# *SLC*®-2000 Access System

## *SPQ*®440( ) (RT) POTS/SPOTS® Channel Unit—
## SAC1AAC (*SPQ*440)
## SAC1AAG (*SPQ*440B)
## SAC1AC0 (*SPQ*440C)
## SAC1ACX (*SPQ*440D)

## Features/Functions

- Automatically provides loop-start or ground-start service
- Supports *CLASS** services including calling name/ number delivery (CND) services
- Four channels
- Meets universal voice grade (UVG) requirements in TR-NWT-000057
- Adaptive balance to enhance V.34 and digital modem performance (*SPQ*440D)
- Supports line side answer supervision (LSAS)
- Supports voice frequency data enhancement (VFDE) operation (*SPQ*440D)
- Faceplate BUSY LEDs
- Automatic level compensation (ALC)
- Faceplate test access to tip and ring for four channels
- Enhanced inventory
- Extended range (*SPQ*440C, *SPQ*440D)
- Conforms to appropriate industry standards
- UL† Recognized
- Automatically provides plain old telephone service (POTS) or special service loss profile
- No option switches

* Service mark of Bell Communications Research, Inc.

† Registered trademark of Underwriters Laboratories Inc.

## Description

This data sheet describes the *SPQ*440( ) remote terminal (RT) POTS/*SPOTS* quad channel unit (COMCODE 106842594, *SPQ*440; 107119695, *SPQ*440B; 107500746, *SPQ*440C; and 108123605, *SPQ*440D) and is intended for the end-user of the unit. The *SPQ*440B CU exhibits an improved automatic level compensation (ALC) loss profile. The *SPQ*440C/*SPQ*440D CU is a 1500 ohm extended range version of the *SPQ*440B CU. The *SPQ*440( ) channel units present a current feed interface to four tip/ring pairs and provide on hook transmission and *CLASS* compatibility.

This data sheet has been reissued to introduce the *SPQ*440D quad POTS/*SPOTS* current feed (CF) channel unit which is equivalent to an *SPQ*440C CU but with improved performance when supporting voiceband modems. The *SPQ*440D CU when installed in a FiberReach Narrowband Shelf ONU or Multi-Services Distant Terminal (MSDT) extension of a *SLC*-2000 Access System RT, Release 4.6 and later, supports the voice frequency data enhancement (VFDE) feature. The VFDE feature allows a *SLC*-2000 Access System operating as a TR-303* compliant remote digital terminal (RDT) to operate in the clear channel mode. A digital loop carrier system that can operate in the clear channel mode will generally produce significant increases in connect rates of V.34 modems and "digital" modems such as X2, K56flex, or V.90 modems. The VFDE feature, a proprietary enhancement of the TR-303 protocol, is achieved in a Release 4.6 RDT *hosting any incumbent channel unit* such as the *SPQ*400( ) CU or *SPQ*440C CU. The VFDE feature is also achieved in a Release 4.6 RDT hosting an *SPQ*440D CU. However, where the Release 4.6 RDT configuration includes an MSDT or FiberReach NBS ONU, use of a VFDE enhanced CU such as the *SPQ*440D CU is necessary to realize the VFDE feature in the ONU. The *SPQ*440D CU also enhances voiceband modem performance through the use of adaptive balance.

The *SPQ*440( ) can be used in a *SLC* ®-2000 central office terminal (COT), RT, MSDT or FiberReach NBS ONU. The *SPQ*440( ) furnishes a 2-wire current feed interface to the customer loop and provides four channels of service. Structural impedance is 600 ohms in series with 2.16 µF. The transmit and receive insertion losses for the SPQ440( ) channel units are variable, reflecting the ALC feature.

The on-hook insertion losses of the *SPQ*440( ) units are also determined by an ALC algorithm. See Table 2, *Salient SPQ*440( ) *Electrical and Transmission Specifications*. On-hook loss values are determined by the measured tip/ring resistance during the previous off-hook state.

* Bellcore Technical Reference TR-NWT-000303 Issue 2, December 1992, and all Supplements, *Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface*. TR-303 has been reissued as GR-303-CORE.

The *SPQ*440( ) units automatically provide either a loop-start or a ground-start (PBX) signaling interface over loops as long as 900 ohms, but the loop range for the *SPQ*440C/*SPQ*440D has been extended to 1500 ohms. The ringing range of the *SPQ*440( ) CU is to a large extent determined by the ringing generator employed by the bank. The 3A, 3B, and 3C ringing generators feeding 20 Hz ringing through an *SPQ*440( ) CU will produce at least 40 VAC (TR-NWT-000057 requirement) across an impedance equivalent to five ringers (5 REN) through a loop of 1050 ohms (1100 ohms, *SPQ*440C/*SPQ*440D) or less. The *SPQ*440( ) units when fed by these ringing generators will ring at least four REN over loops of 1500 ohms.

The *SPQ*440( ) channel unit can be used in a universal arrangement with a *SLC* -2000 RT connected to a *SLC* -2000 COT or a *SLC*®96 COT, where the channel unit hosted by the COT uses signaling defined by TR-08*, or TR-08 integrated configuration with a *5ESS*® switch integrated digital carrier line unit (IDCU), *5ESS* digital carrier line unit (DCLU) or other local digital switch (LDS) that conforms with the TR-08 standard at the central office. The COT end of the channel can be terminated with an *SPQ*340, AUA32, or AUA39( ) channel unit for locally switched special services, or an *SPQ*300, AUA31 or AUA38( ) POTS channel unit at the far end if only loop start signaling is required. With a *SLC* 96 COT, the COT channel unit can be a WP36 *SPOTS* unit or, if only loop-start signaling is required, a WP10( ) POTS unit. Where an *SPQ*440( )/AUA39( ) *SPOTS* channel unit pair provides a loop-start circuit served by a *5ESS* switch, the RANGEX or ground reference option (see Table 1) of the *5ESS* switch must be set — otherwise, ringing will not be tripped during the silent interval.

During on-hook conditions, the channel unit is not powered down. On-hook transmission (OHT) in each direction is provided where the far end is terminated with an AUA38( ), AUA39( ), or WP10D channel unit, or a digital switch — see Table 1. This OHT capability, coupled with the OHT capability of the listed COT channel units in the COT-to-RT direction permits these combinations to provide several services requiring OHT in that direction [for example, individual calling line identification (ICLID)]. The *SPQ*440( ) has automatic level compensation in the on-hook state — See Table 2.

Loop range depends upon whether the *SPQ*440( ) is part of a special service circuit. In a ground-start or loop-start locally switched special service application where the distant channel unit is a *SPQ*340, WP36, AUA32, or AUA39( ) (or the DCLU/IDCU *SPOTS* channel unit equivalent), the loop is limited to carrier serving area (CSA) range for transmission performance consistent with special service circuits. Where the distant channel unit is a *SPQ*300, WP10(_), AUA31, or AUA38( ) (or the DCLU/IDCU POTS equivalent), the loop range of the *SPQ*440C/*SPQ*440D extends to 1500 ohms (plus telset resistance) — over this range the *SPQ*440C/*SPQ*440D supplies current varying in amount from 30 mA (shortest loop) to a minimum of 20 mA (1500 ohms). The *SPQ*440 and

* Bellcore Technical Reference TR-TSY-000008 Issue 2, August 1987, and all Supplements, *Digital Interface Between the SLC96 Digital Loop Carrier System and a Local Digital Switch.*

*SPQ*440B units supply these currents out to 900 ohms.

In a loop start circuit the *SPQ*440( ) CU provides the fast forward disconnect feature which repeats a central office's (CO) open switching interval (OSI) that is longer than 50 msec. This fast forward disconnect feature maintains the OSI condition up to 1.5 seconds, then resumes the normal loop current feed (LCF) condition to reestablish supervision despite a prolonged OSI.

The channel unit stores a plug-in inventory record in non-volatile memory available for reading through an inventory compatible host (e.g., *SLC*-2000 Access System). The inventory record includes 10-character *COMMON LANGUAGE*[*] *CLEI*, COMCODE, ECI, Function, Loss, and ID codes.

## Description of Figures and Tables

- Figure 1 shows the faceplate diagram for the *SPQ*440( ) CU.
- Table 1 lists the on-hook transmission capabilities.
- Table 2 lists the salient electrical and transmission specifications for the *SPQ*440( ) CU.
- Table 3 lists the environment specifications.
- Table 4 lists the power drain of the *SPQ*440( ) CU.
- Table 5 lists the edge connections.

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

## Compatibility

The *SPQ*440( ) channel unit is compatible with all current and planned releases of the *SLC*-2000 Access System. The *SPQ*440( ) CU can be mounted in the RT or MSDT (Release 2.0 or later) or FiberReach NBS (Release 4.3 or later). In addition, the *SPQ*440( ) CU is compatible with all releases of the switched digital broadband access system (SDBAS). The *SPQ*440( ) CU is compatible with the VFDE feature of Release 4.6 and later of the *SLC*-2000 Access System, when installed in the RDT operating in the TR-303 mode; the *SPQ*440D additionally supports the VFDE feature when installed in a FiberReach NBS or MSDT extension of such an RDT. The VFDE feature of the 5ESS-2000® local digital switch is available in Software Update (SU) package 98-0008 for the 5E11(1) Software Release and in SU package 98-0007 for 5E12(1) Software Release and in the Beginning Managed Introduction (BMI) of 5E13(1) Software Release. The far-end termination can be any AUA or *SPQ* POTS/*SPOTS* current sink loop start/ground start channel unit, or other termination as shown in the following list:

- *SLC* -2000 *SPQ*®340 *SPOTS* channel unit
- *SLC* -2000 *SPQ*®300 POTS channel unit
- *5ESS* switch integrated digital carrier unit (IDCU)
- *5ESS* switch digital carrier line unit (DCLU)
- AUA39( ) *SPOTS* channel unit
- AUA32 *SPOTS* channel unit
- AUA38( ) POTS channel unit
- AUA31 POTS channel unit
- *SLC* 96 WP36( ) *SPOTS* channel unit
- *SLC* 96 WP10( ) POTS channel unit

The *SPQ*440( ) CU supports the line side answer supervision (LSAS) service feature when used with an AUA39B, *SPQ*300, or *SPQ*340 (universal configuration), or suitably programmed local digital switch (integrated configuration).*

The *SPQ*440( ) channel unit is compatible with pair gain test controller (PGTC) and similar test systems. There are no options or settings that need to be selected on this channel unit.

* In an integrated configuration, the *SPQ*440( ) will respond to RLCF signaling in a GR-303-CORE configuration or in a TR-TSY-000008 configuration if the local digital switch is programmed for line side answer supervisory signaling according to Bellcore Technical Reference Bulletin “change to TR-TSY-000008, Issue 2, August 1987 and Revision 1, September 1993” Bulletin 1, 10/94.

## Specifications

Table 1 gives the on-hook Transmission Capabilities for the *SPQ*440( ) CU.

**Table 1. *SPQ*440( ) POTS/*SPOTS* CU — On-hook Transmission Capability**

| ON-HOOK TRANSMISSION CAPABILITIES | | | |
|---|---|---|---|
| **CO Termination** | **Signaling** | **Direction** | **OHT Services CND, MWI, MR** |
| WP10 | LS | COT→RT | ✔* |
| WP10B | LS | COT→RT | ✔ * |
| WP10C | LS | COT→RT | ✔* |
| *SPQ*300 | LS | COT↔RT | ✔ |
| AUA38( ) | LS | COT↔RT | ✔ |
| WP10D | LS | COT↔RT | ✔ |
| WP36 | LS /GS | COT→RT | ✔* |
| *SPQ*340 | LS /GS | COT↔RT | ✔ |
| AUA39 | LS†/GS | COT↔RT | ✔ ‡ |
| AUA39B | LS /GS | COT↔RT | ✔ |
| INTEGRATED:§ | | | |
| POTS CU mode | LS | IDCU/DCLU↔RT | ✔ |
| SPOTS CU mode | LS /GS | IDCU/DCLU↔RT | ✔ |

Legend:

CND — Calling name/number delivery (CND). Individual calling line identification (ICLID) feature of CND transmits number, using frequency shift keying (FSK), during silent ringing interval

MWI — Visual message waiting indication(MWI). Central office (CO) switch transmits FSK to turn on indicator during idle state.

MR — Meter reading.

LS — Loop start (LS) signaling.

GS — Ground start (GS) signaling.

* Meter must present off-hook termination when responding to poll.

† When an AUA39 CU is connected to the floating battery feed of a *5ESS* Switch, either the RANGEX or GNDREF *5ESS* Switch option should be set, to provide the necessary low resistance tip/ground interface when the switch sends the CND message. The RANGEX option is preferred. The AUA39B CU does not require these switch options:

RANGEX=Y [up to Release 5E9(2)] or RANGEX=EXT [Release 5E9(2) or later]

GNDREF=Y

‡ CND only

§ Digital carrier line unit (DCLU) or integrated digital carrier unit (IDCU) interface feature of *5ESS* Switch, or other switch with digital loop interface compliant with Bellcore TR-TSY-000008. (Compatibility for MWI on ground start circuits is not covered by TR8.)

Table 2 lists salient electrical and transmission specifications for *SPQ*440( ) channel unit. The parameters are off-hook unless specified otherwise. Table 3 lists the environment specifications.

**Table 2. Salient *SPQ*440( ) Electrical and Transmission Specifications (Note 1)**

| Parameter | POTS | Special Services |
|---|---|---|
| Loop resistance (excluding telset):<br>*SPQ*440, *SPQ*440B<br>*SPQ*440C, *SPQ*440D | <br>0-900 ohms<br>0-1500 ohms | <br>CSA<br>CSA |
| 1 kHz VF loss between CO and network interface (NIF) at customer location, customer premises equipment (CPE) off-hook:<br>*SPQ*440, *SPQ*440B<br>*SPQ*440C, *SPQ*440D | <br><br>4 dB to 8 dB<br>3.5 dB to 8* dB | <br><br>2 dB to 5 dB<br>2 dB to 5 dB |
| Nominal 1 kHz VF loss, SPQ440( ) only, CPE off-hook:<br>*SPQ*440, *SPQ*440B<br>*SPQ*440C, *SPQ*440D | <br>0 dB to 6 dB<br>0 dB to 5 dB | <br>0 dB o 3.4 dB<br>0 dB to 3.4 dB |
| Nominal 1 kHz VF loss, SPQ440( ) only, CPE on-hook:<br>*SPQ*440*;* 1:1, 1:2 only<br>*SPQ*440, 1:3 only<br>*SPQ*440B only<br>*SPQ*440C, *SPQ*440D<br>First installed, telset on-hook, SPQ440C, *SPQ*440D | <br>3.4 dB to 8 dB<br>5 dB to 9.5 dB<br>5 dB to 9.5 dB<br>2.5 dB to 3.75 dB<br>2.5 dB | <br>2 dB to 5.4 dB<br>6 dB to 9.5 dB<br>6 dB to 9.5 dB<br>2.5 dB<br>2.5 dB |
| Return loss at COT (reference Z of 900 ohms + 2.16 µF, SPQ440( ) terminated at voice frequencies with 900 ohms + 2.16 µF for POTS or TR-57 CSA test loops for special services, DC resistance of off-hook loop terminations<br>< 430 ohms, CPE on-hook or off-hook) | <br><br><br>ERL > 18 dB, SRL > 10 dB | <br><br><br>ERL >10 dB, SRL > 5 dB |
| Return loss at RT (reference Z of 600 ohms + 2.16 µF, CO terminated with 900 ohms + 2.16 µF, off-hook DC resistance of < 430 ohms, CPE on-hook or off-hook):<br>*SPQ*440, *SPQ*440B<br>*SPQ*440C, *SPQ*440D | <br><br><br>ERL > 22 dB, SRL > 14 dB<br>ERL > 18 dB, SRL > 10 dB | <br><br><br>ERL > 22 dB, SRL > 14 dB<br>ERL > 19 dB, SRL > 11 dB |
| Frequency response (loss relative to 1004 Hz, end to end), *SPQ*440( ) | <u>Frequency range</u><br>300-3000 Hz<br>3200 Hz | <br>-0.5 dB to +1.0 dB<br>-0.5 dB to +1.5 dB |
| Structural impedance (output impedance) | 600 ohms + 2.16 µF | 600 ohms + 2.16 µF |
| Impulse noise at a threshold of 47 dBrnC0 for 15 minutes | ≤ 15 counts | ≤ 15 counts |

* Assumes 26 gauge cable is loaded beyond 15 kft.

Note 1: End-to-end performance specified with SPQ300 or SPQ340 at COT, terminated with 900 ohms + 2.16 µF.

**Table 3. Environmental Specifications**

| |
|---|
| **A. Temperature Range (Ambient)**<br>1. Operating, per TR-NWT-000057: in Lucent Technologies cabinet mounted RT, outside ambient temperatures of -40° F (-40° C) with no solar load to +115° F (46° C) with maximum solar load and maximum power dissipation. Lucent Technologies cabinets are designed to assure that the components within do not exceed their rated temperatures for the above conditions.<br>2. Storage, per TR-NWT-000057: ambient temperatures of -40° to 140° F (-40° to 60° C). |
| **B. Relative Humidity**<br>1. Operating, per TR-NWT-000057. For outside ambient temperature 84° F (29° C) or less, relative humidity of 5% to 95%. For ambient temperatures above 84° F (29° C), the relative humidity is limited to that corresponding to a specific humidity of 0.024 pounds of water per pound of dry air.<br>2. Storage, per TR-NWT-000057: ambient temperatures 84° F (29° C) or less, 10% to 95%. For ambient temperatures above 84° F (29° C), the relative humidity is limited to that corresponding to a specific humidity of 0.024 pounds of water per pound of dry air. |

**Table 4. Power drain for *SPQ*440C and *SPQ*440D POTS/SPOTS CU**

| Condition | Value |
|---|---|
| All channels idle | 1.1 W |
| Each added channel active (T/R r*esistance 600 ohms):* | 1.4 W |
| Each added channel ringing | 0.2 W |

## Installation and Testing

There are no switches to set on this unit. Procedures for testing the unit are given in 363-208-001, *SLC*-2000 *Access System, User/Service Manual.*

The *SPQ*440( ), in all its applications, is compatible with mechanized loop testing (MLT) and the pair gain test controller (PGTC) and the extended test controller (XTC), operating in the PGTC mode, test systems.

The faceplate jack provides easy test access to the tip (T) and ring (R) of all four channels (A, B, C, D) through the channel unit faceplate test cord adapter part number 400395M, available from Telecom Assistance Group, Inc., West Berlin, New Jersey; (1-800-824-7005).

## Faceplate Features

The *SPQ*440( ) channel units share a common faceplate layout. The *SPQ440*( ) has one test access faceplate jack and four red LED indicators; Refer to Figure 1.

The faceplate LEDs indicate as follows:

- **A BUSY** (Red LED): When lit, indicates that the A channel is busy.
- **B BUSY** (Red LED): When lit, indicates that the B channel is busy.
- **C BUSY** (Red LED): When lit, indicates that the C channel is busy
- **D BUSY** (Red LED): When lit, indicates that the D channel is busy

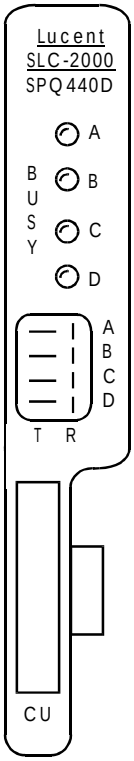


**Figure 1. *SPQ*440D Faceplate Diagram**

**Table 5. Edge Connections For *SPQ*440( ) (RT) POTS/*SPOTS* Channel Unit**

| Finger | Function |
|---|---|
| 1 | Frame Ground |
| 2 | Ringing Ground |
| 3 | T2 (3rd channel) |
| 4 | R2 (3rd channel) |
| 5 | T3 (4th channel) |
| 6 | R3 (4th channel) |
| 17, 20, 21 | Circuit Ground |
| 22, 23, 25, 50 | +5 Volts DC |
| 26 | -48 Volts DC |
| 27 | Ringing |
| 29 | T1 (2nd channel) |
| 30 | R1 (2nd channel) |
| 31 | T (1st channel) |
| 32 | R (1st channel) |
| 49 | -5 Volts DC |

## References

The following documents provide additional information about the *SLC*-2000 Access System:

| | |
|---|---|
| 363-205-004 | *SLC-2000 Access System, Multi-Services Distant Terminal Feature, User/Service and Ordering Manual* |
| 363-206-300 | *DDM*-2000 *FiberReach Multiplexer — Applications, Planning, and Ordering Guide* |
| 363-208-000 | *SLC*-2000 *Access System Applications, Planning, and Ordering Guide* |
| 363-208-001 | *SLC*-2000 *Access System User/Service Manual* |
| 363-208-003 | *SLC*-2000 *Access System Command and Message Manual* |
| 363-208-200 | *Switched Digital Broadband Access System Applications, Planning, and Ordering Guide* |
| 363-208-201 | *Switched Digital Broadband Access System Release 1.01 Optical Network Unit User/Service Manual* |

## Technical Assistance

Follow local procedures for obtaining technical assistance. Lucent Technologies 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 Lucent Technologies Regional Technical Assistance Center at 1-800-225-RTAC.

## Ordering Information

Additional copies of this document (363-005-369) are available from the Customer Information Center — call 1-888-582-3688.

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