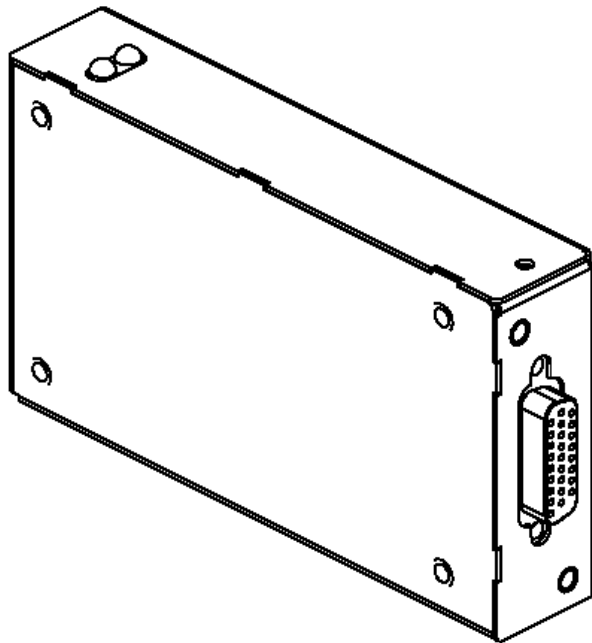




## **TAMS 1800 Series USB Controlled Switches**



### **Installation & Operation**

# TAMS 1800 Series USB Controlled Switches Installation & Operation

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## Introduction

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The TAMS 1800 Series USB Controlled Switches provide a flexible, scalable switching solution for functional test.

Switches are available in multiplexer, matrix, and general-purpose configurations. Each switch can be used stand-alone, or they can be combined to build larger and more complex configurations. The easiest way to combine switches is via the “Analog Bus”, a common set of connections on the rear of each module. These Analog Bus connections can be daisy chained together with simple flex cables or ribbon cables. The Analog Bus contains a 4 wire signal path, Trigger In and Trigger Out, and a Product Under Test Common/Ground.

All signal switches contain a Product Under Test Common/Ground design that provides for many ground connections, wide ground planes under all user signals, and complete isolation between the Product Under Test Common/Ground and the PC/USB ground.

Software is provided for a Graphical User Interface and a VXIplug&play driver and an IVI Switch Class driver. The switches are USBTMC (Universal Serial Bus, Test and Measurement Class) devices, so they can be directly controlled with SPCI (Standard Commands for Programmable Instruments) commands via a traditional instrument IO library such as SICL or VISA. This allows a user to write test programs in virtually any language or environment, include NI TestStand, NI LabVIEW, NI LabWindows, Agilent VEE, Microsoft VisualBASIC, C, C++, etc.

The Graphical User Interface provides interactive control and readback of each device. This is very useful for debugging, since the GUI shows the state of each device even while a user-written test program is controlling the device.

The TAMS 1800 Series Switches connects to a PC through a standard USB cable. Both USB 1.1 and 2.0 are supported. The TAMS 1800 Series Switches operates at USB Full Speed.

This manual explains the common aspects of each switch. An addendum for each switch explains the switch specifics. The TAMS Application Note “AN-1801: Switching in the real world” explains how to build a practical switching system from the TAMS 18xx switch building blocks.

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

Note: all specifications are subject to change without notice.

Other products and companies referred to herein are trademarks or registered trademarks of their respective companies or mark holders.

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## **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.

## Install the software *first*

---

### System requirements.

The TAMS 1800 software requires all of the following:

- Microsoft Windows 2000 or Microsoft Windows XP
- Color display resolution of at least 1024 x 768 for the Graphical User Interface
- Microsoft Internet Explorer version 5.01 or later
- Microsoft .NET Framework version 1.1
- Adobe PDF reader
- Either one of the following IO libraries: <sup>1</sup>
  - National Instruments VISA library
  - Agilent IO Libraries Version M or newer

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, then click Start / Run... and then type

`D:\setup.exe`

where D: is the CD-ROM drive. This will install the Microsoft .NET Framework on the PC, if needed, and then install the TAMS 1800 Series software.

3. The Adobe PDF Reader can be downloaded for free from [www.adobe.com](http://www.adobe.com).

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

If you are going to use the VXIplug&play or IVI driver, that driver and some supporting software must be installed as well. The supporting software is called the “NI IVI Compliance Package (ICP)”, and it is available for free download from National Instruments at [www.ni.com/ivi/ivi\\_prod.htm](http://www.ni.com/ivi/ivi_prod.htm).

---

<sup>1</sup> Do NOT install both the NI and Agilent IO libraries on the same controller.

After installing the ICP, install the VXIplug&play or IVI driver by selecting Start / TAMS 1800 Series Switch Software / Drivers and selecting your driver from the list.

You are now ready to connect the hardware.

## ***Then connect the hardware***

---

Be certain that the software is installed before the hardware.

1. Connect the TAMS 18xx device to the host PC or USB hub via the supplied USB cable. The PC will detect new USB hardware and will automatically configure and load the USBTMC driver, since that was installed above.
2. The activity light on the front of the TAMS 18xx will flicker.

You are now ready to verify operation with the TAMS 18xx Switch Front Panel. For more detailed hardware installation, see “Hardware Installation”.

## **Controlling Switches with the TAMS Switch Front Panel**

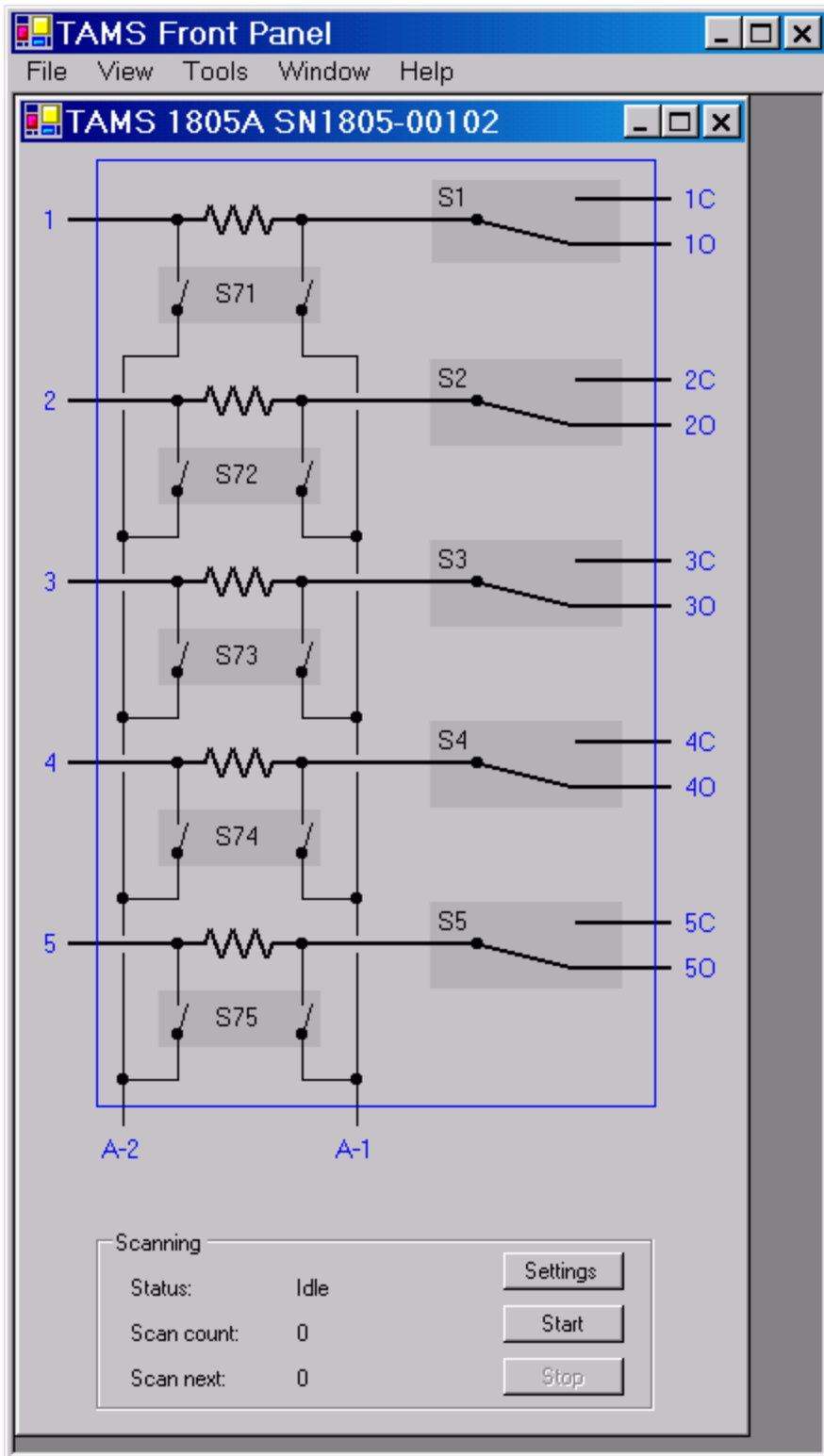
---

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 1800 Series Switch Software / TAMS Switch Front Panel. The GUI will start and display a window for each TAMS 1800 switch found. If your switch does not appear, click View/Refresh on the menu.



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

The device window shows the switches and their interconnects, and always shows the current state of each switch. To operate a switch, simply click on it with the mouse.

---

## Printing

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

---

## Changing colors

Selecting Tools / Options ... allows changing the colors of the GUI.

---

## Resource names or Descriptors

Resource Names or Resource Descriptors are used to identify the switch device when writing your test program. Selecting Tools / Resource Name... shows the Resource Name for the currently active device. Click “Yes” to copy this string to the clipboard. Then paste the string into the development environment for your test program. For example, the following function call to viOpen in VISA will open the device with serial number SN1805-00001.

```
status = viOpen(resource_manager_handle,  
               "USB0::0x142E::0x1805::SN1805-00001::INSTR",  
               VI_NULL, VI_NULL, vi)
```

For more information on writing your test program, see “Writing Test Programs”.

---

## Error messages

The blank area of the window will show any error messages from the device. Note that the error message will continue to be displayed until the error string is read via the “SYST:ERR?” query, or the message is cleared by clicking on the red area.

---

## Hardware Installation

---

### Installation Requirements and Options

This product must be mounted to an earth grounded rack or chassis.

In general, the switches can be mounted either above a deck or chassis, or behind a bulkhead or panel in a chassis. Devices should not be mounted closer than 1.2” center to center. There are threaded inserts for #6 Machine Screws on two different sides. The screws may protrude a maximum 0.25” inside of the product.

The bottom surface provides two mounting holes 1.75” (or one “Rack Unit”) apart, for mounting to the side rack rails of a 19” rack. These can also be used to mount on a deck inside of a chassis.

The front surface provides two mounting holes, which can be used to mount the product behind a panel or bulkhead in your chassis or fixture box. The file [dimension.pdf](#) contains a drawing showing basic dimensions for panel mounting. See [Help/Documentation/dimension.pdf](#).

Depending upon the switch configuration, each switch device will draw a minimum of approximately 30mA and a maximum of approximately 450mA, so you may have to use powered USB hubs to supply this level of current.

The switch devices operate with USB 1.1 or USB 2.0 full speed.

---

## **USB Power Considerations**

The TAMS 1800 Series Switches are powered from the USB bus. This power must always be applied, otherwise the switches would lose their state. Therefore, power management should be disabled in applications where the switches cannot be powered down. Power management on the PC can be disabled via Power Options in the Windows Control Panel.

---

## **Connecting switches to other switches**

TAMS 1800A series switches can be interconnected via the “Analog Bus” on the rear of each unit. This bus contains four analog lines, two grounds or commons, a trigger in, and a trigger out. The switches can be “daisy-chained” together until you run out of USB devices (127 max, 5 levels of hubs).

An example part number for the interconnect cable is Digi-Key A9BBG-0803F-ND.

For operation above 42V, note that a second level of insulation is required for this interconnect cable. Typically, the switches will be mounted inside of a chassis or rack, which could provide the necessary screw access for the second level of insulation.

With most signal switches, there would be a concern about connecting too many switches together, as the signal path capacitance increases, especially for large matrix switches. Note, however, that for the TAMS 18xx switches, each switch can be separately connected or disconnected from the “Analog Bus”, greatly reducing stray capacitance.

For more information, see TAMS Application Note “AN 1801: Switching in the real world.”

---

## **Connecting switches to your Product Under Test**

The various switch modules have a variety of different connectors to make connections out to your product under test. The switch modules that use high density “D-subminiature” connections can easily be mated to standard cables available from [www.l-com.com](http://www.l-com.com) or other vendors. The switch modules that use screw terminal blocks are easily connected with custom wiring. Note that a second level of insulation must be provided for custom cabling that contains any voltages above 42V.

For more information, see TAMS Application Note “AN 1801: Switching in the real world.”

---

## Connecting switches to instruments

There are two ways to connect the switches to your instruments. The first is via the Analog Bus on the rear of the switches. A cable is provided which will allow application-specific connection from the Analog Bus to instruments. Note that for signals above 42V, a second level of insulation must be provided. Typically, the switches will be mounted inside of a chassis or rack, which could provide the necessary screw access for the second level.

The second method of connecting switches to instruments is via the front panel connectors. D-subminiature cables and connectors are so common that there are a variety of ways to make these connections, including building them up from crimped pins or adapting molded cables.

Trigger in/trigger out connections are made via the Analog bus. The Trigger Out is pulled up to 5V nominal by a 3.3K Ohm resistor. When a TAMS 18xx sends a Trigger Out, the line is driven low for 2-4uS. The Trigger In is falling edge active. Typical connections are:

<u>TAMS 18xx</u>	<u>Digital Voltmeter</u>
Trigger Out	Trigger In
Trigger In	Voltmeter Complete/Trigger Out

For more information, see TAMS Application Note “AN 1801: Switching in the real world.”

---

## Grounding and Signal Integrity

The TAMS 1800 Series signal switches were designed for high signal integrity. The “Analog Common” or “A-Common” terminals are intended to connect with the ground of the Product Under Test. Starting with the front connections, there is an Analog Common pin for each signal pin, allowing twisted pair cabling out to your Product Under Test.

These A-Common pins are all connected to a ground plane that runs beneath all the signal paths on the circuit board. This ground plan is also connected to the rear “Analog Bus” A-Common connections.

This A-Common signal is completely isolated from the PC/USB ground.

## Writing test programs

---

There are a number of ways to write a test program to control the TAMS 1800 Series Switches. They provide trade-offs in throughput, features, and integration into your existing test programming environment.

### Direct IO

---

Direct IO is the fastest method of controlling the switch, and it allows the most flexible access to all features of the switch. Direct IO requires using an IO library such as VISA or SICL, available from NI or Agilent. Applications like NI LabVIEW and Agilent VEE also support Direct IO.

The SCPI (Standard Commands for Programmable Instruments) and IEEE 448.2 commands are used to control the switch, providing some compatibility and familiarity if you have experience with other switch products.

The basic commands are OPEN, CLOSE, and OPEN ALL. For example,

```
OPEN (@1)           -- open relay number 1
OPEN (@1:5)         -- open relays 1, 2, 3, 4, and 5
OPEN (@1, 2, 3, 10:15, 60)
-- open relays 1, 2, 3, 10, 11, 12, 13, 14, 15, and 60

CLOSE (@1)          -- close relay number 1
CLOSE (@1:5)        -- close relays 1, 2, 3, 4, and 5
CLOSE (@1, 2, 3, 10:15, 60)
-- close relays 1, 2, 3, 10, 11, 12, 13, 14, 15, & 60

OPEN ALL            -- open every relay on the device
```

The OPEN and CLOSE commands reference relay numbers, not pin or terminal numbers.

For a simple example showing the basic commands, see Example1.vb or Example1.cpp or Example1.vi or Example1.vee. See Help/Examples in the TAMS 18xx Switch Front Panel.

To learn the complete command set, see the menu Help/Documentation/Direct IO.pdf in the TAMS 18xx Switch Front Panel.

---

## IVI Device Specific Driver / National Instruments LabWindows

The IVI Device Specific Driver (or VXIplug&play-style driver) provides a slightly higher level of access to the commands, allowing you to ignore the detailed syntax of command strings. However, the advanced features of the switch, such as interrupts / service requests and scanning, are not supported in this driver model.

Note that IVI Device Specific drivers may not be re-usable with other devices, since the name of the device is “hard-coded” into the function calls. If this is an issue for your application, see the IVI driver below.

IVI uses a “connect pin to pin” model, and therefore refers to the pin or terminal names rather than the relay names. IVI calls the product pin or terminals “channels”.

Consider this example for a TAMS 1805A card. This example is written in “C” using National Instruments LabWindows.

```
static ViStatus s; // Status returned from calls
static ViSession h; // Instrument handle

s = ts1805a_init (
    "USB0::0x142E::0x1805::SN1805-00001::INSTR",
    VI_TRUE, // Query the device
    VI_TRUE, // Reset the device
    &h);

ts1805a_Connect (h, "1", "1c"); // Close relay 1
s = ts1805a_close (h);
```

The call to “ts1805a\_Connect” connects channel “1” with channel “1c”. In other words, it closes relay 1. This call opens relay 1:

```
ts1805a_Connect (h, "1", "1o");
```

If you are going to use the IVI driver, that driver and some supporting software must be installed as well. The supporting software is called the “NI IVI Compliance Package (ICP)”, and it is available for free download from National Instruments at [www.ni.com/ivi/ivi\\_prod.htm](http://www.ni.com/ivi/ivi_prod.htm).

After installing the ICP, install the IVI driver by selecting Start / TAMS 1800 Series Switch Software / Drivers and selecting your driver from the list.

Note that calls of the form

```
ts1805a_Connect (h, "1", "1c"); // Close relay 1
dvm_Read (dvm, &reading);      // Read from DVM
```

are likely to fail, because the `_Connect` call returns before the switches are debounced. See the functions `ts1805_IsDebounced` and `ts1805_WaitForDebounce` in `example-ivi.c` for sample code to synchronize the switching with other instrument operations.

For a simple example showing the IVI driver, see `example-ivi.c`. To learn the complete IVI driver, load the files in the TS1805A subdirectory (usually installed at `C:\Program Files\IVI`) into NI LabWindows and explore the detailed help of the “Function Panel”.

---

## IVI Driver / National Instruments LabWindows

The IVI Driver provides the highest level of access to the commands, and provides some degree of code reuse via device portability. However, the advanced features of the switch, such as interrupts / service requests and scanning, are not supported in the IVI driver model.

Please review the previous section on the IVI Device Specific Driver, as the IVI Driver is built on the IVI Device Specific driver, and therefore uses the same connection model, installation requirements, and debounce synchronization requirements.

Consider this example code. This was developed in National Instruments LabWindows, using the IVISwch driver.

```
static ViStatus s; // Status returned from calls
static ViSession h; // Instrument handle

s = IviSwch_init (
    "SwitchLogicalName",
        // Set the Logical_name using NI's MAX -
        // Measurement and Automation Explorer
    VI_TRUE, // Query the device
    VI_TRUE, // Reset the device
    &h);

IviSwch_Connect (h, "1", "1c"); // Close relay 1
s = IviSwch_close (h);
```

For a simple example showing the IVI driver, see example-ivi.c. To learn the complete IVI Swch driver, load the files in the IviSwch subdirectory (usually installed at C:\Program Files\IVI) into NI LabWindows and explore the detailed help of the "Function Panel".

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## National Instruments LabVIEW

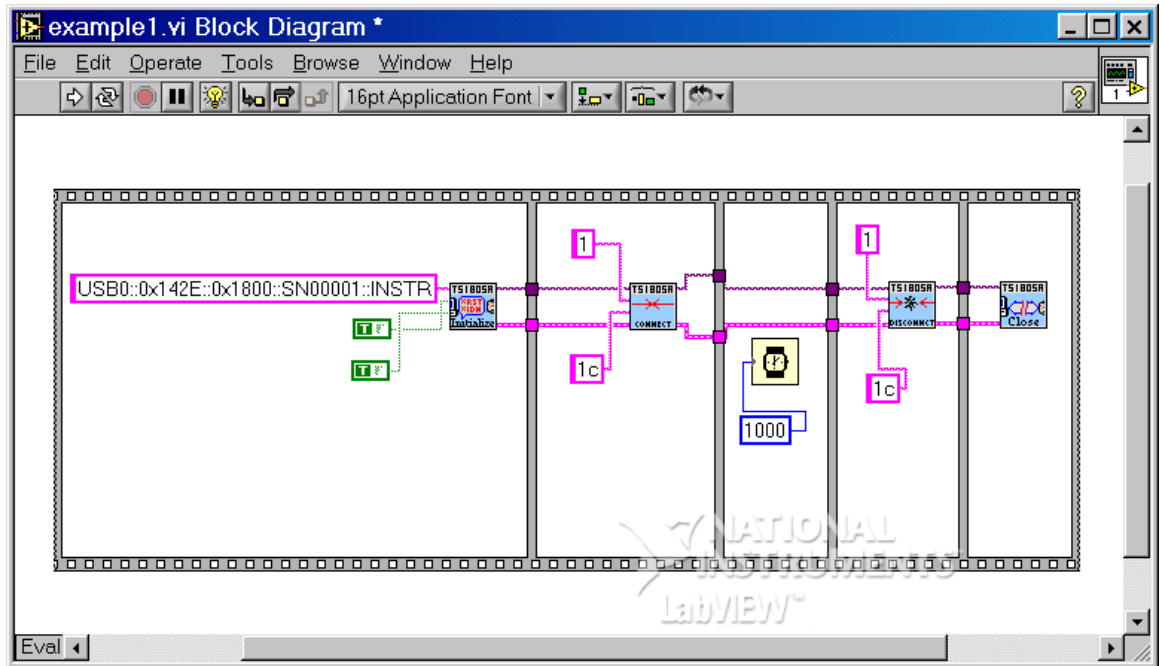
There are two methods to program the TAMS Switches in LabVIEW. The first is to use Direct IO commands sent directly to the device. See the Direct IO section above for more information on this method.

The second method is to convert the supplied IVI driver to a LabVIEW driver and program calls to this converted driver. For this method, follow these steps:

1. Install the IVI driver as described above in section "IVI Device Specific Driver".
2. Create a LabVIEW driver from the IVI driver.

- a. In the LabVIEW block diagram window, select menu Tools / Instrumentation / Import CVI driver
  - b. Import the .fp file for your device (typically at C:\Program Files\IVI\Drivers\ts18???.fp, where ?? is the model number of your device)
  - c. In the dialog box “CVI Functional Panel Converter”, browse to the correct DLL file (typically at C:\Program Files\IVI\Bin\ts18???, where ?? is the model number of your device)
  - d. Click OK twice
3. Create a LabVIEW block diagram that calls this converted driver
- a. From the Functions Palette, choose Input / Instr drivers, and then choose your device.
  - b. Place Initialize, Connect, Close, and other functions in your program as needed.
  - c. Use the TAMS Switch Front Panel / Tools /Resource Name to copy the resource name to the clipboard
  - d. Paste the resource name into a string constant to be input to the Initialize function.

An example program is shown in example1.vi. It uses the LabVIEW sequencer to first Initialize the device, then connect channels “1” and “1c”, then wait 1000 ms, then disconnect channels “1” and “1c”, and then close the device.



## Appendix A: Installation Reference

The installation procedure places files in the following directories.  
 The default install\_dir is C:\Program Files\TAMS\TAMS 1800 Series Switch Software.  
 The default IVI or VXIplug&play directory is C:\Program Files\IVI

**Table 1**

File	Location	Description
TAMS18xx.exe	install_dir	Graphical User Interface
Installation and Operation.pdf	install_dir	This manual.
TAMS18xx.pdf	install_dir	Manual for the specific switch
*.c, *.h, *.vb, *.vee, *.vi	install_dir/Examples	Example programs
TS18xxa.msi	install_dir/Drivers	VXIplug&play and IVI driver install package
TS18xx.dll	IVI_dir\bin	IVI / VXIplug&play driver

TS18xx.h	IVI_dir\include	IVI / VXIplug&play driver include file
TS18xx.lib	IVI_dir\lib\msc	IVI / VXIplug&play driver library
TS18xx.c	IVI_dir\Drivers\ts18xxa	Driver source code
TS18xx.fp	IVI_dir\Drivers\ts18xxa	NI LabWindows function panel

## Appendix B: Error Messages

---

+0, "No error"	
+1, "No scan list"	Some commands, like INIT, require that a scan list be set.
+2, "Invalid during scan"	Some commands, like CLOSE and OPEN, are invalid while the device is scanning.
-101, "Invalid char"	An invalid character was received. Valid characters are A-Z, a-z, 0-9, : ; * @ ( ) ? + space newline comma
-102, "Syntax error"	The command was not recognized. See "Help/Manuals/Direct IO" for command reference.
-120, "Numeric data error"	There was a numeric overflow while parsing a number.
-200, "Execution error"	Internal error. Please call TAMS Inc.
-211, "Trigger ignored"	A *TRG or TRIG:IMM command was sent, but the device is not scanning or the TRIG:SOURCE is not BUS, MIX, or HOLD.
-213, "Init ignored"	The device received an INIT command while it was already scanning. (Use ABORT to abort a scan.)
-220, "Parameter error"	A state recall command (*RCL) referenced a state that has not yet been saved.
-222, "Data out of range"	A relay number was out of range.
-223, "Too much data"	A scan list or a relay list was too long.
-229, "Too many relays closed"	In order to limit the current draw as required by USB, some devices have a fixed limit of the number of relays that can be closed. A typical limit for most cards is 30 relays.
-400, "Query error"	A query was received by the device BEFORE a previous query was finished.

## Appendix C: Software License Agreement

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### 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 by 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 sublicense 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 to 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 states 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 its Distributors.

## Warranty Information

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### 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 its 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

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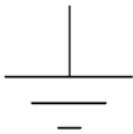
This symbol indicates a caution. See the manual for a complete explanation, and only continue when all conditions are fully understood and met.



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.



This symbol indicates a potentially hazardous voltage. Use caution.



This symbol indicates Earth Ground. Use the provided screw and lock washer to make a connection to Earth Ground.

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

Warning: This product must only be used to switch current limited circuits that are isolated from any Mains Circuits.

This product must have no Mains AC connections.

This product must have no connections to a telecommunications network.

This product must be mounted to an Earth grounded rack or chassis.

If the product is mounted inside of a screw-access enclosure then single insulation jumper cables may be used to interconnect one product to another via the “Analog Bus” terminals.

If the product is not mounted inside of a screw-access enclosure then double insulation cables must be used to interconnect one product to another via the “Analog Bus” terminals.

See the manual for your specific product for additional safety warnings.

Beware of hazardous voltages at product terminals.

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.

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

## **Declaration of Conformity**

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The Declaration of Conformity is on file at TAMS Inc.

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TAMS 1800 Series USB Controlled Switches  
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