

# TimeExpander

## Network Timing Expander



097-45200-10  
Issue 2

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## Acronyms and Abbreviations

AIS	alarm indication signal
BITS	building integrated timing supply
CC	composite clock
CTAC	Customer Technical Assistance Center
DSI	digital signal, level 1 (1.544 Mb/s)
ESD	electrostatic discharge
ESF	extended superframe
LOS	loss of signal
PRS	primary reference source
RMA	Return Material Authorization
RU	rack unit (1.75 inches)
SDH	synchronous digital hierarchy
SONET	synchronous optical network
T1	digital transmission (1.544 Mb/s)
CI	Clock Input card
TOTA	Timing Output T1 Automatic card
TOCA	Timing Output Composite Clock Automatic card
ST3E	Stratum 3 Enhanced clock card

## FCC Regulatory Statement

*Warning: This equipment generates, uses, and can radiate radio frequency energy, and if not used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.*





## *Description*

*This chapter provides functional and physical descriptions of the TimeExpander.*

# Introduction

The TimeExpander is a network timing expander that provides synchronization via DS1 or composite clock timing signals.

The TimeExpander accepts reference signal(s) from a Primary Reference Clock (PRC), a suitable stratum clock, a network timing reference, or a timing signal derived from the overhead of an optical carrier (i.e., SONET or SDH). Under normal operating conditions, all clock signals are traceable to a PRC or Stratum-1.

The TimeExpander is available in four different system configurations. The differences between the types are: whether a clock card is included, and the mix of output signal types. These differences are obtained by different card types installed in the shelf. Table A lists the system types and differences.

Table A. Systems

System Part #	Cards Installed				Outputs	
	CI 090-40010-04	ST3E 090-40019-04	TOTA 090-40012-05	TOCA 090-40011-03	DS1	CC
990-45200-03	2	0	2	0	20	0
990-45200-04	2	0	1	1	10	10
990-45200-05	2	1	2	0	20	0
990-45200-06	2	1	1	1	10	10

# Functional Description

## Overview

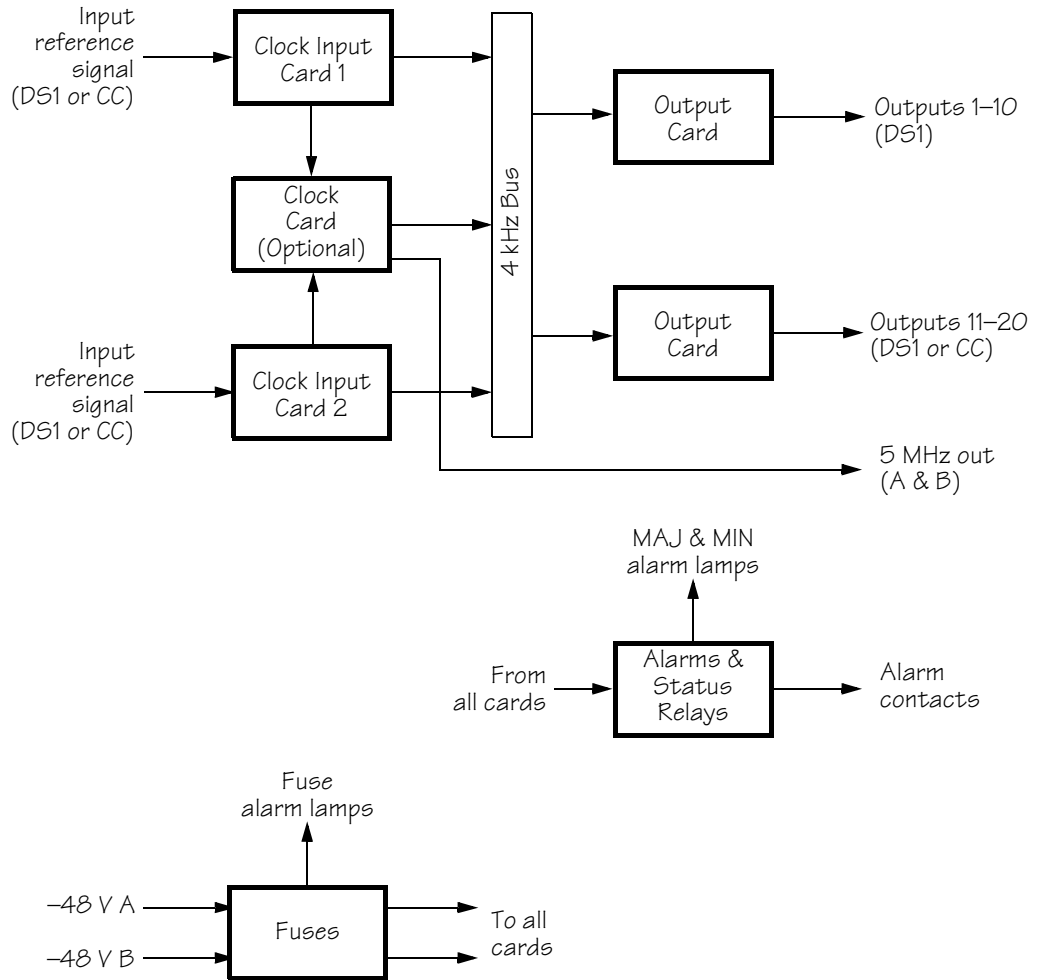
Figure 1 shows a block diagram of the TimeExpander. The TimeExpander accepts reference inputs, develops stable timing output signals, provides timing outputs in DS1 or composite clock formats for other equipment, and provides the alarm interface for an office alarm system.

The clock input cards accept reference signals from a local Primary Reference Clock (PRC). Dual input cards provide redundancy. Each clock input card provides an output timing signal to a 4-kHz timing bus and to the clock card (if equipped).

The clock card (optional) regenerates a signal from an input reference, buffers short-term timing variations, and provides long-term averaging of the input reference. If the input is disrupted or is out of tolerance, the clock card provides the necessary bridge in timing (holdover) and allows the network to continue to operate slip-free for 6 to 8 hours.

One model of timing output card provides DS1 output timing signals in a framed, all-ones format. Another model provides composite clock output timing signals. The shelf can provide DS1 outputs, or DS1 and composite clock outputs.

Figure 1. Block Diagram



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## Input Cards

An input signal is applied to each clock input card. A pair of clock input cards provides input reference signal redundancy.

The clock input cards can accept either a DS1 or a composite clock reference signal.

The clock input cards generate a 4 kHz signal locked to the input reference signal. The 4 kHz signal is applied to a 4 kHz timing bus.

If the input reference fails for one clock input card, the clock card automatically uses the signal from the other clock input card. The redundant clock input card remains in service until the failed reference is restored. A similar process occurs if one clock input card fails.

Transfer between CI cards can be manually initiated by pressing either front-panel XFR switch. Clock Card.

## Clock Card

Under normal operating conditions, the clock card monitors the 4 kHz signals from both input cards. The clock card uses the signal from the first input card that becomes active.

If both input cards or reference signals fail, the clock card goes into holdover mode. This causes the output cards to automatically use the timing signal from the clock card.

The clock card is phase-locked to the 4-kHz signal from an input card. The clock card regenerates the timing signal using stable oscillators. Microprocessor control and management of the timing process provide stable timing signals if the input references fail. The clock card drives a third line in the 4-kHz bus.

The output of the clock card is taken from a synthesizer. The output stays locked to the reference input as long as the following factors are within the ST3E limits defined by GR-1244:

- Frequency is within the pull-in range
- The maximum frequency step is not exceeded
- The rate of frequency change (slope) is not exceeded

The clock card provides two 5 MHz output signals directly to connectors at the rear of the shelf.

## Output Cards

The output cards provide DS1 or composite clock timing output signals. The output card selects one of the three signals on the 4 kHz timing bus to drive the output signals. The selection priority of the timing signals is as follows:

1. Clock
2. Clock Input 1
3. Clock Input 2

If no timing signals are present on the 4 kHz timing bus, the ST and INPUT lamps go off, the FAIL lamp lights on the output card, and the outputs are muted.

If the output card fails or the output monitor determines that six or more output drivers have failed or are shorted, the front panel FAIL lamp lights and a major alarm is generated. If one to five output drivers fail or are shorted, the front panel PORT ALM lamp lights.

It is recommended that network elements (NEs) which require two timing references (primary and secondary) be assigned output ports from two separate TOTA cards for diversity. For example, assign the primary reference to port 1 on the TOTA card in slot TO1, and the secondary reference to port 1 on the TOTA card in slot TO2.

---

## Alarm and Status Outputs

Major and minor shelf alarms are indicated on the front-panel lamps labeled MAJ and MIN. In addition, major and minor shelf alarms are provided as normally open and normally closed relay contacts on the rear of the shelf.

The following alarms have normally open relay contacts on the backplane: input 1 alarm, input 2 alarm, holdover alarm, and port alarm.

## Power

The -48 volt dc power supplied to the shelf from the office battery is protected by fuses on the shelf. After going through the fuses, the -48 volts is sent to each card in the shelf.

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## Physical Description

The TimeExpander shelf front panel contains fuses for the office battery A and B feeds, and lamps for indicating system status.

The shelf contains two clock input cards, one clock card (optional), and two timing output cards. The rear panel contains a terminal block for power, wire-wrap pins for reference input signals, output signals, and alarms, and BNC connectors for 5 MHz output signals.



# *Installation*

*This chapter provides the steps required to install and power-up the TimeExpander.*

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# Unpacking

Install the TimeExpander using the instructions in the order given in this chapter. If any difficulties are encountered during the installation process, contact Symmetricom's Customer Technical Assistance Center (CTAC) at:

- 888-367-7966 (from inside the U.S.A. only – toll free)
- 408-428-7907

CTAC includes Product Technical Support for technical information, and Customer Service for information about an order, Return Material Authorizations (RMAs), and other information.

**Warning:** When handling electronic equipment, use local office procedures regarding electrostatic discharge (ESD), including:

- Use grounded wrist straps connected to equipment frame ground when handling cards.
- Store cards only in antistatic packaging provided by the factory.

**Note:** Save packing material. All equipment returned *must be packed in the original packing material*. Contact CTAC if additional packaging is needed.

Unpack equipment carefully; check for completeness against the purchase order. Notify Symmetricom if items are missing.

Inspect equipment for shipping damage, including bent or loose hardware, and broken connectors.

If equipment was damaged in transit, contact Customer Service to request an RMA, and notify the carrier.

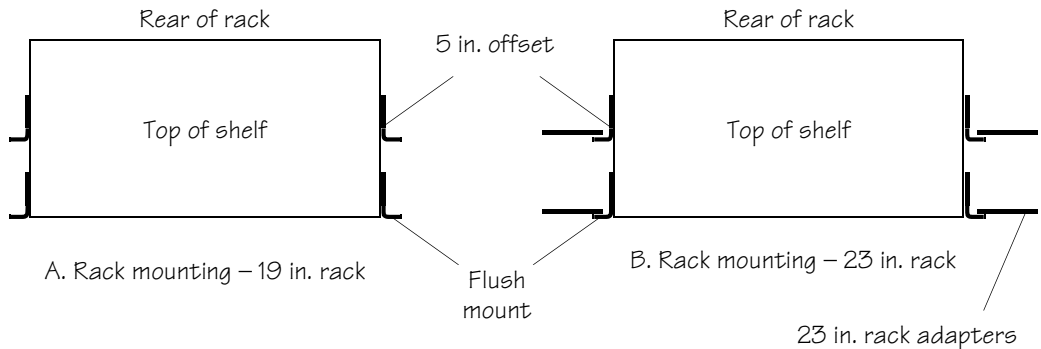
# Shelf Rack Mounting

The mounting ears, as shown in Figure 2, can be positioned for flush or 5 inch offset mounting, in either a 19 inch rack (Figure 2A) or a 23 inch rack (Figure 2B).

Position the mounting ears on the shelf for flush mounting or 5 inch offset mounting, as required. If mounting in a 23 inch rack, attach the 23 inch rack adapters, then mount the shelf in the rack.

2

Figure 2. Rack Mounting Options



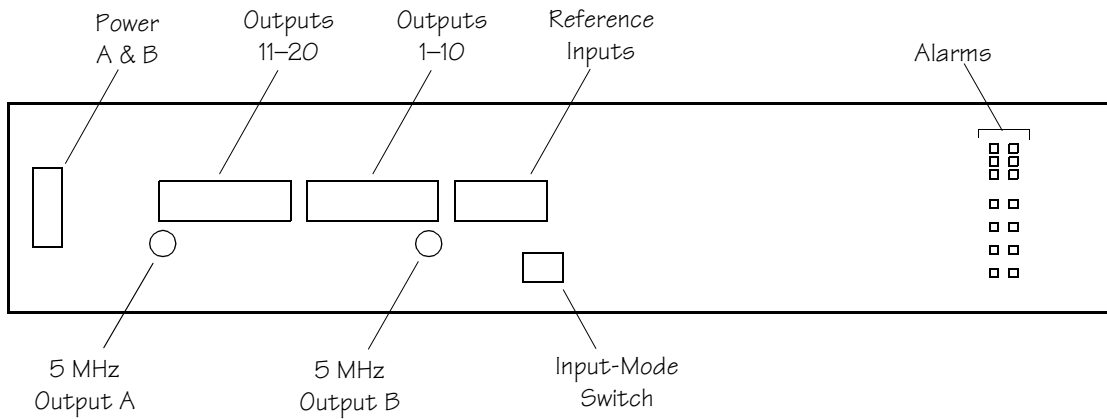
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# Cabling

All connections to the TimeExpander are made on the rear of the shelf. Figure 3 shows the location of the items on the rear of the shelf.

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Figure 3. Shelf Rear Panel Items



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## Frame Ground

Frame ground connects to terminal block TB1. The location of TB1 is shown in Figure 3. A detail of TB1 is shown in Figure 4. Make the ground connection, following one of the methods described below, depending on whether a rack ground rod is installed.

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## With Rack Ground Rod

Crimp an appropriate-size spade lug to the frame ground wire and connect the spade lug to the screw labeled FRM on TB1.

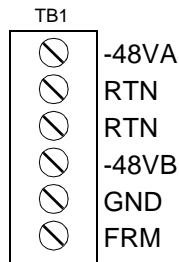
Solder the other end of the frame ground wire to the 6 AWG frame ground rod run vertically at the side of the rack using one of the following methods.

- Crimp an appropriate-size spade lug to the frame ground wire, then bend the lug around the 6 AWG rod, and solder.
- Strip enough insulation from the ground wire to permit three complete turns around the 6 AWG rod, and solder.

*Note:* When soldering, use a 25 watt soldering iron to ensure the 6 AWG rod is heated sufficiently, to prevent a cold solder connection.

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Figure 4. TB1



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## Without Rack Ground Rod

Crimp an appropriate-size spade lug to the frame ground wire and connect the spade lug to the screw labeled FRM on TB1.

Crimp an appropriate-sized spade lug to the other end of the frame ground wire, and secure the lug to a convenient screw hole on the rack. Before inserting and tightening the screw, remove the paint and sand the area around the screw hole, to ensure proper conductivity.

## Power

*Warning:* Ensure the fuses in the fuse panel used to power the TimeExpander are removed before connecting the power leads. Do not apply power until directed to do so during Power-Up.

The -48 volt dc battery and battery return connect to terminal block TB1. The location of TB1 is shown in Figure 3. A detail of TB1 is shown in Figure 4.

If two office battery supplies (battery A and battery B) are not available, connect the single office battery to the -48VA terminal of TB1.

Ensure the power wires are long enough to go from the shelf rear panel to the fuse panel which will supply office battery.

Make the battery A connection by connecting the -48 volt dc lead to the -48VA terminal of TB1. Make the battery A return connection by connecting the return lead to the RTN terminal next to the -48VA terminal on TB1.

Make the battery B connection by connecting the -48 volt dc lead to the -48VB terminal of TB1. Make the battery B return connection by connecting the return lead to the RTN terminal next to the -48VB terminal on TB1.

## Alarms

The location of alarm wire-wrap pins is shown in Figure 3. A detail of alarm pins is shown in Figure 5. The alarm pins provide dry-contact relay closure points.

For the major (MAJ) and minor (MIN) alarms, normally open (NO), common (C), and normally closed (NC) contacts are available. For the input 1 (INPUT 1), input 2 (INPUT 2), holdover (HOLDOVER), and port (PORT) alarms, common (C) and normally closed (NC) contacts are available.

Figure 5. Alarm Pins

	MAJ	MIN
NO	<input type="checkbox"/>	<input type="checkbox"/>
C	<input type="checkbox"/>	<input type="checkbox"/>
NC	<input type="checkbox"/>	<input type="checkbox"/>
	C	NO
INPUT 1	<input type="checkbox"/>	<input type="checkbox"/>
	C	NO
INPUT 2	<input type="checkbox"/>	<input type="checkbox"/>
	C	NO
HOLDOVER	<input type="checkbox"/>	<input type="checkbox"/>
	C	NO
PORT	<input type="checkbox"/>	<input type="checkbox"/>

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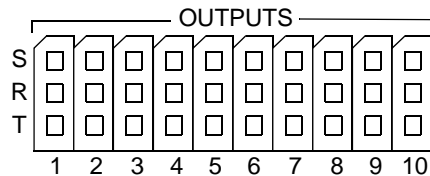
## Outputs 1–10

The location of outputs 1 through 10 is shown in Figure 3. A detail of the wire-wrap pins for the first ten outputs is shown in Figure 6. Outputs 1 through 10 are DS1 signals. Wire-wrap pins are available for the tip (T), ring (R), and shield (S) of the DS1 output cable.

*Note:* The shield of a DS1 signal cable is normally grounded only at the signal source. Grounding the shield at both ends of the cable is not recommended.

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Figure 6. Outputs 1–10





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## Outputs 11–20

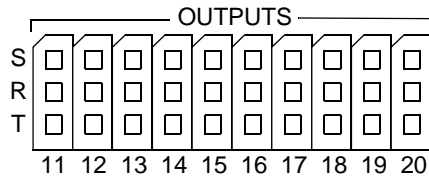
Outputs 11 through 20 may be DS1 signals or composite clock signals, depending on the system. In either case, the location of outputs 11 through 20 is shown in Figure 3. A detail of the wire-wrap pins for outputs 11 through 20 is shown in Figure 7. Wire-wrap pins are available for the tip (T), ring (R), and shield (S) of the output cable.

*Note:* The shield of a DS1 signal cable is normally grounded only at the signal source. Grounding the shield at both ends of the cable is not recommended.

2

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Figure 7. Outputs 11–20



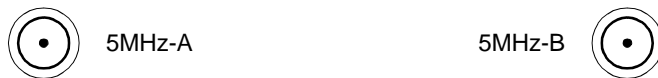
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## 5 MHz Outputs

The locations of the two 5 MHz outputs are shown in Figure 3. A detail of the 5 MHz outputs is shown in Figure 8. The 5 MHz outputs use SMC connectors. There is a connector for both an A output (5 MHz-A) and a B output (5 MHz-B).

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Figure 8. 5 MHz Outputs



## Reference Inputs

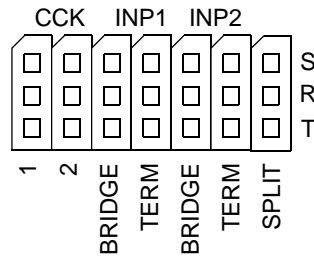
The location of the reference inputs is shown in Figure 3. A detail of the wire-wrap pins used for reference inputs is shown in Figure 9.

### Composite Clock References

For two composite clock reference inputs, use the pins labeled CCK. Wire the first composite clock input to the pins labeled 1 under CCK. Wire the second composite clock input to the pins labeled 2 under CCK. Wire-wrap pins are provided for the tip (T), ring (R), and shield (S).

2

Figure 9. Reference Inputs



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## Single DS1 Reference

For a single DS1 reference input, use the single set of pins labeled SPLIT. This input provides a 100  $\Omega$  termination, and routes the single reference signal to both input cards. Wire-wrap pins are provided for the tip (T), ring (R), and shield (S).

*Note:* The shield of a DS1 signal cable is normally grounded only at the signal source. Grounding the shield at both ends of the cable is *not* recommended.

*Note:* Set the DS1 Input Mode Switch to the SPLIT position. Refer to the DS1 Input Mode Switch section for details.

## Two DS1 References

For two DS1 reference inputs, use the pins labeled INP1 and INP2. For a bridging input (low level), use the set of pins labeled BRIDGE. For an input terminated in 100  $\Omega$  (high level), use the set of pins labeled TERM. Wire-wrap pins are provided for the tip (T), ring (R), and shield (S).

*Note:* The shield of a DS1 signal cable is normally grounded only at the signal source. Grounding the shield at both ends of the cable is *not* recommended.

*Note:* Set the DS1 Input Mode Switch to the NORM position. Refer to the DS1 Input Mode Switch section for details.

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## DSI Input Mode Switch

The location of the input mode switch is shown in Figure 3. A detail of the input mode switch is shown in Figure 10, which shows the switch in the NORM position.

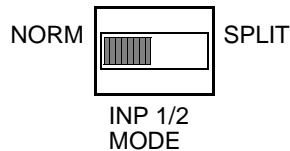
Set the input mode switch to one of the following positions:

- **SPLIT (right) position:** use this position when using a single DS1 input reference signal connected to the SPLIT wire-wrap pins (the signal on this set of pins is routed to both input cards).
- **NORM (left) position:** use this position when using two DS1 input reference signals, one connected to the INP1 wire-wrap pins and one to the INP2 wire-wrap pins.

2

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Figure 10. DSI Input Mode Switch



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# Card Options

The cards in the TimeExpander have switches used to set options. To check and set the card options, follow the steps in Procedure A.

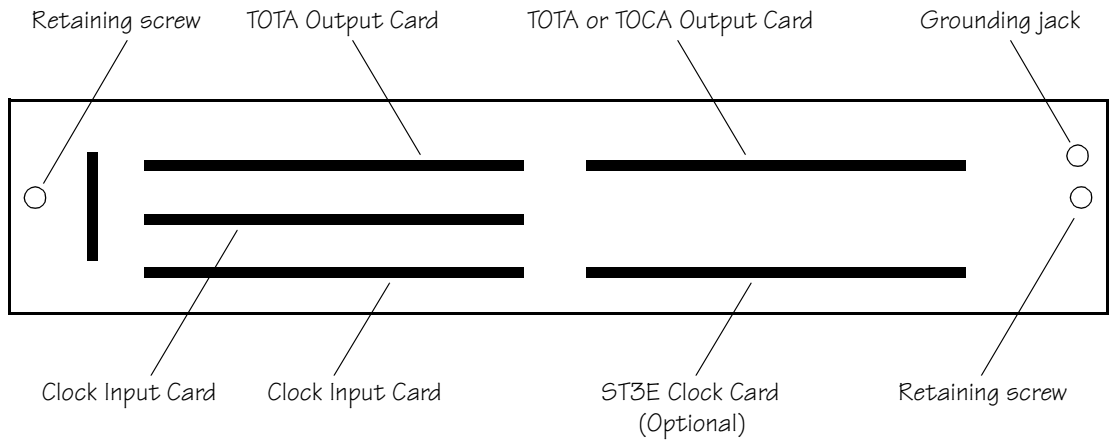
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## Procedure A. Option Switch Setting

Step	Action
<p>Use this procedure to change an option on a card. Refer to Figure 11 for the location of items in the shelf.</p> <p>Required Equipment:</p> <ul style="list-style-type: none"><li>• Grounding wrist strap</li></ul>	
1	Refer to Figures 12 through 15 to check the factory settings of all options on all installed cards. If the factory settings of all cards correspond to the desired settings for each card, this procedure is completed; skip to Power-Up. To change the options on a card, continue with the next step.
2	Put on the grounding wrist strap and insert the wrist-strap plug into the grounding jack.
3	Loosen the retaining screws that secure the front panel, then remove the front panel.
4	Use the nylon loop connected to the card to pull the desired card out of the shelf.
5	Change the card switches to the desired settings using Figures 12 through 15.
6	Reinsert the card into the same location in the shelf. Ensure that the card is fully seated in the shelf connector.
7	To set the switches on other cards, repeat Steps 4 through 6.
8	When all card switches have been set as desired, reinstall the front panel and secure the panel with the retaining screws.
9	Remove the grounding wrist strap. This procedure is completed.

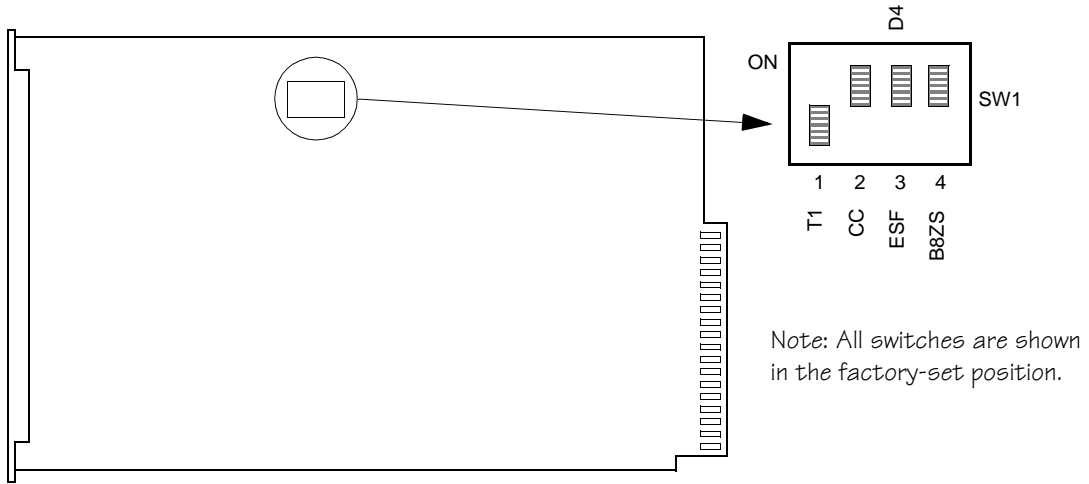
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Figure 11. Shelf Item Locations



Note: The card name, located near the top or bottom edge, can be seen after the card is removed.

Figure 12. Input Card Switch Settings

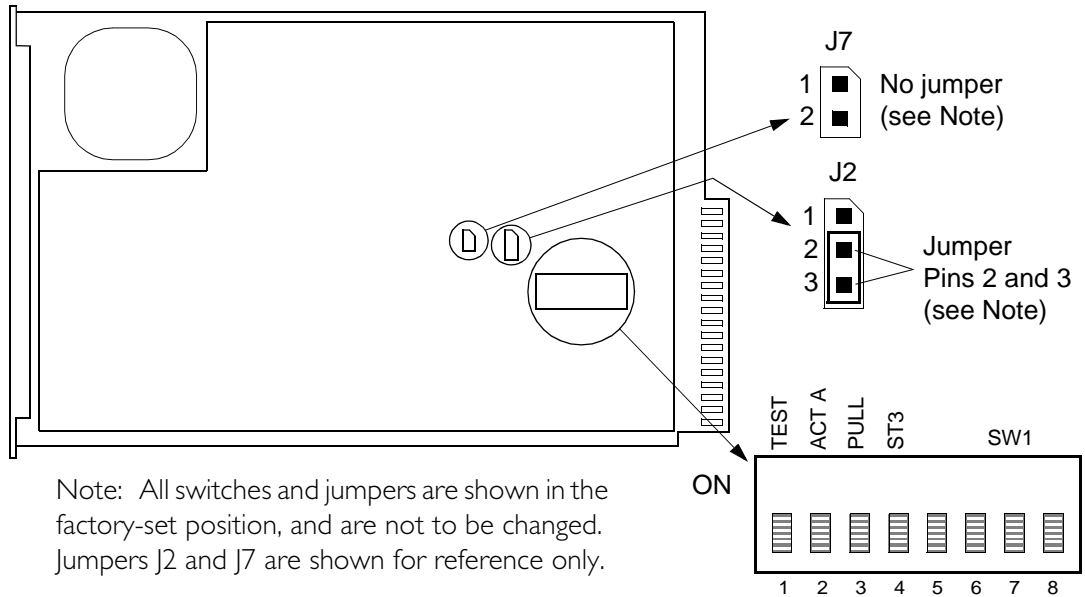


SW1 Settings

Section	Position	Meaning	Factory Setting
1	ON	DSI is not the input reference	—
	OFF	DSI is the input reference	X
2	ON	CC is not the reference	X
	OFF	CC is the reference	—
3	ON	D4 framing	X
	OFF	ESF framing	—
4	ON	No bipolar 8-zero substitution	X
	OFF	Bipolar 8-zero substitution	—



Figure 13. Clock Card Switch Settings



Note: All switches and jumpers are shown in the factory-set position, and are not to be changed. Jumpers J2 and J7 are shown for reference only.

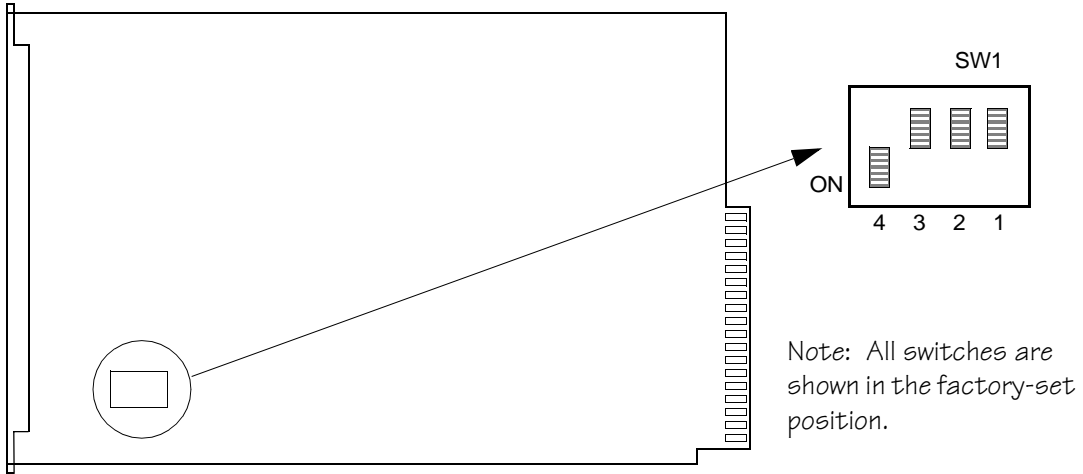
SW1 Switch Settings

Section (Note 1)	Setting	Function	Factory Setting
3 (Note 2)	ON	$\pm 2 \times 10^{-6}$ pull-in	—
	OFF	$\pm 5.6 \times 10^{-6}$ pull-in	X
5 (Note 3)	ON	Holdover causes a major alarm	—
	OFF	Holdover causes a minor alarm	X

Notes:

1. All sections of switch SW1 other than 3 and 5 must be set to the OFF position.
2. If the clock input reference source to the TimeExpander is ST3E quality or better, section 3 may be set to ON. If not, it must be set to OFF.
3. Loss of all input references causes the card to go into Holdover.

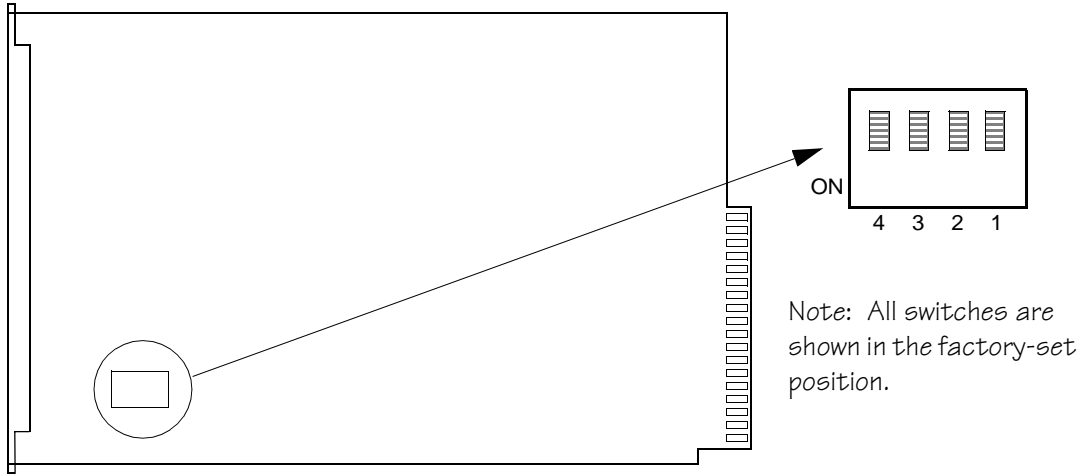
Figure 14. TOTA Card Switch Settings



SW1 Settings

4	3	2	1	Meaning	Factory Setting
OFF	OFF	—	—	Not allowed	—
ON	OFF	—	—	D4 framing	X
OFF	ON	—	—	ESF framing	—
ON	ON	—	—	Not allowed	—
—	—	ON	—	Not allowed	—
—	—	OFF	—	Normal	X
—	—	—	ON	Not allowed	—
—	—	—	OFF	Normal	X

Figure 15. TOCA Card Switch Settings



SWI Settings

4	3	2	1	Meaning	Factory Setting
OFF	OFF	—	—	0 m to 457 m (0 ft to 1500 ft)	X
ON	OFF	—	—	458 m to 610 m (1501 ft to 2000 ft)	—
OFF	ON	—	—	610 m to 762 m (2001 ft to 2500 ft)	—
ON	ON	—	—	762 m to 914 m (2501 ft to 3000 ft)	—
—	—	ON	—	PORT ALM lamp lit when disabling pin inserted in jack	—
—	—	OFF	—	PORT ALM lamp NOT lit when disabling pin inserted in jack	X
—	—	—	ON	Not allowed	—
—	—	—	OFF	Normal	X

# Power-Up

To power and test the TimeExpander, follow the steps in Procedure B.

## Procedure B. Power-Up

Step	Action	Result
<p>Use this procedure to power-up and test the TimeExpander. Refer to the Figure 9, Reference Inputs to connect the reference input signals in this procedure.</p>		
<p>Test Equipment:</p> <ul style="list-style-type: none"><li>• Digital volt-ohmmeter (Fluke 77 or equivalent)</li></ul>		
1	Apply power to the TimeExpander by installing the fuses in the external fuse panel that powers the TimeExpander.	<ul style="list-style-type: none"><li>– MAJ lamp is lit red.</li><li>– MIN lamp is lit red.</li><li>– On Input 1 and Input 2: Fail lamp is lit red.</li><li>– On DSI Outputs 1–10: Fail lamp is lit red; D4 or ESF lamp is lit green</li><li>– On Outputs 11–20:<ul style="list-style-type: none"><li>For DSI Outputs 11–20: Fail lamp is lit red; D4 or ESF lamp is lit green</li><li>For CCK Outputs 11–20: Fail lamp is lit red; 500' or 1000' lamp is lit green</li></ul></li><li>– On Clock: Free Run lamp flashes green</li></ul>

Procedure B. Power-Up (cont'd)

Step	Action	Result
2	<p><u>If using one DSI reference:</u> temporarily connect the DSI reference to the INP1 pins (BRIDGE for high level, TERM for low level); set the INP 1/2 MODE switch on the rear of the shelf to the NORM position.</p> <p><u>If using two DSI references:</u> temporarily connect one DSI reference to the INP1 pins (BRIDGE for high level, TERM for low level); set the INP 1/2 MODE switch on the rear of the shelf to the NORM position.</p> <p><u>If using two composite clock references:</u> temporarily connect one composite clock reference to the CCK 1 pins.</p> <p>(The reference signal connected in this step will be disconnected later in this procedure.)</p>	<ul style="list-style-type: none"> <li>- MIN lamp is lit red.</li> <li>- On Input 1: DSI or CC lamp (depending on the reference type used) is lit green; after approximately 15 s, Fail lamp goes off and Src Act lamp lights green</li> <li>- On DSI Outputs 1–10: Fail lamp is off; D4 or ESF lamp is lit green</li> <li>- On Outputs 11–20: For DSI Outputs 11–20: Fail lamp is off; D4 or ESF lamp is lit green For CCK Outputs 11–20: Fail lamp is off; 500' or 1000' lamp is lit green</li> </ul>
3	<p><u>If using one DSI reference:</u> temporarily jumper from the DSI reference on INP1 to the same type of pins (BRIDGE for high level, TERM for low level) on INP2.</p> <p><u>If using two DSI references:</u> temporarily connect the second DSI reference to the INP2 pins (BRIDGE for high level, TERM for low level).</p> <p><u>If using two composite clock references:</u> temporarily connect the second composite clock reference to the CCK 2 pins.</p> <p>(The reference signal connected in this step will be disconnected later in this procedure.)</p>	<ul style="list-style-type: none"> <li>- MIN lamp is lit red.</li> <li>- On Input 2: DSI or CC lamp (depending on the reference type used) is lit green; after approximately 15 s, Fail lamp goes off</li> <li>- MAJ lamp goes off</li> </ul>



Procedure B. Power-Up (cont'd)

Step	Action	Result
4	On either Input 1 or Input 2, press the Xfr pushbutton.	The Src Act lamp that was lit goes off, and the Src Act lamp on the other Input lights green.
5	If not equipped with a Clock, skip to Step 7.	None.
6	Wait 30 min, then observe the Clock lamps.	<ul style="list-style-type: none"> <li>– Fail: off.</li> <li>– Inp Tol: off.</li> <li>– Free Run: off.</li> <li>– Hold Ovr: off.</li> <li>– Lkd: lit green.</li> <li>– Act: lit green.</li> <li>– Ref A: lit green if the Scr Act lamp is lit green on Input 1, otherwise off.</li> <li>– Ref B: lit green if the Scr Act lamp is lit green on Input 2, otherwise off.</li> </ul>
7	Use a volt-ohmmeter to check the alarm contacts on the rear of the shelf.	<ul style="list-style-type: none"> <li>– MAJ: NO and C contacts are open.</li> <li>– MIN: NO and C contacts are open.</li> <li>– INPUT 1: C and NO contacts are open.</li> <li>– INPUT 2: C and NO contacts are open.</li> <li>– HOLDOVER: C and NO contacts are open.</li> <li>– PORT: C and NO contacts are open.</li> </ul>
8	Remove the reference input connected in Step 3.	<ul style="list-style-type: none"> <li>– MAJ lamp: off.</li> <li>– MIN lamp: lit red.</li> </ul>

Procedure B. Power-Up (cont'd)

Step	Action	Result
9	Use a volt-ohmmeter to check the alarm contacts on the rear of the shelf.	<ul style="list-style-type: none"> <li>– MAJ: NO and C contacts are open.</li> <li>– MIN: NO and C contacts are closed.</li> <li>– INPUT 1: C and NO contacts are open.</li> <li>– INPUT 2: C and NO contacts are closed.</li> <li>– HOLDOVER: C and NO contacts are open (if not equipped with a clock, these contacts are open).</li> <li>– PORT: C and NO contacts are open.</li> </ul>
10	Remove the reference input connected in Step 2.	<ul style="list-style-type: none"> <li>– MAJ lamp: lit red.</li> <li>– MIN lamp: lit red.</li> </ul>
11	Use a volt-ohmmeter to check the alarm contacts on the rear of the shelf.	<ul style="list-style-type: none"> <li>– MAJ: NO and C contacts are closed.</li> <li>– MIN: NO and C contacts are closed.</li> <li>– INPUT 1: C and NO contacts are closed.</li> <li>– INPUT 2: C and NO contacts are closed.</li> <li>– HOLDOVER: C and NO contacts are closed.</li> <li>– PORT: C and NO contacts are open.</li> </ul>
12	Remove all temporary connections to the reference input pins (INP1, INP2, CCK 1, CCK 2)	None.



Procedure B. Power-Up (cont'd)

Step	Action	Result
13	<p><u>If using one DSI reference:</u> permanently connect the DSI reference to the SPLIT pins (this is a terminated input for high level signals); set the INP 1/2 MODE switch on the rear of the shelf to the SPLIT position.</p> <p><u>If using two DSI references:</u> permanently connect one DSI reference to the INP1 pins (BRIDGE for high level, TERM for low level); permanently connect the second DSI reference to the INP2 pins (BRIDGE for high level, TERM for low level).</p> <p><u>If using two composite clock references:</u> permanently connect one composite clock reference to the CCK 1 pins; permanently connect the second composite clock reference to the CCK 2 pins.</p>	<ul style="list-style-type: none"> <li>– MAJ lamp: off.</li> <li>– MIN lamp: off.</li> </ul>
14	<p>On the OUTPUTS 1–10 wire-wrap pins on the rear of the shelf, temporarily connect the tip (T) and ring (R) pins together of any one output.</p>	<p>On DSI Outputs 1–10: Port Alm lamp lights red.</p>
15	<p>Use a volt-ohmmeter to check the alarm contacts on the rear of the shelf.</p>	<ul style="list-style-type: none"> <li>– MAJ: NO and C contacts are open.</li> <li>– MIN: NO and C contacts are open.</li> <li>– INPUT 1: C and NO contacts are open.</li> <li>– INPUT 2: C and NO contacts are open.</li> <li>– HOLDOVER: C and NO contacts are open.</li> <li>– PORT: C and NO contacts are closed.</li> </ul>
16	<p>Remove the connection made in Step 14.</p>	<p>None. This procedure is completed.</p>



# Troubleshooting

*This chapter provides a description of the front-panel items of the TimeExpander. Troubleshooting information for alarms and abnormal lamp indications are also provided.*

## Chapter 3

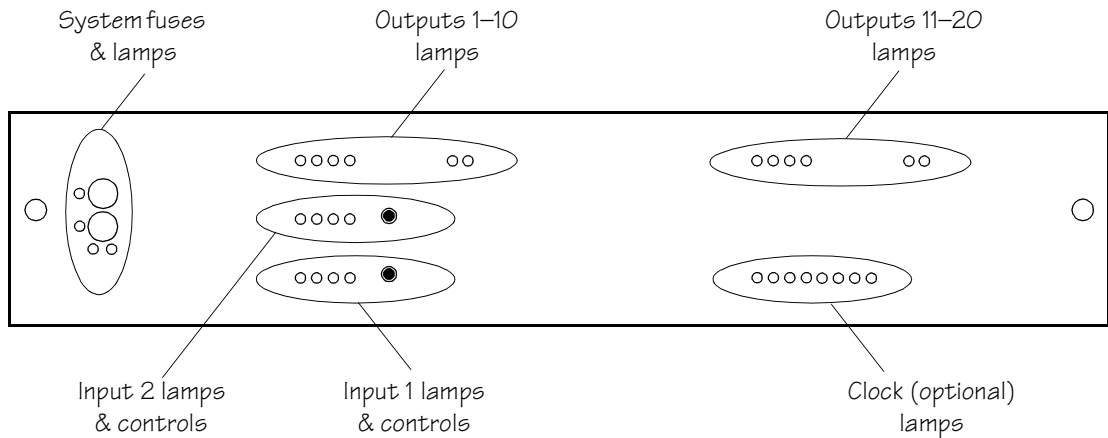
---

# Front-Panel Items

The front-panel items are shown in Figure 16. A description of these items and troubleshooting information is provided on the pages that follow.

---

Figure 16. Front Panel Indicators



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## System Fuses & Lamps

The location of all front-panel items is shown in Figure 16. The system fuses and lamps are shown in Figure 17 and described in Table B.

---

Figure 17. System Fuses & Lamps

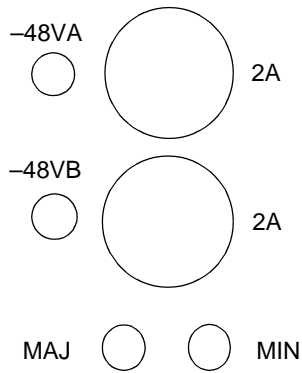


Table B. System Fuses & Lamps

Label	Type	Status	Description	Action
-48VA	Fuse	—	This is office battery A fuse (2A).	—
	Lamp	Red	Office battery A fuse is blown.	Replace office battery A fuse.
		Off	Office battery A fuse is ok.	None required.
-48VB	Fuse	—	This is office battery B fuse (2A).	—
	Lamp	Red	Office battery B fuse is blown.	Replace office battery B fuse.
		Off	Office battery B fuse is ok.	None required.
MAJ	Lamp	Red	A card has failed.	Check card lamps.
		Off	Normal condition.	None required.
MIN	Lamp	Yellow	A fuse has blown, or there is a problem with an input or output signal.	Check fuse lamps, then check card lamps.
		Off	Normal condition.	None required.

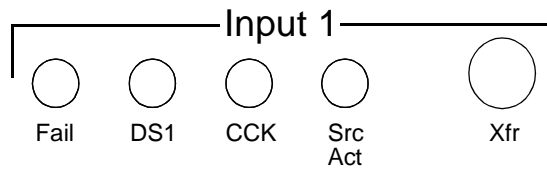
---

## Input Lamps & Controls

The location of all front-panel items is shown in Figure 16. The input lamps and controls are shown in Figure 18 and Figure 19, and described in Table C.

---

Figure 18. Input 1 Lamps & Controls



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Figure 19. Input 2 Lamps & Controls

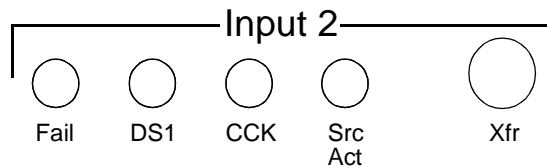


Table C. Input Lamps & Controls

Label	Type	Status	Description	Action
Fail	Lamp	Red	Input card or input has failed.	Check input reference for proper signal type (DSI or CC), level, frequency, and framing. If ok, replace card per Procedure A.
		Off	Normal condition.	None required.
DSI	Lamp	Green	DSI source is present.	None required.
		Off	DSI source is not present.	If DSI reference signal is used: Check input reference for proper signal type (DSI or CC), level, frequency, and framing.
CCK	Lamp	Green	CCK source is present.	None required.
		Off	CCK source is not present.	If CC reference signal is used: Check input reference for proper signal type (DSI or CC), level, and frequency.
Src Act	Lamp	Green	Input card is on-line providing a reference to ST and output cards.	None required.
		Off	Input card is in standby mode.	None required.
Xfr	Push-button switch	—	When pressed, switches the source active (Src Act) status from one input card to the other.	None required.

---

## Clock (Optional) Lamps

The location of all front-panel items is shown in Figure 16. The clock lamps are shown in Figure 20 and described in Table D.

---

Figure 20. Clock (Optional) Lamps

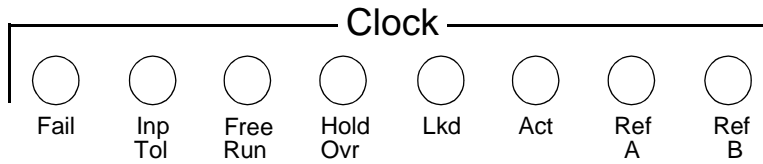


Table D. Clock (Optional) Lamps

Label	Type	Status	Description	Action
Fail	Lamp	Red	Card has failed.	Replace clock card per Procedure A.
		Off	Normal condition.	None required.
Inp Tol	Lamp	Red	Input reference to the clock input card is not in Stratum-3 pull-in range.	Check input reference frequency.
		Off	Input reference to the clock input card is in Stratum-3 pull-in range.	None required.
Free Run	Lamp	Green	No valid input reference was available at power up.	Check input reference for proper signal type (DS1 or CC), level, frequency, and framing.
		Off	Normal condition.	None required.
Hold Ovr	Lamp	Red	Input signal is not present or is out of pull-in range.	Check input reference for proper signal type (DS1 or CC), level, frequency, and framing.
		Off	Normal condition.	None required.
Lkd	Lamp	Green	Normal condition.	None required.
		Off	The input wander spec has been exceeded.	Check input reference for proper signal type (DS1 or CC), level, frequency, and framing.
Act	Lamp	Green	This card is active and providing internal reference to the timing output cards.	None required.
		Off	This card is not active and not providing internal reference to the timing output cards.	None required.



Table D. Clock (Optional) Lamps (cont'd)

Label	Type	Status	Description	Action
Ref A	Lamp	Green	This card is tracking the output of clock input card 1.	None required.
		Off	This card is not tracking the output of clock input card 1.	None required.
Ref B	Lamp	Green	This card is tracking the output of clock input card 2.	None required.
		Off	This card is not tracking the output of clock input card 2.	None required.

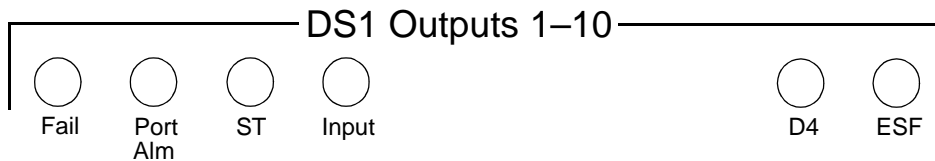
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## DS1 Outputs 1–10 & 11–20 Lamps

The location of all front-panel items is shown in Figure 16. The DS1 outputs 1–10 lamps are shown in Figure 21, and the DS1 outputs 11–20 lamps are shown in Figure 22. Both sets of lamps are described in Table E.

---

Figure 21. DS1 Outputs 1–10 Lamps



---

Figure 22. DS1 Outputs 11–20 Lamps

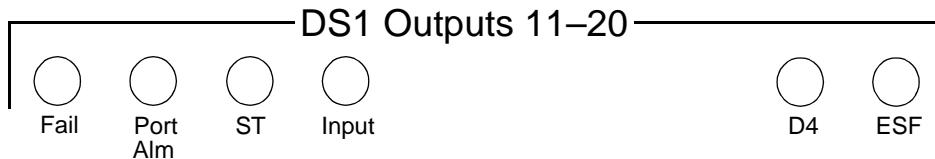


Table E. DSI Outputs 1–10 & 11–20 Lamps

Label	Type	Status	Description	Action
Fail	Lamp	Red	This card has failed or there is a loss of all input references to this card.	If the ST or Input lamp is lit green, replace this output card per Procedure A. If the ST or Input lamp is not lit green, check the Input cards.
		Off	Normal condition.	None required.
Port Alm	Lamp	Red	1 to 5 outputs have failed, have been externally shorted, or have not been terminated.	Check for external shorts and unterminated outputs. If ok, replace this card per Procedure A.
		Off	1 to 5 outputs have not failed or have not been externally shorted.	None required.
ST	Lamp	Green	This card is receiving a reference signal from the clock card.	None required.
		Off	This card is not receiving a reference signal from the clock card. Normal indication if not equipped with a clock card.	If equipped with a clock card, replace the clock card per Procedure A. If not equipped with a clock card, none required.
Input	Lamp	Green	This card is receiving a reference signal from one or more of the following: clock input card 1 or clock input card 2.	None required.
		Off	This card is not receiving a reference signal from clock input card 1 or clock input card 2.	Check input reference for proper signal type (DSI or CC), level, frequency, and framing.
D4	Lamp	Green	The outputs from this card are set for D4 framing.	None required.
		Off	The outputs from this card are not set for D4 framing.	None required.

Table E. DSI Outputs 1–10 & 11–20 Lamps (cont'd)

Label	Type	Status	Description	Action
ESF	Lamp	Green	The outputs from this card are set for ESF framing	None required.
		Off	The outputs from this card are not set for ESF framing	None required.

---

## CCK Outputs 11-20 Lamps

The location of all front-panel items is shown in Figure 16. The composite clock (CCK) outputs 11 through 20 lamps are shown in Figure 23 and described in Table F.

---

Figure 23. CCK Outputs 11-20 Lamps

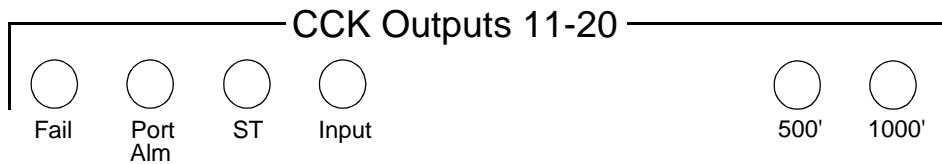


Table F. CCK Outputs 11-20 Lamps

Label	Type	Status	Description	Action
Outputs 11–20 Lamps (Composite Clock)				
Fail	Lamp	Red	This card has failed or there is a loss of all input references to this card.	If the ST or Input lamp is lit green, replace this output card per Procedure A. If the ST or Input lamp is not lit green, check the Input cards.
		Off	Normal condition.	None required.
Port Alm	Lamp	Red	1 to 5 outputs have failed, have been externally shorted, or have not been terminated.	Check for external shorts and unterminated outputs. If ok, replace this card per Procedure A.
		Off	1 to 5 outputs have not failed or have not been externally shorted.	None required.
ST	Lamp	Green	This card is receiving a reference signal from the clock card.	None required.
		Off	This card is not receiving a reference signal from the clock card. Normal indication if not equipped with a clock card.	If equipped with a clock card, replace the clock card per Procedure A. If not equipped with a clock card, none required.
Input	Lamp	Green	This card is receiving a reference signal from one or more of the following: clock input card 1 or clock input card 2.	None required.
		Off	This card is not receiving a reference signal from clock input card 1 or clock input card 2.	Check input reference for proper signal type (DS1 or CC), level, frequency, and framing.

Table F. CCK Outputs 11-20 Lamps (cont'd)

Label	Type	Status	Description	Action
500'	Lamp	Green	Option switch SWI-4 on board is set to the ON position	None required.
		Off	Option switch SWI-4 on board is not set to the ON position	None required.
1000'	Lamp	Green	Option switch SWI-3 on board is set to the ON position	None required.
		Off	Option switch SWI-3 on board is not set to the ON position	None required.

---

# Card Replacement

Procedure A provides the steps for replacing cards in the TimeExpander.

---

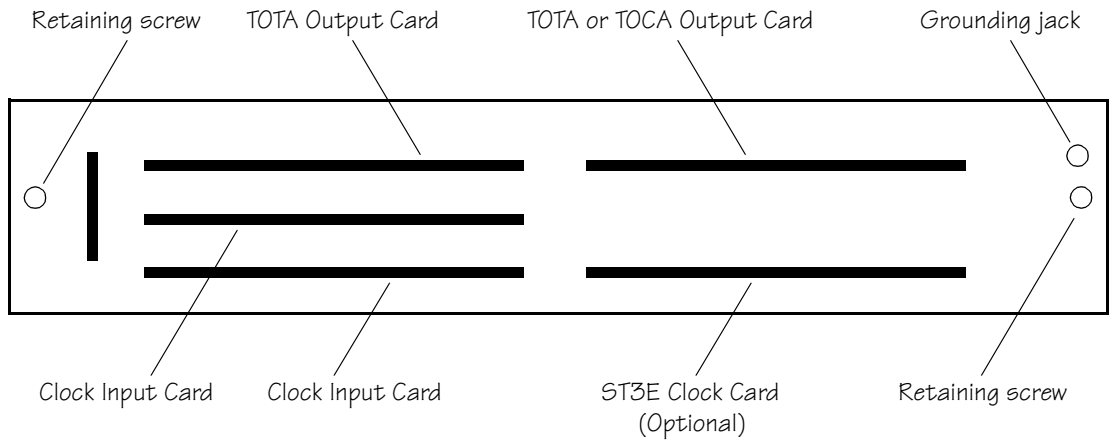
## Procedure A. Card Replacement

Step	Action
Use this procedure to replace a card. Refer to Figure 24 for the location of items in the shelf.	
Required Equipment:	
• Grounding wrist strap	
1	Put on a grounding wrist strap and insert the wrist-strap plug into the grounding jack.
2	Loosen the retaining screws that secure the front panel, then remove the front panel.
3	Use the nylon loop connected to the card being replaced to pull the card out of the shelf.
4	Ensure that the switch settings on the replacement card are set the same as on the card being replaced.
5	Install the replacement card.
6	Reinstall the front panel and secure the panel with the retaining screws.
7	Remove the grounding wrist strap. This procedure is completed.

---



Figure 24. Location of Shelf Items



Note: The card name, located near the top or bottom edge, can be seen after the card is removed.

---

# Returning Equipment

When returning defective equipment for factory repair, obtain the following information prior to calling Symmetricom:

- A complete description of the trouble (alarms, equipment behavior, etc.), part number, serial number, issue/revision level, and warranty expiration date.
- If the warranty has expired, a purchase order with “bill to” information.
- A customer field technical contact including address, phone number and FAX number.
- Return shipping information.

To return defective or damaged equipment, follow Procedure B.

Repaired equipment is typically shipped within 30 days of receipt by Symmetricom, or per contract terms. Shipping costs to Symmetricom are paid by the customer; shipping costs back to the customer are paid by Symmetricom.

---

## Procedure B. Returning Equipment

Step	Action
1	<p>Call Symmetricom's Customer Technical Assistance Center at one of the following numbers to obtain a Return Material Authorization (RMA) number and shipping address:</p> <p style="padding-left: 40px;">From inside the U.S., call 888-367-7966 toll free</p> <p style="padding-left: 40px;">From outside the U.S., call 408-428-7907</p> <p><i>Note:</i> Retain the RMA number for future reference. The RMA number is used by Symmetricom for internal tracking of the unit. Reference the RMA number in all communications with Symmetricom regarding the unit.</p>
2	<p>Pack the defective equipment, including a list containing all the information obtained above, in the original packing material. If the original packing material is not available, inform Symmetricom, and the appropriate shipping material will be provided.</p> <p><i>Note:</i> Equipment must be returned in the original packaging or approved replacement packaging, for the warranty to be honored.</p>
3	<p>Mark the RMA number and equipment serial number on the outside of the shipping carton.</p>
4	<p>Ship the equipment prepaid and insured to the address provided by the Customer Technical Assistance Center.</p>

---

# Technical Assistance

For technical assistance, contact:

Symmetricom, Inc.  
2300 Orchard Parkway  
San Jose, CA 95131-1017

U.S.A. Call Center:  
888-367-7966 (from inside U.S.A. only – toll free)  
408-428-7907

U.K. Call Center:  
+44.7000.111666  
+44.1604.586740

Fax: 408-428-7998

E-mail: [ctac@symmetricom.com](mailto:ctac@symmetricom.com)

Internet: <http://www.symmetricom.com>

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# Sales

For sales assistance, contact:

Symmetricom, Inc.  
2300 Orchard Parkway  
San Jose, CA 95131-1017

U.S.A. Call Center:  
888-367-7966 (from inside U.S.A. only – toll free)  
408-428-7907

U.K. Call Center:  
+44.7000.111888  
+44.1604.586740

Fax: 408-428-7998

E-mail: [info@symmetricom.com](mailto:info@symmetricom.com)

Internet: <http://www.symmetricom.com>

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## Manual Updates

From time to time, this manual may be updated. The updated version of the manual will be available for downloading in electronic form via the internet. After downloading, the manual can be viewed on a computer or printed out.

To register for access to the manual update site via the internet, send an e-mail to “[manuals@symmetricom.com](mailto:manuals@symmetricom.com)” with the following information:

- Name
- Title
- Company
- Address

An e-mail will be returned, which will include the internet address of the update site, and a name and password necessary to access the site.

# *Specifications*

*This chapter provides the specifications of the TimeExpander.*

Chapter 4

## DSI Reference Inputs

Connector Type:	Wire-wrap pins
Connector Label:	INP 1 (TERM and BRIDGE) INP 2 (TERM and BRIDGE) (Alternatively, a single DSI can drive both inputs using the SPLIT connector)
Connector Location:	Rear panel
Number of Inputs:	2 max (1 for each input card)
Frequency:	1.544 MHz
Impedance:	Terminated in 100 $\Omega$ Bridged
Format:	DSI
Line Code:	Alternate mark inversion (AMI)
Amplitude (Bridged):	0.1 to 0.35 V base-to-peak
Amplitude (Terminated):	1.0 V to 3.5 V base-to-peak
Jitter Tolerance	10-unit intervals, peak-to-peak, 0 kHz to 310 Hz; 0.3-unit intervals, 10 kHz to 50 kHz
Framing:	D4 ESF
Parameters Monitored:	LOS AIS OOF
Error Threshold	Error rate of $10^{-6}$ (based on BPV)



## DSI Outputs

Connector Type:	Wire-wrap pins
Connector Label:	OUTPUTS 1–10 OUTPUTS 11–20
Connector Location:	Rear panel
Number of Outputs:	20 max (10 in connector OUTPUTS 1–10, plus 10 in connector OUTPUTS 11–20 if equipped)
Frequency:	1.544 Mb/s
Impedance:	100 $\Omega$
Format:	DS1
Payload	Framed all ones
Line Code:	Alternate mark inversion (AMI)
Amplitude:	2.4 V to 3.6 V base to peak when terminated in 100 $\Omega$
Framing:	D4 ESF
Transmission During Alarms:	Squelch

---

## Composite Clock Reference Inputs

Connector Type:	Wire-wrap pins
Connector Label:	CCK 1 CCK 2
Connector Location:	Rear panel
Number of Inputs:	2 max (1 per input card)
Frequency:	64 kb/s
Impedance:	Terminated in 100 $\Omega$
Format:	All ones, RTZ, 62.5% duty cycle, one bipolar violation every 8th pulse
Amplitude:	1.5 to 4.0 V base-to-peak

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## Composite Clock Outputs (Optional)

Connector Type:	Wire-wrap pins
Connector Label:	OUTPUTS 11–20
Connector Location:	Rear panel
Number of Outputs:	10
Frequency:	64 kb/s
Impedance:	133 $\Omega$ balanced
Format:	All ones, RTZ, 62.5% duty cycle, with bipolar violation every eighth pulse
Amplitude:	2.7 to 5.5 V peak, 3 V nominal

---

## 5 MHz Outputs

Connector Type:	SMC
Connector Label:	5MHz-A 5MHz-B
Connector Location:	Rear panel
Frequency:	5 MHz
Impedance:	75 $\Omega$
Format:	Sine wave
Amplitude:	13 dBm $\pm$ 2 dBm
Harmonic Spurious:	Less than $-60$ dBc

## Alarms

Connector Type:	Wire-wrap pins
Connector Label:	MAJ (NO, C, NC) MIN (NO, C, NC) INPUT 1 (C, NO) INPUT 2 (C, NO) HOLDOVER (C, NO) PORT (C, NO)
Contact Type:	Dry contact
Contact Rating:	1 A @ 30 V dc 0.5 A @ 60 V dc 0.5 A @ 125 V ac
Major:	Deactivated when powered and not in major alarm; activated when not powered, or powered and in major alarm
Minor:	Deactivated when not powered, or powered and not in minor alarm; activated when powered and in minor alarm
Input 1:	Deactivated when not powered, or powered and Input 1 card is not in alarm; activated when powered and Input 1 card is in alarm
Input 2:	Deactivated when not powered, or powered and Input 2 card is not in alarm; activated when powered and Input 2 card is in alarm
Holdover:	Deactivated when not powered, or powered and Clock card is not in alarm or not equipped; activated when powered and Clock card is in alarm
Port:	Deactivated when not powered, or powered and neither output card has a port alarm; activated when powered and either output card has a port alarm

---

## Power

Connectors:	Terminal block
Connector Label:	TBI
Voltage:	-40 V dc to -56 V dc (A and B)
Current:	400 mA (fully loaded including clock card)
Shelf Fuses:	2 A
Recommended Battery Feed Fuse:	3 A

## Mechanical

Mounting:	19 in. rack 23 in. rack (with extension ears)
Rack Mounting Position:	Flush or 5 in. offset
Width:	15.1 in.
Height:	2.8 in.
Depth:	9 in.
Weight:	7.5 lb

## Environmental

Operating Temperature:	0 °C to +45 °C
Operating Humidity:	0 % to 95 % RH (noncondensing)
Electromagnetic Compliance:	FCC Part 15, Sub Part B, Class A