NEC

User's Manual

DemoKit-KA1

Demonstration Kit for
NEC Electronics Low-Pin-Count Devices

Document No. U17680EU1V0UM00

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M8E 02.10

DemoKit-KA1 complies with the EMC protection requirements.

WARNING

This is "Class A" (EN 55022:1998) equipment. This equipment can cause radio frequency noise when used in the residential area. In such cases, the user/operator of the equipment may be required to take appropriate countermeasures under his responsibility.
EEDT-ST-001-11

CAUTION

This equipment should be handled like a CMOS semiconductor device. The user must take all precautions to avoid build-up of static electricity while working with this equipment. All test and measurement tool including the workbench must be grounded. The user/operator must be grounded using the wrist strap. The connectors and/or device pins should not be touched with bare hands.
EEDT-ST-004-10

Revision History

Date	Revision	Section	Description
August 2005	—	—	Initial release

Contents

1. Introduction

DemoKit-KA1 is a demonstration kit for the NEC Electronics low-pin-count 78K0S/KA1+ microcontrollers (MCUs). Designed for connection to user hardware such as digital I/O or analog signals, the kit supports on-board flash programming and real-time execution of application programs up to 4 KB.

1.1 Features

- Easy-to-use capabilities to demonstrate simple device functions
  - Pushbuttons
  - LED outputs
  - A/D reference voltage
  - I/O lines
  - UART interface
- USB interface-supplied power; no separate power supply needed
- Windows-based PG-LPC flash programming software that allows you to select and download application programs for evaluation purposes
- Analog-to-digital (A/D) signal conversion
- Various I/O signals
  - All I/O ports to be connected to user hardware
  - Timer I/O signals
  - UART interface via USB UART chip FT232
  - Four analog input lines
  - Four I/O ports connected to LEDs
  - One pushbutton for external interrupt generation
- NEC Electronics C compiler and assembler (32 KB maximum program code size)
- Applilet reference device driver generator
- System Simulator Plus (SM+) software debugger
- Full documentation for the NEC Electronics 78K0S/KA1+ microcontroller and the NEC Electronics software tools and PG-LPC flash programming software

The DemoKit-KA1 is not intended for code development. NEC Electronics does not support attempts to use the kit in commercial or technical products.

1.2 System Requirements

- Windows® 98SE, Windows ME, Windows 2000 or Windows XP operating system
- 166 MHz (minimum) Pentium®-class processor
- 64 MB RAM
- 256-color display (1024 × 768)
- Mouse
- CD-ROM drive
- 40 MB of free hard disk space
- USB interface that enables communication based on USB version 1.1 or later

(Requirements are valid if the NEC Electronics software development tools and PG-LPC flash programming software are to be installed.)

1.3 Package Contents

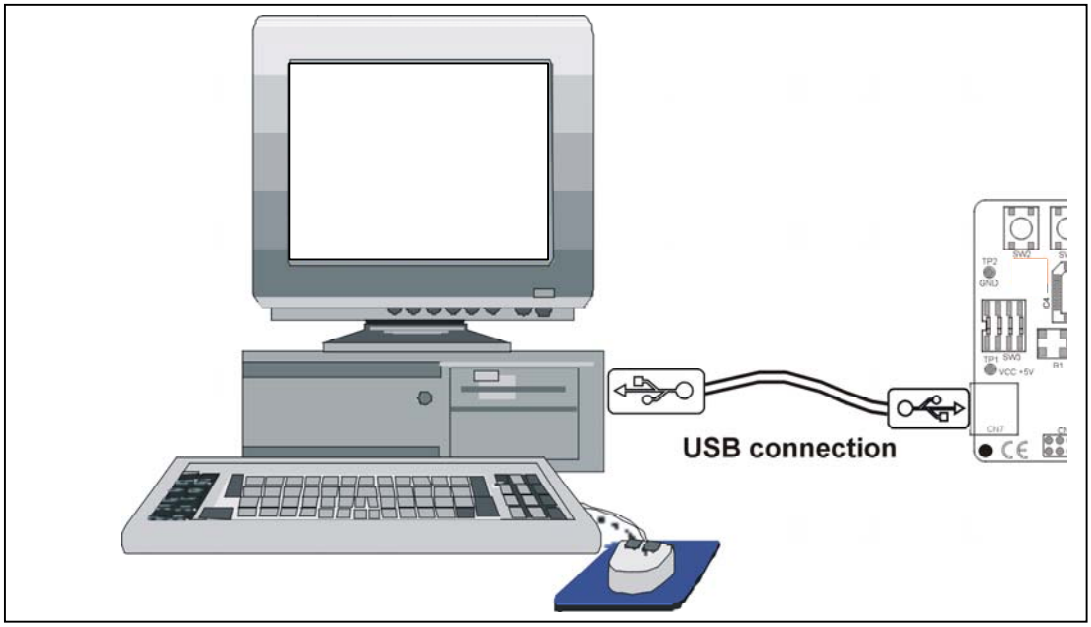
Please verify that you have received all parts listed in the contents list bundled with the DemoKit-KA1 package. If any part is missing or seems to be damaged, please contact your NEC Electronics sales representative.

Note: Updates to this manual, additional documentation and/or utilities available for the *DemoKit-KA1* may be downloaded from **http://www.necelam.com/microcontrollers/devtools.php.**

2. System Configuration

Figure 1 illustrates the system configuration.

Figure 1. System Configuration



2.1 DemoKit-KA1

DemoKit-KA1 is a demonstration kit for NEC Electronics' low-pin-count 78K0S microcontrollers. The µPD78F9222 is a typical device from this family and was used to realize the *DemoKit-KA1*, which connects to the host system via a USB interface cable. The host may be used for programming the MCU's flash memory and for executing application programs on the *DemoKit-KA1* platform. The *DemoKit-KA1* operates the µPD78F9222 microcontroller at a speed of 8 MHz.

2.2 Host Computer

The USB host interface enables communication with the board. The FT232 USB UART chip allows application software to access the USB device in the same way it would a standard RS-232 interface. To the Windows operating system, the FTDI's virtual COM port (VCP) driver appears as an extra communications port, in addition to any existing hardware communications ports. For detailed specifications for the host interface, refer to section 10, "Connectors and Cables."

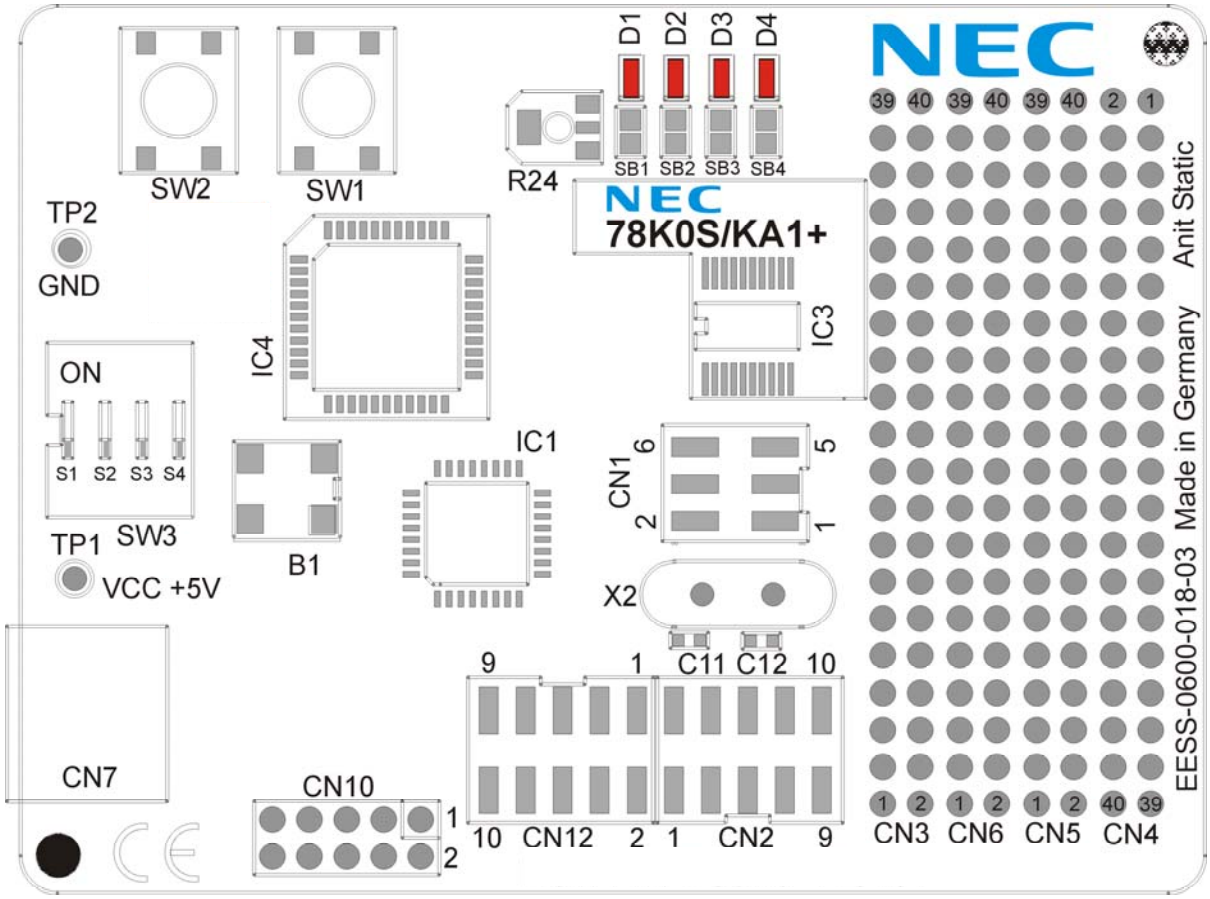
2.3 Power Supply

The USB interface supplies 5V of power to the *DemoKit-KA1*; no separate power supply is needed.

3. Board Components

The *DemoKit-KA1* board is equipped with pushbuttons, LEDs and several connectors to the host computer and target hardware. Additionally, the board provides a wire-wrap field (2.54 mm grid) that can be used to integrate user application hardware.

Figure 2. Board Connectors, Switches and LEDs



The µPD78F9222's on-chip resources are free for user application hardware and software. Before connecting any external signals to the board, please refer to the MCU user's manual for the electrical specifications of the available I/O ports.

3.1 SW3 Configuration Switch

The board's various operating modes can be set using SW3 switches S1–S4.

SW3	Factory Settings	Function
S1	OFF	Normal operation
S2	OFF	No UART
S3	OFF	CPU clock = 8 MHz
S4	OFF	No handshake for UART

3.1.1 Operating Mode Selection: SW3/S1

SW3 switch S1 controls the board's operating mode. Setting SW3/S1 to ON allows reprogramming of the MCU's internal flash memory using the PG-LPC flash programming software.

SW3, S1	Operating Mode
OFF (default)	Normal operation; user program stored in the device's flash memory is executed
ON	Flash memory programming mode

3.1.2 UART Selection: SW3/S2

SW3 switch S2 controls the board's serial communication. Setting SW3/S2 to ON connects the RxD6 and TxD6 UART6 signals to the FT232 interface lines.

SW3, S2	Operation
OFF (default)	RxD6 / TxD6 disconnected
ON	RxD6 / TxD6 connected to FT232 interface lines

3.1.3 SW3/S3: Clock Mode Selection

SW3 switch S3 controls the clock operation frequency of the *DemoKit-KA1* board.

SW3/S3	Clock Frequency
OFF (default)	8 MHz
ON	4 MHz

3.1.4 SW3/S4: UART Mode Selection

SW3/S4 controls the board's UART communication mode. Setting SW3/S4 to ON enables UART communication with handshake. In this mode, CPU pins P40 and P41 are connected to the FT232 interface lines and used as RTS and CTS control signals.

SW3, S4	Description
OFF (default)	UART communication without handshake
ON	UART communication with handshake (P40=RTS; P41=CTS)

3.2 SW1: User Button

SW1 is a pushbutton that connects V_{SS} to the CPU's INTP0 external interrupt input, which is equal to port P30 of the MCU. The port may be programmed to generate INTP0, as described in the user's manual for the 78K0S/KA1+device. Pressing this button applies a low signal level at port P30.

3.3 SW2: Start Button

The SW2 reset button activates the power-on reset and is connected to the reset input of the CPU. Pressing this button applies a low signal level to the RESET pin.

3.4 CN7: USB Interface Connector

The CN7 connector allows connecting the PG-LPC flash programming software to the *DemoKit-KA1* board to program application programs in the CPU's internal flash memory. Connection CN7 provides the board power supply of 5V, and also UART6 of the 78K0S/KA1+ device to the host system.

3.5 Connector CN1 / Clock Configuration

Connector CN1 is used to define the operating clock of the *DemoKit-KA1* board. Closing the connectors CN1/3–5 and CN1/4–6 (default setting) provides an 8 MHz clock frequency to the MCU. In this mode, the clock frequency is supplied by the CPLD.

Alternatively, an external crystal oscillator can be equipped to the *DemoKit-KA1* board. To use this mode, close connectors CN1/1–3 and CN1/2–4.

CN1	Jumper Setting	Mode
1–2	Open (default)	Clock frequency = 8 MHz, supplied by CPLD
3–5	Closed (default)	
4–6	Closed (default)	
1-3	Closed	Clock supply by external oscillator. When using this mode, be sure to equip a crystal oscillator and corresponding capacitors to X1, C12 and C11.
2–4	Closed	
5–6	Open	

3.6 CN2 and CN12: External Peripheral Configuration

Connectors CN2 and CN12 allow you to connect and disconnect external board hardware to the MCU.

CN2	Jumper Setting	Mode
1–2	Closed (default)	RESET pin connected to CPLD
3–4	Closed (default)	RESET pin connected to button SW2
5–6	Closed (default)	INTP0 pin connected to button SW1
7–8	Closed (default)	P40 connected to CPLD (RTS line of FT232)
9–10	Closed (default)	P41 connected to CPLD (CTS line of FT232)
CN12	**Jumper Setting**	**Mode**
1–2	Closed (default)	Power supply, V_{CC} = 5V connected to MCU and external potentiometer R24
3–4	Closed (default)	AV_{REF} pin connected to V_{CC}
5–6	Closed (default)	ANI0 pin connected to R24 potentiometer arm
7–8	Closed (default)	P44/RxD6 connected to CPLD (RxD line of FT232)
9–10	Closed (default)	P43/TxD6 connected to CPLD (TxD line of FT232)

3.7 External Potentiometer R24

A 10K potentiometer R24 is connected between V_{CC} and ground. Closing connector CN12/1–2 supplies V_{CC} to R24. The potentiometer arm can be connected to the MCU's ANI0 analog input by closing connector CN12/5–6.

3.8 A/D Converter Reference Voltage Input

The reference voltage of the potentiometer R24 can be supplied to the AV_{REF} input by closing connector CN12/3–4.

3.9 External LEDs D1–D4

The D1–D4 LEDs are connected to the 78K0S/KA1+ device and are free for user application purposes. The LEDs are connected via a 4.7K pull-up resistor to V_{CC} and is therefore active low.

Port	LED
P23	D1
P130	D2
P45	D3
P123	D4

To disconnect an LED from a port for alternative usage, cut the connection (default) of the corresponding soldering bridge SB1–SB4.

3.10 External connectors CN3, CN4, CN5, and CN6

CN3, CN4, CN5, and CN6 are connectors for external user hardware. All CPU signals are connected to CN3, with the exception of X1 and X2 signals. The *DemoKit-KA1* board provides a wire wrap field—connectors CN4, CN5 and CN6—allowing the integration of additional application hardware.

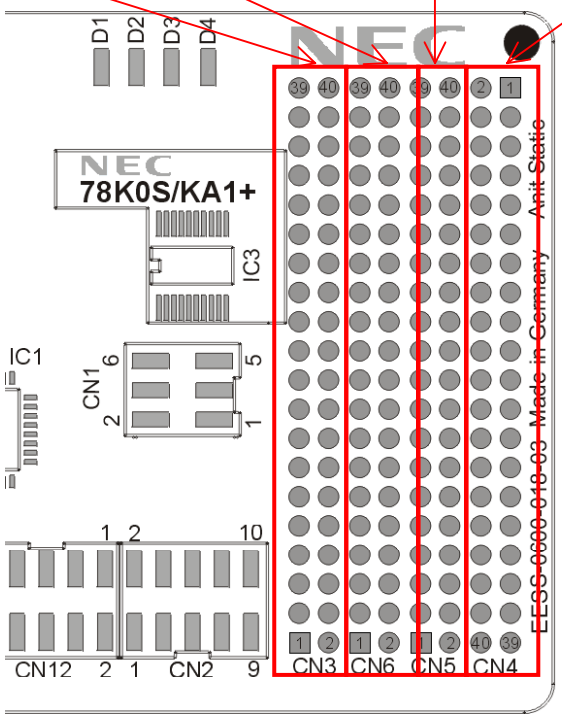
CN3		CN3	
39	V_{CC}	40	AV_{REF}
37	V_{CC}	38	P20
35	V_{CC}	36	P21
33	V_{CC}	34	P22
31	V_{CC}	32	P23
29	V_{CC}	30	P130
27	V_{CC}	28	P45
25	V_{CC}	26	P44
23	V_{CC}	24	P43
21	V_{CC}	22	P42
19	V_{CC}	20	P41
17	V_{CC}	18	P40
15	V_{CC}	16	P30
13	V_{CC}	14	P31
11	V_{CC}	12	RESET
9	V_{CC}	10	V_{DD}
7	V_{CC}	8	P123
5	V_{CC}	6	N.C.
3	V_{CC}	4	N.C.
1	V_{CC}	2	V_{SS}

CN6		CN6	
39	N.C.	40	N.C.
37	N.C.	38	N.C.
35	N.C.	36	N.C.
33	N.C.	34	N.C.
31	N.C.	32	N.C.
29	N.C.	30	N.C.
27	N.C.	28	N.C.
25	N.C.	26	N.C.
23	N.C.	24	N.C.
21	N.C.	22	N.C.
19	N.C.	20	N.C.
17	N.C.	18	N.C.
15	N.C.	16	N.C.
13	N.C.	14	N.C.
11	N.C.	12	N.C.
9	N.C.	10	N.C.
7	N.C.	8	N.C.
5	N.C.	6	N.C.
3	N.C.	4	N.C.
1	N.C.	2	N.C.

CN5		CN5	
39	N.C.	40	N.C.
37	N.C.	38	N.C.
35	N.C.	36	N.C.
33	N.C.	34	N.C.
31	N.C.	32	N.C.
29	N.C.	30	N.C.
27	N.C.	28	N.C.
25	N.C.	26	N.C.
23	N.C.	24	N.C.
21	N.C.	22	N.C.
19	N.C.	20	N.C.
17	N.C.	18	N.C.
15	N.C.	16	N.C.
13	N.C.	14	N.C.
11	N.C.	12	N.C.
9	N.C.	10	N.C.
7	N.C.	8	N.C.
5	N.C.	6	N.C.
3	N.C.	4	N.C.
1	N.C.	2	N.C.

CN4		CN4	
2	N.C.	1	GND
4	N.C.	3	GND
6	N.C.	5	GND
8	N.C.	7	GND
10	N.C.	9	GND
12	N.C.	11	GND
14	N.C.	13	GND
16	N.C.	15	GND
18	N.C.	17	GND
20	N.C.	19	GND
22	N.C.	21	GND
24	N.C.	23	GND
26	N.C.	25	GND
28	N.C.	27	GND
30	N.C.	29	GND
32	N.C.	31	GND
34	N.C.	33	GND
36	N.C.	35	GND
38	N.C.	37	GND
40	N.C.	39	GND

(N.C. = not connected)



4. Memory Map

The memory layout of the μPD78F9222's 4 KB flash ROM is shown in Table 1.

Table 1. Memory Map of μPD78F9222's 4 KB Flash ROM

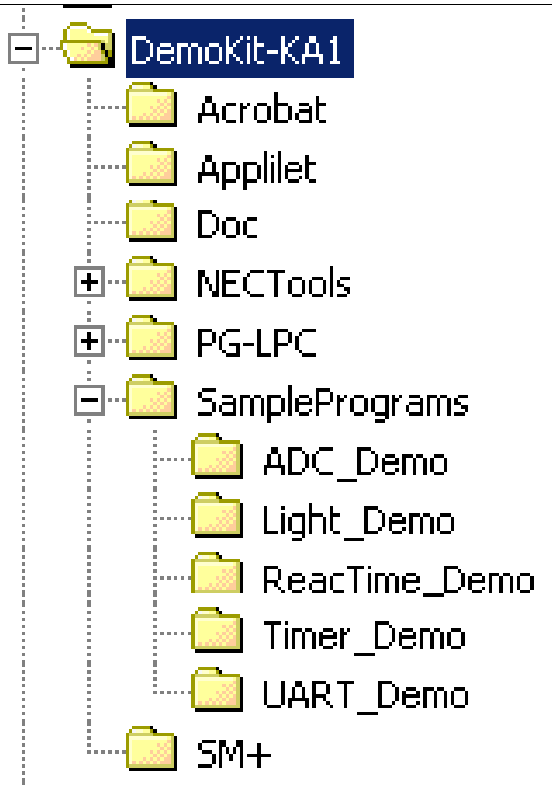
Address Area	0xFFFF 0xFF00	SFR area 256 × 8 bits	Free for application software
	0xFEFF 0xFE00	Internal high-speed RAM 256 × 8 bits	
	0xFDFF 0x1000	Use prohibited	
	0x0FFF 0x0000	Flash memory 4096 × 8 bits	Free for application software

The *DemoKit-KA1* board does not reserve any of the MCU's resources; consequently all available device memory is free for application software.

5. Getting Started

The Windows-based PG-LPC flash programming software allows you to select and download application programs to the *DemoKit-KA1* board. Communication between the host system and board is via a USB interface. Before you can download and run a program, the hardware and software must be installed properly.

Figure 3. CD-ROM Contents



- Acrobat Reader for 32-Bit Windows operating system
- Applilet reference device driver generator
- Documentation
- NEC Electronics tools: compiler and assembler (evaluation)
- PG-LPC flash programming software, including USB drivers
- Sample programs for *DemoKit-KA1*
… AD converter demonstration
… Light show
… Reaction time measurement
… Timer demonstration
… UART demonstration
- System Simulator SM+

5.1 Hardware Installation

After unpacking the *DemoKit-KA1*, connect the board to the host using the provided USB interface cable. Afterward, install the USB driver as directed in section 5.2, “Software Installation.”

5.2 Software installation

The *DemoKit-KA1* package comes with the several demonstration software packages:

- Applilet and System Simulator (SM+)
- NEC Electronics software development tools, including a C compiler, assembler, linker, and project manager
- PG-LPC flash programming GUI
- Sample programs

The NEC Electronics software development tools and PG-LPC flash programming GUI must be installed on your computer. For detailed information about installation, refer to the following chapters and documentation corresponding to the software tools.

5.2.1 SM+ (Product ID: 00001664C)

- Windows XP users
  - Please refer to the v1.01 Operating Precautions document for restrictions.
  - In Windows XP SP2, when you activate the SIMULATION FUNCTION, the SM+'s **Help→ Current Window** dialog doesn't work normally. From the **Start** menu, you must select **Program → NEC Tools32 → SM+ for 78K0S_Kx1+ Help → CHAPTER 6 SIMULATION FUNCTION**.
- The sample programs can be downloaded to the *DemoKit-KA1* board directly from the CD-ROM. If you intend to modify or debug (simulate) the sample programs, then you need to copy the complete `\SamplePrograms` folder to your hard disk.
- Note: Before modification or rebuilding of sample programs, do not forget to remove the "read-only" attribute of the copied files.

5.2.2 NEC Electronics Software Development Tools

To install the NEC Electronics software development tools, select the `SETUP` program in the `\NECTools\` directory of the CD-ROM and follow the setup dialogs through the process.

5.2.3 PG-LPC Flash Programming GUI

To install the PG-LPC flash programming GUI, select the `SETUP` program in the directory `\PG-LPC\` of the CD-ROM. The setup dialogs will guide you through the installation process.

5.2.4 Sample Programs

The sample programs do not require any installation for downloading to the *DemoKit-KA1* board. If the sample programs must be modified, copy them using Windows Explorer into a directory on your local hard disk.

Note: Before modifying or rebuilding the sample programs, don't forget to remove the "read-only" attribute of the copied files.

5.2.5 Driver

To use the board, you must install one of the drivers in the “C:\Program Files\NECTools32\PG-LPC\DRIVERS” folder:

- For Windows 98SE/Me systems, follow the procedure explained in section 5.2.5.1.
- For Windows 2000 systems, follow the procedure explained in section 5.2.5.2.
- For Windows XP systems, follow the procedure explained in section 5.2.5.3.

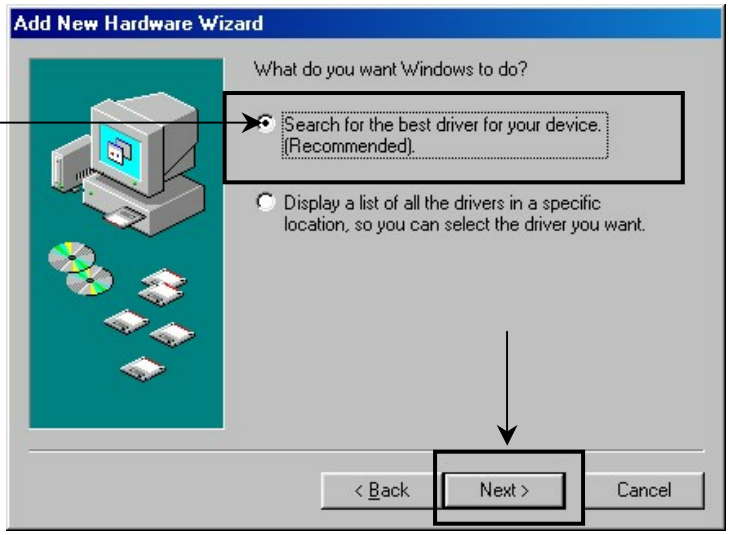
5.2.5.1 Windows 98SE/ME Systems

1. Once the DemoKit-KA1 board and host connect, the Plug and Play feature initializes the wizard for adding new hardware. Click **Next**.

Figure 4. Add New Hardware Wizard (Windows 98SE)

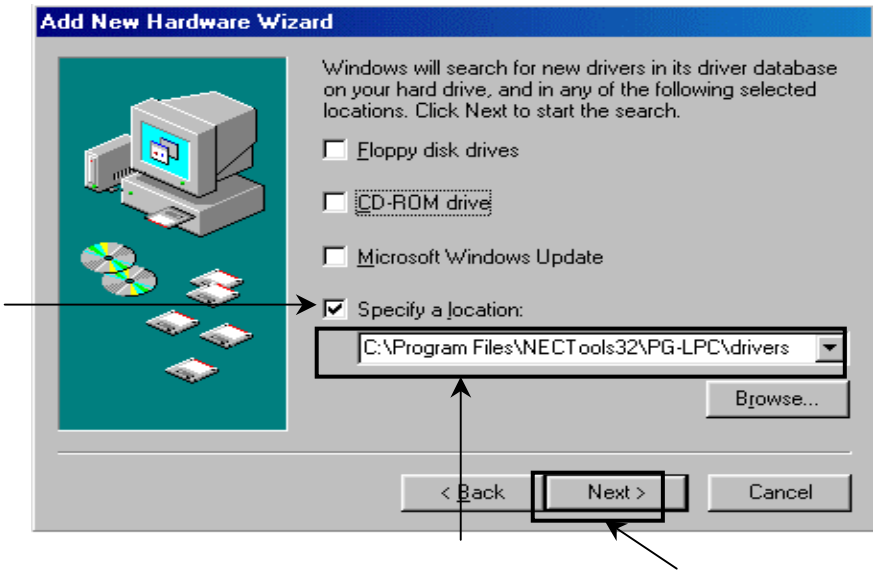
2. In the Search Method box, check "Search for a suitable driver ..." and then click **Next**.

Figure 5. Search Method (Windows 98SE)



3. Check the "Specify a location" box, select "C:\Program Files\NECTools32\PG-LPC\DRIVERS" and then click **Next**.

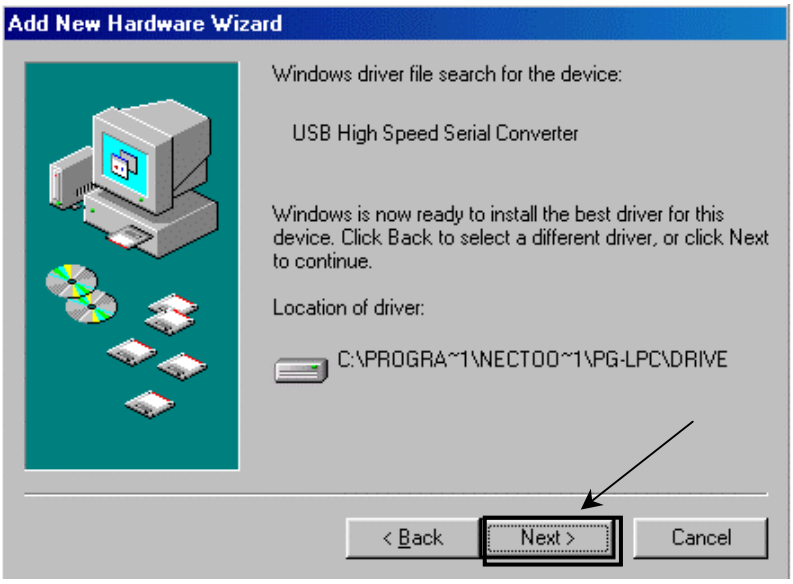
Figure 6. Search Location Specification (Windows 98SE)



Note: If the destination folder changed at the time of PG-LPC installation, enter "new-folder\PG-LPC\DRIVERS".

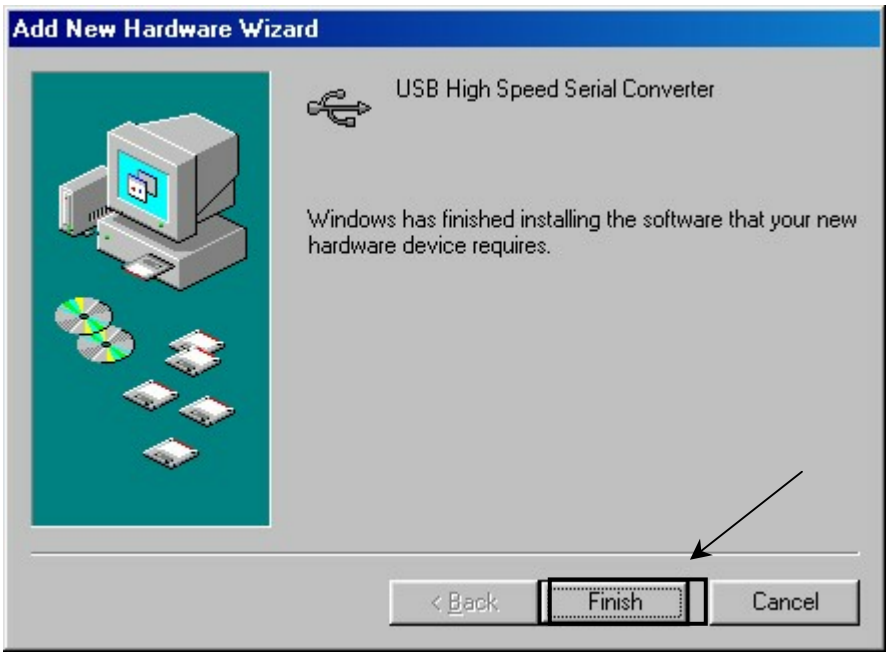
4. When you see this window, click **Next**.

Figure 7. Checking Driver to Be Installed (Windows 98SE)



5. After installation of the software, click **Finish** to install the USB serial port driver.

Figure 8. Installation Completion (Windows 98SE)



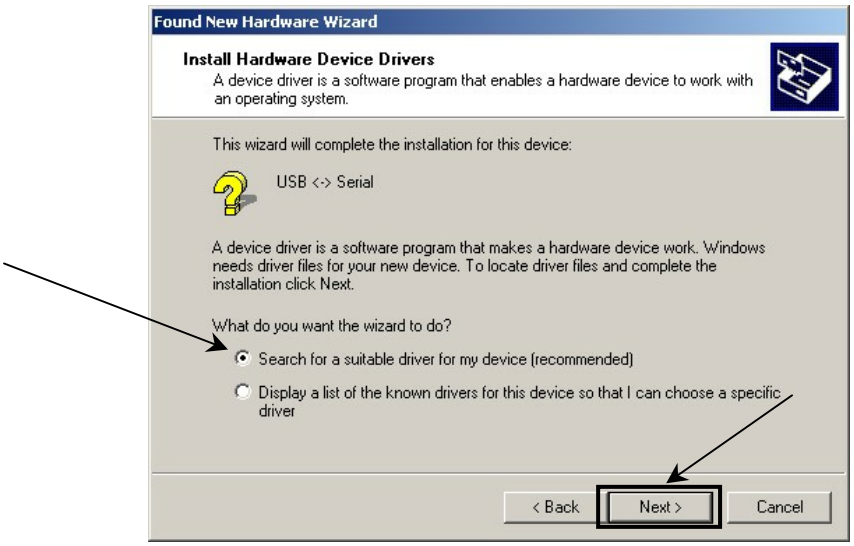
5.2.5.2 Windows 2000 Systems

1. When the *DemoKit-KA1* board and host computer connect, the Plug and Play function initializes the wizard for finding new hardware. Click **Next**.

Figure 9. Found New Hardware Wizard 1 (Windows 2000)

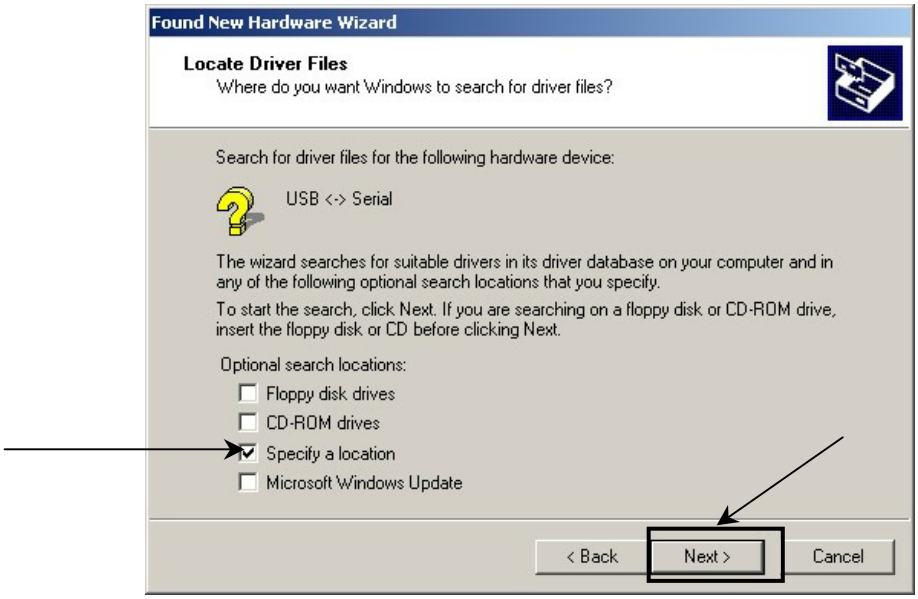
2. In the first box, check "Search for a suitable driver ..." and then click **Next**.

Figure 10. Search Method 1 (Windows 2000)



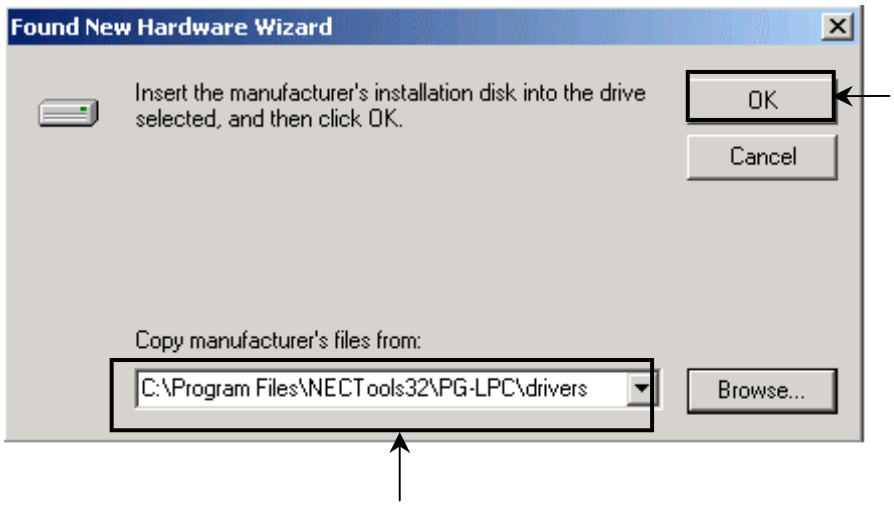
3. Check the "Specify a location" *only* and then click **Next**.

Figure 11. Driver File Location 1 (Windows 2000)



4. Select "C:\Program Files\NECTools32\PG-LPC\DRIVERS" and then click **OK**.

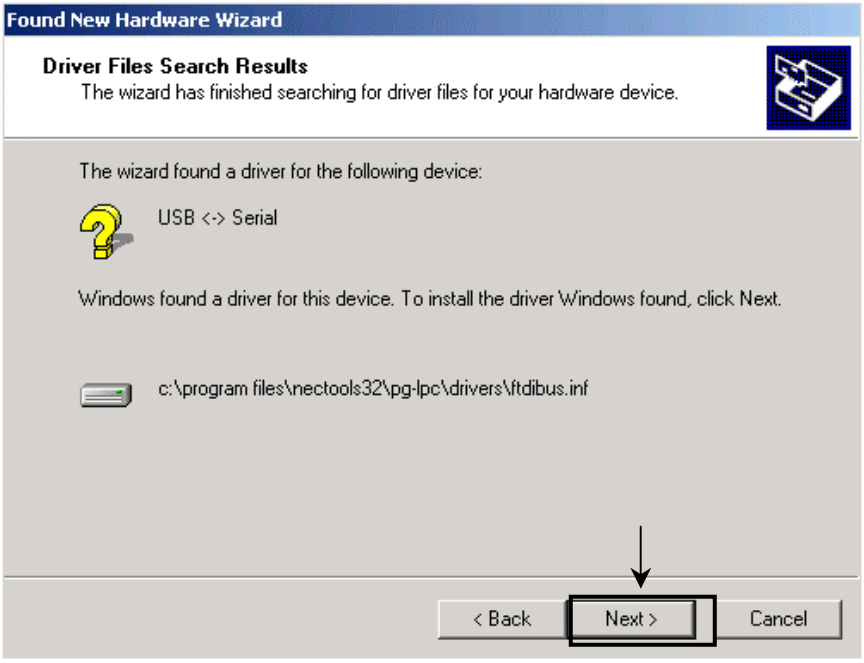
Figure 12. Address Specification 1 (Windows 2000)



Note: If the installation destination folder changed at the time of PG-LPC installation, enter *new-folder-name*\PG-LPC\DRIVERS.

5. Click **Next**.

Figure 13. Driver File Search 1 (Windows 2000)



6. Click **Finish** to complete the installation.

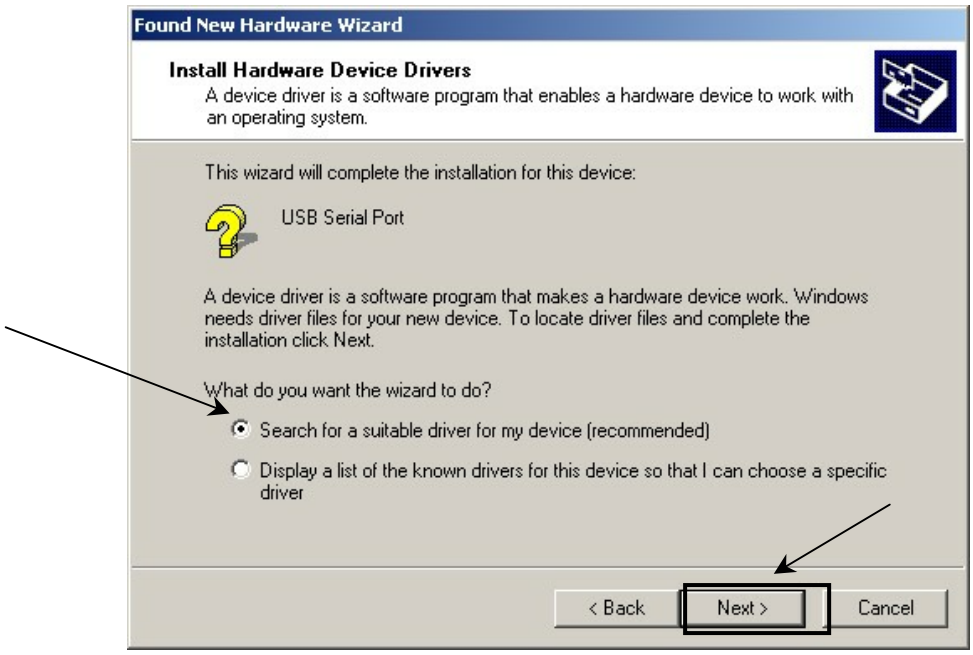
Figure 14. USB Driver Installation Completion 1 (Windows 2000)

7. Click **Next** to install the USB serial port driver.

Figure 15. Found New Hardware Wizard 2 (Windows 2000)

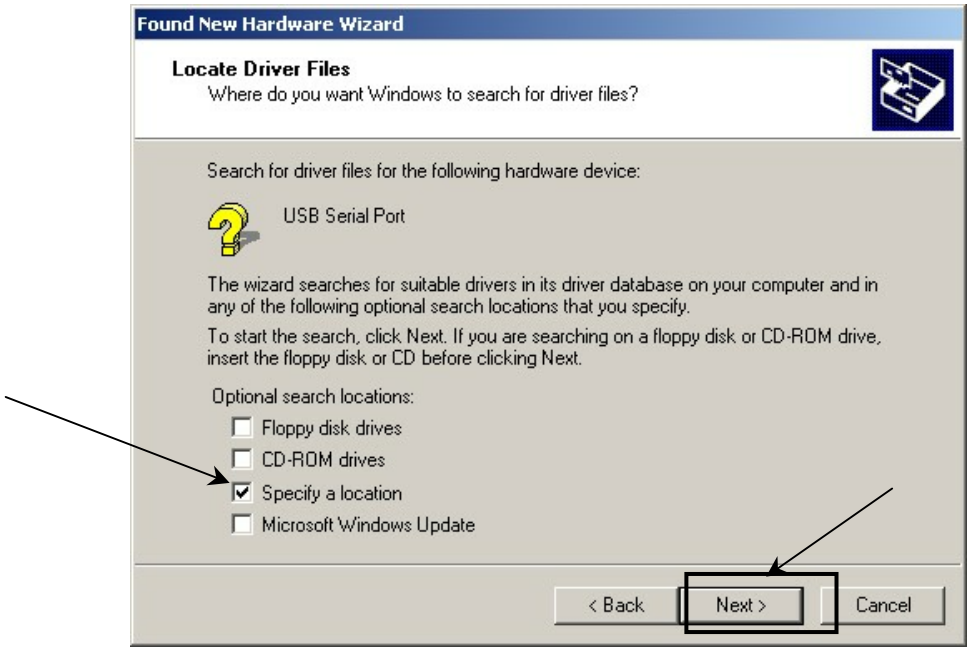
8. Check "Search for a suitable driver ..." and then click **Next**.

Figure 16. Search Method 2 (Windows 2000)



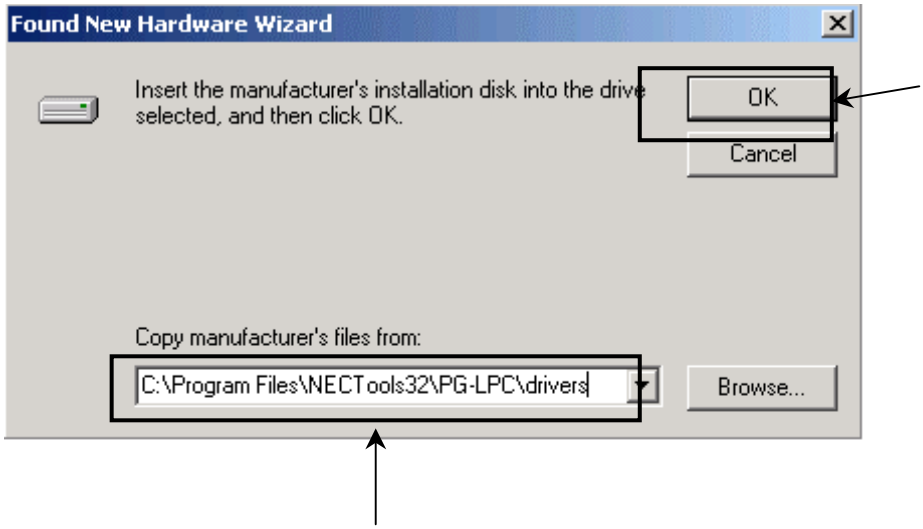
9. Check the "Specify a location" box only and then click **Next**.

Figure 17. Driver File Location 2 (Windows 2000)



10. Select **C:\Program Files\NECTools32\PG-LPC\DRIVERS** and then click **OK**.

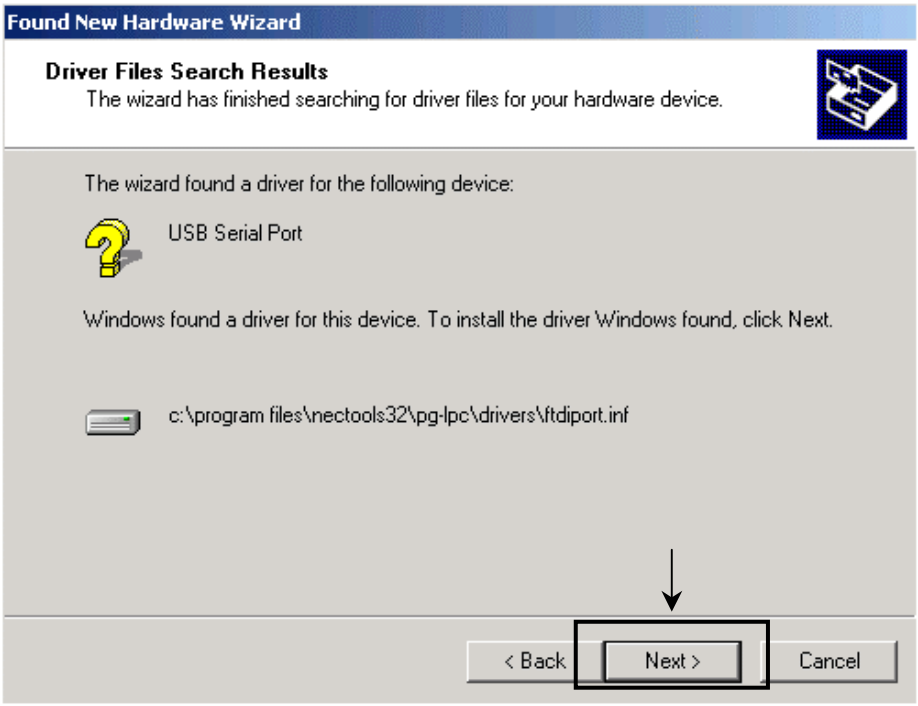
Figure 18. Address Specification 2 (Windows 2000)



Note: If the destination folder changed at the time of PG-LPC GUI software installation, enter *new-folder-name*\PG-LPC\DRIVERS.

11. Click **Next**.

Figure 19. Driver File Search 2 (Windows 2000)



12. Click **Finish** to complete the installation.

Figure 20. USB Driver Installation Completion 2 (Windows 2000)

5.2.5.3 Windows XP Systems

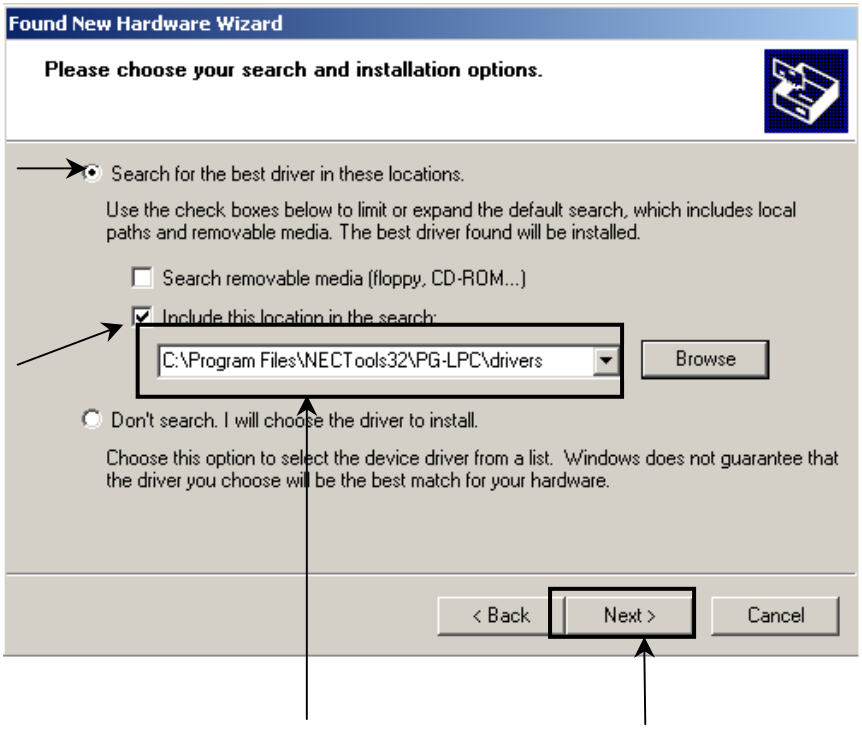
13. When the *DemoKit-KA1* board and host machine connect, the Plug and Play function initializes the wizard for finding new hardware. Check **Install from a list or specific ...** and then click **Next**.

Figure 21. Found New Hardware Wizard 1 (Windows XP)

14. Check **Search for the best driver in these locations** and **Include this location in the search**.

15. Select **C:\Program Files\NECTools32\PG-LPC\DRIVERS** and then click **Next**.

Figure 22. Search Location Specification 3 (Windows XP)



16. When you see the **has not passed Windows Logo testing to verify its compatibility with Windows XP** message, click **Continue Anyway**.

Figure 23. Windows XP Logo Testing 3 (Windows XP)

17. When you see this box, click **Finish**.

Figure 24. USB Driver Installation Completion 1 (Windows XP)

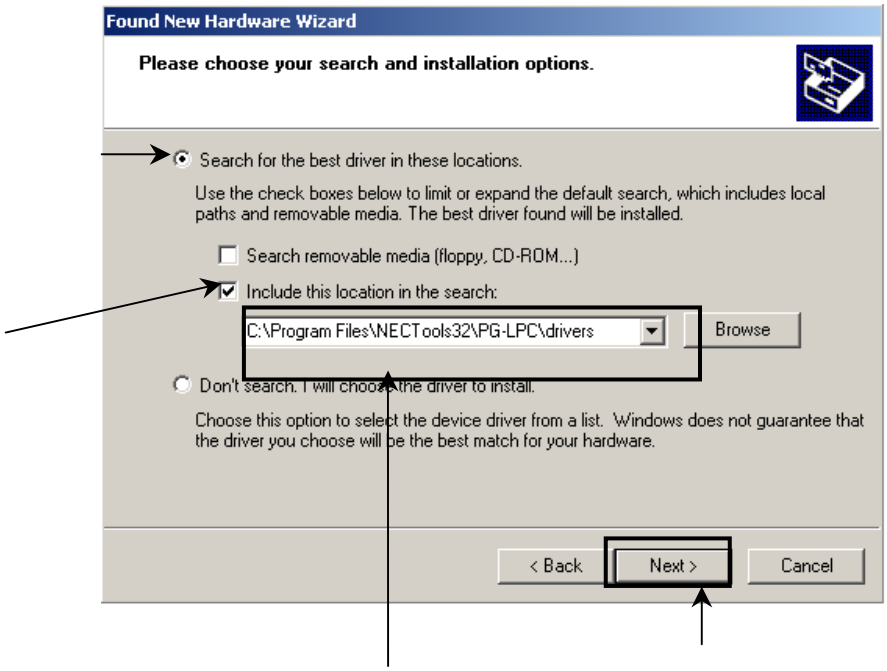
18. Click **Next** to install the driver.

Figure 25. Found New Hardware Wizard 2 (Windows XP)

19. Check **Search for the best driver in these locations** and **Include this location in the search**.

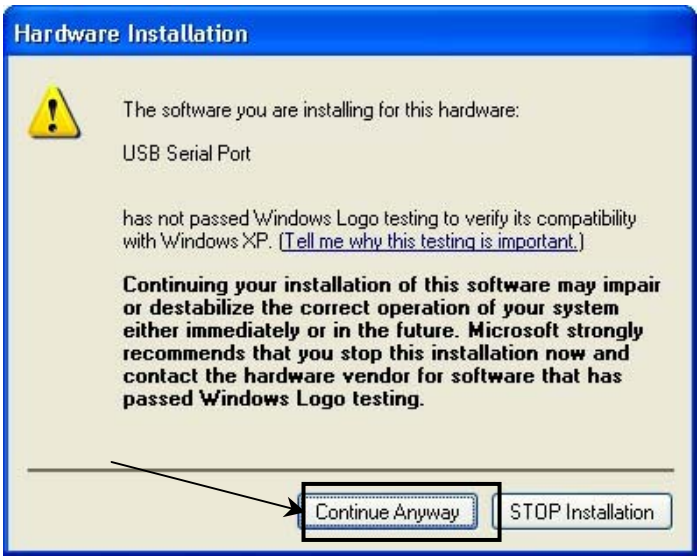
20. Select **C:\Program Files\NECTools32\PG-LPC\DRIVERS** and then click **Next**.

Figure 26. Search Location Specification 2 (Windows XP)



21. When you see the "has not passed Windows Logo testing to verify its compatibility with Windows XP" message, click **Continue Anyway**.

Figure 27. Windows XP Logo Testing 2 (Windows XP)



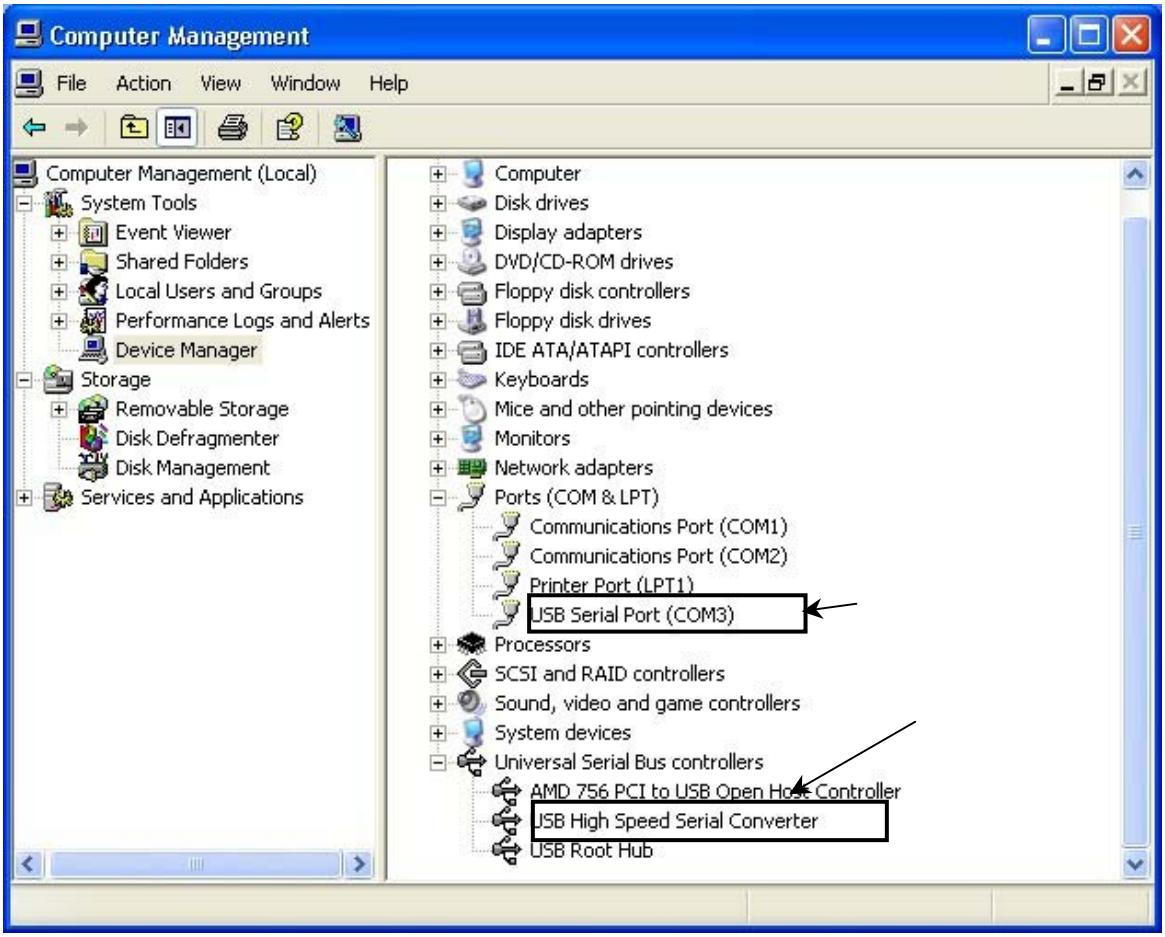
22. When you see this dialog box, click **Finish**.

Figure 28. USB Serial Port2 Driver Installation Completion (Windows XP)

5.3 Confirmation of USB Driver Installation

After installing the two types of USB drivers, check that the drivers have been installed correctly, according to the procedure below. When using the *DemoKit-KA1* board, the information to be checked here is needed. Click the **Device Manager** tab and then check that the drivers are installed correctly.

Figure 29. Device Manager



5.3.1 Windows 98SE/ME Systems

Do not select **Update** and **Erase** when communicating with the *DemoKit-KA1* board.

5.3.2 Windows 2000/XP Systems

Do not perform a hardware modification scan when communicating with the *DemoKit-KA1* board. Note: In the GUI port list box, the same communication port as COM? of the USB serial port (COM?) needs to be selected. If the drivers above are not displayed, or the mark "×" or "!" is prefixed, refer to the section on “Troubleshooting.”

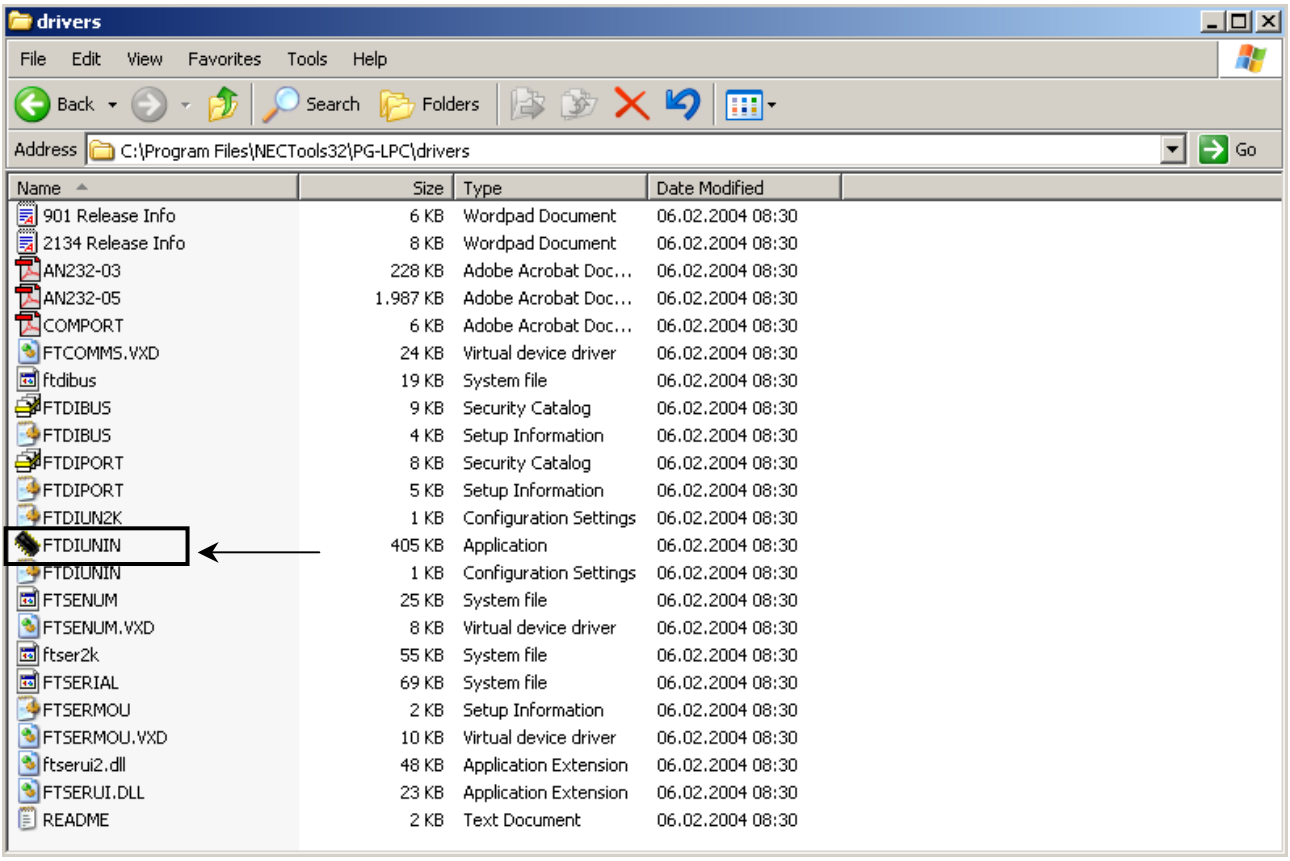
5.4 Driver Uninstallation

The driver uninstallation program is installed on the host machine when the PG-LPC software is installed. Use the procedure below to uninstall the driver.

1. When using Windows 2000 or Windows XP, log on as the computer administrator.

2. Double-click **My Computer** → (C:) **Program Files** → **NECTools32** → **PG-LPC** → **DRIVERS** → **FTDIUNIN.exe**.

Figure 30. Driver Uninstallation

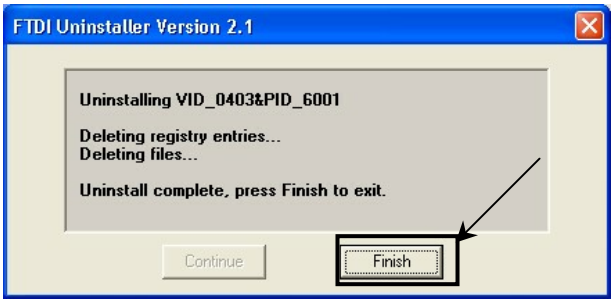


3. Click **Continue**.

Figure 31. Driver Uninstaller

4. Click **Finish** to complete driver uninstallation.

Figure 32. Completion of Driver Uninstallation



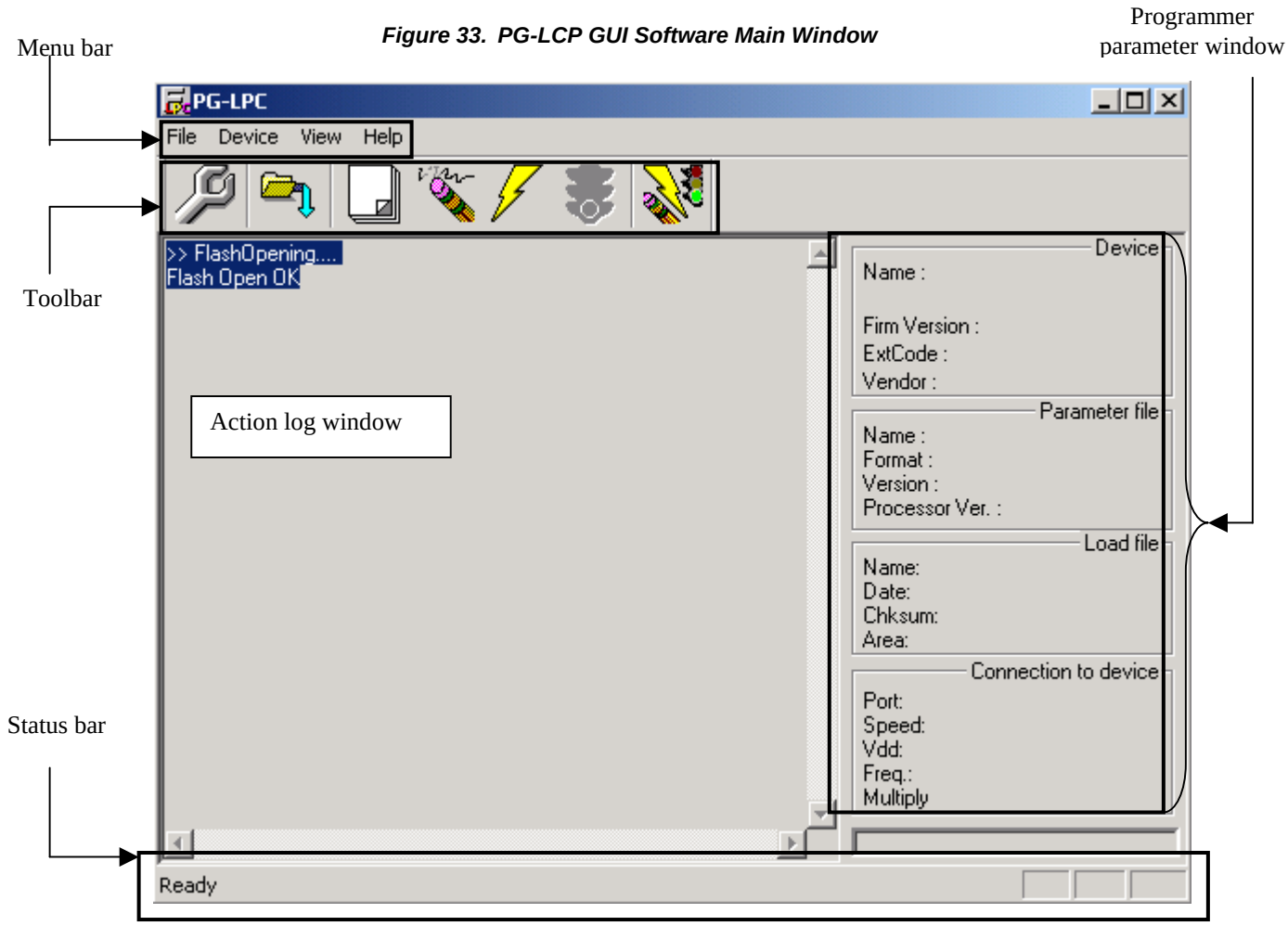
Caution: If the PG-LPC software was uninstalled earlier, the Ftdiunin.exe was also deleted. In this case, manually delete "USB Serial Port (COM?)" and "USB High Speed Serial Converter" from the device manager.

6. PG-LPC Flash Programming Software

6.1 Starting the Software GUI

Select PG-LPC.EXE from the **Start** menu and wait for the main window to appear.

Figure 33. PG-LCP GUI Software Main Window



This window consists of the following:

Name	Display Information
Menu bar (displayed at the top)	Displays menu items executable by the PG-LPC.
Toolbar (displayed under the menu bar)	Displays frequently used commands as icons.
Action log window (displayed under the toolbar)	Displays a PG-LPC action log
Programmer parameter window (displayed to the right of the action log window)	Displays programming parameter settings.
Status bar	Displays status.

6.2 Toolbar

The toolbar contains buttons for executing PG-LPC commands.

	[Device] → [Setup] button
	[File] → [Load] button
	[Device] → [Blank Check] button
	[Device] → [Erase] button
	[Device] → [Program] button
	[Device] → [Autoprocedure (EPV)] button

6.3 Menu Bar

The menu bar contains a number of command menus. Depending on the device type and its actual status, some commands may be disabled.

6.3.1 File Menu

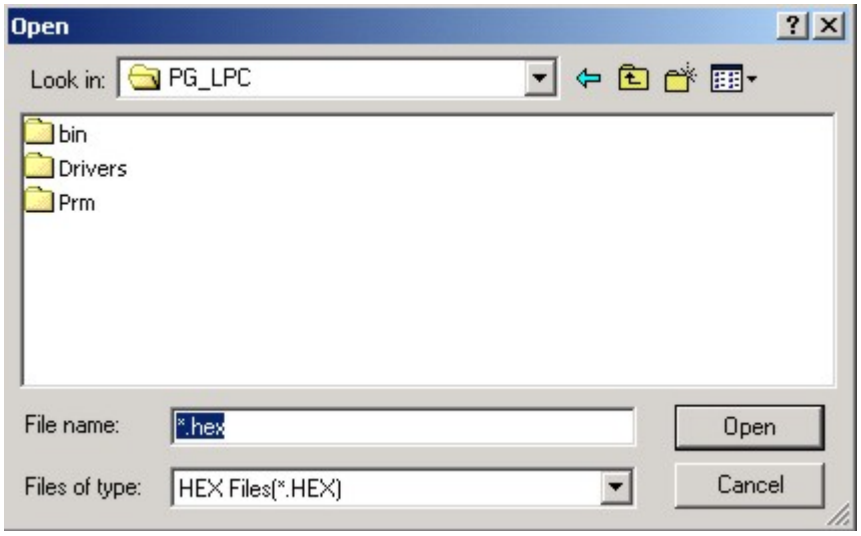
Clicking the **File** menu displays the **Load** and **Quit** commands.

Figure 34. File Menu

6.3.1.1 Load Command

The **Load** command allows you to select a program file. The selected program file is programmed into the flash memory of the device by executing the **Program** command or **Autoprocedure(EPV)** command.

Figure 35. Open Dialog Box



The file selection window for program loading displays the most recently used directory to which a user program has been loaded. After a user program is loaded, a checksum calculation is made and the result is displayed in the programmer parameter window.

- Clicking the **Open** button selects a user program to be written to the target device.
- Clicking the **Cancel** button closes the window without selecting a program.

6.3.1.2 Quit Command

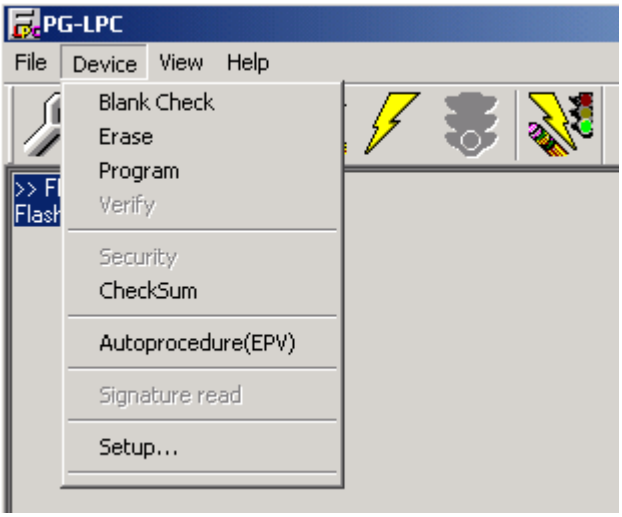
The **Quit** command terminates the PG-LPC GUI software. Clicking × on the right task bar also terminates the PG-LPC GUI software.

User settings are saved in the PG-LPC.INI file, so that the GUI software starts up next time with the same settings. PG-LPC.INI is created in the Windows folder when Windows 98SE, Windows ME, or Windows XP is used. When Windows 2000 is used, PG-LPC.INI is created in the WinNT folder.

6.3.2 Device Menu

Clicking the **Device** menu displays the commands such as **Blank Check**, **Erase** and **Program** for programming operations.

Figure 36. Device Menu



6.3.2.1 Blank Check Command

The **Blank Check** command allows you to make a blank check on the 78K0S/KA1+ target machine connected to the PG-LPC. If the flash memory of the device is erased, a blank check is terminated normally. If the flash memory is not completely erased, the indication "not blank" is provided. Before starting programming, erase the flash memory of the target device.

6.3.2.2 Erase Command

The **Erase** command erases the flash memory of the 78K0S/KA1+ device connected to the PG-LPC. While the flash memory is being erased, the progress status is displayed in the action log window to indicate programmer operation.

Execution of the **Blank Check** command before the **Erase** command is executed follows the setting of 'Command options' of the Advance tab displayed by selecting **Device** → **Setup**. Upon completion of **Erase** command execution, the GUI software displays the result of executing the command on the target device.

6.3.2.3 Program Command

The **Program** command sends a specified user program to the target device and writes the program to the flash memory. The execution of Verify operation for detecting an error in user program communication from the PG-LPC to the target device after the execution of the **Program** command follows the setting of the 'Command options' on the Advance tab displayed by selecting **Device** → **Setup**.

During programming, the progress status is displayed in the action log window to indicate programmer operation. This progress status display window displays the progress status on target device programming by percentage. Upon completion of **Program** command execution, the GUI software displays the result of executing the command on the target device.

6.3.2.4 Verify Command

This command is not supported.

6.3.2.5 Security Command

This command is not supported.

6.3.2.6 Checksum Command

The **Checksum** command reads the checksum value of the 78K0S/KA1+ device connected with the PG-LPC. This value differs from the value displayed in the parameter window of the main window.

6.3.2.7 Autoprocedure (EPV) Command

The **Autoprocedure(EPV)** command executes the **Erase** and **Program** commands in succession. Upon completion of **Autoprocedure(EPV)** command execution, the GUI software displays the result of executing the command on the target device.

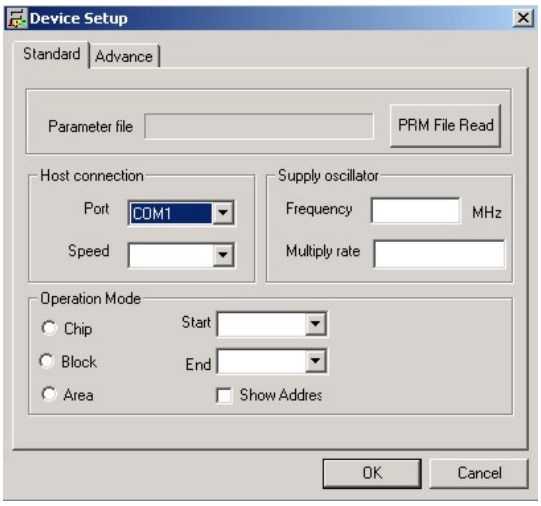
6.3.2.8 Signature Read Command

This command is not supported.

6.3.2.9 Setup Command

The **Setup** command allows you to make settings related to flash memory rewriting according to the user environment and to set command options. Each time the GUI software is started, the most recently used parameter file (.PRM) is read and the settings are displayed. The **Device Setup** dialog box allows you to modify the settings of items other than those consisting of shadowed characters according to the user environment. The **Standard** tab is used to set the environment for rewriting the flash memory of the target device. The mode of communication with the target, the operating clock, and so forth differ depending on the device used.

Figure 37. Device Setup Window: Standard



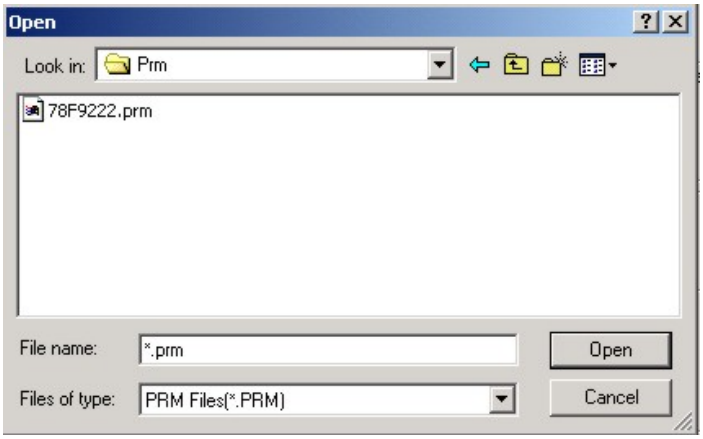
- Clicking **OK** saves the settings selected on the Standard and Advance tabs and closes the dialog box.

- Clicking **Cancel** closes the dialog box without saving the settings selected on the Standard and Advance tabs.

- **Parameter file** holds parameters and timing data required to rewrite the target device's flash memory. Do not modify the data in the parameter file because the data is related to the guarantee of rewrite data. The parameter file is protected by the checksum function. If the checksum result indicates an error, PG-LPC does not accept the parameter file.

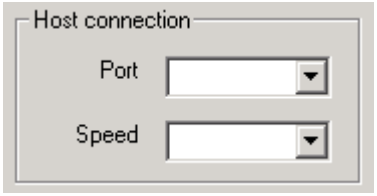
Figure 38. Device Setup: Parameter File Selection

Figure 39. Open Dialog Box



- The **Look in:** list displays a list of available .prm files. Select the one you want to open and then click **Open**. The communication interface to the device box is used to select a channel for communication between the *Low Pin Count—Do it!* board and host machine.

Figure 40. Host Connection Box



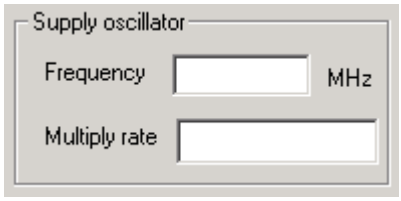
- The **Port** list displays the channels available for communication between the *Low Pin Count—Do it!* board and host machine. Note: Selectable ports can be checked using the Device Manager. For details, refer to "Confirmation of USB Driver Installation."

- The **Speed** list enables you to select a rate for the selected communication channel.

- The **Supply oscillator** box is used to select a clock that determines the programming frequency and data transfer rate. Selecting a frequency sets the clock frequency of the target system, which can vary from one device to another. Be sure to check the specifications for the device used before making a selection. Selecting a multiply rate specifies the division rate or multiplication rate of the target device. If the target device has an on-chip phase-

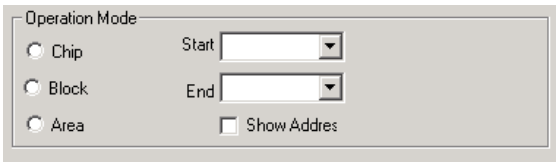
locked loop (PLL) circuit, enter a division rate or multiplication rate according to the use environment. Division and multiplication rates differ depending on the device, so be sure to check the specifications of the device used before choosing a rate. If the target device does not have an on-chip PLL circuit, select "1.0". On the initial screen, the default setting is displayed according to the parameter file.

Figure 41. Supply Oscillator Box



The **Operation Mode** box enables you to divide the flash memory of some target devices into blocks or areas. Some devices do not have the block and area division modes, and some have only one mode. In these cases, modes that don't exist cannot be selected.

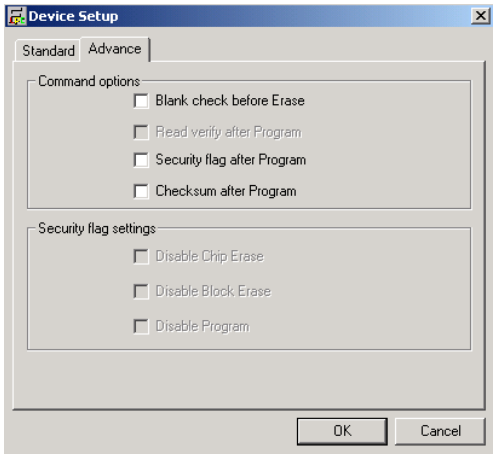
Figure 42. Operation Mode



- Choosing **Chip** subjects the entire flash memory area of the target device to rewrite processing.
- Choosing **Block** requires you to specify range using the **Start** and **End** lists. The block of flash memory specified is then subject to reconfiguration.
- Selecting **Area** requires you to specify a range using the Start and End lists. The specified area of flash memory is then subject to reconfiguration.
- Selecting **Show Address** displays the addresses in the **Start** and **End** lists. If this check box is not checked, numbers are displayed.

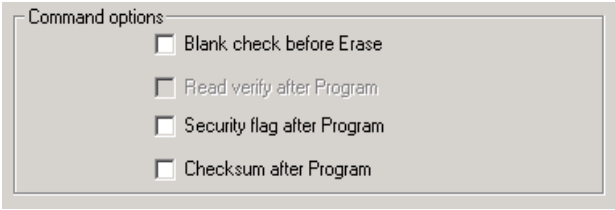
The **Advance setup** tab is used to specify the command options and security flag settings. When "Advance" is clicked, the following window is displayed:

Figure 43. Advance Tab



The **Command options** box is used to specify the PG-LPC flash processing command options.

Figure 44. Command Options Box

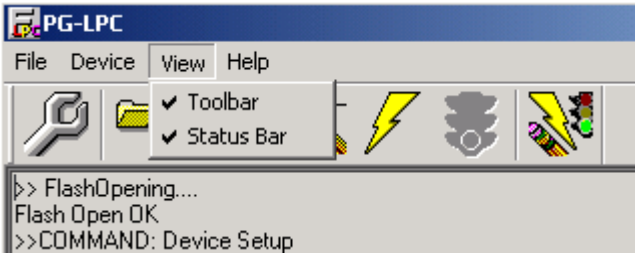


- Selecting the **Blank check before Erase** box executes a **Blank Check** command before an **Erase** command or **EPV** command is executed. If the result of a blank check indicates OK, erase processing is not executed.
- **Security flag after Program** box: Not usable
- Selecting the **Checksum after Program** box reads the flash memory checksum value of the target device after execution of a **Program** and **EPV** command. This value differs from the value displayed in the parameter window of the main window.

6.3.3 View Menu

Clicking the **View** menu displays the **Toolbar** and **Status Bar** commands.

Figure 45. [View Menu



6.3.3.1 Toolbar Command

Checking the **Toolbar** command displays the toolbar. Unchecking the command hides the toolbar.

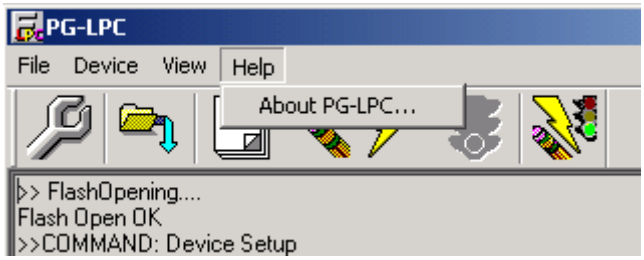
6.3.3.2 Status Bar Command

Checking the **Status Bar** command displays the status bar. Unchecking the command hides the status bar.

6.3.4 Help Menu

Clicking the **Help** menu displays the About PG-LPC… command.

Figure 46. Help Menu



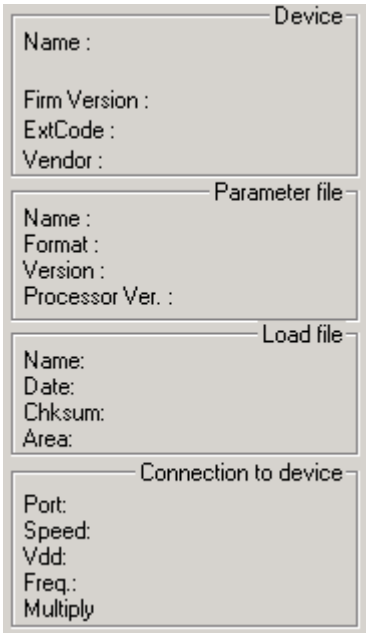
Clicking the **About PG-LPC** command displays information about the PG-LPC program. To terminate the display, click **OK**.

Figure 47. About PG-LPC Window

6.4 Programmer Parameter Window

This window displays the settings of the programming parameters.

Figure 48. Programmer Parameter Window



- **Device**: Updated after communication with the target device to display information about the target device.

- **Parameter file**: Updated after **Setup** command execution to display information about a read parameter file.

- **Load file**: Updated after **Load** command execution to select information about a selected program file.

- **Connection to device**: Updated after **Setup** command execution to display information about the connection with the target device.

7. Using the PG-LPC Flash Programming Software

This section explains the basic operations of the PG-LPC GUI for programming the *DemoKit-KA1* board. This chapter covers how to start the system, execute the EPV command, and program the target device μPD78F9222 mounted on the *DemoKit-KA1* board. The conditions of the series of operations described in this section are as follows:

- Target board :*DemoKit-KA1*
- Target device :μPD78F9222
- Clock :8 MHz
- Voltage level :5V
- PG-LPC
  - Parameter file :78F9222.PRM
  - Clock setting :8 MHz (multiplied by 1)
  - Port :COM4 (115200 bps)
  - Operation mode :Chip
  - Write HEX :Light_demo.hex
  - Option setting :Blank check before Erase

7.1 Installing the PG-LPC GUI Software

Install the PG-LPC GUI software on the host machine you are using, by referring to the section on "Software Installation" (if the software has not been installed yet).

7.2 Installing the Driver

Install the USB driver on the host machine you are using by referring to the section on "Software Installation" (if the driver has not been installed yet).

7.3 Installing the Parameter File

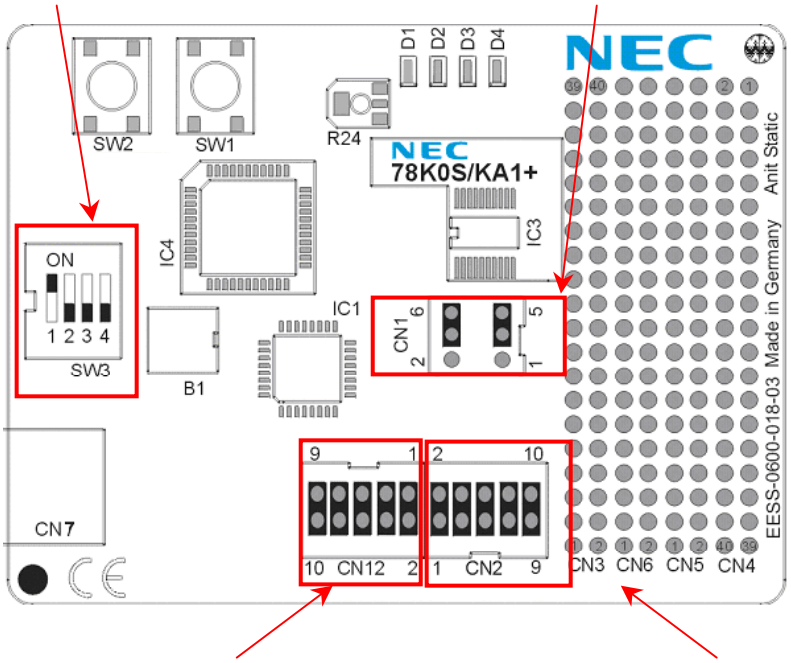
The parameter file for the μPD78F9222 device is installed automatically during PG-LPC installation in the PG-LPC install-path\PRM folder. Nevertheless, newest version of parameter file for the μPD78F9222 device can by downloaded from http://www.necelam.com/microcontrollers/devtools.php.

7.4 Connecting and Starting

1. Set the *DemoKit-KA1* board to the flash programming mode by switching SW3/S1 to ON. The recommended configuration of connectors CN1, CN2 and CN12 is shown below:

SW3	Setting
S1	ON
S2	Don't care
S3	Don't care
S4	Don't care

CN1	Jumper setting
1-2	Open
3-5	Closed
4-6	Closed



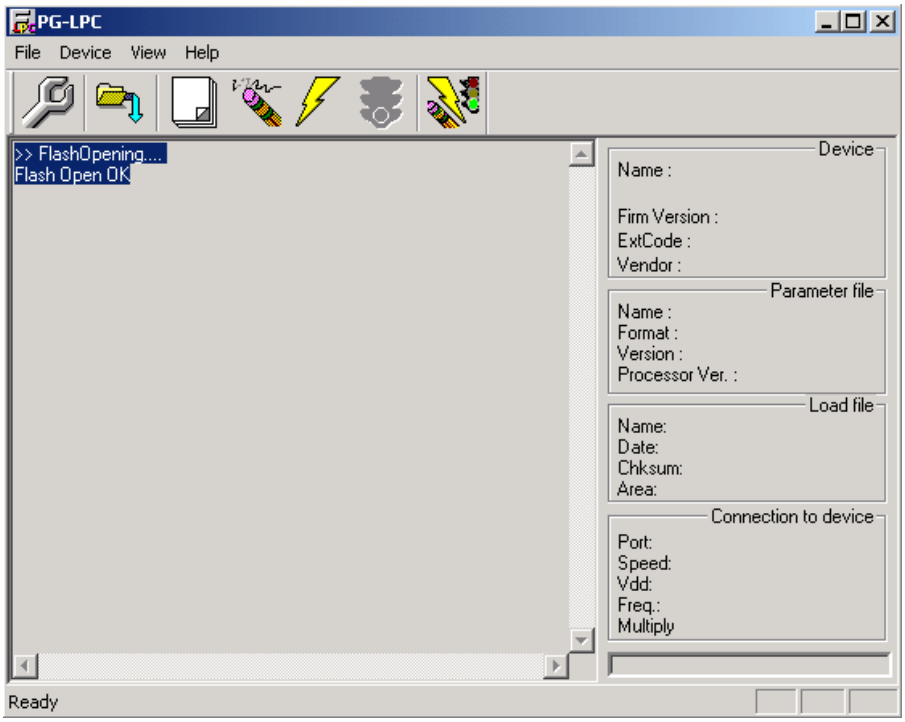
CN12	Jumper Setting
1-2	Closed
3-4	Don't care
5-6	Don't care
7-8	Don't care
9-10	Don't care

CN2	Jumper Setting
1-2	Closed
3-4	Don't care
5-6	Don't care
7-8	Don't care
9-10	Don't care

2. The Plug and Play function connects the board with the host machine via the USB cable.

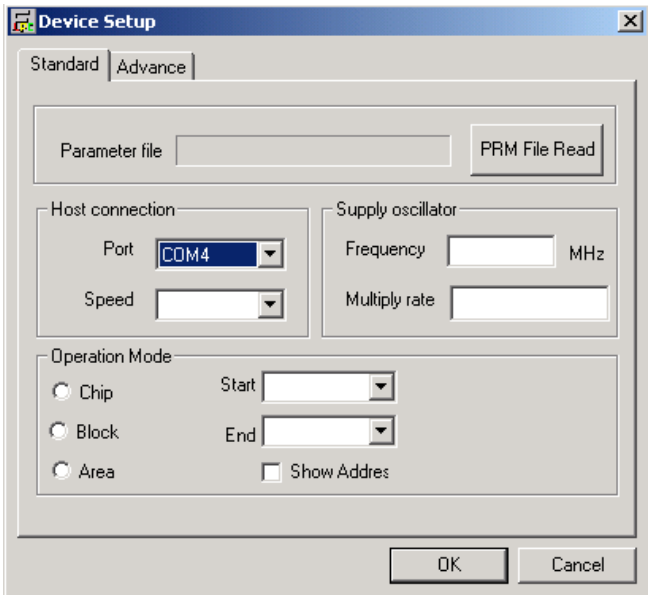
3. Start the PG-LPC GUI.

Figure 49. PG-LPC Main Window



4. Set the programming environment by selecting **Device** → **Setup** to display the **Standard** tab in the **Device Setup** box.

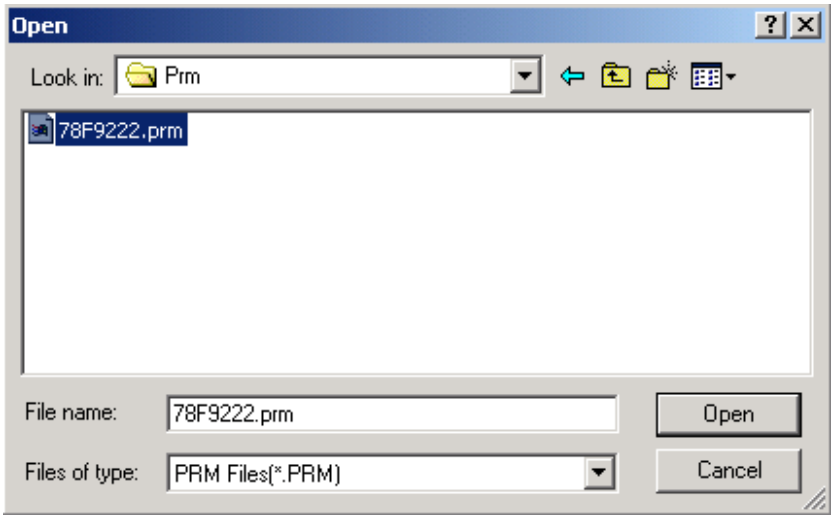
Figure 50. Device Setup: Standard Tab



5. Click **PRM File Read** to display the **Open** dialog box.

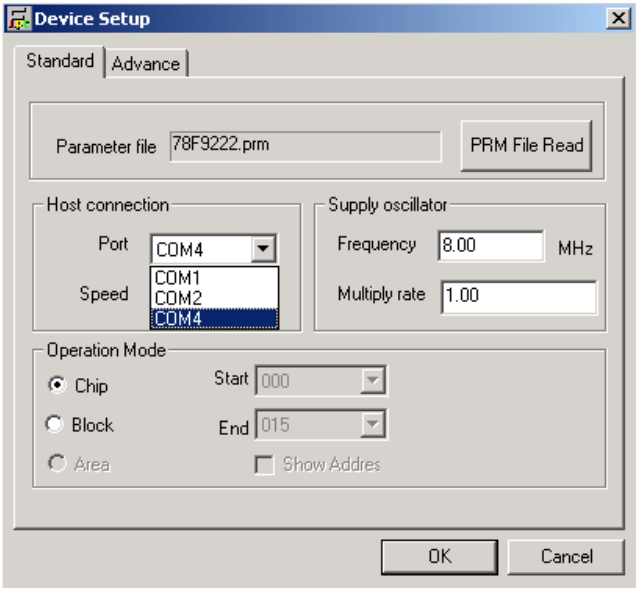
6. Select **78F9222.prm** and then click **Open**.

Figure 51. Parameter File Selection



7. From the **Port** list, select the communication port that matches the host machine being used. Select the communication speed of the host connection.

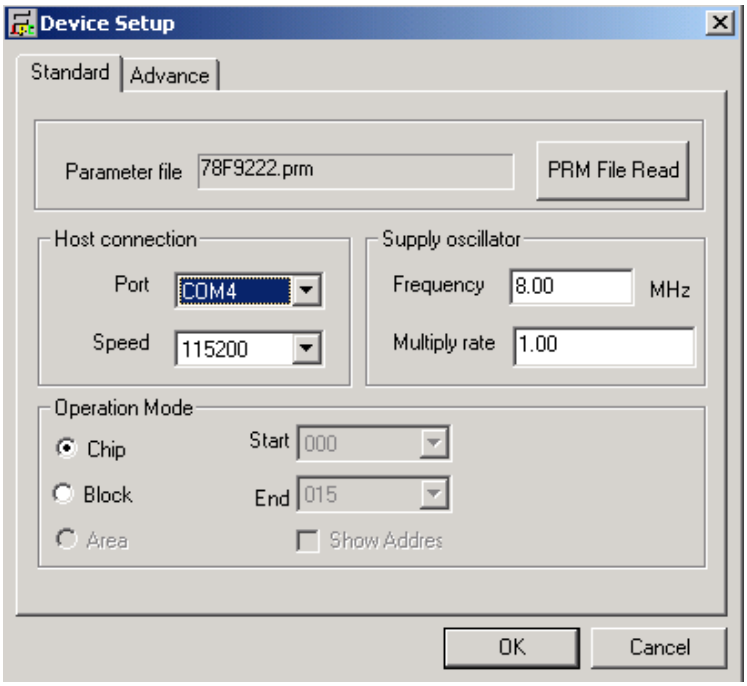
Figure 52. Port Selection



Note: Selectable ports can be checked using Device Manager. For details, refer to “Confirmation of USB Driver Installation.”

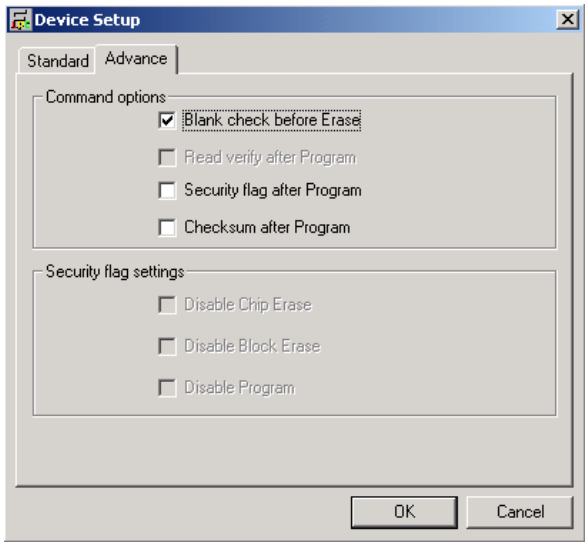
8. Set "Supply oscillator" according to the specifications of the *DemoKit-KA1* board:
   - Frequency = 8.00 MHz
   - Multiply rate = 1.00
   - Operation Mode = Chip

Figure 53. Device Setup: Settings for Standard Tab



9. Switch to the **Advance** tab.

Figure 54. Advance Tab: Device Setup Dialog Box

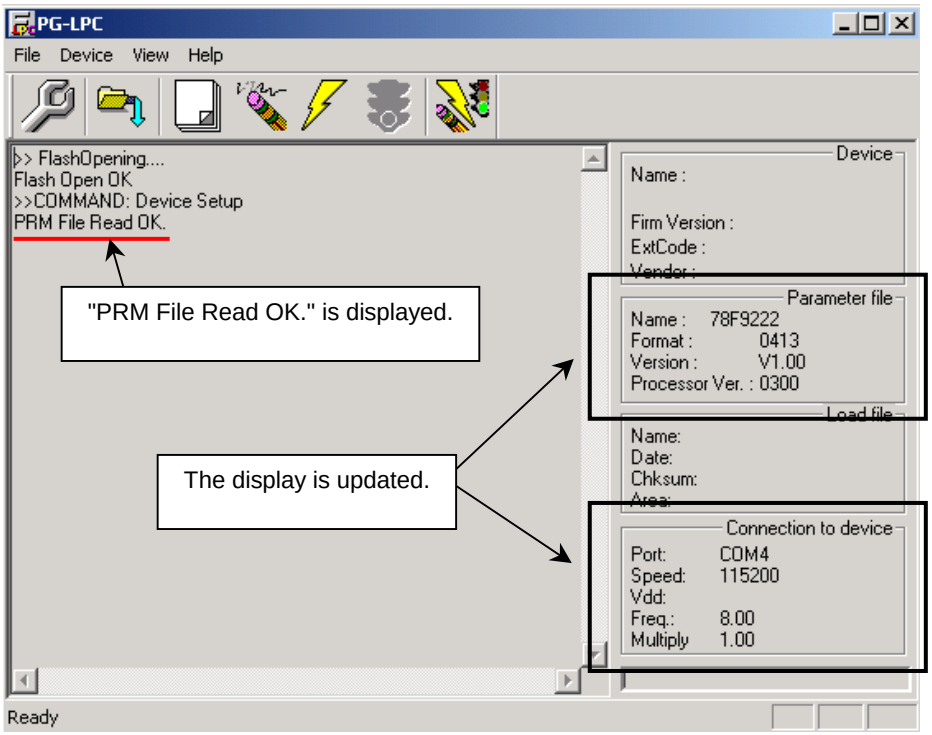


7.5 Command Options

7.5.1 Executing a Blank Check Before Erase Command

Click **OK** to set parameters for the GUI software and display the following dialog box.

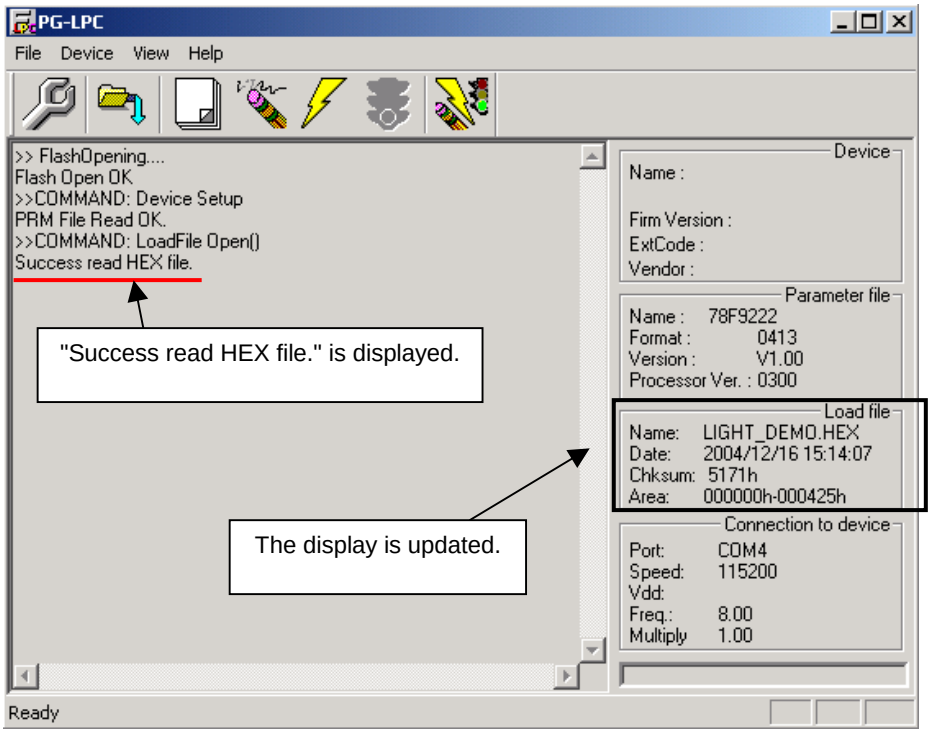
Figure 55. Completion of Parameter Setting



7.5.2 Selecting and Opening a User Program

Click **File** → **Load** → **Open** to select and open a file to be written to the target device.

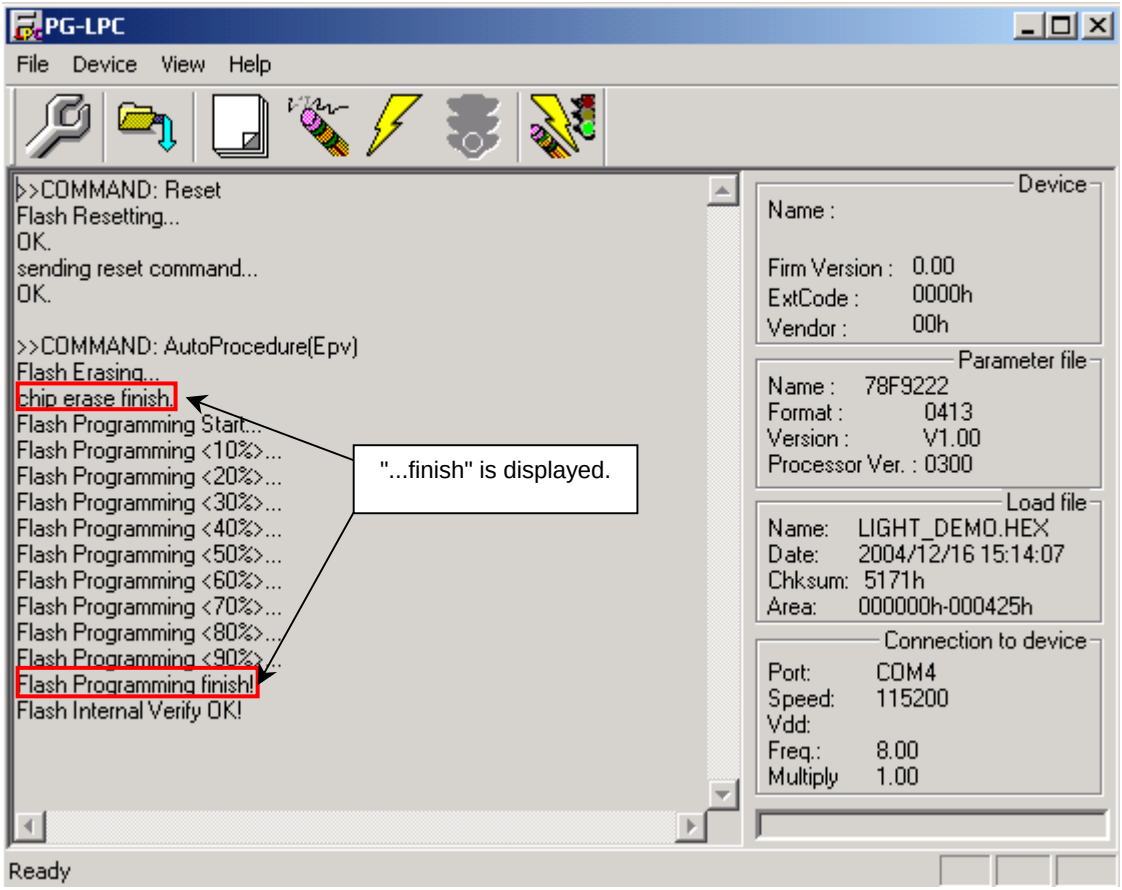
Figure 56. After Downloading



7.5.3 Executing the Autoprocedure(EPV) Command

Click **Device** → **Autoprocedure(EPV)** to execute the automatically execute the **Blank Check** → **Erase** → **Program** commands in sequence on the μPD78F9222 device.

Figure 57. After EPV Execution



7.5.4 Terminating the GUI

Select **File** → **Quit** to terminate the GUI software. All settings executed so far are saved in the PG-LPC.INI file, so that those settings can be reused when the GUI software is restarted.

7.5.5 Executing "LIGHT_DEMO" Application

Set the *DemoKit-KA1* board to normal operation by switching SW3/S1 to OFF. The Plug and Play function will then initialize the board in normal operating mode.

7.5.6 Restarting the GUI

When the system restarts, the main window appears.

8. TROUBLESHOOTING

In driver installation, recognition based on Plug and Play is disabled.

Cause:

The USB connector may not be inserted normally into the USB port of the personal computer.

Action:

Check that the USB connector is inserted fully into the USB port of the personal computer. Alternatively, disconnect the USB connector, then insert the USB connector again after a while.

The driver file cannot be found at a specified location.

Cause:

The PG-LPC software of the *DemoKit-KA1* board may not be installed correctly.

Action:

Install the GUI software again by referring to "Software Installation."

In checking by Device Manager, "USB Serial Port" or "USB High Speed Serial Converter" is not displayed. Alternatively, the "!" or "×" is prefixed.

Cause:

The USB connector may not be inserted normally into the USB port of the personal computer.

Action:

Check that the USB connector is inserted fully into the USB port of the personal computer. Alternatively, disconnect the USB connector from the USB port, and then insert the USB connector again after a while.

Cause:

The driver may not be installed correctly.

Action:

10. When this product is connected to the personal computer, right-click the driver marked with "!" or "×".

11. Click **Erase** when displayed.

12. On the Device Manager, execute **Hardware Modification Scan**.

13. Install the driver again with Plug and Play.

Cause:

The device may not be recognized (in the case of connection with the USB hub).

Action:

Try the following:

- Disconnect the USB connector, and then insert the USB connector again.
- Connect the USB connector to another port of the USB hub.

If the same symptom occurs, do not use the USB hub, but directly connect the connector to the USB port of the personal computer.

When this product is connected with a personal computer, the "Add New Hardware Wizard" screen is displayed.

Cause:

If the USB connector of this product is inserted not into the USB port used at the installation time but into another USB port, this product may be recognized as a new hardware item.

Action:

Install the driver by referring to section 7.2.

Communication with the *DemoKit-KA1* board is disabled.

Cause:

The driver may not be installed correctly.

Action:

Check if "USB Serial Port" and "USB High Speed Serial Converter" are installed correctly by referring to section 7.2.

Cause:

The Port list box may not be set correctly.

Action:

Set the port checked using Device Manager.

Cause:

The power, clock or reset signal may not be supplied to the 78K0S/KA1+ device correctly.

Action:

14. Check that the clock is supplied to the 78K0S/KA1+ device, connector CN1.

15. Check that the power is supplied to the 78K0S/KA1+ device, connector CN12.

16. Check that the CPLD reset signal is supplied to the 78K0S/KA1+ device, connector CN2.

Cause:

The PRM file selected in [Device Setup] may be incorrect.

Action:

Use the 78F9222.prm that matches the *DemoKit-KA1* target device. For information about the PRM file, refer to section 7**.**

Cause:

The setting of "Supply oscillator" in the **Device Setup** dialog box may be incorrect.

Action:

Make a correct setting according to the specifications of the target device.

9. Sample Programs

9.1 General Introduction

Each of the sample programs is located in a single directory, which will be called main-directory of the sample. The five sample projects files are included in one NEC Electronics workspace file named "LPC_Demo.prw".

Table 2. Example directory structure

Name	
ADC_Demo	A/D converter demonstration
Light_Demo	Light show
ReacTime_Demo	Reaction time measurement
Timer_Demo	Timer demonstration
UART_Demo	UART demonstration
LPC_Demo.fni	Workspace setting file
LPC_Demo.prk	
LPC_Demo.prw	NEC Electronics workspace file

A main directory of each sample contains the project inclusive all output files of the development tools. All sample programs use the same directory structure:

Table 3. Example structure

Name	
ADC_Demo.mak	Make file
ADC_Demo.plg	
ADC_Demo.prj	Project file
ADC_Demo.prw	Individual workspace file
ADC_Demo.sdb	
adc_samplesession.c	C source file
adc_samplesession.hex	Output files for *DemoKit-KA1* board (i.e. Intel HEX file)
adc_samplesession.lmf	Output load module file, linker
adc_samplesession.map	Map file
adc_samplesession.pcc	Parameter file for compiler
adc_samplesession.plk	
adc_samplesession.poc	
adc_samplesession.rel	Object module file
adc_samplesession.sym	

The main directory contains the project files for PM+ and the corresponding C source file. All output files of the development tools for each target are generated. To open PM+ for a sample program, double-click the LPC_Demo.prw workspace file in the **`SamplePrograms`** directory. This will include all sample programs in one workspace.

For details about using Applilet and SM+, refer to their respective manuals. Also note that the execution time in SM+ is based on the performance of the computer, so please set the "sim" variable and recompile code.

Figure 58. NEC Electronics Project Manager Plus (PM+) 78K0/K0S

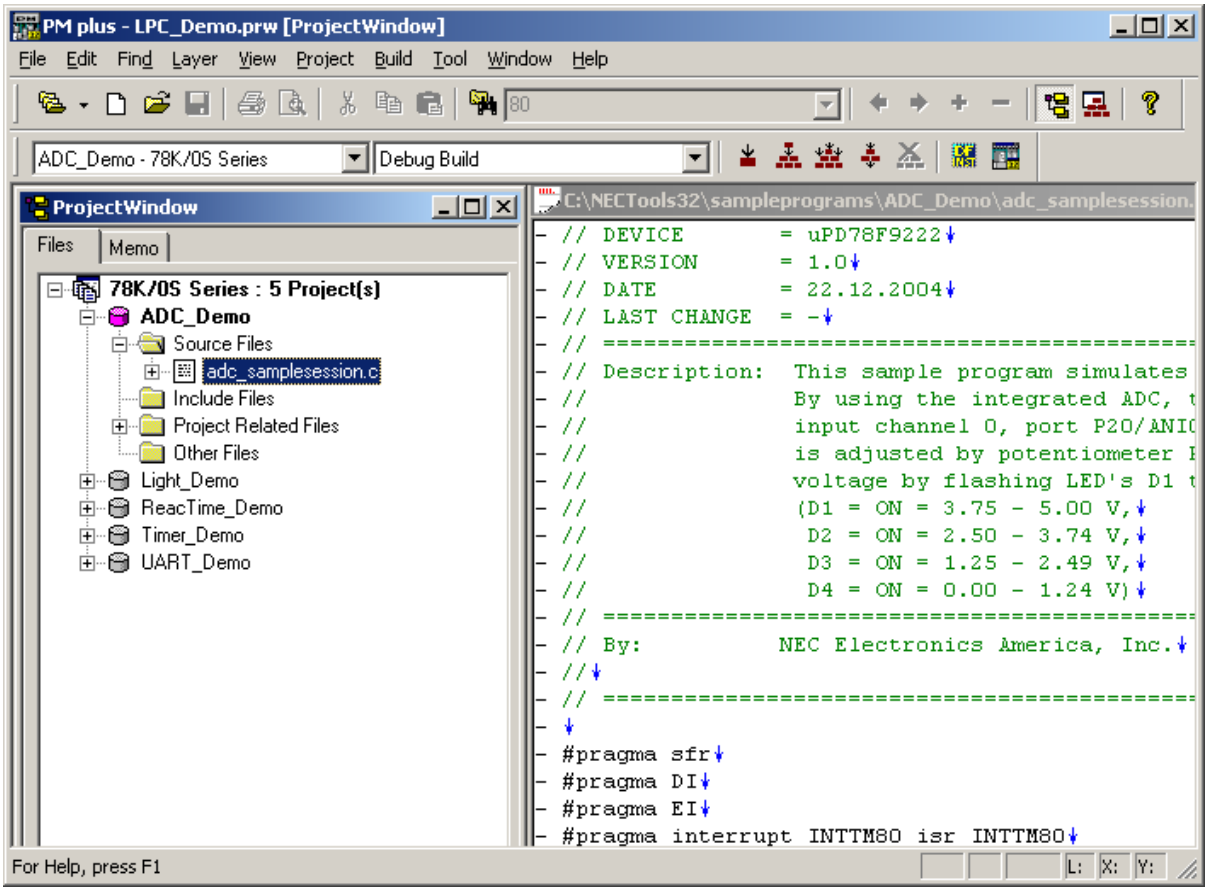
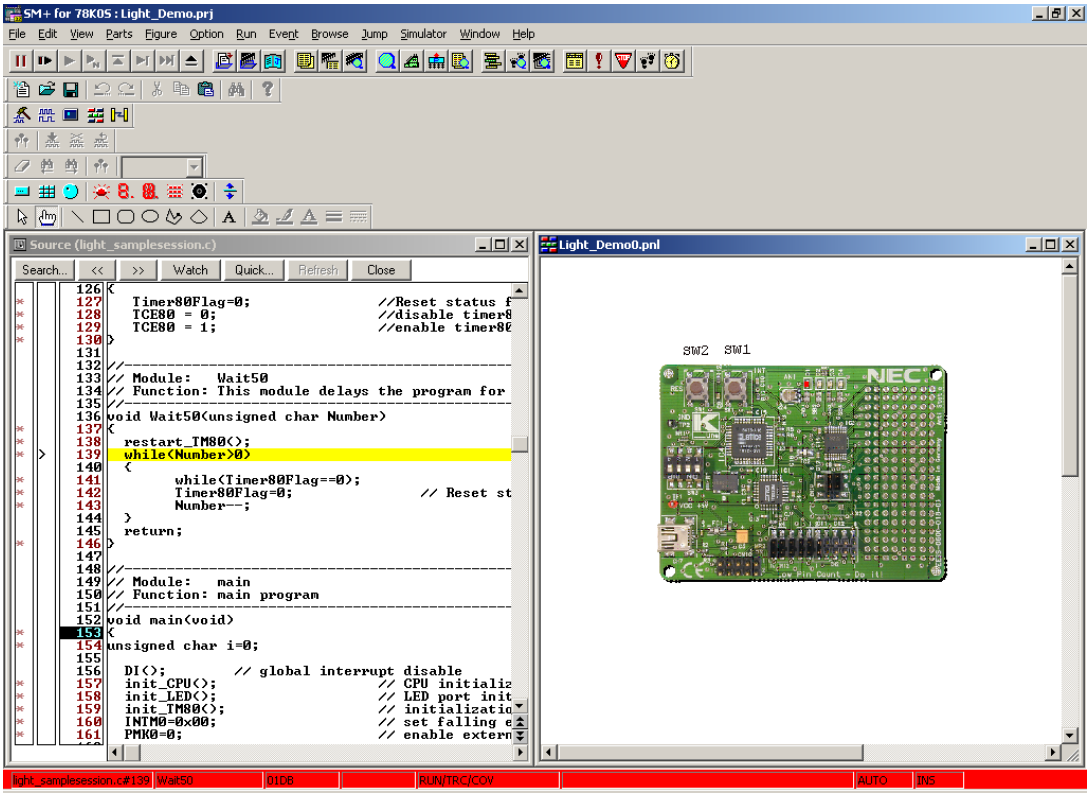


Figure 59. NEC Electronics System Simulator (SM+) 78K0S



9.2 ADC Demo

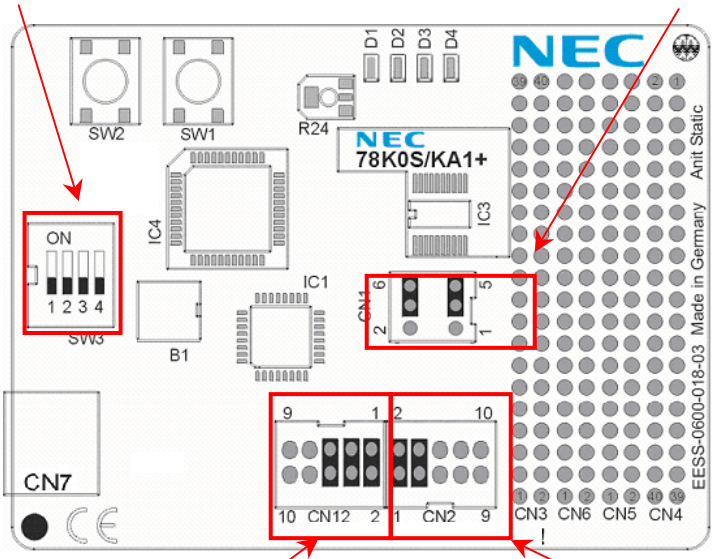
This sample program simulates a simple voltage meter. Using the integrated A/D converter, the program measures the voltage supplied to the converter on input channel 0, port P20/ANI0. The potentiometer R24 adjusts the input voltage, and the board shows the measured voltage by flashing the D1–D4 LEDs.

Used Internal Peripherals	Used External Parts
Timer80	LEDs D1–D4
A/D converter	Potentiometer R24
	Button SW2

To run the ADC demo, set the configuration of switch SW3 and connectors CN1, CN2 and CN12 to the following:

SW3	Setting
S1	OFF
S2	OFF
S3	OFF
S4	OFF

CN1	Jumper Setting
1-2	Open
3-5	Closed
4-6	Closed



CN12	Jumper Setting
1-2	Closed
3-4	Closed
5-6	Closed
7-8	Don't care
9-10	Don't care

CN2	Jumper Setting
1-2	Closed
3-4	Closed
5-6	Don't care
7-8	Don't care
9-10	Don't care

9.3 Light Demo

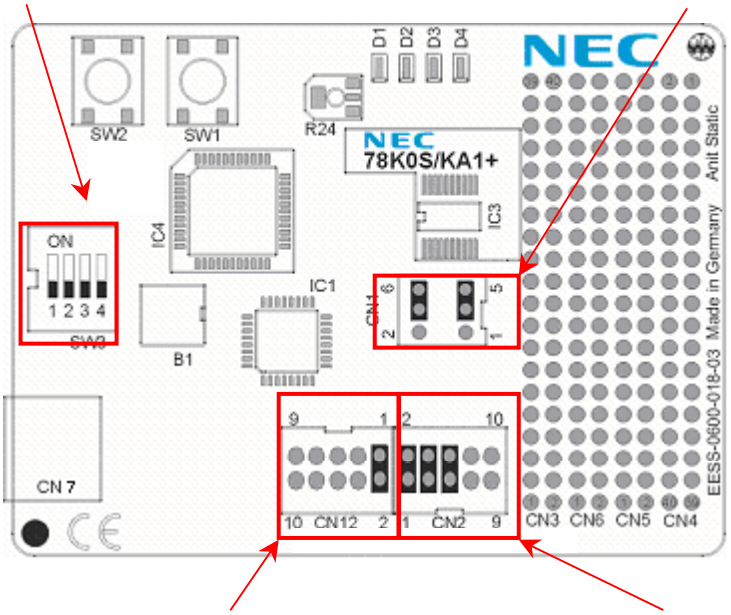
This sample programs plays one of eight predefined lightshows. After the program-start-signal, the program plays the first lightshow. By pressing button SW1 the next show is selected. Pressing button SW2 restarts the application.

Used Internal Peripherals	Used External Parts
Timer80	D1–D4 LEDs
	Button SW1
	Button SW2

To run the Light demo please set the configuration of switch SW3 and connectors CN1, CN2 and CN12 to the following:

SW3	Setting
S1	OFF
S2	OFF
S3	OFF
S4	OFF

CN1	Jumper setting
1-2	open
3-5	closed
4-6	closed



CN12	Jumper Setting
1-2	Closed
3-4	Don't care
5-6	Don't care
7-8	Don't care
9-10	Don't care

CN2	Jumper Setting
1-2	Closed
3-4	Closed
5-6	Closed
7-8	Don't care
9-10	Don't care

Note: To run light demo with SM+, modify the sim variable to 1 and then compile the code. Set sim to 0 to run on flash device. The execution time on SM+ will be a lot faster; hence, setting the sim variable in the code is required.

9.4 ReacTime Demo

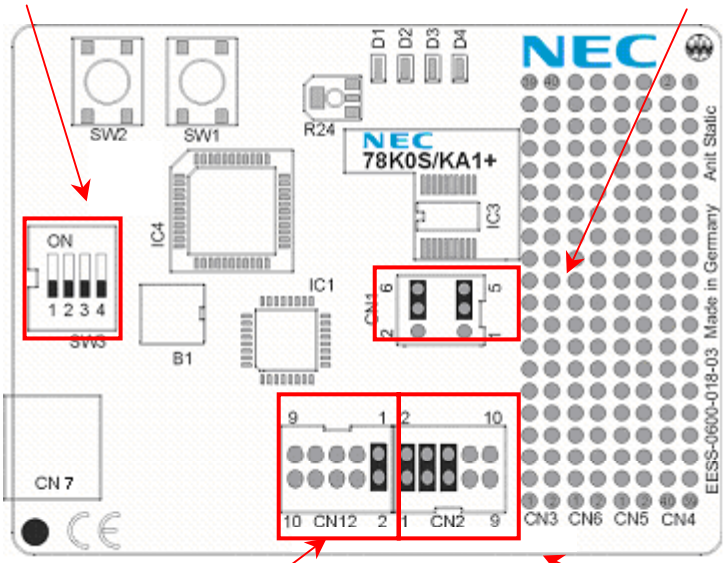
This sample program demonstrates a reaction time measurement. The application starts by flashing D1–D4 LEDs two times. After a press of button SW1, the application waits for a random time between 0.50 and 3.45 seconds. Then D4 LED switches on and measurement starts by incrementing a reaction counter every 50 ms. The actual counter value is shown by D1–D4 (binary format) until you press the SW1 button again. After the press is detected, measurement stops and the reaction time is shown by flashing the D1–D4 LEDs. Pressing button SW2 starts a new measuring cycle.

Used Internal Peripherals	Used External Parts
Timer80	LED's D1- D4
TimerH1	Button SW1
	Button SW2

To run the ReacTime demo, set the configuration of switch SW3 and connectors CN1, CN2 and CN12 as follows:

SW3	Setting
S1	OFF
S2	OFF
S3	OFF
S4	OFF

CN1	Jumper Setting
1-2	Open
3-5	Closed
4-6	Closed



CN12	Jumper Setting
1-2	Closed
3-4	Don't care
5-6	Don't care
7-8	Don't care
9-10	Don't care

CN2	Jumper Setting
1-2	Closed
3-4	Closed
5-6	Closed
7-8	Don't care
9-10	Don't care

9.5 Timer Demo

This sample program simulates a darkroom timer. The board starts after reset flashing all LEDs.

After first key press of SW1, the board starts counting up expose times in unit of minutes (binary output format). Pressing SW1 a second time selects the shown elapse time and starts the counting.

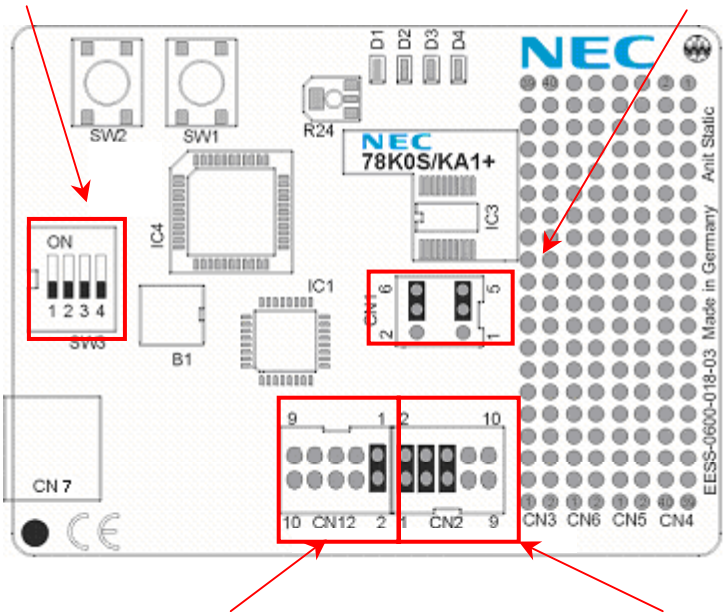
After the selected time is finished, the LEDs flash 20 times to display the elapse time and stop mode is entered. Pressing SW1 releases stop mode.

Used Internal Peripherals	Used External Parts
Timer80	D1–D4 LEDs
TimerH1	Button SW1
	Button SW2

To run the Timer demo please set the configuration of switch SW3 and connectors CN1, CN2 and CN12 to the following:

SW3	Setting
S1	OFF
S2	OFF
S3	OFF
S4	OFF

CN1	Jumper Setting
1-2	Open
3-5	Closed
4-6	Closed



CN12	Jumper Setting
1-2	Closed
3-4	Don't care
5-6	Don't care
7-8	Don't care
9-10	Don't care

CN2	Jumper Setting
1-2	Closed
3-4	Closed
5-6	Closed
7-8	Don't care
9-10	Don't care

Note: To run timer demo with SM+, modify the sim variable to 1 and then compile the code. Set sim to 0 to run on flash device. Note that in SM+, the execution timing will not be correct and will run a lot faster.

9.6 UART Demo

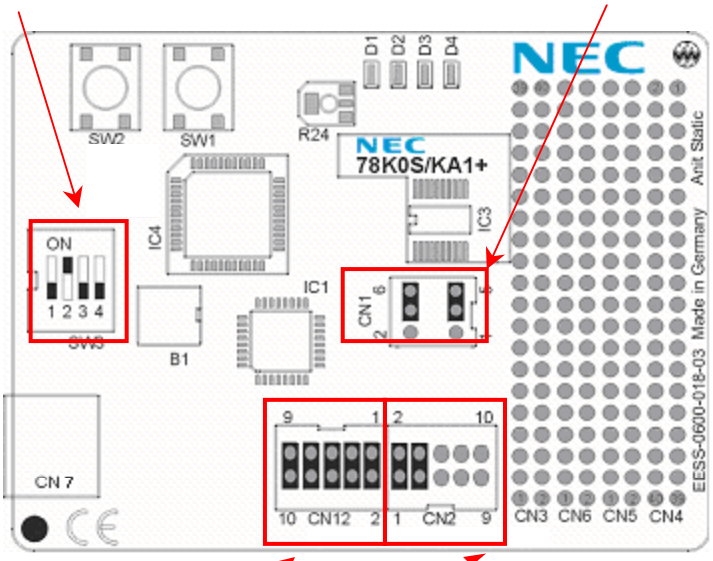
This sample program simulates a voltage meter with serial communication channel. The sample program does a cyclic measurement of the input voltage of AD converter channel 0, port P20/ANI0, and transfers the measured result via UART6 to a terminal program running on the host machine. The data transfer speed is set to 115200 bps per default. The input voltage can be changed by potentiometer R24.

Used Internal Peripherals	Used External Parts
Timer80	D1–D4 LEDs
A/D converter	Button SW2
UART6	

To run the UART demo, set the configuration of switch SW3 and connectors CN1, CN2 and CN12 as follows:

SW3	Setting
S1	OFF
S2	ON
S3	OFF
S4	OFF

CN1	Jumper Setting
1-2	Open
3-5	Closed
4-6	Closed



CN12	Jumper setting
1-2	Closed
3-4	Closed
5-6	Closed
7-8	Closed
9-10	Closed

CN2	Jumper setting
1-2	Closed
3-4	Closed
5-6	Don't care
7-8	Don't care
9-10	Don't care

10. Connectors and Cables

Figure 60. Connector CN7, USB Mini-B Type Host Connector Pin Configuration

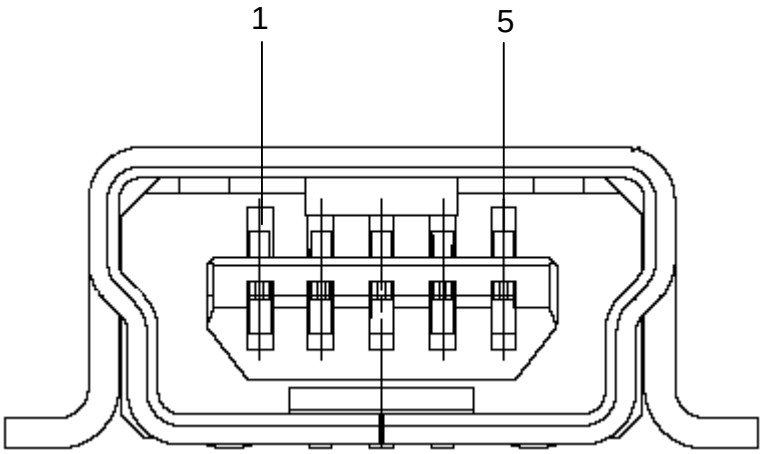


Table 4. Pin Configuration of USB Connector CN7

USB Connector CN7	Signal Name
1	VBUS
2	DM
3	DP
4	N.C.
5	GNDBUS

For connection with the host machine, use a USB cable (Mini-B type). For confirmation, NEC Electronics used only the USB cable delivered with the *DemoKit-KA1* board.

10.1 USB Interface Cable (Mini-B type)

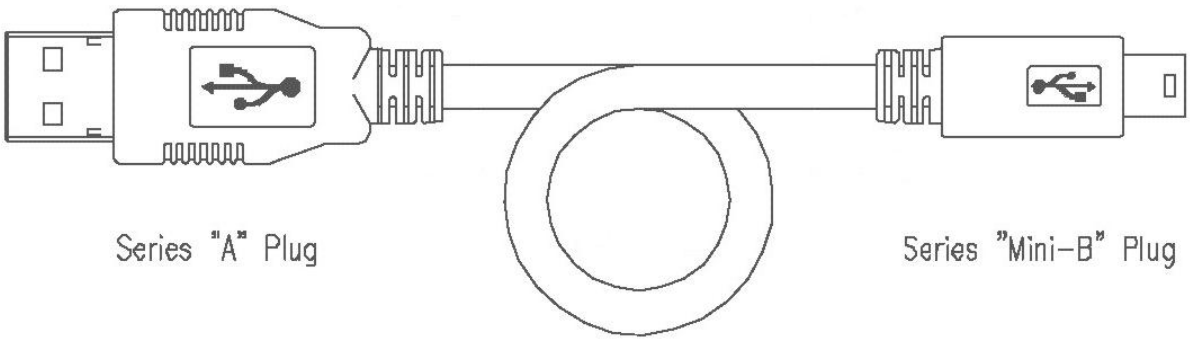
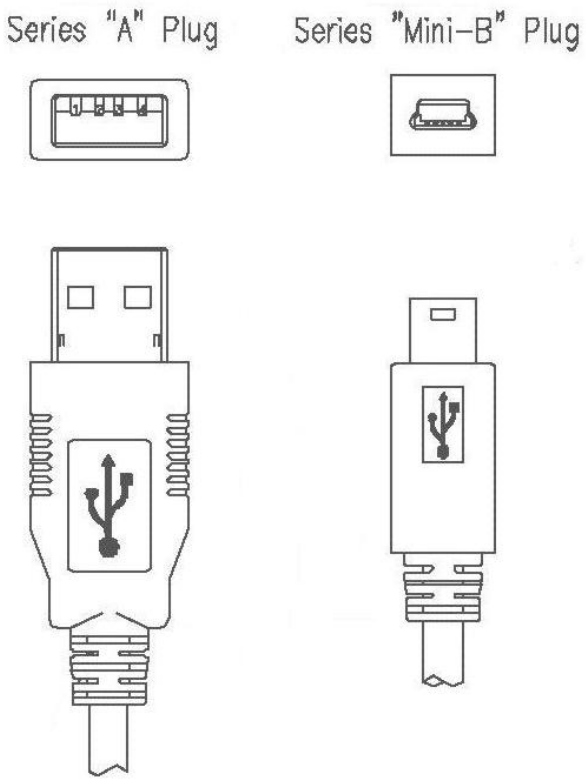
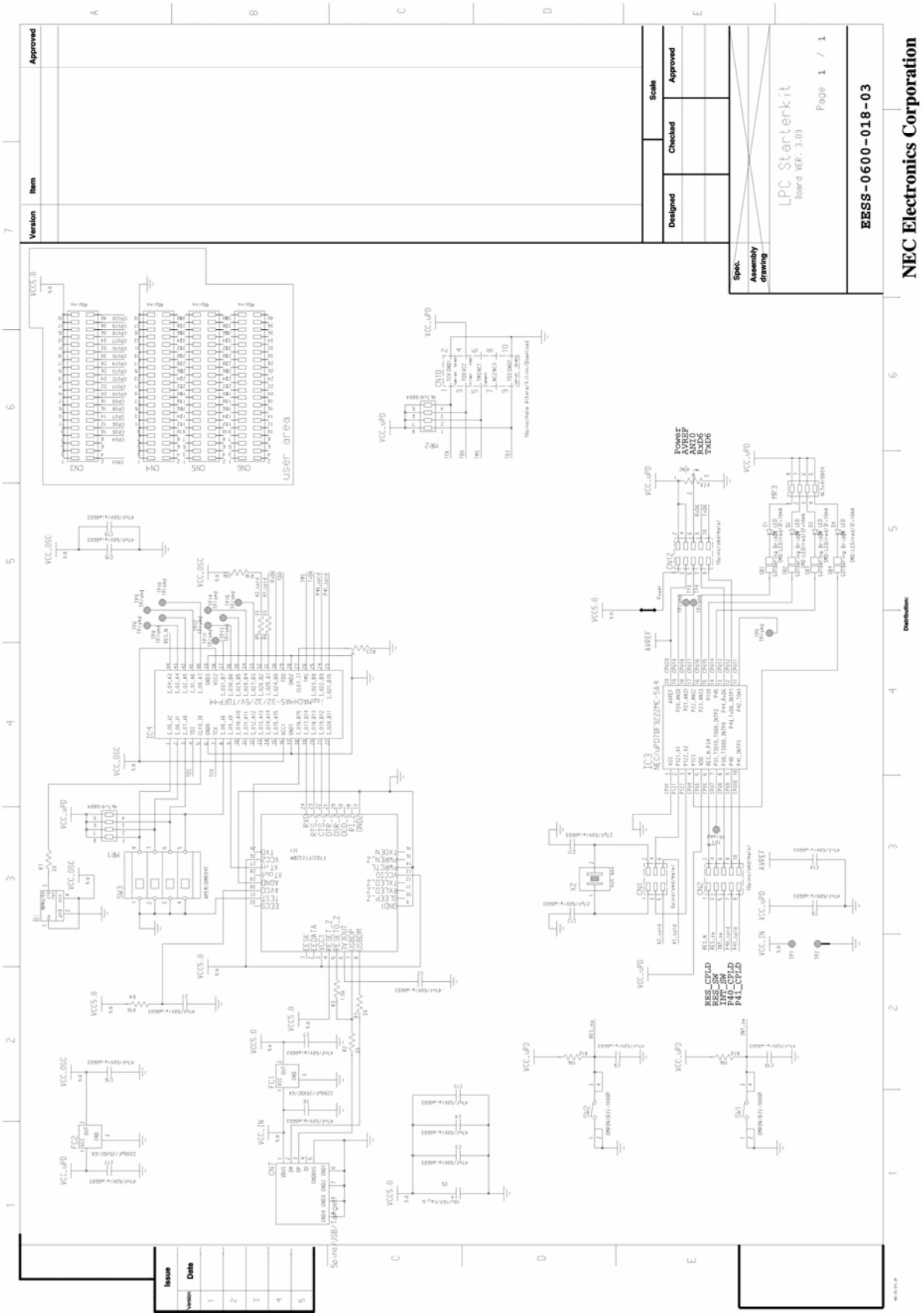


Figure 61. USB Interface Cable (Mini-B type)



11. Schematics



Note: Schematics also are available on CD-ROM directory `\Doc\DemoKit-KA1_SCHEMATICS.pdf`