DIGITAL DATA SYSTEM
NODAL TIMING SUPPLY
TESTS

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1. GENERAL

1.01 This section provides installation and maintenance test procedures for the Digital Data System (DDS) nodal timing supply (NTS).

1.02 This section is reissued to add information defining the purpose of the signal tracing tests that require the use of the oscilloscope. Revision arrows are used to emphasize the more significant changes.

1.03 Light-emitting diodes (LEDs) or lamps that are not specifically mentioned in a test procedure should be ignored.

2. APPARATUS

2.01 The following test equipment is required to perform the procedures in this section:

1—General purpose oscilloscope

Note: ▶This oscilloscope is used only to perform signal tracing tests (see 5.01).◀

3—Special test cords with P-11H966 terminal assemblies on each end

2—P-11H966 terminal assemblies.

3. INITIAL TEST

3.01 The following initial test is used to confirm that the newly installed NTS is working properly. This test is performed only after the initialization procedure for initial startup, located in Section 314-913-310, has been completed.

STEP	PROCEDURE
	Note: Verify that input selector (IS) switch on the display and control unit is selecting IU-A, that both FST switches on HL61 circuit packs (CPs) are set to NORM position, and that all alarms are off.
1	Depress INH PLL-B control key.
2	Depress NORM control key.
3	Momentarily depress RESET control key.

STEP	PROCEDURE

Requirement: The A ON, A NORM, B NORM, A-A, and A-B LEDs are lighted. All other LEDs and lamps are off.

4. PHASE METERING PROCEDURES

4.01 The following procedures use the phase metering circuit (PMC), CP HL57, to measure the phase between any two 8-kHz signals developed by the NTS. The PMC can measure the phase between:

(a) The output of timing supply interface unit A (TSIU-A) and TSIU-B (initial startup phase buildout)

(b) The output of phase-locked loop A (PLL-A) and PLL-B

(c) The output of a TSIU and a PLL.

The phase difference is displayed as a decimal number between 00 and 64 on the phase metering numerical display on the display and control unit. This numerical display represents the phase difference in 1/64ths of a cycle between the two 8-kHz signals connected to the meter. The readings are circular, ie, the next higher number after 64 is 00 again. A reading of 64 is considered equivalent to a reading of 00.

4.02 ***Phase Meter Checkout:*** The following phase meter checkout should be used to determine whether the PMC is functioning properly before it is used in any of the succeeding procedures.

STEP	PROCEDURE

Note 1: The PMC, which receives signals from PLL-A, cannot function properly if a trouble in PLL-A affects these signals.

Note 2: To ensure proper connection between P-11H966 terminal assembly and CP, terminal assembly ***must*** be inserted into test point (TP) with metal strip facing to the right.

1 Set switches S1 and S2 on CP HL57 to positive (+) position.

2 Connect one end of a special test cord (with a P-11H966 terminal assembly) to TP 1 (IN1) on CP HL57.

3 Connect one end of another special test cord to TP 8 on CP HL60 of PLL-A.

4 Using clip leads, connect two free ends of special test cords together.

Requirement: Within 2 seconds, the invalid (INV) LED lights. The numerical display remains off.

5 Connect a third special test cord from TP 7 (IN2) on CP HL57 to clip lead connection so that same signal from TP 8 on CP HL60 is connected to both phase meter inputs.

STEP	PROCEDURE
	Requirement: Within 2 seconds, the INV LED is off and a 2-digit number appears on numerical display. This number is either 00 or 64.
6	Set switch S1 on CP HL57 to minus (-) position.
	Requirement: The numerical display reads 32.
7	Set switch S2 on CP HL57 to the minus (-) position.
	Requirement: The numerical display reads either 00 or 64.
8	Remove connection to TP 1 on CP HL57.
	Requirement: Within 2 seconds, the INV LED lights and numerical display is blanked.
9	Remove all test point connectors.
	Requirement: The INV LED is off.

4.03 ***Initial Startup Phase Build-Out Procedure (Output of TSIU-A and TSIU-B):*** This procedure is used for initial installation of the NTS or if the output frequencies or phases of ***both*** PLLs have been disturbed by a trouble.

STEP	PROCEDURE
	Note: To ensure proper connection between P-11H966 terminal assembly and CP, terminal assembly ***must*** be inserted into TP with metal strip facing to the right.
1	Perform phase meter checkout (4.02) to verify that PMC, CP HL57, is performing properly.
2	Depress FREE RUN control key. Momentarily depress RESET control key.
	Requirement: The FR (PLL-A) and B LOCK TO A LEDs are lighted.
3	Rotate phase build-out switch on CP HL65 to position 6.
	Note: If position 6 is not labeled, turn phase build-out switch to position 1 and then turn it five positions counterclockwise. This is position 6.
4	Set both transition switches (S1 and S2) on CP HL57 to positive (+) position.
5	Insert a special test cord from TP 1 (IN1) on CP HL57 to TP 6 of TSIU-A, CP HL65.
	Requirement: The INV LED is lighted.

STEP	PROCEDURE
6	Insert a special test cord from TP 7 (IN2) on CP HL57 to TP 6 of TSIU-B, CP HL65. ***Requirement:*** A number from 00 to 64 appears on numerical display. The INV LED is off. ***Note:*** If INV LED remains lighted and numerical display is blanked, one of the input signals is not an 8-kHz signal. Recheck to be sure that the correct TPs and CPs have been selected.
7	While observing numerical display, rotate phase build-out switch on CP HL65 of TSIU-B until a reading of 00 or 64 is obtained. ***Note:*** If it is not possible to obtain a reading of 00 or 64, reading closest to 00 or 64 should be used. For example, if a reading of 04 is obtained and one more turn of phase build-out switch gives a reading of 62, then 62 should be used since it is closer to 64 than 04 is to 00.
8	Remove test cords from CPs. ***Requirement:*** The numerical display is blanked and INV LED is off.
9	Depress NORM control key on display panel. Momentarily depress RESET control key. ***Requirement:*** The A NORM and B NORM LEDs are lighted. The FR (PLL-A) and B LOCK TO A LEDs are off.

4.04 ***Normal Phase Build-Out Procedure:*** This procedure should be used only if there is no doubt that the output frequency and phase of only one or none of the PLLs have been disturbed by a trouble. Also this procedure must not be performed unless the NO FRM LED for the TSIU to be adjusted is off.

STEP	PROCEDURE
	Note: To ensure proper connection between P-11H966 terminal assembly and CP, terminal assembly ***must*** be inserted into TP with metal strip facing to the right.
1	Perform phase meter checkout (4.02) to verify that PMC, CP HL57, is performing properly.
2	Depress FREE RUN control key. Momentarily depress RESET control key. ***Requirement:*** The FR (PLL-A) and B LOCK TO A LEDs are lighted.
3	Set both transition switches (S1 and S2) on CP HL57 to positive (+) position.
4	Insert a special test cord from TP 1 (IN1) on CP HL57 to TP 6 of TSIU to be adjusted.

STEP	PROCEDURE

Requirement: The INV LED is lighted.

5 Determine which PLL is supplying output circuits. If pair of LEDs A-A and A-B are on while pair B-A and B-B are off, then PLL-A is the supply. If reverse conditions are true, then PLL-B is the supply.

6 Insert another special test cord from TP 7 (IN2) on CP HL57 to TP 8 of high-frequency countdown circuit, CP HL60, of supplying PLL, determined in Step 5.

Requirement: A number from 00 to 64 appears on numerical display. The INV LED is off.

Note: If INV LED remains lighted and numerical display is blanked, one of input signals is not an 8-kHz signal. Recheck to be sure that correct TPs and CPs have been selected.

7 While observing numerical display, rotate phase build-out switch on CP HL65 of TSIU until a reading of 01 is obtained.

Note: If a reading of exactly 01 cannot be obtained, reading closest to 01 should be used. For example, if a reading of 05 is obtained and one more turn of switch gives a reading of 63, then 63 should be used since it is closer to 01 than is 05.

8 Remove test cords from CPs.

Requirement: The numerical display is blanked and INV LED is off.

9 Depress NORM control key on display panel. Momentarily depress RESET control key.

Requirement: The A NORM and B NORM LEDs are lighted. The FR (PLL-A) and B LOCK TO A LEDs are off.

4.05 ***Phase Measuring Procedure for the Output of PLL-A and PLL-B:*** ⧫This procedure measures the phase difference between the 8-kHz signals at the output of PLL-A and PLL-B.⧫

STEP	PROCEDURE

Note: To ensure proper connection between P-11H966 terminal assembly and CP, terminal assembly ***must*** be inserted into TP with metal strip facing to the right.

1 Perform phase meter checkout (4.02) to verify that PMC, CP HL57, is performing properly.

2 Set both transition switches (S1 and S2) on CP HL57 to positive (+) position.

STEP	PROCEDURE
3	Insert a special test cord from TP 1 (IN1) on CP HL57 to TP 8 of high-frequency countdown circuit, CP HL60, of PLL-A. ***Requirement:*** The INV LED is lighted.
4	Insert another special test cord from TP 7 (IN2) on CP HL57 to TP 8 on CP HL60 of PLL-B. ***Requirement:*** A number between 00 and 64 appears on numerical display. The INV LED is off. ***Note:*** If INV LED remains lighted and numerical display is blanked, one of input signals is not an 8-kHz signal. Recheck to be sure that correct TPs and CPs have been selected.
5	After needed indications have been observed, remove test cords from CPs. ***Requirement:*** The numerical display is blanked and INV LED is off.

4.06 ***Phase Measuring Procedure for the Output of a TSIU and a PLL:*** ♦This procedure measures the phase difference of the 8-kHz signals at the output of a TSIU and a PLL.♦

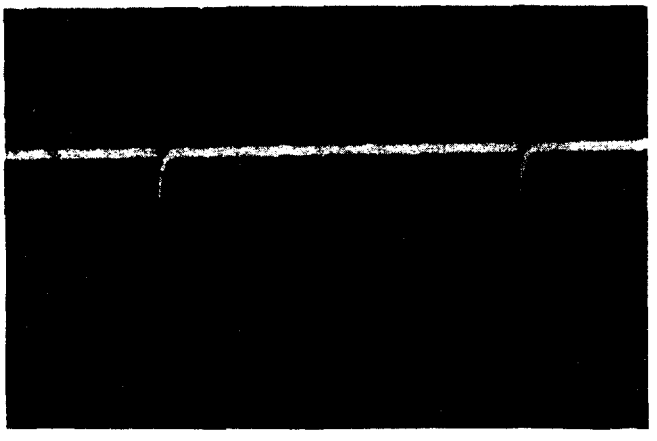
STEP	PROCEDURE
	Note: To ensure proper connection between the P-11H966 terminal assembly and CP, terminal assembly ***must*** be inserted into TP with metal strip facing to the right.
1	Perform phase meter checkout (4.02) to verify that PMC, CP HL57, is performing properly.
2	Set both transition switches (S1 and S2) on CP HL57 to positive (+) position.
3	Insert a special test cord from TP 1 (IN1) on CP HL57 to TP 6 on CP HL65 of selected TSIU; this is input signal to PLL. ***Requirement:*** The INV LED is lighted.
4	Insert another special test cord from TP 7 (IN2) on CP HL57 to TP 8 of high-frequency countdown circuit, CP HL60, of PLL to be checked; this is output signal of PLL. ***Requirement:*** A number between 00 and 64 appears on numerical display. The INV LED is off. ***Note:*** If the INV LED remains lighted and numerical display is blanked, one of input signals is not an 8-kHz signal. Recheck to be sure that correct TPs and CPs have been selected.

STEP	PROCEDURE
5	After needed indications have been observed, remove all test cords. ***Requirement:*** The numerical display is blanked and INV LED is off.

5. WAVEFORMS

5.01 ▮The following oscilloscope waveforms can aid in locating a trouble condition in an NTS that cannot be located by using the troubleshooting flowcharts in Section 314-913-310. The trouble can normally be isolated to a connection or wire between CPs. This signal tracing approach requires the use of the oscilloscope. P-11H966 terminal assemblies are used to gain access to CP TPs.◀

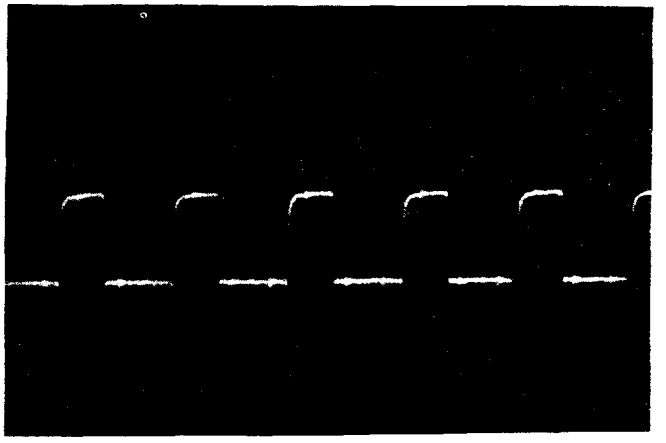
5.02 Waveform A is the 8-kHz F-bit signal derived by each TSIU. The pulse occurs once every 125 μs and has a pulse width of 0.5 μs. This waveform can be observed at TP 6 on CP HL65 of each TSIU. TP 12 on CP HL65 is ground.



HORIZONTAL SCALE: 20 μS/DIV
VERTICAL SCALE: 2 V/DIV

Fig. 1—Waveform A

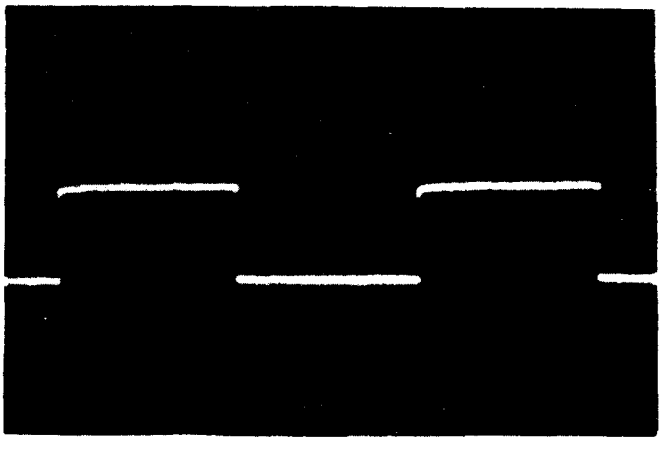
5.03 Waveform B is the 512-kHz signal supplied to the timing supply output circuits (TSOCs) by the PLL. The pulse occurs approximately once every 1.95 μs. Notice that the waveform stays at 0 voltage for a larger percentage of the duty cycle than it is high. This is a normal condition. This waveform can be observed at TP 1 on CP HL60 of both high-frequency countdown circuits. TP 12 on CP HL60 is ground.



HORIZONTAL SCALE: 1 μS/DIV
VERTICAL SCALE: 2 V/DIV

Fig. 2—Waveform B

5.04 Waveform C is the 8-kHz signal supplied to the TSOCs by the PLL. The pulse occurs once every 125 μs. This waveform can be observed at TP 8 on CP HL60 of both high-frequency countdown circuits. TP 12 on CP HL60 is ground.



HORIZONTAL SCALE: 20 μS/DIV
VERTICAL SCALE: 2 V/DIV

Fig. 3—Waveform C