bdiGDB

JTAG debug interface for GNU Debugger

ColdFire

User Manual

Manual Version 1.02 for BDI3000

abatron

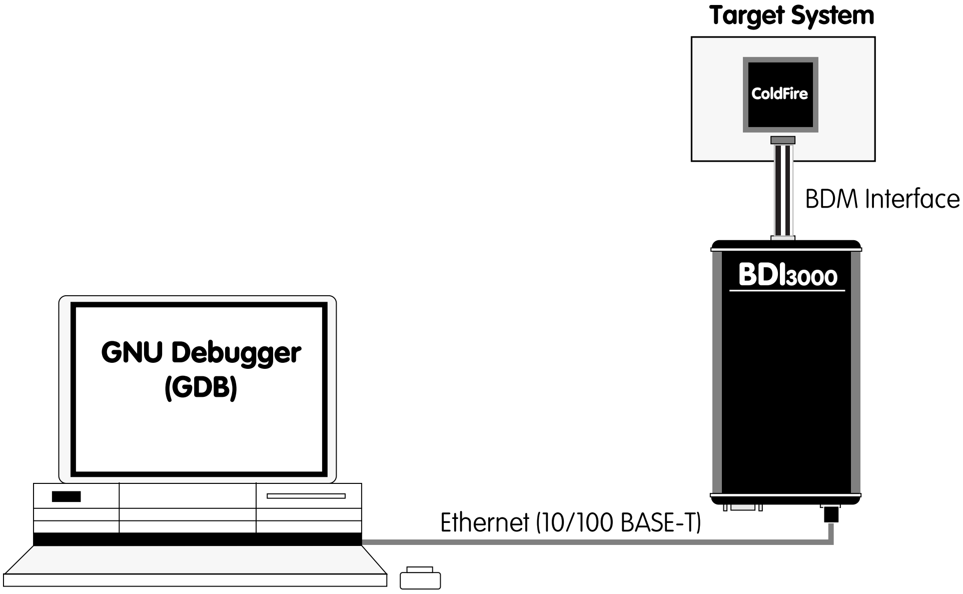
Appendices

1 Introduction

bdiGDB enhances the GNU debugger (GDB), with Background Debug Mode (BDM) debugging for ColdFire based targets. With the built-in Ethernet interface you get a very fast code download speed. No target communication channel (e.g. serial line) is wasted for debugging purposes. Even better, you can use fast Ethernet debugging with target systems without network capability. The host to BDI communication uses the standard GDB remote protocol.

An additional Telnet interface is available for special debug tasks (e.g. force a hardware reset, program flash memory).

The following figure shows how the BDI3000 interface is connected between the host and the target:



1.1 BDI3000

The BDI3000 is the main part of the bdiGDB system. This small box implements the interface between the JTAG pins of the target CPU and a 10/100Base-T Ethernet connector. The firmware of the BDI3000 can be updated by the user with a simple Linux/Windows configuration program or interactively via Telnet/TFTP. The BDI3000 supports 1.2 – 5.0 Volts target systems.

1.2 BDI Configuration

As an initial setup, the IP address of the BDI3000, the IP address of the host with the configuration file and the name of the configuration file is stored within the flash of the BDI3000.
Every time the BDI3000 is powered on, it reads the configuration file via TFTP.

Following an example of a typical configuration file:

```
; Configuration file for a MCF5307 board
; -------------------------------------
; the initialistion list used to setup the target system
[INIT]
WCREG   0xC0F       0x10000001  ;MBAR: map internal registers to 0x10000000
WCREG   0xC04       0x00800021  ;RAMBAR: map internal SRAM to 0x00800000
WM16    0x10000080  0xFFE0      ;CSAR0: Flash at 0xFFE00000
WM16    0x1000008A  0x0D80      ;CSCR0: Flash 3 waits, 16bit,
WM32    0x10000084  0x000F0001  ;CSMR0: Flash 1MB, R/W, valid
WM16    0x10000100  0x8230      ;DCR: SDRAM Trc=6, RC=48
WM32    0x10000108  0x00001300  ;DACR0: base=0x00000000; timing=2,4,2,1,-1; CBM=011
WM32    0x1000010C  0x003C0001  ;DCMR0: mask=4MB; enable
WM32    0x10000108  0x00001308  ;DACR0: Initiate Precharge All Command
WM32    0x00000400  0x00000000  ;Execute PALL command
WM32    0x10000108  0x00009300  ;DACR0: enable refresh
WM32    0x10000110  0x00401300  ;DACR1: base=0x00400000; timing=2,4,2,1,-1; CBM=011
WM32    0x10000114  0x007C0001  ;DCMR1: mask=8MB; enable
WM32    0x10000110  0x00401308  ;DACR1: Initiate Precharge All Command
WM32    0x00400400  0x00000000  ;Execute PALL command
WM32    0x10000110  0x00409300  ;DACR1: enable refresh
DELAY         20            ;Delay for Refresh
WM32    0x10000108  0x00009340  ;DACR0: Initiate Mode Register Set Command
WM32    0x00000400  0x00000000  ;Execute MRS command
WM32    0x10000110  0x00009340  ;DACR1: Initiate Mode Register Set Command
WM32    0x00400400  0x00000000  ;Execute MRS command

[TARGET]
CPUTYPE     MCF5307
CPUCLOCK    90000000    ;the CPU clock rate after processing the init list
BREAKMODE   SOFT        ;SOFT or HARD
VECTOR      CATCH       ;catch unhandled exceptions

[HOST]
IP          151.120.25.115
FILE        E:\cygnus\root\usr\demo\mcf5307\fibo.exe
FORMAT      COFF
LOAD        MANUAL      ;load code MANUAL or AUTO after reset

[FLASH]
WORKSPACE   0x00800000  ;workspace in target RAM for fast programming algorithm
CHIPTYPE    AM29F       ;Flash type (AM29F | AM29BX8 | AM29BX16 | I28BX8 | I28BX16)
CHIPSIZE    0x80000     ;The size of one flash chip in bytes (e.g. AM29F010 = 0x20000)
BUSWIDTH    16          ;The width of the flash memory bus in bits (8 | 16 | 32)
FILE        D:\abatron\bdi360\ColdFire\pro\sbc5307.sss
ERASE       0xFFE00000  ;erase sector  0 of flash
ERASE       0xFFE20000  ;erase sector  1 of flash

[REGS]
DMM1    0x10000000
FILE    E:\cygnus\root\usr\demo\mcf5307\reg5307.def
```

Based on the information in the configuration file, the target is automatically initialized after every reset.

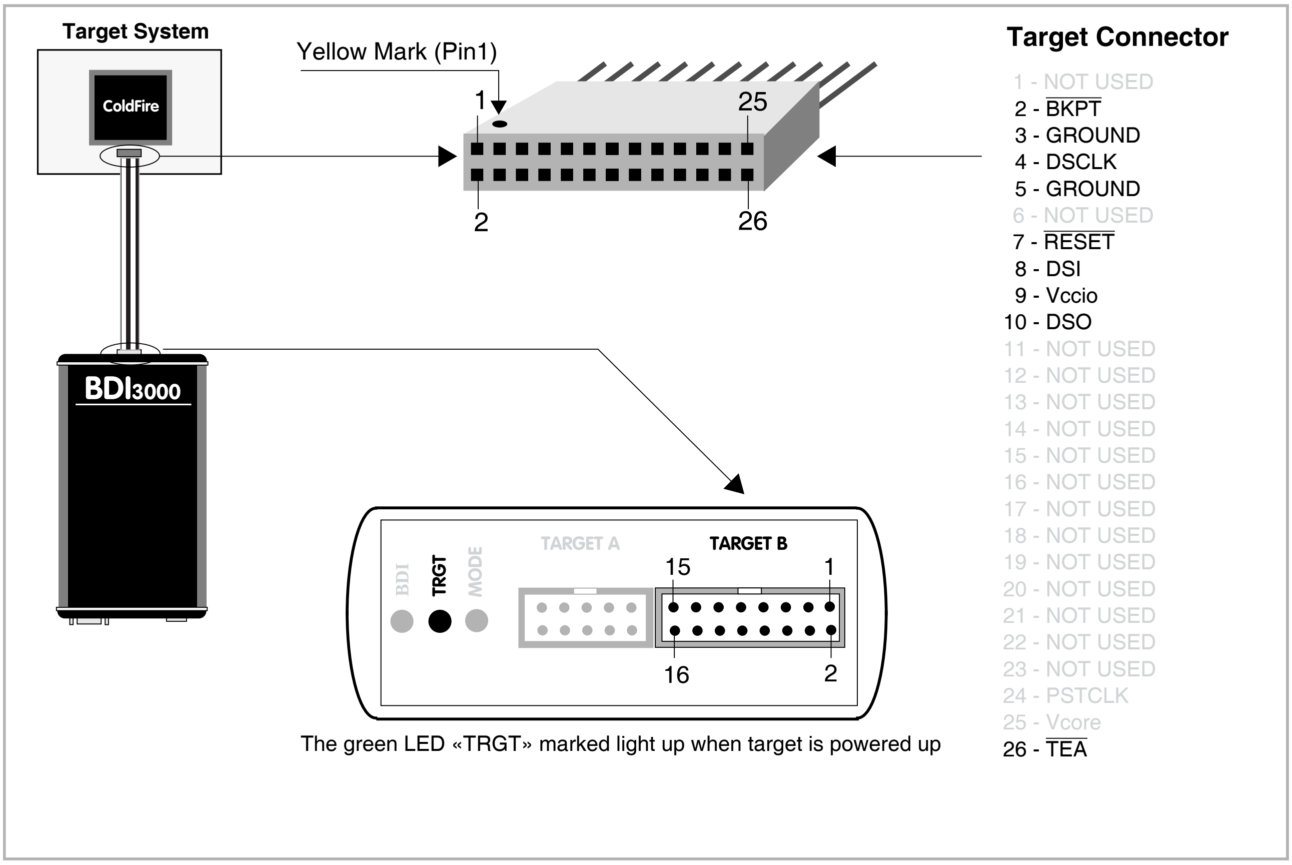
2 Installation

2.1 Connecting the BDI3000 to Target

The enclosed cable to the target system is designed for the Motorola recommended 26-pin Berg connector. In case where the target system has an appropriate connector, the cable can be directly connected. The pin assignment is in accordance with the Motorola specification.

⚠

In order to ensure reliable operation of the BDI (EMC, runtimes, etc.) the target cable length must not exceed 20 cm (8").



The green LED «TRGT» marked light up when target is powered up

For BDI TARGET B connector signals see table on next page.

Warning:
Before you can use the BDI3000 with an other target processor type (e.g. ColdFire <--> ARM), a new setup has to be done (see chapter 2.5). During this process the target cable must be disconnected from the target system.

⚠

To avoid data line conflicts, the BDI3000 must be disconnected from the target system while programming a new firmware for an other target CPU.

TARGET B Connector Signals

Pin	Name	Description
1	DSO	**DATA SERIAL OUT** For background debug mode, serial data output from the MCU.
2	<reserved>	
3	DSI	**DATA SERIAL IN** For background debug mode, serial data input signal to the MCU.
4	<reserved>	
5	<reserved>	
6	Vccio Target	**1.2 – 5.0V:** This is the target reference voltage. It indicates that the target has power and it is also used to create the logic-level reference for the input comparators. It also controls the output logic levels to the target. It is normally fed from Vcc I/O on the target board.
7	DSCLK	**DEVELOPMENT SERIAL CLOCK** For background debug mode, serial shift clock to the MCU.
8	$\overline{\text{BKPT}}$	**BREAKPOINT** BKPT is an active-low signal that signals a hardware breakpoint for the ColdFire core. It is used to force the ColdFire core to enter debug mode.
9	$\overline{\text{TEA}}$ (optional)	**TRANSFER ERROR ACKNOWLEDGE (currently not implemented)** Active-low open-drain signal, used to abort a bus cycle. This signal may be helpful for ColdFire devices which has no built-in bus monitor (e.g. MCF5307). The BDI is able to terminate an invalid memory access. Otherwise BDM communication may hang until a reset is applied.
10	<reserved>	
11	<reserved>	
12	GROUND	**System Ground**
13	$\overline{\text{RESET}}$	**RESET** Active-low open-drain signal, used to force a system reset.
14	PSTCLK (not used)	**PROCESSOR STATUS CLOCK** This signal is not used by the BDI3000. See note below.
15	<reserved>	
16	GROUND	**System Ground**

Note:
The BDI3000 does not support some older V2 cores (MCF5204, MCF5206(e) and MCF5272). These cores need synchronous BDM signals and this is not supported by the BDI3000.

2.2 Connecting the BDI3000 to Power Supply

The BDI3000 needs to be supplied with the enclosed power supply from Abatron (5VDC).

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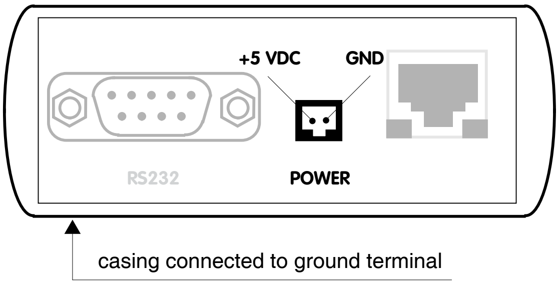
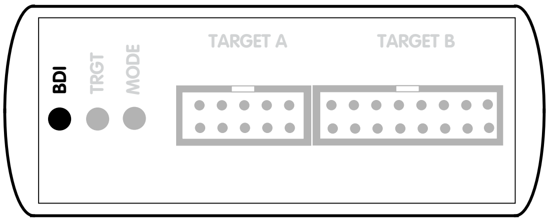
Before use, check if the mains voltage is in accordance with the input voltage printed on power supply. Make sure that, while operating, the power supply is not covered up and not situated near a heater or in direct sun light. Dry location use only.

⚠

For error-free operation, the power supply to the BDI3000 must be between 4.75V and 5.25V DC. **The maximal tolerable supply voltage is 5.25 VDC. Any higher voltage or a wrong polarity might destroy the electronics.**





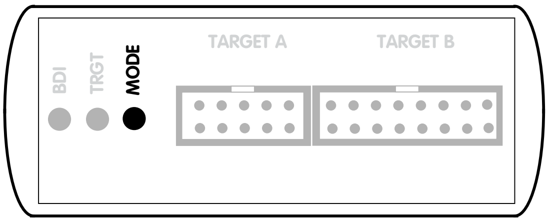
The green LED «BDI» marked light up when 5V power is connected to the BDI3000

Please switch on the system in the following sequence:

- 1 –> external power supply
- 2 –> target system

2.3 Status LED «MODE»

The built in LED indicates the following BDI states:



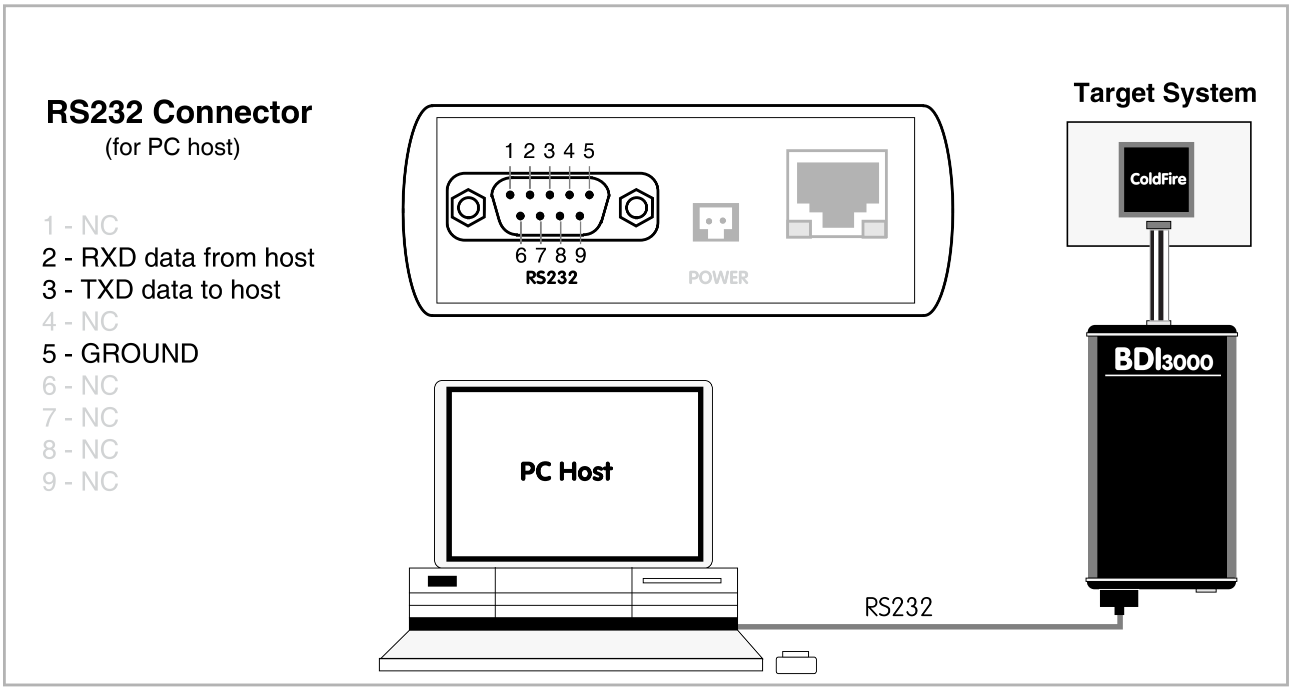
MODE LED	BDI STATES
OFF	The BDI is ready for use, the firmware is already loaded.
ON	The output voltage from the power supply is too low.
BLINK	The BDI «loader mode» is active (an invalid firmware is loaded or loading firmware is active).

2.4 Connecting the BDI3000 to Host

2.4.1 Serial line communication

Serial line communication is only used for the initial configuration of the bdiGDB system.

The host is connected to the BDI through the serial interface (COM1...COM4). The communication cable (included) between BDI and Host is a serial cable. There is the same connector pinout for the BDI and for the Host side (Refer to Figure below).

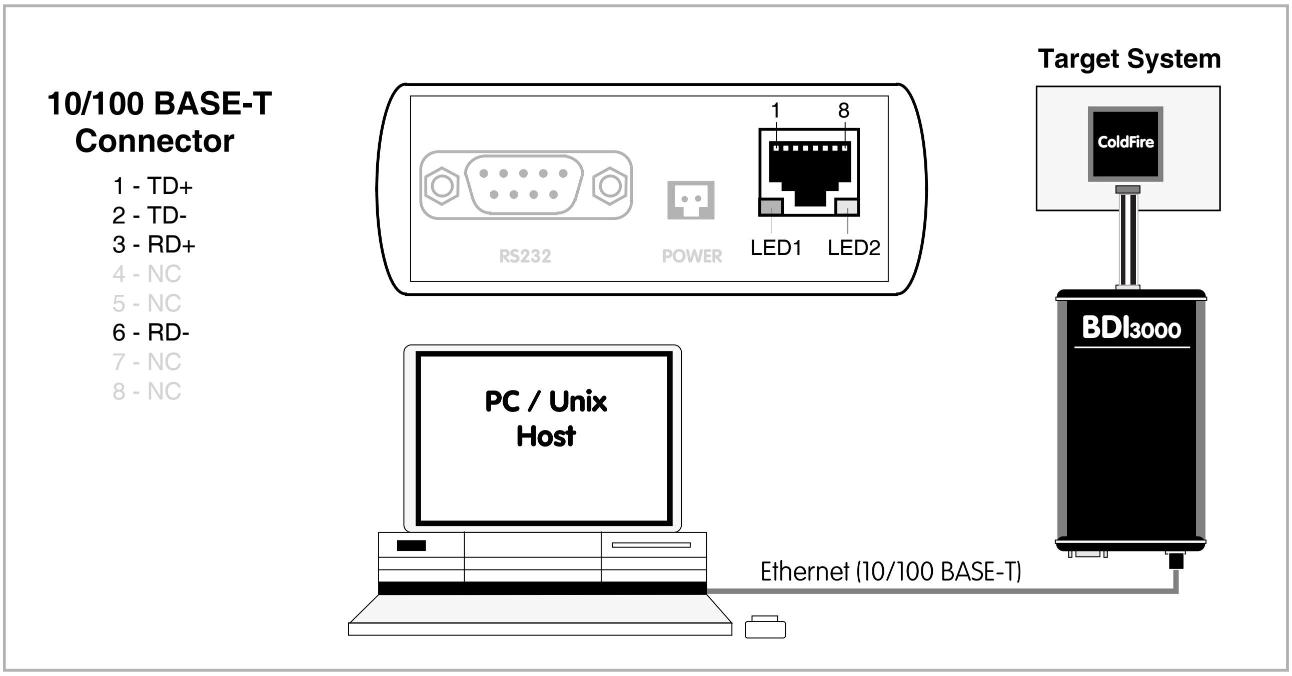


RS232 Connector
(for PC host)

1 - NC
2 - RXD data from host
3 - TXD data to host
4 - NC
5 - GROUND
6 - NC
7 - NC
8 - NC
9 - NC

2.4.2 Ethernet communication

The BDI3000 has a built-in 10/100 BASE-T Ethernet interface (see figure below). Connect an UTP (Unshielded Twisted Pair) cable to the BD3000. Contact your network administrator if you have questions about the network.



The following explains the meanings of the built-in LED lights:

LED	Function	Description
LED 1 (green)	Link / Activity	When this LED light is ON, data link is successful between the UTP port of the BDI3000 and the hub to which it is connected. The LED blinks when the BDI3000 is receiving or transmitting data.
LED 2 (amber)	Speed	When this LED light is ON, 100Mb/s mode is selected (default). When this LED light is OFF, 10Mb/s mode is selected

2.5 Installation of the Configuration Software

On the enclosed diskette you will find the BDI configuration software and the firmware required for the BDI3000. For Windows users there is also a TFTP server included.

The following files are on the diskette.

b30mcfgd.exe	Windows Configuration program
b30mcfgd.xxx	Firmware for the BDI3000
tftpsrv.exe	TFTP server for Windows (WIN32 console application)
*.cfg	Configuration files
*.def	Register definition files
bdisetup.zip	ZIP Archive with the Setup Tool sources for Linux / UNIX hosts.

Overview of an installation / configuration process:

- Create a new directory on your hard disk
- Copy the entire contents of the enclosed diskette into this directory
- Linux only: extract the setup tool sources and build the setup tool
- Use the setup tool or Telnet (default IP) to load/update the BDI firmware
  Note: A new BDI has no firmware loaded.
- Use the setup tool or Telnet (default IP) to load the initial configuration parameters
  - IP address of the BDI.
  - IP address of the host with the configuration file.
  - Name of the configuration file. This file is accessed via TFTP.
  - Optional network parameters (subnet mask, default gateway).

Activating BOOTP:
The BDI can get the network configuration and the name of the configuration file also via BOOTP. For this simple enter 0.0.0.0 as the BDI's IP address (see following chapters). If present, the subnet mask and the default gateway (router) is taken from the BOOTP vendor-specific field as defined in RFC 1533.

With the Linux setup tool, simply use the default parameters for the -c option:

```
[root@LINUX_1 bdisetup]# ./bdisetup -c -p/dev/ttyS0 -b57
```

The MAC address is derived from the serial number as follows:
MAC: 00-0C-01-xx-xx-xx , replace the xx-xx-xx with the 6 left digits of the serial number
Example: SN# 33123407 ==>> 00-0C-01-33-12-34

Default IP: 192.168.53.72
Before the BDI is configured the first time, it has a default IP of 192.168.53.72 that allows an initial configuration via Ethernet (Telnet or Setup Tools). If your host is not able to connect to this default IP, then the initial configuration has to be done via the serial connection.

2.5.1 Configuration with a Linux / Unix host

The firmware update and the initial configuration of the BDI3000 is done with a command line utility. In the ZIP Archive bdisetup.zip are all sources to build this utility. More information about this utility can be found at the top in the bdisetup.c source file. There is also a make file included.
Starting the tool without any parameter displays information about the syntax and parameters.

To avoid data line conflicts, the BDI3000 must be disconnected from the target system while programming the firmware for an other target CPU family.

Following the steps to bring-up a new BDI3000:

1. Build the setup tool:
The setup tool is delivered only as source files. This allows to build the tool on any Linux / Unix host. To build the tool, simply start the make utility.

```
[root@LINUX_1 bdisetup]# make
cc -O2   -c -o bdisetup.o bdisetup.c
cc -O2   -c -o bdicnf.o bdicnf.c
cc -O2   -c -o bdidll.o bdidll.c
cc -s bdisetup.o bdicnf.o bdidll.o -o bdisetup
```

2. Check the serial connection to the BDI:
With "bdisetup -v" you may check the serial connection to the BDI. The BDI will respond with information about the current loaded firmware and network configuration.
Note: Login as root, otherwise you probably have no access to the serial port.

```
$ ./bdisetup -v -p/dev/ttyS0 -b115
BDI Type : BDI3000 (SN: 30000154)
Loader   : V1.00
Firmware : unknown
MAC      : ff-ff-ff-ff-ff-ff
IP Addr  : 255.255.255.255
Subnet   : 255.255.255.255
Gateway  : 255.255.255.255
Host IP  : 255.255.255.255
Config   : ÿÿÿÿÿÿÿ........
```

3. Load/Update the BDI firmware:
With "bdisetup -u" the firmware is programmed into the BDI3000 flash memory. This configures the BDI for the target you are using. Based on the parameters -a and -t, the tool selects the correct firmware file. If the firmware file is in the same directory as the setup tool, there is no need to enter a -d parameter.

```
$ ./bdisetup -u -p/dev/ttyS0 -b115 -aGDB -tMCF
Connecting to BDI loader
Programming firmware with ./b30mcfgd.100
Erasing firmware flash ....
Erasing firmware flash passed
Programming firmware flash ....
Programming firmware flash passed
```

4. Transmit the initial configuration parameters:

With "bdisetup -c" the configuration parameters are written to the flash memory within the BDI.
The following parameters are used to configure the BDI:

BDI IP Address — The IP address for the BDI3000. Ask your network administrator for assigning an IP address to this BDI3000. Every BDI3000 in your network needs a different IP address.

Subnet Mask — The subnet mask of the network where the BDI is connected to. A subnet mask of 255.255.255.255 disables the gateway feature. Ask your network administrator for the correct subnet mask. If the BDI and the host are in the same subnet, it is not necessary to enter a subnet mask.

Default Gateway — Enter the IP address of the default gateway. Ask your network administrator for the correct gateway IP address. If the gateway feature is disabled, you may enter 255.255.255.255 or any other value.

Config - Host IP Address — Enter the IP address of the host with the configuration file. The configuration file is automatically read by the BDI3000 after every start-up.

Configuration file — Enter the full path and name of the configuration file. This file is read via TFTP. Keep in mind that TFTP has it's own root directory (usual /tftpboot). You can simply copy the configuration file to this directory and the use the file name without any path.
For more information about TFTP use "man tftpd".

```
$ ./bdisetup -c -p/dev/ttyS0 -b115 \
> -i151.120.25.102 \
> -h151.120.25.112 \
> -fe:/bdi3000/mytarget.cfg
Connecting to BDI loader
Writing network configuration
Configuration passed
```

5. Check configuration and exit loader mode:

The BDI is in loader mode when there is no valid firmware loaded or you connect to it with the setup tool. While in loader mode, the Mode LED is blinking. The BDI will not respond to network requests while in loader mode. To exit loader mode, the "bdisetup -v -s" can be used. You may also power-off the BDI, wait some time (1min.) and power-on it again to exit loader mode.

```
$ ./bdisetup -v -p/dev/ttyS0 -b115 -s
BDI Type : BDI3000 (SN: 30000154)
Loader   : V1.00
Firmware : V1.00 bdiGDB for ColdFire
MAC      : 00-0c-01-30-00-01
IP Addr  : 151.120.25.102
Subnet   : 255.255.255.255
Gateway  : 255.255.255.255
Host IP  : 151.120.25.112
Config   : /bdi3000/mytarget.cfg
```

The Mode LED should go off, and you can try to connect to the BDI via Telnet.

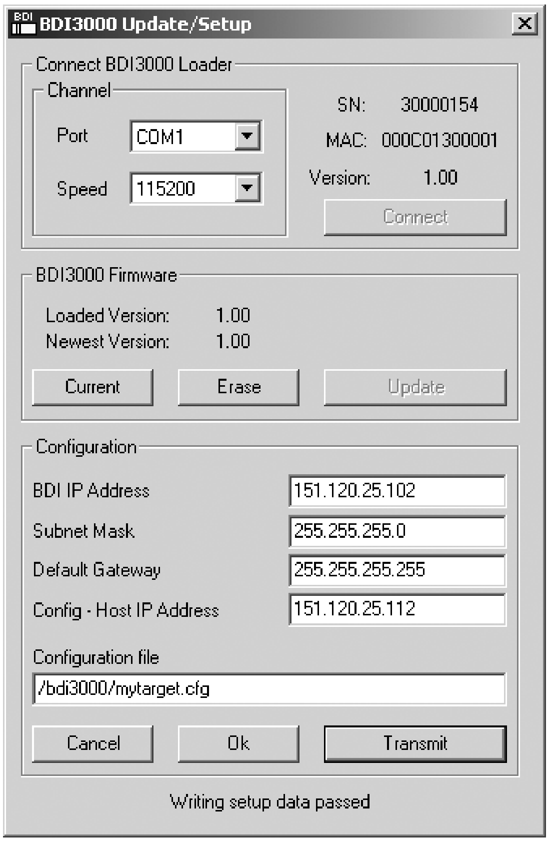
```
$ telnet 151.120.25.102
```

2.5.2 Configuration with a Windows host

First make sure that the BDI is properly connected (see Chapter 2.1 to 2.4).

⚠

To avoid data line conflicts, the BDI3000 must be disconnected from the target system while programming the firmware for an other target CPU family.


BDI3000 Update/Setup

Connect BDI3000 Loader

Channel

Port: COM1

Speed: 115200

SN: 30000154

MAC: 000C01300001

Version: 1.00

BDI3000 Firmware

Loaded Version: 1.00

Newest Version: 1.00

Configuration

BDI IP Address: 151.120.25.102

Subnet Mask: 255.255.255.0

Default Gateway: 255.255.255.255

Config - Host IP Address: 151.120.25.112

Configuration file: /bdi3000/mytarget.cfg

Writing setup data passed

dialog box «BDI3000 Update/Setup»

Before you can use the BDI3000 together with the GNU debugger, you must store the initial configuration parameters in the BDI3000 flash memory. The following options allow you to do this:

Port — Select the communication port where the BDI3000 is connected during this setup session. If you select Network, make sure the Loader is already active (Mode LED blinking). If there is already a firmware loaded and running, use the Telnet command "boot loader" to activate Loader Mode.

Speed — Select the baudrate used to communicate with the BDI3000 loader during this setup session.

Connect — Click on this button to establish a connection with the BDI3000 loader. Once connected, the BDI3000 remains in loader mode until it is restarted or this dialog box is closed.

Current — Press this button to read back the current loaded BDI3000 firmware version. The current firmware version will be displayed.

Erase

Press this button to erase the current loaded firmware.

Update

This button is only active if there is a newer firmware version present in the execution directory of the bdiGDB setup software. Press this button to write the new firmware into the BDI3000 flash memory.

BDI IP Address

Enter the IP address for the BDI3000. Use the following format:
xxx.xxx.xxx.xxx e.g.151.120.25.101
Ask your network administrator for assigning an IP address to this BDI3000. Every BDI3000 in your network needs a different IP address.

Subnet Mask

Enter the subnet mask of the network where the BDI is connected to.
Use the following format: xxx.xxx.xxx.xxxe.g.255.255.255.0
A subnet mask of 255.255.255.255 disables the gateway feature.
Ask your network administrator for the correct subnet mask.

Default Gateway

Enter the IP address of the default gateway. Ask your network administrator for the correct gateway IP address. If the gateway feature is disabled, you may enter 255.255.255.255 or any other value.

Config - Host IP Address

Enter the IP address of the host with the configuration file. The configuration file is automatically read by the BDI3000 after every start-up.

Configuration file

Enter the full path and name of the configuration file. This name is transmitted to the TFTP server when reading the configuration file.

Transmit

Click on this button to store the configuration in the BDI3000 flash memory.

Note:
Using this setup tool via the Network channel is only possible if the BDI3000 is already in Loader mode (Mode LED blinking). To force Loader mode, enter "boot loader" at the Telnet. The setup tool tries first to establish a connection to the Loader via the IP address present in the "BDI IP Address" entry field. If there is no connection established after a time-out, it tries to connect to the default IP (192.168.53.72).

2.5.3 Configuration via Telnet / TFTP

The firmware update and the initial configuration of the BDI3000 can also be done interactively via a Telnet connection and a running TFTP server on the host with the firmware file. In cases where it is not possible to connect to the default IP, the initial setup has to be done via a serial connection.

⚠

To avoid data line conflicts, the BDI3000 must be disconnected from the target system while programming the firmware for an other target CPU family.

Following the steps to bring-up a new BDI3000 or updating the firmware.
Connect to the BDI Loader via Telnet.
If a firmware is already running enter "boot loader" and reconnect via Telnet.

```
$ telnet 192.168.53.72
or
$ telnet <your BDI IP address>
```

Update the network parameters so it matches your needs:

```
LDR>network
   BDI MAC     : 00-0c-01-30-00-01
   BDI IP      : 192.168.53.72
   BDI Subnet  : 255.255.255.0
   BDI Gateway : 255.255.255.255
   Config IP   : 255.255.255.255
   Config File :

LDR>netip 151.120.25.102
LDR>nethost 151.120.25.112
LDR>netfile /bdi3000/mytarget.cfg


LDR>network
   BDI MAC     : 00-0c-01-30-00-01
   BDI IP      : 151.120.25.102
   BDI Subnet  : 255.255.255.0
   BDI Gateway : 255.255.255.255
   Config IP   : 151.120.25.112
   Config File : /bdi3000/mytarget.cfg

LDR>network save
saving network configuration ... passed
   BDI MAC     : 00-0c-01-30-00-01
   BDI IP      : 151.120.25.102
   BDI Subnet  : 255.255.255.0
   BDI Gateway : 255.255.255.255
   Config IP   : 151.120.25.112
   Config File : /bdi3000/mytarget.cfg
```

In case the subnet has changed, reboot before trying to load the firmware

```
LDR>boot loader
```

Connect again via Telnet and program the firmware into the BDI flash:

```
$ telnet 151.120.25.102

LDR>info
   BDI Firmware: not loaded
   BDI CPLD ID : 01285043
   BDI CPLD UES: ffffffff
   BDI MAC     : 00-0c-01-30-00-01
   BDI IP      : 151.120.25.102
   BDI Subnet  : 255.255.255.0
   BDI Gateway : 255.255.255.255
   Config IP   : 151.120.25.112
   Config File : /bdi3000/mytarget.cfg

LDR>fwload e:/temp/b30mcfgd.100
erasing firmware flash ... passed
programming firmware flash ... passed

LDR>info
   BDI Firmware: 26 / 1.00
   BDI CPLD ID : 01285043
   BDI CPLD UES: ffffffff
   BDI MAC     : 00-0c-01-30-00-01
   BDI IP      : 151.120.25.102
   BDI Subnet  : 255.255.255.0
   BDI Gateway : 255.255.255.255
   Config IP   : 151.120.25.112
   Config File : /bdi3000/mytarget.cfg
LDR>
```

To boot now into the firmware use:

```
LDR>boot
```

The Mode LED should go off, and you can try to connect to the BDI again via Telnet.

```
telnet 151.120.25.102
```

2.6 Testing the BDI3000 to host connection

After the initial setup is done, you can test the communication between the host and the BDI3000. There is no need for a target configuration file and no TFTP server is needed on the host.

- If not already done, connect the BDI3000 system to the network.
- Power-up the BDI3000.
- Start a Telnet client on the host and connect to the BDI3000 (the IP address you entered during initial configuration).
- If everything is okay, a sign on message like «BDI Debugger for Embedded PowerPC» and a list of the available commands should be displayed in the Telnet window.

2.7 TFTP server for Windows

The bdiGDB system uses TFTP to access the configuration file and to load the application program. Because there is no TFTP server bundled with Windows, Abatron provides a TFTP server application **tftpsrv.exe**. This WIN32 console application runs as normal user application (not as a system service).

Command line syntax: tftpsrv [p] [w] [dRootDirectory]

Without any parameter, the server starts in read-only mode. This means, only read access request from the client are granted. This is the normal working mode. The bdiGDB system needs only read access to the configuration and program files.

The parameter [p] enables protocol output to the console window. Try it.
The parameter [w] enables write accesses to the host file system.
The parameter [d] allows to define a root directory.

tftpsrv p	Starts the TFTP server and enables protocol output
tftpsrv p w	Starts the TFTP server, enables protocol output and write accesses are allowed.
tftpsrv dC:\tftp\	Starts the TFTP server and allows only access to files in C:\tftp and its subdirectories. As file name, use relative names. For example "bdi\mpc750.cfg" accesses "C:\tftp\bdi\mpc750.cfg"

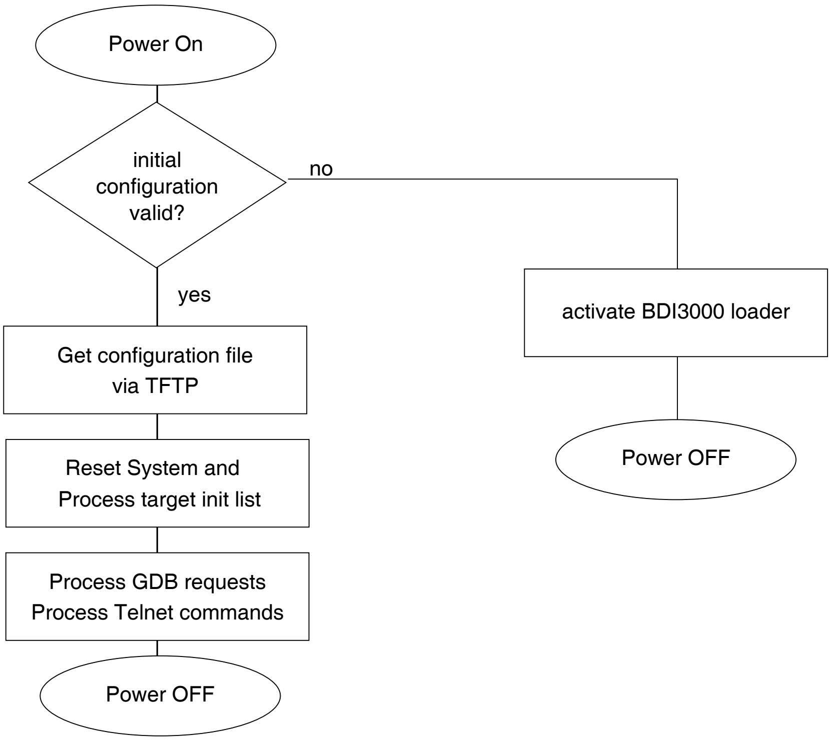
You may enter the TFTP server into the Startup group so the server is started every time you login.

3 Using bdiGDB

3.1 Principle of operation

The firmware within the BDI handles the GDB request and accesses the target memory or registers via the BDM interface. There is no need for any debug software on the target system. After loading the code via TFTP debugging can begin at the very first assembler statement.

Whenever the BDI system is powered-up the following sequence starts:


Power On
initial configuration valid?
no
yes
Get configuration file via TFTP
Reset System and Process target init list
Process GDB requests Process Telnet commands
Power OFF
activate BDI3000 loader
Power OFF

Breakpoints:
There are two breakpoint modes supported. One of them (SOFT) is implemented by replacing application code with a HALT instruction. The other (HARD) uses the built in breakpoint logic. If HARD is used, only up to 1 (4 for V4 cores) breakpoints can be active at the same time.
The following example selects SOFT as the breakpoint mode:

```
BREAKMODE   SOFT     ;<AGENT> SOFT or HARD, HARD uses hardware breakpoints
```

All the time the application is suspended (i.e. caused by a breakpoint) the target processor remains freezed.

Target Exceptions:
If enabled, the BDI will catch all unhandled exceptions. This is only possible if the vector table is writable. At vector 0 the BDI writes a HALT, RTE instruction sequence and lets all other vectors point to this short exception handler. The BDI reads back the VBR after processing the initilaisation list in order to get the base address of the vector table.

```
[INIT]
WCREG  0x801      0x00000000          ;set vector base

[TARGET]
VECTOR CATCH                          ;enable vector catching
```

3.2 Configuration File

The configuration file is automatically read by the BDI after every power on.
The syntax of this file is as follows:

```
; comment
[part name]
identifier parameter1 parameter2 ..... parameterN  ; comment
identifier parameter1 parameter2 ..... parameterN
.....
[part name]
identifier parameter1 parameter2 ..... parameterN
identifier parameter1 parameter2 ..... parameterN
.....
                              etc.
```

Numeric parameters can be entered as decimal (e.g. 700) or as hexadecimal (0x80000).

3.2.1 Part [INIT]

The part [INIT] defines a list of commands which should be executed every time the target comes out of reset. The commands are used to get the target ready for loading the program file. Commands in this section are processed in order from top to bottom.

WDREG register value   Write value to the selected data register.
    register   the register number 0 .. 7
    value   the value to write into the register
    Example: WDREG 0 5

WAREG register value   Write value to the selected address register.
    register   the register number 0 .. 7
    value   the value to write into the register
    Example: WAREG 0 5

WCREG register value   Write value to the selected control register.
    register   the register number(e.g. 0x801 for VBR)
    value   the value to write into the register
    Example: WCREG 0xC0F 0x10000001 ;MBAR

WM8 address value   Write a byte (8bit) to the selected memory place.
    address   the memory address
    value   the value to write to the target memory
    Example: WM8 0xFFFFFA21 0x04 ; SYPCR: watchdog disable ...

WM16 address value   Write a half word (16bit) to the selected memory place.
    address   the memory address
    value   the value to write to the target memory
    Example: WM16   0x10000100 0x8230   ;DCR

WM32 address value

Write a word (32bit) to the selected memory place.

address the memory address

value the value to write to the target memory

Example: WM32 0x1000010C 0x003C0001 ;DCMR0

MMAP start end

Because a memory access to an invalid memory space via BDM can lead to a deadlock, this entry can be used to define up to 32 valid memory ranges. If at least one memory range is defined, the BDI checks against this range(s) and avoids accessing of not mapped memory ranges.

start the start address of a valid memory range

end the end address of this memory range

Example: MMAP 0xFFE00000 0xFFFFFFFF ;Boot ROM

DELAY value

Delay for the selected time. A delay may be necessary to let the clock PLL lock again after a new clock rate is selected.

value the delay time in milliseconds (1...30000)

Example: DELAY 500 ; delay for 0.5 seconds

WTLB tag data

Only V4e cores: Adds an entry to the TLB array(s). For a detailed description of the tag/data value look at the V4e MMU description. The first WTLB entry in the init list also clears the hole TLB array.

tag virtual page number, ASID, shared and valid bit

data real page number, size, cache mode and SRWXL bits

Example: WTLB 0x00000001 0x1001025C ;SRAM 8k CB RWX

MMU setup example:

```
NOP                    ;Set Memory Map
WCREG   0x0C0F     0x10000001 ;MBAR   : map internal REGS to 0x10000000
WCREG   0x0008     0x11000001 ;MMUBAR : map MMU registers to 0x11000000
WCREG   0x0C04     0x20000035 ;RAMBAR0: map internal SRAM to 0x20000000
WCREG   0x0C05     0x20001035 ;RAMBAR1: map internal SRAM to 0x20001000
NOP                    ;MMU : Map internal registers
WTLB    0x10000001 0x10000298 ;0x10000000 -> 0x10000000, 8k, NP, RW-
WTLB    0x10002001 0x10020298 ;0x10002000 -> 0x10002000, 8k, NP, RW-
WTLB    0x10004001 0x10040298 ;0x10004000 -> 0x10004000, 8k, NP, RW-
WTLB    0x10006001 0x10060298 ;0x10006000 -> 0x10006000, 8k, NP, RW-
WTLB    0x10008001 0x10080298 ;0x10008000 -> 0x10008000, 8k, NP, RW-
WTLB    0x1000A001 0x100A0298 ;0x1000A000 -> 0x1000A000, 8k, NP, RW-
WTLB    0x1000C001 0x100C0298 ;0x1000C000 -> 0x1000C000, 8k, NP, RW-
WTLB    0x1000E001 0x100E0298 ;0x1000E000 -> 0x1000E000, 8k, NP, RW-
NOP                    ;MMU : Map 32k System RAM to 0x00000000
WTLB    0x00000001 0x1001025C ;0x00000000 -> 0x10010000, 8k, CB, RWX
WTLB    0x00002001 0x1001225C ;0x00002000 -> 0x10012000, 8k, CB, RWX
WTLB    0x00004001 0x1001425C ;0x00004000 -> 0x10014000, 8k, CB, RWX
WTLB    0x00006001 0x1001625C ;0x00008000 -> 0x10016000, 8k, CB, RWX
WM32    0x11000000 0x00000001 ;MMUCR: enable MMU
```

3.2.2 Part [TARGET]

The part [TARGET] defines some target specific values.

CPUTYPE type

This value gives the BDI information about the connected CPU.

type
MCF5202, MCF5203
MCF5207, MCF5208, MCF5214, MCF5216,
MCF5249, SCF5250, MCF5251, MCF5253
MCF5230, MCF5232, MCF5233, MCF5234, MCF5235
MCF5270, MCF5271, MCF5274, MCF5275
MCF5280, MCF5281, MCF5282
MCF5210, MCF5211, MCF5212, MCF5213,
MCF5221, MCF5222, MCF5223, MCF5225, MCF5227
MCF5307, MCF5301
MCF5327, MCF5328, MCF5329, MCF5372, MCF5373
MCF5407, MCF5470, MCF5480, MCF5441, MCF5445

Example: CPUTYPE MCF5282

BDIMODE mode param

This parameter selects the BDI debugging mode. The following modes are supported:

LOADONLY Loads and starts the application core. No debugging via BDM.

AGENT The debug agent runs within the BDI. There is no need for any debug software on the target. This mode accepts a second parameter. If RUN is entered as a second parameter, the loaded application will be started immediately, otherwise only the PC is set and BDI waits for GDB requests.

Example: BDIMODE AGENT RUN

CPUCLOCK value

The BDI needs to know how fast the target CPU runs after processing the init list. The BDM communication speed is selected based on this value. If this value defines a clock rate that is higher than the real clock, BDM communication may fail. When defining a clock rate slower than possible, BDM communication still works but not as fast as possible.
For V3/V4 cores, enter the PSTCLK value.

value the CPU (PSTCLK) clock in hertz

Example: CPUCLOCK 25000000 ; CPU clock is 25.0MHz

STARTUP mode [runtime]

This parameter selects the target startup mode. The following modes are supported:

RESET This default mode forces the target to debug mode immediately out of reset. No code is executed after reset.

STOP In this mode, the BDI lets the target execute code for "runtime" milliseconds after reset. This mode is useful when monitor code should initialize the target system.

RUN After reset, the target executes code until stopped by the Telnet "halt" command.

Example: STARTUP STOP 3000 ; let the CPU run for 3 seconds

BREAKMODE mode [NOUHE] This parameter defines how breakpoints are implemented. The current mode can also be changed via the Telnet interface. By default the BDI sets the CSR[UHE] bit so a halt instruction in user-mode will be handled by the BDI. If the option NOUHE is present, the BDI will not set this bit and a halt in user mode will cause an invalid instruction exception that can be handled by an application debugger resident in the target system.

SOFT This is the normal mode. Breakpoints are implemented by replacing code with a TRAP instruction.

HARD In this mode, the breakpoint hardware is used. Only 1 (4) breakpoints at a time are supported.

Example: BREAKMODE HARD ; enable use of break hardware

VECTOR CATCH When this line is present, the BDI catches all unhandled exceptions. Catching exceptions is only possible if the vector table is writable.

Example: VECTOR CATCH ; catch unhandled exception

SIO port [baudrate] When this line is present, a TCP/IP channel is routed to the BDI's RS232 connector. The port parameter defines the TCP port used for this BDI to host communication. You may choose any port except 0 and the default Telnet port (23). On the host, open a Telnet session using this port. Now you should see the UART output in this Telnet session. You can use the normal Telnet connection to the BDI in parallel, they work completely independent. Also input to the UART is implemented.

port	The TCP/IP port used for the host communication.
baudrate	The BDI supports 2400 ... 115200 baud
Example:	SIO 7 9600 ;TCP port for virtual IO

WAKEUP time This entry in the init list allows to define a delay time (in ms) the BDI inserts between releasing the RESET line and starting communicating with the target. This init list entry may be necessary if RESET is delayed on its way to the processors reset pin. If not defined a delay of 1 ms is used.

time	the delay time in milliseconds (10 ... 60'000)
Example:	WAKEUP 3000 ; insert 3sec wake-up time

RESET time This entry in the init list allows to define the time (in ms) the BDI asserts the RESET signal. If not defined, reset is asserted for 1 ms.

time	the reset time in milliseconds (10 ... 60'000)
Example:	RESET 500 ; assert RESET for 500 ms

3.2.3 Part [HOST]

The part [HOST] defines some host specific values.

IP ipaddress
The IP address of the host.
ipaddress the IP address in the form xxx.xxx.xxx.xxx
Example: IP 151.120.25.100

FILE filename
The default name of the file that is loaded into RAM using the Telnet 'load' command. This name is used to access the file via TFTP. If the filename starts with a $, this $ is replace with the path of the configuration file name.
filename the filename including the full path or $ for relative path.
Example: FILE F:\gnu\demo\mcf\test.elf
FILE $test.elf

FORMAT format [offset]
The format of the program file and an optional load address offset. Currently binary, S-record, a.out, ELF and COFF formats are supported. If the code is already stored in ROM on the target, select ROM as the format. The optional parameter "offset" is added to any load address read from the image file.
format BIN, SREC, AOUT, ELF, COFF or ROM
Example: FORMAT COFF
FORMAT COFF 0x10000

LOAD mode
In Agent mode, this parameters defines if the code is loaded automatically after every reset.
mode AUTO, MANUAL
Example: LOAD MANUAL

START address
The address where to start the program file. If this value is not defined and the core is not in ROM, the address is taken from the code file. If this value is not defined and the core is already in ROM, the PC will not be set before starting the program file. This means, the program starts at the normal reset address (0x0100).
address the address where to start the program file
Example: START 0x1000

DEBUGPORT port [RECONNECT]
The TCP port GDB uses to access the target. If the RECONNECT parameter is present, an open TCP/IP connection (Telnet/GDB) will be closed if there is a connect request from the same host (same IP address).
port the TCP port number (default = 2001)
Example: DEBUGPORT 2001

PROMPT string
This entry defines a new Telnet prompt. The current prompt can also be changed via the Telnet interface.
Example: PROMPT 5307>

DUMP filename
The default file name used for the Telnet DUMP command.
filename the filename including the full path
Example: DUMP dump.bin

3.2.4 Part [FLASH]

The Telnet interface supports programming and erasing of flash memories. The bdiGDB system has to know which type of flash is used, how the chip(s) are connected to the CPU and which sectors to erase in case the ERASE command is entered without any parameter

.

CHIPTYPE type

This parameter defines the type of flash used. It is used to select the correct programming algorithm.

format AM29F, AM29BX8, AM29BX16, I28BX8, I28BX16,
AT49, AT49X8, AT49X16, STRATAX8, STRATAX16,
MIRROR, MIRRORX8, MIRRORX16,
S29M64X8, S29M32X16,
AM29DX16, AM29DX32

Example: CHIPTYPE AM29F

CHIPSIZE size

The size of **one** flash chip in bytes (e.g. AM29F010 = 0x20000). This value is used to calculate the starting address of the current flash memory bank.

size the size of one flash chip in bytes

Example: CHIPSIZE 0x80000

BUSWIDTH width

Enter the width of the memory bus that leads to the flash chips. Do not enter the width of the flash chip itself. The parameter CHIPTYPE carries the information about the number of data lines connected to one flash chip. For example, enter 16 if you are using two AM29F010 to build a 16bit flash memory bank.

with the width of the flash memory bus in bits (8 | 16 | 32)

Example: BUSWIDTH 16

FILE filename

The default name of the file that is programmed into flash using the Telnet 'prog' command. This name is used to access the file via TFTP. If the filename starts with a $, this $ is replace with the path of the configuration file name. This name may be overridden interactively at the Telnet interface.

filename the filename including the full path or $ for relative path.

Example: FILE F:\gnu\mcf\bootrom.hex
FILE $bootrom.hex

FORMAT format [offset]

The format of the file and an optional address offset. The optional parameter "offset" is added to any load address read from the program file.

format SREC, BIN, AOUT, ELF or COFF

Example: FORMAT SREC
FORMAT ELF 0x10000

WORKSPACE address

If a workspace is defined, the BDI uses a faster programming algorithm that runs out of RAM on the target system. Otherwise, the algorithm is processed within the BDI. The workspace is used for a 1kByte data buffer and to store the algorithm code. There must be at least 2kBytes of RAM available for this purpose.

address the address of the RAM area

Example: WORKSPACE 0x00000000

ERASE addr [increment count] [mode [wait]]

The flash memory may be individually erased or unlocked via the Telnet interface. In order to make erasing of multiple flash sectors easier, you can enter an erase list. All entries in the erase list will be processed if you enter ERASE at the Telnet prompt without any parameter. This list is also used if you enter UNLOCK at the Telnet without any parameters. With the "increment" and "count" option you can erase multiple equal sized sectors with one entry in the erase list.

address Address of the flash sector, block or chip to erase

increment If present, the address offset to the next flash sector

count If present, the number of equal sized sectors to erase

mode BLOCK, CHIP, UNLOCK
Without this optional parameter, the BDI executes a sector erase. If supported by the chip, you can also specify a block or chip erase. If UNLOCK is defined, this entry is also part of the unlock list. This unlock list is processed if the Telnet UNLOCK command is entered without any parameters.
Note: Chip erase does not work for large chips because the BDI time-outs after 3 minutes. Use block erase.

wait The wait time in ms is only used for the unlock mode. After starting the flash unlock, the BDI waits until it processes the next entry.

Example:
```
ERASE 0xff040000 ;erase sector 4 of flash
ERASE 0xff060000  ;erase sector 6 of flash
ERASE 0xff000000 CHIP ;erase whole chip(s)
ERASE  0xff010000 UNLOCK 100 ;unlock, wait 100ms
ERASE 0xff000000 0x10000 7 ; erase 7 sectors
```

Example for the MCF5307 evaluation board flash memory:

```
[FLASH]
WORKSPACE   0x00800000  ;workspace in target RAM for fast programming algorithm
CHIPTYPE    AM29F       ;Flash type (AM29F | AM29BX8 | AM29BX16 | I28BX8 | I28BX16)
CHIPSIZE    0x80000     ;The size of one flash chip in bytes (e.g. AM29F010 = 0x20000)
BUSWIDTH    16          ;The width of the flash memory bus in bits (8 | 16 | 32)
FILE        D:\abatron\bdi360\ColdFire\pro\sbc5307.sss
ERASE       0xFFE00000  ;erase sector  0 of flash
ERASE       0xFFE20000  ;erase sector  1 of flash
ERASE       0xFFE40000  ;erase sector  1 of flash
ERASE       0xFFE60000  ;erase sector  1 of flash
```

the above erase list maybe replaces with:

```
ERASE               0xFFE00000 0x20000 4 ;erase 4 sectors
```

Supported Flash Memories:
There are currently 3 standard flash algorithm supported. The AMD, Intel and Atmel AT49 algorithm. Almost all currently available flash memories can be programmed with one of this algorithm. The flash type selects the appropriate algorithm and gives additional information about the used flash.

For 8bit only flash:	AM29F (MIRROR), I28BX8, AT49
For 8/16 bit flash in 8bit mode:	AM29BX8 (MIRRORX8), I28BX8 (STRATAX8), AT49X8
For 8/16 bit flash in 16bit mode:	AM29BX16 (MIRRORX16), I28BX16 (STRATAX16), AT49X16
For 16bit only flash:	AM29BX16, I28BX16, AT49X16
For 16/32 bit flash in 16bit mode:	AM29DX16
For 16/32 bit flash in 32bit mode:	AM29DX32

The AMD and AT49 algorithm are almost the same. The only difference is, that the AT49 algorithm does not check for the AMD status bit 5 (Exceeded Timing Limits).
Only the AMD and AT49 algorithm support chip erase. Block erase is only supported with the AT49 algorithm. If the algorithm does not support the selected mode, sector erase is performed. If the chip does not support the selected mode, erasing will fail. The erase command sequence is different only in the 6th write cycle. Depending on the selected mode, the following data is written in this cycle (see also flash data sheets): 0x10 for chip erase, 0x30 for sector erase, 0x50 for block erase.
To speed up programming of Intel Strata Flash and AMD MirrorBit Flash, an additional algorithm is implemented that makes use of the write buffer. This algorithm needs a workspace, otherwise the standard Intel/AMD algorithm is used.

The following table shows some examples:

Flash	x 8	x 16	x 32	Chipsize
Am29F010	AM29F	-	-	0x020000
Am29F800B	AM29BX8	AM29BX16	-	0x100000
Am29DL323C	AM29BX8	AM29BX16	-	0x400000
Am29PDL128G	-	AM29DX16	AM29DX32	0x01000000
Intel 28F032B3	I28BX8	-	-	0x400000
Intel 28F640J3A	STRATAX8	STRATAX16	-	0x800000
Intel 28F320C3	-	I28BX16	-	0x400000
AT49BV040	AT49	-	-	0x080000
AT49BV1614	AT49X8	AT49X16	-	0x200000
M58BW016BT	-	-	M58X32	0x200000
SST39VF160	-	AT49X16	-	0x200000
Am29LV320M	MIRRORX8	MIRRORX16	-	0x400000

Note:
Some Intel flash chips (e.g. 28F800C3, 28F160C3, 28F320C3) power-up with all blocks in locked state. In order to erase/program those flash chips, use the init list to unlock the appropriate blocks:

```
WM16    0xFFF00000      0x0060          unlock block 0
WM16    0xFFF00000      0x00D0
WM16    0xFFF10000      0x0060          unlock block 1
WM16    0xFFF10000      0x00D0
        ....
WM16    0xFFF00000      0xFFFF          select read mode
```

or use the Telnet "unlock" command:

```
UNLOCK [<addr> [<delay>]]
```

addr — This is the address of the sector (block) to unlock

delay — A delay time in milliseconds the BDI waits after sending the unlock command to the flash. For example, clearing all lock-bits of an Intel J3 Strata flash takes up to 0.7 seconds.

If "unlock" is used without any parameter, all sectors in the erase list with the UNLOCK option are processed.

To clear all lock-bits of an Intel J3 Strata flash use for example:

```
BDI> unlock 0xFF000000 1000
```

To erase or unlock multiple, continuous flash sectors (blocks) of the same size, the following Telnet commands can be used:

```
ERASE  <addr> <step> <count>
UNLOCK <addr> <step> <count>
```

addr — This is the address of the first sector to erase or unlock.

step — This value is added to the last used address in order to get to the next sector. In other words, this is the size of one sector in bytes.

count — The number of sectors to erase or unlock.

The following example unlocks all 256 sectors of an Intel Strata flash (28F256K3) that is mapped to 0x00000000. In case there are two flash chips to get a 32bit system, double the "step" parameter.

```
BDI> unlock 0x00000000 0x20000 256
```

MCF52xxx internal flash (CFM):

To erase and program the ColdFire Flash Module (CFM) you have to access it via the backdoor addresses (IPSBAR + 0x04000000). This backdoor address has to be used for erase and program commands. Following an example how to setup for CFM programming when IPSBAR is at the default address off 0x40000000.

```
[FLASH]
WORKSPACE   0x20000000  ;workspace in target SRAM for fast programming algorithm
CHIPTYPE    CFM         ;MCF52xxx internal flash
BUSWIDTH    32          ;The width of the flash memory bus in bits (8 | 16 | 32)
FILE        E:\cygwin\home\bdidemo\coldfire\evb5282_cmf.bin
FORMAT      BIN 0x44000000
ERASE       0x44000000 MASS
ERASE       0x44040000 MASS
```

Before you can erase/program the CFM, the CFM Clock Divider needs to be setup via an init list entry. Check the MCF52xxx user’s manual about how to setup the CFMCLKD.

```
WM8  0x401D0002   0x54  ;CFMCLKD : Flash clock divider for 64MHz
```

3.2.5 Part [REGS]

In order to make it easier to access target registers via the Telnet interface, the BDI can read in a register definition file. In this file, the user defines a name for the register and how the BDI should access it (e.g. as memory mapped, memory mapped with offset, ...). The name of the register definition file and information for different registers type has to be defined in the configuration file.
The register name, type, address/offset/number and size are defined in a separate register definition file. This way, you can create one register definition file for the MCF5307 that can be used for all possible positions of the internal memory map. You only have to change one entry in the configuration file.

An entry in the register definition file has the following syntax:

```
name      type      addr      size
```

name — The name of the register (max. 12 characters)

type — The register type

DREG	Data register
AREG	Address register
CREG	Control register
MM	Absolute direct memory mapped register
DMM1...DMM4	Relative direct memory mapped register
IMM1...IMM4	Indirect memory mapped register
CMM1...CMM4	Control register based memory mapped register

addr — The address, offset or number of the register

size — The size (8, 16, 32) of the register

The following entries are supported in the [REGS] part of the configuration file:

FILE filename — The name of the register definition file. This name is used to access the file via TFTP. The file is loaded once during BDI startup.

filename	the filename including the full path
Example:	FILE C:\bdi\regs\mcf5485.def

DMMn base — This defines the base address of direct memory mapped registers. This base address is added to the individual offset of the register.

base	the base address
Example:	DMM1 0x01000

IMMn addr data — This defines the addresses of the memory mapped address and data registers of indirect memory mapped registers. The address of a IMMn register is first written to "addr" and then the register value is access using "data" as address.

addr	the address of the Address register
data	the address of the Data register
Example:	DMM1 0x02200000

CMMn addr mask
This defines the control register that holds the base address of control register based memory mapped registers.The base address is added to the individual offset of the register.

addr — the address of the Control register

mask — the mask applied to the control register value before it is used as base address.

Example: CMM2 0x008 0xFFFF0000 ; MMUBAR

Note:
The following register names are already predefined:
d0 .. d7, a0 .. a7, fp, sp, vbr, sr, pc, cacr, acr0, acr1, rambar, rombar, mbar

Example for a register definition (MCF5485):

Entry in the configuration file:

```
[REGS]
CMM1    0xC0F    0xfffc0000          ; MBAR
CMM2    0x008    0xffff0000          ; MMUBAR
FILE    $reg5485.def
```

The register definition file:

```
;name            type     addr            size
;-------------------------------------------
;
; Additional Control Register
;
cacr             CREG     0x002           32
asid             CREG     0x003           32
acr0             CREG     0x004           32
.....
;
; CMM2 must point to MMUBAR
;
mmucr            CMM2     0x000           32
mmuor            CMM2     0x004           32
.....
;
; CMM1 must point to MBAR
;
;    System Integration Unit (SIU)
sdramds1         CMM1     0x004           32
sbcr             CMM1     0x010           32
cs0cfg01         CMM1     0x020           32

.....
```

Now the defined registers can be accessed by name via the Telnet interface:

```
BDI> rd mmucr
BDI> rm csar0 0xFFE0
```

3.3 Debugging with GDB

Because the target agent runs within BDI, no debug support has to be linked to your application. There is also no need for any BDI specific changes in the application sources. Your application must be fully linked because no dynamic loading is supported.

3.3.1 Target setup

Target initialization may be done at two places. First with the BDI configuration file, second within the application. The setup in the configuration file must at least enable access to the target memory where the application will be loaded. Disable the watchdog and setting the CPU clock rate should also be done with the BDI configuration file. Application specific initializations like setting the timer rate are best located in the application startup sequence.

3.3.2 Connecting to the target

As soon as the target comes out of reset, BDI initializes it and loads your application code. If RUN is selected, the application is immediately started, otherwise only the target PC is set. BDI now waits for GDB request from the debugger running on the host.

After starting the debugger, it must be connected to the remote target. This can be done with the following command at the GDB prompt:

```
(gdb)target remote bdi3000:2001
```

bdi3000	This stands for an IP address. The HOST file must have an appropriate entry. You may also use an IP address in the form xxx.xxx.xxx.xxx
2001	This is the TCP port used to communicate with the BDI

If not already suspended, this stops the execution of application code and the target CPU changes to background debug mode.

Remember, every time the application is suspended, the target CPU is freezed. During this time no hardware interrupts will be processed.

Note: For convenience, the GDB detach command triggers a target reset sequence in the BDI.

```
(gdb)...
(gdb)detach
... Wait until BDI has resetet the target and reloaded the image
(gdb)target remote bdi3000:2001
```

3.3.3 Breakpoint Handling

GDB versions before V5.0:
GDB inserts breakpoints by replacing code via simple memory read / write commands. There is no command like "Set Breakpoint" defined in the GDB remote protocol. When breakpoint mode HARD is selected, the BDI checks the memory write commands for such hidden "Set Breakpoint" actions. If such a write is detected, the write is not performed and the BDI sets an appropriate hardware breakpoint. The BDI assumes that this is a "Set Breakpoint" action when memory write length is 2 bytes and the pattern to write is a trap instruction (0x4E4?).

GDB version V5.x:
GDB version 5.x uses the Z-packet to set breakpoints (watchpoints). For software breakpoints, the BDI replaces code with a HALT instruction. When breakpoint mode HARD is selected, the BDI sets an appropriate hardware breakpoint.

User controlled hardware breakpoints:
The ColdFire has a special watchpoint / breakpoint hardware integrated. Normally the BDI controls this hardware in response to Telnet commands (BI, BDx) or when breakpoint mode HARD is selected. Via the Telnet commands BI and BDx, you cannot access all the features of the breakpoint hardware. Therefore the BDI assumes that the user will control / setup this breakpoint hardware as soon as TDR is written to with a value that is not zero. This way the debugger or the user via Telnet has full access to all features of this watchpoint / breakpoint hardware. Clearing TDR gives control back to the BDI.

3.3.4 GDB monitor command

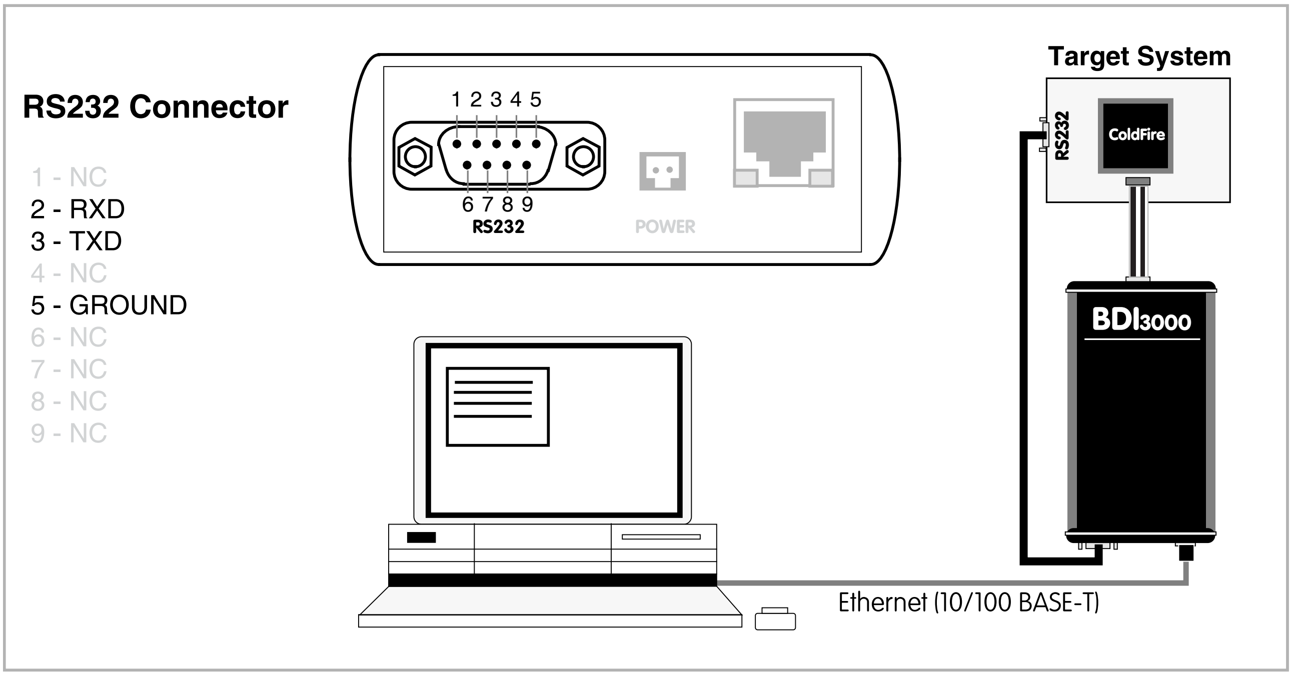
The BDI supports the GDB V5.x "monitor" command. Telnet commands are executed and the Telnet output is returned to GDB.

```
(gdb) target remote bdi3000:2001
Remote debugging using bdi3000:2001
0x10b2 in start ()
(gdb) mon break
Breakpoint mode is SOFT
(gdb) mon break hard

(gdb) mon break
Breakpoint mode is HARD
(gdb)
```

3.3.5 Target serial I/O via BDI

A RS232 port of the target can be connected to the RS232 port of the BDI3000. This way it is possible to access the target’s serial I/O via a TCP/IP channel. For example, you can connect a Telnet session to the appropriate BDI3000 port. Connecting GDB to a GDB server (stub) running on the target should also be possible.



The configuration parameter "SIO" is used to enable this serial I/O routing.
The used framing parameters are 8 data, 1 stop and not parity.

```
[TARGET]
....
SIO     7       9600            ;Enable SIO via TCP port 7 at 9600 baud
```

Warning!!!
Once SIO is enabled, connecting with the setup tool to update the firmware will fail. In this case either disable SIO first or disconnect the BDI from the LAN while updating the firmware.

3.4 Telnet Interface

A Telnet server is integrated within the BDI. The Telnet channel is used by the BDI to output error messages and other information. Also some basic debug commands can be executed.

Telnet Debug features:

- Display and modify memory locations
- Display and modify general and special purpose registers
- Single step a code sequence
- Set hardware breakpoints (for code and data accesses)
- Load a code file from any host
- Start / Stop program execution
- Programming and Erasing Flash memory

During debugging with GDB, the Telnet is mainly used to reboot the target (generate a hardware reset and reload the application code). It may be also useful during the first installation of the bdiGDB system or in case of special debug needs (e.g. setting breakpoints on variable access).

Multiple commands separated by a semicolon can be entered on one line.

Following a list of the available Telnet commands:

```
"MD    [<address>] [<count>]  display target memory as word (32bit)",
"MDH   [<address>] [<count>]  display target memory as half word (16bit)",
"MDB   [<address>] [<count>]  display target memory as byte (8bit)",
"DUMP  <addr> <size> [<file>] dump target memory to a file",
"MM    <addr> <value> [<cnt>] modify word(s) (32bit) in target memory",
"MMH   <addr> <value> [<cnt>] modify half word(s) (16bit) in target memory",
"MMB   <addr> <value> [<cnt>] modify byte(s) (8bit) in target memory",
"MT    <addr> <count>         memory test",
"MC    [<address>] [<count>]  calculates a checksum over a memory range",
"MV                           verifies the last calculated checksum",
"RD    [<name>]               display CPU or user defined register",
"RDFP                         display floating point registers",
"RDUMP [<file>]               dump all user defined register to a file",
"RM    <name> <value>         modify CPU or user defined register",
"TLB   <from> [<to>]          display TLB entry (only V4e cores)",
"WTLB  <idx> <epn> <rpn>      write TLB entry (only V4e cores)",
"RESET                        reset the target system",
"BREAK [SOFT | HARD]          display or set current breakpoint mode",
"GO    [<pc>]                 set PC and start target system",
"TI    [<pc>]                 single step an instruction",
"HALT                         force target to enter debug mode",
"BI  <addr>                   set instruction hardware breakpoint",
"CI  [<id>]                   clear instruction hardware breakpoint(s)",
"BD  [R|W] <addr>             set data watchpoint (32bit access)",
"BDH [R|W] <addr>             set data watchpoint (16bit access)",
"BDB [R|W] <addr>             set data watchpoint ( 8bit access)",
"CD [<id>]                    clear data breakpoint(s)",
"INFO                         display information about the current state",
"LOAD   [<offset>] [<file> [<format>]] load program file to target memory",
"VERIFY [<offset>] [<file> [<format>]] verify a program file to target memory",
"PROG   [<offset>] [<file> [<format>]] program flash memory",
"                             <format> : SREC or BIN or AOUT or ELF",
"ERASE  [<address> [<mode>]]  erase a flash memory sector, chip or block",
"                <mode>  : CHIP, BLOCK or SECTOR (default is sector)",
"ERASE  <addr> <step> <count> erase multiple flash sectors",
"UNLOCK [<addr> [<delay>]]    unlock a flash sector",
"UNLOCK <addr> <step> <count> unlock multiple flash sectors",
"DELAY  <ms>                  delay for a number of milliseconds",
"HOST   <ip>                  change IP address of program file host",
"PROMPT <string>              defines a new prompt string",
"CONFIG                       display or update BDI configuration",
"CONFIG <file> [<hostIP> [<bdiIP> [<gateway> [<mask>]]]]",
"HELP                         display command list",
"BOOT  [loader]               reboot the BDI and reload the configuration",
"QUIT                         terminate the Telnet session"
```

Note:
The Telnet command RESET does only reset the target system. The configuration file is not loaded again. If the configuration file has changed, use the Telnet command BOOT to reload it.

Note:
The DUMP command uses TFTP to write a binary image to a host file. Writing via TFTP on a Linux/Unix system is only possible if the file already exists and has public write access. Use "man tftpd" to get more information about the TFTP server on your host.

4 Specifications

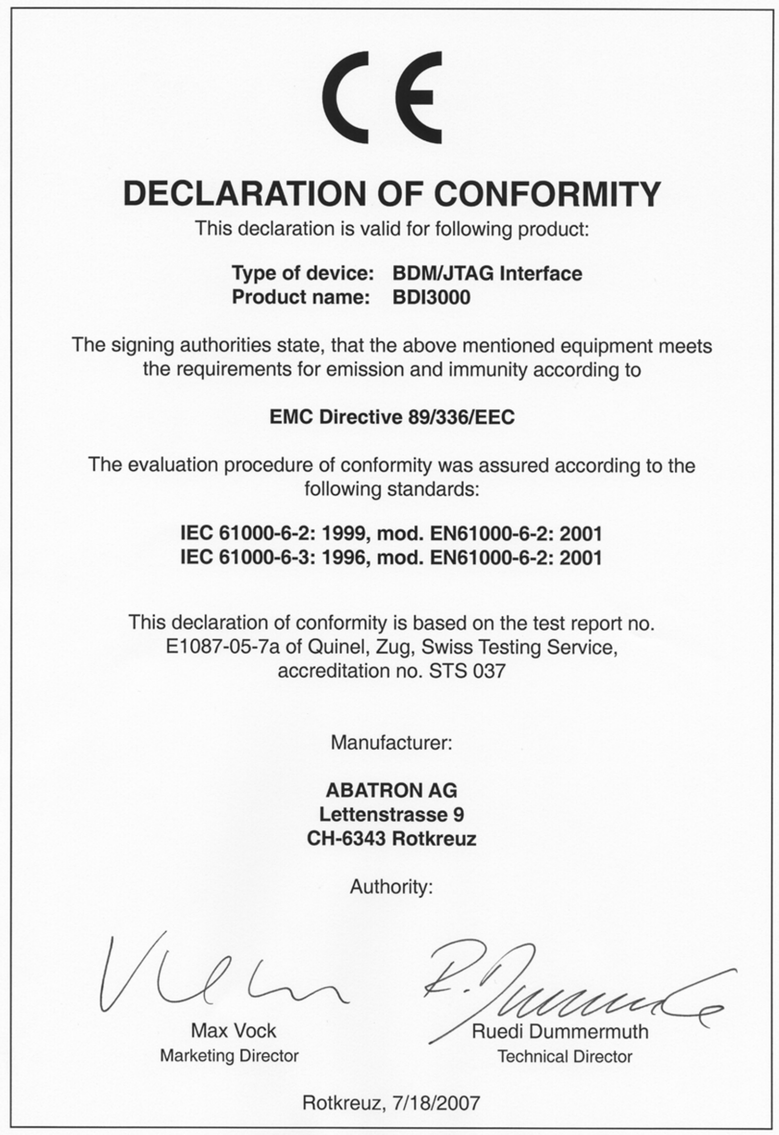
Operating Voltage Limiting	5 VDC ± 0.25 V
Power Supply Current	typ. 500 mA max. 1000 mA
RS232 Interface: Baud Rates	9’600,19’200, 38’400, 57’600,115’200
Data Bits	8
Parity Bits	none
Stop Bits	1
Network Interface	10/100 BASE-T
BDM/JTAG clock	up to 32 MHz
Supported target voltage	1.2 – 5.0 V
Operating Temperature	+ 5 °C ... +60 °C
Storage Temperature	-20 °C ... +65 °C
Relative Humidity (noncondensing)	<90 %rF
Size	160 x 85 x 35 mm
Weight (without cables)	280 g
Host Cable length (RS232)	2.5 m
Electromagnetic Compatibility	CE compliant
Restriction of Hazardous Substances	RoHS 2002/95/EC compliant

Specifications subject to change without notice

5 Environmental notice

Disposal of the equipment must be carried out at a designated disposal site.

6 Declaration of Conformity (CE)



CE

DECLARATION OF CONFORMITY

This declaration is valid for following product:

Type of device: **BDM/JTAG Interface**
Product name: **BDI3000**

The signing authorities state, that the above mentioned equipment meets the requirements for emission and immunity according to

EMC Directive 89/336/EEC

The evaluation procedure of conformity was assured according to the following standards:

IEC 61000-6-2: 1999, mod. EN61000-6-2: 2001
IEC 61000-6-3: 1996, mod. EN61000-6-2: 2001

This declaration of conformity is based on the test report no. E1087-05-7a of Quinel, Zug, Swiss Testing Service, accreditation no. STS 037

Manufacturer:

ABATRON AG
Lettenstrasse 9
CH-6343 Rotkreuz

Authority:

Max Vock
Marketing Director

Ruedi Dummermuth
Technical Director

Rotkreuz, 7/18/2007

7 Abatron Warranty and Support Terms

7.1 Hardware

ABATRON Switzerland warrants that the Hardware shall be free from defects in material and workmanship for a period of 3 years following the date of purchase when used under normal conditions. Failure in handling which leads to defects or any self-made repair attempts are not covered under this warranty. In the event of notification within the warranty period of defects in material or workmanship, ABATRON will repair or replace the defective hardware. The customer must contact the distributor or Abatron for a RMA number prior to returning.

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Appendices

A Troubleshooting

Problem
The firmware can not be loaded.

Possible reasons

- The BDI is not correctly connected with the Host (see chapter 2).
- A wrong communication port is selected (Com 1...Com 4).
- The BDI is not powered up

Problem
No working with the target system (loading firmware is okay).

Possible reasons

- Wrong pin assignment (BDM/JTAG connector) of the target system (see chapter 2).
- Target system initialization is not correctly –> enter an appropriate target initialization list.
- An incorrect IP address was entered (BDI3000 configuration)
- BDM/JTAG signals from the target system are not correctly (short-circuit, break, ...).
- The target system is damaged.

Problem
Network processes do not function (loading the firmware was successful)

Possible reasons

- The BDI3000 is not connected or not correctly connected to the network (LAN cable or media converter)
- An incorrect IP address was entered (BDI3000 configuration)

B Maintenance

The BDI needs no special maintenance. Clean the housing with a mild detergent only. Solvents such as gasoline may damage it.

C Trademarks

All trademarks are property of their respective holders.