Optical Encoder Engineering Information

QUADRATURE

All Grayhill encoders use quadrature output code, which is the same as a 2-bit, repeating gray code. Quadrature is the most popular and cost effective output format because only two detectors are required. However, quadrature can only be used in applications where incremental data is required. Absolute positioning is not possible because the code repeats every four positions. In other words, changes in the encoder in magnitude and direction can be determined, but the actual position of the encoder cannot. In most applications this is not a problem.

In a quadrature rotary optical encoder two detectors are used to provide outputs, "A" and "B". The code rotor either blocks the infrared light or allows it to pass to the detectors. As the shaft turns the rotor, the outputs change state to indicate position. The resulting output is two square waves which are 90° out of phase.

OPEN COLLECTOR OUTPUT

The open collector output is typical of the Series 61B, 61C and 62, and is the simplest form of output available. The first step in interfacing with open collector outputs is to provide an external pull-up resistor from each output to the power source. These pull-up resistors provide the output with the high-state voltage when the phototransistor is "off".

In a phototransistor, base current is supplied when light strikes the detector, which effectively grounds the output. Typically, the detector is operated in saturation. This means sufficient light is provided to completely sink, or ground, all the current provided by the pull up resistor plus that of the interfacing electronics. In the logic high state, the light is sufficiently blocked by the rotor and the detector functions like an open circuit. The pull up resistor then provides sourcing current to the interfacing electronics. This "on" or "off" digital arrangement allows the open collector to interface with popular integrated circuit technologies such as TTL, TTL LS, CMOS, and HCMOS.

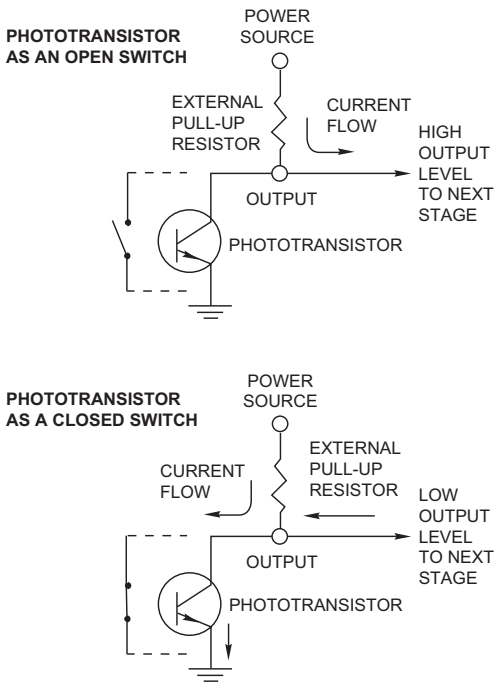
SCHMITT TRIGGERS

To provide signal enhancement it is recommended that a Schmitt Trigger be connected to each output. This device is already included in the Series 61K, 61R, 63K and 63R encoders. The Schmitt Trigger "cleans up" the output into a pure digital signal. It does this by removing the small linear region between the "on" and "off" states of the detector. During this transition the light is only partially blocked and the output is somewhere between what the interfacing circuit might consider to be "on" or "off". In other words, the output is not completely digital. The Schmitt Trigger contains a very important feature which makes it attractive for this application. The device has a higher threshold, or trigger level, when it is in the "on" state than it does in the "off" state. This hysterisis filters any electrical noise, which can cause the output to change state rapidly during the transition. And since the output from the Schmitt Trigger is a pure digital signal and is isolated from the phototransistor, the signal is basically immune to loading problems that can effect encoders without the Schmitt Trigger. Schmitt Triggers are available in most popular IC technologies.

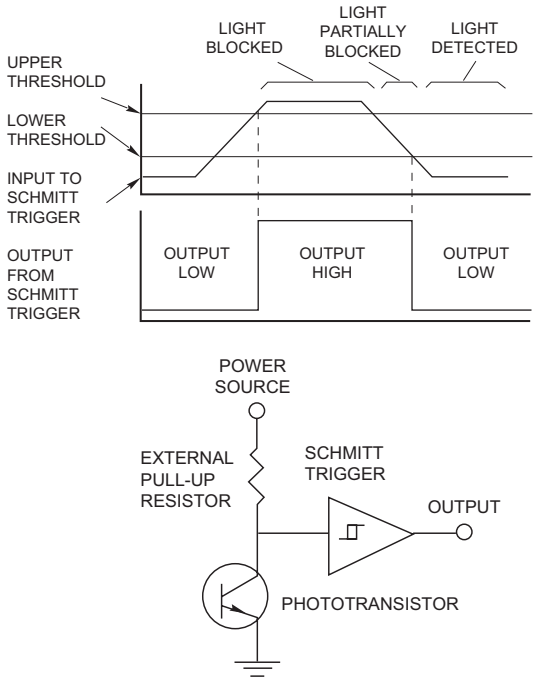
SHAFT AND PANEL SEAL

A shaft and panel seal are available to provide water-tight mounting for the Series 61B, 61D, 61K, 61R and 62 encoders. Sealing is accomplished by an o-ring shaft seal and a panel seal washer. The panel seal washer in the 61B and 61D encoders does not affect the overall dimensions of the switches. In the 61K and 61R encoders, the .045" thick washer is placed over the threads and sits flat on the base of the bushing. The 61KS and 61RS are also epoxy-sealed on the bottom of the switch to provide a completely sealed switch.

Open Collector Output



Schmitt Trigger



Series 65
Optical Encoder Interface

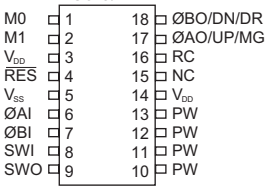
Features
- Interfaces with all Grayhill and Most Standard Quadrature Optical Encoders
- Power Reduction of Up to 75-90% in Optical Encoder Use Through Power Management Feature
- User Selectable Output Modes: Magnitude/Direction, Up/Down,
- Standard Quadrature
- Simplified Microprocessor Interface Reduces Design Time
- Debounces Encoder Integral Pushbutton Switch
- Ideal for Battery Powered Applications that Include Optical Encoders

Description
The GH65C11-X is designed to receive input from standard quadrature optical encoders. The power management feature allows power to the encoder to be applied only during sampling intervals, thus conserving power (especially advantageous in battery powered systems). Sample rate is a nominal 4K per second allowing high speed quadrature input. The optical encoder interface can operate in 1 of 3 user-selectable output modes. These modes are: magnitude and direction, up and down count, and standard quadrature. Debouncing of an integral pushbutton switch within the optical encoder can also be accomplished.

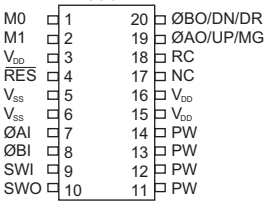
Name	Type*	Description
M0, M1	I	Mode selection input pins
V_{DD}	P	3–6 Vdc power source
$\overline{RES}$	I	Reset pin, normally connected to V_{DD}
V_{SS}	P	GND, 0v nominal power return
ØAI, ØBI	I	Phase A and B quadrature input pins
SWI	I	Switch input pin
SWO	O	Debounced switch output pin
NC	O	No connect, this pin must be left unconnected
PW	O	Power source for encoder power management
RC	I/O	RC oscillator pin
ØBO/DN/DR	O	Phase B, down, direction, mode conditional output pin
ØAO/UP/MG	O	Phase A, up, magnitude, mode conditional output pin

* Pin Types: I = Input, O = Output, P = Power.

SOIC/DIP



SSOP



Ordering information

GH65C11-X-YY

Temperature:
C = Commercial (0° C to 70° C)
N = Industrial (-40° C to 85° C)

Packaging:
PD = 18 lead 300 mil wide Plastic DIP
SO = 18 lead 300 mil wide gull wing SOIC
SS* = 20 lead SSOP

* The SS package style is not available in the -40°C to 85°C temperature range.

Available from your local Grayhill Distributor. For prices and discounts, contact a local Sales Office, an authorized local Distributor or Grayhill.