NEC

User's Manual

V850ES/Fx3 - CAN it!

Demonstration Kit for the V850ES/Fx3 32-bit RISC microcontroller

Document No. U18560EE1V0UM00
Date Published January 2007

CAUTION

This is a Test- and Measurement equipment with possibility to be significantly altered by user through hardware enhancements/modifications and/or test or application software. Thus, with respect to Council Directive 89/336/EEC (Directive on compliance with the EMC protection requirements), this equipment has no autonomous function. Consequently this equipment is not marked by the CE-symbol.

EEDT-ST-005-10

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

Redemption of Waste Electrical and Electronic Equipment (WEEE) in accordance with legal regulations applicable in the European Union only: This equipment (including all accessories) is not intended for household use. After use the equipment cannot be disposed of as household waste. NEC Electronics (Europe) GmbH offers to take back the equipment. All you need to do is register at www.eu.necel.com/weee.

Regional Information

Some information contained in this document may vary from country to country. Before using any NEC product in your application, please contact the NEC 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 otherlegal issues may also vary from country to country.

NEC Electronics Inc. (U.S.)
Santa Clara, California
Tel: 408-588-6000
800-366-9782
Fax: 408-588-6130
800-729-9288

NEC Electronics (Europe) GmbH
Duesseldorf, Germany
Tel: 0211-65 03 0
Fax: 0211-65 03 1327

Sucursal en España
Madrid, Spain
Tel: 091- 504 27 87
Fax: 091- 504 28 60

Succursale Française
Vélizy-Villacoublay, France
Tel: 01-30-67 58 00
Fax: 01-30-67 58 99

Filiale Italiana
Milano, Italy
Tel: 02-66 75 41
Fax: 02-66 75 42 99

Branch The Netherlands
Eindhoven, The Netherlands
Tel: 040-244 58 45
Fax: 040-244 45 80

Branch Sweden
Taeby, Sweden
Tel: 08-63 80 820
Fax: 08-63 80 388

United Kingdom Branch
Milton Keynes, UK
Tel: 01908-691-133
Fax: 01908-670-290

NEC Electronics Hong Kong Ltd.
Hong Kong
Tel: 2886-9318
Fax: 2886-9022/9044

NEC Electronics Hong Kong Ltd.
Seoul Branch
Seoul, Korea
Tel: 02-528-0303
Fax: 02-528-4411

NEC Electronics Singapore Pte. Ltd.
Singapore
Tel: 65-6253-8311
Fax: 65-6250-3583

NEC Electronics Taiwan Ltd.
Taipei, Taiwan
Tel: 02-2719-2377
Fax: 02-2719-5951

NEC do Brasil S.A.
Electron Devices Division
Guarulhos, Brasil
Tel: 55-11-6465-6810
Fax: 55-11-6465-6829

Revision History

Date	Revision	Chapter	Description
12-01-2007	V1.00	---	First release

Table of Contents

List of Figures

List of Tables

1. Introduction

V850ES/Fx3 – CAN it! is a demonstration kit for the V850ES/Fx3 32-bit RISC microcontroller. It supports On-Board debugging via the TK-V850 interface (monitor debugging) or via N-Wire. Additional FLASH programming and real time execution of application programs based on the V850ES/FG3 32-bit RISC microcontroller is supported by the *V850ES/Fx3 – CAN it!* demonstration kit. The board is prepared to be connected to user hardware parts such as digital I/O or analogue signals.

1.1 Main features of *V850ES/Fx3 – CAN it!*

- Easy to use device demonstration capabilities
  V850ES/Fx3 – CAN it! 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, LIN and CAN serial interfaces.

- TK-V850 debugging
  The *V850ES/Fx3 – CAN it!* supports an On-Board debug function by using the IAR C-SPY debugger and the UART / USB interface without a need of additional debug hardware. It allows FLASH programming and supports standard debug functions i.e. code execution, single stepping, software breakpoints, memory manipulation etc.

- N-Wire debugging
  The *V850ES/Fx3 – CAN it!* is prepared to be equipped with a 20-pin connector in order to connect the QB-V850MINI-EE On-Chip debug emulator to use On-Chip debug function of the V850ES/FG3 device. Please note, the QB-V850MINI-EE is separate product from NEC and it is not included in this starterkit package.

- Power supply via USB interface
  V850ES/Fx3 – CAN it! is powered via USB interface, no separate power supply is needed.

- Character LCD module
  V850ES/Fx3 – CAN it! provides a 12*2 character LC display, allowing the implementation of human / machine interfaces, 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 *V850ES/Fx3 – CAN it!* board for evaluation purposes.

- Analogue to digital signal conversion is supported

- Various input / output signals available, such as

  - 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
  - High Speed CAN bus interfaces with transceiver PCA82C250
  - LIN bus support, via TJA 1020 transceiver
  - 16 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 V850 and the IAR C-SPY debugger / simulator are included. This package is restricted in such that maximum program code size is limited to 16 kByte.

- Full documentation is included for the NEC V850ES/FG3 microcontroller, IAR Systems Embedded Workbench, IAR Systems C-SPY debugger / simulator and the NEC FPL FLASH programming software.

V850ES/Fx3 – CAN it! **is not intended for code development. NEC does not allow and does not support in any way any attempt to use** ***V850ES/Fx3 – CAN it!*** **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 *V850ES/Fx3 – CAN it!* package. If any part is missing or seems to be damaged, please contact the dealer from whom you received your *V850ES/Fx3 – CAN it!* starterkit.

Note: Updates of the IAR Embedded Workbench for V850, FP3 FLASH programming software, documentation and/or utilities for *V850ES/Fx3 – CAN it!*, if available, may be downloaded from the NEC WEB page(s) at **http://www.eu.necel.com/updates**

1.4 Trademarks

IAR Embedded Workbench, visualSTATE, IAR MakeApp and C-SPY are registered trademarks of IAR Systems AB. Microsoft and Windows are registered trademarks of Microsoft Corporation. Adobe and Acrobat Reader are registered trademarks of Adobe Systems Incorporated.

All other product names are trademarks or registered trademarks of their respective owners.

2. *V850ES/Fx3 – CAN it!* system configuration

The *V850ES/Fx3 – CAN it!* system configuration is given in the diagram below:

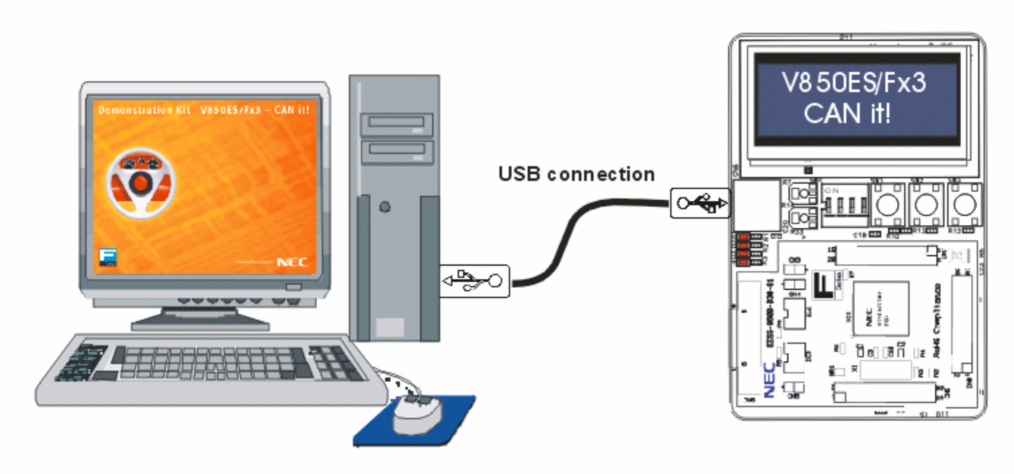


Figure 1: ***V850ES/Fx3 – CAN it!*** **system configuration**

2.1 *V850ES/Fx3 – CAN it!*

V850ES/Fx3 – CAN it! is a demonstration kit for the V850ES/FG3 32-Bit RISC microcontroller. The *V850ES/Fx3 – CAN it!* board is connected to the host system via a USB interface cable. The host system may be used for On-Board debugging of application software by using the IAR C-SPY debugger or the programming of the V850ES/FG3 internal FLASH memory by using the FPL programming GUI, to allow execution of application programs on the *V850ES/Fx3 – CAN it!* starterkit hardware.

The V850ES/Fx3 – CAN it! is equipped within an 4.0000 MHz crystal oscillator. This allows running the V850ES/FG3 device at a speed of 32 MHz by using the internal PLL of the microcontroller.

2.2 Host computer

The USB host interface enables communication to the *V850ES/Fx3 – CAN 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.

2.3 Power supply via USB interface

V850ES/Fx3 – CAN it! is powered by USB interface, no separate power supply is needed. The USB interface provides the *V850ES/Fx3 – CAN it!* board with 5V supply voltage.

3. *V850ES/Fx3 – CAN it!* baseboard components

The *V850ES/Fx3 – CAN it!* 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, FLASH programmer and LIN busses.

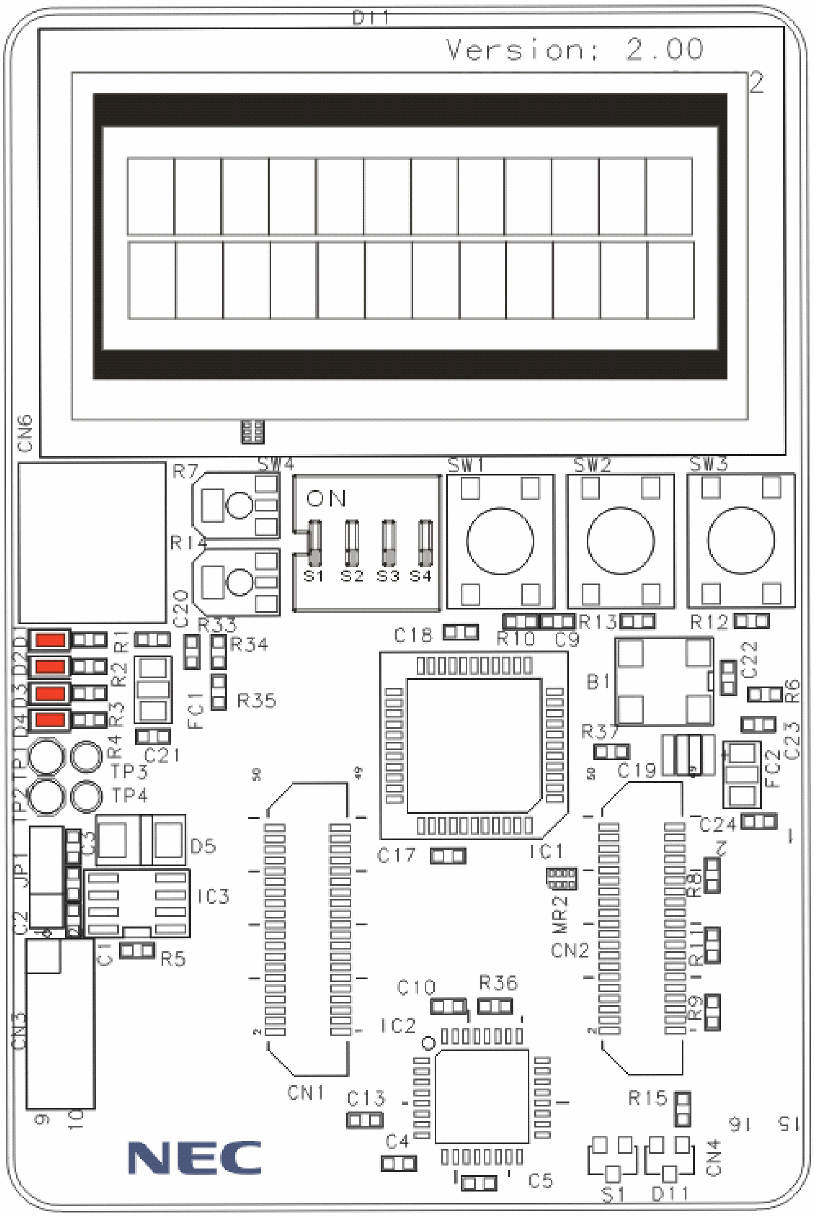


Figure 2: ***V850ES/Fx3 – CAN it!*** **baseboard connectors, switches and LED's**

Some of the *V850ES/Fx3 – CAN it!* components are free for user application hardware and software. Please read the user's manual of the V850ES/FG3 device carefully to get information about the electrical specification of the available I/O ports before you connect any external signal to the *V850ES/Fx3 – CAN it!* 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 V850ES/FG3 CPU module.

3.2 User button SW2

SW2 is a push button connecting V_{cc} to external interrupt input INTP4 of the microcontroller. This is equal to port P913 of the V850ES/FG3 device. The port may be programmed to generate interrupt INTP4. The necessary initialisation for this purpose is described in the user's manual of the V850ES/FG3 device. The port is connected to a 4.7K pull down resistor.

3.3 User button SW3

SW3 is a push button connecting V_{cc} to external interrupt input INTP5 of the microcontroller. This is equal to port P914 of the V850ES/FG3 device. The port may be programmed to generate interrupt INTP5. The necessary initialisation for this purpose is described in the user's manual of the V850ES/FG3 device. The port is connected to a 4.7K pull down resistor.

3.4 Configuration switch SW4

The different operation modes of the *V850ES/Fx3 – CAN it!* board can be set by SW4 switches S1-S4.

SW4	Factory settings	Functionality
S1	OFF	Operation mode select
S2	OFF	TK-V850 / FPL mode select
S3	OFF	UART/ LIN mode selection
S4	OFF	User switch

Table 1: Configuration switch SW4, factory settings

3.4.1 Operation mode selection SW4/S1

SW4 switch S1 controls the operation mode of the *V850ES/Fx3 – CAN it!* board. Setting SW4/S1 to ON enables the TK-V850 On-Board debug function. Additional On-Board FLASH programming by using the FPL software is supported in this mode.

Within normal operation mode (setting SW4/S1 to OFF) the user program stored in the internal FLASH memory of V850ES/FG3 device is executed. Additional debugging via N-Wire interface and FLASH programming via the PG-FP4 FLASH programmer is supported in this mode.

SW4, S1	Operation mode
OFF	Normal operation mode
ON	TK-V850 debugging / FPL FLASH programming mode

Table 2: Operation mode selection SW4/S1

For more details on how to configure *V850ES/Fx3 – CAN it!* in order to use On-Chip debugging please refer to **CHAPTER 5, ON-CHIP DEBUGGING**.

3.4.2 TK-V850 / FPL mode selection switch SW4/S2

SW4 switch S2 selects the TK-V850 On-Board debugging or FPL FLASH programming mode. Setting SW4/S2 to OFF enables the TK-V850 On-Board debug function. Switching SW4/S2 to ON allows On-Board FLASH programming by using the FPL FLASH programmer software.

SW4, S2	Operation mode
OFF	TK-V850 debugging mode
ON	FPL FLASH programming mode

Table 3: TK-V850 / FPL mode selection switch SW4/S2

For more details on how to configure *V850ES/Fx3 – CAN it!* in order to use On-Chip debugging please refer to **CHAPTER 5, ON-CHIP DEBUGGING**.

3.4.3 UART/ LIN mode selection SW4/S3

SW4 switch S3 controls the serial communication mode of *V850ES/Fx3 – CAN it!* board. Setting SW4/S3 to OFF connects the UARTD0 receive and transmit signals to the FT232 interface lines and the UARTD2 receive and transmit signals to the TJA1020 LIN transceiver. Switching SW4/S3 to ON connects the UARTD0 and UARTD2 signals vice versa.

SW4, S3	Operation Mode
OFF	UARTD0 connected to FT232 UART chip UARTD2 connected to TJA1020 LIN transceiver
ON	UARTD0 connected to TJA1020 LIN transceiver UARTD2 connected to FT232 UART chip

Table 4: UART/ LIN mode selection SW4/S3

By using the TK-V850 debugging / FPL FLASH programming mode set switch SW4/S3 to OFF. UARTD0 is reserved as communication channel for On-Board debugging or FLASH programming and can not be used by a user program.

3.4.4 User switch SW4/S4

SW4 switch S4 is connected to port P911 of the V850ES/FG3 device. This switch can be freely used by the user software. Switching SW4/S4 to ON applies V_{ss} to port P911.

SW4, S4	V850ES/FG3
OFF	V_{cc} applied to P911
ON	V_{ss} applied to P911

Table 5: User switch 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

The CN6 connector allows connecting the IAR C-SPY debugger or FPL FLASH programming software to the *V850ES/Fx3 – CAN it!* board in order to debug application software or program the V850ES/FG3 internal FLASH memory. The board power supply of 5V is also provided by connector CN6.

For standard communication to a host system, i.e. by using a terminal program, the input/output signals of UARTD0 respectively UARTD2 of the V850ES/FG3 device are connected to CN6. Please configure switch SW4 accordingly to use this mode.

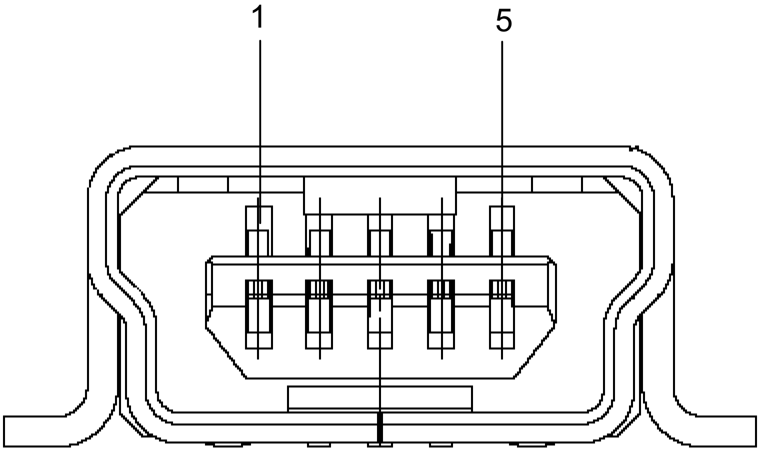


Figure 3: Connector CN6, USB Mini-B Type Host Connector Pin Configuration

USB Connector CN6	Signal
1	VBUS
2	DM
3	DP
4	N.C.
5	GNDBUS

Table 7: Pin Configuration of USB Connector CN6

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 *V850ES/Fx3 – CAN it!* board.

3.7 Connector CN4

CN4 connector (not assembled) allows connecting the PG-FP4 flash programmer to *V850ES/Fx3 – CAN it!* board in order to program application software into the FLASH memory of the V850ES/FG3 device. 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 8: CN4, PG-FP4 connector

When using PG-FP4, the programming interface to the V850ES/FG3 device must be set to clock serial interface, CSI. Set configuration of switch SW4 of the *V850ES/Fx3 – CAN it!* board to the following:

SW4	Setting
S1	OFF
S2	OFF
S3	Don't care
S4	Don't care

Table 9: 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 *V850ES/Fx3 – CAN it!* board is equipped with a character LC display. 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 a character RAM where the user can define its own characters. The display is connected to the V850ES/FG3 device via three control lines and eight data lines.

Display Pin	Display Signal	V850ES/FG3 Signal	*V850ES/Fx3 - CAN it!* baseboard
1	Vss	-	GND
2	Vcc	-	Vcc
3	V0	-	R7 potentiometer arm
4	RS	PDL12	-
5	R/W	PDL13	-
6	E	PDL7	-
7	DB0	PDL0	-
8	DB1	PDL1	-
9	DB2	PDL2	-
10	DB3	PDL3	-
11	DB4	PDL8	-
12	DB5	PDL9	-
13	DB6	PDL10	-
14	DB7	PDL11	-
15	A	-	Vcc via diode

Table 10: 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 *V850ES/Fx3 – CAN it!*.

3.10 External Potentiometer R14

A 47K potentiometer R14 is connected between Vcc and ground. The potentiometer arm is connected to port P713 of V850ES/FG3 device. This is equal to the ANI13 analogue input.

3.11 AD converter reference voltage input

A 1.2V reference voltage is supplied to the ANI14 analogue input, equal to port P714 of V850ES/FG3 device.

3.12 Temperature sensor

For temperature measurement and primarily as an application example a silicon temperature sensor KTY13-5 is connected to the ANI15 analogue input, equal to port P715 of V850ES/FG3 device.

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

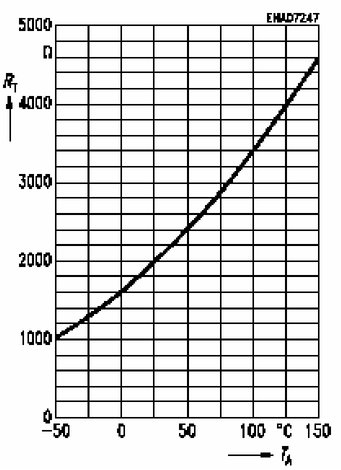
T_A °C	k_T min.	k_T typ.	k_T max.
– 50	0.506	0.518	0.530
– 40	0.559	0.570	0.581
– 30	0.615	0.625	0.635
– 20	0.676	0.685	0.694
– 10	0.741	0.748	0.755
0	0.810	0.815	0.821
10	0.883	0.886	0.890
20	0.960	0.961	0.962
25		1.0 1)	
30	1.039	1.040	1.041
40	1.119	1.123	1.126
50	1.204	1.209	1.215
60	1.291	1.300	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 11: Distribution of temperature factor k_T

The sensor resistance can be calculated as following: $R_T = k_T * R_{25} = •(T_A)$

I_B = 1 mA; Example: R_{25} = 2000 Ω



The temperature at the sensor can be calculated from the change in the sensors resistance from the following equation, which approximates the characteristic curve:

$$T = \left(25 + \frac{\sqrt{\alpha^2 - 4 \times \beta + 4 \times \beta \times k_T} - \alpha}{2 \times \beta} \right) °C$$

with: $\alpha = 7{,}88 \times 10^{-3} \times K^{-1}$

$\beta = 1{,}937 \times 10^{-5} \times K^{-2}$

$k_T = \frac{R_T}{R_{25}}$

3.13 External LED's D1–D4

LED's D1 to D4 are connected to port PCT of the V850ES/FG3 device. A low signal output at each port switches the corresponding LED on.

LED	V850ES/FG3 Signal
D1	PCT0
D2	PCT1
D3	PCT4
D4	PCT6

Table 12: LED D1–D4 connection

4. *V850ES/Fx3 – CAN it!* CPU module components

The V850ES/FG3 CPU module is equipped with 2 connectors CN7 and CN8 in order to be connected to user defined hardware. Additionally the V850ES/FG3 CPU module contains about connector CN9 (not assembled) for N-Wire debugging and connectors CN3, CN4 and CN6 for CAN communication purpose.

4.1 *V850ES/Fx3 – CAN it!* CPU module

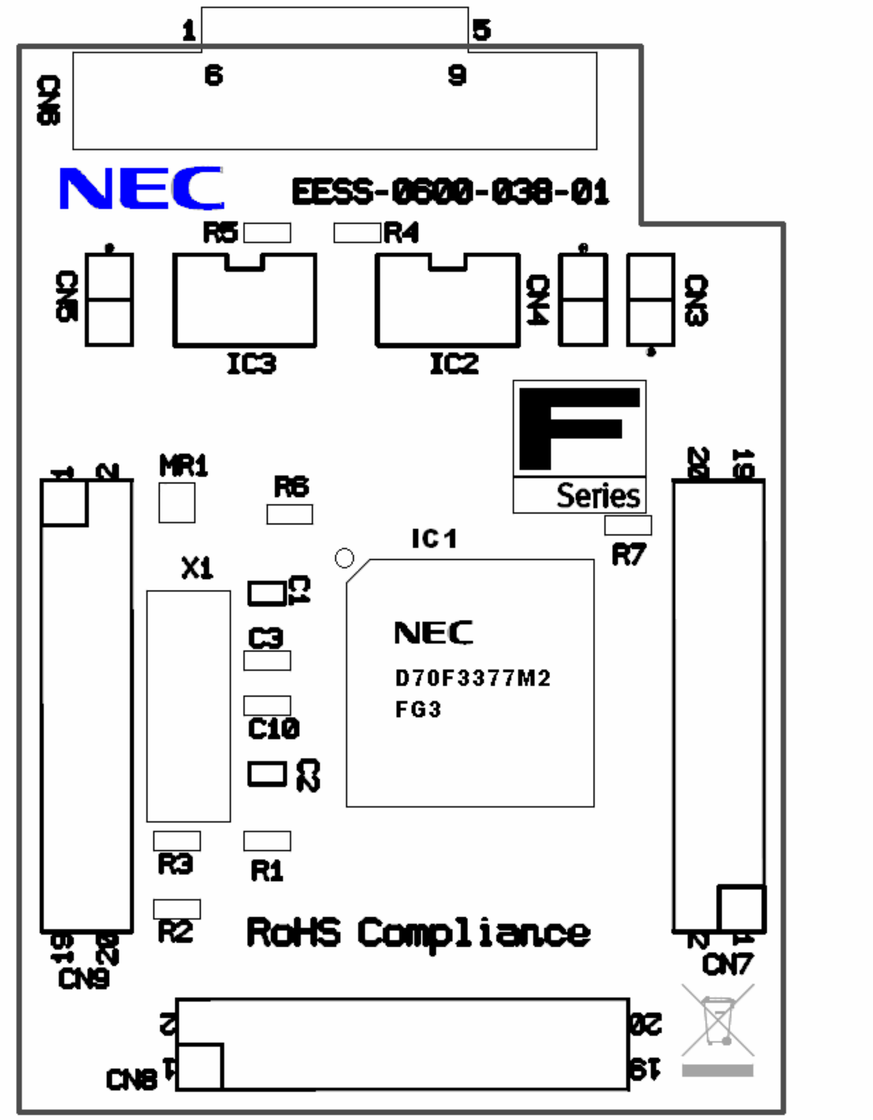


Figure 4: ***V850ES/Fx3 – CAN it!*** **CPU module components**

4.1.1 External connector CN7 and CN8

CN7 and CN8 are connectors for external user hardware. The following signals of the V850ES/FG3 microcontroller are connected to CN7 and CN8:

CN7	V850ES/FG3 Signal	CN7	V850ES/FG3 Signal
1	P99, SCKB1, TIAB00, TOAB00	2	P79, ANI9
3	PCS0	4	P78, ANI8
5	PCS1	6	P77, ANI7
7	PCM0	8	P76, ANI6
9	PCM1, CLKOUT	10	P75, ANI5
11	PCM2	12	P74, ANI4
13	PCM3	14	P73, ANI3
15	P712, ANI12	16	P72, ANI2
17	P711, ANI11	18	P71, ANI1
19	P710, ANI10	20	P70, ANI0

Table 13: Connector CN7

CN8	V850ES/FG3 Signal	CN8	V850ES/FG3 Signal
1	P10, INTP9	2	P51, KR1, TIAB02, TOAB02, TOAB0B1
3	P11, INTP10	4	P90, KR6, TXDD1
5	P00, TIAA31, TOAA31	6	P91, KR7, RXDD1
7	P01, TIAA30, TOAA30	8	P92, TIAB11, TOAB11
9	P02, NMI, TIAA40, TOAA40	10	P93, TIAB12, TOAB12
11	P03, INTP0, ADTRG, TIAA41, TOAA41	12	P94, TIAB13, TOAB13
13	P04, INTP1, CRXD0	14	P95, TIAB10, TOAB10
15	P32, ASCKD0, TOAA01, TIAA00, TOAA00	16	P96, TIAA21, TOAA21
17	P35, TIAA11, TOAA11	18	P97, SIB1, TIAA20, TOAA20
19	P50, KR0, TIAB01, TOAB01, TOAB0T1	20	P98, SOB1, TIAB03, TOAB03

Table 14: Connector CN8

4.2 High Speed CAN connector CN6

CN6 is a D-SUB 9 connector for High Speed CAN with CiA standard pin assignment. The used CAN transceiver is the PCA82C250 with bus termination. The transceiver is connected to the CAN0 interface of the V850ES/FG3 device per default, whereby the standby mode control is selected by port P915.

CN6	Signal
1	N.C.
2	CANL
3	GND
4	N.C.
5	N.C.
6	N.C.
7	CANH
8	N.C.
9	N.C.

Table 15: CAN connector CN6

4.3 CAN connectors, CN3 and CN4

By closing the connectors CN3 and CN4 (not assembled) both CAN macros of the V850ES/FG3 device are connected via a PCA82C250 CAN transceiver each. Within this mode a simple CAN network with two CAN nodes can be simulated.

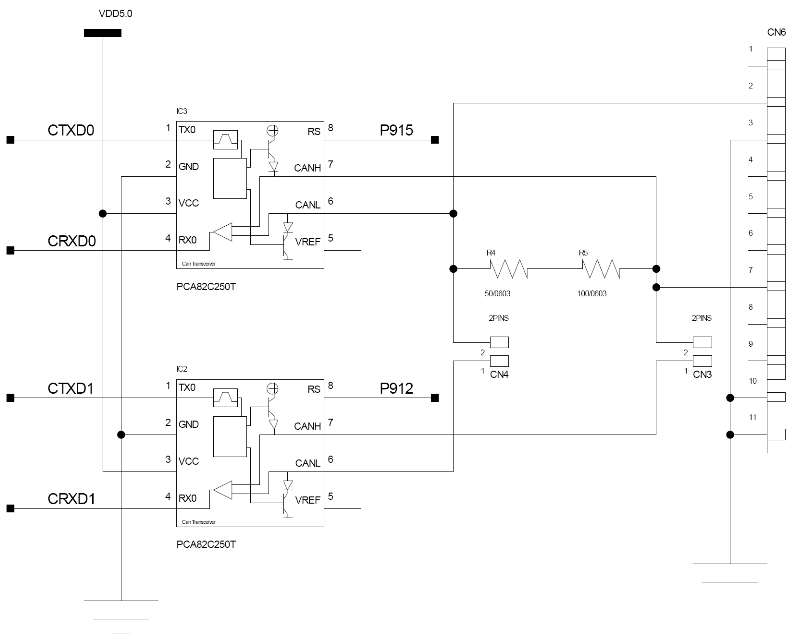


Figure 5: CAN transceivers

The CAN0 interface of the V850ES/FG3 device is connected to transceiver IC3, whereby the standby mode control of the CAN transceiver is selected by port P915.
The CAN1 interface of the V850ES/FG3 device is connected to transceiver IC2, whereby the standby mode control of the CAN transceiver is selected by port P912.

4.4 External power supply input, CN5

By using connector CN5 (not assembled) external power supply can be applied to the *V850ES/Fx3 – CAN it!* board without a need of an active USB connection.

CN5	Input
1	GND
2	VDD (+5V)

Table 16: External power supply input, CN5

Note: Be sure to unplug the USB connection before applying external power supply to input CN5.

4.4.1 N-Wire connector CN9

Connector CN9 (not assembled) allows connecting the QB-V850MINI-EE On-Chip debug emulator to the *V850ES/Fx3 – CAN it!* board in order to use the N-Wire debug function of the V850ES/FG3 device. QB-V850MINI-EE is a separate product from NEC and it is not included in this starterkit package.

CN9	Signal	CN9	Signal
1	GND	2	DCK
3	GND	4	DMS
5	GND	6	DDI
7	GND	8	DRST
9	GND	10	N.C.
11	GND	12	RESET
13	GND	14	FLMD0
15	GND	16	N.C.
17	GND	18	DDO
19	GND	20	VCC

Table 17: N-Wire connector CN9

To enable N-Wire debugging by using the QB-V850MINI-EE, please set switch SW4 to the following configuration:

SW4	Setting
S1	OFF
S2	OFF
S3	Don't care
S4	Don't care

Table 18: SW4 configuration for OCD via QB-V850MINI-EE

For more details on how to configure V85*0ES/Fx3 – CAN it!* in order to use On-Chip debugging please refer to **CHAPTER 5, ON-CHIP DEBUGGING**.

5. On-Chip debugging

The *V850ES/Fx3 – CAN it!* board offers two possibilities to use On-Chip debugging. The TK-V850 debug function of *V850ES/Fx3 – CAN it!* allows On-Chip debugging without a need of external debug hardware. Within this mode the default USB / UART connection to the Host computer is used as debug interface. All standard debug functions are available in the On-Board debugging mode like FLASH programming / downloading, code execution, single stepping, breakpoints, memory manipulation etc.

Additionally *V850ES/Fx3 – CAN it!* supports N-Wire debugging by using the QB-V850MINI-EE On-Chip debug emulator in order to use On-Chip debug function of the V850ES/FG3 device. The system configuration for On-Chip debugging is shown in the figure below.

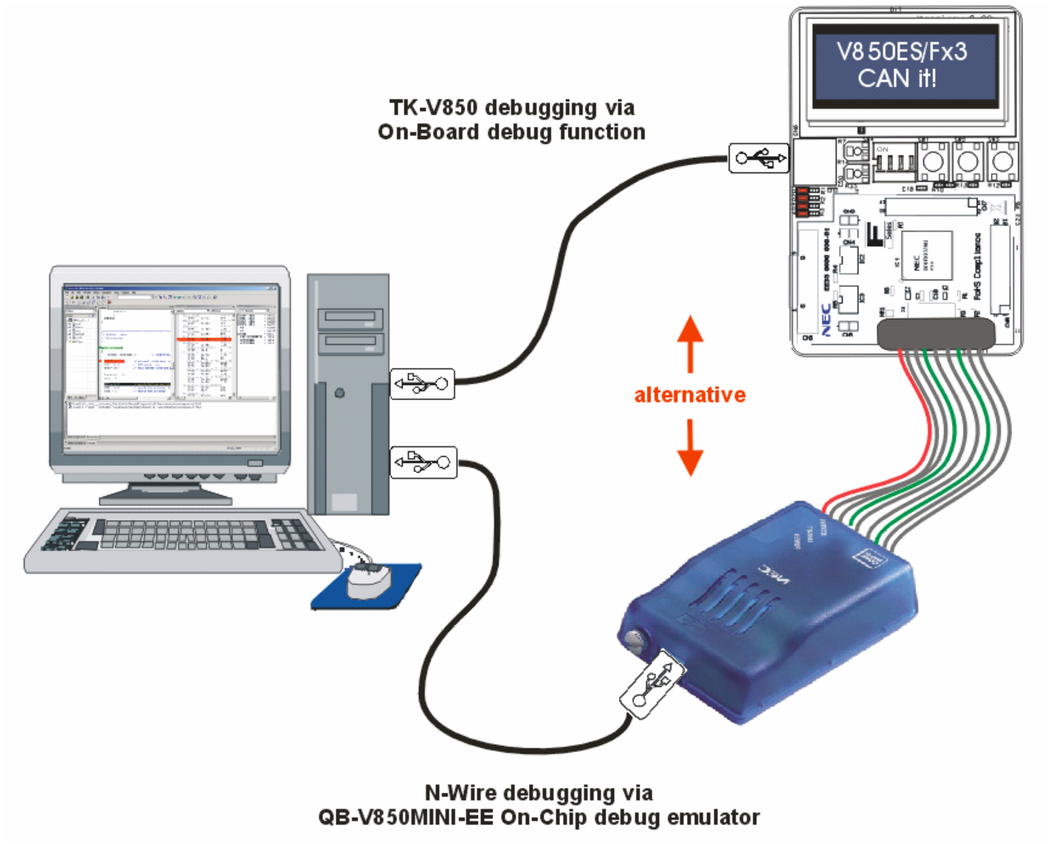


Figure 6: Configuration for On-Chip debugging

5.1 OCD via TK-V850 debugging

To operate the *V850ES/Fx3 – CAN it!* board within the On-Board debug mode configure switch SW4 as following:

SW4	Setting
S1	ON
S2	OFF
S3	OFF
S4	Don't care

Table 19: SW4 configuration for TK-V850 debugging

5.2 OCD via N-Wire debugging

To operate the *V850ES/Fx3 – CAN it!* board together with the QB-V850MINI-EE On-Chip debug emulator, configure switch SW4 as following:

SW4	Setting
S1	OFF
S2	OFF
S3	Don’t care
S4	Don’t care

Table 20: SW4 configuration for N-Wire debugging

6. *V850ES/Fx3 – CAN it!* installation and operation

6.1 Getting started

The IAR C-SPY debugger allows to download and debug application software on the *V850ES/Fx3 – CAN it!* starterkit hardware. Additionally the FPL FLASH programming software can be used for simple FLASH programming of the V850ES/FG3 internal FLASH memory. As communication interface between the host computer and the *V850ES/Fx3 – CAN it!* board a USB interface line is needed. Before you can download, debug or execute an application program, hardware and software must be installed properly.

6.1.1 CD-ROM contents

The CD-ROM shows following directory structure:

V850ES/Fx3 – CAN it! (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 V850	- IAR Embedded Workbench for V850
SamplePrograms	- Sample programs for *V850ES/Fx3 – CAN it!*
TK-V850 Driver	- TK-V850 Driver for *V850ES/Fx3 – CAN it!*
DDF	… Device Description File and … SFR Description File for IAR C-SPY
DEVICES	… Menu File for IAR Embedded Workbench
NEC	… TK-V850 driver for IAR C-SPY … Device File

Table 21: V850ES*Fx3 – CAN it!* CD-ROM directory structure

7. Hardware installation

After unpacking *V850ES/Fx3 – CAN it!,* connect the board to your host computer using the provided USB interface cable. When *V850ES/Fx3 – CAN it!* is connected, the USB driver needs to be installed on the host machine. Please refer to the following **CHAPTER 8 SOFTWARE INSTALLATION**.

8. Software installation

The *V850ES/Fx3 – CAN it!* package comes with several software demo packages:

- IAR Systems Embedded Workbench for V850, including C compiler, assembler, linker, librarian and IAR C-SPY debugger
- TK-V850 Driver for *V850ES/Fx3 – CAN it!*
- FPL FLASH programming software
- Sample programs

The IAR Systems Embedded Workbench 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 Workbench.

8.1 IAR Systems Embedded Workbench for V850 installation

To install the IAR Systems Embedded Workbench for V850 including C-SPY debugger, 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.

8.2 TK-V850 driver installation

To install the TK-V850 driver for the *V850ES/Fx3 – CAN it!* in order to use the IAR C-SPY debugger and On-Board debugging, select the `SETUP` program in the directory `\TK-V850 driver\` of the CDROM. The setup dialogues will guide you through the installation process.

8.3 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.

8.4 Sample program installation

To install the sample programs for the *V850ES/Fx3 – CAN it!* board select the `SETUP` program in the directory `\SamplePrograms\` of the CDROM. The setup dialogues will guide you through the installation process.

8.5 USB Driver Installation

When the *V850ES/Fx3 – CAN it!* board and FPL is used, the driver needs to be installed on the host machine. Install the driver according to the following procedure:

8.5.1 Installation on Windows 98SE/Me

1. When the *V850ES/Fx3 – CAN 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>.

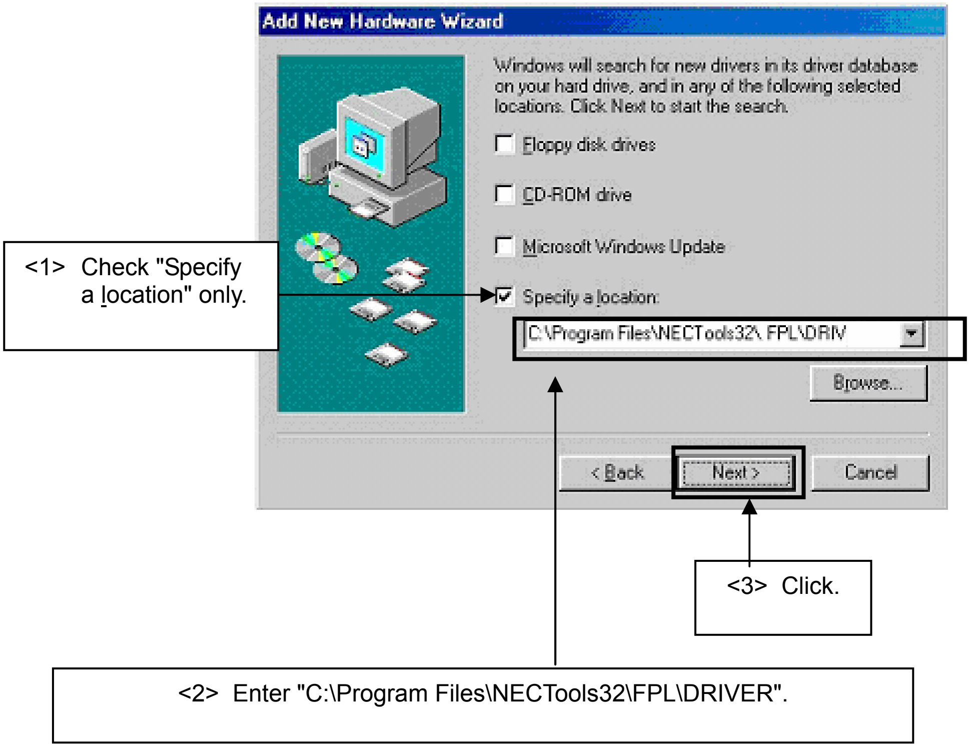
Figure 7: Add New Hardware Wizard (Windows 98SE)

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

Figure 8: 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 9: Search Location Specification (Windows 98SE)



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 10: 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 11: Installation Completion (Windows 98SE)

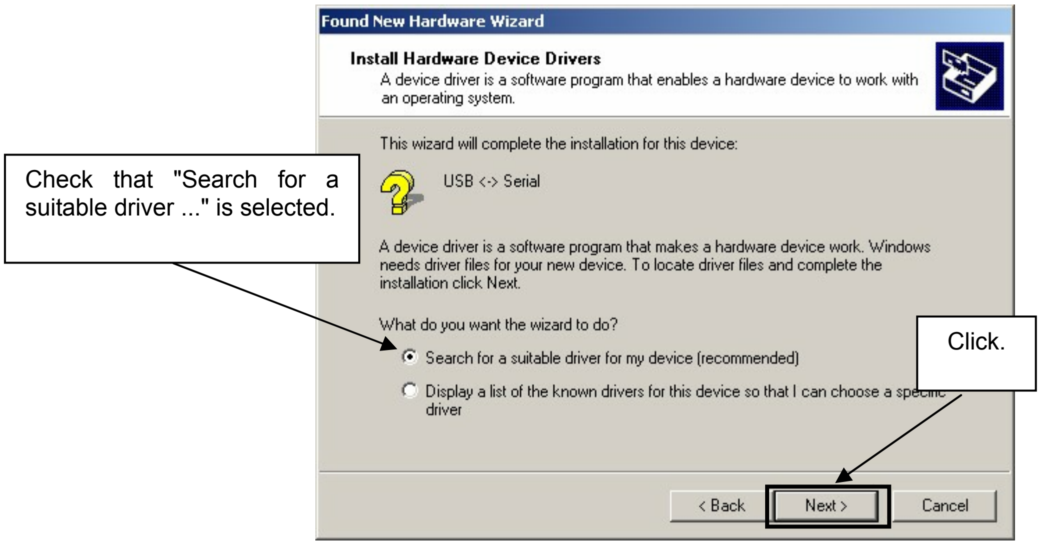
8.5.2 Installation on Windows 2000

1. When the *V850ES/Fx3 – CAN 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 12: Found New Hardware Wizard 1 (Windows 2000)

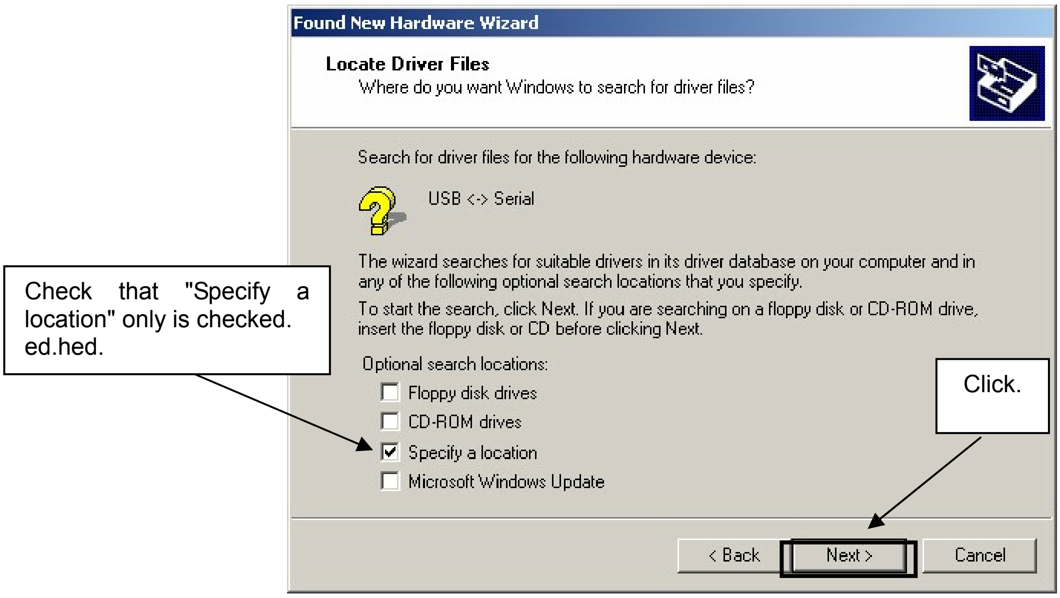
2. The window below is displayed. So, check that "Search for a suitable driver ..." is selected, then click Next>.

Figure 13: Search Method 1 (Windows 2000)



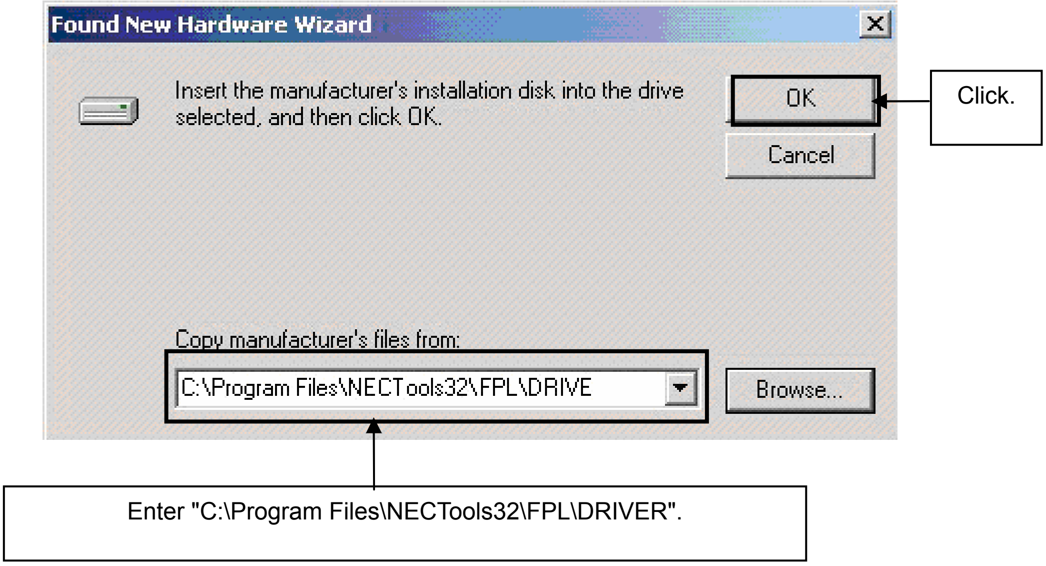
3. Check the "Specify a location" check box only, then click Next>.

Figure 14: Driver File Location 1 (Windows 2000)



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

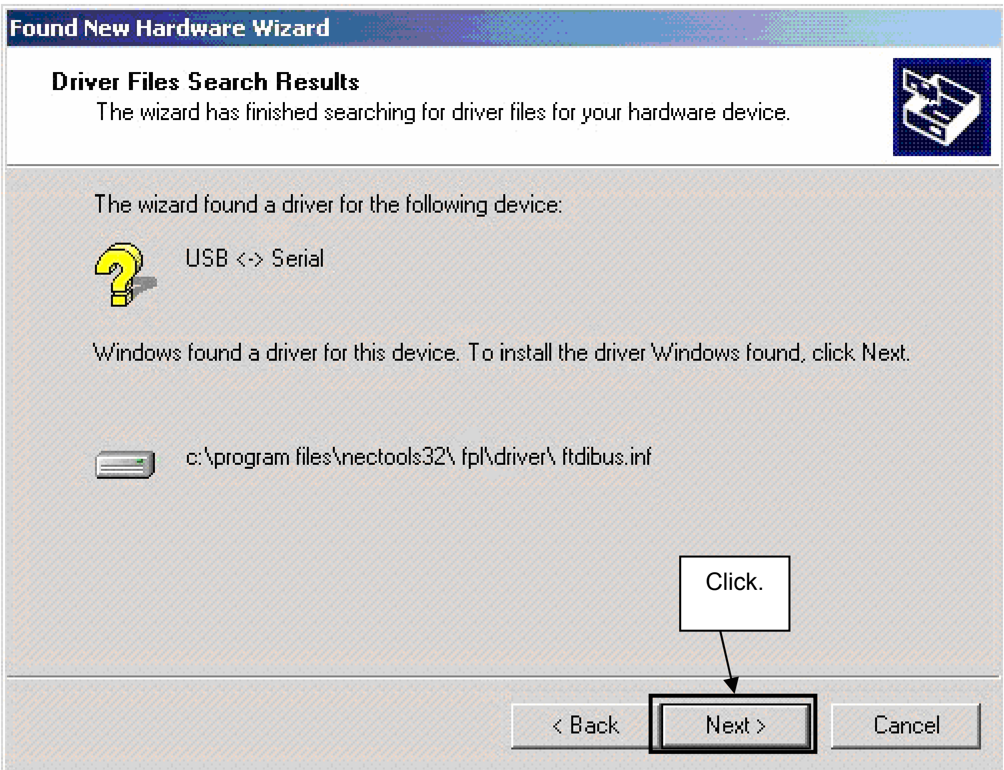
Figure 15: Address Specification 1 (Windows 2000)



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

5. Click Next>.

Figure 16: Driver File Search 1 (Windows 2000)



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

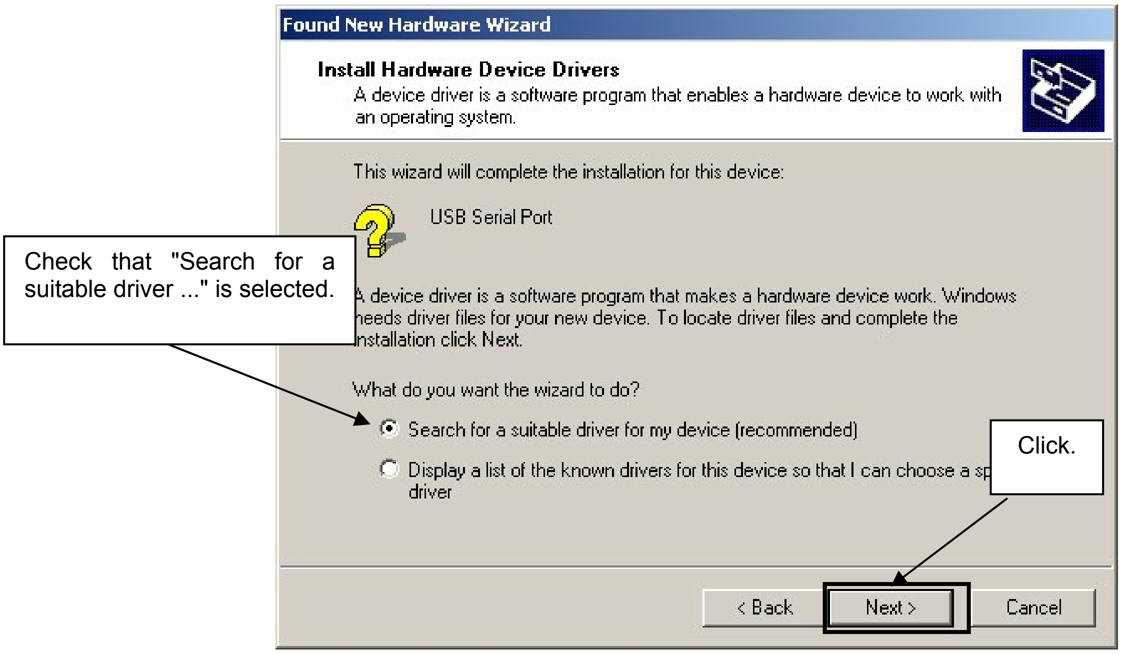
Figure 17: USB Driver Installation Completion 1 (Windows 2000)

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

Figure 18: Found New Hardware Wizard 2 (Windows 2000)

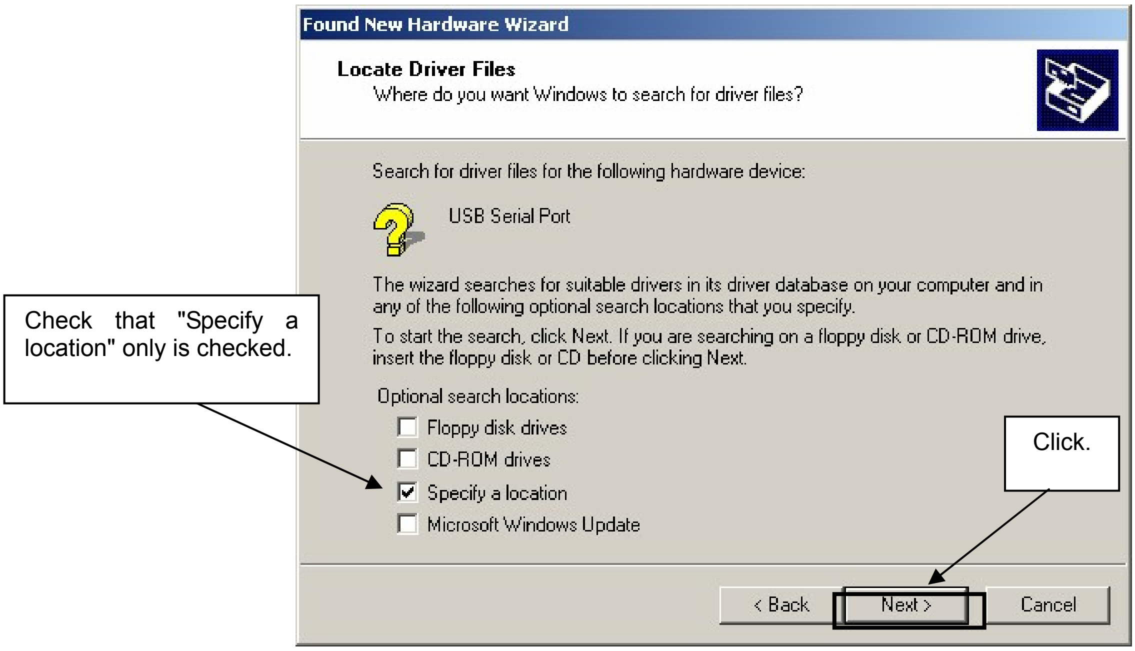
8. The window below is displayed. So, check that "Search for a suitable driver ..." is selected, then click Next>.

Figure 19: Search Method 2 (Windows 2000)



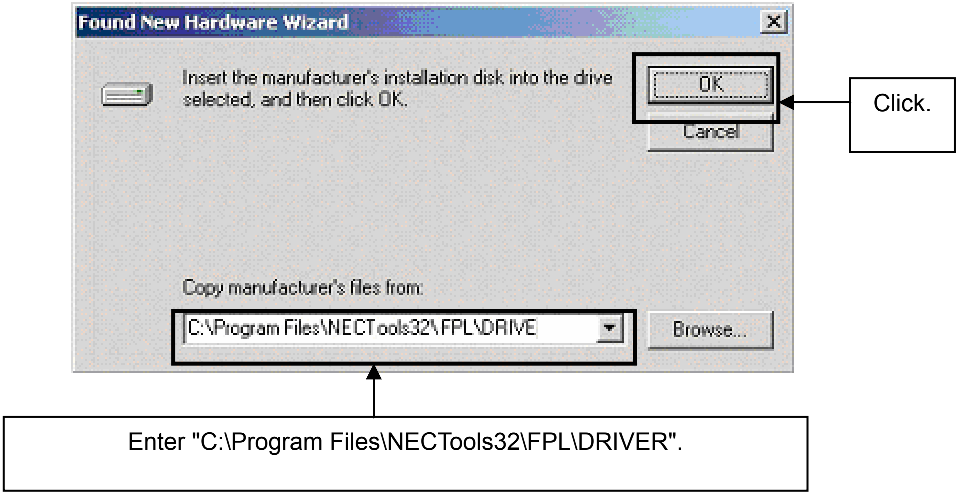
9. Check the "Specify a location" check box only, then click Next>.

Figure 20: Driver File Location 2 (Windows 2000)



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

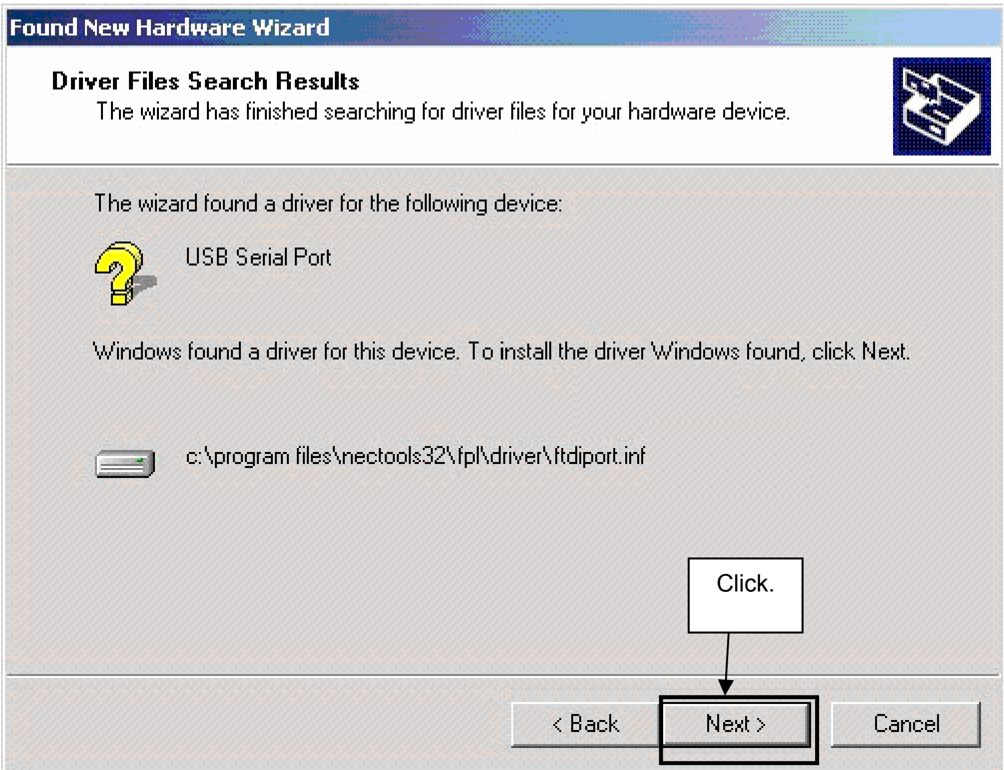
Figure 21: Address Specification 2 (Windows 2000)



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

11. Click Next>.

Figure 22: Driver File Search 2 (Windows 2000)



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

Figure 23: USB Driver Installation Completion 2 (Windows 2000)

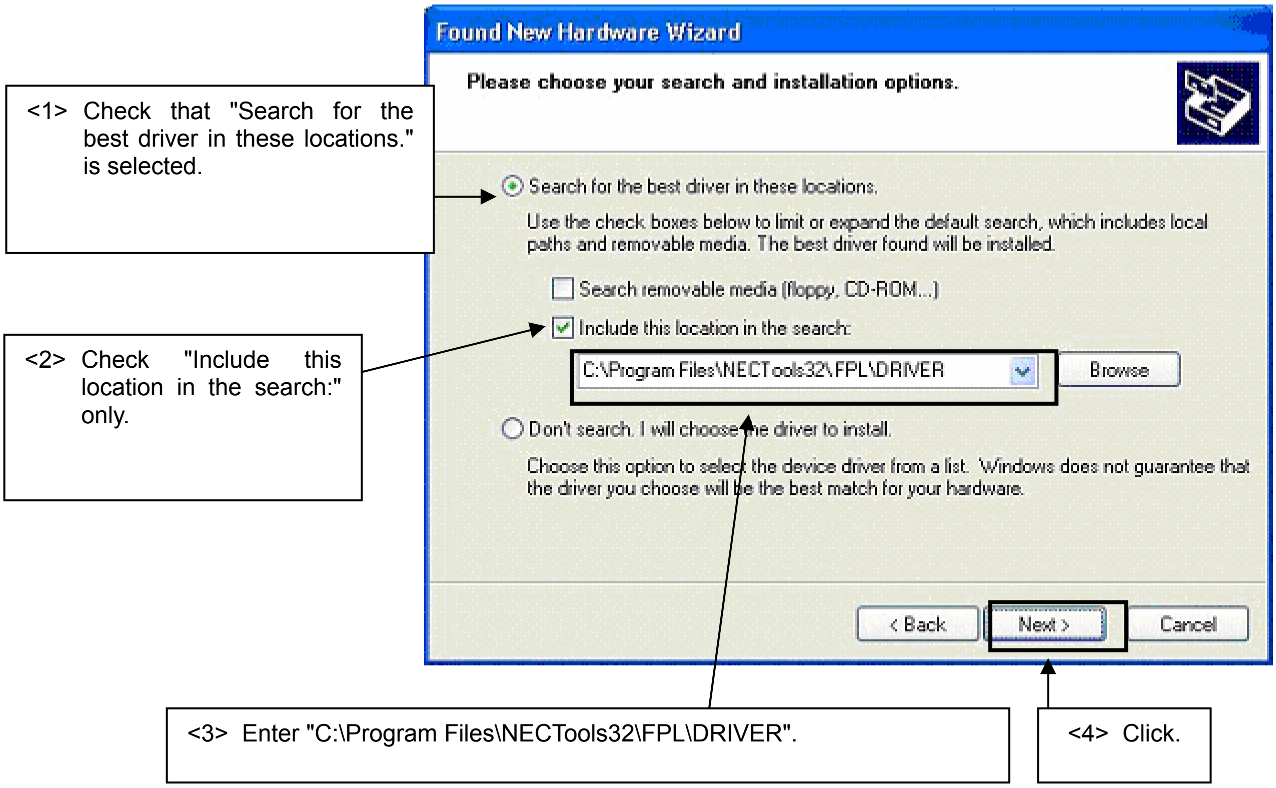
8.5.3 Installation on Windows XP

1. When the *V850ES/Fx3 – CAN 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. Check that "Install from a list or specific ..." is selected, then click Next>.

Figure 24: Found New Hardware Wizard 1 (Windows XP)

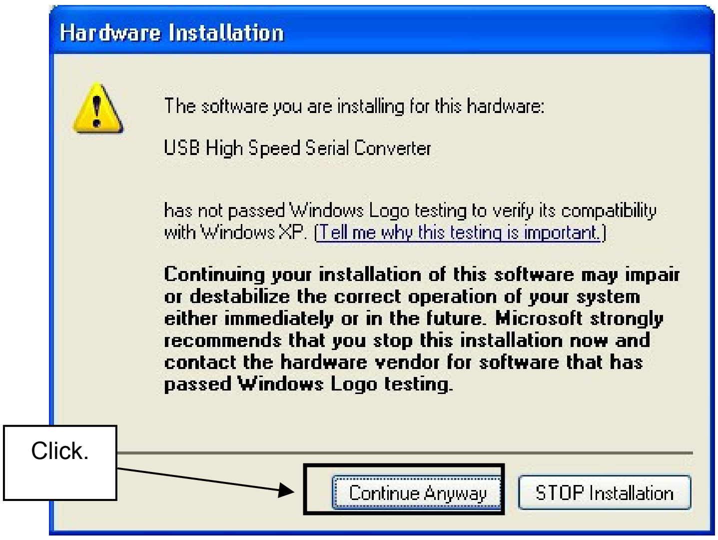
2. Check that "Search for the best driver in these locations." is selected. Check the "Include this location in the search:" check box and enter "C:\Program Files\NECTools32\FPL\DRIVER" in the address bar, then click Next>.

Figure 25: 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 26: Windows XP Logo Testing 3 (Windows XP)



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

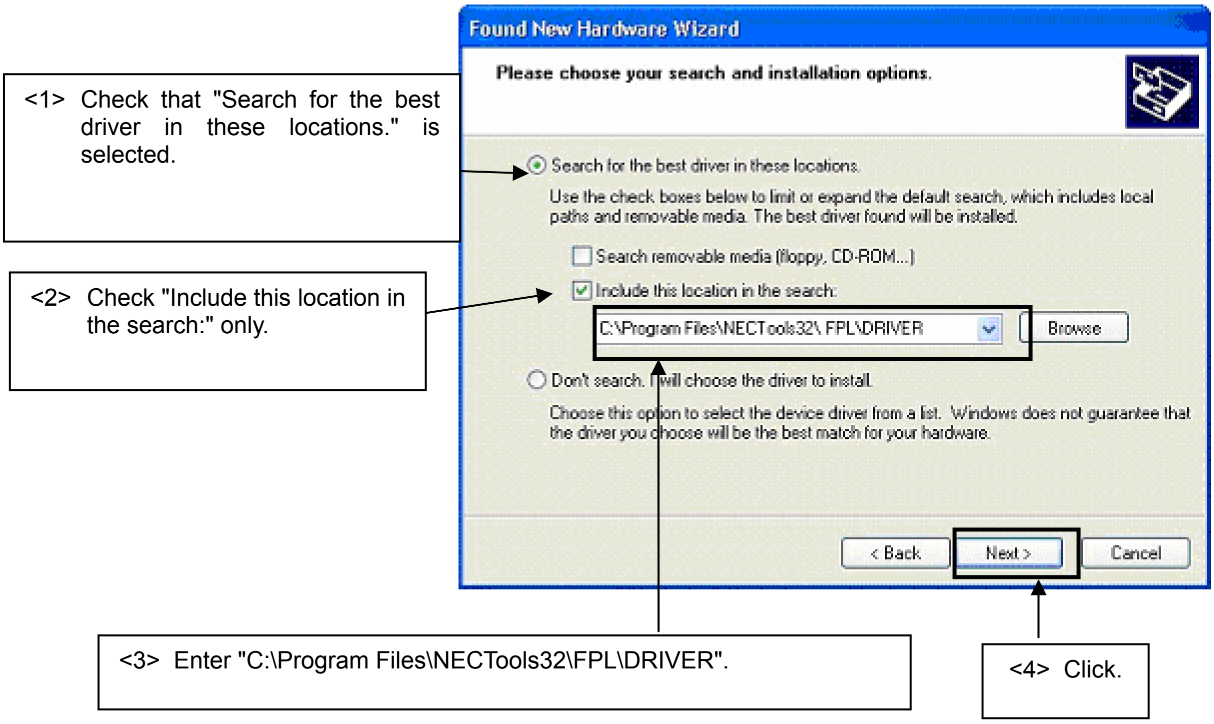
Figure 27: USB Driver Installation Completion 1 (Windows XP)

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

Figure 28: Found New Hardware Wizard 2 (Windows XP)

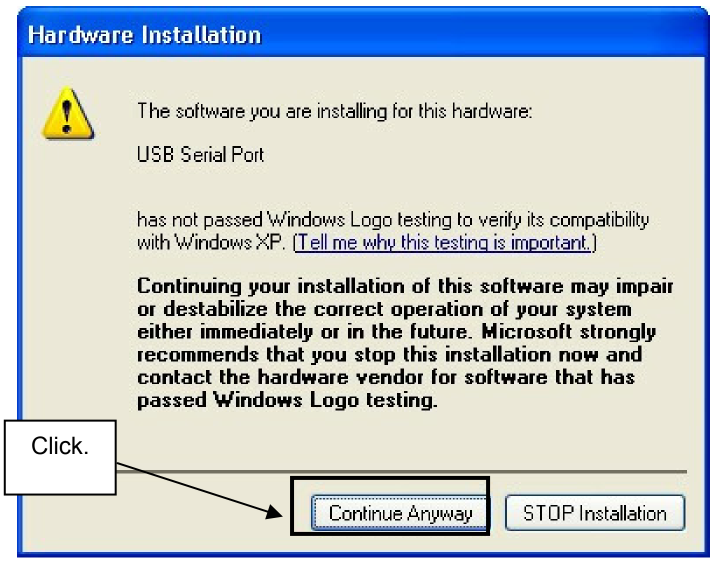
6. Check that "Search for the best driver in these locations." is selected. Check the "Include this location in the search:" check box and enter "C:\Program Files\NECTools32\FPL\DRIVER", then click Next>.

Figure 29: 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 30: Windows XP Logo Testing 2 (Windows XP)



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

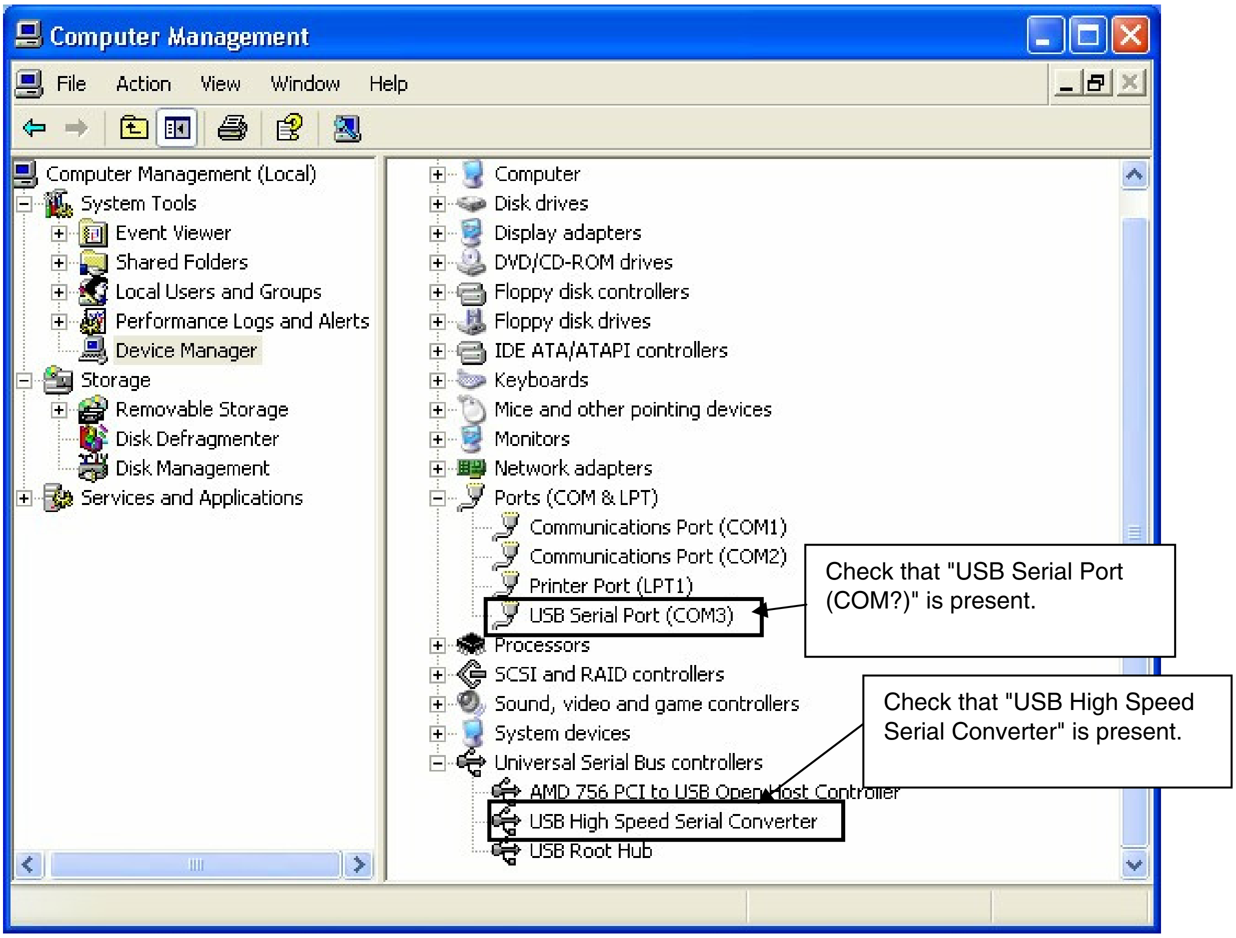
Figure 31: USB Serial Port2 Driver Installation Completion (Windows XP)

8.6 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 *V850ES/Fx3 – CAN it!* 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 32: 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 11 TROUBLESHOOTING**.

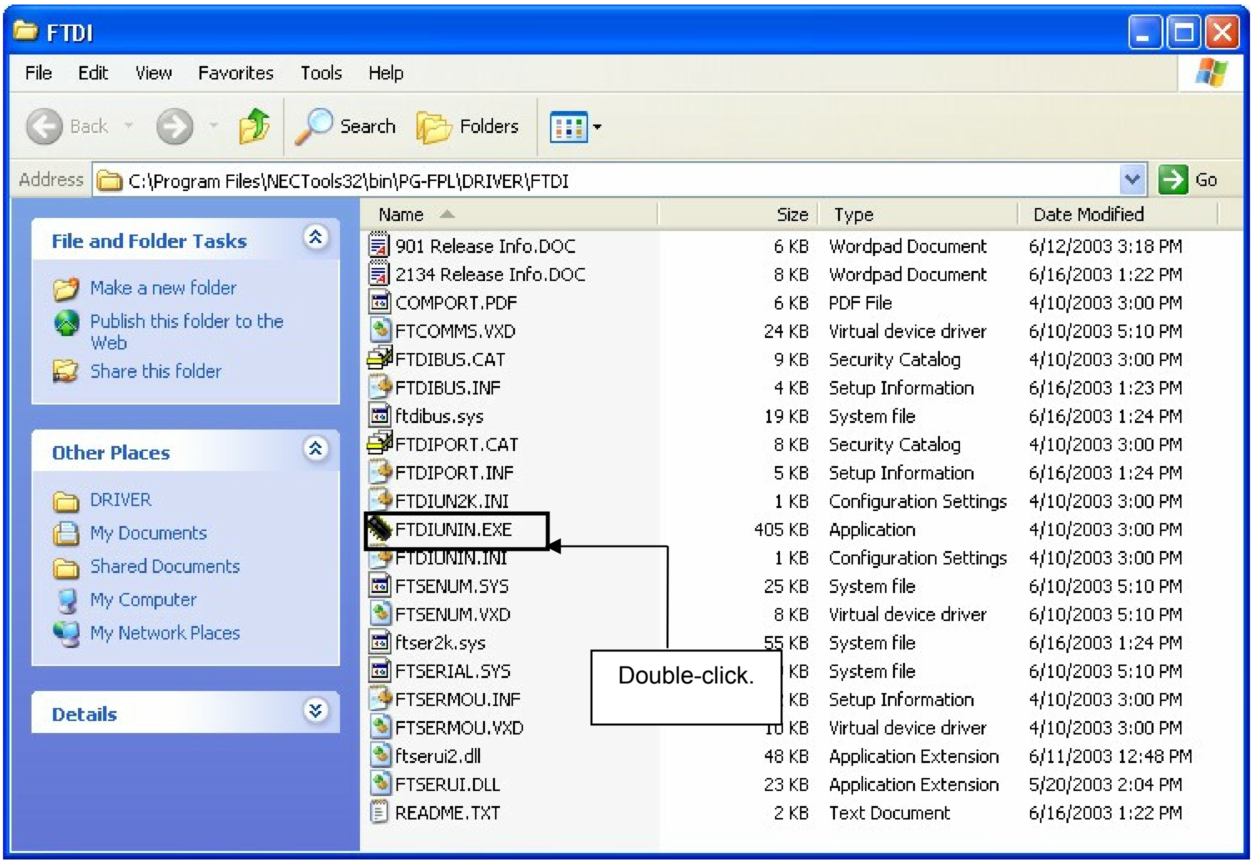
8.7 Driver Uninstallation

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.

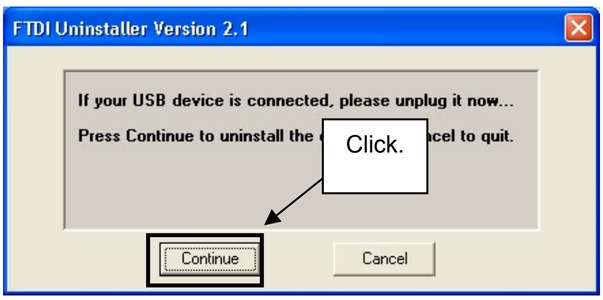
2. Double-click in the order from "My Computer" to "(C:)" to "Program Files" to "NECTools32" to "FPL" to "DRIVER". "Ftdiunin.exe" is displayed. Double-click "Ftdiunin.exe".

Figure 33: Driver Uninstallation



3. Click Continue.

Figure 34: Driver Uninstaller



4. Click Finish to complete driver uninstallation.

Figure 35: 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.

9. FPL FLASH programming software

9.1 Introduction

The parameter file of the V850ES/FG3 device is installed automatically during installation of FPL GUI, folder <FPL install-path>\PRM. Nevertheless, newest version of parameter file for the µPD70F3377 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.eu.necel.com/updates

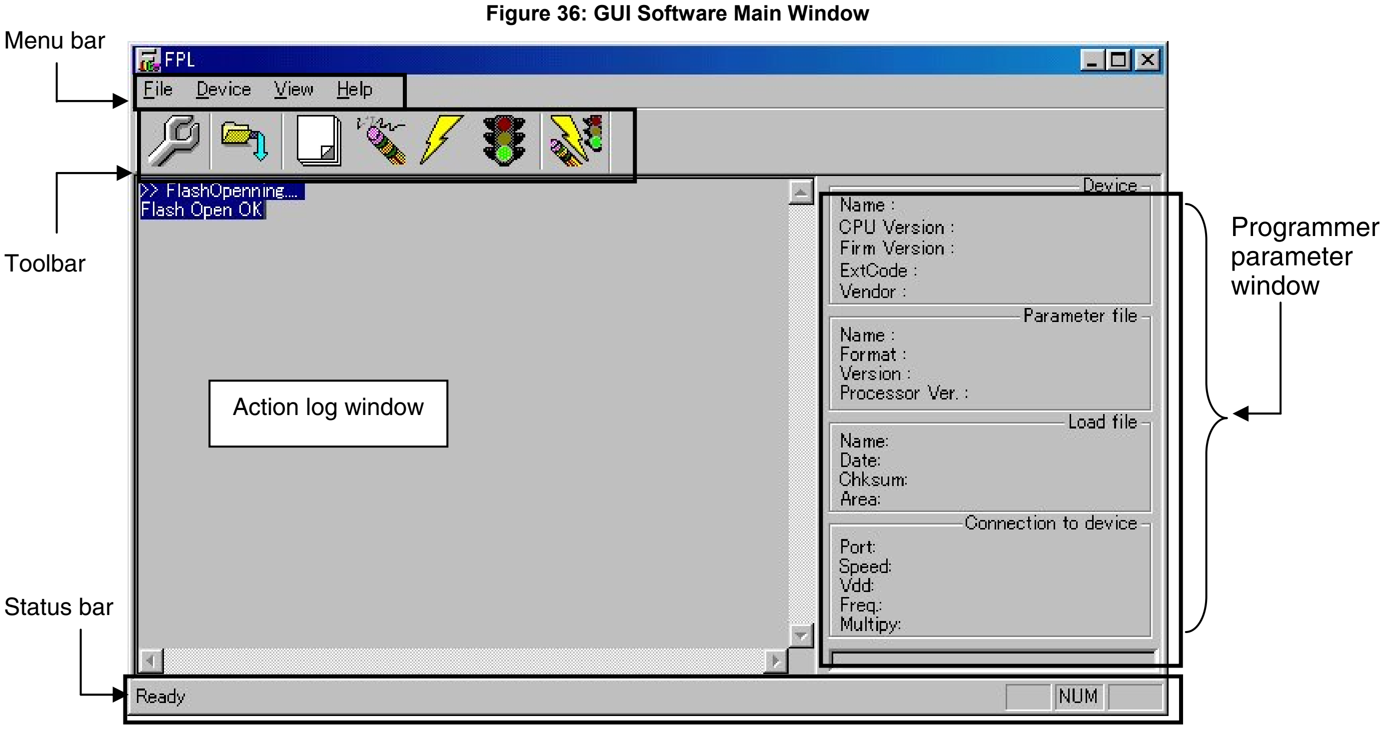
Copy the parameter file downloaded from the NEC Electronics Web site into sub-directory <FPL.EXE-install-path>\PRM created during GUI software setup (refer to **CHAPTER 6 SOFTWARE INSTALLATION**).

9.2 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 36: GUI Software Main Window



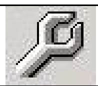
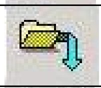
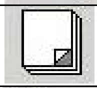
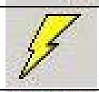
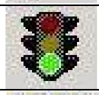
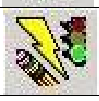
This window consists of the following items:

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.

9.3 Toolbar

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

Figure 37: 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

9.4 Menu Bar

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

9.4.1 [File] menu

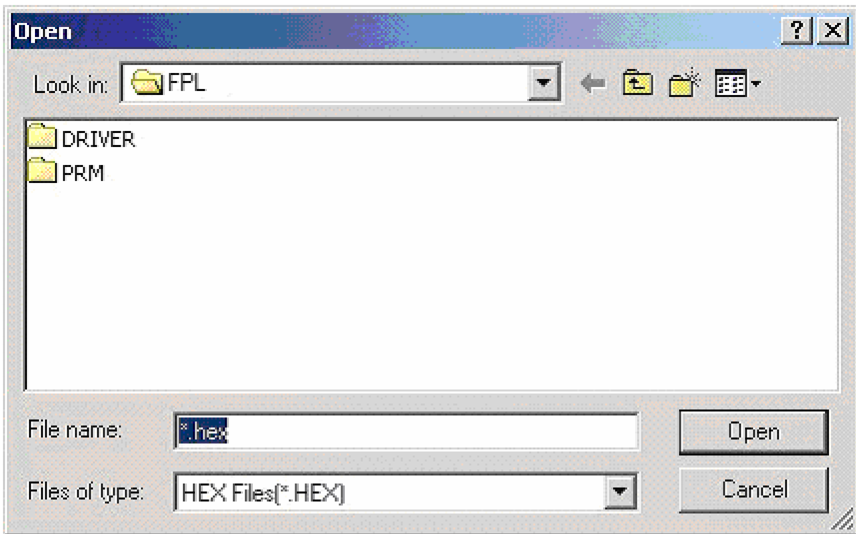
Clicking the [File] menu displays the pull-down menu as shown below.
This menu mainly contains commands related to file operation.

Figure 38: [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 39: 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

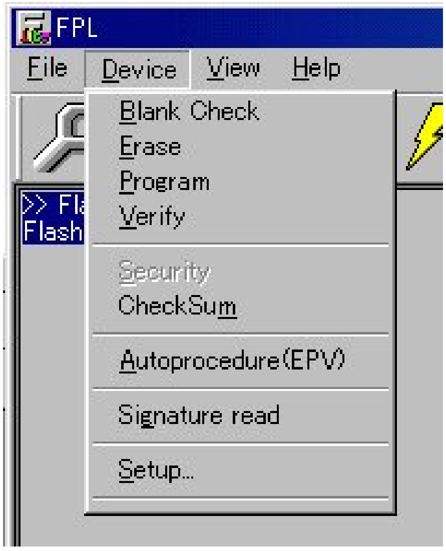
The [Quit] menu is the command for terminating the FPL GUI software. Clicking × on the right side of the task bar also terminates the FPL GUI software.
User settings are saved in the FPL.INI[Note] file, so that the GUI software starts up next time with the same settings.

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.

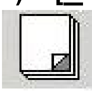
9.4.2 [Device] menu

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 40: [Device] Menu



(1) [Blank Check] command

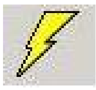


The [Blank Check] command allows you to make a blank check on the target device connected to the FPL. If the flash memory of the target device is erased, a blank check is terminated normally. If the flash memory is not completely erased, the indication "not blank" is provided. Before starting programming, 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



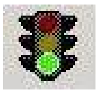
The [Program] command sends a specified user program to the target device and writes the program to the flash memory.

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

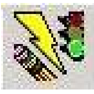
This command is not supported.

(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.

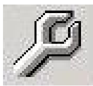
During EPV execution, the progress status is displayed in the action log window to indicate programmer operation. For a selected command, its execution operation, and messages, refer to **CHAPTER 8 HOW TO USE FPL**.

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

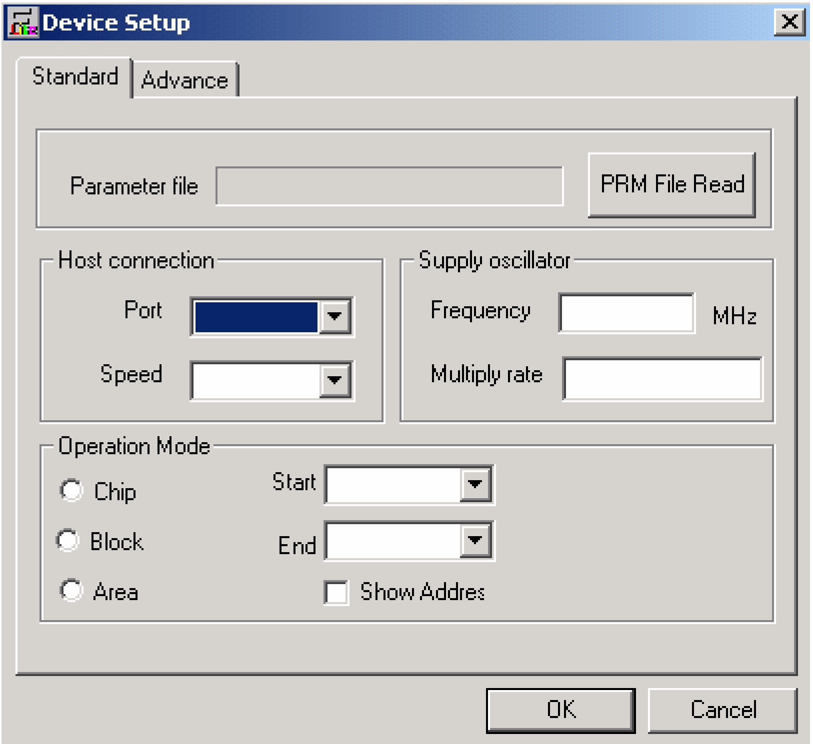


The [Setup] menu allows you to make settings related to flash memory rewriting according to the user environment and to set command options. Each time the GUI software is started, the most recently used parameter file (.PRM) is read and the settings are displayed. The [Setup] menu allows you to modify 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 41: 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 42: Setup Window - Parameter File Selection

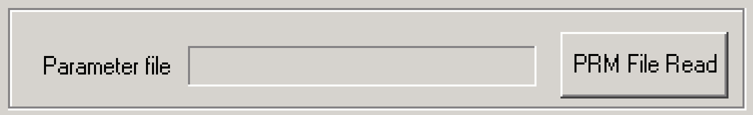
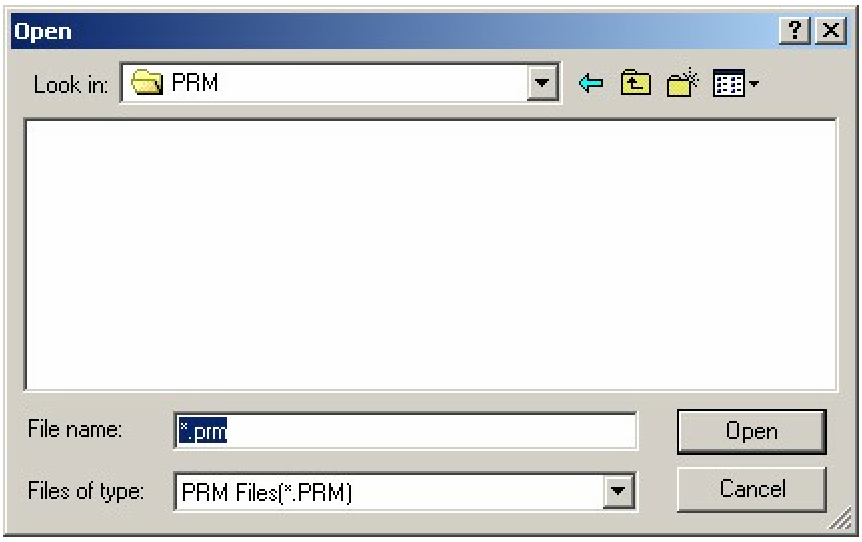


Figure 43: Parameter File Selection Window



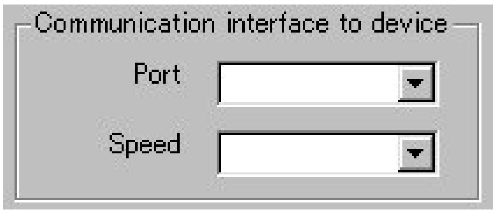
[PRM File Read button]

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 *V850ES/Fx3 – CAN it!* board and host machine.

Figure 44: Setup Window - Communication interface to device



[Port list box]

Select a channel for communication between the *V850ES/Fx3 – CAN it!* board and host machine.

- COM1 to COM16

Remark Selectable ports can be checked using Device Manager. For details, refer to **CHAPTER 8.6 Confirmation of USB Driver Installation**.

[Speed list box]

Select a communication rate for the selected communication channel from the following:

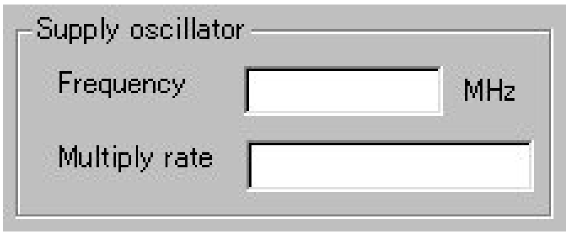
- 9600 bps
- 19200 bps
- 38400 bps

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 45: 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 46: 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.

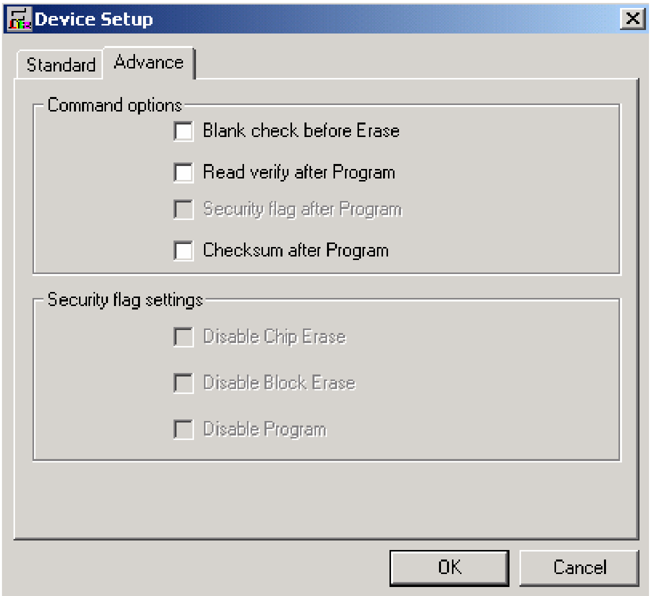
[When Area is selected]
Specify the Area number range subject to rewrite processing by using Start/End.
The Start/End list boxes display the Area numbers where the flash memory of the target device is configured.

[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:

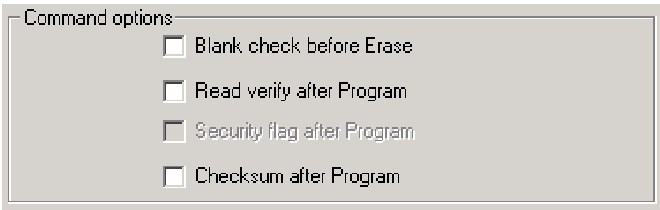
Figure 47: Device Setup Window - Advance



<1> Command options

This dialog box is used to specify the FPL flash processing command options.

Figure 48: 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

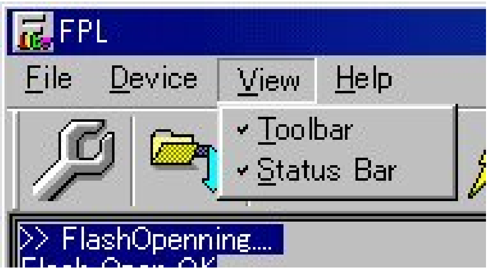
[Checksum after Program check box]
If this check box is checked, the flash memory checksum value of the target device is read from the target device after execution of the Program command and EPV command.
This value differs from the value displayed in the parameter window of the main window.

<2> Security flag settings Not usable

9.4.3 [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 49: [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.

9.4.4 [Help] menu

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

Figure 50: [Help] Menu

(1) [About FPL] command

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

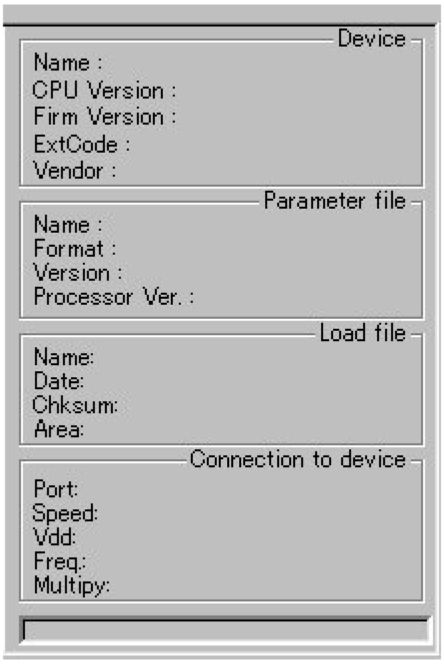
Clicking OK terminates the display.

Figure 51: About FPL Window

9.5 Programmer Parameter Window

This window displays the settings of the programming parameters.

Figure 52: 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.

10. How to use FPL FLASH programming software

This chapter explains the basic operation of the FPL GUI for programming the *V850ES/Fx3 – CAN it!* board. This chapter covers how to start the system, execute the EPV command, and program the V850ES/FG3 target device.

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

Hardware configuration of *V850ES/Fx3 – CAN it!* :

Base board	:	*V850ES/Fx3 – CAN it!*
Target device	:	V850ES/FG3 (µPD70F3377)
Clock	:	4 MHz
Voltage level	:	5 V

Software configuration of FPL:

Parameter file:		70F3377.PRM
Clock setting	:	4 MHz Multiplied by 8
Port	:	COM8 (38400 bps)
Operation mode:		Chip
Write HEX	:	ADC_demo.hex
Option setting	:	Blank check before Erase

10.1 Installing the FPL GUI software

Install the FPL GUI software on the host machine you are using, by referring to **CHAPTER 8 SOFTWARE INSTALLATION** (if the software has not been installed yet).

10.2 Installing the driver

Install the USB driver on the host machine you are using, by referring to **CHAPTER 8 SOFTWARE INSTALLATION** (if the driver has not been installed yet).

10.3 Installing the parameter file

The parameter file for the V850ES/FG3 device is installed automatically during installation of FPL GUI, folder <FPL install-path>\PRM. Nevertheless, newest version of parameter file for the µPD70F3377 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:

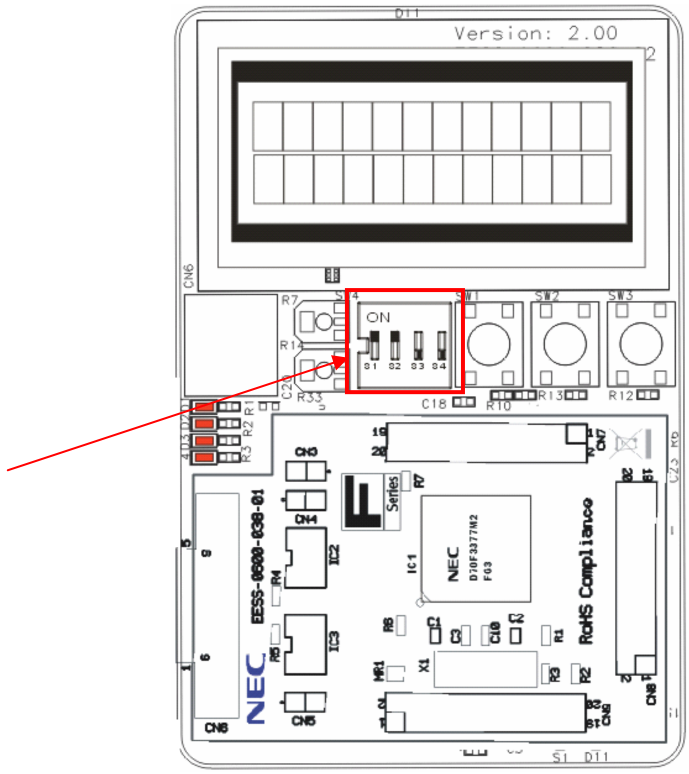
http://www.eu.necel.com/updates

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 8 SOFTWARE INSTALLATION**).

10.4 Connecting and starting

<1> Set the *V850ES/Fx3 – CAN it!* board to the FLASH programming mode by switching SW4/S1 and SW4/S2 to ON. The UARTD0 of the V850ES/Fx3 device is used as FLASH programming interface, therefore set switch SW4/S3 to OFF:

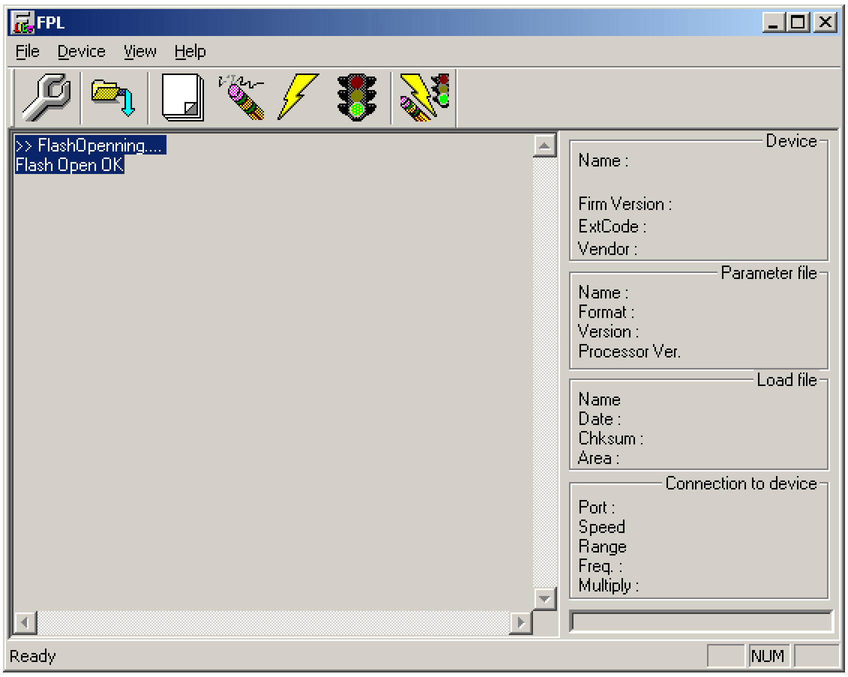
SW4	Setting
S1	ON
S2	ON
S3	OFF
S4	Don't care



<2> <Plug and Play> Connect the *V850ES/Fx3 – CAN it!* 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.

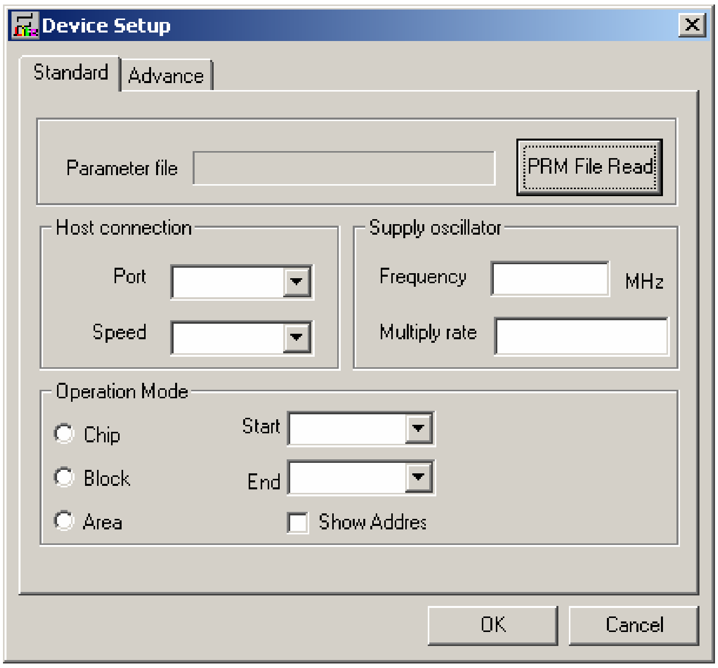
Figure 53: GUI Software Startup Screen



10.5 Setting the programming environment

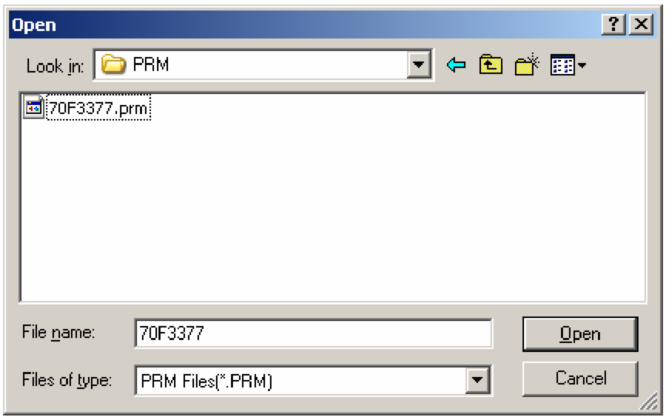
<1> Select [Device] → [Setup] from the menu bar.
<2> The Standard dialog box for device setup is activated.

Figure 54: <Standard Device Setup> Dialog Box



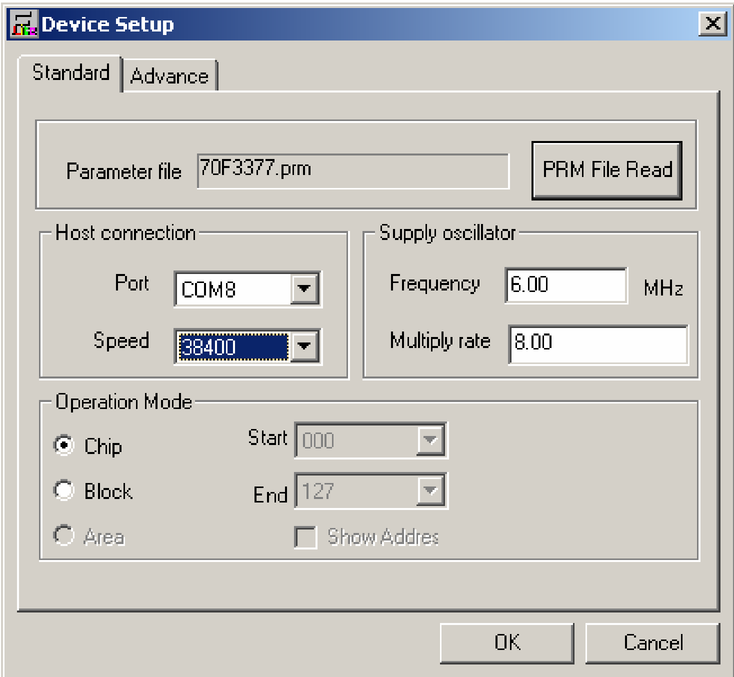
<3> Click PRM File Read to open the parameter file selection window.
Select the parameter file “70F3377.prm” then click Open.

Figure 55: 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.

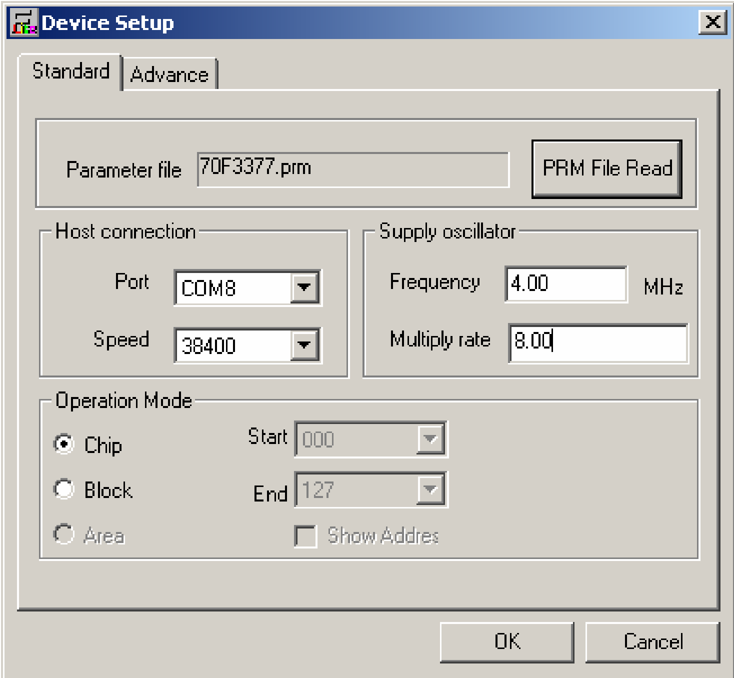
Figure 56: Port Selection



Remark Selectable ports can be checked using Device Manager. For details, refer to **CHAPTER 8.6 Confirmation of USB Driver Installation**.

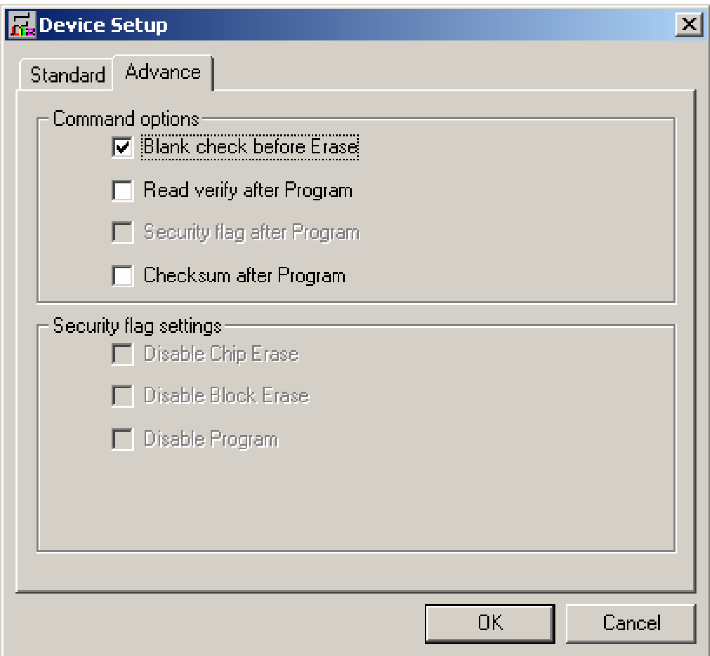
<5> Set "Supply oscillator" according to the specifications of the *V850ES/Fx3 – CAN it!* board, “Frequency = 4.00 MHz” and “Multiply rate = 8.00”. In "Operation Mode", please specify the “Chip” mode. The following figure shows the recommended settings:

Figure 57: <Standard Device Setup> Dialog Box after Setting



<6> Switch to the Advance dialog box.

Figure 58: <Advance Device Setup> Dialog Box

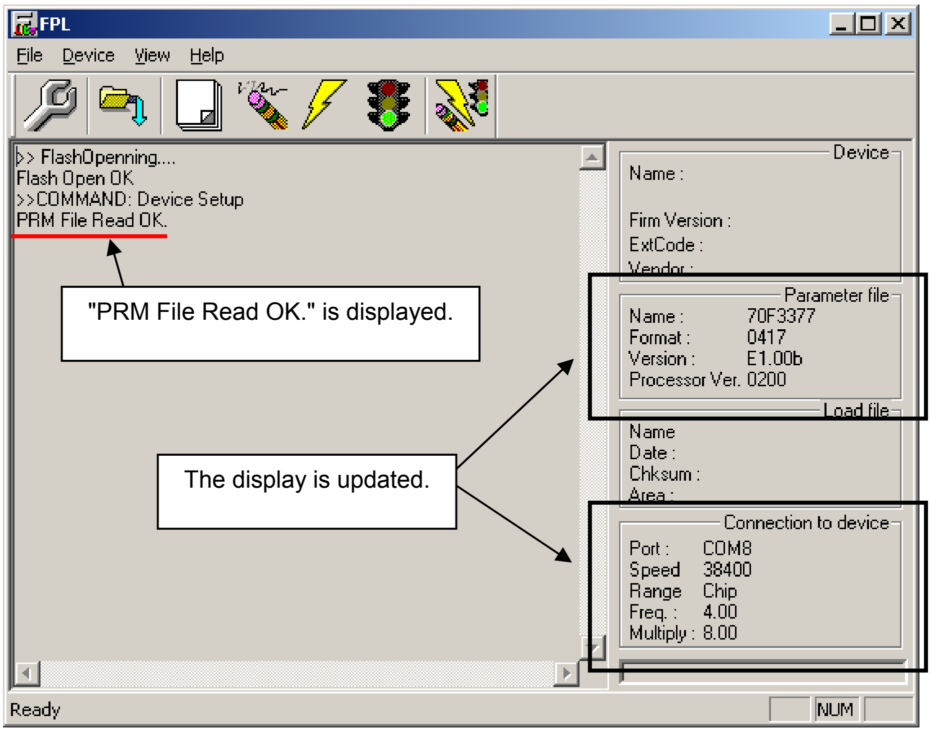


<Command options>

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:

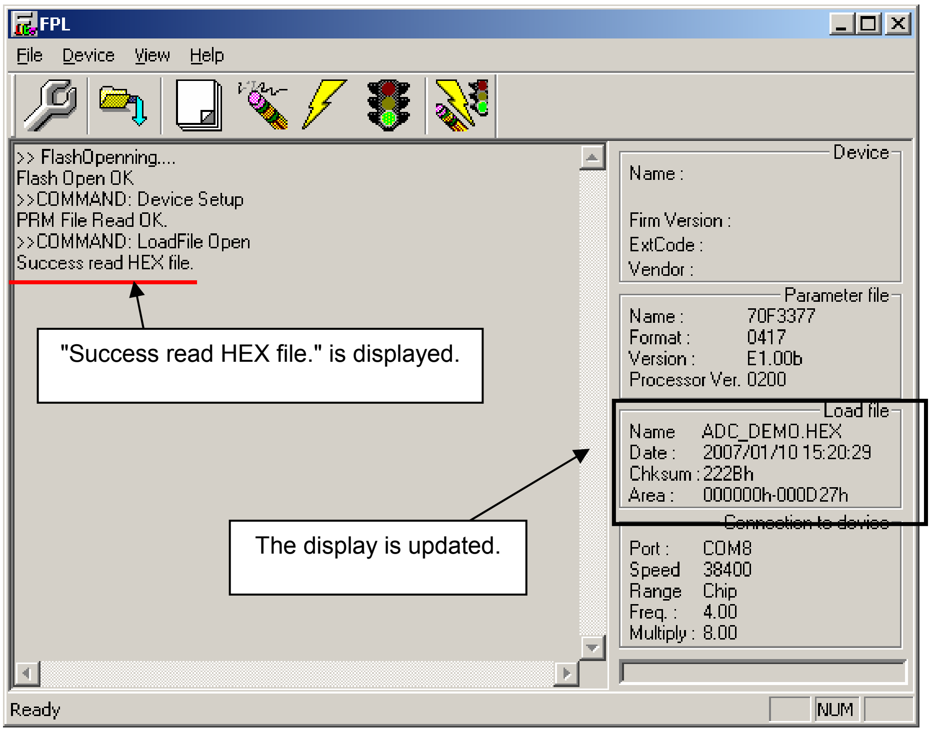
Figure 59: Completion of Parameter Setting



10.6 Selecting a user program

<1> Select [File] → [Load].
<2> Select a program file to be written to the target device, then click Open.

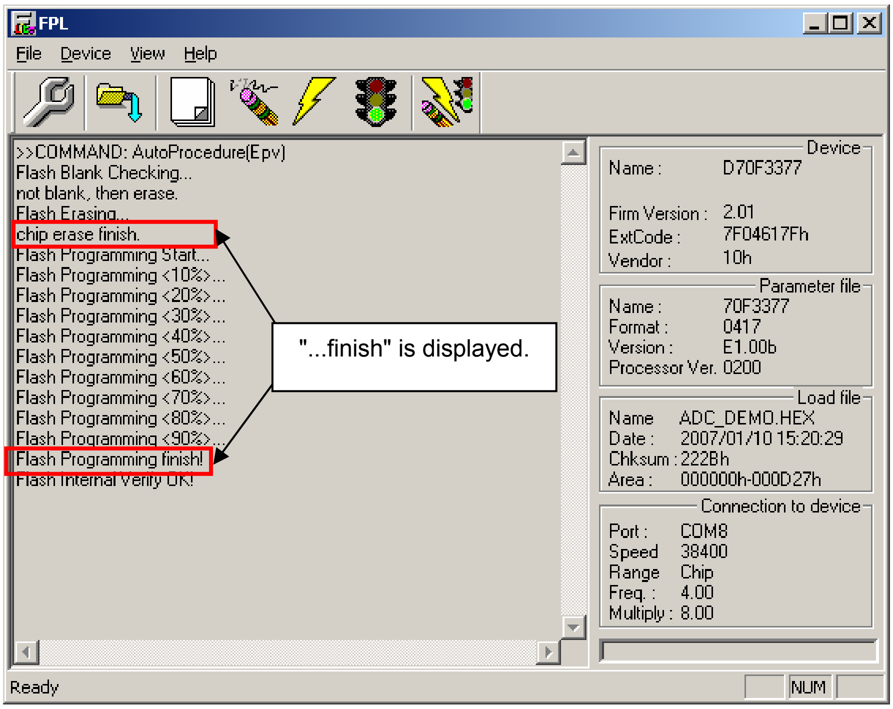
Figure 60: After Downloading



10.7 [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 µPD70F3377 device.

Figure 61: After EPV Execution



10.8 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.

10.9 Execute "ADC_DEMO" application

Set the *V850ES/Fx3 – CAN it!* board to the normal operation mode by switching SW4/S1 and SW4/S2 to OFF. < Plug and Play> the *V850ES/Fx3 – CAN it!* board to start in normal operation mode or press the reset button SW1 to release the normal operation mode.

10.10 Restarting the GUI

When the system is restarted, the same screen as shown in Figure 59 appears.

11. 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 8 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 8.5 USB Driver Installation**.

Communication with the *V850ES/Fx3 – CAN 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 **CHAPTER 8.5 USB 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 *V850ES/Fx3 – CAN it!* board is operating in normal mode.
Action:
Set the board to the FLASH programming mode by setting SW4 switches S1 and S2 to ON and connect UARTD0 signals to the FTDI USB/UART chip by switching SW4/S3 to OFF.

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 9 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.

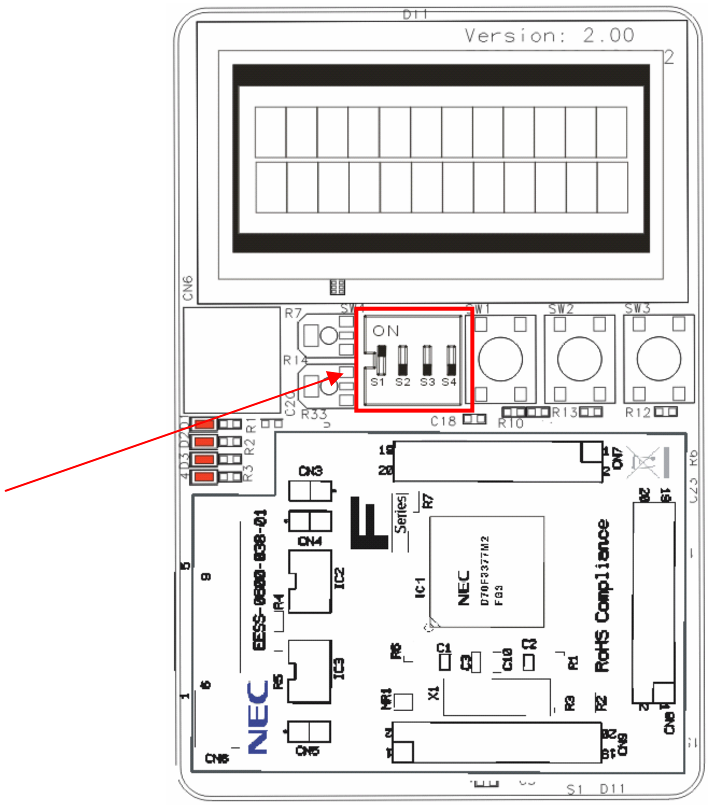
12. TK-V850 debugging

Before using the On-Board debug function of the *V850ES/Fx3 – CAN it!* board together with the IAR C-SPY debugger it is necessary to install the USB driver first. The *V850ES/Fx3 – CAN it!* starterkit uses a monitor program for debugging purpose. The communication between the starterkit and the IAR C-SPY debugger - that is running on the personal computer - is done via the standard UART / USB connection. The monitor program is automatically downloaded to the starterkit in that case when the V850ES/FG3 internal FLASH memory was erased by the user i.e. by using the FPL. Therefore the user has not to take care about the monitor.

As communication interface the build-in UARTD0 of the V850ES/FG3 device is used by the monitor. Consequently it can not be used by the user program.

To set the *V850ES/Fx3 – CAN it!* starterkit to the On-Board debug mode configure SW4 as following:

SW4	Setting
S1	ON
S2	OFF
S3	OFF
S4	Don't care



12.1 Monitor resources

The debugging feature of the *V850ES/Fx3 – CAN it!* starterkit has been realized by a monitor program that is running on the V850ES/FG3 device. Therefore, the following resources are reserved by monitor and can not be used by a user program.

12.1.1 UARTD0

The UARTD0 of the V850ES/FG3 device is reserved for the monitor program and can not be used by a user program.

Device	UART for Debugging	Interrupt control flags	Terminals used
V850ES/FG3 (µPD70F3377)	UARTD0	UD0RMK UD0SMK	P30 / TXDD0 P31 / RXDD0

Additionally, please note the following points:

- Do not change the control registers of UARTD0.
- Do not change or disable the interrupt control / mask flags of UARTD0.
- Do not change the port mode or port mode control registers for port bits P30 and P31.
- Debugging functions like forcible break (debugger stop command) do not operate normally in the following states where the clock supply to UARTD0 is disabled:
    - IDLE mode
    - STOP mode
    - Main oscillation (fx) is stopped.

12.1.2 Interrupt vectors

The following interrupt vectors are used by the monitor program and can not be used by a user program.

Device	Interrupt vector address	Function
V850ES/FG3 (µPD70F3377)	0x0060 – 0x0063	DBTRAP debug interrupt vector
	0x02C0 – 0x02C3	UARTD0 receive interrupt vector
	0x02B0 – 0x02B3	UARTD0 status interrupt vector

12.1.3 Reset vector

When a user program is downloaded by using the IAR C-SPY debugger, the reset vector (address 0x0000) of the user program is replaced by the one of monitor program. The debugger moves the reset vector of the user program automatically to address 0x0004. The correction of the relative jump address is also done automatically by the debugger.

Example:

0x0000	MOV _start, R31
0x0006	JMP R31
0x0008	

→

0x0000	JR monitor
0x0004	MOV _start, R31
0x000A	JMP R31

12.1.4 Memory area

The monitor program is located in the highest FLASH block of the V850ES/FG3 device. Only 2 kByte of memory are allocated by the monitor program.

Device	Address range	Function
V850ES/FG3 (µPD70F3377)	0x0007F800 - 0x0007FFFF	Reserved for monitor program

Moreover, the monitor reserves 10 bytes of the global stack area by halting the user program, caused by a forcible break (debugger stop command) or a software breakpoint.

12.1.5 Clock operation

After releasing a reset, the monitor program sets the operation clock of the CPU to the maximum speed of 32 MHz. The monitor program switches also to the maximum CPU speed of 32 MHz when releasing a forcible break (debugger stop command) or when the user program execution is stopped caused by a software breakpoint. After the user program execution is restarted (debugger go command) the monitor restores the previous CPU operation clock setting.

Note: Do not change the frequency of the external oscillator connected to the X1 and X2 pins. The baud rate calculation for UARTD0 is based on a 4 MHz input frequency, otherwise no communication to the *V850ES/Fx3 – CAN it!* starterkit can be established.

12.1.6 Other limitations

The watchdog timer can not be used. Please be sure to set the option bytes of the V850ES/FG3 device accordingly to allow the watchdog timer disable.

The forcible break (debugger stop command) can not be used when the global interrupts were disabled by the user program (DI instruction).

12.2 IAR sample session

When everything is set up correctly the IAR Embedded Workbench can be started. To do so, start the Embedded Workbench from Windows "Start" menu > "Programs" > folder "IAR Systems" > "IAR Embedded Workbench Kickstart for V850". The following screen appears:

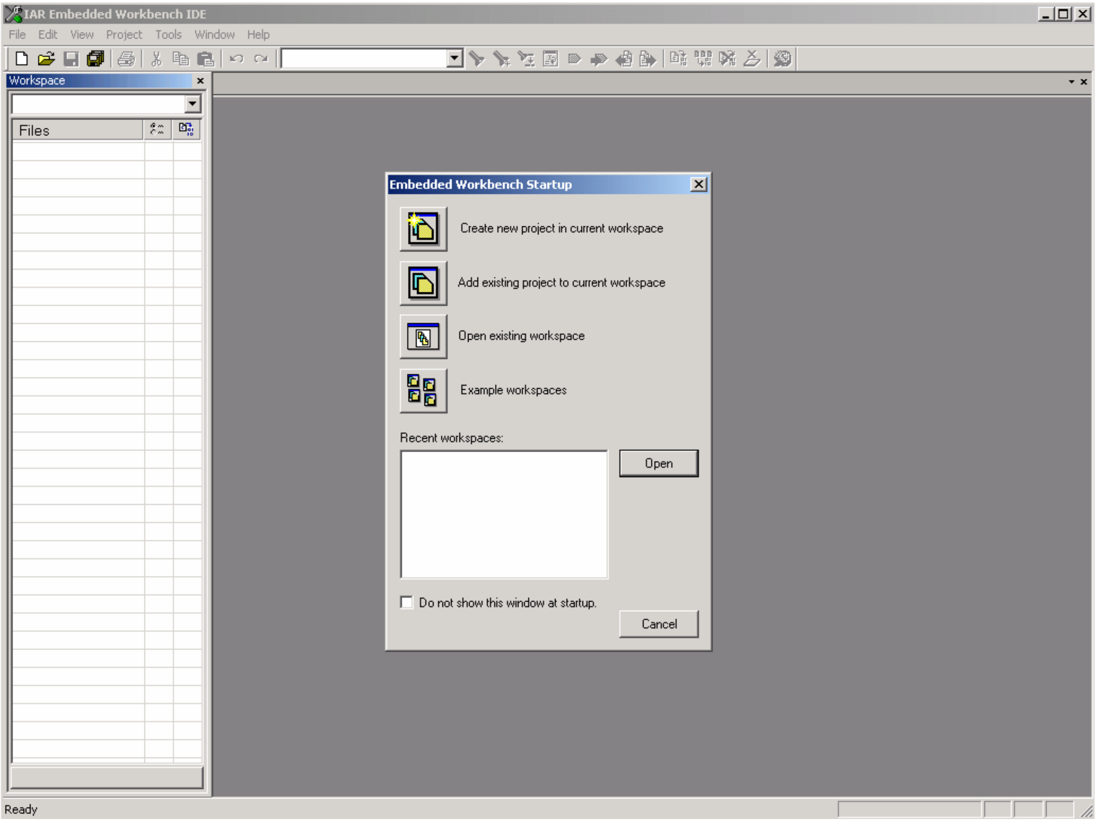


Figure 62: IAR Embedded Workbench

Now select the option "Open exiting workspace" from the "File" menu and locate the sample project. Open the file "V850ESFX3_CANit.eww". This is the workspace file that contains general information about the demonstration projects and settings.

After the demo workspace has been opened the projects contained in the workspace are displayed. Now click on the little "+" sign next to the "ADC_demo" project to show files that were part of the project. The screen should now look similar to this:

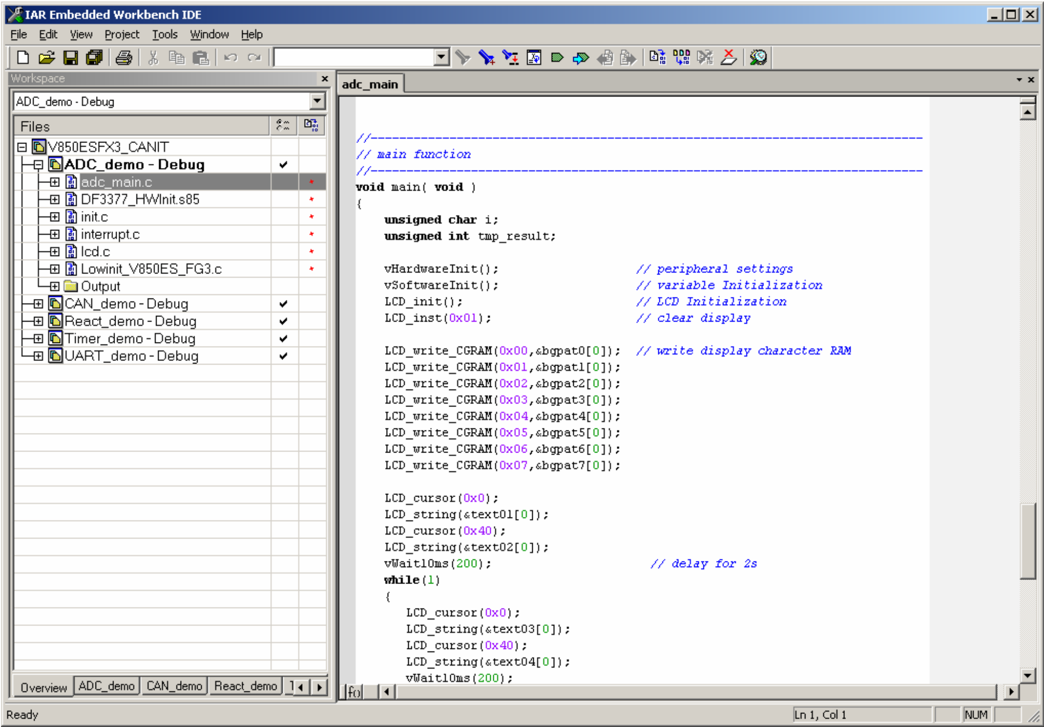


Figure 63: IAR project workspace

As a next step check some settings of the IAR Embedded Workbench that have to be made for correct operation and usage of the On-Board debug function of the *V850ES/Fx3 – CAN it!* board. First highlight the upper folder called "ADC_demo – Debug" in the workspace window. Then select "Project" > "Options" from the pull-down menus. Next select the category "Debugger". Make sure that the driver is set to "TK-V850" in order to use the On-Board debug function of the *V850ES/Fx3 – CAN it!* board. The device description file must be set to "io70f3377.ddf" according to the V850ES/FG3 device.

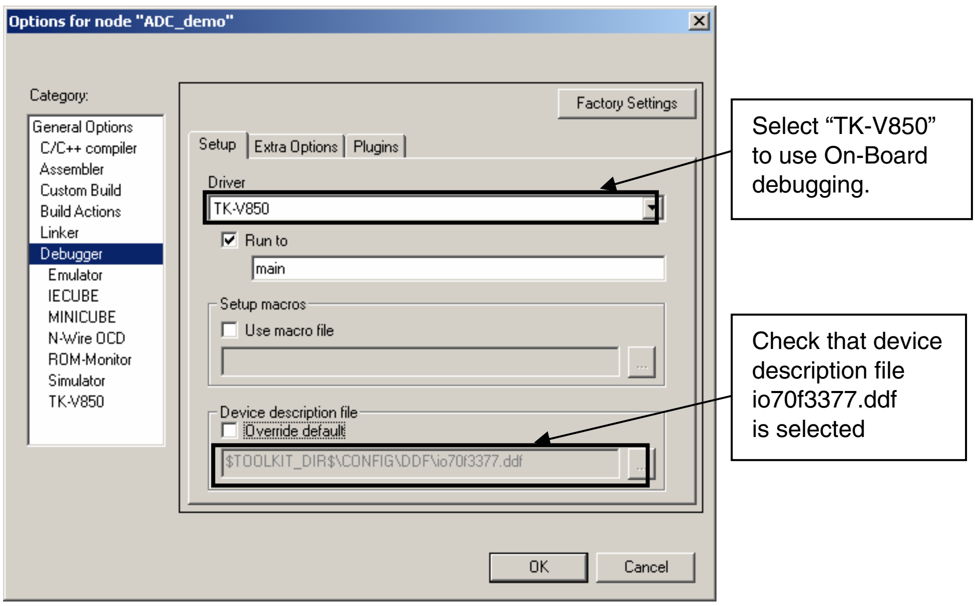


Figure 64: IAR debugger options 1/2

Before using the On-Board debug function it is necessary to set the corresponding USB serial COM port of the host computer. To set the COM port, please select the category "TK-V850" and choose the corresponding serial port.

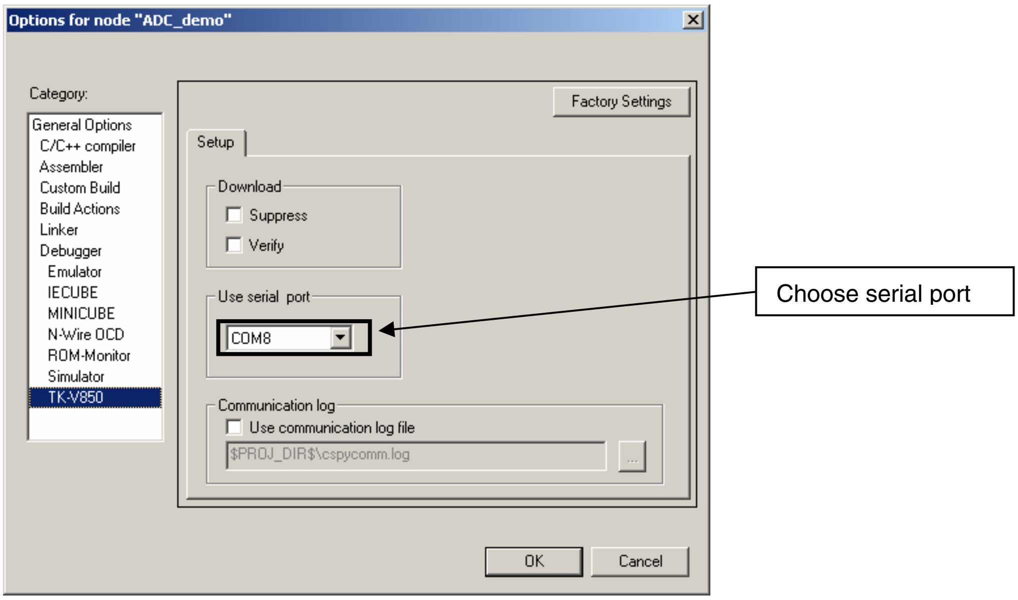


Figure 65: IAR debugger options 2/2

Next the correct linker settings of the demo project will be checked. This can be done in the "Linker" category as shown below. Select the "Config" tab and check that the linker command file "lnk70f3377.xcl" is selected. This file is used by the linker and contains information on where to place the different sections of code and data that may be used within the demo project:

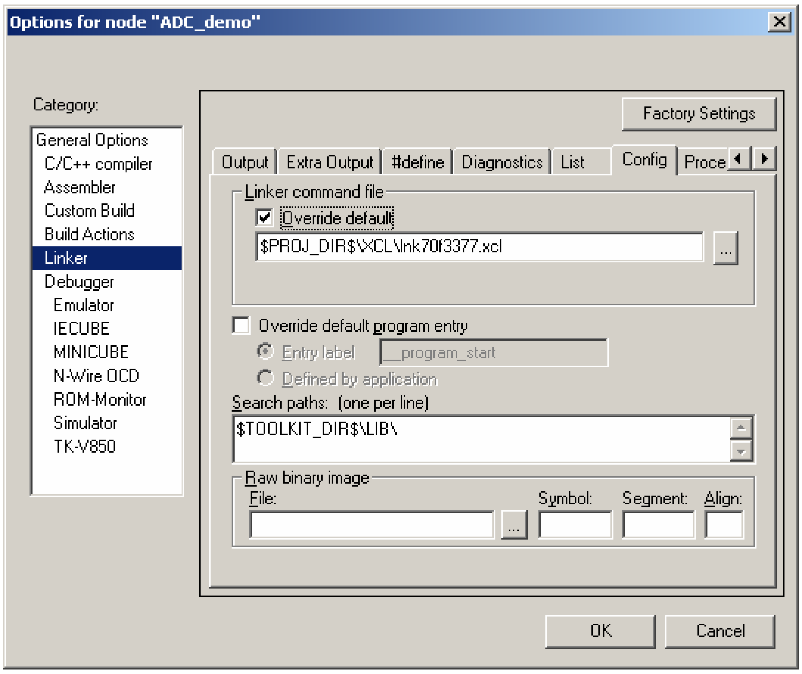


Figure 66: IAR Linker options

Now after everything has been setup correctly it's time to compile and link the demonstration project. Close the Options menu and select "Rebuild All" from the "Project" menu. If the project is compiled and linked without errors or warnings it can now be downloaded to the *V850ES/Fx3 – CAN it!* board and debugged.

To start the IAR C-SPY debugger select the option "Debug" from the "Project" menu or press the () "Debugger" button. In the next step the TK-V850 Emulator has to be configured before downloading a new application. Press the OK button to enter the hardware setup menu. Set the configuration as show in the figure below and start the download by pressing the OK button.

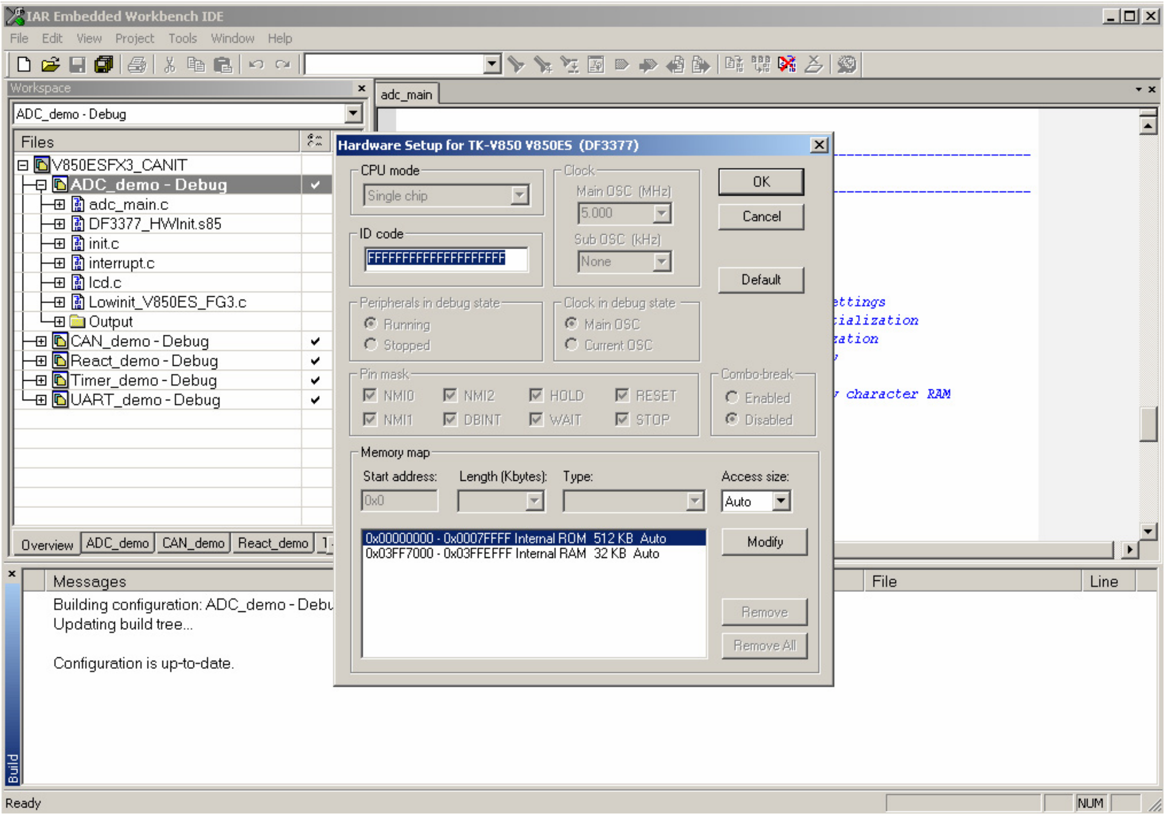


Figure 67: TK-V850 hardware setup menu

Now the debugger is started and the demo project is downloaded to the *V850ES/Fx3 – CAN it!* board. In other words, the FLASH memory of the V850ES/FG3 device is reprogrammed with the user application. The progress of downloading is indicated by blue dots in the TK-V850 Emulator window.

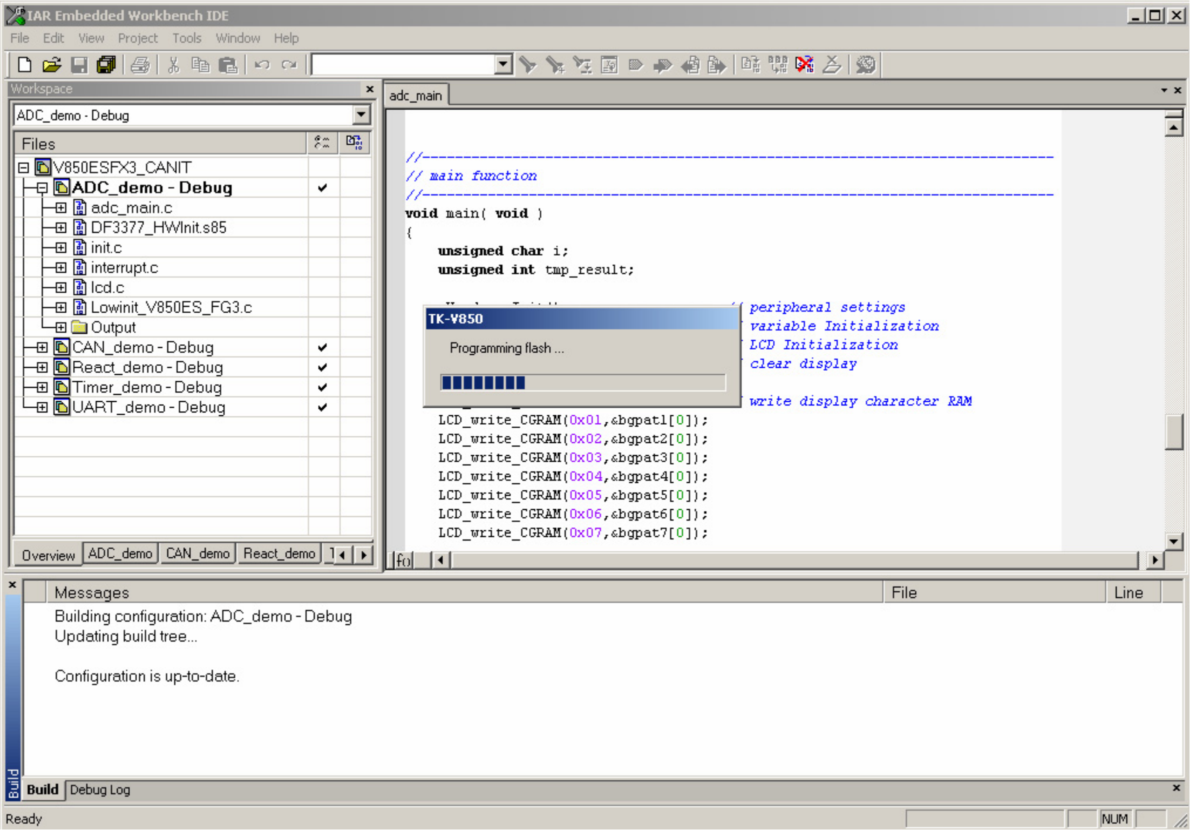


Figure 68: IAR project download

After the download was completed all debug features of IAR C-SPY debugger are available, i.e. Single Stepping (Step Over/-In/-Out), Go, Stop, Breakpoints, Register / Memory view etc.

To get more details on the debugger configuration and capabilities please refer to the “V850 IAR Embedded Workbench IDE User Guide” of the IAR installation.

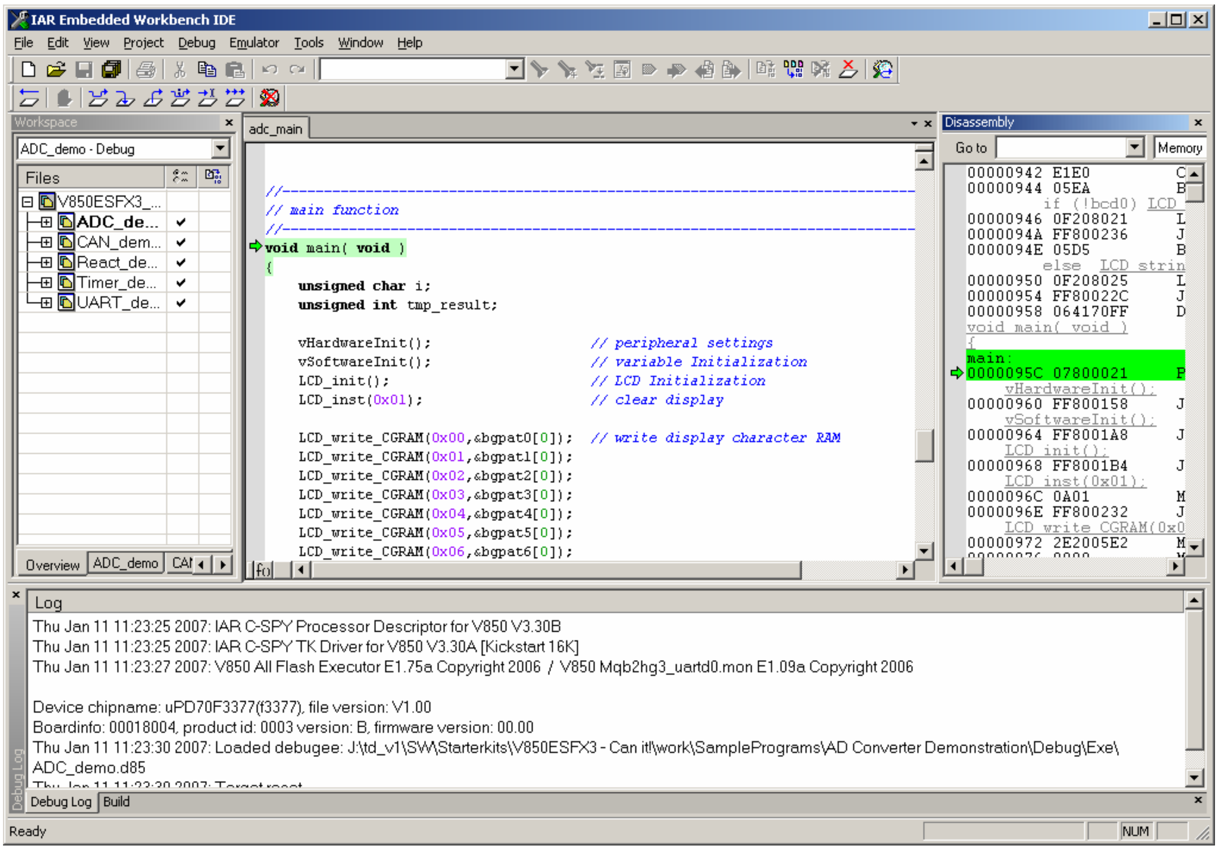


Figure 69: IAR C-SPY debugger

13. Sample programs

13.1 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 tool. The workspace file “**V850ESFX3_CANit.eww**” is located on top of the sample program directories. All sample programs use the same directory structure:

AD Converter Demonstration	V850ES/FG3 project and output files
Debug	debug output files for IAR C-SPY debugger
inc	C header files
Release	release output files, i.e. Intel HEX file
settings	configuration files, IAR Embedded Workbench
source	C source files
xcl	Linker control file
ADC_demo.dep	dependency information file, IAR Embedded Workbench
ADC_demo.ewd	project setting file, IAR C-SPY debugger
ADC_demo.ewp	project file, IAR Embedded Workbench
CAN Demonstration	V850ES/FG3 project and output files
Reaction Time Measurement	V850ES/FG3 project and output files
Timer Demonstration	V850ES/FG3 project and output files
UART Demonstration	V850ES/FG3 project and output files
V850ESFX3_CANit.eww	workspace file, IAR Embedded Workbench V850

Table 22: Example directory structure

The main directory contains only the project files for the IAR Systems Embedded Workbench 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 file of the V850ES/FG3 device. Each sample project uses two targets. One target is the “Debug” (directory `/Debug`) that holds all information for debugging purpose and the other one the “Release” target (directory `/Release`) contains the programmable file, i.e. the Intel HEX file, for programming the V850ES/FG3 internal FLASH memory.

All output files of the development tools for the corresponding target are generated in the directories `/Debug` and `/Release`.

For details of using the IAR Embedded Workbench and the IAR C-SPY debugger please refer to the “V850 IAR Embedded Workbench IDE User Guide”.

13.2 ADC demo

This sample program realizes a simple voltage meter. By using the integrated ADC, the voltage supplied to ADC on input channel ANI13, port P713 of the V850ES/FG3 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
TimerM	Character LC display
A/D converter	Potentiometer R14
	Button SW2
	Button SW3
	LED's D1- D4

13.3 CAN demo

This sample program simulates a simple CAN network consisting of two CAN nodes. By using the integrated ADC, the voltage supplied to the ADC input channel ANI13, port P713 of the V850ES/FG3 device is measured. The input voltage is adjusted by potentiometer R14. The measured voltage is transferred via CAN channel 0 to CAN channel 1 each 500ms. The transmit and receive status is shown on the LC display. Please close connectors CN3 and CN4 two connect both CAN transceivers and to allow communication. In case of an error frame or missing acknowledgement a fast recovery of the CAN channel is done. The communication can be restarted by pressing button SW3.

Used Internal Peripherals	Used External Parts
TimerM	Character LC display
A/D converter	Potentiometer R14
CAN0 controller	Button SW2
CAN1 controller	Button SW3
	LED's D1- D4
	CAN transceiver IC2
	CAN transceiver IC3

13.4 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 5.45 seconds. Then the measurement starts by incrementing a reaction counter every 10ms. 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
TimerM	Character LC display
TimerTAA0	Button SW2
	Button SW3
	LED's D1- D4

13.5 Timer demo

This sample program demonstrates a real time clock. After the program is started the TimerTAA0 is initialized to generate a clock reference, based on the 8 MHz main-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
TimerM	Character LC display
TimerTAA0	Button SW2
	Button SW3
	LED's D1- D4

13.6 UART demo

This sample program realizes a temperature meter with serial communication channel. The sample program does a cyclic measurement of the input voltage of ANI15 analogue input, equal to port P715 of V850ES/FG3 device, connected to the temperature sensor KTY13-5. The temperature is calculated and the result is transferred via UARTD2 to a terminal program running on the host machine. The data transfer speed is set to 9600 bps per default. Additionally the temperature is displayed on the LCD. Before the temperature measurement is started the calibration of the temperature sensor has to be done, by adjusting the temperature offset via button SW2 and SW3.

Used Internal Peripherals	Used External Parts
TimerM	Character LC display
TimerTAA0	Temperature sensor KTY13-5
A/D converter	Button SW2
UARTD2	Button SW3
	LED's D1- D4

Please note, by using the On-Board debug mode (TK-V850 debugging) serial communication via UARTD2 is not possible because the USB/UART communication channel is used for debugging purpose. To connect UARTD2 to the FTDI USB/UART chip please set switch SW4/S3 to ON.

14. USB interface cable (Mini-B type)

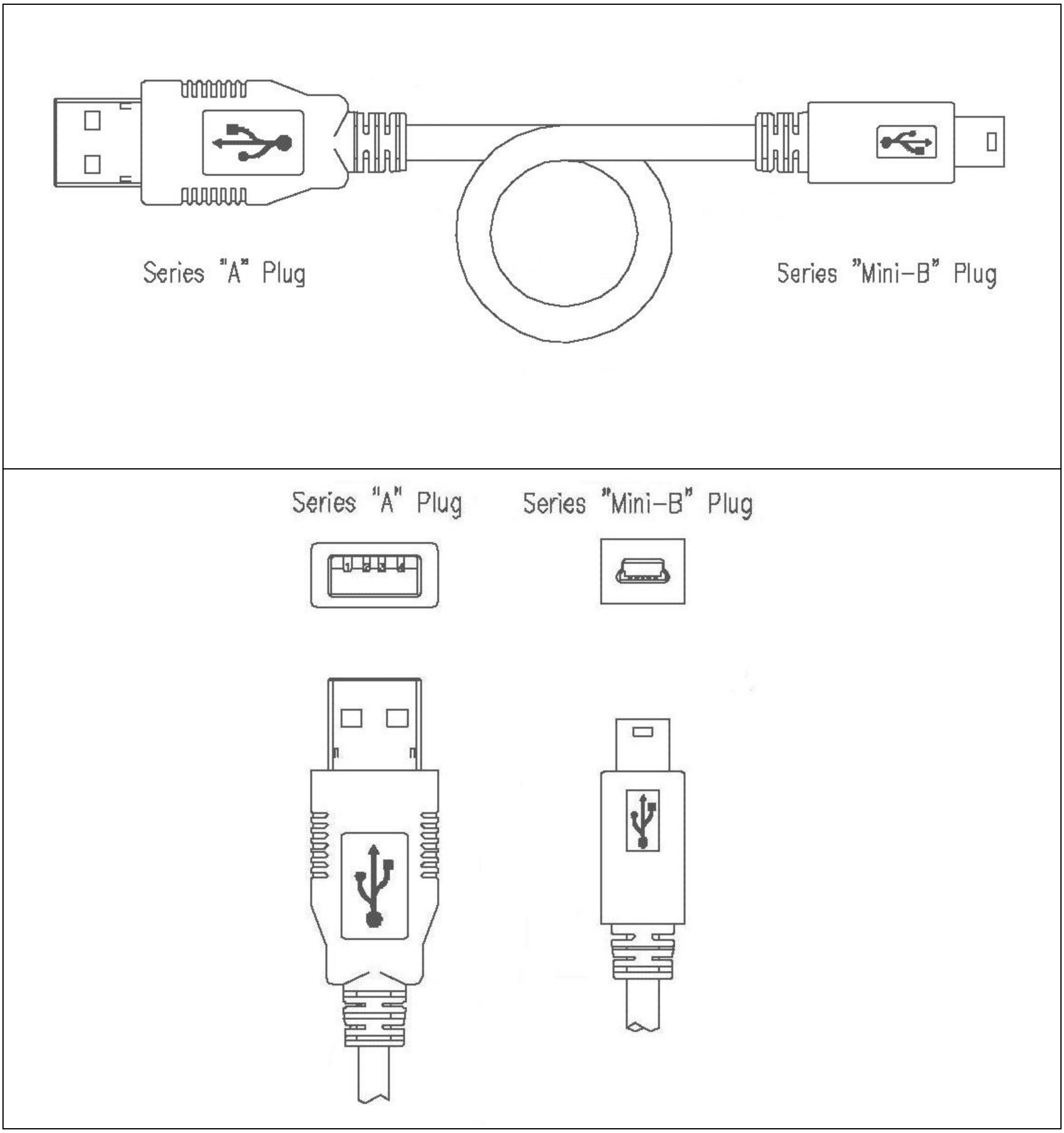


Figure 70: USB interface cable (Mini-B type)

15. Schematics

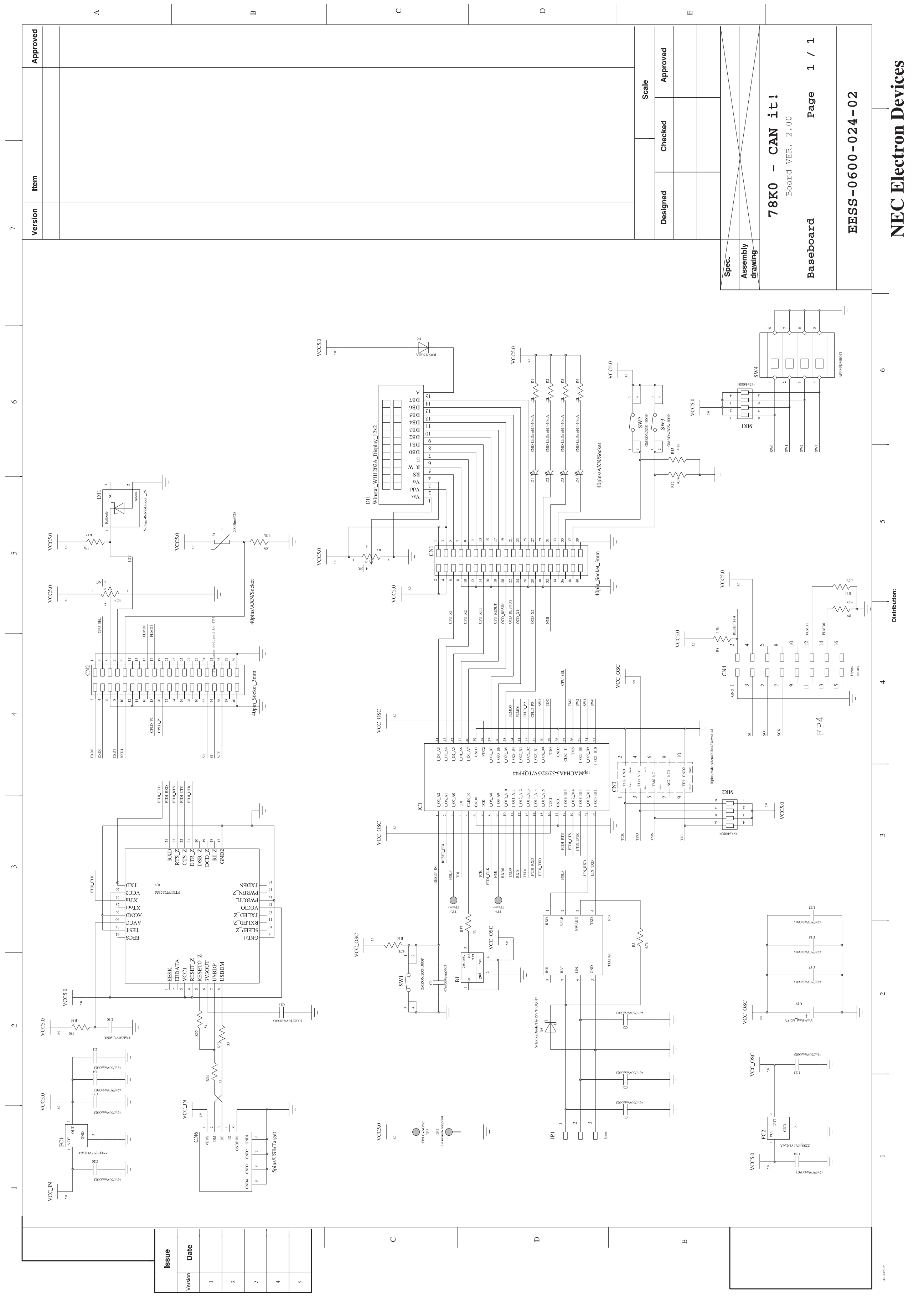


Figure 71: *V850ES/Fx3 – CAN it!* baseboard schematics

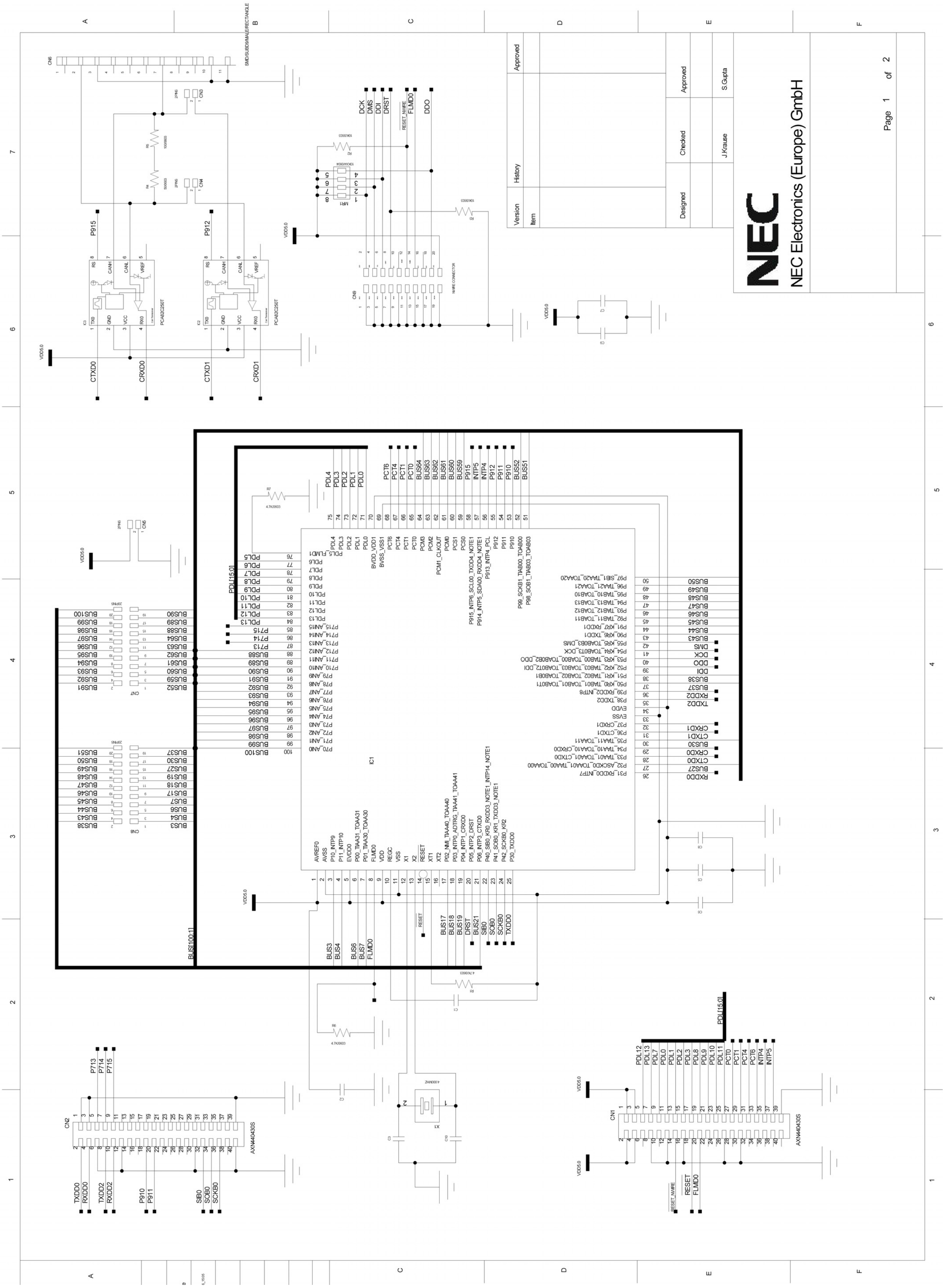


Figure 72: ***V850ES/Fx3 – CAN it!*** **CPU module schematics**

[MEMO]