



**TAMS 81488/84487/84488/85488
GPIB Cards for Linux**



Installation & Operation

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GPIB Cards for Linux
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Introduction

The TAMS GPIB Interfaces are intended to add IEEE-488 (also called GPIB and HP-IB) capabilities to any computer with a PCI or PCI Express (PCIe) bus.

The TAMS card takes full advantage of the PCI/PCIe bus performance and delivers the highest possible level of throughput.

The TAMS PCI Interface supports both the 3.3v and 5v PCI specifications as a universal card. The TAMS PCI Express (PCIe) Interfaces are PCIe 1.0a compatible x1 cards.

Thanks to HP's/Agilent's software architecture and the design of the TAMS driver, once the driver is loaded (which is done once at installation) the TAMS card can be used in any application without requiring more computer overhead or any changes to code developed for HP's/Agilent's GPIB/HP-IB cards.

Whether you are using TAMS BASIC for Linux or programming in C with the TAMS I/O Libraries, your code will now run at full performance without modification.

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 Appendix C.

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

Handling Interfaces- Some Words of Caution

You should note the following guidelines to avoid equipment damage when handling any interface cards.

- Make sure the computer's power is turned OFF and the power cord is removed from the AC power outlet, before removing or installing interfaces. Modern backplanes supply power even when the computer is turned off. Damage to the computer can occur if the PCI bracket touches the circuitry of the motherboard while power is applied.

Caution Plugging or unplugging an interface with the power on can damage the interface and the computer.

- Most interfaces contain components that are sensitive to damage from electrostatic discharge. Use protective measures including anti-static workstation and personal grounding devices, if possible. When installing an interface, do not leave the interface exposed longer than necessary.

Caution Whenever you remove, install, or handle an interface, hold it by its support bracket and side edges only. Do not touch its electrical components or traces.

Configuring the Equivalent Loads

As shipped, there are two resistor packs installed in sockets J2 and J3. These provide 10 additional equivalent loads, as defined in the IEEE 488.1-1987 standard. For systems with few devices and long cable lengths, the additional loads provide increased signal integrity and better transfer rates on the cable. In most situations, they can be left installed, which gives a total of 11 loads for the card.

However, there is a maximum of 20 equivalent loads per bus system. Most devices have one equivalent load, so a maximum of nine additional devices can be used while the resistors are installed. If your bus system will have more than nine additional devices, carefully remove both of the resistor packs and store them.

If the resistors need to be reinstalled later on, be sure that the visual key aligns with pin 1 on the sockets. The two resistor packs are equivalent, and can be interchanged. Both resistor packs must be installed together.

For full details on the constraints in configuring a bus system, refer to section 5.2.3 in the IEEE 488.1-1987 specification. The TAMS card is capable of operation at 1,000,000 bytes per second, and therefore the constraints in that section apply. This requires 48 mA tri-state drivers be used in all devices, all devices must be powered on, and cabling must be a maximum of 15 meters total length with at least one equivalent load per meter of cabling.

Installing the GPIB Interface

Before installing the GPIB card note the setting of the rotary DIP switch(es) on the card. Each interface installed in the computer must have a unique switch setting. The 85488 has two interfaces on a single card, each with an independent switch. Each of these must also be set to unique numbers. It is a good idea to write the switch setting on the metal support bracket with a felt tipped pen.

Make sure the computer's power is turned OFF and the power cord is removed from the AC power outlet, before removing or installing interfaces. Modern backplanes supply power even when the computer is turned off. Damage to the computer can occur if the PCI bracket touches the circuitry of the motherboard while power is applied.

Refer to the Owner's Guide of your computer for instructions on opening your computer and installing PCI or PCIe boards.

Follow the instructions being careful to handle the TAMS interface board only by its edges. After the board has been plugged in and the retaining screw installed, the computer should be reassembled.

Depending on the computer, it may be advisable to connect the small Cannon connector of the required GPIB cable to the TAMS interface card prior to fully seating the PCI board. Ensure that the thumbscrews and the small connector are tight for a good connection.

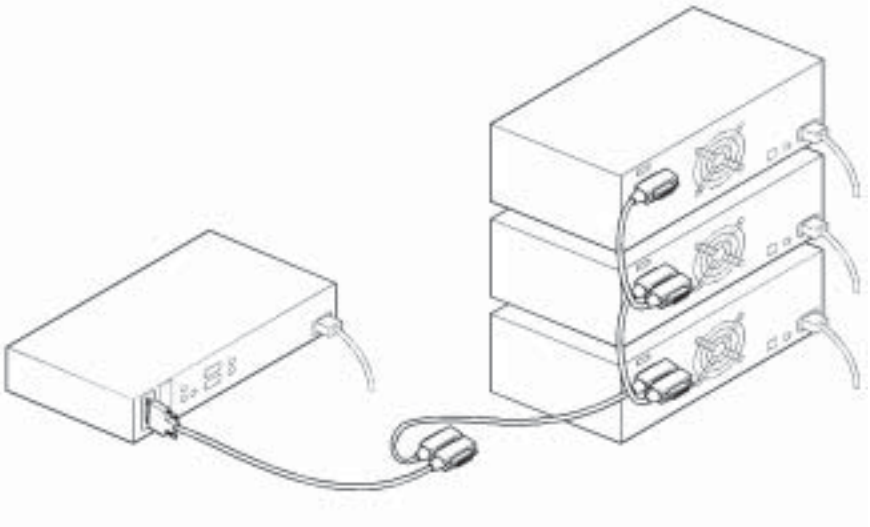
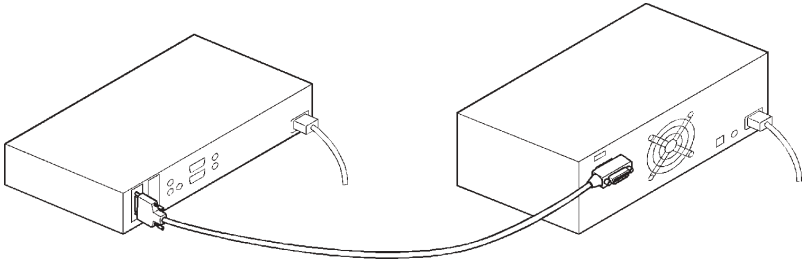


GPIB cable required by the TAMS interface.

Connecting the GPIB Cable

The IEEE 488 specification is for a daisy chain configuration, and so the standard connector on the cable supplied can be attached directly to any GPIB device or to any device in a chain of GPIB devices.

The following illustrations show correct connections. The lower illustration shows two connectors daisy-chained without being attached to an instrument. This is discouraged, since the jackscrews do not securely hold the connectors together in that configuration.



You are now ready to install the software that came with the GPIB card.

Installing the Software

Note The T81488 driver version 2.4 and later supports the 84487/84488/85488 PCIe cards in addition to the PCI 81488 card.

Note You must have root permission to install the software. In addition, you must have permission to write to the directories in Appendix A. Installation of the T81488 driver software also requires that the TAMS I/O Libraries (T82091) already be installed.

1. Insert the installation media into the drive and wait for the busy light to remain off.
2. If your system does not automount the CD-ROM, mount the CD-ROM. To do this you will need to know the device file for your CD-ROM drive and the directory where you wish to mount it. These can vary depending upon your hardware and Linux distribution.

On **Red Hat Enterprise Linux Workstation 3**, this is usually accomplished with

```
/bin/mount /dev/cdrom /mnt/cdrom
```

On later versions of **Red Hat Enterprise Linux Workstation**, this is usually accomplished with

```
/bin/mount /dev/cdrom /media/cdrecorder
```

3. Install the software. There are two ways in which you may do this.

If you wish to install the current version of the TAMS I/O Libraries and all related drivers, including the one for the 81488, simply run the INSTALL program from the CD-ROM.

```
/media/cdrecorder/INSTALL
```

The exact location will vary depending on where you mounted the CD-ROM in Step 2.

If you already have the TAMS I/O Libraries installed, you may install this driver manually.

```
cd /media/cdrecorder/RHEL4u3.i686  
rpm -Uvh T81488-2.0-RHEL4u3.i686.rpm
```

The directory and filename will vary depending on the operating system distribution, processor architecture, and driver revision. Some directories have a 'whichrpm.sh' script in them, which should be used to determine the RPM architecture. In these

cases, installation will look more like this. (Note the use of backquotes rather than single quotes.)

```
cd /media/cdrecorder/RH9RHEL3.i686
rpm -Uvh T81488-2.0-RH9RHEL3.`./whichrpm.sh`.rpm
```

4. The T81488 RPM will automatically load the t81488 kernel module and create the necessary device files. Each time you start up your computer after this, the t81488 kernel module will be loaded and related device files will be created.
5. Once the installation is complete, unmount the CD.

```
cd /
/bin/umount /dev/cdrom
```

6. Once the CD is unmounted, remove the media from the drive and store it in a safe place.

In general, the installation procedure places the files in the necessary directories by default. Appendix A is a reference for the Linux systems administrator, who might wish to know where these files are placed.

You will still need to configure the new TAMS GPIB card as a SICL instrument card, as covered in the next section.

Configuring the Interface

Each interface installed in your system must be configured using one of the following methods before it can be used. The configuration process assigns a name and number by which applications can identify the interface. There are also GPIB parameters that are given initial values at this point.

Note The 85488 card has two interfaces. Each one needs to be configured.

Configuring the Interface Using `iosetup`

After installation of the driver software and loading of the `t81488` kernel module (handled automatically by the RPM package), the `SICL iosetup` command must be executed to configure the TAMS card as a `SICL` instrument card. See the man page on `iosetup` (1M).

The `t81488` driver is implemented as a custom `TULIP` driver. Therefore, the system does NOT need to be rebooted after changing the configuration using `iosetup`. However, the `SICL iclear` command should be used after making changes to ensure that the configuration changes have taken effect. See the man page on `iclear` (1).

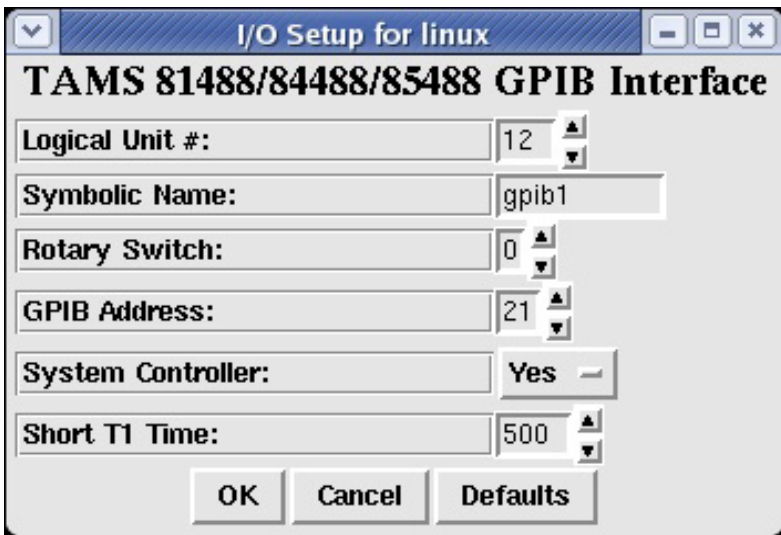
The following information must be supplied by the user during the `iosetup` process:

1. **Logical Unit #:** the user must supply a logical unit number for the TAMS card that is distinct from all other logical unit numbers currently configured under `SICL`.
2. **Symbolic Name:** the user must supply a symbolic name for the TAMS card that is distinct from all other symbolic names currently configured under `SICL`.
3. **Rotary Switch:** the user must specify the setting of the rotary DIP switch on the card.
4. **GPIB Address:** the user must specify the GPIB bus address that the TAMS card is to use on the GPIB bus. This value must not be the same as any other device connected to the GPIB cable. It may be the same as other GPIB interface cards in the computer, so long as those other cards are not attached to the card via the GPIB cables. If the TAMS card is set up as a system controller, it is traditional to give it GPIB bus address 21. This is not required, but does serve to reduce confusion.
5. **System Controller:** the user must specify “Yes” if the TAMS card is to be used as the system controller. The value “No” will cause the card to function as a non-system controller.

- Short T1 Time: the user must specify the IEEE-488.1 T1 delay value for write data transactions in nanoseconds. Reasonable values are an integer between 350 and 1100.

The Short T1 Time affects the rate at which your GPIB interface handshakes bytes out onto the bus when it is writing. This does not alter the speed at which data handshakes into the card on a read.

If all of the devices on your bus are capable of high speed (1 MB/sec) transfers, then you can set the Short T1 Time to 350 nsec, which will yield the fastest data transfers. If any of the devices are not capable of high speed communication, then use a Short T1 Time of 500 nsec. IEEE 488.1-1987 section 5.2.3 provides details on requirements for high speed communications.



t81488 Driver Configuration

Configuring the Interface Manually

Alternatively one can edit `/etc/opt/sicl/hwconfig.cf` directly.

In `/etc/opt/sicl/hwconfig.cf` the configuration lines have the form:

```
<lu> <name> t81488 <location> <gpib_addr> <syscon> <short T1>
```

Note The third field will always contain t81488, whether the card is a 81488, 84487, 84488, or 85488.

The fields are defined as:

1. Logical Unit (lu): the user must supply a logical unit number for the TAMS card that is distinct from all other logical unit numbers currently configured under SICL. A good choice for this, if your system only has one GPIB card, is 7.
2. Symbolic Name (name): the user must supply a symbolic name for the TAMS card that is distinct from all other symbolic names currently configured under SICL. A good choice for this, if your system only has one GPIB card, is “gpib1” (without the quotes).
3. Location: this number should match the rotary DIP switch setting on the card.
4. GPIB Address: the user must specify the GPIB bus address that the TAMS card is to use on the GPIB bus. This value must not be the same as any other device connected to the GPIB cable. It may be the same as other GPIB interface cards in the computer, so long as those other cards are not attached to the card via the GPIB cables.

If the TAMS card is set up as a system controller, it is traditional to give it GPIB bus address 21. This is not required, but does serve to reduce confusion.

5. System Controller: the user must specify “1” if the TAMS card is to be used as the system controller. The value “0” will cause the card to function as a non system controller.
6. Short T1 Delay Time: the user must specify the IEEE-488.1 T1 delay value for write data transactions in nanoseconds. Reasonable values are an integer between 350 and 1100.

The Short T1 Time affects the rate at which your GPIB interface handshakes bytes out onto the bus when it is writing. This does not alter the speed at which data handshakes into the card on a read.

If all of the devices on your bus are capable of high speed (1 MB/sec) transfers, then you can set the Short T1 Time to 350 nsec, which will yield the fastest data transfers. If any of the devices are not capable of high speed communication, then use a Short T1 Time of 500 nsec. IEEE 488.1-1987 section 5.2.3 provides details on requirements for high speed communications.

The system does not need to reboot after editing the `hwconfig.cf` file.

Appendix A: Systems Administration Reference

The installation procedure places files in the following directories:

File	Location	Description
t81488.so	/opt/sicl/lib	t81488 shared library for SICL
t81488.o	/lib/modules/<kernel version>/	kernel driver module
t81488.ko	kernel/drivers/char	
t81488	/etc/init.d	start/stop scripts for (un)loading the kernel module
S95t81488 K05t81488	/etc/rc.d/rc[345].d	Links to /etc/init.d/t81488
t81488.*	/dev	t81488 device files

Appendix B: Software License Agreement

Software License Agreement

Please carefully read this License Agreement before installing the software. Rights in the software are offered only on the condition that the Customer agrees to all terms and conditions of the License Agreement. If you do not agree to the terms of the License Agreement, you may return the unopened software package and 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 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 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 its 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 its 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.

Appendix C: 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 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.)

Appendix D: Specifications

General Characteristics

Weight	62.4 grams (81488/84488)
	56.7 grams (84487)
	79.4 grams (85488)
Size (excluding bracket)	11.9 cm x 7.6 cm (81488)
	13.3 cm x 7 cm (84487/84488)
	13.3 cm x 9.4 cm (85488)
Form Factor	PCI Std. Height Short Card (81488)
	PCI-Express Low Profile Short Card (84487)
	PCI-Express Std. Height Short Card (84488/85488)
Interfaces	1 IEEE 488 (81488/84487/84488)
	2 IEEE 488 (85488)
	1 PCI (81488)
Power Required	1 PCI-Express x1 (84487/84488/85488)
	5V @ 0.300 amps (81488)
	3.3V @ 0.65 amps (84487/84488/85488)
	12V @ 0.25 amps (84487/84488)
Standards	12V @ 0.40 amps (85488)
	IEEE 488.1-1987
	IEEE 488.2
	PCI 3.0 (81488)
	PCI-Express 1.0a (84487/84477/85488)
	RoHS (84487/84488/85488)

Environmental Specifications

Operating Temperature	0 degrees C to 40 degrees C
Storage Environment	-20 degrees C to 55 degrees C
Operating Humidity	10-90%, non-condensing

Ordering Information

URL	http://www.tamsinc.com/hpib
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TAMS 81488/84487/84488/85488 GPIB Cards for Linux
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