FIRMWARE UPGRADABLE

GEMINI-1

For the Philips FLASH Microcontroller Families

USER GUIDE

(Preliminary)

CE

EQUINOX TECHNOLOGIES

EQUINOX TECHNOLOGIES UK LIMITED

The Embedded Solutions Company

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Electromagnetic Compatibility (EMC) Compliance

The GEMINI-1 Programmer is a CE Approved Product. It is designed only for use in a development environment only. This means that the user must ensure that there is no possibility of damage from electrostatic discharge (ESD). Since the devices and equipment to which this product is likely to be connected may well themselves be susceptible to ESD, this should not pose any difficulty.

For example, if you are handling microcontrollers and EEPROMS etc. then you will already be used to appropriate precautions, such as the use of anti-static mats, wrist straps and so on. You should treat your GEMINI-1 with the same care as you would these type of device. Always ensure that you are not yourself carrying a static charge before handling the product. Wearing an earthed anti-static wrist strap is recommended.

Equinox have taken great care in designing this product to be compliant with the European EMC directive. When using the equipment be sure to follow the instructions provided. Although RF emissions are within prescribed limits, care should be taken if you are using the product near to sensitive apparatus. If you experience any difficulty please refer to Equinox technical support.

ESD Points to remember

- Work in a static-free environment.
- Wear an earthed wrist strap when handling either the programmer and/or any programmable device.

Please Note:

This equipment is designed for use in a 'Development Environment' only and is NOT guaranteed to operate correctly in a 'Production Environment'.

Use of this product in a 'Production Environment' will invalidate your warranty.

Technical Support

It is often the case that users experience problems when installing or using a product for the first time. Due to the low-cost nature of this product, Equinox are unable to answer technical support questions about this product or its use by telephone.

If you have a technical support problem, please consult the following list for help:

1 This manual

2 Troubleshooting Guide (see page 25)

3 On-line help

Press <F1> for help at any time.

The help system is context-sensitive. Simply press <F1> on any error message and the possible causes of the error should be listed. This help system is updated on a regular basis. Please see software update details for information on keeping up-to-date with software revisions.

Please note: The help system does not work within Windows 3.11

4 Internet Web Site

Equinox have setup a Philips microcontroller support page on our web site. This page is designed to provide up-to date information on all issues concerning both Philips microcontrollers and support tools.

The microcontroller support page can be found at: ***www.equinox-tech.com/philips***

5 E-mail

Please e-mail any technical support questions about this product to: ***gemini1@equinox-tech.com***

Equinox will try our best to answer your questions about this product as quickly as possible. However, we can not promise an immediate reply. Please consult our web site for new software updates as the problem that you are enquiring about may have already been fixed in a new version.

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Please fax any technical support questions about this product to: ***+44 (0) 1204 535555***

Equinox will try our best to answer your questions about this product as quickly as possible. However, we can not promise an immediate reply. Please consult our web site for new software updates as the problem that you are enquiring about may have already been fixed in a new version.

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Web site ..... : www.equinox-tech.com

For technical support on this product please e-mail us at: gemini1@equinox-tech.com

Software Updates

In line with our policy of continuous improvement, the 'Gemini' software is updated on a regular basis. The firmware of the actual programmer is also periodically updated. If you would like to receive an automatic e-mail every time a new version is released, please make sure you have registered your system with Equinox and you have quoted your e-mail address. You may cancel this service at any time.

The Meridian software updates can currently be downloaded from the following places:

Internet : www.equinox-tech.com
Select <Software> This will take you to the software download page

About Philips Microcontrollers

Philips manufacture a complete family of In-System Programmable (ISP) 8051 FLASH microcontrollers each with differing FLASH & SRAM. Data sheets for these devices can be viewed and printed using the Acrobat pdf reader software supplied on the Philips CD-ROM. As data sheets are often updated on a regular basis, it is recommended that you consult the Philips web site for the latest information.

A few sources of further information about Philips microcontrollers are listed below:

Philips web site : http://www.philips.com

Equinox web site : www.equinox-tech.com/philips

If you have any silicon related technical support question about Philips 8051 FLASH microcontrollers which can not be answered by looking at the Philips/Equinox web sites, please e-mail us with a detailed description of the problem at: support@equinox-tech.com

Important - Please note

Equinox Technologies are unable to answer direct technical support questions concerning Philips microcontrollers. Please contact your local Philips distributor or sales office if you require any further information.

Contents

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Introduction

The GEMINI-1 is a state-of-the-art device programmer supporting the new range of In-System Programmable (ISP) microcontrollers from Philips. These microcontrollers feature serially downloadable memory allowing both CODE and DATA (if device features EEPROM) areas to be updated in-system without physically removing the target device from the application board. The serial programming is through the on-chip UART.

Please Note:

This programmer is designed for development use only.

GEMINI-1 DEVICE PROGRAMMER HIGHLIGHTS

Supports In-System Programming (ISP) of the following microcontroller families:

- Philips P89C51Rx+ (+12V Vpp)
- Philips P89C51Rx2 (No Vpp required)
- Powerful 'GEMINI' programmer interface software:
  - Compatible with Windows 3.1, 95, 98 and NT
  - Device commands include Check Signature, Blank Check, Erase, Read, Write, Verify, Security, Auto-program
  - Powerful buffer system with Blank Check, Erase, Fill, Goto and Checksum commands
  - Supports reading and writing of target device fuse bits and lock bits
  - Supports Binary and Intel HEX file formats
  - User-configurable
    - ~ RESET polarity
    - ~ RESET timing state machine
    - ~ Target Baud Rate
  - Context-sensitive help system
- Field upgradable firmware via Internet downloadable utility - caters for new programmer algorithms in the future
- On-board Vpp generator (+12V)
- Programmer 'Active' signal - used to drive an LED on the target system
- Connects to spare PC COM (serial) port
- Robust 'EMC-friendly' design plus I/O pin protection
- CE compliant product

Order Code: EQ-GEM1 (4.8-5.0V)

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Device Support

Philips FLASH Microcontroller Family					
Device	**FLASH Code Size** (Bytes)	**SRAM** (Bytes)	**I/O Pins**	**Vpp**	**Programming Mode Supported**
P89C51RA+	8K		32	+12V	ISP
P89C51RB+	16K		32	+12V	ISP
P89C51RC+	32K	512	32	+12V	ISP
P89C51RD+	64K	1K	32	+12V	ISP
P89C51RB2	16K	512	32	+5V	ISP
P89C51RC2	32K	512	32	+5V	ISP
P89C51RD2	64K	1K	32	+5V	ISP

Key

ISP = In-System Programming Mode

CAUTION: Make sure you do not exceed the maximum voltage of the target device.

System Specifications

Minimum System Contents

- GEMINI-1 Serial Download Programmer
- PC Serial extension cable set
- Windows Driver Software
- Equinox CD-ROM
- GEMINI-1 User Guide

GEMINI-1 Serial Programmer Specifications

Programmer Size	: 55 x 53 x 16mm
Shipped Weight	: Approx 0.10kg
PC Connection	: Serial Port 25-pin female D Connector
Programming Cable	: Length 300mm
Header	: 10-way IDC 0.1" pitch bump polarised
Power Supply	: Requires power from target system or external power supply.

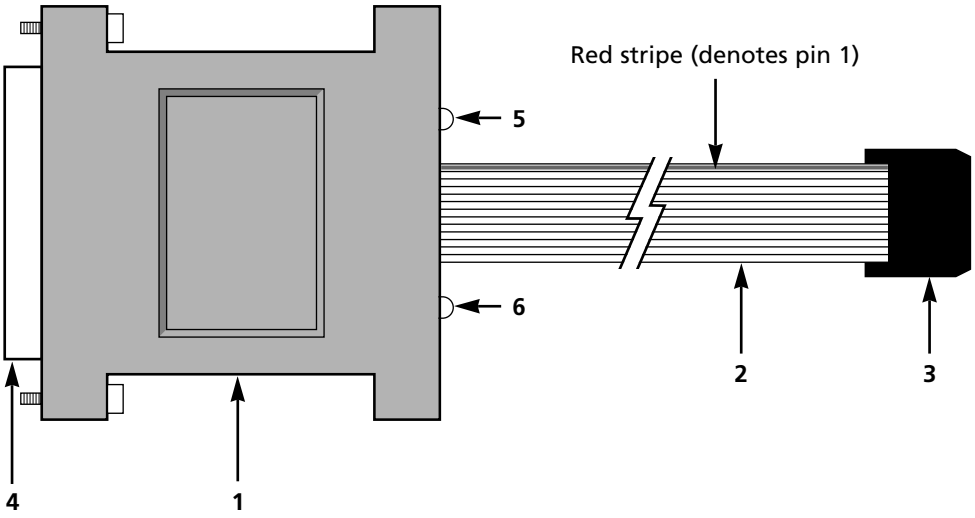
GEMINI-1 Vcc. 4.8 - 6.0V
- I_S (supply) approx 50mA when programming
- I_S (supply) approx 27mA in standby

Minimum PC requirements

The minimum hardware and software requirements to ensure that the programmer operates correctly are as follows:

- 100% IBM compatible 386+
- Windows 3.1 or higher
- Minimum 4MB RAM
- Minimum 1MB free hard disk space
- Spare PC serial port

Hardware Overview

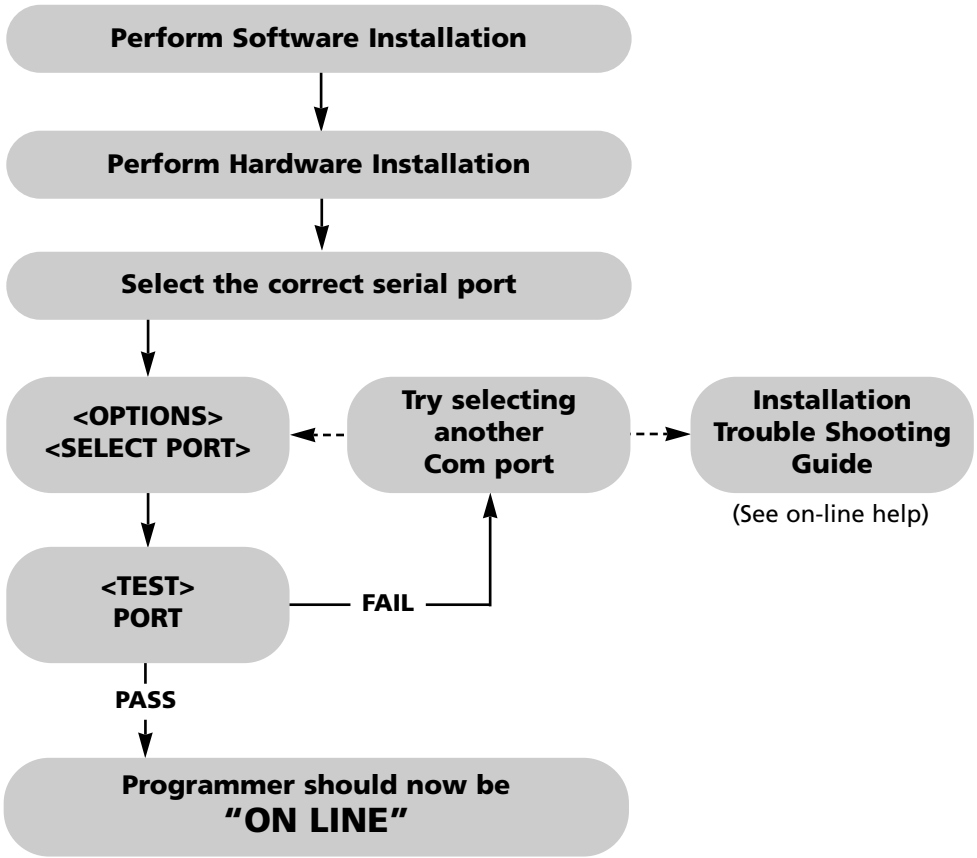


Key

1 GEMINI-1 Programmer
2 Serial Programming Cable (length approx 300mm)
3 10-way IDC Header Plug
4 25 pin female D-Connector (plugs into PC serial port)
5 Power LED
6 Active LED

Hardware/Software Installation Overview

The Hardware/Software Overview for the installation process of the GEMINI-1 programmer is detailed diagrammatically below. Please refer to the following pages for a more detailed explanation.



GEMINI for Windows Overview

The GEMINI-1 programmer is supplied with 'GEMINI for Windows' PC driver software. This software is supplied on one 3.5" floppy disk or can be downloaded from the Equinox web site.

GEMINI-1 Programmer Interface Software

- Powerful Windows Programmer Interface Software compatible with Windows 3.11™ Windows 95™, Windows 98™ & Windows NT™
- Device: Check, Signature, Erase, Blank Check, Read, Program, Verify, Special Options and Security
- Supports programming of microcontroller fuse bits
- Programmable RESET polarity
- Powerful RESET Timing utility allows most RESET circuits to be accommodated including C/R, External Watchdog and 3-pin CPU supervisor devices
- Powerful Auto-Program Utility
- Fast programming times
- Powerful Multiple File Loading Utility
- Supports Bin & HEX file formats
- Supports Reading/Writing of the Status Byte
- Comprehensive context-sensitive on-line help system

To Install 'Gemini for Windows' software:

- Boot the PC into Windows environment (Win 3.1, Win 95 or NT)
- Insert 'GEMINI for Windows' disk into floppy disk drive (A: / B:)
- Select the 'Run...' command from the 'File' menu in the Program Manager
- Select 'Browse' and navigate to the floppy drive (A: / B:)
- Select 'meridian.exe'
- Select the 'OK' button

The software installation program should now display an introductory screen. Please follow the on-screen prompts in order to complete the software installation process.

On completion, the installation program will install the 'GEMINI' icon within a new program group called 'Equinox'.

To launch the software, simply double-click on the 'GEMINI' icon.

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Hardware Installation Instructions

Overview

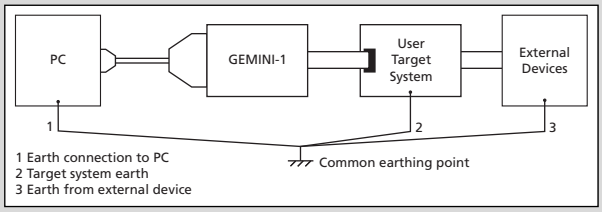
The GEMINI-1 programmer connects to any spare PC **serial** (COM) port. If you only have one serial port and this is in use for e.g. a modem, it may be possible to add another serial port to your machine by inserting a new I/O card.

For further hardware installation help, please refer to the: **Installation Troubleshooting Guide**

Warning !

To avoid catastrophic damage to PC, programmer or target system:

- Ensure that both your target system and PC are connected to a common earth point.
- Make sure that all interconnections are made before applying power to PC and target system.
- If you are using a laptop or PC which is not connected to mains earth, it is recommended that you make a hard-wired connection from the COM port D-connector shell and the target system to a common earth point.
- Avoid plugging and unplugging ISP connector while either the PC or target system is powered up.
- Please ensure that any devices connected to the user target system are also properly grounded to the same common earth point.
- Please see Diagram opposite



Any damage caused to the programmer through inadequate earthing is not covered under warranty

Hardware Installation Instructions continued

Installation Instructions

1 Connect the serial cable provided to a spare COM port on the PC using the 9-25 way adaptor if necessary.

2 Connect the GEMINI-1 to the other end of the serial cable.

3 Connect the IDC plug at the end of the serial programming cable into the 10-way IDC header
on the user target board (not supplied).

4 Apply power to the target board. Please ensure that the target system is powered up. The programmer will not operate unless a Vcc in the specified range is applied on pin 1 of the IDC connector. **(The GEMINI-1 draws its power from the target)**

Warning!

The Gemini programmer features an on-board Vpp generator circuit which produces a Vpp of +12V on the Vpp pin of the programmer under control of the Gemini driver software.

Please take the following points into consideration when using the programmer:

1 If the selected devices requires a Vpp of +12V to be applied, the programmer will switch the Vpp line from +5V to +12V to commence the programming operation. This voltage will only be released at the end of the programming operation.

2 The programmer will always output +5V on the Vpp line. As this programmer line is connected to the EA/Vpp pin of the target microcontroller, +5V will always be present on this pin from the programmer.

3 When the programmer switches on the Vpp generator, a large surge current is drawn from the target system supply. This can be as high as 700mA for a period of a few milliseconds. If your target system can not supply this inrush current, you may find the target system power supply current limits and the programming operation will fail. In these circumstances, it is necessary to use an external power supply which can cope with the inrush current. This problem will only occur with the Philips P89C51RA+ family which require the +12V Vpp.

Serial Port Selection (Select Port)

The GEMINI-1 programmer plugs into a spare serial (com) port of any IBM compatible PC including the majority of laptop machines.

To select the Correct Serial Port

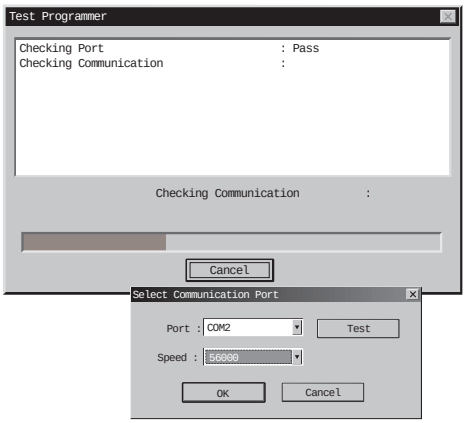
i. From the menu bar select <Options> <Select Port>

The available COM ports on your computer are now displayed.

ii. Select the COM port to which the programmer is connected

ii. Select the desired target microcontroller baud rate e.g. 9,600K

The baud rate is the maximum baud rate which the target microcontroller can reliably communicate at.
See Device programming section for further information.



iii. Select <Test>
A programmer communications test is now performed.

This tests both the programmer, cable and PC serial port. It does not communicate with the target microcontroller

Communications Test Pass

The programmer has been detected OK by the GEMINI software. If you now <Cancel> out of the <Test Port> dialogue box, the words 'ON LINE' should now be displayed at the bottom right of the GEMINI Window.

Installation is complete and the programmer should now be ready to-use.

Please Note

This test has not verified that the programmer can communicate with the target microcontroller.

Communications Test Fail

The programmer was not detected on the COM port selected. Please check that the correct COM port was selected, and if not, repeat the <Select Port> < Test> operation.

If your PC is not fast enough to operate at the default highest communication speed, it may be necessary to slow the communication down. This can be achieved by choosing a slower baud rate from the list provided.

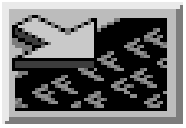
If the programmer is still not detected, please refer to the Installation Troubleshooting Guide located in the "On-Line" help.

Software Overview

The **GEMINI for Windows™** software features many powerful functions which can be activated by simply clicking a single icon. Other utilities and commands are available by selecting the relevant menu option.

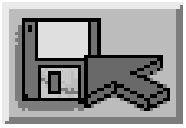
For further information about the **GEMINI for Windows™** software , please refer to the 'On-line Help System' supplied with the software (F1).

The most commonly used functions for which an icon exits are listed below.



LOAD FILE TO BUFFER (F9 or Ctrl + L)

Allows you to select a file or multiple files and load the file(s) into the programmer buffer area(s). Currently supports Intel Hex and Binary file formats as standard.



SAVE TO DISK (Ctrl + S)

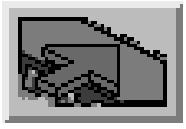
Allows you to save the contents of the buffer(s) to a file.
Currently supports Intel Hex and Binary file formats as standard.

BLANK CHECK

Checks if the currently selected device is blank.
i.e. All locations = FFh

VERIFY DEVICE

Compares the contents of the buffer area(s) with the contents of the currently selected device.



WRITE DEVICE

Writes with contents of the buffer into the device
Note:
This operation does NOT perform an electronic erase before writing data.

Software Overview continued

DEVICE READ

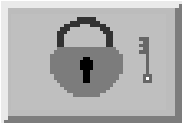
Reads the contents of the currently selected device into the programmer buffer area(s).

ERASE DEVICE

Performs an ELECTRONIC erase on the currently selected device.

DEVICE AUTO-PROGRAM

Performs a complete programming cycle including Signature Check, Erase, Blank check, Write, Special Options, Security etc.



SECURITY

Allows you to READ/WRITE the security lock bits of any device which supports this feature.

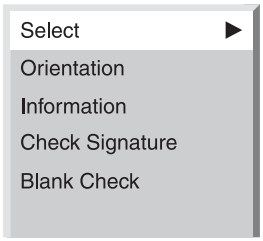
Device Programming Guide

The GEMINI-1 Programmer is now ready to program a target device.

In the following example we have chosen to program a Philips **P89C51RC+IN** microcontroller located on the user target system.

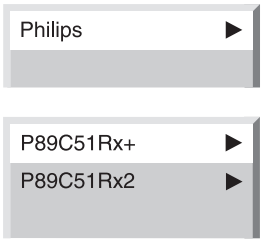
1 From GEMINI, select <Options> <Create Library Info>

This operation interrogates the target programmer and generates a 'notepad' document which details information about your programmer and generates a list of devices supported by the programmer. From the list you can see which 'TARGET ISP' devices can be programmed with the GEMINI-1. i.e. only devices listed as 'yes' or LNR' are supported.



2 To select the target device click on the <Device menu>

Choose <Select>, <Philips>, <Target (ISP)> and finally click on the desired target device, in our example <P89C51RC+ISP>.



3 From the< Device menu>, select<Information>

This will give you a description of the target device.

4 Setting a target frequency

Select <Options><Target settings> then set F_{OSC} click <OK>

5 Setting of Baud Rate and COM Port

Select <Options><Select Port>

Device Programming Guide continued

Overview

The following tables detail the result of testing the programming of various target microcontrollers in the laboratory. These timings and settings are meant for guidance only. E&OE. Results may differ depending on microcontroller batch, power supply, target system etc.

Definitions:

Voltage	- Supply voltage to programmer and target device
Fosc	- Frequency of target microcontroller oscillator
Code time	- Time taken to program the target device CODE area with random data

All measurements were taken with the following equipment:

Gemini V0.24

PC - DX2-50

GEMINI-1 Programmer

Windows 95

Target communication speed: Variable

WARNING

High currents are drawn by the GEMINI-1 programmer during erasing & writing. Care must be taken to ensure the target power supply can supply the necessary current.

Device Programming Guide continued

P89C51RC+IN - Timing Characteristics

Erase + Blank Check time Secs	Write Code Secs	Frequency MHz	Baud rate
16	107.2	32	9600
13	58.1	32	19200

P89C51RD+IN - Timing Characteristics

Erase + Blank Check time Secs	Write Code Secs	Frequency MHz	Baud rate
25	213.2	32	9600
20	116.1	32	19200

Device Programming Guide continued

Further information to be added

Device Programming Guide continued

8 Loading user code/data to the buffer areas

To program the target system the buffer must first be loaded with the user code/data.

- Select <File> <Load to Buffer...>

  The 'Load to Buffer' dialogue is now displayed.
- To load a file into the CODE area, click <Browse> in the code section.

  Select the required file, click <Load>

  This loads the same file into both the code and data areas by default.
- To load a different file into the DATA area , click<Browse> in the data section.

  Select the required file, click <Load>

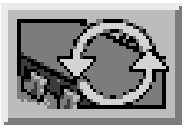
  The buffer(s) should now be loaded.

  Click <OK> to quite out of the 'Load dialogue box'.

9. Using <Auto-Program> to program a target device

The most straightforward method of programming a target device is to select <Device><Auto-Program> or click the <Auto-Program> icon.

An 'Auto-Program' performs the following actions:



- Pre-programming State machine operation
- Check Signature
- Chip Erase
- Blank Check (CODE/DATA areas)
- Write CODE area
- Verify Pass 2 - CODE area
- Write DATA area
- Verify Pass 2 - DATA area
- Write Special Options (Status Byte.)
- Write Security

The auto-program operation is setup by selecting <Device><Auto-program Options>.

Device Programming Guide continued

10. Using the <Device> commands individually

It is possible to fire off any programmer command individually from the <Device> menu.

Please note:

i. The programmer will, by default, perform a 'Pre-programming State machine operation' and a 'Check Signature' for each operation selected. The 'Check Signature' can be disabled using a tick box.

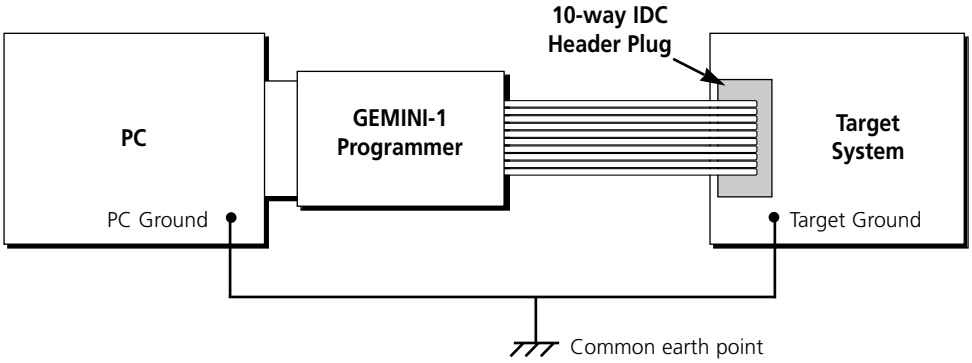
ii. The <Device><Write> operation does not perform a 'Chip Erase' operation. If there is already non-FF data in the target device then the 'Write' operation will fail. A manual <Device><Erase> is required to erase the device.

iii. The <Device><Special Options> operation allows the user to read the current values of the fuse bits of the target device (if the device supports this). New values can also be written to the target device.

In-System Programming Overview

It is possible to In-System Program (ISP) members of the Philips microcontroller by using the on-chip UART. The GEMINI-1 programmer implements ISP of these devices by generating the necessary programming waveforms under control of PC software.

Typical Hardware Configuration for In-System Programming (ISP) Mode

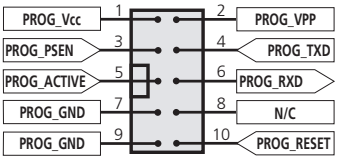


ISP Header (Target System)

GEMINI-1 - Target System Connection Details

The programmer 10-way ribbon cable supplied is terminated with a standard 10-way 0.1" pitch IDC plug. This is designed to mate with the complimentary male 10-way IDC header on the target system. The pin-out of the header is shown opposite:

10-Way IDC Header
Top Pin View



Note: *This is the view of the connector fitted to the target board, as seen from above (the component side).*

ISP Pin Assignments

Pin	GEMINI-1 Pin Name	Target Microcontroller Pin Name	Description
1	PROG_Vcc	Vcc	Target Vcc connection
2	PROG_Vpp	EA/Vpp	Target Vpp pin - Vpp is applied to this pin (if required)
3	PROG_PSEN	PSEN	Driven LOW by programmer to enter 'Boot Loader' mode
4	PROG_TXD	RXD	Programmer Transmit line
5	PROG_ACTIVE	LED or Interrupt pin	Programmer Active LED/Interrupt pin
6	PROG_RXD	TXD	Programmer Receive line
7	PROG_GND	Vss	Target GROUND (Vss) connection
8	N/C	-	-
9	PROG_GND	Vss	Target GROUND (Vss) connection
10	PROG_RESET	RESET	Target RESET control pin

Y = This connection must be made **x** = Optional

N/C = No Connect **MCU** = ??????????????????

Connector recommendations

The IDC connector supplied with the GEMINI-1 programmer is 'bump' polarised so that it can not be inserted the wrong way around in a polarised socket. If the connector used on the target system is not polarised, it is advised that measures are taken to prevent the connector being plugged in the wrong way around. This could be achieved by removing pin 8 (a second ground) from the target header and placing a blanking piece of plastic in pin 8 of the cable header.

Target System Requirements

The following target system requirements must be met for the GEMINI-1 programmer to operate correctly :

- **Target oscillator**

  The target microcontroller oscillator must be running between certain prescribed frequencies. These can be found in the relevant microcontroller data sheets.

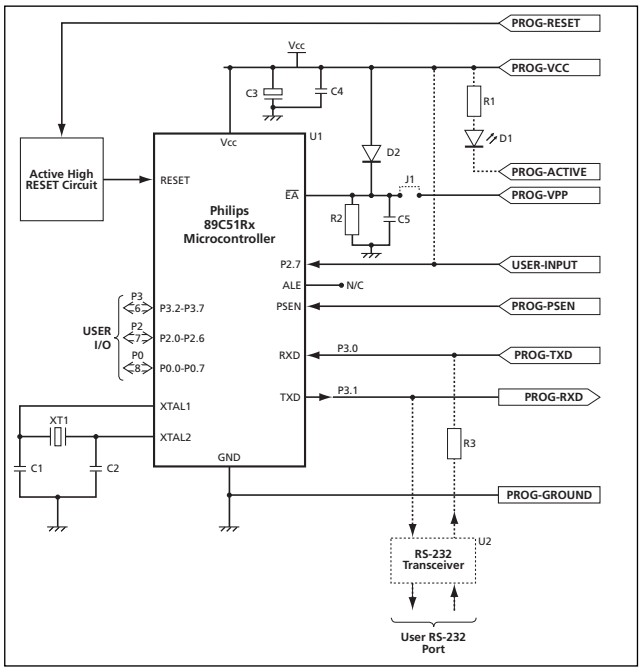
- **Power**

  The GEMINI-1 requires a regulated DC supply to operate. This supply can be taken either from the user target system or an external power supply unit (PSU). The programmer should operate correctly between the specified operating voltage limits (see hardware specifications).

- **RESET circuit**

  The serial programming mode of the Philips FLASH microcontroller devices is initiated by asserting the RESET pin in the correct sense for a certain period of time. The programmer must, therefore, be able to assert the RESET pin on the user target microcontroller. External control of the RESET pin can be implemented in a number of different ways.

Philips 8051 FLASH Microcontroller - ISP Notes



Philips 8051 FLASH Microcontroller - ISP Notes continued

Further information to be added

Upgrading the programmer firmware

This programmer features upgradable firmware technology which allows the actual control code within the programmer to be updated in the field. Upgrading the programmer firmware allows new features, new device algorithms and bug corrections to be added to the product in the future by means of a straightforward Windows reprogramming utility, without having to return the product to Equinox. All new programmers are shipped with the latest firmware from Equinox, but if your system has been purchased from a distributor and has been in stock for a long period of time, it may be that the firmware version is out-of-date.

How do I check what version of firmware my programmer is running?

i. Make sure the programmer is plugged into a spare COM port and is powered up

ii. Launch the GEMINI software -> The software should display "On Line"

iii. Select <Options><Programmer Info> -> The firmware revision and date of loading are displayed.

iv. Alternatively, select <Options><Create Library Info> and a text file is created containing all the programmer settings

How do I update the programmer firmware?

If the firmware version of your programmer is older than that on the Equinox Web Site, please download the new files from the 'Software Updates' page. It is important that you download both the latest 'gemini.exe' and 'configit.exe' programs. If you follow the instructions supplied with the 'configit.exe' program, the whole process should take less than 2 minutes.

What do I do if there any problems?

If the firmware update fails for any reason, please check the instructions supplied with 'configit.exe' in the first instance. If the problem persists or the program reports that a code is needed from Equinox, please e-mail or fax the full details below to Equinox, and we will attempt to get you up and running as quickly as we can.

Details required:

Name, Company name, telephone number, fax number, e-mail, place of purchase, programmer serial number (usually printed on a label on the programmer) and any update code you are prompted to send.

Please note: It is possible that the firmware upgrade process may fail and there might be a delay in receiving license codes back from Equinox. **PLEASE DO NOT** attempt to upgrade your firmware if your immediate design process depends on it!

GEMINI-1 Compatible Target Systems

The products listed below have been specially designed to interface with the GEMINI-1 programmer:

- **Microcontroller Personality Module**

  This dedicated Microcontroller Personality module supports most 40-pin Philips microcontrollers. The module features an ISP header which connects to the 'GEMINI-1' programmer. The pod can be plugged into either the 'Evaluation' module for running the simple examples or into a separate 'Prototyping' module where the developer may construct his/her own circuitry for a 'real' project.

  Order Code: EQ-PM4

Troubleshooting Guide

1 Installation problems

- Does your PC meet the minimum PC requirements of this product?
- Do you have a spare PC (serial) COM port?
- Have you connected the serial cable from the PC COM port to the GEMINI-1?
- Have you selected the correct COM port?
- Is the serial port already in use by another application?
- Are you using the correct serial cable as supplied with the programmer?

2 In-system programming (ISP)

- Does the target RESET circuit allow remote control of the RESET line from the Gemini-1?
- Is the target system powered up to the correct voltage (i.e. +5V)?
- Is the target oscillator running?

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