

Quad Circuit (3638-80) and Dual Circuit (3638-81) ISDN Channel Unit

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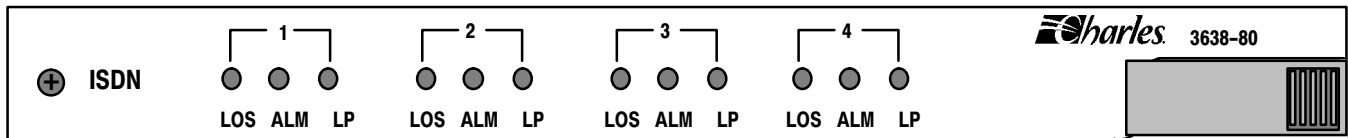


Figure 1. Quad Circuit ISDN Front Panel (3638-80)

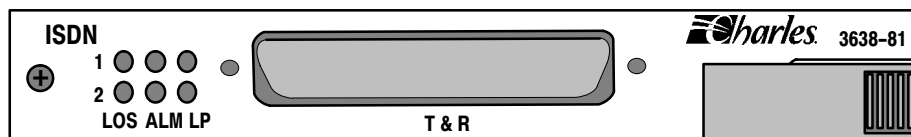


Figure 2. Dual Circuit ISDN Front Panel (3638-81)

1. GENERAL

1.1 Document Purpose

This document provides general, installation and testing information for the quad and dual circuit ISDN channel units. This document covers the following model numbers:

Model Number	Description	Figure
3638-80	Quad Circuit ISDN Channel Unit	Figure 1
3638-81	Dual Circuit ISDN Channel Unit	Figure 2

1.2 Equipment Function

The ISDN unit is part of the 360-80 Intelligent Channel Bank (ICB). This unit provides a means to extend 2B+D U-interface ISDN channels from an ISDN switch to a remote location over T1/E1 facilities. Each circuit on this unit requires three DS0 time slots for the full 2B+D service.

1.3 Equipment Location/Mounting

The Quad Circuit ISDN Channel unit plugs into any full-size slot of the Charles 360-80 ICB. The Dual Circuit ISDN Channel unit plugs into the half-size slot of the 360-80 ICB.

1.4 Equipment Features

The ISDN unit provides the following features:

- Basic rate 2B+D ISDN service to remote locations over existing single, twisted pair wiring
- NT or LT operational mode (provides optional sealing current to loop connected devices in LT mode)
- Manual local and remote loopback in NT operation
- 18 Kft nominal range on mixed gauge wire
- ISDN 2B1Q interface meets all Layer1 requirements, per ANSI T1.601-1992
- Transports ISDN Basic Rate 2B+D over T1/E1 facilities in the 3-DS0 format, per TR-NWT-000397
- All Layer1 maintenance functions
- Performance monitoring of the Layer1 facility, per TR-NWT-000397
- Distinctive metallic DC test signature identifies either LT or NT line unit mode of operation, per TR-NWT-000397
- Loopback detection for full 2B+D and individual B channels in both T1/E1 and loop directions through the maintenance channel
- Front panel LEDs indicate synchronization, alarm and loopback status
- Rear panel connector provides a bipolar composite clock output signal
- Supports 4 circuits of ISDN operation (12 DS0 time slots)
- Temperature hardened (-40 to +65 C)
- Complies with UL 1950, FCC part 68 and FCC part 15.

1.5 Indicators

The Quad/Dual ISDN Channel Unit provides a variety of status information. The following is a list of status information available through the management interface. Except for the composite clock, status information is available for each circuit.

- LOS (Loss-Of-Synchronization) LED state (On, Off)

- ALM (Alarm) LED state (On, Off)
- LP (Loopback) LED state (On, Off)
- Configuration (2B+D, 1B+D, D)
- Time slots used (T1=1–24, none) (E1=1–15, 17–31, none)
- Mode (LT, NT)
- Loopback type (NT mode only) (local, LULT, NT1, none)
- Sealing current (On, Off) (LT mode only)
- Message code detected (request corrupted CRC, return to normal, hold state, none)
- Composite clock source for output (circuit 1–4, none)

1.6 Control Interface

The Quad/Dual ISDN Channel Unit is managed through the craft port or the Network Management Software (NMS) that controls the provisioning of the unit and obtains status information from the unit. Provisioning is described in the Optioning section of this document. For operation, see the craft port or NMS documentation.

This unit will maintain its default provisioning until that provisioning is altered through the control interface. If this unit's provisioning is changed, it will maintain the new provisioning even if power is lost. If replaced with a new unit, the new unit will default to the same provisioning as was set for the prior unit. If this unit is installed in a location that was used by a different type of unit, this unit will use its own default provisioning.

2. INSPECTION

2.1 Inspect for Damages

Inspect the equipment thoroughly upon delivery. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company.

2.2 Equipment Identification

Charles equipment is identified by a model and issue number imprinted on the front panel or located elsewhere on the equipment. Each time a major engineering design change is made on the equipment, the issue number is advanced by 1 and imprinted on subsequent units manufactured. Therefore, be sure to include both the model number and its issue number when making inquiries about the equipment.

2.3 Static Concerns

Each unit is shipped in static-protective packaging to prevent damages from electrostatic charges. Use approved static-preventive measures, such as static-conductive wrist straps and a static-dissipative mat, when handling units outside of their protective packaging. A unit intended for future use should be tested as soon as possible and returned to its original protective packaging for storage.



STATIC-SENSITIVE



This equipment contains static-sensitive electronic devices. To prevent electrostatic charges from damaging static-sensitive units:

- **Use approved static-preventive measures (such as static-conductive wrist straps and static-dissipative mats) at all times whenever touching units outside of their original, shipped, protective packaging.**
- **Do not ship or store units near strong electrostatic, electromagnetic, or magnetic fields.**
- **Always use the original static-protective packaging for shipping or storage. Return a tested unit to its original protective packaging for storage.**

3. APPLICATION GUIDELINES

The ISDN unit may be used at both the central office terminal (COT) location and the remote terminal (RT) location. See Figure 3 for configuration based on location.

ISDN Basic Rate information is transported over a carrier in the 3-DS0 format, as specified in TR-NWT-000397. Three time slots are required to support both B channels and the D channel. Using the DS0 format, the B channels are used to carry digitized voice or 64 kbps data, and the remaining D channel and overhead bits are encoded into the third DS0 time slot, referred to as the D+ channel.

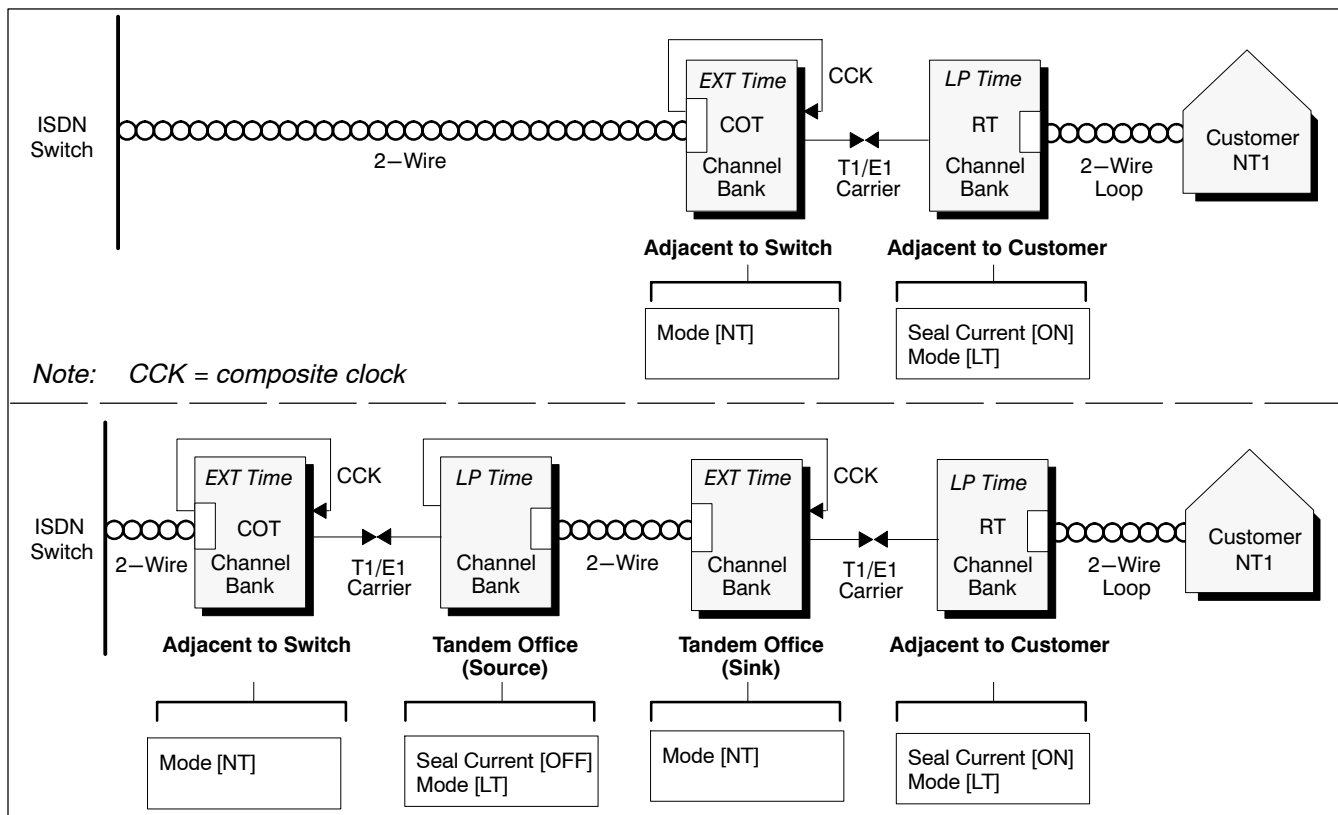


Figure 3. Configuration Settings at Network Locations

4. CIRCUIT DESCRIPTION

The ISDN unit design consists of a network interface and a 2W Loop U-interface, with a control section, a sealing current source, and lightning protection, as shown in Figure 4.

4.1 Network Interface

The network interface is a gate array and associated backplane interconnect circuitry. This device is configured by a serial link from the control section and communicates through the interchip digital link (IDL) with the U-interface.

The network interface provides the conversion between 64 Kbit/s DS0 time slots of the carrier bit stream and the U-interface. The interface handles the time slot assignment. In addition, the interface generates a cyclic redundancy check (CRC) for outgoing data as well as monitoring the CRCs of incoming data for the detection of errors. Error counts are maintained so that the carrier's bit error rate performance can be made available to the network.

ISDN Basic Rate information is transported over a carrier in the 3-DS0 format, as specified in TR-NWT-000397. Three time slots are required to support both B channels and the D channel. Using the DS0 format, the B channels are used to carry digitized voice or 64 kbps data, and the remaining D channel and overhead bits are encoded into the third DS0 time slot, referred to as the D+ channel (as shown in Table 1).

Bit 5 of the D+ octet is reserved for the transmission of maintenance information over the carrier. This maintenance information allows for performance monitoring of a specific line unit, LT, or NT through the CRC and Far End Block Error (FEBE) bits from bit error rate information which is stored in the memory of the respective unit. This information is passed through the Embedded Operations Channel (EOC) within the maintenance channel. The multiplexing scheme is shown in Figure 5. The ISDN unit is required to respond to EOC codes when appropriate. The EOC commands specified in ANSI T1.601-1992 are listed in Table 2.

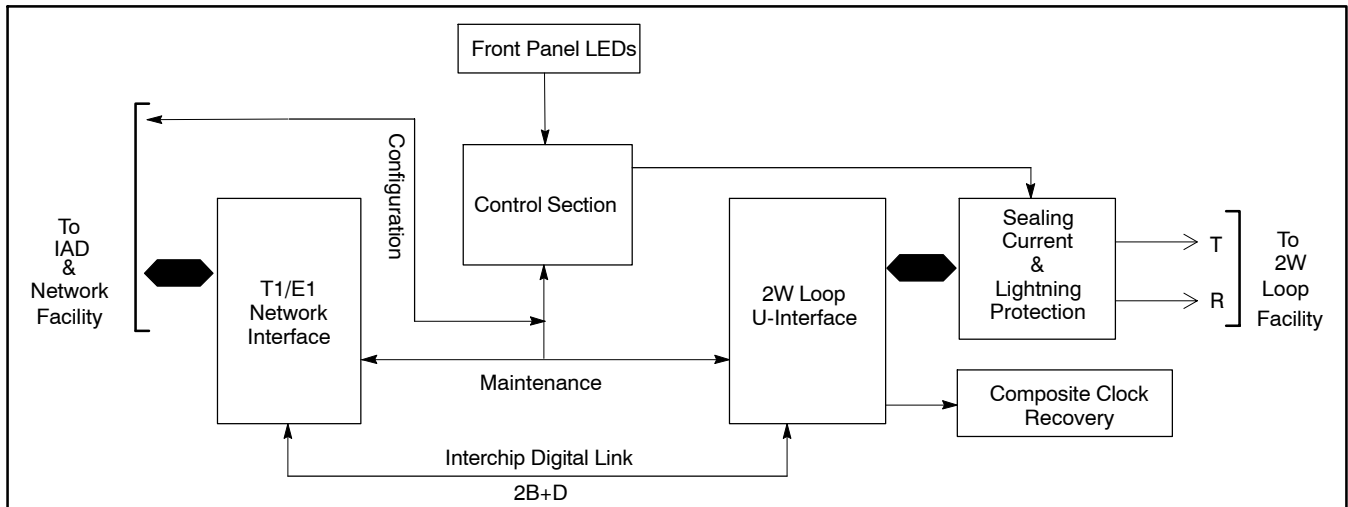


Figure 4. ISDN Unit Functional Block Diagram

Table 1. D+ Channel Bit Assignment

Bit#	Description	Bit#	Description
1	Spare bit. Set to 1 when not used.	5	Maintenance (DSL Overhead) channel bit *
2	DS1 yellow alarm bit. Set to 1, except for alarm.	6	D channel, first bit.
3	Zero byte indicator for B1 time slot. Set to 1 for B1=0.	7	D channel, second bit.
4	Zero byte indicator for B2 time slot. Set to 1 for B2=0.	8	1s Density requirement bit. Set to 1.

* Bit pattern: . . . 1* M₁₁ 0 M₁₂ 0 M₁₃ 0 M₁₄ 0 M₁₅ 0 M₁₆ 0 M₂₁ . . . 0 M₈₆ 1 M₁₁ 0 . . . Where M_{ij} = M-overhead bit *j* from DSL Basic Frame *i*. 1 = DSL superframe mark*

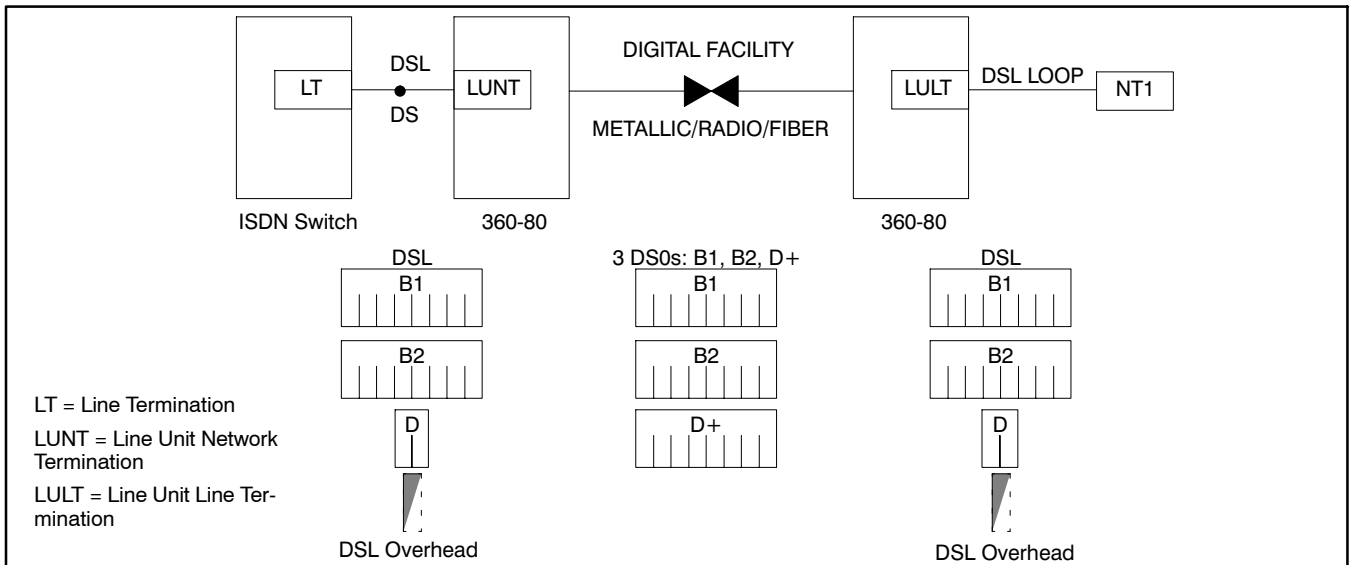


Figure 5. 3-DS0 Time Division Multiplexing of ISDN Basic Access

Table 2. Embedded Operations Channel (EOC) Commands

Message	Encoding	
Operate 2B+D Loopback	0101	0000
Operate B ₁ Loopback	0101	0001
Operate B ₂ Loopback	0101	0010
Request Corrupted <i>crc</i>	0101	0011
Notify of Corrupted <i>crc</i>	0101	0100
Return to Normal	1111	1111
Hold State	0000	0000
Unable to Comply	1010	1010
Channel Test	0010	0000

4.2 2W Loop U-Interface

The 2W loop interface is a U-interface with magnetics and a line interface circuit. This device is configured by a serial link from the control section and can be optioned as either an LT or NT line unit.

The U-interface allows full duplex communications over a single, twisted wire pair. The interface has the following characteristics:

- Rate: 160 Kbit/s full duplex
- Frequency: 40 kHz
- Line Code: 2B1Q
- Max Line Loss: 42 db @ 40 kHz
- Max Distance: 18 kFt w/1300 ohm resistance design
- Frame Format: See Figure 6

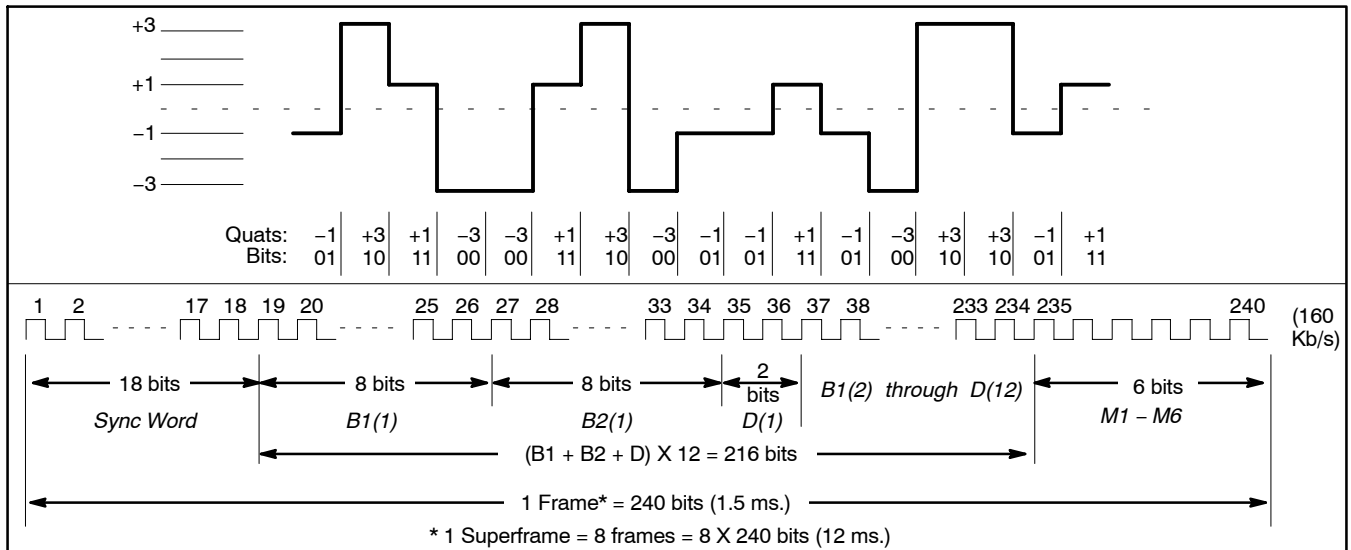


Figure 6. Example of 2B1Q Quaternary Symbols

4.3 Composite Clock Recovery

The composite clock recovery circuit derives timing information from the 2W Loop Interface and creates a composite clock signal to a rear panel connector which may then be used by the ICB's controller unit. Systems requiring synchronization to the 2W loop must use this circuit.

Table 3. Frame Format—Network to NT

	Quat Positions	Framing	12x(2B+D)	Overhead Bits (M ₁ – M ₆)						
		1–9	10–117	118s	118s	119s	119m	120s	120m	
	Bit Positions	1–18	19–234	235	236	237	238	239	240	
Superframe #	Basic Frame #	Sync Word	2B+D	M1	M2	M3	M4	M5	M6	
A							Net to NT	NT to Net		
	1	SW	2B+D	eoca ₁	eoca ₂	eoca ₃	act	act	1	1
	2	SW	2B+D	eocd _m	eoci ₁	eoci ₂	dea	(ps ₁)*	1	febe
	3	SW	2B+D	eoci ₃	eoci ₄	eoci ₅	1	(ps ₂)*	crc ₁	crc ₂
	4	SW	2B+D	eoci ₆	eoci ₇	eoci ₈	1	(ntm)*	crc ₃	crc ₄
	5	SW	2B+D	eoca ₁	eoca ₂	eoca ₃	1	(cso)*	crc ₅	crc ₆
	6	SW	2B+D	eocd _m	eoci ₁	eoci ₂	1	1	crc ₇	crc ₈
	7	SW	2B+D	eoci ₃	eoci ₄	eoci ₅	uoa	(sai)*	crc ₉	crc ₁₀
	8	SW	2B+D	eoci ₆	eoci ₇	eoci ₈	aib	(nib)*	crc ₁₁	crc ₁₂
<p>* For <i>NT to Network</i>, all values are the same except for six values shown in parentheses in the bold-bordered column (4th "Overhead Bit" column). The value within the parentheses is the value used for <i>NT to Network</i>. Therefore, do not use the values in parentheses for "Network to NT".</p> <p><i>Note: 8 x 1.5 ms basic frames to 12 ms superframe. NT-to-Network superframe delay offset from Network-to-NT superframe by 60+/- 2 quats (about 0.75ms). All bits other than the Sync Word are scrambled.</i></p>										
<p>KEY:</p> <p><i>act</i>—Activation bit (set=1 during activation)</p> <p><i>aib</i>—Alarm indication bit</p> <p><i>crc</i>—Cyclic redundancy check, covers 2B+D+M₄ (1 = most significant bit, 2 = next significant bit, etc.)</p> <p><i>cso</i>—Cold-start-only bit (set=1 to indicate cold-start-only)</p> <p><i>dea</i>— Deactivation bit (set = 0 to announce deactivation)</p> <p><i>eoc</i>—Embedded operations channel (a=address bits, dm = data/message indicator (0=data, 1=message), i=information (data or message)</p> <p><i>febe</i>—Far end block error bit (set=0 for errored super-frame)</p> <p><i>nib</i>—Network indicator bit</p>						<p><i>ntm</i>—NT in test mode bit (set = 0 to indicate test mode)</p> <p><i>ps1, ps2</i>—Power status bits (set=0 to indicate power problems)</p> <p>Quat—Pair of bits forming quaternary symbol.</p> <p>s=sign bit (first in quat), m=magnitude bit (second in quat)</p> <p><i>sai</i>—S activation indicator bit</p> <p><i>uoa</i>—U only activation indicator bit</p> <p>"1"—Reserved bit for future standard (set = 1)</p> <p>2B+D—User data, bits 19–234 in frame</p> <p>M—M channel, bits 235–240 in frame</p> <p>SW/ISW—Synchronization word/Inverted synchronization word, bits 1–18 in frame</p>				

5. INSTALLATION

5.1 Installing the Unit

CAUTION

Installation and removal of units should be done with care. Do not force a unit into place. If excessive resistance is encountered while installing a unit, remove the unit and check the card guides and connector to verify proper alignment and the absence of foreign material.

5.1.1. Installing a New Unit

Step	Action
1.	If not already installed, install the rear panel, screwing it to the appropriate mounting locations on the shelf using the provided hardware.
2.	Insert the unit into the shelf, making sure that the unit is aligned with the card guides inside the shelf.
3.	Slide the unit fully in to the shelf.
4.	Once the unit is fully inserted, tighten the securing screw on the front panel of the unit. The unit will perform a self-test to ensure that it is compatible with the network management software on the system.
5.	Wire the unit per the wiring information in the wiring section.
6.	After the self-test is performed, check the software provisioning of the card using either the front panel craft interface on the front of the controller unit or the network management interface on the rear of the controller (see the section on network management for more information).

5.1.2. Installing a Replacement Unit

If you are replacing a unit that is already in service, insure that the unit is the same as the unit being replaced.

Step	Action
1.	Remove the wiring connectors from the front and rear of the unit.
2.	Unscrew the front panel securing screw to release the unit from the shelf.
3.	Using the card ejector, remove the unit from the shelf.
4.	Follow the procedure for installing a new unit.

5.2 Attaching the Rear Panel

Install the rear panel of the unit before the all units are installed in the shelf and before wiring begins.

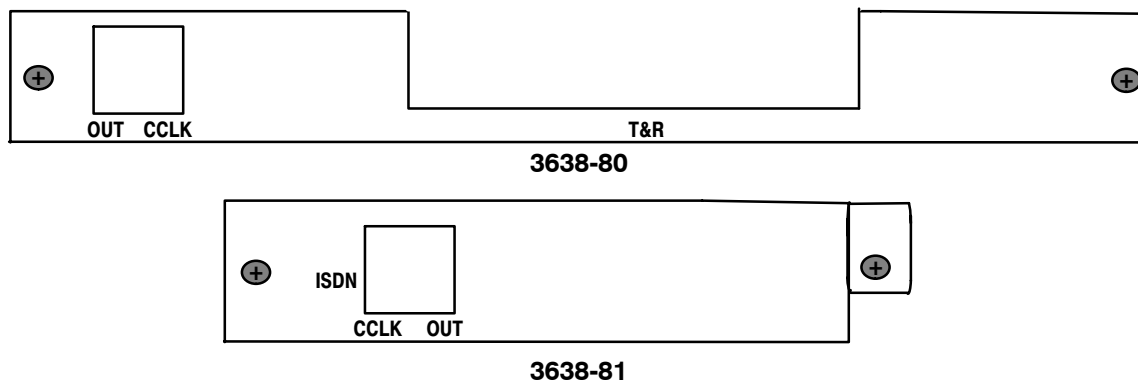


Figure 7. Quad/Dual Circuit ISDN Unit Rear Panels

5.3 Wiring the Unit

When the Quad/Dual Circuit ISDN unit is installed in a Charles ICB, it makes electrical connection to associated common equipment through a prewired backplane provided as part of the ICB.

Connection of the 2W loop is made to the T&R leads of the channel unit connector. Refer to the ICB documentation for more information on these connections.

Connection of the composite clock is made via the rear panel jack. When required, these connections should be made to the ICB composite clock input pins. Additional information can be found in the 360-80 shelf and Control Unit documents.

Table 4. Pin Chart for 50 pin (25 pair) Male TELCO Connector

Circuit #	Pin	
Circuit 1	Pin 1 = R	Pin 26 = T
Circuit 2	Pin 3 = R	Pin 28 = T
Circuit 3	Pin 5 = R	Pin 30 = T
Circuit 4	Pin 7 = R	Pin 32 = T

5.4 Status Indicators

The front panel has one set of three LEDs per circuit that show the status of each circuit.

Table 5. LED States

Label	Status	Description
LOS	ON	Loss of U-interface or TR-397 framing
	OFF	Normal operation
ALM	ON	Loss of synchronization at far end
	OFF	No alarms (normal operation)
LP	ON	Loopback active
	OFF	Loopback not active

6. OPTIONING

The unit comes from the factory with default provisioning. This provisioning can be altered through the Network Management interface. When this unit is inserted into a previously provisioned slot, if the card type matches, the unit will change its provisioning options to match the previously provisioned unit. If the unit type does not match, the unit will assume its default provisioning. The provisioning options are as follows:

Option	Choices	Default
Per circuit channel type active	2B+D, 1B+D, D	2B+D
Per circuit time slots used	T1=1-24, None E1=1-15,17-31, None	For 3638-80: Sequence* For 3638-81: T1=None; E1=Sequence
Per circuit mode	LT, NT	LT
Per circuit loopback type (NT mode)	Local, LULT, NT1, None	None
Per circuit sealing current (LT mode)	On, Off	On
Composite clock source for output	circuit 1-4, None	None

*Sequence indicates that the default circuit uses 3 time slots. Therefore, if plugged in to the slot for channels 1-12, circuit 1 would use time slots 1-3, circuit 2 would use time slots 4-6, and so on up to circuit 4 which would use time slots 10-12.

When provisioned to provide basic rate service (2B+D), each ISDN unit circuit occupies up to three time slots.

7. TESTING

Request for loopbacks are sent to the appropriate device by the EOC channel in the maintenance channel. The setting of the loopback provisioning determines the device to be looped back. Up to four intermediate devices may be commanded to loop back in the network-to-customer direction.

The NT1 can be commanded to loop back regardless of the number of intermediate devices. The unit provisioning selects between loop and carrier sides and selects the desired B channel to be tested (B1 or B2). LED indicators on the front panel report any error status.

7.1 Loopback Testing

The ISDN unit responds to D, 1B+D, and 2B+D loopbacks initiated through the embedded operation channel (EOC) from either an ISDN switch or another upstream device.

The ISDN unit can provide a loopback and monitoring capabilities of the unit's performance. Selecting LPBK through provisioning provides a bidirectional loopback for the selected B channel. Performance monitoring indicates the status of either the 2-wire loop or the carrier. Performance monitoring is nonintrusive to B1, B2, and the D channel, thereby non-service-affecting. Other tests performed on a specific B channel will not interrupt service on the remaining channels.

The ISDN unit provides the loopbacks shown in Figure 8 when the unit is in the NT mode. Activating a loopback will loopback the 2B+D traffic for a selected channel to an ISDN switch or another upstream device.

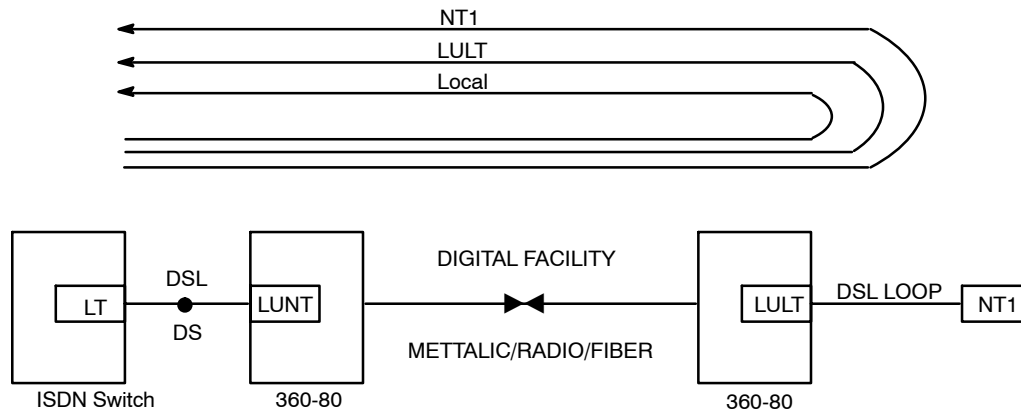


Figure 8. ISDN Loopback Testing

8. TECHNICAL ASSISTANCE

If technical assistance is required, contact the Charles Technical Services Center at:

847-806-8500

847-806-8556 (FAX)

800-607-8500

techserv@charlesindustries.com (e-mail)

9. WARRANTY & CUSTOMER SERVICE

9.1 Warranty

Charles offers a 2-year warranty on this product. Contact your local Sales Representative at the address or telephone numbers below for warranty details. The warranty provisions are subject to change without notice. The terms and conditions applicable to any specific sale of product shall be defined in the resulting sales contract.

Charles Industries, Ltd.
5600 Apollo Drive
Rolling Meadows, Illinois 60008-4049
U.S.A.
847-806-6300 (Main Office)
847-806-6231 (FAX)

9.2 Field Repairs (In-Warranty Units)

Field repairs involving the replacement of components within a unit are not recommended and may void the warranty and compatibility with any applicable regulatory or agency requirements. If a unit needs repair, contact Charles for replacement or repair instructions, or follow the *Repair Service Procedure* below.

9.3 Advanced Replacement Service (In-Warranty Units)

Charles offers an “advanced replacement” service if a replacement unit is required as soon as possible. With this service, the unit will be shipped in the fastest manner consistent with the urgency of the situation. In most cases, there are no charges for in-warranty repairs, except for the transportation charges of the unit and for a testing and handling charge for units returned with no trouble found. Upon receipt of the advanced replacement unit, return the out-of-service unit in the carton in which the replacement was shipped, using the pre-addressed shipping label provided. Call your customer service representative at the telephone number above for more details.

9.4 Standard Repair and Replacement Service (Both In-Warranty and Out-Of-Warranty Units)

Charles offers a standard repair or exchange service for units either in- or out-of-warranty. With this service, units may be shipped to Charles for either repair and quality testing or exchanged for a replacement unit, as determined by Charles. Follow the *Repair Service Procedure* below to return units and to secure a repair or replacement. A handling charge applies for equipment returned with no trouble found. To obtain more details of this service and a schedule of prices, contact the Charles Service Center at 217-932-5292 (FAX 217-932-2943).

Repair Service Procedure

1. Prepare, complete, and enclose a purchase order in the box with the equipment to be returned.
2. Include the following information:
 - Company name and address
 - Contact name and phone number
 - Inventory of equipment being shipped
 - Particulars as to the nature of the failure
 - Return shipping address
3. Ship the equipment, purchase order, and above-listed information, transportation prepaid, to the service center address shown below.

Charles Service Center
503 N.E. 15th St, P.O. Box 339
Casey, IL 62420-2054
U.S.A.
4. Most repaired or replaced units will be returned within 30 or 45 days, depending on the product type and availability of repair parts. Repaired units are warranted for either 90 days from the date of repair or for the remaining unexpired portion of the original warranty, whichever is longer.

10. SPECIFICATIONS

This section contains electrical and physical specifications of the Quad and Dual Circuit ISDN Channel units.

10.1 Electrical

The electrical specifications of the Quad and Dual Circuit ISDN Channel units are:

Parameters	Functional Specification	
Number of lines per unit	3638-80: 4 circuits (occupy up to 3 time slots each) 3638-81: 2 circuits (occupy up to 3 time slots each)	
Encoding	2B1Q	
Signal Rate	160 Kb/s	
Warm Start Time	Complies with ANSI T1.601	
Cold Start Time	Complies with ANSI T1.601	
Activation and Deactivation	Complies with ANSI T1.601	
Transmit Driver	2.5V (ANSI 1992 requirement)	
Maximum Line Loss	42 dB @ 40 KHz	
Maximum Distance	18 Kft (1300 ohms)	
Input Impedance	135 ohms	
Transmit Linearity	Minimum 45 dB	
Bit Error Rate	Maximum 10^{e-7} (10Kft of # 18 AWG , +1db NEXT Margin)	
Power Feeding	-48V/ 4-20mA (LT mode)	
EOC message code and function supported	Message	Message code:
	Operate 2B+D loopback	0101 0000
	Operate B1channel loopback	0101 0001
	Operate B2 channel loopback	0101 0010
	Request corrupted CRC	0101 0011
	Notify corrupted CRC	0101 0100
	Return to normal	1111 1111
	Hold state	0000 0000
	Unable to comply	1010 1010
Power Supply Current (42 to 56 volts)	3638-80: Average = 0.115 amps; worst case = 0.139 amps 3638-81: Average = 0.056 amps; worst case = 0.068 amps	
Heat Dissipation	3638-80: 7 watts 3638-81: 3.4 watts	

10.2 Physical

The physical specifications of the Quad and Dual Circuit ISDN Channel units are:

Feature	Quad Circuit (3638-80)		Dual Circuit (3638-81)	
	U.S.	Metric	U.S.	Metric
Height	0.75 inch	1.9 centimeters	0.75 inch	1.9 centimeters
Width	9.625 inches	24.45 centimeters	5.64 inches	14.32 centimeters
Depth	9.25 inches	23.49 centimeters	9.25 inches	23.49 centimeters
Weight	1.18 pounds	540 grams	0.68 pound	312 grams

Feature	Quad Circuit (3638-80)		Dual Circuit (3638-81)	
	U.S.	Metric	U.S.	Metric
Temperature	-40° to +149° F	-40° to +65° C	-40° to +149° F	-40° to +65° C
Humidity	to < 95%		to < 95%	

