TAMS PCI GPIO Card

Installation & Operations Instructions

TAMS 71622 PCI GPIO Card
Instructions and Software License

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Updated information can be found on our web site at www.tamsinc.com/71622.htm.

Introduction

Unpacking Your Product

When you open our TAMS GP-IO Card shipment, examine its contents. Do not remove the GP-IO card from its protective bag yet. Make sure your shipment contains the following items:

TAMS 622-66501	GPIO Card
71622-90003	Installation & Operation Instructions
71622-0100	Software CD
72091-0700	LTU for TAMS I/O Libraries for HP-UX 11i
4001	Product Registration Card

Please complete the registration card and return it to TAMS.

Overview and General Information

This guide explains how to install the TAMS 71622 GPIO (General Purpose Input Output) interface in a HP Workstation.

In contrast to the HP 98622 GPIO and HP 2074/5 interfaces, the TAMS interface is configured within the software, rather than by setting switches on the GPIO hardware itself. TAMS recommends that the rotary switch on the upper edge of the TAMS 622-66501 card be set to the PCI slot number the card is going to reside in. This is a software convenience only. To set the configuration values for the TAMS card within the software, you will either run a software configuration utility, or edit a software configuration file. Therefore, this guide provides a detailed description of the TAMS 71622's functionality for software configuration purposes. You will need this information to set the values you want for the TAMS interface via the configuration method specific to your operating system.

GPIO is a parallel interface that is flexible and allows a variety of custom connections. A PCI expansion slot is required to accommodate the GPIO interface card.

The TAMS interface provides 16 bit data exchange with peripheral devices that do not support more common interface protocols like HP-IB or RS-232. Connection flexibility is augmented in the TAMS GPIO interface by extra status and control lines, a choice of handshake methods, several data-latching options, and selectable data width and polarity.

There are two basic modes for the data ports in the TAMS GPIO interface. The TAMS card can be configured like an HP 98622 GPIO interface, which is called *Compatibility Mode*. Alternately, the TAMS card can be configured with a bi-directional data port and auxiliary control lines, which is called *Enhanced Mode* and supported by HP 2074/5.

Installing the Interface

Note Configuration of TAMS GP-IO interface assumes knowledge of SICL configuration procedures specific to the platform. Refer to SICL documentation.

This section explains how to install the TAMS GPIO interface in the computer. To complete the installation, you will:

1. Make sure the computer power switch is off.
2. Refer to the Owner's Guide of your computer for instructions on opening your computer and installing PCI boards.
3. Install the GPIO interface in the workstation or PC by plugging the card into the PCI slot.

   Follow the instructions being careful to handle the TAMS 622-66501 board only by its metal bracket. Avoid contact with the edges. After the board has been plugged in and the retaining screw installed the computer should be reassembled.
4. TAMS recommends that the rotary switch on the upper edge of the TAMS 622-66501 card be set to the PCI slot number the card is going to reside in. This is a software convenience only.
5. Prepare and install the GPIO interface cable.

Note To set the configuration values for the TAMS card within the software, you will either run a software configuration utility, or edit a software configuration file.

Note The TAMS card is a PCI device. Unlike most EISA and ISA devices a PCI device does not require I/O address nor IRQ settings. Those settings are automatically and efficiently managed by the Operating System and require no user participation.

Installing the software with HP-UX 10.X

Note You must have root permission to install the software. In addition, you must have permission to write to the directories in Table 3 in Appendix B. Installation of the TAMS GPIO driver (T71622) will require rebooting the system.

This installation procedure is not suitable for diskless clients.

1. Insert the installation media into the drive and wait for the busy light to remain off.
2. Mount the cdrom, for example:

   ```
   /etc/mount  /dev/dsk/c0t2d0 /SD_CDROM
   ```

   `/dev/dsk/c0t2d0` is the device file for your cdrom drive and `/cdrom` is a directory used as a mount point.
3. Run the interactive HP-UX swinstall utility.

   ```
   /usr/sbin/swinstall
   ```

4. Verify that the Source Host Name and Source Depot Path are correct (usually the Specify Source window will open automatically, it can be accessed by selecting ‘Change Source’ from the Actions menu). The Source Depot Path is normally `/var/spool/sw`, unless you have copied the package from the installation media to a Source Depot. If this is the case you will need to change the Source Depot Path to point to the installation media. For example: `/ SD_CDROM`. Once Source Host Name and Source Depot Path are set correctly select ‘OK’.
5. The SD Install - Software Selection window should contain an entry named ‘T71622-32-32’ for 32 bit machines and ‘T71622-32-64’ for 64 bit machines. The installation procedure should screen them from seeing the other ones but some methods of installing the software will not see them. Highlight this entry by clicking on it once. Choose ‘Mark For Install; from the Actions menu, and ‘Yes’ should appear in the Marked column.
6. Select ‘Install’ from the Actions menu.
7. The HP-UX swinstall utility will analyze the host system configuration and the software package requirements. Once the analysis phase is complete select OK to start the installation.

8. As the final stage of the configuration, the HP-UX swinstall utility will automatically rebuild the kernel and reboot the system.

9. Once the system has rebooted you may 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 B is a reference for the Unix systems administrator, who might wish to know where these files are placed.

After the system reboots, you will need to use iosetup to configure the new TAMS GPIO card as a SICL instrument card, as covered in the next section.

Interface Configuration

Note Configuration of TAMS GP-IO interface assumes knowledge of SICL configuration procedures specific to the platform. Refer to SICL documentation.

HP-UX 10.x

1. Make sure the HP SICL software package, TAMS 622-66501 card(s) and the t71622 driver are installed and the computer rebooted.

2. Change to the directory containing SICL configuration file “hwconfig.cf”. The file contains detailed description and configuration examples for TAMS GPIO interface card. For location of the “hwconfig.cf” file refer to SICL installation and configuration manuals.

3. Use examples in the “hwconfig.cf” file to add manually an entry or entries in the “hwconfig.cf” file. You may also run SICL’s iosetup utility, select “Custom TULIP driver” and click “Configure” button. The field values can be found by looking at the configuration examples found in the “hwconfig.cf” file.

4. Ignore prompt to reboot. TAMS 71622 does not need the machine to be rebooted after configuration or reconfiguration.

Related Software Documentation

HP Standard Instrument Control Library for HP-UX

To configure the TAMS GPIO interface for the HP Standard Instrument Control Library (HP SICL) for HP-UX, see the “Installing and Configuring the HP I/O Libraries” chapter of the *HP I/O Libraries Installation and Configuration Guide for HP-UX*.

To develop HP SICL I/O applications for the TAMS card on HP-UX, see the “Using GPIO with HP SICL” chapter of the *HP SICL User’s Guide for HP-UX*. HP SICL functions, including those that are GPIO specific, are fully defined in the HP SICL Reference Manual. The TAMS card also provides functionality enhancements.

HP BASIC/UX 700

To configure the TAMS GPIO interface for HP BASIC/UX 700, see the “Configuring HP SICL for Series 700” chapter of the *Installing and Maintaining HP BASIC/UX* manual.

To develop HP BASIC/UX 700 I/O applications for the TAMS card on HP-UX see “The GPIO Interfaces” chapter of the *HP BASIC Interface Reference* manual.

Configuration Information

This section provides a detailed, functional description of the TAMS 71622 GPIO interface. You will need to understand this information in order to set the appropriate configuration values for the TAMS card via the configuration method required for your software. This information should also be helpful when you are preparing and installing the GPIO cable.

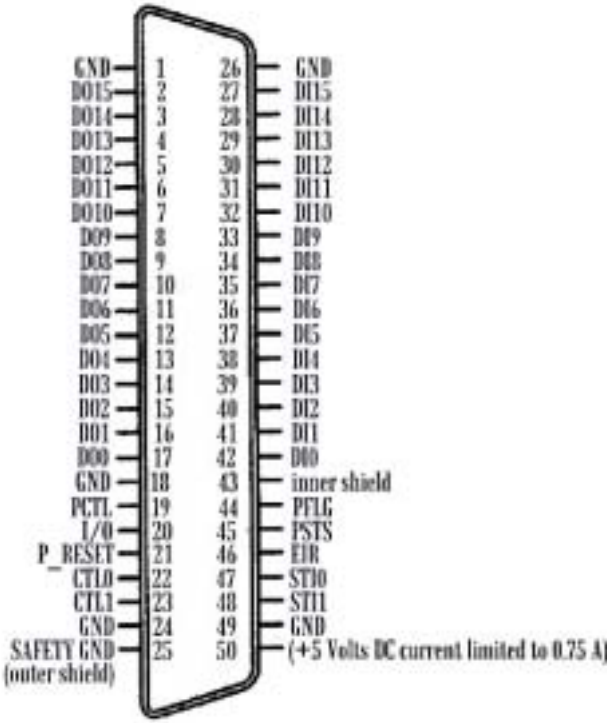
After you have read this section and decided how you want to configure the TAMS card, refer to your software documentation to configure your I/O application software for the TAMS interface. (See the “Related Software Documentation” section of this guide.)

This section contains the following sections:

- Connector Pinouts
- Data Lines
- Peripheral Information Lines:
    - Peripheral Control and Peripheral Flag Handshake Lines (PCTL and PFLG)
    - Input/Output Direction Control Line (I/O)
    - Peripheral Status Line (PSTS)
    - Peripheral Reset Line (P_RESET)
    - External Interrupt Request Line (EIR)
    - Control Output Lines (CTL0 and CTL1)
    - Status Input Lines (STI0 and STI1)
- Direct Memory Access (DMA)

Connector Pinouts

The following figure shows you the Pinouts on the TAMS GPIO interface connector.



TAMS 622-66501 GPIO Connector Pinouts

Label	Line(s)
DI0 through DI15	Data Input
DO0 through DO15	Data Output
PCTL and PFLG	Peripheral Control and Peripheral Flag handshake
I/O	Input/Output direction control
PSTS	Peripheral Status
P_RESET	Peripheral Reset
EIR	External Interrupt Request
CTL0 and CTL1	Control Output
STI0 and STI1	Status Input
PIN 50	+5 Volts DC current limited to 0.75 A

Key Differences between TAMS 71622 & HP 2074/5

TAMS 71622 PCI DMA.

The TAMS interface has two modes of transfer: DMA and interrupt driven. A program may control transfer mode used by calls to ***ihint()***. There are six values that could be specified to this call:

I_HINT_USEPOLL

I_HINT_USEINTR

I_HINT_USEDMA

I_HINT_IO

I_HINT_SYSTEM

I_HINT_DONTCARE

If I_HINT_USEPOLL is specified it always defaults to I_HINT_USEINTR. This is due to the fact that with advances in hardware and operating systems, there is no situation that using polled mode would have advantage over interrupt mode. Interrupt mode is not noticeably slower than polled and it releases the processor while waiting for interrupts greatly improving system overall performance.

If I_HINT_USEINTR is used, all inbound and outbound transfer will be performed in interrupt mode. Each transfer of a single 8 or 16-bit data item (depending on configured GPIO width) will be initiated, and processor freed to perform other tasks. Once the transfer is complete, the processor will initiate another transfer.

If the transfer is inbound and a termination and/or end character is specified, before initiating another transfer the driver will check if the termination condition occurred.

The ***igpioctrl(id, I_GPIO_READ_EOI, <end_char>)*** and ***itermchr(id, <term_chr>)*** calls control end and termination characters.

If I_HINT_USEDMA is specified, DMA will always be used for outbound transfer. For inbound transfer interrupt mode is always used. No call to ***ihint()*** is required to restore DMA transfer mode. For next transfer DMA will be resumed for outbound and if no termination and/or end character is specified, for inbound transfer.

If I_HINT_IO or I_HINT_SYSTEM or I_HINT_DONTCARE is used it will default to I_HINT_USEDMA. The I_HINT_IO is intended for best transfer performance and I_HINT_SYSTEM for most system performance executing other applications.

The fact is that both qualities are delivered best when DMA is used.

However there is a difference between above three modes and I_HINT_USEDMA.

It is possible for PCI bus DMA transfer to fail due to hardware or OS unstabilities. If this happens, The three modes described in this paragraph will default from that moment to I_HINT_USEINTR until the computer is rebooted. Explicit ***ihint()*** call with I_HINT_USEDMA will always use DMA and if a DMA bus error occurs the iread or iwrite will return error.

However, the PCI bus DMA error is very unlikely to occur. It could not be expected at all on a stable hardware running stable operating system.

TAMS 71622 PCTL delay.

The TAMS interface is much more flexible than any other available GPIO interface. With HP 2074/5 interface a user has a choice of one of eight values. The gaps between those values are significant and prevent performance optimization. The TAMS card accepts values directly in nanoseconds. The range extends from 90 nanoseconds to 245000 nanoseconds (245 microseconds) allowing optimal transfer performance according to the length of cable used. In addition the time specified is applied with accuracy at any mode of transfer, while other available GPIO interfaces add as much as 500 ns when different modes are used.

This caused users to configure more PCTL time than actually required to compensate for worst possible transfer mode case.

The TAMS 71622 PCTL delay is configurable via HP SICL ioconfig utility, or it may be changed at any time from within an application by call to ***igpioctrl(id, I_GPIO_PCTL_DELAY, <val>)*** where ***<val>*** could be one of eight HP 2074/5 compatible values, or directly a value in nanoseconds between 90 and 245000 inclusive.

The eight (0-7) of HP 2074/5 compatible values are interpreted as follows:

0 - 200ns, 1 - 400ns, 2 - 700ns, 3 - 1.2us, 4 - 2us, 5 - 5us, 6 - 10us, 7 - 50us.

Booting after configuring is not required with TAMS Interface.

When the TAMS PCI GPIO card is configured via ioconfig utility or manually (hwconfig.cf file on UNIX or registry on Windows) it does not require rebooting to take effect. Always choose Cancel or No button when prompted to rebuild the kernel or/and reboot the machine.

Changes take effect when a session on a newly configured interface is started for the first time within a process.

Care should be taken when a running application uses TAMS 71622 interface while it is configured.

If for example a polarity is changed on an interface while an application uses it, it may take effect in the middle of a transfer causing undesired effects. However no fatal effects like system crash or device hang could be caused.

Note Kernel rebuilding and/or rebooting is required only once after T71622 driver installation.

Appendix A: Wiring

Data Lines

There are 32 data lines on the TAMS 622-66501: 16 designated as data input, and 16 designated as data output. Color codes are provided for TAMS 622-001 GPIO cable and HP 5061-4209 GPIO cable.

Data Input Lines

The 16 data input lines are labeled DIO through DI15. The following tablelists the connector pin numbers and cable wire color codes for the data input lines.

Data Input Lines

Label	Pin No.	622-001	5061-4209
DI0	42	White on Grey	Black
DI1	41	Brown on Blue	Brown
DI2	40	White on Violet	Red
DI3	39	White on Blue	Orange
DI4	38	White on Green	Yellow
DI5	37	White on Yellow	Green
DI6	36	White on Orange	Blue
DI7	35	White on Pink	Violet
DI8	34	Brown on Green	White/Brown/Red
DI9	33	Brown on Yellow	White/Brown/Orange
DI10	32	Brown on Orange	White/Brown/Yellow
DI11	31	Brown on Pink	White/Brown/Green
DI12	30	Tan on Grey	White/Red/Orange
DI13	29	Tan on Violet	White/Red/Yellow
DI14	28	Tan on Blue	White/Red/Green
DI15	27	Tan on Green	White/Red/Blue

Data Output Lines

The 16 data output lines are labeled DO0 through DO15. The following table lists the connector pin numbers and wire color codes for the data output lines.

Data Output Lines

Label	Pin No.	622-001	5061-4209
DO0	17	Grey on White	White/Black
DO1	16	Blue on Brown	White/Brown
DO2	15	Violet on White	White/Red
DO3	14	Blue on White	White/Orange
DO4	13	Green on White	White/Yellow
DO5	12	Yellow on White	White/Green
DO6	11	Orange on White	White/Blue
DO7	10	Pink on White	White/Violet
DO8	9	Green on Brown	White/Orange/Yellow
DO9	8	Yellow on Brown	White/Orange/Green
DO10	7	Orange on Brown	White/Orange/Blue
DO11	6	Pink on Brown	White/Orange/Violet
DO12	5	Grey on Tan	White/Yellow/Green
DO13	4	Violet on Tan	White/Yellow/Blue
DO14	3	Blue on Tan	White/Yellow/Violet
DO15	2	Green on Tan	White/Yellow/Gray

Peripheral Information Lines

The following table lists the connector pin numbers and wire color codes for the peripheral information lines.

Peripheral Information Lines

Label	Pin No.	622-001	5061-4209
GRD	1	Yellow on Tan	
GRD	18	Violet on Brown	
PCTL	19	Tan on White	White/Grey
I/O	20	Grey on Brown	White/Black/Brown
P_RESET	21	Orange on Pink	White/Black/Red
CTL0	22	Brown on Tan	White/Red/Violet
CTL1	23	Pink on Tan	White/Red/Grey
GRD	24	Brown on White	
Safety GRD	25	Orange on Tan	
GRD	26	Tan on Yellow	
Safety GRD	42	Brown on Violet	
PFLG	44	White on Tan	Grey
PSTS	45	Brown on Grey	White/Black/Grey
EIR	46	Pink on Orange	White/Brown/Grey
STI0	47	Tan on Brown	White/Brown/Blue
STI1	48	Tan on Pink	White/Brown/Violet
GRD	49	White on Brown	
+5 (fused)	50	Tan on Orange	

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.)

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