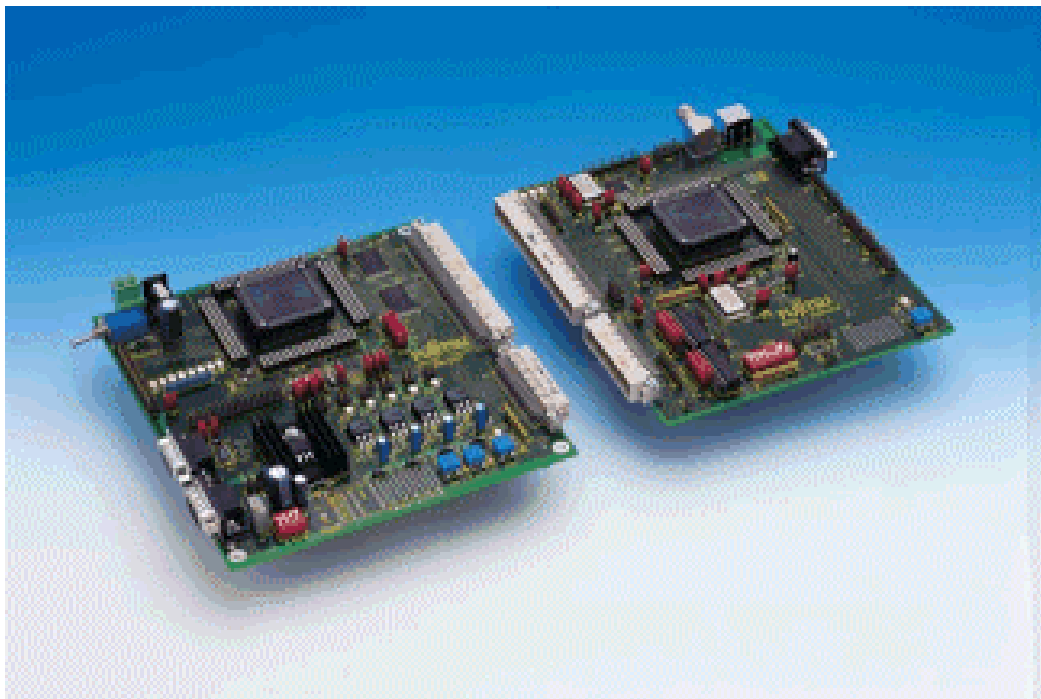# Cremson Graphic Controller Family Modular Starterkit

User's Manual
for board configuration

MB91F361/2 CPU-Module
+
MB86290A 'Cremson' or MB86291 'Scarlet'

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Vers. 1.0

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Read this first

This manual describes the **Fujitsu CREMSON MODULAR STARTERKIT** and how to use it with the tools provided.

To work with this starterkit, a <u>CPU-module and a graphic subboard</u> is required ! This manual describes the starterkit in the board configuration CPU-module (MB91F361/2) + subboard "Cremson" or "Rose/Scarlet"

How to use this manual

The goal of this manual is to help you learn how to develop your own applications for the Fujitsu Graphic Controllers using the **CREMSON MODULAR STARTERKIT** together with the Windows-based tools.

This manual is divided into 5 parts. Parts 1-3 contains hands-on information to help you getting started using the evaluation board the same day you receive it. Part 1 is a general description of the board. Part 2 contains installation instructions and parts 3 and 4 will guide you through example sessions.

Important notice

Each board of the Cremson modular starterkit series contains one evaluation board, documentation and software on a CD-ROM.

For documentation or software updates, please refer to our web site www.fujitsu-fme.com !

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Contents

1. Introduction

The Fujitsu Cremson Modular Starterkit is a stand-alone application board that makes it easy to evaluate and demonstrate almost all features of one particular graphic controller. The board is a combination of a CPU-main board and a graphic subboard equipped with the graphic chip.

Fujitsu has a number of graphic controllers for embedded systems organized in different device families. All graphic controllers from one particular family are software-compatible. Therefore, this evaluation system has different software packages, manuals etc. depending on the device family.
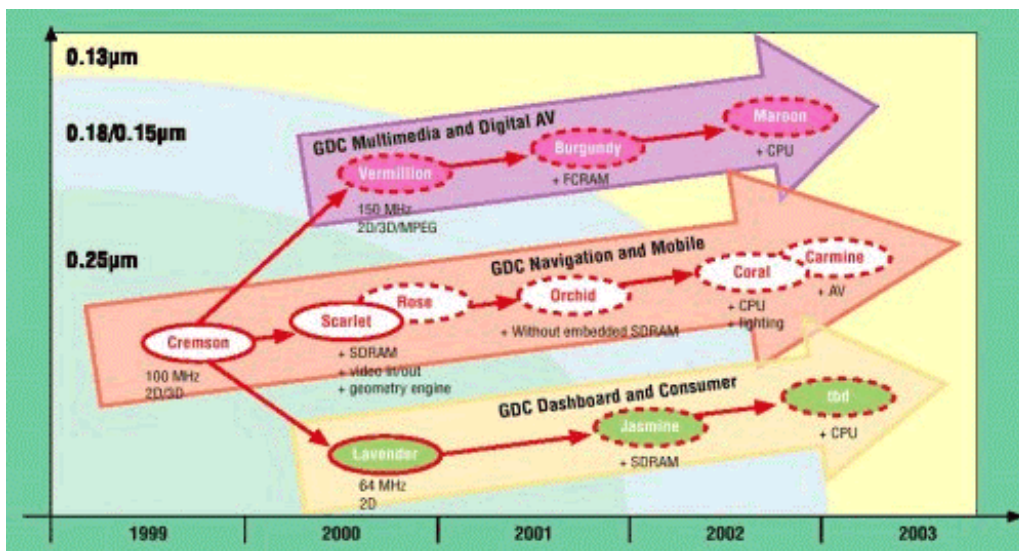
Fujitsu's device families of graphic controllers

1.1. Board Configuration

There are a number of boards available for each Fujitsu graphic controller as well as at least one CPU type.

Make sure you have both, a CPU- and a graphic-subboard available. The boards are available individually !

This manual describes the starterkit in the board configuration CPU-module using MB91F361/2
and graphics-subboard "Cremson" or "Rose/Scarlet".
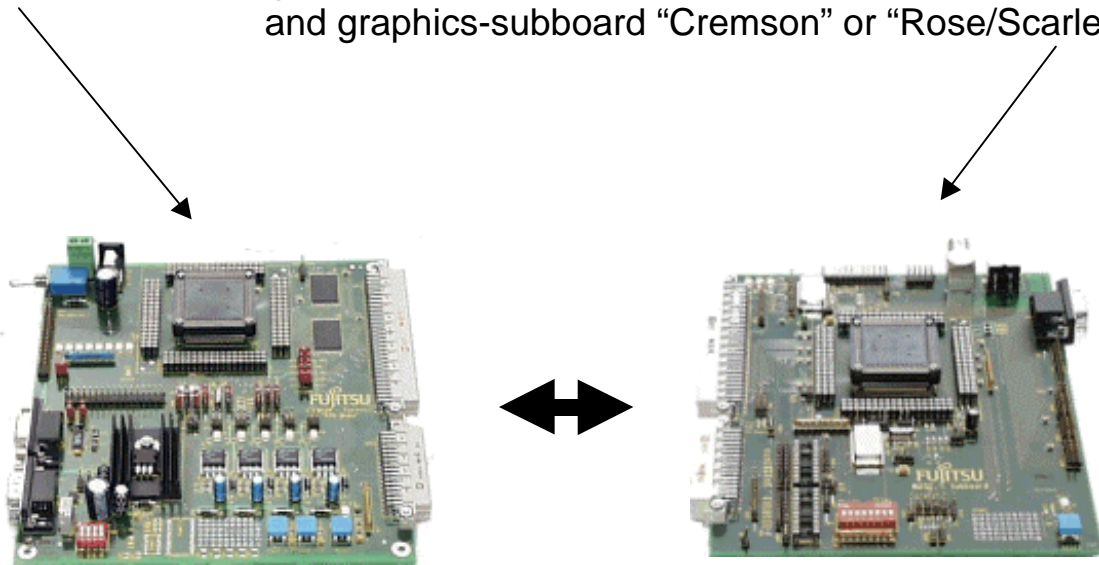
For manuals on other configurations, refer to the documentation on the provided CD-ROM or to the Fujitsu-website.

2.1.   Hardware Installation

What you'll need :

✓ Host : IBM(-comp) PC with Windows 9x or Windows NT ; 1 COM-port

✓ Power Requirements: A power supply, capable of supporting 9-12V DC at about 1200 mA. Note that the power connector must be + at the shield and - in the centre. Power supplies are available from Fujitsu.

✓ RS232 : An 'extension' (1:1) RS232 cable with DB9 m+f connectors

✓ A second VGA-monitor including a standard VGA-cable (alternatively, a different display type can be connected)

---

1. Combine the CPU-board and the graphic subboard

2. Connect the power supply

3. Switch on the board
   the power-LEDs should light up

4. Connect the RS232 cable
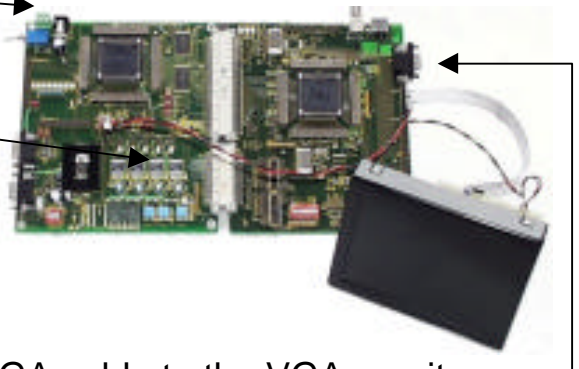
Connect the VGA cable to the VGA monitor
(or use the pin-headers for other displays)

The board is now ready to use.

2.2.   Software installation

Insert the provided CD-ROM, browse to the "Modular Starterkit"-section and select the Installation option for your CPU-module and Graphic Controller. Follow the instructions to extract the software package.

Note : If you don't have Softune Workbench installed on your PC already, you should extract the Softune Workbench package first. Then, you should install the "board software", which conatins example projects and additional tools.

2.3.   Softune   Development Environment installation

Insert the provided CD-ROM, browse to the installation page and select the Installation option for Softune Workbench. Follow the instructions to unpack and install **Softune Workbench for FR** ,as well as some example projects and additional tools for the Cremson Starterkit. It is recommended to use the default installation path C:\Softune.

Then select the installation option for your board software (tools and examples).

After the installation, you will find all language tools, the IDE and other system files within the directory Softune\Bin. Samples for the Starterkit can be found in the \sample directory. The \tools directory contains additional software tools (terminal, flashloader etc.).

Execute "FR Family Softune Workbench" from your Start-Menu.

If any errors occur during installation, remove any previous versions of Softune Workbench from your PC and retry. Make sure you have enough disk space available and you have Windows 95, 98 or NT installed. For more information see the provided installation information and last-minute information.

3.　　　Getting Started

Make sure you have the software installed on your PC and the evaluation board is ready to use. For details refer to the Hardware and Software Installation chapters. This chapter uses the available examples to illustrate some features of Softune Workbench.

3.1.　　Using the Starterkit

To work with the starterkit, you need to download and program a software into the flash-ROM of the CPU provided on the CPU-board. To get started, there are a two different possibilites :

1. Using the provided "API-commander" software (a command interpreter) – this allows to get familiar with all the features of the graphic controller.
2. A stand-alone project developed with "Softune Workbench". Use one of the example projects provided as a basis for your own software.

We recommend to use the "API-commander" software first to get familiar with the features of the graphic controller. This software is a basic command interpreter which communicates with a terminal program on your PC and allows to execute all commands from the "Cremson graphic driver API" as well as some additional commands. Locate the "APIcommanderVxx.mhx" file in the sample/APIcommander/ABS-directory and follow the next steps to download this software to your evaluation board.

ⓘ Please check weather your system is already pre-programmed !

## 3.2.　　Downloading Software

Before downloading any software to the CPU, make sure you have a hex-file "name.mhx" available and your project settings are correct (CPU-type, linker-settings etc.).
You will find a flash-programming tool "MB91360 Flash Programmer" after the installation. Please do not use any other tool for flash programming. A damage of the internal flash memory of the CPU may result.

3.3.   MB91360 Flash Programmer

The tool „MB91360 Flash Programmer" is a general flash programming tool which works with all devices of the MB91360 series.

Make sure you have installed the Flash Programmer from your CD-ROM. The package includes the executable (`Flashprg.exe`) as well as some binary files (`Brloadxx.bin`) and a user's guide (`Flashprg.pdf`).
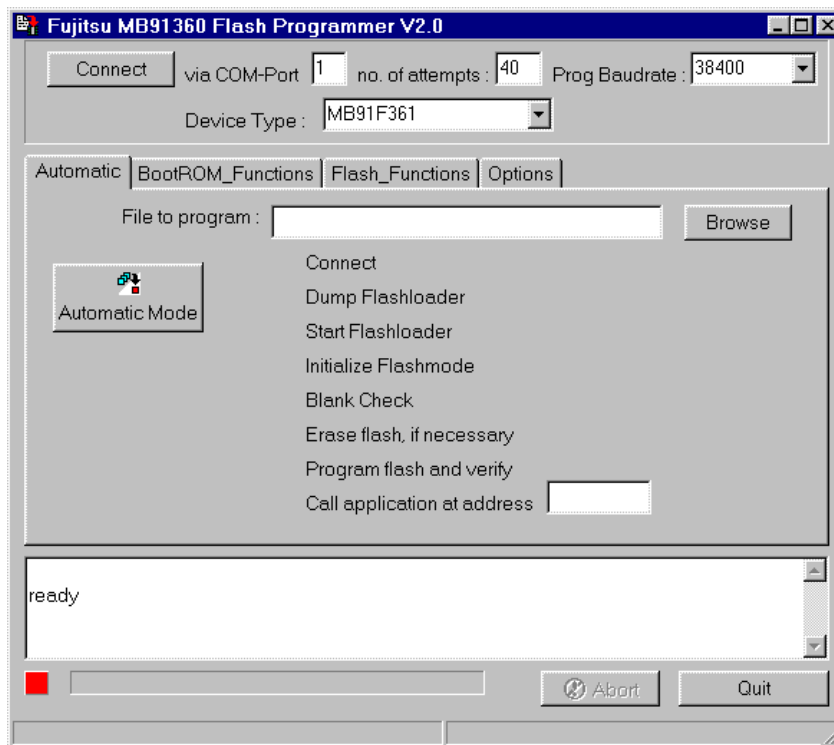
MB91360 Flash Programmer

Follow these steps to use the MB91360 Flash Programmer :

1. Connect a serial cable (RS232 „extension"-type 1:1 / male-female) from a PC COM-port (1-4) to your CPU-board „UART0"-connector.

2. Specify a (hex-)file in the "file to program"-field (use the browse-button to select). This file must be a converted linker output file from Softune in the Motorola™ Hex-Format "*.MHX" (for programming your own applications, be sure to have the load module converter started in Softune Workbench to generate MHX-files !).

3. Specify the COM-port, CPU-type (depending on your CPU-board) and the desired baudrate for programming.

4. Press and hold on the **reset button** on the CPU-module, then click **Automatic Mode** and release the reset button. The programming sequence will be executed automatically (You may also use the connect button in the same way first to assure a working connection before using the „Automatic mode").

   CAUTION : DO NOT INTERRUPT THE FLASH PROGRAMMING OR CUT OFF THE POWER DURING PROGRAMMING ! IT CAN DAMAGE THE FLASH ROM PERMANTENTLY !!!
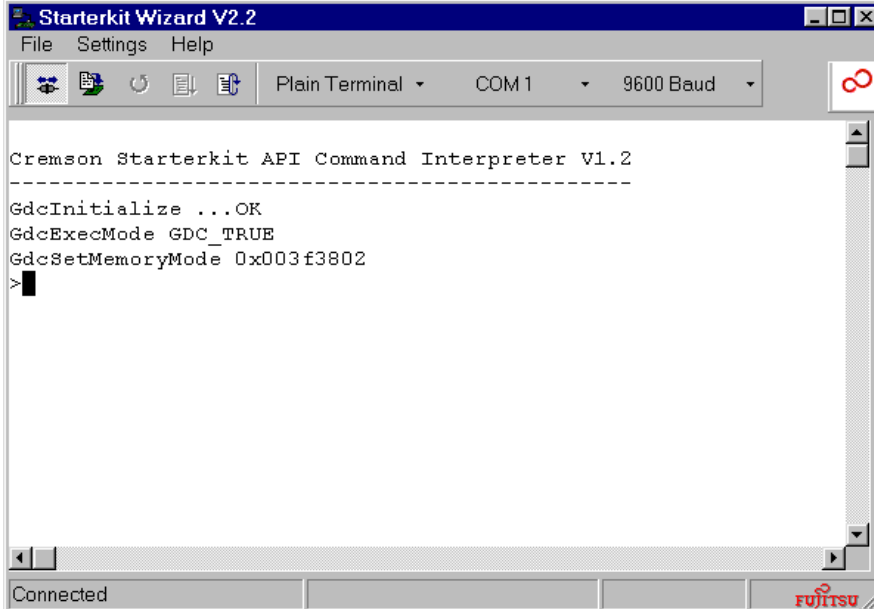
5. After a successful programming procedure, hit reset of both boards to invoke the application you have programmed.

ⓘ Take special care not to write anything to the „security vector". If you do, you will not be able to re-program the device ever again ! This vector is left blank on all provided templates. See the hardware manual for details !

ⓘ The Flash Programmer uses the internal Boot-ROM functions of the MB91F36x device for flash programming. See the hardware manual for details !

   For more information and trouble shooting, see the „MB91360 Serial flash programmer user's guide" (Flashprg.pdf) which is included in the installation.

3.4.   Using the API-commander

If you have successfully programmed the APIcommander-software to your CPU-module, close the flashprogrammer tool and open the provided terminal program „Starterkit Wizard" (SKWizVxx.exe). This program is a standard terminal program with some more extensions for your Cremson modular starterkit.

Execute Starterkit Wizard, select the COM-port (make sure, you still have the RS232-line connected to your CPU-module) and press on the connect-button. Then reset the starterkit. You should see this message :

```
Cremson Starterkit API Command Interpreter V1.2
-----------------------------------------------
GdcInitialize ...OK
GdcExecMode GDC_TRUE
GdcSetMemoryMode 0x003f3802
>
```

Now you are able to control the Cremson or Scarlet device connected on the subboard directly by using (almost) all commands available from the „Cremson graphic driver API".

In addition, you can send a sequence of these commands as textfiles to execute a linear set of functions. Try the following example :

Click on the „Load File" button and locate the folder „SEQ" which contains a number of example files. Choose „SetupVGA.seq" and click OK. You will see the commands executed from the file :

```
Fujitsu Starterkit Wizard C:\Program Files\Borland\Delphi 2.0\Source\skw...
File   Settings   Help

        Plain Terminal  ▾    COM 1    ▾    9600 Baud  ▾

>GdcDispTiming 800,656,96,640,525,490,2,480
>GdcDispDividePos 640
>GdcDispClock 0x700
>GdcDispOn
>GdcDispDimension GDC_DISP_LAYER_BL,GDC_ENABLE,GDC_16BPP_FORMAT,
x0,0,640,480
>GdcDispPos GDC_DISP_LAYER_BL,GDC_DISP_BANK_0,0,0
>GdcDispLayerOn GDC_DISP_LAYER_B
>GdcDrawDimension GDC_16BPP_FORMAT, GDC_DISP_LAYER_B, 640, 480
>GdcColor GDC_WHITE
>GdcBltFill 0,0,640,480
>
>
>
>
>
>

Download completed.                                          FUJITSU
```

If you have a VGA-monitor connected to the graphic-subboard, you now should see a white screen on the monitor.

Now try to execute a very simple graphic function on your own – drawing a line. To do so, enter the following commands :

```
>GdcColor GDC_RED
>GdcPrimType GDC_LINES
>GdcDrawVertex2D 0,0
>GdcDrawVertex2D 640,480
>GdcPrimEnd
```

You should now see a red line across the monitor. This example shows how the APIcommander works : You can enter a set of commands exactly the way you would have to when writing a program. This allows to test and verify the correct graphic output before you copy these commands in your source-code. However, you have to modify the commands according to the C-syntax. If you would transfer the above example to a C-file, it would have to look like this :

```
GdcColor(GDC_RED);
GdcPrimType(GDC_LINES);
GdcDrawVertex2D(INT_TO_FIXED(0), INT_TO_FIXED(0));
GdcDrawVertex2D(INT_TO_FIXED(640), INT_TO_FIXED(480));
GdcPrimEnd();
```

ⓘ Compare the sequence-files and provided source-code examples for details about the syntax differences. For example, see the "APITemplate640480"-project and the sequence-file "setupVGA", which are functionally identical.

3.5. Using the Cremson Starterkit Demon -Program

Another way to control the functions of the APIcommander-software is the provided demo program „Cremson Starterkit Demon" (Cremkitdemo.exe). This program is a windows-based „remote-control-unit" for almost all functions of the Cremson/Scarlet Graphic-Controller. It requires the APIcommander-software running on the CPU-module (see previous section).
Start the program, reset the CPU-module and the graphic-subboard, then press the connect button.
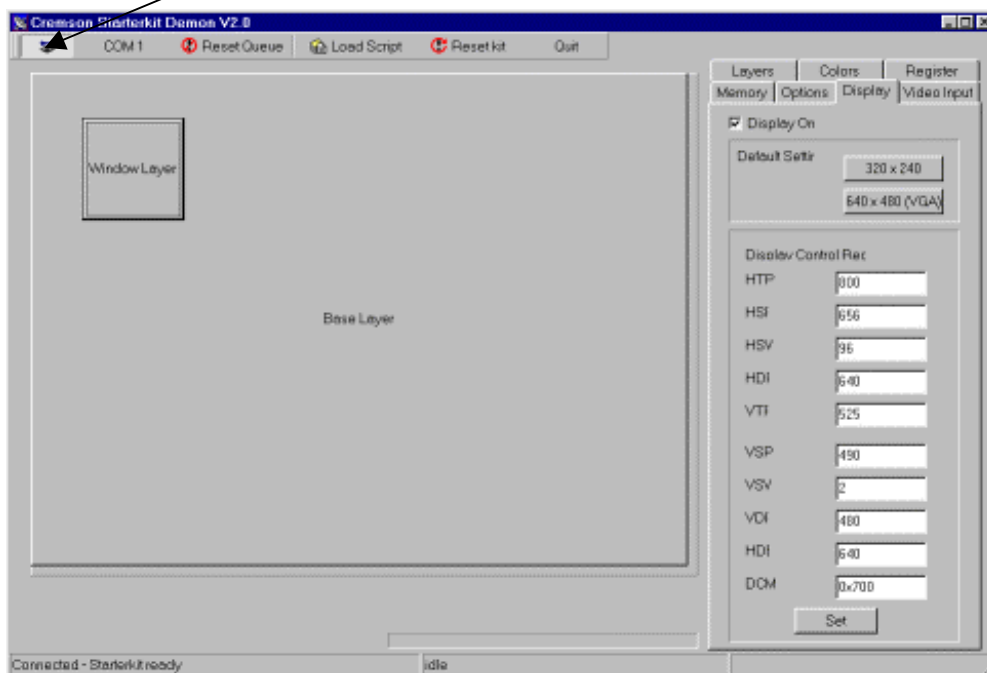
You can use this tool to control the graphic functions without having to write source-code for the API interface. This program is helpful if you have to find the right settings for your display (Display control registers), to test your memory mappings, the scaling functions for the video interface and so on. It can also execute SEQ-files and is therefore useful to quickly setup a demo with your own equipment.

Make sure you have Softune Workbench for FR installed on your PC and the evaluation board is ready to use. For details refer to the Hardware and Software Installation chapters. This chapter uses the available examples to illustrate some features of Softune Workbench.

4.1.   Softune Workbench Development Introduction

Start Softune Workbench. Select "File – Open Project" to load the first example "PrimDemo.Prj". In the project tree on the left side, you can open the "source"-folder which contains the source-files registered to this project. A double-click on one of the files will invoke the built-in editor, which supports syntax-highlighting, tags and various other functions.
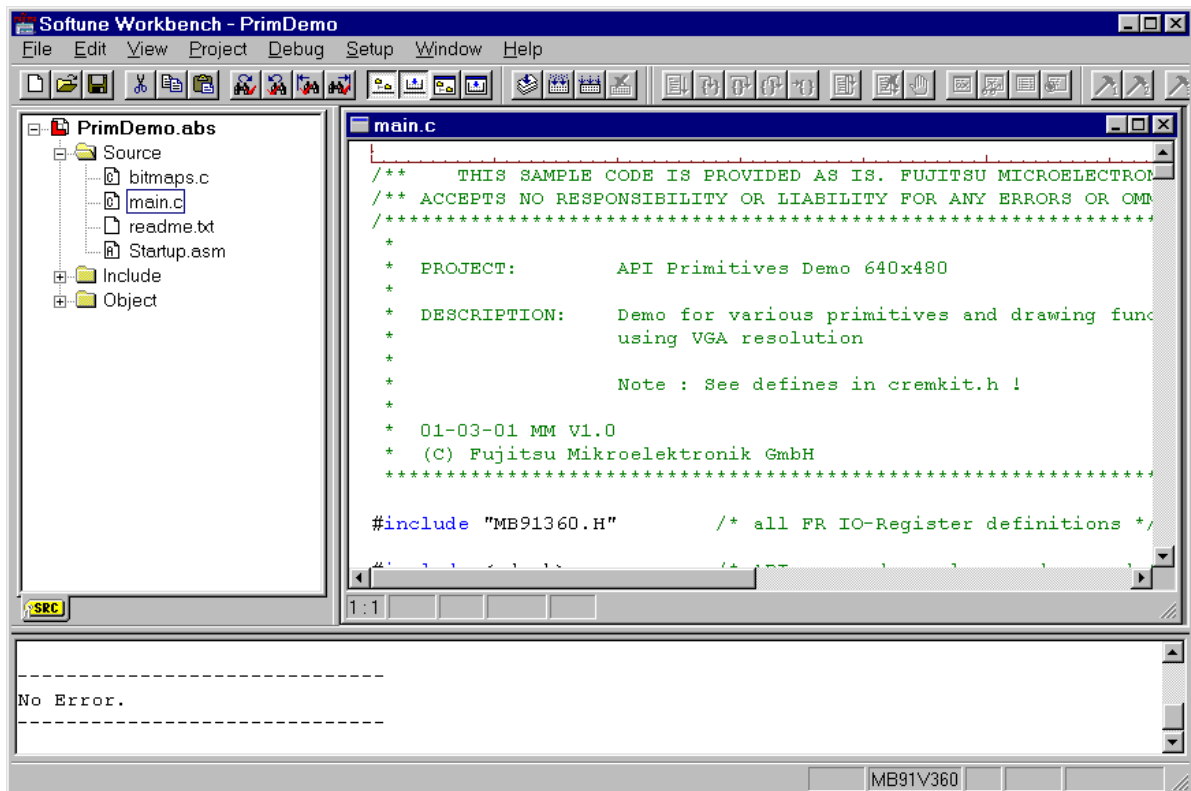
ⓘ You may customize the editor by a right-click on the editor window.

Whenever you make changes to your source-files, you have to re-compile and link the related files to produce a valid loadmodule (ABS-file). This is done using the MAKE-function. MAKE invokes the

assembler, C-compiler and linker for FR whenever necessary (only the changed files will be re-compiled).

If you wish to re-compile the entire project regardless of any changes, you can use the BUILD-function. To check for syntax-errors on a specific source-file, use the COMPILE/ASSEMBLE function.

These three functions are available on the button-bar or from the main menu (Project – Compile / Make / Build / Abort).

Click on MAKE or BUILD. Messages from the individual language tools will be fed into the output window at the bottom of the main screen. If the tool chain (C-compiler → Assembler → Linker) was completed successfully, the message "No Error" will appear.

If you get any errors during compilation, an appropriate message will be generated. Try this with a simple syntax-error (e.g. delete a semicolon ";" from the end of a C-line) and click on MAKE again. You will now see a message like this :

```
Now Making...
main.c
*** c:\softune\sample\..\PrimDemo\src\main.c(43) E4062C: syntax error near `for'

------------------------------
Error detected.
------------------------------
```

To locate the position in the source-file, where the error occured, double-click on the message. The editor will open the appropriate source-file, indicating the error highlighted in red. Correct the error and re-compile the project as explained above.

If more errors occurred, you can go through the error list step by step using the menu "Edit – Top/Previous/Next/Bottom Error" or using the appropriate buttons which have the same functions :

ⓘ To get on-line help about a specific error, select the error message and press F1. In many cases, you can get some useful hints how to solve the problem. Of cource, you can also use the HELP-menu anytime during development or debugging.

4.2. Creating projects using the API

To create your own projects for graphical applications using the Cremson or Scarlet devices, it is recommended to use and modify the provided example projects and templates.

Note : the provided software are designed for Fujitsu MB9136x controllers. If you are using a different CPU, you cannot use the library and include files in this installation !

The template "APITemplate640480" can be easily modified for own applications using VGA resolution. See this project-setup to learn about the necessary files and project-settings :

```
API_template.abs              Main.c : contains the actual source-code
  Source
    main.c                    Readme.txt : text description
    readme.txt               Startup.asm : required for the CPU startup
    Startup.asm
  Include                     Colors.h : some definitions for color-codes
    colors.h                  Cremkit.h : contains the device-settings
    cremkit.h                Gdc- and crmtypes.h : type-definitions
    crmtypes.h
    gdc.h                     Gdc.h : contains all API-function prototypes
    gdctypes.h                Intvecs.h : CPU-Interrupt-definitions
    intvecs.inc               MB91360.h : CPU-IO-Registers
    MB91360.H
  Object                      API_FR_Scarlet : API-library-file
    API_FR_Scarlet.lib
```

Also, take into account that the demo projects are using a fixed memory (linker-) map. If you need to change the memory-map, please refer to the hardware-manual of the CPU-device for details ! The default-settings are:

Section	Location	Functions
STACK_AREA	0x0003D000/0x0003D4FF	Stack-area (internal RAM)
RAM_AREA	0x0003D500/0x00040FFF	Variables (internal RAM)
CODE_AREA	0x00180000/0x001EFFFF	code, API, bitmaps
ROM_AREA	0x001F4000/0x001FFFFF	Startup, const, vectors
EXT_ROM_AREA	0x00300000/0x003FFFFF	External flash
GDC_RAM	0x00400000/0x005FFFFF	GDC RAM
GDC_REG	0x01FC0000/0x01FFFFFF	GDC Register

5. Appendix

5.1. Appendix A : Supported API commands

The following commands are implemented in the API-commander. For details about their function, parameters and environment settings, refer to the "Graphic Driver"-Manual on the provided CD-ROM. Also see the Cremson- or Scarlet-hardwaremanual for details.

API-command table :

GdcInitialize	GdcFlush
GdcSync	GdcVFlush
GdcVSync	GdcInterrupt
GdcExecMode	GdcDrawDimension
GdcBufferCreateZ	GdcBufferCreateC
GdcBufferClearZ	GdcBufferClearC
GdcDrawClipFrame	GdcColor
GdcColorI	GdcBackColor
GdcBackColorI	GdcSetAttrMisc
GdcSetAttrLine	GdcSetAttrSurf
GdcSetAttrTexture	GdcSetAttrBlt
GdcSetAlpha	GdcSetLinePattern
GdcSetTextureBorder	GdcPrimType
GdcPrimEnd	GdcDrawVertex2D
GdcDrawVertex2Di	GdcDrawVertex3D
GdcDrawVertex3Df	GdcTexCoord2D
GdcTexCoord3D	GdcTexCoord2Df
GdcTexCoord3Df	GdcTexCoord2DNf
GdcTexCoord3DNf	GdcDrawVertex2Dx
GdcDrawVertex3Dx	GdcDrawVertex3Di
GdcTexCoord2Dx	GdcTexCoord3Dx
GdcTexCoord2DNx	GdcTexCoord3DNx
GdcSlopeCalcType	GdcTextureMemoryMode
GdcTextureLoadInt	GdcTextureLoadExt
GdcTextureDimension	GdcBltTexture
GdcBltFill	GdcBitPatternDraw
GdcBltCopy	GdcBltCopyAlt
GdcBltCopyAltSync	GdcBltDraw
GdcBitPatternMode	GdcSetRop
GdcDispClock	GdcDispTiming
GdcDispTimingWindow	GdcDispDividePos
GdcDispOn	GdcDispOff
GdcDispLayerOn	GdcDispLayerOff
GdcDispDimension	GdcDispPos
GdcDispDoFlip	GdcOverlayPriorityMode
GdcOverlayBlend	GdcColorPalette
GdcColorTransparent	GdcColorZeroMode
GdcChromaKeyMode	GdcColorKey
GdcCursorAddress	GdcCursorPattern
GdcCursorDisplay	GdcCursorPos
GdcCursorPriority	GdcCursorColorTransparent
GdcCursorColorZeroMode	GdcSetDisplayListBuffer
GdcFlushDisplayList	GdcClearInterruptStatus

GdcSetInterruptMask	GdcSetMemoryMode
GdcSoftwareReset	GdcCapSetVideoCaptureMode
GdcCapGetErrorStatus	GdcCapClearErrorStatus
GdcCapSetVideoCaptureBuffer	GdcCapSetImageArea
GdcCapSetWindowMode	GdcCapSetVideoCaptureScale
GdcGeoInitialize	GdcGeoInterrupt
GdcGeoSync	GdcGeoLoadMatrix
GdcGeoLoadMatrixf	GdcGeoNdcDcViewportCoef
GdcGeoNdcDcViewportCoeff	GdcGeoNdcDcDepthCoef
GdcGeoNdcDcDepthCoeff	GdcGeoViewVolumeXYClip
GdcGeoViewVolumeXYClipf	GdcGeoViewVolumeZClip
GdcGeoViewVolumeZClipf	GdcGeoViewVolumeWminClip
GdcGeoViewVolumeWminClipf	GdcGeoSetAttrMisc
GdcGeoSetAttrSurf	GdcGeoPrimType
GdcGeoPrimEnd	GdcGeoDrawVertex2D
GdcGeoDrawVertex2Df	GdcGeoDrawVertex2Di
GdcGeoDrawVertex3D	GdcGeoDrawVertex3Df
GdcGeoDrawVertex3Di	GdcGeoTexCoord2D
GdcGeoTexCoord2Df	GdcGeoTexCoord2DN
GdcGeoTexCoord2DNf	GdcGeoGetInterruptStatus
GdcGeoClearInterruptStatus	GdcGeoSetInterruptMask
GdcGeoBltTexture	GdcVertexColor32
GdcVertexColor3f	GdcSetupMode
GdcTexCoord3DW	GdcTexCoord3DWf
GdcTexCoord3DWN	GdcTexCoord3DWNf

There are a number of additional commands implemented. These commands are not listed in the graphic-driver manual !

Additional command table :

Additional command	Parameters	function
Rem		remark (no operation) for seq-files
TextOut	X,Y,constant string	text-out function using bitpattern-draw
InitSAA7111	-	Init Video decoder through CPU
SetReg	Width (0=8bit, 1=16bit, 2=32bit) ,address, data	write to register
ReadReg	Width (0=8bit, 1=16bit, 2=32bit) ,address	read register
CopyMem	Source, dest, length (32-bit)	copy memory
FillMem	Address, length, pattern (32-bit)	fill memory
SetBaud	Baudrate (e.g. 19200)	set baudrate

5.2. Appendix B : Related Documents

Available manuals :

1. MB86290A „Cremson" Hardware Manual
2. MB86291 „Scarlet" Hardware Manual
3. Package information
4. Cremson/Scarlet Graphic Driver Manual
5. Board Manuals for Modular Starterkit
6. MB91360 Hardware Manual
7. MB91F36x Datasheet
8. FR Family C-Compiler Manual
9. FR Family Instruction Manual
10. FR Family Assembler Manual
11. FR Family Simulator Manual
12. FR Family Emulator Manual
13. FR Family Linkage Kit Manual
14. FR Family Softune Workbench Manual

Note : All documents are available from the provided CD-ROM, Fujitsu's Microcontroller CD-ROMs or from our web-site.

5.3. Appendix C : Trouble shooting

Problem	Solution
Evaluationboard does not initialize after power-on. LEDs (Power indicator) does not light up.	Check voltage supply and jumpers : ☛ The voltage on DC-Power plug should be in the range of 9-12V (@1A). The plug should have + on shield and – on the center. LEDs D4,7,10,13,16 (on F361-CPU-board) should light up after switching on the board. Use a multimeter to see whether 5V are present on the Vcc/Gnd terminals. ☛ Check jumper positions according to board manual ! ☛ Remove all user extensions on the board to avoid shorts !
Evaluationboard stays in reset. Reset indicator LED ligths up permanently.	☛ The Reset-LED should flash once. If this LED lights up permantantly, the voltage is too low (below 4.25V) - Increase the voltage and power limit settings of your power supply to solve the problem. ☛ Remove all user extensions on the board to avoid shorts or leakage currents !
The communication from the PC to the evaluation board fails (Communication errors)	☛ Make sure your COM-port number and the baudrate settings are correct. ☛ Check if the UART-jumpers (JP21,22 on F361-board) are closed. ☛ Make sure no other programs are using the same COM-port on your PC. Close all other applications (e.g. Flash programmer utilities, terminals etc.) ☛ Use the provided RS232-cable (1:1 extension type) to connect from your PC to the „UART0" connector. ☛ If you are using a PC without a fast UART (16550 type), you have to switch to a lower baudrate (e.g. 38400 Baud) and re-program.

There is no picture on my VGA-monitor	☛ Make sure all jumpers on both boards are set correctly (see board-manuals) ☛ Make sure you are using a VGA-cable with all lines (including C-sync) connected 1:1 !
Hardware units of the CPU such as LEDs, user buttons, UART0 or CAN are not working.	☛ Make sure you have enabled these units on the evaluation board using the appropriate jumpers. See the hardware manual for information on how to control the peripherals.
The video input does not work	☛ Make sure you have the right settings for the SAA7111 video decoder.

For more information see the the provided manuals, last minute information and additional or updated documentation on our web-site.