SLC® Series 5 Carrier System

AUA44( ) 4-Wire Current Sink Special Services Channel Unit — 5SCU7C6 (AUA44) 5SC27C0 (AUA44B)

Features/Functions

- Four-wire special service applications:
  - — FX or OPS
  - — Loop-start, ground-start or tandem signaling
- On-hook transmission performance same as off-hook
- Reverse battery capability for LSAS applications (AUA44B)
- Faceplate test access to tip and ring pairs (AUA44B)
- BUSY LED on faceplate (AUA44B)
- Enhanced inventory readout (AUA44B)
- Conforms to appropriate industry standards
- Compatible with *CLASS** services.

* Service Mark of Bell Communications Research, Inc.

Description

This data sheet describes the AUA44( ) 4-wire current sink channel unit (CU) (COMCODE 105678171, AUA44; 107391732, AUA44B) which is intended for use in non-locally-switched ground-start and loop-start special services. The AUA44( ) CU provides a single channel of service; it uses the odd-numbered channel associated with a physical plug-in slot. The AUA44( ) CU can be used in a *SLC*® Series 5 Carrier System in a central office terminal (COT), remote terminal (RT) or in a Multi-Services Distant Terminal (MSDT). The AUA44( ) can also be used in an MSDT homed on a *SLC*-2000 Access System RT.

Typical services are foreign exchange trunks and lines and off premises station lines. The unit may interface with other transmission equipment or cable. The AUA44( ) CU can be connected to a distant D-bank via an integrated network access facility (INA-facility) arrangement.

The AUA44( ) CU includes capability for plug-in inventory. The unit stores in its nonvolatile memory an inventory record that includes its 10-character *CLEI** code, readable by a compatible host.

Figure 1 is the functional block diagram of an AUA44( ) CU, and Figure 2 shows the faceplates.

Functions

The AUA44( ) CU provides one channel of service which can function in one of two modes.

4FXO: The foreign exchange-office end (4FXO) function is used in non-locally-switched loop-start and ground-start (LS/GS) circuits where the current sink unit must be 4-wire. For foreign exchange applications, the unit is always located at the central office terminal (COT). For off-premises station applications, the unit can be at the COT or the station (RT) end of the circuit. These applications are generally 2-wire at the customer end. Therefore, when the AUA44( ) CU is used in the circuit to provide transmission capabilities not available in a 2-wire CU, the cable it faces is usually terminated in a 4-wire to 2-wire converter at the far end. The AUA44( ) in the 4FXO mode can directly interface another carrier channel unit such as a D4 type 4FXS CU, or connect to a PBX or foreign exchange switch using a maximum of 15 dB of cable.

4TDM: The tandem function is used to provide a back-to-back carrier interface for loop-start and ground-start circuits. The AUA44( ) CU can also be used for 2-state circuits such as tie trunks, but the AUA54( ) CU is preferred.

Transmission Treatment

The AUA44( ) channel unit provides wide ranges of transmission level point, structural impedance, and equalization capability — see Tables 1 and 3 for a listing of corresponding options and their ranges. For loaded cable, equalization is limited to the transmit direction (post-equalization only). Transmission treatment is independent of the busy/idle condition.

* COMMON LANGUAGE is a registered trademark and CLEI, CLLI, CLCI and CLFI are trademarks of Bell Communications Research, Inc.

Distribution Cable

The AUA44( ) CU is designed to deliver trunk quality service over loaded or nonloaded cables defined in Table 4. The various types of cables are categorized below.

Short (CSA) Cable: Cables considered short generally do not extend beyond the range defined by the carrier serving area (CSA). The CSA cable design rules have been established by Bellcore to facilitate the deployment of digital loop carrier (DLC) equipment that does not require outside plant repeaters or network channel terminating equipment (NCTE). To accomplish this end, the CSA rules regulate the range and structure of RT-to-customer cable. The CSA design rules are listed in Section 2.2 of TR-NWT-000057. CSA cables must be nonloaded and no longer than 12 kilofeet (kft).

Extended Range, Nonloaded Cable: Nonloaded cables that extend beyond the limits of the carrier serving area are intended to conform with one of several sets of rules that have been promulgated by AT&T and Bellcore, such as Modified Resistance Design rules. At the time of divestiture, the most current AT&T guidance was contained in Recommendation Letter RL 83-04-013. The rules also were documented in the 902-xxx-xxx layer of Bell System Practices.

Nonloaded loops longer than CSA range are compatible with the *SPQ*® 444 CU provided they conform to the construction rules in those standards. Such cables do not exceed 18 kft nor do any exceed the 2800 ohm resistance, 15 dB loss capability of the AUA44( ) unit.

Loaded Cable: Loops longer than 18 kft should be H88 loaded. Such loops are compatible with the AUA44( ) CU provided the service does not require the most stringent equalization* called out in TR-NWT-000057, and provided the resistance does not exceed 2800 ohms. Attenuation can range to the crosstalk limit, which is usually 12 dB for loaded cable but not more than 15 dB.

Options

The AUA44( ) CU has options (refer to Tables 1, 2, and 3) that must be set before service can be provided. All options for the CU are set by entering commands into the *SLC* Series 5 craft interface unit (CIU, J99404TA-1), special channel administration tool (SCAT, COMCODE 107040347) or craft interface

* Certain sections of TR-NWT-000057 require that the equalized attenuation of cable plus channel units be no less than -0.2 dB (gain of +0.2 dB) at any frequency from 400 Hz to 2800 Hz, relative to the attenuation at 1000 Hz. The AUA44( ) equalization of the above loaded cables allows the relative attenuation to be as negative as -0.7 dB, with the most negative value occurring at about 1.8 kHz.

terminal (CIT, *SLC*-2000 System provisioning tool) which transmits the settings to the bank where they are stored in nonvolatile memory. The BCU then writes the settings into memory registers on the CU immediately, or when a CU is later installed or replaced. The CIU is also used during manual testing of the transmission performance of the AUA44( ) CU. The procedures for setting options and performing tests with the CIU are described in AT&T 363-205-402, *SLC Series 5 Carrier System Channel Unit Installation and Testing*. The CIU for the *SLC* Series 5 Carrier System is described in AT&T 363-205-101, *Craft Interface Unit, Description*. Instructions for provisioning the AUA44( ) using the CIT are given in the *SLC-2000 System User/Service Manual,* AT&T 363-208-001.

NOTE:
The 6-character *CLEI* code for the AUA44 CU, 5SCU7C, must be used when provisioning the AUA44B CU in *SLC* Series 5 Systems.

Facility Failure

When the system controller notifies the channel unit that a facility failure has occurred, the AUA44( ) carries out the following actions:

- Adopts the LS or GS idle condition for 2.5 seconds, then busies out the service for the remainder of the failure
- Sends idle signaling to the far end
- Disables the test relay and transmission in the receive direction.

Remote Test Access

Local or remote test access to the AUA44( ) channel unit is available when the unit's test relay is operated. This access includes full splitting access to the transmission leads and splitting access toward the carrier channel on the E and EX signaling leads. See Figure 1.

Table 1. AUA44( ) Channel Unit Options.

Option	CU Function	
	4FXO	4TDM
Function Code	X	X
Transmit Attenuator	X	X
Receive Attenuator	X	
Equalizer Nonloaded/Loaded*	X	
Equalizer Slope*	X	
Equalizer Bandwidth*	X	
Equalizer Height*	X	
Transmit and Receive Impedance	X	

* Adjustable equalization is provided for the transmit direction only for post-equalization of the cable transmission characteristics.

Table 2. AUA44( ) Channel Unit Function Codes.

Function Code	CU Function	Signaling Mode
FXO1	4FXO	Loop-Start Signaling Signaling Leads Normal* No Toll Diversion Capability
FXP1	4FXO	Loop-Start Signaling Signaling Leads Normal* Toll Diversion Capability†
FXO2	4FXO	Loop-Start Signaling Signaling Leads Reversed‡ No Toll Diversion Capability
FXP2	4FXO	Loop-Start Signaling Signaling Leads Reversed‡ Toll Diversion Capability†
FXO3	4FXO	Ground-Start Signaling Signaling Leads Normal* No Toll Diversion Capability
FXP3	4FXO	Ground-Start Signaling Signaling Leads Normal* Toll Diversion Capability†
FXO5	4FXO	Ground-Start Signaling Signaling Leads Reversed‡ No Toll Diversion Capability
FXP5	4FXO	Ground-Start Signaling Signaling Leads Reversed‡ Toll Diversion Capability†
TDOA	4TDM	4-State Signaling Signaling Leads looped Through CXR toward Office
TDSA	4TDM	4-State Signaling Signaling Leads looped Through CXR toward Subscriber
TDOB	4TDM	4-State Signaling Signaling Leads nonlooped Through CXR toward Office
TDSB	4TDM	4-State Signaling Signaling Leads nonlooped Through CXR toward Subscriber
TDOC	4TDM	2-State Signaling** Signaling Leads looped

Table 2 (Cont'd.) Function Code	CU Function	Signaling Mode
TDSC	4TDM	2-STATE Signaling** Signaling Leads nonlooped
TDOD	4TDM	2-STATE Signaling†† Signaling Leads nonlooped
TDSD	4TDM	2-STATE Signaling†† Signaling Leads nonlooped

* Tip signaling lead connected to T-R, ring signaling lead connected to T1-R1.

† "Toll Diversion" means that a disallowed outgoing address has been dialed through the PBX; this event is signaled as a battery reversal by the switch. The FXP(_) function code enables the AUA44( ) CU to recognize a battery reversal and to transmit a unique signaling code. This capability is also used for Line Side Answer Supervision (LSAS).

‡ Ring signaling lead connected to T-R, tip signaling lead connected to T1-R1

** The choice of either TDOC or TDSC will result in the same signaling mode, 2-state signaling with looped signaling leads.

†† The choice of either TDOD or TDSD will result in the same signaling mode, 2-state signaling with nonlooped signaling leads.

Table 3. AUA44( ) Channel Unit Option Ranges

Option	Range
Transmit Attenuator	4FXO: 0.0 to 16.5 dB in steps of 0.1*
	4TDM: 0.0 to 11.6 dB in steps of 0.1†
Receive Attenuator	4FXO: 0.0 to 16.5 dB in steps of 0.1‡
	4TDM: none
Equalizer Nonloaded/Loaded	N or L
Equalizer Slope	0 to 15 in steps of 1
Equalizer Bandwidth	0 to 15 in steps of 1
Equalizer Height	0 to 15 in steps of 1
Transmit and Receive Impedance**	150, 600, or 1200 Ohms

* The 4FXO mode provides transmit (T/R input) insertion gain of 15.0 and 1 kHz equalizer gain per 915-710-116 section 11E.

† The 4TDM mode provides transmit (T/R input) insertion gain of 3.6 dB. The recommended 4TDM transmit attenuator range is 0.0 to 1.5 dB.

‡ The 4FXO mode provides receive (T1/R1 output) insertion gain of 6.0 dB.

** Selecting 150 ohms produces slope equalization equivalent to 150/600 ohm impedance mismatch independent of equalizer settings. This option is automatically set to 600 ohms for the 4TDM function of the channel unit.

Table 4. Recommended Cables for 4-Wire Designed Special Services

A. LOSS/RESISTANCE RANGE

1. Loss — 15 dB*
2. Resistance — 2800 ohms

B. NONLOADED CABLE

Compliant with Resistance Design, Modified Resistance Design (MRD), or Revised Resistance Design (RRD) rules as were promulgated in Bell System Practices and AT&T Recommendation Letter RL 83-04-013, with the RT playing the role of a CO. For nonloaded cable, the most significant rule was that bridged tap is limited to 6 kft.

C. LOADED CABLE

Loops greater than 18 kft (total length including bridged tap) require standard H88 loading, which for use with AUA44( ) should conform to:

1. Maximum cable: 15 dB, 2800 ohms
2. Bridged tap
   - 6 kft maximum
   - No loaded bridged tap and no bridged tap between loads
3. COT/RT end section length
   - Resistance 900 ohms or less: 1.5 kft to 7.5 kft, provided voiceband frequency response meets transmission requirements
   - Resistance greater than 900 ohms: 3000 ft. ± 120 ft. (build-out permitted)
4. Customer end section: main section plus bridged tap, 3 kft to 9 kft.

* Crosstalk considerations in the loop plant frequently restrict the attenuation to 12 dB for loaded cable.

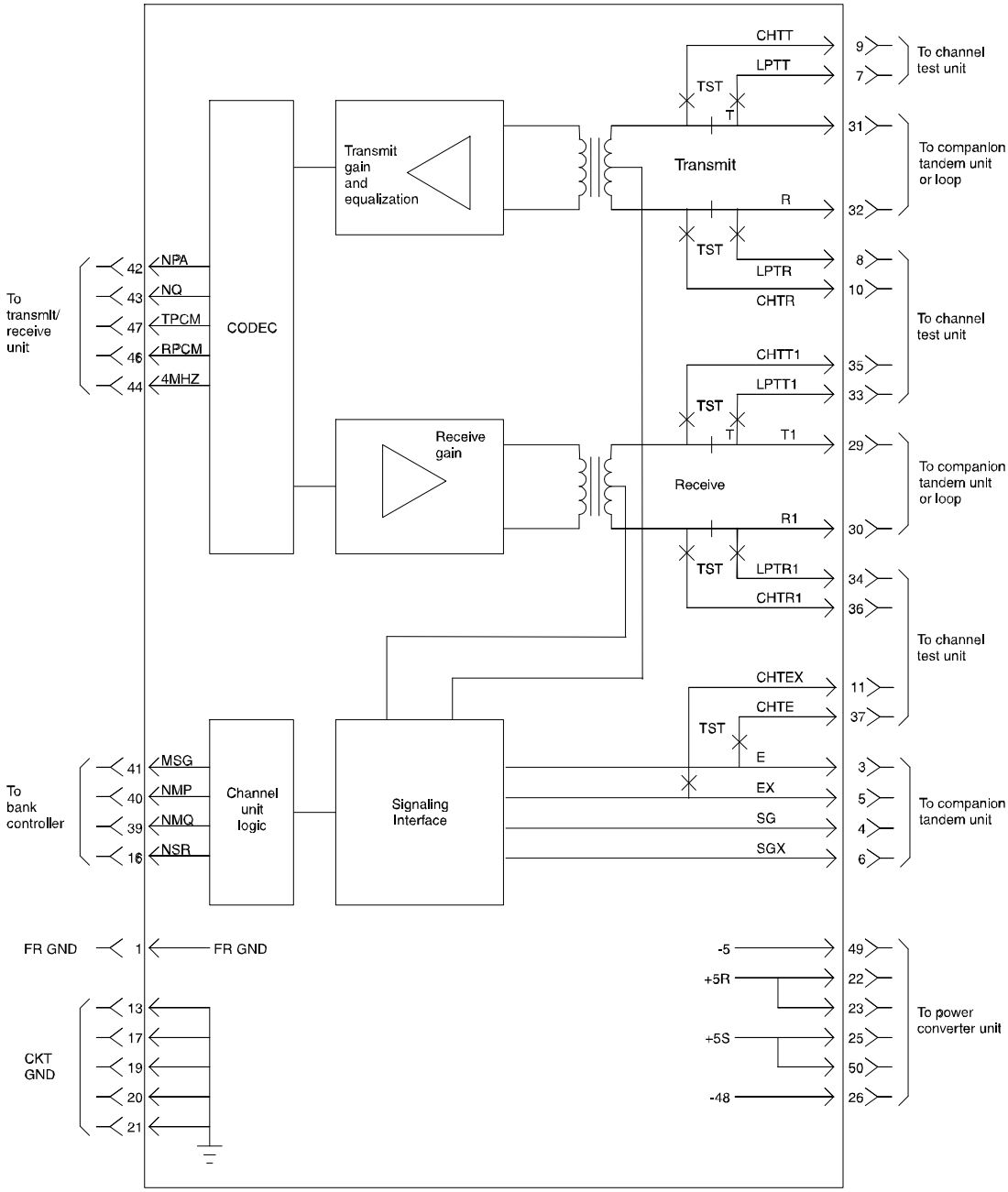

Figure 1. AUA44( ) Block Diagram

Compatibility

AUA44( ) CU end-to-end compatibility and application information can be found in AT&T 915-710-116, S*LC Series 5 Carrier System Channel Unit Application and Prescription Setting*, Section 7.02 and Figure 32, and AT&T 363-205-010 *SLC Series 5 Carrier System Applications and Planning Guide*, Section 6. In both of these documents, the reader should be aware of the following:

a. AUA41 is to be read AUA41( )

b. AUA42 is to be read AUA42( )/*SPQ*442

c. AUA43 is to be read AUA43( )/*SPQ*443

d. AUA44 is to be read AUA44( )/*SPQ*444

e. AUA54 is to be read AUA54( )/*SPQ*454

f. *SLC* Series 5 is to be read *SLC* Series 5/*SLC*-2000

NOTE:
The AUA44( ) in 4TDM mode is also end-to-end compatible with the AUA36( ), AUA45( ), AUA56( ), and AUA75 CUs.

AT&T 915-710-116, in several places, refers to compatibility of channel units located beyond a digital connectivity unit (DCU). The *SLC*-2000 System does not support DCUs, but the document can nevertheless be applied to *SLC*-2000 System applications if references to DCU-equipped terminals in the text are replaced by digital switch, digital cross-connect equipment, or an INA facility used to connect a *SLC*-2000 RT to a D4-type terminal.

Specifications

The AUA44( ) CU conforms to the appropriate criteria of ANSI*, Bellcore, FCC, GTE, and UL** standards.

Table 5 gives specifications of salient transmission parameters. For complete transmission specifications, consult Chapter 6 of AT&T 363-205-010, *SLC Series 5 Carrier System Applications and Planning Guide.* The transmission and signaling ranges of the AUA44( ) in 4TDM mode are the same —1.5 dB. This range translates to about 3 kft of 26 gauge cable.

Table 5. Salient Transmission Parameters for 4-Wire AUA44( ) Channel Units

Parameter	Condition	Value
Cable Resistance	4FXO 4TDM	0-2800 ohms T/R, T1/R1 loop resistance 0-250 ohms E/EX/SG/SGX conductor resistance
Transmit Gain	4FXO	-1.5 to +15.0 dB in steps of 0.1*
	4TDM	-8.0 to +3.6 dB in steps of 0.1†
Receive Gain	4FXO	-10.5 to +6.0 dB in steps of 0.1
	4TDM	-2.1 dB
Equalization		Post-equalization of cable less than 15 dB (H88) or 18 kft (NL) is comparable to D4 4FXO CU J98726SC. Pre-equalization and post-equalization available by emulating 150-ohm mismatch
Structural impedance	4FXO	600 or 1200 ohms
	4TDM	600 ohms
Return loss (With reference to structural impedance)	300-3000 Hz 1000 Hz	23 dB 28 dB
Longitudinal balance (IEEE Method 455-1976)	200 Hz 500 Hz 1000 Hz 3000 Hz	≥ 67 dB ≥ 67 dB ≥ 67 dB ≥ 62 dB
Peak-to-average ratio (P/AR) (pulse distortion)		≥ 94

* Range with 0 equalizer settings. To determine additional equalizer gain see AT&T 915-710-116 Section 11.23.

† The recommended range is -2.1 to +3.6 dB.

* Registered trademark of American National Standards Institute, Inc.

** Registered trademark of Underwriters Laboratories, Inc.

Faceplate Features

The AUA44B faceplate has one faceplate jack and one red LED indicator. Refer to Figure 2 for the faceplate diagram.

The faceplate test jack provides bridging test access to both tip/ring pairs (T/R, T1/R1) through the ITT RTG16L2H15A channel unit faceplate test cord (COMCODE 405755208). Tip and ring leads provide VF input to the CU; tip1 and ring1 leads connect to the CU output.

BUSY (Red LED): The BUSY LED will light upon power up in any terminal when service is activated and in response to an LED TEST command at an MSDT. For the 4FXO function, the BUSY LED will be lit whenever the far end goes off-hook or when ring-ground is applied in ground-start applications. For the 4TDM function, the BUSY LED will be lit whenever the signaling in either direction is off-hook.

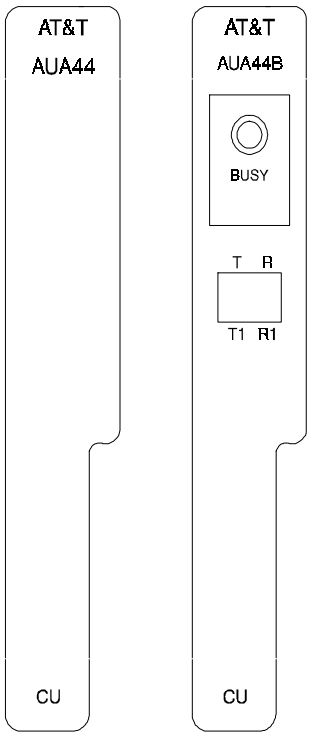

Figure 2. AUA44( ) Faceplate Diagram

References

The following documents provide additional information about the *SLC* Series 5 Carrier System and the *SLC*-2000 Multi-Services Distant Terminal:

AT&T 363-205-004	*SLC-2000 Multi-Services Distant Terminal Feature—User /Service and Ordering Manual*
AT&T 363-205-010	*SLC Series 5 Carrier System Applications and Planning Guide*
AT&T 363-205-101	*SLC Series 5 Carrier System Craft Interface Unit—Description*
AT&T *363-205-110*	*SLC Series 5 - Cable Measurement Method for Determining Provisioning Settings for Special Services Channel Units*
AT&T 363-205-402	*SLC Series 5 Carrier System Channel Unit Installation*
AT&T *363-208-000*	*SLC-2000 Access System Applications, Planning, and Ordering Guide*
AT&T 363-208-001	*SLC-2000 Access System—User/Service Manual*
AT&T 915-710-115	*SLC Series 5 Carrier System Application Engineering*
AT&T 915-710-116	*SLC Series 5 Carrier System Channel Unit Application and Prescription Setting*

Bellcore's technical reference for digital loop carrier systems, TR-NWT-000057, Issue 2, January 1993, is one of several telephone company sponsored documents that offer criteria by which to judge such systems.

Technical Assistance

Follow local procedures for obtaining technical assistance. AT&T also provides in-hours or emergency out-of-hours help for the *SLC* Series 5 Carrier System and the *SLC*-2000 Access System. Call the AT&T Regional Technical Assistance Center at **1-800-225-RTAC**.

Ordering Information

Additional copies of this document (AT&T 363-005-108) are available from the Customer Information Center — call 1-800-432-6600.

Comments

Comments about this document can be directed to:

AT&T Network Systems Customer Education and Training
Documentation Services
2400 Reynolda Road
Winston-Salem, NC 27106-4606

Copyright Information