Getting Started with Evaluation Board EVB002

The GreenArrays EVB002 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 0h. It is currently shipped with configuration settings as shown herein, and with polyFORTH® that may be booted from flash.

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 (DB014), and the Programmers' References for arrayForth® version 3, 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.

Please see DB014 for a description of the differences between EVB001 and EVB002 kits.

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.

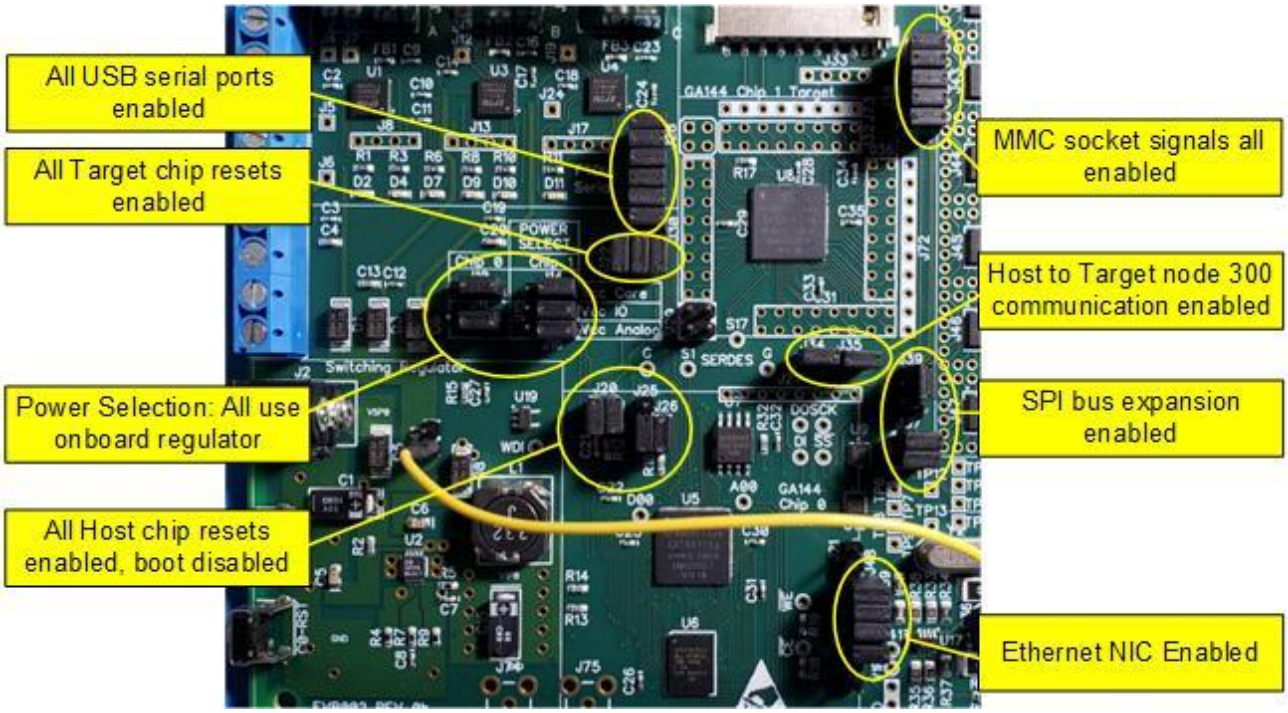
1.1 Recommended Working Area

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.*

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

Host-Target Communication

J34

1	Host 300.1
2	Target 300.1

J35

1	Host 300.17
2	Target 300.17

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	J25.2

J25

1	RST- from reset/dog chip
2	Signal to J20.4
3	Reset Button & RC Circuit

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

SPI Bus Expansion

J39

1	Host 600. 17
2	FLASHENABLE-
3	Ground

J37

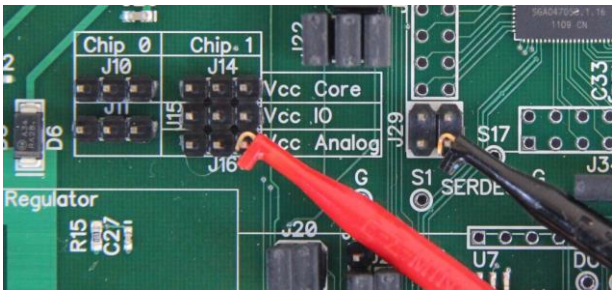
FLASH ENABLE- on SPI bus.	1	2	Inputs to NAND. Output low enables MMC on SPI bus.
	3	4	

Ethernet NIC Signals

Host pins	J21		J48	*NIC Signals*
617.ao	1			
617.ai	2			
517.17	3	1	1	Y2 xtal hi
417.17	4	2	2	Y2 xtal hi
317.17	5	3	3	Tx (to opamp)
217.17	6	4	4	Rx (raw)
117.ao	7			
117.ai	8			

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; all four pins of header J29, near the Target chip, are 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 any of the three USB connections J3, J9 or J18 (don't worry about other power options at this time). 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 some chips' limits. When the checks are complete, re-insert the power select jumpers.

1.4 Prepare your Win32 Host and Set-up COM ports A, B, C.

Although any terminal emulator may communicate with the serial interfaces on the EVB002, it is important to be certain about system configuration and functionality at the outset. Accordingly, if you have not done so already, this is the time to install arrayForth-3 as prescribed in the Appendices to DB013 *arrayForth 3 User's Manual*. We run on Windows platforms routinely at GreenArrays, but we don't have or use working copies of the Mac or Unix/WINE systems so those are not maintained. If using one of these other platforms, read the entire Windows appendix as well.

You must keep track of which COM port numbers now connect to which of the board's USB ports.

1.5 Simple Confidence Test using polyForth

Connect any serial terminal emulator program such as PuTTY (or the aF-3 terminal emulator if you are already familiar with its use) 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 polyForth. You should see:

```
pF/G144.03b1 12/21/18  (or whichever version is in flash)
hi _
```

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 using arrayForth 3

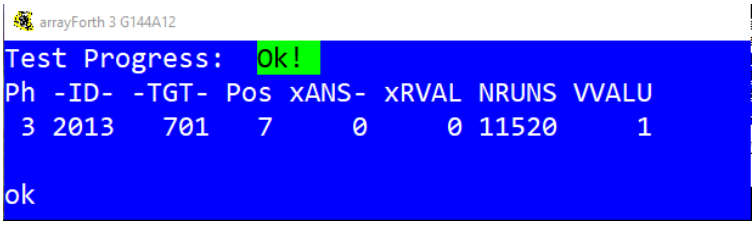
Assuming you have installed arrayForth-3 as above, have verified factory default jumper settings as above, and are armed with the COM port numbers for USB ports A, B, and C:

With USB ports A and C connected to the EVB002, and with NO-BOOT jumper J26 installed, run saneFORTH on your PC or other platform as per instructions in DB013 for your platform, and establish the AFORTH environment (some of the shortcuts we provide automate the initial steps. If you see only `sF386/NT` ... ID line, you will need to say **`HI`** . If you see the SYSTEM HELP screen, you will need to say **`AFORTH`** . If you see the arrayForth-3 HELP screen you are already there.

Type the following phrases in the order shown 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, moving the USB cable between ports as necessary if you only have the one we provide:

```
10 SELFTEST   (runs factory tests on host chip via port A)
12 SELFTEST   (runs factory tests on target chip via port C)
10 AUTOTEST   (tests target chip under host chip control using synchronous boot,
               and tests SERDES between the chips, all via port A)
```

Hit ENTER at the end of each of the above phrases. While a test is running you will see a screen like the one shown here. The "Test Progress" is initially **`busy`** in white on blue, and while the test is running the numbers on the third line are updated as the testing progresses. When the testing is completed successfully, you will see the "**`Ok!`** " advisory in black on green. If there is a failure, it will instead display "**`FAIL!`**" in black on magenta.



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 two main development tools used in programming our chips.

- **arrayForth-3 (aF-3)** is a full blown, self -reproducing professional operating system suite for IA32 PC platforms (saneFORTH) and for the GA144 running in a Virtual Machine of several nodes with external SRAM (polyFORTH). Many of our software development tools run in both environments, although some (like Softsim) are only practical on the PC while others (like the internal IDE) are only feasible running inside the chip itself. Mass storage is provided by the PC (serial disk) and by the EVB002 (16 MB SPI Flash). All software supported by Greenarrays has been developed and is maintained using aF-3.

  See DB013 *arrayForth 3 User's Manual* for details of using this system on each platform and for clarification of the relationships between these separately named systems. See especially the *Getting Started* part of the Introduction to that manual if you are not experienced in using systems like polyFORTH; they are simple but by definition that means they aren't what you may be accustomed to.

- **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. It's not supported by GreenArrays but source code is available and it may be supported by individuals.

- **Third Party Tools** have been developed by at least two users of our chips. See our website, Documentation & Software, for more information about these tools.

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

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, 1 or 2 GB MMC card intended for use as primary mass storage by polyFORTH when MMC is supported. One USB cable. Two Clip-leads. One long jumper wire for Ethernet transmitter power. One each DB9, VGA, 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
0h	None	N/A

GreenArrays®

Application Note AN021 *Revised 8/19/22*

IMPORTANT NOTICE

GreenArrays Incorporated (GAI) reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to GAI's terms and conditions of sale supplied at the time of order acknowledgment.

GAI disclaims any express or implied warranty relating to the sale and/or use of GAI products, including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

GAI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using GAI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

GAI does not warrant or represent that any license, either express or implied, is granted under any GAI patent right, copyright, mask work right, or other GAI intellectual property right relating to any combination, machine, or process in which GAI products or services are used. Information published by GAI regarding third-party products or services does not constitute a license from GAI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from GAI under the patents or other intellectual property of GAI.

Reproduction of GAI information in GAI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. GAI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of GAI products or services with statements different from or beyond the parameters stated by GAI for that product or service voids all express and any implied warranties for the associated GAI product or service and is an unfair and deceptive business practice. GAI is not responsible or liable for any such statements.

GAI products are not authorized for use in safety-critical applications (such as life support) where a failure of the GAI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of GAI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by GAI. Further, Buyers must fully indemnify GAI and its representatives against any damages arising out of the use of GAI products in such safety-critical applications.

GAI products are neither designed nor intended for use in military/aerospace applications or environments unless the GAI products are specifically designated by GAI as military-grade or "enhanced plastic." Only products designated by GAI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of GAI products which GAI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

GAI products are neither designed nor intended for use in automotive applications or environments unless the specific GAI products are designated by GAI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, GAI will not be responsible for any failure to meet such requirements.

For current information on GreenArrays products and application solutions, see www.GreenArrayChips.com

Mailing Address: GreenArrays, Inc., 821 East 17th Street, Cheyenne, Wyoming 82001
Printed in the United States of America
Phone (775) 298-4748 fax (775) 548-8547 email Sales@GreenArrayChips.com