WOWL  
Interface Control Document

# Introduction

The WOWL is a submersible temperature and pressure sensor and data logger. When on the surface, it provides communication via a Bluetooth interface. This document describes that interface.

## CRC32

This technology makes use of the CRC32 algorithm in several places. This is based on the implementation given in the PNG standard:

<https://www.w3.org/TR/PNG/#D-CRCAppendix>

# WOWL Service

The WOWL device provides the WOWL service, on UUID 0x3090. At this time, the service provides eight characteristics.

## Pressure Offset, in Millibars (0x3091)

This 8-bit unsigned value is added to the pressure measurement. It can be used to trick the WOWL into thinking it is submerged, which is useful in generating records for testing. NOTE: at this time, the radio stays on while the device is submerged. When this is not the case, this characteristic will be removed, so as to prevent the device from becoming incommunicative forever.

## Record Count (0x3092)

This field returns the number of records stored in non-volatile memory, as a u16.

## Measurement Results (0x3093)

If the host device registers for notifications on this UUID, it will receive the incoming data at a rate of once per 10 seconds when the device is surfaced, and neither downloading or erasing data. All data are in LSB. See Table 1. The data will come in chunks of 20 bytes each, padded with zeros as needed.

|  |  |  |
| --- | --- | --- |
| Table . WOWL Measurement Data Format | | |
| Data Item | Format | Units |
| Measurement Count | u32 | Measurements |
| Status | u32 | See Table 2 |
| Reserved | u32 | N/A |
| Charging Voltage | f32 | volts |
| Charging Current | f32 | amps |
| Rectified Charging Coil Voltage | f32 | volts |
| Battery Voltage | f32 | volts |
| CPU Temperature | f32 | °C |
| Temperature via NTC | f32 | °C |
| Temperature via RTD | f32 | °C |
| Temperature from SI7051-A20-IMR Digital Temperature Sensor | f32 | °C |
| Pressure | f32 | mbar |
| Temperature from Pressure Sensor | f32 | °C |
| Temperature of NTC ADC | f32 | °C |
| Temperature of RTD ADC | f32 | °C |
| CRC32 of fields above | u32 | N/A |
| **Characteristic Length** | **64 bytes** | **--** |

**NOTE:** Be sure to de-register the notifications before disconnecting.

|  |  |
| --- | --- |
| Table . WOWL Status Bitfield | |
| Bit | Meaning if Set |
| 0 | Charging |
| 1-7 | RESERVED |
| 8 | Firmware Operation Complete |
| 9 | Firmware Operation Failed |
| 10-15 | RESERVED |
| 16 | Connected to BLE |
| 17 | Advertising for BLE |
| 18-22 | RESERVED |
| 23 | Last Command Unsupported |
| 24 | Flash Failure |
| 25 | SI7051 Temperature Sensor Failure |
| 26 | Spurious I²C Event |
| 27 | Pressure Sensor Failure |
| 28-31 | RESERVED |

## Record Download Request (0x3094)

This characteristic specifies which records are transmitted when a download is requested.

|  |  |  |
| --- | --- | --- |
| Table . WOWL Download Request | | |
| Field | Format | Units |
| Offset | u16 | Records |
| Count | u16 | Records |
| **Characteristic Length** | **4 bytes** | **--** |

## Record Download Data (0x3095)

This characteristic receives the downloaded records, if set to transmit notifications.

|  |  |  |
| --- | --- | --- |
| Table . WOWL Download Data | | |
| Data Item | Format | Units |
| Record Index | u16 | Records |
| Record Status | u16 | See Table 5 |
| Record Data | SAMPLE | See Table 1 |
| **Characteristic Length** | **68 bytes** | **--** |

The ‘Record Status’ field contains the result of the record retrieval process.

|  |  |
| --- | --- |
| Table . WOWL Record Read Error Codes | |
| Code | Description |
| 0 | No Error |
| 1 | Device Error |
| 2 | Record is Blank |
| 3 | CRC Mismatch |
| 4-65535 | RESERVED |

Note that the CRC field of the Record Data does **not** include the Record Index or Record Status fields.

## Commands (0x3096)

This u8 characteristic receives user commands. **It must be written with the WriteCharValue GATT operation, not WriteLongCharValue.** The commands are queued, and will only take effect when the device is at standby (i.e., not busy or submerged). The exception is the RESET command which takes effect immediately.

|  |  |
| --- | --- |
| Table . WOWL Commands | |
| Code | Description |
| 0 | RESERVED |
| 1 | Commence Download |
| 2 | Start Erasure of Records |
| 3 | Reset Processor |
| 4 | DFU Setup |
| 5 | DFU Write |
| 6 | DFU Reprogram |
| 7-255 | RESERVED |

## DFU Setup (0x3097)

This characteristic is used to inform the WOWL about an upcoming firmware upgrade. The fields are given below.

|  |  |  |
| --- | --- | --- |
| Table . WOWL DFU Setup Fields | | |
| Data Item | Format | Units |
| Firmware Length | u32 | Bytes |
| CRC32 | u32 | N/A |
| **Characteristic Length** | **8 bytes** | **--** |

## DFU Data (0x3098)

This characteristic is used to store blocks of the firmware file, for commit by the device to program memory. The entire block should be used.

# Stored Data Download Procedure

Here are the steps to download data from the WOWL.

1. Determine the appropriate number of records to download per request. A number smaller than “all of them” may be more robust. The author has tested up to 16.
2. Connect to the device.
3. Consult the Record Count characteristic.
4. Set the Record Download Request characteristic with the offset (initially zero) and count (determined in step 0, trimmed to the value in step 2).
5. Request notifications for the Record Download Data characteristic.
6. Set the Command characteristic to 1.
7. Repeat steps 3 through 5, increasing the offset appropriately each iteration. If data does not match the provided checksum, or the Record Index falls out of synchronicity, request that record again with a side request for that offset, count of one.
8. Cancel notifications of the Record Download Data characteristic.
9. Disconnect from the device.

# Device Firmware Update (DFU) Procedure

Enumerated below are the suggested steps for reprogramming the WOWL.

1. Connect to the device.
2. Update the DFU Setup characteristic with the size of the firmware and its CRC32.
3. Send the DFU Setup command.
4. Wait one second for the device to erase the temporary storage area.
5. Write the first data block to the DFU Data characteristic.
6. Send the DFU Write command.
7. Repeat steps 5 and 6 until all the firmware is written.
8. Send the DFU Reprogram command. If successful, the device will reset itself and the Bluetooth connection will be severed.
9. After a short wait the device will be available for reconnection.
10. The ‘Firmware Revision String’, part of the Device Information Service, at UUID 0x2A26, will contain the software build date and time.