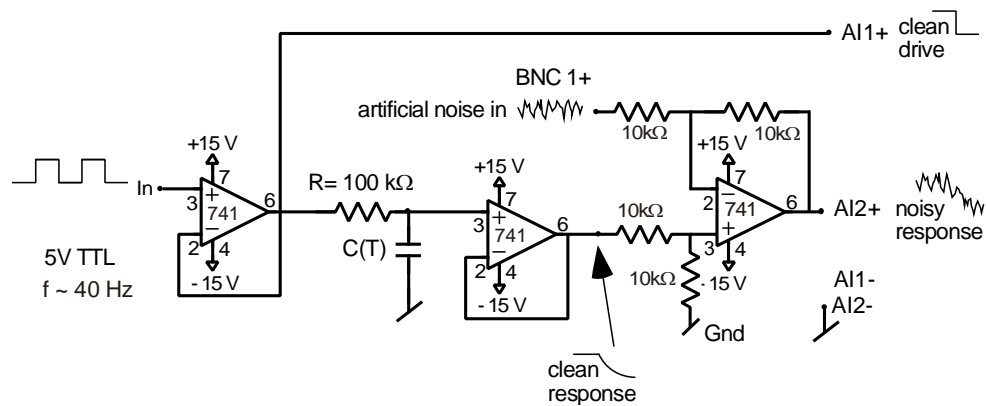
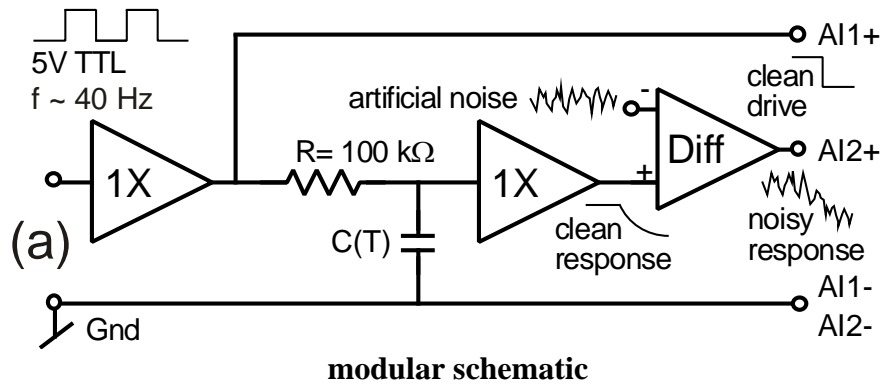


## C(T) Signal Circuitry



**Circuit schematics for the capacitance measurement circuit:** the capacitor  $C(T) \sim 10$  nF is the ceramic (doped ferroelectric) capacitor in the bug capacitor that varies strongly with temperature. By measuring the RC time constant versus  $T$ , we can deduce  $C(T)$ . The  $R = 100$  k $\Omega$  metal-film resistor is combined with it to make a simple RC circuit with a nominal time constant of  $\tau \sim 1$  ms. The measurement protocol is to measure the RC decay response to the downward edge of a 5V TTL square-wave drive signal at  $f \sim 40$  Hz with a measurement time of 10 ms so as to allow the RC circuit to fully relax within the measurement interval. The voltage followers (1X) serve to isolate the RC circuit from the other impedances in the system; this is necessary given the relatively large 100 k $\Omega$  resistance used to make the time constant easily observable. In addition to the voltage followers, a difference amplifier (Diff) is included on the output as an option to artificially inject noise into the system. By simply grounding the noise input instead, the pure signal is recovered. Both the drive signal and the response are measured using two of the NI ELVIS analog input pairs.

## 741 Operational Amplifier Pin-Out

