information about the corresponding TD slot when in the "IN" position and inhibit alarm information when in the "out" position. The "out" position is designated as the unlabeled position below the "IN" label on the TA for each numbered TD. Since there is no option setting for the TD-1 position, a TD must always be used in this slot. Press the MEM button on the AHG1 after these options are set.

Requirement: All LEDs on the AHG1 TA will be extinguished. All lamps on the fuse and alarm panel will be extinguished.

13 Setup a dual-trace oscilloscope for differential measurements with Channel 2 added and inverted using an internal trigger.

- Set Channels 1 and 2 to 2V/DIV
- Set Time Base to 500ns/DIV

14 Using the dual-trace oscilloscope, measure the first ten DS-1 outputs associated with the TD-1 circuit pack (Table E). Use a 100 ohm resistor across each X and Y lead. Connect the dual-trace oscilloscope probes across the resistor and connect both of the ground leads on the probe to the most convenient terminal on the A row of the SDE () terminal blocks. If cables are attached to the SDE ( ) terminal blocks, measurements must be taken at the far end cable.

Requirement: The waveforms observed must match the waveform shown in Fig. 15.

Note: All output measurements will be made at SDE A and SDE B terminal blocks. Refer to Tables E and F for the output test points corresponding to the TD circuit pack positions TD-1, TD-2, TD-3, and TD-4.

15 Repeat Step 14 for the remaining DS-1 outputs for each AHG25 TD located in the panel. If there are unused TD slots in the panel, then one of the working AHG25 TD packs may be rolled to the unused positions. To prevent audible alarms from being reported during this check, the ACO switch on the Fuse and Alarm panel may be activated (switch light is on).

Note 1: All output cable connections from the CDU should have shield connections from the SDE () terminal blocks and should be kept as short as possible.

Note 2: All unused AHG25 TD outputs should be terminated with a 100 ohm load across the corresponding tip and ring terminals on the appropriate SDE () terminal blocks. The resistors are furnished with each AHG25 TD circuit pack and may be installed by wire-wrapping to the SDE () terminal blocks.

Note 3: The corresponding 100 ohm resistor(s) should be removed if a previously unused AHG25 output(s) is to be used.

STEP	PROCEDURE

16 When finished testing the DS-1 outputs, replace the AHG25 TDs into their assigned slots. Depress the MEM button on the TA circuit pack and press the ACO button to extinguish light.

Requirement: All LEDs will be extinguished on the TA and all lamps on the fuse and alarm panel will be extinguished.

Note: This is the end of verifying output signals for the AHG25 TD. If the AHG4 TD is used, Steps 17 through 22 should be followed. If the AHG26 TD is used, Steps 23 through 26 should be followed.

17 Install backplane wiring as shown in Table G.

Note 1: This wiring provides the AHG4 TD with output connections. The output wiring is dependent on the output option used (attenuated or nonattenuated). The attenuated output option is normally used. If, however, noise proves to be a problem, the nonattenuated output along with an external attenuator located near the PFS will be used.

Note 2: Detailed wiring information showing input connections to the PFS-2B may be found in SD-50802-1 or T-50802-30.

18 Option the AHG4 as follows. Refer to Fig. 16 for the location of the option switches.

- Set the frequency to 64 kHz or 512 kHz.
- Set the dip switch positions 1 and 2 to +10 dB.

Note: The AHG4 is capable of transmitting an output of very low level signals that are difficult to view with an oscilloscope. However, the nonattenuated outputs provide a signal that may be checked easily. This signal is at a 7 dBm level for the 64 kHz output and a 10 dBm level for the 512 kHz output.

19 Connect a dual-trace oscilloscope (set to the differential mode, add and invert) to the backplane pins of the TD-4 (connector 48 [tip] and 21 [ring]).

- Channels 1 and 2 set to .5V/DIV, DC coupling, ALT
- Time base set to 20 μs/DIV (for 64 kHz output)
- Time base set to 2 μs/DIV (for 512 kHz output)
- Trigger set to Channel 1, AC coupling, AUTO

20 Place a 133 ohm resistor across pins 48 (tip) and 21 (ring) to simulate a load. Connect Channel 1 to one side of the 133 ohm resistor and Channel 2 to the other side of the resistor. The ground of the probe should be connected to frame ground.

21 Observe the waveform on the oscilloscope.

STEP	PROCEDURE

Requirement: The observed waveform will match the waveform shown in Fig. 17A or 17B.

Note: The output frequency is dependent on the PFS used (either 64 kHz or 512 kHz). The output attenuation is dependent on the frequency (-54 dBm for 64 kHz and -23 dBm for 512 kHz).

22 Remove the AHG4 TD from the CDU and option the TD for the proper output for the desired frequency. The output settings are given in Table H and Fig. 16.

Requirement: With wiring installed from the CDU to the PFS, the LOSS OF SYNC alarms on the PFS will clear and the Sensitrol will indicate a stable reading of approximately zero.

Note: This is the end of verifying output signals for the AHG4 TD. If the AHG26 TD is used, Steps 23 through 26 should be followed.

23 Install backplane wiring as shown in Table I.

Note 1: This wiring provides the AHG26 TD with output connections. The output wiring is dependent on the TD slot chosen. The same wiring is used for both output level options.

Note 2: Detailed wiring information showing input connections to the Distribution Hybrid Tree may be found in SD-51498-01.

24 Option the AHG26 TD for the desired output level (-20 dBm or -35 dBm). Refer to Fig. 18 and Table J for the location of the option switch.

Note: The AHG26 TD is capable of transmitting an output of very low level signals that are difficult to view with an oscilloscope. However, a faceplate jack provides an output level of +10 dBm unbalanced into 75 ohms. This faceplate output is buffered from the main output and provides an indication of the frequency output from the TD.

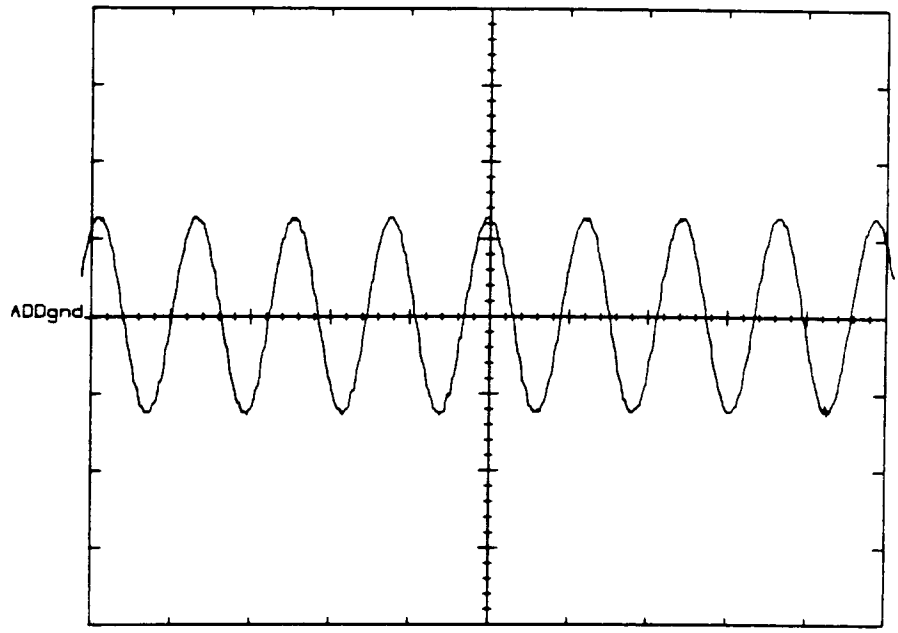
25 The faceplate output signal may be viewed by using a bantam plug and terminating the resulting signal across 75 ohms.

- Channels 1 and 2 set to .5 V/DIV, DC coupling, ALT
- Time base set to 500 ns/div
- Trigger set to Channel 1, AC coupling, AUTO

Place the oscilloscope probes on either side of the 75 ohm resistor.

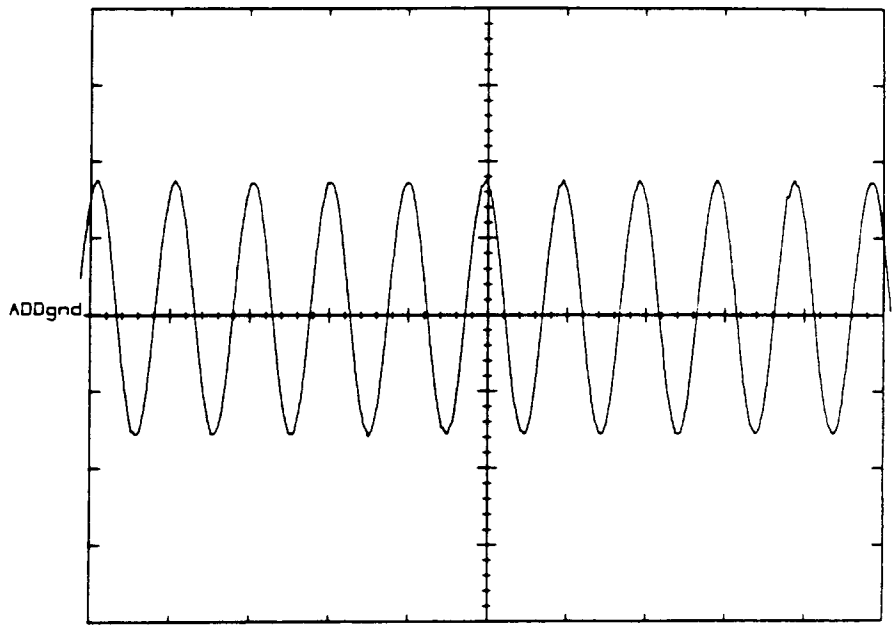
Requirement: The waveform shown in Fig. 19 shall be obtained.

26 Remove the Bantam Plug from the AHG26 TD.



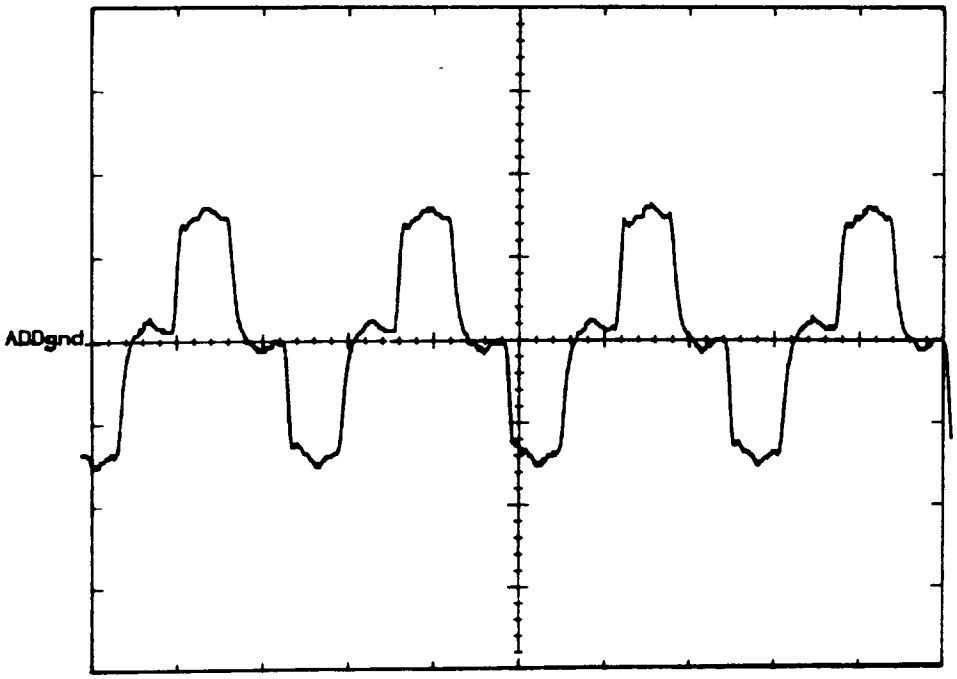
NOTE: OSCILLOSCOPE SETTING
CH1 500mV A 50 ns
CH2_ 500mV
ADD 500mV

Fig. 7 - 16.384 MHz CTS Input Waveform



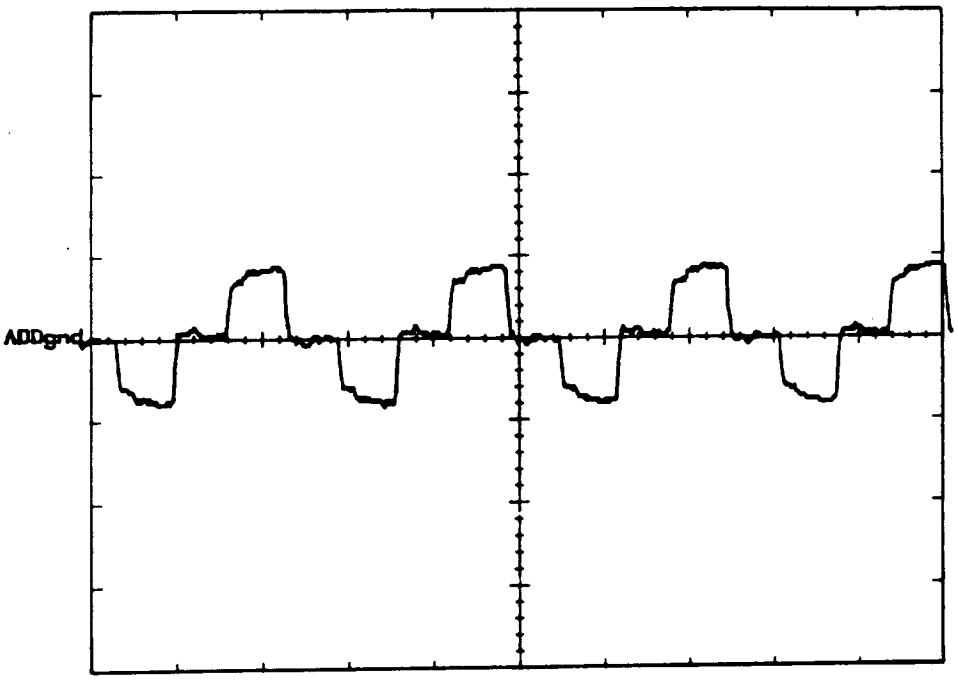
NOTE: OSCILLOSCOPE SETTING
CH1 500mV A 500 ns
CH2_ 500mV
ADD 500mV

Fig. 8 - 2.048 MHz Input Waveform



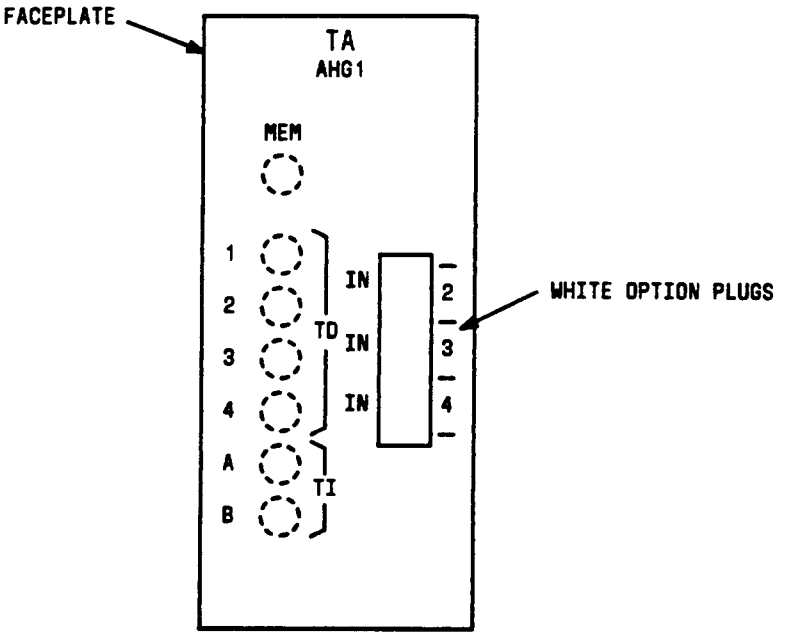
NOTE: OSCILLOSCOPE SETTING
CH1 2V A 500ms
CH2 2V
ADD 2V VERT 93.8 mV

Fig. 9 - Typical DS-1 Input Waveform



NOTE: OSCILLOSCOPE SETTING CH2 500mV VERT -531mV
CH1 500mV A 500ms ADD 500mV

Fig. 10 - Typical DS-1 Bridged Input Waveform



Note:
White option plugs are placed in the "IN" position for the corresponding equipped TD slot. The white option plugs are placed in the unlabeled TD "OUT" position for the corresponding unequipped TD slot.

Fig. 11 - Location of Options for the AHG1 TA

TABLE A
AHG1 TIMING ALARM OPTIONS

TD POSITIONS USED				TD OPTION		
1	2	3	4	2	3	4
YES	NO	NO	NO	OUT	OUT	OUT
YES	YES	NO	NO	IN	OUT	OUT
YES	YES	YES	NO	IN	IN	OUT
YES	YES	YES	YES	IN	IN	IN

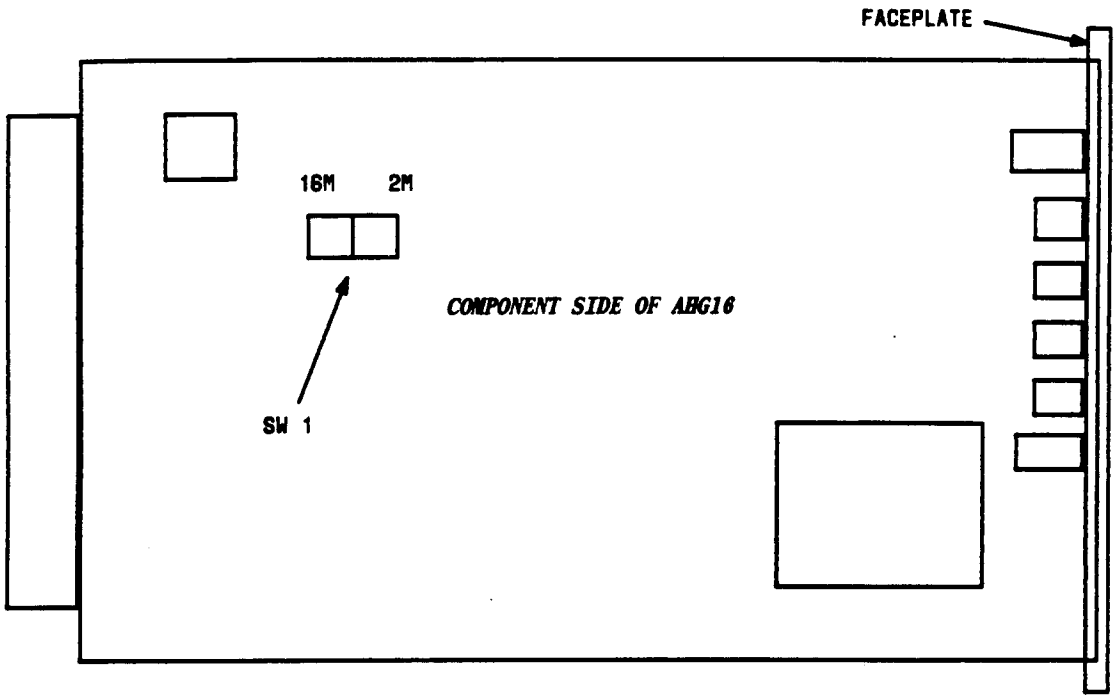


Fig. 12 - Location of Options for the AHG16 TI

TABLE B AHG16 TIMING INTERFACE OPTIONS	
SWITCH 1 POSITION	OPTION
16M	16.384 MHz CTS Input
2M	2.048 MHz Sine Wave Input

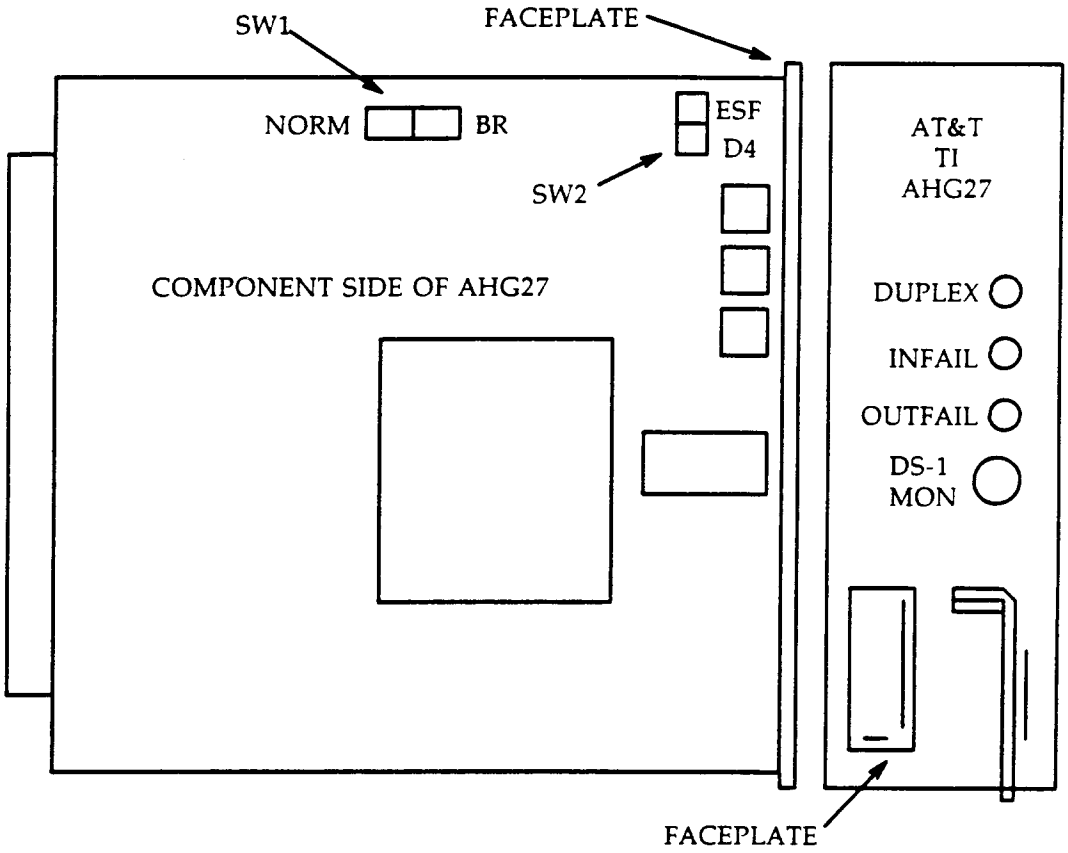


Fig. 13 - Location of Options for the AHG27 TI

TABLE C AHG27 TIMING INTERFACE OPTIONS	
SWITCH 1 POSITION	**OPTION**
NORM	Standard Level DS-1 Input
BR	Monitor Level DS-1 Input

TABLE D AHG25 TIMING DISTRIBUTOR OPTIONS	
SWITCH 101 POSITION	OPTION
D4	DS-1 Output Framing Format is D4
ESF	DS-1 Output Framing Format is ESF
IN	Cut Off Option Enabled
OUT	Cut Off Option Disabled

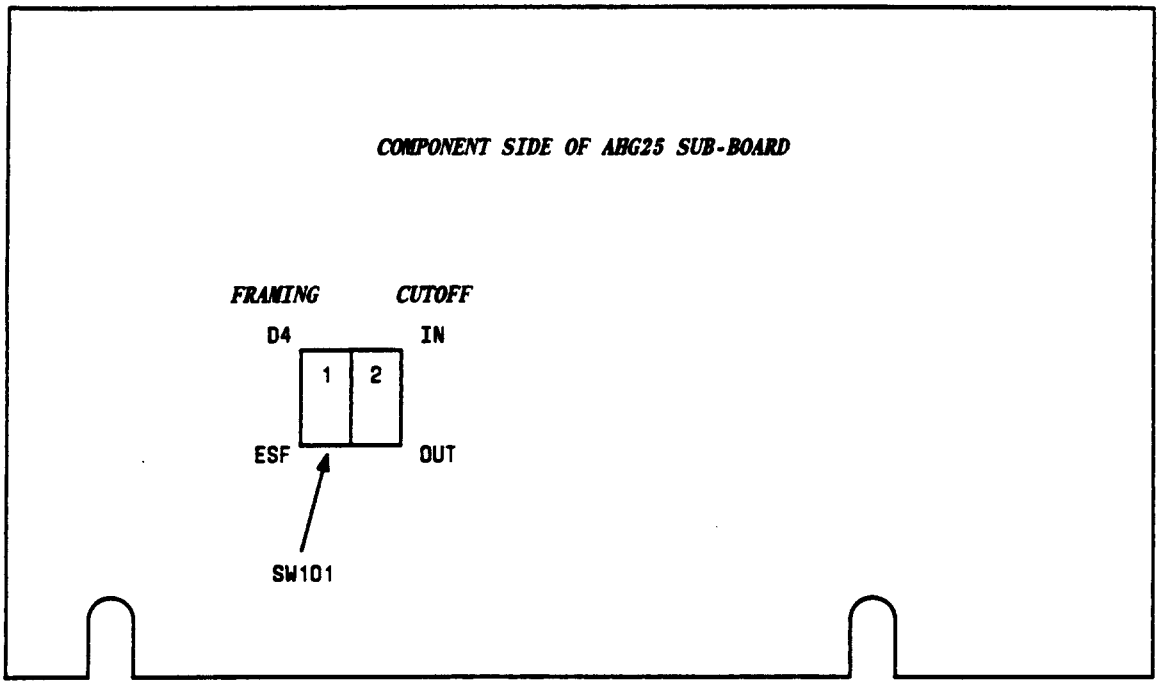
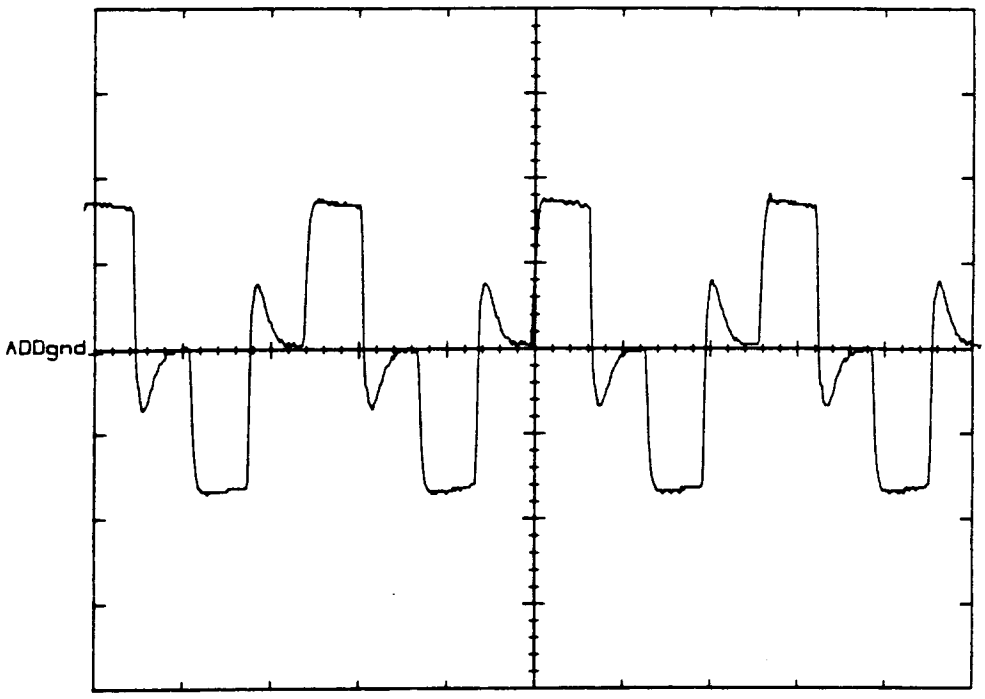


Fig. 14 - Location of Options for the AHG25 TD



NOTE: OSCILLOSCOPE SETTING

CH1 2V A 500ns
CH2_ 2V
ADD 2V

Fig. 15 - DS-1 AHG25 Output Waveform

TABLE E (NOTE 1)
SDE A TERMINAL BLOCK CONNECTIONS

SIDE A					SIDE B				
OUTPUT LEAD	X CONNECTION TERMINAL BLOCK	TERMINAL	LEAD	SDE BACKPLANE CONNECTION	OUTPUT LEAD	X CONNECTION TERMINAL BLOCK	TERMINAL	LEAD	SDE BACKPLANE CONNECTION
L1Y	SDE A	C1	32	TD-1	L11Y	SDE A	C11	32	TD-2
L1X	SDE A	B1	5	TD-1	L11X	SDE A	B11	5	TD-2
S	SDE A	A1		TD-1	S	SDE A	A11		TD-2
L2Y	SDE A	C2	33	TD-1	L12Y	SDE A	C12	33	TD-2
L2X	SDE A	B2	6	TD-1	L12X	SDE A	B12	6	TD-2
S	SDE A	A2		TD-1	S	SDE A	A12		TD-2
L3Y	SDE A	C3	34	TD-1	L13Y	SDE A	C13	34	TD-2
L3X	SDE A	B3	7	TD-1	L13X	SDE A	B13	7	TD-2
S	SDE A	A3		TD-1	S	SDE A	A13		TD-2
L4Y	SDE A	C4	35	TD-1	L14Y	SDE A	C14	35	TD-2
L4X	SDE A	B4	8	TD-1	L14X	SDE A	B14	8	TD-2
S	SDE A	A4		TD-1	S	SDE A	A14		TD-2
L5Y	SDE A	C5	36	TD-1	L15Y	SDE A	C15	36	TD-2
L5X	SDE A	B5	9	TD-1	L15X	SDE A	B15	9	TD-2
S	SDE A	A5		TD-1	S	SDE A	A15		TD-2
L6Y	SDE A	C6	37	TD-1	L16Y	SDE A	C16	37	TD-2
L6X	SDE A	B6	10	TD-1	L16X	SDE A	B16	10	TD-2
S	SDE A	A6		TD-1	S	SDE A	A16		TD-2
L7Y	SDE A	C7	38	TD-1	L17Y	SDE A	C17	38	TD-2
L7X	SDE A	B7	11	TD-1	L17X	SDE A	B17	11	TD-2
S	SDE A	A7		TD-1	S	SDE A	A17		TD-2
L8Y	SDE A	C8	39	TD-1	L18Y	SDE A	C18	39	TD-2
L8X	SDE A	B8	12	TD-1	L18X	SDE A	B18	12	TD-2
S	SDE A	A8		TD-1	S	SDE A	A18		TD-2
L9Y	SDE A	C9	40	TD-1	L19Y	SDE A	C19	40	TD-2
L9X	SDE A	B9	13	TD-1	L19X	SDE A	B19	13	TD-2
S	SDE A	A9		TD-1	S	SDE A	A19		TD-2
L10Y	SDE A	C10	41	TD-1	L20Y	SDE A	C20	41	TD-2
L10X	SDE A	B10	14	TD-1	L20X	SDE A	B20	14	TD-2
S	SDE A	A10		TD-1	S	SDE A	A20		TD-2

*Note 1*The first ten output taps on SDE A terminal block provides outputs from side A (TD-1). The second ten output taps on SDE A terminal block provides outputs from side B (TD-2).
*Note 2:*The X and Y leads may be designated Tip (T) and Ring (R).

TABLE F (NOTE 1)
SDE B TERMINAL BLOCK CONNECTIONS

Side A					Side B				
OUTPUT LEAD	X CONNECTION TERMINAL BLOCK	TERMINAL	LEAD	SDE BACKPLANE CONNECTION	OUTPUT LEAD	X CONNECTION TERMINAL BLOCK	TERMINAL	LEAD	SDE BACKPLANE CONNECTION
L21Y	SDE B	C1	32	TD-3	L31Y	SDE B	C11	32	TD-4
L21X	SDE B	B1	5	TD-3	L31X	SDE B	B11	5	TD-4
S	SDE B	A1		TD-3	S	SDE B	A11		TD-4
L22Y	SDE B	C2	33	TD-3	L32Y	SDE B	C12	33	TD-4
L22X	SDE B	B2	6	TD-3	L32X	SDE B	B12	6	TD-4
S	SDE B	A2		TD-3	S	SDE B	A12		TD-4
L23Y	SDE B	C3	34	TD-3	L33Y	SDE B	C13	34	TD-4
L23X	SDE B	B3	7	TD-3	L33X	SDE B	B13	7	TD-4
S	SDE B	A3		TD-3	S	SDE B	A13		TD-4
L24Y	SDE B	C4	35	TD-3	L34Y	SDE B	C14	35	TD-4
L24X	SDE B	B4	8	TD-3	L34X	SDE B	B14	8	TD-4
S	SDE B	A4		TD-3	S	SDE B	A14		TD-4
L25Y	SDE B	C5	36	TD-3	L35Y	SDE B	C15	36	TD-4
L25X	SDE B	B5	9	TD-3	L35X	SDE B	B15	9	TD-4
S	SDE B	A5		TD-3	S	SDE B	A15		TD-4
L26Y	SDE B	C6	37	TD-3	L36Y	SDE B	C16	37	TD-4
L26X	SDE B	B6	10	TD-3	L36X	SDE B	B16	10	TD-4
S	SDE B	A6		TD-3	S	SDE B	A16		TD-4
L27Y	SDE B	C7	38	TD-3	L37Y	SDE B	C17	38	TD-4
L27X	SDE B	B7	11	TD-3	L37X	SDE B	B17	11	TD-4
S	SDE B	A7		TD-3	S	SDE B	A17		TD-4
L28Y	SDE B	C8	39	TD-3	L38Y	SDE B	C18	39	TD-4
L28X	SDE B	B8	12	TD-3	L38X	SDE B	B18	12	TD-4
S	SDE B	A8		TD-3	S	SDE B	A18		TD-4
L29Y	SDE B	C9	40	TD-3	L39Y	SDE B	C19	40	TD-4
L29X	SDE B	B9	13	TD-3	L39X	SDE B	B19	13	TD-4
S	SDE B	A9		TD-3	S	SDE B	A19		TD-4
L30Y	SDE B	C10	41	TD-3	L40Y	SDE B	C20	41	TD-4
L30X	SDE B	B10	14	TD-3	L40X	SDE B	B20	14	TD-4
S	SDE B	A10		TD-3	S	SDE B	A20		TD-4

*Note 1:*The first ten output taps on SDE B terminal block provides outputs from side A (TD-3). The second ten output taps on SDE B terminal block provides outputs from side B (TD-4).
*Note 2:*The X and Y leads may be designated Tip (T) and Ring (R).

TABLE G (NOTES 1, AND 2)

AHG4 OUTPUT WIRING PER TD SLOT

ATTENUATED-OUTPUT CONNECTIONS

FROM		TO		
CONNECTOR	TERMINALS	CONNECTOR	TERMINALS	TYPE
J4 (TD-1)	22	SDE A	D1	GRD
J4 (TD-1)	20	SDE A	E1	TIP
J4 (TD-1)	47	SDE A	F1	RING
J6 (TD-2)	22	SDE A	D20	GRD
J6 (TD-2)	20	SDE A	E20	TIP
J6 (TD-2)	47	SDE A	F20	RING
J8 (TD-3)	22	SDE B	D1	GRD
J8 (TD-3)	20	SDE B	E1	TIP
J8 (TD-3)	47	SDE B	F1	RING
J10 (TD-4)	22	SDE B	D20	GRD
J10 (TD-4)	20	SDE B	E20	TIP
J10 (TD-4)	47	SDE B	F20	RING

NONATTENUATED-OUTPUT CONNECTIONS

FROM		TO		
CONNECTOR (NOTE 3)	TERMINALS	CONNECTOR	TERMINALS	TYPE
J4 (TD-1)	22	SDE A	D1	GRD
J4 (TD-1)	21	SDE A	E1	TIP
J4 (TD-1)	48	SDE A	F1	RING
J6 (TD-2)	22	SDE A	D20	GRD
J6 (TD-2)	21	SDE A	E20	TIP
J6 (TD-2)	48	SDE A	F20	RING
J8 (TD-3)	22	SDE B	D1	GRD
J8 (TD-3)	21	SDE B	E1	TIP
J8 (TD-3)	48	SDE B	F1	RING
J10 (TD-4)	22	SDE B	D20	GRD
J10 (TD-4)	21	SDE B	E20	TIP
J10 (TD-4)	48	SDE B	F20	RING

*Note 1:*All tip, ring, and ground wires are 26-gauge twisted triples with three twists per inch and within one half at each end.

*Note 2:*All cabling from the SDE () terminal blocks to the PFS (J68857AC) will be 22BF-type cable and should not exceed a length of 1000 feet.

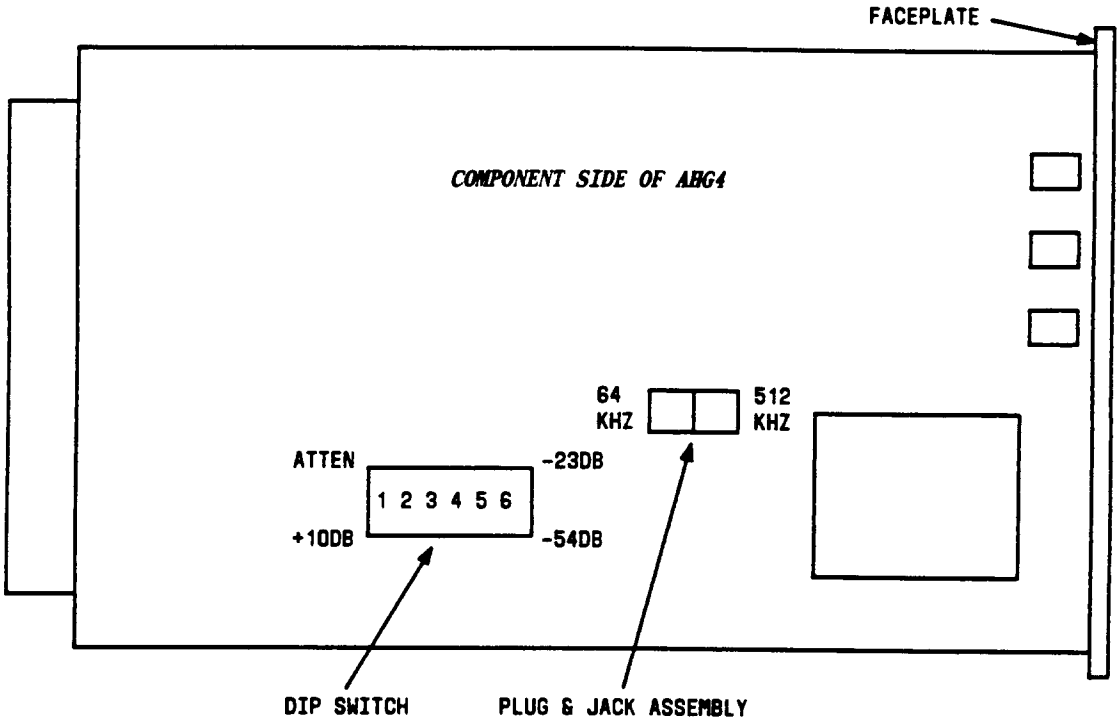


Fig. 16 - Location of Options for the AHG4 TD

TABLE H (NOTE)

AHG4 TD OUTPUT OPTION SETTINGS

PLUG POSITION	SWITCH 1-2	SWITCH 5-6	OUTPUT
64 kHz	ATTEN	-54 dB	64 kHz @ -54dBm
512 kHz	ATTEN	-23 dB	512 kHz @ -23 dBm
64 kHz	+10dB	0	64 kHz @ +7 dBm
512 kHz	+10 dB	0	512 kHz @ +10 dBm

Note: Switch positions 3 and 4 are unused.

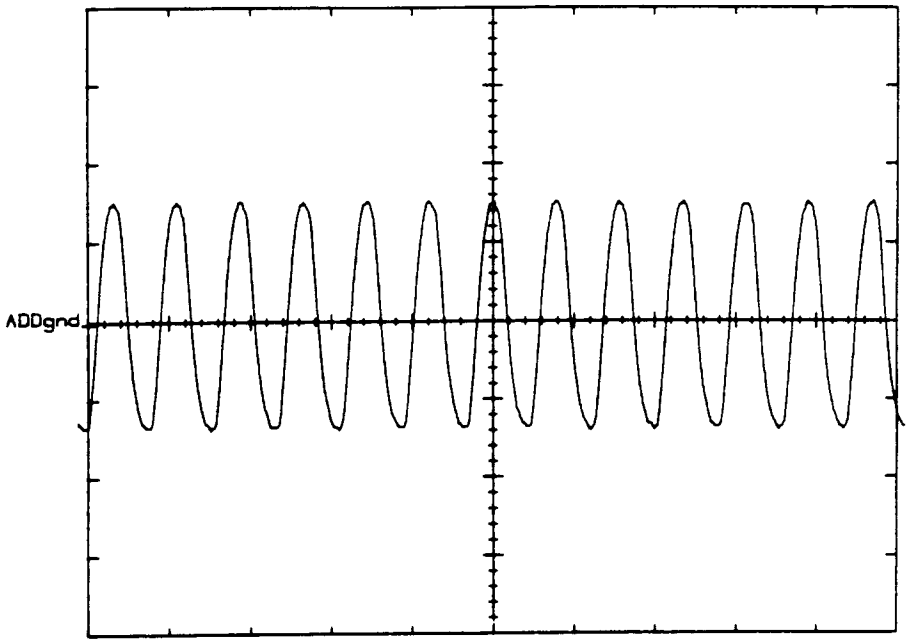


Fig. 17A - 64-kHz AHG4 Output Waveform

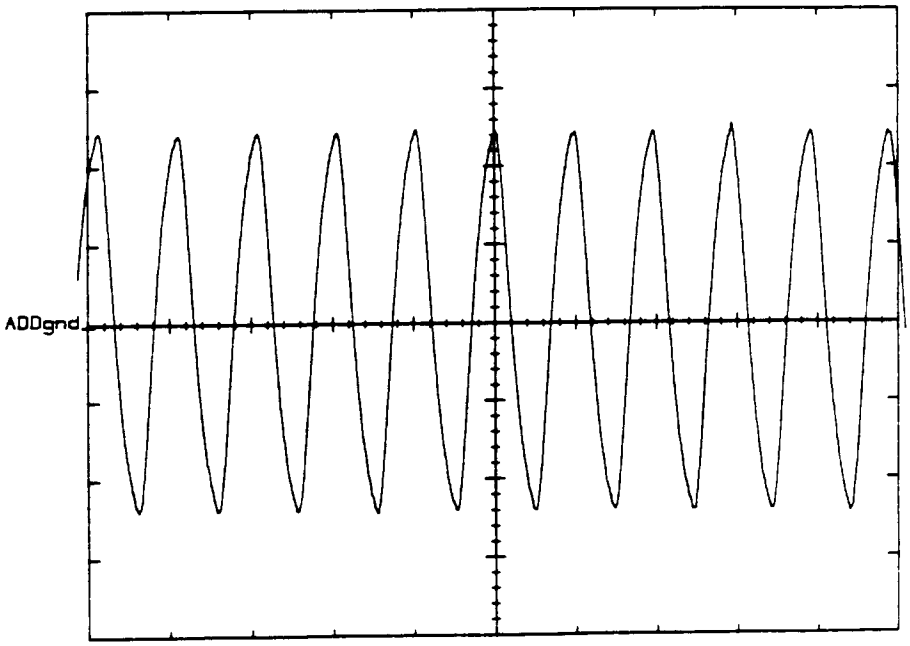


Fig. 17B - 512-kHz AHG4 Output Waveform

TABLE I (NOTES 1 AND 2)

AHG26 OUTPUT WIRING CONNECTIONS PER TD SLOT

SLOT	FROM		TO		TYPE
	CONNECTOR	TERMINALS	CONNECTOR	TERMINALS	
TD1 SLOT	J4 (TD 1)	20	SDE A	E1	SHIELD
	J4 (TD 1)	47	SDE A	F1	TIP
	SDE A	A1	SDE A	E1	-
TD2 SLOT	J6 (TD 2)	20	SDE A	E20	SHIELD
	J6 (TD 2)	47	SDE A	F20	TIP
	SDE A	A20	SDE A	E20	-
TD3 SLOT	J8 (TD 3)	20	SDE B	E1	SHIELD
	J8 (TD 3)	47	SDE B	F1	TIP
	SDE B	A1	SDE B	E1	-
TD4 SLOT	J10 (TD 2)	20	SDE B	E20	SHIELD
	J10 (TD 2)	47	SDE B	F20	TIP
	SDE B	A20	SDE B	E20	-

Note 1: All wiring between the backplane and SDE ( ) terminal blocks shall be twisted pair with three twists per inch (26 gauge or equivalent).

Note 2: All cabling from SDE ( ) terminal blocks shall be 728A or equivalent and not to exceed 1500 feet.

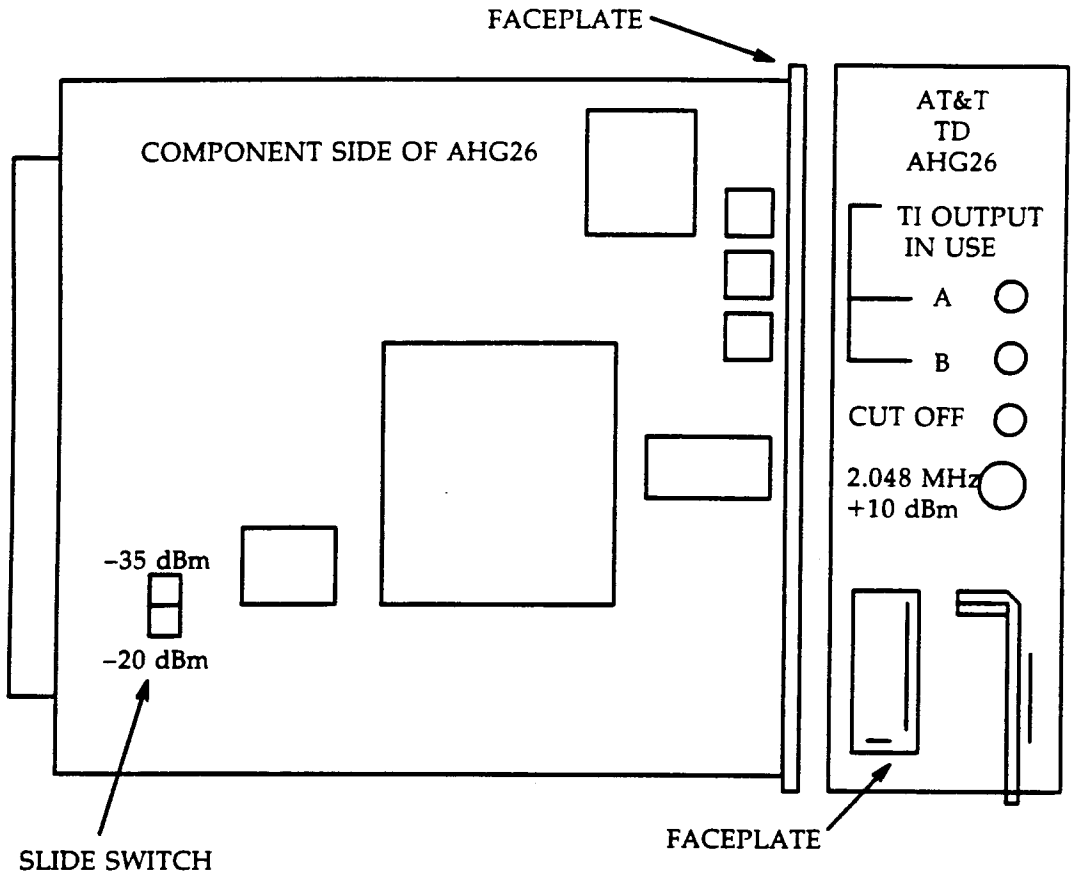
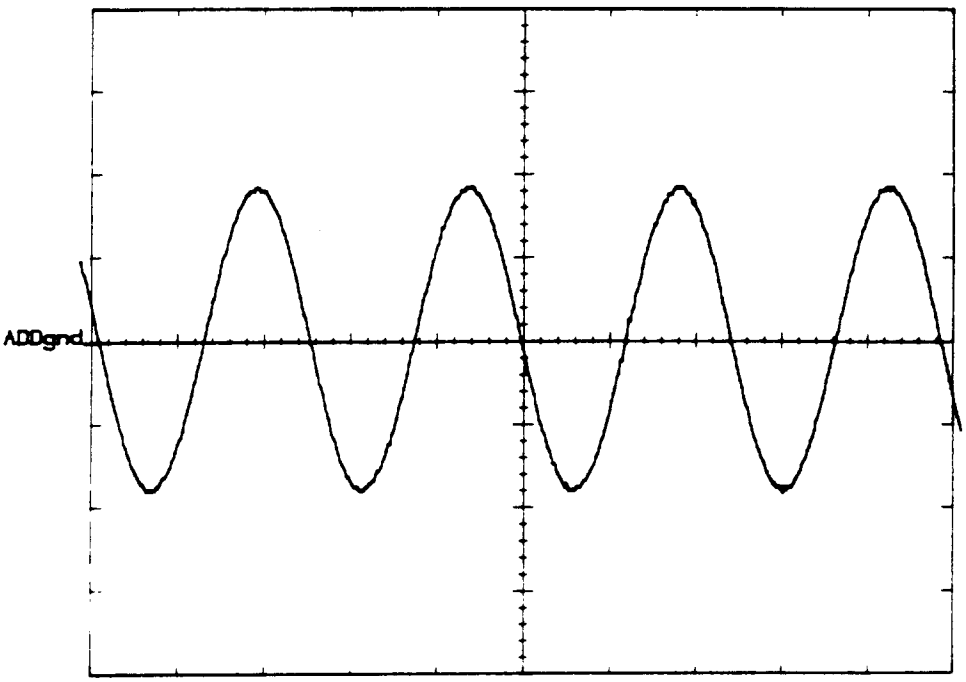


Fig. 18 - Location of Options for the AHG26 TI

TABLE J AHG26 TIMING DISTRIBUTOR OPTIONS	
SWITCH 1 POSITION	**OPTION**
-35 dBm	2.048 MHZ Sine Wave Output @ -35 dBm
-20 dBm	2.048 MHz Sine Wave Output @ -20 dBm



NOTE: OSCILLOSCOPE SETTING
CH1 500mV ADD 500mV VERT -602mV
CH2 500mV A 200mS

Fig. 19 - AHG26 TD Monitor (2.048 MHz) Output

D. CHART 4 — REPLACING CIRCUIT PACKS

STEP	PROCEDURE
	Replacement of the Timing Alarm Circuit Pack
1	*Note:* The AHG1 is the only code for the TA circuit pack. The TA circuit pack reports the alarm status from the TI and TD circuit packs. The TA does not interact directly with the timing signals of the CDU and therefore may be removed without disruption of service.
2	Press the ACO switch located on the Fuse and Alarm panel so that the switch lights. ***Requirement:*** Audible alarms will be silenced.
3	Remove the TA circuit pack from the TA slot. ***Requirement:*** The MJ and MN lamps will light on the F&A Panel. Visual and status reporting alarms will be registered.
4	Position the white option plugs on the faceplate of the replacement TA corresponding to the filled TD positions. Refer to Fig. 11 and Table A.
5	Insert the replacement TA circuit pack into the TA slot. ***Requirement:*** The MJ and MN lamps on the F&A Panel will extinguish. Office alarms will clear.
6	Press the MEM switch on the faceplate of the TA. ***Requirement:*** All LEDs on the TA should extinguish.
7	Press the ACO switch located on the Fuse and Alarm panel. ***Requirement:*** The ACO lamp should extinguish.
	Replacement of the Timing Interface Circuit Packs ***Warning: There are two codes of TI circuit packs available for the CDU: AHG16 and AHG27. Two TI circuit packs (of the same type) are used in a single CDU panel which creates an A and B timing side. The removal of a single TI will cause the associated timing side to lose its input signal and cause that side's output signals to fail.***
8	***Press the ACO switch on the Fuse and Alarm panel.*** ***Requirement:*** The ACO switch lights and the Audible alarms will be silenced.
9	Prior to removing the bad TI, the options should be set on the replacement TI circuit pack. The

STEP	PROCEDURE

placement and listing of the TIs options is presented on Fig. 12, Table B (for the AHG16 TI) and Fig. 13, Table C (for the AHG27 TI).

10 Remove the bad TI.

Requirement: The associated TI LED will light on the TA circuit pack. The MN lamp will light on the Fuse and Alarm panel.

11 Insert the replacement TI into the empty TI slot.

Requirement: The IN FAIL and OUT FAIL red LEDs will light for approximately 10 seconds. When the IN FAIL and OUT FAIL LEDs extinguish, only the IN SCE and DUPLEX LEDs will light.

12 For the AHG16 TI, use a frequency counter to measure the frequency at the TST faceplate jack on the replaced TI. Use a pin jack to connect the tip of the frequency counter's probe. Connect the ground lead to the faceplate latch.

Requirement: The frequency is 2.048 MHz.

13 Press the MEM switch on the TA circuit pack.

Requirement: All LEDs on the TA will extinguish.

14 Press the ACO switch on the Fuse and Alarm panel.

Requirement: The ACO lamp will extinguish.

Replacement of the Timing Distributor Circuit Packs

Note: There are three codes of TD circuit packs that are available for the CDU: AHG4, AHG25, and AHG26. The TDs may be placed in any TD slot. **(The TD/S slots should not be used).**

15 Press the ACO switch on the Fuse and Alarm panel.

Requirement: The ACO switch lights and the audible alarms will be silenced.

16 If the AHG4 TD is used, set the output options on the replacement TD according to those given in Table H and Fig. 16. If the AHG25 TD is used, set the output options on the replacement TD according to those given in Fig. 14 and Table D. If the AHG26 TD is used, set the output options on the replacement TD according to those given in Fig. 18 and Table J.

Note: Office alarms will sound at this point. Make sure a replacement TD is available before

STEP	PROCEDURE
	removing the bad TD.
17	Remove the bad TD from the panel.
18	Insert a TD of the same type as the one removed into the appropriate TD slot. ***Requirement:*** The red CUTOFF LED will light for approximately two seconds and then extinguish.
19	The CUTOFF LED extinguishes. ***Requirement:*** Only one TI OUTPUT IN USE LED will light on the replacement TD. Office alarms will be silenced. The TI A OUTPUT IN USE LED will light for TD positions 1 and 3. The TI B OUTPUT IN USE LED will light for TD positions 2 and 4.
20	Press the MEM switch on the TA. ***Requirement:*** All LEDs are extinguished on the TA.
21	Press the ACO switch on the Fuse and Alarm panel. ***Requirement:*** The ACO LED extinguishes. ***Note:*** If replacing an AHG4 TD, reset the Sensitrol indicator at the PFS. After resetting, the Sensitrol should indicate a steady, mid-scale reading of approximately zero.

E. CHART 5 — AUXILIARY PANEL EXPANSION OPTION

STEP	PROCEDURE

Note 1: The auxiliary panels must be placed within a six foot cabling distance from the main panel. The auxiliary panel consists of the J98726Z-1 panel, one TA, and at least one TD. As an ESD precaution it is recommended that blank board ED8C715 (or equivalent) be placed in the vacant TI slots of the auxiliary panel. The only requirement for the main panel is that it contain two TI circuit packs of the same type and one TA circuit pack.

Note 2: The CDU's output signals are made available at the SDE A and SDE B terminal blocks above the shelf assembly. The side A and side B timing signals are divided between the SDE () terminal blocks. The first ten output taps on SDE A and SDE B terminal blocks provide outputs from side A (TD-1 and TD-3 respectively). The second ten output taps on SDE A and SDE B terminal blocks provide outputs from side B (TD-2 and TD-4 respectively).

1 Connect the auxiliary panel to the –48 volt battery. Refer to Chart 1 for verification information of the –48 volt battery.

Caution: The installation of cabling between the backplanes of the main and auxiliary panels must be done with care and may cause service affecting hits if the main panel is in service. Therefore, it is recommended that the installation be done during off-peak hours.

2 Connect the auxiliary panel to the office alarm. Refer to Chart 1 for verification information of the auxiliary panel alarms. If a consolidation of alarms is desired between the main and auxiliary panels, this may be done by adding 26 AWG jumper wires between the E() terminals and the "A" row of the BK A terminal block. Multiple alarm connections of 22 AWG may then be made between the BK A terminal blocks of the main and auxiliary panels.

Note: The actual wiring is connected between the backplanes of each panel with two separate multi-wire shielded cables (Fig. 20). Each cable consists of three 26-gauge twisted pairs in a common shield. One of the cables connects to dedicated output signals from TI A of the main panel and to TI A slot of the auxiliary panel. The other cable connects to dedicated output signals from TI B of the main panel to TI B slot of the auxiliary panel. An individual ground return is carried by the second wire in each pair. The shield for each cable will be connected to frame ground of the main panel but left open at the auxiliary panel.

3 Dress the cables as shown in Fig. 21. Keep all pigtails short (not to exceed 1.5 inches).

4 Connect the common ends of the ground wires of each pair of each cable with a crimp eyelet. Any unused wires should be trimmed to shield at both ends.

5 Connect only the shield at the main panel end with a soldered pig-tail (not to exceed 1.5 inches) and also to the crimp eyelet.

6 Connect the eyelet to the second tap screw from the right edge of the backplane as shown in Fig.

STEP	PROCEDURE

4.

Note: The auxiliary panel connections are given in Table K. The first auxiliary panel is connected by cables A1 and A2 and the second auxiliary panel is connected by cables B1 and B2.

7 To connect the main panel, connect the eyelet to the second top backplane screw from the right edge of the backplane as shown in Fig. 4.

8 Connect the A2 (B2) cable to J3 as given in Table K.

Note: At this point, the auxiliary panel is fully connected and ready for operation. The auxiliary panel may accept up to four TD circuit packs and the TD-1 slot must be occupied.

9 Insert an AHG1 TA circuit pack into the TA slot on the auxiliary panel. All white option plugs on the faceplate will be in the "out" position (Fig. 11), Table A.

Requirement: All of the red LEDs on the AHG1 will light.

Note: Each TI supplies input timing signals to only two TD positions: TI A supplies output signals to TD positions 1 and 3; TI B supplies output signals to TD positions 2 and 4. This TD arrangement is referred to as a "duplex" configuration.

10 Prior to installation, options should be set on the TD circuit packs. The placement and listing of these options for the AHG4 TD are shown in Fig. 16 and Table H; the placement and listing of these options for the AHG25 are shown in Fig. 14 and Table D. If the AHG26 TD is used, set the output options on the replacement TD according to those given in Fig. 18 and Table J.

11 Install the (TD) circuit packs. One of the packs should be in an even numbered TD slot (2,4) and the other pack should be in an odd numbered TD slot (1,3). Both the AHG4 or AHG26 TD are not used in pairs. Therefore, for these two TDs, the complementary TD slot should be left vacant.

Requirement: Only one TI OUTPUT IN USE LED will light on each TD. The TDs in slots 1 and 3 will have the TI A IN USE LEDs lit. The TDs in slots 2 and 4 will have the TI B IN USE LEDs lit.

Note: In each TD position (except position 1) where a TD is used, the corresponding white option plug on the AHG1 should be placed in the "IN" position. The white option plugs allow the AHG1 to report alarm information about the corresponding TD slot when in the "IN" position and inhibit alarm information when in the "out" position. The "out" position is designated as the unlabeled position below the "IN" label on the TA for each numbered TD. Since there is no option setting for the TD-1 position, a TD must always be used in this slot. Press the MEM button on the AHG1 TA after these options are set.

12 Set the AHG1 TA option plugs (Fig. 11), Table A.

STEP	PROCEDURE

13 Press the MEM button on the AHG1 TA.

Requirement: All LEDs on the AHG1 TA will be extinguished. All lamps on the Fuse and Alarm panel will be extinguished.

Note 1: Steps 14 through 17 are for the verification of the AHG25 TD outputs. Steps 18 through 23 are for verification of the AHG4 TD output. Steps 24 through 28 are for the verification of the AHG26 TD output.

Note 2: Output DS-1 measurements must be taken across a 100 ohm terminating resistor.

14 Set up dual-trace oscilloscope for differential measurements with Channel 2 added and inverted using an internal trigger.

- Set Channels 1 and 2 to 2V/DIV
- Set Time Base to 500ns/DIV

15 Using the dual-trace oscilloscope, measure the first ten DS-1 outputs associated with the TD-1 circuit pack (Table D). Use a 100 ohm resistor across each X and Y lead. Connect the dual-trace oscilloscope probes across the resistor and connect both of the ground leads on the probe to the most convenient terminal on the A row of the SDE () terminal blocks.

Requirement: The waveforms observed must match the waveform shown in Fig. 15.

Note: All output measurements will be made at SDE A and SDE B terminal blocks. Refer to Tables E and F for the output test points corresponding to the TD circuit pack positions TD-1, TD-2, TD-3, and TD-4.

16 Repeat Step 15 for the remaining DS-1 outputs for each AHG25 located in the panel. If there are unequipped TD slots in the panel, then one of the spare AHG25 TD packs may be rolled to the unequipped positions. To prevent audible alarms from being reported during this check, the ACO switch on the Fuse and Alarm panel may be activated (switch light is on).

Note 1: All output cable connections from the CDU should have shield connections from the SDE () terminal blocks and should be kept as short as possible. These connections should be made at the appropriate SDE () terminal block connections.

Note 2: All unused AHG25 TD outputs should be terminated with a 100 ohm load across the corresponding tip and ring terminals on the appropriate SDE () terminal blocks. Resistors (100 ohm loads) are furnished with each AHG25 TD and may be installed by wire-wrapping to the corresponding SDE () terminal blocks.

Note 3: The corresponding 100 ohm resistor(s) should be removed if a previously unused AHG25 TD output is to be used.

STEP	PROCEDURE

17 When finished testing the DS-1 outputs, replace the AHG25 TDs into their assigned slots. Depress the MEM button on the TA circuit pack and press the ACO button if its light is on.

Requirement: All LEDs will be extinguished on the TA and all lamps on the Fuse and Alarm panel will be extinguished.

Note: This is the end of verifying output signals for the AHG25 TD. If the AHG4 TD is used, Steps 18 through 23 should be followed. If the AHG26 TD is used, Steps 24 through 28 shall be followed.

18 Install backplane wiring as shown in Table E.

Note 1: This wiring provides the AHG4 TD with output connections. The output wiring is dependent on the output option (attenuated or nonattenuated). The attenuated output option is normally used. If, however, noise proves to be a problem, the nonattenuated output along with an external attenuator located near the PFS will be used.

Note 2: Detailed wiring information showing input connections to the PFS-2B may be found in SD-50802-1 and T-50802-30.

19 Option the AHG4 as follows: (Refer to Fig. 16 for the location of the option switches.)

- Set the frequency to 64 kHz or 512 kHz.
- Set the dip switch positions 1 and 2 to +10 dB.

Note: The AHG4 is capable of transmitting an output of very low level signals that are difficult to view with an oscilloscope. However, the nonattenuated outputs provide a signal that may be checked easily. This signal is at a 7 dBm level for the 64 kHz output and a 10 dBm level for the 512 kHz output.

20 Connect a dual-trace oscilloscope (set to the differential mode, add and invert) to the backplane pins of the TD-4 (connector 48 [tip] and 21 [ring]).

- Channels 1 and 2 set to .5V/DIV, DC coupling, ALT
- Time base set to 20 μs/DIV (for 64 kHz output)
- Time base set to 2 μs/DIV (for 512 kHz output)
- Trigger set to Channel 1, AC coupling, AUTO

21 Place a 133 ohm resistor across pins 48 (tip) and 21 (ring) to simulate a load. Connect Channel 1 to one side of the 133 ohm resistor and Channel 2 to the other side of the resistor. The ground of the probe should be connected to frame ground.

22 Observe the waveform on the oscilloscope.

STEP	PROCEDURE

Requirement: The observed waveform will match the waveform shown in Fig. 17A or 17B.

Note: The output frequency is dependent on the PFS used (either 64 kHz or 512 kHz). The output attenuation is dependent on the frequency (–54 dBm for 64 kHz and –23 dBm for 512 kHz).

23 Remove the AHG4 TD from the CDU and option the TD for the proper output for the desired frequency. The option settings are given in Table H.

Requirement: With wiring installed from the CDU to the PFS, the LOSS OF SYNC alarms on the PFS will clear and the Sensitrol will indicate a stable reading of approximately zero.

Note: This is the end of verifying signals from the AHG4 TD. If the AHG26 TD is used, Steps 24 through 28 shall be followed.

24 Install backplane wiring as shown in Table I.

Note: This wiring provides the AHG26 TD with output connections. The output wiring is dependent on the TD slot chosen. The same wiring is used for both output level options.

25 Option the AHG26 TD for the desired output level (-20 dBm or -35 dBm). Refer to Fig. 18 for the location of the option switch.

Note: The AHG26 is capable of transmitting an output of very low level signals that are difficult to view with an oscilloscope. However, a faceplate jack provides an output level of +10 dBm unbalanced into 75 ohms. This faceplate output is buffered from the main output and provides an indication of the frequency output from the TD.

26 The faceplate output signal may be viewed by using a bantam plug and terminating the resulting signal across 75 ohms.

- Channels 1 and 2 set to .5 V/DIV, DC coupling, ALT
- Time base set to 500 ns/div
- Trigger set to Channel 1, AC coupling, AUTO

27 Place the oscilloscope probes on either side of the 75 ohm resistor.

Requirement: The waveform shown in Fig. 19 shall be obtained.

28 Remove the Bantam Plug from the AHG26 TD.

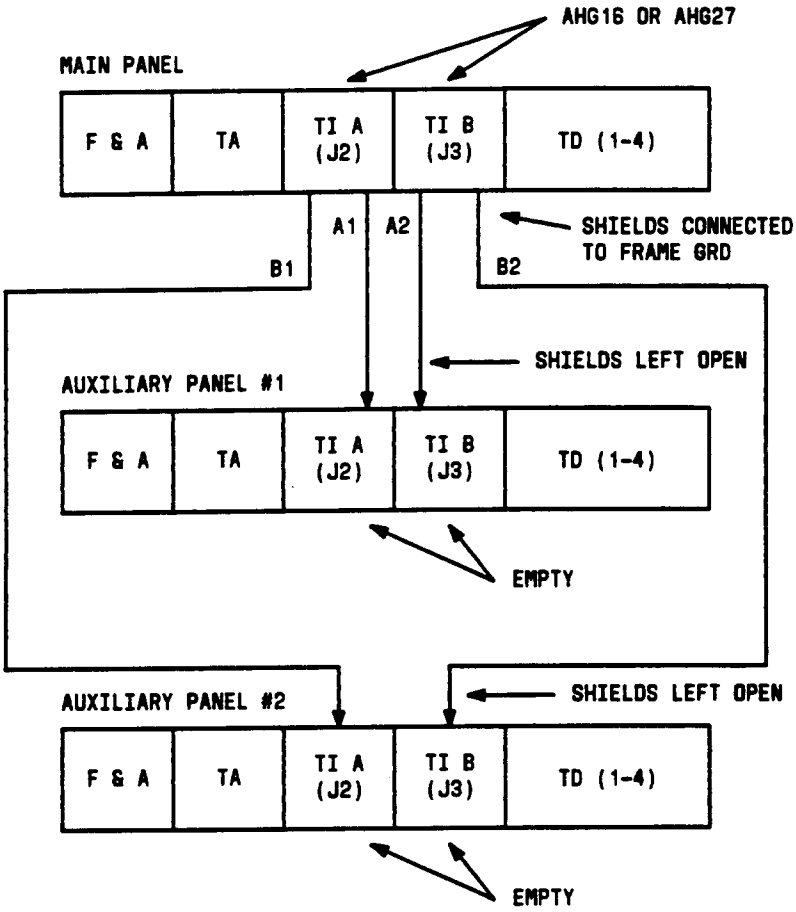


Fig. 20 - Cabling Diagram Showing Wiring Between Main and Auxiliary Panels

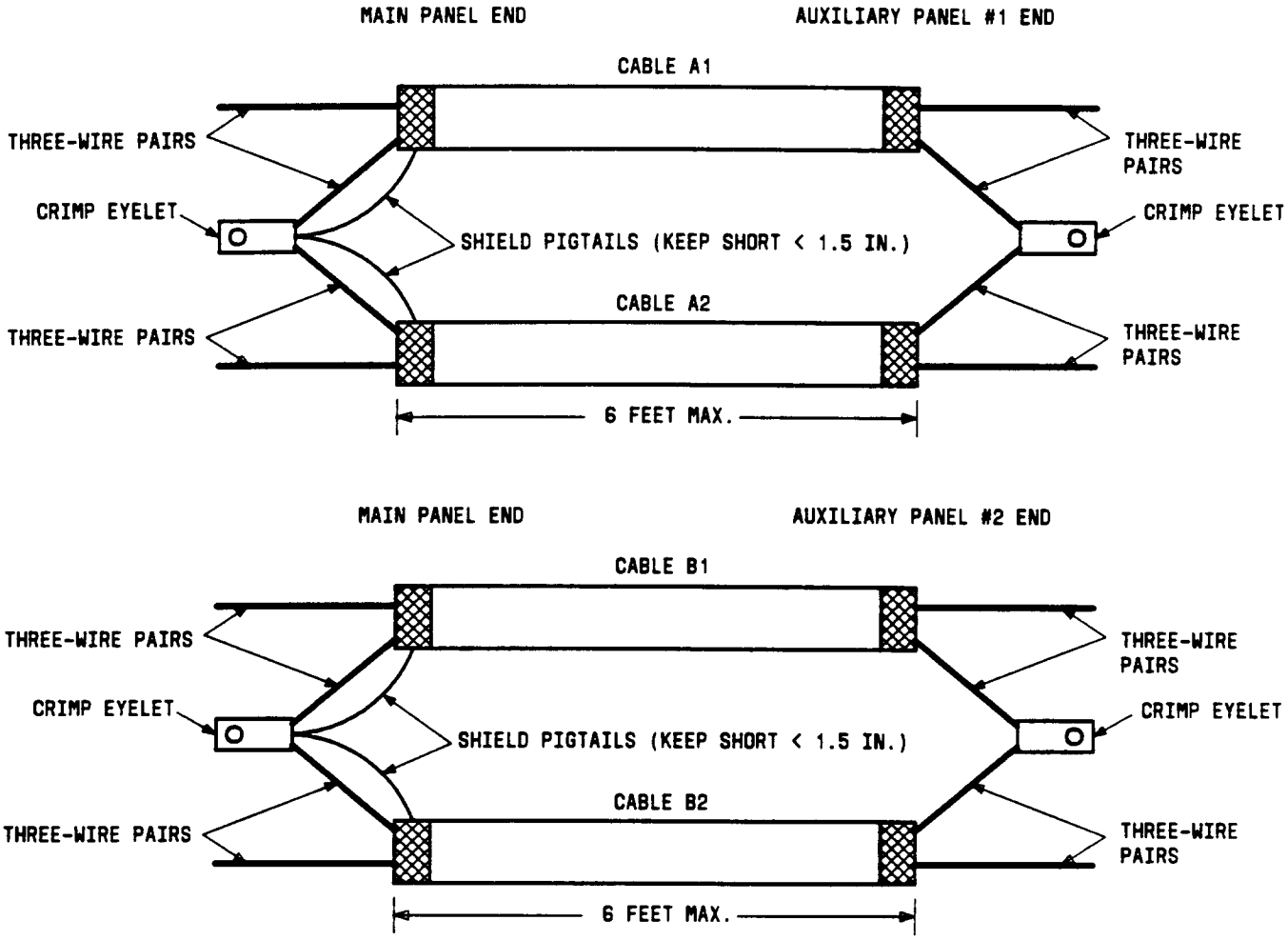


Fig. 21 - Cable Dressing for Auxiliary Panel Expansion

TABLE K (NOTES 1 , 2, AND 3)

CABLING CONNECTIONS FOR AUXILIARY PANEL EXPANSION

FROM MAIN PANEL		TO AUXILIARY PANEL #1 (NOTE 3)		
CONNECTOR	TERMINALS	CONNECTOR	TERMINALS	CABLE
J2 (TI A)	15	J1 (TA)	2	A1
J2 (TI A)	7	J2 (TI A)	3	A1
J2 (TI A)	34	J2 (TI A)	30	A1
J3 (TI B)	15	J1 (TA)	3	A2
J3 (TI B)	7	J3 (TI B)	2	A2
J3 (TI B)	34	J3 (TI B)	29	A2
FROM MAIN PANEL		**TO AUXILIARY PANEL #2 (NOTE 3)**		
CONNECTOR	TERMINALS	CONNECTOR	TERMINALS	CABLE
J2 (TI A)	42	J1 (TA)	2	B1
J2 (TI A)	8	J2 (TI A)	3	B1
J2 (TI A)	35	J2 (TI A)	30	B1
J3 (TA)	42	J1 (TA)	3	B2
J3 (TI B)	8	J3 (TI B)	2	B2
J3 (TI B)	35	J3 (TI B)	29	B2

*Note 1:*Each auxiliary panel is fed by two shielded cables (A1 and A2 for auxiliary panel #1; and B1 and B2 for auxiliary panel #2). Each cable contains three twisted pairs of 26-gauge wire.

*Note 2:*The shield connection is tied to frame ground on the main panel, but not connected on the auxiliary panel.

*Note 3:*The maximum overall cable length for each auxiliary panel should not exceed 6 feet.

F. CHART 6 — CDU MAINTENANCE AND TROUBLESHOOTING

STEP	PROCEDURE

Note 1: The following is a brief procedure for checking the operation of an in service Clock Distribution Unit (CDU). This procedure takes advantage of signals located at test points on the backplane. This test procedure is written for either the J98726Z-1 panel with the following circuit packs: AHG1 (TA); AHG16 or AHG27 (TI); AHG4 AHG25, or AHG26 (TD).

Note 2: The following test equipment will be needed:

- A dual trace oscilloscope
- A VOM (volt-ohm-milliammeter)
- A frequency counter able to measure to 2.048 MHz with an input impedance of 1 Meg-ohm

Visual Check

1 Examine the alarm and ACO lamps on the fuse and alarm panel.

Requirement: All lamps shall be dark. ***Note :*** The lamps indicate the real-time status of the CDU. If any lamp is lighted it indicates a potentially service affecting problem. The FA lamp indicates that either one of the fuses is blown or that one of the -48 volt power feeds is dead. The MN lamp indicates that at least one TI has experienced either an input or output signal failure. The MJ lamp indicated that at least one TD has experienced an input signal failure.

2 Press the ACO switch (if not already lighted) located on the fuse and alarm panel.

Requirement: The ACO switch shall light.

3 Press the ACO switch located on the fuse and alarm panel.

Requirement: The ACO switch shall extinguish. ***Note :*** If the ACO switch does not light, replace the bulb in the switch.

4 Examine the LEDs on the TA.

Requirement: These LEDs are intended to record past problems with either the TI or TD circuit packs. Make note of the lighted LEDs as this may indicate a potential problem.
Note : The LED indications on the TA represent either past or present alarms. If the CDU has a past history of alarms, then the appropriate LEDs will be lighted on the TA. To clear these alarm status LEDs, the MEM button on the TA may be pressed. If all TA LEDs do not extinguish after pressing the MEM button then either a problem with the indicated circuit pack exists, or the appropriate TD option plug for TDs 2-4, are not correctly placed (the TD plugs are placed in the "IN" position when the corresponding position is used and in the "out" (unlabeled) position when the corresponding position is not used.

STEP	PROCEDURE

5 Press the MEM switch on the TA.

Requirement: Any lighted LEDs on the TA shall extinguish. If they do not then either the TA is optioned incorrectly, defective or the CDU is in alarm. Refer to the appropriate Charts for corrective action.

6 Examine the LED indications on the TI circuit packs.

Requirement: Only one IN SCE LED for both TIs (TIA or TIB) shall be lighted.

7 Examine the LED indications on each TD circuit pack.

Requirement: Only one LED on each TD shall be lighted.

Power Check

8 Using the VOM, verify that -48 volts exists at TS 1 between terminals 1 and 2, 3 and 4, 5 and 6. (Terminals 1, 3, and 5 are GRD.)

Requirement: The measured voltage shall be between -41 and -60 volts. *Note :* Three separate, independently fused power feeds are recommended for use with the CDU. This ensures power redundancy during a power feed failure. The same practice should extend to any equipment feeding the CDU (ie. bridging repeaters).

System Check

Note 1: Two inputs signal sources must be used with an externally synchronized CDU. Diverse inputs are recommended since this ensures against dual input failures. The inputs must be either a pair of:

- 16.384 MHz Composite Timing Signal
- 2.048 MHz Sine Wave
- DS-1 with either D4 or ESF framing"

Note 2: The AHG27 TI provides the capability of being directly bridged onto a working DS-1 line. If this option is chosen, two 432 ohm bridging resistors must be placed at the DS-X to provide the monitor level signal to the CDU.

Note 3: DS-1 inputs shall only be from 4ESS, 5ESS or DACS. DS-1 facilities may not provide suitable inputs because of excess jitter.

9 Visually verify that two appropriate sources are cabled to TS 2.

Requirement: If a pair of 16.384 MHz CTS or 2.048 MHz signals are used they are cabled to

STEP	PROCEDURE

terminals: 4 (T), 5 (R), 3 (GRD) and 9 (T), 10 (R), 8 (GRD). If a pair of framed DS-1 inputs are used they are cabled to terminals: 1 (T), 2 (R), 3 (GRD) and 6 (T), 7 (R), 8 (GRD).

Note: The output signals from the CDU originate at the SDE A and SDE B terminal blocks. Each terminal block has 6 rows (labeled A through F) and twenty columns. The A row is frame ground. The B and C rows are tip and ring outputs. The first ten columns of SDE A and SDE B are connected to the TD-1 and TD-3 positions. These two TDs supply the SIDE 1 outputs. The second ten columns of SDE A and SDE B are connected to the TD-2 and TD-4 position. These two TDs supply the SIDE 2 outputs.

10 If an AHG16 TI is used with either a 16.384 MHz CTS or 2.048 MHz input, the frequency of each TI's phase locked loop (PLL) circuitry may be measured with a frequency counter. Connect a frequency counter to the TST face plate jack with a pin plug. Connect the probe's shield to the faceplate latch.

Requirement: The frequency will be 2.048 MHz +/- 1 Hz.

11 Remove the pin plug.

12 If either the AHG16 or AHG27 TIs are used, the frequency of each TI may be compared. This operation may be done by using a dual-trace oscilloscope with the following adjustments:

- Channels 1 and 2 set to 5V/DIV, DC coupling, ALT
- Time base set to .2 ms/DIV
- Trigger set to Channel 1, AC coupling, AUTO

13 Connect Channel 1 to TI test points as follows:

- Terminal 25 of J2
- Probe's shield to frame ground.

14 Connect Channel 2 to TI test points as follows:

- Terminal 25 of J3
- Probe's shield to frame ground.

15 Examine the two traces on the oscilloscope.

Requirement: Two 4 kHz square waves should be visible. There should be no rolling or cycle slipping between the two square waves. The phases need not be aligned.

16 If using the AHG26 TD connect a frequency counter to the 2.048 MHz +10 dBm faceplate jack. Use a bantam plug to obtain access to the tip (Probe) and ring (Shield) connections. Measure across a 75 ohm resistor for proper termination.

STEP	PROCEDURE

Requirement: A frequency of 2.048 MHz +/- 1 Hz shall be measured.

17 Remove the frequency counter leads, terminating resistor, and bantam plug.

Troubleshooting the Signal Path

Note 1: CDU signal failures may occur in three possible places:

- At the input of each TI circuit pack
- Between the TI and TD circuit packs
- At the output(s) of the TD circuit packs

Note 2: Measurements made with an oscilloscope may be used to determine where the problem is and how to correct it. As the CDU employees circuit pack modularity, circuit pack replacement rather than repair is recommended.

The following steps will verify the input signals to the following TI circuit packs: AHG16 and AHG27.

Caution: The following procedure deals with the measurement of critical backplane signals. As disruption of these signals may cause a temporary loss of service, it is recommended that this procedure be done during off peak hours.

18 Set up a dual-trace oscilloscope for differential measurements with Channel 2 added and inverted using an internal trigger.

- Set Channels 1 and 2 to 2V/DIV (DS-1 norm) or .2V/DIV (DS-1 bridged) or .5 V/DIV (16.384 MHz CTS or 2.048 MHz).
- Channel 2 invert
- Set the time base to 1 μs/DIV (DS-1) or 500 ns/DIV (2.048 MHz) or 50 ns/DIV (16.384 MHz CTS).

19 Connect the probes of the dual-channel oscilloscope across the input tip and ring points of TS 2. As long as TI circuit packs are in the panel, no terminating resistor is necessary. Connect ground leads of the probes to frame ground.

Requirement: If the input waveform is a DS-1 signal, the waveform will match either Fig. 9 or 10. If the input waveform is a 2.048 MHz sine wave, the waveform will match Fig. 8. If the input waveform is a 16.384 MHz CTS input, the waveform will match Fig. 7.

Note: The next series of tests will evaluate the timing signals between the TI and TD circuit packs. These signals are dual-rail unipolar composite clock in format. The TIs have output sensing circuits that determine if these signals are good. The TIs also have this capability for the separate auxiliary panel outputs.

STEP	PROCEDURE
20	Set up a dual-trace oscilloscope for differential measurements with Channel 2 added and inverted using an internal trigger. • Set Channels 1 and 2 to 2V/DIV • Channel 2 invert • Set the time base to 20 μs/DIV
21	Connect Channels 1 and 2 to the NR1 and PR1 terminals (2 and 29 respectively) of J2 (TIA). The shield leads shall connect to frame ground. ***Requirement:*** The waveform should match Fig. 22.
22	Connect Channels 1 and 2 to the NR1 and PR1 terminals (2 and 29 respectively) of J3 (TIB). The shield leads shall connect to frame ground. ***Requirement:*** The waveform should match Fig. 22.
23	Connect Channels 1 and 2 to the NR2 and PR2 terminals (3 and 30 respectively) of J2 (TIA). The shield leads shall connect to frame ground. ***Requirement:*** The waveform should match Fig. 22.
24	Connect Channels 1 and 2 to the NR2 and PR2 terminals (3 and 30 respectively) of J3 (TIB). The shield leads shall connect to frame ground. ***Requirement:*** The waveform should match Fig. 22.
25	Connect Channels 1 and 2 to the NR3 and PR3 terminals (7 and 34 respectively) of J2 (TIA). The shield leads shall connect to frame ground. ***Requirement:*** The waveform should match Fig. 22.
26	Connect Channels 1 and 2 to the NR3 and PR3 terminals (7 and 34 respectively) of J3 (TIB). The shield leads shall connect to frame ground. ***Requirement:*** The waveform should match Fig. 22.
27	Connect Channels 1 and 2 to the NR4 and PR4 terminals (8 and 35 respectively) of J2 (TIA). The shield leads shall connect to frame ground. ***Requirement:*** The waveform should match Fig. 22.
28	Connect Channels 1 and 2 to the NR4 and PR4 terminals (8 and 35 respectively) of J3 (TIB). The shield leads shall connect to frame ground.

STEP	PROCEDURE

Requirement: The waveform should match Fig. 22.

Note 1: The next series of tests will evaluate the timing signals output by the TD circuit packs.

Note 2: Proper evaluation of the CDU's working outputs may not be accurately done at the SDE () terminal block access. Transmission line characteristics allow only an accurate evaluation of output signal to be made at the destination. The following tests assume that measurements will be made at the network element (NE) terminating the signal. Caution must be observed while taking these measurements as working systems are involved.

29 If the AHG25 TD output(s) are to be examined, set-up an oscilloscope to view the waveform at the terminating NE. The dual-trace oscilloscope will be set for differential measurements with Channel 2 added and inverted using an internal trigger.

- Set Channels 1 and 2 to 2V/DIV
- Channel 2 invert
- Set the time base to 1 μs/DIV.

30 Connect Channel 1 to Tip and Channel 2 to Ring. The probe's shields shall be tied to frame ground.

Requirement: Depending on the cabling distance, the waveform should match Fig. 15.

31 If problems persist with the AHG25 TD output(s), a DS-1 analyzer will need to be used. Set the analyzer to monitor framing and data pattern.

Requirement: The framing should be either D4 or ESF (depending on the AHG25 option) and the data pattern shall be all ones.

32 If the AHG4 or AHG26 TD output(s) are to be directly examined a frequency selectable voltmeter will need to be used. Because of the extremely low level signals, care must be exercised in taking the measurement.

33 Set the frequency selective voltmeter for the center frequency required by the terminating NE (2.048 MHz or 512 kHz or 64 kHz).

Requirement: The resulting level shall be within the specifications for the terminating NE. Acceptable ranges for the NE's inputs are as follows:

- 2.048 MHz -20 to -30 dBm (OMFS)
- 2.048 MHz -35 to -45 dBm (Distribution Hybrid Tree)
- 512 kHz -23 to -33 dBm

STEP	PROCEDURE

- 64 kHz -54 to -64 dBm

Note 1: The 728A type cable is recommended for use with the AHG26 TD. This cable has an attenuation of .34 dB per 100 feet @ 2.048 MHz. A maximum cabling distance of 1500 feet is recommended.

Note 2: The 22BF type cable is recommended for use with the AHG4 TD. This cable has an attenuation of .35 dB per 100 feet @ 512 kHz. A maximum cabling distance of 1000 feet is recommended.

Note 3: If troubles are incurred that cannot be cleared, notify the AT&T Technologies installation force or your supervisor.

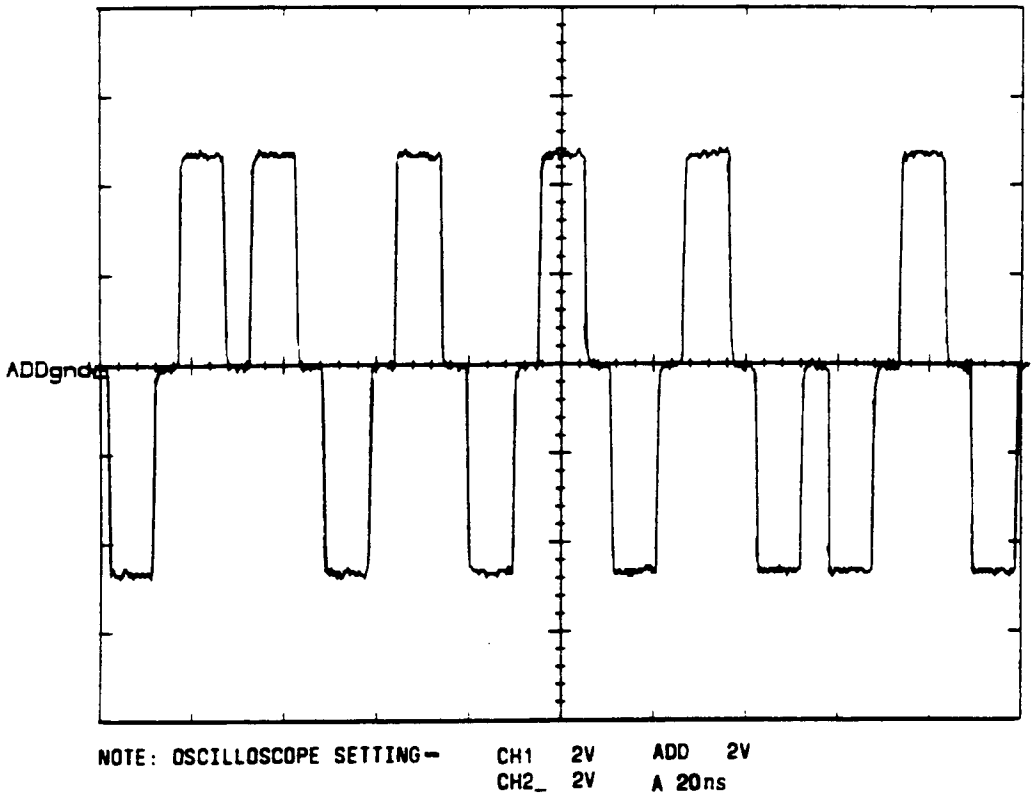


Fig. 22 - Dual-Rail Unipolar Backplane Signals

6. CLEI CODES

A. Circuit Packs

PACK	CODE
AHG1	D4PQ100AXX
AHG4	D4PQ107AXX
AHG16	D4PQ114AXX
AHG25	D4PQ115AXX
AHG26	D4PQ118AXX
AHG27	D4PQ119AXX

B. Z-1 Panel

PANEL	CODE
J98726Z-1	D4ME1E0B

7. GLOSSARY

7.01 Terms used in this document are identified as follows:

- **CDU:** Clock Distribution Unit
- **CTS:** Composite Timing Signal
- **DACS:** Digital Access and Cross Connect System
- **ESD:** Electro-Static Discharge
- **F&A Panel:** Fuse and Alarm Panel
- **IN FAIL:** Input Failure
- **IN SCE TR:** Input Source Transfer
- **LED:** Light Emitting Diode
- **PFS:** Primary Frequency Supply
- **PLL:** Phase-Locked Loop
- **SDE:** Synchronization Distribution Expander
- **TA:** Timing Alarm Circuit Pack
- **TD:** Timing Distributor Circuit Pack
- **TI:** Timing Interface Circuit Pack
- **TS:** Terminal Strip
- **TST:** Test Access Jack

- **4ESS:** Number 4 Electronic Switching System
- **5ESS:Number 5 Electronic Switching System**

8. REFERENCES

8.01 The following publications provide more information on the CDU.

- SD-7C389-02 Issue 3 (or higher)
- T-7C3890-33 Issue 4 (or higher)
- 314-813-101 – Description and Operation
- 314-813-102 – Data Sheet – AHG16 Timing Interface
- 314-913-222 – Data Sheet – AHG1 Timing Alarm
- 314-913-223 – Data Sheet – AHG4 Timing Distributor
- 314-913-228 – Data Sheet – AHG25 Timing Distributor.
- 314-813-103 – Data Sheet – AHG26 Timing Distributor
- 314-813-104 -- Data Sheet – AHG27 Timing Interface

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