Sensor classes

Sensor

This is the base class all the other sensor classes are derived from.

Special sensor classes

The classes derive from **Sensor** and provide helper functions specific to the corresponding sensor type. Each of the functions makes sure the sensor is in the required mode and then returns the specified value.

Touch Sensor

Color Sensor

Ultrasonic Sensor

Gyro Sensor

Infrared Sensor

Sound Sensor

Light Sensor

# Motor classes

## Tacho motor

## Large EV3 Motor

## Medium EV3 Motor

## DC Motor

## Servo Motor[¶](http://python-ev3dev.readthedocs.io/en/latest/motors.html#servo-motor)

# Appendix A: Sensor Data

This page contains sensor-specific data for each type of supported sensor.

## Generic EV3 Analog Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | ev3-analog-XX |
| Connection Type | EV3/Analog |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| ANALOG | Raw analog value | V (volts) | 3 | 1 | value0: Voltage (0 - 5000) |

### Commands

This sensor does not support commands.

## Generic NXT Analog Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | nxt-analog |
| Connection Type | NXT/Analog |
| Number of Modes | 2 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| ANALOG-0 | Raw analog value | V (volts) | 3 | 1 | value0: Voltage (0 - 5000) |
| ANALOG-1 | Raw analog value - pin 5 high | V (volts) | 3 | 1 | value0: Voltage (0 - 5000) |

### Commands

This sensor does not support commands.

## Charmed Labs Pixy (CMUcam5) for LEGO

### General Info

|  |  |
| --- | --- |
| Driver Name | pixy-lego |
| Website | [charmedlabs.com](http://charmedlabs.com/default/pixy-lego/) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 |
| Vendor ID | Pixy |
| Product ID | Pixy |
| Number of Modes | 8 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| ALL | All | none | 0 | 6 | value0: Signature low byte  value1: Signature high byte  value2: X  value3: Y  value4: Width  value5: Height |
| SIG1 | Signature #1 | none | 0 | 5 | value0: Count  value1: X  value2: Y  value3: Width  value4: Height |
| SIG2 | Signature #2 | none | 0 | 5 | value0: Count  value1: X  value2: Y  value3: Width  value4: Height |
| SIG3 | Signature #3 | none | 0 | 5 | value0: Count  value1: X  value2: Y  value3: Width  value4: Height |
| SIG4 | Signature #4 | none | 0 | 5 | value0: Count  value1: X  value2: Y  value3: Width  value4: Height |
| SIG5 | Signature #5 | none | 0 | 5 | value0: Count  value1: X  value2: Y  value3: Width  value4: Height |
| SIG6 | Signature #6 | none | 0 | 5 | value0: Count  value1: X  value2: Y  value3: Width  value4: Height |
| SIG7 | Signature #7 | none | 0 | 5 | value0: Count  value1: X  value2: Y  value3: Width  value4: Height |

### Commands

This sensor does not support commands.

## Dexter Industries Flexible Sensor for Mindstorms NXT

### General Info

|  |  |
| --- | --- |
| Driver Name | di-dflex |
| Website | [www.dexterindustries.com](https://www.dexterindustries.com/manual/dflex/) |
| Connection Type | NXT/Analog |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| FLEX | Flex | none | 0 | 1 | value0: Flex (0-100) |

### Commands

This sensor does not support commands.

## Fatcatlab 9DOF Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | fcl-9dof |
| Website | [fatcatlab.com](http://fatcatlab.com/product/9dof-sensor) |
| Connection Type | EV3/UART |
| Number of Modes | 3 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| GYRO | Gyroscope | d/s(degrees per second) | 1 | 3 | value0: X-axis rotational speed (-20000 to 20000)  value1: Y-axis rotational speed (-20000 to 20000)  value2: Z-axis rotational speed (-20000 to 20000) |
| ACC | Accelerometer | g(standard gravity) | 3 | 3 | value0: X-axis acceleration (-16000 to 16000)  value1: Y-axis acceleration (-16000 to 16000)  value2: Z-axis acceleration (-16000 to 16000) |
| MAGNET | Magnetometer | uT(microteslas) | 0 | 3 | value0: X-axis magnetic flux density (-4800 to 4800)  value1: Y-axis magnetic flux density (-4800 to 4800)  value2: Z-axis magnetic flux density (-4800 to 4800) |

### Commands

This sensor does not support commands.

## Fatcatlab ADC Adapter

### General Info

|  |  |
| --- | --- |
| Driver Name | fcl-adc |
| Website | [fatcatlab.com](http://fatcatlab.com/product/adc-adapter) |
| Connection Type | EV3/UART |
| Number of Modes | 3 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| CH1-VOLTAGE | Channel 1 | mV(millivolts) | 0 | 1 | value0: Voltage (0 to 3300) |
| CH2-VOLTAGE | Channel 2 | mV(millivolts) | 0 | 1 | value0: Voltage (0 to 3300) |
| VOLTAGE | Both Channels | mV(millivolts) | 0 | 2 | value0: Channel 1 Voltage (0 to 3300)  value1: Channel 2 Voltage (0 to 3300) |

### Commands

This sensor does not support commands.

## Fatcatlab Altitude Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | fcl-altitude |
| Website | [fatcatlab.com](http://fatcatlab.com/product/altitude-sensor) |
| Connection Type | EV3/UART |
| Number of Modes | 2 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| PRESSURE | Pressure | hPa(hectopascals) | 1 | 1 | value0: Pressure (3000 to 11000) |
| ALTITUDE | Altitude | m (meters) | 1 | 1 | value0: Altitude (-5000 to 90000) |

### Commands

This sensor does not support commands.

## Fatcatlab Gesture Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | fcl-gesture |
| Website | [fatcatlab.com](http://fatcatlab.com/product/gesture-sensor) |
| Connection Type | EV3/UART |
| Number of Modes | 4 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| GESTURE | Gesture | none | 0 | 1 | value0: Gesture (0 to 6) [[1]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#fcl-gesture-mode0-value0) |
| PROXIMITY | Proximity | none | 0 | 1 | value0: Voltage (0 to 127) |
| RGB-RAW | Color | none | 0 | 3 | value0: Red  value1: Green  value2: Blue |
| CLEAR [[2]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#fcl-gesture-mode3) | Clear | none | 0 | 1 | value0: Always 1 |

### Commands

This sensor does not support commands.

### Notes

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [[1]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id7) | Gesture Values:   | **Value** | **Description** | | --- | --- | | 0 | none | | 1 | left | | 2 | right | | 3 | up | | 4 | down | | 5 | near | | 6 | far | |
| [[2]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id8) | The CLEAR mode is used to reset the value of the GESTURE mode back to zero. |

## Fatcatlab Humidity Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | fcl-humidity |
| Website | [fatcatlab.com](http://fatcatlab.com/product/humidity-sensor) |
| Connection Type | EV3/UART |
| Number of Modes | 3 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| CENTIGRADE | Temperature (Celsius) | C(degrees Celsius) | 1 | 1 | value0: Temperature (-400 to 1250) |
| FAHRENHEIT | Temperature (Fahrenheit) | F(degrees Fahrenheit) | 1 | 1 | value0: Temperature (-400 to 2570) |
| HUMIDITY | Humidity | %RH(percent relative humidity) | 1 | 1 | value0: Humidity (0 to 1000) |

### Commands

This sensor does not support commands.

## Fatcatlab IR Receiver

### General Info

|  |  |
| --- | --- |
| Driver Name | fcl-ir |
| Website | [fatcatlab.com](http://fatcatlab.com/product/ir-receiver) |
| Connection Type | EV3/UART |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| IR DATA | IR Remote Control | none | 0 | 1 | value0: Channel 1 (0 to 60) [[3]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#fcl-ir-mode0-value0) |

### Commands

This sensor does not support commands.

### Notes

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [[3]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id11) | Button values:   | **Value** | **Button** | | --- | --- | | 0 | none | | 1-9 | 1-9 (digits) | | 10 | 0 (zero) | | 11 | + (plus) | | 12 | - (minus) | | 13 | ⏮ (previous) | | 14 | ⏭ (next) | | 15 | ⏯ (play/pause) | | 21 | OK | | 22 | ↰ (back) | | 30 | ⏻ (power) | | 40 | MENU | | 50 | 🔇 (mute) | | 60 | MODE | |

## Fatcatlab Light Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | fcl-light |
| Website | [fatcatlab.com](http://fatcatlab.com/product/light-sensor) |
| Connection Type | EV3/UART |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| ILLUMINANCE | Illuminance | lx (lux) | 0 | 1 | value0: Illuminance (0 to 65535) |

### Commands

This sensor does not support commands.

## HiTechnic NXT Color Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-color |
| Connection Type | NXT/I2C |
| Default Address | 0x01 |
| Vendor ID | HiTechnc |
| Product ID | Color |
| Number of Modes | 7 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| COLOR | Color | none | 0 | 1 | value0: Color (0 to 17) [[4]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-color-mode0-value0) |
| RED | Red component | none | 0 | 1 | value0: Reflected light intensity (0 to 255) |
| GREEN | Green component | none | 0 | 1 | value0: Reflected light intensity (0 to 255) |
| BLUE | Blue component | none | 0 | 1 | value0: Reflected light intensity (0 to 255) |
| RAW | Raw values | none | 0 | 3 | value0: Red Component (0 to 255)  value1: Green Component (0 to 255)  value2: Blue Component (0 to 255) |
| NORM | Normalized values | none | 0 | 4 | value0: Red Component (0 to 255)  value1: Green Component (0 to 255)  value2: Blue Component (0 to 255)  value3: ??? Component (0 to 255) |
| ALL | All values | none | 0 | 4 | value0: Color (0 to 17) [[4]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "ht-nxt-color-mode0-value0)  value1: Red Component (0 to 255)  value2: Green Component (0 to 255)  value3: Blue Component (0 to 255) |

### Commands

This sensor does not support commands.

### Notes

|  |  |
| --- | --- |
| [4] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id13), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id14))  Color Values:  Color chart |

## HiTechnic NXT Angle Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-angle |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=NAA1030) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 |
| Vendor ID | HITECHNC |
| Product ID | AnglSnsr |
| Number of Modes | 3 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| ANGLE | Angle | deg(degrees) | 0 | 1 | value0: Angle (0 to 359) |
| ANGLE-ACC | Accumulated angle | deg(degrees) | 0 | 1 | value0: Angle (-2147483648 to 2147483647) |
| SPEED | Rotational speed | RPM(revolutions per minute) | 0 | 1 | value0: Angle (-32768 to 32768) |

### Commands

| **Command** | **Description** |
| --- | --- |
| RESET | Reset accumulated angle |
| CAL [[5]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-angle-cmd1) | Reset angle and accumulated angle and save to EEPROM |

### Notes

|  |  |
| --- | --- |
| [[5]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id16) | When Calibrating the sensor wait least 25ms before further reads from the sensor. That means disable polling by setting poll\_ms to 0 before sending this command. |

## HiTechnic NXT Acceleration / Tilt Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-accel |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=NAC1040) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 |
| Vendor ID | HITECHNC |
| Product ID | Accel. |
| Number of Modes | 2 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| ACCEL | Single-axis acceleration | none | 0 | 1 | value0: Acceleration (coarse value) [[6]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-accel-mode0-value0) |
| ALL | Three-axis acceleration | none | 0 | 6 | value0: X-axis acceleration (most significant byte)  value1: Y-axis acceleration (most significant byte)  value2: Z-axis acceleration (most significant byte)  value3: X-axis acceleration (least significant byte) [[7]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-accel-mode1-value3)  value4: Y-axis acceleration (least significant byte) [[7]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-accel-mode1-value3)  value5: Z-axis acceleration (least significant byte) [[7]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-accel-mode1-value3) |

### Commands

This sensor does not support commands.

### Notes

|  |  |
| --- | --- |
| [[6]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id18) | Value is 8 most significant bits out of 10-bit total resolution. |
| [7] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id19), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id20), [*3*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id21)) Only the 2 most significant bits are used. Actual value is MSB << 2 + LSB >> 6 orMSB << 2 + LSB & 0x03 (can someone confirm which one?). |

## HiTechnic NXT Barometric Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-barometric |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=NBR1036) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 |
| Vendor ID | HiTechnc |
| Product ID | Barometr |
| Number of Modes | 2 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| PRESS | Barometric Pressure | m (???) | 1 | 1 | value0: Absolute Pressure (0 to 3000) |
| TEMP | Temperature | C(degrees Celsius) | 1 | 1 | value0: Absolute Pressure (0 to 1000) |

### Commands

This sensor does not support commands.

## HiTechnic NXT Color Sensor V2

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-color-v2 |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=NCO1038) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 |
| Vendor ID | HiTechnc |
| Product ID | ColorPD |
| Number of Modes | 9 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| COLOR | Color | none | 0 | 1 | value0: Color (0 to 17) [[8]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-color-v2-mode0-value0) |
| RED | Red component | none | 0 | 1 | value0: Reflected light intensity (0 to 255) |
| GREEN | Green component | none | 0 | 1 | value0: Reflected light intensity (0 to 255) |
| BLUE | Blue component | none | 0 | 1 | value0: Reflected light intensity (0 to 255) |
| WHITE | White component | none | 0 | 1 | value0: Reflected light intensity (0 to 255) |
| NORM | Normalized values | none | 0 | 4 | value0: Red Component (0 to 255)  value1: Green Component (0 to 255)  value2: Blue Component (0 to 255)  value3: White Component (0 to 255) |
| ALL | All values | none | 0 | 5 | value0: Red Component (0 to 255)  value1: Green Component (0 to 255)  value2: Blue Component (0 to 255)  value3: White Component (0 to 255)  value4: ??? (0 to 255) |
| PASSIVE | Passive values | none | 0 | 4 | value0: Red Component (0 to 255?)  value1: Green Component (0 to 255?)  value2: Blue Component (0 to 255?)  value3: White Component (0 to 255?) |
| RAW | Raw values | none | 0 | 4 | value0: Red Component (0 to 255?)  value1: Green Component (0 to 255?)  value2: Blue Component (0 to 255?)  value3: White Component (0 to 255?) |

### Commands

This sensor does not support commands.

### Notes

|  |  |
| --- | --- |
| [[8]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id24) | Color Values:  Color chart |

## HiTechnic NXT EOPD

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-eopd |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=NEO1048) |
| Connection Type | NXT/Analog |
| Number of Modes | 2 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| LONG | Proximity (long range) | none | 0 | 1 | value0: Proximity (0-100) [[9]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-epod-mode0-value0) |
| SHORT | Proximity (short range) | none | 0 | 1 | value0: Proximity (0-100) [[9]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-epod-mode0-value0) |

### Commands

This sensor does not support commands.

### Notes

|  |  |
| --- | --- |
| [9] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id26), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id27)) This value is the square root of the raw value. You can derive a value proportional (linear) to distance by dividing a constant by this value, e.g. 35 / value0. |

## HiTechnic NXT Force Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-force |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=NFS1074) |
| Connection Type | NXT/Analog |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| FORCE | Raw value (non-linear) | none | 0 | 1 | value0: (0-1023) |

### Commands

This sensor does not support commands.

## HiTechnic NXT Gyro Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-gyro |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=NGY1044) |
| Connection Type | NXT/Analog |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| GYRO | Angular speed | d/s(degrees per second) | 0 | 1 | value0: Angular speed (-540 to 400) |

### Commands

This sensor does not support commands.

## HiTechnic NXT IRLink Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-ir-link |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=NIL1046) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 |
| Vendor ID | HiTechnc |
| Product ID | IRLink |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| IRLINK | ??? | none | 0 | 1 | value0: ??? |

### Commands

This sensor does not support commands.

## HiTechnic NXT IRReceiver Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-ir-receiver |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=NIR1032) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 |
| Vendor ID | HiTechnc |
| Product ID | IRRecv |
| Number of Modes | 2 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| 1-MOTOR | Single Motor Control | pct(percent) | 0 | 1 | value0: Motor 1A Speed (-128 and -100 to 100) [[10]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value0)[[11]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value-name) |
| 8-MOTOR | Eight Motor Controls | pct(percent) | 0 | 8 | value0: Motor 1A Speed (-128 and -100 to 100) [[10]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value0)[[11]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value-name)  value1: Motor 1B Speed (-128 and -100 to 100) [[10]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value0)[[11]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value-name)  value2: Motor 2A Speed (-128 and -100 to 100) [[10]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value0)[[11]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value-name)  value3: Motor 2B Speed (-128 and -100 to 100) [[10]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value0)[[11]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value-name)  value4: Motor 3A Speed (-128 and -100 to 100) [[10]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value0)[[11]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value-name)  value5: Motor 3B Speed (-128 and -100 to 100) [[10]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value0)[[11]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value-name)  value6: Motor 4A Speed (-128 and -100 to 100) [[10]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value0)[[11]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value-name)  value7: Motor 4B Speed (-128 and -100 to 100) [[10]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value0)[[11]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-receiver-mode0-value-name) |

### Commands

This sensor does not support commands.

### Notes

|  |  |
| --- | --- |
| [10] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id32), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id34), [*3*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id36), [*4*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id38), [*5*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id40), [*6*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id42), [*7*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id44), [*8*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id46), [*9*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id48)) Value of -128 is brake. Speed values only occur in discrete steps (-100, -86, -72, -58, -44, -30, -16, 0, 16, 30, 44, 58, 72, 86 and 100). |
| [11] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id33), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id35), [*3*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id37), [*4*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id39), [*5*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id41), [*6*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id43), [*7*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id45), [*8*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id47), [*9*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id49)) In the description, “Motor NX”, the number N is the channel, and the letter X is the channel. “A”” is the red/left control and “B”” is the blue/right control. |

## HiTechnic NXT PIR Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-pir |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=NIS1070) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 |
| Vendor ID | HITECHNC |
| Product ID | PIR |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| PROX | IR Proximity | pct(percent) | 0 | 1 | value0: Proximity (-100 to 100) |

### Commands

This sensor does not support commands.

## HiTechnic NXT Compass Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-compass |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=NMC1034) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 |
| Vendor ID | HITECHNC (or HiTechnc) |
| Product ID | Compass |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| COMPASS | Compass Direction | deg(degrees) | 0 | 1 | value0: Direction (0 to 359) |

### Commands

This sensor does not support commands.

## HiTechnic NXT Magnetic Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-mag |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=NMS1035) |
| Connection Type | NXT/Analog |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| MAG | Magnetic field??? | none | 0 | 1 | value0: ??? |

### Commands

This sensor does not support commands.

## HiTechnic NXT IRSeeker V2

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-ir-seek-v2 |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=NSK1042) |
| Connection Type | NXT/I2C |
| Default Address | 0x08 |
| Vendor ID | HiTechnc |
| Product ID | NewIRDir |
| Number of Modes | 4 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| DC | Direction (unmodulated) | none | 0 | 1 | value0: Direction (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-seek-v2-mode0-value0) |
| AC | Direction (modulated) | none | 0 | 1 | value0: Direction (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-seek-v2-mode0-value0) |
| DC-ALL | All values (unmodulated) | none | 0 | 7 | value0: Direction (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "ht-nxt-ir-seek-v2-mode0-value0)  value1: Sensor 1 signal strength (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-seek-v2-mode0-value0)  value2: Sensor 2 signal strength (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-seek-v2-mode0-value0)  value3: Sensor 3 signal strength (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-seek-v2-mode0-value0)  value4: Sensor 4 signal strength (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-seek-v2-mode0-value0)  value5: Sensor 5 signal strength (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-seek-v2-mode0-value0)  value6: Sensor mean (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-seek-v2-mode0-value0) |
| AC-ALL | All values (modulated) | none | 0 | 6 | value0: Direction (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-seek-v2-mode0-value0)  value1: Sensor 1 signal strength (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-seek-v2-mode0-value0)  value2: Sensor 2 signal strength (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-seek-v2-mode0-value0)  value3: Sensor 3 signal strength (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-seek-v2-mode0-value0)  value4: Sensor 4 signal strength (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-seek-v2-mode0-value0)  value5: Sensor 5 signal strength (0 to 9) [[12]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-ir-seek-v2-mode0-value0) |

### Commands

This sensor does not support commands.

### Notes

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [12] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id54), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id55), [*3*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id56), [*4*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id57), [*5*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id58), [*6*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id59), [*7*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id60), [*8*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id61), [*9*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id62), [*10*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id63), [*11*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id64), [*12*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id65), [*13*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id66), [*14*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id67), [*15*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id68))  Direction values:   | **Value** | **Description** | | --- | --- | | 0 | No signal | | 1 | Far left | | ... |  | | 5 | Center | | ... |  | | 9 | Far right | |

## HiTechnic NXT Sensor Multiplexer

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-nxt-smux |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=NSX2020) |
| Connection Type | NXT/I2C |
| Default Address | 0x08 |
| Vendor ID | HiTechnc |
| Product ID | SensrMUX |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| MUX | Status | none | 0 | 2 | value0: Run state [[13]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "ht-nxt-smux-mode0-value0)  value1: Status [[14]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-smux-mode0-value1) |

### Commands

| **Command** | **Description** |
| --- | --- |
| HALT | Halt |
| DETECT[[15]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-smux-cmd1) [[16]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-nxt-smux-cmd1-sensors) | Start auto-detection |
| RUN | Run |

### Notes

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [[13]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id70) | Run state:   | **Value** | **Description** | | --- | --- | | 0 | Halt | | 1 | Detect | | 2 | Run | |
| [[14]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id71) | Status bits:   | **Bit** | **Description** | | --- | --- | | 0 | Low/no battery | | 1 | Running | | 2 | Halted | | 3 | Error | |

|  |  |
| --- | --- |
| [[15]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id72) | The sensor mux must be halted before sending the detect command, otherwise it will result an error (-EPERM). |
| [[16]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "id73) | Only these sensors can be automatically detected:   * LEGO NXT Ultrasonic * HiTechnic NXT Compass * HiTechnic NXT Color * HiTechnic NXT Acceleration / Tilt * HiTechnic NXT IR Seeker * HiTechnic Super Pro * HiTechnic NXT Color V2 * HiTechnic NXT IR Seeker V2 |

## HiTechnic NXT SuperPro Prototype Board

### General Info

|  |  |
| --- | --- |
| Driver Name | ht-super-pro |
| Website | [www.hitechnic.com](http://www.hitechnic.com/cgi-bin/commerce.cgi?preadd=action&key=SPR2010) |
| Connection Type | NXT/I2C |
| Default Address | 0x08 |
| Vendor ID | HiTechnc |
| Product ID | SuperPro |
| Number of Modes | 5 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| AIN | Analog inputs | none | 0 | 4 | value0: Analog input A0 (0 to 1023)  value1: Analog input A1 (0 to 1023)  value2: Analog input A2 (0 to 1023)  value3: Analog input A3 (0 to 1023) |
| DIN | Digital inputs | none | 0 | 1 | value0: Bits B0-B7 (0 to 255) |
| DOUT | Digital outputs | none | 0 | 1 | value0: Bits B0-B7 (0 to 255) |
| DCTRL | Digital input/output controls | none | 0 | 1 | value0: Bits B0-B7 (0 to 255) |
| STROBE | Strobe output | none | 0 | 1 | value0: Bits S0-S3 (0 to 15) |
| LED | LED control | none | 0 | 1 | value0: LED state [[17]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ht-super-pro-mode5-value0) |
| AOUT-0 | Analog output O0 | none | 0 | 5 | value0: Mode  value1: Frequency, most significant byte  value2: Frequency, least significant byte  value3: Voltage, most significant byte  value4: Voltage, least significant byte |
| AOUT-1 | Analog output O1 | none | 0 | 5 | value0: Mode  value1: Frequency, most significant byte  value2: Frequency, least significant byte  value3: Voltage, most significant byte  value4: Voltage, least significant byte |

### Commands

This sensor does not support commands.

### Notes

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [[17]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id75) | LED states:   | **Value** | **Description** | | --- | --- | | 0 | None | | 1 | Red | | 2 | Blue | | 3 | Red and blue | |

## LEGO EV3 Ultrasonic Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-ev3-us |
| Website | [education.lego.com](https://education.lego.com/en-us/products/ev3-ultrasonic-sensor/45504) |
| Connection Type | EV3/UART |
| Number of Modes | 7 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| US-DIST-CM | Continuous measurement - sets LEDs on, steady | cm(centimeters) | 1 | 1 | value0: Distance (0-2550) |
| US-DIST-IN | Continuous measurement - sets LEDs on, steady | in (inches) | 1 | 1 | value0: Distance (0-1003) |
| US-LISTEN | Listen - sets LEDs on, blinking | none | 0 | 1 | value0: Presence (0-1) [[18]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-us-mode2-value0) |
| US-SI-CM | Single measurement - LEDs on momentarily when mode is set, then off | cm(centimeters) | 1 | 1 | value0: Distance (0-2550) [[19]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-us-mode3-value0) |
| US-SI-IN | Single measurement - sets LED on momentarily when mode is set, then off | in (inches) | 1 | 1 | value0: Distance (0-1003) [[19]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-us-mode3-value0) |
| US-DC-CM[[20]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-us-mode5) | ??? - sets LEDs on, steady | cm(centimeters) | 1 | 1 | value0: Distance (0-2550) |
| US-DC-IN[[20]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-us-mode5) | ??? sets LEDs on, steady | in (inches) | 1 | 1 | value0: Distance (0-1003) |

### Commands

This sensor does not support commands.

### Notes

|  |  |
| --- | --- |
| [[18]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id77) | A value of 1 indicates that another ultrasonic sensor has been detected. A 1 can also be triggered by a loud noise such as clapping. |
| [19] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id78), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id79)) A measurement is taken when the mode is set and value0 will not change after this. To take another measurement set the mode again. **NOTE:** If you write the mode too frequently (e.g. every 100msec), the sensor will sometimes lock up and writing to the mode attribute will return an error. A delay of 250msec between each write to the mode attribute seems sufficient to keep the sensor from locking up. |

|  |  |
| --- | --- |
| [20] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id80), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id81)) Not sure what DC mode stands for. Seems to work like the continuous measurement modes. |

## LEGO EV3 Gyro Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-ev3-gyro |
| Website | [education.lego.com](https://education.lego.com/en-us/products/ev3-gyro-sensor-/45505) |
| Connection Type | EV3/UART |
| Number of Modes | 5 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| GYRO-ANG[[21]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-gyro-mode0-reset) | Angle | deg(degrees) | 0 | 1 | value0: Angle (-32768 to 32767) [[22]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-gyro-mode0-value0-overflow) [[23]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-gyro-mode0-value0-direction) |
| GYRO-RATE[[24]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-gyro-mode1-calibration) | Rotational Speed | d/s(degrees per second) | 0 | 1 | value0: Rotational Speed (-440 to 440) [[23]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-gyro-mode0-value0-direction) |
| GYRO-FAS | Raw sensor value ??? | none | 0 | 1 | value0: ??? (-1464 to 1535) [[23]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-gyro-mode0-value0-direction) |
| GYRO-G&A[[21]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-gyro-mode0-reset) [[24]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-gyro-mode1-calibration) | Angle and Rotational Speed | none | 0 | 2 | value0: Angle (-32768 to 32767) [[22]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-gyro-mode0-value0-overflow) [[23]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-gyro-mode0-value0-direction)  value1: Rotational Speed (-440 to 440) [[23]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-gyro-mode0-value0-direction) |
| GYRO-CAL | Calibration ??? | none | 0 | 4 | value0: ???  value1: ???  value2: ???  value3: ??? |

### Commands

This sensor does not support commands.

### Notes

|  |  |
| --- | --- |
| [21] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id83), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id89)) The angle in GYRO-ANG or GYRO-G&A modes can be reset by changing to a different mode and changing back. |
| [22] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id84), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id91)) If you spin around too many times in GYRO-ANG or GYRO-G&A mode, it will get stuck at 32767 or overflow through -32768 depending on when the sensor was manufactured. |

|  |  |
| --- | --- |
| [23] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id85), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id87), [*3*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id88), [*4*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id92), [*5*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id93)) Clockwise is positive when looking at the side of the sensor with the arrows. |
| [24] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id86), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id90)) The sensor is calibrated when the GYRO-RATE or the GYRO-G&A mode is set. If the sensor is moving when setting the mode, the calibration will be off. |

## LEGO EV3 Color Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-ev3-color |
| Website | [education.lego.com](https://education.lego.com/en-us/products/ev3-color-sensor/45506) |
| Connection Type | EV3/UART |
| Number of Modes | 6 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| COL-REFLECT | Reflected light - sets LED color to red | pct(percent) | 0 | 1 | value0: Reflected light intensity (0 to 100) |
| COL-AMBIENT | Ambient light - sets LED color to blue (dimly lit) | pct(percent) | 0 | 1 | value0: Ambient light intensity (0 to 100) |
| COL-COLOR | Color - sets LED color to white (all LEDs rapidly cycling) | col(color) | 0 | 1 | value0: Detected color (0 to 7) [[25]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-color-mode2-value0) |
| REF-RAW | Raw Reflected - sets LED color to red | none | 0 | 2 | value0: ??? (0 to 1020???)  value1: ??? (0 to 1020???) |
| RGB-RAW | Raw Color Components - sets LED color to white (all LEDs rapidly cycling) | none | 0 | 3 | value0: Red (0 to 1020???)  value1: Green (0 to 1020???)  value2: Blue (0 to 1020???) |
| COL-CAL[[26]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-color-mode5) | Calibration ??? - sets LED color to red, flashing every 4 seconds, then goes continuous | none | 0 | 4 | value0: ???  value1: ???  value2: ???  value3: ??? |

### Commands

This sensor does not support commands.

### Notes

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [[25]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id95) | Color values:   | **Value** | **Color** | | --- | --- | | 0 | none | | 1 | black | | 2 | blue | | 3 | green | | 4 | yellow | | 5 | red | | 6 | white | | 7 | brown | |
| [[26]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id96) | This mode is not usable. When in COL-CAL mode, the color sensor does not respond to the keep-alive sent from the EV3 brick. As a result, the sensor will time out and reset. |

## LEGO EV3 Touch Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-ev3-touch |
| Website | [education.lego.com](https://education.lego.com/en-us/products/ev3-touch-sensor/45507) |
| Connection Type | EV3/Analog |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| TOUCH | Button state | none | 0 | 1 | value0: State (0 or 1) [[27]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-touch-mode0-value0) |

### Commands

This sensor does not support commands.

### Notes

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| [[27]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id98) | Values:   | **Value** | **Description** | | --- | --- | | 0 | Released | | 1 | Pressed | |

## LEGO EV3 Infrared Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-ev3-ir |
| Website | [education.lego.com](https://education.lego.com/en-us/products/ev3-infrared-sensor/45509) |
| Connection Type | EV3/UART |
| Number of Modes | 6 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| IR-PROX | Proximity | pct(percent) | 0 | 1 | value0: Distance (0 to 100) [[28]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode0-value0) |
| IR-SEEK | IR Seeker | pct(percent) | 0 | 8 | value0: Channel 1 Heading (-25 to 25) [[29]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode1-value0)  value1: Channel 1 Distance (-128 and 0 to 100) [[30]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode1-value1)[[31]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode1-no-beacon)  value2: Channel 2 Heading (-25 to 25) [[29]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode1-value0)  value3: Channel 2 Distance (-128 and 0 to 100) [[30]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode1-value1)[[31]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode1-no-beacon)  value4: Channel 3 Heading (-25 to 25) [[29]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode1-value0)  value5: Channel 3 Distance (-128 and 0 to 100) [[30]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode1-value1)[[31]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode1-no-beacon)  value6: Channel 4 Heading (-25 to 25) [[29]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode1-value0)  value7: Channel 4 Distance (-128 and 0 to 100) [[30]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode1-value1)[[31]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode1-no-beacon) |
| IR-REMOTE | IR Remote Control | btn(button) | 0 | 4 | value0: Channel 1 (0 to 11) [[32]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode2-value0)  value1: Channel 2 (0 to 11) [[32]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode2-value0)  value2: Channel 3 (0 to 11) [[32]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode2-value0)  value3: Channel 4 (0 to 11) [[32]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode2-value0) |
| IR-REM-A | IR Remote Control | none | 0 | 1 | value0: Channel 1 [[33]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode3-value0) |
| IR-S-ALT[[34]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-ev3-ir-mode4) | Alternate IR Seeker ??? | pct(percent) | 0 | 4 | value0: ??? (0 to 100)  value1: ??? (0 to 100)  value2: ??? (0 to 100)  value3: ??? (0 to 100) |
| IR-CAL | Calibration ??? | none | 0 | 2 | value0: ??? (0 to 1023)  value1: ??? (0 to 1023) |

### Commands

This sensor does not support commands.

### Notes

|  |  |
| --- | --- |
| [[28]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id100) | 100% is approximately 70cm/27in. |
| [29] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id101), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id104), [*3*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id107), [*4*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id110)) When looking in the same direction as the sensor, -25 is far left and +25 is far right. |

|  |  |
| --- | --- |
| [30] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id102), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id105), [*3*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id108), [*4*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id111)) 100% is approximately 200cm/78in. |
| [31] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id103), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id106), [*3*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id109), [*4*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id112)) The absence of a beacon on a channel can be detected when distance == -128 (and heading == 0). |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [32] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id113), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id114), [*3*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id115), [*4*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id116))  Button values:   | **Value** | **Description** | | --- | --- | | 0 | none | | 1 | red up | | 2 | red down | | 3 | blue up | | 4 | blue down | | 5 | red up and blue up | | 6 | red up and blue down | | 7 | red down and blue up | | 8 | red down and blue down | | 9 | beacon mode on | | 10 | red up and red down | | 11 | blue up and blue down |   red == left and blue == right  Pressing more that 2 buttons at one time is not supported. It will usually read 0. Pressing an up/down button while beacon mode is activated with turn off beacon mode. |
| [[33]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "id117) | Button values:   | **Value** | **Blue Down** | **Blue Up** | **Red Down** | **Red Up** | | --- | --- | --- | --- | --- | | 262/384 |  |  |  |  | | 287 |  |  |  | X | | 300 |  |  | X |  | | 309 |  |  | X | X | | 330 |  | X |  |  | | 339 |  | X |  | X | | 352 |  | X | X |  | | 377 |  | X | X | X | | 390 | X |  |  |  | | 415 | X |  |  | X | | 428 | X |  | X |  | | 437 | X |  | X | X | | 458 | X | X |  |  | | 467 | X | X |  | X | | 480 | X | X | X |  | | 505 | X | X | X | X |   X = button pressed  The most significant byte is always 0x01. In the least significant byte, the 4 most significant bits represent each button. Bit 7 is the blue down button, bit 6 is the blue up button, bit 5 is the red down button, bit 4 is the red up button. Beware that when no buttons are pressed, bit 7 is set (value == 384). You can test that bits 0-3 are all 0 to check this.  Example:  **if** ((value **&** 0x0F) **==** 0) {  **//** no buttons are pressed  } **else** {  **if** (value **&** 0x80)  **//** blue down button **is** pressed  **if** (value **&** 0x40)  **//** blue up button **is** pressed  **if** (value **&** 0x20)  **//** red down button **is** pressed  **if** (value **&** 0x10)  **//** red up button **is** pressed  }  Bits 0-3 seem to be some sort of checksum or parity check. Bit 0 = bit 4, bit 1 = ~(bit 5), bit 2 = ~(bit 6), bit 3 = 0 if bits 0-2 are even or 1 if bits 0-2 are odd.  Also, when the beacon mode is active or for about 1 second after any button is released the value is 262.  This mode only works with the remote on channel 1. |

|  |  |
| --- | --- |
| [[34]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id118) | IR-S-ALT mode is not usable. When switching to this mode, the sensor quits responding to the keep-alive messages and the sensor resets. |

## LEGO WeDo USB Hub

### General Info

|  |  |
| --- | --- |
| Driver Name | wedo-hub |
| Website | [education.lego.com](https://education.lego.com/en-us/products/wedo-usb-hub/9581) |
| Connection Type | USB |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| HUB | Hub status | none | 0 | 2 | value0: Status bits [[35]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#wedo-hub-mode0-value0)  value1: Voltage (millivolts) |

### Commands

| **Command** | **Description** |
| --- | --- |
| OUT-OFF | Turns off the outputs of the ports. |
| OUT-ON | Turns on the outputs of the ports. |
| CLEAR-ERR | Clears error. |

### Notes

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [[35]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id120) | Status Bits:   | **Bit** | **Description** | | --- | --- | | 0 | Echo | | 1 |  | | 2 |  | | 3 |  | | 4 |  | | 5 |  | | 6 | High Power | | 7 | Outputs Off | |

## LEGO WeDo Motion Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | wedo-motion |
| Website | [education.lego.com](https://education.lego.com/en-us/products/wedo-motion-sensor/9583) |
| Connection Type | Wedo/Analog |
| Number of Modes | 2 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| PROX | Proximity | pct(percent) | 0 | 1 | value0: Proximity (0 - 100) |
| RAW | Raw analog value | none | 0 | 1 | value0: Proximity (0 - 255) |

### Commands

This sensor does not support commands.

## LEGO WeDo Tilt Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | wedo-tilt |
| Website | [education.lego.com](https://education.lego.com/en-us/products/wedo-tilt-sensor/9584) |
| Connection Type | Wedo/Analog |
| Number of Modes | 3 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| TILT | Tilt status | none | 0 | 1 | value0: Tilt (0 to 5) [[36]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#wedo-tilt-mode0-value0) |
| TILT-AXIS | Tilt around 2 separate axes | none | 0 | 3 | value0: Tilt Left/Right (-1/0/1) [[37]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#wedo-tilt-mode1-value0)  value1: Tilt Back/Front (-1/0/1) [[37]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#wedo-tilt-mode1-value0)  value2: Tilt value valid (0/1) [[37]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#wedo-tilt-mode1-value0) |
| RAW | Raw analog value | none | 0 | 1 | value0: Tilt (0 - 255) [[38]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#wedo-tilt-mode2-value0) |

### Commands

This sensor does not support commands.

### Notes

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [[36]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id123) | Tilt values:   | **Value** | **Description** | | --- | --- | | 0 | Level | | 1 | Front | | 2 | Back | | 3 | Left | | 4 | Right | | 5 | Unknown | |
| [37] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id124), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id125), [*3*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id126))  Axis values:   | **Value0** | **Value1** | **Value2** | **Description** | | --- | --- | --- | --- | | 0 | 0 | 1 | Level | | 0 | 1 | 1 | Front | | 0 | -1 | 1 | Back | | -1 | 0 | 1 | Left | | 1 | 0 | 1 | Right | | 0 | 0 | 0 | Unknown | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [[38]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id127) | Raw values:   | **Value** | **Description** | | --- | --- | | 0 | Unknown | | < 48 | Back | | < 99 | Right | | < 153 | Level | | < 204 | Front | | < 255 | Left | |

## LEGO Energy Display

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-power-storage |
| Website | [education.lego.com](https://education.lego.com/en-us/products/energy-display/9668) |
| Connection Type | NXT/I2C |
| Default Address | 0x02 |
| Vendor ID | LEGO |
| Product ID | Store |
| Number of Modes | 8 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| IN-VOLT | Input Voltage | V (volts) | 3 | 1 | value0: Voltage (0 to 10000) |
| IN-AMP | Input Current | A(amps) | 3 | 1 | value0: Current (0 to 10000) |
| OUT-VOLT | Output Voltage | V (volts) | 3 | 1 | value0: Voltage (0 to 10000) |
| OUT-AMP | Output Current | A(amps) | 3 | 1 | value0: Current (0 to 10000) |
| JOULE | Energy | J(Joules) | 0 | 1 | value0: Energy (0 to 100) |
| IN-WATT | Input Power | W(Watts) | 3 | 1 | value0: Power (0 to 10000) |
| OUT-WATT | Output Power | W(Watts) | 3 | 1 | value0: Power (0 to 10000) |
| ALL | All | none | 3 | 7 | value0: Input Voltage (0 to 10000)  value1: Input Current (0 to 10000)  value2: Output Voltage (0 to 10000)  value3: Output Current (0 to 10000)  value4: Energy (0 to 100)  value5: Input Power (0 to 10000)  value6: Output Power (0 to 10000) |

### Commands

This sensor does not support commands.

## LEGO NXT Temperature Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-nxt-temp |
| Website | [education.lego.com](https://education.lego.com/en-us/products/mindstorms-temperature-sensor/9749) |
| Connection Type | NXT/I2C |
| Default Address | 0x4C |
| Vendor ID | LEGO |
| Product ID | Temp. |
| Number of Modes | 2 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| NXT-TEMP-C | Continuous measurement | C (°C) | 1 | 1 | value0: Temperature (-550 to 1280) |
| NXT-TEMP-F | Continuous measurement | F (°F) | 1 | 1 | value0: Temperature (-670 to 2624) |

### Commands

This sensor does not support commands.

## LEGO NXT Touch Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-nxt-touch |
| Website | [shop.lego.com](http://shop.lego.com/en-US/Touch-Sensor-9843) |
| Connection Type | NXT/Analog |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| TOUCH | Button state | none | 0 | 1 | value0: State (0 or 1) [[39]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-nxt-touch-mode0-value0) |

### Commands

This sensor does not support commands.

### Notes

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| [[39]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id131) | Values:   | **Value** | **Description** | | --- | --- | | 0 | Released | | 1 | Pressed | |

## LEGO NXT Light Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-nxt-light |
| Website | [shop.lego.com](http://shop.lego.com/en-US/Light-Sensor-9844) |
| Connection Type | NXT/Analog |
| Number of Modes | 2 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| REFLECT | Reflected light - LED on | pct(percent) | 1 | 1 | value0: Reflected light intensity (0 to 1000) |
| AMBIENT | Ambient light - LED off | pct(percent) | 1 | 1 | value0: Ambient light intensity (0 to 1000) |

### Commands

This sensor does not support commands.

## LEGO NXT Sound Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-nxt-sound |
| Website | [shop.lego.com](http://shop.lego.com/en-US/Sound-Sensor-9845) |
| Connection Type | NXT/Analog |
| Number of Modes | 2 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| DB | Sound pressure level - Flat weighting | pct(percent) | 1 | 1 | value0: Sound pressure level (0 to 1000) |
| DBA | Sound pressure level - A weighting | pct(percent) | 1 | 1 | value0: Sound pressure level (0 to 1000) |

### Commands

This sensor does not support commands.

## LEGO NXT Ultrasonic Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-nxt-us |
| Website | [shop.lego.com](http://shop.lego.com/en-US/Ultrasonic-Sensor-9846) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 |
| Vendor ID | LEGO |
| Product ID | Sonar |
| Number of Modes | 5 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| US-DIST-CM | Continuous measurement | cm(centimeters) | 0 | 1 | value0: Distance (0 to 255) |
| US-DIST-IN | Continuous measurement | in (inches) | 1 | 1 | value0: Distance (0 to 1000) |
| US-SI-CM | Single measurement | cm(centimeters) | 0 | 1 | value0: Distance (0 to 255) [[40]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-nxt-us-mode2-value0) |
| US-SI-IN | Single measurement | in (inches) | 1 | 1 | value0: Distance (0 to 1000) [[40]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-nxt-us-mode2-value0) |
| US-LISTEN | Listen | none | 0 | 1 | value0: Presence (0 or 1) [[41]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#lego-nxt-us-mode4-value0) |

### Commands

This sensor does not support commands.

### Notes

|  |  |
| --- | --- |
| [40] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id135), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id136)) The value is read when the mode is set and does not change - even when polling is enabled. To read a new value, set the mode again (e.g. echo US-SI-CM > mode). |
| [[41]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "id137) | A value of 1 indicates that another ultrasonic sensor has been detected. A 1 can also be triggered by a loud noise such as clapping. |

## Microinfinity Digital Gyroscope And Accelerometer

### General Info

|  |  |
| --- | --- |
| Driver Name | mi-xg1300l |
| Website | [www.minfinity.com](http://www.minfinity.com/eng/page.php?Main=1&sub=1&tab=5) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 |
| Vendor ID | mnfinity [[42]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#mi-xg1300l-vid) |
| Product ID | XG1300L [[42]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#mi-xg1300l-vid) |
| Number of Modes | 4 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| ANGLE | Angle | deg(degrees) | 2 | 1 | value0: Z-axis angle (-18000 to 18000) |
| SPEED | Rotational speed | d/s(degrees per second) | 2 | 1 | value0: Z-axis rotational speed |
| ACCEL | Acceleration in X, Y, Z axis | g(Standard gravity) [[43]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#mi-xg1300l-units) | 3 | 3 | value0: Acceleration in X axis  value1: Acceleration in Y axis  value2: Acceleration in Z axis |
| ALL | All values | none | 0 | 5 | value0: Z-axis angle (-18000 to 18000) [[44]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#mi-xg1300l-mode3-value0)  value1: Z-axis rotational speed [[45]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#mi-xg1300l-mode3-value1)  value2: X-axis acceleration [[46]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#mi-xg1300l-mode3-value2)  value3: Y-axis acceleration [[46]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#mi-xg1300l-mode3-value2)  value4: Z-axis acceleration [[46]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#mi-xg1300l-mode3-value2) |

### Commands

| **Command** | **Description** |
| --- | --- |
| RESET[[47]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#mi-xg1300l-cmd0) | Reset device |
| ACCEL-2G | Set accelerometer scaling to 2G |
| ACCEL-4G | Set accelerometer scaling to 4G |
| ACCEL-8G | Set accelerometer scaling to 8G |

### Notes

|  |  |
| --- | --- |
| [42] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id139), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id140))  CruizCore XG1300L doesn’t follow LEGO guidelines by returning vendor, product and firmware version values. As a result, this sensor can’t be automatically detected. Until we find another way to identify the sensor, the driver has to be loaded manually.  Register I2C device:  echo mi**-**xg1300l 0x01 **>** **/**sys**/**class**/**lego**-**port**/**port**<**N**>/**set\_device |
| [[43]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "id141) | 1g≈9.81m/s21g≈9.81m/s2 |

|  |  |
| --- | --- |
| [[44]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id142) | Two decimal places |
| [[45]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id143) | Two decimal places |

|  |  |
| --- | --- |
| [46] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id144), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id145), [*3*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id146)) Three decimal places, range as was set by last command |
| [[47]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "id147) | Recalculate bias drift, reset accumulated angle, set accelerometer scaling factor to 2G, this has to be done with sensor not moving and is strongly recommended to be called manually before work. |

## mindsensors.com Gyro, MultiSensitivity Accelerometer and Compass

### General Info

|  |  |
| --- | --- |
| Driver Name | ms-absolute-imu |
| Website | [www.mindsensors.com](http://www.mindsensors.com/ev3-and-nxt/15-gyro-multisensitivity-accelerometer-and-compass-for-nxt-or-ev3) |
| Connection Type | NXT/I2C |
| Default Address | 0x11 [[48]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-absolute-imu-address) |
| Vendor ID | mndsnsrs |
| Product ID | AbsIMU |
| Number of Modes | 6 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| TILT | Tilt | deg(degrees) | 0 | 3 | value0: X-axis angle (0 to 180)  value1: Y-axis angle (0 to 180)  value2: Z-axis angle (0 to 180) |
| ACCEL[[49]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-absolute-imu-mode1) | Acceleration | g(Standard gravity) [[50]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-absolute-imu-mode1-units) | 3 | 3 | value0: X-axis acceleration  value1: Y-axis acceleration  value2: Z-axis acceleration |
| COMPASS[[51]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-absolute-imu-mode2) | Compass | deg(degrees) | 0 | 1 | value0: Heading (0 to 360) |
| MAG [[51]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-absolute-imu-mode2) | Magnetic field | none | 0 | 3 | value0: X-axis magnetic field  value1: Y-axis magnetic field  value2: Z-axis magnetic field |
| GYRO [[52]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-absolute-imu-mode4) | Gyro | d/s(degrees per second) | 1 | 3 | value0: X-axis rotational speed  value1: Y-axis rotational speed  value2: Z-axis rotational speed |
| ALL [[53]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-absolute-imu-mode5) | All data | none | 0 | 23 | value0:  value1:  value2:  value3:  value4:  value5:  value6:  value7:  value8:  value9:  value10:  value11:  value12:  value13:  value14:  value15:  value16:  value17:  value18:  value19:  value20:  value21:  value22: |

### Commands

| **Command** | **Description** |
| --- | --- |
| BEGIN-COMP-CAL | Begin compass calibration |
| END-COMP-CAL | End compass calibration |
| ACCEL-2G [[54]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-absolute-imu-cmd2) | Change accelerometer sensitivity to 2G and gyro sensitivity to 250 deg/sec |
| ACCEL-4G [[54]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-absolute-imu-cmd2) | Change accelerometer sensitivity to 4G and gyro sensitivity to 500 deg/sec |
| ACCEL-8G [[54]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-absolute-imu-cmd2) | Change accelerometer sensitivity to 8G and gyro sensitivity to 2000 deg/sec |
| ACCEL-16G [[54]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-absolute-imu-cmd2) | Change accelerometer sensitivity to 16G and gyro sensitivity to 2000 deg/sec |

### Notes

|  |  |
| --- | --- |
| [[48]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id149) | The address is programmable. See manufacturer documentation for more information. |
| [[49]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "id150) | Only returns data from models with an accelerometer (AbsoluteIMU-AC / AbsoluteIMU-A). |

|  |  |
| --- | --- |
| [[50]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id151) | Standard gravity (g) is defined as 1g=9.81m/s21g=9.81m/s2 |
| [51] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id152), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id153)) Only returns data from models with a compass (AbsoluteIMU-C / AbsoluteIMU-AC / AbsoluteIMU-ACG). |

|  |  |
| --- | --- |
| [[52]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id154) | Only returns data from models with a gyro (AbsoluteIMU-ACG). |
| [[53]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "id155) | Reads all data from the sensor. Use bin\_data attribute to read values. Some values will not be scaled. See manufacturer docs for more info. |

|  |  |
| --- | --- |
| [54] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id156), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id157), [*3*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id158), [*4*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id159)) Wait 50 msec after sending command for sensor to reconfigure itself. |

## mindsensors.com GlideWheel-AS

### General Info

|  |  |
| --- | --- |
| Driver Name | ms-angle |
| Website | [www.mindsensors.com](http://www.mindsensors.com/ev3-and-nxt/17-glidewheel-as-angle-sensor-for-nxt-or-ev3) |
| Connection Type | NXT/I2C |
| Default Address | 0x18 |
| Vendor ID | mndsnsrs |
| Product ID | AngSens |
| Number of Modes | 4 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| ANGLE | Angle | deg(degrees) | 0 | 1 | value0: Angle |
| ANGLE2 | High-precision angle | deg(degrees) | 1 | 1 | value0: Angle |
| SPEED | Rotational Speed | rpm(revolutions per minute) | 0 | 1 | value0: Rotational Speed (-4000 to 4000) |
| ALL | All values | none | 0 | 3 | value0: Angle  value1: Angle x2 [[55]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-angle-mode3-value1)  value2: Rotational Speed [[56]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-angle-mode3-value2) |

### Commands

| **Command** | **Description** |
| --- | --- |
| RESET | Reset angle values |

### Notes

|  |  |
| --- | --- |
| [[55]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id161) | Angle value times 2 (i.e. value of 10 = angle of 5 degrees). Allows for 0.5 degree precision. |
| [[56]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id162) | Value needs to be converted to 16-bit signed integer. Example:if (value2 > 32767) value2 = value2 - 65536 |

## mindsensors.com EV3 Sensor Multiplexer

### General Info

|  |  |
| --- | --- |
| Driver Name | ms-ev3-smux |
| Website | [www.mindsensors.com](http://www.mindsensors.com/ev3-and-nxt/23-ev3-sensor-multiplexer-for-ev3-or-nxt) |
| Connection Type | NXT/I2C |
| Default Address | 0x50, 0x51, 0x52 [[57]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-ev3-smux-addresses) |
| Vendor ID | mndsnsrs |
| Product ID | Ev3SMux |
| Number of Modes | 2 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| MUX [[59]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-ev3-smux-mode0) | EV3 Sensor Multiplexer | none | 0 | 0 |  |

### Commands

This sensor does not support commands.

### Notes

|  |  |
| --- | --- |
| [[57]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id164) | This sensor appears as three separate sensors, one for each channel on the sensor mux. |
| [58] | In addition to loading three [lego-sensor] devices for the sensor mux itself, three [lego-port] devices are added as well. These [ms-ev3-smux-port] devices must be used to manually specify the type of sensor that is attached to each port. |

|  |  |
| --- | --- |
| [[59]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id165) | This mode does not do anything useful. |

## mindsensors.com Light Sensor Array

### General Info

|  |  |
| --- | --- |
| Driver Name | ms-light-array |
| Website | [www.mindsensors.com](http://www.mindsensors.com/ev3-and-nxt/47-light-sensor-array-for-nxt-or-ev3) |
| Connection Type | NXT/I2C |
| Default Address | 0x0A [[60]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-light-array-address) |
| Vendor ID | mndsnsrs |
| Product ID | LSArray |
| Number of Modes | 2 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| CAL | Calibrated values | pct(percent) | 0 | 8 | value0: LED 0 (0 to 100)  value1: LED 1 (0 to 100)  value2: LED 2 (0 to 100)  value3: LED 3 (0 to 100)  value4: LED 4 (0 to 100)  value5: LED 5 (0 to 100)  value6: LED 6 (0 to 100)  value7: LED 7 (0 to 100) |
| RAW | Uncalibrated values | none | 0 | 8 | value0: LED 0 (0 to ???)  value1: LED 1 (0 to ???)  value2: LED 2 (0 to ???)  value3: LED 3 (0 to ???)  value4: LED 4 (0 to ???)  value5: LED 5 (0 to ???)  value6: LED 6 (0 to ???)  value7: LED 7 (0 to ???) |

### Commands

| **Command** | **Description** |
| --- | --- |
| CAL-WHITE | Calibrate white |
| CAL-BLACK | Calibrate black |
| SLEEP[[61]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-light-array-mode2) | Put sensor to sleep |
| WAKE [[62]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-light-array-mode3) | Wake up the sensor |
| 60HZ | Configures sensor for 60Hz electrical mains |
| 50HZ | Configures sensor for 50Hz electrical mains |
| UNIVERSAL | Configures sensor for any (50/60Hz) electrical mains |

### Notes

|  |  |
| --- | --- |
| [[60]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id167) | The address is programmable. See manufacturer documentation for more information. |
| [[61]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "id168) | poll\_ms must be set to 0 in order for sensor to sleep. |

|  |  |
| --- | --- |
| [[62]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id169) | Will return an error (-ENXIO) if sensor is actually asleep. Completes successfully if sensor is already awake. |

## mindsensors.com Line Follower Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | ms-line-leader |
| Website | [www.mindsensors.com](http://www.mindsensors.com/ev3-and-nxt/48-line-follower-sensor-for-nxt-or-ev3) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 [[63]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-line-leader-address) |
| Vendor ID | mndsnsrs |
| Product ID | LineLdr |
| Number of Modes | 4 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| PID | Line Follower | pct(percent) | 0 | 1 | value0: Steering (-100 to 100) [[64]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-line-leader-mode0-value0) |
| PID-ALL | Line Follower - all values | none | 0 | 3 | value0: Steering (-100 to 100) [[64]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-line-leader-mode0-value0)  value1: Average (0 to 80) [[65]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-line-leader-mode1-value1)  value2: Result (as bits) [[66]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-line-leader-mode1-value2) |
| CAL | Calibrated values | pct(percent) | 0 | 8 | value0: LED 0 (0 to 100)  value1: LED 1 (0 to 100)  value2: LED 2 (0 to 100)  value3: LED 3 (0 to 100)  value4: LED 4 (0 to 100)  value5: LED 5 (0 to 100)  value6: LED 6 (0 to 100)  value7: LED 7 (0 to 100) |
| RAW | Uncalibrated values | none | 0 | 8 | value0: LED 0 (0 to ???)  value1: LED 1 (0 to ???)  value2: LED 2 (0 to ???)  value3: LED 3 (0 to ???)  value4: LED 4 (0 to ???)  value5: LED 5 (0 to ???)  value6: LED 6 (0 to ???)  value7: LED 7 (0 to ???) |

### Commands

| **Command** | **Description** |
| --- | --- |
| CAL-WHITE | Calibrate white |
| CAL-BLACK | Calibrate black |
| SLEEP[[67]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-line-leader-cmd2) | Put sensor to sleep |
| WAKE [[68]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-line-leader-cmd3) | Wake up the sensor |
| INV-COL | Color inversion (White line on a black background) |
| RST-COL | Reset Color inversion (black line on a white background). |
| SNAP [[69]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-line-leader-cmd6) | Take a snapshot. |
| 60HZ | Configures sensor for 60Hz electrical mains |
| 50HZ | Configures sensor for 50Hz electrical mains |
| UNIVERSAL | Configures sensor for any (50/60Hz) electrical mains |

### Notes

|  |  |
| --- | --- |
| [[63]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id171) | The address is programmable. See manufacturer documentation for more information. |
| [64] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id172), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id173)) “Steering” is the power value returned by the sensor to correct your course. Add this value to your left motor and subtract from right motor. |

|  |  |
| --- | --- |
| [[65]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id174) | “Average” is the weighted average of the sensor reading. The average is a weighted average of the bits set to 1 based on the position. i.e. left most bit has weight of 10, second bit has\* weight of 20. |
| [[66]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "id175) | “Result” is a byte value of the sensor reading. Each bit corresponding to the sensor where the line is seen is set to 1, or else the bit is zero. |

|  |  |
| --- | --- |
| [[67]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id176) | poll\_ms must be set to 0 in order for sensor to sleep. |
| [[68]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "id177) | Will return an error (-ENXIO) if sensor is actually asleep. Completes successfully if sensor is already awake. |

|  |  |
| --- | --- |
| [[69]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id178) | The “SNAP” command looks at the line under the sensor and stores the width and position of the line in sensor’s memory. Subsequently, sensor will use these characteristics of line to track it. This command inverts the colors if it sees a white line on black background. (PID parameters are not affected.) |

## mindsensors.com Vision Subsystem v4 for NXT or EV3

### General Info

|  |  |
| --- | --- |
| Driver Name | ms-nxtcam |
| Website | [www.mindsensors.com](http://www.mindsensors.com/ev3-and-nxt/14-vision-subsystem-v4-for-nxt-or-ev3-nxtcam-v4) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 [[70]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-nxtcam-address) |
| Vendor ID | mndsnsrs |
| Product ID | NXTCAM |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| TRACK[[71]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-nxtcam-mode0) | Tracking | none | 0 | 6 | value0: Object count  value1: Color index  value2: X upper left  value3: Y upper left  value4: X lower right  value5: Y lower right |

### Commands

| **Command** | **Description** |
| --- | --- |
| TRACK-ON | Enable tracking |
| TRACK-OFF | Disable tracking |
| TRACK-OBJ | Set to object tracking mode |
| TRACK-LINE | Set to line tracking mode |
| SORT-SIZE | Sort by size |
| SORT-COL | Sort by color |

### Notes

|  |  |
| --- | --- |
| [[70]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id180) | The address is programmable. See manufacturer documentation for more information. |
| [[71]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "id181) | This driver only allows for tracking a single object. To track more than one object and for other more advanced uses, you can disable this driver by setting poll\_ms to 0 and using the direct attribute to directly read and write I2C messages. See [Appendix C: I2C Devices](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/i2c.html) and the manufacturers documentation for more information. |

## mindsensors.com Vision Subsystem v5 for NXT or EV3 (with fixed lens)

### General Info

|  |  |
| --- | --- |
| Driver Name | ms-nxtcam5 |
| Website | [www.mindsensors.com](http://www.mindsensors.com/vision-for-robots/191-vision-subsystem-v5-for-nxt-or-ev3-with-fixed-lens) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 [[72]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-nxtcam5-address) |
| Vendor ID | mndsnsrs |
| Product ID | NXTcam5 |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| TRACK[[73]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-nxtcam5-mode0) | Tracking | none | 0 | 6 | value0: Object count  value1: Color index  value2: X upper left  value3: Y upper left  value4: X lower right  value5: Y lower right |

### Commands

| **Command** | **Description** |
| --- | --- |
| TRACK-OBJ | Select object tracking mode |
| TRACK-FACE | Select face tracking mode |
| MULTI-MOVIE | Begin capturing continuous movie (end by any other command) |
| MOVIE | Capture short movie clip |
| PICTURE | Capture still picture |
| TRACK-EYE | Select eye tracking mode |
| TRACK-QR | Select QR code tracking mode (future) |
| TRACK-LINE | Select line tracking mode |

### Notes

|  |  |
| --- | --- |
| [[72]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id183) | The address is programmable. See manufacturer documentation for more information. |
| [[73]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html" \l "id184) | This driver only allows for tracking a single object. To track more than one object and for other more advanced uses, you can disable this driver by setting poll\_ms to 0 and using the direct attribute to directly read and write I2C messages. See [Appendix C: I2C Devices](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/i2c.html) and the manufacturers documentation for more information. |

## mindsensors.com Multiplexer for NXT/EV3 Motors

### General Info

|  |  |
| --- | --- |
| Driver Name | ms-nxtmmx |
| Website | [www.mindsensors.com](http://www.mindsensors.com/ev3-and-nxt/21-multiplexer-for-nxtev3-motors) |
| Connection Type | NXT/I2C |
| Default Address | 0x03 [[74]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-nxtmmx-address) |
| Vendor ID | mndsnsrs |
| Product ID | NxTMMX |
| Number of Modes | 2 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| STATUS | Status | V (volts) | 3 | 1 | value0: Battery voltage |
| STATUS-OLD[[76]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-nxtmmx-mode1) | Status (for older firmware versions) | V (volts) | 3 | 1 | value0: Battery voltage |

### Commands

This sensor does not support commands.

### Notes

|  |  |
| --- | --- |
| [[74]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id186) | The address is programmable. See manufacturer documentation for more information. |
| [75] | The NxtMMX driver also loads two [tacho-motor] class devices. Use the tacho-motor class devices to actually control the motors. You can identify the motors by the address attribute. It will bein<X>:i2c<Y>:mux<Z> where <X> is 1-4, <Y> is 3 (unless you changed the address) and <Z> is 1 or 2 (matches M1 or M2 printed on the NxtMMX). |

|  |  |
| --- | --- |
| [[76]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id187) | The I2C register for battery voltage was changed for EV3 compatibility. If the STATUS mode does not seem to work, try this mode instead. |

## mindsensors.com 8-channel Servo Controller

### General Info

|  |  |
| --- | --- |
| Driver Name | ms-8ch-servo |
| Website | [www.mindsensors.com](http://www.mindsensors.com/ev3-and-nxt/25-8-channel-servo-controller-for-nxt-or-ev3) |
| Connection Type | NXT/I2C |
| Default Address | 0x58 [[77]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-8ch-servo-address) |
| Vendor ID | mndsnsrs |
| Product ID | NXTServo |
| Number of Modes | 2 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| V3 | EV3 Compatible | V (volts) | 3 | 1 | value0: Battery voltage (0 to 9400) [[79]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-8ch-servo-mode0-value0) |
| OLD [[80]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-8ch-servo-mode1) | Older versions | V (volts) | 3 | 1 | value0: Battery voltage (0 to 9400) [[79]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-8ch-servo-mode0-value0) |

### Commands

This sensor does not support commands.

### Notes

|  |  |
| --- | --- |
| [[77]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id189) | The address is programmable. See manufacturer documentation for more information. |
| [78] | The ms-8ch-servo driver loads separate servo motor devices (one for each of the 8 channels) in addition to the [The lego-sensor Subsytem](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensors.html#id36) device. See the [servo-motor Subsystem](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/motors.html#servo-motor-class) for more information. The servo-motor class address attribute will return in<X>:i2c<Y>:sv<Z> where <X> is the input port the servo controller is connected to, <Y> is the address and <Z> is the channel as indicated on the servo controller itself. |

|  |  |
| --- | --- |
| [79] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id190), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id192)) The current voltage scaling is based on the manufacturers documentation, however it seems to be low. If you are seeing this too, please open an issue on GitHub and we will change the scaling. |
| [[80]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id191) | Older versions of this sensor have the battery voltage at a different address. If the default mode does not return a value, try this mode. |

## mindsensors.com Sensor building kit for NXT with PCF8574 IC

### General Info

|  |  |
| --- | --- |
| Driver Name | pcf8574 |
| Website | [mindsensors.com](http://mindsensors.com/index.php?module=pagemaster&PAGE_user_op=view_page&PAGE_id=71) |
| Connection Type | Other/I2C |
| Default Address | 0x38 [[81]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#pcf8574-address) |

### Notes

|  |  |
| --- | --- |
| [[81]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id194) | Valid addresses are 0x38..0x3F (configurable via input pins) |
| [82] | Sample usage:  Register I2C device:  echo pcf8574 0x38 **>** **/**sys**/**bus**/**i2c**/**devices**/**i2c**-<**port**+**2**>/**new\_device  Finding device class node and initializing:  for chip in $(find /sys/class/gpio -name gpiochip\*)  do  if [[ "$(cat $chip/label)" == "pcf8547" ]]  then  base=$(cat $chip/base)  # Pins are active low  for i in {0..7}  do  gpio=$(($base + $i))  echo $gpio > /sys/class/gpio/export  # gpios on this chip are active low  echo 1 > /sys/class/gpio/gpio$gpio/active\_low  # initialize direction here  done  # do whatever with the gpios  fi  done |

## mindsensors.com Sensor building kit for NXT with PCF8591 IC

### General Info

|  |  |
| --- | --- |
| Driver Name | pcf8591 |
| Website | [mindsensors.com](http://mindsensors.com/index.php?module=pagemaster&PAGE_user_op=view_page&PAGE_id=92) |
| Connection Type | Other/I2C |
| Default Address | 0x48 [[83]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#pcf8591-address) |

### Notes

|  |  |
| --- | --- |
| [[83]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id196) | Valid addresses are 0x48..0x4F (configurable via input pins) |
| [84] | Sample usage:  Register I2C device:  echo pcf8591 0x48 **>** **/**sys**/**bus**/**i2c**/**devices**/**i2c**-<**port**+**2**>/**new\_device  Finding device class node:  for chip in $(find /sys/class/hwmon -name hwmon\*)  do  if [[ "$(cat $chip/device/name)" == "pcf8591" ]]  then  # do whatever  fi  done |

## mindsensors.com Digital Pneumatic Pressure Sensor

### General Info

|  |  |
| --- | --- |
| Driver Name | ms-pps58-nx |
| Website | [www.mindsensors.com](http://www.mindsensors.com/ev3-and-nxt/127-digital-pneumatic-pressure-sensor-for-nxt-or-ev3) |
| Connection Type | NXT/I2C |
| Default Address | 0x0C |
| Vendor ID | mndsnsrs |
| Product ID | PPS58 |
| Number of Modes | 7 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| RAW | Raw sensor value | Pa | 0 | 1 | value0: Pressure (0 to 400,000 Pa) |
| ABS-PSI | Absolute pressure (PSI) | PSI(Pounds per square inch) | 0 | 1 | value0: Pressure (0 to 58 PSI) |
| ABS-MBAR | Absolute pressure (millibar) | mbar(millibar) | 0 | 1 | value0: Pressure (0 to 4000 millibar) |
| ABS-KPA | Absolute pressure (kPa) | kPa(kilopascals) | 0 | 1 | value0: Pressure (0 to 400 kPa) |
| REL-PSI | Gauge pressure (PSI) | PSI(Pounds per square inch) | 0 | 1 | value0: Pressure (0 to 58 PSI minus the reference pressure) |
| REL-MBAR | Gauge pressure (millibar) | mbar(millibar) | 0 | 1 | value0: Pressure (0 to 4000 millibar minus the reference pressure) |
| REL-KPA | Gauge pressure (kPa) | kPa(kilopascals) | 0 | 1 | value0: Pressure (0 to 400 kPa minus the reference pressure) |

### Commands

| **Command** | **Description** |
| --- | --- |
| ZERO [[85]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-pps58-nx-cmd0) | Change Reference pressure to current absolute pressure. |

### Notes

|  |  |
| --- | --- |
| [[85]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id198) | The reference pressure is used to calculate the gauge pressure. Therefore, this command only affects the REL-\* modes. |

## mindsensors.com Pixy Adapter for MINDSTORMS EV3 or NXT

### General Info

|  |  |
| --- | --- |
| Driver Name | ms-pixy-adapter |
| Website | [www.mindsensors.com](http://www.mindsensors.com/ev3-and-nxt/35-pixy-adapter) |
| Connection Type | NXT/I2C |
| Default Address | 0x01 [[86]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-pixy-adapter-address) |
| Vendor ID | mndsnsrs |
| Product ID | PixyAdpt |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| TRACK[[87]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-pixy-adapter-mode0) | Tracking | none | 0 | 6 | value0: Object count  value1: Color index  value2: X upper left  value3: Y upper left  value4: X lower right  value5: Y lower right |

### Commands

| **Command** | **Description** |
| --- | --- |
| SORT-SIZE | Sort by size |
| SORT-COL | Sort by color |

### Notes

|  |  |
| --- | --- |
| [[86]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id200) | The address is programmable. See manufacturer documentation for more information. |
| [[87]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id201) | This driver only allows for tracking a single object. To track more than one object and for other more advanced uses, you can disable this driver by setting poll\_ms to 0 and using the direct attribute to directly read and write I2C messages. See the [Using I2C Sensors] page and the manufacturers documentation for more information. |

## mindsensors.com Realtime Clock for NXT

### General Info

|  |  |
| --- | --- |
| Driver Name | ds1307 |
| Website | [mindsensors.com](http://mindsensors.com/index.php?module=pagemaster&PAGE_user_op=view_page&PAGE_id=77) |
| Connection Type | Other/I2C |
| Default Address | 0x68 |

### Notes

|  |  |
| --- | --- |
| [88] | Sample usage:  Register I2C device:  echo ds1307 0x68 **>** **/**sys**/**bus**/**i2c**/**devices**/**i2c**-<**port**+**2**>/**new\_device  Finding device class node:  for chip in $(find /sys/class/rtc -name rtc\*)  do  if [[ "$(cat $chip/name)" == "ds1307" ]]  then  # do whatever  fi  done |

## mindsensors.com Touch Sensor Multiplexer for NXT & EV3

### General Info

|  |  |
| --- | --- |
| Driver Name | ms-nxt-touch-mux |
| Website | [mindsensors.com](http://mindsensors.com/index.php?module=pagemaster&PAGE_user_op=view_page&PAGE_id=135) |
| Connection Type | NXT/Analog |
| Number of Modes | 1 |

### Modes

| **Mode** | **Description** | **Units** | **Decimals** | **Num. Values** | **Values** |
| --- | --- | --- | --- | --- | --- |
| TOUCH-MUX | Touch sensors | none | 0 | 3 | value0: Sensor T1 state [[89]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-nxt-touch-mux-mode0-value0)  value1: Sensor T2 state [[89]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-nxt-touch-mux-mode0-value0)  value2: Sensor T3 state [[89]](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#ms-nxt-touch-mux-mode0-value0) |

### Commands

This sensor does not support commands.

### Notes

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| [89] | ([*1*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id204), [*2*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id205), [*3*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensor_data.html#id206))  Values:   | **Value** | **Description** | | --- | --- | | 0 | Released | | 1 | Pressed | |

# Appendix B: Motor Data

This page contains sensor-specific data for each type of supported motor.

## Actuonix L12 EV3 100mm

### General Info

|  |  |
| --- | --- |
| Driver Name | act-l12-ev3-100 |
| Website | [www.actuonix.com](http://www.actuonix.com/product_p/l12-ev3-100.htm) |
| Connection Type | ev3 |

## Actuonix L12 EV3 50mm

### General Info

|  |  |
| --- | --- |
| Driver Name | act-l12-ev3-50 |
| Website | [www.actuonix.com](http://www.actuonix.com/product_p/l12-ev3-50.htm) |
| Connection Type | ev3 |

## LEGO Motor 9V Mini-motor, newer lighter weight

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-43362 |
| Website | [rebrickable.com](http://rebrickable.com/parts/43362c01) |
| Connection Type | rcx |

## LEGO EV3 Large Servo Motor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-ev3-l-motor |
| Website | [shop.lego.com](http://shop.lego.com/en-US/EV3-Large-Servo-Motor-45502) |
| Connection Type | ev3 |

## LEGO EV3 Medium Servo Motor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-ev3-m-motor |
| Website | [shop.lego.com](http://shop.lego.com/en-US/EV3-Medium-Servo-Motor-45503) |
| Connection Type | ev3 |

## LEGO Technic Motor 9V Geared

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-47154 |
| Website | [rebrickable.com](http://rebrickable.com/parts/44486c02) |
| Connection Type | rcx |

## LEGO Motor 9V Micromotor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-70823 |
| Website | [rebrickable.com](https://rebrickable.com/parts/2986) |
| Connection Type | rcx |

## LEGO Motor 9V Mini-motor, older heavier weight

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-71427 |
| Website | [rebrickable.com](http://rebrickable.com/parts/71427c01) |
| Connection Type | rcx |

## LEGO Technic Motor 9V

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-74569 |
| Website | [rebrickable.com](http://rebrickable.com/parts/2838c01) |
| Connection Type | rcx |

## LEGO Power Functions Train Motor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-88002 |
| Website | [shop.lego.com](http://shop.lego.com/en-US/LEGO-Power-Functions-Train-Motor-88002) |
| Connection Type | rcx |

## LEGO Power Functions L-Motor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-88003 |
| Website | [shop.lego.com](http://shop.lego.com/en-US/Power-Functions-L-Motor-88003) |
| Connection Type | rcx |

## LEGO Power Functions Servo Motor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-88004 |
| Website | [shop.lego.com](http://shop.lego.com/en-US/Power-Functions-Servo-Motor-88004) |
| Connection Type | rcx |

## LEGO Power Functions XL-Motor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-8882 |
| Website | [shop.lego.com](http://shop.lego.com/en-US/LEGO-Power-Functions-XL-Motor-8882) |
| Connection Type | rcx |

## LEGO Power Functions M-Motor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-8883 |
| Website | [shop.lego.com](http://shop.lego.com/en-US/LEGO-Power-Functions-M-Motor-8883) |
| Connection Type | rcx |

## LEGO Power Functions E-Motor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-9670 |
| Website | [education.lego.com](https://education.lego.com/en-us/products/e-motor/9670) |
| Connection Type | rcx |

## LEGO NXT (Interactive Servo) Motor

### General Info

|  |  |
| --- | --- |
| Driver Name | lego-nxt-motor |
| Website | [shop.lego.com](http://shop.lego.com/en-US/Interactive-Servo-Motor-9842) |
| Connection Type | ev3 |

# Appendix C: I2C Devices

The I2C standards only specify how data is sent from device to device. It does not specify the layout of the registers of a device. LEGO, however, has guidelines for 3rd party manufactures so that they can provide sensors with a (fairly) uniform register layout.

We call sensors that were designed following LEGO’s guidelines **NXT/I2C** sensors. This common register layout lets us autodetect the type of sensor and proves access to the sensor via the [lego-sensor class](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensors.html#id36).

We refer to sensors that do not conform to LEGO’s specifications as **Other/I2C** sensors. There are so many types of I2C chips in the wild that are already supported on Linux that we do not attempt to autodetect them. To use them, we just need to find a compatible driver and manually load it.

This page discusses both types of I2C sensors.

## Addressing

I2C uses a 7-bit addressing scheme (there is also 10-bit addressing but it is not implemented in the ev3dev I2C driver). When sending an address over the bus, the address is shifted to the left 1 bit and the least significant bit is used to indicate read or write.

**Note**

The I2C address that is used in ev3dev is different from the other EV3/NXT programming languages/environments. **This means the address in your sensors’ documentation is probably not the address that you need for ev3dev!** In ev3dev (and Linux in general), we used the **unshifted** 7-bit address.

I2C addresses 0x01 through 0x07 (unshifted) are reserved for special use by the I2C specifications. However, these addresses are used by some sensors anyway (most notably the NXT Ultrasonic sensor). The ev3dev kernel has been patched to allow these to work, but some userspace tools will not work with devices at these addresses. For example, we distribute a patched version of the i2c-tools package to work around this.

There is a [table of I2C addresses](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/i2c.html#table-of-i2c-addresses) at the end of the page.

## Using NXT/I2C Sensors

See the page on the [lego-sensor class](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensors.html#id36) for general usage. This page only covers the I2C specifics.

## Polling

When we say “polled”, we just mean that the EV3 brick initiates a read command to read data from the sensor. The data that is read depends on the current mode that is selected. You can change the polling rate using the poll\_ms attribute (of the lego-sensor device). You can also disable polling by setting poll\_ms to 0. When polling is disabled, you can initiate a data read by setting the mode again. By default, NXT/I2C sensors are polled every 100 milliseconds. The default value can be changed via a module parameter.

## Direct Reading and Writing of the Sensor

**Warning**

Be very careful when reading from or writing to your sensors. It is theoretically possible to break them if you read or write to the wrong register.

In most cases, setting the mode of a sensor will write the proper data if necessary, so you don’t actually need to write data using this method. However, it is possible to write arbitrary data to I2C sensors using the direct attribute. Use seek to specify the register to read or write from and always specify the number of bytes to read or write.

Example: Reading the white calibration data from the mindsensors.com Light Sensor Array. This reads 8 bytes from register 0x5A.

$ hd -s $(( 0x5A )) -n 8 direct

Example: Sending a “calibrate white” command to the mindsensor.com Light Sensor Array. This just writes the ascii character W to register 0x41.

$ echo -e -n "W" | dd bs=1 of=direct seek=$(( 0x41 ))

## Manually Loading Devices

If you have autodetection disabled (e.g. using the other-i2c mode of a port) or if you have managed to change the I2C address of your sensor to something other than the default or you are using something that is not even a LEGO compatible sensor, you will have to manually load a device in order to be able to use your sensor. We just have to tell the I2C adapter which driver to use and the address of the device.

The I2C adapter device nodes are at /sys/bus/i2c/devices/i2c-N where N is the number of the input port plus 2. To load a device, we write to the new\_device attribute. NOTE: These nodes only exist when you have an I2C sensor plugged into an input port or the port was manually set to an I2C mode.

Example:

*# echo nxt-i2c-sensor 0x0B > /sys/bus/i2c/devices/i2c-5/new\_device*

## Using Other/I2C Sensors

As we already discussed, Other/I2C sensors generally have an existing Linux driver that you can use. This means that each sensor will work a bit differently. You can load a device just like for manually loading an NXT/I2C device, except we use a different driver name. You can find the names of drivers [here](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/sensors.html#supported-sensors).

Example: Using the mindsensors.com Realtime Clock Sensor on input port 2.

$ echo ds1307 0x68 > /sys/bus/i2c/devices/i2c-4/new\_device

$ dmesg | tail

...

i2c-legoev3 i2c-legoev3.4: registered on input port 2

i2c i2c-4: new\_device: Instantiated device ds1307 at 0x68

rtc-ds1307 4-0068: SET TIME!

rtc-ds1307 4-0068: rtc core: registered ds1307 as rtc1

rtc-ds1307 4-0068: 56 bytes nvram

$ cd /sys/class/rtc

$ ls

rtc0 rtc1

$ cd rtc1

$ ls

date device max\_user\_freq since\_epoch time

dev hctosys name subsystem uevent

Now, I just need to figure out what to do with TWO realtime clocks!

## Direct I2C Communication (Going Driverless)

You actually don’t need a driver to use your I2C sensors. Drivers do make it much safer and easier, but if you really want full control, it is yours for the taking. There are symlinks for each I2C adapter to make finding them easy.

$ ls /dev/i2c-in\*

/dev/i2c-in2 /dev/i2c-in3

**Note**

The symlinks and the underlying I2C device are only present when an I2C sensor is plugged into a port. Also, if a driver is loaded for a particular I2C device, you will get an error that it is in use. You should disable probing in the nxt-i2c-sensor module (or blacklist the driver in/etc/modprobe.d).

You can use the i2c-tools package or an I2C library in your programming language of choice to communicate with I2C devices this way. You don’t want to do this if a device is already loaded so you will want to disable autodetection first if the sensor is the autodetected type. Beware that many sensors, including the NXT Ultrasonic Sensor use an address of 0x01, which is illegal according to the I2C standards. i2c-tools and any library that does some error checking may prevent you from accessing the sensor. In ev3dev-jessie, the i2c-tools package has been patched to work around this.

## Practical examples

### Changing the Polling Rate

Using the NXT Ultrasonic Sensor:

$ cat poll\_ms

100

$ while true; do cat value0; done

22

23

26

27

30

25

...

22

24

26

26

22

22

^C

$ echo 1000 > poll\_ms

$ while true; do cat value0; done

22

22

22

22

22

22

22

25

25

25

25

25

25

25

25

...

^C

$ echo 0 > poll\_ms

$ cat value0 # value0 will be last value measured before polling stopped

23

$ cat value0 # move the sensor and try again

23

$ cat mode

[NXT-US-CM] NXT-US-IN NXT-US-SI-CM NXT-US-SI-IN NXT-US-LIST

$ echo NXT-US-CM > mode # reads data

$ cat value0

29

$ cat value0 # move the sensor and try again

29

^C means you have to press CTRL+C to make the loop stop.

### Sample /etc/modprobe.d/nxt-i2c-sensor.conf

*# Module configuration for nxt-i2c-sensor*

*# Uncomment this line to disable polling*

*#options nxt-i2c-sensor default\_poll\_ms=0*

*# Uncomment this line to disable autodetection*

*#options nxt-i2c-sensor allow\_autodetect=N*

### How to find the I2C adapter node without adding 2

$ IN2\_I2C\_ADAP=$(udevadm info -q path -n /dev/i2c-in2)"/../.."

$ echo $IN2\_I2C\_ADAP

/devices/platform/legoev3-ports/in2/in2:nxt-i2c-host/i2c-legoev3.4/i2c-4/i2c-dev/i2c-4/../..

### Using i2c-tools

With the mindsensors.com Realtime Clock Sensor on input port 2:

& i2cdump 4 0x68

No size specified (using byte-data access)

WARNING! This program can confuse your I2C bus, cause data loss and worse!

I will probe file /dev/i2c-4, address 0x68, mode byte

Continue? [Y/n] y

0 1 2 3 4 5 6 7 8 9 a b c d e f 0123456789abcdef

00: 11 35 00 01 01 01 00 03 50 71 48 60 f5 01 6b 0c ?5.???.?PqH`??k?

10: 78 e3 2d 4e 92 6e c7 69 25 61 6b 5b 04 34 15 05 x?-N?n?i%ak[?4??

20: cc 3e 4e 4b 41 8a 59 09 1b f3 1a 2a 7c 47 a7 90 ?>NKA?Y????\*|G??

30: 20 6a 95 7a 3b da 5b de 73 31 a2 3a 6e 59 ed f8 j?z;?[?s1?:nY??

40: 11 35 00 01 01 01 00 03 50 71 48 60 f5 01 6b 0c ?5.???.?PqH`??k?

50: 78 e3 2d 4e 92 6e c7 69 25 61 6b 5b 04 34 15 05 x?-N?n?i%ak[?4??

60: cc 3e 4e 4b 41 8a 59 09 1b f3 1a 2a 7c 47 a7 90 ?>NKA?Y????\*|G??

70: 20 6a 95 7a 3b da 5b de 73 31 a2 3a 6e 59 ed f8 j?z;?[?s1?:nY??

80: 11 35 00 01 01 01 00 03 50 71 48 60 f5 01 6b 0c ?5.???.?PqH`??k?

90: 78 e3 2d 4e 92 6e c7 69 25 61 6b 5b 04 34 15 05 x?-N?n?i%ak[?4??

a0: cc 3e 4e 4b 41 8a 59 09 1b f3 1a 2a 7c 47 a7 90 ?>NKA?Y????\*|G??

b0: 20 6a 95 7a 3b da 5b de 73 31 a2 3a 6e 59 ed f8 j?z;?[?s1?:nY??

c0: 12 35 00 01 01 01 00 03 50 71 48 60 f5 01 6b 0c ?5.???.?PqH`??k?

d0: 78 e3 2d 4e 92 6e c7 69 25 61 6b 5b 04 34 15 05 x?-N?n?i%ak[?4??

e0: cc 3e 4e 4b 41 8a 59 09 1b f3 1a 2a 7c 47 a7 90 ?>NKA?Y????\*|G??

f0: 20 6a 95 7a 3b da 5b de 73 31 a2 3a 6e 59 ed f8 j?z;?[?s1?:nY??

$ i2cget -y 4 0x68 0x01 | sed s/0x// # read minutes

35

$ i2cset -y 4 0x68 0x08 0x46 0x72 0x65 0x65 0x20 0x72 0x61 0x6d 0x20 0x73 0x70 0x61 0x63 0x65 0x21 i

$ i2cdump -y -r 0x08-0x16 4 0x68

No size specified (using byte-data access)

0 1 2 3 4 5 6 7 8 9 a b c d e f 0123456789abcdef

00: 46 72 65 65 20 72 61 6d Free ram

10: 20 73 70 61 63 65 21 space!

## Useful Info

| *Table of I2C addresses*[*¶*](http://docs.ev3dev.org/projects/lego-linux-drivers/en/ev3dev-jessie/i2c.html#id1) | | |
| --- | --- | --- |
| **Shifted Address  (write/read)** | **Unshifted Address  (hex (dec))** | **Notes** |
| 0x00/0x01 | **0x00** (0) | I2C spec: General call address / START byte |
| 0x02/0x03 | **0x01** (1) | LEGO NXT Ultrasonic and many 3rd party sensors  I2C spec: CBUS address |
| 0x04/0x05 | **0x02** (2) | LEGO Energy Storage  I2C spec: Reserved for different bus format |
| 0x06/0x07 | **0x03** (3) | mindsensors.com Motor Multiplexer  I2C spec: Reserved for future purposes |
| 0x08/0x09 | **0x04** (4) | I2C spec: Hs-mode master code |
| 0x0A/0x0B | **0x05** (5) | I2C spec: Hs-mode master code |
| 0x0C/0x0D | **0x06** (6) | I2C spec: Hs-mode master code |
| 0x0E/0x0F | **0x07** (7) | I2C spec: Hs-mode master code |
| 0x10/0x11 | **0x08** (8) | Some HiTechnic sensors |
| 0x12/0x13 | **0x09** (9) |  |
| 0x14/0x15 | **0x0A** (10) | mindsensors.com Light Sensor Array |
| 0x16/0x17 | **0x0B** (11) |  |
| 0x18/0x19 | **0x0C** (12) | mindsensors.com PPS58-Nx Pressure Sensor |
| 0x1A/0x1B | **0x0D** (13) |  |
| 0x1C/0x1D | **0x0E** (14) |  |
| 0x1E/0x1F | **0x0F** (15) |  |
| 0x20/0x21 | **0x10** (16) |  |
| 0x22/0x23 | **0x11** (17) | mindsensors.com AbsoluteIMU Accel/Compass/Gyro |
| 0x24/0x25 | **0x12** (18) |  |
| 0x26/0x27 | **0x13** (19) |  |
| 0x28/0x29 | **0x14** (20) |  |
| 0x2A/0x2B | **0x15** (21) |  |
| 0x2C/0x2D | **0x16** (22) |  |
| 0x2E/0x2F | **0x17** (23) |  |
| 0x30/0x31 | **0x18** (24) | mindsensors.com GlideWheel-AS Angle Sensor |
| 0x32/0x33 | **0x19** (25) |  |
| 0x34/0x35 | **0x1A** (26) |  |
| 0x36/0x37 | **0x1B** (27) |  |
| 0x38/0x39 | **0x1C** (28) |  |
| 0x3A/0x3B | **0x1D** (29) |  |
| 0x3C/0x3D | **0x1E** (30) |  |
| 0x3E/0x3F | **0x1F** (31) |  |
| 0x40/0x41 | **0x20** (32) |  |
| 0x42/0x43 | **0x21** (33) |  |
| 0x44/0x45 | **0x22** (34) |  |
| 0x46/0x47 | **0x23** (35) |  |
| 0x48/0x49 | **0x24** (06) |  |
| 0x4A/0x4B | **0x25** (37) |  |
| 0x4C/0x4D | **0x26** (38) |  |
| 0x4E/0x4F | **0x27** (39) |  |
| 0x50/0x51 | **0x28** (40) |  |
| 0x52/0x53 | **0x29** (41) |  |
| 0x54/0x55 | **0x2A** (32) |  |
| 0x56/0x57 | **0x2B** (43) |  |
| 0x58/0x59 | **0x2C** (44) |  |
| 0x5A/0x5B | **0x2D** (45) |  |
| 0x5C/0x5D | **0x2E** (46) |  |
| 0x5E/0x5F | **0x2F** (47) |  |
| 0x60/0x61 | **0x30** (48) |  |
| 0x62/0x63 | **0x31** (49) |  |
| 0x64/0x65 | **0x32** (50) |  |
| 0x66/0x67 | **0x33** (51) |  |
| 0x68/0x69 | **0x34** (52) |  |
| 0x6A/0x6B | **0x35** (53) |  |
| 0x6C/0x6D | **0x36** (54) |  |
| 0x6E/0x6F | **0x37** (55) |  |
| 0x70/0x71 | **0x38** (56) | PCF8574 IC |
| 0x72/0x73 | **0x39** (57) |  |
| 0x74/0x75 | **0x3A** (58) |  |
| 0x76/0x77 | **0x3B** (59) |  |
| 0x78/0x79 | **0x3C** (60) |  |
| 0x7A/0x7B | **0x3D** (61) |  |
| 0x7C/0x7D | **0x3E** (62) |  |
| 0x7E/0x7F | **0x3F** (63) |  |
| 0x80/0x81 | **0x40** (64) |  |
| 0x82/0x83 | **0x41** (65) |  |
| 0x84/0x85 | **0x42** (66) |  |
| 0x86/0x87 | **0x43** (67) |  |
| 0x88/0x89 | **0x44** (68) |  |
| 0x8A/0x8B | **0x45** (69) |  |
| 0x8C/0x8D | **0x46** (70) |  |
| 0x8E/0x8F | **0x47** (71) |  |
| 0x90/0x91 | **0x48** (72) | PCF8591 IC |
| 0x92/0x93 | **0x49** (73) |  |
| 0x94/0x95 | **0x4A** (74) |  |
| 0x96/0x97 | **0x4B** (75) |  |
| 0x98/0x99 | **0x4C** (76) | LEGO Temperature Sensor |
| 0x9A/0x9B | **0x4D** (77) |  |
| 0x9C/0x9D | **0x4E** (78) |  |
| 0x9E/0x0F | **0x4F** (79) |  |
| 0xA0/0xA1 | **0x50** (80) | mindsensors.com EV3 Sensor Multiplexer |
| 0xA2/0xA3 | **0x51** (81) | mindsensors.com EV3 Sensor Multiplexer |
| 0xA4/0xA5 | **0x52** (82) | mindsensors.com EV3 Sensor Multiplexer |
| 0xA6/0xA7 | **0x53** (83) |  |
| 0xA8/0xA9 | **0x54** (84) |  |
| 0xAA/0xAB | **0x55** (85) |  |
| 0xAC/0xAD | **0x56** (87) |  |
| 0xAE/0xAF | **0x57** (87) |  |
| 0xB0/0xB1 | **0x58** (88) | mindsensors.com 8 Channel Servo Controller |
| 0xB2/0xB3 | **0x59** (89) |  |
| 0xB4/0xB5 | **0x5A** (90) |  |
| 0xB6/0xB7 | **0x5B** (91) |  |
| 0xB8/0xB9 | **0x5C** (92) |  |
| 0xBA/0xBB | **0x5D** (93) |  |
| 0xBC/0xBD | **0x5E** (94) |  |
| 0xBE/0xBF | **0x5F** (95) |  |
| 0xC0/0xC1 | **0x60** (96) |  |
| 0xC2/0xC3 | **0x61** (97) |  |
| 0xC4/0xC5 | **0x62** (98) |  |
| 0xC6/0xC7 | **0x63** (99) |  |
| 0xC8/0xC9 | **0x64** (100) |  |
| 0xCA/0xCB | **0x65** (101) |  |
| 0xCC/0xCD | **0x66** (102) |  |
| 0xCE/0xCF | **0x67** (103) |  |
| 0xD0/0xD1 | **0x68** (104) | mindsensors.com Realtime Clock |
| 0xD2/0xD3 | **0x69** (105) |  |
| 0xD4/0xD5 | **0x6A** (106) |  |
| 0xD6/0xD7 | **0x6B** (107) |  |
| 0xD8/0xD9 | **0x6C** (108) |  |
| 0xDA/0xDA | **0x6D** (109) |  |
| 0xDC/0xDD | **0x6E** (110) |  |
| 0xDE/0xDF | **0x6F** (111) |  |
| 0xE0/0xE1 | **0x70** (112) |  |
| 0xE2/0xE3 | **0x71** (113) |  |
| 0xE4/0xE5 | **0x72** (114) |  |
| 0xE6/0xE7 | **0x73** (115) |  |
| 0xE8/0xE9 | **0x74** (116) |  |
| 0xEA/0xEB | **0x75** (117) |  |
| 0xEC/0xED | **0x76** (118) |  |
| 0xEE/0xEF | **0x77** (119) |  |
| 0xF0/0xF1 | **0x78** (120) | I2C spec: 10-bit slave addressing |
| 0xF2/0xF3 | **0x79** (121) | I2C spec: 10-bit slave addressing |
| 0xF4/0xF5 | **0x7A** (122) | I2C spec: 10-bit slave addressing |
| 0xF6/0xF7 | **0x7B** (123) | I2C spec: 10-bit slave addressing |
| 0xF8/0xF9 | **0x7C** (124) | I2C spec: Reserved for future purposes |
| 0xFA/0xFB | **0x7D** (125) | I2C spec: Reserved for future purposes |
| 0xFC/0xFD | **0x7E** (126) | I2C spec: Reserved for future purposes |
| 0xFE/0xFF | **0x7F** (127) | I2C spec: Reserved for future purposes |