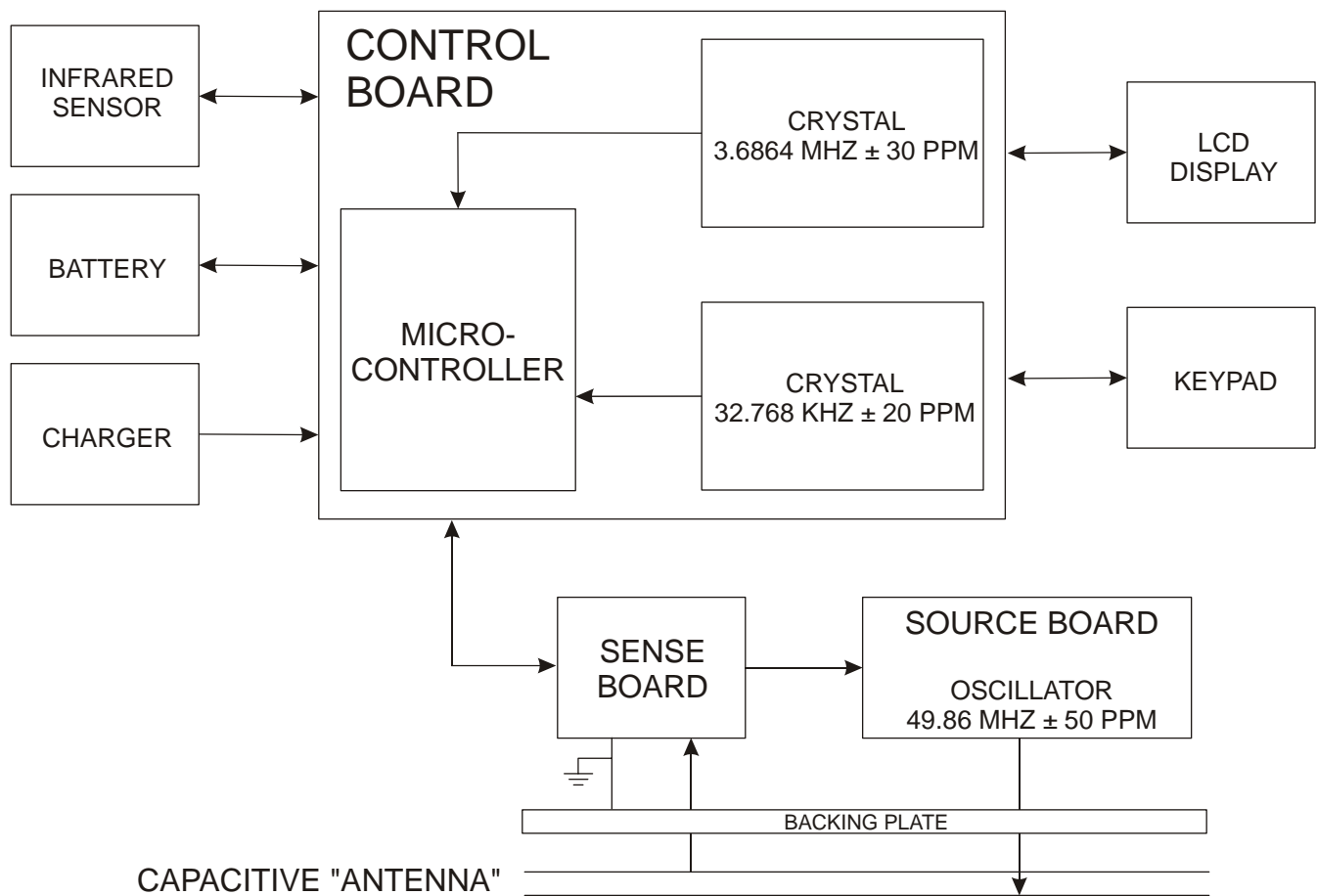# PaveTracker Plus Circuit Description

PaveTracker Plus (PT+) is a portable, battery-powered instrument which measures density of asphalt pavement. It does so by measuring the capacitance of a sensor (antenna) which is a function of the asphalt's dielectric constant. This requires that an electric field be induced into the asphalt, and the PT+ uses a 49.86 MHz square wave oscillator for this purpose.

The PT+ circuitry is shown in figure 1.

Figure 1 - PaveTracker Plus Block Diagram

The microcontroller-based control board executes system firmware and provides interfaces to the system peripherals. Its Atmel AT91M55800A microcontroller is clocked by an internal oscillator controlled by a 3.6848 MHz crystal. A phase-locked loop circuit in the AT91M55800A derives an internal 18 MHz clock from the 3.6864 MHz clock for use within the microcontroller. A separate 32.768 KHz crystal provides a timebase for the microcontroller's real-time clock/calendar function.

The liquid crystal display module provides a four line by 20 character display. It is connected to the control board by a 16-conductor flat cable supplying power, data and control signals. The microcontroller uses this interface to send characters to the module for display, to read back displayed data and to determine module status.

The 32-key keypad is interfaced by a 13-conductor flat cable which provides row and column lines. These lines are read and driven, respectively, by the microcontroller every five milliseconds to detect keystrokes.

The infrared sensor is an optional device for measuring the temperature of asphalt upon which the PT+ is placed. A five-wire interface provides +12 VDC power and ground to the sensor and returns an analog voltage level to the microcontroller's analog-to-digital converter.

The PT+ is powered by a nominal 6.0 volt, 4000 mAh battery consisting of five NiMH C cells. A battery charging circuit on the control board recharges the battery when an external +12 VDC, 2A power supply is plugged into the PT+ battery charger jack.

The sense board interfaces to the control board via a 14-conductor ribbon cable. It contains an analog-to-digital converter driven by the control board's microcontroller's SPI interface. The cable also provides +5 VDC and –4 VDC power supplies to the sense board. The A/D converter's input is connected to one plate of a capacitive sensor (antenna) whose capacitance is a function of the underlying asphalt's dielectric constant. The sense board also supplies +5 VDC power to a separate source board containing an oscillator.

The source board's 49.86 MHz square wave oscillator output is applied to the other plate of the capacitive sensor. Since the source board, like the sense board, is mounted to the capacitive sensor's backing plate, the signal lines connecting them to the sensor's plates are very short.