## What is PSP-Nx-v4

PSP-Nx-v4 is a digital interface to connect
SONY® Playstation 2 controller to NXT.
When used with wireless controller, it acts
as programmable remote control for NXT.
The PS2 controller has two analog
joysticks and 16 buttons. Using PSP-Nx-v4
interface, values of all 16 buttons and 2 joysticks can be read by the
NXT over the wireless link.

## Connections

Using a standard NXT cable, connect the PSP-Nx-v4 to any one of
the four ports of NXT.

Attach wireless receiver to PSP-Nx. Please refer the section below
on how to mount Play station-2 controller receiver on PSP-Nx-v4
interface.

## Mounting Playstation 2 receiver on PSP-Nx-v4

You can insert the Play station 2 wireless controller receiver in the
socket on PSP-Nx-v4 interface. The receiver socket can be inserted
only in one orientation, note the rounded corners to match
orientation before inserting.

⚠ **NOTE**
A LED blinking in Blue color on PSP-Nx-v4 (one blink per second)
indicates that the receiver is not connected correctly to PSP-Nx-v4.
When connected properly, this blinking stops.

## Mounting PSP-Nx-v4 on your contraption

The holes on the PSP-Nx-v4 enclosure are designed
for tight fit of Technic pins (or axles) with '✚' cross
section. The holes however are not designed for
repeated insertions/removals of these pins.

To mount PSP-Nx-v4 on your contraption we suggest that you use
two dark gray 'Technic Axle 3 with Stud' as shown.
Insert axles from the top of the PSP-Nx-v4 and secure with a
bushing on the back or mount it on your contraption directly.

Alternately, you may use blue 'Technic Axle Pin with Friction', as shown.
While disassembling contraption, leave the pins on PSP-Nx-v4.

⚠  **MOUNTING TIP**
If you are mounting it on LEGO/NXT/EV3 Plastic robots, mount the PSP-Nx and dongle at the undercarriage of the robot, between the wheels, (so that it doesn't entice users to hold it as a handle).

If you are mounting on FTC/ VEX robots, you should mount the PSP-Nx dongle protected from the impacts the robot is going to take. (those robots take impacts as high as a car-crash).

## Project Ideas Using PSP-Nx

Be innovative in designing and creating your project!
If you need guidance and ideas for project, please visit LEGO Mindstorms Community website at following url:
http://us.mindstorms.lego.com/en-us/Community/NXTLog/DisplayProjectList.aspx?tag=pspnx

## Programming Techniques for PSP-Nx-v4

**EV3 Method:**
To use capabilities of the sensor, please download EV3 blocks available at following URL:
http://www.mindsensors.com/index.php?controller=attachment&id_attachment=160

Installation instructions for EV3 block are available at:
http://www.mindsensors.com/content/13-how-to-install-blocks-in-ev3

Download EV3 sample program from following URL and modify it to suit your needs.
http://www.mindsensors.com/index.php?controller=attachment&id_attachment=159

**NXT-G Method:**
Please download **PSP-Nx-v4.zip** NXT block from following URL and import it into your NXT-G IDE.

http://www.mindsensors.com/index.php?controller=attachment&id_attachment=263

Installation instructions for NXT-G are available at:
http://www.mindsensors.com/content/21-nxt-g-blocks-how-to-install-blocks

Also download sample programs from following url and modify them to suit your needs.
http://www.mindsensors.com/index.php?controller=attachment&id_attachment=35

⚠️ **NOTE**
Ensure to use latest LEGO firmware on NXT (1.29 or higher).

**RobotC Method:**
You can use example program in C and robotC compiler to use PSP-Nx-v4 on your NXT robot. Download sample program from following URL: https://github.com/botbench/robotcdriversuite

**NXC Method:**
Download the library file and sample programs from following URL, and modify the sample programs to suit your needs.
http://www.mindsensors.com/index.php?controller=attachment&id_attachment=39

If you need to use PSP-Nx-v4 in your existing program, at the top of your NXC program file, include the library with following directive:

```
#include "PSP-Nx-v4-lib.nxc"
```

⚠️ **NOTE**
Ensure to use latest LEGO firmware on NXT (1.29 or higher).

**LabVIEW Method:**
There are two interfaces provided to program using LabVIEW.
  📁✍️   **Direct Control**, where LabVIEW instrument running on PC can receive direct input from the device and control NXT.
  📄✍️   **Remote Programs**, where LabVIEW instrument written on PC, can be compiled and downloaded to your NXT.
Download the LabVIEW library file from following URL, and unzip on your PC.

http://www.mindsensors.com/index.php?
controller=attachment&id_attachment=314

Download the PSP-Nx-v4 Direct control and Remote Program
examples from following location, and modify to suite your needs.
http://www.mindsensors.com/index.php?
controller=attachment&id_attachment=72

## LED Indications:

The blinking of LED on PSP-Nx-v4 indicates following:

| LED state | Situation |
|-----------|-----------|
| LED blinks Green | LED will blink Green momentarily when it receives a packet from Wireless Controller. |
| LED Blinks Blue at about 1 second interval. | Wireless Receiver Dongle is not attached correctly to PSP-Nx-v4 |
| LED blinks Red (For Models equipped with Referee Signal Receiver). | The Referee has sent a signal that disables Controller input to your NXT program. i.e. Joystick value changes or button presses will not be received by your program. |

## Trouble Shooting Connectivity

If you are having trouble connecting PSP-Nx-v4 with wireless
Joystick, please refer to Connectivity Guide at following URL:

http://mindsensors.com/pdfs/PSP-Nx-v4-Connectivity-Guide.pdf

## Recommended Controllers

If you wish to use PSP-Nx with your own controller, we recommend
any of the following controllers:

dreamGEAR LavaGlow 2.4GHZ RF Wireless Controller
Pelican Chameleon Wireless Controller for PlayStation 2
Mad Catz Lynx? PS2 Wireless Controller (P8246)
Logitech Cordless Precision G-X2H14A
Thrustmaster T-Wireless 3 in 1 Rumble Force
Thrustmaster Run n Drive Wireless 3-in-1 Gamepad Blister

PSP-Nx does **NOT** work with the following controllers:

Logitech Cordless Action PS2 Controllers
React Wireless Rechargeable Controller for PlayStation 2
Sony PlayStation 2 DualShock Controllers
Sony SCPH-10010
GameStop Brand 'Predator S-Type' PS2 Wireless Controller
Lynxmotion Joysticks

## Controller Button Layout

Picture below shows the layout of buttons on one of the controllers.
Shape/location of buttons on your controller may vary slightly.
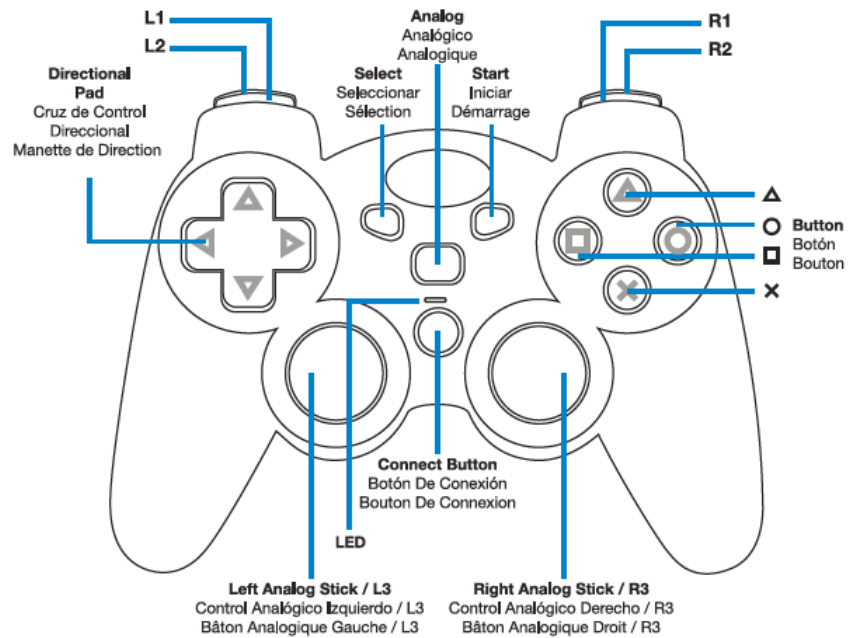
## Advanced Information

## Supported Commands

Following table lists the commands for use and setup:

| Commands | | Action |
|---|---|---|
| ASCII | Hex | |
| I | 0x49 | Initialize the Playstation 2 Wireless Receiver dongle (attached to PSP-Nx) |

## I2C Registers:

| Register | Read | Write |
|---|---|---|
| 0x00-0x07 | Software version – *V4.01* | - |
| 0x08-0x0f | Vendor Id - *mndsnsrs* | - |
| 0x10-0x17 | Device ID – *PSPNX* | - |
| | | |
| 0x41 | Mode | Command |
| 0x42 | Button Set 1 | - |
| 0x43 | Button Set 2 | - |
| 0x44 | X-Left joystick | - |
| 0x45 | Y-Left joystick | - |
| 0x46 | X-Right joystick | - |
| 0x47 | Y-Right joystick | - |
| | | |
| 0x4A | Pressure Exerted on button: ↑ | |
| 0x4B | Pressure Exerted on button: → | |
| 0x4C | Pressure Exerted on button: ↓ | |
| 0x4D | Pressure Exerted on button: ← | |
| 0x4E | Pressure Exerted on button: L2 | |
| 0x4F | Pressure Exerted on button: R2 | |
| 0x50 | Pressure Exerted on button: L1 | |
| 0x51 | Pressure Exerted on button: R1 | |
| 0x52 | Pressure Exerted on button: △ | |
| 0x53 | Pressure Exerted on button: ◯ | |
| 0x54 | Pressure Exerted on button: ✕ | |

| 0x55 | Pressure Exerted on button: ☐ | |
|------|-------------------------------|--|

**Pressure value:**

The Pressure value is an integer between 0 and 255, where 0 indicates no pressure (the button is not pressed), and 255 indicates maximum pressure.

**Bit information for Button Sets:**

The Button Set 1 and 2 are one byte long values, in which each bit represents state of Joystick buttons as follows (the bit is zero when the button is pressed):

| Value | Button Set 1 | Button Set 2 | Binary Value | Integer Value |
|-------|--------------|--------------|--------------|---------------|
| Bit 1 | ← | ☐ | 01111111 | 127 |
| Bit 2 | ↓ | ✕ | 10111111 | 191 |
| Bit 3 | → | ○ | 11011111 | 223 |
| Bit 4 | ↑ | △ | 11101111 | 239 |
| Bit 5 | - | R1 | 11110111 | 247 |
| Bit 6 | R3 | L1 | 11111011 | 251 |
| Bit 7 | L3 | R2 | 11111101 | 253 |
| Bit 8 | - | L2 | 11111110 | 254 |

## Current Consumption

Average measured current profile is as follows:

| Current Consumption | Duration |
|---------------------|----------|
| 12mA | Continuous |

## I2C Bus address

**Factory Default Address: 0x02**

**Changing the I2C Address:**
The I2C address of PSP-Nx-v4 can be changed.
To change address, send following sequence of data on command register. Write this data without any break in sequence (or without any read operation in-between). The new address becomes effective immediately.
The new address should be an even number between 2 and 254 (hex 0x02 and 0xFE).
Data Sequence:

```
0xA0, 0xAA, 0xA5, <new I2C address>
```

**Note:** Send these commands with no break/read operation in between.  This new address is effective immediately. Please note down your address carefully for future reference.

**Instructions for changing the I2C address can be found at:**

NXT and EV3
[http://www.mindsensors.com/blog/how-to/change-i2c-device-address](http://www.mindsensors.com/blog/how-to/change-i2c-device-address).