



# Multi-Protocol USB Host Adapter

## Product Datasheet

Revision 1.2

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## 1 Key Features

- Support for SPI @ 12MHz max clock
- Support for I2C @ 3.4MHz max clock
- Support for UART @ 1000000 max baud
- Support for Dallas 1-Wire
- Support for Atmel Single-Wire Interface
- Provides 3v3 and  $V_{USB}$  power rails
- 1 x DAC Output, 5 x ADC Inputs
- GPIO / Interrupt / PWM Support
- Programmable RGB Status LED
- Field-Upgradeable Device Firmware
- Cross-platform Support for Windows, Mac, Linux
- Robust, low-profile Aluminum Enclosure
- USB Type-C Connector

## 2 Applications

- Firmware Development
- Proof of Concept Development
- System Debugging
- Automated Hardware Testing
- Automated Firmware Testing
- EEPROM Programming
- FLASH Programming
- FRAM Programming

## 3 Description

The Binho Multi-Protocol USB Host Adapter allows one to interface their computer directly to hardware circuits. This device is powered by the USB connection to the host PC and is also able to provide downstream power to test circuits.



The Binho Multi-Protocol USB Host Adapter features 5 signal pins, 1 x 3v3 pin, 1 x  $V_{USB}$  pin, and 3 x GND pins on its 10pin wire harness. The wire harness terminates with a female 1.27mm 2x5 IDC connector. In IO Mode, the 5 signal pins can be used for varying functions such as Digital Input, Digital Output, PWM Output, Digital Interrupt (on rising edge, falling edge, or change), Analog Input, or Analog Output.

Additionally, the host adapter is able to utilize these pins to communicate on several digital buses: I2C, SPI, UART, (Dallas)1-Wire, and (Atmel) Single-Wire Interface. While in these modes of operation, remaining available pins can be assigned to other related or unrelated purposes such as gpio, interrupts, chip selects, PWM signals, or analog input or outputs.

The Binho Multi-Protocol USB Host Adapter is ideal for manual testing during firmware development and debugging as well as a perfect way to automate hardware testing and validation. A common use-case of this product in production environments is for EEPROM/Flash Memory programming along with functional testing activities.

## 4 Included Components

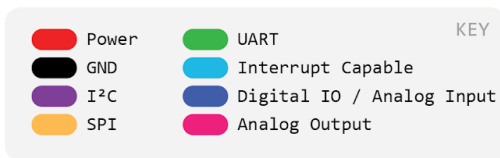
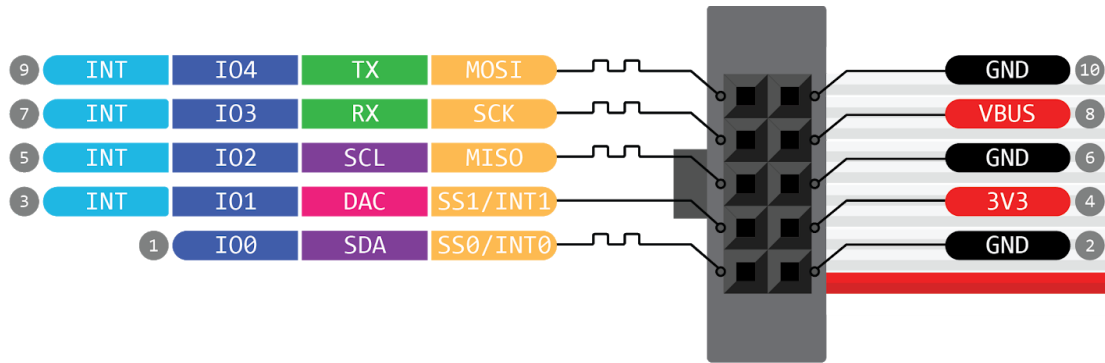
The Binho Multi-Protocol USB Host Adapter comes along with a Breadboard Breakout Adapter and 1 foot USB type C (male) to type A (male) cable in a soft-shell zippered case.



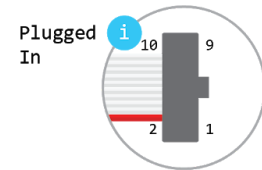
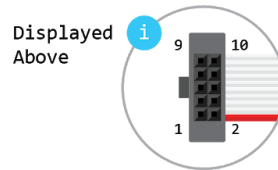
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## 6 Pin Configuration



 PWM Capable



 **Absolute** MAX per pin 10mA

 GPIO pins rated for 3.3V **Never** connect them to 5V signals

**VBUS** Connected to 5V USB Port **Absolute** MAX 200mA

**3V3** 3V3 output from regulator **Absolute** MAX 100mA

Pin Name	Pin Number	Pin Function(s)
I00	1	SDA (I2C), Digital In, Digital Out, Analog In, PWM
I01	3	Digital In, Digital Out, Analog In, Analog Out, Interrupt
I02	5	MISO (SPI), SCL (I2C), Digital In, Digital Out, Analog In, Interrupt, PWM
I03	7	SCK (SPI), RX (UART), Digital In, Digital Out, Analog In, Interrupt, PWM
I04	9	MOSI (SPI), TX (UART), Digital In, Digital Out, Analog In, Interrupt, PWM
3V3	4	3.3V power rail
5V / V <sub>USB</sub>	8	V <sub>USB</sub> (typically 5V) power rail
GND	2, 6, 10	Ground connection

**Note:**

Dallas 1-WIRE and Atmel SWI (Single-Wire Interface) protocol can be configured to work with any of the five IO pins. It is especially convenient to use with IO0 or IO2 as it's possible to engage a suitable internal pull up resistor on these channels.

## 7 Electrical Specifications

### 7.1 Absolute Maximum Ratings

Parameter	Min	Max	Unit
3v3 Rail Current		100	mA
5V / $V_{USB}$ Rail Current		200	mA
IO pin Current		10	mA
IO pin Voltage	-0.3	3.6	V
Operating Temperature	-25	85	°C

### 7.2 ESD Rating

The Binho Multi-Protocol USB Host Adapter features IEC-61000-4-2 Level 4 ESD protection up to +/- 15KV contact and air discharge.

### 7.3 Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit
3v3 Rail Current		50		mA
5V / $V_{USB}$ Rail Current		100		mA
IO pin Current		2	7	mA
IO pin Voltage	0		3.3	V
Operating Temperature	0	25	80	°C

## 7.4 Electrical Characteristics

Parameter	Min	Typ	Max	Unit
$V_{IL}$ Input low-level Voltage			1.00	V
$V_{IH}$ Input high-level Voltage	1.82			V
$V_{OL}$ Output low-level Voltage		0.3	0.6	V
$V_{OH}$ Output high-level Voltage	2.64	2.97		V
ADC Resolution			12	bits
DAC Resolution			10	bits

## 7.5 RoHS Compliance

The Binho Multi-Protocol USB Host Adapter is compliant to RoHS Directive 2011/65/EU of the European Parliament and the Council from 08/06/2011 on restriction of the use of certain hazardous substances in electrical and electronic appliances.

## 8 Application Information

### \*\*\*NOTICE\*\*\*

The best source of the latest and most up-to-date information regarding the features of this product and the very specifics of how to operate the device can be found on our customer support portal. This support portal features a full set of comprehensive documentation and can be found at <https://support.binho.io>. More details on all of the items below can be found in the support portal.

### 8.1 Device Firmware Update

The Binho Multi-Protocol USB Host Adapter features field-upgradeable firmware over USB. This allows for new features to be developed and released to all devices, such as support for new protocols.

### 8.2 Cross-Platform Support

The Binho Multi-Protocol USB Host Adapter works well on all modern PC operating systems, such as Windows, Mac OS, and Ubuntu (Linux). One way in which this is achieved is by implementing the USB connection as a CDC (Virtual COM Port) device, and as a mass-storage device while performing a firmware update. This means there is no need to install custom device drivers, allowing the device to be used on any operating system which provides a system driver for these device classes. Additionally, numerous examples and tools are provided as open-source python scripts which can be run on any platform.

### 8.3 ASCII Command Set

The Binho Multi-Protocol USB Host Adapter is controlled via a human-readable ASCII command set. The commands and responses were intelligently designed for easy use via manual entry in a serial console program and at the same time are robust enough for effective automation.

### 8.4 Multi-Adapter/Gang-able Operation

Binho Multi-Protocol USB Host Adapters can be operated in gang-able fashion with many units connected to the same host PC. This allows for making complicated automated test fixtures or custom gang programming stations a breeze. Many examples exist demonstrating how easy it is to work with multiple devices.

### 8.5 Programmable RGB Status LED

The Binho Multi-Protocol USB Host Adapter features a programmable RGB status LED. This can be used to distinguish a certain adapter when used in a multi-adapter setup/test fixture, to indicate that a particular part of the test script is being performed, or anything else you can imagine.

## 8.6 Digital IO

Each of the five IO pins on the Binho Multi-Protocol USB Host Adapter can be used as a digital input or digital output pin. Some pins also feature the ability to operate as an interrupt pin, which can be configured to fire on rising edge, falling edge, or both. Furthermore, some pins also feature the ability to provide a PWM output.

## 8.7 Analog IO

Each of the five IO pins on the Binho Multi-Protocol USB Host Adapter can be used as an analog input pin. These pins go to a 12-bit ADC ( $V_{REF}=3.3V$ ). Please note that the ADC is not calibrated, and this functionality is not meant to serve as an oscilloscope or other precise piece of analog test equipment. It is not characterized for performance on AC signals and should be considered suitable for measurement of  $\sim DC$  signals. Additionally, there is one pin that is capable of generating an analog output signal from the internal 10-bit DAC.



## 9 Supported Protocols

### \*\*\*NOTICE\*\*\*

The best source of the latest and most up-to-date information regarding the supported protocols and the very specifics of how to use them can be found on our customer support portal. This support portal features a full set of comprehensive documentation and can be found at <https://support.binho.io>. More details on all of the items below can be found in the support portal.

### 9.1 I2C Protocol

The Binho Multi-Protocol USB Host Adapter supports communication as an I2C Master device. Support for I2C Slave device is coming soon. The I2C CLK frequency is programmable from 100kHz to 3.4MHz in 1kHz steps. The device also features internal 2.2kOhm pull-up resistors on the SCL and SDA signals which can be programmatically engaged/disengaged as desired. While working as an I2C Master, it's possible to use the other 3 available pins as desired. Support for I2C Slave operation is coming soon and will be made available to all existing devices via firmware update.

### 9.2 SPI Protocol

The Binho Multi-Protocol USB Host Adapter supports communication as a SPI Master device. Support for SPI Slave device is coming soon. The SPI SCL frequency is programmable from 1MHz to 12MHz in 1kHz steps. While working as an SPI Master, it's possible to use the available pins for either 1) CS pin and INT pin, 2) CS0 pin and CS1 pin to support communication with 2 SPI Slave Devices, or 3) any combination of CS, INT, or other available pin function. Support for SPI Slave operation is coming soon and will be made available to all existing devices via firmware update.

### 9.3 UART Protocol

The Binho Multi-Protocol USB Host Adapter supports communication as a UART pass-through, supporting baud rates up to 1000000bps. This allows communication over the Virtual COM port as if it were a typical USB to UART adapter. Note that the use of hardware flow control (CTS/RTS signals) is not supported. While working in UART mode, it's possible to use the other 3 available pins as desired.

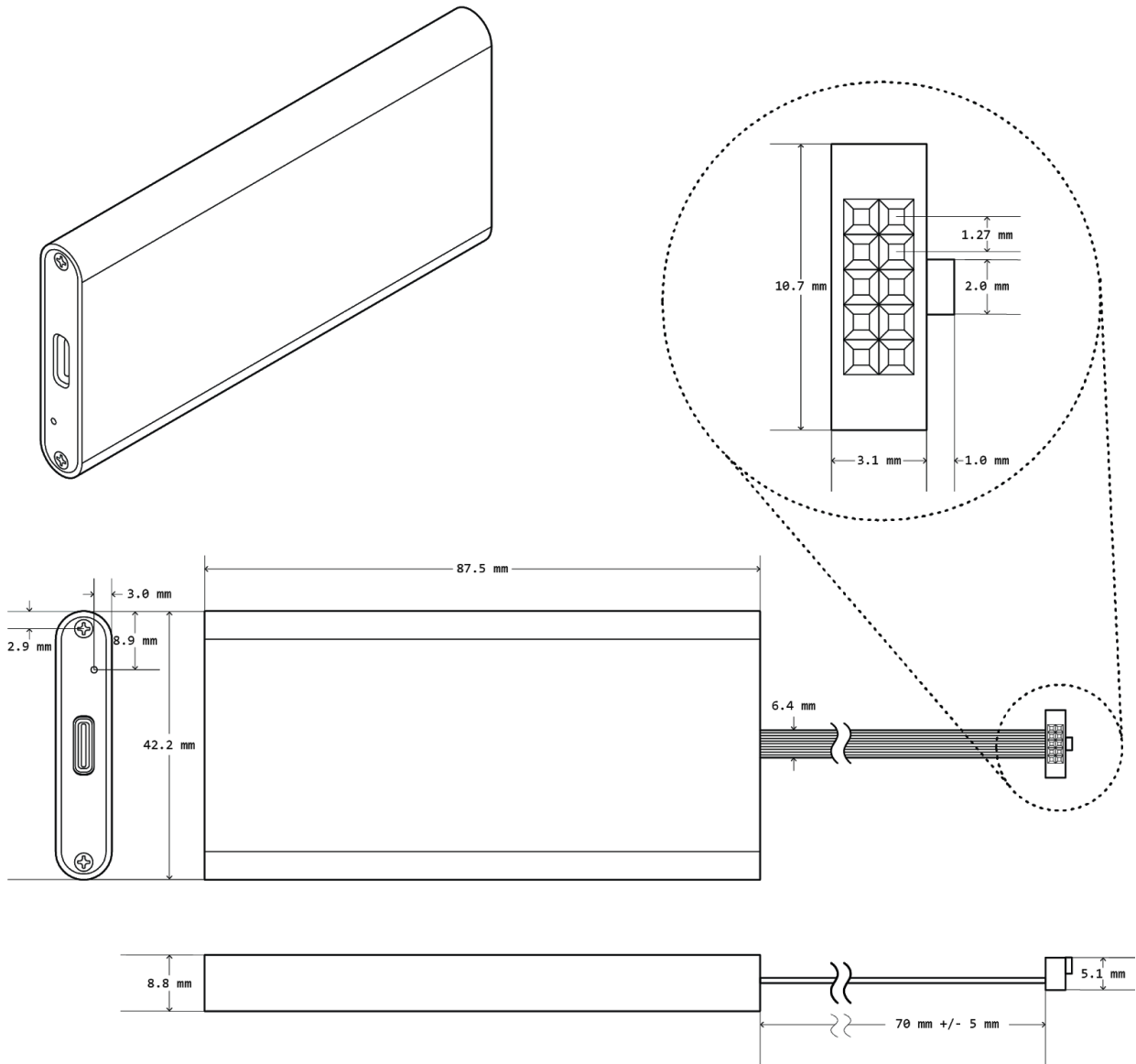
### 9.4 1-WIRE Protocol

The Binho Multi-Protocol USB Host Adapter supports communication as a Dallas 1-WIRE Master device. This protocol can be configured to work on any of the five IO pins. It is especially convenient to use with IO0 or IO2 as it's possible to engage a suitable internal pull up resistor on these channels, eliminating the need for an external resistor. Support for 1-WIRE Slave device is coming soon and will be made available to all existing devices via firmware update.

## 9.5 Single-Wire Interface Protocol

The Binho Multi-Protocol USB Host Adapter supports communication as an Atmel SWI (Single-Wire Interface) Master device. This protocol can be configured to work on any of the five IO pins. It is especially convenient to use with IO0 or IO2 as it's possible to engage a suitable internal pull up resistor on these channels, eliminating the need for an external resistor.

# 10 Mechanical Drawing



**Binho Multi-Protocol USB Host Adapter Dimensioned Drawing**

## 11 Revision Log

Rev	Description of Changes	Date
1.0 [Draft]	Initial Draft	4/24/19
1.1	Added figures and missing values. Updated Max I2C CLK Frequency to 3.4MHz	6/11/19
1.2	Updated Mechanical Drawing To Improve Clarity	6/23/19

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