12-Channel (3657-80) and 6-Channel (3657-81) 2-Wire Foreign Exchange Subscriber, Private Line Automatic Ringdown and Dial Pulse Originating Unit for T1

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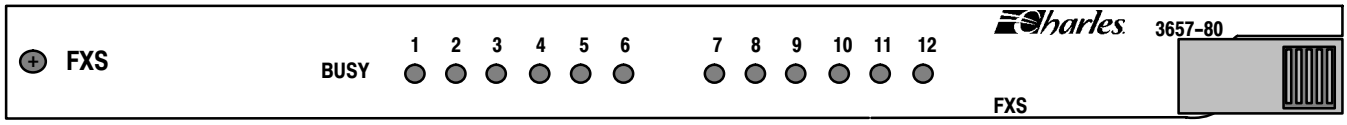


Figure 1. 3657-80 FXS Front Panel

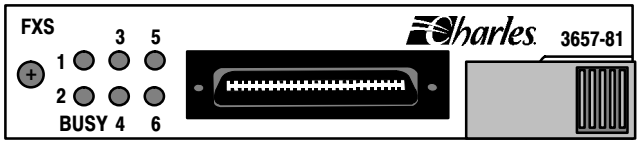


Figure 2. 3657-81 FXS Front Panel

1. GENERAL

1.1 Document Purpose

This document provides general, installation and testing information for the 12-Channel and 6-Channel 2-Wire (2W) Foreign Exchange Subscriber (FXS), Private Line Automatic Ringdown (PLARD) and Dial Pulse Originating (DPO) Unit. This document covers model numbers 3657-80 and 3657-81.

1.2 Equipment Function

The 2-wire FXS/DPO/PLARD unit is part of the 360-80 Intelligent Channel Bank (ICB), and is one of several types of channel units available for the 360-80 ICB. This unit can only be used with a T1 Controller unit.

1.3 Equipment Location/Mounting

The 12-channel (3657-80) plugs into any full size slot of the Charles 360-80 ICB. The 6-channel (3657-81) plugs into the half-size slot of the Charles 360-80 ICB.

Note: This unit requires an issue 2 or later ICB shelf.

1.4 Equipment Features

The FXS/DPO/PLARD provides the following features:

- Each of the circuits on the FXS can be independently configured for a 2W FXS, MEGACOM, PLARD or DPO application
- In FXS mode, optional loop start or ground start
- In the MEGACOM applications, each circuit can be configured for loop start, ground start immediate or wink
- In the PLARD application, each circuit can operate in D3 or D4 signaling mode
- Each circuit can operate independently in the DPO mode as a 2 wire loop with reverse battery supervision application.
- Built-in Ring Generator
- Optional network per-channel loopback
- Temperature hardened (–40° to +65° C)
- Prescription attenuation for the transmit and receive levels
- Mu-law encoding
- 900 or 600 ohm impedance
- Front panel BUSY LED, indicates BUSY/IDLE status
- Optional burst, continuous or interrupted ringing in PLARD mode
- Automatic trunk processing during a carrier failure
- Compliance with AT&T Publication 43801
- Complies with FCC part 68 and UL 1950, FCC part 15.

1.5 Control Interface

The 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.

1.6 Indicators/Configuration Options with NMS and ICB Management Software

This unit provides a variety of status information. The following is a list of all status indicators;

- Per channel Busy LED state (On, Off)
- Per channel time slot used (1 through 24, none)
- Per channel unit mode (FXS, MEGACOM, DPO, PLARD)
- Per channel FXS interface mode (loop start, ground start)
- Per channel interface impedance (600, 900)
- Per channel transmit level TLP setting (−10 to +6 dBm in 0.1 dBm increments)
- Per channel receive level TLP setting (−15 to +1.0 dBm in 0.1 dBm increments)
- Per channel loopback (loopback, release)
- Per channel CGAI (Idle, Busy)
- Per channel CGAD (Idle, Busy)
- Per channel MEGACOM ground start initiate (Immediate, wink) or loop start
- Per channel PLARD ringing options (burst, continuous, interrupted)
- Per channel D3/D4 PLARD signaling

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 module 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 modules outside of their protective packaging. A module intended for future use should be tested as soon as possible and returned to its original protective packaging for storage.

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

3.1 Foreign Exchange (FX) Channel Units

FX channel units are available in both Station (FXS) and Office (FXO) versions. FX units operate with either loop or ground start signaling.

FXS units provide talk battery and ringing toward the station equipment and detect off-hook and address signaling (dialing) from the station equipment. FXS units will generally connect to telephone instruments or PBX/Analog trunk circuits.

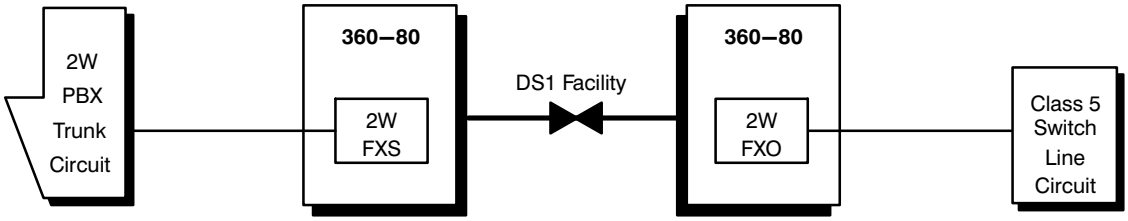


Figure 3. Typical FX (Foreign Exchange) Arrangement

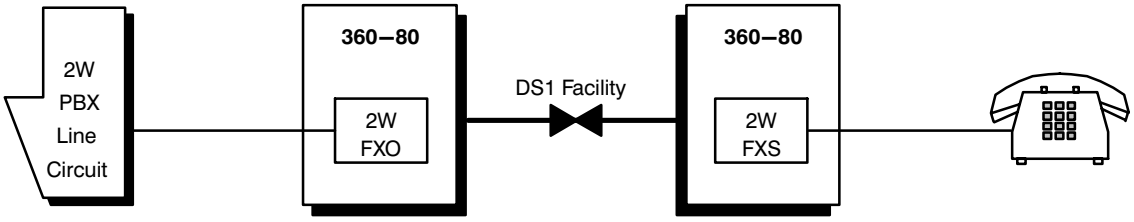


Figure 4. Typical OPX (Off-Premises Extension) Arrangement

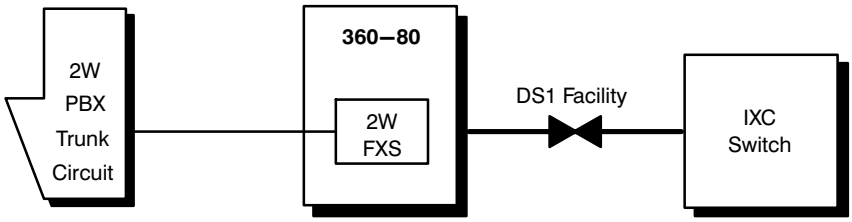
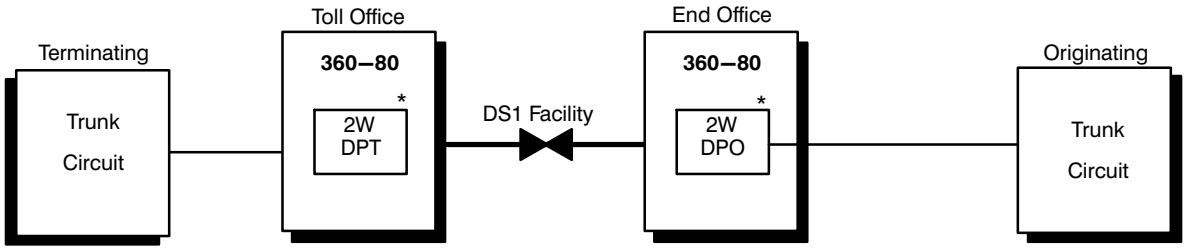


Figure 5. Access to IXC Switched Services

3.2 Loop Reverse Battery (DPO, DPT) Channel Units

These units have historically been used for one-way interoffice trunk circuits. The DPO unit provides talk battery toward the trunk circuit and reverses the battery for supervision purposes. The DPT unit provides loop open/closure toward the trunk circuit and detects battery reversals. DPO units can be used to connect to Class 5 Central Office DID trunks. See Figure 6 & Figure 7.



*Either end could be replaced with an E&M circuit depending on the trunk interface.

Figure 6. Typical One-Way Interoffice Trunk Application

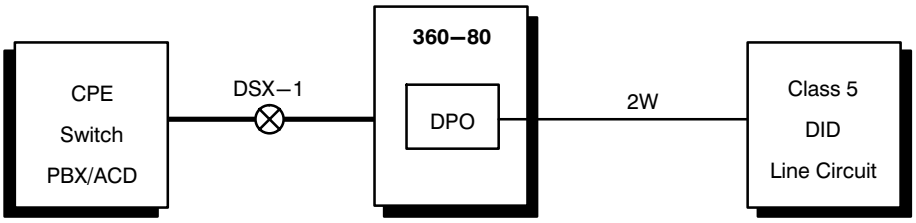


Figure 7. Typical DPO Application (used to access Class 5 DID line circuit)

3.3 Ringdown (PLARD) Channel Units

Private line automatic ringdown units are used to establish point to point circuits between two telephone sets or other station equipment. See Figure 8.

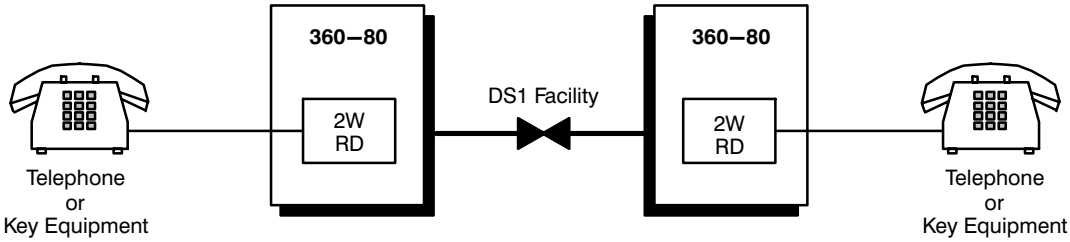


Figure 8. Typical Ringdown Arrangement

3.4 MEGACOM Channel Units

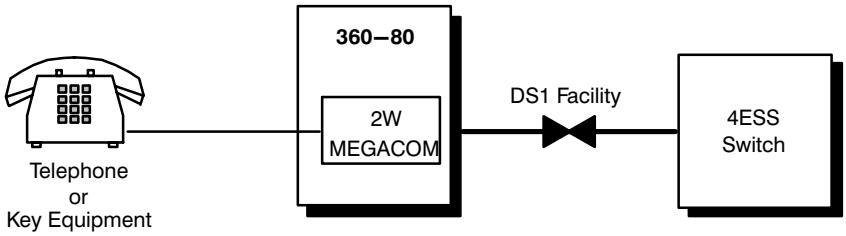


Figure 9. Typical MEGACOM Application

4. CIRCUIT DESCRIPTION

The following describes one of the circuits on the FXS and can be considered typical of any of the circuits.

4.1 Voice Operation

4.1.1. Incoming Voice Operation, All Modes

Each circuit, or channel, of the unit receives digital voice and signaling information from the DS1 facility interface unit of the ICB. The digital voice information is converted to analog voice information and conveyed to the level adjusting circuit. The range of the received voice information can be adjusted for receive transmission level point (TLP) of +1 to −15 dBm. The voice information goes through a hybrid, which transmits it to the two wire transmission facilities. The impedance of the hybrid can be configured for either a balanced 600 or 900 ohm facility.

4.1.2. Outgoing Voice Operation, All Modes

Analog voice information sent from the the two-wire transmission facility is passed to the 600 or 900 ohm impedance matching hybrid, and is then sent to the level adjusting circuit. The transmit TLP level range that can be accommodated is from +6 to −10 dBm. The analog voice information is converted to digital and multiplexed with the other channels and sent to the DS1 facility interface unit to be transmitted to the far-end equipment.

4.2 FXS Signalling

4.2.1. Incoming calls, ground start mode

An incoming call is started on the DS1 facility interface side of the ICB from the far end. The digital signaling information from the DS1 facility interface unit is converted into the A and B signaling highway information on the unit (see Table 1). The incoming call starts with the local station equipment ringing, but ringing cannot be applied to the ring lead unless the tip lead is referenced to ground. In ground start, the far end signals a tip ground by changing the A highway to a 0. The unit responds by applying a ground reference to the tip lead.

The incoming A signaling highway is used to determine the state of the tip ground condition and the B highway is used to determine when to apply ringing voltage to the ring lead. When the incoming A signaling highway is 1 and the incoming B signaling highway is 1, only –48VDC will be applied to the ring lead. When the A signaling highway is 0 and the B signaling highway is 0, the tip lead will have a ground reference on it and the ring lead will have ringing voltage applied to it. The incoming B highway reflects the ringing cadence. The outgoing A highway reflects the on-hook/off-hook state of the local station equipment and the outgoing B highway remains at 1 and is not used in this scenario. See Table 1.

Table 1. Incoming calls, ground start

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
Tip open, no ringing	1	1	Ground start idle	0	1	On-hook, no ring ground
Tip ground, no ringing	0	1	Tip ground	0	1	On-hook, no ring ground
Tip ground, ringing	0	0/1	Ringing/no ringing	0	1	On-hook, no ring ground
Tip ground, no ringing	0	1	busy	1	1	Off-hook, no ring ground
Tip open, no ringing	1	1	Idle	0	1	On-hook, no ring ground
Tip ground	–	–	Forced busy	0	0	—

4.2.2. Incoming calls, loop start mode

If configured for loop start, the tip lead is always at ground, no matter what state the A signaling highway is in. The B highway is used to determine when to apply ringing voltage to the ring lead. When the B signaling highway is 1, only –48 VDC will be applied to the ring lead (normal talk battery). When the B signaling highway is 0, the ring lead will also have ringing voltage applied to it. The incoming B highway reflects the ringing cadence. The outgoing A highway reflects the on-hook/off-hook state of the local station equipment and the outgoing B highway remains at 1 (not used in this scenario). See Table 2.

Table 2. Incoming calls, loop start

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
Tip ground, no ringing	0	1	Loop start idle	0	1	On-hook
Tip ground, ringing	0	0/1	Ringing/no ringing	0	1	On-hook
Tip ground, no ringing	0	1	Busy	1	1	Off-hook
Tip ground, no ringing	0	1	Idle	0	1	On-hook
Tip ground (existing)	–	–	Forced busy	1	1	—

4.2.3. Outgoing calls, ground start mode

At idle, the local station equipment (see Table 3) will be in an idle condition (no loop closure), and with no ground applied to the ring lead. When the ground start mode is in idle, there is no tip ground from the unit, so the station equipment off-hook cannot be detected. To initiate a call, the station equipment must apply a ground potential to

the ring lead. This draws ring lead current and the outgoing B signaling highway will change from the idle condition (1) to a ring ground condition (0). The far end response will be the signal to apply tip lead ground.

With the tip lead at ground, the off-hook can now be detected; the local station equipment can remove the ring ground and there will be normal tip and ring lead current. This will cause the unit to change the outgoing A highway to a 1 and change the B highway back to a 1. This is the normal busy condition of the unit.

The circuit can return to idle in two ways:

Far-end disconnect: If in ground start mode and the incoming A highway changes back to 1, the unit removes the tip ground. Tip and ring current stops, causing outgoing A highway to return to 0.

Local station disconnect: If the local station equipment goes on-hook, the outgoing A highway goes to a 0 and the far end responds by changing the incoming A highway back to a 1. Then the unit removes the tip ground.

Table 3. Outgoing calls, ground start

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
Tip open, no ringing	1	1	Idle	0	1	On-hook, no ring ground
Tip open, no ringing	1	1	Ring ground	0	0	On-hook, ring ground
Tip ground, no ringing	0	1	Busy	1	1	Off-hook, no ring ground
Tip ground, no ringing	0	1	Dial pulsing	1/0/1	1	Off/on/off-hook, no ring ground
Tip open, no ringing	1	1	Idle	0	1	On-hook, no ring ground

4.2.4. Outgoing calls, loop start mode

At idle, the local station equipment (see Table 4) will be in an idle condition with no loop closure. In loop start mode, there is always a tip ground from the unit no matter what the state of the incoming A highway is.

The outgoing A highway will show the off-hook condition by changing from 0 (idle condition) to 1 (busy condition). Ring ground is not used in loop start, and the B highway is always 1.

The circuit returns to idle when the near end station goes on hook.

Table 4. Outgoing calls, loop start

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
Tip ground, no ringing	0	1	Idle	0	1	On-hook
Tip ground, no ringing	0	1	Busy	1	1	Off-hook
Tip ground, no ringing	0	1	Dial pulsing	1/0/1	1	Off/on/off-hook
Tip ground, no ringing	0	1	Idle	0	1	On-hook

4.3 MEGACOM signaling

In MEGACOM service, both highways have the same value in both directions. Only the A highway is monitored.

4.3.1. Incoming call operation, loop start mode

In loop start mode, an incoming call starts when the far end seizes the circuit, resulting in the unit ringing the local station equipment at a 2 seconds on/4 seconds off cadence (see Table 5). The local station equipment answers and the circuit enters the normal busy condition. The circuit is released when both the local equipment goes on-hook and the far end goes idle. This mode is similar to the D3 mode of PLARD operation.

Table 5. Incoming calls, loop start

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
No ringing	0	0*	Idle	0	0	On-hook
Ringing	1	1*	Ringing	0	0	On-hook
No ringing	1	1*	Busy	1	1	Off-hook
No ringing	0	0*	On-hook	0	0	On-hook
Tip ground (existing)	–	–	Forced busy	1	1	—
* = *Highway not monitored.*						

When the incoming A highway changes from idle (0) to busy (1), the unit applies a 2 seconds on/4 seconds off ringing cadence to the tip and ring leads. This continues until either the station equipment goes off-hook, or the incoming A highway returns to 0. During local station ringing periods, the far end receives a ringback tone.

4.3.2. Incoming call operation, ground start immediate mode

In ground start immediate mode, when the incoming A highway goes to a 1, the unit places a ground reference on the tip lead and then starts the 2 seconds on/4 seconds off ringing cadence on the ring lead (see Table 6). This continues until the station equipment goes off-hook or the A signaling highway returns to 0.

Table 6. Incoming calls, ground start

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
No tip ground, no ringing	0	0*	Idle	0	0	On-hook, no ring ground
Tip ground, ringing	1	1*	Ringing	0	0	On-hook, no ring ground
Tip ground no ringing	1	1*	Answer (busy)	1	1	Off-hook, no ring ground
No tip ground, no ringing	0	0*	Idle	0	0	On-hook, no ring ground
Tip ground	–	–	Forced busy	1	1	—
* = *Highway not monitored.*						

During local station ringing periods, the far end receives a ringback tone. Control of the circuit is from the far end. Even if the local equipment goes on-hook first, tip ground is maintained until the far end releases. If the far end releases first, the local station equipment loses tip ground. Unable to maintain loop current, the local station equipment is forced to an on-hook condition.

4.3.3. Incoming call operation, ground start wink mode

Incoming call operation in wink mode is similar to incoming call operation ground start, immediate mode. The circuit in this mode is controlled by the far end. See Table 7.

Table 7. Incoming calls, ground start wink

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
No tip ground, no ringing	0	0*	Idle	0	0	On-hook, no ring ground
Tip ground, ringing	1	1*	Ringing	0	0	On-hook, no ring ground
Tip ground, no ringing	1	1*	Off hook (talk busy)	1	1	Off-hook, no ring ground
No tip ground, no ringing	0	0*	Idle	0	0	On-hook, no ring ground
Tip ground	–	–	Forced busy	1	1	—
* = *Highway not monitored.*						

4.3.4. Outgoing call operation, loop start mode

In the loop start mode, an outgoing call will start when the local station equipment goes off-hook (see Table 8). The far end responds and the circuit enters the normal busy condition. The circuit is released when both the local equipment goes on-hook and the far end goes idle. This mode is similar to the D3 mode of PLARD operation.

Table 8. Outgoing calls, loop start

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
No ringing	0	0*	Idle	0	0	On-hook
No ringing	0	0*	Off-hook	1	1	Off-hook
No ringing (no change)	1	1*	far-end answer (busy)	1	1	Off-hook
No ringing (no change)	0	0*	Idle	0	0	On-hook
* = *Highway not monitored.*						

After the station equipment goes off-hook, it will send its address signaling information (usually in the form of DTMF tones).

4.3.5. Outgoing call operation, ground start immediate mode

During idle (see Table 9) the local station equipment is in an on-hook condition (no loop closure) with no ground applied to the ring lead. Because there is no tip ground from the unit, the station equipment going off-hook cannot be detected. To initiate a call, the station equipment must apply a ground potential to the ring lead. This draws ring lead current. The outgoing A&B signaling highways change, from idle (0,0) to 1,1. The far end responds by applying tip lead ground and changing the incoming A&B highways from 0,0 to 1,1. With the tip lead at ground, the off-hook can now be detected; the local station equipment removes the ring ground and there is normal loop current. This is the normal busy condition. Address signaling can take place (usually in the form of DTMF tones).

The circuit can return to idle in two ways:

1. If the incoming A&B highways change back to 0,0, the tip ground is removed, loop current stops and the outgoing A&B highways return to 0,0.
2. If the local station equipment goes on-hook, the outgoing A&B highways go to 0,0 and the far end responds by changing the incoming A highways back to 0,0. The unit removes the tip ground to the station equipment.

Table 9. Outgoing calls, ground start immediate

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
No tip ground, no ringing	0	0*	Idle	0	0	On-hook, no ring ground
No tip ground, no ringing	0	0*	Ring ground	1	1	Off-hook, ring ground
Tip ground, no ringing	1	1*	Tip ground (busy)	1	1	Off-hook, no ring ground
Tip open, no ringing	0	0*	Idle	0	0	On-hook, no ring ground
* = *Highway not monitored.*						

Control of the circuit is from the far end. Once the circuit is busy, even if the local equipment goes on-hook first, tip ground is maintained until the far end releases. If the far end releases first, the local station equipment loses tip ground. Unable to maintain loop current, the local station equipment is forced to an on-hook condition.

4.3.6. Outgoing call operation, ground start wink mode

During idle, the local station equipment is in an on-hook condition (no loop closure) with no ground applied to the ring lead (see Table 10). Because there is no tip ground from the unit, the station equipment going off-hook cannot be detected. To initiate a call, the station equipment applies a ground potential to the ring lead. This draws ring lead current, causing the outgoing A&B signaling highways to change from idle (0,0) to 1,1.

The far end response to this is a wink signal to apply tip lead ground. The incoming A&B highways wink 0,1,0. This causes the unit to place the tip lead at ground. The off-hook can now be detected; the local station equipment removes the ring ground and there is normal loop current. Address signaling can take place at this time (usually in the form of DTMF tones). The far end will normally provide answer supervision and change the incoming A&B highways to 1,1. This is the normal busy condition of the unit.

The circuit can return to idle in two ways:

1. If the incoming A&B highways change back to 0,0, the tip ground is removed, loop current stops and the outgoing A&B highways return to 0,0.

2. If the local station equipment goes on-hook, stopping the loop current, the outgoing A&B highways go to 0,0 and the far end responds by changing the incoming A highways back to 0,0. The unit removes the tip ground to the station equipment.

Table 10. Outgoing calls, ground start wink

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
No tip ground, no ringing	0	0*	Idle	0	0	On-hook, no ring ground
No tip ground, no ringing	0	0*	Ring ground	1	1	On-hook, ring ground
Tip ground, no ringing	0/1/0	0/1/0*	Tip ground (wink)	1	1	Off-hook, no ring ground
Tip ground, no ringing	1	1*	Answer (busy)	1	1	Off-hook, no ring ground
Tip open, no ringing	0	0*	Idle	0	0	On-hook, no ring ground
* = *Highway not monitored.*						

The wink is about 250 ms in duration. Control of the circuit is from the far end. Once the circuit is busy, even if the local equipment goes on-hook first, tip ground is maintained until the far end releases. When the far end releases, the local station equipment loses tip ground. Unable to maintain off-hook, the local station equipment is forced to an on-hook condition.

4.4 PLARD Signaling

4.4.1. Incoming call, automatic ring-down—D4 mode

During idle, the signaling highways, in both directions are at 1,1. When the remote station equipment goes off-hook, the incoming A&B highways will change to 0,0. This causes the unit to apply ringing voltage to the local station equipment; when it answers, the outgoing A&B highways change to 0,0. This is the normal busy condition. The circuit returns to idle when both ends return on-hook and the signaling highways in both directions go to 1,1.

Table 11. Incoming calls, automatic ring-down—D4 mode

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
No ringing	1	1*	Idle	1	1	On-hook
Ringing	0	0*	Local end ringing	1	1	On-hook
No ringing	0	0*	Busy (near end answer) normal talk state	0	0	Off-hook
No ringing	1	1*	Idle	1	1	On-hook
* = *Highway not monitored.*						

4.4.2. Incoming call, automatic ring-down—D3 mode

D3 mode operation is very similar to D4 mode operation, except that the A & B signaling highways are inverted as shown in Table 12.

Table 12. Incoming calls, automatic ring-down—D3 mode

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
No ringing	0	0*	Idle	0	0	On-hook
Ringing	1	1*	Local end ringing	0	0	On-hook
No ringing	1	1*	Busy (near end answer) normal talk state	1	1	Off-hook
No ringing	0	0*	Idle	0	0	On-hook
* = *Highway not monitored.*						

4.4.3. Outgoing call, automatic ring-down—D4 mode

During idle, the signaling highways in both directions are at 1,1. When the local station equipment goes off-hook, the outgoing A&B highways change to 0,0. This rings the far end equipment; when it answers, the incoming A&B highways change to 0,0. This is the normal busy condition. The circuit returns to the idle condition when both ends return to on-hook and the signaling highways in both directions go to 1,1

Table 13. Outgoing calls, automatic ring-down—D4 mode

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
No ringing	1	1*	Idle	1	1	On-hook
No ringing	1	1*	Off-hook (far end ringing)	0	0	Off-hook
No ringing	0	0*	Busy (far end answer) normal talk state	0	0	Off-hook

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
No ringing	1	1*	Idle	1	1	On-hook
* = *Highway not monitored.*						

4.4.4. Outgoing call, automatic ring-down—D3 mode

D3 mode operation is very similar to D4 mode operation, except that the A & B signaling highways are inverted as shown in Table 14.

Table 14. Outgoing calls, automatic ring-down—D3 mode

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
No ringing	0	0*	Idle	0	0	On-hook
No ringing	0	0*	Off-hook (far end ringing)	1	1	Off-hook
No ringing	1	1*	Busy (far end answer) normal talk state	1	1	Off-hook
No ringing	0	0*	Idle	0	0	On-hook
* = *Highway not monitored.*						

4.5 Dial Pulse Originating (DPO) signaling

4.5.1. Outgoing call operation

DPO operation is normally only one way, although reverse make busy is allowed.

When the local end initiates the call, the local equipment goes off-hook and the outgoing A&B highways change from idle (0,0) to busy (1,1). When the far end responds, with a change from 0,0 to 1,1 as either a wink or steady supervision, the unit reverses the talk battery polarity on the 2-wire line. The circuit returns to idle when the local end returns on-hook and the outgoing A&B highways are 0,0; the far end signals 0,0 back on the receive A&B highways. The reverse make busy condition is an abnormal condition used to keep an idle circuit from being used. When this happens, the local station equipment is in an on-hook condition but the far end signals 1,1 on the incoming A&B highways. This results in the unit reversing polarity to the local station equipment on the 2-wire.

Table 15. Outgoing call operation

Analog output	Incoming		Call progress	Outgoing		Analog input
	A	B		A	B	
Normal battery polarity	0	0*	Idle	0	0	On-hook
Normal battery polarity	0	0*	Off-hook	1	1	Off-hook
Normal/reverse/normal	0/1/0	0/1/0*	Wink	1	1	Off-hook
Reverse battery polarity	1	1*	Busy—normal talk state	1	1	Off-hook
Normal battery polarity	0	0*	Idle	0	0	On-hook
Reverse battery polarity	1	1*	Reverse make busy (trunk out of service condition)	0	0	On-hook
Reverse battery	–	–	Forced busy	1	1	—
* = *Highway not monitored.*						

5. INSTALLATION

5.1 Installing the Unit

5.1.1. Attaching the Rear Panel

The rear panel of the 3657-80 should be installed before all units are installed in the shelf and before wiring begins. The 3657-81 does not require a new rear panel.

Figure 10. 3657-80 2W FXS/PLARD/DPO Rear Panel

5.1.2. Installing a New Unit

Use the following steps to install the 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. **WARNING** **If there is already a rear panel installed on the shelf, check for interference when mounting. The rear panel may need to be removed and replaced with the rear panel that has been shipped with the new unit.**
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).

5.1.3. 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 connector from the 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 Wiring the Unit

For the 6-channel unit (3657-81) the first six circuits are used on the Telco connector (see Table 16).

Both the 3657-80 and 3657-81 have specific tip and ring lead functionality based on channel optioning. Tip and ring lead polarity must be maintained when connecting with far-end equipment.

Table 16. Pin Chart for Male 50-pin (25-pair) TELCO Connector

3657-80	3657-81	Circuit	Pins	
		Circuit 1	Pin 1 = R	Pin 26 = T
			Pin 2 = Not connected	Pin 27 = Not connected
		Circuit 2	Pin 3 = R	Pin 28 = T
			Pin 4 = Not connected	Pin 29 = Not connected
		Circuit 3	Pin 5 = R	Pin 30 = T
			Pin 6 = Not connected	Pin 31 = Not connected
		Circuit 4	Pin 7 = R	Pin 32 = T
			Pin 8 = Not connected	Pin 33 = Not connected
		Circuit 5	Pin 9 = R	Pin 34 = T
			Pin 10 = Not connected	Pin 35 = Not connected
		Circuit 6	Pin 11 = R	Pin 36 = T
			Pin 12 = Not connected	Pin 37 = Not connected
		Circuit 7	Pin 13 = R	Pin 38 = T
			Pin 14 = Not connected	Pin 39 = Not connected
		Circuit 8	Pin 15 = R	Pin 40 = T
			Pin 16 = Not connected	Pin 41 = Not connected
		Circuit 9	Pin 17 = R	Pin 42 = T
			Pin 18 = Not connected	Pin 43 = Not connected
		Circuit 10	Pin 19 = R	Pin 44 = T
			Pin 20 = Not connected	Pin 45 = Not connected
		Circuit 11	Pin 21 = R	Pin 46 = T
			Pin 22 = Not connected	Pin 47 = Not connected
		Circuit 12	Pin 23 = R	Pin 48 = T
			Pin 24 = Not connected	Pin 49 = Not connected

6. OPTIONING

6.1 Software Optioning

Refer to the Network Management Interface documentation for software optioning information.

When installed, this unit uses the default provisioning, which 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's provisioning options change to match the previously provisioned unit. If the unit type does not match the unit being replaced, it assumes its default provisioning. The individual channel provisioning options are as follows:

Option	Choices	Default
Per channel time slot allocation	1–24, none	3657-80: timeslot = channel number 3675-81: None
Per channel operating mode	FXS, MEGACOM, DPO, PLARD	FXS
Per channel FXS mode	loop start, ground start	Loop start
Per channel MEGACOM Ground start initiate	immediate, wink	Immediate
Per channel PLARD Ring Down/D3 mode	interrupted, burst, continuous	interrupted
Per channel forced busy	on, off	off

Option	Choices	Default
Per channel PLARD Ring Down/D4 mode	interrupted, burst, continuous	interrupted
Per channel transmit level setting	−10 to +6 dBm in 0.1 dB increments	0 dBm
Per channel receive level setting	−15 to +1.0 dBm in 0.1 dB increments	−3 dBm
Per channel loopback	active, release	release
Per channel CGAI action	idle, busy	idle
Per channel CGAD action	idle, busy	busy
Per channel impedance	600 or 900 ohms	600 ohms

7. TECHNICAL ASSISTANCE

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

847-806-8500
847-806-8556 (FAX)
800-607-8500
techserv@charlesindustries.com (e-mail)

8. WARRANTY & CUSTOMER SERVICE

8.1 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
847-806-6300 (Main Office)
847-806-6231 (FAX)

8.2 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.

8.3 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.

8.4 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 Industries for either repair and quality testing or exchanged for a replacement unit, as determined by Charles Industries. 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

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.

9. SPECIFICATIONS

9.1 Regulatory

Complies with FCC part 68, FCC part 15 and UL 1950.

9.2 Electrical

Parameter	Specification
Number of Subscribers for Each unit	3657-80: 12 circuits 3657-81: 6 circuits
Quantizing Level	8 bit, Mu-law encoding
Insertion Loss	0 ± 0.5 dB (@ 1004 Hz)
XMT input TLP range	–10.0 to +6.0 dBm
XMT default input level	0 dBm
RCV output TLP range	+1.0 to –15.0 dBm
RCV default output level	–3.0 dBm
XMT and RCV prescription ATTN	0 to 16dB in increments of 0.1dB
Gain from Frequency Change (single circuit)	300 to 3000 Hz: –0.25 to +0.5 dB 3000 to 3400 Hz: –0.25 to +1.5 dB
Gain from Input Level Tracking	+3 to –37 dBm0: < 0.25 dB –37 to –50 dBm0: < 0.50 dB
Impedance	900 Ohm +2.15 uf or 600 Ohm +2.15 uf
Trans-hybrid loss	ERL: > 28 dB SRL: > 18 dB
Return Loss	ERL: ≥ 28 dB SRL: ≥ 17 dB

Parameter	Specification
Longitudinal Balance	300 to 600 Hz: ≥ 52 dB 600 to 2400 Hz: ≥ 52 dB 2400 to 3000 Hz: ≥ 52 dB 3000 to 3400 Hz: ≥ 53 dB
Idle Channel Noise	Max 20 dBrnCO
Signal to Quantizing Distortion Ratio	0 to –30 dB: > 33 dB –30 to –40 dB: > 27 dB –40 to –45 dB: > 22 dB
Cross Talk Attenuation	>65 dB
Operating Loop Resistance (RT side)	1800 Ohm (including the internal resistance of the phone)
Loop on-hook detection sensitivity	On-hook detection 10,000 ohms or greater.
Loop off-hook detection sensitivity	Off-hook detection 2500 ohms or less.
Ring Ground detection	1500 ohm or less when connected to –5volts.
Loop Current (RT side)	20 mA under 1200 Ohm loop resistance.
Ring Trip time	250 ms or less with 2000 ohm or less loop resistance.
Subscriber Signaling Type	Loop Start and Ground Start
RT Feeding Voltage (when in idle status)	(Vbat – 6) VDC
Ringing Voltage Signal	20 Hz, sine wave >65 VAC (RMS) with a load of 15 REN per unit. Each circuit or channel can handle 5 REN.
LEDs	Green LEDs on the unit. If the channel or circuit is busy, the LED will be lit to indicate a busy status to the local craft person.
Loopback	DS1 facility side loopback
Power Supply Current	3657-80: 0.40 amp. (all circuits busy, short loop) 3657-81: 0.21 amp. (all circuits busy, short loop)
Heat Dissipation	3657-80: 19.9 watts (all circuits busy, short loop) 3657-81: 10.5 watts (all circuits busy, short loop)

9.3 Physical

See Table 17 for the physical characteristics of the unit.

Table 17. Physical Specifications

Feature	3657-80		3657-81	
	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 pound, 1.1 ounces	0.49 kilogram	10.6 ounces	0.30 kilogram
Temperature	–40° to 149° F	–40° to +65° C	–40° to 149° F	–40° to +65° C
Humidity	To 95% (non-condensing)		To 95% (non-condensing)	