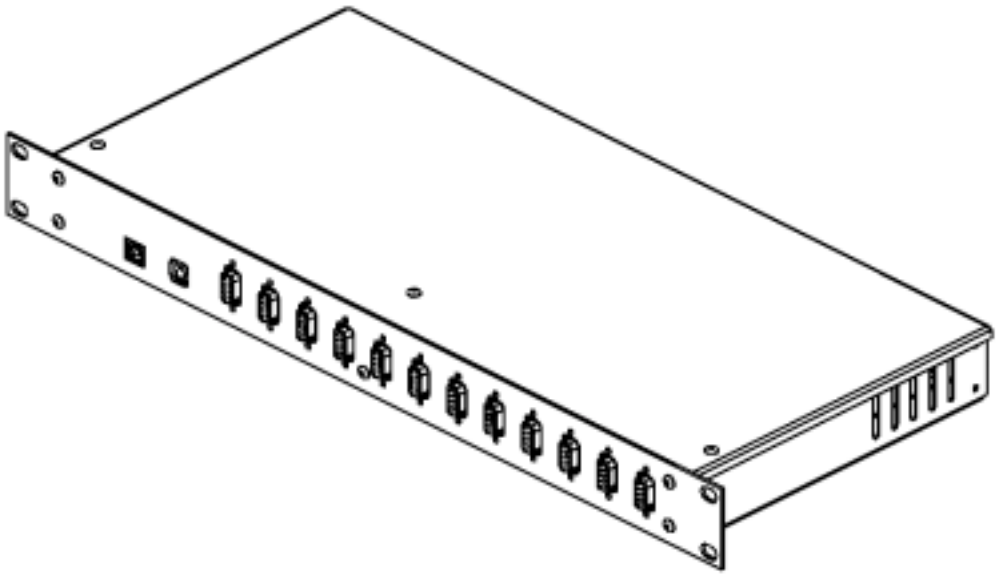
TAMS
Test & Measurement Systems Inc.

TAMS 1887A
USB Switch Controller



Installation & Operation

TAMS 1887A USB Switch Controller
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Introduction

The TAMS 1887A USB Switch Controller provides control and readback of up to twelve Agilent 1810 Series Microwave Switches.

Software is provided for a Graphical User Interface and a run time library. The Graphical User Interface provides interactive control and readback of each switch, configuration of each switch, and saving and restoring of switch positions. The run time library allows the user to write programs in C, Visual Basic, National Instruments LabView, and Agilent VEE. Programs have access to the full range of TAMS 1887A functionality.

The TAMS 1887A connects to a PC through a standard USB cable. Both USB 1.1 and 2.0 are supported. The TAMS 1887A operates at USB Full Speed.

The TAMS 1887A includes a power supply that powers the internal circuit of the 1887A and drives the switches. Only a trivial amount of power is taken from the USB.

Please observe all safety precautions listed at the end of this manual.

Hardware Warranty

All TAMS products use the highest quality components and are assembled to the highest specifications. Should a defect exist, or a failure occur, we apologize. Any defective unit will be repaired or replaced immediately.

Please follow the instructions below for service response.

- In the US please return it to TAMS. Please call or Fax for return instructions.
- Internationally, please contact the local distributor for return instructions.

Any customer may contact TAMS, or return products directly to TAMS, but for customers outside the US, this may cause a delay, which could be avoided by working with the local distributor.

The complete hardware warranty information is in the back of this manual.

For software warranty information see the Software License in Appendix D.

About the microwave switches

The TAMS 1887A controls up to twelve microwave switches. Specifically, the Agilent 1810, 1811, and 1812 switches with option 201 (subminiature "D") connect directly to the front panel via standard 9 pin D-subminiature cables.

The switches themselves come in a variety of configurations, but they all have two "Positions": A (also known as Position 1) and B (also known as position 2). For example, Position A might be used to route a signal to one amplifier, and position B to route the same signal to a different amplifier.

Each switch has two coils, also labeled "A" and "B". Sending a pulse current through the "A" coil causes the switch to move to Position A. Same for B. After the switch has moved to its new position, it is "latched" into that position, and the current should be removed (the TAMS 1887A does this automatically).

The Agilent 1810, 1811, and 1812 switches have two drive options: "Standard Drive" and "TTL Drive".

For "Standard Drive", the TAMS 1887A applies the coil voltage to one pin of each coil, and the TAMS 1887A drives the other pin to ground to actuate a coil.

For "TTL Drive", the TAMS 1887A supplies the coil voltage to the switch, but actuates the switch with a TTL level signal.

The TAMS 1887A automatically senses which drive option is installed on the switch, and automatically actuates the switch.

As explained below in "Coil voltages and overcurrent protection", the coil voltage of the switch must match the coil voltage of the TAMS 1887A.

Install the software *first*

System requirements.

The TAMS 1887A software requires all of the following:

- Microsoft Windows 2000 or Microsoft Windows XP
- Microsoft Internet Explorer version 5.01 or later
- Microsoft .NET Framework version 1.1
- Adobe PDF reader

1. Insert the installation media into the drive and wait for the busy light to remain off.

2. If the installation does not start automatically, click Start / Run… and then type

   ```
   D:setup.exe
   ```

   where D: is the location of the drive. This will install the TAMS 1887A software on the PC. If necessary, the Microsoft .NET Framework will also be installed on the PC.

3. The Adobe PDF Reader can be downloaded for free from www.adobe.com.

The software will be copied to the hard drive and the PC will be configured to recognize the TAMS 1887A when it is first plugged into the USB.

You are now ready to connect the hardware.

Then install the hardware

Be certain that the software is installed before the hardware.

1. Plug the Agilent 1810 Series switches into the TAMS 1887A using 9 pin D-Subminiature male to male cables. The cables must be straight through and shielded.

2. Connect the power supply cord to the rear of the TAMS 1887A and then plug the power supply cord into a grounded outlet on the same circuit as the PC. The power light on the front of the TAMS 1887A will illuminate.

3. Plug the USB cable into the host PC or a hub connected to the host PC. Then plug the opposite end of the cable into the TAMS 1887A. The PC will detect new USB hardware and automatically configure and load the TAMS 1887A driver, since that was installed above.

4. The activity light on the front of the TAMS 1887A will flicker once.

You are now ready to verify operation with the TAMS 1887A Graphical User Interface.

Controlling Switches with the Graphical User Interface

This chapter will walk through the Graphical User Interface (or GUI) in order to explore its functions.

Start the GUI

Start the GUI by selecting Start / Programs / TAMS 1887 USB Switch Controller. The GUI will start and display a window for each TAMS 1887A found.


TAMS USB Switch Controller
File
Window
Help
tamsUSBsc1, SN1887A-0050, 5V coil
Switch 1
A
B
Switch 7
A
B
Switch 2
A
B
Switch 8
A
B
Switch 3
A
B
Switch 9
A
B
Switch 4
A
B
Switch 10
A
B
Switch 5
A
B
Switch 11
A
B
Switch 6
A
B
Switch 12
A
B

Notice that the title bar of the window displays an identification string “tamsUSBsc1” and a serial number “SN1887A-0050”. These will be useful when you need to distinguish between multiple TAMS 1887A’s in a system. See “Using more than one TAMS 1887A in a system” below. Also note that the title bar specifies that all switches connected to this TAMS 1887A must use 5V coils (Agilent 1810 option 105).

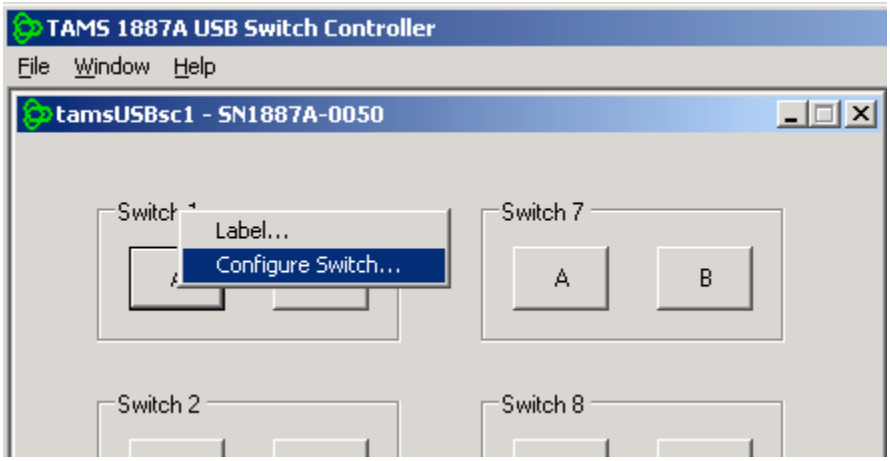
If no TAMS 1887A is connected, select File / New to bring up a new device window.

The device window shows the twelve switches, labeled Switch 1 through Switch 12 by default. Each switch has two position buttons, labeled “A” and “B” by default. The labels are easily changed and the switches controlled by clicking on the buttons, but first we have to configure the switches.

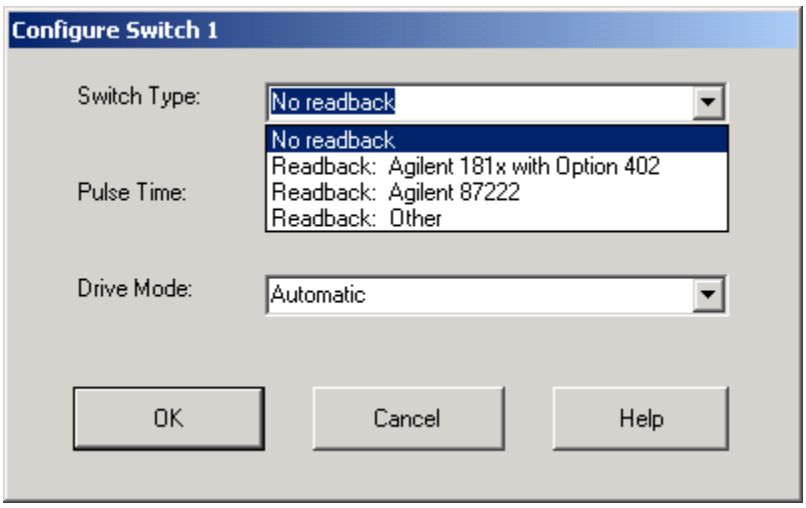
Configuring the switches for readback

Readback is the ability of the switch to indicate its current position back to the TAMS 1887A. For example, Agilent 1810, 1811, and 1812 switches support readback if they have option 402, “Position Indicators”. In this case, the TAMS 1887A can be configured to read back the position of each switch and continuously update the GUI, even when another program is controlling the switches.

To configure Switch 1 for readback, right click the mouse on “Switch 1”. This will drop down a context menu with the selections “Label …” and “Configure Switch…”.



Select “Configure Switch…” to display the “Configure Switch” dialog.



The first choice for “Switch Type” is “No readback”, indicating that the switch has no readback capability. If “No readback” is selected, the GUI will not readback the position of the switch. Make this selection if the switch is an Agilent 181x series without option 402, Position Indicators, or if the switch is any other type without readback.

The other choices all indicate that the switch supports readback. Select the choice that matches the switch.

The Pulse Time can also be set from this dialog box. Pulse Time is the number of milliseconds that the switch coil needs to be driven in order to change switch position. Setting this too small will fail to change the switch position. Setting it too long will potentially damage the switch.

Agilent 1810, 1811, and 1812 switches have an option 403 that will automatically interrupt the current after the switch is latched. Since the TAMS 1887A automatically removes the coil drive after the switch is latched, the TAMS 1887A will work with or without Agilent option 403.

Drive mode allows selection of Standard, TTL, and Automatic modes. In Standard mode, the output line is grounded for the pulse, which will operate a standard latching relay. In TTL mode, the output line is driven to 4.5V nominal for the pulse. Automatic mode allows the TAMS 1887A to detect the switch type and select either Standard or TTL drive for the given switch, and should be used for all but special applications. See “Detailed Operation” for more information.

Click OK to close the configuration dialog box.

Reading back the switch position

The TAMS 1887A continuously scans the position of all switches configured for readback, painting the buttons blue if readback is enabled. If readback is not available, then the switches are painted yellow, indicating the last button pressed.

Readback can be very useful for test system debug, since the GUI shows the state of each switch even when a user-written program is controlling the switches.

Operating the switches

To change the position of the switch, click on the buttons for position “A” or “B”. The switch will latch to that position. This is the same “A” and “B” nomenclature used in the Agilent documentation. (Some Agilent documentation refer to positions “1” and “2”, in which case “A” maps to “1”).

The switches will hold their position until it is changed again. They will even hold their position after power is removed and restored.

Labeling the switches and positions

To label the switches and positions, right click on them, bringing up the context menu. From the context menu, select “Label …”. This brings up a dialog box to change the label on the switch or the button. This allows the GUI to directly reflect the circuit paths being switched. For example, if Switch 1 is used to select a model 700 amplifier or a model 800 amplifier, then the switch could be labeled “Amplifier” and the positions “700” and “800”.

These labels are saved and restored via File / Save and File / Open.

Saving and restoring switch positions and labels

Once the switches and the buttons are labeled and the switch positions are set, you may want to identify those states with names and store them away. Select File / Save As… to store away an ASCII file which will record all switch and position labels as well as the current switch configuration and positions for the currently active TAMS 1887A window.

Select File / Open to read the file, restoring all labels and switch positions for the currently active TAMS 1887A window.

Printing

Selecting File / Print… will print each window on a separate page.

Changing Colors

Selecting File / Preferences ... allows changing the colors of the buttons.

Controlling Switches with programs

The runtime library provides all necessary functions to write programs to control the switches in an automated test application. Programs can be written in C, Visual Basic .NET, NI LabView, and Agilent VEE.

Overview

Whatever the language, the concepts for controlling switches through a program are the same:

1. Call tamsSCstart. This will return a handle, which is a 32 bit number passed into most of the other functions.
2. Call tamsSCswitch to set a switch to position A or position B.
3. Optionally call tamsSCsetPulseTime or tamsSCgetPulseTime to control the pulse width used to energize the switch coils. If controlling Agilent 1810 series switches, the pulse widths are already correct and these functions can be ignored.
4. Optionally call tamsSCreadbackSwitch to verify the operation of the switch. In most applications this is not necessary, but some applications readback the position of the switch to avoid unnecessary switch operations.
5. Call tamsSCend. This closes the device and frees resources.
6. If there is an error, call tamsSCerror to return a string describing the error.
7. If there is more than one TAMS 1887A in the system, review the section “Using more than one TAMS 1887A in a system”.
8. The runtime library “tamsSC.dll” must be in the path. It is installed in the Windows/System32 directory.

The runtime library consists of seven functions. Each function is described in detail under Help / Programming Reference in the GUI.

Microsoft C

C language programs must include the file “tamsSC.h”, located in the “C” subdirectory under the TAMS 1887A install directory. See Appendix A. Either add this directory to the Include path, or copy this file to your working project directory.

C language programs must link against the import library “tamsSC.lib”, located in the “C” subdirectory under the install directory. This .lib file was generated using Microsoft Visual Studio .NET, as was the tamsSC.dll. These libraries are “unmanaged code”, meaning they are native Intel code and do not require the .NET framework.

The “C” language example programs can be loaded into Microsoft Visual Studio via copy and paste. Select Help/Programming Examples … to bring up the Programming Examples dialog box. Select the desired example, and the code will appear in the large window. Then click and drag the mouse to select a portion of the program, or press the “Select All” button. The “Copy to clipboard” button will then

copy the selected text to the clipboard, where a “Paste” command will insert it into the programming environment, such as Microsoft Visual Studio.

Visual Basic .NET

Visual Basic programs must import the tamsSC class via the statement

```
imports UserProgram.tamsSC
```

at the top of each module.

This class is defined in the file tamsSC.vb, which is located in the Visual Basic subdirectory under the TAMS 1887A install directory. See Appendix A. This file must be added to your project via File / Add Existing Item .. from the Visual Studio environment. Change “UserProgram” to the name of your VisualBasic program.

The Visual Basic example programs can be loaded into Microsoft Visual Studio via copy and paste following the instructions above under “C”.

LabView

These NI LabView example programs are found in the NI LabView subdirectory under the TAMS 1887A install directory. See Appendix A.

Example 1 – starts a TAMS 1887A session, sets switch 4 to position “2” or “B”, and then ends the session.

Example 2 – opens two TAMS 1887A devices, operates a switch in each one, and then ends each session.

Example 3 – calls each function in the library.

Each of these programs includes error checking which should be incorporated into all user written programs.

Agilent VEE

These Agilent VEE example programs are found in the Agilent VEE subdirectory under the install directory. See Appendix A.

Verify.vee – verifies that the imported library was correctly found, and that Agilent VEE can call the TAMS 1887A runtime library.

Example 1 –starts a TAMS 1887A session, sets switch 4 to position “2” or “B”, and then ends the session.

Example 2 – opens two TAMS 1887A devices, operates a switch in each one, and then ends each session.

Example 3 – calls each function in the library.

Each of these programs includes error checking via the UserFunction TamsErrorCheck, which should be incorporated into all user written programs.

Using more than one TAMS 1887A in a system

When only one TAMS 1887A device is connected to the computer, no special identification is required. Just call tamsSCstart with a null string (“”) and the software will find the single TAMS 1887A and return a handle to it.

When more than one TAMS 1887A device is connected to the computer, each one needs to be identified, even if they are connected through different hubs.

To identify each TAMS 1887A connected, follow these steps:

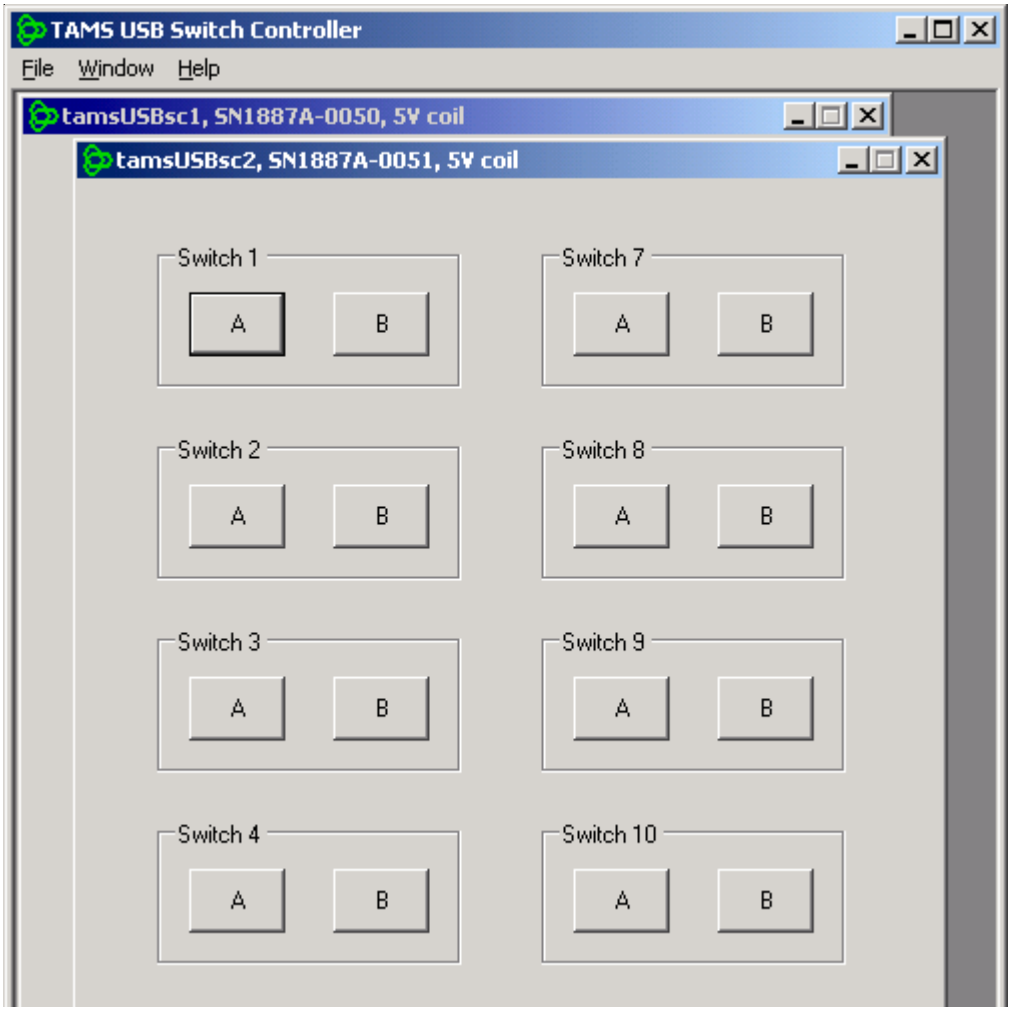
1. Start the GUI by selecting Start / Programs / TAMS 1887 USB Switch Controller. The GUI will start and will display a window for each TAMS 1887A found.
2. Make a note of the identifier strings for each TAMS 1887A. For example, in the figure below, the identifier strings are “tamsUSBsc1” and “tamsUSBsc2”.
3. For each TAMS 1887A, the user written program must declare a separate handle, must set each handle with a separate call to tamsSCstart, and must close each handle with a separate call to tamsSCend. Each call to a tamsSC function must take the correct handle for the intended operation.

For example, in VB:

```
Dim handle1, handle2 as IntPtr

handle1 = tamsSCstart (“tamsUSBsc1”)
handle2 = tamsSCstart (“tamsUSBsc2”)

‘ Insert switch operations using handle1 or handle2

tamsSCswitch (handle1, SWITCH_4, POSITION_A)
tamsSCclose (handle1)
tamsSCclose (handle2)
```

In “C”:

```
tHANDLE   handle1, handle2;

handle1 = tamsSCstart (“tamsUSBsc1”);
handle2 = tamsSCstart (“tamsUSBsc2”);

// Insert switch operations using handle1 or handle2
tamsSCswitch (handle1, SWITCH_4, POSITION_A);
tamsSCclose (handle1);
tamsSCclose (handle2);
```



The error handling has been omitted for clarity. Complete examples are given in Example2 for each language.

Each call to tamsSCstart takes the Identifier string as a parameter. To ensure referencing the correct TAMS 1887A, operate the switches using the GUI and observe the correct USB Activity light on the front of the TAMS 1887A.

Replacing a TAMS 1887A in a system

A TAMS 1887A can be replaced without modification of the programs.

If there is only one TAMS 1887A in the system, just replace the unit and all programs will continue to run. This is because the call to tamsSCstart contains an empty string, and therefore the software just finds the single TAMS 1887A device.

If there is more than one TAMS 1887A in the system, then the configuration file needs to be edited. Please review the section “Using more than one TAMS 1887A” to gain familiarity with the configuration file and the identification strings.

1. Start the GUI by selecting Start / Programs / TAMS 1887 USB Switch Controller. The GUI will start and will display a window for each TAMS 1887A found.
2. Make a note of the identifier strings and serial numbers for each TAMS 1887A. For example, in the figure above, the identifier strings are “tamsUSBsc1” and “tamsUSBsc2”, serial numbers “SN1887A-0050” and “SN1887A-0051”.
3. Edit the file tamsSCconf.txt in the TAMS 1887A install directory. See Appendix A. Use notepad or a similar text editor. Change the serial number from the old unit to the serial number for the new unit. Save the file and exit the editor.

Now, when programs run, the calls to tamsSCstart will be mapped to the new serial number. When the GUI runs, it will enumerate all the serial numbers, and map them to the old identification strings.

Detailed Operation

When a button is clicked in the GUI, or tamsSCswitch () is called at runtime, the following sequence occurs:

1. If running, the GUI paints the button that was just pressed Yellow (no readback color) or Blue (readback color).
2. If the switch is configured for Drive Mode Automatic, the TAMS 1887A drives the appropriate output line low for 1ms. After 1ms, the TAMS 1887A determines (from the amount of current draw) if the switch is using “Standard drive” or “TTL drive”. These terms “Standard Drive” and “TTL drive” are from the Agilent 1810 datasheet.
3. For “Standard Drive”, the TAMS 1887A will pull the output line low. The TAMS 1887A will start a real time clock for the “pulse time”.
4. For “TTL Drive”, the TAMS 1887A will drive the output line to nominally 4.5V at 4mA. The TAMS 1887A will start a real time clock for the “pulse time”.
5. The TAMS 1887A will monitor the current draw. If the current draw exceeds an internal limit, the output line will be immediately returned to idle state and the front panel “Overcurrent” LED will flash. The flashing will continue until that same output line is successfully used in a subsequent switch operation. The TAMS 1887A can be used to control switches while the Overcurrent LED is flashing.
6. After the specified “pulse time” has expired, the TAMS 1887A returns the output line to idle state.
7. If readback is configured, the TAMS 1887A will read the input lines, updating the GUI to show switch positions in blue. A user written program may call tamsSCreadbackSwitch to determine the actual switch position.

Readback is accomplished by sensing one input bit associated with each switch. The input is pulled high by the TAMS 1887A, but moving the switch to Position B or Position 2 will pull the line low. For user written programs, the switch position can be determined via tamsSCreadbackSwitch.

Coil voltages and overcurrent protection

The TAMS 1887A protects itself and the switches from damage caused by overcurrent or overvoltage.

The TAMS 1887A coil voltage must match the switch coil voltage for proper switch operation. The TAMS 1887A can be ordered factory set for 5V or 24V nominal.

Switches can be ordered with a variety of coil voltages.

There are two cases of mismatch.

If the TAMS 1887A supplies a lower voltage than the coil is designed for, then the switch will simply sit idle. This will be noticeable by lack of a “click” from the switch, and by the GUI not painting the selected button (if readback is enabled). The only remedy is to match the two voltages. Nothing will be damaged by the mismatch.

If the TAMS 1887A supplies a higher voltage than the coil is designed for, then the coil will draw too much current. The TAMS 1887A will immediately shut down the output to prevent any damage. The “Overcurrent” light will blink, and the GUI will paint the switch buttons red. The light will continue to blink and the buttons will remain red until the fault is cleared by successfully operating a switch on that same switch port. Again, the only remedy is to match the two voltages.

Appendix A: Installation Reference

The installation procedure places files in the following directories.
The default install_dir is C:\Program Files\TAMS\TAMS 1887 USB Switch Controller.
The default system_dir is C:\Windows\System32

Table 1

File	Location	Description
tamsSC.lib	install_dir\C	Import library for "C" programs
tamsSC.h	install_dir\C	Header file for "C" programs
tamsSC.dll	system_dir & install_dir	Runtime library for C, Visual Basic, NI LabView, and Agilent VEE
tamsSC.vb	install_dir\VB	Import class for Visual Basic
tamsSwitchController.exe	install_dir	Graphical User Interface
tamsSCconf.txt	install_dir	Configuration file, maps Serial Number to ID strings
tamsSC-vee.h	install_dir\Agilent VEE	Header file for Agilent VEE import
example1-3.vi	install_dir\NI LabView	NI Lab View example programs
example1-3.vee	install_dir\Agilent VEE	Agilent VEE example programs

Appendix B: Specifications

Supported Configurations

Operating systems: Windows 2000 and Windows XP

Microsoft Internet Explorer version 5.01 or later is required

USB versions: 2.0 and 1.1

Agilent Microwave switches:

- N1810, N1811, or N1812, UL or TL
- 5V or 24V coil (option 105 or 124)
- 9 pin D-subminiature connector (option 201)
- Standard or TTL drive (with or without option 401)
- with or without position indicators (with or without option 402)
- with or without current interrupts (with or without option 403)

Electrical

USB connection: USB “B” type connector

USB current consumption: 1mA maximum

Coil voltages (factory preset): 5V or 24V nominal

Output lines: 24 each

Standard Drive Capabilities:

- 24V maximum
- 600mA current sink maximum
- Overcurrent shutdown protection
- Built in inductive flyback protection diodes

TTL Drive Capabilities:

- Logical “High” voltage: 4.0 V minimum, 4.5V nominal
- Current: 2mA drive maximum

Input lines: 12 each, pulled up to 5V nominal, CMOS inputs, TTL level compatible

Pulse time: 1mS to 100mS nominal

Cables: 9 pin D-subminiature male to male, straight through, maximum length 3 meters.

General

Power Supply: 100V – 240V ~ (+/- 10%) 50/60 Hz, 100mA

Power Consumption: 15 Watts maximum

Operating Temperature: 0C to 40C

Storage Temperature: -40C to 70C

Transportation Temperature: -40C to 70C

Operating Altitude: 3000 meters maximum

Operating Humidity: 10 – 80% RH, non-condensing

Classifications:

Class I Equipment (requiring a grounded type electrical supply for safety)
Pollution Degree 2
Installation (Over-Voltage) Category II for transient voltages

Note: all specifications are subject to change without notice.

Appendix C: Connector Pinout

Front View of female connector on the front of the TAMS 1887A.
Pin one is shown square for identification.
This is the same pinout as the Agilent 1810 series of switches.

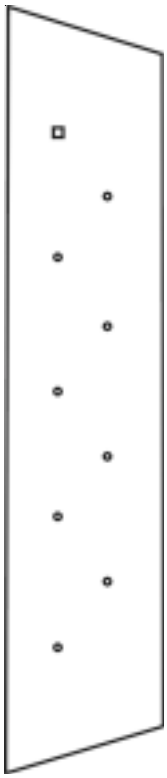
Pin 1 – GND

Pin 2 – No connect

Pin 3 – Drive Position “B”

Pin 4 – Drive Position “A”

Pin 5 – Coil voltage**



Pin 6 — GND

Pin 7 – Readback Position “B”

Pin 8 – No connect

Pin 9 – No connect

**Coil voltage is 5V (default) or 24V nominal, factory pre-set.

Appendix D: Software License Agreement

Software License Agreement

Please carefully read this License Agreement before opening the media. Rights in the software are offered only on the condition that the Customer agrees to all terms and conditions of the License Agreement. **Opening the Media indicates your acceptance of these terms and conditions.** If you do not agree to the License Agreement, you may return the unopened software package and the hardware for a full refund.

In return for the payment of fee TAMS grants the Customer a license to use the software, until terminated subject to the following

Customer may use the software on any one computer.
Customer may not reverse assemble or decompile the software.
Customer may make copies for archival purposes.
Customer has no other rights to copy.
All copies of the software must bear the copyright notice(s) contained on the original.

OWNERSHIP: Customer agrees that they do not have any title or ownership of the software, other than ownership of the physical media. Customer acknowledges and agrees that the software is copyrighted and protected under the copyright laws.

Customer Acknowledges and agrees that the software may have been developed by a third party software supplier named in the copyright notice(s) included with the software, who shall be authorized to hold Customer responsible for any copyright infringement or violation of this License Agreement.

TRANSFER OF RIGHTS IN SOFTWARE: Customer may transfer rights in the software to a third party only as part of the transfer of all their rights and only if Customer obtains the prior agreement of the third party to be bound buy the terms of this License Agreement.

Upon such transfer, Customer agrees that their rights in the software are terminated and that they will either destroy their copies and adaptations or they will deliver them to the third party.

Transfer to a US government department or agency or to a prime or lower tier contractor in connection with a US government contract shall be made only upon their prior written agreement to terms required by TAMS.

SUBLICENSING AND DISTRIBUTION: Customer may not subliscence the software or distribute copies or adaptations of the software to the public in physical media or by telecommunications without the prior written consent of TAMS

TERMINATION: TAMS May terminate this software license for failure to comply with any of these terms provided TAMS has requested Customer to cure the failure and Customer has failed to do so within thirty (30) days of such notice.

UPDATES AND UPGRADES: Customer agrees that the software does not include updates and upgrades which may be available from TAMS under a separate support agreement.

EXPORT CLAUSE: Customer agrees not to export or re-export the software or any copy or adaptation in violation of the US Export Administration regulations or other applicable regulations.

LIMITED WARRANTY

TAMS warrants for a period of 90 days from the date of purchase that the software product will execute it's programming instructions when properly installed on the computer or workstation with a supported version of the Operating System. TAMS does not warrant that the operation of the software will be uninterrupted or error free. In the event that this software product fails to execute it's programming instructions during this warranty period , Customer's remedy shall be to return the CD media to TAMS for replacement. Should TAMS be unable to replace the media within a reasonable amount of time, Customer's alternate remedy shall be a refund of the purchase price upon return of the entire product and all copies.

TAMS warrants the media upon which the product is recorded top be free from defects in materials and workmanship under normal use for a period of 90 days from the date of purchase. In the event any media prove to be defective during the warranty period, Customer's remedy shall be to return the media to TAMS for replacement. Should Tams be unable to replace the media within a reasonable amount of time, Customer's alternate remedy shall be a refund of the purchase price upon return of the entire product and all copies.

NOTICE OF WARRANTY CLAIMS Customer must notify TAMS in writing of any warranty claim within the warranty period.

LIMITATION OF WARRANTY: TAMS makes no other express warranty, whether written or oral , with respect to this product. Any implied warranty of merchantability or fitness is limited to the 90-day duration of this written warranty. Some sates or provinces do not allow limitations on how long an implied warranty lasts, so the above limitation or exclusion may not apply to you.

This warranty gives specific legal rights, and you may also have other rights which vary from state to state, province to province or country to country.

EXCLUSIVE REMEDIES : The remedies provided above are Customer’s sole and exclusive remedies. In no event shall TAMS be liable for any direct, indirect special, incidental, or consequential damages (including lost profit) whether based on warranty, contract, tort or any other legal theory. Some states provinces or countries do not allow the exclusion or limitation of incidental or consequential damages, so the limitation or exclusion may not apply to you.

WARRANTY SERVICE: Warranty service may be obtained directly from TAMS or from any of it’s Distributors.

Warranty Information

ONE YEAR LIMITED WARRANTY

Test & Measurement Systems, Inc. warrants to the purchaser that the Interface card will be free of all defects in material and/or workmanship for one year from the date of shipment to the customer.

In the event of malfunction or failure attributable directly to faulty material and/or workmanship, TAMS will at it's option, repair or replace the defective product or components, to whatever extent it shall deem necessary to restore the product or component, to proper operating condition. TAMS may at its option repair or replace, a defective unit with a new or refurbished unit.

The customer shall be solely responsible for the failure of any TAMS product, resulting from accident abuse, or misapplication of the product, and TAMS assumes no liability as a consequence of such events under the terms of this warranty.

While TAMS has made every effort to provide clear and accurate technical information about the application of this product, TAMS assumes no liability for any events arising out of the use of this technical information.

This Warranty gives you specific legal rights and you may also have other rights which vary from state to state, and from country to country.

This Warranty is in Lieu of all other express warranties which now or hereafter might otherwise arise with respect to this product. ANY AND ALL IMPLIED WARRANTIES OF MERCHANT ABILITY AND FITNESS FOR PARTICULAR USE, SHALL HAVE NO GREATER DURATION THAN THE PERIOD FOR THE EXPRESS WRITTEN WARRANTY APPLICABLE TO THIS PRODUCT AS SHOWN ABOVE, AND SHALL TERMINATE AUTOMATICALLY AT THE EXPIRATION OF SUCH PERIOD.

(Some states and countries do not allow limitations on how long an implied warranty lasts, so this limitation may not apply to you) No action shall be brought for breach of any implied or express warranty after one year subsequent to the expiration of the period of the express written warranty.

Incidental and consequential damages caused by malfunction, defect, or otherwise and with respect to breach of any express or implied warranty, are not the responsibility of TAMS, and to the extent permitted by law, are hereby excluded both for property and to the extent not unconscionable, for personal injury damage. (Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.)

Safety

This symbol indicates a caution. See the manual for a complete explanation, and only continue when all conditions are fully understood and met.

This symbol indicates that the product complies with the requirements of the Low Voltage Directive and the EMC Directive, and carries the CE Mark accordingly.

Ordinary protection: This unit is for indoor use only. It is not protected against a harmful ingress of moisture.

This product is only intended to be used in a 19” Instrument Rack.

This product must be plugged into a grounded outlet. This grounded outlet should be on the same circuit as the controlling computer.

This product uses components that may be damaged by electrostatic discharge. Although all such components are protected, take precautions to avoid electrostatic discharge into the connectors.

Do not use this product in a manner not specified by TAMS.

Do not use this product to control any device other than Agilent microwave switches.

Only qualified, TAMS-trained personnel may service this product.

The power cord is the means of disconnect. If the power cord is not accessible to the operator, then another means of disconnect (i.e. power switch on the rack) must be provided by the user.

Take care when plugging or unplugging switches, as the 9 pin d-subminiature connectors may cause a short circuit. The TAMS 1887A will detect this short and shut down the outputs as described earlier in the manual.

Declaration of Conformity

Manufacturer's Name: Test & Measurement Systems Inc. (TAMS)

Manufacturer's Address: 750 14th Street SW
Loveland, CO 80537
USA

Declares, that the product:

Product Name: TAMS 1887A USB Switch Controller
Model Number: TAMS 1887A

Conforms with the following European Directives:

The product herewith complies with the requirements of the Low Voltage Directive and the EMC Directive and carries the CE Marking accordingly.

Conforms with the following product standards:

EMC **IEC 61326:2000, Electrical Equipment for Measurement, Control and Laboratory Use – Part 1: General Requirements**

Specification	Test Method	Test Conditions	Result
Electrostatic Discharge	EN 61000-4-2	+-4kV Contact / VCP / +-4 kV Air	Compliant
Radiated RF Immunity	EN 61000-4-3	80 – 1000 MHz, 3 V/m, 80% 1kHz AM	Compliant
EFT/Burst	EN 61000-4-4	+-0.5kV I/O (>3 meters), +-1kV AC mains	Compliant
Surge Immunity	EN 61000-4-5	+-1.0kV comm.. mode, +-0.5 kV diff. mode, AC mains	Compliant
Conducted RF Immunity	EN 61000-4-6	150 kHz to 80 MHz, 3Vrms, 80% 1kHz AM, power and I/O > 3 meters	Compliant
Voltage Dips and Interrupt	EN 61000-4-11	100% reduction, 0.5 cycle, positive (90 deg) 100% reduction, 0.5 cycle, negative (270 deg)	Compliant

Safety **IEC 60950-1, Information Technology Equipment - Safety - Part 1: General Requirements**

17 June 2004

Charles Heller

Date

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TAMS 1887A USB Switch Controller
Printed in USA Revision 1.0
Part #1887-90001