AUA252CI2 Intelligent All-Rate OCU Dataport

(For use in SLC®-5/SLC-2000-type Shelves)

CLEI* Code: 5SC47HPEAA

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1. GENERAL

1.1 Document Purpose

This practice describes the Westell AUA252C Issue 2 Intelligent All-Rate Office Channel Unit Dataport (OCU-DP) for use in SLC®-5/SLC-2000-type shelves. Figure 1 shows the front panel of the AUA252CI2.

- NOTE -
Hereafter the AUA252CI2 Intelligent All-Rate OCU Dataport Unit may be referred to as the "OCU-DP" or "AUA."

1.2 Document Status

Whenever this practice is updated, the reason will be stated in this paragraph. Revision A of this practice replaces practice 057-035601, provides a general format update, and updates the company contact information. The Issue 2 equipment provides improved manufacturability and an enhanced sealing current source.

1.3 Product Purpose and Description

Westell's Intelligent All-Rate Office Channel Unit Dataport, (OCU) Model AUA252C Issue 2, provides access to the Digital Data System (DDS), Switched-56 and other compatible networks, through Lucent SLC-5, SLC-2000, or Westell IDB5000 terminal assemblies. The unit provides a terminal interface for primary service rates of 2.4, 4.8, 9.6, 19.2[1], 38.4, 56, and 64 kb/s. Secondary channel service capability is available with line rates of 3.2, 6.4, 12.8, 25.6, 51.2, and 72 kb/s. Switched-56 and Enhanced Switched-56 operation are provided for integrated and

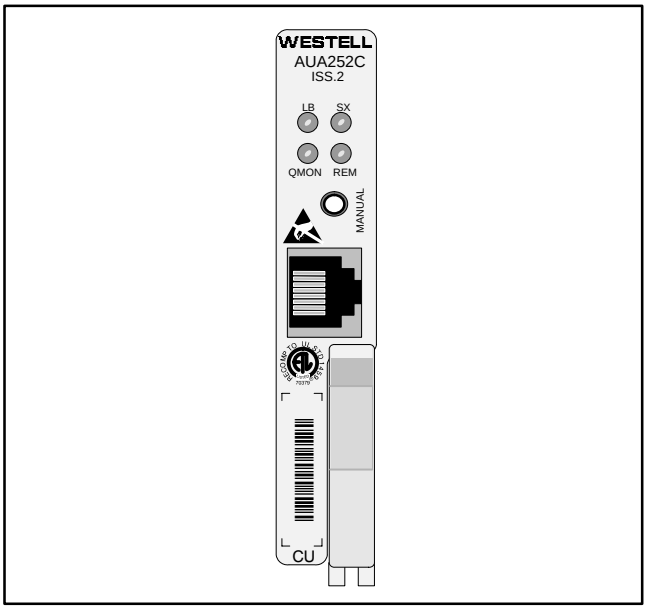

Figure 1. Front View of AUA252CI2

universal SLC configurations. The unit's Automatic Line Build Out (ALBO) receiver detects a maximum attenuated level of 40 dB for subrate speeds, including 19.2 and 38.4 kb/s, and 45 dB for 56 and 64 kb/s rates. The AUA252CI2 provides front panel test access that is compatible with industry standard test equipment and procedures without the use of a Craft Interface Unit (CIU). Front panel LEDs indicate OCU and CSU loopback status, presence of sealing current, poor signal quality, and remote provisioning. Additional features include error correction, zero code suppression, latching loopback and extended range output. All switch options are either remotely provisioned through the DS0 channel, or locally provisioned with option switches. Remote or local provisioning is selected with a front panel push button switch and its state is displayed by a front panel LED.

1.4 Product Mounting

The AUA mounts in a single channel unit position of a SLC-5 or SLC-2000 assembly (or a Westell IDB5000 Series terminal assembly) and provides the interface between the DSX-0 loop and the channel bank's common equipment.

1.5 Product Features

Features of Westell's AUA are as follows:

[1] Licensed under Patent No. 4,862,480.

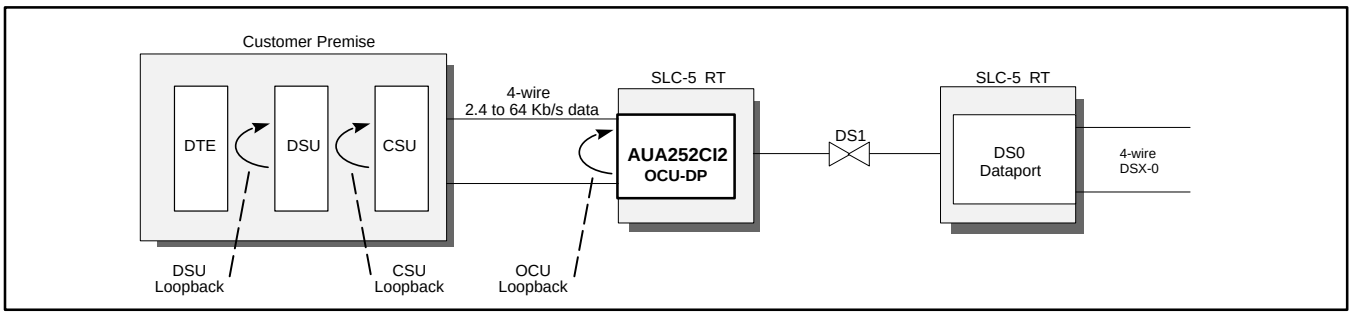

Figure 2. Network Application

- Compatible with existing Digital Data System (DDS) equipment, Basic Dedicated Digital Service (BDDS), and Switched-56 Service
- Provides 2.4, 4.8, 9.6, 19.2, 38.4, 56, and 64 kb/s service rates
- Secondary channel data transmission at all bit rates (except 64 kb/s)
- Automatic Line Build Out (ALBO) provides a minimum dynamic range of 40 dB for 19 to 26 gauge non-loaded cable facilities at all sub-rates, and 45 dB at 56 and 64 kb/s
- Extended range option provides an additional 6 dB boost when unit detects a loop with more than 34 dB of loss
- Switched-56 & Enhanced Switched-56 operation in integrated and universal configurations
- Switch-selected error correction for all customer service rates (excluding switched-56)
- OCU and CSU loopback with latching loopback option
- Front-panel LED to indicate OCU or CSU loopback status
- Zero Code Suppression option
- Quality Monitor option to prevent excess errors from interfering in a bridge application
- Q-MON LED to indicate when the quality monitor threshold is exceeded
- LED to indicate presence of sealing current
- Front panel LED to indicate a remotely provisioned unit
- Front panel test jack provides far and near test access with standard DDS equipment
- Compatible with in-band control of intelligent DDS channel equipment
- Low power consumption
- Meets or exceeds TA-TSY-000077 and TR-NPL-000157 technical requirements
- Meets TR-TSY-001089 lightning and power cross requirements
- Meets UL 1459 power cross requirements
- 7-year warranty

2. APPLICATIONS

The AUA252CI2 is designed primarily for SLC-5 and SLC-2000 remote terminal applications that provide access to digital data networks via DS1 facilities, as illustrated in Figure 2. The unit mounts in a single channel unit position of the remote terminal assembly and provides the interface between a 4-wire digital data customer loop and the remote terminal's common equipment. The customer loop interface allows full-duplex transmission of bipolar, Return To Zero (RTZ) data between the remote terminal and the Customer Premise Equipment (CPE) at standard data rates of 2.4 through 64 kb/s. The AUA252CI2 can also be used in COT applications when the switch presents an OCU interface.

2.1 Customer Loop Range

Automatic Line Build-Out (ALBO) circuitry provides a maximum loss range of 40 dB on 19 to 26 AWG non-loaded cable at all service rates below 56 kb/s. The maximum loss range for data rates 56 kb/s and above is 45 dB. A 6 dB transmit signal boost can be optioned with the EXTENDED RANGE (EXRG) SWITCH and is operational for 56 kb/s or higher rates to support DSU equipment that has insufficient loss range.

2.2 Secondary Channel Capability

In addition to interfacing the primary service rates, the OCU-DP is equipped to accommodate secondary channel data. Secondary Channel Capability allows a customer with a secondary channel capable Data Service Unit (DSU) to transmit and receive data over a low speed secondary channel simultaneously with the high speed primary data. The secondary channel data rates are listed in Table 1. The secondary channel is typically used in applications such as remote banking where maintenance and control data must be communicated between remote equipment and a host computer.

LOOP RATE (Kb/s)	PRIMARY RATE (Kb/s)	SECONDARY RATE (b/s)
3.2	2.4	133.33
6.4	4.8	266.66
12.8	9.6	533.33
25.6	19.2	1066.66
51.2	38.4	2133.33
72	56	2666.66
72	64	NA

Table 1. Data Rates

2.3 Switched-56 Operation

A 56 kb/s station advances on-hook signals to the network by sending Control-Mode-Idle (CMI) signals and off-hook signals by sending Data-Mode-Idle (DMI) signals. An ENHANCED Switched-56 option is provided to force an FEV signal (0101XOV) towards the local loop when the OCU receives an on-hook network signal containing supervisory tones (non Zero Band X111 XXXC). This option allows call progress information towards the local loop. Both integrated and universal SLC configurations are supported.

2.4 Error Correction

The OCU-DP is equipped to provide error correction at all customer service rates to ensure acceptable data error rates on the T1 facility. For sub-rate data up to 9.6 kb/s, error correction is based on a majority count of the byte-stuffed data. At 19.2, 38.4, 56 and 64 kb/s, error correction is based on parity bytes that are generated using the BCH coding scheme and transmitted with the data. At 56, 38.4, and 64 kb/s, the parity byte is transmitted in a separate DS0 channel from the data. The parity byte channel is in the next consecutive channel following the data. Error correction can be disabled when desired.

2.5 Loopback

The OCU-DP provides several loopback modes to facilitate testing and troubleshooting to isolate the source of a failure to the local loop, the CPE, or the network. Loopback modes include: alternating OCU, CSU, DSU, and latching OCU and CSU loopback at data rates of 2.4 to 56 kb/s.

The AUA252CI2 provides both alternating loopback and latching loopback during Switched-56 operation. When operating at 64 kb/s, only the latching loopback modes can be used for testing. The loopback functions are controlled by network control codes transmitted from the Serving Test Center (STC).

2.5.1 Alternating OCU Loopback

As shown in Figure 2, the OCU loopback mode isolates the subscriber loop and CPE from the network by providing a loopback point at the drop-side interface of the OCU-DP. When Alternating OCU loopback is activated, the unit's receive output is looped back to its transmit input and connections to the subscriber loop are open. Alternating OCU loopback remains activated only as long as the unit is receiving Alternating OCU loopback code from the STC.

2.5.2 Alternating CSU Loopback

The CSU loopback mode isolates the CPE from both the subscriber loop and the network by providing loopback at the CPE side of the Customer Service Unit. Upon receiving the Alternating CSU loopback code, the OCU reverses the flow of sealing current towards the CPE. The CPE must detect sealing current reversal to activate loopback. The OCU-DP maintains sealing current reversal, and maintains loopback, as long as it is receiving the Alternating CSU loopback code from the STC.

2.5.3 Alternating DSU Loopback

The DSU loopback mode isolates the customer's DTE from the data transmission path by providing a loopback point at the DTE side of the Data Service Unit. When the OCU-DP detects the Alternating DSU loopback code, it encodes the DS0 network control codes as bipolar violations which are then transmitted towards the CPE over the customer loop. The CPE initiates DSU loopback upon receiving the encoded network commands. The OCU-DP continues to transmit the Alternating DSU loopback code towards the CPE until the network ceases loopback code transmission.

2.5.4 Latching Loopback

The latching OCU and CSU loopback modes provide loopback at the same points as their non-latching counterparts. While the non-latching loopback modes require the presence of the loopback code interleaved with a quasi-random BERT test pattern, the latching loopback modes remain in effect independently of any STC codes other than the latching loopback release code. Because latching loopback remains in effect in the absence of loopback code, a wider range of tests can be performed using various types of test signals and stress patterns. Latching loopback is also supported in Switched-56 operation.

3. FUNCTIONAL OPERATION

Refer to Figure 3 as needed while reading the following functional description.

The AUA252CI2 provides the interface between a 4-wire digital data loop and the common equipment of a Series 5 remote terminal. The functions required at this interface include conversion from sub-rate, 56 or 64 kb/s data in a bipolar, RTZ (Return To Zero) format at the customer loop ports to 64 kb/s DS0 signals, interpretation of network-to-customer and customer-to-network control signals, and error correction. The following paragraphs provide a brief description of all AUA252CI2 functions.

3.1 Transmit Path (Customer-to-Network)

Bipolar RTZ data from the customer loop is applied to the XMT IN port of the OCU-DP. This incoming bipolar signal is transformer coupled to the Loop Interface and Automatic Line Build-Out (ALBO) circuit. The Loop Interface and Automatic Line Build-Out circuit automatically equalize the incoming signal, accommodating a minimum dynamic range of 45 dB for 56 kb/s and above on 19 to 26 gauge facilities, and converts the incoming bipolar RTZ data to a unipolar NRZ signal. The Loop

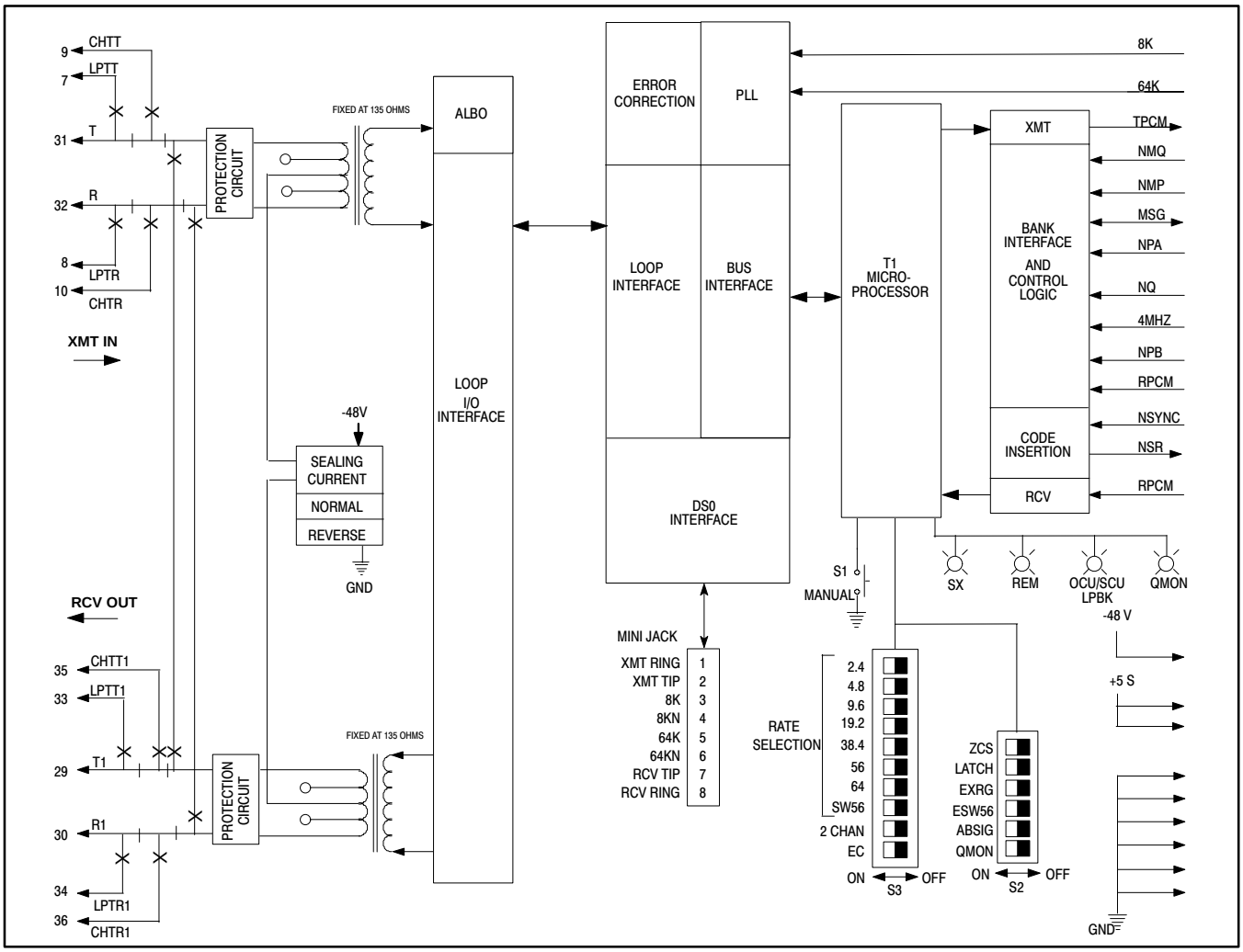

Figure 3. Functional Diagram

Interface also detects bipolar violations that indicate customer-to-network control codes. These customer-to-network control codes are tagged for identification by the Microprocessor. The unipolar output of the Loop Interface circuitry is applied to the Loop/Network Synchronization circuits where incoming data is bit and byte synchronized to the composite data network clock.

3.2 Customer-to-Network Signal Processing

The synchronized data is routed to the Microprocessor where customer data bytes are processed for network control, secondary channel data (when used), and error correction. The data is then converted to 64 kb/s DS0 bytes. Customer data is formed into 8-bit DS0 bytes by adding one network control bit to every 7 data bits at 56 kb/s, and by adding two network control bits to every 6 data bits at 19.2, 38.4 kb/s and sub-rate speeds. The 64 kb/s DS0 bytes are composed of eight data bits. One network control bit is added to each customer data byte (at all baud rates except 64 kb/s) as bit 8 and is used to differentiate between normal data and customer-to-network control bytes. Normal data is indicated by a logic 1 in the bit-8 position; customer-to-network control bytes are indicated by a logic 0. The loop-to-DS0 code map for customer-to-network control codes is given in Table 2. At sub-rate speeds a second network control bit is added as bit 1 of the DS0-A byte. Bit 1 is always sent as a logic 1 by the OCU-DP to maintain secondary channel compatibility.

SIGNAL	LOCAL LOOP CODE	DS0 CODE
IDLE	*X111 X0V	X111 1110
LPBK	X010 X0V	X010 1100
ABNORMAL STATION	— —	X001 1110

**X = Don't care V= Bipolar violation*

Table 2. Customer-To-Network Control Code Map

3.3 Secondary Channel Processing

In normal data transmission, the eighth bit of each data byte indicates network control codes. In secondary channel operation, the eighth bit is shared between this function and the secondary channel data. This process requires special signal formatting on both the customer loop and in the DDS network in order to maintain secondary channel data continuity and synchroniza-

tion (see Table 3). On the transmit side, the OCU-DP performs the necessary translation from the customer loop signal format to that of the data net-work under control of the Microprocessor. Secondary channel operation is selected by the 2 CHAN switch option located on the unit's printed circuit board.

	BIT POSITIONS*								
BYTE	1	2	3	4	5	6	7	8	9
Sub-rate Loop Byte	D	D	D	D	D	D	F	C	
Sub-rate Network Byte	1	D	D	D	D	D	D	C	
56 Kb/s Loop Byte	D	D	D	D	D	D	D	F	C
56 Kb/s Network Byte	D	D	D	D	D	D	D	C	
64 Kb/s Network Byte	D	D	D	D	D	D	D	D	

** D Bit: Primary Channel. F Bit: Framing Bit (1011 1100 pattern). C Bit: Multiplexed Secondary Channel data and control status*

Table 3. Secondary Channel Byte Format

3.4 Switched-56 Operation

In the Switched-56 mode, the OCU-DP enters a maintenance mode during Alternating loopback or Latching loopback operation. Conventional 56 kb/s DDS testing is allowed while the AUA252C is in the loopback mode. Switched-56 operation is restored after loopback is removed.

A 56 kb/s station advances on-hook signaling by sending control-mode-idle transmission signals and off-hook signaling by sending data-mode-idle transmission signals. When the network sends an off-hook signal towards the OCU-DP set for switched 56 operation, the OCU-DP controls transmission signaling so that all signals sent towards the station are data signals. All NETWORK-to-CPE signals are stuffed with a network control bit that corresponds to the AB signaling status. With the ENHANCED Switched-56 option enabled, call progress information is also mapped towards the CPE.

3.5 Error Correction

The OCU-DP provides majority logic error correction for sub-rate data up to 9.6 kb/s. The unit takes advantage of byte-stuffed rate matching to implement majority logic error correction on the transmit side. To match the 64 kb/s DS0 rate, sub-rate data bytes are repeated 5, 10, or 20 times for customer data rates of 9.6, 4.8, and 2.4 kb/s respectively. The OCU at the other end of the circuit compares the repeated bytes to derive an error corrected signal. Error correction at all speeds can be disabled when desired.

The OCU-DP provides parity byte error correction for 19.2, 38.4, 56 and 64 kb/s data. Parity bytes are formed by the Microprocessor using the BCH parity code. At 19.2 kb/s, parity bytes are sent with the data bytes (i.e., in the same DS0 channel time slot). Since the microprocessor must arrange sub-rate DS0 bytes into 5-byte blocks to accommodate majority logic error correction, it is convenient to do the same for 19.2 kb/s DS0-A and DS0-B bytes. Therefore, in the 19.2 kb/s DS0-A byte format (error corrected) data is sent in the following manner: two data bytes, two parity bytes (one for each data byte), and a synchronization byte (which is the complement of the second parity byte and is used to mark the end of the five-byte block). In the 19.2 kb/s DS0-B byte format (no error correction), data is sent as follows: unassigned mux, two data bytes (with most significant bits having leading 1s used for synchronization), and two unassigned mux bytes (see Table 4). Due to bandwidth limitations, parity bytes for 38.4, 56 and 64 kb/s data must be sent in a separate DS0 channel time slot from the data bytes. The parity byte is assigned to the even channel following the data channel.

BYTE POSITION	DS0-A	DS0-B
1	data-1	unassigned mux
2	data-2	data-1
3	parity-1	data-2
4	parity-2	unassigned mux
5	pairity-2 complement	unassigned mux

Table 4. Network 19.2 Kb/s Byte Block Format

3.6 Data Bus Interface

The processed data is clocked out of the microprocessor's Speed Buffer. This buffer is a 3-byte elastic register that phase synchronizes the data bytes to the framed PCM DS0-A channel. The synchronized bytes are read out of the OCU-DP to the remote terminal common equipment interface circuit. The XMT Bus Interface circuit contains the necessary logic to generate the transmit time slot window and the common control channel unit identification.

3.7 Receive Path (Network-to-Customer)

The receive path of the OCU-DP operates in essentially the reverse of the transmit path; 64 kb/s DS0 bytes from the common equipment are converted to customer data bytes at customer data rates of 2.4, 4.8, 9.6, 19.2, 38.4, 56 or 64 kb/s, and sent to the CPE via a 4-wire loop. The 64 kb/s DS0 bytes are read into the OCU-DP channel unit via the RDATA lead under control of the RCV Bus Interface circuit. The RCV Bus Interface circuit contains the logic required to generate the receive time slot window and common control channel unit identification. The received DS0 bytes are applied to the Code Insertion circuit, which also monitors the CGA status from the common equipment. If the CGA signal is active (indicating the remote terminal has lost synchronization to the DS1 bit stream) a MUX-OUT-OF-SYNC code is sent to the CPE. Otherwise, the DS0 bytes are applied to the Error Correction circuit.

3.8 Receive Error Correction

Error correction on the OCU-DP is controlled by the Microprocessor. The Microprocessor automatically sets the Error Correction circuit to provide majority logic or parity byte error correction - depending on the selected customer service rate. Majority logic error correction used for sub-rate data up to 9.6 kb/s is based on a best 3-out-of-5 byte voting scheme. The microprocessor locates and marks the boundaries of the 5-byte blocks received data used for the majority count, and the Error Correction circuit outputs a single-corrected byte. Error correction at all speeds can be disabled when desired.

Parity byte error correction, used for 19.2, 38.4, 56 and 64 kb/s data, is based on BCH encoded parity bytes. Parity bytes for 19.2

kb/s data are located by the microprocessor using a synchronization byte sent from the distant OCU. The location of the parity byte for 56 and 64 kb/s data, is in the second DS0 channel following the data time slot.

3.9 Loopback

The error-corrected data is routed to the Microprocessor where it is interrogated for network control codes and secondary channel data and converted to the baseband rate. The network control codes are indicated by a logic 0 in the bit-8 position of the DS0 byte. Network-to-Customer control codes and the DS0 equivalents are listed in Table 5.

The majority of the network control codes are simply mapped to the customer loop; Exceptions to this rule are the OCU and CSU loopback codes. When the OCU loopback code is detected, the microprocessor instructs the Loopback Control circuit to operate the OCU relay and light the front-panel OCU/CSU LPBK LED. When the OCU relay is operated, the channel unit's receive output is connected to its transmit input and the connections to the customer loop are isolated. The OCU-DP remains in the OCU loopback mode until the OCU loopback code has been absent for a period of time determined by the customer data rate. When the CSU loopback code is detected, the microprocessor instructs the loopback control circuit to operate the CSU relay and light the front-panel OCU/CSU LPBK LED. When the CSU relay is operated, sealing current is reversed to the CPE indicating to the channel service unit that CSU loopback code has been received from the network. CSU loopback is maintained until the CSU loopback code has been absent for a period of time determined by the customer data rate.

SIGNAL	DS0 CODE	LOCAL LOOP CODE
IDLE	S111 1110	S111 X0V
CHANNEL LPBK	S010 1000	S010 100
DSU LPBK	S010 1100	S010 X0V
ABNORMAL STATION	S001 1110	S001 X0V
MUX-OUT-OF-SYNC	S001 1010	S001 X0V
UNASSIGNED MUX CHAN	S001 1000	S001 X0V
TEST CODE	S001 1100	S01 X0V
TEST ALERT	S110 1100	S110 X0V
MJU ALERT	S111 0010	S111 001
LPBK ENABLE	S101 0110	S101 011
FAR-END VOICE	S101 1010	S101 X0V
TRANSITION IN PROGRESS	S011 10101	S011 X0V
BLOCK CODE	S000 1010	S000 X0V
RELEASE	S111 1000	S111 X0V

X = either 1 or zero. V = Bipolar violation. S = 1 or 0 for 56 kb/s only

Table 5. Network-To-Customer Control Code Map

3.10 Latching Loopback

The OCU-DP also provides a latching loopback function for both OCU and CSU loopback points. Latching loopback is identical to its non-latching counterparts except that latching loopback is maintained in the absence of actual loopback code. This allows use of codes other than the standard loopback codes for circuit testing. Both OCU and CSU latching loopback modes are activated and deactivated by the predefined control code sequences sent from the network. Latching loopback control code sequences are given in Table 6.

Enable Sequence	Bytes Sent	Byte Name	Network Code
1	35-40	Transition In Progress (TIP)	*S0111010
2	35-40 OR 35-40	OCU Loopback Select Code (LSC) CSU Loopback Select Code (LSC)	S1010101
3	100-200	Loopback Enable (LBE)	S1010110
4	10-40	Far End Voice (FEV)	S1011010
Disable	35-40	Transition In Progress (TIP)	S0111010

**S = Subrate framing bit; not used for detection of the DS0 code.*

Table 6. Latching Loopback Codes

3.11 Subscriber Loop Interface & Extended Range

The unipolar NRZ output of the microprocessor is applied to the loop interface circuit where it is converted to a bipolar, RTZ signal suitable for transmission on the customer loop. Network-to-customer control codes are mapped to the customer loop as bipolar violations, which are inserted into the data by the loop interface circuit. The loop interface circuit also provides the OCU-DP's extended range feature. Newer CSU/DSU designs with sensitive receivers allow facility losses of up to 45 dB. CSU/DSU receivers with limited range at 56 kb/s can be compensated by the OCU extended range option, which boosts the receiver signal by 6 dB when cable loss is sensed to be greater than 34 dB.

3.12 Channel Unit Common Circuitry Timing

Data network synchronization for the OCU-DP is derived from the composite clock from the backplane. The composite clock signal consists of integrated bit (64 kb/s) and byte (8 kb/s) clock signals.

3.13 Sealing Current

The OCU-DP sealing current for the customer loop via simplex leads provided by the transformer coupling circuits. The unit's current source consists of a 1500 ohm limited battery feed. The amount of sealing current supplied by the OCU-DP is dependent on the loop length of the 4-wire facility. Continuous application of sealing current helps prevent transmission degradation by breaking down resistance that may build up at non-soldered cable splices. The OCU-DP reverses polarity of sealing current via the CSU relay contacts to initiate customer loopback.

3.14 Carrier Group Alarm (CGA)

Whenever a disruption of service to a data customer occurs, the OCU-DP sends the MUX-OUT-OF-SYNC code to the CPE. The service disruption can be caused by either an out-of-frame condition in the remote terminal equipment or by loss of synchronization in the DS0 byte stuffed block.

4. INSTALLATION

- INSPECTION NOTE -

Visually inspect the unit for damages prior to installation. If the equipment was damaged in transit, immediately report the extent of the damage to the transportation company and to Westell (see Part 8 for telephone number).

- PRECAUTIONARY STATEMENT -

Never install telephone wiring during a lightning storm.

Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.

Never touch uninsulated telephone wires/terminals unless the telephone line is disconnected at the network interface.

Use caution when installing or modifying telephone lines.

CAUTION - STATIC-SENSITIVE

This product contains static-sensitive components! Proper electrostatic discharge procedures must be followed to maintain personal and equipment safety. Do not store near magnetic, electromagnetic or electrostatic fields. Always store or ship units in the original static-protective packaging.

- NOTE -

The central office terminal requires an AUA3 OTU Office Timing Unit clocked by a composite clock signal from an office timing reference, preferably a Building Integrated Timing Supply (BITS).

4.1 Mounting Location

The AUA252CI2 mounts in one channel unit position of Lucent SLC-5, SLC-2000 or Westell IDB5000 Series Central Office Terminal (COT) assemblies, or the equivalent.

- CAUTION -

Use care when installing and removing modules - *do not force a module into place*. If a module resists insertion, remove it and check for obstructions in or near the connectors and mounting slots. The module may then be carefully aligned and gently re-inserted.

4.2 Installer Connections

Installer connections for the drop-side ports of the OCU-DP and the subscriber loop are made via the connectorized cables of the SLC-5, SLC-2000, or IDB5000 COT assembly. All other connections required by Westell's AUA252CI2 including power, are integral to the channel bank or terminal assembly.

5. PROVISIONING

The OCU is provisioned either remotely through the DS0 channel or locally with option switches. A front panel LED displays the remote (REM) provisioning status. The AUA252CI2 contains option switches that condition the unit for proper operation in a given application. All options should be set according to the WORD document.

5.1 Toggling Local/Remote Provisioning

Depress the front panel **MANUAL** push button for more than 3 seconds to toggle between **local** or **remote** provisioning. All options are programmed by switches or optioned through the network DS0 channel. The REM LED is off when locally optioned. If the unit is remotely optioned and later optioned locally, the remote options can be restored by depressing the MANUAL switch for more than 3 seconds. The REM LED should turn on. (The factory default is *local* provisioning.)

- NOTE -

The unit will be set to OCU Latching Loopback if the MANUAL push button switch is depressed for less than 2 seconds. Push the MANUAL push button switch for less than 2 seconds a second time to remove the Latching OCU Loopback.

5.2 Local Provisioning

To provision the unit locally, set the switch options on the board. As described in Figure 4 and Table 7.

5.2.1 Rate Selection

Set the appropriate S3 switch to the "ON" position to select the line rate for your application: **2.4, 4.8, 9.6, 19.2, 38.4, 56, 64,** or **SW56.**

5.2.2 Secondary Channel Operation

If secondary channel operation is required, set option switch S3-9 (**2 CHAN**) to the "ON" position.

5.2.3 Error Correction

If error correction for any rate is required, select switch S3-10 (**EC**) to the "ON" position. Rates 2.4, 4.8, and 9.6 use majority vote error correction within its single time slot; 19.2 error correction is also accomplished within its own timeslot.

- NOTE -

The second time slot associated with the channel unit's physical position is used for 38.4, 56, and 64 kb/s rates.

Switched-56 error correction is not network supported and is not provisionable.

5.2.4 Zero Code Suppression

When switch S2-1 (**ZCS**) is set to "OFF", the AUA252CI2 allows eight consecutive zeros to be transmitted to the network. If zero code suppression is set to "ON", a string of eight zeros is encoded to ensure adequate ones density in the network's DS1 facility. Zero code suppression is automatically disabled for 56 kb/s with secondary channel and 64 kb/s channel services.

5.2.5 Latching Loopback

If latching loopback operation is required, set switch S2-2 (**LATCH**) to the "ON" position. This option is also supported with Switched-56 operation.

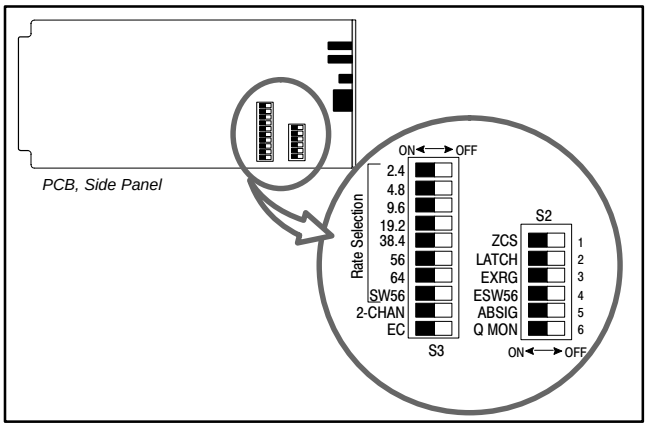

Figure 4. Option Switches

Switch # and Label	Position	Function
S3-1 thru S3-8 Rate Selection 2.4, 4.8, 9.6, 19.2, 38.4, 56, 64, SW56	ON*	Select rate by setting one switch to ON and the rest to OFF.
	OFF	Rate not selected.
S3-9 2 CHAN	ON	Enables secondary channel operation.
	OFF	Disables secondary channel operation.
S3-10 EC	ON	Enables error correction.
	OFF	Disables error correction.
S2-1 ZCS	ON	Enables Zero Code Suppression (ZCS) to prevent all zeros toward network, normally set to "ON" for 56 kb/s (without secondary channel) & lower rates.
	OFF	Disables ZCS to allow all zeros toward network (ZCS is automatically disabled, OFF, for 56 kb/s with Secondary Channel and 64 kb/s rates).
S2-2 LATCH	ON	Enables latching loopback.
	OFF	Disables latching loopback.
S2-3 EXRG	ON	Enables a 6 dB RCV OUT boost when loop loss is greater than 34 dB for 56 Kb/s or higher rate.
	OFF	Disables 6 dB RCV OUT boost.
S2-4 ESW56	ON	Enables call progress information to the CPE.
	OFF	Disables call progress information to the CPE.
S2-5 ABSIG	ON	Derives AB signaling from channel bank hardware.
	OFF	Derives AB signaling automatically from DS0 channel.
S2-6 QMON	ON	Enables loop disconnect upon detection of poor signal quality.
	OFF	Disables quality monitor.

** Only one rate switch (S3-1 thru S3-8) can be set to ON for a given application. All switch options are reconfigurable with remote provisioning (see REM LED).*

Table 7. Option Switch Settings

5.2.6 RCV OUT Extended Range

Customer DSU receivers with limited dynamic range at 56 kb/s can be compensated by the OCU extended range option. Set switch S2-3 (**EXRG**) to the "ON" position to boost the receive out signal by 6.0 dB for 56 kb/s or higher rates. The signal is boosted only if cable loss is sensed to be greater than 34 dB.

5.2.7 Enhanced Switched-56

With Switched-56 operation, call progress information transfer towards the CPE is enabled with switch S2-4 (**ESW56**) set to the "ON" position. Use this option operating with a newer generation DSU that provides call progress information on its front panel display or speaker.

5.2.8 Switched-56 AB Signaling

Switched-56 network-to-CPE signals are received in either streamed format or AB bit-robbed signaling format. Streamed signals can originate from an intermediate DS0 tandem point that converted AB bit- robbed signals to streamed ones. AB bit-robbed signals originate from the serving central office switch and are required to be in the streamed form towards the DSU. Set option switch S2-5 (**ABSIG**) to the "ON" position to derive AB signals from the backplane hardware of the channel bank. When the **ABSIG** option is set to "OFF", the unit automatically detects and recovers signaling from the DS0 channel only.

5.2.9 Quality Monitor

In digital bridging applications, errored upstream signals from noisy CPE or facilities can render the digital bridge inoperable. To prevent bridge lockout, the quality monitor option automatically disables upstream transmission when the bit error rate of 10^{-6} is exceeded. The OCU-DP will then inject an Abnormal Station Code towards the network and will display this state with a lit front panel QMON LED. Bursty errors will not cause the QMON state to activate. The OCU-DP will revert back to its normal state when the error rate is measured to be below the threshold. Set switch S2-6 (**QMON**) to the "ON" position to enable the quality monitor.

5.3 Remote Provisioning

Remote provisioning of all options is accomplished with distinct DS0 codes when the OCU-DP is in the command mode. **All switch options are reconfigurable with remote provisioning**. Remote provisioning is activated by a sequence of DS0 bytes that are similar to the Bellcore defined latching loopback sequence. Once in this mode, provisioning is controlled and status is accessed with an in-band data-link between the remote test equipment (e.g. TPI 108/109 RT II) and the microprocessors in the OCU. The front panel REM LED indicates the remotely provisioned state.

5.3.1 Inventory Information

The following information is available directly from a remote menu:

- Device type
- CLEI Code
- Part Number
- Revision Number
- Serial Number

5.3.2 Diagnostics

The following information is available directly from TPI's remote menu:

- □ Loop Receive Signal yes/no
- □ Loop Sealing Current yes/no
- □ Customer Remote Test Code yes/no
- □ T1 Out-of-Frame yes/no
- □ T1 Out-of-Frame count
- □ Non-volatile Memory Failure yes/no
- □ Configuration Invalid yes/no
- □ Signal Quality poor/good
- □ Streaming Data yes/no
- □ Idle Loop Circuit yes/no
- □ New Device yes/no
- □ Receive Signal Level loss (dB)
- □ Bipolar Violation Errors
- □ Errored Seconds Count
- □ Elapsed Minutes Count
- □ Device Self Test pass/fail
- □ Clear New Device State
- □ Clear Status Report
- □ Reset Device

5.4 Channel Bank Provisioning

Channel slot provisioning information, entered through a Craft Interface, is required by the SLC-5 or SLC-2000 system to allow the channel unit to be recognized and operate properly. Through the Craft Interface, address the appropriate system, terminal, and slot number, and enter the following information.

- Enter the **CLEI** as **5SCU48**. This code is used, rather than the AUA252CI2's actual CLEI, in order for the SLC-2000 system to recognize the unit as an OCU-DP.
- Select the **Function Code as OCU**.
- Select a **Data Rate** to match the service being provided. This enables the channel bank slot. The AUA252CI2 must be separately provisioned for a matching rate.
- Select the type of **Error Correction** desired, e.g., **SCEC, MVEC,** or **NONE**. This provisions the channel bank to support the correct number of slots for error correction, but does not affect the actual operation of the AUA252CI2.
- Enter a value of **YES** or **NO** for **Secondary Channel Used**. The value entered is not used by the AUA252CI2.
- Enter a value of **YES** or **NO** for **All Zero Code Allowed**. The value is not used by the AUA252CI2.
- Enter a value of **YES** or **NO** for the **Redline** option.

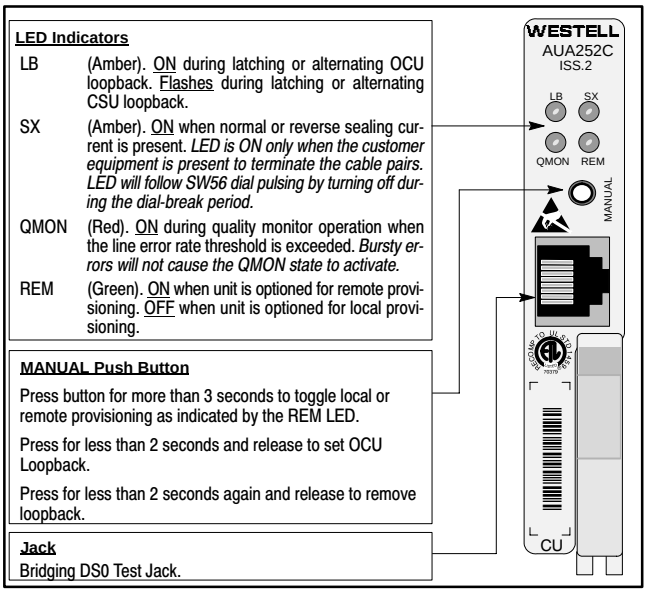

Figure 5. Front Panel Operation

5.5 Clear Channel Capability

When the AUA252CI2 is used in the 64 kb/s mode of operation, it is required that the Digital Loop Carrier System be equipped with a Line Interface Unit (LIU) capable of B8ZS operation to allow unconstrained clear channel capability.

6. FRONT PANEL OPERATION

Please see Figure 5 for a description of the AUA252CI2's front panel operation.

7. TESTING

Initial testing consists of performing the standard test procedures for DDS dataport channel units using the TPI 108/109, or equivalent, receiver and transmitter data test sets. These procedures are intended only to ascertain proper operation of the unit and, if problems should occur, to isolate those problems to the most probable area.

7.1 Front Panel Access

A modular mini-jack on the AUA252CI2 front panel provides logic-level access for testing with standard DDS test equipment. Composite 8 kb/s and 64 kb/s clock signals and receive and transmit channel signals are brought out on the RJ48 jack for far and near test set access. With respect to the AUA252CI2, "far" is towards the carrier, and "near" is towards the loop.

7.2 Trouble Reporting

If trouble is encountered, verify all installer connections to the assembly and check that the CO power fuse is not blown. Also verify all module connections and option switch settings, and verify the modules are making a positive connection with the shelf connector. If trouble persists, replace the suspect unit and

repeat procedures outlined. These procedures are not designed to effect repairs or modifications. Any tests beyond those outlined herein, or repairs made beyond replacing a faulty unit, are not recommended and may void the warranty.

8. CUSTOMER & TECHNICAL SERVICES

If technical or customer assistance is required, contact Westell by calling or using one of the following options:

Voice: (630) 898-2500
Voice: (800) 323-6883
email: *global_support@westell.com*

Visit the Westell World Wide Web site at http://**www.Westell.com** for additional information about Westell.

9. WARRANTY & REPAIRS

9.1 Warranty

Westell warrants this product to be free of defects at the time of shipment. Westell also warrants this product to be fully functional for the time period specified by the terms and conditions governing the sale of the product. Any attempt to repair or modify the equipment by anyone other than an authorized Westell representative will void the warranty.

9.2 Repair and Return

Westell will repair or replace any defective Westell equipment without cost during the warranty period if the unit is defective for any reason other than abuse, improper use, or improper installation. Before returning the defective equipment, first request a Return Material Authorization (RMA) number from Westell. Once an RMA number is obtained, return the defective unit, freight prepaid, along with a brief problem description, to:

Westell, Inc.
ATTN: R.G.M. Department
750 N. Commons Drive
Aurora, IL 60504-7940

Replacements will be shipped in the fastest manner consistent with the urgency of the situation. Westell will continue to repair or replace faulty equipment beyond the warranty period for a nominal charge. Contact Westell for details.

10. SPECIFICATIONS

The electrical specifications and the compliance/regulatory agency specifications are listed below, the ordering information is shown in Table 9, and the physical specifications are shown in Table 8.

Feature	U.S.	Metric
Height	3.5 in.	8.9 cm
Width	0.64 in.	1.6 cm
Depth	9.85 in.	25 cm
Weight (approx.)	14 oz.	400 g
Operating Temp.	-49° to +149°F	-45° to +65°C
Humidity	0 to 95% (no condensation)	

Table 8. Physical Specifications

Electrical Specifications

A. Network Interface: 64 Kb/s DS0-A.

B. Primary Service Rates: 2.4, 4.8, 9.6, 19.2, 38.4, 56, and 64 Kb/s.

C. Rate Matching: 64 Kb/s sub-rate byte stuffing.

D. Duty Cycle Conversion: Bipolar Return-to-Zero (RTZ) to Unipolar Non-Return-To-Zero (NRZ).

E. Network-to-Customer Code Map: See Table 5.

F. Customer-to-Network Code Map: See Table 2.

G. Code Recognition: Recognizes and responds to all DDS-compatible network-to-customer and customer-to-network control codes per Technical Advisory TA-TSY-000077.

H. Timing: Derived from composite clock (64 Kb/s bit and 8 Kb/s byte).

I. DS0 Control Bit Insertion: Bit 8 set to logic 1 for customer data, or logic 0 for control data.

J. Pulse Amplitude and Extended Range (toward CPE): 1.66 Vp max. @ 1.2, 2.4, 4.8, 19.2, 56 or 64 Kb/s; 0.83 Vp max. @ 9.6 Kb/s, 3 V Max. @ 56 Kb/s and above when extended range is enabled and loop loss is > 34 dB.

K. Facility Impedance: 135 Ohms from 100 Hz to twice the line rate.

L. Sealing Current: 1500 ohm limited battery feed; polarity can be reversed under network control.

M. Automatic Line Build Out (38.4 Kb/s and below): 0 to -40 dB (min) dynamic range at half the bit rate for 19 to 26 gauge facilities.

N. Automatic Line Build Out (56 Kb/s and above): 0 to -45 dB (min) dynamic range at half the bit rate for 19 to 26 gauge facilities.

O. Secondary Channel Bit Rates and Byte Format: Per TR-NPL-000157 (see Table 1 and Table 3).

P. Power: -48 V, and -5 VDC and +5 VDC supplies.

Q. Power Consumption: 1.0 Watt, nominal.

R. Applicable Technical References: TA-TSY-000077, TR-NPL-000157, AT&T Pub 62310 Rev. dated 11/87.

Part #	Description
AUA252CI2	SLC-5/SLC-2000 Intelligent Office Channel Unit Dataport (OCU-DP). *CLEI* Code: 5SC47HPEAA. Barcode: 239275.*

**CLEI is a trademark of Telcordia Technologies.*

Table 9. Ordering Information