

**5ESS® SWITCHING EQUIPMENT**

**DIGITAL NETWORK UNIT-SONET  
(DNU-S)  
CIRCUIT**

**CONTENTS**

1. GENERAL DESCRIPTION . . . . .	1
1.1 PURPOSE OF CIRCUIT . . . . .	1
1.2 GENERAL DESCRIPTION OF OPERATION . . . . .	1
2. DETAILED DESCRIPTION . . . . .	1
2.1 PACK DESCRIPTIONS . . . . .	1

## 1. GENERAL DESCRIPTION

### 1.1 PURPOSE OF CIRCUIT

The purpose of the DNU-S is to terminate SONET Lines, converting the SONET data and signaling format to the SM-2000 Peripheral Control and Timing (PCT) link format. This provides a high speed (51.84 Mbs in the initial release) link directly to the 5ESS from transmission equipment.

### 1.2 GENERAL DESCRIPTION OF OPERATION

The DNU-S is a single-shelf, double high unit mounted in an SM-2000 LTP cabinet. The unit uses four different pack types: the KLU2 Common Control (CC) pack, the KLU3 Common Data (CD) pack, the KTU1 Transmission Multiplexer (TMUX) pack, and the KTU2 STS-1 Facility Interface (SFI) pack. Two different types of paddle boards attach to the back of the unit to terminate SONET and PCT cables: the Common Optical Termination (COT) and the STSX-1 Link Interface (SLI). The maximum unit equipment is 2 CCs, 4 CDs, 14 TMUXs, 4 SFIs, 12 SLIs, 24 COTs, 12 STS-1 links mapped to 12 duplex PCT links. Functionally, the DNU-S is split into two data groups, which are electrically isolated from each other except for the control connections to the CCs -- either CC can control either data group.

The SONET lines initially supported are the STSX-1 electrical interfaces conforming to the STS-1 format detailed in SONET standard [BEL91A]. The STS-1 data rate is 51.84 Mb/s, supporting 672 DSO channels formatted as 28 DS1 Virtual Tributaries (VT.5s). The signaling information can contain sub-sampled out-slot, robbed-bit, or none. SONET path, line, and section overhead is also contained in the STS-1 format.

The PCT links are optical 65.536 Mb/s Time Division Multiplexed (TDM) interfaces over these links. Each PCT link carries 1024 byte long frames repeated at an 8 KHz rate. In each frame are 768 data bytes that may be switched through the SM-2000 TSI, 192 bytes containing sub-sampled signaling information and 64 bytes containing framing and PCT link maintenance data.

## 2. DETAILED DESCRIPTION

### 2.1 PACK DESCRIPTIONS

Each DNU-S has two CC packs, operating in an active/standby arrangement. Primary functions, as performed by the active CC, include:

- termination of messaging and control channels from the SM
- unit initialization, maintenance and diagnostics
- control of all DNU-S circuits
- non-volatile storage of CC and TMUX control programs

Each DNU-S has a minimum of two with maximum of four CD packs. Two packs are in data group 0 and two in data group 1. The packs in each data group operate in an active/standby arrangement. The two CDs per data group are designated as mates. CDs per data group can terminate up to six PCT links. Primary CD functions include:

- terminate PCT links through COT paddle boards
- extract PCT link data and control and pass to appropriate packs
- synchronize DNU with system timing using PCT link as source
- map TMUX SONET data into PCT format and vice versa

- support TMUX sparing

Each DNU-S has a minimum of two with a maximum of four SFI packs. The packs are split two per data group in an active/standby arrangement. Primary SFI functions include:

- termination of the SONET STSX-1 signal through the SLIs
- bipolar 3-zero substitution (B3ZS) encoding and decoding
- interfacing each STSX-1 link to one of six TMUXs or the spare TMUX

Each DNU-S can be equipped with up to fourteen TMUX packs. There are a maximum of seven TMUXs per data group. One of the TMUXs in each data group is designated the spare; the other six are the service TMUXs. Normally, the spare TMUX has no active data -- the service TMUXs normally carry all active data. However, in case of a problem, the spare TMUX can be substituted for any of the service TMUXs. Primary functions of the TMUX include:

- perform the conversion from SONET format to PCT (PIDB) format
- terminate SONET line, path and section overhead and facility overhead
- Virtual Tributary extraction
- DS1 framing and extraction
- detection of DS1 facility alarms
- DS1 Cyclic Redundancy Code (CRC) checking

#### 2.1.1 INTERFACES

There are a maximum of twelve SONET interfaces per DNU-S. These are the only outside plant interfaces. The SONET cables terminate on the SLI paddle boards where each signal is split out into two signals and run to both SFI packs in a data group. Two 75 ohm coax cables are used per SONET link -- one transmit, one receive.

There are a maximum of twelve duplex SM-2000 PCT interfaces per DNU-S. The PCT optical cables terminate on the COT paddleboards. There are a maximum of 48 optical cables per DNU-S and a maximum of 24 COT paddle boards. Each paddle board has a transmit and receive optical cable. Two COTs are paired, both passing identical data in a duplex arrangement; so if one link goes down, the hardware switches to the other duplicated link. Each side of a duplex PCT link terminates on Peripheral Link Interface (PLI) board at the SM-2000. The PLI paddle boards are cross-coupled between the two sides of the SM-2000 Time Slot Interchange (TSI) unit. The DNU-S PCT links will operate active/standby for data.

Each DNU-S pack receives a separate -48 volt and -48 volt return connection to the cabinet modular fuse/filter unit. Each pack is separately fused. This makes a total of 28 pairs of -48s and returns to the fuse/filter unit. The COTs receive their power from the CD packs. The SLIs are passive paddle boards, requiring no power. In addition to the pack cables, there are eight cable pairs for a future implementation of OC-3 Link Interfaces (OLIs) and an X.25 control interface. In this version of the DNU-S the OLIs are not equipped and X.25 control interface are not equipped.

The DNU-S has the ability to monitor its own cabinet alarms from the modular fuse/filter unit and the fan unit. Two cables are needed to monitor cabinet alarms. One from the DNU-S to modular fuse/filter unit, and one from the fan unit to the DNU-S.

#### Working Limits

- Battery range: -39.5 to -57.0 volts.

- The DNU-S will operate with environmental limits as specified in BellCore NEBS Technical Reference TR-NWT-000063.

DNU-S electrical and architectural limits or requirements may be found listed in the DNU-S Architecture Design Specification and Requirements document.

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