**Interface Control Document (ICD)**

**for the**

**Thermostat PC-MCU System**

**Serial Messaging Protocol**

**October 29th, 2015**

**Version 1.0**

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# INTRODUCTION

This Personal Computer (PC) – Microcontroller Unit (MCU) Interface Control Document (ICD) defines the serial messaging protocol currently implemented as part of the Thermostat application. It is intended to be a living document and requires updates as necessary.

# REFERENCES

|  |  |
| --- | --- |
| **Document Name:** | **Version Number:** |
| Embedded Systems Task Specification | N/A |
| System Design Specification (SPS) for the Thermostat PC-MCU System | 1.0 |

Table 1: References

# MESSAGE STRUCTURE

This section describes the structure of the message protocol used in the Thermostat application.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Message Header:** | **Message Type:** | **Message Data:** | **CRC :** | **Message Footer:** |
| 1 Byte | 1 Byte | 2 Bytes | 2 Bytes | 1 Byte |

Table 2: Message Structure

# MESSAGE BYTE DESCRIPTION

## Message Header

The Message Header (1 Byte) is defined as the character ‘&’.

## Message Type

The Message Type field is a one-byte field that consists of the type of received message. This field is used for processing the message based upon the byte value at this location. Table 1 below lists the various types of messages that currently exist.

|  |  |
| --- | --- |
| **Message Name:** | **Message ID:** |
| DEFAULT\_MSG | 0x50 |
| TEMP\_SENSOR\_READING\_MSG | 0x52 |
| TEMP\_SENSOR\_READING\_REQUEST\_MSG | 0x56 |
| NORMAL\_ALARM\_SET\_MSG | 0x53 |
| WARNING\_ALARM\_SET\_MSG | 0x54 |
| DANGER\_ALARM\_SET\_MSG | 0x55 |

Table 3: Message Types

## Message Data

The Message Data field is used to send sensor reading data from the MCU to the PC Thermostat application.

## Message Cyclic Redundancy Check

The Message Cyclic Redundancy Check (CRC) field is a 2 byte field that carries the message CRC for integrity checks at the receiving end.

## Message Footer

The Message Footer field is a 1 byte field that carries an ending character to denote the end of the message.

# MESSAGES

This section describes in detail each of the messages outlined in section 2.2 above.

## DEFAULT\_MSG

### Message Description

The default message type is used only on instantiation of any of the messages defined below. No processing is done for this message and is never meant to be sent or received.

|  |  |
| --- | --- |
| Message Size: | 7 Bytes |
| Message Frequency: | N/A |
| Transmission: | N/A |

### Message Structure

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Byte 1:** | **Byte 2:** | **Byte 3 and 4:** | **Byte 5 and 6:** | **Byte 7:** |
| 0x26 | 0x50 | Variable Data | Variable CRC | 0x24 |

Table 4: DEFAULT\_MSG Structure

## TEMP\_SENSOR\_READING\_MSG

### Message Description

The TEMP\_SENSOR\_READING\_MSG message is sent from the microcontroller to the host computer. This message contains the raw temperature reading from the I2C Temperature sensor for processing on the host side.

|  |  |
| --- | --- |
| Message Size: | 7 Bytes |
| Message Frequency: | 1 Hz |
| Transmission: | MCU to PC |

### Message Structure

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Byte 1:** | **Byte 2:** | **Byte 3 and 4:** | **Byte 5 and 6:** | **Byte 7:** |
| 0x26 | 0x52 | Variable Data | Variable CRC | 0x24 |

Table 5: TEMP\_SENSOR\_READING\_MSG Structure

## TEMP\_SENSOR\_READING\_REQUEST\_MSG

### Message Description

The TEMP\_SENSOR\_READING\_MSG message is sent from the host computer to the microcontroller. This message requests a temperature reading of the I2C Temperature sensor connected on the microcontroller.

|  |  |
| --- | --- |
| Message Size: | 7 Bytes |
| Message Frequency: | 1 Hz |
| Transmission: | PC to MCU |

### Message Structure

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Byte 1:** | **Byte 2:** | **Byte 3 and 4:** | **Byte 5 and 6:** | **Byte 7:** |
| 0x26 | 0x56 | Variable Data | Variable CRC | 0x24 |

Table 6: TEMP\_SENSOR\_READING\_REQUEST\_MSG Structure

## NORMAL\_ALARM\_SET\_MSG

### Message Description

The NORMAL\_ALARM\_SET\_MSG message is sent from the host computer to the microcontroller. This message requests the microcontroller to activate the normal alarm LED.

Per the System Functional Requirements, this indicator is activated when the temperature is at or below the configured value for LOW\_THRESHOLD.

|  |  |
| --- | --- |
| Message Size: | 7 Bytes |
| Message Frequency: | Variable |
| Transmission: | PC to MCU |

### Message Structure

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Byte 1:** | **Byte 2:** | **Byte 3 and 4:** | **Byte 5 and 6:** | **Byte 7:** |
| 0x26 | 0x53 | Variable Data | Variable CRC | 0x24 |

Table 7: NORMAL\_ALARM\_SE\_MSG Structure

## WARNING\_ALARM\_SET\_MSG

### Message Description

The WARNING\_ALARM\_SET\_MSG message is sent from the host computer to the microcontroller. This message requests the microcontroller to activate the warning alarm LED.

Per the System Functional Requirements, this indicator is activated when the temperature is above the configured value for LOW\_THRESHOLD but below the configured value for HIGH\_THRESHOLD.

|  |  |
| --- | --- |
| Message Size: | 7 Bytes |
| Message Frequency: | Variable |
| Transmission: | PC to MCU |

### Message Structure

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Byte 1:** | **Byte 2:** | **Byte 3 and 4:** | **Byte 5 and 6:** | **Byte 7:** |
| 0x26 | 0x54 | Variable Data | Variable CRC | 0x24 |

Table 8: WARNING\_ALARM\_SET\_MSG Structure

## DANGER\_ALARM\_SET\_MSG

### Message Description

The DANGER\_ALARM\_SET\_MSG message is sent from the host computer to the microcontroller. This message requests the microcontroller to activate the danger alarm.

Per the System Functional Requirements, this indicator is activated when the temperature is at or above the configured value for HIGH\_THRESHOLD.

|  |  |
| --- | --- |
| Message Size: | 7 Bytes |
| Message Frequency: | Variable |
| Transmission: | PC to MCU |

### Message Structure

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Byte 1:** | **Byte 2:** | **Byte 3 and 4:** | **Byte 5 and 6:** | **Byte 7:** |
| 0x26 | 0x55 | Variable Data | Variable CRC | 0x24 |

Table 9: DANGER\_ALARM\_SET\_MSG Structure