178A TEST SET

DESCRIPTION AND OPERATION

CONTENTS PAGE

1. GENERAL

1.01 This section covers the description and operation of the 178A test set. The 178A is a portable test set designed for use in DATAPHONE® Select-A-Station service. The overall system and service description is covered in Section 314-410-550.

1.02 Whenever this section is reissued, the reason for reissue will be given in this paragraph.

1.03 The 178A test set is designed to functionally test the system in response to a trouble report or to perform preservice testing prior to turning up the system for service. The test set can functionally test the four options of data station selectors (DSSs) used in the two service offerings and any of the allowed tandem arrangements of primary and secondary DSSs. This portable test set can be used at the various work locations such as the central office DSS location or the test center.

A. Service Characteristics

1.04 There are two service offerings and three DSS options available as follows:

(a) Sequential Offering

- Auto-step DSS option
- Auto-step DSS option with reset
- Controlled-step DSS option

(b) Addressable Offering.

In the sequential offering the connection sequence to remote stations is determined by the customer and specified on the service order (SO). Limited control over the order of connections is provided only with the auto-step DSS option with reset. The addressable offering provides message codes that allow for varying the order of station selection and connection time on an in-service basis.

1.05 Tandem connection of DSSs is permitted in the controlled-step DSS option of the sequential offering and in the addressable offering. This type of connection enables a large geographic concentration of remote stations to be served economically. Two DSSs, denoted as a primary and a secondary, may

be connected in tandem. The number of secondary DSSs that can connect to a primary DSS is limited only by the number of output ports on the primary. The maximum number of ports available is 128 in the sequential offering and 125 in the addressable offering.

2. PHYSICAL DESCRIPTION

2.01 The 178A test set, Fig. 1, is contained in a portable carrying case and can be operated in an upright or horizontal position. The cover is used to hold and store the accessory cords. The test set cover is hinged and may be removed for convenience.

2.02 The test set in the carrying case is approximately 17 inches wide, 13 inches high, 7 inches deep and weighs approximately 22 pounds.

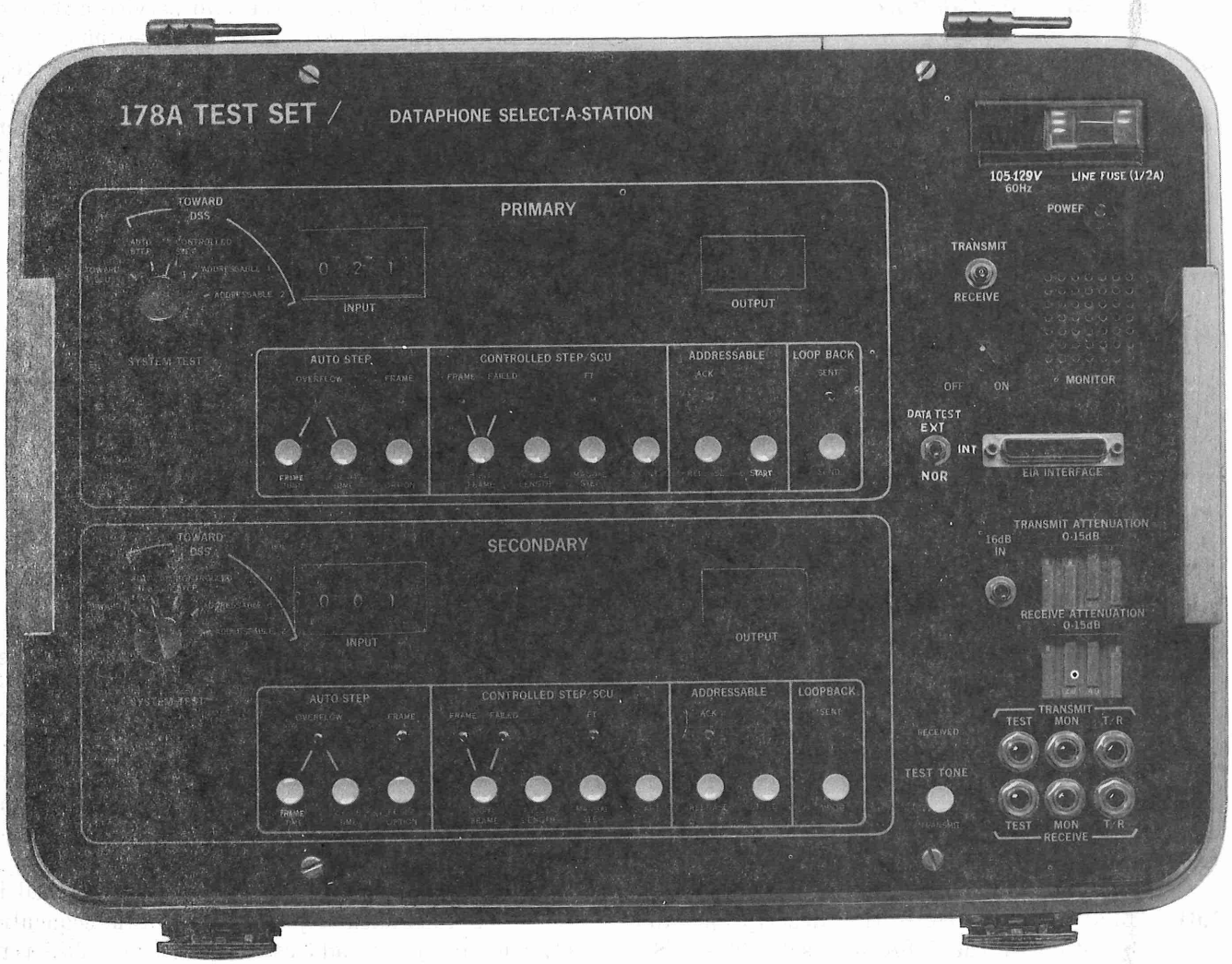

Fig. 1—178A Test Set-Front Panel View

Front Panel Controls and Displays

2.03 The test set controls are divided into two sections, PRIMARY and SECONDARY. A primary DSS is tested by the primary section and a secondary DSS is tested by the secondary section. The selector control unit (SCU) at the master station is tested using both the primary and secondary sections. Each section on the front panel contains the following controls:

- A rotary switch used to select the type of system
- A 3-digit thumb-wheel switch used to control the decimal point location or enter port addresses
- A 3-digit display for indicating test results
- Numerous pushbuttons to start various tests
- Light emitting diodes (LEDs) to display results of various tests.

Note: The TEST TONE pushbutton and LED are used in conjunction with testing both primary and secondary DSSs. Therefore, they are located outside the sectioned portions on the front panel.

2.04 The various pushbuttons and LEDs used in testing a particular type of DSS (either primary or secondary) are found within the same sectional area.

2.05 The 178A test set is powered from a 110 Vac source (usually a wall outlet). A 1/2-amp fuse is contained in the input POWER receptacle. The ON-OFF switch is a pushbutton (labeled POWER) that is lighted when power is applied and the button is depressed. The test set has a built-in LED test that is made each time power is applied to the set. During each initial application of power, all 15 LEDs and the display indicators light for a brief period and then turn off.

Loudspeaker

2.06 A loudspeaker is provided to monitor the signals into and out of the test set circuits. A toggle switch is provided to select the transmit or receive sides and an ON-OFF volume control is provided. If external transmission test equipment is plugged into the TEST jacks, the 178A test set circuits, including the loudspeaker, are isolated from the line.

3. FUNCTIONAL DESCRIPTION

3.01 The test set is designed to interface with a 4-wire circuit at an analog signal level. This will normally be, but is not restricted to, the primary link at test jacks available on the DSS or at a testboard. Two coil patch cords, equipped with 310-type plugs at each end, are supplied with the set. These cords have a usable length of 12 feet and plug into the T/R jacks located on the lower right corner of the front panel.

Note: Tip-sleeve type plugs must not be used since they have a larger diameter and will cause the jacks to fail mechanically.

3.02 Six jacks are located on the lower right corner of the set. Three jacks are on the TRANSMIT side and three are on the RECEIVE side. The transmit jack labeled T/R is used to connect the set to a circuit for sending signals from the test set. The receive T/R jack is used to connect the set to a circuit for receiving signals from a circuit. The various 4-wire circuit access points for the 178A test set are shown in Fig. 2. This figure also shows the expected 1004-Hz levels at these access points.

3.03 After the 178A test set has been connected to a circuit or DSS, other transmission test equipment can be connected and used to perform transmission tests. The TEST and MON jacks on the transmit and receive side are provided for connecting transmission test equipment to the network. Whenever the TRANSMIT TEST or RECEIVE TEST jacks are used, the connection from the circuit to the 178A test set is broken and the transmission test equipment has full access to the circuit. The MON jacks are used to permit test equipment to bridge onto the tip and ring leads of each circuit pair. Bridging should only be made on a high impedance basis.

3.04 Figure 2 shows the 178A test set can connect directly to a DSS using the DSS IN and DSS OUT jacks on the RL5 circuit pack. The test set can also connect to the primary circuit at a test center that has access. Test access to the selector control unit (SCU) at the master station is made using the TRANS TST and RCV TST jacks on data auxiliary set (DAS) 829-type L1A.

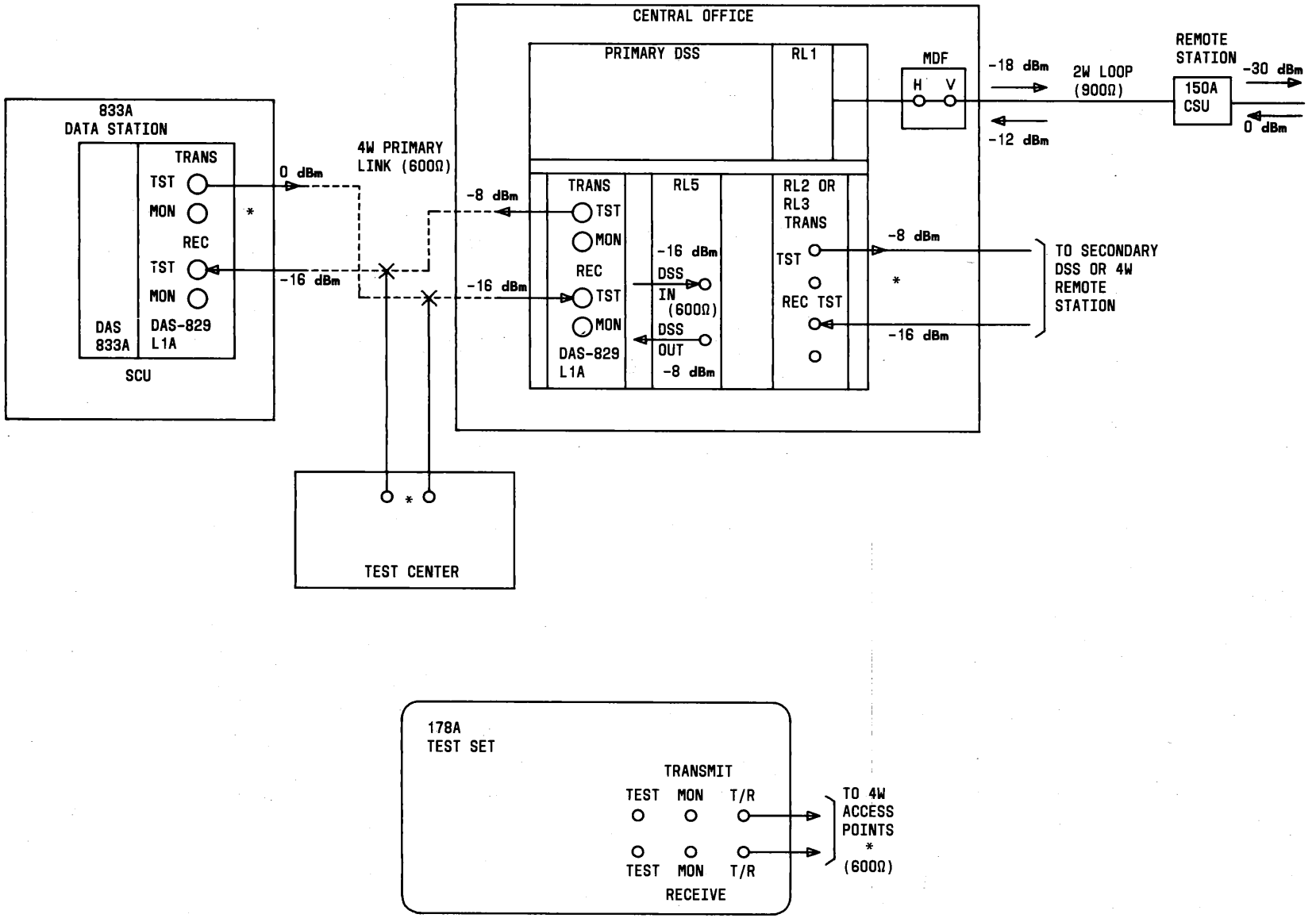

Fig. 2—Diagram Showing Test Access Points for 178A and Expected 1004-Hz Levels

Signal Level Adjustment

3.05 A set of attenuators is provided in the test set for both the receive and transmit circuit pairs. These attenuators provide signal level adjustment capability for the range of the test set. The transmit attenuator is made up of a fixed 16-dB attenuator controlled by a toggle switch and a 15-dB attenuator variable from 0 to 15 dB in steps of 1 dB. The total range of this attenuator is from 0 to 31 dB. With the toggle switch set to the 16-dB OUT position and all the slide switches set so that the number under each slide cannot be seen, the test set transmits a signal at a level of 0 dBm. For an application requiring a lower level, the transmit attenuator toggle switch and pad are set accordingly.

3.06 The receive attenuator consists of an attenuator pad variable from 0 to 15 dB in steps of 1 dB. The test set requires a receive level of -16 dBm. Any receive level greater than -16 dBm must be padded down using the receive attenuator pad.

> ***Note:*** Signal levels below -16 dBm are not provided at the standard access points in the DSS or SCU for normal operation when all equipment and circuits are properly aligned and working.

Electronic Industries Association (EIA) Interface Connector

3.07 An EIA interface connector is provided for connecting an external data test set, such as a 914-type DTS or 921A DTS, for use in making data tests. This connector will normally be used for tests from a test center to either the SCU or DSS when the addressable offering of the service is used. The adjacent toggle switch is called the DATA TEST switch. This switch has three operating positions labeled EXT, INT, and NOR which designate the external, internal, and normal switch positions, respectively. When the switch is in the EXT position, the receive data (BB) and the send data (BA) leads of the test sets internal data set 202T are brought out to the EIA connector. This provides an access point for a data test set such as the 914-type or 921A to the transmitted data signals on the circuit. When the switch is in the INT position, a data test on an addressable system can be made. This test is described in 6.21 of this section. When the switch is in the NOR position, the BB and the BA leads of the test sets internal data set 202T are connected to appropriate internal control circuits.

4. INITIAL SETUP

4.01 After the test set has been connected to a circuit, the receive and transmit attenuators are then set to their proper levels. The SYSTEM TEST switch is set to the appropriate test position on both the PRIMARY and SECONDARY sides of the front panel.

> ***Note:*** If only a primary DSS is to be tested, the secondary system test switch can be on any position. For addressable testing, both primary and secondary system test switches must be in the same position even if only a primary DSS is tested.

4.02 If a functional test of the SCU is to be performed, place both the primary and secondary SYSTEM TEST switches in the TOWARD SCU position. If a DSS or DSSs are to be tested, place the primary switch in the position that describes the primary DSS mode, and place the secondary switch in the position that describes the secondary DSS mode.

> ***Note:*** The ADDRESSABLE-1 position is used for an addressable system with the single character addressing option, and the ADDRESSABLE-2 position is used for an addressable system with the double character addressing option (error control option).

5. DESCRIPTION OF TESTS TOWARD THE SELECTOR CONTROL UNIT (SCU)

A. Testing Toward The SCU

5.01 The tests toward the SCU given in this part are usually made at the DSS or test center location. The procedures for making a more complete interface and functional test at the SCU are given in Section 598-083-106—TOP using the 914-type data test set.

Functional Test of SCU

5.02 The 178A test set can functionally test the tone receivers and tone generators in the

SCU. The buttons and LEDs that are used are located in the CONTROLLED STEP/SCU section of both the PRIMARY and SECONDARY sections on the front panel. First, an attendant at the master station must manually place the SCU in the functional test mode by depressing the FT switch on the DAS 833A of the SCU to be tested. Then, at the 178A test set, set the SYSTEM TEST switch on the PRIMARY and SECONDARY sections to the TOWARD SCU position. A primary tone (2975-Hz) is sent toward the SCU by depressing and holding the primary MANUAL STEP button on the test set. In response, the SCU will send back a secondary tone (2800-Hz) causing the secondary FT LED to light. When the MANUAL STEP button is released, the secondary FT LED will go off. Similarly, a secondary tone is sent toward the SCU by depressing and holding the secondary MANUAL STEP button. In response, the SCU will send back a primary tone, causing the primary FT LED to light. When the MANUAL STEP button is released, the primary FT LED will go off. At the completion of the test, the attendant at the master station must release the FT switch on the DAS 833A to return the SCU to the normal operating mode.

B. Channel Loopback Test

5.03 Another test that can be performed in conjunction with the SCU is a channel loopback test. The attendant at the master station is instructed to manually enable the channel loopback mode by depressing the LB switch on the DAS 833A of the SCU. A test tone can be transmitted from the 178A test set by depressing and holding the TEST TONE TRANSMIT button located on the lower right-hand corner. This tone is looped around by the DAS 829-type L1A in the SCU and is received at the 178A test set causing the TEST TONE RECEIVED LED to light. When the TEST TONE TRANSMIT button is released, the TEST TONE RECEIVED LED will go off. To restore the SCU to the normal operating mode, the attendant at the master station must release the LB switch on the DAS 833A. To verify that this has been done, again depress and hold the TEST TONE TRANSMIT button on the 178A test set. The TEST TONE RECEIVED LED will not light if loopback has been released.

Further transmission tests toward the SCU using transmission test sets can be used when the channel is looped back. These tests typically are used to verify benchmark readings of 1004-Hz loss, frequency response, and envelope delay distortion (EDD). These test sets can gain access to the circuit through the 178A test set jacks as given in 3.03.

6. DESCRIPTION OF TESTS TOWARD DATA STATION SELECTOR (DSS)

6.01 The tests toward the DSS in this part are usually made at the test center location. The more detailed test procedures are given in Section 666-617-101—TOP. The test procedures are also given in Section 590-105-101—TOP when tests are to be made at the DSS location.

A. Auto-Step DSS Option

6.02 A DSS operating with the auto-step option cycles through its port assignments without any control from the SCU at the master station. There are two appropriate operating parameters set at initial installation of the DSS. These are the number of ports per cycle and the connection time per port. A frame tone is transmitted by the DSS at the beginning of each cycle. Therefore, the tests applicable to this option consist of measuring the time duration of the frame tone and measuring the time interval between successive detections of the frame tone. The first test is called the frame time test while the second test is called the cycle time test. These tests can be performed on both a primary or a secondary DSS.

Frame Time Test

6.03 To perform the frame time test, depress the FRAME TIME button on the appropriate section of the test set. The output display will light showing all zeros and then start counting. There is normally a delay before the display starts counting. This delay is dependent upon the hold time of the system and the number of ports in the cycle. The delay is related to the time required to go through a complete cycle of the ports in the DSS under test. For systems with long hold times and long cycle lengths, this time delay can be

considerable. The waiting period or delay occurs since the FRAME TIME button can be depressed at any time relative to the appearance of the frame tone. To ensure an accurate measurement of the frame tone duration, the first appearance of the frame tone sets the measuring circuit and then the next appearance is measured. This reading on the display can be related to the actual port connect time setting in the DSS using Table A. This table shows, for example, that if the DSS has been optioned to provide a connect time of 100 milliseconds (ms), the display reading would show .129 seconds. When the counting stops, the reading on the 3-digit display is the actual time interval of the frame tone less the detection time.

TABLE A

FRAME TIME INTERVAL READING IN SECONDS	HOLD TIME OPTION (Ms)	FRAME TIME INTERVAL READING IN SECONDS	HOLD TIME OPTION (Ms)
		.879	600
.009	20	.939	640
.024	30	1.18	800
.039	40	1.42	960
.054	50	1.66	1120
.069	60	1.90	1280
.084	70	2.14	1440
.099	80	2.38	1600
.114	90	2.62	1760
.129	100	2.86	1920
.144	110	3.10	2080
.159	120	3.34	2240
.174	130	3.58	2400
.189	140	3.82	2560
.204	150	4.76	3200
.219	160	5.20	3480
.279	200	6.70	4480
.339	240	7.66	5120
.399	280	8.62	5760
.459	320	9.58	6400
.519	360	10.5	7040
.579	400	11.5	7680
.639	440	12.4	8320
.699	480	13.4	8960
.759	520	14.4	9600
.819	560	15.3	10240

6.04 If the count exceeds the capacity of the interval counter, the OVERFLOW LED will light. For example, if the input thumb-wheel switch is set to 000 allowing readings up to 0.999 seconds and the OVERFLOW LED lights, the overflow condition will cause the display to go blank. If this occurs, set the thumb-wheel switches to 001, 002, or 003. Each increment causes the decimal point to move one position to the right. In the setting of 003, the decimal point disappears allowing readings up to 999 seconds. The setting of 003 should only be required in the cycle time test.

Cycle Time Test

6.05 This test measures the ports per cycle or time for one complete cycle of the DSS, including the two frame ports. The INPUT thumb-wheel switches should be set between 000 and 003, depending upon the expected time interval result indicated in Table B. If the DSS is optioned for a long connect time and has a large number of ports, the cycle time can exceed 999 seconds. If this occurs, the OVERFLOW LED will light but the count will not stop until the interval of 1999 seconds is exceeded. For cycle time intervals greater than 999 seconds but less than 1999 seconds, the OVERFLOW LED will light and the 3-digit display will indicate the least three significant figures of the measured time interval. For example, if the number of seconds expected is 1200, the INPUT thumb-wheel switches would be set to 003. The display will indicate 200 when the OVERFLOW LED lights. As expected, time intervals in excess of 1999 seconds will cause the display to go blank when the OVERFLOW condition is reached.

6.06 To perform the cycle time test, the CYCLE TIME button on the test set is depressed. The output display will light with all zeros and then start counting. When the counting on the display indicator stops, observe and record the OUTPUT DISPLAY reading; then, locate and compare this reading and the Hold Time Option of the DSS with Table B. Locate the ports per cycle of the DSS by moving to the far left Ports Per Cycle column of Table B on the same horizontal line as the Cycle Time in Seconds reading. For example, the connect time (Hold time option) per port of the DSS is 240 ms and the Output Display of Cycle Time in Seconds reading is 21.6 seconds.

On Table B locate the Hold Time of 240 ms at the top portion of the table, then drop down on the same vertical column under 240 ms to the display reading of 21.6 seconds. Now move to the far left Ports Per Cycle column on the same horizontal line as the reading of 21.6 seconds. The result should be 88 ports per cycle and agree with the service record on that particular DSS.

Note: As in the frame time test, the time before the display begins counting will vary depending on the hold time of the system and number of ports in the polling cycle. For systems with long hold times and long cycle lengths, the waiting period could be several minutes. If the CYCLE TIME button is depressed just after the DSS has moved off the frame port, an entire polling cycle must be completed before the frame tone reappears.

B. Auto-Step DSS Option With Reset

Frame Time and Cycle Time Test

6.07 If the DSS is equipped with the automatic step with reset option, the waiting time for the previous two tests can be shortened before the display begins counting. The reset option allows the DSS to be remotely returned to the frame port. After the FRAME TIME or CYCLE TIME button is depressed, the RESET OPTION button is depressed. This action causes the cycle to reset to the frame port and the FRAME LED will light. If the display is still not counting, wait until the FRAME LED goes off, then depress the RESET OPTION button again. The display will start counting if the DSS is operating properly.

C. Controlled-Step DSS Option

6.08 In the controlled-step option mode, the DSS steps from one port to another in a fixed sequence controlled by the SCU in the master station. In the following tests, the 178A test set replaces the master station and the SCU, and controls the DSS. The SYSTEM TEST switch in the appropriate section must be set to the CONTROLLED STEP position for these tests.

Hunt Frame Test

6.09 In this test the 178A test set transmits a tone burst to the DSS and waits for a time duration of 110 ms. Within that period, the 178A test set expects to receive a frame tone from the DSS. If the 178A test set does not detect a frame tone, another tone burst is transmitted followed by an additional waiting time of 110 ms. If the 178A test set detects the frame tone (on two successive ports), the FRAME LED will light indicating a successful completion of the hunt frame test. If the frame port is not found (frame tone is not detected), the test set will continue to transmit up to 200 tone bursts to the DSS. If the 178A test set reaches this count without detecting the frame tone, the test fails as indicated by the lighting of the FAIL LED.

Note: Detection of the frame port as indicated by the FRAME LED requires frame tone on two successive ports. This differs from the FT LED which lights anytime the frame tone is detected and does not require detection of the frame tone on two successive ports.

6.10 The hunt frame test is made by depressing the HUNT FRAME button on the test set. The OUTPUT display is then lighted and counts as the test progresses. The numbers displayed on the OUTPUT display indicator are used only to indicate that the test is progressing normally. When the test has been completed, either passing or failing, the OUTPUT display indicators are turned off.

Cycle Length Test

6.11 This test verifies that the number of ports in a polling cycle corresponds to the number assigned to the DSS on the service records. The test can only be performed after the frame port has been detected as indicated by the lighting of the FRAME LED on the test set.

6.12 The cycle length test is made by depressing the CYCLE LENGTH button on the test set. This causes the 178A test set to transmit a

series of tone bursts, approximately 110 ms apart, to the DSS. These tone bursts advance the DSS one port at a time until the frame port signal is again detected. During the cycle length test, the OUTPUT display remains lighted and indicates the number of the port as it is polled. The number that is displayed when the frame port is detected indicates the actual number of ports in the cycle. However, it does not include the two frame ports.

MANUAL STEP Button

6.13 The MANUAL STEP button provides the means to advance or step the DSS one port at a time. This feature can be used to manually step the DSS through all the assigned ports from the test set location. It also provides the capability to stop on one or more specific ports for an extended period of time.

START Button

6.14 Another feature in the controlled-step portion of the 178A test set is provided by the START button. This feature is used whenever a particular port address on the DSS is required at the test set. The process of providing this specific address is begun by first entering the port number on the INPUT thumb-wheel switches. The START button is then depressed. The 178A test set will transmit a series of tone bursts to the DSS, approximately 110 ms apart, and stop when the port number as designated on the INPUT thumb-wheel switches is accessed. The OUTPUT display will count as the DSS cycles through the polling sequence and will stop when the test set stops transmitting tone bursts. The port number, as indicated on the OUTPUT display, should be the same number as designated on the INPUT thumb-wheel switches. This procedure can only be performed following a successful hunt frame test.

> ***Note:*** It is not necessary to repeat the hunt frame test each time a specific port address is required.

D. Addressable DSS Offering

6.15 Previous tests have been directed at testing the sequential offering service. In the addressable offering, the DSS ports can be polled or selected in a random sequence. The 178A test set transmits programmed addresses and accesses a specific port on the DSS. This type of DSS operation also features an addressable/auto-step mode of operation. With this type of operation, the DSS can operate in the addressable mode for some time and be placed in the auto-step DSS option mode by sending an appropriate control port address plus output port address from the 178A test set to the DSS.

6.16 To send an address to the DSS in the addressable mode set both SYSTEM TEST switches to the ADDRESSABLE 1 or ADDRESSABLE 2 position, then depress the RELEASE button on the 178A test set. This causes the test set to transmit a tone burst to the DSS and release it from its present port connection. When the DSS is released, an acknowledgement tone is transmitted to the 178A test set and causes the ACK LED to light. This indication confirms that the DSS has been released and the address procedure can continue.

6.17 The decimal address of the desired port must be entered using the INPUT thumb-wheel switches. The START button on the 178A test set is then depressed and the test set sends the desired address. This action also causes the ACK LED to go off which indicates that the DSS is in a connected state.

Special Addresses

6.18 There are a number of special port addresses than can be used in testing the 178A test set. These are listed as follows:

(a) 127—This address causes the DSS to send a 1 kHz test tone. After this address has been transmitted, the TEST TONE RECEIVED LED will light on the 178A test set.

(b) 513—When 513 is entered using the INPUT thumb-wheel switches, the 178A test set will transmit address 126 followed immediately by address 113. This is interpreted by the DSS as the share load command. The DSS will then send back a 2-character status report. (For dualized operation only).

(c) 425—When 425 is entered using the INPUT thumb-wheel switches, the 178A test set will transmit address 126 followed immediately by the address 25. The DSS interprets this as the swap links command. (For dualized operation only).

(d) 414—The 178A test set transmits address 126 followed by address 14. The DSS interprets this as the shut down dual command. The DSS will then send back a 2-character status report. (For dualized operation only).

(e) 502—The 178A test set transmits address 126 followed by address 102. In response, the DSS goes into the digital loopback mode which loops the data signal back toward the 178A test set. An external data test set can be connected to the 178A test set for data performance measurements. The 178A test set can also perform a functional data test as given in 6.21.

(f) 490—The 178A test set transmits address 126 followed by address 90. In response, the DSS sends back a 2-character status report.

(g) 200 to 324—The 178A test set transmits the address 125 followed by the address entered using the INPUT thumb-wheel switches minus 200. The DSS interprets this as a command to go from the addressable mode to the auto-step mode and to start at the address entered minus 200. For example, if the address 225 is entered using the INPUT thumb-wheel switches, the 178A test set will send address 125 followed by address 25.

Display of Status Words

6.19 When the DSS sends back a status report (after receiving 490, 513, or 414), it transmits a 2-character status report. In order to display these two characters with one display, the following method is used. The display on the test set first shows all 8s, goes blank, shows the first character, goes blank, shows the second, goes blank again, and then repeats the cycle. Using this method the two characters are shown in sequence.

6.20 Table C shows the possible first and second words and their meanings. There are several first words that are impossible to obtain unless there is an error in transmission.

Data Test Using the 178A Test Set

6.21 The 178A test set can be used to perform a functional data test with a DSS in the addressable mode. This is only a qualitative test as no measure is made of distortion. The DSS is first conditioned to the digital loopback mode using port address 502. The SYSTEM TEST switches are set to the ADDRESSABLE 1 position and the DATA TEST switch is set to the INT position. Without first depressing the RELEASE button, send any address from 000 to 124 by depressing the START button twice. The OUTPUT display shows all 8s, goes blank, shows the address sent, goes blank, shows the address sent, goes blank, and then repeats the cycle. If the address shown on the OUTPUT display is different from the address sent, an error was made somewhere in the channel or DSS. After the test is completed, the DATA TEST switch must be returned to the NOR position.

E. Channel Loopback Tests

6.22 The DAS 829-type L1A in a DSS can be looped back under certain conditions. An auto-step or auto-step with reset DSS can be looped back at any time. A controlled-step DSS can only be looped back when it is on the frame port. An addressable DSS can only be looped back when it is in the released state. To accomplish loopback once the DSS is properly conditioned, the SEND LOOPBACK button on the test set is depressed momentarily. This will cause a 2713-Hz tone of approximately 5 to 7 seconds to be sent toward the DSS. After the tone has been sent, the LOOPBACK SENT LED will light indicating the loopback tone has been sent.

> ***Note:*** The lighting of the LOOPBACK SENT LED does not indicate that the DSS is in the loopback mode.

6.23 The DAS 829-type L1A in the DSS receives and detects the loopback tone and goes into the loopback mode ***after*** the tone is removed. To verify that the DSS is in loopback, the TEST TONE TRANSMIT button in the lower right-hand portion of the front panel is depressed and held. A test tone of 1013 Hz is transmitted toward the DSS. If loopback has been achieved, the test tone is looped back and causes the RECEIVED TEST TONE LED to light. The LED will be lighted as long as the TEST TONE TRANSMIT button is held. To release loopback at the DSS, another 2713-Hz, loopback tone is sent by depressing the SEND LOOPBACK button momentarily. To verify that the DSS has released from the loopback mode, depress and hold the TEST TONE TRANSMIT BUTTON. The TEST TONE RECEIVED LED will not light if loopback has been released.

TABLE B
DETERMINATION OF PORTS PER CYCLE FROM CYCLE TIME READING

PORTS PER CYCLE	HOLD TIME OPTION IN MILLISECONDS												
	20	30	40	50	60	70	80	90	100	110	120	130	
8	.20	.30	.40	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	OUTPUT DISPLAY CYCLE TIME IN SECONDS
16	.36	.54	.72	.90	1.08	1.26	1.44	1.62	1.80	1.98	2.16	2.34	
24	.520	.780	1.04	1.30	1.56	1.82	2.08	2.34	2.60	2.86	3.12	3.38	
32	.680	1.20	1.36	1.70	2.04	2.38	2.72	3.06	3.40	3.74	4.08	4.42	
40	.840	1.26	1.68	2.10	2.52	2.94	3.36	3.78	4.20	4.62	5.04	5.46	
48	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	
56	1.16	1.74	2.32	2.90	3.48	4.06	4.64	5.22	5.80	6.38	6.96	7.54	
64	1.32	1.98	2.64	3.30	3.96	4.62	5.28	5.94	6.60	7.26	7.92	8.58	
72	1.48	2.22	2.96	3.70	4.44	5.18	5.92	6.66	7.40	8.14	8.88	9.62	
80	1.64	2.46	3.28	4.10	4.92	5.74	6.56	7.38	8.20	9.02	9.84	10.7	
88	1.80	2.70	3.60	4.50	5.40	6.30	7.20	8.10	9.00	9.90	10.8	11.7	
96	1.96	2.94	3.92	4.90	5.88	6.86	7.84	8.82	9.80	10.8	11.8	12.7	
104	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.6	11.7	12.7	13.8	
112	2.28	3.42	4.56	5.70	6.84	7.98	9.12	10.3	11.4	12.5	13.7	14.8	
120	2.44	3.66	4.88	6.10	7.32	8.54	9.76	11.0	12.2	13.4	14.6	15.9	
128	2.60	3.90	5.20	6.50	7.80	9.10	10.4	11.7	13.0	14.3	15.6	16.9	

TABLE B (Cont)

PORTS PER CYCLE	HOLD TIME OPTION IN MILLISECONDS										
	140	150	160	200	240	280	320	360	400	440	
8	1.40	1.50	1.60	2.00	2.40	2.80	3.20	3.60	4.00	4.40	
16	2.52	2.70	2.88	3.60	4.32	5.04	5.80	6.50	7.20	8.00	
24	3.64	3.90	4.16	5.20	6.24	7.30	8.32	9.40	10.4	11.4	OUTPUT DISPLAY
32	4.76	5.10	5.44	6.80	8.16	9.52	10.9	12.2	13.6	15.0	
40	5.88	6.30	6.72	8.40	10.1	11.8	13.4	15.1	16.8	18.5	
48	7.00	7.50	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0	
56	8.12	8.70	9.28	11.6	13.9	16.2	18.6	21.0	23.2	25.5	CYCLE TIME IN SECONDS
64	9.24	9.90	10.6	13.2	15.8	18.5	21.1	23.8	26.4	29.0	
72	10.4	11.1	11.8	14.8	17.8	20.7	23.7	26.6	29.6	32.6	
80	11.5	12.3	13.1	16.4	19.7	23.0	26.2	29.5	32.8	36.1	
88	12.6	13.5	14.4	18.0	21.6	25.2	29.0	32.4	36.0	39.6	
96	13.7	14.7	15.7	20.0	23.5	27.4	31.4	35.3	39.2	43.1	
104	14.8	15.9	17.0	21.2	25.4	29.7	34.0	38.2	42.4	46.6	
112	16.0	17.1	18.2	23.0	27.4	31.9	36.5	41.0	45.6	50.2	
120	17.1	18.3	20.0	24.4	29.3	34.2	39.0	43.9	48.8	53.7	
128	18.2	19.5	21.0	26.0	31.2	36.4	42.0	46.8	52.0	57.2	

TABLE B (Cont)

PORTS PER CYCLE	HOLD TIME OPTION IN MILLISECONDS																		
	480	520	560	600	640	800	960	1120	1280	1440	1600	1760	1920	2080	2240	2400	2560	3200	
8	4.80	5.20	5.60	6.00	6.40	8.00	9.60	11.2	12.8	14.4	16.0	17.6	19.2	20.8	22.4	24.0	25.6	32.0	
16	8.64	9.40	10.1	11.0	11.5	14.4	17.3	20.2	23.0	25.9	28.8	31.7	34.6	37.4	40.3	43.2	46.1	57.6	
24	12.5	13.5	14.6	15.6	16.6	20.8	25.0	29.1	33.3	37.4	41.6	45.8	50.0	54.1	58.2	62.4	66.6	83.2	OUTPUT DISPLAY
32	16.3	17.7	19.0	20.4	21.8	27.2	32.7	38.1	43.5	49.0	54.4	59.8	65.3	70.7	76.2	81.6	87.0	109	
40	20.2	21.8	23.5	25.2	26.9	33.6	40.3	47.0	53.8	60.5	67.2	73.9	80.6	87.4	94.1	101	108	134	
48	24.0	26.0	28.0	30.0	32.0	40.0	48.8	56.0	64.0	72.0	80.0	88.0	96.0	104	112	120	128	160	
56	27.8	30.2	32.5	34.8	37.1	46.4	55.7	65.0	74.2	83.5	92.8	102	111	120	130	139	148	186	CYCLE TIME IN SECONDS
64	31.7	34.3	37.0	39.6	42.2	52.8	63.4	73.9	84.5	95.0	105	116	126	137	147	158	169	211	
72	35.5	38.5	41.4	44.4	47.4	59.2	71.0	82.9	94.7	106	118	130	142	153	165	177	189	236	
80	39.4	42.7	45.9	49.2	52.5	65.6	78.7	91.8	105	118	131	144	157	170	183	197	210	262	
88	43.2	46.8	50.4	54.0	57.6	72.0	86.4	100	115	130	144	158	172	187	202	216	230	288	
96	47.0	51.0	54.9	58.8	62.7	78.4	94.0	109	125	141	156	172	188	203	219	235	251	314	
104	50.9	55.1	59.4	63.6	67.8	84.8	102	118	135	152	169	186	203	220	237	254	271	339	
112	54.7	59.3	63.8	68.4	73.0	91.2	109	127	145	164	182	200	219	237	255	274	292	365	
120	58.6	63.4	68.3	73.2	78.1	97.6	117	136	156	175	195	214	234	253	273	292	312	390	
128	62.4	67.6	72.8	78.0	83.2	104	125	146	166	187	208	229	250	270	291	312	333	416	

TABLE B (Cont)

PORTS PER CYCLE	HOLD TIME OPTION IN MILLISECONDS											
	3480	4480	5120	5760	6400	7040	7680	8320	8960	9600	10240	
8	34.8	44.8	51.2	57.6	64.0	70.4	76.8	83.2	89.6	96.0	102	
16	62.6	80.6	92.1	103	115	126	138	149	161	172	184	
24	90.5	116	133	149	166	183	199	216	233	249	266	OUTPUT DISPLAY
32	118	152	174	195	217	239	261	283	304	326	348	
40	146	188	215	242	268	295	322	349	376	403	430	
48	174	224	256	288	320	352	384	416	448	480	512	
56	202	259	297	334	371	408	445	482	519	556	593	CYCLE TIME IN SECONDS
64	229	295	338	380	422	464	507	549	591	633	675	
72	257	331	378	426	473	521	568	615	663	710	757	
80	285	367	419	472	524	577	629	682	734	787	839	
88	313	403	461	518	576	633	691	748	806	864	921	
96	341	439	501	564	627	690	752	815	878	941	1003	
104	368	474	542	610	678	746	814	882	949	1017	1085	**OVERFLOW** lamp is on for these times
112	396	510	583	656	729	802	875	948	1021	1094	1167	
120	424	546	624	702	780	858	937	1015	1093	1171	1249	
128	452	582	665	749	332	915	998	1081	1165	1248	1331	

TABLE C
SPECIAL STATUS WORDS FOR ADDRESSABLE OFFERING

WORD 1			WORD 2			
DECIMAL READOUT	HOLD TIME (MS)	SHELF	DECIMAL READOUT	PORTS PER CYCLE	STATUS	SHELF
000*	10	A	000	8	OPNS	A
001	20	A	001	16	OPNS	A
002	30	A	002	24	OPNS	A
003	40	A	003	32	OPNS	A
004	50	A	004	40	OPNS	A
005	60	A	005	48	OPNS	A
006	70	A	006	56	OPNS	A
007	80	A	007	64	OPNS	A
008	90	A	008	72	OPNS	A
009	100	A	009	80	OPNS	A
010	110	A	010	88	OPNS	A
011	120	A	011	96	OPNS	A
012	130	A	012	104	OPNS	A
013	140	A	013	112	OPNS	A
014	150	A	014	120	OPNS	A
015	160	A	015	125	OPNS	A
016*	40	A	016	8	SD	A
017*	80	A	017	16	SD	A
018*	120	A	018	24	SD	A
019*	160	A	019	32	SD	A
020	200	A	020	40	SD	A
021	240	A	021	48	SD	A
022	280	A	022	56	SD	A
023	320	A	023	64	SD	A
024	360	A	024	72	SD	A
025	400	A	025	80	SD	A
026	440	A	026	88	SD	A
027	480	A	027	96	SD	A
028	520	A	028	104	SD	A
029	560	A	029	112	SD	A
030	600	A	030	120	SD	A
031	640	A	031	125	SD	A

* - Invalid Condition
SD - Shut Down
OPNS - Operational, Not Sharing Load
OPSL - Operational, Sharing Load

TABLE C (Cont)

WORD 1			WORD 2			
DECIMAL READOUT	HOLD TIME (MS)	SHELF	DECIMAL READOUT	PORTS PER CYCLE	STATUS	SHELF
032*	160	A	032	8	OPSL	A
033*	320	A	033	16	OPSL	A
034*	480	A	034	24	OPSL	A
035*	640	A	035	32	OPSL	A
036	800	A	036	40	OPSL	A
037	960	A	037	48	OPSL	A
038	1120	A	038	56	OPSL	A
039	1280	A	039	64	OPSL	A
040	1440	A	040	72	OPSL	A
041	1600	A	041	80	OPSL	A
042	1760	A	042	88	OPSL	A
043	1920	A	043	96	OPSL	A
044	2080	A	044	104	OPSL	A
045	2240	A	045	112	OPSL	A
046	2400	A	046	120	OPSL	A
047	2560	A	047	125	OPSL	A
048*	640	A	048*	8	SD	A
049*	1280	A	049*	16	SD	A
050*	1920	A	050*	24	SD	A
051*	2560	A	051*	32	SD	A
052	3200	A	052*	40	SD	A
053	3840	A	053*	48	SD	A
054	4480	A	054*	56	SD	A
055	5120	A	055*	64	SD	A
056	5760	A	056*	72	SD	A
057	6400	A	057*	80	SD	A
058	7040	A	058*	88	SD	A
059	7680	A	059*	96	SD	A
060	8320	A	060*	104	SD	A
061	8960	A	061*	112	SD	A
062	9600	A	062*	120	SD	A
063	10240	A	063*	125	SD	A

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OPSL - Operational, Sharing Load

TABLE C (Cont)

WORD 1			WORD 2			
DECIMAL READOUT	HOLD TIME (MS)	SHELF	DECIMAL READOUT	PORTS PER CYCLE	STATUS	SHELF
064*	10	B	064	8	OPNS	B
065	20	B	065	16	OPNS	B
066	30	B	066	24	OPNS	B
067	40	B	067	32	OPNS	B
068	50	B	068	40	OPNS	B
069	60	B	069	48	OPNS	B
070	70	B	070	56	OPNS	B
071	80	B	071	64	OPNS	B
072	90	B	072	72	OPNS	B
073	100	B	073	80	OPNS	B
074	110	B	074	88	OPNS	B
075	120	B	075	96	OPNS	B
076	130	B	076	104	OPNS	B
077	140	B	077	112	OPNS	B
078	150	B	078	120	OPNS	B
079	160	B	079	125	OPNS	B
080*	40	B	080	8	SD	B
081*	80	B	081	16	SD	B
082*	120	B	082	24	SD	B
083*	160	B	083	32	SD	B
084	200	B	084	40	SD	B
085	240	B	085	48	SD	B
086	280	B	086	56	SD	B
087	320	B	087	64	SD	B
088	360	B	088	72	SD	B
089	400	B	089	80	SD	B
090	440	B	090	88	SD	B
091	480	B	091	96	SD	B
092	520	B	092	104	SD	B
093	560	B	093	112	SD	B
094	600	B	094	120	SD	B
095	640	B	095	125	SD	B

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TABLE C (Cont)

WORD 1			WORD 2			
DECIMAL READOUT	HOLD TIME (MS)	SHELF	DECIMAL READOUT	PORTS PER CYCLE	STATUS	SHELF
096*	160	B	096	8	OPSL	B
097*	320	B	097	16	OPSL	B
098*	480	B	098	24	OPSL	B
099*	640	B	099	32	OPSL	B
100	800	B	100	40	OPSL	B
101	960	B	101	48	OPSL	B
102	1120	B	102	56	OPSL	B
103	1280	B	103	64	OPSL	B
104	1440	B	104	72	OPSL	B
105	1600	B	105	80	OPSL	B
106	1760	B	106	88	OPSL	B
107	1920	B	107	96	OPSL	B
108	2080	B	108	104	OPSL	B
109	2240	B	109	112	OPSL	B
110	2400	B	110	120	OPSL	B
111	2560	B	111	125	OPSL	B
112*	640	B	112*	8	SD	B
113*	1280	B	113*	16	SD	B
114*	1920	B	114*	24	SD	B
115*	2560	B	115*	32	SD	B
116	3200	B	116*	40	SD	B
117	3840	B	117*	48	SD	B
118	4480	B	118*	56	SD	B
119	5120	B	119*	64	SD	B
120	5760	B	120*	72	SD	B
121	6400	B	121*	80	SD	B
122	7040	B	122*	88	SD	B
123	7680	B	123*	96	SD	B
124	8320	B	124*	104	SD	B
125	8960	B	125*	112	SD	B
126	9600	B	126*	120	SD	B
127	10240	B	127*	125	SD	B

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OPSL - Operational, Sharing Load

7. REFERENCES

7.01 The following documents provide additional information on the 178A test set.

NUMBER	TITLE
CD & SD 73129-01	178A Test Set—Description

SECTION	TITLE
314-410-550	DATAPHONE® Select-A-Station—Overall System Description
590-105-100	Data Station Selector J70180AA—Description and Operation
590-105-101	Data Station Selector J70180AA—TOP
666-617-100	DATAPHONE® Select-A-Station Service—TestCenters—Administrative Procedures
666-617-101	Test Center Procedures—TOP

8. GLOSSARY

8.01 A list of unique terms and their definitions used in this section are as follows:

Addressable—A service offering in which the customer has in-service control of both the duration and order of connections to a number of remote stations.

Automatic Step—A DSS option of the sequential offering in which the duration and order of connections are fixed.

Automatic Step with Reset—A DSS option of the sequential offering in which the duration and order of connections are fixed, but the DSS will reset to the beginning of the connection cycle upon command from the master station.

Channel Service Unit (CSU)—A standard termination device located at the remote station.

Control Step—A DSS option of the sequential offering which allows the customer to have in-service control over the duration of the connection. However, the connection sequence is fixed.

Data Auxiliary Set 829-Type—Circuit packs used to provide 4-wire terminations for 4-wire facilities.

Data Auxiliary Set 833A—A circuit pack that provides control signaling functions in the SCU at the master station.

Data Station Selector (DSS)—A switching device located in central offices and having the capability of making connections between a 4-wire input and up to 128 outputs, 2-wire or 4-wire, one at a time, under the control of a master station.

Frame Signal—A signal from the DSS in the central office to the SCU at the master station to indicate the beginning of a connection cycle.

Hold Time—The time during which a circuit remains connected.

Master Station—The one station of a multistation circuit that communicates with each remote station and has control of the connections.

Primary Link—The 4-wire transmission facility between the master station and SCU and a primary DSS.

Remote Office Link—A polled link from a DSS to a remote station using interoffice facilities.

Remote Station—One of many stations on a multistation circuit that is connected to the master station by DSSs.

Secondary Link—The 4-wire transmission facility between a primary DSS and a secondary DSS.

Selector Control Unit (SCU)—The equipment associated with one circuit located at the master station and used by the customer to transmit control signals to DSSs and receive supervisory signals from DSSs.

Sequential—A service offering to a customer in which the order of connections from the master station to the remote stations is fixed by that initial assignment to the DSS output ports.

Special Service Center (SSC)—A test center with responsibility for coordination and control of customer service within a specific serving territory.