

M16C

Target Setup for the In-Circuit Debugger

1.0 Abstract

The ICD (In-Circuit Debugger), or USB-Monitor, is a low cost, compact interface that has two functions for Renesas' M16C Flash microcontrollers: 1) an in-circuit debugger tool with KD30 Debugger, and 2) an in-system programmer with FoUSB (Flash-over-USB™) Flash Programmer. The following article introduces, and shows examples of, how to configure the target hardware with Renesas' M16C Flash MCU to interface with the ICD for in-circuit debugging.

2.0 Introduction

When used with KD30, the ICD provides an easy-to-use in-circuit debugging environment during application development. In addition, when used with the FoUSB Flash Programmer, it also provides an in-system programming interface to the target Renesas M16C Flash MCU.

The ICD, by taking advantage of Universal Serial Bus (USB), provides plug-and-play connectivity and fast data transfers between the computer and the M16C target board. The ICD is powered by Renesas' M37641 full speed USB Flash MCU, which also makes it upgradeable to support future Renesas M16C MCUs.

Powering the ICD is user selectable: USB Bus powered or Target powered. When used in bus-powered mode, the USB bus supplies power to the ICD and target board. When in target-powered mode, USB bus power is disconnected and the ICD sources power from the M16C target board. Renesas recommends to use Target Power Mode and NOT USB Bus Power Mode when connected to non-Renesas SKP target boards. If you plan to use the ICD to supply power to non-SKP boards, please contact Renesas representative for details and assistance.

Aside from a standalone kit (RTA-FoUSB-MON), the ICD comes included with the following Renesas Starter Kits:

- MSV30102-SKP
- MSV30262-SKP
- MSV30245-SKP
- M16C System Evaluation Kit
- SKP16C26
- SKP16C28
- SKP16C62P
- SKP8CMini

PC with Windows™ 98,
2000, Me, or XP and
available USB port



Figure 1 ICD System Connectivity

A picture of the ICD with key components indicated is shown below.

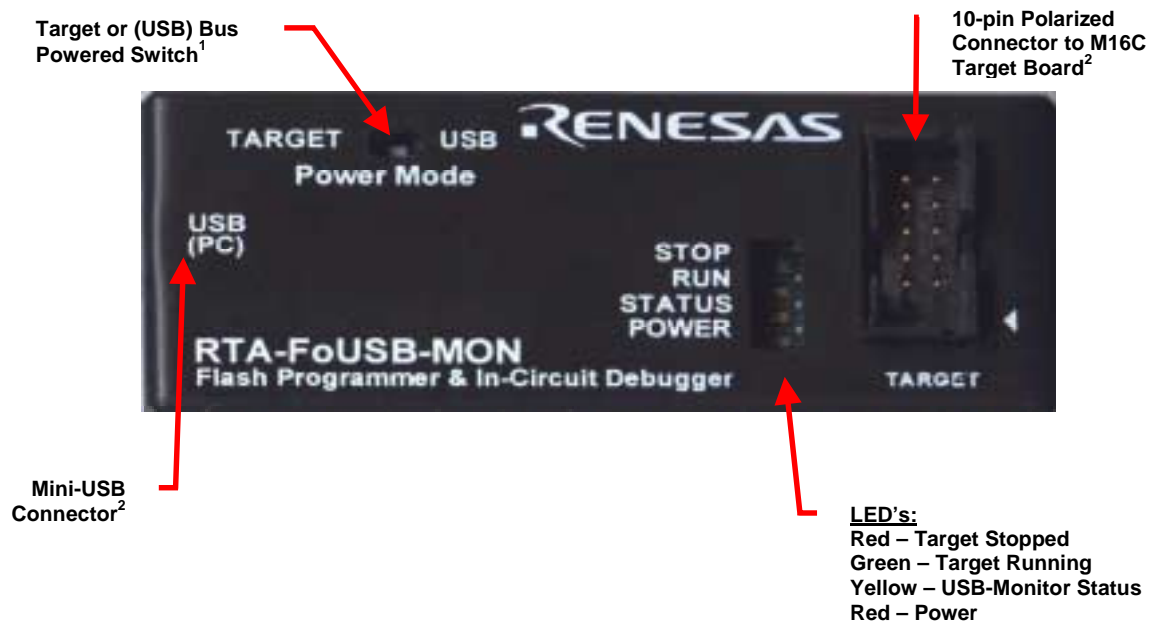


Figure 2 ICD (or USB-Monitor)

Note:

1. The USB Bus Power Mode was designed to supply power to Renesas SKP boards.

If non-Renesas SKP boards (i.e. customer developed M16C board) are used as target boards, use the ICD in Target Power mode. Contact your Renesas representative if you plan to use the ICD in Bus Power mode to supply power to your non-SKP target board.

2. The ICD ships with a 6' mini USB cable to connect to your PC and a 6" 10-pin flat ribbon target cable to connect to the M16C target board.

3. The ICD requires 5V for re-programming if a new MCU file (MMI) needs to be downloaded to the ICD (i.e. when the target MCU selected does not match the MCU file on the ICD). To accomplish this, disconnect the ICD from the target, set to Bus Power Mode, and then download new MCU file. After MCU file has been downloaded, switch back to Target Power Mode.

3.0 Target Hardware Connectivity for In-Circuit Debugging

This section describes the hardware connections to the ICD for in-circuit debugging operations. Examples for different M16C MCU's are shown at the end of the section. For target MCU resources used during in-circuit debugging, see reference section for details.

The ICD connects to an M16C target board through a polarized, .100" (2.54mm), 10-pin connection using a flat ribbon cable. It communicates with the M16C MCU using the boot UART/SIO in a clocked SIO configuration. The signals used and how these signals are assigned is described below.

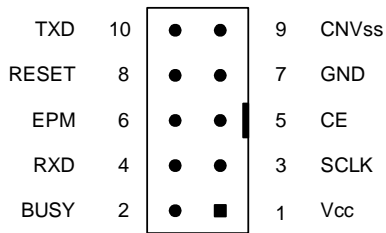


Figure 3 Target Board 10-Pin Header/Connector Signal Assignment

Note: All target interface lines are in high impedance state until instructed to do otherwise by the KD30 Debugger application.

3.1 Vcc – Power Supply Pin

This provides the common connection point for power between ICD and the target board. This must be connected to the target board's Vcc line/plane.

In Target Power mode, the ICD requires at least 3.3V and 45mA to operate properly. The ICD requires 5V when downloading new MCU Monitor Image (MMI).

3.2 Busy – Target MCU SIO Busy Signal

This line indicates whether the target is busy (and cannot receive data) or not. This must be connected to the target MCU's boot UART/SIO BUSY (CTS/RTS) pin.

This pin cannot be used while the ROM monitor is running (during in-circuit debug operations).

3.3 SCLK – Target MCU Serial Clock Signal

This clock is used for synchronous serial communication between ICD and target board. This must be connected to the target MCU's boot UART/SIO SCLK pin.

This pin cannot be used while the ROM monitor is running (during in-circuit debug operations).

3.4 RXD –Target MCU Receive Data Input Signal (ICD Transmit Data Output Signal)

This is the ICD SIO transmit data output. This must be connected to the target MCU's boot UART/SIO receive data input (RXD) pin.

This pin cannot be used while the ROM monitor is running (during in-circuit debug operations).

3.5 CE Pin

This pin is used to enter boot mode for programming of the target M16C MCU. Not all M16C MCU's have a CE pin. If a CE pin exists on the target MCU, it should be connected to this pin (refer to serial mode flash programming in the target MCU's datasheet). If not, leave pin unconnected.

This pin is in high impedance when in user mode (during debug operations).

If the target MCU's CE pin is used as input, isolate the driving circuit from the header connection with a 1Kohm resistor.

If to be left unconnected (if users decides to), care must be taken to ensure that the target MCU's CE pin has a high signal level using a pull-up resistor during any programming operations.

3.6 EPM Pin

The pin is used to control target MCU's EPM pin (if it exists on the target MCU). EPM pin is used during programming of the target MCU. If this pin exists on the target MCU (and in Target Powered mode), it should be connected to the header (refer to serial mode flash programming of the target MCU's datasheet). If not, leave pin unconnected.

If the target MCU's EPM pin is used as input, isolate the driving circuit from the header connection using a 1Kohm resistor.

If the EPM pin of the M16C MCU is left unconnected (no external circuit and not connected to 10-pin header), care must be taken to ensure that the target MCU's EPM pin has a low signal level using a pull-down resistor during any programming operations.

3.7 GND – Ground Pin

This provides the common point where the ICD ground and target board ground planes can be connected. This must be connected to target board's GND line/plane.

3.8 RESET – Target MCU Reset Signal

This active low signal is used by the ICD to reset the target MCU. This must be connected to the target board's reset circuit or target MCU's reset pin.

The user must ensure that the ICD can drive the pin to a valid low level with 5mA current.

3.9 CNVss – Target MCU CNVss Pin

This active high signal is used by the ICD to control the target MCU's CNVss pin for programming purposes. This must be connected to the target MCU's CNVss pin. During normal operation, this pin must have a low signal. To accomplish this, connect a 10K (nominal) pull-down resistor. See M16C MCU datasheet on CNVss pin description for details.

3.10 TXD – Target MCU Transmit Data Output Signal (ICD Receive Data Input Signal)

This is the ICD SIO receive data input. This must be connected to the target M16C MCU's boot UART/SIO transmit data output (TXD) pin.

This pin must be pulled down with a resistor connected to GND. The target MCU's ROM monitor polls this pin for the presence of the ICD before running the user program. Without the pull-down resistor, the target MCU will only run the ROM monitor program.

This pin cannot be used while the ROM monitor is running (during in-circuit debug operations).

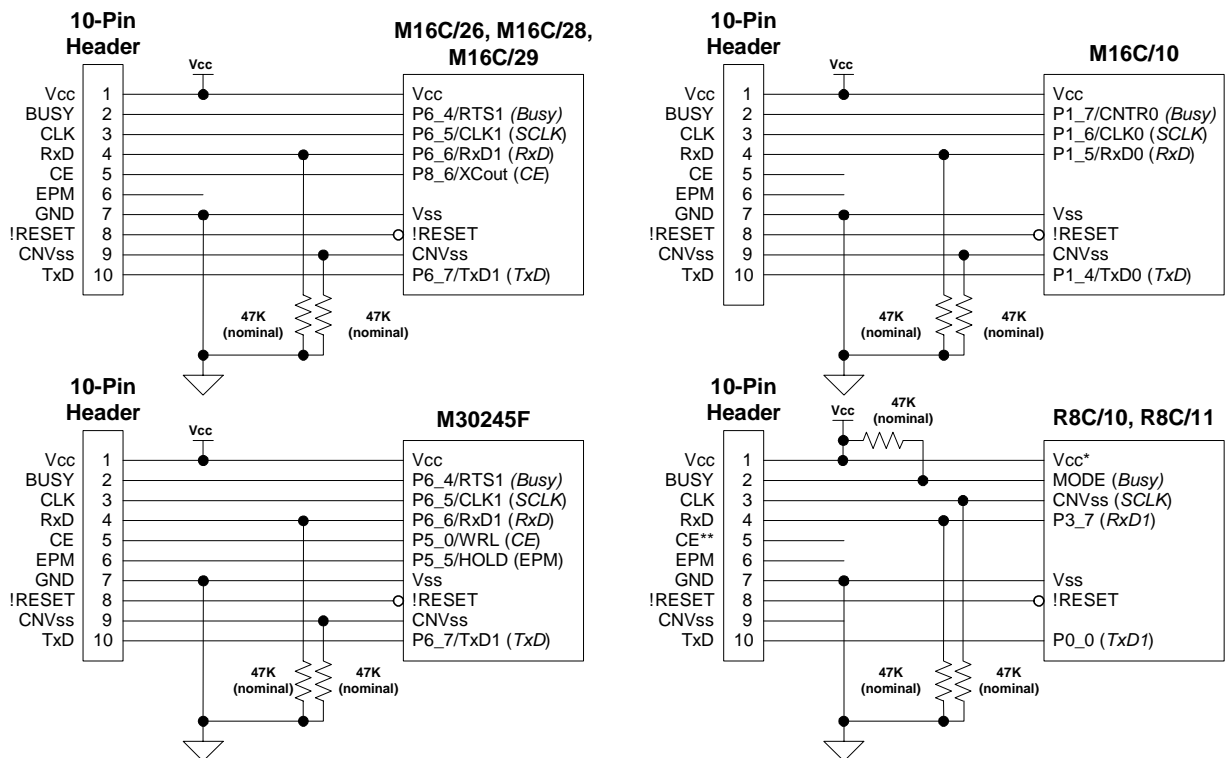
3.11 Hardware Summary and Precautions

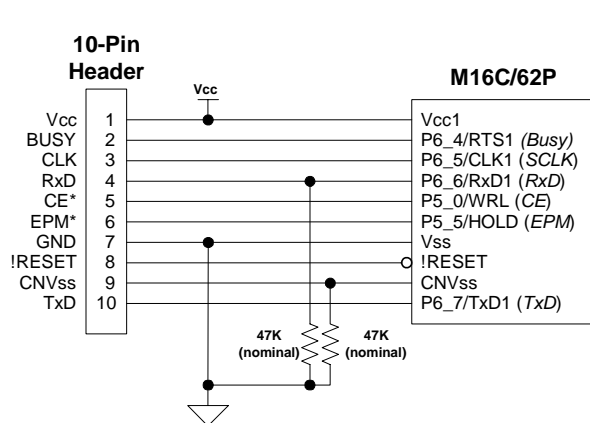
- Connect pull-down resistors to RXD and CNVss lines.
- Connect Reset line to the target MCU Reset pin or the target board's reset circuit.
- If EPM or CE lines are used as input pins, isolate the driving circuit from the 10-pin header using a 1Kohm resistor.
- If possible, avoid using the boot SIO/UART pins for other purposes.
- Table 1 lists the M16C Flash MCU's supported, CE or EPM pin support, the boot UART/SIO, DBC interrupt support, and the number of breakpoints that can be set in KD30.

Table 1 M16C MCU Support Summary

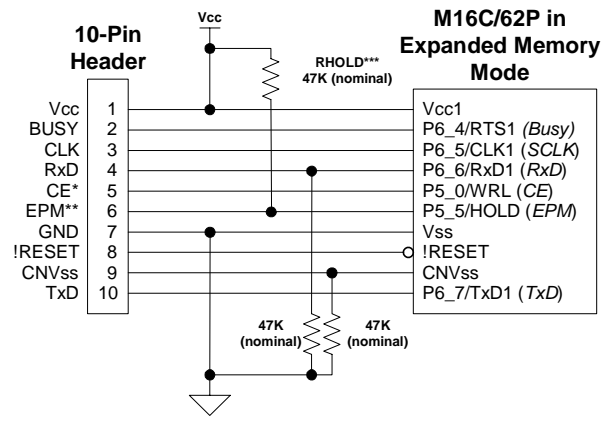
M16C MCU	CE/EPM Pin	Boot UART/SIO	DBC Irq Support	Breakpoints
M16C/10	None	UART0	No	2
M30245FC	Both	UART1	No	2
M16C/26	CE	UART1	Yes	6
M16C/28	CE	UART1	Yes	6
M16C/29	CE	UART1	Yes	6
M3062GF8N	Both	UART1	No	2
M16C/62P, 6N	Both	UART1	Yes	8
M306V7FG	Both	UART0	No	2
R8C/10, /11	None	UART1	Yes	2

Examples of target board hardware connection to 10-pin header (ICD) when used for debugging purposes only. If you cannot find your M16C Flash MCU in the examples shown, please contact Renesas representative for assistance.





* CE and EPM pins are high impedance in user mode (during debug).



* CE and EPM pin are high impedance in user mode (during debug).
** HOLD/EPM pin must be pulled high in memory expansion mode.

Note: If you cannot find your M16C Flash MCU in the examples shown, please contact Renesas representative for assistance.

4.0 Conclusion

The ICD is an easy-to-use interface for setting up an M16C MCU development environment to support in-circuit debugging. It does not require a lot of resources from the target board. Correct hardware connectivity will guarantee proper operation.

5.0 Reference

Renesas Technology Corporation Semiconductor Home Page

<http://www.renesas.com>

E-mail Support

support_apl@renesas.com

User's Manual

- RTA-FoUSB-MON User's Manual
- Target Setup for FoUSB Programmer App Note
- Firmware Requirements for In-Circuit Debugger Support App Note

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