Operation and Service Manual

Octal Four-Wire Multiplexer

SIM925

SRS Stanford Research Systems

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

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Contents

General Information

The SIM925 Octal Four-Wire Multiplexer, part of Stanford Research Systems' Small Instrumentation Modules family, is a switch that connects one of eight four-wire input channels to a four-wire output (common). It is possible to bypass all of the channels; connecting the output to the bypass channel allows cascading of multiple modules.

Safety and Preparation for Use

The excitation leads and the (unbuffered) sense leads in the SIM925 are isolated from the Earth, the power-line-outlet ground, the metal chassis of the module, and from each other. No dangerous voltages are generated by the module. However, if a dangerous voltage is applied to an input, it may be present on the output connector, and may cause injury or death.

Do not exceed ±15 volts to the Earth at each input, output, or bypass terminal.

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

The SIM925 is a single-wide module designed to be used inside the SIM900 Mainframe. Do not turn on the power to the mainframe or connect inputs or outputs to the module 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.

- Front-panel buttons are set as [Channel];
  [Channel ▲▼] is shorthand for "[Channel ▲] & [Channel ▼]".

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

- Signal names are set as ¬STATUS.

- Signal levels are set as HIGH.

- Remote command names are set as *IDN? .

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

- Special ASCII characters are set as ⟨CR⟩.

Remote command examples will all be set in monospaced font. In these examples, data sent by the host computer to the SIM925 are set as `straight teletype font`, while responses received by the host computer from the SIM925 are set as *`slanted teletype font`*.

Specifications

Performance Characteristics

		Min	Typ	Max	Units
Switching	Input channels	8, plus 1 bypass channel			
	Wires per channel	4			
	Switch capacity			10	mA
				10	V DC
	Switch thermal EMF			10	μV
	Order	Break-before-make (default);			
		Make-before-break [1]			
	Speed [2]			50	ms
Channel resistance	Series			2.0	Ω
	Isolation		10		GΩ
Input capacitance	Selected channel [3]			60	pF
	Selected to unselected channel [4]			25	pF
	Unselected channels [3]			25	pF
Active buffer	Bandwidth		1		MHz
	Input noise, 10 Hz		30		nV/$\sqrt{\text{Hz}}$
	1 kHz		16		nV/$\sqrt{\text{Hz}}$
	Bias current		5		pA
	Input overload limits	±0.99		±1.04	V
Operating	Temperature [5]	0		40	°C
	Power	+5, ±15			V DC
	Supply current, +5 V		50		mA
	±15 V		10		mA

Conditions:
[1] Accessible through the remote interface only.
[2] Break-before-make.
[3] Between every two leads, and between each lead and the ground.
[4] Between every two leads.
[5] Non-condensing.

General Characteristics

Interface	Serial (RS–232) through SIM interface
Connectors	DB–37 (female, front)
	DB–9 (male, rear)
	DB–9 (female, 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 your SIM925 Octal Four-Wire Multiplexer.

In This Chapter

1.1   Introduction to the Instrument

The SIM925 is designed for low-level signal applications. Sets of four leads can be switched with a single command; each set forms a *channel* of the SIM925. Two of the four leads are sense leads, and two are excitation leads. Within each channel, the two sense leads (labeled $+V$ and $-V$) are equivalent, and the two excitation leads (labeled $+I$ and $-I$) are equivalent: the ± signs are strictly notational, and impose no polarity requirement. However, the sense leads and the excitation leads switch at different times (Section 2.1). Only the sense leads can be buffered. Kelvin-lead measurements are supported with this buffering. If the buffer is switched out, the module forms a simple relay-based, 4-pole/8-throw switch. The bypass connection allows multiple modules to be cascaded, providing unlimited networking possibilities.

sense leads

excitation leads
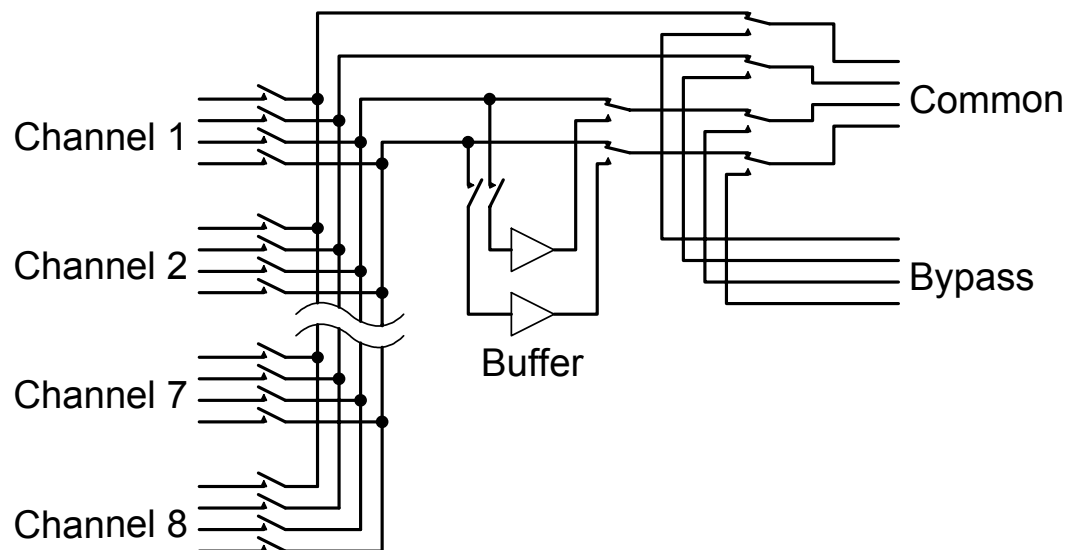
Figure 1.1: The SIM925 block diagram.

The digital control circuitry in the SIM925 is designed with a special clock-stopping architecture. The microcontroller is turned on only when switch settings are being changed, during remote communications, or when an overload condition occurs. This guarantees that no digital noise contaminates low-level analog signals.

remote interface

Switch settings may be changed from the front panel or through the remote interface (RS–232 or GPIB). These settings can also be queried. If armed, the module generates a status signal to alert the user of an overload condition. The SIM925 can be operated outside the SIM900 Mainframe by powering it with its required DC voltages.

1.1.1   Front and rear panels

Figure 1.2: The SIM925 front and rear panels.

1.2   Front-Panel Operation

The seven-segment display indicates the selected channel. When a channel is *selected*, its input relays are latched in the closed position. Use the [Channel ▲▼] buttons to change the selected channel up or down. The display

—

(dash) indicates that all channels' input relays are latched in the open position. *This state is not the same as the bypassed state.*

bypass   In order to bypass all input channels and connect the bypass channel to the common output, press the [Bypass] button. The yellow *Bypass* LED indicator will turn on. This connection can be made or broken while an input channel stays selected. The selected input channel will still be indicated on the display, but will be disconnected from the common. Press the [Bypass] button again to disconnect the bypass channel from the common.

buffer   A press of the [Buffer] button connects the sense leads of a selected

channel to a pair of unity-gain, high-impedance voltage buffers. This action also connects the outputs of the buffers to the common, unless the common is connected to bypass. The green *Buffer* LED is on when the buffer is active. If the magnitude of the voltage (with respect to the chassis ground) on one or both sense leads exceeds the limits in the specification table on Page vi, the red *OVLD* LED indicator turns on. The LED stays on for a minimum of 40 ms; after this time it will turn off if the overload condition has ceased.

1.3   Connections

The SIM interface connector is discussed in Section 1.5.1.

1.3.1   Input connector

The female DB–37 connector on the front panel accommodates the eight input channels. The connector signals are specified in Table 1.1.

Pin	Signal	Description	Pin	Signal	Description
1	$+I$ Ch. 1	Excitation, Channel 1	20	$-I$ Ch. 1	Excitation, Channel 1
2	$+V$ Ch. 1	Sense, Channel 1	21	$-V$ Ch. 1	Sense, Channel 1
3	GND Pass-Thru	Pass-through ground	22	$+I$ Ch. 2	Excitation, Channel 2
4	$-I$ Ch. 2	Excitation, Channel 2	23	$+V$ Ch. 2	Sense, Channel 2
5	$-V$ Ch. 2	Sense, Channel 2	24	$+I$ Ch. 3	Excitation, Channel 3
6	$-I$ Ch. 3	Excitation, Channel 3	25	$+V$ Ch. 3	Sense, Channel 3
7	$-V$ Ch. 3	Sense, Channel 3	26	GND Pass-Thru	Pass-through ground
8	$+I$ Ch. 4	Excitation, Channel 4	27	$-I$ Ch. 4	Excitation, Channel 4
9	$+V$ Ch. 4	Sense, Channel 4	28	$-V$ Ch. 4	Sense, Channel 4
10	$+I$ Ch. 5	Excitation, Channel 5	29	$-I$ Ch. 5	Excitation, Channel 5
11	$+V$ Ch. 5	Sense, Channel 5	30	$-V$ Ch. 5	Sense, Channel 5
12	GND Pass-Thru	Pass-through ground	31	$+I$ Ch. 6	Excitation, Channel 6
13	$-I$ Ch. 6	Excitation, Channel 6	32	$+V$ Ch. 6	Sense, Channel 6
14	$-V$ Ch. 6	Sense, Channel 6	33	$+I$ Ch. 7	Excitation, Channel 7
15	$-I$ Ch. 7	Excitation, Channel 7	34	$+V$ Ch. 7	Sense, Channel 7
16	$-V$ Ch. 7	Sense, Channel 7	35	GND Pass-Thru	Pass-through ground
17	$+I$ Ch. 8	Excitation, Channel 8	36	$-I$ Ch. 8	Excitation, Channel 8
18	$+V$ Ch. 8	Sense, Channel 8	37	$-V$ Ch. 8	Sense, Channel 8
19	GND Pass-Thru	Pass-through ground			

Table 1.1: Front-panel (input) connector pin assignments, DB–37.

The pass-through ground is not connected to the chassis ground inside the SIM925.

1.3.2 Bypass connector

The female DB–9 connector on the rear panel accommodates the bypass leads. The connector signals are specified in the following table.

Pin	Signal	Description
1	$+I$	Excitation
2	$-I$	Excitation
3	GND Pass-Thru	Pass-through ground
4	$+V$	Sense
5	$-V$	Sense
6	GND Pass-Thru	Pass-through ground
7	GND Pass-Thru	Pass-through ground
8	GND Pass-Thru	Pass-through ground
9	GND Pass-Thru	Pass-through ground

Table 1.2: Bypass connector pin assignments, DB–9 (female).

1.3.3 Common connector

The male DB–9 connector on the rear panel is the output common. The connector signals are specified in the following table.

Pin	Signal	Description
1	$+I$	Excitation
2	$-I$	Excitation
3	GND Pass-Thru	Pass-through ground
4	$+V$	Sense
5	$-V$	Sense
6	GND Pass-Thru	Pass-through ground
7	GND Pass-Thru	Pass-through ground
8	GND Pass-Thru	Pass-through ground
9	GND Pass-Thru	Pass-through ground

Table 1.3: Common connector pin assignments, DB–9 (male).

1.4 Power-On

The instrument retains the selected channel, the state of the bypass, the state of the buffer, and the switching order (Section 2.1) in non-volatile memory. Upon power-on, those settings will be restored to their state before the power was turned off.

In the absence of mechanical disturbances, all switches retain their latched state after the power has been turned off and until the next time the power is turned on. See Section 4.1.1 for more detail.

The power-on configuration of the remote interface is detailed in Section 3.3.1.

1.5   Restoring the Default Configuration

The default configuration of the SIM925 is no input channel selected, bypass OFF, buffer OFF, switching order set to break-before-make. To reset the module into this configuration, turn the SIM900 Mainframe power on while holding a front-panel button of the SIM925.

The same configuration can also be reached from the remote interface by issuing the *RST command.

The primary connection to the SIM925 Octal Four-Wire Multiplexer is the rear-panel DB–15 SIM interface connector. Typically, the SIM925 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 SIM925 directly, without using the SIM900 Mainframe. This section provides details on the interface.

⚠ CAUTION

The SIM925 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 SIM925 together with the SIM900 Mainframe for most applications.

1.5.1   SIM interface connector

The DB–15 SIM interface connector carries all the power and communication lines to the instrument. The connector signals are specified in Table 1.4.

Pin	Signal	Direction Src ⇒ Dest	Description
1	SIGNAL_GND	MF ⇒ SIM	Ground reference (unused in SIM925)
2	¬STATUS	SIM ⇒ MF	Status/service request (GND = asserted, +5 V = idle)
3	RTS	MF ⇒ SIM	HW handshake (unused in SIM925)
4	CTS	SIM ⇒ MF	HW handshake (unused in SIM925)
5	¬REF_10MHZ	MF ⇒ SIM	10 MHz reference (no connection in SIM925)
6	−5V	MF ⇒ SIM	Power supply (no connection in SIM925)
7	−15V	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 SIM925)
13	+5V	MF ⇒ SIM	Power supply
14	+15V	MF ⇒ SIM	Power supply
15	+24V	MF ⇒ SIM	Power supply (no connection in SIM925)

Table 1.4: SIM interface connector pin assignments, DB–15.

1.5.2   Direct interfacing

The SIM925 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 Tyco part number 747909–2 (or equivalent). Clean, well-regulated supply voltages of ±15.0 V DC, +5.0 V DC must be provided, following the pinout specified in Table 1.4. Ground must be provided on

Pin 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. See Section 3.5 for the description of status messages.

1.5.2.1   Direct interface cabling

If the user intends to directly wire the SIM925 independent of the SIM900 Mainframe, communication is usually possible by directly connecting the appropriate interface lines from the SIM925 DB–15 plug to the RS–232 serial port of a personal computer.[1] Connect RXD from the SIM925 directly to RxD on the PC, TXD directly to TxD, and similarly RTS→RTS and CTS→CTS. 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 contemporary personal computers, a cable must be made with a female DB–15 socket to mate with the SIM925, 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 1.5.

DB–15/F to SIM925		Name
	DB–9/F	
10 ⟷	3	TxD
11 ⟷	2	RxD
	5	Computer Ground
	to Power Supply	
7 ⟷	−15 V DC	
13 ⟷	+5 V DC	
14 ⟷	+15 V DC	
8, 9 ⟷	Ground (Supply return current)	

Table 1.5: SIM925 direct interface cable pin assignments.

1.5.2.2   Serial settings

The initial serial port settings at power-on are: baud rate 9600, 8 bits, no parity, 1 stop bit, and no flow control. The baud rate of the SIM925 cannot be changed. Flow control is not implemented in the SIM925. 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, these lines are typically compatible with desktop personal computers.

2 Description of Operation

This chapter provides a number of additional details of the operation of the SIM925.

In This Chapter

2.1   Switching Order

There are two settings for the order in which the input relays of the SIM925 switch, selecting the input channel: break-before-make and make-before-break. The "making" and "breaking" of the connections refers to the excitation leads *only*. The sense leads are always disconnected ("broken") before being connected to a new input channel ("made").

break-before-make   If the order is break-before-make (the default), the two sense leads and the two excitation leads are disconnected from the input to the SIM925 at approximately the same time (within 1 ms of each other). At a typical time of 5 ms later, the two sense leads and the two excitation leads are connected to the new input channel, at approximately the same time (within 1 ms of each other).

make-before-break   From the remote interface, use the MODE command to change the switching order. If the order is changed to make-before-break, the two sense leads are disconnected from the input to the SIM925 at approximately the same time (within 1 ms of each other). At a typical time of 5 ms later, the two sense leads and the two excitation leads are connected to the new input channel at approximately the same time (within 1 ms of each other). The excitation leads remain connected to the old input channel at this time. Another 5 ms (typ.) later, the two excitation leads are disconnected from the old input channel within 1 ms of each other, and the switching sequence is complete.

If the new channel setting is "no channel selected" (CHAN 0) and the mode is break-before-make, the four leads are disconnected at approximately the same time (within 1 ms of each other). If the new channel setting is "no channel selected" and the mode is make-before-break, the two excitation leads are disconnected approximately 5 ms after the two sense leads. If the old channel setting was "no channel selected", all four leads switch to the new input at approximately the same time.

If the remote interface is not available and the switching order setting is stored in the non-volatile memory, use the manual reset procedure (Section 1.5) to change the order to the default.

2.2   Clock Stopping

The microprocessor clock of the SIM925 stops if the module is idle, "freezing" the digital circuitry. The following actions "wake up" the clock:

1. A power-on.

2. A press of a front-panel button.

3. Activity (send or receive) at the remote interface.

4. A buffer input overload.

The clock runs for as long as is necessary to complete a change of settings, or to communicate the output of a query through the remote interface. However, the clock will remain active for as long as the overload condition exists.

This default behavior can be modified with the remote command AWAK. Setting AWAK ON will prevent the clock from stopping. The module returns to AWAK OFF upon power-on.

3 Remote Operation

This chapter describes operating the SIM925 over the serial interface.

In This Chapter

3.1   Index of Common Commands

Symbol	Definition
i	Bit number (0–7)
j	Unsigned integer
n	Channel number (1–8); *n* = 0 means "none"
s	Character string
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

General

HELP(?)	3 – 9	Instrument Help
AWAK(?) {z}	3 – 10	Keep Clock Awake

Configuration

MODE(?) {z}	3 – 10	Switching Order
CHAN(?) {n}	3 – 10	Channel
BPAS(?) {z}	3 – 11	Bypass
BUFR(?) {z}	3 – 11	Buffer
RELY j, z	3 – 11	Relay

Status

*CLS	3 – 12	Clear Status
*STB? [i]	3 – 12	Status Byte
*SRE(?) [i,] {j}	3 – 12	Service Request Enable
*ESR? [i]	3 – 12	Standard Event Status
*ESE(?) [i,] {j}	3 – 12	Standard Event Status Enable
CESR? [i]	3 – 13	Communication Error Status
CESE(?) [i,] {j}	3 – 13	Communication Error Status Enable
PSTA(?) {z}	3 – 13	Pulse ¬STATUS Mode
LBTN?	3 – 13	Last Button
OVLD?	3 – 13	Buffer Overload

Interface

NOTE(?) n {, s}	3 – 14	Arbitrary Note
*RST	3 – 14	Reset
*IDN?	3 – 15	Identify
*TST?	3 – 15	Self Test
*OPC(?)	3 – 15	Operation Complete

Serial Communications

3.2   Alphabetic List of Commands

★

*CLS	3 – 12	Clear Status
*ESE(?) [*i*,] {*j*}	3 – 12	Standard Event Status Enable
*ESR? [*i*]	3 – 12	Standard Event Status
*IDN?	3 – 15	Identify
*OPC(?)	3 – 15	Operation Complete
*RST	3 – 14	Reset
*SRE(?) [*i*,] {*j*}	3 – 12	Service Request Enable
*STB? [*i*]	3 – 12	Status Byte
*TST?	3 – 15	Self Test

A

AWAK(?) {*z*}	3 – 10	Keep Clock Awake

B

BPAS(?) {*z*}	3 – 11	Bypass
BUFR(?) {*z*}	3 – 11	Buffer

C

CESE(?) [*i*,] {*j*}	3 – 13	Communication Error Status Enable
CESR? [*i*]	3 – 13	Communication Error Status
CHAN(?) {*n*}	3 – 10	Channel
CONS(?) {*z*}	3 – 15	Console Mode

H

HELP(?)	3 – 9	Instrument Help

L

LBTN?	3 – 13	Last Button
LCME?	3 – 16	Command Error
LEXE?	3 – 16	Execution Error

M

MODE(?) {*z*}	3 – 10	Switching Order

N

NOTE(?) *n* {, *s*}	3 – 14	Arbitrary Note

O

OVLD?	3 – 13	Buffer Overload

P

PARI(?) {z}	3 – 17	Parity
PSTA(?) {z}	3 – 13	Pulse ¬STATUS Mode

R

RELY j, z	3 – 11	Relay

T

TERM(?) {z}	3 – 17	Response Termination
TOKN(?) {z}	3 – 17	Token Mode

3.3   Introduction

Remote operation of the SIM925 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 amplifier from a remote computer, either through the SIM900 Mainframe or directly via RS–232 (see Section 1.5.2.1).

See Table 1.4 for the specification of the DB–15 SIM Interface Connector.

3.3.1   Power-on configuration

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

Where appropriate, the power-on default value for parameters is listed in **boldface** in the command descriptions.

3.3.2   Communication buffers

The SIM925 stores incoming bytes from the host interface in a 64-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 SIM925 are buffered in a 64-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.

3.3.3   Device Clear

The SIM925 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 SRST command; if directly interfacing via RS–232, then use a serial break signal. After receiving the Device Clear, the interface is reset to 9600 baud and the CONS mode is turned OFF. Note that this *only* resets the communication interface; the basic function of the SIM925 is left unchanged; to reset the multiplexer, use *RST.

The Device Clear signal will also terminate the output of the HELP? command from the SIM925.

3.4 Commands

This section provides syntax and operational descriptions for remote commands.

3.4.1 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 should be omitted for queries. Parameters in [ ] are optional in both set and query commands. Parameters listed without 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 whitespaces are ignored. Execution of the command 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 as an 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.

3.4.2 Notation

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

Symbol	Definition
i	Bit number (0–7)
j	Unsigned integer
n	Channel number (1–8); $n = 0$ means "none"
s	Character string
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

3.4.3 Examples

Each command is provided with a simple example illustrating its usage. In these examples, all data sent by the host computer to the SIM925 are set as `straight teletype font`, while responses received by the host computer from the SIM925 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, and are intended to provide a convenient starting point for user programming.

3.4.4   General commands

HELP(?)   Instrument Help

                                     Outputs a condensed version of Section 3.1 to the remote interface.

                                     HELP may be used with or without the query sign, with the same
                                     effects.

                  Example: HELP?
                               Notation:
                               i is bit number (0..7);
                               j is an 8-bit unsigned integer (0..255);
                               n is channel number (1..8); n = 0 means "all channels OFF";
                               z is a token
                               (?) question required for queries, illegal for set commands;
                               [] = parameter is optional for both set and query forms;
                               {} = parameter is required to set, illegal for queries;
                               parameter without brackets is always required;
                               the brackets themselves should not be sent.

                               General commands:
                               HELP?   - Send this text.
                               AWAK(?) {z}   - Keep the module clock awake.

                               Configuration commands:
                               MODE(?) {z}   - Make before break, or break before make.
                               CHAN(?) {n}   - Channel.
                               BPAS(?) {z}   - Bypass.
                               BUFR(?) {z}   - Buffer.
                               RELY j, z   - Individual relay.

                               Status commands:
                               *CLS   - Clear Status.
                               *STB?   [i]   - Query the Status Byte.
                               *SRE(?) [i,] {j} - Service Request Enable.
                               *ESR?   [i]   - Query Standard Event Status register.
                               *ESE(?) [i,] {j} - Standard Event Status Enable.
                               CESR?   [i]   - Query the Communications Error Status.
                               CESE(?) [i,] {j} - Communications Error Status Enable.
                               PSTA(?) {z}   - Pulse Status or change its level.
                               LBTN?   - Which button last pressed?
                               OVLD?   - Buffer currently overloaded?
                               Interface commands:
                               NOTE(?) n {,s}   - Record scratch note (n = 0..9).
                               *RST   - Reset to known state.
                               *IDN?   - Identify.

```
*TST?           - Does nothing.
*OPC(?)         - Operation complete.
CONS(?) {z}     - Console OFF/ON.
LEXE?           - Last Execution Error.
LCME?           - Last Communications Error.
LDDE?           - Last Device-Dependent Error.
TOKN(?) {z}     - Turn token mode OFF/ON.
TERM(?) {z}     - Cmd line end (NONE, CR, LF, CRLF, LFCR).


Serial interface command (baud rate is always 9600):
PARI(?) {z}      - Parity (NONE, EVEN, ODD, MARK, SPACE).
```

AWAK(?) {z}

Keep Clock Awake

Set (query) the SIM925 keep-awake mode {to z = (**OFF 0,** ON 1)}.

Ordinarily, the clock oscillator for the SIM925 microcontroller is held in a stopped state, and only enabled during processing of events (Section 2.2). Setting AWAK ON forces the clock to stay running, and is useful only for diagnostic purposes.

Example: AWAK ON

3.4.5 Configuration commands

These commands govern the operation of the SIM925.

MODE(?) {z}

Switching Order

Set (query) the switching order {to z = (MBB 0, **BBM 1**)}.

Controls the order of switching during channel changes, as either make-before-break (MBB) or break-before-make (BBM). The order only applies to the excitation leads; the sense connections always break before being made (Section 2.1).

The MODE value is retained in non-volatile memory and is *not* modified by a power-on reset.

Example: TOKN ON; MODE?
              BBM

CHAN(?) {n}

Channel

Set (query) the selected channel {to n = (1–8; **0** for all channels off)}.

Example: CHAN 5

BPAS(?) {*z*}		Bypass
		Set (query) the rear-panel bypass channel {to *z* = (**OFF 0,** ON 1)}.
	Example:	BPAS?
		0

BUFR(?) {*z*}		Buffer
		Set (query) the sense-lead active buffer {to *z* = (**OFF 0,** ON 1)}.
	Example:	BUFR ON

RELY *j*, *z*   Relay

Set relay number *j* to *z* = (**OPEN 0,** CLOSE 1).

This low-level command provides direct control over the relay hardware in the SIM925, independent of the CHAN, BPAS, and BUFR commands. To return the SIM925 to a "simple" channel configuration, issue a CHAN set command. There is no corresponding low-level query for RELY.

Relay numbers are (Section 4.3):

Value *j*	Relay	Switches signals	Signal description
1	K201	$\pm I$ Ch. 1	Excitation, Channel 1
2	K202	$\pm V$ Ch. 1	Sense, Channel 1
3	K203	$\pm I$ Ch. 2	Excitation, Channel 2
4	K204	$\pm V$ Ch. 2	Sense, Channel 2
5	K205	$\pm I$ Ch. 3	Excitation, Channel 3
6	K206	$\pm V$ Ch. 3	Sense, Channel 3
7	K207	$\pm I$ Ch. 4	Excitation, Channel 4
8	K208	$\pm V$ Ch. 4	Sense, Channel 4
9	K209	$\pm I$ Ch. 5	Excitation, Channel 5
10	K210	$\pm V$ Ch. 5	Sense, Channel 5
11	K211	$\pm I$ Ch. 6	Excitation, Channel 6
12	K212	$\pm V$ Ch. 6	Sense, Channel 6
13	K213	$\pm I$ Ch. 7	Excitation, Channel 7
14	K214	$\pm V$ Ch. 7	Sense, Channel 7
15	K215	$\pm I$ Ch. 8	Excitation, Channel 8
16	K216	$\pm V$ Ch. 8	Sense, Channel 8
17	K217	$\pm V$ Mux	Buffer amplifier input
18	K218	$\pm V$ Mux	Buffer amplifier output
19, 20	K219 & K220	$\pm I$:COMMON & $\pm V$:COMMON	Bypass

There is no independent control over the bypass *I* and *V* relays, they open and close together.

Example: RELY 9,CLOSE

3.4.6   Status commands

The Status commands query and configure registers associated with status reporting of the SIM925. See Section 3.5 for the status model.

---

*CLS   Clear Status

*CLS immediately clears the ESR, CESR, and the OVLD bit in the SB register.

Example: *CLS

---

*STB? [*i*]   Status Byte

Query 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.

*STB? clears the OVLD bit (Section 3.5.1) in the SB register.

Example: *STB?
             16

---

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

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

Example: *SRE 0,1

---

*ESR? [*i*]   Standard Event Status

Query the Standard Event Status Register [Bit *i*].

Upon execution of *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*]		Communication Error Status
		Query the Communication Error Status Register [Bit *i*].
		Upon executing a **CESR?** query, the returned bit(s) of the CESR register are cleared.
	Example:	CESR? **0**

CESE(?) [*i*,] {*j*}		Communication Error Status Enable
		Set (query) the Communication Error Status Enable Register [Bit *i*] {to *j*}.
	Example:	CESE? *2*

PSTA(?) {*z*}		Pulse ¬STATUS Mode
		Set (query) the Pulse ¬STATUS mode {to *z* = (**OFF 0,** ON 1)}.
		When **PSTA** ON is set, all new service requests 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.
	Example:	PSTA? *OFF*

LBTN?		Last Button
		Query the number of the last button pressed. The response is 1, 2, 3, or 4, corresponding to [Channel ▲], [Channel ▼], [Bypass], and [Buffer]. **0** is returned if no button was pressed since the last **LBTN?** .
		A query of **LBTN?** always clears the button code, so a subsequent **LBTN?** will return **0**.
	Example:	LBTN? *5*

OVLD?		Buffer Overload
		Query the current overload state of the sense-lead active buffer. The response is 1 if an overload condition exists, **0** otherwise.
		This command complements the status bit described in Section 3.5.1. Once cleared by ***STB?** or ***CLS**, the overload status bit will stay cleared even though the overload condition may persist.

Example: OVLD?
             1

3.4.7   Interface commands

The Interface commands provide control over the interface between the SIM925 and the host computer.

NOTE(?) *n* {, *s*}

Arbitrary Note

Set (query) an arbitrary note in location *n*.

The SIM925 has ten (10) non-volatile memory blocks *n* = (0–9) for storing arbitrary configuration notes. The content of each note {*s*} is an arbitrary string of up to 16 characters in length, with the following restrictions:

- No commas (",") or semicolons (";") may be in *s*.

- Any whitespace characters (space, tab) are automatically removed from *s* before storage by the SIM925.

- All alphabetic characters (a–z) are automatically converted to uppercase (A–Z) before storage.

Example: NOTE 2,Last Cal‿12JAN05
             NOTE? 2
             LASTCAL‿12JAN05
             (note the space removal, and conversion to uppercase letters).

---

*RST

Reset

Reset the SIM925 to its default configuration.

*RST sets the following:

- Clock oscillator to stop during idle time (AWAK OFF).

- Channel changes to break-before-make (MODE BBM).

- No channel selected (CHAN 0).

- Bypass channel disconnected (BPAS OFF).

- Buffer amplifier disconnected (BUFR OFF).

- The token mode to OFF.

*RST does *not* affect PSTA, CONS, TERM, and all service-enable registers (*SRE, *ESE, or CESE).

Example: *RST
             CONS?
             1

---

*IDN?   Identify

Query the device identification string.

The identification string is formatted as:

`Stanford Research Systems,SIM925,s/n******,ver#.###`

where `SIM925` is the model number, `******` is a 6-digit serial number, and `#.###` is the firmware revision level.

Example: `*IDN?`
             Stanford Research Systems,SIM925,s/n004700,ver2.0

---

*TST?   Self Test

There is no internal self-test in the SIM925 after the power-on, so this query always returns `0`.

Example: `*TST?`
             `0`

---

*OPC(?)   Operation Complete

Sets the OPC flag in the ESR register.

The query form ***OPC?** writes a 1 into the output queue when complete, but does not affect the ESR register.

Example: `*OPC?`
             1

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.

A reset does not alter **CONS**. The value in boldface above is the power-on value. **CONS** is set to `OFF` upon Device Clear.

Example: `CONS ON`

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

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 command 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
10	Bad integer
11	Bad integer token
12	Bad token value
14	Unknown token

Example: `*IDN`
`LCME?`
4
The error (4, "Illegal set") is due to the missing "?".

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 SIM925 that return tokens will return a text keyword; otherwise they return a decimal integer value. Thus, the only possible responses to the TOKN? query are ON and 0.

Example: TOKN OFF

TERM(?) {*z*}	Response Termination

Set (query) the ⟨term⟩ sequence {to *z* = (NONE 0, CR 1, LF 2, **CRLF 3,** or 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/or 10 (line feed). The token mnemonic gives the sequence of characters.

A reset does not alter TERM. The value in boldface above is the power-on value.

Example: TOKN ON; TERM?
            CRLF

3.4.8 Serial communication commands

Note that the SIM925 can only support a single baud rate of 9600, and does not support flow control. A reset does not change the serial interface settings; use Device Clear.

PARI(?) {*z*}	Parity

Set (query) the parity {to *z* = (**NONE 0,** ODD 1, EVEN 2, MARK 3, SPACE 4)}. The value in boldface is the power-on value.

Example: TOKN ON; PARI?
            EVEN

3.5   Status Model

status registers   The SIM925 status registers follow the hierarchical IEEE–488.2 format. A block diagram of the status register array is given in Figure 3.1.
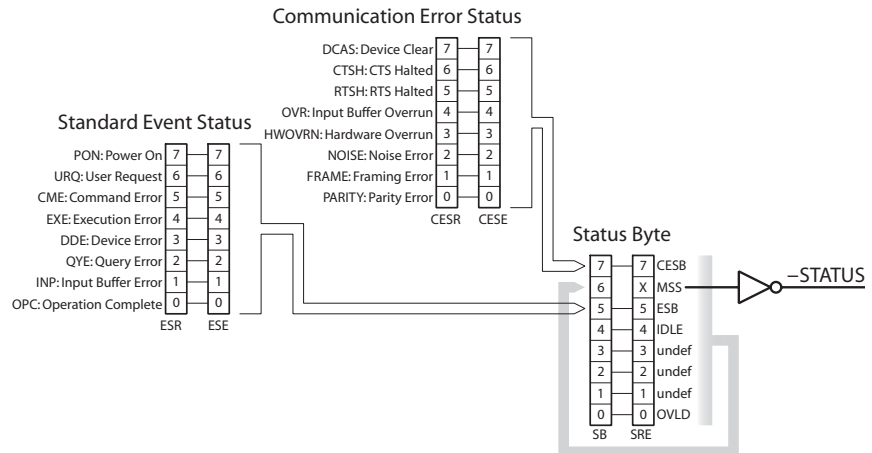

Figure 3.1: Status register model for the SIM925 Octal Four-Wire Multiplexer.

There are two categories of registers in the SIM925 status model:

Event Registers :   These read-only registers record the occurrence of defined events. If the event occurs, the corresponding bit is set to 1. Upon querying an event register, all 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 a 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.

At power-on, all status registers are cleared.

3.5.1   Status Byte (SB)

The Status Byte is the top-level summary of the SIM925 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.

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 overload event has occured at the input of the sense-lead active buffer. The command *STB? clears the bit. If the overload condition ceases, the bit remains latched until cleared by *STB? or *CLS. If the bit is cleared by *STB? while the overload condition persists, the bit will remain cleared until the overload condition ceases and reoccurs. Use OVLD? to query the current state of the overload.

IDLE : Indicates that the input buffer is empty and the command parser is idle. Can be used to help synchronize SIM925 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.

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

3.5.2   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 MSS. 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.

3.5.3   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

events, 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. Unused in the SIM925.

EXE : Execution Error. Indicates the error in a command that was successfully parsed. Out-of-range parameters are an example.

CME : Command Error. Indicates a command parser-detected error.

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

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

3.5.4 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). The register can be set and queried with the *ESE(?) command.

3.5.5 Communication Error Status (CESR)

The Communication Error Status Register consists of 8 event flags; each of the flags is set by the corresponding event, and cleared only by reading the register 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 the 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 the incoming data. Causes the input buffer to be flushed, and resets the command parser.

RTSH :   RTS Holdoff Event. Unused in the SIM925.

CTSH :   CTS Holdoff Event. Unused in the SIM925.

DCAS :   Device Clear. Indicates that the SIM925 received the Device Clear signal (an RS–232 ⟨break⟩). Clears the input buffer and the output queue, and resets the command parser.

3.5.6   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). The register can be set and queried with the CESE(?) command.

4   Circuit Description

This chapter presents a brief description of the SIM925 circuit design.
A complete parts list and circuit schematics are included.

In This Chapter

4.1   Component Details

4.1.1   Latching relays

All switches in the multiplexer are double-pole, double-throw latching relays. These relays (K201–K220) have been selected for a low contact thermal EMF. When the relays are not changing state, their coils are not energized. Thus there is no holding EMF to preserve the switch in its state against a strong mechanical disturbance. *Do not shake, drop, or bump the multiplexer.* The state of the relays is reasserted upon power-on.

4.1.2   Configuring unselected channels

The sense and excitation leads of a selected input channel are connected to the common output, whereas those of an unselected input channel are normally left unconnected. However, the instrument's user can connect external circuitry to these leads by soldering to the pads of breakout connector J203 on the circuit board. The most frequent modification is to ground the leads of all unselected channels. It is easily accomplished by jumpering across neighboring pads of J203.

Pos.	Signal	Description	Pos.	Signal	Description
1	Unsel. $+I$ Ch. 1	Excitation, Channel 1	2	GND Pass-Thru	Pass-through ground
3	Unsel. $-I$ Ch. 1	Excitation, Channel 1	4	GND Pass-Thru	Pass-through ground
5	Unsel. $+V$ Ch. 1	Sense, Channel 1	6	GND Pass-Thru	Pass-through ground
7	Unsel. $-V$ Ch. 1	Sense, Channel 1	8	GND Pass-Thru	Pass-through ground
9	Unsel. $+I$ Ch. 2	Excitation, Channel 2	10	GND Pass-Thru	Pass-through ground
11	Unsel. $-I$ Ch. 2	Excitation, Channel 2	12	GND Pass-Thru	Pass-through ground
13	Unsel. $+V$ Ch. 2	Sense, Channel 2	14	GND Pass-Thru	Pass-through ground
15	Unsel. $-V$ Ch. 2	Sense, Channel 2	16	GND Pass-Thru	Pass-through ground
17	Unsel. $+I$ Ch. 3	Excitation, Channel 3	18	GND Pass-Thru	Pass-through ground
19	Unsel. $-I$ Ch. 3	Excitation, Channel 3	20	GND Pass-Thru	Pass-through ground
21	Unsel. $+V$ Ch. 3	Sense, Channel 3	22	GND Pass-Thru	Pass-through ground
23	Unsel. $-V$ Ch. 3	Sense, Channel 3	24	GND Pass-Thru	Pass-through ground
25	Unsel. $+I$ Ch. 4	Excitation, Channel 4	26	GND Pass-Thru	Pass-through ground
27	Unsel. $-I$ Ch. 4	Excitation, Channel 4	28	GND Pass-Thru	Pass-through ground
29	Unsel. $+V$ Ch. 4	Sense, Channel 4	30	GND Pass-Thru	Pass-through ground
31	Unsel. $-V$ Ch. 4	Sense, Channel 4	32	GND Pass-Thru	Pass-through ground
33	Unsel. $+I$ Ch. 5	Excitation, Channel 5	34	GND Pass-Thru	Pass-through ground
35	Unsel. $-I$ Ch. 5	Excitation, Channel 5	36	GND Pass-Thru	Pass-through ground
37	Unsel. $+V$ Ch. 5	Sense, Channel 5	38	GND Pass-Thru	Pass-through ground
39	Unsel. $-V$ Ch. 5	Sense, Channel 5	40	GND Pass-Thru	Pass-through ground
41	Unsel. $+I$ Ch. 6	Excitation, Channel 6	42	GND Pass-Thru	Pass-through ground
43	Unsel. $-I$ Ch. 6	Excitation, Channel 6	44	GND Pass-Thru	Pass-through ground
45	Unsel. $+V$ Ch. 6	Sense, Channel 6	46	GND Pass-Thru	Pass-through ground
47	Unsel. $-V$ Ch. 6	Sense, Channel 6	48	GND Pass-Thru	Pass-through ground
49	Unsel. $+I$ Ch. 7	Excitation, Channel 7	50	GND Pass-Thru	Pass-through ground
51	Unsel. $-I$ Ch. 7	Excitation, Channel 7	52	GND Pass-Thru	Pass-through ground
53	Unsel. $+V$ Ch. 7	Sense, Channel 7	54	GND Pass-Thru	Pass-through ground
55	Unsel. $-V$ Ch. 7	Sense, Channel 7	56	GND Pass-Thru	Pass-through ground
57	Unsel. $+I$ Ch. 8	Excitation, Channel 8	58	GND Pass-Thru	Pass-through ground
59	Unsel. $-I$ Ch. 8	Excitation, Channel 8	60	GND Pass-Thru	Pass-through ground
61	Unsel. $+V$ Ch. 8	Sense, Channel 8	62	GND Pass-Thru	Pass-through ground
63	Unsel. $-V$ Ch. 8	Sense, Channel 8	64	GND Pass-Thru	Pass-through ground

Table 4.1: Breakout connector J203 pad assignments.

4.1.3   Digital control and clock stopping

The SIM925 is controlled by microcontroller U107. Digital buffers U108–U110 provide the current necessary to energize the latching relays.

A critical aspect of the design is the clock-stop circuitry implemented by U103 and U105. A simple RC oscillator is enabled or disabled at Pin 1 of U105. This pin is driven by synchronizing flip-flop U103B to ensure that no "runt" clock pulses are produced that would violate the minimum clock period of U107. Four separate clock starting signals are combined by U101 and U102, as discussed in Section 2.2.

The fast start time of the RC oscillator ensures that incoming se-

rial 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 SIM925 guarantees that no digital clock artifacts can be generated during quiescent operation.

4.2 Parts List

STANFORD RESEARCH SYSTEMS, INC.					
SIM925 Octal Four-Wire Multiplexer	Switch/Digital Board (1 of 1)			Revision B	ECO 3
BILL OF MATERIALS	December 13, 2005				
Item	Qty.	Reference	Part	SRS P/N	Manufacturer	Manf. P/N
1	4	C101,C102,C103,C109	10μ T	5-00098-030	AVX	TAP106K035SRW
2	1	C104	330p	5-00381-100	KEMET	C1206C331J5GAC
3	1	C105	9.0--50p	5-00106-090	XICON	24AA024
4	3	C106,C107,C108	1000p	5-00387-100	KEMET	C1206C102J1GACTM
5	21	X101,X102,X103,X104,X105,	0.1μ	5-00299-100	KEMET	C1206C104K5RACTM
		X106,X107,X108,X109,X110,				
		X111,X112,X113,X114,X115,				
		X116,X117,X118,X119,X201,				
		X202				
6	1	D101	BAT54S	3-00945-143	DIODES INC	BAT54S-7
7	1	D301	Yellow	3-00426-060	AEG	TLUY2401
8	1	D302	Green	3-00424-060	AEG	TLUG2401
9	1	D303	Red	3-00425-060	AEG	TLUR2401
10	1	J101	15 Pin D	1-00367-040	CINCH	DAKL-15PATI-E
11	0	J102	Header 0.100" 4×1	no part		
12	1	J103	Socket 0.100" 3×2	1-00302-010	SAMTEC	CES-103-01-G-D
13	1	J201	Header 0.050" 7×2/Mixed	1-01063-109	SAMTEC	FTSH-107-04-L-M-T
14	1	J202	37 Pos D	1-01072-041	TYCO	745784-4
15	0	J203	Header 0.100" 32×2	no part		
16	1	J204	Header 0.100" 9×2	1-01061-000	FAB	ASM, CABLE SIM925
17	1	J301	Socket 0.050" 7×2/SM	1-01064-119	SAMTEC	FLE-107-01-G-DV-A
18	20	K201,K202,K203,K204,K205,	ASX2204H	3-01492-203	PANASONIC	ASX2204H
		K206,K207,K208,K209,K210,				
		K211,K212,K213,K214,K215,				
		K216,K217,K218,K219,K220				
19	3	L101,L102,L103	FR43 bead	6-00174-051	FAIR-RITE	2643666611
20	0	MH101,MH102,MH103,MH104,	Mounting hole	no part		
		MH301,MH302				
21	3	Q101,Q102,Q103	MMBT3904	3-00601-150	ON SEMI	MMBT3904LT1

Item	Qty.	Reference	Part	SRS P/N	Manufacturer	Manf. P/N
22	1	R101	100k×4 D 5%	4-01704-120	BI	BCN164A-104-J7
23	3	R102,R201,R202	1.0k	4-01479-100	VISHAY	CRCW1206102JRT1
24	1	R103	210	4-01052-110	VENKEL	TRN55CF-2100TR
25	1	R104	4.7k	4-01495-100	VENKEL	CR1206-8W-472JT
26	1	R105	3.9k×4 D	4-00917-120	BI	BCN164A-392-J7
27	1	R106	22k	4-01511-100	VISHAY	CRCW1206223JRT1
28	1	R107	10	4-01431-100	VENKEL	CR1206-8W-100JT
29	3	R108,R116,R117	270	4-01465-100	VISHAY	CRCW1206271JRT1
30	3	R109,R118,R119	100 5%	4-01455-100	VISHAY	CRCW1206101JRT1
31	7	R110,R111,R114,R115,R120,	100k 5%	4-01527-100	VISHAY	CRCW1206104JRT1
		R121,R122				
32	2	R112,R113	10k	4-01503-100	VISHAY	CRCW1206103JRT1
33	1	R123	2.0k	4-01486-100	VISHAY	CRCW1206202JRT1
34	1	R124	1.2k	4-01481-100	VISHAY	CRCW1206122JRT1
35	1	R125	2.2k	4-01487-100	VISHAY	CRCW1206222JRT1
36	2	R203,R206	348k	4-01361-110	VISHAY	SMM0204-348K-50-1%-R95
37	3	R204,R207,R208	24.9k	4-01251-110	VISHAY	SMM0204-24.9K-50-1%-R95
38	1	R205	24.3k	4-01250-110	VENKEL	TRN55CF-2432TR
39	3	R209,R210,R211	2.4M	4-01560-100	VISHAY	CRCW1206245JRT1
40	1	R212	1.00k	4-01117-110	VISHAY	SMM0204-1001-FT2-R95
41	1	R213	2.94k	4-01162-110	VISHAY	SMM0204-2941-FT2-R95
42	2	R301,R302	4.7k×4 D	4-00911-120	BI	BCN164A-472-J7
43	4	S301,S302,S303,S304	B3F-1052	2-00053-000	OMRON	B3F-1052
44	0	TP101	Test point	no part		
45	2	U101,U102	74HC08	3-00663-103	PHILIPS	74HC08D
46	1	U103	74HC74	3-00742-103	ON SEMI	MC74HC74AD
47	1	U104	74HC14	3-00662-103	PHILIPS	74HC14D
48	1	U105	74AC00	3-01405-100	FSC	74AC00SC
49	1	U106	MAX6348 4.4V	3-00903-124	MAXIM	MAX6348UR44-T
50	1	U107	68HC912B32	3-01379-114	FREESCALE	MC68HC912B32CFU8
51	1	U108	74LV574A	3-01081-106	TI	SN74LV574APW
52	2	U109,U110	74LVC16374A	3-00979-106	IDT	74LVC16374APV
53	1	U201	OPA2130A	3-01403-120	TI	OPA2130UA
54	2	U202,U203	LM393	3-00728-121	TI	LM393D
55	1	U301	74HC595A	3-00672-103	ON SEMI	MC74HC595ADT
56	1	U302	HDSP-A101	3-00290-061	AVAGO	HDSP-A101
57	1	no designator	37 Pin D	1-01065-255	TYCO	747916-2
58	1	no designator	37 Pos Hood	1-01066-259	TYCO	748677-4
59	1	no designator	9 Pos D	1-00311-256	TYCO	747905-2
60	1	no designator	9 Pos Hood	1-01068-259	TYCO	748677-1

Item	Qty.	Reference	Part	SRS P/N	Manufacturer	Manf. P/N
61	4	no designator	Button Cap	0-00996-999	OMRON	B32-1000
62	4	no designator	4-40x1/4 Pan Phil	0-00187-999	J&M	4C25MPPLZ
63	2	no designator	4-40x3/16 Pan Phil	0-00241-999	J&M	4C18MPPLZ
64	6	no designator	#4 Split Washer	0-00096-999	J&M	4NLOCLZ
65	2	no designator	4-40x3/8 Flat Phil	0-00835-999	ACF	PUM-04C06-0-Z
66	4	no designator	4-40x1/8 Pan Slot	0-00148-999	MCMASTER	90283A103
67	4	no designator	4-40x1/8 Pan Phil	0-00515-999	ACF	PPM-04C02-0-Z
68	8	no designator	4-40x1/8 Black Flat Phil	0-00371-999	ACF	PUM-04C03-0-B
69	2	no designator	4-40x1/4 HX M/F Standoff	0-00079-999	RAF	4500-440-SS26MODB1/4
70	6	no designator	1.5" 24AWG Uninsulated	0-00772-999	>	>
71	1	no designator	1.5" 22AWG Red	0-00196-999	>	>
72	1	no designator	Circuit Board	7-01535-999	FAB	SIM925 Board Rev. B
73	1	no designator	Front Panel	7-01544-999	FAB	SIM925 Front Panel Rev. A
74	1	no designator	Lexan Overlay	7-01546-999	FAB	SIM925 Front Lexan Rev. B
75	1	no designator	Rear Panel	7-01545-999	FAB	SIM925 Rear Panel Rev. A
76	2	no designator	Top/Bottom Bracket	7-00933-999	FAB	SIM Sglw. Bracket Rev. D
77	2	no designator	Module Cover	7-00932-999	FAB	SIM Module Cover Rev. C2
78	4	no designator	Rubber Foot	0-00188-999	MOUSER	5167-202
79	1	no designator	Serial Number Label	9-01545-999	FAB	SIM SN Label Rev. A

4.3   Schematic Diagrams

Circuit schematic diagrams follow this page.

Appendix A   Index

¬STATUS signal, 1 – 2, 1 – 7, 3 – 12, 13, 3 – 19
⟨break⟩ signal, *see* Device Clear

Active buffer, *see* Buffer

Baud rate, 1 – 8, 3 – 6
    default, 3 – 6
Bias current, *see* Buffer, bias current
Block diagram, 1 – 2
Break-before-make, vi, 1 – 5, 2 – 2, 3 – 10, 3 –
    14
Breakout connector, 4 – 3
Buffer, vi, 1 – 2, 3, 1 – 5, 3 – 11, 3 – 13
    bandwidth, vi
    bias current, vi
    button, *see* Button, [Buffer]
    communication
      input, 3 – 6, 3 – 19–21
      output, *see* Output queue
    digital, 4 – 3
    indicator, 1 – 3
    input noise, vi
    input overload, vi, 1 – 2, 2 – 3, 3 – 13, 3 –
      19
      OVLD indicator, 1 – 3
      limits, vi, 1 – 3
    overflow, 3 – 6, 3 – 21
Button, 1 – 5, 2 – 2,3 – 13, 3 – 20
    [Buffer], 1 – 3
    [Bypass], 1 – 3
    [Channel], 1 – 3
Bypass, iii, 1 – 2, 3, 1 – 5, 3 – 10, 11, 3 – 13
    button, *see* Button, [Bypass]
    connector, 1 – 5
    indicator, 1 – 3

Capacitance, *see* Input capacitance
Cascading, iii, 1 – 2
Channel
    button, *see* Button, [Channel]
    selecting, *see* Input channel, selecting
Channel capacitance, *see* Input capacitance

Channel resistance, *see* Resistance, series
Circuit schematics, *see* Schematic diagrams
Clock stopping, 1 – 2, 2 – 2, 3 – 10, 3 – 14, 4 – 3
Command
    error, 3 – 16, 3 – 20
    parameters, 3 – 7, 3 – 16
    separator, 3 – 7
    terminator, 3 – 6, 7, 3 – 14, 3 – 17
Common, iii, 1 – 3, 4 – 2
    connector, 1 – 5
Console mode, 3 – 6, 3 – 14, 15

DB–15, vi, 1 – 7, 8
DB–37, vi, 1 – 4
DB–9
    female, vi, 1 – 5, 1 – 8
    male, vi, 1 – 5, 1 – 8
Default configuration, *see* Reset
Device Clear, 3 – 6, 3 – 15, 3 – 17, 3 – 21
Dimensions, vi
Display, 1 – 3

Error
    command, *see* Command, error
Excitation, iii, 1 – 2, 1 – 4, 5, 2 – 2, 3 – 10, 4 – 2,
    3
Execution error, 3 – 15, 3 – 20

Firmware revision, 3 – 15
Flow control, 1 – 8, 3 – 6, 3 – 17
Four-wire, iii, 1 – 2
Front panel, 1 – 2, 3, 2 – 2
    connector, vi, *see* Input, connector
    display, *see* Display
    operation, 1 – 3
Full duplex, *see* Console mode

General information, iii
Ground
    chassis, 1 – 3, 4, 1 – 7
    Earth, *see* Ground, chassis
    pass-through, 1 – 4, 5, 4 – 3