

MicroComm DXL

DXL Quick Troubleshooting Guide

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1 Introduction

This quick guide gives you basic information on how to troubleshoot a MicroComm DXL system.

First, the MicroComm DXL system's basic networks and functionality are described to give you an understanding of the system in order to determine the location of a problem based on its symptoms.

Next is a description of diagnostic functions, which can tell you where certain types of problems arise.

Finally, some common problems and solutions are outlined.

2 Network Basics

There are five main types of wiring within a DXL system.

1. The USB Exchange Data Network carries the digital audio and control signals between the controller and expanders within an exchange (i.e. from DCC to DCE or vice versa).
2. The Digital Audio Trunk Network carries the digital audio trunk signals between exchanges in a non-VoIP system.
3. The Ethernet System Data/Control Network is an Ethernet network that sends control information, status updates, and other data between exchanges (DCCs). In a VoIP system, it carries the digital audio between exchanges. It also can be used to control the DXL system from a touchscreen or PLC through an Ethernet network.
4. The LonWorks Data Network may be present only in non-VoIP systems. It transmits master station control information (master keypad presses, or display updates) and DIO status updates (switch presses, commands to turn on outputs) between the DCC and Lonworks based devices such as master stations and DIO cards.
5. The field device wiring is the wiring (generally analog) that actually transmits the audio, switch, or other signals from the head end equipment to field devices such as master stations, telephones, intercom stations, and page zones.

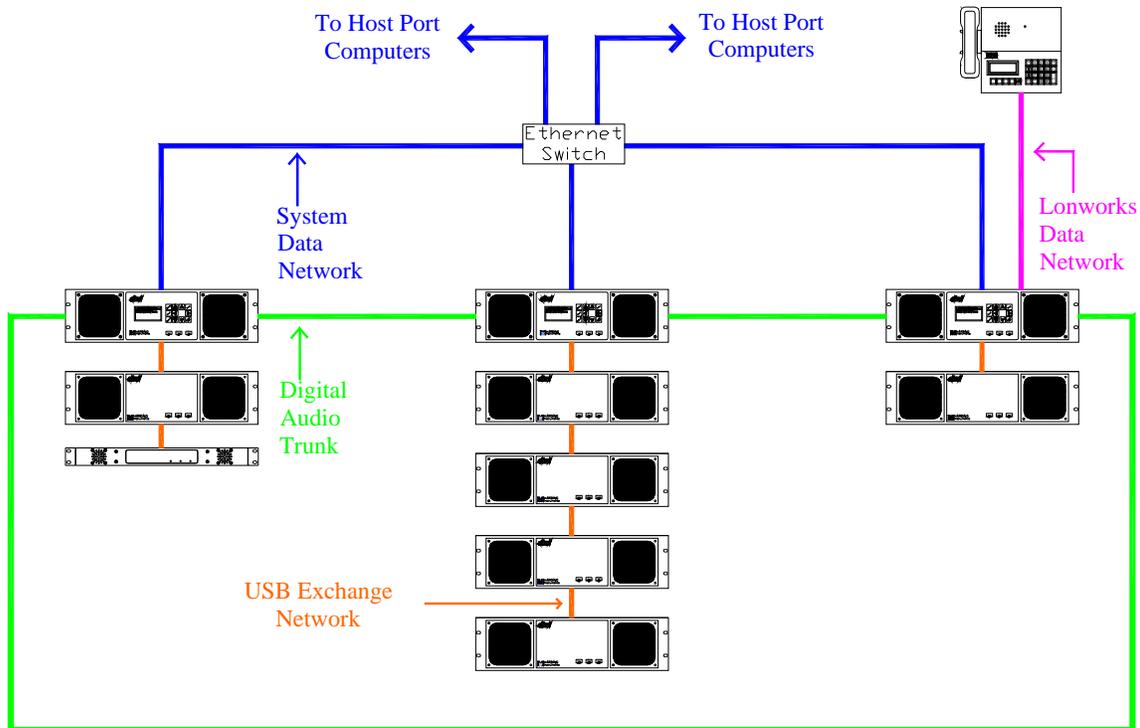


Figure 1. Overview of DXL system networks

2.1 Exchange Data Network (USB)

An exchange consists of one DCC and a number of other devices, typically DCE's. Communication between the DCC and other devices in the exchange is performed via a USB network.

This network carries the control information from the controller (DCC) to the expanders within an exchange (such as a DCE, PZE, or TBE). This network also transmits the digital audio signals within an exchange (between the DCC and the expanders). This network is thus used to connect up audio calls, receive call switches, and transmit audio within this exchange.

A problem related to all functions on one particular expander not working may indicate a problem with the Exchange Data Network (USB) connection to that expander.

Due to the data capacity of the DCC USB ports, a maximum of two DCEs or TBEs can be connected in a chain to a single USB port on the DCC. If an exchange contains 4 DCE and TBE expanders combined, there should be one expander directly connected to each of the USB ports on the DCC, and one remaining expander connected to each of the already connected expanders, as shown in Figure 2.

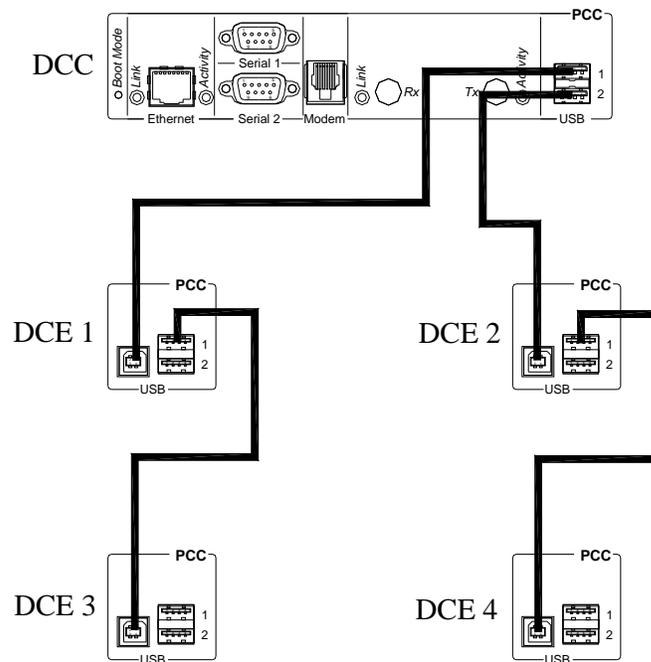


Figure 2. Detail of Exchange Data Network Connections

If the networks are inadvertently set up that there are more than two expanders with audio (i.e. DCE or TBE) connected to one USB port on the DCC, then the third expander in the chain will not work (with the first symptom being that it will not even have its install light flashing when first powered on and will not be recognized by the DCC) until it is moved to the other DCC USB chain which has less than 2 audio expanders on it.

Note: You can not have more than 4 expanders with audio (DCE and TBE combined) connected to one DCC due to this limitation. If you have more than 4 expanders with audio you will need to add another DCC controller unit for this area.

This limitation does not apply to PZE Page Zone Expanders, as they only have relays and no audio, and thus have much less data requirements on the USB network. Up to 12 PZE's can be added to the system using free USB ports, even if two other audio expanders are already indirectly connected to one DCC USB port.

2.2 Digital Audio Trunk Network (CEPT)

The Digital Audio Trunk network transmits the audio between exchanges in a non-VoIP DXL system. Some of the DXL documentation refers to this as the “CEPT” network, named after the European standards committee that developed the telephone E1 network used by the DXL system.

Digital Audio Trunk networks can be either wired (copper) or fiber optic. The Digital Audio Trunk network in a system must be one type system-wide – either all of the digital audio trunks must be copper, or all of them must be fiber optic. In a copper network each connection is one pair of twisted pair data cable, while in a fiber network each connection is one multimode fiber.

Digital Audio Trunk networks are always organized in complete loops. Unlike the DXI, which has a redundant Digital Audio Trunk loop, the DXL has a single loop. This means that a break anywhere in the loop will cause problems with all audio between exchanges.

The following diagram shows an example with a three exchange system.

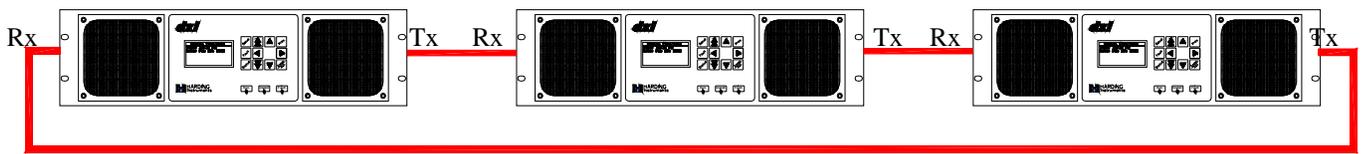


Figure 3: Digital Audio Trunk configuration for a three exchange system

2.3 System Data/Control Network (Ethernet)

The System Data/Control network is used to transmit control and status information between DCC’s. In a multi-exchange system, this allows the system to seamlessly make audio connections from devices on one exchange to devices on other exchanges. If the system has an Ethernet host (i.e., a controlling touchscreen or PLC), then the Ethernet network can be used to transmit status and control information between the host and DXL system.

The System Data/Control Network in a VoIP system is also used to transmit the audio between exchanges. When using a VoIP system, it is recommended that the Ethernet switching equipment support 802.1p QoS (Quality of Service) to provide priority for the voice traffic on the network to prevent loss or disruption of audio due to other network traffic.

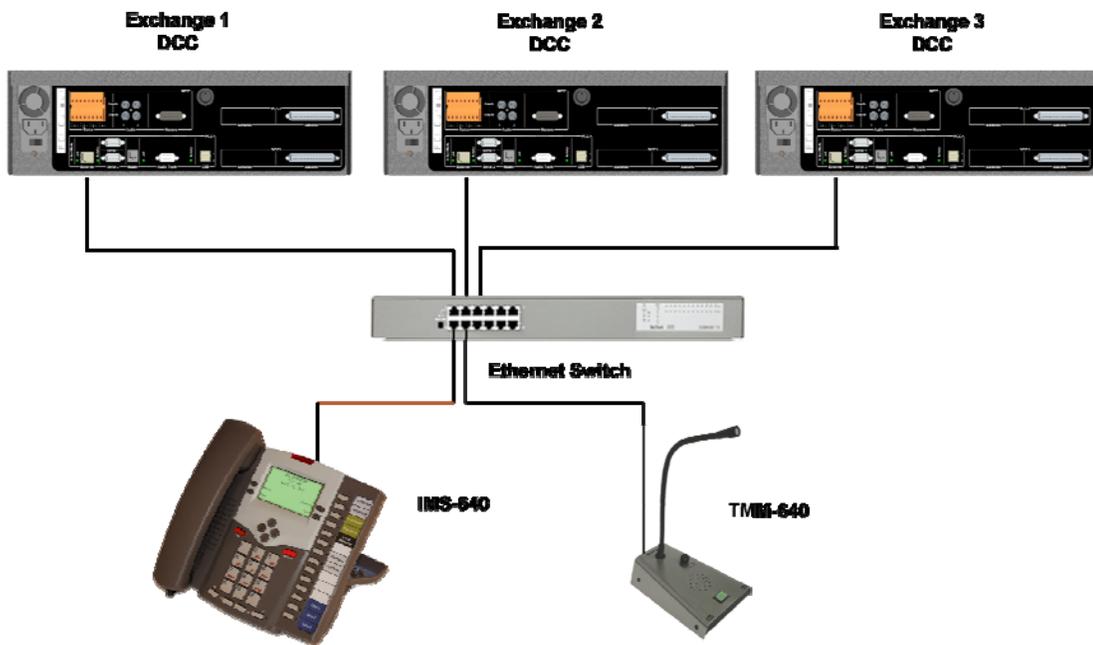


Figure 4. Data/Control Network (Ethernet)

The System Data/Control Network is a standard Ethernet network. The DXL DCC's provide RJ45 Ethernet jacks for connection to a 10/100 megabit Ethernet network. A single network connection on a DCC is used for inter-exchange communications, host communications, and in a VoIP system, audio communications between exchanges.

2.4 Lonworks Data Network

If the intercom system contains any Lonworks devices such as Harding masters with a keypad and display (i.e., an IMS-440 or IMS-130) or DIO discrete I/O cards, a Lonworks network is required to transmit control information such as display data, key presses, or switch/output status information between the device and the DXL system.

Lonworks control networks are freeform topology networks, which can be any combination of bus (daisy chain) and star networks, as long as the network does not loop back on itself.

Lonworks control networks should always have one and only one network termination on it. This network termination should be 51 ohms, and while it can be located at any point on the network, the most common and logical place to put this network terminator is across the Lonworks port on the "Xlon" Lonworks card installed in the PCI slot on the DCC.

Free Topology Repeaters (FTRs) can be used to extend the Lonworks network. Free Topology Repeaters have a built in network termination.

Note: Due to the nature of the Lonworks free topology network, the network requires the correct cabling or it will not work reliably. It is important to ensure that the cabling is the correct type when specifying and installing Lonworks network cabling. If the devices on the Lonworks network sometimes reset or if the network is intermittent, one of the first things to check is if the correct type of cabling is used.

2.5 Station/Master Wiring

Analog audio is transmitted to and from masters and stations over shielded twisted pairs. Half duplex devices (such as speaker intercoms) require a single pair for audio, while full duplex devices (such as masters or handset intercoms) require one pair for the microphone and one pair for the speaker.

Harding 400 and 401 series intercom stations multiplex switch signals onto their audio wires and the DXL can monitor these wires for faults (i.e., open or short circuits). Harding 300 series intercom stations and intercom stations from other manufacturers have a separate pair of wires for a switch. The audio pairs of a 300 series station port cannot be monitored for faults, and while there is an option for monitoring faults on the switch pairs of a 300 series station port, this is typically not used.

3 Troubleshooting Basics

The first step of troubleshooting is determining what the problem is and where to start looking for the solution.

- Describe what the problem is. Is there no intercom audio at all on both the master and station? Is the audio working, but is one way only, quiet, or distorted? If this is the case which side (master, station, or both) has the problem? Is the problem a station call button or buttons that do not call in?
- Determine the extent of the problem. Are all masters everywhere unable to place calls? Do some masters experience a problem while others do not? If a station does not work when connected to a master, does it work when other masters call it? Are all the masters or stations with problems on the same station control card? Are they all connected to the same DCC or DCE? Or are they all connected to the same exchange?
- Determine where the problem is. Usually you will need to find out which master ID and/or station ID numbers are the problem devices. In the intercom system, every device (master, station, etc.) is given an ID number during configuration. This ID number needs to be determined to assist troubleshooting. Note, this is the intercom system number, not the touchscreen icon number, architectural number, etc. You may have to cross reference the "name" field in the DXL system, or look at the site drawings, configuration spreadsheets, or other information to determine the intercom system number.

Determining the extent and location of the problems will help you to determine where to start looking for the fault.

- If the problem is specific to one particular station or one particular master, then the problem may be due to the field wiring to that station or master, the intercom station or master itself, or may be due to a blown channel on a station or master control card.
- If the problem occurs with a number of stations connected to the same box (DCC or DCE), but other stations connected to the same box work, the problem may be due to a disconnected field cable or terminal block, or a blown station control card.
- If the problem occurs with all masters and stations connected to a given DCE, but other masters and stations connected on other boxes (DCC or DCEs) on the same exchange work, the problem may be that the DCE has not been added with the DCC “DCE Add/Remove” function, or that the DCE may be disconnected from the USB port, may be turned off, or is not functioning properly.
- If the problem occurs in all devices connected in one equipment room, then the problem may be with the DCC for that equipment room, or the network cabling going to that DCC.
- If the problem only occurs when connecting from a master on one exchange to stations or page zones on another exchange, then the problem may be related to the digital audio trunk network, either with a broken digital audio trunk link (for a non-VoIP system), an Ethernet connection problem (for a VoIP system), or that one (or more) of the DCC’s is not operating (hence breaking the digital audio trunk link at that location). On a non-VoIP system, because the audio trunk is a single directional loop, even if only one link in the loop is broken, you will have no audio between all exchanges. On a VoIP system, the Ethernet audio trunking is point to point, so it can tolerate some failures in the trunk (Ethernet). However, because the lowest numbered exchange is in control of the trunk networks, if the lowest numbered exchange is not connected to the Ethernet or not set up or turned on, the system will not have audio between all exchanges.
- If the problem is system-wide, then the problem may be due to an Ethernet networking problem, touchscreen/PLC to intercom system communication failure, or a DCC failure.

There are a number of methods to troubleshoot the intercom system.

3.1 Troubleshooting Using the Front Panel of a DCC

The DXL DCC controllers monitor many components of the system and can indicate through a DCC’s front panel display when there are system troubles, and which components have problems. The front panel can also be accessed remotely using the diagnostics tools in DXL Administrator.

Each DCC, DCE, PZE, and TBE has the same three lights (*Run*, *Install*, and *Fault*) on its front panel that can indicate a number of conditions to the user. These lights are a good starting point for determining what problems exist in the system and give some direction as to where to look in the front panel menus to further isolate a problem.

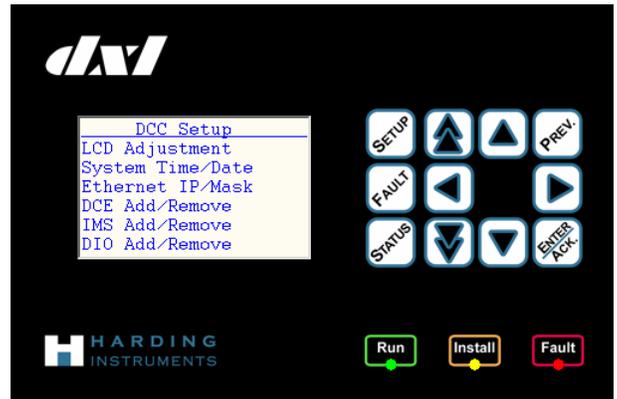


Figure 5: DCC Front Panel

The green *Run* light indicates that the device has power and is running. If the run light is off when the device is plugged in and turned on, you may have a power supply problem.

The yellow *Install* light on a DCC flashes when a device connected to the DCC’s exchange data network needs to be “installed”. Installation in this sense means letting the DCC know which USB endpoint the device is located at. This is done via the front panel interface of the DCC.

The expander (DCE, PZE, or TBE) that needs to be installed first will also have its install light lit. Get to the main setup menu of the DCC by pressing the *Setup* button twice, then select “*DCE Add/Remove*” to get to this screen:

```
DCE Add/Remove
Install DCE
Remove DCE
Install PZE
Remove PZE
Install TBE
Remove TBE
```

Selecting the appropriate “*Install*” command for a DCE, PZE, or TBE will bring you to a screen where you can select from the configured expanders (DCEs, PZEs or TBEs) connected to the exchange. Use the up and down arrow keys to select the DCE, PZE, or TBE that has a flashing *Install* light and press *Enter/Ack* to install it.

After installing the first device, the next device that needs to be installed (if there is one) will turn on its install light. After all devices connected to a DCC have been installed, the install light on the DCC will turn off.

The red *Fault* light of a DCC, DCE, PZE, or TBE flashes when there are unacknowledged faults (problems) detected on that device.

If the source of the fault is directly connected to the DCC, only the DCC *Fault* light will flash. If the source of the fault is connected to an expander such as a DCE, PZE, or TBE, the *Fault* light on that DCE, PZE, or TBE will flash and the *Fault* light on the DCC will flash. The faults detected by the DXL and indicated by the *Fault* light include:

- Supervised wiring problems on masters, intercoms and status inputs
- Fan problems
- Low backup battery
- Expanders which are not operating
- Digital audio trunk problems
- Ethernet failures

3.1.1 The Fault Menus

The *Fault* light simply indicates that there are one or more new (unacknowledged) faults are present on the exchange. The fault menu on the DCC’s front panel display shows exactly what the fault is. Faults can exist in one of three states in a DXL system: *Unacknowledged*, *Acknowledged*, and *Cleared*. All faults are initially of the type unacknowledged. Once the maintenance staff member has noticed and recorded a fault, the fault can be acknowledged. Note that an acknowledged fault has not been fixed; acknowledging a fault simply indicates that the maintenance is aware that the fault occurred so the DXL system does not mark it as a “New” fault. Since only *unacknowledged* faults cause the fault lights to flash, the user can acknowledge faults that he or she is aware of and still be alerted by the fault light if any new, unacknowledged faults should occur. A *Cleared* fault is a problem that the system detects has been fixed. If an acknowledged fault becomes cleared, it will disappear from the faults lists. If an unacknowledged fault becomes cleared, it will remain in the unacknowledged faults list to make sure that the operator is aware that the fault occurred. This helps diagnose intermittent wiring problems, which will often cause a fault that later clears itself. Acknowledging a cleared fault will cause it to disappear from the faults lists.

The fault menu is entered by pressing the *Fault* key on the front panel of the DCC. Pressing the *Fault* key a second time will ensure that you are at the top level of the fault menu, as shown below.

From the fault screen shown here, you can extract the following information

- There are 23 unacknowledged (new) faults on this exchange
- All 23 of the are on the DCC

```
Exchange Faults
Unacknowledged 23
DCC Faults      23
DCE '1' Faults  0
DCE '2' Faults  0
DCE '3' Faults  0
DCE '4' Faults  0
```

In this case, the fault light on the DCC would be flashing, but the faults lights on any connected DCEs, PZEs, or TBEs would be off.

To acknowledge the faults, move the cursor to the “*Unacknowledged*” line and press the *Enter/Ack* key. This changes the screen to a descriptive listing of all the unacknowledged faults on the exchange. The up and down arrow keys scroll through the list of faults and the *Enter/Ack* key acknowledges the selected fault.

```
Unacknowledged Faults
DCC Cnfg      A
DCC MCC Spkr1 A
DCC MCC Micr1 A
DCC MCC StIn1 A
DCC MCC StIn2 A
DCC MCC StIn3 A
```

The first column in the faults list indicates the device that the fault is associated with; in this case all faults on the example above are associated with the DCC. The second column shows the card that the fault is associated with; in this case all but the first fault on screen are associated with the master control card. The first fault, "DCC Cnfg", indicates that there is not a valid configuration loaded onto this exchange and is not associated with any particular card. The last column indicates the status of the fault. "A" indicates an Active fault. "C" indicates a Cleared fault, which means that there was a fault since the errors were last acknowledged, but that fault is not active now. "K" indicates an acKnowledged fault, and indicates that this fault is an old fault that was acknowledged previously in the fault screen.

Acknowledging a fault will remove it from the unacknowledged faults list. Until the fault is cleared, it will still be listed on the faults list for the DCC, DCE, PZE, or TBE that the fault is associated with.

Table 1: Faults that occur only on a DCC

Fault Listing	Fault Description
Battery	The memory backup battery is low, dead, or missing.
Cnfg	The DCC does not have a valid configuration to load
DCE 'X'	DCE X (i.e. 1,2,3, or 4) was previously added with the <i>Install DCC</i> menu but is now not operating (X denotes the DCE number [1,2,3, or 4] in the configuration files of the DCE that is not operating)
PZE 'X'	PZE X was previously added with the <i>Install PZE</i> menu but is now not operating
TBE 'X'	TBE X was previously added with the <i>Install TBE</i> menu but is now not operating
Ethn X	Ethernet failure, indicating that another DCC in the system is not responding to Ethernet messages (X denotes the ID number of the exchange that the DCC is on)
Trnk	The digital audio trunk receive port is not receiving a valid signal
VoIP PCIXX or "Master Name" i.e. Central #1	On newer firmware, the message will be VOIP PCIXX where XX is the port number the master is assigned in the configuration. On older firmware, any message from a DCC which isn't listed in the other entries of these tables may be a VoIP fault, with the message being the VoIP master name that is faulted. This fault indicates that a VoIP master which is configured for this DCC is not set up or connected yet (it has not registered with the DCC)

Table 2: Faults that can occur on a DCC or DCE

Fault Listing	Fault Description
MCC SpkrX	The Speaker pair of master X on the master control card is faulted
MCC MicrX	The Microphone pair of master X on the master control card is faulted
MCC StInX	Supervised status input pair X on the master control card is faulted
SCC1 StnXX	The wiring pair to station XX on SCC 1 is faulted
SCC2 StnXX	The wiring pair to station XX on SCC 2 is faulted
SCC1 CFG	The SCC installed in slot SCC1 doesn't match what is in the configuration for this box
SCC2 CFG	The SCC installed in slot SCC2 doesn't match what is in the configuration for this box
MCC CFG	The MCC installed doesn't match what is in the configuration for this box

Table 3: Faults that can occur on any devices (DCC, DCE, PZE, TBE)

Fault Listing	Fault Description
Fans	Cooling fans are not running properly

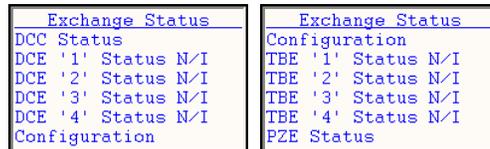
The memory that a DCC stores configuration files in requires a battery to retain information when the DCC is not powered on. If the battery is dead or not present, configuration information will be lost. Therefore, a “Battery” fault and a “Cnfg” fault will occur together in this case.

The “Fans” fault indicates that the DXL device is not measuring the expected fan speed from the front cooling fans. A bug in firmware versions older than 2.3.0b4 sometimes causes the DXL system to report a fan fault even though the fans are working properly. If you experience a fan fault with an older version of firmware, if the fans are turning and moving air without much noise, they should be fine. The grills on the front of a DCC or DCE are held on by thumbscrews and may be removed to get a better look at the fans. Upgrading the firmware will eliminate false fan faults in the future.

3.1.2 The Status Menus

The “SpkrX”, “MicrX”, “StInX”, and “SmXX” faults described above all have to do with supervised wiring problems. Supervised wiring is wiring where the DXL transmits switch signals as DC offsets, rather than simply checking if the wires are open or short circuited. These DC offsets are what allow the same wires to be used for audio and switches, allow two switches on one pair of wires, and allow the DXL system to monitor wiring for faults.

As described in “Troubleshooting With Common Equipment” later in this document, you can measure the DC offsets on supervised wiring using a multimeter. However, the DXL is already measuring all DC offsets to determine the supervision status and can display the wiring status through the status menus. The Status menus are accessed by pressing the *Status* button on a DCC’s front panel. Pressing the *Status* button twice will ensure that you are at the top-level status menu, as shown below. The menu has more entries than will fit on one screen. Below are two screenshots below showing all entries.

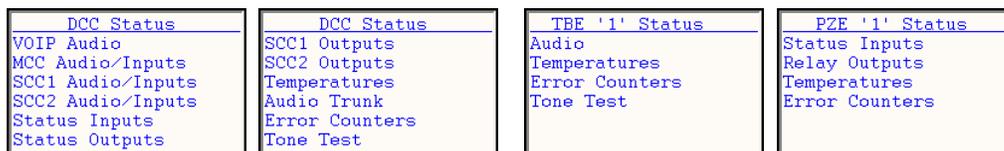


The text “N/I” beside a DCE, TBE, or PZE on the above screen indicates that the indicated expander is not installed. If you have this expander in the system configuration, you must use the “Setup” menu “Add/Remove DCE” to install it.

The text “N/A” beside a DCE, TBE, or PZE on this screen indicates that the indicated expander is not responding to the DCC on the USB port. If this expander is in the configuration, check that the expander has power and is turned on, and that the USB cable from the DCC to the expander is connected.

Selecting any of the DCC, DCE, TBE, or PZE status options will bring you to a list of different things you can check the status of on that controller or expander.

Typical status menu screens are as follows



When you select one of the options, a status screen will appear. For most status screens, the screen will show four columns. The left-most column is the port number on that card. The second column indicates the ID number in the configuration of the device on that port. The third column indicates the name given to that device. The fourth column indicates the status of that device. For ports that are unused in the configuration file, the ID number and name will be filled with dashes.

DCC SCC1 Status			
01	1	Station 1	I
02	2	Station 2	0
03	---	-----	0
04	---	-----	0
05	---	-----	0
06	---	-----	0

For example, shown to the right is the intercom status of station ports on the first SCC card, where intercom station #1 is on SCC1 port 1, and intercom station #2 is on SCC1 port 2.

- “VOIP Audio” on a DCC will show the status of VoIP master stations.
 - IMS-640 and TMM-640 masters that are connected and working normally should show status “RC” (Registered and Connected).
 - Other VoIP devices should normally show status “R” (Registered) when not in an audio call, and “RC” (Registered and Connected) when in an audio call
 - If a VoIP master shows status “N”, it is not connected. This means that is not set up yet with the DCC’s server address, is not powered, or is not connected to the Ethernet network.

```
DCC_VOIP_Status RC
01 3 VOIP Master N
02 ---
03 ---
04 ---
05 ---
06 ---
```

- “MCC Audio/Inputs” on a DCC or DCE will show the status of master wiring.

- For IMS/TMM master ports:
 - The first status digit indicates the status of the speaker pair.
 - The second status digit indicates the status of the microphone pair.
 - The individual wiring status is the same as intercom station wiring below.
 - A status of “S” means that the input is faulted with a short (short circuited)
 - A status of “O” means that the input is disconnected (open circuited), or that the wire pair to the master is reverse polarity (+ and – wires are switched)
 - If either digit is “S” or “O”, then there is a wiring problem to the master.
 - A status indication of “B” may indicate that one of the audio wires in that pair is shorted to ground.
 - Typical status would be “IA”, which means that the master is wired correctly, with the master on hook (the master is using the handsfree speaker/mic). Other possible normal states are indicated to the right.
 - Status of “AI” is not normal state with an idle master and usually indicates that the speaker and microphone pairs are switched.

```
DCE1_MCC_Status SM
1 1 TMM Master 1 IA
2 --- ON
```

State	Master Status
IA	Idle, On Hook
II	Idle, Off Hook
AA	PTT, On Hook
AI	PTT, Off Hook
BA	Mute, On Hook
BI	Mute, Off Hook

- For TSM master ports:
 - A status of “ON” means that the telephone is on hook (usually meaning it is idle and not in use)
 - A status of “OF” means that the telephone is off hook (usually meaning it is in use)
 - A status of “RG” means that the telephone is ringing
 - If the telephone is off hook and pressing keys, you will see the key being pressed (“0” - “9”, “*”, “#”)

- “SCC1Audio/Inputs” and “SCC2 Audio/Inputs” on a DCC or DCE will show the status of station wiring on SCC1 and SCC2 respectively.

- For stations on a SCC-400 or SCC-401, or supervised switches on SCC-300 cards:
 - A status of “I” means that the input is connected with no switches on (idle)
 - A status of “A” indicates that the “A” switch (switch 1) is held down.

```
DCC_SCC1_Status
01 1 Station 1 I
02 2 Station 2 0
03 ---
04 ---
05 ---
06 ---
```

- A status of “B” indicates that the “B” switch (switch 2) is held down. If the switch is not being pressed, it could mean that one of the audio wires is shorted to ground.
- A status of “S” means that the input is faulted with a short (short circuited)
- A status of “O” means that the input is disconnected (open circuited), or that the wire pair is reverse polarity (+ and – wires are switched)
- For unsupervised switches on SCC-300 cards:
 - A status of “S” means that the input switch is on (short circuited)
 - A status of “O” means that the input switch is off (open circuited)

State	Station Status
I	Idle
A	Switch A pressed
B	Switch B pressed or short to ground
S	Short circuit fault
O	Open circuit fault

- “Audio” on a TBE will show the ID numbers and names of the ports of a TBE. However, TBEs do not have supervised inputs, so this does not display the wiring status of the inputs.

- “Status Inputs” on a DCC, DCE, or PZE shows the status of the status input switches.

- For supervised inputs:
 - A status of “Idle” means that the input is connected with no switches on (idle)
 - A status of “A sw” or “B sw” indicates that the respective switch is held down.
 - A status of “Scct” means that the input is faulted with a short (short circuited)
 - A status of “Occt” means that the input is disconnected (open circuited)
- For unsupervised inputs:
 - A status of “Scct” means that the input switch is on (short circuited)
 - A status of “Occt” means that the input switch is off (open circuited)

DCC Status Inputs	
Status In 1=	Idle
Status In 2=	Occt
Status In 3=	Occt
Status In 4=	Occt

PZE1 Status Inputs	
StatIn 01=	Idle
StatIn 02=	Idle
StatIn 03=	Idle
StatIn 04=	Idle
StatIn 05=	Idle
StatIn 06=	Idle

- “*Status Outputs*” on a DCC or DCE shows the status of the MCC card status output relays. Each relay will have the On/Off state of the relay shown.

```
DCC Status Outputs
Status Out 1= Off
Status Out 2= Off
Status Out 3= Off
Status Out 4= Off
```

- “*Relay Outputs*” on a PZE shows the status of the PZE status output and zone select relays for each of the three relay banks. “The Status Out X” for that bank shows the On/Off state of the Status relay, while the “Relay X.1” through “Relay X.6” for that bank shows the On/Off state for each of the zone select relays in that bank.

```
PZE1 Relay Outputs
Status Out 1= Off
Relay 1.1 = Off
Relay 1.2 = Off
Relay 1.3 = Off
Relay 1.4 = Off
Relay 1.5 = Off
```

- “*SCC1 Outputs*” and “*SCC2 Outputs*” on a DCC or DCE will show the status of 401 series station LED indicators on SCC1 and SCC 2 respectively.

- “On” and “Off” indicate the LED is solid on or solid off.
- “Fast” indicates the LED is flashing ¼ second on, ¼ second off.
- “Flash” indicates the LED is flashing ½ second on, ½ second off.
- “Wink” indicates the LED is mostly on, flashing 7/8 second on, 1/8 second off.
- “Blink” indicates the LED is mostly off, flashing 1/8 second on, 7/8 second off

```
DCC SCC1 Outputs
01 1 Station=Off
02 2 Station=Off
03 --- -----Off
04 --- -----Off
05 --- -----Off
06 --- -----Off
```

- “*Temperatures*” will show the internal temperature, power supply voltage status, and fan status of the associated device.

```
DCC Temperatures
FAN SPEED= SLOW
PCC TEMP = 28 C
MCC TEMP = 30 C
SCC1 TEMP= 33 C
SCC2 TEMP= 0 C
LEFT FAN = SPINNING
```

- “*Audio Trunk*” on a DCC will show the status of the digital audio trunk links. Two values will be shown.
 - The line marked “*Local =*” will show the status of the digital audio trunk of this DCC.
 - “*Local = Works (#X)*” indicates that the receive port is receiving a valid signal (where **X** indicates which exchange’s Transmit port is connected to this DCC’s receive port).
 - “*Local = Failed*” indicates that the receive port on this DCC is not receiving a valid signal. Check the digital audio trunk path (fiber or wire) between the transmit port of the previous exchange and the receive port of this exchange.
 - “*Local = N/I*” (“Not Installed”) indicates that the project configuration has not included this DCC in an audio trunk loop. If this is the case in a multi-exchange system, then you will need to correct the project configuration in the “*DXL Administrator*” program to include all of the exchanges in the “*Audio Trunk*” properties.
 - The line marked “*Loop =*” will show the status of the digital audio trunk on the other DCC’s of this system.
 - “*Loop = Works*” indicates that all of the audio trunks are working.
 - “*Loop = Failed*” indicates that one or more of the other DCCs are not receiving a signal. In this case you will have to view the front panel of the other DCC’s to determine which link is not working in order to correct this. Any “*Loop = Failed*” indicators will result in calls across exchanges not working until the digital audio trunk is fully restored.

If the audio trunk status indicates a digital audio trunk problem, isolate which segment this is caused by (i.e. which segment that a DCC reports “*Local = Failed*” on) and then check this audio trunk network segment connection, perform a fiber power test, etc. to determine the cause of this network problem.

- “*Error Counters*” shows some diagnostic information mainly useful to Harding staff. One item which may be of interest on a DCC is the “*Start*” time and date, which shows when the DCC was last started (or rebooted).
- “*Tone Test*” is a function that allows you to put a tone on one or all audio ports of the device. It can be used for testing purposes. If you want to test that a particular speaker, station, or master is wired up properly, you can put a tone on that port to test it. If you need to find out which station or speaker an un-labeled wire pair goes to, you can put a tone on that port and have someone go through that portion of the facility to find out which station or speaker has the tone. If you want to test the stations or speakers in an area, you can put a tone on all ports and test that the stations or speakers work and test the volume and sound quality. The volume of the tone can be changed, and the type of tone can be specified, with frequencies 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, or a spread-spectrum white noise tone.

```
DCC Tone Test
Output>None
Volume>XXXXXX
Sound >WHITE NOISE
```

3.2 Troubleshooting Using Common Equipment

There are some troubleshooting procedures that can be performed with common equipment. These are normally performed during initial installation of system.

3.2.1 Supervised intercom station and master station troubleshooting

DXL 400 and 401 series intercom stations are designed so that the intercom wiring from the head end equipment powers them and that they can transmit audio, up to two switches, an optional LED output, and line supervision (fault) status on the same pair of intercom wires.

DXL master stations, including IMS-440, MAI-420, MAI-425, and TMM-440 masters, also use this same supervised audio wiring.

The line supervision and switch status are transmitted to the DXL as a DC offset on the line. Using a multimeter in DC voltage mode, you can easily determine if an intercom or master station is properly wired.

You can measure the voltage of the station wiring in the head end equipment room terminal blocks, or at the intercom station itself by measuring across the back side of the circuit board where the field wiring connector connects to.

The most common supervised devices (400 series intercom stations and 300/400 series master stations) are outlined below.

Other devices which have an option of being supervised, but which are rarely used in supervised mode, are status inputs on DCCs and DCEs with master control cards and switch inputs on DCCs and DCEs with 300 series station control cards. For equivalent information on these devices, see their respective Installation Manuals.

3.2.1.1 Supervised 400/401 intercom status

The intercom status and the switches being pressed on a 400 or 401 intercom station can be determined by measuring the voltage across the intercom wiring pair.

- A normal 400 and 401 series intercom station will have a voltage of 16-17V measured across the line. This indicates that the intercom station is connected and that no switches are pressed.
- A voltage of approximately 10V indicates that the bottom switch (switch B) is depressed.
- A voltage of approximately 6V indicates that the top switch (switch A) is depressed.
- A voltage of 0V can indicate a short circuit (if measuring at the head end terminal block) or can indicate an unconnected wire (if measuring at the intercom station)
- A voltage of 24V will usually indicate that the + and – wires are reversed. A voltage of 24V (if measuring at the head end terminal block) could also indicate that the station is unconnected (which can be verified by going to the intercom station, which would measure 0V in this case)

- A voltage of 12V (half of 24V) usually indicates that one of the audio wires is shorted to ground (for example, the shield ground is touching an audio wire).

A quick chart with these measurements is shown below.

SCC-400 Intercom Audio Voltage

Intercom Speaker Audio State	SCC-400 Voltage
CRQ (SWB)	10V
Other (SWA)	6V
Normal (Idle)	16V
Open Circuit Fault	24V
Short Circuit Fault	0V

3.2.1.2 Master Station Status

Master stations use the same type of wiring and switch supervision status that intercom stations use. There are two pairs of wires for a typical master station – a speaker audio pair and a microphone audio pair.

The speaker audio pair indicates whether the push to talk and microphone mute switches are pressed. The microphone audio pair indicates whether the handset (if present) is on hook or off hook.

For either pair of wires, the following voltages would indicate a wiring problem:

- A voltage of 0V can indicate a short circuit (if measuring at the head end terminal block) or can indicate an unconnected wire (if measuring at the master station)
- A voltage of 24V will usually indicate that the + and – wires are reversed. A voltage of 24V (if measuring at the head end terminal block) could also indicate that the master station is unconnected (which can be verified by going to the master station, which would measure 0V in this case)
- A voltage of 12V (half of 24V) usually indicates that one of the audio wires is shorted to ground (for example, the shield ground is touching an audio wire).

The normal states you may find a master station in would be:

- A speaker voltage of 16-17V and a microphone voltage of 6-7V indicate that the master station is using its hands free speaker (the telephone handset is “on hook”) and its push to talk switch is not depressed.
- A speaker voltage of 16-17V and a microphone voltage of 16-17V indicate that the master station is using its handset (the telephone handset is “off hook”) and its push to talk switch is not depressed.

If the push to talk switch was pressed and held, the speaker voltage in either of the above cases would drop to 6-7V. Likewise if the “Mic mute” switch was pressed and held, the switch voltage would drop to approximately 10V.

One error that is occasionally made when wiring the master station is switching the speaker and microphone pairs. In this case, you may see the speaker wiring measuring 6-7V and the microphone wiring measuring 16-17V with the handset on hook and no switches pressed. If you see this combination of voltages, then check the master wiring.

The charts with typical master voltage measurements are shown below.

Master Speaker Audio Voltage

Master Speaker Audio State	Voltage
PTT (SWA)	6V
Mic Mute (SWB)	10V
Normal (Idle)	16V
Open Circuit Fault	24V
Short Circuit Fault	0V

Master Microphone Audio Voltage

Master Microphone Audio State	Voltage
On Hook (SWA)	6V
CRQ/Other (SWB)	10V
Off Hook (Idle)	16V
Open Circuit Fault	24V
Short Circuit Fault	0V

4 Common Problems and Solutions

4.1 Master station displays “NOT BOUND”

The message on the master “Not bound” indicates that the master is not currently configured or “installed”. This occurs when a new master is added to a DXL system (during installation) or when a master is replaced with a new master without using the *Install IMS* menu on the DCC’s front panel.

To correct this, go into the Setup menu on the DCC’s front panel by pressing the *Setup* button, and use the “*IMS Add/Remove*”, then “*Install IMS*” menu items to add the IMS. When prompted to “*hit service pin*” go to the master, wait for the *Connect* light to turn on, and the *Network B* light to turn off, and then press the *service* button. If the DCC detects the service pin press, it will display “*Got Service Pin!*”

4.2 Master station displays “** CONFIGURATION **” or “DISCONNECTED”

If the master displays “** CONFIGURATION **” on the first line and alternates between “ATTEMPT A”, “ATTEMPT B”, and “DISCONNECTED”, it indicates that the master has lost its Lonworks connection. Check the Lonworks network wiring to this master. If the master has just been installed, try using the “*IMS Add/Remove*” function as above. If it does not install properly, check the network wiring back to the DCC’s Lonworks card.

4.3 Master station initially displays text on screen on reset, then the screen blanks out

If the master station comes up with text “** CONFIGURATION **” initially on the screen, but it blanks out after a few seconds, it may indicate that the master is connected on the Lonworks network, but the configuration is not correct. Try the following to attempt to resolve the problem.

- First, try to configure the master using the “*IMS Add/Remove*” function as above.
- If this error occurs during initial installation or after a configuration change, ensure that the master station is configured properly in the project configuration. Use the “*DXL Administrator*” program, and select the

“*Configure: Master*” pulldown. Then click on this master station and bring up its properties screen. Ensure that this master’s “*Type*” is set to “*IMS Master*” (i.e. a master with keypad and display). Note that if you cannot select “*IMS Master*” then likely the configuration for this exchange does not include an Xlon Lonworks card, in which case you will need to select the “*Configure: Hardware*” pulldown, then select this exchange, “*DCC*”, “*Main PCC*”, then “*PCI slot*” items in the tree, then add a PCI card of type “*Xlon*”.

4.4 Master station has no audio

If the master station has no audio, or audio only in one direction, then you can follow the following steps to identify the cause of the problem.

First of all, check the wiring between the master and the MCC port it is connected to, ensuring that the wiring to the master matches the pinout on the master connector (see the specific master station’s Installation Manual for this pinout).

You can also verify the master station wiring by using a DC voltmeter to check the voltage across the “speaker” and “microphone” wiring pairs between the master and MCC card. Ensure that the master is connected and powered up when making this measurement. Also, if you have a master with telephone handset (such as an IMS-440) first put the handset on the hook switch cradle.

The voltage on the “speaker” pair should be approximately 16-17 V. The voltage on the “microphone” pair should be approximately 6-7V. If the voltages are not as above, then the cause can be any of the following:

- If either pair measures 24V, then the most likely cause is that the wiring is reverse polarity (+ to - and - to +). If the voltage measures as 24V at the head end side and 0V on the master side, then that master wiring pair is not connected.
- If either pair measures 0V on the master side it likely is not connected, or shorted to ground somewhere. Checking the wiring at the head end side will measure 0V if it is shorted or if the wiring between the MCC connector and the terminal block is not connected.
- If either pair is approximately 12V, then it may mean that you have some wiring shorted to ground (i.e. a wire touching the audio shielding, other pins inside the master connector, etc.)
- If the speaker pair measures 6-7V and the microphone pair measures 16-17V then the speaker and microphone pairs might be switched.

If the master station voltages measure correctly, and the audio problem still persists, then you can check the following:

- If the master is a IMS-440 desktop master, the operator may have inadvertently pressed the “Head” or “HS” button to direct the audio to the headset connector. Try pressing the “Head” or “HS” button to check if this corrects the issue (if it doesn’t, press the “Head” or “HS” button again to restore the audio to the original state). If a headset is not in use, then you can disable the function of this button by changing an internal jumper on the IMS master to prevent this re-occurrence in the future. Check the IMS-440 installation manual for information on how to change this jumper.
- If the master is a touchscreen master, verify that the touchscreen is actually sending the command to make a connection (use the DXL system logs)
- Verify that the master is physically connected to the master ports that are listed in the project configuration.
- If the master has an external speaker and microphone (such as a console mount speaker/microphone or a DSM-140 desktop speaker), verify that it is connected to the master speaker/mic connector properly. Ensure that the microphone polarity is correct, otherwise it will not work. Also if not using a Harding supplied microphone, ensure that the microphone is an “electret” type of microphone.
- If the microphone audio (audio from master to station) has no audio, or has “static” on the audio, or if the microphone is obviously broken (such as a broken gooseneck on a TMM-440 or DSM-140 master) then the microphone itself may be the cause, in which case you can replace the microphone. Spare gooseneck microphones (for TMM-440 and DSM-140) or microphone elements (for IMS-440 or panel mount SMK speaker/microphone kits) are available from Harding for this purpose, or alternatively you can use a spare master of the appropriate type and send the master with microphone problems in for repair.

4.5 Intercom station has no audio

If an intercom has no audio, or has quiet or muffled audio, you can try the following steps to identify the cause.

For generic (300 series) intercoms, you will have to check the intercom wiring continuity with the assistance of an ohmmeter, or a “toner”.

For Harding (400 and 401 series) intercoms, you can verify the intercom station wiring by using the *Faults* screen. This will indicate stations that report wiring faults. To check the fault cause for indicated faults, or to manually check a station, ensure that the intercom station is still connected to the head end equipment, and use a DC voltmeter to measure across the intercom wiring pair at the head end or intercom end of the wiring. Alternatively, you can go to the front panel, press the Status button, then select the DCC or DCE that this station is connected to, then “*SCC1 Audio/Inputs*” or “*SCC2 Audio/Inputs*” (depending on where the station is connected to). The voltage on the intercom wiring pair should normally be 16-17 V (if using a volt meter), and the status indicator text (right most character on the line of the status screen associated with this station port) should be “*I*” (for Idle). If it is not, then you can check the following:

- If the wire pair measures 24V and the status indicator text shows “*O*” (for Open), then it is likely that the wiring is reverse polarity (+ to - and - to +).
- If the wire pair measures 0V on the head end side of the wiring, or the status indicator text shows “*S*” (for Shorted), the two wires in the audio pair is likely shorted together.
- If the wire pair measures 0V on the intercom end side of the wiring, the wire pair measures 24V on the head end side, and the status indicator text shows “*O*” (for Open), the intercom wiring is not connected or broken.
- If the wire pair is approximately 12V, and the status indicator text shows “*B*” (indicating Switch B is pressed), then it may mean that you have some wiring shorted to ground (i.e. a wire touching the audio shielding somewhere, a nicked wire contacting the conduit, intercom audio shield wiring touching the inside of a back box, etc.). Note that because the audio shielding is common to all station ports on one station card, a voltage measurement of 12V on one intercom on a station card may actually indicate a wiring short to ground on any of the other channels on that card. In this case, you may have to check the voltages on all stations on this SCC card, and if any unusual voltage readings are observed, disconnect all stations and re-connect one at a time until the problem is found.

If the intercom station voltages measure correctly (or if it is a generic 300 series station and the wiring looks correct), then you can check the following:

- If you are using a touchscreen or graphic panel, verify that the touchscreen is actually sending the command to make a connection (use the DXL system logs)
- Verify that the station is physically connected to the card and port that it is configured for in the project configuration.
- Verify that the DCC or DCE that the station is connected to is working and configured (go to the front panel of the DCC and check for faults, and make sure that the DCE (if the station is on a DCE) is installed (i.e. does not show “*N/I*” indicating Not Installed on the status screen)

4.6 Intercom station has no audio at station, humming noise while listening at master

If the intercom has no audio when the master station is talking to the intercom station, and only a humming noise (and no voice) when the master station is listening to the intercom station, the most common cause is that the intercom speaker is not working. This is only applicable for 400 series intercom stations, not 300 series intercom stations.

This commonly occurs for outdoor stations, as exposure to moisture and humidity can cause the speaker coils to corrode, causing the speaker connection to have an open circuit as seen by the intercom amplifier.

To confirm that the speaker is open, you can use a multimeter in resistance measurement mode. Measure the resistance between the two contacts on the speaker itself (usually connected to green and black wires from the intercom circuit board). A good intercom speaker will typically measure about 45 ohms, while a corroded intercom speaker will usually have an impedance that shows open (i.e. anything over a kilo ohm). If the speaker is not approximately 45 ohms, then likely the speaker is open and needs to be replaced.

If the speaker shows open, then inspect the circuit board and other components of the intercom. If the intercom circuit board and connectors look in reasonable condition without corrosion, you may be able to simply replace the speaker with another 45 ohm speaker such as the speaker included in a Station Repair Kit (SRK). If the connector or other components on the circuit board also show signs of damage or corrosion, you may want to replace the circuit board as well with the circuit board in a Station Repair Kit, or alternatively replace the whole intercom station itself with a spare intercom.

4.7 Intercom station with LED has LED blinking irregularly and/or muffled or no audio

DXL 401 series intercom stations (with an LED) require special signals from the SCC-401 card driving them to drive the LED and to control the voice direction. In order to work properly, these stations have to be configured properly, as well as be connected to a SCC-401 card.

If an intercom station sounds muffled, or its LED has an irregular blink pattern (two blinks, a pause, then repeat) then it may indicate that it is a 401 series intercom station that is not configured properly. Check the following:

- Ensure that the intercom station is connected to an SCC-401 card. All 401 series stations must be connected to an SCC-401 card, even if you are not using the LED.
- Check that the intercom station is configured properly. If this error occurs during initial installation or after a configuration change, ensure that the intercom station is configured properly in the project configuration. Use the *“DXL Administrator”* program, and select the *“Configure: Station”* pulldown. Then click on this intercom station and bring up its properties screen. Ensure that this station’s *“Type”* is set to *“LED Station”*. If the intercom station is not a *“LED Station”* type, then you will need to change the station or station template to set this parameter to *“LED Station”*.

4.8 Intercom call buttons do not work, but audio works when the intercoms are called

When intercom call buttons do not work, but when a master station can connect to talk and listen to the intercom station without problems, there may be a number of causes.

- The intercom may have its wiring reverse polarity. If the intercom station has just been installed or replaced, a reverse polarity connection may cause this symptom.

Intercom stations on SCC-400 and SCC-401 cards need to have the Audio+ on the card connected to the Audio+ on the station, and Audio- on the card connected to Audio- on the station to work properly. If + is connected to - then the intercom call button will not work, yet the intercom station audio will work fine. To check this, use a voltmeter in DC voltage measurement mode. Go to either the head end terminal blocks, or to the intercom station, and measure the DC voltage across the + and - terminals. A normal intercom station should measure approximately 16-17V. If the intercom station measures 24V, then it likely is an indication of a reversed wire pair.

- If this is a new intercom which has not been in service before, then it may be possible that one of the push button components may have come loose during shipping. The component that is most likely to come loose is the switch spring, which depresses the switch on the circuit board. If the end of the switch actuator closest to the circuit board does not have this spring, the switch will not be depressed when the pushbutton is depressed. In this case, replace the spring (either by finding the spring from the original packing material, or use a replacement spring). The side view of the intercom station showing the components is shown below, with the switch spring circled.

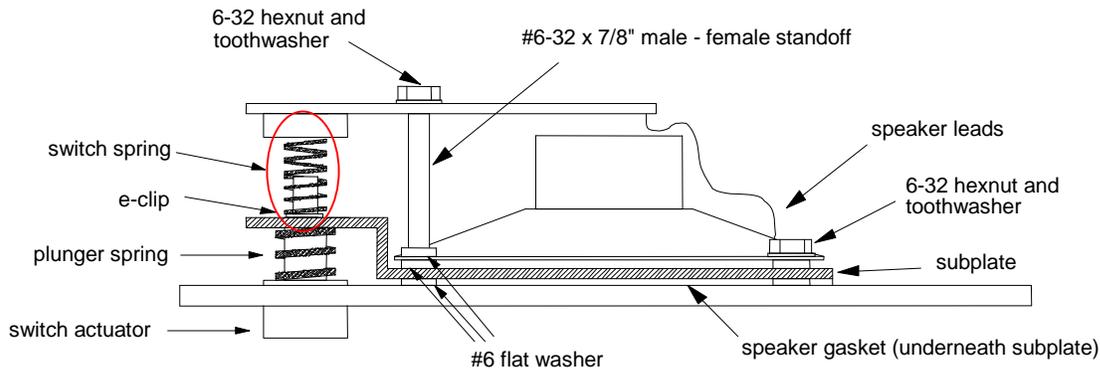


Figure 6. Spring Location in Intercom Station Switch

- The intercom may not be configured properly. If the intercom call button has never worked, then check the intercom station project configuration for this station. Use the “*DXL Administrator*” program, and select the “*Configure: Station*” pulldown. Then click on this intercom station and bring up its properties screen. First of all, verify that the station port listed on the configuration is the port where the station is connected to. If this is correct, then verify the switch configuration by selecting the “*Switches*” tab. In almost all cases, switch #2 is the call request switch (*even for single button stations*) since the bottom button on an intercom station is switch #2. Ensure that Switch #2 has the action “*Call Request*”. Double click the “*Call Request*” text and ensure that the “*Master*” listed is the master you wish the call request to be sent to. If you have used a template for this station, you may have to set that in the station’s template rather than the station (or create a new template for this type of station).
- The intercom might be blown. Try putting replacing the circuit board with a Station Repair Kit (SRK) circuit board, or a spare intercom in place of this intercom.
- This may also be caused by touchscreen/PLC programming problems. If the intercom station calls in once, but does not call in again unless the DXL DCC is re-booted, then this is likely a touchscreen or PLC programming problem. When the DXL system sends a call request command to a master (or masters) controlled by the PLC or touchscreen, it will queue it up and not send another request (even if the button is pressed again) until that specific master (or masters) answers the call. If another touchscreen master answers the call (rather than the master or masters that the call was directed to) then the DXL system will not clear the call off the queue and it will still not recognize new call requests for that station. The solution in this case is for the touchscreen/PLC programmer to send the “*Ican*” command to the DXL system to clear the call off the call queue under these circumstances.

4.9 Intercom call buttons usually work normally, then later stop calling in

This symptoms of this problem is that intercom call buttons usually work normally after the system starts up, but some time later the call request button stops working.

Once the call request button stops working, the only ways to get the call button working again is to make an audio connection to the intercom station from a master, or to reboot the DCC.

If these symptoms are exhibited, then this is likely a communication problem between the DXL DCC and the touchscreen/PLC. As above, when the DXL system sends a call request, it will queue it up, and only send it once until the master it sent the call request to answers the call. If the touchscreen or PLC “miss” the call request, it will remain in the DXL master call queue and not re-send the call-in until it is answered. However, since the touchscreen is not showing the call in on the screen, likely the staff members will not answer the call unless they see someone waiting at the door on their cameras.

If this appears to sound like the problem, then have your touchscreen or PLC programmer examine the DXL system logs, and check their communication programming. Some causes for this may be:

- The DXL system might be sending commands faster than the PLC can process. In the case of PLC Ethernet communications, possibly the Ethernet processor on the PLC might not be able to process the combined network traffic of PLC and DXL communications. Adding a dedicated processor for DXL communications may solve this problem.
- The PLC or touchscreen programming may occasionally get interrupted before it can fully process a DXL response.
- There may be a “race condition” between the communication processor on the PLC and the PLC main processor, in which case the communication processor receives the messages from the DXL system, but the main processor does not process it before the communication processor receives another message from the DXL system.
- The PLC or touchscreen system may have a “processing” timer that is running slower than it is polling messages from or receiving messages from the DXL system.

4.10 Masters or DIO cards spontaneously reset

In cases where Lonworks devices such as IMS masters or DIO cards “reset” spontaneously, this is usually caused by an intermittent Lonworks control network.

In this context, a “reset” is when you hear the master “click”, the display dims, then it re-starts a few seconds later with a startup message, then a blank screen, then the usual master call queue. A DIO will also click, its lights will turn off, then start flashing about 30 seconds later.

If you have experienced any of the above symptoms, you might want to check the Lonworks network.

4.11 Periodic ticking or hissing noise in one direction on audio calls

If you have a situation where you notice a periodic “ticking” or “hissing” noise on connections to another exchange, and if this noise appears to be only in one direction, this may be due to a marginal digital audio trunk connection.

In the following example, the system uses four exchanges. When a control master in exchange 2 calls an intercom station in exchange 4, while the master is listening, the audio as heard on the master has a periodic “ticking” noise on top of the received audio, yet while the master is pressing its push to talk button, the audio as heard on the station is clear.

To determine where to look for this problem, you can use some knowledge of how the digital audio trunk is connected in the system. The DXL system will always transmit the audio in a loop fashion, from the transmit port of one DCC to the receive port of the next DCC. If the audio from master to station is clean, then the complete digital audio trunk from the master to station should be okay. If the audio from station to master has noise on it, then one (or more) of the links in this path may have a poor digital audio trunk connection or weak signal. The next diagram shows what is known from the above information.

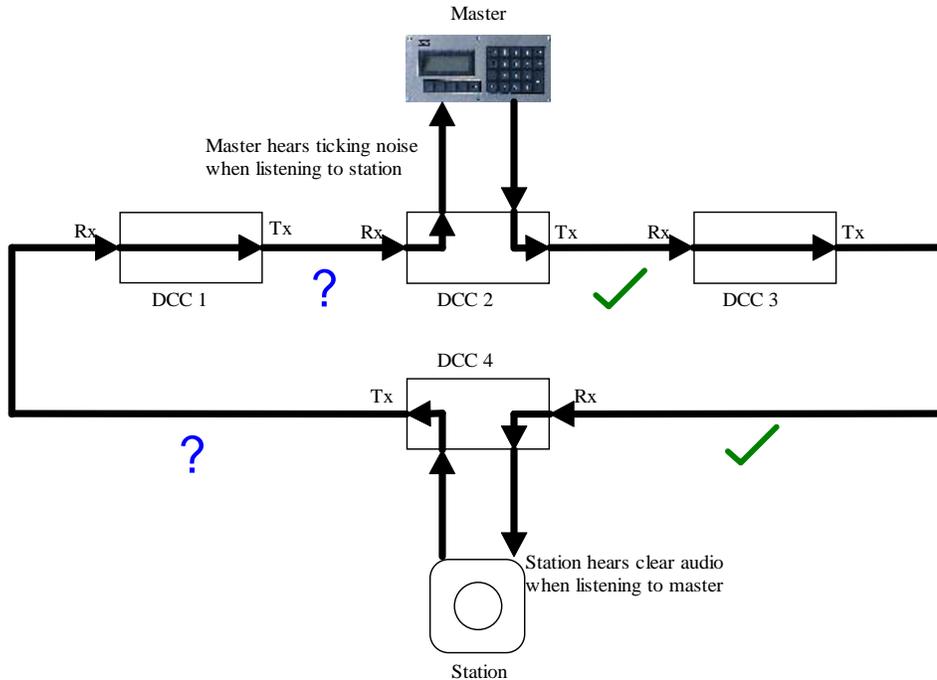


Figure 7. Noisy Digital Audio Trunk audio path between master and station with a marginal link

To further isolate the problem, now initiate a call from the master to a station on another exchange in the noisy path. Place a call from the same master on exchange 2 to a station on exchange 1 and determine which side hears noisy audio.

If the station on exchange 1 still hears clear audio, yet the master on exchange 2 hears noisy audio, then the below diagram shows the information known about the digital audio trunk path. This has isolated the problem to the link from exchange 1 transmit to exchange 2 receive, so now you can check the wiring and correct the problem.

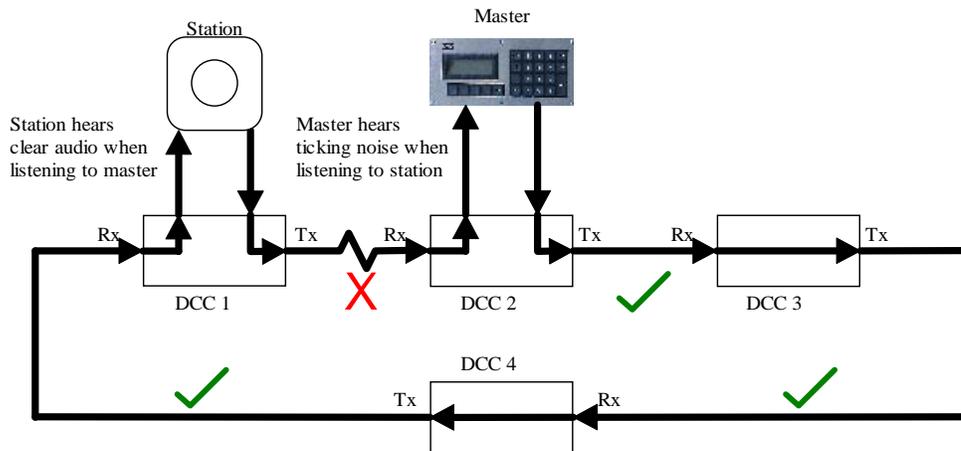


Figure 8. Digital Audio Trunk audio path between master and station with a marginal link between 1 and 2

If on the other hand, when calling from a master on exchange 2 to a station on exchange 1, the station hears the noise and the master has clear audio, this indicates that the link between exchange 4 transmit to exchange 1 receive is the noisy connection.

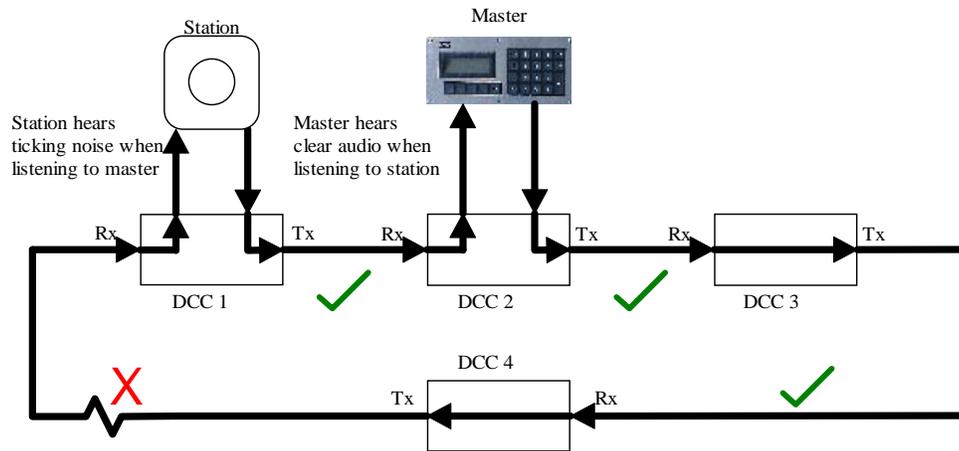


Figure 9. Digital Audio Trunk audio path between master and station with a marginal link between 4 and 1