

## 1 Introduction

This document describes the low cost monitor mode interface MONIF08-LC. This interface is designed to work with micro controllers of the Motorola HC08-Family.

Main specifications:

- 9-pin DSUB-male plug for PC COM interface
- Target connection via 10 pin ribbon cable
- Power supply via target connection (5V). This means no separate power supply needed
- Low cost and space saving assembly
- Supports all debug – features (break-Interrupt, reset on DTR-edge)
- Additional use as level converter for serial interface (SCI) of the micro controller

## 2 General

The monitor mode interface MONIF08-LC is an interface that connects between the PC serial interface and the monitor mode connections of a HC08 micro controller.

The monitor mode of the HC08-family in general supports in-circuit debugging and in-circuit flash programming.

This interface supports the common debug –features (Break-Interrupt, Reset on DTR-edge).

It is compatible with common monitor mode debugger software (e.g. the P&E or MON08 debugger integrated into the CodeWarrior IDE) and common flash programming tools (e.g. HC08\_ISP).

Additionally this interface can be used to connect the micro controllers SCI interface to the COM port of the PC. Via a common terminal program (e.g. Hyperterminal) application generated SCI messages can be monitored. If supported by the application, test data can be sent to the micro controller. In the CAN test application this feature is used to display the messages on the CAN via SCI and to generate CAN messages on a specific keypress.



## 3 Connection and Setup

The MONIF08-LC is connected to the target via a 10 pin ribbon cable. The MONIF08 is supplied with 5V from the target circuit and thus needs no additional power supply.

The pinout shown here is 1 to 1 compatible with the 10pin connector on the EB08-xx series of our evaluation boards.

10 Pin Nr.	Signal
1	NC
2	NC
3	HC08_RxD
4	HC08_TxD
5	GND
6	+5V
7	HC08_IRQ
8	HC08_PTA0
9	NC
10	HC08 Reset

NC: no connect, do not connect anything here.

Layout of corresponding pinheader, view from above

			K		
9	7	5	3	1	
10	8	6	4	2	

K: Coding interleave  
Pin 1 is marked with an arrow

The 9pin DSUB connector is to be connected to the PC COM interface with a 1:1 (straight) cable. No further steps for setup are necessary.

A cheap and simple adapter to the 16pin MON08 / P&E Cyclone connector layout, which is widely used on Motorola EVBs, is available on request. Order No. is MON08-LC Opt. 001.

## 4 PC Software Setup

### 4.1 Debugging with Metrowerks / P&E

There are two possibilities to use a the MONIF08-LC with the Metrowerks IDE:

MON08 – interface (this is limited to 1KB in the special edition) or P&E Debug (limited to 4 KB) .

Additional information on issues regarding PE debug can be found in the documentation in the MetroWerks installation directory

.....\Metrowerks\CodeWarrior CW08\_V2.1\CodeWarrior Manuals\pdf\Manual Engine HC08.pdf

To select PE Debug, choose an appropriate example from the MetroWerks examples directory. For the GZ16, there is an small assembly language example that can be run in demo mode (not even a special edition license key is required).

To check this example, go down the examples path

....\Metrowerks\CodeWarrior CW08\_V2.1\CodeWarrior\_Examples\HC08\HC08 PEDebug\GR\_GZ Demos\GZ16 Demo\

and open the project „GZ16 Demo.mcp“.

Click on the green Debug button. The project assembles and links and after this the debugger is launched.

Change the debug mode to “In circuit debug / programming” (PE Debug Menu, Mode: )

Now a window comes up "Attempting to contact target...". Here setup as shown:

Target Hardware Type = Class II (Motorola ICS without processor, ..., 16pin ribbon cable)

Select the proper COM port number. To change settings, first click on “close“. For the ‘GZ16 Starterkit the Baud rate is to be set to 4430. Set the drop-down menu to “specified” and enter 4430.

Set Target MCU Security Bytes = "Blank Device" (If the controller is blank, select FF-FF-FF-FF-FF-FF-FF as security bytes) . If not, select the right security bytes or select the ignore checkbox and delete the device before programming. More details are available with the “help” button. See also 5.1

If programming was successful, the debugger comes up and the program can be single stepped, a breakpoint can be set and so on.

If the break interrupt feature (see 5.2) is to be used to stop a program that did not run on a break point, some additional assembly lines have to be added. The updated project GZ16ASM\_break is included on the GZ16STK-CD in the GZ16STK\_CodeWarriorExamples directory.

The break interrupt is issued with the red “Halt” button or with pressing F6.

Power on reset issues: as long as the monitor mode entry to the target was OK, no physical power on reset is necessary. For convenience, just press enter without actually removing the power. If this doesn't work, you will have further tries. Now an physical power on reset is necessary.

### 4.2 Monitoring via SCI

The SCI mode is selected automatically via control signals DTR and RTS (both set to logic low = high voltage on interface lines) from the PC when opening a session in Hyperterminal. Be sure to configure the terminal to the appropriate baud rate.

There are some other useful terminal programs besides Hyperterminal which can be downloaded from the internet:

- TeraTerm
- OCConsole

For some applications, these may be more suitable than the Windows Hyperterminal.

### 4.3 Flash Programming with HC08-ISP

HC08\_isp offers the ability to load the full flash area of the GZ16. The P&E Debug special edition is limited to 4 KB.

Installation is explained in the readme.txt file on the installation disk.

The HC08\_ISP offers a quick start guide as part of the help.

## 5 Technical Background Information for Monitor Mode

Additional information to Monitor Mode related questions can be found on the Motorola web site and in the documentation on the MetroWerks installation directory

.....\Metrowerks\CodeWarrior CW08\_V2.1\CodeWarrior Manuals\pdf\Manual Mon08.pdf

Hardware issues are shown in the appropriate ‘HC08 controllers technical data, section Monitor ROM (MON).

### 5.1 Monitormode-Entry

For monitor mode entry the following sequence is performed:

After starting the debugging / programming software the software sets DTR to low. This switches IRQ-pin of the target  $\mu\text{C}$  to  $V_{hi}$  (8 volts) for entering the monitor mode. The falling edge of the DTR-signal triggers reset low for about 10ms. After release of the reset line the controller checks the pin conditions for monitor mode entry as described in the appropriate 'HC08 controllers technical data, section Monitor ROM (MON). Part of this conditions is that PTA0 is set to high level and IRQ set to  $V_{hi}$  ( $V_{dd}+2.5\text{ V}$ ). The other conditions (additional pins set to high or low) are to be met by the target circuitry. If all conditions are met the target  $\mu\text{C}$  enters the monitor mode and the debug / program tool sends the security bytes.

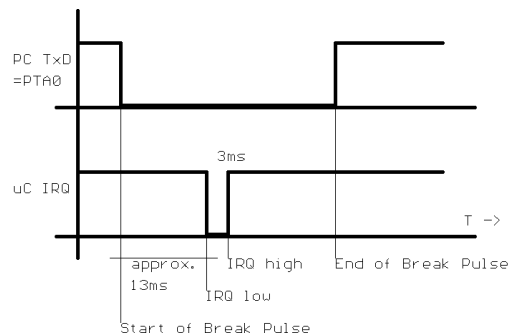
If the security bytes ever didn't match at first try, a manual power on reset of the board is needed for second try. In all other circumstances, no additional power on reset is needed.

## 5.2 Break-Interrupt

If you loose the control of program flow during debugging you could re-enter the monitor mode by a break interrupt. The RAM status is left unchanged and the program could continue its flow from the interruption. You also know the address of the interruption in the program flow. The Break-interrupt pulls the IRQ-signal to low for about 2ms and thus triggers the external interrupt. You have to extend the service routine for external interrupt (see below). The external interrupt must not be disabled. Polling PTA0 could detect the interrupt source (break or user circuit) and switch to the monitor mode or the user-ISR.

Timing diagram of break pulse:

(low pulses on TxD shorter than 13 ms will not generate an interrupt, so the serial communication is not disturbed if baud rate is higher than 700 Bd)



The example external interrupt service routine shows how this works:

(This example (GZ16ASM\_break) is included in the CodeWarrior example project on the starterkit disk)

```
EXTISR:
    brset 0,PTA,nobreak          ;if PTA0 = high User Routine
                                ;if not, Break Interrupt

waitwhile0:
    brclr 0,PTA,waitwhile0      ;Wait until PTA0 goes high again
                                ;(End of Break pulse on TxD)
    jmp   $ff63                  ;jump into Monitor ROM on GZ16 (only
                                MASKSET 1L35K, for Maskset 4L35K use "jmp $ff75")

nobreak: ;here the User ext Int ISR can be placed
    rti
```

The adress \$ff63 may be different for every maskset and for every type of micro controller. It must match the content of \$fefc and \$fed which is the vector adress for SWI in monitor mode.

Therefore, a more universal but bit more complicated solution can be used:

```
EXTISR:
    brset 0,PTA,nobreak          ;if PTA0 = high User Routine
                                ;if not, Break Interrupt

waitwhile0:
    brclr 0,PTA,waitwhile0      ;Wait until PTA0 goes high again
                                ;(End of Break pulse on TxD)
    lda   $fedf                  ;push contents of SWI vector
    psha
    lda   $fefc
    psha
    rts                          ;jump to SWI handler

nobreak: ;here the User ext Int ISR can be placed
    rti
```

## 6 Using SCI while Debugging in Monitor Mode

With one MONIF08-LC you can use either the SCI or the monitor mode.

Using a special setup using a second MONIF08-LC or a RS232-TTL-Adapter and a specially configured 10 pin ribbon cable this limitation can be overcome.

For this purpose a RS232-TTL-Adapter plus the special cable can be purchased from us (order No. MONIF08-LC Opt. 002) . Price will be about 25 EUR, plus shipping costs and taxes (VAT) depended on shipping destination.

## 7 Precautions

MOS devices in general are sensitive to electrostatic discharge. Be sure to perform a potential equalization (connect ground first) before connecting the MONIF08-LC to the target circuit. This protects the target controller and the interface from damage.

The MONIF-LC gets its supply voltage from the target supply. The typical current consumption is less than 20mA. The tolerable voltage is 5V+/- 10%. Always check the correct polarity and supply voltage level before switching on power. Especially higher voltages (even on the signal lines) will destroy the device.

Always disconnect power before connecting the interface.

The PC and the power supply of the target circuit have to meet the requirements of a SELV-circuit (safety extra low voltage circuits) as described in EN60950 / UL950.

The allowed temperature range is 10..30°C.

## 8 Package content

Basic device MONIF08-LC

Target-Connection-Cable ca. 25cm, both ends with 10pin Crimp-Plug

This user documentation on disk

1:1-RS232-Cabel 9pin (male-female) for longer RS232 connections (1,8m long)

### 8.1 Optional accessory

Optional accessory is to be ordered separately.

MON08-LC Opt. 001: Adapter Board 10 pin to 16 pin MON08 / P&E Cyclone connector layout

MON08-LC Opt. 002: RS232-TTL-Adapter plus the special cable for using SCI while debugging

## 9 Contact

If you have questions about the product or application, please feel free to contact us.

We are also grateful for hints regarding errors or ambiguous phrases in this document.

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