Urban NaviGator DBW Serial Interface Specification

This document describes all the serial message structure used to perform drive-by-wire operation on the Urban NaviGator.

# Braking and Acceleration Control

You will need to connect to the NI myRIO to control the braking and acceleration effort of the vehicle. The myRIO code has a state structure:

(Picture of myRIO states and transitions)

## Revision Changes

All DAC values are to be removed from the message

## Serial Communication Parameters:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Rx: | Pin 10 Connector A | Baud Rate: | 115200 | Data Bits: | 8 |
| Tx: | Pin 14 Connector A | Parity | None | Stop Bits: | 1 |

## DBW Device to Tablet:

The DBW board will send two messages to the connected device. The first message is a periodic update message sent every 100 milliseconds. This message is a brief description of the current state of the DBW device. It is sent along with a Cyclic Redundancy Check value so that the receiver can test the validity of the data within the message.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Header | State | Pause | Brake % | Throttle Effort | CRC | Terminator |
| 147 | Ref. Table | Ref. Table | 0-100 | 0-100 | 0-255 | 147 |

|  |  |  |
| --- | --- | --- |
| Value | State | Pause |
| 32 | Inactive | - |
| 64 | Manual-Active | No pause in effect |
| 128 | Full-Auto | Pause is in effect |
| 255 | E-stop | - |

The second message is a response message that will be sent whenever a message is received. The response variable will either be 128 for a correct message or 64 for a message with corrupted data. This should instruct the connected device whether or not to resend the message.

|  |  |  |
| --- | --- | --- |
| 1 | 2 | 3 |
| Header | Response | Terminator |
| 137 | C:128 IC:64 | 127 |

## Tablet to DBW Board

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Header | Auto Req. | Left Blinker | Right Blinker | Pause  Cmd. | Brake  % | Throttle % | CRC | Terminator |
| 137 | Ref. Table | Ref. Table | Ref. Table | Ref. Table | 0-100 | 0-100 | 0-255 | 127 |

# Steering Angle Control

Steering angle control is achieved through connecting to the SmartMotor that is attached to the steering column. You will have to go through a SEALevel communication converter that turns RS-232 to USB. This will require a driver: (link the driver software).

## Serial Communication

|  |  |  |  |
| --- | --- | --- | --- |
| Baud Rate: | 38400 | Data Bits: | 8 |
| Parity | None | Stop Bits: | 1 |

Commands to SmartMotor:

|  |  |
| --- | --- |
| Command | Description |
| RUN | Command to begin the SmartMotor program. Must be sent if SmartMotor resets. |
| p=# | Command to request a certain angle from the SmartMotor. The number is in units of encoder counts. The conversion must be known ahead of time to get accurate angles. 155,000 encoder count/max turn. |
| f=2 | Command to shutdown SmartMotor |

Message sent by SmartMotor:

|  |  |
| --- | --- |
| Command | Description |
| c=# | Sent periodically to report the current encoder count position. |
| HOMING | Sent after receiving the “RUN” command |
| HOMING\_COMPLETE | Sent after completing the homing process |
| READY | Sent after homing is complete and signals the program is ready for inputs. |
| NORMAL\_SHUTDOWN | Sent when shutdown command is received, f=2 |
| EMERGENCY\_SHUTDOWN | Sent when shutdown is required due to errors/limits |
| OVER\_CURRENT | Sent if motor exceeds current limit i.e. motor stalled. Motor is shutdown |
| THERMAL\_LIMIT | Sent if motor exceeds thermal limit. Motor is shutdown |

Messages from the SmartMotor will be sent with a carriage return at the end of each message.

# Shifting Control

Shifting angle control is achieved through connecting to the SmartMotor that is attached to the shifting mechanism. You will have to go through a SEALevel communication converter that turns RS-232 to USB. This will require a driver: (link the driver software).

## Serial Communication

|  |  |  |  |
| --- | --- | --- | --- |
| Baud Rate: | 38400 | Data Bits: | 8 |
| Parity | None | Stop Bits: | 1 |

Commands to SmartMotor:

|  |  |
| --- | --- |
| Command | Description |
| RUN | Command to begin the SmartMotor program. Must be sent if SmartMotor resets. |
| h=1 | One of the two requirements for the program to start. The other being the brake pressed. |
| s=0 | Command to request park gear |
| s=255 | Command to request reverse gear |
| s=128 | Command to request neutral gear |
| s=1 | Command to request drive gear |
| s=2 | Command to request regen gear |

Message sent by SmartMotor:

|  |  |
| --- | --- |
| Command | Description |
| BREAK\_PEDAL\_HIGH | Sent when the brake pedal is not pressed |
| BREAK\_PEDAL\_LOW | Sent when the brake pedal is pressed |
| HOMING | Sent after receiving the “RUN” command |
| HOMING\_COMPLETE | Sent after completing the homing process |
| NORMAL\_SHUTDOWN | Sent when shutdown command is received, f=2 |
| READY | Sent after homing is complete and signals the program is ready for inputs. |
| FAULT High: Pot reading is too high. | Error message when encoder value is not correct for a desired gear |
| FAULT Low: Pot reading is too low. | Error message when encoder value is not correct for a desired gear |
| PARK | Sent after completing the transition to park gear |
| REVERSE | Sent after completing the transition to reverse gear |
| NEUTRAL | Sent after completing the transition to neutral gear |
| DRIVE | Sent after completing the transition to drive gear |
| REGEN | Sent after completing the transition to regen gear |
| ACTUATING\_TO\_PARK | Sent after request for park is received and is actuating to park |
| ACTUATING\_TO\_REVERSE | Sent after request for reverse is received and is actuating to reverse |
| ACTUATING\_TO\_NEUTRAL | Sent after request for neutral is received and is actuating to neutral |
| ACTUATING\_TO\_DRIVE | Sent after request for drive is received and is actuating to drive |
| ACTUATING\_REGEN | Sent after request for regen is received and is actuating to regen |
| UNKNOWN\_COMMAND | Sent if request is not one of the specified values |

Messages from the SmartMotor will be sent with a carriage return at the end of each message.