Getting Started with Evaluation Board EVB001

The GreenArrays EVB001 Evaluation Board is a versatile and powerful application development platform for the GA144-1.20 chips. As such it has many configuration options. The current Printed Circuit Board (PCB) revision shown on the silkscreen is 0.1.1, and it is currently shipped with a starter eForth that may be booted from flash and with configuration settings as shown herein.

Please familiarize yourself with this information before connecting anything to your new board. It will walk you through initial connection, check-out and use of the board.

In addition, please download and read the other relevant documentation such as the Programmers' Reference for the F18 computers (DB001), the G144A12 Chip Data Book (DB002), the Evaluation Board Data Book (DB003), and the Programmers' References for arrayForth™, eForth, polyFORTH®, and other software as appropriate. The current editions of all GreenArrays documents, including this one, may be found on our website at http://www.greenarraychips.com . It is always advisable to ensure that you are using the latest documents before starting work.

Your satisfaction is very important to us! Please contact Hotline@greenarraychips.com if you have questions or need help with using your board.

Contents

1. Initial Check-Out

This section outlines procedures for inspecting a board and verifying its configuration and function. These procedures are very similar to those we follow in the factory before shipping boards to you.

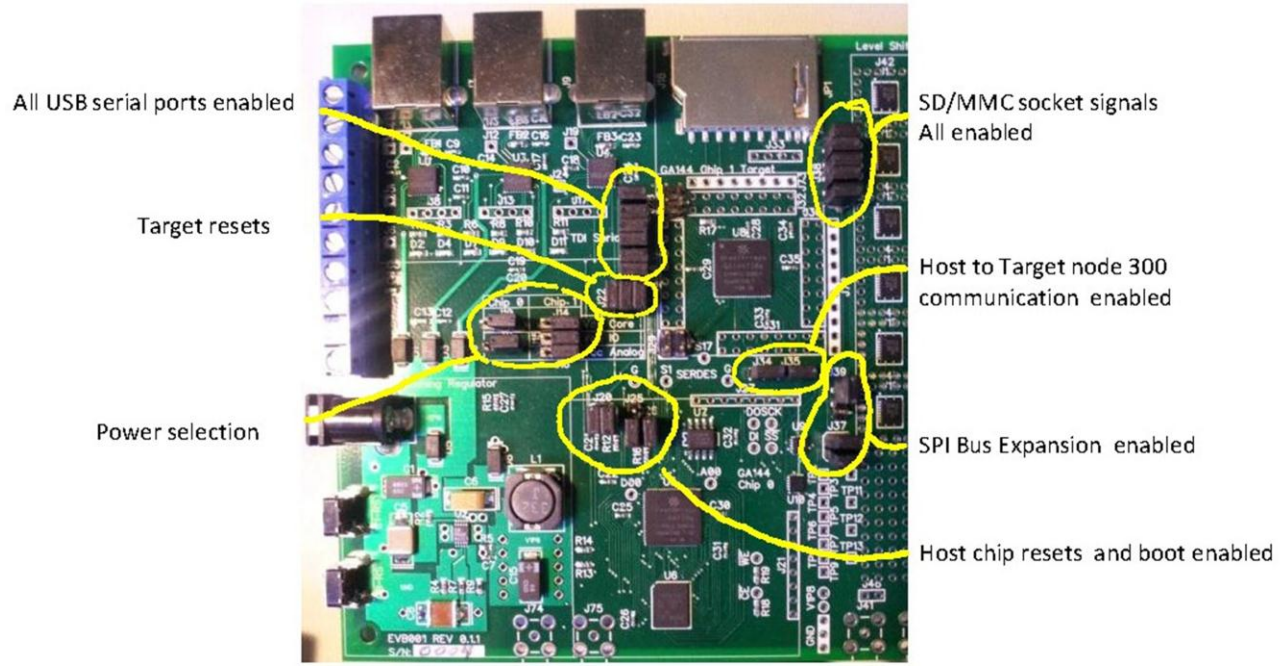
1.1 Recommended Working Area

Since the purpose of this board is to provide you with direct access to the very sensitive pins of your chips, you should set up a working area to protect the chips against Electrostatic Discharge (ESD) from your body. We recommend, as a basic precaution, that you use an anti-static mat connected to a single-point earth ground in common with any other equipment in use, and that you wear a wrist strap, as shown in the adjacent photo, while handling or probing the board. It is always a good idea to avoid wearing clothing that tends to accumulate static charges, and to touch the mat or a grounded part of the board when approaching the work area and before touching other parts of the board. *Note that the metal shield of the SD card slot is a good ground for this purpose; the shields of the USB connectors are not grounded in rev 0.1.1.*

If you have any questions about correct procedures, please check our website or contact the hotline for more information

1.2 Factory Default Jumper Settings

Begin by setting all jumpers to the default settings as we shipped the board to you. Please refer to this illustration and to the detailed information that follows:



1.2.1 Table of Jumpers

Host and Target Power Select

J10

1	External Host Pwr
2	V_{DD}C to Host
3	

J11

1	External Host Pwr
2	V_{DD}I and A to Host
3	Main 1.8v Bus

J14

1	External Target Pwr
2	V_{DD}C to Target
3	Main 1.8v Bus

J15

1	External Target Pwr
2	V_{DD}I to Target
3	Main 1.8v Bus

J16

1	External Target Pwr
2	V_{DD}A to Target
3	Main 1.8v Bus

USB Port Data Connections to Chips

J23

From Port A	1	2	Host 708.17
To Port A	3	4	Host 708.1
From Port B	5	6	Host 200.17
To Port B	7	8	Host 100.17
From Port C	9	10	Target 708.17
To Port C	11	12	Target 708.1

Target Chip Reset

J22

Host 500.17	1	2	Target RESET- pin
USB C RTS signal	3	4	
Target reset circuit	5	6	

Host Chip Reset and Boot

J20

RESET pin	1	2	RESET pin
USB A RTS	3	4	Reset ckt & J25.3

J25

1	Ground
2	SPI Flash RST- pin
3	Host reset ckt & J20.4

J26

1	Host 705.17
2	**NO BOOT when IN**

SD/MMC Socket Signals

Socket pins	J38	J40	*SPI bus signals*
CLK/SCLK	1	1	SPI CLK MMC
DAT3/CS-	2	2	SPI CS- MMC
CMD/SI	3	3	SPI DO
DAT0/SO	4	4	SPI DI
V_{DD}	5	5	1.8v

Host-Target Communication

J35

1	Host 300.17
2	Target 300.17

J34

1	Host 300.1
2	Target 300.1

SPI Bus Expansion

J39

1	Host 600. 17
2	FLASHENABLE-
3	Ground

J37

FLASH ENABLE- on SPI bus.	1	2	Inputs to NAND. Output low enables MMC on SPI bus.
	3	4	

1.3 Check the Power Supply

In the factory, we check the power supply before applying DC power to most of the board. Begin by removing all of the power select jumpers J10, J11, J14, J15 and J16 as shown here. Connect a voltmeter as shown; the four pin header J29, near the Target chip, is ground and pin 3 (right side) of any of the power select headers is connected to the output of the on-board switching regulator.

After setting the board up in this way, provide input power to the regulator, using either a "wall-wart" in J2 or any of the three USB connections J3, J9 or J18. Your voltmeter should indicate very nearly 1.8 volts. We do not recommend checking resistance between V_{DD} and ground on this board, because many meters apply high voltages exceeding many chips' limits. When the checks are complete, re-insert the power select jumpers.

If you use a "wall-wart" power source, it needs to provide 3.6 to 19.5 volts (a lower limit of 4v is more practical) on a type "N" connector, positive voltage on center pin. If the supply can produce 4.5 to 5 watts then it should be able to power the 80% efficient switching regulator at its maximum rated output of 2A at 1.8v.

1.4 Identify and Set-up COM Ports for USB A, B, C

Each USB connector identified as A, B, and C reading left to right goes to an FTDI USB to serial adaptor chip. These have unique serial numbers for the benefit of systems that use them to assign a permanent COM port number to each device. If using Windows or Parallels, attach the cables one at a time, identify the COM port numbers, and using Device Manager find Advanced Port Settings. Change Latency Timer from default 16 ms to 1 ms, and change USB Transfer Sizes from default 4096 to 128 bytes. These settings will greatly improve performance. Subsequently each port may be used at any baud rate from 19,200 to 921,600. See the arrayForth User's Manual installation sections for more information or other platforms. *Please contact us right away if this information does not meet your needs.* However you do it, you must keep track of which COM port numbers connect to which of the board's USB ports.

1.5 Simple Confidence Test using eForth

Connect any serial terminal emulator program such as PuTTY or HyperTerm to USB port B, 8 data bits, no parity, one stop bit *and no flow control*. Remove NO-BOOT jumper J26 and press the host chip reset button (C0-RST) on the lower left corner of the board, then hit the space bar on the terminal to auto-baud eForth. The terminal should display this:

```
eForth btc:20110826 ga144:20110826
ok
```

Hit the enter key. You should see another ok which indicates that a great deal of the board is working. *Please contact us right away if you do not see these things!*

1.6 Test GA144 Chips

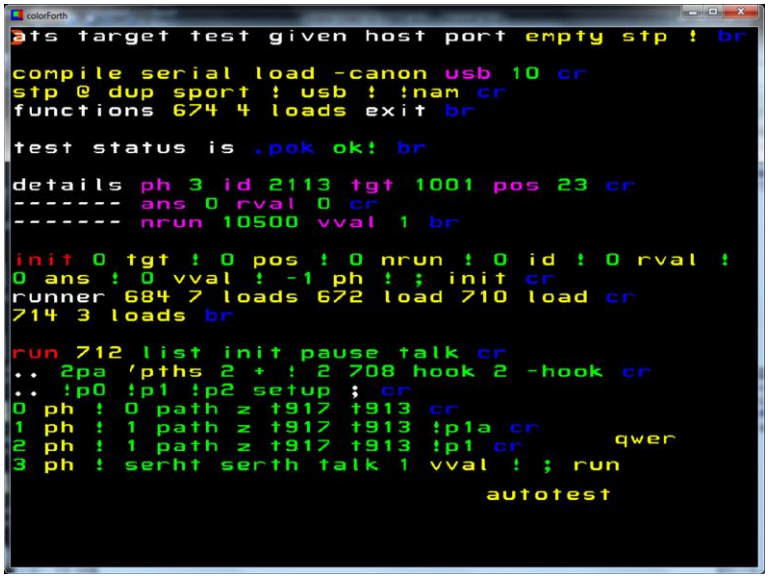
To completely self-test the chips, download the *arrayForth User's Manual* and the current Windows Installer from our website (see 3.2 below). Follow instructions in the User's Manual for your host platform to install the arrayForth software and identify and configure your COM ports. You do not need to edit the colorForth code at this point but you do need to get the COM ports identified and the connections to USB ports A and C configured as instructed for your platform.

With USB ports A and C connected, and with NO-BOOT jumper J26 installed, run arrayForth as per instructions for your platform. Type the following phrases to run self-tests, substituting the actual COM port for USB A (host IDE) for 10 and the port for USB C (target IDE) for 12:

```
10 selftest   (runs factory tests on host chip)
12 selftest   (runs factory tests on target chip)
10 autotest   (tests target chip under host chip control using synchronous boot,
               and tests SERDES between the chips)
```

Each word or number is entered by the space or ENTER keys. To delete a word or number before entering it, use backspace. While a test is running you will see a screen like the one shown here. The "test status" is initially **busy** in grey, and while the test is running the green numbers following the the magenta variable names are updated as the testing progresses. When testing is completed, the **busy** status changes to **ok!** as shown in green, or **fail!** in red. The expected result is, obviously, **ok!** .

Please contact us right away if you do not see the expected results or if you have any difficulty in running these tests!



2. Move On to Programming

Now that you've verified the integrity of your board and its connections with a host machine, it's time to take a closer look at the three main development tools used in programming our chips.

- **arrayForth** is currently the main tool for working with F18 code: Editing its source in colorForth representation, compiling it, making HTML listings, debugging it interactively using the IDE, generating boot streams, and writing flash. This system is written in the Intel IA32 instruction set (x86) and runs on Microsoft Windows systems (including Windows hosted by Mac Parallels), as well as unix systems using WINE.
- **eForth** is a very simple and portable implementation of ANS Forth. This particular implementation runs on a 16-bit Virtual Machine that runs on our chips. eForth requires only a terminal emulator on USB port B, although the supplied emulator provides additional useful capabilities.
- **polyFORTH** is a full blown, self -reproducing professional application development operating system that also runs on a Virtual Machine programmed for our chips. Mass storage is provided by the evaluation board and terminal services by an external system. Eventually all the F18 programming tools will be implemented by this polyFORTH system.

Please see our website for to download these tools, their documentation, and other relevant code, documentation and application notes.

3. Resources and Details

3.1 What's in the Box

In addition to the Eval Board itself, there is an antistatic bag containing parts you may find useful. The exact composition of this bag is subject to change, but as of the time of this writing it contains the following items: One Dual voltage, 2 GB MMC card intended for use as primary mass storage by polyFORTH when that system is released. One USB cable. Two Clip-leads. One each DB9, RJ48, and USB-B sockets. Three TRS audio jacks. Long single and double row male headers that may be cut up and soldered where needed. Five LEDs and five 47Ω resistors for diagnostic and general use.

3.2 Getting Help

There is a special webpage for customers who have bought our evaluation boards; please visit it now at this URL: http://www.greenarraychips.com/home/support This page is updated frequently and will always have the latest information for you. Email hotline@greenarraychips.com for prompt replies to your questions. The hotline team will provide you with additional contact information for direct, personal support such as Skype ID and phone numbers upon request.

General documentation and downloads are posted in http://www.greenarraychips.com/home/documents

3.3 Errata in Current PCB Revision

PCB REV	DESCRIPTION	FIX OR WORK-AROUND
0.1.1	The VGA connector hole pattern J70 is rotated 180 degrees..	Do not use J70. The pattern and wiring will be corrected in the next board revision.
0.1.1	The FTDI transmit and receive LEDs are not populated due to an error in circuit design.	Do not use. Circuit and layout will be corrected in the next board revision.
0.1.1	The general purpose LEDs (see J57) are not populated due to an error in circuit design.	Do not use. Circuit and connectors will be changed in the next board revision.

GreenArrays™

Application Note AN004 *Revised 9/20/11*

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