HDBB2 breakout board
user's manual

Contents

CNCdrive
motion controls

1. Features

The HDBB2 is a signal breakout board making the wiring and connections to the LPT port or motion controller easy.
There are 4 pieces of axis connectors to connect to our servo drives directly with straight wired „patch cables".
All inputs connected via onboard optical isolator.
4 outputs have open-drain high power transistor outputs for driving external relay coils, solenoids, etc. directly upto 50Volts.
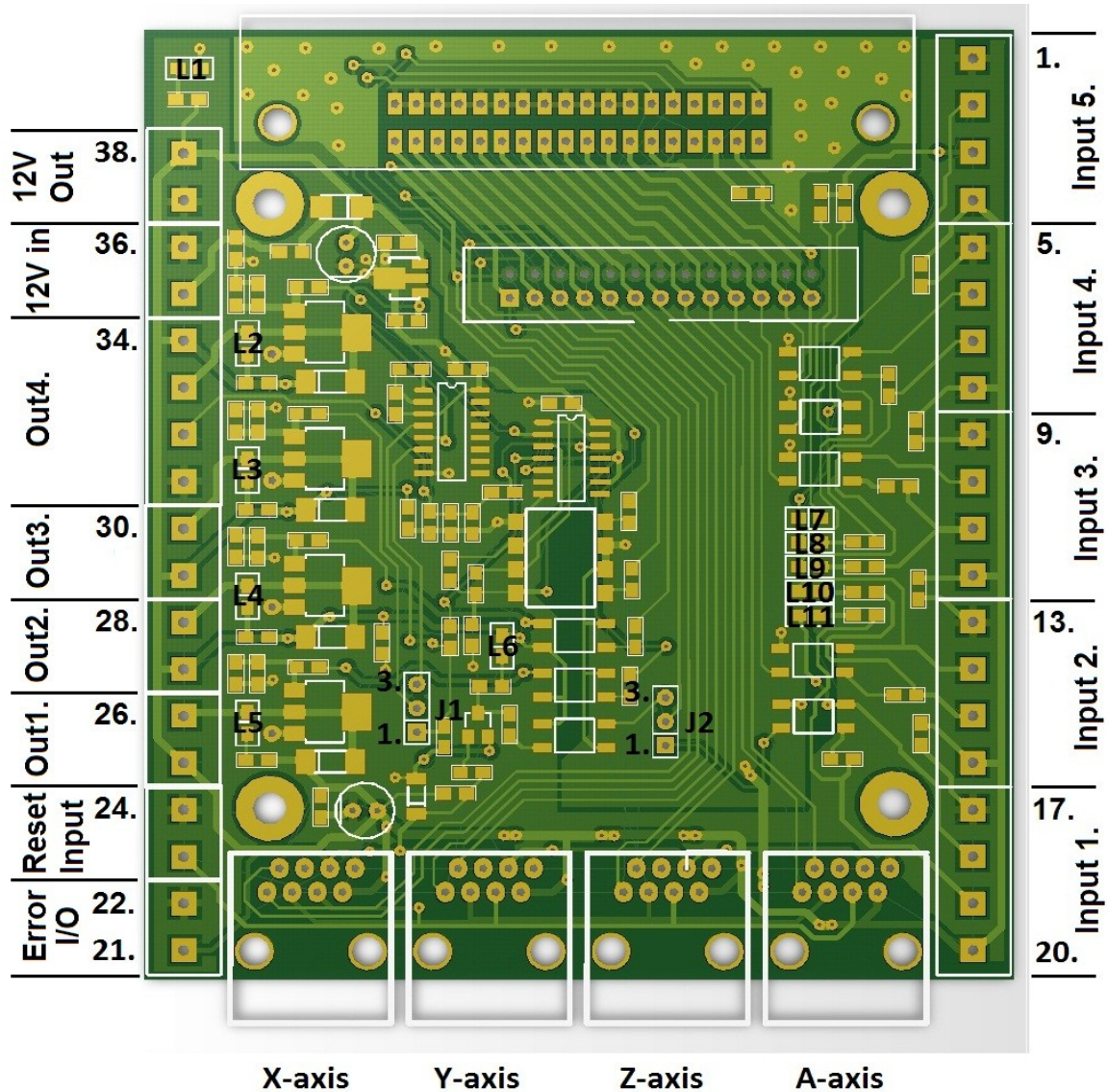All in and outputs have LED indicators which makes the installation and connections debugging easy.
The board integrates a safety chargepump circuit which can be disabled/enabled with jumper.
One analog 0-5V output is also onboard for software handled spindle speed control.

2. Pinouts
2.1. Screw terminals

Screw terminals have standard RM5.0 pitch and connections of external devices can be made through these connectors.

The pinout of the screw terminals are as follows:

01.) PGND	02.) Input 5.-	03.) Input 5.+	04.) 12Vout
05.) PGND	06.) Input 4.-	07.) Input 4.+	08.) 12Vout
09.) PGND	10.) Input 3.-	11.) Input 3.+	12.) 12Vout
13.) PGND	14.) Input 2.-	15.) Input 2.+	16.) 12Vout
17.) PGND	18.) Input 1.-	19.) Input 1.+	20.) 12Vout
21.) Error I/O	22.) PGND	23.) Reset input	24.) PGND
25.) 12Vout	26.) Output 1.	27.) 12Vout	28.) Output 2.
29.) 12Vout	30.) Output 3.	31.) PGND	32.) Analog output
33.) Output 4.	34.) 12Vout	35.) 12V DC input	36.) PGND
37.) PGND	38.) 12Vout		

* PGND means the external 12VDC powersupply's negative (GND) terminal.

2.2 Centronics port

The centronix port is for the LPT port connection to the control PC. Use a standard DSUB-25 to Centronix-36 standard printer cable to connect this port to the computer's LPT (printer) port.

2.3 IDC port

The IDC port is a 26 pin ribbon connector and is useful for connection to external motion controller like the Smoothstepper etc.

2.4 RJ45 axis connectors

Connectors marked with 'X', 'Y', 'Z' and 'A' has identical pinout except the step and direction pins.

>   Pinout of RJ45 connectors:
>   1.) Step signal
>   2.) Direction signal
>   3.) LPT port ground
>   4.) N/C (No internal connection)
>   5.) Reset signal (Output from breakout board)
>   6.) Common ERROR line (Bidirectional line)
>   7.) DC power output+
>   8.) DC power output-

2.5 12V DC input terminals

>   12Volts rectified and smoothed DC Voltage should be applied to between the „12V DC input" (35.) terminal and the PGND (36.) terminal of the board. The connected Voltage should be isolated from the computer and therefor it should be from an external power supply. Typically a small 12VDC output switching mode or linear power supply can be used with 1-2 Ampers current capability.
>   Please note that this power source supplies the servo drives' digital part and also the encoders connected to the drives and the externaly connected relays, therefor the current requirents of these devices should be taken into account when selecting and sizing the power supply.

2.6 12Vout terminals
>   12Vout terminals are connected to the 12V DC input terminal via a power diode and these terminals outputs 12-0.6Volts Voltage for suppliing external devices.

3. LPT port to I/O assignment

The blow diagram show the pin mapping of the signals. Both the LPT and the Centronix port pinouts are listed.

Function on board	LPT port pin number	Centronix port pin number
X-axis step signal	2	2
X-axis direction signal	3	3
Y-axis step signal	4	4
Y-axis direction signal	5	5
Z-axis step signal	6	6
Y-axis direction signal	7	7
A-axis step signal	8	8
A-axis direction signal	9	9
Input#1 [common error line]	15	32
Input#2	10	10
Input#3	11	11
Input#4	12	12
Input#5	13	13
Output#1	17	36
Output#2	1	1
Output#3 [charge pump]	14	14
Output#4 [analog output]	16	31
Signal ground	18-25	19-30
Shield	Cover	17

4. LED indicators

On the HDBB2 every board functions have visual feedback with LEDs. (light emmiting diodes).
In point 2.1 drawing each LED is marked with „Lx" signs, where 'x' is a number. The LED meanings are summarised in the below table:

LED number (Lx)	Function	Description (Lights if...)
1	Power on	12VDC is connected to the board
2	Output#4 active	the open-drain #4 output is active
3	Output#3 active	the open-drain #3 output is active
4	Output#2 active	the open-drain #2 output is active
5	Output#1 active	the open-drain #1 output is active
6	Drive fault	All drives working and are not in fault
7	Input#5 active	Input#5 is triggered with external Voltage
8	Input#4 active	Input#4 is triggered with external Voltage
9	Input#3 active	Input#3 is triggered with external Voltage
10	Input#2 active	Input#2 is triggered with external Voltage
11	Input#1 active	Input#1 is triggered with external Voltage

5. Functions

Board functions are summarised here.

5.1 Opto isolated Inputs

There are 5 pieces of inputs onboard and all inputs are isolated from the parallel port and the signals fed through optical isolators.
All inputs are marked with – and + terminals. The + terminal is connected to an 1kOhm resistor and this resistor is connected to the anode of the optoisolator's LED.
The – terminal is connected directly to the cathode of the optoisolator's LED.
In parallel with the optoisolator LED a 1kOhm in series with a green LED is connected, these LEDs are marked with 'Lx' in point 2.1. of this datasheet and this LED gives visual feedback of the input state. When the input is triggered the onboard LED connected to the input lights up.

The equivalent circuit of the onboard inputs is shown below:
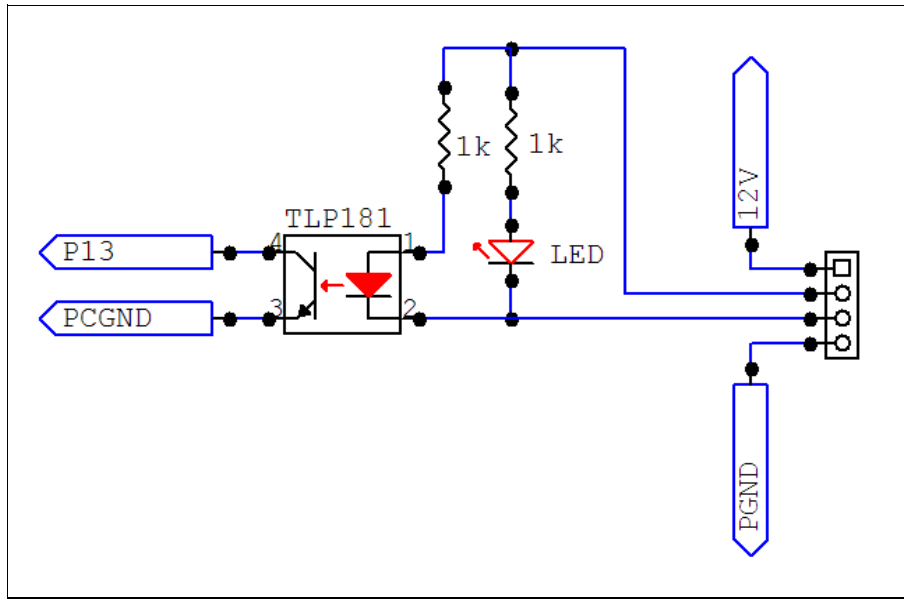
5.2 Open-drain outputs

All 4 pieces of digital outputs on the board are open-drain N-channel Mosfet tranzistor outputs.

These outputs are capable to work upto 50Volts and can switch upto 1Ampers of current, therefor these outputs can drive power relays, solenoids or even small DC motors in one direction. If high power devices have to be switched, please consider the maximum power dissipation of the device and check it's heating on the board.

The equivalent circuit of the open-drain outputs is shown below:
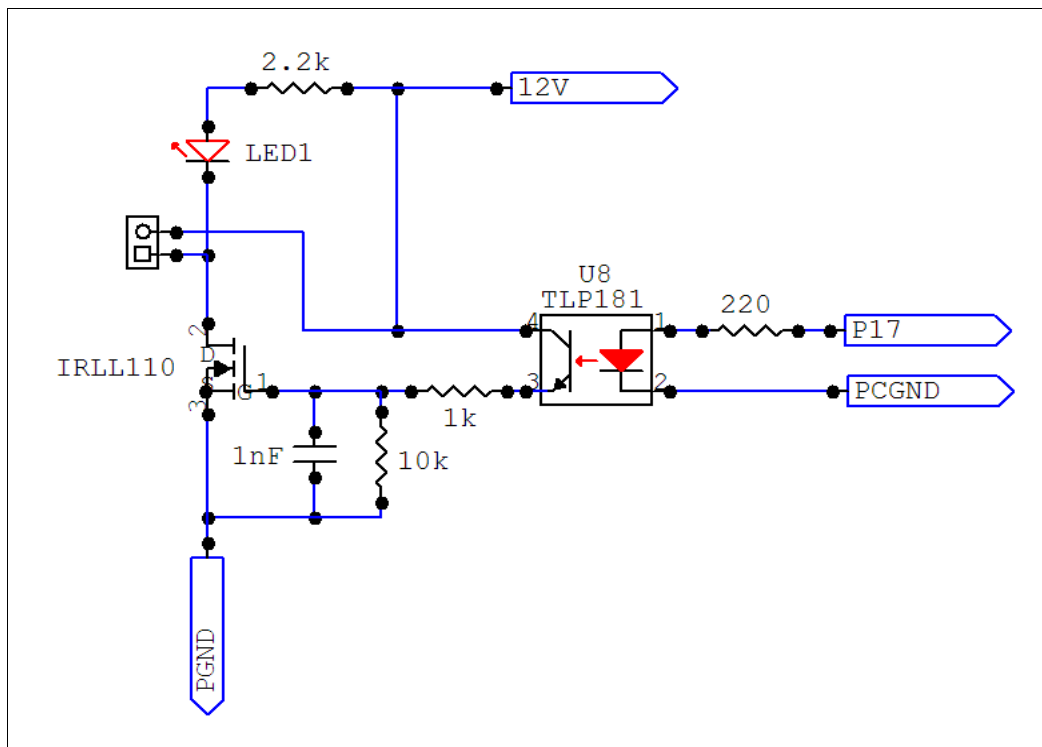
5.3 Analog output

There is one 0..5 Volts analog output onboard, this output is shares the LPT port pin with Output#4. The digital 0-5Volts TTL signal from the LPT port is optically isolated and smoothed with an onboard RC filter to analog 0 to 5Volts Voltage. The analog Voltage level is proportional with the LPT port digital signal's duty cycle. A PWM can be applied to the LPT port pin (from software) and with variing the duty cycle of this signal the analog output Voltage value can be changed. A 0% on duty cycle output on the LPT port pin gives a 0Volts analog output Voltage and a 100% on duty cycle output on the LPT port pin gives an 5Volts analog output Voltage. The output is scaled linear, so an 50% duty cycle signal gives a 2.5Volts analog output Voltage.

5.4 Charge pump safety circuit

The charge pump is a safety circuit which reading the signal on an LPT port pin and if it receiving a pulse train with approximately 12.5kHz frequency then it's output goes active (high) after around 100mseconds. If there is no pulse train on the charge pump's input circuit for more than around 50mseconds then the output goes inactive (low).
The onboard chargepump circuit shares an LPT port pin and mapped to the same LPT port pin as Output#3 and an external relay can be driven as charge pump safety relay.
The chargepump function can be selected with putting J1 jumper to 2-3 position and in this case the Open-drain output#3 is driven by the charge pump circuit instead of direcly with the LPT port output pin. The charge pump circuit can be disabled with placing J1 jumper to 1-2 state and in this case the charge pump circuit goes inactive and Open-drain output#3 can be driven directly with the LPT port output pin.

5.5 Optional error and reset signals

Optionally normally opened (NO) pushbuttons or toggle switches can be connected to these terminals. The reset terminal is connected to all of the RJ45 axis connectors onboard and pulling this line low resets all of the connected servo drives.
The error line works the same way as the reset line, pulling this line low resets all of the connected servo drives.
The error line is bidirectional which means that the drive can also pull this line low in case of any faults and the error line can be monitored with external devices, controllers, etc.
For more information about how the error and reset signal work please read the servo drives users manuals.

6. Jumpers

There are 2 pieces of onboard jumpers, on the picture in point 2.1 of this manual these jumpers are marked with J1 and J2.
The jumpers have different functions as follows:

- J1 jumper is for the „charge pump safety circuit / standard digital output" selection. For more information please read section 5.4 in this manual.

- J2 jumper is for the „common error line / standard digital input" selection.
If this jumper is in the 1-2 state then input#1 works as standard digital input as described in point 5.1 in this manual.
If this jumper is in the 2-3 state then input#1 gets disabled and the common error line of the drives gets connected to the LPT port input pin of input#1.
The common error line is the drives's error lines conencted together and also wired to the error signal terminal onboard. If the ecommon error line goes low because of any drive's internal fault or because the user triggers the error input terminal then this signal is feed back to the LPT port pin of input#1.
This signal can be used forexample to trigger an E-stop in the CNC control software.

7. Example connections

Connections of external devices can be done in several ways. In this document section we showing some example to make connections to in and outputs of the HDBB2 board.
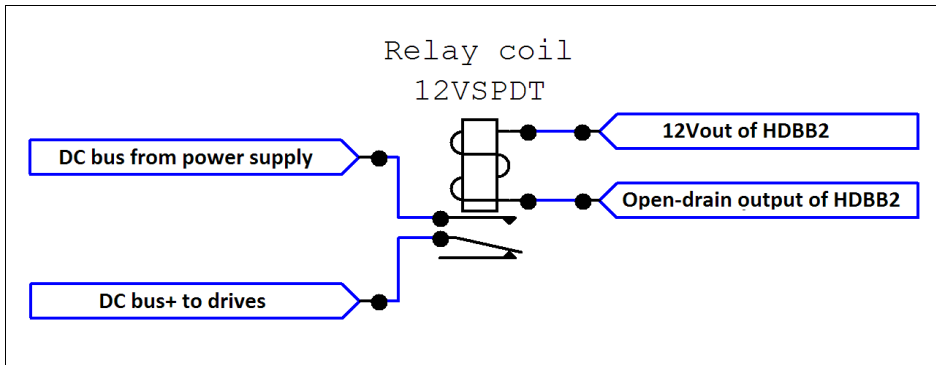
7.1 Connecting external relays

Relays can be driven with the open-drain outputs.
Mechanical or solid state relays can be used with the HDBB2 and this datasheet summarising connecting both types.

7.1.1 Connecting a mechanical relay with 12Volts rated coil

Because the HDBB using 12Volts input Voltage it is the easiest to connect relays with 12Volts Voltage because in this case there is no need for any more external power supply.

An example external 12Volts relay coil connected to a HDBB2output is shown below:
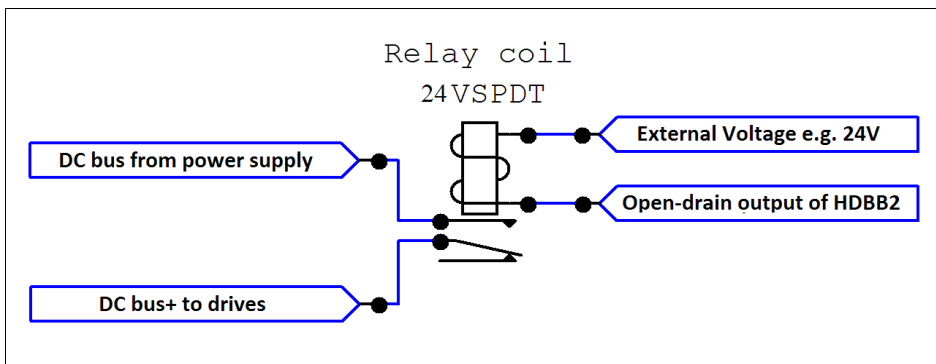

7.1.2 Connecting a mechanical relay with other rated coil Voltage

If other Voltage then 12Volts rated relay coil is used the only solution is using an external power supply with an output Voltage equal the coil's rated Voltage.

This way any relay Voltage can be used upto 50Volts.

An example external 24Volts relay coil connected to a HDBB2 output is shown below:

7.1.3 Connecting a solid state relay (SSR)

Solid state relays (SSR) are non-mechanical type relays where the switching circuit inside the relay is an electric circuit mostly with a Mosfet or Triak.
These kind of relays having an optocoupler with LED on their inputs and they can be driven similar way as a standard LED. A series resistor have to be connected in series with the LED anode of the SSR. This series resistor is used to limit the LED current to a value adviced in the SSR's datasheet. For value on the series resistor please see the used SSR's product manual.
The shematics of the SSR connection to the HDBB2 board is shown below:
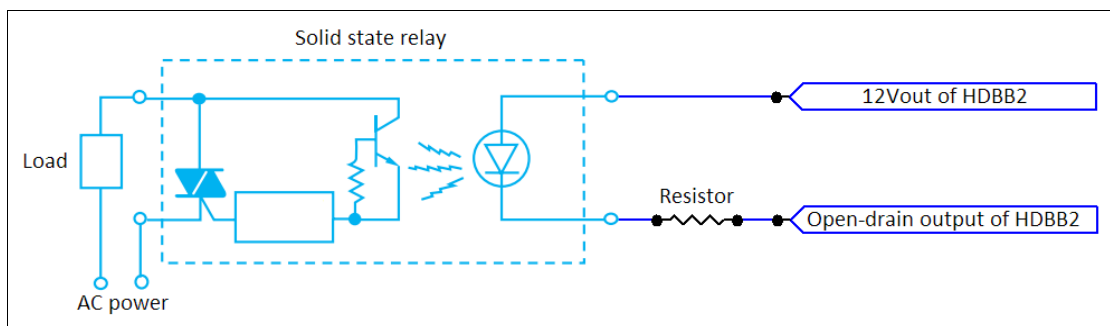
7.1.4 Connecting a relay to the safety charge pump circuit

The working of the onboard safety charge pump circuit is described in details in point 5.4 in this manual. After enabling the charge pump safety circuit with placing jumper J1 to position 2-3 the Open-drain output#3 on the HDBB2 board becomes under control of the charge pump circuit.
A relay can be connected to output#3 to switch on the Voltage to the power electronics only when the charge pump circuit is active, in other words when the CNC control software is running and producing the charge pump signal to the HDBB2. This relay disconnects the power from the power electronics if the charge pump signal get lost.
For this relay the same connections can be made (depends on what relay is used) as described in points 7.1.1, 7.1.2 and 7.1.3 of this manual.

7.2 Connecting switches and sensors

In the HDBB2 all inputs have optical isolators which isolates the inputs from the external switch or sensor's Voltage.
All inputs have a 12Volts output, Ground and Input – and Input + screw terminals next to eachother. Because both the positive and negative 12V bus rails and optocoupler anode and cathode is accessible the connections to any type of external switches is possible.
The following sub-section of this datasheet showing how to connect different type of sensors.
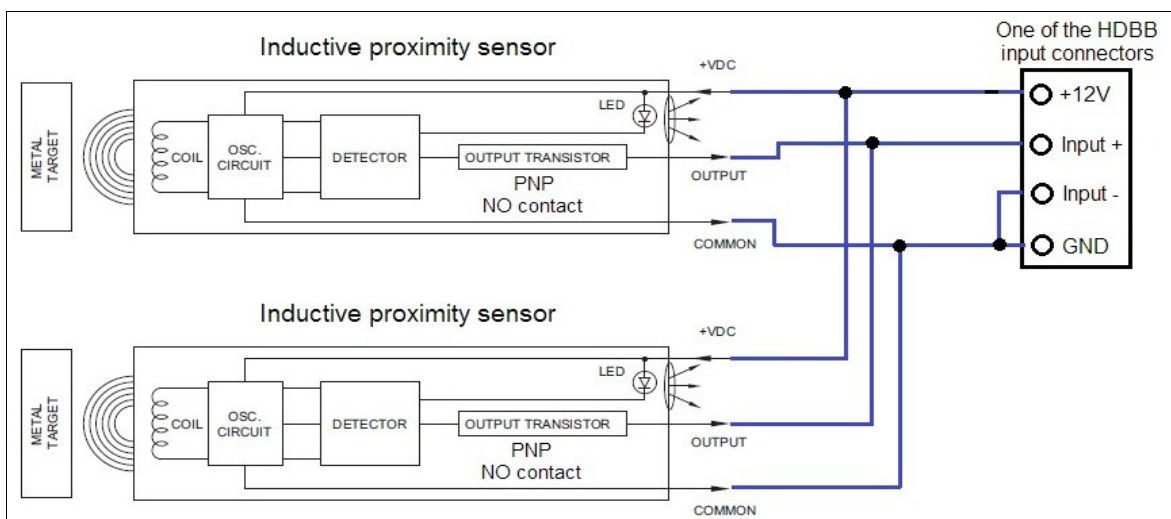
7.2.1. Connecting an NPN switches to inputs

Any number of NPN NO contact type switches can be wired in parallel to a single input as shown on the below schematics drawing:
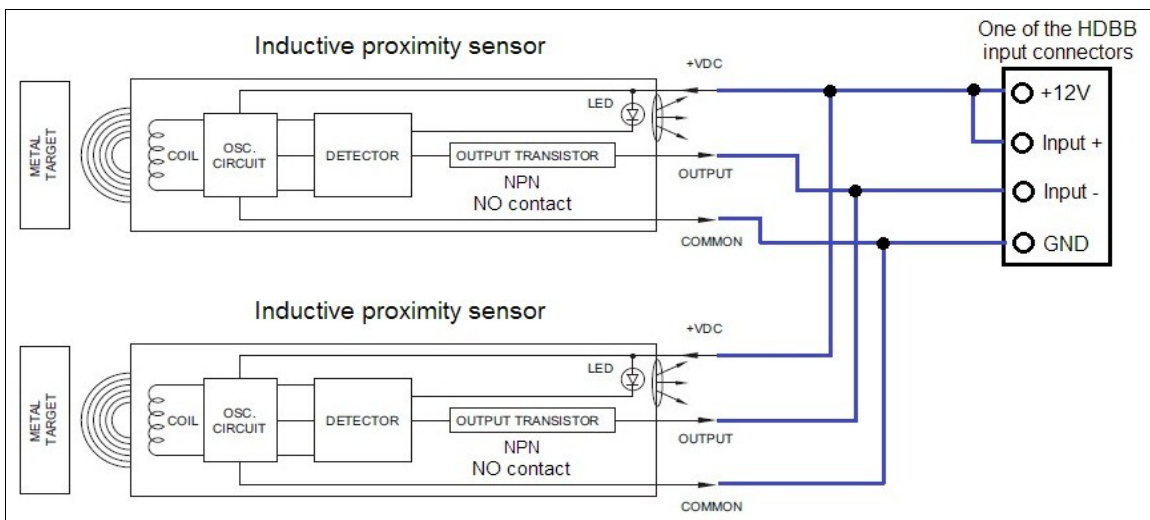
7.2.2. Connecting a PNP switches to inputs

Any number of PNP NO contact type switches can be wired in parallel to a single input as shown on the below shematics drawing:
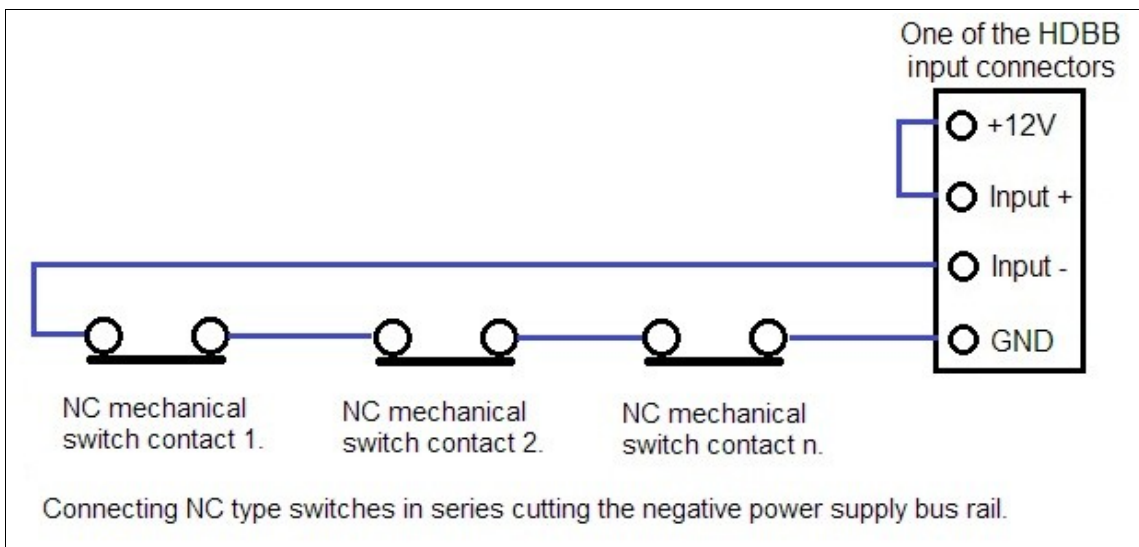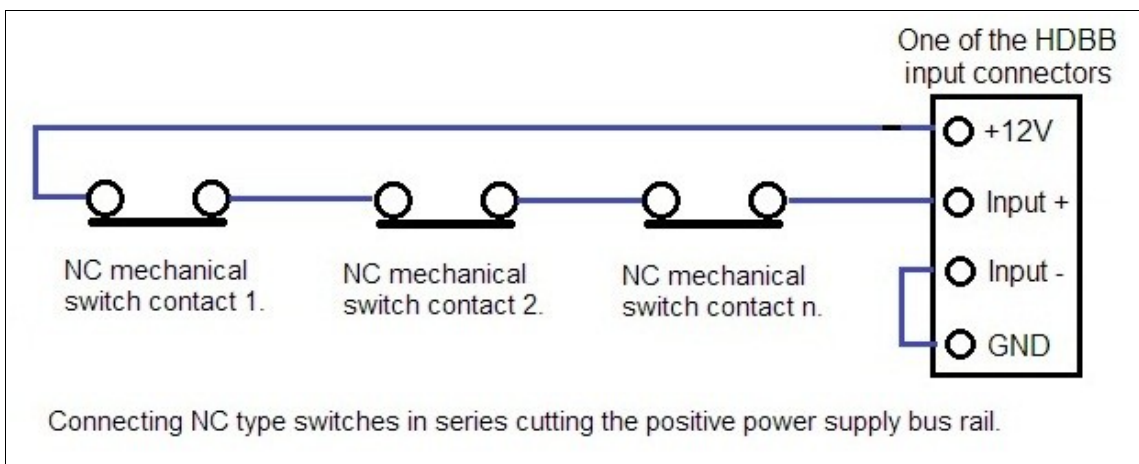
7.2.3. Connecting mechanical switches to inputs

Any number of mechanical NC contact switches can be wired in series to a single input.

There are two ways of connecting mechanical NC type switches to the inputs. One way is to cut the positive supply rail to the input + terminal with the NC switch contact and link the GND to the input – terminal. The other way is to cut the negative supply rail to the input – terminal with the NC switch contact and link the 12V+ to the input + terminal.

The two type of connections works identical, the only difference is which side of the powersupply rail the switches closing and opening to the HDBB2 input. The two connection methods are drawn on the below figures:

Connecting NC type switches in series cutting the positive power supply bus rail.

Connecting NC type switches in series cutting the negative power supply bus rail.

Datasheet Rev.	Date	Notes
1.0	31.03.2012	Premilary release for review and internal use only.
1.1	07.04.2012	Drawing in 7.1.3. was revised and corrected.
1.2	24.07.2012	Points 7.2 and it's sub-points was finalised and content was added. Picture in point 2.1 was extended with lables.
1.3	28.12.2012	Visual appearence of document upgraded.

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