Operation and Service Manual

Isolation Amplifier

SIM984

SRS Stanford Research Systems

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Certification

Stanford Research Systems certifies that this product met its published specifications at the time of shipment.

Warranty

This Stanford Research Systems product is warranted against defects in materials and workmanship for a period of one (1) year from the date of shipment.

Service

For warranty service or repair, this product must be returned to a Stanford Research Systems authorized service facility. Contact Stanford Research Systems or an authorized representative before returning this product for repair.

Contents

General Information

The SIM984 Isolation Amplifier, part of Stanford Research Systems' Small Instrumentation Modules family, is a wide bandwidth, low noise isolation amplifier for use with analog signals from DC to 1 MHz.

Service

Do not install substitute parts or perform any unauthorized modifications to this instrument.

The SIM984 is a single-wide module designed to be used inside the SIM900 Mainframe. Do not turn on the power until the module is completely inserted into the mainframe and locked in place.

Symbols you may Find on SRS Products

Symbol	Description
∿	Alternating current
⚡	Caution - risk of electric shock
⏚	Frame or chassis terminal
⚠	Caution - refer to accompanying documents
⏚	Earth (ground) terminal
—⊣⊢—	Battery
∿	Fuse
|	On (supply)
◯	Off (supply)

Notation

The following notation will be used throughout this manual.

⚠ WARNING   A warning means that injury or death is possible if the instructions are not obeyed.

⚠ CAUTION   A caution means that damage to the instrument or other equipment is possible.

Typesetting conventions used in this manual are:

- Front-panel buttons are set as [Button].

- Front-panel indicators are set as *Overload*.

- Remote command names are set as *IDN?

- Literal text other than command names is set as OFF.

Remote command examples will all be set in monospaced font. In these examples, data sent by the host computer to the SIM984 are set as `straight teletype font`, while responses received by the host computer from the SIM984 are set as *`slanted teletype font`*.

Specifications

Performance Characteristics

Isolation voltage	±1000 V (max)
Leakage current	<2 μA at 1000 Vdc
Isolation capacitance	1000 pF
Isolation Mode Rejection Ratio (IMRR)	150 dB at DC
Maximum input	±10 V
Input impedance	1 MΩ
Input noise (typ.)	15 nV/$\sqrt{\text{Hz}}$ @ 1 kHz
Input offset drift	3 μV/°C (typ.)
Output voltage range	±10 V
Output current	±20 mA (max.)
Output resistance	50 Ω
Output offset	±0.1 V, adjustable
Output offset drift	1 mV/°C (typ.)
Output noise (typ.)	80 μVrms (100 Hz bandwidth)
	200 μVrms (10 kHz bandwidth)
	1.5 mVrms (1 MHz bandwidth)
Gain	× 1, × 10, × 100
Gain accuracy	±0.5%
THD	0.005% (1 kHz, 600 Ω load)
Frequency range	DC to 100 Hz (low BW)
	DC to 10 kHz (medium BW)
	DC to 1 MHZ (high BW)
Output Slew rate	25 V/μs (Vout = 20 Vpp)
Operating temperature	0 °C to 40 °C, non-condensing
Power	+5 V (100 mA)
	±15 V (300 mA)
	+24 V (100 mA) —TBD—

General Characteristics

Interface	Serial (RS-232) through SIM interface
Connectors	banana jack (2 front)
	BNC (1 front, 1 rear)
	DB–15 (male) SIM interface
Weight	1.5 lbs
Dimensions	1.5″ W × 3.6″ H × 7.0″ D

1   Getting Started

This chapter gives you the necessary information to get started quickly with the SIM984 Isolation Amplifier.

In This Chapter

1.1   Introduction to the Instrument

The SIM984 Isolation Amplifier is a low-noise, programmable gain amplifier for isolating analog signals from DC to 1 MHz.

1.1.1   Overview

The basic function of the SIM984 is to isolate and (possibly) amplify an analog signal. The input presents a $1\,\mathrm{M\Omega}$ impedance between the red and black banana jacks, but is high impedance (floating) between each input jack and chassis ground. A maximum of ±1000 Vdc can be between either jack and ground, but the potential *between* the input jacks must be less than ±10 V. The input is DC coupled.

A gain of ×1, ×10, or ×100 can be set from the front panel. The output bandwidth is also adjustable from the front panel, with three choices of high-frequency cut-off: 100 Hz, 10 kHz, and 1 MHz. Finally, the output DC offset can be trimmed using a thin screwdriver accessing the "Offset" hole near the output BNC.

1.1.2   Power-on State

The SIM984 stores its operation state (gain and bandwidth configuration) in non-volatile memory. At power-on, the SIM984 will return to its previous configuration after a brief system check and initialization.

1.2   Front-Panel Operation

The front panel of the SIM984 (see Figure 1.1) provides a simple operator interface.

1.2.1   Inputs

The input to the SIM984 is through the red and black banana jacks in the front-panel "INPUT" block.

⚠ **WARNING**

The banana jacks are isolated from the chassis for use with insulated test leads. If the user connects a BNC–to–Banana adaptor to the SIM984 to allow inputs from a BNC-terminated cable, it is critical that no dangerous voltages be applied to the cable, as the exposed shield of the input BNC could create an electrical hazard.

1.2.2   Gain

User gain settings of ×1, ×10, and ×100, are selected with the left and right [Gain] buttons.

Figure 1.1: The SIM984 front and rear panels.

1.2.3   Bandwidth

User bandwidth settings of DC–100 Hz, DC–10 kHz, and DC–1 MHz are with the left and right [Bandwidth] buttons.

1.2.4   Output

The amplified, band-limited signal appears at the (ground-referenced) BNC connectors on the front and rear panels. Each output connection is through a 50 Ω resistor. For normal operation, the user should not need to terminate the output. If a 50 Ω termination is applied, the output signal will be divided in half.

If the output signal exceeds ±10 V, the output overload detection is activated. This is indicated by the red *OVLD* near the top of the "OUTPUT" block on the front panel.

The SIM984 output offset voltage may be trimmed by adjusting the

output offset through the front-panel access hole in the "OUTPUT" block.

1.3 SIM Interface

The primary connection to the SIM984 Isolation Amplifier is the rear-panel DB–15 SIM interface connector. Typically, the SIM984 is mated to a SIM900 Mainframe via this connection, either through one of the internal Mainframe slots, or the remote cable interface.

It is also possible to operate the SIM984 directly, without using the SIM900 Mainframe. This section provides details on the interface.

⚠ CAUTION *The SIM984 has no internal protection against reverse polarity, missing supply, or overvoltage on the power supply pins. Misapplication of power may cause circuit damage. SRS recommends using the SIM984 together with the SIM900 Mainframe for most applications.*

1.3.1 SIM interface connector

The DB–15 SIM interface connector carries all the power and communications lines to the instrument. The connector signals are specified in Table 1.1

Pin	Signal	Direction Src ⇒ Dest	Description
1	SIGNAL_GND	MF ⇒ SIM	Ground reference for signal
2	−STATUS	SIM ⇒ MF	Status/service request (GND = asserted, +5 V = idle)
3	RTS	MF ⇒ SIM	HW handshake (not used in SIM984)
4	CTS	SIM ⇒ MF	HW handshake (not used in SIM984)
5	−REF_10MHZ	MF ⇒ SIM	10 MHz reference (no connection in SIM984)
6	−5 V	MF ⇒ SIM	Power supply (no connection in SIM984)
7	−15 V	MF ⇒ SIM	Power supply
8	PS_RTN	MF ⇒ SIM	Power supply return
9	CHASSIS_GND		Chassis ground
10	TXD	MF ⇒ SIM	Async data (start bit = "0" = +5 V; "1" = GND)
11	RXD	SIM ⇒ MF	Async data (start bit = "0" = +5 V; "1" = GND)
12	+REF_10MHz	MF ⇒ SIM	10 MHz reference (no connection in SIM984)
13	+5 V	MF ⇒ SIM	Power supply
14	+15 V	MF ⇒ SIM	Power supply
15	+24 V	MF ⇒ SIM	Power supply

Table 1.1: SIM Interface Connector Pin Assignments, DB-15

1.3.2   Direct interfacing

The SIM984 is intended for operation in the SIM900 Mainframe, but users may wish to directly interface the module to their own systems without the use of additional hardware.

The mating connector needed is a standard DB–15 receptacle, such as Amp part # 747909-2 (or equivalent). Clean, well-regulated supply voltages of ±15,+5 and +24 VDC must be provided, following the pin-out specified in Table 1.1. Ground must be provided on pins 1 and 8, with chassis ground on pin 9. The −STATUS signal may be monitored on pin 2 for a low-going TTL-compatible output indicating a status message.

1.3.2.1   Direct interface cabling

If the user intends to directly wire the SIM984 independent of the SIM900 Mainframe, communication is usually possible by directly connecting the appropriate interface lines from the SIM984 DB–15 plug to the RS-232 serial port of a personal computer.[1] Connect RXD from the SIM984 directly to RD on the PC, TXD directly to TD. In other words, a null-modem style cable is *not* needed.

To interface directly to the DB–9 male (DTE) RS-232 port typically found on personal computers, a cable must be made with a female DB–15 socket to mate with the SIM984, and a female DB–9 socket to mate with the PC's serial port. Separate leads from the DB–15 need to go to the power supply, making what is sometimes know as a "hydra" cable. The pin-connections are given in Table 1.2.

1.3.2.2   Serial settings

The initial serial port settings at power-on are: 9600 Baud, 8–bits, no parity, 1 stop bit, and no flow control. The serial baud rate and word size are fixed, but the parity may be changed with the PARI command.

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[1] Although the serial interface lines on the DB-15 do not satisfy the minimum voltage levels of the RS-232 standard, they are typically compatible with desktop personal computers

DB–15/F to SIM984	Name
DB–9/F	
10 ⟷ 3	TxD
11 ⟷ 2	RxD
5	Computer Ground
to P/S	
7 ⟷ −15 VDC	
13 ⟷ +5 VDC	
14 ⟷ +15 VDC	
15 ⟷ +24 VDC	
8,9 ⟷ Ground (P/S return current)	
1 ⟷ Signal Ground (separate wire to Ground)	

Table 1.2: SIM984 Direct Interface Cable Pin Assignments

2 Remote Operation

This chapter describes operating the SIM984 over the serial interface.

In This Chapter

2.1   Index of Common Commands

symbol	definition
i,j	Integers
z	Literal token
(*?*)	Required for queries; illegal for set commands
var	parameter always required
{*var*}	required parameter for set commands; illegal for queries
[*var*]	optional parameter for both set and query forms

Amplifier

GAIN(?) {*i*}	2 – 7	Gain
BWTH(?) {*i*}	2 – 7	Bandwidth

Status

*STB? [*i*]	2 – 7	Status Byte
*SRE(?) [*i*,] {*j*}	2 – 7	Service Request Enable
*CLS	2 – 7	Clear Status
*ESR? [*i*]	2 – 8	Standard Event Status
*ESE(?) [*i*,] {*j*}	2 – 8	Standard Event Status Enable
CESR? [*i*]	2 – 8	Comm Error Status
CESE(?) [*i*,]{*j*}	2 – 8	Comm Error Status Enable
OVLD?	2 – 8	Overload Condition
PSTA(?) {*z*}	2 – 9	Pulse –STATUS Mode

Interface

*RST	2 – 9	Reset
*IDN?	2 – 9	Identify
*OPC(?)	2 – 9	Operation Complete
CONS(?) {*z*}	2 – 10	Console Mode
LEXE?	2 – 10	Execution Error
LCME?	2 – 11	Command Error
PARI(?) {*z*}	2 – 11	Parity
TOKN(?) {*z*}	2 – 11	Token Mode
TERM(?) {*z*}	2 – 12	Response Termination

2.2   Alphabetic List of Commands

★

*CLS	2 – 7	Clear Status
*ESE(?) [*i*,] {*j*}	2 – 8	Standard Event Status Enable
*ESR? [*i*]	2 – 8	Standard Event Status
*IDN?	2 – 9	Identify
*OPC(?)	2 – 9	Operation Complete
*RST	2 – 9	Reset
*SRE(?) [*i*,] {*j*}	2 – 7	Service Request Enable
*STB? [*i*]	2 – 7	Status Byte

B

BWTH(?) {*i*}	2 – 7	Bandwidth

C

CESE(?) [*i*,]{*j*}	2 – 8	Comm Error Status Enable
CESR? [*i*]	2 – 8	Comm Error Status
CONS(?) {*z*}	2 – 10	Console Mode

G

GAIN(?) {*i*}	2 – 7	Gain

L

LCME?	2 – 11	Command Error
LEXE?	2 – 10	Execution Error

O

OVLD?	2 – 8	Overload Condition

P

PARI(?) {*z*}	2 – 11	Parity
PSTA(?) {*z*}	2 – 9	Pulse –STATUS Mode

T

TERM(?) {*z*}	2 – 12	Response Termination
TOKN(?) {*z*}	2 – 11	Token Mode

2.3   Introduction

Remote operation of the SIM984 is through a simple command language documented in this chapter. Both set and query forms of most commands are supported, allowing the user complete control of the isolation amplifier from a remote computer, either through the SIM900 Mainframe or directly via RS-232 (see Section 1.3.2.1).

2.3.1   Power-on configuration

The settings for the remote interface are 9600 baud with no parity and no flow control, and local echo disabled (CONS OFF).

Most of the SIM984 instrument settings are stored in non-volatile memory, and at power-on the instrument returns to the state it was last in when power was removed. Exceptions are noted in the command descriptions.

Reset values of parameters are shown in **boldface**.

2.3.2   Buffers

Incoming data from the host interface is stored in a 32-byte input buffer. Characters accumulate in the input buffer until a command terminator (either ⟨CR⟩ or ⟨LF⟩) is received, at which point the message is parsed and executed. Query responses from the SIM984 are buffered in a 32-byte output queue.

If the input buffer overflows, then all data in *both* the input buffer and the output queue are discarded, and an error is recorded in the CESR and ESR status registers.

2.3.3   Device Clear

The SIM984 host interface can be asynchronously reset to its power-on configuration by sending an RS-232-style ⟨break⟩ signal. From the SIM900 Mainframe, this is accomplished with the SIM900 SRST command; if directly interfacing via RS-232, then use a serial break signal. After receiving the Device Clear, the interface is reset and CONS mode is turned OFF. Note that this *only* resets the communication interface; the basic function of the SIM984 is left unchanged; to reset the instrument, see *RST.

2.4   Commands

This section provides syntax and operational descriptions for reomote commands.

2.4.1   Command Syntax

The four letter mnemonic (shown in CAPS) in each command sequence specifies the command. The rest of the sequence consists of parameters.

Commands may take either *set* or *query* form, depending on whether the "?" character follows the mnemonic. *Set only* commands are listed without the "?", *query only* commands show the "?" after the mnemonic, and *optionally query* commands are marked with a "(?)".

Parameters shown in { } and [ ] are not always required. Parameters in { } are required to set a value, and are omitted for queries. Parameters in [ ] are optional in both set and query commands. Parameters listed without any surrounding characters are always required.

Do *not* send ( ) or { } or [ ] as part of the command.

Multiple parameters are separated by commas. Multiple commands may be sent on one command line by separating them with semicolons (;) so long as the input buffer does not overflow. Commands are terminated by either ⟨CR⟩ or ⟨LF⟩ characters. Null commands and whitespace are ignored. Execution of command(s) does not begin until the command terminator is received.

tokens   Token parameters (generically shown as z in the command descriptions) can be specified either as a keyword or integer value. Command descriptions list the valid keyword options, with each keyword followed by its corresponding integer value. For example, to set the response termination sequence to ⟨CR⟩+⟨LF⟩, the following two commands are equivalent:

<div align="center">

TERM CRLF   —or—   TERM 3

</div>

For queries that return token values, the return format (keyword or integer) is specified with the TOKN command.

2.4.2   Notation

The following table summarizes the notation used in the command descriptions:

symbol	definition
i,j	Integers
z	Literal token
(*?*)	Required for queries; illegal for set commands
var	parameter always required
{*var*}	required parameter for set commands; illegal for queries
[*var*]	optional parameter for both set and query forms

2.4.3   Examples

Each command is provided with a simple example illustrating its usage. In these examples, all data sent by the host computer to the SIM984 are set as `straight teletype font`, while responses received the host computer from the SIM984 are set as *`slanted teletype font`*.

The usage examples vary with respect to set/query, optional parameters, and token formats. These examples are not exhaustive, but are intended to provide a convenient starting point for user programming.

2.4.4   Amplifier Commands

GAIN(?) {*i*}   Gain

Set (query) input gain {to state *i*=(**0** (×1), 1 (×10), 2 (×100))}.

```
GAIN 2
```

BWTH(?) {*i*}   Bandwidth

Set (query) the signal bandwidth {to state *i*=(**0** (DC–100 Hz), 1 (DC–10 kHz), 2 (DC–1 MHz))}.

Example: BWTH?
             1

2.4.5   Status Commands

The Status commands query and configure registers associated with status reporting of the SIM984.

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*STB? [*i*]   Status Byte

Reads the Status Byte register [bit *i*].

Execution of the *STB? query (without the optional bit *i*) always causes the −STATUS signal to be deasserted. Note that *STB? *i* will *not* clear −STATUS, even if bit *i* is the only bit presently causing the −STATUS signal. See also the PSTA command.

The OVLD bit in *STB is cleared upon reading.

Example: *STB?
             1

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*SRE(?) [*i*,] {*j*}   Service Request Enable

Set (query) the Service Request Enable register [bit *i*] {to *j*}.

Example: *SRE 0,1

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*CLS   Clear Status

*CLS immediately clears the ESR, CESR, and the OVLD bit in the Status Byte.

Example: *CLS

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*ESR? [*i*]		Standard Event Status
		Reads the Standard Event Status Register [bit *i*].
		Upon executing *ESR?, the returned bit(s) of the ESR register are cleared.
	Example:	*ESR? *64*
*ESE(?) [*i*,] {*j*}		Standard Event Status Enable
		Set (query) the Standard Event Status Enable Register [bit *i*] {to *j*}.
	Example:	*ESE 6,1 ESE? *64*
CESR? [*i*]		Comm Error Status
		Query Comm Error Status Register [for bit *i*].
		Upon executing a CESR? query, the returned bit(s) of the CESR register are cleared.
	Example:	CESR? *0*
CESE(?) [*i*,]{*j*}		Comm Error Status Enable
		Set (query) Comm Error Status Enable Register [for bit *i*] {to *j*}
	Example:	CESE? *0*
OVLD?		Overload Condition
		Query Overload Condition. If the SIM984 is overloading, OVLD? returns 1; otherwise 0.
	Example:	OVLD? *0*

PSTA(?) {*z*}	Pulse −STATUS Mode
	Set (query) the Pulse −STATUS Mode {to *z*=(OFF 0, ON 1)}.
	When PSTA ON is set, any new service request will only *pulse* the −STATUS signal low (for a minimum of 1 μs). The default behavior is to latch −STATUS low until a *STB? query is received.
	At power-on, PSTA is set to OFF.
Example:	PSTA? *OFF*

2.4.6   Interface Commands

Interface commands provide generic control over the interface between the SIM984 and the host computer.

*RST	Reset
	Reset the SIM984 to default configuration.
	After *RST, the gain is set to ×1 and the bandwidth to DC–100 Hz. This is equivalent to the following command sequence: GAIN 0; BWTH 0
Example:	*RST

*IDN?	Identify
	Read the device identification string.
	The identification string is formatted as: Stanford_Research_Systems,SIM984,s/n******,ver#.# where ****** is the 6-digit serial number, and #.# is the firmware revision level.
Example:	*IDN? *Stanford_Research_Systems,SIM984,s/n003075,ver1.02*

*OPC(?)	Operation Complete
	Operation Complete. Sets the OPC flag in the ESR register.
	The query form *OPC? writes a 1 in the output queue when complete, but does not affect the ESR register.
Example:	*OPC

CONS(?) {z}		Console Mode

Set (query) the Console mode {to *z*=(**OFF 0**, ON 1)}.

CONS causes each character received at the Input Buffer to be copied to the Output Queue.

At power-on and Device-Clear, CONS is set to OFF.

Example: CONS?
0

LEXE?   Execution Error

Query the last execution error code. A query of LEXE? always clears the error code, so a subsequent LEXE? will return 0. Valid codes are:

Value	Definition
0	No execution error since last LEXE?
1	Illegal value
2	Wrong token
3	Invalid bit
16	Command not ready

Example: *STB? 12; LEXE?; LEXE?
3
0

The error (3, "Invalid bit,") is because *STB? only allows bit-specific queries of 0–7. The second read of LEXE? returns 0.

LCME?	Command Error

Query the last command error code. A query of LCME? always clears the error code, so a subsequent LCME? will return 0. Valid codes are:

Value	Definition
0	No execution error since last LCME?
1	Illegal command
2	Undefined command
3	Illegal query
4	Illegal set
5	Missing parameter(s)
6	Extra parameter(s)
7	Null parameter(s)
8	Parameter buffer overflow
9	Bad floating-point
10	Bad integer
11	Bad integer token
12	Bad token value
13	Bad hex block
14	Unknown token

Example: `*IDN`
`LCME?`
4

The error (4, "Illegal set") is due to the missing "?".

PARI(?) {z}	Parity

Set (query) parity {to z = (**NONE 0**, ODD 1, EVEN 2, MARK 3, SPACE 4)}.

After power-on, modules default to PARI NONE.

Example: `PARI EVEN`

TOKN(?) {z}	Token Mode

Set (query) the Token Query mode {to z=(**OFF 0**, ON 1)}.

If TOKN ON is set, then queries to the SIM module that return tokens will return the text keyword; otherwise they return the decimal integer value.

Thus, the only possible responses to the TOKN? query are ON and 0.

On reset, TOKN is set to OFF.

Example: `TOKN OFF`

TERM(?) {*z*}	Response Termination

Set (query) the ⟨term⟩ sequence {to *z*=(`NONE 0`, `CR 1`, `LF 2`, **`CRLF 3`**, `LFCR 4`)}. The ⟨term⟩ sequence is appended to all query responses sent by the module, and is constructed of ASCII character(s) 13 (carriage return) and 10 (line feed). The token mnemonic gives the sequence of characters.

At power-on, TERM is set to `CRLF`.

Example: `TERM?`
            3

2.5   Status Model

The SIM984 status registers follow the hierarchical IEEE–488.2 format. A block diagram of the status register array is given in Figure 2.1.

There are two categories of registers in the SIM984 status model:

Event Registers : These read-only registers record the occurrence of defined events. When the event occurs, the corresponding bit is set to 1. Upon querying an event register, any set bits within it are cleared. These are sometimes known as "sticky bits," since once set, a bit can only be cleared by reading its value. Event register names end with SR.

Enable Registers : These read/write registers define a bitwise mask for their corresponding event register. If any bit position is set in an event register while the same bit position is also set in the enable register, then the corresponding summary bit message is set. Enable register names end with SE.

2.5.1   Status Byte (SB)

The Status Byte is the top-level summary of the SIM984 status model. When masked by the Service Request Enable register, a bit set in the Status Byte causes the −STATUS signal to be asserted on the rear-panel SIM interface connector.

Typically, −STATUS remains asserted (low) until a *STB? query is received, at which time −STATUS is deasserted (raised)[1]. After clearing the −STATUS signal, it will only be re-asserted in response to a
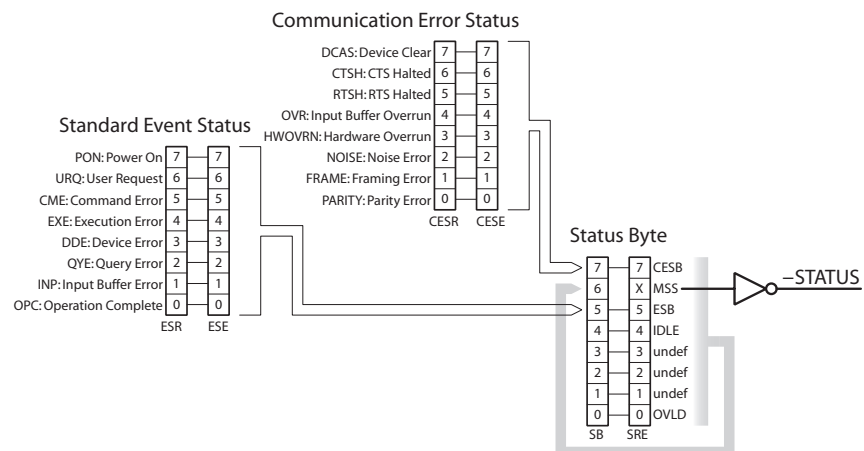
---

[1] but see the PSTA command

Figure 2.1: Status Register Model for the SIM984.

new status-generating condition.

Weight	Bit	Flag
1	0	OVLD
2	1	undef (0)
4	2	undef (0)
8	3	undef (0)
16	4	IDLE
32	5	ESB
64	6	MSS
128	7	CESB

OVLD : Overload Bit. Indicates whether an amplifier overload has occurred.

IDLE : Indicates that the Input Buffer is empty and the command parser is idle. Can be used to help synchronize SIM984 query responses.

ESB : Event Status Bit. Indicates whether one or more of the enabled events in the Standard Event Status Register is true.

MSS : Master Summary Status. Indicates whether one or more of the enabled status messages in the Status Byte register is true. Note that while –STATUS is released by the *STB? query, MSS is only cleared when the underlying enabled bit message(s) are cleared.

CESB : Communication Error Summary Bit. Indicates whether one or more of the enabled flags in the Communication Error Status Register has become true.

Most bits in the Status Byte are *not* cleared by the *STB? query. These bits are only cleared by reading the underlying event registers, or by clearing the corresponding enable registers. The one exception is the OVLD bit, which itself *is* an event bit, and so is cleared by the *STB? query.

2.5.2 Service Request Enable (SRE)

Each bit in the SRE corresponds one-to-one with a bit in the SB register, and acts as a bitwise AND of the SB flags to generate the MSS bit in the SB and the –STATUS signal. Bit 6 of the SRE is undefined—setting it has no effect, and reading it always returns 0. This register is set and queried with the *SRE(?) command.

This register is cleared at power-on.

2.5.3 Standard Event Status (ESR)

The Standard Event Status register consists of 8 event flags. These event flags are all "sticky bits" that are set by the corresponding event, and cleared only by reading or with the *CLS command. Reading a single bit (with the *ESR? *i* query) clears only bit *i*.

Weight	Bit	Flag
1	0	OPC
2	1	INP
4	2	QYE
8	3	DDE
16	4	EXE
32	5	CME
64	6	URQ
128	7	PON

OPC : Operation Complete. Set by the *OPC command.

INP : Input Buffer Error. Indicates data has been discarded from the Input Buffer.

QYE : Query Error. Indicates data in the Output Queue has been lost.

DDE : Device Dependent Error. This bit is undefined in the SIM984.

EXE : Execution Error. Indicates an error in a command that was successfully parsed. Out-of-range parameters are an example. The error code can be queried with LEXE?.

CME : Command Error. Indicates a parser-detected error. The error code can be queried with LCME?.

URQ : User Request. Indicates a front-panel button was pressed.

PON : Power On. Indicates that an off-to-on transition has occurred

2.5.4 Standard Event Status Enable (ESE)

The ESE acts as a bitwise AND with the ESR register to produce the single bit ESB message in the Status Byte Register (SB). It can be set and queried with the *ESE(?) command.

This register is cleared at power-on.

2.5.5 Communication Error Status (CESR)

The Communication Error Status register consists of 8 event flags; each of which is set by the corresponding event, and cleared only by reading or with the *CLS command. Reading a single bit (with the CESR? *i* query) clears only bit *i*.

Weight	Bit	Flag
1	0	PARITY
2	1	FRAME
4	2	NOISE
8	3	HWOVRN
16	4	OVR
32	5	RTSH
64	6	CTSH
128	7	DCAS

PARITY : Parity Error. Set by serial parity mismatch on incoming data byte.

FRAME : Framing Error. Set when an incoming serial data byte is missing the STOP bit.

NOISE : Noise Error. Set when an incoming serial data byte does not present a steady logic level during each asynchronous bit-period window.

HWOVRN : Hardware Overrun. Set when an incoming serial data byte is lost due to internal processor latency. Causes the Input Buffer to be flushed, and resets the command parser.

OVR : Input Buffer Overrun. Set when the Input Buffer is overrun by incoming data. Causes the Input Buffer to be flushed, and resets the command parser.

RTSH : Undefined for the SIM984.

CTSH : Undefined for the SIM984.

DCAS : Device Clear. Indicates the SIM984 received the Device Clear signal (an RS-232 ⟨break⟩). Clears the Input Buffer and Output Queue, and resets the command parser.

2.5.6   Communication Error Status Enable (CESE)

The CESE acts as a bitwise AND with the CESR register to produce the single bit CESB message in the Status Byte Register (SB). It can be set and queried with the CESE(?) command.

This register is cleared at power-on.

3 Circuits

This chapter presents a brief description of the SIM984 circuit design.

In This Chapter

3.1 Circuit Descriptions

3.1.1 Isolated power

Page 3 of the schematics shows the isolated supply that powers the input stage. A spread-spectrum oscillator (U302) provides the AC drive signal for power amplifier U301 to drive the isolating transformer T301. The large capacitor C305 prevents any runaway DC current from saturating the transformer, which could be generated by offset voltages at U301.

3.1.2 Input amplifier

The upper portion of Page 2 shows the floating input amplifier. Gain is controlled through latching relays U214 and U215, the control coils of which are earth-referenced.

The (amplified) signal is optically coupled through U205, U206, U207, and U208.

3.1.3 Output circuitry

The (earth-referenced) output circuitry includes the output bandwidth control. This circuitry is on the lower portion of Page 2 of the schematics. The overall AC gain is trimmed using VR202 at the factory, and should not require user adjustment.

DC offset can be adjusted with VR203, accessed from the front panel of the instrument. Note that the offset trim is referenced to the output, and comes *after* the gain is applied.

3.1.4 Digital control

The SIM984 is controlled by microcontroller U107.

A critical aspect of the design is the clock-stop circuitry implemented by U102 and U105. A simple RC-oscillator is enabled or disabled at pin 1 of U102, which is driven by synchronizing flip-flop U105B to ensure that no "runt" clock pulses are produced that would violate U107's minimum clock periods. Four separate clock-starting signals are combined by U106:

- Power-on reset

- Amplifier overload

- Incoming serial data

- Front-panel button press

The fast start-time of the RC-oscillator ensures that incoming serial data will be correctly decoded by the microcontroller's UART, even when the clock is started by the serial start bit of the incoming data. When the microcontroller has completed all pending activity, it drives the STOP signal high (pin 71 of U107), effectively halting its own processor clock. In this way, the SIM984 guarantees no digital clock artifacts can be generated during quiescent operation.

3.2 Schematic Diagrams

Schematic diagrams follow this page.