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**User's Manual**

# K_Line - Play it! - 2

## Demonstration Kit for the K_Line Family

CE

*K_Line – Play it!-2* complies with the EMC protection requirements

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**WARNING**

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

EEDT-ST-001-11

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**CAUTION**

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

EEDT-ST-004-10

## Revision History

| Date | Revision | Chapter | Description |
|------|----------|---------|-------------|
| 28-01-2005 | V1.00 | --- | First release |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

## Table of Contents

## List of Figures

## List of Tables

## 1. Introduction

*K_Line – Play it!-2* is a demonstration kit for the NEC's K_Line 78K0 / V850ES microcontroller family. It supports onboard FLASH programming and real time execution of application programs up to 4 kBytes of program code for the 78K0 CPU module and up to 16 kBytes of program code for the V850 CPU module. The board is prepared to be connected to user hardware parts such as digital I/O or analogue signals.

### 1.1  Main features of *K_Line  – Play it!-2*

*   Easy to use device demonstration capabilities
    *K_Line - Play it!-2* contains elements to easily demonstrate simple I/O-functions, i.e. push buttons, 12*2 character LC display, LED output, AD reference voltage, I/O lines, UART serial interface.

*   Power supply via USB interface
    *K_Line - Play it!-2* is powered via USB interface, no separate power supply is needed.

*   Character LCD module
    *K_Line - Play it!-2* provides a 12*2 character LC display, allowing the implementation of human / machine interface, comfortable input / output functions, output of measurement values, output of status information etc.

*   FPL, FLASH programming software
    A windows based FLASH programming software allows to select and download application programs to the *K_Line - Play it!-2* 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
    °  Two or three wire serial I/O
    °  UART interface, via USB UART chip FT232
    °  LIN bus support, via TJA 1020 transceiver
    °  8 analogue input lines
    °  Temperature sensor KTY13-5
    °  4 I/O ports connected to LED
    °  2 push buttons prepared for external interrupt generation

*   The IAR Embedded Workbench for 78K0/78K0S and the IAR C-SPY debugger / simulator are included. These packages are restricted in such that maximum program code size is limited to 4 kByte of program code.

*   The IAR Embedded Workbench for V850 and the IAR C-SPY debugger / simulator are included. These packages are restricted in such that maximum program code size is limited to 16 kByte of program code.

*   Full documentation is included for the NEC 78K0/KF1+, NEC V850ES/KG1+, IAR Systems Embedded Workbenches, IAR Systems C-SPY debugger / simulator and the NEC FPL FLASH programming software.

***K_Line - Play it!-2* is not intended for code development. NEC does not allow and does not support in any way any attempt to use *K_Line - Play it!-2* in a commercial or technical product.**

### 1.2  System requirements

**HOST PC**          A PC supporting Windows 98SE, Windows ME, Windows 2000 or
                     Windows XP is required for the IAR Systems Embedded Workbench
                     demo-version and the FPL FLASH programming software.
                     Pentium 166 MHz (at least), 128 MB of RAM, 256-color display (1024 *
                     768), mouse, CD-ROM drive and 200 Mbytes of free hard disk space are
                     required to install the tool packages.

                     Above listed requirements are valid for the IAR Systems Embedded
                     Workbench and the FPL FLASH programming software.

**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
*K_Line - Play it!-2* package. If any part is missing or seems to be damaged, please contact the dealer
from whom you received your *K_Line - Play it!-2*.

**Note:**    Updates to this User Manual, additional documentation and/or utilities for *K_Line - Play it!-2*, if
             available, may be downloaded from the NEC WEB page(s) at **http://www.ee.nec.de/updates**.

## 2. *K_Line - Play it!-2* system configuration

The *K_Line - Play it!-2* system configuration is given in the diagram below:
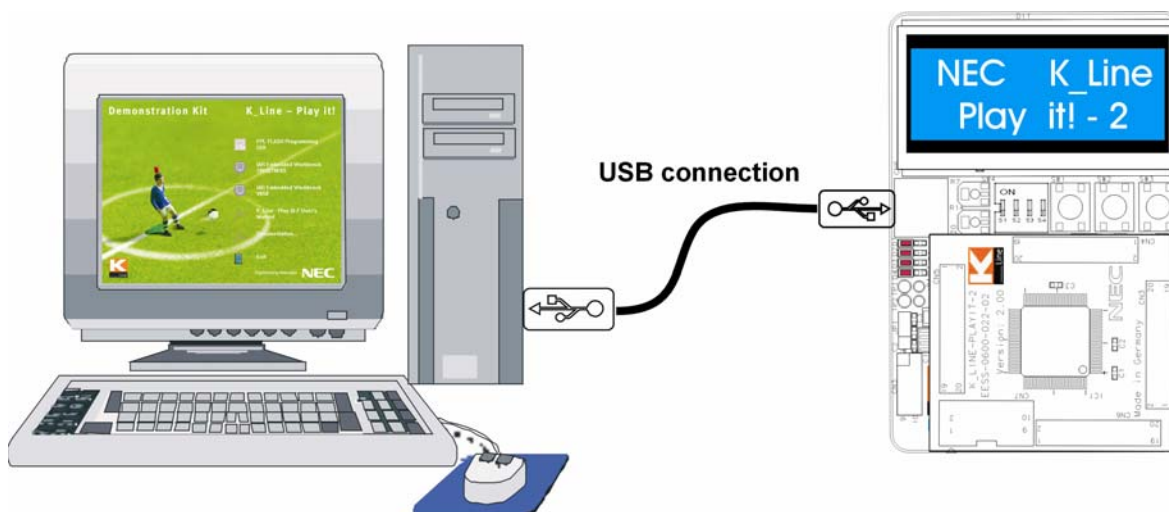
Figure 1: *K_Line - Play it!-2* system configuration

### 2.1 *K_Line - Play it!-2*

*K_Line - Play it!-2* is a demonstration kit for the NEC K_Line family devices. Two K_Line CPU modules are included, one is based on the 78K0/KF1+ device as a typical device from K_Line with the 78K0 8-Bit CPU core and the second one based on the V850ES/KG1+ device as a typical device with the V850ES 32-bit CPU core.

The *K_Line - Play it!-2* board is connected to the host system via USB interface cable. The host system may be used for onboard FLASH programming of 78K0/KF1+ and V850ES/KG1+ internal FLASH memories and to allow execution of application programs on *K_Line - Play it!-2* platform.

*K_Line - Play it!-2* runs both CPU modules at 8.0000 MHz operating speed. Sub-clock is provided with 32.768 kHz.

### 2.2 Host computer

The USB host interface enables communication to the *K_Line - Play it!-2* 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

*K_Line - Play it!-2* is powered by USB interface, no separate power supply is needed. The USB interface provides the *K_Line - Play it!-2* board with 5V supply voltage.

## 3.  *K_Line - Play it!-2* baseboard components

The *K_Line - Play it!- 2* baseboard is equipped with push buttons, a 12*2 character LC display, LED's and with several connectors in order to be connected to host computers or FLASH programmer.
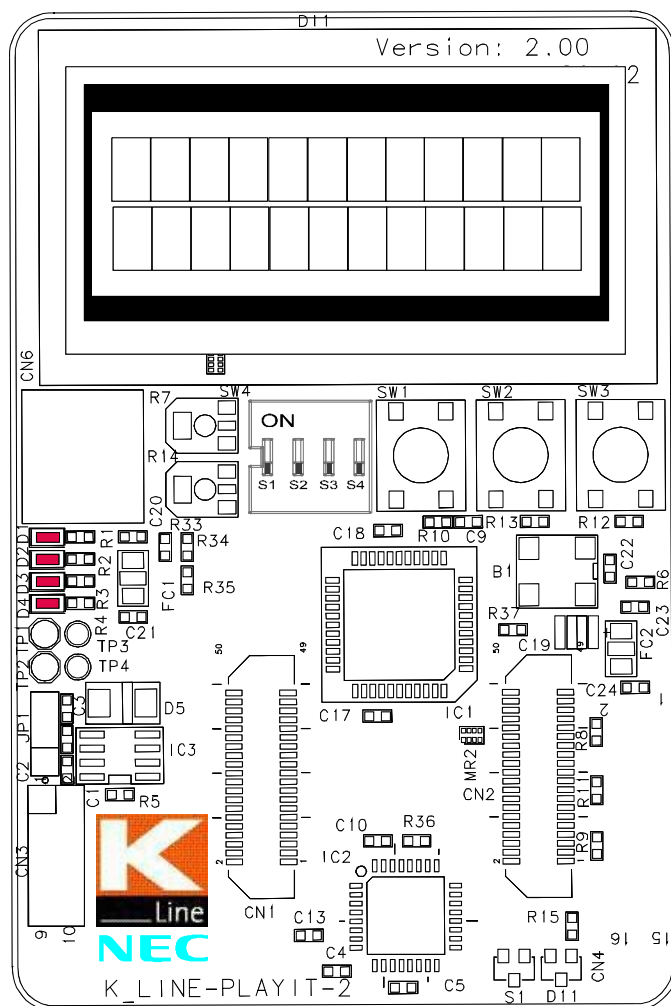


**Figure 2:  *K_Line - Play it!-2* baseboard connectors, switches and LED's**

Some of the *K_Line - Play it!-2* components are free for user application hardware and software. Please read the user's manual of the 78K0/KF1+ and the V850ES/KG1+ device carefully to get information about the electrical specification of the available I/O ports before you connect any external signal to the *K_Line - Play it!-2* board.

### 3.1 RESET button SW1

SW1 is a reset button. It activates the power on reset. It is connected to the reset input of the CPU module.

### 3.2 User button SW2

SW2 is a push button connecting $V_{CC}$ to external interrupt input INTP0 of the CPU module. This is equal to port P120 of the 78K0 CPU module and port P03 of the V850 CPU module. The port may be programmed to generate interrupt INTP0. The necessary initialisation for this purpose is described in the user's manual of the 78K0/KF1+ and the V850ES/KG1+ device. The port is connected to a 1.2K pull down resistor.

### 3.3 User button SW3

SW3 is a push button connecting $V_{CC}$ to external interrupt input INTP1 of the CPU module. This is equal to port P30 of the 78K0 CPU module and port P04 of the V850 CPU module. The port may be programmed to generate interrupt INTP1. The necessary initialisation for this purpose is described in the user's manual of the 78K0/KF1+ and the V850ES/KG1+ device. The port is connected to a 1.2K pull down resistor.

### 3.4 Configuration switch SW4

The different operation modes of the *K_Line - Play it!-2* board can be set by SW4 switches S1-S4.

| SW4 | Factory settings | 78K0/KF1+ | V850ES/KG1+ |
|-----|------------------|-----------|-------------|
| S1 | OFF | Normal operation mode | Normal operation mode |
| S2 | OFF | CPU clock = 8 MHz | CPU clock = 8 MHz |
| S3 | OFF | UART6 select | UART0 select |
| S4 | OFF | LIN bus disabled | LIN bus disabled |

**Table 1: Configuration switch SW4, factory settings**

### 3.4.1 Operation mode selection SW4/S1

SW4 switch S1 controls the operation mode of the *K_Line - Play it!-2* board. Setting SW4/S1 to ON allows to reprogram the internal FLASH memory of the 78K0/KF1+ and V850ES/KG1+ device using the FPL FLASH programming software.

| SW4, S1 | Operation mode |
|---------|----------------|
| OFF (default) | Normal operation mode |
| ON | FLASH memory programming mode |

**Table 2: Operation mode selection SW4/S1**

Within normal operation mode the user program stored in the FLASH memory of 78K0/KF1+ and V850ES/KG1+ device is executed.

### 3.4.2 Clock mode / OCD mode selection SW4/S2

SW4 switch S2 controls the clock operation frequency of the *K_Line - Play it!-2* board when using the V850 CPU module. By using the 78K0 CPU module switch S2 selects the on-chip debug function of the 78K0/KF1+ device. Setting switch S2 to ON allows, connecting the QB-78K0MINI on-chip debug emulator to the K_Line – Play *it!-2* 78K0 CPU module, connector CN7.

| SW4, S2 | 78K0/KF1+ | V850ES/KG1+ |
|---------|-----------|-------------|
| OFF (default) | Clock frequency = 8 MHz | Clock frequency = 8 MHz |
| ON | enable on-chip debugging | Clock frequency = 4 MHz |

**Table 3: Clock mode / OCD mode selection SW4/S2**

### 3.4.3 UART selection SW4/S3

SW4 switch S3 specifies the corresponding UART signals connected to the FT232 interface lines.

| SW4, S3 | 78K0/KF1+ | V850ES/KG1+ |
|---------|-----------|-------------|
| OFF (default) | UART6 select | UART0 select |
| ON | UART0 select | UART1 select |

**Table 4: UART selection SW4/S3**

### 3.4.4 UART/ LIN mode SW4/S4

SW4 switch S4 controls the serial communication mode of *K_Line - Play it!-2* board. The corresponding UART signals RxD and TxD selected by SW4/S3 are connected to the TJA1020 LIN transceiver when setting SW4/S4 to ON. Setting SW4/S4 to OFF connects the UART signals to the FT232 interface lines.

| SW4, S4 | Operation mode |
|---------|----------------|
| OFF (default) | UART mode |
| ON | LIN mode |

**Table 5: UART / LIN selection SW4/S4**

### 3.5 LIN plug JP1

JP1 is a 3 pin connector for the LIN bus, connected to the transceiver TJA1020.

| JP1 | Signal | Description |
|-----|--------|-------------|
| 1 | BAT | Reference voltage for the LIN bus level |
| 2 | LIN | LIN bus line |
| 3 | GND | Ground |

**Table 6: LIN plug JP1**

### 3.6 USB interface connector CN6

CN6 connector allows connecting the FPL FLASH programming software to the *K_Line - Play it!-2* board in order to program application programs into the CPU internal flash. The board power supply of 5V is also provided by connector CN6.

Additionally connector CN6 connects optionally UART6/0 of the 78K0/KF1+ device and UART0/1 of the V850ES/KG1+ device to the host system.

### 3.7 Connector CN4

CN4 connector (not assembled) allows connecting the PG-FP4 flash programmer to *K_Line – Play it!-2* board in order to program application programs into the CPU internal flash memory of the connected CPU module. Please note, PG-FP4 is a separate product from NEC and it is not included in this package.

| CN4 | Signal |
|-----|--------|
| 1 | GND |
| 2 | RESET |
| 3 | SI |
| 4 | $V_{CC}$ |
| 5 | SO |
| 6 | N.C. |
| 7 | SCK |
| 8 | N.C. |
| 9 | N.C. |
| 10 | N.C. |
| 11 | N.C. |
| 12 | FLMD1 |
| 13 | N.C. |
| 14 | FLMD0 |
| 15 | N.C. |
| 16 | N.C. |

**Table 7: CN4, PG-FP4 connector**

When using PG-FP4, the programming interface to the 78K0/KF1+ and V850ES/KG1+ device must be set to clock serial interface, SIO-ch0 without handshake. Set configuration of switch SW4 of *K_Line – Play it!-2* board to the following:

| SW4 | Setting |
|-----|---------|
| S1 | OFF |
| S2 | OFF |
| S3 | OFF |
| S4 | OFF |

**Table 8: SW4 configuration when using PG-FP4**

### 3.8 External Potentiometer R7

A 47K potentiometer R7 is connected between Vcc and ground. The potentiometer arm is connected to the V0 signal of the LCD module. It controls the operating voltage - contrast adjustment - of the display.

### 3.9 Display D1, 12*2 character LC display

The *K_Line - Play it!-2* board is equipped with a character LC display D1. The display font is equal to 12 character words at 2 lines. The LCD module contains about a character generator ROM - including predefined standard characters - and character RAM where user can rewrite characters by program. The display is connected to the 78K0 and V850 CPU module via three control lines and eight data lines.

| Display Pin | Display Signal | Port 78K0/KF1+ | Port V850ES/KG1+ | *Play it!-2* board |
|---|---|---|---|---|
| 1 | Vss | - | - | GND |
| 2 | Vcc | - | - | Vcc |
| 3 | V0 | - | - | R7 potentiometer arm |
| 4 | RS | P66 | PCT4 | - |
| 5 | R/W | P65 | PCT1 | - |
| 6 | E | P64 | PCT0 | - |
| 7 | DB0 | P40 | PDL0 | - |
| 8 | DB1 | P41 | PDL1 | - |
| 9 | DB2 | P42 | PDL2 | - |
| 10 | DB3 | P43 | PDL3 | - |
| 11 | DB4 | P44 | PDL4 | - |
| 12 | DB5 | P45 | PDL5 | - |
| 13 | DB6 | P46 | PDL6 | - |
| 14 | DB7 | P47 | PDL7 | - |
| 15 | A | - | - | Vcc via diode |

**Table 9: Display connections**

For more details about the LC display specification, commands and character table, please refer to the corresponding User's Manual "WH1202A-NFA-ET.pdf" located in the `/doc` folder of the *K_Line – Play it!-2* CDROM.

### 3.10 External Potentiometer R14

A 47K potentiometer R14 is connected between Vcc and ground. The potentiometer arm is connected to port P20 of 78K0/KF1+ and P70 of V850ES/KG1+ device. This is equal to the ANI0 analogue input.

### 3.11 AD converter reference voltage input

A 1.2V reference voltage is supplied to the ANI1 analogue input, equal to port P21 of 78K0/KF1+ and P71 of V850ES/KG1+ device.

### 3.12 Temperature sensor

For temperature measurement and primarily as an application example a silicon temperature sensor KTY13-5 is connected to the ANI2 analogue input, equal to port P22 of 78K0/KF1+ and port P72 of V850ES/KG1+ device.

The temperature sensor has a resistor range of $R_{25\ min}$ = 1950 Ω and $R_{25\ max}$ = 1990 Ω at 25 degrees centigrade, with $I_{OP}$ = 1mA. The distribution of the temperature factor $k_T$ is shown in the table below:

| $T_A$ | $k_T$ | | |
|---|---|---|---|
| °C | min. | typ. | max. |
| − 50 | 0.506 | 0.518 | 0.530 |
| − 40 | 0.559 | 0.570 | 0.581 |
| − 30 | 0.615 | 0.625 | 0.635 |
| − 20 | 0.676 | 0.685 | 0.694 |
| − 10 | 0.741 | 0.748 | 0.755 |
| 0 | 0.810 | 0.815 | 0.821 |
| 10 | 0.883 | 0.886 | 0.890 |
| 20 | 0.960 | 0.961 | 0.962 |
| 25 | 1.0 [1] | | |
| 30 | 1.039 | 1.040 | 1.041 |
| 40 | 1.119 | 1.123 | 1.126 |
| 50 | 1.204 | 1.209 | 1.215 |
| 60 | 1.291 | 1.300 | 1.308 |
| 70 | 1.383 | 1.394 | 1.405 |
| 80 | 1.478 | 1.492 | 1.506 |
| 90 | 1.577 | 1.594 | 1.611 |
| 100 | 1.680 | 1.700 | 1.720 |
| 110 | 1.786 | 1.810 | 1.833 |
| 120 | 1.896 | 1.923 | 1.951 |
| 130 | 2.010 | 2.041 | 2.072 |
| 140 | 2.093 | 2.128 | 2.163 |
| 150 | 2.196 | 2.235 | 2.274 |

1) Normalising point

**Table 10: Distribution of temperature factor $k_T$**

The sensor resistance can be calculated as following: $$R_T = k_T * R_{25} = \int (T_A)$$
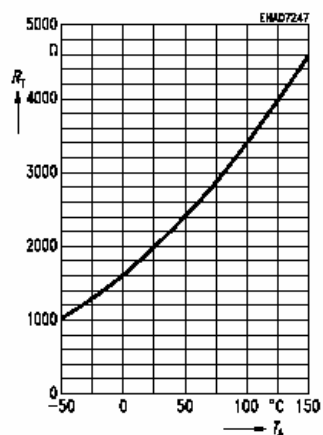
### 3.13  External LED's D1–D4

LED's D1 to D4 are connected to port P5 of the 78K0/KF1+ device. For the V850ES/KG1+ device port PCM is connected to LED's D1 to D4. A low signal output at each port switches the corresponding LED on.

| LED | Port 78K0/KF1+ | Port V850ES/KG1+ |
|-----|----------------|------------------|
| D1 | P50 | PCM0 |
| D2 | P51 | PCM1 |
| D3 | P52 | PCM2 |
| D4 | P53 | PCM3 |

**Table 11: LED D1–D4 connection**

## 4.  *K_Line - Play it!-2 CPU module* components

Both *K_Line – Play it!-2* CPU modules are equipped with 4 connectors in order to be connected to user defined hardware. One is the 78K0/KF1+ CPU module and the other the V850ES/KG1+ CPU module. Additionally the 78K0/KF1+ CPU module contains about connector CN7 for on-chip debugging purpose.

### 4.1  *K_Line - Play it!-2,* 78K0 CPU module



**Figure 3:** *K_Line - Play it!-2,* **78K0 CPU module components**

### 4.1.1  External connector CN3, CN4, CN5, and CN6

CN3, CN4, CN5, and CN6 are connectors for external user hardware.

| CN3 | Port 78K0/KF1+ | CN4 | Port 78K0/KF1+ | CN5 | Port 78K0/KF1+ | CN6 | Port 78K0/KF1+ |
|---|---|---|---|---|---|---|---|
| 1 | AV$_{REF}$ | 1 | P13, TxD6 | 1 | P03, SI11 | 1 | P43, AD3 |
| 2 | AV$_{SS}$ | 2 | P14, RxD6 | 2 | P02, SO11 | 2 | P42, AD2 |
| 3 | P120, INTP0 | 3 | P15, TOH0 | 3 | P01, TI010, TO00 | 3 | P41, AD1 |
| 4 | P33,TI51,TO51,INTP4 | 4 | P16, TOH1, INTP5 | 4 | P00, TI000 | 4 | P40, AD0 |
| 5 | P32, INTP3 | 5 | P17, TI50, TO50, FLMD1 | 5 | P67, ASTB | 5 | P77, KR7 |
| 6 | P31, INTP2 | 6 | P140, PCL, INTP6 | 6 | P66, WAIT | 6 | P76, KR6 |
| 7 | P30, INTP1 | 7 | P141, BUZ, BUSY0, INTP7 | 7 | P65, WR | 7 | P75, KR5 |
| 8 | FLMD0 | 8 | P63 | 8 | P64, WD | 8 | P74, KR4 |
| 9 | V$_{DD}$ | 9 | P62 | 9 | P57, A15 | 9 | P73, KR3 |
| 10 | NC | 10 | EV$_{SS}$ | 10 | P56, A14 | 10 | P72, KR2 |
| 11 | V$_{SS}$ | 11 | EV$_{DD}$ | 11 | P55, A13 | 11 | P71, KR1 |
| 12 | X1 | 12 | P61 | 12 | P54, A12 | 12 | P70, KR0 |
| 13 | X2 | 13 | P60 | 13 | P53, A11 | 13 | P27, ANI7 |
| 14 | RESET | 14 | P142, SCKA0 | 14 | P52, A10 | 14 | P26, ANI6 |
| 15 | XT1 | 15 | P143, SIA0 | 15 | P51, A9 | 15 | P25, ANI5 |
| 16 | XT2 | 16 | P144, SOA0 | 16 | P50, A8 | 16 | P24, ANI4 |
| 17 | P130 | 17 | P145, STB | 17 | P47, AD7 | 17 | P23, ANI3 |
| 18 | P10, SCK10, TxD0 | 18 | P06, TI011,TO01 | 18 | P46, AD6 | 18 | P22, ANI2 |
| 19 | P11, SI10, RxD0 | 19 | P05, SSI11, TI001 | 19 | P45, AD5 | 19 | P21, ANI1 |
| 20 | P12, SO10 | 20 | P04, SCK11 | 20 | P44, AD4 | 20 | P20, ANI0 |

**Table 12: CN3, CN4, CN5, and CN6 connection to 78K0/KF1+**

**4.1.2  OCD connector CN7**

CN7 connector allows connecting the QB-78K0MINI on-chip debug emulator to the *K_Line – Play it!-2* 78K0 CPU module in order to use on-chip debug function of the 78K0/KF1+ device. QB-78K0MINI is a separate product from NEC and it is not included in this starterkit package.

| CN7 | Function |
|-----|----------|
| 1 | RESET_IN |
| 2 | RESET_OUT |
| 3 | FLMD0 |
| 4 | VDD_IN |
| 5 | X2 |
| 6 | GND |
| 7 | X1 |
| 8 | GND |
| 9 | N.C. |
| 10 | N.C. |

**Table 13: OCD connector CN7**

To enable on-chip debugging for the 78K0/KF1+ CPU module, please set switch SW4 to the following configuration:

| SW4 | Setting | 78K0/KF1+ |
|-----|---------|-----------|
| S1 | OFF | Normal operation mode |
| S2 | ON | enable on-chip debugging |
| S3 | don't care | UART6/0 select |
| S4 | don't care | UART/LIN select |

**Table 14: SW4 configuration for OCD**

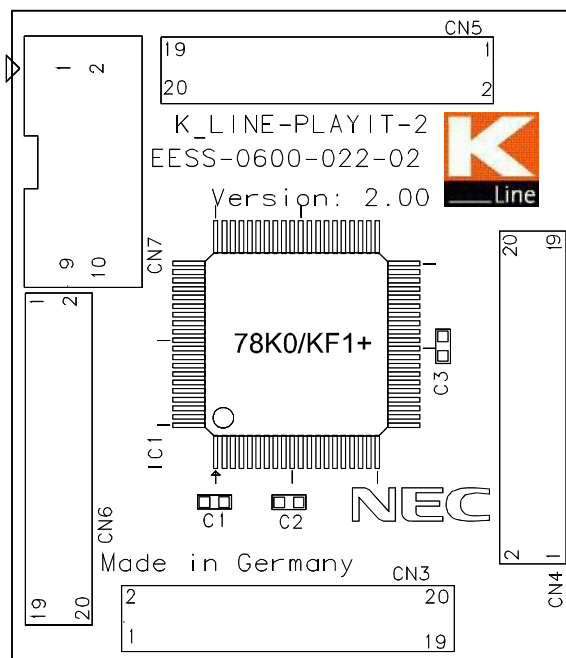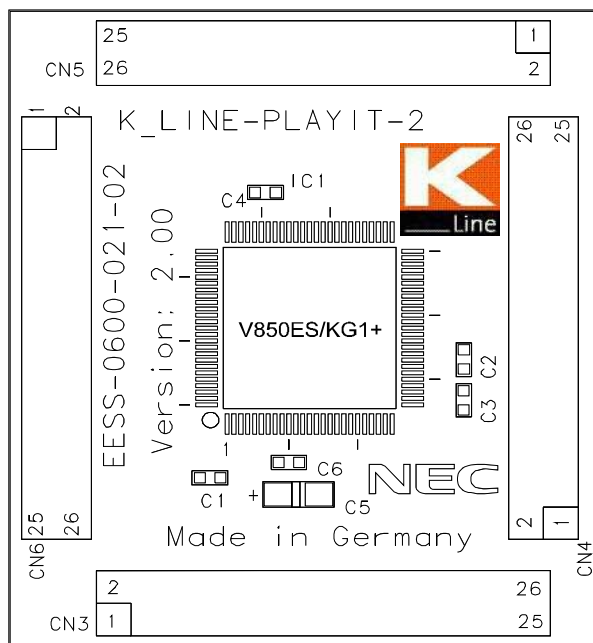### 4.2  *K_Line - Play it!-2,* **V850 CPU module**



**Figure 4:** *K_Line - Play it!-2, V850* **CPU module components**

### 4.2.1  External connector CN3, CN4, CN5, and CN6

CN3, CN4, CN5, and CN6 are connectors for external user hardware.

| CN3 | Port V850ES/KG1+ |
|-----|------------------|
| 1 | $AV_{REF0}$ |
| 2 | $AV_{SS}$ |
| 3 | P10, ANO0 |
| 4 | P11, ANO1 |
| 5 | $AV_{REF1}$ |
| 6 | P00, TOH0 |
| 7 | P01, TOH1 |
| 8 | FLMD0, IC |
| 9 | $V_{DD}$ |
| 10 | REGC |
| 11 | $V_{SS}$ |
| 12 | X1 |
| 13 | X2 |
| 14 | RESET |
| 15 | XT1 |
| 16 | XT2 |
| 17 | P02, NMI |
| 18 | P03, INTP0 |
| 19 | P04, INTP1 |
| 20 | P05, INTP2 |
| 21 | P06, INTP3 |
| 22 | P40, SI00, RXD2 |
| 23 | P41, SO00, TXD2 |
| 24 | P42, SCK00 |
| 25 | P30, TXD0, TO02 |
| 26 | N.C. |

| CN4 | Port V850ES/KG1+ |
|-----|------------------|
| 1 | P32, ASCK0, ADTRG, TO01 |
| 2 | P31, RXD0, INTP7, TO03 |
| 3 | P34, TI001, TO00, TIP01 |
| 4 | P33, TI000, TO00, TIP00 |
| 5 | P36 |
| 6 | P35, TI010,TO01 |
| 7 | $EV_{SS}$ |
| 8 | P37 |
| 9 | P38, SDA0 |
| 10 | $EV_{DD}$ |
| 11 | P50, TI011, RTP00, KR0 |
| 12 | P39, SCL0 |
| 13 | P52, TO50, RTP02, KR2 |
| 14 | P51, TI50, RTP01, KR1 |
| 15 | P54, SOA0, RTP04, KR4 |
| 16 | P53, SIA0, RTP03, KR3 |
| 17 | P90, TxD1, KR6, A0 |
| 18 | P55, SCKA0, RTP05, KR5 |
| 19 | P92, TI020, TO02, A2 |
| 20 | P91, RxD1, KR7, A1 |
| 21 | P94, TI030, TO03, A4 |
| 22 | P93, TI021, A3 |
| 23 | P96, TI051, TO51, A6 |
| 24 | P95, TI031, A5 |
| 25 | N.C. |
| 26 | P97, SI01, A7 |

| CN5 | Port V850ES/KG1+ |
|-----|------------------|
| 1 | P98, SO01, A8 |
| 2 | P99, SCK01, A9 |
| 3 | P910, SIA1, A10 |
| 4 | P911, SOA1, A11 |
| 5 | P912, SCKA1, A12 |
| 6 | P913; INTP4, A13 |
| 7 | P914, INTP5, A14 |
| 8 | P915, INTP6, A15 |
| 9 | PCS0, CS0 |
| 10 | PCS1, CS1 |
| 11 | PCM0, WAIT |
| 12 | PCM1, CLKOUT |
| 13 | PCM2, HLDAK |
| 14 | PCM3, HLDRQ |
| 15 | PCT0, WR0 |
| 16 | PCT1, WR1 |
| 17 | PCT4, RD |
| 18 | PCT6, ASTB |
| 19 | $BV_{SS}$ |
| 20 | $BV_{DD}$ |
| 21 | PDL0, AD0 |
| 22 | PDL1, AD1 |
| 23 | PDL2, AD2 |
| 24 | PDL3, AD3 |
| 25 | PDL4, AD4 |
| 26 | N.C. |

| CN6 | Port V850ES/KG1+ |
|-----|------------------|
| 1 | PDL6, AD6 |
| 2 | PDL5, AD5, FLMD1 |
| 3 | PDL8, AD8 |
| 4 | PDL7, AD7 |
| 5 | PDL10, AD10 |
| 6 | PDL9, AD9 |
| 7 | PDL12, AD12 |
| 8 | PDL11, AD11 |
| 9 | PDL14, AD14 |
| 10 | PDL13, AD13 |
| 11 | PDH0, AD16 |
| 12 | PDL15, AD15 |
| 13 | PDH2, A18 |
| 14 | PDH1, A17 |
| 15 | PDH4, A20 |
| 16 | PDH3, A19 |
| 17 | P77, ANI7 |
| 18 | PDH5, A21 |
| 19 | P75, ANI5 |
| 20 | P76, ANI6 |
| 21 | P73, ANI3 |
| 22 | P74, ANI4 |
| 23 | P71, ANI1 |
| 24 | P72, ANI2 |
| 25 | N.C. |
| 26 | P70, ANI0 |

**Table 15: CN3, CN4, CN5, and CN6 connection to V850ES/KG1+**

### 4.3 78K0/KF1+ memory map

The 78K0/KF1+ memory layout is shown in the table below.

| Address area | | | |
|---|---|---|---|
| | 0xFFFF<br><br>0xFF00 | SFR Area | Free for application software |
| | 0xFEDF<br><br>0xFB00 | Internal high speed RAM | |
| | 0xFAFF<br><br>0xF800 | Reserved | |
| | 0xF7FF<br><br>0xF400 | Internal expansion RAM | Free for application software |
| | 0xF3FF<br><br>0xF000 | External memory | |
| | 0xEFFF<br><br>0x0000 | Flash memory | Free for application software |

**Table 16: 78K0/KF1+ memory map**

The *K_Line - Play it!-2* does not reserve any resources of the 78K0S/KF1+ device, consequently all available memory of the device is free for application software.

### 4.4 V850ES/KG1+ memory map

The V850ES/KG1+ memory layout is shown in the table below.

| Address area | | | |
|---|---|---|---|
| | 0x3FFFFFF<br><br>0x3FFF000 | SFR Area | Free for user application software |
| | 0x3FFEFFF<br><br>0x3FFD800 | Internal high speed RAM | |
| | 0x3FFD7FF<br><br>0x1000000 | Reserved | |
| | 0x0FFFFFF<br><br>0x0100000 | External memory | |
| | 0x001FFFF<br><br>0x0000000 | Flash memory | Free for user application software |

**Table 17: V850ES/KG1+ memory map**

The *K_Line - Play it!-2* does not reserve any resources of the V850ES/KG1+ device, consequently all available memory of the device is free for application software.

## 5. *K_Line - Play it!-2* installation and operation

### 5.1 Getting started

The windows based FPL FLASH programming software allows to select and download application programs to *K_Line - Play it!-2* starterkit. As communication interface between PC host system and the *K_Line - Play it!-2* board a USB interface line is needed. Before you can download and run a program, hardware and software must be installed properly.

### 5.1.1 CD-ROM contents

The CD-ROM shows following directory structure:

| | |
|---|---|
| K_Line – Play it!-2 (F:) | CD-ROM ROOT |
| Acrobat | - Acrobat Reader for 32Bit Windows OS |
| Doc | - Documentation |
| FPL | - FPL FLASH programming software |
| Drivers | … USB driver |
| FPL | … FPL setup directory |
| PRM | … PRM parameter files |
| IAR Embedded Workbench 78K | - IAR Embedded Workbench for 78K0/78K0S |
| IAR Embedded Workbench V850 | - IAR Embedded Workbench for V850 |
| SamplePrograms | - Sample programs for *K_Line – Play it!-2* |
| AD Converter Demonstration | … AD converter demonstration |
| Reaction Time Measurement | … Reaction time measurement |
| Timer Demonstration | … Timer demonstration |
| UART Demonstration | … UART demonstration |

**Table 18:** *K_Line - Play it!-2* **CD-ROM directory structure**

## 6. Hardware installation

After unpacking *K_Line - Play it!-2,* connect the board to your host computer using the provided USB interface cable. When *K_Line - Play it!-2* is connected, the USB driver needs to be installed on the host machine. Please refer to the following **CHAPTER 7 SOFTWARE INSTALLATION**.

## 7. Software installation

The *K_Line - Play it!-2* package comes with several software demo packages:

- IAR Systems Embedded Workbench for 78K0/78K0S, including C compiler, assembler, linker, librarian and IAR C-SPY debugger / simulator
- IAR Systems Embedded Workbench for V850, including C compiler, assembler, linker, librarian and IAR C-SPY debugger / simulator
- FPL FLASH programming software
- Sample programs

The IAR Systems Embedded Workbenches and the FPL FLASH programming GUI must be installed on your PC. For detailed installation hints, refer to the following chapters and to the corresponding documentation of the IAR Embedded Workbenches.

The sample programs can be downloaded to the *K_Line - Play it!-2* board directly from the CDROM. Only if you intend to modify or debug (simulate) the sample programs it is necessary to copy them to your local hard disk.

Remark:     Before modification or re-building of sample programs, do not forget to remove "Read-only" attribute of copied files.

### 7.1  IAR Systems Embedded Workbench for 78K0/78K0S installation

To install the IAR Systems Embedded Workbench for 78K0/K0S including C-SPY debugger / simulator, select the SETUP program in the directory \IAR Embedded Workbench 78K\ew78k\ of the CDROM. The setup dialogues will guide you through the installation process.

### 7.2  IAR Systems Embedded Workbench for V850 installation

To install the IAR Systems Embedded Workbench for V850 including C-SPY debugger / simulator, select the SETUP program in the directory \IAR Embedded Workbench V850\ewv850\ of the CDROM. The setup dialogues will guide you through the installation process.

### 7.3  FPL FLASH programming GUI installation

To install the FPL FLASH programming GUI select the SETUP program in the directory \FPL\ of the CDROM. The setup dialogues will guide you through the installation process.

### 7.4  Sample program installation

The sample programs do not require any installation for download to the *K_Line - Play it!-2* board. If the sample programs shall be modified it is required to copy them into any directory of your local hard disk. A file copy using the Windows explorer is the recommended procedure.

Remark:     Before modification or re-building of sample programs, do not forget to remove "Read-only" attribute of copied files.

### 7.5  USB Driver Installation

When the *K_Line - Play it!-2* board and FPL is used, the driver needs to be installed on the host machine. Install the driver according to the following procedure:

### 7.5.1  Installation on Windows 98SE/Me

1.  When the *K_Line - Play it!-2* 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 5:  Add New Hardware Wizard (Windows 98SE)**
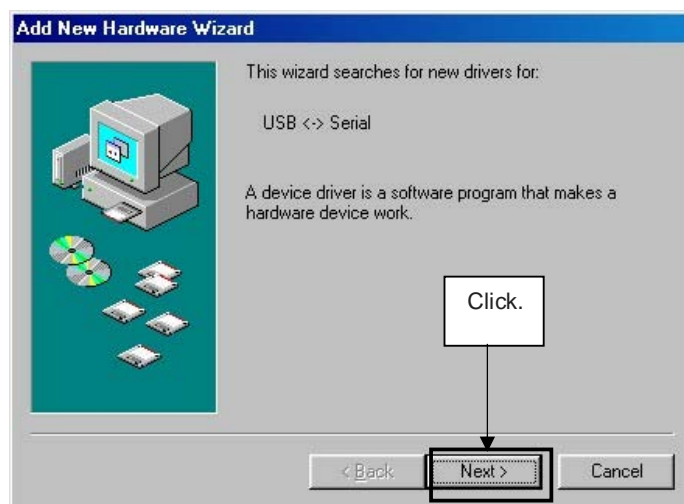


2.  The window below is displayed. So, check that "Search for a suitable driver ..." is selected, then click Next>.

**Figure 6: Search Method (Windows 98SE)**
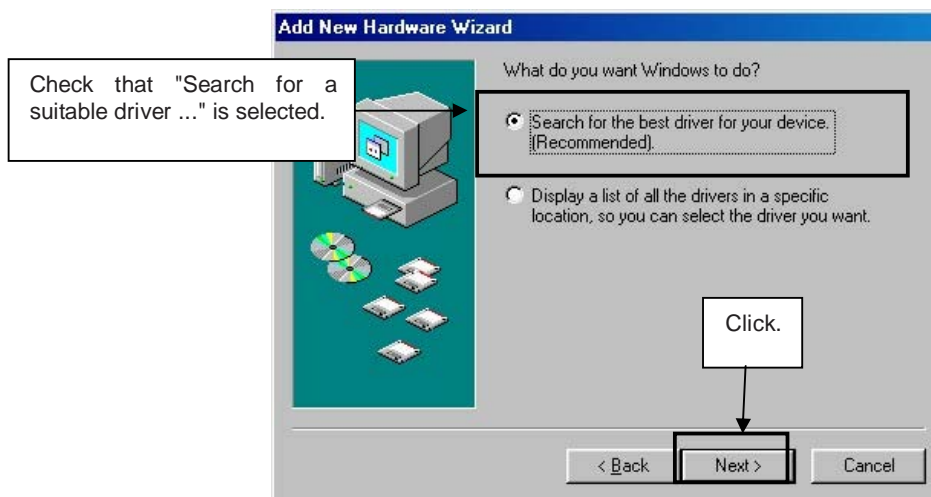
3. Check the "Specify a location" check box only and enter "C:\Program Files\NECTools32\FPL\DRIVER" in the address bar, then click Next>.

**Figure 7: Search Location Specification (Windows 98SE)**
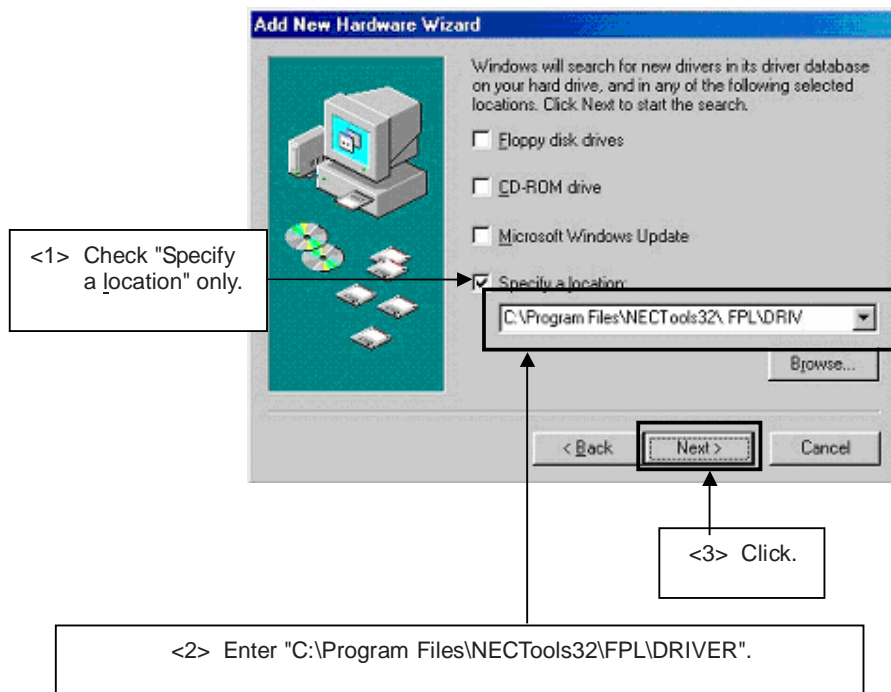


<1> Check "Specify a location" only.

<2> Enter "C:\Program Files\NECTools32\FPL\DRIVER".

<3> Click.

Remark   If the installation destination folder is changed at the time of GUI software installation, enter "new-folder\DRIVER".

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

**Figure 8: Checking Driver to Be Installed (Windows 98SE)**



Click.

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 9: Installation Completion (Windows 98SE)**



**7.5.2 Installation on Windows 2000**

1. When the *K_Line - Play it!-2* 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 10: 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 11: Search Method 1 (Windows 2000)**

Check that "Search for a suitable driver ..." is selected.
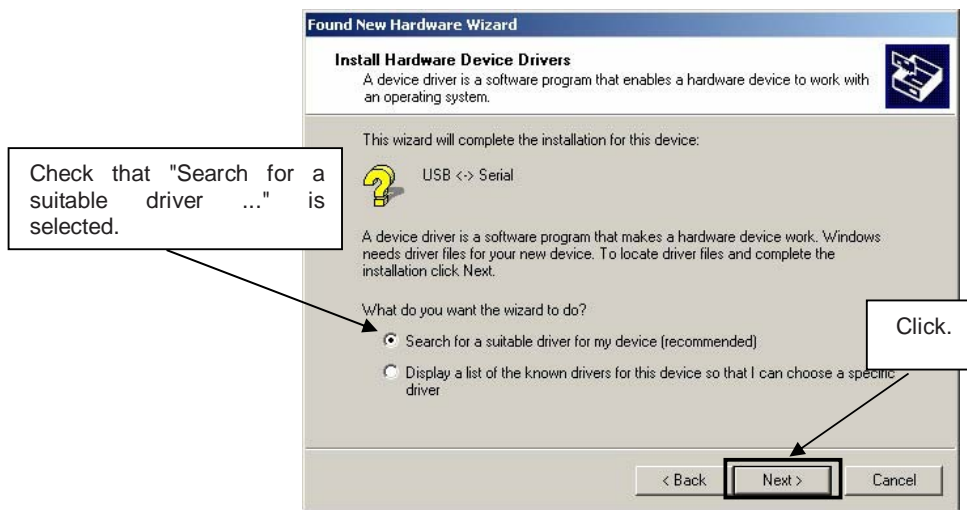
Click.

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

**Figure 12: Driver File Location 1 (Windows 2000)**

Check that "Specify a location" only is checked. ed.hed.
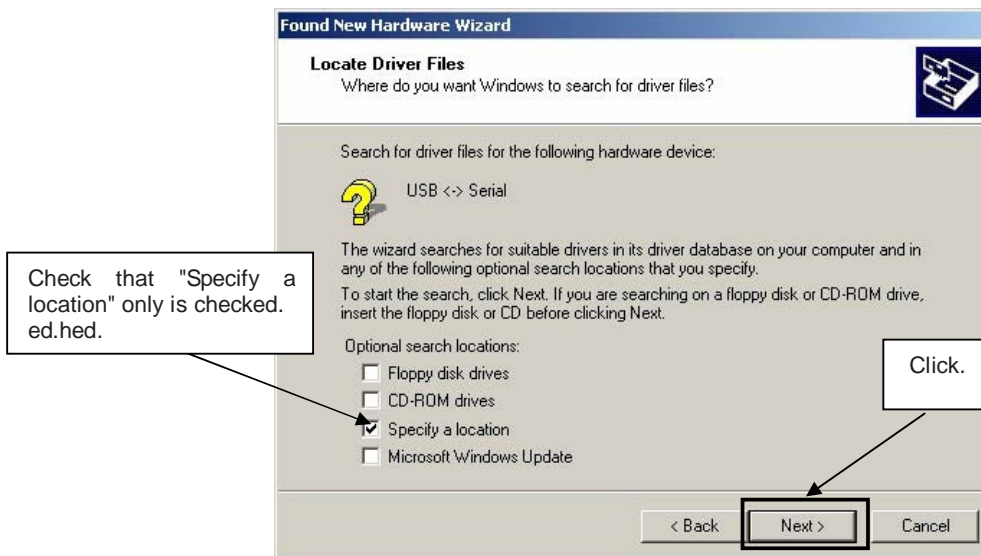
Click.

4. Enter "C:\Program Files\NECTools32\FPL\DRIVER" in the address bar, then click OK.

**Figure 13: Address Specification 1 (Windows 2000)**
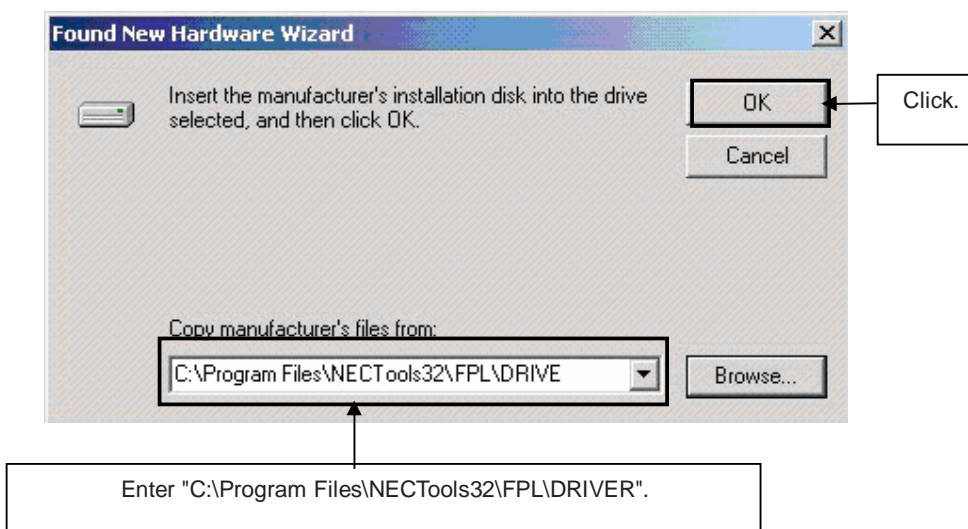


Remark If the installation destination folder is changed at the time of GUI software installation, enter "new-folder\FPL\DRIVER".

5. Click Next>.

**Figure 14: Driver File Search 1 (Windows 2000)**

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

**Figure 15: USB Driver Installation Completion 1 (Windows 2000)**



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

**Figure 16: 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 17: Search Method 2 (Windows 2000)**



Check that "Search for a suitable driver ..." is selected.
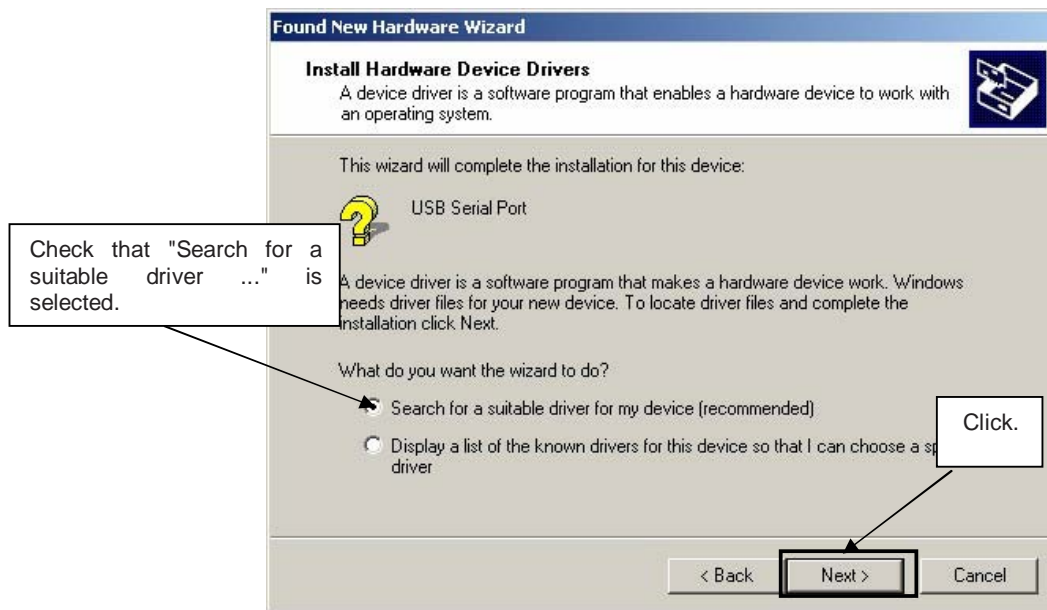
Click.

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

**Figure 18: Driver File Location 2 (Windows 2000)**



Check that "Specify a location" only is checked.
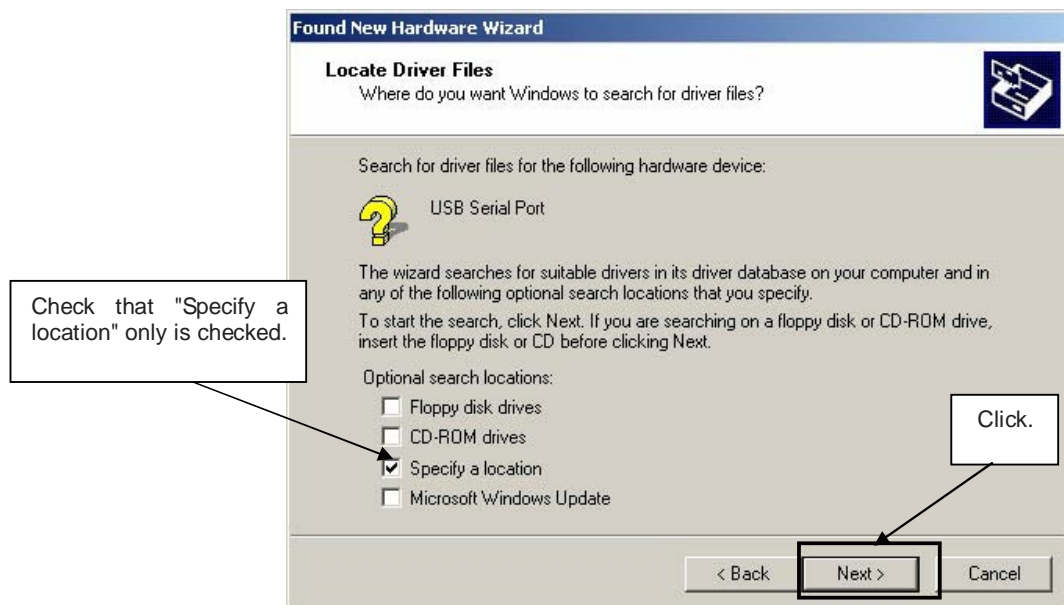
Click.

10. Enter "C:\Program Files\NECTools32\FPL\DRIVER" in the address bar, then click OK.

**Figure 19: Address Specification 2 (Windows 2000)**
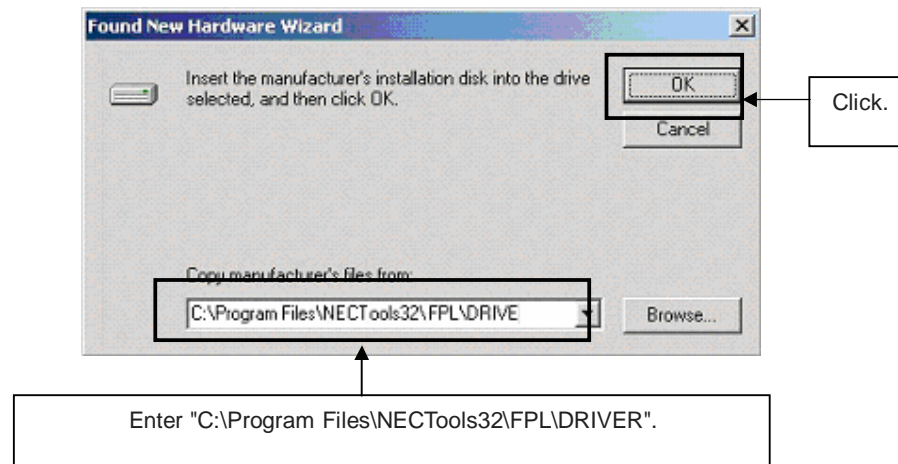


Remark    If the installation destination folder is changed at the time of GUI software installation, enter "new-folder\DRIVER".

11. Click Next>.

**Figure 20: Driver File Search 2 (Windows 2000)**
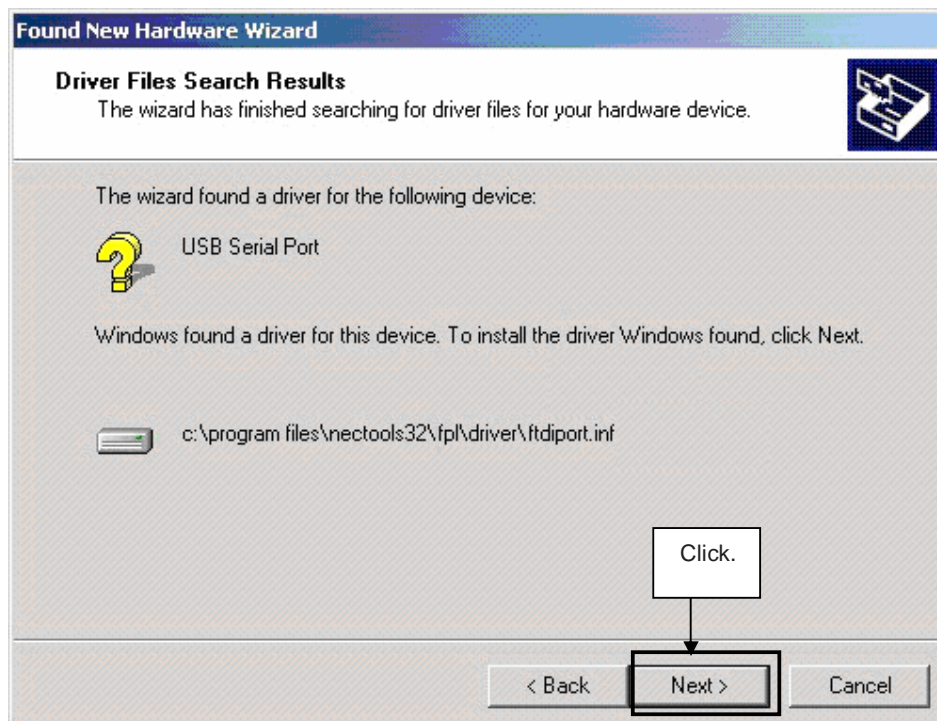
12.  Click Finish to complete the installation of the USB driver.

**Figure 21: USB Driver Installation Completion 2 (Windows 2000)**
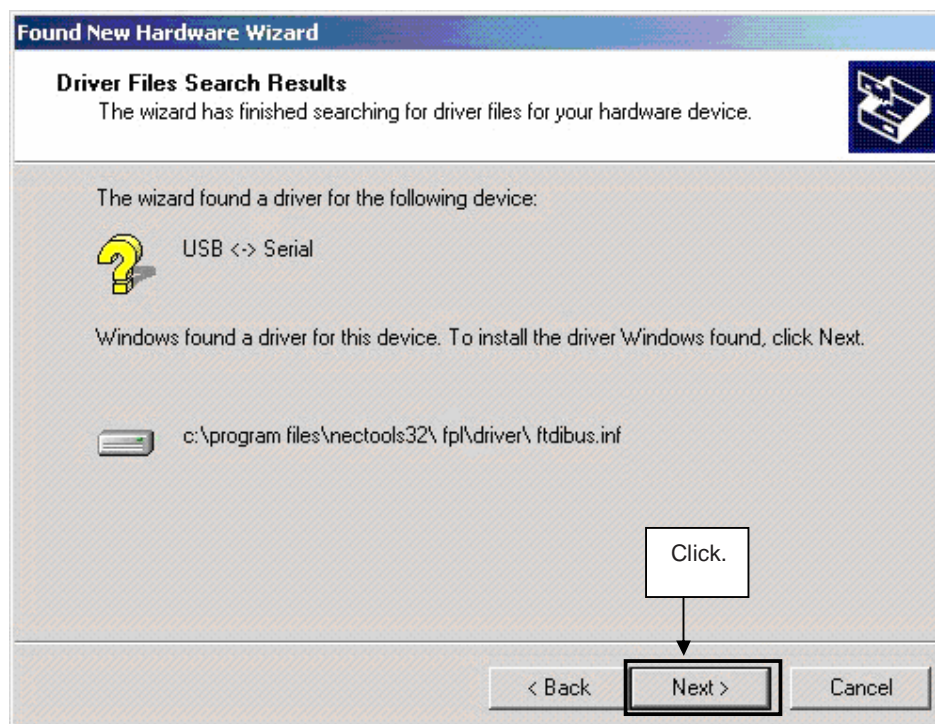
Completing the Found New Hardware Wizard

USB Serial Port

Windows has finished installing the software for this device.

Click.

To close this wizard, click Finish.

< Back  Finish  Cancel

### 7.5.3  Installation on Windows XP

1.  When the *K_Line - Play it!-2* board is connected with the host machine, the board is 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 22: Found New Hardware Wizard 1 (Windows XP)**

Welcome to the Found New Hardware Wizard

This wizard helps you install software for:

USB <-> Serial

If your hardware came with an installation CD or floppy disk, insert it now.

What do you want the wizard to do?

Check that "Install from a list or specific ..." is selected.

○ Install the software automatically (Recommended)
⦿ Install from a list or specific location (Advanced)

Click Next to continue.

Click.

< Back  Next >  Cancel

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\FPL\DRIVER" in the address bar, then click Next>.

**Figure 23: Search Location Specification 3 (Windows XP)**

<1> Check that "Search for the best driver in these locations." is selected.

<2> Check "Include this location in the search:" only.

**Found New Hardware Wizard**

Please choose your search and installation options.

◉ Search for the best driver in these locations.

Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.

☐ Search removable media (floppy, CD-ROM...)

☑ Include this location in the search:

C:\Program Files\NECTools32\FPL\DRIVER    [Browse]

○ Don't search. I will choose the driver to install.

Choose this option to select the device driver from a list.  Windows does not guarantee that the driver you choose will be the best match for your hardware.

[< Back]  [Next >]  [Cancel]

<3> Enter "C:\Program Files\NECTools32\FPL\DRIVER".

<4> Click.

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

**Figure 24: Windows XP Logo Testing 3 (Windows XP)**

**Hardware Installation**

⚠ The software you are installing for this hardware:

USB High Speed Serial Converter

has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)

**Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.**

Click.

[Continue Anyway]  [STOP Installation]

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

**Figure 25: USB Driver Installation Completion 1 (Windows XP)**



5. Proceed to the installation of the USB Serial Port driver. Click Next>.
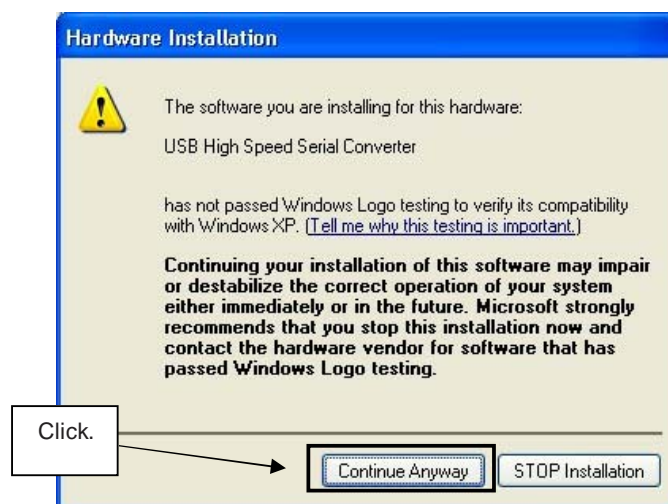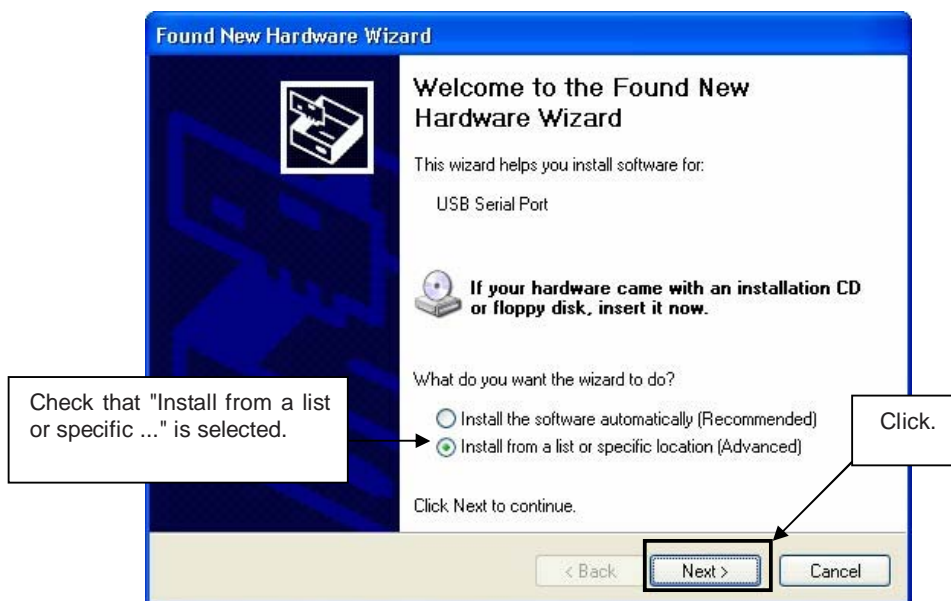
**Figure 26: Found New Hardware Wizard 2 (Windows XP)**

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\FPL\DRIVER", then click Next>.

**Figure 27: Search Location Specification 2 (Windows XP)**

<1> Check that "Search for the best driver in these locations." is selected.

<2> Check "Include this location in the search:" only.

<3> Enter "C:\Program Files\NECTools32\FPL\DRIVER".
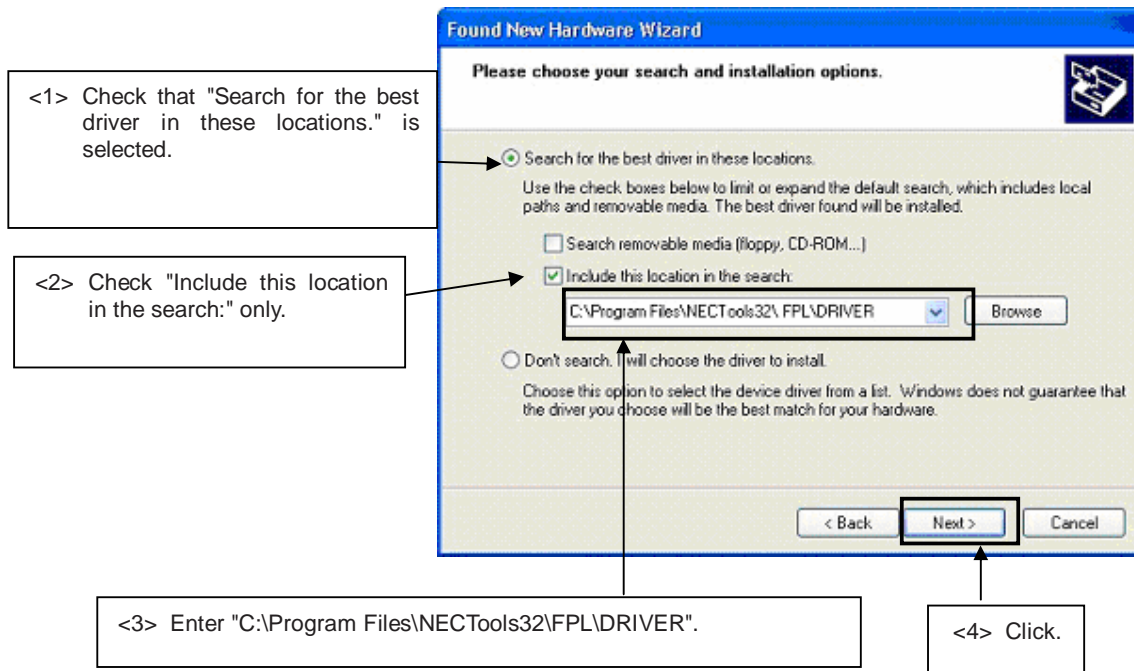
<4> Click.

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

**Figure 28: Windows XP Logo Testing 2 (Windows XP)**

Click.

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

**Figure 29: USB Serial Port2 Driver Installation Completion (Windows XP)**

### 7.6 Confirmation of USB Driver Installation

After installing the two types of drivers, check that the drivers have been installed normally, according to the procedure below. When using the *K_Line - Play it!-2* board in combination with FPL GUI, the information to be checked here is needed.

By clicking the "Device Manager" tab, check that the drivers are installed normally.

**Figure 30: Device Manager**
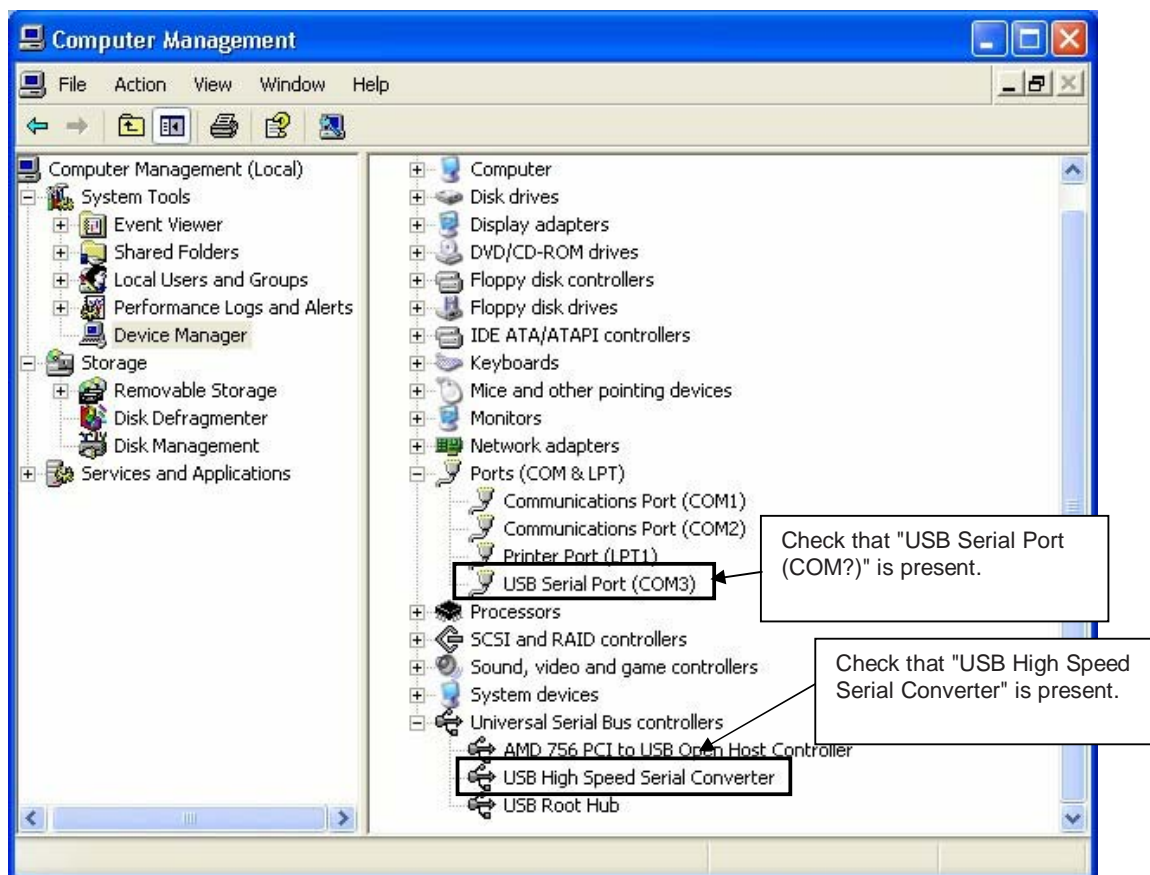


For Windows 98SE/Me

> Caution  Do not select Update and Erase when communicating with the target device.

For Windows 2000/XP

> Caution  Do not perform "Hardware Modification Scan" when communicating with the target device.

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**.

### 7.7  Driver Uninstallation

The driver uninstallation program is installed on the host machine when the FPL software is installed. Use the procedure below for driver uninstallation.

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

2.  Double-click in the order from "My Computer" to "(C:)" to "Program Files" to "NECTools32" to "FPL" to "DRIVER".  "Ftdiunin.exe" is displayed.  Double-click "Ftdiunin.exe".

**Figure 31: Driver Uninstallation**
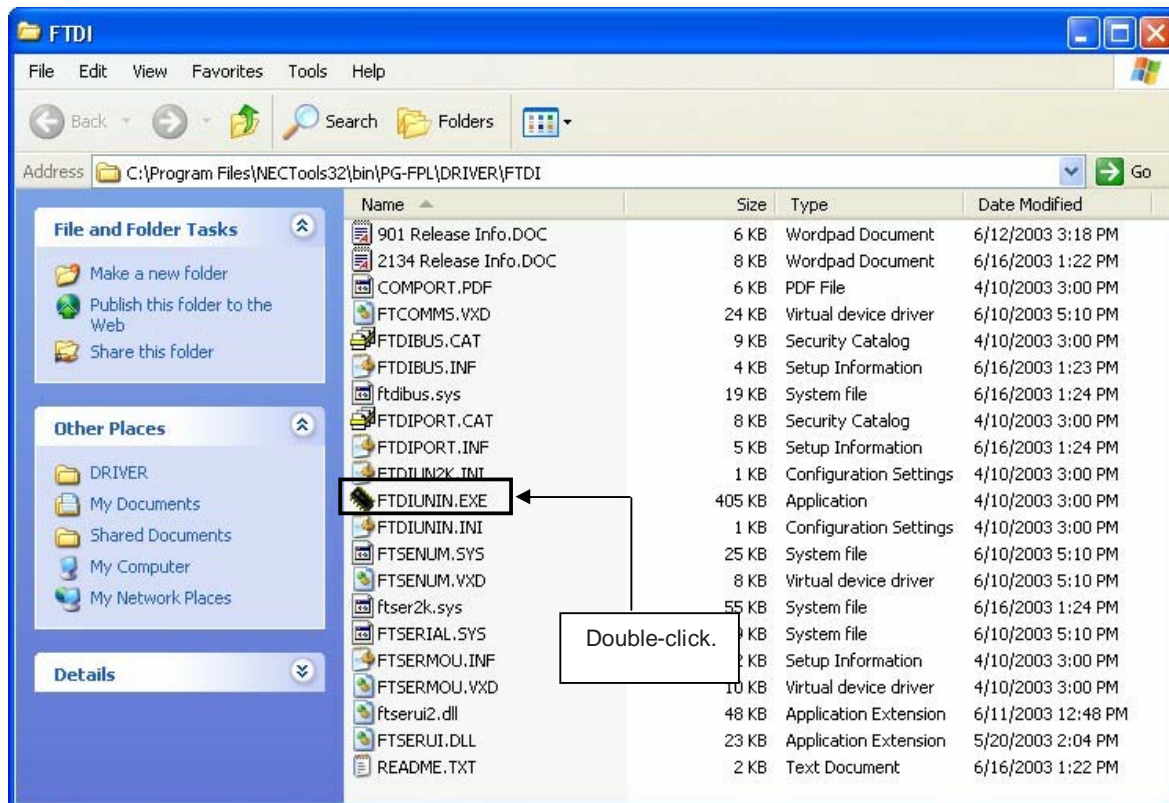


3.  Click Continue.

**Figure 32: Driver Uninstaller**

4.    Click Finish to complete driver uninstallation.

**Figure 33: Completion of Driver Uninstallation**



| Caution | If the GUI software is uninstalled earlier, "Ftdiunin.exe" is also deleted.  At this time, delete "USB Serial Port (COM?)" and "USB High Speed Serial Converter" from Device Manager manually. |
|---|---|

## 8. FPL FLASH programming software

### 8.1 Introduction

The parameter files for the 78K0/KF1+ and V850ES/KG1+ devices are installed automatically during installation of FPL GUI, folder <FPL install-path>\PRM. Nevertheless, newest version of parameter file for the µPD78F0148HD and µPD70F3311 device can by download from the NEC Electronics Web site.

Download the parameter file for the PG-FP4 from the following NEC Electronics Web site:

http://www.ee.nec.de/updates

Copy the parameter file downloaded from the NEC Electronics Web site into sub-directory <FPL.EXE-install-path>\PRM created during GUI software setup (refer to **CHAPTER 7 SOFTWARE INSTALLATION**)..

### 8.2 Starting up the GUI Software

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

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

**Figure 34: GUI Software Main Window**
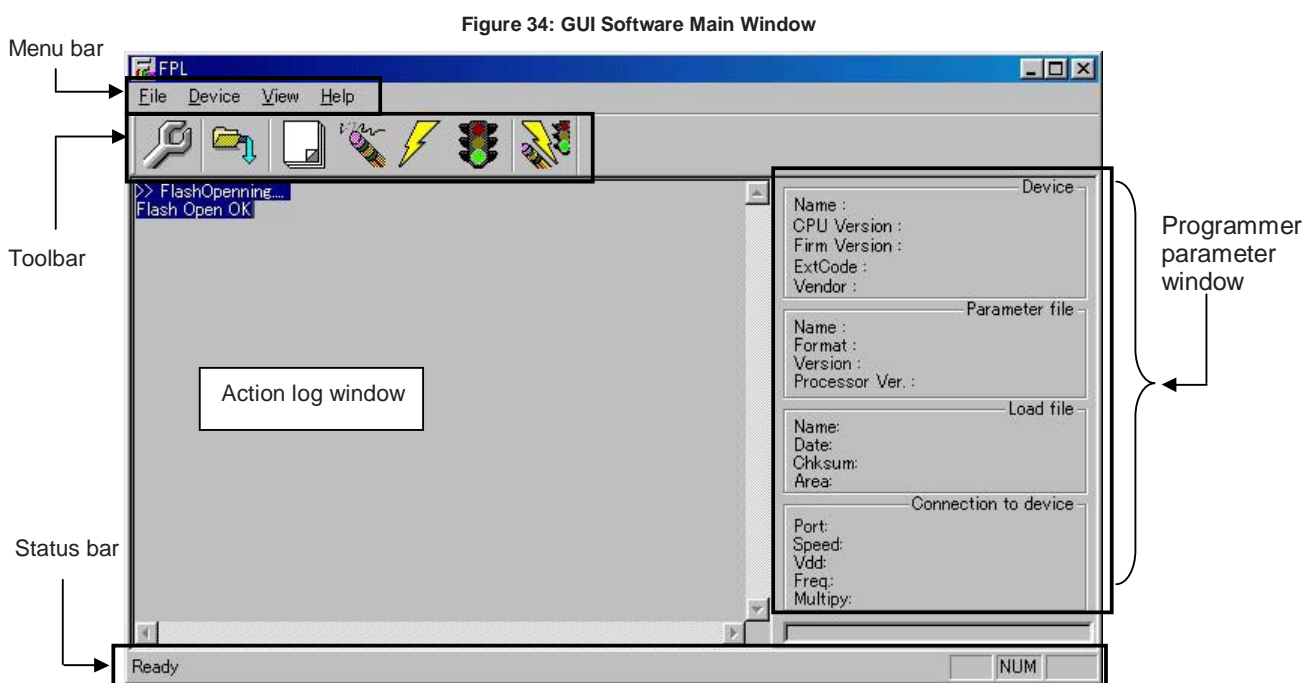
This window consists of the following items:

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

## 8.3 Toolbar

The toolbar contains buttons for starting the important procedures of the FPL.

**Figure 35: Toolbar Buttons**

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

### 8.4　Menu Bar

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

### 8.4.1　[File] menu

Clicking the [File] menu displays the pull-down menu as shown below.
This menu mainly contains commands related to file operation.
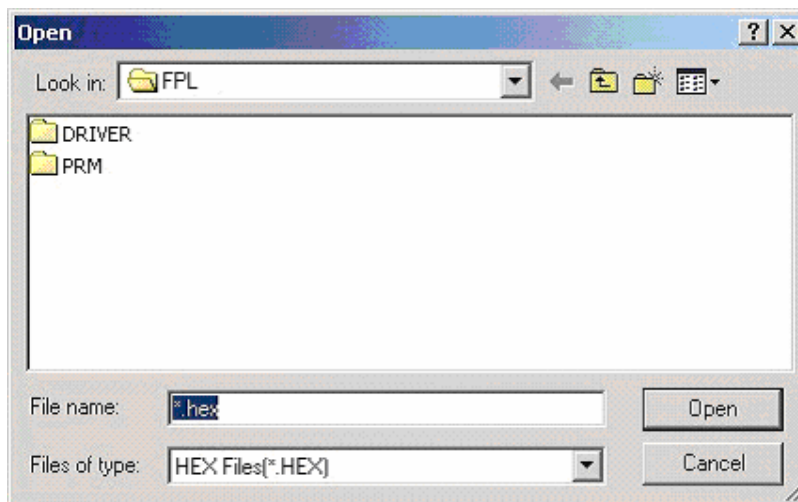
**Figure 36: [File] Menu**



### (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 37: 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 FPL GUI software.  Clicking ☒ on the right side of the task bar also terminates the FPL GUI software.
User settings are saved in the FPL.INI[Note] file, so that the GUI software starts up next time with the same settings.

Note　FPL.INI is created in the Windows folder when Windows 98SE, Windows Me, or Windows XP is used.
When Windows 2000 is used, FPL.INI is created in the Winnt folder.

**8.4.2　[Device] menu**

Clicking the [Device] menu displays the pull-down menu as shown below.
This menu mainly contains commands for programming operations such as deletion, programming, and verification on the target device.

**Figure 38: [Device] Menu**

**(1)** **[Blank Check] command**

The [Blank Check] command allows you to make a blank check on the target device connected to the FPL.  If the flash memory of the target 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 target device connected to the FPL.  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 FPL 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**

The [Verify] command sends a specified user program to the target device connected with the FPL, and performs verification against the data written to the flash memory of the target device.

During verification, the progress status is displayed in the action log window to indicate programmer operation.  This progress status display window displays the progress status of target device verification by percentage.

Upon completion of [Verify] command execution, the GUI software displays the result of executing the command on the target device.

**(5)  [Security] command**

This command is not supported.

**(6)  [Checksum] command**

The [Checksum] command reads the checksum value of the target device connected with the FPL.

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, [Program] command and [Verify] command in succession.

When a user program is to be resent to the target device for comparison with the data written to the flash memory of the target device because of a user program communication error, execute the [Program] command by selecting [Device] → [Setup] and specifying 'Command options' on the Advance tab, then set the automatic execution of the [Verify] command.

During EPV execution, the progress status is displayed in the action log window to indicate programmer operation.  For a selected command, its execution operation, and messages, refer to **CHAPTER 9 HOW TO USE FPL**.

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**

The [Signature read] command reads the signature information (device name, flash memory information, and so forth) of the target.

**(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.  For details, refer to the manual of the device used, when making settings.
The window shown below is opened.

**Figure 39: Device Setup Window - Standard**
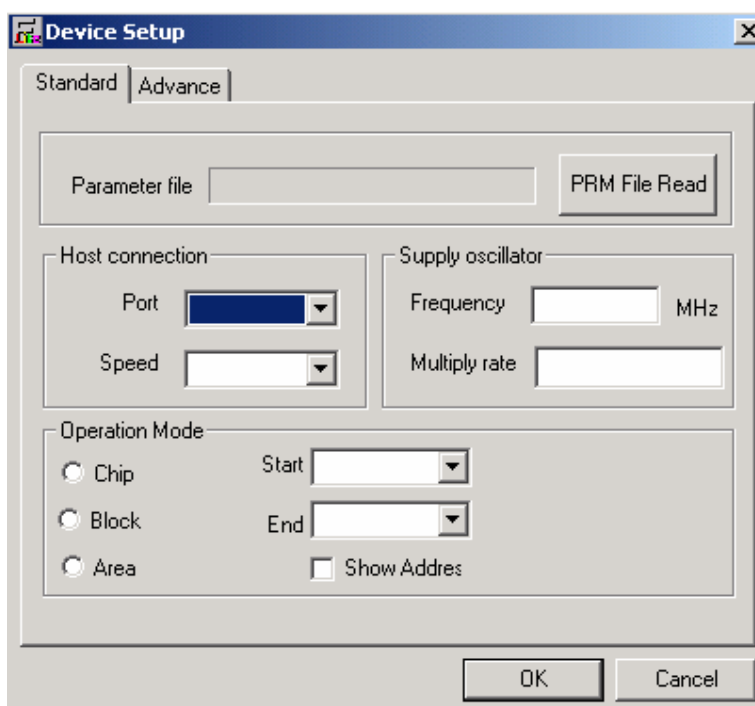


This window shows all basic options that can be set in accordance with the user environment and target device.

[ 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, the FPL does not accept the parameter file.

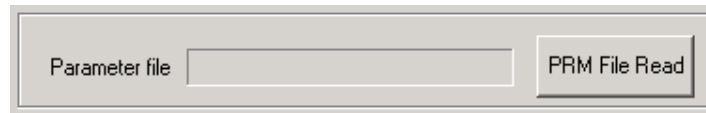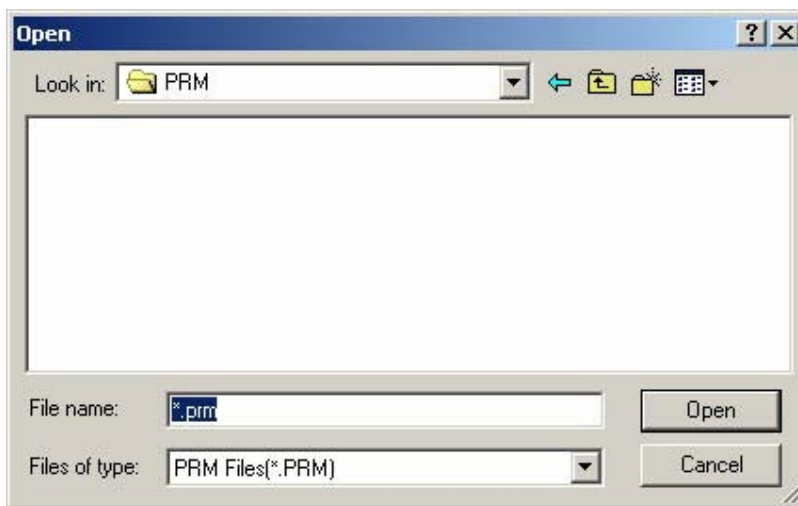**Figure 40: Setup Window - Parameter File Selection**



**Figure 41: 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 *K_Line – Play it!-2* board and host machine.

**Figure 42: Setup Window - Communication interface to device**
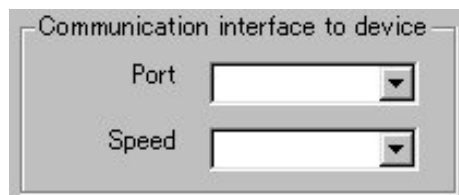


[Port list box]
Select a channel for communication between the *K_Line – Play it!-2* board and host machine.
- COM1 to COM16

Remark    Selectable ports can be checked using Device Manager.  For details, refer to **CHAPTER 7.6 Confirmation of USB Driver Installation**.

[Speed list box]
Select a communication rate for the selected communication channel from the following:
- 9600 bps
- 19200 bps
- 38400 bps

Remark    For selectable communication rates, refer to the user's manual of the device used.

<3>  Supply oscillator
"Supply oscillator" is used to select a clock that determines programming, data transfer, and a transfer rate.

**Figure 43: Setup Window - Supply Oscillator Selection**
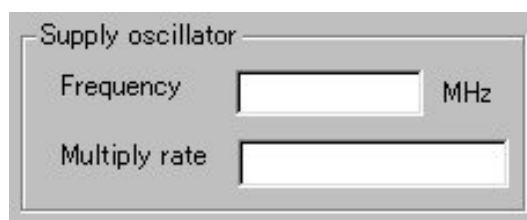


[Frequency box]
Sets the clock frequency of the target system.
The range of operating frequency varies from one device to another.  So, check the specifications of the device used before making a setting.

[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 "1.0".
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 44: 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**
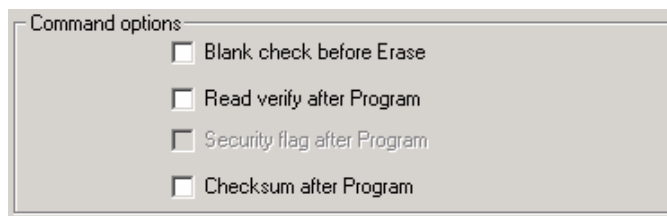The Advance setup menu is used to specify the command options and security flag settings.
When "Advance" is clicked, the following window is displayed:

**Figure 45: Device Setup Window - Advance**
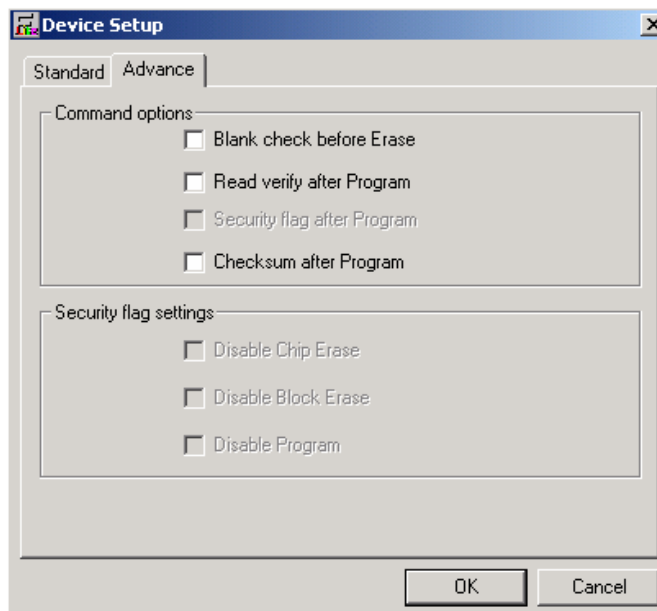
<1> Command options
This dialog box is used to specify the FPL flash processing command options.

**Figure 46: 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.

[Read verify after Program check box]
If this check box is checked, write data is sent from the programmer after execution of the Program command and EPV command, then the data is verified against the data written to the flash memory.

[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.

<2> Security flag settings  Not usable

**8.4.3  [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 47: [View] Menu**
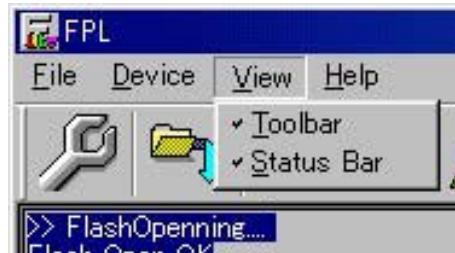


**(1)  [Toolbar] command**

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.

**8.4.4 [Help] menu**

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

**Figure 48: [Help] Menu**



**(1)** **[About FPL] command**

The [About FPL] command opens the program entry window as shown below and indicates the version.

Clicking OK terminates the display.

**Figure 49: About FPL Window**

### 8.5  Programmer Parameter Window

This window displays the settings of the programming parameters.

**Figure 50: 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 FPL FLASH programming software

This chapter explains the basic operations of the FPL GUI for programming the *K_Line - Play it!-2* board. This chapter covers how to start the system, execute the EPV command, and program the target device. On the following pages the FLASH programming via FPL is shown based on the V850ES/KG1+ device. The programming of the 78K0/KF1+ device is similar!

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

Hardware configuration of *K_Line - Play it!-2*:

Base board     :     *K_Line - Play it!-2*
CPU module   :     V850ES/KG1+
Target device :     µPD70F3311
Clock            :     8 MHz
Voltage level  :     5 V

Software configuration of FPL:

Parameter file:     70F3311.PRM
Clock setting   :     8 MHz Multiplied by 1
Port              :     COM4 (38400 bps)
Operation mode:   Chip
Write HEX      :     V850_UART_DEMO.hex
Option setting :     Blank check before Erase

**(1)   Installing the FPL GUI software**
Install the FPL GUI software on the host machine you are using, by referring to **CHAPTER 7 SOFTWARE INSTALLATION** (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 **CHAPTER 7 SOFTWARE INSTALLATION** (if the driver has not been installed yet).

**(3)   Installing the parameter file**
The parameter files for the 78K0/KF1+ and V850ES/KG1+ devices are installed automatically during installation of FPL GUI, folder <FPL install-path>\PRM. Nevertheless, newest version of parameter file for the µPD78F0148HD and µPD70F3311 device can by download from the NEC Electronics Web site.

Download the parameter file for the PG-FP4 from the following NEC Electronics Web site:

http://www.ee.nec.de/updates
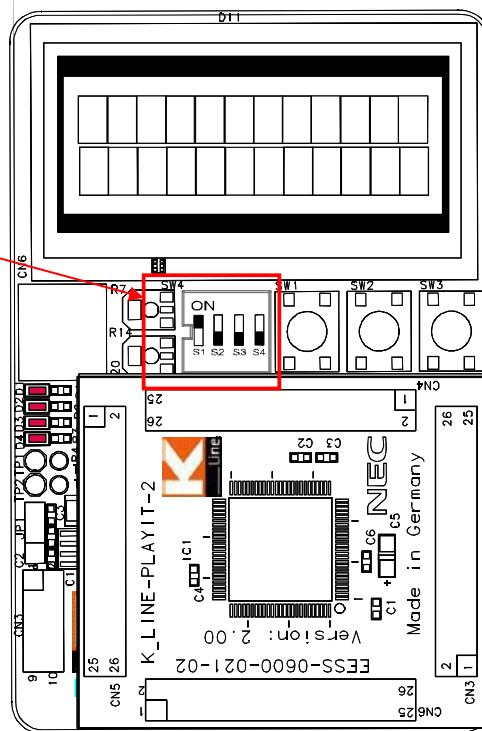
Copy the parameter file downloaded from the NEC Electronics Web site into sub-directory <FPL.EXE-install-path>\PRM created during GUI software setup (refer to **CHAPTER 7 SOFTWARE INSTALLATION**)..

**(4)    Connecting and starting**

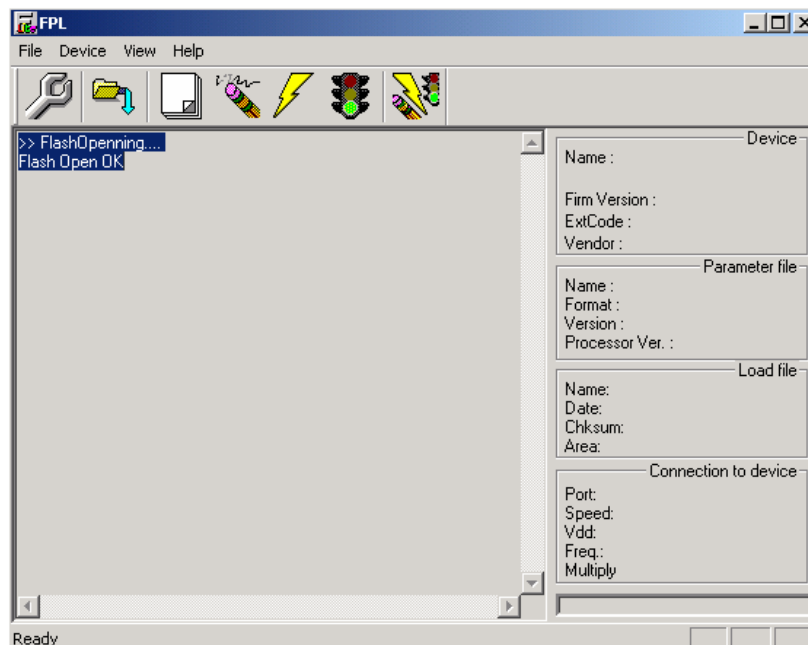&lt;1&gt; Set the *K_Line - Play it!-2* board to the FLASH programming mode by switching SW4/S1 to ON:

| SW4 | Setting |
|-----|---------|
| S1 | ON |
| S2 | OFF |
| S3 | OFF |
| S4 | OFF |



&lt;2&gt; &lt;Plug and Play&gt; Connect the *K_Line - Play it!-2* board with the host machine via the USB cable. If the connection was already done, press the reset button SW1 to release the FLASH programming mode.
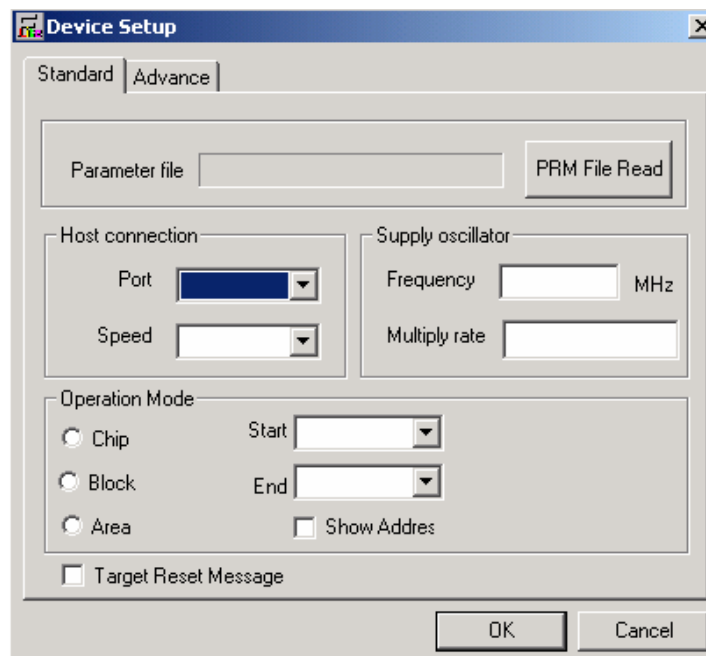
<3>  Start the FPL GUI.

**Figure 51: 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 52: <Standard Device Setup> Dialog Box**

<3> Click PRM File Read to open the parameter file selection window.
Select the parameter file "70F3311.prm" then click Open.

In case of programming the 78K0/KF1+ device please chose the
"78F0148HD.prm" file.

**Figure 53: Parameter File Selection**
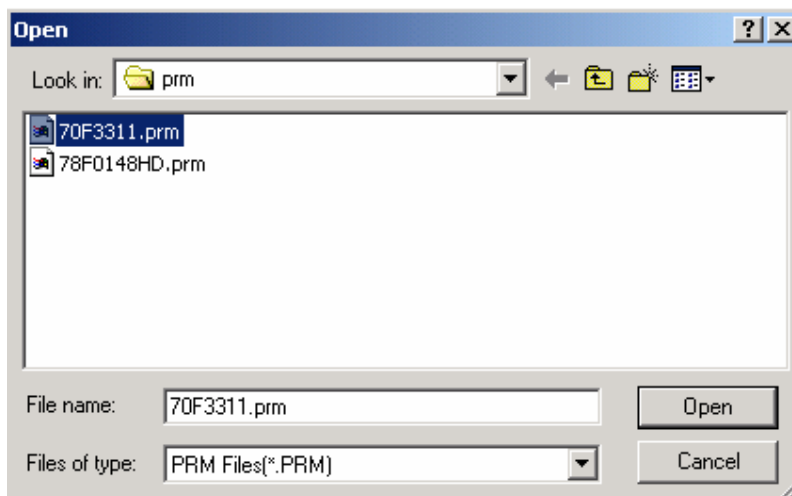


<4> From the Port list box, select the communication port that matches the host machine being used. Select the communication speed of the Host connection.

**Figure 54: Port Selection**
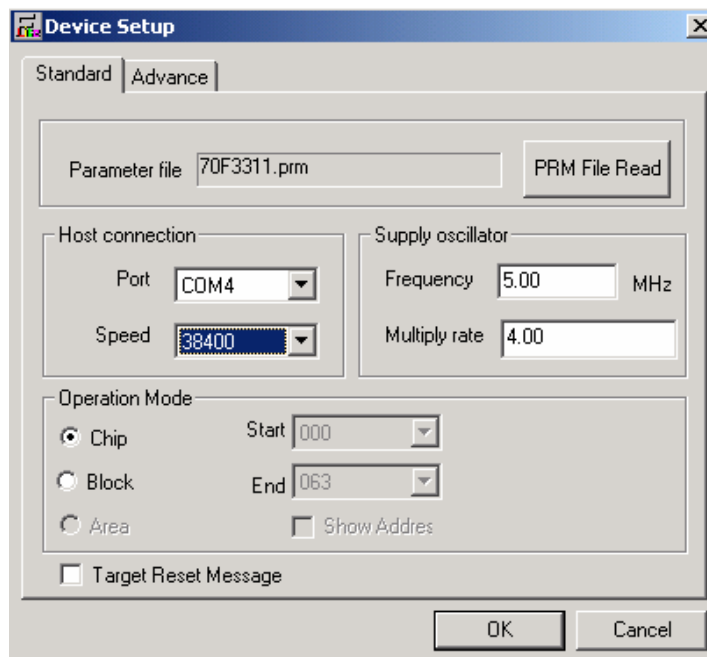


Remark    Selectable ports can be checked using Device Manager.  For details, refer to **7.6 Confirmation of USB Driver Installation**.

<5> Set "Supply oscillator" according to the specifications of the *K_Line - Play it!-2* 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 55: <Standard Device Setup> Dialog Box after Setting**
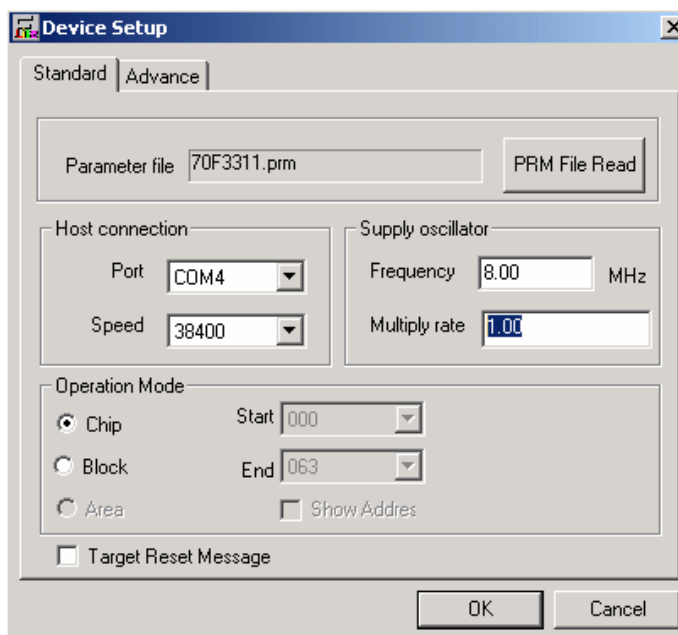


<6> Switch to the Advance dialog box.

**Figure 56: <Advance Device Setup> Dialog Box**
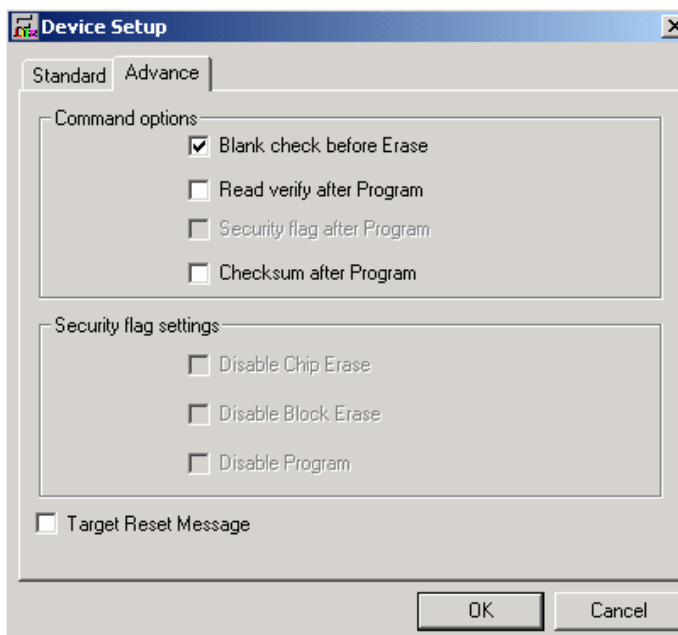


<Command options>
Blank check before Erase :  Checked

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

**Figure 57: Completion of Parameter Setting**



"PRM File Read OK." is displayed.

The display is updated.
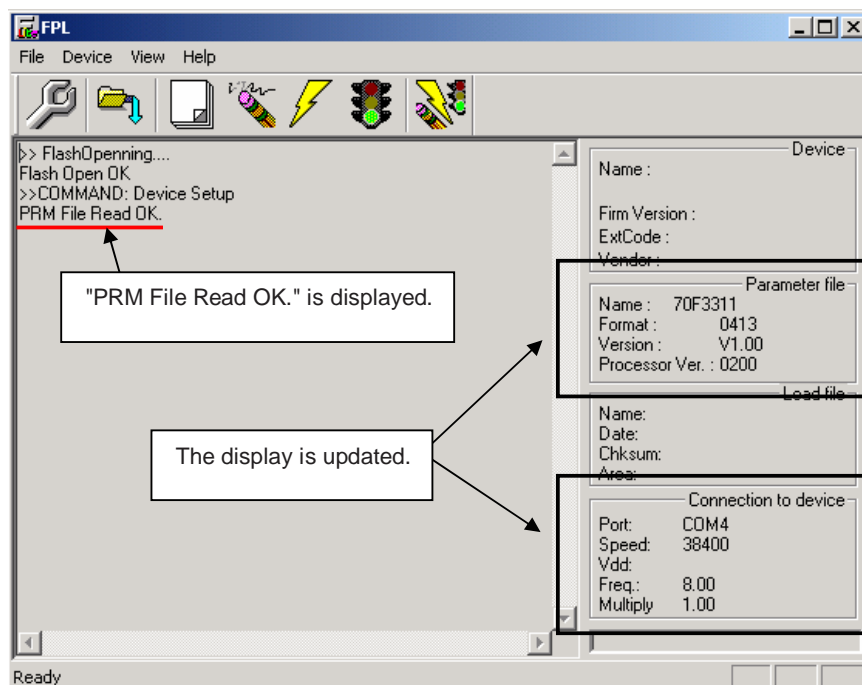
**(6)   Selecting a user program**
<1> Select [File] → [Load].
<2> Select a program file to be written to the target device, then click Open.

**Figure 58: After Downloading**



"Success read HEX file." is displayed.

The display is updated.
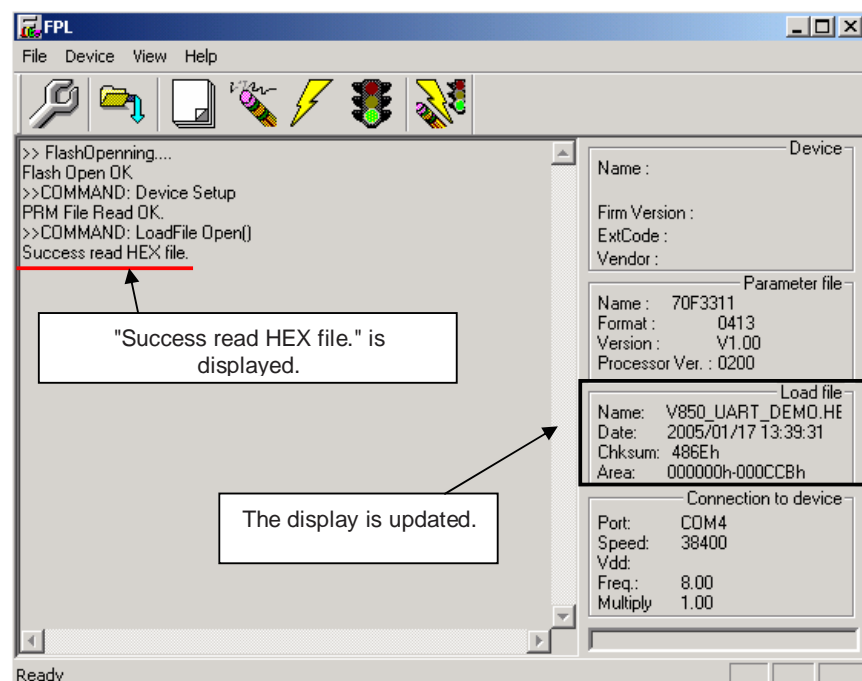
**(7)     [Autoprocedure(EPV)] command execution**
Select [Device] → [Autoprocedure(EPV)] from the menu bar.
When the [Autoprocedure(EPV)] command is executed, Blank Check → Erase → Program and FLASH Internal Verify are executed sequentially for the µPD70F3311 device.

**Figure 59: After EPV Execution**
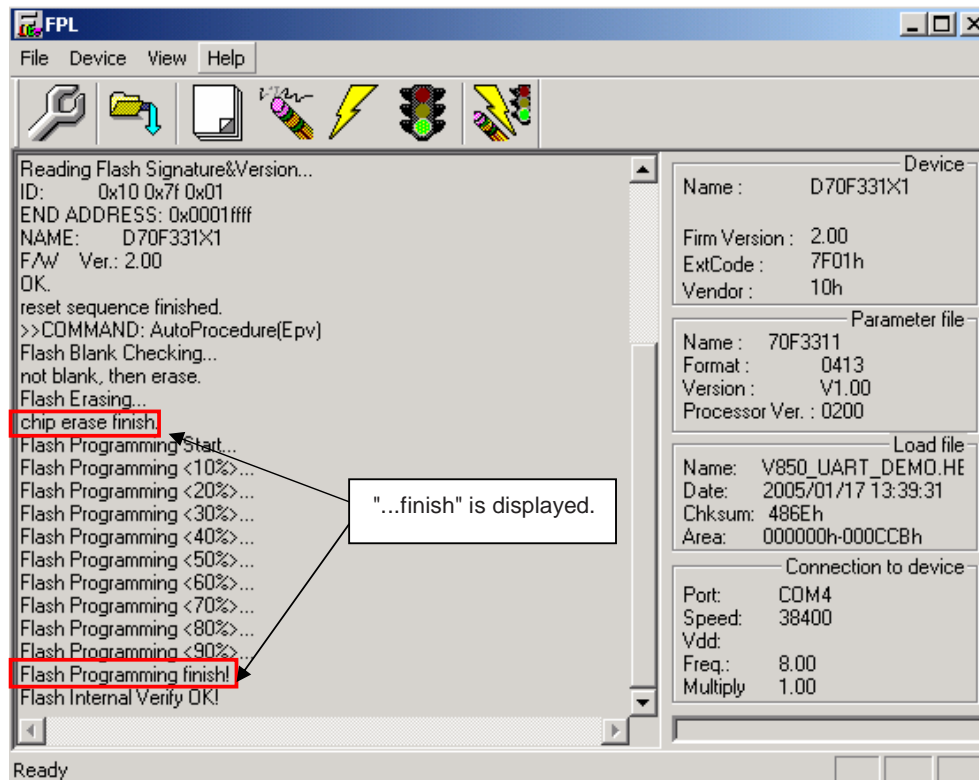


**(8)     Terminating the GUI**
Select [File] → [Quit] to terminate the GUI software. All settings executed so far are saved in the FPL.INI file, so that those settings can be reused when the GUI software is restarted.

**(9)     Execute "V850_UART_DEMO" application**
Set the *K_Line - Play it!-2* board to the normal operation mode by switching SW4/S1 to OFF.
< Plug and Play> the *K_Line - Play it!-2* board to start in normal operation mode or press the reset button SW1 to release the normal operation mode.

**(10)   Restarting the GUI**
When the system is restarted, the same screen as shown in Figure 58 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 FPL FLASH programming software may not be installed correctly.
Action:
Install the GUI software again by referring to **CHAPTER 7 Software Installation**.

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

Cause:
The USB connector may not be inserted normally into the USB port of the personal computer.
Action:
Check that the USB connector is inserted fully into the USB port of the personal computer.
Alternatively, disconnect the USB connector from the USB port, 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 not inserted 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 **CHAPTER 7.5 USB Driver Installation**.

Communication with the *K_Line - Play it!-2* 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 **CHAPTER 7.5 Driver Installation**.

Cause:
The COM port selected via the "Port list box" within device setup menu of FPL may not be set correctly.
Action:
Set the port checked using Device Manager.

Cause:
The *K_Line - Play it!-2* board is operating in normal mode.
Action:
Set the board to the FLASH programming mode by setting SW4 switch S1 to ON.

Cause:
The PRM file selected in [Device Setup] may be incorrect.
Action:
Use the corresponding PRM file that matches the target device. For information about the PRM file, refer to **CHAPTER 8 FPL 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

### 11.1 General Introduction

Each of the sample programs is located in a single directory, which will be called main-directory of the sample. This main directory of each sample contains the complete project inclusive all output files of the development tools. All sample programs use the same directory structure:

| | |
|---|---|
| 📁 _78K0 | **78K0/KF1+ project and output files** |
| 📁 Debug | output files for IAR C-SPY debugger / simulator |
| 📁 Release | output files for 78K0/KF1+ CPU module (i.e. Intel HEX file) |
| 📁 Settings | configuration files, IAR Embedded Workbench |
| 📄 78K0_uart_demo.dep | dependency information file, IAR Embedded Workbench |
| 📄 78K0_uart_demo.ewd | project setting file, IAR C-SPY debugger |
| 📄 78K0_uart_demo.ewp | project file, IAR Embedded Workbench |
| 📁 _V850 | **V850ES/KG1+ project and output files** |
| 📁 Debug | output files for IAR C-SPY debugger / simulator |
| 📁 Release | output files for V850ES/KG1+ CPU module (i.e. Intel HEX file) |
| 📁 Settings | configuration files, IAR Embedded Workbench |
| 📄 V850_uart_demo.dep | dependency information file, IAR Embedded Workbench |
| 📄 V850_uart_demo.ewd | project setting file, IAR C-SPY debugger |
| 📄 V850_uart_demo.ewp | project file, IAR Embedded Workbench |
| 📄 io70f3311.ddf | device description file, IAR C-SPY debugger |
| 📄 io70f3311.sfr | special function register definition file, IAR C-SPY debugger |
| 📁 inc | C header files |
| 📁 settings | configuration files, IAR Embedded Workbench |
| 📁 source | C source files |
| 📁 xcl | xcl files |
| 📄 78K0_uart_demo.eww | workspace file, IAR Embedded Workbench 78K0/78K0S |
| 📄 V850_uart_demo.eww | workspace file, IAR Embedded Workbench V850 |

**Table 19: Example directory structure**

The main directory contains only the workspace files for the IAR Systems Embedded Workbench 78K0/78K0S and V850. All source files are located in the directory /source and the /inc directory contains the header files. The /xcl directory contains the linker control files of the 78K0/KF1+ and V850ES/KG1+ device. Each sample project uses two targets for each microcontroller device. One target is the IAR C-SPY debugger / simulator directory /Debug and the other is the *K_Line – Play it!-2* hardware directory /Release.

All output files of the development tools for the corresponding target 78K0 or V850 are generated in the directories /Debug and /Release.

For details of using IAR Embedded Workbench and the IAR C-SPY debugger / simulator please refer to the manuals.
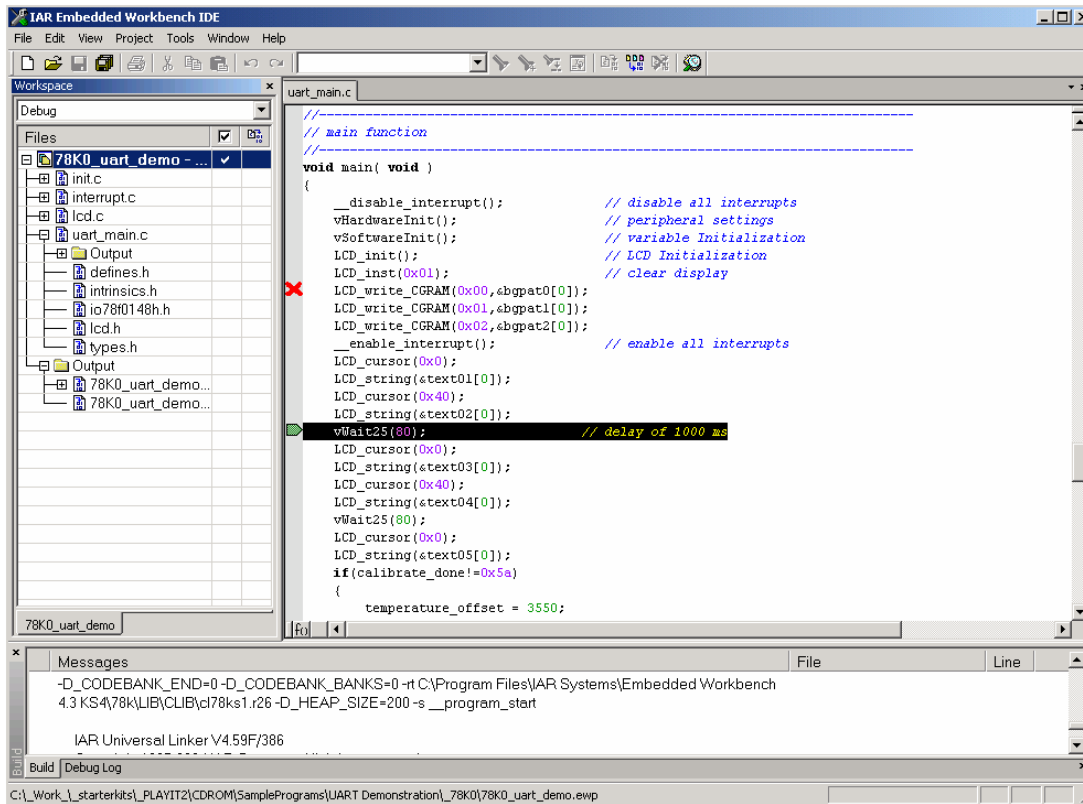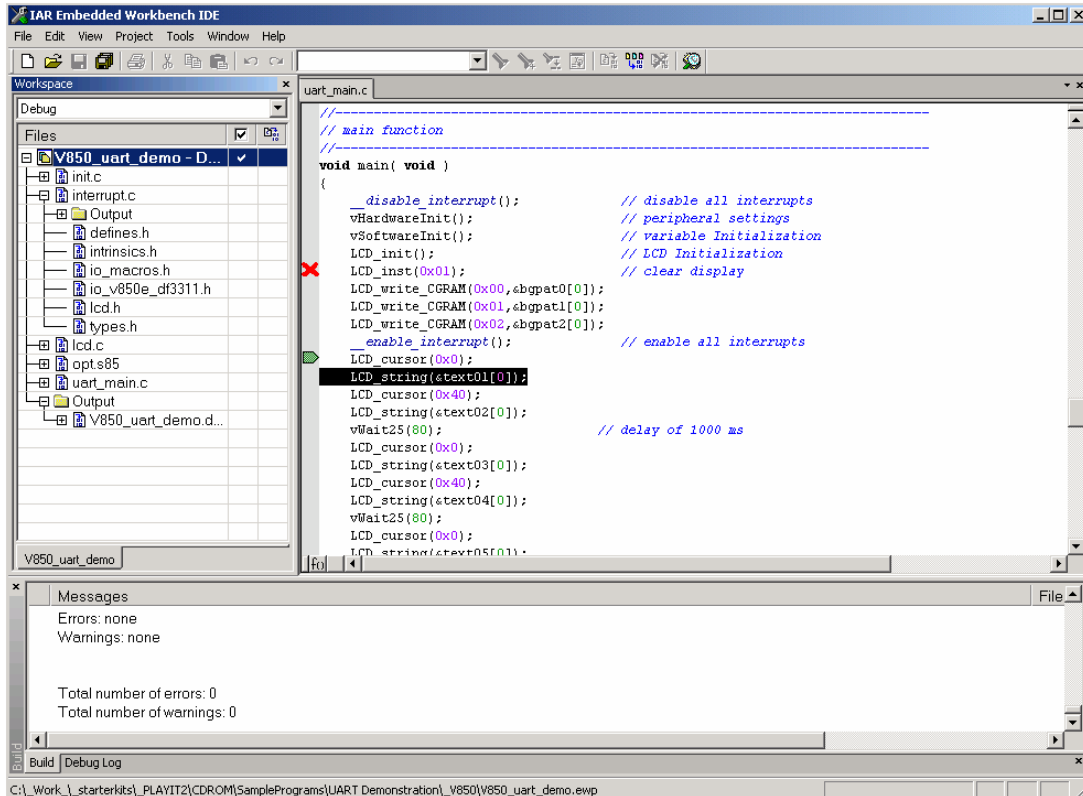
**Figure 60: IAR Embedded Workbench 78K0/K0S**
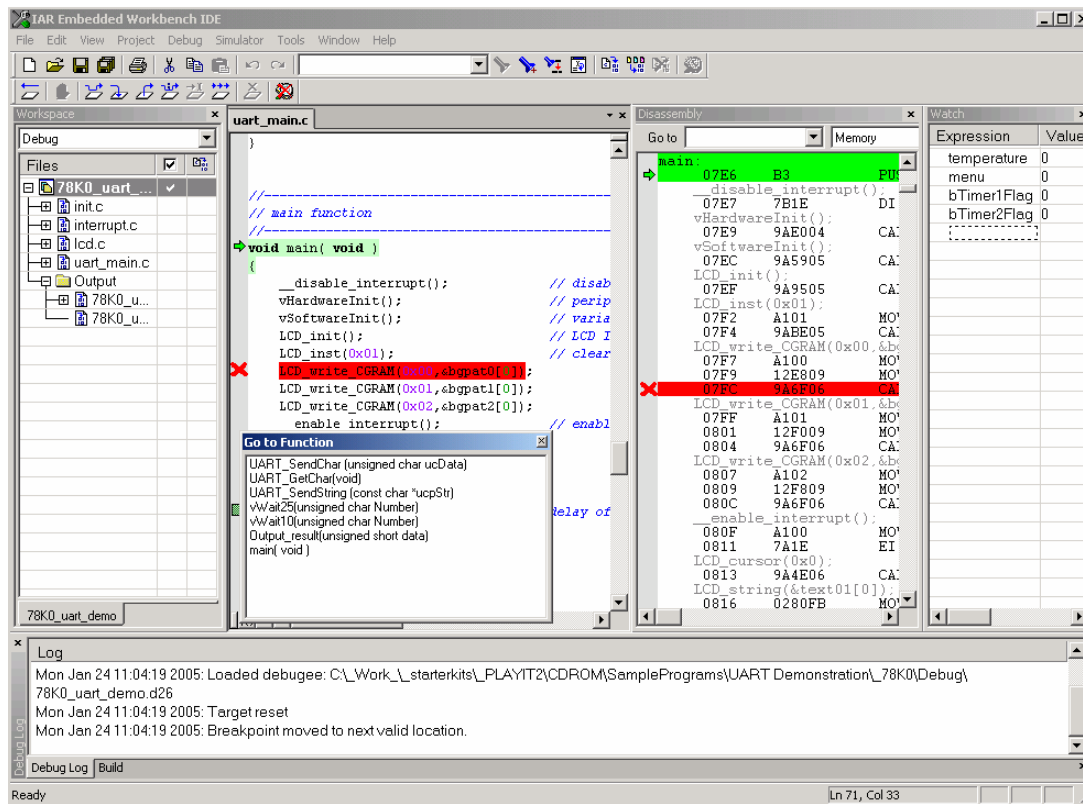


**Figure 61: IAR Embedded Workbench V850**

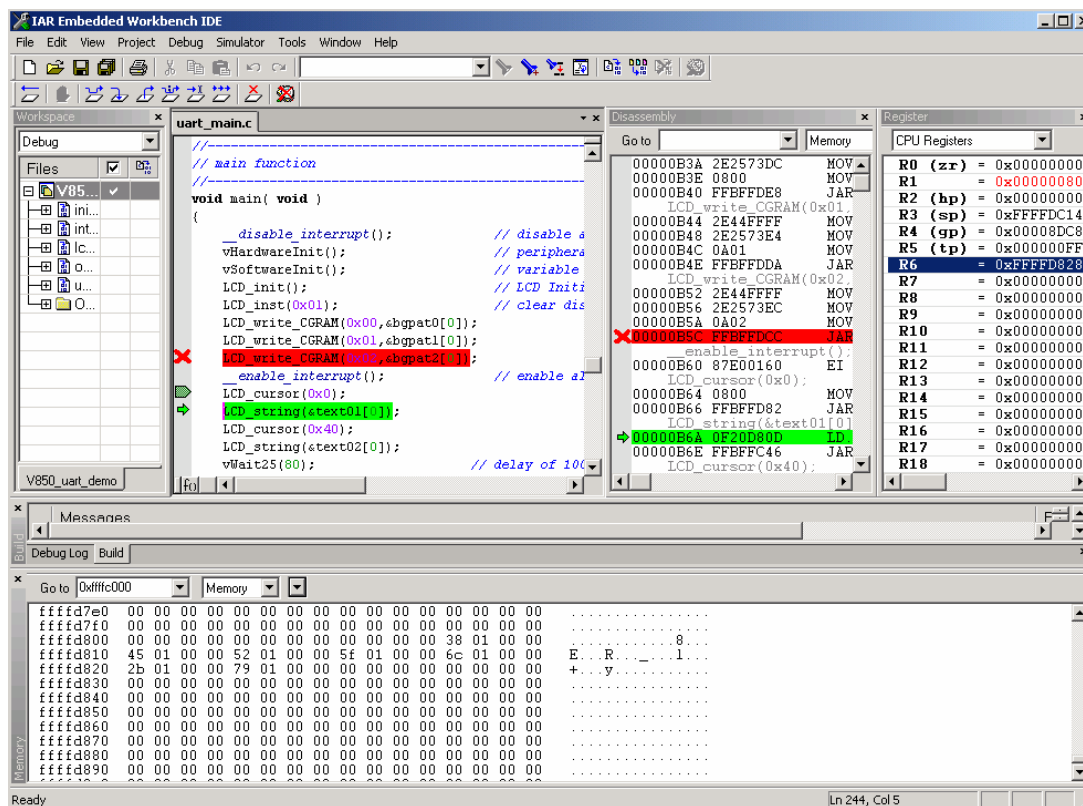**Figure 62: IAR C-SPY Debugger / Simulator 78K0/78K0S**



**Figure 63: IAR C-SPY Debugger / Simulator V850**

### 11.2  ADC demo

This sample program simulates a simple volt meter. By using the integrated ADC, the voltage supplied to ADC on input channel 0, port P20 of 78K0/KF1+ and P70 of V850ES/KG1+ device, is measured. The input voltage is adjusted by potentiometer R14. The board shows the measured voltage by driving the LC display. The output format can be changed by pressing button SW2.

| Used Internal Peripherals | Used External Parts |
|---|---|
| Timer00 | Character LC display |
| Timer01 | Potentiometer R14 |
| Timer50 | Button SW2 |
| A/D converter | Button SW3 |
|  | LED's D1- D4 |

To run the ADC demo please set the configuration of switch SW4 the following:

| SW4 | Setting |
|---|---|
| S1 | OFF |
| S2 | OFF |
| S3 | don't care |
| S4 | don't care |

### 11.3  ReacTime demo

This sample program demonstrates a reaction time measurement. After the button SW3 is pressed the application waits for a random time duration between 0.50 and 3.45 seconds. Then the measurement starts by incrementing a reaction counter every 50ms. The actual counter value is shown by a bar graph using the character LC display until the next keystroke of button SW3. When the button SW3 is pressed again, the measurement stops and the reaction time is shown on the LC display. Pressing button SW2 starts a new measuring cycle.

| Used Internal Peripherals | Used External Parts |
|---|---|
| Timer00 | Character LC display |
| Timer01 | Button SW2 |
| Timer50 | Button SW3 |
| | LED's D1- D4 |

To run the ReacTime demo please set the configuration of switch SW4 to the following:

| SW4 | Setting |
|---|---|
| S1 | OFF |
| S2 | OFF |
| S3 | don't care |
| S4 | don't care |

### 11.4  Timer demo

This sample program demonstrates a real time clock. After the program is started the watch timer is initialized to generate an exact clock reference, based on the 32.768 kHz sub-clock. The actual time is displayed using the LCD module. By pressing button SW2 / SW3 the time can be adjusted.

| Used Internal Peripherals | Used External Parts |
|---|---|
| Timer00 | Character LC display |
| Timer01 | Button SW2 |
| WatchTimer | Button SW3 |
|  | LED's D1- D4 |

To run the Timer demo please set the configuration of switch SW4 to the following:

| SW4 | Setting |
|---|---|
| S1 | OFF |
| S2 | OFF |
| S3 | don't care |
| S4 | don't care |

### 11.5  UART demo

This sample program simulates a temperature meter with serial communication channel. The sample program does a cyclic measurement of the input voltage of ANI2 analogue input, equal to port P22 of 78K0/KF1+ and port P72 of V850ES/KG1+ device, connected to the temperature sensor KTY13-5. The temperature is calculated and the result is transferred via UART0 to a terminal program running on the host machine. The data transfer speed is set to 115200 bps per default. Additional the temperature is displayed on the LCD. Before the temperature measurement is started the calibration of the temperatures sensor has to be done, by adjusting the temperature offset via button SW2 and SW3.

| Used Internal Peripherals | Used External Parts |
|---|---|
| Timer00 | Character LC display |
| Watch Timer | Temperature sensor KTY13-5 |
| A/D converter | Button SW2 |
| UART0 | Button SW3 |
| | LED's D1- D4 |

To run the UART demo please set the configuration of switch SW4 to the following:

| SW4 | Setting | |
|---|---|---|
| | 78K0/KF1+ CPU module | V850ES/KG1+ CPU module |
| S1 | OFF | OFF |
| S2 | OFF | OFF |
| S3 | ON | OFF |
| S4 | OFF | OFF |

## 12. Connectors and Cables

### 12.1 USB host connector CN6

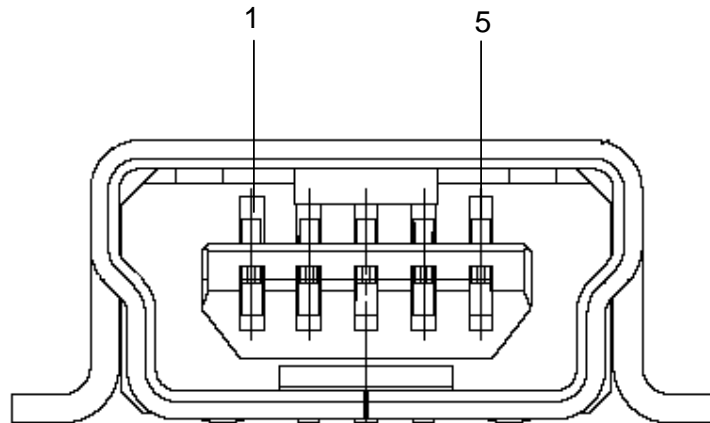**Figure 64: Connector CN6, USB Mini-B Type Host Connector Pin Configuration**



**Table 20: Pin Configuration of USB Connector CN6**

| USB Connector CN6 | 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 *K_Line - Play it!-2* board.
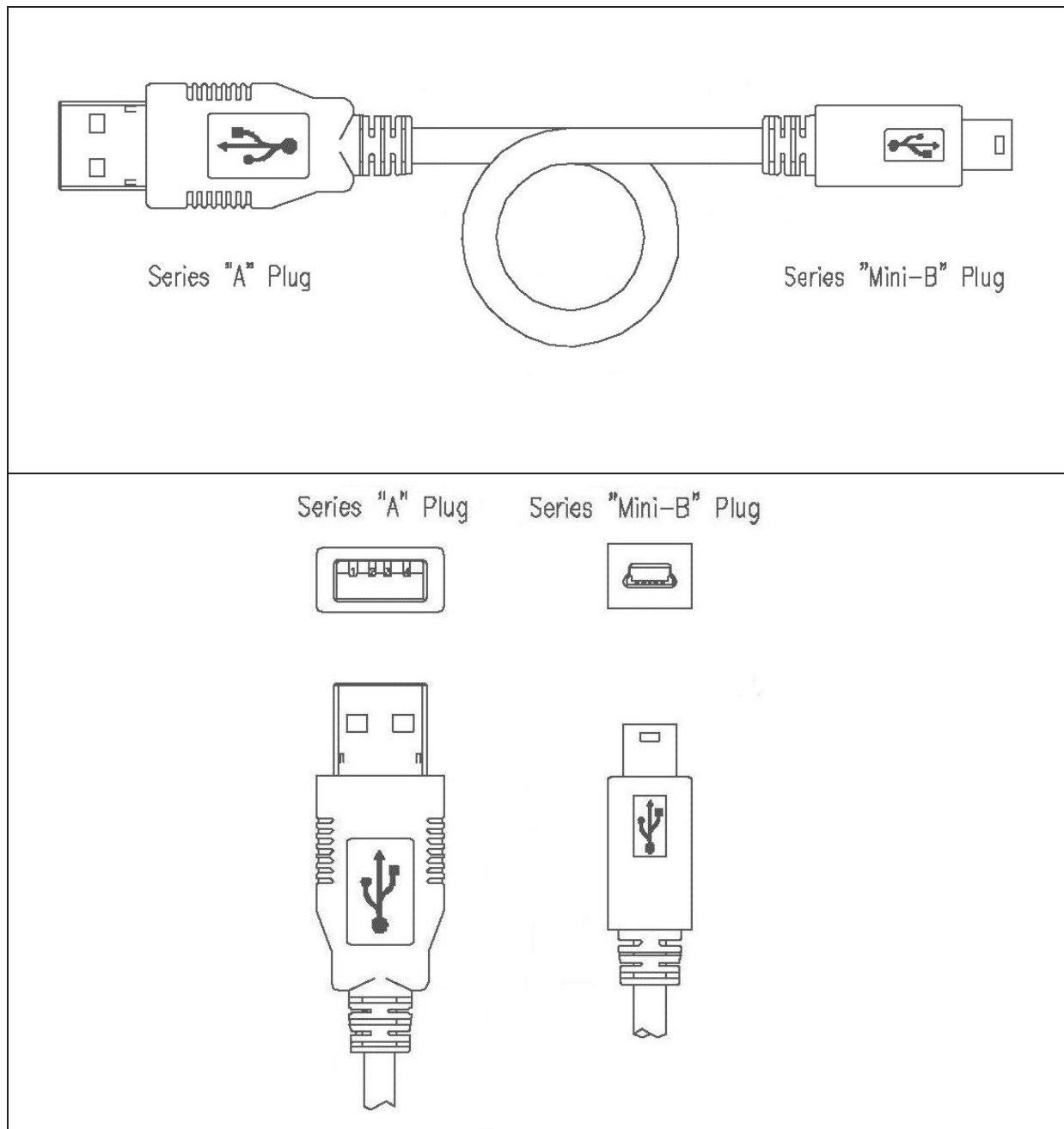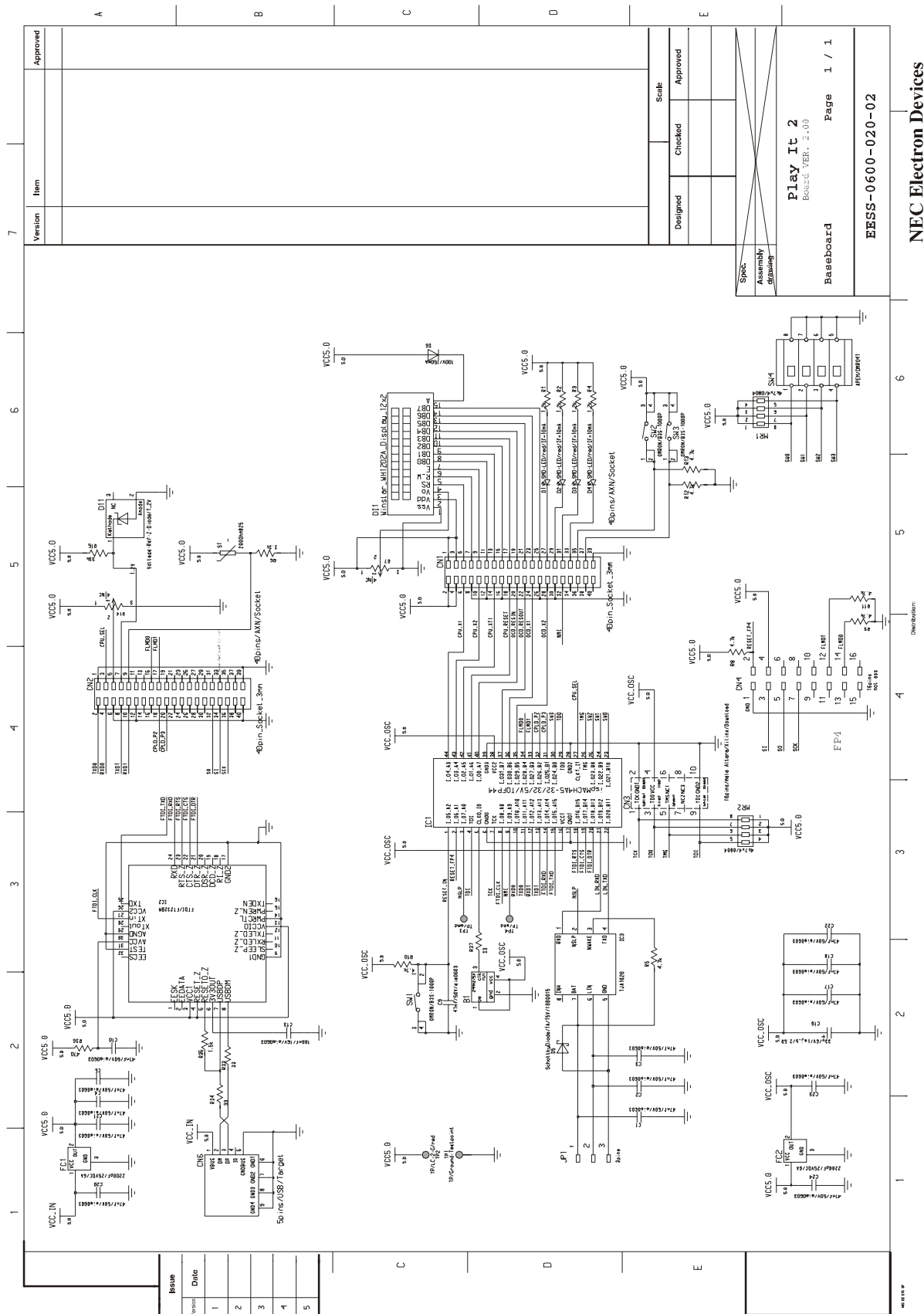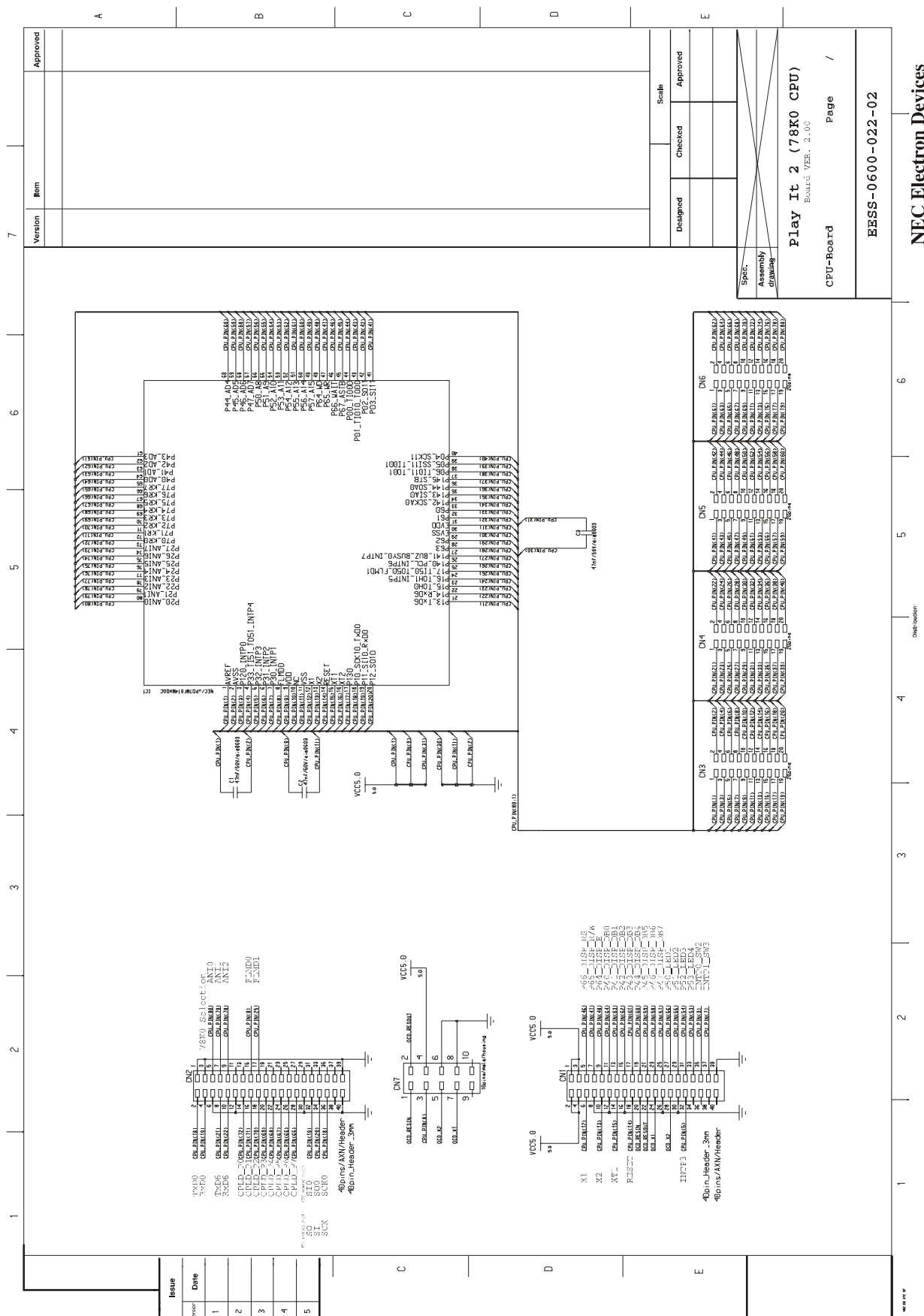
**12.2 USB interface cable (Mini-B type)**



Series "A" Plug

Series "Mini-B" Plug
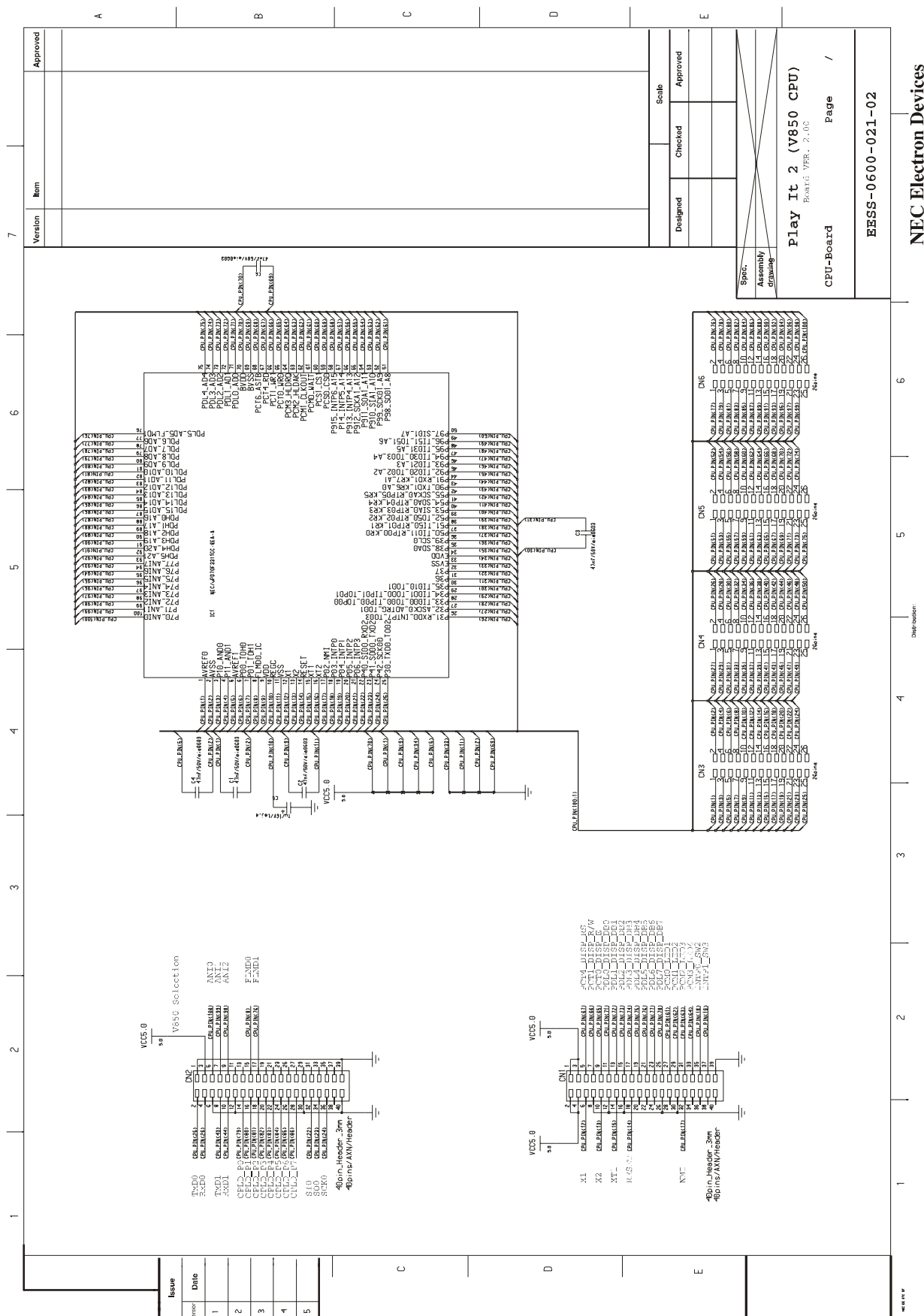
**Figure 65: USB interface cable (Mini-B type)**

## 13. Schematics



**Figure 66: *K_Line - Play it!-2* baseboard schematics**

**Figure 67:** *K_Line - Play it!-2* 78K0/KF1+ CPU module schematics

**Figure 68:** *K_Line - Play it!-2* V850ES/KG1+ CPU module schematics