

55400A

SYNCHRONIZATION SUPPLY UNIT

SYSTEM MANUAL

This manual describes a Symmetricom synchronization system for a telecommunications network. This system includes source clocks, receiver clocks, and network management software.

This manual is the primary document for the 55400A synchronization supply unit (SSU) and 55409A mini-SSU hardware. The other elements of the synchronization system are described here to a lesser degree. The SSU, the mini-SSU, the 55300A GPS telecom reference source, and the 5071A primary frequency source receive the most coverage.

This manual applies to the 55400A SSU system you have received unless update information is included with the equipment.

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Warning Symbols That May Be Used In This Book



Instruction manual symbol; the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual.



Indicates hazardous voltages.



Indicates earth (ground) terminal.



or



Indicates terminal is connected to chassis when such connection is not apparent.



Indicates Alternating current.



Indicates Direct current.

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In This Manual

This part of the system manual helps you identify system tasks and indicates where to go for more information. It includes information on the organization, tasks, and abbreviations used in this manual.

Although most of this system manual supports the 55400A synchronization system, it also describes the installation, configuration, and some initial troubleshooting information for two Symmetricom source clocks:

- 5071A primary frequency standard
- 55300A GPS telecom primary reference source

References to the manuals supplied with these products are made where more detailed information is available. Where this occurs, specific document titles are included.

Finding information fast

To quickly locate a topic, turn to one of the following areas:

Table of contents

Find it at the front of this manual. It is a listing of all the topics covered in this manual. Use it to examine the overall content of this manual.

System manual organization

It starts on the next page. The information here describes the structure of the system manual. Find the topic you want and go to the location in the document for more information about it.

List of tasks

This list comes after the manual organization pages. Some major objectives, such as putting an SSU into service, are divided into the individual tasks necessary to accomplish each objective.

Index

Use the index at the back of this manual when you need information about a specific topic.

55400A System Manual Organization

This manual is organized into six major sections. Each chapter expands on the major topic of the section.

Section A—Learn the System

Information on what it is and how it works.

Chapter A1 System Overview—Provides an overview of the Symmetricom synchronization system.

Chapter A2 System Description—Describes the SSU in more detail.

Chapter A3 System Specifications—Presents the technical specifications for the system.

Chapter A4 Event/Alarm System—Describes the event and alarm system for the SSU that provides status about the system.

Chapter A5 Local/Remote Management—Tells what communication alternatives are supported for the 55400A SSU, 55409A mini-SSU, 55300A GPS, and 5071A frequency standard.

Section B—Prepare for the System

Information on preparing the site and the tools required.

Chapter B1 Tools and Equipment—Lists the tools and equipment needed to install the system.

Chapter B2 Equipment Rack—Describes a rack cabinet, equipment placement, and cable routing.

Chapter B3 Equipment Requirements—Specifies the dimensions and power requirements for the system equipment.

Section C—Install the System

Information on how to install the SSU, GPS primary reference source, and primary frequency standard.

Chapter C1 Installation Guidelines—Presents guidelines for the installation.

Chapter C2 Install the 55400A SSU—How to install the 55400A SSU master subrack.

Chapter C3 Install Expansion Subracks—How to install the 55400A SSU expansion subrack.

Chapter C4 Install the 55300A Primary Reference—How to install the 55300A GPS.

Chapter C5 Install the 5071A Frequency Standard—How to install the 5071A cesium clock.

Chapter C6 Install the 55409A Mini-SSU—How to install the 55409A mini-SSU subrack.

Section D—Configure the SSU

Describes the plug-in cards for the SSU: theory of operation, switch settings, and basic operation.

Chapter D1 Configure ITH Clock Cards—Understand and configure the ITH cards.

Chapter D2 Configure Output Cards—Understand and configure the output cards.

Chapter D3 Configure Communication Cards—Understand and configure the AIC/IMC/NIMC cards.

Section E—Qualify the System

Ensure the system is ready to be put into service.

Chapter E1 Qualification Procedures—Perform qualification procedures on the SSU, GPS, and cesium clock.

Chapter E2 Equipment Tests—Perform equipment tests on the SSU, GPS, and cesium clock.

Section F—Repair the System

Determine cause of problems and return the system to service.

Chapter F1 Troubleshoot the System—Troubleshoot problems with the system.

Chapter F2 Troubleshoot the SSU—Repair the SSU.

Chapter F3 Replacement Parts—Replace parts in the SSU.

Objective — Put SSU master subrack into service

Tasks	Topics	Description	See Chapter
Prepare site for equipment	Summary of tools needed.	a list of tools used to install SSU	B1
	Information about racking equipment	see recommended positioning in rack	B2
	Size and power requirements	Dimensions and current usage	B3
Install master subrack	Unpack and inspect	guidelines	C1
	Subrack	install into rack	C2
	Power connections	how to fabricate and run cables	C2
	Alarm connection	relay information and connector pinout	C2
	Remote connection	user information and connector pinout	C2
	Inputs	types of connectors	C2
	Outputs	types of connectors	C2
	Local connection	user information and connector pinout	C2
Configure cards	ITH cards	set parameter switches	D1
	Output cards	set parameter switches	D2
	Communication card	set parameter switches	D3
Install cards	ITH cards	installation steps	C2
	Output cards	installation steps	C2
	Communication card	installation steps	C2
Qualify for operation	Initial settings	verify configuration, set date, time, and ID	E1
	Configure for network operation	set network parameters for LAN, TP4, or X.25 interface using 55450A local craft terminal software	See Chapter 10 in TL1 Reference Manual for parameter descriptions
Test	Final checks	check alarms and outputs	E2
The SSU is ready to operate			

Objective — Put SSU expansion subrack into service

Tasks	Topics	Description	See Chapter
Prepare site for equipment	Summary of tools needed.	a list of tools used to install SSU	B1
	Information about racking equipment	see recommended positioning in rack	B2
	Size and power requirements	Dimensions and current usage	B3
Install expansion subrack	Unpack and inspect	guidelines	C1
	Subrack	install into rack	C2
	Power connections	how to fabricate and run cables	C2
	Outputs	types of connectors	C2
	Subrack cabling	cabling requirements between subracks	C3
Configure cards	Expansion synchronization cards	set parameter switches	C3
	Expansion communications card	set parameter switches	C3
	Output cards	set parameter switches	D2
Connect subrack cables and install cards	Add first expansion subrack	installation steps	C3
	Add additional expansion subrack	installation steps	C3
	Replace expansion subrack	removal steps	C3
Qualify for operation	Communication	verify communication between subracks	C3
Test	Final checks	check outputs	E2
The SSU is ready to operate			

Objective — Put mini-SSU subrack into service

Tasks	Topics	Description	See Chapter
Prepare site for equipment	Summary of tools needed.	a list of tools used to install mini-SSU	B1
	Information about racking equipment	see recommended positioning in rack	B2
	Size and power requirements	Dimensions and current usage	B3
Install subrack	Unpack and inspect	guidelines	C1
	Subrack	install into rack	C2
	Power connections	how to fabricate and run cables	C2
	Alarm connection	relay information and connector pinout	C2
	Remote connection	user information and connector pinout	C2
	Inputs	types of connectors	C6
	Outputs	types of connectors	C6
	Local connection	user information and connector pinout	C2
Configure cards	ITH cards	set parameter switches	D1
	Output cards	set parameter switches	D2
	Communication card	set parameter switches	D3
Install cards	ITH cards	installation steps	C2
	Output cards	installation steps	C2
	Communication card	installation steps	C2
Qualify for operation	Initial settings	verify configuration, set date, time, and ID	E1
	Configure for network operation	set network parameters for LAN, TP4, or X.25 interface using 55450A local craft terminal software	See Chapter 10 in TL1 Reference Manual for parameter descriptions
Test	Final checks	check alarms and outputs	E2
The mini-SSU is ready to operate			

Objective — Put 55300A GPS Reference Source into service

Tasks	Topics	Description	See Chapter
Prepare site for equipment	Summary of tools needed.	a list of tools used to install GPS unit	B1
	Information about racking equipment	see recommended positioning in rack	B2
	Size and power requirements	Dimensions and current usage	B3
Install GPS reference source	Unpack and inspect	guidelines	C1
	Rack mount shelf	install into rack	C4
	GPS module	install into shelf	C4
	Power connections	how to fabricate and run cables	C4
	Port 1 connection	user information and connector pinout	C4
	Alarm connection	relay information and connector pinout	See Chapter 3 in User's Guide for GPS reference source
	Time of Day connection	user information and connector pinout	See above
	Remote Access Port connection	user information and connector pinout	See above
Qualify for operation	Signal connectors	description	C4
	SatStat application	install and run to verify general health of the GPS reference source	See Chapter 1 in User's Guide for GPS reference source
	Initial settings	set local time and verify holdover actions	E1
Test	Final checks	check outputs	E2
The GPS reference source is ready to operate			

Objective — Put 5071A Frequency Standard into service

Tasks	Topics	Description	See Chapter
Prepare site for equipment	Summary of tools needed.	a list of tools used to install GPS unit	B1
	Information about racking equipment	see recommended positioning in rack	B2
	Size and power requirements	Dimensions and current usage	B3
Install frequency standard	Unpack and inspect	guidelines	C1
	Rack mount unit	install into rack	C5
	Power connections	how to fabricate and run cables	C5
	Signal connectors	description	C5
Qualify for operation	Initial settings	set continuous operation, output ports, and local time	E1
Test	Final checks	check outputs	E2

The frequency standard is ready to operate

Abbreviations used in this manual

The terms listed here are used throughout this system manual.

Table 1. List of Terms

Term	Definition
ACO	Alarm cutoff
AIC	Alarm interface card
AIS	Alarm indication signal
AMI	Alternate mark inversion
CAS	Channel associated signaling
CCS	Common channel signaling
CRC4	Cyclic redundancy check
DCE	Data communications equipment
DDFS	Direct digital frequency synthesis
DTE	Data terminal equipment
E1	European signal, 2048 kbps
EEPROM	Electrically erasable programmable read only memory
EIA	Electronics Industries Association
ETSI	European Telecommunications Standards Institute
FFOFF	Fractional frequency offset
GPS	Global positioning system
HDB3	High-density bipolar 3
IMC	Information management card
ITH	Input track and hold card
LED	Light emitting diode
LMRTIE	Latest maximum relative time interval error
LOS	Loss of signal
MRTIE	Maximum relative time interval error
NC	Normally closed
NIMC	Network information management card
NO	Normally open
NVRAM	Non-volatile random access memory
OOF	Out of frame
OSMF	Open synchronization management framework
PRC	Primary reference clock

Table 1. List of Terms (continued)

Term	Definition
SDH	Synchronous digital hierarchy
SSM	Synchronization status message
SSU	Synchronization supply unit
SWDL	Software download mode
TDEV	Time deviation
TL1	Transaction language 1
TRSC	Traffic re-synchronization card

A1

System Overview

Learn about a synchronization system

In This Chapter

The first part of this chapter introduces the concept of synchronization and why a synchronized network is valuable. The remainder of the chapter describes the 55400A Synchronization System.

The following topics are covered in this chapter:

- Introduction to network synchronization
- A telecom synchronization system described
- What makes up the Symmetricom synchronization system
- Building a network sync system
- Detailed 55400A system description
- 55400A system options, supplied accessories, and features

What is Network Synchronization?

Synchronization is the means of keeping all digital equipment in a communications network operating at the same average rate. The need for synchronization has increased due to the wide-scale digital conversion of telecommunications networks and to the introduction of SDH and SONET technologies. For the transmission of digital data, information is coded into discrete data frames, or packets. When these packets are transmitted through a network of digital communication links and nodes, all parts of the system must be synchronized in order to avoid data loss or the retransmitting of data.

WHY USE CLOCKS?

A network clock located at the origination site controls the rate at which the packets are transmitted from the sending node. A second network clock is located at the receiving node, controlling the rate at which the information is being read. The objective of network timing is to keep the source and receiver clocks in step so that the receiving node can properly interpret the digital signal. Poor synchronization at nodes within a network will cause the receiving node to either drop data or have to reread information sent to it.

EFFECTS OF POOR SYNC

Poor synchronization is caused by differences in timing accuracy among clocks at different network levels or by phase movements called jitter and wander. Jitter and wander distort network timing references as they are distributed from one node to another. As the frequency of the clock drifts, quality of service problems increase. These problems can include dropped sessions and the need for retransmission in wire-line systems, or dropped calls and delayed handoffs in the wireless area.

A Telecom Sync System

Most telecommunications administrations use a hierarchical source-receiver method to synchronize their networks. The master clock for a network is one or more primary reference sources (PRS). This clock reference is distributed through a network of receiver clocks.

A node with the most stable, robust clock is designated as a source node. The source node transmits a timing reference to one or more receiver nodes. The receiver nodes, having equal or worse timing performance than the source node, lock onto the timing reference of the source node and then pass the reference to other receiver nodes. This way timing is distributed down a hierarchy of nodes.

These receiver nodes are usually designed to accept two or more timing references. At any time, one reference is active while all other alternate references are standby. In the case where the active reference is lost, the receiver node can switch references and lock to an alternate reference. Thus, each receiver node has access to timing from two, or more, source nodes providing redundant operation.

Source Clocks

A PRS is a master clock for a network. One class of PRS is a stratum 1 clock. By definition, a stratum 1 clock is free running. This means that it does not use a timing reference to derive or steer its timing. A cesium clock, such as the 5071A Primary Frequency Standard, meets this requirement. A stratum 1 clock, as defined by the American National Standard for Telecommunications (ANSI), is able to maintain a frequency accuracy of better than 1×10^{-11} .

Not every PRS clock needs to be implemented with a primary atomic standard, such as the 5071A. Other examples of PRS are Global Positioning System (GPS) and LORAN-C clocks. These systems use rubidium or quartz oscillators that are steered by timing information obtained from GPS or LORAN-C. They are not considered stratum 1 sources because they are steered, but they are classified as primary reference sources.

Receiver Clocks

The role of a receiver clock is to recover the clock from a reference signal and maintain timing as close to the source node's timing as possible. To accomplish this, the receiver clock must perform two basic tasks:

- It must reproduce the source clock's timing from a reference signal, even though the reference signal may have errors.
- It must maintain adequate timing in the absence of a timing reference.

The normal mode of operation for a receiver clock is to extract timing from the source clock's reference. Should any short-term reference errors occur, the receiver clock must be able to handle them. These errors may be timing instabilities (jitter) or short-term reference interruptions (error bursts). Errors of these kinds are usually caused by the facility transporting the reference from the source clock to the receiver clock.

A receiver clock uses low-pass filters to handle short-term timing instabilities. During short interruptions of the timing reference, a receiver clock is designed to have two, or more, references so that it can switch references during short-term impairments.

The second mode of operation is a receiver clock running with a loss of all its timing references. This mode is called "Holdover" and refers to the capability of the receiver clock to operate when it is not locked to an external reference. It uses data acquired during previous tracking of the timing reference to help maintain its accuracy.

Symmetricom Network Synchronization System

Symmetricom has developed a complete synchronization system that includes cesium and GPS timing sources, timing distribution, and network synchronization management. This manual will describe these system elements to varying degrees. Although all elements of the system are described, the 55400A will receive the most complete description. References to documents for the other products are included as needed. The figure below shows the sync system elements.

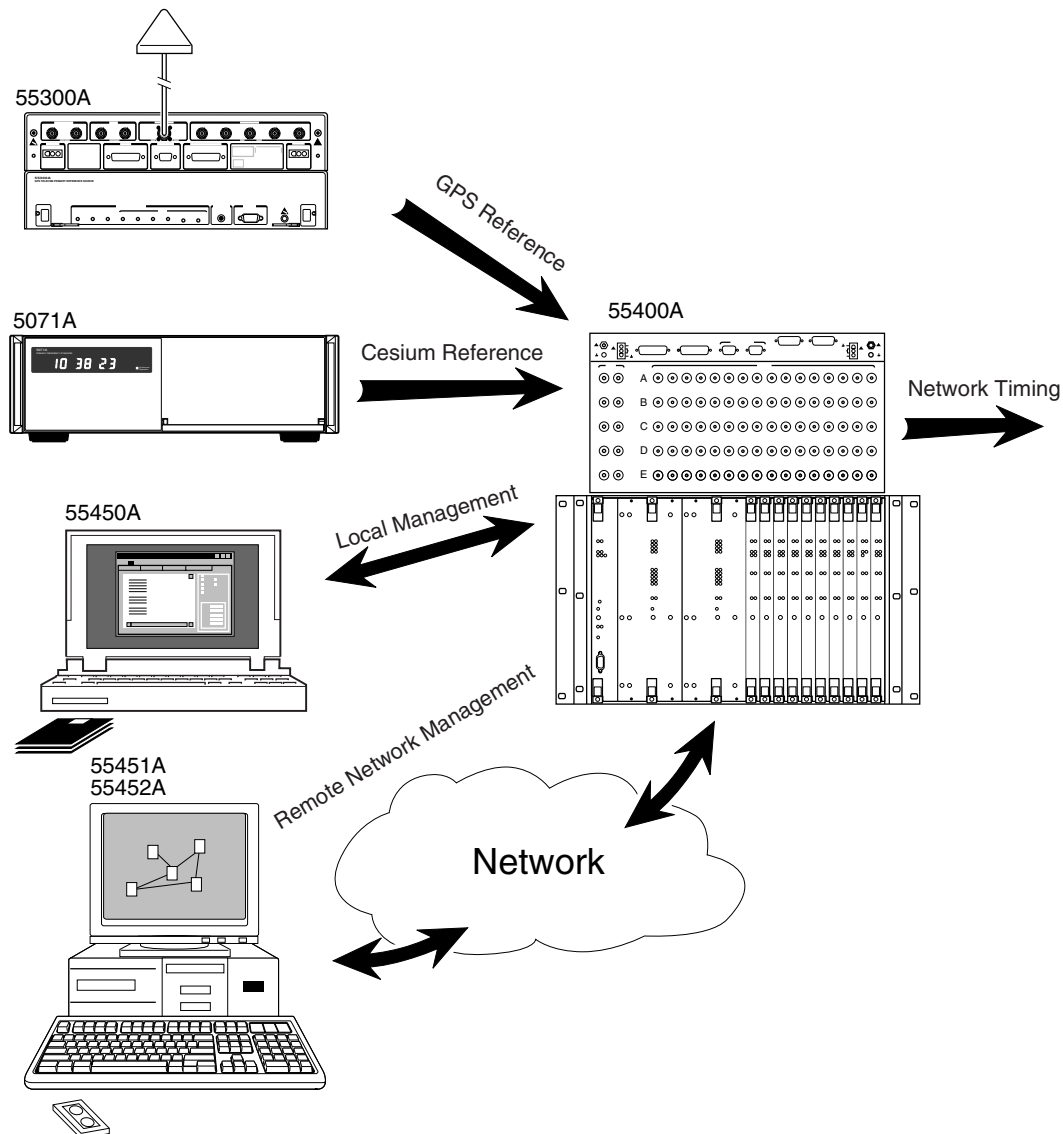


Figure A1-1. Symmetricom Network Synchronization System

System Summary

The Symmetricom network synchronization system can be built up from some or all of the following products:

- 5071A primary frequency standard
- 55300A GPS telecom primary reference source
- SatStat application software
- 55400A synchronization supply unit (SSU)
- 55409A mini-SSU
- 55450A local craft terminal software
- 55451A open synchronization management framework (OSMF) for NT
- 55452A open synchronization management framework (OSMF) for UX

5071A Primary Frequency Standard

The 5071A is a stratum-1 clock that is free running and requires no timing reference to derive or steer its timing. Originally designed for standards labs, telecom inputs and outputs were added so it could be interfaced to telecom equipment. This timing source sits at the top of the hierarchical timing structure in a synchronization network.

55300A GPS Telecom Primary Reference Source

Based on GPS technology, the 55300A provides highly accurate frequency outputs of 2048 kHz, 2048 kbps, and 10 MHz. This equipment can be used as a synchronization source for all office levels in a telecommunications network.

The GPS satellite system is typically used to determine position and time. The 55300A uses the GPS system to supply very accurate frequencies for use as references in telecom networks.

NOTE

See “In This Manual” for a list of tasks to put a GPS reference source into service.

SatStat (p/n 59551-13401)

Supplied with the 55300A, this application provides the status of the receiver for GPS synchronization, satellite acquisition, and the condition of the equipment hardware.

55400A Synchronization Supply Unit (SSU)

The 55400A is a modular, fully-redundant timing distribution system for 2048 kbps primary rate networks. It is ideal for situations where SDH (Synchronous Digital Hierarchy) technology is being deployed or expanded. The system distributes precise timing synchronization signals to network equipment within a wire-line network node or office.

NOTE

See “In This Manual” for a list of tasks to put an SSU master subrack into service.

55409A Mini-SSU

The mini-SSU is a scaled-down version of the standard SSU. It is designed for situations where the distribution of timing synchronization is needed but without the greater number of inputs and outputs of the standard SSU. The location of the mini-SSU is most appropriate near the end of the synchronization chain where there is only a limited number of network elements needing synchronization. The following table summarizes the differences between the SSU and the mini-SSU.

Table A1-1. Quick Comparison of SSU and Mini-SSU

Feature	SSU	Mini-SSU
Number of inputs	Up to 9	3
Number of outputs	80 (up to 400 total with four expansion subracks)	Up to 32
Supports expansion subracks	Yes	No
Supports network management	Yes	Yes
EIA or ETSI rack mounting	Yes	Yes
Number of output cards in protected pairs that can be accommodated in subrack	10 (5 pairs)	4 (2 pairs)
Clock types available	Enhanced Stratum-2, Stratum-2, Enhanced transit node, Transit node, Local node	Local node

NOTE

See “In This Manual” for a list of tasks to put an mini-SSU subrack into service.

55450A Local Craft Terminal software

This PC-based program simplifies the tasks of configuring, commissioning, monitoring, and troubleshooting an 55400A SSU. The software provides a graphical user interface that uses the pointing and clicking with a computer mouse to take the place of typing in strings of TL1 commands. The 55450A can connect to an SSU via the RS-232 local port or a modem. This manual refers to the local craft terminal software where it can be used to simplify configuring and monitoring the SSU.

55451A OSMF for NT

The 55451A open synchronization management framework (OSMF) facilitates the management activities of fault detection, performance, configuration, and security. OSMF is an open network management product running on NT-compatible computers and based on telecommunication industry standard platforms.

55452A OSMF for UX

The 55452A open synchronization management framework (OSMF) facilitates the management activities of fault detection, performance, configuration, and security. OSMF is an open network management product running on HP-UX workstations and based on telecommunication industry standard platforms.

System Integration Issues

This system manual attempts to address the needs of someone building up a network synchronization system. This involves concerns about power needs, the appropriate environment, input/output cable considerations, etc.

This manual contains a complete description of all operating, software, and hardware issues for the 55400A SSU. For the other equipment that makes up the synchronization system, enough details are included to allow you to install and verify the equipment's operation. If your documentation needs for the other equipment go beyond what is contained in this manual, please see the references found here for the complete documentation supplied with those products.

The system integration topics include the following:

- equipment size and weight
- environmental requirements
- power requirements
- grounding issues
- signal and power cabling and connectors
- input/output signal levels
- communication tools for equipment control

Most of these issues will be addressed in Sections B and C of this manual. Those parts contain the chapters dealing with preparing for installation and installing the equipment. Once the equipment is integrated and operating, you can have a PRC providing a high-level timing signal to the 55400A SSU. Other timing reference signals could come from traffic-bearing signals, as well.

TIP It is the task of the 5071A frequency standard and the 55300A GPS reference source to provide timing signals. The 55400A SSU will monitor the signals for quality and determine the most appropriate signal to use and distribute based on how its reference selection process has been configured.

55400A SSU System

The 55400A synchronization supply unit (SSU) is a modular, fully-redundant timing distribution system for 2048 kbps primary rate networks. It is ideal for situations where SDH (Synchronous Digital Hierarchy) technology is being deployed or expanded. The system provides precise timing synchronization signals to network equipment within a wire-line network node or office.

The 55400A conforms to telecommunications design standards, supporting both the ETSI SSU (Synchronization Supply Unit) and the Bellcore BITS (Building Integrated Timing Supply) concepts. The SSU can track five incoming reference signals (up to nine inputs with Option 001 for the Input Track/Hold cards) from higher, or equal, levels of the network, qualify the signals, then filter and distribute precise timing signals to the node's equipment. Incoming reference signals may come from cesium standards at the top level of the network, GPS reference sources, non-traffic E1 signals, or live traffic signals.

System Components

The 55400A is a modular system consisting of a master subrack (and expansion subracks when more than 80 outputs are required) and plug-in cards. See Figure A1-2 for an illustration of a master subrack loaded with a full configuration of one information management card (IMC), two input track/hold cards (ITH), and ten output cards.

System Power

Customer-supplied redundant –48 Vdc office battery inputs power the 55400A system. Each plug-in card is individually fused and contains its own dc-to-dc converter.

Reference Input Signals

The 55400A can accept five reference signals when the system is using the standard ITH cards. Systems using Option 001 ITH cards support up to nine input signals. The Primary Reference Clock (PRC) input signal can be 5 or 10 MHz. The other eight inputs can be any combination of 2048 kbps or 2048 kHz signals.

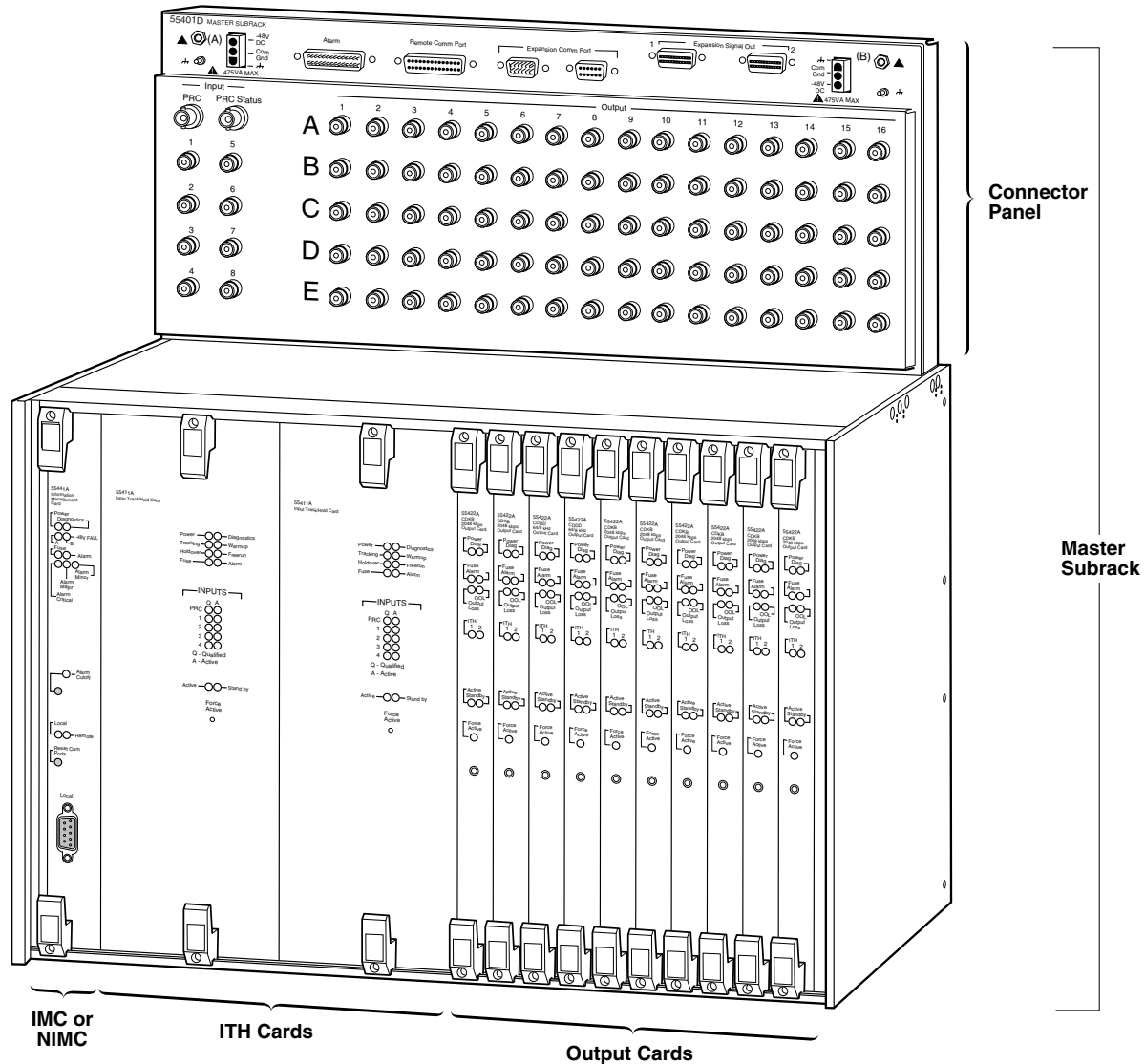


Figure A1-2. 55400A Synchronization Supply Unit

Master Subrack

The master subrack is the frame that houses the plug-in cards and accepts external signals and power for system operation. A master subrack typically contains the following cards:

- 1 alarm/communication card (IMC or NIMC)
- 2 clock cards that compare status and ensure redundancy (ITH)
- 1 to 10 output cards installed in pairs for redundant operation

Information Management Card

Each master subrack contains a card that manages alarms from the system and also provides an interface for communication with local or remote controllers.

The alarms are collected from every other card in the subrack. Upon receiving one or more alarm conditions, this card will determine if the one alarm, or combination of alarms, is a minor, major, or critical alarm state and activate the alarm relays and appropriate LED indicators on the front panel.

Different versions of the information management card support local, remote, and network communication protocols.

Input Track/Hold Cards

The ITH cards are typically used in a protected-pair configuration. Each ITH clock card qualifies the input signals while filtering jitter and wander on the selected input signal before sending a reference signal to the output cards. The ITH cards duplicate functions in the event that the active ITH card fails and the standby card has to take over. Both ITH cards track the selected reference signal with the active ITH card taking over as the system reference should all the input reference signals fail.

Output Cards

When configured in the recommended 1:1 protected mode, each pair of output cards provides 16 protected outputs for network elements. The 1:1 protection mode employs a combination of an active card paired with a standby card ready to take its place should the active card develop a problem. Alternately, a single unprotected output card can provide 16 output signals.

Expansion Subrack

A system containing one master subrack can be expanded by adding up to four expansion subracks. This adds up to 320 outputs to the 80 of the master subrack for a total of 400 1:1 protected outputs. Each of the expansion subracks receive its timing from the master subrack. A communications channel is provided between the subracks for status and event messaging.

All communication with the external world is through the master subrack. Each expansion subrack connects to the master subrack for its communication and synchronization signals. Each expansion subrack houses a pair of expansion clock cards and a communication card, in addition to the output cards. Instructions for preparing and installing the expansion subrack are contained in chapter C3, "Install Expansion Subracks."

55409A Mini-SSU Subrack

The mini-SSU subrack is basically a frame and backplane that accepts plug-in cards providing synchronization signals to network elements. The cards can be configured as follows:

- 1 alarm/communication card (if needed)
- 1 ITH clock card, or 2 for redundant operation
- 1 to 4 output cards installed in pairs for redundant operation
- 1 input/output connector module (16 outputs)
- 1 output connector module (if 16 more outputs needed)

Instructions for preparing and installing the mini-SSU subrack are contained in chapter C6, "Install the 55409A Mini-SSU."

Options Available

55400A SSU

Options to the SSU include an alternate type of input/output connector, BALUN transformers, support for an additional four input references, and a communication card that supports putting the SSU on a network. These options are explained below.

55401D Master Subrack / 55402D Expansion Subrack

Option 001 to the subrack provides a subrack connector panel with 1.6/5.6 Siemens-type connectors for the 2048 kbps/kHz inputs and all the outputs in place of the standard BNC connectors.

If the 2048 kbps or 2048 kHz input and output cabling has a 120 Ω impedance, a 75 to 120 Ω BALUN will be required on the input and output connectors to properly terminate the signals. In-line BALUNS are available for BNC or Siemens-type connectors:

- A Siemens BALUN can be ordered as Option 002 to the subrack. Order the quantity required.
- A BNC BALUN can be ordered as Option 003 to the subrack. Order the quantity required.

Input Track and Hold Card

Option 001 to the Input Track/Hold card provides the capability to accept up to nine input signals (four additional to the five that are standard).

Network Information Management Card

In its standard configuration, the 55442A card supports a TCP/IP network connection. Option 002 provides X.25 connectivity. Option 003 provides a TP4 network interface. Option 004 provides expanded memory for storage of continuous measurement data.

Composite Clock Card

The 55483A card requires a patch panel in order to supply balanced outputs. Option 002 provides a patch panel with Siemens 75 Ω 1.6/5.6 connectors. Option 003 supplies BNC connectors on the patch panel.

NOTE

When operating the composite clock card in a protected-pair configuration, order the patch panel option for only one card.

Traffic Re-synchronization Card

The 55471A traffic re-sync card requires the use of a 75 Ω termination on each input for correct impedance matching with the subrack backplane. Option 002 provides a single 75 Ω feed-thru termination for subracks with Siemens 1.6/5.6 connectors. Option 003 supplies one 75 Ω feed-thru termination for subracks with BNC connectors. If additional terminations are needed, refer to chapter F3, “Replacement Parts” for the part number.

55409A Mini-SSU

The options for the mini-SSU cover the I/O modules and a communication card described below. See chapter C6 for illustrations of the subrack.

55409A Mini-SSU Subrack—I/O modules

The selection of these options to the subrack determines the connector type and impedance characteristics of the input and output connectors. If additional modules are needed, order the product numbers listed inside the parentheses below.

- Option 011 provides BNC, 75 Ω unbalanced connectors (inputs and outputs/55498A option 011)
- Option 012 provides micro Siemens 1.0/2.3, 75 Ω unbalanced connectors (inputs and outputs/55498A option 012)
- Option 021 provides BNC, 75 Ω unbalanced connectors (outputs only/55497A option 021)
- Option 022 provides micro Siemens 1.0/2.3, 75 Ω unbalanced connectors (outputs only/55497A option 022)

Network Information Management Card

In its standard configuration, the 55442A card supports a TCP/IP network connection. Option 002 provides X.25 connectivity. Option 003 provides a TP4 network interface. Option 004 provides expanded memory for storage of continuous measurement data.

5071A Primary Frequency Standard

The 5071A frequency standard provides 5 or 10 MHz for use as a reference source for the SSU. Optional features can supply a clock rate of 2.048 Mb/s and support operation from a –48 Vdc central office battery.

- Option 048 provides for 48 Vdc operation
- Option 270 provides 2.048 Mbps, 75 Ω unbalanced, CCS
- Option 908 provides a rack mount kit to install the HP 5071A into a rack without the handles

55300A GPS Telecom Primary Reference Source

The 55300A telecom primary reference source uses GPS technology to supply a reference clock for the SSU. Available output frequencies include 10 MHz, 2048 kbps, and 2048 kHz. In addition, a complete line of GPS accessories is available.

- The 55300A module requires a rack mount shelf such as the 55320A (shown in chapter C4).
- Option 002 to the 55320A provides a right angle N-type connector for LMR 400 cable. This simplifies the connection of the antenna cable to the GPS antenna connector on the rack mount shelf.
- Option H04 provides the following to support connection to a LAN:

Lantronix LRS1-T Remote Access Server

–48 Vdc to 6 Vdc Converter

GPS Accessories

- GPS Antenna
- Lightning arrestor
- Line amplifier with L1 bandpass filter
- L1 bandpass filter
- 1:2 Distribution amplifier/splitter
- 1:4 Distribution amplifier/splitter
- Cables

Accessories Supplied

55400A SSU

An installation accessories kit is supplied with the master and expansion subracks. For more information about the contents of the kits, refer to chapter C3, “Install the 55400A NSU.” Rack mounting flanges are also included.

5071A Primary Frequency Standard

The Option 907 handles kit is included.

55300A GPS Telecom Primary Reference Source

Accessories included with the 55300A:

- 34399A RS-232 Adapter Kit
- RS-232 Serial interface cable
- HP SatStat software

34399A RS-232 Adapter Kit

- Adapter, 9-pin M to 25-pin M (straight through) for PCs and printers, part number 5181-6640
- Adapter, 9-pin M to 25-pin F (straight through) for PCs and printers, part number 5181-6641
- Adapter, 9-pin M to 25-pin M (converts Null modem cable to Modem cable) part number 5181-6642
- Adapter, 9-pin M to 9-pin M (converts Null modem cable to Modem cable) part number 5181-6639

RS-232 Serial Interface Cable

Serial interface cable, 9-pin (female-female), part number 5182-4794

SatStat (p/n 59551-13401)

A software application that presents a GPS receiver screen that shows the status of satellite acquisition, GPS synchronization, and the condition of the receiver hardware.

System Features

The features of the Symmetricom synchronization system listed here are fully described in chapter A3, “System Description.”

Architecture and Design

55400A SSU

- Redundant architecture.
- Up to nine timing reference inputs with four modes for selecting and qualifying inputs: automatic, forced, manual, or SSM (synchronization status messaging).
- 1:1 protected outputs.
- Hot-swap cards.
- Firmware upgrades can be downloaded without interrupting system operation.

55409A Mini-SSU

- Redundant architecture.
- Up to three timing reference inputs with four modes for selecting and qualifying inputs: automatic, forced, manual, or SSM (synchronization status messaging).
- 1:1 protected outputs.
- Hot-swap cards.
- Firmware upgrades can be downloaded without interrupting system operation.

55300A GPS Reference Source

- Plug-in card that fits into a rack-mounted shelf.
- No periodic maintenance.
- Compatible with other equipment vendors.

5071A Frequency Standard

- Automatic start-up with no adjustments or alignments.
- Does not require a controlled operating environment.
- Remote status checking.

55400A SSU Performance

- Extremely low jitter and wander generation.
- No output phase hits on input switch-over.
- Built-in monitoring of the following performance measurements:

MRTIE (Maximum Relative Time Interval Error)

LMRTIE (Latest MRTIE)

TDEV (Time Deviation)

FFOFF (Fractional Frequency Offset)

SPREAD (Frequency differences between channels)

55400A SSU Expandability

- Up to 400 1:1 protected outputs with additional expansion subracks.
- Synchronization Status Message (SSM) supported for synchronization quality messages.
- Local and remote network synchronization management of security, system configuration, system performance, and faults.

A2

System Description

A description of how the SSU system works and how to use it

In This Chapter

The Symmetricom Synchronization System can consist of reference sources, an SSU, and both local and remote management software. It can provide a complete solution to the need for network timing. Central to the sync system is the SSU.

NOTE

This chapter provides instructions on how to modify SSU settings.

This chapter deals mainly with the 55400A SSU. Details are provided on the following topics:

- Review of the Symmetricom Sync System
- Definition of an SSU
- How the SSU works
- A look at the SSU block diagram
- How input signals are qualified based on conditions and performance measurements
- How SSU input signals are selected

Elements of the Symmetricom Sync System

The synchronization system consists of the component parts listed in Table A2-1.

Table A2-1. Elements of the Symmetricom Synchronization System

Network Synchronization System	Purpose
5071A primary frequency standard	Supplies Stratum 1 level signals.
55300A GPS primary reference source	Supplies primary reference source signals economically.
55400A synchronization supply unit (SSU)	A timing signal generator that filters and distributes timing signals for a network.
55450A local craft terminal software	Simplifies configuring, monitoring, and troubleshooting an SSU.
55451A open synchronization management framework (OSMF) for NT 55452A open synchronization management framework (OSMF) for UX	Converts synchronization into a managed network function and assists in the activities of fault detection, configuration, performance, and security of many SSUs.

Symmetricom Synchronization System

“Data synchronization is nothing more than accurate clock timing provided to the digital element to ensure integrity of the information being sent.”

-- Anonymous

5071A Primary Frequency Standard

The 5071A is a stratum-1 source that can provide the 55400A with a 5 or 10 MHz sinewave signal as a PRC source. This cesium-based clock can also produce a 2.048 Mbps signal depending on the telecommunications output option installed in the 5071A.

NOTE

For information on how to install and start up the 5071A, refer to chapter C5, “Install the 5071A Frequency Standard.”

55300A GPS Primary Reference Source

A primary reference source using the GPS system. This unit can provide a 10 MHz sine wave signal, 1 PPS, IRIG-B, and 2048 kbps, depending on the option installed in the 55300A.

NOTE

For information on how to install and start up the 55300A, refer to chapter C4, “Install the 55300A GPS Reference Source.”

55400A Synchronization Supply Unit

This SSU is a timing distribution system that accepts timing signals, qualifies these signals for use, filters any jitter, and selects one of the signals to use as a reference. Then, precise reference-based timing signals are distributed to the node's network elements.

NOTE

For information on how to install and start up the 55400A, refer to chapter C2, “Install the 55400A SSU.”

55450A Local Craft Terminal software

This is a Windows-based application that runs on a PC and simplifies the configuration and the monitoring of an SSU. Supported operating systems include Windows 95 and Windows NT 4.0. It also supports the monitoring of the GPS receiver. Communication is supported over an RS-232 or modem connection.

55451A OSMF for NT

This management software runs on a PC with the NT operating system. It supports management and control of entire networks of SSUs.

55452A OSMF for UX

This management software runs on HP-UX workstations. It supports management and control of entire networks of SSUs.

What is an SSU?

An SSU (synchronization supply unit) is a combination of a slave clock and a distribution unit. The SSU tracks an upstream equipment clock or reference source and produces multiple copies of the clock it is tracking for the timing of downstream equipment. The 55400A is an SSU because it performs the following primary and secondary tasks.

The primary functions of an SSU are:

- Track the incoming reference
- Remove jitter and wander from the reference
- Distribute the restored reference to downstream equipment

The secondary functions of an SSU are:

- Support multiple input references
- Supply the clock when no input references are present (holdover)
- Provide redundancy for input and output signal processing circuitry
- Manage alarms
- Report operational status and problems to support systems
- Simplify the operation, administration, maintenance, and provisioning of the system

Monitors input signals for:

- A minimum amplitude level
- Appropriate formatting of E1 signals
- Frequency stability
- SSM quality

Measures jitter and wander performance with:

- Time Deviation (TDEV)
- Maximum Relative Time Interval Error (MRTIE)
- Latest Maximum Relative Time Interval Error (LMRTIE)
- Fractional Frequency Offset (FFOFF)
- Frequency differences between channels (SPREAD)

Selects the system reference from the qualified input signals using one of four synchronization modes:

- Automatic reference switching
- Manual reference switching
- Synchronization Status Messaging (SSM) reference switching
- Forced reference switching

Constantly checks itself for:

- Hardware faults
- Changes to operating conditions such as qualification or disqualification of signals, card removal, input being tracked

Reports status:

- Local or remote control software retrieves system events from the SSU describing operating changes or problems
- System events that are stored in one of several log files for later reference to help determine the cause of system problems or unusual behaviors

To learn about the SSU's capabilities

Learn more about the 55400A SSU by turning to the pages listed below:

- For some initial information about the SSU, read “*SSU Questions and Answers*” starting on page A2-7.

Input Signal Monitoring and Qualification

- An overview of the input qualification process and the monitoring of non-reference signals on page A2-16.

Performance Measurements

- Learn how to use the performance measurements starting on page A2-20.

Input Reference Selection

- Learn how to have the SSU select a qualified reference using non-SSM modes on page A2-33.
- SSM mode description starts on page A2-37.

SSU Questions and Answers

A synchronization system provides precise timing signals and network management capabilities to keep your telecommunications network synchronized and controlled. The heart of this system is the 55400A SSU.

This section helps you learn about how the 55400A works by answering several basic questions. It starts with the input signals and continues through the initial start-up process of the SSU.

WHERE CAN THE INPUT SIGNALS COME FROM?

The input signals can originate from cesium standards, such as the 5071A Primary Frequency Standard, a GPS reference source, such as the 55300A, non-traffic E1 signals, or live E1 traffic signals.

Table A2-2. Types of Input Signals

Acceptable Input References	Input Signal Type	Number of Inputs	Comments
5 MHz or 10 MHz	Sine Wave or Square Wave	1	
2048 kbps	Framed 2048 kbps HDB3	Up to 8 for kbps or kHz	4 inputs are standard, 8 inputs with Option 001 ITH cards
2048 kHz	2048 kHz per ITU-T G.703, Table 10	Up to 8 for kbps or kHz	4 inputs are standard, 8 inputs with Option 001 ITH cards

TIP One approach when setting up a synchronization network for SDH and other modern network technologies is to use GPS receivers at all the key network nodes and at outlying areas where timing transport is a problem. Where GPS is deployed, use it as the primary source of timing and use a cesium-traceable signal as a secondary source at that node. The advantages of using GPS in this manner include no requirement for traceability, an elimination of jitter and wander problems due to timing transport, pointer movements do not accumulate, and timing loops are easily avoided.

WHY IS IT A GOOD IDEA TO SET THE CARD SWITCHES AT THE INITIAL INSTALLATION?

The parameters for the card provisioning will be set using the switches on each card. This is very important when the system is initially installed. Although software configuration of some parameters can override the physical switch setting, it is recommended that at initial installation the switches be used to configure the cards. This step will help prevent problems from occurring when a module must be replaced in the future. The configuration settings for the card switches are covered in Section D of this manual. When the switch settings are determined, it is a good idea to keep a list of them for reference.

Setting the switches for card provisioning is very important, especially for the ITH card. This card will store these switch settings in non-volatile memory, if the installation procedure is followed. The settings enable the inputs and indicate to the card the type of input signals it should expect so the card can monitor the signals for correct formatting. Other switches configure the card for the type of local oscillator it contains. These switches are set at the factory and should not need to be changed, but the list of oscillator configurations is included in case someone inadvertently changes these switches. (See chapter D1, “Configure ITH Clock Cards.”) Normally, it is the stored values that are written to another ITH card that is installed in the system at some later time. It is a good practice to keep the switch settings and stored memory values the same initially.

WHICH ARE THE FIRST CARDS INSTALLED?

The ITH cards are the first cards to be inserted into the subrack at power-up. The location of the ITH cards is marked on the subrack. The actual procedures in chapter C2, “Install the 55400A SSU,” must be followed during installation. The procedures include the details of why it is important to install the ITH cards one at a time. These cards must complete their warm-up process before they will accept any commands via the communication ports.

While the ITH cards are warming up is usually a good time to connect the input signals. This way the ITH cards can begin the process of qualifying the input signals for use as system references. There is an explanation later in this chapter about exactly how an input signal is qualified and selected.

WHAT FOLLOWS THE ITH CARDS?

After the two ITH cards have been installed and the input signals have been connected, the output cards are next. The simpler switch choices here deal mostly with whether the cards are intended to be used with, or without, a standby card. Although some output cards, such as the traffic re-sync card or the 1, 5, or 10 MHz card, will require their own switch selections.

**HOW DO I
COMMUNICATE
WITH THE SSU?**

Following the installation of the output cards, the last card to be installed is the one that is the pipeline for communicating information and alarms between the SSU and the outside world. That world can be a technician observing the front panel alarm LEDs or operators monitoring the condition of the SSU with a computer at the local port, or some distant computer on a LAN connection. (The ability to control the SSU with a computer is described more fully in the next chapter.) This communication card can be one of several types depending on the way the system is intended to be used:

- Information Management Card—this card supports serial communication through a local or remote port.
- Network Information Management Card—local communication is supported along with a TCP/IP, X.25, or TP4 network interface depending on the option of the card.

**HOW IS AN INPUT
SIGNAL QUALIFIED
FOR USE?**

After the ITH cards exit the warm-up mode they will begin checking the input signals and deciding if they are suitable for use as a reference. Once an input signal is qualified and becomes active, the SSU will track this input, and the output signals will be ready for use.

As part of the process for determining if a signal is suitable for use as reference, the ITH card is checking for certain conditions on the input signal, making performance measurements, such as TDEV and MRTIE, and recording events as specified by the alarm and event settings to advise of current system status. The default settings for notification of alarms and events can be modified as explained later in this chapter.

**WHAT HAPPENS
AFTER
QUALIFICATION?**

How is a particular input selected as a system reference? It depends. At initial installation, the default selection mode is Automatic. This mode selects from the qualified input signals based on the number of the input port to which the signal is connected. The lower the number of the port, the higher the signal moves in the queue for selection. So the PRC (Input 0) has the highest preference for being selected as the reference in the Automatic synchronization mode. The assigning of different values to the inputs can modify this default order of 0 to 9. This modification is described later in this chapter.

WHAT ARE OTHER SYNC MODES FOR SELECTING THE REFERENCE SIGNAL?

Other sync modes are available besides Automatic. The Forced mode allows a particular input signal to be selected as the reference, as long as it has been qualified. This mode is very restrictive because if that signal should become disqualified, the system will go into holdover even though other input signals are qualified and available. A less limiting mode is called Manual. Manual mode lets any qualified input be selected for use. Whenever that signal should become disqualified, the system reverts to Automatic mode, so the unit does not enter holdover mode as long as there is another qualified input signal available.

A selection priority can be assigned directly with the PC software or using the TL1 keyword, PRIORITY. This allows you to assign a selection sequence based on your preference and knowledge of the input signal quality. In addition, the Automatic mode can take a revertive or non-revertive behavior. Revertive means that the qualified input signal with the highest priority will always be chosen to be the active input. For example, if the active reference has a priority level of 2 and another input with a better priority (0 or 1) becomes qualified, the SSU will make that input the active reference.

Non-revertive means that even though an input signal with a higher priority than the current active reference becomes qualified, no switch will be made to that input until the current reference becomes disqualified.

DOES THE SSU SUPPORT SSM?

Yes. SSM is a reference selection mode that supports enhanced system management and maintenance for the SONET format. This mode uses the Synchronization Status Messages that are carried in the overhead byte of STM-n input signals to indicate the quality level of the sources to which the sync signals are traceable, or the acceptability of them for use as references. The SSM concept applies primarily to SDH networks. A network element that is configured to read the messages will be able to extract that information and use it to avoid timing loops while at the same time allowing the network element to reconfigure to use the most suitable reference source from the available reference inputs.

The use of SSM is another tool for network management that requires the close study by a network planner to ensure that the synchronization system operates efficiently in periods of stress when a network reconfiguration is necessary.

**WHAT CAN CAUSE
A REFERENCE
SIGNAL TO
BECOME
DISQUALIFIED?**

Any of the following events may cause a signal to become disqualified:

- The input signal does not satisfy the signal conditions set for the type of signal expected.

For example, the input signal is configured for an E1 signal (2048 kbps), but a 2048 kHz signal is connected to the input. (See “Input Signal Qualification” in this chapter)

- A performance measurement on the input signal crosses a threshold setting.

For example, if the TDEV threshold was set to 28 ns for an integration time of 1 second and the actual TDEV measurement was 29 ns, the input signal would be disqualified. (See “Qualification: Performance Measurements” in this chapter)

- There is an input signal instability that lasts for longer than specified.

For example, a 2-second time period can be set as a Discontinuity Time. Instabilities that last for longer than 2 seconds will cause the input signal to be disqualified. (See “Input Signal Qualification” in this chapter)

- The pull-in range is exceeded.

For example, if the pull-in range value for an ITH card is 4600 ppb (4.6 ppm), this is the extent that the incoming signal can vary from the frequency of the local oscillator. Any deviation over this limit will disqualify the signal. (See “Input Signal Qualification” in this chapter)

- If using SSM mode, the SSM quality level of an input signal has dropped below the acceptable level.

For example, because of changes in the source responsible for one of the input signals, the SSM value has changed to “Do not use for synchronization.” (See “Input Signal Selection” in this chapter)

**HOW DOES THE
SSU KEEP YOU
ADVISED OF ITS
OPERATING
CONDITION?**

The SSU has an extensive reporting capability using its event and alarm system. The alarm level of operating events can be defined and whether or not the event should be saved in a log file for future reference. Automatic messages will be sent to the communication ports for display by local or remote management software whenever operating events occur.

**CAN I USE SPARE
INPUT CHANNELS
TO MONITOR
OTHER SIGNALS?**

Yes. This is a valuable feature if you want to monitor 2048 kbps/kHz signals in the office other than those being used as system references. The signal can be monitored and tested just as a signal being qualified for use, but as long as the input channel is not enabled, the signal will not be considered for use as a reference source. An input channel can be enabled or disabled with a switch setting on the ITH cards, a TL1 command, or with the SSU application software. The standard ITH cards support the use of four inputs while Option 001 to the ITH cards increases the number of 2048 kbps/kHz inputs to eight.

If no information is being received from the input of interest, it could mean that the MONITOR keyword is disabled. This keyword was added because previously there was no way to suppress events related to input ports that were not being used. Nuisance alarms would still be generated when a disabled input port had no signal connected.

To use the SSU to monitor an input signal that is not being used as a system reference, set ENABLE for the input you want to monitor to "N," set MONITOR to "Y," and connect the signal.

Example:

```
ED-SYNC : : ITH-3 : SC1 : : : ENABLE=N, MONITOR=Y ;
```

This example configures the SSU to suppress events related to input channel 3.

**WHAT IS
HOLDOVER?**

An ITH card goes into holdover mode whenever all inputs are disqualified, provided that an input has been tracked for at least ten minutes. If not enough tracking data exists, the card goes into freerun. During holdover, the oscillator on the ITH card becomes the system reference. The collected tracking data helps steer the oscillator, helping correct for such effects as temperature drift.

**WHAT IS
FREERUN?**

If the ITH card determines that there are no qualified inputs, and not enough tracking data exists to support holdover mode, the ITH card goes into freerun mode. At this point, the system reference is the ITH card oscillator operating without the benefit of any steering data.

SSU System Block Diagram

The 55400A system distributes precise timing synchronization signals for 2048 kbps or 2048 kHz rate networks. The system uses a fully-redundant architecture. The recommended configuration provides redundant signal monitoring and qualification of input signals, and protected outputs. It is composed of one, or more, subracks with modular circuit boards (cards) installed in the subrack. A block diagram is shown in Figure A2-1. The system tracks up to nine incoming reference signals from higher or equal levels of the of the network, selects an input signal based on criteria programmed by the system administrator, then filters and distributes precise timing signals to the node's equipment.

Notice in the block diagram how the system architecture uses a duplication of signal processing. Independent evaluations of input signal quality along with a comparing of results between the ITH cards are constantly taking place. The input references are separately evaluated by the two ITH cards, and then one will compare its results with the other. Alarms can be raised when there is disagreement on the results. In addition, reference signal paths through the system are duplicated to eliminate failures that could result from any single card failing.

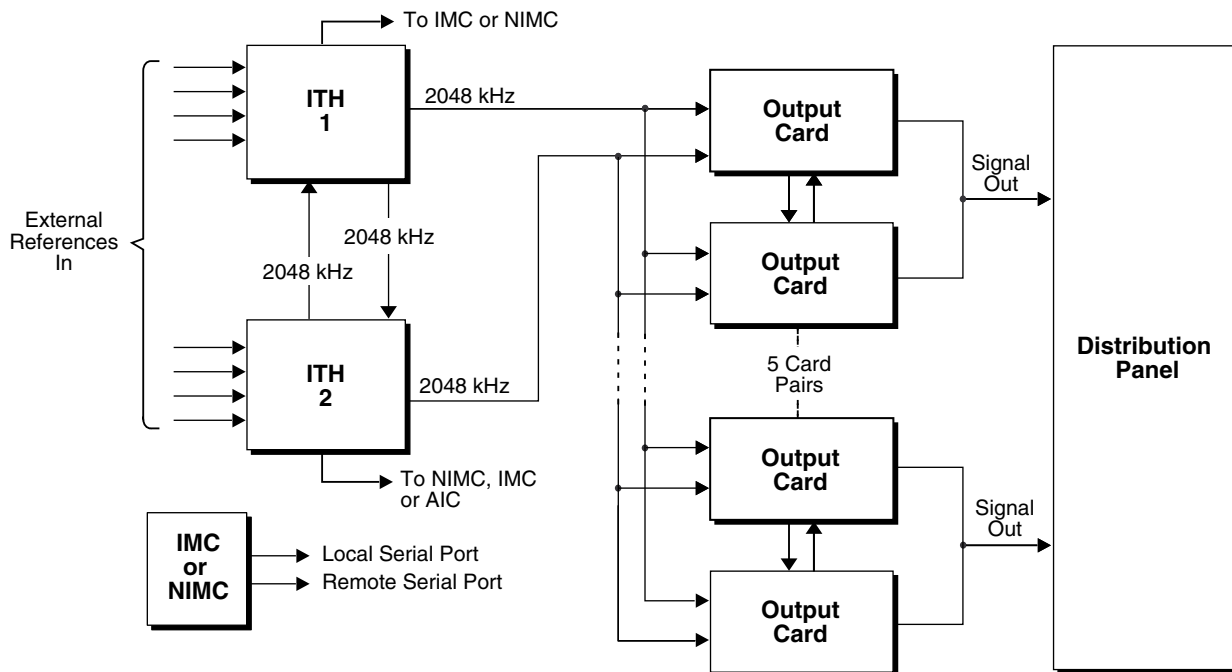


Figure A2-1. 55400A SSU—System Block Diagram

The block diagram shows the recommended configuration including two ITH cards and protected pairs of output cards. A single subrack can support up to 80 outputs. The 55400A system can be expanded to provide as many as 400 protected outputs with the addition of up to four expansion subracks.

Power and Grounding

System Power

Redundant –48 Vdc office battery inputs power the 55400A system. Both inputs are bussed to each card in the subrack. Each output card has a fuse and contains its own dc-to-dc converter.

System Grounding

Common ground on the subrack is the battery return for each –48 Vdc supply. The frame ground, or chassis ground, must be separate from common ground.

Input Signals

The 55400A provides up to ten input connections for the following signals:

- 1—Primary Reference Clock (PRC). Accepts a 5 or 10 MHz signal from a cesium clock or a GPS receiver.
- 1—PRC status signal. This is a signal that changes state to indicate if the PRC has a problem. The SSU can use this signal to disqualify the PRC.
- Up to 8—2048 kbps or 2048 kHz signals. (Requires Option 001 ITH cards. 4 input signals are supported with the standard ITH cards.)

Clocks

The 55400A offers local oscillators of differing stability levels. It is this clock that will determine the stability of the output signals during periods of holdover. The system only enters holdover mode should all the input references fail. The oscillators are part of the ITH cards. The oscillator types are described in chapter A3, “System Specifications.” It is usually recommended that each system contain two ITH cards to provide redundancy.

Each ITH card receives the input reference signals, determines their quality for use by the system, and selects the most appropriate input signal to use as the active reference. In normal operation, the on-card oscillator will “track” the active input signal, and the ITH card will produce a precise frequency for the output cards based on the

reference. If that reference is disqualified, the ITH card will select a remaining qualified input signal as the reference until that signal is disqualified or the system is forced to use another input signal. In the event that all input references fail, the ITH card goes into holdover mode using its own oscillator as the system reference.

Output Signals

The 55400A can hold up to ten output cards. When configured in the recommended 1:1 protected output mode, the cards work in pairs. Each pair of output cards provides up to 16 outputs for network elements. The output card types are described in chapter A3, "System Specifications."

Alarms/Information Management

The 55400A has three ways to communicate its system status and alarms to the external environment:

- Status and alarm LEDs on the plug-in cards.
- Alarm signal relays accessible through the Alarm port connector.
- Computer connection for much more extensive and detailed information.

The computer connection to the SSU can be through the local port, the remote port using a modem, or through a LAN connection. The SSU supports the TL1 command interface, but the 55450A interface application hides the complexity of TL1 and lets you configure, monitor, and troubleshoot the SSU through a Windows-based, mouse-driven PC application.

Alarms are monitored from every card in the subrack. Upon the occurrence of any alarms, a determination is made whether any combination of alarms is a critical, major, or minor alarm state and then the corresponding alarm relays and LEDs are activated. The system alarms are displayed on the Alarms/Information Management cards. This alarm-only card can display status and alarm conditions with LEDs. It does not support any computer communication capabilities. The information management cards will display status and alarms and also provide computer communication. The alarm/information management card types are described in chapter A3, "System Specifications."

Input Signal Qualification

All input signals must be qualified before they will be considered for use as an active reference. Each of the signals at the input channels is subjected to numerous evaluations. The evaluations involve checking for certain signal conditions or errors, and making performance measurements of signal quality.

The Input Track/Hold cards are central to this process. Typically there is an active and standby ITH card. Each independently evaluates, qualifies, and monitors all input signals. The results of detected signal conditions and performance measurements are compared. Any disagreements will be reported.

Input Qualification Process

The input qualification diagram in Figure A2-2 shows the path an input signal follows to qualification.

Diagram Blocks

Each of the blocks in the qualification diagram is described here.

Amplitude check

The amplitude level of the input signal is checked. The level must be above the sensitivity threshold of the input circuitry for the qualification process to begin. If the level ever falls below the threshold of the input circuitry, the signal will be disqualified.

Measurements

Performance measurements evaluating signal quality can be part of the qualification process. These measurements include TDEV, MRTIE, LMRTIE, FFOFF, and SPREAD. (Each of these measurements is explained later in this chapter.) Thresholds for these measurements need to be set before they can be used to qualify input signals.

In addition, measurements are assumed to be good until measurement results determine otherwise. If you wish to wait until measurement results complete before qualification of the signal can take place, use the TL1 keyword MEASDLY. Refer to the *55400A TL1 Programming Reference Manual* for more information.

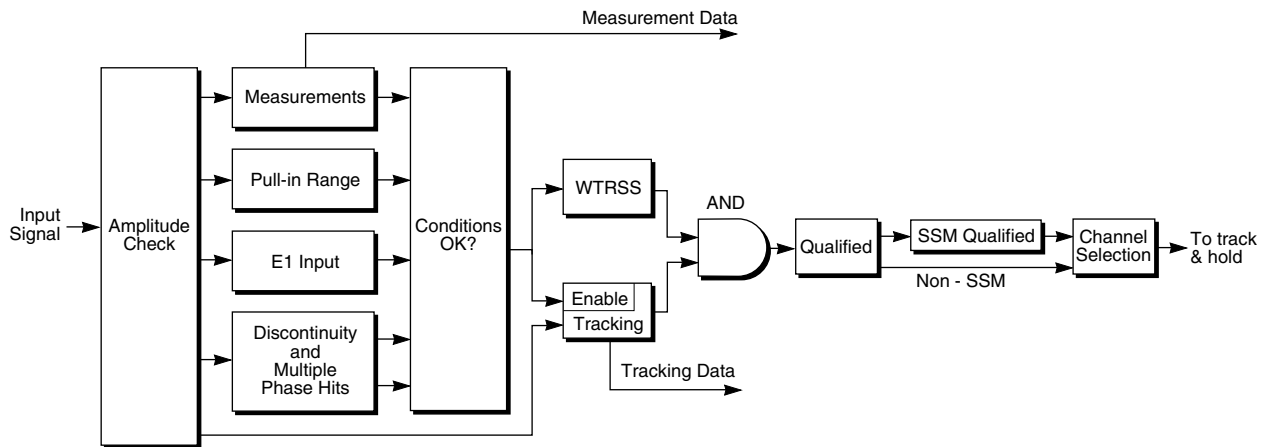


Figure A2-2. Input Qualification Block Diagram

Pull-in range

Normally there should be very little absolute frequency difference between the input signal and the local oscillator on the ITH card. The default value for the pull-in range of an ITH card with quartz oscillator is 4.6 ppm. In this case, as long as the measured frequency difference between an input signal and the quartz local oscillator is less than 4.6 ppm, the qualification process for the input signal continues.

The default value can be changed using a TL1 command (PIRANGE) or the local craft terminal software. The measurement time for pull-in range depends on the tracking mode of the local oscillator. The local oscillator can be in one of three tracking modes depending on how long it has been operating:

- First 20 minutes—Track 1
- Next 8 hours—Track 2
- After 8 hours—Track 3

The pull-in range continuously compares the absolute frequency of the input signal to the local oscillator for:

- 3 sec. in Track 1
- 48 sec. in Track 2
- 192 sec. in Track 3

If the frequency difference of a qualified input signal ever exceeds the pull-in range value, the input signal is disqualified.

E1 input checks

E1 input signals are checked for the following formatting:

- **CRC-4**—Enabled using a TL1 command or a switch on the ITH card. The qualification process continues if there are no CRC-4 errors. If CRC-4 errors ever occur, the input signal will be disqualified.
- **CAS/CCS**—Enabled using a TL1 command or a switch on the ITH card. The selected format must be detected or the signal will not be qualified. If the selected format is not detected on a qualified signal, it will be disqualified.
- **OOF** (out of frame)—There can be no framing errors on the input signal. If a framing problem occurs on a qualified E1 input signal, it will be disqualified.
- **AIS** (alarm indication signal)—No AIS can exist on an E1 signal being qualified. If an alarm indication signal later occurs on a qualified E1 input signal, it will be disqualified.

Discontinuity and multiple phase hits

The qualification process requires that the input signal exhibit a reasonable lack of signal problems, such as discontinuities and phase shifts. The length and frequency of short-term signal interruptions can be used to disqualify an input signal or prevent an input signal from being qualified.

Any LOS (loss of signal) will cause a discontinuity event, as will any excessive phase build-out. For short duration problems, the errors are corrected, and the problem is noted. The duration of what will be acceptable is set with the DSCTIME TL1 keyword. The default setting is two seconds. This means that two consecutive errored seconds is acceptable but if a discontinuity or phase build-out extends to three seconds, the input will be disqualified.

In addition, the frequency of errored seconds is counted and timed. If three separate occurrences of discontinuity or phase build-out of any length take place within the most-recent five-minute time period, the input signal will be disqualified. Only after five minutes following the first of the three corrections will the signal be eligible for re-qualification.

WTRSS and Tracking

When the results of all the above described conditions and measurements are correct, the conditions must remain valid (no errors) for a period of time specified with the wait timer (WTRSS keyword). The default setting for this wait time is 30 seconds, but can be set as high as 1,000 seconds. At the same time, the ITH card begins collecting the tracking data that will allow the ITH card to lock onto the input signal when it becomes the active reference for the SSU. To support signal qualification, 192 seconds of tracking data is required.

Qualification

The input signal is now qualified for use as a reference. Non-SSM signals are sent to the input signal selection process. For an input channel used in the SSM mode, its SSM value must be below the cutoff value, and it cannot be one of the illegal values. (See the SSM description later in this chapter.) Once the list of qualified input channels is known, the channel selection process makes the decision on which input reference to make the active reference and communicates that to the track and hold section of the ITH card.

Using the SSU to Monitor Other Signals

If there are any spare inputs on the 55400A SSU, other office signals can be connected. These would be 2048 kbps or 2048 kHz signals that you might want to monitor but not use as references.

First, it is important that the inputs being used strictly for monitoring purposes are disabled. Otherwise, the SSU might try to use the connected signals as references. At system installation, it is best to use the switches on the ITH cards to disable inputs. These switch settings are read during the installation process as described in chapter C2. Once the SSU is on-line, it is simpler to enable or disable inputs using the local craft terminal software (Go to the Configuration tab>Input) or use the TL1 command ENABLE. An example of how to disable an input and use it to monitor an office signal is shown below.

```
ED-SYNC : ITH-4 : SC1 : : ENABLE=N, MONITOR=Y;
```

This command will disable input channel 4 and set the monitor feature to treat this input as it would any other with the exception that the signal will never be considered for use as a reference.

Qualification: Performance Measurements

In addition to the signal conditions described above, input qualification can also be based upon performance measurement results of signal quality. The measurements are based on phase deviation data that is collected continuously by the SSU and compared to a “reference clock.” In this case, the reference clock is the output from the Input Track/Hold card that has been corrected for the effects of wander on the local oscillator.

The performance measurements are:

- Time Deviation (TDEV)—expressed in units of ns
- Maximum Relative Time Interval Error (MRTIE)—ns
- Latest Maximum Relative Time Interval Error (LMRTIE)—ns
- Fractional Frequency Offset (FFOFF)—ppm
- Frequency Differences (SPREAD)—ppm

Each of these measurements can be configured with a threshold value. The 55400A can use the measurement results as one of the conditions for qualifying or disqualifying an input signal. An event can be set to occur whenever the specified threshold is crossed, going in either direction.

NOTE

For new installations, an ITH card should be allowed to track a good-quality input for at least ten minutes before configuring it to use measurements to qualify inputs. This will ensure that holdover mode is available if all inputs are disqualified. However, it is preferable to wait 24 hours before configuring the measurement criteria to qualify inputs, so that all performance measurements are available.

By default, all performance measurement thresholds are set to zero at the factory. This means that if the qualification criteria for an input is enabled (CRI=Y) before setting thresholds, that input will immediately be disqualified. Do not enable the “CRI” property until after setting thresholds.

By configuring these measurements with different observation times, it is possible to create a mask with thresholds that when crossed will cause an input signal to be disqualified for use as a reference. The PC software and OSMF applications can display graphs of the measurement data, while TL1 commands can be used to retrieve individual data values.

TDEV

TDEV is a statistical measure used to characterize the underlying noise in a timing signal. It is essentially a modified form of the standard deviation of the time interval error expressed in time units over various averaging times. TDEV describes the deviation of the incoming signal from a “perfect” signal. This perfect signal is derived from the output of the Input Track/Hold card and has been corrected for the effects of wander on the local oscillator.

HOW CALCULATED TDEV values are computed based on 98 average phase deviation values separated by τ (tau), the averaging time. So measurement time is the averaging time multiplied by 98. For example, a 16-second TDEV measurement is based on 1,568 seconds of phase measurements. Similar to MRTIE, overlapping data enables TDEV values to be available for interrogation at a higher rate than would be possible with measurement that did not overlap.

EXAMPLE This is an example of TDEV data retrieved using the TL1 command RTRV-PM-TSG. It describes the results computed by the ITH1 card on the signal at input 4:

TL1 Command

```
RTRV-PM-TSG::ITH-4:SC1::TDEV;
```

Data retrieved

```
"ITH1-4:TDEV-1S,25.000000,COMPL"  
"ITH1-4:TDEV-4S,25.000000,COMPL"  
"ITH1-4:TDEV-16S,25.000000,COMPL"  
"ITH1-4:TDEV-64S,25.000000,COMPL"  
"ITH1-4:TDEV-256S,NA,NA"  
"ITH1-4:TDEV-1024S,NA,NA"
```

This example shows the TDEV values that have been calculated for averaging times of 1, 4, 16, and 64 seconds. The values for 256 and 1024 seconds are not yet available. **The measurement unit is nanoseconds.**

Table A2-3. TDEV Measurement Parameters

Measurement Tau (Tau = averaging time)	First Data Available After	Updated Every	Includes Data From Last
TDEV-1S (1 second)	98 s	96 s	98 s
TDEV-4S (4 seconds)	392 s	192 s	392 s
TDEV-16S (16 seconds)	1568 s	384 s	1568 s
TDEV-64S (64 seconds)	6272 s	768 s	6272 s
TDEV-256S (256 seconds)	25088 s	1536 s	25088 s
TDEV-1024S (1024 seconds)	100352 s	3072 s	100352 s

MRTIE

MRTIE is a measure of the maximum time interval error (peak-to-peak) over an observation time. MRTIE captures this maximum phase variation of the input signal. The incoming signals are measured with reference to the ideal output of the Input Track/Hold card. The local oscillator has been subjected to a wander-correction algorithm.

Retrieval of results for a particular observation time returns the worst-case result recorded over the last 24 hours, if available. MRTIE values from 1 second to 24 hour observation times are available every 15 minutes.

NOTE

To be able to properly configure the MRTIE measurement, it is important to understand that MRTIE results are affected by a frequency offset of the input reference.

For example, if a reference switch occurs that results in the SSU tracking a signal with frequency offset from normal, over time this offset frequency becomes the reference for measurements on all input channels. Since MRTIE is sensitive to any frequency offset, you should consider setting the MRTIE mask on all channels based on the lowest-quality input signal enabled. Generally, this limit might be suggested by ETSI prETS 300 462-3.

HOW CALCULATED MRTIE is measured by stepping a window the size of the observation time through a block of data. The block size is 24 hours (or less if 24 hours of data are not yet available). For an observation time of 1 second, the step size is 1 second. The results are updated every 15 minutes. For example, the MRTIE value reported for MRTIE-1H would be the worst-case maximum time interval error recorded over the last 24 hours, assuming that data have been collected for at least 24 hours. If you wanted to then see the MRTIE for the most recent 1 hour, you would retrieve the LMRTIE-1H value.

This is an example of MRTIE data retrieved using the TL1 command RTRV-PM-TSG. It describes the results computed by the ITH1 card on the signal at input 1:

TL1 Command

```
RTRV-PM-TSG::ITH-1:SC1::MRTIE;
```

Data retrieved

```
"ITH1-1:MRTIE-1S,400.000000,COMPL,, ,75-MIN"
"ITH1-1:MRTIE-15M,1500.000000,COMPL,, ,75-MIN"
"ITH1-1:MRTIE-30M,1500.000000,COMPL,, ,75-MIN"
"ITH1-1:MRTIE-1H,1700.000000,COMPL,, ,75-MIN"
"ITH1-1:MRTIE-2H,NA,NA,, ,75-MIN"
"ITH1-1:MRTIE-8H,NA,NA,, ,75-MIN"
"ITH1-1:MRTIE-24H,NA,NA,, ,75-MIN"
```

This data show the MRTIE values that have been collected over the past 75 minutes. Values have been calculated for observation times of 1 second, 15 and 30 minutes, and 1 hour. Results for the other times are not yet available. The total measurement time is indicated only for MRTIE measurements, and it will continue to increase in 15-minute increments for 24 hours. Once the measurement time reaches 24 hours, data older than 24 hours will be discarded as new data are collected.

The measurement unit is nanoseconds.

Table A2-4. MRTIE Measurement Parameters

Measurement Time (Time = observation time)	First Data Available After	Updated Every	Includes Data From Last
MRTIE-1S (1 second)	1 s	15 min.	24 hours*
MRTIE-1M (1 minute)	1 min.	15 min.	24 hours*
MRTIE-15M (15 minutes)	15 min.	15 min.	24 hours*
MRTIE-30M (30 minutes)	30 min.	15 min.	24 hours*
MRTIE-1H (1 hour)	1 hour	15 min.	24 hours*
MRTIE-2H (2 hours)	2 hours	15 min.	24 hours*
MRTIE-8H (8 hours)	8 hours	15 min.	24 hours*
MRTIE-24H (24 hours)	24 hours	15 min.	24 hours*

* if available

LMRTIE

LMRTIE is similar to MRTIE, but only the most recently acquired data over the observation time is retrieved. So where MRTIE can show the worst-case condition that has occurred over the last 24 hours, LMRTIE can help reveal if a problem still exists. Use LMRTIE to study the most recent behavior of an input signal. For transient error detection, the 1-second LMRTIE value is useful. **The measurement unit is nanoseconds.**

NOTE

To be able to properly configure the LMRTIE measurement, it is important to understand that LMRTIE results are affected by a frequency offset of the input reference.

For example, if a reference switch occurs that results in the SSU tracking a signal with frequency offset from normal, over time this offset frequency becomes the reference for measurements on all input channels. Since LMRTIE is sensitive to any frequency offset, you should consider setting the LMRTIE mask on all channels based on the lowest-quality input signal enabled. Generally, this limit might be suggested by ETSI prETS 300 462-3.

Table A2-5. LMRTIE Measurement Parameters

Measurement Time (Time = observation time)	First Data Available After	Updated Every	Includes Data From Last
LMRTIE-1S (1 second)	1 s	1 s	1 s
LMRTIE-1M (1 minute)	1 min.	15 min.	1 min.
LMRTIE-15M (15 minutes)	15 min.	15 min.	15 min.
LMRTIE-30M (30 minutes)	30 min.	15 min.	30 min.
LMRTIE-1H (1 hour)	1 hour	15 min.	1 hour
LMRTIE-2H (2 hours)	2 hours	15 min.	2 hours
LMRTIE-8H (8 hours)	8 hours	15 min.	8 hours
LMRTIE-24H (24 hours)	24 hours	15 min.	24 hours

FFOFF

FFOFF measures the fractional frequency offset between an input signal and the Input Track/Hold card output. As a result, the frequency of the active reference will always measure the same as the ITH output because the ITH card is tracking that input. For this reason, the FFOFF results should generally not be used as a qualification criteria for the inputs. Instead use FFOFF to monitor the frequency behavior of all the input signals. It will show the variation on any of the input signals, except for the active reference. **The measurement unit is parts per million.**

NOTE

Do not use this measurement to disqualify an input. Setting the CRI parameter = N for FFOFF will exclude the FFOFF results from consideration to qualify/disqualify and input signal. (See “How performance properties are set” in this chapter.)

Table A2-6. FFOFF Measurement Parameters

Measurement Tau (Time = averaging time)	First Data Available After	Updated Every	Includes Data From Last
FFOFF-3S (3 seconds)	3 s	1 s	3 s
FFOFF-12S (12 seconds)	12 s	4 s	12 s
FFOFF-48S (48 seconds)	48 s	16 s	48 s
FFOFF-192S (192 seconds)	192 s	64 s	192 s
FFOFF-768S (768 seconds)	768 s	256 s	768 s
FFOFF-3072S (3072 seconds)	3072 s	1024 s	3072 s

SPREAD

SPREAD is a measure of the difference between the maximum and minimum FFOFF measurement results on the input signals. All inputs are included in this measurement unless some channels have been specifically excluded. If a FFOFF measurement is not available on a channel (for example, no input signal is connected), then that channel is automatically excluded until an FFOFF measurement is available. This measurement is useful for determining if the input signals are diverging in frequency. **The measurement unit is parts per million.**

NOTE

SPREAD cannot be used as a criterion for qualifying an input channel. For performance monitoring, it is recommended to initially use SPREAD instead of FFOFF, as SPREAD gives a view of relative performance across all channels. If it is observed that the SPREAD results are too large, then the FFOFF values for individual inputs may be useful in diagnosing the problem.

Table A2-7. SPREAD Measurement Parameters

Measurement Tau (Time = averaging time)	First Data Available After	Updated Every	Includes Data From Last
SPRD-3S (3 seconds)	(1)	(1)	(1)
SPRD-12S (12 seconds)	(1)	(1)	(1)
SPRD-48S (48 seconds)	(1)	(1)	(1)
SPRD-192S (192 seconds)	(1)	(1)	(1)
SPRD-768S (768 seconds)	(2)	(2)	(2)
SPRD-3072S (3072 seconds)	(2)	(2)	(2)

(1) Because SPREAD depends on FFOFF measurements from multiple channels and these FFOFF values may be updated at different times, SPREAD measurements are not updated as regularly as the other measurements. For averaging times of 3, 12, 48, and 192 seconds, SPREAD will be updated about once per minute.

(2) For longer averaging times, SPREAD will be updated when new FFOFF values become available, provided at least one minute has elapsed since the last update (in some cases the updates may occur more often).

Suggestions on Setting Performance Thresholds

It is possible to use thresholds for the performance measurements as a means of qualifying signals or just use the measurements to monitor performance for historical purposes. It is very important to carefully choose appropriate threshold limits if you are going to have the results impact whether inputs are qualified for use. A system administrator can help determine the settings.

Telecom standards ETSI prETS 300 462-3 and 462-4 describe the jitter and wander performance requirements for synchronization networks compatible with digital networks. These documents can contribute to helping you set qualification limits that make sense for your situation. One suggestion is to determine an appropriate mask curve for a measurement and then set the limit to some percentage of the maximum allowable value. In order to avoid unintended disqualification of input signals, ensure that any limits set are suitable to your network environment.

It is a good idea to only monitor the performance measurement results at first by keeping the CRI property set to “No.” This way you can set a baseline for the measurement results. Use this data along with recommendations from telecom standards and the system administrator to arrive at appropriate threshold values.

Measurement considerations

For measurements such as Fractional Frequency Offset, MRTIE/LMRTIE, and TDEV, a reference source must be used. Since the SSU is a slave clock, there is no internal perfect reference available. So the reference used by the SSU is the tracked input reference after it has been filtered for jitter and wander deviations. It is the best available reference as it has the long-term stability of the input reference and the good short-term stability of the LO.

An understanding of the measurement technique is useful in determining the desired configuration of the SSU. For example, if a very stable and accurate PRC provides the tracked signal under normal conditions, it is still important to consider the situation if this signal becomes unavailable. If a reference switch occurs and the SSU switches to a secondary reference that has the same nominal frequency as the primary reference (traceable to Stratum-1), the measurements made remain accurate even though they are made with another reference.

The SSU internally tracks all of the input signals and stores this data so it is ready to operate properly after a switch to any of the input signals.

Concern about drift on the input reference

Because the performance measurements rely on the integrity of the tracked input signal, a degrading of this signal's frequency stability can affect the measurement results.

If a reference switch occurs resulting in the tracking of a signal with frequency offset from nominal, over time this offset frequency will become the reference for measurements on all channels. Thus, the offset will be reflected in all measurements that are affected by frequency offset.

Measurements affected by frequency offset

TDEV measurements are not affected by a fixed frequency offset. However, slow frequency drift of the tracked signal can affect TDEV, especially at the longer averaging times. The low-pass filtering of the reference signal, and the short-term stability characteristics of the LO, result in immunity of the shorter averaging-time TDEV measurements to a slow frequency drift of the reference. Therefore, TDEV may still be used to disqualify the input signal in the presence of drift.

MRTIE and LMRTIE are directly affected by frequency offset, and the SSU is not able to determine if the measured signal or the tracked signal (used as the reference) is the source of the offset. For this reason, you should consider setting MRTIE (or LMRTIE) masks on all channels based on the worst channel enabled. This would generally be suggested by ETSI prETS 300 462-3.

How to determine if references are drifting?

QUESTION If certain measurements results can be misleading when references drift from the nominal frequency, is there a way to detect this drift before it becomes a problem?

ANSWER To help detect that an input signal is slowly drifting away from its nominal frequency (and before it reaches its pull-in limit) use the Spread and Fractional Frequency Offset (FFOFF) measurements.

Spread is the frequency difference between the highest and lowest frequency signals provided to the SSU and is independent of the LO and which signal is being tracked. By default, all inputs are included in this measurement although you can selectively exclude inputs if desired. If any input begins to drift away from nominal, this will increase the spread value, which can trigger an alarm. Then, examination of the individual signals using the Fractional Frequency

Offset results will show the frequency deviation of each input from the reference (derived from the tracked input). Knowledge of the network architecture is important to be able to determine input, or inputs, causing the problem.

How to use Spread and FFOFF

Although it is possible to disqualify an input based on its Fractional Frequency Offset, this is not recommended. FFOFF provides useful information, but needs to be considered in combination with knowledge of the synchronization network architecture. It is possible (but probably not desirable) that several inputs to an SSU may be driven, via different paths, from a single upstream source. Failure of that source could cause all of these inputs to drift simultaneously. If majority logic is used to determine the “failed” signal, then these might erroneously be judged “good” while a single good signal might be disqualified. For this reason, the 55400A can report Spread to alert you of a developing problem and provide measurements of Fractional Frequency Offset to help you determine by how much each input signal varies in fractional frequency from the input currently being tracked. Knowledge of the network organization is required to interpret these measurement results before corrective action can be taken.

There is another danger in using FFOFF to automatically disqualify a signal. As noted above, FFOFF shows the frequency deviation of an input from a reference which is based on the tracked signal. If the tracked signal has an offset from nominal, this will show up as a frequency offset on other signals that may in fact have less offset from the nominal frequency.

Performance measurement properties

By default the SSU assumes all input signals are good until measurements can prove otherwise. There is a way to prevent an input signal from being qualified until measurements have proven that an input signal is suitable for use. A keyword provides a way to introduce a time delay that must elapse before a signal can be judged qualified. The length of the delay can be set such that the performance measurements of interest will have time to complete before the time delay expires. The TL1 keyword is *MEASDLY*.

Performance measurements have the following properties:

- THR-n—threshold value.
- CRI-y/n—use/don’t use in the input qualification criterion.
- RPT-y/n—generate/don’t generate an event when a threshold is crossed in either direction.

- PM-y/n—do/don't automatically display each new measurement as it occurs. Must also use AUTOPM keyword. AUTOPM enables/disables all uploads from a particular channel while the PM property lets you specify the measurement results desired for each channel.
- GOOD-n—can be used to specify the number of consecutive good measurements that must occur following a bad measurement in order for an input signal to be qualified.

By default, the properties for all measurements are set to the following values:

- THR-0
- CRI-N
- RPT-N
- PM-N
- GOOD-1

Set the threshold value for TDEV, MRTIE, and LMRTIE in terms of nanoseconds (ns). The FFOFF and SPRD measurements are expressed in terms of parts per million (ppm).

Configuring performance measurements

Performance measurements are configured most easily using the software applications that greatly simplify communication with the 55400A. Of course, this task can also be accomplished with TL1 commands, although this method requires more effort because of the need to learn the command syntax.

Hardware needed

The hardware requirement to support the ability to communicate with the SSU is an IMC or NIMC, a controller connected to the Local or Remote port, or a network connection to the Network Information Management card.

Easier measurement setup using software applications

The easiest way to configure these measurements is by using the PC-based local craft terminal application. You can select whether or not to use the measurement results for qualifying an input, set the threshold value, have the SSU report when a threshold is crossed, and include the results in an automatic message any time new data becomes available.

The performance measurement settings are located under the “Fault Management” tab, and then click on “Threshold.” Here you can configure the measurements as needed. For a description of each of the entry fields, press the “F1” key on your computer keyboard.

Measurement setup using TL1 command syntax

Consult the *55400A TL1 Programming Reference Manual* for information on how to use TL1 commands. The following TL1 commands are used with the performance measurements as specified below:

- ED-SYNC for TDEV, MRTIE, LMRTIE, and FFOFF
- ED-EQPT for SPRD

TL1 command example to set TDEV properties

```
ED-SYNC::ITH-2:SC1:::TDEV-16S=THR-27&CRI-Y&RPT-Y&PM-Y;
```

In this example, a TDEV measurement with an averaging time of 16 seconds and a threshold setting of 27 ns is specified for the input signal at channel 2. The measurement results will be part of the criterion for qualifying the input and an event will be generated whenever the results go above or below the threshold value. The input signal will be disqualified if the results exceed the threshold setting. The measurement result will be displayed when new data are available (updated every 384 seconds) as long as the AUTOPM keyword is set to Yes.

NOTE

It is possible to request uploading of more data than the communications channels can handle. If this occurs, some upload reports may be lost. The problem is more likely to occur if you request automatic uploading of data at 1-second intervals.

To avoid this problem, MRTIE and LMRTIE 1-second measurements can be reported at 15-minute intervals, rather than every second. For these two measurements, enabling automatic reporting on the 15-minute values will cause the 1-second values to also be reported along with the 15-minute values. This occurs even though the 1-second data is not explicitly enabled for automatic reporting. If you explicitly enable reporting of the 1-second data, it will be uploaded every second for LMRTIE measurements. MRTIE measurements are only calculated at 15-minute intervals.

TL1 command example to set delay for qualification

```
ED-SYNC::ITH-2:SC1:::MEASDLY=20;
```

This example assumes that it is desired that 20 minutes be allowed for a performance measurement to complete on Input 2 before the input signal can be judged qualified.

Input Reference Troubleshooting

TIP Once it is determined using SPREAD that a fractional frequency difference exists among the input signals, the system administrator based on a knowledge of the network architecture can use FFOFF to check individual signals and answer questions such as, “Is only one input moving away from the active reference?” This would indicate one problem input. “Are all the inputs moving away from the active reference?” This could indicate that the active reference may be the problem. This is an example of how using SPREAD and FFOFF to provide critical information can help you better understand the performance of your network.

Input Signal Selection

After the input signals have been qualified as ready for use, it is the synchronization mode that determines which of the qualified inputs is selected as the active reference. The synchronization mode can be one of the following:

- Automatic (default mode)
- Manual
- SSM
- Forced

When in the automatic mode, typically the PRC input is selected first, if available, and then when that input should become disqualified, the next signal in the default sequence of inputs 1 to 8 is next chosen. Of course, this description assumes that all inputs are enabled and properly qualified.

NOTE

An Option 001 ITH clock card is required to provide up to eight inputs in addition to the PRC input. A standard ITH card supports the PRC and four inputs.

There are also manual and forced synchronization modes when it is desirable to use a particular input signal. In addition to these three modes of automatic, manual, and forced, there is a fourth mode that makes the choice of input signal based on a synchronization message carried or imposed on the input signal. All of these synchronization modes will be explained in greater detail below.

Table A2-8. Summary of Sync Mode Operation

Synchronization Mode	How initial signal is selected	Action when signal is disqualified	Action when initial signal is qualified again
Automatic	By default, it is the PRC, or another by changing priority value.	Switch to next signal in priority sequence.	If revertive=Y, switch back to initial signal. If revertive=N, stay with current signal until disqualified.
Manual	The input signal is specified.	Changes to automatic mode.	Changes back to manual mode.

Table A2-8. Summary of Sync Mode Operation (continued)

Synchronization Mode	How initial signal is selected	Action when signal is disqualified	Action when initial signal is qualified again
SSM For more on SSM input selection, see “SSM Behaviors” at end of this chapter.	Signal with the highest SSM quality.	Switch to next signal in SSM priority sequence.	If revertive=Y, switch back to initial signal. If revertive=N, stay with current signal until disqualified.
Forced	The input signal is specified.	Goes into holdover.	Changes back to forced mode.

Automatic Synchronization Mode

The synchronization mode determines the reference selection process for the active reference input. If no mode is specified, the automatic mode is used by default.

It is important to understand how preference is assigned to the input references so that a preferred order of use can be imposed, if desired. The numbering of the inputs on the SSU front panel plays a part here. The PRC input is designated “0” and the 2048 kbps/kHz inputs are labeled “1” to “8” on the subrack. By default, the priority selection order is input 0 first, followed by inputs 1, 2, 3, 4, etc.

How to set the synchronization mode:

To set the sync mode, use one of the following methods:

1. **TL1 Command:** Use *SYNCMDE*.
2. **55450A:** Use the local craft terminal software application and click on the Input tab of the Configuration form. The sync mode and desired input channel can be selected on the Input form.
3. **55451A/55452A:** Using the OSMF software application:
 - a. Select the SSU on the map.
 - b. Go to OSMF>Configuration>Modify menu.
 - c. Click on the **ITH Card** button.
 - d. Click on the appropriate **Sync Mode** setting
 - e. Click on the **Apply** button and then the **Close** button.

Changing the Priority Sequence

The priority assigned to each input can be modified. This lets you determine not only the input selected first, but also the order in which the remaining input signals will be selected should they be needed.

Of course, to support communication with the SSU either the IMC (Information Management Card) or NIMC (Network Information Management Card) is required.

How to set the input signal priority:

To revise the priority order, use one of the following methods:

1. **TL1 Keyword:** Use *PRIORITY*.
2. **55450A:** Use the local craft terminal software application and go to the Input tab of the Configuration form. The priority level can be selected for each of the inputs using the pull-down menu.
3. **55451A/55452A:** Using the OSMF software application:
 - a. Select the SSU on the map.
 - b. Go to OSMF>Configuration>Modify menu.
 - c. Click on the **Input Channel** you are configuring.
 - d. Select the **Input Priority** value you are assigning.
 - e. Click on the **Apply** button and then the **Close** button.

NOTE

If the same priority value is assigned to more than one input with all other factors being equal, the input with the lower input channel number will be selected for use first.

An example in Table A2-9 helps demonstrate this concept of selection order where inputs are assigned non-default values and in one case two inputs are assigned the same value.

Table A2-9. Input Selection Example

Input Channel Number	Assigned Priority	Selection Sequence
0 (PRC)	2	second
1	1	first
2	4	fifth
3	3	third
4	3	fourth

Revertive/Non-revertive Input Selection

The input selection for automatic mode can be revertive or non-revertive. Revertive means that the qualified input signal with the highest priority will always be chosen as the active input. For example, if the active reference has a priority level of 2 and another input with a better priority (1) becomes qualified, the SSU will make that new input the active reference.

Non-revertive means that even though an input signal with a higher priority than the current active reference becomes qualified, no switch will be made to that input until the current reference becomes disqualified.

How to set the revertive mode:

The default condition is Revertive=Y. To change the setting, do one of the following:

1. **Switch Setting:** Set the revertive tracking mode switch on the ITH cards. All of the switch settings for the ITH cards are described in chapter D1.
2. **TL1 Keyword:** Use REVERT.
3. **55450A:** Use the local craft terminal software application and go to the Input tab of the Configuration form. The revertive mode can be selected using the check box under Sync Mode.
4. **55451A/55452A:** Using the OSMF software application:
 - a. Select the SSU on the map.
 - b. Go to OSMF>Configuration>Modify menu.
 - c. Click on the **ITH Card** button.
 - d. Click on **Yes for Enable Revertive Mode**.
 - e. Click on the **Apply** button and then the **Close** button.

Manual Synchronization Mode

The manual mode allows the system administrator to select a particular input signal. When the specified input is qualified, it is used as the system reference. If it becomes disqualified, the automatic mode takes over. The manual mode is enabled when the manual input again becomes qualified.

Forced Synchronization Mode

Similar to the Manual mode, a particular input is specified. The difference is that there is no fall back to the Automatic mode when the designated signal is no longer qualified. So the reference is used until it is disqualified. At that point, the system goes into the holdover mode. The system remains in holdover until the specified input signal is again qualified. The Forced mode is generally used for testing purposes only.

Synchronization Status Message Mode (SSM)

In an effort to improve management of SONET/SDH networks, Synchronization Status Messages (SSMs) were designed to support input reference selection in the new, flexible network architectures currently being implemented. The 55400A supports the use of SSMs.

The basic frame structure at 2048 kbps, as defined in ITU-T Recommendation G.704, allocates spare bits in frames not containing an alignment signal to convey synchronization status messages in a synchronization interface. Only E1 framed data signals with CRC-4 have the capability to carry SSM information.

How SSM works

SSMs are embedded in the overhead bytes of a reference signal. A four-bit code identifies the quality of the clock source to which the sync signal is traceable and whether the signal is available for use as a sync source. SSMs can be useful in the avoidance of timing loops in SONET rings, while allowing the network elements to independently reconfigure to the most appropriate synchronization source from the set of available sources. For SSMs to operate successfully, it is important that good judgement be used in the design and provisioning of the telecom network.

There are sixteen bit patterns with values from 0 to 15 to convey signal quality. The ITU-T G.704 uses four states to define synchronization levels and two for comment messages. One comment indicates that the quality of the signal is unknown, and the other that the signal should not be used for synchronization. The remaining ten patterns are reserved for quality levels defined by individual operators.

The 55400A SSU can read the synchronization quality level of an input reference signal that is carrying an SSM. This message can be used by the SSU in an internal algorithm that determines which of the qualified input signals will be selected as the timing reference. In addition, the SSM value of the current reference, or the assigned SSM value of the internal oscillator when in holdover, can be carried on the E1 outputs.

SSMs can communicate the following messages:

- The sync traceability of this signal is unknown.

This message is designed for situations where all equipment may not be SSM-capable. The four bits that denote the unknown traceability are defined as “0000”, or the null set. This way a signal from a NE that is not SSM-capable can be accommodated at a receiving NE which is SSM-capable. The implementation is effective because an unknown sync traceability message indicates that the signal is normally at Stratum 1 traceability. This message is useful where not all of the NEs have been upgraded to SSM

- This signal is traceable to a G.811 clock source.
- This signal is traceable to a G.812 transit node source.
- This signal is traceable to a G.812 local node source.
- This signal is traceable to a synchronous equipment timing source.
- Do not use this signal for synchronization.

SSM Quality Levels:**Table A2-10. Synchronization Status Message (SSM)**

QL	bit pattern	Quality Level Description
0	0000	Quality unknown (existing synchronization network)
1	0001	Reserved
2	0010	Rec. G.811
3	0011	Reserved
4	0100	Rec. G.812 transit (default)
5	0101	Reserved
6	0110	Reserved
7	0111	Reserved
8	1000	Rec. G.812 local
9	1001	Reserved
10	1010	Reserved
11	1011	Synchronous Equipment Timing Source (SETS)
12	1100	Reserved
13	1101	Reserved
14	1110	Reserved
15	1111	Do not use for synchronization

Configuring the SSU for SSM-based Reference Selection

There are a number of settings necessary to properly configure the SSU for SSM operation. This section summarizes those settings, but you should refer to the *55400A TL1 Programming Reference Manual* for a complete description of the keywords and the command syntax. A list of the settings is included here and then each is described in turn below.

Summary of the SSM settings:

- Specify the SA bit on the input or output
- Set a cutoff value
- Set preference between equal SSM inputs
- Assign an SSM value
- Enable reading of SSM
- Retrieve current SSM value for the input channel
- Specify a holdover SSM value
- Set Sync Mode to SSM

Specify the SA bit to use for SSM on an input or output

An SA bit is used for carrying SSM information in the Time Slot 0 (TS0) bits of a non-frame aligned signal (NFAS) frame of an E1 signal. The spare bits are SA4, SA5, SA6, SA7, and SA8. One of these will be designated to carry the SSM information. On an input channel, this keyword specifies the SSM bit to be read on an E1 input signal. When used with an output card module, the bit position where the SSM will be written on an E1 output signal is identified.

TL1 Keyword = SSMBIT

Uses ED-SYNC command for an input port.

Uses ED-EQPT command for an output port.

If using the 55450A local craft terminal software, you can find this feature by following the menu path – Configuration tab>Input>SSM Bit (for E1 inputs), Configuration tab>Output>SSM Bit (for E1 outputs)

Range = SA4, SA5, SA6, SA7, or SA8

Set an SSM cutoff value

This feature specifies the minimum SSM quality level for an input to be considered for use as a reference. The SSM sync mode must be enabled for this cutoff feature to operate.

If the SSM value of the signal is equal to, or greater than, the QCUTOFF value, the channel will be disqualified and the SSM sync selection will be re-evaluated. The SSM value can be the actual value carried on the signal or the value assigned with the QLEVEL keyword (0 is best, 15 is worst). If no other channels meet the SSM requirements, the SSU will go into holdover mode (or the freerun mode if the SSU has not yet collected enough frequency data from an input reference to discipline the local oscillator's frequency behavior when no qualified reference is available).

NOTE

Be aware that changing the sync mode to SSM can cause channels to be disqualified because SSM qualification is one of the input conditions checked during input qualification. This process is restarted when the sync mode is switched to SSM mode.

TIP For firmware versions before R3744, the input would be disqualified only when the current SSM value was greater than the cutoff value. A signal with an SSM value equal to the cutoff value would still be considered for use. Once an SSM-qualified signal was disqualified, the selection of another SSM-qualified signal would be evaluated. If no channels met the SSM requirements, the SSU would attempt to use the Automatic sync mode. In automatic mode, any qualified input could be selected for use as the reference.

TL1 Keyword = QCUTOFF

Uses ED-SYNC command.

If using the 55450A local craft terminal software, you can find this feature by following the menu path – Configuration tab>Input>SSM Cutoff

Range = 0 to 15 (Default = 4) Each channel is initially set to a value of 4. That equals a G.812 transit level source.

Set a selection priority for equal SSM inputs

This feature can be used to provide a way to select between inputs that have the same SSM quality level. The signal with the numerically lowest SSMPRI value among those equally qualified in SSM terms will be selected as the reference.

NOTE

The SSM priority setting is not affected by the revertive mode meaning that if an SSM signal with a better SSM priority become qualified at some point, the SSU will not automatically switch to that reference.

TL1 Keyword = SSMPRI

Uses the ED-SYNC command.

Range = 0 to 8 (Default = 3)

Impose an assumed SSM value

This feature is useful in cases where it is desired to assign an SSM quality level to non-E1 inputs, or to E1 inputs that do not carry SSM information. The SSM level assigned will always be used for non-E1 inputs, but the assigned SSM level will only be used for E1 inputs when the Read SSM feature has been disabled. The assumed SSM level is always used for the PRC input when in the SSM sync mode.

TL1 Keyword = QLEVEL

Uses the ED-SYNC command.

*If using the 55450A local craft terminal software, you can find this feature by following the menu path – Configuration
tab>Input>Assumed SSM Level*

Range = 0 to 15 (Default = 15, Do not use for synchronization.)

Enable reading of the incoming SSM

This feature enables the reading of the SSM bit on an E1 input. If this feature is disabled, the assumed SSM value (QLEVEL) will be used instead. For an input SSM bit to be read correctly, the appropriate SA bit must be specified and the format of the input signal must be appropriate (that is, an E1 format using CRC-4 coding). This feature does not apply to PRC and 2048 kHz inputs. Whenever an input signal is lost from an SSM-enabled channel, the SSU will detect that as a “Do not use for synchronization” until a new SSM value is read from the input signal framing information.

TL1 Keyword = SSMENB

Uses the ED-SYNC command.

*If using the 55450A local craft terminal software, you can find this feature by following the menu path – Configuration
tab>Input>Read SSM*

Range = Y or N (Default = N) Y = If input signal is E1, read the SSM bits and use them for SSM priority evaluation. N = Do not read SSM value from the E1 input signal. Use the assigned SSM value instead.

Display the current SSM value

This feature retrieves the current SSM value for the input channel if SSM reading has been enabled. If SSM reading has been disabled, then the assumed SSM value will be retrieved instead.

TL1 Keyword = CURRSSM

Uses the RTRV-SYNC command.

If using the 55450A local craft terminal software, you can find this feature by following the menu path – Configuration tab>Input>Current SSM Level

Specify a holdover SSM value

This feature specifies the quality level assumed for the local oscillator in SSM mode. This value will be placed onto the output stream when in holdover mode, as long as the holdover action produces an E1 signal.

TL1 Keyword = HFQLEVEL

Uses the ED-EQPT command.

If using the 55450A local craft terminal software, you can find this feature by following the menu path – Configuration tab>Input>Holdover SSM

Range = 0 to 15 (Default = depends on the type of local oscillator)

Set sync mode to SSM

This feature specifies the mode to use to control how the input channel is selected as a reference source.

TL1 Keyword = SYNCMDE

Uses the ED-EQPT command.

If using the 55450A local craft terminal software, you can find this feature by following the menu path – Configuration tab>Input>Sync Mode>SSM

Values = Auto, Manual, Forced, SSM (Default = Auto)

SSM Behaviors**What happens if no input signals meet the SSM requirements?**

Prior to firmware revision R3744, an SSU in SSM sync mode would switch to the automatic mode to make a reference selection. With firmware revision R3744 and above, the SSU will go into holdover when no input signals satisfy the SSM requirements.

What happens if two signals are identical in SSM evaluation qualities?

The signal with the lowest-assigned SSM priority setting will be selected. If more than one signal has the same priority setting, the determining factor will be the assigned input priority value (see page A2-35). If the SSM decision process ever reaches this point with more than one signal with the same input priority value, the signal connected to the input channel with the lowest numerical value will be selected. Inputs are numbered 0 to 8.

A3

System Specifications

For SSU, mini-SSU, GPS Primary Reference, and Primary Frequency Standard

In This Chapter

This chapter describes the specifications for the three telecom timing devices that make up the Symmetricom Sync System. Only the major specifications for the GPS unit and the frequency standard are included here. For the complete specifications for these products, refer to the documents supplied with those products.

55400A SSU

The 55400A synchronization supply unit (SSU) is a modular, fully redundant, timing distribution unit for 2048 kbps primary rate networks. It is ideally suited for telecommunications networks where SDH technology is being deployed or expanded. This chapter describes the following topics for the SSU:

- SSU system specifications
- Input references
- Input performance monitoring
- Clock and output cards
- Alarm and communication cards
- Master and expansion subrack specifications

55409A Mini-SSU

The 55409A mini-SSU is a scaled-down version of the SSU intended for locations where only a limited number of network elements need synchronization signals. Many of the plug-in modules are the same as for the standard SSU. This chapter describes the following topics for the mini-SSU:

- Mini-SSU system specifications
- Input/Output modules
- Input clock card
- Output cards
- Alarm and communication cards

55300A GPS Reference Source

This chapter describes the following topics for the GPS source:

- 55320A rack mount shelf specifications
- Alarm output specifications
- Environmental specifications
- GPS antenna and antenna cable specifications

5071A Frequency Standard

This chapter describes the following topics for the frequency standard:

- Time standard characteristics
- Remote interface
- Telecom signals option
- Environmental specifications

55400A SSU

The 55400A SSU meets all industry standards including:

- ITU G.812/G.813
- prETS300 462-3/4
- exceeds ANSI requirements for stratum-2 and ITU transit node (type V) and local node (type VI) holdover stabilities

55400A SSU Specifications

Table A3-1. SSU System Specifications

Description	Specification
Number of Reference Inputs	Up to 9, 1:1 protected
Number of Outputs per Subrack	80, 1:1 protected
Expansion Rack Capability	4 additional subracks, 80 1:1 protected outputs each
Frequency Stability in Holdover (@ 25°C) (after 10 days of continuous operation)	
Stratum 2—Quartz	$\pm 3.0 \times 10^{-11}$ /day for three days
Enhanced Stratum 2—Rubidium	$\pm 2.0 \times 10^{-11}$ /day
Enhanced Transit Node	$\pm 1.0 \times 10^{-10}$ /day for three days
Transit Node	$\pm 5.0 \times 10^{-10}$ /day
Local Node	$\pm 1.0 \times 10^{-8}$ /day
Jitter and Wander Tolerance	Complies with ITU-T G.823
Output Phase Variation	
Reference switch-over	< 1 ns
ITH Card switch-over	< 15 ns
Output Card switch-over	< 15 ns
ITH Card failure	< 15 ns
Output Card failure	< 1 μ s
Alarm Interface	
Relay closure	Open and closed contacts
Severities	Critical, Major, and Minor
Usage	With and without alarm cutoff
Management Ports	
Language	TL1
Local	RS-232-D, DCE
Remote	RS-232-C, DTE
Network	TCP/IP, X.25, TP4
System Supply Voltage	–36 Vdc to –57 Vdc

Table A3-1. SSU System Specifications (continued)

Power Requirements (fully loaded) Cold Start After warm-up	3.0 A at –48 Vdc 7.0 A (maximum) at –48 Vdc
Operating Temperature	–5 to 45°C
Electromagnetic compatibility	Complies with: IEC 801-2 ESD Immunity, 8 kV air discharge, 4 kV contact discharge IEC 801-3 Radiated Immunity, 3 V/m IEC 801-4 Electrical Fast Transient Immunity, 500 V
Dimensions of Subracks – H × W × D mm (in.)	533 × 435 × 270 (21.0 × 17.1 × 10.6)
Weight	18 kg (40 lbs) fully loaded
Rack Mounting	ETSI or EIA

Input References

- Accepts up to nine input reference signals with programmable priority.
- 1:1 protected with pair of ITH clock cards
- The PRC (Primary Reference Clock) reference input can accept either 5 or 10 MHz
- Up to Eight reference inputs can accept any combination of 2048 kHz (G.703.10) or 2048 kbps (G.703.6/G.704)
- Reference signals may come from cesium standards, GPS reference sources, or live traffic signals

PRC Reference Input

Table A3-2. 5 or 10 MHz PRC Input

Description	Specification
Number of Inputs	1
Input Signal Type	Sine Wave or Square Wave
Input Signal Parameter Monitored	MRTIE and TDEV
Input Impedance	50 Ω
Reference Input Frequency	5 or 10 MHz
Input Protection	1:1
Input Sensitivity	0.5 V peak-to-peak
Damage Level	5.0 V rms

PRC Status Input

Table A3-3. PRC Status Input

Description	Specification
Number of inputs	1
Input Signal Type	TTL input – logic state “High” when normal

2048 kHz Reference Inputs

Table A3-4. 2048 kHz Inputs

Description	Specification
Number of Inputs	Up to 8 total 2048 kHz or 2048 kbps
Input Signal Type	2048 kHz per ITU-T G.703, Table 10
Input Signal Parameters Monitored	MRTIE, TDEV, FFOFF, and SPREAD*
Input Impedance	75 Ω unbalanced, 120 Ω balanced (option)**
Input Signal Level	
75 Ω	Per ITU-T G.703, Table 10
120 Ω	Per ITU-T G.703, Table 10
Input Signal Jitter and Wander Tolerance	Complies with ITU-T G.823
Input Protection	1:1
Disqualification Threshold	–24 dB (typical)
Damage Level	2.5 V peak

* FFOFF = Fractional Frequency Offset, SPREAD = Frequency Spread between channels

** Inline Balun transformer must be used on inputs for 120 Ω operation (part numbers 1250-2739 for Siemens connectors or 1250-2735 for BNC connectors).

E1 Reference Inputs

Table A3-5. 2048 kbps Inputs

Description	Specification
Number of Inputs	Up to 8 total 2048 kbps or 2048 kHz
Input Signal Type	Framed 2048 kbps HDB3
Framing Protocols	CCS or CAS, with or without CRC4
Input Signal Parameters Monitored	MRTIE, TDEV, FFOFF, and SPREAD, LOS, AIS, and OOF
Input Impedance	75 Ω unbalanced, 120 Ω balanced (option)*
Input Signal Level	
75 Ω	Per ITU-T G.703, Table 6
120 Ω	Per ITU-T G.703, Table 6
Input Signal Jitter and Wander Tolerance	Complies with ITU-T G.823
Input Protection	1:1
Disqualification Threshold	–32 dB of cable loss (typical)
Damage Level	3.5 V peak

* Inline Balun transformer must be used on inputs for 120 Ω operation (part numbers 1250-2739 for Siemens connectors or 1250-2735 for BNC connectors).

Input Performance Monitoring

The reference input described above are each monitored continuously at a rate of 204 samples per second. TDEV has integration times of 1, 4, 16, 64, 256, and 1024 seconds. The results are updated every 2 to 50 minutes. MTIE has observation periods of 1 second, 1, 15 and 30 minutes, and 1, 2, 8, and 24 hours. The results are updated every 15 minutes.

Specifications for Wander Generation — 55412, 55413, and 55429 Clock Cards

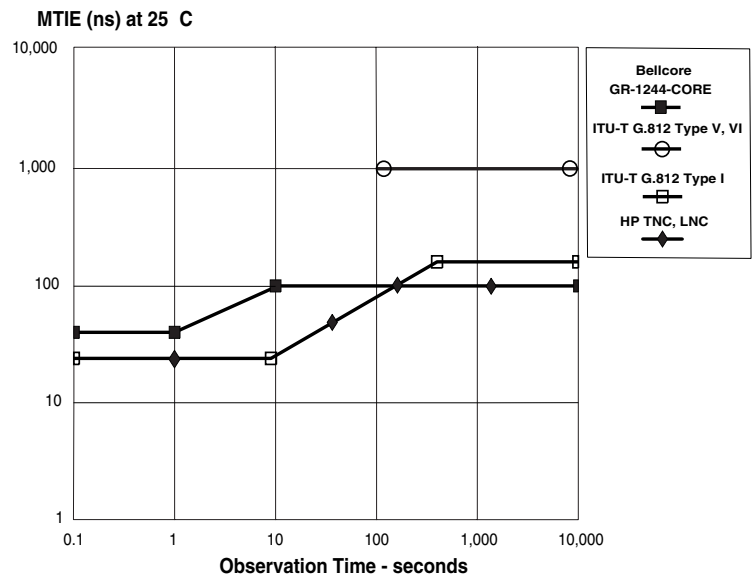


Figure A3-1. Wander Generation — MTIE

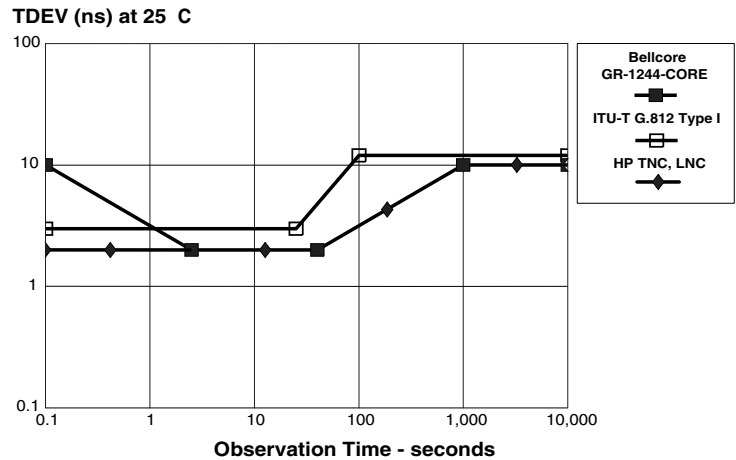


Figure A3-2. Wander Generation — TDEV

*Specifications for Wander Generation — 55414 and 55415
Clock Cards*

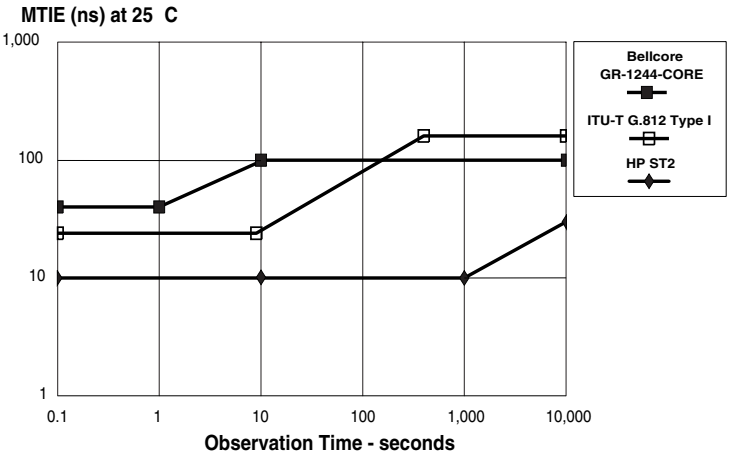


Figure A3-3. Wander Generation — MTIE

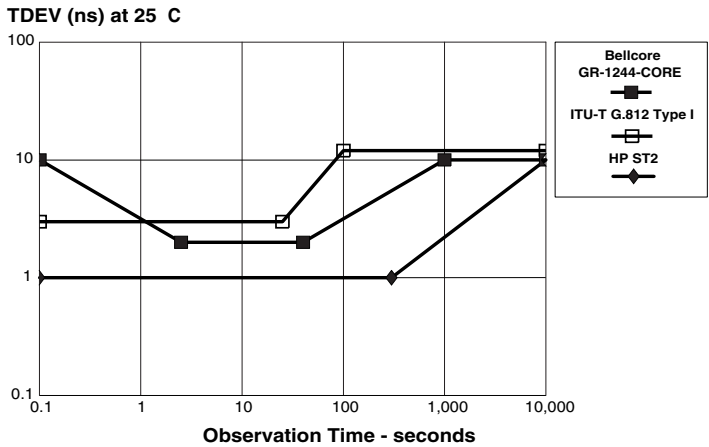


Figure A3-4. Wander Generation — TDEV

Input/Output System Cards

ITH Clock Cards

The 55400A offers a variety of Input Track and Hold (ITH) cards. They differ by their performance as listed in the specification tables shown below. The typical configuration in a master subrack is a redundant pair of ITH cards. All the ITH cards perform the following functions. The clock cards are listed in decreasing level of performance:

- Input qualification
- Performance monitoring
- Input selection and rearrangement
- Filtering
- Tracking
- Holdover
- Switch-over

Enhanced Stratum 2 Clock

Table A3-6. 55414B Enhanced Stratum 2—Input Track and Hold Card

Description	Specification
Oscillator	Rubidium
Accuracy	$\pm 5 \times 10^{-10}$
Clock Holdover Stability (@ 25°C)	$\pm 2 \times 10^{-11}/\text{day}$
Pull-in Range (programmable)	$\pm 1.6 \times 10^{-8}$ (default)
Warm-up Time	30 minutes
Non-volatile Memory Battery Backup	10-year minimum lifetime

Enhanced Transit Node Clock**Table A3-7. 55415B Enhanced Transit Node–Input Track and Hold Card**

Description	Specification
Oscillator	Quartz with SmartClock™ technology
Clock Holdover Stability (@ 25°C) Compliant to: ETSI prETS 300 462-4 ITU-T G.812 Level -II ANSI stratum-2	$\pm 1 \times 10^{-10}$ /day for three days
Pull-in-Range (programmable)	$\pm 4.6 \times 10^{-6}$ (default)
Warm-up Time	≤ 2 hours
Non-volatile Memory Battery Backup	10-year minimum lifetime

Transit Node Clock**Table A3-8. 55412B Transit Node–Input Track and Hold Card**

Description	Specification
Oscillator	Quartz
Clock Holdover Stability (@ 25°C) Compliant to ITU-T G.812 / Transit Node	$\pm 5 \times 10^{-10}$ /day
Pull-in-Range (programmable)	$\pm 4.6 \times 10^{-6}$ (default)
Warm-up Time	30 minutes
Non-volatile Memory Battery Backup	10-year minimum lifetime

Local Node Clock**Table A3-9. 55413B Local Node–Input Track and Hold Card**

Description	Specification
Oscillator	Quartz
Clock Holdover Stability (@ 25°C) Compliant to ITU-T G.812 / Local Node	$\pm 1 \times 10^{-8}$ /day
Pull-in Range (programmable)	$\pm 4.6 \times 10^{-6}$ (default)
Warm-up Time	30 minutes
Non-volatile Memory Battery Backup	10-year minimum lifetime

Output Cards

The 55400A supports a number of different output cards. The cards are typically used in pairs for redundant operation. An output card can provide up to 16 outputs, although some card types are limited to only eight (see specifications for each card).

NOTE

Inline Balun transformers must be used on outputs for 120 Ω operation (part numbers 1250-2739 for Siemens connectors or 1250-2735 for BNC connectors).

Traffic Re-synchronization Card

The 55471A Traffic Re-synchronization Card (TRSC) provides eight channels for E1 signals. Four of these channels will re-time the input signals and four will only buffer the input signals.

NOTE

Each input must be externally terminated with a 75 Ω termination to properly match the input impedance of the subracks. Individual terminations are available from Symmetricom as Option 002 for Siemens 1.6/5.6 subrack connectors and Option 003 for BNC subrack connectors.

Table A3-10. 55471A Traffic Re-synchronization Card

Description	Specification
Input Types	2048 kbps, CCS or CAS multiframe, with or without CRC-4 multiframe, conforming to ITU-T G.704
Input Electrical	Conforms to ITU-T G.703 section 6
Input Tolerance	Conforms to ITU-T G.823
Output Types	Same as input types
Output Electrical	Conforms to ITU-T G.703 section 6
Output Jitter and Wander	Conforms to DE/TM-3017-4 section 8 referred to SSU timing reference input
Input Signal Parameters Monitored	Loss of Signal (LOS) and Out of Frame (OOF)
Input Sensitivity	-13 dB
Damage Level	3.5 V peak
Output Signal Type	2048 kbps, framed per ITU-T G.703 Table 6, with HDB3 encoding
Buffer Size	2 frames, 512 bits
Buffer Hysteresis	256 bits
Delay (re-timed signal path)	131 μ s (nominal) 256 μ s (maximum)
Number of Outputs	8 (4 re-timed, 4 pass-through)

2048 kbps Card

This E1 card provides 16 outputs according to ITU-T 2048 kbps recommendations.

Table A3-11. 55481B Clock Distribution Card–2048 kbps

Description	Specification
Output Type	2048 kbps framed per ITU-T G.703, Table 6
Waveform	75 Ω , 120 Ω , per ITU-T G.703, Table 6
Wave Shape	Rectangular, per ITU-T G.703, Figure 15
Impedance	75 Ω unbalanced, 120 Ω balanced
Drive Capability	0 to 200 meters of cable (0.8 mm) or RG-59
Framing	CCS or CAS, with or without CRC4
Squelched Outputs	Yes
Number of Outputs	16
Programmable Traffic Pattern	Traffic value with no more than 1 zero
Phase Variation due to Output Card Failure	$\leq 1 \mu\text{s}$

2048 kHz Card

This 2048 kHz card provides 16 outputs according to ITU-T recommendations.

Table A3-12. 55482A Clock Distribution Card–2048 kHz

Description	Specification
Output Type	2048 kHz per ITU-T G.703, Table 10
Waveform	75 Ω , 120 Ω , per ITU-T G.703, Table 10
Wave Shape	Square wave per ITU-T G.703, Figure 21
Impedance	75 Ω unbalanced, 120 Ω balanced
Drive Capability	0 to 200 meters of cable (0.8 mm) or RG-59
Squelched Outputs	Yes
Number of Outputs	16
Phase Variation due to Output Card Failure	$\leq 1 \mu\text{s}$

Composite Clock Card

The 55483A Clock Card together with a patch panel provides 16 balanced outputs at 64/8 kHz with an electrical waveform that meets the requirements of the interface at 64 kbit/s as specified in ITU-T Recommendation G.703.1.

Table A3-13. 55483A Composite Clock Distribution Card–64/8 kHz

Description	Specification
Output Type	Interface at 64 kbit/s as per ITU-T Recommendation G.703 Section 1
Line Code	Bipolar, return-to-zero
Test Load Impedance	120 Ω resistive (Tables 1 & 3, G.703) 110 Ω resistive (Table 2, G.703)
Pulse Amplitude	1.0 V $\pm$ 0.1 V as per Tables 1, 2 & 3, G.703
Pulse Shape	Per mask in ITU-T G.703, Figure 5b and Figure 9
Drive Capability	0 to 450 meters of twisted pair cable (0.8 mm)
Squelched Outputs	Yes
Number of Outputs	16

1/5/10 MHz Card

This card is capable of producing one of three output frequencies for each output port. The different frequencies (1 MHz, 5 MHz, or 10 MHz) are selected using switches on the card.

Table A3-14. 55484A Clock Distribution Card–1/5/10 MHz

Description	Specification
Output Type	1/5/10 MHz selectable
Pulse Amplitude	2.4 V peak-to-peak
Impedance	50 Ω unbalanced
Squelched Outputs	Yes
Number of Outputs	8 (Outputs 9 through 16 on subrack)
Phase Variation due to Output Card Failure	≤ 2 UI

1544 kbps Card

This card provides 1544 kbps outputs according to ITU-T recommendations.

Table A3-15. 55485B Clock Distribution Card–1544 kbps

Description	Specification
Output Type	1544 kbps framed per ITU-T G.703, Table 4
Waveform	100 Ω per ITU-T G.703, Table 4
Wave Shape	Rectangular, per ITU-T G.703, Figure 10
Impedance	100 Ω resistive, unbalanced
Drive Capability	0 to 200 meters of cable (0.8 mm) or RG-59
Framing	D4 or ESF
Squelched Outputs	Yes
Number of Outputs	16

2048 kHz and 2048 kbps Card

This card supplies both 2048 kHz and 2048 kbps output signals. The card provides 2048 kHz on outputs 1 to 8 and 2048 kbps on outputs 9 to 16. This card requires 55400A firmware version R3744 H, or later.

Table A3-16. 55488A Clock Distribution Card–2048 kHz/2048kbps

Description	Specification
Outputs 1 to 8	2048 kHz
Output Type	2048 kHz per ITU-T G.703, Table 10
Waveform	75 Ω , 120 Ω per ITU-T G.703, Table 10
Wave Shape	Square wave, per ITU-T G.703, Figure 21
Outputs 9 to 16	2048 kbps
Output Type	2048 kbps framed per ITU-T G.703, Table 6
Waveform	75 Ω , 120 Ω per ITU-T G.703, Table 6
Wave Shape	Rectangular, per ITU-T G.703, Figure 15
Framing	CCS or CAS, with or without CRC4
Programmable Traffic Pattern	Traffic pattern with no more than 1 zero
All Outputs	
Impedance	75 Ω unbalanced, 120 Ω balanced
Drive Capability	0 to 200 meters of cable (0.8 mm) or RG-59
Squelched Outputs	Yes

Alarm and Communication Cards

The 55400A offers a series of cards to support status reporting by the SSU to the outside world. The card choice depends on the environment in which the SSU is operating. Refer to the table below.

Table A3-17. Alarm and Communication Card Differences

Requirement	Card to Use
You want the alarm signals and also want to communicate with the SSU using a computer to configure, monitor performance, troubleshoot problems, and support expansion subracks.	55441A Information Management Card (IMC)
You want what is provided by the IMC plus the ability to put the SSU on a network.	55442A Network Information Management Card (NIMC). Different network interface versions are available.

55441A Information Management Card (IMC)

The IMC provides ports for computer communication with the 55400A. These serial data ports support data reporting and control. For local use, such as installation, on site configuration and troubleshooting, the port is wired as a DCE and is located on the front of the card. The other port for remote use is wired as a DTE and is located on the connector panel of the subrack.

Alarm signals from all the other cards are received by the IMC, which processes these signals and reports an alarm status. The IMC provides for storage of the most recent 100 messages of alarm and performance data.

Functions of the SSU supported by the card include

- Configuration and provisioning of the equipment
- Firmware download for the Information Management and Input Track and Hold cards
- Transfer of event and alarm messages
- Setting input priority and alarm thresholds

Two push-button switches are located on the front panel, one for alarm cutoff (silences the audible alarms) and one to reset the local and remote communication ports.

Table A3-18. 55441A Information Management Card

Description	Specification
Number of Ports	2
Port Types	
Local	RS-232D, DCE
Remote	RS-232C, DTE
Communication Parameters	
Baud Rate	1200, 2400, 9600, and 19200
Number of Bits	8
Parity	None
Stop Bits	1
Hardware Flow Control (selectable)	CTS/RTS/DSR/DTR/RI/CD
Language	TL1
Event Log	
Capacity	Stores last 100 events
Battery Backup	10-year minimum lifetime
Alarm Relay Contact Ratings	
Switching Power	60 W, 62.5 VA
Switching Voltage	60 Vdc, 30 Vac
Switching Current	1A maximum
Critical, Major, & Minor Alarm Relays, with or without alarm cutoff	Open and closed contacts
ACO (alarm cutoff) Switch—front panel	Push button, when pressed silences the audible alarm and lights the ACO LED.

55442A Network Information Management Card (NIMC)

The NIMC provides the functionality of the IMC plus a network connection that supports control of the SSU over the network. The NIMC also has an additional port that accepts alarm lines from other equipment in the rack for reporting to a network manager. The table below describes the types of network connections and options available for the NIMC. The specifications for the IMC also apply to the NIMC, except for the Port Types. All cards have a Local port.

Table A3-19. 55442A Network Information Management Card

Description	Specification
LAN Interface (Std)	10Base-T (physical) IEEE 802.3 and Ethernet (link layer) TCP/IP (layers 3 and 4)
X.25 Interface (Option 002)	V.24 DTE (physical) CCITT Rec. X.25, LAPB DTE (frame layer) CCITT Rec. X.25, PLP (packet layer)
TP4 Interface (Option 003)	10Base-T (physical) IEEE 802.3 and IEEE 802.2 (link layers) ISO 8473 (network) ISO 8073 (transport)
Expanded Memory (Option 004)	Available for all network versions. Supports acquisition of up to 24 hours of continuous time interval error data.

Master Subrack

The 55401D master subrack is ETSI-compliant and houses all of the individual SSU cards.

Master Subrack Connector Panel

The connector panel is located at the top of the subrack. Connections are provided for the following signals:

- Dual power inputs and chassis grounds
- Alarm relays
- Remote communication
- Expansion communication
- Expansion signals
- Reference inputs (up to 9)
- Primary reference status
- Outputs

The standard output connector is BNC. Option 001 to the subrack provides Siemens 1.6/5.6 75 Ω connectors instead of BNC 75 Ω output connectors.

Master Subrack Specifications

Table A3-20. 55401D Master Subrack

Description	Specification
Subrack Power Inputs – dual	–36 Vdc to –57 Vdc
Dimensions of Subrack – H $\times$ W $\times$ D mm (in.)	533 $\times$ 435 $\times$ 270 (21.0 $\times$ 17.1 $\times$ 10.6)
Connectors – outputs	BNC 75 Ω are standard (Siemens 75 Ω , 1.6/5.6 optional)
Rack Mounting	ETSI or EIA racks

Expansion Subrack

The 55402D expansion subrack contains the same kind of output cards as the master subrack. Both the expansion rack IMC and expansion rack ITH cards are specific to the expansion subrack. Up to four 55402D expansion subracks may be used with the master subrack. Each expansion subrack can provide up to 80 1:1 protected outputs. One master subrack and four expansion subracks can provide up to a total of 400 1:1 protected outputs.

Typically, each expansion subrack requires two expansion synchronization cards and one expansion communication card to operate with a master subrack.

Expansion Sync and Communication Cards

55419A Expansion Synchronization Card

When expanding the 55400A system beyond its master subrack configuration (80 outputs), the 55402D expansion subrack requires two synchronization cards. This card provides the necessary synchronization connections with the master subrack.

55443A Expansion Communication Card

The communication card provides the necessary communication link between the expansion and master subracks

Expansion Subrack Connector Panel

The connector panel on the expansion subrack provides connections for the following signals:

- Dual power inputs and chassis grounds
- Expansion communication
- Expansion signals
- Outputs

The standard output connector is BNC. Option 001 to the subrack provides Siemens 1.6/5.6 75 Ω connectors instead of BNC output connectors.

Expansion Subrack Specifications**Table A3-21. 55402D Expansion Subrack**

Description	Specification
Subrack Power Inputs – dual	–36 Vdc to –57 Vdc
Dimensions of Subrack – H × W × D mm (in.)	533 × 435 × 270 (21.0 × 17.1 × 10.6)
Connectors – outputs	BNC 75 Ω are standard (Siemens 75 Ω , 1.6/5.6 optional)
Rack Mounting	ETSI or EIA racks

55409A Mini-SSU

The 55409A mini-SSU subrack is a compact version of the standard SSU subrack. The mini-SSU has fewer inputs and fewer outputs as compared to the standard SSU.

55409A Mini-SSU Specifications

Table A3-22. Mini-SSU System Specifications

Description	Specification
Number of Reference Inputs	3, 1 PRC (5 or 10 MHz), 2–2048 kbps or kHz (optional 1:1 protection with second ITH card)
Number of Subrack Outputs	16 or 32 (optional 1:1 protection with output card pairs)
Expansion Rack Capability	None
Frequency Stability in Holdover (@ 25°C) (after 10 days of continuous operation) Local Node (Stratum 3E)	$\pm 1.0 \times 10^{-8}/\text{day}$
Jitter and Wander Tolerance	Complies with ITU-T G.823
Jitter and Wander Limits	Complies with ITU-T G.823 Type I
Alarm Interface Relay closure Severities Usage	Open and closed contacts Critical, Major, and Minor With and without alarm cutoff
Management Ports Language Local Remote Network	TL1 RS-232-D, DCE RS-232-C, DTE TCP/IP, X.25, TP4
System Supply Voltage	–36 Vdc to –57 Vdc
Power Requirements (fully loaded) Cold Start After warm-up	2.1 A at –48 Vdc 3.0 A (maximum) at –48 Vdc
Operating Temperature	–5 to 45°C
Electromagnetic compatibility	Complies with: IEC 801-2 ESD Immunity, 8 kV air discharge, 4 kV contact discharge IEC 801-3 Radiated Immunity, 3 V/m IEC 801-4 Electrical Fast Transient Immunity, 500 V
Dimensions of 55409A Subrack – H × W × D mm (in.)	300 × 435 × 270 (21.0 × 17.1 × 10.6)

Table A3-22. Mini-SSU System Specifications (continued)

Weight	14.5 kg (32 lbs) fully loaded
Rack Mounting	ETSI or EIA

Required Input/Output Module

The choice of module as an option to the mini-SSU subrack determines the connector type and impedance characteristics for the input and output connectors:

- Option 011 provides BNC, 75 Ω unbalanced connectors (includes 2 inputs and 16 outputs)
- Option 012 provides micro Siemens 1.0/2.3, 75 Ω unbalanced connectors (includes 2 inputs and 16 outputs)

Optional Output Module

The choice of module as an option to the mini-SSU subrack determines the connector type and impedance characteristics for the output connectors:

- Option 021 provides BNC, 75 Ω unbalanced connectors (includes 16 outputs only)
- Option 022 provides micro Siemens 1.0/2.3, 75 Ω unbalanced connectors (includes 16 outputs only)

Mini-SSU Input References

See page A3-6 for the required characteristics of the inputs to the mini-SSU. The inputs include:

- 1—5 or 10 MHz PRC (connector on subrack)
- 1—PRC status input (connector on subrack)
- 2—2048 kbps or kHz inputs (connectors on input/output module)

Mini-SSU Input Clock Card

The 55429B Local Node ITH card performs the following functions:

- Input qualification
- Performance monitoring
- Input selection and rearrangement
- Filtering
- Tracking
- Holdover
- Switch-over (if using 2 ITH cards for 1:1 protection)

The performance specifications are the same as for the 55413B on page A3-11.

NOTE

The 55429B has the same performance as the 55413B and is only intended for use with the 55409A mini-SSU. The only functional difference is that the 55429B supports a total of three input references, including the PRC input.

Mini-SSU Output Cards

The mini-SSU can hold up to four output cards. This is two output cards with each protected by a second card. A maximum of 32 outputs would be available in this configuration (requires the additional output module). Two unprotected output cards could also generate 32 output signals. The specifications for the output cards begin on page A3-12.

Mini-SSU Alarm and Communication Cards

If alarm reporting and management capability is desired for the mini-SSU, the IMC or NIMC is needed. See the descriptions beginning on page A3-16.

55300A GPS Reference Source

This primary reference source provides the following features:

- Cesium-like (Stratum 1) performance meets the requirements of GR-2830-CORE, ITU-T G.811, and ANSI T1.101-1994
- Highly reliable quartz oscillator with SmartClock technology
- Enhanced GPS technology
- Standard Time-of-Day (TOD) available through the RS-232C connector or IRIG-B format via a BNC connector

GPS ETSI Rack Mount Shelf

Two shelves are available for the 55300A, one with 75 Ω unbalanced outputs (55320A) and one with 120 Ω balanced outputs (55322A). The 2048 kHz output is per ITU-T G.703, Table 10 and the 2048 kbps is per ITU-T G.703, Table 6.

Table A3-23. Rack Mount Shelf for 55300A

Description	Specification
Rack Mount Configuration	Compatible with standard ETSI 535 mm or EIA 19" racks
Dimensions of Shelf — H x W x D mm (in)	168.4 x 425 x 257.3 (6.63 x 16.73 x 10.13)
Weight of Rack Mount	2.8 kg (6.1 lbs)
Power Requirements	Dual redundant power inputs (A and B) –48 Vdc nominal
Connectors on Rack Mount	
10 MHz Output	BNC 50 Ω nominal
1 PPS	BNC 50 Ω nominal
TOD IRIG-B	BNC 50 Ω nominal
2048 kHz Output	BNC 75 Ω nominal
GPS Antenna	Type-N (female)
Power Inputs	Augat snap-on pressure clamp
2048 kbps Output	BNC 75 Ω unbalanced (55320A) DE-9S 120 Ω balanced (55322A)
1 PPS	BNC (2) RS-422 differential pair (55320A) DE-9S (2) RS-422 (55322A)
Alarms	DB-25P (male)
Time of Day (TOD)	RS-232 DE-9P DTE (male) (1 PPS DCD included)
Remote Access Port	RS-232 DB-25S DTE (female)

Alarm Output

The GPS reference source provides six alarm relays for use as office alarms.

Table A3-24. 55300A Alarm Outputs

Description	Specification
Alarms available	Critical, Major, and Minor; alarm causes are selectively assignable to alarms
Alarm Relay Contact Ratings Switching Power Switching Voltage Switching Current	60 W maximum 125 Vac or 220 Vdc maximum 2 A maximum
Alarm Relays (6) 3 Critical, Major, Minor 3 Critical, Major, Minor with alarm cutoff	Normally open and normally closed contacts Normally open and normally closed contacts
Alarm causes	Power failure, output failure, oscillator failure, synthesizer failure, loss of GPS signal (holdover), self-test failure

Power/Environmental

Note the power requirements for the GPS reference source.

Table A3-25. 55300A Power/Environmental

Description	Specification
Power Requirements	–48 Vdc nominal, 700 mA start-up; 350 mA steady state –37 to –60 Vdc operating range
Temperature Range	Operating: 0°C to +50°C Storage: –40°C to +80°C

GPS Antenna and Antenna Cable

In addition to the antenna and cable, a full line of GPS accessories is available from Symmetricom. Refer to chapter C4 for more information.

Table A3-26. 55300A GPS Antenna and Cable

Description	Specification
Active Antenna (58532A)	30 dB (typical) active gain with dielectric filter
Antenna Power Requirements	5 V (nominal); 50 mA maximum (supplied by 55300A)
Temperature Range	Operating: -40°C to +85°C Storage: -45°C to +90°C
Antenna Cable Type	A line amplifier is required with LMR 400 cable for distances greater than 377 ft (110 m).
Cable Connectors	Type-N male connector at the 55300A Type-N male connector at the antenna

5071A Frequency Standard

This primary frequency standard provides the following features:

- 5 or 10 MHz programmable outputs
- Time and date clocks
- Easily synchronized 1 pulse per second (1PPS) output
- Accurate and precise output frequency steering
- Event log
- Remote control capability
- Telecom output options

Time Standard Characteristics

If a more detailed description of the frequency standards specifications is needed, refer to the *5071A Operating and Programming Manual* included with the equipment.

Table A3-27. 5071A Time Standard Characteristics

Description	Specification
Frequency Accuracy	$\pm 1 \times 10^{-12}$ $\pm 5 \times 10^{-13}$ (Option 001)
Clock Display	24-hour red LED display of hours, minutes, seconds
Clock 1PPS Outputs	
Amplitude	≥ 2.4 V into 50 Ω
Width	20 μ s $\pm$ 10 ns
Rise Time	< 5 ns
Connectors	BNC
Location	one on front panel
Clock Synchronization	
Automatic synchronization	to within 50 ns of reference pulse
Sync Pulse	2 inputs, each may be independently armed
Amplitude	+2 to +10 V maximum
Width	100 ns minimum, 100 μ s maximum
Rise Time	< 50 ns
Input Impedance	50 Ω nominal
Time Reference	rising edge
Connectors	BNC
Location	one on front panel
Manual synchronization	-.5 to +.5 s with resolution of 50 ns

Remote Interface

The frequency standard does support a limited communication capability using an RS-232 interface.

Table A3-28. 5071A Remote Interface

Description	Specification
Remote Interface Software command set Connector	RS-232C (DTE configuration) SCPI (Software Commands for Programmable Instruments), version 1990.0 9-pin male rectangular D, subminiature type
Status Output Output - Circuit is TTL open collector with internal pull-up resistor. Circuit can sink up to 10 mA. Connector	Provides a logic output to monitor normal and abnormal operation externally. Parameters which define abnormal operation can be user programmed. TTL High, Normal TTL Low, Fault BNC located on rear panel

Power/Environmental

This frequency standard supports a wide operating range.

Table A3-29. 5071A Power/Environmental (Option 048)

Description	Specification
Input Voltage Damage Level	40 to 58 Vdc 72 V
Input Power Warm-up Operating	85 W 50 W
Temperature Operating Non-operating Humidity	0 to 55°C –40 to 70°C 0 to 95% relative humidity (at maximum temperature of 45°C)
Weight	30 kg (66 lb)
Dimensions — H x W x D—mm (in)	133.4 x 425.5 x 523.9 (5.25 x 16.75 x 20.62)

Rear Panel Telecom Signals

This table describes an 5071A with option 272 (2048 kbps, 75 Ω unbalanced, CAS with CRC4). Other options are available. When the telecom option includes either 100 or 120 Ω balanced output lines, the Framed Output connector is a two-center conductor BNC.

Table A3-30. 5071A Rear Panel Telecom Signals (Option 272)

Description	Specification
Framed output (2048 kbps)	Framed output complies with ITU-T G.703, Table 6 formatted per ITU-T G.704 4.8 V p-p max into 75 Ω (6 V p-p into 100 or 120 Ω)
8 kHz Sync In	8 kHz, TTL level into 50 Ω
8 kHz Sync Out	8 kHz, TTL level into 50 Ω
Sync Out (2048 kHz)	3 V p-p max into 75 Ω per ITU-T G.703, Table 10
Sync Out (2048 kHz)	TTL level into 50 Ω

Backdating

This section contains information about products that are no longer current.

Stratum 2 ITH Clock Card

Table A3-31. 55411B Stratum 2—Input Track and Hold Card

Description	Specification
Oscillator	Quartz with SmartClock™ technology
Clock Holdover Stability (@ 25°C) Compliant to ANSI T1.101 / Stratum 2	$\pm 3 \times 10^{-11}$ /day for three days
Pull-in-Range (programmable)	$\pm 4.6 \times 10^{-6}$ (default)
Warm-up Time	≤ 2 hours
Non-volatile Memory Battery Backup	10-year minimum lifetime

A4

Event/Alarm System

SSU events and alarms explained

In This Chapter

This chapter describes the system used by the 55400A to communicate its operating status both to the front panel via LEDs, and more extensively over the communications port to a local or remote manager. For other equipment in the rack, such as reference sources, the SSU can pass along alarms from that equipment through its network card to a remote manager.

It is important to understand the 55400A event and alarm system. The system can be customized to meet your specific network needs. For the majority of events, you can assign a level of severity to the event and specify whether it will be saved into an event log that can be referenced in the future. The current state of system events is constantly being maintained, updated, and reported automatically if it is configured to report events.

Topics described in this chapter include:

- Events and alarms defined
- Event types
- Alarm property
- Log property
- Summary of events
- How to modify event properties
- Event description and typical cause and resolution
- Event reporting

NOTE

The information in this chapter also applies to the 55409A mini-SSU.

Events and Alarms

In general, events are conditions that occur in, or are detected by, the 55400A. Examples of events can range from normal behaviors such as notification that an input signal has been qualified for use as a reference, to failure incidents that may threaten the continuation of service. Alarms are a subset of these events that have been configured, either by default or by you, to generate an alarm indication and to produce an alarm message over the TL1 interface.

In summary:

- Events are conditions that occur in, or are detected by the 55400A
- Alarms can be assigned to these events

Event Properties

Every event has two properties that are configured to default settings at the factory. For most events, you can modify these settings:

- ALM property—specifies the severity of the event
- LOG property—specifies if the event should be saved into the Event Log

Types of Events

State events—State events are those that indicate an ongoing condition. These include state changes such as the failure of an output card (OPCDFL) or an indication that an input signal is now being tracked by the SSU (SNTRCK). State events are capable of generating alarms.

Transient events—Transient events are those that are short-lived, or temporary. In most cases, these events provide status messages. For example, the event log has been cleared (LOGCLR). These events do not generate alarms.

State Events and the Alarm Property

State events have a set (active) and cleared state. The SSU internally manages this behavior by acknowledging the occurrence of events and clearing the events when they are resolved. This is an automatic behavior. Depending on the setting for the Alarm property, the SSU can generate an alarm indication and a report over the TL1 interface when an event occurs and also send a notification of when the event is no longer active.

Alarm Property

The alarm property is set individually for each event. Use the ED-EQPT command. The state event's ALM property can have one of the following values:

- **NONE**—No alarm or report is generated by either the setting or clearing of this event.
- **NONALM**—No alarm is generated. Both the setting and clearing of the event will generate an event message over the TL1 interface, indicating the change in state.
- **MINOR**—The setting of this event will generate a Minor Alarm indication and generate an alarm message over the TL1 interface. When this event is cleared, the alarm indication is cleared and a clear alarm message is sent.
- **MAJOR**—A Major Alarm indication will be generated and an alarm message will be sent over the TL1 interface. When this event is cleared, the alarm indication is cleared and a clear alarm message is sent.
- **FAIL**—A MAJOR ALARM indication will be generated, unless no standby unit is available to take over operation for the failed unit (or the standby unit has also set a FAIL condition), then the alarm level is promoted to CRITICAL. If a Major Alarm is indicated and the standby unit later becomes unavailable, this alarm will be promoted to CRITICAL and a new TL1 alarm message will be issued.

Transient Events and the Alarm Property

Transient events do not have an ongoing state. They do not generate alarm indications.

Alarm Property

The alarm property is set individually for each event. Use the ED-EQPT command. The transient events can have only the following values for the ALM property:

- **NONE**—No alarm or report is generated by this event.
- **NONALM**—No alarm is generated. This event will generate an event message over the TL1 interface, indicating its occurrence.

Events and the Log Property

The 55400A contains two different kinds of logs:

- Event log maintained on the ITH cards. (You can control what is recorded in this log.)
- Automatic Output log maintained on the IMC/NIMC card. (You cannot control what is recorded in this log.)

Event Log

The Log property refers to the Event Log that is maintained on each of the ITH cards. This log is a chronological record of both alarmed and non-alarmed events that is maintained independently on each ITH card. The events include those that occur on that ITH card and on the associated Expansion Sync cards (contained in Expansion subracks). Some events occurring on the IMC and NIMC cards are also sent to the ITH cards for logging.

These logs hold 1,000 events, and are stored in non-volatile memory—they will be retained even if the card is removed from the subrack. The user can specify which events are to be included in the event logs by using the LOG property. As more events are received, the oldest events are discarded. Events are retrieved in a last-in, first-out fashion. Events stored in the logs are those with their Log property set to Y and can include events not initially reported, (that is, events with the Alarm property set to NONE). The user can also clear these logs, if desired.

Operating Hint for Event Log

The primary purpose of these logs is for troubleshooting. In fact, it is common to record non-reported events (that is, events with the Alarm property set to NONE) in these logs so that they can be examined later to determine the sequence of events leading up to a network or system problem.

Automatic Output Log

This is the second log that is part of the 55400A. It is included here to highlight the differences with the Event log. The Automatic Output (AO) Log records all recent Automatic output messages produced by the SSU. AO messages include alarmed and non-alarmed event reports, automatic updating of performance monitoring data, if enabled, and information on a user logging on and off of the communications ports. This log is stored in the IMC/NIMC and is volatile—if the IMC/NIMC is removed from the subrack, the log will be lost. The user has no explicit control over what is stored in this log, and cannot clear this log except by removing power to the INC/NIMC card.

The number of messages retained in this log varies depending on the length of the messages but is generally around 100 to 150. As more messages are received, the earliest ones are dropped. The logon and logoff messages, which are only sent to the communications port where the event occurred, are only retrievable by a RTRV-AO from that port—other messages are sent to both communications ports and can be retrieved from either port. Events are retrieved on a first-in, first-out basis.

Operating Hint for Automatic Output Log

The primary purpose of this log is for recovery of Automatic Output messages that the operating system (Element Manager) may have missed.

Summary

Event Logs are stored on each ITH card and record events that occur on that ITH card and on the corresponding Expansion Sync cards (in Expansion Subracks). In addition, some events occurring on the IMC/NIMC are forwarded to the ITH cards for logging. The primary use of this log is to help determine the sequence of events leading up to a network or system problem.

To retrieve from the Event Log: RTRV-LOG:::SC1::EVTTOP; (to retrieve the ten most recent events), RTRV-LOG:::SC1::EVTCONT; (to continue retrieving the next ten events)

The Automatic Output Log is stored on the INC/NIMC and is a record of all the automatic messages generated. The primary purpose of this log is to allow an operating system to retrieve any automatic output messages that may have been missed when first transmitted.

To retrieve from the AO Log: RTRV-AO:::SC1; (to retrieve all messages in the log)

What goes in each log?

The contents of the Event log is controlled by the LOG property of the event, while the ALM property controls which events generate messages and are therefore included in the Automatic Output log. (Other automatic reports, such as automatic performance monitoring uploads and session-related messages, will also be included in the Automatic Output log.)

How to Modify/Retrieve Event Properties

There are two main ways to change or retrieve the current event properties:

- One of the 55400A SSU control Software applications
- TL1 commands

Software Applications

The PC software and the OSMF software both support the ability to modify an event's alarm and log properties. The advantage of using this method is that it is much simpler than having to learn the syntax for the TL1 command lines. The software also shows only the supported alarm and log options.

The 55450A local craft terminal software uses a Windows interface with pull-down menus to access the event properties. Go to the Fault Management>Event Setup tab. There are two columns for selecting properties: Priority Actions for the ALM property and Log for the LOG property.

The 55452A OSMF software allows you to edit event behaviors within the "Configuration:Modify" dialog box. Click on Event Actions.

TL1 Commands

Use the ED-EQPT command to change the properties of an event.

```
ED-EQPT::ITH:<ctag>:::<event code>=LOG-<YorN>&ALM-  
<alarm severity>;
```

Example:

```
ED-EQPT::ITH:SC1:::INPLOS=LOG-Y&ALM-MINOR;
```

This example sets the 55400A to create a minor alarm and record the event in the Event log when an input signal is lost.

Use the RTRV-EQPT command to determine the properties set for an event.

```
RTRV-EQPT::ITH:<ctag>:::PARAMETER=<event code>;
```

Example:

```
RTRV-EQPT::ITH:SC1:::PARAMETER=INPLOS;
```

This example will retrieve the alarm and log properties for the event indicating an input loss.

Summary Table of Events

This table summarizes each event by listing its description, type, and the default ALM and LOG properties. Each event is described in more detail at the end of this chapter. The event type includes the SSU subsystem involved with the event. The following table does not describe all of the aspects needed to allow you to properly configure events/alarms. Please refer to the *55400A TL1 Programming Reference Manual* for complete details. **The asterisk (*) indicates that the property is NOT user configurable.**

Table A4-1. State Event Summary (Asterisk=not user configurable)

Event Code	Brief Description	Event Type	Default Alarm Property (ALM)	Default Log Property (LOG)
BTTMODE	BTT mode active	State	NONE*	NO*
CFGCHD	Configuration changed	State	NONE*	NO*
CFGRST	Configuration reset	ITH-Transient	NONALM*	YES
IMCCRST	IMC configuration reset	IMC/NIMC-Transient	NONALM*	YES*
IMCNCDN	No IMC rack communication downward	Subrack or IMC/NIMC-State	MINOR*	YES
IMCNCUP	No IMC rack communication upward	Subrack or IMC/NIMC-State	MINOR*	YES
IMCNVFL	IMC NVRAM failed	IMC/NIMC-State	MAJOR*	YES
IMCPRFL	IMC EEPROM failed	Subrack or IMC/NIMC-State	MAJOR*	YES
IMCRST	IMC beginning reset	IMC/NIMC-Transient	NONALM*	NO*
INDISQ	Input disqualified	INPUT-State	MINOR	YES
INEXPH	Input excessive phase hits	INPUT-State	NONE	NO
INMEAS	Input disqualified by measurements	INPUT-State	NONE	NO
INMSDLY	Waiting for measurements	INPUT-State	NONE	YES
INPAIS	Input AIS	INPUT-State	NONE	NO
INPLOS	Input loss of signal	INPUT-State	NONE	NO
INPOOF	Input loss of framing	INPUT-State	NONE	NO
INPRCDQ	Input PRC status disqualified	INPUT-State	NONE	NO

Summary Table of Events

Issue 1

Table A4-1. State Event Summary (Asterisk=not user configurable)(continued)

Event Code	Brief Description	Event Type	Default Alarm Property (ALM)	Default Log Property (LOG)
INPSSM	Input SSM changed	ITH-Transient	NONALM	NO
INPULL	Pull-in range exceeded	INPUT-State	NONE	NO
ITHACTV	ITH active	ITH-State	NONALM	YES
ITHCDIN	Other ITH card inserted	ITH-Transient	NONALM	YES
ITHCDRM	Other ITH card removed	ITH-Transient	NONE	YES
ITHDISA	ITH disagree on channel quality	ITH-State	NONALM	YES
ITHFAIL	ITH failed	ITH-State	FAIL	YES
ITHGONE	ITH missing	ITH-State	FAIL*	NO*
ITHHLTH	ITH marginal failure'	ITH-State	MINOR	YES
ITHNCDN	No ITH rack communication downward	ITH-State	MINOR	YES
ITHNCOM	ITH communications failed	ITH-State	NONALM	YES
ITHNCUP	No ITH rack communication upward	ITH-State	MINOR	YES
ITHNVFL	NVRAM failed	ITH-State	MAJOR	YES
ITHOFFL	ITH offline	ITH-State	MAJOR	YES
ITHPRFL	ITH EEPROM failed	ITH-State	MAJOR	YES
ITHWARM	ITH warm-up	ITH-State	FAIL	YES
LOGCLR	Event log cleared	ITH-Transient	NONE	YES
LSTCFG	Latest configuration change	IMC/NIMC-State	NONE*	NO*
MEASRNG	Measurement range exceeded	INPUT-State	NONALM	YES
MEASRP	Measurement reported beyond threshold	INPUT-State	NONALM	YES
MEASRST	Measurements restarted	ITH-Transient	NONE	YES
MODMONL	Modem online at remote port	IMC/NIMC-State	NONE*	NO*
MODMRDY	Modem ready at remote port	IMC/NIMC-State	NONE*	NO*

Summary Table of Events

Issue 1

Table A4-1. State Event Summary (Asterisk=not user configurable)(continued)

Event Code	Brief Description	Event Type	Default Alarm Property (ALM)	Default Log Property (LOG)
NETCLOS	Network connection closing	IMC/NIMC-Transient	NONALM*	NO*
NORESP	Complete response not received	State	NONE*	NO*
OPCDFL	Output card failed	OUTPUT-State	FAIL*	YES
OPCDIN	Output card inserted	OUTPUT-Transient	NONALM*	YES
OPCDMS	Output card type mismatch	OUTPUT-State	FAIL*	YES
OPCDNA	Output card not accessible	OUTPUT-State	FAIL*	YES
OPCDNP	Output card not present	OUTPUT-State	FAIL*	NO*
OPCDPMM	Output card protect mismatch	OUTPUT-State	NONALM	YES
RACKDUP	Duplicate rack number	SUBRACK or IMC/NIMC-State	MAJOR*	NO*
RACKOOR	Rack number out of range	SUBRACK or IMC/NIMC-State	MAJOR*	NO*
RCKALM [1-8]	Rack alarm 1-8	NIMC-State	MAJOR (1-7)* MINOR (8)*	NO*
SECACTV	Inferior ITH is active	ITH-State	MINOR	NO
SGLSWMM	Single/Double ITH switch mismatch	IMC/NIMC-State	MAJOR*	NO*
SNDRIFT	Drift exceeds limits	INPUT-State	NONALM	YES
SNFAIL	Sync failure	State	MAJOR or FAIL*	NO*
SNFREE	Freerun mode	ITH-State	MAJOR	YES
SNHAVL	Holdover available	ITH-State	NONALM	YES
SNHOLD	Holdover mode	INPUT-State	MAJOR	YES
SNOPER	Sync in normal operating mode	ITH-State	NONALM	YES
SNPWRA	Power supply A failed	Subrack or IMC/NIMC-State	MAJOR*	YES
SNPWRB	Power supply B failed	Subrack or IMC/NIMC-State	MAJOR*	YES
SNSAVL	SmartClock available	ITH-State	NONALM	YES
SNSCSUS	SmartClock suspended	ITH-State	MINOR	YES
SNSSM	SSM algorithm executed	ITH-Transient	NONALM	YES

Summary Table of Events

Issue 1

Table A4-1. State Event Summary (Asterisk=not user configurable)(continued)

Event Code	Brief Description	Event Type	Default Alarm Property (ALM)	Default Log Property (LOG)
SNTRCK	Tracking this input	INPUT-State	NONALM	YES
SRINVMM	Inventory mismatch	IMC/NIMC-State	MAJOR*	NO*
SWDL	Software download mode	State	NONE*	NO*
SWDLMMC	SWDL mismatch, IMC shows clear	IMC/NIMC-State	NONE*	NO*
SWDLMMS	SWDL mismatch, IMC shows set	IMC/NIMC-State	NONE*	NO*
TRAOOR	Traffic value invalid for card	OUTPUT-State	NONALM	YES
TRCBLOS	TRSC buffer input loss of signal	OUTPUT-State	NONALM	YES
TRCHSLP	TRSC input high slip	OUTPUT-State	NONALM	YES
TRCLOS	TRSC input loss of signal	OUTPUT-State	NONALM	YES
TRCOOF	TRSC input out of frame	OUTPUT-State	NONALM	YES
TRCSLIP	TRSC input slip	OUTPUT-Transient	NONALM	YES
UNKALM	Unidentified alarm detected	State	MINOR or MAJOR*	NO*
UNKSTAT	Expansion status unknown	IMC/NIMC-State	MAJOR*	NO*
XFER	Istate not identical	ITH-State	MINOR	NO

Event Descriptions

What follows is a listing of the events in alphabetical order along with a description, the typical cause(s), and a suggested response, where appropriate.

BTTMODE—Block text transfer mode active

Description

This *state* event is generated when the system goes into the block text transfer mode. This mode is used for downloading firmware to the IMC, NIMC, ITH, Expansion Communication, and Expansion Synchronization cards.

Typical Cause

The firmware download process has started but not yet finished.

Response

Wait for the download process to complete or send the CANC-BTT command to end the download process.

CFGCHD—Configuration changed

Description

The CFGCHD condition is unique to a particular communications port (local or remote). This *state* event indicates that there is a possibility that a change to a parameter of the SSU has occurred.

Here is the way it works: A flag is set to indicate the possibility of a change whenever there is a change initiated by some means other than the port (local or remote) being used to interrogate the condition. For example, the flag to indicate a configuration change is set if the other port issues a command changing the setup or if an existing parameter is reset as a result of the insertion of an ITH card with its switch set to force a return to default settings.

In the case where no new changes were made by reading the default ITH card settings, only a renewal of existing settings, the flag still gets set. In addition, the flag is set whenever the IMC is inserted into the subrack or power is initially applied. So this event should not be interpreted to mean that an actual change has occurred in every instance, but this event should be used as a signal to indicate that some change may have occurred.

Typical Cause

The following commands can cause this condition: ED-EQPT, ED-SYNC, SET-ATTR, SET-TH. This event is reported at the port (local or remote) not used to make the change. Actions such as inserting an ITH card or IMC can also generate this event.

Response

To clear the condition send the command: RTRV-COND:::SC1::CFGCHD; to the port reporting the condition.

CFGRST—Configuration reset***Description***

This *transient* event is reported when the ITH card configuration is reset to its default, or switch-defined values.

Typical Cause

Switch S5–7 on the ITH card has been set to Off and the card has been inserted into the subrack. This forces the ITH card to reset its configuration to that defined by the switch settings. These values are written into non-volatile memory of both ITH cards. For example, an input needs to be disabled using the card's switches. To force the ITH card to read its switch settings, remove the standby ITH card, make changes to the switches as needed, and set switch S5–7 to Off. Re-install the card. When the Diagnostics LED starts blinking, remove the card, set switch S5-7 back to On and re-install the card.

Response

Not applicable.

IMCCRST—IMC configuration reset***Description***

This *transient* event is reported whenever the Information Management Card is reset to its default, or switch-defined values.

Typical Cause

A change is made to the IMC settings. For example, a change needs to be made to the local port data rate. Set the data rate switches as needed and then set switch S4–2 to Off. Re-install the card. The switch settings will be read into non-volatile memory. After a short time, remove the card, set the switch S4–2 back to On, and re-install the card.

Response

Not applicable.

IMCNCNDN—No IMC rack communication downward***Description***

In a multiple-subrack system, the IMC communication link is a loop supporting communications in two directions: up and down. This *state* event indicates that the IMC or Expansion Comm card is not able to communicate in the downward direction.

Typical Cause

The Expansion Comm port connector is not properly connected to the last expansion subrack.

Response

Check the expansion comm port cabling from the right-side port. Re-route the cables to minimize cross-talk.

IMCNCUP—No IMC rack communication upward***Description***

In a multiple-subrack system, the IMC communication link is a loop supporting communications in two directions: up and down. This *state* event indicates that the IMC or Expansion Comm card is not able to communicate in the upward direction.

Typical Cause

The Expansion Comm port connector is not properly connected to the next subrack.

Response

Check the expansion comm port cabling from the left-side port. Re-route the cables to minimize cross-talk.

IMCNCVFL—IMC NVRAM failed***Description***

This *state* event is generated when there is a failure to access the non-volatile memory on the IMC/NIMC, or the contents of the non-volatile memory may have been corrupted.

Typical Cause

The NVRAM component has failed.

Response

Replace the NVRAM component or replace the card. If the failure occurs on the NIMC, the network parameters will need to be configured. See chapter E1.

IMCPRFL—IMC EEPROM failed***Description***

This *state* event indicates that a failure to access the EEPROMs has occurred, or the contents of the EEPROMs may have been corrupted.

Typical Cause

One of the EEPROMs has failed on the Information Management Card or Network IMC.

Response

Replace the EEPROMs or replace the entire card.

IMCRST—IMC beginning reset***Description***

This *transient* event indicates a change was made to the network address parameters of the Network IMC and that the card is being reinitialized.

Typical Cause

Any of the network parameters have been changed and copied to the working memory of the Network IMC.

Response

Not applicable.

INDISQ—Input disqualified***Description***

This *state* event indicates that a reference input has been disqualified for some reason by the ITH card.

Typical Cause

The input signal may no longer be present. The input signal format may be set incorrectly for the type of input signal at the input. The input signal may be in AIS. The input signal may be experiencing significant phase discontinuities.

Response

Set correct format for input signal, if there is disagreement. Check quality of input signal.

INEXPH—Input excessive phase hits***Description***

This *state* event indicates that phase hits have been detected on this input for a duration in excess of the set discontinuity time. Another possibility is that phase-hits of duration less than the discontinuity time have occurred on three or more separate occasions in the past 5 minutes.

Typical Cause

The input signal quality is degrading.

Response

The SSU should be configured to switch to a qualified input. Wait for the suspect input to requalify or begin investigation of signal.

INMEAS—Disqualified by measurements***Description***

This *state* event indicates that an input has been disqualified because a performance measurement threshold was exceeded. That particular measurement had been configured to disqualify the input if the threshold was crossed.

Typical Cause

A TDEV, MRTIE, LMRTIE, or FFOFF measurement had been configured to be used as input qualification criteria and the set threshold value was exceeded. Another possibility is that the threshold value was not set correctly.

Response

Investigate the quality of the input signal. Set the CRI parameter to N if you no longer want this measurement to be used as a qualification criteria.

INMSDLY—Waiting for measurements

Description

The SSU by default assumes that all measurement results are good until completed measurements indicate otherwise. If this behavior is not acceptable, there is a feature that can be used to delay qualification of input signals until measurements have had time to complete. This *state* event indicates that the wait for measurements to finish is active.

Typical Cause

This event only can occur if the MEASDLY keyword, which allows a qualification holdoff time to be specified, is set to a value greater than zero.

Response

The time value for MEASDLY should be set slightly greater than the amount of time required by the measurement(s) of interest. If the measurement results are good at the end of the time period, the signal will be qualified. If bad, the signal will continue to be disqualified until the measurements fall below the set thresholds.

When the MEASDLY keyword is set with a value greater than 0, the INMSDLY event is first set (and the MEASDLY timer is started) when the performance measurements are restarted due to one of the following conditions:

- Initial start-up of the ITH card.
- Input signal frequency is outside the measurement range.
- There are discontinuities on the input signal exceeding the DSCTIME value.
- The TL1 command used to restart performance measurements (INIT-REG-TSG) is executed with the DISQ parameter. The syntax is shown here: `INIT-REG::ITH-2:SC1::DISQ;`

Once the INMSDLY event is set, any restart of a measurement will reset the timer, requiring the full time set with MEASDLY to elapse before the event is cleared. If the value of MEASDLY is changed while INMSDLY is set, the new value will take effect immediately. However, if INMSDLY is not already set, increasing the value of MEASDLY will not cause the setting of INMSDLY, regardless of the time since the last measurement restart. Set MEASDLY to zero to disable the wait for measurements.

INPAIS—Input AIS***Description***

This *state* event indicates that an E1 input reference (2048 kbps) is AIS (unframed all ONES). This condition will cause the input signal to be disqualified for use as a reference.

Typical Cause

There has been an upstream equipment failure. Another possibility is that the incorrect format has been selected for the type of input signal. The signal format is set on the ITH cards with switch settings, TL1 commands, or the local and remote management applications.

Response

Investigate quality of input signal. If the signal is correct, change the format expected by the SSU at that input.

INPLOS—Input loss of signal***Description***

This *state* event indicates that the amplitude of an input signal has dropped below the minimum required level.

Typical Cause

There has been an upstream equipment failure. Another possibility is that an input signal is not connected to the SSU at the identified input port.

Response

Disable the input port if it is not being used.

INPOOF—Input loss of framing***Description***

This *state* event indicates that an out-of-frame error has occurred on an E1 input.

Typical Cause

This could indicate a condition such as missing framing bits or that CRC-4 is not being received correctly. Another possibility is that the SSU input format is not configured correctly for the type of input signal.

Response

Check the ITH card configuration settings for CRC-4 (Y or N) and the input signal mode (CAS or CCS).

INPRCDQ—Input PRC status disqualified***Description***

This *state* event occurs when the PRC status input signal being monitored by the SSU has changed state to indicate that the PRC input signal should not be used as a reference.

Typical Cause

The upstream PRC (Cesium or GPS) is experiencing trouble.

Response

Investigate the upstream PRC.

INPSSM—Input SSM changed***Description***

This *transient* event indicates that the SSM value of this particular input has changed. This is only applicable to E1 inputs where the Read SSM feature has been enabled.

Typical Cause

The SSM quality level indicated by upstream equipment has changed.

Response

If it is no longer necessary to read the SSM value from the incoming signal, set the TL1 keyword SSMENB=N.

INPULL—Pull-in range exceeded***Description***

This *state* event indicates that an input frequency has drifted in excess of the Pull-In Range threshold.

Typical Cause

The input signal quality has degraded. Another possibility is that the pull-in range was set too low for the type of input signal.

Response

Begin by setting the pull-in range (PIRANGE) to the default value for the type of oscillator contained on the ITH cards. The default value for quartz oscillators is 4600 ppb and for rubidium is 16 ppb.

ITHACTV—ITH active***Description***

This *state* event indicates that the specified ITH card is now the synchronization source for all output cards.

Typical Cause

The ITH card has come out of the warm-up state or a switch to a different ITH card has occurred.

Response

This is a normal event indicating which one of the ITH cards is active.

ITHCDIN—Other ITH card inserted***Description***

This *transient* event indicates that another ITH card has been inserted.

Typical Cause

The event is reported by the ITH card that is already inserted and operating when a second ITH card is inserted.

Response

This is a normal event.

ITHCDRM—Other ITH card removed***Description***

This *transient* event indicates that one of the ITH cards was removed. It is reported by the remaining ITH card.

Typical Cause

An ITH card has been removed. Other possibilities include a hardware failure or a firmware error on the ITH card.

Response

Replace the ITH card.

ITHDISA—ITH disagree on channel quality

Description

During normal operation the standby ITH card sends its measurement results of each input's performance behavior and other criteria (LOS, AIS, etc.) to the active ITH for comparison. If there is a significant difference between the results for a sufficient period of time (usually this is triple the amount of time required for the questionable measurement), the active ITH card will generate this *state* event that has a default alarm condition of MAJOR. The channel number of the questionable input will be reported. The input signal will be disqualified by the ITH card that has concluded there is a problem.

Typical Cause

The ITH cards report different quality levels for the same reference input. Possible causes of measurement disagreement:

1. There is a hardware problem with one ITH card.
2. A square wave signal (kHz) is connected to an ITH card input configured as E1 (kbps).
3. An input signal has a measured parameter that is very close to the limit of acceptability, possibly because the input signal is noisy or low amplitude.

Response

Increase the performance measurement thresholds, set the correct input signal format, verify input signal quality, or replace the ITH card.

ITHFAIL—ITH failed

Description

This *state* event indicates that the identified ITH card has failed. The card will take itself out of service and generate this event.

Typical Cause

The ITH card has failed.

Response

Replace the ITH card.

ITHGONE—ITH missing***Description***

This *state* event indicates that one of the ITH or Expansion Sync cards has been removed or cannot be detected by the IMC or Expansion Comm cards. The default alarm level is FAIL.

Typical Cause

An ITH or Expansion Sync card has been removed. Other possibilities are that an ITH card has re-started after a firmware error or a hardware failure has occurred on the ITH or Expansion Sync card.

Response

Re-insert the card that has been removed or replace the ITH or Expansion Sync card.

ITHHLTH—ITH marginal failure***Description***

This *state* event is generated if one of the monitored functions on the card is close to failing.

Typical Cause

It can be caused when a “jittering” power supply voltage is detected. This condition can sometimes occur shortly after power is restored to the card. This event can also occur before an ITHFAIL event or when the oscillator type switch settings do not agree with the actual oscillator contained on the ITH card.

Response

Wait for the ITH card to warm up or verify the oscillator type switch settings (switch S6 on the ITH card).

ITHNCDN—No ITH rack communication downward***Description***

In a multiple-subrack system, the ITH communication link is a loop supporting communications in two directions: up and down. This *state* event indicates that an ITH or Expansion Sync card is not able to communicate with the Expansion Sync card in the downward direction.

Typical Cause

The Expansion Comm port connector is not properly connected to the previous subrack.

Response

Check the expansion comm port cabling from the right-side port. Re-route the cables to minimize cross-talk.

ITHNCOM—ITH communications failed***Description***

This *state* event indicates that there is a problem with communication between the ITH cards.

Typical Cause

The ITH card has failed. Another possibility is a failure of the backplane.

Response

Use the **RTRV-NETTYPE-ALL:::SC1;** command to identify the communications problem.

ITHNCUP—No ITH rack communication upward***Description***

In a multiple-subrack system, the ITH communication link is a loop supporting communications in two directions: up and down. This *state* event indicates that the ITH or Expansion Sync is not able to communicate in the upward direction.

Typical Cause

The Expansion Comm port connector is not properly connected to the next subrack.

Response

Check the expansion comm port cabling from the left-side port. Re-route the cables to minimize cross-talk.

ITHNVFL—NVRAM failed***Description***

This *state* event is generated when there is a failure to access the non-volatile memory on one of the ITH cards, or the contents of the non-volatile memory may have been corrupted.

Typical Cause

The NVRAM component has failed. Another possibility is that the ITH card was not removed for a short time and then reinserted as instructed in the procedure to upgrade the firmware EEPROMs.

Response

If this event occurred during a firmware upgrade installation, remove and then reinsert the ITH card. Otherwise, replace the NVRAM component or replace the ITH card.

ITHOFFL—ITH Offline

Description

ITH offline is a *state* event with an alarm severity of MAJOR. It usually indicates some kind of problem with one of the ITH cards (or Expansion Sync cards) short of total failure.

Typical Cause

Reasons for one of the ITH cards to go offline include:

- ITH cannot synchronize with other ITH card
- Main rack ITH card is in warm-up mode
- ITH output signal is out of specification
- ITH cannot communicate with other ITH card

In these cases, the standby ITH card will be taken offline temporarily but will be available should the other ITH card fail.

Response

Ways to resolve this problem include the following:

- Replace the suspect ITH card and wait 20 minutes for the warm-up cycle to complete.
- Attempt to reset the card by sending commands to put the offline card into Download mode and then cancel the Download mode.

Assuming that ITH 2 is the offline card send the following TL1 commands:

```
ACT-SWDL: : ITH2 : SC1 ;
```

```
CANC-SWDL: : ITH2 : SC1 ;
```

NOTE

Loss of service may result if the Force Active button is pressed on an Offline ITH card.

ITHPRFL—ITH EEPROM failed

Description

This *state* event indicates that a failure to access the EEPROMs on the ITH card has occurred, or the contents of the EEPROMs may have been corrupted.

Typical Cause

One of the EEPROMs has failed.

Response

Replace the EEPROMs or replace the ITH card.

ITHWARM—I TH Warmup***Description***

This *state* event indicates that the oscillator in the ITH card is warming to operating temperature. The card is not yet ready to go into the active or standby mode. No TL1 commands will be accepted in this warm-up mode which may last up to 20 minutes.

Typical Cause

The ITH card was just installed.

Response

Wait until ITH card comes out of warm-up mode.

LOGCLRD—Event log cleared***Description***

This *transient* event is generated when the event log is cleared via a TL1 command to the SSU.

Typical Cause

The event log stored in the ITH card has been cleared.

Response

Normal event.

LSTCFG—Latest configuration change***Description***

This *state* event is reported to provide information such as the date and time when the last configuration change was made to the SSU.

Typical Cause

The execution of any command that may change the configuration, from either communication port, will update this time, regardless of whether a configuration change actually occurred. It may be that a command was sent that only reset an existing condition.

In addition, the resetting of the entire configuration, as would occur with a Configuration Reset or an IMC Configuration Reset, will be recorded as a latest configuration change.

Response

This event is only reported by the RTRV-COND-TSG command and is not automatically reported when the configuration changes. It can be retrieved either by the generic RTRV-COND-TSG command or by using the same command to specifically request this condition.

MEASRNG—Measurement range exceeded***Description***

The internal measurements use fixed-point math for rapid calculations. As a result, they have a limited range of operation before an overflow condition occurs. To ensure the measurements operate properly, a range-limiting function is employed when the input signal is 8 ppm above the local oscillator's nominal frequency. When the input goes outside this range, the measurements are stopped and this *state* event is generated. When the input returns to an acceptable value, the measurements are restarted and the event is cleared.

Typical Cause

The input signal frequency has drifted beyond the measurement range of the ITH card. The input signal is weak or noisy.

Response

Investigate upstream signal quality. Increase input signal strength, if possible.

MEASRP—Measurement reported beyond threshold***Description***

This *state* event is generated when a performance measurement crosses its threshold. The event report contains the specific measurement threshold that was crossed. This event does not imply disqualification of the input. Notice of disqualification is accomplished with the INMEAS event.

Typical Cause

Performance measurements on an input signal exceeded the defined measurement threshold value.

Response

Investigate upstream signal quality or modify the measurement threshold setting.

MEASRST—Measurements restarted***Description***

This *transient* event is generated when the performance measurements for the specified channel have restarted.

Typical Cause

The INIT-REG command was sent or an input signal discontinuity was detected.

Response

Unless the INIT-REG command was sent, investigate the upstream signal quality.

MODMONL—Modem online at remote port***Description***

This *state* event indicates the modem connected to the remote port of the SSU has established communication with a remote modem.

Typical Cause

A normal event when a modem connection is being established.

Response

Normal event.

MODMRDY—Modem ready at remote port***Description***

This *state* event indicates that the modem connected to the remote port of the SSU has been initialized and is ready to receive an incoming call.

Typical Cause

A normal event when a modem is being initialized.

Response

Normal event.

NETCLOS—Network connection closing***Description***

This *transient* event indicates that a change was made to the network parameters of the Network IMC and that the NIMC is closing the network connection. It is then necessary for the user to re-establish a network connection for communication to continue.

Typical Cause

The NIMC working memory parameters have been changed and the NIMC must reboot.

Response

Wait for the connection to close and then re-establish the network connection.

NORESP—Complete response not received***Description***

The *state* event indicates that a card in the system fails to respond to a request from the IMC to report its conditions and alarms.

Typical Cause

A hardware failure on the suspect card or the backplane could have occurred. This event can only be generated in response to a RTRV-ALM-TSG or RTRV-COND-TSG command. When this condition is reported, the IMC card will only be able to report (using the UNKALM event) the alarms that the non-responsive card is indicating on the backplane alarm lines but will not be able to report any details of these alarms.

Response

If this condition does occur, it is recommended that the RTRV-COND command be sent again because the reporting failure could have been the result of too much traffic on the communication loop. If the condition persists, replace the suspect card.

OPCDFL—Output card failed***Description***

This *state* event indicates that the output card has failed.

Typical Cause

The output card has suffered an out of lock condition or output loss. Another possibility is that the ITH card has a hardware failure.

Response

If only one output card has this failure, replace that output card. If multiple output cards have this failure, replace the ITH card.

OPCDIN—Output card inserted***Description***

This *transient* event indicates that an output card has been inserted into the identified location in the subrack.

Typical Cause

Normal event.

Response

Normal event

OPCDMS—Output card type mismatch***Description***

This *state* event occurs if two cards in a protected pair are not the same type.

Typical Cause

This event can occur if the pair of cards are different types, or for some cards, if the switch settings do not match. This event will only be generated if the two cards have had their protect switches set to the protected pair mode.

Response

Remove one of the output cards that don't match. For cards of the same type, verify that the switches are set identically on both cards in a protected pair.

OPCDNA—Output card not accessible***Description***

This *state* event is generated when the ITH cards cannot communicate with the specified output card.

Typical Cause

The output card did not initialize properly or has suffered a hardware failure.

Response

Remove and re-insert the output card or replace the output card.

OPCDNP—Output card not present***Description***

This *state* event indicates that one of the output cards previously detected has been removed or that only one card of a protected pair is present.

Typical Cause

An output card is removed or a protection switch is set incorrectly.

Response

Install the missing output card. If an output card that was operating in a protected pair is now operating as an unprotected card, set the protection switch to stand-alone operation. If it is necessary to remove a protected card, or a pair of cards, for an extended period of time, the TL1 command, RMV-EQPT, can be used to remove the card(s) from the internal inventory of the expected cards. When the cards are later reinserted, they will be added back to the equipment inventory.

OPCDPMM—Output card protect mismatch***Description***

This *state* event indicates that there is a setting mismatch of the protection switches on two output cards that have been installed as a protected pair.

Typical Cause

Protection switches not set correctly

Response

Check protection switch setting on each output card.

RACKDUP—Duplicate rack number

Description

This *state* event occurs in a multiple-subrack system when two subracks have their backplane switch set to the same value. It is extremely important that each of the subracks have unique switch settings and that the master subrack always has its switch set to the “0” position. The expansion subracks can be set to “1”, “2”, “3”, or “4”. The backplane switch is located behind the INC/NIMC card.

Typical Cause

Backplane switches are not set correctly.

Response

Verify that the master subrack ID switch is set to “0”. Verify that each expansion subrack ID switch is set to “1”, “2”, “3”, or “4”. It is a good idea to maintain a record of the assigned subrack numbers and their location around the communications loop. This information can help diagnose a communications problem later.

RACKOOR—Rack number out of range

Description

This *state* event occurs when a subrack backplane switch has been set to a number outside of the established range. The only allowable setting for the master subrack is “0”. The expansion subracks can be set to “1”, “2”, “3”, or “4”. The backplane switch is located behind the IMC/NIMC card.

Typical Cause

The rack ID switch has been set to an invalid number. The master subrack ID switch is not set to “0”. An expansion subrack may have its ID switch set to a number greater than “4”.

Response

Verify that all ID switch settings are correctly set.

RCKALM [1-8]—Rack alarms

Description

The Network IMC card has a front-panel connector that can accept up to eight different alarm events from devices external to the 55400A. This is a way to use the NIMC to communicate external alarms to a management system through the 55400A.

For example, one of inputs might be connected to an alarm line from an external GPS receiver, thereby causing the SSU to report an alarm when one occurs in that unit. Rack alarms 1-4 have been assigned specific messages, while alarms 5-8 provide a more generic message. Rack alarms 1 through 7 are assigned a major alarm level. Rack alarm 8 is a minor alarm. This is a *state* event.

(1) Ext. Rack Power Alarm

(2) Ext. Cesium 2 Alarm

(3) Ext. GPS Reports Critical Alarm

(4) Ext. GPS Reports Major Alarm

(5,6,7,8) Ext. Rack Alarm

Typical Cause

External equipment is generating the indicated rack alarm.

Response

Investigate external equipment generating the alarm.

SECACTV—Inferior ITH is active

Description

The use of ITH cards with oscillators of different quality levels is supported in the 55400A. This *state* event is generated when the ITH card designated as inferior takes over as the active ITH. (See also “Mixing Oscillator Types” in chapter D1.)

Typical Cause

This can only occur when two different types of ITH cards are used in the SSU. The ITH card designated as superior has failed or the Force Active push-button has been pressed to force a change to the inferior ITH card.

Response

Investigate why the switch took place. If defective, replace the superior ITH card with one of the same type. Use the Force Active push-button to switch back to the superior ITH card or send the command: **SW-DX-EQPT::ITH:SC1;**

SGLSWMM—Single/Double ITH switch mismatch***Description***

The use of only a single ITH card is supported in the 55400A. This *state* event indicates that the IMC/NIMC switch setting for number of ITH cards does not match the actual ITH configuration for the SSU.

Typical Cause

Either the switch is set for single ITH operation but two ITH cards are installed in the master subrack, or the switch is set for dual ITH operation but there is only a single ITH card in the master subrack.

Response

For an Information Management Card, Alarm Interface Card, or Expansion Communications Card, check Switch S6-1. For a Network IMC, check Switch S8-1. Set switch to Off if using a single ITH card and On if two ITH cards are installed.

SNDRIFT—Drift exceeds limits***Description***

This *state* event indicates that in the process of measuring the frequency of the input signal and comparing it to the LO, a discrepancy was detected. The event by itself does not disqualify an input signal, but does serve as an indication that a problem condition may be developing, based on what other events may occur. During the time that new drift measurements are made (drift measurements take from 24–72 hours) the operating performance of the LO is not being saved in the algorithm that is used to improve the holdover performance of the LO.

Typical Cause

This could indicate a drift problem with an input signal frequency or an ITH card oscillator.

Response

Investigate the upstream signal quality. Verify the oscillator type switch settings (switch S6 on the ITH card). Replace the ITH card if necessary.

SNFAIL—Sync failure***Description***

This *state* event is reported when the Information Management Card or the Network IMC receives a FAIL severity indication from the backplane or from an expansion subrack, without a message identifying the cause of the alarm. The IMC/NIMC will query the responsible card to try to learn the cause of the FAIL alarm. If this attempt is successful, the SNFAIL condition will be cleared.

Typical Cause

An example is an ITH card that fails in such a way that it is unable to report the cause of its failure, but it is able to signal an alarm over the backplane of the SSU subrack.

Response

Replace the failed card.

SNFREE—Freerun mode***Description***

This *state* event indicates that the ITH card is generating an output that is not referenced to any initial frequency. There are no qualified inputs, and holdover mode is not available.

Typical Cause

The ITH card has recently been powered on or there is an input configuration error that is preventing inputs from being qualified.

Response

Wait for an input to become qualified or if a problem with input configuration is suspected, verify the ITH card switch settings.

SNHAVL—Holdover available***Description***

This *state* event is reported when the ITH card has collected enough tracking data to be able to enter into holdover mode should all references become unavailable.

Typical Cause

This is a normal event after an ITH card has been powered on or after power has been interrupted.

Response

Normal event.

SNHOLD—Holdover mode***Description***

This *state* event is generated when the ITH card is in holdover mode.

Typical Cause

All inputs are disqualified or the ITH card is being forced to track a disqualified input.

Response

Investigate upstream input signals. If the Synchronization mode is set to Forced, try the Automatic mode. Verify that the ITH card input configuration settings are correct.

SNOPER—Sync in normal operating mode***Description***

This is a *state* event indicating that the specified time constant is being used by the ITH card to track the active reference.

Typical Cause

Normal event after the ITH card has been powered on.

Response

Normal event.

SNPWRA—Power supply A failed***Description***

This *state* event is generated when power supply A fails.

Typical Cause

The cable going to rack power connector 'A' has been disconnected, or the voltage is out of the –36 to –57 Vdc range.

Response

Verify that the power cable is properly connected, and verify the rack power supply voltage is between –36 to –57 Vdc.

SNPW RB—Power supply B failed***Description***

This *state* event is generated when power supply B fails.

Typical Cause

The cable going to rack power connector 'B' has been disconnected, or the voltage is out of the –36 to –57 Vdc range.

Response

Verify that the power cable is properly connected, and verify the rack power supply voltage is between –36 to –57 Vdc.

SNSAVL—SmartClock available***Description***

This *state* event is specific to systems that contain Stratum 2 level ITH cards. It is generated when the Stratum 2 ITH cards are prepared to use SmartClock in holdover mode.

Typical Cause

The ITH card has been operating for at least 32 hours continuously.

Response

Normal event.

SNSCSUS—SmartClock suspended***Description***

This *state* event is generated to report that while in holdover mode, the LO has fallen outside the pull-in range, and the SmartClock algorithm is no longer steering the oscillator.

Typical Cause

Due to excessive oscillator drift or excessive time in holdover mode, the oscillator frequency has moved outside the pull-in range.

Response

End holdover mode by configuring the SSU to qualify an input signal.

SNSSM—SSM algorithm executed***Description***

This is a *transient* event to indicate that as a result of a change somewhere, the SSM selection algorithm was initiated. The Synchronization mode must be set to SSM in order for the SSM algorithm to operate.

Typical Cause

Most often this indicates an input signal has been qualified or disqualified. Another cause could be an SSM level change on one of the inputs.

Response

This is a normal event if the SSM enable feature is being used.

SNTRCK—Tracking this input

Description

This *state* event is generated when the system begins tracking an input. Tracking requires at least 192 seconds of data collection from the input signal. Once the tracking requirement is satisfied, the input signal is declared qualified and ready for use as a reference input.

Typical Cause

This is a normal event after an input has been qualified and selected for use as a reference.

Response

Normal event.

SRINVMM—Inventory mismatch

Description

The IMC or NIMC and each ITH card in the master subrack maintain an inventory of the cards in the master subrack and any expansion subracks. These separate inventories should agree. This *state* event is reported if these inventories do not agree.

Typical Cause

Usually this event is the result of adding or removing an expansion subrack, although it can indicate a more serious failure of card-to-card or rack-to-rack communications.

Response

Ensure that the condition clears once the subrack communication has been re-established by connecting the Expansion Comm Port cables between the master subrack and any expansion subracks.

SWDL—Software download mode***Description***

This *state* event indicates that the download mode has been activated. Activities that are not associated with a firmware download are inhibited.

Typical Cause

One of the ITH, IMC/NIMC, Expansion Comm, or Expansion Sync cards has entered the software download mode.

Response

This is a normal event during firmware upgrades.

SWDLMMC—SWDL mismatch, IMC shows clear***Description***

This *state* event is generated by the IMC/NIMC when a card reports it is in the download mode, but the IMC was not aware of this condition.

Typical Cause

This event will be generated by the IMC/NIMC if it is removed and re-inserted while another card is in download mode.

Response

To correct this mismatch, execute the CANC-SWDL command and then send the command to activate the download mode for the desired card (ACT-SWDL). (Error messages may be received when the command is executed.)

SWDLMMS—SWDL mismatch, IMC shows set***Description***

This *state* event is generated by the IMC/NIMC when it believes a card is in the download mode, but that card does not report that it is in the download mode.

Typical Cause

This event will be generated by the IMC/NIMC if a card is removed and re-inserted while it is in download mode.

Response

To correct this mismatch, send the command to activate the download mode for the desired card (ACT-SWDL). (Error messages may be received when the command is executed.) If it is not longer desired that the card be in download mode, send the command to cancel the download mode for the card.

TRAOOR—Traffic value invalid for card***Description***

This *state* event indicates that the traffic value specified for the subrack slot could not be supported by the output card currently installed in that slot.

Typical Cause

Since it is the slot of the subrack that is configured with a traffic value, replacing output cards that support a traffic pattern with those of a different type could cause a TRAOOR event where none was occurring before. The 55481A output card only supports a traffic patten of 255.

Response

Set the traffic pattern to 255 or replace an 55481A card with an 55481B.

TRCBLOS—TRSC buffer input loss of signal***Description***

This *state* event, generated by the Traffic Re-synchronization Card, indicates the input signal to the buffered channel has been lost or severely attenuated. The buffered output signal will go to AIS or squelch, depending on the board's switch setting.

Typical Cause

An enabled buffer input may have no signal connected. Or an input signal may have been lost.

Response

Investigate the upstream input signal. Disable unused buffer channels.

TRCHSLP—TRSC input high slip***Description***

This *state* event, generated by the Traffic Re-synchronization Card, indicates multiple slips are occurring at a rate greater than, or equal to, the HSLIMIT threshold value.

Typical Cause

The input signal frequency is drifting.

Response

Investigate upstream equipment.

TRCLOS—TRSC input loss of signal***Description***

This *state* event, generated by the Traffic Re-synchronization Card, indicates the input signal to the re-timed channel has been lost or severely attenuated. The output signal will squelch or transmit AIS, depending on the board's switch setting.

Typical Cause

An enabled re-timed input may have no signal connected. Or an input signal may have been lost.

Response

Investigate the upstream input signal. Disable unused re-timed channels.

TRCOOF—TRSC input out of frame***Description***

This *state* event, generated by the Traffic Re-synchronization Card, indicates a frame loss at the input has occurred.

Typical Cause

The signal has framing errors or there is a mismatch between the board's switch settings for the channel and the input signal type.

Response

Investigate upstream equipment or verify correct TRSC switch settings.

TRCSLIP—TRSC input slip***Description***

This *transient* event, generated by the Traffic Re-synchronization Card, indicates a frame has been repeated or lost on the output of this re-timed channel. A slip event will also occur if a repeated frame is input to the channel.

Typical Cause

Input signal frequency is drifting.

Response

Investigate upstream equipment.

UNKALM—Unidentified alarm detected***Description***

This *state* event indicates that an alarm signal has been received over the backplane, or from an expansion subrack, but that the IMC/NIMC card has not received a message identifying the cause of the alarm.

Typical Cause

A card has failed but has not reported the failure to the IMC/NIMC.

Response

Replace the failed card. Note that a FAIL indication received under these same conditions will generate a SNFAIL alarm, instead of an UNKALM. The severity will be either MAJOR or FAIL, depending on whether a backup card is available.

UNKSTAT—Expansion status unknown***Description***

The Expansion Comm card periodically reports the status of the expansion subrack to the master subrack. This *state* event indicates that the master subrack is not receiving these reports. When a report is received, this event will be cleared.

Typical Cause

A subrack-to-subrack communication problem may exist. Another possibility is that a card has failed but not reported the failure to the master subrack IMC/NIMC.

Response

Check the expansion subrack communication port cables. Check the expansion subrack signal cables. Replace the failed card.

XFER—Istate not identical***Description***

The two ITH cards in an SSU must operate with the same settings (for example, inputs, formats, etc.). When a new ITH card is inserted, the two cards negotiate over which will send the instrument state to the other. Until the state has been transferred, the two cards could operate differently depending on which card is active.

This *state* event is raised during the transfer. For ITH cards with the same firmware revision, the transfer takes less than one minute. For mismatched ITH firmware revisions, it can take five to ten minutes.

Typical Cause

The settings in the two ITH cards are not identical when an ITH card was inserted. The ITH card firmware was upgraded. The Istate switch on the ITH card is set to Off (S5–7). This forces the card's settings to be copied to the other ITH card.

Response

Wait ten minutes for the settings to transfer. If the Diagnostics LED is flashing, remove card, set S5–7 to On and reinsert card.

Event Reporting

Events related to the input signals are normally only reported by the active ITH card. This is done to avoid having the two ITH cards send duplicate reports. Events related to operating conditions on an ITH card, which are unrelated to the input signals, are reported by an ITH card, regardless of whether the card is active.

NOTE

Any Minor alarm from an ITH card will be promoted to a major alarm after 24 hours.

EVENT REPORTS FROM THE STANDBY ITH CARD

ITH cards normally operate in a redundant pair configuration. Although both ITH cards independently monitor the input references for correct behavior and report any problems to the IMC/NIMC card, typically only the events reported by the active ITH card are passed to the TL1 interface.

The suppressing of events from the standby ITH card reduces traffic over the TL1 interface, but it may lead to behavior that can appear confusing. For example, if the active ITH-1 card were to disqualify the signal at Input 1, the message access identifier would indicate ITH1-1 as the source of the event. Later, if the other ITH card became active and that card were able to qualify the Input 1 signal, that event would generate a message showing the clearing of the alarm with an access identifier of ITH2-1. So ITH-2 will show the clearing of an alarm that was originally set by the other ITH card.

Ways to view events from the standby ITH card:

- Use the RTRV-COND or RTRV-ALM TL1 command with the standby card access identifier (either ITH1 or ITH2), and all standing events from that card will be retrieved.
- Set the TL1 keyword, RPTALL, to YES. The setting and clearing of events for both ITH cards will be reported. The use of the RTRV-COND and RTRV-ALM commands will retrieve all events reported by both ITH cards.

RPTALL Keyword

This keyword controls access to the event reporting by the ITH cards.

Keyword Syntax

To set a value:

```
ED-EQPT:::<ctag>:::RPTALL=<value>;
```

To retrieve set value:

```
RTRV-EQPT:::<ctag>:::PARAMETER=RPTALL;
```

Values

Y (Yes) = Report events from both ITH cards. There is no filtering of events from the standby ITH card. For example, the loss of an input signal will be reported twice, once from each ITH card.

N (No) = Report events only from the active ITH card. There will be no redundant reports from the standby ITH card, except as noted below. This is the default value.

NOTE

This keyword has no effect on the event log maintained by each of the ITH cards. Those logs will store all events for which the Log property is set to Yes. The RTRV-LOG command may specify which log is to be retrieved, or if none is specified, the log from the active ITH card will be retrieved. This keyword will affect what is saved in the Automatic Output log recorded on the IMC/NIMC card because this log stores all of the automatic messages sent to the TL1 interface (including events reported from the ITH cards).

Keyword Examples

To have events from both ITH cards reported:

```
RTRV-EQPT:::ABC001:::RPTALL=Y;
```

To retrieve the setting for the RPTALL keyword:

```
RTRV-EQPT:::ABC001:::PARAMETER=RPTALL;
```

NOTE

In firmware revision R3833 and later, input-related events will be reported from an inactive ITH card if the severity of the alarm (MINOR, MAJOR, etc.) is higher than any alarm currently being reported by the active ITH card

NOTE

In firmware revision R3833 and later, input-related alarms from the inactive ITH card will be reported (regardless of the setting of the RPTALL keyword) if RPTALL is included in the RTRV command, as follows:

```
RTRV-COND:::ABC001::RPTALL;  
RTRV-ALM:::ABC001::RPTALL;
```

A5

Local/Remote Management

Sync system communication capabilities

In This Chapter

The hardware and software elements of the Symmetricom Sync System have already been described in chapter A1, “System Overview.” This chapter describes all the ways we have of communicating with the equipment in order to install, configure, monitor operation, and troubleshoot problems. You will find that certain combinations of hardware and software provide very powerful capabilities including the ability to combine the synchronization elements into one large managed network.

This chapter describes:

- Ways to communicate with the 55400A SSU

NOTE

All communication capabilities for the SSU subrack are also supported for the 55400A mini-SSU subrack.

- Ways to communicate with the 55300A GPS primary reference source
- Ways to communicate with the 5071A primary frequency standard
- Details needed to configure and use these communication capabilities

55400A SSU

The 55400A SSU supports the communication alternatives described in the table below. Details of the connector types and cabling are covered later in this chapter.

Table A5-1. 55400A SSU Communication Summary

Port Connection	Purpose	Capabilities	Comments
Local Port on Information Management Card or Network IMC (RS-232/DCE)	For use by local crafts person when installing or monitoring SSU	Full TL1 control of SSU including: configuration, security management, performance monitoring, retrieval of alarm and event status information, fault diagnosis	55450A local craft terminal software (a Windows-based graphical user interface providing a point-and-click interface) replaces use of TL1 commands.
Remote Port on SSU connector panel. Requires Information Management Card (RS-232/DTE)	To communicate with SSU through a modem	Same as for the Local port	
LAN Port on the standard Network IMC (RJ-45, TCP/IP)	To communicate with SSU through a TCP/IP network	Full TL1 control. With 55451A or 55452A OSMF, an entire network of sync elements can be managed.	No Remote port operation supported
X.25 Port (uses Remote port). Requires Option 002 Network IMC	To communicate with SSU through an X.25 network	Same as for LAN port	No LAN port operation supported
TP4 Interface (uses LAN port). Requires Option 003 Network IMC (RJ-45)	To communicate with SSU through a TP4 network interface	Same as for LAN port	No Remote port operation supported

NOTE

The information in Table A5-1 also applies to the 55409A mini-SSU system.

Local Port Connection

(For installation and troubleshooting using 55450A local craft terminal software)

Setup

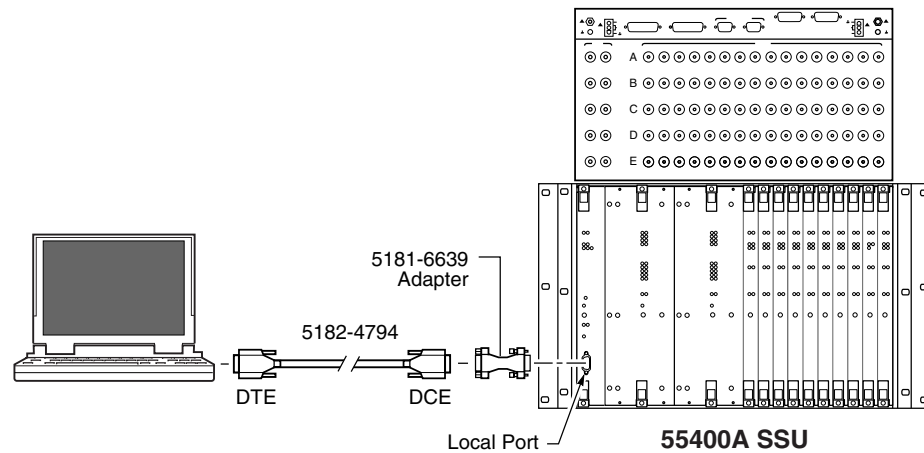


Figure A5-1. PC connection to 55400A local port

55400A Communication Card

- 55441A IMC or 55442A NIMC

Cable and Adapter

- RS-232 serial interface cable, 9-pin (female-female)
Available from Symmetricom as part number 5182-4794.

Used for connecting a computer to the 55400A.

- Adapter, 9-pin (male-male)
Available from Symmetricom as part number 5181-6639.

Used for adapting the interface cable to the 55400A Local Port.

NOTE

The Symmetricom cable and adapter used with the 55400A can be replaced by an RS-232 serial interface cable, 9-pin (male-female).

Configuration

Table A5-2. SSU Communication Settings

Computer Com Port	55400A (Communication Card)
Baud Rate = 9600	Baud Rate = 9600 (default)
Data Bits = 8	Local Port Echo = On (default)
Parity = None	
Stop Bits = 1	
Flow Control = None	Flow Control = None (default)

NOTE

The switch settings for the SSU communication card are documented in chapter D3.

Connection

55450A local craft terminal software

Only a limited description is provided here about how to install and run this software. A user's manual is supplied with the software and online help is included. Use that documentation if more information is required.

RUN the Setup file to install the local craft software.

START the program.

CONFIGURE the RS232 parameters from the Communication screen.

- Select RS-232
- Set the Port value as needed
- Set the Baud rate as needed

CONNECT to the SSU by selecting the Connect checkbox

If security is enabled for the SSU, a login window will appear and prompt you to enter the correct username and password.

Terminal Emulator and TL1 Command Set

If you are connecting to the SSU using a terminal emulator program, you will need to use TL1 commands. Refer to the *55400A SSU TL1 Programming Reference Manual* for more information on how to use TL1 commands.

Modem Connection

(For remote control using TL1 commands)

Setup

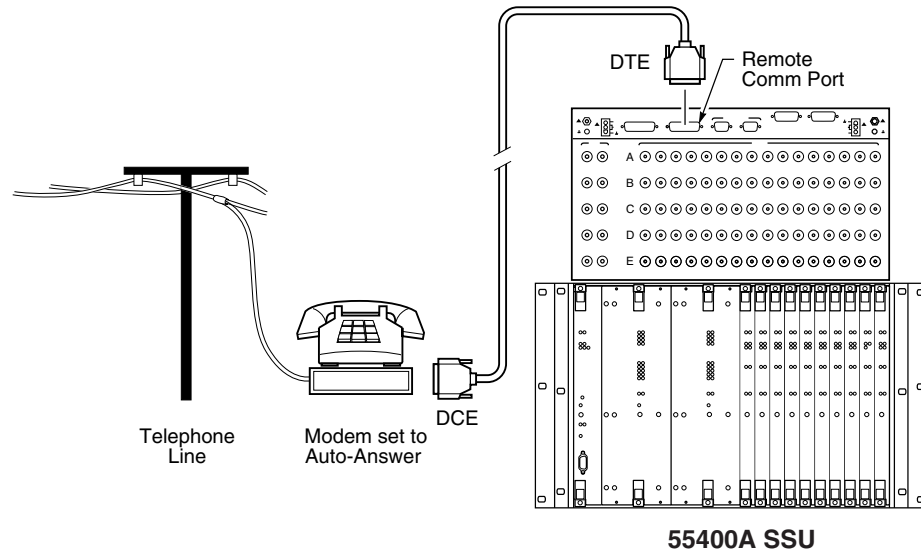


Figure A5-2. Modem connection to 55400A remote port

55400A Communication Card

- 55441A IMC

Modem

- (2) Multitech Systems MT2834ZDX "MultiModemZDX"

Cables

- Serial cable to connect from PC serial port to modem, 9-pin female to 25-pin male
- Serial cable to connect from SSU remote port to modem, 25-pin male to 25-pin male
- (2) Telephone cables to connect from modems to wall jack

Configuration/Connection

Refer to chapter 9 in the *55400A SSU TL1 Programming Reference Manual* for more information on how to configure the SSU using modems.

LAN Interface Connection

(For remote management using OSMF management software)

Setup

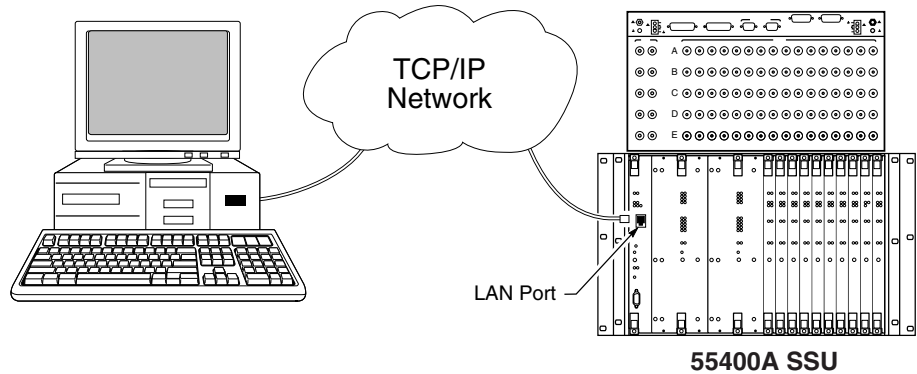


Figure A5-3. Network connection to 55400A LAN port

55400A Communication Card

- 55442A Network Information Management Card

Cable

- 10Base-T cable with 8-pin modular RJ-45 connectors

Configuration/Connection

Refer to chapter 10 in the *55400A TL1 Programming Reference Manual* for more information on how to configure the SSU using a LAN interface.

X.25 Interface Connection

(For remote management using OSMF management software)

Setup

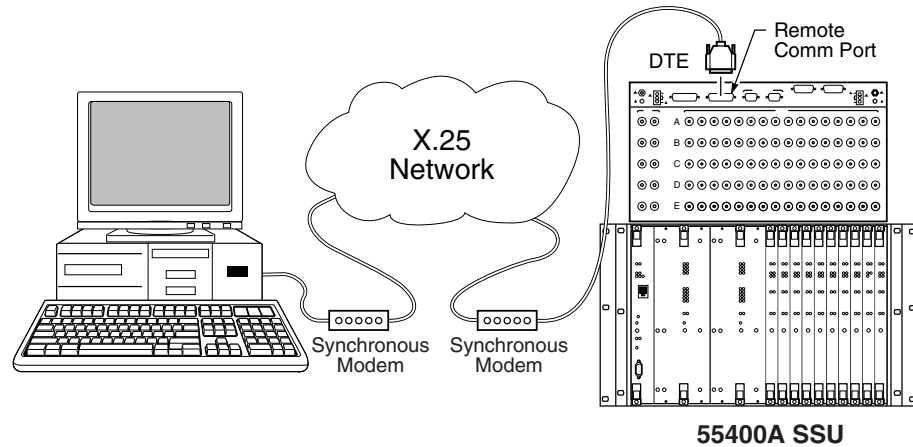


Figure A5-4. X.25 network connection to 55400A remote port

55400A Communication Card

- 55442A Option 002 Network Information Management Card

Cable

- Straight-through modem cable (25-pin D-type connectors)

Configuration/Connection

Refer to chapter 10 in the *55400A TL1 Programming Reference Manual* for more information on how to configure the SSU using an X.25 network interface.

TP4 Interface Connection

(For remote management using OSMF management software)

Setup

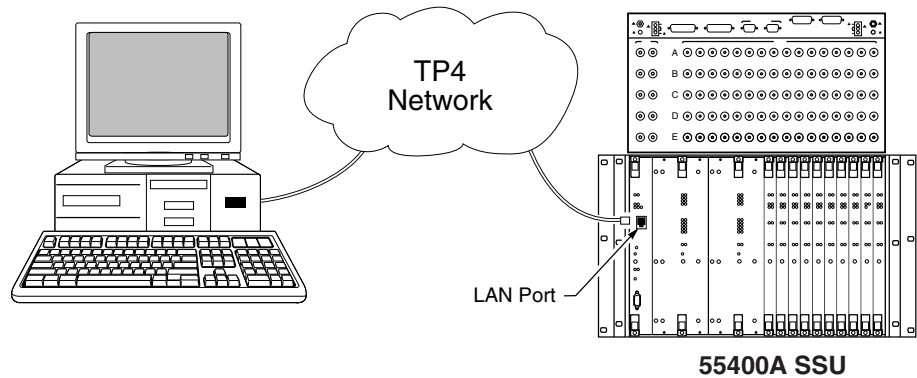


Figure A5-5. TP4 network connection to 55400A LAN port

55400A Communication Card

- 55442A Option 003 Network Information Management Card

Cable

- 10Base-T cable with 8-pin modular RJ-45 connectors

Configuration/Connection

Refer to chapter 10 in the *55400A TL1 Programming Reference Manual* for more information on how to configure the SSU using a TP4 network interface.

55300A GPS Reference Source

The 55300A GPS reference source supports the communication alternatives described in the table below. Details of the connector types and cabling used is presented in later chapters. For other information about this GPS unit, consult the documentation included with the equipment.

Table A5-3. 55300A GPS Communication Summary

Connection Port	Purpose	Capabilities	Comments
Port 1 on front panel (RS-232/DCE)	For use by local crafts person when installing or monitoring GPS unit	Full TL1 control of GPS unit including: configuration, security management, performance monitoring, retrieval of alarm and event status information, fault diagnosis	
Remote Access Port on recessed top panel (RS-232/DTE)	To communicate with SSU through a modem or a TCP/IP network connection	Full TL1 control. With 55451A or 55452A OSMF, the GPS reference source can be remotely managed	Network connection requires OSMF and a terminal server.
Time of Day port on recessed top panel (RS-232/DTE)	To provide network time protocol to a computer	Provides 1 PPS signal, time of day, and status information.	Use the SCPI instrument language or the SatStat application over this port. The SatStat application provides continuous updates of the GPS receiver status.

Port 1 Connection

(For installation and troubleshooting using TL1 commands)

Setup

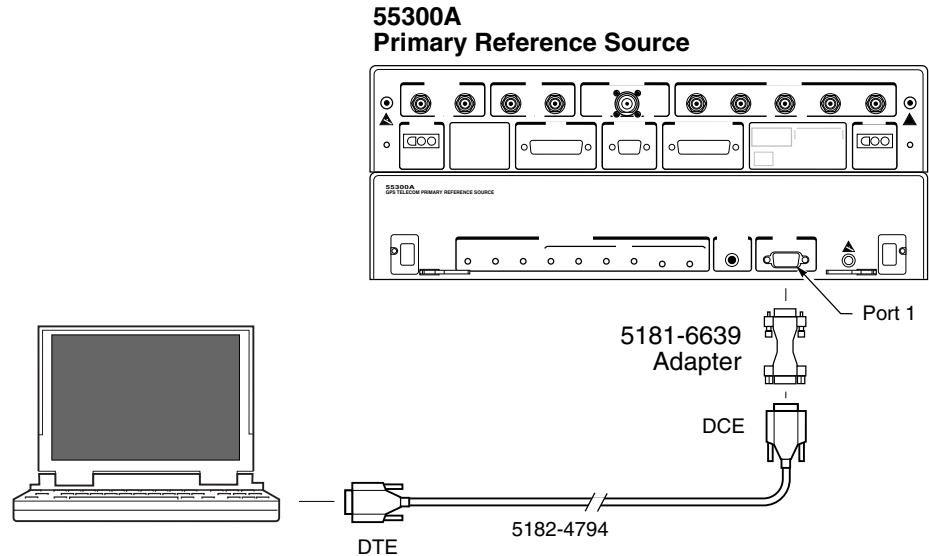


Figure A5-6. PC connection to 55300A port 1

Cable and Adapter

- RS-232 serial interface cable, 9-pin (female-female) (supplied with 55300A)

Used for connecting a computer to the 55300A.

- Adapter, 9-pin (male-male) (supplied with 55300A)

Used for adapting the interface cable to the 55300A Port 1.

NOTE

The Symmetricom cable and adapter used with the 55300A can be replaced by an RS-232 serial interface cable, 9-pin (male-female).

Configuration

Table A5-4. Communication Settings (55300A default values)

Computer Com Port	55300A (Port 1)
	Software Pacing = None
Baud Rate = 9600	Baud Rate = 9600
Data Bits = 8	Data Bits = 8
Parity = None	Parity = None
Stop Bits = 1	Stop Bits = 1
Flow Control = None	
	Full Duplex = On

NOTE

To change the Port 1 values, use 55300A ED-EQPT commands.

Connection

Terminal Emulator and TL1 Command Set

If you are connecting to the GPS using a terminal emulator program, you will need to use TL1 commands. Refer to the *55300A GPS Programming Guide* for more information on how to use TL1 commands.

Modem Connection

(For remote control using TL1 commands)

Setup

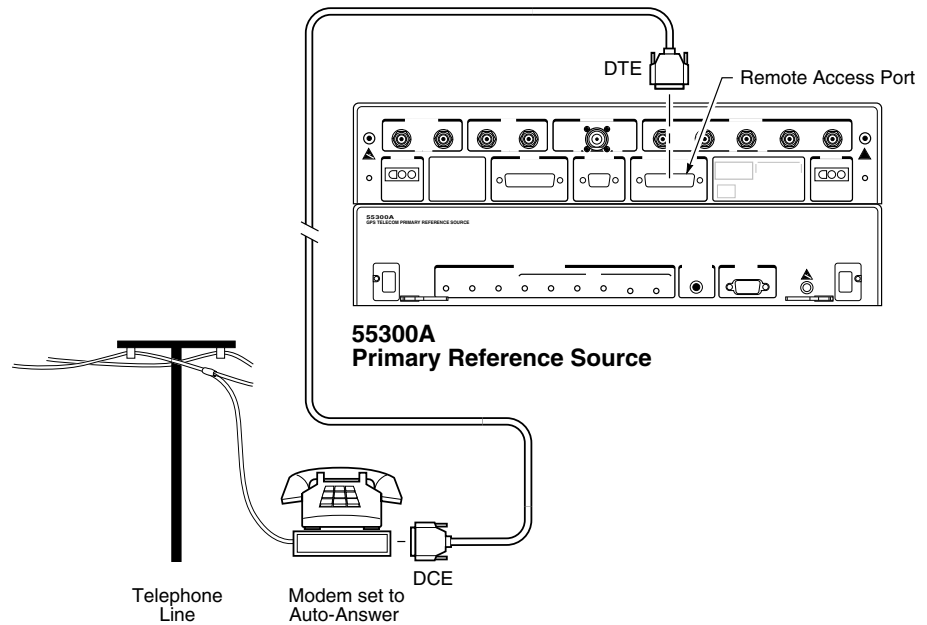


Figure A5-7. Modem connection to 55300A remote access port

Modem

- (2) Multitech Systems MT2834ZDX “MultiModemZDX”

Cables

- Serial cable to connect from PC serial port to modem, 9-pin female to 25-pin male
- Serial cable to connect from GPS remote access port to modem, 25-pin male to 25-pin male
- (2) Telephone cables to connect from modems to wall jack

Configuration

Table A5-5. Communication Settings (55300A default values)

Computer Com Port	55300A (Remote Access Port)
	Software Pacing = None
Baud Rate = 9600	Baud Rate = 9600
Data Bits = 8	Data Bits = 8
Parity = None	Parity = None
Stop Bits = 1	Stop Bits = 1
Flow Control = None	Hardware Flow = None
	Local Echo = Off

NOTE

To change the Remote Access Port values, use 55300A ED-EQPT commands.

Connection

Refer to chapter 3 in the *55300A GPS User's Guide* for more information on how to connect to the GPS using modems.

LAN Interface Connection

(For remote management using OSMF management software)

Setup

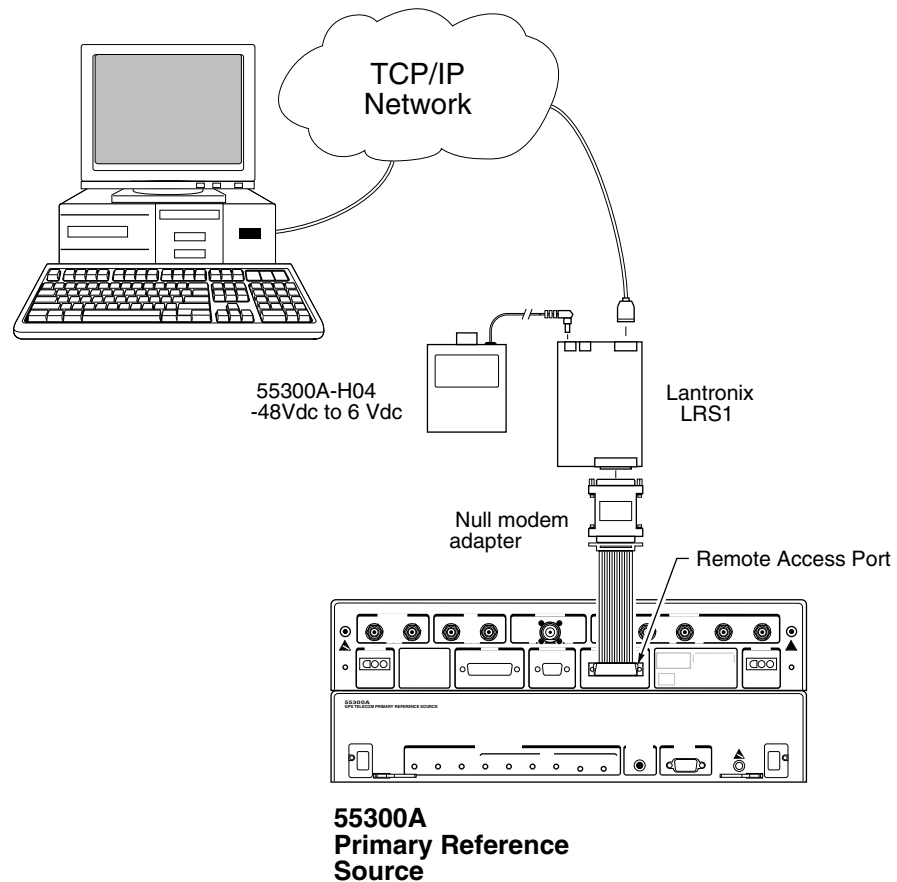


Figure A5-8. LAN connection to 55300A remote access port

Terminal Server

- Lantronix LRS1 Remote Access Server (part of 55300A option H04)

Cables

- DTE-to-DTE cable to connect from GPS remote access port to Lantronix LRS1. Use the supplied straight-through ribbon cable with the null modem adapter.
- 10Base-T cable with 8-pin modular RJ-45 connectors to connect from Lantronix LRS1 to the network.

Power Converter

- Symmetricom –48 Vdc to 6 Vdc converter. Supplies the voltage needed by the Lantronix LRS1 from the local –48 Vdc power source. (part of 55300A option H04)

Configuration**Table A5-6. Communication Settings (55300A default values)**

Computer Com Port	55300A (Remote Access Port)
	Software Pacing = None
Baud Rate = 9600	Baud Rate = 9600
Data Bits = 8	Data Bits = 8
Parity = None	Parity = None
Stop Bits = 1	Stop Bits = 1
Flow Control = None	Hardware Flow = None
	Local Echo = Off

NOTE

To change the Remote Access Port values, use 55300A ED-EQPT commands.

Connection

Refer to chapter 3 in the *55300A GPS User's Guide* for more information on how to make an RS-232 connection to the GPS reference source.

Time of Day Port Connection

(For installation and troubleshooting)

Setup

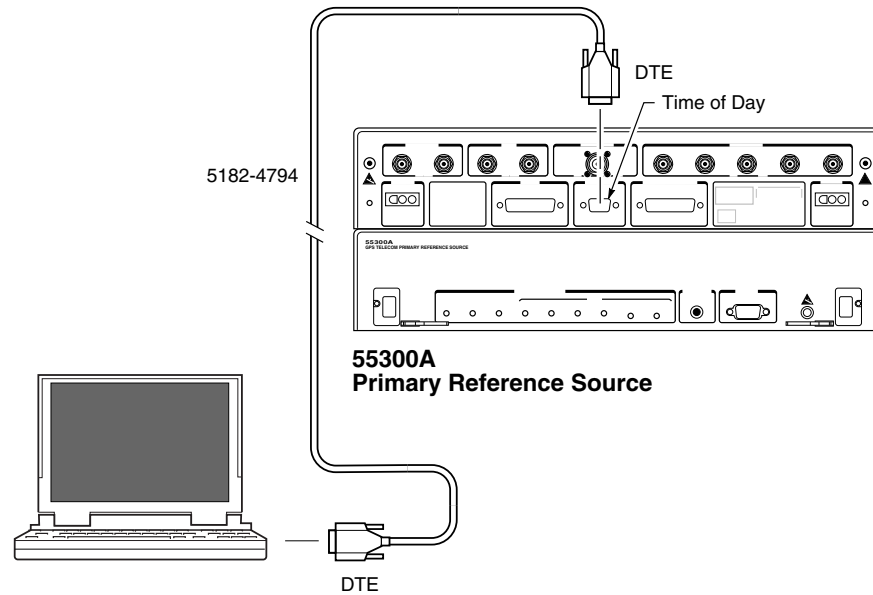


Figure A5-9. PC connection to 55300A time of day port

Cable and Adapter

- RS-232 serial interface cable, 9-pin (female-female)
Available from Symmetricom as part number 5182-4794.

Used for connecting a computer to the 55400A.

- Adapter, 9-pin (male-male)
Available from Symmetricom as part number 5181-6639.

Used for adapting the interface cable to the 55400A Local Port.

NOTE

The Symmetricom cable and adapter used with the 55400A can be replaced by an RS-232 serial interface cable, 9-pin (male-female).

Configuration

Table A5-7. Communication Settings (55300A default values)

Computer Com Port	55300A (Time of Day Port)
	Software Pacing = None
Baud Rate = 9600	Baud Rate = 9600
Data Bits = 8	Data Bits = 8
Parity = None	Parity = None
Stop Bits = 1	Stop Bits = 1
Flow Control = None	
	Full Duplex = On

NOTE

To change the Time of Day port values, use 55300A SYST:COMM:SER commands.

Connection

SatStat software

Only a limited description is provided here about how to install and run this software. The 55300A User's Guide provides complete instructions on how to install and use this software application. Refer to that documentation if more information is needed.

RUN the Setup file to install the SatStat software.

START the program.

The software displays the status of the receiver, the number of satellites being tracked, and more.

SELECT **CommPort>Port Open**

This action will display the receiver status screen.

CONFIGURE the RS232 parameters if no connection to the 55300A is started. From the menu toolbar, select **CommPort>Settings**.

- Set the Port value as needed
- Set the Baud value as needed

5071A Frequency Standard

The 5071A frequency standard supports the communication alternatives described in the table below. Details of the connector types and cabling used is presented in later chapters. For other information about this frequency standard, consult the documentation included with the equipment.

Table A5-8. 5071A Communication Summary

Connection Port	Purpose	Capabilities	Comments
RS-232C serial port on rear panel (DTE)	For use by local crafts person when installing or monitoring frequency standard	Perform instrument setup, synchronization, adjusting epoch, and reporting operating parameters.	Uses SCPI instrument language.
	To communicate with frequency standard through a modem	Same as above	Same as above

Interface capabilities

The 5071A supports a more limited set of interface capabilities as compared to the SSU and GPS elements, but if there is a need to query the operating status or the 24-hour time, refer to *5071A Operating and Programming Manual*. This document describes how to use the serial port for connection to a printer, terminal, or modem.

B1

Tools and Equipment

Overview of installation needs

In This Chapter

This chapter describes the tools and equipment needed to install the following products:

- 55401D master subrack
- 55402D expansion subrack
- 55409A mini-SSU subrack
- 55300A GPS reference source
- 55320A rack mount shelf
- 5071A frequency standard

Use this chapter only as a guide. Installation information later in this manual includes more details about using the items described here.

55401D Master Subrack

Installation Accessories Kit

The supplied kit includes –48 Vdc locking power connectors, frame ground spade lug connector, rack mount flanges, EIA rack mounting screws with washers, and EIA rack mounting U-nuts.

Tools

- large Phillips or Pozidriv #2 screwdriver for rack mount screws
- 7 mm nut driver for frame ground stud on subrack front panel
- wire strippers for making power cables
- diagonal cutters for making power cables
- Molex Hand Crimping Tool 11-01-0084—crimping device for making power cables
- ESD wrist strap

Equipment

- multimeter for checking voltage levels and cables for opens/shorts
- oscilloscope for checking output signals
- laptop computer running Windows 95 or Windows NT
- 55450A local craft terminal software

55402D Expansion Subrack

Installation Accessories Kit

The supplied kit includes –48 Vdc locking power connectors, frame ground spade lug connector, rack mount flanges, EIA rack mounting screws with washers, and EIA rack mounting U-nuts.

Tools

- large Phillips or Pozidriv #2 screwdriver for rack mount screws
- 7 mm nut driver for frame ground stud on subrack front panel
- wire strippers for making power cables
- diagonal cutters for making power cables
- Molex Hand Crimping Tool 11-01-0084—crimping device for making power cables
- ESD wrist strap

Equipment

- multimeter for checking voltage levels and cables for opens/shorts
- oscilloscope for checking output signals
- laptop computer running Windows 95 or Windows NT
- 55450A local craft terminal software

55409A Mini-SSU Subrack

Installation Accessories Kit

The supplied kit includes –48 Vdc locking power connectors, frame ground spade lug connector, rack mount flanges, EIA rack mounting screws with washers, and EIA rack mounting U-nuts.

Tools

- large Phillips or Pozidriv #2 screwdriver for rack mount screws
- 7 mm nut driver for frame ground stud on subrack front panel
- wire strippers for making power cables
- diagonal cutters for making power cables
- Molex Hand Crimping Tool 11-01-0084—crimping device for making power cables
- ESD wrist strap

Equipment

- multimeter for checking voltage levels and cables for opens/shorts
- oscilloscope for checking output signals
- laptop computer running Windows 95 or Windows NT
- 55450A local craft terminal software

55320A Rack Mount Shelf

This shelf will hold the 55300A GPS module.

Tools

- large Phillips or Pozidriv #2 screwdriver for rack mount screws
- 7 mm nut driver for frame ground stud on the front panel of the rack mount shelf
- wire strippers for making power cables
- diagonal cutters for making power cables
- Molex Hand Crimping Tool 11-01-0084—crimping device for making power cables

Equipment

- multimeter for checking voltage levels and cables for opens/shorts
- oscilloscope for checking output signals
- laptop computer running Windows 95
- SatStat software

GPS Antenna System

A very important part of installing the 55300A is the antenna system necessary to bring the GPS signal to the device. There is a complete line of GPS accessories available from Symmetricom. Each accessory is packaged with an information note that documents the product and recommendations for installation. Here is a brief description of the GPS accessories and the purpose of each.

58532A GPS L1 Reference Antenna

Designed for outdoor locations, the antenna is supplied with a mounting base to simplify installation of the antenna to a mast. The antenna requires 5 Vdc, which is supplied from the GPS receiver via the connecting cable.

58529A Line Amplifier with L1 Bandpass Filter

This device is a broadband amplifier integrated with an L1 bandpass filter. It is designed to overcome cable loss and protect the GPS receiver from out-of-band noise and interference. With narrow bandwidth and steep rolloff, it insures accurate satellite tracking and signal reception even in the presence of electromagnetic disturbances.

58530A GPS L1 Bandpass Filter

For environments that suffer from known interference sources, this bandpass filter should be included as part of each installation close to the antenna.

58539A GPS L1 Lightning Arrestor

Lightning arrestors are used to protect elements of the antenna system from electromagnetic fields associated with nearby lightning strikes. The impact of surge voltages and currents can be minimized if the system is well-grounded to earth through the lightning arrestor. This arrestor is optimized for use in the GPS L1 frequency range to reduce the amplitude of lightning-induced voltages.

GPS Antenna Cables

LMR 400 cable is available from Symmetricon. LMR 400 is low-loss cable allowing longer lengths of cable before a line amplifier is required. The cable can be ordered in kit form or as a finished cable. The kit comes with only one connector installed. You install the second connector after cutting the cable to the appropriate length for your installation.

5071A Primary Frequency Standard

Tools

- large Phillips or Pozidriv #2 screwdriver for rack mount screws
- spade or ring lugs for rear-panel power supply connections
- wire strippers
- pliers

Equipment

- multimeter for checking voltage levels and cables for opens/shorts
- option 908 provides rack mount kit to install the 5071A into a rack without the handles
- if the 5071A will be installed in an ETSI equipment rack (535 mm), 19-inch rails are required to accommodate the frequency standard

CAUTION

Due to the weight of the 5071A (30 kg), mounting the unit in a rack requires two installers. A shelf or rails in the rack must be used to support the weight of the 5071A along with the rack mount kit. Failure to do so will result in rack-mount flange failure and subsequent equipment damage.

B2

Equipment Rack

Suggestions for rack loading and cable routing

In This Chapter

This chapter describes recommendations for equipment racks.

- Rack dimensions
- Rack configuration--ventilation, shelving, etc.
- Cable routing

Rack Cabinet Description

In an ETSI environment, a typical rack cabinet has the following dimensions: 2200 mm H x 600 mm W x 600 mm D.

NOTE

If not installing an 5071A, a 300 mm deep rack could be used although it is not recommended because air flow through a rack that size is more limited.

Racking Space Definitions

A 2200 mm rack will provide usable racking space of 2000 or 2050 mm. In standard units of 25 mm, this is 80 or 82 standard units. This can also be expressed as 45 or 46 rack units where one rack unit (RU) is equal to 44.45 mm (1.75 in).

General Earthquake Precautions

1. Securely mount the base of the rack cabinet to the floor and the roof to an overhead structure.
2. Attach adjacent rack cabinets to each other.
3. Insure that floor mounting points are solidly attached to the building's structure. Raised or wooden floors may require additional bracing.
4. Secure all loose items in and around the rack cabinet, including all cables and equipment.

Rack Cabinet Configuration

This section covers topics related to the equipment rack configuration to support proper ventilation through the rack. This is not a concern for temperature-controlled environments.

NOTE

The recommendations here ensure that adequate ventilation can take place over the operating temperature range of the Symmetricom sync system equipment.

Four Different Rack Configurations

The following drawings show suggested configurations for four possible equipment combinations. All configurations include a circuit breaker panel at the top of each rack cabinet.

Recommendations

- 1** If the rack cabinet will hold 55400A master and expansion subracks, cable interconnections will be easier if the master subrack is installed near the bottom of the rack.
- 2** The 2 RU gap (1 RU = 44.45 mm/1.75 in) at the bottom of each configuration creates an air inlet area to improve ventilation through the rack cabinet. If a filler panel is used to cover the front opening below the subrack, be certain there is an unobstructed opening for ventilation on the other three sides of the reserved space.
- 3** Since the air exhausted from the 5071A is usually 13°C warmer than ambient air, mount this primary frequency standard in the upper portion of the rack cabinet.

Configuration #1

A frequency standard, GPS, and two SSUs providing up to 160 outputs.

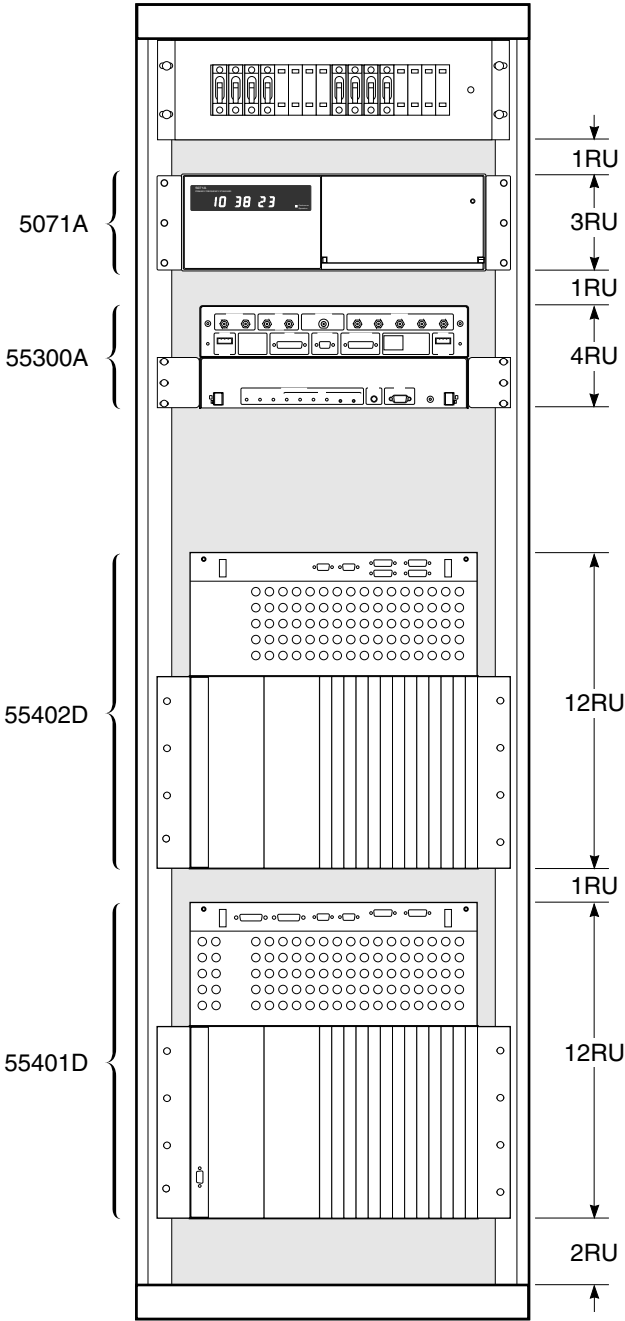


Figure B2-1. Two Reference Sources and Two SSUs

Configuration #2

GPS reference along with two SSUs.

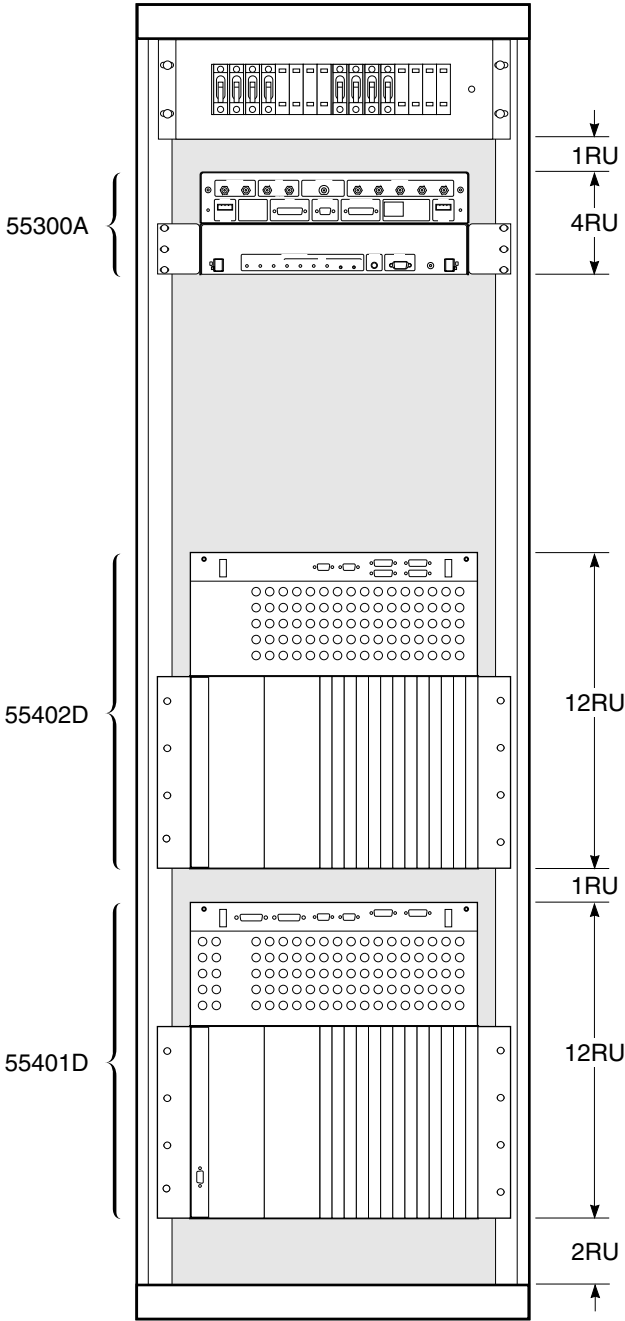


Figure B2-2. One Reference Source and Two SSUs

Configuration #3

A single rack cabinet containing three SSUs providing up to 240 outputs.

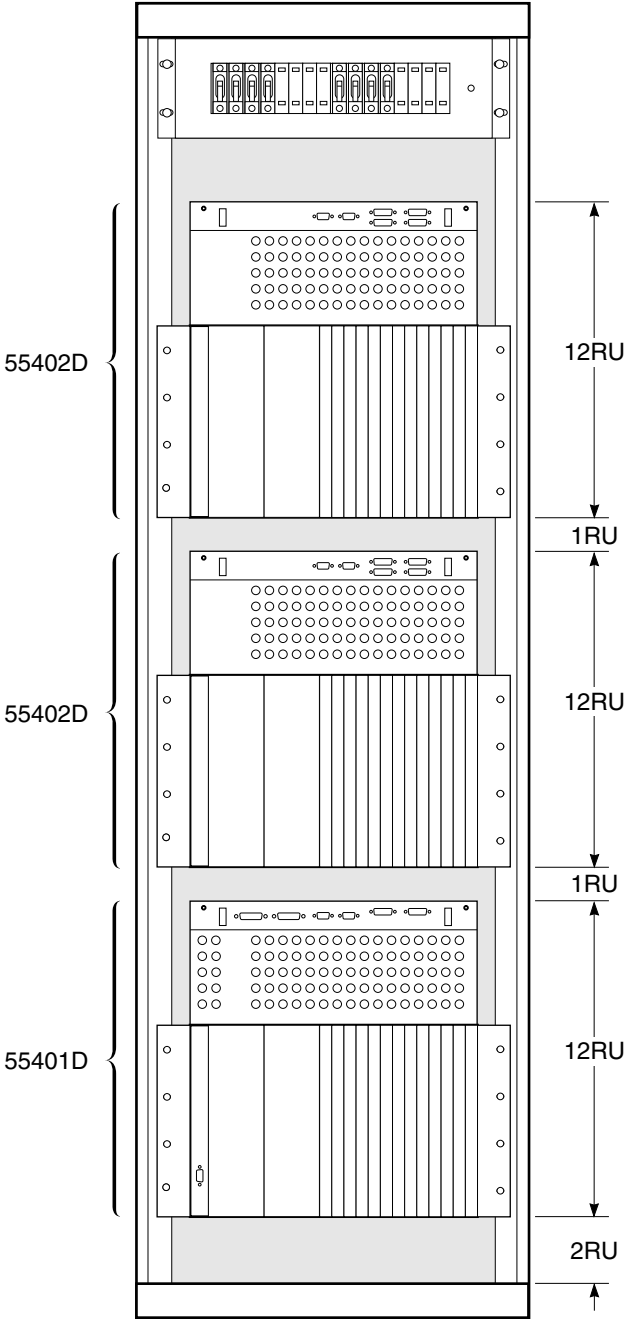


Figure B2-3. Three SSUs

Configuration #4

A single rack cabinet containing a GPS reference and a mini-SSU.

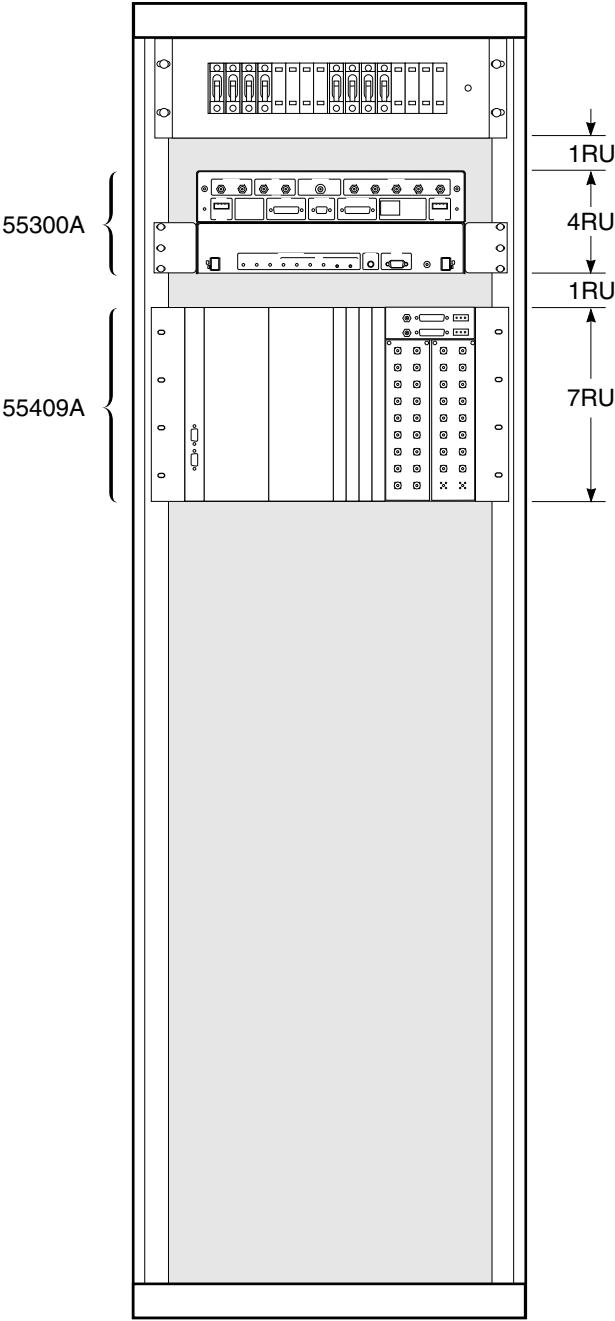


Figure B2-4. Reference Source and mini-SSU

SSU Cable Routing

Managing the cabling from the connector panel can be a challenge with a fully loaded SSU using all the available outputs. Up to 80 output cables can be attached at the connector panel.

NOTE

Unless care is exercised in routing the cables over the lower portion of the subrack containing the plug-in cards, there is a danger that the cabling will interfere with the proper ventilation of the SSU.

Illustration of Cable Dressing

Refer to the figure below for a drawing of how to dress the subrack cables in order to minimize the blocking of airflow through the SSU subrack. The approach is to take half of the output cables to each side of the rack. The callouts are described on the next page.

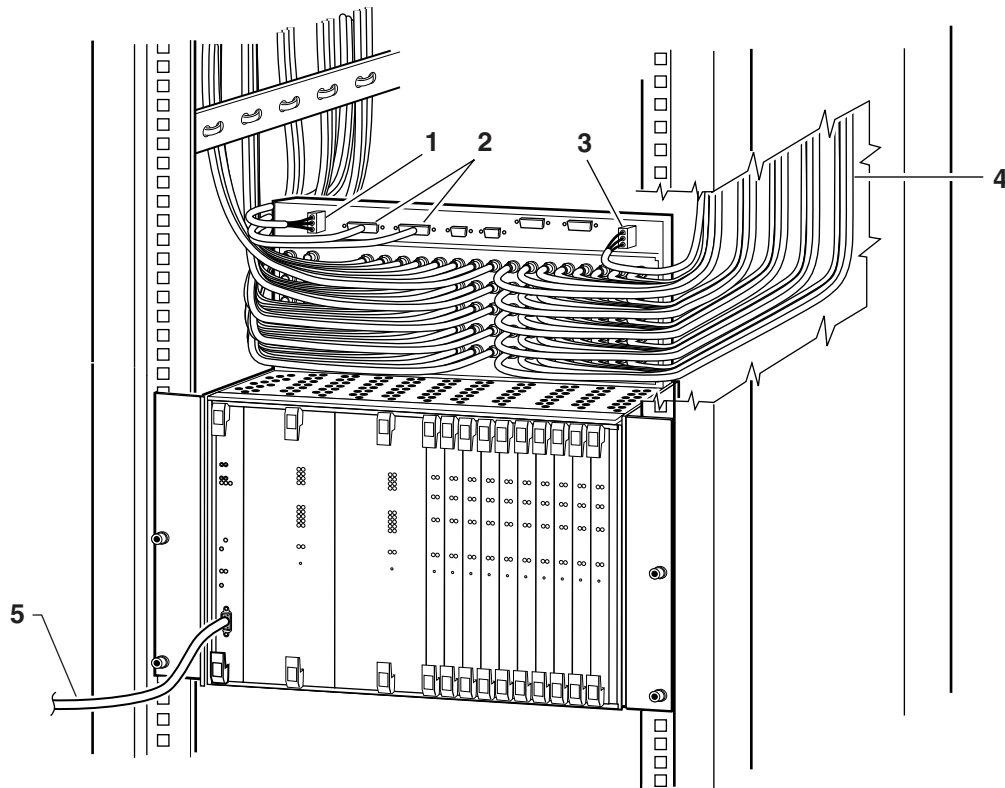


Figure B2-5. Cable Dressing for SSU

Figure Description Callouts

- 1** DC input (A) connector cabling
- 2** Alarm and remote comm port cabling
- 3** DC input (B) connector cabling
- 4** Input/Output cabling—The input cables can be grouped together in one bundle. Each row of output cables is divided into two bundles of eight cables, one to each side of the rack cabinet where they are tied to cable guides. Dress the cables so they stay close to the connector panel and do not extend out over the ventilation area above the plug-in cards.
- 5** Local comm port serial cabling

CAUTION

Do not install the 55400A near motors, generators, transformers, or other equipment which can radiate strong magnetic fields. Location near such equipment may impair operation.

Mini-SSU Cable Routing

Figure B2-6 shows how to dress the subrack cables. Note that the cables should be routed through the right-side opening of the subrack.

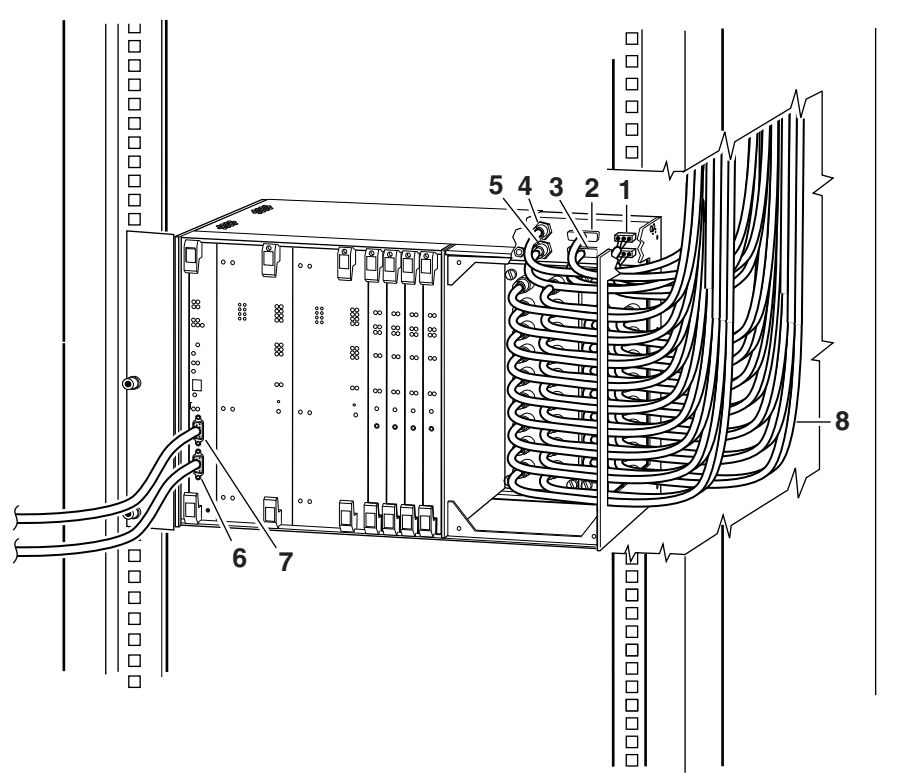


Figure B2-6. Cable Routing for Mini-SSU

1 -48 VDC Input (A) and (B) cables	5 PRC Status input cable
2 Alarm port cable	6 Local port cable
3 Remote port cable	7 Rack Alarms port cable (NIMC only)
4 PRC input cable	8 2048 kHz/kbps Inputs (2) and Output cabling (16 or 32)

After completing cable routing and hookup, be sure to install the cover to protect circuit board and connectors.

B3

Equipment Requirements

Symmetricom Sync System requirements for space, power, and environment

In This Chapter

Use the information in this chapter to help allocate floor space and rack space for the planned equipment installation.

- Equipment dimensions
- Equipment power requirements
- Equipment environmental considerations

NOTE

Due to the high reliability requirements for telecom equipment, it is recommended that you take advantage of the dual-redundancy power supply capability of the Symmetricom sync system equipment by providing two separate power connections to the rack cabinet from separate power sources.

Equipment Dimensions

The size and weight of the equipment is included here so you can plan the space requirements in your rack. The height is expressed in millimeters and rack units (RU). A rack unit is 44.45 mm/1.75 in.

Table B3-1. 55400A SSU Subrack Dimensions

Dimension	Value
Height	533 mm (12RU)
Width	435 mm
Depth	270 mm
Weight	18 kg (fully loaded)

Table B3-2. 55409A Mini-SSU Subrack Dimensions

Dimension	Value
Height	300 mm (7RU)
Width	435 mm
Depth	270 mm
Weight	14.5 kg (fully loaded)

Table B3-3. 55320A GPS Rack Mount Shelf Dimensions*

Dimension	Value
Height	169 mm (4RU)
Width	425 mm
Depth	258 mm
Weight	3.6 kg

* *The 55300A GPS module is inserted into the rack mount shelf.*

Table B3-4. 5071A Frequency Standard Dimensions

Dimension	Value
Height	134 mm (3RU)
Width	426 mm
Depth	524 mm
Weight	30 kg*

** Support rails or a shelf must be used with the 5071A.*

Power Requirements

The equipment is designed to accept power from two independent power sources. This approach ensures that no single power source failure is enough to stop operation of the sync system equipment.

It is recommended that you take advantage of the dual-redundancy power supply capability of the equipment by providing two separate power connections to the rack cabinet from separate power sources.

Current Demands

Each equipment requires two separately fused –48 Vdc power supplies. The power supplies for the 5071A need to be capable of providing 3 A of current. The 55300A draws approximate 0.75 A at start-up and then the current demand drops to about 0.33 A after warm-up. The 55400A draws up to 3 A at a cold start-up, and the current demand can increase to approximately 7 A as the output cards are brought online after system warm-up. The table below summarizes the maximum current for the sync system equipment.

Table B3-5. Maximum Current Usage

Equipment	Max. Current Demand
55400A SSU	7 A at –48 Vdc
55409A Mini-SSU	3 A at –48 Vdc
55300A	1 A at –48 Vdc
5071A	3 A at –48 Vdc

Power Supply Fuse Recommendations

Individual situations will differ in regard to the fuse requirements. Some installations will incorporate fusing as part of the power source itself, so fusing at the rack may not be necessary.

It is recommended that the power source be fused. Then power can be routed to a power strip or busbar in the rack for distribution to the equipment. Another option is to provide a circuit breaker panel in the rack cabinet to provide power supply fuses for individual equipment.

The 55400A plug-in cards have individual fusing for the –48 Vdc supply. If additional fusing is desired, a 10 A fuse box for each –48 Vdc line is recommended.

The 55300A uses a 3A slow blow or time delay fuse. The 5071A uses a 1A slow blow or time delay fuse.

Environmental Considerations

The Symmetricom sync equipment is designed for installation into a standard equipment room environment.

CAUTION

Do not install the 55400A near motors, generators, transformers, or other equipment which can radiate strong magnetic fields. Location near such equipment may impair operation.

Whether installed in a telecom rack or a rack cabinet enclosure, leave an air gap below the 55400A to encourage maximum air flow through the unit. Provide an opening for ventilation at the bottom of the rack cabinet.

NOTE

The 5071A has a wide operating temperature range of 0°C to 55°C and works more efficiently with warmer temperatures. However, the air exhausted out of the unit is usually 13°C warmer than ambient air. Installing the 5071A in the same cabinet with the 55300A GPS unit or the 55400A SSU requires the 5071A to be mounted in the top portion of the rack cabinet.

C1

Installation Guidelines

Unpacking, inspection, handling, and recommendations

In This Chapter

This chapter describes the following topics:

- Unpacking and inspecting equipment
- Procedures to avoid electrostatic discharge damage
- Installation guidelines

Unpacking and Inspection

Unpacking

After receiving the shipment containers, move them to a suitable unpacking and staging location, then carefully unpack each shipping container.

NOTE

Retain all packing containers and materials. Keep plug-in cards in ESD protection packaging until ready to configure and install the cards.

Inspection

Inspect the shipping container and cushioning material for damage. If damage is evident, keep the packing materials until the contents of the shipment have been checked for completeness and the equipment has been checked mechanically and electrically.

- a. Verify that the shipment is complete by checking the actual materials received against the packing slip, bill of lading, and purchase order.
- b. If there is shipping damage to any of the equipment, notify the shipping company and Symmetricom. File a damage report and claim with the shipping company.
- c. Notify the shipping company when there is a difference between the bill of lading and the materials received.
- d. Notify Symmetricom if there are differences between the materials received and the purchase order or packing slip.

ESD Prevention Procedures

Electronic components and assemblies can be permanently degraded or damaged by ESD (electrostatic discharge). Use the following precautions when installing or maintaining the equipment:

- a. Ensure that static-sensitive devices or assemblies are stored in static shielding bags or containers.
- b. Ensure that static-sensitive devices or assemblies have their switches or jumpers configured at static-safe work stations providing proper grounding for technical personnel.
- c. Do not wear clothing subject to static charge build-up, such as wool or synthetic materials.
- d. Do not handle components or assemblies in carpeted areas.
- e. Do not remove an assembly or component from its static shielding protection until installation.
- f. Avoid touching assembly edge connectors (handle by card edges or assembly front panel).
- g. Use one of the available front-panel ESD banana-plug ground jacks for an ESD wrist-strap connection during installation or maintenance procedures.

System Guidelines

Assumptions made

The person installing the equipment is familiar with basic electronics and the typical requirements associated with telecom equipment installations.

A –48 Vdc source is being used to power all telecom equipment to be installed.

Recommendations

The equipment described in this manual has two power inputs so that the failure of one power source cannot cause the equipment to fail. Ensure this redundancy is maintained by running power from two separate sources to the dual-power input equipment.

C2

Install the 55400A SSU

Power, cables, subrack, and cards

In This Chapter

This chapter covers installing the SSU. References are made to other chapters for the configuring of cards, but the installation instructions are here.

NOTE

See “In This Manual” for a list of tasks to put an SSU master subrack into service.

Master Subrack Connector Characteristics

There are three variations of master subrack that have been released. The differences relate to the characteristics of the applicable connectors as summarized in the following table.

Table C2-1. Master subracks

Connector	55401B	55401C	55401D
PRC input and Status input	Grounded BNC	Grounded BNC	Grounded BNC
2048 kHz/kbps inputs	Floating	Floating	Floating
Outputs (80)	Floating	Grounded	Grounded
–48 Vdc	Non-locking	Locking	Locking
Expansion signals	Non-terminated	Terminated	Terminated and shielded

Accessories, Tools, and Equipment

Accessories

An installation accessories kit will be supplied with the 55401D master subrack. The items in this kit are described in Table C2-2.

Table C2-2. Accessories supplied with 55401D master subrack

Accessory	Qty	Purpose	Part #
Locking power connector	2	–48 Vdc power inputs	1251-5272
Spare 1A telecom fuse	1	Communication card	2110-1129
Spare 2A telecom fuse	1	Output cards	2110-1125
Spare 3A telecom fuse	1	ITH cards	2110-1000
Crimp lug terminal	2	Frame ground connection	0360-0041
Screw–10-32 w/nylon washer	6	EIA rack mounting	0570-1366
U-nut	6	EIA rack mounting	0590-0804
Connector pins	8	Power connector	1251-2418

Two pairs of rack mounting flanges are also included for mounting the SSU into an EIA or ETSI rack.

Tools

Table C2-3 describes the required tools and where they are used. The list of tools does not include a crimp tool that will be needed to make the mating connectors for the input/output connectors.

Table C2-3. Tools needed to install 55401D master subrack

Tool	Purpose
Large Phillips or Pozidriv #2 screwdriver	Rack mounting screws
Molex Hand Crimping Tool (11-01-0084)	Power cables
7 mm nut driver	Frame ground stud on subrack front panel
Wire strippers	Making cables
Diagonal cutters	making cables
ESD wrist strap	ESD protection when installing cards

Equipment

Table C2-4 describes the required equipment and where they are used.

Table C2-4. Equipment needed to qualify 55401D master subrack

Equipment	Purpose
Digital multimeter	Check voltage and cables for opens/shorts
54603A general purpose oscilloscope, or equivalent	Check signal characteristics during qualification

Install the Master Subrack

The following paragraphs provide the information for mounting a master subrack in a rack cabinet. Review chapter B2 for master subrack positioning information. Try to install it near the bottom of the rack cabinet if there are plans to add expansion subracks.

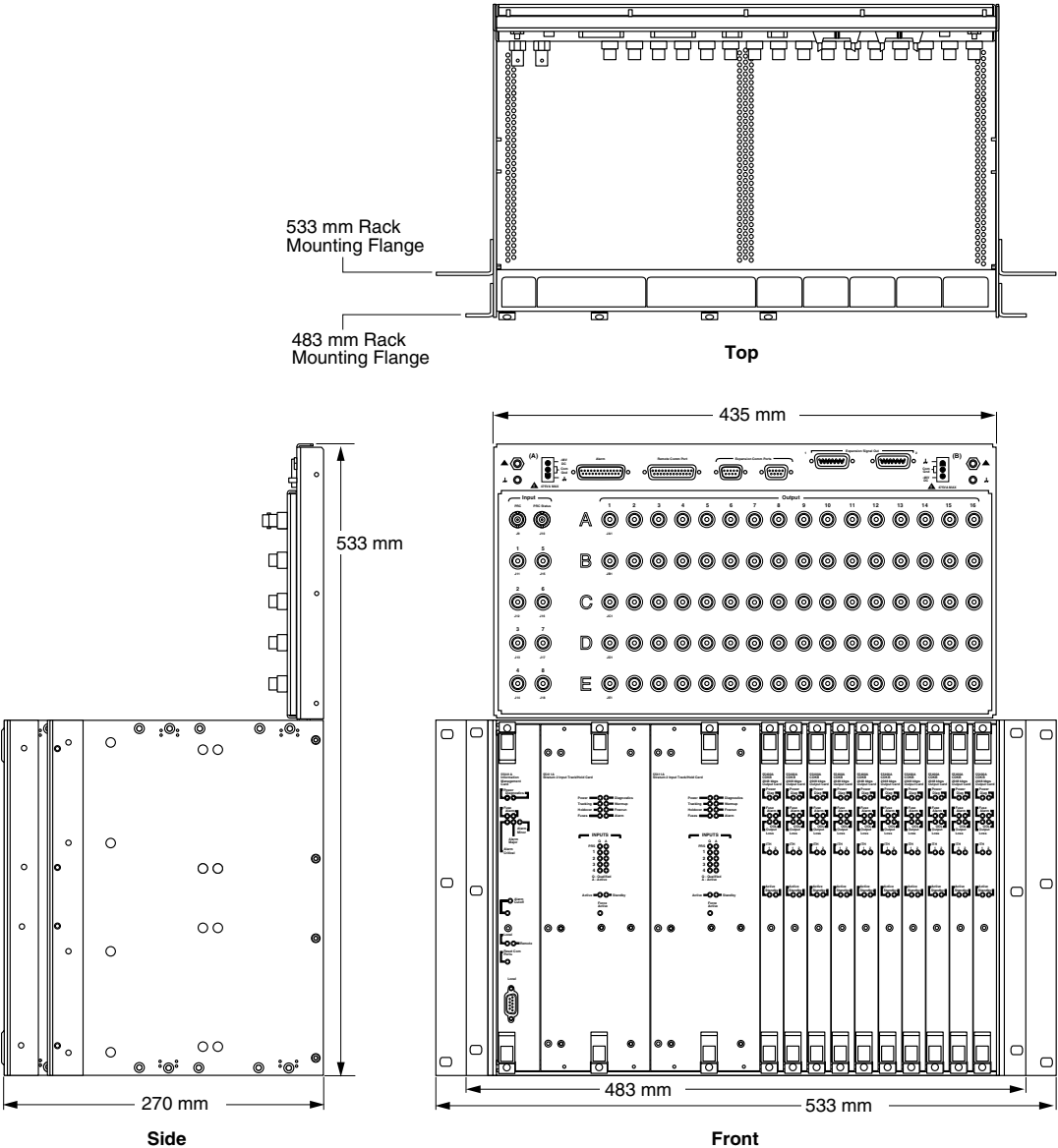


Figure C2-1. 55401D Master Subrack Dimensions

Subrack Mounting Standards

The 55401D master subrack can be mounted using one of two dimension standards

- ETSI—535 mm
- EIA—482 mm

These two standards are accommodated by the two different sizes of mounting flanges supplied with the subrack. The flanges can be mounted at various positions on the subrack to vary the depth at which the subrack is installed in the rack.

Subrack Installation Procedure

Use the following procedure to attach the mounting flanges to the 55401D subrack and install the subrack into the rack cabinet.

Figure C2-2 and Figure C2-3 show the positioning for each of the flanges.

- 1 Place the subrack (with all cards removed) on a work surface with the front panel facing you. Select the mounting flanges you will use.
- 2 Position each mounting flange with its mounting holes so it aligns with the mounting holes in the side of the subrack (front or middle).
- 3 Attach the flanges to the subrack with the supplied hardware.

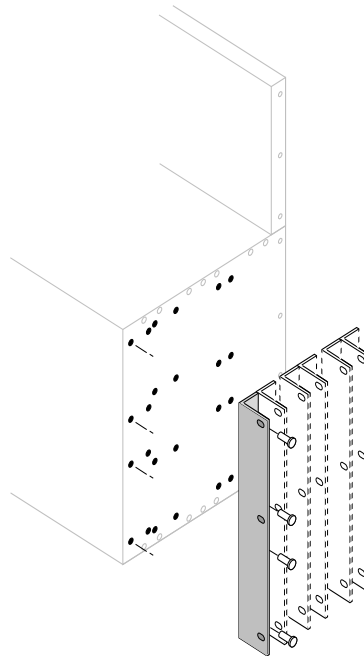


Figure C2-2. ETSI mounting flange attachment

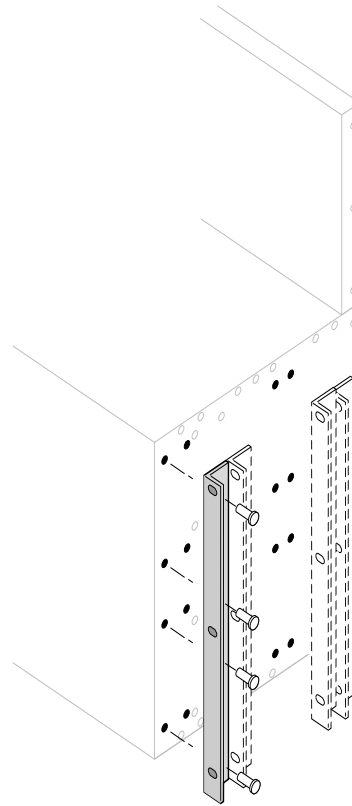


Figure C2-3. EIA mounting flange attachment

- 4 Place the subrack in position in the rack. Refer to chapter B2 for positioning details.

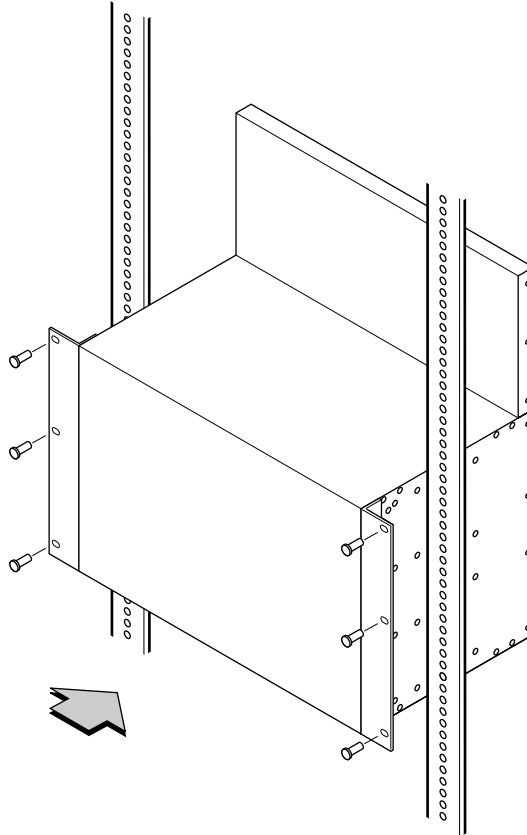
NOTE

If the rack cabinet will hold 55400A master and expansion subracks, cable interconnections will be easier if the master subrack is installed near the bottom of the rack. Position it no lower than 2 RU (90 mm) from bottom of rack.

Install the Master Subrack

Issue 1

- 5 Attach the subrack to the rack with the hardware supplied with the mounting flanges.

**Figure C2-4. Subrack installation**

Backplane Switch

The subrack has a configuration switch on the backplane used to define whether subrack is a master or expansion subrack. As shown in Figure C2-5, this switch is set at the factory to the “0” position. Verify that the setting is “0” for the master subrack. Change the selection, if necessary, using a flat-blade screwdriver.

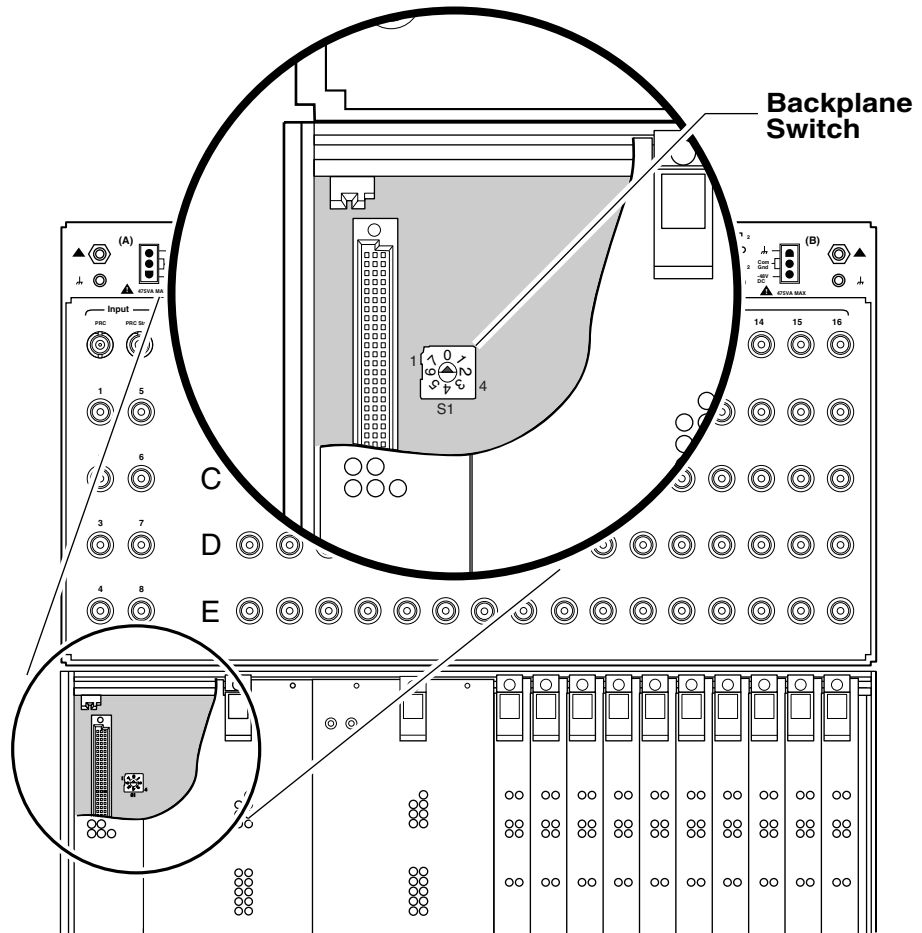


Figure C2-5. Backplane Switch Location

Connectors and Cabling

This section discusses the front panel connectors and the pinouts needed to build the connecting cables.

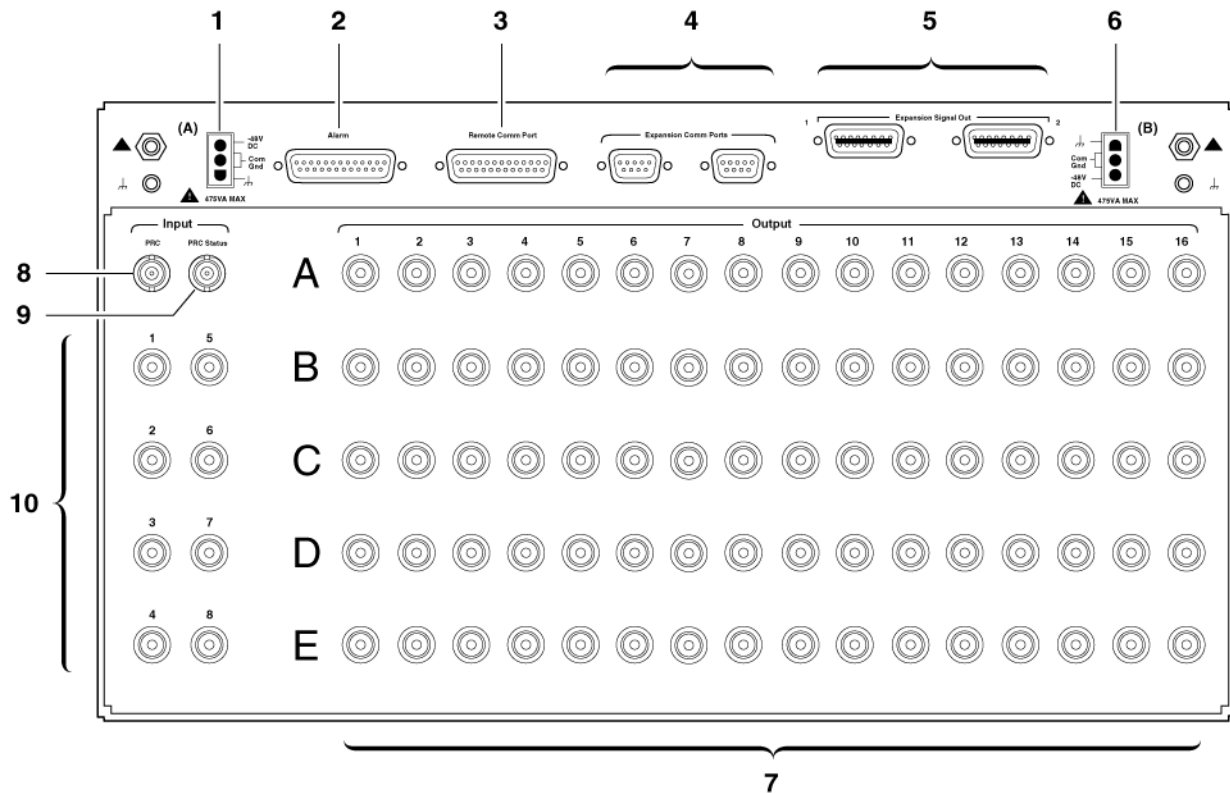


Figure C2-6. Connector panel details

1— Locking power input connector (A)	6— Locking power input connector (B)
2— Alarm connector, 25-pin (male), IDC type	7— 80 output connectors. BNC-type or Siemens-type available.
3— Remote Comm Port connector, 25-pin (female), IDC type	8— PRC (5 or 10 MHz) BNC-type input reference connector
4— Expansion Comm Port connectors, two 9-pin (one male, one female)	9— PRC Status input BNC-type 50 Ω connector
5— Expansion Signal connectors, two 15-pin (female)	10— Eight 2048 kbps/kHz 75 Ω input reference connectors. BNC-type or Siemens-type available.

–48 Vdc Power Inputs

The SSU supports use of redundant power sources.

CAUTION

The SSU uses a –48 Vdc office battery as its primary voltage source. Though not normally considered high voltage, the office battery has more than the minimum power necessary to present a potential fire hazard. Use extreme caution when working around or connecting circuits energized by the office battery.

Grounding issues

Before running power cables, consider how best to provide frame grounding for the subrack. A frame ground can be connected in one of three ways:

1. As part of the cabling through the –48 Vdc power connector.
2. Through a single-wire connection to the ground stud on the connector panel.
3. Through the rack mount brackets when the rack cabinet itself is properly grounded.

NOTE

To prevent battery return-to-frame ground faults, do not connect battery return on the subrack to the frame ground.

Recommendations for cabling to the subrack

Power to the master or expansion subrack is applied at the connector panel. Use the following procedure as a guide to supply power wiring to the subrack.

- a. Following local practices, select a wire size appropriate to ensure an office battery voltage of –36 to –57 Vdc at the subrack. The current requirement for the subrack can be from 7 to 10 A. The connector pins used for the power connectors can accept a wire size up to 1.2 mm (0.05 in). This wire size corresponds to an AWG (American Wire Gauge) value of 18.
- b. Switch off the circuit breakers or remove the fuses to the branch circuit feeds that will supply the subrack.
- c. Route redundant (“A” and “B”) –48 Vdc office battery feeds to the subrack to ensure uninterrupted operation. If your facility does not provide redundant “A” and “B” battery sources, split the power feeds at the main battery distribution fuse board (BDFB), the branch battery feed panel, or at the rack cabinet.

- d. If the battery feeds originate at the BDFB or branch panel, run the two battery feeds to the subrack through cable runs on opposite sides of the facility. Running both feeds in the same cable rack creates a single-point source of power failure and should be avoided.
- e. Route the power cables on opposite sides of the rack cabinet. Leave a length of cable for both feeds sufficient for later dressing into cable bundles.
- f. Check the battery feed lines for possible shorts to one another or to ground using a multimeter.

Assembling the power connectors

Use the following procedure to attach the power connectors to the battery feed lines.

- a. Strip 5 mm (3/16 in) of insulation from one set of the power supply wires.
- b. Crimp the terminal pins to the wires according to standard procedures. Figure C2-7 shows a crimped connector pin. The connector pins can accept a wire size up to 1.2 mm (0.05 in). If possible, use a crimping tool such as Molex Hand Crimping Tool 11-01-0084.

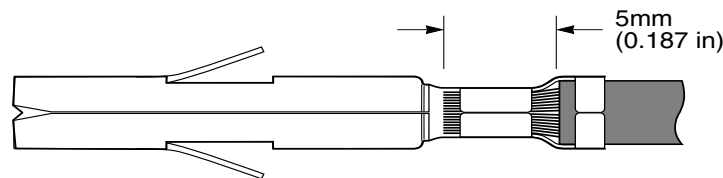


Figure C2-7. View of crimped connector pin

- c. Position the power connector so that it matches the drawing in Figure C2-8 (the locking mechanism should face you). Take the Ground wire and grasp the wire insulation behind the connector pin. Push this wire into plug position “1” (as shown in the drawing) of the power connector until the connector pin snaps into place.

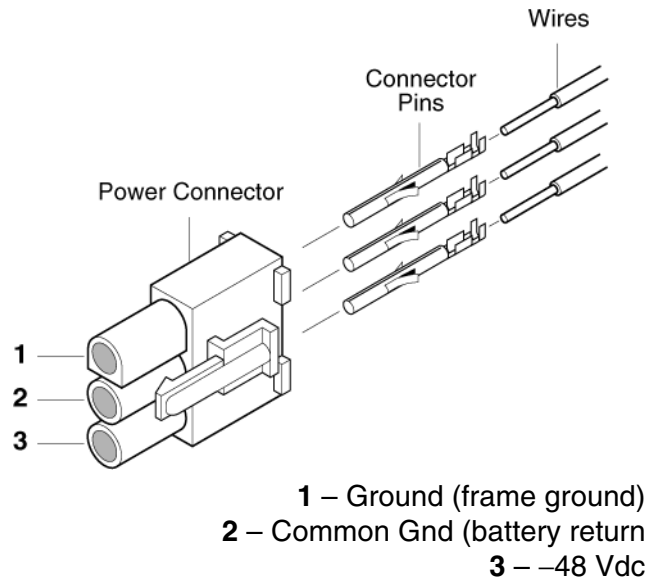


Figure C2-8. Subrack -48 Vdc power connector

- d. Using the same procedure as for step c., push the Com Gnd wire into connector position “2” and the -48 Vdc wire into connector position “3”.
- e. Repeat steps a. through d. for the second power connector.

Making the frame Ground Connection

If a dedicated wire to the frame ground stud is selected as the method for grounding the subrack, follow these steps for each of the ground connections:

- a. Route wiring from ground to the subrack.
- b. At the subrack, crimp the supplied spade lug connector to the ground wire.
- c. Using a 7 mm nut driver loosen the frame ground stud nut.
- d. Slide the spade lug connector under the ground stud nut and tighten.

Connecting dc Power

The following procedure describes how to connect power to the subrack. To connect the finished power cables for the two dc supplies, follow these steps:

- a. Using a multimeter, verify that there are no multiple battery grounds, or any shorts at the power source end of the wires.
- b. Reinstall the fuses or set the circuit breakers to On at the branch circuit distribution that supplies the -48 Vdc power.
- c. Use a multimeter to measure the voltage of the battery feed leads at the subrack. The voltage must measure in the range -36 Vdc to -57 Vdc.
- d. Plug the left-hand dc power connector into the left-side (A) power jack on the subrack connector panel.

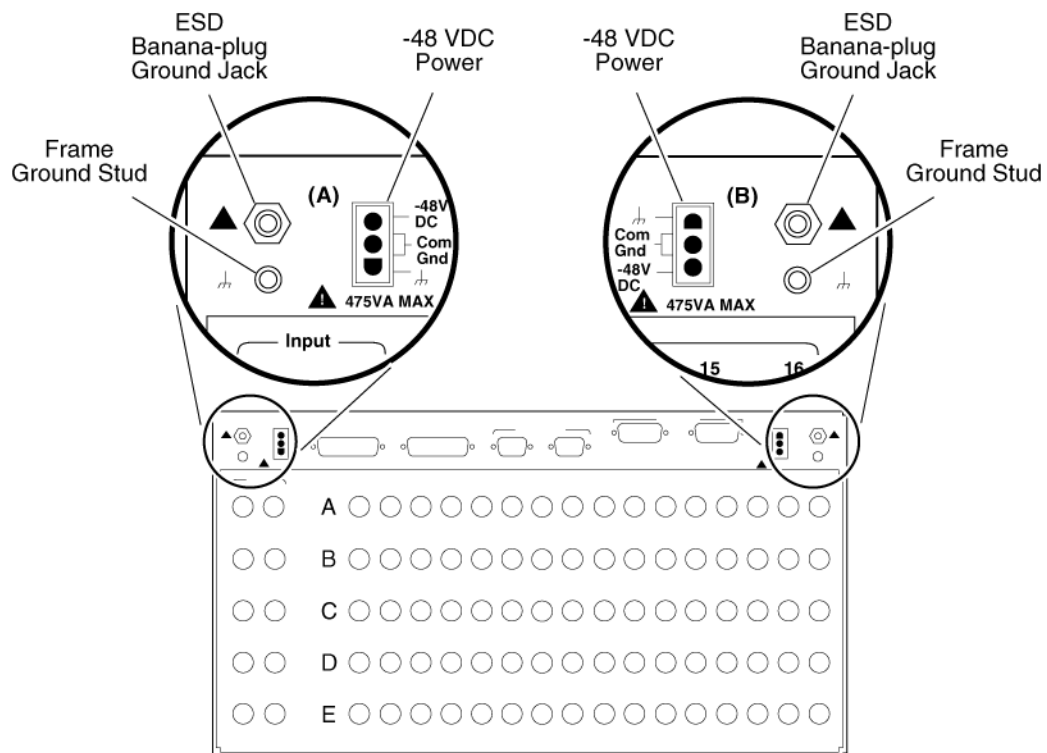


Figure C2-9. Power connector and ground stud locations

- e. Plug the right-hand dc power connector into the right-side (B) power jack.

Alarm connector

The master subrack connector panel has a 25-pin D connector (male) for all office alarms supported by the 55400A. A total of seven alarms are available:

- Critical visual
- Critical audible
- Major visual
- Major audible
- Minor visual
- Minor audible
- Card assembly fuse

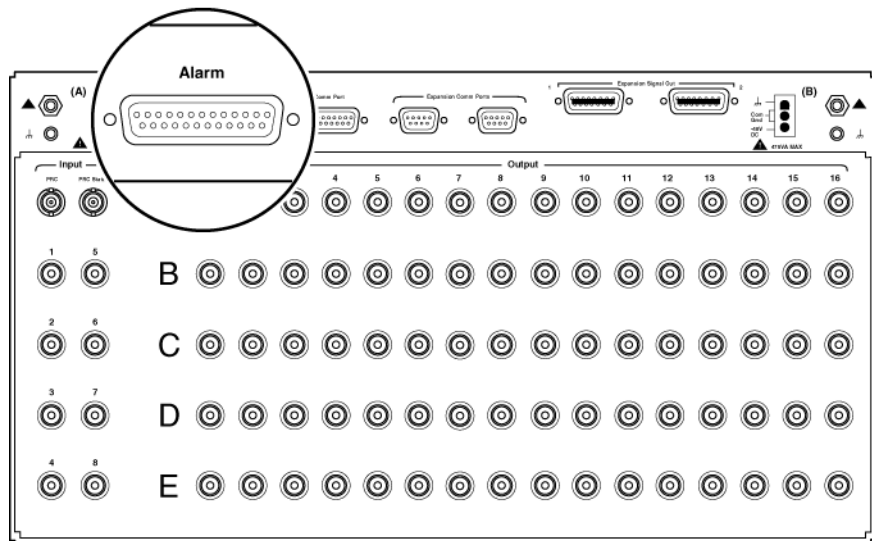


Figure C2-10. Alarm connector location

Relay type

All alarm relay outputs are Form-C, dry contact closures (common, alarmed open, and alarmed closed) except for the card assembly fuse alarm which supplies a -48 Vdc alarm-active output.

Combining critical and major alarms

If your facility supports only major and minor alarms, the communication card can be configured to combine critical and major alarms. This is accomplished through a switch setting on the communication card. (Communication card is a reference to the Information Management Card and Network IMC.)

Remote detection of someone pressing the ACO button

When critical alarms are combined with major alarms by a switch setting (S5-3 on the communication card), the critical alarm relays (visual and audible) may be used to indicate an Alarm Cutoff (ACO) button press on the front panel.

HOW THIS WORKS Following the occurrence of an alarm condition in the 55400A, if someone presses the ACO button to reset the audible alarm relay, the critical alarm relays move into the alarmed condition. The critical alarm relays remain in the alarmed state until the alarm condition is no longer present. This optional behavior is useful when a remote indication of someone pressing the ACO button is desired.

Relay operation

Each alarm can be wired as alarmed open or alarmed closed. Refer to your alarm system to determine the appropriate configuration.

An alarmed-open relay contact is held closed during normal operation (also called normally closed or NC). An alarm condition will cause the NC relay contact to open. Likewise, an alarmed-closed relay will have its contact held open during normal operation (also called normally open or NO). An alarm condition will cause the NO relay contact to close. Refer to the diagram in Figure C2-11.

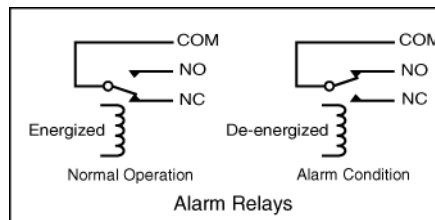


Figure C2-11. Relay circuit diagram

Wiring the alarm cable

Use the table below to fabricate an alarm cable. If your office alarm system uses alarmed open contacts, provide jumpers on your alarm system to override the alarms while wiring the office alarm connector.

If your office alarm system uses only major and minor alarms, wire those pins only. Then configure the communication card to combine critical and major alarms. (This switch setting is described in chapter D3.)

Table C2-5. Alarm connector pinout

Pin Number	Description
1	Card assembly fuse alarm (–48 V)
2	Minor alarm – audible – alarmed open (NC)
3	Minor alarm – audible – common
4	Minor alarm – visual – alarmed open (NC)
5	Minor alarm – visual – common
6	Major alarm – audible – alarmed open (NC)
7	Major alarm – audible – common
8	Major alarm – visual – alarmed open (NC)
9	Major alarm – visual – common
10	Critical alarm – audible – alarmed open (NC)
11	Critical alarm – audible – common
12	Critical alarm – visual – alarmed open (NC)
13	Critical alarm – visual – common
14	GND (Ground)
15	Minor alarm – audible – alarmed closed (NO)
17	Minor alarm – visual – alarmed closed (NO)
19	Major alarm – audible – alarmed closed (NO)
21	Major alarm – visual – alarmed closed (NO)
23	Critical alarm – audible – alarmed closed (NO)
25	Critical alarm – visual – alarmed closed (NO)

TEST CABLE Once the alarm cable is fabricated, test the wiring as needed for this installation. Short together the common and alarm lines for alarmed closed relays to generate an alarm. Remove jumper from the common and alarm lines for alarmed open relays. (Alarms will be generated in the 55400A during qualification procedures.)

Remote Comm Port connector

The master subrack provides a 25-pin D connector (female) for remote serial-data communications. It is possible to perform management tasks through this port including: security management, configuration, performance monitoring, and fault diagnosis. These same tasks can also be accomplished using the Local port that is part of the Information Management Card and the Network IMC.

Why use the remote port?

The remote port supports the following configurations:

- RS-232 serial interface (on IMC supports modem operation)
- X.25 network interface (on NIMC with Option 002 supports RS-232/V.24 DTE)

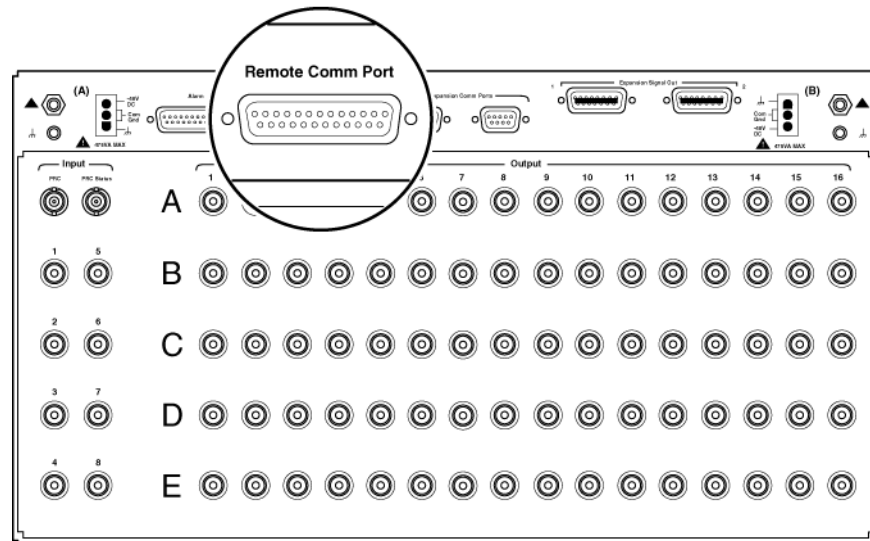


Figure C2-12. Remote connector location

RS-232 Serial Interface

Requires an information management card to be installed as the communication card. The interface is RS-232. Modem operation is supported. (55441A IMC)

X.25 Network Interface

Requires a network information management card with option 002 to be installed as the communication card. The interface is RS-232/V.24 DTE. (55442A Option 002 NIMC)

Wiring the remote cable

Use the tables below to fabricate a remote cable. The pinouts are included here for the two remote port configurations. The signal paths present at the remote port are determined by the type of communication card installed:

- A standard RS-232 interface with the IMC installed
- An X.25 network interface with the NIMC (Option 002) installed

A connector for the subrack-end of the cable is supplied as part of the Installation Accessories Kit included with the subrack.

Remote Port RS-232 Interface

The remote connector provides a standard serial interface with full duplex capability (DTE configuration). Signal voltage levels comply with the EIA-232-E standard. For more on a modem connection to the remote port, refer to chapter A5, “Local/Remote Management.”

Table C2-6. Remote connector pinout

Pin Number	Description
1	No connection
2	TxD (Transmitted data)
3	RxD (Received data)
4	RTS (Request to send)
5	CTS (Clear to send)
6	DSR (Data set ready)
7	GND (Signal ground)
8	DCD (Data carrier detect)
9–19	No connection
20	DTR (Data terminal ready)
22	RI (Ring indicator)
23–25	No connection

Remote port RS-232C wiring diagram

Here is an example of an available Symmetricom interface cable used to connect a computer to the remote port.

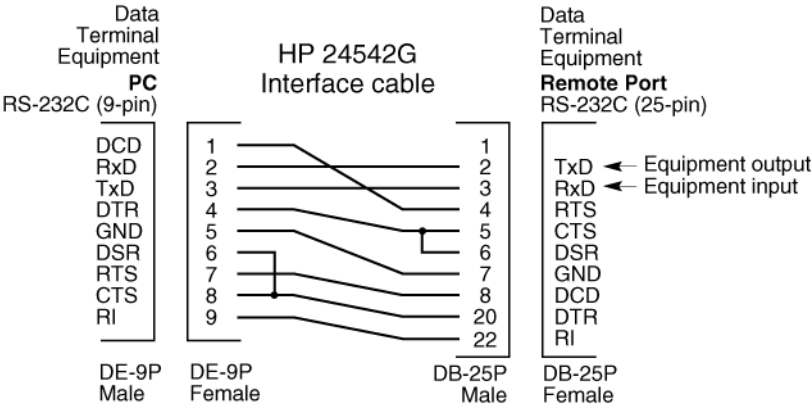


Figure C2-13. Remote port cabling example

Remote Port X.25 Network Interface

In this configuration, the remote port can only be used for an X.25 network connection. The remote connector supports compliance with the RS-232/V.24 DTE physical layer. The major difference as compared to the standard RS-232 interface is the accommodation for the external transmit and receive clock signals on pins 15 and 17 that are part of the X.25 interface. The X.25 interface requirements and configuration procedures are covered in chapter 10 of the *55400A TL1 Programming Reference Manual*.

Table C2-7. Remote connector pinout for X.25

Pin Number	Description	Signal Direction
1	No connection	—
2	TxD (Transmitted data)	Out
3	RxD (Received data)	In
4	RTS (Request to send)	Out
5	CTS (Clear to send)	In
6	DSR (Data set ready)	In
7	GND (Signal ground)	—
8	DCD (Data carrier detect)	In
9–14	No connection	—
15	Tx clk (Transmitted clock)	In
16	No connection	—
17	Rx clk (Received clock)	In
18–19	No connection	—
20	DTR (Data terminal ready)	Out
21–25	No connection	—

System Expansion connectors

The 55401D master subrack provides expansion capability to accommodate up to four expansion subracks. Each expansion subrack provides up to 80, 1:1 protected outputs enabling an expanded system to have a total of 400 outputs maximum.

The expansion connectors include expansion comm ports and expansion signal connectors. When any subrack is connected to another, there are four communication cables that interconnect them. Instructions for installing expansion subracks are not contained in this chapter. If you need to install an expansion subrack go to chapter C3, “Install Expansion Subracks.”

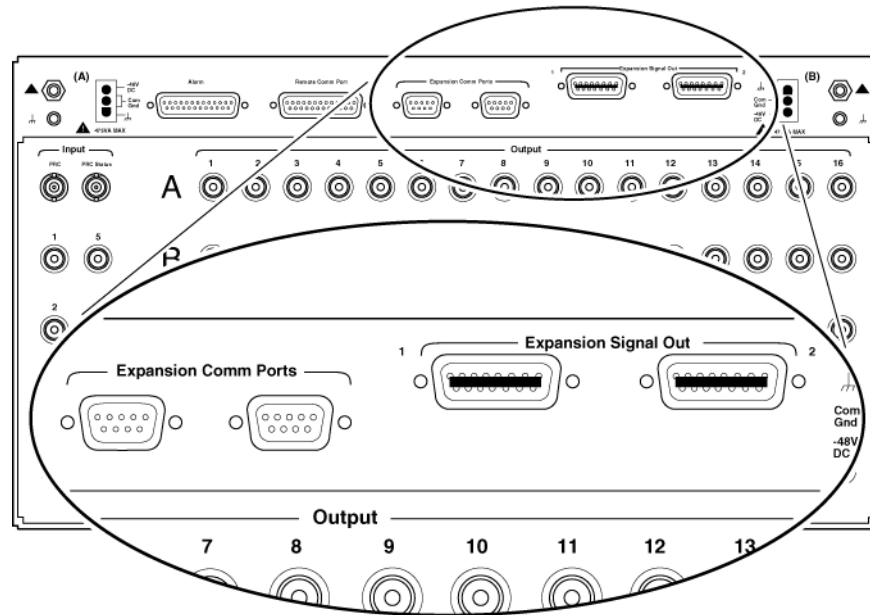


Figure C2-14. Expansion connector locations

Reference Input connectors

The input portion of the 55401D master subrack provides two grounded BNC connectors for a PRC (primary reference clock) and a PRC status signal. In addition, there are eight floating inputs for 2048 kbps or 2048 kHz signals. Those can be ordered as BNC or Siemens-type connectors.

NOTE

Only the first four 2048 kbps/kHz inputs (1–4) are usable when standard clock cards (Input Track & Hold Cards) are installed in the master subrack. Option 001 clock cards are required to support an additional four inputs (5–8).

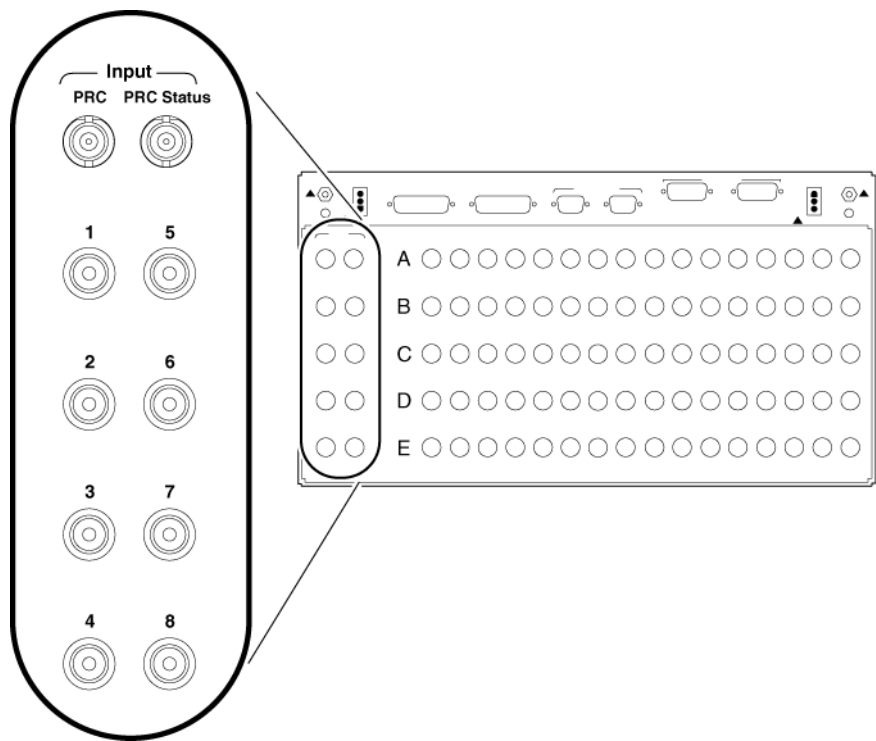


Figure C2-15. Input connector locations

The following table summarizes the input connectors and their requirements.

Table C2-8. Input connector descriptions

Description	Comments	Impedance
PRC	5 or 10 MHz only	50 Ω input
PRC Status	TTL High level in—PRC is normal, TTL Low level in—PRC has problem	
Inputs 1–8	2048 kbps or 2048 kHz	75 Ω inputs

Output connectors

The master subrack connector panel has 80 grounded output connectors arranged into five rows of 16 connectors. These can be BNC or Siemens-type connectors. Each row of 16 connectors corresponds to a pair (typically) of output cards installed in the output card slots labeled A through E on the subrack. Up to 16 outputs are provided by an output card (or a protected pair of output cards), although the exact number is dependent on the specific card type.

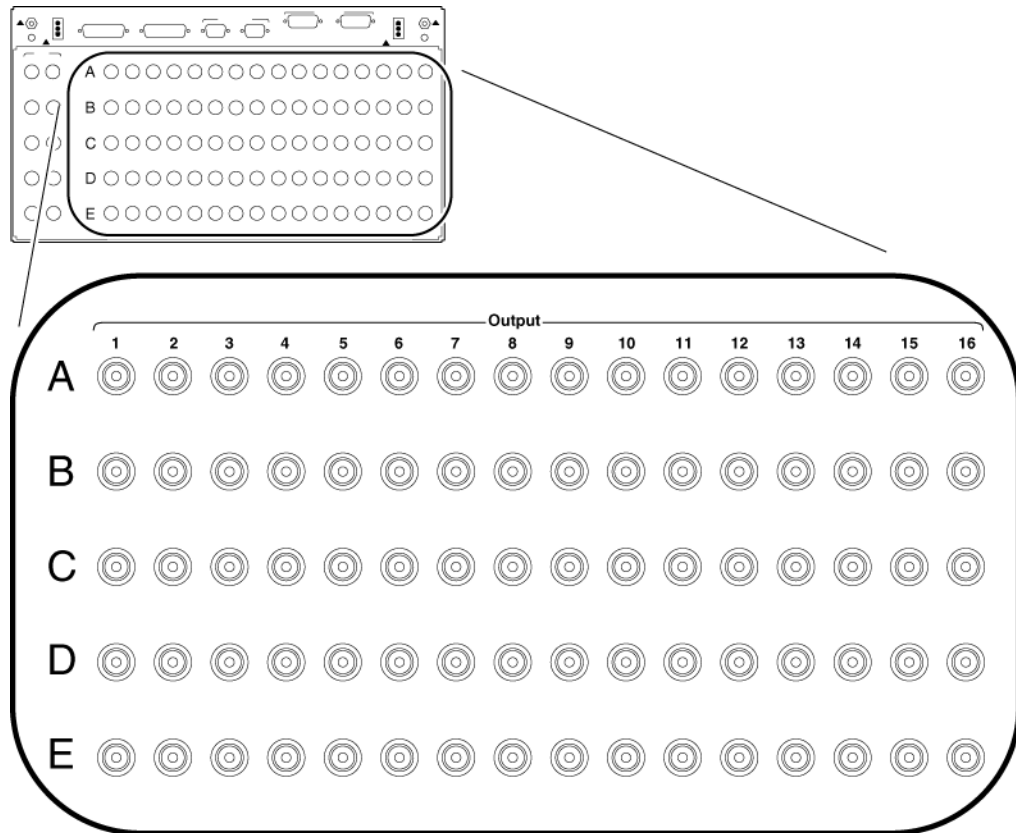


Figure C2-16. Output connector locations

BALUNs for Inputs and Outputs

Except for the 50 Ω input impedance of the PRC connector, all the input and output connectors on the SSU have an impedance of 75 Ω (unbalanced). If the office where the SSU is installed requires 120 Ω balanced inputs or outputs, a Balun transformer will be required for each SSU signal connector. The Baluns are available from Symmetricom. The part numbers are listed in chapter F3, Replacement Parts.

Installation

Parts needed:

- Balun
- Solid conductor wire (twisted pair)
- Impact tool

The wire thickness should be between 0.511mm or 0.643 mm (24 or 22 AWG). The impact tool simplifies the attachment of the wires to the Balun. No stripping of the wire is required. The use of a ground wire at the connector is optional.

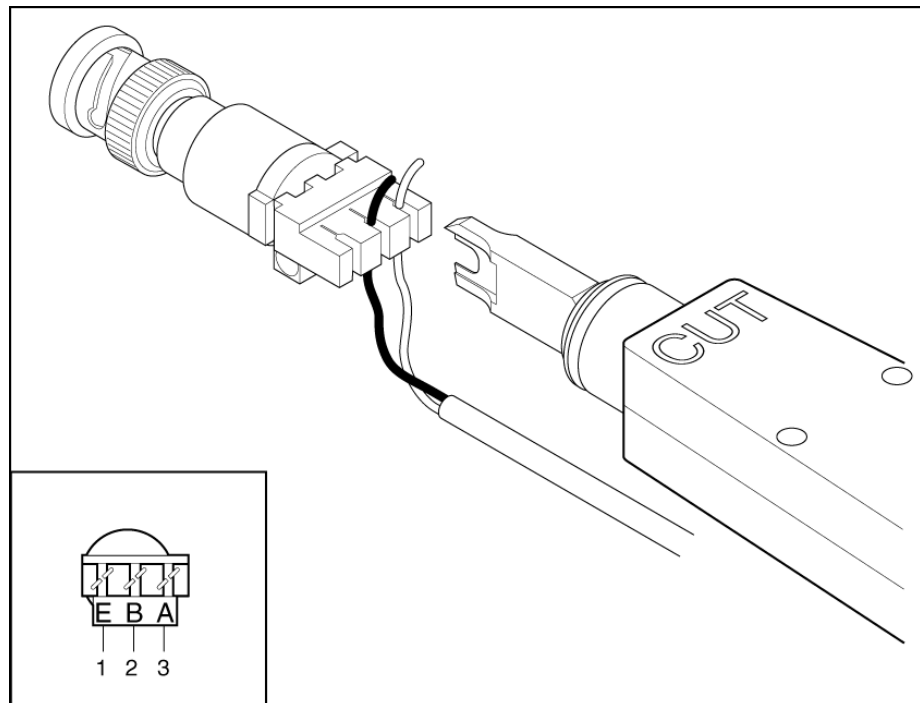


Figure C2-17. Wiring of Balun for 120 Ω balanced operation

Balun Terminals: 1–Earth ground, 2–one twisted-pair wire, 3–one twisted-pair wire

Local Port connector

This port is not on the subrack but the communication card. Both the Information Management Card and the Network IMC contain the local port on the card itself. It is a 9-pin DE connector (female) using an RS-232 interface.

This port is wired as a DCE device and provides for system communication with a local terminal or computer running a terminal emulator program. The 55400A supports the use of the TL1 language communication and control. A more convenient way to communicate with the SSU is using the 55450A local craft terminal software. This Windows-based application presents a point-and-click interface as a way to configure the SSU instead of having to use TL1 command syntax.

Through this port it is possible to perform management tasks including security management, configuration, performance monitoring, fault diagnosis, and firmware download. These same tasks can be performed via the remote port described earlier in this chapter.

Wiring the local cable

A serial communications interface cable wired as a “straight-through” cable is needed to connect between the local port and a computer.

A connector for the SSU-end of the cable is supplied as part of the Installation Accessories Kit included with the subrack.

Local Port RS-232 Interface

The local port connector provides a standard serial interface with full duplex capability (DCE configuration). Signal voltage levels comply with the EIA-232-E standard.

Table C2-9. Local Port connector pinout

Pin Number	Description
1	DCD (Data carrier detect)
2	RxD (Received data)
3	TxD (Transmitted data)
4	DTR (Data terminal ready)
5	GND (Signal ground)
6	DSR (Data set ready)
7	RTS (Request to send)
8	CTS (Clear to send)
9	RI (Ring indicator)

Local port RS-232 wiring diagram

Here is an example of an interface cable used to connect a computer to the local port.

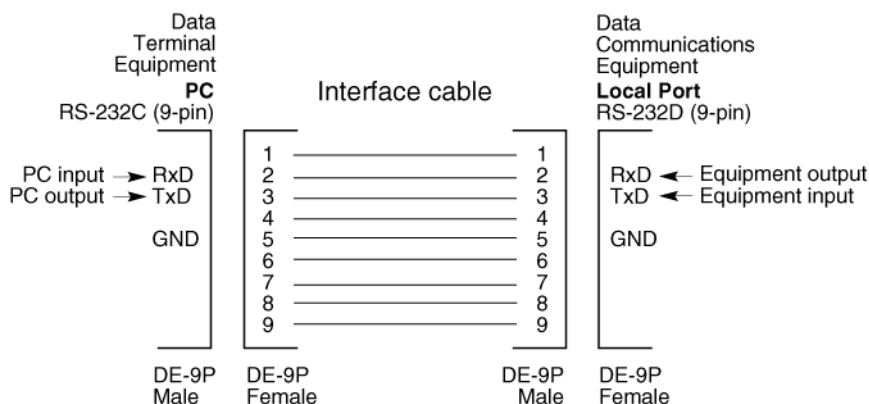


Figure C2-18. Local port cabling example

Connect the Input Signal Cables

Connect the appropriate input signals to the SSU. With the standard ITH cards, the PRC input and inputs 1 through 4 will accept signals. If you have ITH cards with Option 001, inputs 5 through 8 can also be used.

Reference Input Signals

Ensure that the reference signals meet the requirements for the SSU input signals. See chapter A3 for input reference requirements.

NOTE

If the inputs are taken from the 5071A or 55300A equipment, refer to chapter E2 for the testing of those output signals before using them with the SSU.

Connecting the input signals at this time will ensure fewer problems during the installation of the SSU plug-in cards. When setting switches on the ITH cards, be sure to disable unused input channels.

Refer to Figure B2-5 on page B2-8 for the recommended way to route cables to and from the SSU.

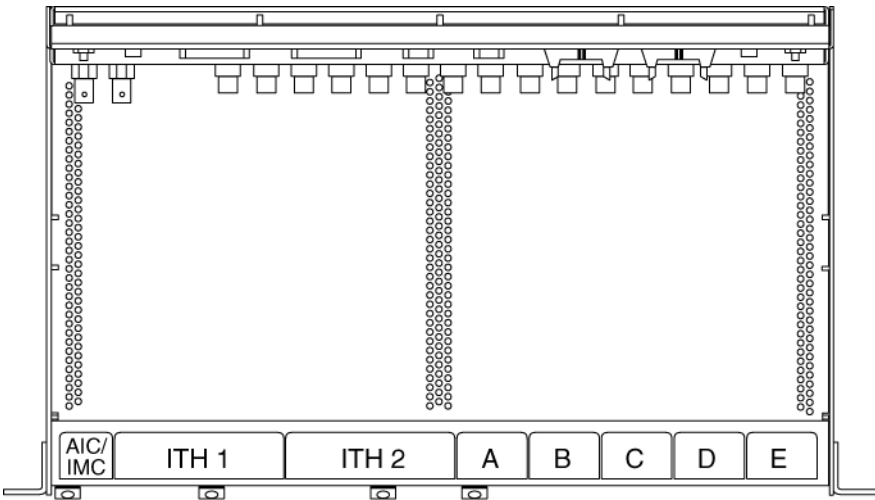
Install the Plug-in Cards

The following sections describe how to install the ITH cards, output cards, and communication card in turn. The procedures assume that the subrack has already been installed and power is applied.

The 55400A uses a redundant architecture. This means that no single failure can bring down the system. To support this concept, all of the output cards, as well as the clock cards, should be installed in protected pairs.

Plug-in Card Locations

The subrack has space for a communication card, two clock cards, and five pairs of output cards (A, B, C, D, and E slots).



Top View

Figure C2-19. Guide for card installation

The communication card slot (labeled AIC/IMC) takes one of the two communication cards:

- Information Management Card
- Network Information Management Card

The ITH slots take the two clock cards, and the “A” to “E” slots each accept pairs of output cards. Each row of outputs on the connector panel (labeled “A” to “E”) corresponds to a pair of output cards installed in slots “A” to “E.”

NOTE

If the output cards will not be installed as protected pairs, install only one card per labeled pair of slots. For example, one output card could be installed in either of the two slots designated as “B.” The second slot should remain empty.

Plug-in Card Identification

Card assemblies are identified by:

- Symmetricom model number on the front panel of each assembly
- Serial number on the side panel of cards

If there are any questions regarding a specific component, note the model number and serial number on each card assembly and include it in any correspondence with Symmetricom.

Overview of Card Switch Settings

Each plug-in card contains switches that need to be configured before use to ensure proper operation. As the procedure describes each card to be installed, there will be a pointer to the location of the switch settings the card in this manual.

TIP Create and maintain a switch configuration record for each card being installed in the system. One way to do this is to copy the switch configuration tables in this manual and mark your settings. Keep this documentation accessible. If a card ever needs to be replaced, the record is then available for configuring the replacement card correctly.

Initial Installation of 55400A System Cards

This is the procedure to follow when installing 55400A system cards for the first time:

- Configure the card
- Install the card
- Observe the card status
- Repeat for the next card

Install the cards in this order as instructed in the following topics:

- ITH clock cards
- Output cards
- Communication card

NOTE

It is strongly recommended that all card configuration at the time of the initial installation be accomplished by making the switch settings on the cards. This approach ensures that all card parameters are initially set to known states and can avoid confusion later during the service life of the SSU.

Install the ITH Clock Cards

These cards are very important to the overall performance of an SSU. They each contain a local oscillator that will track an input reference as well as all the circuitry for judging the health of the input signals. The two clock cards regularly compare individual results to increase the likelihood that a bad reference is quickly detected.

To install the first ITH card

1. Set switches

- a. Set the switch settings for this card include enabling inputs, selecting input formats, PRC frequency, and tracking mode. *Refer to chapter D1 for ITH card switch settings, and then return to this procedure.*

CAUTION

The next step should only be performed during initial installation of the SSU.

- b. Set switch S5–7 to “Off.” (See Note below.)

NOTE

If this ITH card assembly contains Option 001, there can be confusion about the location of this S5 switch. If the ITH assembly is labeled as Option 001 on the front panel, there are three circuit boards rather than the standard two boards. In this case, the S5 switch referenced here is located on the middle board. Otherwise, S5 is on the top board.

2. Plug in card

- a. Carefully insert the first ITH card into the ITH-1 slot.
- b. Ensure that the card assembly is in proper alignment with its mating backplane connector.
- c. Push the card assembly into place until it is fully seated into the backplane connectors without any binding or jamming.

3. Observe

- a. The self-test routine will execute.
- b. Wait until the ITH diagnostics LED starts blinking. Typically this takes less than one minute.

WHAT IS HAPPENING?

When the ITH card is first installed, the switch settings are read into on-card non-volatile memory overwriting any existing settings (this process is also called the “Istate transfer”). The blinking LED indicates that the switch settings have been written into memory.

4. Last step

Remove the card, set switch S5–7 to “On” and reinsert the card.

NOTE

To avoid situations where one ITH card may in the future inadvertently copy its configuration parameters to the other, performing the last step is required. The ITH card will stop operating and set a major alarm if the S5–7 switch is not set back to “On” shortly after the diagnostic LED starts blinking.

To install the second ITH card

1. Set switches

Set the switches for this card the same as for the first ITH card with switch S5–7 set to On.

NOTE

If this ITH card assembly contains Option 001, there can be confusion about the location of this S5 switch. If the ITH assembly is labeled as Option 001 on the front panel, there are three circuit boards rather than the standard two boards. In this case, the S5 switch referenced here is located on the middle board. Otherwise, S5 is on the top board.

2. Plug in card

Carefully install the second ITH card into the ITH-2 slot.

**WHAT IS
HAPPENING?**

The settings contained in the memory of the first card will automatically be copied to the second card.

3. Observe

The self-test routine will execute.

4. Next actions

- a. Before installing any more cards, wait until the ITH warmup LEDs go off. Depending on conditions, this can take from 2–20 minutes.
- b. Now connect the input references you have configured the ITH cards to expect. Wait until at least one input has been qualified (“Q” LED is on) and is being tracked as the active reference (“A” LED is on).
- c. Do not continue to the next section until both ITH cards indicate a tracking condition and all alarm LEDs are off.

NOTE

A minor alarm will occur if input channels are enabled yet have no input signal connected to that input. If necessary, recheck the ITH cards for the correct switch settings. If changes are made to the switch settings, repeat this procedure beginning at step 1 of “To install the first ITH card.”

Important

The ITH clock cards are different from the other cards because they share information about their operating condition and their judgments of the input signals. Provisioning is kept in non-volatile memory, with the switch settings as a backup for the most important variables. A replacement ITH card will generally obtain provisioning from the active ITH card already in the system. Changes to the ITH provisioning state can be made to an operating system without taking it out of service.

ITH Card Changes During Service

At least two major types of ITH card changes can take place during the service operation of an SSU:

- ITH card replacement
- Change to a parameter setting while in service

These two situations are described here.

To Replace an ITH Card while the System is in Service

Use this procedure if you are replacing one ITH card with another without making any changes to the configuration of the ITH cards.

1. Remove the failed ITH card

NOTE

When replacing an ITH card in a system that is in service, be sure that the card being replaced is in the standby mode. (DO NOT remove the active card.)

2. Set switches

- a. Set the switches on the replacement card to be the same as the card it is replacing.
- b. Check that switch S5–7 is set to “On.” This setting ensures that the parameter settings from the active ITH card will automatically be copied into the memory of the replacement card when it is installed.

3. Plug in card

- a. Carefully insert the ITH card into the subrack.
- b. Ensure that the card assembly is in proper alignment with its mating backplane connector.
- c. Push the card assembly into place until it is fully seated into the backplane connectors without any binding or jamming.

4. Observe

- a. The self-test routine will execute.
- b. Wait until the ITH card completes the warm-up period and successfully completes the qualification of inputs.

5. Last Step

- a. Tighten the mounting screws at the top and bottom of the card.

To Force an ITH Parameter Change during Service

There may be instances during the operation of a system when you want to change a parameter setting without taking the system out of service. For example, you may need to disable an input or change a format type from 2048 kHz to kbps.

NOTE

Although it is possible to change parameter settings during service by modifying switch settings it is not recommended because this method can cause the SSU to go into holdover if the switches are not set correctly.

Most parameter changes to operating ITH cards can be accomplished more easily using TL1 commands or the local/remote management software from Symmetricom described earlier in this manual. For more information about the software applications and connecting a computer to the SSU, refer to chapters A1 and A5.

Install the Output Cards

The output cards determine the number and type of output signals the SSU will provide for downstream network elements.

Typically, output cards are installed as protected pairs.

NOTE

Problems may be encountered when different model output cards are combined in pairs. DO NOT install as a pair output cards that have different model numbers. For example, a 55481B should never be installed as a pair with a 55484A card. In cases where two different cards are combined, alarms may, or may not, be set and most often the output signals from the cards will be degraded to the point that the output signals no longer meet the requirements of the pulse mask.

This procedure assumes that the output cards are installed as protected pairs.

1. Set switches

- a. Set the switch settings for the first card of a pair. *Refer to chapter D2 for output card switch settings, and then return to this procedure.*
- b. Set the switches on the second card of the pair the same as the first.

2. Plug in cards

- a. Carefully insert the output cards, one at a time, into one of the slots labeled with a letter from “A” to “E.”
- b. Ensure that each card assembly is in proper alignment with its mating backplane connector.
- c. Push each card assembly into place until it is fully seated into the backplane connectors without any binding or jamming.

3. Observe

- a. The self-test routine for each card will execute.
- b. LEDs indicating power is applied, the active ITH card, and the active or standby state for the individual card.

4. Next actions

- a. Repeat this procedure for the additional output cards to be installed.

Install the Communication Card

The communication card for the 55400A SSU can be either of the following:

- Information Management Card
- Network Information Management Card

To install the communication card

1. Set switches

- a. Set the switch settings for this card as appropriate. *Refer to chapter D3 for communication card switch settings*, and then return to this procedure.

2. Plug in card

- a. Carefully insert the communication card into the IMC slot.
- b. Ensure that the card assembly is in proper alignment with its mating backplane connector.
- c. Push the card assembly into place until it is fully seated into the backplane connectors without any binding or jamming.

3. Observe

- a. The self-test routine will execute.
- b. LED indicating power is applied, diagnostics LED flashes once, alarm LED flashes once, and critical alarm LED remains on.

4. Press

- a. Alarm Cutoff push-button to turn off critical alarm LED.

At this point, SSU system should be in an all-green LED status.

NOTE

This will not be true if there are any enabled inputs that have no reference signal connected. Inputs are disabled/enabled on the ITH cards using switch settings or the local/remote management software from Symmetricom described earlier in this manual.

What is Next?

- 1 Perform the qualification tasks in chapter E1 and then the equipment tests in chapter E2.

The qualification tasks consist of:

- Display current status
- Verify SSU configuration
- Set SSU date and time
- Set SSU system ID
- Configure SSU for network operation (if needed)

The equipment tests consist of:

- Alarm tests
- Output checks

NOTE

If installing the SSU with the frequency standard or GPS reference source, complete those installations before starting the qualification procedures.

- 2 Connect the outputs to network elements.

The last step is to connect the output signals to the network elements that require synchronization.

Backdating

NOTE

This section contains material that applies to older versions of subracks prior to the 55401D and 55402D.

External Line Filters

Subracks before models 55401D and 55402D require the use of external line filters (two per subrack). These filters are required to satisfy the European-based CE mark requirements for conducted emissions. For all other installations, use of these filters is recommended as a safeguard against emission leakage onto the -48 Vdc power supply lines. The subracks affected are:

- 55401B
- 55401C
- 55402C

The following information provides recommendations for the power supply cabling to the subrack, assembly of the power connectors for the external filters, and installation of the external line filters.

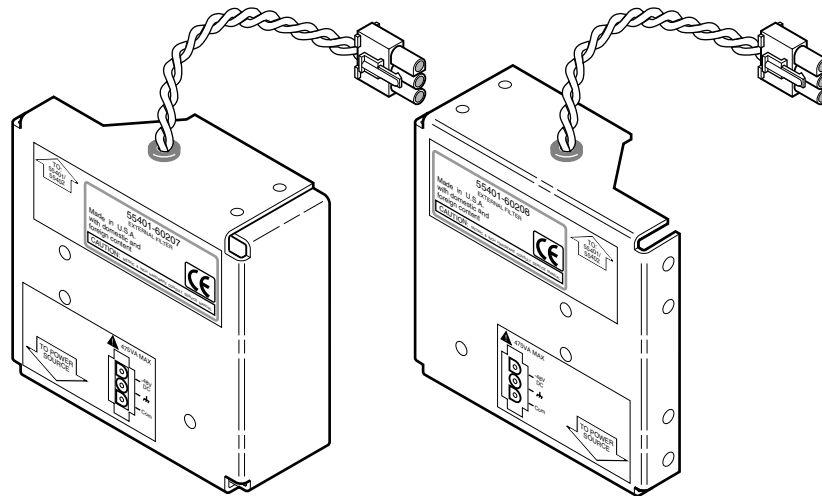


Figure C2-20. External line filters

NOTE

Two different types of connectors are used on some subracks. If the connectors at the end of the line filter cables are not the same type as those on the subrack, read the following information.

Changing Connector Types

Parts for assembling two additional power connectors are included for instances where the power connectors on the subrack are different from those on the external line filter cables that connect to the subrack. Connectors can be a three-pin or four-pin configuration.

If it is necessary to replace a three-pin type connector with a four-pin type, follow the next procedure. If a four-pin type should need to be replaced with a three-pin type follow the procedure on page C2-12.

To install four-pin power connector

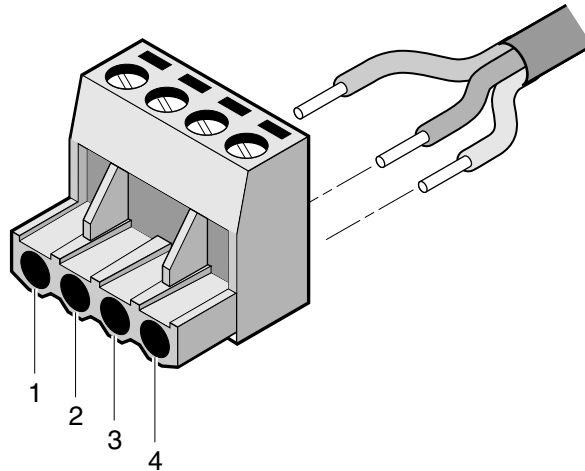


Figure C2-21. Power Connector

1 – Ground (frame ground)

2, 3 – Common Gnd (battery return)

4 – -48 Vdc

Wire identification

Refer to this wire identification information when replacing a connector on the external line filter:

- Green wire = Ground (frame ground)
- Black wire = Common Ground (battery return)
- Red wire = -48 Vdc

Assembly procedure

1. Strip 9 mm of insulation from the wires. (Use wire no larger than 2 mm diameter.)
2. Connect the frame ground wire (if present) to plug position 1.
3. Connect the common ground wire to plug position 2 or 3.
4. Connect the –48 Vdc wire to plug position 4.

CAUTION

Common ground pins of the two –48 Vdc subrack connectors are internally connected.

Grounding issues

Before running power cables, consider how best to provide frame grounding for the subrack. A frame ground can be connected in one of three ways:

1. As part of the cabling through the –48 Vdc power connector.
2. Through a single-wire connection to the ground stud on the connector panel.
3. Through the rack mount brackets when the rack cabinet itself is properly grounded.

NOTE

To prevent battery return-to-frame ground faults, do not connect battery return on the subrack to the frame ground.

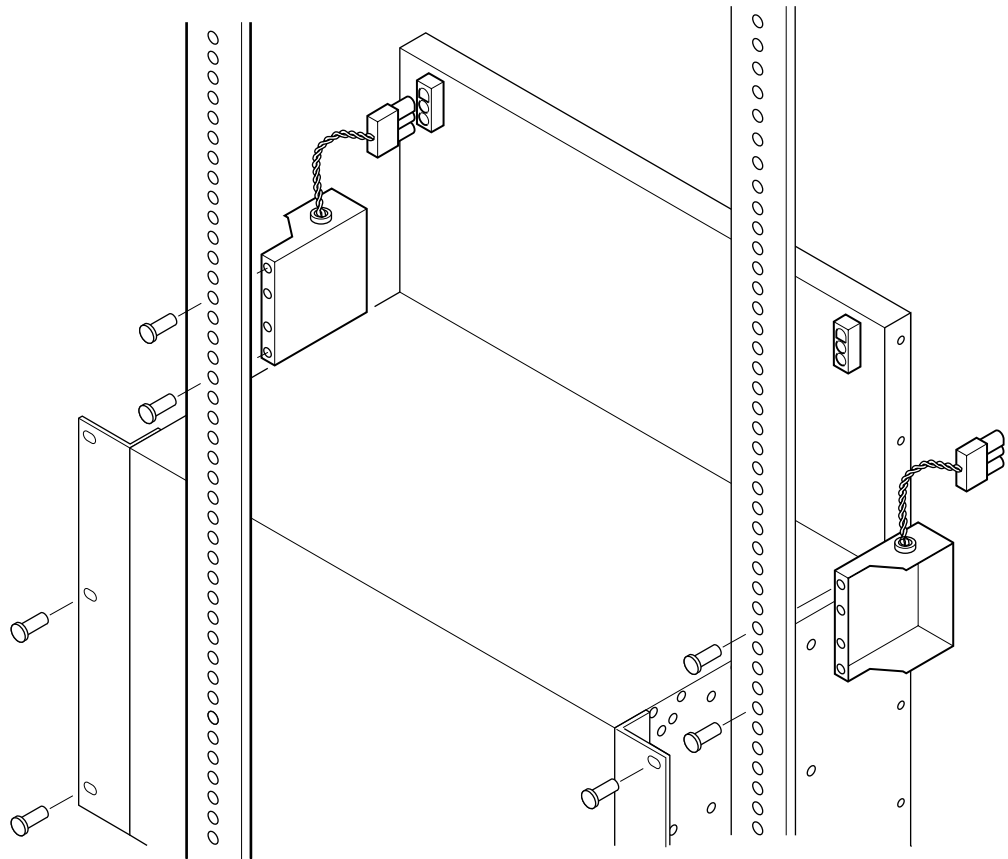
Install the Filters and Apply Power to the Subrack

1. If necessary, review the recommendations for running power cables to the subrack. (See page C2-11.)
2. Connect the leads of the battery feed lines to the branch circuit power source terminals according to local practices.
3. Set the branch circuit breakers to on, or re-install the branch fuses.
4. Measure the voltage of the battery leads at the subrack. The voltage must measure from –36 to –57 Vdc.
5. Plug the assembled power connector on the left-hand side of the subrack into the 55401-60207 External Filter.
6. Attach the external filter to the equipment rack using the supplied screws. (See Figure C2-22.)
7. Plug the power cable at the top of the filter into the “A” power connector on the subrack.

Backdating

Issue 1

8. Plug the assembled power connector on the right-hand side of the subrack into the 55401-60208 External Filter.
9. Attach the external filter to the equipment rack using the supplied screws. (See Figure C2-22.)
10. Plug the power cable at the top of the filter into the “B” power connector on the subrack.

**Figure C2-22. View of subrack with external filters**

C3

Install Expansion Subracks

Installation, cabling, verifying, and backdating

In This Chapter

This chapter describes how to install an expansion subrack on a system that is already in service. The topics include:

- General information
- Equipment rack recommendations
- Switch settings for expansion subrack communication cards
- Cabling information
- Installing the first expansion subrack
- Installing an additional subrack
- Replacing or removing an expansion subrack
- Using local craft terminal software and TL1 syntax to verify communication between master and expansion subracks
- Expansion subrack events
- Installing the adapter box on the “B” or “C” subrack

NOTE

See “In This Manual” for a list of tasks to put an SSU expansion subrack into service.

Assumptions in these procedures

- Although the procedures show a 55402D expansion subrack being installed, replaced, or removed in a system with a 55401D master subrack, the procedures apply to the other subracks, as well.
- Typically, all SSU systems include a master subrack that contains two ITH clock cards. These procedures assume that your master subrack contains two ITH clock cards which makes it possible to install or remove an expansion subrack while the master subrack is in service.
- These procedures call out some steps that must only be performed on the standby side of the system to ensure that the active, online side is not disturbed.

Subracks Covered by the Procedures

These installation procedures apply to the following subrack configurations:

- 55401D
- 55402D
- 55401B with adapter box
- 55401C with adapter box
- 55402C with adapter box

NOTE

The adapter box is described in the backdating section of this chapter.

Expansion Subrack Connector Characteristics

There are two variations of expansion subracks that have been released. The differences relate to the characteristics of the connectors as summarized in the following table.

Table C3-1. Expansion subrack connectors

Connector	55402C	55402D
Outputs (80)	Grounded	Grounded
–48 Vdc	Locking	Locking
Expansion signals	Terminated	Terminated and shielded

NOTE

Refer to the chapter on specifications (chapter A3) for more details about the subracks including dimensions and power requirements.

Accessories, Tools, and Equipment

Accessories

An installation accessories kit will be supplied with the 55402D expansion subrack. It contains connectors that can be used for making connecting cables. The items in this kit are described in Table C3-2.

Table C3-2. Accessories supplied with 55402D expansion subrack

Accessory	Qty	Purpose	Part #
Locking power connector	2	–48 Vdc power inputs	1251-5272
Spare 1A telecom fuse	1	Communication card	2110-1129
Spare 2A telecom fuse	1	Output cards	2110-1125
Spare 3A telecom fuse	1	ITH cards	2110-1000
Crimp lug terminal	2	Frame ground connection	0360-0041
Screw–10-32 w/nylon washer	6	EIA rack mounting	0570-1366
U-nut	6	EIA rack mounting	0590-0804
Connector pins	8	Power connector	1251-2418

Two pairs of rack mounting flanges are also included for mounting the SSU into an EIA or ETSI rack.

Tools

Table C3-3 describes the required tools and where they are used. The list of tools does not include a crimp tool that will be needed to make the mating connectors for the input/output connectors.

Table C3-3. Tools needed to install 55402D expansion subrack

Tool	Purpose
Large Phillips or Pozidriv #2 screwdriver	Rack mounting screws
Molex Hand Crimping Tool (11-01-0084)	Power cables
7 mm nut driver	Frame ground stud on subrack front panel
Wire strippers	Making power cables
Diagonal cutters	Making power cables
ESD wrist strap	ESD protection when installing cards

Equipment

Table C3-4 describes the required equipment and where they are used.

Table C3-4. Equipment needed to qualify 55402D expansion subrack

Equipment	Purpose
Digital multimeter	Check voltage and cables for opens/shorts
54603A general purpose oscilloscope, or equivalent	Check signal characteristics during qualification

Install the Expansion Subrack

The physical installation of the expansion subrack is the same as for the master subrack. For this reason, there are references back to the installation of the master subrack for rack positioning and power inputs.

Position in the Rack Cabinet

It is recommended that the master subrack be installed near the bottom of the rack cabinet and the expansion subrack be installed above it. See chapter B2 for drawings of three different equipment configurations showing master and expansion subracks. The recommended spacing between the equipment is shown as well.

With the master subrack near the bottom, the installation of the first expansion subrack above it simplifies the cabling between the subracks.

NOTE

Cable Length Limit: The following cable length limitation will determine how far from the master subrack any expansion subrack may be located:

The master subrack can drive the expansion signals through up to 8 meters of cable length. This means that if you were to take one cable from each pair of Expansion Signal cables used to connect the subracks together and lay them out end-to-end, the total cable length cannot exceed 8 meters.

For example, if you were connecting two expansion subracks to a master subrack and the first subrack was located 6m from the master subrack, the second expansion subrack should be no more than 2m away from the first.

Installing the expansion subrack

Follow the instructions in chapter C2, “Subrack Installation Procedure” to install the expansion subrack in the rack cabinet.

Connecting the –48 Vdc power inputs

Follow the procedures in chapter C2, “–48 Vdc Power Inputs” through “Connecting dc Power” to apply power to the expansion subrack.

Expansion Subrack Cabling

When a master and expansion subrack are cabled together, there are four cables that interconnect them. Two cables connect the Expansion Comm ports and two cables connect the Expansion Signal ports.

The following drawings show in diagram form how the cables are connected for single and multiple expansion subrack configurations.

Expansion Subrack Cable Kits

There are two cable kits required for an expansion subrack:

- 55424A Expansion Subrack Cable Kit
- 55425A Expansion Subrack Comm Return Kit

55424A kit contains

- 1 expansion comm cable
- 2 expansion signal cables

All cables are the same length. An option number to the product specifies the desired length. Lengths of 2, 3, 4, 5, 6, 7, and 8 meters are available.

55425A kit contains

- 1 expansion comm cable
- 2 connector terminators

The single cable is used to connect from the last (most-distant) expansion subrack back to the master subrack. An option number to the product specifies the desired length. Lengths of 2, 3, 4, 5, 6, 7, 8, 10, 13, and 18 meters are available.

NOTE

When determining the length of cable needed, be sure to take into account any distance in going from rack to rack via cable trays, etc. Do not route cables around motors, generators, or other equipment that produces electromagnetic fields.

Expansion Subrack Cable Diagrams

The drawings are to show only the cable connections between subracks. No effort is made to indicate the proper routing of cables. In all diagrams, the subrack connector designations from left to right are:

- Expansion Comm port (9-pin male connector)
- Expansion Comm port (9-pin female connector)
- Expansion Signal In (two 15-pin female connectors)
- Expansion Signal Out (two 15-pin female connectors)

Master with Single Expansion Subrack

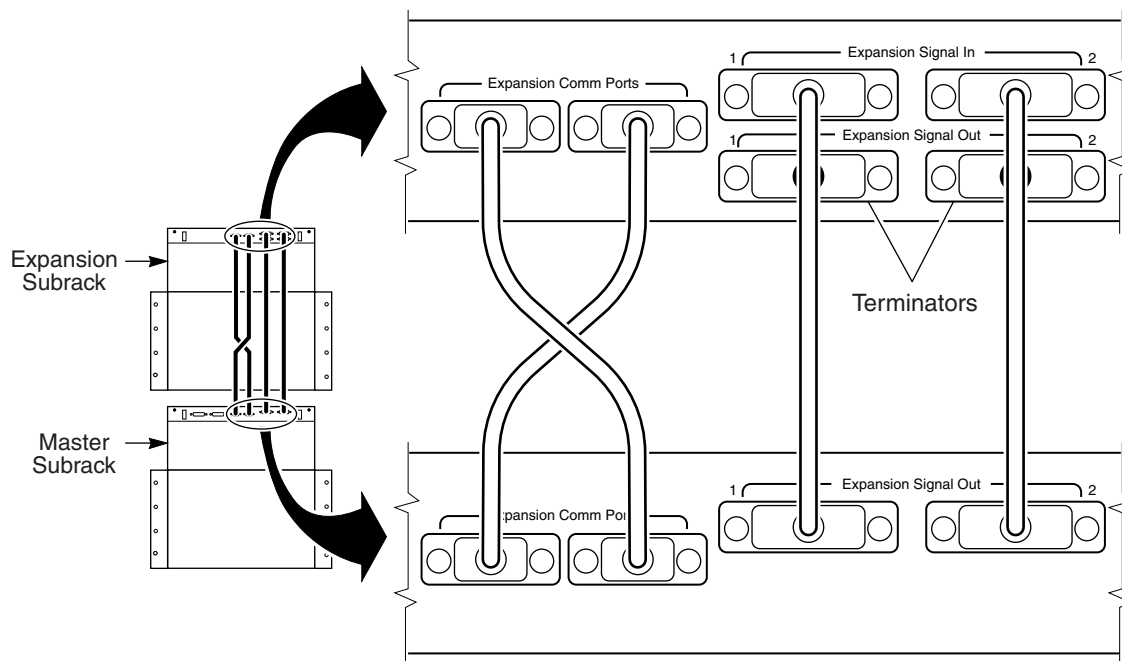


Figure C3-1. Cable diagram of master and one expansion subrack

NOTE

Two terminators plug into the unused Expansion Signal Out 1 and 2 connectors on the expansion subrack.

Master with Two Expansion Subracks

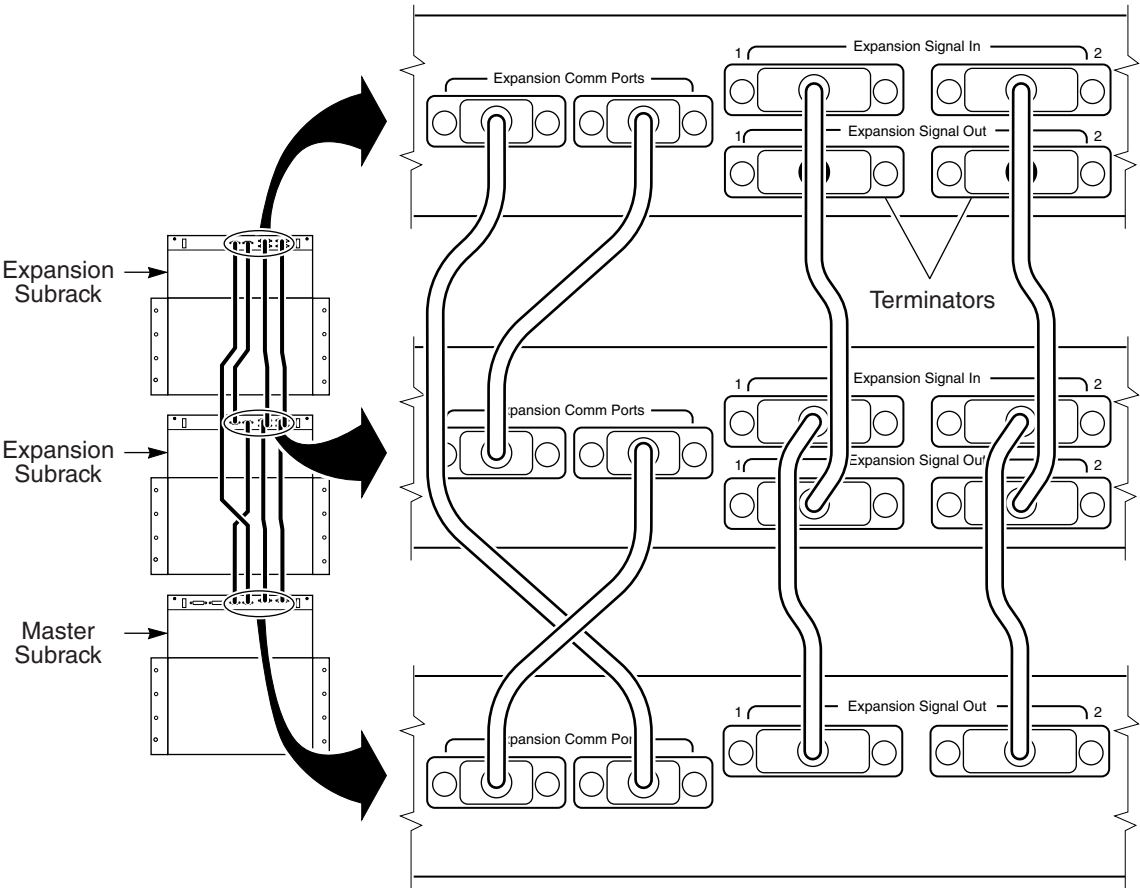


Figure C3-2. Cable diagram of master and two expansion subracks

NOTE Two terminators plug into the unused Expansion Signal Out 1 and 2 connectors on the last expansion subrack.

Master with Three Expansion Subracks

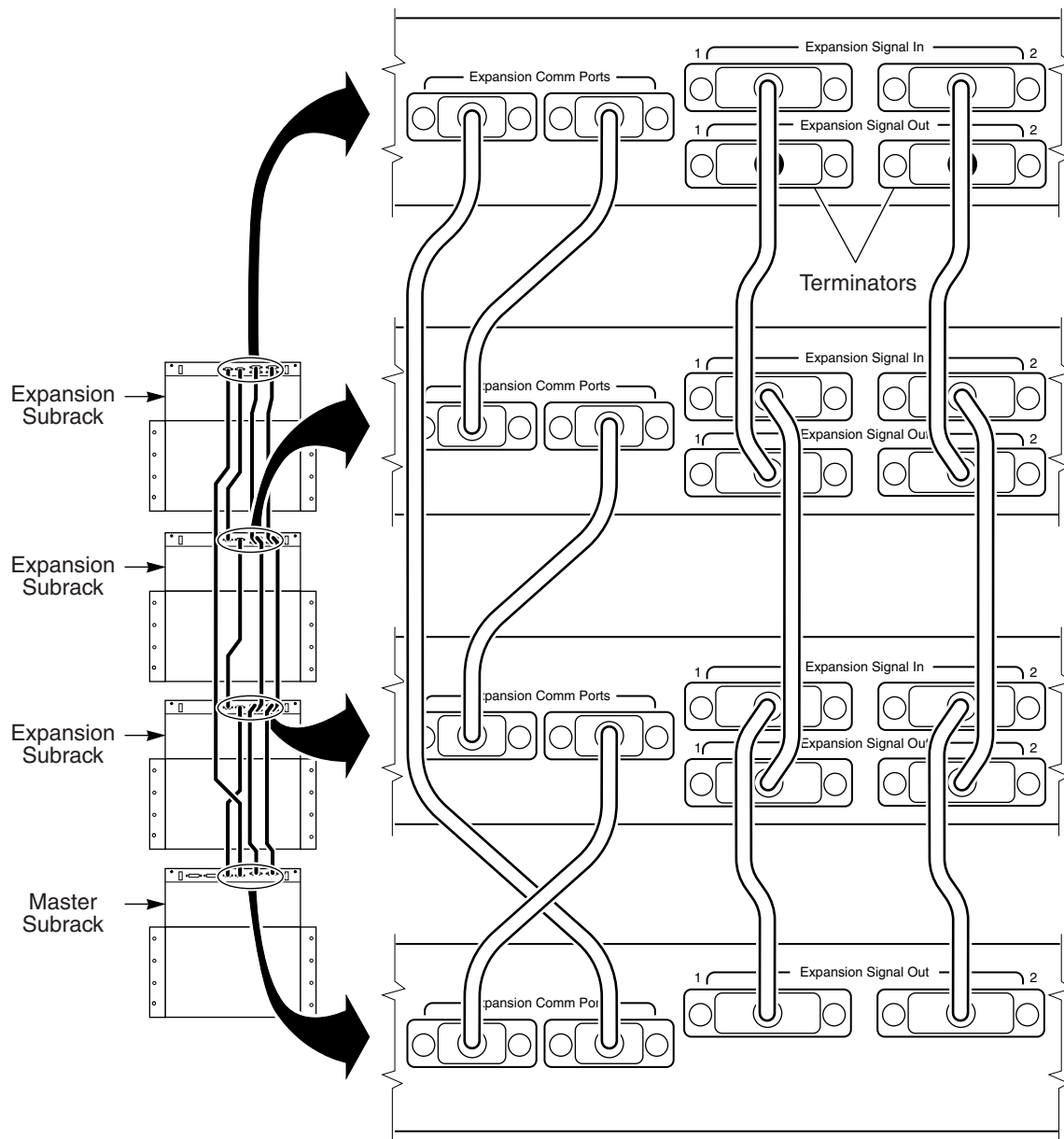


Figure C3-3. Cable diagram of master and three expansion subracks

NOTE

Two terminators plug into the unused Expansion Signal Out 1 and 2 connectors on the last expansion subrack.

Master with Four Expansion Subracks

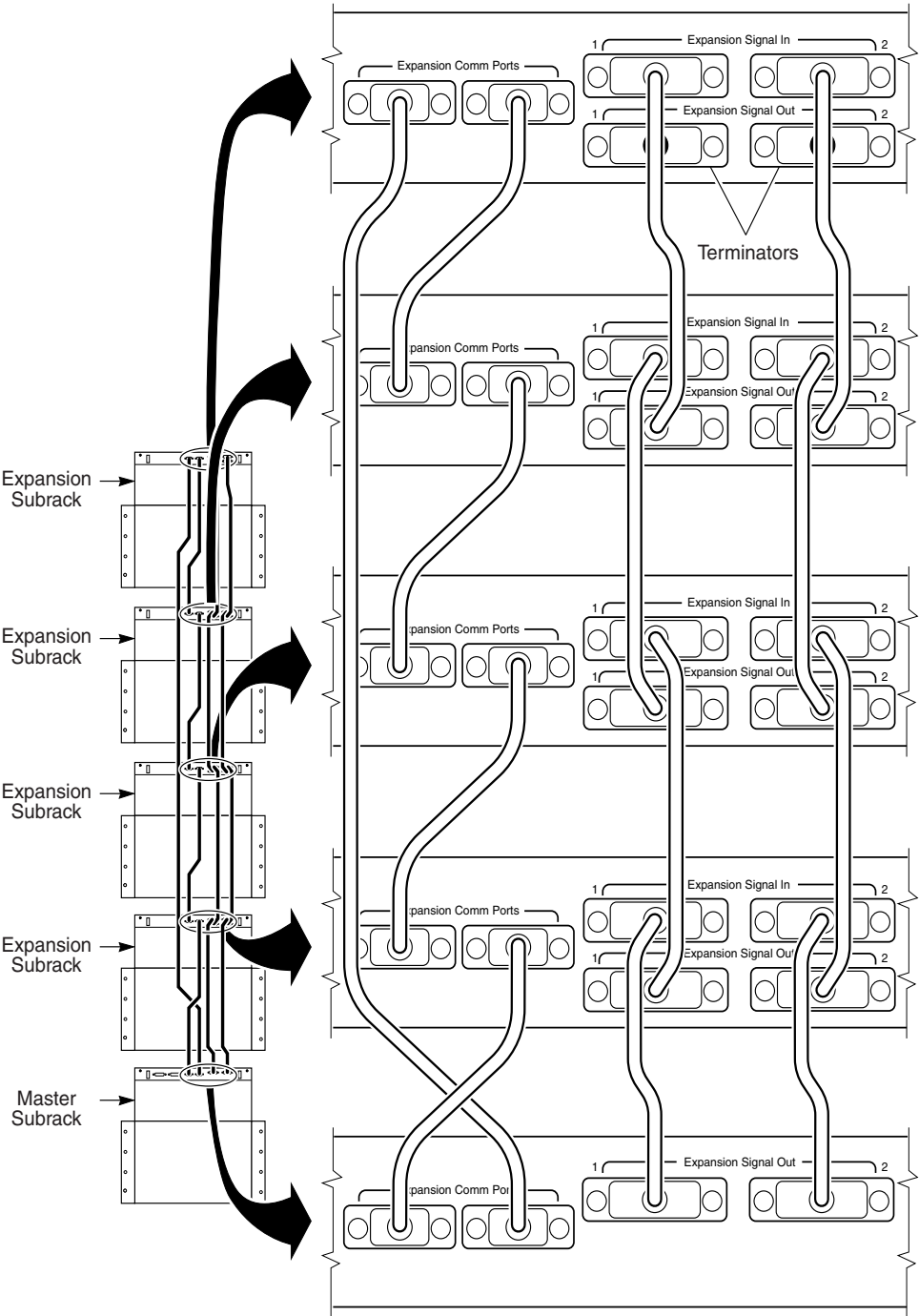


Figure C3-4. Cable diagram of master and four expansion subracks

NOTE

Two terminators plug into the unused Expansion Signal Out 1 and 2 connectors on the last expansion subrack.

Expansion Subrack Cards

The expansion subrack contains output cards for generating timing signals as well as the cards needed to maintain communication and synchronization with the master subrack and other expansion subracks. Each of the communication and synchronization cards has switch settings.

There are two types of expansion cards that handle the alarm management, the routing of synchronization signals, and communication with the master subrack:

- 55419A Expansion Synchronization Card
- 55443A Expansion Communications Card

55419A Expansion Synchronization Card

There are normally two synchronization cards in each expansion subrack to provide redundant operation. The function of these cards in the expansion subrack is similar to that of the ITH clock cards in the master subrack. See Table C3-5 for the card's switch settings.

Table C3-5. Expansion Sync Card Switch Setting

Switch	Bit	Parameter	Off	On (Default)
S4	1-7	Reserved	—	—
	8	Firmware Startup State	Force download mode	Verify firmware on startup

Switches S1, S2, S3, and S5 are not used.

55443A Expansion Communications Card

A single communications card is required in each expansion subrack. The function of this card is similar to the communication card in the master subrack. See Table C3-6 for the card's switch settings.

Table C3-6. Expansion Comm Card Switch Setting

Switch	Bit	Parameter	Off	On (Default)
S5	1	Firmware Startup State	Force download mode	Verify firmware on startup
	2-8	Reserved	—	—
S6	1	Single ITH operation	One ITH card in master subrack	Two ITH cards in master subrack
	2-4	Reserved	—	—

Switches S3 and S4 are not used.

Access Identifier for Multiple Subracks

An additional <aid> parameter in TL1 command strings is needed to identify the location of the output cards in multiple-subrack systems. The particular subrack must be identified in the command line to ensure that the correct card is configured or identified.

What follows is an example of how to interpret the access identifier for output cards in expansion subrack systems. Refer to the *55400A TL1 Programming Reference Manual* for more information on how to use and interpret access identifiers.

<aid> Parameter

The access identifier for multiple-subrack systems is in the form:

Sn-OUTx

Where *n* is the ID number of the subrack and *x* is the letter of the output card slots where the card, or pair of cards, is located. (When two output cards are installed as a protected pair, the command applies to both cards.)

Example Command

In this example, the command sets the output cards in slot C of the first expansion subrack to squelch their outputs when the master subrack goes into holdover mode.

```
ED-EQPT : :S1-OUTC:1:::HLDACT=SQUELCH;
```

ID Number

The ID number of the subrack is set with a switch at the time the subrack is installed. Values can be 0, 1, 2, 3, or 4. The master subrack always takes the “0” value. The remaining numbers are used for the expansion subracks. In this case, the command is directed to the subrack with its ID number set to “1.”

Card Slot

The letter (A, B, C, D, or E) refers to the position in the subrack where the output card is located. The ten slots for output cards are divided into pairs with each pair of slots having a letter assigned using a label on the subrack itself.

Adding the First Expansion Subrack

NOTE

This procedure is written to allow the expansion subrack to be installed while the master subrack is in service.

Install the subrack and the cards

- a. Install the empty expansion subrack into the rack cabinet and apply -48 Vdc at power inputs A and B. Refer to chapter C2 for information on rack mounting and applying power to the subrack.
- b. Set the backplane switch on the expansion subrack to “1” (for the first expansion subrack). This step establishes the expansion subrack’s identification number. The switch is located near the upper left of the backplane behind where the expansion communications card will be installed. (See Figure C3-5.)

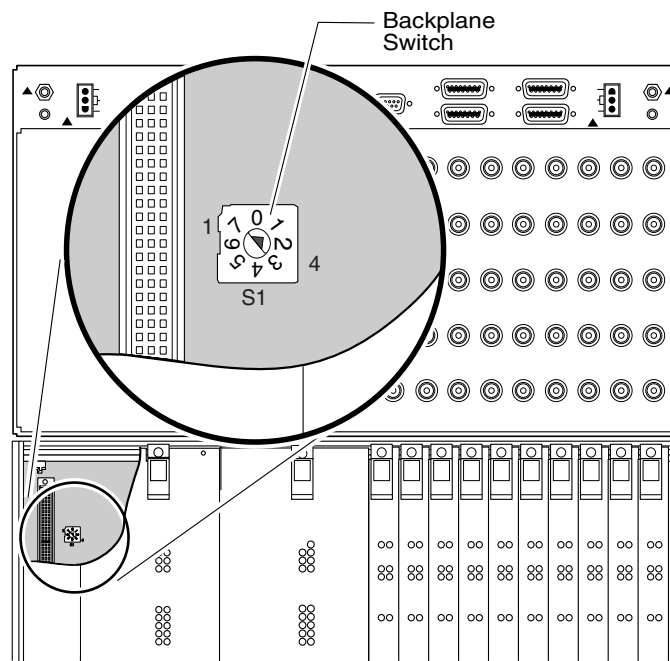


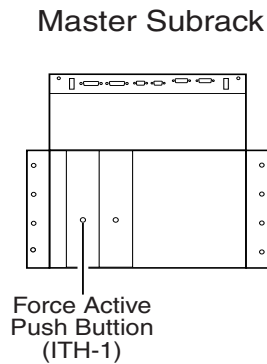
Figure C3-5. Expansion subrack backplane switch location

- c. Check the switch settings on the expansion synchronization cards, as described earlier in this chapter, and install the two cards into the expansion subrack. The cards go into the same slots in the expansion subrack that the ITH-1 and ITH-2 cards do in the master subrack. Ignore any alarms in the expansion subrack until the end of this procedure. Tighten the retaining screws.

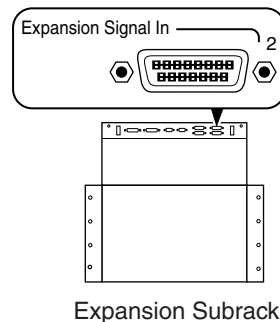
Adding the First Expansion Subrack

Issue 1

- d. Configure and install the output cards that are part of this expansion subrack. Refer to chapter D2 for more on configuring the output cards. Tighten the retaining screws.
- e. On the master subrack, verify that no alarm conditions exist and take note of which ITH card is in the Active mode. (This is important so that at the end of this procedure the same ITH card can be returned to its role as the active ITH card.)
- f. On the master subrack, set the ITH-1 card to the Active mode by pressing the **Force Active** push button on this card.

**Connect the first expansion signal cable**

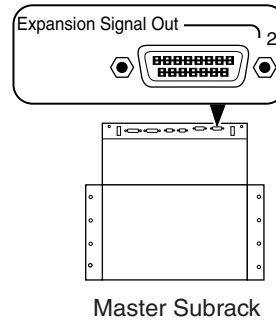
- a. Take one of the expansion signal cables (15-wire) and connect one end to the expansion subrack at the **Expansion Signal In—2** connector. Tighten the cable connector in place.



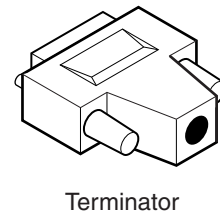
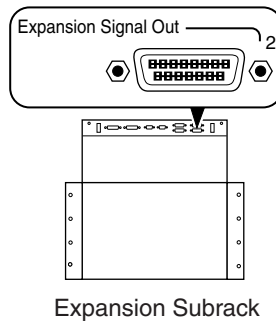
Adding the First Expansion Subrack

Issue 1

- b. Connect the other end of the expansion signal cable to the master subrack at the **Expansion Signal Out—2** connector. Tighten the cable connector in place.



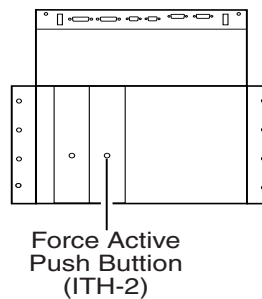
- c. Plug one of the connector terminators into the expansion subrack at the open **Expansion Signal Out—2** connector.



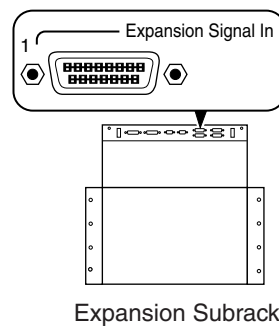
Connect the second expansion signal cable

- a. In the expansion subrack, verify that the 55419A expansion sync card in slot “ITH-2” is in the active mode by observing that the **Active** LED is on.
- b. In the master subrack, set the ITH-2 card to the active mode by pressing the **Force Active** push button on this card.

Master Subrack



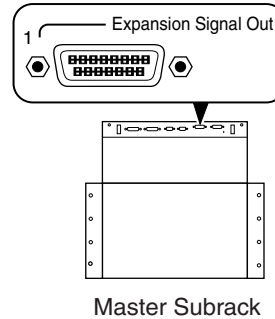
- c. Take the second expansion signal cable (15-wire) and connect one end to the expansion subrack at the **Expansion Signal In—1** connector. Tighten the cable connector in place.



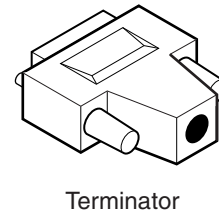
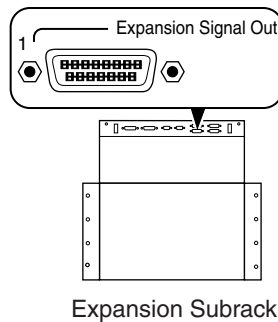
Adding the First Expansion Subrack

Issue 1

- d. Connect the other end of the expansion signal cable to the master subrack at the **Expansion Signal Out—1** connector. Tighten the cable connector in place.



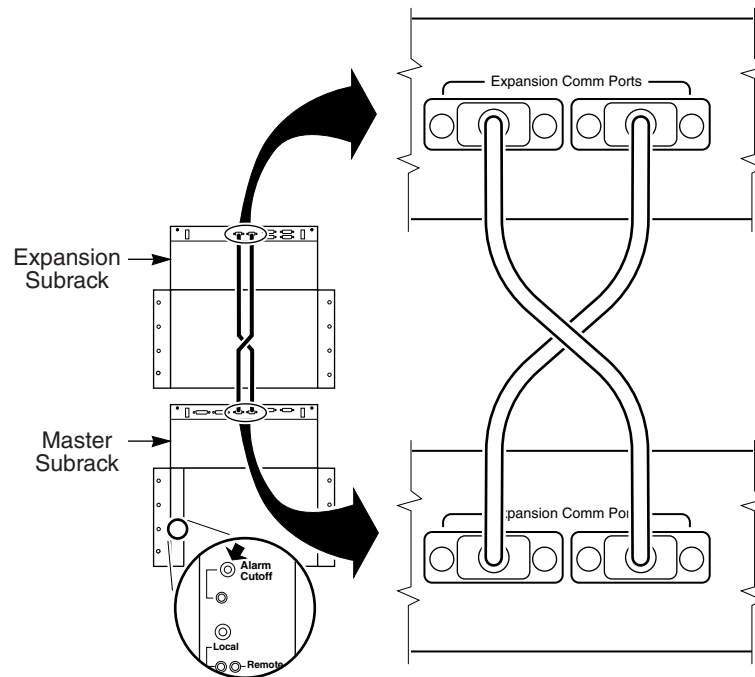
- e. Plug the second connector terminator into the expansion subrack at the open **Expansion Signal Out—1** connector.



- f. In the expansion subrack, verify that the 55419A expansion sync card in slot “ITH-1” is in the standby mode by observing that the **Standby** LED is on.
- g. Set the ITH card that was the active master at the beginning of the procedure to the active mode again by pressing the **Force Active** push button on that ITH card. This step ensures that the ITH card that was the active master at the start of this installation is again in that same role.

Connect the expansion communication cables

- a. Configure and install the 55443A expansion communications card into the left-most slot of the expansion subrack. Tighten the retaining screws.
- b. Take one of the expansion comm cables (9-wire) and connect between the expansion and master subrack at the Expansion Comm Port connectors. Tighten the cable in place using the securing posts.
- c. Install the second expansion comm cable between the expansion and master subrack. Tighten the cable in place.
- d. On the master subrack, press the **Alarm Cutoff** push button several times to clear all alarms. If alarms still remain, review this installation procedure before continuing.



- e. Perform the communication test procedure that is included later in this chapter under “Verify Communication Between Subracks.”

Expansion Subrack Events

The 55400A system is constantly monitoring itself for the presence of alarm conditions. After adding or removing an expansion subrack, check to ensure that no expansion-related events are being reported. As described later in this chapter, the check can be accomplished using TL1 commands or a management software application from Hewlett-Packard.

Send the following TL1 command to the master subrack and verify that no expansion subrack events are active:

```
RTRV-NETTYPE-ALL:::ABC1;
```

Expansion Event Descriptions

A brief explanation of the expansion subrack events is given here. These events are described in more detail in chapter A5.

IMCNCDN — (No IMC communication downward) In a multiple-subrack system, the communications link is a loop supporting communications in two directions: up and down. This event indicates that there is a break in the downward direction. Check expansion comm port cabling from the right-side port. (Minor alarm)

IMNCUP — (No IMC communication upward) In a multiple-subrack system, the communications link is a loop supporting communications in two directions: up and down. This event indicates that there is a break in the upward direction. Check expansion comm port cabling from the left-side port. (Minor alarm)

RACKDUP — (Duplicate subrack number) This event occurs in a multiple-subrack system when two, or more, subracks have their backplane switch set to the same value. It is extremely important that each of the subracks have different switch settings and that the master subrack always has its backplane switch set to the “0” position. The backplane switch is located behind the communications card.

NOTE

It is a good idea to maintain a record of the assigned subrack numbers and their location in the communications loop. This information can help diagnose a communications problem.

After correcting a problem of duplicate subrack numbers, execute the RTRV-COND-TSG and RTRV-NETTYPE-ALL commands to verify that the system has corrected its internal inventories of card modules. If reports of missing output cards continue, the RMV-EQPT command can be used to correct the actual inventory by deleting cards from the existing inventory of cards. (Major alarm)

RACKOOR — (Subrack number out of range) This event occurs when a subrack backplane switch has been set to a number outside the established range. The allowable settings are: 0, 1, 2, 3, 4. The master subrack must always be set to “0”. The backplane switch is located behind the communications card. (Major alarm)

NOTE

It is a good idea to maintain a record of the assigned subrack numbers and their location in the communications loop. This information can help diagnose a communications problem.

ITHNCDN — (No ITH communication downward) In a multiple-subrack system, the ITH communications link is a loop supporting communications in two directions: up and down. This event indicates that there is a break in the downward direction. Check expansion comm port cabling from the right-side port. (Minor alarm by default, can be modified)

ITHNCUP — (No ITH communication upward) In a multiple-subrack system, the ITH communications link is a loop supporting communications in two directions: up and down. This event indicates that there is a break in the upward direction. Check expansion comm port cabling from the left-side port. (Minor alarm by default, can be modified)

SRINVMM — (Subrack inventory mismatch) This event is generated by the IMC/NIMC and indicates that the subrack inventories maintained separately by the IMC/NIMC and ITH cards in the master subrack do not agree. (Major alarm)

NOTE

Alarm LED Behavior with Expansion Subracks: An alarm occurring in an expansion subrack is indicated with an alarm LED on the failed card, an alarm-level indication (minor, major, or critical) on the Expansion Comm card in the expansion subrack containing the failed card, and an alarm-level indication on the IMC or NIMC in the master subrack.

Add Additional Expansion Subrack

NOTE

This procedure is written to allow the expansion subrack to be installed while the master subrack is in service.

Install the subrack and the cards

- a. Install the empty expansion subrack into the rack cabinet and apply –48 Vdc at power inputs A and B. Refer to chapter C2 for information on rack mounting and applying power to the subrack.
- b. Set the backplane switch on the new expansion subrack to one of the allowed numbers that is not being used. It is critical that each subrack has a different ID number. The master subrack must always be set to “0” and the expansion subracks can use numbers from 1 to 4. The switch is located near the upper left of the backplane behind where the expansion communications card will be installed.
- c. If you do not know what numbers are being used by other expansion subracks, either send the TL1 command: RTRV-NETTYPE-ALL:::ABC1 to identify the current subrack numbers or remove the communications card from each expansion subrack to check on the backplane switch setting. Set the backplane switch on the new expansion subrack to the next unused ID number. This step establishes the expansion subrack’s identification number.
- d. Check the switch settings on the expansion synchronization cards, as described earlier in this chapter, and install the two cards into the expansion subrack. The cards go into the same slots in the expansion subrack that the ITH-1 and ITH-2 cards do in the master subrack. Ignore any alarms in the expansion subrack until the end of this procedure. Tighten the retaining screws.
- e. Configure and install the output cards that are part of this expansion subrack. Refer to chapter D2 for more on configuring the output cards. Tighten the retaining screws.
- f. On the master subrack, verify that no alarm conditions exist and take note of which ITH card is in the Active mode. (This is important so that at the end of this procedure the same ITH card can be returned to its role as the active ITH card.)
- g. On the master subrack, set the ITH-1 card to the Active mode by pressing the **Force Active** push button on this card.

Connect the first expansion signal cable

- a. Take one of the expansion signal cables (15-wire) and connect one end to the new expansion subrack at the **Expansion Signal In—2** connector. Tighten the cable connector in place.
- b. Connect the other end of the expansion signal cable to the expansion subrack that is “upstream” from the one being installed at the **Expansion Signal Out—2** connector. Tighten the cable connector in place.
- c. Plug one of the connector terminators into the new expansion subrack at the open **Expansion Signal Out—2** connector. These terminators are not required for the master subrack.

Connect the second expansion signal cable

- a. In the new expansion subrack, verify that the 55419A expansion sync card in slot “ITH-2” is in the active mode by observing that the **Active** LED is on.
- b. In the master subrack, set the ITH-2 card to the active mode by pressing the **Force Active** push button on this card.
- c. Take the second expansion signal cable (15-wire) and connect one end to the new expansion subrack at the **Expansion Signal In—1** connector. Tighten the cable connector in place.
- d. Connect the other end of the expansion signal cable to the expansion subrack that is “upstream” from the one being installed at the **Expansion Signal Out—1** connector. Tighten the cable connector in place.
- e. Plug the second connector terminator into the new expansion subrack at the open **Expansion Signal Out—1** connector.
- f. In the new expansion subrack, verify that the 55419A expansion sync card in slot “ITH-1” is in the standby mode by observing that the **Standby** LED is on.
- g. Set the ITH card that was the active master at the beginning of the procedure to the active mode again by pressing the Force Active push button on that ITH card. This step ensures that the ITH card that was the active master at the start of this installation is again in that same role.

Connect the expansion communication cables

Overview: The expansion communication cables connect from the master subrack to the first expansion subrack, from that expansion subrack to the next expansion subrack, and finally from the last expansion subrack back to the master subrack.

- a. Configure and install the 55443A expansion communications card into the left-most slot of the expansion subrack. Tighten the retaining screws.

NOTE

The connectors on each expansion comm cable (9-pin) include a male and female gender type. This configuration reduces the chance of connecting cables incorrectly.

- b. Connect an expansion comm cable such that the cable from the male connector on the first expansion subrack connects to the next expansion subrack. Repeat this until all expansion subracks are connected.
- c. Connect an expansion comm cable from the male connector on the last expansion subrack to the female connector on the master subrack. Tighten all cables in place.
- d. On the master subrack, press the **Alarm Cutoff** push button several times to clear all alarms. If alarms still remain, review this installation procedure before continuing.
- e. Perform the communication test procedure that is included later in this chapter under “Verify Communication Between Subracks.”

Replace an Expansion Subrack

NOTE

This procedure is written to allow the expansion subrack to be replaced while the master subrack is in service.

Prepare to remove expansion subrack

- a. Ensure that the expansion subrack to be replaced is no longer providing synchronization signals for downstream equipment.
- b. Verify that no alarm conditions exist in the system.
- c. On the master subrack, take note of which ITH card is in the Active mode. (This is important so that at the end of this procedure, the same ITH card can be returned to its role as the active ITH card.)
- d. On the master subrack, set the ITH-1 card to the Active mode by pressing the **Force Active** push button on this card.

Remove the expansion subrack

- a. On the expansion subrack to be replaced, unplug the expansion signal cables at the **Expansion Signal In—2** and **Expansion Signal Out—2** connectors.
- b. On the master subrack, set the ITH-2 card to the Active mode by pressing the **Force Active** push button on this card.
- c. On the expansion subrack to be replaced, unplug the expansion signal cables at the **Expansion Signal In—1** and **Expansion Signal Out—1** connectors.
- d. On the expansion subrack to be replaced, unplug the expansion communication cables.
- e. Disconnect the power cables from the expansion subrack.
- f. Remove the expansion subrack from the rack cabinet.

Install the expansion subrack

- a. Install the replacement expansion subrack into the rack cabinet and apply –48 Vdc at power inputs A and B.
- b. Set the backplane switch on the replacement subrack to the same value as the subrack that was removed. The switch is located near the upper left of the backplane behind where the expansion communications card will be installed.
- c. Transfer the expansion synchronization cards into the replacement expansion subrack. Tighten the retaining screws.

- d. Transfer the output cards into the replacement expansion subrack. Tighten the retaining screws.

Connect the expansion signal cables

- a. Connect the expansion signal cables at the **Expansion Signal In—1** and **Expansion Signal Out—1** connectors. If the replaced expansion subrack had connector terminators attached, plug a connector terminator into the **Expansion Signal Out—1** connector.
- b. On the master subrack, set the ITH-1 card to the Active mode by pressing the **Force Active** push button on this card.
- c. Connect the expansion signal cables at the **Expansion Signal In—2** and **Expansion Signal Out—2** connectors. If the replaced expansion subrack had connector terminators attached, plug a connector terminator into the **Expansion Signal Out—2** connector.
- d. Set the ITH card that was the active master at the beginning of the procedure to the active mode again by pressing the **Force Active** push button on that ITH card. This step ensures that the ITH card that was the active master at the start of this replacement procedure is again in that same role.

Connect the expansion communication cables

- a. Transfer the expansion communications card into the left-most slot of the expansion subrack. Tighten the retaining screws.
- b. Connect the expansion communication cables as before.
- c. On the master subrack, press the Alarm Cutoff push button several times to clear all alarms. If alarms still remain, review this replacement procedure before continuing.
- d. Perform the communication test procedure that is included later in this chapter under “Verify Communication Between Subracks.”

Remove an Expansion Subrack

NOTE

This procedure is written to allow the expansion subrack to be removed while the master subrack is in service.

In a system with multiple expansion subracks, it is assumed that the expansion subrack most distant from the master subrack is removed from service.

Prepare to remove expansion subrack

- a. Ensure that the expansion subrack to be removed is no longer providing synchronization signals for downstream equipment.
- b. Verify that no alarm conditions exist in the system.
- c. On the master subrack, take note of which ITH card is in the Active mode. (This is important so that at the end of this procedure, the same ITH card can be returned to its role as the active ITH card.)
- d. On the master subrack, set the ITH-1 card to the Active mode by pressing the **Force Active** push button on this card.

Remove the expansion signal cables

- a. On the expansion subrack to be removed, unplug the expansion signal cable at the **Expansion Signal In—2** connector and the subrack to which it is connected. Remove the connector terminator from the **Expansion Signal Out—2** connector.
- b. On the last remaining expansion subrack, attach the connector terminator at the **Expansion Signal Out—2** connector. Ignore any alarm conditions for now.
- c. On the master subrack, set the ITH-2 card to the Active mode by pressing the **Force Active** push button on this card.
- d. On the expansion subrack to be removed, unplug the expansion signal cable at the **Expansion Signal In—1** connector and the subrack to which it is connected. Remove the connector terminator from the **Expansion Signal Out—1** connector.
- e. On the last remaining expansion subrack, attach the connector terminator at the **Expansion Signal Out—1** connector.
- f. Set the ITH card that was the active master at the beginning of the procedure to the active mode again by pressing the **Force Active** push button on that ITH card. This step ensures that the ITH card that was the active master at the start of this removal procedure is again in that same role.

Remove the expansion communication cables

- a. Unplug the expansion communication cables from the expansion subrack to be removed.
- b. If the only expansion subrack is being removed, jumper the Expansion Comm Port connectors on the master subrack together with a cable. This is done so that the master subrack can perform a new inventory of the remaining equipment.
- c. If one or more expansion subracks remain, connect an expansion comm cable from the last expansion subrack to the master subrack.
- d. After a short time (approximately 2 minutes), the system will complete a new inventory of the remaining equipment. For the system that now only consists of a master subrack, The jumper cable can now be removed.
- e. On the master subrack, press the **Alarm Cutoff** push button several times to clear all alarms. If alarms still remain, review this removal procedure before continuing.
- f. Perform the communication test procedure that is included later in this chapter under “Verify Communication Between Subracks.”

Verify Communication Between Subracks

NOTE

To verify communications between the master and expansion subracks and to check for alarm conditions, perform either procedure 1 or 2 described below.

Procedure 1—TL1 Commands

This procedure instructs you to send two TL1 commands to the master subrack that should return information about the pair of subracks indicating that the two subracks are able to communicate. The first command identifies the equipment installed in both the master and expansion subracks. The second command retrieves any active alarms.

- a.** Send the following command to the master subrack:

```
RTRV-NETTYPE-ALL:::1;
```

- b.** The information returned will be similar to the following example response:

```
SSU 98-12-03 13:36:22
1 COMPLD
"TSG:Symmetricon,55400,TSG
"S0,IMC:,55441,,R3833D
"S0,ITH1:,55411,,R3833D
"S0,ITH2:,55411,,R3833D
"S0-OUT1A:,55481"
"S0-OUT2A:,55481"
```

```
SSU 98-12-03 13:36:23
1 COMPLD
"TSG:Symmetricon,55400,TSG
"S1,IMC:,55443,,R3833D
"S1,ITH1:,55419,,R3833D
"S1,ITH2:,55419,,R3833D
"S1-OUT1A:,55481"
"S1-OUT2A:,55481"
```

- c.** Send the following command to the master subrack:

```
RTRV-COND:::1;
```

This command retrieves both equipment and signal-related conditions from the 55400A system. The expansion subrack events are described earlier in this chapter.

- d.** Verify that no expansion subrack events are still active.

Procedure 2—Local Craft Terminal Software

This procedure uses the 55450A local craft terminal software as a tool for verifying communication between the master and the just installed expansion subrack.

Refer to the documentation in chapter A5 for information on connecting a computer to the Local Port of the master subrack.

- a. Start the application, connect to the SSU, and go to the pull-down menu, SSU>Show 55400A Status.
- b. Observe that a status window is displayed for each SSU subrack that is part of the system. Verify that no alarms are active in the status windows.
- c. Click on the status window of the master subrack (the status window is larger than the others and lists subrack events below the front panel representation).
- d. Observe that all ITH or IMC/NIMC rack communication events have been cleared. Check the cabling between the subracks if alarms exist.

This completes the installation of the expansion subrack.

What is Next?

- 1 Perform the appropriate output card checks in chapter E2.

The equipment tests consist of:

- Output checks

- 2 Connect the outputs to network elements.

The last step is to connect the output signals to the network elements that require synchronization.

Backdating Information

NOTE

This section contains material that applies to versions of subracks prior to the 55401D and 55402D.

Systems with subracks before models 55401D and 55402D require the 55426A adapter box to support the use of expansion subracks. These subracks are:

- 55401B—uses 55426A Option 001 adapter box
- 55401C—uses 55426A adapter box
- 55402C—uses 55426A adapter box

If you are installing a 55402D expansion subrack into a system that contains a 55401B or 55401C master subrack, an adapter box will need to be installed only on the master subrack. Follow the procedure in this section to install the adapter box and then refer to “Adding the First Expansion Subrack” installation procedure earlier in this chapter.

Expansion Adapter Box

The 55400A synchronization supply unit requires the use of an adapter box on older subracks (before version “D”). The adapter box provides the correct termination for the expansion signal cabling that carries the synchronization signals between master and expansion subracks.

The installation procedure presented here shows how to install the box on the version “B” or “C” subracks. A master subrack that had been previously installed will require an adapter box when an expansion subrack is added for the first time.

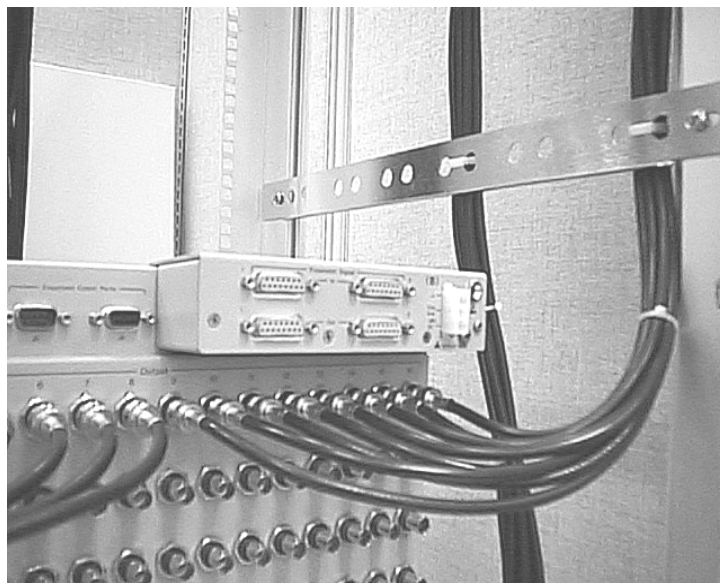


Figure C3-6. View of adapter box

There are two versions of the 55426A adapter box. The only difference is the type of power connector used on the adapter box:

- 55401B master subrack requires the 55426A Option 001 SSU expansion adapter box with a 4-pin press-on connector
- 55401C master subrack requires the 55426A SSU expansion adapter box with a Molex 3-pin locking connector
- 55402C expansion subrack requires the 55426A SSU expansion adapter box with a Molex 3-pin locking connector

Parts supplied with adapter boxes**Table C3-7. Adapter box supplied parts**

Quantity	Description
1	51 mm stand-off
1	screw and lock washer for stand-off
7	flat-head screws
1	pan-head screw and lock washer
2	spare nuts for rear panel

Tools required

- 5.5 mm nut driver
- 7 mm nut driver
- small Phillips or Pozidriv screwdriver
- large Phillips or Pozidriv screwdriver

System Firmware Requirements

If an expansion is being added to an older system that includes a 55401B or 55401C master subrack, ensure that the system firmware is revision 3724A, or later. In the master subrack, the communication card and the ITH clock cards all contain control firmware.

Check firmware revision

The firmware revision number can be checked one of the following ways:

1. Send a TL1 command using the 55450A local craft terminal software or a terminal emulation program connected to the local port of the communication card. The information retrieved will include the firmware revision at the end of the lines describing the IMC and ITH cards in the format Rxxxxx.

```
RTRV-NETTYPE-ALL:::1;
```


Backdating Information

Issue 1

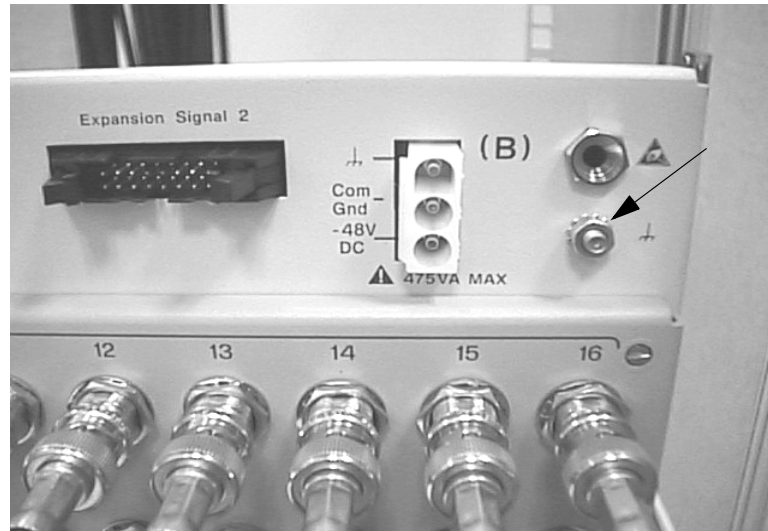
2. Remove the communication card from the master subrack. The EEPROMs on the card will have a label indicating a firmware revision.
3. Review the system test data pack forms shipped with the master subrack from the factory. The firmware revision number is included on the system final configuration/shipping log form.

NOTE

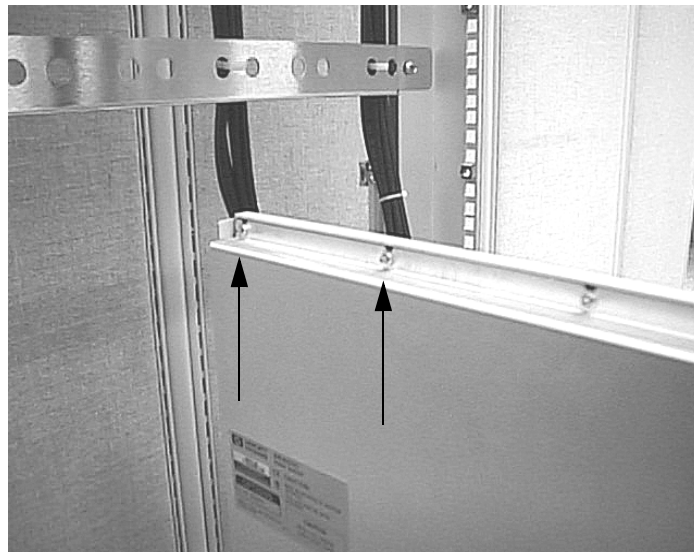
Methods 2 and 3 may not be valid if newer firmware has been downloaded to the EEPROMs without making a modification to the labels.

Firmware upgrade

Newer versions of firmware for the master subrack may be available for download over the Internet. Contact Symmetricom for details.

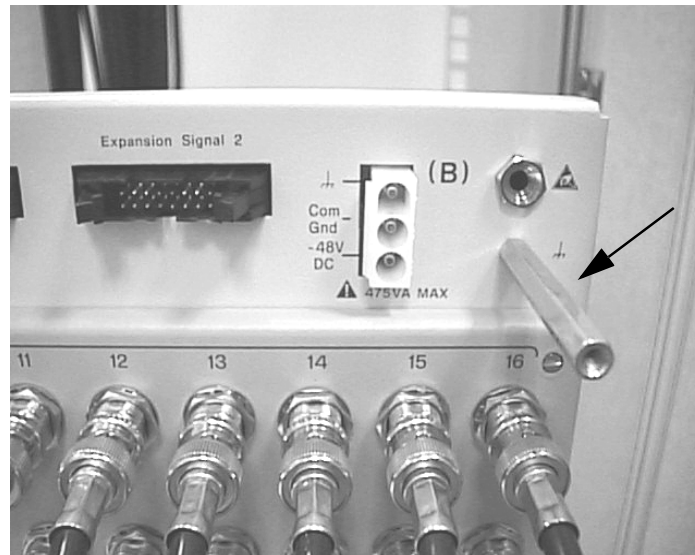
Install the adapter box**1. Remove nut on grounding stud**

Using the 7 mm nut driver, remove the nut and star washer from the grounding stud shown in the picture above. Discard the nut and washer.

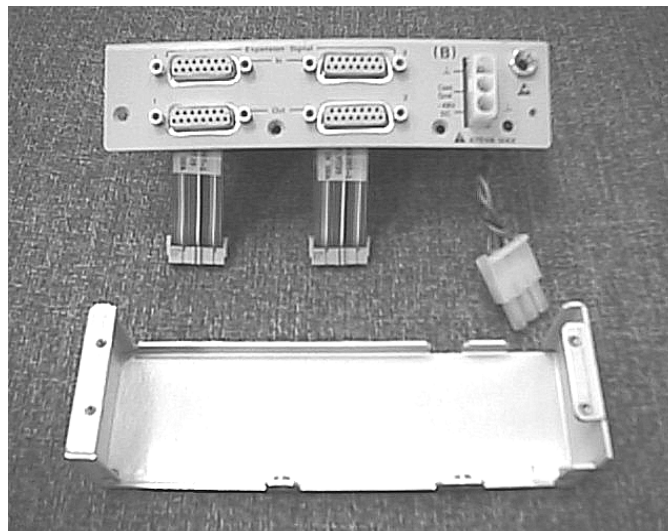
2. Loosen rear panel nuts

Using the 5.5 mm nut driver, loosen the two nuts on the subrack rear panel shown in the picture above.

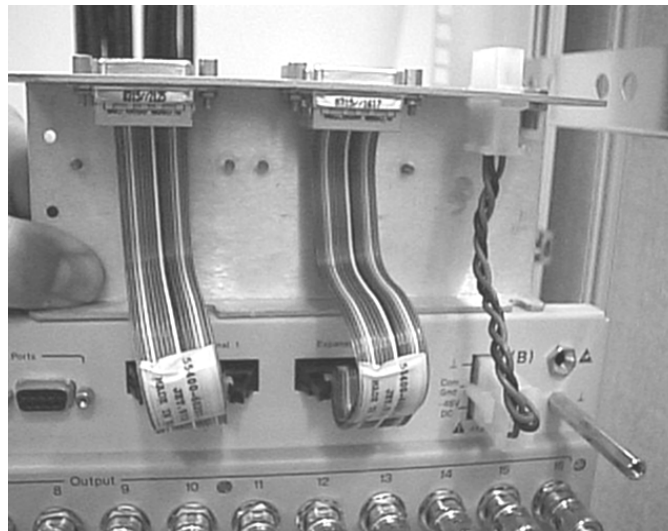
TIP: Use your fingers to loosen the nuts once they can be turned easily. Back off each nut only until it is flush with the end of the screw shaft. Extra nuts are included in the event the nuts are dropped.

3. Attach the stand-off

On the front panel, hand-tighten the stand-off to the grounding stud.

4. Disassemble adapter box

Remove the screws holding the two halves together.

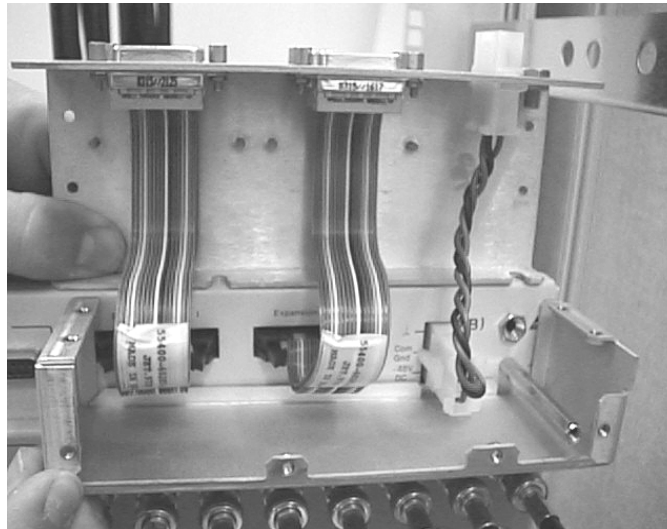
5. Attach adapter box cables to the subrack

NOTE

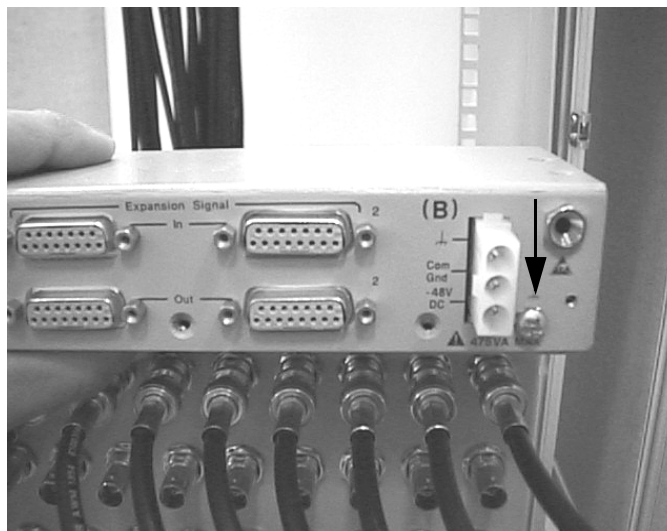
For a system that is online, to perform this step it is necessary to remove the “B” side power cable from the subrack. Be aware that this action will cause a Major alarm to be generated by the SSU.

Position the top half of the adapter box above the subrack and connect the three cables as shown in the picture above: 2 expansion signal cables and 1 power cable.

Make sure all three cables are locked securely in place.

6. Position adapter box for assembly

Set the bottom half of the adapter box on the ledge below the expansion signal and power connectors while holding the top half out of the way. (There are cutouts in the bottom piece to allow it to fit around the stand-off and power connector.)

7. Assemble and add screws

- a. Carefully hook the top half of the box over the top of the subrack at an angle so that the bend at the top fits between the loosened nuts and the rear panel as it is lowered into place.

- b. Close the top part of the box over the bottom half. Squeeze the top and bottom together so that the screw holes for both halves line up. Thread the stand-off screw and lock washer into place loosely as shown in the picture above.
- c. Thread the 8 remaining screws (7 flat-head and 1 pan-head with lock washer) into place loosely.
- d. Using the large Philips screwdriver, tighten the stand-off screw.
- e. Using the small Philips screwdriver, tighten the remaining screws.
- f. Re-connect the “B” side power supply to the connector on the adapter box.

NOTE

For a system that is online, clear the Major alarm by pressing the **Alarm Cutoff** push button.

Next Steps

Now that the adapter box is installed on the subracks that require it, review the rest of this chapter for information on installing the expansion subrack, cables, cards, and verifying correct operation of the expansion subracks after installation. Go to “Adding the First Expansion Subrack” installation procedure earlier in this chapter.

C4

Install the 55300A GPS Reference Source

Tools, power, cables, antenna, and rack

In This Chapter

This chapter describes the installation of the primary reference source.

For more details about the GPS product, refer to the following manuals that are supplied with the 55300A GPS reference source:

- 55300A User's Guide
- 55300A Programming Guide

PURPOSE The goal of this chapter is to provide enough information that you can install and apply power to this equipment.

If you do not already have a GPS antenna feed to your rack cabinet, this element may be the more difficult part of any 55300A installation. The next section provides more detail about GPS accessories.

NOTE

See “In This Manual” for a list of tasks to put a GPS reference source into service.

GPS Accessories and Tools

The GPS accessories needed for the installation of the primary reference source will depend on the specific characteristics of your situation. All of the accessories include documentation that describes how to install them.

Accessories

A minimum set of GPS accessories to support installation consists of the following:

- 58532A GPS L1 Antenna (Option AUB provides mounting mast)
- 58521A LMR 400 Cable (other cable type available)

If the antenna installation requires a long cable run between the antenna and the GPS receiver, add the following accessory:

- 58529A Line Amplifier with Bandpass Filter

An amplifier is required if the run of LMR 400 cable is more than 115 meters (377 feet). Two amplifiers are recommended when cable length exceeds 240 meters (787 feet).

When an antenna system is being installed in an area with high lightning activity, it is a good idea to provide protection from electromagnetic fields associated with nearby lightning strikes. The impact of surge voltages and currents can be minimized if the system is well grounded to earth through a lightning arrestor. Symmetricom offers the following:

- 58539A GPS L1 Lightning Arrestor

Tools

- GPS handheld receiver—this device can be useful both during installation and in case troubleshooting the GPS antenna system is required. The receiver can help you select the best antenna location to provide optimal reception of GPS signals. It should come with its own antenna and a BNC-type connector that will allow connection of the handheld device to your GPS antenna system to help isolate problems that may come up during installation and operation. It should be capable of providing +5 Vdc to power the antenna system.
- Molex Hand Crimping Tool 11-01-0084—a crimping device for making power cables

- Pozidriv #2 or large Phillips screwdriver for rack mount screws
- 7 mm nut driver for frame ground stud on the front panel of the rack mount shelf
- wire strippers for making cables
- diagonal cutters for making cables
- multimeter for checking voltage levels and cables for opens/shorts
- oscilloscope for checking output signals

Antenna System Overview

Where to go for antenna installation information

Information Note—supplied with each accessory

Basic antenna system

The most simple antenna system consists of the antenna and mounting base, mounting mast and cable. This configuration assumes the following:

- The length of cable used is less than 115 m (LMR 400 cable)
- The installation is NOT in an area where lightning activity is a concern
- There are no known sources of possible interference with the GPS signal

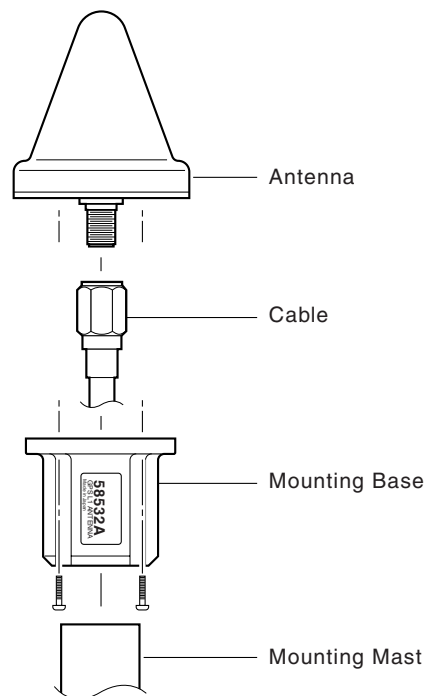


Figure C4-1. Basic antenna system

Antenna system with amplifier/filter

This antenna system configuration includes an amplifier/filter because of a long distance (> 115 m) between antenna and 55400A. This configuration assumes the following:

- The length of cable used is greater than 115 m (LMR 400 cable) and there could be sources of possible interference with the GPS signal so the amplifier/filter is included
- The installation is NOT in an area where lightning activity is a concern so a lightning arrestor is not included

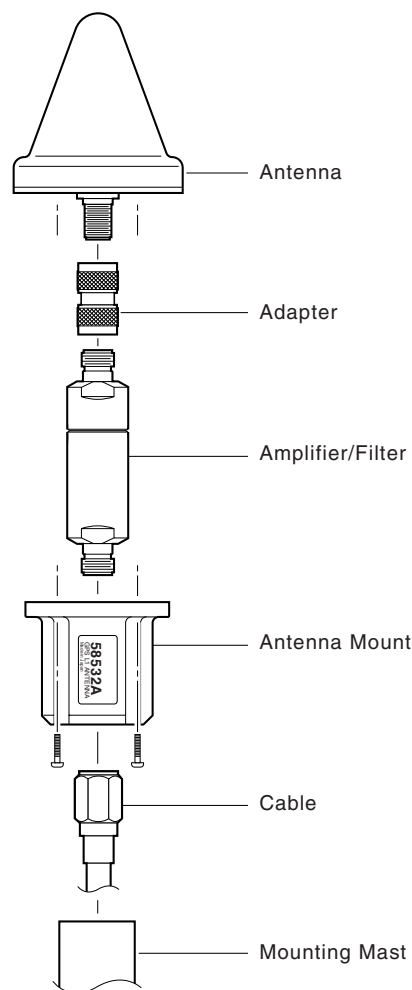


Figure C4-2. Antenna system with amplifier/filter

Lightning arrestor for antenna system

In areas where lightning activity is a concern, include a lightning arrestor in the antenna system. Typically, it will be installed just inside the building where the antenna cable enters.

NOTE

For more on installation, refer to the Information Note supplied with the lightning arrestor.

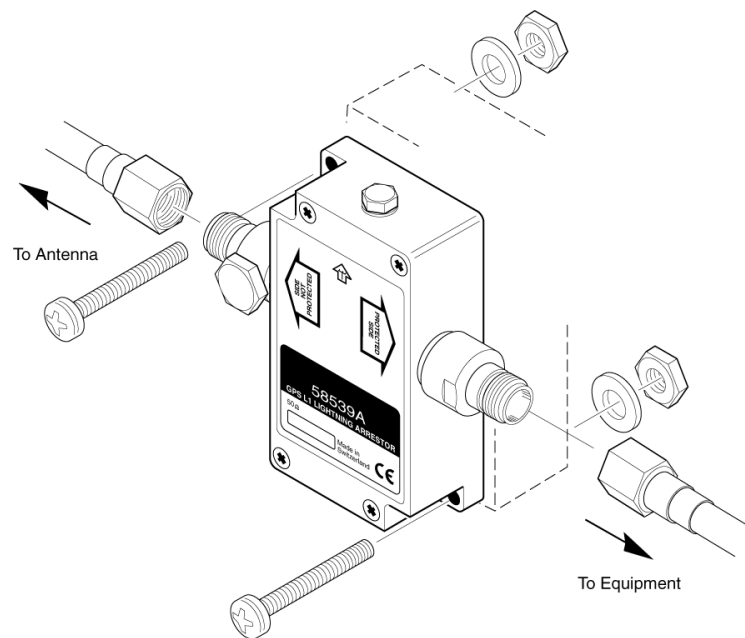


Figure C4-3. Lightning arrestor

Install the Rack Mount Shelf

The 55300A is actually a module that fits into a rack mount shelf. Two types of ETSI rack mount shelves are available for the 55300A module:

- 55320A GPS rack mount shelf for unbalanced outputs
- 55322A GPS rack mount shelf for balanced outputs

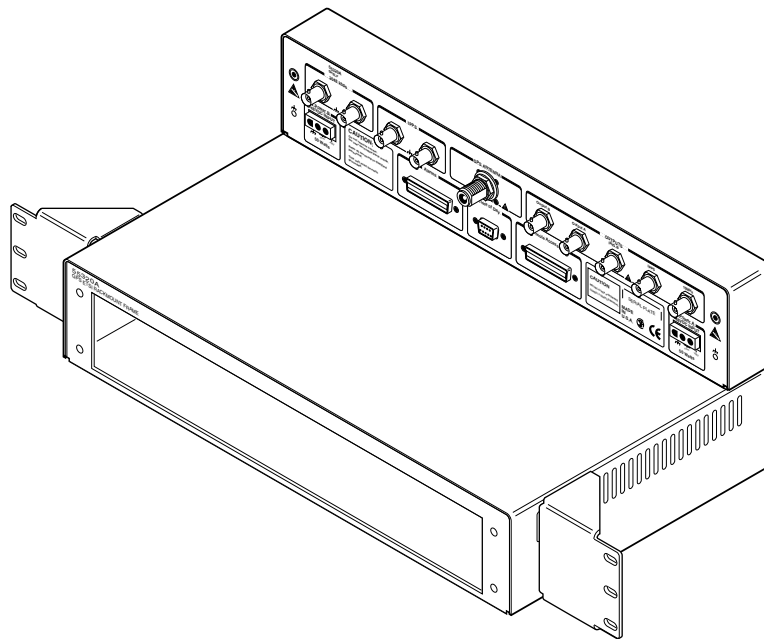


Figure C4-4. 55320A rack mount shelf

Rack mount shelf installation procedure

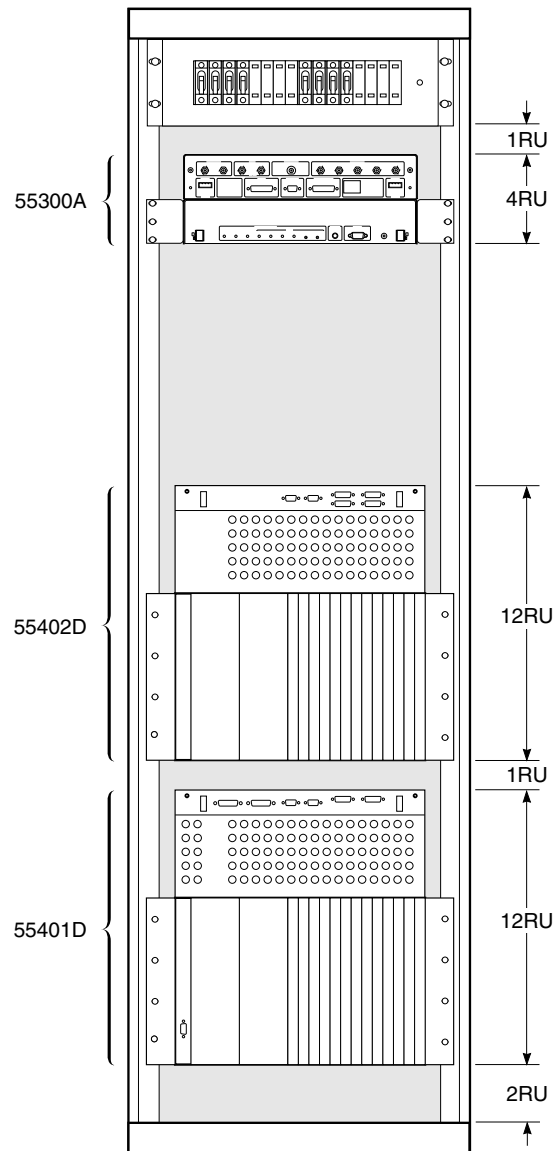
Use the following procedure to attach the mounting flanges to the shelf and install the shelf into the rack cabinet.

1. Place the subrack (without the 55300A installed) on a work surface with the front panel facing you.
2. Position each mounting flange with its mounting holes so it aligns with the mounting holes in the signal of the shelf.
3. Attach the flanges to the shelf with the supplied hardware.

Install the Rack Mount Shelf

Issue 1

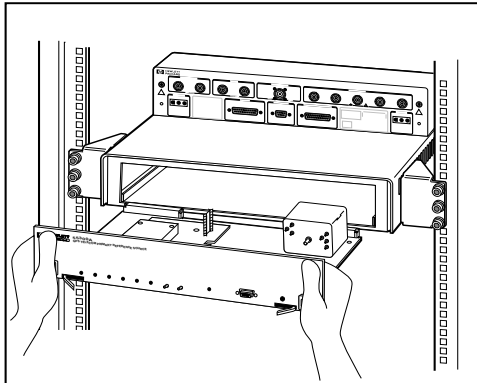
4. Place the shelf in position in the rack. Refer to the figure below for recommended position. Installing the shelf near the top of the rack cabinet will usually make it easier to run the antenna cable to the GPS unit.

GPS reference and 2 SSUs**Figure C4-5. Rack position for 55300A**

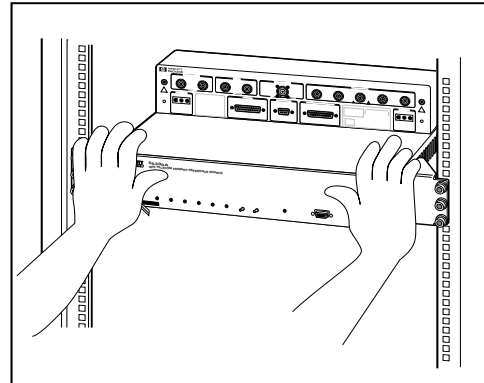
5. Attach the shelf to the rack with the hardware supplied with the mounting flanges.

Install the GPS Module

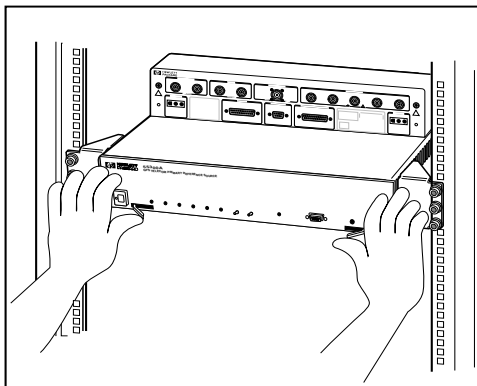
Install the 55300A GPS module into the rack mount shelf as shown in Figure C4-6.



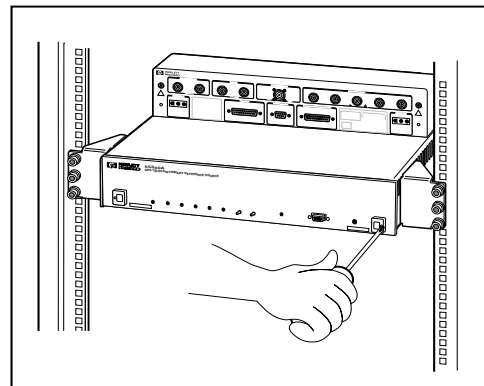
1. Align and position the edges of the module with the guide rails inside the shelf.



2. Firmly press the unit all the way back into the shelf.



3. Push in levers.



4. Tighten both screws.
Note: Failure to tighten screws can cause unreliable behavior.

Figure C4-6. Installing the 55300A into the rack mount shelf

Connectors and Cabling

This section discusses the front panel connectors and the pinouts needed to build the connecting cables.

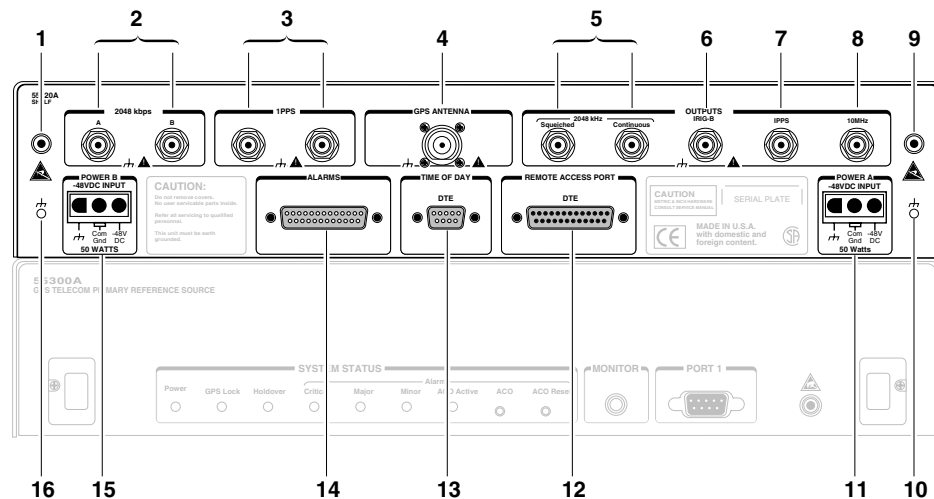


Figure C4-7. 55320A front panel

- 1 **Banana jack** for grounding an ESD wrist strap
- 2 **2048 kbps outputs** (75 Ω)
- 3 **1PPS–RS-422 differential pair output signals.** The left connector outputs a positive 1PPS signal, and the right connector outputs a negative 1PPS signal.
- 4 **GPS antenna input**, N-type connector (female)
- 5 **Two 2048 kHz outputs.** The squelched signal is present only after the unit is locked to GPS. The continuous signal is always present.
- 6 **IRIG-B output.** It provides formatted time-code signals after the unit is locked to GPS.
- 7 **1PPS–50 Ω TTL level signal**
- 8 **10 MHz output** (50 Ω)
- 9 **Banana jack** for grounding an ESD wrist strap
- 10 **Frame ground stud** for chassis ground connection
- 11 **Power A –48 Vdc input**

- 12 Remote Access Port**—RS-232, DB-25S (female). DTE configuration serial interface port for remote control, monitoring, and retrieving the unit's memory data. The communication language is TL1.
- 13 Time of Day**—DE-9P (male). DTE configuration serial interface port supplying time of day and a 1PPS signal (accurate to UTC) for the network time protocol driver. This port is also used with the SatStat application.
- 14 Alarms**—DB-25P (male). Provides alarm relays for critical, major, and minor office alarms (both visual and audible).
- 15 Power B**—48 Vdc input
- 16 Frame ground stud** for chassis ground connection

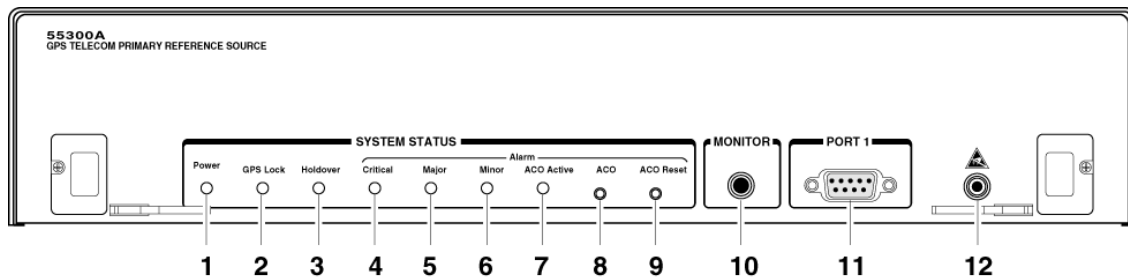


Figure C4-8. 55300A front panel

- 1 Power**—indicates that power is applied to the unit.
- 2 GPS Lock**—indicates that the unit is tracking satellites and phase-locked its internal reference to the GPS reference.
- 3 Holdover**—indicates that the unit has lost GPS lock.
- 4 Critical**—indicates a hardware condition or other failure that requires attention.
- 5 Major**—indicates there is a problem that can potentially affect the output signals. For example, the unit has been operating in holdover for an extended period of time. This duration can be user-specified.
- 6 Minor**—indicates the unit has detected a momentary, abnormal internal condition, but this condition will not affect the operation of the unit.
- 7 ACO Active**—indicates that the local alarm cutoff is active.
- 8 ACO**—a push-button switch that, when pressed, silences the audible, local external alarms without turning off the alarm LED.

- 9 ACO Reset**—a push-button switch that, when pressed, resets the local alarm cutoff.
- 10 Monitor**—a 2048 kbps output from a standard miniature telecommunication phone jack. This telecom output is a protected test output with a signal level –18 dB from the level of the 2048 kbps signals at the 55320A panel.
- 11 Port 1**—RS-232, DE-9S (female). DCE configuration serial interface port for local monitoring and retrieving data stored in the unit's memory data. The communication language is TL1.
- 12 Banana jack** for grounding an ESD wrist strap.

–48 Vdc power inputs

The PRS supports use of redundant power sources.

CAUTION

The PRS uses a –48 Vdc office battery as its primary voltage source. Though not normally considered high voltage, the office battery has more than the minimum power necessary to present a potential fire hazard. Use extreme caution when working around or connecting circuits energized by the office battery.

Grounding issues

Before running power cables, consider how best to provide frame grounding for the subrack. A frame ground can be connected in one of three ways:

1. As part of the cabling through the –48 Vdc power connector.
2. Through a single-wire connection to the ground stud on the connector panel.
3. Through the rack mount brackets when the rack cabinet itself is properly grounded.

NOTE

To prevent battery return-to-frame ground faults, do not connect battery return on the subrack to the frame ground.

Recommendations for cabling to the shelf

Power to the shelf is applied at the connector panel. Use the following procedure as a guide to supply power wiring to the shelf.

- a.** Following local practices, select a wire size appropriate to ensure an office battery voltage of –37 to –60 Vdc at the shelf. The current requirement for the PRS can be from 0.75 to 1 A. The connector pins used for the power connectors can accept a wire size up to

1.2 mm (0.05 in). This wire size corresponds to an AWG (American Wire Gauge) value of 18.

- b.** Switch off the circuit breakers or remove the fuses to the branch circuit feeds that will supply the subrack.
- c.** Route redundant (“A” and “B”) –48 Vdc office battery feeds to the subrack to ensure uninterrupted operation. If your facility does not provide redundant “A” and “B” battery sources, split the power feeds at the main battery distribution fuse board (BDFB), the branch battery feed panel, or at the rack cabinet.
- d.** If the battery feeds originate at the BDFB or branch panel, run the two battery feeds to the subrack through cable runs on opposite sides of the facility. Running both feeds in the same cable rack creates a single-point source of power failure and should be avoided.
- e.** Route the power cables on opposite sides of the rack cabinet. Leave a length of cable for both feeds sufficient for later dressing into cable bundles.
- f.** Check the battery feed lines for possible shorts to one another or to ground using a multimeter.

Assembling the power connectors

Use the following procedure to attach the power connectors to the battery feed lines.

- a.** Strip 5 mm (3/16 in) of insulation from one set of the power supply wires.
- b.** Crimp the connector pins to the wires according to standard procedures. Figure C4-9 shows a crimped connector pin. The connector pins can accept a wire size up to 1.2 mm (0.05 in). If possible, use a crimping tool such as Molex Hand Crimping Tool 11-01-0084.

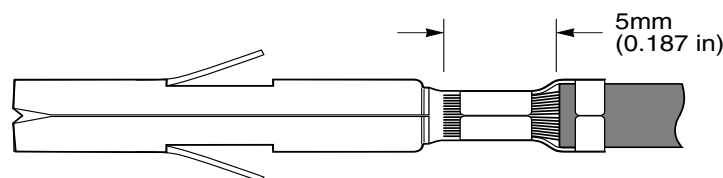


Figure C4-9. View of crimped connector pin

- c. Position the power connector so that it matches the drawing in Figure C4-10 (the locking mechanism should face you). Take the Ground wire and grasp the wire insulation behind the connector pin. Push this wire into plug position “1” of the power connector until the connector pin snaps into place.

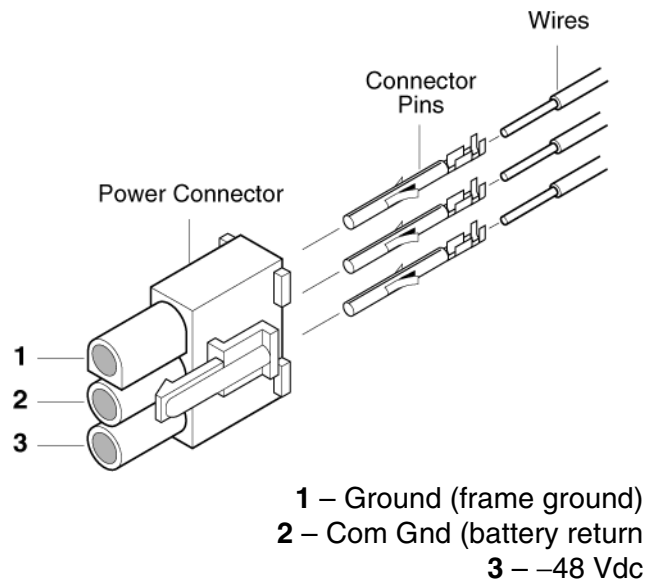


Figure C4-10. Subrack -48 Vdc power connector

- d. Using the same procedure as for step c., push the Com Gnd wire into connector position “2” and the -48 Vdc wire into connector position “3”.
- e. Repeat steps a. through d. for the second power connector.

Making the frame Ground Connection

If a dedicated wire to the frame ground stud is selected as the method for grounding the shelf, follow these steps for each of the ground connections:

- a. Route wiring from ground to the shelf.
- b. At the shelf, crimp the supplied spade lug connector to the ground wire.
- c. Using a 7 mm nut driver loosen the frame ground stud nut.
- d. Slide the spade lug connector under the ground stud nut and tighten.

Connecting dc power

The following procedure describes how to connect power to the shelf. To connect the finished power cables for the two dc supplies, follow these steps:

NOTE

Do not connect power to the 55300A unless a fully operational antenna system is already connected to the GPS antenna input. Power applied with no antenna input, or a non-functioning antenna system will cause the GPS unit to initiate an extended search process that may increase the time to reach a GPS lock condition. The extended search process can be halted by disconnecting and reconnecting both of the external –48 Vdc supplies (leave power off for more than five seconds).

Before continuing, install the antenna system and verify operation, if possible, using a GPS handheld receiver that can supply +5 Vdc to the antenna. (Refer to chapter F1, “Troubleshoot System.”)

- a. Using a multimeter, verify that there are no multiple battery grounds, or any shorts at the power source end of the wires.
- b. Reinstall the fuses or set the circuit breakers to On at the branch circuit distribution that supplies the –48 Vdc power.
- c. Use a multimeter to measure the voltage of the battery feed leads at the shelf. The voltage must measure in the range –37 Vdc to –60 Vdc.
- d. Plug the right-hand dc power connector into the right-side (A) power jack.
- e. Plug the left-hand dc power connector into the left-side (B) power jack on the subrack connector panel.

Power-up sequence

When the 55300A is powered-up for the first time, the unit will normally step through the following sequence:

- a. An internal diagnostic check is performed and all front-panel indicators flash
- b. All front-panel indicators turn off except for the Power indicator
- c. After approximately five minutes, the 55400A may go into Major alarm. The front-panel indicator and alarm relay are activated.
- d. At this point, the 55300A begins to search for all available satellites.
- e. When four, or more, satellites are tracked, the unit will automatically compute its location.

- f. The 55300A then reaches a stable operating condition. The GPS Lock indicator turns on and the Major alarm is cleared indicating that the unit has phase-locked its internal reference to the GPS timing reference.

Port 1 connector

This port is on the 55300A module card. It is a 9-pin DE connector (female) using an RS-232 interface.

This port is wired as a DCE device and provides for system communication with a local terminal or computer running a terminal emulator program. The 55300A supports the use of the TL1 language communication and control.

Through this port it is possible to perform management tasks including security management, configuration, performance monitoring, and fault diagnosis. These same tasks can be performed via the remote access port described earlier in this chapter.

Wiring the local cable

A serial communications interface cable wired as a “straight-through” cable is needed to connect between the local port and a computer.

Port 1 RS-232 Interface

The Port 1 connector provides a standard serial interface with full duplex capability (DCE configuration). Signal voltage levels comply with the EIA-232-E standard.

Table C4-1. Local connector pinout

Pin Number	Description
1	DCD (Data carrier detect)
2	RxD (Received data)
3	TxD (Transmitted data)
4	DTR (Data terminal ready)
5	GND (Signal ground)
6	DSR (Data set ready)
7	RTS (Request to send)
8	CTS (Clear to send)
9	RI (Ring indicator)

Port 1 RS-232 wiring diagram

Here is an example of an interface cable used to connect a computer to the Port 1 connector.

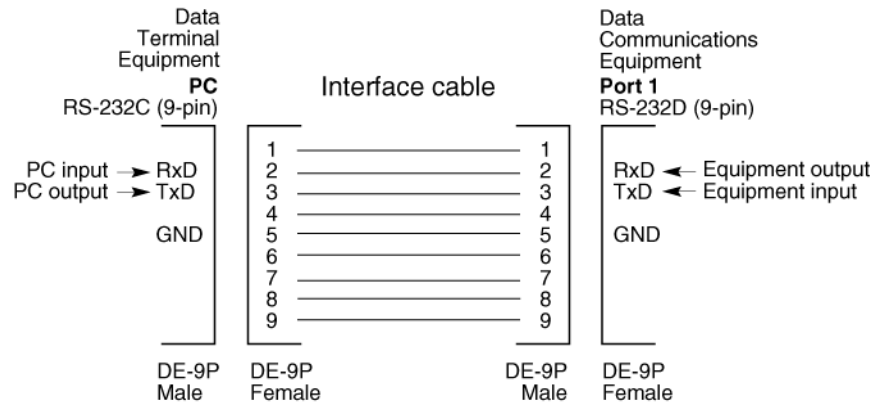


Figure C4-11. Port 1 connection example

What is Next?

- 1 Perform the qualification tasks in chapter E1 and then the equipment tests in chapter E2.

The qualification tasks consist of:

- Run SatStat to verify operation
- Set local time
- Verify holdover actions
- Configure the GPS reference source for network operation (if needed)

The equipment tests consist of:

- Verify outputs (10 MHz, 2048 kHz/kbps)

NOTE

If installing the GPS reference source with the frequency standard or SSU, complete those installations before starting the qualification procedures.

- 2 Connect the output to the SSU.

Once the outputs from the GPS reference source have been checked, the last step is to connect the output signal to the SSU.

C5

Install the 5071A Frequency Standard

Power, cables, accessories, and tools

In This Chapter

This chapter describes the installation of the primary frequency standard.

For more details about the frequency standard product, refer to the following manuals that are supplied with the 5071A primary frequency standard:

- 5071A Operating and Programming Manual
- 5071A Telecommunications Options Supplemental Manual

PURPOSE The goal of this chapter is to provide enough information that you can install and apply power to this equipment.

NOTE

See “In This Manual” for a list of tasks to put a frequency standard into service.

Accessories and Tools

The accessories needed for the installation of the primary frequency standard will depend on the specific characteristics of your situation.

Accessories

A minimum set of accessories to support installation consists of the following:

Due to the length of the 5071A and the placement of the output connectors on the rear panel, the use of 90-degree adapters is required.

- Right angle Type-N adapter (m to f) for 5 or 10 MHz output (50 Ω)
- Right angle BNC adapter for 2048 kbps output (75 Ω)

CAUTION

The weight of the 5071A is 30 kg. Supporting the weight of the unit requires the use of both a rack mount kit AND mounting shelves or rails.

- Rack cabinet shelves or rails (19-inch rails are required when installing the 5071A in an ETSI equipment rack)
- Option 908 Rack Flange Kit (for use without handles)
- ring or spade lugs for rear-panel power supply connections

Tools

- Pozidriv #2 or large Phillips screwdriver for rack mount screws and rear-panel power connections
- wire strippers for making cables
- diagonal cutters for making cables
- multimeter for checking voltage levels and cables for opens/shorts
- oscilloscope for checking output signals

Install the 5071A

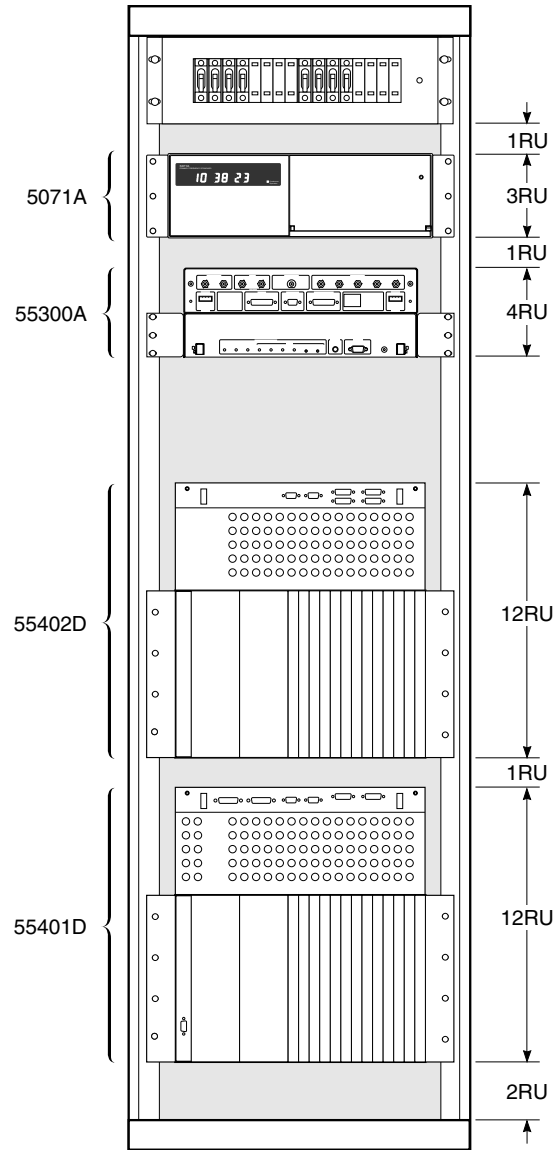
The 5071A is a frequency standard that requires no inputs of any sort to provide Stratum 1-level timing signals.

Rack Mount Procedure

Use the following procedure to attach the mounting flanges to the frequency standard and install it into the rack cabinet.

1. Place the frequency standard on a work surface with the front panel facing you.
2. Install the mounting flanges as instructed in the supplied documentation.
3. Remove the plastic feet from the bottom of the frequency standard.
4. Install a support tray or rails into the rack cabinet to support the 5071A. Refer to the figure below for recommended position.

Since the air exhausted from the 5071A is usually 13°C warmer than ambient air, mount the frequency standard in the upper portion of the rack cabinet.

Frequency Standard, GPS reference, and 2 SSUs**Figure C5-1. Rack position for 5071A**

5. Lift the frequency standard into the rack cabinet.

CAUTION

The weight of the 5071A is 30 kg. Mounting the unit into a rack cabinet requires two installers.

6. Attach the frequency standard to the rack with the hardware supplied with the mounting flanges.

Connectors and Cabling

This section discusses the rear-panel connectors of the 5071A with telecommunications options.

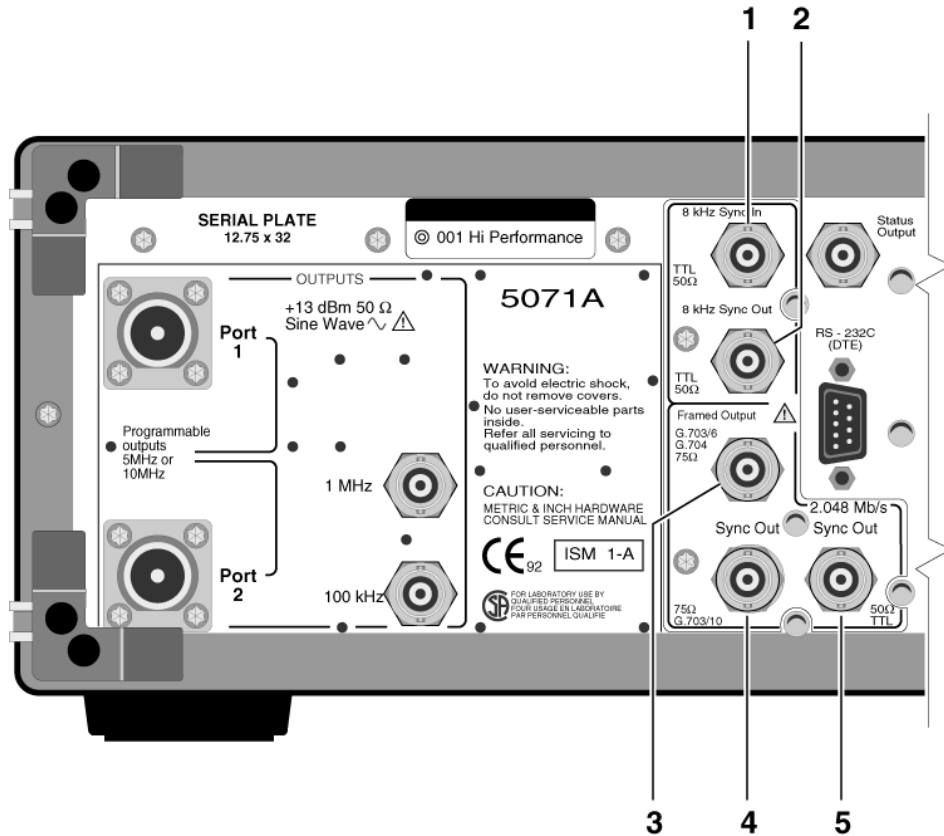


Figure C5-2. Rear panel (1) of telecom option

Table C5-1. Callout descriptions (1)

Callout Number	Function	Connector Type	Signal Characteristic
1	8 kHz Sync In	BNC (f)	8 kHz, TTL level into 50 Ω
2	8 kHz Sync Out	BNC (f)	8 kHz, TTL level into 50 Ω
3	2048 kbps Framed Output	BNC (f)	4.8 V p-p max into 75 Ω (6 V p-p into 100 or 120 Ω)
4	2048 kHz Sync Out	BNC (f)	3 V p-p max into 75 Ω
5	2048 kHz Sync Out	BNC (f)	TTL level into 50 Ω

NOTE

The drawings on these two pages show a 5071A with Telecom Options 048 and 272. When the telecom option includes either 100 or 120 Ω balanced outputs, the Framed Output connector will be a two-center-conductor BNC.

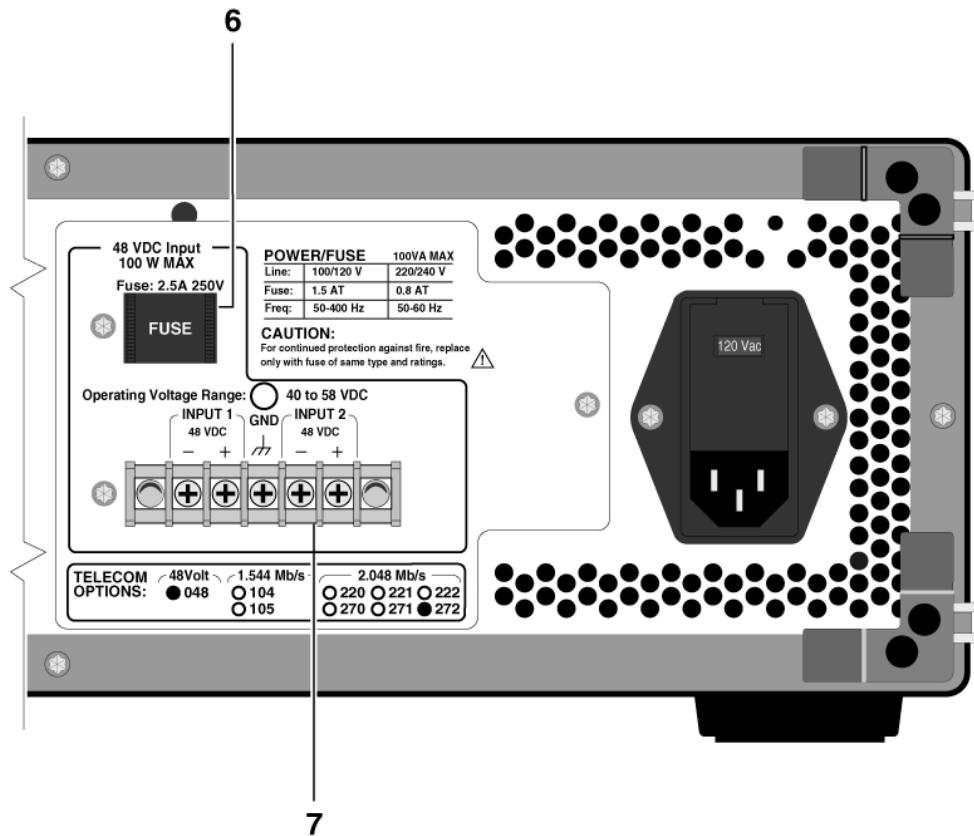


Figure C5-3. Rear panel (2) of telecom option

Table C5-2. Callout descriptions (2)

Callout Number	Function	Connector Type	Signal Characteristic
6	DC Power Fuse	Cartridge Fuse	Fuses external dc power, 2.5 A, 250 Volt rating, time delay
7	DC Power Input	5-screw Terminal Strip	40–58 Vdc, 100 W max, as labeled on rear panel

–48 Vdc Power Inputs

The frequency standard supports use of redundant power sources.

CAUTION

The 5071A with telecom options uses a –48 Vdc office battery as its primary voltage source. Though not normally considered high voltage, the office battery has more than the minimum power necessary to present a potential fire hazard. Use extreme caution when working around or connecting circuits energized by the office battery.

Recommendations for cabling to the frequency standard

Power to the unit is applied at the terminal strip. Use the following procedure as a guide to supply power wiring to the unit.

- a. Following local practices, select a wire size appropriate to ensure an office battery voltage of –40 to –58 Vdc at the frequency standard. The current requirement for the unit can be up to 3 A.
- b. Switch off the circuit breakers or remove the fuses to the branch circuit feeds that will supply the subrack.
- c. Route redundant (“Input 1” and “Input 2”) –48 Vdc office battery feeds to the subrack to ensure uninterrupted operation. If your facility does not provide redundant battery sources, split the power feeds at the main battery distribution fuse board (BDFB), the branch battery feed panel, or at the rack cabinet.
- d. If the battery feeds originate at the BDFB or branch panel, run the two battery feeds to the subrack through cable runs on opposite sides of the facility. Running both feeds in the same cable rack creates a single-point source of power failure and should be avoided.
- e. Route the power cables on opposite sides of the rack cabinet. Leave a length of cable for both feeds sufficient for later dressing into cable bundles.
- f. Route wiring from ground to the terminal strip on the rear panel.
- g. Check the battery feed lines for possible shorts to one another or to ground using a multimeter.

Connecting dc power

The following procedure describes how to connect power to the frequency standard. To connect the finished power cables for the two dc supplies, follow these steps:

- a. Using a multimeter, verify that there are no multiple battery grounds, or any shorts at the power source end of the wires.
- b. Reinstall the fuses or set the circuit breakers to On at the branch circuit distribution that supplies the -48 Vdc power.
- c. Use a multimeter to measure the voltage of the battery feed leads at the frequency standard. The voltage must measure in the range -40 Vdc to -58 Vdc.
- d. Uninstall the fuses or set the circuit breakers to Off at the branch circuit distribution while attaching the battery feeds to the power terminal strip.
- e. Attach the Input 1 battery feeds to the terminal strip using spade lugs or similar technique. Connect the system or power source ground to the GND terminal.
- f. Attach the Input 2 battery feeds to the terminal strip using spade lugs or similar technique. Connect the system or power source ground to the GND terminal.
- g. Reinstall the fuses or set the circuit breakers to On at the branch circuit distribution that supplies the -48 Vdc power.

Start-up sequence

After power is applied to the 5071A, the unit will normally step through the following sequence:

- a. The amber Attention light is lit indicating normal power-up sequence and the following messages are displayed on the LCD in the order shown:
 - Warming up (Indicates self-test passed successfully)
 - Setting Osc. Control
 - Setting RF amplitude
 - Setting E_mult voltage
 - Logging signal levels
 - Setting C-field
 - Locking servo loops
 - Operating normally
- b. After about 15 minutes, the Attention light goes off, and the Continuous light (green) flashes.

- c.** Open the front-panel door to access the controls by turning the knob to the left and pulling out.
- d.** Press the blue Shift key, then 5 (Utilities). The display shows >Reset<.
- e.** Press the Enter key. This resets the continuous operation circuit, causing the LED to be on constantly. Any subsequent fault will cause the Continuous LED to start flashing, or go off.

What is Next?

- 1 Perform the qualification tasks in chapter E1 and then the equipment tests in chapter E2.

The qualification tasks consist of:

- Set to continuous operation
- Configure output ports
- Synchronize to an external 1PPS reference signal (if 55300A is part of the sync system)
- Set local time and display it

The equipment tests consist of:

- Verify 5/10 MHz output ports
- Verify telecom outputs

NOTE

If installing the frequency standard with the GPS reference source or the SSU, complete those installations before starting the qualification procedures.

- 2 Connect the output to the SSU.

Once the outputs from the frequency standard have been checked, the last step is to connect the output signal to the SSU.

C6

Install the 55409A Mini-SSU

Power, cables, subrack, and cards

In This Chapter

This chapter describes how to install the 55409A mini-SSU system. The topics include:

- General information
- Accessories, tools, and equipment needed
- Mini-SSU description
- Installing the 55409A mini-SSU subrack
- Configuring the cards
- Installing the cards
- Troubleshooting

NOTE

See “In This Manual” for a list of tasks to put a mini-SSU subrack into service.

Assumptions in this Chapter

- There is a great deal of similarity between the standard SSU and the mini-SSU. There are references here to other chapters for the information needed to install the subrack and configure the plug-in cards for the mini-SSU.
- Typically, the mini-SSU system includes a subrack that contains two ITH clock cards. At any time, one card will be in the active mode and the other will be in standby. These procedures assume that your mini-SSU subrack contains two ITH clock cards.

Firmware Requirement

The 55409A mini-SSU requires firmware revision 3851D, or later.

Mini-SSU Subrack Connector Characteristics

The following table summarizes the characteristics of the mini-SSU subrack connectors.

Table C6-1. Mini-SSU subrack connectors

Connector	55409A
PRC input and Status input	Grounded BNC
2048 kHz/kbps inputs	Floating
Outputs	Grounded
–48 Vdc	Locking

NOTE

Refer to the chapter on specifications for more details about the subracks including dimensions and power requirements.

Accessories, Tools, and Equipment

Accessories

An installation accessories kit will be supplied with the 55409A mini-SSU subrack. The items in this kit are described in Table C6-2.

Table C6-2. Accessories supplied with 55409A mini-SSU subrack

Accessory	Qty	Purpose	Part #
Locking power connector	2	–48 Vdc power inputs	1251-5272
Spare 1A telecom fuse	1	Communication card	2110-1129
Spare 2A telecom fuse	1	Output cards	2110-1125
Spare 3A telecom fuse	1	ITH cards	2110-1000
Crimp lug terminal	1	Frame ground connection	0360-0041
Screw–10-32 w/nylon washer	6	EIA rack mounting	0570-1366
U-nut	6	EIA rack mounting	0590-0804
Connector pins	8	Power connector	1251-2418

Two pairs of rack mounting flanges are also included for mounting the mini-SSU into an EIA or ETSI rack.

Tools

Table C6-3 describes the required tools and where they are used. The list of tools does not include a crimp tool that will be needed to make the mating connectors for the input/output connectors.

Table C6-3. Tools needed to install 55409A mini-SSU subrack

Tool	Purpose
Large Phillips or Pozidriv #2 screwdriver	Rack mounting screws
Molex Hand Crimping Tool (11-01-0084)	Power cables
7 mm nut driver	Frame ground stud on subrack front panel
Wire strippers	Making power cables
Diagonal cutters	Making power cables
ESD wrist strap	ESD protection when installing cards

Equipment

Table C6-4 describes the required equipment and where they are used.

Table C6-4. Equipment needed to qualify 55409A mini-SSU subrack

Equipment	Purpose
Digital multimeter	Check voltage and cables for opens/shorts
54603A general purpose oscilloscope, or equivalent	Check signal characteristics during qualification

Description of the 55409A Mini-SSU

The 55409A mini-SSU provides highly accurate frequency outputs of 2048 kHz and 2048 kbps, which can be used to distribute synchronization signals at nodes in a telecommunications network. The mini-SSU is a modular, fully redundant timing distribution system intended for use where the greater number of inputs and outputs of the standard SSU are not needed.

The mini-SSU has fewer reference inputs and outputs than the standard 55400A SSU. The mini-SSU is suitable for smaller, remote sites where 32 or fewer outputs are needed, whereas the standard SSU is recommended for large central office sites.

The mini-SSU conforms to key telecommunications standards. It supports both ETSI SSU and Bellcore BITS (Building Integrated Timing Supply) standards. The SSU tracks up to *three* incoming reference signals from equal, or higher, levels of the network, qualifies the signals, then filters and distributes precise timing to the node's equipment. Incoming reference signals may come from cesium standards at the top level of the network, GPS reference sources, non-traffic E1 signals, or live traffic signals.

System Components

The mini-SSU hardware consists of one subrack, one or two Input Track and Hold (ITH) cards, one Network Information Management (NIMC) card or Information Management (IMC) card, and up to four output cards.

See Figure C6-1 for an illustration of a fully-loaded subrack with NIMC card, ITH cards, and output cards.

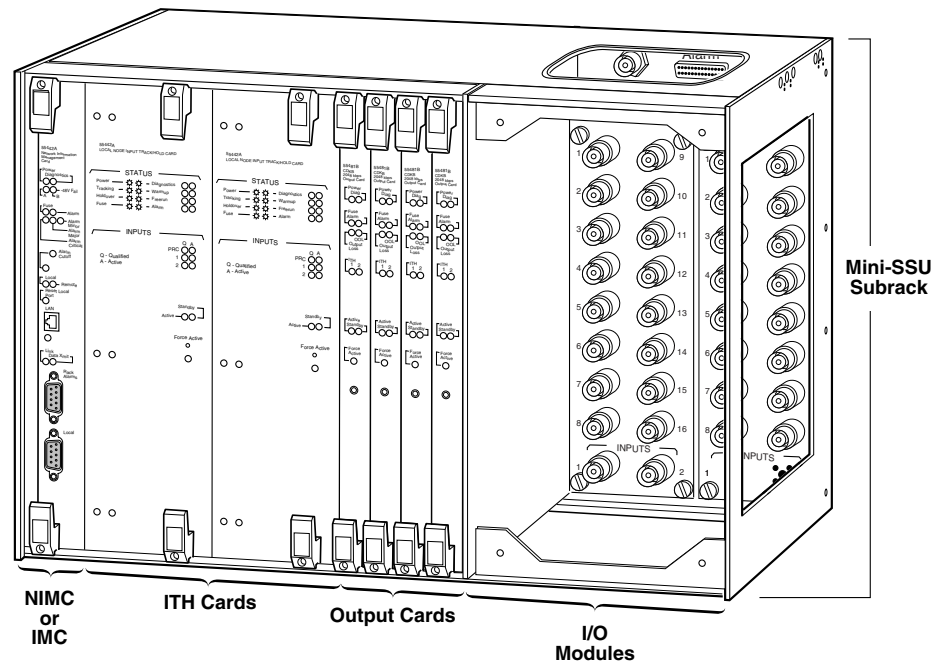


Figure C6-1. 55409A Mini-SSU

System Power

Power for the mini-SSU is supplied via redundant -48 Vdc office battery inputs. Each plug-in card is individually fused and contains its own dc-to-dc converter.

Reference Input Signals

The mini-SSU can accept three reference signals when the system is using the standard ITH cards. The Primary Reference Clock (PRC) input signal can be 5 or 10 MHz. The other two inputs can be either 2048 kHz or 2048 kbps signals.

Subrack

The 55409A subrack is the frame that houses the plug-in cards and accepts external signals and power for system operation. It consists of a chassis, backplane, and input/output modules.

Input Track/Hold Cards

The ITH cards are typically used in a protected-pair configuration as shown in Figure C6-2. The clock on each ITH card qualifies the input signals while filtering jitter and wander on the selected input signal before sending a reference signal to the output cards. The ITH cards duplicate functions in the event that the active ITH card fails and the standby card has to take over. The active ITH card tracks the selected input and takes over as the system reference should all the input reference signals fail.

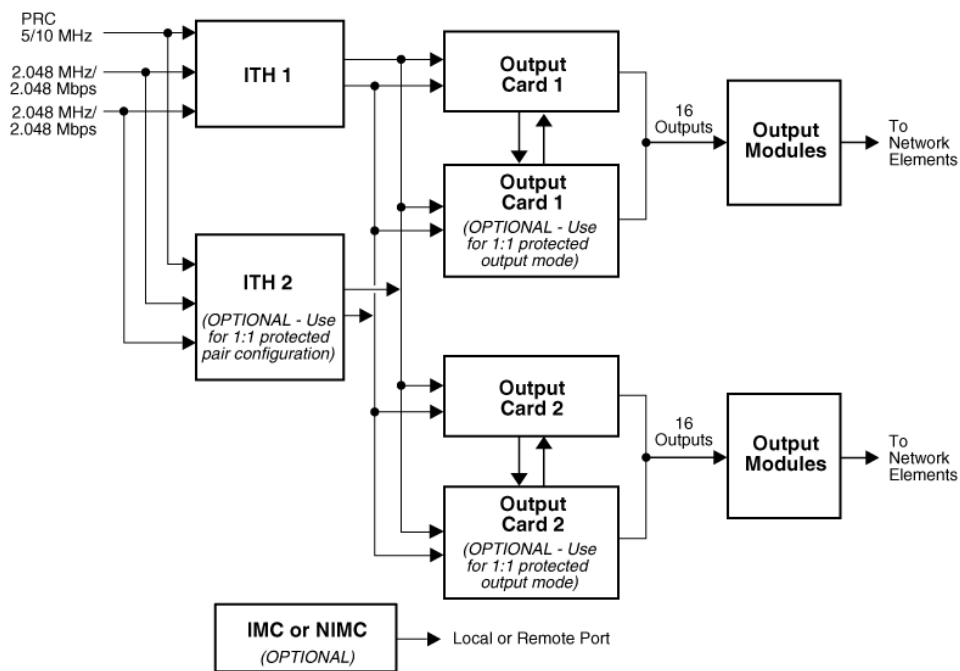


Figure C6-2. 55409A Mini-SSU—System Block Diagram

Output Cards

When configured in the recommended 1:1 protected mode as shown in Figure C6-1, each pair of output cards provides 16 protected outputs for network elements. The 1:1 protection mode employs a combination of an active card paired with a standby card ready to take its place should the active card develop a problem. Alternately, a single unprotected output card can provide 16 output signals.

Alarm/Communication Card

Each subrack can contain a communication card (NIMC or IMC), as shown in Figure C6-1. This card manages alarms from the system and can also provide an interface for communication with local or remote controllers.

The communication card collects alarms from every other card in the subrack. Upon detection of one or more alarm conditions, the card determines if the one alarm, or combination of alarms, is a minor, major, or critical alarm state and activates the alarm relays and appropriate LED indicators on the front panel.

NOTE

The communication capabilities of the mini-SSU are the same as for the standard SSU as described in chapter A5.

Input/Output Modules

The input and output connectors for the mini-SSU are contained on plug-in modules that attach to the subrack. Different types of connectors are available.

Each module provides 16 outputs. The output signals are produced by the output cards contained in the subrack. The modules may have input connectors.

55409A Mini-SSU Front-Panel Details

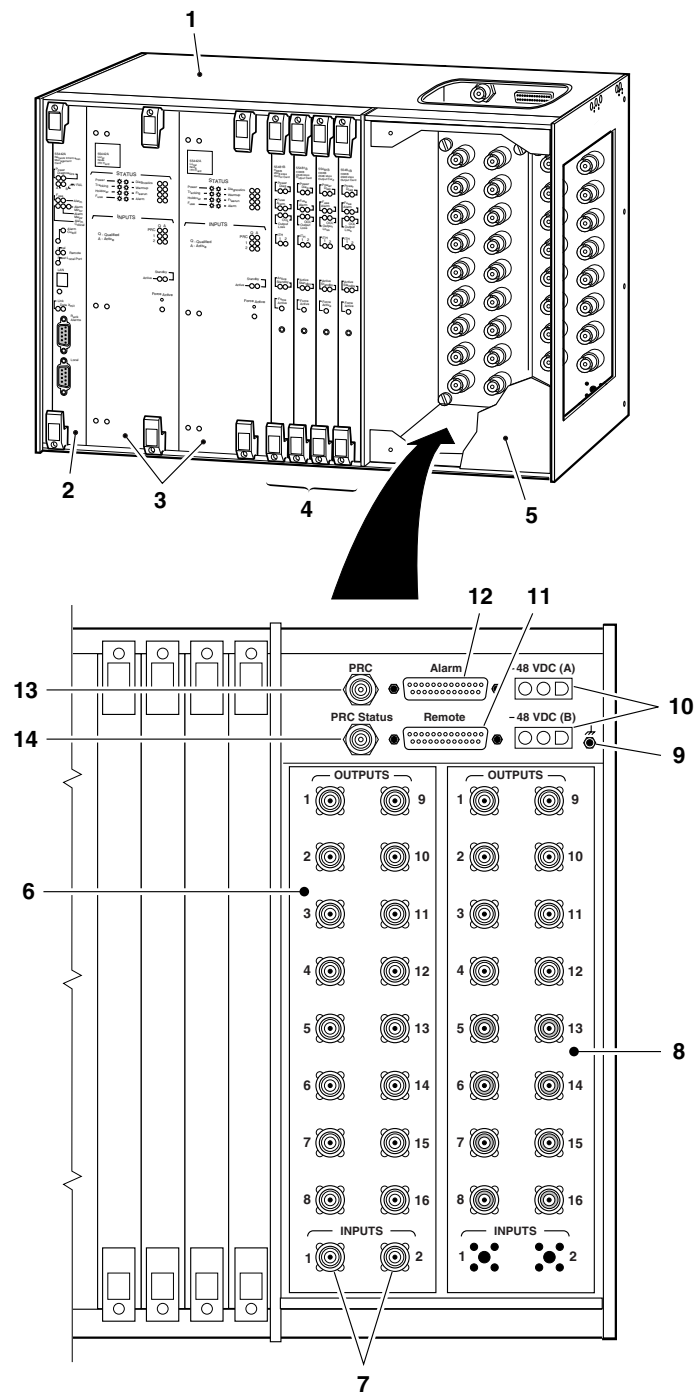


Figure C6-3. Mini-SSU Front-Panel Details

- 1 55409A Subrack.** This subrack can be mounted into an equipment rack using one of two mounting dimension standards: EIA 482.6 mm and ETSI 535 mm. These standards are accommodated by the two pairs of supplied rack mounting flanges. See the installation section in the *55400A SSU System Manual*.
- 2 55442A Network Information Management card (NIMC), or 55441A Information Management card (IMC).**
When the *NIMC* or *IMC* card is used in the SSU, it provides ports for computer communications with the SSU (local, remote, and LAN) plus alarm functions.
- 3 55429B Input Track and Hold cards.** Each card qualifies input signals while filtering jitter and wander on the selected input. The clock on the ITH card tracks the selected input and takes over as the system reference should the input signals fail.
- 4 Output cards.** When configured in the 1:1 protected output mode, each pair of output cards provides 16 protected outputs for network elements. The 1:1 protection mode employs a combination of an active card paired with a standby card ready to take its place should the active card develop a problem.
A single, unprotected output card provides 16 outputs.
- 5 Protective cover.** Secures over the opening at the front of the subrack to limit access to the cables.
- 6 55498A I/O Module.** It contains 16 output connectors. This module allows you to connect the distributed 2048 kHz/kbps output signals derived from the reference input signals to the network elements. The slot “A” output cards provide the signals for this I/O module.
- 7 2048 kHz/kbps inputs** (part of 55498A).
Each of these two inputs accepts a 2048 kHz or kbps input reference signal.
- 8 55497A Output Module.** It provides an additional 16 output connectors. The slot “B” output cards provide the signals for this output module.
- 9 Frame-ground stud** for chassis-ground connection.
- 10 –48 VDC(A) and (B)** office battery input connectors, modular interlocking. These are for connecting redundant dc power to the SSU. The dc voltage range to power the SSU is –36 Vdc to –57 Vdc.
- 11 Alarm** interface DB-25P (male) connector provides three independent alarm relays for the critical, major, and minor alarms for all office alarms (both visual and audible).
- 12 Remote** Comm Port RS-232, DB-25S (female), DTE configuration, serial interface port for remote control, monitoring, and retrieving of SSU’s memory data. The communication language is TL1.
- 13 PRC** (5 or 10 MHz Primary Reference Clock) BNC 50Ω input connector. This input accepts a Stratum 1-level 5 or 10 MHz signal from a cesium clock (e.g., 5071A) or a GPS receiver (e.g., 55300A). This input connector is grounded.
- 14 PRC Status** BNC 50Ω input connector. This input, associated with the PRC input, accepts a TTL signal (positive true) that can indicate if the primary clock has a problem. This condition can be used to disqualify the PRC. This input connector is grounded.

Mini-SSU Inputs and Outputs

Figure C6-4 shows the origin and direction flow for mini-SSU signals.

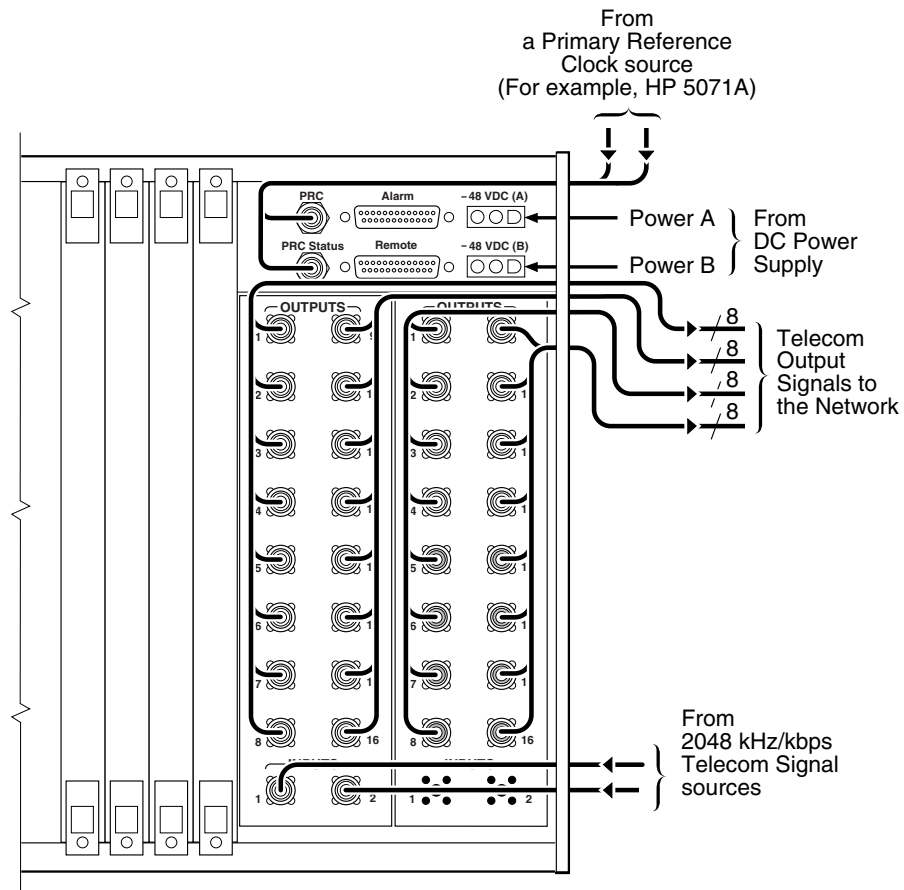


Figure C6-4. Typical Input and Output Connections for Mini-SSU

Install the Mini-SSU Subrack

The physical installation of the expansion subrack is the same as for the master subrack. For this reason, there are references back to the installation of the master subrack for rack positioning and power inputs.

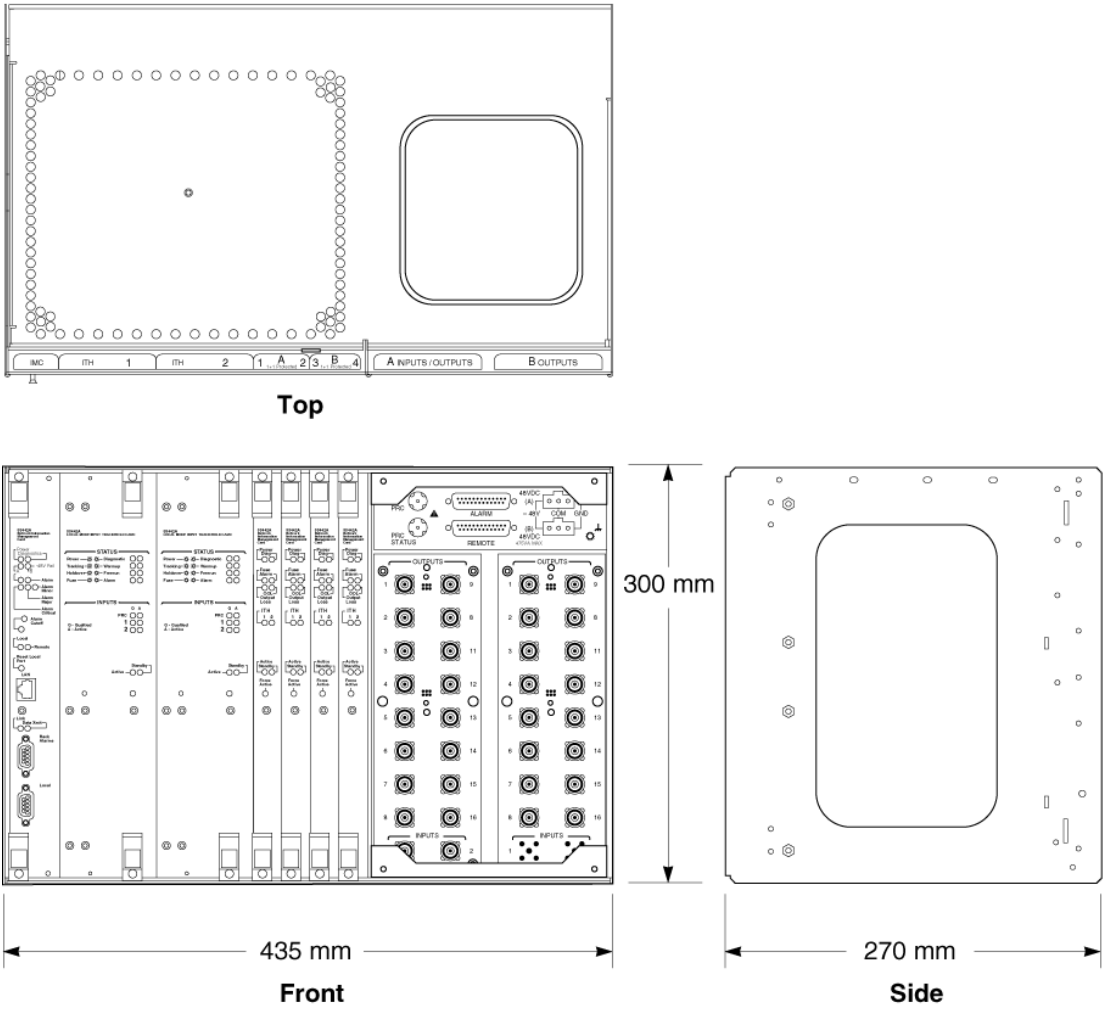


Figure C6-5. 55409A Mini-SSU Subrack Dimensions

Position in the Rack Cabinet

A possible location for the mini-SSU subrack in a rack cabinet is shown in chapter B2. The recommended spacing between the equipment is shown as well.

Installing the mini-SSU subrack

Follow the instructions in chapter C2, “Install the 55400A SSU” on page C2-6 to install the mini-SSU subrack in the rack cabinet.

Connecting the –48 Vdc power inputs

Follow the procedures in chapter C2, “–48 Vdc Power Inputs” on page C2-11 through “Connecting dc Power” on page C2-14 to assemble power cables and apply power to the mini-SSU subrack.

Alarm Port

If using the alarm connector to feed alarms from the mini-SSU to the office alarm system, review the description and pinout beginning on page C2-15.

Remote Port

If using the remote connector, review the description and pinout beginning on page C2-18.

Local Port

If using the local port on the communication card for configuring the mini-SSU or troubleshooting, review the description and connector pinout beginning on page C2-26.

Configure the Plug-in Cards

Before the plug-in cards are installed into the mini-SSU, the switch settings on each card need to be checked and set as appropriate.

Overview of Card Switch Settings

Each plug-in card contains switches that need to be configured before use to ensure proper operation. As the following sections describe each card to be installed, there will be a pointer to the location of the card's switch settings in this manual.

TIP Create and maintain a switch configuration record for each card being installed in the system. One way to do this is to copy the switch configuration tables in this manual and mark your settings. Keep this documentation accessible. If a card ever needs to be replaced, the record is then available for configuring the replacement card correctly.

ITH Card

Chapter D1 describes the ITH clock cards including the jumper and switch settings. Turn to that chapter for information on setting up the ITH card for use.

Review the information starting on page D1-17 to set switches and jumpers for the ITH card.

NOTE

The 55429B ITH card for the mini-SSU is identical in performance to the 55413B, except that the mini-SSU ITH card supports only two 2048 kbps/kHz inputs, instead of four or eight. Use switch "S2" on the ITH card to set the parameters for the two inputs.

Output Cards

Chapter D2 covers the switch settings for the output cards. The information is organized by the type of card.

Communication Card

Chapter D3 contains the switch settings for the communication cards. A description of the IMC switch settings begins on page D3-8. The NIMC switch settings are covered beginning on page D3-18.

Network Usage

If the mini-SSU will be used on a network, there are additional parameters that will need to be configured. Review the topic, “Preparing the NIMC for Network Use” on page D3-21. Important additional network information is covered in chapter 10 of the *55400A TL1 Programming Reference Manual*.

Connect the Input Signal Cables

Now is a good time to connect the input signals to the mini-SSU. The PRC input and two 2048 kbps/kHz inputs on the I/O module are supported.

Connecting the input signals at this time will ensure fewer problems during installation. When setting switches on the ITH cards, be sure to disable unused input channels.

Refer to Figure B2-6 on page B2-10 for the recommended way to route cables to and from the mini-SSU.

Install the Plug-in Cards

The following sections describe how to install the ITH cards, output cards, and communication card in turn. The procedures assume that the subrack has already been installed and power is applied. No input reference signals have yet been connected.

The 55409A mini-SSU uses a redundant architecture. This means that no single failure can bring down the system when separate power sources and plug-in cards are used in protected pairs. To support this concept, the output cards and the clock cards should be installed in protected pairs. If redundant operation is not needed, the mini-SSU can operate with a single ITH card and a single output card for each 16 outputs.

Plug-in Card Locations

The subrack has space for a communication card, two clock cards, and two pairs of output cards (A and B slots).

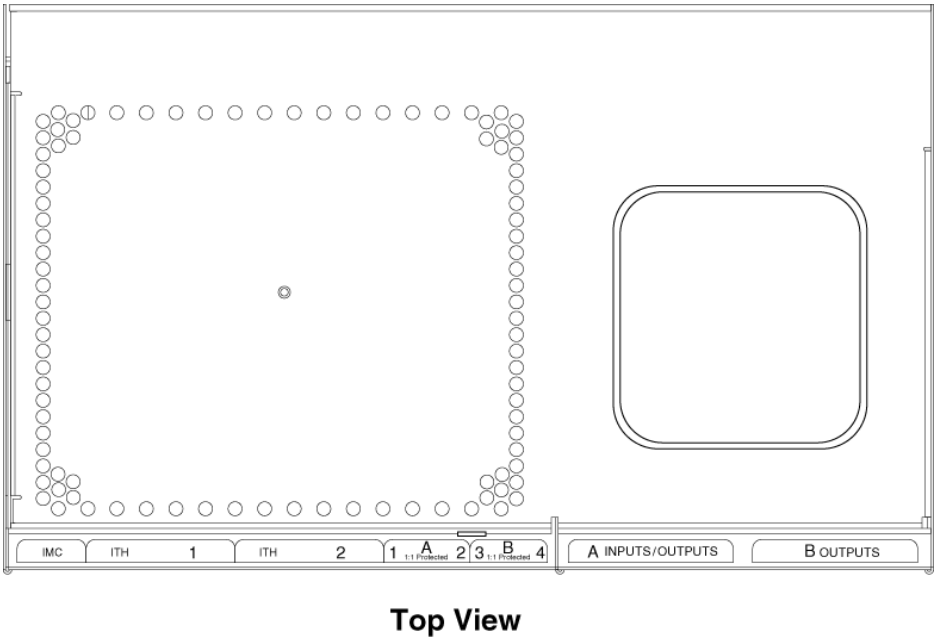


Figure C6-6. Guide for card installation

The communication card slot (labeled IMC) takes one of the two communication cards:

- Information Management Card
- Network Information Management Card

The ITH slots take the two clock cards, and the “A” and “B” slots each accept a pair of output cards. Each group of 16 outputs on the connector modules (labeled “A outputs” and “B outputs”) corresponds to the pair of output cards installed in slots “A” or “B.”

NOTE

If the output cards will not be installed as protected pairs, install only one card per labeled pair of slots. For example, one output card could be installed in either of the two slots designated as “B.” The second slot should remain empty.

Plug-in Card Identification

Card assemblies are identified by:

- Symmetricom model number on the front panel of each assembly
- Serial number on the side panel of cards

If there are any questions regarding a specific component, note the model number and serial number on each card assembly and include it in any correspondence with Symmetricom.

Initial Installation of 55409A System Cards

This is the sequence to follow when installing 55409A cards for the first time:

- Configure the card
- Install the card
- Observe the card status
- Repeat for the next card

Install the cards in this order as instructed in the following topics:

- ITH clock cards
- Output cards
- Communication card

NOTE

It is strongly recommended that all card configuration at the time of the initial installation be accomplished by making the switch settings on the cards. This approach ensures that all card parameters are initially set to known states and this can avoid confusion later during the service life of the SSU.

ITH Clock Cards

Go to “Install the ITH Clock Cards” on page C2-32.

Output Cards

Go to “Install the Output Cards” on page C2-37.

Communication Card

Go to “Install the Communication Card” on page C2-38.

Input/Output Modules

Normally, there is no need to remove these modules. The only time these modules need to be removed would be to be to configure them for use with the 55471A Traffic Re-synchronization Card (TRSC). The TRSC is the only output card that contains both inputs and outputs so some of the connectors that are normally outputs for all other output cards are used as inputs for the TRSC. Those inputs require a 75 Ω termination for proper signal matching to the backplane of the subrack.

The modules have jumpers on the back side of the board to select a 75 Ω termination for the connectors used as inputs with the TRSC. The designated inputs are connectors 1, 3, 5, 7, 9, 11, 13, and 15 when using the TRSC. Some are buffered channels and some are re-timed. For detailed information on the TRSC, refer to the description beginning on page D2-27.

Output module jumpers

The mini-SSU output modules have jumpers to provide a 75 Ω termination for the connectors used as inputs to the Traffic Re-synchronization Card (TRSC). This capability takes the place of external feed-thru 75 Ω terminations that are required if these inputs are not terminated on the module using the jumpers.

Procedure for jumper placement:

1. Remove the module by loosening the thumbscrews at the corners of the module.

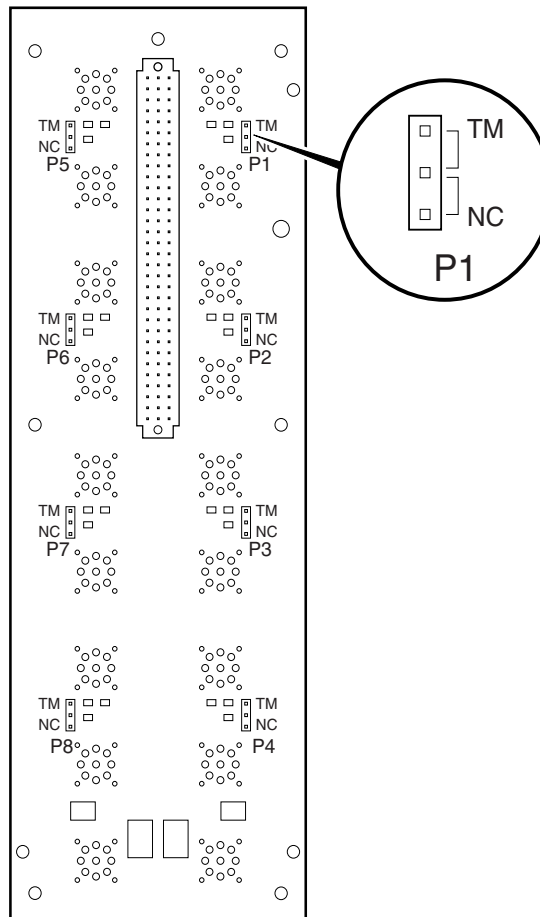
Install the Plug-in Cards

Issue 1

2. See Figure C6-7 for a view of the output module and the jumper pins. There are eight jumper locations on each output module at connectors: 1, 3, 5, 7, 9, 11, 13, and 15. These connectors are used as inputs for the TRSC.
3. To set a 75 Ω termination for one of the connectors used as an input to the TRSC, move the jumper to the “TM” position (place the jumper over the top pin and the middle pin).
4. To remove a 75 Ω termination from one of the connectors, move the jumper to the “NC” position (place the jumper over the middle pin and the bottom pin).

CAUTION

Jumpers must be moved back to the “NC” position whenever TRSC cards are no longer used in the mini-SSU. For example, if a TRSC card is replaced by another type of output card, the failure to reset jumpers on the output module will cause an attenuation of the output signals from those terminated connectors.

**Figure C6-7. Output Module rear view**

What is Next?

- 1 Perform the qualification tasks starting with “Prepare 55400A for Operation” on page E1-14. Then follow the test procedures starting with “Perform 55400A SSU Tests” on page E2-7.

The qualification tasks consist of:

- Display current status
- Verify mini-SSU configuration
- Set mini-SSU date and time
- Set mini-SSU system ID
- Configure mini-SSU for network operation (if needed)

The equipment tests consist of:

- Alarm tests
- Output checks

NOTE

If installing the mini-SSU with the frequency standard or GPS reference source, complete those installations before starting the qualification procedures.

- 2 Connect the outputs to network elements.

The last step is to connect the output signals to the network elements that require synchronization.

Troubleshooting

Follow procedures starting on “Before You Begin” on page F1-2.

To Check firmware revision

The firmware revision number can be checked one of the following ways:

1. Send a TL1 command using the 55450A local craft terminal software or a terminal emulation program connected to the local port of the communication card. The information retrieved will include the firmware revision at the end of the lines describing the IMC and ITH cards in the format Rxxxxx.

```
RTRV-NETTYPE-ALL:::1;
```

2. Remove the communication card from the mini-SSU subrack. The EEPROMs on the card will have a label indicating a firmware revision.
3. Review the system test data pack forms shipped with the master subrack from the factory. The firmware revision number is included on the system final configuration/shipping log form.

NOTE

Methods 2 and 3 may not be valid if newer firmware has been downloaded to the EEPROMs without making a modification to the labels.

Firmware upgrade

Newer versions of firmware for the mini-SSU subrack may be available for download over the Internet. Contact Symmetricom for details.

D1

Configure ITH Clock Cards

Configure, operate, and support

In This Chapter

This chapter describes the Input Track and Hold (ITH) cards for use in the 55401 series of master subracks. The topics include the following:

- Functions/features
- Clock card description
- Overview of performance measurements
- Overview of jitter and wander
- Front panel LEDs
- Mixing oscillator types
- Operating with a single ITH card
- Configuring switches on the card
- Backdating

NOTE

Although firmware versions are backwards-compatible, it is recommended to always have the same version of firmware in both ITH cards.

NOTE

The information in this chapter also applies to the 55409A mini-SSU.

ITH Card Functions/Features

Heart of the system

The Input Track and Hold card is the central element in the SSU. It is the heart of the synchronization tasks provided by the SSU. The main function of the ITH is to track and filter the input reference. The card also provides a holdover capability using a local oscillator. The ITH card monitors each of the reference inputs. A standard card supports five inputs consisting of one PRC and four 2048 kbps or MHz. They are monitored for errors and performance thresholds. If all signals are judged good, they are all qualified for use.

How the tracked signal is selected

The input signals become available for tracking when they are qualified. There is only one input that is tracked at any time. The one selected depends on the priority that has been assigned to it.

Assigning priority is a way of imposing a preference to the order in which the input signals will be selected. If a tracked input is lost for some reason, the ITH card will select another from the qualified inputs based on the priority settings.

ITH cards monitor each other

ITH cards work in a pair relationship. The input signals are internally connected to both cards. Each of the ITH cards works independently of the other qualifying and making judgements as to the quality of the input signals. The ITH cards continuously compare these findings to ensure that there is a backup card in agreement with the active card as to the quality of the input references.

If all input signals fail

The ITH card provides a holdover performance based upon the model of ITH card used in the system. An ITH card goes into Holdover mode whenever all inputs are disqualified, provided an input has been tracked for at least ten minutes. It is only after ten minutes of tracking a qualified input that the ITH card will have acquired enough information to go into holdover. If all inputs are disqualified before the ITH card has been tracking an input for ten minutes, the ITH card will enter Freerun mode.

If the ITH card uses a double-oven quartz oscillator (55411 or 55415), it will “learn” the local oscillator’s aging and temperature effects while tracking the active reference input. After tracking an input for 32 hours, the ITH card will go into Symmetricom SmartClock holdover if all inputs are disqualified. This mode provides a superior output quality as compared to the normal holdover performance. The highest qualify Symmetricom SmartClock holdover is available after 72 hours of tracking a reference input.

ITH Card Description

The ITH card is essentially a slave clock; it tracks an input reference and it tests the quality of the input signal. If an input signal meets all the tests for qualification, it can be selected for use as the system reference. When for any reason no input signals are judged suitable for use as a reference, the local oscillator on the active ITH card becomes the system reference. Over time, the ITH card “learns” how the local oscillator behaves and uses this information to discipline the oscillator when it is operating without a reference. The 55400A provides a number of ITH cards with different oscillator performance to meet different network requirements.

As described in greater detail in chapter A2, the cards will qualify the input signals by checking for proper formatting, signal level, and stability, as well as making performance measurements of signal quality. Then based on an automatic or user-imposed order of assigned input preference, the ITH card will select the most appropriate signal to use as the reference.

The different ITH cards differ only in the quality of the local oscillator that becomes the system reference only when all input signals are judged unavailable. A description of oscillator types and specifications can be found in chapter A3, “System Specifications.”

Option 001

The Option 001 to the ITH cards provides an additional input card to the ITH assembly increasing by four the number of input signals that can be accepted by the ITH card. A standard ITH card will handle a PRC and four 2048 kbps or kHz input signals.

Theory of operation

Each master subrack typically includes two ITH cards: one is always operating as the active card, while the other waits in standby mode to take over should the active card ever fail. Refer to the block diagram while reading this text.

Power

Each ITH card is powered by a –48 Vdc power supply and produces +5 Vdc and ±12 Vdc using a dc-to-dc converter on the card. The reference input signals are routed to both of the ITH cards from the backplane of the subrack. Output signals from one ITH card are sent to the other ITH card for monitoring.

Input Paths

The input signals pass through a differential amplifier. The resulting signal is split into two paths: a MHz path and a Mbps path. The Mbps path includes a clock recovery circuit and a framer that monitor the 2048 kbps input signals for certain conditions and failures and generates a 2048 kHz signal from them.

The input signal passes into a monitoring circuit which produces digital phase and time values. These values are read by the ITH microprocessor. They are the basis for all jitter measurements and frequency calculations.

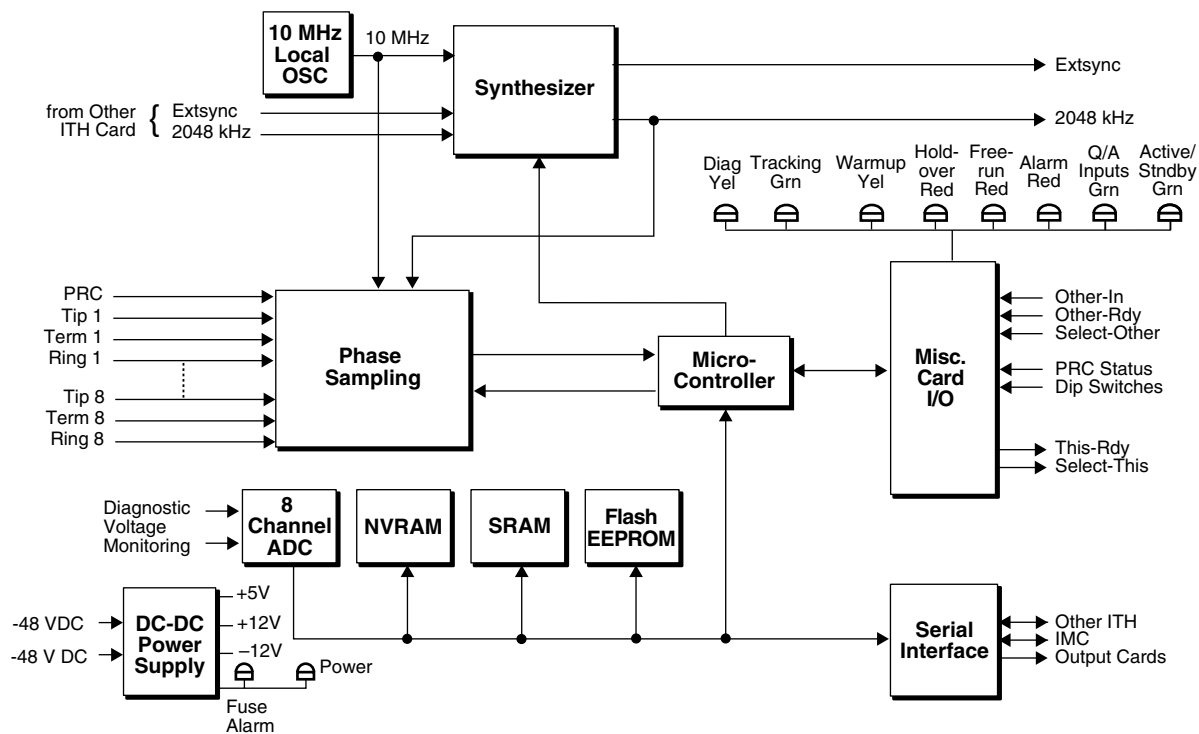


Figure D1-1. ITH card block diagram

Frequency control

The microprocessor controls the synthesizer to produce an output frequency that is the same as the tracked reference input. Since the phase sampler and synthesizer are both referenced from the same local oscillator, any error in the local oscillator frequency produces a frequency correction factor that is applied to the synthesizer.

The ITH card uses a tracking mechanism that consists of a digital feed-forward frequency-lock-loop. This synthesizer consists of a numerical accumulator and a filter. The local oscillator is compared with the reference input. The digital phase difference is filtered and differentiated to produce a frequency correction digital word that is directly proportional to the frequency it should produce. The data word is used (fed forward) to modify the ratio of the synthesizer to produce an output that tracks the reference input. The filter reduces synthesizer phase noise before the signal is passed on to the backplane.

Phase control

The local oscillator is also phase compared with all other references and the ITH card produces frequency correction terms for each reference. Whenever it becomes necessary to substitute one reference for another, the appropriate correction term is employed thereby causing no loop transients. In addition, since it is a frequency correction and not a phase correction, there is no phase change.

A phase detector phase-locks the standby ITH card output to that of the active ITH to avoid phase hits in the event the standby card has to take over for the active card. The phase detector monitors both its own output and the output of the other ITH card. It provides the fine adjustment required to maintain phase lock. The phase detector and synthesizer accommodate a frequency tolerance (pull-in, pull-out range) of approximately ± 300 parts per million. If that tolerance is exceeded, the standby card will not track the reference, and a sync error is reported.

Alarms, detection, and control lines

There are two ITH card alarm lines that encode four alarm states connected to the communication card: no alarm, minor alarm, major alarm, and failure.

The ITH card has a read register that monitors the presence and status of the other ITH card, the PRC status line, alarm signals, and acknowledge pulses from the output cards. The write register can squelch the ITH output or assert the card's output select line. Squelching the ITH backplane output clock is required to ensure that output cards will not try to track the output of a bad ITH card.

Performance measurements to evaluate quality of input signals

When the input reference is behaving normally (that is, the reference is traceable to stratum-1), the measurements on the other input channels can be used to generate alarms using thresholds or to reject the input signals. The next several sections describe how this works.

Event reports from inactive ITH card

Although both ITH cards are independently monitoring the input references for multiple behaviors and reporting any problems to the communication card, normally it is only the events reported by the active ITH card that are passed to the communication card.

This “filtering” of events from the inactive ITH card reduces traffic over the TL1 port, but it may lead to behavior that can appear confusing to anyone monitoring the SSU events. For example, if the ITH1 card were to disqualify the Input 1 signal, the access identifier included with the event message would be “ITH1-1.” This identifier refers to the signal at input channel 1 of the ITH1 card. Later, if the other ITH card becomes active and this card is able to qualify the Input 1 signal, that event would generate a message showing the clearing of the alarm with an access identifier of ITH2-1, although there is no previous message in the event log showing that an alarm occurred on the ITH2 card when the Input 1 signal was disqualified in the first place.

It is possible to modify this normal behavior and have events from both ITH cards reported. Use the RPTALL keyword described in the *55400A TL1 Programming Reference Manual*. The default value is “No” which blocks the redundant reports of ITH events from the standby ITH card.

This keyword has no effect on the event log itself. Each ITH card maintains its own log and will store all of its events for which the LOG property is set to “Y.” The RTRV-LOG command may either specify which log is to be retrieved, or if none is specified, the log from the active ITH card will be retrieved.

If you want to view all the events from the standby ITH card at any time, use the RTRV-COND or RTRV-ALM command and include an access identifier for the standby card (ITH1 or ITH2).

Disagreement between ITH cards

Normal operation may include a behavior where one ITH card qualifies an input signal and the second ITH card does not. Because the cards operate independently and come to separate conclusions about each input signal, there can be instances when the two ITH cards disagree with each other. This condition will raise an alarm.

In this case, different inputs can be active on each card. This condition should be investigated to determine the cause. One reason it may occur is because an input signal characteristic is very near a limit.

Refer to chapter F2, “Troubleshoot the SSU,” for additional information.

Active ITH card in holdover, Standby ITH card not

Should the active ITH card go into holdover while the standby card is still tracking an input, an automatic switch of active to standby and standby to active ONLY if all of the following conditions are true:

- Neither ITH card is configured as “inferior” (see Mixed oscillator operation)
- Both ITH cards are in normal operating mode (event SNOOPER) indicating that the card has been operating long enough to be in tracking mode 3
- The active ITH card is not tracking an input signal
- The standby ITH card is tracking an input signal

When all these conditions become true and after approximately 60-90 seconds, the active and standby ITH cards will switch states.

The user may use the TL1 command or the front panel push button to revert to the previous arrangement, and it will not switch back. If the above conditions clear, (that is, any of the conditions become false), then if all the conditions become true again, the automatic switch would occur again.

Performance Measurements Overview

QUESTION How is it that the SSU, a slave clock, can support performance measurements on the incoming reference signals when the SSU does not have an internal reference superior to the input signal being evaluated?

ANSWER The signal used as the reference for the performance measurements is the input reference being tracked after it has been subjected to filtering for jitter and wander. It is the best available reference because at this point it has the long-term stability of the input reference and the good short-term stability of the local oscillator (LO). Since the SSU compares the output to the input in the measurement of TDEV, MRTIE, and LMRTIE, they are relative measurements.

Measurement reference background

The oscillator on the ITH card provides very good short-term stability but may have a significant offset from the nominal frequency over time. On each ITH card a digital phase detector continuously measures the phase difference between the input reference and the LO. From this data, the frequency difference at any time is continuously being produced and used as correction to the output synthesizer being driven by the LO. It is this synthesizer that generates the output frequency. As a result, the output frequency tracks a low-pass filtered version of the input reference while the LO free runs. This way the SSU nominal frequency output tracks the long-term frequency of the reference and has the short-term stability of the LO. At the same time, by monitoring these internal frequency corrections over time, it is possible to determine the short-term fluctuations of the reference and the long-term drift of the LO.

In addition, the SSU makes the same measurement of the phase difference between any other input signals not currently being tracked and the LO. An unused frequency correction word is produced continuously with time for each input signal just as if the input signal was being tracked. The only difference is that the correction word is held in reserve and is not actually used to correct the output synthesizer. In fact, the correction frequency for all references, being actively tracked or not, are simultaneously being produced by the SSU hardware and firmware. By observing these frequency corrections, the frequency difference between the LO and any reference is known at any time on a continuous basis. Using this technique, the SSU is prepared to switch to any of the input signals without any disruption in output quality, continuity, and accuracy.

Jitter and Wander Filtering

One of the tasks of the SSU is to remove jitter and wander from the input reference before distributing it to downstream equipment.

QUESTION How does the SSU filter the input reference?

ANSWER The SSU uses a tracking filter consisting of a digital phase-lock loop (PLL) on the ITH card. The PLL locks the phase of the output signal to that of the input reference. Depending on the bandwidth of the loop, any changes at the input can be spread out over a longer time at the output, thereby smoothing out any variations. When the bandwidth of a phase-lock loop is narrow, there is a longer response time to changes on the input signal, so the extent of filtering is greater. With a wide bandwidth, less filtering takes place. The loop bandwidth depends on the time constant of the phase-lock loop.

Time Constant setting controls loop bandwidth

The loop bandwidth is inversely proportional to the time constant value. The smaller the time constant number, the wider the bandwidth and the faster the system responds to changes on the reference input. So at 192 seconds, the system will react more quickly with less filtering of the input signal. With longer time constants, more filtering takes place as the system is slower to react to any changes on the input reference. A longer time constant requires a higher quality local oscillator because the oscillator will be steered less frequently.

The ITH card uses a programmable time constant to control the bandwidth of the loop. The minimum value is 192 seconds, and the maximum is 49,152 seconds. Changing the time constant allows you to change the filtering characteristics of the SSU.

EXAMPLES If the input signal is from a local cesium source, a short time constant for that input channel is appropriate (192 seconds). Little filtering is required because this signal exhibits excellent short-term and long-term stability. A local GPS reference, on the other hand, has more short-term noise than a cesium signal and as a result, a longer time constant is a better choice for the GPS signal.

Any input reference from a network usually is of less quality than a local cesium or GPS input because of the jitter and wander added by the transmission path. With a lower-quality input, more emphasis is placed on the ability of the PLL, with a longer time constant, to provide increased filtering. The better the local oscillator stability, the longer the time constant the oscillator can support.

SUMMARY The time constant value is really a setting that tries to achieve a balance between the noise characteristics of the input reference and the noise characteristics of the local oscillator. It is a matter of providing an appropriate level of filtering for the input signal based on the nature of the noise present on the input signal and the inherent stability of the local oscillator to support the filtering.

Each input channel can be assigned a different time constant value. The table below shows the recommended time constant values for different ITH card types and input references. The default value for the time constant is determined by the type of oscillator contained on the ITH card. This default value is initially assigned to all input channels.

The supported settings for each input channel are: 192, 768, 3072, 12288, and 49152 seconds.

Table D1-1. Recommended Time Constant Values (in seconds)

ITH Clock Card	Local Cesium time constant	Local GPS time constant	Network Reference time constant
55414 Enhanced Stratum 2–rubidium	192	49512	3072 (default)
55411 Stratum 2–quartz	192	3072	768 (default)
55415 Enhanced transit node	192	3072	768 (default)
55412 Transit node	192	768	192 (default)
55413 Local node	192	192	192 (default)

NOTE

Unless you have studied your network enough to have a very good understanding of the absolute noise behavior of the input signals, use the recommended time constant value for the reference signals from the network. Time constant values for individual inputs can be changed using the TL1 keyword *TCONST* or the 55450A local craft terminal software.

TL1 Syntax

```
ED-SYNC::ITH-0:1::TCONST=192;
```

Sets the PRC input to a time constant of 192 seconds.

```
RTRV-SYNC::ITH-0:1::PARAMETER=TCONST;
```

Retrieves the loop time constant for the PRC input channel.

Tracking modes

There are three tracking modes that each ITH card will step through after start-up. Each tracking mode has more stringent operating limits for the local oscillator as it reaches its final drift rate. These modes allow for the fact that the longer the local oscillator is running, the closer the oscillator will be to reaching its final drift rate. The time constant value only applies in the final tracking mode.

The ITH card will be in Track 1 mode for 20 minutes after it comes out of warm-up. Track 2 mode lasts for 8 more hours. And finally, Track 3 mode takes over. In Track 3 mode, the PLL will operate with the time constant programmed into the circuit (192 to 49,512 seconds). You can expect the best-quality signal output from the ITH card when it is in Track 3 mode.

ITH Front Panel Indicators

An ITH card uses LEDs to indicate the current operating conditions to an observer. Much more information is available from the card itself through the TL1 interface. An explanation of the LEDs follows.

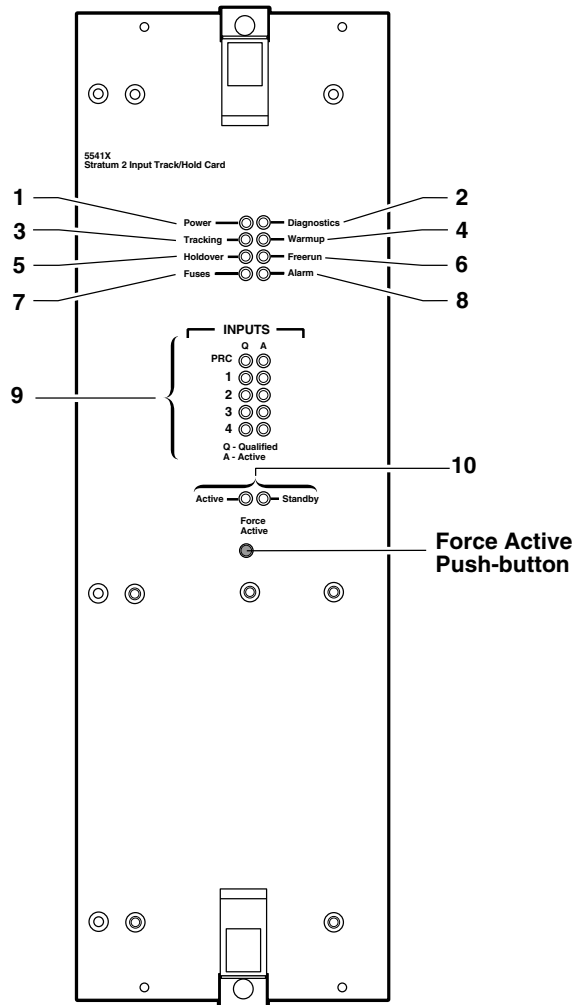


Figure D1-2. Example of ITH card front panel (without Option 001)

Table D1-2. ITH card LEDs

No.	LED	Indicates when lighted
1	Power	Power is present.
2	Diagnostics	Diagnostics are being performed or a diagnostic failure has occurred.
3	Tracking	ITH card has qualified an input and is using it as a system reference.
4	Warmup	ITH oscillator oven is warming to operating temperature and the card is not yet active.
5	Holdover	ITH oscillator, using recent tracking data from a qualified reference, is providing the output frequency. No qualified references are available.
6	Freerun	ITH oscillator is generating an output but without the use of any frequency information from a reference.
7	Fuse	ITH card fuse is open.
8	Alarm	ITH card is in the alarm state.
9	Inputs	For each input there is a Q and A where: Q = This input has been qualified for use A = This input is the active reference
10	Active	This ITH card is the synchronization source for the subrack.
10	Standby	ITH card is in the standby state generating an output that is phase-locked to the output of the other (active) ITH card and ready to take over for the active card.

ITH Card Assembly

An ITH card assembly can consist of up to three circuit boards:

- Option 001 auxiliary board
- Standard main board
- Power supply board

The Option 001 board adds the capability to accept four additional input signals in addition to the one PRC and four 2048 kbps/kHz inputs provided by the standard ITH card assembly. In the drawing below, the Option 001 board is at the top with the standard board next and the power supply board at the bottom.

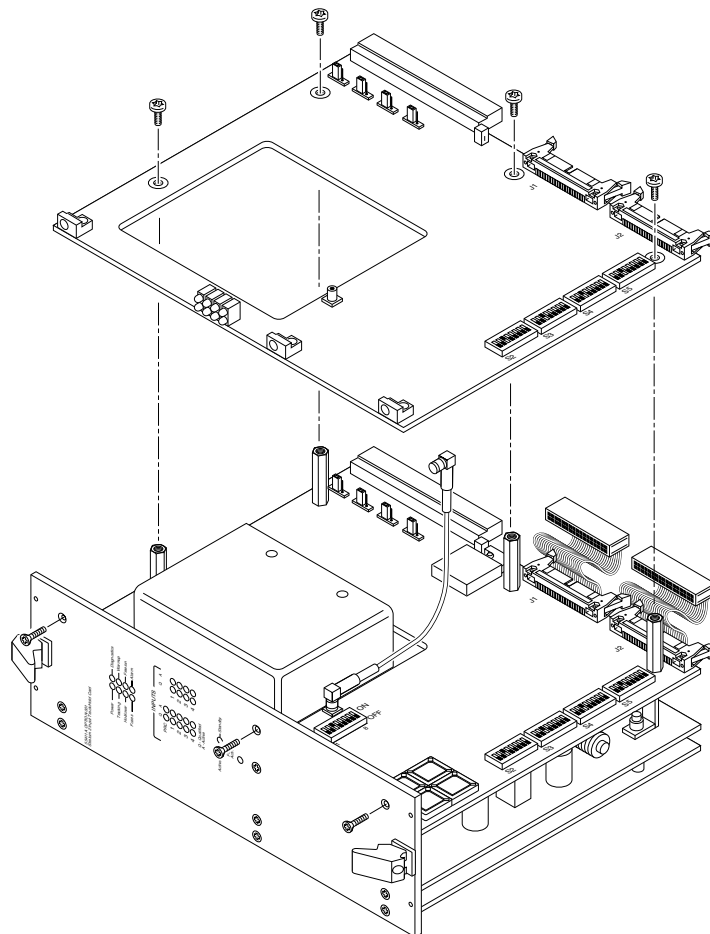


Figure D1-3. ITH card assembly with Option 001 board (top)

Configuring ITH Cards

The input track and hold card assemblies contain switches for setting parameters and jumpers for selecting bridged or terminated inputs.

The switch settings will be divided into those for the main board and the auxiliary board (the aux. board is included with Option 001 to the ITH assembly).

ITH main board switches

Switches for standard ITH card assembly. Refer to Figure D1-4 for the location of the switches.

Table D1-3. ITH main board switch settings

Switch	Bit	Parameter	Off	On
S2	1	Input 1 Type	2048 kbps	2048 kHz
	2	Input 1	Disabled	Enabled
	3	Input 1 Mode	CAS	CCS
	4	Input 1 CRC4	Enabled	Disabled
	5	Input 2 Type	2048 kbps	2048 kHz
	6	Input 2	Disabled	Enabled
	7	Input 2 Mode	CAS	CCS
	8	Input 2 CRC4	Enabled	Disabled
S3	1	Input 3 Type	2048 kbps	2048 kHz
	2	Input 3	Disabled	Enabled
	3	Input 3 Mode	CAS	CCS
	4	Input 3 CRC4	Enabled	Disabled
	5	Input 4 Type	2048 kbps	2048 kHz
	6	Input 4	Disabled	Enabled
	7	Input 4 Mode	CAS	CCS
	8	Input 4 CRC4	Enabled	Disabled
S4	1	PRC Frequency	5 MHz	10 MHz
	2	PRC Input	Disabled	Enabled
	3	Input 1 E1 Coding	AMI	HDB3
	4	Input 2 E1 Coding	AMI	HDB3
	5	Input 3 E1 Coding	AMI	HDB3

Table D1-3. ITH main board switch settings (continued)

Switch	Bit	Parameter	Off	On
S4	6	Input 4 E1 Coding	AMI	HDB3
	7	Mixed Oscillators	Inferior	Same/Superior
	8	Tracking Mode	Non-revertive	Revertive
S5	1–6	Reserved	—	—
	7	ITH Startup State	Switch settings overwrite memory values	Switch settings do not overwrite memory values
	8	Firmware Startup State	Force download mode	Verify firmware on startup
S6	1	Oscillator Type	See next table	See next table
	2	Oscillator Type	See next table	See next table
	3	Oscillator Type	See next table	See next table
	4–8	Reserved	—	—

Switches for local oscillator types**NOTE**

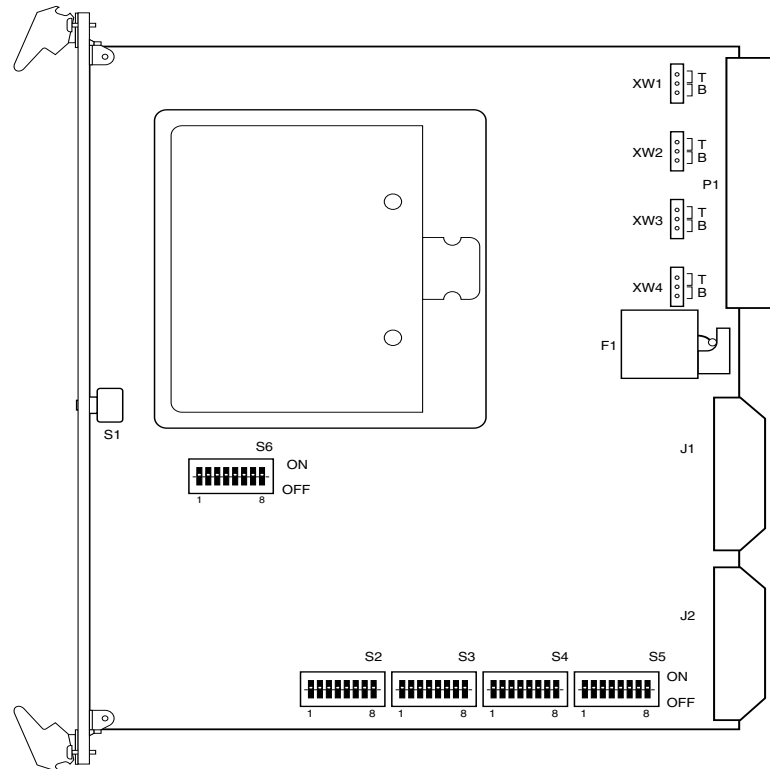
These switches are set at the factory according to the type of oscillator used in the ITH assembly. ITH problems will occur if these switches are not set correctly for the particular type of oscillator card.

Table D1-4. ITH main board oscillator settings

Oscillator Type	S6–1	S6–2	S6–3
55411 Stratum 2	On	On	On
55412 Transit Node	On	Off	On
55413 Local Node	Off	Off	On
55414 Enhanced Stratum 2 Rubidium	Off	On	On
55415 Enhanced Transit Node	Off	On	Off

Configuring ITH Cards

Issue 1

**Figure D1-4. ITH main board switch locations****ITH card jumpers**

The ITH card may be jumpered to provide the capability for bridging or terminating a 2048 kbps traffic-bearing signal.

Terminating

In termination mode, the traffic signal goes directly into the SSU and is terminated into 75 Ω unbalanced. This is appropriate when the SSU is the last in a series of equipment and the signal is not being used elsewhere.

NOTE

To achieve a balanced 120 Ω termination, an inline balun transformer (120 Ω balanced to 75 Ω unbalanced) is required on the subrack input connector.

Bridging

Use the bridging mode if the signal will be used for synchronization, and it also must be used somewhere else after going to the SSU, such as to a switch or digital cross-connect.

When bridging with traffic passing by the SSU, using a high-impedance, 3.3 k Ω probe will not disturb the traffic line that has a characteristic impedance of 75 Ω or 120 Ω . This in addition to the 3.3 k Ω terminating impedance of the SSU when in bridging mode provides a much higher amplitude for the input signal as opposed to using the 75 Ω termination in this situation.

NOTE

Because the SSU has a fairly low disqualification threshold for 2048 kbps signals, a low signal level will usually work but may be more sensitive to changes in the input signal amplitude.

Procedure for jumper placement

There are four jumpers each on the ITH main board and auxiliary board. Refer to Figure D1-4 and Figure D1-5 for the location of the jumpers.

- a. Locate the jumper on the board associated with the input channel you need to configure:
 - Input 1 (main bd.) or 5 (aux bd.) = XW1
 - Input 2 (main bd.) or 6 (aux bd.) = XW2
 - Input 3 (main bd.) or 7 (aux bd.) = XW3
 - Input 4 (main bd.) or 8 (aux bd.) = XW4
- b. Set the jumper in the “T” position for 75 Ω unbalanced termination and 120 Ω termination (see the Note below).

NOTE

To achieve a balanced 120 Ω termination, an inline balun transformer (75 Ω to 120 Ω) is required on the subrack input connector.

- c. Set the jumper in the “B” position for 3.3 k Ω bridging.

ITH auxiliary board switches

Switches for the Option 001 auxiliary ITH board. The Option 001 board is the top board of the three boards that make up the ITH assembly. Refer to Figure D1-5 for the location of the switches.

NOTE

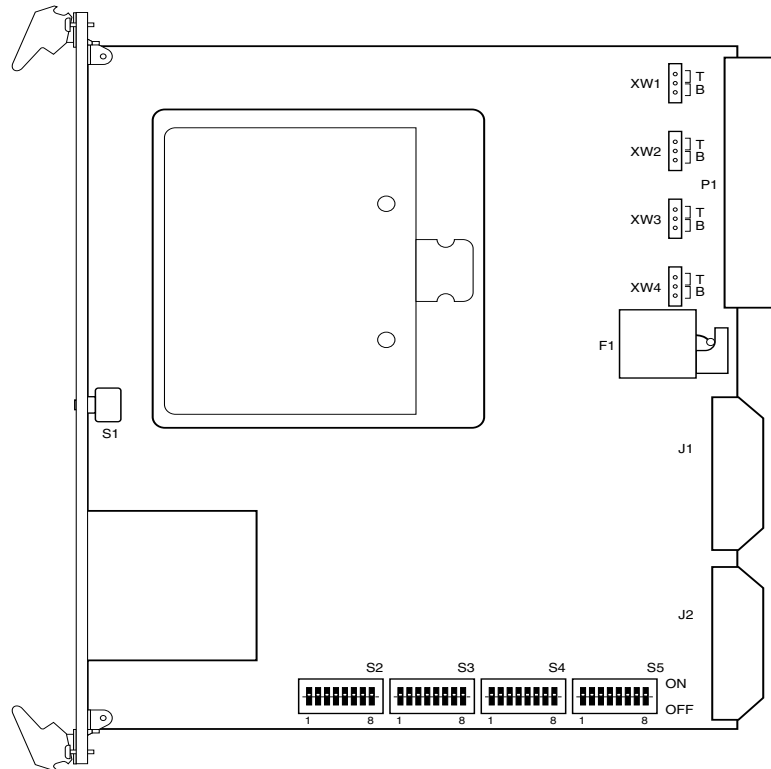
Switches S4 and S5 on the Option 001 auxiliary board are not functional.

Table D1-5. ITH auxiliary board switch settings

Switch	Bit	Parameter	Off	On
S2	1	Input 5 Type	2048 kbps	2048 kHz
	2	Input 5	Disabled	Enabled
	3	Input 5 Mode	CAS	CCS
	4	Input 5 CRC4	Enabled	Disabled
	5	Input 6 Type	2048 kbps	2048 kHz
	6	Input 6	Disabled	Enabled
	7	Input 6 Mode	CAS	CCS
	8	Input 6 CRC4	Enabled	Disabled
S3	1	Input 7 Type	2048 kbps	2048 kHz
	2	Input 7	Disabled	Enabled
	3	Input 7 Mode	CAS	CCS
	4	Input 7 CRC4	Enabled	Disabled
	5	Input 8 Type	2048 kbps	2048 kHz
	6	Input 8	Disabled	Enabled
	7	Input 8 Mode	CAS	CCS
	8	Input 8 CRC4	Enabled	Disabled

Configuring ITH Cards

Issue 1

**Figure D1-5. ITH Option 001 auxiliary board switch locations**

Mixing Oscillator Types

Although the 55400A system normally operates with a matched pair of ITH cards, the 55401 series of subracks does support the use of mixed oscillator types, that is, different ITH cards. This arrangement may be acceptable when your network synchronization requirements are such that a lower stability holdover clock would still be acceptable in the unusual event that all input references are lost and the “superior” ITH card fails as well. Specifically, the following ITH card model numbers can be mixed. The ITH card with the better stability is listed first:

- 55414 with 55411
- 55414 with 55415
- 55411 with 55412
- 55411 with 55413
- 55415 with 55412
- 55415 with 55413

Operating differences

You need to be aware of the differences in SSU operation with mixed type oscillators. It regards the switching between ITH cards under certain conditions.

The two different oscillator types can be referred to as the “superior” and “inferior” oscillator. Normally, the superior oscillator should be the active ITH. Whenever the ITH with the inferior oscillator becomes the active ITH, a non-logged, minor alarm is generated by that card. Once the superior ITH is operating normally again, an automatic switch will take place to make the superior card active and return the inferior card to standby.

Switch setting

To support the use of a mixed ITH combination, there is a card switch setting on the ITH main board used to identify the inferior oscillator. When using a pair of equivalent ITH cards, set S4–7 to “On” for both cards.

Table D1-6. Mixed oscillator switch setting

Switch	Bit	Parameter	Off	On
S4	7	Mixed Oscillators	Inferior	Same/Superior

NOTE

If you are operating the SSU with the following combinations of ITH cards: 55411 and 55415 OR 55412 and 55413 leave the mixed oscillator switch in the On position for both cards. The oscillators are of such similar performance that technically the system does not consider them different.

TL1 keywords for mixed ITH cards

When operating with a matched pair of ITH cards, there are TL1 keyword features that apply to both cards because they have equivalent performance values. These features include a setting for the tracking time constant, the pull-in range, and the holdover SSM value.

In the case where ITH cards of different types are used, there are additional keywords that only apply to the inferior oscillator of a mixed oscillator pair. Refer to the *55400A TL1 Programming Reference Manual* for details on how to use these keywords for the inferior ITH card:

- TCONSTSEC—time constant for secondary oscillator
- PIRANGESECQ—pull-in range for secondary oscillator
- HFQLEVLSEC—holdover SSM quality level for secondary oscillator

TL1 event for mixed ITH cards

To support mixed ITH card operation, there is an additional event which by default automatically generates a non-logged, minor alarm. This SECACTV event is generated by the ITH card with the inferior oscillator when that card becomes the active card.

Operating with a Single ITH Card

Although the normally recommended configuration for the SSU includes the use of two ITH cards in a master subrack, operation with only one ITH card is supported. This single ITH card configuration does sacrifice the redundancy provided by a second ITH card and can lead to a situation where a failure of the one ITH card could severely limit the ability of the SSU to provide timing signals to downstream equipment.

Operating differences

No events related to the interaction of a pair of ITH cards will occur, such as the constant comparison of the input signal quality and performance measurements.

Expansion subracks

If a master subrack operates with a single ITH card, any expansion subracks must only use one expansion sync card per subrack located in the same relative slot as the ITH card in the master subrack.

Alarms and events

There is an event to indicate that the communication card switch setting does not match the actual ITH card configuration (one card or two). The event, SGLSWMM (single/double ITH switch mismatch), indicates that either the switch is set for single ITH operation but two ITH cards are part of the master subrack, or the switch is set for dual ITH operation but there is only a single ITH card in the master subrack. The default behavior for this event is that the message is not logged and a major alarm is generated. The table below summarizes the switch setting for the communication cards.

Table D1-7. Single ITH card switch setting for communication card

Communication card	Switch	Bit	Parameter	Off	On
55431A AIC	S6	1	Single ITH	Enabled	Disabled
55441A IMC	S6	1	Single ITH	Enabled	Disabled
55442A NIMC	S8	1	Single ITH	Enabled	Disabled
55443A Exp. Comm	S6	1	Single ITH	Enabled	Disabled

Firmware upgrades

In a typical ITH configuration that includes two ITH cards, parameter settings stored in memory are shared by the two cards. During a firmware download, the active ITH card would copy the settings from its memory to the newly upgraded card. This is not possible when operating with only a single ITH card. In this case, when the firmware is upgraded, the ITH card parameter settings are restored to those specified with the card's switches since the settings in memory are erased during the firmware download process and they cannot be copied from a second ITH card.

Expansion Sync Cards

The 55419A Expansion Synchronization Card performs the function of the ITH card in the expansion subrack.

The cards and their switch settings are described in chapter C3, “Install Expansion Subracks.”

Backdating

ITH Card “A” Models vs. “B”

The model “B” ITH card is considered a second generation ITH card. It has improved performance due to an upgraded microprocessor and expanded memory. The original “A” model ITH card can be used alongside a “B” card.

Single ITH Operation

Single ITH operation is supported by firmware version 3744E and later.

D2

Configure Output Cards

Theory, configuration, backdating

In This Chapter

This chapter describes the Output cards for use in the 55400A series of subracks. The topics include the following:

- Functions/features
- Generic output card description
- Front panel LEDs
- Individual card descriptions and configuration
- Backdating

Output Card Functions/Features

The output cards accept the reference signals from the ITH cards and produce a variety of signals for downstream network elements. Typically, there are sixteen outputs per card, but this can vary depending on the specific card type.

The cards are usually configured as a protected pair, so that if one card should fail, the second card takes over and continues to supply output signals.

An output card can be configured to operate without a backup card where no protection is desired. In this case, instead of having two cards side-by-side in a protected-pair configuration, a single card would be in a slot with no card installed alongside it. There is a switch setting on each card to select the protected or stand-alone mode.

Each output card uses a phase-lock-loop to handle any short interruptions that may occur on the input. This ensures a smooth continuation of output signals during short disruptions of the reference signals to the output cards that may occur, for example, when an ITH card is removed and replaced.

Output cards available at this time include the following functions:

- 2048 kbps
- 2048 kHz
- 64/8 kHz composite clock
- 1, 5, 10 MHz
- 1544 kbps
- E1 re-synchronization

Each card is described in detail in this chapter.

Output Card Description

There are a number of types of output cards for the 55400A system. This section describes the features common to all the output cards.

Theory of Operation

Each output card receives the -48 volts from the backplane. This voltage is converted by an on-board dc-to-dc converter to provide supply voltages for the output line driver circuits and card logic.

The signals to each output card are the same. They consist of the following signals:

- Control bus clock
- Control bus data lines
- EXTSYNC signals from each of the ITH cards
- ITH select line from the write register of each ITH card
- An independent verification from each ITH card that it is functioning properly
- Clock signals delivered from the backplane at 2048 kHz

Each output card performs the following functions:

- Receives the two backplane clock frequencies (one from each ITH Card)
- Makes a determination of which clock is the active one and should therefore be tracked
- Filters out jitter from the backplane clock using a phase-locked loop (PLL)
- Distributes its output to lines on the backplane which provide signals to all outputs leading from the system
- Uses transformers to drive the outputs

Common Circuit Blocks

Although differences exist between each type of output card, the following circuit blocks are present on every card

- Input clock selection.
- Control circuitry
- Phase-locked loop (PLL)
- EXTSYNC PLL
- Switch/LEDs

Clock Input Selection

The input clock is selected by circuitry operating under the guidance of a selection algorithm that determines which of the two ITH cards will be tracked

Communication Control

The output card receives serial communication signals from either ITH card over the control bus, interprets those signals, and updates registers with instruction-specific card settings—for example, to mute an output, clear an alarm, set an alarm, or provide an ACK.

The Card Status lines are used to determine which board of a protected pair is active, that is, driving the load, and which is in standby mode.

PLL

A phase-locked loop on each output card creates an output from the backplane input clock and is responsible for smoothing noise from the backplane.

EXTSYNC PLL

EXTSYNC is present on every output card but is only used by two output card types: the composite clock and 2048 kbps output cards. Its function is explained for each card below.

Switch/LEDs

Each output card type has one dual in-line package (DIP) switch. It is an eight-place ON/OFF-switch assembly that controls instrument state parameters. In addition, there is an identical set of LED indicators on every front panel.

Output Card Front Panel Indicators

All output cards contain a standard set of LEDs to indicate the current operating conditions to an observer. An explanation of the LEDs follows.

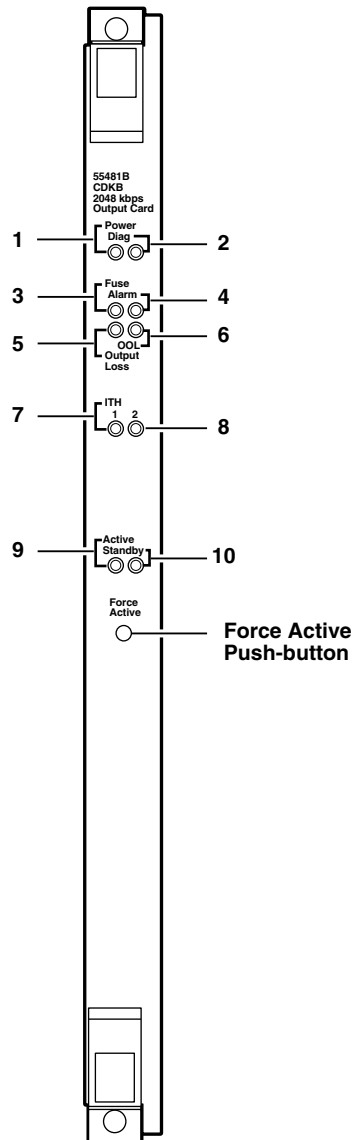


Figure D2-1. 55400A Output Card

Table D2-1. Output card LEDs

No.	LED	Indicates when lighted
1	Power	Power is present.
2	Diagnostics	N/A
3	Fuse	Card fuse is open.
4	Alarm	Card is in the alarm state.
5	Output Loss	An active output has failed.
6	OOL (Out of Lock)	Phase-locked loop on card is unlocked.
7	ITH1	Output card is tracking ITH card 1.
8	ITH2	Output card is tracking ITH card 2.
9	Active	Output card is providing outputs.
10	Standby	Output card is not providing outputs.

2048 kbps Clock Distribution Card

55481B—16 outputs

This section covers the circuitry unique to the 2048 kbps output card. Refer to Figure D2-2 for the block diagram.

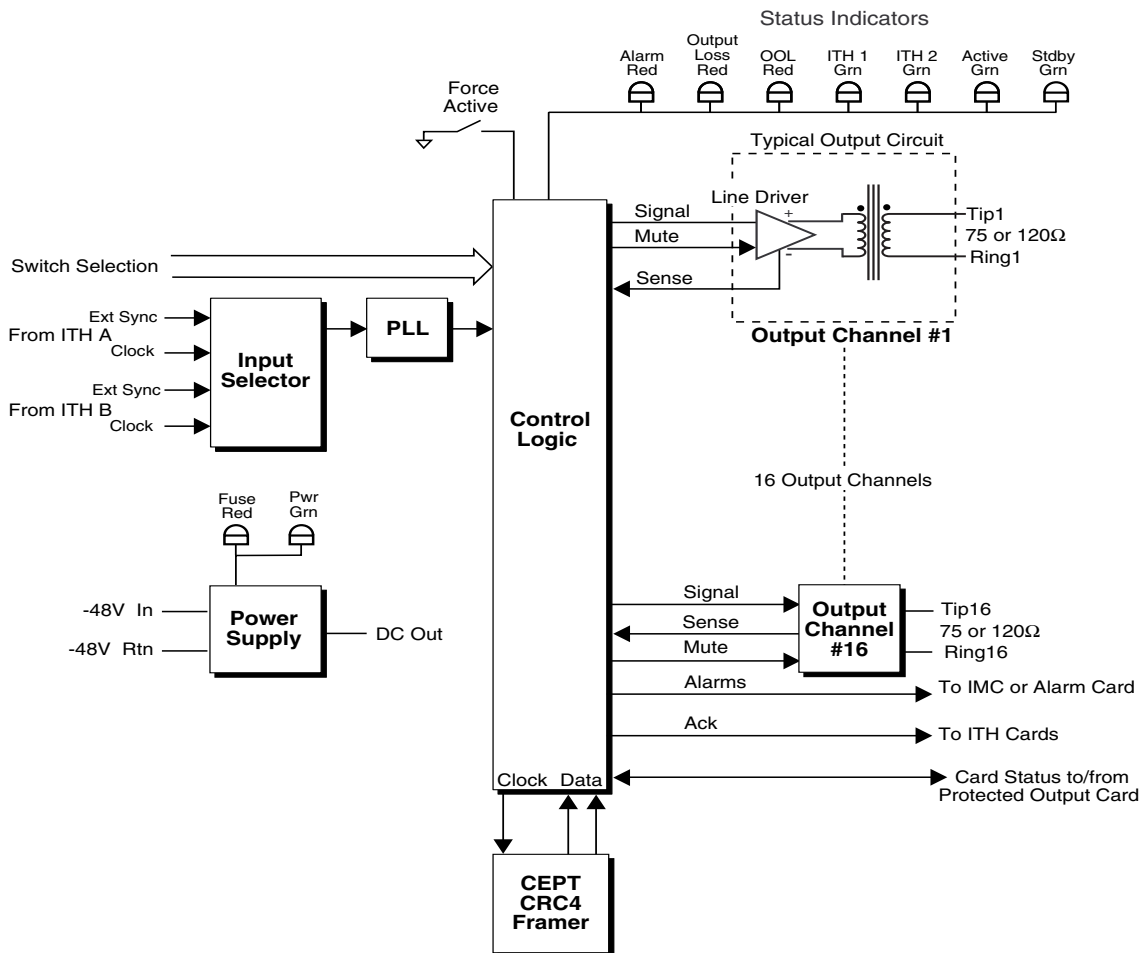


Figure D2-2. 2048 kbps Output Card Block Diagram

The EXTSYNC PLL is synchronized to the EXTSYNC input. In the event of a failure where neither ITH card is generating EXTSYNC, the output card can continue generating its own EXTSYNC.

EXTSYNC PLL output is phase-aligned on a fine and coarse scale by an output pulse, which is used by the framer IC for multi-frame and frame synchronization of outputs provided by a pair of output cards in the subrack.

In addition to a muting signal, the output line driver circuit on the card receives two drive signals from the control circuitry. In response to these inputs, the circuit generates an output signal at 2048 kbps. Two sense signals are returned from this circuit to the control circuitry to provide verification of correct circuit function. The output line driver circuit provides the power and clamping necessary to generate the correct output level and meet the pulse mask, whether the card is operated by itself or as part of a protected pair. It also protects against single circuit faults in the 1:1 protection mode.

Configuring 2048 kbps card

This output card assembly is equipped with one dual inline switch package to set the instrument-state parameters.

A programmable data pattern can be transmitted by this card during the traffic time slots. For more information, refer to the description of the *TRAFFIC* keyword in the *55400A TL1 Programming Reference Manual*.

Switch settings

Set the switches according to your system requirements.

Table D2-2. 55481B Output card switch settings

Switch	Bit	Parameter	Off	On
S1	1	Output Protection Mode	Stand-alone	Protected
	2	CCS/CAS Output	CCS	CAS
	3	Transmit CRC4	Disabled	Enabled
	4–8	Undefined	—	—

Switch location

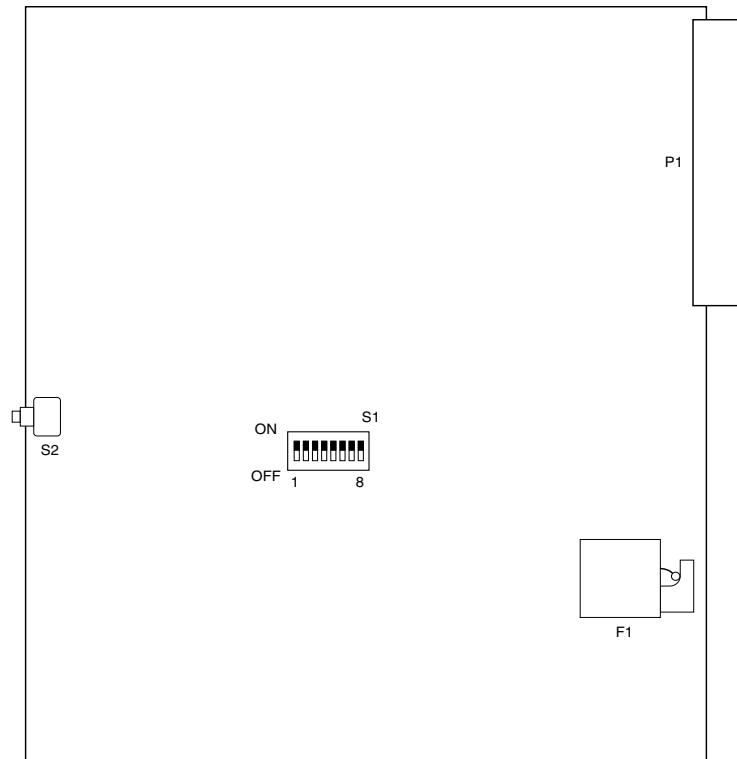


Figure D2-3. 2048 kbps Output Card Switch

2048 kHz Clock Distribution Card

55482A—16 outputs

This section covers the circuitry unique to the 2048 kHz output card. Refer to Figure D2-4 for the block diagram.

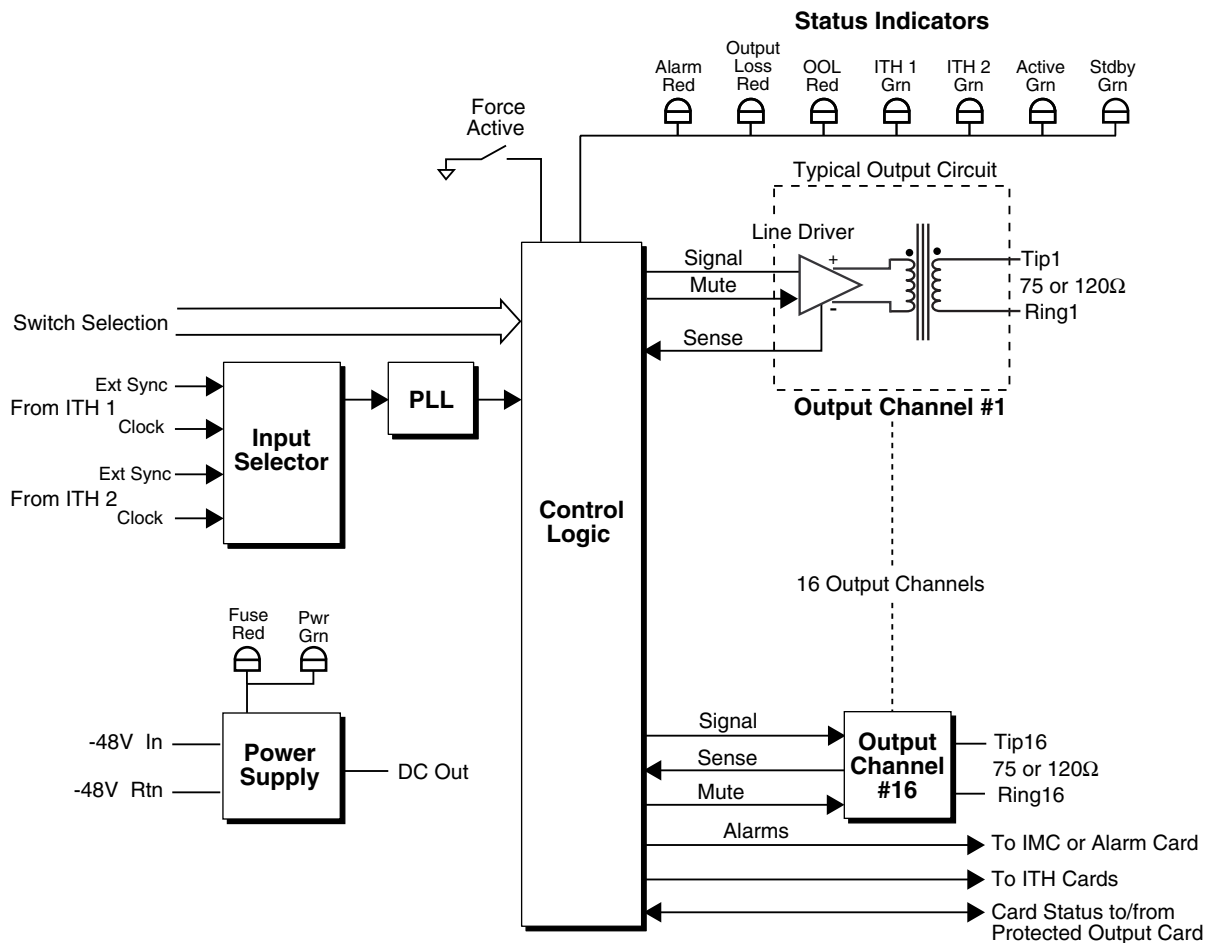


Figure D2-4. 2048 kHz Output Card Block Diagram

The EXTSYNC PLL is synchronized to the EXTSYNC input. In the event of a failure where neither ITH card is generating EXTSYNC, the output card can continue generating its own EXTSYNC.

In addition to a muting signal, the output line driver circuit receives two drive signals from the control circuitry. In response to these inputs, the circuit generates an output signal at 2048 kHz. Two sense signals are returned from this circuit to the control circuitry to provide verification of correct circuit function. The output line driver circuit provides the power and clamping necessary to generate the correct output level and meet the pulse mask, whether the card is operated by itself or as part of a protected pair. It also protects against single circuit faults in the 1:1 protection mode.

Configuring 2048 kHz card

This output card assembly is equipped with one dual inline switch package to set the instrument-state parameters.

Switch settings

Set the switches according to your system requirements.

Table D2-3. 55482A Output card switch settings

Switch	Bit	Parameter	Off	On
S1	1	Output Protection Mode	Stand-alone	Protected
	2–8	Undefined	—	—

Switch location

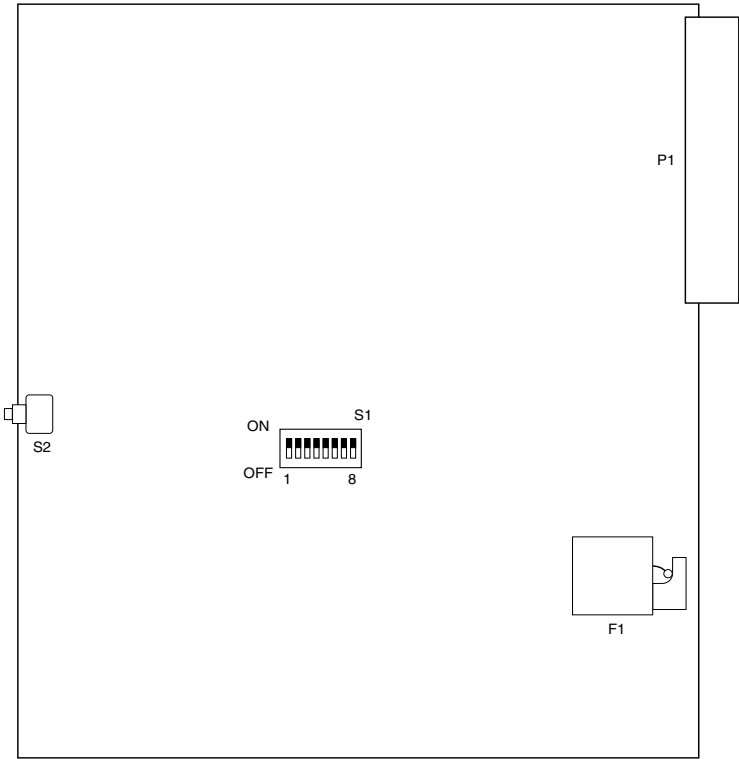


Figure D2-5. 2048 kHz Output Card Switch

64/8 kHz Composite Clock Distribution Card

55483A—16 outputs

This section covers the circuitry unique to the 64/8 kHz output card. Refer to Figure D2-6 for the block diagram.

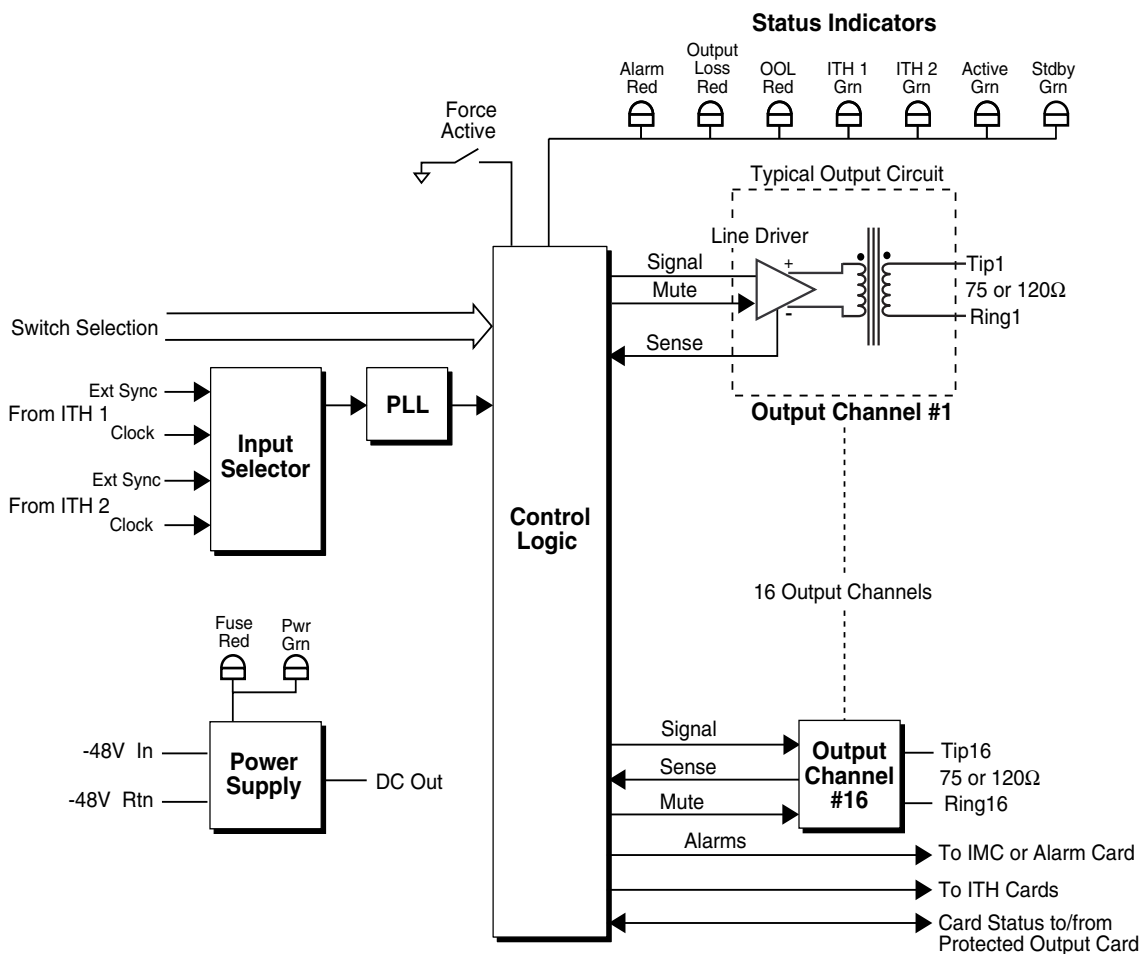


Figure D2-6. 64/8 kHz Composite Clock Card Block Diagram

The EXTSYNC PLL is synchronized to the EXTSYNC input. In the event of a failure where neither ITH card is generating EXTSYNC, the output card can continue generating its own EXTSYNC.

In addition to a muting signal, the output line driver circuit on the composite clock card receives two drive signals from the control circuitry. In response to these inputs, the circuit generates the composite clock outputs. Two sense signals are returned from this circuit to the control circuitry to provide verification of correct circuit function. The output line driver circuit provides the required power to drive a 133 Ω load within the pulse mask limits.

EXTSYNC PLL output is phase-aligned on a fine and coarse scale. The two output signals are pulses that alternate between the two signals. The rate of the double pulses corresponds to the bipolar violations of the composite clock output to be generated. The use of the EXTSYNC PLL circuit to generate these drive signals guarantees that composite clocks produced by a pair of cards within the same subrack are in phase alignment.

Patch Panel for Balanced Outputs

The 55483A Clock Card together with a patch panel provides 16 balanced outputs at 64/8 kHz with an electrical waveform that meets the requirements of the interface at 64 kbit/s as specified in ITU-T Recommendation G.703.1.

The patch panel is required because the 55401D subrack has grounded outputs that cannot provide balanced output signals. Center-tapped transformers in the patch panel convert the single-ended 75 Ω signals from the 55400A to balanced 120 Ω outputs. The Option 002 patch panel provides Siemens 1.5/5.6 input and RJ-45 output connectors. The Option 003 patch panel supplies BNC input and RJ-45 output connectors.

This section provides circuit and parts information for the patch panel. The information includes a circuit diagram and pin designations for the connectors.

Parts Included with Patch Panel

- Rack Mount Flanges—ETSI and EIA
- Screws for rack mount flanges

The figures below show a circuit diagram of the patch panel and the pinout for the RJ-45 connectors.

Part of Patch Panel

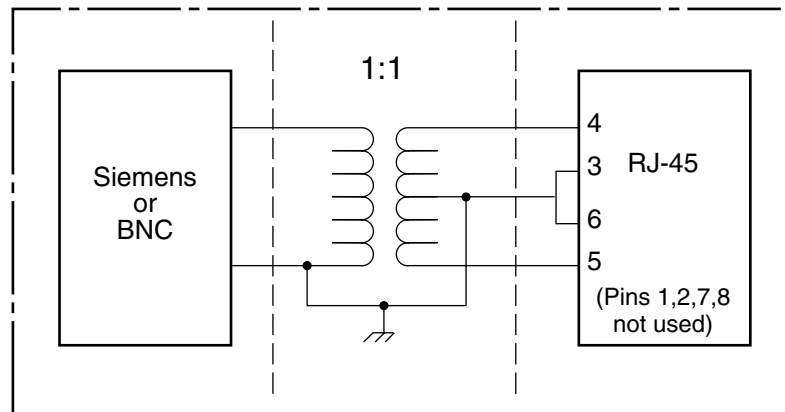


Figure D2-7. Patch Panel Circuit Diagram

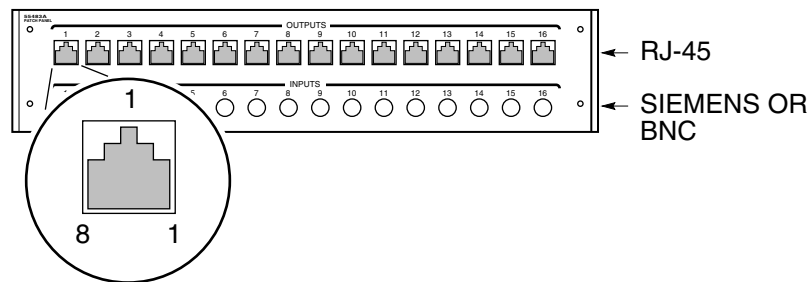


Figure D2-8. Patch Panel Front View

NOTE

The patch panel must be used with the 55483A in order to meet the requirements of ITU-T G.703.1 for balanced outputs.

Configuring 64/8 kHz card

This output card assembly is equipped with one dual inline switch package to set the instrument-state parameters.

Switch settings

Set the switches according to your system requirements.

Table D2-4. 55483A Output card switch settings

Switch	Bit	Parameter	Off	On
S1	1	Output Protection Mode	Stand-alone	Protected
	2–8	Undefined	—	—

Switch location

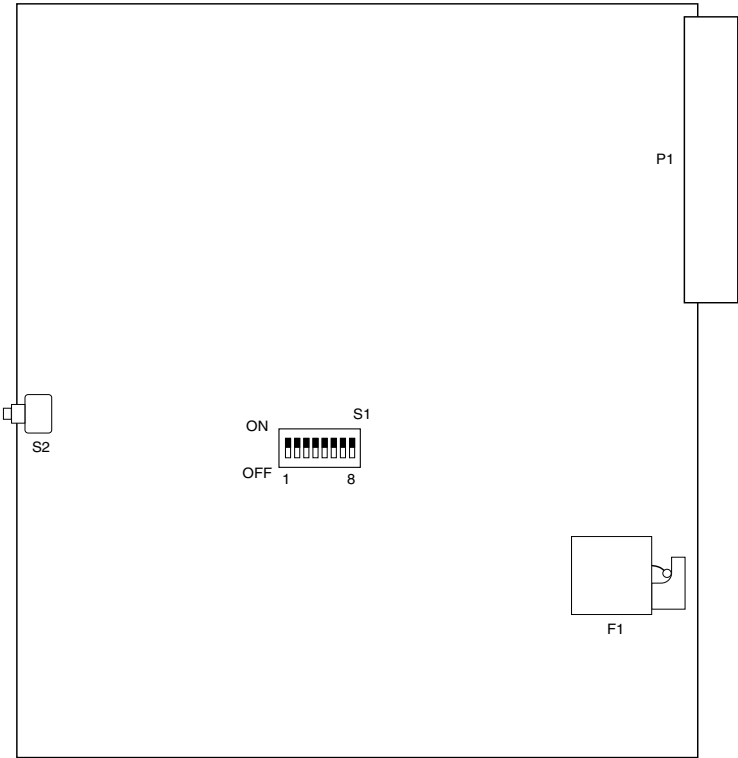


Figure D2-9. Composite Clock Output Card Switch

1/5/10 MHz Clock Distribution Card

55484A—8 outputs

This section covers the circuitry unique to the 1/5/10 MHz output card. Refer to Figure D2-10 for the block diagram.

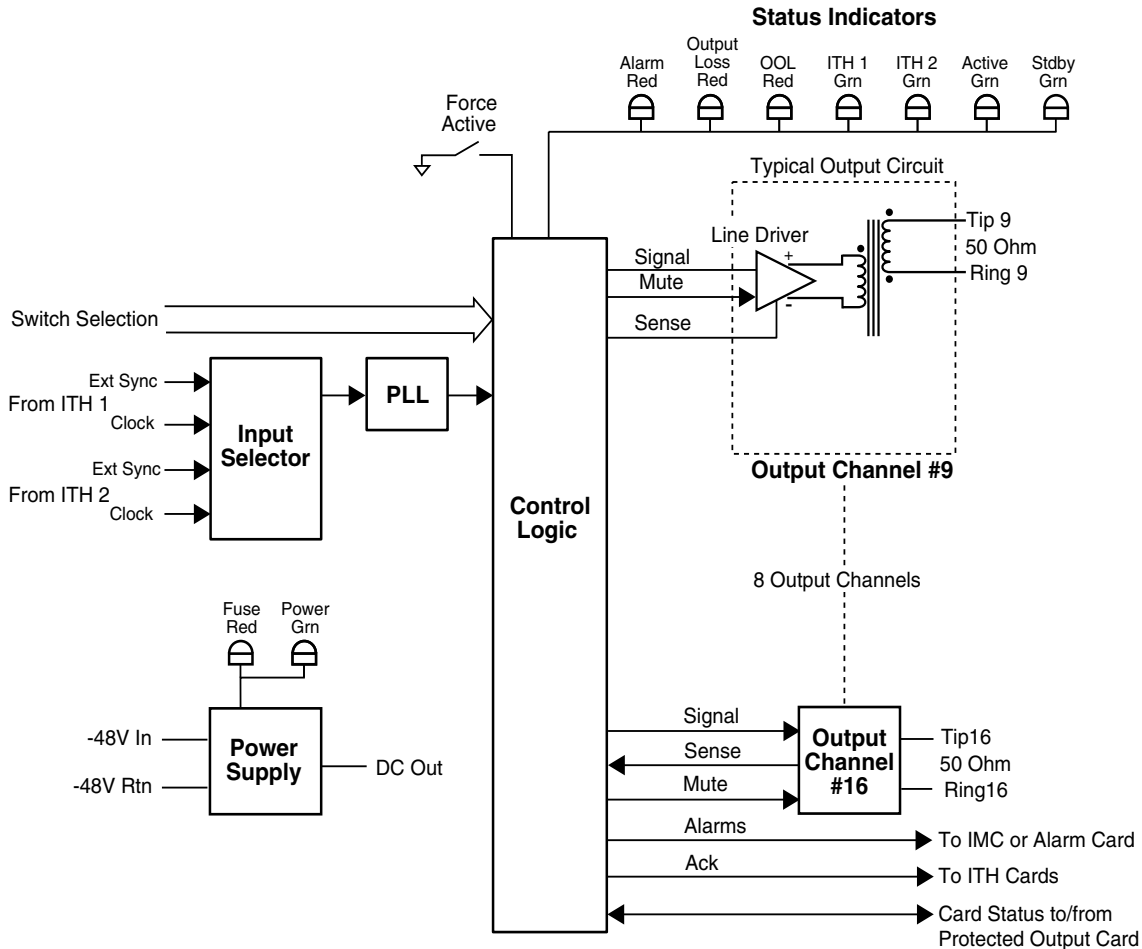


Figure D2-10. 1/5/10 MHz Output Card Block Diagram

This card is capable of producing one of three output frequencies for each output port. The different frequencies (1 MHz, 5 MHz, or 10 MHz) are selected using dual in-line switch assemblies. In addition, there is a switch to select the output protection mode.

The output card provides up to eight output signals on outputs 9 through 16. Each output can be configured to one of these four states:

- 1 MHz
- 5 MHz
- 10 MHz
- Off

NOTE

As with all output cards, those used as a protected pair must have identical switch settings or an output card mismatch event will occur.

The PLL on the card is synchronized to the clock input. The EXTSYNC input aligns the phase of the output clock across a pair of output boards. A pair of switches is used to set the frequency of individual outputs.

In addition to a muting signal, the output line driver circuit receives two drive signals from the control circuitry. In response to these inputs, the circuit generates an output signal at the selected frequency. Two sense signals are returned from this circuit to the control circuitry to provide verification of correct circuit function. The output line driver circuit provides the power and clamping necessary to generate the correct output level, whether the card is operated by itself or as part of a protected pair. It also protects against single circuit faults in the 1:1 protection mode.

Configuring 1/5/10 MHz card

This output card assembly is equipped with five dual inline switch packages to set the instrument-state parameters.

Switch settings

Set the switches according to your system requirements.

Table D2-5. 55484A Output card protection setting

Switch	Bit	Parameter	Off	On
S1	1	Output Protection Mode	Stand-alone	Protected
	2–4	Undefined	—	—

Table D2-6. 55484A Output card frequency setting

Output Port	Output Frequency	Switch Setting	Switch Setting
9	1 MHz	S5-1/On	S5-2/On
	5 MHz	S5-1/Off	S5-2/On
	10 MHz	S5-1/On	S5-2/Off
	No output	S5-1/Off	S5-2/Off
10	1 MHz	S5-3/On	S5-4/On
	5 MHz	S5-3/Off	S5-4/On
	10 MHz	S5-3/On	S5-4/Off
	No output	S5-3/Off	S5-4/Off
11	1 MHz	S5-5/On	S5-6/On
	5 MHz	S5-5/Off	S5-6/On
	10 MHz	S5-5/On	S5-6/Off
	No output	S5-5/Off	S5-6/Off
12	1 MHz	S5-7/On	S5-8/On
	5 MHz	S5-7/Off	S5-8/On
	10 MHz	S5-7/On	S5-8/Off
	No output	S5-7/Off	S5-8/Off
13	1 MHz	S6-1/On	S6-2/On
	5 MHz	S6-1/Off	S6-2/On
	10 MHz	S6-1/On	S6-2/Off
	No output	S6-1/Off	S6-2/Off
14	1 MHz	S6-3/On	S6-4/On
	5 MHz	S6-3/Off	S6-4/On
	10 MHz	S6-3/On	S6-4/Off
	No output	S6-3/Off	S6-4/Off
15	1 MHz	S6-5/On	S6-6/On
	5 MHz	S6-5/Off	S6-6/On
	10 MHz	S6-5/On	S6-6/Off
	No output	S6-5/Off	S6-6/Off
16	1 MHz	S6-7/On	S6-8/On
	5 MHz	S6-7/Off	S6-8/On
	10 MHz	S6-7/On	S6-8/Off
	No output	S6-7/Off	S6-8/Off

Switch locations

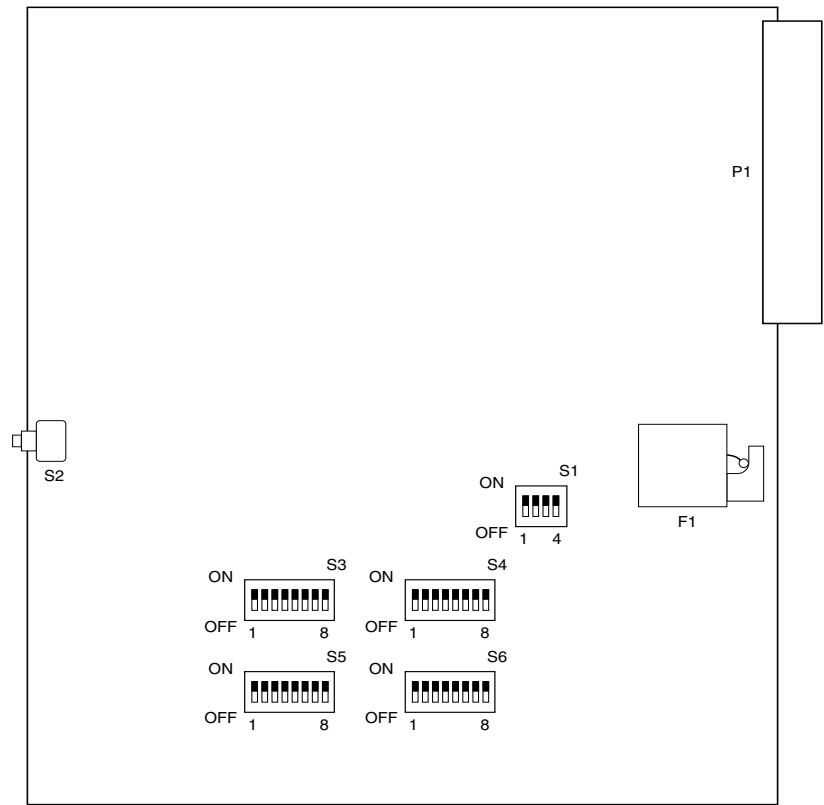


Figure D2-11. 1/5/10 MHz Clock Distribution Output Card Switches

1544 kbps Clock Distribution Card

55485B—16 outputs

This section covers the circuitry unique to the 2048 kbps output card. Refer to Figure D2-12 for the block diagram.

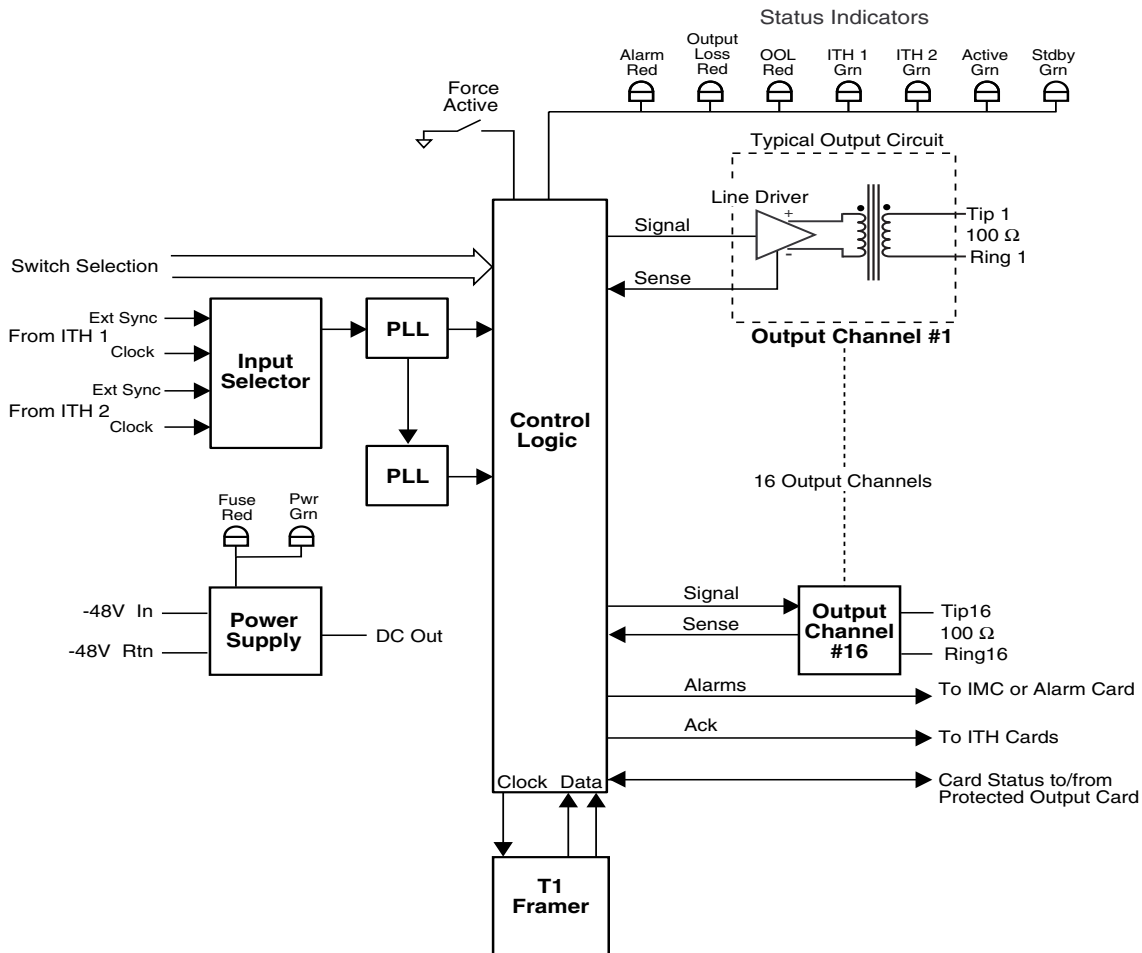


Figure D2-12. 1544 kbps Clock Distribution Card Block Diagram

The EXTSYNC PLL is synchronized to the EXTSYNC input. In the event of a failure where neither ITH card is generating EXTSYNC, the output card can continue generating its own EXTSYNC.

The EXTSYNC PLL output is phase-aligned on a fine and coarse scale by an output pulse, which is used by the framer IC for multi-frame and frame synchronization of 1544 kbps output cards in the subrack.

In addition to a muting signal, the output line driver circuit on the card receives two drive signals from the control circuitry. In response to these inputs, the circuit generates an output signal at 1544 kbps. Two sense signals are returned from this circuit to the control circuitry to provide verification of correct circuit function. The output line driver circuit provides the power and clamping necessary to generate the correct output level and meet the pulse mask, whether the card is operated by itself or as part of a protected pair. It also protects against single circuit faults in the 1:1 protection mode.

Configuring 1544 kbps card

This output card assembly is equipped with one dual inline switch package to set the instrument-state parameters.

Switch settings

Set the switches according to your system requirements. Switch S3 selects the data pattern transmitted during the 1544 kbps traffic time slots. The default setting is with all bits set to 1 (On). This causes a data value of 0xFF to be transmitted.

Table D2-7. 55485B Output card switch settings

Switch	Bit	Parameter	Off	On
S2	1	Output Protection Mode	Stand-alone	Protected
	2	D4/ESF Format Mode	D4	ESF
	3	Undefined	—	—
	4	Undefined	—	—
S3	1	First bit (MSB)	0	1
	2		0	1
	3		0	1
	4		0	1
	5		0	1
	6		0	1
	7		0	1
	8	Last bit (LSB)	0	1

Switch locations

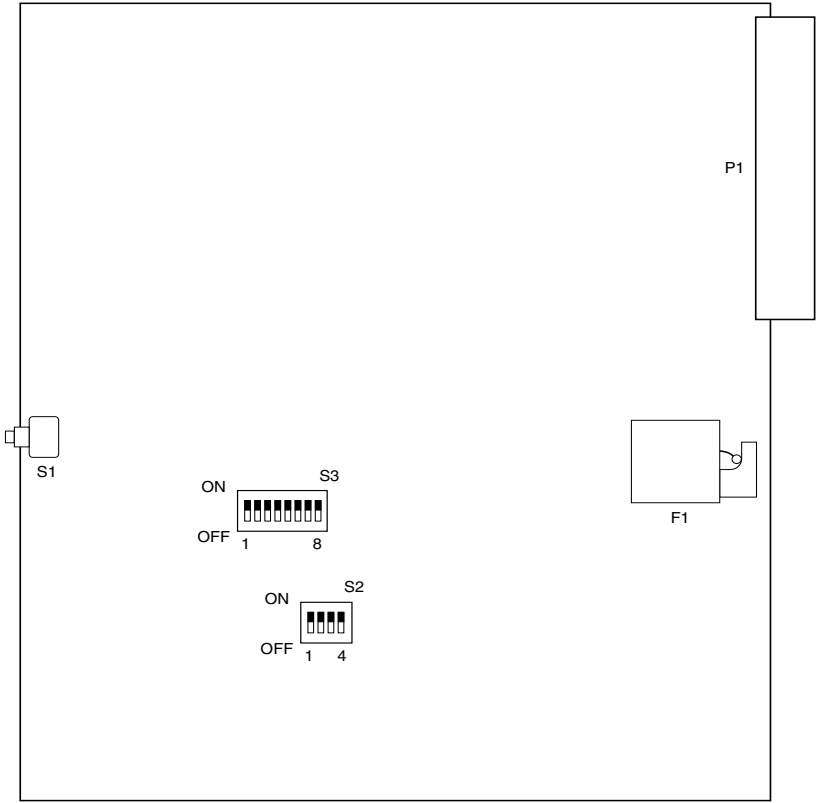


Figure D2-13. 1544 kbps Output Card Switch Locations

2048 kHz/2048 kbps Clock Distribution Card

55488A—16 outputs

This card supplies both 2048 kHz and 2048 kbps output signals. Subrack outputs 1 through 8 provide 2048 kHz and outputs 9 through 16 provide 2048 kbps.

Since this card combines the functions of the 55482A and 55481B output cards, please refer to the documentation for those cards for a description of the circuitry.

Configuring 2048 kHz/2048 kbps card

This output card assembly is equipped with one dual inline switch package to set the instrument-state parameters.

A programmable data pattern can be transmitted on the 2048 kbps outputs during the traffic time slots, as is the case for the 55481B. For more information, refer to the description of the *TRAFFIC* keyword in the *55400A TL1 Programming Reference Manual*.

Switch settings

Set the switches according to your system requirements.

Table D2-8. 55488A Output card switch settings

Switch	Bit	Parameter	Off	On
S1	1	Output Protection Mode	Stand-alone	Protected
	2	CCS/CAS Output	CCS	CAS
	3	Transmit CRC4	Disabled	Enabled
	4–8	Undefined	—	—

NOTE

Set S1–2 and S1–3 as desired for the 2048 kbps outputs (ports 9 through 16). These settings have no effect on the 2048 kHz outputs.

Switch location

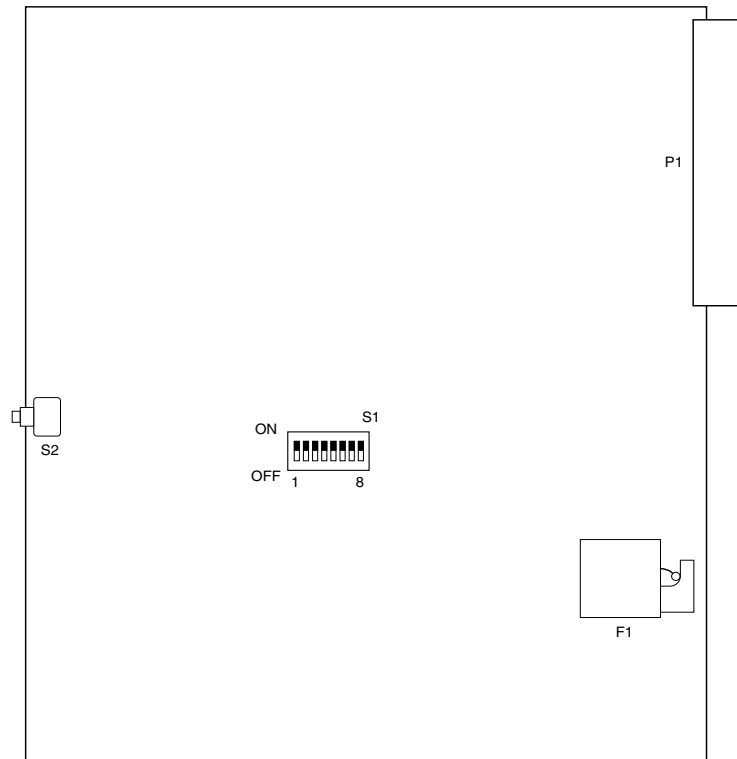


Figure D2-14. 2048 kHz/2048 kbps Output Card Switch

Traffic Re-synchronization Card

55471A—8 inputs/8 outputs

SUMMARY The 55471A Traffic Re-synchronization Card (TRSC) provides eight channels for E1 signals. Four of these channels will re-time the input signals and four will only buffer the input signals. (Firmware revision 3744E, or later, is required in the IMC or NIMC, and the ITH cards to support TRSC operation.)

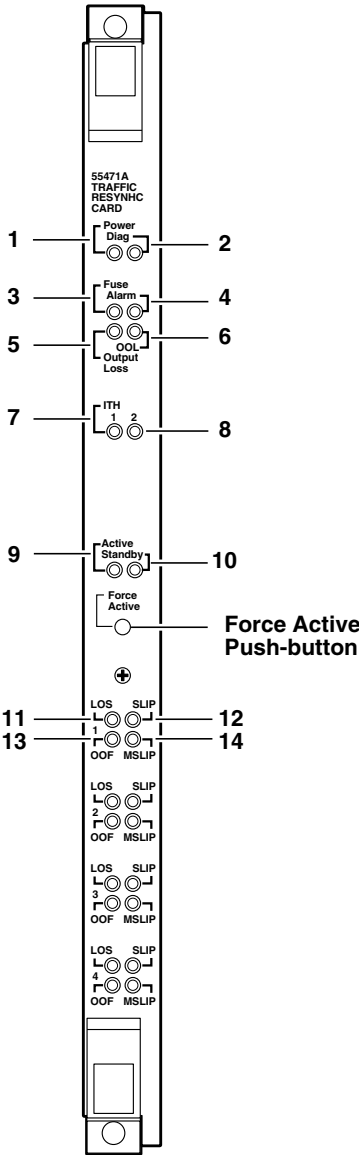


Figure D2-15. 55471A Traffic Re-sync Card

TRSC Front Panel LEDs

Besides the standard LEDs, there are additional LEDs on this card to indicate conditions related to the input and processing of the signals by this card. The descriptions here are referenced to the drawing on the previous page.

- 1 Power: –48 Volts is present.
- 2 Diag: Board diagnostics are being performed or a diagnostics failure has occurred.
- 3 Fuse: The –48 Volt fuse is open.
- 4 Alarm: Card is in alarm condition (refer to the Alarm section below for details)
- 5 Output Loss: Each of the eight outputs is constantly monitored for valid output. If an output does not match the expected value, then all outputs are squelched. The board will switch to Standby. The Alarm LED will also light. This event indicates a hardware failure.
- 6 OOL: On-card phase-lock loop is unlocked. The Alarm LED will also light.
- 7 ITH1: TRSC is tracking ITH card 1
- 8 ITH2: TRSC is tracking ITH card 2
- 9 Active: Outputs of card are active.
- 10 Standby: Outputs of card are squelched.
Force Active push button: Forces card to become the active card in a 2-card protected pair. The redundant card is forced into Standby mode.
- 11 LOS 1–4: Indicates loss of signal for the identified channel transmitting re-timed traffic. The output will squelch or transmit AIS, depending on the switch setting. Alarm LED will also light.
- 12 SLIP 1–4: Indicates a frame slip detection for the identified channel transmitting re-timed traffic. A slip indication occurs when there is an underflow or overflow of the on-card two-frame storage buffer. The underflow condition (buffer is empty) results in transmission of a repeated frame of data. The overflow condition causes the loss of one frame of data.
- 13 OOF 1–4: Indicates out of frame detection for the identified channel transmitting re-timed traffic or a mismatch between the switch settings for the channel and the input signal type.
- 14 MSLIP 1–4: Indicates multiple slips detected for the identified channel transmitting re-timed traffic at a rate equal to, or greater than, the frequency offset specified with the HSLIMIT keyword.

Alarm Conditions

These are the conditions that cause the Alarm LED to light:

- Signal loss (LOS) on input of any enabled channel.
- Signal loss on output of any enabled channel.
- Card out of lock (OOL).
- A card used in stand-alone mode has its switch set to protected (a pair of cards expected).
- Card has a power supply value out of range.
- Both reference clocks to the card have failed.
- One of the four re-timed inputs has detected a framing error.
- A multiple slip condition has occurred on one of the four re-timed inputs.
- A hardware failure has occurred.

Theory of Operation

Refer to the block diagram while reading this description. A TRSC has eight channels, four of which are re-timed and four which are only buffered. The input section of all eight channels is similar and is fed from the input connectors on the subrack to the backplane connector of the TRSC.

NOTE

All TRSC inputs must use an external 75 Ω feed-thru termination because of internal backplane requirements.

The input signal to the TRSC is a 2048 kbps E1 signal which uses a bipolar format with a peak-to-peak amplitude of approximately 4.8 V. The bipolar 2048 kHz signals are input to a receiver chip through a 1:2 step-up transformer. The receiver can compensate for line losses and uses peak detection and a variable threshold to improve the signal-to-noise ratio. The recovery process splits the data and clock information on the input signal and processes them separately. The receiver then increases the signals to a TTL level and synchronizes the data and clock signals. The output from the receiver is three separate signals that correspond to positive and negative pulses occurring on the incoming Tip and Ring inputs, and the recovered clock.

The eight E1 output signals from the TRSC have the same multiframe structures as their respective inputs, either CCS (PCM31) or CAS (PCM30), with or without CRC-4 multiframe. The TRSC also supports the use of the spare CRC-4 bits for the Synchronization Status Message (SSM). The SSM bits can be set by the TRSC, or the card can just pass through the value from the incoming data.

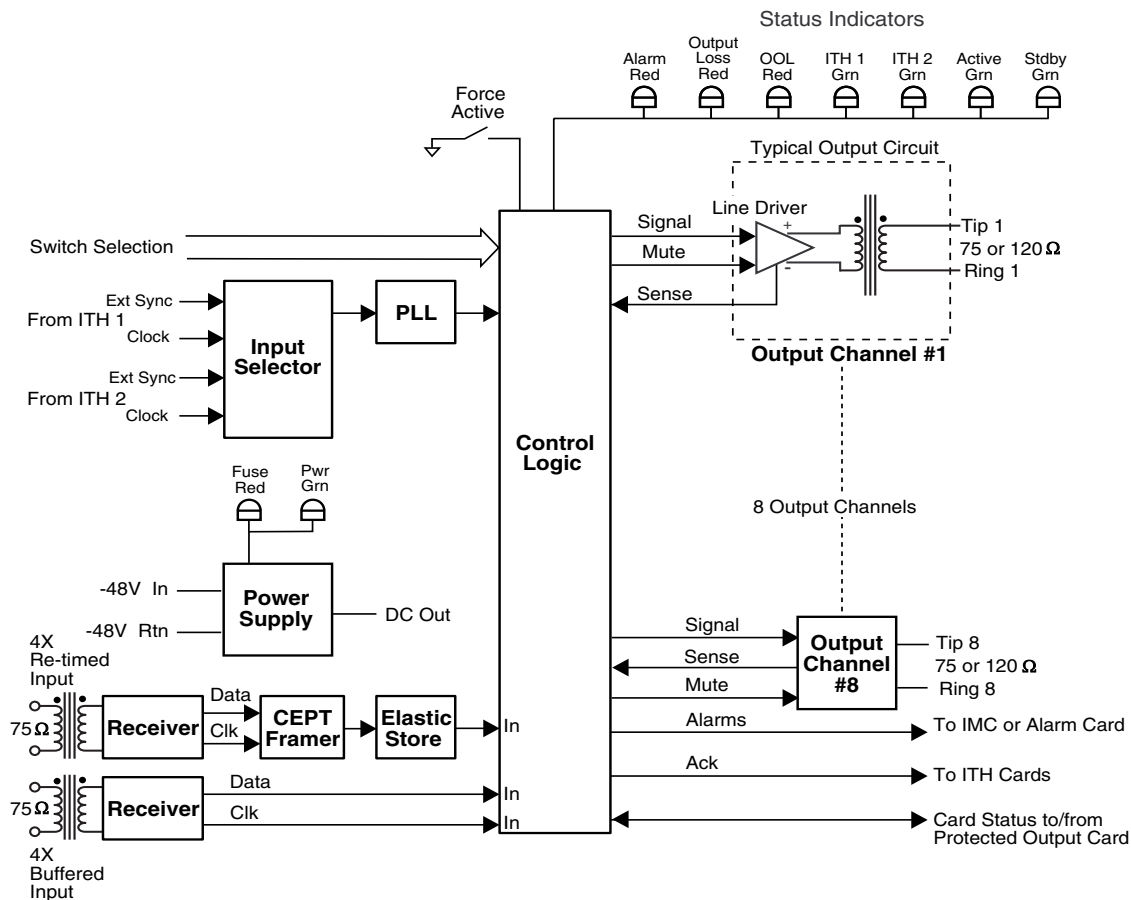


Figure D2-16. Traffic Re-synchronization Card Block Diagram

The four re-timed channels of the TRSC provide precision timing for network equipment that cannot receive external clock timing. These channels accept E1 (2048 kHz) traffic-bearing signals, remove jitter and wander from the signals, and then supply these re-synchronized signals for use by downstream network equipment. When any network element (NE) derives its timing from these signals, the NE is synchronized to the network.

In addition, the TRSC accepts up to four other signals that it can buffer, performing a repeater function. These input signals are recovered with the resulting output signals being restored to the correct nominal amplitude levels. These four buffered channels do not re-time the input signals nor do they filter any wander and jitter. All eight channels can function independently, for the most part. The exceptions are noted in the section on operation behaviors.

Re-timed Channels (1, 2, 3, 4)

The re-timed channels use the LOS detector from the receiver to give both a front panel LED indication and to force the output to AIS or squelch. The recovered signals from the receiver are fed to the receive side of their corresponding framer device. Here the differential signal is converted into a single-ended signal and, depending on the input type selected, frame sync is established and the multi-frame sync signal is generated.

Next the single-ended signal and the recovered clock are input to the elastic storage buffer where the re-timing function takes place. The buffer depth varies to compensate for jitter and wander between the input clock and the reference clock. The nominal delay, or depth, is one frame, the maximum is two frames and the minimum is zero frames.

Whenever the buffer depth reaches either two frames or zero frames, a slip has occurred and the TRSC will assert the SLIP output event. The elastic storage buffer then automatically re-centers the data pointer in the buffer. If the depth was two frames when the align signal was asserted, then a frame is deleted. If the depth is zero frames, a frame is repeated.

The slip-compensated multiframe alignment signal is fed to the framer to establish the transmit side multiframe timing. The framer formats the data as required and the data is output as differential signals and processed for the output stage. This same circuitry allows modification or pass-through of the SSM bits in the CRC-4 multiframe payload.

Buffered Channels (5, 6, 7, 8)

The four buffered channels are not re-timed and so the data in equals the data out, including any jitter or wander in the timing. The input signals are recovered, though, so if the input is attenuated, the output will be restored to the proper nominal amplitude levels. This action makes the TRSC useful as a repeater for these four channels.

If the Loss of Signal detector is asserted for any of the channels, then that particular output will go to AIS (unframed all ones) or squelch, depending on the switch settings described later in this section. The LOS LED on the TRSC front panel only indicates this condition for the four re-timed channels, so although there is no visual LOS indicator for the buffered channels, there is a TL1 event that is reported when a buffered channel experiences an LOS condition.

The recovered clocks and data signals are used by the TRSC to produce a signal compatible with the output stage to reproduce the original bipolar format. The output stages are transformer-coupled and direct the signals to the appropriate connector on the subrack.

TRSC Port Assignments

Output cards, normally used in protected pairs, occupy the plug-in module area in the subrack designated with letters A to E. These same letters are used on the subrack connector panel to designate the rows of outputs from the corresponding output cards. For example, the outputs cards located in the “A” slots supply signals to the row of connectors labeled with “A.”

Normally, each row of the subrack’s connectors are outputs only. However, in the case of the TRSC, the row of connectors corresponding to the location of the TRSC are made up of both inputs and outputs, as specified in the table below.

Table D2-9. Traffic Re-synchronization Card Port Assignments

Retimed Channels	Subrack Input Port	Subrack Output Port	Buffered Channels	Subrack Input Port	Subrack Output Port
Channel 1	1	2	Channel 5	3	4
Channel 2	5	6	Channel 6	7	8
Channel 3	9	10	Channel 7	11	12
Channel 4	13	14	Channel 8	15	16

75 Ω Termination

All TRSC inputs must be externally terminated with a 75 Ω termination:

Connect a feed-thru 75 Ω termination between the input signal cable and the TRSC input port.

These are available from Symmetricom. Refer to chapter F3, “Replacement Parts.”

NOTE

If using the TRSC in the mini-SSU subrack, the output modules have on-board 75 Ω terminations that can be selected with jumpers to eliminate the need for external terminators on the TRSC inputs. See chapter C6.

Operation Behaviors

This section describes details of the TRSC operation that can be useful for helping to understand how the card works. IT IS RECOMMENDED THAT YOU READ THIS SECTION BEFORE USING THE TRSC.

Configuration

- Firmware revision 3744E, or later, is required in the IMC or NIMC, and in the ITH cards to support TRSC operation.
- The input signal types (CAS/CCS/CRC-4) and the LOS Action can only be configured using the card's switches.
- SSM operation is only supported with a CRC-4 multiframe structure. When SSM modification is enabled (using TL1 keyword, TRSCSSM=INSERT), CRC-4 must be enabled on the TRSC via a switch setting to force recalculation of the CRC-4 bits.

Inputs

- Each input must be externally terminated with a 75 Ω termination to properly match the input impedance of the subracks.
- The HDB3 signal format is supported for the TRSC but not the AMI format.

Outputs

- Bit Transparency—The TRSC attempts to maintain maximum data transparency. The exceptions are:
 - 1. Bits 2-8 of an alignment frame are always overwritten with the frame alignment signal (0011011).
 - 2. Bits 2 and 3 (remote alarm indication bit) of a non-alignment frame are always output as “1” and “0”, respectively.
- A CRC-4 error on the output signal will be generated if the Remote Alarm bit is set on a CRC-4 input signal. This is because the Remote Alarm bit is always cleared by the TRSC, but the CRC-4 is not always regenerated. To prevent this problem, use the TRSCSSM=INSERT keyword to force the CRC-4 to be regenerated.

- The re-timed outputs may have a single bipolar error when the standby TRSC is switched to the active mode.
- Common Associated Signaling (CAS) employs a bit-oriented signaling technique utilizing time slot 16. The CAS multiframe alignment signal is contained in time slot 16 of frame 0. The first four bit locations contain the bit sequence: 0000. The remaining four bits are used as spare and alarm bits. In the other 15 frames, time slot 16 is reserved for channel signaling data. It is NOT recommended to use the bit sequence “0000” for the ABCD signaling bits because this will emulate the multiframe alignment word and cause loss of synchronization in downstream equipment.

Alarms and Events

- The Alarm LED will remain lighted until signals are connected to all input channels (re-timed and buffer) that are enabled. The default condition for the TRSC is to have all channels enabled. Disable unused channels using the TL1 command, SQUELCH. This is described in this document under, To Enable or Disable TRSC Channels.
- Buffered Channels (channels 5-8) are monitored only for loss of signal. The TRCBLOS (Traffic Re-sync Card Buffer Loss of Signal) event will be generated when a loss of signal occurs on one of the buffered (not re-timed) channels.
- Loss of signal, out of frame, slip, and multiple slip conditions will create alarm conditions on the TRSC and generate TL1 events, but these conditions will not generate alarms on the IMC/NIMC cards.
- The OOF (Out Of Frame) LED will stay continuously lit if the input signal type does not match the card's switch setting for that input channel.
- HSLIMIT settings above 10,000 ppb combined with high slip rates (one or more slips every 12 seconds) will periodically cause the MSLIP LED to incorrectly extinguish and an “Ended TRSC Input High Slip” event to incorrectly occur. This happens because of the relatively slow rate at which the TRSC slip alarm is polled.

Card Configuration

Configuring a TRSC is a bit more difficult than with other cards because this card has inputs as well as outputs. Switches are used to set the following parameters:

- Signaling mode
- CRC-4 Yes or No

- Output protection mode
- LOS action

The rest of this section describes the switch settings, where the switches can be found on the card, and the command to enable or disable channels on the card.

Switch Settings

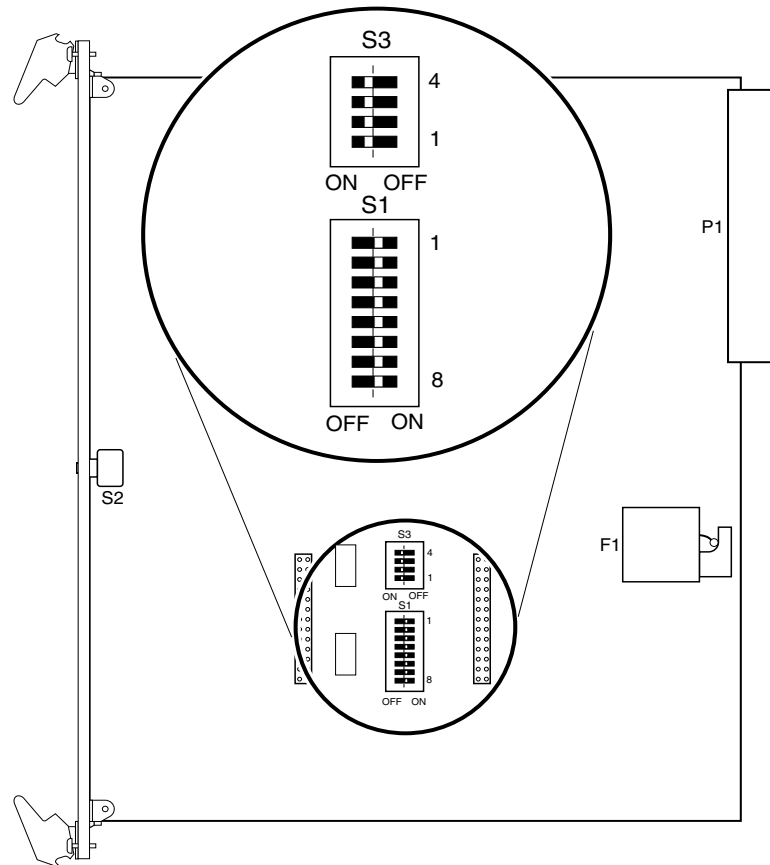
The table below shows the parameters set via the TRSC switches. Refer to Figure D2-17 for the location of the switches on the 55471A card. Switch 1 is used to set the output format for the four re-timed channels. Switch 3 sets the protection mode and the action the card will take when a loss of signal condition is detected.

Table D2-10. TRSC switch settings

Switch	Bit	Parameter	Off	On
S1	1	Channel 1 Signaling Mode	CCS	CAS
	2	Channel 1 CRC-4 Mode	Non-CRC-4	CRC-4
	3	Channel 2 Signaling Mode	CCS	CAS
	4	Channel 2 CRC-4 Mode	Non-CRC-4	CRC-4
	5	Channel 3 Signaling Mode	CCS	CAS
	6	Channel 3 CRC-4 Mode	Non-CRC-4	CRC-4
	7	Channel 4 Signaling Mode	CCS	CAS
	8	Channel 4 CRC-4 Mode	Non-CRC-4	CRC-4
S3	1	Output Protection Mode	Stand-alone	Protected
	2	LOS Action	AIS	Squelch
	3	Reserved	—	—
	4	Reserved	—	—

NOTE

Switches S1 and S3 are not oriented in the same direction. Carefully observe the On and Off positions.

TRSC Switch Locations**Figure D2-17. Traffic Re-synchronization Card Assembly Switches*****NOTE***

Switches S1 and S3 are positioned differently. Verify proper orientation for the On and Off settings when making switch selections.

To Enable or Disable TRSC Channels

The TRSC provides eight channels. Four channels will re-time input signals and four will only buffer the input signals. Use the following TL1 command information to specify the channels that should or should not be used. The default condition is all channels enabled.

Table D2-11. Traffic Re-synchronization Card Port Assignments

Retimed Channels	Subrack Input Port	Subrack Output Port	Buffered Channels	Subrack Input Port	Subrack Output Port
Channel 1	1	2	Channel 5	3	4
Channel 2	5	6	Channel 6	7	8
Channel 3	9	10	Channel 7	11	12
Channel 4	13	14	Channel 8	15	16

NOTE

For the TRSC, the SQUELCH command acts on the channel number, not the output port number as with other output cards. For example, to squelch Output Port 10, you would squelch Channel 3.

Syntax Examples

```
ed-sync::sn-outx-y:1::squelch=y;
```

Syntax Explanation: Where n=number of the subrack (0-4), x=letter of the slot where the output card is located (A-E), and y=the channel number (1-8). "1" is an example of a Correlation Tag. This is a user-defined string of up to six alphanumeric characters. Any responses or acknowledgments will include the Correlation Tag. This is useful when more than one person is sending commands at the same time. The Correlation Tag can be used to identify the person to which the commands and responses belong.

- 1 To disable all channels of subrack number 1 (first expansion subrack) with the TRSC in slot B, send the following command:

```
ed-sync::s1-outb-1&2&3&4&5&6&7&8:1::squelch=y;
```

- 2 To enable the four re-timed channels, send the following command:

```
ed-sync::s1-outb-1&2&3&4:1::squelch=n;
```

- 3 To query the status of TRSC buffered Channel 5 in a master subrack, slot C, send the following query:

```
rtrv-sync::s0-outc-5:1::parameter=squelch;
```

TRSC Keyword Functions

There are two TL1 Keywords to support the functions of the TRSC. Refer to the *55400A TL1 Programming Reference Manual* for more information about TL1 keywords and commands. The TRSC keywords deal with setting an alarm threshold for the occurrence of multiple slips within the TRSC and with specifying whether an SSM should be simply passed through or modified according to conditions in the SSU.

- HSLIMIT
- TRSCSSM

HSLIMIT Keyword

Sets a detection threshold for the slip rate. When the threshold is met or exceeded, a multiple slip (MSLIP) alarm event is triggered and the MSLIP LED lights.

SSM Insertion

The Synchronization Status Message (SSM) is a four-bit code that indicates the current synchronization quality level to downstream equipment. The TRSC supports the ability to pass through SSM information or insert an SSM value based on the quality of the reference timing source being used by the TRSC. During normal operation, the TRSC inserts onto its output the SSM quality level of the reference signal being tracked by the SSU. In Holdover mode, the value set with the keyword, HFQLEVL, will be inserted on the transmitted re-timed signal. Once the SSU leaves Holdover mode and returns to tracking an input reference signal, the TRSC will end transmitting the holdover synchronization status and return to sending the synchronization status of the tracked reference.

Backdating

55481A clock distribution card—2048 kbps

This card can carry a traffic pattern, but it is limited to all ONES (0xFF). The 55481B card can carry a traffic value that contains 1 ZERO.

Behavior when mixing “A” and “B” cards

When installing “A” and “B” 2048 kbps cards in a protected pair, be aware that the system behavior will depend on the firmware version that the system is running.

Before Firmware Version 3744H

If a 55481A is paired with a 55481B, both cards will automatically have the traffic pattern value set to 255 (all ONES).

Firmware Version 3744H and later

If a 55481A is paired with a 55481B that is operating with a traffic pattern other than 255, the 55481A card will be taken off-line and an alarm will be issued. The 55481B card will generate the specified legal traffic pattern. If a pattern with more than one zero is set for the slot where the 55481B is located, the card will be programmed to 0xFF (255).

Refer to the Traffic keyword description in the *55400A TL1 Programming Reference Manual* for the keyword syntax.

55485A clock distribution card—1544 kbps

8 outputs (9 through 16 on subrack)

NOTE

This card is not compatible with the 55485B card, which provides 16 outputs. Do not install “A” and “B” 55485 cards in a protected pair.

D3

Configure Communication Cards

Theory, configuration, backdating

In This Chapter

This chapter describes the Communication cards for use in the 55401 and 55409 series of subracks. The topics include the following:

- Functions/features
- Individual card descriptions and configuration
- Backdating

Communication Card Functions/Features

The purpose of the communication card is to provide the following functions:

- Alarm management and reporting
- Interface to the external world for system status and management

Different Cards for Different Applications

The different models of communication cards provide different capabilities depending on the needs of the SSU system.

Alarm management and local/remote communication

55441A Information Management Card (IMC) contains:

- Functions of the AIC
- Local communication port for accessing internal status information and configuring system parameters
- Remote port supports the same communication functions over a modem
- Support for expansion subracks

Alarm management and local/network communication

55442A Network Information Management Card (NIMC) contains:

- Functions of the AIC
- Local port communication
- Networking capability
- Support for expansion subracks

NOTE

The communication card is not a redundant element of the SSU and it is not required for SSU operation. The SSU can still accept, process, and distribute timing signals should the communication card fail.

Each card is described in detail in this chapter.

Information Management Card

The Information Management Card (IMC) provides local and remote communication and alarm functions for the 55400A system. The card's front panel is shown in Figure D3-1. Figure D3-2 illustrates the card's circuitry. Table D3-1 defines the LEDs on the front panel.

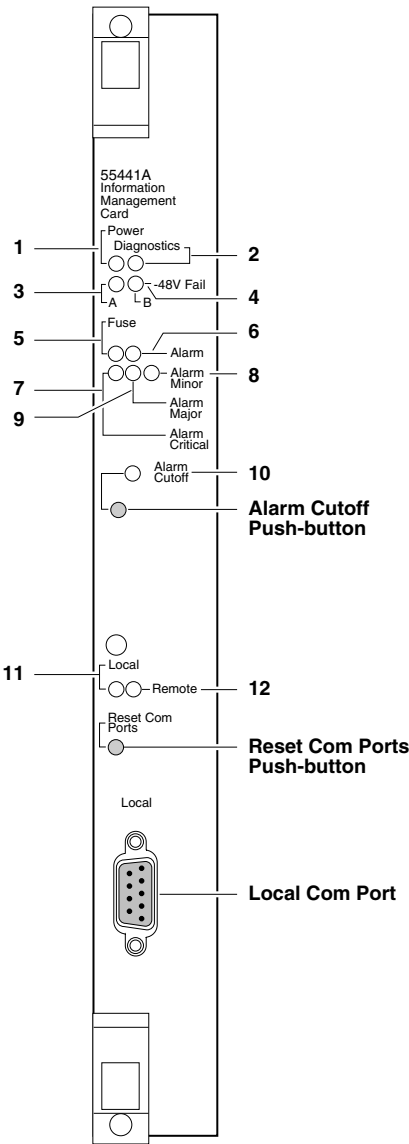


Figure D3-1. 55441A Information Management Card

Table D3-1. Information Management Card LEDs

No.	LED	Indicates when lighted
1	Power	Power is present.
2	Diagnostics	Diagnostics are being performed.
3	–48 V Fail A	–48 Vdc (A) input is outside normal voltage range.
4	–48 V Fail B	–48 Vdc (B) input is outside normal voltage range.
5	Fuse	AIC card fuse is open.
6	Alarm	Card is in the alarm state.
7	Alarm Critical	Critical alarm exists in master subrack.
8	Alarm Minor	Minor alarm exists in master subrack.
9	Alarm Major	Major alarm exists in master subrack.
10	Alarm Cutoff	Audible or visual alarm was present: audible has been silenced: alarm state continues.
11	Local	Local port is busy. Indicates that a user is logged on.
12	Remote	Remote port is busy. Indicates that a user is logged on.

IMC Description

The power supply on the IMC receives –48 volts from the backplane and converts it to an output voltage using its on-board dc-to-dc converter.

The IMC accepts status signals from each ITH card, status lines from each pair of output cards, and the Alarm Cutoff and Reset Com Ports lines from push-buttons at the IMC front panel.

Alarm generation circuits continually monitor status lines from the ITH cards and the output cards. Data from these circuits are interpreted by a hardware state machine for a possible alarm condition. Whenever an alarm condition is detected, the alarm generation circuitry determines the alarm severity. Appropriate IMC alarm relays are then switched.

Alarm Cutoff push button

When the Alarm Cutoff push button on the IMC front panel is pressed, the Alarm Cutoff LED on the IMC front panel lights up and the audible alarm relay contacts return to the non-alarmed state. The cutoff LED will remain lit until the alarm condition is over. Once the Alarm Cutoff button has been pressed and the alarm condition is no longer present, the alarm function resets automatically.

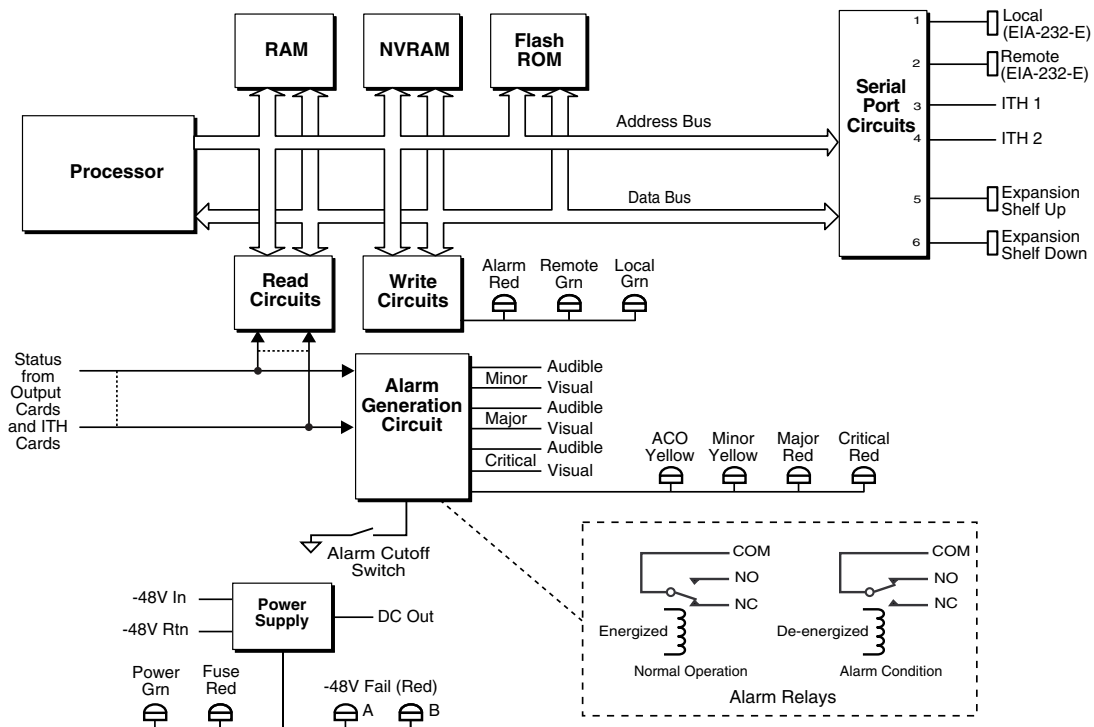


Figure D3-2. Information Management Card Block Diagram

Drive lines from the alarm generation circuitry activate visual and audible alarms. There are three alarm relays for office visual and audible alarms: critical, major, and minor, for a total of six relays in all. The LED array at the IMC front panel is activated by the alarm generation circuitry.

Control Circuitry

The control circuitry consists of RAM, NVRAM, flash EEPROMs, read ports, a write port, a central processor, and address decoding logic. All input status lines and lines from the alarm generation circuitry are fed into the read ports. The data bus is connected to all RAM, NVRAM, flash EEPROMs, and the write port for communication with the central processor. An address bus from the central processor feeds the address decoding logic and the serial port circuits. Chip select lines from the address decoding logic are provided to the three serial port circuits and the I/O ports.

Three serial port circuits give the IMC the ability to communicate with the outside world. They provide local and remote terminal communications, communications with the two ITH cards, and communications with any expansion subrack. The serial port circuits connect the IMC with remote or local terminals which can configure the system, download firmware, receive event and alarm messages, set input priority tables, and set alarm thresholds.

Reset Com Ports

Pressing the Reset Com Ports push-button switch on the IMC front panel causes the IMC to read the communication switch settings on the card into memory. For example, if TL1 commands had been used to change the baud rate or flow control values from those specified by the switch settings, this push-button resets the values to the switch values. Also, after making any changes to the switch settings, re-install the card and press this push button to force the card to read the new values into memory.

TL1 commands can be used for communications between the IMC and a local or remote terminal. The IMC reports alarms automatically to the terminal in real time. The IMC card provides a log of the most recent TL1 automatic responses.

Local Port on IMC

The Local Port supports connection to a local terminal. A user can send TL1 commands to configure the system, retrieve event and alarm messages, set input priority tables, download firmware, and set alarm thresholds. These same tasks can be performed using a graphical user-interface application, such as the 5450A local craft terminal software.

Table D3-2. Local connector pinout

Pin Number	Description
1	DCD (Data carrier detect)
2	RxD (Received data)
3	TxD (Transmitted data)
4	DTR (Data terminal ready)
5	GND (Signal ground)
6	DSR (Data set ready)
7	RTS (Request to send)
8	CTS (Clear to send)
9	RI (Ring indicator)

Configuring IMC card

This IMC card assembly is equipped with four dual inline switches to set the instrument-state parameters for the card.

Switch settings

Set the switches according to your system requirements. All switches are set to On at the factory except for S4–1. The default setting for Security is Off.

Table D3-3. 55441A IMC card switch settings

Switch	Bit	Parameter	Off	On
S3	1–2	Local Port Baud Rate	See Table D3-6 for details	
	3	Local Port Flow Control	Enabled	Disabled
	4–5	Remote Port Baud Rate	See Table D3-7 for details	
	6	Remote Port Flow Control	Enabled	Disabled
	7	Local Port Echo	Disabled	Enabled
	8	Remote Port Echo	Disabled	Enabled
S4	1	Security	Disabled	Enabled
	2	IMC Startup State	Switch settings override memory values.	Use memory values.
	3	Force Enable Local Port	Local port is enabled even if previously disabled by TL1 command	Normal operation where TL1 command can disable local port.
	4	Modem Control	Enabled	Disabled
	5–8	Reserved	—	—
S5	1	Firmware Mode	Force download mode.	Verify firmware code.
	2	Reserved	—	—
	3	Combine Critical/Major Alarms	Enabled	Disabled
	4–8	Reserved	—	—
S6	1	Single ITH Operation	Enabled	Disabled
	2–4	Reserved	—	—

NOTE

If S5–3 is set to Off, Critical and Major alarms are combined as Major alarms. The Critical alarm relay will indicate if the ACO push button has been pressed.

Set the switches according to you system requirements.

Table D3-4. 55441A Local Port Baud settings

Baud Rate	Switch S3–1	Switch S3–2
1200	ON	OFF
2400	OFF	ON
9600	ON	ON
19.2 k	OFF	OFF

Set the switches according to you system requirements.

Table D3-5. 55441A Remote Port Baud settings

Baud Rate	Switch S3–4	Switch S3–5
1200	ON	OFF
2400	OFF	ON
9600	ON	ON
19.2 k	OFF	OFF

NOTE

Whenever the local/remote baud rate or flow control switch settings are modified, re-install the card and press the Reset Comm Ports push button to force the card to read the new values into memory.

Switch location

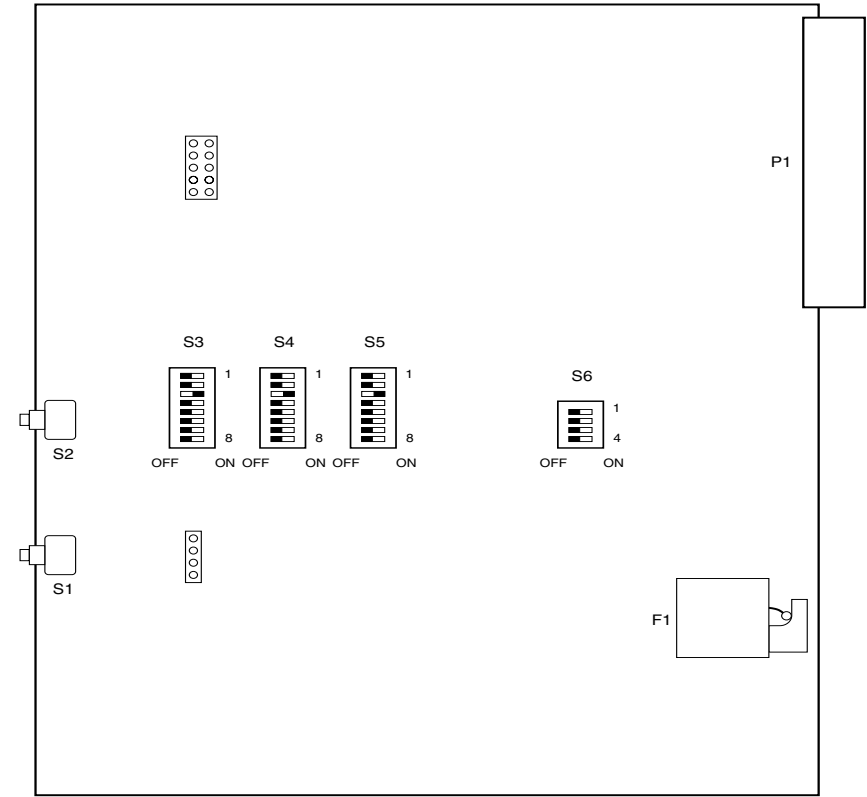


Figure D3-3. IMC Card Switch

Network Information Management Card

The Network IMC makes it possible to install the SSU on a network and manage it from a remote location. A LAN, X.25 (Option 002), or TP4 (Option 003) interface is available. The card's front panel is shown in Figure D3-4. The network version of the IMC also adds a rack alarm port described below. The LED indicators on the network card are described in Table D3-6.

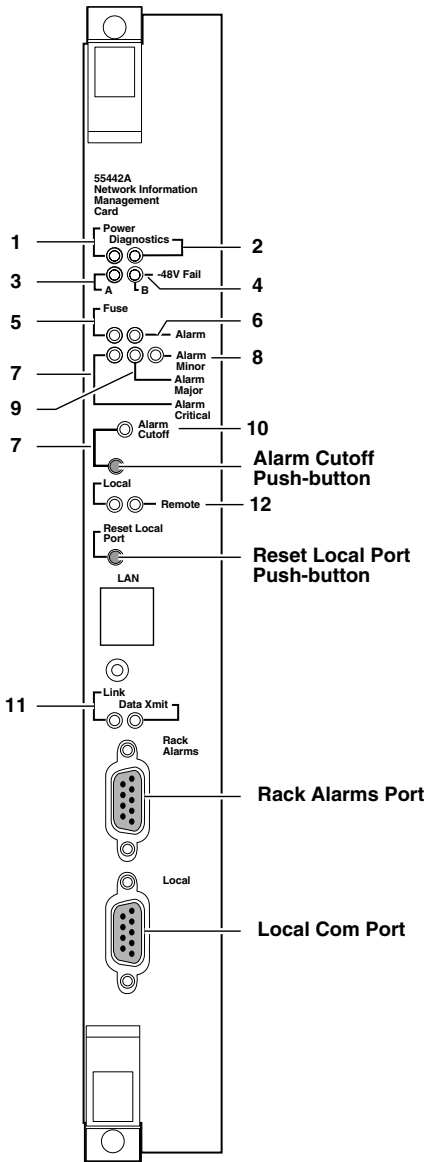


Figure D3-4. 55442A Network Management Card

Table D3-6. Network Information Management Card LEDs

No.	LED	Indicates when lighted
1	Power	Power is present.
2	Diagnostics	Diagnostics are being performed.
3	–48 V Fail A	–48 Vdc (A) input is outside normal voltage range.
4	–48 V Fail B	–48 Vdc (B) input is outside normal voltage range.
5	Fuse	AIC card fuse is open.
6	Alarm	Card is in the alarm state.
7	Alarm Critical	Critical alarm exists in master subrack.
8	Alarm Minor	Minor alarm exists in master subrack or external rack.
9	Alarm Major	Major alarm exists in master subrack or external rack.
10	Alarm Cutoff	Audible or visual alarm was present: audible has been silenced: alarm state continues.
11	Link/Data Xmit	Link shows that network connection is active. Xmit shows data transfer.
12	Local/Remote	Local or Remote port is busy. Indicates that a user is logged on.

NIMC Description

Because the circuitry of the NIMC is similar to that of the IMC, please refer to the description for the IMC to understand the operation of this card. This section will concentrate on what is different about this card.

Network IMC Port Assignments

Depending on the type of NIMC you have, the communication ports will be assigned differently.

Table D3-7. Network Card Port Assignments

Network IMC Card	Network Type	Port Usage
55442A standard	TCP/IP	Uses LAN port on NIMC, Remote port not functional.
55442A Option 002	X.25	Uses Remote port on subrack, LAN port not functional.
55442A Option 003	TP4	Uses LAN port on NIMC, Remote port not functional.

Rack Alarms Connector

The 55442A Network Information Management Card includes a rack alarm input connector. Alarm signals from other equipment in the rack can be connected to the 55400A. This way the SSU can pass these external alarms over the network to the Network Manager. These alarm inputs can be used for alarms that indicate faults in the rack power supply and in other equipment installed in the rack. Table D3-8 describes the alarm connector pinout and the assigned alarm severity.

NOTE

The word “External” in Table D3-8 means outside of the 55400A subrack.

Table D3-8. 55442A Rack Alarms Connector Pinout

Pin Number	Description
1	Ground
2	External Rack Power Alarm (Major)
3	External Cesium 2 Alarm (Major)
4	External GPS Reports Critical Alarm (Major)

Table D3-8. 55442A Rack Alarms Connector Pinout (continued)

Pin Number	Description
5	External GPS Reports Major Alarm (Major)
6	External Rack Alarm 5 (Major)
7	External Rack Alarm 6 (Major)
8	External Rack Alarm 7 (Major)
9	External Rack Alarm 8 (Minor)

The Rack Alarms connector provides ground on pin 1 and a TTL High level on pins 2 through 9. An open indicates a non-alarm condition. Any grounding of pins 2 through 9 indicates an alarm condition. For example, Pin 2 could be used to monitor the power to the rack, and Pin 3 could support an alarm for a second 5071A Primary Frequency Standard in the rack. Pins 4 and 5 can be used for the GPS equipment in the rack. Pins 6 through 9 can be used as needed. The one Minor alarm (pin 9) will not be promoted to Major by the Network IMC. Any promotion is the responsibility of the equipment generating the alarm. The SSU simply forwards these rack alarms to the Network Manager.

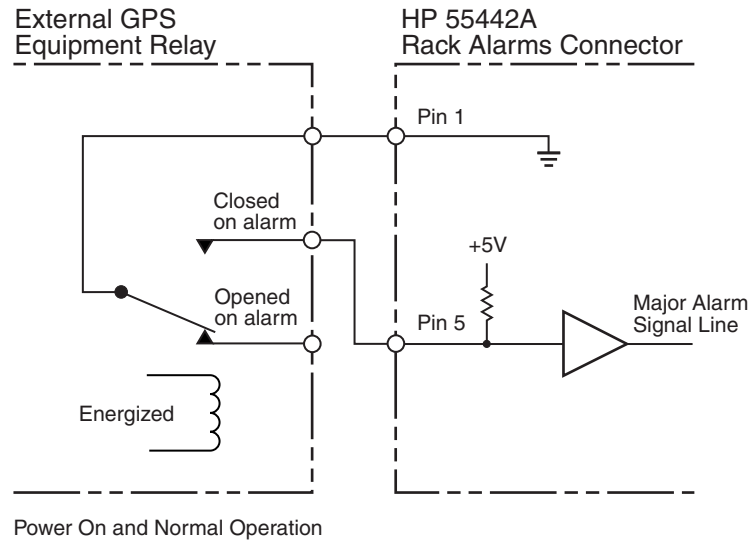
Here are examples of the Rack Alarm reports sent to the Network Manager:

```
SSU 97-08-19 14:54:31
**0005 REPT ALM TSG
"IMC:MJ,RCKALM1,NSA,08-19,14:54:31:\"Ext. Rack Power
Alarm\"
;
```

```
SSU 97-08-19 14:54:31
**0005 REPT ALM TSG
"IMC:MJ,RCKALM2,NSA,08-19,14:54:31:\"Ext. Cesium 2
Alarm\"
;
```

Example of Wiring Diagram for Rack Alarms Connector

The drawing in Table D3-5 shows how a relay in a GPS device in the equipment rack could be connected to the Rack Alarms Port. When the relay went into the alarm condition, the Network IMC would send a Major alarm message to the Network Manager. The operation would be similar for the other alarm lines.

**Figure D3-5. Example of Relay to Rack Alarms Connection*****LAN Port on NIMC***

The LAN port uses an 8-pin modular RJ-45 connector for terminating 10Base-T cabling.

Local Port on NIMC

The Local Port supports connection to a local terminal. A user can send TL1 commands to configure the system, retrieve event and alarm messages, set input priority tables, download firmware, and set alarm thresholds. These same tasks can be performed using a graphical user-interface application, such as the 55450A local craft terminal software.

Table D3-9. Local connector pinout

Pin Number	Description
1	DCD (Data carrier detect)
2	RxD (Received data)
3	TxD (Transmitted data)
4	DTR (Data terminal ready)
5	GND (Signal ground)
6	DSR (Data set ready)
7	RTS (Request to send)
8	CTS (Clear to send)
9	RI (Ring indicator)

Remote Comm Port on master subrack

The Remote Port is located on the SSU subrack itself. It is the X.25 interface connector for the Option 002 55442A Network IMC. This port is not operational with the LAN or TP4 version of the 55442A. Remote management of the SSU can be accomplished using the TL1 command syntax or by using a graphical user-interface application for network management, such as the 55452A open synchronization management framework for HP-UX.

Table D3-10. Remote connector pinout for X.25

Pin Number	Description	Signal Direction
1	No connection	—
2	TxD (Transmitted data)	Out
3	RxD (Received data)	In
4	RTS (Request to send)	Out
5	CTS (Clear to send)	In
6	DSR (Data set ready)	In
7	GND (Signal ground)	—
8	DCD (Data carrier detect)	In
9–14	No connection	—

Table D3-10. Remote connector pinout for X.25 (continued)

Pin Number	Description	Signal Direction
15	Tx clk (Transmitted clock)	In
16	No connection	—
17	Rx clk (Received clock)	In
18–19	No connection	—
20	DTR (Data terminal ready)	Out
21–25	No connection	—

NOTE

The remote port can only be used for an X.25 network connection. The RTS and DTR signals are always asserted (active). The handshake signals: CTS, DSR, and DCD are not used by the SSU. The X.25 network connection for the 55400A requires the use of a leased-line synchronous modem, not a dial-up type.

Alarm Cutoff push button

When the Alarm Cutoff push-button is pressed, the Alarm Cutoff LED lights up and the audible alarm relay contacts return to the non-alarmed state. The LED will remain lit until the alarm condition no longer exists. After the button has been pressed and the alarm condition no longer exists, the alarm function resets automatically.

Reset Local Port push button

Pressing the Reset Com Ports push-button switch on the IMC front panel causes the IMC to read the communication switch settings on the card into memory. For example, if TL1 commands had been used to change the baud rate or flow control values from those specified by the switch settings, this push-button resets the values to the switch values. Also, after making any changes to the switch settings, re-install the card and press this push button to force the card to read the new values into memory.

Option 004 Expanded Memory

The expanded memory option makes it possible to record up to 24 hours of consecutive, filtered time interval error measurements (CTIE). For information about how to use this feature, see chapter 8 of the *55400A TL1 Programming Reference Manual*.

Configuring NIMC card

This NIMC card assembly is equipped with five dual inline switches to set the instrument-state parameters for the card.

Switch settings

Set the switches according to your system requirements. All switches are set to On at the factory except for S4–1. The default setting for Security is Off.

Table D3-11. 55442A NIMC card switch settings

Switch	Bit	Parameter	Off	On
S3	1–2	Local Port Baud Rate	See Table D3-14 for details	
	3	Local Port Flow Control	Enabled	Disabled
	4–6	Reserved	—	—
	7	Local Port Echo	Disabled	Enabled
	8	Reserved	—	—
S4	1	Security	Disabled	Enabled
	2	NIMC Startup State	Switch settings override memory values.	Use memory values.
	3	Force Enable Local Port	Local port is enabled even if previously disabled by TL1 command	Normal operation where TL1 command can disable local port.
	4–8	Reserved	—	—
S5	1	Firmware Mode	Force download mode.	Verify firmware code.
	2	Reserved	—	—
	3	Combine Critical/Major Alarms	Enabled	Disabled
	4–8	Reserved	—	—
S6	1–4	Reserved	Must be Off.	Do not use.
	5–7	Reserved	—	—
	8	Enforce IP Match (see next page)	Disabled	Enabled
S8	1	Single ITH Operation	Enabled	Disabled
	2–4	Reserved	—	—

Set the switches according to you system requirements.

Table D3-12. 55442A Local Port Baud settings

Baud Rate	Switch S3-1	Switch S3-2
1200	ON	OFF
2400	OFF	ON
9600	ON	ON
19.2 k	OFF	OFF

NOTE

Whenever the local baud rate or flow control switch settings are modified, re-install the card and press the Reset Local Port push button to force the card to read the new values into memory.

Enforce IP Match

When switch S6-8 is set to On (enabled), only communication from the addresses of the primary and alternate element managers (EM1 and EM2) will be accepted. Communication from all other network addresses will be ignored. When this switch is set to Off, communication from any network address will be accepted.

NOTE

In the case of the TCP/IP LAN version of the NIMC, the IP match function will also include the addresses of the primary and alternate local managers (LM1 and LM2).

Switch location

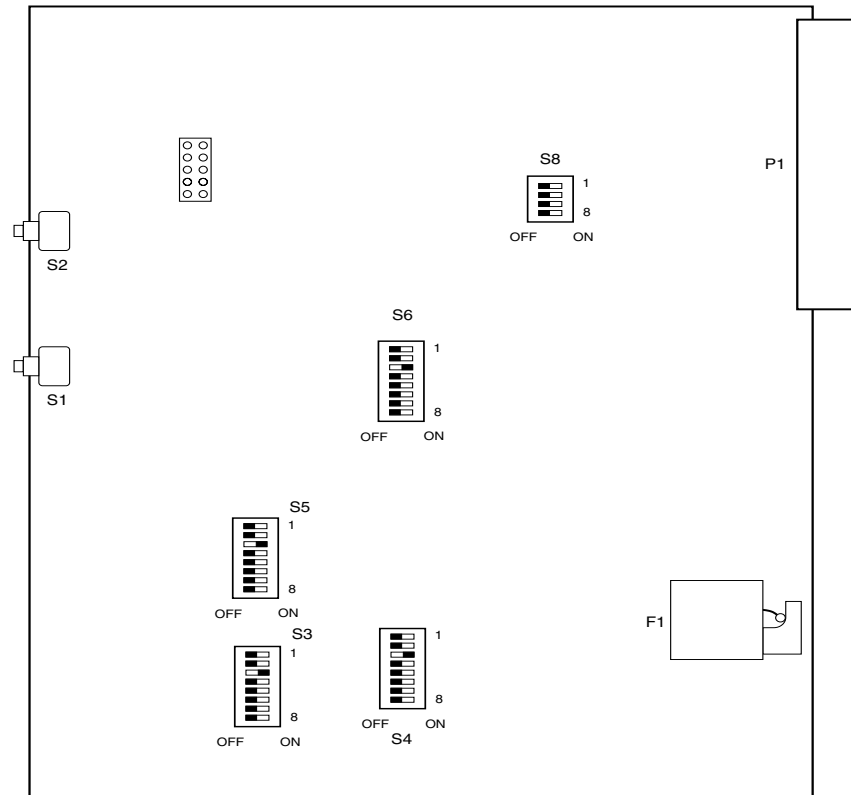


Figure D3-6. NIMC Card Switch

NOTE

When the S5-3 switch is set to Off, Critical and Major alarms are combined as Major alarms. The Critical alarm relay will indicate if the ACO push button has been pressed.

Preparing the NIMC for Network Use

The most important step in preparing an NIMC for use on a network is configuring the network parameters on the card. Before the SSU can be used on a network, there is an extensive list of network parameters that must be set correctly for each of the network interfaces.

The procedure for preparing an NIMC for use on a network is described in chapter E1, “Qualification Procedures.”

NOTE

Only an overview to the different network parameters is presented here. Refer to chapter 10, “Network Parameters,” in the *55400A TL1 Programming Reference Manual* for detailed instructions on configuring the NIMC for network operation.

Saving Network Parameters into Memory

All network parameters that require address settings or port numbers are stored in two separate regions of Network IMC memory. The two areas of memory are called: Working Memory (WKG) and Auxiliary Memory (AUX). The WKG memory contains the parameter settings being used by the network, while the AUX memory holds a backup copy of these parameters. The WKG memory parameters cannot be directly set. Any parameter modifications are first set in the AUX memory and then when you are sure the settings are correct, the CPY-MEM-SECU command is used to transfer the AUX memory to WKG memory.

55442A Network IMC

The 55442A Network IMC supports a 10Base-T LAN connection. Before testing the LAN port or installing the SSU on a network, the following network parameters must be set via the SSU Local Port (the TL1 keywords are shown in parentheses):

- IP address of network element/SSU (IPNEX)
- IP subnetwork mask (IPSUBNETX)
- IP address of default gateway (IPGATEX)
- IP address of element manager (IPEM1X)
- IP address of local manager (IPLM1X)
- Command port number (PORTCMDSX)
- Automatic event output port number (PORTAOX)

55442A Option 002 Network IMC

The 55442A Option 002 Network IMC supports an X.25 network connection. Before testing the X.25 port or installing the SSU on a network, the following network parameters must be set via the SSU Local Port (the TL1 keywords are shown in parentheses).

Always set the following parameters:

- X.25 address of network element/SSU (X25NEX)
- X.25 address of element manager (X25EM1X)
- Logical channel starting number (X25SRTSVCX)
- Logical channel ending number (X25ENDSVCX)

Set the following parameters only if necessary. Default values are typically acceptable:

- Level 3 packet size (X25L3PKSZ)
- Level 3 window size (X25L3WX)
- Level 2 window size (X25L2KX)
- Retransmission timer (X25T1X)
- Acknowledgment timer (X25T2X)
- Idle timer (X25T3X)
- Retransmission count (X25N2X)
- Frame size (X25N1X)

55442A Option 003 Network IMC

The 55442A Option 003 Network IMC supports a 10Base-T connection. Before using the TP4 interface or installing the SSU on a network, the following network parameters must be set via the SSU Local Port (the TL1 keywords are shown in parentheses):

- NSAP address of network element/SSU (NSAPNEX)
- NSAP address of element manager (NSAPEM1X/NSAPEM2X)
- TSAP for command port (TSAPCMDX)
- TSAP for automatic output port (TSAPAOX)
- Low-level encryption of communications (SCRAMBLEX)

Expansion Communication Card

The 55443A Expansion Communications Card performs the function of the communication card in the expansion subrack.

This card is described in chapter C3, “Install Expansion Subracks.”

Backdating

This section contains information about products that are no longer current.

55431A Alarm Interface Card (AIC)

The AIC collects alarm information from every other card located in the subrack and determines whether any combination of alarms is a critical, major, or minor alarm state. The appropriate alarm relays are activated and the lights the corresponding critical, major, or minor LED indicator on the front panel.

Table D3-13. 55431A Alarm Interface Card Relays

Description	Specification
Alarm Relay Contact Ratings	
Switching Power	60 W, 62.5 VA
Switching Voltage	60 Vdc, 30 Vac
Switching Current	1A maximum
Critical, Major, & Minor Alarm Relays, with or without alarm cutoff	Open and closed contacts
ACO (alarm cutoff) Switch—front panel	Push button, when pressed silences the audible alarm and lights the ACO LED.

Alarm management only

55431A Alarm Interface Card (AIC) provides:

- Alarm signals from the SSU and nothing more.
- Alarm Information Card—the only way this card communicates with the outside world is with the LED indicators on its front panel indicating status and alarms. No type of local or remote communication is supported.

More detailed information about the AIC is included below.

Alarm Interface Card

The Alarm Interface Card (AIC) only provides alarm functions. The card's front panel is shown in Figure D3-7. Figure D3-8 illustrates the card's circuitry. Table D3-14 defines the LEDs on the front panel.

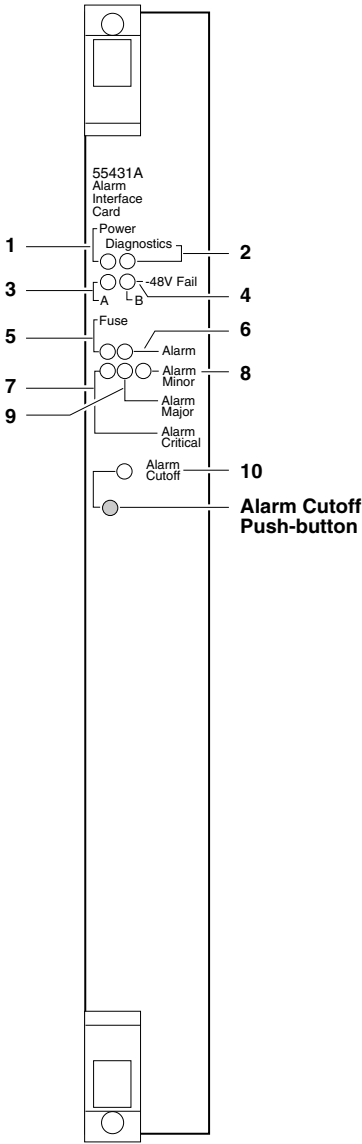


Figure D3-7. 55431A Alarm Interface Card

Table D3-14. Alarm Interface Card LEDs

No.	LED	Indicates when lighted
1	Power	Power is present.
2	Diagnostics	N/A
3	–48 V Fail A	–48 Vdc (A) input is outside normal voltage range.
4	–48 V Fail B	–48 Vdc (B) input is outside normal voltage range.
5	Fuse	AIC card fuse is open.
6	Alarm	Card is in the alarm state.
7	Alarm Critical	Critical alarm exists in master subrack.
8	Alarm Minor	Minor alarm exists in master subrack.
9	Alarm Major	Major alarm exists in master subrack.
10	Alarm Cutoff	Audible or visual alarm was present: audible has been silenced: alarm state continues.

AIC Description

The power supply on the AIC receives –48 volts from the backplane and converts it to an output voltage using its on-board dc-to-dc converter.

The AIC accepts status signals from both ITH cards, status lines from each pair of output cards, and the Alarm Cutoff line from the push-button at the AIC front panel.

Alarm generation circuits continually monitor status lines from the ITH cards and the output cards. Data from these circuits are interpreted by a hardware state machine for a possible alarm condition. Whenever an alarm condition is detected, the alarm generation circuitry determines the alarm severity. Appropriate AIC alarm relays are then switched. When the Alarm Cutoff push-button on the AIC front panel is pressed, the Alarm Cutoff LED on the AIC front panel lights up and the audible alarm relay contacts return to the non-alarmed state. The cutoff LED will remain active until the alarm condition is over. Once the Alarm Cutoff button has been pressed and the alarm condition is no longer present, the alarm function resets automatically.

Drive lines from the alarm generation circuitry activate visual and audible alarms. There are three alarm relays for office visual and audible alarms: critical, major, and minor. The LED array at the AIC front panel is activated by the alarm generation circuitry.

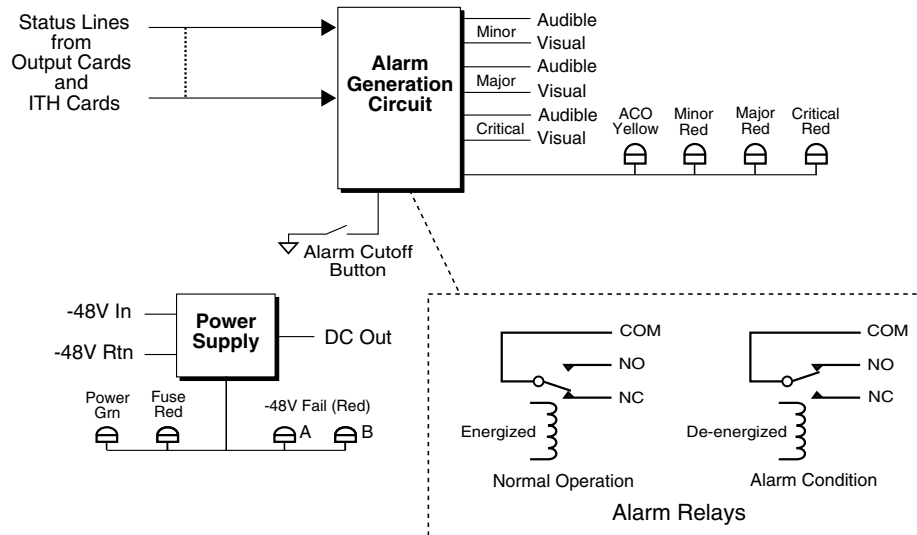


Figure D3-8. Alarm Interface Card Block Diagram

Configuring AIC card

This AIC card assembly is equipped with two dual inline switches to set the instrument-state parameters for the card.

Switch settings

Set the switches according to you system requirements. The switch locations are shown in Figure D3-9

Table D3-15. 55431A AIC card switch settings

Switch	Bit	Parameter	Off	On
S5	1-2	Reserved	—	—
	3	Combine Critical/Major Alarms	Enabled	Disabled
	4-8	Reserved	—	—
S6	1	Single ITH Operation	Enabled	Disabled
	2-4	Reserved	—	—

Switch location

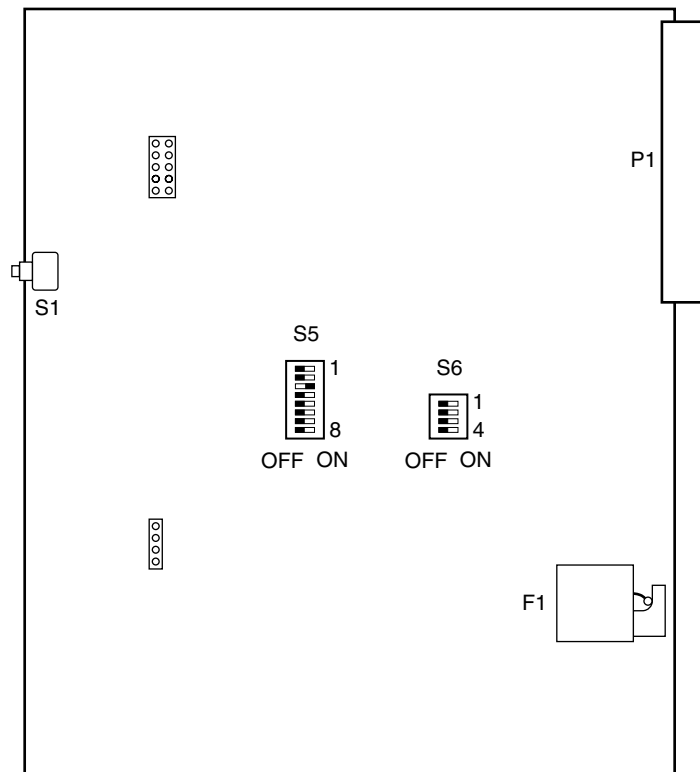


Figure D3-9. AIC Card Switch

NOTE

When the S5-3 switch is set to Off, Critical and Major alarms are combined as Major alarms. The Critical alarm relay will indicate if the ACO push button has been pressed.

E1

Qualification Procedures

Make final settings and verify operation

In This Chapter

This chapter addresses the issues involved with bringing up a sync system for the first time.

Assumptions

- All sync equipment is installed and power is applied

Tasks

55300A–

- Install SatStat to communicate with 55300A and display current GPS time
- Set 55300A to local time
- Verify Threshold 1, 2, and Holdover Action for 55300A
- Configure the 55300A for use with open synchronization management framework (OSMF) software (if needed)

5071A–

- Set 5071A to continuous operation
- Configure 5071A output ports
- Synchronize 5071A to 55300A
- Set the 5071A to display local time

55400A–

- Install 55450A local craft terminal to communicate with the SSU
- Run local craft terminal program
- Verify SSU configuration
- Set SSU date and time
- Set SSU system ID
- Configure SSU for use with open synchronization management framework (OSMF) software (if needed)

NOTE

The 55400A tasks should also be performed on the 55409A mini-SSU.

Prepare 55300A for Operation

Before beginning this procedure, ensure that the GPS unit has achieved GPS Lock. An LED on the front panel will light to indicate that the GPS unit is properly tracking the reference signal from the GPS satellites.

NOTE

If more than 30 minutes have elapsed since power-up and there is no indication of GPS lock, refer to the troubleshooting information in the *55300A GPS User's Guide*.

Display the current GPS time using the SatStat application

Install the SatStat application to allow access to the GPS receiver status screen. Continuous updates of different aspects of the receiver operation are available. This software program is supplied with the 55300A.

1. Connect a computer to the 55300A Time of Day port.

Refer to “Time of Day Port Connection for Installation and Troubleshooting” in chapter A5. This section describes how to connect a computer to the 55300A, load, and run the SatStat software.

2. Once the SatStat application is showing the receiver status screen, select **Function>Clock** from the menu bar.

A clock display now shows the current GPS time as it continuously updates.

Set the 55300A to local time

In the previous procedure a connection was established between the GPS unit and the computer with the SatStat program. Refer to that procedure if SatStat is not already running.

1. Go to the **Control & Query** form in SatStat.

This form should be visible somewhere on the application screen.

2. When it is selected, go to **Query>Timezone offset**.
3. Observe the current GPS time displayed by SatStat. Usually this is UTC time if no offset value has been introduced.
4. By default the command to return the current user-entered time offset from UTC time is already entered in the command box. Click on **“Send Cmd”** to see if any offset has been entered.
5. Enter the offset value that will cause the GPS clock to display local time. For example, observe GPS time and calculate the offset to be added to achieve current local time. If current time is behind displayed time by 8 hours, enter the following offset command to display local time:
(the syntax is :PTIME:TZONE <hour offset>,<minute offset>)
Type :PTIME:TZONE -8,0
6. Click on **“Send Cmd”**.
7. Verify that the command executes without errors and the GPS time display shows the current time.
8. Select **File>Exit** to close the SatStat program.

Verify Holdover Actions

The 55300A has default parameter settings from the factory that dictate how the GPS receiver will treat the telecom outputs when in holdover. Verify that these settings are appropriate for your situation. If not, they can be changed.

Prepare to send TL1 commands

This procedure includes communication with the 55300A using TL1 commands. This can be accomplished using a computer running a terminal emulator program. The computer should be connected to Port 1 of the 55300A.

1. Connect a computer to the Port 1 connector of the 55300A.

Refer to “Port 1 Connection” in chapter A5. This section describes how to connect a computer to the 55300A in order to use TL1 commands.

2. Run a terminal emulator program on the computer

NOTE

The actions described here apply only to the 2048 kbps telecom outputs only, not the 1 PPS, 5/10 MHz, or 2048 kHz outputs.

Holdover Action Keywords

- THRESHOLD1
- THRESHOLD2
- HOLDACT

THRESHOLD1

The first threshold has a range in seconds from 0 to 3,888,000. The default setting is 1800 seconds (30 minutes). After the GPS unit has been in holdover for 30 minutes, it will generate an event with a minor alarm level (default setting). The alarm severity can be modified.

To retrieve current Threshold 1 setting:

```
RTRV-EQPT::GPS:123:::PARAMETER=THRESHOLD1;
```

To modify Threshold 1 setting:

```
ED-EQPT::GPS:123:::THRESHOLD1=<seconds>;
```

Event generated when holdover extends past Threshold 1 setting:

EXCTH1 (Exceeding holdover duration threshold 1)

This event has a minor alarm level assigned by default. This alarm property can be changed to NONE, NONALM, MAJOR, or CRITICAL.

To change EXCTH1 alarm level setting to major:

```
ED-EQPT::GPS:123:::EXCTH1=ALM-MAJOR&LOG-Y;
```

THRESHOLD2

The second threshold has a range in seconds from 0 to 3,888,000. The default setting is 86400 (24 hours). After the GPS unit has been in holdover for 24 hours, it will generate an event with a major alarm level and then execute the defined Holdover Action (HOLDACT).

To retrieve current Threshold 2 setting:

```
RTRV-EQPT::GPS:123:::PARAMETER=THRESHOLD2;
```

To modify Threshold 2 setting:

```
ED-EQPT:GPS:123:::THRESHOLD2=<seconds>;
```

Event generated when holdover extends past Threshold 2 setting:

EXCTH2 (Exceeding holdover duration threshold 2)

This event has a major alarm level assigned by default. This alarm property can be changed to NONE, NONALM, MINOR, or CRITICAL.

To change EXCTH2 alarm level setting to critical:

```
ED-EQPT::GPS:123:::EXCTH2=ALM-CRITICAL&LOG-Y;
```

HOLDACT

The holdover action is initiated when the GPS unit is in holdover for longer than the length of time specified with the THRESHOLD2 parameter. The action taken on the 2048 kbps outputs can be set to one of the following:

- SQUELCH—Squelch the telecom outputs
- AIS—Send the AIS message on the telecom outputs (default setting)
- CONTINUE—Continue the telecom outputs

To retrieve current setting:

```
RTRV-EQPT::GPS:123:::PARAMETER=HOLDACT;
```

To modify setting:

```
ED-EQPT:GPS:123:::HOLDACT=<action>;
```

NOTE

Refer to the *55300A Programming Guide* for the description and syntax used for these commands, events, and alarm settings.

Configure the 55300A for Network Operation

The 55300A can be managed by the Symmetricom open synchronization management framework (OSMF) software over a network. The use of the Lantronix LRS1 Remote Access Server is recommended to interface the GPS reference source to a LAN via TCP/IP. Before you can establish communication between the GPS reference source and the OSMF software over a network, certain parameters must be configured in the remote server.

NOTE

The Lantronix LRS1 Remote Access Server is used to interface the GPS reference source to a LAN via TCP/IP. This will allow the GPS reference source to communicate with the OSMF network management system. This configuration allows OSMF to receive events and alarms from the GPS reference source and to manage it over a network. This procedure describes how to configure the Lantronix terminal server for use with the GPS reference source. Other terminal servers may be used but are not supported.

Configure the LRS1

1. Connect power to the LRS1 using the –48 Vdc to 6 Vdc converter box (55300A–H04).
2. Connect the LRS1 to a local terminal or PC via the RS-232 connector.

The cable and adapter to make this connection are supplied with the 55300A. (Cable #5182-4794, Adapter #5181-6641)

3. Open a terminal session to the RS-232 port used with the LRS1. Configure the terminal session for:
 - Baud Rate = 9600
 - Data Bits = 8
 - Parity = None
 - Stop Bits = 1
 - Flow Control = None
4. A **Username>** prompt will be displayed. Enter username “system”. At the **Local>** prompt, enter the command “set priv”. Enter “system” as the password when prompted.

NOTE

The LRS1 comes with “EZCon” configuration software that runs under Windows 95 and Windows NT. This software can be used to configure the LRS1 instead of using a command line method. This procedure uses the command line method.

Set up the Network Information for the LRS1

1. Enter the following commands at the **Local>** prompt:

Local> DEFINE SERVER IPADDRESS 15.1.153.222*

** Example IP address. Use the IP address assigned to the LRS1 by your network administrator.*

Local> DEFINE IP SUBNET xxx.xxx.xxx.xxx

Replace x's with the Subnet mask assigned by your network administrator.

Local> DEFINE IP ROUTE DEFAULT NEXTROUTER
xxx.xxx.xxx.xxx 1

Replace x's with the Gateway address assigned by your network administrator.

Local> DEFINE PORT 1 ACCESS REMOTE

Local> DEFINE PORT 1 FLOW CONTROL NONE

2. Reboot the LRS1 by removing power and then applying power to the LRS1.

The boot-up sequence will take about two minutes.

NOTE

Telnet sessions will not be allowed to connect during the boot-up sequence.

Connect OSMF to the GPS Reference Source

1. The cable connection between the GPS reference source and the terminal server is via RS-232. Use a DTE-to-DTE interface cable to connect from the Remote Access Port (DB25) of the GPS reference source to the DB25 serial port of the LRS1.

A straight through RS-232 cable with a null modem adapter provides the correct interface connection. For an illustration of the LAN connection, see page A5-15. Refer to the LRS1-T Remote Access Server Installation Guide and the 55300A GPS reference source User's Guide for detailed RS-232 information.

2. Attach the 10Base-T LAN connector (RJ45) to the Ethernet port of the LRS1.

Test the LRS1 Connection

1. Telnet to the LRS1 unit from the OSMF workstation:

```
telnet xxx.xxx.xxx.xxx 2001
```

Replace x's with the LRS1 IP address.

2. You should see the prompt from the GPS reference source.
3. Press the “CTRL” and “]” keys to break the telnet session. Type “quit” to exit the telnet prompt.

NOTE

A telnet session may also connect to the default telnet port (23) which is the configuration port. When connected to this port, the configuration of the LRS1 may be viewed or changed.

For UNIX only: Configure the OSMF service port for GPS Reference Source

1. On the OSMF workstation, edit the */etc/services* file.
2. Change the line:

“gpsUnit 2001/tcp # SV-UX GPS Unit”

to

“gpsUnit 3001/tcp # SV-UX GPS Unit”

NOTE

The port for the gpsUnit must use 3001 which supports raw data flow on the LRS1. If using the NT OSMF, this procedure is not required. Other terminal servers may use a different service port.

3. The GPS reference source may now be managed from the OSMF platform.

Prepare 5071A for Operation

Set 5071A to continuous operation

After the 5071A has been operating for approximately 15 minutes, the amber Attention LED on the front panel goes off, and the green Continuous Operation LED starts flashing.

NOTE

Normally, the purpose of this LED is to indicate by flashing that power was lost during operation. A reset operation is necessary to make the LED stay on without flashing. When the Continuous Operation LED is on and not flashing, this indicates the frequency standard has been functioning continuously since the last reset.

Reset Continuous Operation LED:

1. Open the front-panel door to access the controls by turning the knob to the left and pulling out.
2. Press the blue **Shift** key, then **5** (Utilities). The display shows **>Reset<**.
3. Press the **Enter** key.
4. This action resets the continuous operation circuit, causing the LED to be on continuously. Any fault that occurs later will cause the Continuous Operation LED to start flashing or turn off.
5. For more information, refer to the *5071A Operating and Programming Manual*.

Configure 5071A output ports

The 5071A has two output frequency ports. These can be configured to output either 5 or 10 MHz. Determine what the system requires and configure the ports by following this procedure.

1. Press the **Top** key.
2. Select **>Config<** using the cursor keys and press the **Enter** key.
3. Select **>Outputs<** and press the **Enter** key.
4. Choose **Port 1** and press **Inc** or **Dec** key to select frequency.
5. Choose **Port 2** and press **Inc** or **Dec** key to select frequency.
6. Press **Top** key to return to the top of the menus.

Synchronize 5071A to 55300A

This procedure assumes that the sync system includes both the Symmetricom frequency standard and the GPS reference. Ensure that the GPS unit has achieved GPS Lock. An LED on the front panel will light to indicate that the GPS unit is properly tracking the reference signal from the GPS satellites. If an 55300A is not part of this installation, skip this procedure.

NOTE

If more than 30 minutes have elapsed since power-up and there is no indication of GPS lock, refer to the troubleshooting information in the *55300A GPS User's Guide*.

1. Connect a BNC cable from the 55320A 1 PPS connector (use the 1 PPS connector between the IRIG-B and 10 MHz connectors) to the Sync Input on the front panel of the 5071A.
2. Press the **Top** key.
3. Select **>Clock<** and press **Enter**.
4. Select **>Sync<** and press **Enter**.
5. Select **>Arm Front<** and press **Enter**.
6. The 5071A will then synchronize to the next sync pulse and the display will show, "Caught a sync pulse."
7. Press **Top** key to return to the top of the menus.
8. Disconnect the BNC cable.

Set the 5071A to display local time

This procedure assumes:

- 55300A is part of the sync system installation
 - You are displaying the current GPS time using SatStat as described on page E1-3.
 - If an 55300A is not part of this installation, determine the local time from another reference source.
1. On the 5071A, press the blue **Shift** key, then **8** (Set Clock).
 2. Using the numeric keys, enter the local time with the seconds value set in advance of current time so you can synchronize it with the seconds displayed by the GPS receiver (or another reference source).
 3. Press the **Enter** key on the 5071A at the instant the GPS seconds value (or the value from another reference source) agrees with the entered seconds value.
 4. Select **>Display<**.
 5. Press the **Inc** key to set Display to On and press **Enter**.

Prepare 55400A for Operation

Before beginning this procedure ensure that the SSU is showing “all green” status. No alarm LEDs should be lit.

NOTE

If the SSU has an alarm condition, go to chapter F1 and begin troubleshooting the problem.

Display the current SSU status using the 55450A local craft terminal software

Install the 55450A application to allow access to the SSU status and parameters. This software program is available from Symmetricom. The software is supplied with a user’s manual.

1. Refer to the 55400A Local Port connection for installation and troubleshooting in chapter A5. This section describes how to connect a computer to the 55400A, load, and run the local craft terminal software.
2. Once the 55450A application is running and successfully connects to the SSU, the program will query the settings of the 55400A and display the input settings on the Configuration screen that is selected by the program at start-up.

Verify SSU Configuration

There are configuration switches on all 55400A plug-in cards. The switch settings specify such parameters as:

- Disabling or enabling of input channels
- Type of input signal, signal coding, etc.

Many of these parameters can also be set via the local craft terminal program. All switches are set to default conditions at the factory. The default settings should have already been modified as needed.

1. On the **Configuration** screen, click on the **Input** tab, if not already selected.
2. Verify that the parameters are set as desired for:
 - Enabled
 - Signal Type
 - Signaling and CRC4 (if 2048 kbps signal)
 - PRC frequency

3. Make any additional selections for:
 - Priority
 - Sync Mode
 - Revertive
4. Click on **Include in Spread** if you want to include that channel in the performance measurement called Spread.

*All of the input features are described in the online help. The easiest way to access this information is to first verify that the **Input** tab is enclosed in a dotted-line box (click on the **Input** tab) and then press the **F1** key.*

5. Click on the **Output** tab.
6. Using the local craft terminal software you can selectively enable outputs, specify holdover action, set an SSM bit, and select output traffic bits.
7. For online help information, first verify that the **Output** tab is enclosed in a dotted-line box (click on the **Output** tab) and then press the **F1** key.

Set the SSU date and time

1. Using the menu bar, go to **Service>Set SSU Date and Time**.
2. Enter the local date and time in the format shown: YY-MM-DD,HH,MM,SS. Set the seconds value in advance of the current time and click on **OK** when synchronized with the 5071A or GPS time displays.

Set the SSU System ID

1. Using the menu bar, go to **Service>Set SSU System ID**.
2. Enter a name for the SSU. The system identifier can be up to 20 characters. For example, SSU_1, SSU_2, etc. The system name is shown with any communication there is with the SSU.
3. Disconnect from the SSU by going to the **Communication** screen and clicking on the **Connect** checkbox.

Configure the SSU for Network Operation

Before you can establish communication between the SSU and the Symmetricom open synchronization management framework (OSMF) software over a network, parameters and switch settings must be configured at the SSU.

NOTE

This procedure describes how to configure the SSU to communicate with the OSMF software over a TCP/IP protocol network. The configuration issues will be similar for the other supported network protocols. An illustration of the network connection is shown on page A5-7.

Prepare the 55442A NIMC LAN (TCP/IP) Card

1. If the NIMC is already installed in the subrack, loosen the two retaining screws and remove it.
2. Verify that the “Security” feature (switch S4–1) and “Force Enable Local Port” feature (Switch S4–3) are both set to the Off position.

The NIMC switch locations are shown in chapter D3.

3. Install the NIMC into the SSU subrack. Verify that the power LED is lit.
4. Establish communication with the SSU through the Local Port of the NIMC using the 55450A local craft terminal software as described at the beginning of the 55400A procedures in this chapter.
5. Verify the date and time setting by checking the time stamp on the Communication screen. Set the date and time, if necessary, using the pull-down Service menu.

Configure the Network Parameters

1. Create a new user with the name “svsec” and a security level of SECURITY.

Go to the Service menu and select “User Administration”. Click on “Add User”. Enter user name and select security level. Enter a password in both the “New Password” and “Confirm Password” boxes. This password will be used later when managing the SSU using the OSMF software.

NOTE

Passwords are case sensitive with up to ten characters, with at least one special character (such as a period, asterisk, ampersand, or percent) and at least one non-alphabetical character (such as a number). For example, “chess.1” is a valid password.

2. Verify that the Automatic Remote Output feature is configured correctly.

On the Communications screen, type the following command:

```
rtrv-eqpt:::1:::parameter=rmtao;
```

The RMTAO parameter should be set to ALWAYS. This is the default value. If necessary, send the following command to change the value:

```
ed-eqpt:::1:::rmtao=always;
```

3. Set the following network parameters to the values specified by the system administrator. To enter the values, use the Service menu and select “Configure NIMC TCP/IP”. The following table summarizes the parameters requiring configuration.

Table E1-1. Primary TCP/IP Network Parameters

Parameter Keyword	Description	Range of Values	Comment
IPNE	IP address of the SSU.	0.0.0.0 to 255.255.255.255	
IPSUBNET	Subnetwork mask used for extracting the network identifier from the IP address.	0.0.0.0 to 255.255.255.xxx *	* The last byte can only be set to 0 or 128.
IPGATE	IP address of the default gateway.	0.0.0.0 to 255.255.255.255	
IPEM1	IP address of the primary element manager.	0.0.0.0 to 255.255.255.255	
AOMERGE	Merges automatic output messages and commands on command port.	Set to N	
SCRAMBLE	Scrambles communication between SSU and OSMF.	Set to Y	

4. The following table summarizes the network parameters that should not normally require any changes to their default values.

Table E1-2. Secondary TCP/IP Network Parameters

Parameter Keyword	Description	Range of Values	Comment
IPEM2	IP address of the alternate element manager.	0.0.0.0 to 255.255.255.255	Must be set to 0.0.0.0 unless the Replication Option is installed as part of OSMF.
IPLM1	IP address of the primary local manager.	0.0.0.0 to 255.255.255.255	
IPLM2	IP address of the alternate local manager.	0.0.0.0 to 255.255.255.255	
PORTCMDS	Used to specify the port number for the command/response reporting	5001 to 20000 Must use 7588 as the default for OSMF.	Do not set to the same address as the automatic output port.
PORTAO	Use to specify the port number for the event reporting.	5001 to 20000 Must use 7589 as the default for OSMF.	Do not set to the same address as the command port.
INACTTIME	Used to specify the length of time a connection will continue without the occurrence of an auto output message.	0 to 10000 in units of 0.1 s.	

5. Click on the Apply button and confirm the changes when prompted.
6. Wait 1 minute for the NIMC to reboot, then disconnect from the SSU by going to the **Communication** screen and clicking on the **Connect** checkbox. Disconnect the Local port cable.

Perform the Final Steps

1. Remove the NIMC again from the subrack.
2. Set the “Security” feature (switch S4–1) and “Force Enable Local Port” feature (Switch S4–3) to the On position.

The NIMC switch locations are shown in chapter D3.

3. Install the NIMC into the SSU subrack and tighten the two retaining screws.
4. Attach the 10Base-T LAN connector. Verify that the Link LED is lit. The SSU is now configured to communicate with OSMF over the network.
5. When managing the SSU for the first time with OSMF, the IP address and password will need to be entered.

NOTE

If the “OSMF client package” is running or will be installed, switch S6–8 *must* be set to Off. When this switch is set to Off, the SSU will accept communications from any IP address.

If your situation requires that the SSU accept communication *only* from the OSMF host workstation address (IPEM1) or the replication system address (IPEM2), switch S6–8 should be set to On. When this switch is set to On, communications from all other addresses will be ignored, *including* client workstations.

E2

Equipment Tests

Sync system element testing

In This Chapter

This chapter includes the final tests for the components of the 55400A system. For both the 55300A GPS and the 5071A frequency standard, only checks to verify operation are included with pointers to other documentation if final acceptance testing needs to be performed on that equipment.

Topics included in this chapter are:

- Tests to verify operation of certain 5071A output signals

If it is necessary to perform complete acceptance tests for the frequency standard, refer to the 5071A Operating and Programming Manual.

- Tests to verify operation of certain 55300A output signals

If it is necessary to perform complete acceptance tests for the GPS reference source, refer to the 55300A GPS User's Guide.

- Final 55400A alarm tests and output checks

Testing results of the 55400A cards are included with the product. The results can be kept in the inside pocket of the system manual binder.

NOTE

The 55400A tests should also be performed on the 55409A mini-SSU.

Perform 5071A Tests

The following tests for the 5071A frequency standard provide a verification of operation. This is a cursory check for the presence of signals. If you wish to perform a more complete test of the 5071A output signals, you can refer to the performance tests provided in Appendix A of the *5071A Operating and Programming Manual*. The telecom signals are described in the *5071A Telecommunications Options Supplemental Manual*.

This section tests for the following signals:

- 5 or 10 MHz outputs
- Telecom option 2048 kbps signal
- Telecom option 2048 kHz signal

Test Equipment Needed

- 54600-series oscilloscope or equivalent general-purpose oscilloscope
- Type-N connector to BNC adapter
- 75 Ω feed-thru terminator (11094B)
- 50 Ω feed-thru terminator (11048C)
- 50 Ω BNC cable
- 75 Ω BNC cable

Before you begin

Ensure that the 5071A is operating properly. Verify this by observing that the Attention LED is off and the green Continuous Operation LED is on.

5 or 10 MHz Output

Two outputs provide a 5 or 10 MHz sinewave signal of 1 Vrms into 50 Ω , (nominal) on the rear panel of the 5071A.

1. Connect the 50 W feed-thru terminator to the oscilloscope input.
2. Connect the Type-N connector to Port 1 of the 5071A.
3. Connect the oscilloscope to Port 1 using the 50 Ω BNC cable and, verify that a 5 or 10 MHz output signal is present.
4. Repeat for Port 2.

Telecom Outputs

The 5071A with the Option 272 provides an ITU-T 2048 kbps framed output and 2048 kHz signal on the rear panel of the 5071A.

1. Connect the 75 Ω feed-thru terminator to the oscilloscope input.
2. Using the 75 Ω BNC cable, connect an oscilloscope to the Framed Output connector and verify that the appropriate signal is present. See Figure E2-2 and Figure E2-3.
3. Using the 75 Ω BNC cable, connect an oscilloscope to the 75 Ω Sync Out connector and verify that the appropriate signal is present. See Figure E2-4 and Figure E2-5.
4. Repeat for Output B.

Perform 55300A GPS Tests

The following tests for the 55300A GPS reference source provide a verification of operation. This is a cursory check for the presence of signals. If you wish to perform a more complete test of the 55300A output signals, you can refer to the acceptance tests provided in chapter 2 of the *55300A User's Guide*.

This section tests for the following signals:

- Telecom signals at outputs A and B
- 2048 kHz outputs (Squelched and Continuous)
- 10 MHz output

Test Equipment Needed

- 54600-series oscilloscope or equivalent general-purpose oscilloscope
- 75 Ω feed-thru terminator (11094B)
- 50 Ω feed-thru terminator (11048C)
- 50 Ω BNC cable
- 75 Ω BNC cable

Before you begin

Ensure that the 55300A is showing GPS Lock.

Telecom Outputs

The 55300A with the ETSI option provides two 2048 kbps outputs.

1. Connect the 75 Ω feed-thru terminator to the oscilloscope input.
2. Using a 75 Ω BNC cable, connect an oscilloscope to Output A and verify that an appropriate signal is present as shown in Figure E2-2 and Figure E2-3.
3. Repeat for Output B.

2048 kHz Outputs

When the 55300A is locked to GPS, both outputs are active. The output labeled “Squelched” will stop operating whenever the unit loses GPS lock.

1. Using a 75 Ω BNC cable, connect the oscilloscope to the 2048 kHz Squelched output and verify that an appropriate signal is present as shown in Figure E2-4 and Figure E2-5.
2. Repeat for the 2048 kHz Continuous output.

10 MHz Output

This output provides a 10 MHz sine wave signal greater than 1 volt into 50 Ω load.

1. Connect the 50 Ω feed-thru terminator to the oscilloscope input.
2. Connect the oscilloscope to the 10 MHz output using the 50 Ω BNC cable and verify that the signal is present.

Perform 55400A SSU Tests

Test Equipment Needed

- 54600-series oscilloscope or equivalent general-purpose oscilloscope
- 75 Ω feed-thru terminator (11094B)
- 50 Ω feed-thru terminator (11048C)
- 50 Ω BNC cable (for testing 55484A)
- 75 Ω BNC cable

Alarm tests

These tests will verify that certain simulated failures will generate the appropriate alarms.

A. Reference Switching

This test assumes that multiple inputs have been connected and qualified for use by the system. The loss of one of the inputs will be tested.

1. Disconnect the input signal being tracked.

The signal being tracked is indicated by the “Active” LED on the ITH card.

2. Observe LED response:

Both ITH cards—

- Qualified and Active LEDs for the reference signal removed turn off.
- Active LED for the reference signal now being tracked turns on.
- Alarm LED turns on.

IMC/NIMC—

- Minor alarm LED turns on.

3. Reconnect the input signal.

The response described assumes that the tracking mode is set to revertive and the reconnected signal is requalified before verifying the LED response.

4. Observe LED response:
Both ITH cards—
 - Qualified and Active LEDs for the requalified signal turn on.
 - Active LED for the reference signal no longer being tracked turns off.
 - Alarm LED turns off.
5. Press the Alarm Cutoff pushbutton to turn off IMC/NIMC alarm LED.

B. ITH Card Removal

This test verifies the alarm condition that would occur should the active ITH fail.

1. Remove the active ITH card.
2. Observe LED response:
Remaining ITH card—
 - Standby LED turns off, active LED turns on.Output cards—
 - ITH-selection LEDs switch to the remaining ITH card (1 or 2).IMC/NIMC card—
 - Major alarm LED turns on.
3. If Office Alarms are connected to the SSU, ensure that Major office alarms are generated (visual and audible).
4. Reinstall the ITH card.

This behavior assumes that it may be necessary to wait a period of time until the replaced ITH card is once again tracking an input signal. After reinstalling the ITH card, LEDs may cycle through “Warmup,” “Freerun,” and finally “Tracking.”

- Reinstalled ITH card—
- Standby LED turns on.
 - LED conditions will be the same as for the active ITH card.
5. Press the Alarm Cutoff pushbutton to turn off IMC/NIMC alarm LED.
 6. Press the Force Active pushbutton on the reinstalled ITH card to make this ITH card the active card as it was at the beginning of this procedure.

C. Output Card Removal

This test verifies that the simulated failure of an output card (of a 1:1 protected card pair) will cause the appropriate alarm indication.

1. Remove a standby output card.
2. Observe LED response:
IMC/NIMC card–
 - Major alarm LED turns on.
3. Reinstall the output card.
4. Observe LED response:
Output card–
 - Power, ITH card, and standby LEDs turn on.
5. Press the Alarm Cutoff pushbutton to turn off IMC/NIMC alarm LED.
6. Remove an active output card from a protected pair of cards.
7. Observe LED response:
Output card–
 - Remaining output card switches to active.
IMC/NIMC–
 - Major alarm LED turns on.
8. Remove second card of the protected pair of cards.
9. Observe LED response:
IMC/NIMC–
 - Critical alarm LED turns on.
10. Reinstall the two output cards.
11. Press the Alarm Cutoff pushbutton twice to turn off the alarm LEDs.

D. Securing the Card Assemblies

After completing the alarm tests, secure all the card assemblies to the subrack by tightening the mounting screws at the top and bottom of the front panels.

Output Checks

These tests verify that the outputs from the 55400A are operating according to specifications. At least one output from each card pair, or stand-alone card should be checked.

Equipment Setup

For each output tested, connect the output to the oscilloscope as shown in Figure E2-1.

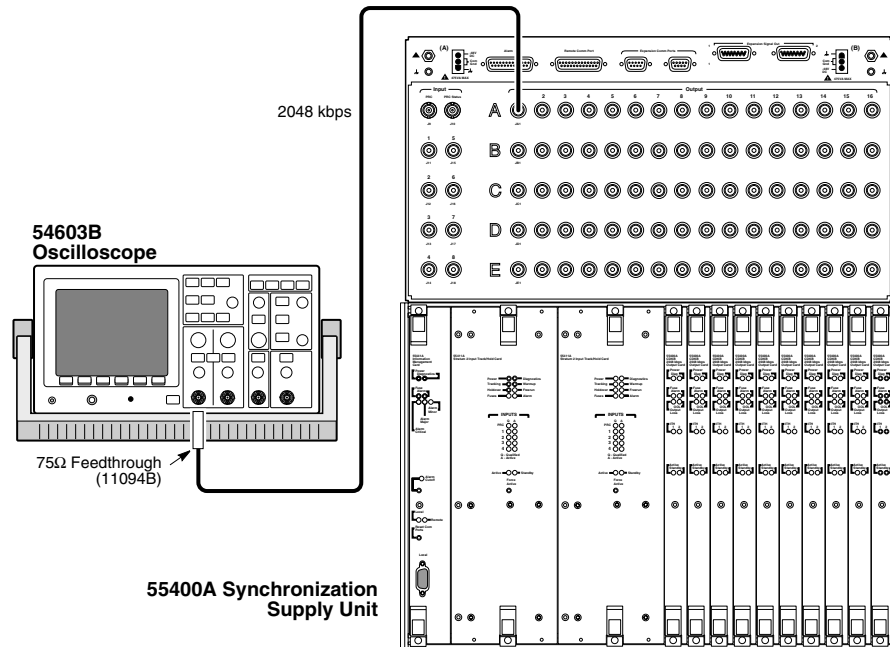


Figure E2-1. Output check equipment setup

55481A/B 2048 kbps Output Check

Use the 75 Ω feed-thru and the 75 Ω cable. Verify that the amplitude peak and pulse width of each output checked complies with the waveform shown in Figure E2-2 and Figure E2-3.

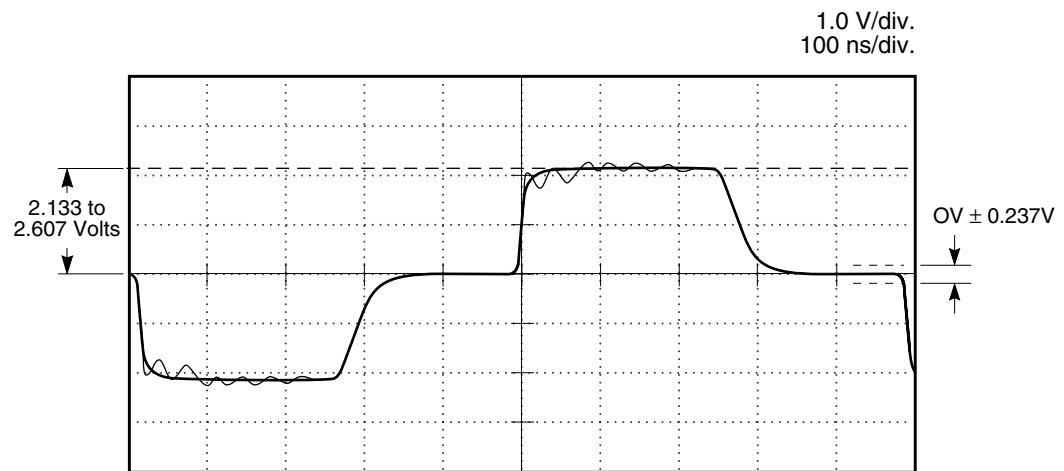


Figure E2-2. 2048 kbps Voltage Peak Test

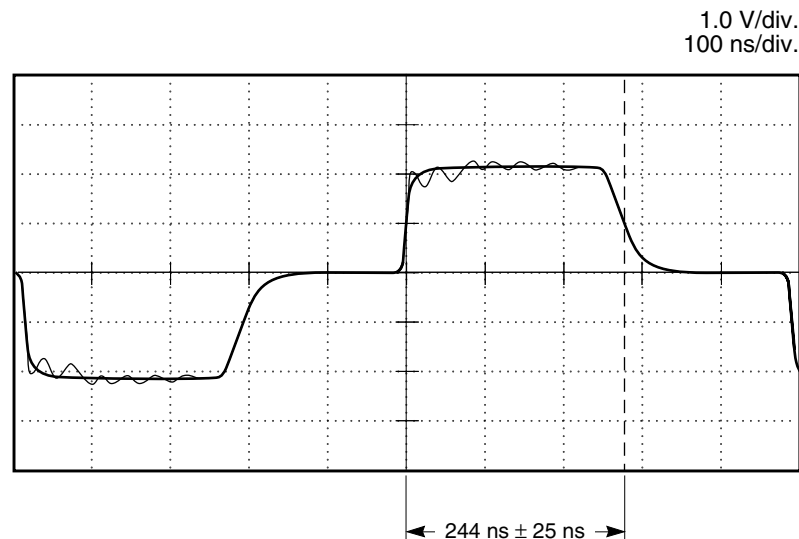


Figure E2-3. 2048 kbps Pulse Width Test

55482A 2048 kHz Output Check

Use the 75 Ω feed-thru and the 75 Ω cable. Verify that the amplitude peak and pulse width of each output checked complies with the waveform shown in Figure E2-4 and Figure E2-5.

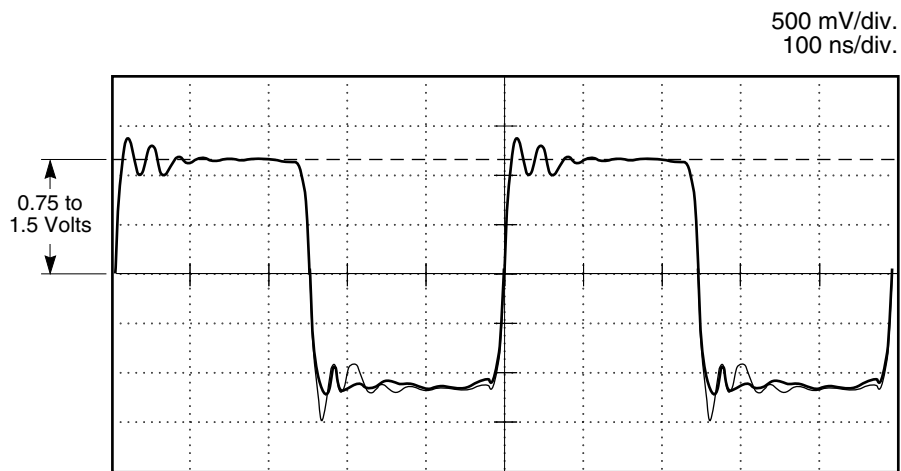


Figure E2-4. 2048 kHz Voltage Peak Test



Figure E2-5. 2048 kHz Pulse Width Test

55483A 64/8 kHz Composite Clock Output Check

Use this test to verify that the outputs are within specified requirements. At least one output from each card pair, or stand-alone card, should be checked.

Figure E2-6 shows a pinout for the patch panel and a wiring diagram for the connection to the oscilloscope.

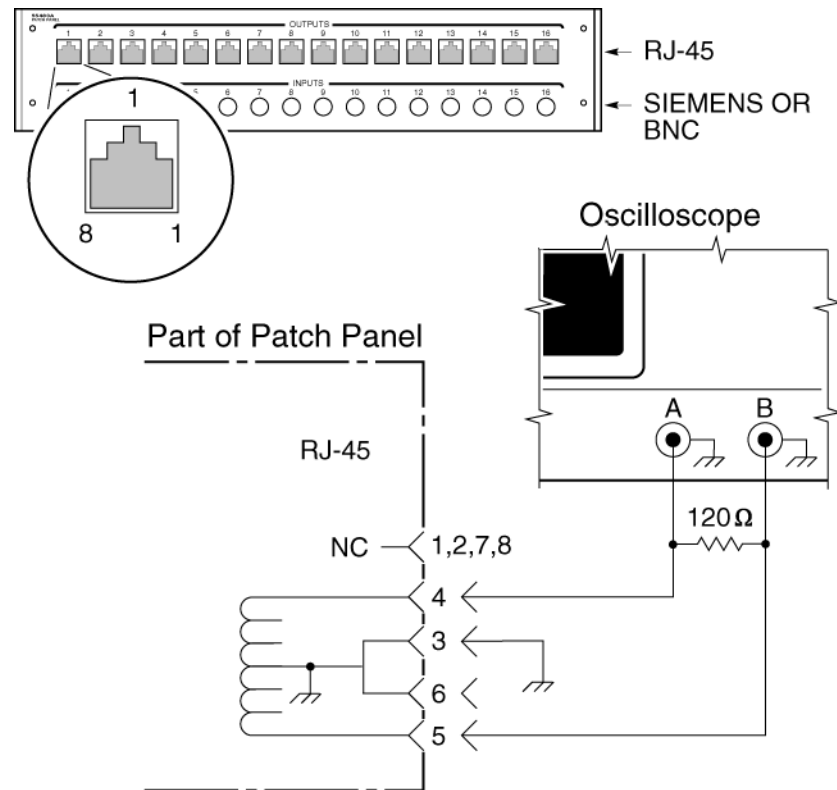


Figure E2-6. 64/8 kHz Composite Clock Test Setup

Testing the composite clock card

The composite clock card requires the use of the patch panel. It uses transformers to produce the balanced outputs. To measure the balanced signals from the patch panel, wire an RJ45 connector as follows (see Figure E2-6):

- Connect one wire from pin 4 at the patch panel to the center conductor of one oscilloscope input
- Connect one wire from pin 5 at the patch panel to the center conductor of another oscilloscope input

- Connect one wire from pin 3 or 6 (ground) at the patch panel to the outer conductor of both oscilloscope inputs
- Connect a 120 Ω resistor across the wires to the oscilloscope input center conductors
- Set the oscilloscope to A–B
- Use high impedance inputs (1 M Ω)

Balanced-output Testing

For each output checked, compare the output to Figure 5b and Figure 9/G.703 from ITU-T Recommendation G.703.

NOTE

The 55483A must be used with the patch panel in order to meet the requirements of ITU-T G.703.1 for balanced outputs.

55484A 1/5/10 MHz Output Check

Use this test to verify that the outputs are within specified requirements. At least one output from each card pair, or stand-alone card, should be checked.

NOTE

This card only provides eight outputs on subrack ports 9 through 16. Switch settings on the card select the output frequency. Refer to chapter D2 for details.

For each output tested, connect that output to an oscilloscope set as described for the configured output frequency. The three figures that follow show the waveform and mask for the three different output frequencies. Use the 50 Ω feed-thru and the 50 Ω cable.

The three waveforms shown on the following pages represent the 1:1 protected mode meaning that two 55484A cards are providing redundant operation for the eight outputs supported by this output card.

55484A 1 MHz Output

Verify that the signal at the output complies with the mask shown in Figure E2-7.

Set oscilloscope:

- Impedance = 50 Ω
- Sensitivity = 500 mV/div
- Timebase = 100 ns/div
- Holdoff = 40 ns

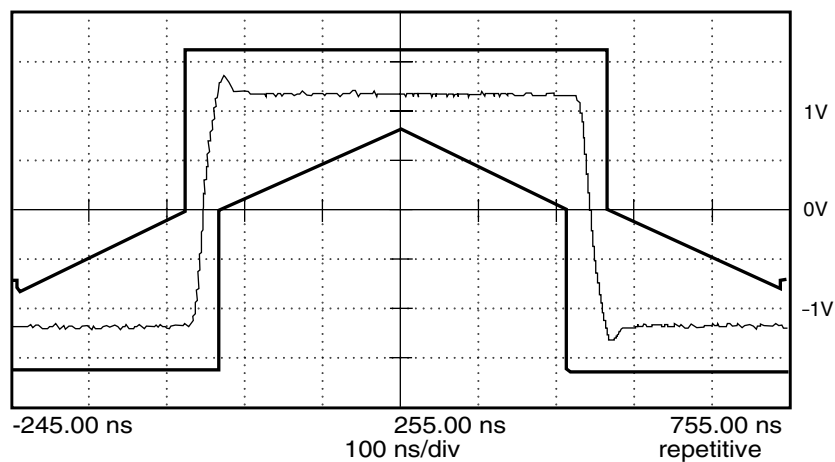


Figure E2-7. 1 MHz output

Verify amplitude and pulse width:

- Peak-to-peak value = 2.4 V $\pm$ 0.24 V
- Positive pulse width = 500 ns (nominal)

55484A 5 MHz Output

Verify that the signal at the output complies with the mask shown in Figure E2-8.

Set oscilloscope:

- Impedance = 50 Ω
- Sensitivity = 500 mV/div
- Timebase = 20 ns/div
- Holdoff = 40 ns

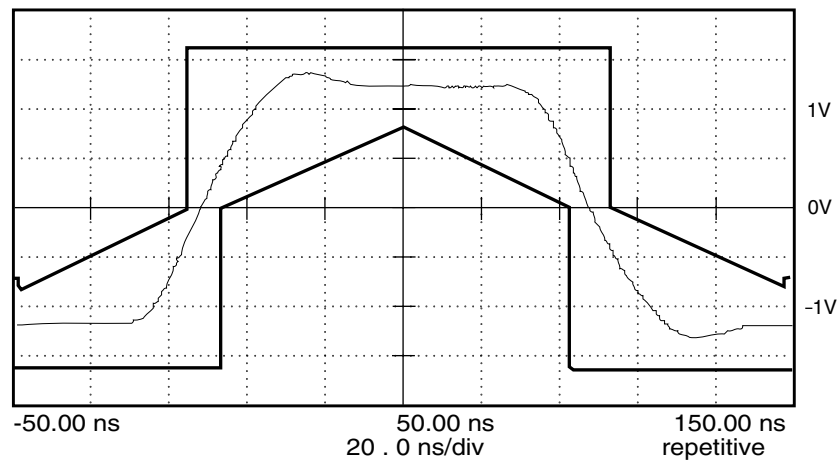


Figure E2-8. 5 MHz output

Verify amplitude and pulse width:

- Peak-to-peak value = 2.4 V $\pm$ 0.24 V
- Positive pulse width = 100 ns (nominal)

55484A 10 MHz Output

Verify that the signal at the output complies with the mask shown in Figure E2-9.

Set oscilloscope:

- Impedance = 50 Ω
- Sensitivity = 500 mV/div
- Timebase = 10 ns/div
- Holdoff = 40 ns

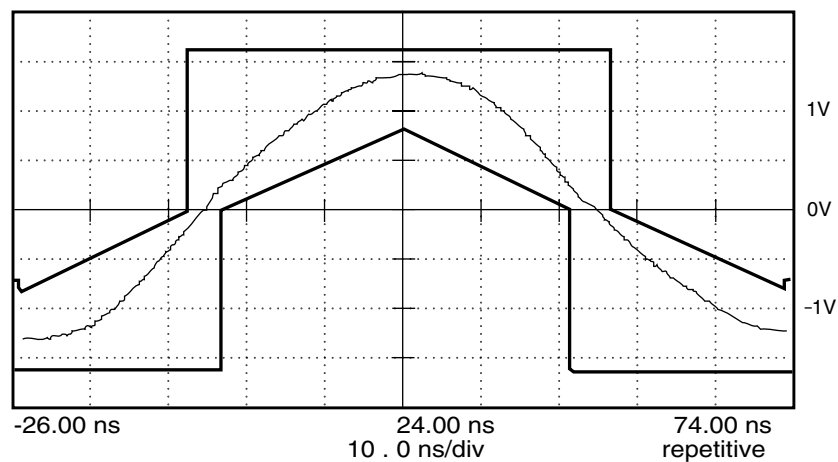


Figure E2-9. 10 MHz output

Verify amplitude and pulse width:

- Peak-to-peak value = 2.4 V $\pm$ 0.24 V
- Positive pulse width = 50 ns (nominal)

55485A/B 1544 kbps Output Check

Use this test to verify that the outputs are within specified requirements. At least one output from each card pair, or stand-alone card, should be checked.

NOTE

The 55485A provides only eight outputs on subrack ports 9 through 16. The 55485B provides 16 outputs.

For each output tested, connect that output to an oscilloscope set to high impedance (1 M Ω). Use a 75 Ω feed-thru as the test load impedance. Refer to Figure E2-10 and Figure E2-11 for the amplitude and pulse width expected.

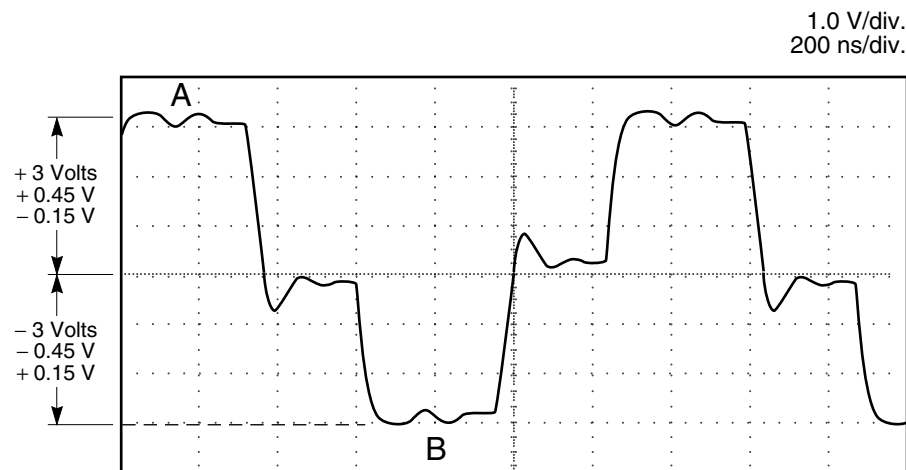


Figure E2-10. 1544 kbps Amplitude Test

Verify that the 1544 kbps signal has a positive amplitude (A) of 2.85 V to 3.45 V as shown in Figure E2-10.

Verify that the 1544 kbps has a negative amplitude (B) of -2.85 V to -3.45 V as shown in Figure E2-10.

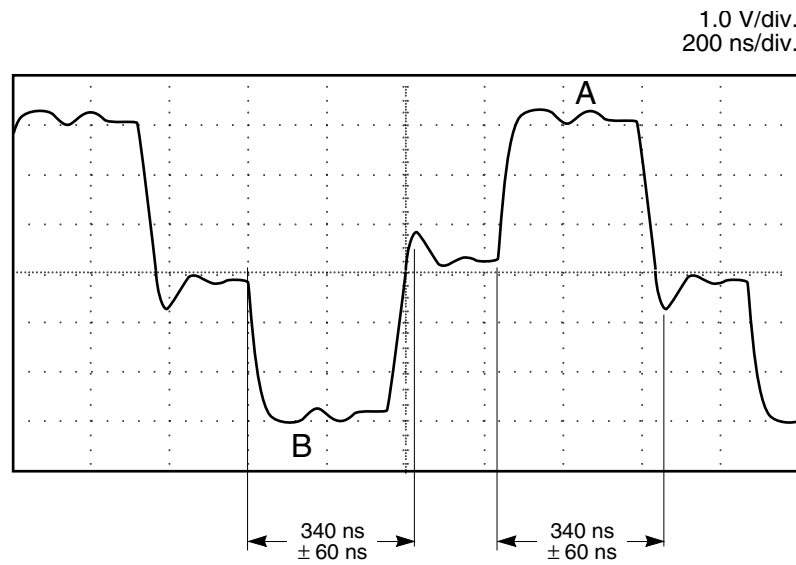


Figure E2-11. 1544 kbps Pulse Width Test

Verify that the 1544 kbps signal has a positive pulse width (A) of 280 ns to 400 ns as shown in Figure E2-11.

Verify that the 1544 kbps signal has a negative pulse width (B) of 280 ns to 400 ns as shown in Figure E2-11.

55488A 2048 kHz/2048 kbps Output Check

Since this card combines the functions of the 55482A and 55481B output cards, please refer to the test procedures in this chapter to verify the output signals. Use the 75 Ω feed-thru and the 75 Ω cable.

- For output ports 1 through 8 (2048 kHz), use test waveforms on page E2-12
- For output ports 9 through 16 (2048 kbps), use test waveforms on page E2-11

55471A Traffic Re-synchronization Output Check

SUMMARY This TRSC card accepts up to eight E1 input signals. Four signals can be re-timed by the card which removes jitter and wander, and four signals can be buffered. The buffer action makes the card useful as a repeater. No jitter or wander is removed, but the signal is restored to the proper amplitude levels, if attenuated.

NOTE

This test requires an E1 input signal. If a 55481A/B output card is part of the system, use one of its outputs for this test. The output signal format should be set to CAS with CRC-4 enabled.

Normally, each row of the subrack's connectors are outputs only. However, in the case of the TRSC, the row of connectors corresponding to the location of the TRSC is made up of both inputs and outputs, as specified in the table below.

Table E2-1. Traffic Re-synchronization Card Port Assignments

Retimed Channels	Subrack Input Port	Subrack Output Port	Buffered Channels	Subrack Input Port	Subrack Output Port
Channel 1	1	2	Channel 5	3	4
Channel 2	5	6	Channel 6	7	8
Channel 3	9	10	Channel 7	11	12
Channel 4	13	14	Channel 8	15	16

Use a 75 Ω Termination on Inputs

All TRSC inputs must be externally terminated with a 75 Ω termination:

Connect a feed-thru 75 Ω termination between the input signal cable and the TRSC input port.

These 75 Ω terminators are available from Symmetricom. Refer to chapter F3, "Replacement Parts."

NOTE

If using the TRSC in the mini-SSU subrack, the output modules have on-board 75 Ω terminations that can be selected with jumpers to eliminate the need for external terminators on the TRSC inputs.

Output tests

Prepare the Cards

1. If using an E1 output from the 55481A/B card, remove the card, or pair of cards if operating in a protected pair, from the subrack.
2. Record the switch settings for S1-2 and 3.
3. Set output card switches S1-2 and 3 to On for this test. This sets the E1 outputs to CAS with CRC-4.
4. Set TRSC switches S1-1 through S1-8 to On. This sets all four re-timed channels to CAS with CRC-4 enabled.
5. Set TRSC switch SS-2 to On. This sets the card to squelch any re-timed channel that loses and input signal.
6. Perform the following tests for each TRSC card, one channel at a time.

Output Mask Check

1. Connect an E1 output signal to a TRSC input using an external 75 Ω termination. Use the port assignments table to identify inputs and outputs on the subrack.
2. If it is a re-timed channel, check that all the LEDs for that channel (LOS, OOF, SLIP, and MSLIP) are off.
3. Check the output signal from the TRSC against the waveforms shown in Figure E2-2 and Figure E2-3.
4. Remove the signal from the TRSC input and verify that the output is squelched.
5. If it is a re-timed channel, observe that the Alarm and LOS LEDs are lit.
6. If it is a buffered channel, only the Alarm LED will be lit.
7. Repeat tests for all eight input channels.
8. Press the Force Active push-button on the standby TRSC and repeat this output check procedure.

AIS check

1. Disconnect any input signal to the TRSC.
2. Remove the TRSC cards and set switch S3-2 to Off for both cards. Re-install cards. This setting change will cause the TRSC to generate an AIS condition (unframed all ones) when no input signal is connected. Verify this by observing that an AIS signal is present on each output.
3. Press the Force Active push-button on the standby TRSC card and verify that an AIS signal is present on each output.

Disable all channels

1. Send the following TL1 command to disable channels 1-8.

```
ED-SYNC::Sn-OUTx-1&&8:1:::SQUELCH=Y
```

where n=number of the subrack and x= letter of the slot where the TRSC cards are located.

2. Confirm with the oscilloscope that channels 1-8 have been squelched.
3. Press the Force Active push-button on the standby TRSC card and verify that all outputs have been squelched.
4. Send the following TL1 command to enable channels 1-8.

```
ED-SYNC::Sn-OUTx-1&&8:1:::SQUELCH=N
```

5. Remove the TRSC cards and configure the switch settings as appropriate for the site installation. Disable and enable channels as appropriate. Return the switches on the 55481A/B cards to their original settings, if they were modified for the tests.

NOTE

Refer to chapter D2 for switch and configuration details for all output cards.

Connect Output Cables

After checking the outputs, you can connect the output signals to the downstream network elements requiring synchronization. See Figure B2-5 or Figure B2-6 for the recommended method of routing cables from the subrack.

Unused Outputs

NOTE

The default condition for the output cards is for all outputs to be enabled.

If you want to disable unused outputs, use the local craft terminal software (Configuration>Output) or the TL1 keyword SQUELCH.

Security

If access to the SSU needs to be restricted, enable the security feature. Security is set with a combination of a switch setting and parameters using TL1 commands or the local craft terminal software. See the getting started information in the *55400A TL1 Programming Reference Manual*.

F1

Troubleshoot the System

Isolate the problem and determine how to repair

In This Chapter

- Considerations and needs in order to troubleshoot the system
 - A procedure to isolate the failed system components
-

Before You Begin

This process assumes you are familiar with the components of the Symmetricom sync system and understand the tasks performed by each element.

If unfamiliar with the sync system, you should review chapter A1, “System Overview” before beginning. Additional details about how the SSU works are found in chapter A2, “System Description.”

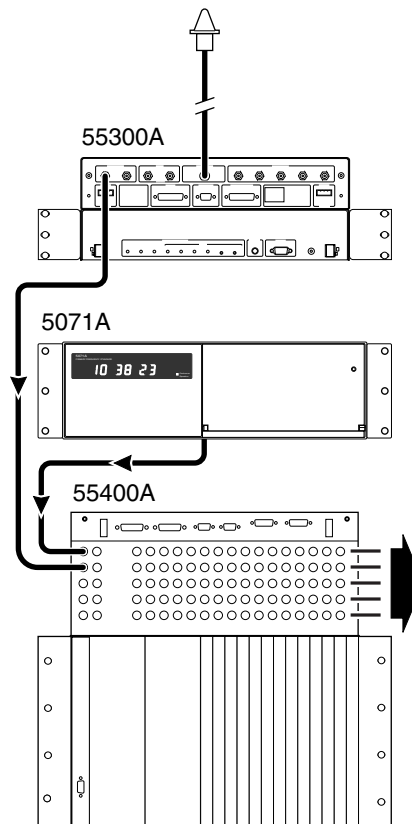


Figure F1-1. Symmetricom Sync System Components

Repair strategy for the sync equipment

- 55400A—plug-in module replacement, described in this manual
- 55300A—antenna system component or plug-in module replacement, described in *55300A Operating and Programming Manual*
- 5071A—repair strategy described in *5071A Operating and Programming Manual*

This chapter describes a troubleshooting process for the 55400A and 55300A. The 5071A documentation should be consulted if that unit has a problem.

This troubleshooting process assumes an IMC or NIMC card is part of the SSU system. The alternative Alarm Indication Card does not provide the capability to retrieve the system status that greatly improves the ability to isolate a problem with the system.

Summary of Troubleshooting Process

The troubleshooting process describes how to approach a system with a problem.

Guidelines for troubleshooting

NOTE

Before taking any action—take some time to observe the failure symptoms.

- Visually inspect the sync system
- Come to some initial conclusions
- Interrogate the status of the 55400A SSU and 55300A
- Review the event log
- Isolate the problem
- If you determine the problem is with the 55400A SSU, you will then refer to the next chapter in order to correct the problem and resume full service.
- If the problem is with the 55300A GPS, information for a first-level attempt at fixing the GPS unit is provided in this chapter. If this does not solve the problem, refer to the documentation for that product.
- If problem is with the 5071A cesium clock, refer to the documentation for that product.

NOTE

The 55400A troubleshooting information also applies to the 55409A mini-SSU.

REQUIRED TROUBLESHOOTING EQUIPMENT

In order to identify and understand problems with the Symmetricom sync system, the following items are required:

Computer

- Computer with RS-232 interface

Used for troubleshooting both the 55400A and 55300A.

55400A communication card

Two communication cards for the SSU have a connector (the Local Port) for connecting a computer that will simplify troubleshooting.

- 55441A Information Management Card (IMC)
- 55442A Network Information Management Card (NIMC)

Used for troubleshooting the 55400A.

Cable and Adapter

- RS-232 serial interface cable, 9-pin (female-female) (supplied with 55300A)
Available from Symmetricom as part number 5182-4794.

Used for connecting a computer to the 55300A or 55400A.

- Adapter, 9-pin (male-male) (supplied with 55300A)
Available from Symmetricom as part number 5181-6639.

Used for adapting the interface cable to the 55400A Local Port or the 55300A Port 1.

NOTE

The Symmetricom cable and adapter used with the 55400A can be replaced by an RS-232 serial interface cable, 9-pin (male-female).

Application Software

- 55450A local craft terminal software

Used to retrieve status information from the 55400A.

- SatStat program (supplied with 55300A)
Available from Symmetricom as part number 59551-13401.

Used to retrieve status information from the 55300A.

Troubleshooting Tool

- GPS handheld receiver
Available from Symmetricom as part number 59991A-T45.

NOTE

The GPS handheld must have a detachable antenna and provide +5V at its antenna connector.

Used to help isolate a problem with the 55300A.

Troubleshooting Process

The approach here is to try and reduce the number of failure possibilities before taking any steps that might further affect the supplying of timing service:

- ASSUMPTION** The sync system has been in service for some time so installation mistakes are not considered here as the possible cause of problems. If there are problems after installation, first review the installation procedures.
1. This process has you begin by observing the equipment to try and isolate the problem to a single piece of sync equipment.
 2. Once the offending equipment is identified, the equipment can usually provide some information about its condition.
 3. Then once the extent of the problem is better understood, appropriate action can be taken to repair the offending equipment.

The goal of this process is to help isolate the problem to a single piece of equipment and then point to more information on how to further troubleshoot that equipment.

CAUTION

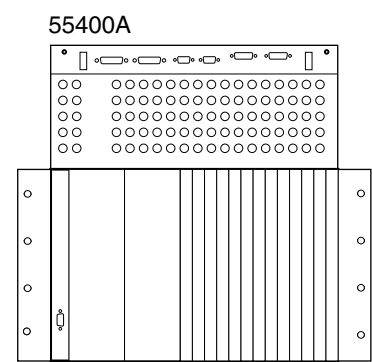
The 55400A provides signals vital to proper operation of communications networks. Improper service techniques can defeat the built-in redundancy, which can escalate a minor problem into one causing failure of the communications network.

Troubleshooting and servicing must only be performed by trained personnel with an understanding of the 55400 operation and in strict conformance to the procedures in this manual.

Overview of Main Sync System Elements

The sync system consists of timing references and a timing signal generator that accepts the references, evaluates and selects the reference to use, tracks and filters the reference before distributing it to multiple downstream network elements.

SSU Guidelines



The SSU is the most critical element in the sync system. It can continue to operate should it lose a reference. For example, if one of the references is lost, the SSU will automatically switch to using one of the remaining qualified references. Of course, this assumes that there are multiple reference signals supplied to the SSU from entirely separate sources. If all references are lost, the SSU will go into holdover mode.

CAUTION

Multiple references taken from a single 55300A GPS receiver or 5071A frequency standard do not satisfy the need for signals from independent sources. In this case, a failure of one unit could cause the loss of multiple input signals to the SSU resulting in holdover status.

The SSU is also the most complex and dynamic element in the sync system. It is continuously monitoring and judging the quality of input signals, its own internal conditions, as well as the state of its output signals. It is at the center of the sync system and usually is the first element in the system to realize a problem has occurred.

Input Guidelines

The input references to the SSU can originate from local clock sources, such as GPS or cesium, as well as from live traffic signals. There are two major components to the GPS unit: the antenna system and the receiver. With the aid of a handheld GPS receiver it is possible to isolate the problem to one or the other component. The cesium clock is a stand-alone reference. Information about other input references should be requested from the network administrator.

Output Guidelines

The SSU monitors its output cards for failures, but it cannot determine absolute signal quality of each output signal. In some cases, the downstream equipment may be detect a timing problem before the SSU.

1. Observe the sync equipment

The sync equipment can include the 55400A SSU, 55300A GPS, and the 5071A cesium clock.

OBSERVE Try to isolate the problem by observing which component of the sync system is in alarm.

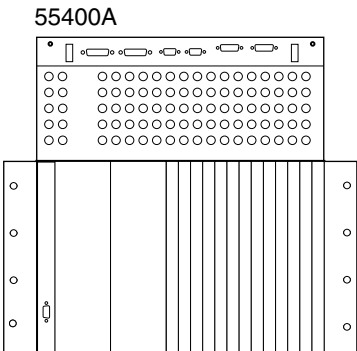
A red LED turns on to indicate an alarm condition in the 55400A and 55300A. An alarm condition in the 5071A is indicated with a yellow LED on its front panel display (Attention LED). Note which equipment is in alarm.

2. Silence the audible office alarms

Office alarms can be generated by any of the sync system equipment:

- 55400A SSU can communicate problems through its alarm connector on the master subrack
- 55300A GPS can communicate problems through its alarm connector on the GPS shelf
- 5071A frequency standard can communicate problems to the SSU through the PRC Status line and the 55442A Network IMC card when it is included in the master subrack. (This card includes a Rack Alarms connector that can be wired to pass alarms from equipment outside the SSU through the SSU to the office alarms.)
- SSU with Network IMC has rack alarm input which are used by other equipment to generate alarms in the SSU.

If 55400A SSU is in alarm



- SILENCE ALARM

If there is an audible alarm sounding, identify the equipment in the alarm state. If it is the SSU, press the Alarm Cutoff push button (ACO) on the 55400A communication card to silence the audible alarm.
- RESULT

Once the ACO push button is pressed, the audible alarm relay contacts return to the non-alarmed state. The Alarm Cutoff LED remains lit until the alarm condition is corrected.

If SSU alarm condition is cleared

If the alarm LED turns off, this indicates the condition that caused the alarm no longer exists. When this happens you should interrogate the SSU to determine and record what initially caused the alarm to occur.

- CONNECT PC

Connect a PC to the SSU Local Port (located on the IMC and NIMC card) and run the 55450A local craft terminal software.
- NOTE

Refer to chapter A5, “Local/Remote Management,” for instructions on how to connect and configure the computer, and run the software.
- Although only a terminal emulator program is needed to perform this procedure, it is recommended that you use the 55450A local craft terminal software to take advantage of the point-and-click interface.

- PREPARE TO SEND COMMAND

Once the application is running, establish a connection to the SSU. (A successful connection is indicated by the “Retrieving data...” message at the top of the application window.) Once connected, go to the **Communication** screen. Click the cursor inside the screen area.

- NOTE

If security is set on the SSU, you will need access to a valid user ID and password in order to complete the login to the SSU.

SEND COMMAND Type the following command string to retrieve the event log from the SSU. Include the number of the active ITH card, 1 or 2, to retrieve the most relevant events. The ‘;’ at the end of the line causes the command to execute:

```
rtrv-log::ith1:1::evttop;
```

RESULT The SSU will respond with the ten most recent events from the log and display them on the screen. This log is a chronological record of alarm events and cleared alarms. The events are retrieved in the order of last in, first out.

Information is displayed in the following sequence:

- Affected card—type and position
- Notification code—condition status
- Event—see chapter A4 for explanation
- Service Effect—SA (service affecting) or NSA (non-service affecting)
- Date and time of event
- Brief event description

IF NEEDED To retrieve the next ten messages, type the following command string.

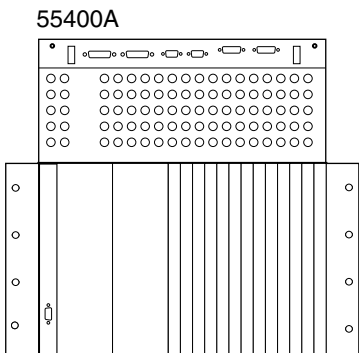
```
rtrv-log::ith1:1::evtcont;
```

RECORD FAULT Repeat this command as necessary. Record the occurrence of any recent failures that have been cleared.

If possible, copy and save the log data to a file for later reference. If it becomes necessary to return a plug-in card to Symmetricom for repair, this information should be included.

NEXT If no other problems exist, stop troubleshooting. Otherwise, continue.

Retrieve alarm and system status from 55400A SSU



- OBSERVE

The LEDs on the front panel of the plug-in module cards: Green LEDs indicate normal operation.
- CONNECT PC

If any alarm LEDs are on, connect a PC to the SSU Local Port (located on the IMC and NIMC card) and run the 55450A local craft terminal software.
- NOTE

Refer to chapter A5, “Local/Remote Management,” for instructions on how to connect and configure the computer, and run the software.
- PREPARE TO SEND COMMAND

Once the application is running, establish a connection to the SSU. (A successful connection is indicated by the “Retrieving data...” message at the top of the application window.) Once connected, go to the **Communication** screen. Click the cursor inside the screen area.
- NOTE

If security is set on the SSU, you will need access to a valid user ID and password in order to complete the login to the SSU.
- SEND COMMAND

Type the following command string. The ‘;’ at the end of the line causes the command to execute:

rtrv-cond:::1;

The SSU will respond with information about input signals, the ITH clock cards, and the output cards.
- REVIEW RESPONSE

Review the contents of the status report. Each event is described using its abbreviation and then a short phrase to specify more detail. Chapter A4 presents a typical cause for each event and suggestions for how to correct the problem causing the event, where appropriate.

What the SSU can indicate about its inputs

The SSU is continuously monitoring a variety of inputs, including reference signals, status input, and more. Table F1-1 summarizes the possible inputs and what the SSU checks.

Table F1-1. SSU-Monitored Input Conditions

Inputs to SSU	Conditions Monitored
5 or 10 MHz	minimum amplitude level, signal continuity, stability, and measurement performance
Status line	change of state indicating a problem with the PRC
2048 kHz	minimum amplitude level, signal continuity, stability, and measurement performance
2048 kbps	minimum amplitude level, signal continuity, stability, measurement performance, framing errors, and alarm indication signal
Power	Voltage level within operating range of SSU
Rack alarms	See rack alarms description below

Inputs from 55300A could include:

- 10 MHz
- 2048 kHz
- 2048 kbps

Inputs from 5071A could include:

- 5 or 10 MHz
- PRC status line
- 2048 kHz
- 2048 kbps

Inputs from other sources, such as traffic signals, could include:

- 2048 kHz
- 2048 kbps

Rack Alarms

If a Network Information Management Card (55442A) is the communication card contained in the SSU, the SSU can carry alarm information from equipment outside the SSU via the rack alarms connector.

Some of the messages the alarm lines carry have already been defined. Others just indicate an alarm number that can be assigned by the system administrator as needed.

All alarm lines have an assigned alarm severity level. Since it can be difficult to know exactly how this connector is being used, consult with the system administrator when rack alarms are used.

Rack Alarm Message Descriptions

The alarm descriptions listed in Table F1-2 will be retrieved from the SSU when the rack alarms are active. (For a pinout of the Rack Alarms connector, see chapter D3.)

Table F1-2. NIMC Rack Alarms Descriptions

Rack Alarm Description	Intended Use
Ext. Rack Power Alarm	Monitor power to the equipment rack
Ext. Cesium 2 Alarm	Monitor PRC status line from a second 5071A
Ext. GPS Reports Critical Alm	Monitor for critical alarm from GPS
Ext. GPS Reports Major Alm	Monitor for major alarm from GPS
External Rack Alarm 5	Monitor for a major alarm from specified equipment
External Rack Alarm 6	Monitor for a major alarm from specified equipment
External Rack Alarm 7	Monitor for a major alarm from specified equipment
External Rack Alarm 8	Monitor for a minor alarm from specified equipment

What the SSU can indicate about itself

The SSU is continuously monitoring itself for hardware faults, changes to operating conditions, changes to SSU card inventory, problems with communication within a subrack and between subracks, and the input being tracked.

What the SSU can indicate about SSU expansion subracks

The SSU will monitor for hardware faults and communications problems within subracks and between subracks.

What the SSU can indicate about the output signals

The SSU will monitor for hardware faults in the output cards, including failed outputs.

What the SSU cannot indicate about the output signals

When output ports are disabled, there is no alarm indication. If downstream equipment reports a loss of input signal, check if an output has been inadvertently disabled.

The easiest way to check output card port status is using the 55450A local craft terminal software.

Go to *Configuration>Output* in the application software.

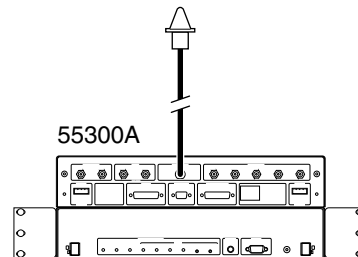
When the SSU enters holdover mode, depending on how the outputs are configured, the output cards will continue to supply a signal, go into AIS, or Squelch. Check the holdover action for each output card.

The easiest way to check output card port status is using the 55450A local craft terminal software.

Go to *Configuration>Output* in the application software.

Excessive noise on the output signals cannot be detected by the SSU. If such is suspected, use an oscilloscope to observe the signals at the SSU output.

If you have isolated the failure to the SSU, go to the next chapter to continue the troubleshooting.

If 55300A GPS is in alarm

SILENCE ALARM If an audible alarm is sounding, identify the equipment in the alarm state. If it is the GPS unit, press the Alarm Cutoff push button (ACO) on the GPS shelf to silence the audible alarm.

RESULT Once the ACO push button is pressed, the audible alarm relay contacts return to the non-alarmed state. The ACO Active LED remains lit until the alarm condition is corrected and the ACO Reset push button is pressed.

OBSERVE The LEDs on the front panel of the shelf: Green LEDs for **Power** and **GPS Lock** indicate normal operation.

CONNECT PC If any alarm LEDs are on, it is recommended that you connect a PC to the **Time of Day** port and run the SatStat software program to determine:

- the status of hardware components
- the state of the GPS synchronization

NOTE

Refer to chapter A5, “Local/Remote Management,” for instructions on how to connect and configure the computer, and run the software.

Isolate problem with 55300A GPS

CHECK ANTENNA SYSTEM If this GPS receiver is not tracking any satellites, according to the synchronization and acquisition portion of the SatStat screen, substitute the GPS handheld receiver in place of the 55300A by connecting the GPS antenna cable to the handheld receiver.

NOTE

The GPS antenna requires +5V from the 55300A to operate. The handheld receiver must be capable of providing +5V to the antenna.

ISOLATE GPS If the handheld receiver is able to track satellites, this indicates a problem with the 55300A. Determine if the power supply or the main board is defective as instructed in the *55300A GPS Primary Reference Source User's Guide*.

On the other hand, if the handheld receiver cannot track satellites, the main board assembly is probably good and the problem is with the antenna, or some component of the cable assembly between the antenna and the receiver.

CHECK ANTENNA If the handheld receiver cannot track satellites, connect the receiver directly to the antenna. If the handheld receiver can then track satellites, investigate the cable assembly. If the handheld receiver still cannot track satellites, replace the antenna and verify operation.

More extensive troubleshooting information can be found in the user's guide supplied with the 55300A.

If GPS alarm condition is cleared

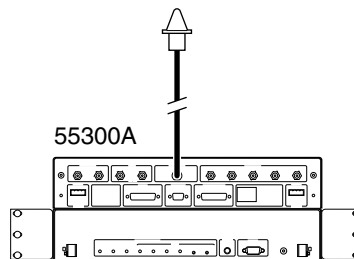
If the alarm LED turns off, this indicates the condition that caused the alarm no longer exists. When this happens you should interrogate the GPS unit to determine and record what initially caused the alarm to occur.

CONNECT PC Connect a PC to the GPS Port 1.

NOTE

Refer to chapter A5, "Local/Remote Management," for instructions on how to connect and configure the GPS and the computer. Only a terminal emulator program running on the computer is needed to perform this procedure.

Retrieve alarm status from 55300A GPS



SEND COMMAND Type the following command string to retrieve the event log from the SSU. The ';' at the end of the line causes the command to execute:

```
rtrv-log:::123::evttop;
```

RESULT The GPS will respond with the ten most recent events from the log and display them on the screen. This log is a chronological record of alarm events and cleared alarms. The events are retrieved in the order of last in, first out.

IF NEEDED To retrieve the next ten messages, type the following command string.

```
rtrv-log:::123::evtcont;
```

RECORD FAULT Repeat this command as necessary. Record the occurrence of any recent failures that have been cleared.

If possible, copy and save the log data to a file for later reference. If it becomes necessary to return this product to Symmetricom for repair, this information should be included.

NEXT If no other problems exist, stop troubleshooting.

If 5071A Cesium Clock is in alarm

5071A



OBSERVE The two LEDs to the right of the time display on the front panel: The **Attention** LED is off and the **Continuous Operation** LED is on to indicate normal operation.

NEXT If the **Attention** LED is on or is flashing, refer to the operating and programming manual supplied with the 5071A equipment for more information. The cesium clock has a fault.

More extensive troubleshooting information can be found in the operating and programming manual supplied with the 5071A.

3. Retrieve status from the sync equipment in alarm

At this point, the audible alarms have been silenced and alarm conditions still exist.

If the 55400A SSU shows any active alarms, retrieve its conditions first. Many times, the SSU status can help isolate problems from other equipment. The next step is to retrieve the event conditions from the SSU.

NOTE

Several of the troubleshooting steps here require use of a PC running application software in order to interrogate the equipment. Follow instructions in chapter A5 to connect the computer, verify communication settings, and run the software referenced here.

Summary

At this point, the problem should have been isolated to one of the three elements of the Symmetricom sync system. If the equipment at fault was either the GPS or cesium frequency standard, the instructions were to consult the documentation included with that product.

If an element of the SSU has failed, refer to the next chapter. It is likely that the failed module has been identified by following the troubleshooting process in this chapter. The next chapter presents information on replacing the failed module.

F2

Troubleshoot the SSU

Determine cause of problem and fix it

In This Chapter

- SSU repair strategy
- LEDs help troubleshoot hardware failures in cards
- How to replace the plug-in cards

Before You Begin

If the problem with the SSU has not yet been isolated to a particular plug-in card, it is recommended that you first perform the SSU troubleshooting procedures in the previous chapter.

NOTE

If the SSU is remotely managed, notify the network management center before beginning any field service.

Before taking any actions to remove cards from the SSU, STOP and analyze the situation. Because of the redundant nature of the SSU, failures can exist and the system can still provide network timing signals.

CAUTION

Although the SSU cards are fully redundant when used in protected pairs, the following field service guidelines must be followed during card replacement. Failure to follow these guidelines can result in severe phase hits, large frequency errors, or complete loss of SSU output signals. The guidelines are summarized here:

- > *Never remove an unprotected ITH card*
- > *Never remove an unprotected output card*
- > *Never force an ITH card into the active mode when it is in freerun mode*
- > *Never remove an active ITH card*
- > *Never remove an active output card*
- > *Never remove or insert cards without wearing an ESD wrist strap*

Central Element—the SSU

The heart of the Symmetricom sync system is the SSU. It accepts input reference signals from equipment and provides output timing signals to downstream network elements.

NOTE

This chapter assumes that you have already performed the SSU troubleshooting procedures in chapter F1. This chapter also applies to the 55409A mini-SSU.

Repair Strategy for the SSU

The 55400A consists of modular circuit board assemblies designed for replacement in the event of failure. Depending on the specific type of card being replaced (ITH, Output, IMC/NIMC), the replacement procedure can be simple or slightly more complicated. This chapter describes those procedures.

TIP Remember:

- The ITH card or output card should be in standby mode before removal.
- Replace a card with one of the same type.
- If replacing a Network IMC, the network parameters must be configured on the replacement card.

If you plan to return a card to Symmetricom for repair, remember to include as much information as possible about the failure condition observed. This should include the specific LEDs that were lit by the failure and a printout of the SSU event log and conditions retrieved, as instructed in the previous chapter. Review the information requested for the failed assembly at the end of this chapter.

Understand the Architecture of the SSU

The 55400A SSU is a modular, fully-redundant timing distribution unit for 2048 kbps telecommunications networks. The SSU tracks up to nine incoming reference signals, qualifies these inputs, filters them, and distributes up to 400 precise timing signals. Incoming reference signals may come from cesium standards, GPS receivers, non-traffic E1 signals, or live traffic signals.

The SSU modules can be divided into three major categories: Input Track and Hold cards, output cards, and alarm management cards.

Within an SSU subrack, ITH cards are typically grouped in redundant pairs. Only one ITH card is active at any time with the second ITH card in standby mode. If the active ITH card should fail, the standby ITH card will automatically become active and the failed card will be placed in standby mode. The ITH cards contain an internal oscillator for holdover operation when all incoming references are lost.

Output cards are also usually grouped in protected pairs. Alarm management cards operate without backup because they are not required for input tracking or output signal generation.

Architecture summary

- ITH cards—rely on the backplane of the subrack in order to receive the input signals and power. The ITH cards operate independently of the output cards and the alarm management card.
- Output cards—rely on the ITH cards for all reference and timing signals. The backplane supplies all power.
- Alarm management card—receives status information from all the other cards. Its power is taken from the backplane.

TIP If all output cards are in alarm, suspect the ITH cards. If both ITH cards are in alarm, suspect the input signals.

TIP Fix any problems with ITH cards before troubleshooting output cards. The output cards receive reference and timing signals needed for proper operation from the ITH cards. ITH card failures can cause output card failures.

Safety Considerations

The 55400A system has been designed in accordance with international safety standards. This manual contains information, notes, cautions, and warnings which must be followed to ensure safe installation and operation. Installation and maintenance procedures requiring access to equipment input, output, and power connections are for use by service trained personnel only.

Electrostatic Discharge (ESD) Considerations

- Use a tested ESD wrist strap connected to one of the banana-plug jacks on the front panel when handling cards.
- Store cards in static-safe packaging supplied with the products.

Good Practices when Replacing SSU Cards

1. Before installing any card, set switches on the replacement card the same as the card being replaced.
2. If you are replacing an ITH card, carefully follow the replacement procedure in this chapter.
3. Never remove an active ITH card. Always set the other ITH card to the active mode first and then remove the standby card.
4. Never remove an active output card because a phase error on the outputs will occur.
5. When replacing a Network Information Management Card, you must reconfigure the network parameters via the Local Port. Refer to chapter D3 for details.
6. Be aware of possible operating differences or limitations when replacing a card with another that has a different letter designation. For example, the 55481B can be configured to carry a data traffic pattern that includes one zero. Replacing a 55481B with a 55481A (this card can only carry all ONES) can (depending on the firmware revision in the ITH cards) either force the traffic pattern of the 55481B to all ONES (firmware version prior to 3744H) or cause the 55481A to go off-line and generate an alarm condition (firmware version 3744H and later). Review the chapters on individual output cards for any incompatibilities between “A” and “B” cards.

Tools and Equipment Required

- screwdrivers
- oscilloscope and 75 Ω cable terminator
- digital multimeter
- 55450A local craft terminal software

Firmware Recommendations

It is recommended that all firmware in the different SSU cards be the same revision. The firmware version currently running in the SSU can be determined by sending the appropriate command as explained in the next section, “Check SSU Communication.” Contact Symmetricom regarding both released firmware versions and newer versions.

Local installation: Instructions for installing the firmware using the local craft terminal software are part of that application’s online help.

Remote installation: Contact Symmetricom regarding instructions for installing the firmware using OSMF.

Fuse Replacement

Each SSU plug-in card uses unique fuses which feature a “blown fuse” indicator position and a fuse alarm LED on its front panel. When the fuse opens due to excessive current, a spring-loaded arm is released which then completes an electrical circuit to illuminate the front-panel fuse LED.

If the fuse LED is on, remove the card and replace the fuse with the same type and amperage-rating color code. If the fuse opens a second time, replace the card.

NVRAM Replacement

See chapter F3.

Check SSU Communication

NOTE

This procedure assumes that the communication card in the master subrack is an IMC or NIMC.

Sometimes it is useful to know that all the cards in the system can communicate properly.

CONNECT PC

Connect a PC to the SSU Local Port (located on the IMC and NIMC card) and run the 55450A local craft terminal software.

NOTE

Refer to chapter A5, “Local/Remote Management,” for instructions on how to connect and configure the computer, and run the software.

Although only a terminal emulator program is needed to perform this procedure, it is recommended that you use the 55450A local craft terminal software to take advantage of the point-and-click interface.

**PREPARE TO SEND
COMMAND**

Once the application is running, establish a connection to the SSU. (A successful connection is indicated by the “Retrieving data...” message at the top of the application window.) Once connected, go to the **Communication** screen. Click the cursor inside the screen area.

NOTE

If security is set on the SSU, you will need access to a valid user ID and password in order to complete the login to the SSU.

SEND COMMAND Type the following command string to retrieve the basic equipment information from the SSU. The “;” at the end of the line causes the command to execute:

```
rtrv-netype-all:::1;
```

RESULT This command string retrieves inventory information from the SSU. Each installed plug-in card will be identified by model number and firmware version (if the card carries firmware). This command also verifies the ability of the SSU to communicate with each card in the master subrack, as well as those cards in any expansion subracks. Include this information with any SSU system card returned for repair.

NOTE

It is recommended that the firmware in all the SSU cards be the same revision.

SEND COMMAND Type the following command string. The “;” at the end of the line causes the command to execute:

```
rtrv-cond:::1;
```

The SSU will respond with information about the status of the input signals, the ITH clock cards, and the output cards.

Diagnosing Alarms

SSU events and alarms are closely related, yet there is a significant difference. Events are conditions that occur in the 55400A or are detected by the 55400A. Alarms are a subset of these events which have been configured using TL1 commands or the local craft terminal software to generate an alarm indication.

Although the SSU is capable of generating many alarm conditions, only a handful of SSU alarms can be cleared by replacing a card. Most SSU alarms are due to operating conditions and are not necessarily indications of equipment failures.

Alarms are divided into three severity levels: Minor, Major, and Critical. The default alarm setting for each event is listed in Table A4-1 on page A4-8. Most events can be configured to generate either a Minor, Major, or Critical alarm. These alarm severity levels are defined as follows:

- A minor alarm indicates that an event has occurred that does not yet affect the SSU quality of service. No immediate action is required.
- A major alarm indicates that an event has occurred that may affect the SSU quality of service. A major alarm is often used to indicate that the active equipment has failed and the standby equipment is now operating. The failed equipment should be replaced promptly to prevent the service from being affected.
- A critical alarm indicates that an event has occurred that has affected the SSU synchronization service. Immediate action is required to restore service.

Front-panel Indicators

Each card has its own Alarm LED. When a card detects an alarm, it will illuminate its Alarm LED. Since the card may be detecting the failure of other equipment, further troubleshooting is required to determine the cause of the alarm. **Do not replace a card just because its Alarm LED is on.**

For example, the Input loss of signal (INPLOS) event can be configured to generate a minor alarm if a reference source is not connected to an enabled SSU input channel. The proper corrective action would be to either connect a suitable reference source to the input channel or to disable the unused input. It would be incorrect to replace the ITH card for this alarm.

ITH Cards

SUMMARY Each ITH card receives the input reference signals, determines their quality for use by the system, and selects the most appropriate input signal to use as the active reference. In normal operation, the on-card oscillator will “track” the active input signal, and the ITH card will produce a precise frequency for the output cards based on the reference. If that reference is disqualified, the ITH card will select a remaining qualified input signal as the reference until that signal is disqualified or the system is forced to use another input signal. In the event that all input references fail, the ITH card goes into holdover mode using its own oscillator as the system reference.

For more information on the ITH cards, refer to chapter D1.

ITH Modes of Operation

ITH cards have four modes of operation: Warmup, Freerun, Tracking, and Holdover. When an ITH card is first powered on, it will be in Warmup mode for five to ten minutes. During Warmup mode, the oscillator oven is heated to the operational temperature. The ITH card does not track inputs nor supply synchronization when it is in the Warmup mode.

After Warmup mode completes, the ITH card enters Freerun mode for one to ten minutes until the ITH card can qualify the input reference signals. Before this, the ITH card does not have sufficient input tracking history to go into Holdover mode. During Freerun mode, a free-running local oscillator on the active ITH card provides the reference for the system. So the ITH does provides a synchronization output, but it is not locked to any of the reference inputs when in the Freerun mode.

After Freerun mode completes, the ITH card enters Tracking mode. This mode is the normal operating mode. During Tracking mode, the ITH card qualifies one or more inputs and locks to the highest priority input.

If all inputs become disqualified, the ITH card will enter Holdover mode. The ITH card will continue to supply synchronization, but this output is subject to the drift characteristics of the internal oscillator. Holdover mode is only available if an input has been tracked for at least ten minutes. Prior to this, the ITH card will enter Freerun mode if all inputs become disqualified.

ITH Troubleshooting Procedure

Identify any lit alarm LEDs on the front of the ITH cards. Red LEDs indicate a card has an alarm condition. The ITH card provides two levels of troubleshooting:

- Card failure conditions corrected by replacing a fuse or a card
- Failure modes used by a service technician to repair a card

Both troubleshooting levels are described here, although it is intended that troubleshooting in the field should be limited to only replacing a fuse or a failed card.

OBSERVE Indicator LEDs on the ITH plug-in card modules

Check front panel of ITH card for alarm indication and find that alarm condition in Table F2-1.

NOTE

If both the active and standby LEDs for an ITH card are off, this indicates that the ITH card has gone offline. This indicates a serious problem with the ITH card. Do not press the Force Active push button when an ITH card is offline. A loss of synchronization outputs can result.

ITH Card LED Conditions

The following table gives a description of the LED indicators.

Table F2-1. ITH Card LED Indicators

Indicator	Mode	Meaning
Power (Green LED)	Normal	Power is present
Tracking (Green LED)	Normal	ITH card is tracking a qualified input
Holdover (Red LED)	Alarm	ITH oscillator, using recent tracking data from a qualified reference, is providing the output frequency. No qualified references are available.
Fuse (Red LED)	Alarm	Card fuse is open
Diagnostics (Yellow LED) On continuously or blinking	Diagnostic	Used to indicate specific failure conditions for the service technician. See following tables for specific ITH card failures.
Warmup (Yellow LED)	Warmup	The oscillator oven is warming to operating temperature and the card is not active yet.
Freerun (Red LED)	Alarm	The card is generating an output, but without the use of any tracking information from a reference.
Alarm (Red LED)	Alarm	A failure has occurred on the card.
Inputs: Q=Qualified (Green LED)	Normal	The associated reference input is qualified and available for tracking.
Inputs: A=Active (Green LED)	Normal	The associated reference input is in use for tracking.
Active (Green LED)	Normal	This card is the synchronization signal source for all output cards.
Standby (Green LED)	Normal	This card is generating an output that is phase-locked to the output of the other (active) ITH card. The standby card will immediately become active upon command, or when the active ITH card fails.

Repair Indications

Follow the directions here based on the LED alarm showing.

HOLDOVER LED If Holdover LED is lit, verify that both ITH cards are in holdover.

If both cards are in holdover, investigate the input signal quality. If only one card is in holdover:

1. Ensure that the ITH card still qualifying input signals is the active card.
2. If the ITH card entered holdover mode because the performance measurements disqualified the inputs, use the INIT-REG command to clear the performance measurements for each disqualified input. The ITH card should requalify the inputs, provided the input signals meet the specified measurement criteria. Refer to the 55400A TL1 Programming Reference Manual for the INIT-REG command details.
3. Monitor the performance of the SSU.

FREERUN LED If both cards are in freerun, investigate the input signal quality. If only one card is in freerun:

1. Ensure that the ITH card still qualifying input signals is the active card.
2. If the ITH card entered freerun mode because the performance measurements disqualified the inputs, use the INIT-REG command to clear the performance measurements for each disqualified input. The ITH card should requalify the inputs, provided the input signals meet the specified measurement criteria. Refer to the 55400A TL1 Programming Reference Manual for the INIT-REG command details.
3. Monitor the performance of the SSU.

FUSE LED Remove card and replace fuse. Some transient condition may have caused the fuse to open. If a replacement fuse should fail, replace this ITH card.

The fuse is located near the rear edge of the card. Unplug the failed fuse and replace with one of the same type and value.

ALARM LED This LED indicates that some failure condition has occurred. This LED along with one, or more, of the others will help isolate the cause of the failure.

DIAGNOSTIC LED The diagnostic LED, along with one or more of the other ITH LEDs can indicate specific hardware failures to the service technician. Refer to the following table for the failure modes indicated by a combination of illuminated LEDs on the card.

ITH CARDS WITH DIFFERENT VERSIONS OF FIRMWARE Behavior: Istate transfer takes approximately ten minutes to complete, instead of less than one minute. Whenever an ITH card with unmatched firmware is inserted into the subrack, it can take an additional ten minutes before the ITH card will qualify any inputs. During this time, there will be an alarm indicated on the active ITH card. This alarm occurs because the Istate is not identical in both ITH cards. Do not remove either ITH card. Do not press the Force Active push button during this period.

ITH CARDS DISAGREE Because the two ITH cards operate independently and come to separate conclusions about the quality of each input signal, there can be instances when the two ITH cards disagree. This condition will raise an alarm.

Reasons why the ITH cards may disagree:

- One of the monitored characteristics is on the edge of acceptability
- A difference in local oscillator operating points causes the input signal to be outside the pull-in range of one card and within the pull-in range of the other
- Different firmware versions in the ITH cards
- A hardware problem exists with one ITH card

Actions to take:

- Retrieve the alarm conditions from each ITH card and compare the results

```
rtrv-cond::s0-ith1:1;
```

```
rtrv-cond::s0-ith2:1;
```

One ITH card will show a disqualified input that the other does not show. Look for other events that do not appear for both cards.

If the alarm event is INPOOF (Input loss of framing) or INPAIS (Input AIS), the problem could be with the signal level of the input signal.

- Check the amplitude of the questionable input signal

If the alarm event is INPLOS (Input loss of signal), the cause could be the input level or a hardware problem.

- Check the amplitude of the questionable input signal

If an input is disqualified as the result of a measurement,

- Verify that the threshold is set correctly
- Compare the measurements from the two ITH cards
- Send the INIT-REG command to restart the measurements

If ITH card needs replacement

Follow the directions under, “Replace an ITH Card.”

Service Technician Failure Modes

The only field repair work recommended by Symmetricom for the SSU is replacement of fuses and faulty cards. The two tables in this section localize failures to specific components for the Symmetricom repair technician.

ITH Card Start-up Failure Modes

The table below summarizes the failures that can occur on power-up.

Table F2-2. ITH Card Start-up Failure Modes

When	Condition	Cause
At start-up	Diagnostic LED on continuously	Diagnostic testing in progress
	Diagnostic LED is blinking, all other LEDs are off	ITH switch settings have been copied to NVRAM of ITH cards in subrack. Action: Remove ITH card with blinking LED, set S5–7 to On, and reinsert card.
	Diagnostic LED is blinking and alternating with: Tracking LED Holdover LED Freerun LED	+ 5 Vdc supply out of limits + 12 Vdc supply out of limits – 12 Vdc supply out of limits
	Diagnostic LED is blinking at a 1-second rate and: PRC Qualified LED on PRC Active LED on Input 1 Qualified LED on Input 1 Active LED on Input 2 Qualified LED on Input 2 Active LED on Input 3 Qualified LED on Input 3 Active LED on Input 4 Qualified LED on Input 4 Active LED on	CPU test failed DUART test failed SRAM data test failed SRAM address test failed NVRAM data test failed NVRAM address test failed E1 framer chip test failed on main board E1 framer chip test failed on auxiliary board/10.2 MHz cable test failed phase monitor FPGA load test failed DDFS FPGA load test failed

ITH Card Operating Failure Modes

The table below summarizes hardware operating failures.

Table F2-3. ITH Card Operating Failure Modes

When	Condition	Cause
During operation	Diagnostic LED on continuously and: PRC Qualified LED on PRC Active LED on Input 1 Qualified LED on Input 1 Active LED on Input 2 Qualified LED on Input 2 Active LED on Input 3 Qualified LED on Input 3 Active LED on Input 4 Qualified LED on Input 4 Active LED on	+ 5 Vdc supply failure + 12 Vdc or – 12 Vdc supply failure VCXO adjustment at minimum limit VCXO adjustment at maximum limit Oscillator oven failure FPGA failure Stack overflow EXTSYNC error Reserved Reserved

Replace an ITH Card

The ITH cards are those that most directly affect the ability of the SSU to supply timing signals. Any time one needs to be replaced, extra care should be taken to ensure that timing signals from the SSU are not interrupted.

Once you have isolated the failure to the ITH card, ensure you have an appropriate replacement. In most cases, this means using an ITH card of the same model number containing the same firmware version as the card being replaced. The mixing of two different types of ITH cards is supported for certain combinations of cards as described in chapter D1, “Configure ITH Clock Cards.”

The procedure that follows describes how to replace an ITH card that has failed.

NOTE

Although the easiest way to make changes to operating SSU cards is with the 55450A local craft terminal software. The changes here deal with setting switches which ensure that the two cards are in agreement. This lessens the chance that the two cards ever get into a situation where one card accidentally writes its switch settings to the other card, this being contrary to what was intended.

1. Remove the failed ITH card

NOTE

When replacing an ITH card in a system that is in service, be sure that the card being replaced is in the standby mode (DO NOT remove the active card).

- a. Always wear a properly-grounded ESD wrist strap when removing or inserting SSU cards.
- b. Using the Phillips-head screwdriver, loosen the six screws holding the card in place. If a screw is lost, review the Replaceable Parts chapter for information on how to order more.
- c. Remove the ITH card assembly from the subrack.

2. Set switches

- a. Set the switches on the replacement card to be the same as the card it is replacing.
- b. Check that switch S5–7 is set to “On.” This setting ensures that the parameter settings from the active ITH card will automatically be copied into the memory of the replacement card when it is installed.
- c. Transfer the serial number plate on the side of the ITH card assembly from the old card to the new card.

3. Plug in replacement card

- a. Carefully insert the ITH card into the subrack.
- b. Ensure that the card assembly is in proper alignment with its mating backplane connector.
- c. Push the card assembly into place until it is fully seated into the backplane connectors without any binding or jamming.
- d. Wait five seconds.
- e. Remove the ITH card so it slides away from the backplane connector. (This step is necessary to clear an “NVRAM failed” alarm.)
- f. Carefully re-insert the ITH card into the SSU.
- g. Tighten the six screws used to secure the card in the subrack.

4. Observe

- a. The self-test routine will execute.
- b. Wait until the ITH card completes the warm-up period and successfully completes the qualification of inputs. This can take from 2–20 minutes.
- c. Verify that any alarm conditions are cleared after pressing the alarm cutoff push button on the communication card several times. The SSU should be in an all-green LED mode.

Output Cards

SUMMARY The 55400A can hold up to ten output cards. When configured in the recommended 1:1 protected mode, the cards work in pairs. Each pair of cards can provide up to 16 outputs of timing signals for network elements.

For information on the output cards, refer to chapter D2.

Output Card Troubleshooting Procedure

Repair ITH cards before beginning this procedure. Identify any lit alarm LEDs on the front of the output cards. Red LEDs indicate a card has an alarm condition. If the fuse LED is lit, remove the card and inspect the fuse. Replace the fuse with the same type and value. If the replacement fuse should fail, replace the card.

Output Card LED Conditions

The following table provides a description of the LED indicators.

Table F2-4. Output Card LED Indicators

Indicator	Mode	Meaning
Power (Green LED)	Normal	Power is present
Diagnostics	N/A	Not supported by card
Fuse (Red LED)	Alarm	Card fuse is open
Alarm (Red LED)	Alarm	A failure has occurred on the card
Output Loss (Red LED)	Alarm	An active output has failed
OOL=Out of Lock (Red LED)	Alarm	The on-card phase-lock loop is unlocked
ITH 1 (Green LED)	Normal	The output card is tracking ITH 1 card
ITH 2 (Green LED)	Normal	The output card is tracking ITH 2 card
Active (Green LED)	Normal	The output card is providing outputs signals
Standby (Green LED)	Normal	The output card is ready to take over should the active output card fail

Other Output Card LED Error Conditions

All output cards include the LED indicators described in the previous table. But one of output cards contains additional LEDs to inform the customer of conditions detected with the special functions provided by this card. The 55471A traffic re-synchronization card (TRSC) is different from the other output cards because it alone accepts input signals directly to the card. Be aware that there are improper configuration settings that can cause an alarm condition without any kind of actual failure.

Refer to chapter D2 for more information on the TRSC card.

55471A Alarm Events

When troubleshooting this card, it is important to understand how the card operates. Read about this card in chapter D2.

Any activity on the LOS, OOF, SLIP, or MSLIP indicators on this card refers to the input and output channels that make up this card. Investigate the input signals to the card and the switch configuration before replacing the card to fix a problem.

Example of configuration causing alarm condition: The alarm LED will remain lighted until signals are connected to all input channels that are enabled. The default condition for the TRSC is all channels enabled. Disable unused channels.

Replace an Output Card

Once you have isolated the failure to the output card, ensure you have an appropriate replacement. In most cases, this means an output card of the same model number as the remaining card in the system.

The procedure that follows describes how to replace an output card that has failed.

1. Remove the failed output card

NOTE

When replacing an output card in a system that is in service, be sure that the card being replaced is in the standby mode. DO NOT remove the active card. Phase hits on the SSU outputs will occur.

- a. Always wear a properly-grounded ESD wrist strap when removing or inserting SSU cards.
- b. Using the Phillips-head screwdriver, loosen the two screws holding the card in place. If a screw is lost, review the Replaceable Parts chapter for information on how to order more.
- c. Remove the output card assembly from the subrack.
- d. If the card is under warranty, send card to Symmetricom or call Symmetricom. Follow the directions for returning a card at the end of this chapter.

2. Set switches

- a. Set the switches on the replacement card to be the same as the card it is replacing.
- b. If the replacement card has no front panel, transfer the front panel from the old card to the new card.

3. Plug in replacement card

- a. Carefully insert the output card into the subrack.
- b. Ensure that the card assembly is in proper alignment with its mating backplane connector.
- c. Push the card assembly into place until it is fully seated into the backplane connectors without any binding or jamming.
- d. Tighten the two screws used to secure the card in the subrack.

4. Observe

- a. The self-test routine will execute.
- b. Verify that alarm condition is cleared after pressing the alarm cutoff push button on the output card.

IMC/NIMC Cards

SUMMARY The SSU supports two cards for providing information about the SSU to the external environment. Both of the communication cards can report system alarms at the front panel, but then the two cards can also support computer and/or network connections for much more extensive management capabilities.

Communication Card Types

- 55441A—Information Management Card (IMC)—handles alarm information plus provides for computer communication via local and remote serial ports for data reporting and control
- 55442A—Network Information Management Card (NIMC)—handles alarm information plus provides a local communication port and a network connection.

One of these two cards is installed in the master subrack. It is the left-most card as you face the subrack.

For information of the communication cards, refer to chapter D3.

Communication Card Troubleshooting Procedure

Identify any lit alarm LEDs on the front of the communication cards. Red LEDs indicate a card has an alarm condition. If the fuse LED is lit, remove the card and inspect the fuse. Replace the fuse with the same type and value. If the replacement fuse should fail again, replace the card.

NOTE

The Alarm LED indicates a failure on this card. The three alarm levels (Critical, Major, Minor) indicate the level of alarm in the subrack as a whole.

The following tables give a description of the LED indicators on the communication cards. The first table is for the AIC; the next one covers the IMC and NIMC. In addition, there is a table that can be used by a Symmetricon repair technician to help isolate a hardware failure.

IMC/NIMC LED Conditions

The following table gives a description of the LED indicators.

Table F2-5. IMC/NIMC Card LED Indicators

Indicator	Mode	Meaning
Power (Green LED)	Normal	Power is present
Diagnostics (Yellow LED) Blinking	Diagnostic	Used to indicate specific failure conditions. See tables below for failure modes.
–48 V Fail A (Red LED)	Alarm	–48 Vdc (A) input is below normal voltage level
–48 V Fail B (Red LED)	Alarm	–48 Vdc (B) input is below normal voltage level
Fuse (Red LED)	Alarm	Card fuse is open
Alarm (Red LED)	Alarm	A failure has occurred on the card.
Alarm Critical (Red LED)	Alarm	A critical alarm state exists in the master or expansion subracks.
Alarm Major (Red LED)	Alarm	A major alarm state exists in the master or expansion subracks.
Alarm Minor (Red LED)	Alarm	A minor alarm state exists in the master or expansion subracks.
Alarm Cutoff (Red LED)	Alarm	Audible or visual alarm was present. Audible alarm has been silenced; alarm state persists.
Local/Remote (Green LED)	Normal	A user is logged on
Link (Green LED)	Normal	Link shows that network connection is active. (NIMC only)
Data Xmit (Green LED)	Normal	Data Xmit shows data transfer (NIMC only)

Service Technician Failure Modes

The only field repair work recommended by Symmetricom for the SSU is replacement of fuses and faulty cards. The following table helps isolate failures of specific components for the Symmetricom repair technician.

Table F2-6. IMC/NIMC Card Start-up Failure Modes

When	Condition	Cause
At start-up	Diagnostic LED on continuously	Diagnostic testing in progress
	Diagnostic LED is blinking and: Local LED on Remote LED on	CPU, SRAM, or NVRAM test failed DUART test failed

Replace a Communication Card

The communication cards have no direct impact on the ability of the SSU to supply timing signals. As a result, you should first repair the ITH cards and the output cards before you deal with the communication card.

Once you have isolated the failure to the communication card, ensure you have an appropriate replacement. In most cases, this means a communication card of the same model number and option number with the same version of firmware.

NOTE

Remember that an NIMC has most likely previously been installed on a network. Part of the replacement procedure will be to configure the network parameters in the new card to the same values as the card being replaced. This requires a knowledge of the original settings established for the card.

1. Remove the failed communication card

NOTE

Depending on the failure condition of the card, it may be possible using the 55450A local craft terminal software to retrieve the network parameter settings when replacing an NIMC. Otherwise the system administrator will need to provide this information.

- a. Always wear a properly-grounded ESD wrist strap when removing or inserting SSU cards.
- b. Remove any cables connected to the communication card.

- c. Using the Phillips-head screwdriver, loosen the four screws holding the card in place. If a screw is lost, review the replacement parts chapter for information on how to order more.
- d. Remove the communication card assembly from the subrack.

2. Set switches

- a. Set the switches on the replacement card to be the same as the card it is replacing.
- b. If the replacement card has no front panel, transfer the front panel from the old card to the new card.

3. Plug in replacement card

- a. Carefully insert the communication card into the subrack.
- b. Ensure that the card assembly is in proper alignment with its mating backplane connector.
- c. Push the card assembly into place until it is fully seated into the backplane connectors without any binding or jamming.
- d. Wait five seconds.
- e. Remove the communication card so it slides away from the backplane connector. (This step is necessary to clear an “NVRAM failed” alarm.)
- f. Carefully re-insert the communication card into the SSU.

4. If replacing a Network IMC do this step, otherwise go to 5.

- a. Connect PC to Local Port. Refer to chapter A5 for more information.
- b. Configure card for network operation using the local craft terminal software. Refer to chapter D3 for more information. If it is not possible to determine the network parameters, carefully remove U50 (NVRAM) from the failed card and insert it into the replacement card. This will transfer the existing network parameters to the new card.
- c. Tighten the four screws used to secure the card in the subrack.

5. Observe

- a. The self-test routine will execute. Wait approximately two minutes.
- b. Verify that any alarm conditions are cleared after pressing the alarm cutoff push button on this card several times.

6. Last Step

- a. Reconnect any cables to the communication card.
- b. For a Network IMC, verify that the network connection operates properly. The Link LED should be on.
- c. The SSU should be in an all-green LED mode.

Replacing Expansion Subrack Cards

The expansion subrack cards include the following:

- Expansion Synchronization Card
- Expansion Communications Card

This procedure describes how to replace the expansion sync or comm card that has failed.

1. Remove the failed card

- a. Always wear a properly-grounded ESD wrist strap when removing or inserting SSU cards.
- b. Using the Phillips-head screwdriver, loosen the screws holding the card in place. If a screw is lost, review the replacement parts chapter for information on how to order more.
- c. Remove the failed card assembly from the subrack.
- d. If the card is under warranty, send card to Symmetricom or call Symmetricom. Follow the directions for returning a card at the end of this chapter.

2. Set switches

- a. Set the switches on the replacement card to be the same as the card it is replacing.
- b. If the replacement card has no front panel, transfer the front panel from the old card to the new card.

3. Plug in replacement card

- a. Carefully insert the card into the subrack.
- b. Ensure that the card assembly is in proper alignment with its mating backplane connector.
- c. Push the card assembly into place until it is fully seated into the backplane connectors without any binding or jamming.
- d. Tighten the two screws used to secure the card in the subrack.

4. Observe

- a. The self-test routine will execute.
- b. Verify that any alarm conditions are cleared after pressing the alarm cutoff push button on the card several times.

Return Procedure for Cards

Contact your Symmetricom sales or service representative when you need to return a faulty 55400A plug-in card.

When returning a card for repair. Include as much information as possible about the failure condition. This should include the specific LEDs that were lit, a printout of the SSU event log and conditions retrieved, as instructed in the previous chapter.

When returning a defective assembly to Symmetricom, please include the following information to ensure a proper repair:

- Date
- Company name
- Submitter's name
- Contact phone or e-mail address
- Product serial number
- Whether the unit is from a recently installed system that has not yet been put into service or an existing system that has been in service
- A printout of the SSU event log and conditions retrieved, as captured in the previous chapter

NOTE

Replacement cards include a Failure Detail Form. Fill out this form while troubleshooting the failed card and send it back with the defective card

The next chapter covers the replacement parts for the SSU plug-in cards.

F3

Replacement Parts

SSU and mini-SSU replacement parts

In This Chapter

This chapter contains replacement part information for the 55400A SSU and mini-SSU. Consult the documentation supplied with the 55300A GPS reference source or the 5071A frequency standard for part information about those products.

The 55400A SSU consists of many individual products each carrying its own part number. The parts listed here are the recommended replacement parts for your SSU.

Contact Information for Parts Ordering

Contact your Symmetricom sales or service representative when you need to order a replacement part.

Firmware

The following SSU system elements contain firmware:

- IMC and NIMC communication cards
- ITH cards
- Expansion Comm cards
- Expansion Sync cards

NOTE

Although newer versions of firmware are backwards-compatible with older versions, it is strongly recommended that you use the same firmware version in all cards, especially the two ITH cards. This configuration is tested at the factory.

NVRAM Replacement

A number of the SSU and mini-SSU cards contain a non-volatile memory used to store such items as parameter settings, event log, and network addresses. The device retains data for a minimum of 10 years in the absence of external power. The NVRAM component on the card is installed in a socket to allow easy replacement.

Table F3-1. NVRAM Replacement Part for SSU and mini-SSU

Assembly	Description	Part Number
all except output cards	NVRAM	1818-4441

NOTE

If the NVRAM failure is on a network IMC, the network parameters will need to be configured again (see chapter E1).

55400A SSU Replacement Parts

ITH Cards

Table F3-2. 55400A ITH Card “A” Model Replacement Parts

Assembly	Description	Part Number
55411A Std.	stratum-2	55411-69100
55411A Opt. 001	stratum-2	55411-69101
55412A Std.	transit node	55412-69100
55412A Opt. 001	transit node	55412-69101
55413A Std.	local node	55413-69100
55413A Opt. 001	local node	55413-69101
55414A Std.	enhanced stratum-2	55414-69100
55414A Opt. 001	enhanced stratum-2	55414-69101
All	2A fuse	2110-1125
All	termination jumper	1258-0141

Table F3-3. 55400A ITH Card “B” Model Replacement Parts

Assembly	Description	Part Number
55411B Std.	stratum-2	55411-69110
55411B Opt. 001	stratum-2	55411-69111
55412B Std.	transit node	55412-69110
55412B Opt. 001	transit node	55412-69111
55413B Std.	local node	55413-69110
55413B Opt. 001	local node	55413-69111
55414B Std.	enhanced stratum-2	55414-69110
55414B Opt. 001	enhanced stratum-2	55414-69111
55415B Std.	enhanced transit node	55415-69110
55415B Opt. 001	enhanced transit node	55415-69111
55429B	Mini-SSU local node	55429-69110
All	3A fuse	2110-1000
All	termination jumper	1258-0141

Output Cards

Table F3-4. 55400A Output Cards Model Replacement Parts

Assembly	Description	Part Number
55471A (2A fuse)	traffic re-sync	55471-69001
75 Ω feed-thru termination for 55471A inputs	Siemens 1.6/5.6 connectors	Call factory
75 Ω feed-thru termination for 55471A inputs	BNC connectors	1250-2002
55481A	2048 kbps	55481-69001
55481B (1A fuse)	2048 kbps	55481-69003
55482A (1A fuse)	2048 kHz	55482-69003
55483A (2A fuse)	64/8 kHz composite clock	55483-69001
55484A (8 outputs, 2A fuse)	1/5/10 MHz	55484-69001
55485A (8 outputs, 2A fuse)	1544 kbps	55485-69001
55485B (16 outputs, 1A fuse)	1544 kbps	55485-69002
55488A (1A fuse)	2048 kHz/2048 kbps	55488-69003
	1A fuse	2110-1129
	2A fuse	2110-1125

Communication Cards

Table F3-5. 55400A Communication Cards Replacement Parts

Assembly	Description	Part Number
55431A	alarm card	55431-69001
55441A	information management card	55441-69001
55442A Standard	LAN network information card	55442-69001
55442A Option 002	X.25 network information card	55442-69002
55442A Option 003	TP4 network information card	55442-69004
All	1A fuse	2110-1129

Expansion Subrack Cards

The expansion subracks use a sync card and comm card.

Table F3-6. 55400A Expansion Subrack Cards Replacement Parts

Assembly	Description	Part Number
55419A	sync card	55419-69001
55443A	communication card	55443-69001
All	1A fuse	2110-1129

BALUNs

Baluns are needed on the SSU inputs and outputs for 120 Ω balanced operation.

Table F3-7.

SSU Connector Type	Balun Part Number
BNC	11250-2735
Siemens 1.6/5.6	1250-2739

55409A Mini-SSU Replacement Parts

ITH Card

The following table contains the replacement ITH cards available for the 55409A mini-SSU.

Table F3-8. 55409A ITH Card Replacement Parts

Assembly	Description	Part Number
55429B	local node	55429-69110
	3A fuse	2110-1000
	termination jumper	1258-0141

NOTE

The 55429B has the same performance as the 55413B and is only intended for use with the 55409A mini-SSU. The only functional difference is that the 55429B supports a total of three input references, including the PRC input.

Input/Output Modules

The following table contains the replacement I/O modules available for the 55409A mini-SSU.

Table F3-9. 55409A ITH Card Replacement Parts

Assembly	Description	Part Number
55497A with BNCs	output module	55497-60001
55497A with micro Siemens	output module	55497-60002
55498A with BNCs	input/output module	55498-60001
55498A with micro Siemens	input/output module	55498-60002

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