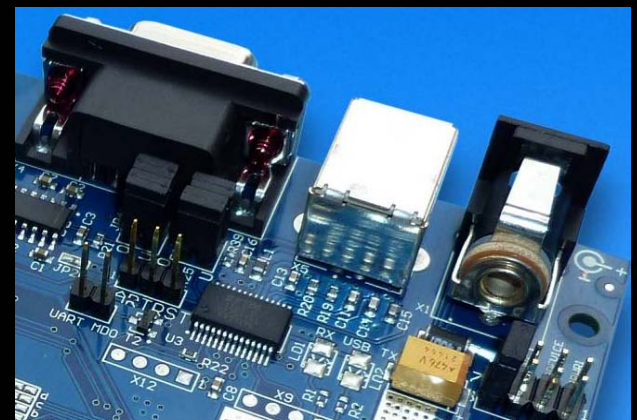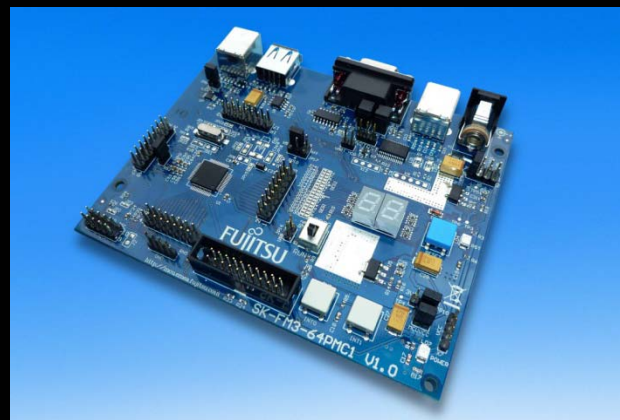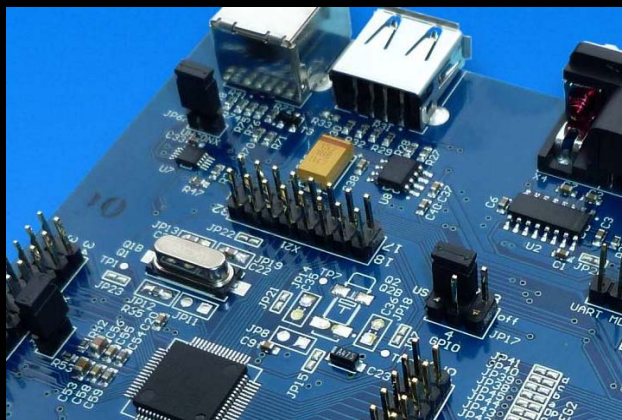# FUJITSU FM3

SK-FM3-64PMC1 (-JLINK)

Warranty and Disclaimer

The use of the deliverables (e.g. software, application examples, target boards, evaluation boards, starter kits, schematics, engineering samples of IC's etc.) is subject to the conditions of Fujitsu Semiconductor Europe GmbH ("FSEU") as set out in (i) the terms of the License Agreement and/or the Sale and Purchase Agreement under which agreements the Product has been delivered, (ii) the technical descriptions and (iii) all accompanying written materials.

Please note that the deliverables are intended for and must only be used for reference in an evaluation laboratory environment.

The software deliverables are provided on an as-is basis without charge and are subject to alterations. It is the user's obligation to fully test the software in its environment and to ensure proper functionality, qualification and compliance with component specifications.

Regarding hardware deliverables, FSEU warrants that they will be free from defects in material and workmanship under use and service as specified in the accompanying written materials for a duration of 1 year from the date of receipt by the customer.

Should a hardware deliverable turn out to be defect, FSEU's entire liability and the customer's exclusive remedy shall be, at FSEU´s sole discretion, either return of the purchase price and the license fee, or replacement of the hardware deliverable or parts thereof, if the deliverable is returned to FSEU in original packing and without further defects resulting from the customer's use or the transport.

However, this warranty is excluded if the defect has resulted from an accident not attributable to FSEU, or abuse or misapplication attributable to the customer or any other third party not relating to FSEU or to unauthorised decompiling and/or reverse engineering and/or disassembling.

FSEU does not warrant that the deliverables do not infringe any third party intellectual property right (IPR). In the event that the deliverables infringe a third party IPR it is the sole responsibility of the customer to obtain necessary licenses to continue the usage of the deliverable.

In the event the software deliverables include the use of open source components, the provisions of the governing open source license agreement shall apply with respect to such software deliverables.

To the maximum extent permitted by applicable law FSEU disclaims all other warranties, whether express or implied, in particular, but not limited to, warranties of merchantability and fitness for a particular purpose for which the deliverables are not designated.

To the maximum extent permitted by applicable law, FSEU's liability is restricted to intention and gross negligence. FSEU is not liable for consequential damages.

Should one of the above stipulations be or become invalid and/or unenforceable, the remaining stipulations shall stay in full effect.

The contents of this document are subject to change without a prior notice, thus contact FSEU about the latest one.
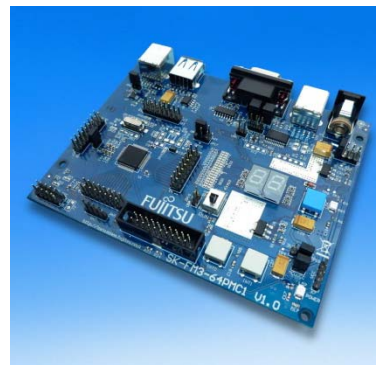
This board and its deliverables must only be used for test applications in an evaluation laboratory environment.

Overview

- **Introduction**
  - About the SK-FM3-64PMC1
  - SK-FM3-64PMC1 content
  - SK-FM3-64PMC1-JLINK content
  - Test it
  - The hardware
  - The software

- **Try yourself**
  - Software examples
  - Program download
  - IAR-Embedded Workbench
  - KEIL µVision

- **Additional documents**
- Schematic 'SK-FM3-64PMC1'
- Data sheet MB9A310 Series
- Peripheral manual
  - Errata sheet
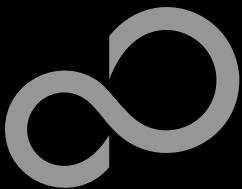- Technical reference manual
- Flash programming manual

- **Contacts**

3

About the SK-FM3-64PMC1

The SK-FM3-64PMC1 is available in two versions:

■ **The SK-FM3-64PMC1 includes a low-cost evaluation board based on the Fujitsu FM3 microcontroller MB9A310 Series**

■ **SK-FM3-64PMC1-JLINK includes a low-cost evaluation board based on the Fujitsu FM3 microcontroller MB9A310 Series and the JTAG adapter J-Link**

■ **The MB9A310 Series includes the following features:**

- Up to 512 KByte Flash Memory
- Up to 32 KByte RAM
- Up to 8 LIN-USART-I²C interfaces
- USB-Host/-Device interface
- Timers (ICUs, OCUs, PPGs, others)
- Up to three 12 bit ADC
- External interrupts
- Low Power Mode
- DMA Controller (8 channels)
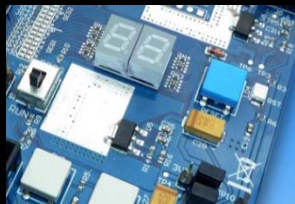
About the SK-FM3-64PMC1

■ **Features of the SK-FM3-64PMC1 board:**

- Microcontroller MB9AF314L
- 1x UART-Transceiver (SUB-D9 connector)
- 1x USB to serial converter (Type-B connector)
- 1x USB-MiniHost (Type-A connector)
- 1x USB-Device (Type-B connector)
- JTAG-Interface on a 20 pin-header
- TSC-Interface to connect for example the Fujitsu SK-TSC-1127S-SB
- 2x LED-Display (7-Segment)
- 2x 'User'-button
- 1x 'Reset'-button, 'Reset'-LED
- All 64 pins routed to pin-header
- On-board 5V and 3V voltage regulators, 'Power'-LED
- Power supply via USB (UART'B'), USB-Device, JTAG or external via a 8V to 12V power connector
- Voltage filter for ADC
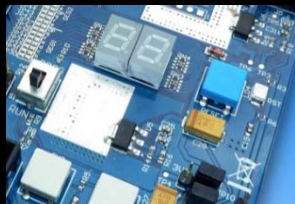
SK-FM3-64PMC1 content

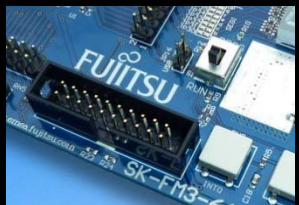- The SK-FM3-64PMC1 kit contains
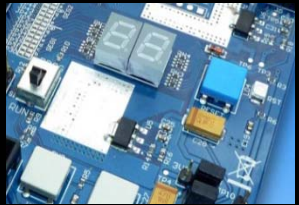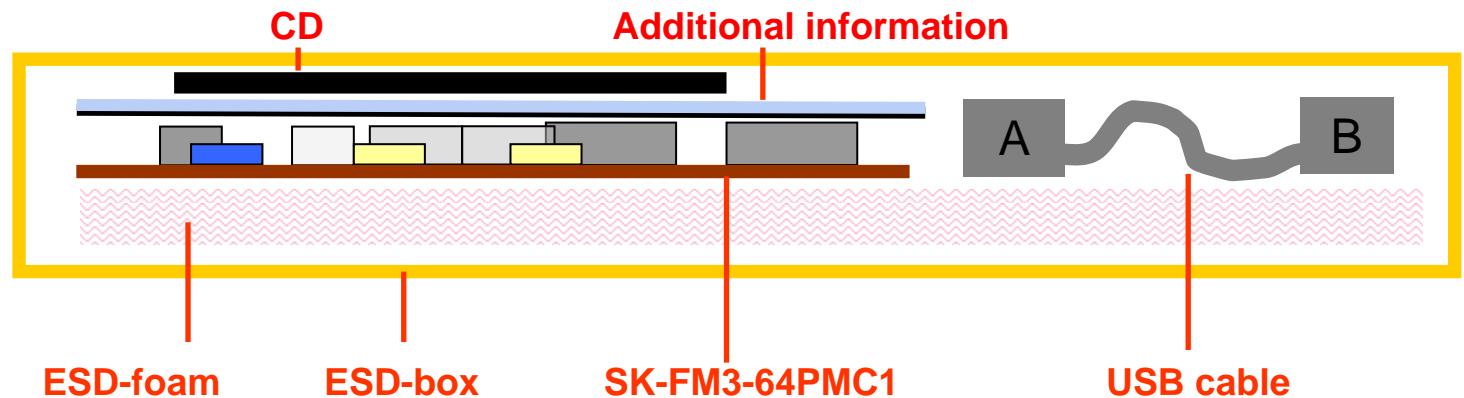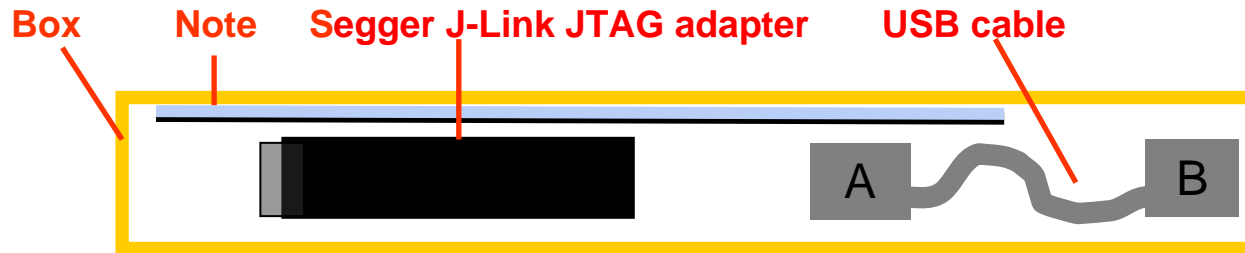 - SK-FM3-64PMC1 evaluation board with MB9AF314L
  - USB cable
  - CD: Documentation, USB driver, Software examples, Programmer

CD   Additional information

A   B

ESD-foam   ESD-box   SK-FM3-64PMC1   USB cable
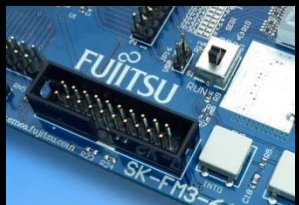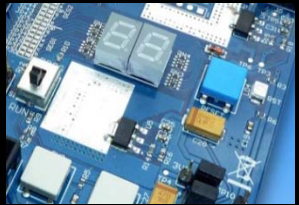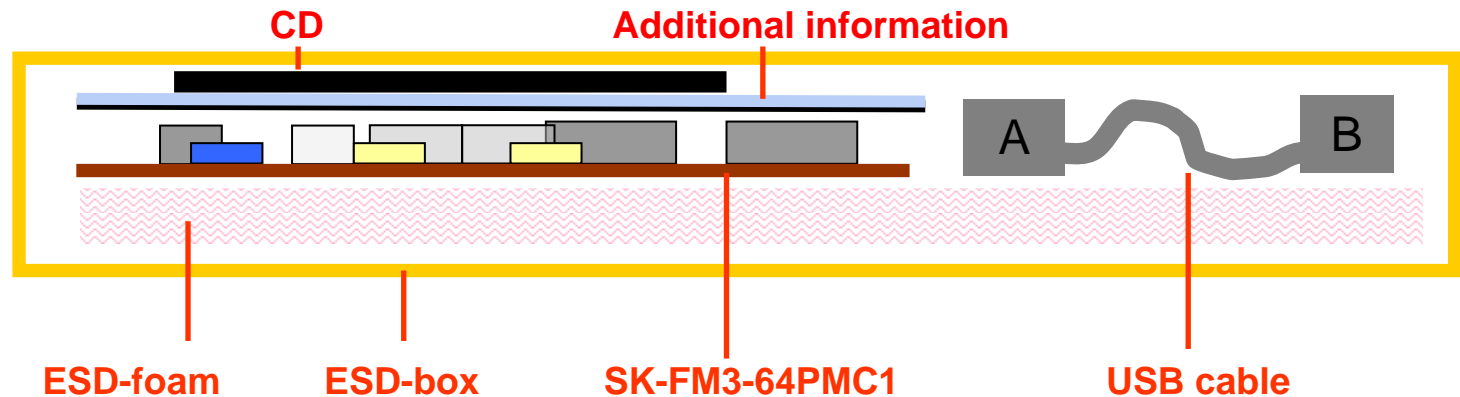
SK-FM3-64PMC1-JLINK content

- The SK-FM3-64PMC1-JLINK kit contains
  - SK-FM3-64PMC1 evaluation board with MB9AF314L
  - USB cable
  - CD: Documentation, USB driver, Software examples, Programmer
 - Segger J-Link JTAG adapter incl. USB cable

Box   **Note**   **Segger J-Link JTAG adapter**   **USB cable**

CD   **Additional information**

ESD-foam   **ESD-box**   **SK-FM3-64PMC1**   **USB cable**

Test it

■ **The microcontroller on the SK-FM3-64PMC1 is already preprogrammed with a simple application.**

● Connect the SK-FM3-64PMC1 via USB (X5) with the PC, verify that jumper J5 is on the USBPWR position.

● Install the USB driver from the CD

● Press the ‚Reset'- Button

● The SK-FM3-64PMC1 will automatically start counting

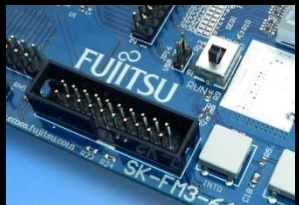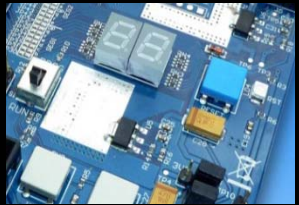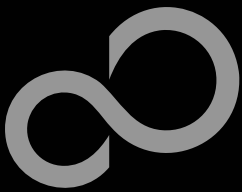● The count direction can be changed by pressing the key buttons

INT1
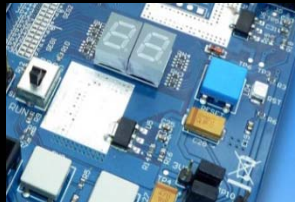
INT0
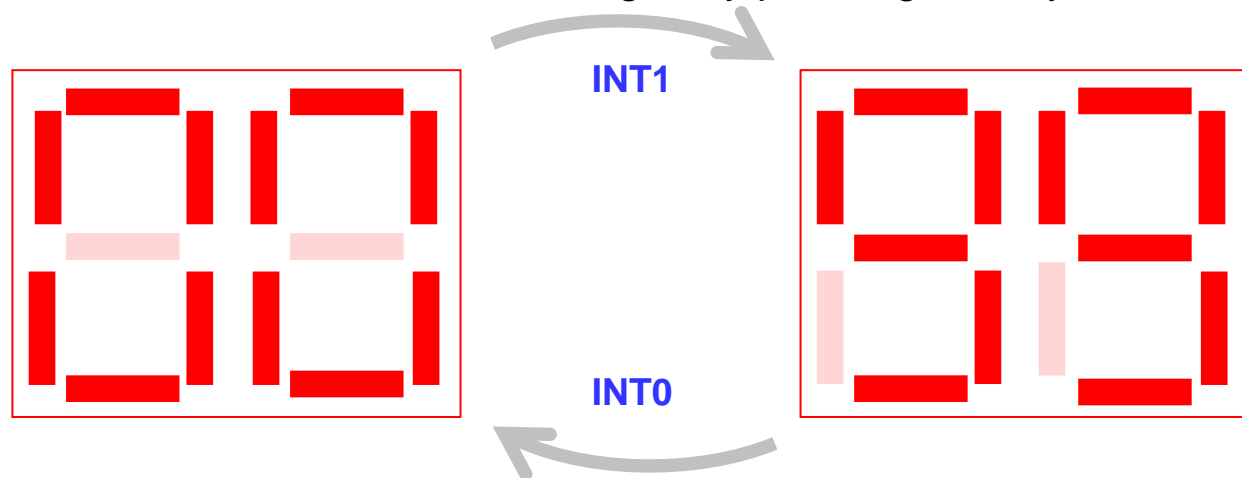
Test it

Congratulations!

- **You finished successfully the first test**

- **Now you will get more details about the SK-FM3-64PMC1**
- **You will learn more about**
    - The on-board features
    - How to program the Flash
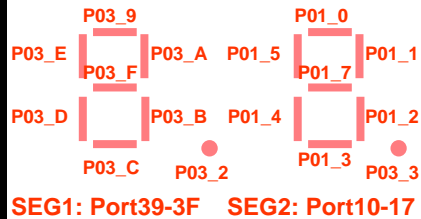   - How to start with IAR-Embedded-Workbench and KEIL µVision
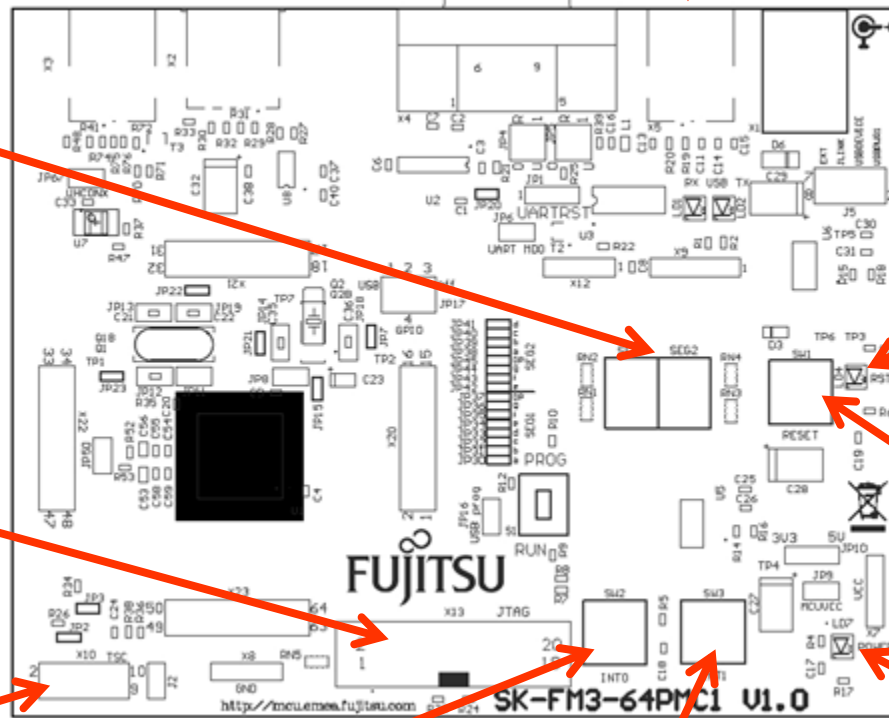
The Hardware

■ **Main features**

7-Segment Display

SEG1: Port39-3F   SEG2: Port10-17

USB Device
USB Host
UART 'A'
USB to UART 'B'
Ext Power +8V...+12V

LED 'Reset'
Keybutton 'Reset'
LED 'Power'
JTAG J-Link
TSC (Touch-Sensor Connector)
Keybutton 'INT0' Port P05_0
Keybutton 'INT1' Port P05_1

SK-FM3-64PMC1 V1.0

The Hardware

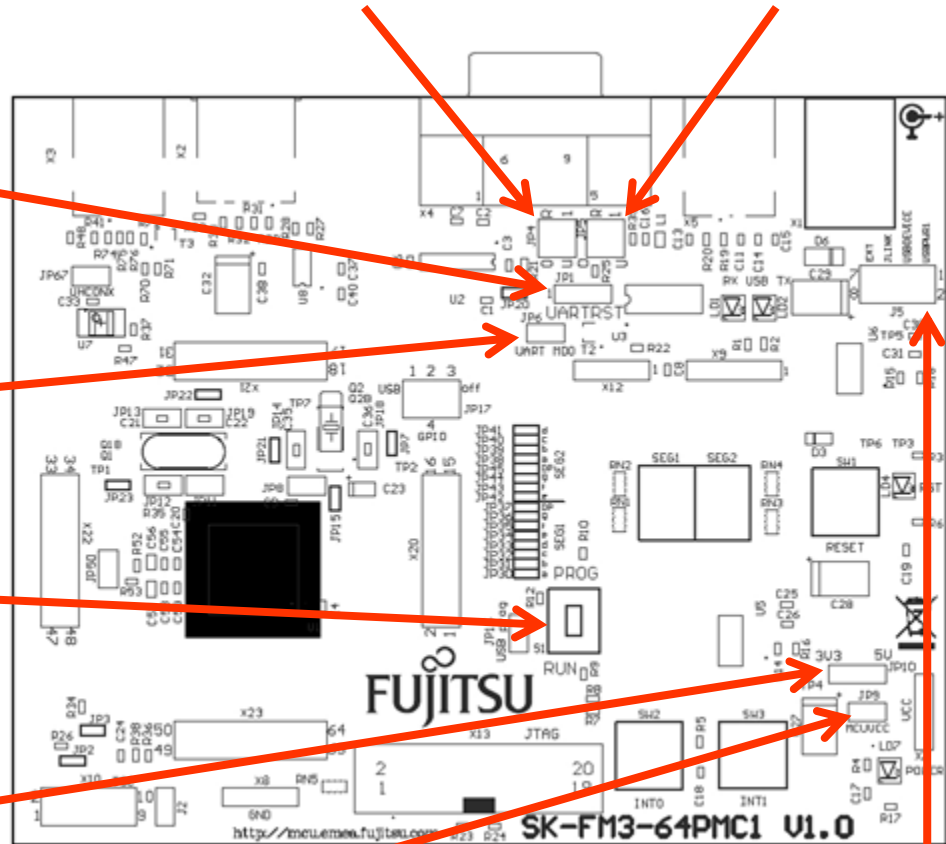■ **The jumpers**

JP4: UART RX select

R-0: UART0=UART'A' / U-4: UART4=UART'B' (USB)

R-4: UART4=UART'A' / U-0: UART0=UART'B' (USB)

JP5: UART TX select

R-0: UART0=UART'A' / U-4: UART4=UART'B' (USB)

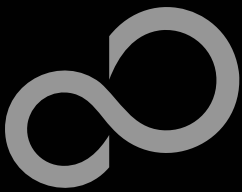R-4: UART4=UART'A' / U-0: UART0=UART'B' (USB)

JP1: DTR-Reset

1-2: DTR-Signal of the UART connector is connected to the MCU reset-pin.

2-3: DTR-Signal of the USB connector is connected to the MCU reset-pin.

Some terminal-programs, e.g. Fujitsu's SerialPort Viewer and Terminal, allow to reset the evaluation board by using the DTR-Signal.

JP6: MD0 selection

Close this jumper to control the MD0 level by the RTS signal of the USB interface

S1: Mode selection

PROG: Program-mode

RUN: Run-mode

JP10: 5V / 3.3V

1-2: 5V supply is used

2-3: 3.3V supply is used

JP9: MCU Vcc

This jumper can be used to measure the current consumption of the MCU

J5: Power Supply

1-2: USB (UART 'B') supply

5-6: JLINK supply

3-4: USB Device supply

7-8: External supply

SK-FM3-64PMC1 V1.0
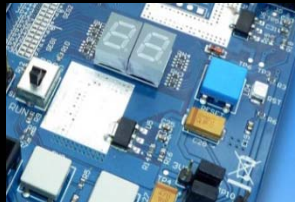
The Hardware

- **The jumpers**

JP67: USB Function HCONX

Open: D+ is not pulled up
Closed: HCONX controls Pullup of D+

JP17: Port8 (USB use)

1-2: USB in use
2-3: USB not in use
2-4: Use Port 8 as digital I/O

JP20:Use of UART'A'

JP21: Subclock (Open: P47)

JP15: C-pin (Capacitor function?)

JP7: Subclock (Open: P46)

JP16: USB prog
(for PROG-Mode S1)
Open: UART programming enabled
Closed: USB programming enabled

JP30-JP45: SEG1 and SEG2

JP2: Pullup resistor TSC
Closed: Pullup SCL3

JP3: Pullup resistor TSC
Closed: Pullup SDA3
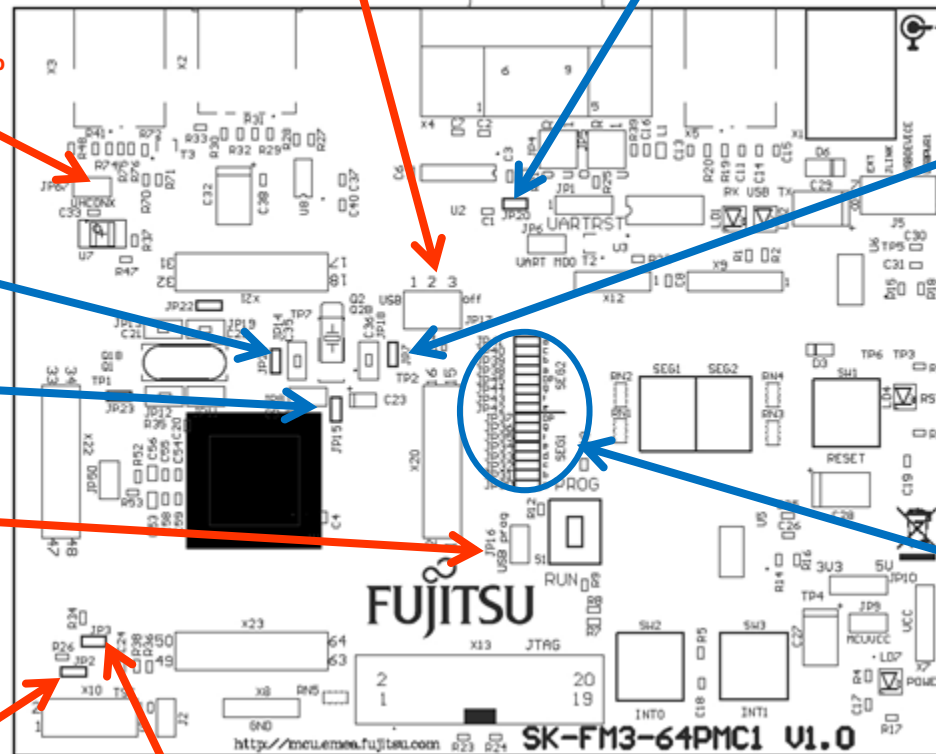
Special solder-jumpers: These jumpers are bridged (default:closed) and enable the function described. To open them just cut the space between the pins, and the function will be disabled. It's useful for current measurements or to use the assigned ports for a different function from the default.
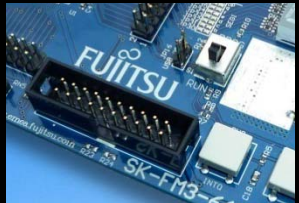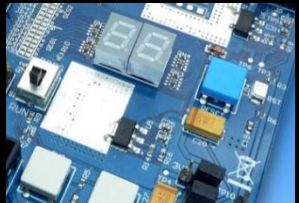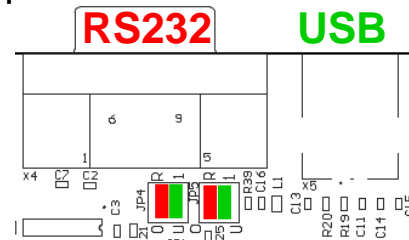
SK-FM3-64PMC1 V1.0

The Hardware

■ **JP4, JP5 : UART selection**

- UART0 and UART4 of the microcontroller can be used together with a typical RS232 SUB-D9 connector and a serial/USB converter
- The jumpers JP4 and JP5 routes the channel to the connector

- UART0 = USB-connector (X5), UART4 = Sub-D9 (X4) (default)
  - Setting of Jumper JP4 and JP5: U-0 / R-1

(default)
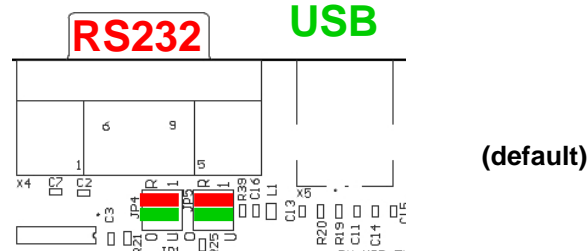
- UART0 = Sub-D9 (X4), UART4 = USB-connector (X5)
  - Setting of Jumper JP4 and JP5: U-1 / R-0
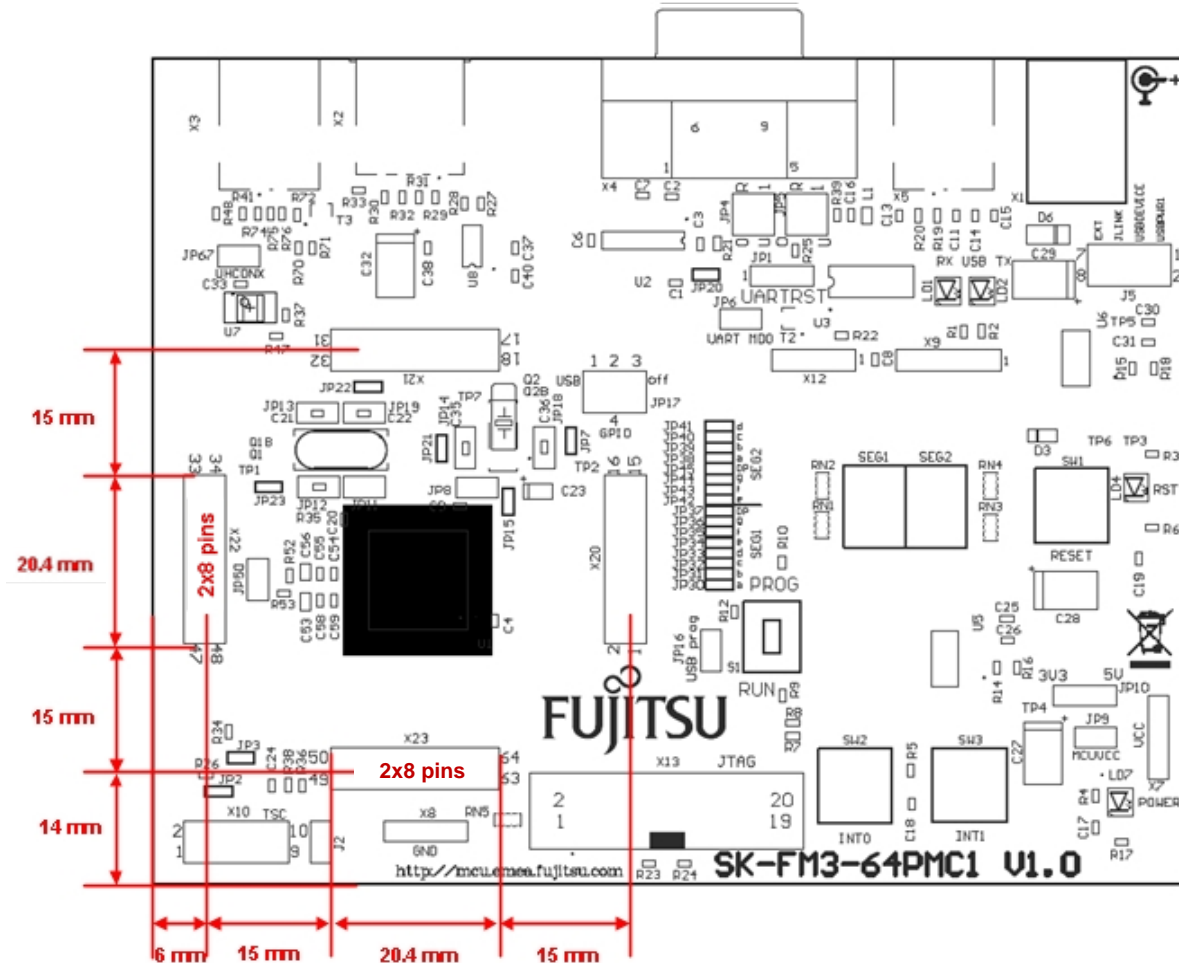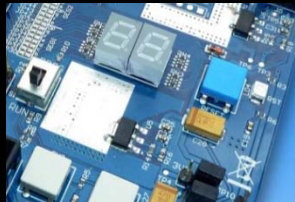

13

The Hardware

■ **Extension headers X20-X23**
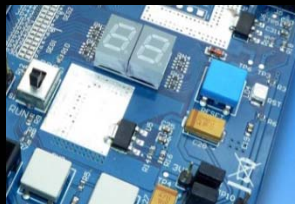
● Standard 0.1" / 2.54mm grid for use with prototype boards

The Hardware

■ The microcontroller pins

Pin	Pin-name	Pin-Function on SK-FM3-64PMC1	Pin	Pin-name	Pin-Function on SK-FM3-64PMC1
1	VCC	MCUVCC	12	P3C/RTO02_0/TIOA2_1	SEG1-D
2	P50/INT00_0/AIN0_2/SIN3_1	Key button 'INT0'	13	P3D/RTO03_0/TIOA3_1	SEG1-E
3	P51/INT01_0/BIN0_2/SOT3_1	Key button 'INT1'	14	P3E/RTO04_0/TIOA4_1	SEG1-F
4	P52/INT02_0/ZIN0_2/SCK3_1	USB current limitation 'INT2'	15	P3F/RTO05_0/TIOA5_1	SEG1-G
5	P30/AIN0_0/TIOB0_1/INT03_2	TINT TSC-Con-nector 'INT32'	16	VSS	GND
6	P31/BIN0_0/TIOB1_1/SCK6_1/INT04_2	GINT TSC-Con-nector 'INT42'	17	C	'C' capacitor
7	P32/ZIN0_0/TIOB2_1/SOT6_1/INT05_2	SEG1-DP	18	VCC	MCUVCC
8	P33/INT04_0/TIOB3_1/SIN6_1/ADTG_6	SEG2-DP	19	P46/X0A	Subclock (optional)
9	P39/DTTI0X_0/ADTG_2	SEG1-A	20	P47/X1A	Subclock (optional)
10	P3A/RTO00_0/TIOA0_1	SEG1-B	21	INITX	Key button 'Reset'
11	P3B/RTO01_0/TIOA1_1	SEG1-C	22	P49/TIOB0_0/AIN0_1	

The Hardware

■ The microcontroller pins (cont'd)

Pin	Pin-name	Pin-Function on SK-FM-100PMC
23	P4A/TIOB1_0/BIN0_1	
24	P4B/TIOB2_0/ZIN0_1	
25	P4C/TIOB3_0/SCK7_1/AIN1_2	
26	P4D/TIOB4_0/SOT7_1/BIN1_2	
27	P4E/TIOB5_0/INT06_2/SIN7_1/ZIN1_2/ MAD101	
28	MD1/PE0	GND
29	MD0	Mode-Switch S1
30	X0/PE2	4 MHz Crystal
31	X1/PE3	4 MHz Crystal
32	VSS	GND

Pin	Pin-name	Pin-Function on SK-FM-100PMC
33	VCC	MCUVCC
34	P10/AN00	SEG2-A
35	P11/AN01/SIN1_1/INT02_1/FRCK0_2	SEG2-B
36	P12/AN02/SOT1_1/IC00_2	SEG2-C
37	P13/AN03/SCK1_1/IC01_2	SEG2-D
38	P14/AN04/INT03_1/IC02_2	SEG2-E
39	P15/AN05/IC03_2	SEG2-F
40	P17/AN07/SIN2_2/INT04_1	SEG2-G
41	AVCC	AVCC
42	AVRH	AVRH
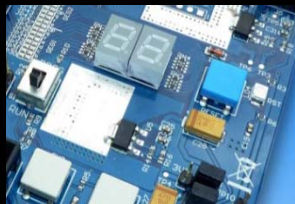
The Hardware

■ The microcontroller pins (cont'd)

Pin	Pin-name	Pin-Function on SK-FM-100PMC
43	AVSS	GND
44	P18/AN08/SOT2_2	SDA2 TSC-Connector
45	P19/AN09/SCK2_2	SCL2 TSC-Connector
46	P23/SCK0_0/TIOA7_1	
47	P22/SOT0_0/TIOB7_1	UART0 (TXD)
48	P21/SIN0_0/INT06_1	UART0 (RXD)
49	P00/TRSTX	JTAG TRSTX
50	P01/TCK/SWCLK	JTAG TCK
51	P02/TDI	JTAG TDI
52	P03/TMS/SWDIO	JTAG TMS
53	P04/TDO/SWO	JTAG TDO

Pin	Pin-name	Pin-Function on SK-FM-100PMC
54	P0A/SIN4_0/INT00_2	UART4(RXD)
55	P0B/SOT4_0/TIOB6_1	UART4(TXD)
56	P0C/SCK4_0/TIOA6_1	USB-Switch Device/Host
57	P0F/NMIX/CROUT_1	Reset TSC Connector
58	P62/SCK5_0/ADTG_3	Current limitation enable
59	P61/SOT5_0/TIOB2_2/UHCONX	USB UHCONX
60	P610/SIN5_0/TIOA2_2/INT15_1	Mode Switch S1
61	USBVCC	USB-Power supply
62	P80/UDM0	USB Data -
63	P81/UDP0	USB Data+
64	AVSS	GND

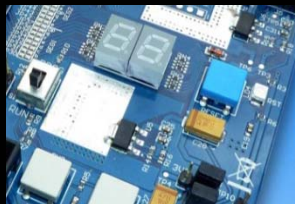**17**
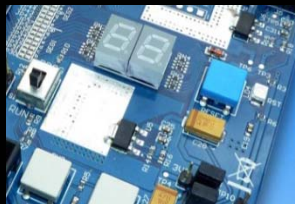
The Software

- **The SK-FM3-64PMC1 CD includes the following software:**
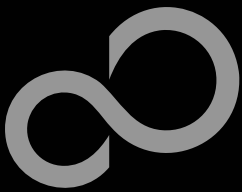   - MCU Flash programming tools
        - FUJITSU FLASH MCU Programmer for FM3
        - FLASH USB DIRECT Programmer
    - USB driver for on-board USB-to-RS232 converter
    - The terminal program SerialPortViewerAndTerminal
    - Software examples for the SK-FM3-64PMC1

- **Please check our dedicated microcontroller website:**

http://mcu.emea.fujitsu.com

- for updates of the Flash programmer tool, utilities and examples
- for data sheets, hardware manuals, application notes, etc.

Installation of the USB-driver

■ **Connect the SK-FM3-64PMC1 via USB (X5) to your PC**

- Windows will 'Found New Hardware: FT232R USB UART' and the Hardware Wizard should start automatically
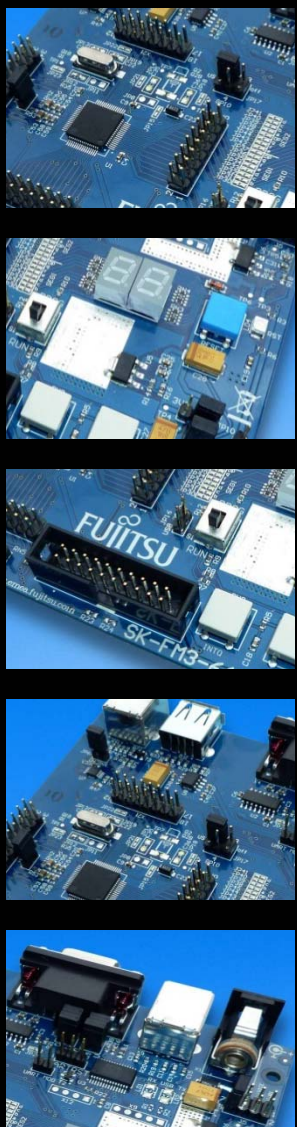 - **Note: The installation procedure may differ with different operating systems**
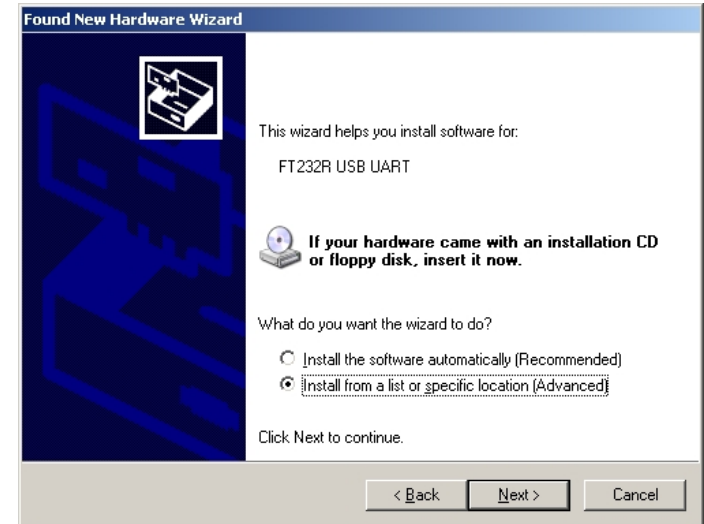
- Do not connect to Windows Update to search for software
- Select 'Install from a list or specific location (Advanced)'
- Within next windows select 'Search for the best driver' and browse on the CD to the folder 'drive:\USB Driver'

Installation of the USB-driver
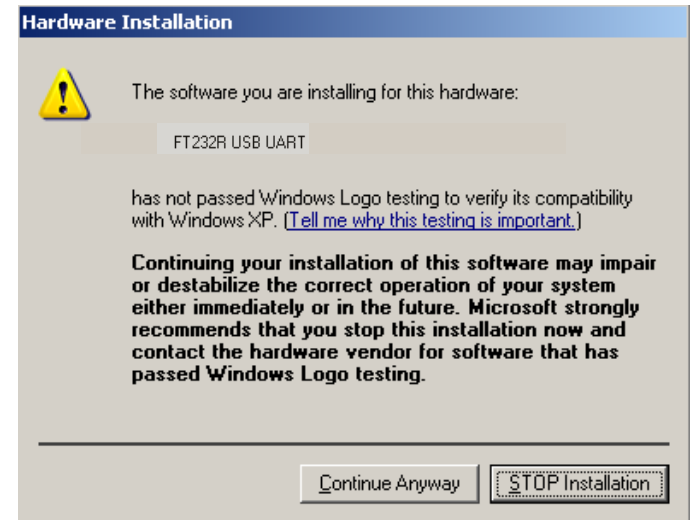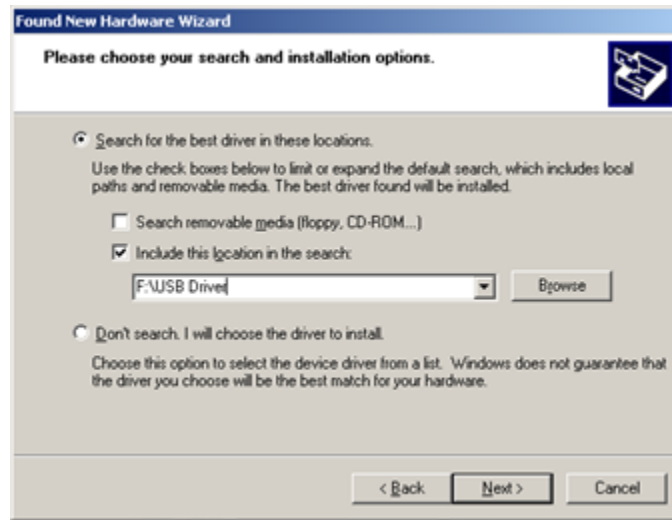
- 'Continue anyway' although the Windows Logo test may not be passed
- Windows completes the installation by copying some files
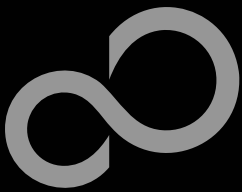- 'Finish' will close the window

Installation of the USB-driver

● Again Windows will 'Found New Hardware: USB Serial Port' and the Hardware Wizard should start automatically
 • **Note: The installation procedure may differ with different operating systems**
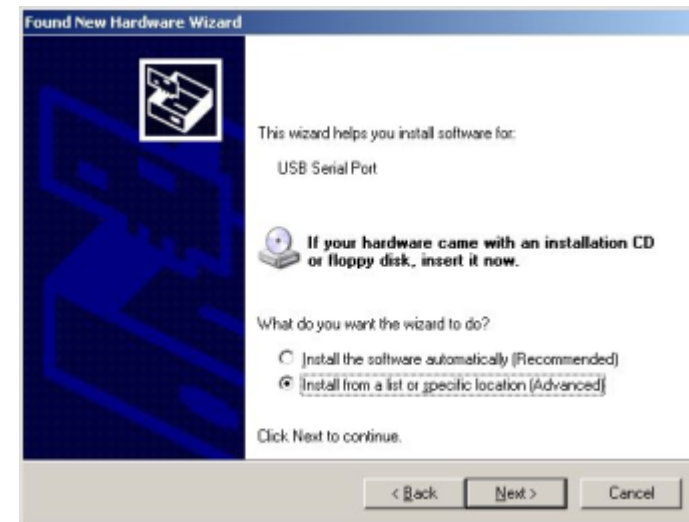
● Do not connect to Windows Update to search for software
● Select 'Install from a list or specific location (Advanced)'
● Within next windows select 'Search for the best driver' and browse on the CD to the folder ''drive:\USB Driver''

Installation of the USB-driver
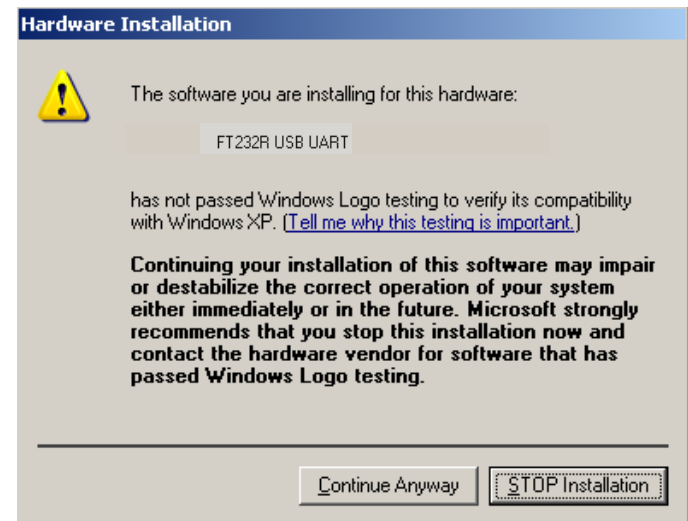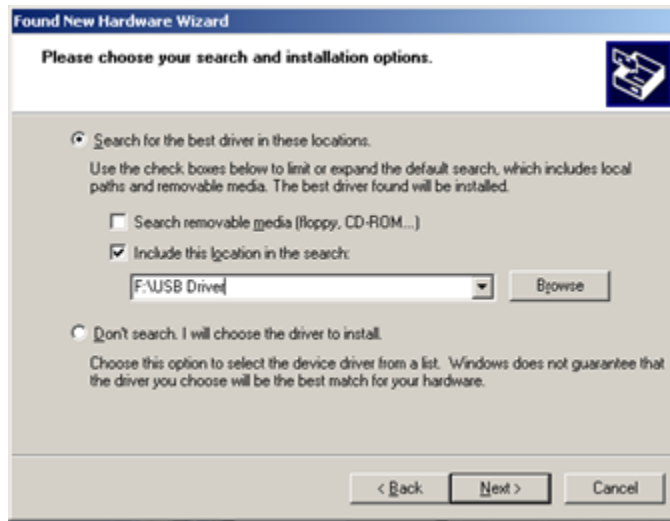
- 'Continue anyway' although the Windows Logo test may not be passed
- Windows completes the installation by copying some files
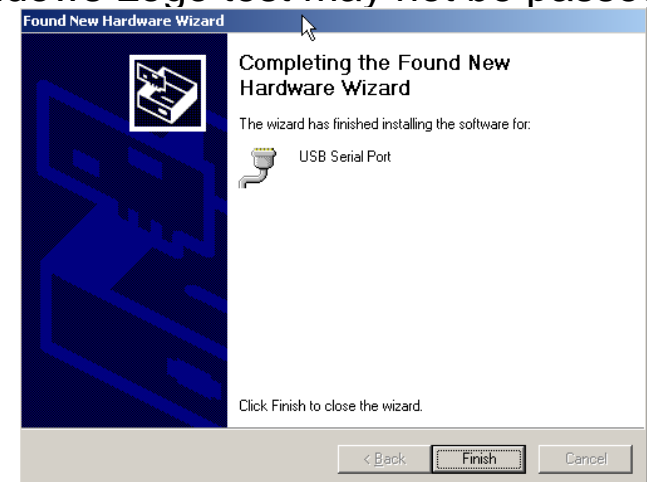
Installation of the USB-driver

There are two options to check that your installation was successful:

■ **Start the Device Manager of the Windows Control Panel**
   ● START -> Settings -> Control Panel
   ● Control Panel -> System -> Hardware -> Device Manager

■ **Check 'Ports' for the assigned virtual COM-port number**
   ● USB Serial Port (e.g.: COM2)
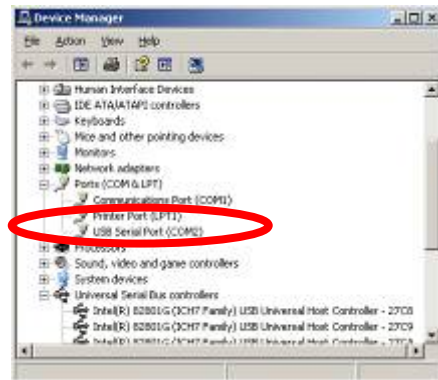
■ **Open the Fujitsu's „SerialPort Viewer and Terminal"**
   ● Double click on the icon [icon] of the taskbar.

■ **It will show the opened ports, check for the assigned virtual COM-port number**
   ● USB Serial Port (e.g.: COM2)

Ready!

Tools and Software Examples

- **SerialPortViewerAndTerminal**
 - Free of charge terminal program
  - Start installation

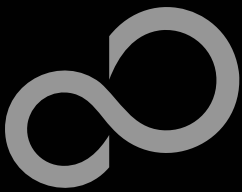- **Following examples are provided with SK-FM3-64PMC1 for IAR Embedded Workbench V6.2 and KEIL µVision4:**
  - mb9af314l_template-v12
    - 'Empty' project as base for user applications
  - mb9af314l_adc_dvm-v12
    - Digital Voltage Meter based on the A/D-converter
  - mb9af314l_uart-v12
    - Simple UART example (UART0)
  - mb9af314l_ioport_counter-v12
    - Counts from 0 to 99 on the 7-segment Display

  Further examples are available on the CD and on our website

  Note:

 Please copy the examples to your local drive!
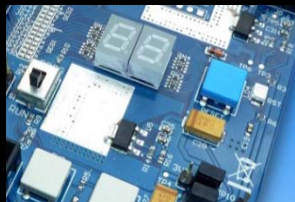
Flash Programming

■ **There are two options to program the flash:**

1. **UART Programming (X4, X5)**
   - Check jumper JP16 is opened
   - Connect UART0 of the board to the USB-Port of the PC
     – via USB (JP4,JP5: U-0, R-1)
     – via RS232 (JP4,JP5: U-1, R-0)
   - Use the FUJITSU FLASH MCU Programmer

2. **USB Programming (X3)**
   - Check jumper JP16 is closed
   - Connect the board via USB-Device (X3) to the USB-Port of the PC
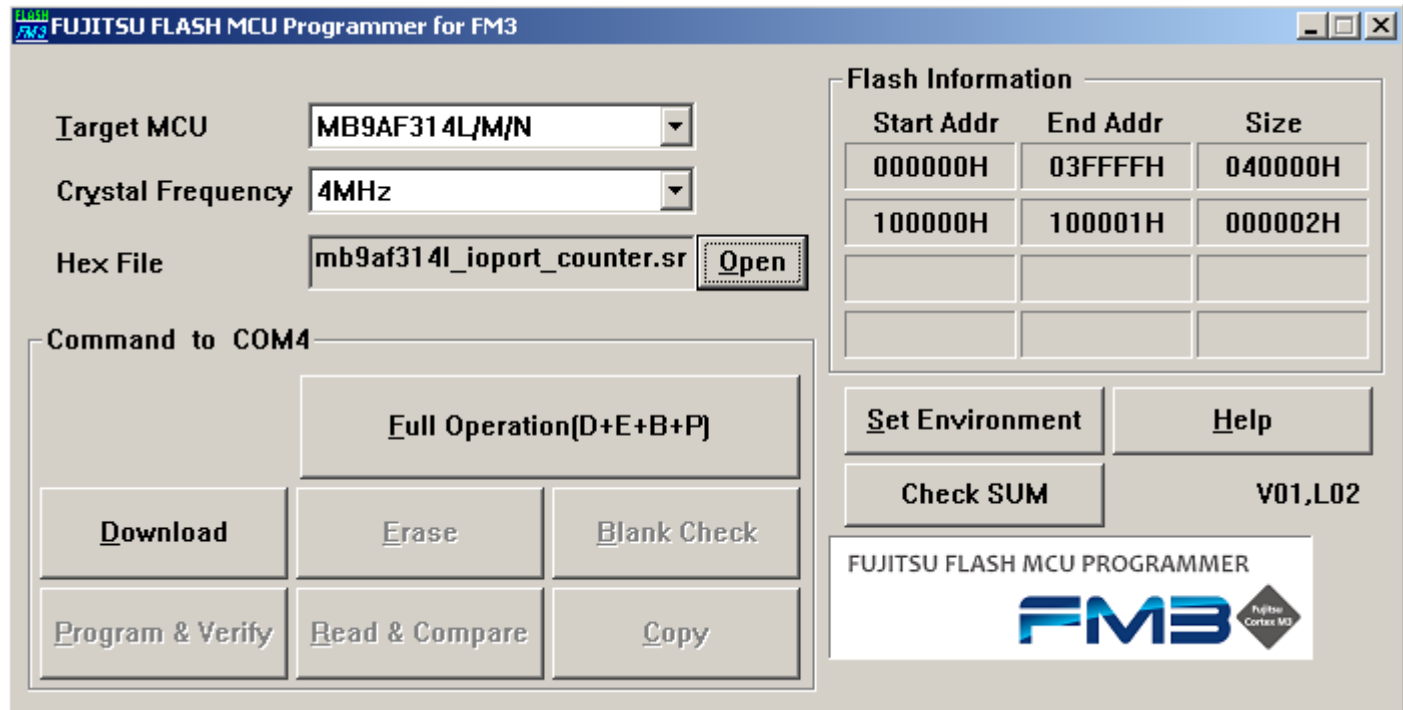   - Use the FLASH USB DIRECT Programmer
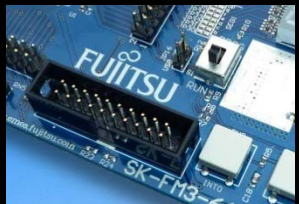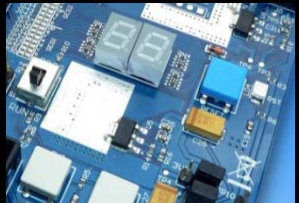
FUJITSU FLASH MCU Programmer for UART Programming

- **FUJITSU FLASH MCU Programmer**
  - Free of charge, no registration required
  - Windows based programming tool for FM3 Fujitsu microcontroller
  - Uses PC serial port COMx (incl. virtual COM port: USB-to-RS232)
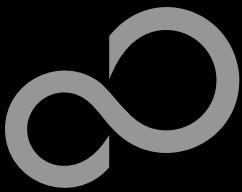 - Start installation

Program Download

- **Start the FUJITSU FLASH MCU Programmer**
- **Select the target microcontroller MB9AF314**
- **Select the crystal frequency (4 MHz)**
- **Choose the software example from the example 'exe'-folder**
  (e.g. Examples\mb9af314l_ioport_counter-v12\example\IAR\output\release\exe\
  mb9af314l_ioport_counter.srec)
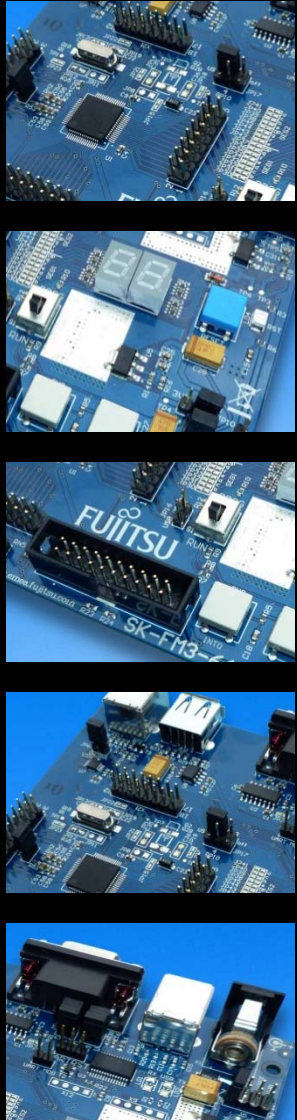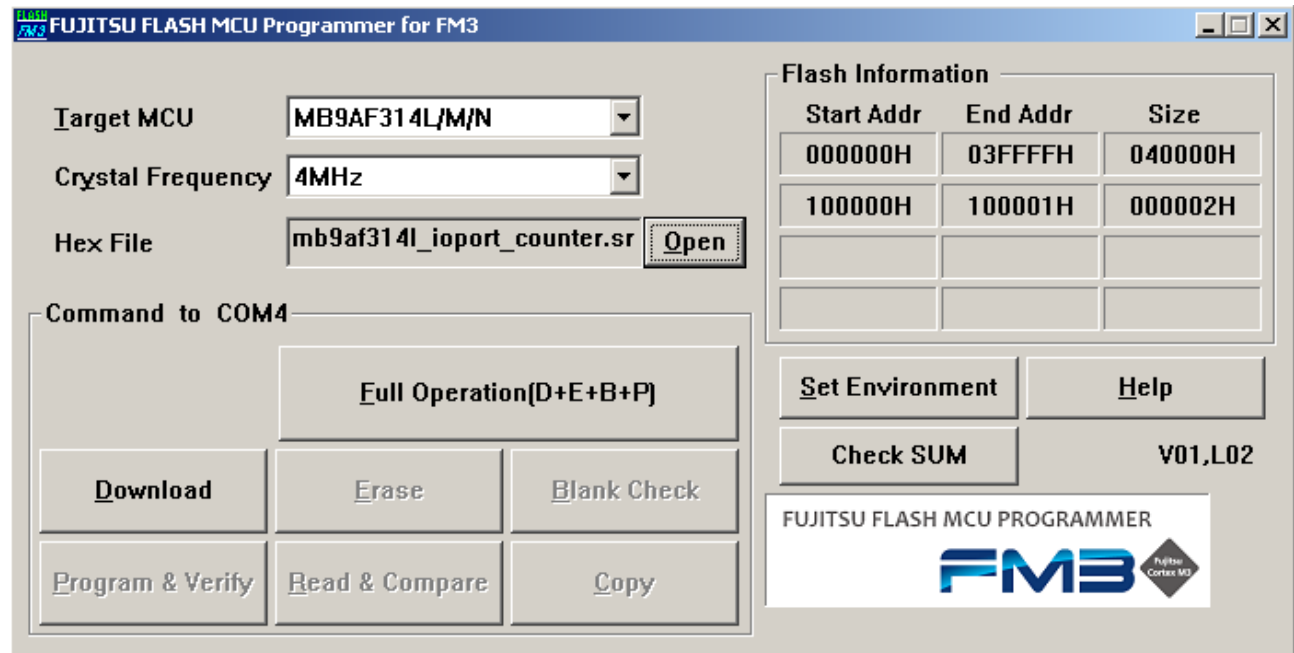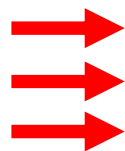
Program Download

■ **Connect to the PC**

- Connect UART0 with RS232 (X4) or with the USB interface X5
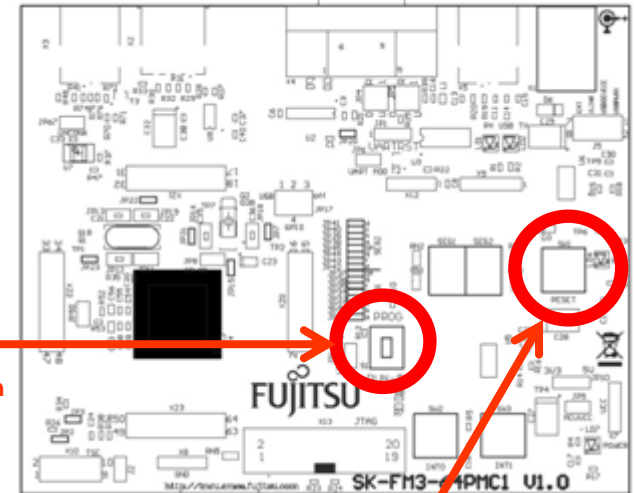- Select COM port (‚Set Environment')

■ **Open JP16**

■ **Set switch S1 to position ‚PROG'**

■ **Press ‚Reset'**

■ **Start ‚Full Operation'**

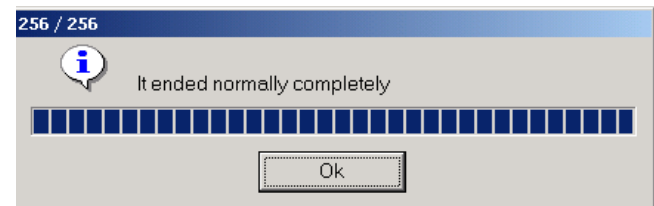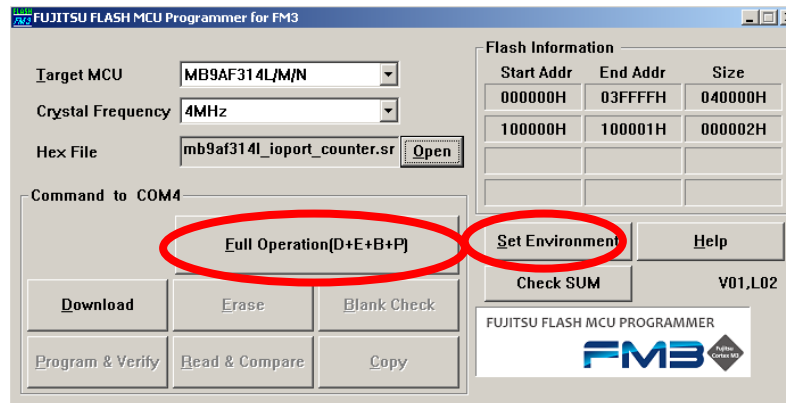**(see JP4, JP5 jumper settings)**

RS232   USB port

S1: Mode selection

PROG: Set switch to position ‚PROG' in order to select the program-mode

Keybutton ‚RESET'

FUJITSU FLASH MCU Programmer for FM3

Target MCU	MB9AF314L/M/N
Crystal Frequency	4MHz
Hex File	mb9af314l_ioport_counter.sr Open

Command to COM4

Full Operation(D+E+B+P)   **Set Environment**   Help

Download   Erase   Blank Check

Program & Verify   Read & Compare   Copy

Flash Information

Start Addr	End Addr	Size
000000H	03FFFFH	040000H
100000H	100001H	000002H

Check SUM   V01,L02

FUJITSU FLASH MCU PROGRAMMER
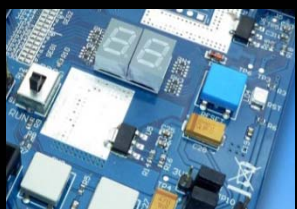
FM3

256 / 256

It ended normally completely

Ok

28

Program Download

- **Close the FUJITSU FLASH MCU Programmer**
- **Set switch S1 to position ‚RUN'**
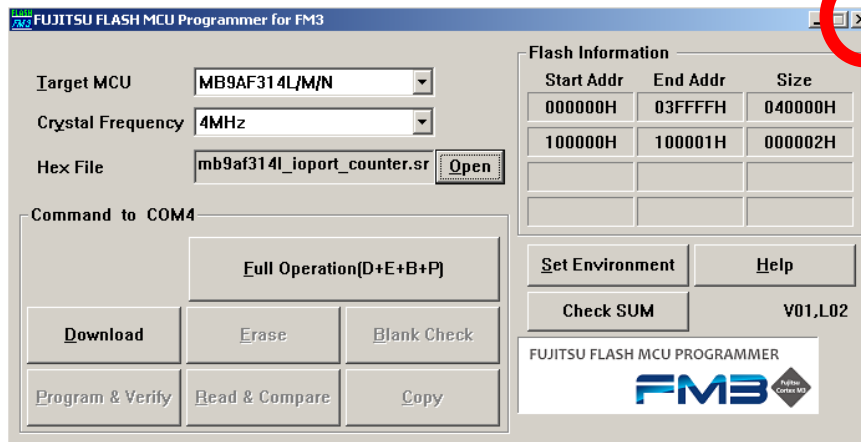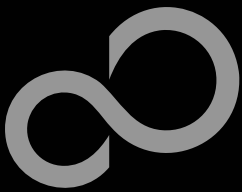- **Press ‚Reset'**

S1: Mode selection

RUN: Set switch to position ‚RUN'
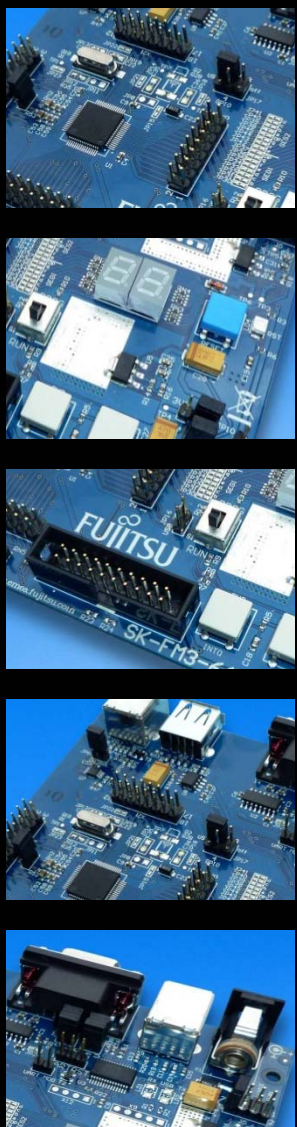in order to select the run-mode
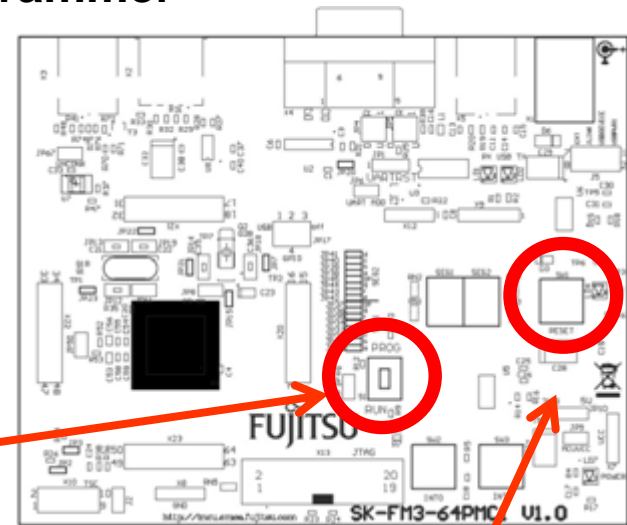
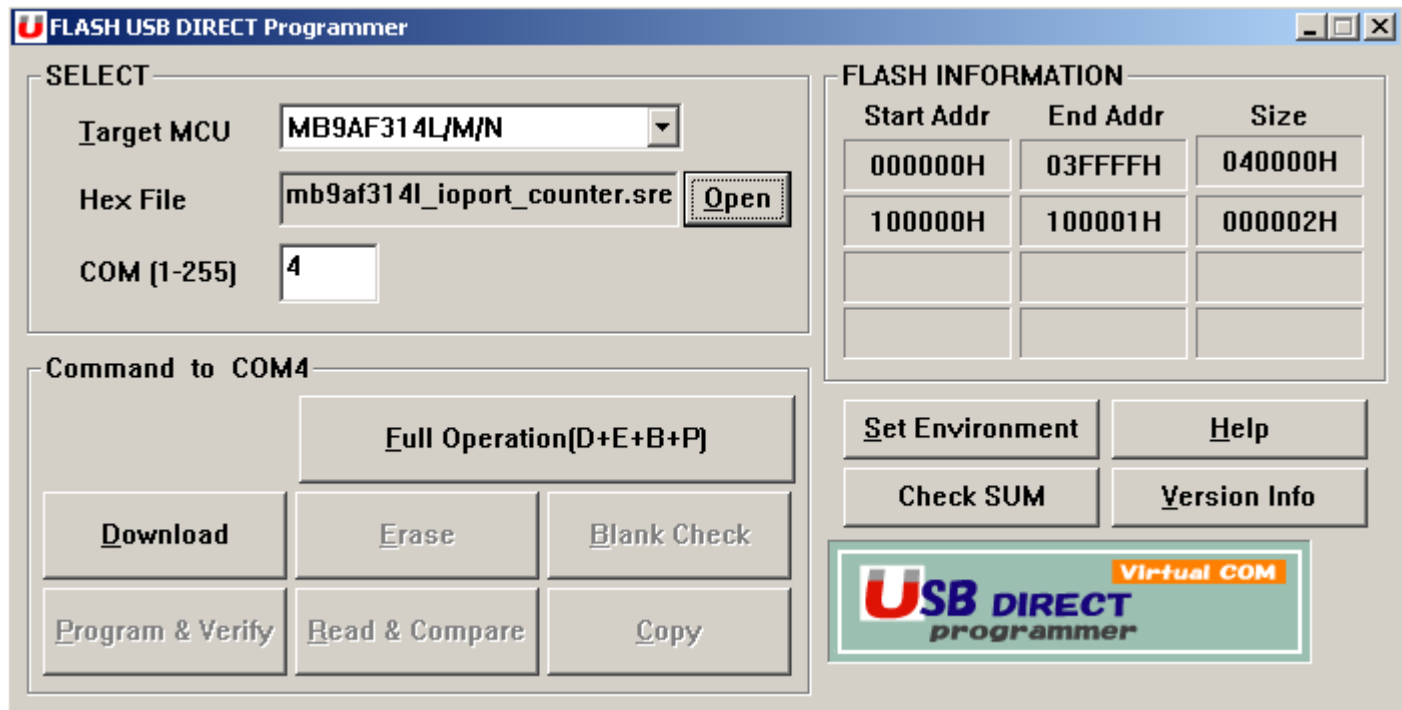

Keybutton ‚RESET'

Close the FUJITSU FLASH MCU Programmer

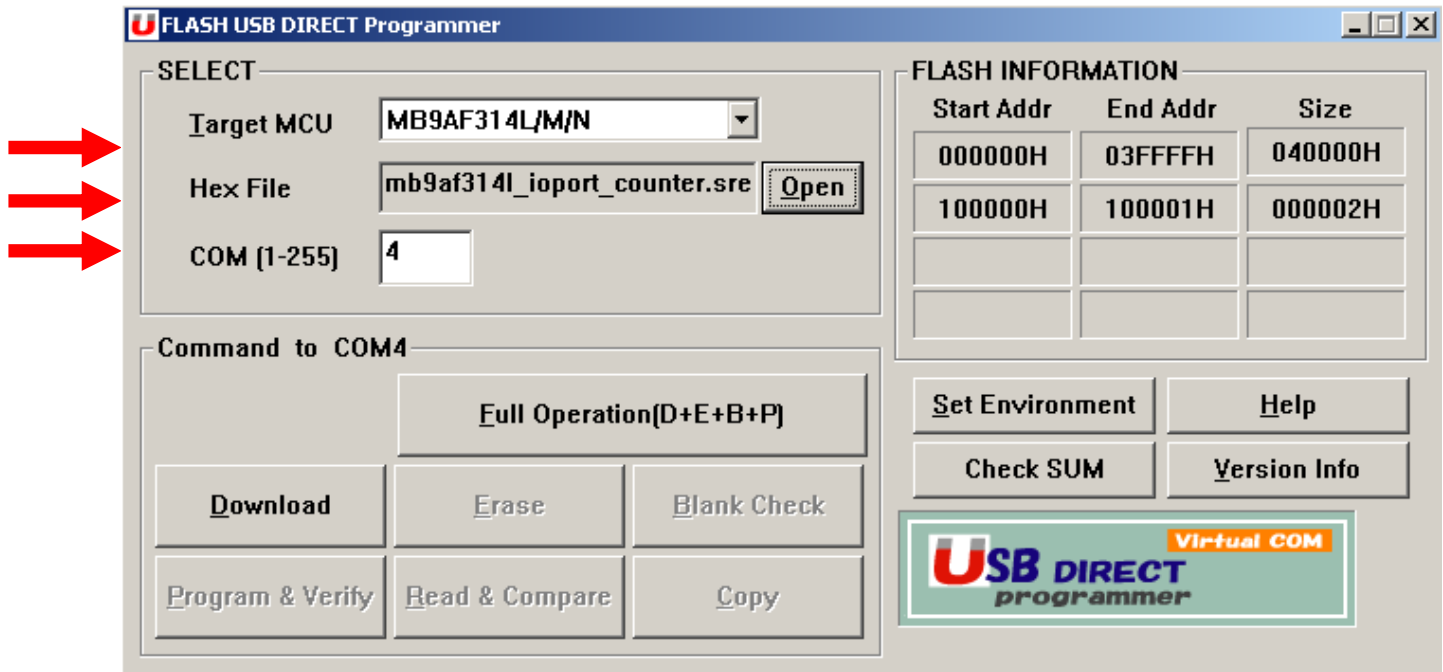# FLASH USB DIRECT Programmer for USB Direct Programming
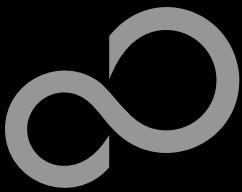
■ **FLASH USB DIRECT Programmer**

- Windows based programming tool for FM3 Fujitsu microcontroller
- Uses direct USB connection (via X3)
- Start installation

Program Download

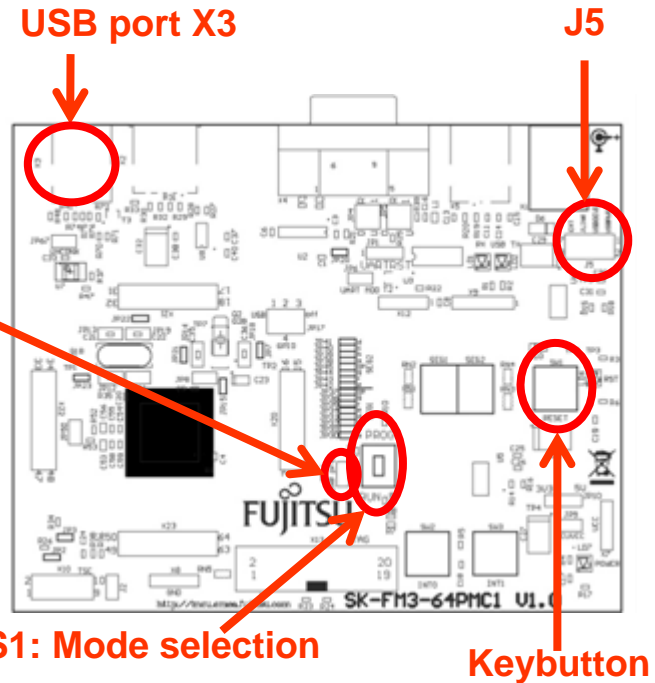■ **Start the FLASH USB DIRECT Programmer**

■ **Select the target microcontroller (MB9AF314)**

■ **Choose the software example from the example 'exe'-folder**
(e.g. .\ *Examples\mb9af314l_ioport_counter-v12\example\IAR\mb9af314l_ioport_counter.srec*)

Program Download

- ■ **Select the MCU power supply (J5)**
- ■ **Close JP16**
- ■ **Set switch S1 to position ‚PROG'**
- ■ **Connect USB port X3 with the PC**
- ■ **Install the USB driver**
  - The driver is in the subfolder ‚driver' of *installed* programmer
  - E.g.: C:\FUJITSU USB DIRECT Programmer
- ■ **Select the COM port**
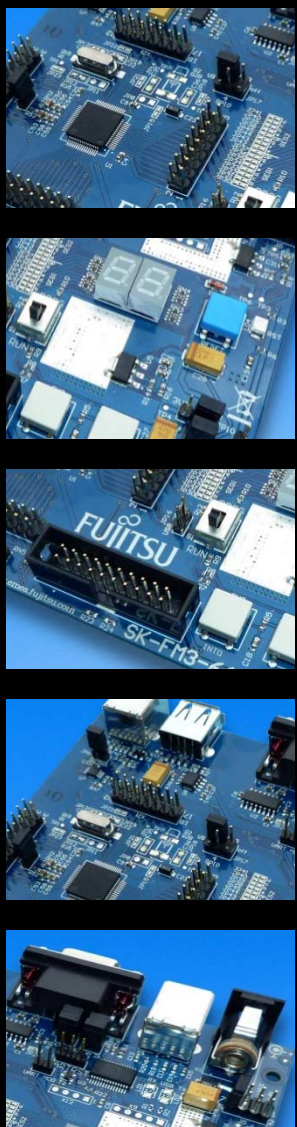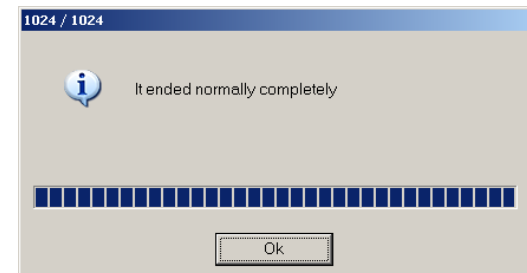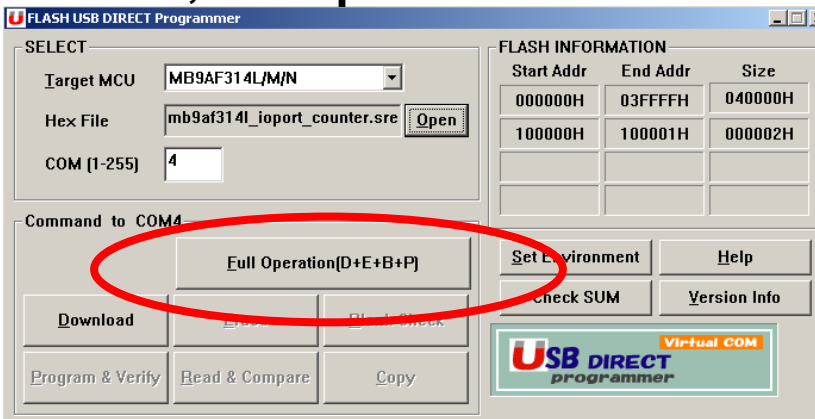- ■ **Press ‚Reset'**
- ■ **Start ‚Full Operation'**

USB port X3 **J5**

JP16

S1: Mode selection **Keybutton**

PROG: Set switch to position ‚PROG' in order to select the program-mode

‚RESET'

SK-FM3-64PMC1 V1.0

FLASH USB DIRECT Programmer

SELECT
Target MCU: MB9AF314L/M/N
Hex File: mb9af314l_ioport_counter.sre Open
COM (1-255): 4

Command to COM4
Full Operation(D+E+B+P)
Download
Program & Verify   Read & Compare   Copy

FLASH INFORMATION

Start Addr	End Addr	Size
000000H	03FFFFH	040000H
100000H	100001H	000002H

Set Environment   Help
Check SUM   Version Info

USB DIRECT programmer   Virtual COM

1024 / 1024

ⓘ It ended normally completely

Ok

Program Download

- **Close the FLASH USB DIRECT Programmer**
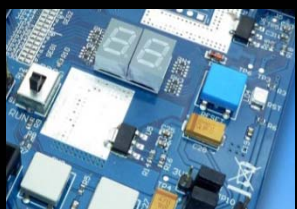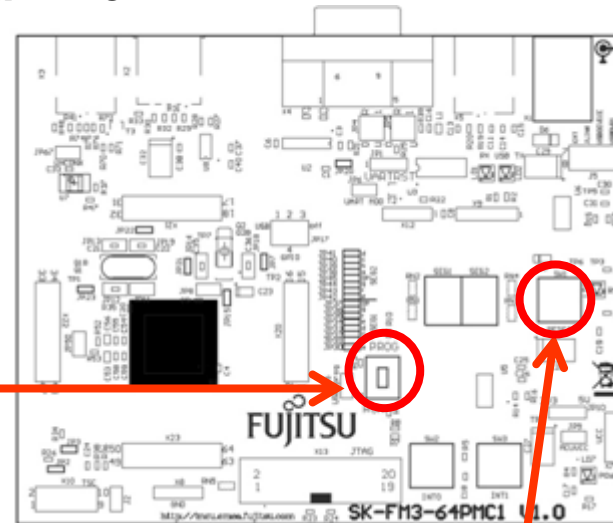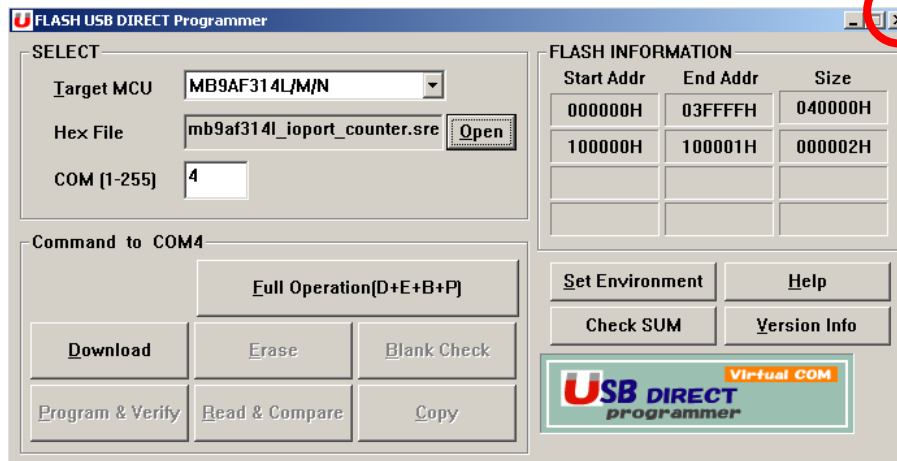- **Set switch S1 to position ‚RUN'**
- **Press ‚Reset'**

S1: Mode selection

RUN: Set switch to position ‚RUN'
in order to select the run-mode

Keybutton ‚RESET'

Close the FLASH USB DIRECT Programmer

FLASH USB DIRECT Programmer

SELECT

Target MCU	MB9AF314L/M/N
Hex File	mb9af314l_ioport_counter.sre Open
COM (1-255)	4

FLASH INFORMATION

Start Addr	End Addr	Size
000000H	03FFFFH	040000H
100000H	100001H	000002H

Command to COM4

Full Operation(D+E+B+P)

Download   Erase   Blank Check

Program & Verify   Read & Compare   Copy

Set Environment   Help

Check SUM   Version Info

USB DIRECT programmer   Virtual COM

33

Debugging via JTAG

- **The MB9AF314L microcontroller offers a JTAG-Interface that is supported by SK-FM3-64PMC1.**

  - Debug your program with a JTAG-Adapter e.g. Segger J-Link
  - Connect the J-Link to the JTAG-Interface routed to the 20-Pin-Header on X13 and to the USB-Port of your PC
  - Use IAR-Embedded Workbench to debug your program
  - If the JTAG-Adaper allows powering the target, then jumper J5 can be set as follows:
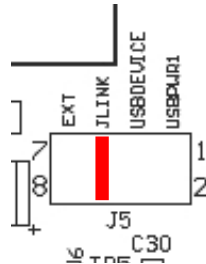
Debugging via TRACE

- **The MB9AF314LPMC microcontroller offers an ETM (Embedded-Trace-Macrocell) that is supported by SK-FM3-64PMC1**
    - An optional JTAG-Adapter supporting trace features is required e.g. **ULINK*pro*** from KEIL
    - The ETM is connected to the board with the JTAG adapter to the 20-Pin-Header X13 (JTAG)
    - Use e.g. KEIL µVision to trace your program
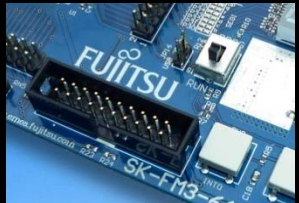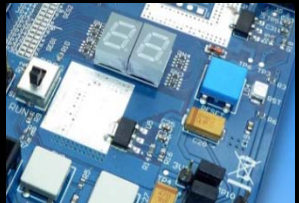
IAR-Embedded Workbench / KEIL µVision IDE and Debugger

- **Installation**
- **Getting Started**
- **Open Project**
- **Build Project**
- **Debug Project**
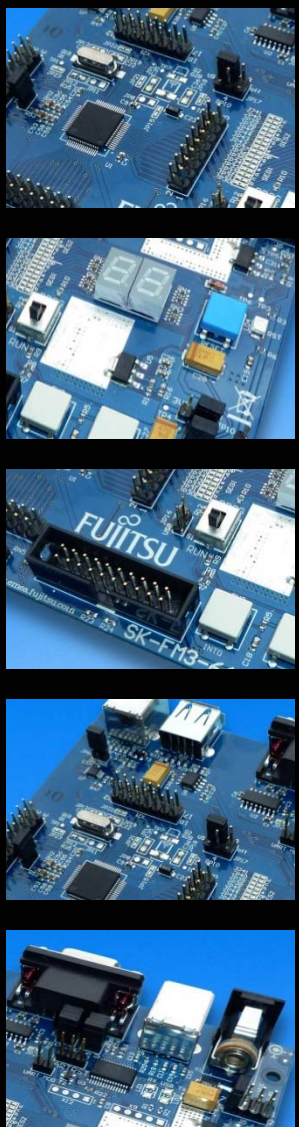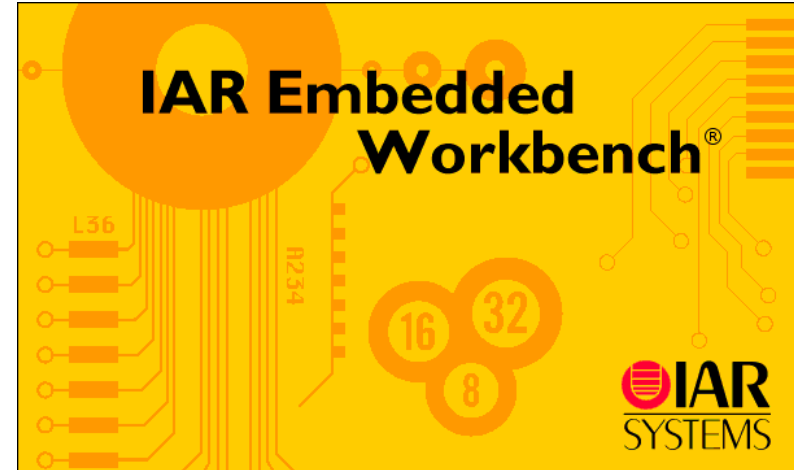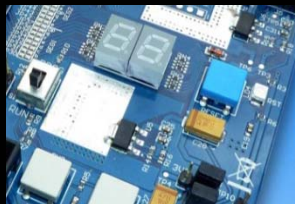
IAR Workbench Getting Started

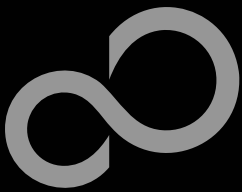- **Install EWARM from IAR-CD or download latest version from IAR Website**
  - EWARM 30-day Evaluation Version
    - http://supp.iar.com/Download/SW/?item=EWARM-EVAL
  - EWARM 32K Kickstart Version
    - http://supp.iar.com/Download/SW/?item=EWARM-KS32

- **Install J-Link Debugger (SK-FM3-64PMC1-JLINK)**
  - Connect J-Link to USB Port and follow installation instructions
    - Drivers:
      <Installation_Path>\IAR Systems\Embedded Workbench x.y\arm\drivers\Jlink\ x64 or *x86*
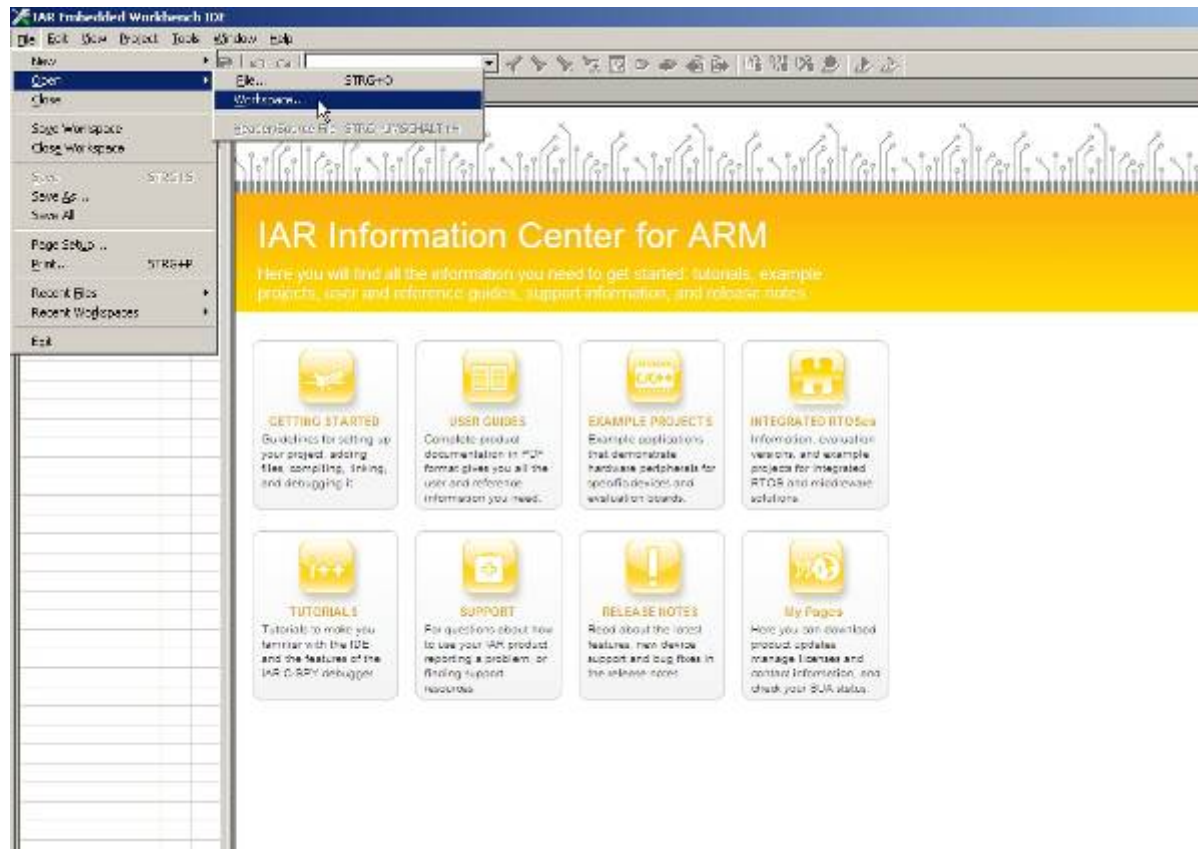
- **Start EWARM Workbench**

IAR Workbench Getting Started

- **Choose *File → Open → Workspace***

- **Select e.g.\ *Examples\mb9af314l_ioport_counter-v12\example\IAR\mb9af314l_ioport_counter.eww***
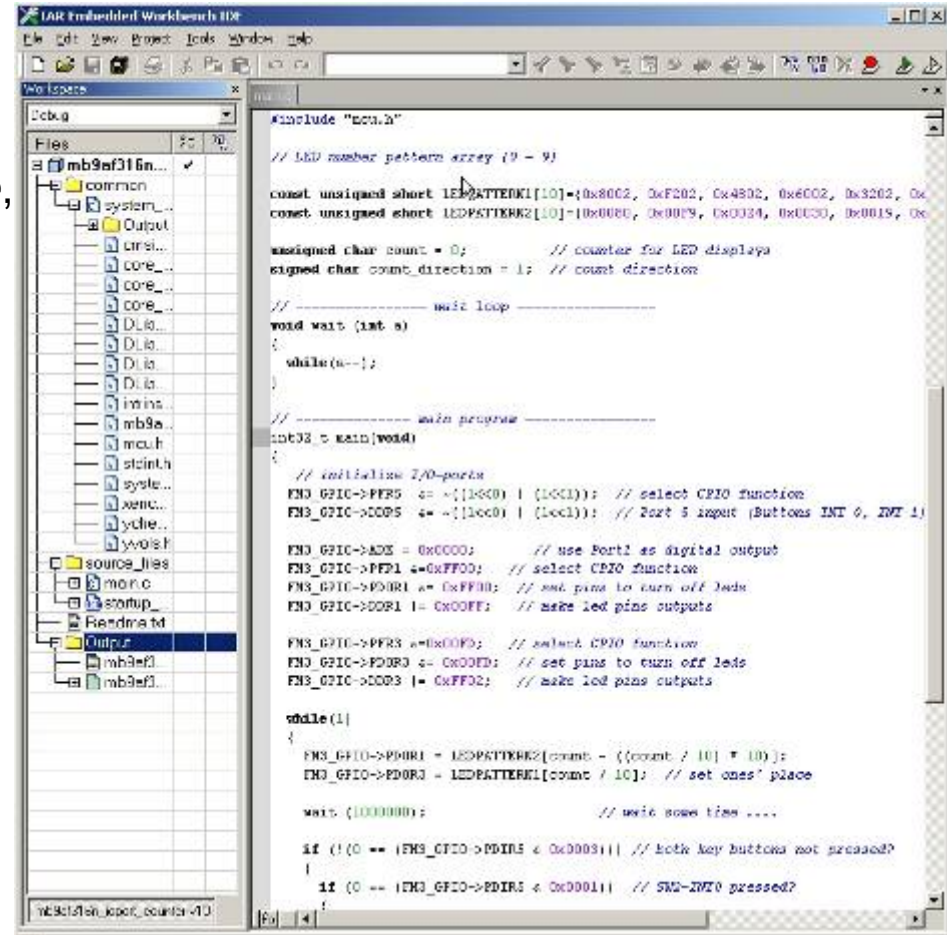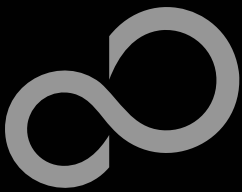
IAR Workbench – Main Window
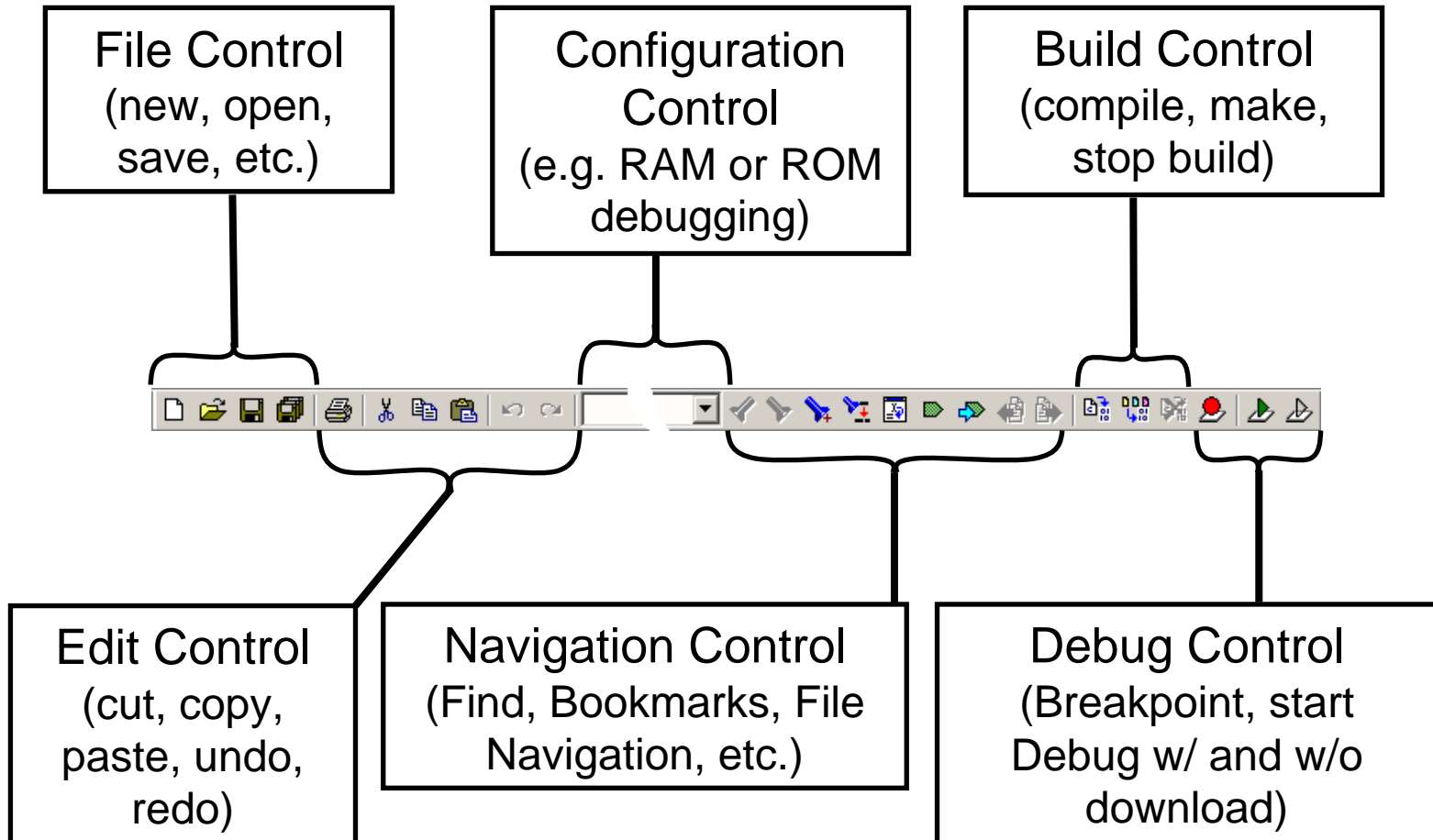
■ IAR Workbench

- ● Workspace on left side of Workbench window
  - Choose:
    View→Workspace, if hidden
  - Open main.c on source files.
- ● Source files on right side of Workbench window as tabbed windows

- ● Project can alternatively be opened by:
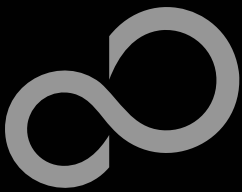 *File→Open→Workspace→*.eww*

IAR Workbench – Menu Bar

- **Menu Bar**

File Control (new, open, save, etc.)	Configuration Control (e.g. RAM or ROM debugging)	Build Control (compile, make, stop build)

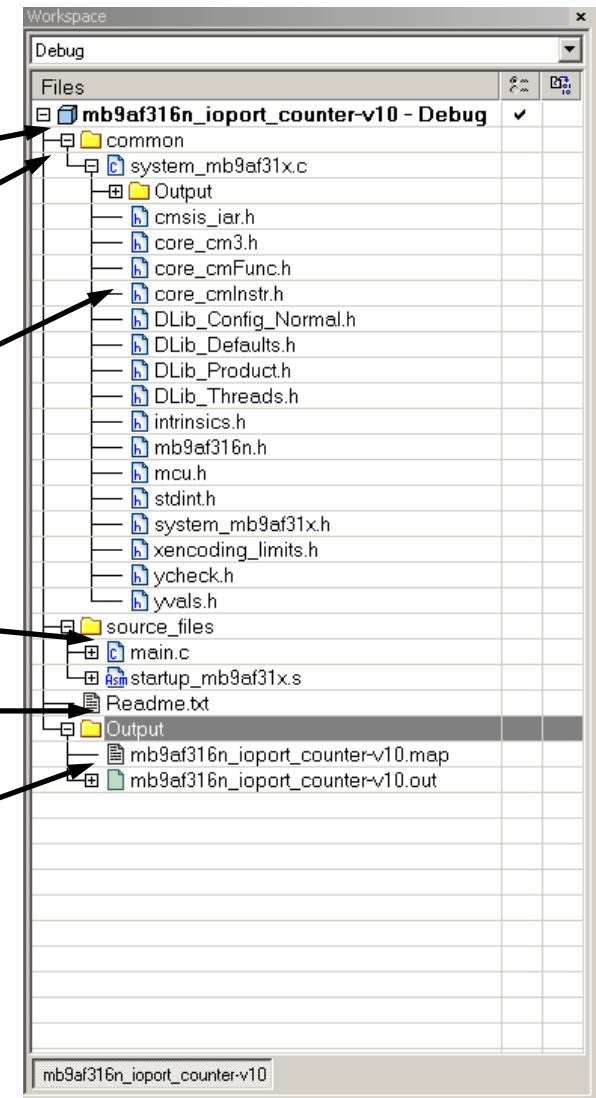| Edit Control (cut, copy, paste, undo, redo)	Navigation Control (Find, Bookmarks, File Navigation, etc.)	Debug Control (Breakpoint, start Debug w/ and w/o download)

IAR Workbench – Workspace
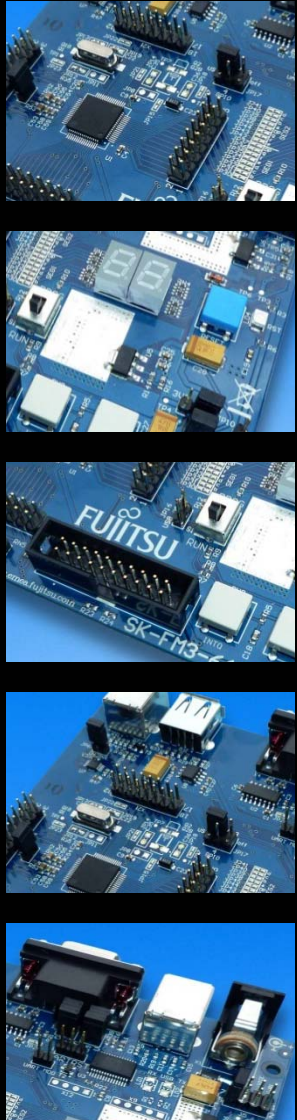
Project Name

Sub Folder common

Includes

Main

Project Description

Project Built Output

Workspace

Debug

Files
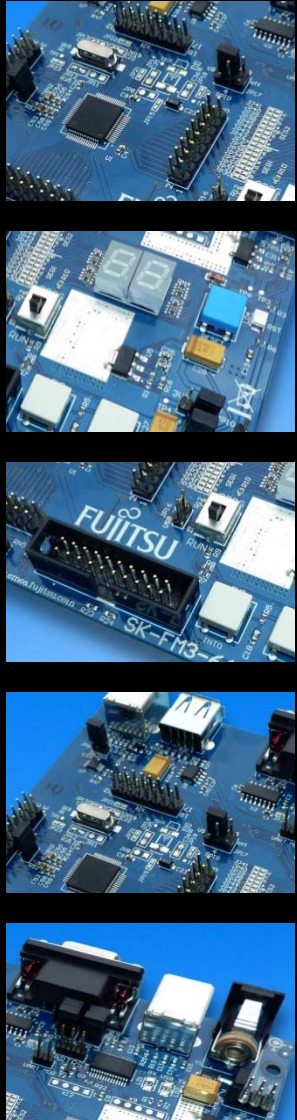- mb9af316n_ioport_counter-v10 - Debug
  - common
    - system_mb9af31x.c
      - Output
      - cmsis_iar.h
      - core_cm3.h
      - core_cmFunc.h
      - core_cmInstr.h
      - DLib_Config_Normal.h
      - DLib_Defaults.h
      - DLib_Product.h
      - DLib_Threads.h
      - intrinsics.h
      - mb9af316n.h
      - mcu.h
      - stdint.h
      - system_mb9af31x.h
      - xencoding_limits.h
      - ycheck.h
      - yvals.h
  - source_files
    - main.c
    - startup_mb9af31x.s
  - Readme.txt
  - Output
    - mb9af316n_ioport_counter-v10.map
    - mb9af316n_ioport_counter-v10.out
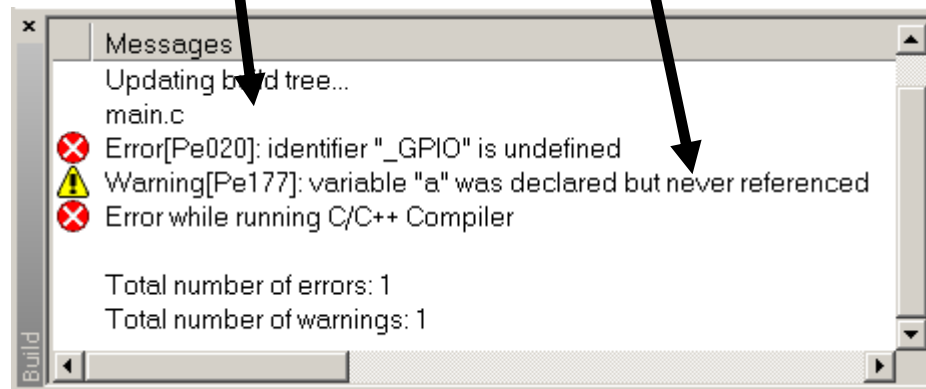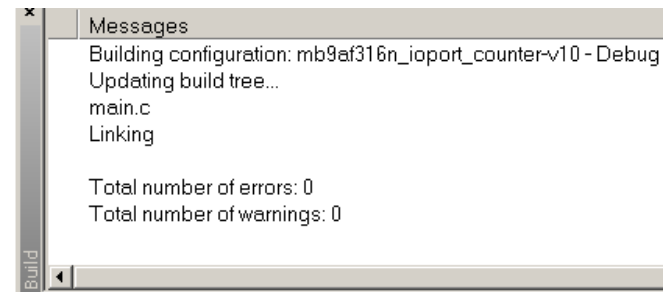
mb9af316n_ioport_counter-v10

41

IAR Workbench – Making Project

■ Making the Project

- ● Use Make-Icon (🔳), <F7> or
  Menu: *Project→Make*
- ● Check for no errors in Output window
  below

- ● Build errors are indicated by ⚠ or ⊗
  In Output window and Source view

Messages
Building configuration: mb9af316n_ioport_counter-v10 - Debug
Updating build tree...
main.c
Linking

Total number of errors: 0
Total number of warnings: 0

Messages
Updating build tree...
main.c
⊗ Error[Pe020]: identifier "_GPIO" is undefined
⚠ Warning[Pe177]: variable "a" was declared but never referenced
⊗ Error while running C/C++ Compiler

Total number of errors: 1
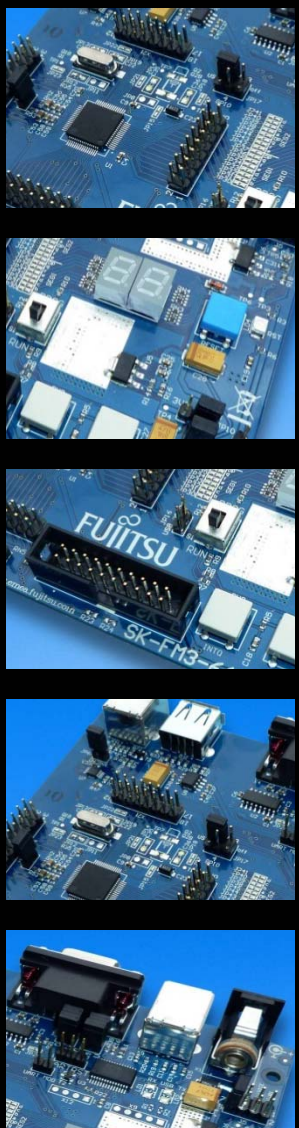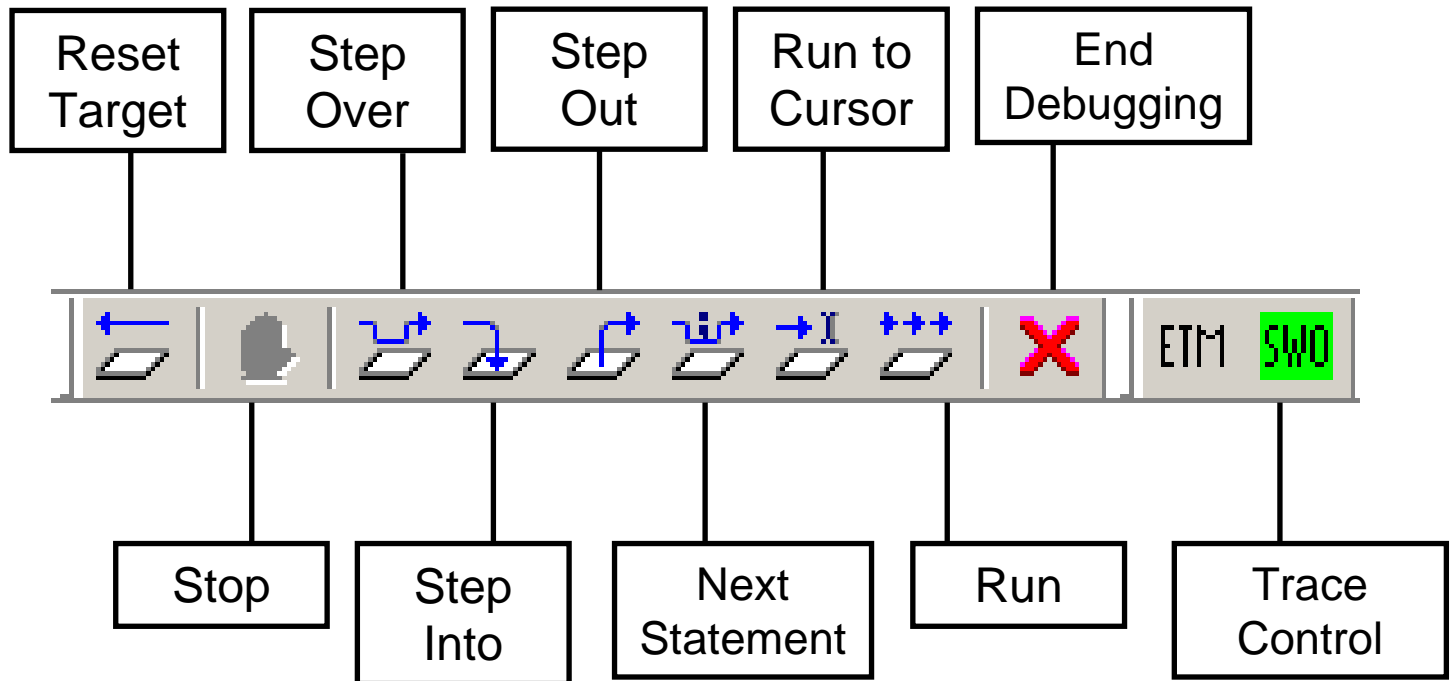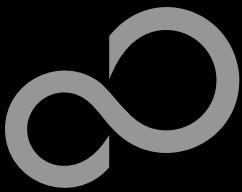Total number of warnings: 1

IAR Workbench – Download to Target

■ **Download to Target and Start Debugging**

- Use ⊳ Icon, <Ctrl>-D, or *Project→Download and Debug*
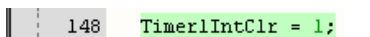- A new menu bar will occur on sucessful connection to target

Reset Target	Step Over	Step Out	Run to Cursor	End Debugging

Stop	Step Into	Next Statement	Run	Trace Control

IAR Workbench – Debug (1)
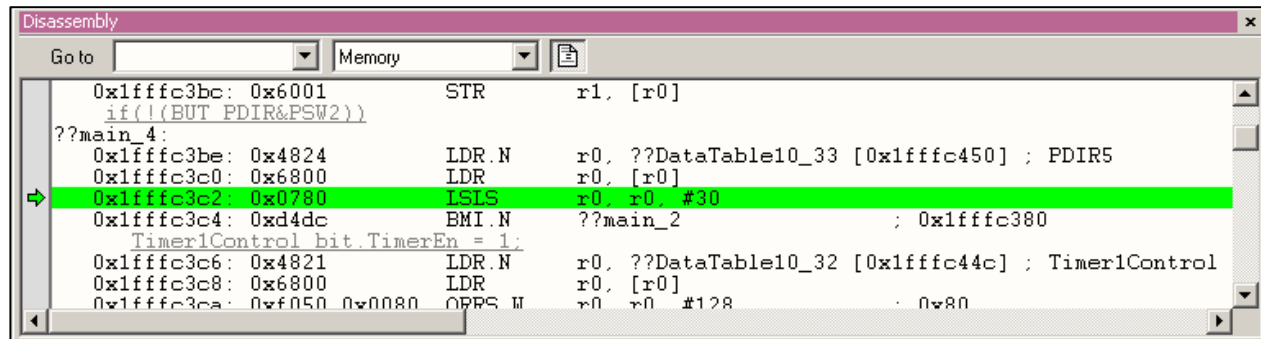
■ **Source Window**

- ● The Source windows do not change contents but get additional information

  - • Current line (PC):

    | → | 165 | `CSW_TMR_bit.MOWT = 9;` |

  - • Halted on Breakpoint:

    | ⊙ | 172 | `PSW_TMR_bit.POWT = 2;` |

  - • Halted on Data break (example):

    | | 148 | `Timer1IntClr = 1;` |

■ **Disassembly Window**

- ● Shows 'pure' disassebly view
- ● Shows mixed mode view


```
Disassembly                                                                              ×
Go to [          ▼] [Memory        ▼] 🗋
       0x1fffc3bc: 0x6001         STR       r1, [r0]                                     ▲
         if(!(BUT_PDIR&PSW2))
??main_4:
       0x1fffc3be: 0x4824         LDR.N     r0, ??DataTable10_33 [0x1fffc450] ; PDIR5
       0x1fffc3c0: 0x6800         LDR       r0, [r0]
  →    0x1fffc3c2: 0x0780         LSLS      r0, r0, #30
       0x1fffc3c4: 0xd4dc         BMI.N     ??main_2                    ; 0x1fffc380
          Timer1Control_bit.TimerEn = 1;
       0x1fffc3c6: 0x4821         LDR.N     r0, ??DataTable10_32 [0x1fffc44c] ; Timer1Control
       0x1fffc3c8: 0x6800         LDR       r0, [r0]
       0x1fffc3ca: 0xf050 0x0080  ORRS.W    r0, r0, #128                ; 0x80           ▼
◄                                                                                       ►
```

IAR Workbench – Debug (2)

■ **Watch Window**

- ● Watch
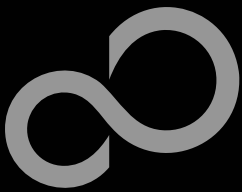 - • Expressions/Variables have to be added by user and are updated by Halt/Breakpoint

Watch 1				
Expression	Value	Location	Type	
count	'.' (0x00)	0x20000004	unsigned char	
<click to ...				

- ● Quick Watch
  - • The Quick watch allows the user to calculate and recalculate expressions even with variables

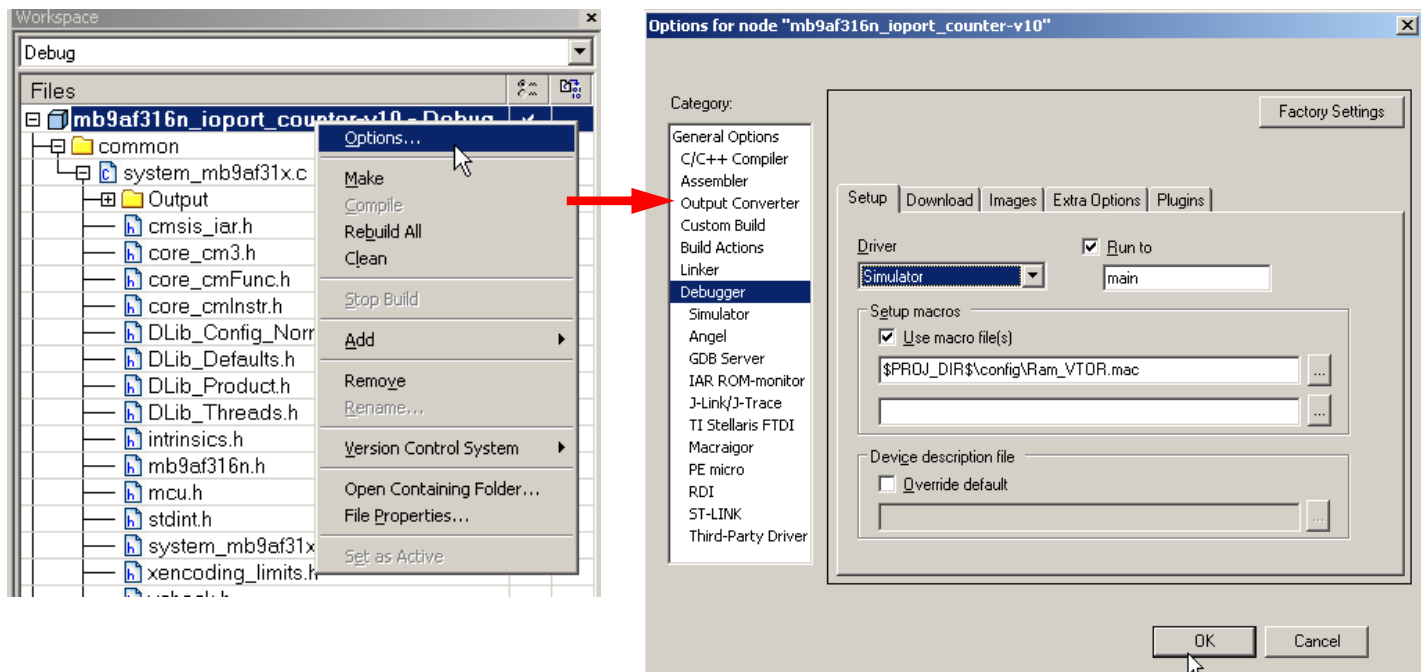| Quick Watch				
count+55/ 0xbc				
Expression	Value	Location	Type	
count+55...	99		int	
Watch 1 **Quick Watch**				

  - • The drop down menu memorizes the last typed contents

IAR Workbench – Simulator

- **Simulator**
    - Mark Project File in Workspace
    - Choose *Project→Options*
    - Choose Simulator in Debugger Setup
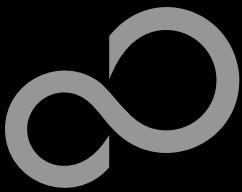   - Start Simulator with usual ![icon] Icon

KEIL µVision IDE and Debugger Getting Started

- **Install µVision from KEIL-CD or download latest version from KEIL Website**
  - Evalualtion Version
    - https://www.keil.com/demo/eval/arm.htm
    - Registration required

- **Install ULINK-ME**
  - Special installation is not needed, because ULINK-ME acts as a USB Human Interface Device (HID) and thus needs no extra USB driver

- **Install ULINK Pro (optional)**
  - ULINK Pro needs an own dedicated USB driver located in: *<Installation Path>\KEIL\ARM\ULINK*
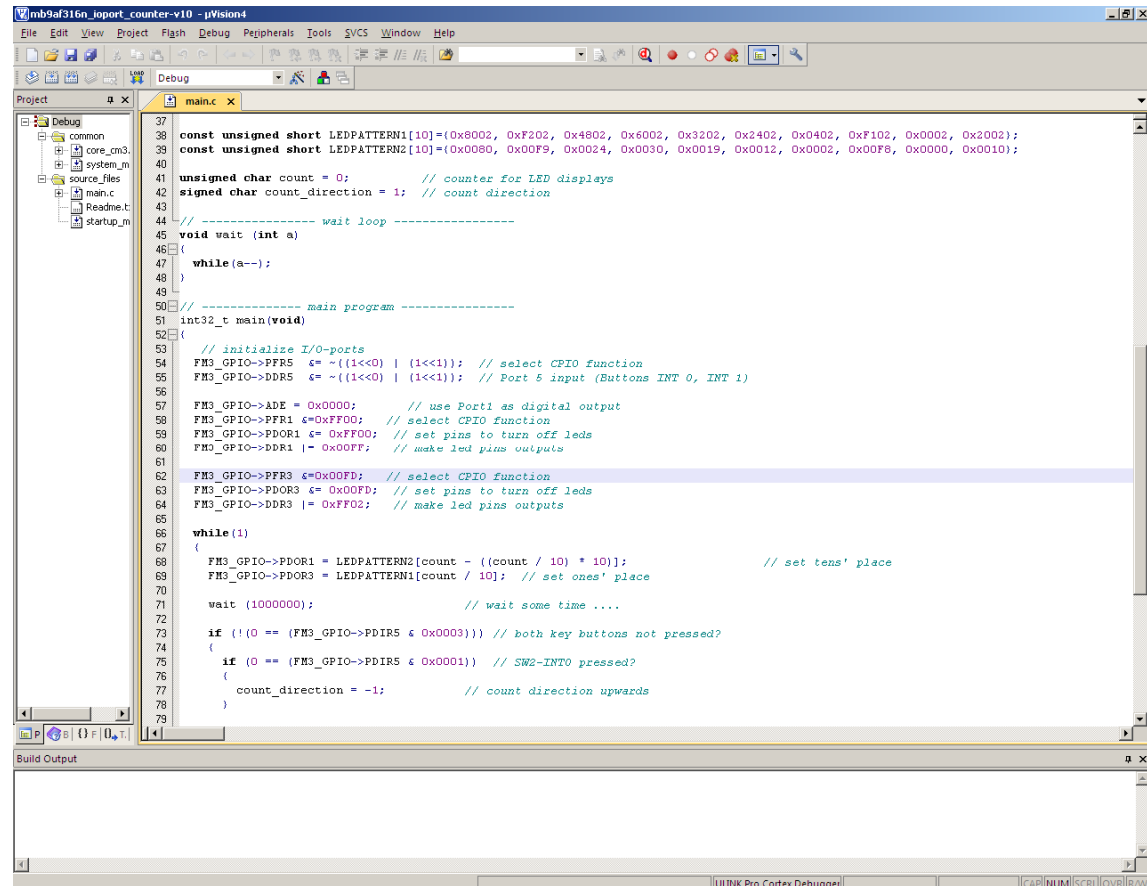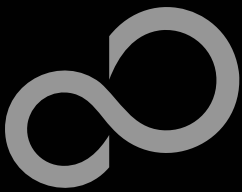
- **Start µVision**
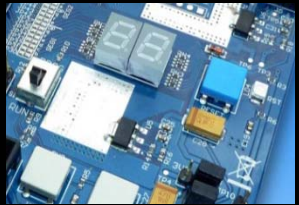
KEIL µVision – Getting Started

■ **Choose Menu:** *Project→Open Project...*

- Browse to: *Examples\mb9af314l_ioport_counter-v10\example*\ARM\
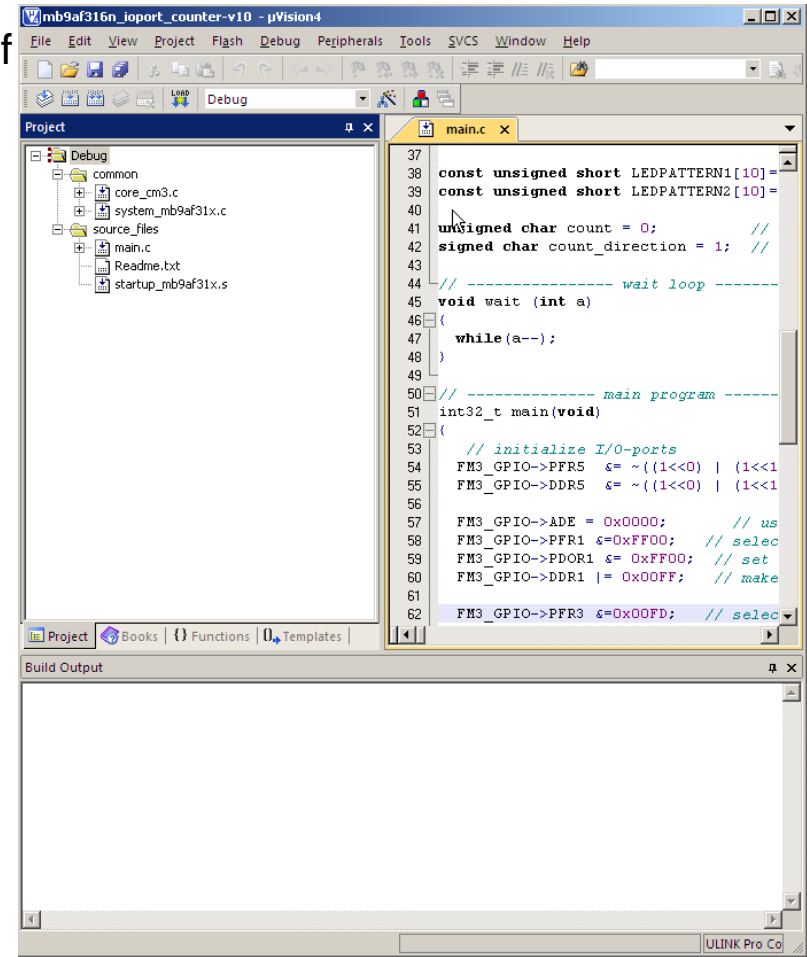- Choose *mb9af314l_ioport_counter-v10.uvproj*

KEIL µVision – Main Window

- **KEIL µVision**
  - Project window on left side of IDE window
    - Choose:
      View→Project Window
      if hidden
  - Source files on left side of IDE window as tabbed windows
  - Output window on bottom side of IDE window

KEIL µVision – Menu Bars (1)

Menu Bar 1

- Can be moved in bar window area or set floating

File Control (new, open, save, etc.)	Navigation Control (Bookmarks + search, etc.) (Text search, search in files, etc.)	Project Window View

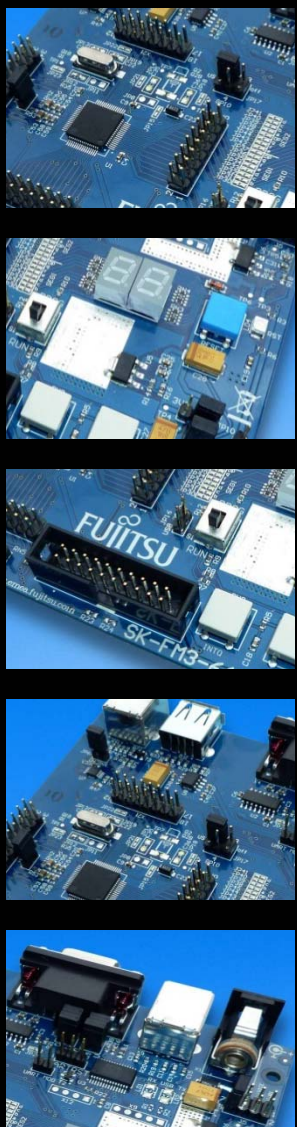| Edit Control (cut, copy, paste, etc) (indention, commenting)	Debug Control (Start/Stop Debug Session, set/remove/disable breakpoints, remove/disable all breakpoints)	IDE Configuration
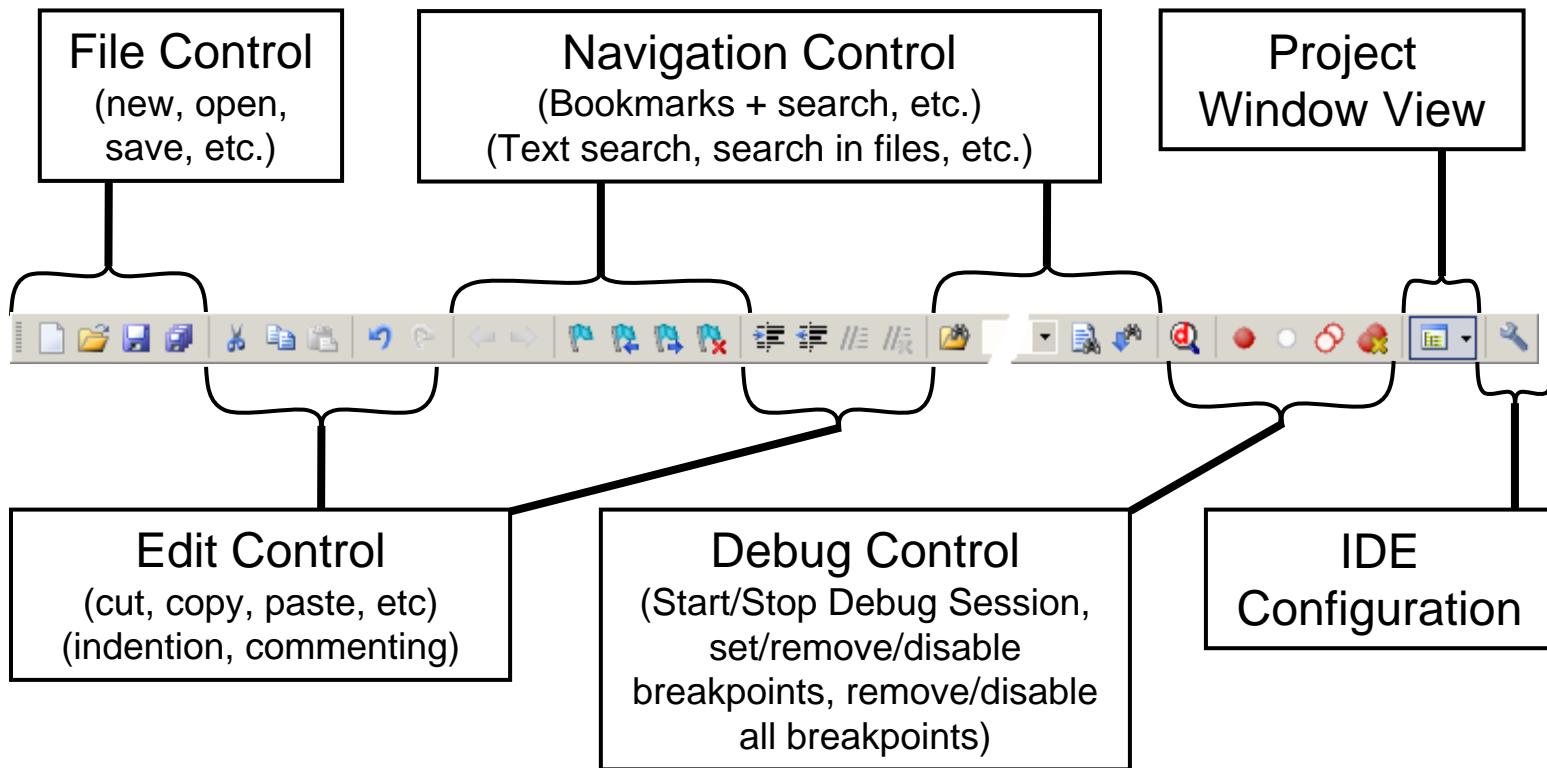
KEIL µVision – Menu Bars (2)

■ Menu Bar 2

- ● Can be moved in bar window area or set floating

Build Control
(Compile [Translate],
Build, Rebuild, etc.)

Configuration
Control
(e.g. Debug or
Release)

Manage Books,
File Extensions,
Environment

`Debug`

Download
to Target

Target
Options

Manage
Multi-
Project
Workspace

KEIL µVision – Project Window

Debug or Release

common code Subfolder

commmon Code Source and HeaderFiles

Main Project Code Subfolder

Main Project Code Source and Header Files

Project Description

Project

- Debug
  - common
    - core_cm3.c
      - stdint.h
    - system_mb9af31x.c
      - stdint.h
      - mcu.h
      - mb9af316n.h
      - core_cm3.h
      - system_mb9af31x.h
  - source_files
    - main.c
      - mcu.h
      - mb9af316n.h
      - core_cm3.h
      - stdint.h
      - system_mb9af31x.h
    - Readme.txt
    - startup_mb9af31x.s

[ ]→Tem... | {} Func..| Books | Proj...

KEIL µVision – Making Project

■ Making the Project

- Use Rebuild Icon
  ( ) or
  Project→Rebuild all target files

- Check for no errors in Output window below

Build Output
```
Build target 'Release'
compiling core_cm3.c...
compiling system_mb9af31x.c...
compiling main.c...
assembling startup_mb9af31x.s...
linking...
Program Size: Code=1132 RO-data=328 RW-data=8 ZI-data=608
FromELF: creating hex file...
".\output\release\mb9af316n_ioport_counter-v10.axf" - 0 Error(s), 0 Warning(s).
```
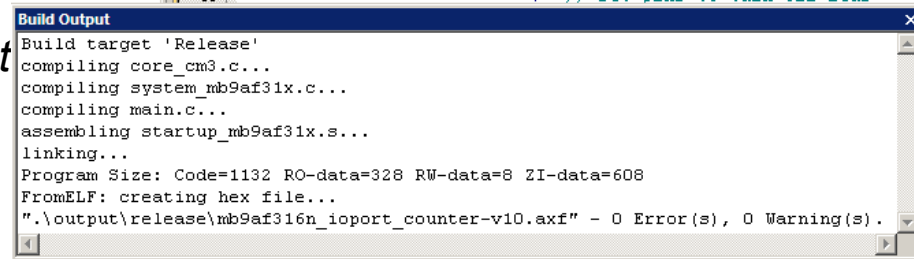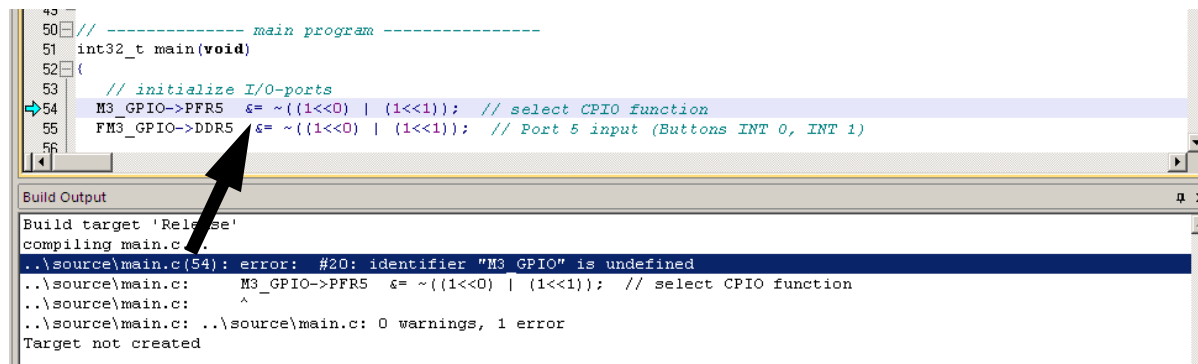
- Build errors are shown in Output window.
  - Can be double-clicked by showing the source line with a blue arrow

```
 50 // -------------- main program ----------------
 51  int32_t main(void)
 52  {
 53      // initialize I/O-ports
⇨54      M3_GPIO->PFR5  &= ~((1<<0) | (1<<1));  // select CPIO function
 55      FM3_GPIO->DDR5 &= ~((1<<0) | (1<<1));  // Port 5 input (Buttons INT 0, INT 1)
 56
```

Build Output
```
Build target 'Release'
compiling main.c...
..\source\main.c(54): error:  #20: identifier "M3_GPIO" is undefined
..\source\main.c:      M3_GPIO->PFR5  &= ~((1<<0) | (1<<1));  // select CPIO function
..\source\main.c:      ^
..\source\main.c: ..\source\main.c: 0 warnings, 1 error
Target not created
```
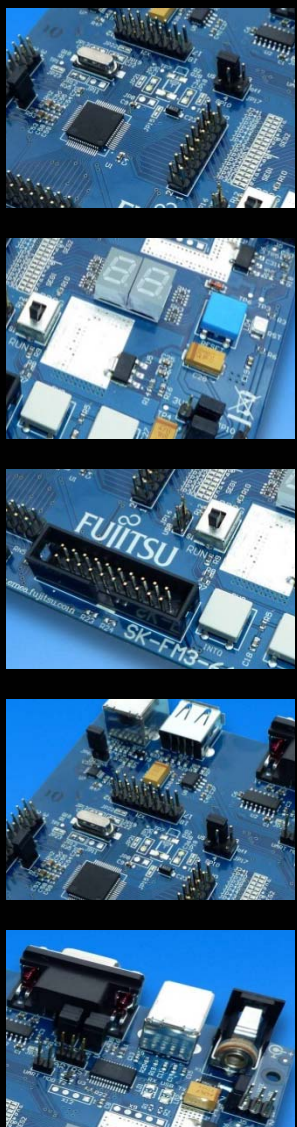
KEIL µVision – Debug (1)

■ Start Debugging

- Download to target first, when MCU Flash does not contain the current application openend and built in the IDE
  - Use Download Icon (🔽) or Menu: *Flash→Download*
- Start Debug Session
  - Use Start/Stop Debug Icon (🔍) or Menu: *Debug→Start/Stop Debug Session*
- Ending Debug Session
  - Use same button as for starting debug session
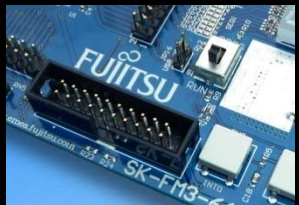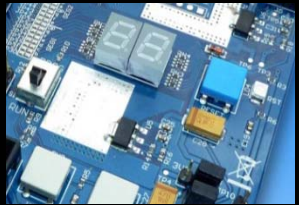
KEIL µVision – Debug (2)

■ **Debugging Icon Bar**

● During a Debug Session there will be visible a new icon bar

| Reset Target | Step Control (Step in, out, etc.) | Show Windows (Command, Disassembly, Symbols, Registers, Call Stack) | Tool Box (can be customized) |

| Start/ Stop Application | Show Source/Code Line of current PC | Show (multiple) Windows (Watch, Memory, Serial, Analysis, Trace, System Viewer) | Debug Restore Views |
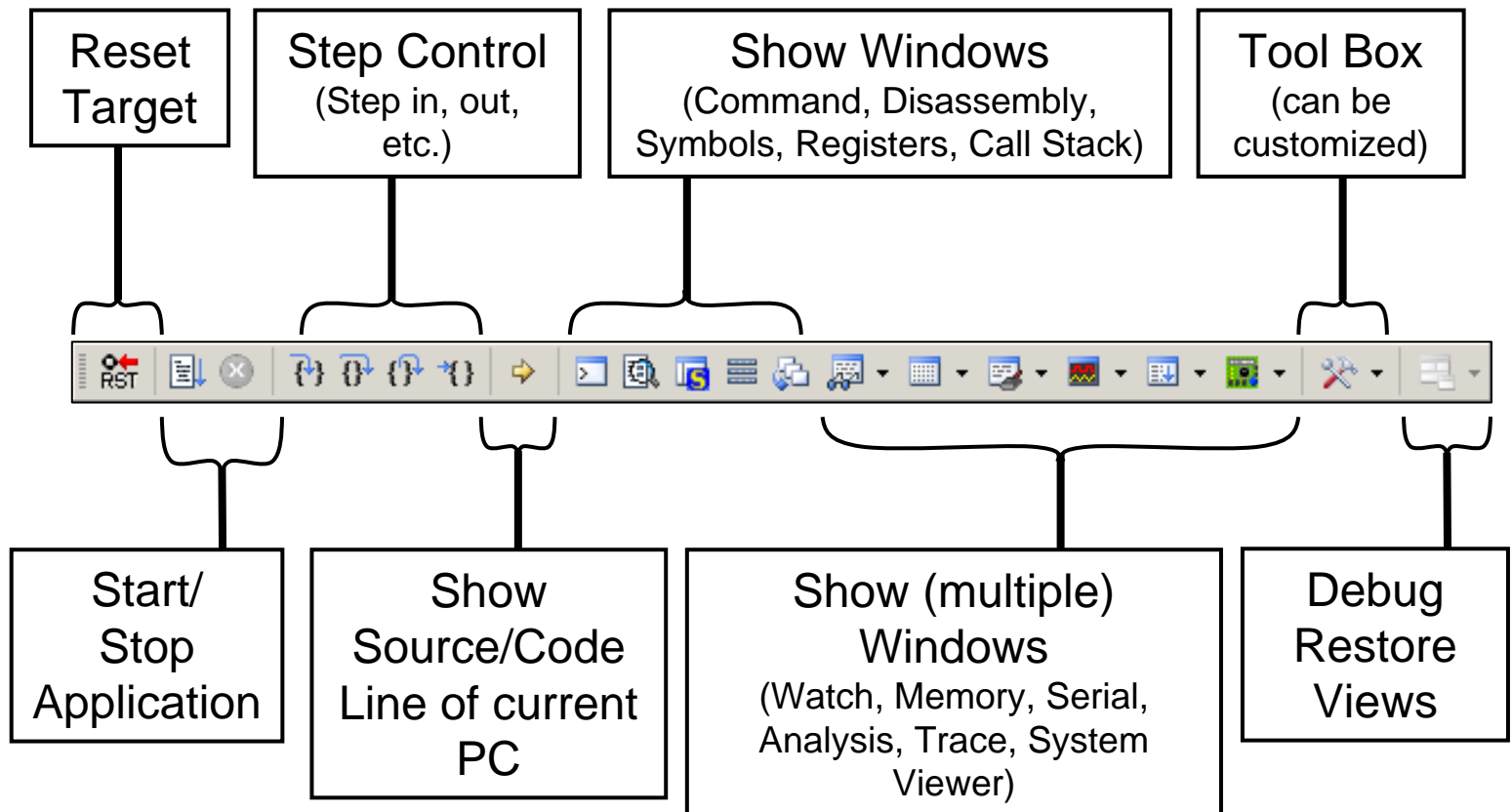
KEIL μVision – Debug (3)

■ Source View

- The Source windows do not change contents but get additional information
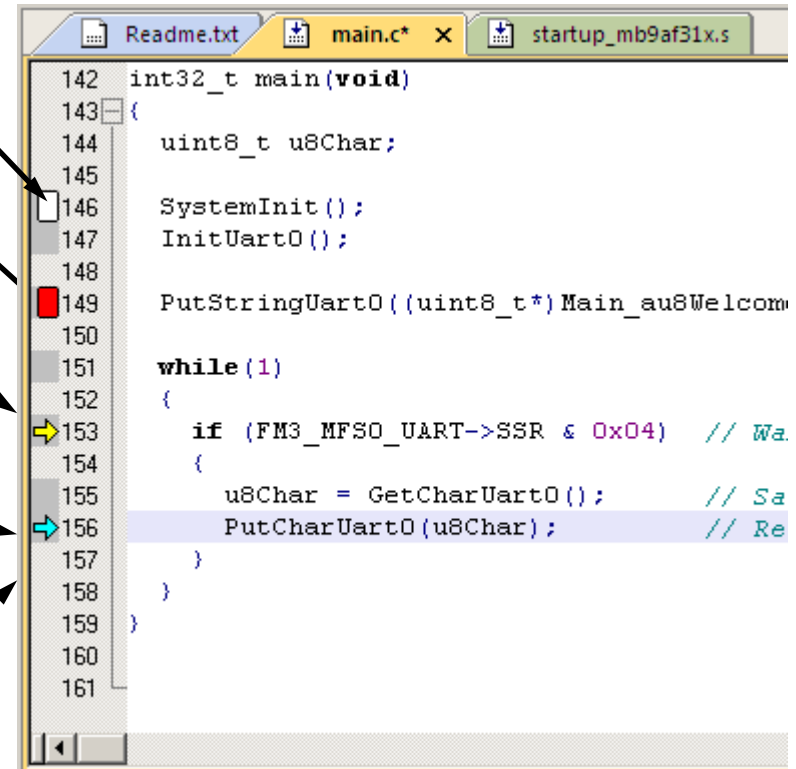
Disabled Breakpoint

Active Breakpoint

Current Program Counter

Current Cursor Line of Source Code

Code Lines with compiled Instructions (dark grey ☐)

```
    Readme.txt    main.c* ×    startup_mb9af31x.s

142   int32_t main(void)
143 ┌ {
144     uint8_t u8Char;
145
146     SystemInit();
147     InitUart0();
148
149     PutStringUart0((uint8_t*)Main_au8Welcom
150
151     while(1)
152     {
153       if (FM3_MFS0_UART->SSR & 0x04)   // Wa.
154       {
155         u8Char = GetCharUart0();        // Sa
156         PutCharUart0(u8Char);           // Re
157       }
158     }
159   }
160
161
```

KEIL µVision – Debug (4)

■ Disassembly View

- Mixed mode is selectable and deselectable

Current Program Counter

Active Breakpoint

Disabled Breakpoint

Current Cursor Line of Code highlighted in yellow background (☐)


```
Disassembly
→ 0x1FFFC430 F0100F04    TST        r0,#0x04
  0x1FFFC434 D005         BEQ        0x1FFFC442
    155:          u8Char = GetCharUart0();
  0x1FFFC436 F7FFFFD2     BL.W       GetCharUar
  0x1FFFC43A 4604         MOV        r4,r0
    156:          PutCharUart0(u8Char);
■ 0x1FFFC43C 4620         MOV        r0,r4
  0x1FFFC43E F7FFFFAF     BL.W       PutCharUar
    151:      while(1)
  0x1FFFC442 E7F3         B          0x1FFFC42C
□ 0x1FFFC444 3000         ADDS       r0,r0,#0x0
  0x1FFFC446 4003         ANDS       r3,r3,r0
```
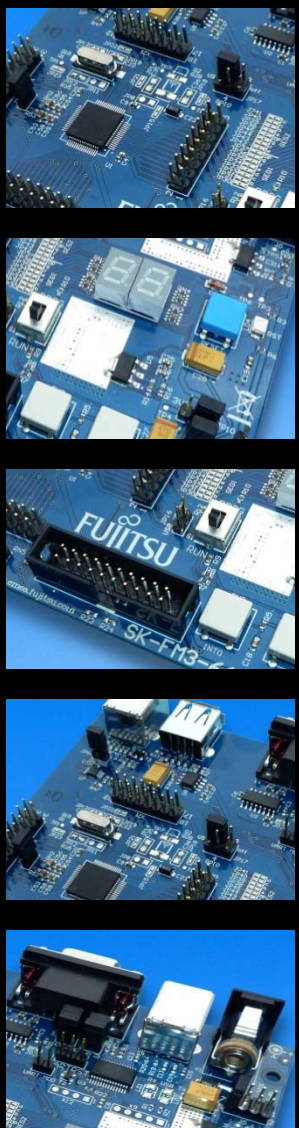
KEIL µVision – Debug (5)

■ **Memory Window**
- Up to 4 Memory windows can be displayed in tabs
- Memory is updated during runtime
- Memory window tabs are shared with Watch windows

■ **Register View**
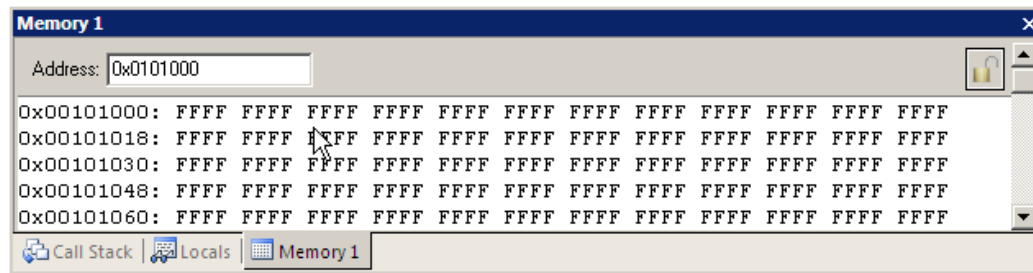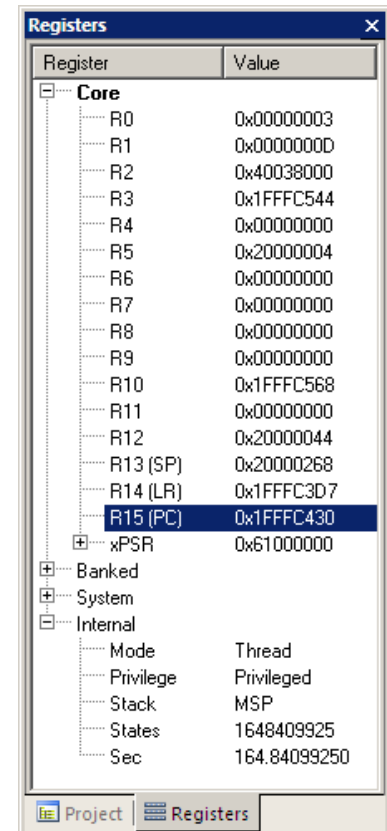- Register view is a tab of the Project window ➡
- Changes are highlighted in dark blue text background
- Register tree knots can be expanded

KEIL µVision – Debug (6)

■ **Variable Windows**

- ● Watch Windows
  - • Up to 2 Watch windows are sharing their tabs with e.g. Memory and Local views
  - • Updated during runtime
  - • Any changes are highlighted in dark blue text backround color
  - • Displayed values can be changed by user during break
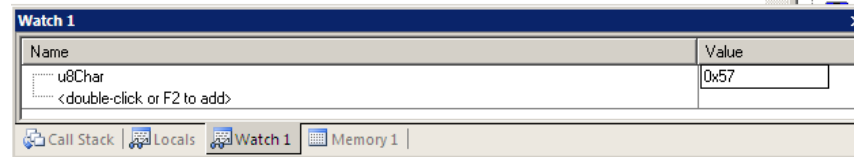
- ● Local View
  - • The local view shares the tab with e.g. Memory and Watch windows
  - • Any changes are highlighted in dark blue text backround color
  - • Displayed values can be changed by user during break

KEIL μVision – Simulator

■ **Simulator**

- The Core Simulator can be selected by the menu:
  Flash→Configure Flash Tools... and then choosing *Use Simulator*
- Look & feel is like using ULINK debugger
- Controlable also with **.ini* files
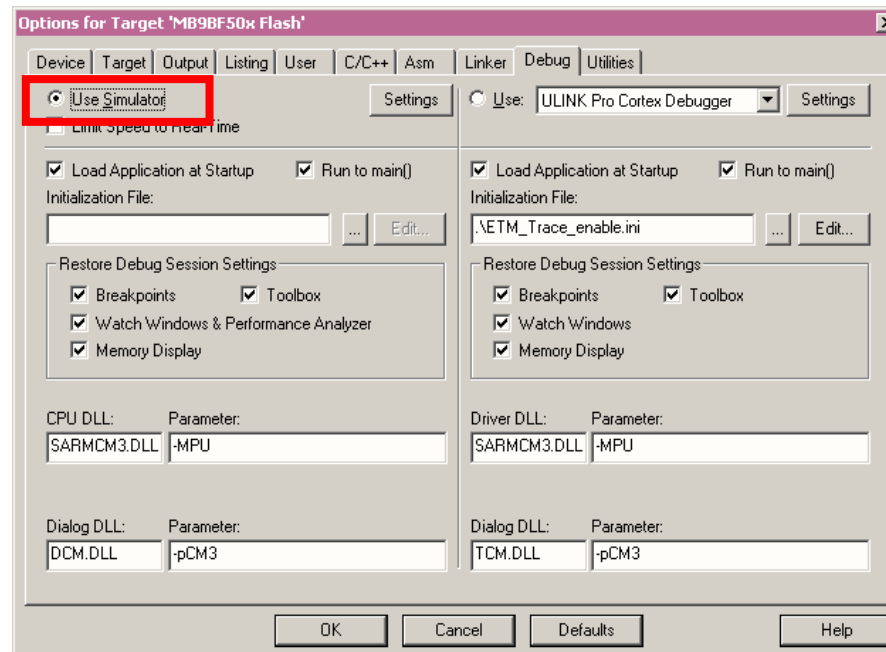
Further Steps

■ **In order to learn more about Fujitsu's microcontrollers**

- Visit our microcontroller website
  - http://mcu.emea.fujitsu.com
  - http://mcu.emea.fujitsu.com/mcu_product/detail/MB9AF314LPMC1.htm
- See our application notes
  - http://mcu.emea.fujitsu.com/mcu_product/mcu_all_appnotes.htm
- See our software examples
  - http://mcu.emea.fujitsu.com/mcu_product/mcu_all_software.htm

■ **Contact your local distributor …**

- for individual support
- to register for our monthly FM3 seminar
- to order the latest 'Fujitsu Micros DVD' containing all information regarding Fujitsu's 8-bit, 16-bit, and 32-bit microcontrollers
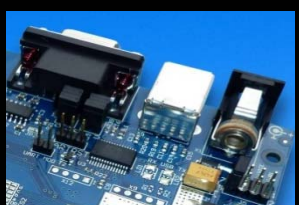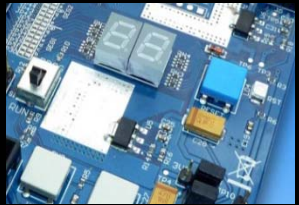
Contacts - Distribution

- **European distributors**

- **Anatec** — **www.anatec.ch**
- **EBV Elektronik** — **www.ebv.com**
- **Farnell** — **www.farnell.com**
- **Glyn** — **www.glyn.de** , **www.glyn.ch**
- **Ineltek** — **www.ineltek.com**
- **Melchioni Electronica** — **www.melchioni.it**
- **PN Electronics** — **www.pne.fr**
- **Rutronik Elektronische Bauelemente** — **www.rutronik.com**

Fujitsu Semiconductor Europe

http://www.fujitsu.com/emea/contact/microelectronics/salesoffices/
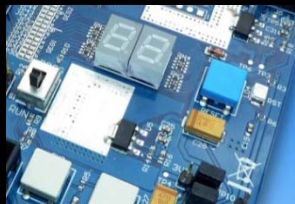
- **Germany (Headquarters)**
  - 63225 Langen   Tel: +49 (0) 61 03 69 00
- **France**
  - 91300 Massy   Tel: +33 (0) 1 64 47 97 00
- **Italy**
  - 20080 Milano   Tel: +39 02 90 45 02 1
- **United Kingdom**
  - Maidenhead   Tel: +44 (0) 1628 50 46 00
- **Hungary**
  - 1143 Budapest   Tel: +36 1 471 21 29
- **Turkey**
  - 34180 Istanbul   Tel: +90 212 557 18 81

- **World Wide Web**
  - http://emea.fujitsu.com/microelectronics
  - http://mcu.emea.fujitsu.com
  - Contact: mcu_ticket.FSEU@de.fujitsu.com

EU-Konformitätserklärung / EU declaration of conformity

CE

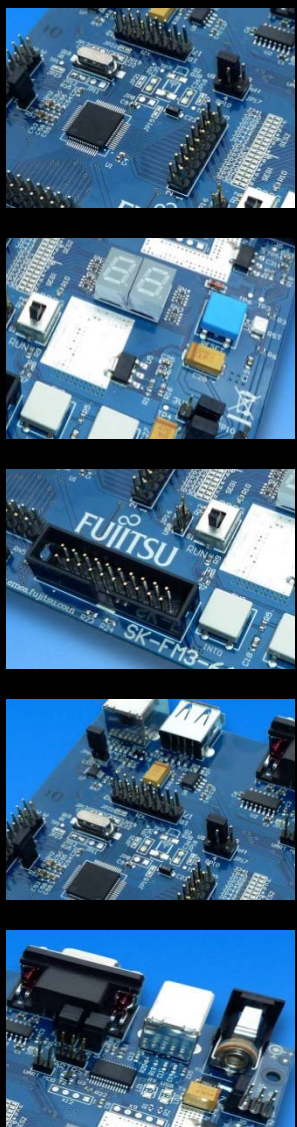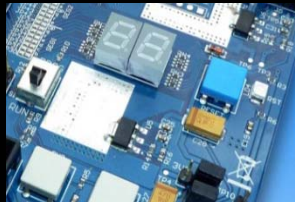**Hiermit erklären wir, Fujitsu Semiconductor Europe GmbH, Pittlerstrasse 47, 63225 Langen, Germany**
dass dieses Board aufgrund seiner Konzipierung und Bauart sowie in den von uns in Verkehr gebrachten
Ausführung(en) den grundlegenden Anforderungen der EU-Richtlinie 2004/108/EC „Elektromagnetische Verträglichkeit"
entspricht. Durch eine Veränderung des Boards (Hard- und/ oder Software) verliert diese Erklärung ihre Gültigkeit!

We, Fujitsu Semiconductor Europe GmbH, Pittlerstrasse 47, 63225 Langen, Germany
hereby declare that the design, construction and description circulated by us of this board
complies with the appropriate basic safety and health requirements according to the EU Guideline 2004/108/EC entitled
'Electro-Magnetic Compatibility'. Any changes to the equipment (hardware and/ or software) will render this declaration
invalid!

Note:

All data and power supply lines connected to this starter kit should be kept as short as possible, with a maximum
allowable length of 3m. Shielded cables should be used for data lines. As a rule of thumb, the cable length used when
connecting external circuitry to the MCU pin header connectors for example should be less than 20cm. Longer cables
may affect EMC performance and cause radio interference.

Recycling

■ **Gültig für EU-Länder:**

● Gemäß der Europäischen WEEE-Richtlinie und deren Umsetzung in landesspezifische Gesetze nehmen wir dieses Gerät wieder zurück.

● Zur Entsorgung schicken Sie das Gerät bitte an die folgende Adresse:

■ **Valid for European Union Countries:**

● According to the European WEEE-Directive and its implementation into national laws we take this device back.

● For disposal please send the device to the following address:

Fujitsu Semiconductor Europe GmbH

Warehouse/Disposal

Monzastraße 4a

D-63225 Langen

■ **This board is compliant with China RoHS**

CD Contents

■ Software

- FUJITSU FLASH MCU Programmer
- FLASH USB DIRECT Programmer
- SerialPortViewerAndTerminal

■ Documents

- Schematic 'SK-FM3-64PMC1'
- Data sheet MB9A310Series
- Peripheral Manual
  - Errata sheet
- Technical Reference Manual
- Flash Programming Manual

■ Examples

- MB9AF314LPMC_template
- Further examples are available on the CD and on our website

Note:
Please copy the examples to your local drive!

Download the latest version from the following website:

http://mcu.emea.fujitsu.com