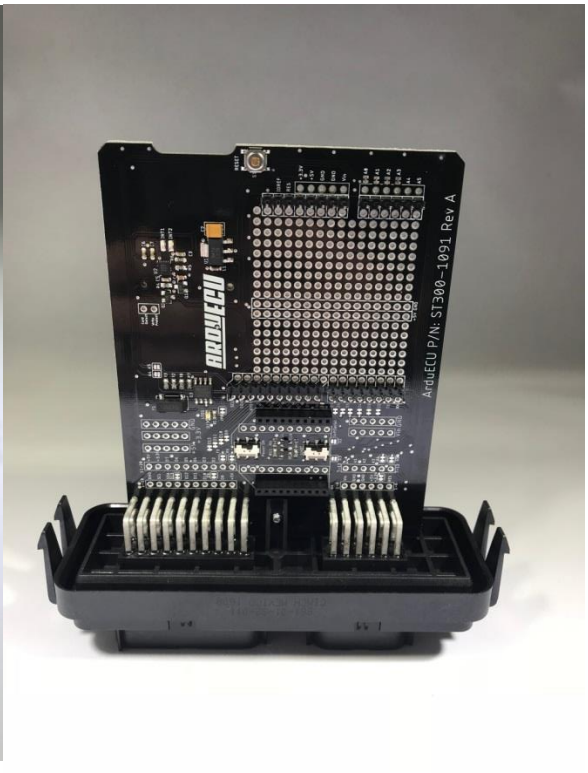
ArduECU MK1U Technical Manual

Rev B



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FCC AND CE NOTICE

PLEASE READ THIS NOTICE CAREFULLY BEFORE USE!

First and foremost, we thank you for your purchase of this ArduECU product!

As with many other open-source hardware platforms, this system operates under the Open Source Hardware initiative and complies with Part 15.101e of Title 47of FCC rules by acting as a "subassembly" to a larger system that You-- the designer, programmer, engineer or hobbyist, will develop and integrate with using the ArduECU platform.

Although this device is acceptable for private use without additional FCC certification, please note that if you wish to develop and/or integrate this ArduECU product into a "finished good" to be used for resale, it may possibly require FCC and/or CE testing for resale, distribution and operation in your local area/region. Please contact us or your local FCC or CE testing lab for questions.

You agree by using this device that the ArduECU brand, and company-- Storme Technologies, LLC is not liable or responsible for the possible misuse, redistribution or unintended operation that may be caused by operating this device.

Please contact info@ardu-ecu.com for further information or if you have further questions regarding this notice.Thank you for your understanding and we hope you enjoy working with your ArduECU!

~The ArduECU Team

Product Overview

The ArduECU MK1U (with the “U” referring to Uno Compatible) is the easiest and most cost effective way to create-your-own durable, IP69K waterproof, Arduino-based controller using an already existing Arduino Uno.

Plug your Arduino Uno into the headers of the breakout board to adapt to the pins to the external connector. This feature opens up endless possibilities for what applications you can use an Arduino Uno with.

Prototype circuits with the on-board prototyping area, perform some data logging via on-board SD card, record time and date stamps, monitor acceleration, angle and speed using the on-board 3-Axis accelerometer, or add wireless modules based on the XBee footprint to control your wireless project or IoT application.

Features

- Converts your Arduino into a waterproof and more durable one
- Ruggedized, IP69K- waterproof rated housing for use in harsh, moist or dirty environments
- Breaks out standard Arduino pins to external 12 and 20 pin headers
- Optional built-in XBee footprint for wireless communications
- Optional built-in SD card for data logging
- Optional built-in Real Time Clock for time and date stamping data
- Optional built-in 3-Axis accelerometer for motion or tilt sensing applications
- Onboard prototyping area for building custom circuitry within the housing that interface with ArduECU and the Uno board
- Adaptable to future external expansion modules (Ex: CANbus, H-Bridge or High Current outputs)
- Stream data to the internet, smartphone or tablet via wireless XBee modules
- Control ArduECU remotely via internet connected smartphone, tablet or PC
- Create IoT (Internet of Things) projects with ease and use a cloud dashboard for viewing or using your data (ex. Cayenne-mydevices, Ubidots, Thingspeak, etc.)
- Compatible with standard Arduino IDE and all Arduino based libraries

Application Examples

- Automobiles, utility trucks, service trucks, semis and command vehicles
- Marine use
- Building and industrial automation
- Outdoor/Indoor lighting control
- Field monitoring, custom weather stations or garden controllers
- Security systems
- Gate control
- Data logging
- Remote/Motion Control
- Internet of Things

Specifications (Arduino Microcontroller)

The below technical specifications reflect that of a typical standard Arduino Uno. Your specific technical specifications for the Arduino will vary depending on what brand is used. Any Arduino Uno based board with the Uno footprint *should* be compatible with ArduECU MK1U.

Power Requirements (hardware dependent)

- Recommended Operating Voltage: 7-12VDC for standard Arduino Uno-based boards
- Operating voltage of 6-20VDC when using Rugged Circuits RuggeDuino

Reference Voltages (hardware dependent)

- 5VDC Reference (max current limit based upon your specific Arduino Uno hardware used)

Communications (hardware dependent)

- (1) Serial (internal and external)
- (2) SPI (internal and external)
- (1) I2C (internal and external)
- (1)USART (internal via Uno USB)
- Wireless (Ex: Bluetooth, Wi-Fi, RF, etc.) via XBee compatible hardware

Processor (hardware dependent)

- Hardware dependent based upon your Arduino Uno selection

Inputs/Outputs (hardware dependent)

- (14) Capable Digital Inputs and Outputs (standard Arduino Uno configuration)
- (6) Analog Inputs (0-5VDC)
- 5 Capable PWM Outputs
- Additional current capability when paired with Rugged Circuits RuggeDuino

Software /Programming

- Fully compatible with existing Arduino architecture
- Code in Wiring Language via free Arduino IDE or in C via Eclipse
- Support for other Arduino-based programming environments
- Programming can be performed via USB on Uno board, or via serial connection located on external connector

Specifications (ArduECU MK1U Housing and Connector Faceplate)

Product Specification
Operating Temperature: -40°C to +85°C
Current: 10 Amp @ 85°C
Contact Resistance: < 10mΩ
Insulation Resistance: > 1000 MΩ
Sealing: IP67, IP69K
Temperature Life: 1000 Hrs @ 85°C
Current Cycling: 500 Hrs @ 10 Amp, 500 cycles 45 min ON – 15 min OFF
Vibration: 10 to 2000 to 10 Hz with 15 g's peak level
Shock: 50 g's – 20 pulses
Salt Spray: 96 Hrs
Temperature Humidity Cycling: 320 Hrs
40 – 8 Hrs cycles -40°C to +85°C
Fluid Resistance: Resists to most fluids used in industrial applications

Specifications (ArduECU MK1U-03, MK1U-04, MK1U-05, MK1U-06)

Power Requirements

- Recommended Operating Voltage: 7-12VDC for standard Arduino Uno-based boards
- Built-in 5VDC and 3.3VDC voltage regulators for ArduECU MK1U hardware features

Hardware Features/Capabilities

- Assembled RTC (Real Time Clock) Hardware for Time and Date Stamping on Data
- Assembled SD Card Hardware for logging sensor data (Wi-Fi card capable for remote access)
- Assembled XBee Hardware/headers for Wireless Communications or additional circuitry
- Assembled Three-Axis Accelerometer for angle and motion sensing applications
- Built in Prototyping area for prototyping and adding your own custom circuits
- Assembled reset button for testing and debugging
- Assembled LED on D13 for diagnostics and debugging purposes
- Built-In Vin, 5VDC and Ground rails for prototyping purposes
- Built-In jumpers for configuration of specific hardware features
- Built in Break-out solder pads for all external header pins
- Assembled Arduino Uno headers for mounting Arduino Uno board
- Assembled 32 Position header/connector faceplate assembly

Specifications (ArduECU MK1U-01, MK1U-02)

- Built in RTC (Real Time Clock) capability for Time and Date Stamping on Data
- Built in SD Card Hardware capability for logging sensor data (Wi-Fi card capable for remote access)
- Built in XBee Hardware/header capability for Wireless Communications or additional circuitry
- Built in Three-Axis Accelerometer capability for angle and motion sensing applications
- Built in Prototyping area for prototyping and adding your own custom circuits
- Built-In reset button capability for testing and debugging
- Built-In LED on D13 capability for diagnostics and debugging purposes
- Built-In Vin, 5VDC and Ground rails for prototyping purposes
- Built-In jumpers for configuration of specific hardware features
- Built in Break-out solder pads for all external header pins
- Comes with Arduino Uno headers for mounting Arduino Uno board
- Comes with 32 Position header/connector faceplate assembly

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ArduECU MK1U Housing Overview

(Same for all ArduECU models)

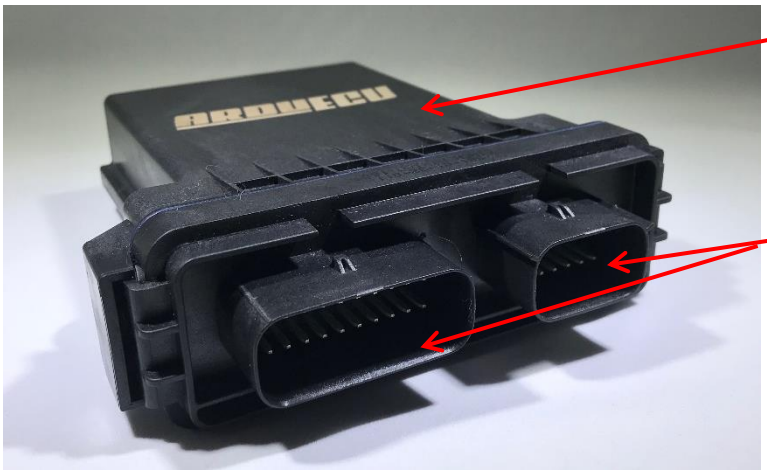


Figure 1. External Features (Front)

Figure 2. External Features (Rear)

Fully Assembled ArduECU MK1U Overview

(ArduECU models: MK1U-03, MK1U-04, MK1U-05, MK1U-06)

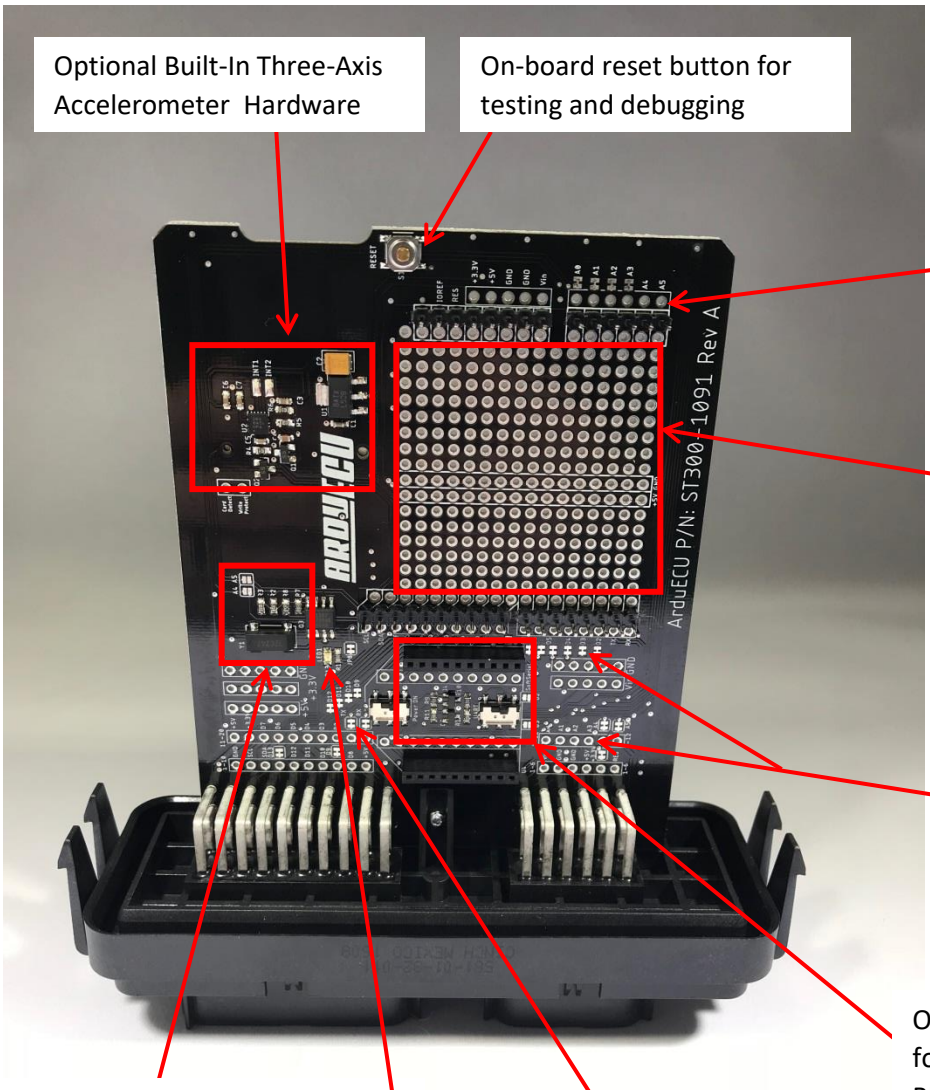


Figure 3. Internal Features (Front of Fully Assembled Units)

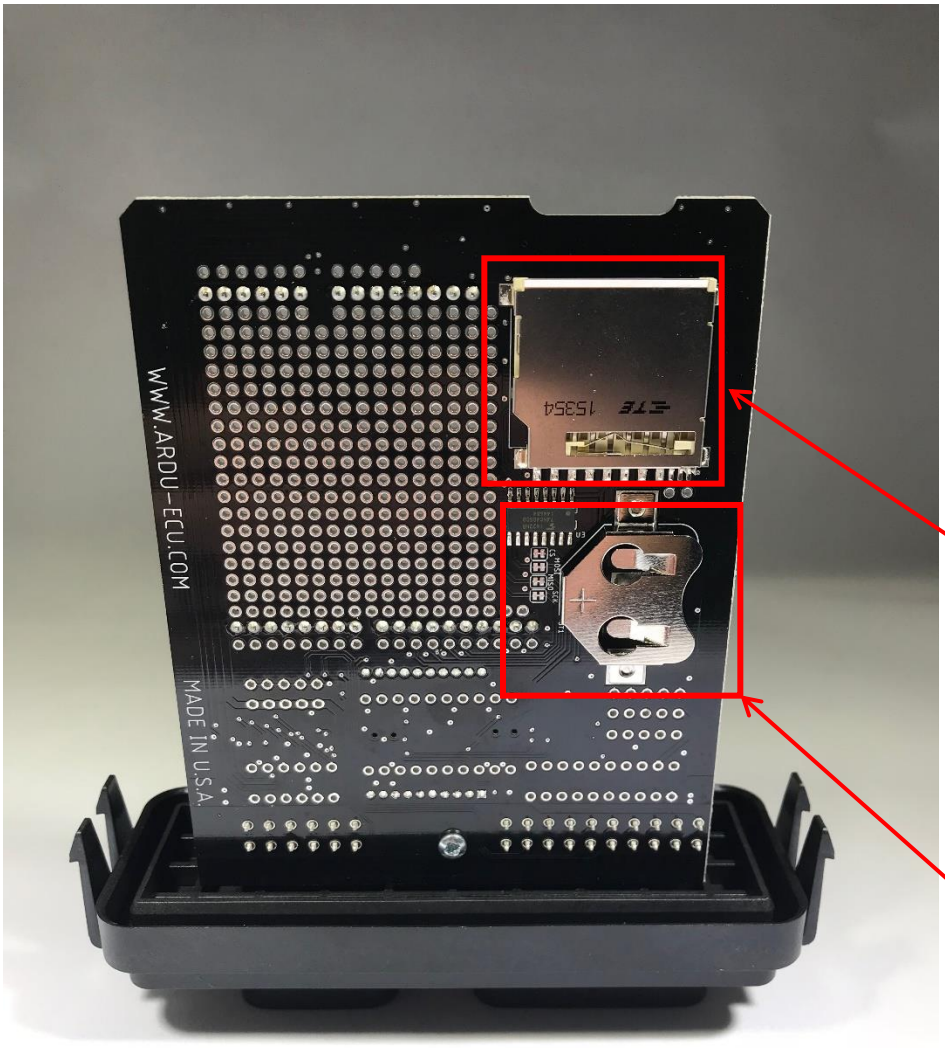
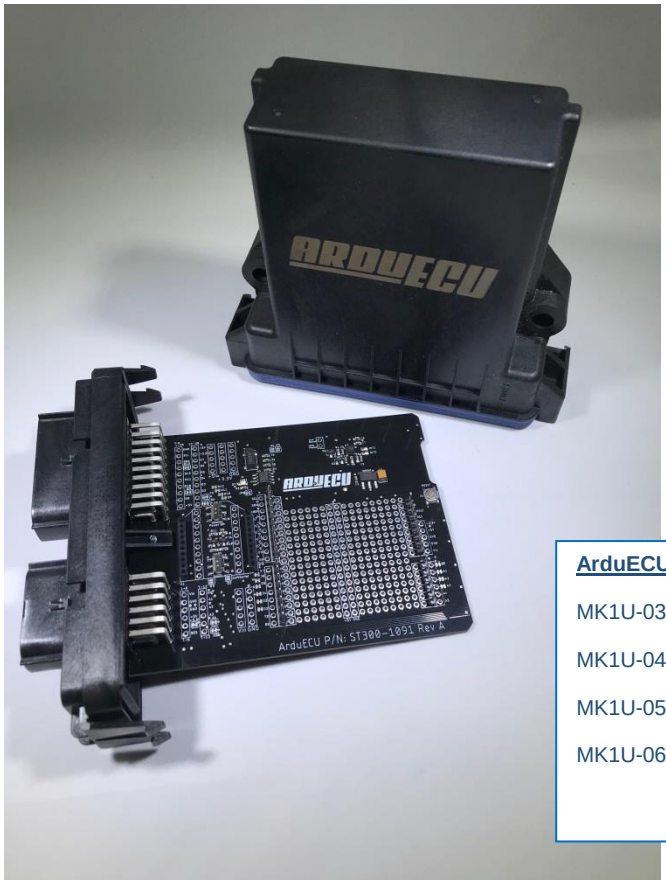


Figure 4. Internal Features (Rear of Fully Assembled Units)



ArduECU MK1U Variations

MK1U-03 Version: board on left without supplied Uno

MK1U-04 Version: board on left with supplied Generic Uno

MK1U-05 Version: board on left with supplied Genuine Uno

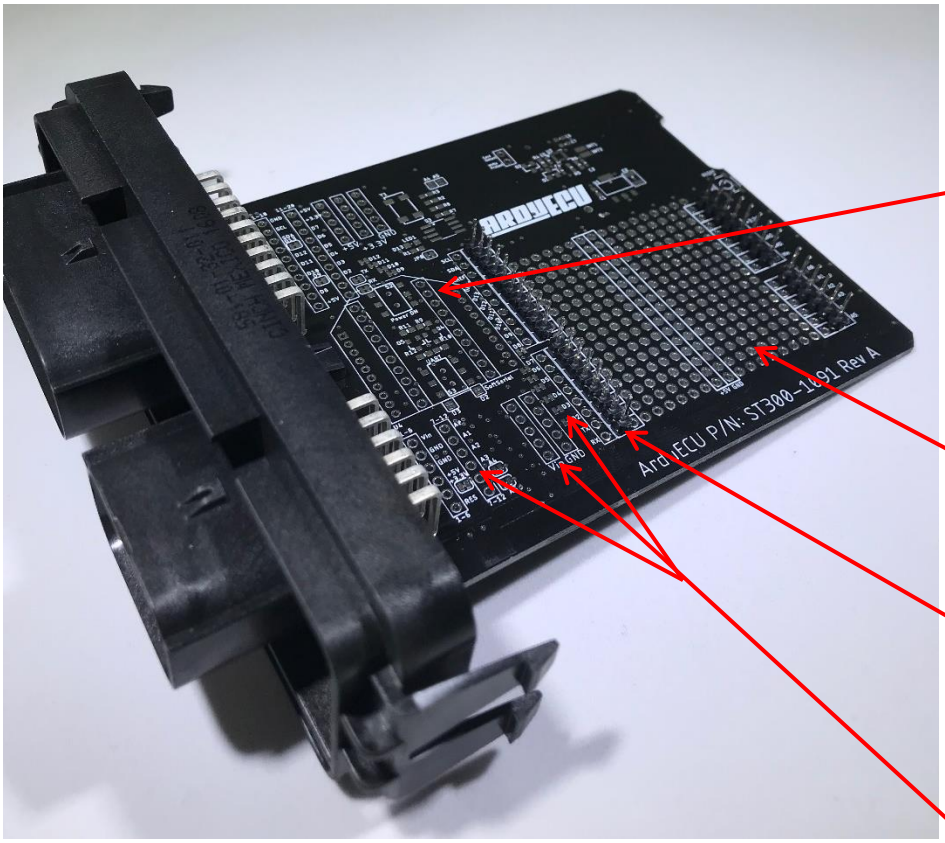
MK1U-06 Version: board on left with supplied Rugged Circuits RuggeDuino

Option to add XBee modules to any version MK1U-03, MK1U-04, MK1U-05, MK1U-06

Figure 4.1. Fully Assembled MK1U Variations

Non- Assembled ArduECU MK1U Overview

(ArduECU models: MK1U-01, MK1U-02)



Capability to hand-solder in components for adding XBee, RTC, SD card, or Accelerometer at a later time

Prototype Center with power and ground rails for adding custom circuits internallv underneath

Standard Arduino Uno Header Configuration (headers installed)

Breakout of all external header pins with removable jumpers (in case the user needs to modify an output for another purpose or does not want it connected to the Arduino Pin)

Figure 5. Internal Features (Top of Non Assembled Units)

ArduECU MK1U Variations

MK1U-01 Version: board pictured in Figure 5 above without supplied Uno

MK1U-02 Version: board pictured in Figure 5 above without supplied Uno and includes all hardware components to solder/assemble the unit yourself

ArduECU MK1U Variations Overview

As shown in the previous sections, the MK1U currently comes in 6 different versions that all vary on price, capability and options. Below outlines the model numbers, associated capabilities and possible intended usage examples for each.

Variant	Part Number	Notes	Intended Usage
MK1U-01	ST300-1105	No hardware is installed or included for RTC, SD Card, Reset, LED, XBee, or Accelerometer. **Only the connector faceplate and Arduino headers are pre-installed.**	This unit is great for extreme applications that might not require the additional hardware features out of the box, but they may be added long term. The user might add custom hardware internally via onboard Prototype Center. The user has an extreme application that requires added durability or water-resistance. **User will provide their own Arduino Uno board.**
MK1U-02	ST300-1106	**This is a DIY solder kit**. No hardware for RTC, SD Card, Reset, LED, XBee, Accelerometer, headers or connector faceplate is installed. **We supply the components, you assemble it yourself.**	This unit is great for extreme applications that might not require the additional hardware features out of the box, but they may be added long term. The user has good soldering skills and plans to assemble the custom hardware features manually. User may also add custom hardware internally via onboard Prototype Center. The user has an extreme application that requires added durability or water-resistance and might use the hardware features for XBee, RTC, SD, Accelerometer, etc. **User will provide their own Arduino Uno board.**
MK1U-03	ST300-1107	**This is a fully assembled unit**; which includes RTC, SD Card, Reset, LED, XBee, Accelerometer, headers and connector faceplate hardware pre-installed.	This unit is great for extreme applications that require the additional hardware features out of the box. User may also add custom hardware internally via onboard Prototype Center. The user has an extreme application that requires added durability or water-resistance and plans to use the hardware features for XBee, RTC, SD, Accelerometer, etc. **User will provide their own Arduino Uno board.**
MK1U-04	ST300-1108	**This is a fully assembled unit**; which includes RTC, SD Card, Reset, LED, XBee, Accelerometer, headers and connector faceplate hardware pre-installed. **Unit comes with installed Generic Arduino Uno board (non-authentic).**	This unit is great for extreme applications that require the additional hardware features out of the box. User may also add custom hardware internally via onboard Prototype Center. The user has an extreme application that requires added durability or water-resistance and plans to use the hardware features for XBee, RTC, SD, Accelerometer, etc. **We will provide Generic Arduino Uno board.**
MK1U-05	ST300-1109	**This is a fully assembled unit**; which includes RTC, SD Card, Reset, LED, XBee, Accelerometer, headers and connector faceplate hardware pre-installed. **Unit comes with installed genuine Arduino Uno board.**	This unit is great for extreme applications that require the additional hardware features out of the box. User may also add custom hardware internally via onboard Prototype Center. The user has an extreme application that requires added durability or water-resistance and plans to use the hardware features for XBee, RTC, SD, Accelerometer, etc. **We will provide Genuine Arduino Uno board.**
MK1U-06	ST300-1100	**This is a fully assembled unit**; which includes RTC, SD Card, Reset, LED, XBee, Accelerometer, headers and connector faceplate hardware pre-installed. **Unit comes with an installed and upgraded, extra Rugged Arduino board called RuggeDuino-- which is provided by Rugged Circuits, LLC.**	This unit is great for extreme applications that require the additional hardware features out of the box. User may also add custom hardware internally via onboard Prototype Center. The user has an extreme application that requires added durability or water-resistance and plans to use the hardware features for XBee, RTC, SD, Accelerometer, etc. **We will provide Rugged Circuits RuggeDuino board.**

Table 1. ArduECU MK1U Variations

ArduECU MK1U Housing Dimensions

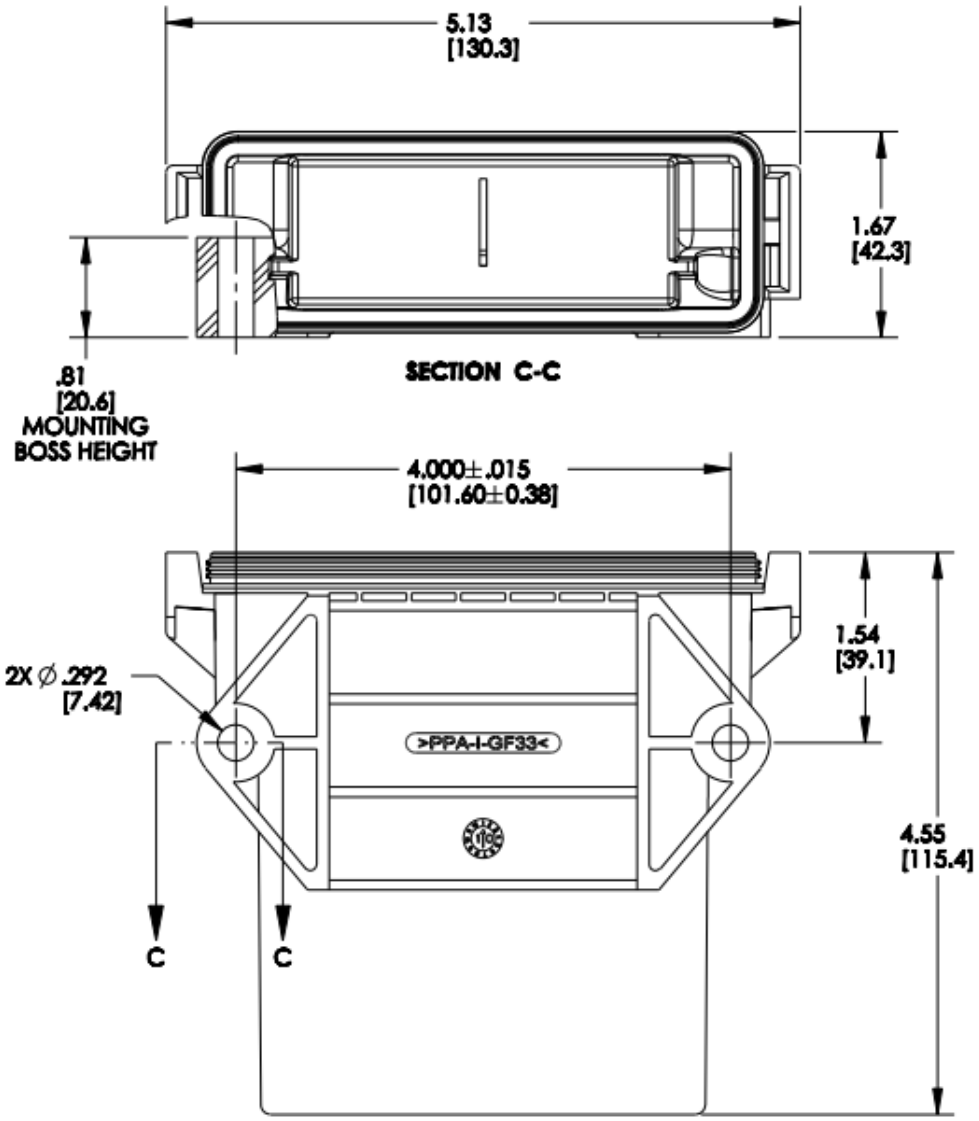


Figure 6. Enclosure Dimensions (in inches)

(Connector layout depicted may vary slightly from actual hardware)

Opening/Closing the ArduECU MK1U Housing:

In order to open the MK1U housing, you'll need to use the 3D printed housing opener tool.

Figure 7. Housing Opener Tool (PN: ST300-1008)

To Open the Housing:

1. To open the MK1U housing, simply slide thin portion of the tool into the slots on the front face of the connector plate where shown by arrows.

2. Press inward until locking tabs are released on both sides.

3. Carefully rock plastic housing back and forth and pull connector faceplate free from housing.

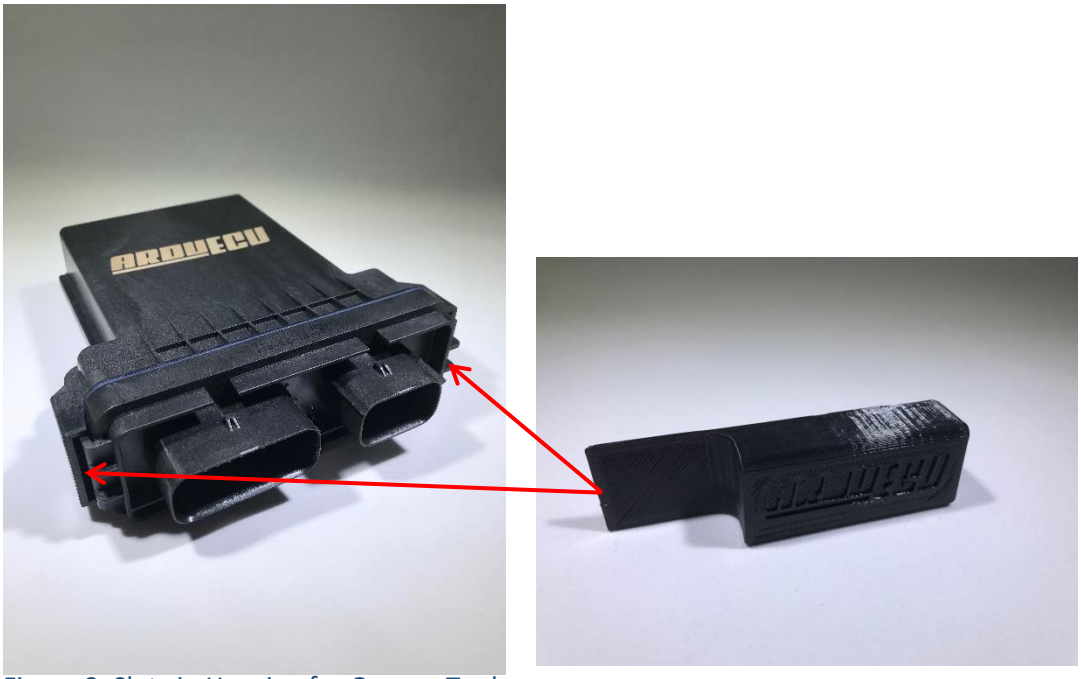


Figure 8. Slots in Housing for Opener Tool

To Close the Housing:

1. Simply slide PCBA into housing and line up locking tabs on connector faceplate with slots in housing.

2. Press firmly to lock both sides of housing in place.

ArduECU MK1 Connector Information:

In order to connect to ArduECU MK1U externally, you need wiring harnesses. Luckily, ArduECU MK1U uses standard Molex MX150 connectors which are readily available and very easy to work with. To make the process easy to integrate, we have harness kits available for purchase that are pre-terminated with 12” flying leads.

All you need to do is solder or splice in your required pins into the existing harness and you are good to go.

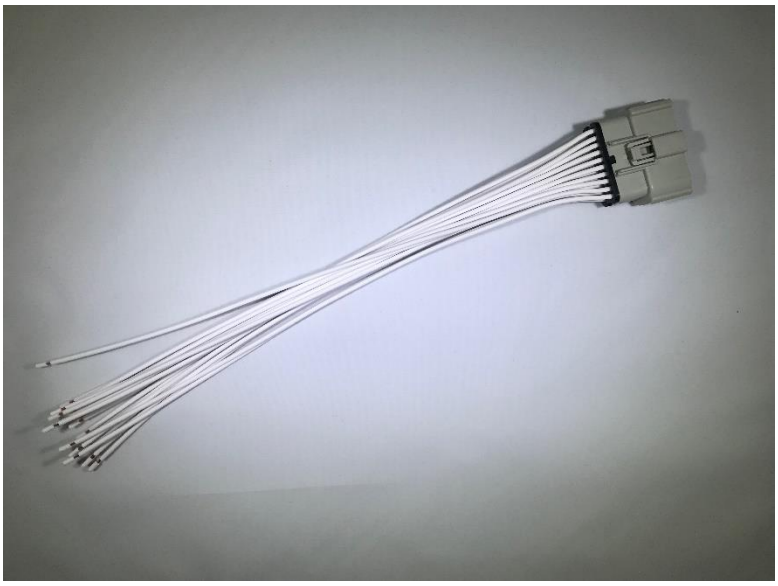


Figure 9. 20-Pin Mating Harness with 12” Flying Leads (PN: ST300-1102)

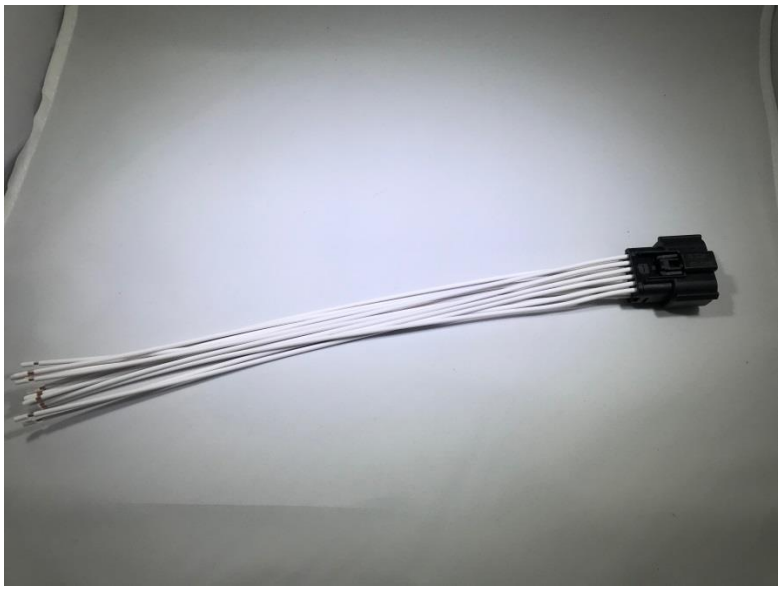


Figure 10. 12-Pin Mating Harness with 12” Flying Leads (PN: ST300-1103)

Figure 11. ArduECU Connector Set (PN: ST300-1104)

*Includes both connector harnesses and accessory kit)

ArduECU Accessory Kit:

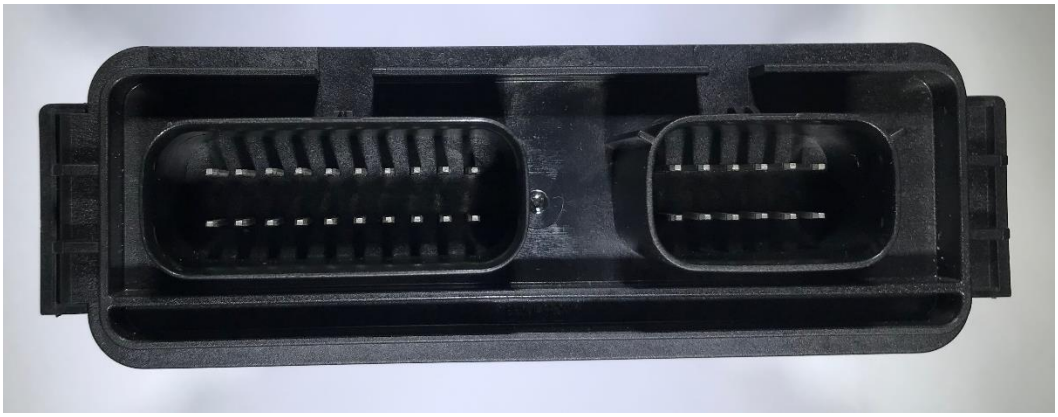
The ArduECU Accessory Kit contains the housing opener tool, solder splices and wire plugs to get you started working with ArduECU. Additional quantiles of each part are available for purchase, if necessary.

Figure 12. Accessory Kit (PN: ST300-1101)

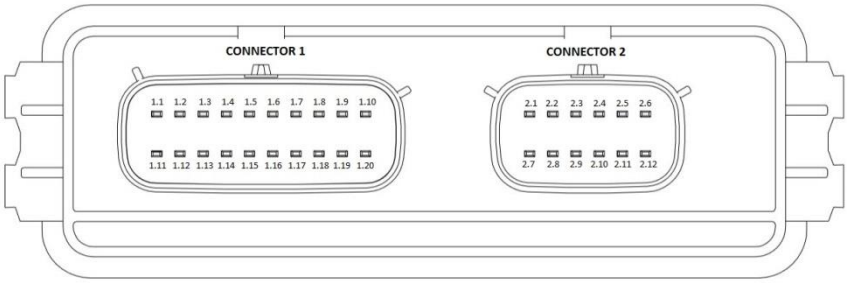
*Includes housing opener tool, connector plugs and solder splices

ArduECU MK1U Pinout:

The ArduECU MK1U pinout resembles something similar to that of the Arduino Uno. All associated Uno pins have been brought out to the external header-- so that way you can interface to sensors, power and other hardware externally without the need for going internal if you so desire.



ArduECU MK1U Pinout Rev A



Connector.Pin	Function
1.1	+5V
1.2	+3.3V
1.3	D7
1.4	D6
1.5	D5
1.6	D4
1.7	D3
1.8	D2
1.9	Tx
1.10	Rx
1.11	GND
1.12	SCL
1.13	SDA
1.14	D13
1.15	D12
1.16	D11
1.17	D10
1.18	D9
1.19	D8
1.20	+5V

Connector.Pin	Function
2.1	Vin
2.2	GND
2.3	GND
2.4	+5V
2.5	+3.3V
2.6	RESET
2.7	A0
2.8	A1
2.9	A2
2.10	A3
2.11	A4
2.12	A5

Figure 13. Connector Diagrams

Standard Arduino Uno Pinout:

ArduECU MK1U architecture is very familiar to you if you know the Arduino Uno. All associated pins and Uno hardware are compatible with ArduECU MK1U. Below is an Arduino Uno pinout diagram for reference; which defines the pinout and function of each pin.

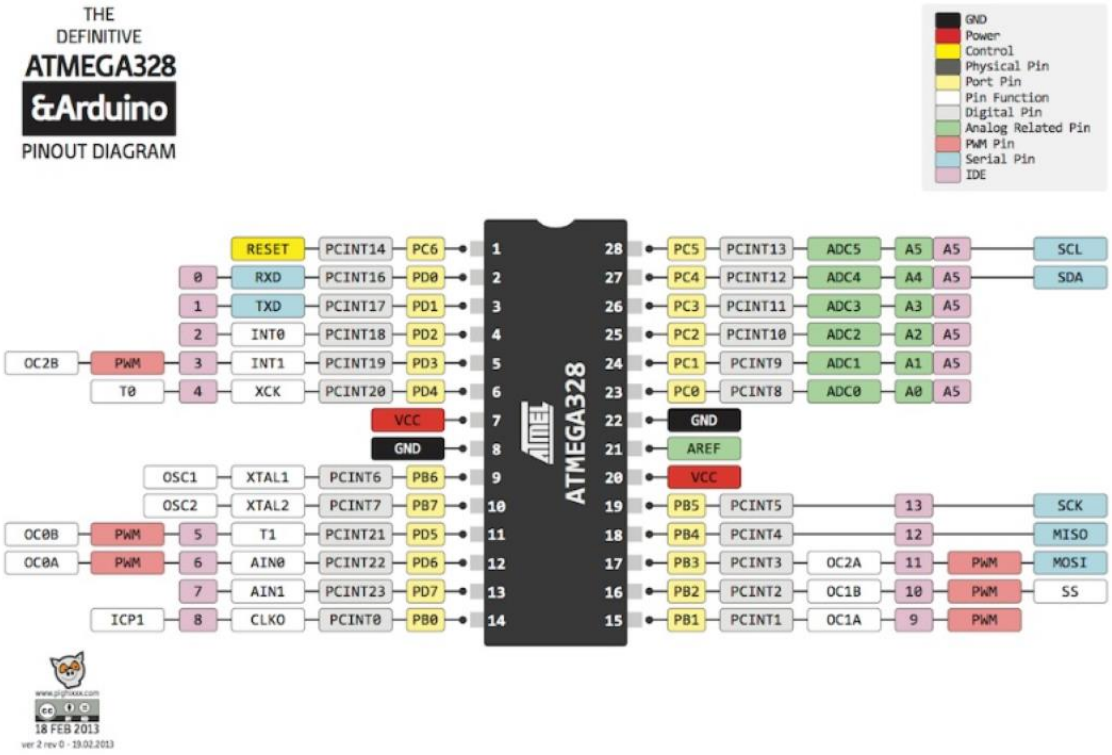


Figure 14. Pin Mapping (Arduino Uno shown for reference)

Schematics:

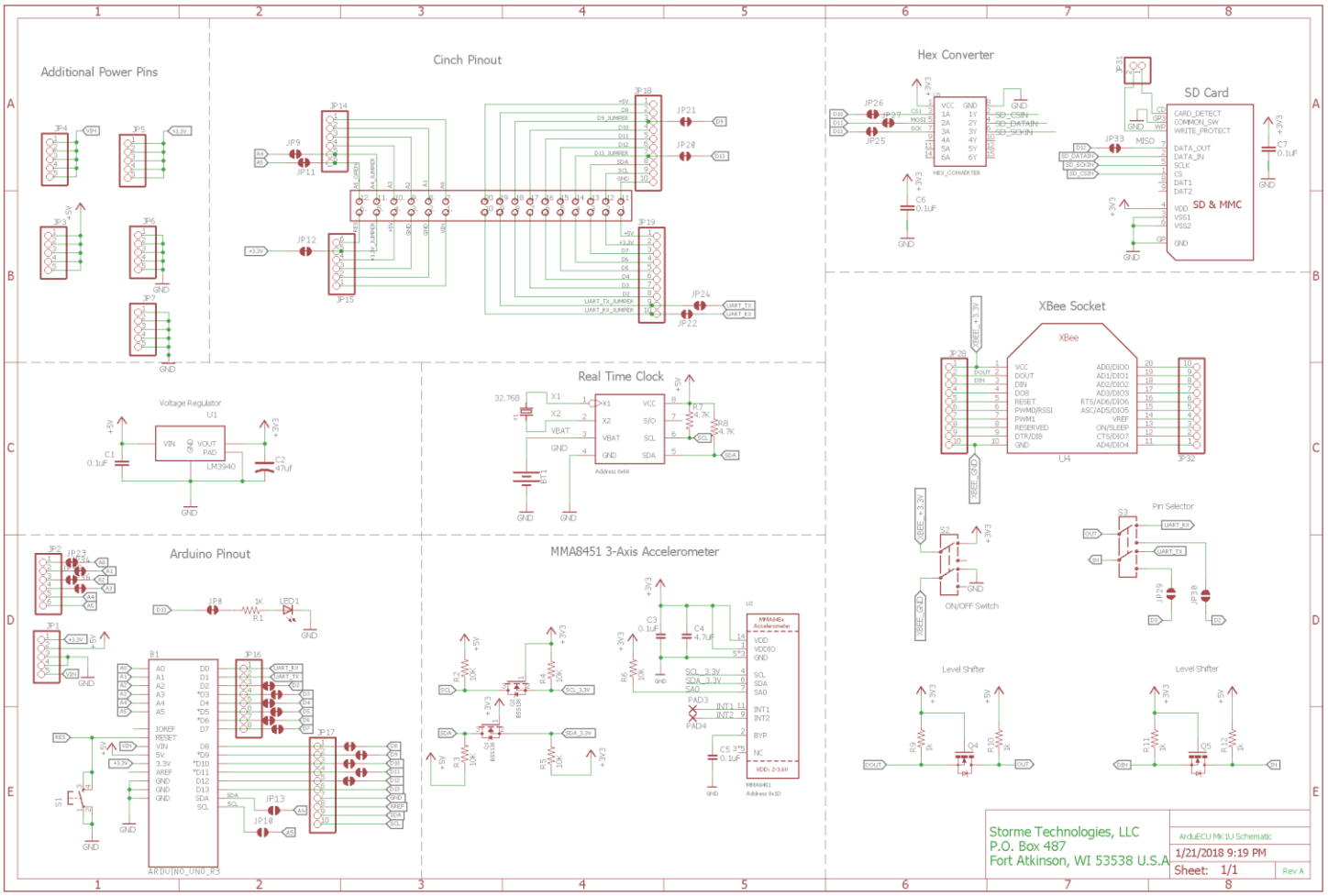


Figure 15. ArduECU MK1U Schematic

Jumper Settings

The board jumper settings and/or switches must be configured properly in order to utilize the RTC (Real Time Clock), SD Card, onboard LED, XBee, Accelerometer etc. Please refer to the schematics on Figure 15 for associated jumper changes needed to configure the hardware.

Programming

Since the ArduECU MK1U utilizes off the shelf Arduino Uno compatible boards, the standard Arduino IDE programming methodologies apply here when programming the unit. Please visit Arduino.cc for more information if you have questions about programming an Arduino.

Source Code and Libraries

Source code and libraries for the RTC, SD Card, onboard LED, XBee, Accelerometer etc., are fairly standard, as compared to other readily available hardware, but we do provide sample code and libraries for the RTC, SD card, onboard LED, XBee and Accelerometer to get you started. Please visit our website for download links.

Ordering Information:

Variant	Part Number	Pricing
MK1U-01	ST300-1105	$49
MK1U-02	ST300-1106	$69
MK1U-03	ST300-1107	$89
MK1U-04	ST300-1108	$104
MK1U-05	ST300-1109	$124
MK1U-06	ST300-1100	$158

Table 2. Ordering Information

Please visit www.shop.stormetech.com, or contact us by email or phone to place an order.

Spare Parts and Accessories:

Part Number	Description	Pricing
ST300-1101	Kit, ArduECU Accessory	$8.00
ST980-1010	Faceplate, ArduECU MK1 32 Position	$14.00
ST300-1024	Housing, ArduECU MK1 without Breather Vent	$14.00
ST300-1008	Tool, ArduECU MK1 Housing Opener	$3.00
ST300-1104	Kit, ArduECU Connector Set	$22.00
ST300-1010	Power Supply, 12VDC 2 Amp Indoor	$12.00
ST300-1009	Converter, Serial to USB	$18.00
ST980-1110	Card, 1GB SD Memory	$7.00

Table 3. Spare Parts and Accessories

Technical Support

We are here to support you regarding purchasing, testing, debugging, setup, programming, returns, RMA's etc. Please contact us with any questions!

Storme Technologies, LLC P.O. Box 487
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Phone: (920) 397-5208

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www.stormetech.com

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