

Technical Note

OPTO In characteristics

OPTO External Trigger-in Characteristics:

JAI cameras support external trigger-in signals. Basically, either a TTL or an OPTO circuit is implemented for each camera (some cameras support both). TTL is one of the most popular circuits and its I/O is common. On the other hand, OPTO-In is not quite as popular as TTL. Therefore, this document describes the characteristics of the OPTO-In circuit which would be useful to design trigger circuits on the system side.

Note: OPTO is short for “opto-isolated.” Opto-isolated circuits use an optocoupler (also called a photocoupler) to transmit signals between two parts of a circuit using light instead of electricity. By keeping the two parts of the circuit electrically isolated, high voltage spikes in the system cannot cause damage to the low voltage circuits inside the camera.

1. Basic Concept of TTL and OPTO:

TTL is one of the most popular circuits for switching. Because of its popularity, users can easily find a variety of TTL circuit examples to follow. However, it has several disadvantages, including:

- Input voltage is limited: 4V +/- 2V
- System circuit and camera circuit are connected directly.
- Cable between system (user side) and camera must be relatively short.

On the other hand, OPTO circuits have the following features:

- Wide range of input voltages are accepted: 3.3V to 24V
- System (user side) circuit and camera circuit are electrically independent; not connected.
- Cable between system (user side) and camera can be comparatively longer than that for TTL.

Considering the above features, JAI cameras support OPTO/TTL slightly differently depending on the interface.

PMCL/CXP: TTL or both. Trigger signal line is supported by the interface cable.

GE/USB: OPTO or both. Trigger signal line is not supported by the interface cable.

2. Example of OPTO-In Circuit:

Fig. 1 shows an example of OPTO-In circuit. This example is from the SP-5000-USB:

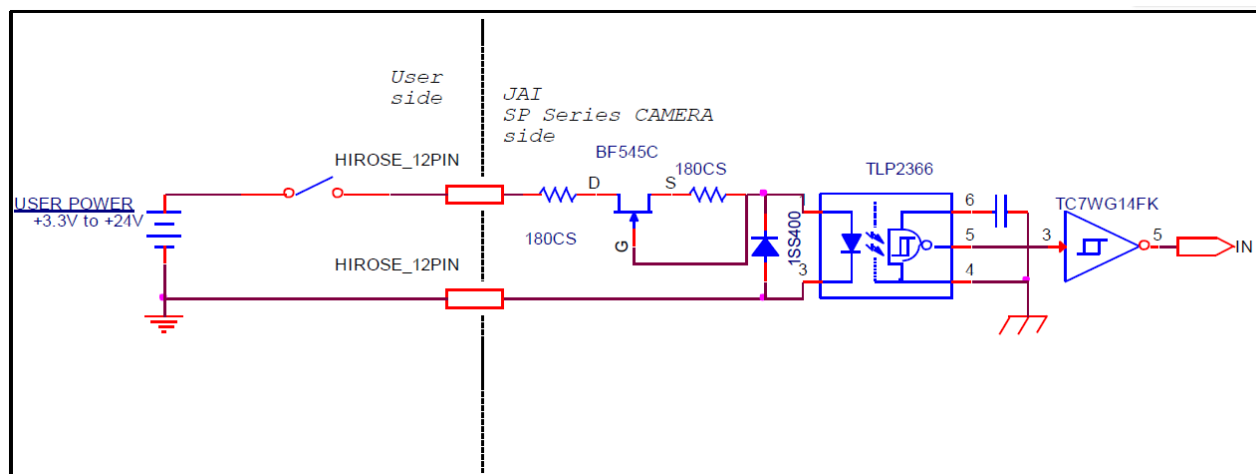


Fig. 1: An example of OPTO-In circuit



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Internal circuitry of JAI Camera:

On right hand side of Figure 1, you can find the photocoupler (optocoupler) inside the blue rectangle. It is enlarged in Figure 2 below. It consists of an LED and a photodetector.

The LED turns on/off in response to the trigger-in signal. The photodetector recognizes the on/off action of the LED and transfers the on/off information into the camera's internal trigger-in circuit.

With this configuration, the system (user side) circuit and the camera circuit are electrically independent; not connected. As a result, a wide range of input voltage is accepted, independent from the camera's voltage requirements.

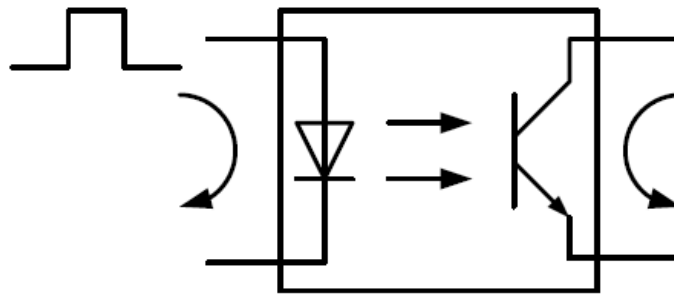


Fig. 2: Photocoupler

System (user side) circuit:

On the left hand side of Figure 1, you can find a simple current-driven circuit. It is much simpler than a typical TTL circuit.

3. Tips for using an OPTO In circuit:

As described in the previous section, the system (user side) circuit is simple. However, in actual use cases, input signals are sometimes noisy or dull and can sometimes cause unexpected behavior in the system, such as missing triggers or timing issues. To improve this, here are some tips for how to use OPTO In.

Improve input signal quality:

To avoid electrical noise coming from outside of the cable, shielded cable and/or twisted-pair cables are recommended.

Provide independent ground between system and camera:

If the ground is common between the system and camera, the voltage drop will affect the recognition level on the camera side. As a result, recognition accuracy becomes worse.

Set an OPTO In filter:

Some cameras, including selected models within JAI's Go Series and Spark Series, support an "OPTO In filter". This function allows the user to select the minimum pulse width needed to be considered valid. Shorter pulses are ignored by the circuit. By choosing the appropriate setting, noise spikes appearing as shorter pulses can be ignored.



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Use GPIO to filter noisy/dull trigger signals:

Please refer to the Technical Notes called “Tips for configuring GPIO” and “Tips for using the Pulse Generator” for two examples of how to use the GPIO to create a trigger noise filter. This can be used when an OPTO In filter is not available or not sufficient.

Rising edge or falling edge:

Based on the combination of the camera’s internal OPTO circuit and the trigger input circuit, the timing characteristics for rising and falling edges will change. In actual usage, if unexpected trigger behavior occurs, experimenting with the use of rising edges or falling edges may improve performance.

End.

