

ADIN1100 10BASE-T1L Ethernet PHY Evaluation Kit

Media Converter to 10BASE-T with ADIN1200 Ethernet PHY

FEATURES

User friendly access to all ADIN1100 features
Graphical user interface (GUI) software on PC
or stand-alone hardware configured operation
Flexible power supplies and prototyping options
On-board ARM Cortex-M ADuCM4050 Microcontroller
10BASE-T1L to 10BASE-T Media Converter

EVALUATION KIT CONTENTS

EVAL-ADIN1100EBZ board
2x plug-in screw-terminal connectors
for 10BASE-T1L cable and external power supply
Cat5e Ethernet cable with RJ45 connectors (1 meter)
USB-A to Micro USB-B cable (1 meter)

EQUIPMENT NEEDED

Link partner with 10BASE-T1L interface
10BASE-T1L compatible Single Pair cable
max. 1.5mm² / AWG 16 to fit screw terminal connector
Power supply source
5 to 32 Vdc, 0.6W, or USB as power for the board
Optional: Link partner with standard RJ45 Ethernet interface
Auto-negotiation resolving to 10BASE-T Full Duplex
Optional: PC running Windows 7 and upwards with USB
interface

SOFTWARE (OPTIONAL)

ADIN1100 Graphical User Interface software package
FTDI USB Virtual Com Port driver for selected host
Serial port terminal software

DOCUMENT NEEDED

ADIN1100 Datasheet

General Description

The EVAL-ADIN1100EBZ is a flexible platform enabling quick evaluation of ADIN1100, robust, low power 10BASE-T1L PHY. It provides 10Mbit per second Single Pair Ethernet (SPE) connections with devices over 1.7km of cable.

The evaluation board offers two modes of operation for maximum flexibility. Connected to a PC via USB port, the full set of ADIN1100 register settings and features such as link quality monitoring and diagnostics can be accessed with the ADIN1100 Graphical User Interface software.

Alternatively, the board can operate in stand-alone mode where it is configured by setting hardware configuration links and switches. Onboard LEDs provide status indication.

The ADIN1100 data (MII, RMII and RGMII) and management (MDIO) interfaces are accessible on header connectors for easy connection to an external host controller.

A small prototyping area and test points are provided for experimentation with alternative cable connection topologies including isolation transformers and/or power coupling inductors.

The platform can perform as a 10BASE-T1L to 10BASE-T media converter. This enables connection to other devices – demos or a custom prototypes – with a 10BASE-T1L Ethernet port and conversion of the data to standard Ethernet accessible via the RJ45 connector.

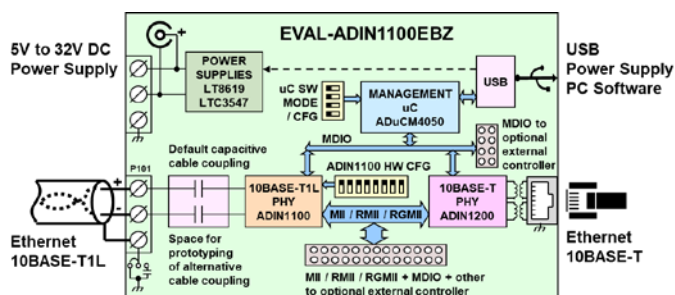


Figure 1. EVAL-ADIN1100-EBZ – Simplified Block Diagram

Rev. PrA

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OVERVIEW

EVAL-ADIN1100EBZ Quick Start Info

Connectors P1, P2
External Board Power Supply
5 to 32Vdc
(If the board is supplied from USB,
the external power is optional)

ADIN1100 Status
LED0: Link/Activity
LED1: 2.4V Amplitude

10BASE-T1L
100Ω Twisted
Single Pair
Ethernet Cable

Jumper J101:
10BASE-T1L Cable Shield
Connected to Earth directly
or via 4000 pF capacitor

Mounting Hole
3.2mm for M3 screw
"Earth" ground (for EMC)

Jumper J1
Board
Power
Selection

Jumper J2, J3
Local Power
3.3V and 1.8V
keep them inserted

**ADIN1100 Hardware
Configuration S201:**
Description of all options
in ADIN1100 datasheet
ON = high, pull-up resistor

**Board Reset
Button S501**
Reset board after
any configuration change

**uC CFG
Switch S403**
Media Converter
Mode 15 - all off

uC LEDs
uC0 Green (Media Conv. on=both links are up)
uC1 Red (Error, on = something is wrong)
uC2 Orange (Heartbeat, blinking = uC alive)
uC3 Blue (Reserved for future / user functions)

Micro USB Connector:
For using the board with PC GUI software
or USB Com port to host terminal software
115200Bd, 8bit, no parity, 1stop bit
Board can get power from USB port or charger

Connector P501 – MDIO:
Can be used for managing external PHYs
using the on board uC and related software.
Also, the on-board PHYs can be managed by
an external host – in this case keep the local
uC in reset by jumper J401 in position GND.

RJ45 10BASE-T Ethernet
Auto-neg., advertising 10Mbit Full Duplex
as the only option to link and operate
10BASE-T1L is 10Mbit Full Duplex, and
this is only media converter – no buffering!

RJ45 LEDs – ADIN1200 Status:
Yellow: Activity, Green: Link up

Jumpers J204, J203, J402
Chip Power Selection:
Set VDDIO, ADIN1200 VDDIO
and uC PWR the same level !!!

Header P201
Digital Signals Access:
MII / RMII / RGMII, MDIO, Reset,
clocks, LEDs, Status, Interrupt

Jumper J301: ADIN1200 (Force) (Hardware) Reset
If not using media converter, insert this to keep ADIN1200 in reset
and release its digital signals. The ADIN1100 MII / RMII / RGMII
on header P201 can then be used without ADIN1200 affecting them

Figure 2. EVAL-ADIN1100EBZ Quick Start Info

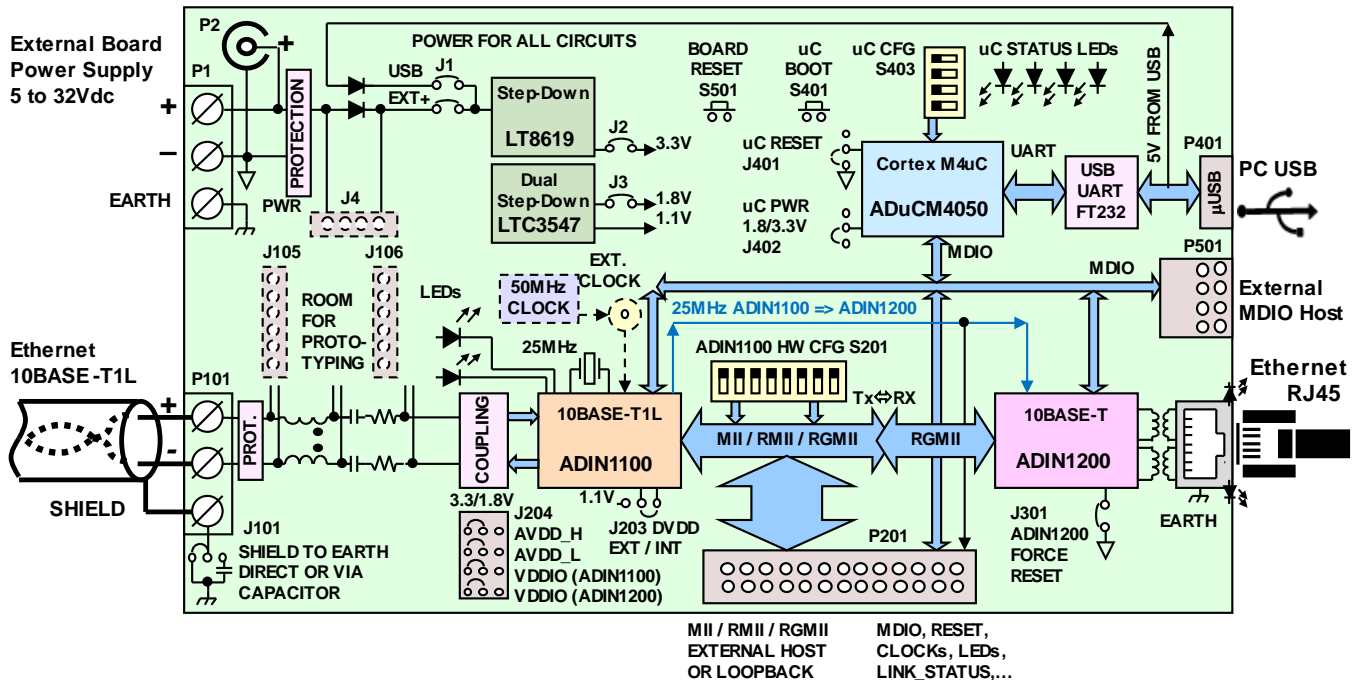


Figure 3. EVAL-ADIN1100EBZ Functional Block Diagram

HARDWARE

POWER SUPPLIES

The EVAL-ADIN1100EBZ can be powered by a power supply with output voltage between 5 to 32V DC connected via the plug-in screw-terminal connector P1, or via the P2 barrel connector plug.

Alternatively, the board can be powered from a host via its USB port, or by a USB charger connected to the micro-USB connector P401.

The power supply source can be selected by link on J1 “BOARD PWR SELECTION”. Inserting link in position “USB” enables the board to receive power from USB connector. Inserting link in position “EXT+” enables the board to receive power from connectors P1 and P2.

If both J1 “BOARD PWR SELECTION” “USB and “EXT+” links are inserted, there is a “diode or” implemented on the input of J1, and the supply with a higher voltage will supply the board.

The power from the source is converted by a step-down converter U501 LT8619 to 3.3V, and with link inserted in position J2 “PWR 3.3V”, the 3.3V rail supplies all circuits on the board. The presence of 3.3V power is indicated by green LED1 “POWER”.

The board power consumption depends on the mode of operation, with the maximum of approximately 0.5W.

10BASE-T1L CABLE CONNECTION

The 10BASE-T1L cable can be connected via pluggable screw-terminal block to connector P101. If more of the pluggable connectors are needed, for easy connecting / changing cables, additional connectors can be purchased from the vendor or distributors: Phoenix Contact, part number 1803581, “Pluggable Terminal Block, 3.81 mm, 3 Ways, 28AWG to 16AWG, 1.5 mm², Screw”.

GROUND CONNECTIONS

The demo board has an “Earth node”. We call it “Earth node” here – though this node may or may not be electrically connected to Earth ground. In a real device this node would be typically connected to the device metal housing / chassis. This Earth node can be connected as required in a wider demo system via “Earth” terminal of the power supply connector P1, or via exposed metal plating of 3 mounting holes in the corners of the board. (The 4th hole does not have metal plating, and also no Earth connection.)

The shield of the 10BASE-T1L cable can be disconnected from this Earth node, connected directly, or connected via 4700pF capacitor (C104). The required connection is selected by relevant link position of J101.

The 10BASE-T Earth connection and metal body of the RJ45 connector (P5) are connected directly to the Earth node.

The local circuit ground, the external power supply (except the “Earth” terminal P1), and the USB connector are connected to the Earth node via approx. 2000pF capacitance and approx. 4.7M Ω resistance.

(!) Note: The EVAL-ADIN1100EBZ has been designed only as an Evaluation board. It has NOT been designed, and it has NOT been tested for electrical safety. Any equipment, device, wire, or cable connected to this demo must be already protected and safe to touch without danger of electric shock.

HARDWARE CONFIGURATION SETUP

Some of the EVAL-ADIN1100EBZ hardware configuration is determined by links (jumpers) and configuration switches on the board. The summary and the default configuration is outlined in tables Table 1 to Table 5.

Table 1. Board Link Configuration

Link Ref.	Default Position	Link Function
J1	USB, EXT+	Board power supply source selection. Both can be inserted simultaneously.
J2	Inserted	Board 3.3V power supply rail
J3	Inserted	Board 1.8V power supply rail
J101	Earth (77)	SHIELD - Connect the shield of the cable to the Earth node either directly or via a capacitor.
J203	LDO	ADIN1100 1.1V power supply selection. LDO ... using ADIN1100 on-chip internal 1.1V linear regulator. EXT ... supplied from 1.1V output of the step-down regulator LTC3547.
J204	All 3.3V	ADIN1100 power supplies selection. If changing, keep the (ADIN1100) VDDIO, ADIN1200 VDDIO and uC PWR all at the same voltage level, 3.3V or 1.8V.
J301	Not inserted	ADIN1200 reset. Insert to keep ADIN1200 in hardware reset and release its digital signals.
J401	BRD	uC Reset. "BRD" ... uC is reset by the "BOARD RESET" push button. "GND" ... uC is held in reset
J402	3.3V	uC Power. Keep at the same level, 3.3V or 1.8V, as the (ADIN1100) VDDIO and the ADIN1200 VDDIO

Table 2. uC Firmware Mode Configuration, S403, uC CFG

Switch Position	Switch Name	Default Position	Description
1	CFG_0	OFF	Mode 15 media converter (default for shipping). All switches OFF
2	CFG_1	OFF	
3	CFG_2	OFF	
4	CFG_3	OFF	

Table 3. ADIN1100 Hardware Configuration, S201, HW CFG

Switch Position	Switch Name	Default Position	Description
1	MEDIA_CNV	OFF	Media converter. (Only for RMII interface mode, not used on this board)
2	MACIF_SEL1	OFF	Mac Interface Select 1
3	SWPD_N	OFF	Software Power Down.
4	MACIF_SELO	ON	Mac Interface Select 0
5	TX2P4_DIS	OFF	Transmit Amplitude 2.4V Disable. (Always turn this switch ON if the AVDDH=1.8V)
6	MS_SEL	OFF	Master/Slave Select. (Used as preference for auto-negotiation)
7	PHYAD_0	OFF	PHY Address 0. Address for management interface (MDIO)
8	PHYAD_1	OFF	PHY Address 1. Address for management interface (MDIO)

Table 4. Board LED indicators

Name	Colour	Sch Ref	Description
uC0	Green	LED400	In media converter mode: Media Converter working - both PHYs links up
uC1	Red	LED401	Error detected by firmware
uC2	Yellow	LED402	Short flash: Heartbeat. Long flash/most time on: Receiving UART commands
uC3	Blue	LED403	Reserved
LED_0	Green	LED200	10BASE-T1L link up/activity
LED_1	Yellow	LED201	In firmware managed modes: 10BASE-T1L TX amplitude 2.4V
(RJ45)	Green	P5	10BASE-T link up
(RJ45)	Yellow	P5	10BASE-T activity
POWER	Green	LED1	Board 3.3V power supply is present

μC MODES OF OPERATION

The EVAL-ADIN1100EBZ can be used in various modes of operations implemented in the uC firmware. Up to 16 modes of operations can be selected by setting the 4 positions of the slide switch S402. The status of the switch is accepted (latched) after the board is powered up or reset.

Therefore, to change the mode of operation, the board must be reset by pressing “RESET” button S400 or by applying power cycle after changing the position of the slide switch S501. The detailed description is in the relevant sections of this document.

Table 5. Firmware Modes of Operation, set by S403, uC CFG

CFG3 ¹	CFG2	CFG1	CFG0	Mode	Description
ON	ON	ON	ON	0	Reserved
ON	ON	ON	OFF	1	Reserved
ON	ON	OFF	ON	2	Reserved
ON	ON	OFF	OFF	3	Reserved
ON	OFF	ON	ON	4	Reserved
ON	OFF	ON	OFF	5	Reserved
ON	OFF	OFF	ON	6	Reserved
ON	OFF	OFF	OFF	7	Reserved
OFF	ON	ON	ON	8	ADIN1100 PHY Test Mode 3 (Idle)
OFF	ON	ON	OFF	9	ADIN1100 PHY Test Mode 2 (Droop)
OFF	ON	OFF	ON	10	ADIN1100 PHY Test Mode 1 (Jitter)
OFF	ON	OFF	OFF	11	ADIN1100 PHY Test TX disabled
OFF	OFF	ON	ON	12	ADIN1100 Frame Generator/Checker
OFF	OFF	ON	OFF	13	ADIN1100 MAC Remote Loopback
OFF	OFF	OFF	ON	14	GUI / Interactive Mode
OFF	OFF	OFF	OFF	15	Media Converter Mode (Default Configuration)

¹ Switch in ON position = signal logic 0 for uC (shorted to ground). Switch in OFF position = signal logic 1 (pulled up by a resistor)

SOFTWARE

The EVAL-ADIN1100EBZ can be used as stand-alone board, with the firmware already programmed in the uC flash memory, the mode of operation set by mode switch, and status indicated by LEDs. There is no software needed for this stand-alone use case.

The demo can also be connected to a PC via USB port, the full set of ADIN1100 register settings and features such as link quality monitoring and diagnostics can be accessed with the ADIN1100 Graphical User Interface software, available from Analog Devices.

Alternatively, the ADIN1100 and ADIN1200 registers, 10BASE-T1L link status monitoring and some diagnostics can be accessed using a simple set of ASCII text commands and messages exchanged over the USB Com Port and a serial port terminal software.

DRIVER FOR USB COM PORT

The EVAL-ADIN1100EBZ uses FTDI FT232 for the USB Com Port connectivity.

Please make sure that appropriate Virtual Com Port driver is included or installed on the host platform before connecting the EVAL-ADIN1100EBZ to that host via USB cable.

The drivers are available from FTDI, at the time of writing this document at <https://ftdichip.com/drivers/vcp-drivers/>.

COM PORT AND TERMINAL SETTINGS

When the EVAL-ADIN1100EBZ is connected to the host, it will become available in the host system as a USB Com Port, and will be assigned a com port number. The number will depend on the system settings, on com port devices previously connected and assigned in the system, and on the FTDI driver settings.

The EVAL-ADIN1100EBZ uC firmware communicates over a standard UART interface, with settings:

Speed 115200 Bd., 1 Start Bit – 8 Data Bits – No Parity – 1 Stop Bit.

The protocol is based on ASCII text commands and messages. Each message and command are finished by <newline>. Each message sent from the firmware to the host is finished by both <CR> and <LF> characters. For the commands received from host the firmware expects the <newline> as character <CR> or <LF> or both <CR> and <LF>.

(To be sure and clear:

<CR> .. “carriage return”, ASCII code 0x0D, 13dec,

<LF> .. “line feed”, ASCII code 0x0A, 10dec.)

TERMINAL SOFTWARE

The EVAL-ADIN1100EBZ firmware works with the common serial terminals. It has been tested on Windows platform with PuTTY, RealTerm, Termite and the old Hyperterminal.

TERMINAL COMMANDS AND MESSAGES

(The examples here were captured using Compuphase Termite).

INITIAL WELCOME MESSAGE

When the EVAL-ADIN1100EBZ is correctly connected, from the uC firmware and UART, via the USB Com Port, to the terminal software, the firmware sends after power or after pressing the board RESET button S501 an initial welcome message:

```
=====
ANALOG DEVICES      10BASE-T1L PHY Demo
=====
(c) 2021 Analog Devices Inc. All rights reserved
=====
Firmware ver.: 12 . 1 . 4784b935
Hardware type: EVAL-ADIN1100EBZ
Hardware ver.: A
Hardware UID : AVAS142049
uCCFG3-2-1-0 : OFF-OFF-OFF-ON (Mode 14)
Firmware Mode: GUI / Interactive mode
=====
Type '<?><new line>' for a list of commands
=====
```

TERMINAL COMMANDS

The most important command is “<?><new line>”.

On the host keyboard, press key “?” followed by key “Enter”, and the firmware will send a list of all commands implemented in this version:

```
?
=====
List of Commands
* MDIO (Clause 22) write to Phy, all numbers in hex.
'mdiowrite <PhyAddr>,<RegAddr>,<Data>'<newLine>
* MDIO (Clause 22) read from Phy, all numbers in hex.
'mdioread <PhyAddr>,<RegAddr>'<newLine>
* MDIO (Clause 45) write to Phy, all numbers in hex.
'mdiowr_cl45 <PhyAddr>,<RegAddr>,<Data>'<newLine>
* MDIO (Clause 45) read from Phy, all numbers in hex.
'mdiord_cl45 <PhyAddr>,<RegAddr>'<newLine>
* Phy (hardware) reset
'phyreset'<newLine>
* Phy status and link properties.
'phystatus'<newLine>
* Start reporting status.
'start'<newLine>
* Stop reporting status.
'stop'<newLine>
* Clear / reset status counters.
'clear'<newLine>
* uC Software Reset.
'reset'<newLine>
* Mode change, overrides uC CFG until next Reset.
'mode <number>'<newLine>
* List implemented modes.
'modes'<newLine>
* Comment - string of up to 98 characters
'/'<string>'<newLine>
* Show list of commands.
'? ' <newLine>
=====
```

STATUS AND DIAGNOSTICS

To see the status of the demo, use command “phystatus”, which will read and show the latest status of the ADIN1200 10BASE-T PHY and ADIN1100 10BASE-T1L PHY:

```
phystatus
ADIN1200 Link is Up,
ADIN1100 Link is Up, Master, 2.4 V
MSE -37.2 dB Rx 0, Err 0
```

To see a continuous update, use commands “start”:

```
start
OK
MSE -38.4 dB Rx 255, Err 0
MSE -38.6 dB Rx 256, Err 0
MSE -38.7 dB Rx 257, Err 0
MSE -38.4 dB Rx 257, Err 0
MSE -38.7 dB Rx 257, Err 0
stop
OK
```

The firmware will periodically, with period of approx. 1 second, send an update. The update in the present firmware version includes:

- “MSE” – 10BASE-T1L Mean Square Error, which indicates link quality.
- “Rx” – number of Ethernet frames received by PHY from 10BASE-T1L cable since the last board / firmware reset, or after use of command “clear”
- “Err” – number of frames with error received since the last board / firmware reset, or after use of command “clear”

To stop the continuous update, use command “stop”.
(Or reset the board.)

µC FIRMWARE UPDATE

The uC (U401 ADuCM4050) is programmed before shipping the demo board, and therefore there is no need to program it, unless a new version of firmware is available, and you want to update it on your board.

The present firmware version can be checked via USB Com Port and terminal software, it is displayed in the welcome message after board reset or in response to “info” command.

Firmware update is distributed as a compiled binary (.hex) file. The easiest way to program it to the uC is using the USB Com Port and CrossCore Serial Flash Programmer, available for free download from analog.com, presently:

<https://www.analog.com/en/design-center/evaluation-hardware-and-software/software/crosscore-serial-flash-programmer.html#software-relatedsoftware>

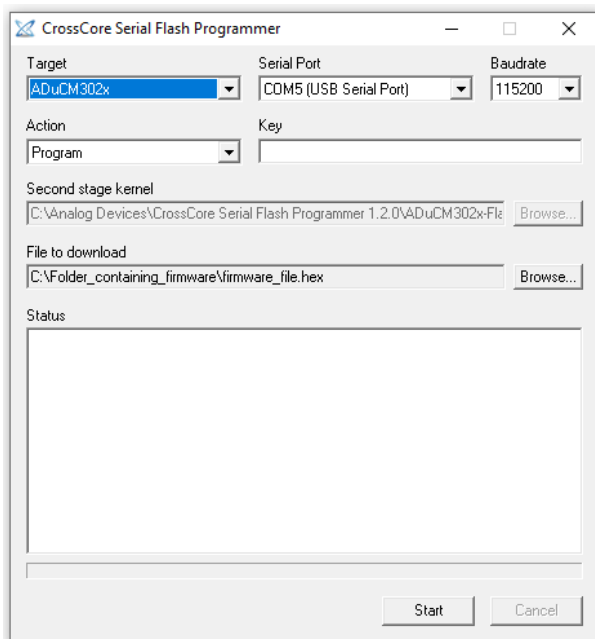


Figure 4. CrossCore Serial Flash Programmer.

USB Com Port driver (same as for using the terminal software) needs to be installed on the PC before connecting the board and using the CrossCore Serial Flash Programmer - see chapter “Driver for USB Com Port”.

When you have the driver and programmer software installed, and firmware update hex file ready, use the following steps:

1. Connect the board (P401) via micro-USB cable to your PC.
 2. Start the CrossCore serial flash programmer software.
 3. Set the programmer (also see Figure 5):
 - Target: ADuCM302x
 - Serial Port: COMx (USB Serial Port) – (the “x” port number is depending on your PC)
 - Baudrate: 115200
 - Action: Program
 - (Second stage kernel is not applicable)
 4. File to download - browse for the firmware file on your PC
 5. On the demo board, simultaneously press and hold buttons S501 “RESET” and S401 “BOOT”. Release the RESET button first, followed by releasing the BOOT button. The on board microcontroller is in the programming state now, and the yellow / orange heart beat LED402 will stop blinking.
 6. Click Start and the code should start to download with messages provided in the Status window and progress bar across the bottom of the window.
- NOTE: If you have been using a terminal program for communicating with the board, either disconnect it / release the com port, or stop the terminal program, otherwise you will see a message “Failed to open serial device”. A message “No autobaud response” most likely indicates that the uC is not in the programming state and you need to go back to step 5.
7. After programing, press & release RESET button.

NOTES

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