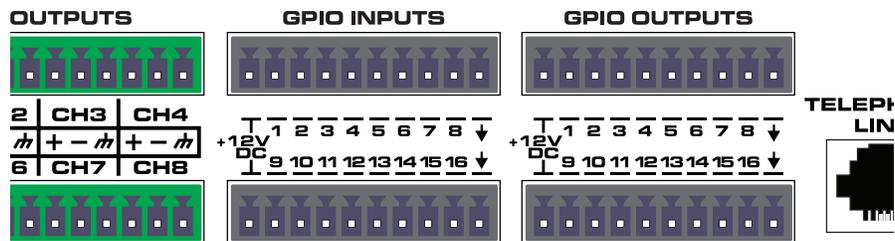# QSC

Technical **Notes**
Q-SYS Core 110f

# Using the **GPIO "raw" inputs and outputs**

The Q-SYS Core 110f features General Purpose Input/Output (GPIO) connections, which are useful and versatile interfaces for connecting a Q-SYS system to miscellaneous controls, sensors, displays, etc., in the outside world. For users who want to go deeper into the GPIO connections, one of the configuration settings on both the inputs and outputs is "Raw."

Raw inputs

A "raw" GPIO input is essentially one with access to the raw circuit features: a pullup resistor that can be enabled or disabled, as well as a simultaneous analog and digital input. In fact, when you designate a Core 110f's GPIO input as "raw" in Q-SYS Designer, two control pins appear: one analog and one digital. You may use either one or both simultaneously. They respectively have the characteristics of the regular analog and digital GPIO inputs.

The main advantage of the "raw" input setting is the added flexibility of enabling the pullup resistor. This makes it possible to actuate the digital input by opening or closing a pair switch contacts to ground. For analog, the pullup resistor also provides a positive voltage bias that allows a two-wire potentiometer (a rheostat, essentially) to manipulate the input. The pullup resistor also allows multiple active-low open collector outputs or switch contact sources to command the same input.

	Pullup enabled use with:	Pullup not enabled use with:
Digital input	• TTL or "open-collector" source • Switch-to-ground contact	• CMOS logic • Two-state voltage source
Analog input	• Two-wire potentiometer • Two-wire variable-resistance sensor	• Three-wire potentiometer • Variable voltage source (0 to 24 V DC)
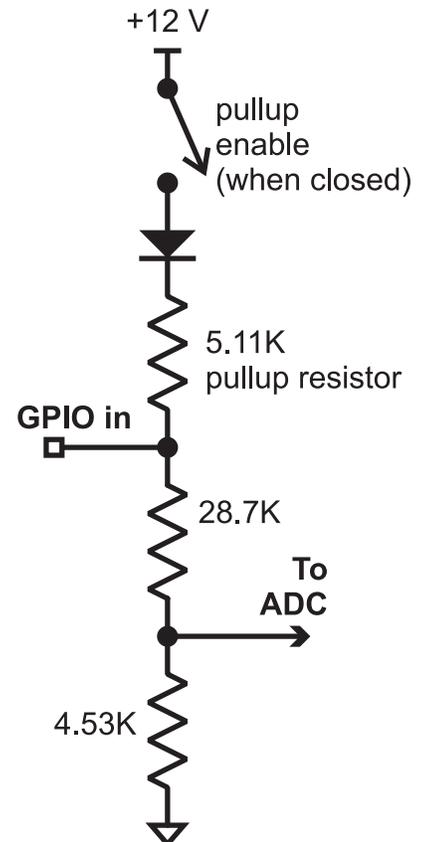
The equivalent circuitry of a "raw" GPIO input.

The digital threshold of the raw GPIO input is approximately +1.65 V; voltages above that threshold will be interpreted as a "1," and voltages below will be interpreted as "0." The threshold is actually based on a value computed by the analog-to-digital converter (ADC), so you can write a script that implements a different threshold. (You can also write scripts to implement hysteresis, multiple thresholds, etc.)

The analog input accepts a positive voltage and the ADC converts it to a corresponding value. The ADC result is full scale when the GPIO input is +24 V, but the input can safely handle up to +36 V without damage.

A "raw" GPIO input has control pins for both an analog and a digital input and also has a **Pullup Enable** button.
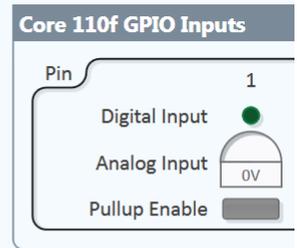
Raw outputs

A GPIO output in the "Raw" setting can be used just like in the "Digital" or the "Open Collector" settings but it has an **Invert** button added. The **Invert** button, as its name suggests, inverts the logical state of the GPIO output; for example "low" or 0 becomes "high" or 1, and vice-versa. The output can drive a 3.3 V logic input (TTL or CMOS) and also can sink up to 200 mA of current when "low" or "inverted high."

Even when configured as a "raw" or "open collector" output, the circuitry always has a 1.0 kΩ pullup resistor and a forward-biased diode in series from the +3.3 V supply rail.

Additional information

For more information on the GPIO capabilities of the Core 110f, see the Tech Note "Using the GPIO inputs and outputs."

The equivalent circuitry of a "raw" GPIO output.