To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

Send any inquiries to http://www.renesas.com/inquiry.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: “Standard”, “High Quality”, and “Specific”. The recommended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as “Specific” without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as “Specific” or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is “Standard” unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.

   “Standard”: Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.

   “High Quality”: Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.

   “Specific”: Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.
8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

User's Manual

78K0S/KA1+ – Do it!

Starter Kit for the NEC Low Pin Count Devices

EZ-0002

Document No. U17514EJ2V0UM00 (2nd edition)
Date Published August 2005 N CP(K)

© NEC Electronics Corporation 2004-2005

[MEMO]

- **The information in this document is current as of March, 2005. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets or data books, etc., for the most up-to-date specifications of NEC Electronics products. Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.**
- No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Electronics. NEC Electronics assumes no responsibility for any errors that may appear in this document.
- NEC Electronics does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC Electronics products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Electronics or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of a customer's equipment shall be done under the full responsibility of the customer. NEC Electronics assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC Electronics endeavors to enhance the quality, reliability and safety of NEC Electronics products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC Electronics products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment and anti-failure features.
- NEC Electronics products are classified into the following three quality grades: "Standard", "Special" and "Specific".

  The "Specific" quality grade applies only to NEC Electronics products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of an NEC Electronics product depend on its quality grade, as indicated below. Customers must check the quality grade of each NEC Electronics product before using it in a particular application.

  "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots.

  "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support).

  "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

The quality grade of NEC Electronics products is "Standard" unless otherwise expressly specified in NEC Electronics data sheets or data books, etc. If customers wish to use NEC Electronics products in applications not intended by NEC Electronics, they must contact an NEC Electronics sales representative in advance to determine NEC Electronics' willingness to support a given application.

(Note)

(1) "NEC Electronics" as used in this statement means NEC Electronics Corporation and also includes its majority-owned subsidiaries.

(2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).

M8E 02. 11-1

Regional Information

Some information contained in this document may vary from country to country. Before using any NEC Electronics product in your application, please contact the NEC Electronics office in your country to obtain a list of authorized representatives and distributors. They will verify:

- Device availability
- Ordering information
- Product release schedule
- Availability of related technical literature
- Development environment specifications (for example, specifications for third-party tools and components, host computers, power plugs, AC supply voltages, and so forth)
- Network requirements

In addition, trademarks, registered trademarks, export restrictions, and other legal issues may also vary from country to country.

[GLOBAL SUPPORT]
http://www.necel.com/en/support/support.html

NEC Electronics America, Inc. (U.S.)
Santa Clara, California
Tel: 408-588-6000
800-366-9782

NEC Electronics (Europe) GmbH
Duesseldorf, Germany
Tel: 0211-65030

- **Sucursal en España**
  Madrid, Spain
  Tel: 091-504 27 87
- **Succursale Française**
  Vélizy-Villacoublay, France
  Tel: 01-30-67 58 00
- **Filiale Italiana**
  Milano, Italy
  Tel: 02-66 75 41
- **Branch The Netherlands**
  Eindhoven, The Netherlands
  Tel: 040-265 40 10
- **Tyskland Filial**
  Taeby, Sweden
  Tel: 08-63 87 200
- **United Kingdom Branch**
  Milton Keynes, UK
  Tel: 01908-691-133

NEC Electronics Hong Kong Ltd.
Hong Kong
Tel: 2886-9318

NEC Electronics Hong Kong Ltd.
Seoul Branch
Seoul, Korea
Tel: 02-558-3737

NEC Electronics Shanghai Ltd.
Shanghai, P.R. China
Tel: 021-5888-5400

NEC Electronics Taiwan Ltd.
Taipei, Taiwan
Tel: 02-2719-2377

NEC Electronics Singapore Pte. Ltd.
Novena Square, Singapore
Tel: 6253-8311

J05.6

CONTENTS

1. INTRODUCTION 7

1.1 Main Features of *78K0S/KA1+ – Do it!* 7
1.2 System Requirements 8
1.3 Package Contents 8

2. *78K0S/KA1+ - Do it!* SYSTEM CONFIGURATION 9

2.1 *78K0S/KA1+ - Do it!* 9
2.2 Host Computer 9
2.3 Power Supply via USB Interface 9

3. *78K0S/KA1+ - Do it!* BOARD COMPONENTS 10

3.1 Configuration Switch SW3 10
3.1.1 Operation mode selection SW3/S1 11
3.1.2 UART selection SW3/S2 11
3.1.3 Clock mode selection SW3/S3 11
3.1.4 UART mode selection SW3/S4 11
3.2 User Button SW1 12
3.3 Start Button SW2 12
3.4 USB Interface Connector CN7 12
3.5 Connector CN1/Clock Configuration 12
3.6 Connectors CN2/CN12/External Peripheral Configuration 13
3.7 External Potentiometer R24 13
3.8 AD Converter Reference Voltage Input 13
3.9 External LEDs D1 to D4 13
3.10 External Connectors CN3,CN4, CN5, and CN6 14

4. 78K0S/KA1+ MEMORY MAP 15

5. *78K0S/KA1+ Do it!* HARDWARE AND SOFTWARE 16

6. SOFTWARE INSTALLATION 17

6.1 Installation of Assembler and Integrated Development Environment PM+ 17
6.2 Installation of C Compiler 19
6.3 Installation of System Simulator 20
6.4 Installation of Device File 21
6.5 Installation of PG-LPC FLASH Programming GUI 23
6.6 Driver Installation 27
6.6.1 Installation on Windows 98SE/Me 27
6.6.2 Installation on Windows 2000 29
6.6.3 Installation on Windows XP 35
6.7 Confirmation of USB Driver Installation 40
6.8 Driver Uninstallation 41

7. INTEGRATED DEVELOPMENT ENVIRONMENT PM+ AND SYSTEM SIMULATOR SM+ 43

7.1 Start and Compilation of PM+ 43
7.2 SM+ Startup and Simulation Execution 46

8. PG-LPC FLASH PROGRAMMING SOFTWARE 47

8.1 Starting up GUI Software 47
8.2 Toolbar 48
8.3 Menu Bar 49
8.3.1 [File] menu 49
8.3.2 [Device] menu 50
8.3.3 [View] menu 57
8.3.4 [Help] menu 58
8.4 Programmer Parameter Window 59

9. HOW TO USE PG-LPC FLASH PROGRAMMING SOFTWARE 60

(1) Installing the PG-LPC GUI software 60
(2) Installing the driver 60
(3) Installing the parameter file 60
(4) Connecting and starting 61
(5) Setting the programming environment 62
(6) Selecting a user program 65
(7) [Autoprocedure(EPV)] command execution 66
(8) Terminating the GUI 66
(9) Execute “LIGHT_DEMO” application 66
(10) Restarting the GUI 66

10. TROUBLESHOOTING 67

11. SAMPLE PROGRAMS 69

11.1 Light Demo 70
11.2 ADC Demo 72
11.3 ReacTime Demo 74
11.4 Timer Demo 76
11.5 UART Demo 78

12. CONNECTORS AND CABLES 82

12.1 USB Host Connector CN7 82
12.2 USB Interface Cable (Mini-B Type) 83

13. SCHEMATICS 84

1. INTRODUCTION

78K0S/KA1+ – Do it! is a starter kit for the NEC Electronics *78K0S/KA1+* microcontrollers.

It supports onboard FLASH programming and real time execution of application programs up to 4 KB based on the 78K0S/KA1+ microcontroller. The board is prepared to be connected to user hardware parts such as digital I/O or analogue signals.

1.1 Main Features of *78K0S/KA1+ – Do it!*

- Easy to use device demonstration capabilities
  78K0S/KA1+ - Do it! contains elements to easily demonstrate simple I/O-functions, i.e. push buttons, LED output, AD reference voltage, I/O lines, UART interface.

- Power supply via USB interface
  78K0S/KA1+ - Do it! is powered via USB interface, no separate power supply is needed.

- PG-LPC, FLASH programming software
  A windows based FLASH programming software allows to select and download application programs to *78K0S/KA1+ - Do it!* board for evaluation purposes.

- Analogue to digital signal conversion is supported

- Various input/output signals available, such as

  ◦ All I/O ports prepared to be connected to user hardware
  ◦ Timer input/output signals
  ◦ UART interface, via USB UART chip FT232
  ◦ 4 analogue input lines
  ◦ 4 I/O ports connected to LEDs
  ◦ 1 push button prepared for external interrupt generation

_78K0S/KA1+ - Do it!_ is not intended for code development. NEC Electronics does not allow and does not support in any way any attempt to use _78K0S/KA1+ - Do it!_ in a commercial or technical product.

1.2 System Requirements

HOST PC The assembler, C compiler, system simulator, and FLASH programming software require a PC running Windows 98SE, Windows Me, Windows 2000, or Windows XP.
A Pentium II 400 MHz CPU, 128 MB or more of RAM, 256-color display (800 × 600), mouse, CD-ROM drive, and a minimum of 90 MB of free hard disk space are required for installation.

Host interface USB interface that enables communication based on USB (Ver1.1 or later)

1.3 Package Contents

Please verify that you have received all parts listed in the package contents list attached to the *78K0S/KA1+ - Do it!* package. If any part is missing or seems to be damaged, please contact the dealer from whom you received your *78K0S/KA1+ - Do it!*.

2. *78K0S/KA1+ - Do it!* SYSTEM CONFIGURATION

The *78K0S/KA1+ - Do it!* system configuration is given in the diagram below:

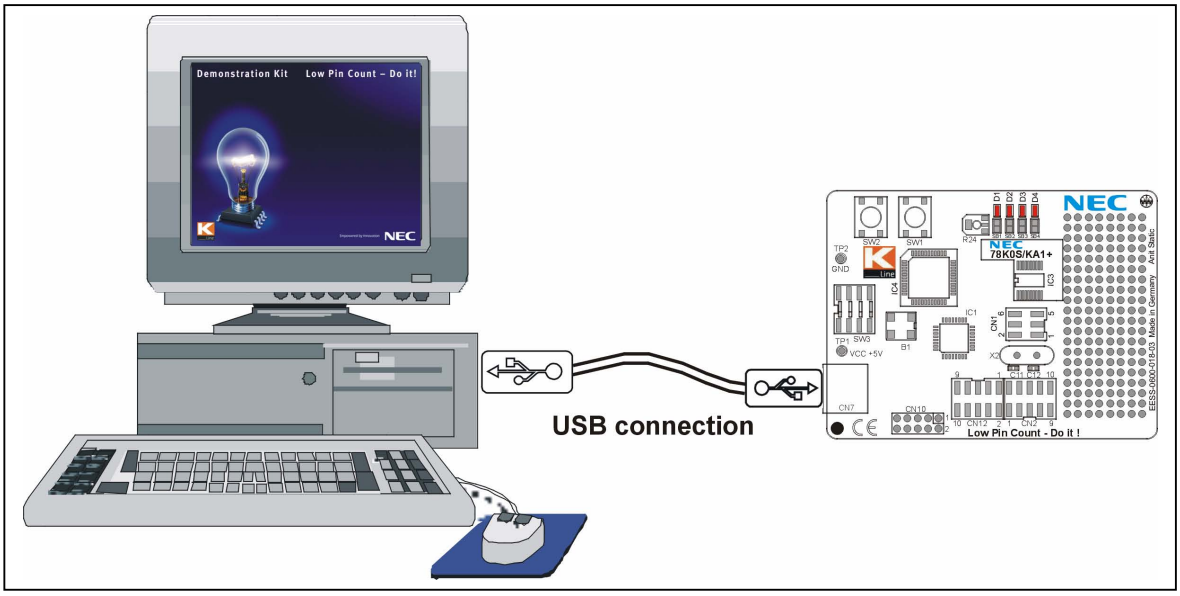


Figure 2-1. *78K0S/KA1+ - Do it!* System Configuration

2.1 *78K0S/KA1+ - Do it!*

78K0S/KA1+ - Do it! is a starter kit for the NEC Electronics 78K0S *Low Pin Count* devices. The μPD78F9222 microcontroller is a typical device from this family and it has been used to realize the *78K0S/KA1+ - Do it!*.

The *78K0S/KA1+ - Do it!* board is connected to the host system via USB interface cable. The host system may be used for programming of μPD78F9222 FLASH memory and to allow execution of application programs on *78K0S/KA1+ - Do it!* platform.

78K0S/KA1+ - Do it! runs the μPD78F9222 microcontroller at 8.00 MHz operating speed.

2.2 Host Computer

The USB host interface enables communication to the *78K0S/KA1+ - Do it!* board. The USB UART chip FT232 allows application software to access the USB device in the same way as it would access a standard RS232 interface. The FTDI's Virtual COM Port (VCP) driver appears to the windows system as an extra Com Port, in addition to any existing hardware Com Ports.

For a detailed specification of the host interface please refer to the chapter **12. CONNECTORS AND CABLES** of this document.

2.3 Power Supply via USB Interface

78K0S/KA1+ - Do it! is powered by USB interface, no separate power supply is needed. The USB interface provides the *78K0S/KA1+ - Do it!* board with 5 V supply voltage.

3. *78K0S/KA1+ - Do it!* BOARD COMPONENTS

The *78K0S/KA1+ - Do it!* board is equipped with push buttons, LEDs and with several connectors in order to be connected to host computers or connect any target hardware. Additionally the *78K0S/KA1+ - Do it!* board provides a wire wrap field (2,54 mm grid) to integrate user application hardware.

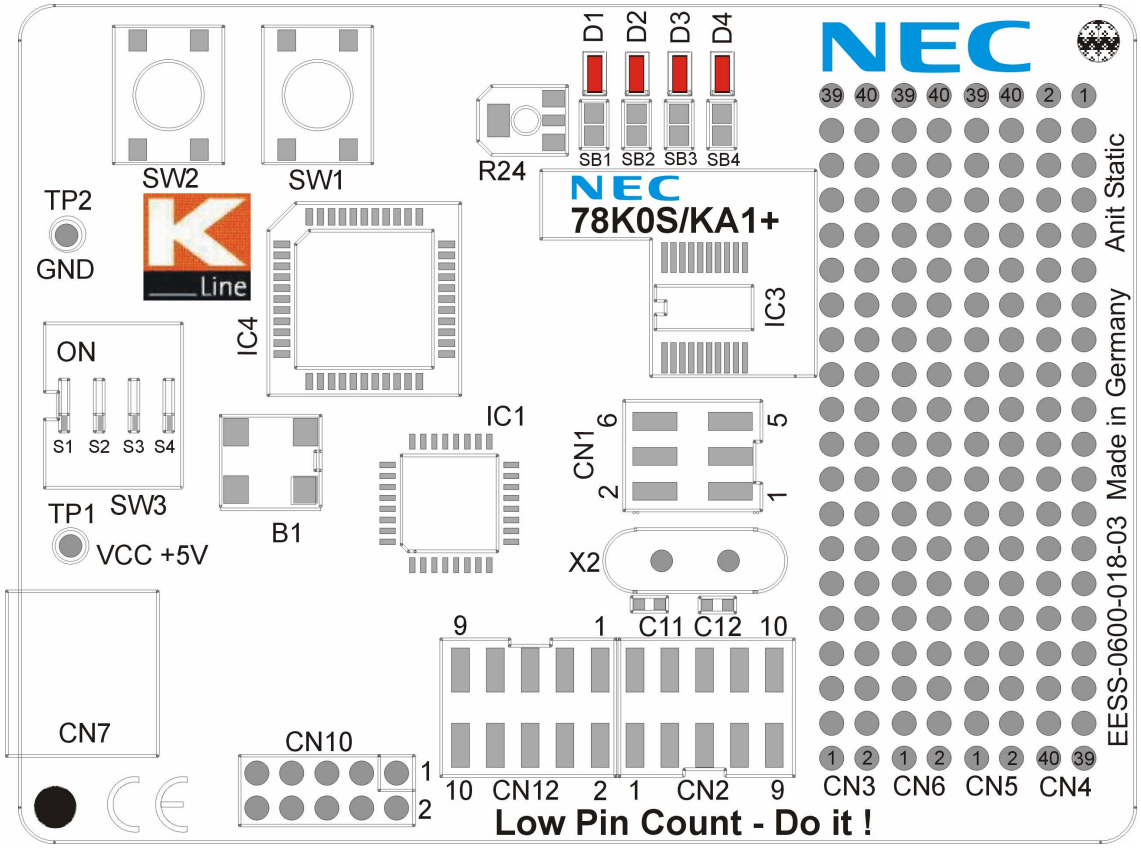


Figure 3-1. *78K0S/KA1+ - Do it!* Board Connectors, Switches, and LEDs

All of the *78K0S/KA1+ - Do it!* μPD78F9222 on-chip resources are free for user application hardware and software. Please read the user's manual of the 78K0S/KA1+ device carefully to get information about the electrical specification of the available I/O ports before you connect any external signal to the *78K0S/KA1+ - Do it!* board!

3.1 Configuration Switch SW3

The different operation modes of the *78K0S/KA1+ - Do it!* board can be set by SW3 switches S1 to S4.

Table 3-1. Configuration Switch SW3, Factory Settings

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

3.1.1 Operation mode selection SW3/S1

SW3 switch S1 controls the operation mode of the *78K0S/KA1+ - Do it!* board. Setting SW3/S1 to ON allows to reprogram the internal FLASH memory of the 78K0S/KA1+ device using the PG-LPC FLASH programming software.

Table 3-2. Operation Mode Selection SW3/S1

SW3, S1	Operation Mode
OFF (default)	Normal operation mode
ON	FLASH memory programming mode

Within normal operation mode the user program stored in the FLASH memory of 78K0S/KA1+ device is executed.

3.1.2 UART selection SW3/S2

SW3 switch S2 controls the serial communication of *78K0S/KA1+ - Do it!* board. The UART6 signals RxD6 and TxD6 are connected to the FT232 interface lines when setting SW3/S2 to ON.

Table 3-3. UART Selection SW3/S2

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

3.1.3 Clock mode selection SW3/S3

SW3 switch S3 controls the clock operation frequency of the *78K0S/KA1+ - Do it!* board.

Table 3-4. Clock Mode Selection SW3/S3

SW3, S3	Operation Mode
OFF (default)	Clock frequency = 8 MHz
ON	Clock frequency = 4 MHz

3.1.4 UART mode selection SW3/S4

SW3 switch S4 controls the UART communication mode of *78K0S/KA1+ - Do it!* board. Setting SW3/S4 to ON enables UART communication with handshake. Within this mode the CPU pins P40 and P41 are connected to the FT232 interface lines and used as RTS and CTS control signals.

Table 3-5. UART Mode Selection SW3/S4

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

3.2 User Button SW1

SW1 is a push button connecting V_{SS} to external interrupt input INTP0 of the CPU. This is equal to port P30 of the 78K0S/KA1+ CPU. The port may be programmed to generate interrupt INTP0. The necessary initialisation for this purpose is described in the user's manual of the 78K0S/KA1+ device. Pressing this button will apply low signal level at port P30.

3.3 Start Button SW2

SW2 is a reset button. It activates the power on reset. It is connected to the reset input of the CPU. Pressing this button will apply low signal level at the RESET pin.

3.4 USB Interface Connector CN7

CN7 connector allows connecting the PG-LPC FLASH programming software to the *78K0S/KA1+ - Do it!* board in order to program application programs into the CPU internal flash. The board power supply of 5V is also provided by connector CN7.

Additionally connector CN7 connects 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 *78K0S/KA1+ - Do it!* board. Shorting the connectors CN1/3-5 and CN1/4-6 (default setting) provides 8 MHz clock frequency to the 78K0S/KA1+ device. In this mode the clock frequency is supplied by the CPLD.

Alternative an external crystal oscillator can be equipped to the *78K0S/KA1+ - Do it!* board. To use this operation mode short connectors CN1/1-3 and CN1/2-4.

Table 3-6. Connector CN1, Clock Configuration

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

3.6 Connectors CN2/CN12/External Peripheral Configuration

Connectors CN2 and CN12 allow connecting and disconnecting of the external board hardware to the 78K0S/KA1+ device.

Table 3-7. Connector CN2, External Peripheral Configuration

CN2	Jumper Setting	Mode
1-2	Shorted (default)	RESET pin connected to CPLD
3-4	Shorted (default)	RESET pin connected to button SW2
5-6	Shorted (default)	INTP0 pin connected to button SW1
7-8	Shorted (default)	P40 connected to CPLD (RTS line of FT232)
9-10	Shorted (default)	P41 connected to CPLD (CTS line of FT232)

Table 3-8. Connector CN12, External Peripheral Configuration

CN12	Jumper Setting	Mode
1-2	Shorted (default)	Power supply, Vcc = 5 V connected to 78K0S/KA1+ and external potentiometer R24
3-4	Shorted (default)	AV_{REF} pin connected to Vcc
5-6	Shorted (default)	ANI0 pin connected to R24 potentiometer arm
7-8	Shorted (default)	P44/RxD6 connected to CPLD (RxD line of FT232)
9-10	Shorted (default)	P43/TxD6 connected to CPLD (TxD line of FT232)

3.7 External Potentiometer R24

A 10k potentiometer R24 is connected between Vcc and ground. Vcc is supplied to R24 by shorting connector CN12/1-2. The potentiometer arm can be connected to the ANI0 analogue input of the 78K0S/KA1+ device by shorting connector CN12/5-6.

3.8 AD Converter Reference Voltage Input

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

3.9 External LEDs D1 to D4

The LEDs D1 to D4 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 Vcc and therefore active low.

Table 3-9. Connection of LEDs D1 to D4

Port	LED
P23	D1
P130	D2
P45	D3
P123	D4

For disconnecting a LED from a port for alternative usage cut the connection (default) of the corresponding soldering bridges SB1 to 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 *78K0S/KA1+ - Do it!* board provides a wire wrap field - connectors CN4, CN5 and CN6 - allowing the integration of additional application hardware.

Table 3-10. External Connectors CN3, CN4, CN5 and CN6

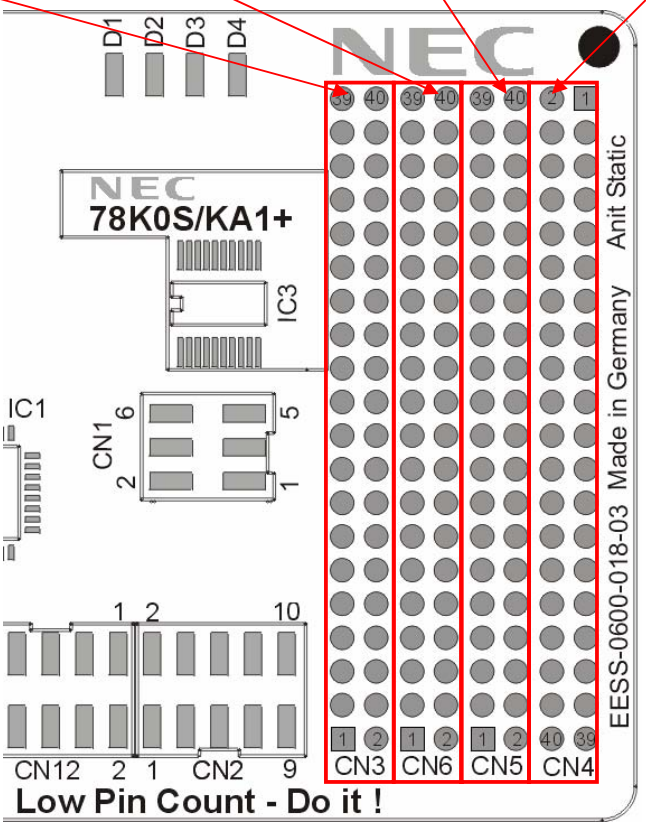
CN3		CN3	
39	V_{CC}	40	AV_{REF}
37	V_{CC}	38	P20
35	V_{CC}	36	P21
33	V_{CC}	34	P22
31	V_{CC}	32	P23
29	V_{CC}	30	P130
27	V_{CC}	28	P45
25	V_{CC}	26	P44
23	V_{CC}	24	P43
21	V_{CC}	22	P42
19	V_{CC}	20	P41
17	V_{CC}	18	P40
15	V_{CC}	16	P30
13	V_{CC}	14	P31
11	V_{CC}	12	RESET
9	V_{CC}	10	V_{DD}
7	V_{CC}	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. 78K0S/KA1+ MEMORY MAP

The memory layout of the μPD78F9222 4 KB FLASH ROM device is shown in the table below.

Table 4-1. 78K0S/KA1+ Memory Map

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

The *78K0S/KA1+ - Do it!* board does not reserve any resources of the 78K0S/KA1+ device, consequently all available memory of the device is free for application software.

5. *78K0S/KA1+ Do it!* HARDWARE AND SOFTWARE

This starter kit consists of a *Do it!* board on which the KA1+ is mounted and Windows-based software. Correct and effective use of the kit requires the proper installation and setting of the hardware and software. The following software is required for this kit.

- RA78K0S: Assembler, integrated development environment
  This is the basic language tool package. The assembler install package includes an integrated development environment (PM+). Be sure to install this software even if developing in C language.

- CC78K0S: C compiler
  This package is required to perform development in C language.

- SM+ for 78K0S/Kx1+: System simulator
  The system simulator is software that allows the operation of a microcontroller to be simulated on a PC. Thus the operation of a microcontroller can be checked on a PC prior to downloading a program to the actual machine.

- DF789234: Device file
  The device file is a file that contains the information specific to the microcontroller. It is required when using the assembler, C compiler, and system simulator.

- PG-LPC: FLASH programming GUI
  This is dedicated programming software used to write to the FLASH memory of the KA+ included in this starter kit.

- Applilet: Device driver configurator
  This software automatically generates the initial settings and control APIs for the peripheral functions (timer, A/D, etc.) of the 78K0S/KA1+. Since this is not a mandatory tool, its installation procedure and use are not covered in this manual. A simple description of this software is included in the FLP2_QuickGuide_v120.pdf file in the supplied CD-ROM. Please refer to this file for details.

Install the above-listed software products from the supplied CD-ROM.

Alternatively, these software products can be downloaded from the NEC Electronics website (http://www.necel.com/micro/index_e.html).

The software installation procedure is described next.

6. SOFTWARE INSTALLATION

When the supplied CD-ROM is set in the CD-ROM drive of the PC, the *Do it!* installation program (Doit_install.exe) starts automatically.

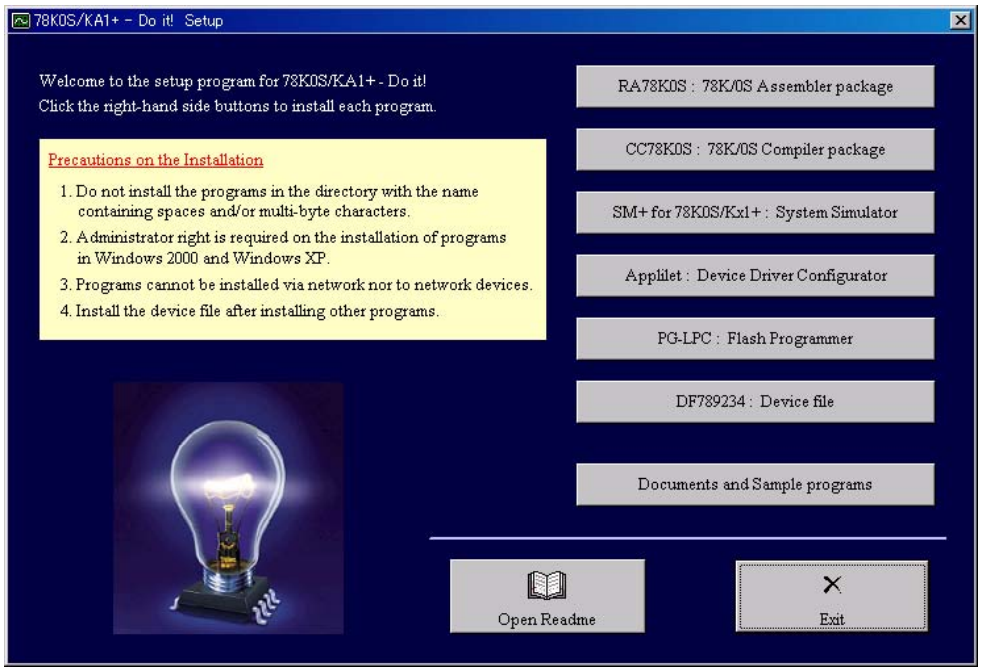


Figure 6-1. *Do it!* Installation Program Window

6.1 Installation of Assembler and Integrated Development Environment PM+

To install the assembler package, which includes integrated development environment PM+, either press the RA78K0S: 78K0S Assembler package button of the *Do it!* installation program, or double-click ra78K0s_wxxx_e.exe from Explorer. This starts the RA78K0S installer.

* The xxx part corresponds to the version number.

1. Check and select the software products to be Installed.

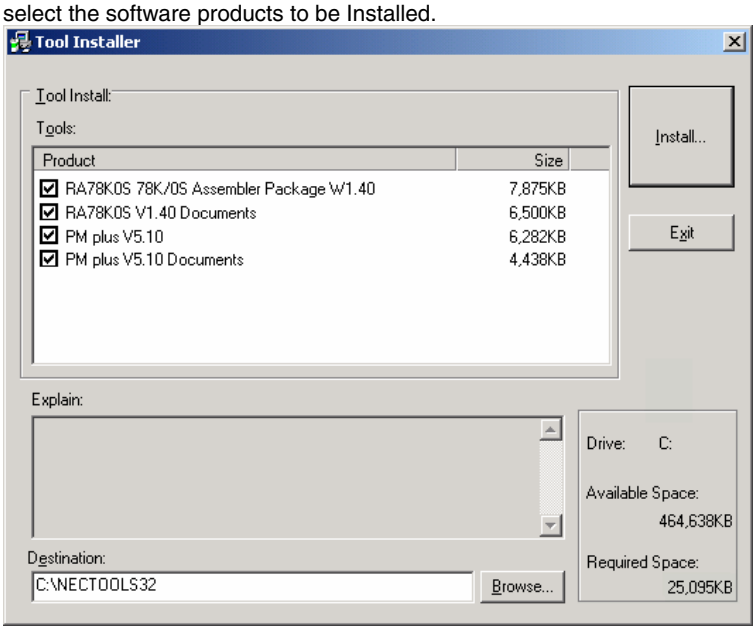


Figure 6-2. RA78K0S Installer Window

2. Specify the installation destination and press the Install... button. The following message is then displayed. Click OK.

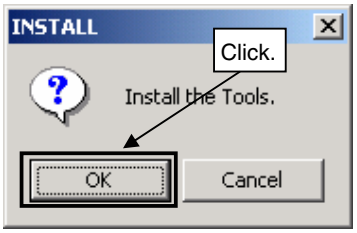


Figure 6-3. Assembler Installation Start Window

3. Once the License Agreement window is displayed, click Yes after reading the contents of the agreement.

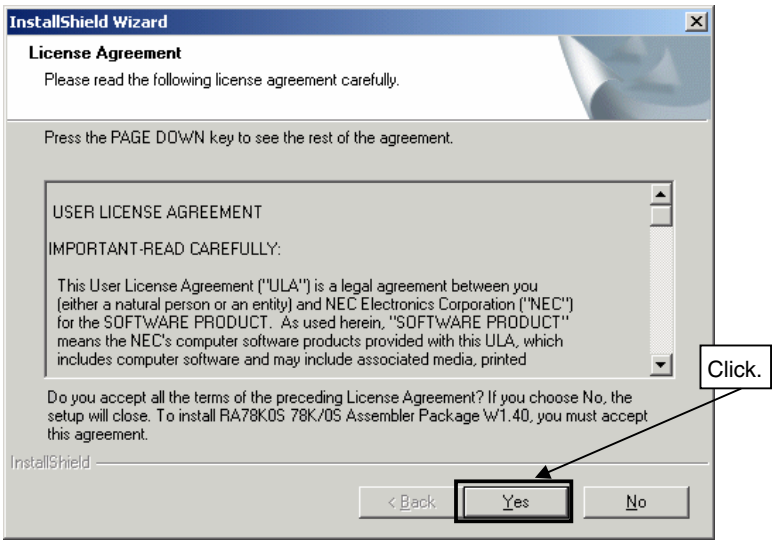


Figure 6-4. License Agreement Window

4. Once the product ID input window is displayed, enter the 9-digit product ID, and then click Next >.
   * For the product ID, refer to the Readme file.

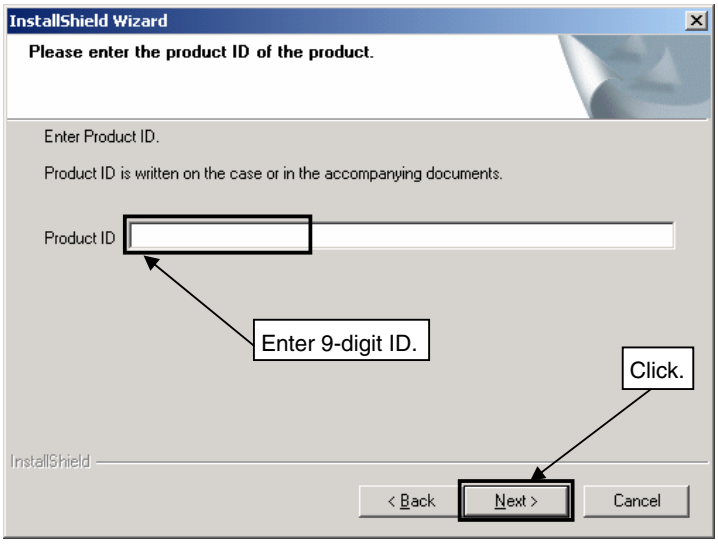


Figure 6-5. Product ID Input Window

5. Once the installation completion message is displayed, click OK.

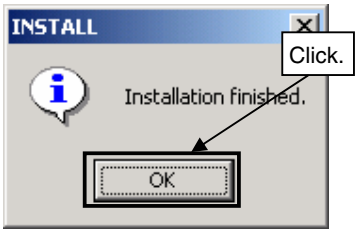


Figure 6-6. Installation Completion Window

6.2 Installation of C Compiler

To perform development in C language, the C compiler must be installed. Either press the CC78K0S: 78K0S Compiler package button in the *Do it!* installation program, or double-click cc78k0s_wxxx_e.exe from Explorer to launch the CC78K0S installation.

* The xxx part corresponds to the version number.

1. Check and select the software products to be installed.

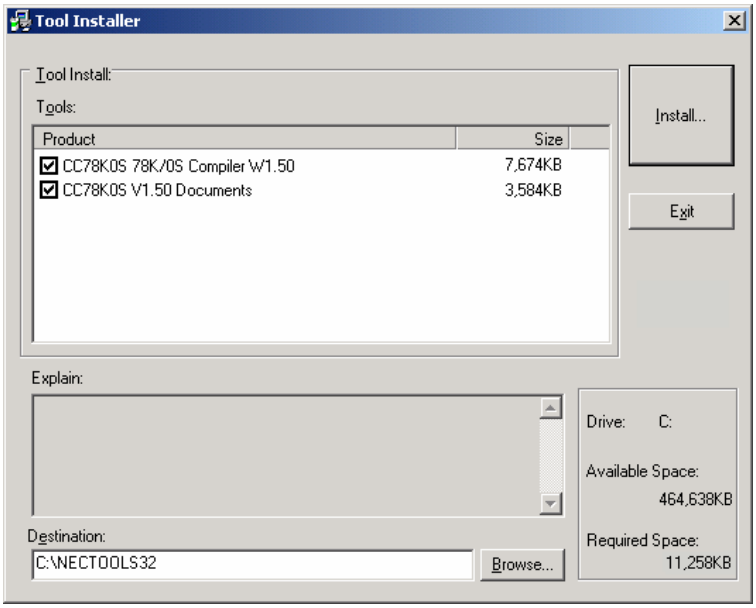


Figure 6-7. CC78K0S Installer Window

2. Specify the installation destination and then press the Install... button. When the following message is displayed, click OK.

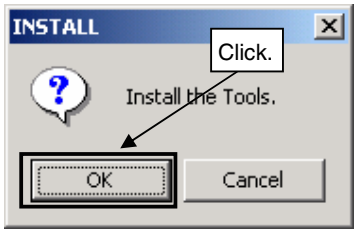


Figure 6-8. C Compiler Installation Start Window

3. Once the license agreement window is displayed, read the agreement and then click Yes.
   * The remainder of the installation procedure is the same as that for the assembler and integrated development environment PM+.
4. The product ID input window is then displayed. Enter the product ID and then click Next >.
   * The product ID of the C compiler differs from that of the assembler and integrated development environment.
5. Once the installation complete message is displayed, click OK.

6.3 Installation of System Simulator

Either press the SM+ for 78K0S/Kx1+: System Simulator button of the *Do it!* installation program, or double-click sm+for78K0s_kx1+_wxxx_e.exe* from Explorer to launch the 78K0S/Kx1+ installer.

* The xxx part corresponds to the version number.

1. Check and select software products to be Installed.

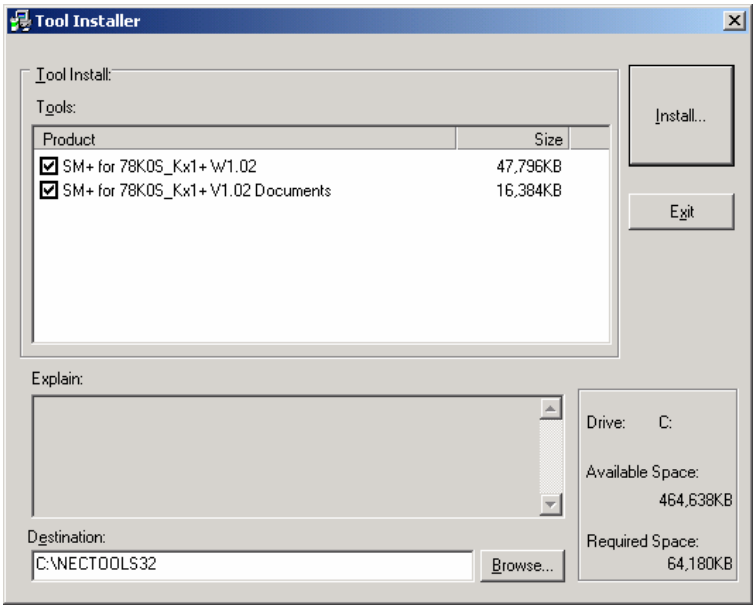


Figure 6-9. SM+ for 78K0S/Kx1+ Installer Window

2. Specify the installation destination and press the Install... button. The following message is then displayed. Click OK.

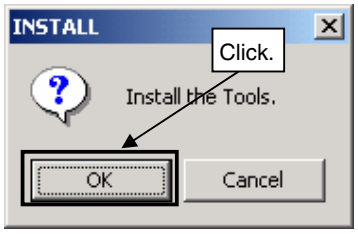


Figure 6-10. System Simulator SM+ Installation Start Window

3. Once the license agreement window is displayed, click Yes after reading the contents of the agreement.
   * The remainder of the installation procedure is the same as that for the assembler and integrated development environment PM+.
4. The product ID input window is then displayed. Enter the product ID and then click Next >.
   * The product ID of the SM+ differs from that of the assembler and integrated development environment, and that of the C compiler.
5. Once the installation complete message is displayed, click OK.

6.4 Installation of Device File

Either press the DF789234: Device file button of the *Do it!* installation program or double-click setup.exe located under the df789234 folder from Explorer to launch the device file installer.

1. The welcome message is displayed. Click Next >.

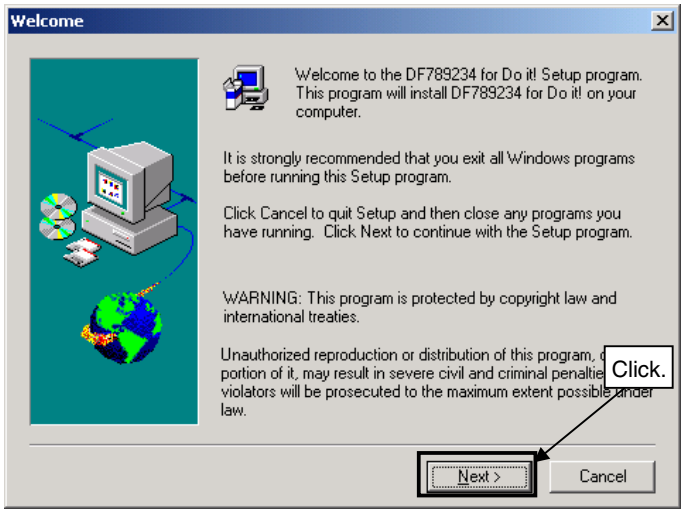


Figure 6-11. Device File Installation Start Window

2. Once the software license window is displayed, click Yes after reading the contents of the license.

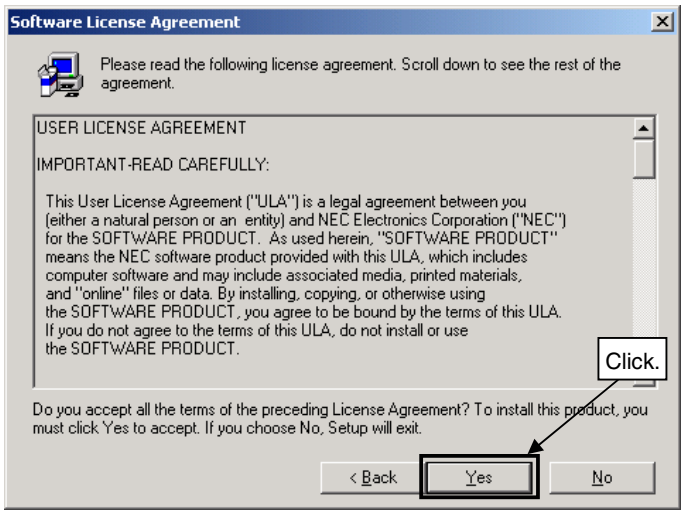


Figure 6-12. Software License Window

3. Select DF789234 in the component selection window and then press the Next > button.

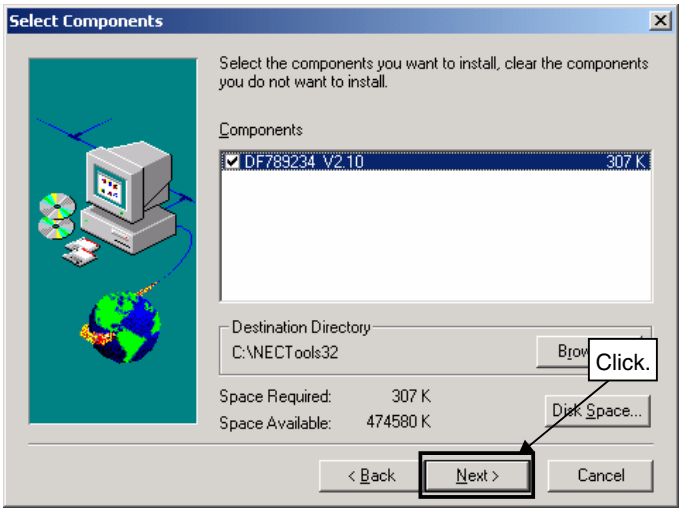


Figure 6-13. Component Selection Window

4. The file copy start window is displayed. Verify the contents and then click Next >.

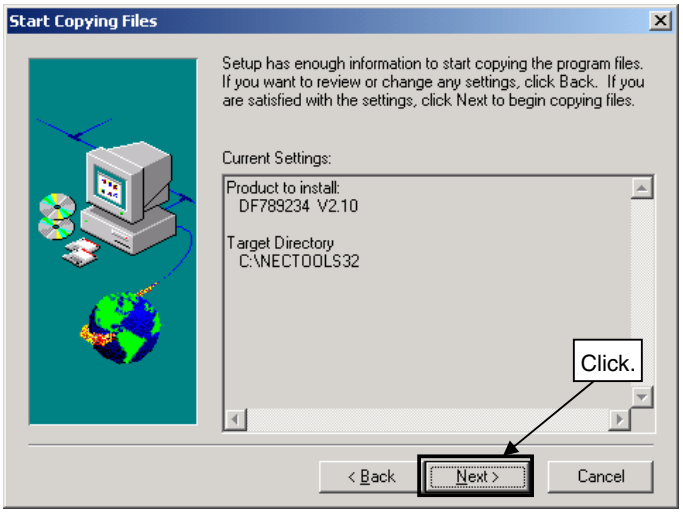


Figure 6-14. File Copy Start Window

5. Once the setup completion window is displayed, click Finish to complete the installation.

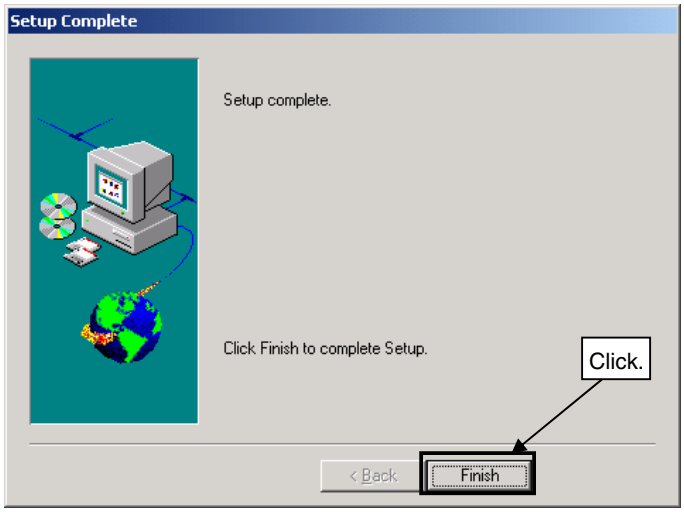


Figure 6-15. Setup Completion Window

6.5 Installation of PG-LPC FLASH Programming GUI

Either press the PG-LPC: FLASH Programmer button of the *Do it!* installation program, or double-click setup.exe located under the pg-lpc folder from Explorer to launch the PG-LPC FLASH programming GUI installer.

1. Once the setup program is launched, click Next >.

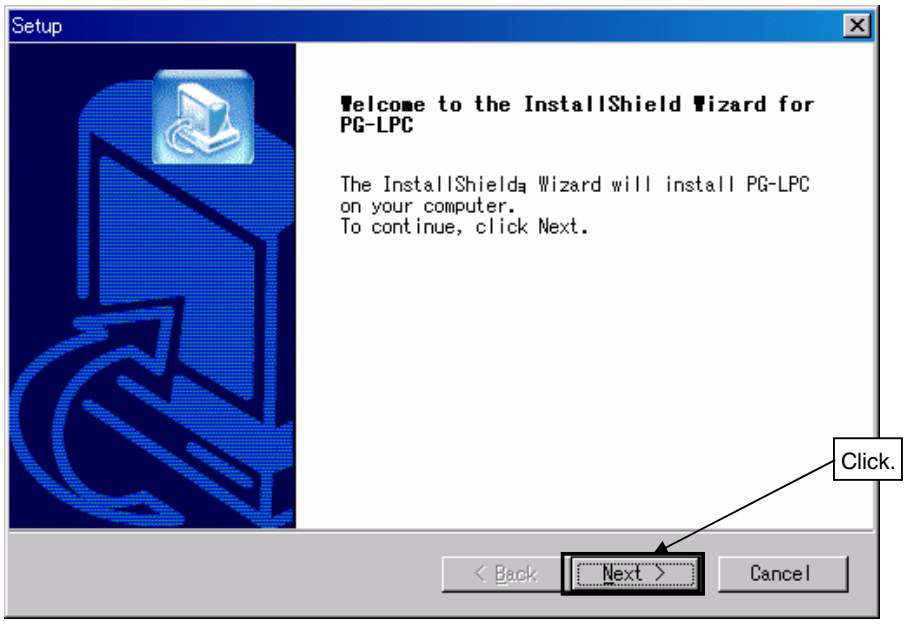


Figure 6-16. PG-LPC Setup Start Window

2. The following window is displayed, showing the license agreement. After reading the contents of the license agreement, click Accepted.

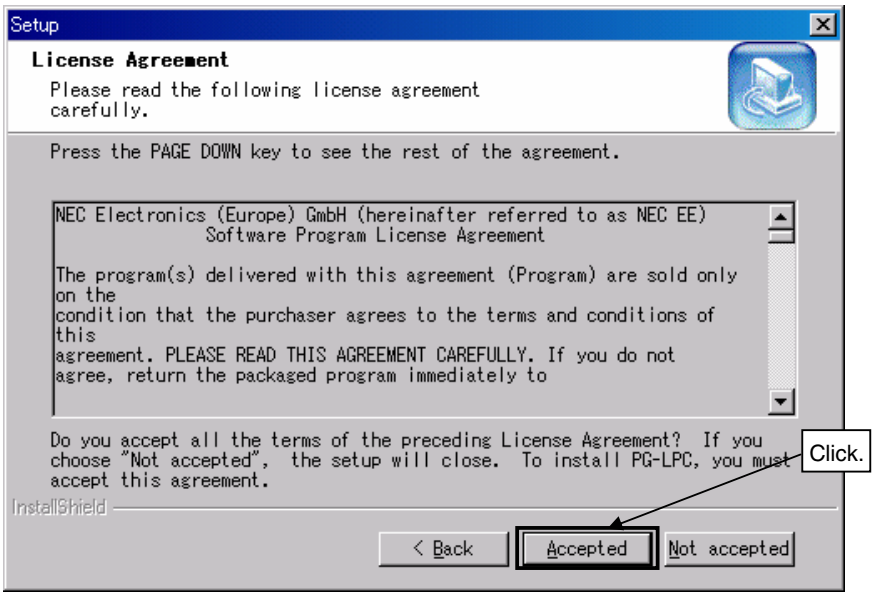


Figure 6-17. License Agreement Window

3. Next, the window for specifying the location where the PG-LPC GUI software is to be installed is displayed. The default installation destination is C:\Program Files\NECTools32\PG-LPC. To use this default, click Next >. To change the installation destination, click Browse... and change the installation destination.

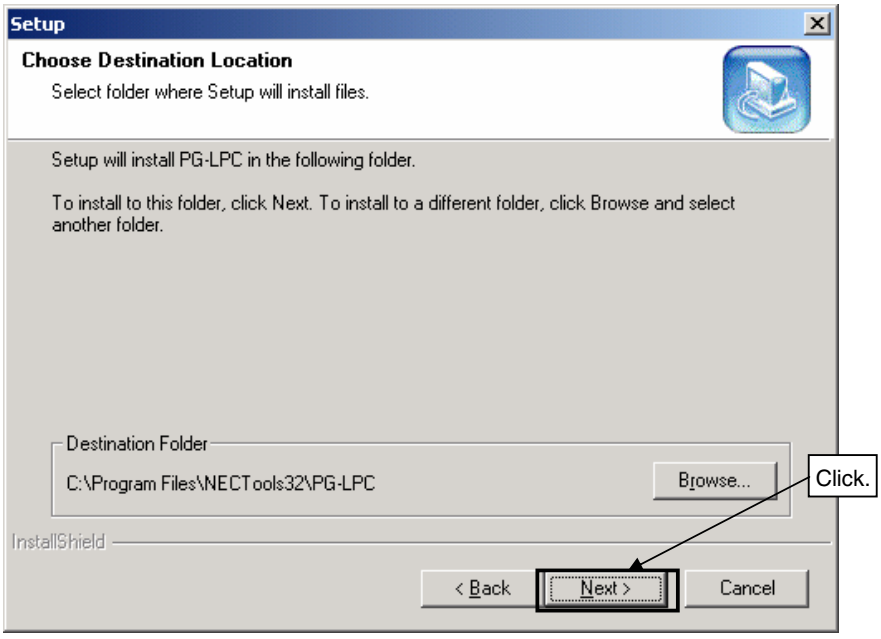


Figure 6-18. Installation Destination Specification Window

4. The window for specifying the installation destination for the program menu is displayed. Click Next >.

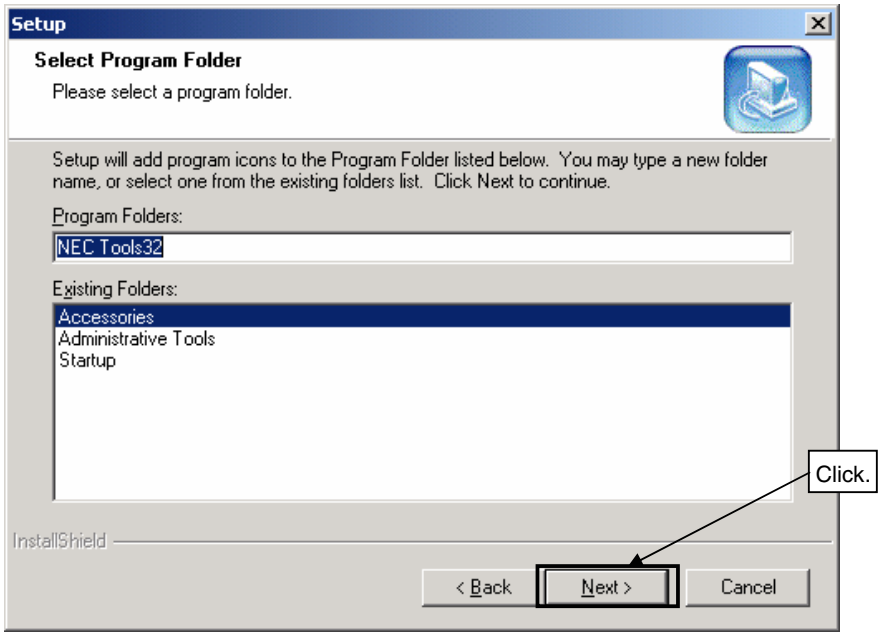


Figure 6-19. Program Folder Selection Window

5. The window for confirming the installation destination is displayed. If the set items are correct, click Next >.

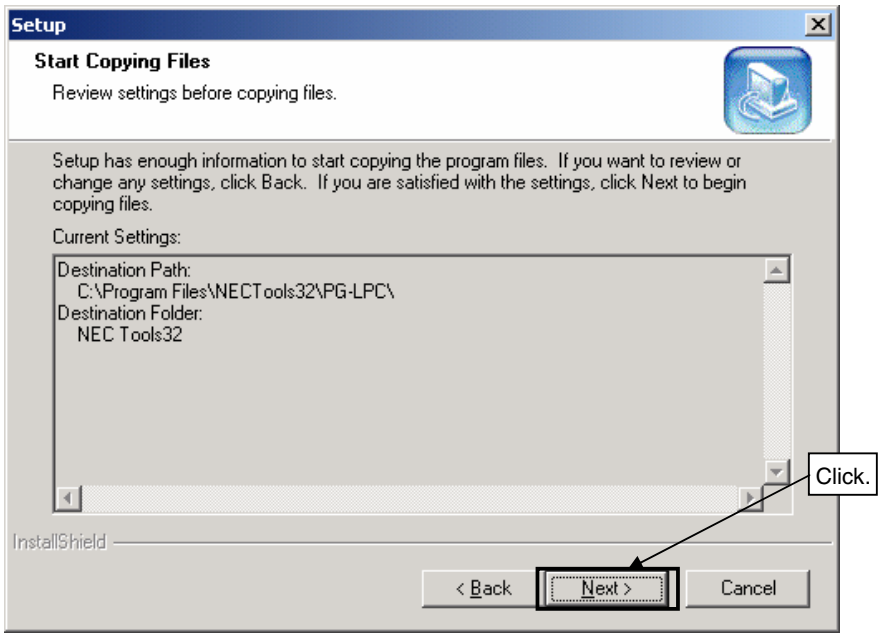


Figure 6-20. File Copy Start Window

6. File copying starts. When file copying is completed, click Finish > to complete the installation procedure.

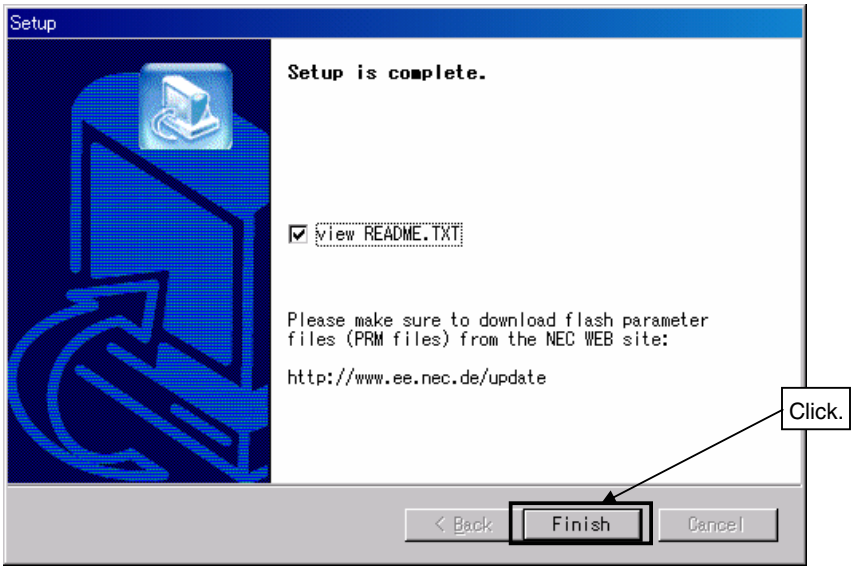


Figure 6-21. Setup Completion Window

During the PG-LPC GUI installation, the parameter file for KA1+ (μPD78F9222) is automatically installed to <PG-LPC install-path>\PRM folder. The latest version of the parameter file (PRM78F9234) can be downloaded from the following NEC Electronics microcontroller website.

http://www.necel.com/micro/ods/eng/index.html

* Download PRM78F9234 by following [ParameterFile PG-FP4 PG-FPLx] and [ParameterFile PG-FP4 PG-FPLx For 78K0S Series] from Development tools download (ODS) (above URL).

6.6 Driver Installation

When *78K0S/KA1+ - Do it!* board is used, the driver needs to be installed on the host machine. After the PG-LPC FLASH programming software has been installed successfully a new folder "C:\Program Files\NECTools32\PG-LPC\DRIVERS" was generated, containing the necessary drivers. Install the driver according to the following procedure:

Installation on Windows 98SE/Me ..... Page 27
Installation on Windows 2000 ..... Page 29
Installation on Windows XP ..... Page 35

6.6.1 Installation on Windows 98SE/Me

1. When the *78K0S/KA1+ - Do it!* board is connected with the host machine, the board is recognized by Plug and Play, and the wizard for adding new hardware is started. Click Next >.

Figure 6-22. Add New Hardware Wizard (Windows 98SE)

2. The window below is displayed. So, check that "Search for a suitable driver ..." is selected, then click Next >.

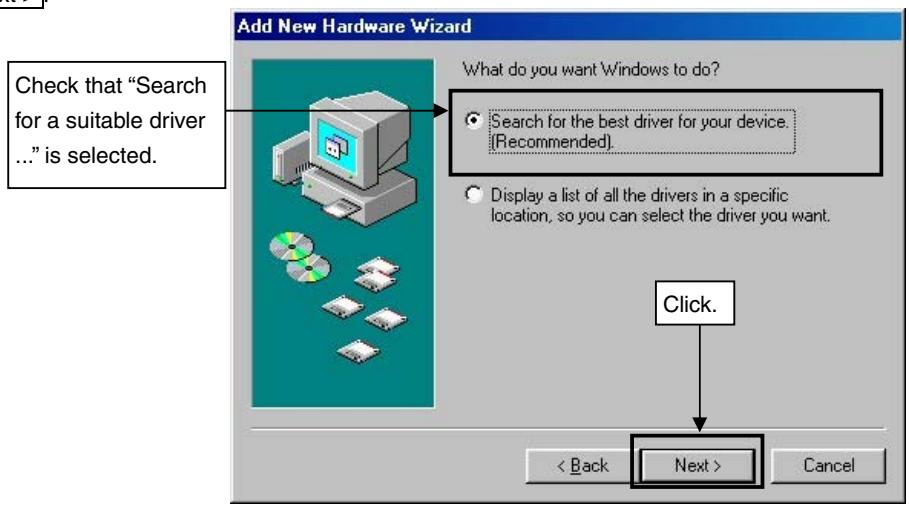


Figure 6-23. Search Method (Windows 98SE)

3. Check the “Specify a location” check box only and enter “C:\Program Files\NECTools32\PG-LPC\DRIVERS” in the address bar, then click Next >.

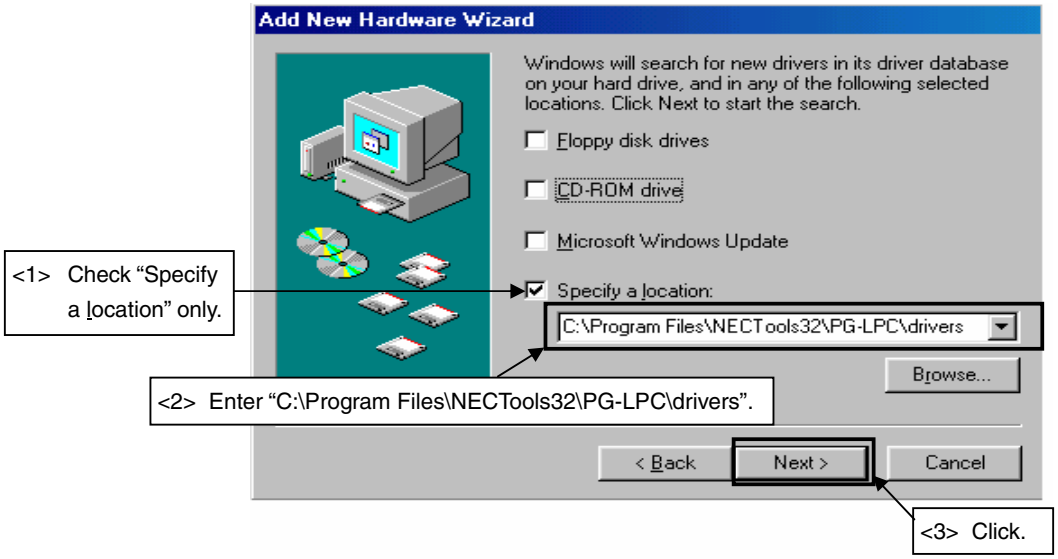


Figure 6-24. Search Location Specification (Windows 98SE)

Remark If the installation destination folder is changed at the time of PG-LPC software installation, enter “new-folder\PG-LPC\DRIVERS”.

4. The window below is displayed. Click Next >.

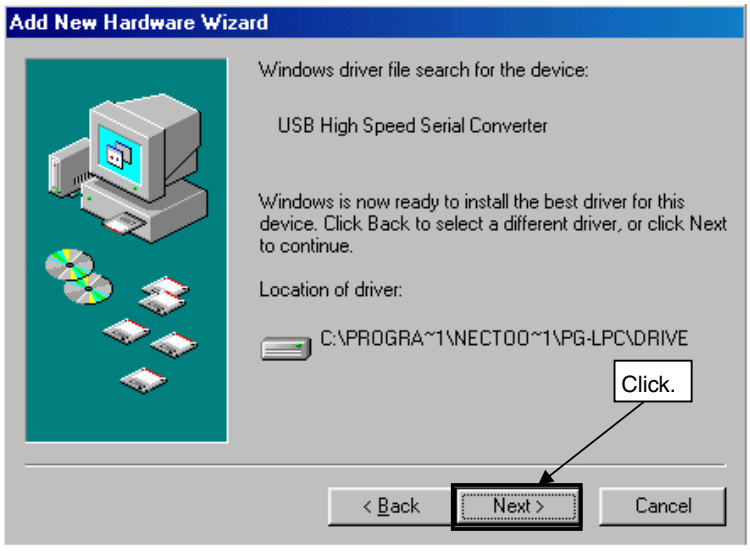


Figure 6-25. Checking Driver to Be Installed (Windows 98SE)

5. When the window below is displayed, the installation of the USB driver is completed. Click Finish. The installation of the USB Serial Port driver is then automatically performed.

Figure 6-26. Installation Completion (Windows 98SE)

6.6.2 Installation on Windows 2000

1. When the *78K0S/KA1+ - Do it!* board is connected with the host machine, the board is recognized by Plug and Play, and the wizard for finding new hardware is started. Click Next >.

Figure 6-27. Found New Hardware Wizard 1 (Windows 2000)

2. The window below is displayed. So, check that “Search for a suitable driver ...” is selected, then click Next >.

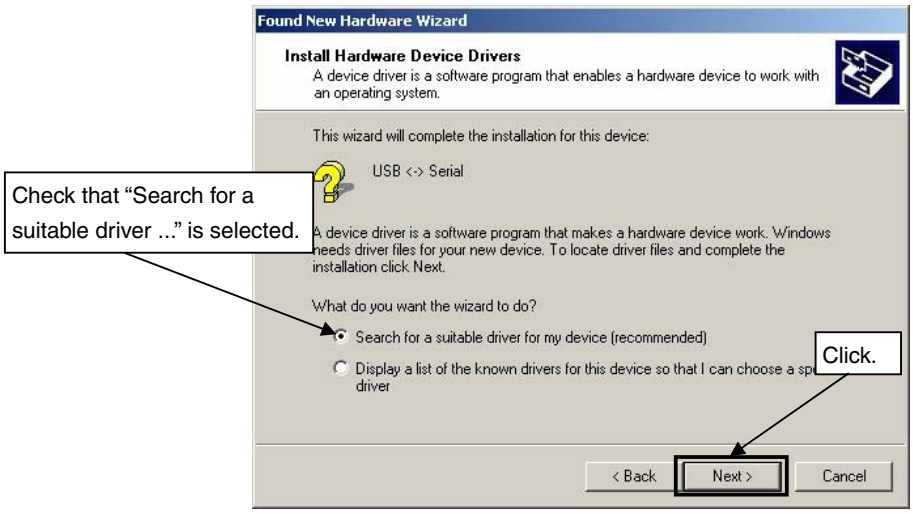


Figure 6-28. Search Method 1 (Windows 2000)

3. Check the “Specify a location” check box only, then click Next >.

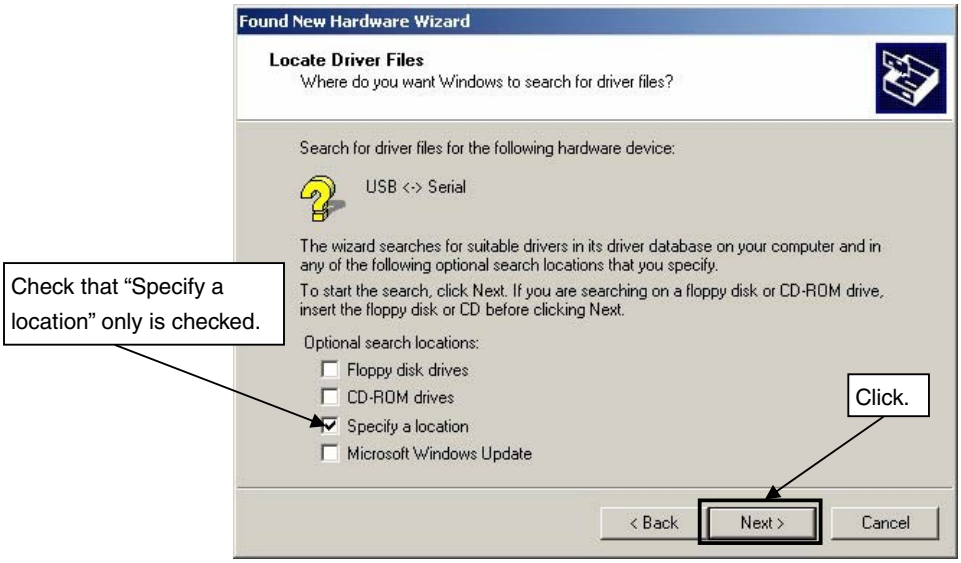


Figure 6-29. Driver File Location 1 (Windows 2000)

4. Enter “C:\Program Files\NECTools32\PG-LPC\DRIVERS” in the address bar, then click OK.

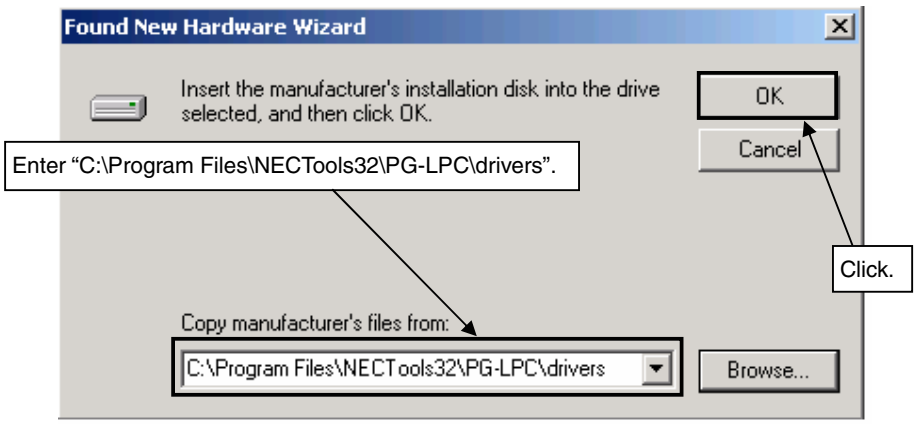


Figure 6-30. Address Specification 1 (Windows 2000)

Remark If the installation destination folder is changed at the time of PG-LPC GUI software installation, enter “new-folder\PG-LPC\DRIVERS”.

5. Click Next >.

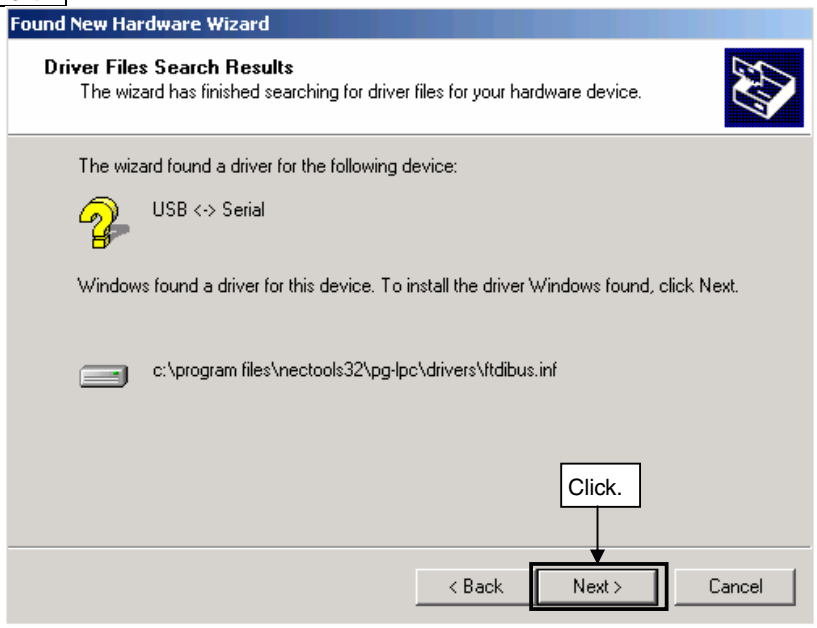


Figure 6-31. Driver File Search 1 (Windows 2000)

6. Click Finish to complete the installation of the USB driver.

Figure 6-32. USB Driver Installation Completion 1 (Windows 2000)

7. Proceed to the installation of the USB Serial Port driver. Click Next >.

Figure 6-33. Found New Hardware Wizard 2 (Windows 2000)

8. The window below is displayed. So, check that “Search for a suitable driver ...” is selected, then click Next >.

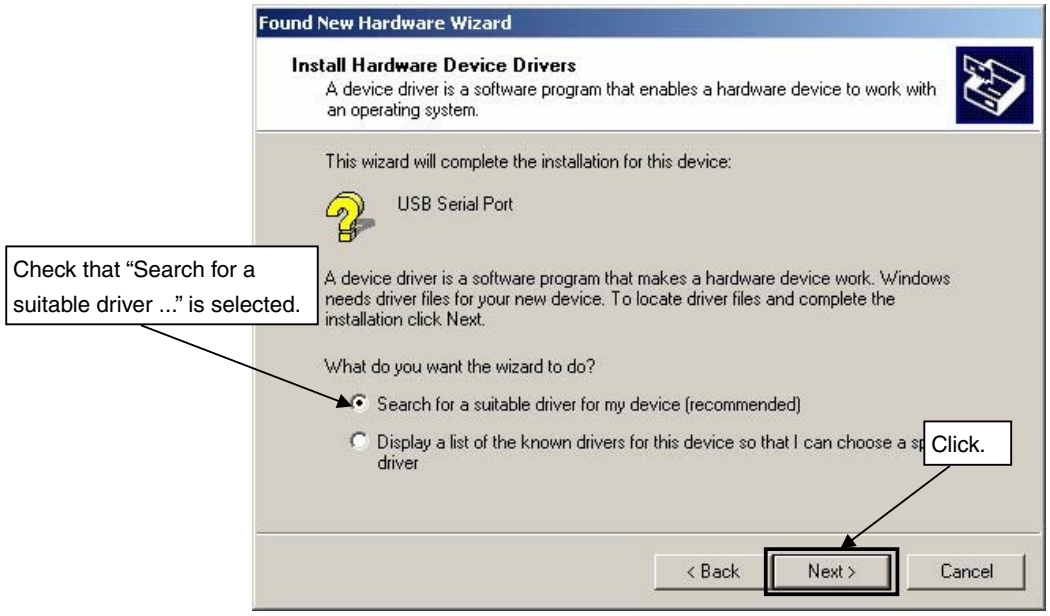


Figure 6-34. Search Method 2 (Windows 2000)

9. Check the “Specify a location” check box only, then click Next >.

Figure 6-35. Driver File Location 2 (Windows 2000)

10. Enter “C:\Program Files\NECTools32\PG-LPC\DRIVERS” in the address bar, then click OK.

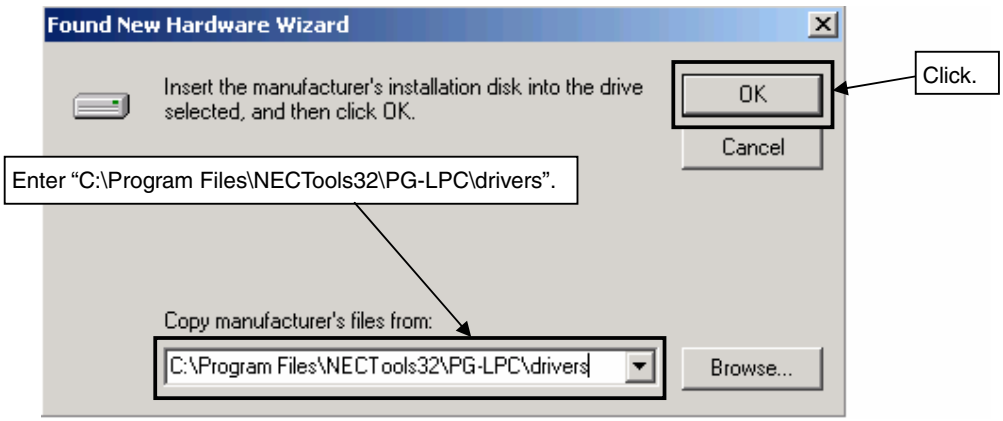


Figure 6-36. Address Specification 2 (Windows 2000)

Remark If the installation destination folder is changed at the time of PG-LPC GUI software installation, enter “new-folder\PG-LPC\DRIVERS”.

11. Click Next >.

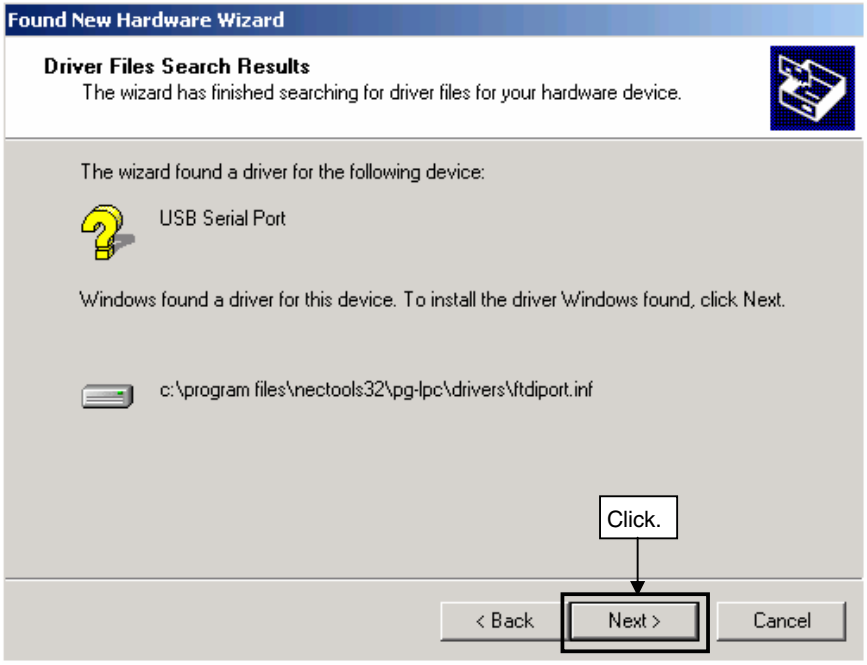


Figure 6-37. Driver File Search 2 (Windows 2000)

12. Click Finish to complete the installation of the USB driver.

Figure 6-38. USB Driver Installation Completion 2 (Windows 2000)

6.6.3 Installation on Windows XP

1. When the *78K0S/KA1+ - Do it!* board is connected with the host machine, the board recognized by Plug and Play, and the wizard for finding new hardware is started. Check that “Install from a list or specific ...” is selected, then click Next >.

Figure 6-39. Found New Hardware Wizard 1 (Windows XP)

2. Check that “Search for the best driver in these locations.” is selected. Check the “Include this location in the search:” check box and enter “C:\Program Files\NECTools32\PG-LPC\DRIVERS” in the address bar, then click Next >.

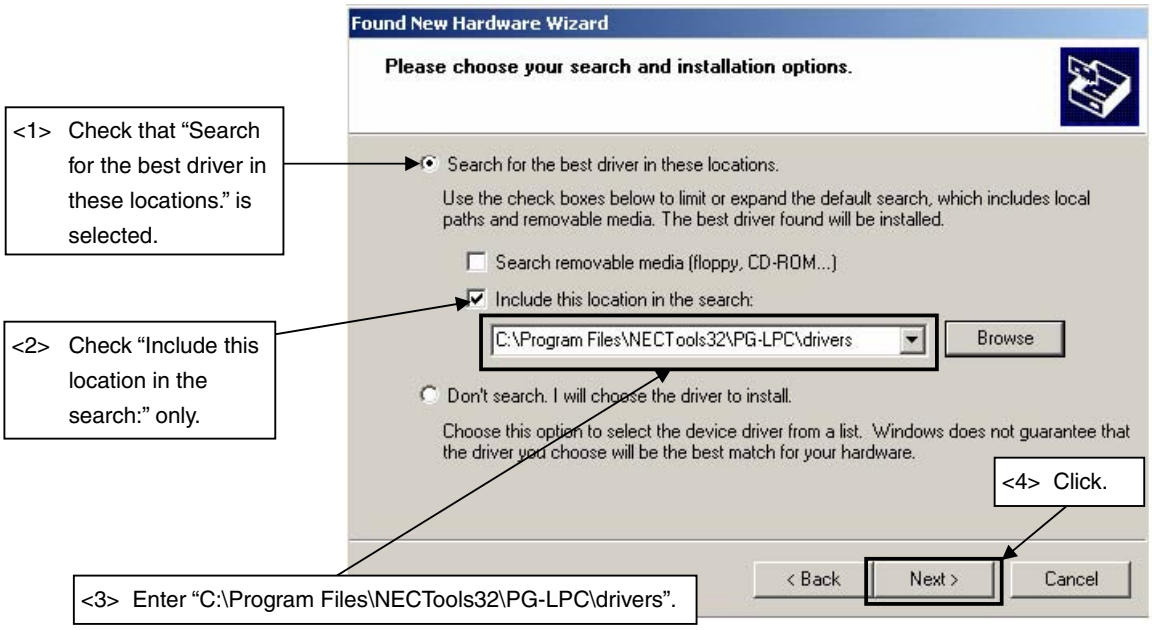


Figure 6-40. Search Location Specification 3 (Windows XP)

3. As shown below, “has not passed Windows Logo testing to verify its compatibility with Windows XP.” is displayed. Click Continue Anyway.

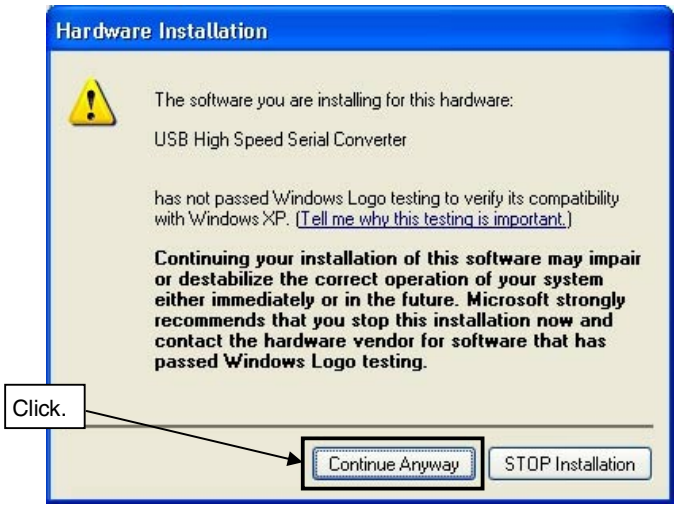


Figure 6-41. Windows XP Logo Testing 3 (Windows XP)

4. When the window below is displayed, the installation of the USB driver is completed. Click Finish.

Figure 6-42. USB Driver Installation Completion 1 (Windows XP)

5. Proceed to the installation of the USB Serial Port driver. Click Next >.

Figure 6-43. Found New Hardware Wizard 2 (Windows XP)

6. Check that “Search for the best driver in these locations.” is selected. Check the “Include this location in the search:” check box and enter “C:\Program Files\NECTools32\PG-LPC\DRIVERS”, then click Next >.

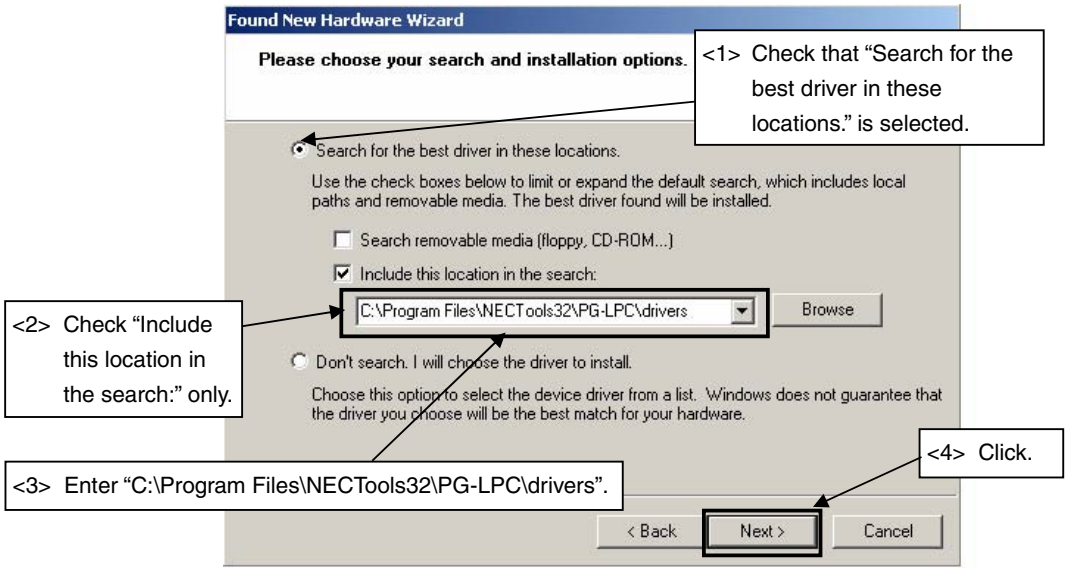


Figure 6-44. Search Location Specification 2 (Windows XP)

7. As shown below, “has not passed Windows Logo testing to verify its compatibility with Windows XP.” is displayed. Click Continue Anyway.

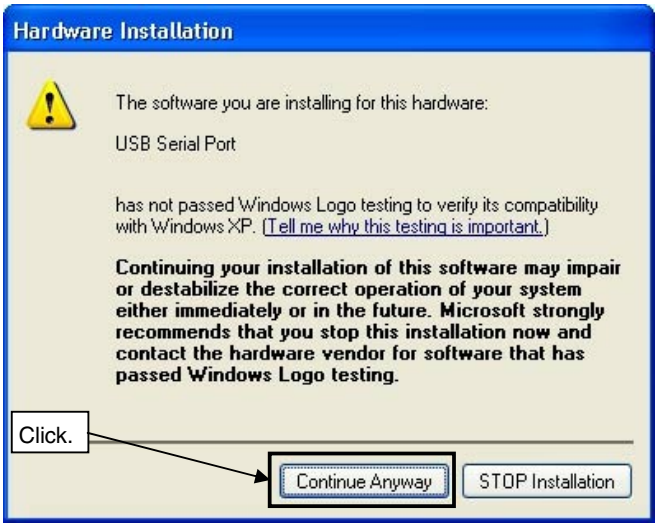


Figure 6-45. Windows XP Logo Testing 2 (Windows XP)

8. When the window below is displayed, the installation of the USB driver is completed. Click Finish.

Figure 6-46. USB Serial Port2 Driver Installation Completion (Windows XP)

6.7 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 *78K0S/KA1+ - Do it!* board, the information to be checked here is needed.

By clicking the “Device Manager” tab, check that the drivers are installed correctly.

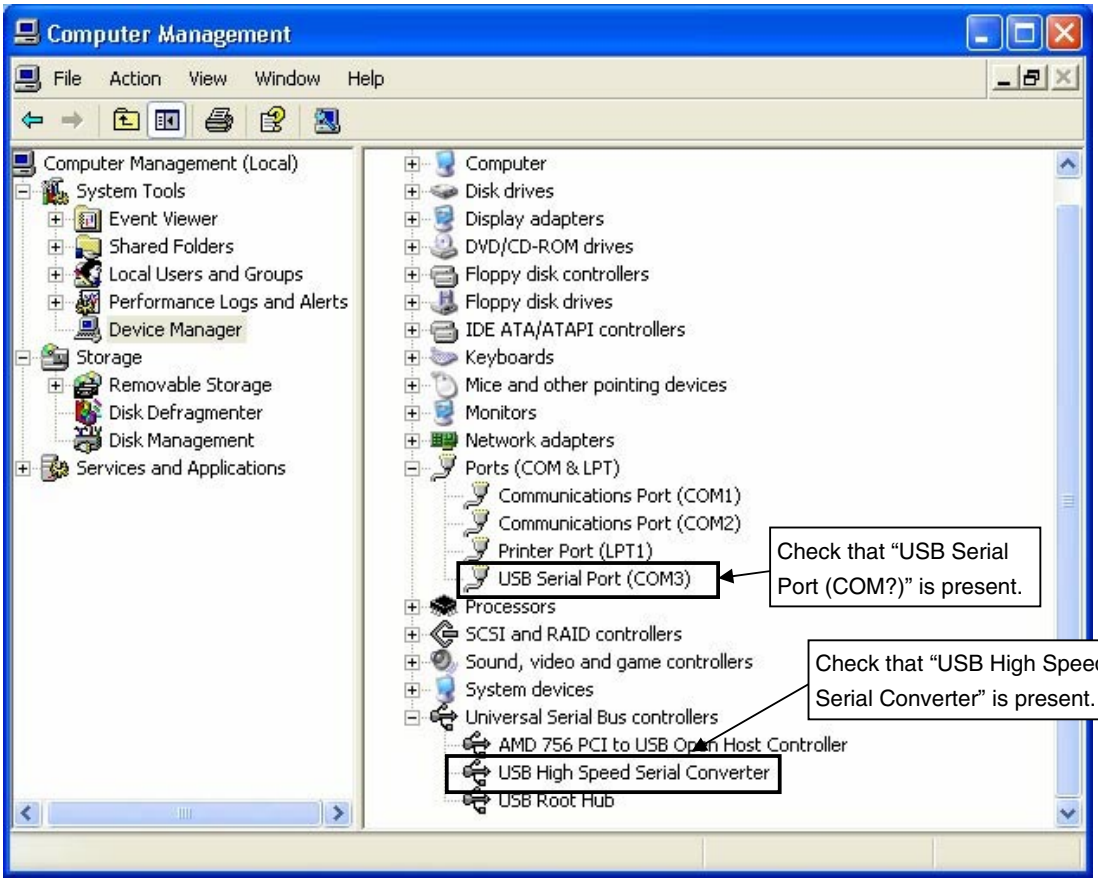


Figure 6-47. Device Manager

For Windows 98SE/Me

Caution	Do not select Update and Erase when communicating with the *78K0S/KA1+ - Do it!* board.

For Windows 2000/XP

Caution	Do not perform “Hardware Modification Scan” when communicating with the *78K0S/KA1+ - Do it!* board.

Remark In the GUI port list box, the same communication port as COM? of USB Serial Port (COM?) needs to be selected.

If the drivers above are not displayed, or the mark “×“ or “!” is prefixed, refer to chapter **10 TROUBLESHOOTING**.

6.8 Driver Uninstallation

The driver uninstallation program is installed on the host machine when the PG-LPC software is installed.

Use the procedure below for driver uninstallation.

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

2. Double-click in the order from “My Computer” to “(C:)” to “Program Files” to “NECTools32” to “PG-LPC” to “DRIVERS”. “Ftdiunin.exe” is displayed. Double-click “Ftdiunin.exe”.

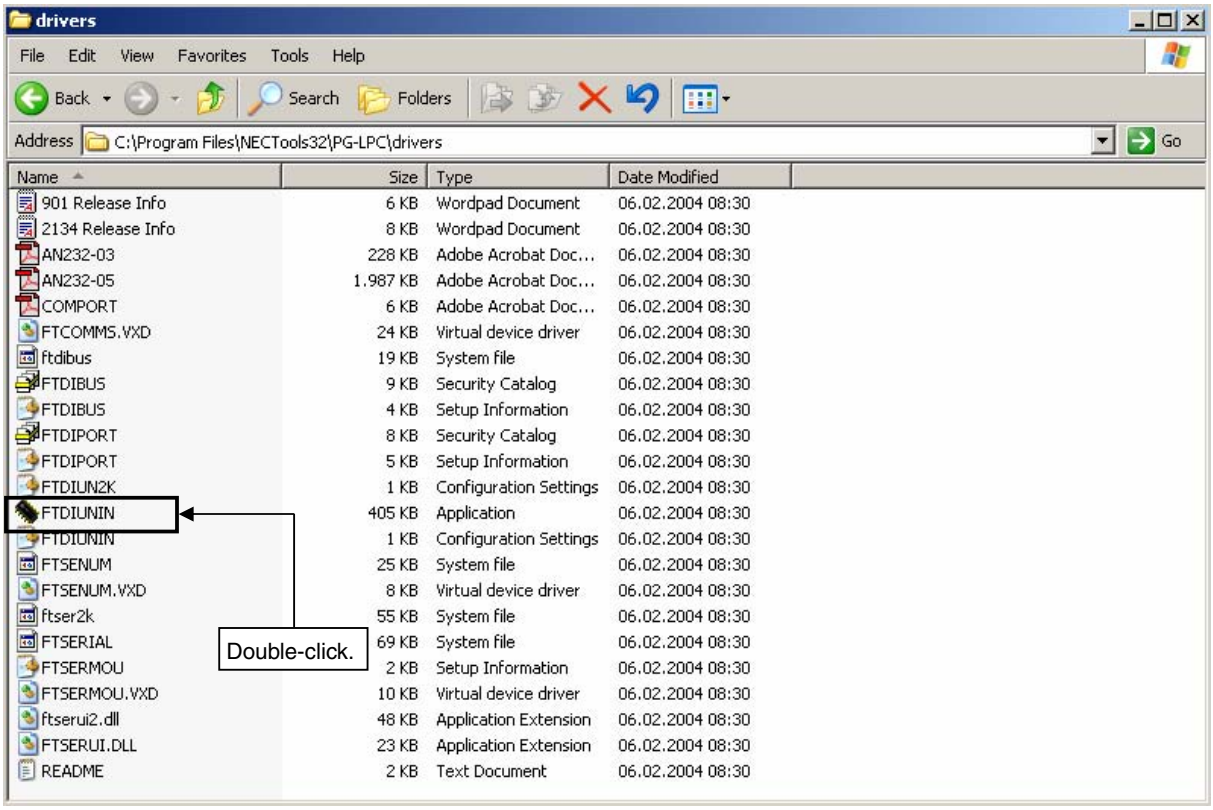


Figure 6-48. Driver Uninstallation

3. Click Continue.

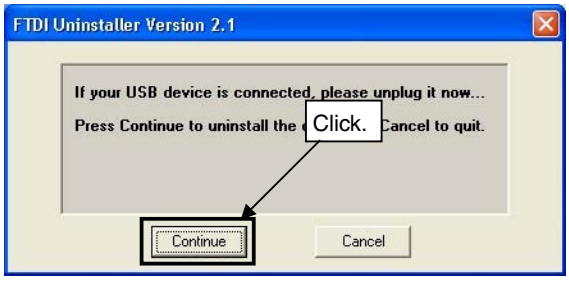


Figure 6-49. Driver Uninstaller

4. Click Finish to complete driver uninstallation.

Figure 6-50. Completion of Driver Uninstallation

Caution	If the PG-LPC software is uninstalled earlier, “Ftdiunin.exe” is also deleted. In such a case, delete “USB Serial Port (COM?)” and “USB High Speed Serial Converter” from Device Manager manually.

7. INTEGRATED DEVELOPMENT ENVIRONMENT PM+ AND SYSTEM SIMULATOR SM+

This chapter describes the basic operation of integrated development environment PM+ and system simulator SM+ for 78K0S_Kx1+ (hereafter, SM+), using the execution of a sample program. The environment assumed in this chapter is described below.

Used sample name: Light_Demo
Used workspace: Light_Demo.prw
Sample program folder: C:\SamplePrograms\Light_Demo

* For the sample program details, refer to chapter 11. It is assumed that the sample program will be copied from the CD-ROM and expanded in the above-listed folder. If it is copied and expanded to a different folder, read the path accordingly.

7.1 Start and Compilation of PM+

1. Start PM+. In the case of the regular installation method, PM+ can be started by clicking Start - Program - NECTools32 - PMplus.

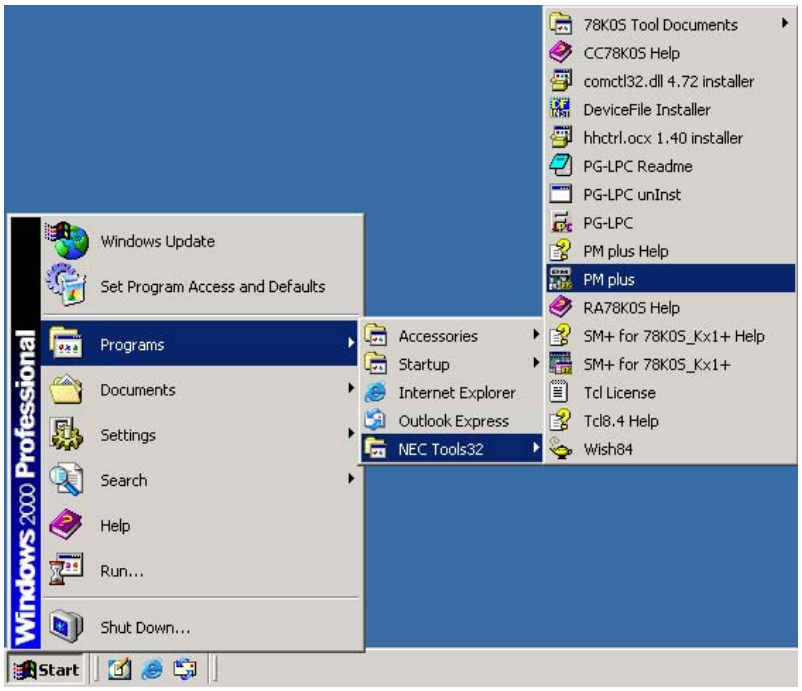


Figure 7-1. PM+ Startup

2. Once PM+ is started, a window such as the one shown in Figure 2 is displayed. Click File - Open Workspace from the pull-down menu and open the workspace selection dialog box.

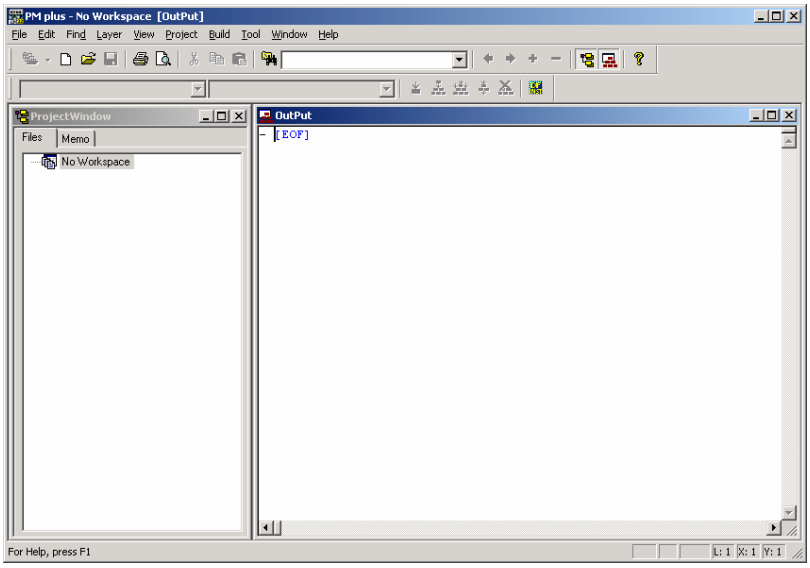


Figure 7-2. PM+ Startup

3. Specify C:\SamplePrograms\Light_Demo\Light_Demo.prw and then click Open.

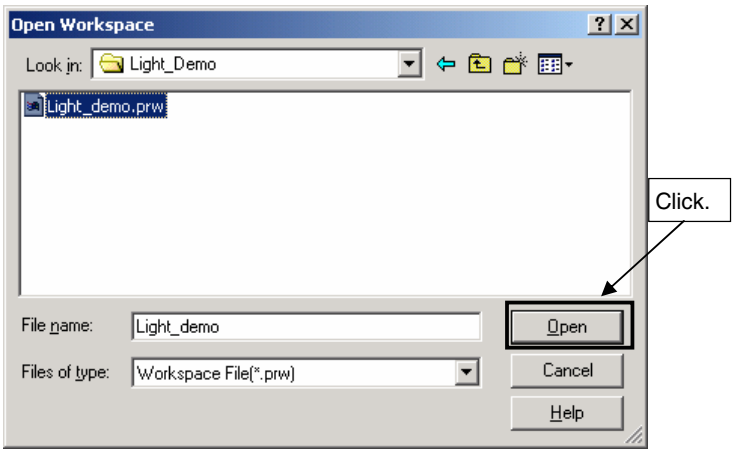


Figure 7-3. Workspace Selection Dialog Box

4. A list of the related files and functions is displayed in the Project Window. When a file or function is clicked, a description of that file or function is displayed in the source window. To edit a program, write directly in the source window.

5. To perform program compilation and assembly, click (build icon).

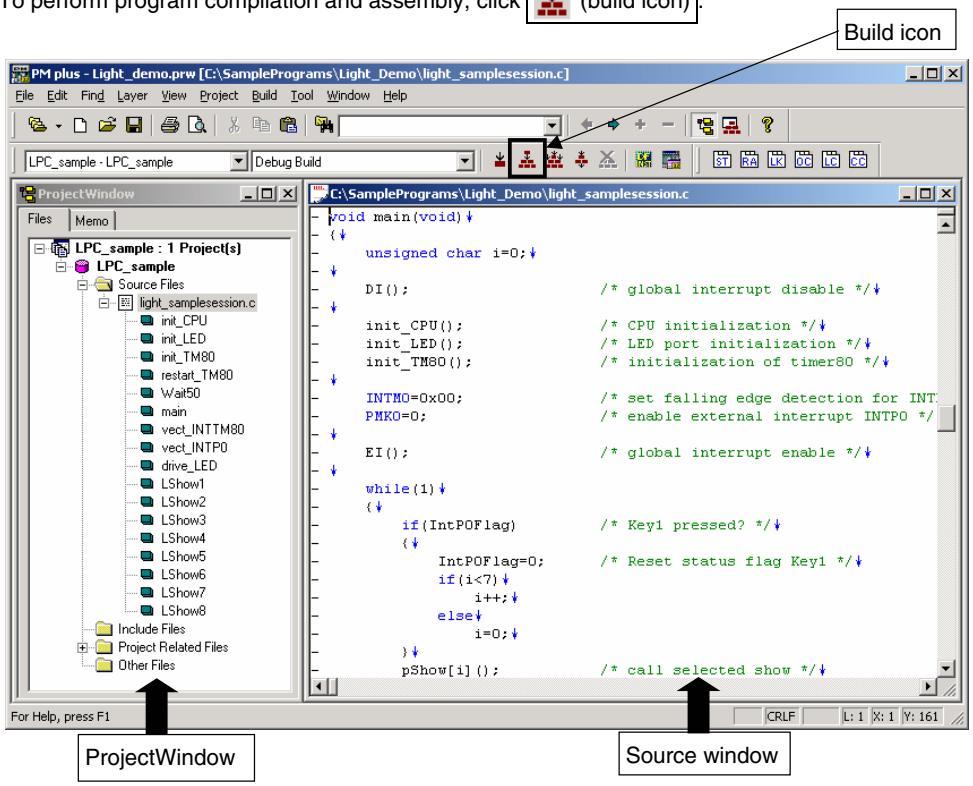


Figure 7-4. PM+ Configuration and Compilation

6. Once compilation and assembly are completed, “Build completed normally.” is displayed. Click the OK button. If an error occurred, “A build error was found.” is displayed. In this case, correct the error by referring to the message in the Output window.

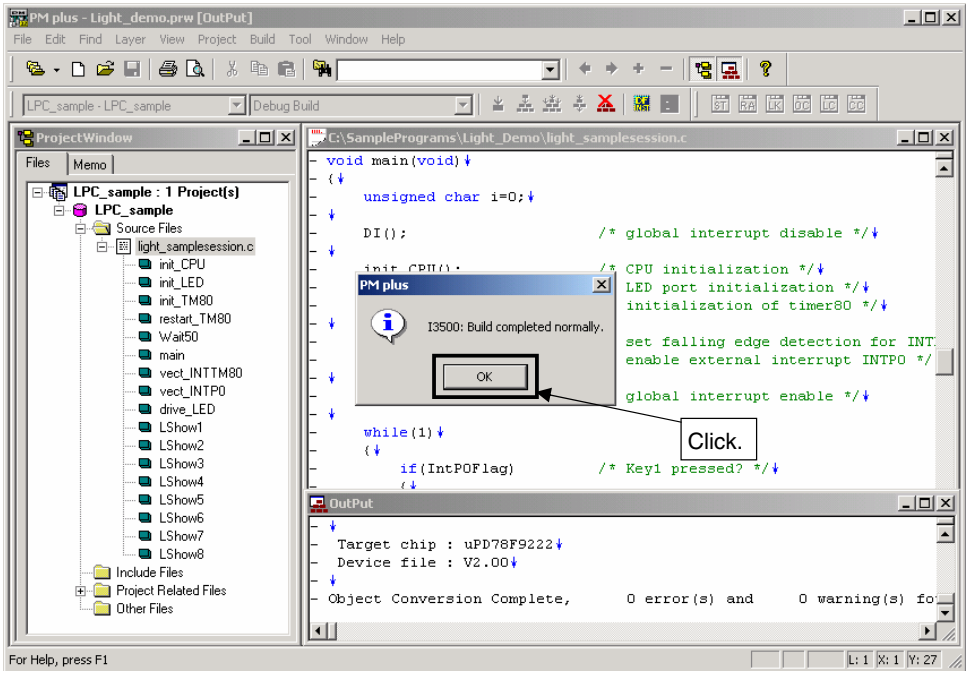


Figure 7-5. Compilation and Assembly Results

7.2 SM+ Startup and Simulation Execution

1. To start SM+, click  Simulator Start Icon of PM+.

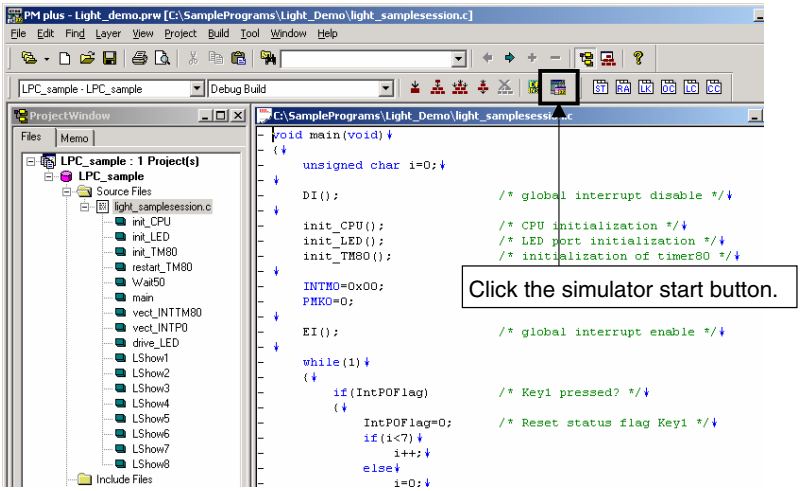
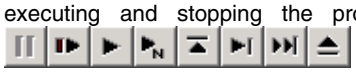


Figure 7-6. SM+ Start

2. Once SM+ has started, a window such as the one shown in Figure 7 is displayed. Operations such as executing and stopping the program are performed by clicking the various execution buttons  displayed in the top left part of the screen.

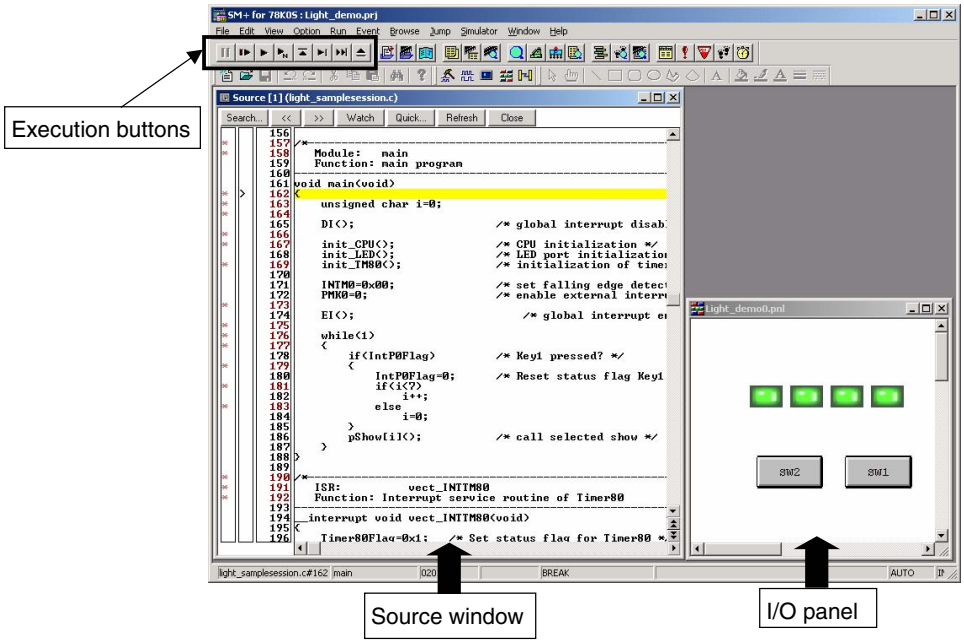


Figure 7-7. SM+ Configuration

3. To execute the program, press the  button. Once execution starts, the cursor in the source window can be used and the location of the source file that is executed can be checked. The I/O panel shows a simulation of the operation of the pins and peripherals according to the program that is currently being executed.
4. To pause the program execution, press the  button, and to perform step execution, press the  button.

* For the detailed use of PM+ and SM+, refer to the online document for each of these products.

8. PG-LPC FLASH PROGRAMMING SOFTWARE

8.1 Starting up GUI Software

- GUI software startup
  Select PG-LPC.EXE from the start menu to start the PG-LPC GUI software.

  When the GUI software is started normally, the following screen appears.

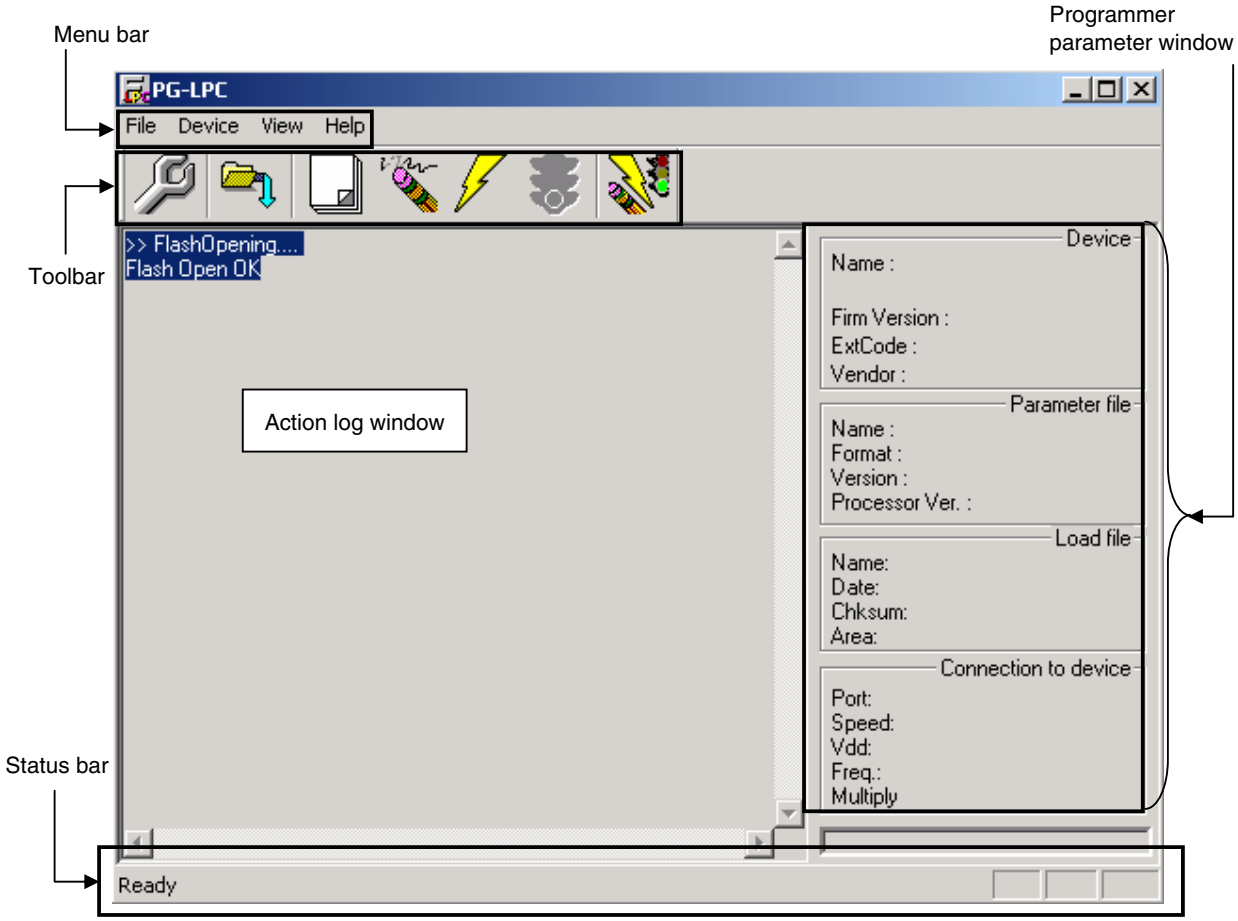


Figure 8-1. PG-LCP GUI Software Main Window

This window consists of the following items:

Table 8-1. Window Names and Functions

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 an PG-LPC action log.
Programmer parameter window (displayed to the right of the action log window)	Displays programming parameter settings.
Status bar	Displays status.

8.2 Toolbar

The toolbar contains buttons for starting the important procedures of the PG-LPC.

Table 8-2. Toolbar Buttons

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

8.3 Menu Bar

Depending on the actual device status and device type, some menu items may be enabled or disabled.

8.3.1 [File] menu

Clicking the [File] menu displays the pull-down menu as shown below.

This menu mainly contains commands related to file operation.

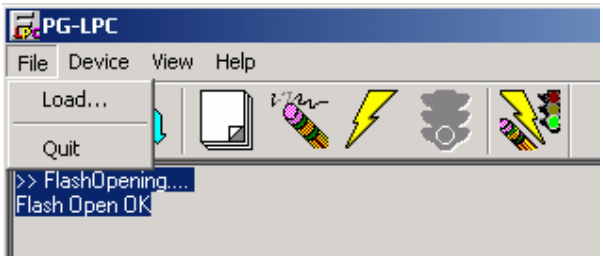


Figure 8-2. [File] Menu

(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.

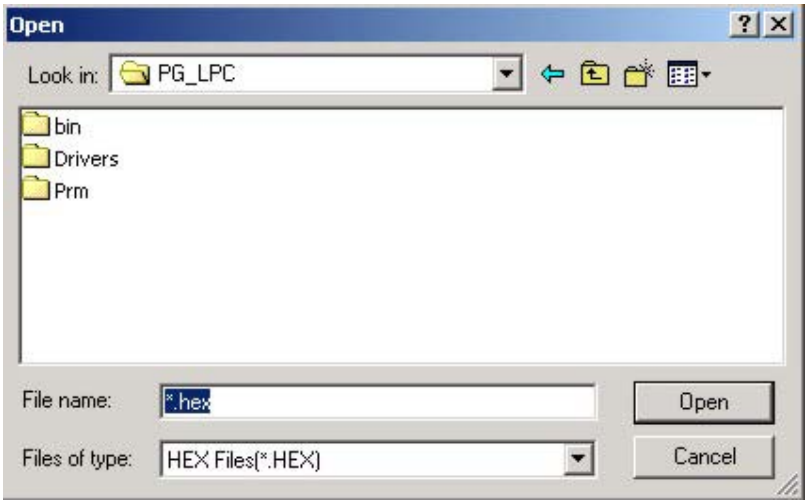


Figure 8-3. HEX File Selection Window

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.

[Open button]

Selects a user program as a program to be written to the target device.

[Cancel button]

Closes the window without selecting a program.

(2) [Quit] command

The [Quit] menu is the command for terminating the PG-LPC GUI software. Clicking ⊠ on the right side of the task bar also terminates the PG-LPC GUI software.

User settings are saved in the PG-LPC.INI[Note] file, so that the GUI software starts up next time with the same settings.

Note 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.

8.3.2 [Device] menu

Clicking the [Device] menu displays the pull-down menu as shown below.

This menu mainly contains commands for programming operations such as blank check, deletion and programming of the target device.

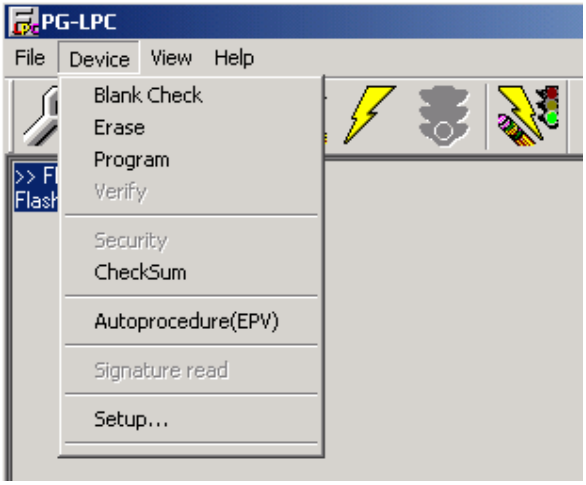


Figure 8-4. [Device] Menu

(1) [Blank Check] command

The [Blank Check] command allows you to make a blank check on the 78K0S/KA1+ target device 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.

(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.

The execution on 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.

(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.

(4) [Verify] command

This command is not supported.

(5) [Security] command

This command is not supported.

(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.

(7) [Autoprocedure(EPV)] command

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

(8) [Signature read] command

This command is not supported.

(9) [Setup] command

The [Setup] menu 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 [Setup] menu allows you to modify the settings of items other than those items consisting of shadowed characters according to the user environment.

(a) Standard setup

This menu 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. The window shown below is opened.

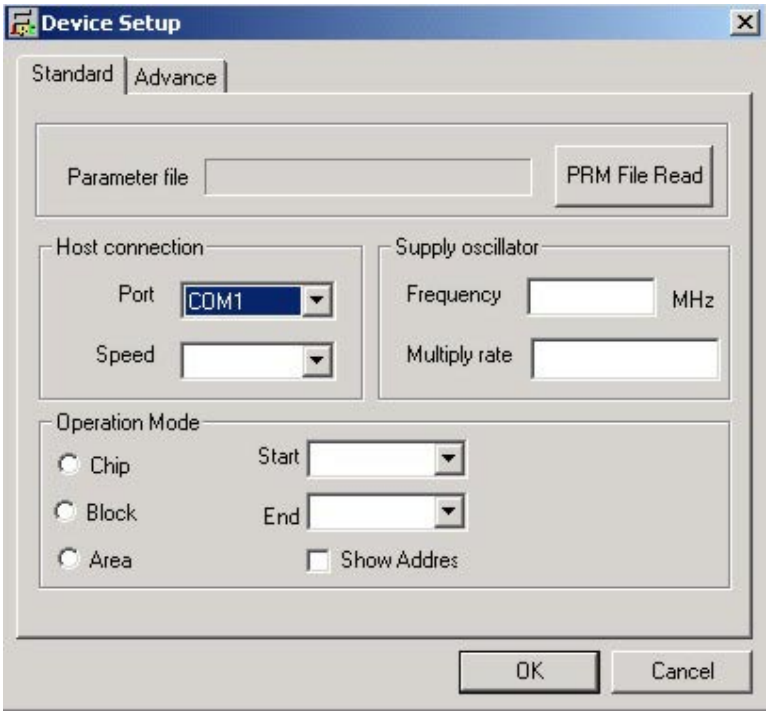


Figure 8-5. Device Setup Window - Standard

This window shows all basic options that can be set in accordance with the user environment and target device.

[OK button]

Clicking the OK button saves the settings on the Standard and Advance menus and closes the window.

[Cancel button]

Clicking the Cancel button closes the window without saving the settings on the Standard and Advance menus.

<1> Parameter file

This file holds parameters and timing data required to rewrite the flash memory of the target device. 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.

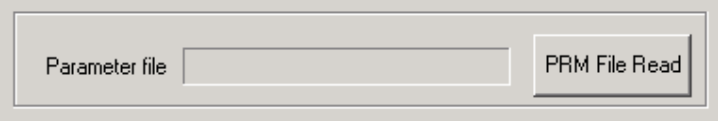


Figure 8-6. Setup Window - Parameter File Selection

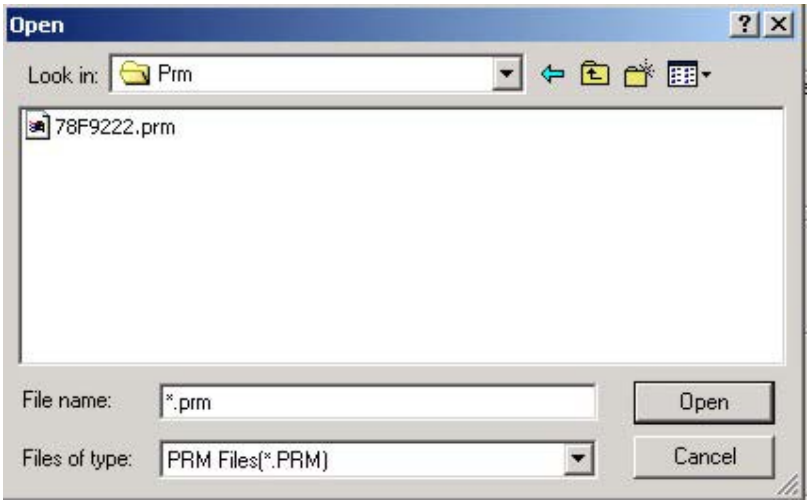


Figure 8-7. Parameter File Selection Window

[PRM File Read button]

A window for specifying a parameter file is displayed. Specify a desired file then click Open.

<2> Communication interface to device

"Communication interface to device" is used to select a channel for communication between the *78K0S/KA1+- Do it!* board and host machine.

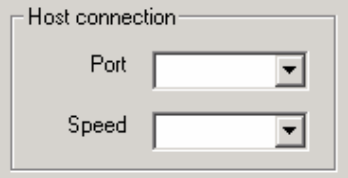


Figure 8-8. Setup Window - Communication Interface to Device

[Port list box]

Select a channel for communication between the *78K0S/KA1+- Do it!* board and host machine.

Remark Selectable ports can be checked using Device Manager. For details, refer to **6.7 Confirmation of USB Driver Installation**.

[Speed list box]

Select a communication rate for the selected communication channel.

<3> Supply oscillator

"Supply oscillator" is used to select a clock that determines programming, data transfer, and a transfer rate.

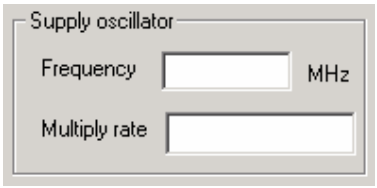


Figure 8-9. Setup Window - Supply Oscillator Selection

[Frequency box]

Sets the clock frequency of the target system.

The range of operating frequency varies from one device to another. So, check the specifications of the device used before making a setting.

[Multiply rate]

Specifies the division rate or multiplication rate of the target device.

If the target device has an on-chip PLL circuit, enter a division rate or multiplication rate according to the use environment.

The selectable division rate or multiplication rate differs depending on the device. Check the specifications of the device used before making a setting.

If the target device does not have an on-chip PLL circuit, select "1.00".

On the initial screen, the default setting is displayed according to the parameter file.

<4> Operation Mode

The setting of “Operation Mode” may divide the flash memory of some target devices into blocks or areas.

This menu is used to select an operation mode of the flash memory. Some devices do not have the block and area division modes, and some devices have only one of the modes. In these cases, a nonexisting mode is unchoosable.

Figure 8-10. Setup Window - Operation Mode

[When Chip is selected]

The entire flash memory area of the target device is subject to rewrite processing.

[When Block is selected]

Specify the Block number range subject to rewrite processing by using Start/End.

The Start/End list boxes display the Block numbers where the flash memory of the target device is configured.

[When Area is selected]

Specify the Area number range subject to rewrite processing by using Start/End.

The Start/End list boxes display the Area numbers where the flash memory of the target device is configured.

[Show Address check box]

Specify whether numbers or addresses are displayed in the Start/End list boxes.

If this check box is checked, addresses are displayed.

If this check box is not checked, numbers are displayed.

(b) Advance setup

The Advance setup menu is used to specify the command options and security flag settings.

When “Advance” is clicked, the following window is displayed:

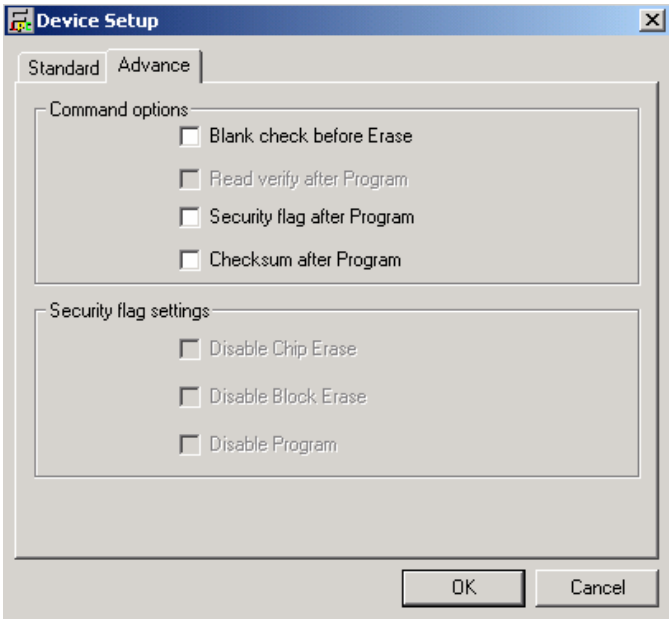


Figure 8-11. Device Setup Window - Advance

<1> Command options

This dialog box is used to specify the PG-LPC flash processing command options.

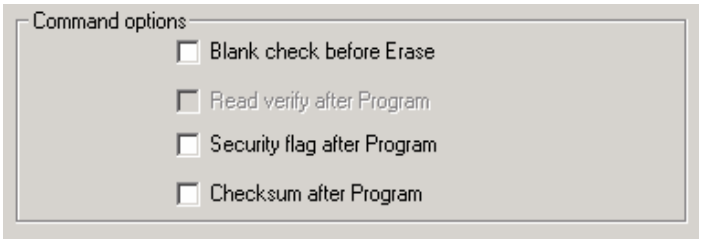


Figure 8-12. Setup Window - Command Options

[Blank check before Erase check box]

If this check box is checked, blank check is made before the 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 check box] Not usable

[Checksum after Program check box]

If this check box is checked, the flash memory checksum value of the target device is read from the target device after execution of the Program command and EPV command.

This value differs from the value displayed in the parameter window of the main window.

8.3.3 [View] menu

Clicking the [View] menu displays the pull-down menu shown below.

This menu contains commands for setting whether to display the toolbar and status bar.

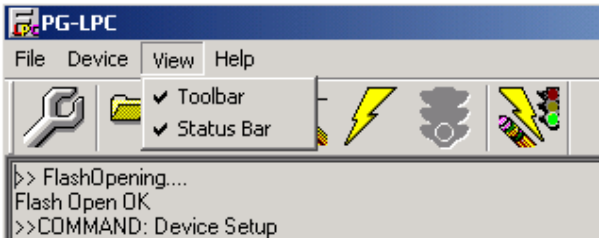


Figure 8-13. [View] Menu

(1) [Toolbar] command

Checking the [Toolbar] command displays the toolbar. Unchecking the command hides the toolbar.

(2) [Status Bar] command

Checking the [Status Bar] command displays the status bar. Unchecking the command hides the status bar.

8.3.4 [Help] menu

Clicking the [Help] menu displays the following pull-down menu:

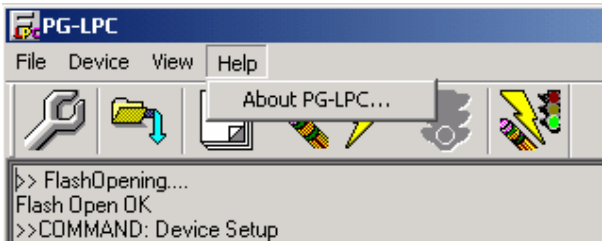


Figure 8-14. [Help] Menu

(1) [About PG-LPC] command

The [About PG-LPC] command opens the program entry window as shown below and indicates the version. Clicking OK terminates the display.

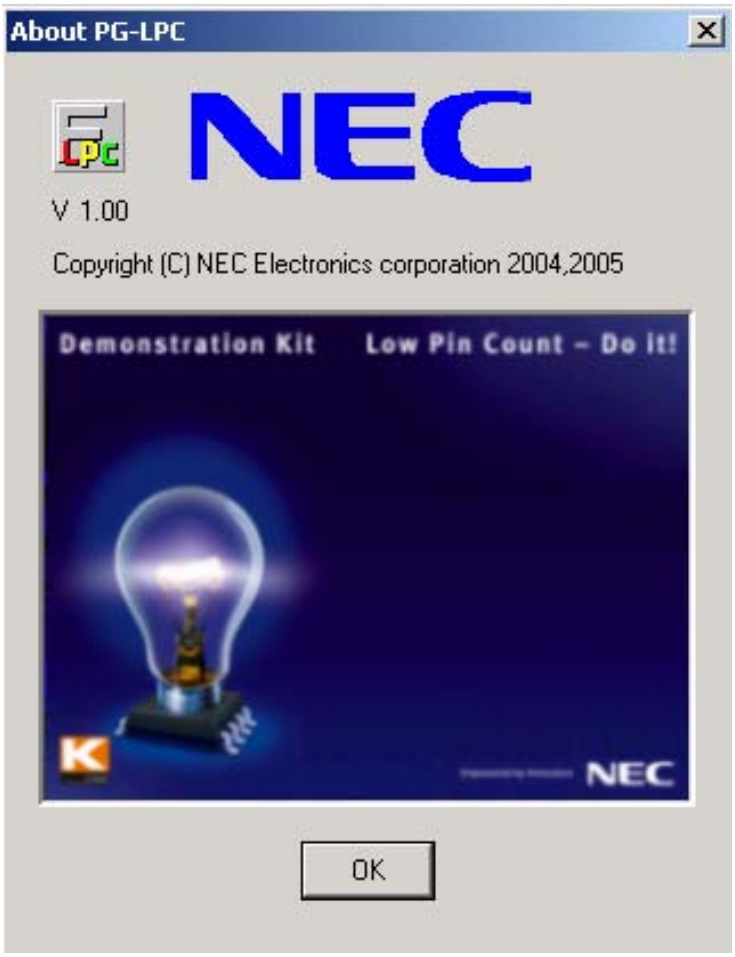


Figure 8-15. About PG-LPC Window

8.4 Programmer Parameter Window

This window displays the settings of the programming parameters.

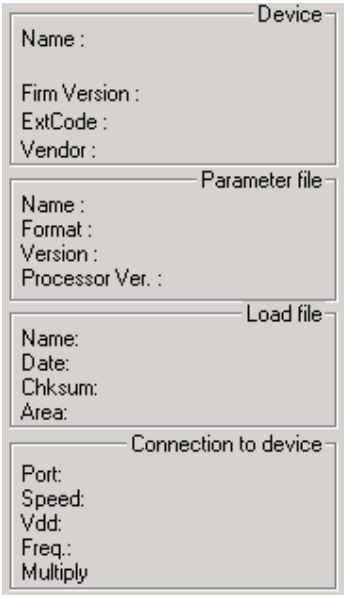


Figure 8-16. Programmer Parameter Window

[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.

9. HOW TO USE PG-LPC FLASH PROGRAMMING SOFTWARE

This chapter explains the basic operations of the PG-LPC GUI for programming the *78K0S/KA1+* - Do *it!* board. This chapter covers how to start the system, execute the EPV command, and program the target device μPD78F9222 mounted on the *78K0S/KA1+ - Do it!* board.

The conditions of the series of operations described in this chapter are as follows:

Target board:	78K0S/KA1+ - Do it!
Target device:	μPD78F9222
Clock:	8 MHz
Voltage level:	5 V

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

(1) Installing the PG-LPC GUI software

Install the PG-LPC GUI software on the host machine you are using, by referring to (1) PG-LPC GUI software installation in chapter 9 (if the software has not been installed yet).

(2) Installing the driver

Install the USB driver on the host machine you are using, by referring to (1) PG-LPC GUI software installation in chapter 9 (if the driver has not been installed yet).

(3) Installing the parameter file

The parameter file for the μPD78F9222 device is installed automatically during installation of PG-LPC GUI, folder <PG-LPC install-path>\PRM. The latest version of the parameter file (PRM78F9234) for the μPD78F9222 device can be downloaded from the following NEC Electronics microcontroller website.

http://www.necel.com/micro/ods/eng/index.html

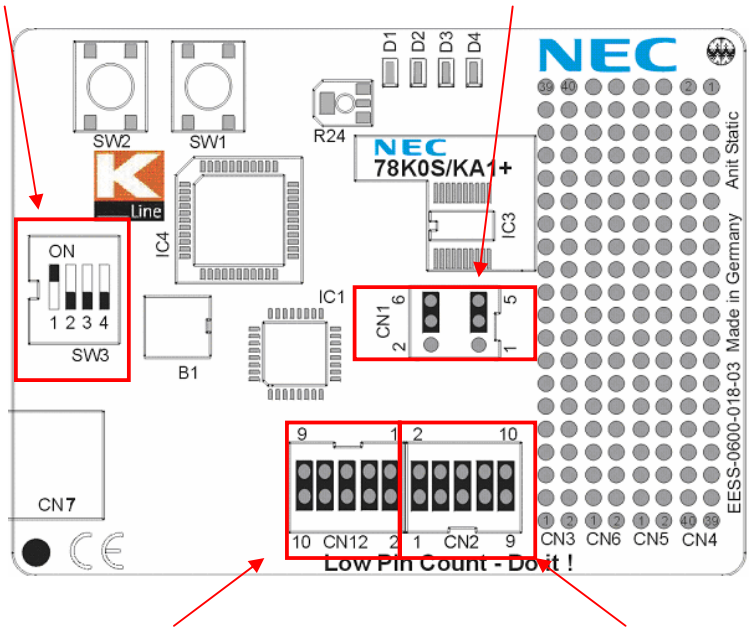
* Download PRM78F9234 by following [ParameterFile PG-FP4 PG-FPLx] and [ParameterFile PG-FP4 PG-FPLx For 78K0S Series] from Development tools download (ODS) (above URL).

(4) Connecting and starting

<1> Set the *78K0S/KA1+ - Do it!* 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	Shorted
4-6	Shorted



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

Figure 9-1. Setting for Flash Programming

<2> <Plug and Play> Connect the *78K0S/KA1+ - Do it!* board with the host machine via the USB cable.

<3> Start the PG-LPC GUI.

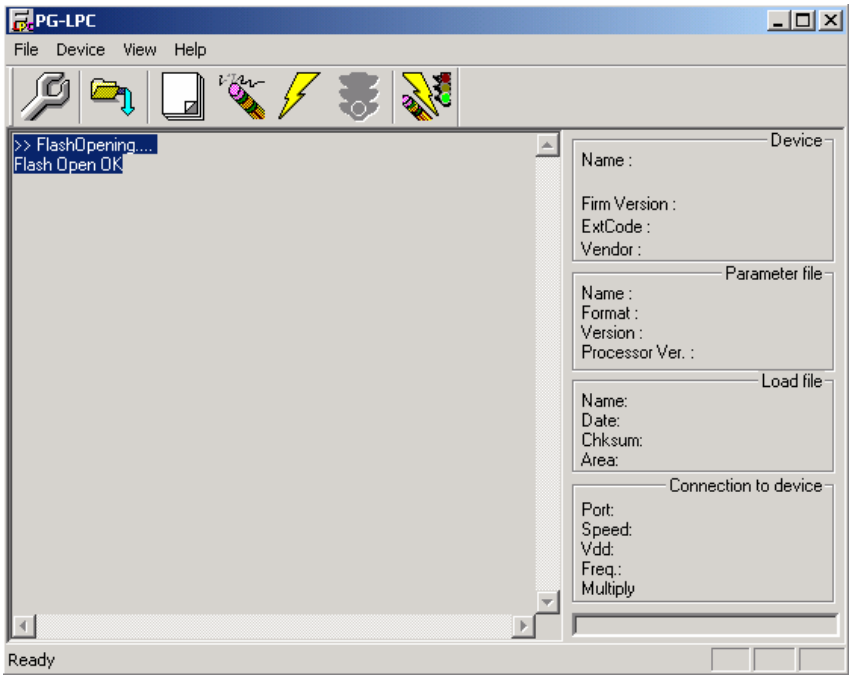


Figure 9-2. GUI Software Startup Screen

(5) Setting the programming environment

<1> Select [Device] → [Setup] from the menu bar.

<2> The Standard dialog box for device setup is activated.

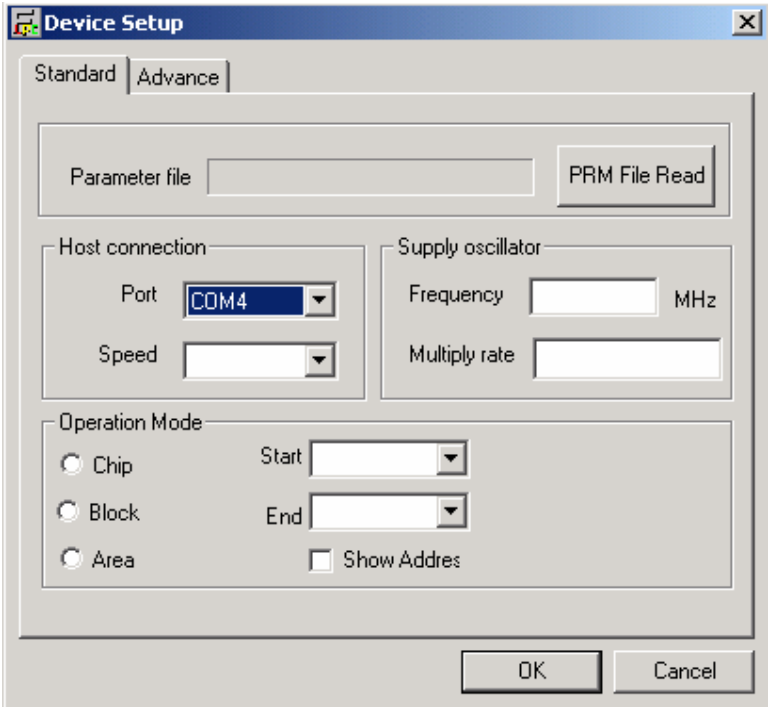


Figure 9-3. <Standard Device Setup> Dialog Box

<3> Click PRM File Read to open the parameter file selection window.
Select the parameter file “78F9222.prm” then click Open.

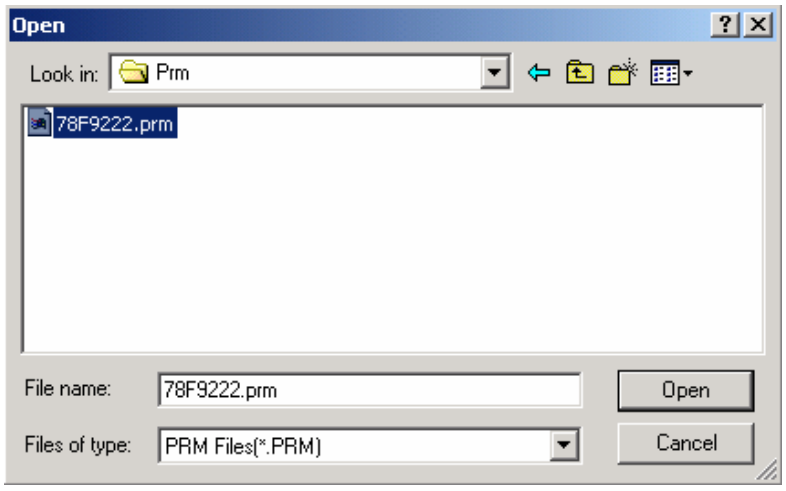


Figure 9-4. Parameter File Selection

<4> From the Port list box, select the communication port that matches the host machine being used. Select the communication speed of the Host connection.

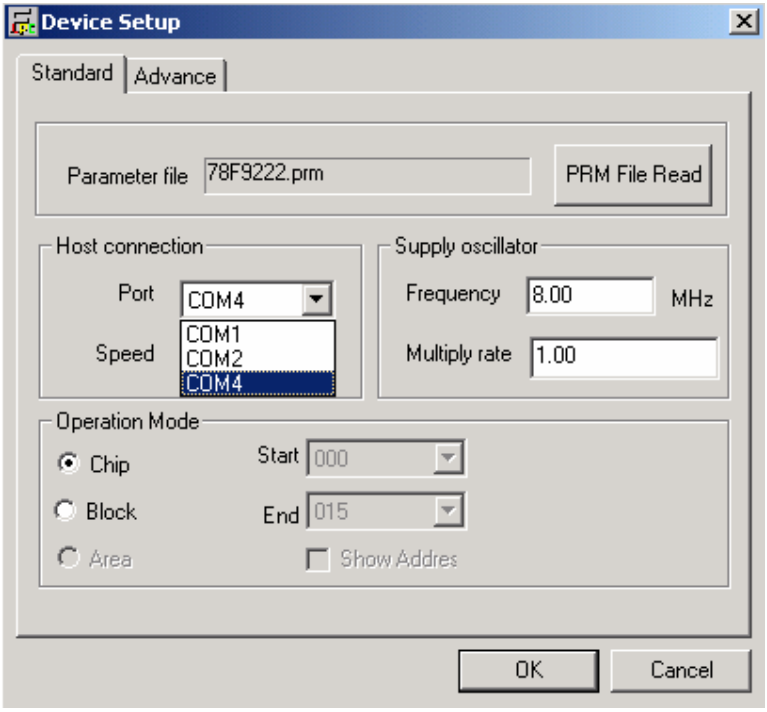


Figure 9-5. Port Selection

Remark Selectable ports can be checked using Device Manager. For details, refer to **6.7 Confirmation of USB Driver Installation**.

<5> Set “Supply oscillator” according to the specifications of the 78K0S/KA1+ - Do it! board, “Frequency = 8.00 MHz” and “Multiply rate = 1.00”. In “Operation Mode”, please specify the “Chip” mode. The following figure shows the recommended settings:

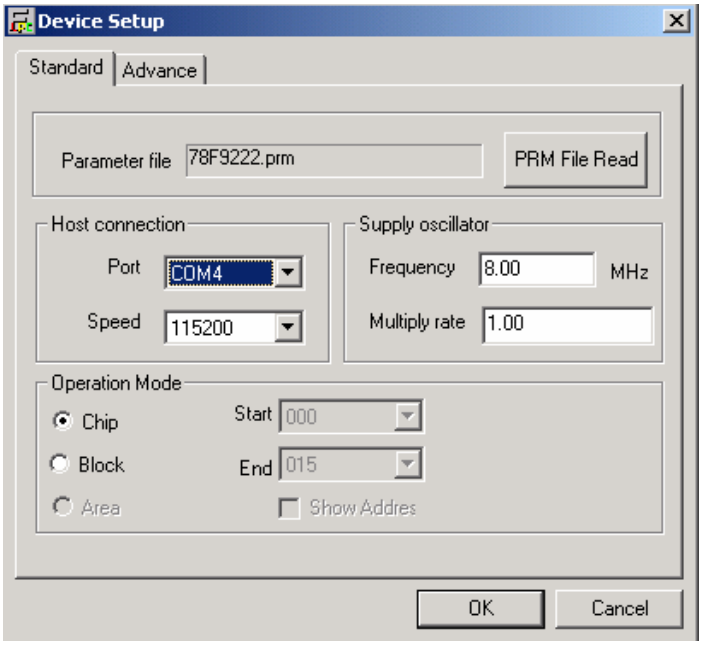


Figure 9-6. <Standard Device Setup> Dialog Box After Setting

<6> Switch to the Advance dialog box.

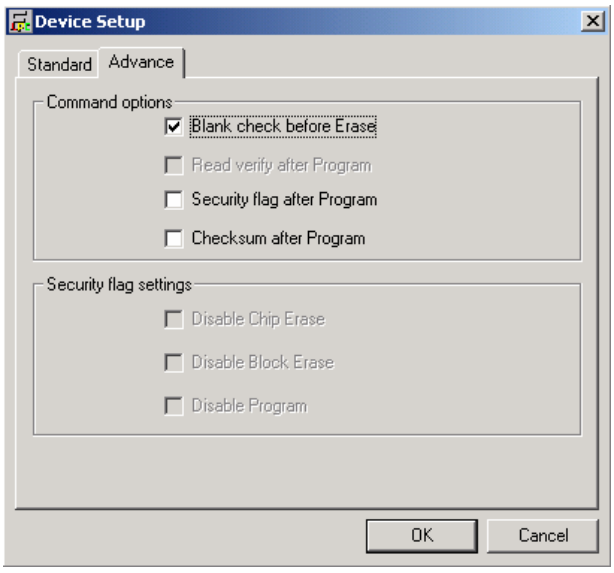


Figure 9-7. <Advance Device Setup> Dialog Box

<Command options>

Blank check before Erase: Checked

<7> Click the OK button. The GUI software sets the parameters.
When the settings have been completed, the following screen is displayed:

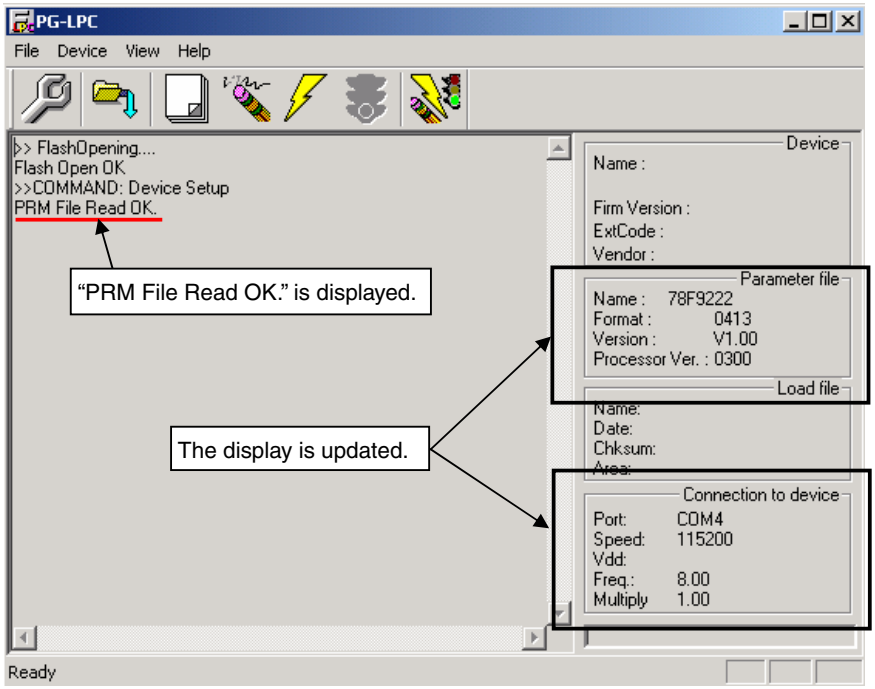


Figure 9-8. Completion of Parameter Setting

(6) Selecting a user program

<1> Select [File] → [Load].

<2> Select a program file to be written to the target device, then click Open.

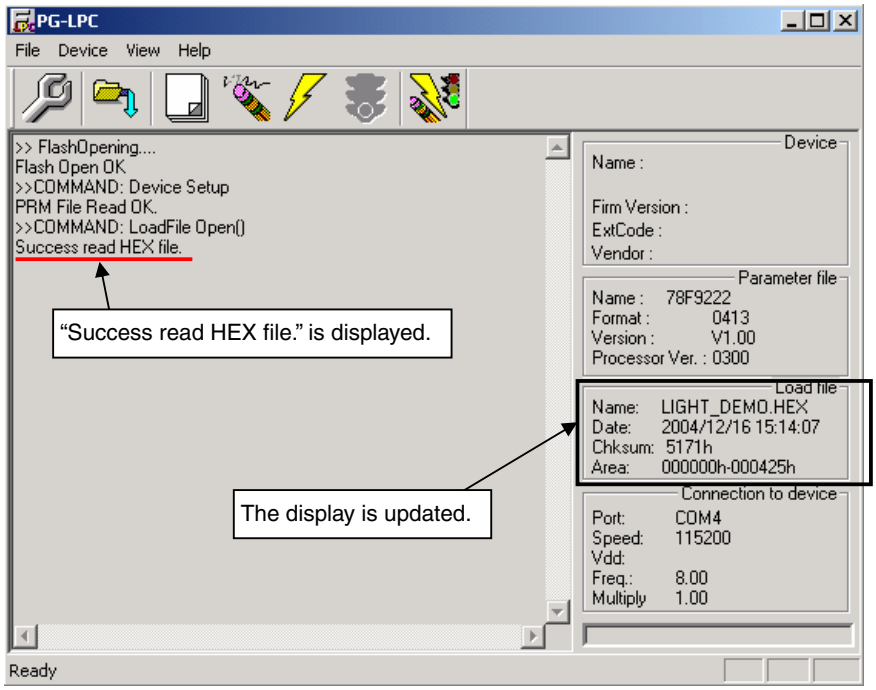


Figure 9-9. After Downloading

(7) [Autoprocedure(EPV)] command execution

Select [Device] → [Autoprocedure(EPV)] from the menu bar.

When the [Autoprocedure(EPV)] command is executed, Blank Check → Erase → Program and FLASH Internal Verify are executed sequentially for the μPD78F9222 device.

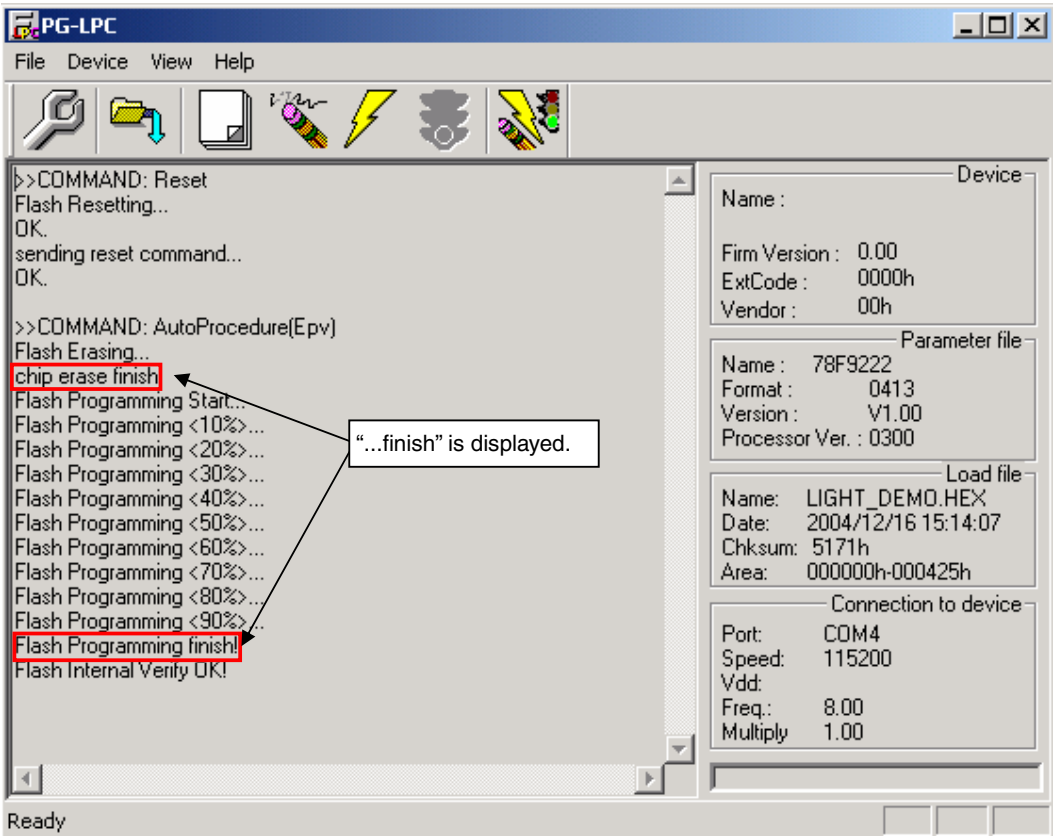


Figure 9-10. After EPV Execution

(8) 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.

(9) Execute "LIGHT_DEMO" application

Set the *78K0S/KA1+ - Do it!* board to the normal operation mode by switching SW3/S1 to OFF. < Plug and Play> the *78K0S/KA1+ - Do it!* board to start in normal operation mode.

(10) Restarting the GUI

When the system is restarted, the same screen as shown in Figure 54 appears.

10. 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 *78K0S/KA1+ - Do it!* board may not be installed correctly.
Action:
Install the GUI software again by referring to **(1) PG-LPC GUI Software Installation** in **Chapter 7**.

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, then insert the USB connector again after a while.

Cause:
The driver may not be installed correctly.
Action:
<1> When this product is connected to the personal computer, right-click the driver marked with “!” or “×“.
Click Erase when displayed.
<2> On Device Manager, execute [Hardware Modification Scan].
<3> 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, 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 **6.6 Driver Installation**.

Communication with the *78K0S/KA1+ - Do it!* 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 **6.6 Driver Installation**.

Cause:
The COM port may not have been correctly set.
Action:
Using the Device Manager, the virtual COM port setting must be changed. Change the settings to appropriate values using the following procedure.

1. Open the Device Manager. Select the USB Serial Port(COM?) from the ports (COM and LPT), and open the Properties.
2. Once the Properties window is displayed, select the PortSetting tab and click the [Advanced] button to display the Extended Settings window.
3. Once the Extended Settings window is displayed, change the Latency Timer (ms) setting in BM Options to 16, and then click [OK].
4. Click the [OK] button to close COM Port Properties, and close the Device Manager window.

* If communication is not possible even after the above settings have been performed, try again by changing the Latency Timer (ms) setting to a different value.

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:
<1> Check that the clock is supplied to the 78K0S/KA1+ device, connector CN1.
<2> Check that the power is supplied to the 78K0S/KA1+ device, connector CN12.
<3> 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 *78K0S/KA1+ - Do it!* target device. For information about the PRM file, refer to chapter 8 **PG-LPC FLASH PROGRAMMING SOFTWARE.**

Cause:
The setting of “Supply oscillator” in [Device Setup] may be incorrect.
Action:
Make a correct setting according to the specifications of the target device.

11. SAMPLE PROGRAMS

The supplied CD-ROM includes five sample programs. Source programs and project files can be downloaded from the NEC Electronics Microcomputer website (http://www.necel.com/micro/index_e.html).

Table 11-1. Sample Program List

Sample Program Name	Folder Name	Description
Light demo	Light_Demo	This demonstration provides 8 types of light shows using 4 LEDs. The interval timer setting and LED control methods can be learned wit this demo.
ADC demo	ADC_Demo	This demonstration realizes a simple voltmeter using variable resistors and analog input. It is suitable for learning the A/D converter setting method, etc.
Reaction time demo	ReacTime_Demo	This demonstration measures the reaction time of the user, by measuring the time taken by the user to press a button after LEDs light as a start signal.
Timer demo	Timer_Demo	This demonstration realizes a darkroom timer using two timers. The user is notified about the fact that the set exposure time has lapsed by a flashing LED.
UART demo	UART_Demo	This demonstration performs data transmission/reception to/from a PC using UART. It displays the measurement data of a voltmeter realized using variable resistors with terminal software on a PC.

In addition to source files, project files for NEC Electronics' integrated development environment PM+ are included.

Object code can be regenerated as needed. For how to use PM+, refer to chapter 7 or the PM+ User's Manual.

Do it! is shipped with the light demo programmed.

11.1 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.

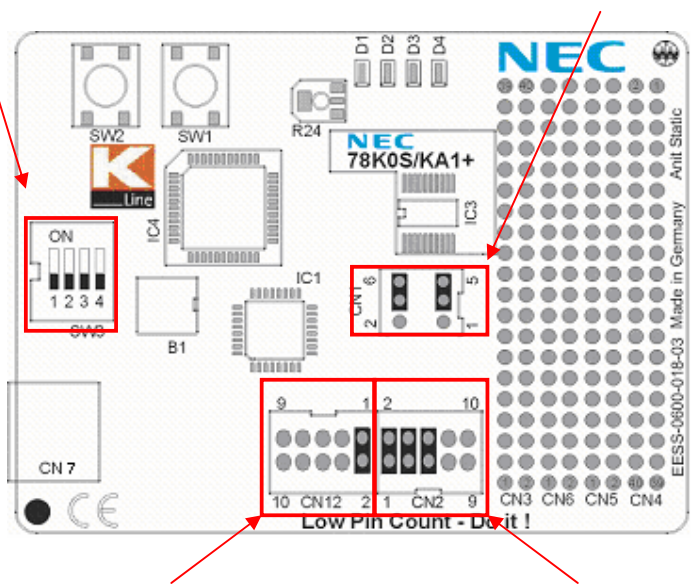
Table 11-2. Peripherals and External Parts Used for Light Demo

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

To run the Light 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	Shorted
4-6	Shorted



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

Figure 11-1. Settings for Light Demo

The same program operation as *Do it!* can be simulated using SM+.

Click File - Open Workspace in PM+ and select Light_demo.prj under the Light_Demo folder. The following screen is displayed when SM+ is started. (For the SM+ startup method, refer to section 7.2.)

Since program download and I/O panel settings have been done in advance, the operation of the Light Demo can be verified by executing the demonstration as is on SM+.

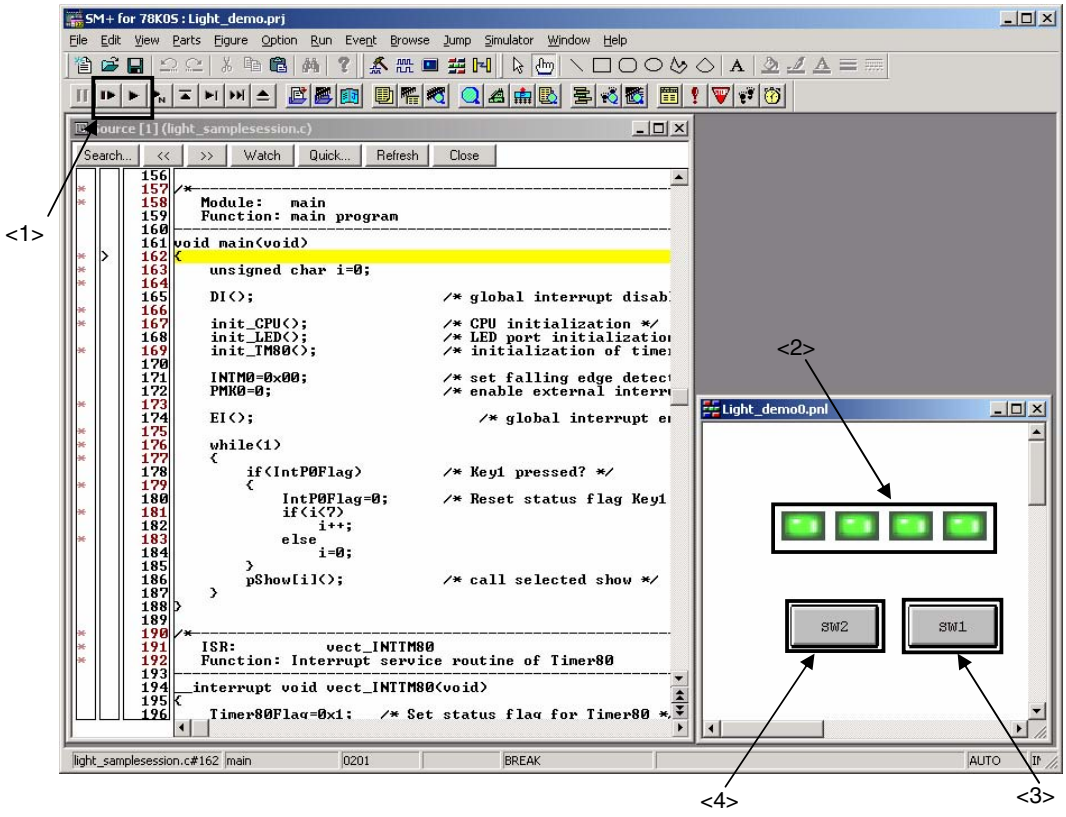


Figure 11-2. 11-2. SM+ Screen (Light_demo)

<1> Press the [Go] or [Restart] button to execute the program.

<2> The fist type of light show starts.

<3> The type of light show changes each time SW1 is pressed.

<4> The entire system is reset every time SW2 is pressed, and the light show of step <2> above starts again.

<5> Stop the program to end the demo.

* If the I/O panel's buttons do not operate, this may be because the object selection mode is selected (in which case the mouse cursor shape is an arrow). Change the mode to the input simulation mode (so that the mouse cursor shape is a hand) and try again.

11.2 ADC Demo

This sample program simulates a simple voltage meter. By using the integrated ADC, the voltage supplied to ADC on input channel 0, port P20/ANI0, is measured. The input voltage is adjusted by potentiometer R24. The board shows the measured voltage by flashing LEDs D1 to D4.

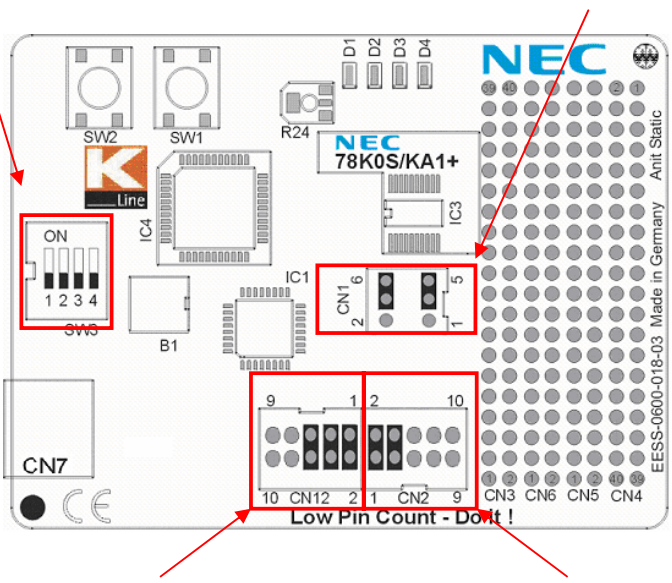
Table 11-3. Peripherals and External Parts Used for ADC Demo

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

To run the ADC 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	Shorted
4-6	Shorted



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

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

Figure 11-3. Settings for ADC Decmo

The same program operation as *Do it!* can be simulated using SM+.

Click File - Open Workspace in PM+ and select ADC_demo.prj under the ADC_Demo folder. The following screen is displayed when SM+ is started. (For the SM+ startup method, refer to section 7.2.)

Since program download and I/O panel settings have been done in advance, the operation of the ADC Demo can be verified by executing the demonstration as is on SM+.

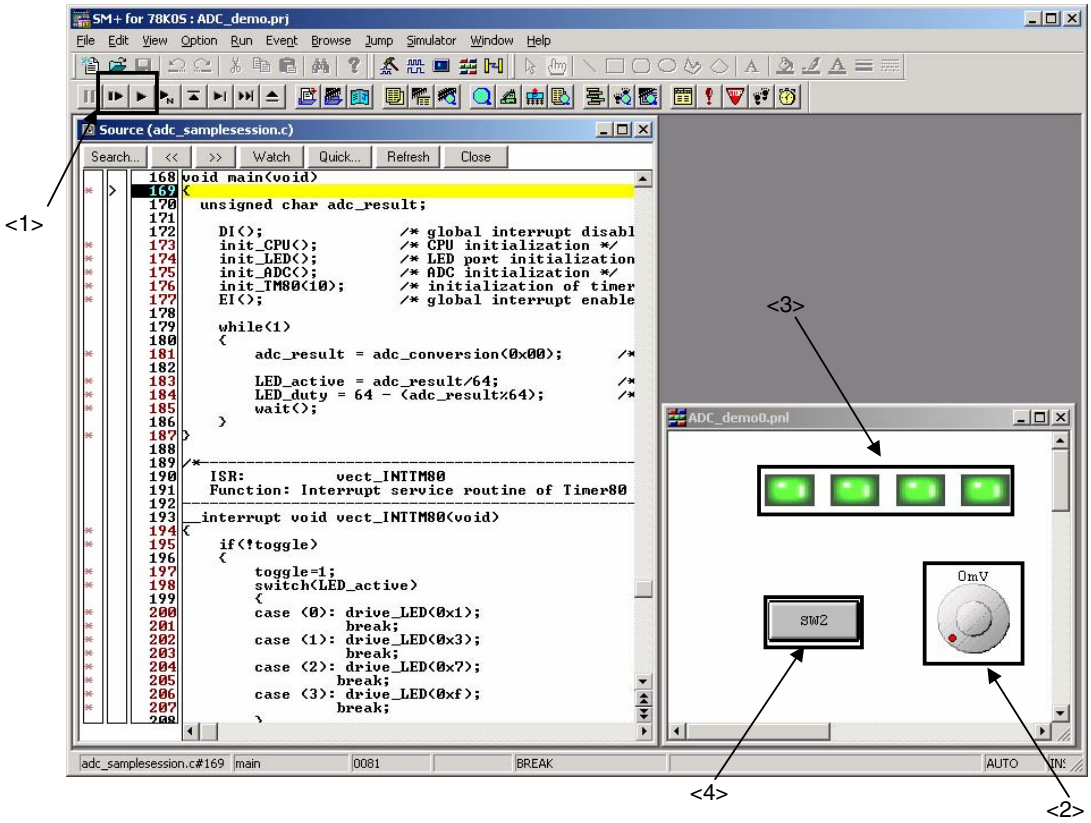


Figure 11-4. SM+ Screen (ADC_demo)

<1> Press the [Go] or [Restart] button to execute the program.

<2> Move the level gauge to a suitable position.

<3> The LED lights according to the position of the level gauge.

<4> To reset KA1+, press SW2.
(**Note**: At this time, the LED does not light unless the level gauge is set again.)

<5> Stop the program to end the demo.

* If the I/O panel's buttons or the level gauge do not operate, this may be because the object selection mode is selected (in which case the mouse cursor shape is an arrow). Change the mode to the input simulation mode (so that the mouse cursor shape is a hand) and try again.

11.3 ReacTime Demo

This sample program demonstrates a reaction time measurement. The application starts by flashing LEDs D1-D4 two times. After a press of button SW1 the application waits for a random time between 0.50 and 3.45 seconds. Then LED D4 is switched on and measurement starts by incrementing a reaction counter every 50ms. The actual counter value is shown by LEDs D1-D4 (binary format) until the next keystroke of button SW1. After a press of button SW1 is detected, the measurement stops and the reaction time is shown by flashing LEDs D1-D4. The binary format is read (for example, in the case of D1: OFF, D2: ON, D3: OFF, D4: ON, 0101 = 5), and this value multiplied by 50 ms is your reaction time. Pressing button SW2 starts a new measuring cycle.

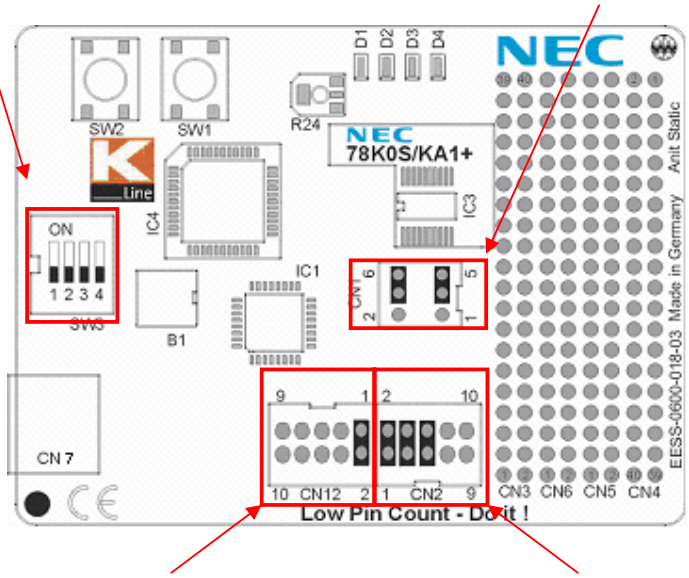
Table 11-4. Peripherals and External Parts Used for ReacTime Demo

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

To run the ReacTime 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	Shorted
4-6	Shorted



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

Figure 11-5. Settings for ReacTime Decmo

The same program operation as *Do it!* can be simulated using SM+.

Click File - Open Workspace in PM+ and select ReacTime_demo.prj under the ReacTime_Demo folder. The following screen is displayed when SM+ is started. (For the SM+ startup method, refer to section 7.2.)

Since program download and I/O panel settings have been done in advance, the operation of the Reaction Time Demo can be verified by executing the demonstration as is on SM+.

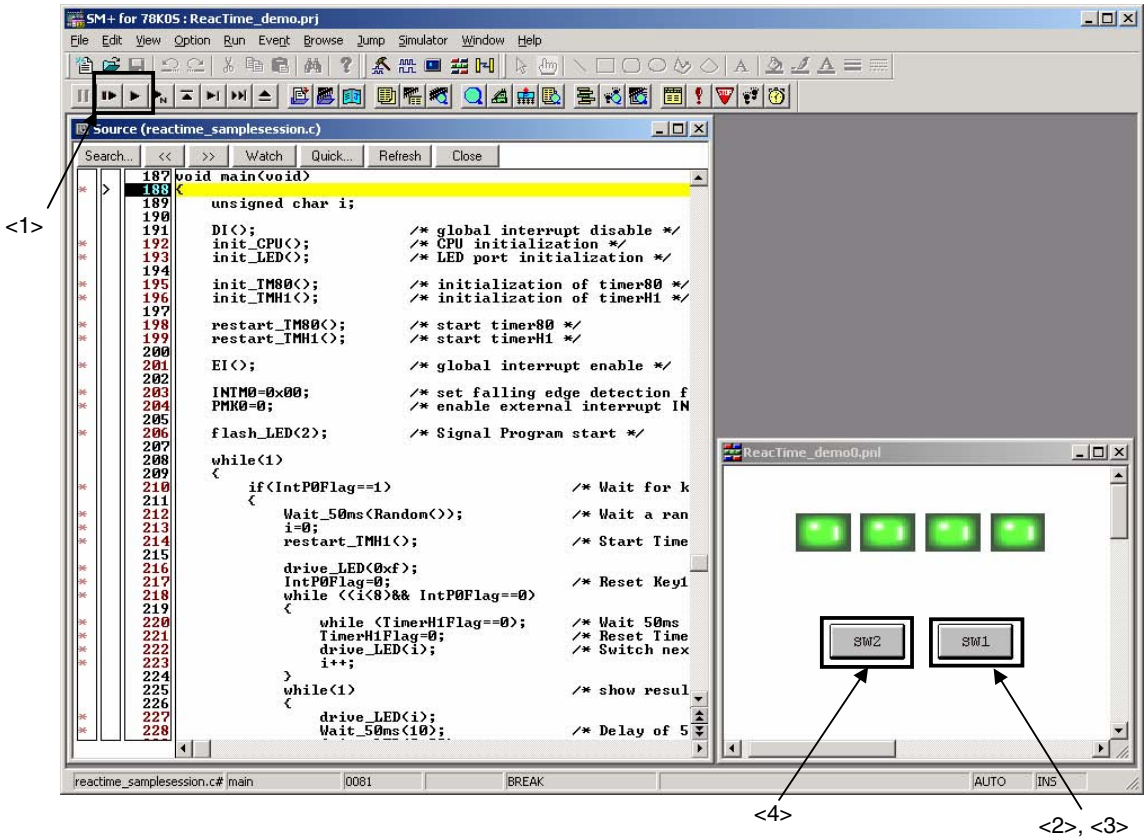


Figure 11-6. SM+ Screen (ReacTime_demo)

<1> Press the [Go] or [Restart] button to execute the program. (All the LEDs flash twice.)

<2> Press SW1. After the lapse of a random length of time (0.5 s to 3.45 s), the LEDs start lighting up. First, D4 lights up and the counter value is incremented in binary format every 50 ms, with D1 lighting up last, upon which measuring ends (during this time, press SW1 again.)

<3> If SW1 is pressed during the measurement period, measuring is interrupted. (This yields your reaction time.)

<4> Pressing SW2 resets KA1+.

<5> Stop the program to end the demo.

* If the I/O panel's buttons do not operate, this may be because the object selection mode is selected (in which case the mouse cursor shape is an arrow). Change the mode to the input simulation mode (so that the mouse cursor shape is a hand) and try again.

Note The SM+ operation time differs from that of *Do it!*, so that it does not match the actual reaction time.

11.4 Timer Demo

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

After the first time the SW1 key is pressed, the board starts counting the exposure time in units of one minute (binary output format), so select an appropriate time. By pressing SW1 a second time the shown elapse time is selected and counting is started.

After the selected time is finished the elapse time is displayed by flashing the LEDs twenty times and the stop mode is entered. The stop mode can be released by pressing SW1, so that simulation can be performed again.

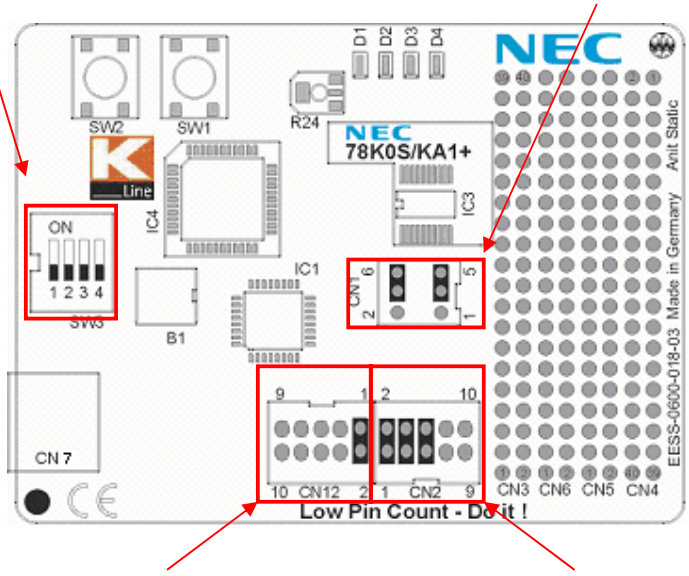
Table 11-5. Peripherals and External Parts Used for Timer Demo

Used Internal Peripherals	Used External Parts
Timer80	LEDs D1-D4
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	Shorted
4-6	Shorted



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

Figure 11-7. Settings for Timer Demo

The same program operation as *Do it!* can be simulated using SM+.

Click File - Open Workspace in PM+ and select Timer_demo.prj under the Timer_Demo folder. The following screen for starting PM+ is displayed as a result. (For the SM+ startup method, refer to section 7.2.)

Since program download and I/O panel settings have been done in advance, the operation of the Timer Demo can be verified by executing the demonstration as is on SM+.

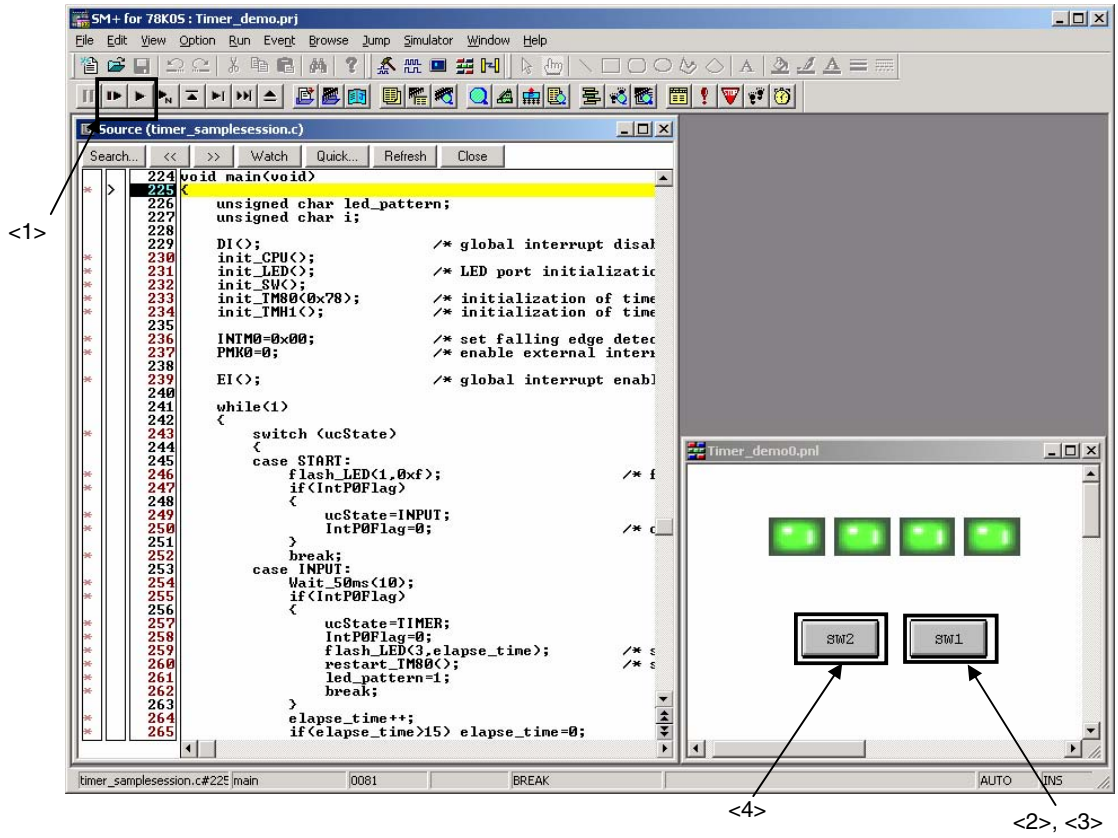


Figure 11-8. SM+ Screen (Timer_demo)

<1> Press the [Go] or [Restart] button to execute the program. (All the LEDs flash continuously.)

<2> Press SW1. The exposure time setting counter is incremented sequentially in binary format from D4. (The setting time unit is one minute.)

<3> Press SW1 again to set the exposure time and start time measurement.
(The LEDs light in the sequence of D4→D3→D2→D1→D4→… during counting.)
When the set exposure time has elapsed, the LED to which the exposure time was specified flashes 20 times and then stops.

<4> Press SW2 to reset KA1+.

<5> Stop the program to end the demo.

* If the I/O panel's buttons do not operate, this may be because the object selection mode is selected (in which case the mouse cursor shape is an arrow). Change the mode to the input simulation mode (so that the mouse cursor shape is a hand) and try again.

Note The SM+ operation time differs from that of *Do it!*, so that it does not match the actual exposure time.

11.5 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 by default. The input voltage can be changed by potentiometer R24.

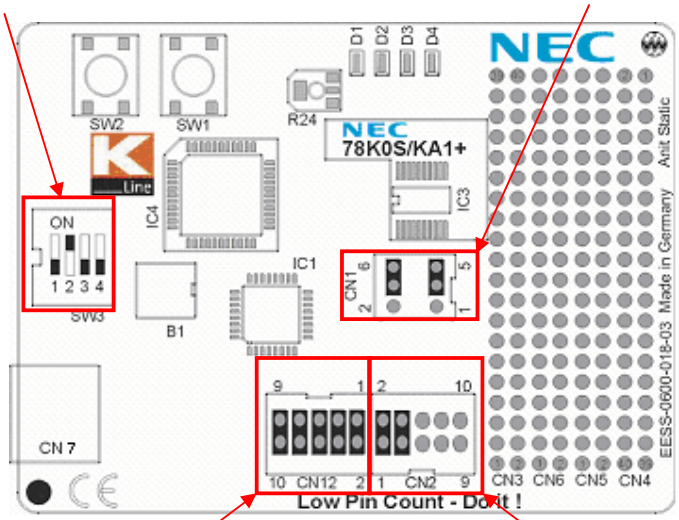
Table 11-6. Peripherals and External Parts Used for UART Demo

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

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

SW3	Setting
S1	OFF
S2	ON
S3	OFF
S4	OFF

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



CN12	Jumper Setting
1-2	Shorted
3-4	Shorted
5-6	Shorted
7-8	Shorted
9-10	Shorted

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

Figure 11-9. Settings for UART Demo

Here, HyperTerminal which comes with Windows is used as the terminal program for illustrative purposes.

HyperTerminal can be started by selecting Programs - Accessories - Communication - HyperTerminal from the start menu.

When HyperTerminal is started for the first time, messages prompting the execution of various initial settings are displayed, so perform these settings accordingly.

Figure 11-10. Connection Settings (1)

If at this time, *Do it!* is connected to a PC, virtual port (in this case, COM4) is listed as the connection destination, so select it.

Figure 11-11. Connection Settings (2)

When a virtual port is selected, the properties dialog box is automatically opened, so perform the appropriate communication settings.

Here, let's perform the settings according to the factory default settings of *Do it!*

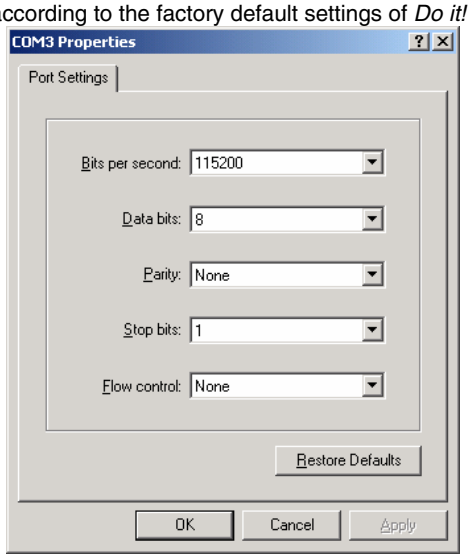


Figure 11-12. COM Properties Window

Once the initial settings have been completed, HyperTerminal starts.

Here, let's press SW2 (RESET) to display the following key input wait screen.

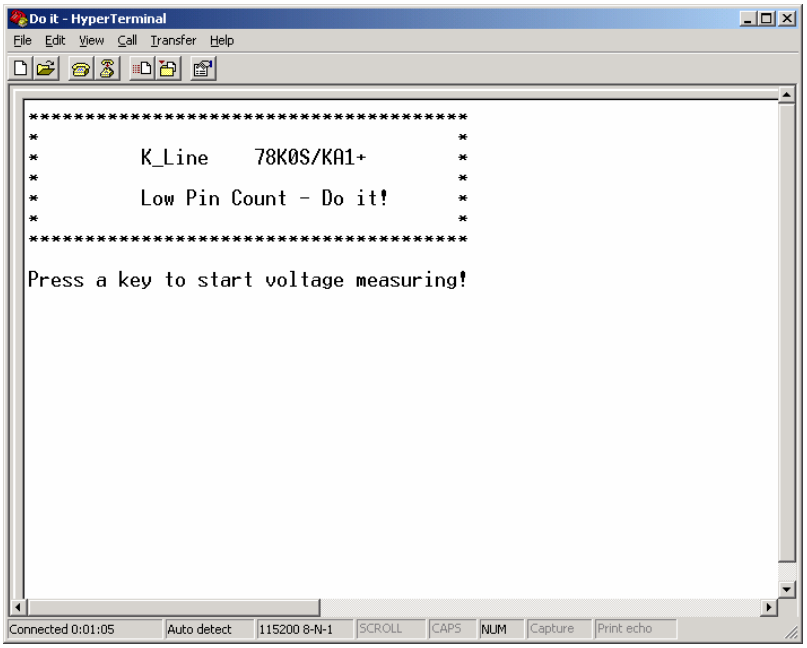


Figure 11-13. Terminal Window (1)

Pressing a suitable key (for example, the [Enter] key) on the PC causes voltage measurement to start, and the measured voltage is displayed on the HyperTerminal screen via UART of KA1+ and the virtual port of the PC.

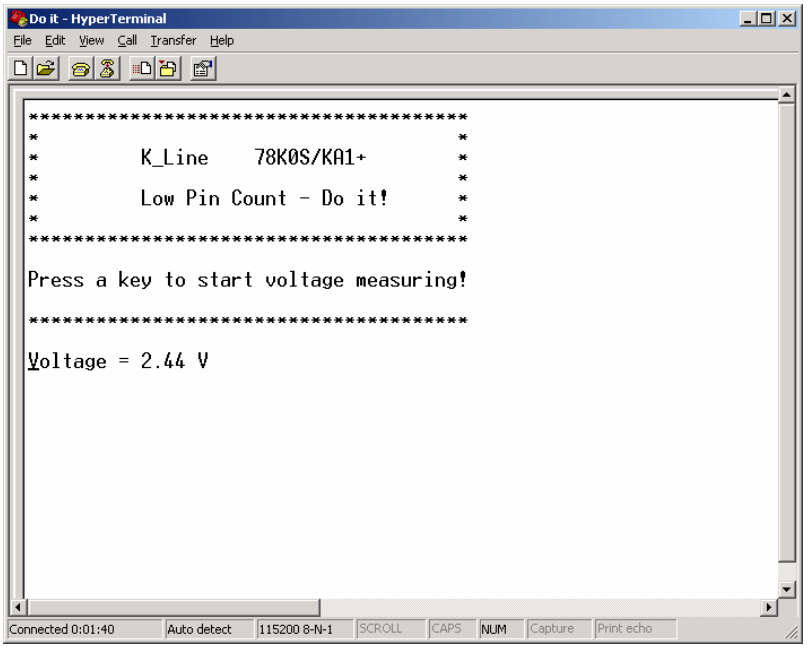


Figure 11-14. 11-14. Terminal Window (2)

Here, changing the variable resistor (R24) of *Do it!* allows the user to monitor the moment-by-moment changes in the voltage value.

The same program operation as *Do it!* can be simulated using SM+.

Click File - Open Workspace in PM+ and select UART_demo.prj under the UART_Demo folder. The following screen is displayed when SM+ is started. (For the SM+ startup method, refer to section 7.2.)

Since program download and I/O panel settings have been done in advance, the operation of the UART Demo can be verified by executing the demonstration as is on SM+.

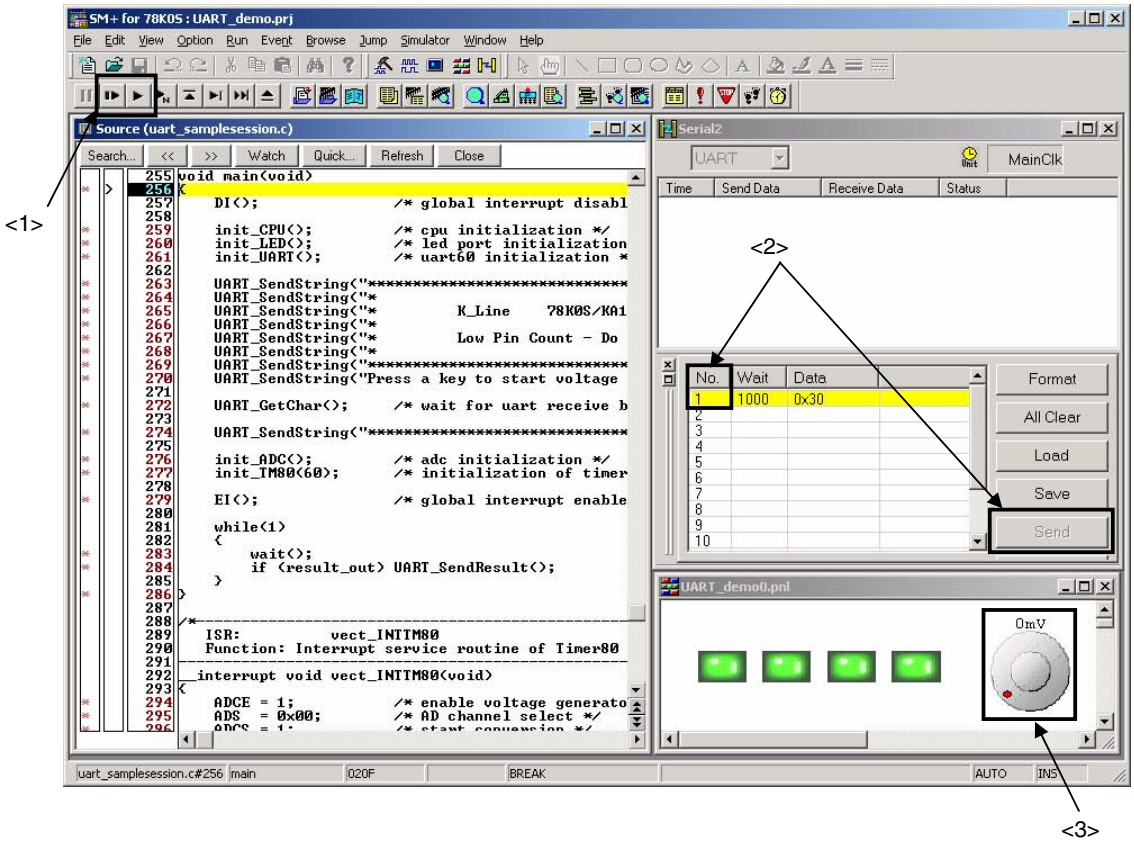


Figure 11-15. SM+ Screen (UART_demo)

<1> Press either the [Go] or the [Restart] button for program execution. As a result, the set character string data is transmitted from the KA1+ side and the key input wait status is entered.
(The transmit/receive data can be checked in the log display area in the top right serial window.)

<2> Following the selection of the dummy data for key input set to the serial editor area, press the [Transmit] button. Following data transmission from external (following reception for the KA1+ side), data transmission starts again from the KA1+ side.

<3> By moving the level gauge, the voltage level is displayed by LED according to the selected level gauge position, and at the same time the voltage level data is transmitted to external via UART.
(The data under transmission can be checked in the log display area in the serial window.)

<4> Stop the program to end the demo.

* If the I/O panel's buttons do not operate, this may be because the object selection mode is selected (in which case the mouse cursor shape is an arrow). Change the mode to the input simulation mode (so that the mouse cursor shape is a hand) and try again.

12. CONNECTORS AND CABLES

12.1 USB Host Connector CN7

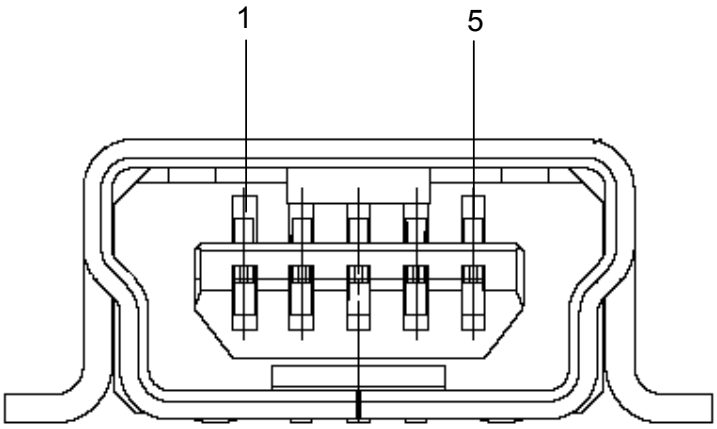


Figure 12-1. Connector CN7, USB Mini-B Type Host Connector Pin Configuration

Table 12-1. 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 *78K0S/KA1+ - Do it!* board.

12.2 USB Interface Cable (Mini-B Type)

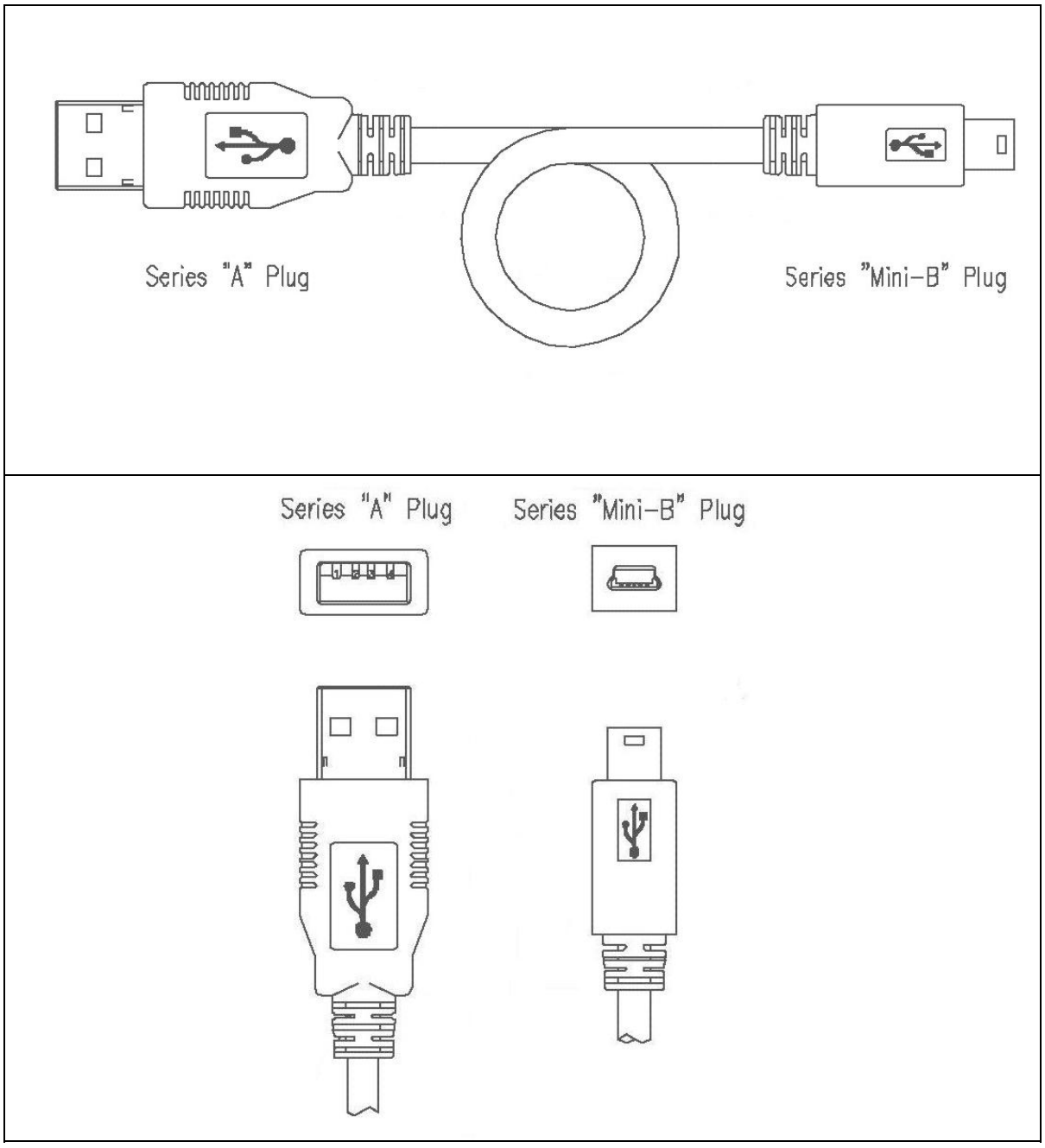


Figure 12-2. USB Interface Cable (Mini-B Type)

13. SCHEMATICS

Remark Schematics also available on CDROM directory file **"LPCDOIT_BOARD_SCHEMATICS.pdf"**

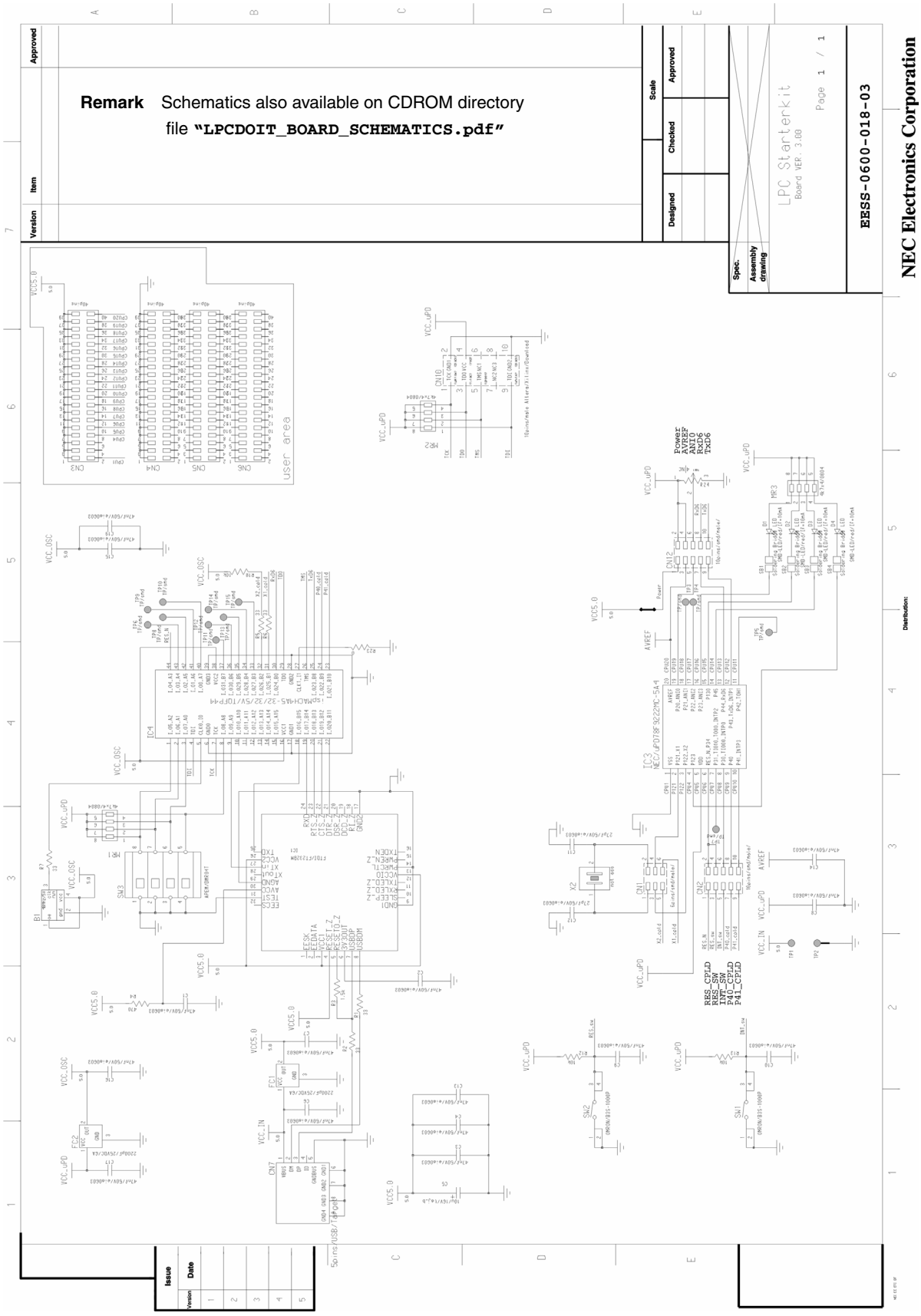


Figure 13-1. 78K0S/KA1+ - Do it! Board Schematics