

**5ESS SWITCHING EQUIPMENT
COMBINED SERVICES UNIT
CIRCUIT**

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1. GENERAL DESCRIPTION

1.1 PURPOSE OF CIRCUIT

The Combined Services Unit (CSU) is a 132 J-type unit shelf that has the functionality of four unit shelves. The four units brought into this shelf are: Modular Metallic Service Unit (MMSU), Digital Service Unit Model 2 (DSU2), Global Digital Service Function (GDSF), and Digital Trunk Line Unit Model 3 (DLTU3).

1.2 GENERAL DESCRIPTION OF OPERATION

The CSU circuit unit modules operate independently of each other. The MMSU module is of one service group and supports Subscriber Line Instrument Measuring tool, Model 2 (SLIM2), Metallic Test Bus (MTB), Scan points (SCAN), Distribute points (Distrib), Gated Diode Crosspoint Compensation (GDX) and Metallic Test Interconnection Buses (MTIB). The DSU2 module is two circuit packs. Depending on the equipment, the DSU2 can support 250 seconds of (RAF) or 20,000 seconds of (SAS). The GDSF module is a single circuit pack and supports, Conferencing, Integrated Service Test Facility (ISTF), Transmission Test Facility (TTF) and Transmission Test Facility 2 (TTF2). The DLTU3 module support trunking applications and can have up to five DFT's installed.

2. DETAILED DESCRIPTION

2.1 MMSU Module

The MMSU module operates in simplex mode. The service group is made up of the following circuit packs: 494LA Power Converter, TN879B Common Pack, TN138 Metallic Access Pack, TN880 GDX Compensator Pack, TN1422 Subscriber Line Instrument Measuring Pack, TN220B Scan Pack, TN221 Signal Distribute Pack, and TN138 Metallic Test Interface Bus Access Pack.

2.1.1 494LA Power Converter

The bulk converter takes -48 volt source and converts it to +5 volt for logic packs within the MMSU module.

2.1.2 TN879B CommonPack

The Common Pack provides the MMSU with an interface to the Peripheral Interface Control Buses (PICB's) from the MCU. All information transferred between the MMSU and the MCU is processed by the TN879B. Orders received from the MCU are interpreted by the TN879B and directed to the MMSU circuit that performs the requested function. The TN879B also formats all replies prior to their transmission to the MCU. These replies return the status of any received order and also data when requested by a Scan order. The TN879B also provides an interface for sending data and address information from the control logic on the common pack to the registers on the various circuit packs within the MMSU. This interface is accomplished by fan out circuit located on the TN879B.

2.1.3 TN138 Metallic Acces Pack

The metallic access pack consists of a 16x4 relay matrix and its associated control logic. The relay matrix is used by the MMSU to interconnect various 5ESS switch circuits under test with their associated test equipment. Each circuit under test and each piece of equipment has a pair of wires which connect via a distribution frame or directly to one or the 16 paired inputs of the TN138. These wired pairs are referred to as Metallic Test Buses (MTB's). There can be as many as 16 junctors. These junctors are used for metallic connections between circuit packs in the MMSU, and for metallic connections to external equipment via the TN138 circuit packs. Each junctor is a pair of wires containing a tip and ring. The junctors run parallel on a backplane and are connected to the Metallic Test Interconnection Bus (MTIB) access slot and (8) general pack locations. The TN138 is controlled by orders sent to the MMSU by the MCU. The MMSU

common pack (TN879B) receives and interprets these orders and then relays them to the TN138 where they will be used to operate relays, read the status of the relay driver outputs, and perform the requested diagnostic evaluation of the TN138 logic. The Metallic Access Pack may be located in the MTIB Access slot and in the first (3) slots of the MMSU module. The MTIB pack is used in conjunction with backplane cables to interconnect other MMSUs. This interconnection is made via MTIBs and is required to provide test equipment connected to one MMSU or access to subscriber lines connected to another MMSU.

2.1.4 TN1422 SLIM2

The SLIM2 Pack provides the MMSU module with line and instrument testing capability. The tests that SLIM2 can perform are as follows: Test for foreign AC voltages, test for foreign DC voltages, test insulation resistance, test loop resistance, test line capacitance, test dial pulse, test DTMF, test register recall, tone and cadence generation, test ringing and home meter. Of the tests provided, the circuit pack can be placed in one of the three modes for testing, routine, operator or linesmen mode. Only one TN1422 circuit pack is required per CSU.

2.1.5 TN880 GDx Compensator Pack

The Compensator Pack provides the MMSU with the capability of compensating for leakage in the concentrator of the line unit. Compensation involves the canceling of leakage current and bias resistance of the concentrator to allow for accurate line testing. Only one TN880 pack is required per test connection. The TN880 is controlled by a firmware program that executes in a BELLMAC 4 microprocessor which provides control and sequencing for the compensation circuitry along with extensive self-diagnostics. The compensator pack may be located in any of the 8 general circuit pack locations within the MMSU module.

2.1.6 TN220B Scan Pack

The Scan Pack provides the MMSU module with the miscellaneous scanning capabilities required by the 5ESS system. Each Scan Pack provides 32 Scan points, and may be located in any of the (8) general circuit pack locations within the MMSU module. Each Scan Pack provides a summary scan of its 32 constituent scan points, where a change in the state of any scan point will cause a service request to be sent to the MMSU common pack, TN879B. The service request is then reported by the common pack to MCU via the PICB. In addition, the states of the scan points may be read directly, 16 bits at a time.

2.1.7 TN221 Distribute Pack

The Signal Distribute Pack provides the MMSU module with the miscellaneous SD capabilities required by the 5ESS system. Each SD pack provides 32 SD points and may be located in any of the (8) general circuit pack locations. The SD points consist of relay closures with 51 ohms series resistance, and options of providing -48 volts and some external series resistance. When the SD relays are closed, the SD points are defined to be in the "on" state (logical 1), when the relays are opened, the SD points are "off" (logical "0"). The TN221 is normally a passive circuit pack, receiving all instructions from the MCU via the common pack TN879B. In normal operation software must set the state of each SD point, which is then latched on the pack until changed by software. All SD points are bit addressable and can be initialized (reset) two different ways. The first way is with a command from the MCU to the SD pack via the common pack. The second way is with the power-up sequence.

2.2 DSU2 MODULE (RECORDED ANNOUNCEMENT FEATURE)

The DSU2 module, when equipped for Recorded Announcement Feature (RAF), is made up of the following circuit packs: TN833C Digital Service Circuit (DSC) and TN1634 Announcement Storage Circuit (ASC).

2.2.1 TN833C Digital Service Circuit

The RAF provides up to 32 independent, simultaneous, variable content announcement channels. Up to 20 of the 32 channels may be configured as "interruptible" announcements by TOUCH-TONE or Multi-Frequency (MF) digits. Announcement services are activated upon requests from the MCU. The application software then sends an announcement request packet that contains: * An announcement request opcode. *The PIDB time slot over which the playback should occur. *The number of phrase ID's associated with the request. *Up to 68 words identifying the phrases that RAF should play. After validating the request, the DSC reads the ASC to obtain the speech samples associated with each phrase in the request packet. As these speech samples are read, they are placed on the PIDB time slot associated with the request. An announcement complete report is sent to the MCU when all phrases specified in the request have been sent out.

2.2.2 TN1634 Announcement Storage Circuit

The ASC can contain a maximum of 2 megabytes of EPROM memory for storage of a digitized announcement speech samples. The ASC contains memory that holds information over address and data for each 16 bits of data stored in announcement memory. The TN1634 is shipped from the manufacturing location with test microcode installed. The test microcode is erased by the customer and reprogrammed with language specific announcements supplied by the customer using the recorded announcement workstation.

2.3 DSU2 MODULE (SERVICE ANNOUNCEMENT SYSTEM)

The DSU2 module, when equipped for Service Announcement System (SAS), is made up of the following circuit packs: TN1841 Service Announcement System Digital Service Circuit (SASDSC) and TN1842 Service Announcement System Memory (SASMEM) with applicable announcement flash cards.

2.3.1 TN1841 Service Announcement System Digital Service Circuit

The SASDSC provides the interface between the MSU and the SASMEM circuit pack. The SASDSC accesses the digitized announcement stored in the SASMEM through a request from the MSU. The announcement is returned to the MSU through the PIDB interface of the SASDSC.

2.3.2 TN1842 Service Announcement System Memory

The SASMEM provides for storage of the digitized announcement. The TN1842 can hold up to eight Flash Cards. The Flash Card memory ranges are, 4Mbyte,(400 seconds worth of storage); 10Mbyte,(1200 seconds worth of storage); 20 Mbyte,(2500 worth of storage). The Flash Card memory ranges can be mixed to meet the required number of announcements needed and are ordered separately from the TN1842 circuit pack.

2.4 GDSF MODULE (GLOBAL DIGITAL SERVICE FUNCTION)

The GDSF module combines four functions into one circuit pack: Conferencing, Integrated Service Test Facility (ISTF), Transmission Test Facility (TTF), and Transmission Test Facility 2 (TTF2).

2.4.1 UN363 Digital Service Circuit

The GDSF circuit pack is configured by a software download. Conference circuits can be set up to provide 3-port or 6-port conferencing.

ISTF acts as a digital testing device that measures bit error rates and error blocks on channels of a PIDB connected to the Time Slot Interchange Unit. ISTF can provide two modes of test: Loopback service and transmission service. Loopback service is provided when the bits received on a PIDB, the ISTF function are sent back out on the same PIDB. Loopback service can be provided in inverted and noninverted mode.

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Transmission service provides the test for a digital bitstream. This involves sending a pattern on one channel and receiving the pattern on another channel. The pattern is analyzed for bit errors to determine how good the channel is.

TTF provides basic tone generation and measurements for trunks. Tones can be sent as single frequencies or multiple tones simultaneously to check for tone loss echo, and noise on the trunk.

TTF2 function allows trunk test calls to be generated. These tests performed are: call disposition, tone generation, and tone measurement. Call disposition analysis is used to recognize call progress, tone detection and voice detection. Tone generation, generates continuous and cadenced tones through outgoing channels. These tones can be custom defined if needed. Tone measurement, measures continuous or cadenced tones to determine the integrity of the trunk.

2.5 DLTU3 MODULE (DIGITAL LINE TRUNK UNIT MODEL 3)

The DLTU3 module supports Host and Remote Trunking Applications. The service group is made up of the following circuit packs: SN346B (Manual Power Start) or SN730 (Auto Power Start), TN1611 or TN1414 (Digital Facility Interface Pack 2 for Host Trunking, Domestic and International), TN1612 or TN1415 (Digital Facility Interface Pack 2 for Remote Trunking Applications, Domestic and International), and TN1421 (Digital Facility Interface Pack 2 for 30 channel Japan CMI).

2.5.1 SN346B Manual Power Start Pack

The manual power start pack provides a start signal to all power converters on all DFI-2 circuit packs populated in the DLTU3 module. A push to start button on the pack needs to be depressed to provide -48 volts to the packs.

2.5.2 SN730 Auto Power Start Pack

The auto power start pack provides a start signal to all power converters on all the DFI-2 circuit packs populated in the DLTU3 module. This pack provides a start signal automatically when the -48 volts reaches a predetermined level.

2.5.3 TN1611 or TN1414 Digital Facility Interface Pack 2, Host Applications

The TN1611 and TN1414 provide host trunking for 24 and 30 channel applications respectively. In most cases, 24 channel trunks apply to domestic offices and 30 channel trunks apply to international offices. The primary function of the DFI-2 packs are to convert T1 format to TSI (Time Slot Interchange) formats for the MCU. The DFI-2 circuit pack receive and locates T1 frames from the DSX, extracts the per-channel signaling information, maps the PCM traffic and signaling information into 24 or 30 of the 32 system time slots frames for the MCU. To transmit, the DFI-2 performs the reverse process. In addition to the basic timing conversion, signaling extraction and format conversion functions, the DFI-2 also monitors the T1 facilities terminating on it and reports their status to the switching module processor. The DFI-2 checks for errors in transmission, such as incorrect CRC bits and violations of bipolar line format. It also checks for slips caused by clock asynchrony between the facility and the 5ESS switch, as well as loss of frame caused by errors in framing bit pattern. The DFI-2 also performs a certain amount of self diagnostics: It checks for faults in the hardware and reports these to the MCU.

2.5.4 TN1612 or TN1415 Digital Facility Interface Pack 2R, Remote Applications

The TN1612 and TN1415 provides an interface for remote SM to Host SM trunking for 24 and 30 channel applications respectively. In most cases, 24 channel trunks apply to domestic offices and 30 channel trunks apply to international offices.

The primary function of the DFI-2R packs are to convert T1 format to TSI (Time Slot Interchange) formats

for the MCU. The DFI-2R circuit pack receive and locates T1 frames from the DSX, extracts the per-channel signaling information, maps the PCM traffic and signaling information into 24 or 30 of the 32 system time slots frames for the MCU. To transmit, the DFI-2R performs the reverse process. In addition to the basic timing conversion, signaling extraction and format conversion functions, the DFI-2R also monitors the T1 facilities terminating on it and reports their status to the switching module processor. The DFI-2R checks for errors in transmission, such as incorrect CRC bits and violations of bipolar line format. It also checks for slips caused by clock asynchrony between the facility and the 5ESS switch, as well as loss of frame caused by errors in framing bit pattern. The DFI-2R also performs a certain amount of self diagnostics: It checks for faults in the hardware and reports these to the MCU. In the RSM application, the DFI-2R also transmit control information between the RSM and Host SM via the 4Kbit/second data link using X.25 protocol and reports the status of the T1-RSM link to the facility interface unit when used in the RSM.

2.5.5 TN1421 Digital Facility Interface Pack C30

The DFI-2 C30's can terminate either host or remote trunks and are for CMI offices specifically. The operation is equivalent as described in the above paragraphs.

3. REFERENCE DATA

3.1 WORKING LIMITS

3.2 FUNCTIONAL DESIGNATIONS

na

3.3 FUNCTIONS

na

3.4 CONNECTING CIRCUITS

The Combined Services Unit interfaces with the following external circuits:

Modular Fuse Filter Unit through power cables.

Modular Time Slot Interchange Unit through PICB's and PIDB's.

Modular Metallic Service Unit, Line Units, ISLU2 through MTIB bus,

and

Digital Cross Connect through T1 lines.

3.5 MANUFACTURING TESTING REQUIREMENTS

3.6 ALARM INFORMATION

na

3.7 TAKING EQUIPMENT OUT OF SERVICE

Reference the following document, AT&T 235-105-xxxx Practices for Procedures.

4. REASONS FOR REISSUE

Addition of Service Announcement System Description.

5. ACRONYMS, ABBREVIATIONS OR INITIALISMS

AC	Alternating Current
ASC	Announcement Storage Circuit
CMI	Coded Mark Inversion
CRC	Cyclic Redundancy Check
CSU	Combined Services Unit
DC	Direct Current
DFI-2	Digital Facility Interface, Model 2
DLTU3	Digital Line Trunk Unit, Model 3
Distrib	Distribute Points
DSC	Digital Service Circuit
DSU2	Digital Service Unit, Model 2
DSX	Digital Cross Connect
DTMF	Dual Tone Multifrequency
EPROM	Erasable Programmable Read Only Memory
GDSF	Global Digital Service Function
GDX	Gated Diode Crosspoint Compensation
MCU	Modular Controller Unit
MF	Multi-Frequency
MTB	Metallic Test Bus
MMSU	Module Metallic Service Unit
MTIB	Metallic Test Interconnection Bus
ISTF	Integrated Service Test Facility
PICB	Peripheral Interface Control Bus
PIDB	Peripheral Interface Data Bus
PCM	Pulse Coded Modulation
RAF	Recorded Announcement Feature
RSM	Remote Switch Module
SAS	Service Announcement System
SASDSC	Service Announcement System Digital Service Circuit
SASMEM	Service Announcement System Memory
SCAN	SCAN Points
SD	Signal Distribute
SLIM2	Subscriber Line Instrument Measuring tool, Model 2
SM	Switch Module
TSI	Time Slot Interchange
TTF	Transmission Test Facility
TTF2	Transmission Test Facility 2

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