

# Tellabs® Titan® 5500 Digital Cross-Connect System — Consolidated Core Switch

Expanded capacity with a smaller footprint saves space and conserves power compared with standard configurations.

## Overview

The Tellabs® Titan® 5500 Digital Cross-Connect System (DCS) Consolidated Core Switch (CCS) expands the maximum capacity to 4608 STS-1 equivalents (STS-1e) from the previous maximum of 3072, with the capability to expand up to 6144. It can be deployed as a standalone system or be used as an expansion switch matrix for existing Tellabs Titan 5500 DCS Standard Core Switch (SCS) systems.

The Tellabs Titan 5500 DCS 4608 CCS switch matrix resides in a single shelf, with 2 shelves required for redundancy. A fully redundant switch matrix, along with Administrative Complex (AC) shelves, fits into just 2 bays — compared to the 9 bays required for a SCS 3072 configuration. In addition, Tellabs continues the commitment to support existing equipment in customers' networks by providing the capability to expand any existing Tellabs 5500 SCS (256, 1024, 1536 and 3072 core sizes) to over 4K core size with as little as one additional bay of equipment. This capability offers significant savings in both floor space and power consumption compared to current standard density core configurations.

## Features and Benefits

- 4608 STS-1 (240G) total capacity in 2 shelves
  - 100% Non-blocking matrix
  - Full STS-1 and VT1.5 grooming capability
    - Native support of DS1 interfaces — no adjuncts
    - Supports STS-1e, DS1, DS3, OC-3, OC-12 and OC-48 interfaces
  - Full transmux capability
  - Centralized management
  - Consolidates 12 bays of equipment into 2 shelves
- Designed for high reliability
  - 1+1 redundant switch shelves
  - Physical separation of switch complexes
- Full suite of Tellabs Titan 5500 DCS features
  - ASIST, bridge & roll, performance monitoring, test access, trace route, etc.
- Designed for easy expansion of port capacity
- Tellabs Titan 5500 DCS reliability stats exceed 99.99975%



Tellabs Titan 5500 Digital Cross-Connect System Consolidated Core Switch (CCS) Rack



Tellabs Titan 5500 Digital Cross-Connect System Consolidated Core Switch (CCS) Shelf

## General Specifications

### Dimensions

- Height: 22.75 in (57.8 cm)
- Width: 21.5 in (54.6 cm)
- Depth: 15.0 in (38.1 cm)
- Mounts in 23-in rack

### Power – fully equipped (per shelf)\*

- < 860 Watts at -48V DC
- < 17.8A at -48V DC
- < 20.4A at -42V DC
- Breaker size: 50 amp

### Normal operating temperature range

- 41°F to 104°F (5°C to 40°C)
- Meets normal operating temperature range requirements specified in Telcordia GR-63-CORE (NEBS)

### Short-term operating temperature range

- 23°F to 122°F (-5°C to 50°C) for no more than 96 consecutive hours, and a total of no more than 15 days per year

### Operating relative humidity range

- 5%–85% (non-condensing)

### Operating short-term relative humidity

- 5% to 90%, but not to exceed 0.024 pounds of water per pound of dry air for no more than 96 consecutive hours, and a total of no more than 15 days per year

### Operating altitude range

- From 196 feet (60 m) below mean sea level up to 13,000 feet (4,000 m) above mean sea level — manufacturer will provide special requirements for installations above 1800 m

\* For current 4608 STS-1 configuration. Shelf is designed for up to 6144 STS-1 to allow for future expansion.

## Standards Compliance

### Technical References (TR)

- TR-TSY-000191, Alarm Indication Signal Requirements and Objectives, Bellcore, Issue 1, May 1986
- TR-TSY-000454, “Supplier Documentation for Network Elements,” Issue 1, 7/88
- TR-TSY-000474, “Operations Technology Generic Requirements (OTGR): Network Maintenance: Network Element,” Issue 3, 11/89
- TR-NWT-00796, “Reliability and Quality Generic Requirements (RQGR),” 1991, Bellcore

- TR-NWT-000815, “Network Element (NE) Memory Administration — Network Element and Network System Security,” Issue 2, 12/92, Bellcore
- TR-TSY-000476, “Operations Technology Generic Requirements (OTGR): Network Maintenance: Access and Testing,” Issue 3, 6/90, Bellcore
- TR-TSY-000827, “Operations Technology Generic Requirements (OTGR): Generic Operations Interfaces — Non-OSI Communications Architecture,” Issue 1, 11/88, Bellcore
- TR-NWT-001244, Clocks for the Synchronized Network: Common Generic Criteria, Issue 1, Bellcore, June 1993
- TR-NWT-000233, Wideband and Broadband Digital Cross-Connect Systems Generic Criteria, Issue 3, Bellcore, November 1993
- TR-NWT-000332, Reliability Prediction Procedure, Issue 5, Bellcore, December 1995
- TR-NWT-000170, Digital Cross-Connect System Generic Requirements and Objectives, Issue 2, January, 1993
- TR-TSY-000012, MML Requirements, Issue 1, Bell Communications Research, January 1985

### Technical Advisories (TA)

- TA-TSY-000200, Specification of System Maintenance Messages at the OS/NE Interface, Issue 4, Bellcore, September 1988
- TA-NWT-001080, “Bellcore Standard Operating Environment Security Requirements,” Issue 2, 6/91, Bellcore

### Generic Requirements (GR)

- GR-253-CORE, Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria, (A Module of TSGR, FR-440; FR-SONET-17; and FD-29) Issue 4, December 2005
- GR-820-CORE, Generic Digital Transmission Surveillance, Issue 1, November 1994
- GR-1244-CORE, Clocks for the Synchronized Network: Common Generic Criteria, Issue 2, December 2000
- GR-1400-CORE, SONET Dual-Fed Unidirectional Path Switched Ring (UPSR) Equipment Generic Criteria, Issue 1, March 1994
- GR-63-CORE, “Network Equipment Building System (NEBS) Generic Requirements: Physical Protection,” Issue 1, October 1995
- GR-2914-CORE, Human Factors Requirements for Equipment to Improve Network Integrity, Issue 1, December 1995
- GR-199-CORE, Operations Technology Generic Requirements (OTGR): Operations Application Messages — Memory Administration Messages, Issue 3, February 1999
- GR-2924-CORE, Generic Requirements for National MCUP Committee CSCANS, Issue 1, April 1996
- GR-833-CORE, Operations Technology Generic Requirements (OTGR): Network Maintenance — Network Element Transport and Surveillance Messages, Issue 4, Bellcore, June 2000

- GR-499-CORE, Set: Transport System Generic Requirements (TSGR): Common Requirements, Issue 3, Bellcore, September 2004
- GR-815-CORE: Generic Requirements for Network Element/ Network System (NE/NS) Security, Issue 1, Bellcore, November 1997
- GR-831-CORE: Operations Application Messages — Language for Operations Application Messages, Issue 1, Bellcore, November 1996
- GR-474-CORE: Network Maintenance: Alarm and Control for Network Elements, Issue 1, Bellcore, December 1997
- GR-1089-CORE: Electromagnetic Compatibility and Electrical Safety — Generic Criteria for Network Telecommunications Equipment, Issue 2, December 1997, Revision 1, February 1999
- GR-1339-CORE, “Generic Reliability Requirements for Digital Cross-Connect Systems,” Issue 1, March 1997, Bellcore
- GR-1250-CORE, “Generic Requirements for Synchronous Optical Network (SONET) File Transfer,” Issue 1, June 1995, Bellcore
- GR-472-CORE, Network Element Configuration Management, Issue 2, November 1996
- GR-78-CORE, General Requirements for the Physical Design and Manufacturing of Telecommunications Products and Equipment, Issue 1, Bellcore, September 1997
- GR-2996-CORE, Generic Requirements for SONET Digital Cross-Connect Systems, Issue 1, Bellcore, January 1999
- GR-1230, SONET Bidirectional Line-Switched-Ring Equipment Generic Criteria, Issue 4, December 1998
- ANSI T1.105-1991, American National Standard for Telecommunications, Digital Hierarchy — Optical Interface Rates and Formats Specifications (SONET)
- ANSI T1.403-1989, American National Standard for Telecommunications, Carrier-to-Customer Installation — DS1 Metallic Interface
- ANSI T1.107-1995, American National Standard for Telecommunications, Digital Hierarchy — Formats Specifications
- ANSI T1.107a-1990, American National Standard for Telecommunications, Digital Hierarchy — Supplement to Formats Specifications — (DS3 format applications)
- ANSI T1.403-1995, American National Standard for Telecommunications, Network-to-Customer Installation — DS1 Metallic Interface
- ANSI T1.403.02-1999, American National Standard for Telecommunications, Network and Customer Installation Interfaces — DS1 Robbed-Bit Signaling State Definitions
- ANSI/IEEE Std. 802.2-1989, Information Processing Systems — Local Area Networks — Part 2: Logical Link Control
- ANSI/IEEE Std. 802.3-1990, Information Processing Systems — Local Area Networks — Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer specification
- ANSI/IEEE 802.3i-1990 (Supplement to ISO/IEC 8802-3 — 1990/ANSIIEEE Std. 802.3-1990) System Configurations for Multiple-segment 10 MB/s Baseband Networks (Section 13) and Baseband Medium Attachment Unit (MAU) and Baseband Medium Type 10BASE-T (Section 14)
- ANSI T1.204-1993, American National Standard for Telecommunications — Operations, Administration, Maintenance and Provisioning (OAM&P) — Lower-Layer Protocols for Telecommunications Management Network (TMN) Interfaces between Operations Systems and Network Elements
- ANSI T1.245-1995, American National Standard for Telecommunications — Directory Service for Telecommunications Management Network (TMN) and Synchronous Optical Network (SONET)
- ANSI T1.105-1995, American National Standard for Telecommunications, Synchronous Optical Network (SONET) — Basic Description Including Multiplex Structure, Rates and Formats
- ANSI T1.276.2003, Operations, Administration, Maintenance and Provisioning Security Requirements for the Public Telecommunications Network: A Baseline of Security Requirements for the Management Plane

#### Special Report (SR)

- SR-332, Reliability Prediction Procedure, Issue 1, Bellcore, May 2001
- SR-3528, NEBS Criteria Levels, Issue 1, Bellcore, November 1995

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- ANSI T1.101-1994, Revision of ANSIT1.101-1987, American National Standard for Telecommunications, Synchronization Interfaces Standard
- ANSI T1.102-1993, American National Standard for Telecommunications, Digital Hierarchy — Electrical Interfaces
- ANSI T1.231-1993, American National Standard for Telecommunications, Digital Hierarchy — Layer 1 In-Service Digital Transmission Performance Monitoring
- ANSI T1.105.03-1994, American National Standard for Telecommunications — Synchronous Optical Network (SONET) — Jitter at Network Interfaces
- ANSI T1.105.03a-1995, American National Standard for Telecommunications — Synchronous Optical Network (SONET) — Jitter at Network Interfaces — DS1 Supplement
- ANSI T1.105.03b-1997, American National Standard for Telecommunications - Synchronous Optical Network (SONET) — Jitter at Network Interfaces — DS3 Wander Supplement

#### ITU Documentation

- Recommendation G.703, Physical/Electrical Characteristics of Hierarchical Digital Interfaces, CCITT, 1991
- Recommendation G.783, Characteristics of Synchronous Digital Hierarchy (SDH) Multiplexing Equipment Functional Blocks, CCITT, 1990

- ITU-T Recommendation G.783 (02/2004), Characteristics of Synchronous Digital Hierarchy (SDH) Equipment Functional Blocks
  - ITU-T Recommendation G.783 Corrigendum 1 (06/2004)
  - Recommendation G.823, The Control of Jitter and Wander Within Digital Networks which are Based on the 2048 Kbps Hierarchy, CCITT, 1988
  - Recommendation X.25, Interfaces Between Data Terminal Equipment (DTE) and Data Circuit-Termination Equipment (DCE) for Terminals Operating in the Packet Mode and Connected to Public Data Networks by Dedicated Circuit, CCITT, 1988
  - Recommendation X.244, Procedure for the Exchange of Protocol Identification During Virtual Call Establishment on Packet Switched Public Data Networks, CCITT, 1988
  - Recommendation M.2100, Maintenance: International Transport Network, Performance Limits for Bringing-into-Service and Maintenance of International Digital Paths, Sections and Transmission Systems, CCITT, 1992
  - Recommendation Q.921, ISDN User-Network Interface — Data link Layer Specification, CCITT, 1988
  - ITU-T Recommendation X.519 (1993) / ISO/IEC 9594-5:1995, Information Technology — Open Systems Interconnection — The Directory: Protocol specifications
  - ITU-T Recommendation X.500 (1993 E) / ISO/IEC 9594-1:1993, Information Technology — Open Systems Interconnection — The Directory: Overview of Concepts, Models and Services
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  - Recommendation G.704 Synchronous Frame Structures Used at 1544, 6312, 2048, 8488 and 44,736 kbps Hierarchical Levels, 07/95
  - Recommendation G.706 Frame Alignment and Cyclic Redundancy Check (CRC) Procedures Relating to Basic Frame Structures Defined in Recommendation G.704, 1990
  - Recommendation G.747 Second Order Digital Multiplex Equipment Operating at 6312 kbps and Multiplexing Three Tributaries at 2048 kbps, 1993
  - Recommendation G.775 Loss of Signal (LOS) and Alarm Indication Signal (AIS) Defect Detection and Clearance Criteria, 11/94
  - Recommendation G.826 Error Performance Parameters and Objectives for International, Constant Bit Rate Digital Paths at or above the Primary Rate, 8/96
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  - Recommendation ITU-T I.432.1, B-ISDN User-Network Interface — Physical Layer Specification: General Characteristics, February 1999
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  - [ITU-32A] ITU-T Recommendation G.7042 Corrigendum 1 (06/2004)
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  - ITU-T Recommendation G.806 Corrigendum 2 (01/2005)
  - ITU-T Recommendation G.8021 (06/2004), Characteristics of Ethernet Transport Equipment Functional Blocks
  - ITU-T Recommendation X.86 (02/2001), Ethernet over LAPS
  - ITU-T Recommendation G.8010/Y.1306 (02/2004), Architecture of Ethernet Layer Networks
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- ISO/IEC 8473: 1988, Information processing systems — Data communications — Protocol for providing the connectionless-mode network service
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- NSIF-033-1999 Requirements for the TCP/IP Protocol Suite on the SONET Access DCN, 1999
- SIF-AR-9903-034R2, Proposed requirements for TL1 over TCP, (Draft Company Contribution)
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- SIF-018-1998, Guidelines for SONET DCN Architecture Engineering (SIF-AR-9701-001R10), (Approved)
- SIF-110-0495R1 (1995) TARP Cleanup, SONET Interoperability Forum
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- SIF-011-1997, FTAM Profile for SONET Operations Communications, 1997

### Internet Engineering Task Force RFCs

- RFC 768, User Datagram Protocol
- RFC 791, Internet Protocol — DARPA Internet Program Protocol Specification
- RFC 792, Internet Control Message Protocol, DARPA Internet Program Protocol Specification
- RFC 793, Transmission Control Protocol, DARPA Internet Program Protocol Specification
- RFC 814, Names, Addresses, Ports and Routes
- RFC 826, An Ethernet Address Resolution Protocol (ARP)
- RFC 854, TELNET Protocol Specification
- RFC 903, A Reverse Address Resolution Protocol
- RFC 950, Internet Standard Subnetting Procedure
- RFC 959, File Transfer Protocol (FTP)
- RFC 1010, Assigned Numbers
- RFC 1011, Official Internet Protocols
- RFC 1034, Domain Names — Concepts and Facilities
- RFC 1035, Domain Names — Implementation and Specification
- RFC 1058, Routing Information Protocol
- RFC 1062, Internet Numbers



- RFC 783, The TFTP Protocol — Revision 2
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- RFC 2131, Dynamic Host Configuration Protocol, March 1997
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- RFC 4251 The Secure Shell (SSH) Protocol Architecture
- RFC 4252 The Secure Shell (SSH) Authentication Protocol
- RFC 4253 The Secure Shell (SSH) Transport Layer Protocol
- RFC 4254 The Secure Shell (SSH) Connection Protocol
- RFC 4255 Using DNS to Securely Publish Secure Shell (SSH) Key
- RFC 4256 Generic Message Exchange Authentication for the Secure Shell Protocol (SSH)

- RFC 4419 Diffie-Hellman Group Exchange for the Secure Shell (SSH) Transport Layer Protocol
- RFC 4432 RSA Key Exchange for the Secure Shell (SSH) Transport Layer Protocol
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