Date:15/03/12
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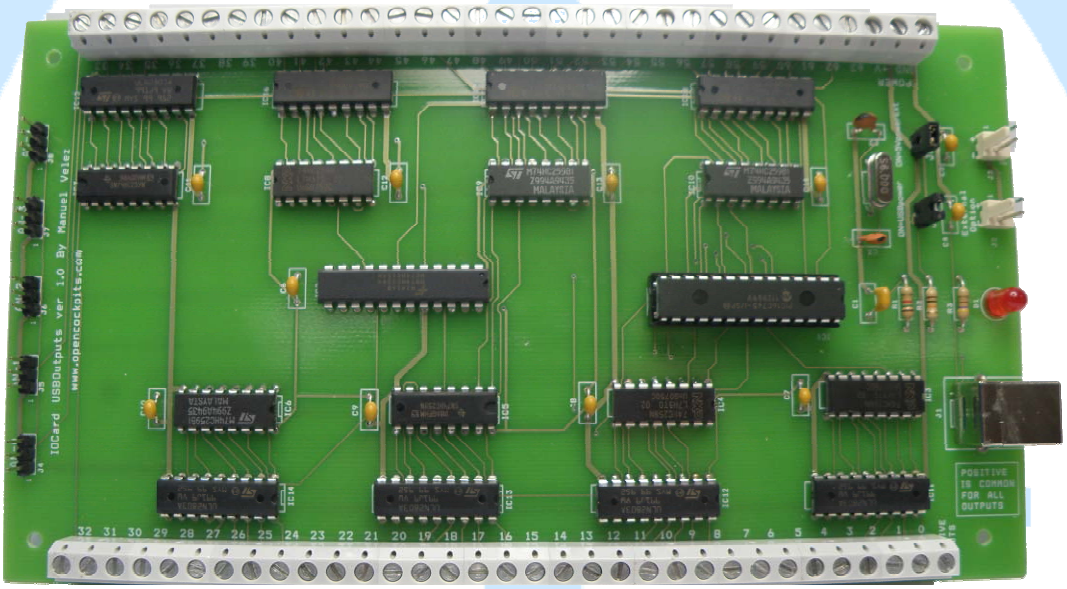
Opencockpits




# IOCard USB Outputs Manual

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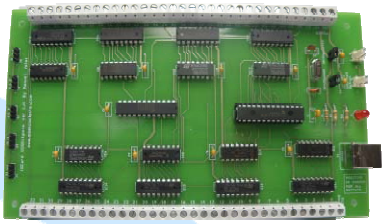
# Introducción:

The IOCard USB Outputs has been designed to manage 64 outputs and to control the current strength of the outputs, also have 5 analog inputs. The connection to the computer is by USB port.

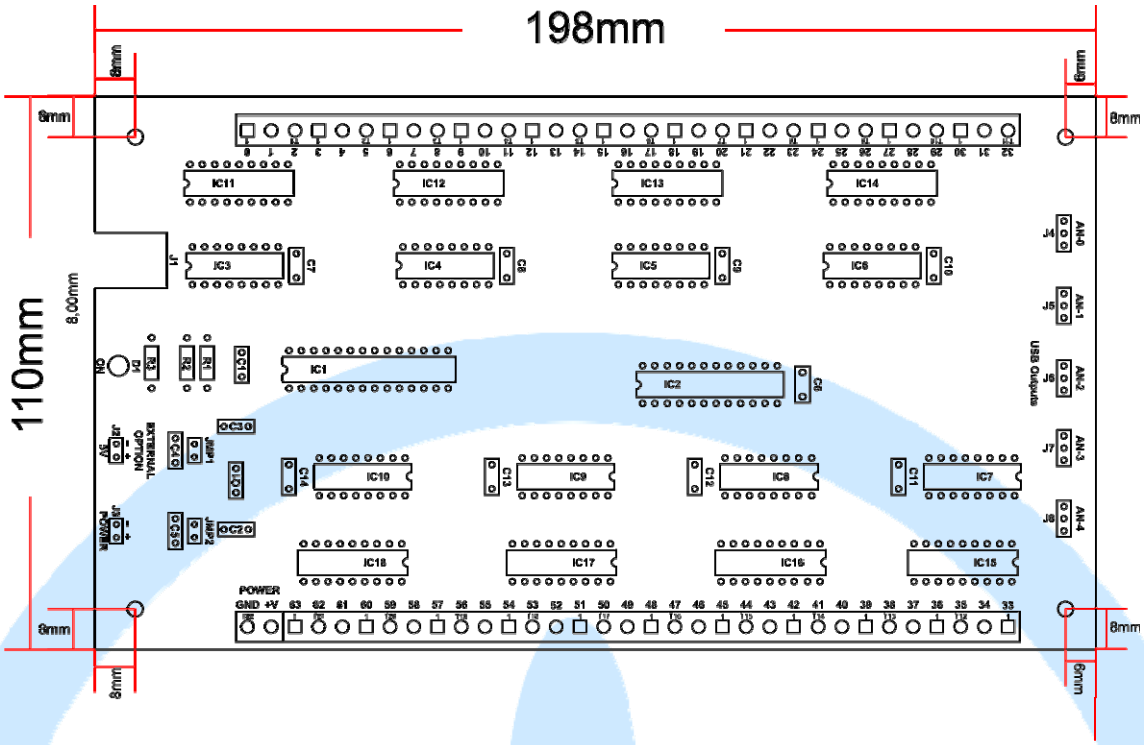
## *Usb Outputs:*



The card when is installed is recognized as HID device and is managed by IOCP protocol with SIOC.
Each of 64 outputs can support up to 50V and 500mA with a maximum of 2,5A for all outputs together. The strength control is 7 bits (0-127) with PWM (Pulse Width Modulation) that can be used to manage leds or lamps for indicators and integral management of panels backlightning. The strength is always the same for all outputs.

# Outline and components:

- C1 = CAPACITOR 220nf
- C2, C3 = CAPACITORS 22pF
- C4 A C14 = CAPACITORS 0.1mF
- D1 = LED DIODE
- IC1 = MICROCONTROLLER 16C745
- IC2 = INTEGRATED CIRCUIT 74HC154
- IC3, IC10 = INTEGRATED CIRCUIT 74HC259
- IC11, IC18 = INTEGRATED CIRCUIT ULN2803
- J1 = USB CONNECTOR
- J2 = POWER SUPPLY CONNECTOR +5V (not reversed polarity protected)
- J3 = EXTERNAL POWER SUPPLY (not reversed polarity protected)
- JMP1 = INTERNAL/EXTERNAL POWER SUPPLY JUMPER SELECTOR
- JMP2 = INTERNAL/EXTERNAL POWER SUPPLY JUMPER SELECTOR
- J4 (AN-0), J5 (AN-1), J6 (AN-2), J7 (AN-3), J8 (AN-4) = ANALOG INPUTS CONNECTORS 3 PIN
- Q1 = QUARTZ CRYSTAL 6Mhz
- R1 = RESISTOR 1K5
- R2 = RESISTOR 10K
- R3 = RESISTOR 470R
- T1 A T22 = PCB SCREW CONNECTORS 3 HOLES.




## *Connectors descriptions:*

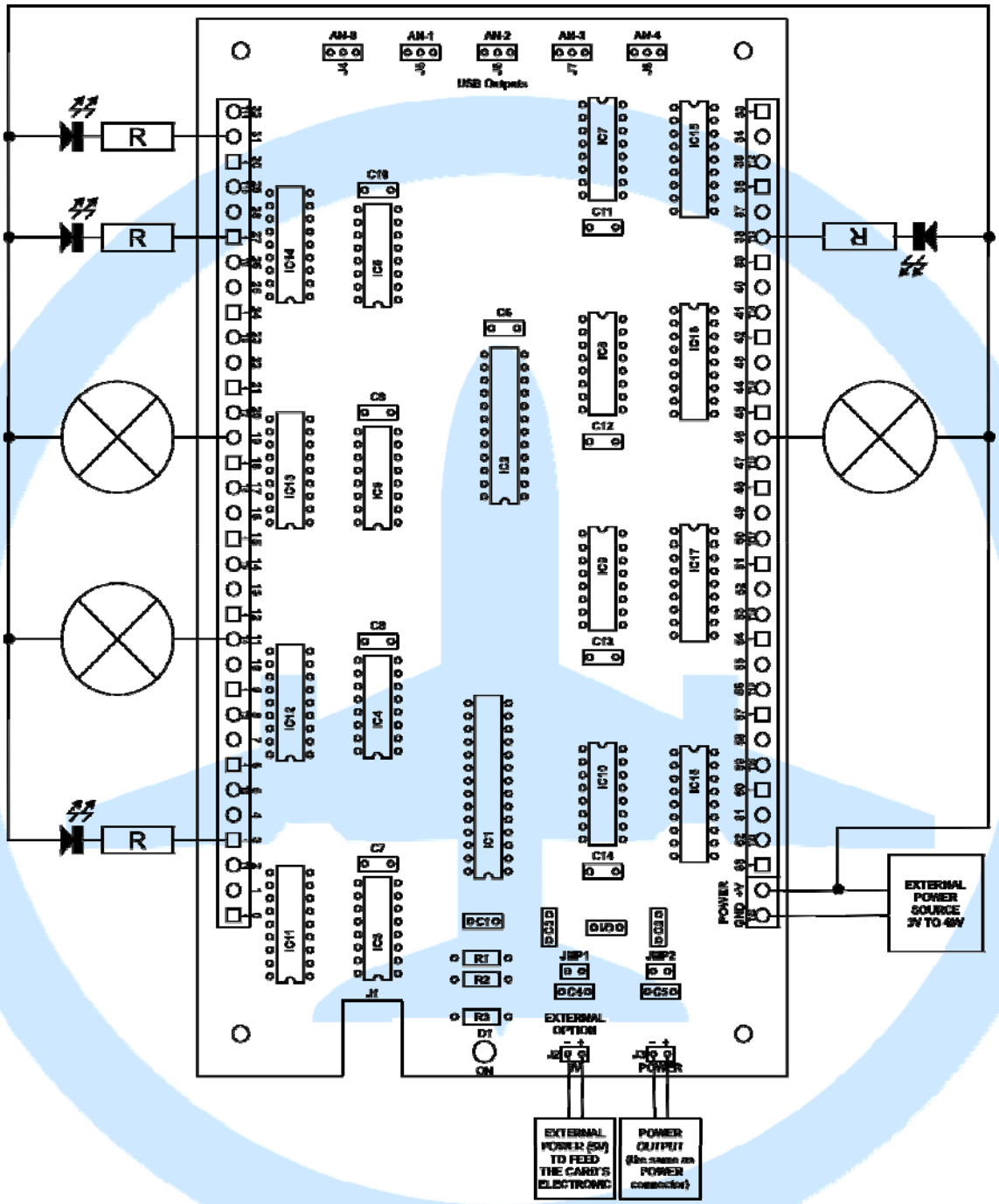
• J1 = USB connector to computer. The computer will recognize automatically the board as HID device.
• T2 = Screw connectors for outputs, numbered from 0 to 63. IMPORTANT: At this connectors we will plug the cathodes (k, GND) for LEDs, lamps or others elements.
• POWER = Power supply connector for LEDs, lamps, etc. The voltage will be from 3V up to 40V, no more (not reversed polarity protected).
• J2 = Input power connector 5V for USB Outputs card from external power supply (not reversed polarity protected).
• J3 = Output feeding connector that have the same voltage that POWER connector.
• J4 a J8 = Connectors for analog inputs AN-0 to AN-4.
• JMP1 y JMP2 = Configuration jumpers for card´s power supply, as shown:

| JUMPER 1 | JUMPER 2 | CARD SUPPLY | OUTP. SUPPLY |
|---|---|---|---|
| OPEN | OPEN | EXTERNAL | EXTERNAL |
| CLOSED | OPEN | USB | EXTERNAL |
| CLOSED | CLOSED | USB | EXTERNAL (5V) |
| OPEN | CLOSED | - | - |

Attention: If You have both jumpers closed and connect the power supply with different voltage of 5V, board will be damaged.

## *Connection scheme:*

Next is shown an example of some elements connections to the USB Outputs card and the power supply (input and outputs) connections too.

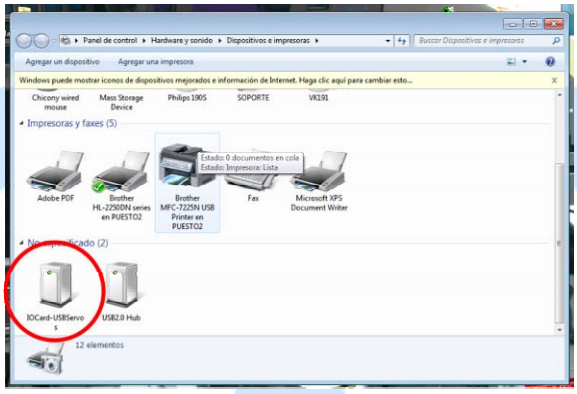



We must take into account that the common of all elements conected is the positive (anode, A), lamps have not polarity but LED´s yes.

# Starting the card:

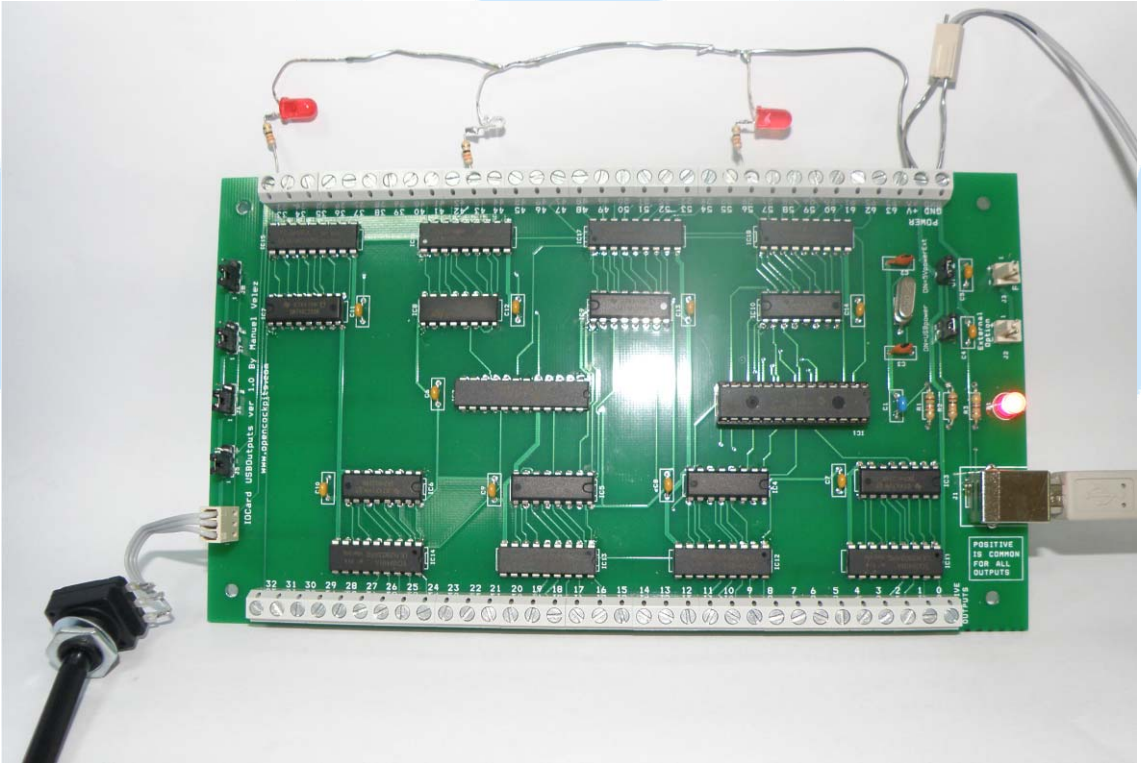
We already know  how IOCard USB Outputs works, let's go to test and connect it to see the results.

At the end of this document there is a list of links to download the necessary software to put into practice this manual.




It has been recognized, at this moment we have two options to test the USB Outputs, one with test_outputs.exe, software made exclusively to test this card with all its options including the level of outputs intensity and two with SIOC Monitor, which doesn´t control the intensity level of the output.

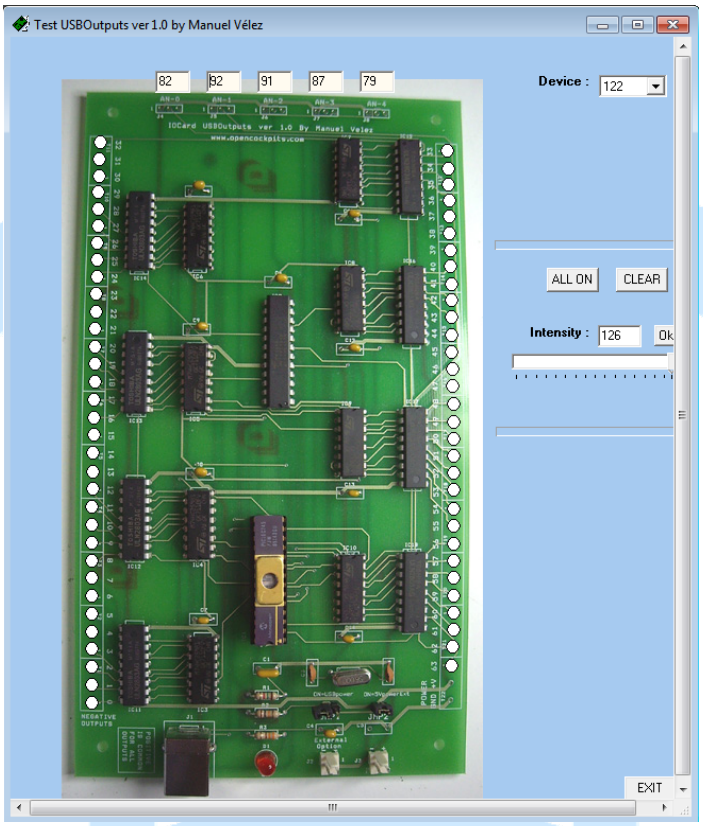
But to test it we will do an example assembly:




In the example we have connected two red LEDs to outputs 33 and 56 and one white LED in output 43, also connect a potentiometer to AN0 (J4) and jumpers on the other analog inputs for their readings will not fluctuate. The feed chosen for the board is USB and the outputs feeding is external of just 5V (JMP1 and JMP2 closed).

## *Test_outputs:*

This software is started directly and shows an image of the card with all their inputs and outputs, which we have access with the mouse to activate or deactivate, besides reading the analog inputs and the slider to change the strength of the outputs (all outputs have the same strength as long).

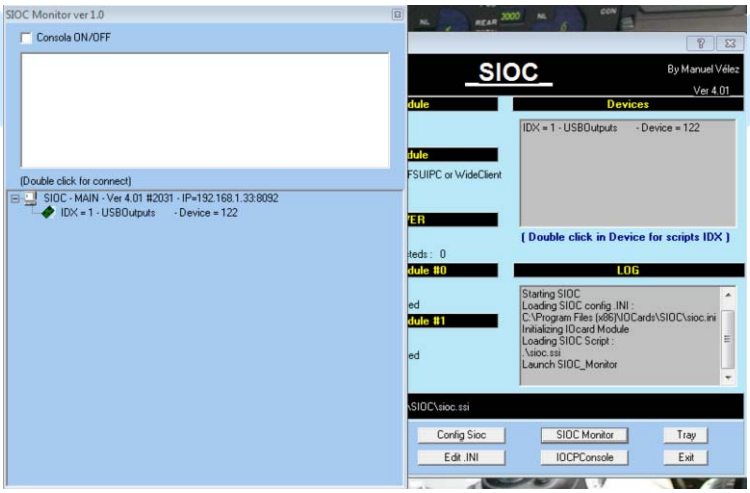



Warning: when You connect the USB, red LED D1 will remain on, if not there is a problem.

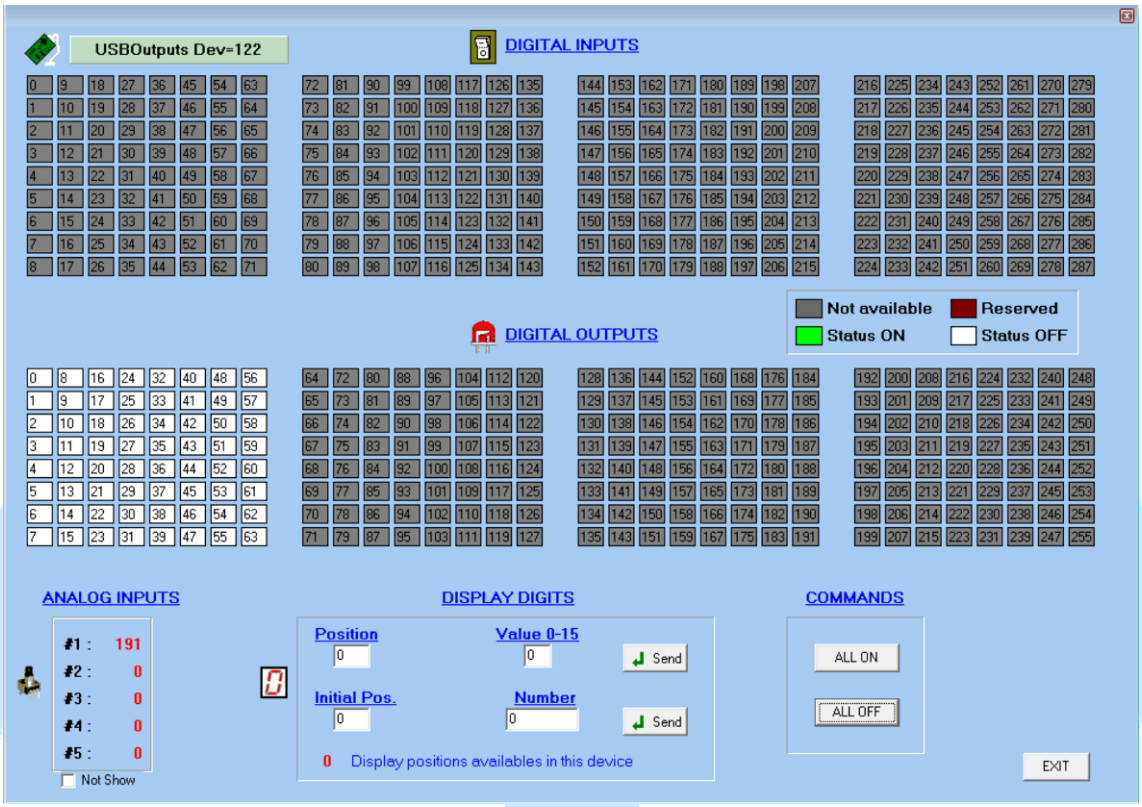
We can now test if our assembly works, by pressing ALL ON and then pressing CLEAR or pressing each output to activate or deactivate it, besides You can play with the output's strength (LEDs will change intensity) and can see the analog values.

## *Sioc Monitor:*

Sioc has an integrated test system for all IOCards, also for the Usb Outputs but without the outputs strength control.

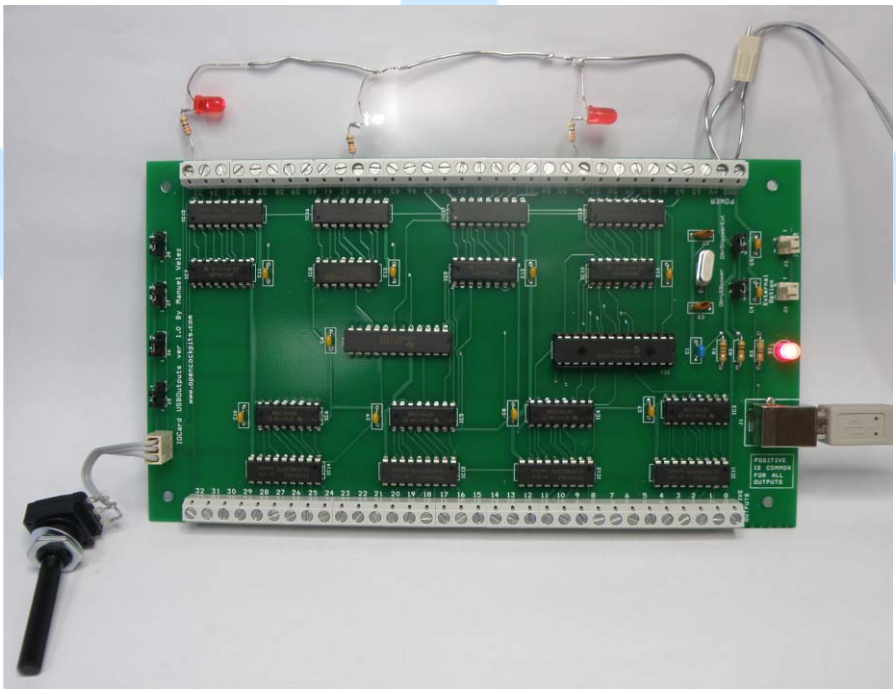


Next, we will test with SIOC program if our assembly went well and everything works. Then run Sioc, we will look if it has been recognized and if so, will press Monitor button and will check the installation:




As we can see the analog input #1 shows the value of our potentiometer and the others shows the value 0, if we turn the potentiometer will see how the value represented goes up or down or vice versa (depending on how we make the connections of the pins) if we are not interested in the turn direction of the values we share external pins of J4 connector or do so through a software Sioc script.

Test now the outputs, if we press the ALL ON button all outputs will be actives and our 3 leds too.



We should do this test to all connectors.

# Installation of software and configuration:

To use the USB Outputs features we should install SIOC (latest version is possible) and FS, FSX, X-Plane, etc.

To manage this card we use scripts, to take card´s control we must edit sioc.ini, so we will assign an index device number to each USB Outputs installed, creating a code line in sioc.ini. It is important remember that USB Outputs have two functions, one to control outputs with current strength management and other to control the reading of analog inputs, both must be declared in sioc.ini as shown:

## *Declaration in SIOC.ini:*

### Outs:

**MASTER=XX,6,1,YY**

**XX** represent the index device number (IDX) in our card's list.
**YY** represent de USB port number where the card is connected (DEVICE, 122 in our example).

### Analog inputs:

**USBAnalogic=XX,YY**

**XX** represent the index device number (IDX) in our card's list.
**YY** represent de USB port number where the card is connected (DEVICE, 122 in our example).

Both values must be the same as outs declaration.

For example, if we connect two USB Outputs cards with device numbers 94 and 122 (this numbers are shown in upper right Sioc window) then we will declare they as shown in sioc.ini:

MASTER=1,6,1,122 [122 is device number on our example computer]
MASTER=2,6,1,94
USBAnalogic=1,122 [122 is device number on our example computer]
USBAnalogic=2,94

## *Declaration on scripts:*

### Outs:

To refer the exact output number, we must take the IDX number declared in sioc.ini to each USB Outputs card. Outputs definition are as shown:

**Var** *VVVV*, **name** *NNNN*, **Link IOCARD_OUT, Output** *SS,* **Device** *DD*

**VVVV** = variable number.
**NNNN** = variable name (optional).
**SS** = output number 0-63.
**DD** = IDX number declared in sioc.ini (if is the only USB Outputs connected and is declared as 0, this code is not necessary into the declaration).

Example of definition:

Var 0001, name bright_ctrl, Link IOCARD_OUT, Output 33, Device 1

## Output's intensity control:

To manage the output's intensity, the outputs will be defined using the 7-segments displays format (Link IOCARD_DISPLAY) but assigning fixed values to digit (Digit 1) and number (Numbers 3). This variable can take values from 0 up to 127 (minimum to maximum):

**Var** *VVVV*, **name** *NNNN*, **Link IOCARD_DISPLAY, DEVICE** *XX*, **Digit 1**, **Numbers 3**

**VVVV** = variable number.
**NNNN** = variable name (optional).
**XX** = IDX device number declared in sioc.ini.

Example of definition:

Var 0001, Name bright, Link IOCARD_DISPLAY, Device 1, Digit 1, Numbers 3

## Analog inputs:

To read the analog inputs we will use the next format:

**Var** *VVVV*, **name** *NNNN*, **Link IOCARD_ANALOGIC, Input** *EE*, **posL** *LLL*, **posC** *CCC*, **posR** *RRR*, **Device** *DD*

**VVVV** = variable number.
**NNNN** = variable name (optional).
**EE** = analog input number 1-5.
**LLL** = device's maximum position to the left.
**CCC** = device's center position.
**RRR** = device's maximum position to the right.
**DD** = Index number declared in sioc.ini (if is the only USB Outputs connected and is declared as 0, this code is not necessary into the declaration).
Example of analog input declaration:

Var 0002, name pot_flaps, Link IOCARD_ANALOGIC, Input 2, posL 1, posC 128, posR 255, Device 1

## *Scripts examples:*

## Outs:

The assembly used before at "starting the card" chapter will help us to test the USB Outputs with scripts, we will have three indicators for nose landing wheel: 1 red LED to output 56 wich is on only when landing gear is up, 1 red LED connected to output 33 wich is on only when the landing gear is down and 1 white LED connected to out 43 wich is on only when the landing gear is in transit.

To star, we will write a script into a new text file named "test_usb_outputs1.txt":

```
// ******************************************************************************
// * Config_SIOC ver 4.01  - By Manolo Vélez - www.opencockpits.com
// ******************************************************************************
// * FileName : test_usb_outputs1.txt
// * Date : 15/03/2012
Var 0001, Name ledarriba, Link IOCARD_OUT, Output 56, Device 1  // landing gear up indicator
Var 0002, Name ledtransito, Link IOCARD_OUT, Output 43, Device 1  // landing gear in transit indicator
```

```
Var 0003, Name ledabajo, Link IOCARD_OUT, Output 33, Device 1  // landing gear down indicator
Var 0004, Name tren, Link FSUIPC_INOUT, Offset $0BEC, Length 4  // nose landing gear position Offset
{
 IF &tren = 0  // if landing gear is up
  {
   &ledarriba = 1  // landing gear up indicator  is on
   &ledtransito = 0  // landing gear in transit indicator is off
   &ledabajo = 0  // landing gear down indicator is off
  }
 IF &tren >= 1  // if landing gear is in transit
  {
   IF &tren < 16383  // and if landing gear is not yet completely down
    {
     &ledarriba = 0  // landing gear up indicator  is off
     &ledtransito = 1  // landing gear transit indicator  is on
     &ledabajo = 0  // landing gear down indicator  is off
    }
  }
 IF &tren = 16383  // if landing gear is completely down
  {
   &ledarriba = 0 // landing gear up indicator  is off
   &ledtransito = 0 // landing gear transit indicator  is  off
   &ledabajo = 1 // landing gear down is on
  }
}
//End of file test_usb_outputs1.txt
```

We will save the file and run it, will run FS and select a fly with retractable gear airplane. We will see that red LED assigned to landing gear down is on (output 33) and the other two indicators are off. We will take off and will up the landing gear, when landing gear is in transit the landing gear down indicator goes off and the landing gear in transit indicator goes on (white LED, output 43) and finally the transit indicator goes off and the landing gear up indicator goes on (red LED output 56) and vice versa.

## Output's intensity control:

In this chapter we will learn to change the output's intensity by hardware and software.

### Hardware.

For this method we will need a simulation software, with our assembly and a potentiometer connected to analog input AN-0 (J4). Here we want see how changes the light's intensity, doing that white LED connected to output 43 goes on when landing gear is down and also to control white LED intensity with the potentiometer, foir that we will write a new script:

```
// ************************************************************************************
// * Config_SIOC ver 4.01   -    By Manuel Velez    -    www.opencockpits.com
// ************************************************************************************
// * FileName : test_intensity_by_hardware_usb_outputs.txt
// * Date : 15/03/2012
Var 0001, name ledabajo, Link IOCARD_OUT, Device 1, Output 43     // nose landing gear down indicator
(LED connected to output 43)
Var 0002, name dimmer, Link IOCARD_ANALOGIC, Device 1, Input 1, PosL 1, PosC 128, PosR 255
// potentiometer connected to analog input 1 (AN-0 or J4)
 {
  &bright = &dimmer
 }
Var 0003, name bright, Link IOCARD_DISPLAY, Device 1, Digit 1, Numbers 3  // dimmer at USB Outputs
Var 0004, name tren, Link FSUIPC_INOUT, Offset $0BEC, Length 4  // Nose landing gear position Offset
 {
  IF &tren <= 16383  // if landing gear is fully or partially down
```

```
  {
   &ledabajo = 1    // nose landing gear down indicator is on
  }
 }
// End of file test_intensity_by_hardware_usb_outputs.txt
```

We will save and run it with Sioc, will start the simulator, will select an airplane with retractable landing gear and will select any airport, we will observe that white LED is on (output 43) and if we turn the potentiometer the LED will change his light intensity, if not there is something wrong and we have to revise the assembly and the script.

### Software.

For this method we will do the same for hardware method but managing the intensity by software. We will do a new script that will fluctuate the LED intensity continously using our assembly:

```
// ***********************************************************************************
// * Config_SIOC ver 4.01   -    By Manuel Velez    -    www.opencockpits.com
// ***********************************************************************************
// * FileName : test_intensity_by_software_usb_outputs.txt
// * Date : 15/03/2012

Var 0001, name ledabajo, Link IOCARD_OUT, Device 1, Output 43  // nose landing gear down indicator
(LED connected to output 43)
Var 0003, name bright, Link IOCARD_DISPLAY, Device 1, Digit 1, Numbers 3  // dimmer at USB Outputs
{
  IF &ledabajo = 1  // if landing gear is down
  {
    &bright = DELAY 127 ,80  // wait 80 ms to up the LED's intensity to 127
    &bright = DELAY 50 ,20  // wait 20 ms to down LED's intensity to 50
  }
}
Var 0004, name tren, Link FSUIPC_INOUT, Offset $0BEC, Length 4  // Nose landing gear position Offset
{
  IF &tren = 16383  // if landing gear is down
  {
    &ledabajo = 1  //  landing gear down indicator is on
    &bright = 127  // first bright assigned to LED (full light)
  }
}
// End of file
```

We will save and run it with Sioc, will start the simulator, will select an airplane with retractable landing gear and will select any airport, we will observe that white LED is on (output 43) and changes his intensity, if not there is something wrong and we have to revise the assembly and the script. (This example does not account for any subsequent change in the landing gear's state).

## Analog inputs:

For USB Output's analog inputs we will use the same example to control the light intensity by hardware since it uses a potentiometer connected to the card. These analog inputs may be used for other purposes than to control USB Output's intensity.
Remember that we want see how to use an analog input, we will change the white LED (output 43) intensity, doing a new script:

```
// ***********************************************************************************
// * Config_SIOC ver 4.01   -    By Manuel Velez    -    www.opencockpits.com
// ***********************************************************************************
// * FileName : test_analog_inputs_usb_outputs.txt
// * Date : 15/03/2012
```

```
Var 0001, name ledabajo, Link IOCARD_OUT, Device 1, Output 43     // nose landing gear down indicator
(LED connected to output 43)
Var 0002, name dimmer, Link IOCARD_ANALOGIC, Device 1, Input 1, PosL 1, PosC 128, PosR 255
// potentiometer reading
 {
   &bright = &dimmer
 }
Var 0003, name bright, Link IOCARD_DISPLAY, Device 1, Digit 1, Numbers 3  // dimmer at USB Outputs
Var 0004, name tren, Link FSUIPC_INOUT, Offset $0BEC, Length 4  // landing gear position Offset
 {
  IF &tren <= 16383   // if landing gear is fully or partially down
   {
    &ledabajo = 1    // landing gear down indicator is on
   }
 }
// End of file test_analog_inputs_usb_outputs.txt
```

We will save and run it with Sioc, will start the simulator, will select an airplane with retractable landing gear and will select any airport, we will observe that white LED is on (output 43) and if we turn the potentiometer the white LED will vary his intensity, if not there is something wrong and we have to revise the assembly and the script.

With this gives end to this manual, we invite you to read the manuals of the others Opencockpits elements and of the SIOC software and give you the thanks for trusting in we.

## Links of interest:

Support area for clients:

http://www.opencockpits.com/catalog/info/