User's Manual TK-78K0/KE2C

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CAUTION

·Do not give any physical damage to this equipment such as dropping

•Do not superimpose voltage to this equipment.

- Do not use this equipment with the temperature below 0° C or over 40° C.
- •Make sure the USB cables are properly connected.
- •Do not bend or stretch the USB cables.
- •Keep this equipment away from water.
- •Take extra care to electric shock.
- 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.

Contents

CHAPTER 1 PREPARATION	7
1.1 Development Tools / Software	8
1.2 Installation of Development Tools	
1.2.1 Installation Package	
1.2.2 Installation of Development Tools	
1.3 Installation of USB Driver	15
1.3.1 Installation on Windows XP	
1.3.2 Installation on Windows 2000	19
1.3.3 Completion of USB Driver Installation	
1.4 Sample Programs	23
1.4.1 Preparation of Sample Programs	23
1.4.2 Overview of Sample Programs	
CHAPTER 2 EXPERIENCES	27
2.1 Start PM+	
2.2 What is PM+	
2.3 Load Workspace (project)	
2.4 Set Linker Options	
2.4.1 "Output1" Tab	
2.5 Set Compiler Options	
2.5.1 "Extend" Tab	
2.6 Create Load Module Files	
2.7 Check Debugger Settings	
2.8 Check Board Settings	41
2.9 Start Debugger (ID78K0-QB)	
2.10 Run Programs	45
2.11 Stop Programs	47
2.12 Close Debugger (ID78K0-QB)	
2.13 Quit PM+	
CHAPTER 3 HARDWARE SPECIFICATIONS	50
3.1 Layout of hardware functions	51
3.2 Hardware Functions	
3.2.1 SW3, SW4	
3.2.2 SW1,SW2	54
3.2.3 SW5 (RESET SW)	54
3.2.4 JP1	54
3.2.5 JP2	
3.2.6 LED1 (POWER)	54
3.2.7 U2(7seg LED)	55
3.2.8 FP1	55
3.2.9 CN1, CN2	55

3.3 Solder-short pad label	56
With using the solder-short pad to cut the circuit, users can customize the circuit	56
3.4 Operation by external power supply	57
CHAPTER 4 TROUBLESHOOTING	58
4.1 If you cannot find USB driver when you connect PC to the kit	58
4.2 Error when you start the debugger	58
4.2.1 "Can not communicate with Emulator" (F0100 or A0109)	59
4.2.2 "Incorrect ID Code." (Ff603)	60
4.2.3 "The on-chip debug function had been disabled in the device." (F0c79)	60
4.2.4 "Disabling the on-chip debug function is prohibited." (F0c33)	60
CHAPTER 5 OTHER INFORMATION	61
5.1 Create a new workspace	62
5.2 Register additional source file	68
5.3 Debugger tips	70
5.3.1 Change display of buttons	70
5.3.2 Display source list and function list	70
5.3.3 Set/delete breakpoints	71
5.3.4 Display global variables	72
5.3.5 Display global variables while programs are running	73
5.3.6 Display local variables	75
5.3.7 Display memory and SFR contents	75
5.4 Erase microcontroller built-in flash memory	76
5.5 Circuit diagram	80

Introduction

TK-78K0/KE2C is the evaluation kit for development using "78K0/Kx2", NEC Electronics 8bit all flash microcontroller.

The user only needs to install the development tools and USB driver, and connect the host machine with the target board to start the code development, build, monitoring the output, and debugging code. (This demonstration kit uses the on-chip debug feature from the microcontroller itself, without emulator connection)

PM+ - SAMPLE_KF2A.prw [OutPut Build To D 📽 🖬 | 🚳 🕰 | 🖇 🗠 🖄 🦄 • • • + -8 🚊 🖇 SAMPLE_KF2A · SAMPLE_KF2A 💽 Debug Build - - × O error(s) and O warning(ectronics Tools\CC78K0\W4.00\ D error(s) and O warning(SAMPLE_KF2A : 1 Project(s) (s) and 0 warning(s s Tools\CC78KO\W4.00\b 0 warning(s 8K0\W4.00\1 0 warning(s 001s\RA78K0\W4.01\1 and 0 warning(s) Tools\RA78K0\W4.01\} Too1s\RA78K0\W4.01\1 0 error(s) and arning(s) : 0 [EOF] otal error(s) : 0 Total

Configuration for Debugging

Overview This manual consists of the following contents.

Read chapter 1 and 2 first for installing the development tools and using the sample programs.

Read chapter 3-5 for customizing the sample programs and the hardware.

- Chapter 1: Preparations Install the development tools Chapter 2: Experiences Experience the basic operations of integrated development environment (PM+) and integrated debugger (ID78K0-QB) with using sample programs. Chapter 3: Hardware Specifications Explain the hardware of TK-78K0/KE2C Chapter 4: Troubleshooting Describe how to solve troubles you may face, such as errors when starting the integrated debugger (ID78K0-QB) Chapter 5: Other Information Introduce other information, such as how to create a new workspace (project) on integrated development environment (PM+), how to register additional source file, and some useful tips of the integrated debugger. The circuit diagrams of demonstration kit are included in this chapter.
- ReaderThis manual is intended for development engineers who wish to become familiar with the
development tools for the 78K0.It is assumed that the readers have been familiar with basics of microcontrollers, C and
Assembler languages, and the Windows[™] operating system.
- Purpose This manual is intended to give users an understanding of the features, hardware configurations, development tools for the 78K0.

CHAPTER 1 Preparation

This chapter describes following topics:

- Overview and installation of development tools
- Installation of development tools
- Overview and preparation of sample programs

Users can experience the development flow such as coding, build, debugging, and test, by using the development tools bundled with TK-78K0/KE2C.

1.1 Development Tools / Software

Device file DF780765 V2.21 A device file contains device specific information. So, users need a device file to use the development tools.

Integrated Development Environment (IDE) PM+ V6.30
 The IDE works on Windows operation system.
 Users can develop a system efficiently by using the editor with idea processor function, compiler, and debugger.

C Compiler CC78K0 W4.00 (code size limited version) C compiler for the 78K0 microcontrollers. The object code size is limited to 32 Kbyte. This compiles C code for 78K0 and ANSI-C code program into assembler code. This produces object code and linker.

If you access the extended function register with CC78K0 W4.00, then configure below.

```
Example ) Define the "EFR".
#define RMGPLS (*((volatile unsigned char *)0xfa44))
void func(){
RMGPLS = 0x12;
}
```

Assembler RA78K0 W4.01 (code size limited version)

Assembler for the 78K0 microcontrollers. The object code size is limited to 32 Kbyte. This convert the assembler code for 78K0 into object program. The object program will be used for debugger.

If you access the extended function register with RA78K0 V4.01, then configure below. EFRNM EQU 0F898H

C1 CSEG MOV A, #12H MOV !EFRNM, A END

78K0 Integrated Debugger ID78K0-QB V3.20

This is the tool for debugging the object program generated by C compiler and assembler. The debugger enables to do C source level debugging. With the debugger, you can debug the code easily and efficiently by referring and changing variables, using step-in debuging function, and so on.

•WriteEZ5

This is the tool to write HEX file on microcontroller built-in memory without using the debugger (ID78K0-QB).

1.2 Installation of Development Tools

1.2.1 Installation Package

The attached CD-ROM includes the development tools and documentations. Users can use the installer to install those development tools and documentations.

1.2.2 Installation of Development Tools

 Please insert the CD-ROM in the drive. The installer will show up automatically. If it does not start automatically, please initiate it by double clicking the SETUP.EXE.

🛃 NEC Electronics Microcomputer Development Tools 🔀				
Welcome to the NEC Electronics Microcomputer development tools setup program.				
	Before you execute this installer, please exit all windows programs.			
	TK-78K0/KE2C_T1.00_[June 7, 2010] Copyright (C) NEC Electronics Corporation 2010			
	Readme First			
¢	Install			
	Documents			
	Sample Program			
	Link to NEC Electronics Microcomputer			
	Exit			

2 Click Install... button.

3 "Tool Installer" dialog box is opened.

Select products that you need to install.

(as default, all the products that you need to use the TK-78K0/KE2C are selected.)

"Explain" area displays an explanation of the selected product.

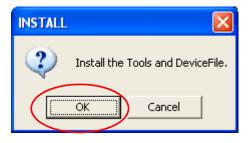
To change the installation destination, click Browse…

When all the settings are completed, click Install... .

 * In this document, it is assumed that users install the programs under "NEC Electronics Tools" directory (default installation directory). Users can find the tools by selecting "Start Menu" -> "Programs" -> "NEC Electronics Tools".

🛃 Tool Installer			×
☐ DeviceFile Install DeviceFile: DF780765 V1.00 78K0/Kx2-C	Search.		Install
Tool Install:			
Product	Size	~	Exit
 ☑ RA78K0 W4.01 ☑ RA78K0 V4.01 Documents 	7,860KB 14,628KB		
PM+ V6.30	17,460KB		
PM+ V6.30 Documents	12,636KB		
CC78K0 W4.00	19,000KB		
CC78K0 V4.00 Documents	14,000KB		
 ☑ BS78K0 V2.00 ☑ BS78K0 V2.00 Documents 	5,100KB 1,824KB		
Explain:			
		Drive	C:
		Avail	able Space:
	~		30,526,508KB
Destination:		Requ	ired Space:
C:\Program Files\NEC Electronics Tools	Browse		133,990KB

④ Click OK when "Install" comfirmation dialog box is opened.



TK-78K0/KE2C User's Manual

(5) Read "software license agreement" and click Yes for continuing the installation. To stop the installation, click No .

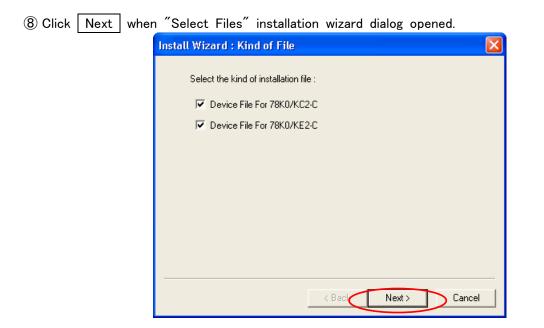
InstallShield Wizard			
License Agreement Please read the following license agreement carefully.			
Press the PAGE DOWN key to see the rest of the agreement.			
USER LICENSE AGREEMENT			
This User License Agreement ("ULA") is a legal agreement between you (either a natural person or an entity) and NEC Electronics Corporation ("NEC") for the SOFTWARE PRODUCT. As used herein, "SOFTWARE PRODUCT" means the NEC's computer software products provided with this ULA, which includes computer software and may include associated media, printed			
Do you accept all the terms of the preceding License Agreement? If you choose No, the setup will close. To install RA78K0 W4.01, you must accept this agreement.			
InstallShield			

6 Enter the product ID, and click Next .

* The product ID is available on the other sheet.

InstallShield Wizard	×
Please enter the product ID of the product.	
Enter Product ID.	
Product ID is written on the case or in the accompanying documents.	
Product ID	
InstallShield <u>Rext Cancel</u>	

O It starts copying the files.



(9) When the installation is completed, the following dialog opens. Click OK .

INSTALL	
i	Installation finished.
	ок

(1) "NEC Electronics Starter Kit Virtual UART" USB driver must be installed on PC before you connect to TK-78K0/KE2C.

Install the USB driver by referring "1.3 Installation of USB Driver".

Notes on the installation authority

To install this tool in Windows 2000 or XP, the authority of an administrator is necessary. Therefore, please login as an administrator.

Notes on the install-directory

Please do not use 2-byte characters, such as umlaut in the directory name, where the product is to be installed.

Note on the version of Windows

If the language of the Windows is not English, a file transfer error during installation might be observed. In this case, please abort the installation in the language, and re-install it in an English version of Windows.

The identical problem may be observed, if a language other than English is specified as the system language in the "Regional Settings Properties" tab.

Limitation

Assembler RA78K0 and C compiler CC78K0 limit the object size to 32 Kbyte.

1.3 Installation of USB Driver

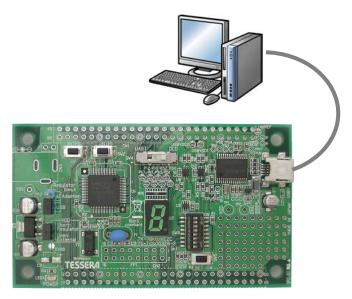
"NEC Electronics Starter Kit Virtual UART" USB driver must be installed on PC before you start using the TK-78K0/KE2C.

Please, follow the instruction below to install the driver.

"Starter Kit USB Driver" must be installed on the PC. If not, please refer to "1.2 Installation of Development Tools" to install the driver first.

CAUTION:

Do not use a USB hub for connecting TK-78K0/KE2C.



Depending on the version of Windows OS, the installation will be differed. Please check your Windows version, and follow the instructions

- Windows XP -> "1.3.1 Installation on Windows XP"

- Windows 2000 -> "1.3.2 Installation on Windows 2000"

After the installation, go to "1.3.3 Completion of USB Driver Installation"

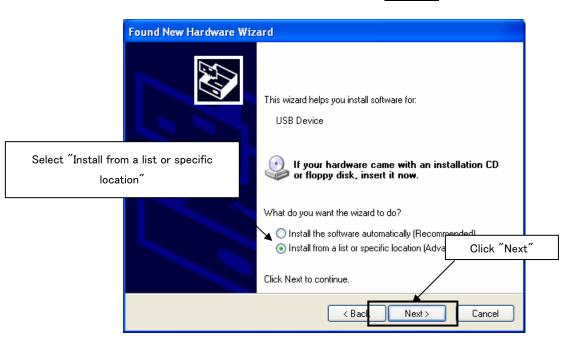
1.3.1 Installation on Windows XP

1. Once the TK-78K0/KE2C is connected with USB, the "Found New Hardware Wizard" will be started.

Select "No, not this time" and click Next > 1.

Found New Hardware Wize	ard	
	Welcome to the Found New Hardware Wizard Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission). Read our privacy policy	
Select "No, not this time"	Can Windows connect to Windows Update to search for software?	
	┘ ○ Yes, this time only	
	Yes, now and every time I connect a device	
	No, not this time	
		lick "Next"
	Click Next to continue.	
	< Back Next > Cancel	

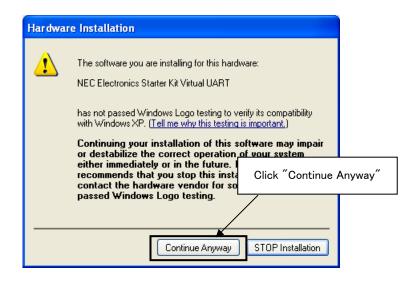
2. Select "Install from a list or specific location" and click Next > .



3. Select "Search for the best driver in these locations.", check "Include this location in the search:", and then click "Browse..." to select the driver directory path. The path should be "C:¥Program Files¥NEC Electronics Tools¥TK-driver" as default installation. If the installation directory is not default, then select "TK-driver" under the installation directory. Click Next > .

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 defa paths and removable media. The best driver found will Select the driver directo	ry
Search removable media (floppy, CD-ROM)	
Include this location in the search:	
C:\Program Files\NEC Electronics Tools\TK-driver V Browse	
O Don't search. I will choose the driver to install.	
Choose this option to select the device driver from a list. Windows does the driver you choose will be the best match for your hardware.	ext″
< Back Next > Cancel	

4. If the following dialog is opened, click Continue Anyway



6. The installation of "NEC Electronics Starter Kit Virtual UART" driver is completed. Click Finish .



7. Go to "1.3.3 Completion of USB Driver Installation".

1.3.2 Installation on Windows 2000

1. Once the TK-78K0/KE2C is connected with USB, the "Found New Hardware Wizard" will be started.

Select "No, not this time" and click Next >

Found New Hardware Wizard			
	Welcome to the Found New Hardware Wizard This wizard helps you install a device driver for a hardware device.		
		Click "Next"	
	To continue, click Next.		
	< Back	Next > Cancel	

 Select "Search for a suitable driver for my device". Click Next > .

Found New Hardware Wizard			
Install Hardware Device Drivers A device driver is a software program that enables a hardware device to work with an operating system.			
This wizard will complete the installation for this device:			
A device driver is a software needs driver files for your new installation click Next.			
What do you want the wizard to do?			
 Search for a suitable driver for my device (recommended) Click "Next" Display a list of the known drivers for this device so that I can choot 			
driver			

 Select "Specify a location". Click Next > .

	Found New Hardware Wizard			
	Locate Driver Files Where do you want Windows to search for driver files?			
	Search for driver files for the following hardware device:			
Select "Specify a location" for suitable drivers in its driver database on your computer and in click Next. If you are searching on a floppy disk or CD-ROM drive, or CD before clicking Next.				
	Optional search locations: Floppy disk drives CD-ROM drives	Click "Next"		
	 Specify a location Microsoft Windows Update 			
	< Back Next :	Cancel		

4. Select the driver directory path. The path should be "C:¥Program Files¥NEC Electronics Tools¥TK-driver" as default installation.

If the installation directory is not default, then select "TK-driver" under the installation directory. Click OK .

		Click "OK"
Found Net	w Hardware Wizard	
	Insert the manufacturer's installation disk into the drive selected, and then click OK.	• ОК
	Select the driver directory	Cancel
	Conversion for burge's files form	
	Copy manufacturer's files from. C:\Program Files\NEC Electronics Tools\TK-driver 💌	Browse

5. Click Next > .

Found New Hardware Wizard
Driver Files Search Results The wizard has finished searching for driver files for your hardware device.
The wizard found a driver for the following device:
Windows found a driver for this device. To install the driver Windows found, click Next.
c:\program files\nec electronics tools\tk-driver\mqb2sall.inf
Click "Next"
< Back Next > Cancel

6. The installation of "NEC Electronics Starter Kit Virtual UART" driver is completed. Click Finish .

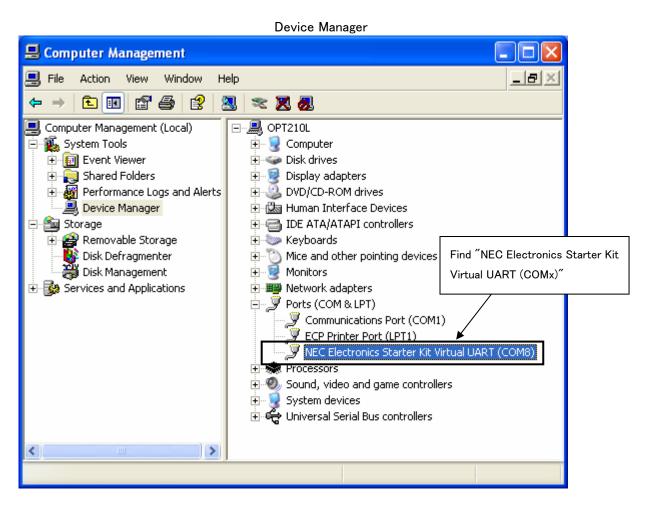
Found New Hardware Wizard						
	Completing the Found New Hardware Wizard Image: Margin of the Software Wizard Image: Margin of the Software Software For this device. Windows has finished installing the software for this device.					
	Click "Finish" To close this wizard, click Finish.					
	< Back Finish Cancel					

7. Go to "1.3.3 Completion of USB Driver Installation".

1.3.3 Completion of USB Driver Installation

Confirm the USB driver is installed on PC.

Start "Device Manager", and find "NEC Electronics Starter Kit Virtual UART" (without "?" mark) under the "Ports (COM & LPT)".



The screen above shows that the COM port number is "COM8". If ID78K0–QB is not in use, you can use this port number for connecting TK–78K0/KE2C.

When you change the USB port connection, the COM port number will be changed as well.

Select this COM port number when you use WriteEZ5.

CAUTION

• Do not do "Hardware Modification Scan" when you communicate with the target device.



This section explains the overview and preparation of sample programs.

1.4.1 Preparation of Sample Programs

(1) Insert the CD-ROM disk in the CD-ROM drive of your PC. The [NEC Electronics Microprocessor Development Tools Setup] screen automatically appears.(if this screen does not appear automatically, start setup.exe from Explorer. etc.)

Velcome to the NEC Electronics Microcomputer Development Tools Welcome to the NEC Electronics Microcomputer development tools setup program. Before you execute this installer, please exit all windows programs. TK-78K0/KE2C T1.00 [June 7, 2010] Copyright (C) NEC Electronics Corporation 2010						
	Readme First Install Documents Sample Program					
	Link to NEC Electronics Microcomputer Exit					
② Press the Sample Prog	ram button to start the WWW browser.					

🧭 Sample Programs - Windows Internet Explorer		
	🖌 🍝 🔁 Bing	P -
<u> Eile E</u> dit <u>V</u> iew F <u>a</u> vorites <u>T</u> ools <u>H</u> elp		
👷 Favorites 🏾 🏀 Sample Programs	🚺 🕈 🔊 🕆 🖃 🌞 🕈 Bage 🕶 😫	oafety + Tools + 🕢 + 🎽
Sample Programs		~
Welcome to TK-78K0/KE2C world. The purpose of sample programs is to experience TK-78I Sample programs consist of the following items.	K0/KE2C.	
 TK78K0 SAMPLE_KE2C SAMPLE_KE2C.prw : Sample prog guide. 	ram described in the TK-78K0/KE2C ev	valuation kit tutorial
Click the link of <u>TK-78K0/KE2C</u> sample program link a	ind install the sample programs.	
<u>TK-78K0/KE2C sample program</u> <u>TK-78K0/KE2C evaluation kit User's manual</u>		
Refer to the <u>User's manual</u> about usage.		×
Done	💡 My Computer	🐴 🔹 🔍 100% 🔹 💡

(3) Click the "TK-78K0/KE2C Sample Programs" link , the following download confimation window appears.

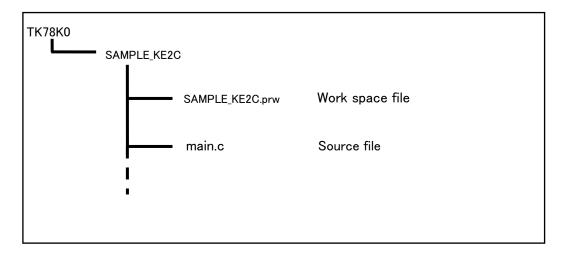
File Download - Security Warning
Do you want to run or save this file?
Name: TK78K0.EXE
Type: Application, 34.3KB From: D:\kyouyuu\TK-78K0_KE2C_T100\SAMPLE
Run Save Cancel
While files from the Internet can be useful, this file type can potentially harm your computer. If you do not trust the source, do not run or save this software. <u>What's the risk?</u>
Click the Save butten.

Save in: Local Disk (C:) dell Documents and Settings drvrtmp Program Files WINDOWS My Documents My Computer File name: IX78K0EXE Save as type: Application 	Save As							? 🛛
My Recent Documents Orymona Program Files WINDOWS WINDOWS WINDOWS File name: TX78K0EXE Save	Save in:	🗇 Local Disk (C	2)	~	6	1 🖻	•	
File name: TK78K0.EXE Save	Documents Desktop My Documents	Documents an	d Settings					
	S							\sim

- (5) After specifying the download destination folder, click the Save button.
- (6) The self-extraction sample program set (TK78K0.exe) is copied to the specified folder. The folder that the "TK78K0" folder is made when this file is executed, and the sample program is stored under the folder in addition is made.

1.4.2 Overview of Sample Programs

The sample programs consist of following directories.



CHAPTER 2 Experiences

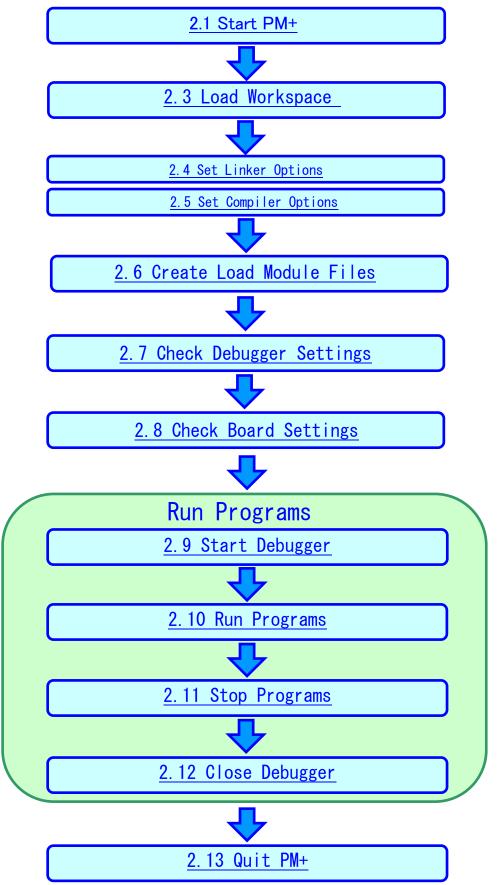
In this chapter, you will experience how to use the development tools with using the sample programs. The development tools are :

- Integrated Development Environment (IDE), PM+
- Integrated Debugger, ID78K0-QB

You will use the programs that you prepared in "1.4 Sample Programs", as the sample programs for TK-78K0/KE2C.

You will be able to understand how to use the development tools and the concept of project files which you need for producing application programs.

The overall steps are as follows:



2.1 Start PM+

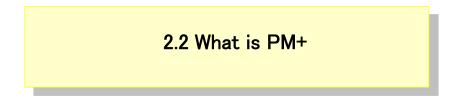
Let's start using the development tools.

First, start the PM+

Select "Windows Start Menu" -> "Program" -> "NEC Electronics Tools" -> "PM+ V6.30".

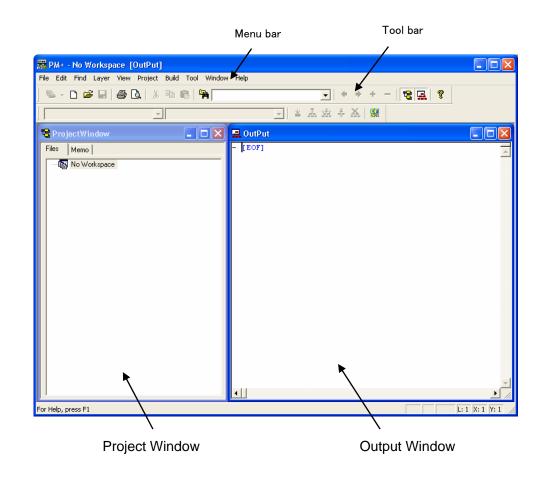
- 第 PM+ - No Workspace [OutPut]	
File Edit Find Layer View Project Build Tool Window Help	
🏝 - D 🛎 🖬 🖨 🖪 % 🖻 🖻 🎀	▼ + + + - 2 ⊡ 8
😤 ProjectWindow 📃 🗖 🗙 🔜 Out	
Files Memo CEC	OF] ▲
For Help, press F1	L: 1 X: 1 Y: 1

PM+ starts up



In PM+, application programs and environment setting are handled as a single project, and series of actions such as program creation using the editor, source management, build, and debugging are managed.

Also, one of more project files is managed together as a workspace.



Project window A window in which project names, source files, and include file are displayed using a tree structure.

Output window A window in which the build execution status is displayed.

For details regarding menu bars and tool bars, refer to "Help" menu in PM+. "Help" on menu bar , then "PM+ Help"

What is a project?

A project is the unit that is managed by PM+. A project refers to an application system and environment development based on PM+.

PM+ saves project information in a "project file".

What is a project file?

A project file contains project information that includes the source files, device name, tool options for compiling, editor, and debugger information.

The file name format is "xxxxx.prj".

Project files are created in the directory you specifies when you create a new workspace.

What is a project group?

A project group is a group comprised of a number of projects in an application system.

The target device of each project must be the same within a project group.

What is a workspace?

A workspace is the unit used to manage all the projects and project group required for one application system.

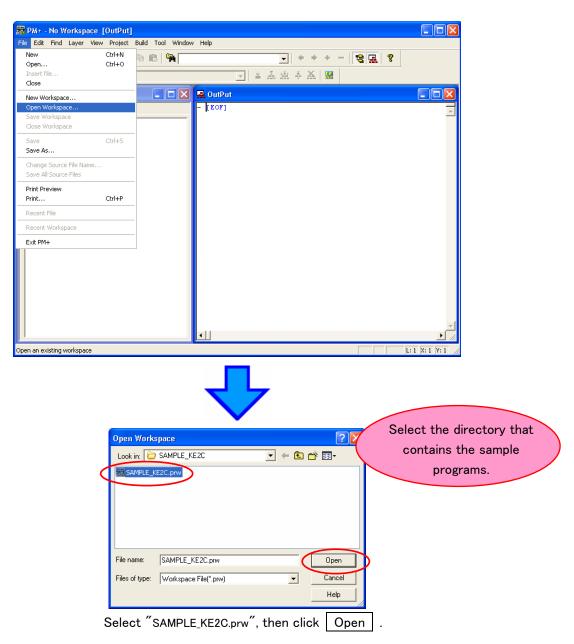
A workspace file contains one or more project files.

The file name format is "xxxxx.prw".

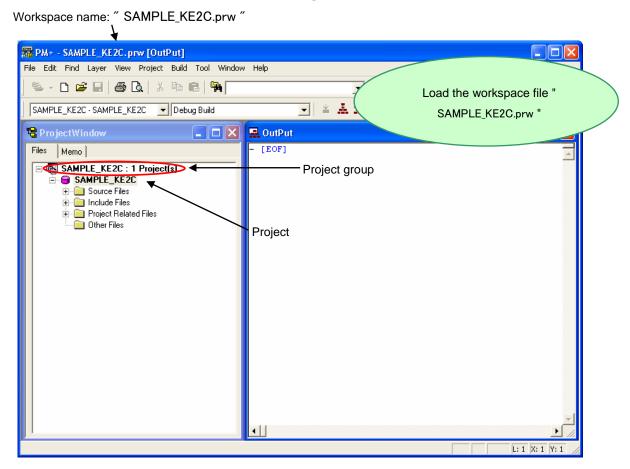
2.3 Load Workspace (project)

In this section, you will use the workspace that you created in "1.4 Sample Programs" For creating a new workspace, refer to "Chapter 5 Other Information". The workspace has information about the build environment for the sample programs.

Select "File" on menu bar and "Open Workspace...". Then, select "SAMPLE_KE2C.prw" under the directory "TK78K0¥SAMPLE_KE2C¥".







The workspace file "SAMPLE_KE2C.prw" contains one project called "SAMPLE_KE2C". You will use this project "SAMPLE_KE2C".

CAUTION:

Please ignore when you get a prompt saying "files could not be found". This may occurred when the installation directory is not a default.

2.4 Set Linker Options

The linker options have been set by the project file. However, some option settings will be covered in this section because the linker option settings are important for debugging. Following two settings are covered specifically.

- Outputs from debugging
- On-chip debug (Disable/Enable, security ID)

Select "Tools" on menu bar, then "Linker options....".

2.4.1 "Output1" Tab

Select "Output1" tab on "Linker Options" window, and see following settings.

Linker Options
Output1 Output2 Library Others
Cload Module File[-o]
Butput File Name:
Cutput Symbol Information[-g]
Create Error List File(-e)
Output File Name:
a.elk Browse
✓ On-Chip Debug[-go]
I SIZE: 512 bytes
Security ID[-gi]
ID: FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
Command Line Options:
-oa.lmf -go512 -gi0FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
OK Cancel Apply Help

- Load Module File settings

Check "Output Symbol Information".

This enables to do source level debugging (setting break points, monitoring variables in watch window, etc).

Also, you can specify the load module file name.

- On-Chip Debug Option Byte

Check "On-Chip Debug Option Byte". This setting enables the on-chip debugging function of the microcontroller.

These settings reserve the memory address area for the monitor program (the flash memory area that the debugger uses for on-chip debugging).

<Address area that reserved by on-chip debugging>

– 2H, 3H

- From 8FH to the byte set in "Size"

- Security ID

Check "Security ID", and enter the security ID which is a unique ID code (10 bytes) to authenticate when the debugger is launched.

The security ID is stored in the flash memory (85H-8EH), and checked if it is the same as the code entered in Linker options dialog when the debugger is launched.

The debugger will not be launched when the security ID is unmatched. By using this function, you can secure the programs from leaks.

If you do not need to set the security, it is recommended to set the security ID

"FFFFFFFFFFFFFFFF" as this is the initial code.

If you forget about the security ID (stored in the address of 85H-8EH) or if you set wrong on-chip debug option byte, you will not be able to use the debugger (ID78K0-QB).

In this case, you can erase 78K0 built-in flash memory with "WriteEZ5" to connect with ID78K0-QB. For details, refer to "5.4 Erase microcontroller built-in flash memory".

2.5 Set Compiler Options

The compiler options have been set by project file. However, because some compiler options are useful, following two settings are covered specifically in this section.

- Enable C++ comments

Select "Tools" on menu bar, then "Compiler options".

2.5.1 "Extend" Tab

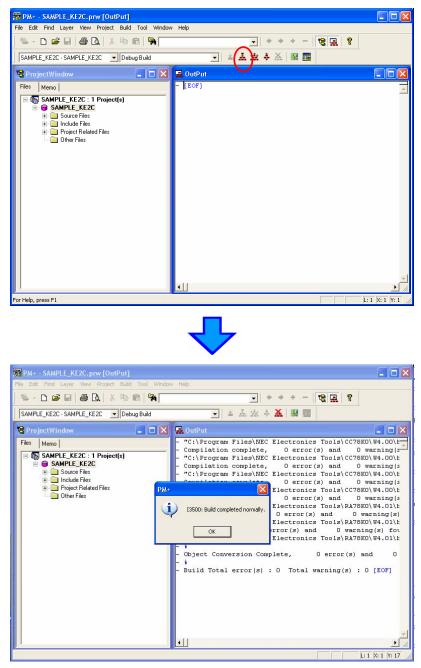
Select "Extend" tab, and check "Enable C++ Comment". This setting allow you to use the C++ comment using "//". It is useful feature when developing code.

Comp	iler Option	ns						×
Pre	processor Extend	Memory	Model	Data Assign Others		Optimize Si	Debug tartup Routin	Output
	- Change So	ource Regi	Ilation			– Kanji Code	e of Source-	
	🔲 Disable	e Extensior	s (ANSI St	andard Only)[za]	SJIS[-z	s]	
	🔲 Treat in	nt and shor	t as char[-;	zi]		C EUC[-z	e]	
	🔲 Treat lo	ong as int[-	zl]			C None[-	zn]	
<	🔽 Enable	C++ Comr	nent, Ignor	e from // Till E	nd of	Line[-zp]	>	
		ent Can Ne	st[-zc]					
	🔲 Not Ex	pand Argu	ment and F	eturn Value[-	zb]			
Com	imand Line O	ptions :						
-zp								×
			OK	C	ancel	Ap	ply	Help

2.6 Create Load Module Files

After developing the source code, you have to create load module files by compiling, assembling, and linking. This process is called build.

Click the build button 📥 , or select "Build" on menu bar, then "Build".



Build has been completed successfully.

What is build?

Build is a function that creates an executable file from source files in a project.PM+ automatically performs compiling, assembling, linking, and other processing actions.To reduce the time for the build, PM+ detects and compiles/assembles only the files that have been updated from the previous build process.

What is rebuild?

Build compiles and assembles only the source files that have been updated from the previous time, whereas rebuild compiles and assembles all the source files.

When setting, such as compiler options, have been changed, you must rebuild instead of build.

2.7 Check Debugger Settings

After the build, you should configure the debugger settings.

The debugger settings have been set by the project file as well. However, because those settings are important for debugging, some settings are covered in this section.

Select "Tools" on menu bar, then "Debugger Setting...".

🚟 PM+ - SAMPLE_KE2C.prw [OutPut]		
File Edit Find Layer View Project Build	Tool Window Help	
SAMPLE_KE2C - SAMPLE_KE2C	Compiler Options Structured Assembler Options Assembler Options Linker Options	▼ + + + - 19 豆 ? 基 並
ProjectWindow Files Memo	Diject Converter Options List Converter Options Startup <u>SK78K0</u>	iles\NEC Electronics Tools\CC78KO\W4.00\1
	Debugger Settings Register Ex-tool Start up Ex-tool	<pre>iomplete, 0 error(s) and 0 warning(z i)ps\NEC Electronics Tools\CC78K0\W4.00\k omplete, 0 error(s) and 0 warning(s iles\NEC Electronics Tools\CC78K0\W4.00\k iomplete, 0 error(s) and 0 warning(s</pre>
Can Project Related Files Other Files	File Compare Device File Installer	iles\NEC Electronics Tools\CC78KO\W4.OO\} omplete, O error(s) and O warning(s iles\NEC Electronics Tools\R178KO\W4.O1\}
	PM+ Settings Font Customize	<pre>lete, 0 error(s) and 0 warning(s) 'iles\NEC Electronics Tools\RA78K0\W4.01\; ', 0 error(s) and 0 warning(s) fou -;iles\NEC Electronics Tools\RA78K0\W4.01\;</pre>
	Record the Key Operations Play Back Save the Key Operations Load the Macro File	sion Complete, 0 error(s) and 0 rror(s) : 0 Total warning(s) : 0 [EOF]
	Play Back the Macro File Register the Macro Files Play Back the Register Macro	-
	I.	- -
Change debugger settings		L: 1 X: 1 Y: 17

Check if "ID78K0-QB V3.20 78K0 Integrated Debugger" is selected on "Debugger".

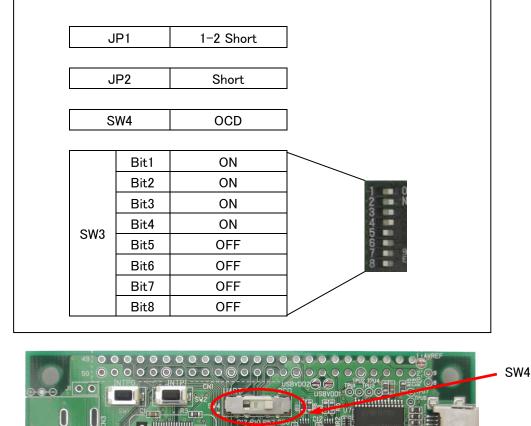
Debugger Settings
Select Debugger
Debugger: ID78K0-QB V3.20 78K0 Integrated Debugger
File Name: C:\Program Files\NEC Electronics Tools\ID78K0-QB\V3.20\
Option:
Debug Target
Debug Target File:
C:\TK78K0\SAMPLE_KE2C\a.Imf
🔽 Execute Symbol Reset after Download
✓ Execute CPU Reset after Download
Debug Options
Download the Debug Target Files in the same Project Group
Debug Target File List:
OK Cancel Help

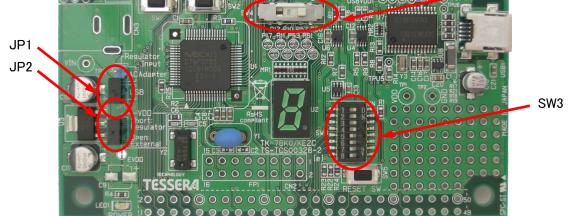
If you cannot select "ID78K0-QB V3.20 78K0 Integrated Debugger", select "Project" on menu bar, "Project settings" -> "Tool version settings" -> "Detailsetting" -> then select "ID78K0-QB".

2.8 Check Board Settings

Before connecting the PC and the TK-78K0/KE2C with USB, you should check the setting of JP1,2 ,SW3,4 on the board.

Set the JP1,2 ,SW3,4 of the TK-78K0/KE2C as follows.





After the switch settings are completed, connect the PC to USB1 on TK-78K0/KE2C with USB cable. If the "Found New Hardware Wizard" is started, install USB driver with referring "1.3 Installation of USB Driver".



Click the debug button 📰 , or select "Build" on menu bar, then "Debug".

If you do r	not see the debug but	ton, go to [″] 2.7 Cł	neck Debugger S	Settings" fo	r changing the settings.

The steps to start the debugger will be explained below.

<mark>₩ PM+ - SAMPLE_KE2C.prw [OutPut] File Edit Find Layer View Project Build Tool Window </mark>		
SAMPLE_KE2C · SAMPLE_KE2C 👤 Debug Build	□ ▲ ▲ ◆ ▲ ■	
🔁 ProjectWindow 📃 🗖 🗙	🖳 OutPut	
Files Memo SAMPLE_KE2C: 1 Project(s) Sample_KE2C Source Files Include Files Project Related Files Other Files	ID78K0-QB	is launched
For Help, press F1		

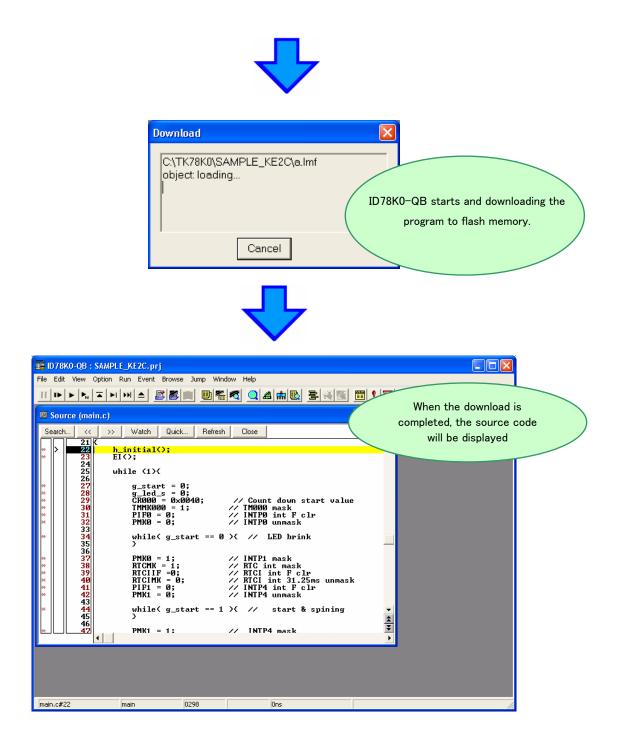


Configuration dialog opens. Set the settings shown below, and then click "OK". ID Code Enter "FFFFFFFFFFFFFFFFFFFFFF" (F x20)

Name: uPD 78F	_			Cancel
Internal ROM/RAM Internal ROM:	60×	- KD-t		Restore
		KBytes		Project
🔲 Use Bank 🗄	Size: 0	 KBytes 		About
Internal high-speed	RAM: 1024*	 Bytes 		Help
Internal Extend RAM	d: 2048*	Bytes		
Main Clock				
C Clock Board	C External C	System	4.00	▼ MHz
Sub Clock	0			
C Clock Board			I	▼ KHz
Target Device Con	nection		ode	
ļ				
Peripheral Break	Monitor Clock	C Permi		ail-safe Break—
	System			Detail
Non Break	C User	Not P	ermit	
Mask	RGET RESET		AL RESET	
Memory Mapping				
Memory Attribute:	Mapping A	ddress:		Add
Target	•	-		Delete

Click Yes when the confirmation dialog for downloading load module file is opened.

ID78KO-	QB 🛛 🔀
2	WF700: Do you want to download Load Module File?
	Yes No



NOTE:

Completion of the download does not mean running the programs. Therefore, it does not make anything happened. To run the demonstration, see "2.10 Run Programs".

2.10 Run Programs

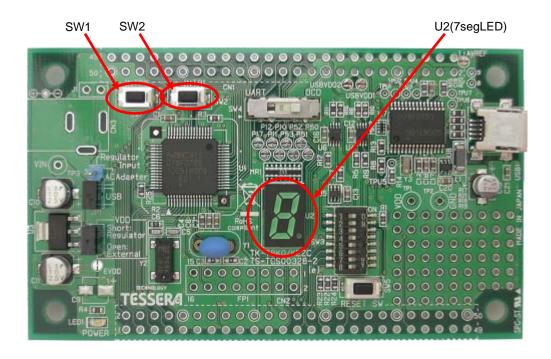
Now, you are ready to run the program.

Click the restart button **ID** , or select "Run" on menu bar, then "Restart".

The sample program runs.

	ition Run Event Br							
	(FI FR 🔺 😰				1 ! V * (5		
🔟 Source (main.	c)							
Search <<	>> Watch 0	Quick Refrest	Close					
* > 22	<pre>h_initial(); EI();</pre>				<u> </u>			
* 23 24 25	while (1)(
* 26 * 27 * 28		= 0;						
* 29 * 30	9_100_5 СR000 = Тммкой	- 0, 0x0040; = 1:	// Count dou // TMAAA mas	vn start value k				
* 31 * 32	g_start g_led_s CR000 = TMMK000 PIF0 = 0 PMK0 = 0	d; d;	// INTPO int // INTPO unma	øn start value k Fclr ask				
× 33 34 35			X // LED I	brink		-		
* 36	, РМКО = 1	ι;	// INTP1 masl	k		Rur	the samp	ole program
l ★ 39	PMKØ = 1 RTCMK = RTCIIF = RTCIMK = PIF1 = 0 PMK1 = 0	1; =0;	// RTC int ma	k ask F clr 31.25ms unmask F clr ask				
* 41	PIF1 = 0 PMK1 = 0	- 6,];];	// INTP4 int // INTP4 unma	F clr sk				
* 43	while(g	g_start == 1	}{ // star	rt & spining	-			
45 46 * 47) , PMK1 = 1		// INTP4 mas					
•			<i>,,</i>		▶			
main.c#22	main	0298	Ons					
				7				
🖽 ID78K0-QB : SA	MPLE_KE2C.prj		~	7				
HD78KO-QB : S/ File Edit View Op	AMPLE_KE2C.prj Ition Run Event Bro	owse Jump Win	dow Help	7				
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When programs are running, the status bar will be red.



Check that the 7segment LED on TK-78K0/KE2C is lighted.

When you press SW1, the segment of the7segLED rotates. When you press SW2, number is displayed on the 7segLED after a while.



You could confirm the sample program is working.

2.11 Stop Programs

Now, you are going to stop the program.

Click the stop button 🔟 , or select "Run" on menu bar, then "Stop".

-	SAMPLE_KE2C.prj						
	Option Run Event Br		ow Help ᄣ 🔍 🛋 🏫 💽 😤 🐳	S	201		
Source (ma Search		Duint Defeat	Claure 1				
21	K		Close				
* > 22 * 23 24	<pre>h_initial(); EI();</pre>						
25	while <1>{						
* 27	g_start g_led_s CR000 = TMMK000 PIF0 = Q PMK0 = Q	= 0; = 0;					
* 29 * 30 * 31	CR000 = TMMK000 PIF0 = 0	0×0040; = 1;	// Count down start (// TM000 mask // INTP0 int F clr // INTP0 unmask	Jalue			
* 32							
* 34	while< s	g_start == 0	>{ // LED brink				
* 37 * 38	PMKØ = 1 RTCMK =	l;	// INTP1 mask // RTC int mask				
* 38 * 39 * 40	PMKØ = 1 RTCMK = RTCIIF = RTCIMK = PIF1 = 0 PMK1 = 0	=0; = 0;	// INTP1 mask // RTC int mask // RTCI int F clr // RTCI int 31.25ms u // INTP4 int F clr // INTP4 unmask	ımask			
* 39 * 40 * 41 * 42 * 43 * 44	PIF1 = 0 PMK1 = 0	ð; ð;	// INTP4 int F clr // INTP4 unmask				
* 43 44 45	while<	g_start == 1){ // start & spin:	ing 🚽			
* 46 * 47	PMV1 - 1		// INTP4 mask	¥			
				•			
					~		
					Stop	the program	n
main c#22	in sin	0000	DUBL				_
ID78K0-0B :	SAMPLE KE2C.pri				ſ		
-	SAMPLE_KE2C.prj Option Run Event Br	owse Jump Winds	ow Help				
File Edit View	Option Run Event Br						
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File Edit View III III III III IIII IIII IIIIIIIIIII	Option Run Event Br ▲ ► ► ► ▲ @ in.c) >> Watch (<u> </u>					
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ile Edit View II III III IIII III Source (main state) X Search <	Option Run Event Br	SIN DR					
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Ile Edit View II IP ▶ ▶ III IP ▶ ▶ Source (ma 241 III 243 IIII 243 IIII 343 IIII 343 IIIII 343 IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	Option Run Event Br The provided and the second se	<pre></pre>	Count down start of // Count down start of // TM000 mask // IMTP0 int F clr // IMTP0 int F clr // IMTP0 unmask // IMTP1 mask // INTP1 mask // INTP1 mask // INTP1 int F clr // RTC1 int F clr // RTC1 int F clr // INTP4 unmask // INTP4 unmask // Start & spin:	value Inask			

When the program stops, the status bar changes back to the original color.

2.12 Close Debugger (ID78K0-QB)

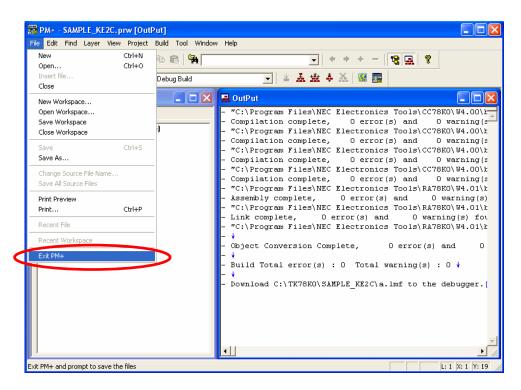
Select "File" on menu bar, then "Exit".

and the last	MPLE_KE2C.prj				
File Edit View Opti Open					
Save As			▝▋▓▁▋▟▐▓▁ቜ▁░		
Close		1			
Download Upload	atch	Quick Refree	sh Close		
Project	, ialC	;			
Environment	· (1)(
Debugger Reset	start	t = 0;			
Exit	тмикоро	s = 0; = 0x0040; 0 = 1;	// Count down start v // TM000 mask	value	
* 31 * 32	PIFØ = PMKØ =	0;	// INTPO int F clr // INTPO unmask		
* > 33 34		g_start ==	0){ // LED brink		
* 35 * 36 * 37) PMKØ =	1:	// INTP1 mask		
* 38 * 39	RTCMK = RTCIIF	= 1; =0;	// RTC int mask // RTCI int F clr // RTCI int 31.25ms un		
* 40 * 41	RTCIMK PIF1 =	0;	<pre>// RTCI int 31.25ms un // INTP4 int F clr // INTP4 unmask</pre>	ımask	
* 42 43 * 44	PMK1 =	-	// INTP4 unmask		
	ubilo(a stant == "	1){ // stant & snini	ing -	
45	while(}	g_start == :	1){ // start & spini	ing 🔹	
			1 >{ // start & spini // INTP4 mask	Â	
45	>				dialog is displayed.
45	>			Â	dialog is displayed.
45	>			Â	dialog is displayed.
45	>			Â	dialog is displayed.
45 46 47	> PMK1 =	1:	// INTP4 mask	The exit confirmation	dialog is displayed.
45 46 47	> PMK1 =	1:	// INTP4 mask	The exit confirmation	dialog is displayed.
45 46 47	> PMK1 =	1:	// INTP4 mask	The exit confirmation	dialog is displayed.
45 46 47	> PMK1 =	1:	// INTP4 mask	The exit confirmation	dialog is displayed.
45 46 47) PMK1 = main	1: 0481	// INTP4 mask	The exit confirmation	dialog is displayed.
45 46 47) PMK1 = main	1:	// INTP4 mask	The exit confirmation	dialog is displayed.
45 46 47) PMK1 = main	1 : 0481 KO-QB	// INTP4 mask	Manual Break	dialog is displayed.
45 46 47) PMK1 = main	1 : 0481 KO-QB This will	// INTP4 mask	Manual Break	dialog is displayed.
45 46 47) PMK1 = main	1 : 0481 KO-QB This will	INTP4 mask	Manual Break	dialog is displayed.

If you click Yes , it saves the settings in the project file, and then closes the ID78K0–QB. It is recommended to save the settings as it saves the window you used, window size, layout, etc. If you click No , it does not save the settings and closes the ID78K0-QB.



Select "File" on menu bar, then "Exit PM+".



PM+ is closed.

The experiences section ends now.

You can find more information how to use the development tool and information about other useful features in "Chapter 5 Other Information".

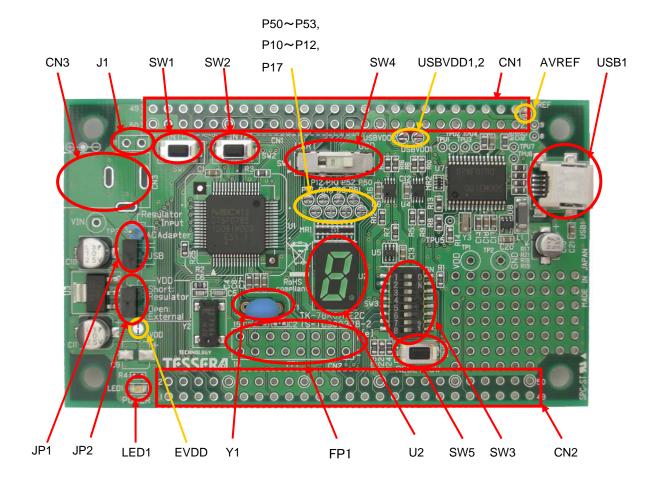
CHAPTER 3 Hardware Specifications

In this chapter, the hardware of TK-78K0/KE2C will be explained.

Microcontroller	μ PD78F0765 ※78K0/KE2C
	External main system clock: 20MHz
Clock	Subsystem clock: 32.768KHz
	Internal high-speed oscillation : 8MHz
	Mini B USB (USB1)
Interface	Expansion connector 50Pin socket x2 (CN1,2) pad only
	MINICUBE2 connector (FP1) pad only
Power supply voltage	5V (USB)
	•7segLED(U2)
Input/output for	•Push switch (SW1,SW2)
operation check use	•Dip switch (SW3 5,6,7,8bit)
	•Reset switch (SW5)
Other hardware	•Mode switch(SW1 1,2,3,4bit)
Other nardware	•Power LED(LED1)

* The name with bracket is the name printed on the board.

3.1 Layout of hardware functions



3.2 Hardware Functions

3.2.1 SW3, SW4

The bit 1–4 on SW3 are for mode settings, and bit 5–8 are DIP switches for general purpose ports that connected to P00, P02 \sim P04 pins in microcontroller.

• For the use of ID78K0R-QB, use following settings.

SW3	
Bit 1	ON/OFF *1
Bit 2	ON
Bit 3	ON
Bit 4	ON

SW4 OCD side

*1 OFF :The microcontroller stays being reset until ID78K0R-QB is started.

ON :The microcontroller runs the programs stored in the flash memory as soon as it gets power supply.

*2 If you use ID78K0-QB, it uses P31 and P32 for communicating with host machine. Therefore, you cannot use P31 and P32.

To run the programs stored in built-in flash memory without using ID78K0-QB, use following settings and re-supply USB power.

You can use P13(TXD6),P14(RXD6) for multipurpose serial port via μ PD78F0730.

You can use the On-chip debug function with connecting a MINICUBE2. (Connecter was not mounted)

SW3	
Bit 1	OFF
Bit 2	OFF
Bit 3	OFF
Bit 4	OFF
SW4 UART	side *2

*2 Select center position when P13,P14 are used on the expansion connector.

Please change to the following settings when writing it in the flash memory with built-in CPU by using Write EZ5.

S	SW3	
	Bit 1	ON
	Bit 2	ON
	Bit 3	ON
	Bit 4	OFF

SW4 UART side

• Bit5-8 of SW3 are connected to following CPU pins

It becomes "Low" if the switch is pushed, and it becomes "Open" if it separates. Please turn on pull-up resistor (PU0) with built-in CPU when using it.

(For details about settings for microcontroller built-in pull-up option resistor, refer to "78K0/Kx2C User's Manual <U19822>".)

SW3	
Bit 5	P00
Bit 6	P02
Bit 7	P03
Bit 8	P04

3.2.2 SW1,SW2

SW1,SW2 are the tact switch.

When you push the switch, it becomes "Low", and when you release the switch, it becomes "Open". Before using this, you need to set the microcontroller built-in pull-up option resistor (PU3,PU12) to ON. (For details about settings for microcontroller built-in pull-up option resistor, refer to "78K0/Kx2C User's Manual <U19822>".)

SW1,SW2

	Port	Port function	Note
SW1	P120	P120/INTP0/EXLVI	
SW2	P30	P30/INTP1	

3.2.3 SW5 (RESET SW)

SW5 is the reset switch. You can reset the microcontroller by pressing this switch.

3.2.4 JP1

JP1 is the jumper short pin to select power supply.

1-2 Short	Use USB power supply from the USB1 connector
2-3 Short	Use CN3, J1 connector power supply

3.2.5 JP2

JP2 is the jumper short pin for CPU power supply.

Short	Use regulator output to the internal power
open	Separate regulator output to the internal power.
	You can use other power supply to the internal power.

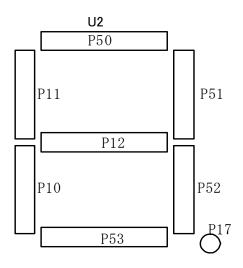
3.2.6 LED1 (POWER)

LED1 is the POWER LED. It is lighted when it gets power supply.

3.2.7 U2(7seg LED)

U2 is general purpose 7SegLED. LED is lighted when each port outputs "Low".

7SegLED segment connection



The figure of 0-9 can be displayed by writing the following values in P1, P5 register.

		i uispiayet	i ligure a	nu set uata	a.
Figure	P5 Data	P1 Data	Figure	P5 Data	P1 Data
0	0xF0	0xFC	5	0xF2	0xF9
1	0xF9	0xFF	6	0xF3	0xF8
2	0xF4	0xFA	7	0xF8	0xFF
3	0xF0	0xFB	8	0xF0	0xF8
4	0xF9	0xF9	9	0xF8	0xF9

Example of displayed figure and set data.

3.2.8 FP1

The connecter for MINICUBE2.

The connecter was not installed. (HONDA TSUSHIN KOGYO CO., LTD. FFC-16BMEP1)

3.2.9 CN1, CN2

The connecter for CN1,CN2 expansion connection. The connecter was not installed. (HIROSE ELECTRIC CO., LTD. HIF-3H-50DA-2.54DSA)

3.3 Solder-short pad label

With using the solder-short pad to cut the circuit, users can customize the circuit. The solder-short pad looks like the picture below.

To open, use cutter to cut the dent part. To short, put solder on the pad.



Solder-short pad name	Before Shipment		Connection
P50∼P53, P10∼P12,	Chart	Short	The ports are connected to 7seg LED via $1.5 \text{K}\Omega$.
P17	Short	Open	You can use port 5 for multipurpose I/O .
AVREF	Short	Short	VDD = AVREF
AVREF	Short	Open	AVREF is separated from AVREF.
EVDD	Short	Short	VDD = EVDD
EVDD	Short	Open	EVDD is separated from EVDD.
	0	Short	Supply USB 5V to CN1 connecter.
USBVDD1,USBVDD2	Open	Open	You can use CN3 and J1.

Note: All ground signals are each connected.

3.4 Operation by external power supply

The power supply of the AC adaptor connected with CN3 is connected only with the power supply terminal of the connector of the board in the surrounding (10, 12, and 16pin of CN1).

The AC adaptor can be made a power supply by the connection of the AC adaptor of 5V to CN3 and connect JP2 jumper short, and JP1 2-3 short.

Moreover, it is also possible to connect the stabilizing supply etc. in the lead line instead of the AC adaptor because CN3 is connected with J1 of a through hall.

- •Acceptable jack (CN3) :HEC0470-01-630 by Hosiden Corp(not mounted)
- •Acceptable plug : 2.1mm DC jack(center plus)
- •Current capacity :100mA or more



This chapter describes how to solve troubles you may face.

4.1 If you cannot find USB driver when you connect PC to the kit

Check Point 1

If you use USB hub, do not use it. (USB hub is not supported)

Check Point 2

Check if you installed "Starter Kit USB Driver" in "<u>1.2 Installation of Development Tools</u>". If not, install the driver.

Check Point 3

Check if the settings of SW3,4 on the kit are correct with referring to "1.3 Installation of USB Driver".

Check Point 4

If above 3 check points are confirmed, disconnect the USB cable from PC and re-connect again. It should show the "Found New Hardware Wizard" wizard. Operate the installation with referring to "<u>1.3 Installation of USB Driver</u>". After the installation, make sure you go through "<u>1.3.3</u> Completion of USB Driver Installation" to confirm the USB driver installation.

4.2 Error when you start the debugger

There could be several reasons to make errors happen.

The solving processes differ depending on errors. Please check the error message first. The solving processes for each error are as follows.

4.2.1 "Can not communicate with Emulator..." (F0100 or A0109)

Check Point 1

If you use USB hub, do not use it. (USB hub is not supported)

Check Point 2

Check if the settings of 3,4 on the kit are correct with referring "<u>1.3 Installation of USB Driver</u>".

Check Point 3

Confirm the USB driver installation with referring to "<u>1.3.3 Completion of USB Driver</u> <u>Installation</u>".

Check Point 4

If above 3 check points are confirmed, close the debugger and disconnect the USB cable from PC. Re-connect USB cable properly to both the PC and the kit, and then re-start the debugger.

4.2.2 "Incorrect ID Code." (Ff603)

This error occurs when the security ID stored on microcontroller built-in flash memory is different from the ID code you entered at the start of debugger.

Security ID entry area at the start of debugger



Check Point 1

Enter correct security ID and click OK on the configuration window.

Check Point 2

If you forgot the security ID, you have to erase the microcontroller built-in flash memory. Before erasing, check if you actually set the security ID with referring to "2.4 Set Linker Options". Also remember the code you set for the security ID.

After this, erase the flash memory with referring to "<u>5.4 Erase microcontroller built-in flash</u> memory".

4.2.3 "The on-chip debug function had been disabled in the device." (F0c79)

This error occurs when the value at address C3H (On-chip debug option byte) in microcontroller built-in flash memory is incorrect. You need to erase the flash memory.

Check Point 1

Check if you actually set the correct on-chip debug option byte with referring to " $\underline{2.4 \text{ Set Linker}}$ Options". If it is not correct, then set correctly.

Check Point 2

Erase the flash memory with referring to "5.4 Erase microcontroller built-in flash memory".

4.2.4 "Disabling the on-chip debug function is prohibited." (F0c33)

Basically, this error occurs when you start (download) the debugger without doing the settings described at "2.4 Set Linker Options". Do the same checking processes as "4.2.3 The on-chip debug function had been disabled in the device. (F0c79)".

CHAPTER 5 Other Information

This chapter explains some useful operation techniques of development tools and circuit diagram of the kit for developing of user programs.

5.1 Create a new workspace (project)

5.2 Register additional source file

5.3 Debugger tips

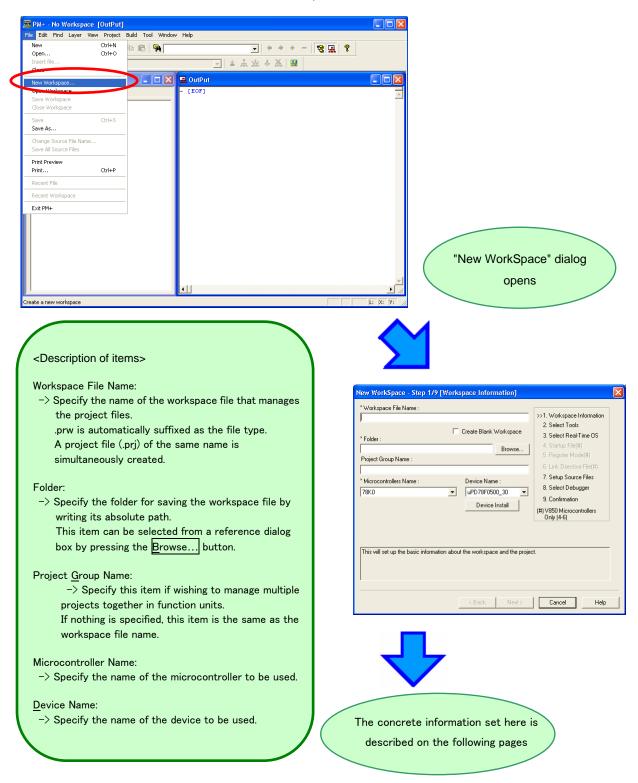
5.4 Erase microcontroller built-in flash memory

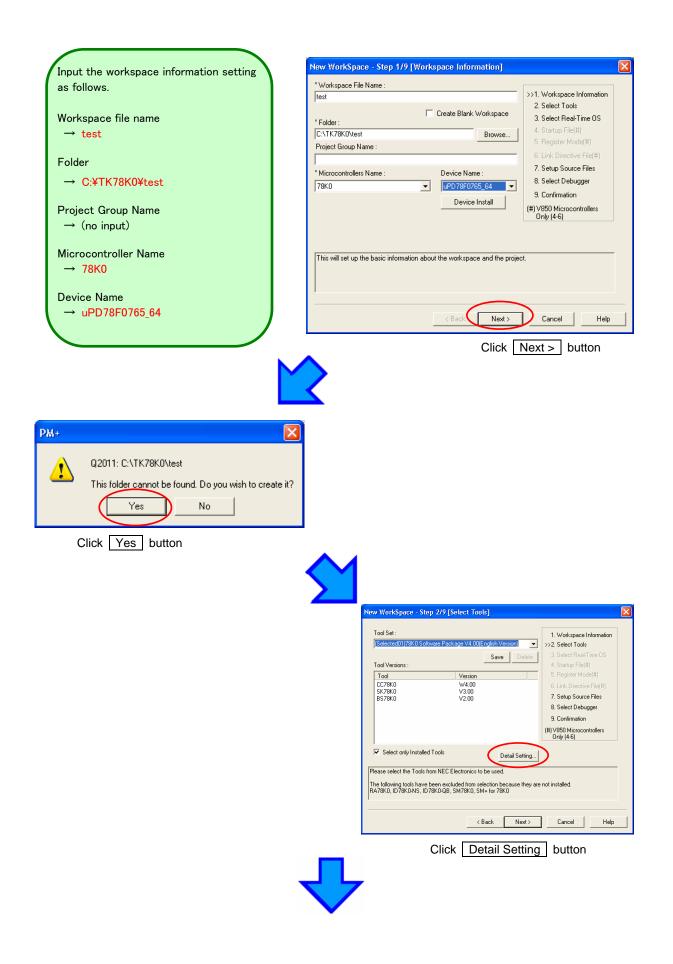
5.5 Circuit diagram

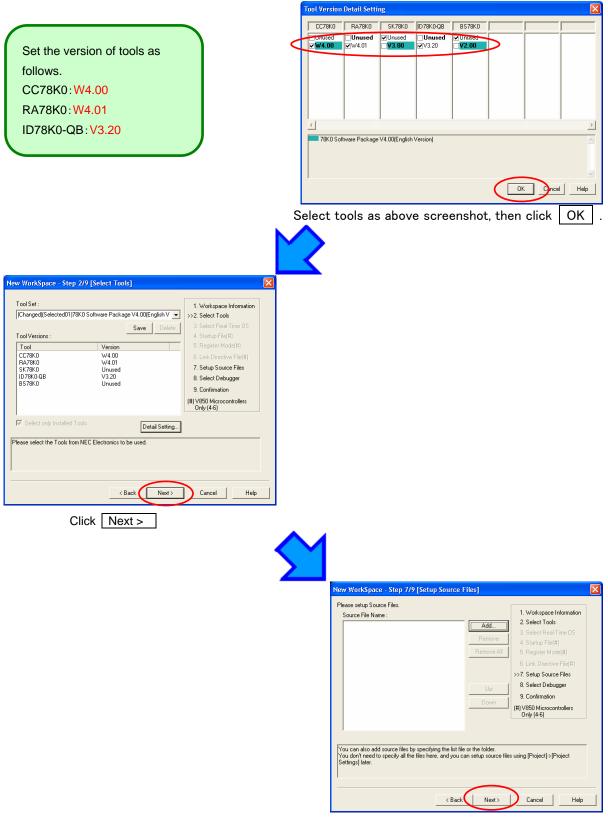
5.1 Create a new workspace

Now, create a new workspace and project.

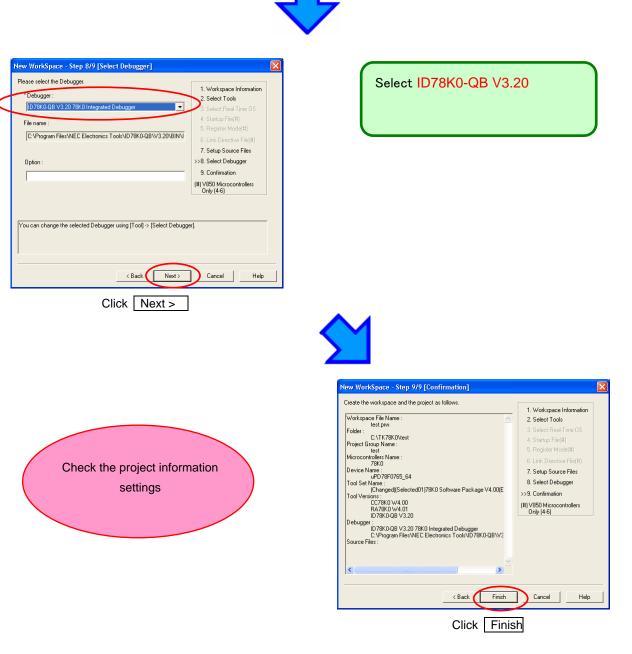
PM+ allows you to create a new workspace with following "New WorkSpace" dialog. Select "File" on PM+ menu bar, then "New Workspace...".



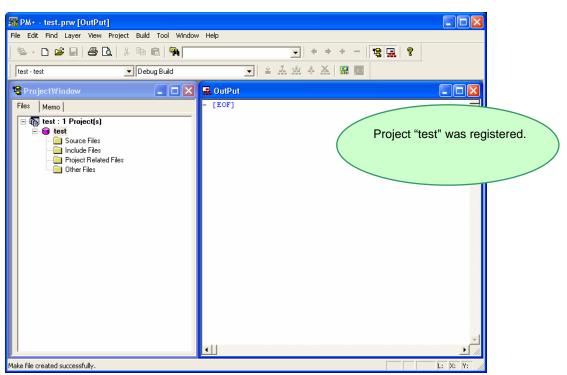




Click Next >



৵



This completes workspace and project creation.

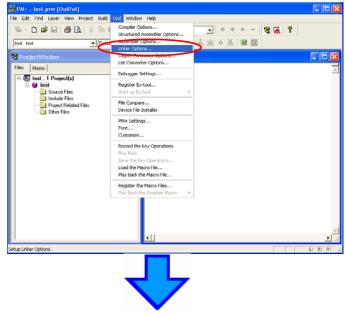
Additional source files can be registered at any time thereafter.

For details, refer to "5.2 Register additional source file".



Next, on chip debug function can be used.

 $[Tool] \rightarrow [Linker Options...]$ is selected.



Linker Options
Output1 Output2 Library Others
Load Module File[-o]
Output File Name:
a.lmf Browse
✓ Output Symbol Information[-g]
Create Error List File[-e]
Output File Name:
🔽 On-Chip Debug[-go]
✓ SIZE: 512 bytes
Security ID[-gi]
ID: FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
Command Line Uptions:
-oa.lmf -go512 -gi0FFFFFFFFFFFFFFFFFFFFFFFFF -pa.map -bcl0.lib -bcl0f.lib -i/"C:\Program A Files\NEC Electronics Tools\CC78K0\W4.00\lib78k0" -s
OK Cancel Apply Help

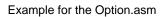


Next, please add the following "option.asm" file and set the method of attesting security ID as the setting of the option byte. Please refer to the user's manual of the device for details of the option byte.

Refer to "78K0/Kx2C user's manual" for the details of the security ID.

"option.asm" please the file must be included in the sample program, and copy this file and use it. Please refer to "Registering additional source file of next page for the method of adding the file.

OPT	CSEG	AT 0080H
		0011
OPTION	N: DB	00H
	DB	00H
	DB	00H
	DB	00H
	DB	03H
TMP	CSEG	AT 0FEDFH
ttmp: D	OS 1	
END		

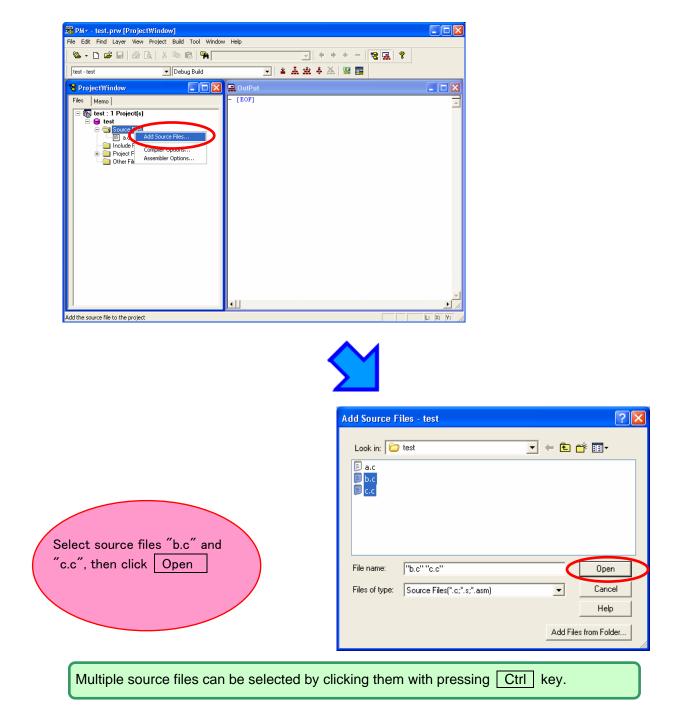


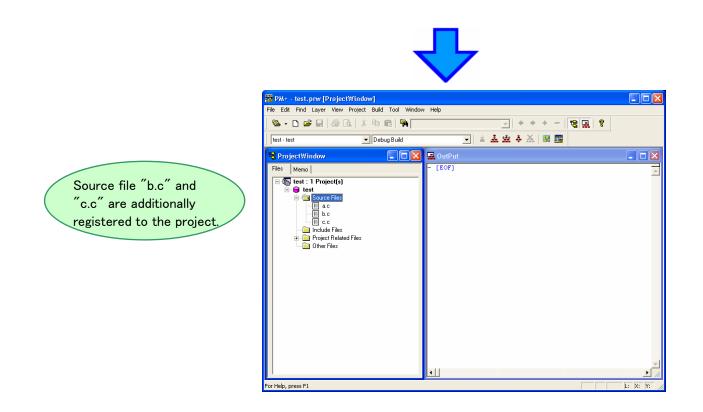
5.2 Register additional source file

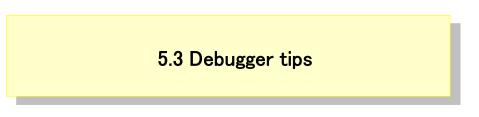
Now, register additional source files.

The following example shows the additional registration of source files "b.c" and "c.c" with source file "a.c" already registered.

Place the cursor on the source file in the Project window of PM+, and select [Add Source Files...] displayed in the right-click menu.







This section describes some useful techniques for the debugger (ID78K0-QB).

5.3.1 Change display of buttons

Execution controls (run, stop, step-in debugging, reset, etc) and opening functional window can be made by below buttons. However, it could be difficult to know which button does what.

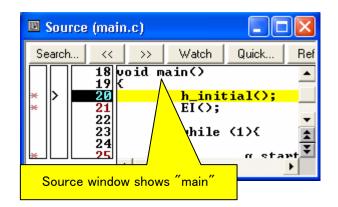
In this case, select "Options" on menu bar, then "Debugger Options". Check "Pictures and Text" on setting area.

With this setting, the buttons display the text as well, so that it is easier to know what they are.

5.3.2 Display source list and function list

When you wish to see source file list or function list, select "Browse" on menu bar, then "Other" \rightarrow "List" to open the list window. The information in the windows is synchronized. Therefore, it is not just for referring to the list, but it is useful when you wish to update files or functions.



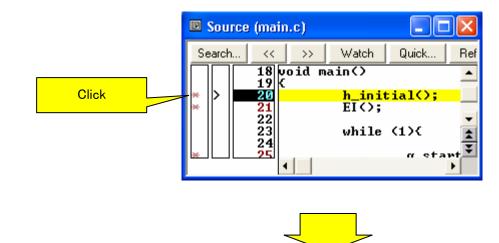


5.3.3 Set/delete breakpoints

Breakpoints are executed by clicking lines in which " * " is displayed

 ${}^{\prime\prime}B{}^{\prime\prime}$ is displayed in the line where a breakpoint is set.

Breakpoints are deleted by clicking "B".



	🗉 Source (main.c)
Breakpoint was set	Search << >> Watch Quick Ref
	18 void main() 19 (
	B > 20 h_initial(); ★ 21 EI();
	B 20 h_initial(); 21 EI(); 22 v 23 while (1)(24 v

5.3.4 Display global variables

With using Watch Window, you can display global variables. There are several ways to register global variables to watch window. In this section, how to register from source window is described.

 $\textcircled{\sc line 1}{\sc line 1}$ Right-click the variable on source window, then select "Add Watch..."

🔟 Source (common.c)	
Search << >> Watch Quick Refi	resh Close
9 /************************************	Move Mix Add Watch Symbol
15 unsigned char g_led_s =	Break when Access to

②Add Watch dialog opens. Click OK .

Add W	itch 🛛 🔀
Name:	o start Add
Radix:	Proper O Hex O Dec O Oct O Bin O String
Size:	Adaptive O Byte O Word O Double Word O
Number:	
	OK Cancel Restore Help

③Adding a variable to watch window is completed.

🛛 Watch		_ 0	X
Add	Delete	Up	
g_start	;	0×00	

5.3.5 Display global variables while programs are running

Global variables can be referred by the pseudo real-time monitor function even when the programs are running.

①Select "Option" on menu bar, then "Extended Option...".

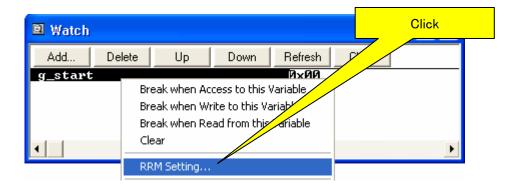
(2)Configure the settings as "Use MINICUBE Extended Function" and "RRM Setting".

Extended Option	
Use MINICUBE Extended Fung	
RAM Monitor	
Break When Readout: 💿 RRM S	etting C Off
Redraw Interval: 500	msec
On Mouse Click: 💿 📢 break	C Hard break
🔲 Clear Register When Re	🔽 Break Sound
Clear Trace Memory Before	Verify Check
OK Cancel	Restore Help
y the sampling interval time of the	e pseudo real-time monitor fu
mpling time can be specified fron	n 0 to 65500 with unit of 100m

③Add a global variable to watch window.

S T It

④Right-click the global variable on watch window, then select "RRM Setting..."



③Click the "Set", then Close the "RRM Setting "window.

RRM Set	ting					×
А	ddress	Size		Symbol	(Set
1 Oxfb7	8	1 💌	Bytes	_g_start		Close
2		-	Bytes			Restore
3	[-	Bytes			Clear
4	[-	Bytes			Delete
5	[-	Bytes			Jump
6	—— î	•	Bytes		- 1	Help
7	—— î	•	Bytes		_	
8	î	•	Bytes		_	
	Size Total	1 7	16 Byt	es		

This completes the settings.

Note:

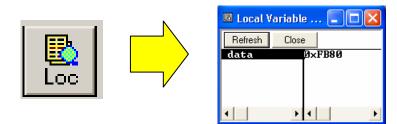
- ${\boldsymbol{\cdot}}$ The user program momentarily breaks upon a read.
- It is recommended to close the memory window when you use the pseudo real-time monitor function.

5.3.6 Display local variables

Local variable window is used to display local variables.

By clicking the button below, you can open the local variable window.

Unlike global variables, local variables cannot be displayed when programs are running.

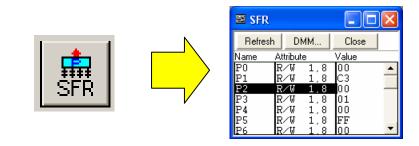


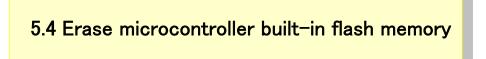
5.3.7 Display memory and SFR contents

By clicking the button below, you can open the memory window.

		🖬 Memory	X
	Ν	Search << >> Refresh DMM Close	_
		Addr +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +A +B +C +D +E +F	
· · · · ·		0FB00 18 7B 65 FF B9 B5 A0 CE 0A 13 70 54 00 C9 8A AD 0FB108C 3A 4F 33 37 EF 04 4B FA AA 0B A9 05 05 00 A5	
Mem		0FB2008 4D 10 FD F6 F5 48 BC 4C 7F 72 63 63 5C 88 52	
	V	OFB3010 A2 24 CE 7A F3 80 DA 60 7C 1E 9E 14 76 74 52 OFB4000 00 01 00 00 00 00 B1 A0 A5 50 3E 3E D6 D5 11	*
		0FB5000 02 05 79 00 00 58 FB 00 59 19 9F 14 7F 42 2A	

By clicking the button below, you can open the SFR window.





①Start WriteEZ5 from NEC Electronics Tools.

📲 Write EZ5		
<u>File D</u> evice <u>V</u> iew <u>H</u> elp		
/P 🖦 🗋 💥 🖋		
Σ≻ FlashOperning Flash Open OK		Name : Firmware : Parameter file - Version :
	~	Load file - Date : Ohksum : Area : Port : Speed : Range : Freq. : Multiply :
<		
Ready		NUM

②Set TK-78K0/KE2C switches, and then connect the PC.

SW3	
Bit 1	ON
Bit 2	ON
Bit 3	ON
Bit 4	OFF

SW4 UART 側

③Click the setup button.

📲 Write EZ5	
<u>File Device View H</u> elp	
/ 🔍 🖳 🖏 🖌 🍍 💸	
≫ FlashUpenning Flash Open OK	Name : Firmware :
	Parameter file - Version :
	Load file – Date : Chksum : Area :
	Connection to device Port : Speed : Range : Freq : Multiply :
Ready	NUM

(4) Click "PRM File Read" button.

📲 Device Setup	X
Standard Advance	
Parameter file	PRM File Read
Host connection	Supply oscillator
Port 🗨	Frequency MHz
Speed	Multiply rate
Operation Mode	
C Chip Start	~
C Block End	~
C Area	Show Addres
Target Reset Message	
	OK Cancel

⑤Please select "78F0765.prm" in the directory of "PRM" in the CD-ROM.

Open ? 🗙
Look in: 🔁 PRM 💽 🗢 🗈 📸 🎫
78F0760.prm 78F0761.prm 78F0762.prm 78F0763.prm 78F0764.prm 78F0765.prm
File name: 78F0765.prm Open
Files of type: Parameter Files(*.pr5;*.prm) Cancel

6 Select the COM port that TK-78K0/KE2C is connected.

📲 Device Setup 🛛 🔀			
Standard Advance			
Parameter file 78F0765.prm PRM File Read			
Host connection Supply oscillator			
Port COM4 Frequency 20.00 MHz			
Speed 115200bps Multiply rate 1.00			
Operation Mode			
Chip Start 000			
C Block End 059			
C Area 🗖 Show Addres			
Target Reset Message			
OK Cancel			

⑦Click "Erase" button.

📲 WriteEZ5	
File Device View Help	
> FlashOpenning	Name :
Flash Open OK >> ParameterFile Reading	Firmware :
Success Read ParameterFile. >>COMMAND: Device Setup PRM File Read OK.	
	Parameter file Name : 78F0765
	Version : V1.00
	Load file
	Name Date:
	Chksum : Area :
	Alca.
	Connection to device
	Speed 115200
	Range Chip Freq.: 20.00
	Multiply : 1.00
Ready	NUM

(8) Erasing the flash memory is completed when "chip erase finish" is displayed like below screenshot.

	📲 WriteEZ5	
	File Device View Help	
	/P 🍡 🗔 🗞 🖊 😻 💕	
\subset	>>COMMAND: Erase Flash Blank Checking Flash Erasing chip erase finish.	Name : 78K0-055 Firmware : 1.01
		Parameter file Name : 78F0765 Version : V1.00
		Load file- Date : Chksum : Area :
		Connection to device Port : COM4 Speed 115200 Range Chip Freq. : 20.00 Multiply : 1.00
	Ready	NUM

5.5 Circuit diagram

From following page, it shows the circuit diagram of the demonstration kit.

