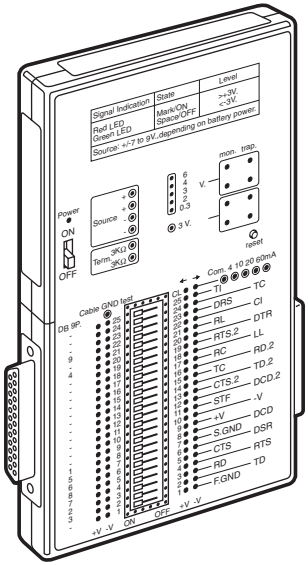
BLACK BOX®
NETWORK SERVICES

**APRIL 2002**
**TS160A-R2**

# SAM-Deluxe




## CUSTOMER SUPPORT INFORMATION

Order **toll-free** in the U.S.: Call **877-877-BBOX** (outside U.S. call **724-746-5500**)
FREE technical support 24 hours a day, 7 days a week: Call **724-746-5500** or fax **724-746-0746**
Mailing address: **Black Box Corporation**, 1000 Park Drive, Lawrence, PA 15055-1018
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# FEDERAL COMMUNICATIONS COMMISSION AND INDUSTRY CANADA RADIO FREQUENCY INTERFERENCE STATEMENTS

This equipment generates, uses, and can radiate radio-frequency energy, and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

*This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.*

*Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.*

## EUROPEAN UNION DECLARATION OF CONFORMITY

This equipment complies with the requirements of the European EMC Directive 89/336/EEC.

CE

# NORMAS OFICIALES MEXICANAS (NOM)
# ELECTRICAL SAFETY STATEMENT

## INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.

13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.

15. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.

16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.

17. Cuidado debe ser tomado de tal manera que objectos liquidos no sean derramados sobre la cubierta u orificios de ventilación.

18. Servicio por personal calificado deberá ser provisto cuando:

    A: El cable de poder o el contacto ha sido dañado; u

    B: Objectos han caído o líquido ha sido derramado dentro del aparato; o

    C: El aparato ha sido expuesto a la lluvia; o

    D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o

    E: El aparato ha sido tirado o su cubierta ha sido dañada.

## TRADEMARKS USED IN THIS MANUAL

*Any trademarks mentioned in this manual are acknowledged to be the property of the trademark owners.*

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# 1. Specifications

**Breakout Switches**: 25

**Leads Monitored**: 25 lines/50 monitors,
(2) monitors/pulse traps

**CE Approval**: Yes

**Connectors**: (1) DB25 male, (1) DB25 female,
(2) DB9/DB25 adapters

**Indicators**: (100) LEDs

**Power**: Nonpowered for basic functions; 9-V battery
(included) for active functions

**Size**: 2"H x 4.8"W x 6.7"D (5.1 x 12.2 x 17 cm)

**Weight**: 4 lb. (1.8 kg)

# 2. Quick Start Guide

If you're already familiar with the SAM's function, follow these steps.

1. Connect the SAM-Deluxe with all switches open between the two interfaces you want to test. The SAM will immediately show if you are dealing with two interfaces of the same kind or "matching" interfaces. (LEDs ON on the same line means you need a cross-pinned cable. "Non-matching" interfaces, on the other hand, connect with a straight cable.)

2. BEFORE GOING FURTHER, test for ground-potential difference. See **Section 4.5**. GPDs can happen only at certain times of day, when a device is switching ON, or in winter (when the heating is switching). A GPD test is a must when the connected devices are connected to different wall outlets. Even outlets that are close to each other might not have the same power source. The level of GPD changes with the way the mains is loaded. If you have any doubts, connect the upper unassigned monitor to the left socket #7. The monitor will show if there are short duration changes.

**NOTE**

**GPD can change if you move the equipment. Run this test in the final installation of the equipment.**

3. After the GPD test, check both interfaces for active circuits or signals missing compared to the standard (cables can have shorts or be broken). Use, if possible, the cables you used in the ready installation.

**NOTE**

**The battery power is only needed for the tests on the upper part (above the reset button) of the SAM. Turn the switch OFF when you're using the interface tests in the lower part, which are line-powered.**

# 3. Introduction

## 3.1 General

The SAM-Deluxe is a full-featured tool for testing and troubleshooting interfaces meeting CCITT specifications V.24 and V.28 or the equivalent standard RS-232C.

You can use the SAM-Deluxe to make installation easy and to verify the proper operation of the most widely accepted interface between computers, peripherals, modems, etc. Compact, simple, and user-friendly, the SAM can easily be used by end users of data communications devices, as well as by specialists who install, repair, or sell RS-232 (V.24) testers.

The SAM-Deluxe offers many features not available on other RS-232 testers, including:

- clear and logical layout of the faceplate,
- full four-state line-monitoring capability,
- convenient cable-test function,
- unique tests for ground-potential difference, and

- current-loop test.

The active circuitry is digital; it works with distinct voltage limits and is high speed. The active circuitry allows monitoring of dubious or high-speed signals. The DC source can force a distinct signal state: the resistance tests the signal strength.

### 3.2 What the Package Includes

Your package should include the following items:

- SAM-Deluxe
- (1) 9-V battery
- (2) dual-gender ribbon cables
- (4) DB9/DB25 adapters
- (12) jumper cables
- Carrying case

If anything is missing or damaged, please call Black Box immediately at 724-746-5500.

## 3.3 Functional Description

### 3.3.1 Interface Connectors

The SAM-Deluxe has one female DB25 connector fixed on the left and one male DB25 connector fixed on the right-hand side. The two dual-gender ribbon cables and DB9/25 adapters allow the tester to connect any type of RS-232 interface. The short DB9F/9M cable supports the standard DB9 connections.

### 3.3.2 Signal Status Display

The SAM-Deluxe has 50 line-powered monitors showing all interface lines at both sides of the breakout switches. Each monitor circuit uses two LEDs indicating the state of the signal (MARK/SPACE/CLOCKING/NONE) defined by the value of the line voltage $V_S$ with respect to signal ground (lead #7 in RS-232/V24 standard).

The red LED indicates a SPACE/ON state of the signal (Volts +3V). The green LED indicates MARK/OFF state (Volts -3V). In both cases, the brightness of the LED corresponds to the voltage value. For clock or data signals, both LEDs will light. If the signal voltage is in a transition region ($-3V<V_S<+3V$), neither LED will light. The active monitors show the

state of the signal at the voltage state at the input. The resettable pulse trap stores any change longer than 20 nanoseconds.

### 3.3.3 Breakout Switches

Each of the 25 interface lines has an individual switch for breaking the circuit configuration. The switches are located in the center part of the main control panel.

### 3.3.4 Access Sockets

On both sides of the breakout switches, there are sockets allowing direct access to both interfaces. This enables cross-patching of lines via jumper wires. Access sockets also permit attaching external monitoring instruments to any line.

### 3.3.5 Jumper Wires/Patching

A set of jumper cables with high-quality plugs is provided to allow cross-patching of interface lines. To facilitate multiple-line connections, two sets of four-plug jumper wires are supplied with the unit.

### 3.3.6 Ground Potential Difference Test Circuit

The difference in ground potentials of the two interfaced devices can cause problems with signal interpretation. A voltage difference of more than 2 V is shown by the ground-potential difference LEDs at the left side of switch #7. A more accurate test can be made by using the 0.3-V input of the top unassigned monitor, short duration changes to be stored by the pulse trap.

### 3.3.7 Power/Test Voltage Sources

The tester can be externally or interface powered. The basic interface functions of the tester do not require battery power. The active top part, the two unassigned monitors, and voltage source are powered by a 9-volt battery. The active circuitry consumes only 2.5 mA. The voltage source uses an additional 1 mA.

When interface-powered, the SAM-Deluxe takes the power from the strongest of eight interface (control) lines (2, 3, 4, 5, 6, 8, 20, and 22). The interface circuitry is normally able to deliver 10 mA per line.

Extremely weak interfaces might require battery power. Connecting the battery automatically disconnects the interface power. The power LED shows the strength of

the interface (battery). A blinking or unlit LED indicates a weak interface or empty battery. One 9 V alkaline battery delivers power for over 150 hours.

### 3.3.8 Current-Loop Test Circuit

You can access the current-loop test circuit via 5 sockets in a horizontal row above breakout switch #25. The common socket on the left side of the SAM forms a common input while the right sockets marked 4, 10, 20, and 60 mA become the second input.

One of two current-loop LED monitors lights up at 80% of the stated current, indicating the current direction as well. Maximum current is 3 times stated with an upper limit of 80 mA.

# 4. Operation

## 4.1 Introduction

The SAM-Deluxe can function as a breakout box, a status activity tester, a ground-potential difference tester, a cable tester, and a current-loop tester. The following instructions explain basic tests it can perform.

## 4.2 Breakout Box Functions/Patching

Breakout functions do not require power. Depending on the configuration of equipment and particular problems to be solved, the tester has to be connected either to one of the devices or between both instruments. When you connect two RS-232 ports, make sure that the power is OFF in both devices to be interfaced. Connect the tester in the circuit.

Switch both devices ON. Enabling/disabling individual lines via the breakout switches and jumpers, crossing over or busing the access sockets allows for any modification of the standard interface. All kinds of null-modem and loopback configurations can be established—for example, to form a basic asynchronous null-modem interface.

- Open (OFF) breakout switches #2 and #3.
- Connect left access socket #2 to right socket #3 via a jumper cable.
- Connect left socket #3 to right socket #2.

Often in addition to lines 2 and 3, similar cross-over of the control lines, usually #6 and 20 and #4 and 5, is required.

### 4.3 Monitoring the Interface Signals

The tester connected according to **Section 4.2** immediately indicates the state of the signals transmitted by the interface. Each of the interface lines has two monitoring systems, located on either side of the corresponding breakout switch. Full monitoring is thus obtained when the signal shows up on both sides of the box.

The red LED lights when the corresponding circuit is in the SPACE/ON state, and the green LED signals the MARK/OFF state. Both LEDs light simultaneously when the signal is variable (data or clock), while both LEDs off mean lack of signal. LED light intensity depends on the

monitored signal strength, which yields valuable information on the status of the interface lines.

For elaborate tests, connect one of the unassigned monitors into the circuit via one jumper wire. The resettable pulse trap stores short-duration changes.

### 4.4 Signal Simulation/Termination

Tests on the RS-232 interface often require signal simulation of control lines. To force a signal, connect the access socket to the appropriate signal source.

+ for control ON/signal space

- for control OFF/signal mark

Two 3-Kohm resistors allow for a signal load according to the CCITT norms; their resistance is to the Signal Ground (line 7).

### 4.5 Ground-Potential Difference Test

Ground-potential difference develops when two pieces of equipment are powered from different power distribution systems or when a ground problem occurs

in one of the devices. The following steps are required to test ground potential difference:

- Switch both devices OFF.
- Open (OFF) all breakout switches #1 through 25.
- Connect the tester between both instruments via any cable supporting line #7.
- Switch both devices ON.

One of the red LEDs located at position #7 lights up if ground-potential difference (GPD) is more than 2 V. Problems with signal-level interpretation can occur when GPD exceeds 2 volts. In that case, ground separation is required in one of the connected devices.

A test for 0.3-volt GPD is possible by connecting the upper, unassigned, monitor to left socket #7 (all switches open). The pulse trap will store short-duration changes.

### 4.6 Current-Loop Circuit Examination

Though current loop differs substantially from the RS-232 (V.24) standard, it is often used in an RS-232

environment to communicate over longer distances or for ground separation.

The current-loop test circuit is a unique feature of the SAM-Deluxe and allows you to examine the current loops that are often mixed with the RS-232 (V.24) circuits, as well as external current-loop interfaces such as short-haul modems. Testing the current-loop circuit using the RS-232 (V.24) lines requires the following operations:

- Identify the breakout switches belonging to the tested current loop.
- Disconnect one of the current-loop wires, either by opening the corresponding breakout switch or by unplugging the jumper cable closing the loop.
- Connect both ends of the opened current loop to the current-loop circuit inputs via jumper cables, one to the left input marked “Common” and the other to the correct dedicated socket marked “…mA” (choose the one that matches the rating of your current-loop system).

In both cases, one of the Current Loop LED monitors lights when the current is at least 80% of the chosen

range, showing current direction as well. The current-loop test circuit does not require power from the battery and is galvanically separated from the 25 RS-232 (V.24) lines.

### 4.7 Cable Testing

The SAM-Deluxe can test any RS-232 DB25 or DB9 interface cable. To test the cable, follow these steps:

1. Open (OFF) all switches #1 through 25.

2. Plug the cable you wish to test into the left and right DB25 connectors. Use the adapters and/or dual-gender cables (all lines are wired through) if there are problems connecting directly.

3. Switch the tester ON.

4. Connect the + or - source to the upper left socket called “Cable GND test.” If GND is wired correctly, the green LED #7 will light. If GND is broken, the red LED lights.

5. Run through lines 1 to 25 on the left side to check for connections and shorts.

6. Run through lines 1 to 25 on the right side to test for shorts (not connected to the left side).

7. Switch the Tester OFF.




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