

TC8916

Up to 24 CHANNEL RS-232/422 BROADCAST & RECEIVE DEVICE

User's Manual

MODEL: _____

S/N: _____

DATE: _____

Notice!

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User's Manual
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Features

- Supports Poll/Response SCADA Networks
- Anti-Streaming Capability for each Channel
- Standard 8 Channels (& up to 24 channel versions available); Separate Units can be Cascaded
- LED Indicators for Each Channel's Tx & Rx Status
- Stand Alone or Rackmount

Description

The TC8916 Broadcast & Receive Device is designed specifically for SCADA and process control applications utilizing an RS-232 or RS-422 interface. It broadcasts & receives information to and from remote devices over either metallic cable or fiber optic media (in conjunction with a fiber optic device). The TC8916 is transparent to all data sent in either direction.

The MAIN port on the TC8916 receives a broadcast message from the main controller via Port 1 and simultaneously broadcasts the message out through all additional ports (Ports 2 through 8, 16, or up to 24 - depending on the model). The broadcast message (sent by the SCADA HOST) has embedded identification (ID) information for each RTU. Only the RTU that matches the SCADA's poll ID number will respond.

An anti-streaming capability is provided for each channel to prevent a single node failure from disabling the system. The channel will be disabled when the RTU's Tx data line exceeds a given length of time (typically 10 seconds). Once disabled, the TC8916 will attempt to resume communications after the jam condition is no longer present.

The TC8916 supports RS-232 or RS-422 interfaces. Connectors are RJ-11. Standard input power is 12V DC or optional 24VDC, 48VDC, or 115/230V AC with an external power cube. Each unit consists of a Base Board and up to eight optional Expansion Boards.

The Base Board provides the following:

PWR A & B Jacks: Only one power connection is required to operate the unit. When power is supplied to the jacks with terminal block connectors A and B (from two different sources), power redundancy is enabled. If either source fails, the other assumes the full load automatically.

Channel 1 Port: Channel 1 is used to connect the RS-232 or RS-422 device whose signal is to be broadcasted via the RJ-11 jacks. This port is referred to as the "MAIN" Port.

CH2 - CH8 Ports: Channels 2 through 8 are used to broadcast and receive the RS-232 or RS-422 signal to/from up to seven user's devices via RJ-11 jacks. The responding devices share the response channel through an OR gate, as only one device (that with the corresponding ID) will respond to the Main's broadcast message at any given time.

Each optional Expansion Board provides the following:

PWR A & B Jacks: There are redundant power supply jacks with terminal block connectors on each expansion board. Any one set of power jacks supplies power to the base board and any expansion boards (the boards are connected internally).

Each card, 8 Ports: Each additional expansion card provides 8 channels for use to broadcast & receive the RS-232 or RS-422 signal to and from additional user's devices via the RJ-11 jacks. Customer can order up to a total of 24 channels including the main channel.

Note: If additional ports are required, the unit can be cascaded to a second unit's Host Port from any one of the Broadcast Ports.

LEDs, DIP Switches and Connectors for Rear and Front Panels

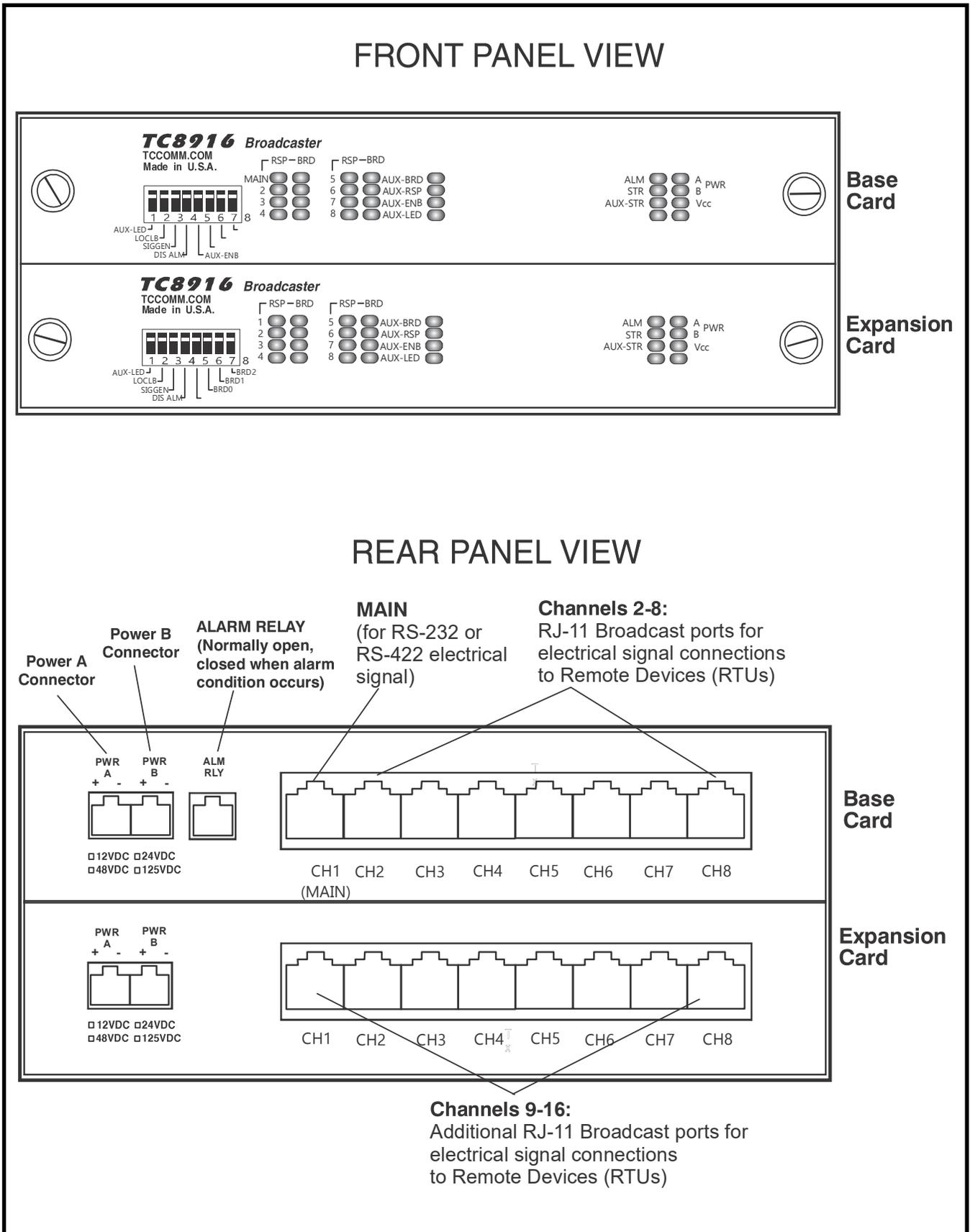


Figure 1. TC8916's Front and Rear Panels

LEDs and DIP Switches for Base Card

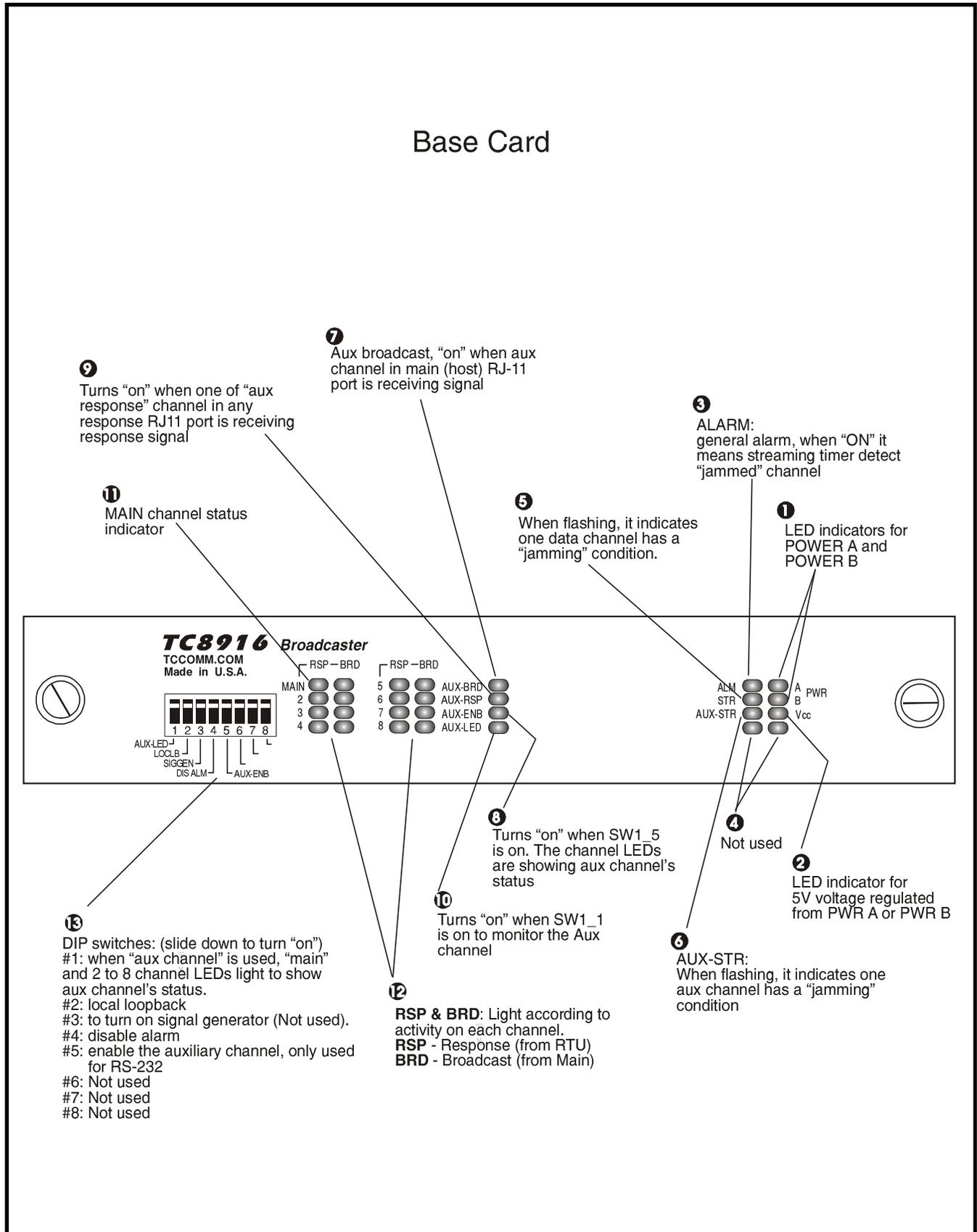


Figure 2. TC8916's Base Board Front Panel

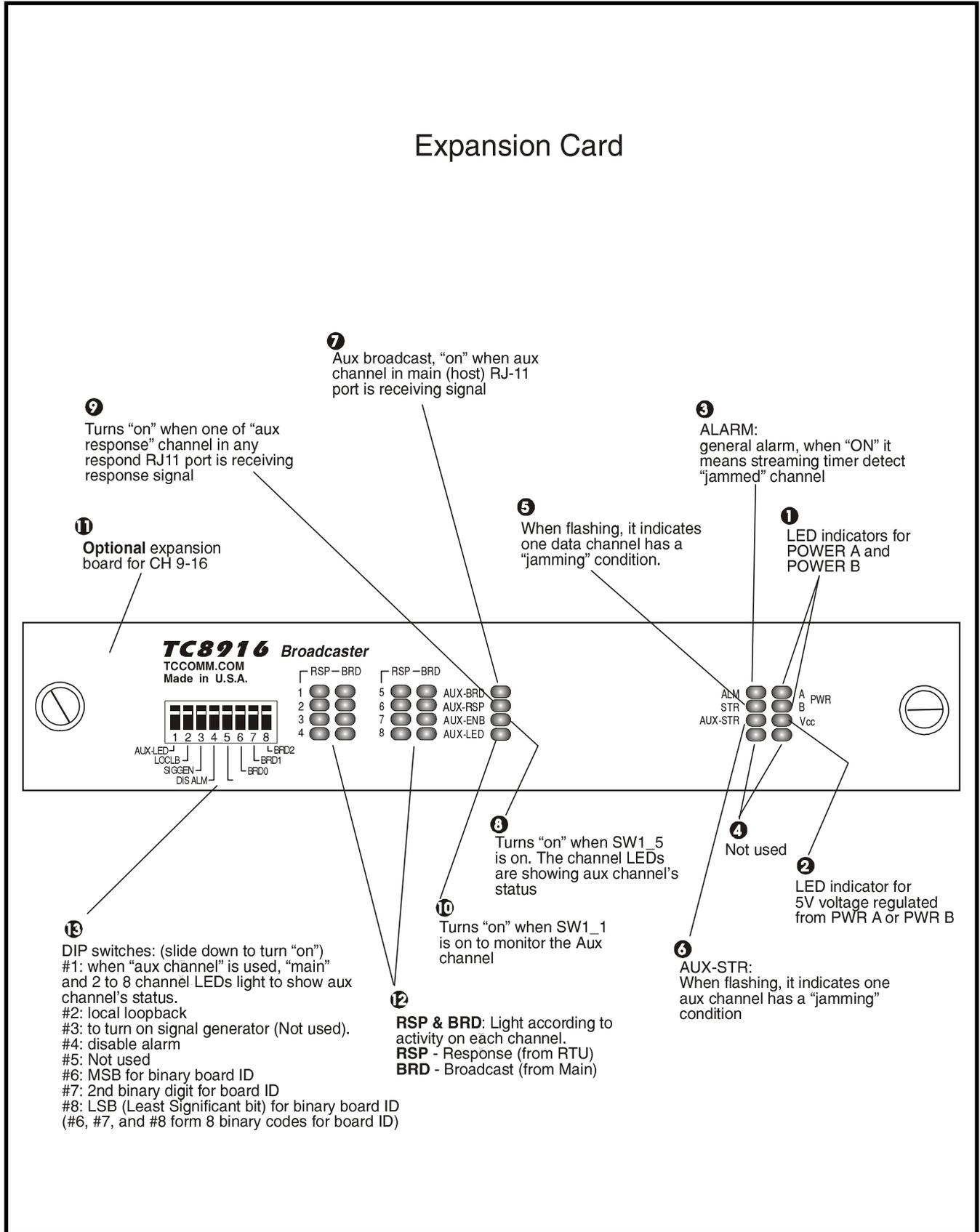


Figure 3. TC8916's Expansion Board Front Panel

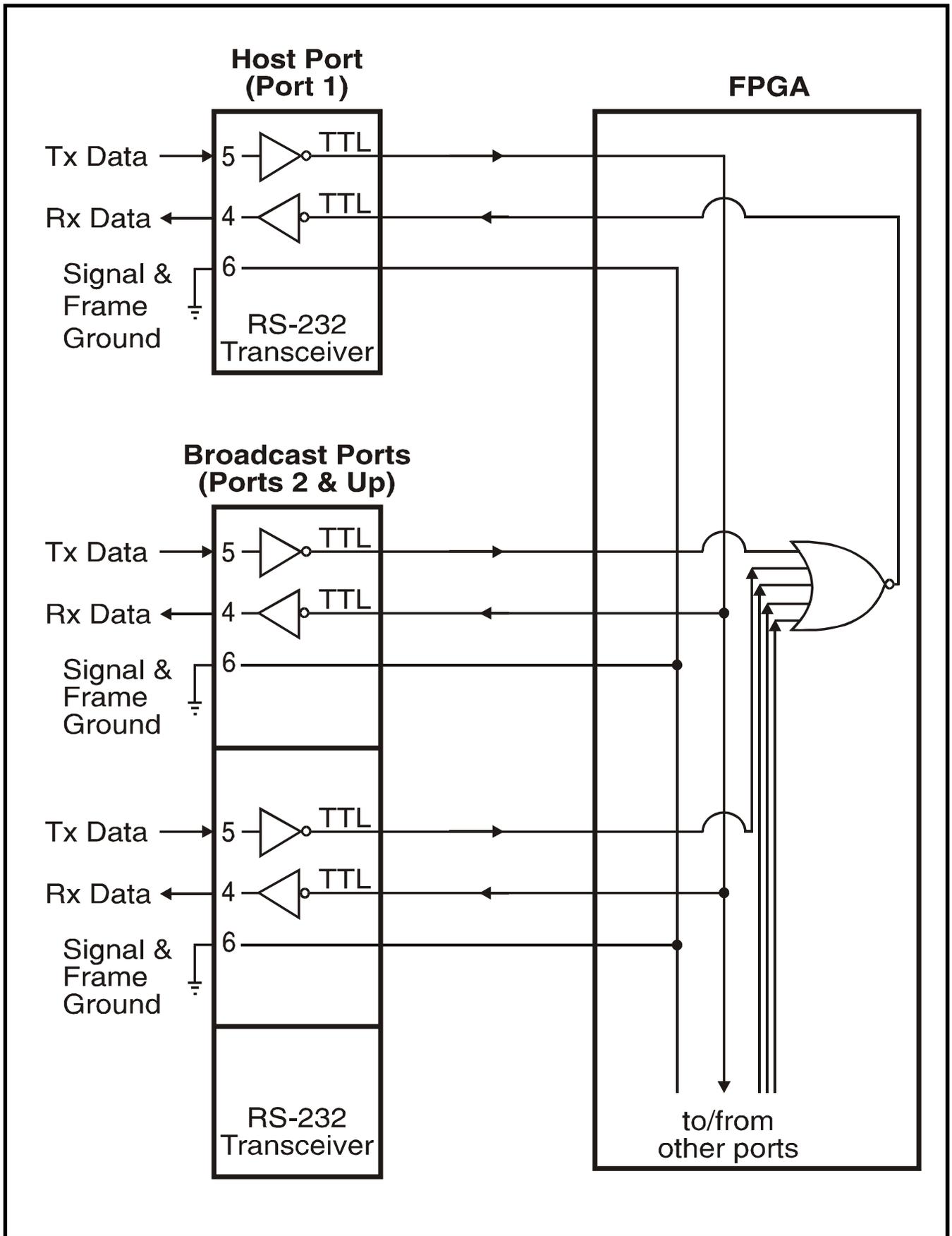


Figure 4. Broadcast & Response Logic Diagram

RS-232 and RS-422 Electrical Signal Interface Pin Assignments

The RJ-11 connectors are located at the rear panel of the TC8916.

RS-232 (Async & Async with Control) and Sync

For RS-232, pin 5 is the input (TxData) pin while pin 4 is the output (RxData) pin. A separate channel on each RJ-11 port is available on pin 3 and pin 2 (for Async with Control or Sync interfaces). The second channel can be used as control (or handshake) signals or Tx Clock and Rx Clock signals for RS-232 synchronous applications. Either pin 6 or pin 1 can be Signal Ground.

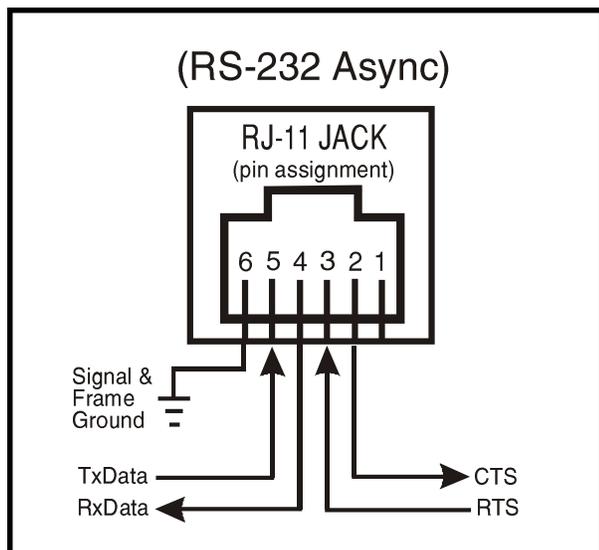


Figure 5. RS-232 Async Pin Assignments

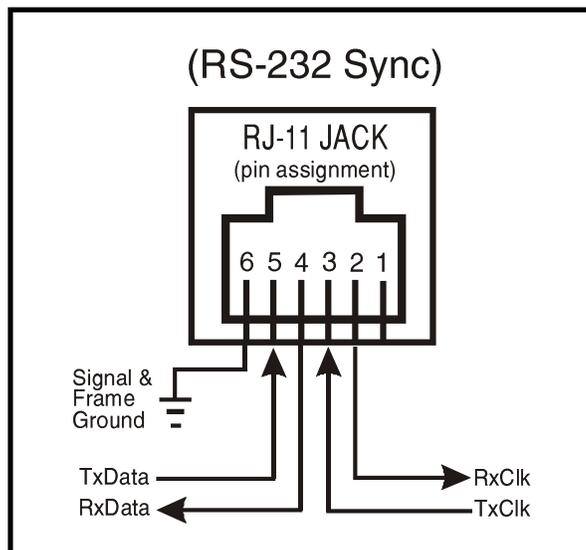


Figure 6. RS-232 Sync Pin Assignments

RS-422 Asynchronous

For RS-422 interfaces, pins 2 and 5 are balanced input pins. Pin 2 is the positive input (TxData +) while pin 5 is negative (TxData -).

Pins 3 and 4 are balanced output pins. Pin 3 is the positive output (RxData +) while pin 4 is the negative (RxData -). Either pin 6 or pin 1 can be Signal Ground.

Only RS-422 Async communications can be used with the TC8916 due to the limited number of pins on the RJ-11 connector.

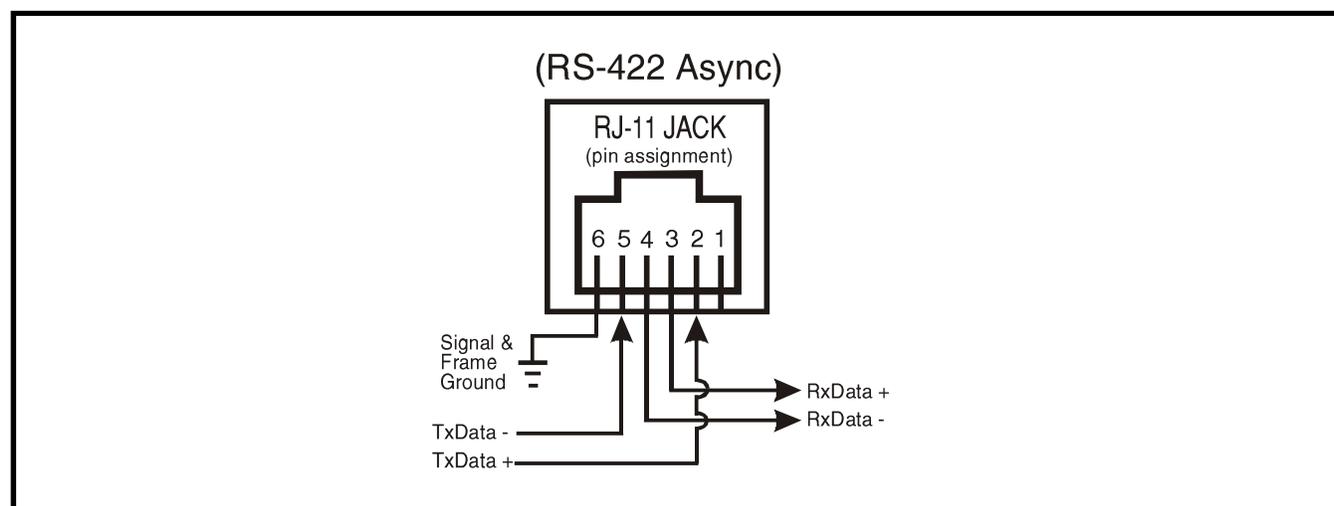


Figure 7. RS-422 Async Pin Assignments

RS-232 RJ-11 to DB25 Female (Async & Sync) Cable Pin Assignments

The user's device can be a DCE or DTE device (which may have a DB25 male connector). The following illustrations depict the RS-232/TTL & RS-422 wiring diagrams for constructing an RJ-11 to DB25 Female adapter cable.

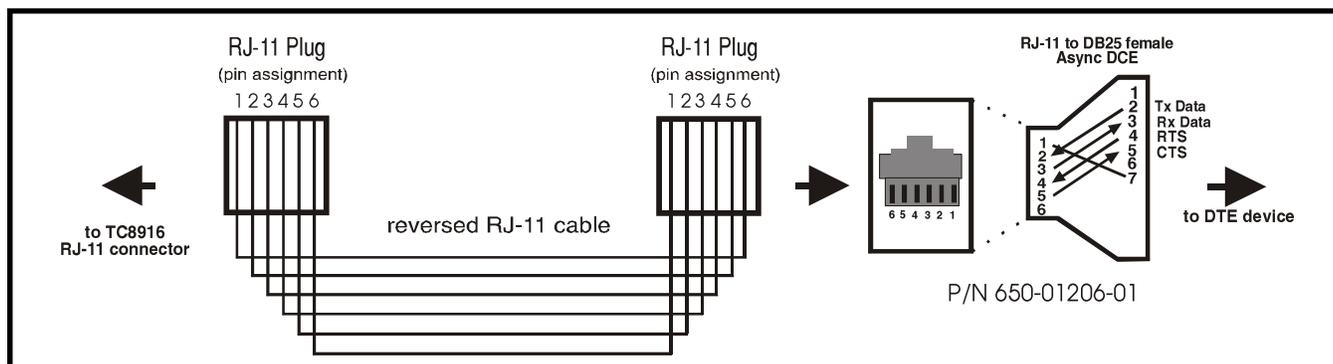


Figure 8. RJ-11 (ASYNC DCE) to DB25 Female Pin Assignments

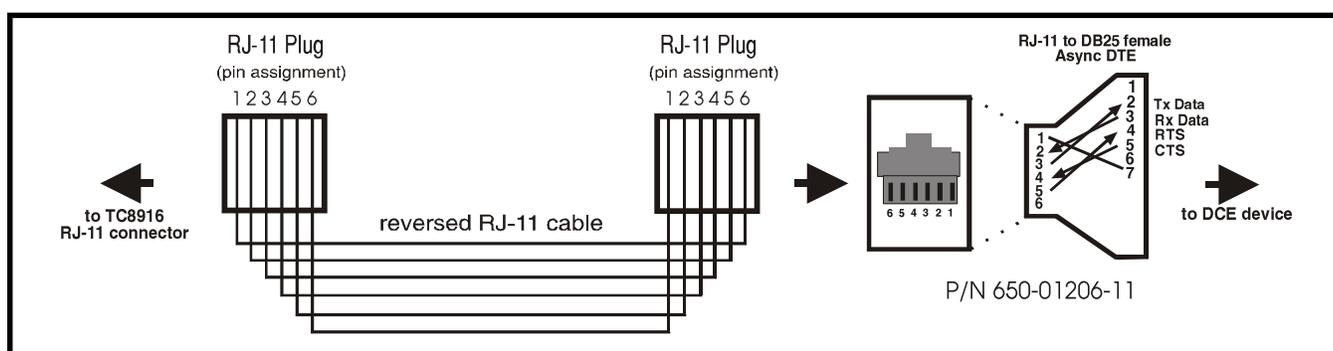


Figure 9. RJ-11 (ASYNC DTE) to DB25 Female Pin Assignments

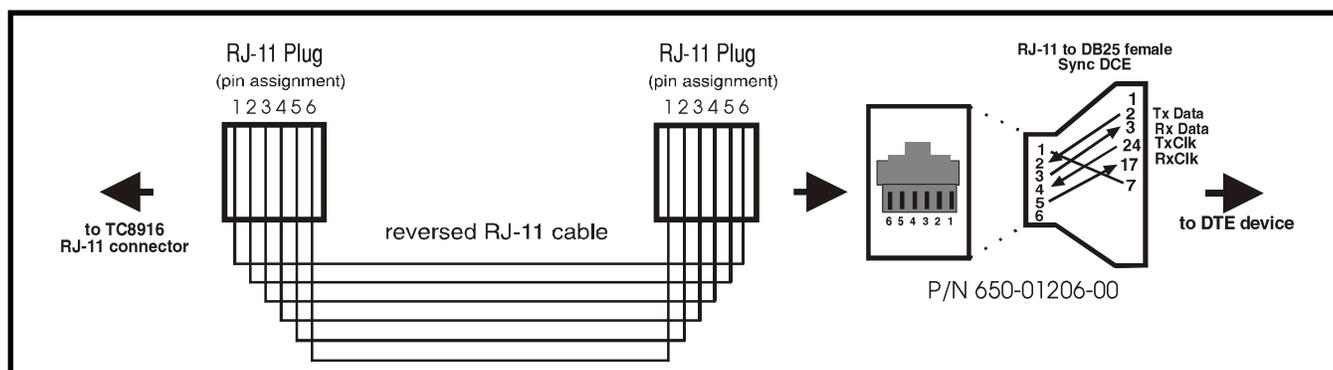


Figure 10. RJ-11 (SYNC DCE) to DB25 Female Pin Assignments

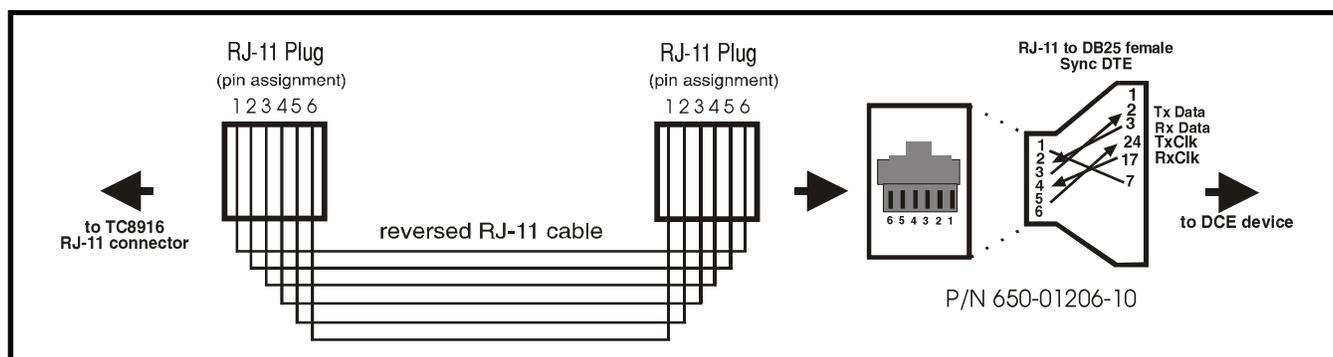


Figure 11. RJ-11 (SYNC DTE) to DB25 Female Pin Assignments

RS-422 RJ-11 to DB25 Female (Async) Cable Pin Assignments

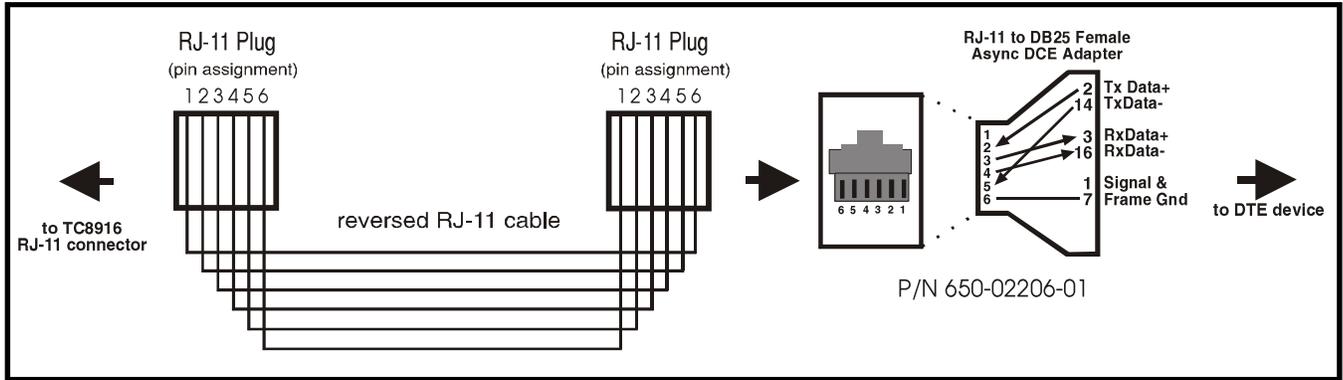


Figure 12. RJ-11 (ASYNC DCE) RS-422 to DB25 Female Pin Assignments

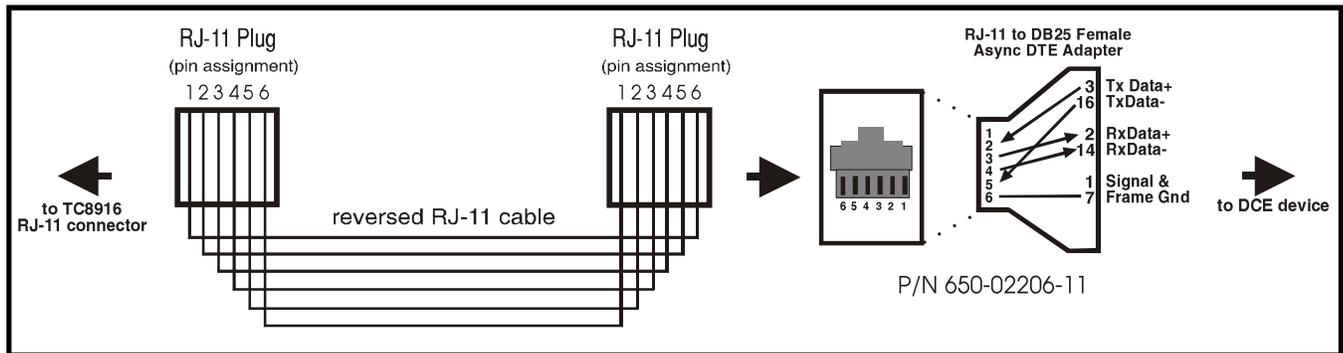


Figure 13. RJ-11 (ASYNC DTE) RS-422 to DB25 Female Pin Assignments

Unpacking the Unit

Before unpacking any equipment, inspect all shipping containers for evidence of external damage caused during transportation. The equipment should also be inspected for damage after it is removed from the container(s). Claims concerning shipping damage should be made directly to the pertinent shipping agencies. Any discrepancies should be reported immediately to TC Communications' Customer Service Department.

Equipment Location

The TC8916 should be located in an area that provides adequate light, work space, and ventilation. Avoid locating it next to any equipment that may produce electrical interference or strong magnetic fields, such as elevator shafts or heavy duty power supplies. As with any electronic equipment, keep the unit from excessive moisture, heat, vibration, and freezing temperatures.

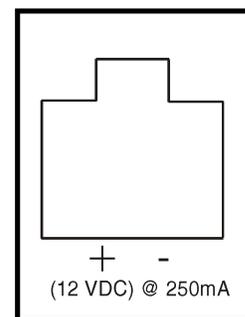
Base Board and Extension Board Setup

The TC8916 has been pretested and switches have been set per factory specifications. Channel 1 is used for the RS-232 or RS-422 signal input to the TC8916 which will be broadcasted to the user's devices. The remaining channels are for electrical signal connections to the user's poll-type devices.

Power Supply

Each TC8916 card is powered by an external DC power adapter rated 9 to 12VDC @250mA. There are two terminal block connectors labeled "PWR A" and "PWR B" on the back of each card, only one is required to power up the unit. Alternate power sources are available as an option (see Chapter 4 - Specifications). A three-board unit consisting of host and expansion boards will not draw more than 600ma current.

Either a power adapter or TC's power card can be utilized to supply the power to the TC8916. The power can be plugged into any power jack terminal block connector on the rear panel. Since each TC8916 card is equipped with a power redundancy capability, the power LEDs on the front panel will light according to which power jack(s) is/are connected.



Electrical Signal Connection

The RJ-11 connectors for the RS-232 or RS-422 electrical signal are located on the rear panel; one "MAIN" Port and 7 Broadcast Ports (additional ports with up to 24 channel versions). The pin assignments for the "MAIN" Port and the "Broadcast" Ports use the same pin-outs. (refer to page 8 for pin connections)

When facing the rear panel, the board on the top is the Base Board, with the MAIN Port located at the left (CH1); Ports 2 through 8 (CH2 to CH8) are located to the right of the main port (see Figure 1).

Anti-Streaming Timer Setup (With Internal DIP Switch SW3)

Anti-streaming is used to eliminate a 'high' signal lockup of the user's device(s). When the Anti-Streaming function is enabled, the TC8916 can detect a 'high' signal over a fixed time duration (set by the internal SW3 timer DIP switches) and will automatically reset that channel to a 'low' signal when "jabbering" is detected. This prevents the defective device connected to the TC8916 from 'locking' or 'freezing up' any of the other devices connected in the system. You will see the "ALM" LED light solidly "on" and the "STR," LED will be flashing for data. When using the "aux channel," the "ALM" LED will be solidly lit and the "AUX-STR" LED will be flashing. The Anti-streaming timer can be set to one of three different time intervals:

STR TIMER-1 (SW3_1 Set to the "On" position & SW3_2 Set to the "Off" position): When the TC8916 detects a 'high' signal for over **2 sec**, it will reset the channel to 'low.'

STR TIMER-2 (SW3_1 Set to the "Off" position & SW3_2 Set to the "On" position): When the TC8916 detects a 'high' signal for over **4 sec**, it will reset the channel to 'low.'

STR TIMER-3 (SW3_1 Set to the "On" position & SW3_2 Set to the "On" position): When the TC8916 detects a 'high' signal for over **8 sec**, it will reset the channel to 'low.'

AUX STR TIMER-1 (SW3_1 Set to the "On" position & SW3_2 Set to the "Off" position): When the TC8916 detects a 'high' signal for over **2 sec**, it will reset the channel to 'low.'

AUX STR TIMER-2 (SW3_1 Set to the "Off" position & SW3_2 Set to the "On" position): When the TC8916 detects a 'high' signal for over **4 sec**, it will reset the channel to 'low.'

AUX STR TIMER-3 (SW3_1 Set to the "On" position & SW3_2 Set to the "On" position): When the TC8916 detects a 'high' signal for over **8 sec**, it will reset the channel to 'low.'

Note: The Default Settings are as follows: All SW2 DIP switches are Off.

System Start Up

1. Apply the power by plugging the power into any power terminal block connector on the rear panel. The power source can be from a power adapter or from a power card (installed either on the left or right side of the rack).
2. Once the power is applied, all the LEDs will flash for a second.
3. The "PWR A" or "PWR B" LED on the front panel(s) of the Base and Expansion boards will light according to which power terminal block connector (A or B) is connected to. Both LEDs will light when power redundancy is utilized. The "Vcc" LED should be lit, indicating an adequate operating voltage is being derived from the power source.
4. Make sure all DIP switches on the front panel are switched to the up "Off" position before testing.
5. At the rear panel, connect the RS-232 or RS-422 signal into the RJ-11 jack (CH1) "MAIN" on the Base Board. The "MAIN" and "BRD" LEDs from CH2 to CH8 on the front panel should light to indicate a valid signal input. If the "MAIN" and/or "BRD" LEDs do not light, it usually indicates a poor or incorrect connection at the input port. If this is the case, double-check your connections and confirm them with the RJ-11 connection diagrams on page 8.
6. If the aux channel(pins 2 & 3) is used, SW1_5 must be enabled to allow for the handshake signal. To see the status of the aux channel, SW1_1 must be set to the down "On" position. The "MAIN" and "BRD" LEDs from CH2 to CH8 on the front panel should light to indicate a valid signal input. If the "MAIN" and/or "BRD" LEDs do not light, it usually indicates a poor or incorrect connection at the input port. If this is the case, double-check your connections and confirm them with the RJ-11 connection diagrams on pages 7 and 8.

When SW1_1 is enabled, you will see the "AUX-BRD" LED lit, the "AUX-RSP" LED will be Off (it will light up once it receives the signal from the RTU or the signal is loopback via hard wired on pins 2 & 3), the "AUX-ENB" will be lit, indicating that the aux channel is being used, and the "AUX-LED" LED will be lit, indicating that the aux channel is being monitored for status purposes.

7. Once the "BRD" LED lights (indicating a valid signal input), a Local Loopback test can be conducted by setting the "LOCLB" DIP switch (SW1_2) to the down position (see Chapter 3 - Testing & Troubleshooting).
8. Return all DIP switches to the Left for normal operation.

TC8916 Card ID Configuration for the Expansion Cards

For the additional (Optional) expansion cards, the Card ID (or address) must be set properly before using the TC8916. Set the Card ID for each card according to the example below. The Card ID of each additional expansion card must be set in a binary sequence.

Verify that each expansion Card ID is configured differently. See example below:

- a. **1st expansion card:** Set BRD0 to the down "On" position. BRD1 & BRD2 are "Off."
- b. **2nd expansion card:** Set BRD1 to the down "On" position. BRD0 & BRD2 are "Off."

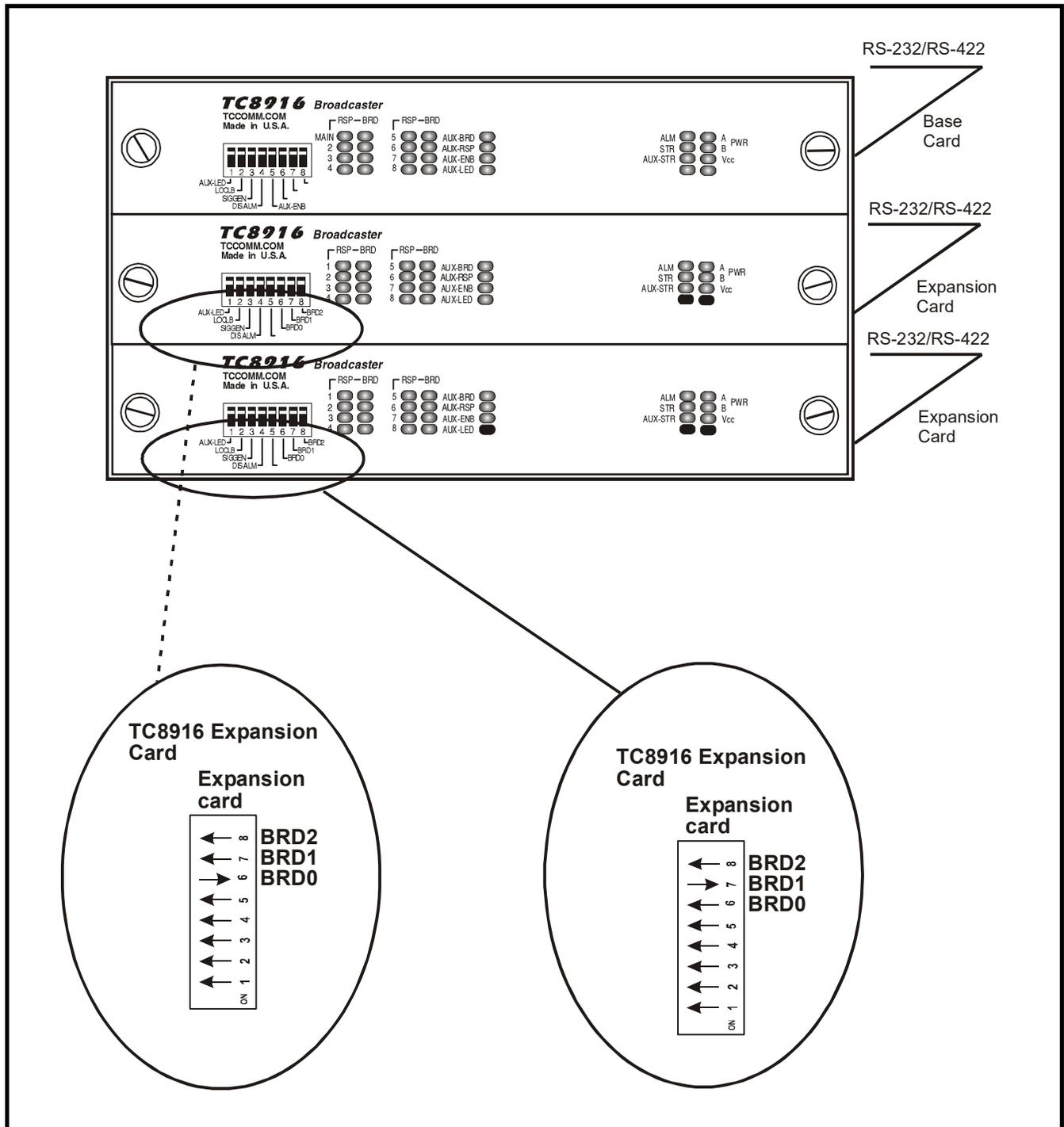


Figure 14. 3 Card TC8916 ID Configuration Example

General

The RJ-11 cable connectors and DB25 connector are frequently the source of various problems. Check out the connectors, cable, and pin connections first. Once installation of the TC8916 is complete, it is a good idea to perform a Local Loopback test to verify that the TC8916 is working properly.

Local Loopback Testing

The purpose of this test is to verify the input/output connections, signal input receiver, and signal output driver of the unit. See step #3 below on bench testing.

The electrical signal injected to pin 5 (TxD) will be looped back to pin 4 (RxD). This loopback is formed inside the TC8916, after the input signal is translated to a TTL signal format.

Bench Testing

It is highly recommended to conduct bench tests before actual installation. Bench testing allows the user to become familiar with all the functions and features of the TC8916 in a controlled environment. Knowledge of the TC8916's functions and features will facilitate installation and troubleshooting efforts later on.

1. Follow steps 1 through 4 from the system startup section on page 13.
2. At step 5, use a BERT (Bit Error Rate Tester) Test Set or other device that will send an RS-232 or RS-422 signal to the RJ-11 MAIN Port on the TC8916.
3. Perform a Local Loopback test by setting the "LOCLB" DIP switch (SW1_2) to the down "On" position. Verify that the "MAIN," "BRD," & "RSP" LEDs light solidly. Verify that the tester or other device is correctly receiving the loopbacked signal.

Return SW1_2 to the up "Off" position when done with the test.

4. Implement the setup of the devices as you will be using them in the field. Plug in your RS-232 or RS-422 source into the TC8916's MAIN Port (CH1). Plug in one of the RTU devices (that you intend to broadcast to) into the RJ-11 Port 2 (CH2). You should see the "MAIN" LED and "RSP & BRD" LEDs of the corresponding CH2 lit, indicating that the signal is correctly broadcasted and received.

Data Rates

Async (RS-232) up to 120 Kbps
Async (RS-422) up to 500 Kbps

Channel Capacity (consult factory for additional channel requirements)

Standard 8 Channels (1 Main + 7 devices)
..... (Optimal) 16 Channels (1 Main + 15 devices)
..... (Optimal) 24 Channels (1 Main + 23 devices)

Electrical

Connector RJ-11 Female
Interface (DCE) RS-232 or RS-422

System

Bit Error Rate 1 in 10⁹ or better
Visual Indicators MAIN, BRD & RSP for each channel, AUX-BRD,
..... AUX-RSP, AUX-ENB, AUX-LED, ALM, STR, AUX-STR PWR A, PWR B, and Vcc

Power Source

Standard 12V DC@250mA
Optional 24VDC, 48VDC
..... 115 or 230V AC with external power cube (or rackmount card)

Temperature

Operating -10°C to 50°C
..... Hi-Temp (optional) -20°C to 70°C
..... Hardened-Temp (optional) -40°C to 80°C
Storage -40°C to 90°C
Humidity 95% non-condensing

Physical (each board - Rackmount Version)

Height (17.6 cm) 7.0"
Width (3.2 cm) 1.26"
Depth (21.8 cm) 8.6"
Weight (266 gm) .6 lb

Features

- ❑ 4 U height (7")
- ❑ Dual Power Capability (Automatic Switchover in the Event of Failure)
- ❑ Universal Switching Power Supply Accepts 90V to 264V AC and 47 to 63 Hz AC
- ❑ Optional -48VDC Power Supply Available
- ❑ Overload & Short Circuit Protection

Description

The TCRM191 and TCRM192 Universal Rack Mount Card Cages hold up to 10 single multiplexer or modem type cards, or up to 5 double-mux or double-modem type cards. In general, the Model TCRM191 is used for multiplexers and the Model TCRM192 for modems.

Both can operate with one power supply or dual load-sharing power supplies. The AC power supply automatically adjusts for 90V to 264V AC input and 47 to 63 Hz operation. The DC power supply accepts -48VDC input. The AC and DC power supplies can be mixed in the same unit.

The dual power supplies feature automatic switchover in the event of a power failure. The Power switch and its LED are located on the front panel.

Both rack assemblies are 19" wide by 7" high. The TCRM191 is 9" deep and TCRM192 is 5.25" deep.

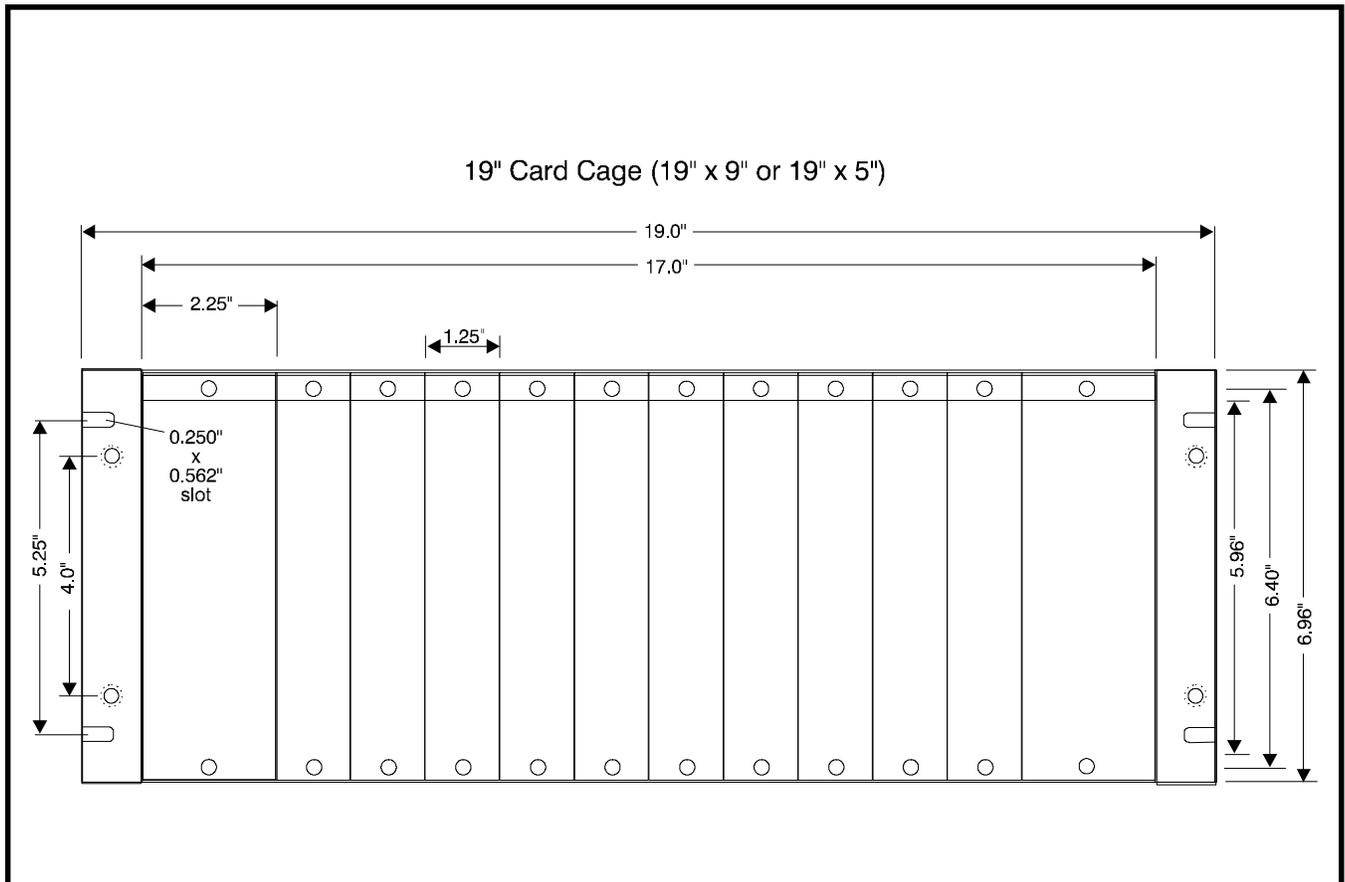


Figure 15. TCRM191/192 Rack Mount Card Cage

Chapter 6 - Appendix

Return Policy

To return a product, you must first obtain a Return Material Authorization number from the Customer Service Department. If the product's warranty has expired, you will need to provide a purchase order to authorize the repair. When returning a product for a suspected failure, please provide a description of the problem and any results of diagnostic tests that have been conducted.

Warranty

Damages by lightning or power surges are not covered under this warranty.

All products manufactured by TC Communications, Inc. come with a five year (beginning 1-1-02) warranty. TC Communications, Inc. warrants to the Buyer that all goods sold will perform in accordance with the applicable data sheets, drawings or written specifications. It also warrants that, at the time of sale, the goods will be free from defects in material or workmanship. This warranty shall apply for a period of five years from the date of shipment, unless goods have been subject to misuse, neglect, altered or destroyed serial number labels, accidents (damages caused in whole or in part to accident, lightning, power surge, floods, fires, earthquakes, natural disasters, or Acts of God.), improper installation or maintenance, or alteration or repair by anyone other than Seller or its authorized representative.

Buyer should notify TC Communications, Inc. promptly in writing of any claim based upon warranty, and TC Communications, Inc., at its option, may first inspect such goods at the premises of the Buyer, or may give written authorization to Buyer to return the goods to TC Communications, Inc., transportation charges prepaid, for examination by TC Communications, Inc. Buyer shall bear the risk of loss until all goods authorized to be returned are delivered to TC Communications, Inc. TC Communications, Inc. shall not be liable for any inspection, packing or labor costs in connection with the return of goods.

In the event that TC Communications, Inc. breaches its obligation of warranty, the sole and exclusive remedy of the Buyer is limited to replacement, repair or credit of the purchase price, at TC Communications, Inc.'s option.

To return a product, you must first obtain a Return Material Authorization (RMA) number and RMA form from the Customer Service Department. If the product's warranty has expired, you will need to provide a purchase order to authorize the repair. When returning a product for a suspected failure, please fill out RMA form provided with a description of the problem(s) and any results of diagnostic tests that have been conducted. The shipping expense to TC Communications should be prepaid. The product should be properly packaged and insured. After the product is repaired, TC Communications will ship the product back to the shipper at TC's cost to U.S. domestic destinations. (Foreign customers are responsible for all shipping costs, duties and taxes [both ways]. We will reject any packages with airway bill indicating TC communications is responsible for Duties and Taxes. To avoid Customs Duties and Taxes, please include proper documents indicating the product(s) are returned for repair/retest).

Limitation of Liability

In no event shall the total liability of TC Communications, Inc. to purchaser and/or end user for all damages including but not limited to compensatory, consequential and punitive damages, exceed the total amount paid to TC Communications, Inc. by purchaser for the goods from which the claim arose, in no event shall TC Communications, Inc. be responsible for indirect and consequential damages.

Continue on next page.

Limitation of Liability (Cont.)

In no event shall liability attached to TC Communications, Inc. unless notice in writing is given to TC Communications, Inc. within ten days of the occurrence of the event giving rise to such claim.

TC Communications, Inc. shall not be responsible for delays or non-deliveries directly or indirectly resulting from or contributed to by foreign or domestic embargoes, seizure, fire, flood, explosion, strike, act of God, vandalism, insurrection, riot, war, or the adoption or enactment of any law, ordinances, regulation, or ruling or order or any other cause beyond the control of TC Communications, Inc.

TC Communications, Inc. shall not be responsible for loss or damage in transit and any claims for such loss or damage shall be filed by the purchaser with the carrier.