RAISONANCE

a KEOLABS brand

RLink for EM6869

Raisonance Tools for C816 family

Getting Started

Document version
7 May 2013

Contents

1. Introduction

This document describes using an RLink for an EM6869 with Ride7 and the monitor. If you are not using this type of hardware, this document is not relevant to you.

This document assumes that you have already read and understood *C816 Getting Started for Ride7*, that you know how to create and use projects for making applications, and how to use the Ride7 debugger. It does not repeat information from these documents. You can find the C816 Getting Started document by clicking in Ride7: **> Help > View documentation** under *C816\Ride7 for C816*.

1.1 Purpose of this manual

This guide can be used by anyone interested in programming and debugging EM6869 targets using Ride7 for C816.

1.2 Scope of this manual

This document describes how to get started using Ride7 for C816 to compile and debug your application or one of the included sample applications. It assumes that you have the prerequisite knowledge of the C and C816 assembly languages.

1.1 Additional help or information

If you want additional help or information, if you find any errors or omissions, or if you have suggestions for improving this manual, go to the KEOLABS' site for Raisonance microcontroller development tools www.raisonance.com, or contact the microcontroller support team.

Microcontroller website: www.raisonance.com
Support extranet site: support-raisonance.com (software updates, registration, bugs database, etc.)
Support Forum: forum.raisonance.com/index.php
Support Email: support@raisonance.com

For information and support about EM68xx chips, contact EM Microelectronic:
http://www.emmicroelectronic.com

1.2 Raisonance brand microcontroller application development tools

January 1, 2012, Raisonance became the brand under which the company KEOLABS sells its microcontroller hardware and software application development tools.

All Raisonance branded products regardless of their date of purchase or distribution are licensed to users, supported and maintained by KEOLABS in accordance with the companies' standard licensing maintenance and support agreements for its microcontroller application development tools. For information about these standard agreements, go to:

Support and Maintenance Agreement: http://www.raisonance.com/warranty.html
End User License Agreement: http://www.raisonance.com/software-license.html

2. Presentation of the tools

Raisonance provides the following tools for working with EM6869 devices:

- **Ride7 + RKit-C816**: PC software that builds, programs and debugs EM6869 applications.
- **RLink**: USB device allowing a PC to communicate with an EM6869 device using the DoCSPI protocol, in order to program and debug it.
- **EM6869 monitor**: software to include in your application for it to communicate with an RLink using the DoCSPI protocol, in order to debug your application from your PC while it is executing in the physical device.

Each tool mentioned above has a dedicated user manual that you can refer to for more details. Documentation for Ride7, SIMICE C816 simulator and RLink-C816 is available on-line from the user interface. Before using any of these tools, you must install and register both Ride7 and RKit-C816. Make sure you are using the latest versions available for download from the Raisonance Extranet.

2.1 Ride7

Ride7 is the PC software, designed by Raisonance, that you can use to make applications for the EM6869, and also to program and debug them using RLink. Please read the Getting Started C816 document, *GettingStartedC816_Ride7.pdf,* before continuing. Among other things it explains how to register the software, which is free of charge (for the Lite version) but required to use the tools.

2.2 RLink

The RLink hardware dongle, allows to program and debug the target EM6869 chip from the PC. Technically, it is a bridge between a PC USB and many serial protocols. The DoCSPI protocol used with the EM6869 devices is one of the supported protocols (in certain RLinks).

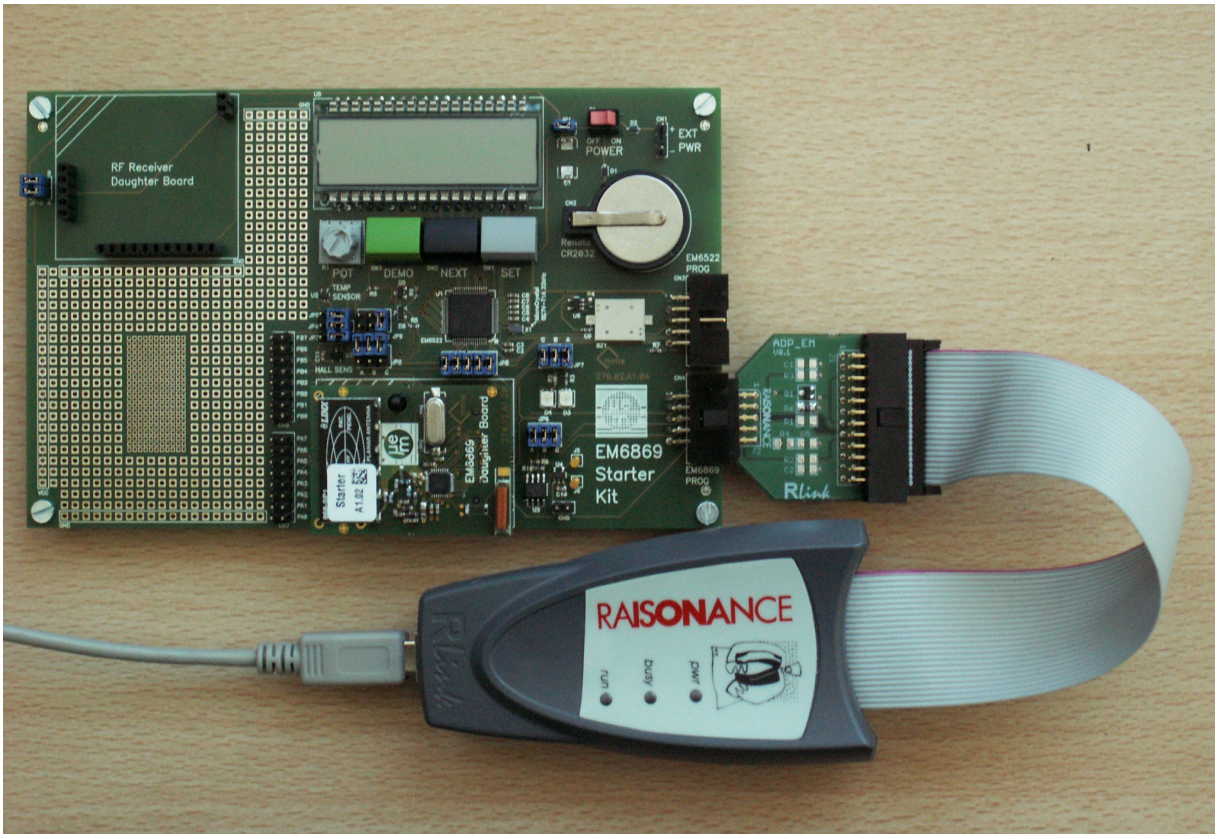
You must install Ride7, which installs the RLink USB driver, before you connect the RLink to your PC.

The RLink features the standard DoCSPI connector as defined by EM Microelectronic. This DoCSPI connector connects to an adaptor which allows communication with the EM6819 when it is powered in the range 1V to 3.3V. Therefore EM6869 operation is limited to supply voltage range from 1.8V to 3.3V in Debug-on-Chip mode. RLink can be used with commercial demonstration boards like the EM6869 Starter-Kit from EM Microelectronic, and also on any custom board featuring an EM6869 chip and a DoCSPI connector.

There are two RLinks that use theDoCSPI protocol, RLink-GASP-PRO and RLink-GASP-Standard: The selection of GASP or DoCSPI is done by using the correct adapter.

- RLink-GASP-PRO programs and debugs without any limitation.
- RLink-GASP-Standard has unlimited programming capability, but debugging is limited to applications no larger than 2K instructions. It should be used for evaluation or for programming in production.
- Other RLinks cannot use the DoCSPI protocol.

To use the RLink with any EM6869 board, you must plug the female DoCSPI connector of the RLink onto the male DoCSPI connector of the target board as shown below.



2.3 EM6869 monitor

The monitor is a piece of software that you can include in your project. It communicates with the RLink using the DoCSPI protocol. This allows you to debug your application from your PC while it is running in the chip, using the same graphical interface as with the simulator.

The monitor provides you with:

- Unlimited static code breakpoints allowing you to stop the execution at compile-time-defined code locations.
- 3 dynamic code breakpoints allowing you to stop the execution at code locations defined (and changeable) during debug. These breakpoints can be required by the debugger for performing source-level stepping.
- Step-by-step capability allowing you to see the execution of your application line by line (of C) or instruction by instruction (assembler).
- Stop while running, so you can see what is happening at any moment.
- Ability to read and write registers and memory locations.

To include (or exclude) the monitor in your application, you must check (or uncheck) the Monitor Library linker option: Click **Options > Project Properties > LD Linker > Librairies** and set option **Monitor Library** to **Yes.**

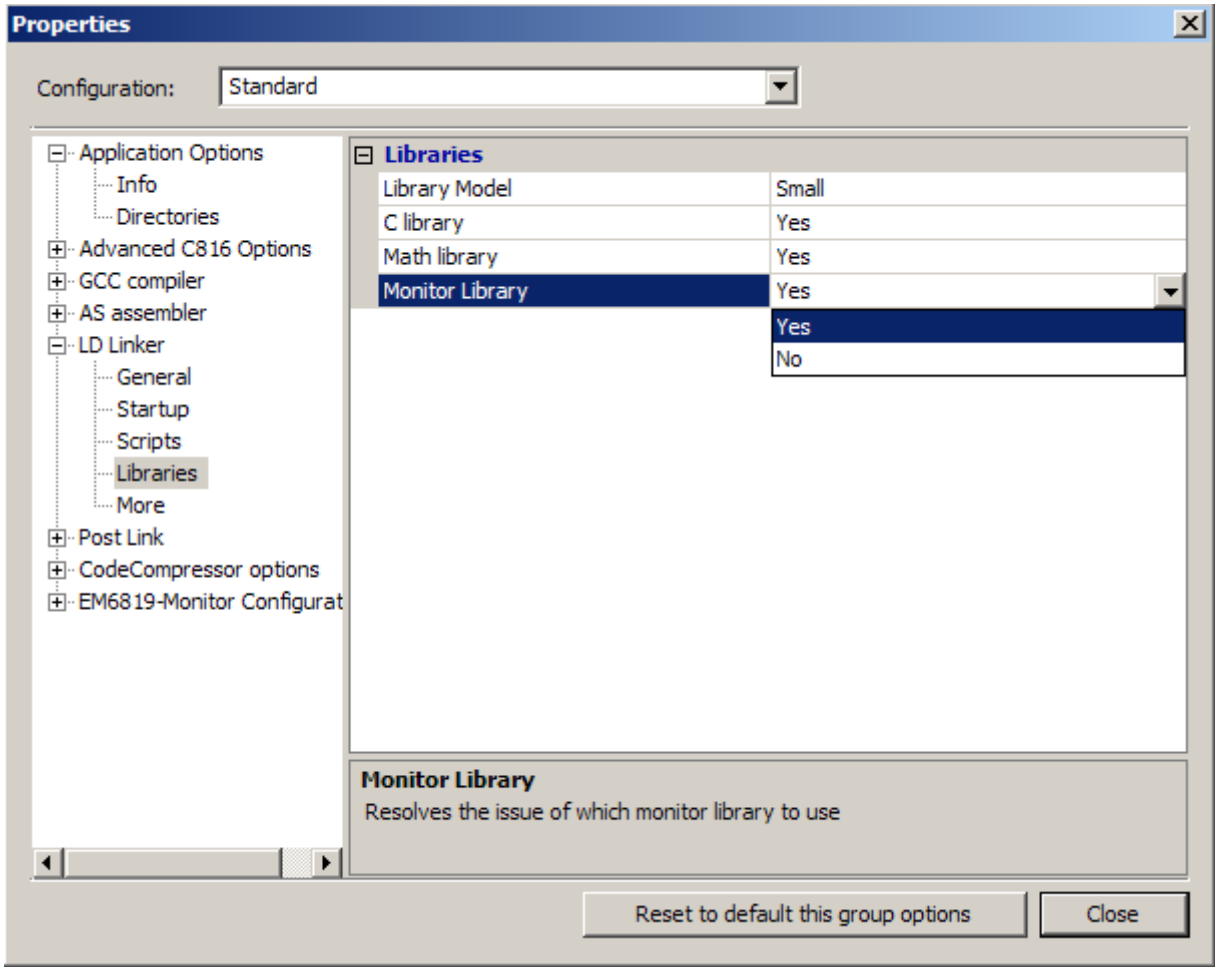
Note: If you do not check this option, you cannot debug.

When you have finished designing your application, or if it gets too big, you might want to remove the monitor code from it. To do this:

Click **Options > Project Properties > LD Linker > Librairies** and set option **Monitor Library** to **No**. This tells the linker not to include the monitor code in the application. Of course, after you do this, you

will not be able to debug it anymore, you can only program it and execute it. As with any linker option change, you must link the application again for the change to be taken into account.

Note: When you are NOT debugging, the application runs the same way whether or not you included the monitor code in it when you built it. Including the monitor code in the application does not mean you must use Ride7 for executing it. The only reason to remove the monitor code is to gain code space, or if you want to have full control of every byte of code in your application.



3. Debugging an example project

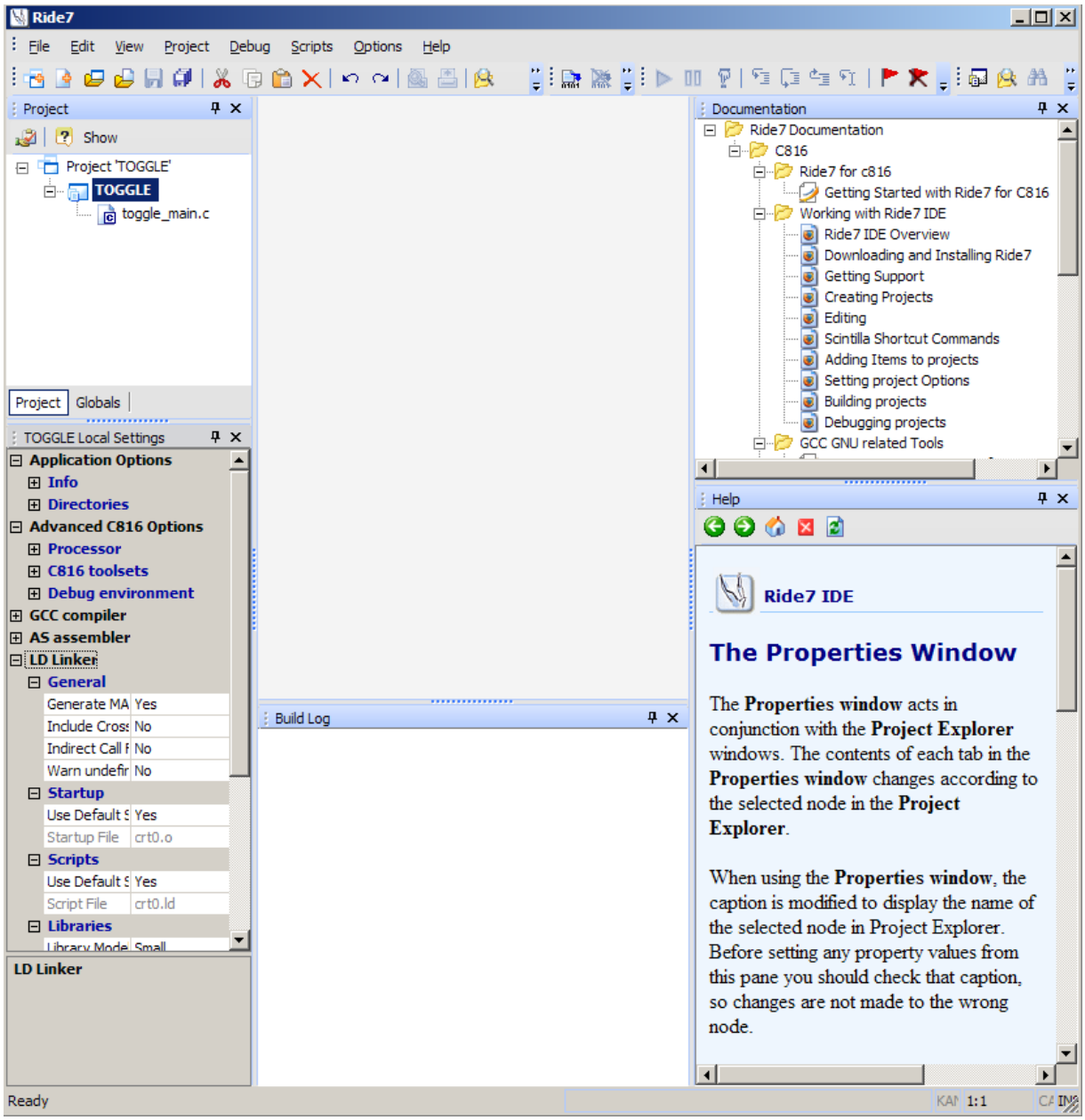
This chapter shows you the features of the monitor and their use through a quick tutorial. We will debug one of the examples for hardware provided with Ride7.

3.1 Opening the example project

First, open Ride7 using the Windows: **Start > Programs > Raisonance Tools > Ride7 > Ride7**.

Open this project, using **Project > Open Project** in Ride7 and select *C:\Program Files\Raisonance\Ride\Examples\C816\EM6869\Toggle_IRQ\Toggle.prj.*

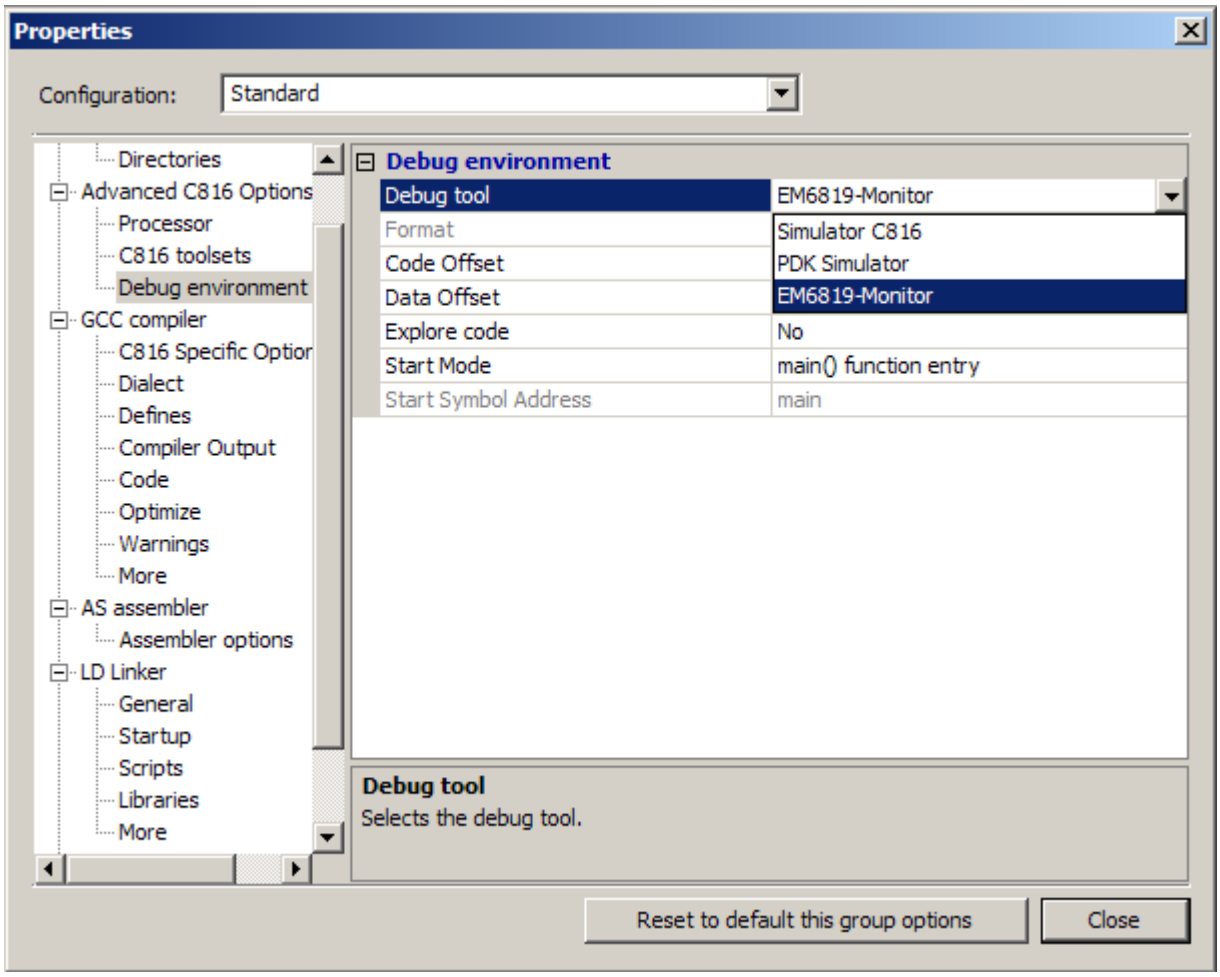
Now the project is opened and is ready to be used.



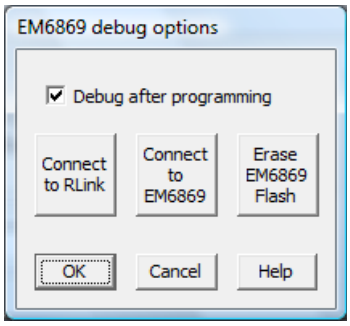
3.2 Setting debug options

Before starting debug, make sure that the project options are correctly set.

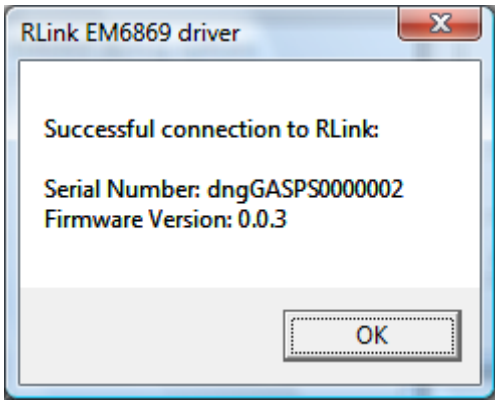
- Open the debugging options window, in which you can tell Ride7 to use the RLink instead of the software simulator for debugging (**Options > Project Properties > Advanced C816 Options > Debug environment**).



- When **EM6869-Monitor** is selected you then select **EM6869-Monitor Configuration** and click on **Click here to open options dialogue box** to open the **EM6869 debug option** box. This window allows you to test and configure the debugger, the target EM6869 and their connections. It also allows you to erase the Flash. Click **Connect to RLink** to check the connection between the PC and the RLink.

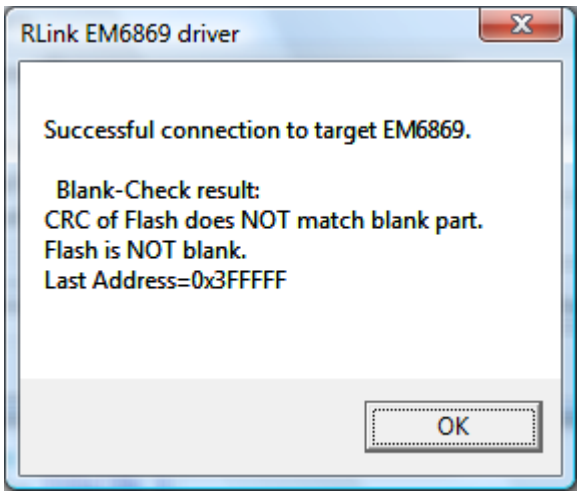


- If successful, this also displays the RLink Serial Number, which Raisonance will need for any support request (except of course, if reading the Serial Number fails…).



Note: This Serial Number is NOT written on the RLink. The only way to find it is with this test.

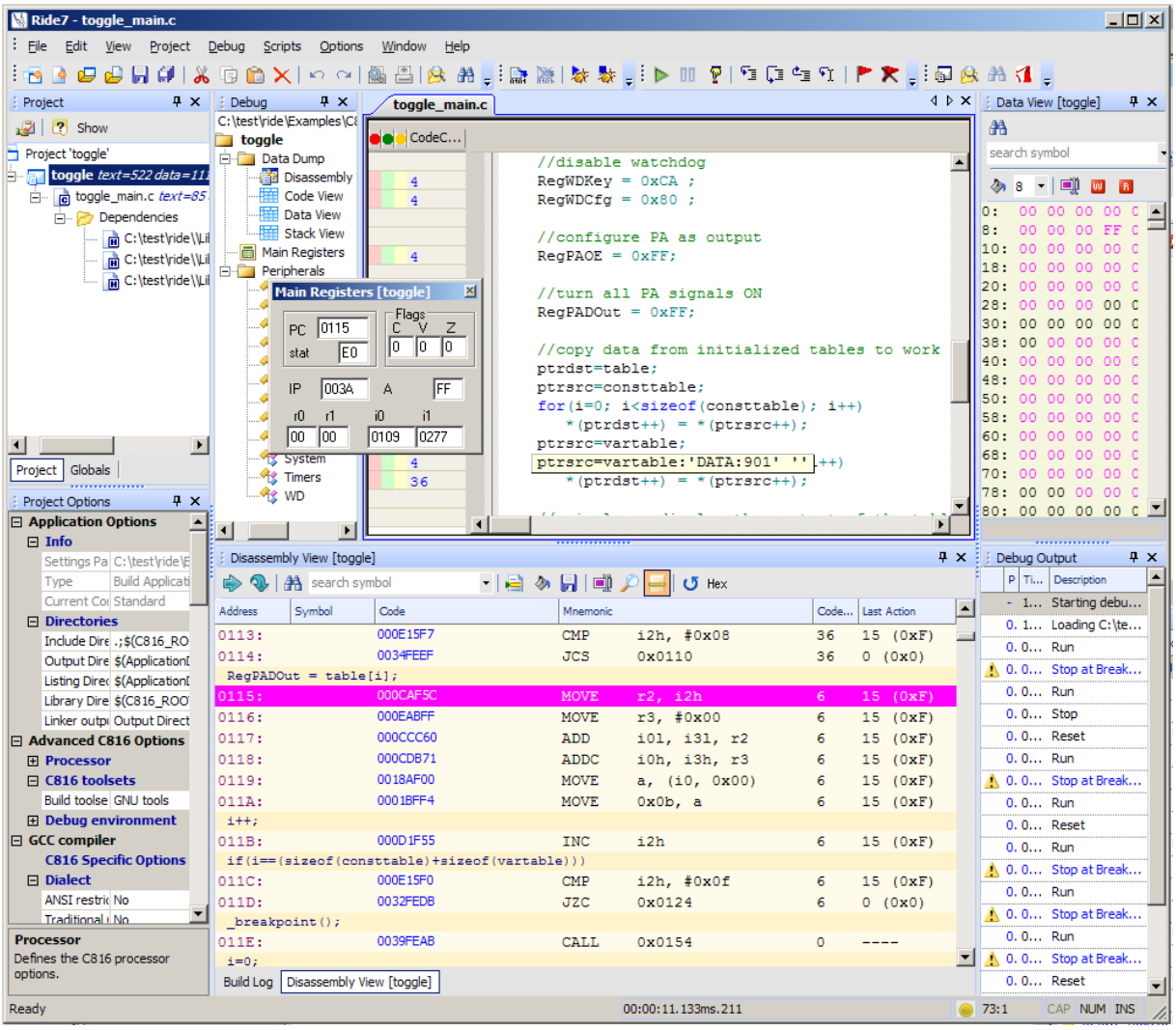
- Click **Connect to EM6869** to check the connection between the RLink and the EM6869, and the EM6869 power. If successful, this also displays some information about the target EM6869, like for example the CRC of the program currently loaded in the Flash. See the EM6869 documentation from EM Microelectronics for more information on these figures.



Note: If you get any errors while doing this, then you must understand and solve them before going on, because the next steps cannot work if these checks fail. The error messages are usually clear enough for you to understand and solve any problem. If not, please contact our support team.

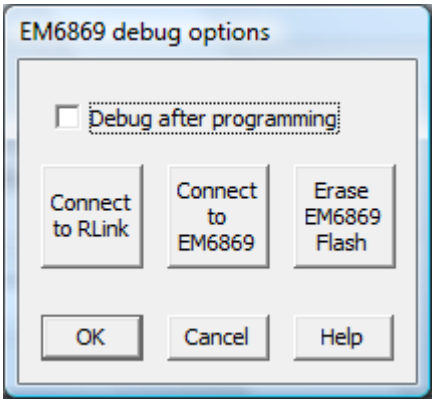
3.3 Starting the debug session

Select **Debug > Start**, your application will be loaded, run and stopped on **main()** function.
The Ride7 environment should look similar to the one shown below:



Note: From a user interface point of view, basic debugging functions are identical (stopping and resuming CPU execution, setting a breakpoint, single-stepping, checking memory and registers, etc.), whether you are using the simulator or a hardware debug tool. Refer to the Getting Started with Ride7 to get familiar with the simulator before starting to work with the hardware debuggers.

3.4 Programming without debugging

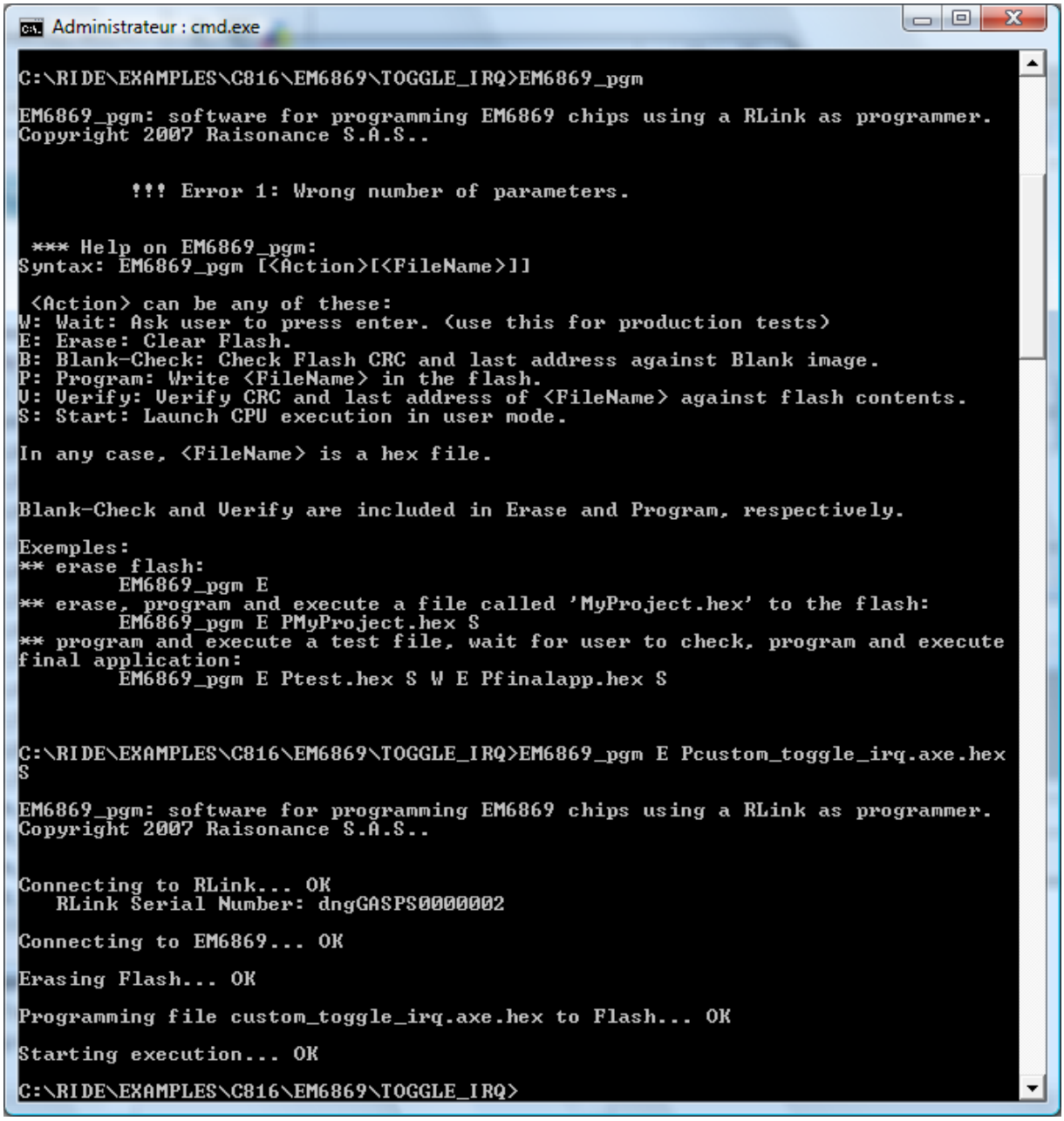


During application development it is sometimes preferable, instead of debugging, to simply program the Flash and let the application run. To do this, terminate the debug session. Go back to the advanced debug options and uncheck the **Debug after programming** checkbox.

3.5 Using EM6869_pgm.exe

Once your application is designed, debugged and validated, you will probably want to mass produce it. This means you will need to program a lot of EM6869 devices with the same code very quickly. If the operator is a subcontractor from another company, you might not want him to have your source code. For these situations, we provide an executable called *EM6869_pgm.exe* that allows you to directly program hex files (generated by Ride7 during the link of applications) to the EM6869 devices without using Ride7. It can also easily be called by a higher-end production and test programs, or just a batch file.

1. Open a command prompt using Windows **Start** menu and use CD command to go to the example project's folder.
2. Execute `EM6869_pgm`, to see the most recent Help for using it.
3. Execute `EM6869_pgm E Ptoggle.axe.hex S`. This erases the EM6869 Flash, programs it with the example's code from the hex file and starts its execution.



3.6 Trying the other examples

Ride7 is installed with at least two other examples that deserve your attention, they can be found in C:\Program Files\Raisonance\Ride\C816\EM6869.

- The “Toggle” example is the simplest possible application for EM6869. You can use it as a starting point for your new applications by duplicating it and modifying the copy.
- The “Toggle_Custom” is about the same, but it also shows how to use custom startup and linker script files. Use it as a starting point for your applications if you need to modify one of these template files.

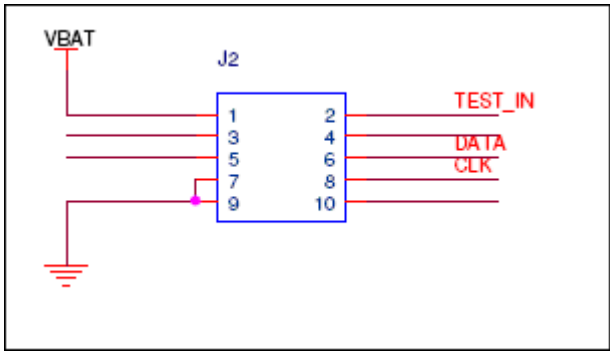
4. Debugging your own application

This chapter describes using the monitor with your own application - what you need to do and what you must be careful about. We cannot guarantee the debugging will work unless you follow this advice.

4.1 Including the DoCSPI connector on the board

When you design your system's PCB, you must take care that it includes a DoCSPI connector, and that this connector is correctly connected to the EM6869 (3 signals), ground, and power (for a total of 5 signals).

The lines must be short to avoid disturbances. We cannot guarantee that the RLink and EM6869 will be able to communicate using DoCSPI if the lines are longer than 10cm between the DoCSPI ADP and the EM6869 CPU.



List of pins:

- 1. VBAT: power from target board to RLink.
- 2. TEST_IN
- 6. DoCSPI DATA (PA7)
- 7. GND
- 8. DoCSPI CLK (PA6)
- 9. GND

4.2 Monitor limitations

The monitor is a level-0 IRQ

- It enables some level-0 interrupts and GIE and needs nested interrupts. It will not work properly if the application disables these features.
- If your application uses level-0 ITs but does not enable GIE, it will work in debug but not in normal execution.
- Other interrupts of any level will not be triggered while the monitor has stopped the execution.
- If the application (more precisely, its startup file) does not handle nested interrupts, you will not be able to stop in ISRs of any level. The standard startup does handle nested interrupts.
- If you do not use the default startup and linker script from Raisonance, we cannot guarantee that the monitor will work. However, it will work in most cases if you do not modify the sensitive parts, which are identified as such by comments.

- Pressing the STOP button in Ride7 while the CPU is in HALT instruction will make it exit HALT mode, altering the normal execution of the application. Ride7 has no way to detect it and resume exec properly in HALT mode.
- You cannot set breakpoints on the level-0 IRQ vector, or on the beginning of the level-0 IRQ decoding code in the startup. Ride7 will refuse it. You can set breakpoints in your ISRs of any level. See the startup code for more information.
- It will not work if the watchdog is activated. The monitor disables the watchdog whenever it enters STOP state and never enables it again. Even then, your application should deactivate the watchdog if you plan to debug.
- It cannot stop the execution if the CPU is in Sleep or PowerDown mode.

The monitor needs about 20 bytes of software stack

- Beware of stack overflow. If the SW stack is full, the debugger will break the application data. Ride7 has no way to detect it and warn you properly.
- The values shown in the data view just below i3 are not correct, you cannot modify them when stopped.
- You cannot modify i3 using the monitor (and you must be careful when modifying the PC).
- If the application modifies i3 to some inconsistent value, the monitor will crash. Especially, when stopping in or stepping over the modification of i3, it will often crash between the modification of the first byte of i3 and the second. Ride7 has no way to detect it and exit properly.
- It initializes i3 to some consistent value at reset. So if your application uses a custom startup that does not initialize i3, it might work in debug but not in normal execution mode (power-up without RLink).

The monitor needs about 170 instructions of code

- If your application is larger than (<Flash size> - 170), then you cannot include the monitor in it.
- If you are using CodeCompressor, you must make sure you configure it for not modifying the monitor.
- You cannot set breakpoints in the monitor code. Ride7 will refuse it.

The monitor uses the DoC peripherals and their SFRs, it is not allowed to modify the other peripherals configuration

- If the application modifies the DoC registers, the monitor will crash. Ride7 has no way to detect it and exit properly.
- The values displayed in the data view for these registers are not consistent and cannot be modified.
- The other peripherals remain active while in the stop state. PWMs go on toggling I/Os, which is good; Timers go on counting time, which could be bad, etc.

The RLink is connected to the EM6869 on the PA6 and PA7 signals

- These two pins cannot be used by the application if you want to debug it. You can make applications that use these two pins, but you will only be able to program and launch them, not debug them.
- Applications using PowerDown Mode will not execute correctly if the RLink is plugged, because the RLink includes some pullup resistors that will make the CPU exit PowerDown Mode as soon as it is activated. This implies that applications using PowerDown Mode cannot be debugged.

5. Conformity

ROHS Compliance (Restriction of Hazardous Substances)

KEOLABS products are certified to comply with the European Union RoHS Directive (2002/95/EC) which restricts the use of six hazardous chemicals in its products for the protection of human health and the environment.

The restricted substances are as follows: lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE).

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6. Glossary

Term	Description
ARM	Advanced RISC Machine
C816	Coolrisc 816
DoC	Debug on Chip
DoCSPI	EM Microelectronic serial protocol
RBuilder	Application builder that allows users to configure device peripherals and out put the required C code automatically for their applications. Code is based on libraries provided by the manufacturer.
REva	Raisonance evaluation platform – modular evaluation boards with main evaluation board (motherboard) and daughter boards featuring different microcontrollers
RFlasher	Raisonance Flasher: Programming interface for user-friendly flash programming
Ride7	Raisonance Integrated Development Environment
RLink	Raisonance's versatile in-circuit debugger and programmer for 8-bit and 32-bit microcontrollers
SFR	Special Function Register

7. Index

8. History

Date	Description
17 Mar 09	Initial version
30 Sep 10	Layout reformat
7 May 2013	Modified cover page, final page and section 1.3 Additional help or information for KEOLABS

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Please check the printed version against the .pdf installed on the computer in the installation directory of the most recent version of the software, for the most up-to-date version.

The examples of code used in this document are for illustration purposes only and accuracy is not guaranteed. Please check the code before use.