XC16x, C16x & ST10 Development Tools

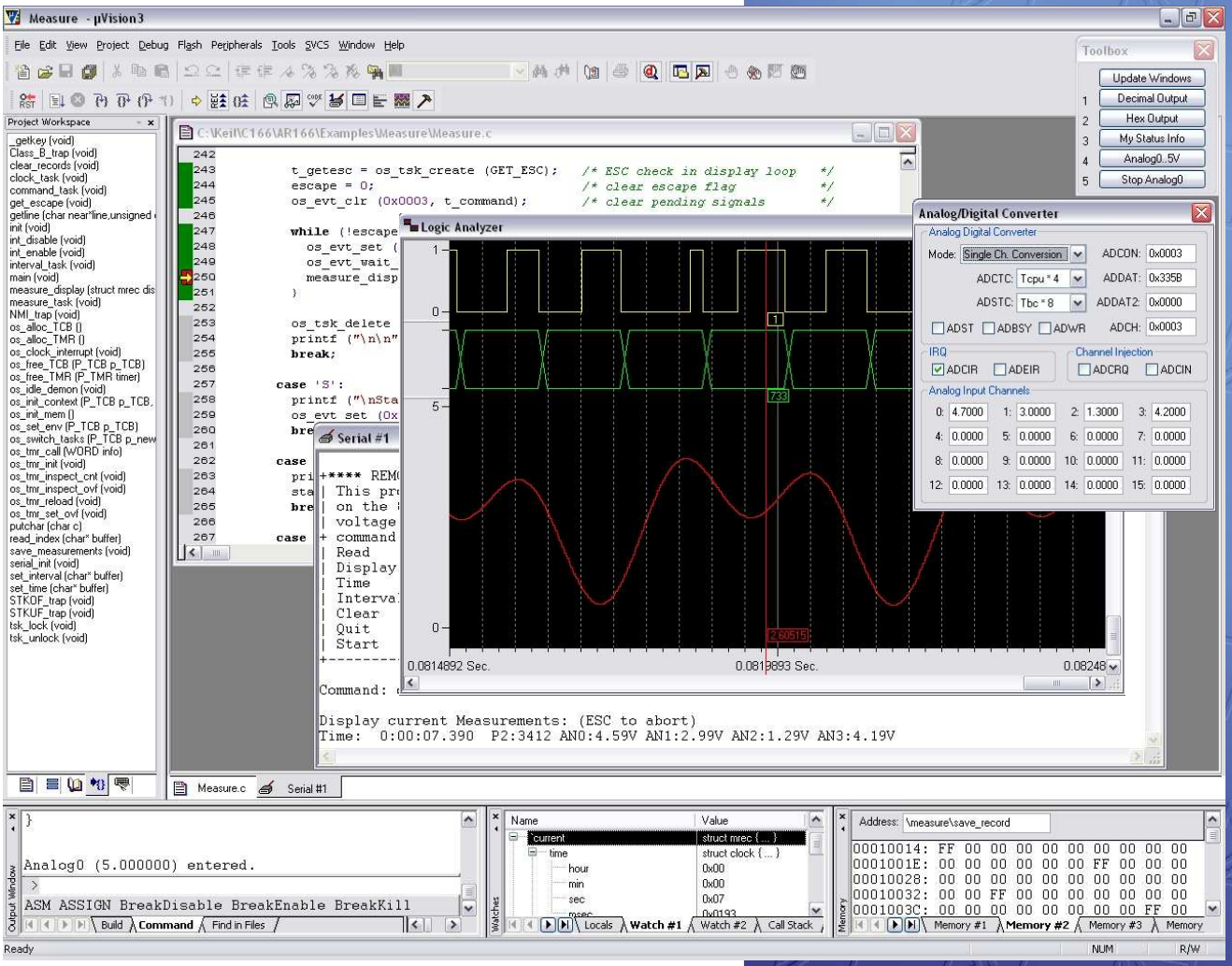
KEIL SOFTWARE

C166

Keil C166 uses leading compiler technology to generate the most efficient code for C16x, XC16x, and ST10 microcontrollers. C166 is fully integrated into the µVision3 IDE/Debugger that combines Project Management, Source Code Editing, Program Debugging, and Flash Programming in a single, powerful environment. This brochure informs you about:

- C166 C Compiler and EC166 Embedded C++ Compiler.
- Advanced RTX166 Real-Time OS with TCP/IP & Flash File System.
- ULINK USB-JTAG Adapter for Debugging & Flash Programming.

Detailed information for the µVision3 IDE/Debugger is provided in the ***µVision3 Quick Start*** guide that explains features such as Editor Functions, Configuration Wizard, Function & Template Window, CPU & Peripheral Simulation, Logic Analyzer, Target Debugging and Flash Programming.



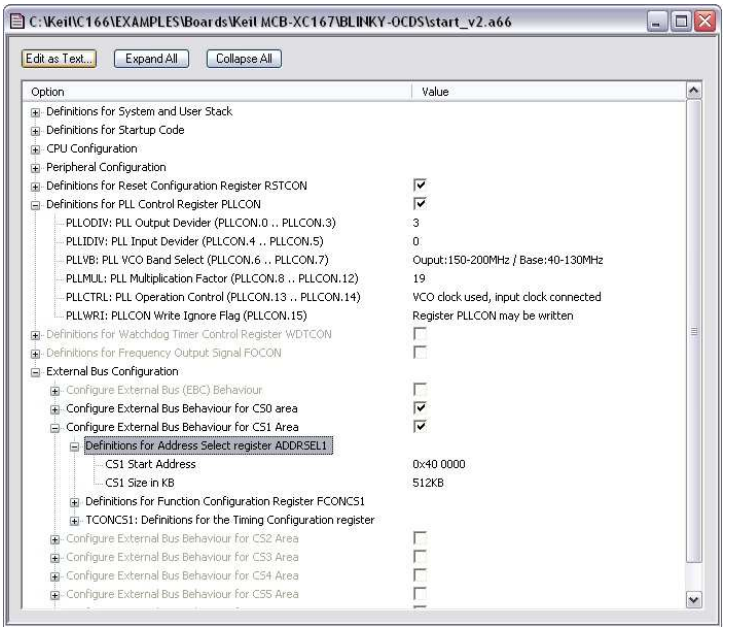
µVision3 integrates the development tools in a single, intelligent environment and supports all C16x, XC16x, and ST10 device.

C166 Compiler - Version 5

The ANSI standard Keil C166 compiler is specifically designed for the XC16x, C16x, and ST10 microcontroller families. Extensions incorporated into the compiler support all resources of your embedded hardware and allow efficient access to interrupts, register banks, SFRs, and memory spaces.

Configuration Wizard

The µVision3 configuration wizard simplifies editing the startup code (and many other configuration files). A graphical interface helps you quickly select the options that match your target system and easily spot potential startup problems.



The Configuration Wizard provides a graphical editor for startup files,

Embedded C++

Keil C166 Version 5 includes an efficient Embedded C++ compiler. EC++ is a new, evolving C++ standard for embedded systems that avoids the overhead involved with C++ programming. The Keil EC++ implementation includes numerous 166-specific language extensions.

In-Line Assembly

A new, updated in-line assembler enables you to insert assembly instructions directly into your program and offers:

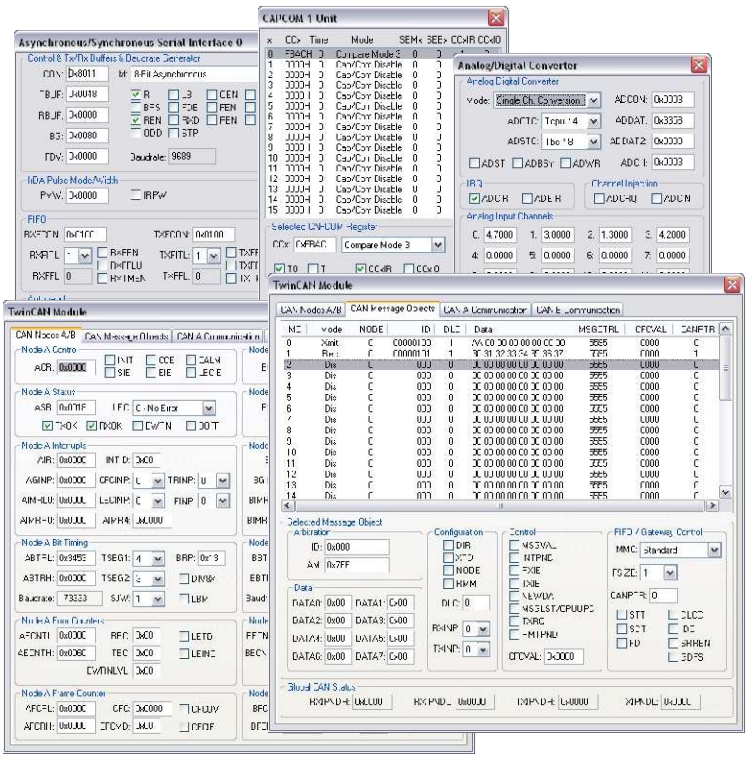
- Access to C program variables by name,
- C-level debugging information (source-level and symbolic),
- Optimized MAC instruction utilization.

Function In-lining

Functions defined with the **__inline** attribute are directly embedded when called (CALL and RET instructions are no longer required). Parameters are accessed directly (they are not passed in special registers or stored on the stack) by the generated code.

Accurate Device Simulation

The µVision3 Debugger accurately simulates all on-chip peripherals and has debug dialogs that help you rapidly test 166 applications.



The µVision3 Debugger provides debug dialogs and accurate simulation of on-chip peripherals. A/D converters, CAN, TwinCAN, CAPCOM, ASC, SSC, PWM, PEC, Timers, Watchdog, and I/O Ports are all fully simulated.

RTX166 - Real Time Operating Systems

Keil provides two Real-Time Operating Systems for the 166 family. Both support all device variants, are royalty-free, and are fully integrated into the C166 toolchain. Each RTOS uses standard 166 stacks (so no overhead is added to your C code). Neither requires a special run-time library.

RTX166 Tiny is an easy-to-use kernel that is part of the C166 package. It is designed for simple real-time programs that do not require much inter-task communication.

Advanced RTX166 (ARTX166) is a full-featured kernel with task priorities, round-robin, preemptive context switching, and support for multiple instances of the same task function. It also includes a Flash file system and TCP/IP network support.

Flash File System

The Flash File System allows you to create, save, read, and modify files stored in Flash memory. It provides file access functions (fopen, fread, fwrite, fgets, fprintf, ...) and may be configured for various Flash devices.

TCP/IP Network Support

The TCP/IP stack in ARTX166 is a ground-up implementation specifically designed for embedded applications. It includes the following protocols:

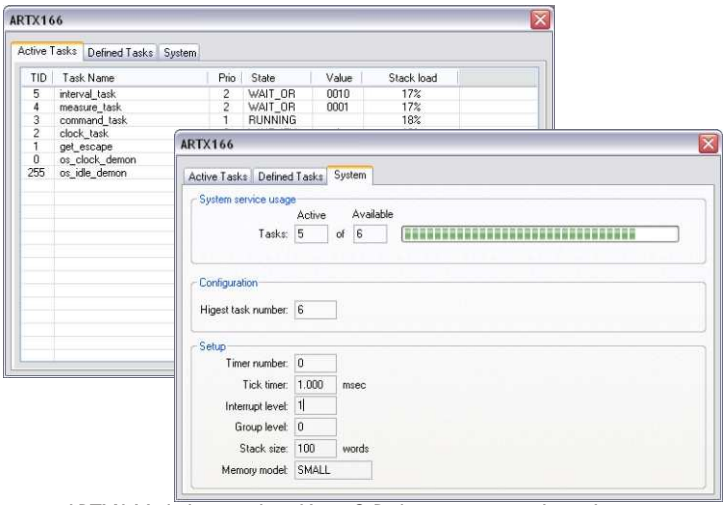
- TCP, UDP, PPP, SLIP, IP, ARP.
- HTTP Web Server and FTP Server.
- DHCP Client.

ARTX166 helps you create embedded TCP/IP solutions that connect to standard internet browsers. It is pre-configured for the Keil MCB-XC167-NET and MCB167-NET evaluation boards and includes examples you may use to quickly get started with your own internet-enabled projects.

Applications with numerous web pages, FTP files, or dynamic content may use the Flash File System to store HTML and data files. Flash System Files are added to the µVision3 project and automatically converted and stored in the final object file.

Advanced RTX166 Function Overview

- **Task Management** functions allow you to define and remove tasks. ARTX166 allows multiple instances of the same task.
- **Event Flag Management** for task synchronisation based on up to 16 event flags.
- **Semaphore Management** for efficient resource sharing.
- **Mailbox Management** for inter-task communication.
- **Time Management** use for task delays (interval or timeout).
- **User Timer Management** allows definition of callback functions which are called after a time delay.
- **Flash File System** functions for file-based data access in Flash ROM and RAM devices.
- **BSD Socket** functions for network communication.



ARTX166 dialogs in the µVision3 Debugger support kernel-aware debugging and provide detailed task and system status.

Technical Data	Advanced RTX166	RTX166 Tiny
Number of tasks	256 maximum	32 maximum
Number of mailboxes	Unlimited	Not supported
Number of semaphores	Unlimited	Not supported
Number of signals	16 Event Flags per task	1 per task
Number of user timers	Unlimited	Not supported
RAM Requirements	Minimum 2-3 KB	8 + 4 * *tasks* Bytes
Code requirements	Less than 4 KB	Less than 1.5KB
Hardware Requirements	One timer	One timer
User task priorities	256	Not supported
Context switch time	Less than 25 µsec.	40-100 µsec.
Interrupt lockout time	0.2 µsec.	Less than 4 µsec.

Timings are based on C167CR running at 20MHz with no waitstates.

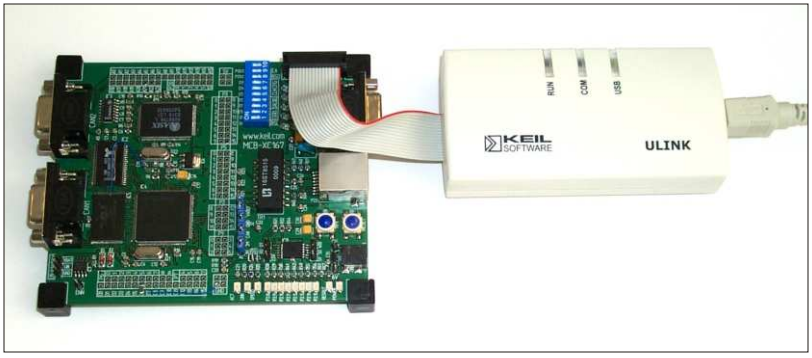
Advantages of Keil C166 and µVision3

Feature	Benefit
The C166 Compiler is highly optimized. In-line functions give you the fastest execution speed. In-line assembly allows optimized MAC instruction sequences.	There is almost no size or speed penalty when using Keil C166. DSP algorithms using the MAC unit may be directly written as C functions.
Embedded C++ Compiler includes specific compiler extensions for the 166 architecture.	EC++ allows you to write object-oriented programs while avoiding the overhead of the C++ language.
The µVision3 Simulator is the only debugger that accurately simulates all on-chip peripherals of the Infineon C16x/XC16x and ST10 devices.	You may write and test application code before production hardware is available. Investigate different hardware configurations to optimize the hardware design.
The µVision3 Device Database automatically configures the development tools for the target microcontroller.	Mistakes in tool settings are practically eliminated and tool configuration time is minimized.
The µVision3 IDE integrates third-party tools like SVCS, CASE, and FLASH/Device Programming.	Quickly access development tools and third-party tools. All configuration details are saved in the µVision3 project.
Identical Editor, Debugger, and Simulator Interfaces.	No need to learn different tool interfaces.
Advanced RTX166 is a full-featured, high-performance Real-Time Operating System that incorporates TCP/IP networking and a Flash File System.	Allows you to implement complex, time-critical applications that can be easily connected to the Internet and accessed using a standard web browser.

ULINK USB-JTAG Adapter

The ULINK USB-JTAG Adapter connects µVision3 to the On-Chip Debugging System (OCDS) of the XC16x, C161U, C165UTAH, or C165H device. ULINK allows you to:

- Download target programs.
- Examine memory and registers.
- Single-step through programs.
- Insert multiple breakpoints.
- Run programs in real-time.
- Program on-chip FLASH.



ULINK connects the PC USB Port to the OCDS Interface of the C16x or XC16x device (in this case the Keil MCB-XC167 NET board).

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