# KD2 Control Service

## *Base UUID: 4F770000ED7D-11E4-840E-0002A5D5C51B*

## *Service UUID: 0x0501*

## Abstract:

This service exposes board specific control methods .

## Summary:

TODO

## Service Dependencies:

This service is not dependent upon any other service.

## GATT Requirements

| Sub-Procedure | Server Requirement |
|---|---|
| Write Characteristic Value | Mandatory |
| Notifications | Excluded |
| Indications | Mandatory |
| Read Characteristic Descriptors | Mandatory |
| Write Characteristic Descriptors | Mandatory |

## Transport Dependencies

| Transport | Supported |
|---|---|
| Classic | false |
| Low Energy | true |
| High Speed | false |

## Error Codes

| Name | Code | Description |
|---|---|---|
| | | |

## Service Characteristics

<table>
<tr><th>Overview</th><th>Properties</th><th>Security</th><th>Descriptors</th></tr>
<tr>
<td>Name:<br>KD2 Feature<br>Requirement:<br>Mandatory</td>
<td>
<table>
<tr><th>Property</th><th>Requirement</th></tr>
<tr><td>Read</td><td>Mandatory</td></tr>
<tr><td>Write</td><td>Excluded</td></tr>
<tr><td>WriteWithoutResponse</td><td>Excluded</td></tr>
<tr><td>SignedWrite</td><td>Excluded</td></tr>
<tr><td>Notify</td><td>Excluded</td></tr>
<tr><td>Indicate</td><td>Excluded</td></tr>
<tr><td>WriteableAuxiliaries</td><td>Excluded</td></tr>
<tr><td>Broadcast</td><td>Excluded</td></tr>
<tr><td>ExtendedProperties</td><td></td></tr>
</table>
</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Name:<br>KD2 Control Point<br>Requirement:<br>Mandatory</td>
<td>
<table>
<tr><th>Property</th><th>Requirement</th></tr>
<tr><td>Read</td><td>Excluded</td></tr>
<tr><td>Write</td><td>Mandatory</td></tr>
<tr><td>WriteWithoutResponse</td><td>Excluded</td></tr>
<tr><td>SignedWrite</td><td>Excluded</td></tr>
<tr><td>Notify</td><td>Excluded</td></tr>
<tr><td>Indicate</td><td>Mandatory</td></tr>
<tr><td>WriteableAuxiliaries</td><td>Excluded</td></tr>
<tr><td>Broadcast</td><td>Excluded</td></tr>
<tr><td>ExtendedProperties</td><td></td></tr>
</table>
</td>
<td>Optional</td>
<td>
<table>
<tr><th>Overview</th><th>Permissions</th></tr>
<tr>
<td>Name:<br>Client Characteristic Configuration<br>Requirement:<br>Mandatory</td>
<td>
<table>
<tr><th>Perm.</th><th>Req.</th></tr>
<tr><td>Read</td><td>Mandatory</td></tr>
<tr><td>Write</td><td>Mandatory</td></tr>
</table>
</td>
</tr>
</table>
</td>
</tr>
</table>

# KD2 Feature

## *Characteristic UUID: 0x0502*

## Summary:

The KD2 Feature characteristic is used to report a list of features supported by the device.

## Value Fields

<table>
<tr><th>Names</th><th>Field Req.</th><th>Format</th><th>Additional Information</th></tr>
<tr><td>Configuration Features</td><td>Mandatory</td><td>8bit</td><td>Bit Field
<table>
<tr><th>Bit</th><th>Size</th><th>Name</th><th>Definition</th></tr>
<tr><td>0</td><td>1</td><td>channel configuration supported</td><td><table><tr><td>0</td><td>False</td></tr><tr><td>1</td><td>True</td></tr></table></td></tr>
<tr><td>1</td><td>1</td><td>com pin mode supported</td><td><table><tr><td>0</td><td>False</td></tr><tr><td>1</td><td>True</td></tr></table></td></tr>
<tr><td>2</td><td>1</td><td>internal compensation supported</td><td><table><tr><td>0</td><td>False</td></tr><tr><td>1</td><td>True</td></tr></table></td></tr>
<tr><td>3</td><td>1</td><td>external (Helena driver board) compensation Supported</td><td><table><tr><td>0</td><td>False</td></tr><tr><td>1</td><td>True</td></tr></table></td></tr>
<tr><td>4</td><td>1</td><td>imu calibration Supported</td><td><table><tr><td>0</td><td>False</td></tr><tr><td>1</td><td>True</td></tr></table></td></tr>
<tr><td>5</td><td>3</td><td>reserved for future use</td><td></td></tr>
</table></td></tr>
<tr><td>Channel Features</td><td>Mandatory</td><td>8bit</td><td>Bit Field
<table>
<tr><th>Bit</th><th>Size</th><th>Name</th><th>Definition</th></tr>
<tr><td>0</td><td>1</td><td>adaptive channel supported</td><td><table><tr><td>0</td><td>False</td></tr><tr><td>1</td><td>True</td></tr></table></td></tr>
<tr><td>1</td><td>7</td><td>reserved for future use</td><td></td></tr>
</table></td></tr>
</table>

# KD2 Control Point

### *Characteristic UUID: 0x0503*

## Summary:

The KD2 Control Point characteristic is used to request a specific function to be executed on the receiving device.

## Value Fields

<table>
<tr><th>Names</th><th>Field Req.</th><th>Format</th><th>Additional Information</th></tr>
<tr><td>Op codes</td><td>Mandatory</td><td>uint8</td><td>Enumerations
<table>
<tr><th>Key</th><th>Value</th><th>Description</th></tr>
<tr><td>1</td><td>request channel configuration</td><td>Request a channel configuration. The desired channel is sent as an uint8 with preceding Op Code 0x01. The response is Op Code 0x20 followed by the channel configuration.<br>See Table 1: channel configuration for configuration definition</td></tr>
<tr><td>2</td><td>set channel configurations</td><td>Initiate the procedure to configure a channel. The new channel configuration is with preceding Op Code 0x02 operand and desired channel number. The response to this control point is Op Code 0x20.<br>See Table 1: channel configuration for configuration definition</td></tr>
<tr><td>3</td><td>request Com pin configuration</td><td>Request the current Com pin configuration setup. The response is Op Code 0x20 followed by the current configuration.<br>See Table 2: com pin enumeration for com pin definitions.</td></tr>
<tr><td>4</td><td>set Com pin configuration</td><td>Initiate the procedure to change the Com pin configuration. The new configuration is sent with preceding Op Code 0x08. The response to this control point is Op Code 0x20.<br>See Table 2: com pin enumeration for com pin definitions.</td></tr>
</table></td></tr>
</table>

| | | | | | |
|---|---|---|---|---|---|
| | | | 5 | request internal compensation | Request the internal compensation values. The response is Op Code 0x20 followed by compensation values.<br>See Table 3: internal compensation for internal compensation value definitions. |
| | | | 6 | set internal compensation | Initiate the procedure to set the internal compensation values. The new compensation values are sent with preceding Op Code 0x0A. The response to this control point is 0x20.<br>See Table 3: internal compensation for internal compensation value definitions. |
| | | | 7 | request external (Helena driver board) compensation | Request the compensation values of connected Helena driver board. The desired driver board is sent as an uint8 with preceding Op Code 0x07. If no board number is given, the first driver is selected. The response is Op Code 0x20 followed by compensation values.<br>See Table 4: Helena driver board compensation for external compensation value definitions. |
| | | | 8 | set external (Helena driver board) compensation values | Initiate the procedure to set the external compensation values. The new compensation values are sent with preceding Op Code 0x08 and desired driver number, if no driver number is given, the first one is selected. The response to this control point is 0x20.<br>See Table 4: Helena driver board compensation for external compensation value definitions |
| | | | 9 | request the imu calibration state | Request the imu calibration state. The response is Op Code 0x20 followed by the state (0 or 1) |
| | | | 10 | initiate the imu calibration | Initiate the procedure to calibrate the imu. The response is Op Code 0x20 |
| | | | 32 | Response Code | The response code is followed by the requested Op Code, the response value and optionally the response parameter |
| | | | 0-0 | Reserved for future use | |
| | | | 11-31 | Reserved for future use | |

<table>
<tr><td></td><td></td><td></td><td><table>
<tr><td>33-255</td><td>Reserved for future use</td><td></td></tr>
</table></td></tr>
<tr><td>Parameter Value</td><td>Optional</td><td>variable</td><td>Refer to the Op Code table above for additional information on the possible values for this filed</td></tr>
<tr><td>Request Op Code<br>Information:<br>The Request Op Code is a sub field of the Parameter Value for "Response Code" Op Code.<br>C1: This Field is Mandatory for "Response Code" Op Code, otherwise this field is Excluded.</td><td>C1</td><td>uint8</td><td>Refer to the Op Code table above for additional information on the possible values for this filed</td></tr>
<tr><td>Response Value<br>Information:<br>The Request Op Code is a sub field of the Parameter Value for "Response Code" Op Code.<br>C1: This Field is Mandatory for "Response Code" Op Code, otherwise this field is Excluded.</td><td>C1</td><td>uint8</td><td>Enumerations<table>
<tr><th>Key</th><th>Value</th><th>Description</th></tr>
<tr><td>1</td><td>Success</td><td>Response for successful operation.</td></tr>
<tr><td>2</td><td>Op Code not supported</td><td>Response if unsupported Op Code is received.</td></tr>
<tr><td>3</td><td>Invalid Parameter</td><td>Response if Parameter received does not meet the requirements of the service or is outside of the supported range</td></tr>
<tr><td>4</td><td>Operation Failed</td><td>Response if the requested procedure failed</td></tr>
<tr><td>0-0</td><td>Reserved for future use</td><td></td></tr>
<tr><td>5-255</td><td>Reserved for future use</td><td></td></tr>
</table></td></tr>
<tr><td>Response Parameter<br>Information:<br>The Response Parameter is a sub field of the Parameter Value for "Response Code" Op Code.<br>C2:This Field is Optional for "Response Code" Op Code, otherwise this field is Excluded.</td><td>C2</td><td>variable</td><td>Note: The Response Parameter Value of the response to the Control Point is a variable length field to allow a list of different values defined by the Service Specification</td></tr>
</table>

<table>
<tr><th>Name</th><th>Format</th><th>Additional Information</th></tr>
<tr><td>Full Output Power<br>Information:<br>Unit is in watts with a resolution of 1/1000.<br>Unit:<br>org.bluetooth.unit.power.watt<br>Exponent: Decimal, -3</td><td>uint16</td><td>valid range: 0 .. 40W</td></tr>
<tr><td>Output Limit<br>Information:<br>Unit is is in percentage with a resolution of 1, in relation to maximum output power.<br>Unit:<br>org.bluetooth.unit.percentage<br>Exponent: Decimal, 0</td><td>uint8</td><td>valid range: 0..100%</td></tr>
<tr><td>Optic Type<br>Information:<br>Unit-less with a resolution of 1/128<br>Exponent: Binary, -7</td><td>uint8</td><td>enumeration:<table><tr><th>Key</th><th>Name</th><th>Additional Information</th></tr><tr><td>0</td><td>non-applicable</td><td>to use if channel is not equipped with an optic</td></tr><tr><td>1</td><td>15° optic</td><td></td></tr><tr><td>2</td><td>22° optic</td><td></td></tr><tr><td>3</td><td>30° optic</td><td></td></tr><tr><td>4-255</td><td>Reserved for future use</td><td></td></tr></table></td></tr>
<tr><td>Optic Offset<br>Information:<br>Unit is in degree with a resolution of 1/100.<br>Unit:<br>org.bluetooth.unit.plane_angle.degree<br>Exponent: Decimal, -2</td><td>int16</td><td>valid range: -180..180°</td></tr>
</table>

*Table 1: channel configuration*

| Key | Name | Additional Information |
|---|---|---|
| 0 | not used | com pin not used |
| 1 | com | com pin used for communication |
| 2 | button | com pin used as external button |
| 3 | pwm | com pin used as active low open drain PWM signal |
| 4-255 | Reserved for future use | |

*Table 2: com pin enumeration*

| Name | Format | Additional Information |
|---|---|---|
| voltage gain factor | uint16 | not used yet |
| voltage offset | int16 | not used yet |
| current gain factor<br>**Information:**<br>Unit-less with a resolution of 1/32768<br>**Exponent:** Binary, -15 | uint16 | |
| current offset | int16 | not used yet |
| temperature gain factor | uint16 | not used yet |
| temperature offset<br>**Information:**<br>Unit is in degree Celcius with a resolution of 1/128<br>Unit: org.bluetooth.unit.thermodynamic_temperature.degree_celsius<br>**Exponent:** Binary, -7 | int16 | |

*Table 3: internal compensation*

| Name | Format | Additional Information |
|---|---|---|
| temperature offset<br>**Information:**<br>Unit is in degree Celcius with a resolution of 1/4<br>Unit: org.bluetooth.unit.thermodynamic_temperature.degree_celsius<br>**Exponent:** Binary, -2 | int16 | |
| left side current gain factor<br>**Information:**<br>Unit-less with a resolution of 1/128<br>**Exponent:** Binary, -7 | uint8 | |
| right side current gain factor<br>**Information:**<br>Unit-less with a resolution of 1/128<br>**Exponent:** Binary, -7 | uint8 | |

*Table 4: Helena driver board compensation*