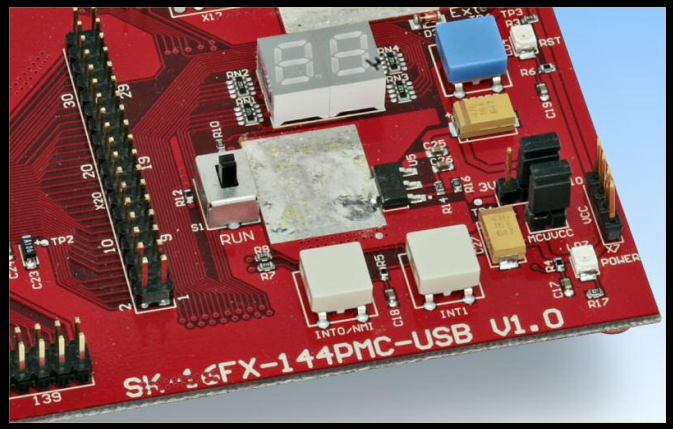
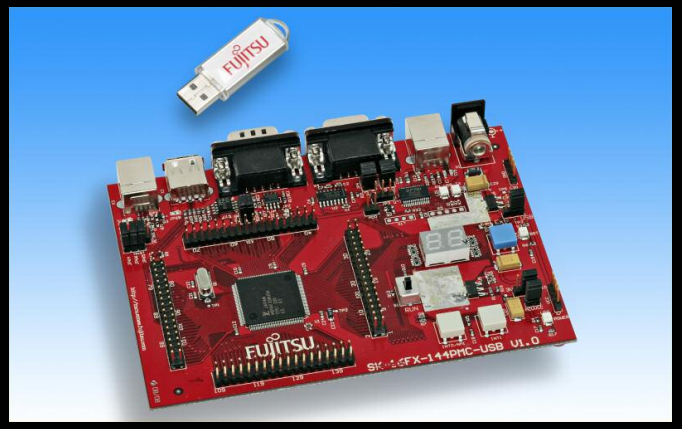
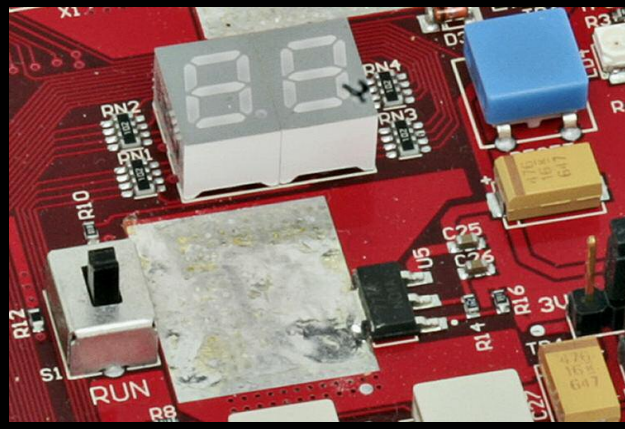






THESYCON

Thesycon® Systemsoftware & Consulting GmbH

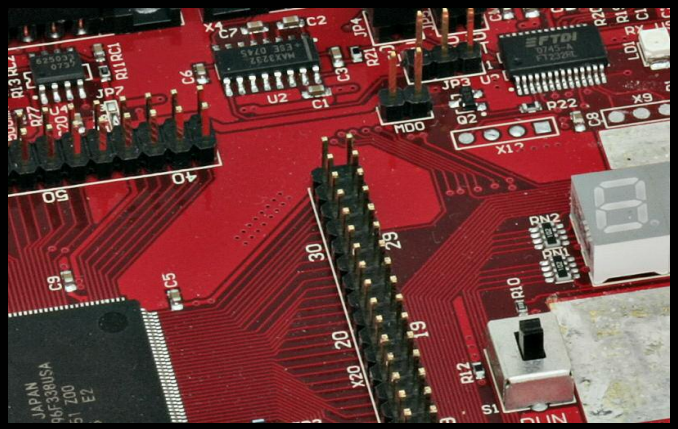
CERTIFIED USB

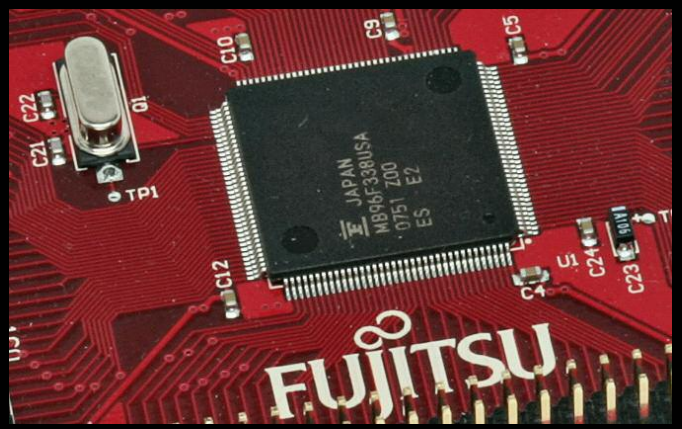
FUJITSU

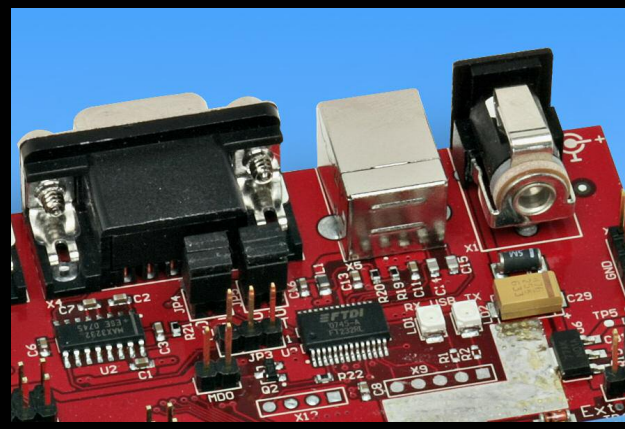
Includes EUROScope lite16FX on-chip debugger

euros

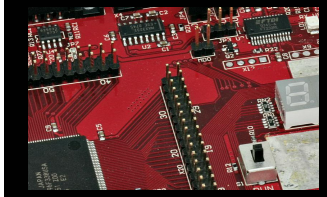
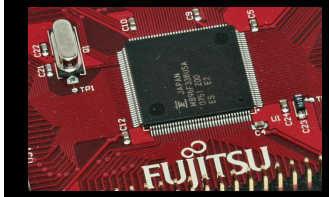
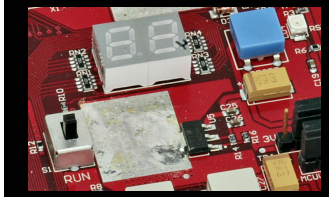
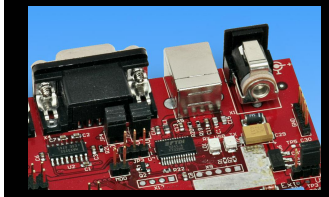
SK-16FX-144PMC-USB V1.1



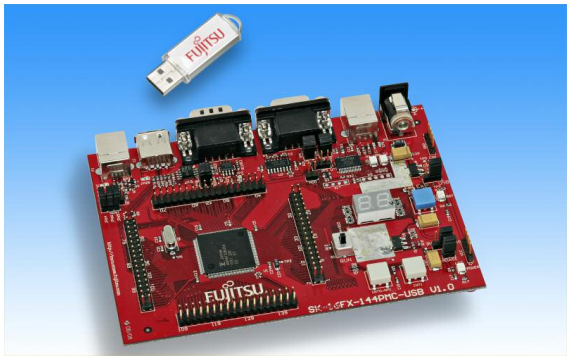




CD V1.1

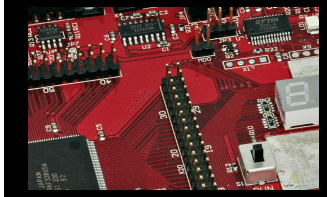
Overview

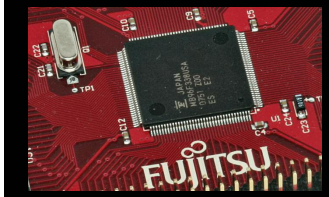


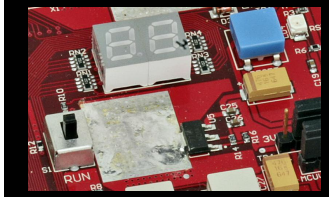
- **Introduction**
  - About the SK-16FX-144PMC-USB
  - SK-16FX-144PMC-USB content
  - Test it
  - The hardware
  - The software
- **Try yourself**
  - Software examples
  - Program download
  - New project
  - EUROScope
  - USB Library
- **Optional tools**
- **Contacts**

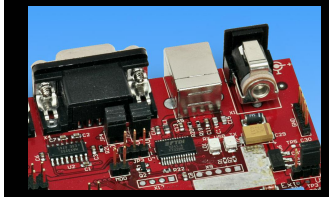
- **Additional documents**
  - Schematic ‘SK-16FX-144PMC-USB’
  - Data sheet MB96330 Series
  - Hardware manual 16FX Family
  - AppNote ‘16FX Hardware Setup’
  - AppNote ‘16FX Getting Started’
  - Customer Information 16FX
  - EUROScope Reference Manual
  - Customer Information EUROScope
  - AppNote ‚EUROScope‘
  - AppNote ‘USB Mini-Host Mass Storage Class’

About the SK-16FX-144PMC-USB





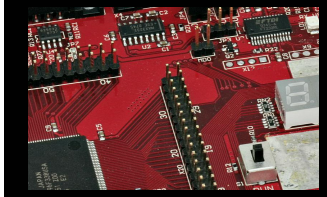


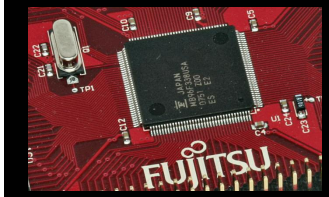


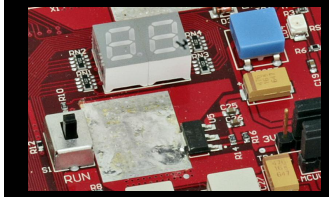
- **The SK-16FX-144PMC-USB includes a low-cost evaluation board based on the Fujitsu 16FX microcontroller MB96330 Series**

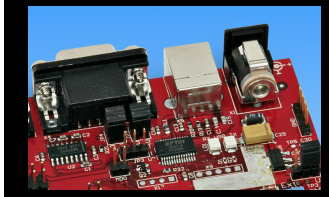
- **The MB96330 Series includes the following features:**
  - Up to 544 KByte Flash Memory
  - Up to 32 KByte RAM
  - Up to 3 CAN controller 2.0B
  - Up to 8 LIN-USART interfaces
  - Two I²C interfaces
  - USB-Host/-Function interface (MB96F33xU only)
  - Timers (ICUs, OCUs, PPGs, others)
  - ADC
  - External interrupts
  - Others

About the SK-16FX-144PMC-USB





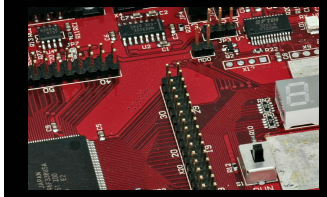


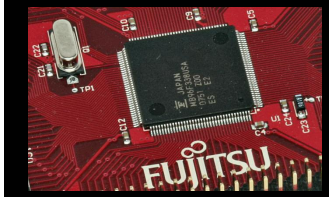


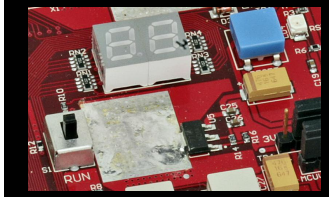
Features of the SK-16FX-144PMC-USB board:

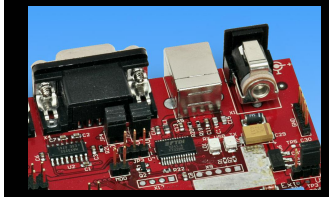
- Microcontroller MB96F338U
- 1x UART-Transceiver (SUB-D9 connector)
- 1x USB to serial converter (Type-B connector)
- 1x High-speed CAN-Transceiver (SUB-D9 connector)
- 1x USB-MiniHost (Type-A connector)
- 1x USB-Function (Type-B connector)
- 2x LED-Display (7-Segment)
- 2x ‘User’-button
- 1x ‘Reset’-button, ‘Reset’-LED
- All 144 pins routed to pin-header
- On-board 5V and 3V voltage regulators, ‘Power’-LED
- Power supply via USB (external power supply possible and recommended for providing USB-MiniHost functionality)

SK-16FX-144PMC-USB content

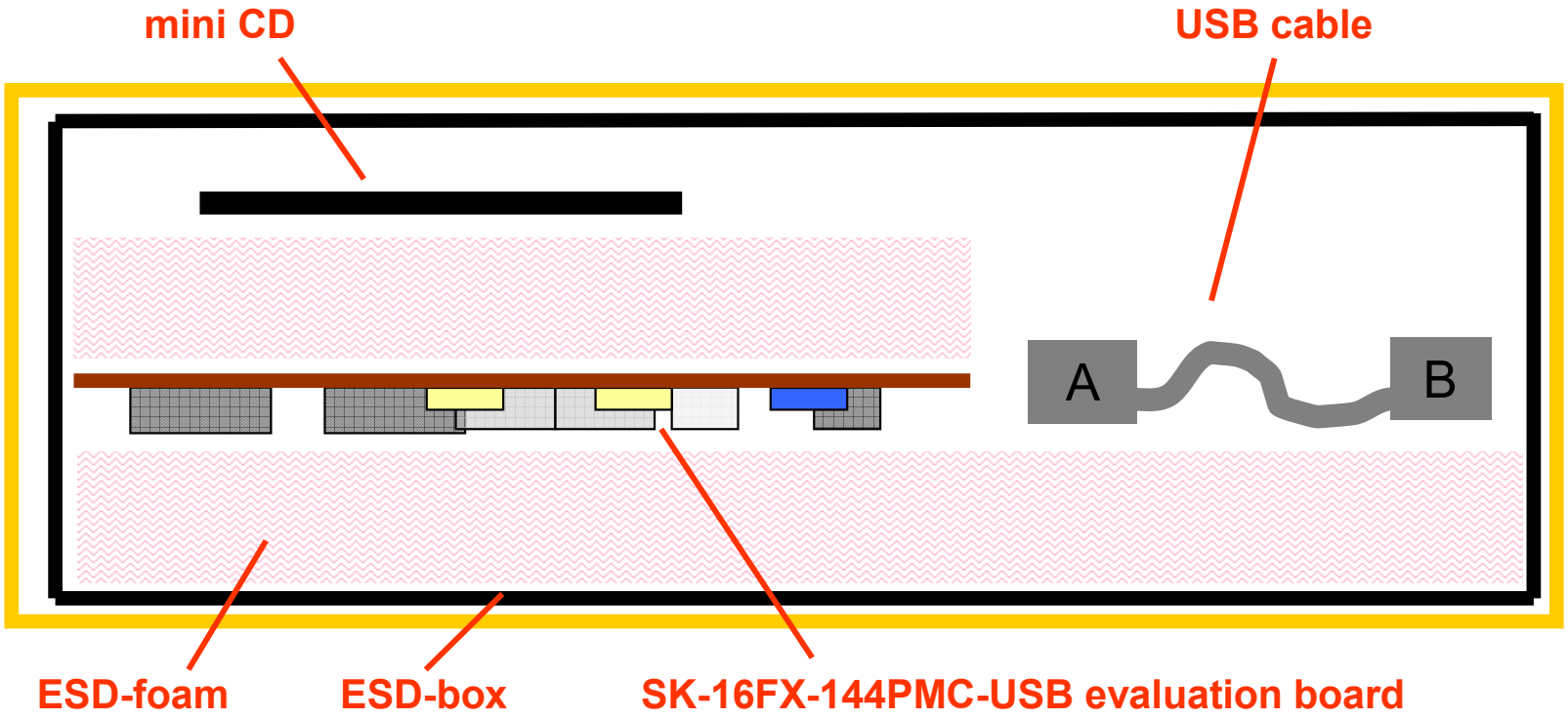




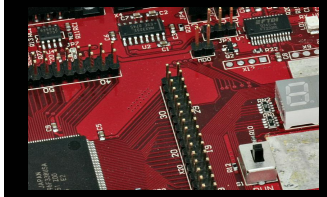


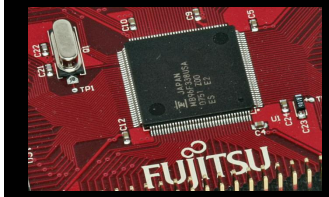


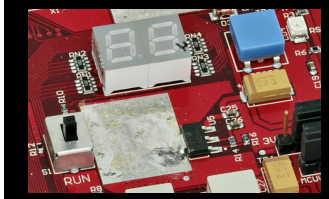
- **The SK-16FX-144PMC-USB contains**
  - SK-16FX-144PMC-USB evaluation board with MB96F338U
  - USB cable
  - Mini CD
    - Documentation, USB driver, Softune Workbench, Examples
    - „EUROScope lite 16FX“

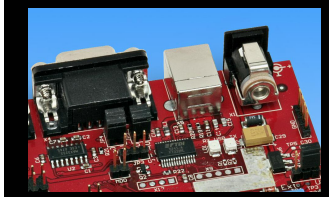


Test it

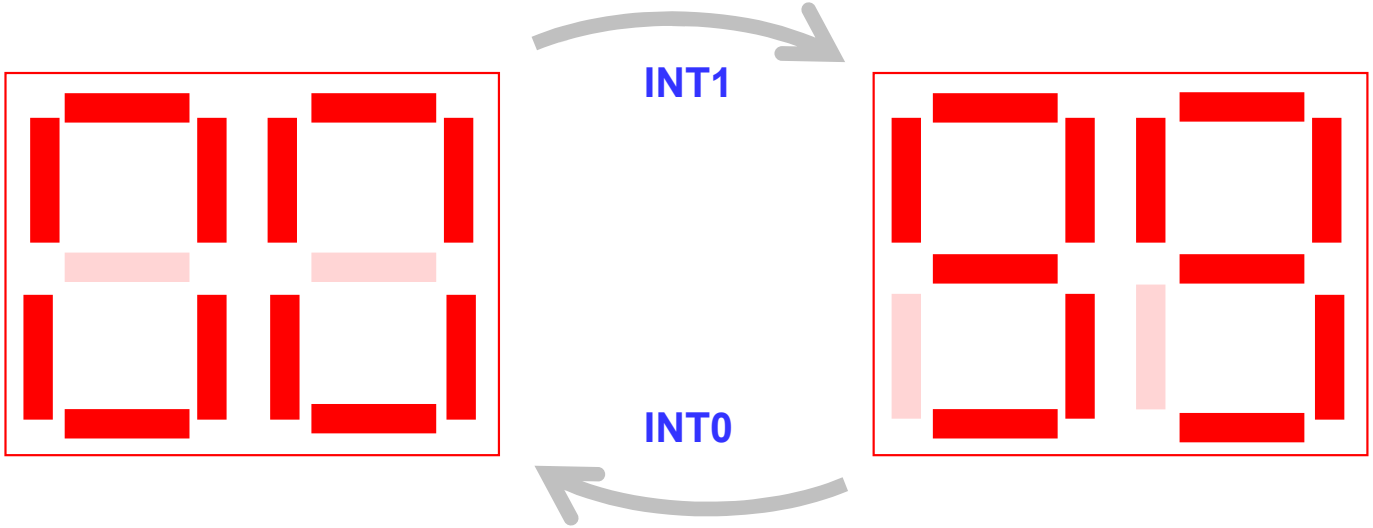




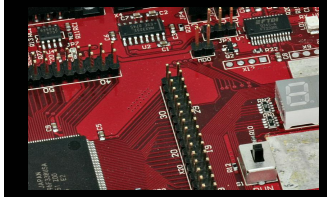


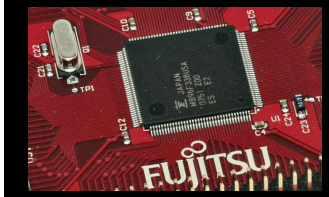


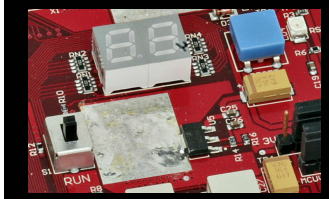
- **The microcontroller on the SK-16FX-144PMC-USB is already preprogrammed with a simple application.**
  - Connect the USB cable to your PC and the SK-16FX-144PMC-USB
  - Install the USB driver from the CD
  - Press the ‚Reset'- Button
  - The SK-16FX-144PMC-USB will automatically start counting
  - The count direction can be changed by pressing the key buttons

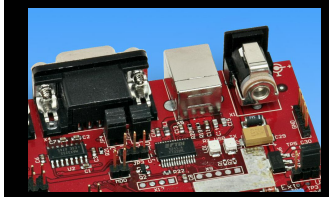


Test it





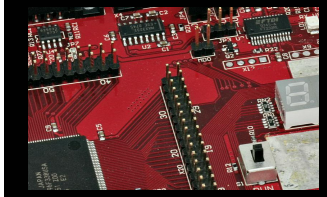


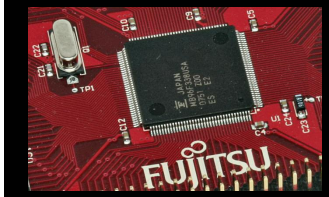


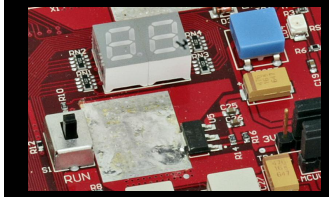
Congratulations!

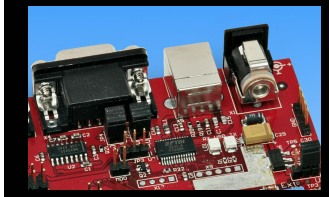
- **You finished successfully the first test**
- **Now you will get more details about the SK-16FX-144PMC-USB**
- **You will learn more about**
  - The on-board features
  - How to program the Flash
  - How to start your own application
  - On-chip debugging with EUROScope

The Hardware

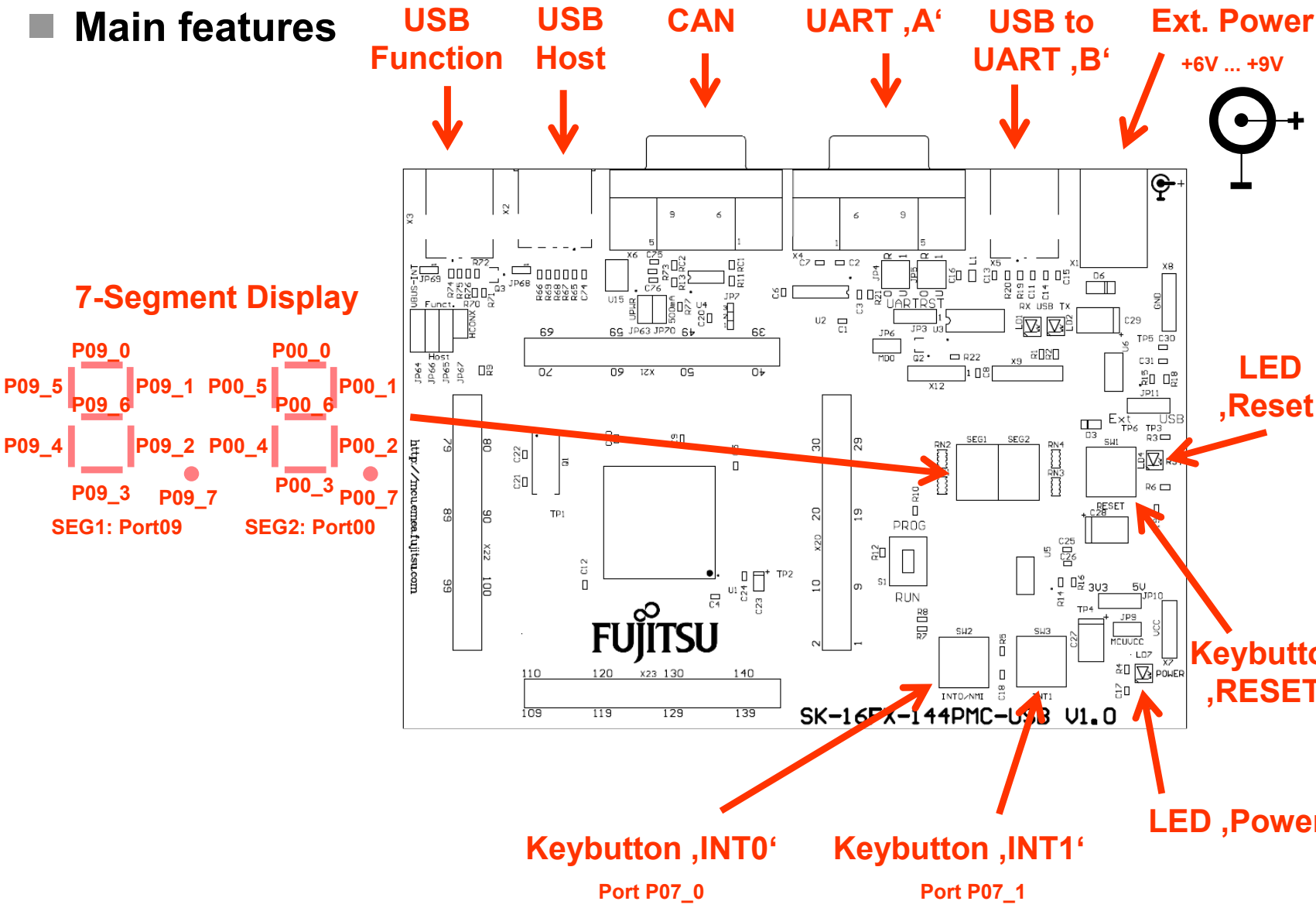




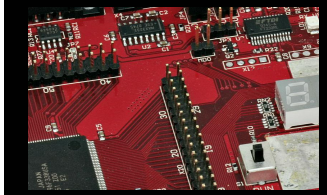


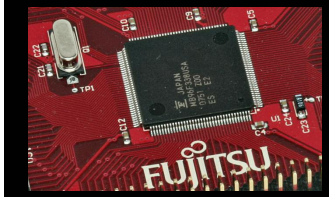


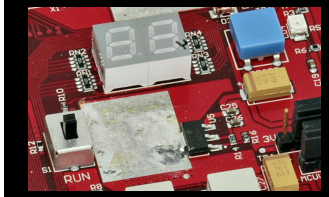
- **Main features**

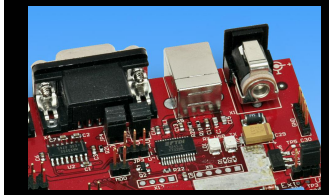


The Hardware









The jumpers

JP4: UART RX select

R-0: UART0=UART'A' / U-1: UART1=UART'B' (USB)

R-1: UART1=UART'A' / U-0: UART0=UART'B' (USB)

JP5: UART TX select

R-0: UART0=UART'A' / U-1: UART1=UART'B' (U

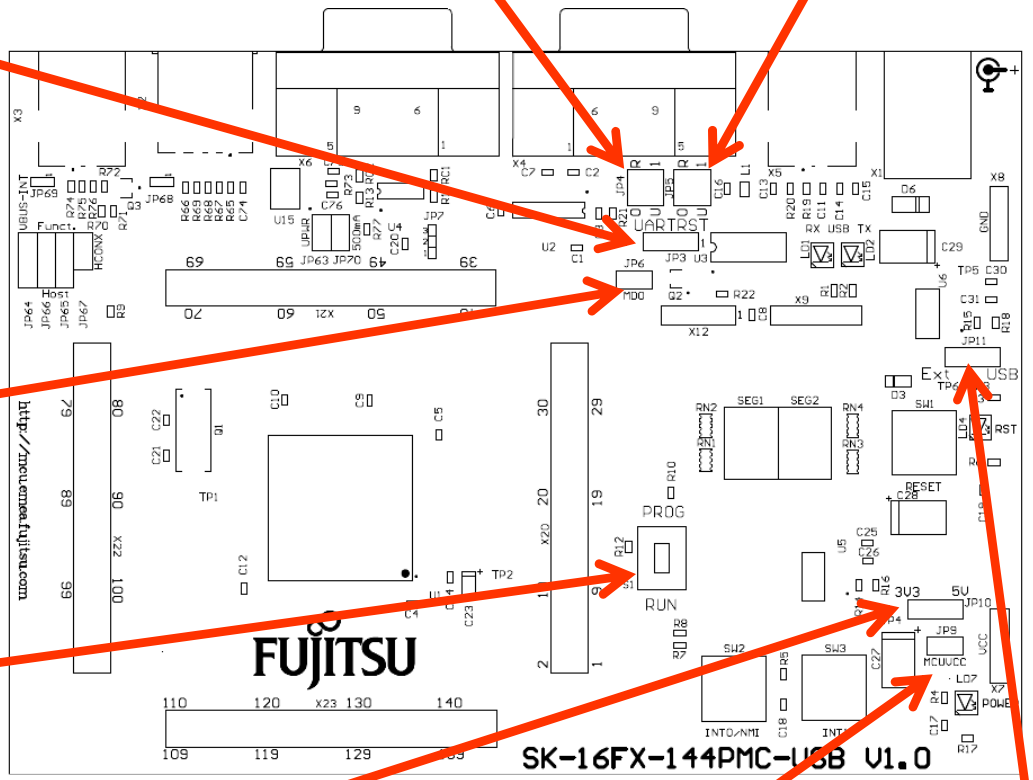
R-1: UART1=UART'A' / U-0: UART0=UART'B' (U

JP3: 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 Skwizard, 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

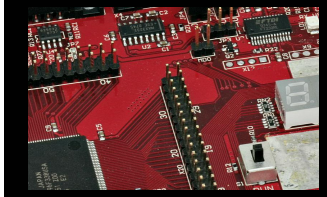
This jumper can be used to measure the current consumption of the MCU

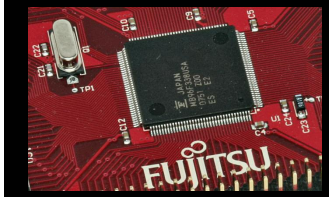
JP11: Power Supp

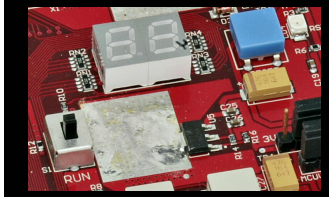
1-2: USB supply is used

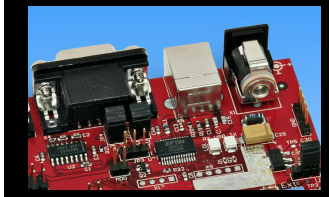
2-3: External supply is use

The Hardware









The jumpers (USB specific)

JP65: Data+ Line selection

1-2: Data+ line connected to USB-Function
2-3: Data+ line connected to USB-Host

JP66: Data- Line selection

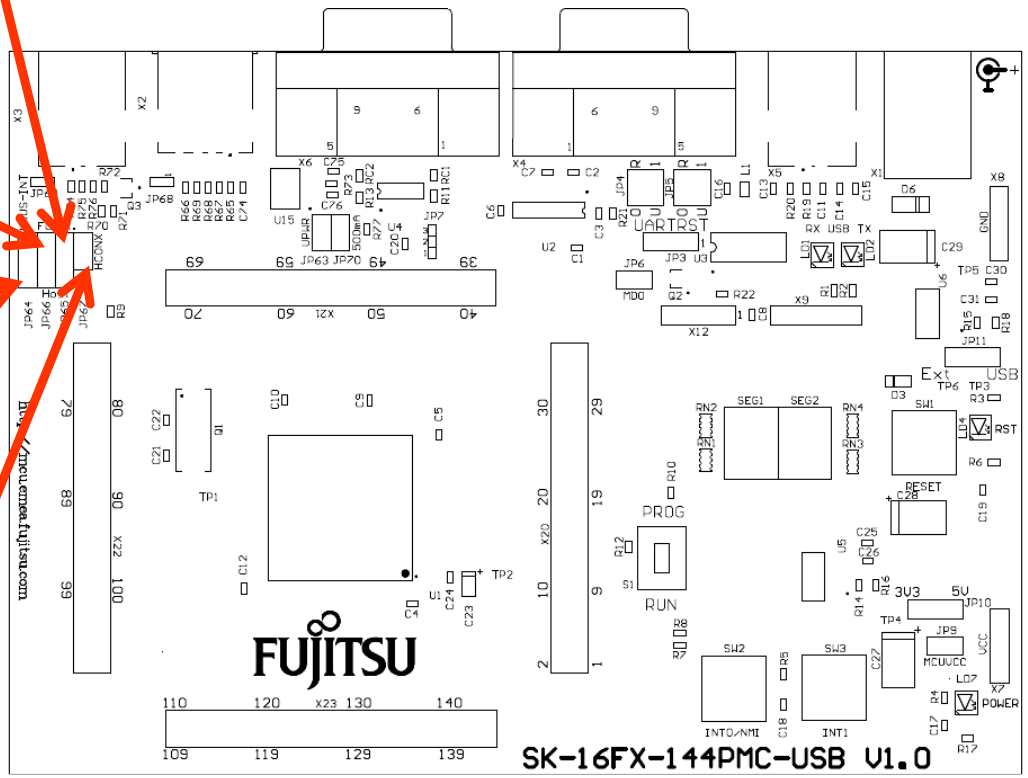
1-2: Data- line connected to USB-Function
2-3: Data- line connected to USB-Host

JP64: Interrupt

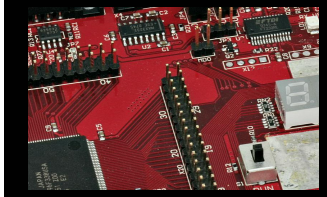
1-2: USB Function VBUS-Interrupt
2-3: No VBUS-Interrupt for USB Function

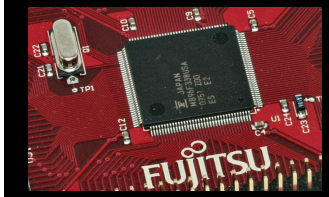
JP67: USB Function HCONX

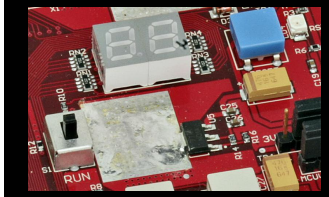
Open: D+ is not pulled up
Closed: HCONX controls Pullup of D+

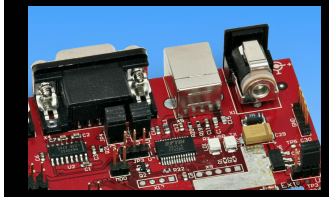


The Hardware





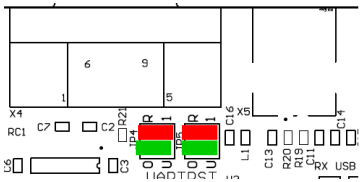




- **JP4, JP5 : UART selection**
  - UART0 and UART1 of the microcontroller can be used together with a typical RS232 SUB-D9 connector and a serial/USB converter
  - The jumpers JP4 and JP5 routes the channel to the connector

  - UART0 = USB-connector (X5), UART1 = Sub-D9 (X4) (default)
    - Setting of Jumper JP4 and JP5: U-0 / R-1

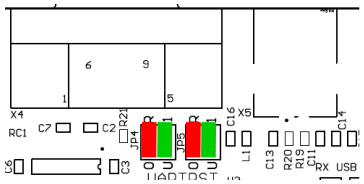
RS232 **USB**



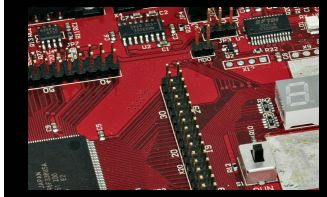
(default)

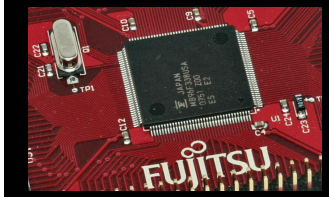
  - UART0 = Sub-D9 (X4), UART1 = USB-connector (X5)
    - Setting of Jumper JP4 and JP5: U-1 / R-0

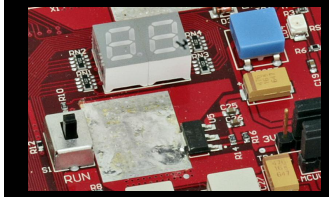
RS232 **USB**

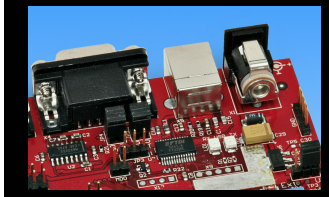


The Hardware







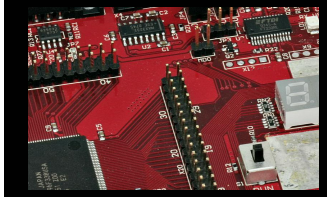


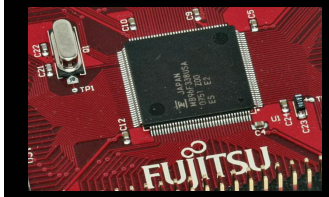
The microcontroller pins

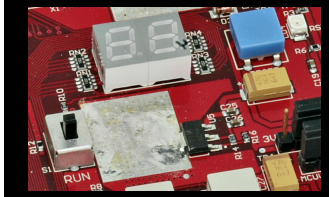
Pin	Pin-name	On SK-16FX-144PMC-USB used by
1	VSS	GND
2	C	'C' capacitors
3	P11_7/IN5_R/A3	
4	P12_0/RX2_R/INT6_R/A4	
5	P12_1/TX2_R/A5	
6	P12_2/PPG0_R/A6	
7	P12_3/PPG1_R/TIN4/A7	
8	P12_4/PPG2_R/TOT4/A8	
9	P12_5/PPG3_R/TIN5/A9	
10	P12_6/PPG4_R/TOT5/A10	
11	P12_7/PPG5_R/A11	
12	P13_0/PPG6_R/A12	
13	P13_1/PPG7_R/A13	
14	P13_2/TIN3_R/A14	
15	P13_3/TOT3_R/A15	
16	P13_4/PPG16	

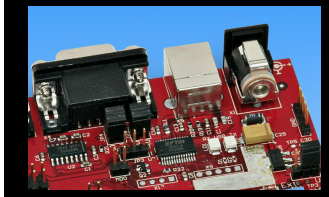
Pin	Pin-name	On SK-16FX-144PMC-USB used by
17	P13_5/PPG17	
18	P13_6/PPG18/IN8	
19	P13_7/PPG19/IN9	
20	P04_2/IN6/RX1/INT9_R/TTG6/TTG14	
21	P04_3/IN7/TX1/TTG7/TTG15	
22	P04_4/SDA0/FRCK0/TIN0_R	
23	P04_5/SCL0/FRCK1/TIN2_R	
24	P04_6/SDA1	
25	P04_7/SCL1	
26	P05_0/AN8/ALARM0/SIN2/INT3_R1	
27	P05_1/AN9/ALARM1/SOT2	
28	P05_2/AN10/SCK2	
29	P05_3/AN11/TIN3/WOT	
30	P05_4/AN12/TOT3/INT2_R	USB
31	P05_5/AN13/INT0_R/NMI_R	
32	P05_6/AN14/INT4_R	

The Hardware







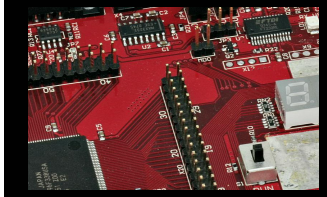


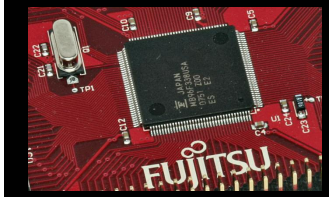
The microcontroller pins (cont'd)

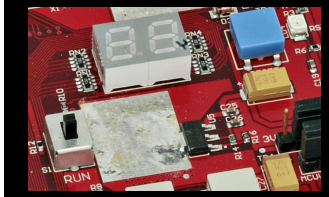
Pin	Pin-name	On SK-16FX-144PMC-USB used by
33	P05_7/AN15/INT5_R/OUT10_R	
34	P06_0/AN0/PPG0/CS0_R	
35	P06_1/AN1/PPG1/CS1_R	
36	VCC	MCUVCC
37	VSS	GND
38	P06_2/AN2/PPG2/CS2_R	
39	P06_3/AN3/PPG3/CS3_R	
40	P06_4/AN4/PPG4/CS4_R	
41	P06_5/AN5/PPG5/CS5_R	
42	P06_6/AN6/PPG6	
43	P06_7/AN7/PPG7	
44	AVCC5	MCUVCC
45	AVRH5	MCUVCC
46	AVRL5	GND
47	AVSS5	GND
48	P07_0/AN16/INT0/NMI	Key button 'INT0/NMI'

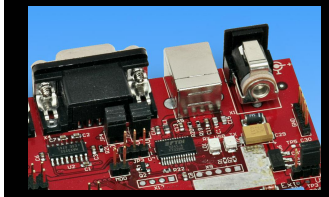
Pin	Pin-name	On SK-16FX-144PMC-USB used by
49	P07_1/AN17/INT1	Key button 'INT1'
50	P07_2/AN18/INT2	
51	P07_3/AN19/INT3	
52	P07_4/AN20/INT4	
53	P07_5/AN21/INT5/SCK9_R	
54	P07_6/AN22/INT6/SOT9_R	
55	P07_7/AN23/INT7/SIN9_R	
56	P14_0/AN24	
57	P14_1/AN25	
58	P14_2/AN26	
59	P14_3/AN27	
60	P14_4/AN28	
61	P14_5/AN29	
62	P14_6/AN30	
63	P14_7/AN31	
64	P15_0/AN32	

The Hardware







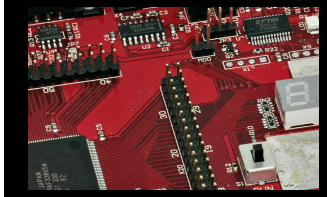


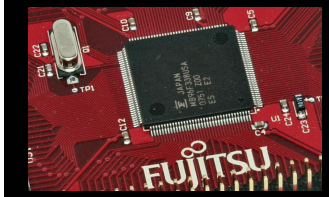
The microcontroller pins (cont'd)

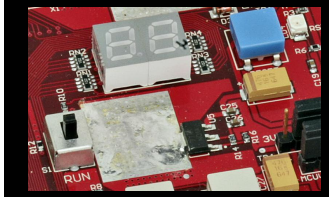
Pin	Pin-name	On SK-16FX-144PMC-USB used by
65	P15_1/AN33	
66	P15_2/AN34	
67	P15_3/AN35	
68	HCONX	USB
69	VCC3	VCC3V3
70	UDP	USB Data+
71	UDM	USB Data-
72	VCC	MCUVCC
73	VSS	GND
74	MD0	Mode-Switch S1
75	MD1	to VCC
76	MD2	Mode-Switch S1
77	X0	4 MHz Crystal
78	X1	4 MHz Crystal
79	VSS	GND
80	X0A/(P04_0)	

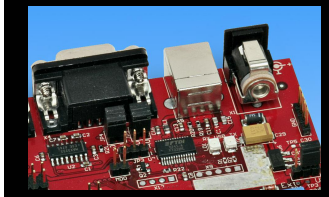
Pin	Pin-name	On SK-16FX-144PMC-USB used by
81	X1A/(P04_1)	
82	RSTX	Key button ‚Reset'
83	P08_0/TIN0/ADTG/INT12_R/CKOTX0	
84	P08_1/TOT0/INT13_R/CKOT0	
85	P08_2/SIN0/TIN2/INT14_R	UART0 (RXD)
86	P08_3/SOT0/TOT2	UART0 (TXD)
87	P08_4/SCK0/INT15_R	
88	P08_5/SIN1/INT1_R	UART1 (RXD)
89	P08_6/SOT1	UART1 (TXD)
90	P08_7/SCK1	
91	P10_0/RX0/INT8_R	CAN0 (RX)
92	P10_1/TX0	CAN0 (TX)
93	P10_2/SCK5	
94	P10_3/SOT5	
95	P10_4/SIN5/INT5_R1	
96	P17_3/SIN9/OUT8	

The Hardware







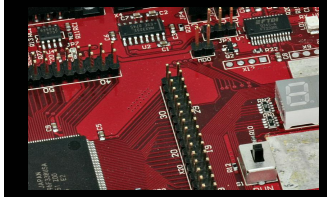


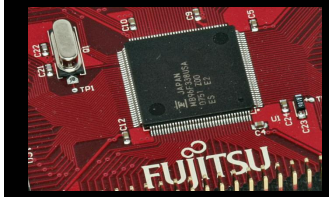
The microcontroller pins (cont'd)

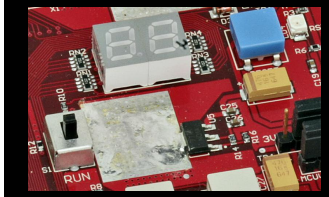
Pin	Pin-name	On SK-16FX-144PMC-USB used by
97	P17_4/SOT9/OUT9	
98	P17_6/OUT11/TTG18/INT3_R	
99	P09_0/PPG8/UBX	SEG1-A
100	P09_1/PPG9/LBX	SEG1-B
101	P09_2/PPG10/CS5	SEG1-C
102	P09_3/PPG11/CS4/FRCK2_R	SEG1-D
103	P09_4/OUT0/CS3	SEG1-E
104	P09_5/OUT2/CS2	SEG1-F
105	P09_6/OUT2/CS1	SEG1-G
106	P09_7/OUT3/CS0	SEG1-DP
107	P00_0/AD00/INT8/SCK7_R/TTG8_R	SEG2-A
108	VCC	MCUVCC
109	VSS	GND
110	P00_1/AD01/INT9/SOT7_R/TTG9_R	SEG2-B
111	P00_2/AD02/INT10/SIN7_R/TTG10_R	SEG2-C
112	P00_3/AD03/INT11/SCK8_R/TTG11_R	SEG2-D

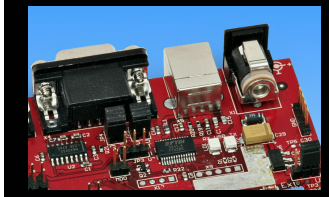
Pin	Pin-name	On SK-16FX-144PMC-USB used by
113	P00_4/AD04/INT12/SOT8_R/PPG8_R	SEG2-E
114	P00_5/AD05/INT13/SIN8_R/PPG9_R	SEG2-F
115	P00_6/AD06/INT14/PPG10_R	SEG2-G
116	P00_7/AD07/INT15/SCK8_R/PPG11_R	SEG2-DP
117	P01_0/AD08/TIN1/CKOT1/TTG16_R	
118	P01_1/AD09/TOT1/CKOTX1/TTG17_R	
119	P01_2/AD10/SIN3/INT11_R/TTG18_R	
120	P01_3/AD11/SOT3/TTG19_R	
121	P01_4/AD12/SCK3/PPG16_R	
122	P01_5/AD13/SIN2_R/INT7_R/PPG17_R	
123	P01_6/AD14/SOT2_R/PPG18_R	
124	P01_7/AD15/SCK2_R/PPG19_R	
125	P02_0/A16/PPG12/CKOT1_R	
126	P02_1/A17/PPG13	
127	P02_2/A18/PPG14/CKOT0_R	
128	P02_3/A19/PPG15	

The Hardware







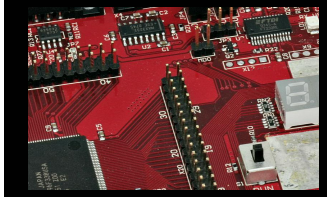


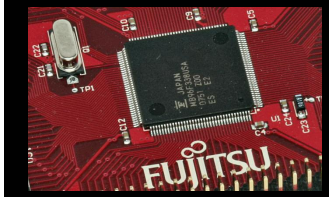
The microcontroller pins (cont'd)

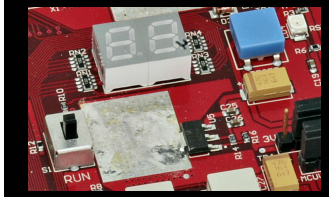
Pin	Pin-name	On SK-16FX-144PMC-USB used by
129	P02_4/A20/IN0/TTG0/TTG8	
130	P02_5/A21/IN1/TTG1/TTG9/ADTG_R	
131	P02_6/A22/IN2/TTG2/TTG10	
132	P02_7/A23/IN3/TTG3/TTG11	
133	P03_0/ALE/IN4/TTG4/TTG12/TOT0_R	
134	P03_1/RDX/IN5/TTG5/TTG13/TOT2_R	
135	P03_2/WRLX/INT10_R/RX2	
136	P03_3/WRHX/TX2	
137	P03_4/HRQ/OUT4	
138	P03_5/HAKX/OUT5	
139	P03_6/RDY/OUT6	
140	P03_7/CLK/OUT7	
141	P11_4/OUT6_R/A0	
142	P11_4/OUT6_R/A0	
143	P11_6/IN4_R/A2	
144	VCC	MCUVCC

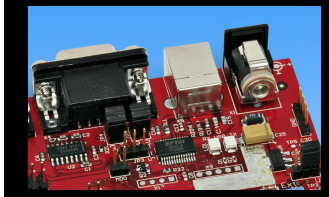
Pin	Pin-name	On SK-16FX-144PMC-USB used by

The Software







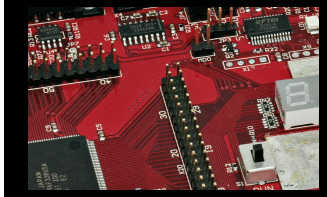


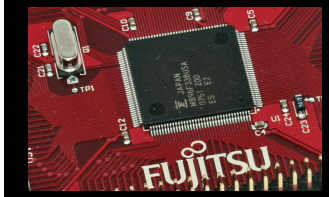
- **The SK-16FX-144PMC-USB CD includes the following software:**
  - Softune Workbench (development platform for Fujitsu microcontroller)
  - MCU Flash programming tool and SKwizard terminal program
  - USB driver for on-board USB-to-RS232 converter
  - On-chip debugger “EUROScope lite 16FX“
  - Software examples for the SK-16FX-144PMC-USB
- **Additionally you can order the latest „Fujitsu MICROS DVD“**
  - Includes documentation & software for all Fujitsu microcontrollers
  - Please contact your local distributor
- **Please check our dedicated microcontroller website**

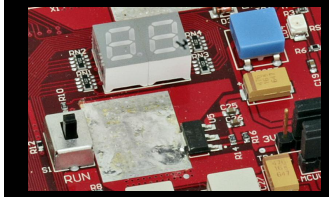
http://mcu.emea.fujitsu.com

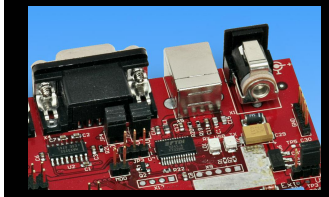
  - for updates of the Flash programmer tool, utilities and examples
  - for data sheets, hardware manuals, application notes, etc.

Installation of the USB-driver

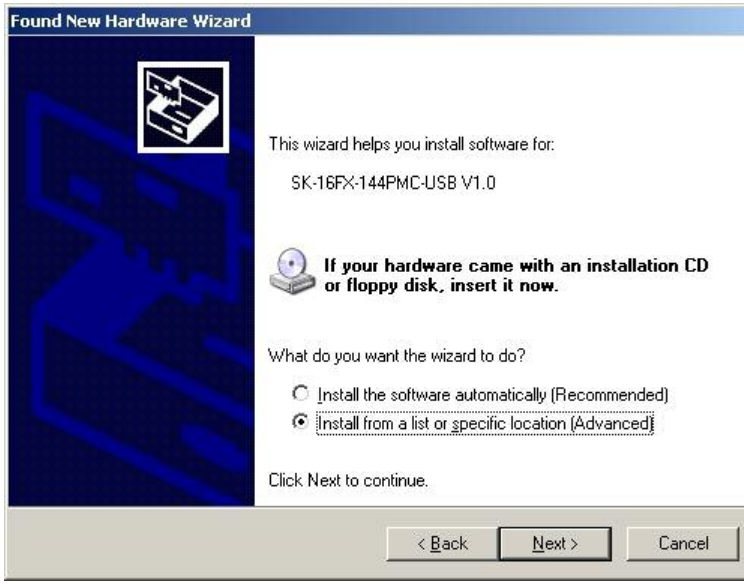






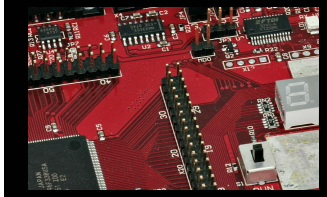
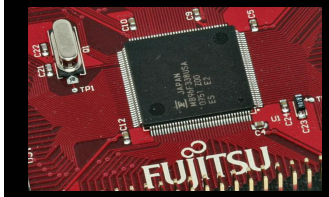
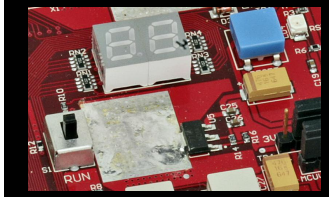
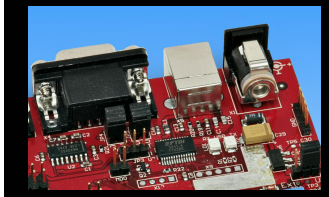


- **Connect the SK-16FX-144PMC-USB to your PC's USB port**
  - Windows will 'Found New Hardware: SK-16FX-144PMC-USB' and the Hardware Wizard should start automatically
    - **Note: The installation procedure may differ with different operating systems**



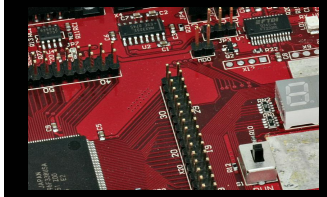
  - Do not connect to Windows Update to search for software
  - Select 'Install from a list or specific location (Advanced)'
  - Within next windows select 'Search for the best driver' and browse on the CD to the folder 'drive:\USB-Driver\Win2000_WinXP'

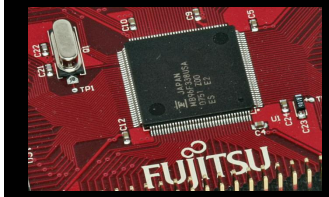
Installation of the USB-driver

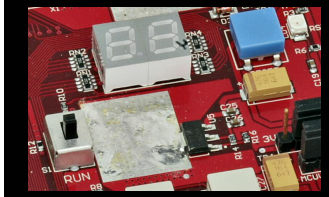






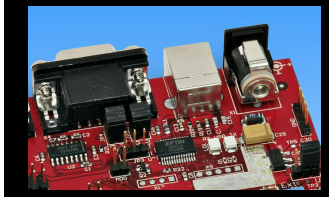
- 'Continue anyway' although the Windows Logo test may not be passed
- Windows completes the installation by copying some files
- 'Finish' will close the window

Installation of the USB-driver





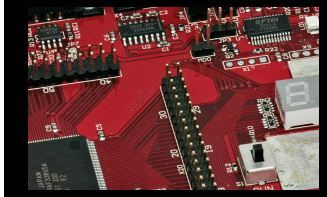


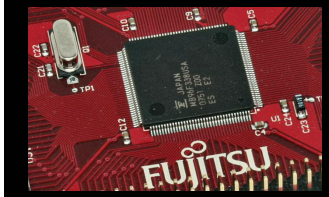


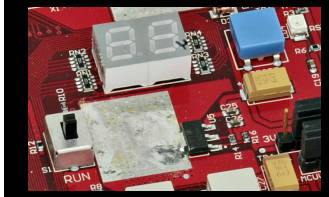
- Again Windows will ‘Found New Hardware: USB Serial Port’ and the Hardware Wizard should start automatically
  - **Note: The installation procedure may differ with different operating systems**

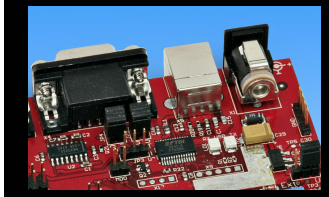
- Do not connect to Windows Update to search for software
- Select ‘Install from a list or specific location (Advanced)’
- Within next windows select ‘Search for the best driver’ and browse on the CD to the folder ‘drive:\USB-Driver\Win2000_WinXP’

Installation of the USB-driver



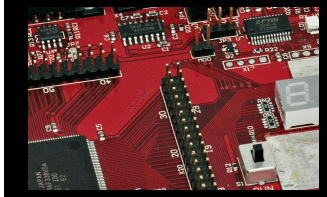


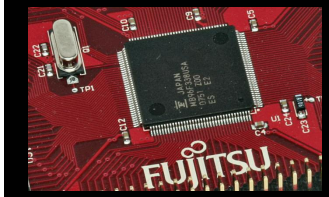


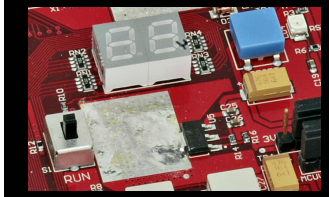


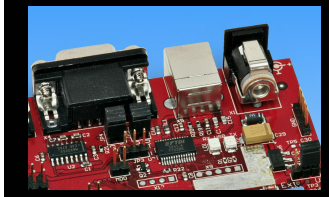
- 'Continue anyway' although the Windows Logo test may not be passed
- Windows completes the installation by copying some files

Installation of the USB-driver

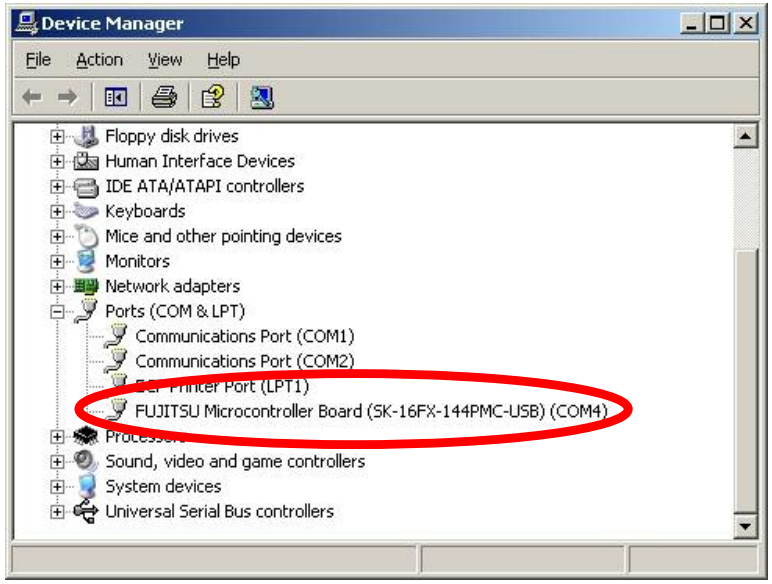






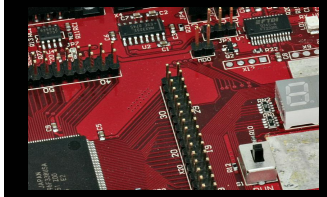


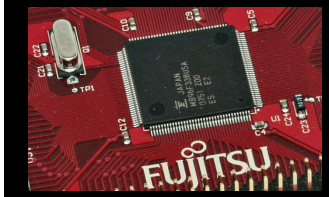
- **Start the Device Manager of the Windows Control Panel**
  - START -> Settings -> Control Panel
  - Control Panel -> System -> Hardware -> Device Manager
- **Check ‘Ports’ for the assigned virtual COM-port number**
  - FUJITSU Microcontroller board (e.g.: COM4)

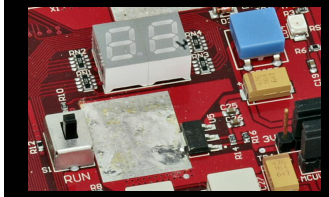


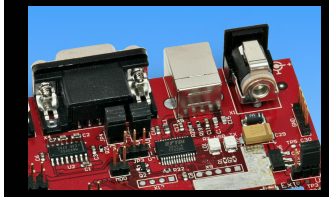
- **Ready!**
  - The SK-16FX-144PMC-USB can be powered via USB (default, JP11)
  - Depending on JP4 and JP5 one UART is connected to USB

The Development Software





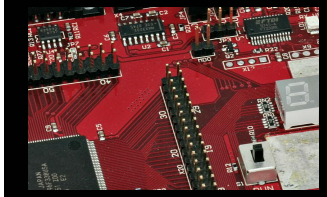


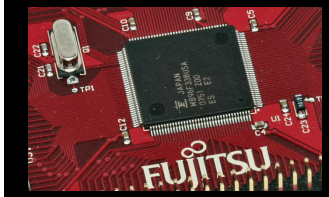


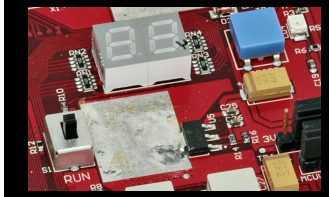
- **Softune Workbench**
  - Free of charge (only registration is required)
  - Windows based development platform for all 16-bit microcontrollers
  - Includes: Editor, C-compiler, assembler, linker, core simulator
  - Supports optional hardware emulator
  - Requires ‘administration’ or ‘power user’ rights on the PC
  - Registration*1
    - https://mcu.emea.fujitsu.com/cusreg/htm/cusreg_form.htm
    - Receive your password for Softune Workbench by email
    - Receive your license file for EUROScope by email
  - Start installation
    - Enter password and choose destination folder (e.g. c:\Softune16)

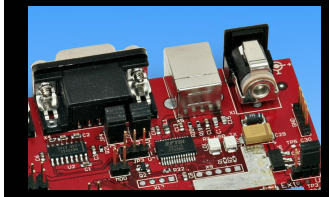
*1 Note: If you want to use EUROScope please install and run it first and note down the Host ID (MAC address) of your PC system. This ID is needed to be filled out in the registration form to obtain a license key.

The FLASH Programmer

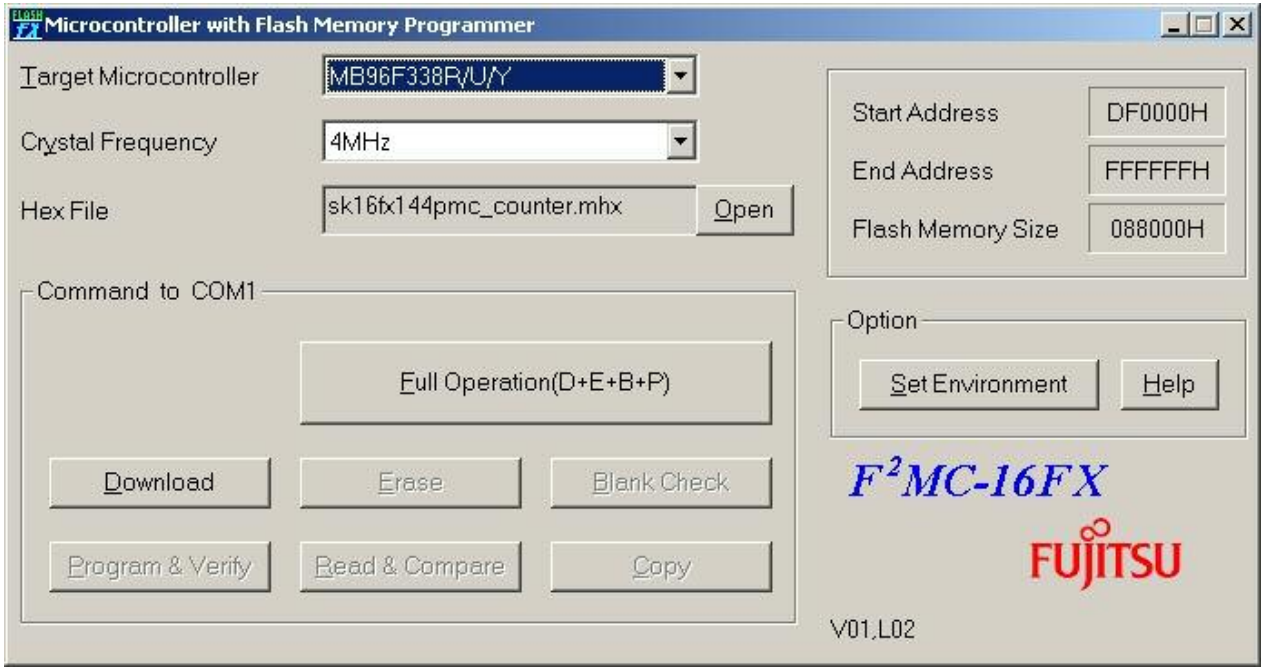




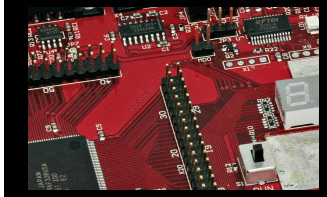


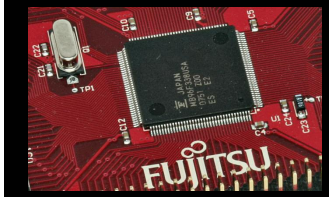


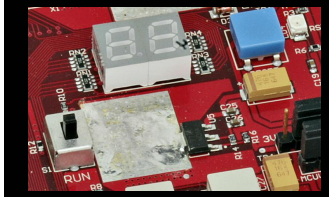
- **MCU Flash programmer**
  - Free of charge, no registration required
  - Windows based programming tool for all 16-bit Fujitsu microcontroller
  - Uses PC serial port COMx (incl. virtual COM port: USB-to-RS232)
  - Start installation

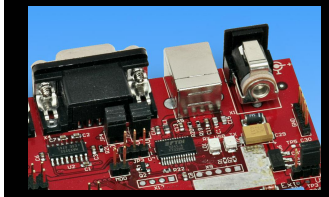


Tools and Software Examples







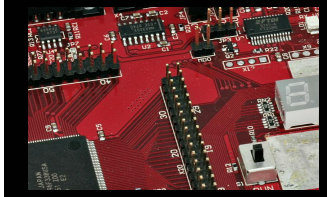


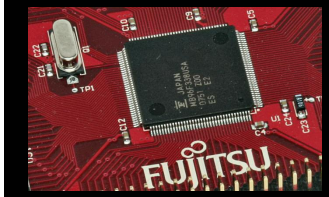
- **SKwizard**
  - Free of charge terminal program
  - Start installation

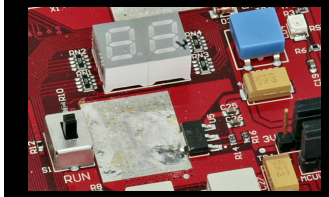
- **Following examples are provided with SK-16FX-144PMC-USB:**
  - sk16fx144pmc_adc_dvm
    - Digital Voltage Meter based on the A/D-converter
  - sk16fx144pmc_can_uart_terminal
    - Simple CAN example controlled by UART1
  - sk16fx144pmc_counter
    - Counts from 0 to 99 on the 7-segment Display
  - sk16fx144pmc_template
    - ‚Empty' project as base for user applications
  - sk16fx144pmc_uart
    - UART example using UART1
  - sk16fx144pmc_usb_host
    - USB Host example
  - 96330-usb_bootloader
    - USB Host Bootloader example

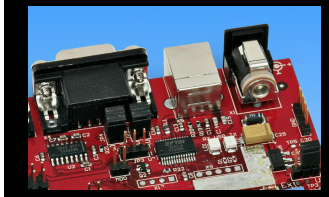
Note:
Do not connect other than EUROScope to UART0 (default: X5/USB).
All examples (except USB-Host examples) are prepared to be used with EUROScope and UART0 is reserved for this debugger.

Program Download

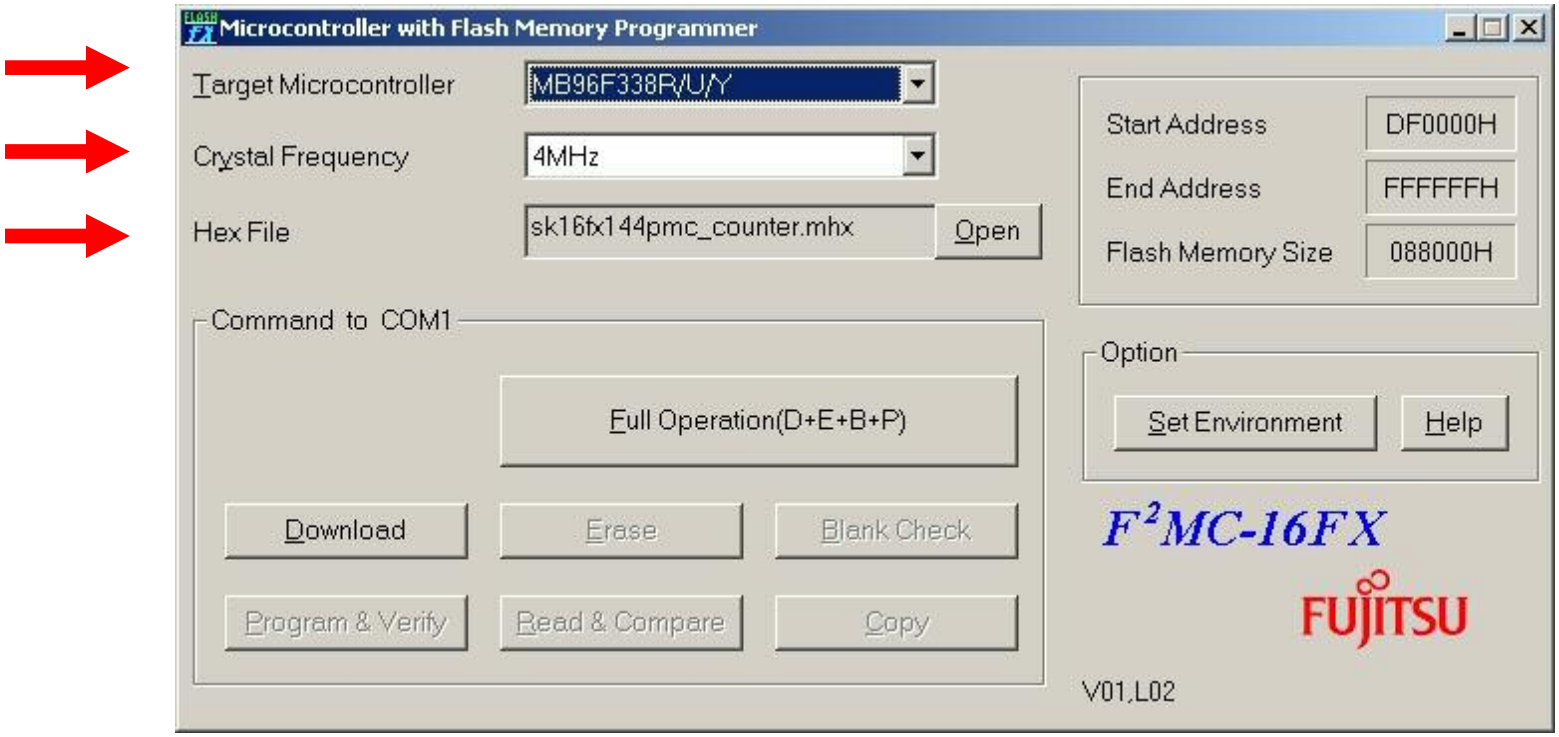




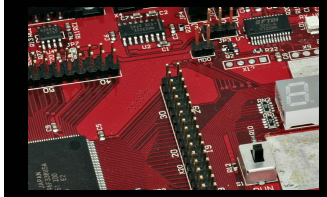


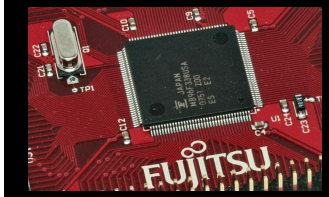


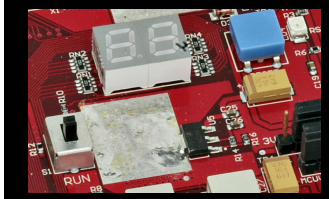
- Start the Fujitsu MCU Flash programmer
- Select the target microcontroller (MB96F338R/U/Y)
- Select the crystal frequency (4 MHz)
- Choose the software example from the example ‘ABS‘-folder
  (e.g. D:\Examples\sk16fx144pmc_counter-v10\ABS\sk16fx144pmc_counter.mhx)

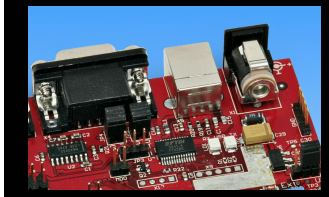


Program Download



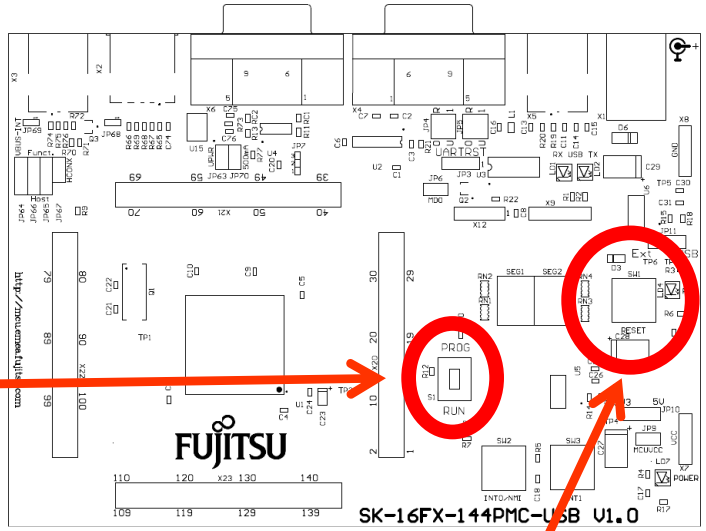






- **Connect to the PC**
  - RS232 or USB can be used
  - Select COM port (‚Set Environment‘)
- **Set jumper S1 to position ‚Prog‘**
- **Press ‚Reset‘**
- **Start ‚Full operation‘**

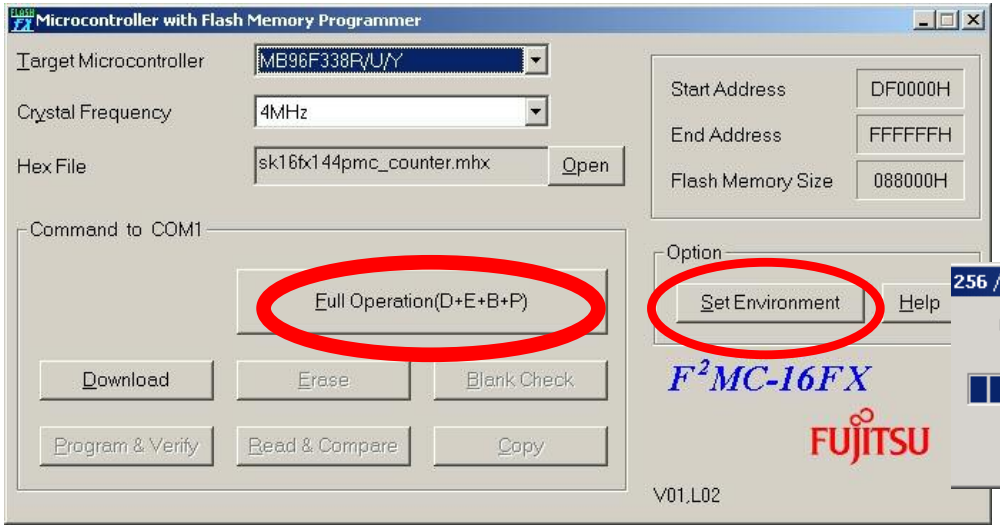
RS232 USB port
(see chapter Jumper settings)

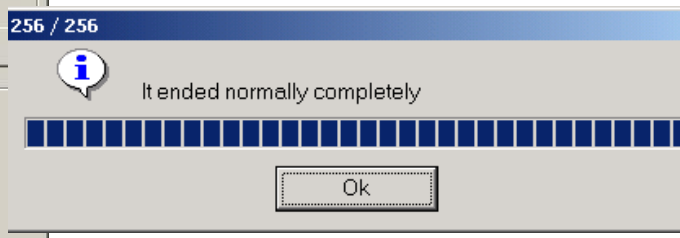


S1: Mode selection

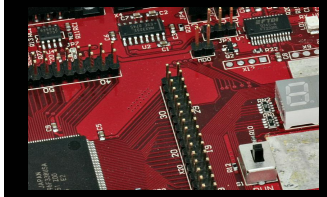
Prog: Set switch to position ‚Prog‘ in order to select the program-mode

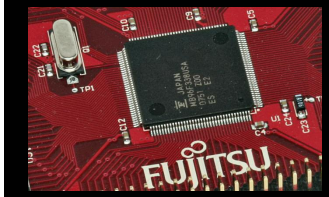
Keybutton ‚RESET‘

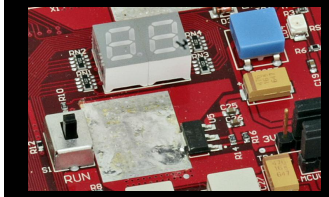


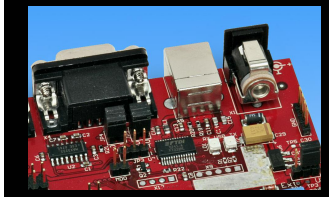


Program Download



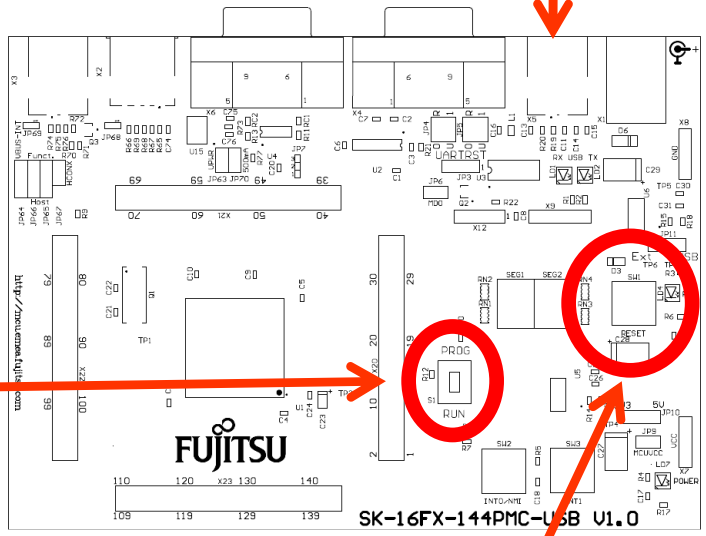






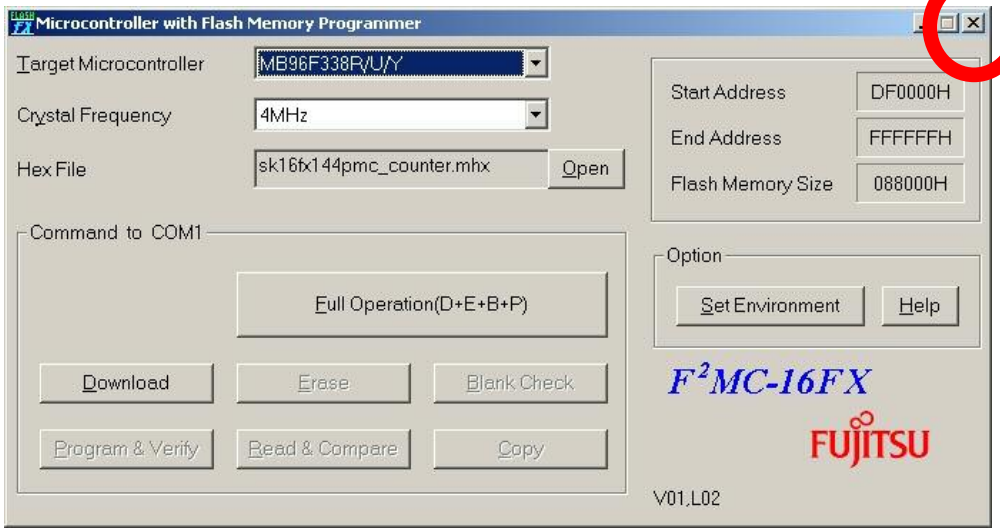
- Close the MCU Flash programmer
- Set jumper S1 to position ‚RUN‘
- Press ‚Reset‘

USB port



S1: Mode selection

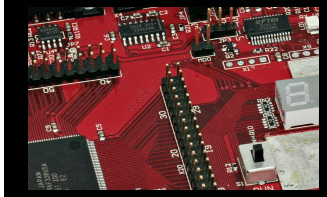
Run: Set switch to position ‚RUN‘ in order to select the RUN-mode

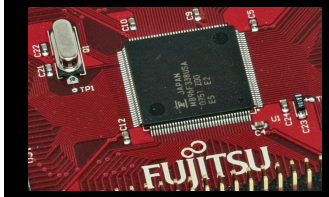


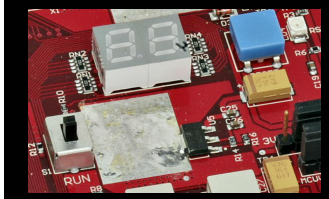
Keybutton ‚RESET‘

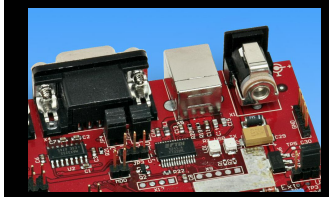
Close the Flash programmer

New Project

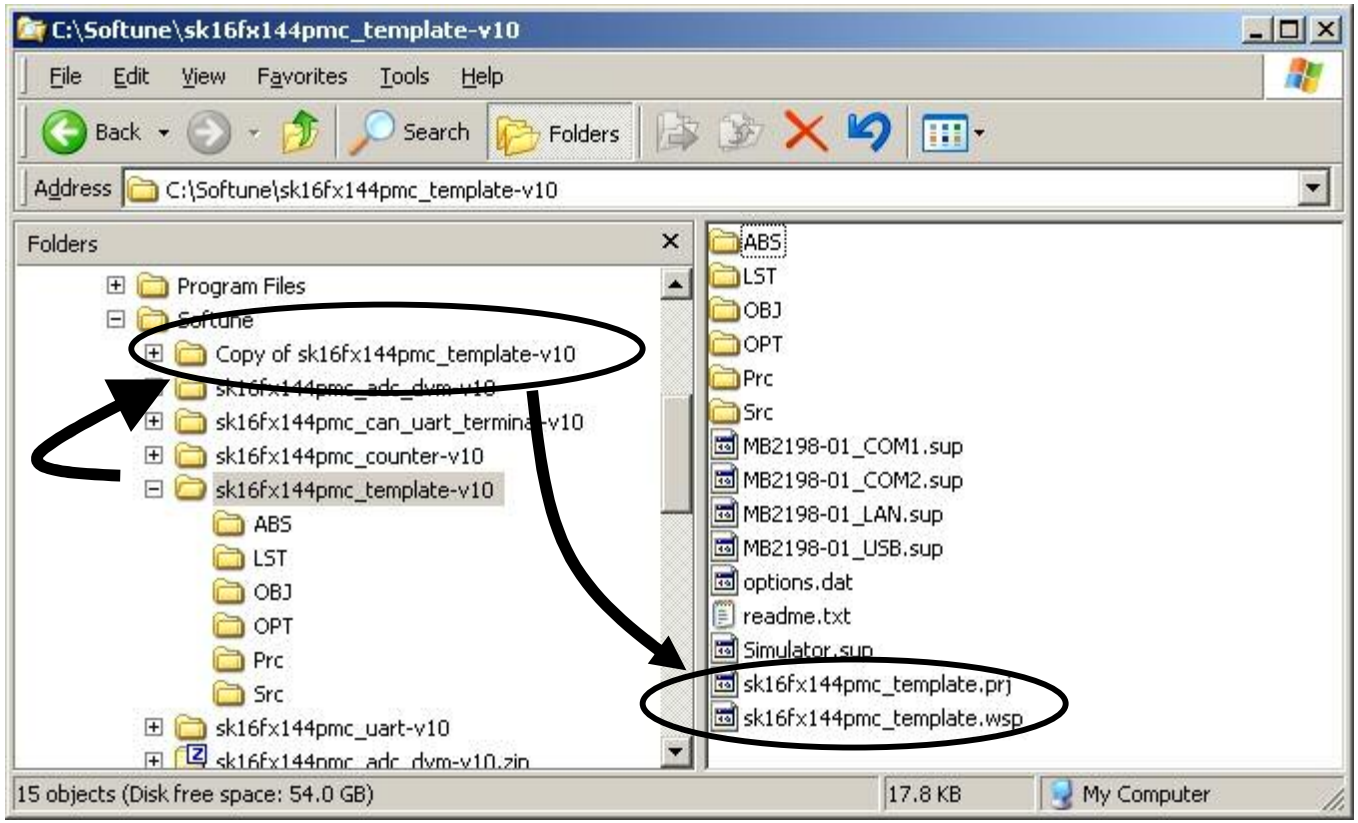




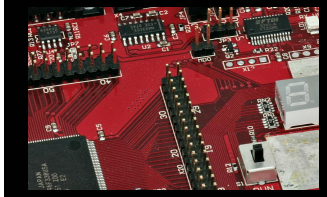


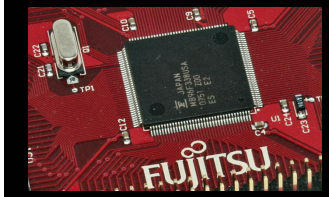


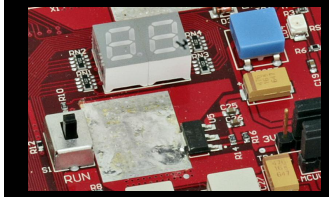
- **In order to start a new user project use the template project**
  - This project includes the startup code, header files, and vector table
- **Copy the folder ‘Template’ within the example folder**
  - Rename ‘Copy of sk16fx144pmc_template-v10’ to ‘my_application’

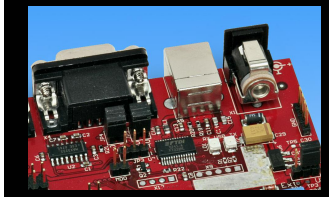


New Project









- **Enter ‘my_application’-folder**
  - Rename ‘sk16fx144pmc_template.prj‘ into ‘my_application.prj‘
  - Rename ‘sk16fx144pmc_template.wsp‘ into ‘my_application.wsp’
- **Edit ’my_application.prj’**
  - rename ‘sk16fx144pmc_template’ -> ‘my_application’
- **Edit ‘my_application.wsp’**
  - rename ‘sk16fx144pmc_ template’ -> ‘my_application’

sk16fx144pmc_template.prj - Notepad

File Edit Format View Help

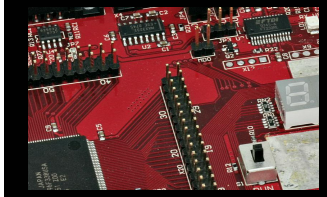
```
LST=LST\
OPT=OPT\

[MEMBER-Debug]
F0=5
F1=0 m 1 ABS\sk16fx144pmc_template.abs
F2=0 a 1 Src\Start.asm
F3=1 c 1 Src\Main.c
F3-1=- src\mb96338us.h
F4=1 c 1 Src\vectors.c
F4-1=- src\mb96338us.h
F5=0 a 1 Src\mb96338us.asm
```

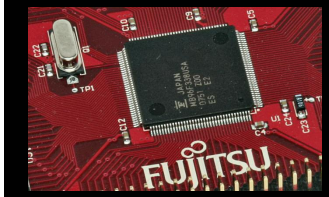
sk16fx144pmc_template.wsp - Notepad

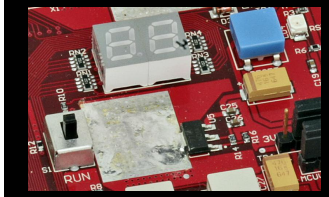
File Edit Format View Help

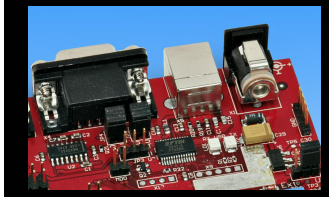
```
[CPUTYPE]
CpuSerise=907

[PrjFile]
Count=1
FILE-0=sk16fx144pmc_template.prj
ActivePrj=sk16fx144pmc_template.prj

[SubPrj-sk16fx144pmc_template.prj]
Count=0

[DebState]
AutoSave=1
Exec=0
AutoLoad=1
```

New Project

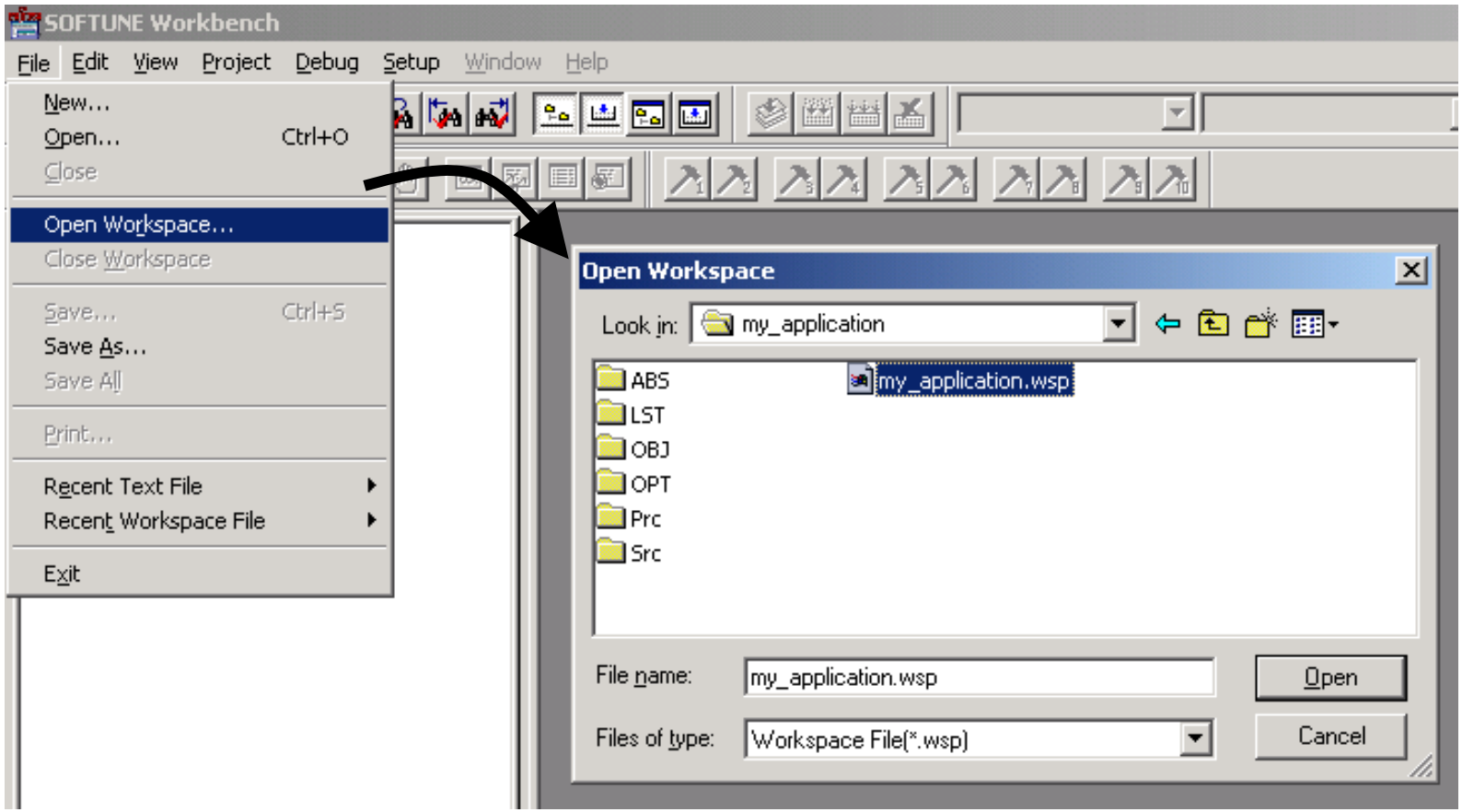




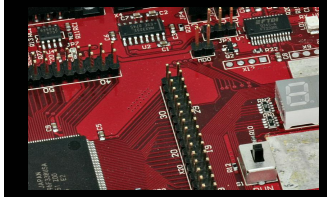


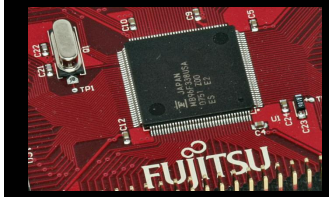


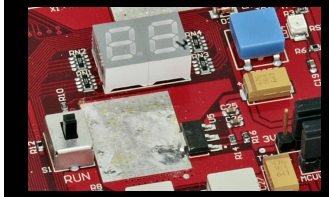
- **Start Softune Workbench and open your project**

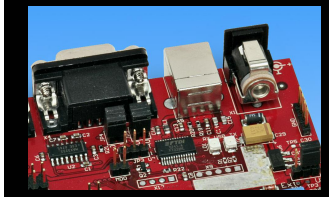


New Project

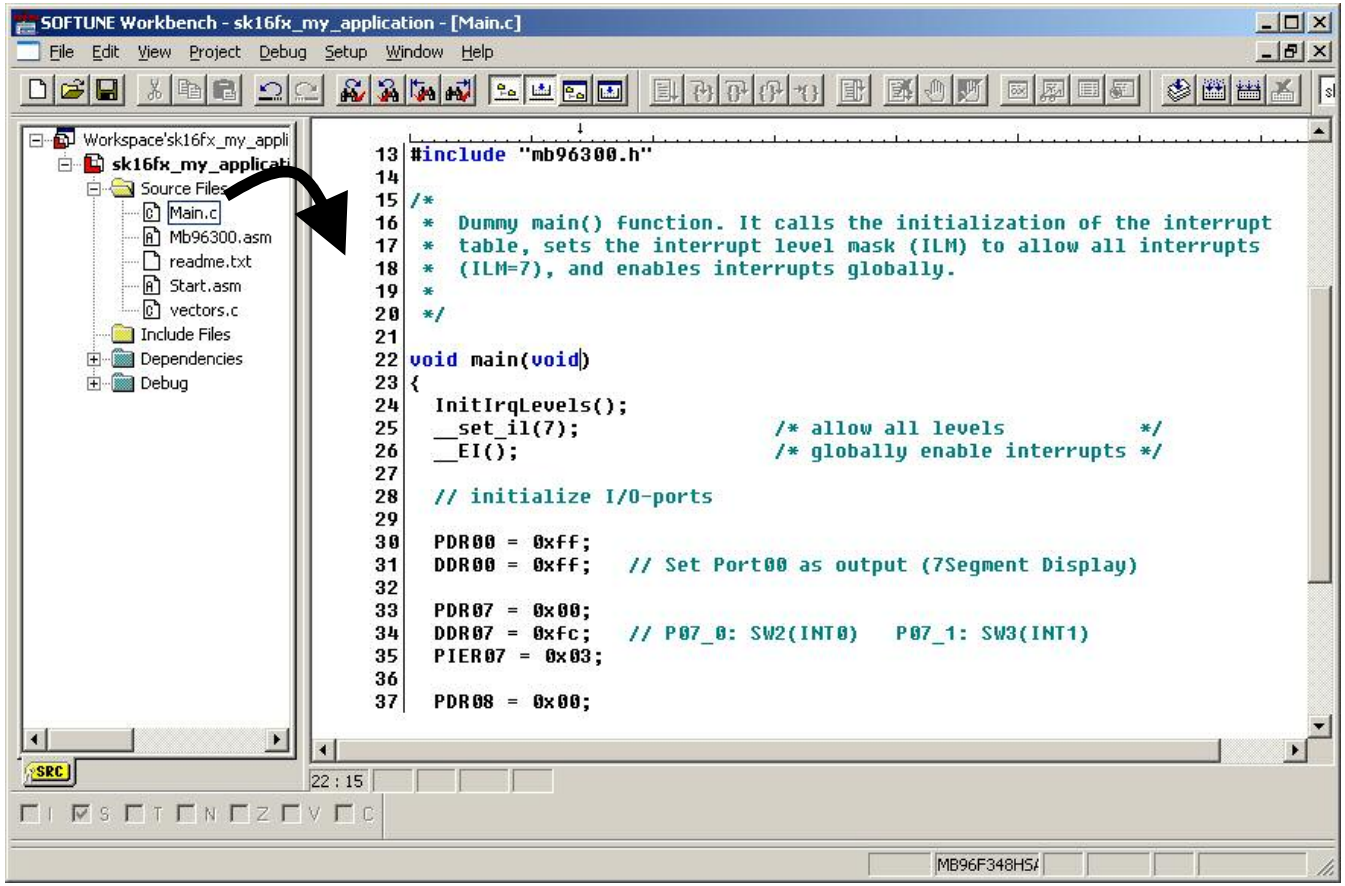


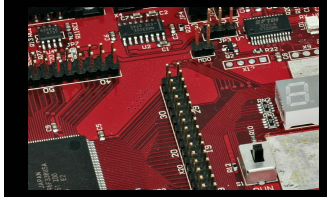
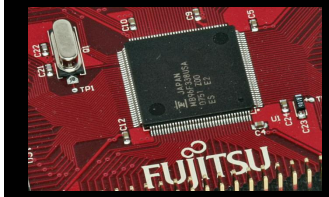
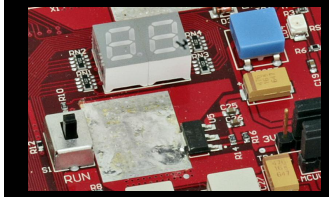
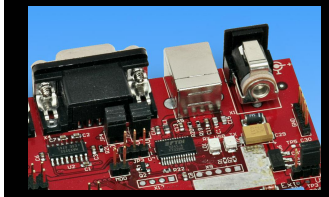






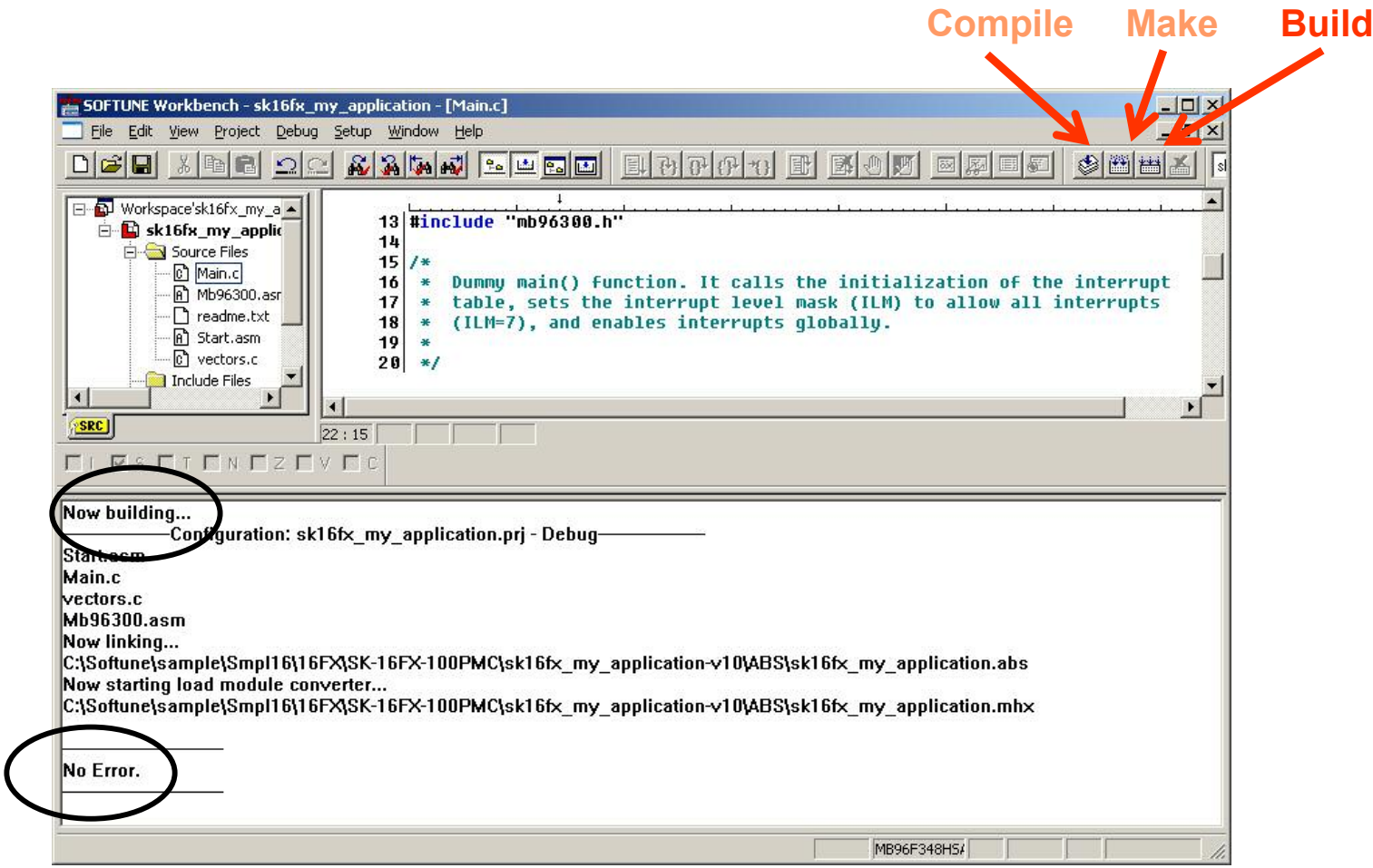
- **Write your application code**
  - `Start.asm` : Startup code
  - `Vectors.c` : Vector table
  - `Main.c` : Your application



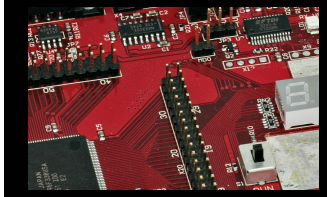






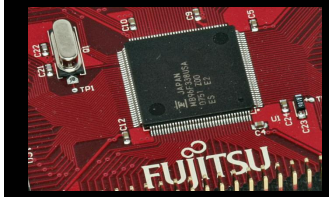
New Project

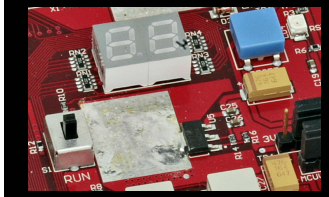
- **Compile and build your project**
  - Generates the MHX-file, which can be programmed to the Flash

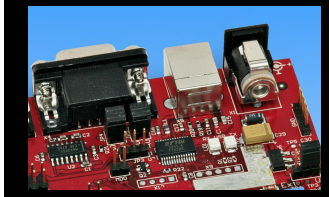


New Project





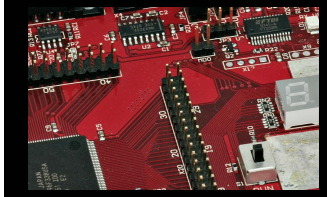


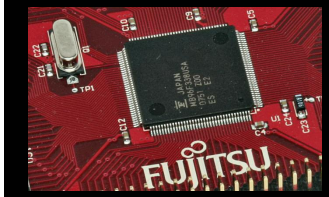


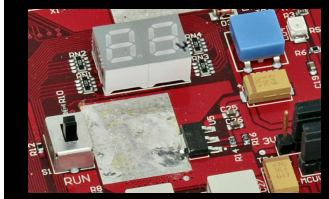
Congratulations!

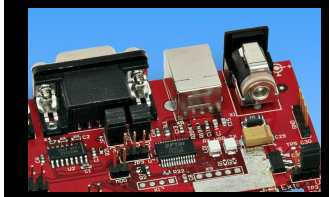
- **You have finished your first project**
  - Please see our application note ‘16FX Getting Started’ for a more detailed introduction.

EUROScope lite 16FX



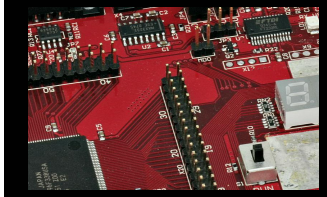


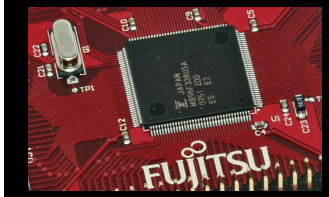


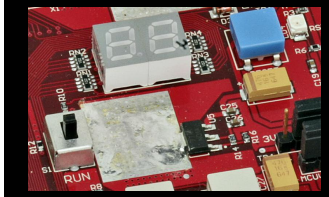


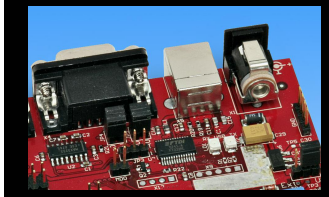
- **„EUROScope lite 16FX“ source-level debugger**
  - On-chip debugging for 16FX microcontroller
  - No kernel linkage / upload required
  - Breakpoints
  - Single step debugging (step, step-in, step-out)
  - Windows for memory, watch, mixed source code, register
  - Plug-ins available for operating systems etc.

EUROScope lite 16FX Installation

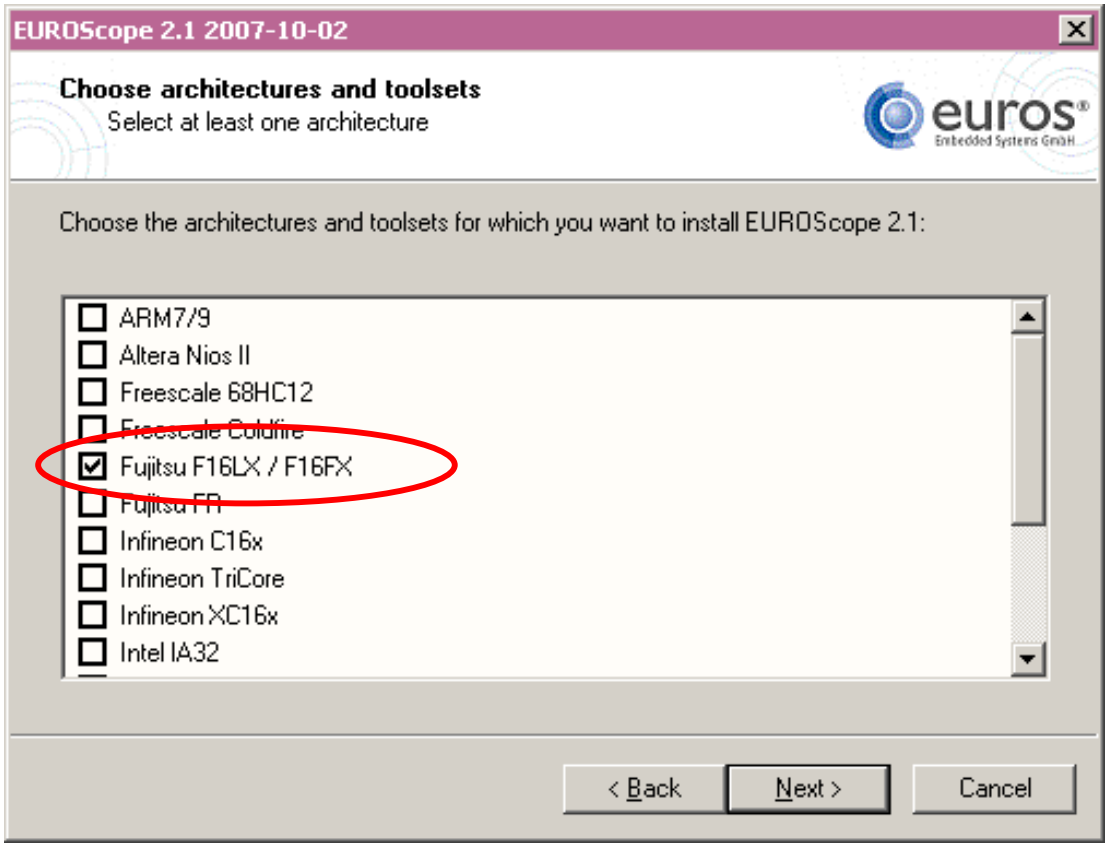




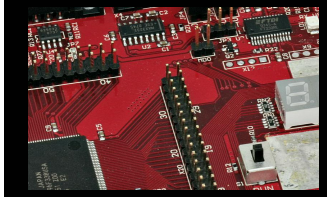
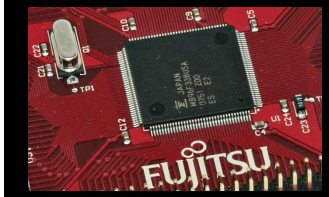


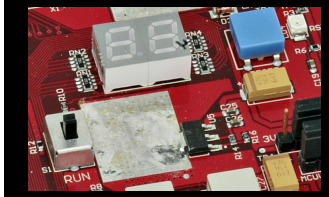


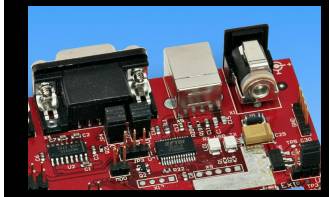
- **Installation of „EUROScope lite 16FX“**
  - Start „EUROScope lite 16FX“ for installation
  - Choose „Fujitsu F16LX / F16FX“ from list



EUROScope lite 16FX Installation

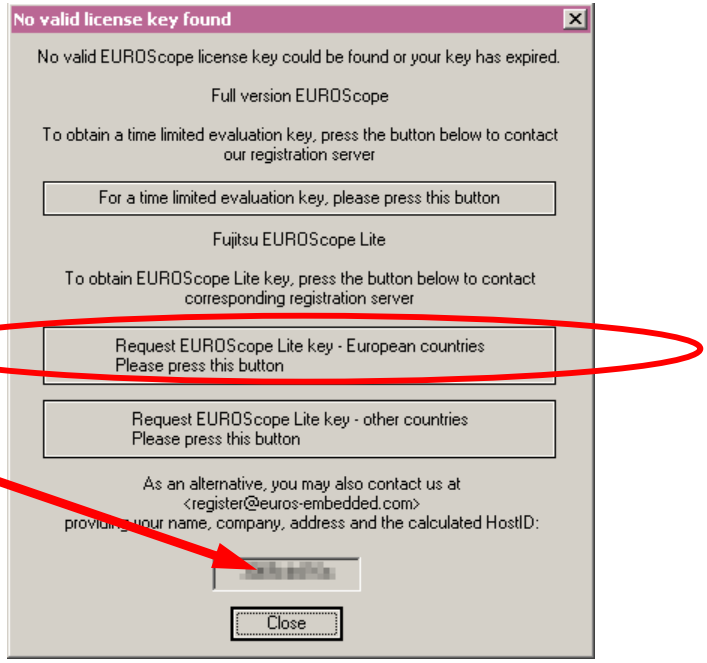






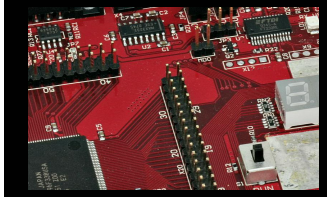
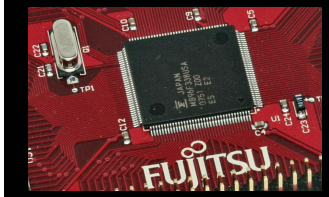
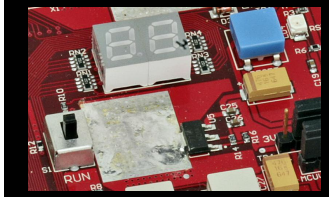
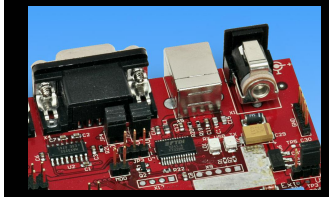


- **License for „EUROScope lite 16FX“**
  - Run EUROScope.exe
    - Copy Host ID (MAC address) of your PC system
    - Request Lite key at https://mcu.emea.fujitsu.com/cusreg/htm/cusreg_form.htm
    - Receive license key file from company EUROS by email
    - Copy license key file (*euros-license.key*) to your local installation path

Host ID of your PC system



EUROScope lite 16FX Project preparation

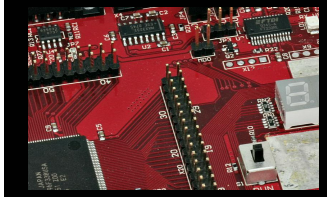






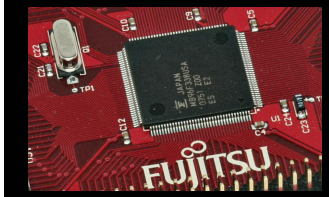
- **All examples within this package are already prepared for the use with EUROScope**
  - Default connection: UART0 routed to X5/USB.

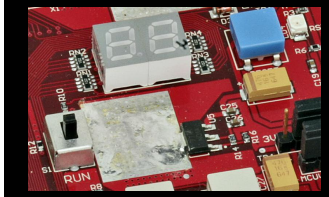
- **In case of new projects or project modifications**
  - Use Softune Workbench
  - Setup the Background Debugging area
    - See *Start.asm* (V1.34), chapter 4.18 (Enable Background Debugging Mode) and chapter 5.9 (Debug Address Specification)
      - See always the latest 'sk16fx144pmc_template' example
  - Build your application project with Softune Workbench
    - Loadmodule (*.*abs*) format is required for debugging

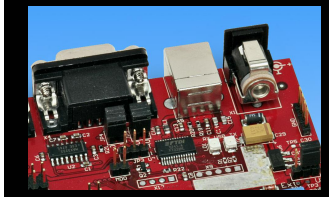
- **Download your project (*.*mhx*) to the board**
  - Use the Fujitsu MCU Flash programmer

EUROScope lite 16FX Configuration

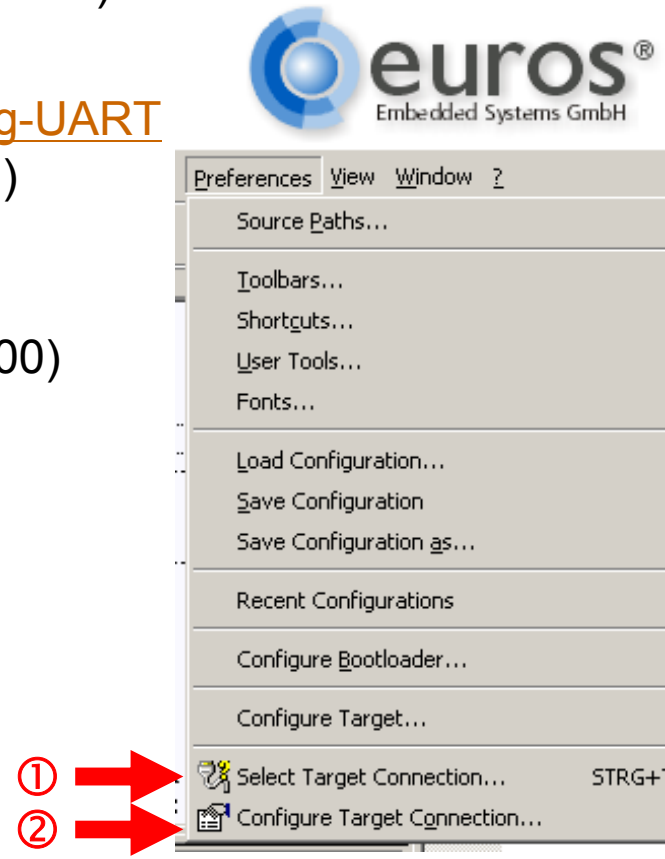




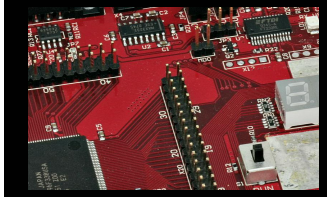
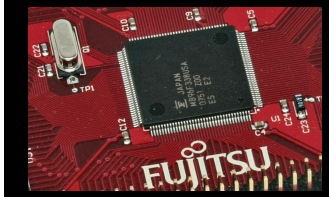
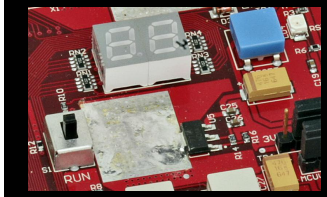
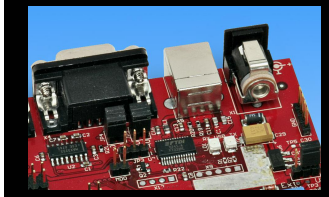




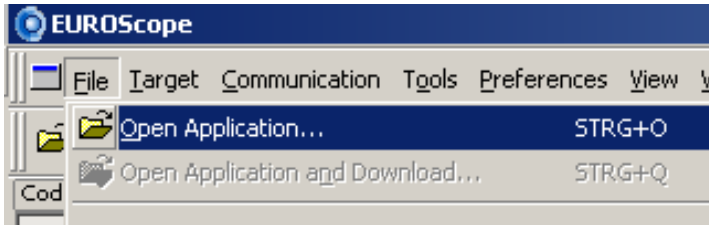
- **Start EUROScope**
- **Ensure the following settings**
  - Select Target Connection ①
    - Choose Fujitsu 16FXBootROM (RS232)
  - Configure Target Connection ②
    - Choose the COM port of the Debug-UART (Default: UART0 routed to X5/USB)
    - Choose the baudrate used in the Debug Address Specification of the *Start.asm* file (Default: 115200)
    - Choose „asynchronous communication“ and „Int/Ext vector mode“



EUROScope lite 16FX
Load ABS file

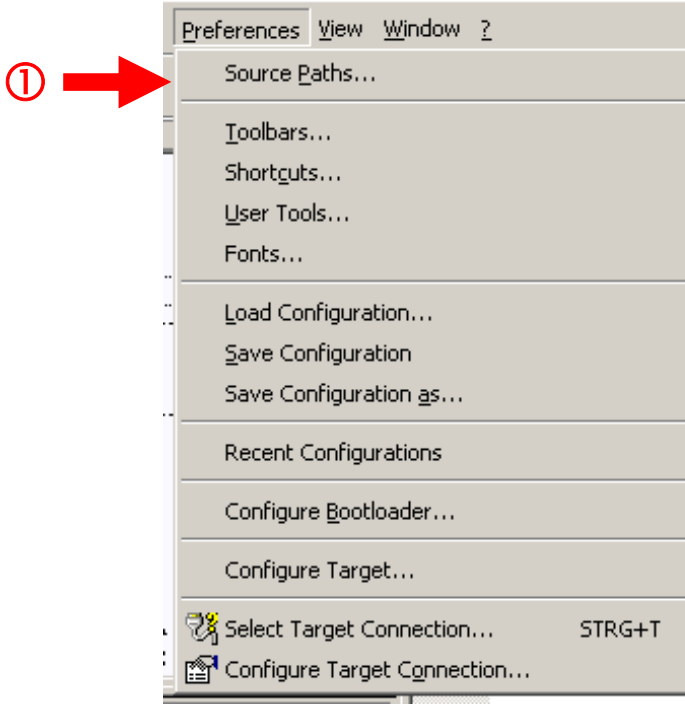






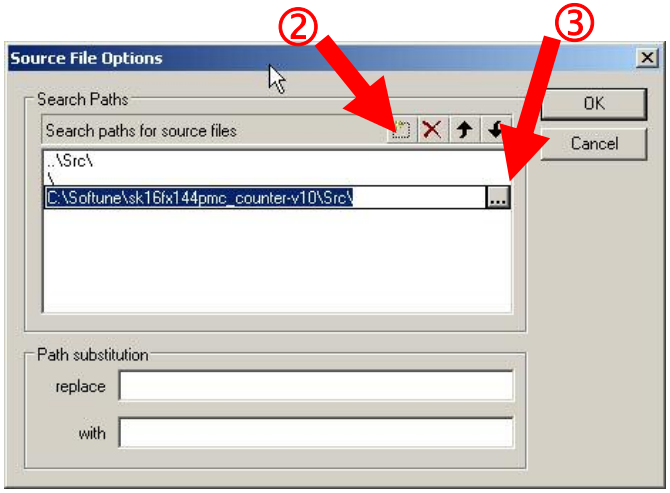
- **Load the *abs* file of your project**
  - File / Open Application ...



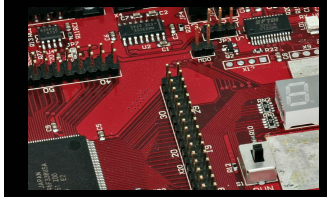
E.g.: <drive>:\Examples\sk16fx144pmc_counter-v10\ABS\sk16fx144pmc_counter.abs

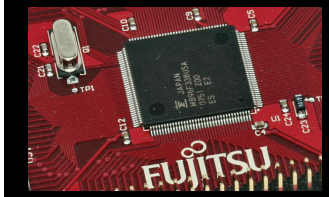
- **Projects may be compiled on another PC or folder structure than the debug PC**
  - Adjust the source path ①
    - Click New (Insert) ②
    - Browse to source folder ③
    - E.g.: <drive>:\Examples\sk16fx144pmc_counter-v10\Src

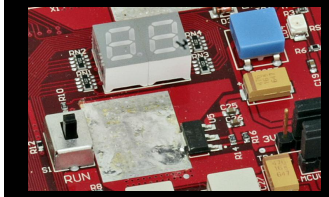


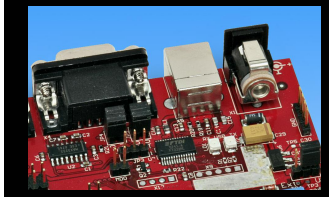


EUROScope lite 16FX
Connect to device





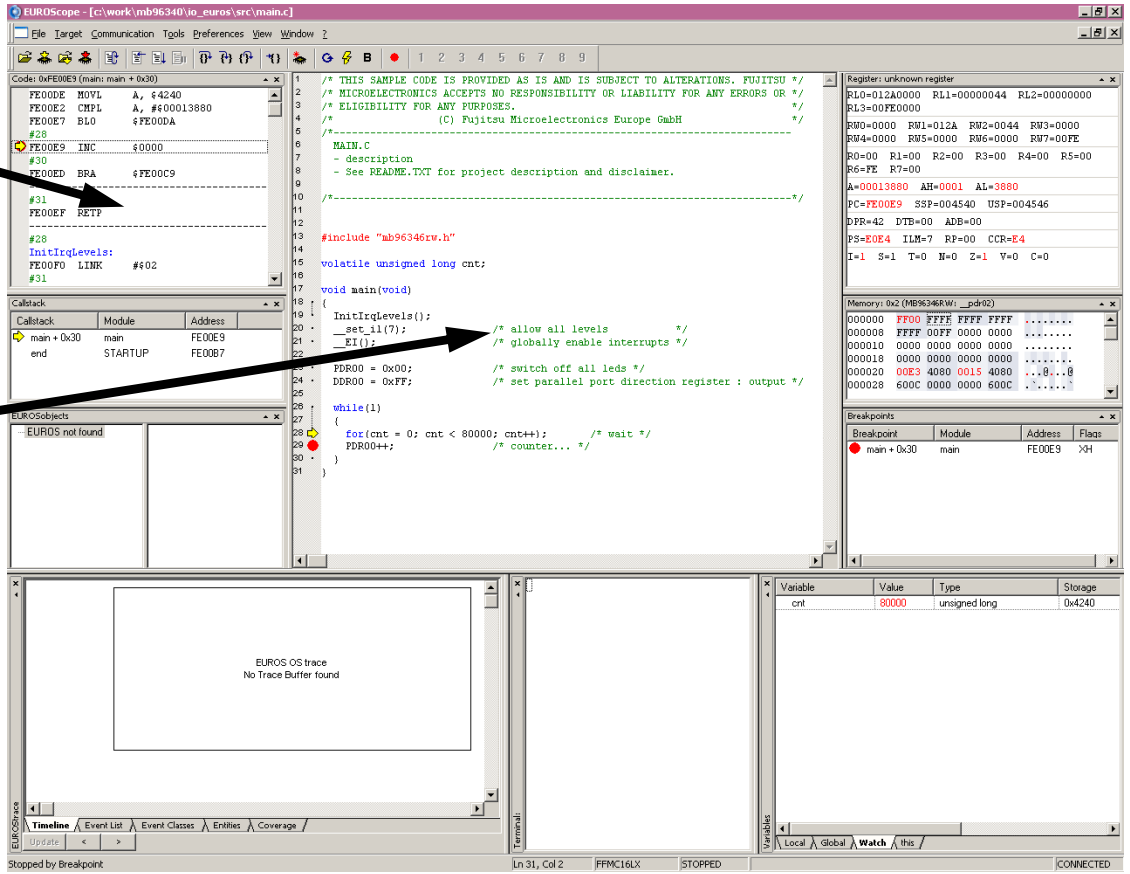


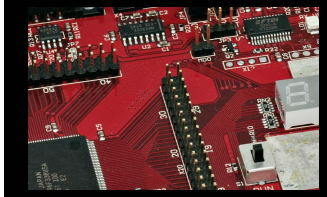
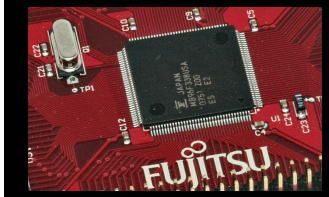
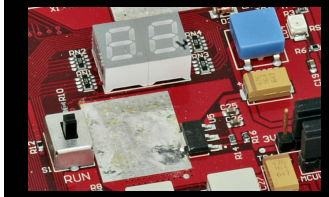
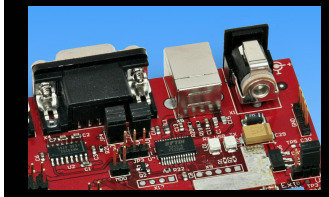


- Start communication (*Communication -> Open*)
- Press reset button
- Communication is established, if code in the assembly and source code window is visible

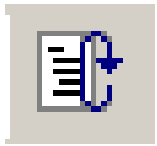
Assembly window

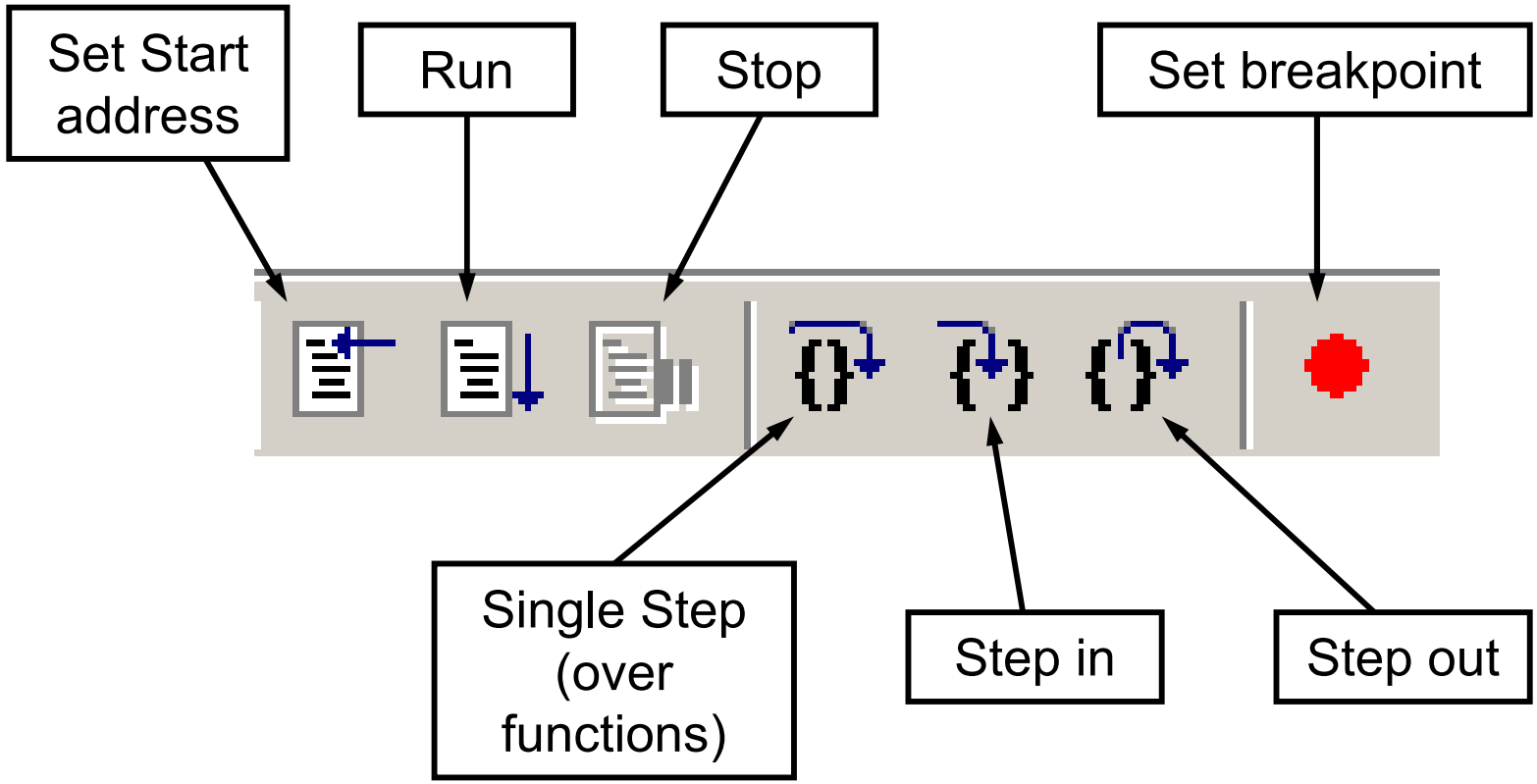
Source code window



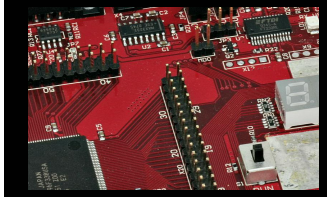






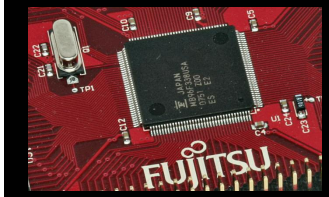
EUROScope lite 16FX
Start Debugging

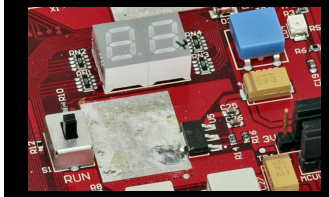
- **Initialize target and run until main function**
  - 
- **Use menu bar for debugging**

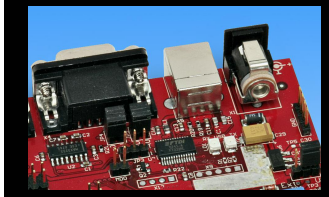


EUROScope lite 16FX Breakpoints



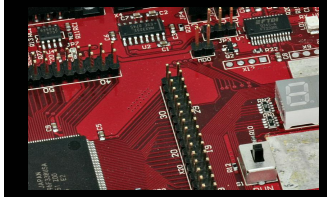


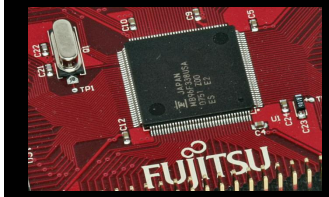


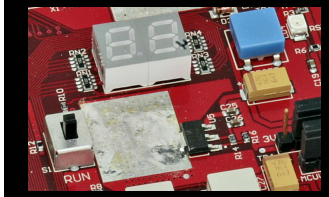


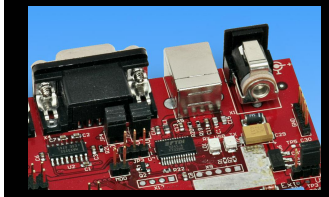
- **Set a breakpoint**
  - Double-click to desired line
    - ‚C' code source: selectables lines are marked by small dot in front
    - ‚Assembly' window: all lines with an instruction can hold a breakpoint
    - Some lines in source code window are grouped. When setting a breakpoint all grouped lines getting the red filled circle, but this is treated as only one breakpoint
- **Activate/deactivate breakpoints**
  - Single-click to breakpoint
- **Delete breakpoint**
  - Double-click to breakpoint until red filled (or white filled) circel disappears

EUROScope lite 16FX Breakpoints









- **Short explanation of EUROScope source code window**

Yellow arrow shows actual programm counter

Point indicates breakable source code line

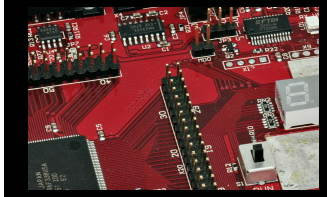
```
131   while(1)
132   {
133     if (SSR1_RDRF != 0)
134     {
135       ch = RDR1;
136       if ((SSR1 & 0xE0) != 0)
137       {
138         SCR1_CRE = 1;
139       }
```

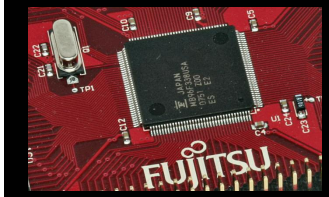
Active breakpoint

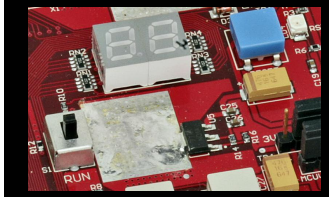
Deactivated breakpoint

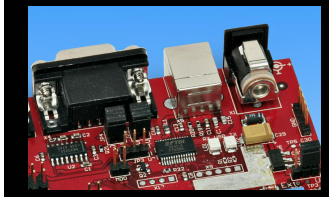
Lines between points indicate a group of breakable lines

EUROScope lite 16FX Processor Status







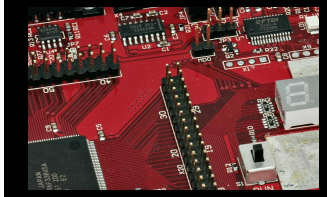


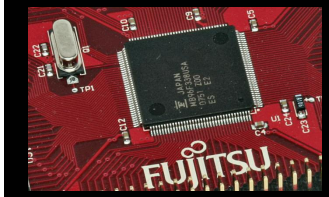
- Processor window provides most important registers
- All processor flags are shown individually
- All values can be changed
- Window is updated on any stop or break of the application
- Changes in values are displayed in red due to prior update

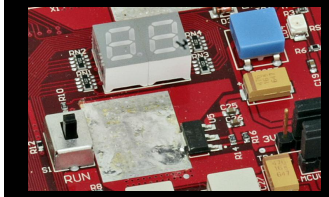
Register: unknown register

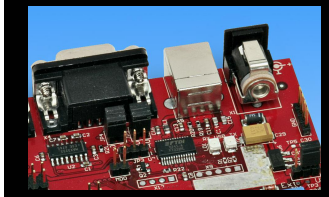
```
RL0=01CC0000  RL1=00F80004  RL2=00020000
RL3=00F80000

RW0=0000  RW1=01CC  RW2=0004  RW3=00F8
RW4=0000  RW5=0002  RW6=0000  RW7=00F8

R0=00  R1=00  R2=02  R3=00  R4=00  R5=00
R6=F8  R7=00

A=00660066  AH=0066  AL=0066

PC=F80169  SSP=00253E  USP=002544

DPR=22  DTB=00  ADB=00

PS=E0E5  ILM=7  RP=00  CCR=E5

I=1  S=1  T=0  N=0  Z=1  V=0  C=1  TBR=0000
```

EUROScope lite 16FX Variable Window

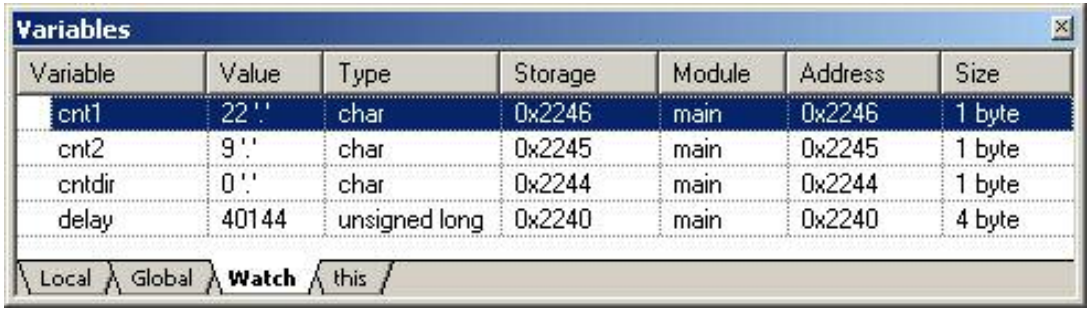




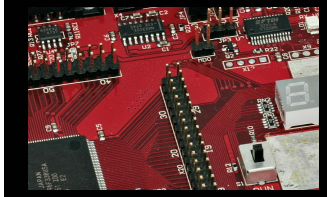


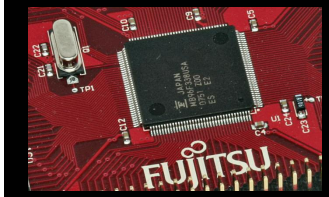


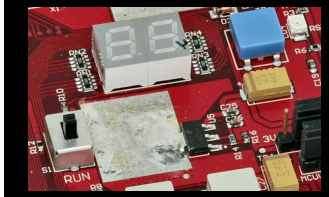
- **Local**
  - Local variables are automatically collected in view „Local“
- **Watch**
  - All local and up to 8 global variables can be added individually to the ‘Watch‘ window
- **Variables are updated on any stop or break of the application**
- **Changed values are displayed in red**
- **Variable values can be changed in ‘value‘ entry**

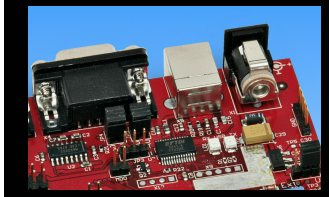


EUROScope lite 16FX Memory View

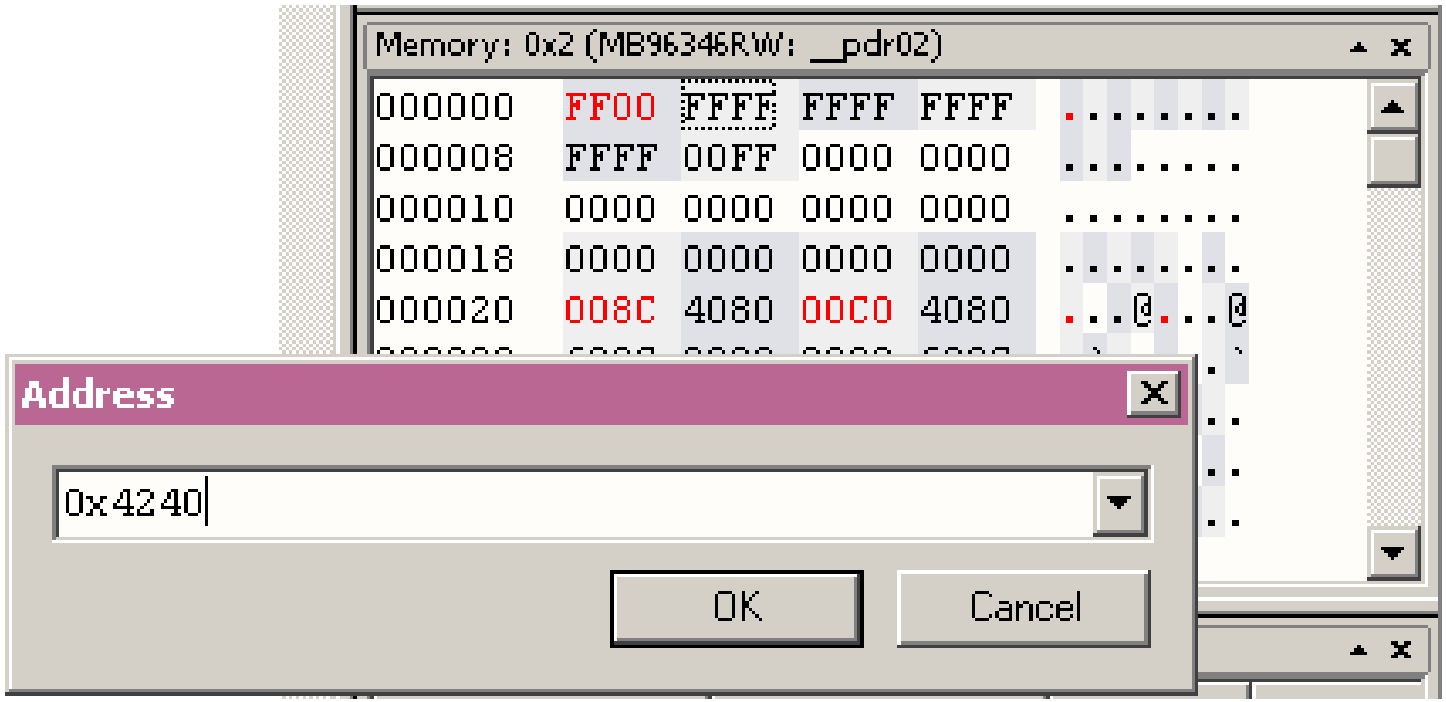


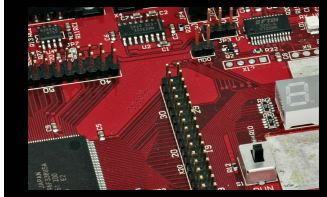
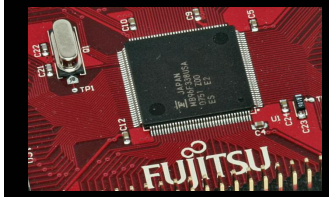
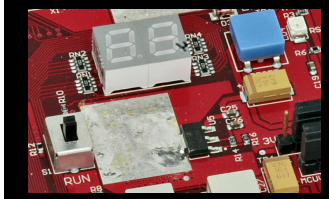
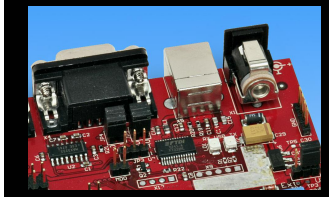






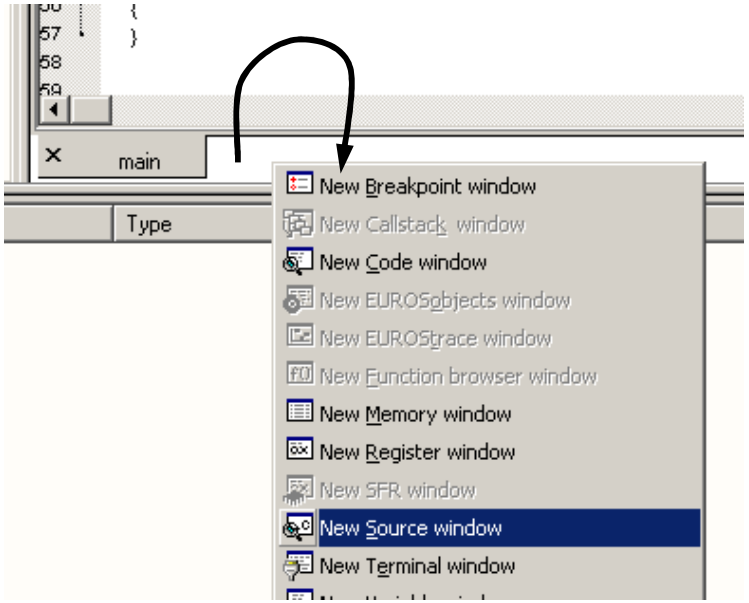
- Memory view is updated on every stop or break
- Value change is displayed in red due to prior update
- Memory content can be changed
- Memory can be filled with a user byte and size

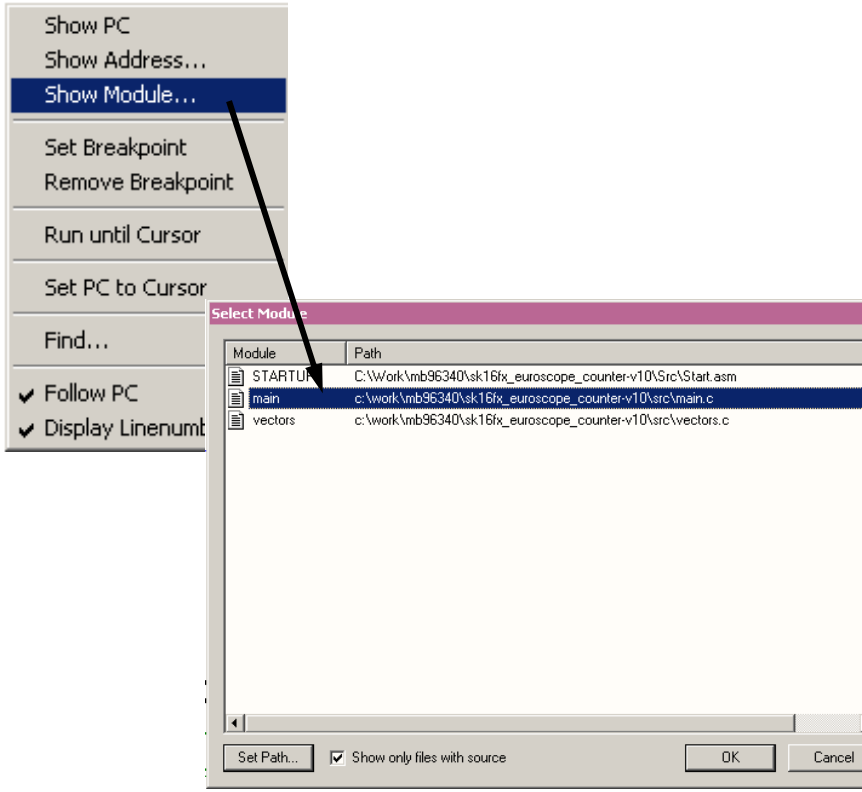


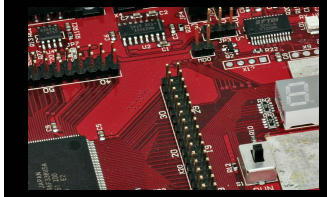
EUROScope lite 16FX
Changing/Adding Source Window

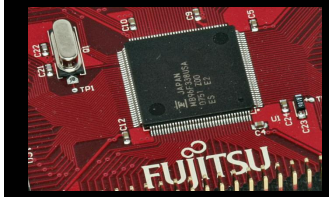
- **New source module window**
  - Go in window tab area and right-button click
  - Choose „New Source window“
- **Change source window**
  - Get menu by right-mouse-button-click in the source window
  - Choose „Show Module...“
  - Browse to Module File

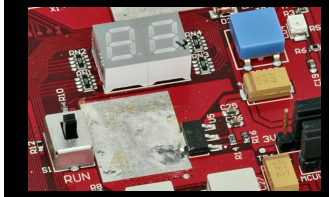


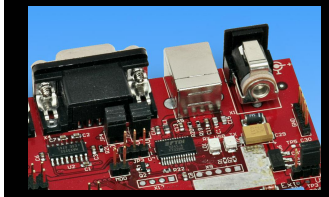


EUROScope lite 16FX Flash Programming



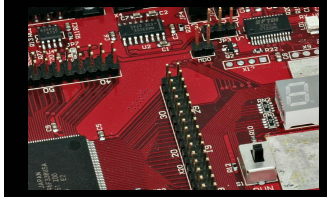


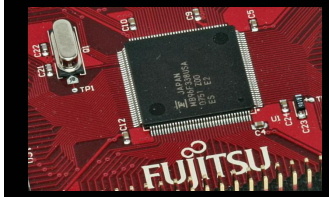


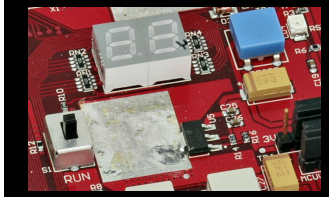


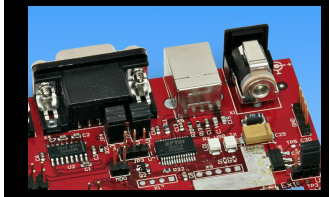
- **Flash programming is available via the Flash button:**
  - BDM configuration can be set before programming
  - Chip erase is supported
  - Flash programming is supported
  - User has to press reset button after Flash programming
  - Fujitsu Flash programming kernels are reused

EUROScope lite 16FX BDM Configuration

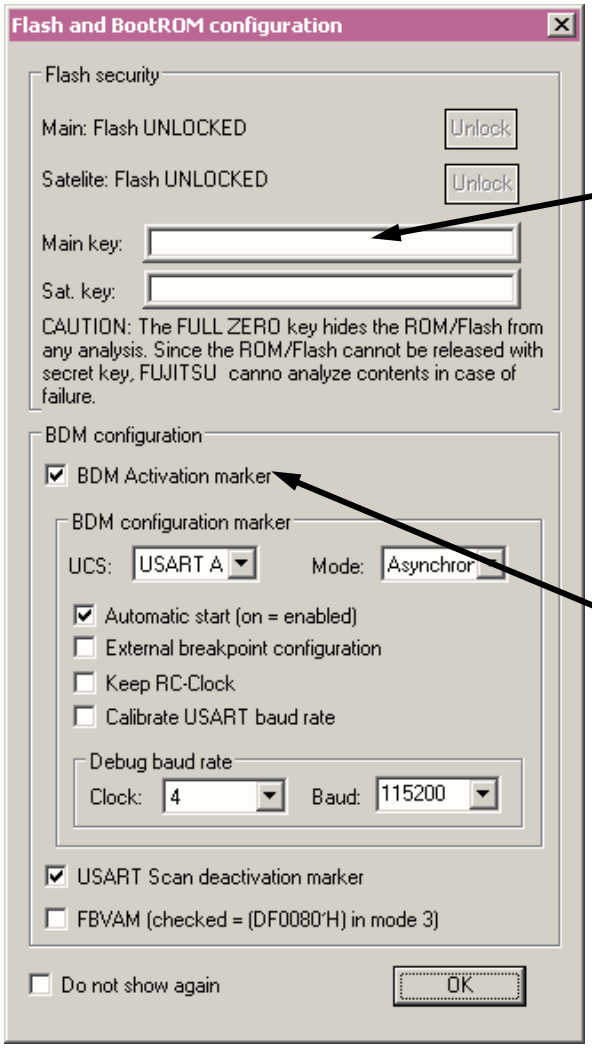








- Background debugging mode configuration
- Flash security unlock

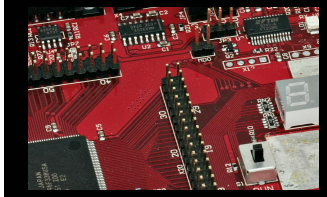


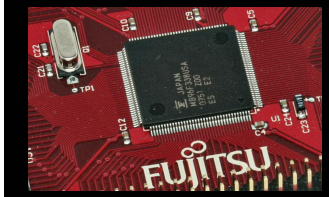
Flash security unlock keys

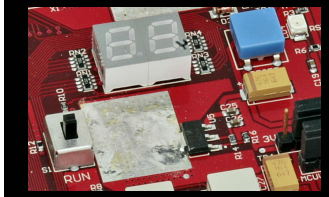
BDM Activation

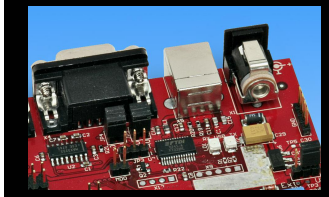
[√] Use EUROScope configuration
[ ] Use MHX file configuration

EUROScope lite 16FX Flash Programming Dialog







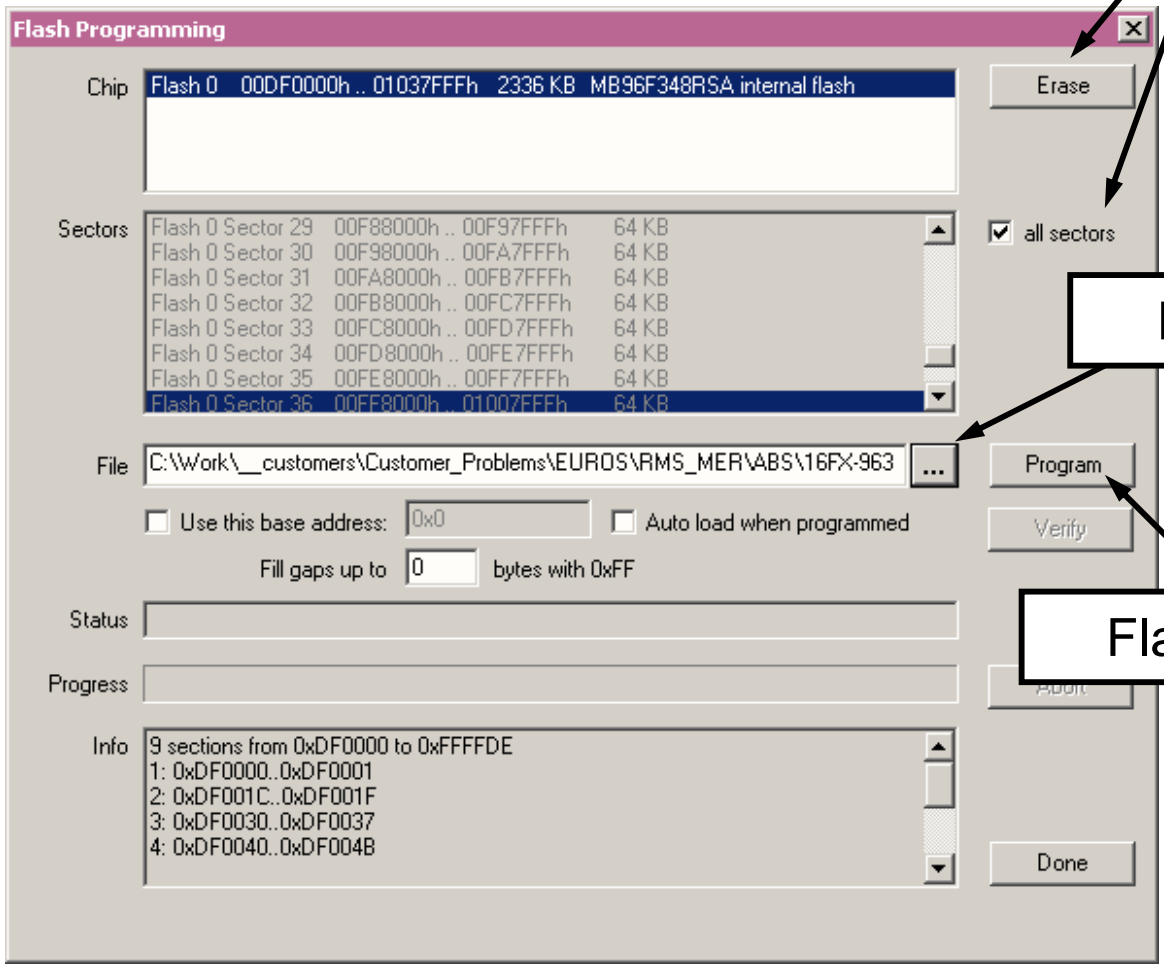


- **Chip erase and Flash programming**
  - Click on ‚Done‘ and reset board after programming

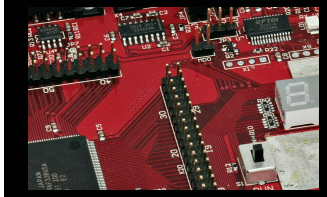
Chip erase (‚all sectors‘ must be checked)

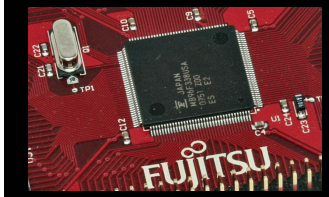
Browse to MHX file

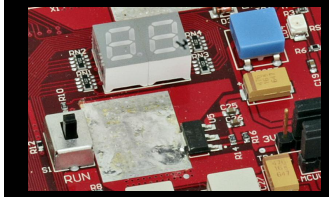
Flash programming

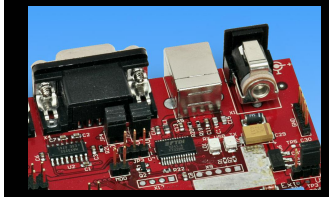


EUROScope lite 16FX Prospect









- **All SK-16FX-144PMC-USB examples* are configured as follows:**
  - UART0 for debugging
  - UART1 may be used by the application
  - Asynchronous communication
  - 115200 bit/s
  - Autorun after reset
  - No breakpoint predefinition

- **For more details of „EUROScope lite 16FX“ please refer to application note**
  - mcu-an-300235-e-16fx_using_EUROScope

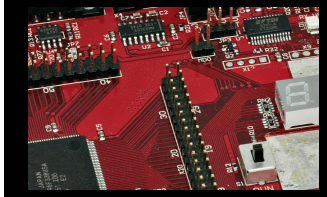
and take care of the following customer information

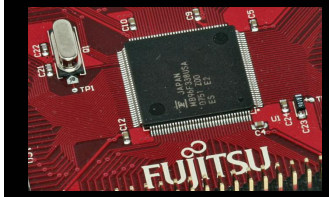
- Customer Information EUROScope

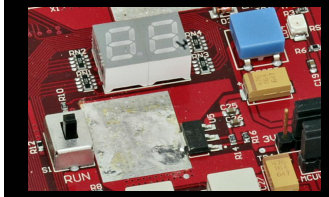
(*) except USB Host examples

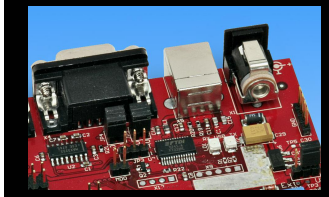
USB Library from THESYCON

Thesycon® Systemsoftware & Consulting GmbH









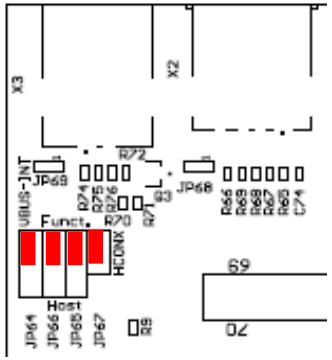
- **The MB96F338U microcontroller offers USB-Host/-Function that is supported by SK-16FX-144PMC-USB**
  - USB-MiniHost (Type-A connector)
  - USB-Function (Type-B connector)

- **The company THESYCON Thesycon® Systemsoftware & Consulting GmbH provides two free-of-charge libraries implemented in C and provided as source code**
  - FUFA - Fujitsu USB Firmware API for USB function
  - FUMA - Fujitsu USB Minihost API for USB minihost

http://www.thesycon.de

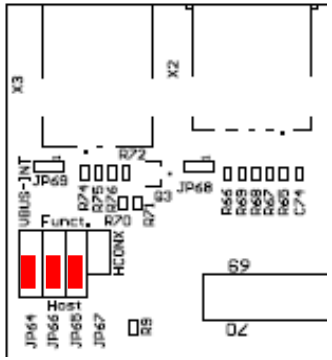
Function

Function Jumper Setting



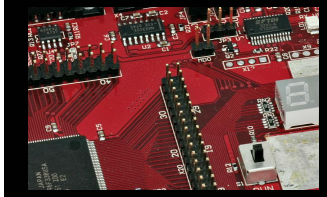
Host

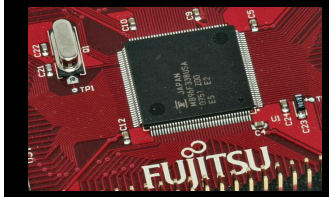
Host Jumper Setting

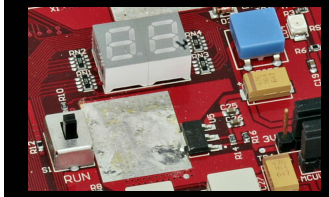


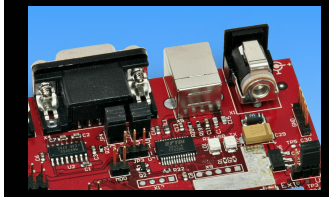
USB Library from Thesycon

Thesycon® Systemsoftware & Consulting GmbH

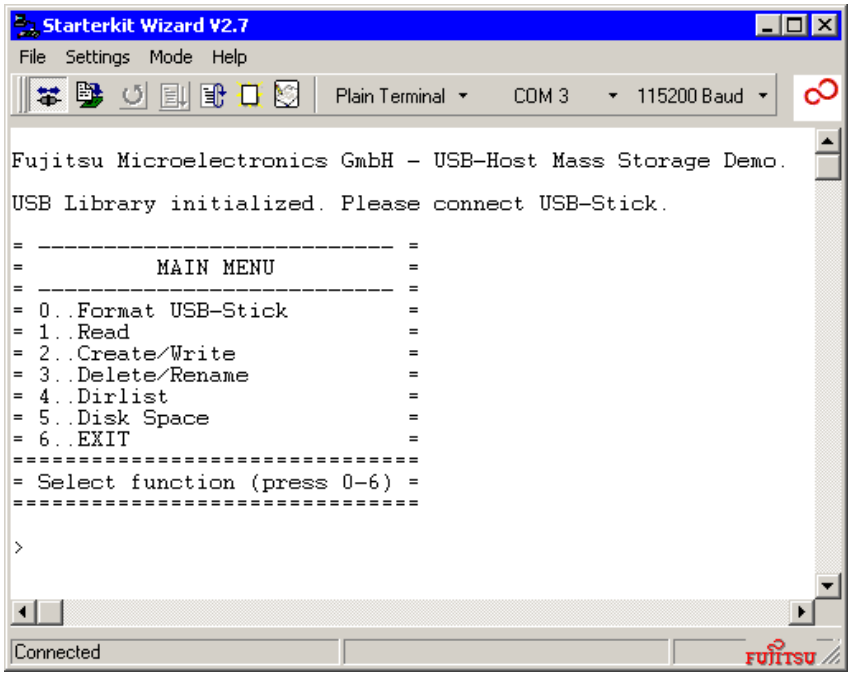




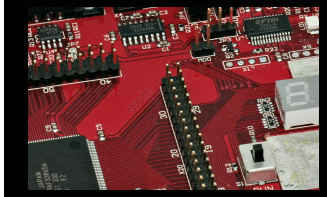


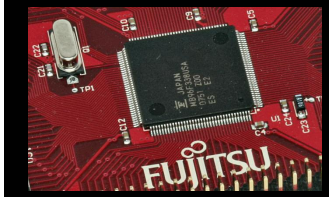


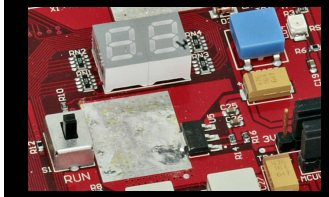
- **Access to a Memory Stick is shown by a demo example**
  - sk16fx144pmc_usb_host
  - incl. FUMA library
  - incl. FAT16 file system from Elm Chan http://elm-chan.org/fsw/ff/00index_e.html
  - Set USB-Host jumpers
  - Download the example sk16fx144pmc_usb_host.mhx
  - Connect UART0 to your PC
  - Start your terminal program with 115.200 Baud, 8N1 e.g. SKwizard
  - Connect your Memory Stick
  - Press Reset
  - For detailes please see the readme.txt of the example or the Application note

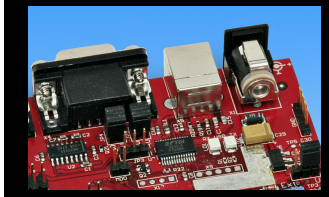


USB (VID / PID)





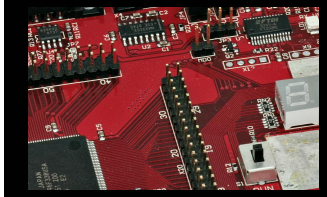


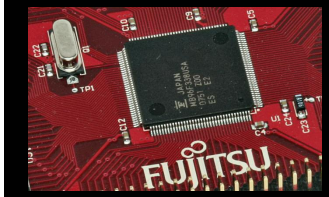


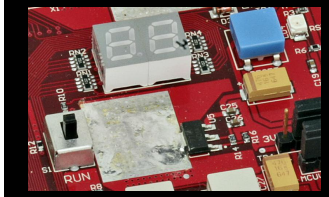
Do you need an USB VID / PID ?

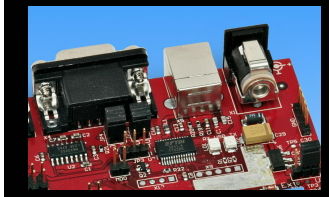
- **If you need an USB VID / PID for development and prototyping then please contact FUJITSU in order to get your sublicense:**
  - Contact: micro_info@fme.fujitsu.com
  - Subject: “USB VID / PID sublicense”
- **In order to get your proper VID /PID please contact USB.org**
  - http://www.usb.org
  - http://www.usb.org/developers/vendor/

Further Steps





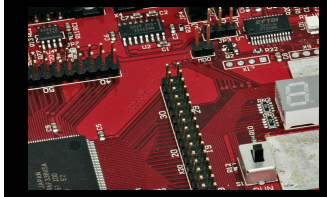


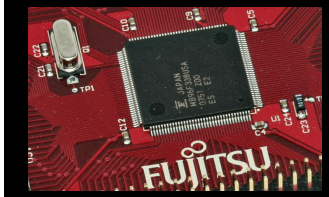


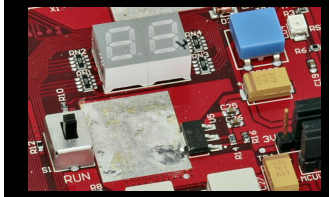
- **In order to learn more about Fujitsu's microcontrollers**
  - Visit our microcontroller website
    - http://mcu.emea.fujitsu.com
      - http://mcu.emea.fujitsu.com/mcu_product/detail/MB96F338UWAPMC.htm
  - See our application notes
    - http://mcu.emea.fujitsu.com/mcu_product/mcu_all_appnotes.htm
  - See our software examples
    - http://mcu.emea.fujitsu.com/mcu_product/mcu_all_software.htm

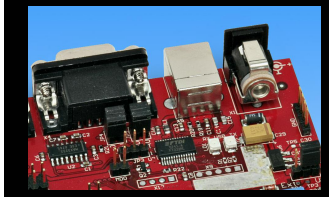
- **Contact your local distributor …**
  - for individual support
  - to register for our monthly 16FX seminar
  - to order the latest 'Fujitsu Micros DVD' containing all information regarding Fujitsu's 8-bit, 16-bit, and 32-bit microcontrollers

Optional Tools



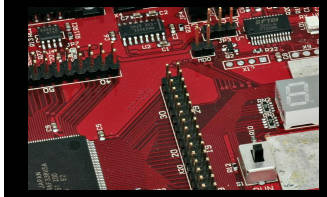


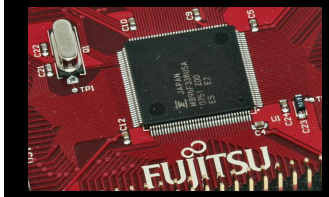


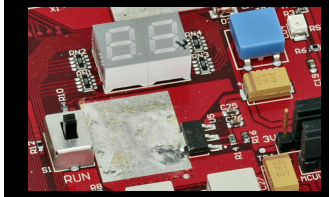


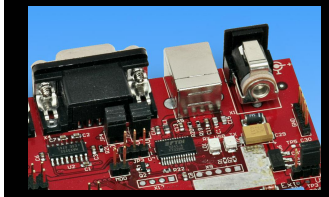
- **High-end evaluation board**
  - SK-96330-144PMC-GDC
  - SK-96330-144PMC
- **Hardware emulator**
  - MB2198-01 + MB2198-500
  - Emulation chip MB96V300B
  - Probe header MB2198-506-E for LQFP package M08
    - Socket NQPACK144SD-ND, HQPACK144SD
- **Programmer**
  - Conitec GALEP-4, GALEP-5
- **Operating systems**
  - ProOSEK®, EUROS, RTA-OSEK, embOS, osCAN, FreeRTOS

Evaluation Board

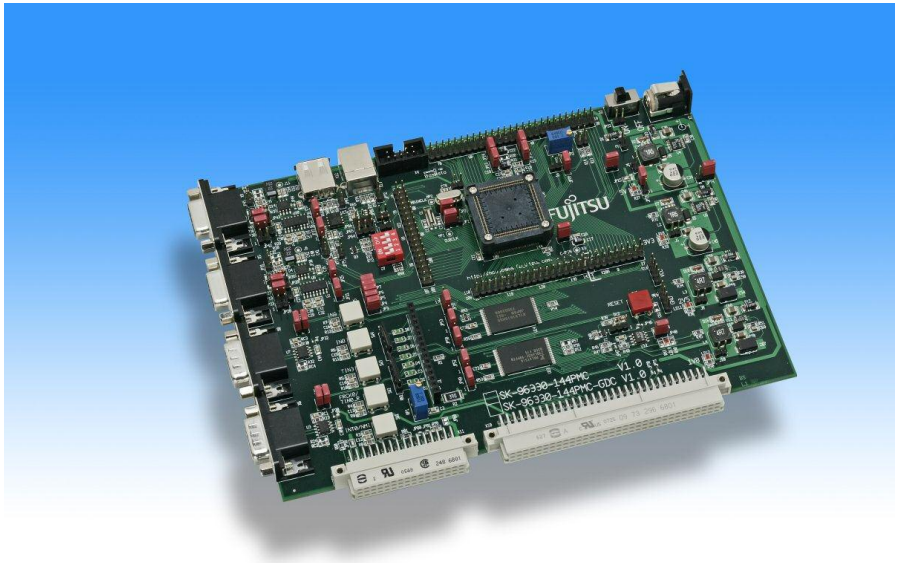






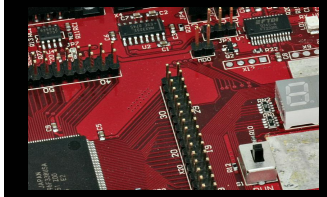


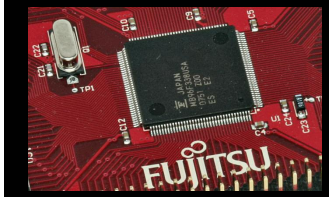
- **SK-96330-144PMC-GDC**
  - Evaluation board for MB96330 Series
  - Access to all on-chip peripherals
  - Ext. Bus Interface (e.g. for Fujitsu Graphic Controller Boards)
  - USB-Host/-Function connectors
  - 2x UART/LIN
  - 2x CAN
  - 8x ‘User’-LEDs
  - 5x ‘User’-Buttons
  - Connector for LC-Display
  - 8 MB Flash
  - 2 MB SRAM

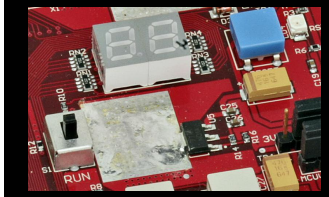


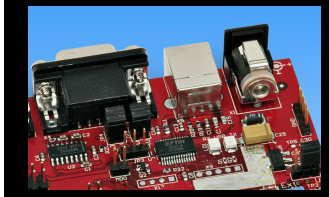
- **SK-96330-144PMC**
  - without external memory
  - without GDC interface

Hardware Emulator



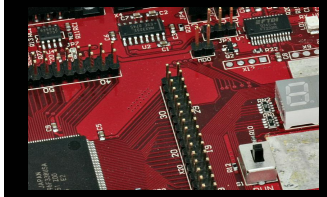


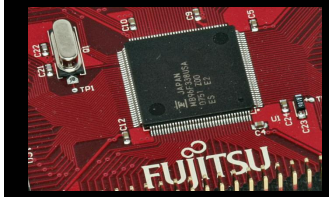


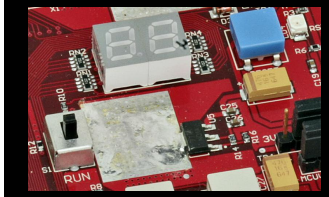


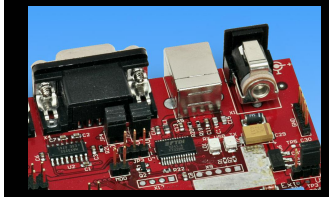
- **In-Circuit emulator for F2MC-16FX**
  - Main unit (MB2198-01), Adapter (MB2198-500), V-Chip (MB96V300B)
  - USB, LAN, and RS232 communication interface
  - Connected to target system via standard Fujitsu probe cable
  - High speed operating frequency
  - 2052 code / 4 data event breakpoints
  - Sequential breakpoints (4 conditions / 3 levels)
  - Trace function

Hardware Emulator

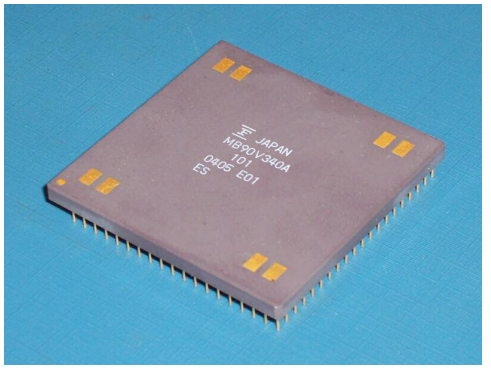




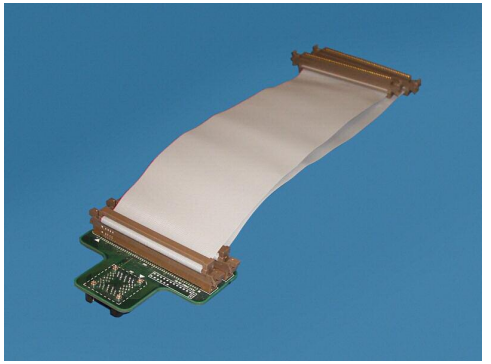




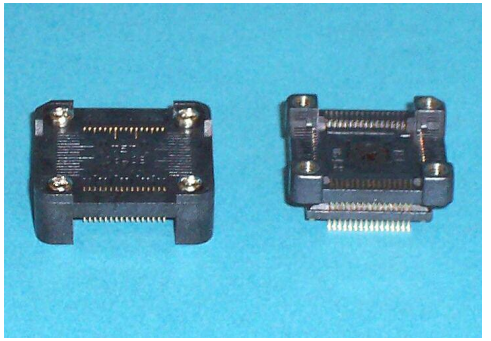
- **Emulation chip MB96V300B**
  - Superset supports all features of 16FX



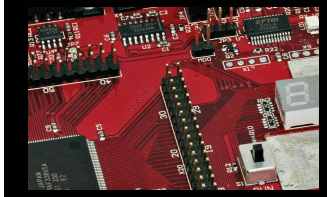
- **Probe header**
  - MB2198-506-E for LQFP package M08

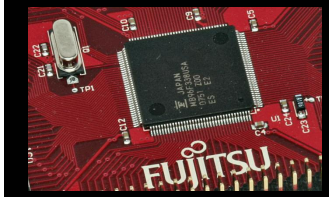


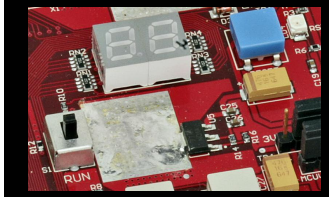
- **Socket for LQFP package M08**
  - NQPACK144SD-ND, HQPACK144SD

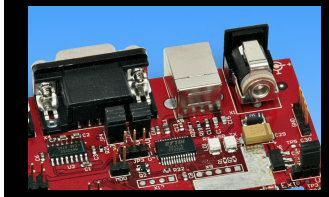


Programmer



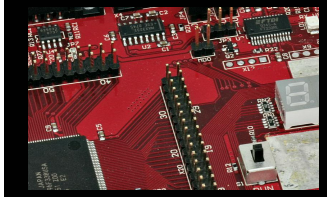


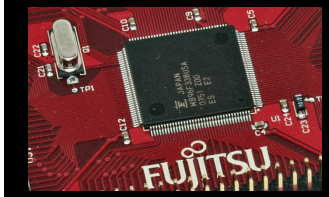


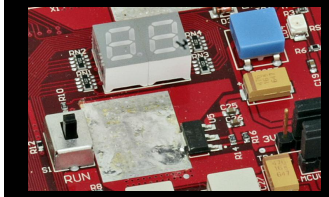


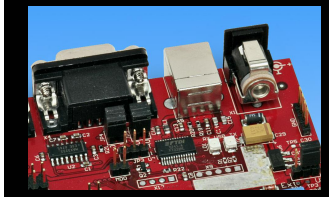
- **GALEP-4 / GALEP-5**
  - Supports parallel programming
  - Supports serial synchronous and asynchronous programming
  - Optional programming cable for serial synchronous programming
  - Allows programming in volume production
  - www.conitec.com

Operating Systems



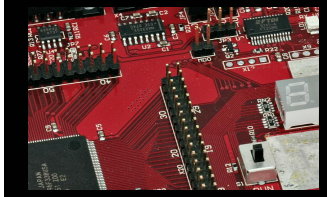


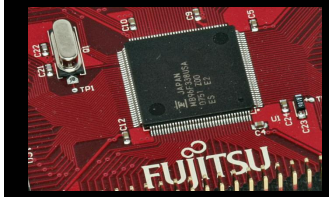


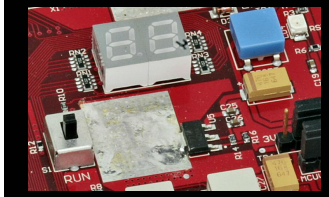


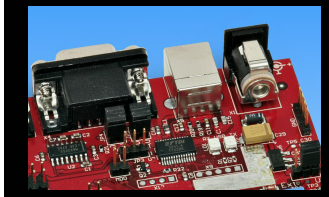
- **ProOSEK®**
  - Real-time operating system, OSEK/VDX
  - www.elektrobit.com
- **EUROS**
  - RTOS including TCP/IP, IrDA, IDE, CAN-Bus, CANopen, Profibus, etc.
  - www.euros-embedded.com
- **RTA-OSEK**
  - Realogy Real-Time Architect (RTA) ,OSEK, incl. timing analysis tool
  - www.etasgroup.com
- **embOS**
  - Small memory footprint for single-chip applications incl. PC viewer
  - www.segger.com
- **osCAN (OSEK/VDX)**
  - osCAN (OSEK/VDX) and further networking software CAN, LIN, FlexRay, etc.
  - www.vector-informatik.de
- **FreeRTOS**
  - Free and open source mini Real Time Scheduler
  - www.FreeRTOS.org

Contacts - Distribution





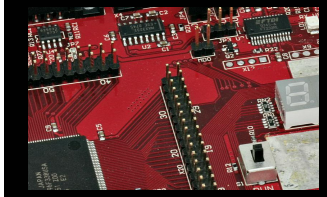
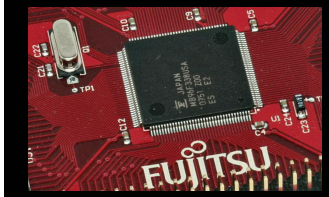


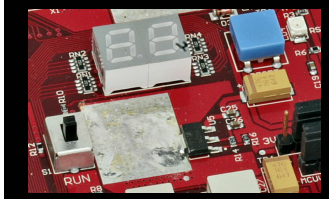


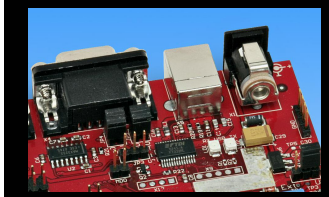
- European distributors

ATeG - Anatec AG	www.anatec.ch
ATeG - Anatronic S.A.	www.anatronic.com
ATeG - Ineltek GmbH	www.ineltek.com
EBV Elektronik GmbH	www.ebv.com
Glyn GmbH & Co. KG	www.glyn.de , www.glyn.ch
Malpassi srl	www.malpassi.it
Melchioni Electronica SpA	www.melchioni.it
PN Electronics	www.pne.fr
Rutronik	www.rutronik.com
Sagitrón	www.sagitron.es/english.htm

Fujitsu Microelectronics Europe

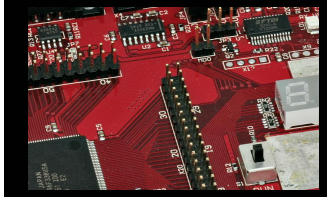
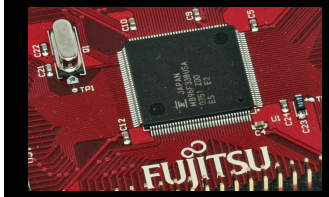
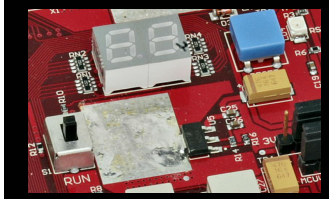
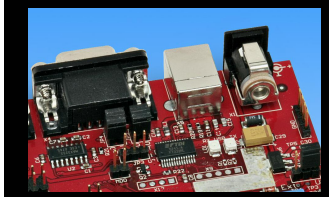








- **Germany (Headquarters)**
  - Pittlerstrasse 47, D-63225 Langen
  - Tel: (0 61 03) 69 00, Fax: (0 61 03) 69 01 22
- **France**
  - 2-12 Chemin des Femmes, F-91300 Massy
  - Tel: (01) 64 47 97 07, Fax: (01) 64 47 97 01
- **Italy**
  - Palazzo Pitagora – Milano 3 City, Via Ludovico il Moro 4B, I-20080 Basiglio, Milano
  - Tel: (02) 90 45 02 1, Fax: (02) 90 75 00 87
- **United Kingdom**
  - Network House, Norreys Drive, Maidenhead, Berkshire SL6 4FJ
  - Tel: (01628) 50 46 00, Fax: (01628) 50 46 66

- **World Wide Web**
  - http://emea.fujitsu.com/microelectronics
  - http://mcu.emea.fujitsu.com
  - Contact: micro_info@fme.fujitsu.com

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:

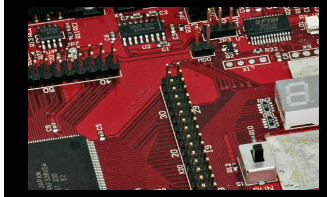
Fujitsu Microelectronics Europe GmbH

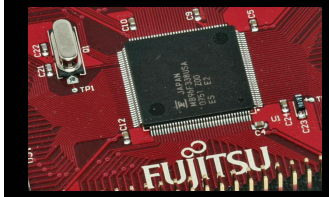
Warehouse/Disposal

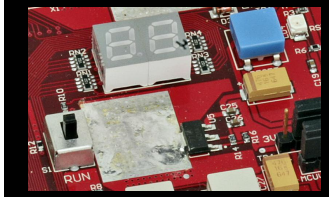
Monzastraße 4a

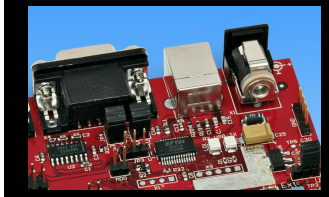
D-63225 Langen

CD Contents









- **Software**
  - Softune Workbench
  - EUROScope lite 16FX
  - MCU Flash programmer
  - SKwizard
  - Thesycon USB driver
- **Documents**
  - Schematic ‘SK-16FX-144PMC-USB’
  - Data sheet MB96330 Series
  - Hardware manual 16FX Family
  - AppNote ‘16FX Hardware Setup’
  - AppNote ‘16FX Getting Started’
  - Customer Information 16FX
  - EUROScope Reference Manual
  - Customer Information EUROScope
  - AppNote ‚EUROScope‘
  - AppNote ‘USB Mini-Host Mass Storage Class’
- **Software Examples**
  - sk16fx144pmc_adc_dvm
  - sk16fx144pmc_can_uart_terminal
  - sk16fx144pmc_counter
  - sk16fx144pmc_template
  - sk16fx144pmc_uart
  - sk16fx144pmc_usb_host
  - 96330-usb_bootloader