Symmetricom

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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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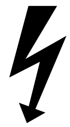
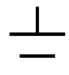
Warning Symbols That May Be Used In This Book

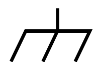
Instruction manual symbol; the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual.



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.

Contents

In This Manual

B1 Tools and Equipment

B2 Equipment Rack

B3 Equipment Requirements

E1 Qualification Procedures

E2 Equipment Tests

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
	Signal connectors	description	C4
Qualify for operation	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 (cont'd)

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.

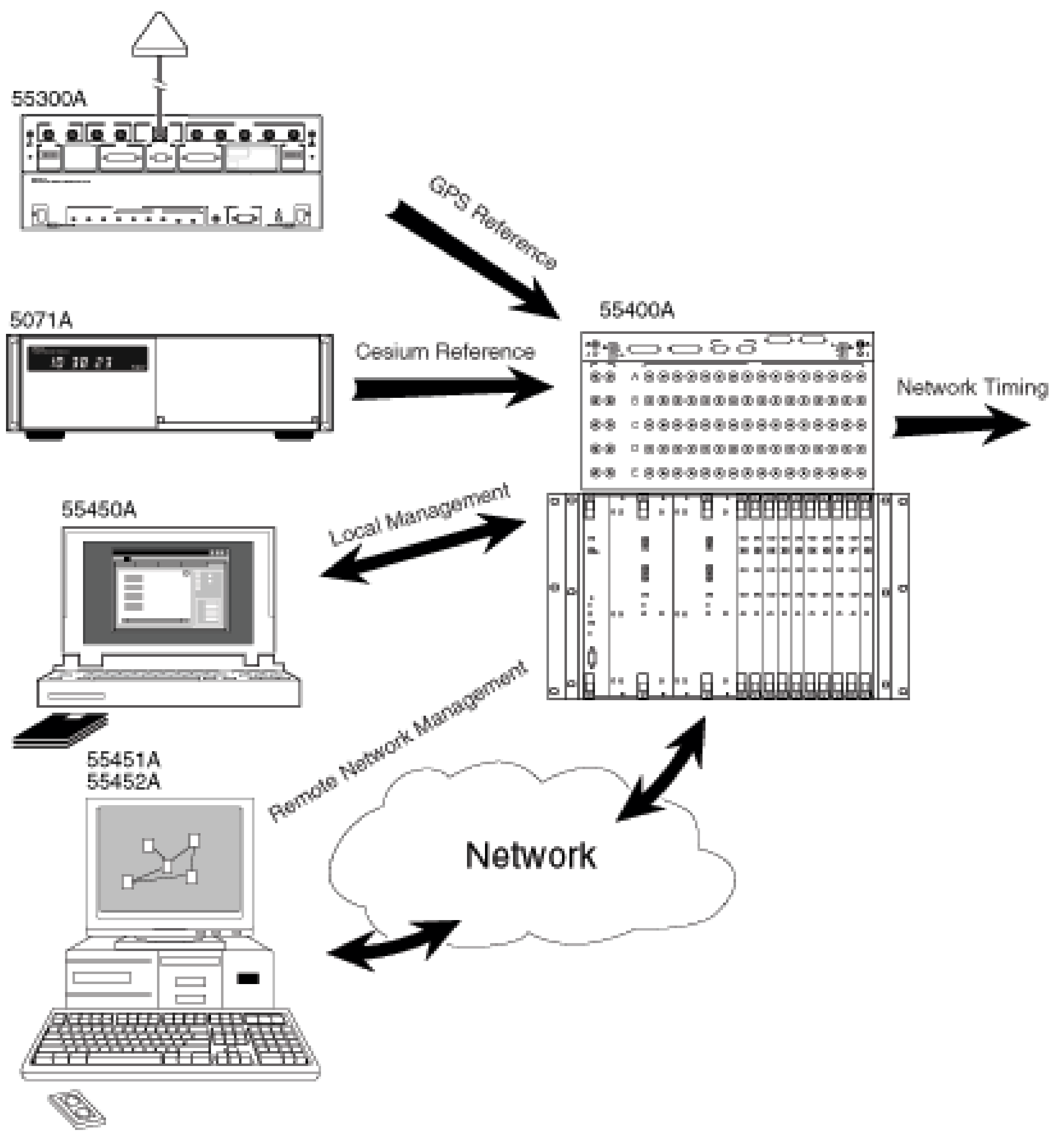


Figure A1-1. Symmetricom Network Synchronization System

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.

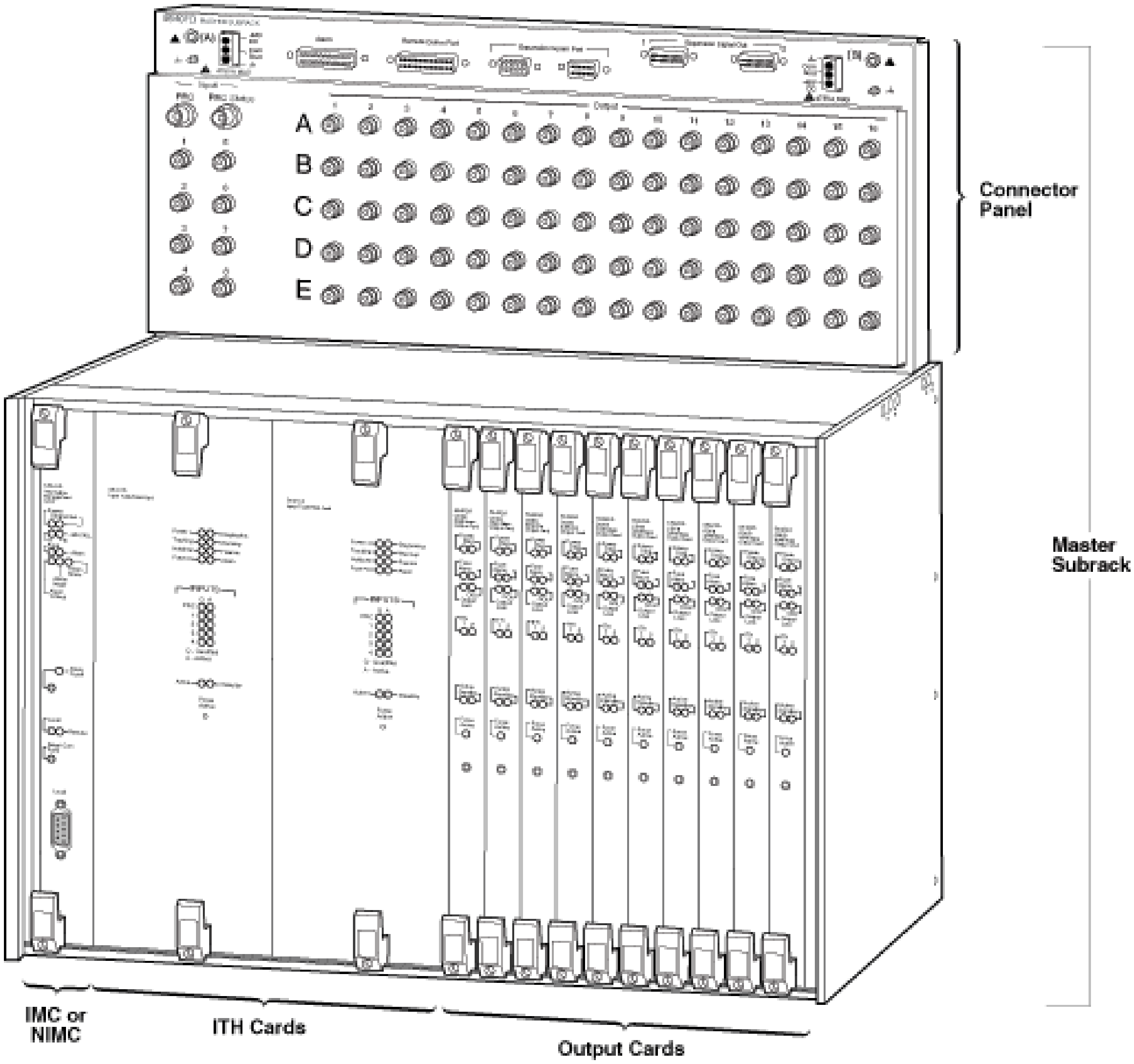


Figure A1-2. 55400A Synchronization Supply Unit

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.

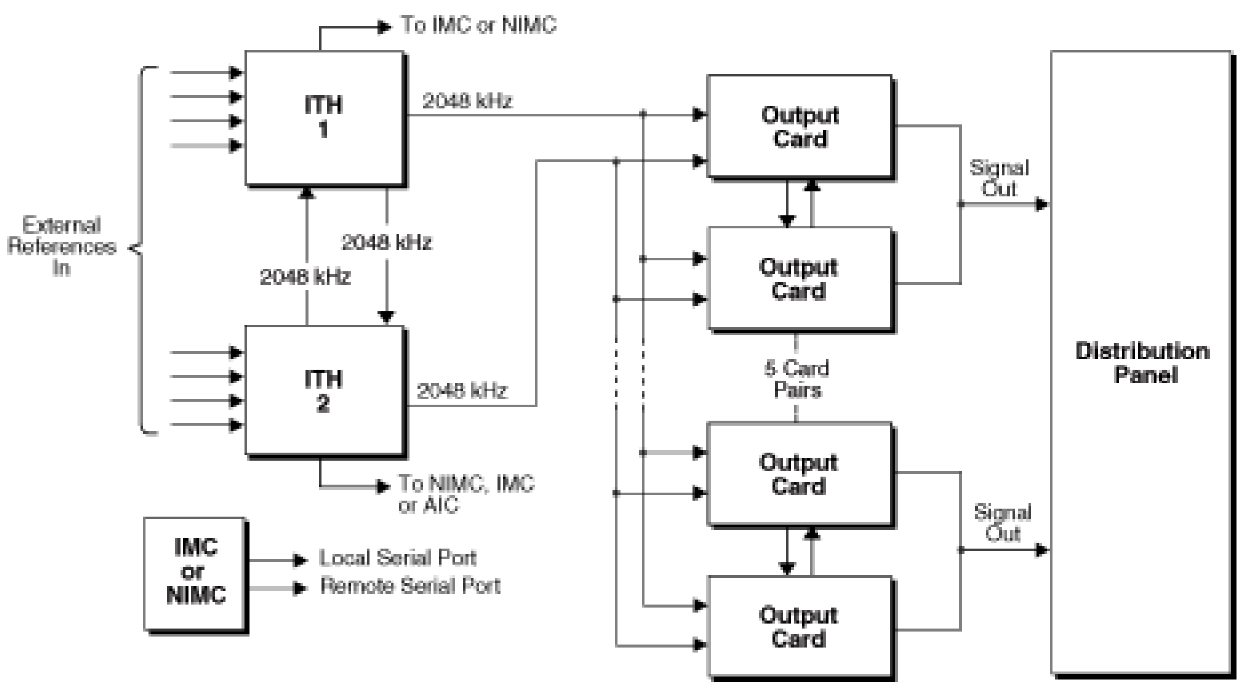


Figure A2-1. 55400A SSU—System Block Diagram

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.

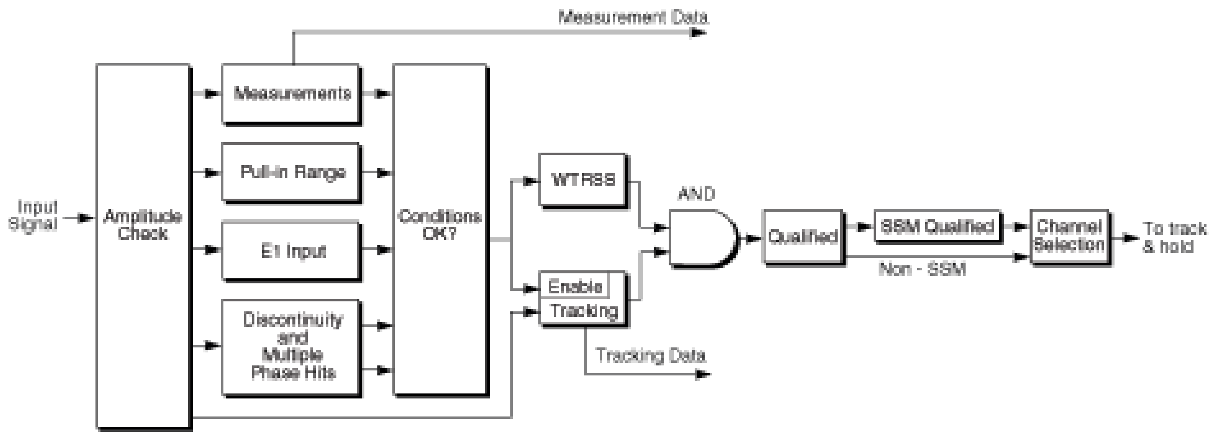


Figure A2-2. Input Qualification Block Diagram

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 (cont'd)

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 = HFQLEVL

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 Enhanced Stratum 2—Rubidium Enhanced Transit Node Transit Node Local Node	 $\pm 3.0 \times 10^{-11}$/day for three days $\pm 2.0 \times 10^{-11}$/day $\pm 1.0 \times 10^{-10}$/day for three days $\pm 5.0 \times 10^{-10}$/day $\pm 1.0 \times 10^{-8}$/day
Jitter and Wander Tolerance	Complies with ITU-T G.823
Output Phase Variation Reference switch-over ITH Card switch-over Output Card switch-over ITH Card failure Output Card failure	 < 1 ns < 15 ns < 15 ns < 15 ns < 1 µs
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

Table A3-1. SSU System Specifications (cont'd)

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 120 Ω	 Per ITU-T G.703, Table 10 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 120 Ω	 Per ITU-T G.703, Table 6 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

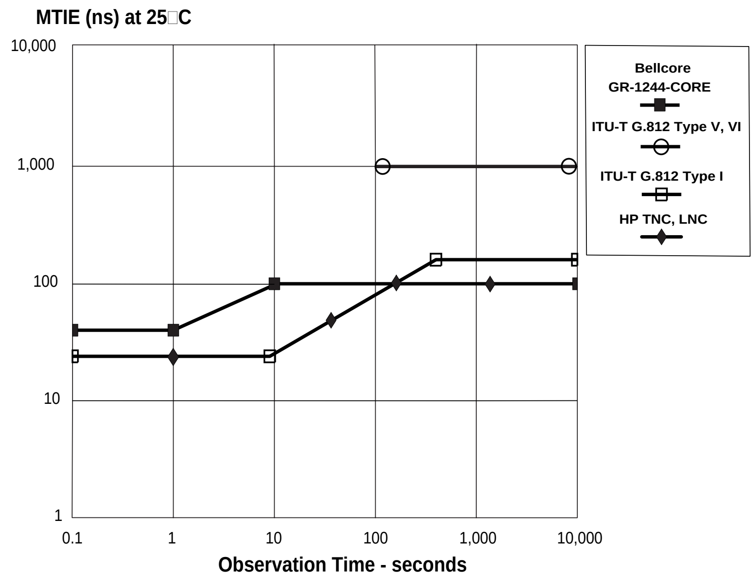


Figure A3-1. Wander Generation — MTIE

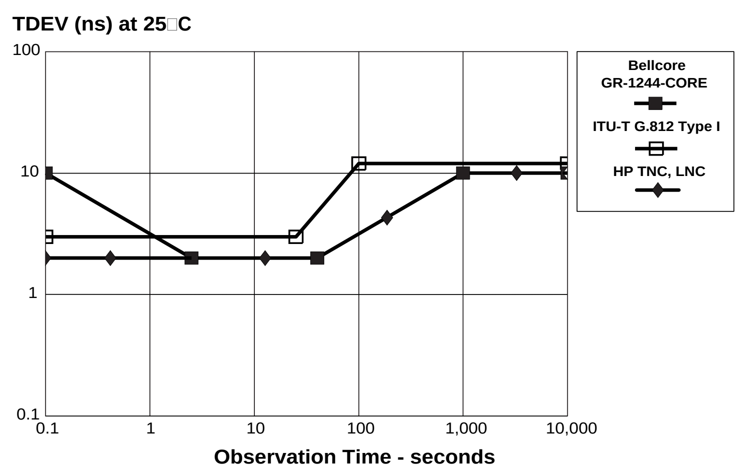


Figure A3-2. Wander Generation — TDEV

Specifications for Wander Generation — 55414 and 55415 Clock Cards

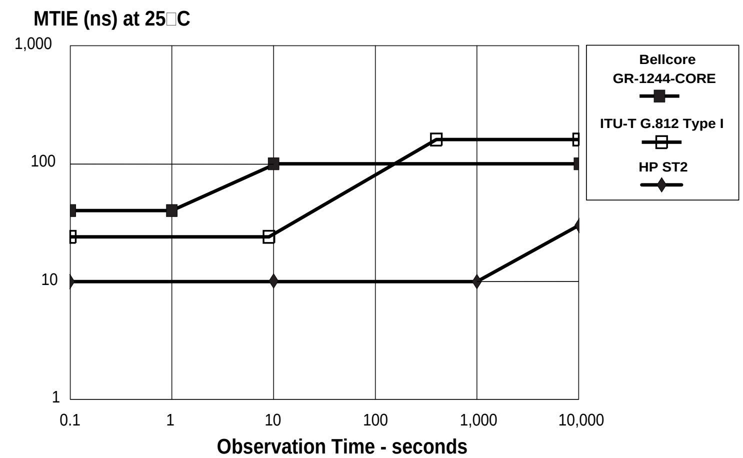


Figure A3-3. Wander Generation — MTIE

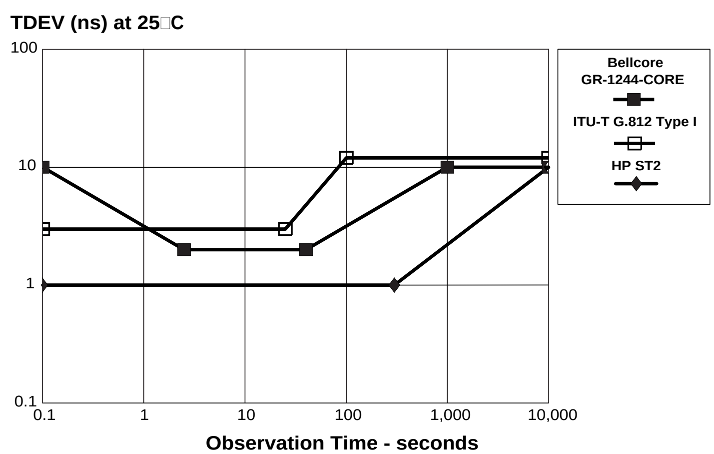


Figure A3-4. Wander Generation — TDEV

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)	$\pm 2 \times 10^{-11}$/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 µs (nominal) 256 µs (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	≤ 1 µs

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	≤ 1 µs

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 ± 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 × 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

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) Rubidium (Enhanced Stratum 2) Enhanced Transit Node Local Node (Stratum 3E)	 $\pm 2.0 \times 10^{-11}$/day $\pm 1.0 \times 10^{-10}$/day for 3 days $\pm 1.0 \times 10^{-8}$/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

Table A3-22. Mini-SSU System Specifications (cont'd)

Dimensions of 55409A Subrack – H × W × D mm (in.)	300 × 435 × 270 (21.0 × 17.1 × 10.6)
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 µs ± 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 µs 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	RS-232C (DTE configuration)
Software command set	SCPI (Software Commands for Programmable Instruments), version 1990.0
Connector	9-pin male rectangular D, subminiature type
Status Output	Provides a logic output to monitor normal and abnormal operation externally. Parameters which define abnormal operation can be user programmed.
Output - Circuit is TTL open collector with internal pull-up resistor. Circuit can sink up to 10 mA.	TTL High, Normal TTL Low, Fault
Connector	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	40 to 58 Vdc
Damage Level	72 V
Input Power	
Warm-up	85 W
Operating	50 W
Temperature	
Operating	0 to 55°C
Non-operating	–40 to 70°C
Humidity	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 serverity 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 (LOGCLRD). 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

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

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
LOGCLRD	Event log cleared	ITH-Transient	NONE	YES
LSTCFGC	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*

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

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

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

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.

IMCNCDN—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.

IMCNVFL—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-NETYPE-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—ITH 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.

LSTCFGC—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.

SNPWRB—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 patter 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

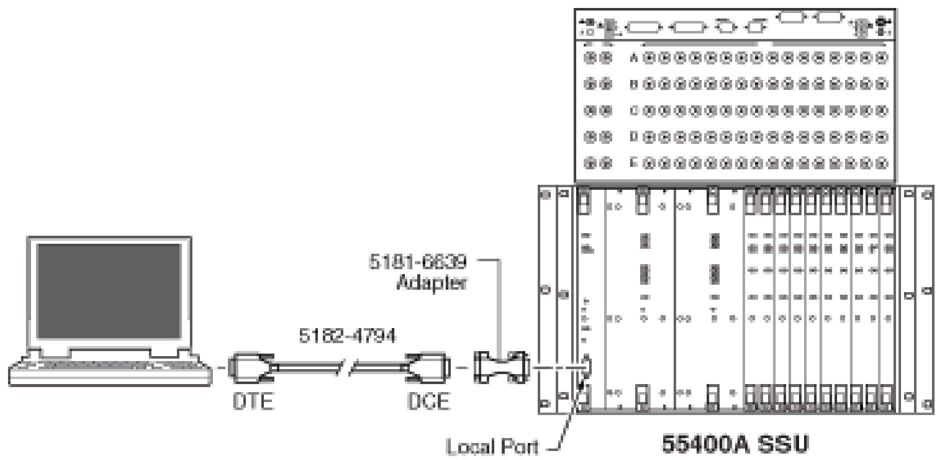


Figure A5-1. PC connection to 55400A local port

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

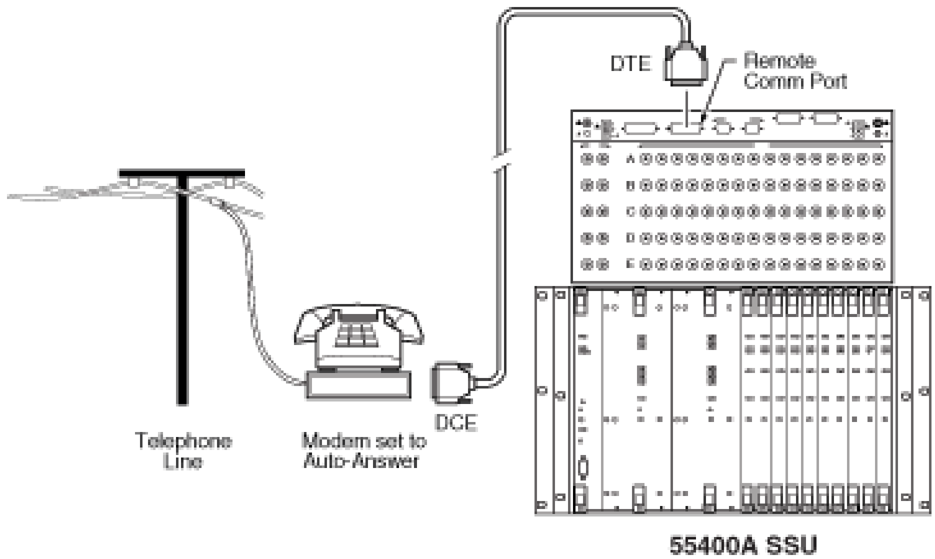


Figure A5-2. Modem connection to 55400A remote port

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

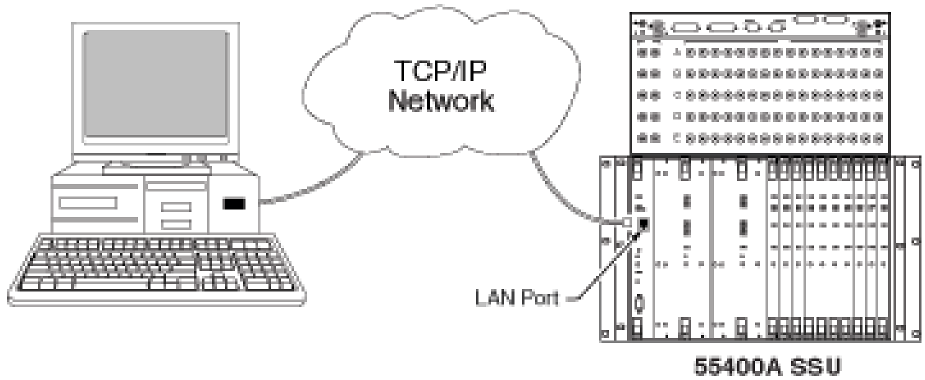


Figure A5-3. Network connection to 55400A LAN port

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

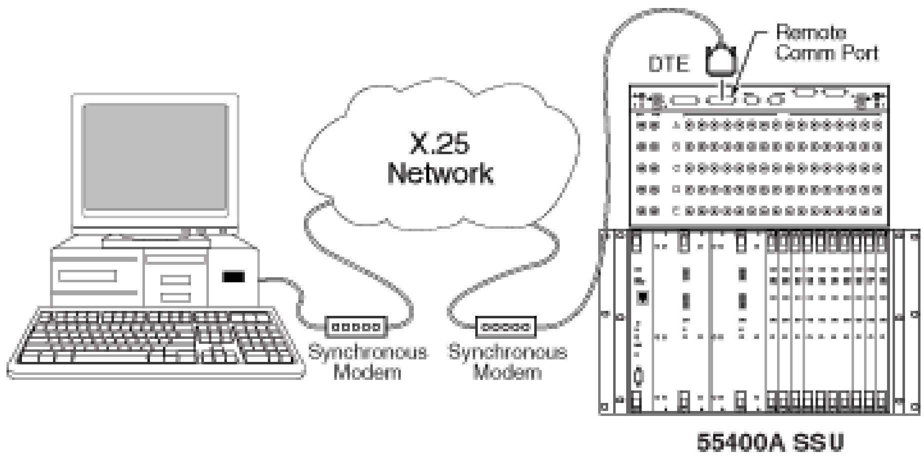


Figure A5-4. X.25 network connection to 55400A remote port

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

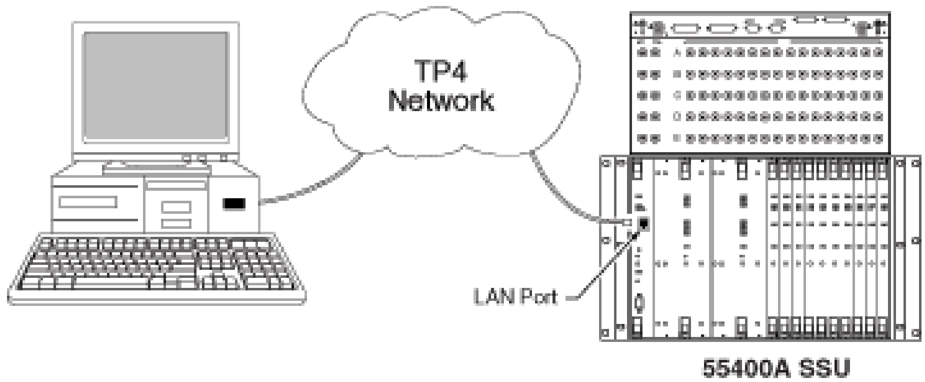


Figure A5-5. TP4 network connection to 55400A LAN port

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

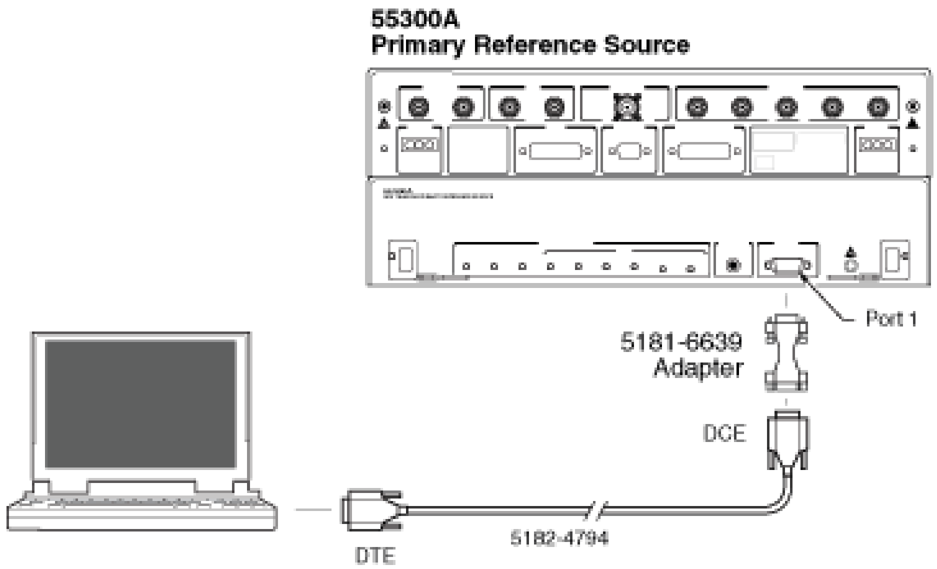


Figure A5-6. PC connection to 55300A port 1

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

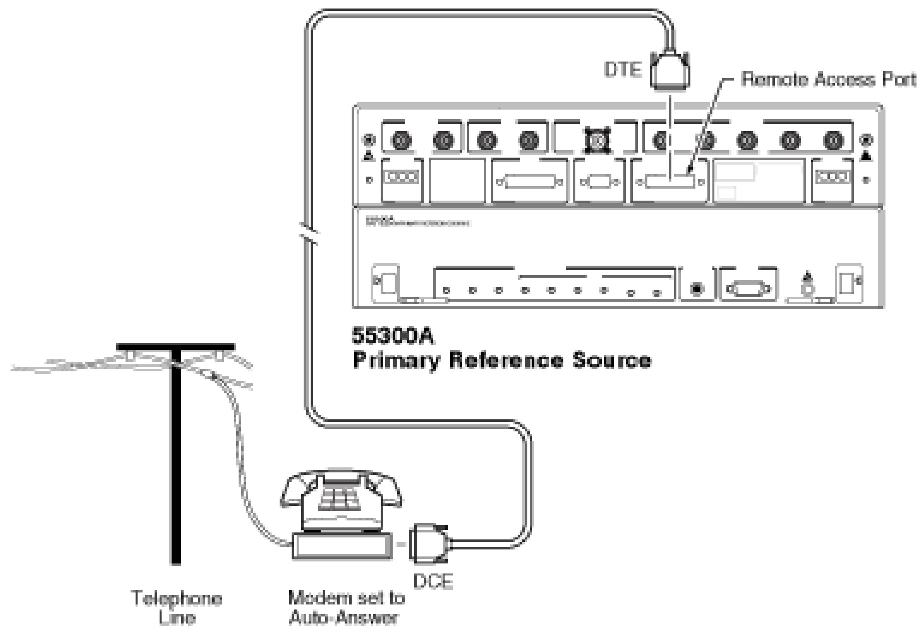


Figure A5-7. Modem connection to 55300A remote access port

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

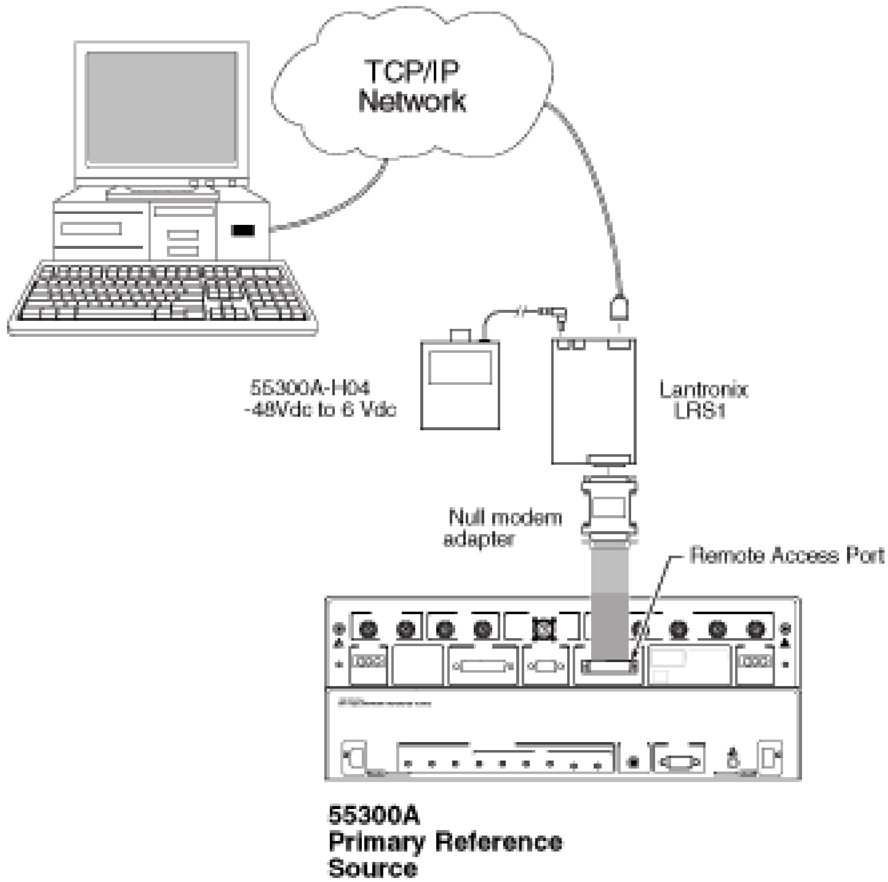


Figure A5-8. LAN connection to 55300A remote access port

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

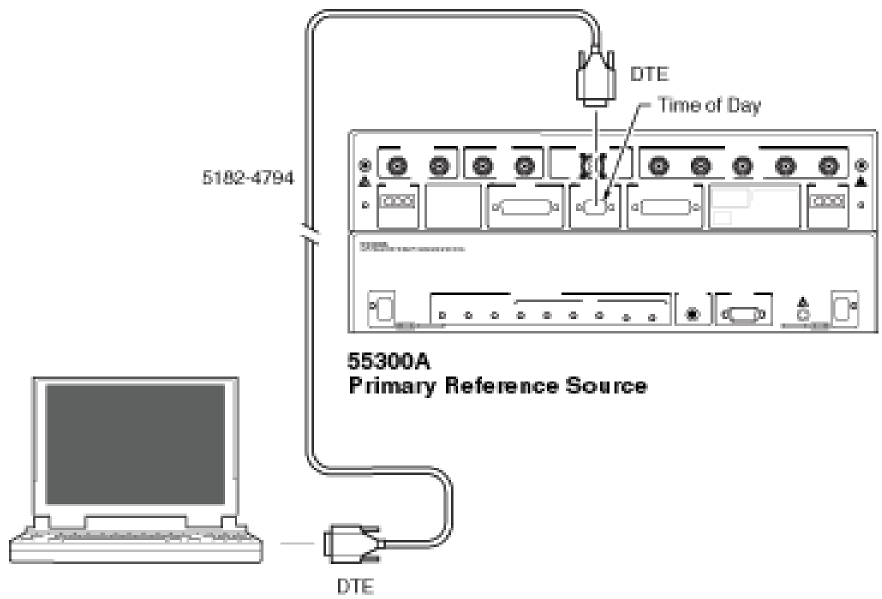


Figure A5-9. PC connection to 55300A time of day port

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 Symmetricom. 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.

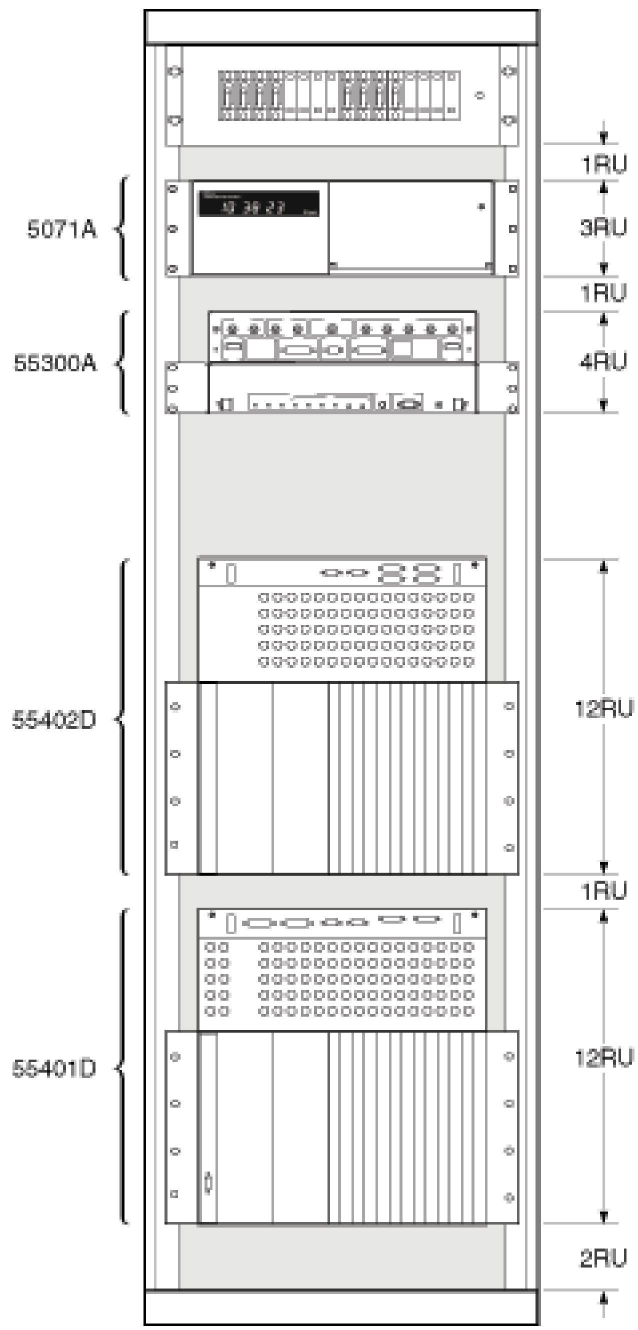


Figure B2-1. Two Reference Sources and Two SSUs

Configuration #2

GPS reference along with two SSUs.

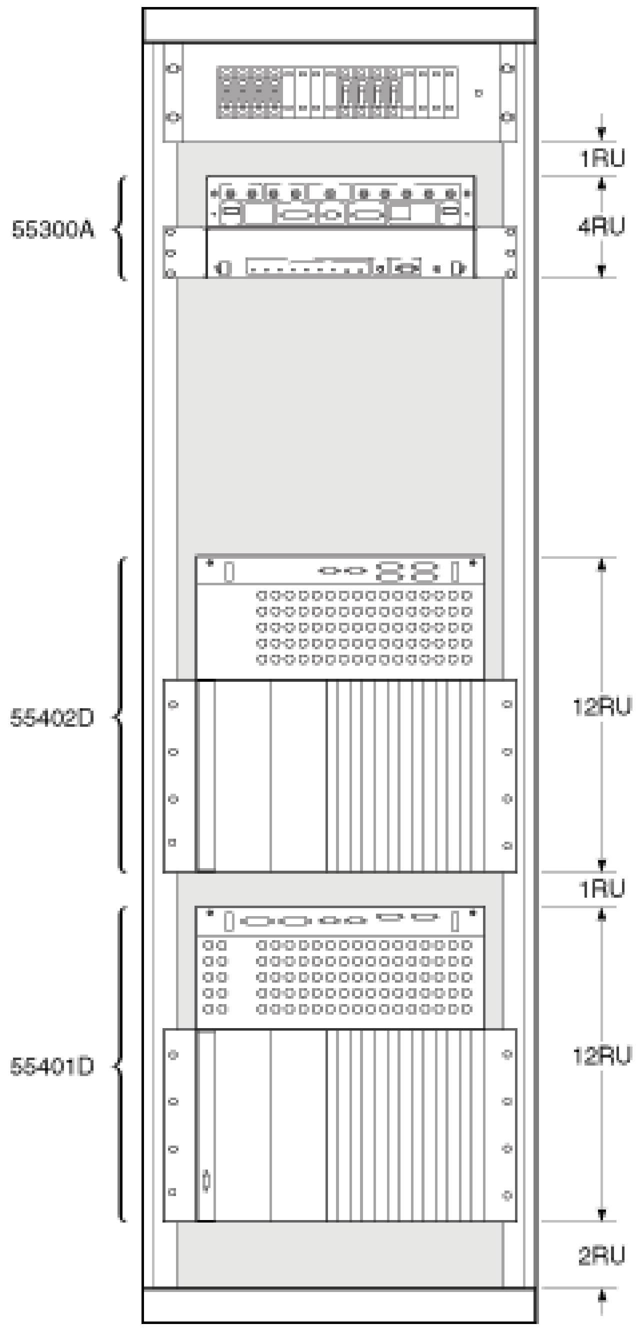


Figure B2-2. One Reference Source and Two SSUs

Configuration #3

A single rack cabinet containing three SSUs providing up to 240 outputs.

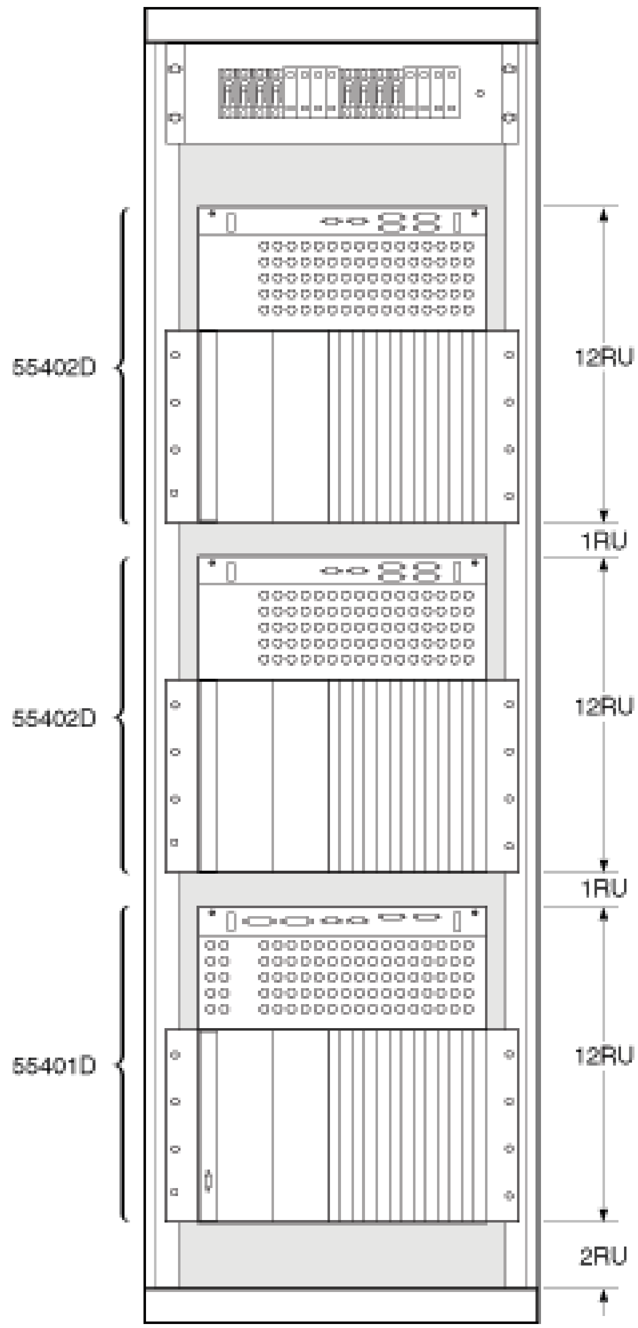


Figure B2-3. Three SSUs

Configuration #4

A single rack cabinet containing a GPS reference and a mini-SSU.

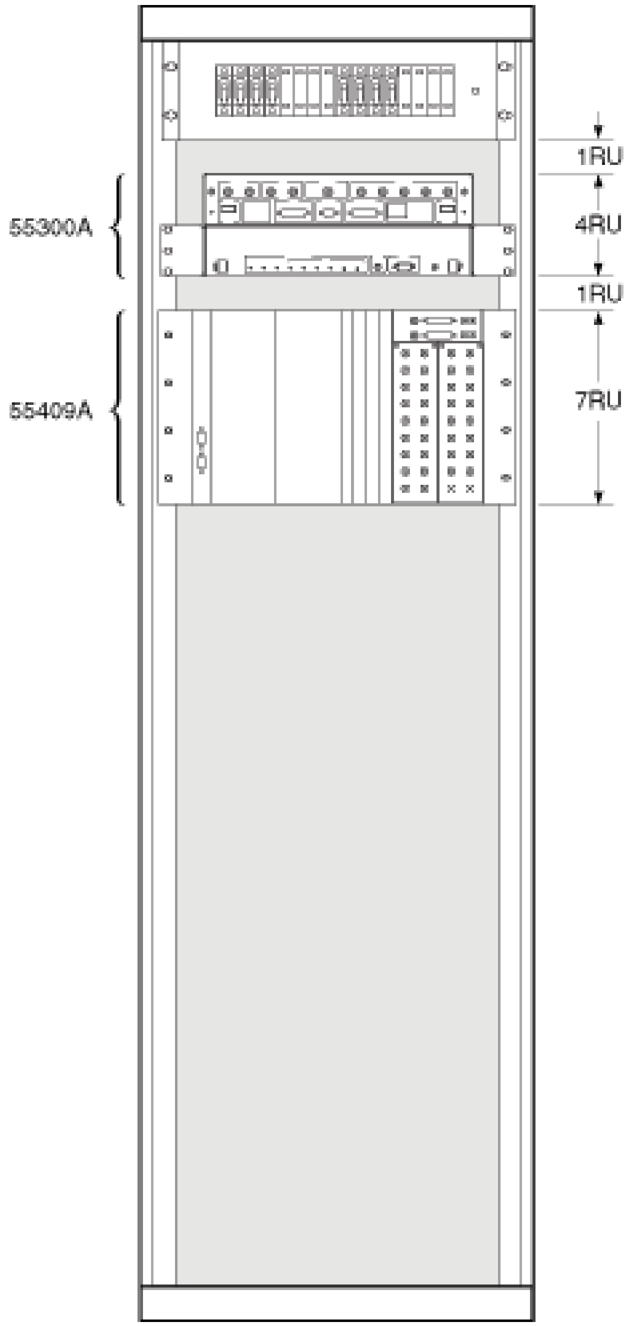


Figure B2-4. Reference Source and mini-SSU

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.

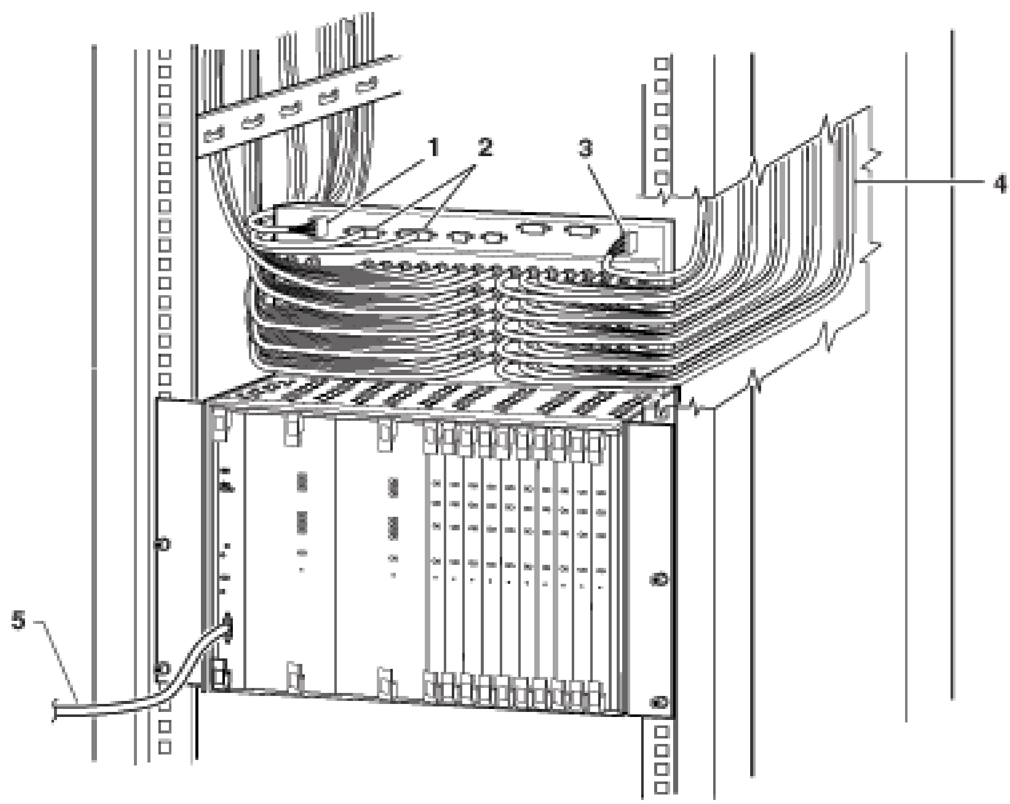


Figure B2-5. Cable Dressing for SSU

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.

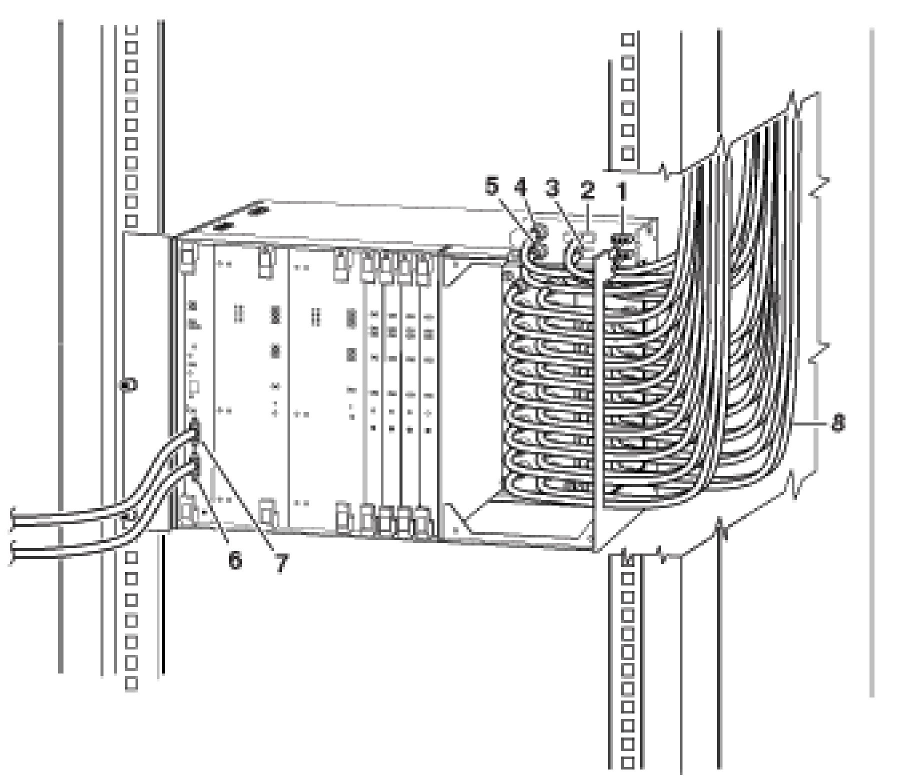


Figure B2-6. Cable Routing for Mini-SSU

1 **-48 VDC Input (A)** and **(B)** cables

2 **Alarm** port cable

3 **Remote** port cable

4 **PRC** input cable

5 **PRC Status** input cable

6 **Local** port cable

7 **Rack Alarms** port cable (NIMC only)

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.

Index

T

V

W

X