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# SYNCHRONIZATION OF ISO120/121 ISOLATION AMPLIFIERS

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Internal clock circuitry in the ISO120/121 precision isolation amplifier (ISO amp) can be synchronized to an external clock signal. Synchronization to an external clock can be used to eliminate beat frequencies in multichannel systems or for rejection of specific AC signals and their harmonics—see the ISO120/121 product data sheet, PDS-820.

The external clock signal can be directly connected to the ISO120/121 if it is a sine or triangle wave of the proper amplitude. At clock frequencies above 400kHz, a square wave external clock can also be directly connected to the ISO120/121. Other clock signals can be used with the addition of the signal conditioning circuit shown in Figure 2.

## SYNCHRONIZING TO A SINE OR TRIANGLE WAVE EXTERNAL CLOCK

The ideal external clock signal for the ISO120/121 is a ±4V sine wave or ±4V, 50% duty-cycle triangle wave. The *ext osc* pin of the ISO120/121 can be driven directly with a ±3V to ±5V sine or 25% to 75% duty-cycle triangle wave and the ISO amp's internal modulator/demodulator circuitry will synchronize to the signal.

| EXTERNAL CLOCK FREQUENCY RANGE | $C_1$, $C_2$ ISO120/121 MODULATOR, DEMODULATOR EXTERNAL CAPACITOR |
|---|---|
| 400kHz to 700kHz | none |
| 200kHz to 400kHz | 500pF |
| 100kHz to 200kHz | 1000pF |
| 50kHz to 100kHz | 2200pF |
| 20kHz to 50kHz | 4700pF |
| 10kHz to 20kHz | 0.01µF |
| 5kHz to 10kHz | 0.022µF |

TABLE I. Recommended ISO120/121 External Modulator/Demodulator Capacitor Values vs External Clock Frequency.

| EXTERNAL CLOCK FREQUENCY RANGE | $C_X$ |
|---|---|
| 400kHz to 700kHz | 30pF |
| 200kHz to 400kHz | 180pF |
| 100kHz to 200kHz | 680pF |
| 50kHz to 100kHz | 1800pF |
| 20kHz to 50kHz | 3300pF |
| 10kHz to 20kHz | 0.01µF |
| 5kHz to 10kHz | 0.022µF |

TABLE II. Recommended $C_X$ Values vs Frequency for Figure 2 Circuit.

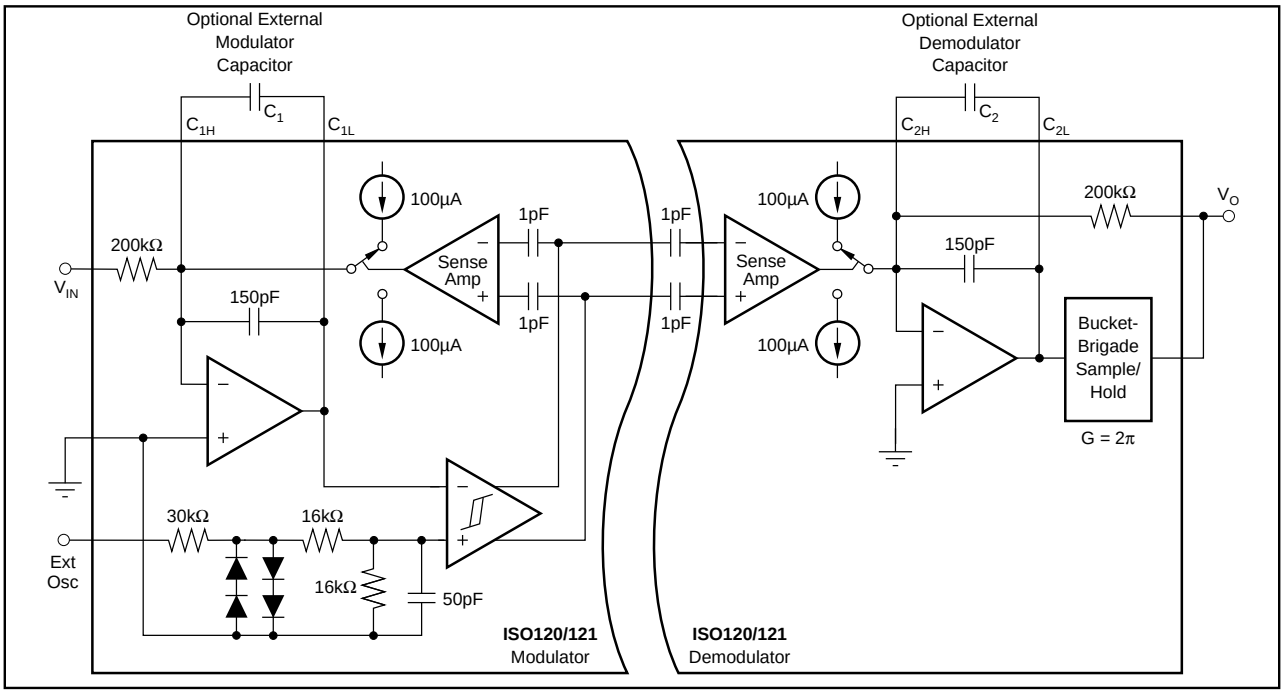


FIGURE 1. ISO120/121 Block Diagram Showing Internal Clamp and Filter Circuitry at the Ext Osc Pin.



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Synchronizing to signals below 400kHz requires the addition of two external capacitors to the ISO120/121. Connect one capacitor in parallel with the internal modulator capacitor and connect the other capacitor in parallel with the internal demodulator capacitor as shown in Figure 1.

The value of the external modulator capacitor, $C_1$, depends on the frequency of the external clock signal. Table I lists recommended values.

The value of the external demodulator capacitor, $C_2$, depends on the value of the external modulator capacitor. To assure stability, $C_2$ must be greater than $0.8 \bullet C_1$. A larger value for $C_2$ will decrease bandwidth and improve stability:

$$f_{-3dB} \approx \frac{1.2}{200k\Omega\ (150pF + C_2)}$$

Where:

$f_{-3dB} \approx$ –3dB bandwidth of ISO amp with external $C_2$ (Hz)

$C_2$ = External demodulator capacitor (F)

For example, with $C_2 = 0.01\mu F$, the $f_{-3dB}$ bandwidth of the ISO120/121 is approximately 600Hz.

## SYNCHRONIZING TO A 400kHz TO 700kHz SQUARE-WAVE EXTERNAL CLOCK

At frequencies above 400kHz, an internal clamp and filter provides signal conditioning so that a square-wave signal can be used to directly drive the ISO120/121. A square-wave external clock signal can be used to directly drive the ISO120/121 *ext osc* pin if: the signal is in the 400kHz to 700kHz frequency range with a 25% to 75% duty cycle, and ±3V to ±20V level. Details of the internal clamp and filter circuitry are shown in Figure 1.

## SYNCHRONIZING TO A 10% TO 90% DUTY-CYCLE EXTERNAL CLOCK

With the addition of the signal conditioning circuit shown in Figure 2, any 10% to 90% duty-cycle square-wave signal can be used to drive the ISO120/121 ext osc pin. With the values shown, the circuit can be driven by a 4Vp-p TTL signal. For a higher or lower voltage input, increase or decrease the 1kΩ resistor, $R_X$, proportionally. e.g. for a ±4V square wave (8Vp-p) $R_X$ should be increased to 2kΩ.

The value of $C_X$ used in the Figure 2 circuit depends on the frequency of the external clock signal. Table II shows recommended capacitor values.

Note: For external clock frequencies below 400kHz, external modulator/demodulator capacitors are required on the ISO120/121 as before.

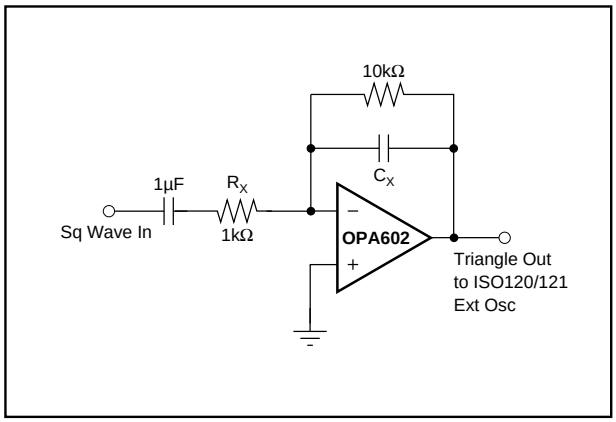


FIGURE 2. Square Wave to Triangle Wave Signal Conditioner for Driving ISO120/121 Ext Osc Pin.

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