

PL1-0

User Manual



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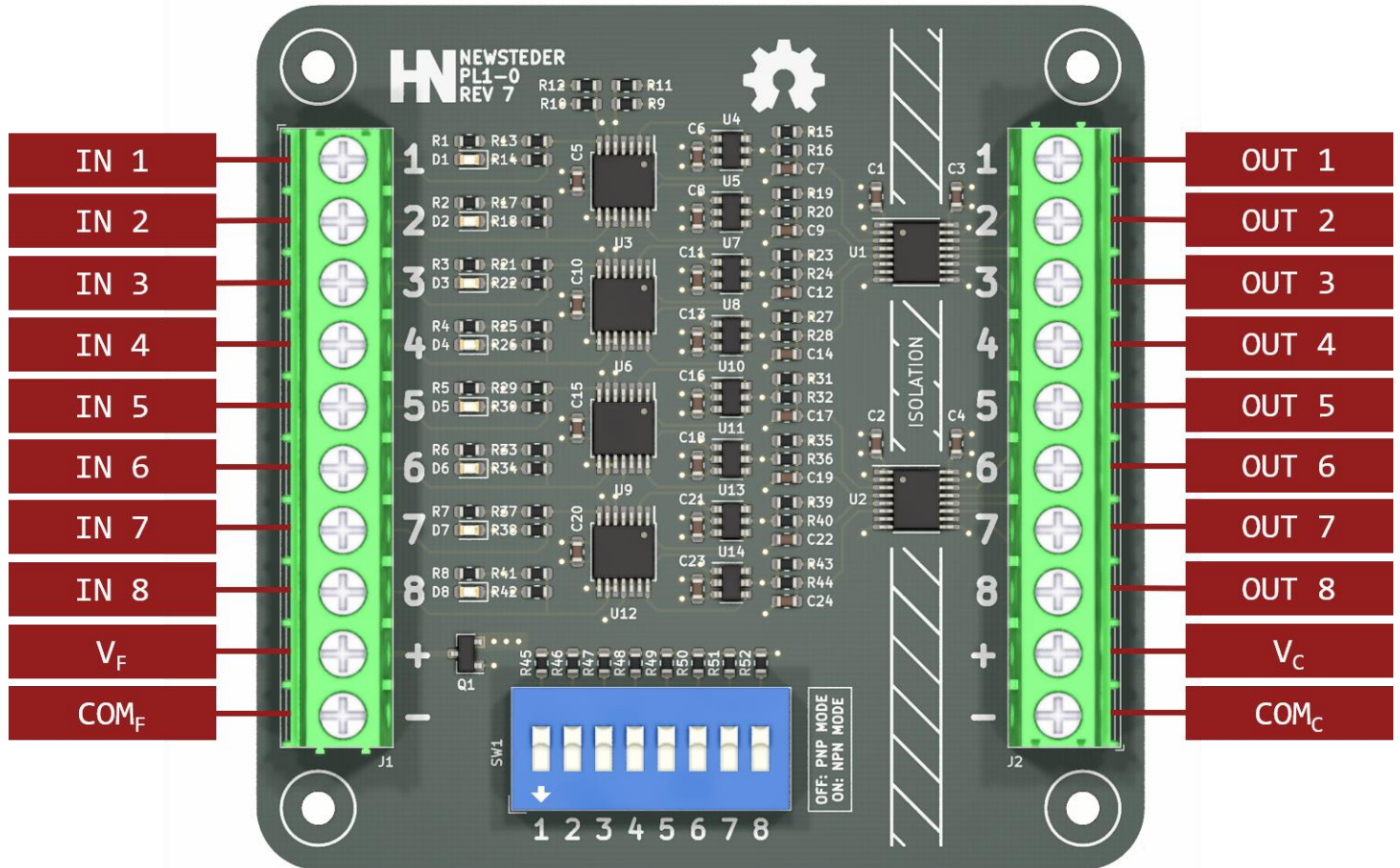
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1 Pin Descriptions



Pin	Description
IN 1..8	Input Signal from Switching Device
V _F	Field-Side Power Supply Voltage
COM _F	Field-Side DC Common
OUT 1..8	Conditioned Output Signal to Microcontroller
V _C	Control-Side Power Supply Voltage
COM _C	Control-Side DC Common

2 Electrical Specifications

Table 1 - Absolute Maximum Ratings

Parameter	Minimum	Maximum
V _F [V] - Field Power Supply Voltage	-0.5	7.0
V _C [V] - Control Power Supply Voltage	-0.5	7.0
V _{IN} [V] - Input Signal Voltage	-0.1	36
I _{OUT} [mA] - Output Signal Drive Current		10

Table 2 - Recommended Operating Conditions

Parameter	Minimum	Typical	Maximum
V _F [V] - Field Power Supply Voltage	4.5	5	5.5
V _C [V] - Control Power Supply Voltage	3.1	3.3 / 5	5.5
V _{IN} [V] - Input Signal Voltage	-0.1		30
I _{OUT} [mA] - Output Signal Drive Current			5

Table 3 - Electrical Characteristics

Parameter	Value
I _{FM} [mA] - Field-Side Power Maximum Current Draw	50
I _{CM} [mA] - Control-Side Power Maximum Current Draw	20
I _{IN} [mA] - Input Signal Maximum Current Draw	5
t _{PD} [ms] - Input to Output Propagation Delay Time	1.5
V _{IH} [V] - Input Signal High-Level Voltage Threshold	4.5
V _{IL} [V] - Input Signal Low-Level Voltage Threshold	1.0

3 Theory of Operation

Each channel operates independently. The Input signal of each channel is routed to two analog voltage comparators. One comparator checks whether the input signal is above 3V (PNP signal). The other checks whether the input signal is below 1.5V (NPN signal). The output from both comparators is routed to an analog voltage switch which is directly controlled by the physical DIP switch located on the board. In this way, the output from either the PNP comparator or the NPN comparator is monitored. After the analog switch, the signal passes through a 1mS RC debounce filter and then continues to the isolation chip. The isolation chip not only provides galvanic isolation but also hysteresis for the input signal.

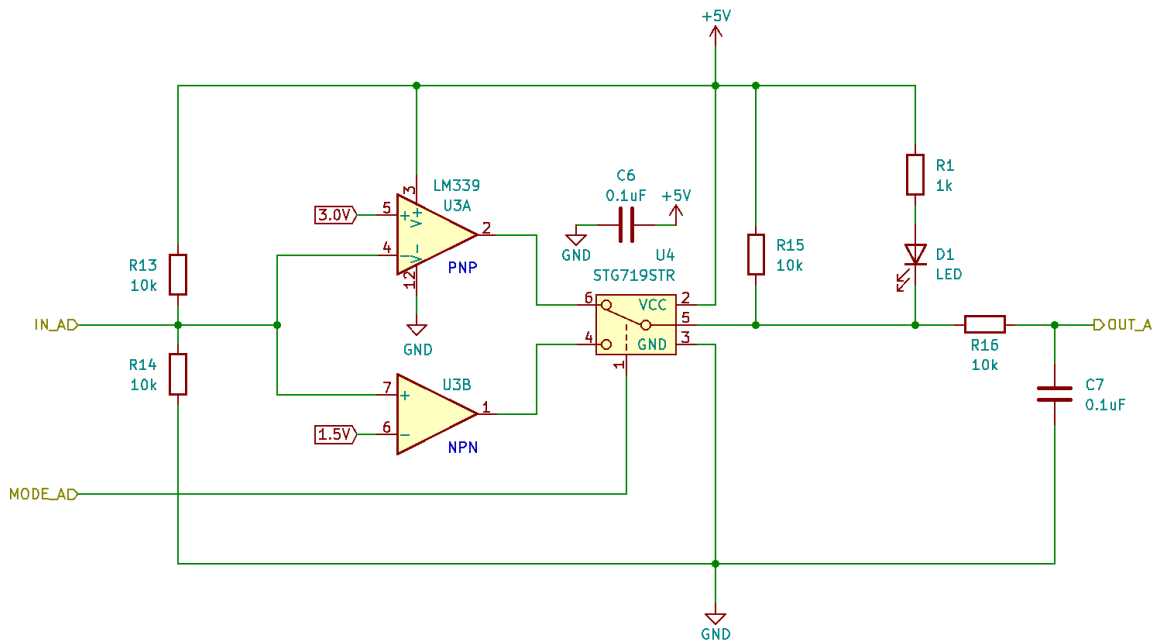


Figure 1 - Single Channel Schematic Without Isolation

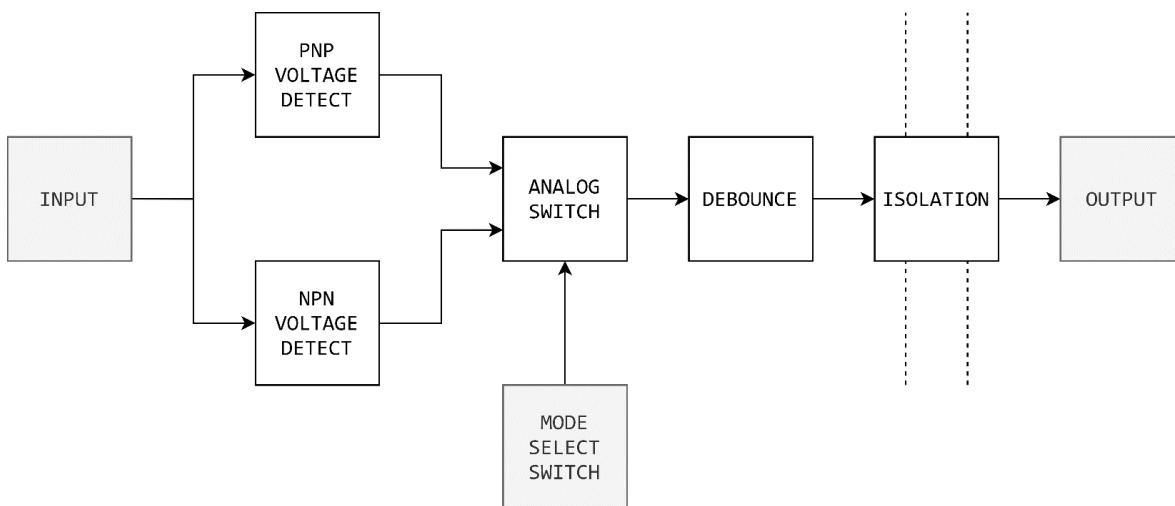


Figure 2 - Single Channel Block Diagram

4 Device Description

4.1 Overview

The PL1-0 is an 8-channel sensor interface board. It allows you to safely connect your 3.3 or 5V microcontroller to both sourcing (PNP) and sinking (NPN) sensors running at up to 30V.

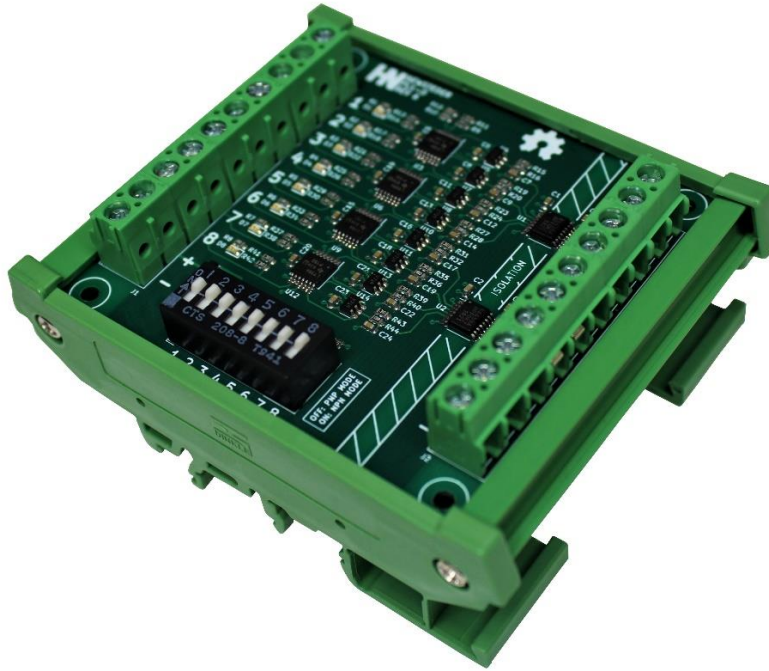


Figure 3 - PL1-0 DIN Rail Mount

Each of the 8 channels have 1 input and 1 output. The input pin is connected to the signal line from a sensor or other switching device. The output pin is connected to a digital I/O pin on a microcontroller.

The PL1-0 shifts, debounces, and isolates the high-voltage signal from the sensor allowing it to be read by a low-voltage device such as an Arduino or Raspberry Pi.

4.2 Power Input

The PL1-0 requires power on both sides of the electrical isolation barrier.

The field-side power requires +5V. The ground connection for the field-side power MUST be common to the ground used by the sensors. If the ground connections are not tied together, the device will not operate properly.

The control-side power can be operated with either a +5V or +3.3V supply. The voltage supplied to the control-side of the board will determine the voltage of each channel's output. That is, +5V supplied to the control-side power terminals will result in +5V output signals from each channel. +3.3V supplied to the control-side power terminals will result in +3.3V output signals from each channel.

4.3 Input Connections

The 8 input terminals are labeled and located on the left side of the board. The inputs feature reverse polarity protection when in either mode. That is, when in NPN mode applying a 30V signal to the channel will not cause any damage.

The input signals can come from mechanical switches, pushbuttons, solid-state sensors, or any switching device that provides a stable output voltage. The inputs can be configured as either PNP (Figure 4), or NPN (Figure 5).

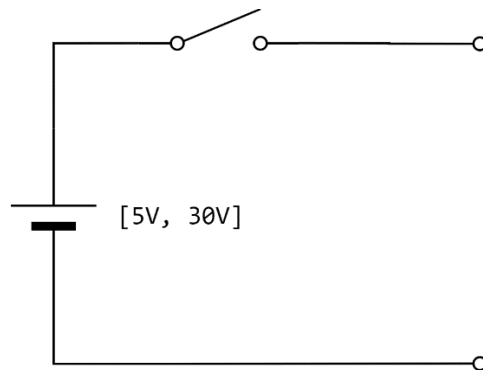


Figure 4 - PNP Signal

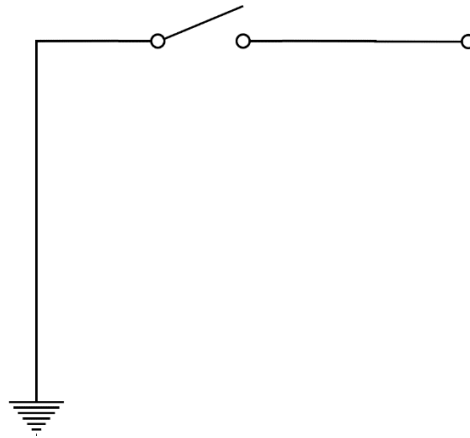


Figure 5 - NPN Signal

When in PNP mode the PL1-0 expects to receive a voltage in the range of [5V, 30V] with respect to the field-side DC common. When in NPN mode the PL1-0 expects to receive a direct connection to the field-side DC common.

4.4 Output Connections

The eight output terminals are connected directly to digital I/O pins on a microcontroller or other control device.

These outputs are active-low. When a channel is in the default “off” state, the corresponding output pin is “high” and has a voltage equal to that of the power supply voltage on the control side of the board.

When a channel’s input is activated the corresponding output will go “low” and the voltage on the output pin will be equal to that of the power supply common on the control side of the board.

4.5 Input Mode Selection

Each of the 8 channels can be configured to operate in one of two modes: PNP or NPN mode. The mode is selected by flipping the appropriate channel on the 8-position DIP switch located on the bottom of the board. The number on the DIP switch will correspond to the channel it modifies (Figure 6).

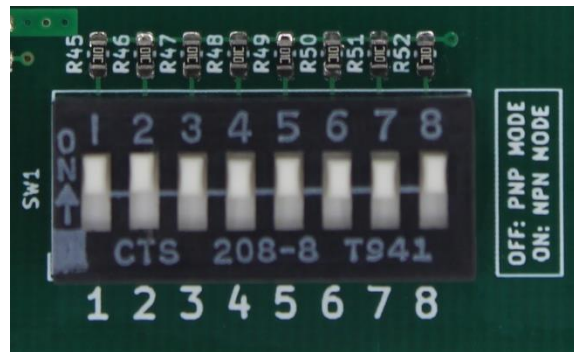


Figure 6 – Mode Select Switch

In PNP mode the input expects a signal from a sourcing sensor which supplies a positive voltage in the range of [5V, 30V] when actuated.

In NPN mode the input expects a signal from a sinking sensor which supplies a connection to the field-side ground when actuated.

5 Example Applications

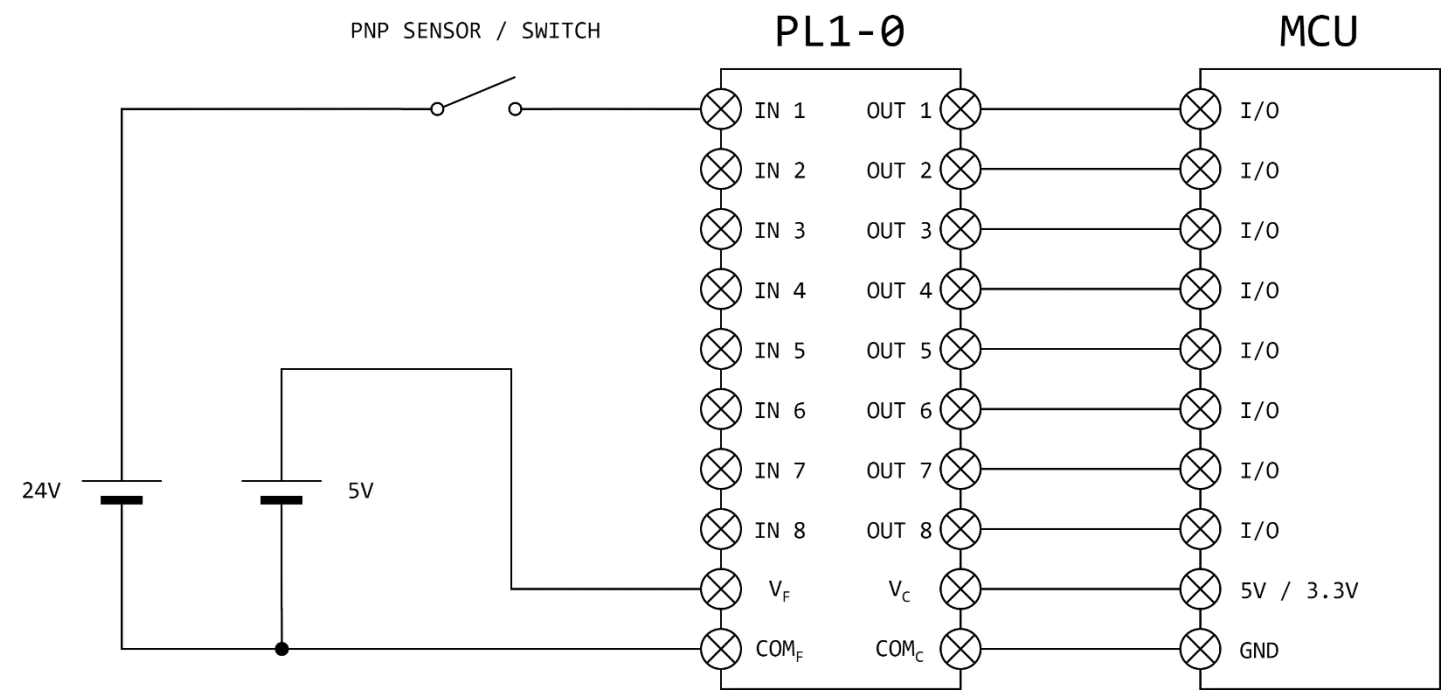


Figure 7 - PL1-0 With 5V or 3.3V MCU and PNP Input Signal

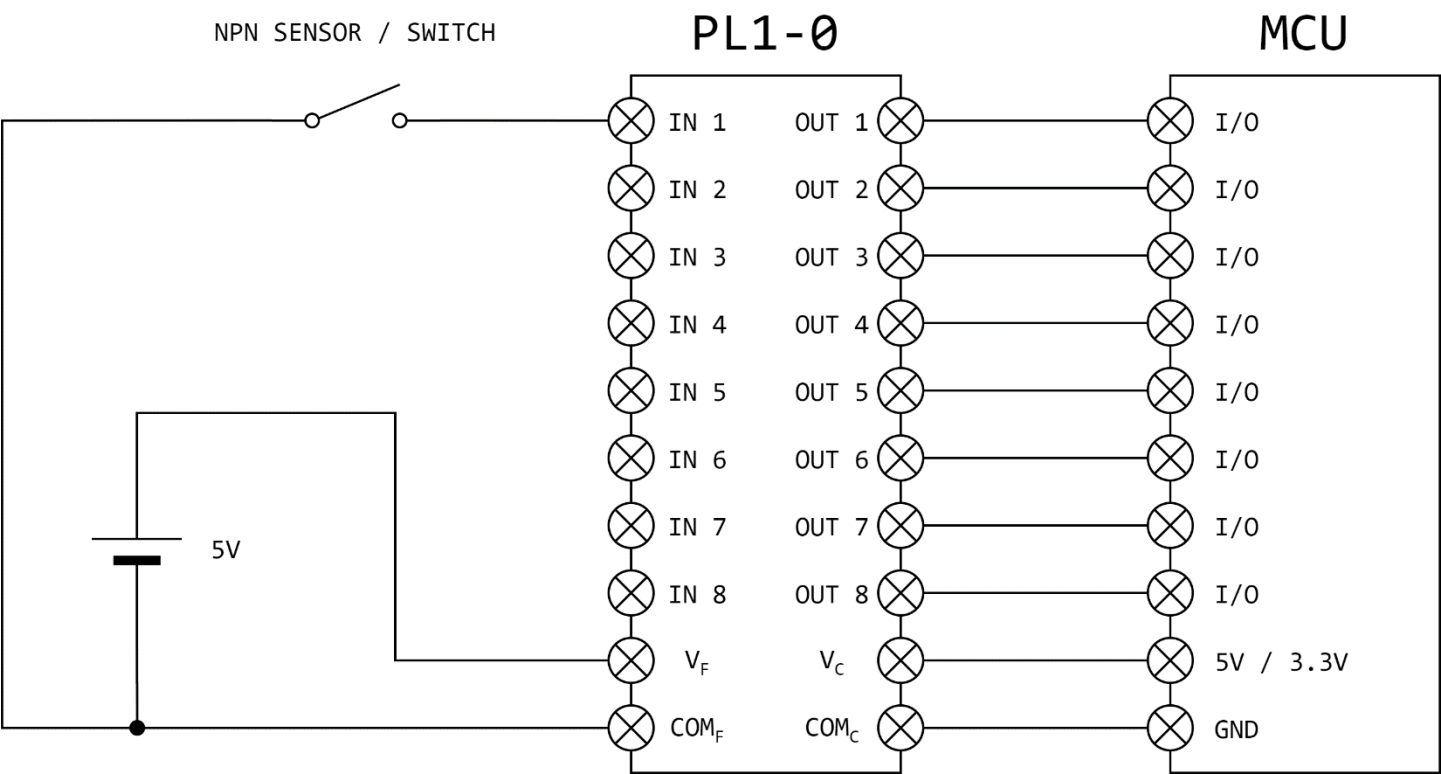


Figure 8 - PL1-0 With 5V or 3.3V MCU and NPN Input Signal

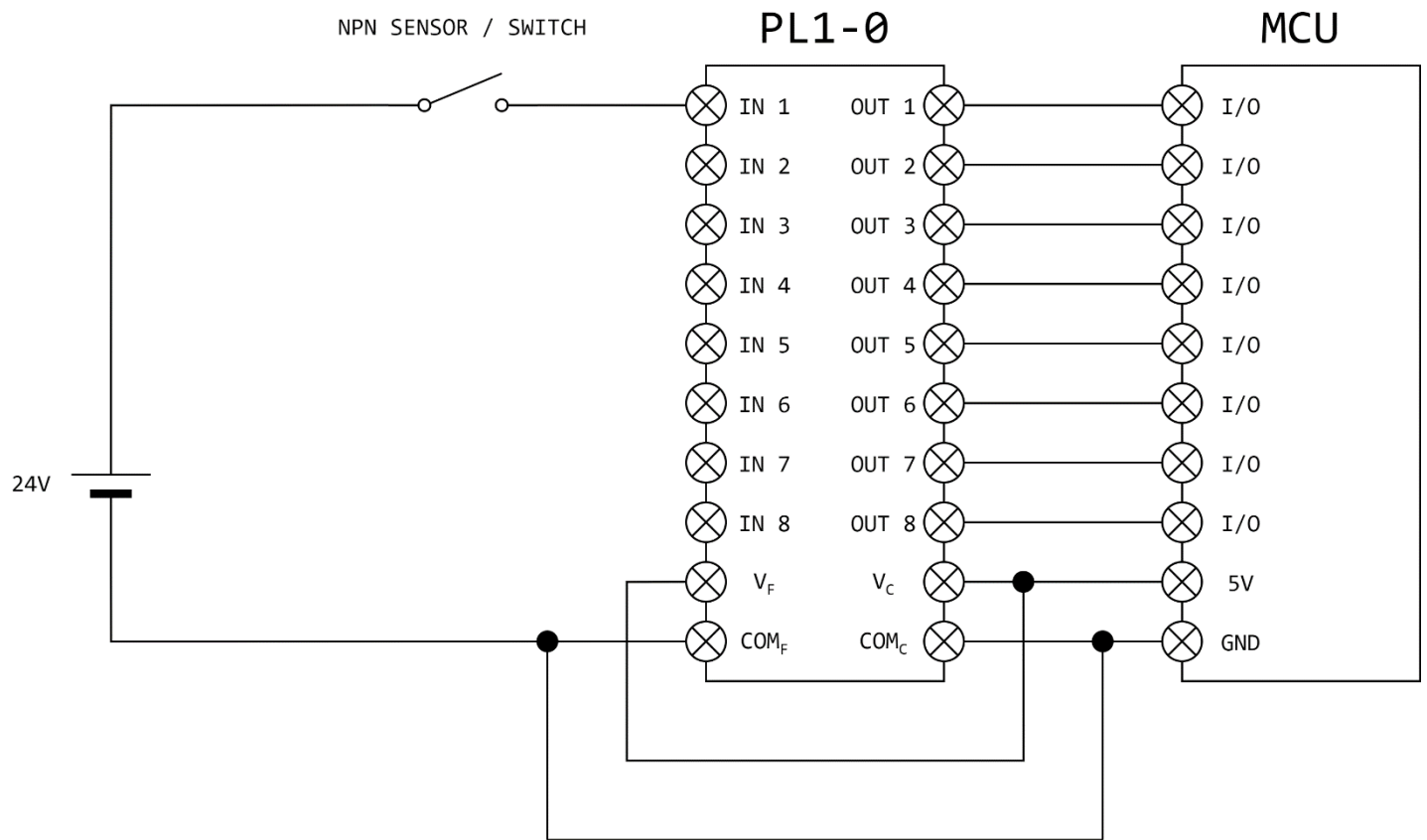


Figure 9 - PL1-0 Operating from MCU Power Supply with No Isolation

6 Revision History

Revision	Description
A	Initial release