

**H & L Associates' UPG6000 / UPG_STEP
Upgrade Kits for
GCA 4800/6000/8000 Steppers
(9289 Interface QBUS-PIO)**

**Installation, Operation and Technical
Manual**

**H & L Associates' Upgrade Kit for
GCA 4800/6000/8000 Steppers
(9289 Interface)**

Installation, Operation and Technical Manual

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May 2001**

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Document Conventions





keys

A keyboard font is used for single key descriptions.

e.g.

'Press  ' indicates the user should press the large key marked Enter or Return

e.g.

'Press   ' indicates the user should hold down the  key and then press the  key

numbers

Numeric data may be entered as a normal decimal number or as a hexadecimal (base 16) number if preceded by a dollar sign (\$) character

e.g.

I/O base segment = 52224

e.g.

I/O base segment = \$CC00

{options}

Command line entries which are optional are enclosed in curly brackets { }

e.g.

C>upg4800 {/m=\$CC00}

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Section A - Introduction

A.1 Product Description

The GCA 4800/6000/8000 stepper (also referred to as a photorepeater or a step-and-repeat camera) produces master patterns for integrated circuit fabrication and consists of a system controller, a rack of electronics (with a GCA 9289 interface chassis) and an optical exposure system.

H&L Associates' UPG6000/UPG_STEP package is designed to increase the efficiency and reliability of the stepper by providing the hardware and software necessary to replace the original Digital Equipment Corporation (DEC) PDP-11 system controller with an IBM-PC/MS-DOS compatible desktop computer (IBM-PC).

The IBM-PC will completely replace the PDP-11, its console terminal, floppy disk drives, printer and other peripherals. The maintenance problems associated with the PDP-11 are eliminated, and the features of an IBM-PC are made available to the user e.g. hard disk storage, local area networks, PC-based IC design software.

This document covers the installation and operation of two similar upgrade products for GCA steppers which use a 9289 interface chassis : **UPG6000** for steppers using a Master Operating Programme (MOP) version 5.0x (5.0,5.02,5.03 etc.) and **UPG_STEP** for steppers using the RSX operating system and a MOP version 605.x, 7.x or greater.

The hardware in the UPG6000/UPG_STEP package comprises the following:

- QBUS-PIO printed circuit board for installation inside the PC
- optional UPG_BUF serial line buffer for those steppers having an integrated alignment system (IAS)

The companion UPG6000/UPG_STEP System Software duplicates the operation of the original equipment software, but differs from the original in that:

- a text mode user interface (TMUI), with windows, dialogue boxes, pull-down menus and mouse support is used for most configuration, data file and setup operations. Context sensitive on-line help is available.
- Data files can be generated from several sources and may reside on local or network drives.

A.2 Package Contents

- one QBUS-PIO printed circuit board (16-bit ISA bus)
- optional UPG_BUF serial buffer unit for systems with an IAS
- System Software on a PC/MS DOS compatible diskette (for UPG6000) or CDROM (for UPG_STEP)
- Installation, Operation and Technical manual

A.3 System Requirements

A.3.1 Hardware

In order to install the UPG6000/UPG_STEP software and accompanying I/O board, the user must provide a PC/MS DOS compatible, Intel 80x86 based computer with the following *minimum* specifications :

- a Pentium II CPU with a clock speed of 233 MHz
- one 16-bit ISA bus expansion slot
- PC/MS DOS Version 6.0 or higher (including Win98 DOS 7.1)
- CGA, EGA/VGA or Monochrome video display
- one 1.44M floppy disk drive, a CDROM drive or network connection

In addition, and depending on the peripheral devices used in the stepper, the user may also be required to provide the following adapters and cables :

- for the optional IAS serial connection, a length of standard RJ45 CAT5 ethernet cable (straight through), 2 metres in length
- for the VT100 serial connection, a DB25F to DB9F, null modem cable, 2 metres in length (AESP C-219FF-6 or equivalent)

The UPG6000/UPG_STEP upgrade kit supplies the additional printed circuit boards and software required to complete the installation

The H&L supplied QBUS-PIO board is shipped with the following jumper settings:

- Interrupt Request (IRQ) jumper installed for IRQ10
- Port I/O base address at hexadecimal address CC00

If these settings conflict with those of other devices installed in the desktop PC, then the QBUS-PIO board must be reconfigured. Information on reconfiguring the QBUS-PIO board will be found in Appendix I of this document.

A.3.2 Software

UPG6000/UPG_STEP programmes should be run under a version of PC/MS-DOS greater than or equal to 6.0. This includes Windows 95/98 running in DOS 'command prompt only' mode.

NOTE

Since the control and test software operate in real time, it is recommended that the UPG6000/UPG_STEP software be run directly from the PC/MS-DOS prompt (e.g. C>). **DO NOT** install memory resident programmes which intercept the system timer interrupt. As well, **DO NOT** operate the photorepeater software in the 'DOS box' of a multitasking operating system e.g. MS Windows. Either of these situations may slow system response and produce erroneous photomasks.

Section B - Installation

B.1 Introduction

Before beginning the UPG6000/UPG_STEP installation, the installer should have a basic knowledge of IBM-PC hardware and PC/MS DOS software. The original instruction manual for the stepper will be required in the future for regular system maintenance and calibration. Before making any changes, it may also be necessary to consider the method that will be used to transfer job files from the current stepper system to the PC upgraded system (see Section D.2.4). If the method used involves capturing job files from the existing system or copying them to floppy diskettes, then that should be done first before any changes are made to the stepper installation.

Appendix I describes how to configure the QBUS-PIO interface board.

Appendix III describes the UPG6000/UPG_STEP user interface and how to invoke commands using a mouse or the keyboard.

B.2 Software Installation

It is recommended that the entire contents of the UPG6000/UPG_STEP System Software diskette be copied to a suitably named directory (e.g. C:\UPG6000) on the user's hard disk. Alternatively, the upgrade software, whether on a CD or a 1.44Meg floppy diskette, comes with an INSTALL programme which can be run. Inserting the floppy or CD in the corresponding drive and typing 'install' at the DOS command line:

e.g. A:\>install or E:\>install

will invoke the software install programme and a user screen similar to Figure B.1 will appear.

The install programme will copy the necessary programmes from the specified source directory to the specified destination directory. The default names for the source and destination directories should work for most installations but the user can change them if so desired. Pressing the **[Install]** button (or) will start the installation process.

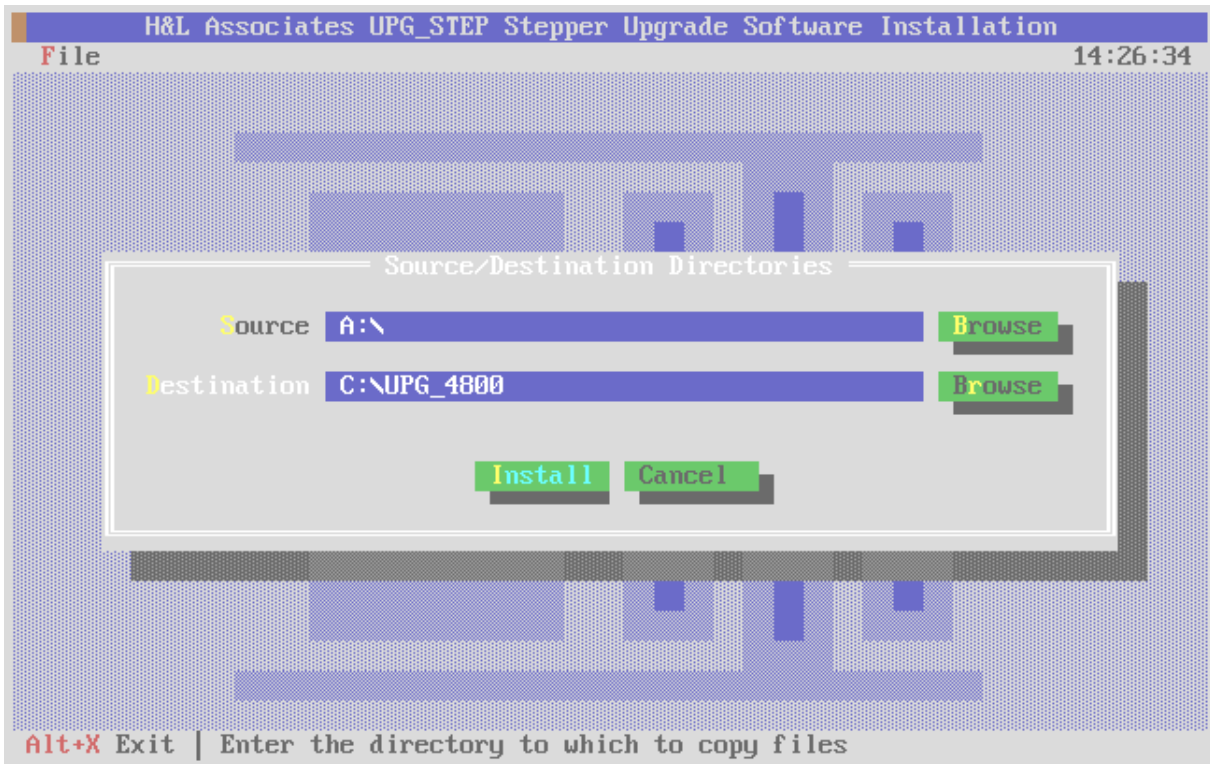
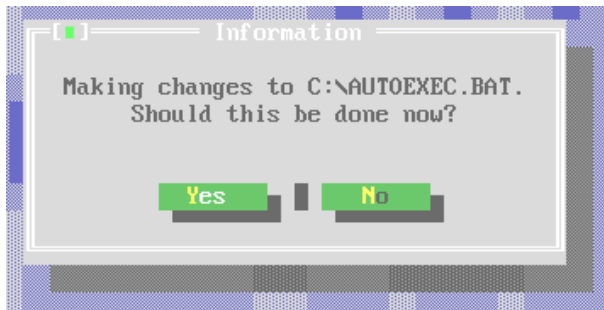


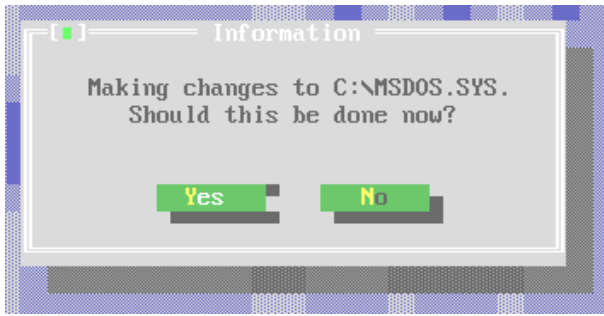
Figure B.1 : Software Installation User Dialogue

The install programme will also optionally make changes to two system files in the user's root directory (C:\) - AUTOEXEC.BAT and, if Win9x is installed, MSDOS.SYS.



The changes to AUTOEXEC.BAT will cause a 32-bit DPMI server to be installed on startup and a modification of the PATH environment variable to include the upgrade destination directory. The user should then be able to invoke the stepper control software from the DOS command line by simply typing 'STEPPER'. If this is the first time that the install programme has been run, then it is recommended that the changes be made. If an install

has already been done and the files are being copied again, the changes to the AUTOEXEC.BAT file don't need to be made.



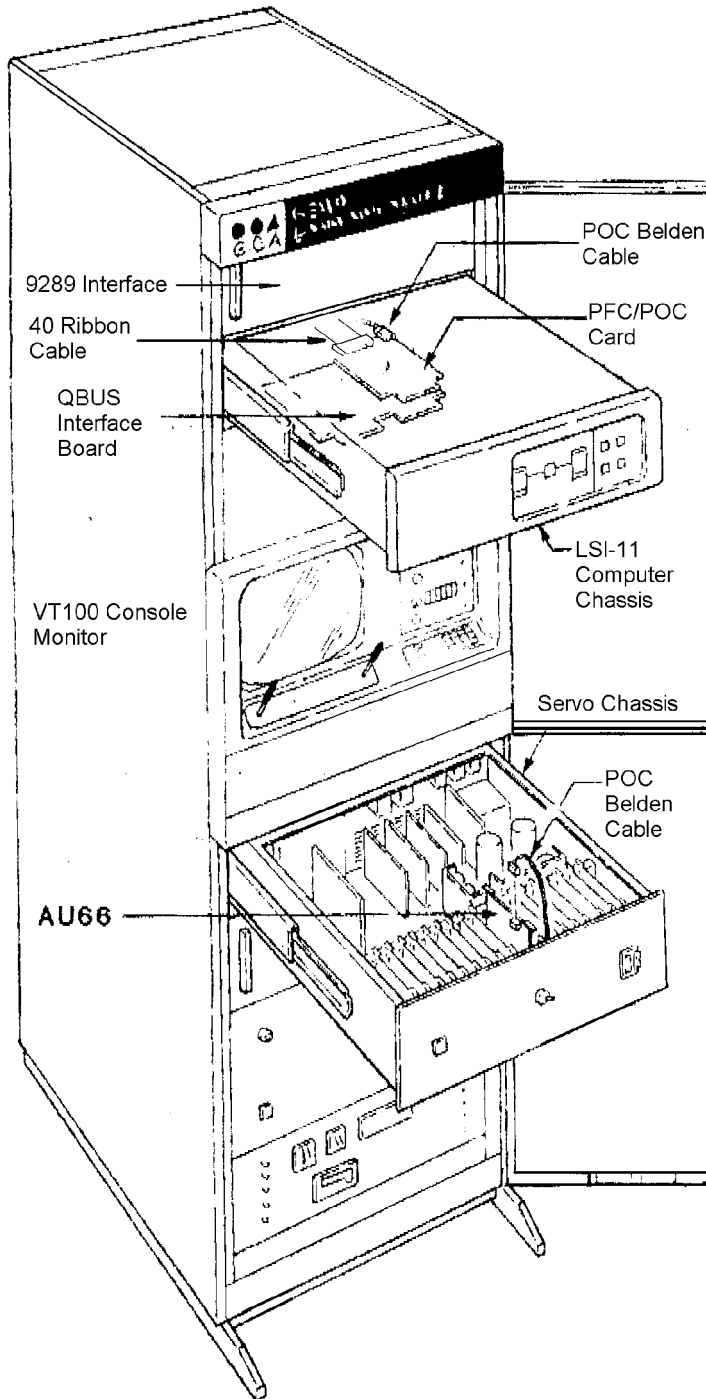
If DOS 7.x (i.e. Win9x DOS) is installed, then modifications will optionally be made to MSDOS.SYS. The changes will cause a startup menu to be invoked after a system reboot which will give the user the option of booting the system normally (into Windows), or into 'Command prompt only' mode (DOS real mode). DOS real mode is the desired mode when operating and controlling the stepper in real-time. Again, if this is the first time that

the install programme has been run, then it is recommended that the changes be made. If an install has already been done and the files are being copied again, the changes to the MSDOS.SYS file don't need to be made.

B.3 Hardware Installation

B.3.1 Original Stepper Connections

The standard GCA stepper includes a DEC minicomputer in the LSI-11 family (Micro-11, PDP-11/23, PDP-11/53 etc) in a rack mounted chassis. Within this chassis is a GCA QBUS parallel interface board (see Figure B.2) and, if the Programmable Offset Control (POC) interface is installed, an additional POC interface board (see Figure B.2).



Within the rack of stepper electronics is a separate GCA9289 interface chassis containing several printed circuit boards. A 40-conductor ribbon cable normally connects one of these 9289 boards (AU58) to the B port of the QBUS parallel interface board in the LSI-11 chassis.

If the POC option is installed then a 40-conductor ribbon cable connects Port A of the QBUS parallel interface to a POC interface board within the LSI-11 chassis. This board, in turn, connects to a board in the servo chassis (AU66) using a 10-conductor cable.

If the Integrated Alignment System (IAS) is installed then a 40-conductor ribbon cable will connect Port C of the QBUS parallel interface to a header on the IAS.

Figure B.2 : Standard Stepper Component Layout

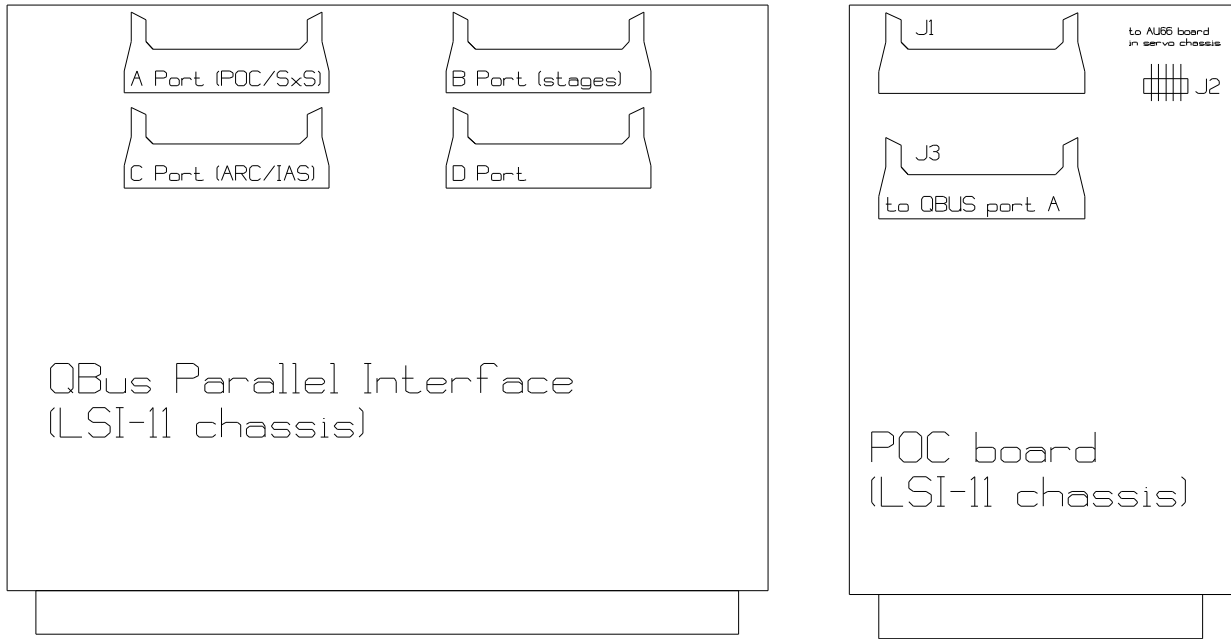


Figure B.3 : QBUS and POC Interface Connections

The installation of the UPG6000/UPG_STEP upgrade kit simply involves disconnecting cables from the LSI-11 and reconnecting them to an equivalent point on the desktop PC.

Note:

For some UPG6000 installations using AU58 interface boards in the 9289 chassis, a modification to the AU58 board is required. Capacitor C2, part of the timing circuit around Z4 (96LS02) is normally 1000pF in value and needs to be increased to 0.1 μ F, either by replacing the capacitor outright or by adding a 0.1 μ F capacitor in parallel to the existing one. Without this modification the stepper may fail to perform a basic origination function, or fail to return to a user prompt after the stages have moved to the origin position.

Most stepper peripheral devices are controlled through a conventional RS-232 serial port.

UPG6000 (MOP 5.0x) The serial panel is as shown in Figure B.4, but the 'CP24 Distribution Panel' has no 9-pin serial connectors

UPG_STEP (MOP 605.x+) The serial panel is as shown in Figure B.4.

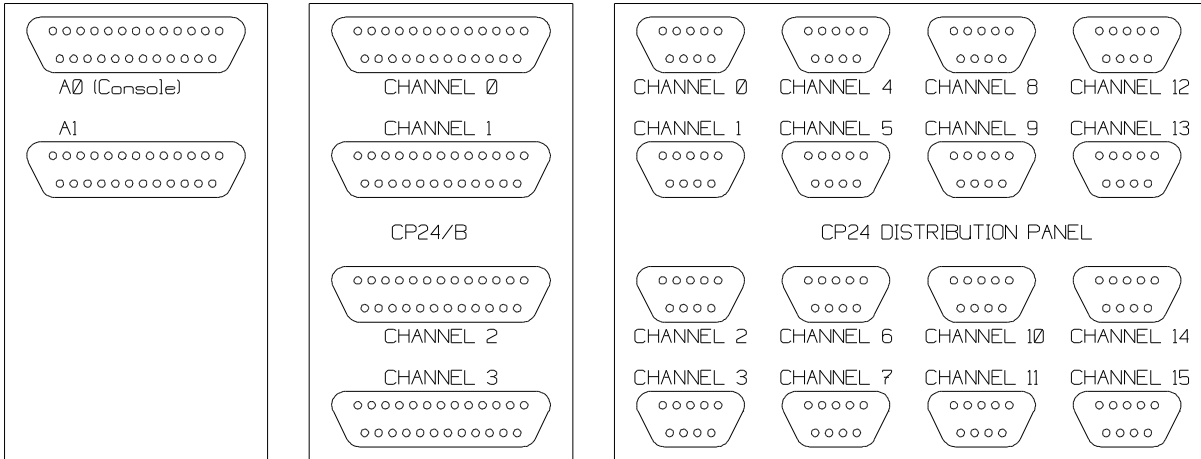


Figure B.4 : Serial Distribution Panel Connections

Emulex Connector	MOP Designation	UPG6000 Definition	Typical Function (baud rate in brackets)	
A0	TT0:	TT0:	supervisor console (9600)	
A1	TT1:	TT1:	user console (9600)	
Channel 0	TT2:	TT2:	line printer	
Channel 1	TT3:	TT3:	unused	
Channel 2	TT4:	TT4:	RMS	Reticle Management System (2400)
Channel 3-15	TT5:-TT21:	unused	unused	

Figure B.5 : Stepper Serial Port Assignments (UPG6000)

Note:

In the original equipment, Channels 0 through 3 are available either as 25-pin connections on panel CP24/B or as 9-pin connections on panel CP24 but not both.

Emulex Connector	MOP Designation	UPG_STEP.EXE Definition	Typical Function (baud rate in brackets)	
A0	TT0:	TT0:	supervisor console	
A1	TT1:	TT1:	user console	
Channel 0	TT2:	YVA0:	NIU	Network Interface Unit
Channel 1	TT3:	YVA1:	WT	Wafer Track (2400)
Channel 2	TT4:	YVA2:	IAS	Integrated Alignment System (9600)
Channel 3	TT5:	YVA3:	RMS	Reticle Management System (2400)
Channel 4	TT6:	YVA4:	AWH	Automatic Wafer Handler (2400)
Channel 5	TT7:	YVA5:	RDM	
Channel 6	TT10:	YVA6:	SS	Smart Set (9600)
Channel 7	TT11:	YVA7:	DFAS	(9600)
Channel 8	TT12:	YVB0:	RRS	Reticle Rotator System (9600)
Channel 9	TT13:	YVB1:	PPC	Programmable Platen Control (2400)
Channel 10	TT14:	YVB2:	ACS	(9600)
Channel 11	TT15:	YVB3:	TDC	Tropel Dose Control (2400)
Channel 12	TT16:	YVB4:		
Channel 13	TT17:	YVB5:	LIB	Lambda Interface Box (9600)
Channel 14	TT20:	YVB6:		
Channel 15	TT21:	YVB7:	MAP	(9600)

Figure B.6 : Stepper Serial Port Assignments (UPG_STEP)

B.3.2 Desktop Computer Connections

The QBUS-PIO card is installed in the IBM-PC and serves as the interface to the electronics within the stepper. Ribbon cables running from this card plug into the GCA 9289 chassis and optionally into the IAS peripheral. A technical description of UPG-PIO board will be found in Appendix I and a basic connection summary is shown in Figure B.7. The installation process involves the following steps:

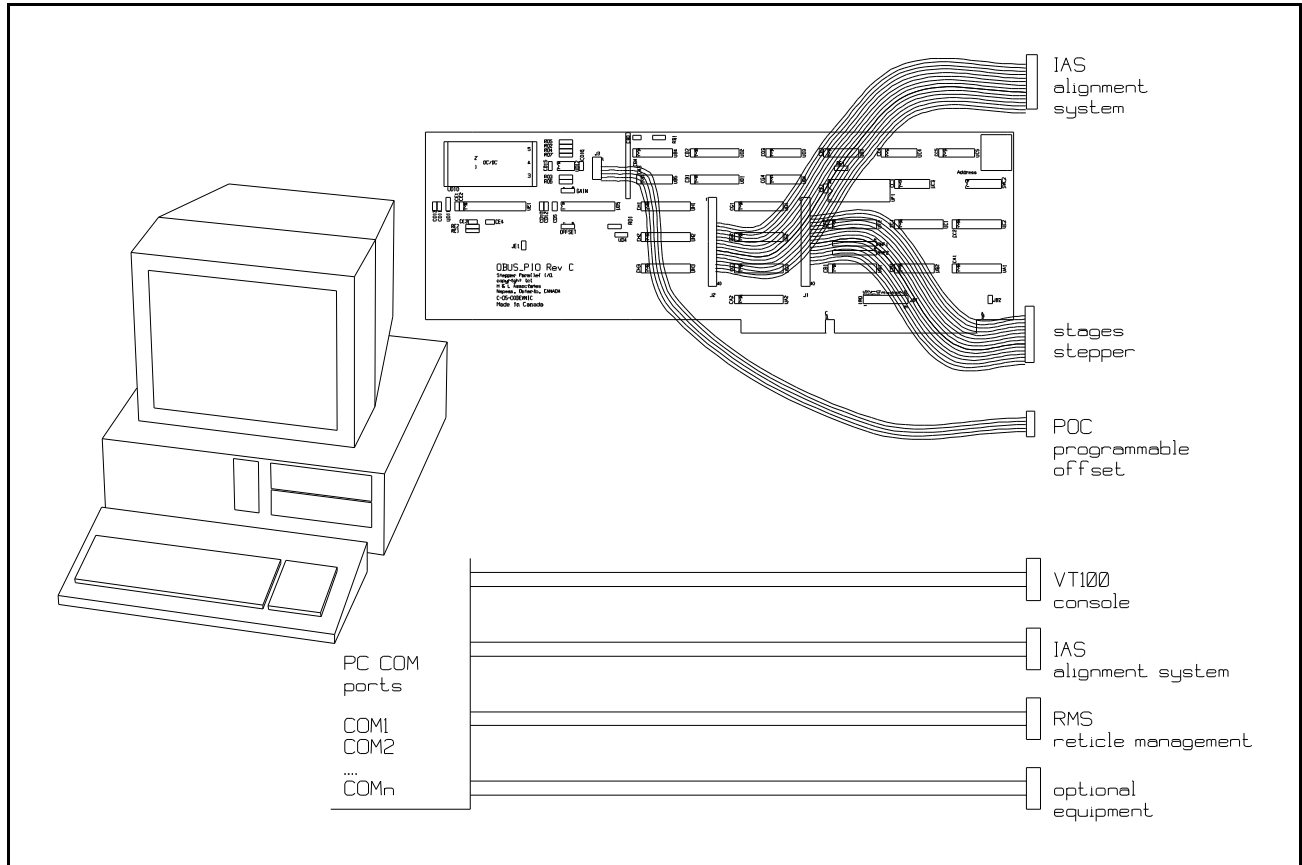


Figure B.7 : Typical UPG6000/UPG_STEP Hardware Installation

- ▶ Confirm the proper configuration of the QBUS-PIO card (see Appendix I) so that it doesn't interfere with the operation of any cards already in the PC.
- ▶ Power down the IBM-PC and open the cover. It is recommended that the computer also be unplugged from the wall outlet.
- ▶ Plug the QBUS-PIO board into any empty 16-bit ISA compatible backplane slot. Tighten the hold down screw of the board's rear bracket to ensure a solid connection.

B.3.3 Parallel Cable Connections

- ▶ Power down the GCA stepper. There should be a 40-conductor ribbon cable running between the AU58 board within the GCA9289 chassis and Port B of the QBUS board within the LSI-11 chassis. Disconnect this cable from the LSI-11 and reconnect it to J1 of the QBUS-PIO board within the PC. Note that each ribbon cable header on the QBUS-PIO board has a small V-shaped marking to indicate pin 1 on the header. The red line on the ribbon cable should line up with this marking on the header. Keyed connectors will force this alignment.
- ▶ If the optional IAS is installed then there should be a 40-conductor ribbon running between this peripheral and Port C of the QBUS board within the LSI-11 chassis. Disconnect this cable from the LSI-11 and reconnect it to J2 of the QBUS-PIO board within the PC.
- ▶ If the optional POC is used then there should be a 10-conductor 'Belden' cable running from a header on the POC board within the LSI-11 chassis to the AU66 board within the servo chassis. Disconnect this cable from the POC board within the LSI-11 and reconnect it to J3 on the QBUS-PIO board within the PC.

B.3.4 Serial Cable Connections

For those stepper systems that use additional peripheral devices attached to serial ports of the LSI-11 or for those wishing to retain use of the VT100 console and its video alignment capabilities (using joysticks and buttons built into the VT100 console), there are additional connections to be made to the serial communications ports of the PC.

Note that a conventional desktop PC generally comes with one (COM1) or two (COM2) serial ports. Low-cost peripheral expansion cards are available for the PC which will add a third (COM3) or fourth (COM4) serial port. PC/MS-DOS does not normally support more than four serial ports but the UPG6000/UPG_STEP software will support the following multi-port serial boards if more than four serial ports are required:

- Boca Research BocaBoard BB1004, BB1008, BB2016 (obsolete products)
 - Chase Research PCI-FAST (PCI bus) and AT-FAST (ISA bus) for 4, 8 or 16 serial ports
 - Control RocketPort/PCI for 2, 4 or 8 serial ports
 - Digi International DigiBoard PC/X where X is 4, 8 or 16 ports
- ▶ There is normally a cable running from the A0 (console) serial port of the LSI-11 to a modified VT100 terminal. If the user wishes to retain use of the modified VT100 terminal for alignment purposes, then disconnect the cable from the A0 serial port and reconnect it to one of the serial ports of the PC. The connection requires a null modem, a DB25 to DB9 adapter and a gender changer, all of which are available in standard cable assemblies (e.g. AESP C-219FF-6). Make a note of the serial port (e.g. COM2) being used on the PC so that the software can be configured to use it.
 - ▶ If the optional IAS is installed then there should be a cable connecting the serial port on the

IAS to the TT4: (Channel 2) port of the LSI-11. Remove this cable and replace it with the UPG_BUF serial buffer unit and a connecting length of RJ45 CAT5 ethernet cable. Technical information on the UPG_BUF unit can be found in Appendix II. Make a note of the COM port (e.g. COM3) being used on the PC so that the software can be configured to use it.

- ▣ Any remaining serial peripherals (e.g. RMS, DFAS etc.) can be disconnected from the LSI-11 serial port and reconnected to one of the remaining serial ports on the PC. Gender changers and DB25 to DB9 adapters may be required. Make a note of the serial port used on the original installation (e.g. TT11) and the serial port being used in the PC (e.g. COM4) so that the software can be properly configured.

This should complete the replacement of the LSI-11 minicomputer with a desktop PC. The computer chassis can now be removed from the rack. If a rack-mounted PC is being used, then it can be mounted in the equipment rack in the position previously occupied by the LSI-11.

A summary of the installation changes is shown in Figure B.8.

Function	Cable Description	Original Source	Upgraded Source	Destination
Stages	GCA 40-conductor ribbon cable	Port B of QBUS Parallel Interface in LSI-11 chassis	J1 of QBUS-PIO board in PC	AU58 board in GCA9289 chassis
optional IAS	GCA 40-conductor ribbon cable	Port C of QBUS Parallel Interface in LSI-11 chassis	J2 of QBUS-PIO board in PC	optional IAS parallel port connection
optional POC	GCA 10-conductor Belden cable	J2 of POC board in LSI-11 chassis	J3 of QBUS-PIO board in PC	AU66 board in stepper servo chassis
optional supervisor console	DB25F to DB9F null modem cable	A0 serial port of LSI-11 distribution panel	serial COM port of PC	VT100 console terminal
optional IAS	UPG_BUF adapter and RJ45 ethernet cable	Channel 2 (TT4:) of LSI-11 distribution panel	serial COM port of PC	optional IAS serial port connection
optional serial peripheral	GCA serial cable*	TTx: of LSI-11 distribution panel	serial COM port of PC	optional peripheral serial port
* may require gender changers and 25-pin to 9-pin adapters				

Figure B.8 : Stepper Upgrade Connection Summary

B.4 Installation Check

The desktop computer can now be closed and powered up normally. Performing the QBUS-PIO installation check involves the following steps:

- ▶ Ensure that the stepper main power is OFF
- ▶ Run the stepper software by typing 'UPG6000' or 'UPG_STEP' (with the optional /m=\$xxxx parameter if required) after the DOS prompt. If the STEPPER.BAT file was created by INSTALL.EXE then this batch file can also be used to invoke the software.

e.g. C:\UPG6000>UPG6000

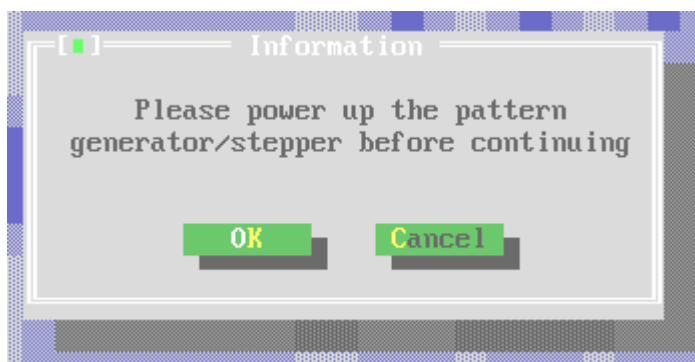
e.g. C:\UPG_STEP>UPG_STEP

e.g. C:\>stepper

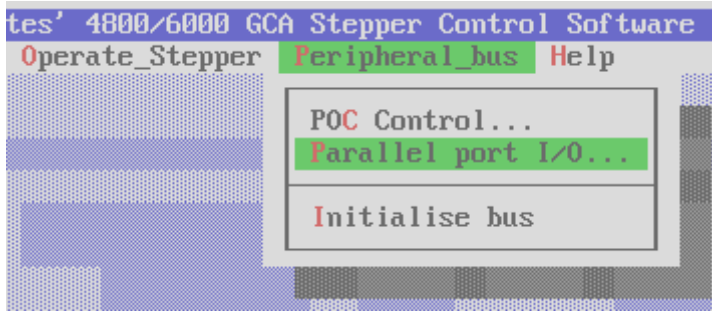
See Section C for more complete information about the commands available in this software. The portions relevant to checking out the hardware installation are summarised below.

The introductory screen of Figure C.1 will appear. Press to acknowledge the message.

If a message appears at startup indicating a problem in accessing the QBUS-PIO card, recheck the board configuration (see Appendix I) and then rerun UPG6000 or UPG_STEP.EXE.

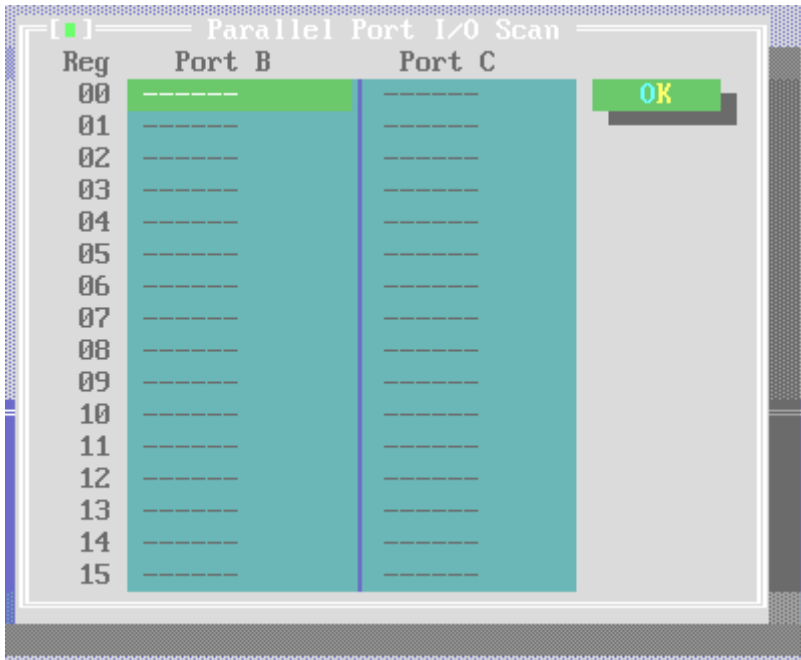
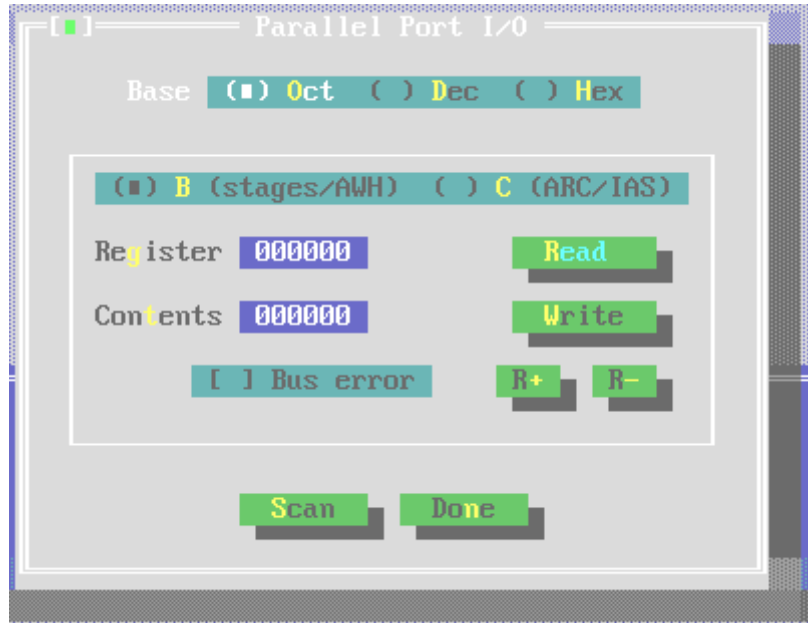


If the QBUS-PIO board has been properly recognised, then the user will be prompted to turn on the main power to the stepper. Turn on the main power to the stepper and press the **[OK]** button (or **[ALT] [K]**)



- ▶ press **[ALT]** **[P]** or select **| Peripheral_bus |** from the main menu
- ▶ press **[P]** or select **| Parallel port I/O... |** from the menu

- ▶ press **[S]** or select the **[Scan]** button to start scanning the interface electronics of the stepper in order to identify the presence or absence of responsive boards



If the interface boards within the GCA9289 interface are properly recognised, then numeric values will show up in the Port B column. If there is a problem in the connection, then a line of dashes will be displayed after the register number. Numeric values will only show up in the Port C column if the optional IAS is attached, powered on and configured to respond to data requests..

If the scan indicates responsive addresses then the installation is complete. Select the **[OK]** button to dispose of the diagnostics dialogue.

The user can now refer to Section C of this document to begin operating the stepper and creating photomasks.

Once the user is satisfied that the UPG6000/UPG_STEP Upgrade Kit is operating properly, the original equipment's LSI-11 controller and related peripheral devices (e.g. floppy disk drives, VT100 console terminal, lineprinter etc.) can be removed.

The original documentation related to operation of the stepper should be retained as the new installation will accept the same commands and operate in the same manner as the original.

B.5 Problems

If the system fails to show proper operation at any stage, then check to ensure the following before calling H&L Associates for help:

IBM-PC

- ☞ the port base address of the QBUS-PIO board does not conflict with any other device in the desktop PC. The QBUS-PIO board is not 'Plug-n-Play', so accommodation of this legacy device must be made.
- ☞ the IRQ levels jumpered on the board do not conflict with levels already assigned to devices in the desktop PC. The BIOS will probably have to be configured to allow 'ISA legacy device' IRQs to be assigned manually.

QBUS-PIO Board

- ☞ the board is properly addressed
- ☞ if the address of the board has been changed, then the `/m=$xxxx` command line option has been specified when running UPG6000/UPG_STEP.EXE
- ☞ the board is properly seated in the 16-bit ISA slot of the IBM-PC
- ☞ the ribbon cables are properly seated and oriented with the red line on the cable lining up with the pin-1 indicator on the header