MetaWatch Remote Message Protocol



# Contents

[1 Contents 2](#_Toc305396274)

[2 Introduction 3](#_Toc305396275)

[3 Revision History 3](#_Toc305396276)

[4 Packet Format 4](#_Toc305396277)

[4.1 CRC Generation 4](#_Toc305396278)

[5 Message Definitions 5](#_Toc305396279)

[5.1 Get Device Type (0x01) 5](#_Toc305396280)

[5.2 Get Device Type Response (0x02) 5](#_Toc305396281)

[5.3 Get Information String (0x03) 6](#_Toc305396282)

[5.4 Get Information String Response (0x04) 6](#_Toc305396283)

[5.5 Diagnostic Loopback (0x05) 6](#_Toc305396284)

[5.6 Write OLED Buffer (0x10) 6](#_Toc305396285)

[5.7 Change Mode – OLED only (0x12) 7](#_Toc305396286)

[5.8 Write OLED Scroll Buffer (0x13) 8](#_Toc305396287)

[5.9 Advance Watch Hands (0x20) 8](#_Toc305396288)

[5.10 Set Vibrate Mode (0x23) 8](#_Toc305396289)

[5.11 Set Real Time Clock (0x26) 9](#_Toc305396290)

[5.12 Get Real Time Clock (0x27) 9](#_Toc305396291)

[5.13 Get Real Time Clock Response (0x28) 9](#_Toc305396292)

[5.14 Nval Operation (0x30) 9](#_Toc305396293)

[5.15 Nval Operation Response (0x31) 10](#_Toc305396294)

[5.17 Status Change Event (0x33) 12](#_Toc305396295)

[5.18 Button Event Message (0x34) 12](#_Toc305396296)

[5.19 General Purpose Phone Message (0x35) 13](#_Toc305396297)

[5.20 General Purpose Watch Message (0x36) 13](#_Toc305396298)

[5.21 Write LCD Buffer (0x40) 13](#_Toc305396299)

[5.22 Configure LCD Idle Buffer Size (0x42) 13](#_Toc305396300)

[5.23 Update LCD Display (0x43) 14](#_Toc305396301)

[5.24 Load Template –LCD only (0x44) 14](#_Toc305396302)

[5.25 Enable Button (0x46) 14](#_Toc305396303)

[5.26 Disable Button (0x47) 15](#_Toc305396304)

[5.27 Battery Configuration Message (0x53) 15](#_Toc305396305)

[5.28 Low Battery Warning Message (0x54) 15](#_Toc305396306)

[5.29 Low Battery Bluetooth off Message (0x55) 16](#_Toc305396307)

[5.30 Read Battery Voltage Message (0x56) 16](#_Toc305396308)

[5.31 Read Battery Voltage Response (0x57) 16](#_Toc305396309)

[5.32 Read Light Sense Message (0x58) 16](#_Toc305396310)

[5.33 Read Light Sensor Response Message (0x59) 17](#_Toc305396311)

# Introduction

This protocol provides the serial message format for the MetaWatch project.

# Revision History

|  |  |  |
| --- | --- | --- |
| Revision | Details | Date |
| 1.0 | Original Release | October 3, 2011 |
| 1.0.1 | Redefine Button Event Message (0x34) payload to include same set of info as that of Enable Button (0x46). | June 11, 2012 |
| 1.0.2 | Add a nval identifier “language” to support local “day of week” format | June 18, 2012 |
| 1.0.3 | Add two parameters: start row and number of rows to “Update LCD Display” (0x43). | June 28, 2012 |

# Packet Format

Messages are sent using the Bluetooth Serial Port Profile. Most messages originate from the phone but the watch can also send messages. For this system the message size is limited to 32 bytes. The minimum message length is 6 bytes. Therefore 6 >= n <= 32.

|  |  |  |  |
| --- | --- | --- | --- |
| Packet Format | | | |
| 0 | Start Byte | 0x01 | This is the ASCII start of frame. |
| 1 | Length Byte | 6-32 | Length of the packet including overhead bytes and CRC. |
| 2 | Message Type | - | The message types are defined in the following section |
| 3 | Options | - | Additional options for the message. Set to 0x00 when not used. |
| 4:n | Data | - | Variable Length Payload |
| n+1:n+2 | CRC | - | The CRC is a 16 bit value. The least significant byte is sent first. |

## CRC Generation

The phone must generate the CRC that matches the MSP430. It uses CRC-CCITT with a starting value of 0xFFFF with reverse input bit order. For example, the Get Device Type message is: 0x01, 0x06, 0x01, 0x00, 0x0B, 0xD9. The CRC is 0xD90B.

# Message Definitions

|  |  |  |
| --- | --- | --- |
| Message Type | Code | Source |
| Get Device Type | 0x01 | Phone |
| Get Device Type Response | 0x02 | Watch |
| Get Information String | 0x03 | Both |
| Get Information String Response | 0x04 | Both |
| Diagnostic Loopback | 0x05 | Both |
| Write OLED Buffer | 0x10 | Phone |
| Change OLED Mode | 0x12 | Phone |
| Write OLED Scroll Buffer | 0x13 | Phone |
| Advance Watch Hands | 0x20 | Phone |
| Set Vibrate Mode | 0x23 | Phone |
| Set Real Time Clock | 0x26 | Phone |
| Get Real Time Clock | 0x27 | Both |
| Get Real Time Clock Response | 0x28 | Both |
| Nval Operation | 0x30 | Phone |
| Nval Operation Response | 0x31 | Phone |
| Status Change Event | 0x33 | Watch |
| Button Event Message | 0x34 | Watch |
| General Purpose Phone Message | 0x35 | Watch |
| General Purpose Watch Message | 0x36 | Phone |
| Write LCD Buffer | 0x40 | Phone |
| Configure LCD Idle Buffer Size | 0x42 | Phone |
| Update LCD Display | 0x43 | Phone |
| Load Template (LCD only) | 0x44 | Phone |
| Enable Button | 0x46 | Phone |
| Disable Button | 0x47 | Phone |
| Battery Configuration Message | 0x53 | Phone |
| Low Battery Warning Message | 0x54 | Watch |
| Low Battery Bluetooth off Message | 0x55 | Watch |
| Read Battery Voltage Message | 0x56 | Phone |
| Read Battery Voltage Response | 0x57 | Phone |
| Read Light Sense Message | 0x58 | Phone |
| Read Light Sensor Response Message | 0x59 | Phone |

## Get Device Type (0x01)

This command is used to query the type of watch that is connected.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0:n | Reserved |  |  |

## Get Device Type Response (0x02)

This message is a response from the watch to the phone.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Device Type | 0 | Reserved |
| 1 | Analog Watch |
| 2 | Digital Watch |
| 3 | Digital Development Board |
| 4 | Analog Development Board |
| 5-255 | Reserved |

## Get Information String (0x03)

This command is reserved for future use.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | String Select | 0-255 | Reserved |

## Get Information String Response (0x04)

This command is reserved for future use.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | String Select | 0-255 | Reserved |
| 1:n | String Response | 0-255 | A null terminated string of characters. |

## Diagnostic Loopback (0x05)

The message from the phone is routed directly back to the phone by the watch.

## Write OLED Buffer (0x10)

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:3 | Mode Select | 0 | Idle |
| 1 | Application |
| 2 | Notification |
| 3-15 | Reserved |
| 4:6 | Page Control | 0 | No Action |
| 1 | Invalidate Page |
| 2 | Invalidate and Clear Page |
| 3 | Invalidate and Fill Page |
| 4 | Activate page (validates page also) |
| 5-7 | Reserved |
| 7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Buffer Select | 0 | Top Page #1 |
| 1 | Bottom Page #1 |
| 2 | Top Page #2 |
| 3 | Bottom Page #2 |
| 1 | Column Index | 0-79 | Top Row |
| 80-159 | Bottom Row |
| 2 | Size | 0-23 | Size of the item in bytes |
| 3:n | Data | 0-255 | Pixel Data |

Only the idle mode contains buffers for the top and bottom page #2. When any byte in a page is written the page is validated. If a page is invalid then it will not be displayed when in idle mode and the middle button is pressed. When the phone wishes to display a page it should set the activate page control bits in the final command it sends.

Scroll control is only valid for the Bottom Page #1 in Notification mode.

If a page is activated and the current mode is not active then the current mode will be changed before displaying the page.

Each display consists of two rows of 80 characters.

|  |  |  |  |
| --- | --- | --- | --- |
| **Page** | **Page Address** | **Rows** | **Row Index** |
| Top Page #1 | 0 | Top Row | 0-79 |
| Bottom Row | 80-159 |
| Bottom Page #1 | 1 | Top Row | 0-79 |
| Bottom Row | 80-159 |
| Top Page #2 | 2 | Top Row | 0-79 |
| Bottom Row | 80-159 |
| Bottom Page #2 | 3 | Top Row | 0-79 |
| Bottom Row | 80-159 |

OLED pixel structure is as follows.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Row 0 | Byte 0, Bit 7 | Byte 1 | Byte … | Byte 79 |
| Byte 0, Bit 6 |  |  |  |
| Byte 0, Bit … |  |  |  |
| Byte 0, Bit 0 |  |  |  |
| Row 1 | Byte 80, Bit 7 |  |  | Byte 159, Bit 7 |
|  |  |  |  |
|  |  |  |  |
| Byte 80, Bit 0 |  |  | Byte 159, Bit 0 |

## Change Mode – OLED only (0x12)

Change the mode of the watch. This command does not cause an update of the top or bottom OLED. It does change how the buttons are handled. When a mode other than IDLE is selected its mode timer is started.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:3 | Mode Select | 0 | Idle |
| 1 | Application |
| 2 | Notification |
| 3-15 | Reserved |
| 3:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Reserved |  |  |

## Write OLED Scroll Buffer (0x13)

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0 | Scroll Complete | 0 | This is not the last packet of scroll information |
| 1 | This is the last packet of scroll information |
| 1 | Scroll Control | 0 | No action |
| 1 | Scroll Start |
| 2:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Size | 1-25 | Size in bytes |
| 1:n | Data | 0-255 | Pixel Data |

The scroll buffer contains 240 bytes that are used to display scroll information. This information is tied to the bottom row of the bottom OLED. This buffer can be written indefinitely.

If the scroll state machine runs out of data then the scroll will be terminated.

The scroll state machine will send a scroll request status message each time it scrolls 80 characters (OLED display columns). The phone is responsible for not writing too many characters to the scroll buffer.

When a scroll is started if the top OLED is on then it will remain on for the duration of the scroll.

## Advance Watch Hands (0x20)

This command will advance the watch hands by the specified amount.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Hours | 0-12 |  |
| 1 | Minutes | 0-60 |  |
| 2 | Seconds | 0-60 |  |

## Set Vibrate Mode (0x23)

This message causes the watch to vibrate.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Control | 0 | Disable (Cancel) |
| 1 | Enable |
| 1 | On Duration LSB | 0-255 | LSB of on duration in milliseconds |
| 2 | On Duration MSB | 0-255 | MSB of on duration in milliseconds |
| 3 | Off Duration LSB | 0-255 | LSB of off duration in milliseconds |
| 4 | Off Duration MSB | 0-255 | MSB of off duration in milliseconds |
| 5 | Number of Cycles | 0-255 | Number of on/off cycles |

## Set Real Time Clock (0x26)

This message sets the real time clock in the MSP430.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | MSB of Year |  | 4 most significant bits of a 12 bit value |
| 1 | LSB of Year |  | 8 least significant bits of a 12 bit value |
| 2 | Month | 1-12 |  |
| 3 | Day of Month | 1-31 |  |
| 4 | Day of Week | 0-6 |  |
| 5 | Hour | 0-23 |  |
| 6 | Minute | 0-59 |  |
| 7 | Second | 0-59 |  |

## Get Real Time Clock (0x27)

This message can be used by the phone or the watch to request the time from the other device.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0:n | Reserved |  |  |

## Get Real Time Clock Response (0x28)

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | MSB of Year |  | 4 most significant bits of a 12 bit value |
| 1 | LSB of Year |  | 8 leas significant bits of a 12 bit value |
| 2 | Month | 1-12 |  |
| 3 | Day of Month | 1-31 |  |
| 4 | Day of Week | 0-6 |  |
| 5 | Hour | 0-23 |  |
| 6 | Minute | 0-59 |  |
| 7 | Second | 0-59 |  |

## Nval Operation (0x30)

The Nval (Non-volatile memory) operation message is used to read and write values to flash. These values will retain their values when the battery is depleted. The flash can be erased and written a limited number of times.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 7:0 | Operation Select | 0x00 | Reserved |
| 0x01 | Read Operation |
| 0x02 | Write Operation |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0:1 | Nval Identifier |  | Unique identifier for the object stored in Non-volatile memory. LSB is in byte 0. |
| 2 | Size |  | Size of the item in bytes |
| 3:n | Data |  |  |

## Nval Operation Response (0x31)

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 7:0 | Status | 0x00 | Success |
| 0x01 | Failure |
| 0x09 | Item Not initialized (Identifier Not found) |
| 0x0A | Operation failed |
| 0x0C | Bad Item length |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0:1 | Nval Identifier |  | Unique identifier for the object stored in Non-volatile memory |
| 2:n | Read Data |  | Value of Identifier |

Table : Nval Identifiers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Identifier Name** | **Identifier** | **Size in bytes** | **Default Value** | **Description** |
| Reserved | 0x0000 | - | - |  |
| Link Key | 0x0001 | - | - | Not accessible by phone |
| Idle Buffer Configuration | 0x0002 | 1 | 0 | 0 = watch controls top |
| 1 = phone controls top 1/3 of display |
| Idle Buffer Invert | 0x0003 | 1 | 0 | 0 = no invert |
| 1 = invert display |
| Idle Mode Timeout | 0x0004 | 2 | - | Reserved |
| Application Mode Timeout | 0x0005 | 2 | 600 | Time in seconds before returning to Idle mode after an update display command is received. Set to 0 for no timeout. |
| Notification Mode Timeout | 0x0006 | 2 | 30 | Time in seconds before returning to Idle or application mode |
| Reserved Mode Timeout | 0x0007 | 2 | - | Reserved |
| Idle Display Timeout | 0x0008 | 2 | 7 | Time in seconds before the display goes blank (OLED only) |
| Application Display Timeout | 0x0009 | 2 | 5 | Time in seconds before the display goes blank (OLED only) |
| Notification Display Timeout | 0x000a | 2 | 5 | Time in seconds before the display goes blank (OLED only) |
| Reserved Display Timeout | 0x000b | 2 | - | Reserved |
|  |  |  |  |  |
| Sniff Debug | 0x1001 | 1 | 0 | When 0 sniff information is not printed to the terminal. |
| Battery Debug | 0x1002 | 1 | 0 | When 0 battery debug information is not printed to the terminal |
| Connection Debug | 0x1003 | 1 | - | Reserved |
| RST/NMI Configuration | 0x1004 | 1 | 0x02 | 1 = Reset pin is enabled |
| 2 = Reset pin is disabled |
| Master Reset | 0x1005 | 2 | 0x0000 | When set to 0xDEAF the non-volatile values will return to their default values upon reset |
|  |  |  |  |  |
| Low Battery Warning Level | 0x2001 | 2 | 3500 | Value in millivolts that a warning message is sent to phone |
| Low Battery Bluetooth Off Level | 0x2002 | 2 | 3300 | Value in millivolts that warning message is sent to phone and Bluetooth radio is turned off |
| Battery Sense Interval | 0x2003 | 2 | 8 | Rate at which battery is monitored in seconds. |
| Light Sense Interval | 0x2004 | 2 | - | Reserved |
| Secure Simple Pairing Enable | 0x2005 | 1 | 0 | 0 = Use pin code 0000 for pairing |
| 1 = Allow secure simple pairing (Not designed for phone control. Only updated on watch reset) |
| Link Alarm Enable | 0x2006 | 1 | 1 | 0 = link alarm disabled |
| 1 = link alarm enabled (vibration will be generated when Bluetooth link is lost) |
| Link Alarm Duration | 0x2007 | - | - | Duration of vibration for link alarm |
| Pairing Mode Duration | 0x2008 | 1 | 0 | 0 = Forever |
| 1-255 Seconds allowed for pairing to complete before a connection timeout message is sent. Not intended for phone control. Only updated on watch reset. |
| Time Format | 0x2009 | 1 | 0 | 0 = Twelve Hour |
| 1 = 24 Hour |
| Date Format | 0x200a | 1 | 0 | 0 = Month First |
| 1 = Day First |
| Display Seconds | 0x200b | 1 | 0 | 0 = Don’t Display Seconds |
| 1 = Display Seconds |
| Language | 0x200c | 1 | 0 | 0 = English  1 = Finnish  2 = German |
|  |  |  |  |  |
| Top OLED Contrast Index Day | 0x3000 | 1 | 4 | 0 = Lowest, 9 = Highest |
| Bottom OLED Contrast Index Day | 0x3001 | 1 | 4 | 0 = Lowest, 9 = Highest |
| Top OLED Contrast Index Night | 0x3002 | 1 | 4 | 0 = Lowest, 9 = Highest |
| Bottom OLED Contrast Index Night | 0x3003 | 1 | 4 | 0 = Lowest, 9 = Highest |
|  |  |  |  |  |

## Status Change Event (0x33)

This message is sent from the watch when it needs to notify the phone that a status change event has occurred.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:3 | Mode Select |  | Event occurred for this mode |
| 4:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Status Change Event Type | 0x00 | Reserved |
| 0x01 | Mode Change |
| 0x02 | Display Timeout |
| 0x03-0x0f | Reserved |
| 0x10 | Scroll Complete |
| 0x11 | Scroll Request |

|  |  |  |  |
| --- | --- | --- | --- |
| Additional Payload Bytes for Scroll Request | | | |
| 1 | Free Scroll Buffer Bytes | 0-240 | Number of bytes that are free in the scroll buffer |

## Button Event Message (0x34)

This message is sent from the watch when a button is pressed (and the button press has been configured to send a message to the phone).

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 |  |  | Option bits are configured in the enable button command |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Button Index | BIT 0 | Button A |
| BIT 1 | Button B |
| BIT 2 | Button C |
| BIT 3 | Button D |
| BIT 4 | Reserved |
| BIT 5 | Button E |
| BIT 6 | Button F |
| BIT 7 | Pull Switch (Analog Only) |
| 1 | Display Mode | 0 | Idle mode |
| 1 | Application Mode |
| 2 | Notification Mode |
| 2 | Button Press Type | 0 | Immediate |
| 1 | Press and Release |
| 2 | Hold and Release |
| 3 | Long Hold and Release |
| 4-255 | Reserved |
| 3 | Callback Message Type |  | When a button is pressed this message will be sent. The phone should set this button to (0x34) to receive a message when a button is pressed |
| 4 | Callback Message Option |  | Options in callback message |

## General Purpose Phone Message (0x35)

This message is a general message that can be sent to the phone. The sub-type further defines the type of message.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 |  |  | User Defined for each message sub-type |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | General Purpose Type |  | Sub type for the general purpose message |
| 1:n | Data |  |  |

## General Purpose Watch Message (0x36)

This message is a general message that can be sent to the watch. A handler must be written for each sub type.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | General Purpose Type |  | Sub type for the general purpose message |
| 1:n | Data |  |  |

## Write LCD Buffer (0x40)

This message is used by the phone to draw an image into the Idle, Application, or notification buffer. In normal operation the top 1/3 of the idle screen is used to draw the clock. The phone does not have to draw every line in the buffer.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:3 | Mode Select |  | Data is written into the corresponding mode’s buffer. |
| 4 | Number of Lines | 0 | Two lines of data in message |
| 1 | One line of data in message |
| 5:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Row Select A | 0-95 | Index of first row to copy into the display buffer |
| 1:12 | Line A |  | First row of data to copy |
| 13 | Row Select B | 0-95 | Index of second row to copy into display buffer |
| 14:25 | Line B |  | Second for of data to copy into display buffer (optional) |

## Configure LCD Idle Buffer Size (0x42)

This command is used to determine who draws the top 1/3 of the idle screen.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Watch Drawn Idle Buffer Size | 0 | Watch controls top 30 lines of the display in IDLE mode (This is where the time is drawn). |
| 1 | Phone controls the entire screen in idle mode. |

## Update LCD Display (0x43)

This message is used to draw a new screen to the display.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:3 | Mode Select |  | The selected buffer will become active. |
| 4 | Reserved |  |  |
| 5:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Start Row | 0 - 95 | The starting row (of the selected buffer) to be drawn to the display. |
| 1 | Number of Rows | 1 - 96 | The number of rows (of the selected buffer) to be drawn to the display. |

## Load Template – LCD only (0x44)

Copy a template stored in flash memory into the display buffer. The clear and fill functions work, but otherwise this message is not implemented.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:3 | Mode Select |  | Template will be loaded into selected mode’s display buffer |
| 4:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Template Select | 0 | Write ‘0’ to each pixel in buffer |
| 1 | Write ‘1’ to each pixel in buffer |
| 2-255 | Reserved |

## Enable Button (0x46)

Each button press type (immediate, press and release, hold and release, and long hold and release) can generate an event. In addition, each button press type can have a different event for each of the display modes (idle, application, and notification). For example, to cause button A to send a message to the phone when in notification mode the message payload would be 0x2, 0x0, 0x0, 0x34, 0x00. The message 0x34 will be sent to the phone once the button press has been detected (without waiting for the button to be released).

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Display Mode | 0 | Idle mode |
| 1 | Application Mode |
| 2 | Notification Mode |
| 1 | Button Index | 0 | Button A |
| 1 | Button B |
| 2 | Button C |
| 3 | Button D |
| 4 | Reserved |
| 5 | Button E |
| 6 | Button F |
| 7 | Pull Switch (Analog Only) |
| 2 | Button Press Type | 0 | Immediate |
| 1 | Press and Release |
| 2 | Hold and Release |
| 3 | Long Hold and Release |
| 4-255 | Reserved |
| 3 | Callback Message Type |  | When a button is pressed this message will be sent. The phone should set this button to (0x34) to receive a message when a button is pressed |
| 4 | Callback Message Option |  | Options in callback message |

## Disable Button (0x47)

The message is used to remove the association of a message with a button event.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Display Mode |  | See Enable Button Command for field descriptions. |
| 1 | Button Index |  |
| 2 | Button Press Type |  |

## Battery Configuration Message (0x53)

This determines at what voltage level a message is sent to the phone and user indicating a low battery event. This message also determines at what level the Bluetooth radio will be shut off to conserve battery power for watch only operation. The default warning level is 3.5 V and the default Bluetooth off level is 3.3V.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Warning Level | 28-42 | Value in 10ths of a volt |
| 1 | Bluetooth Off Level | 28-42 | Value in 10ths of a volt |

## Low Battery Warning Message (0x54)

This message is sent to the phone when the battery is low.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0:n | Reserved |  |  |

## Low Battery Bluetooth off Message (0x55)

This message is sent to the phone when the battery is low and the Bluetooth radio is being shutdown to conserve power and allow the watch to function as a watch.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0:n | Reserved |  |  |

## Read Battery Voltage Message (0x56)

This message will make the watch return the values for the most recent battery sense cycle. It will not cause a new cycle to be performed. The rate of battery sense cycles is determined by a setting stored in non-volatile memory.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0:n | Reserved |  |  |

## Read Battery Voltage Response (0x57)

This message contains the results of the most recent battery sense cycle. Battery sense values are in 100ths of a volt. For example, a value of 3000 means 3.0 Volts. The average value is the average over the last 10 samples.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Power Good |  |  |
| 1 | Battery Charging |  |  |
| 2 | Battery Sense LSB |  |  |
| 3 | Battery Sense MSB |  |  |
| 4 | Battery Sense Average LSB |  |  |
| 5 | Battery Sense Average MSB |  |  |

## Read Light Sense Message (0x58)

This message will cause a light sensor cycle to be performed.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0:n | Reserved |  |  |

## Read Light Sensor Response Message (0x59)

This message contains the results of the light sensor cycle. Light sensor readings are in 100ths of a volt. The average is of the last 10 samples.

|  |  |  |  |
| --- | --- | --- | --- |
| Option Bits | | | |
| 0:7 | Reserved |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Payload Bytes | | | |
| 0 | Light Sense LSB |  |  |
| 1 | Light Sense MSB |  |  |
| 2 | Light Sense Average LSB |  |  |
| 3 | Light Sense Average MSB |  |  |