

Requirements for The Data Logger

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This document specifies the requirements for project codename “Log ALL The Bits!” (hereafter AllBits for short). This should be considered a living document and the requirements herein should be revised as the project takes shape with permission of Dr. Surly and his team of Senior Mad Scientists.

AllBits shall be a portable data logger. As such, it should have the ability to log data live over a USB port or record a block of information to later be transferred to software via USB. Dr. Surly is considering adding the ability to communicate over TCP/IP in addition to USB.

What is Logged

AllBits shall have the ability to record digital and analog data simultaneously. It shall support up to 6 channels of each, though the user should be able to specify which (if any) analog channels are being actively recorded. An optional low-pass filter shall be configurable for the Analog inputs.

Similarly, AllBits should be able to “listen” to various communication buses and record the data that it records. These communication methods are as follows, ranked roughly by priority:

- UART
- I2C (future)
- SPI (future)
- CAN (future)
- USB (future, device-only)

AllBits shall support as many channels of each communication method as possible given our hardware constraints. The ability to support up to 3 UART's is one of the reasons we selected this hardware.

Up to 4096 bytes of data shall be stored when logging (configurable by the user). This space is shared by whichever digital, analog, and communication bits have been enabled (also configurable by the user).

The rate at which the data is recorded shall also be configurable by the user and should be settable between a “data point” every 5 msec to 10 seconds. A “data point” is a single capture of all digital and analog channels, plus whatever the enabled communication channels have recorded during that same window.

What Triggers a Log

AllBits is designed to be used with or without a live connection to software. When connected, it should support the ability to trigger a measurement from the software. In either situation, it shall also support the ability to be configured to trigger based on any of the following situations:

- When a digital bit or bits reach a specific state
- When a digital bit or bits change
- When a digital bit or bits have gone through a specific sequence of states
- When a certain amount of time has elapsed
- When an analog channel is above or below a particular threshold
- When a comm channel receives a particular sequence of bytes

Communication with Software

The data format used should be compatible with Dr. Surly's standard communication protocol, MADBus. This can be applied to both the USB and TCP/IP interfaces. The document "LogAllTheBits Command Specification" reviews this protocol and proposes a command set which follows the standard. It shall be considered part of this spec.

The data parser software that will be communicating with AllBits uses the MessagePack standard to encode results. To simplify parsing, the command protocol has been implemented to output MessagePack format within the standard MADBus frame when reporting results. This is also described in greater detail in the command specification.

It is recognized that the amount of data being handled for this feature will result in packets which are greater than the standard 0-9 nibble pairs described in MADBus, therefore we will be extending the protocol to support A-Z, representing 10 to 35 nibble pairs. This increased packet size should be sufficient to allow us to return a complete "data point" of digital, analog, and comm data captured at once.

Operation Requirements

The recorded data need not survive a power loss condition. Therefore we shall be storing all data in onboard RAM. The system is not required to know the actual date/time, but should be capable of tracking the number of milliseconds elapsed since reset and/or software-commanded clear. All parameters should be able to be reset to defaults on command. All captured data should be erased with the same command.

Status Indicators

As a device which supports standalone operation, AllBits shall have a series of LED indicators to communicate status back to the user. These indicators shall be used at all times. There shall be four status indicators which should be displayed as follows:

	Blink	Solid
LED1 - ARM status	Waiting to be Armed	Armed
LED2 - Trigger status	Waiting to be Triggered	Triggered
LED3 - Capture status	Capturing	Captured
LED4 - Data Available	Data Available	n/a

The status indicators also support the ability to communicate an error state:

	LED1	LED2	LED3	LED4
ERROR	Blink	Off	Off	Blink

