Westronic

Digital Distribution and Multiport Bridges

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Technical Manual

Technical Manual

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D	October, 2000	Logo Update

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Section 1 Product Description

The digital bridge product family, shown in Figure 1-1, consists of the digital distribution bridge and the digital multiport bridge. Both bridges, which use the same shelf and power supply, are identical in appearance and connectivity.

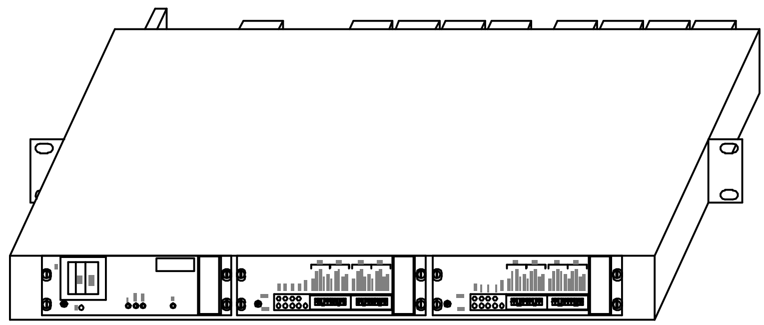


Figure 1-1 Digital Distribution Bridge Shelf

Applications in which one host device must communicate with multiple slave devices generally use the digital distribution bridge. Applications in which multiple peer devices communicate with each other generally use the digital multiport bridge.

Both bridge versions provide advanced network protection through lockout and antistreaming. Lockout prevents one station from interfering with another station's transmission. Antistreaming prevents a failed terminal from monopolizing the line and blocking other terminals. The bridges are completely transparent to the data flowing through them, switching individual bits without regarding start/stop, parity, or word format – useful with protocols such as E-Telemetry.

The digital bridge consists of one or more digital bridge modules (either distribution or multiport or a mix of the two), a power supply, and a shelf. All the cards follow the single eurocard form factor. The chassis mounts in a standard 19- or 23-inch rack.

1.1 Digital Distribution Bridge Overview

The Westronic digital distribution bridge provides the ability for one master serial channel to communicate with multiple tributary channels (Figure 1-2). Systems requiring large numbers of tributary channels can cascade multiple bridges.

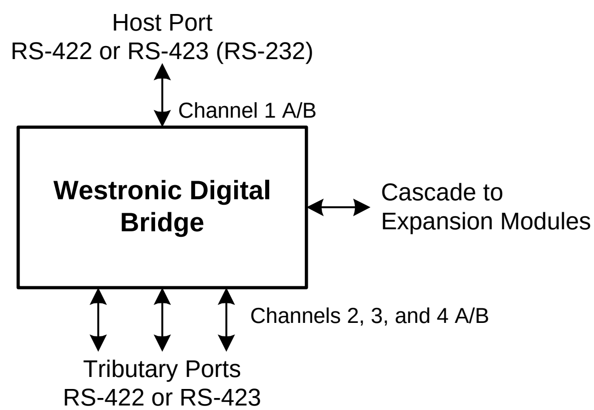


Figure 1-2 Digital Distribution Bridge Concept

Applications include add/drop capability along microwave radio, fiber optic and digital repeater sites, telemetry hubs, and multipoint data circuits.

Each digital distribution bridge module contains six channels, as shown in Figure 1-3. Four serve as user (master or tributary) channels. The remaining two channels allow cascading for bridge expansion.

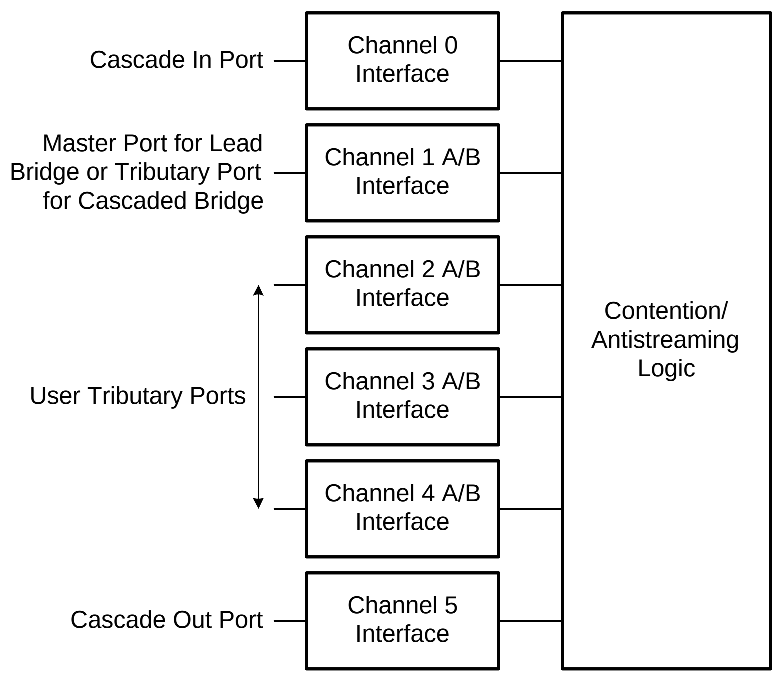


Figure 1-3 Digital Distribution Bridge Block Diagram

You can configure the bridge module as either a *lead* or *cascaded* bridge (see Figure 1-4). Use the lead bridge configuration for a stand-alone bridge or for the bridge connected to the master device in a cascaded system. This configuration has the host channel and three user tributary channels available. Use the cascaded configuration, which has four user channels available, for all bridges cascaded to a lead bridge.

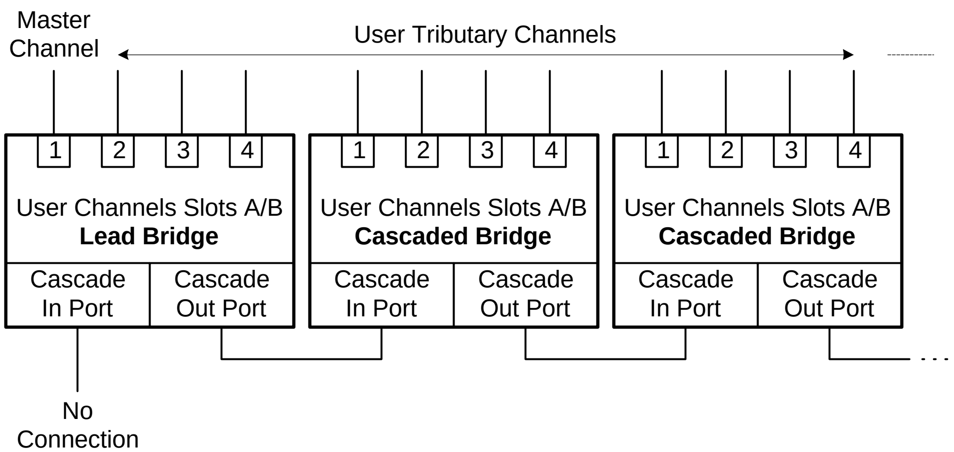


Figure 1-4 Digital Distribution Bridge Cascaded Configuration

1.2 Digital Multiport Bridge Overview

The Westronic digital multiport bridge enables multiple peer devices to communicate with each other (Figure 1-5). Systems requiring large numbers of channels can cascade multiple bridges together.

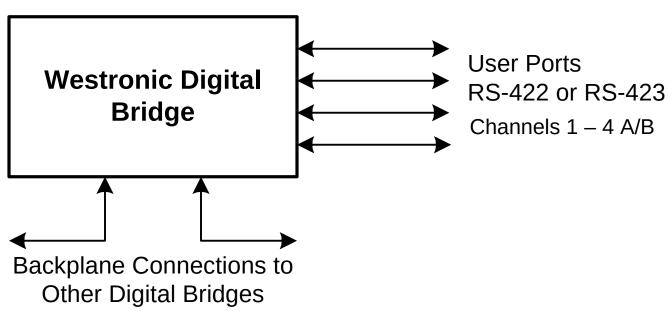


Figure 1-5 Digital Multiport Bridge Concept

Each digital bridge module contains six channels, as shown in Figure 1-6. Four serve as user channels and the remaining two channels allow cascading for bridge expansion.

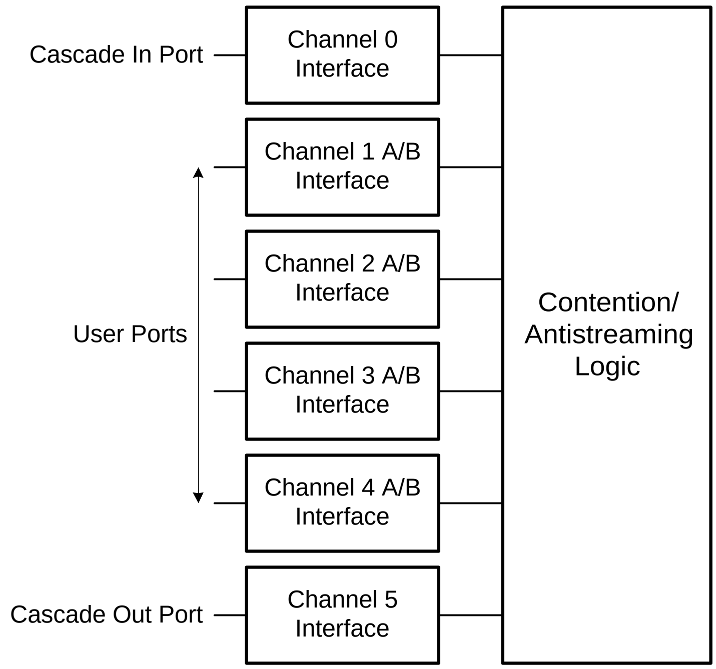


Figure 1-6 Digital Multiport Bridge Block Diagram

While a device connected to one of the user ports is transmitting, devices on the remaining user ports receive the transmitted data. Arbitration logic within the multiport bridge module ensure that no more than one user device transmits at a given time. Figure 1-7 shows how multiple ports can cascade together to expand the number of communicating ports.

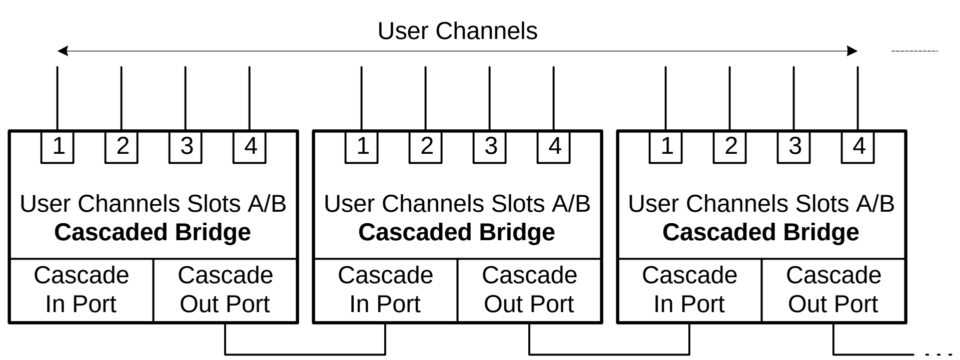


Figure 1-7 Digital Multiport Bridge Cascaded Configuration

1.3 Typical Fiber Ring Telemetry Applications

The new ring structures created with SONET and other types of optical fiber transmission systems have created new challenges to traditional network telemetry. The Add-Drop Multiplexers (ADM) used in these systems provide telemetry data through service channels in the fiber capacity *overhead*. Where the ring structure protects these service channels, traditional standards-based telemetry approaches are workable.

When the ring structure does not protect the service channels, a broken ring presents a problem. When the ADM sites poll the Remote Telemetry Units (RTUs) in one direction (for example, counterclockwise), all ADM sites beyond the break become isolated and no longer under surveillance.

A single polling device that polls all RTUs around a ring is shown at the headend of the ring in Figure 1-8. The polling can be over analog modem or through direct digital connection (RS-422 or RS-232) to the headend ADM. The digital method, which is preferable, is only available where digital service channels support the telemetry protocol framing. For example, E-Telemetry protocol is generally unsuitable for direct digital connection, depending on the type and characteristics of the transmission equipment used.

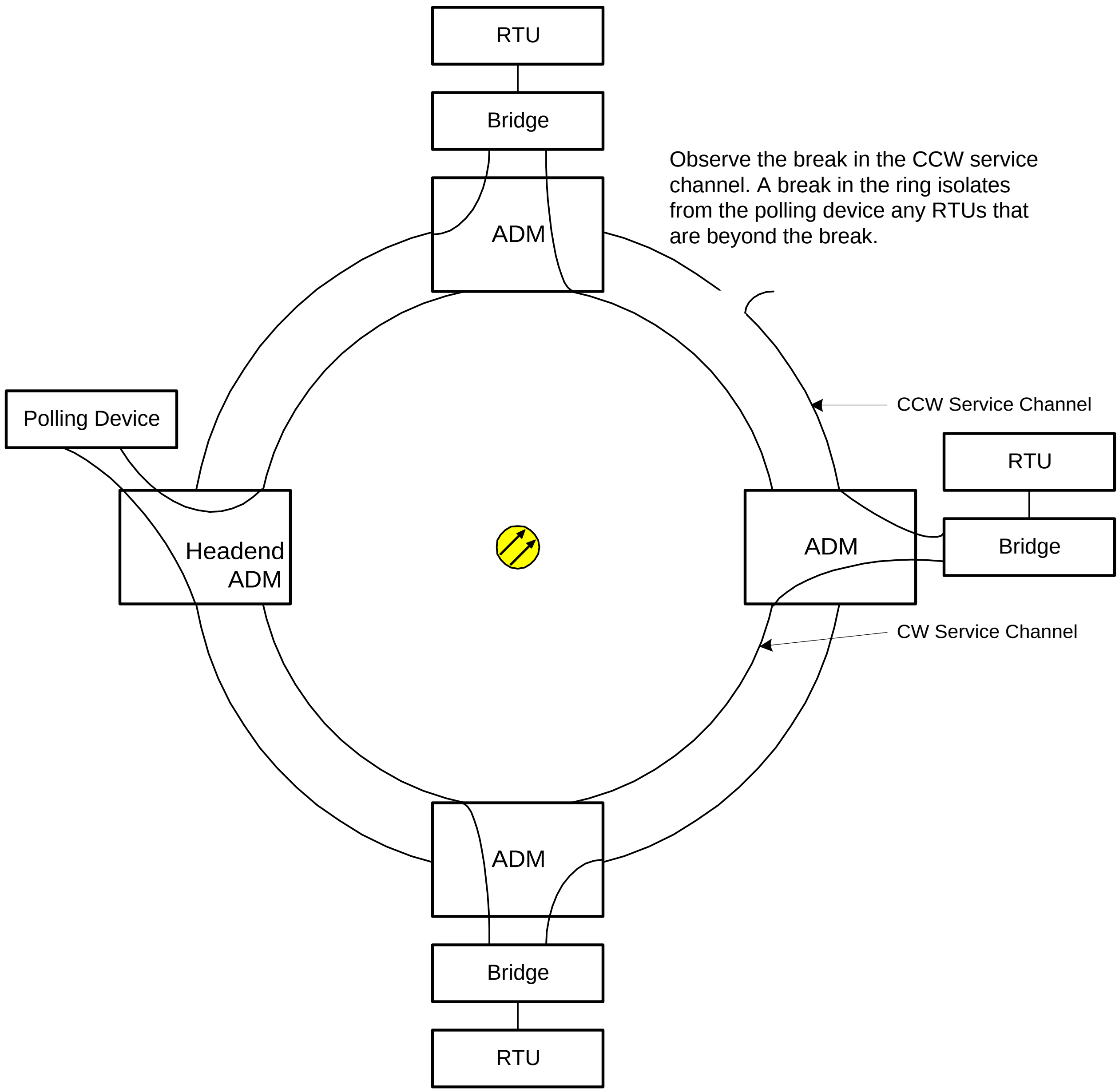


Figure 1-8 Typical Fiber Ring Telemetry Installation

Each site requires analog or digital bridging to permit delivery of a poll to its local RTU and to each of the other RTUs as the poll travels around the ring. Analog bridges can be problematic because of the necessary daisy-chain approach. Polling simultaneously in both directions on the ring is not possible because the data collision makes polling incomprehensible to the RTUs and the responses, if any, incomprehensible to the polling station. Delays around the ring ensure that a data overlap exists at any RTU site, resulting in a garbled message. Westronic digital bridges provide capability to transmit simultaneously in both directions while preventing data collisions.

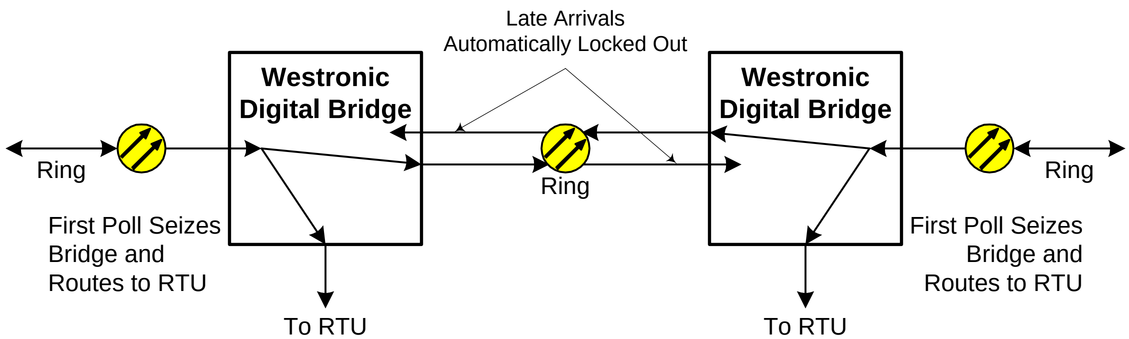
To complete a ring, fit the headend polling port with Westronic distribution bridge PN 520-T011. The shelf contains a power supply and a 1:3 distribution bridge module. Fitted with an additional module, the shelf becomes either a single 1:7 bridge or two individual 1:3 bridges. This example requires a single module only, but shelves can be chained to form even larger bridges.

Connect the polling device to the digital bridge Master port using an RS-422 or RS-423/232 interface. Set the bridge to “data detect” or RTS/CTS/DCD mode, depending on port needs and protocol. For example, TABS protocol uses the data detect mode and does not use the handshake signals.

Connect one of the Tributary ports to the clockwise (CW) service channel and connect another Tributary port to the counterclockwise (CCW) service channel.

Connect a Westronic multiport digital bridge to the CW and CCW service channels at each ADM site. The multiport digital bridge distributes data to each of the other ports. Because the multiport bridge has no dedicated master or tributary ports, each port becomes the master when it receives data and releases the bridge after data transfer completes. As the poll travels around the ring, being repeated to each RTU along the way, it eventually meets itself coming the other direction. This normally results in a garbled message. However, the Westronic digital bridge Automatic Lockout prevents this from occurring.

In this scenario (Figure 1-9), only one port has permission to act as master at any given time; all other ports have their receive data suppressed. Usually, one of the polls arrives at this pivotal bridge first. In the event that both polls arrive simultaneously, the lowest numbered port gains control, repeats the poll to the local RTU, and sends the poll along toward the next bridge. The second-place poll is discarded. The next bridge in the line discards the poll that gained control of the bridge so that neither of the reflected polls travel back around the ring.



Each bridge accepts the earliest received message and blocks the message that arrives a few bits later in time, thus preventing collisions. Noise and other impairments are also prevented from travelling around the ring because the headend uses a distribution bridge rather than a multiport bridge. The distribution bridge acts as a data "stopper." Harris digital bridges also perform antistreaming control to maintain maximum network reliability.

Figure 1-9 Fiber Ring Data Flow

Each bridge has a 10-millisecond release time. Therefore, because the ring propagation delay is very short, the entire second-place poll is discarded and no bits are left over to generate noise on the ring. After a bridge has received the poll, one of its RTUs responds. A 10-millisecond delay between receiving the poll and issuing the response is important. WS2000 and WS3000 products use a minimum RTS/CTS delay of 10 milliseconds and, thus, work correctly. The response travels in both directions around the ring. One response arrives at the headend distribution digital bridge first and gains control. The other response hits the locked-out port and is discarded. Again, the 10-millisecond bridge release time ensures that the entire second response is discarded and no noise passes up to the polling port.

If the ring breaks with either a unidirectional or bidirectional failure mode, the polls still find all the RTUs without any manual intervention. Responses come up the ring side that is still connected to the headend. The polling device does not need to take any special action to recover or restore.

To preclude problems, such as a skew of greater than 10 milliseconds, that cause leftover message parts, use only TABS and E-Telemetry protocols, which are addressed and checked.

1.4 Features and Operation

The following describes digital bridge assembly features and includes information about the power source, alarm connections, and configuration options.

1.4.1 Backplane and Shelf

The digital bridge assembly is a standard one Vertical Unit (VU) or 1.75 inches high by 19-inch rack-mount chassis. Rack adapters allow mounting in a 23-inch rack.

The backplane, providing all user connections and interconnections between modules, has locations for three plug-in modules. The power supply resides in the left slot; the first digital bridge module resides in the middle slot (Slot A); and the second digital bridge module resides in the right slot (Slot B).

Power supply and local alarm connections are through a compression style terminal block (TB1) on the rear of the backplane. Each user channel terminates in an 11-pin Methode connector (J1 through J8). The backplane also has transient protection and optional RS-422 termination networks for each user channel.

1.4.2 Power Supply

The power supply provides +5 Vdc and ±12 Vdc from a –20 through –60 Vdc input. The supply is equipped with a power switch and an On indicating LED. Current-limited test points allow measurement of each output voltage.

1.4.3 Distribution Bridge Module

Each digital distribution bridge module provides control and interface circuitry for four user channels, a cascade in channel, and a cascade out channel. Configuration for each user channel can be DCE or DTE with an RS-422 or RS-232 interface. The two dedicated cascading channels operate at TTL voltage levels.

The host channel broadcasts to all tributary channels. The bridge generates handshake signals to the tributary channels, as appropriate. The bridge allows only one tributary channel at a time to transmit to the host channel. Consequently, each tributary channel contends for access to the host channel.

Channels not supporting handshake signals have a configuration such that a start bit initiates the request to use the channel. Channels in this mode are data detection channels. CTS remains active in the idle state and goes inactive only when the channel becomes unavailable.

The digital bridge incorporates an antistreaming function to prevent a tributary channel device from exluding host device access to other tributary channels. The antistreaming function can be disabled for each individual channel. If any channel transmits for longer than 3 seconds (channel timeout), the bridge disconnects the channel and generates an alarm, which exists as a visual indication and a closed relay contact.

The following explains operation for each of various scenarios. DCE and DTE refer to the bridge channel configuration. If the connected device has a DTE configuration, the bridge channel requires a DCE configuration. Likewise, if the connected device has a DCE configuration, the bridge channel requires a DTE configuration.

1.4.3.1 Host Transmits to a DCE Configuration Channel

1. Host device asserts RTS.
2. Bridge asserts CTS on host channel and asserts RTS on DTE tributary channels or DCD on DCE tributary channels.
3. Host channel Tx data transmits to the tributary channel Rx (DCE configuration) or Tx (DTE configuration) pins.
4. Host device releases RTS.
5. Bridge releases CTS, RTS, and DCD to the applicable channels.

1.4.3.2 Host Transmits to DTE Configuration Channel

1. Host device asserts DCD.
2. Bridge asserts RTS on DTE tributary channels or DCD on DCE tributary channels.
3. Host channel Rx data transmits to the tributary channel Rx (DCE configuration) or Tx (DTE configuration) pins.
4. Host device releases DCD.
5. Bridge releases RTS and DCD to the applicable channels.

1.4.3.3 Tributary Transmits to DCE Configuration Channel with Handshake

1. Tributary device asserts RTS.
2. Bridge asserts DCD (if DCE host) or RTS (if DTE host) and CTS to a selected tributary channel when the channel is enabled for contention and no other tributary channel is currently transmitting. The bridge deasserts CTS to any data detection tributary channels.
3. Data from tributary channel Tx transmits to host channel Rx (DCE configuration) or Tx (DTE configuration) pin.
4. Tributary device releases RTS.
5. After 4 milliseconds, the bridge releases RTS/DCD to the host and CTS to the tributary channel, and restores CTS to any tributary channel operating in data detection mode.

1.4.3.4 Tributary Transmits to DTE Configuration Channel with Handshake

1. Tributary device asserts DCD.
2. Bridge asserts DCD (if DCE host) or RTS (if DTE host) when the channel is enabled for contention and no other tributary channel is currently transmitting. The bridge deasserts CTS to any data detection tributary channels.
3. Data from tributary channel Rx transmits to host channel Rx (DCE configuration) or Tx (DTE configuration) pin.
4. Tributary device releases DCD.
5. After 4 milliseconds, the bridge releases RTS/DCD to the host and restores CTS to any tributary channel operating in data detection mode.

1.4.3.5 Tributary Transmits to DCE Configuration Channel With Data Detection

1. If CTS is asserted, the tributary device begins transmission.
2. Bridge detects start bit and asserts DCD (if DCE host) or RTS (if DTE host) when the channel is enabled for contention and no other tributary channel is currently transmitting. The bridge deasserts CTS to any data detection tributary channels.
3. Data from tributary channel Tx transmits to host channel Rx (DCE configuration) or Tx (DTE configuration) pin.
4. Tributary device stops transmitting data.
5. Bridge detects 10-millisecond idle time on data line, releases RTS/DCD to the host, and restores CTS to data detection channels.

1.4.3.6 Tributary Transmits to DTE Configuration Channel With Data Detection

1. If CTS is asserted, tributary device begins transmission.
2. Bridge detects start bit and asserts DCD (if DCE host) or RTS (if DTE host) when the channel is enabled for contention and no other tributary channel is currently transmitting. The bridge deasserts CTS to any data detection tributary channels.
3. Data from tributary channel Rx transmits to host channel Rx (DCE configuration) or Tx (DTE configuration) pin.
4. Tributary device stops transmitting data.
5. Bridge detects 10-millisecond idle time on data line, releases RTS/DCD to the host, and restores CTS to data detection channels.

1.4.3.7 Tributary Channel Timeout (Antistreaming)

1. Tributary channel has active channel for 3 seconds ± 10%.
2. Bridge deasserts CTS to this channel and disables its data transmission to the host.
3. Bridge arms 400-millisecond tributary channel timer.
4. Bridge activates alarm.
5. When the affected tributary channel ceases data transmission and deasserts its RTS/DCD line (except on data detection channels), its 400-millisecond timer begins counting. After the timer expires, the channel can again contend for host access. Any activity on the data or handshake lines occurring before the affected channel timer expires resets the timer to 400 milliseconds.

1.4.4 Multiport Bridge Module

Each digital multiport bridge module provides control and interface circuitry for four user channels, a cascade in channel, and a cascade out channel. Configuration for each user channel can be DCE or DTE with an RS-422 or RS-232 interface. The two dedicated cascading channels operate at TTL voltage levels.

A user device that wishes to transmit to the host must use standard handshaking signals or the data detection feature to request control of the bridge. After the bridge grants control, the bridge generates handshaking signals to the other user channels, as appropriate. The bridge allows only one user channel at a time to transmit to the host channel. All user channels, except the transmitting channel, hear the transmission.

Channels not supporting handshake signals have a configuration such that a start bit initiates the request to use the channel. Channels in this mode are data detection channels. CTS remains active in the idle state and goes inactive only when the channel becomes unavailable.

The digital bridge incorporates an antistreaming function to prevent a user channel device from excluding bridge access to other user channels. The antistreaming function can be disabled for each individual channel. If any channel times out, the bridge disconnects the channel and generates an alarm, which exists as a visual indication and a closed relay contact.

The following explains operation for each of the various scenarios. DCE and DTE refer to the bridge channel configuration. If the connected device has a DTE configuration, the bridge channel requires a DCE configuration. Likewise, if the connected device has a DCE configuration, the bridge channel requires a DTE configuration.

Note: In the following description, a channel connected to a device that wishes to transmit is referred to as a requesting channel. User channels refer to all available user channels, except the requesting channel. Unless specified otherwise, the bridge is assumed to be idle before the described sequence of events.

1.4.4.1 Requesting Channel Has DCE Configuration

1. Requesting device asserts RTS.
2. Bridge asserts CTS to requesting channel and RTS to DTE user channels or DCD to DCE user channels.
3. Requesting channel Tx data transmits to user channel Rx (DCE configuration) or Tx (DTE configuration) pins.
4. Requesting device releases RTS.
5. Bridge releases CTS and RTS/DCD to the applicable channels.

1.4.4.2 Requesting Channel Has DTE Configuration

1. Requesting device asserts DCD.
2. Bridge asserts RTS to DTE user channels or DCD to DCE user channels.
3. Requesting channel Rx data transmits to user channel Rx (DCE configuration) or Tx (DTE configuration) pins.
4. Requesting device releases DCD.
5. Bridge releases RTS/DCD to the applicable channels.

1.4.4.3 Requesting Channel Has DCE Configuration with Data Detection

1. If CTS is asserted, the requesting device begins transmission.
2. Bridge detects start bit and asserts DCD to DCE user channels or RTS to DTE user channels when the channel is enabled for contention and no other user channel is currently transmitting. The bridge deaasserts CTS for any other data detection channels.
3. Requesting channel Tx data transmits to the other user channel Rx (DCE configuration) or Tx (DTE configuration) pins.
4. Requesting device stops transmitting data.
5. Bridge detects 10-millisecond idle time on data line, releases RTS or DCD to the other user channels, and restores CTS on all data detection channels.

1.4.4.4 Requesting Channel Has DTE Configuration with Data Detection

1. If CTS is asserted, requesting device begins transmission.
2. Bridge detects start bit and asserts DCD to DCE user channels or RTS to DTE user channels when the channel is enabled for contention and no other user channel is currently transmitting. The bridge also deasserts CTS for any other data detection channels.
3. Requesting channel Rx data transmits to the other user channel Rx (DCE configuration) or Tx (DTE configuration) pins.
4. Requesting device stops transmitting data.
5. Bridge detects 10-millisecond idle time on data line, releases RTS or DCD to the other user channels, and restores CTS to data detection channels.

1.4.4.5 Requesting Channel Timeout (Antistreaming)

1. Requesting channel has active channel for 3 seconds ± 10%.
2. Bridge deasserts CTS to this channel and disables its data transmission to the other user channels.
3. Bridge arms 400-millisecond user channel timer.
4. Bridge activates alarm.
5. When the affected user (requesting) channel ceases data transmission and deasserts its RTS/DCD line (except on data detection channels), its 400-millisecond timer begins counting. After the timer expires, the channel can again contend for bridge access. Any activity on the data or handshake lines occurring before the affected channel timer expires resets the timer to 400 milliseconds.

1.4.5 Configuration/Indication Facilities

The configuration DIP switches, accessible from the front panel, allow selection of the following options for each channel:

- DTE/DCE configuartion
- RS-422/RS-232
- Antistreaming
- Data detection
- Channel disable

The front-panel indicator LEDs provide the following information:

- Channel activity on each channel
- Channel disabled for each channel
- One timeout alarm

1.5 Specifications

The digital bridge module occupies two slots (1.6 inches) in a single eurocard style chassis. The module front provides the configuration switches and indicators. See Figure 1-10.

The power supply occupies two slots (1.6 inches) in a single eurocard style chassis. The switch On indicator and test points are accessible at the front edge.

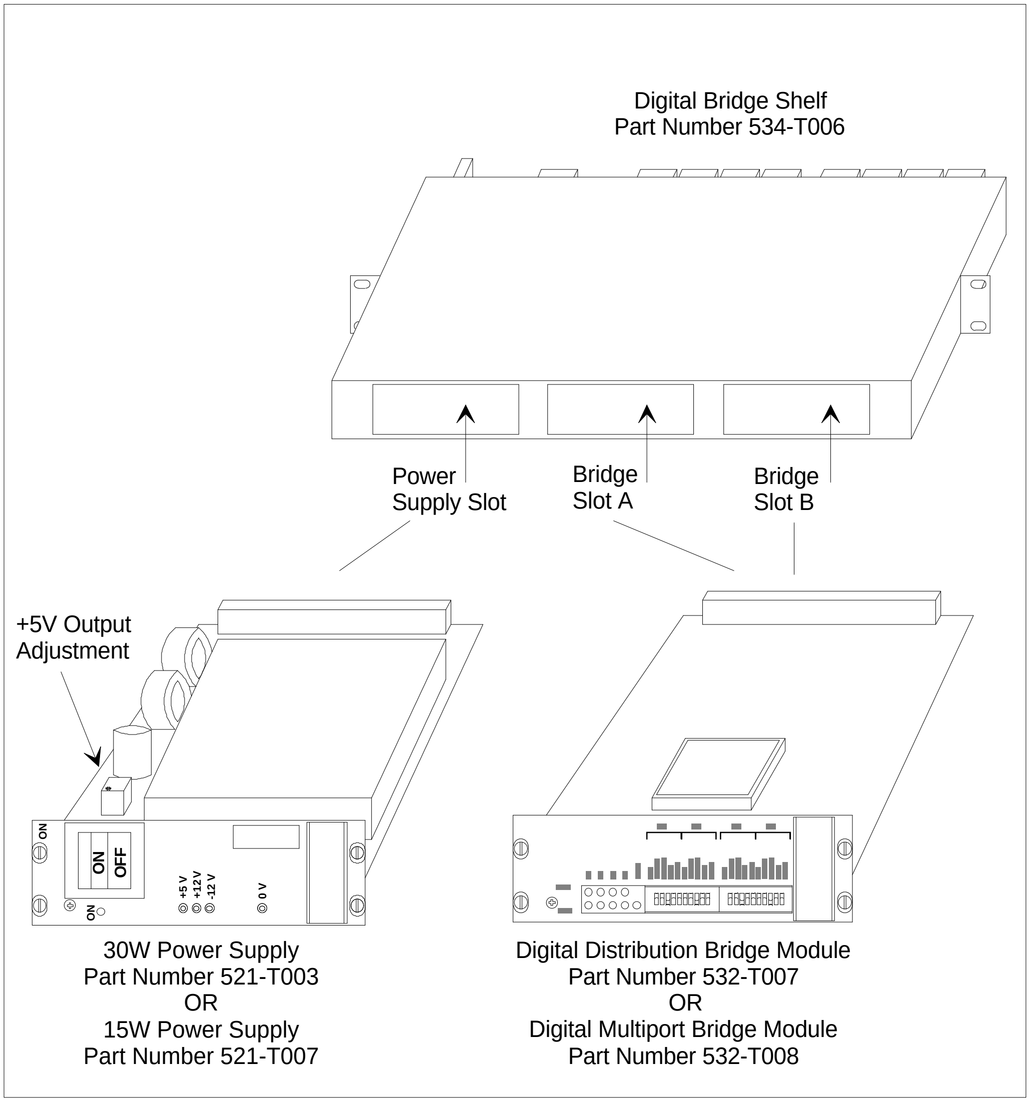


Figure 1-10 Digital Distribution Bridge Shelf and Components

1.5.1 Electrical

This section provides engineering data and electrical requirements for installation of the digital bridge assembly. The following specifications are subject to change without notice.

1.5.1.1 Power Supply

The following information relates to the power supply module:

- Input voltage: –20 to –60 Vdc
- Output voltages:
  +5 Vdc (+4.90 Vdc to +5.20 Vdc)
  +12 Vdc (11.6 Vdc to 12.4 Vdc)
  –12 Vdc (–12.4 Vdc to –11.6 Vdc)
- Output current:
  5 Amps at +5 Vdc
  1 Amp at +12 Vdc
  1 Amp at –12 Vdc
- Power rating: 15 or 30 Watts total (see Table 1-1)
- Regulation: 0.2% line
  2% load

1.5.1.2 Bridge Module

The following power data pertains to the bridge module.

- Power requirements for each module:
  - +5 Vdc at 210 mA
  - +12 Vdc at 17 mA
  - –12 Vdc at 35 mA
- Total power consumption:
  - 1.6 Watts maximum
  - 0.74 Watts quiescent
- Recommended external fuse for the system: 1 Amp Slow Blow

1.5.2 Interfaces

The following provides detailed data on the digital distribution bridge interfaces, which consist of digital serial channels 1 through 4:

- Speed: 9,600 bps maximum
- Electrical interface: RS-422 or RS-232
- Protection: sustained transient voltage up to 2 kV
- Connection: 11-pin Methode connector

1.5.3 Environmental

The following are the digital distribution bridge environmental parameters:

- Operating ambient temperature range: 0° to +55° C
- Humidity: < 95% noncondensing

1.5.4 Mechanical

The following describes the digital distribution bridge unit hardware:

- Dimensions
  - Width: 17.4 inches (44.1 cm)
  - Height : 1.75 inches (4.4 cm)
  - Depth: 8.0 inches (20.3 cm)
- Mounting
  - 19-inch (48.3-cm) rack mount
  - 23-inch (58.4-cm) rack mount with optional adapters
- Weight
  - 8 lbs (3.6 kg) (maximum) fully equipped, unpackaged
  - 11 lbs (5.0 kg) fully equipped, packaged
- Connectors
  - Power, analog, and auxiliary connections: TB1 – 6-position, single-level, compression terminal block that accepts 13- to 24-AWG wires
  - Digital connections: J1 through J10, 11-position, header-terminal connectors. Several companies, such as the following, manufacture the mating connectors:
    - Methode (PN 1300-111-424 or 130F-111-424)
    - Amp (PN 1-643814-1)
    - Westronic (PN 620-T037)

1.5.5 Unit Identification

Use the part numbers listed in Table 1-1 when ordering various configurations and spare parts of the digital distribution bridge units.

Table 1-1 Digital Bridge Part Numbers

Part No	Name	Digital Ports	Power Supply	Mount (Inch)	CLEI Code
Digital Bridge Systems					
520-T009	Digital Bridge, 4 Multiport Assy	4	Yes	19/23	TBA
520-T010	Digital Bridge, 8 Multiport Assy	8	Yes	19/23	TBA
520-T011	Digital Bridge, 1:3 Master	4	Yes	19/23	TBA
520-T012	Digital Bridge, 1:7 Master	8	Yes	19/23	TBA
520-T014	Digital Bridge, 1:3 Secondary	4	No	19/23	TBA
520-T015	Digital Bridge, 1:7 Secondary	8	No	19/23	TBA
Accessories					
620-T037	11-Pin Serial Connector	–	–	–	N/A
990-0150	Serial Insertion Tool	–	–	–	N/A
585-T059	Serial Connection Kit (contains 10 serial connectors and one serial insertion tool)	–	–	–	N/A
Spares					
532-T007	Digital Bridge Unit 1:3	4	N/A	N/A	TBA
521-T003	30-Watt Power Supply	–	Before 2/1994		TBA
521-T007	15-Watt Power Supply	–	After 2/1994		TBA
534-T006	Shelf Assembly	–	–	–	TBA
585-T055	Rack Adapter Kit	–	–	23	N/A
994-T021	Digital Bridge User Guide	–	–	–	N/A

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Section 2 Installation

2.1 Handling Considerations and Precautions

Many Westronic products use modules that contain Complementary Metal Oxide Semiconductor (CMOS) and N-Channel Metal Oxide Semiconductor (NMOS) integrated circuits because these components help maximize noise immunity and promote lower power consumption. However, modules containing CMOS and NMOS integrated circuits require careful handling to avoid damage to the CMOS and NMOS integrated circuits resulting from high static voltage levels. The CMOS and NMOS devices come equipped with protection diodes, but incorrect handling that allows excessive static energy to enter the devices can still cause device failure that is not readily detectable and can lead to premature device failure. Packaging containing CMOS/NMOS components have a label similar to that shown in Figure 2-1.

Static Sensitive
Maintain Antistatic Protection

Figure 2-1 Electrostatic Discharge (ESD) Logo

The following noteworthy points significantly reduce static damage on CMOS or NMOS components, thereby improving system reliability and keeping system downtime to a minimum:

- Always ground yourself using an ESD heel or wrist strap or touch a system rack that is earth grounded before removing or inserting modules to ensure that they are not carrying static charges.
- Always place an extracted module in an antistatic bag or covering for transportation and storage.
- Perform repair work on modules in an antistatic work station that uses personnel grounding protection, such as wrist straps and antistatic matting.

- Exercise extreme care when handling CMOS/NMOS components. Do not touch the pins and always place components in antistatic foam for storage and transportation.
- Ensure that desoldering tools have static reduction. Some desoldering tools can actually generate large static voltages that damage CMOS and NMOS devices.

The bridge module is protected against 2-kV transients while installed in the digital bridge shelf through the shelf power ground.

2.2 Module Substitution

Keep the following important points in mind to assist board diagnosis when a module requires an upgrade, replacement, or substitution:

- Turn power off when removing or inserting modules. Although the boards are designed to withstand removal and insertion with power on, a recommended practice is to turn off system power when substituting modules.
- Make certain that the substitute board has identical configuration strap and switch arrangements as the board it is replacing. Without identical settings, the new module can operate improperly.
- Ensure that the module mates properly with the connector at the chassis rear when inserting the module. A firm push on the module front is usually all that is required to install the module. Never force a board into position because this can damage the module or the rear connector.

Only qualified personnel familiar with the type of electronic design used on the unit should perform module repair.

Describe the suspected problem or fault or operation symptoms observed before the failure occurred (what were the conditions just before the board failed? Can the board be made to fail because of some set of conditions?). This information can aid in reducing repair time.

2.3 Installation Procedures

The following describes how to install the digital bridge into a permanent location. The following is a suggested order of installing the digital distribution bridge hardware:

- Mount the unit
    - Verify strapping/configuration
    - Verify strapping on digital bridge module (lead/slave)

- Verify strapping on backplane
- Verify strapping on DIP switch

▪ Cable the unit

▪ Verify serial port connections

▪ Verify power connections

Refer to the check list at the end of this section for a step-by-step installation guide.

2.3.1 Installing the Main Assembly

The digital bridge assembly is a standard one vertical space (1.75 inches) shelf and mounts in a standard 19-inch telecommunications rack. Adapters provided with the unit allow mounting in a 23-inch rack. Figure 2-2 shows the digital bridge shelf dimensions.

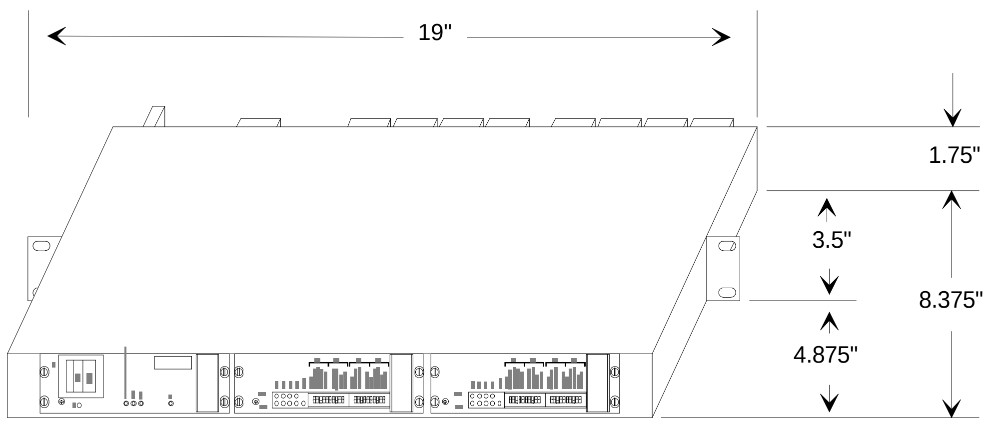

Figure 2-2 Digital Bridge Shelf Dimensions

Notes to Figure 2-2

1. The depth dimension includes the front panel plug-in module handles and rear connector block TB1.
2. The digital bridge shelf occupies one rack unit (1.75 inches) in a standard 19-inch equipment rack. Adapters allow mounting the equipment in a 23-inch rack.
3. A digital bridge module occupies either of two slots in a single eurocard style chassis. The front of each digital bridge unit contains channel configuration switches.
4. The power supply occupies one slot in a single eurocard style chassis. The power switch, On indicator, and test points are accessible at the front edge.

2.3.2 Installing an Expansion Shelf

An expansion shelf has the same dimensions as the main assembly, but generally is not equipped with a power supply. Bolt the expansion chassis into the rack position immediately below the digital bridge shelf to which it is being cascaded.

2.4 Configuration

2.4.1 Overview

Most digital bridge configuration options use the DIP switches on the front of the digital bridge module (Figure 2-3). However, header straps on the backplane (Figure 2-4) or the digital bridge board (Figure 2-5) determine some options. The power supply has no user selectable options.

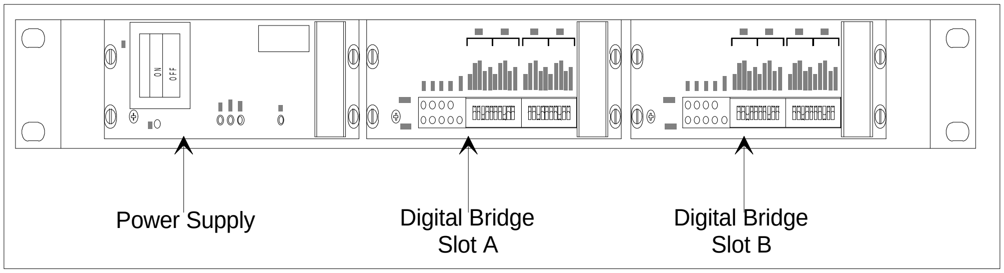

Figure 2-3 Digital Bridge Unit – Front View

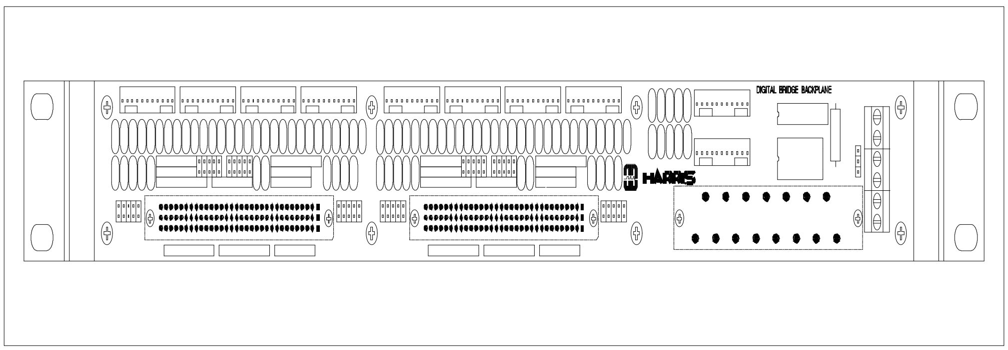

Figure 2-4 Digital Bridge Unit – Rear View

The digital bridge module can reside in two locations in the shelf assembly. The first digital bridge module resides in the middle shelf position (Slot A), whereas the second digital bridge module resides in the right shelf position (Slot B). Associated with Slot A Channels 1 – 4 are backplane connectors J5, J6, J7, and J8 and jumper straps Z3, Z4, Z8, and Z9. Associated with Slot B Channels 1 – 4 are backplane connectors J1, J2, J3, and J4 and jumper straps Z1, Z2, Z6, and Z7.

2.4.2 Master/Slave Selection

The digital bridge module has only one strap option, Z1, to select master/slave or lead/slave operation. Z1 consists of the two front-most header pins located in the upper right corner of Figure 2-5. To configure the digital bridge module as a master/lead module, install a strap across Z1. The module operates as a slave bridge with strap Z1 removed.

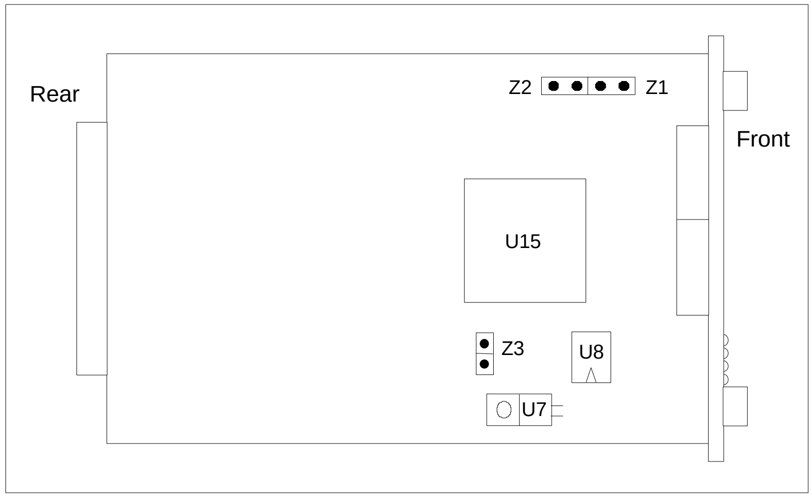

Figure 2-5 Top View of Digital Bridge Board (532-T007)

A shelf can have two independent master modules. In a digital distribution bridge application, the master is the lead module with the host connected to user channel 1. User channels 2, 3, and 4 are tributary ports. Slave modules connect in cascade to an upstream master or another slave.

Cascaded slave modules are part of the bridge formed by the first master. The cascade continues until the slave just ahead of the next master. In Figure 2-6, for example, module 1A is a master. Modules 1B, 2A, 2B, and 3A are all cascade slaves adding channels to the bridge. Module 3B is another master, breaking the chain and creating a new bridge. While modules 4A and 4B are slaves to 3B, they could also be masters starting their own bridge chains. The digital multiport bridge cascades in exactly the same manner, the only difference being that channel 1 of the master module is simply another port on the bridge without any Host significance.

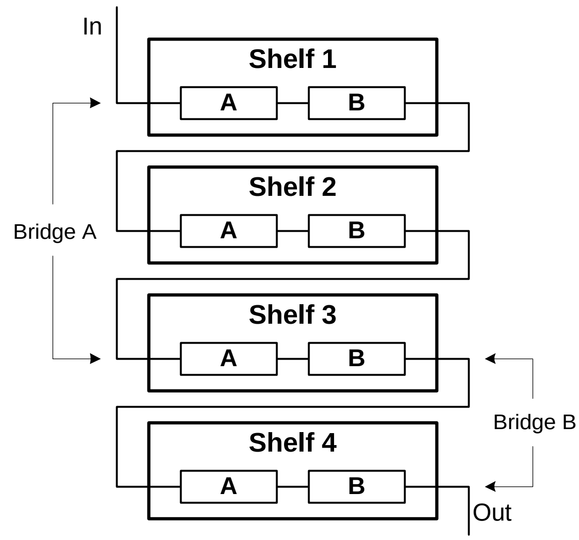

Figure 2-6 Example of a Cascaded Configuration

2.4.3 Channel Operational Parameters

DIP switches on the front of the main board configure the operational parameters for each user channel on a bridge module. You can modify the switches while power is On and the bridge is operating. Each channel has five switches for the functions shown in Table 2-1.

Table 2-1 Channel Switch Functions

Switch	Off	On
Channel Enable	Disabled	Enabled
Antistream Enable	Disabled	Enabled
Data Detect Enable	Disabled	Enabled
DTE/DCE	DTE	DCE
RS-422/RS-423	RS422	RS-423/232

Table 2-2 and Figure 2-7 show the switch layout.

Table 2-2 Digital Bridge Board Configuration Options

Switch	Channel	Segment	Function
S1 (Left)	4	1	Enable
		2	Antistream Enable
		3	Data Detect Enable
		4	DTE/DCE
		5	RS-422/RS-423
	3	6	Enable
		7	Antistream Enable
		8	Data Detect Enable
		9	DTE/DCE
		10	RS-422/RS-423
S2 (Right)	2	1	Enable
		2	Antistream Enable
		3	Data Detect Enable
		4	DTE/DCE
		5	RS-422/RS-423
	1	6	Enable
		7	Antistream Enable
		8	Data Detect Enable
		9	DTE/DCE
		10	RS-422/RS-423

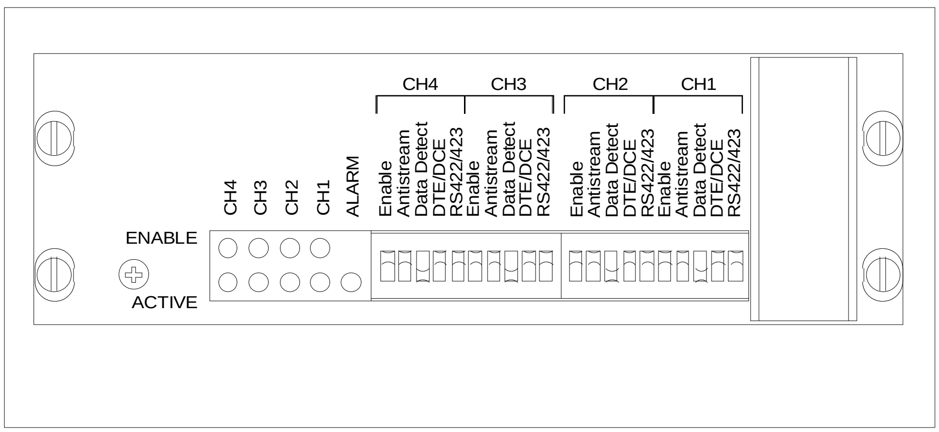

Figure 2-7 Digital Bridge Face Plate (532-T007)

2.4.4 Channel Terminations

The backplane includes optional terminating networks for use in RS-422 applications. Typically the networks are installed across the ‘receiver’ end of a given line (that is, those signals that are bridge inputs). Because each user channel supports DTE and DCE modes in balanced (V.11/RS-422) and unbalanced (RS-423) interface standards, the bridge inputs vary in direction according to the DTE/DCE switch setting, as shown in Table 2-3.

Table 2-3 DTE/DCE Signals

Signal	**Mode** (Note)	
	DTE	**DCE**
Tx	Out	In
Rx	In	Out
RTS	Out	In
CTS	In	Out
DCD	In	Out

Note: Switch 4 (or 9) set to Off establishes DTE; switch 4 (or 9) set to On establishes DCE (see Table 2-2 and Table 2-4).

Table 2-4 shows how to add straps to install the terminating networks and Figure 2-8 shows the header locations.

Table 2-4 Backplane Channel Termination Settings

(Jx) Channel/Header		Pins	Signal
Slot A	**Slot B**		
(J5) 1/Z8 (J6) 2/Z3 (J7) 3/Z4 (J8) 4/Z9	(J1) 1/Z6 (J2) 2/Z1 (J3) 3/Z2 (J4) 4/Z7	1, 2	Tx
		3, 4	DCD
		5, 6	Rx
		7, 8	RTS
		9, 10	CTS

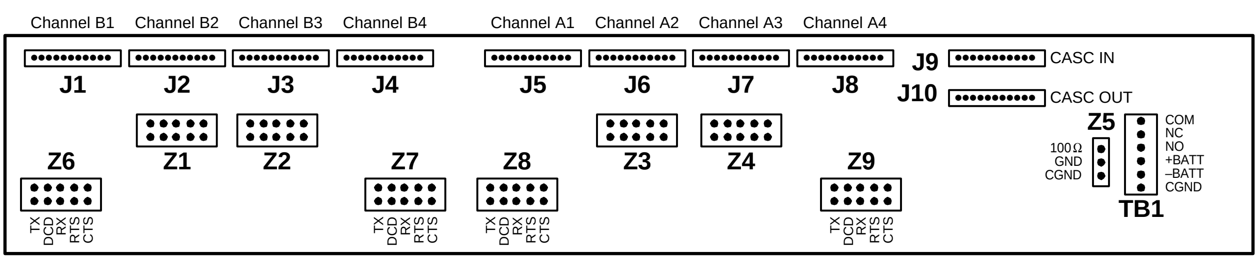

Figure 2-8 Digital Bridge Backplane – Simplified Rear View

2.5 Cabling the Digital Bridge

2.5.1 Connectors

The mating 11-pin female connector for the cable assembly is manufactured by Methode or Amp or can be ordered from Westronic using the following part numbers:

- Methode PN: 130F-111-424 or 1300-111-424
- Amp PN: 1-643814-1
- Westronic PN: 620-T037

Making this cable requires a connector crimping tool (PN 990-0150). A connector kit containing 10 connectors and the crimping tool is available from Westronic (PN 585-T059).

2.5.2 Cables

The digital bridge assembly supports two types of communication modes for digital interfaces: RS-422 and RS-423. The following describes connection and strapping information for the digital bridge assembly.

Note: RS-423 is compatible with the popular standard RS-232. The digital bridge uses RS-423 for two reasons: RS-423 can use the same devices as the RS-422 interface and it can connect directly with RS-232 devices without special consideration.

Use the following cable types:

- RS-422: Standard 2-pair (4 wires), twisted, shielded (4,000 feet maximum) or unshielded (1,000 feet maximum) 24-AWG single-strand cable
- RS-232/423: Standard 3-pair (6 wires), twisted, unshielded (50 feet maximum) 24-AWG single-strand cable

Using the 11-pin connectors previously described, construct the user channel and cascade in/out cables using information provided in Table 2-5, Table 2-6, Figure 2-8, and Figure 2-9. The tables provide pinout information and the figures show locations and pin layout for connectors J1 through J8. Connectors J9 and J10 use the same pin layout.

Table 2-5 RS-422/RS-423 Pin Designations

RS-422	Signal	RS-423	Signal
1	Tx +	–	–
2	Tx –	2	Tx
3	Rx +	–	–
4	Rx –	4	Rx
5	DCD +	–	–
6	DCD –	6	DCD
7	RTS +	–	–
8	RTS –	8	RTS
9	CTS +	–	–
10	CTS –	10	CTS
11	Ground	11	Ground

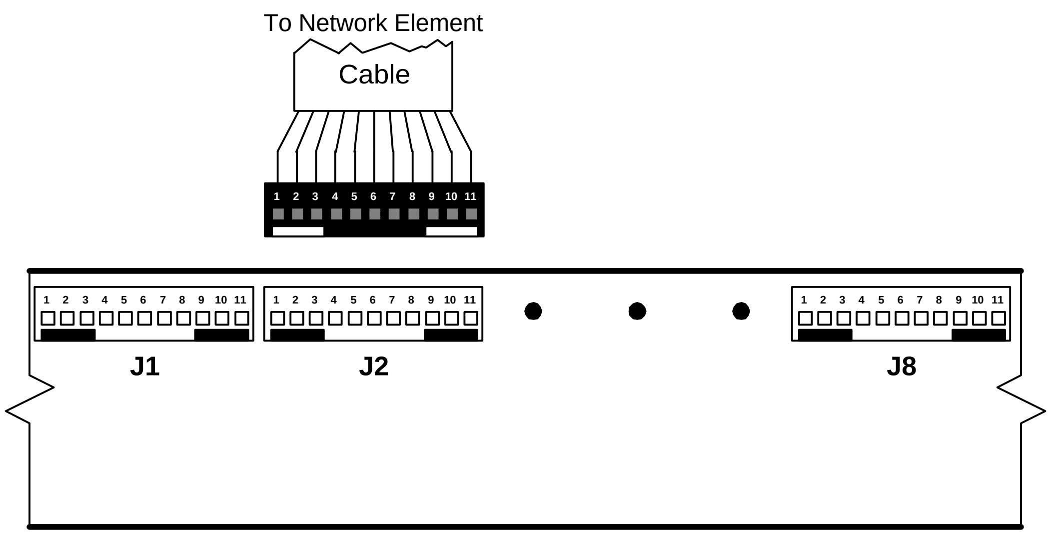

Figure 2-9 Rear View of Serial Port Connectors on the Digital Bridge

Table 2-6 Digital Bridge Cascade Connections

J9 Cascade In		J10 Cascade Out	
Pin	**Designation**	**Pin**	**Designation**
1	Cascade In 0	**1**	Cascade Out 0
2	Cascade In 1	**2**	Cascade Out 1
3	Cascade In 2	**3**	Cascade Out 2
4	Cascade In 3	**4**	Cascade Out 3
5	Cascade In 4	**5**	Cascade Out 4

Table 2-6 Digital Bridge Cascade Connections

J9 Cascade In		J10 Cascade Out	
Pin	**Designation**	**Pin**	**Designation**
6	VCC	**6**	VCC
7	VCC	**7**	VCC
8	+12 Vdc	**8**	+12 Vdc
9	–12 Vdc	**9**	–12 Vdc
10	Signal Ground	**10**	Signal Ground
11	Signal Ground	**11**	Signal Ground

2.5.3 Backplane Connections

2.5.3.1 User and Cascade Channels

After constructing the various interconnecting cables, use Figure 2-8 to locate the user channel digital interface connectors J1 through J8 and the cascade in/out connectors J9 and J10 for cascading digital bridge systems. Connect the cables to the proper connectors.

2.5.3.2 Power/Alarm Terminations and Grounding

Table 2-7 details TB1 power and external alarm connections on the digital bridge assembly. See Figure 2-8 for locating TB1. Also see Figure 2-10, which shows the digital bridge shelf power extension layout.

Table 2-7 Power Terminal Block Connections

TB1 Pin	Designations
1	Alarm Relay Common
2	Alarm Relay Normally Closed
3	Alarm Relay Normally Open
4	+ Battery In
5	– Battery In
6	Chassis Ground

Header Z5 on the backplane allows you to select one of the three system ground options shown in Table 2-8. See Figure 2-8 for locating Z5.

Table 2-8 Backplane Grounding Strap Options

Z5	Ground Configuration
Out	Signal ground not connected to chassis ground
1-2	Signal ground to chassis ground through 100-Ohm resistor
2-3	Signal ground directly to chassis ground

Note: For proper RS-422 circuit operation, the limit for the common mode voltage of signal ground relative to chassis ground is ±5 Vdc. However, direct connection of signal ground to chassis ground can result in reduced noise immunity and ground loops in applications using RS-423 or RS-232 circuits. Consult the site ground plan for proper jumper settings.

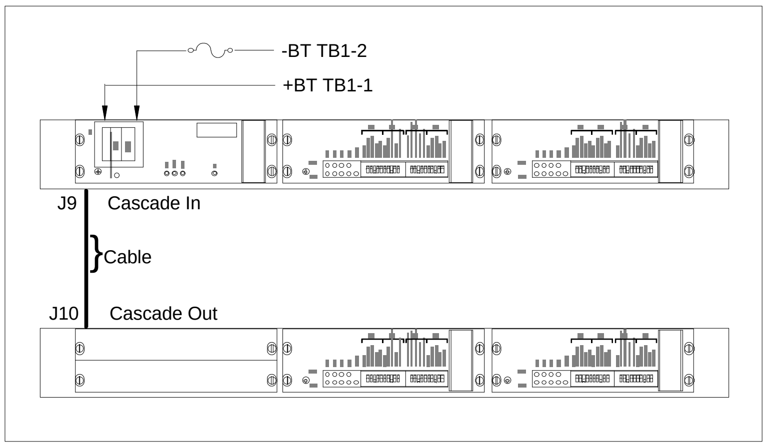

Figure 2-10 Digital Bridge Shelf Power Extension

The following notes apply to Figure 2-10.

- One power supply can provide power to a maximum of four digital bridge shelves (32 channels).
- Power to the master or lead bridge shelf requires 14-AWG stranded wire.
- A second bridge shelf (J10) cascaded to the first bridge shelf (J9) requires 22-AWG stranded wire.
- External battery voltage to the power supply requires a 1 Amp slow-blow fuse.

2.6 Installation Check List

1. Unpack the assembly and inspect for any signs of damage.
2. Bolt the chassis into the rack.

Configure the required serial channel terminations using the minijumpers located on the backplane (see

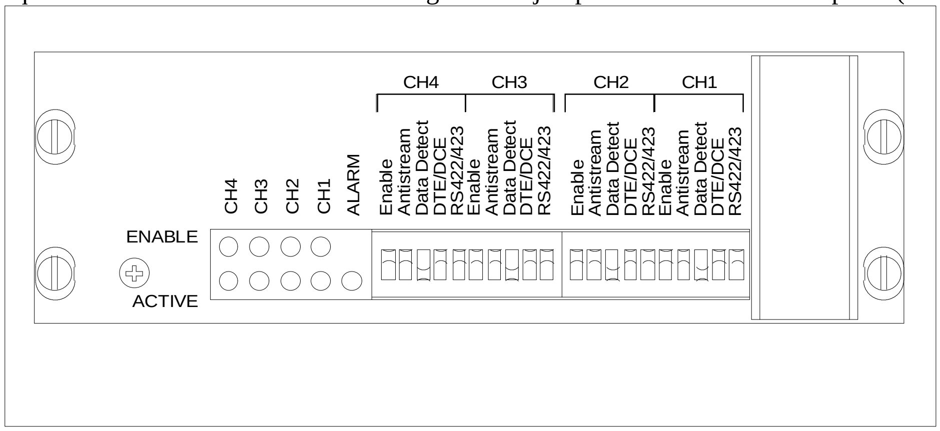

Figure 2-7 Digital Bridge Face Plate (532-T007)

3. Channel Terminations on Page 2-7).
4. Connect the digital interface cabling to the backplane connectors (J1 through J8).
5. Make certain that the power switch is in the Off position.
6. Connect the battery input feed and ground to TB1 on the backplane (see Power/Alarm Terminations and Grounding on Page 2-11).
7. Cable the external alarm output, if required (see Power/Alarm Terminations and Grounding on Page 2-11).
8. Switch system power On and verify that the power supply LED lights. Check voltage levels at this time.
9. Switch system power Off and verify the digital bridge module installation and strapping.

2.6.1 Module Installation

The following provides information on inspecting and installing the digital bridge and power supply modules in the shelf assembly:

1. Remove the modules from the shelf and inspect for any signs of damage.
2. Configure the modules as required (see Master/Slave Selection and Channel Operational Parameters on Pages 2-5 and 2-6, respectively).
3. Insert the modules into the desired slots in the shelf.
4. When inserting a module, ensure that it mates properly with the rear chassis connector. A firm push on the module front is all that is required to install the module. Never force a board into position because this can damage the module or rear connector. Use hardware to secure the module into the chassis.

2.6.2 Expansion Shelf Installation

The following explains how to unpack and install the expansion system:

1. Unpack the assembly and inspect for any signs of damage.
2. Bolt the chassis into the rack position immediately below the digital bridge shelf to which it is being cascaded.

Configure the required serial channel terminations using the minijumpers located on the backplane (see

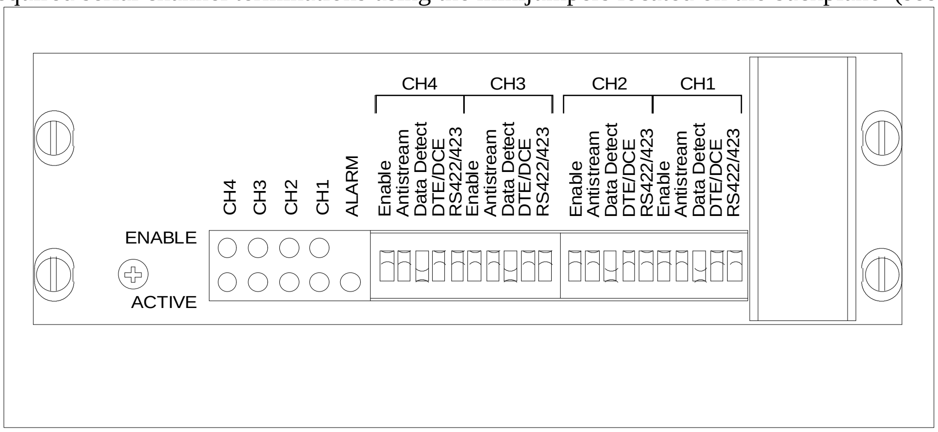

Figure 2-7 Digital Bridge Face Plate (532-T007)

3. Channel Terminations on Page 2-7).
4. Connect digital interface cabling to the backplane connectors (J1 through J8).
5. Verify that the power switch is in the Off position.
6. Connect J9 of the upper shelf (master) to J10 of the lower shelf (secondary) using a 11-pin connection.
7. Cable the external alarm output (if required).
8. Switch the system power On and verify that the power supply LED lights. Check voltage levels at this time.
9. Switch the power Off and verify the digital bridge module installation and strapping.