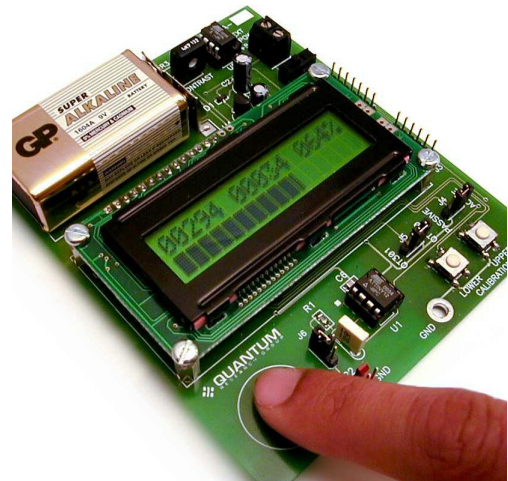## Overview

The E3A board works with Quantum's QT300 16-bit Capacitance to Digital Converter (CDC) sensor IC. The device can be inserted into the 8-pin DIP socket at the front of the board.

QT300 - serial communications interface (16 bit data).

For detailed information about this IC please refer to the QT300 datasheet.

See Figure 2, page 4 for component and connector identification.

Note: references on the PCB to the QT301 should be ignored. It is not available because it is not RoHS compliant.

Fast Start

To begin using the board:

1. Make sure the power switch is 'off'. Insert a 9V alkaline battery into the holder.

2. Ensure that the **DEVICE** jumper (bottom right corner of board) is set to the QT300.

3. Make sure the **MODE** jumper is set to **ACTIVE**.

4. Turn on the power switch.

5. Calibrate the E3A to your finger as a simple test. While not touching any other part of the E3A:

   a. Keeping your hand away from the Sensor pad, press the **LOWER** button using a plastic pen or pencil.

   b. Put a finger lightly on the middle of the Sensor pad and press the **UPPER** button using a plastic pen or pencil.

6. Slide your finger from the lower left corner of the board towards the middle of the Sensor pad area; you will observe the change in signal strength on the LCD. Refer to the 'LCD Display' section, page 3 for more information.

Because of Kirchoff's Current Law ("all currents must return to their origin", which also applies to capacitive fields), the sensor is less sensitive if you are not holding it or if the board's ground is not electrically coupled to something else. Thus, placing the board on your desk will result in less sensitivity than if you hold it by the batteries or connect the board's ground to something larger (or to earth ground).

Touching the cal buttons with your finger while pressing them, while on battery power, will cause an undesirable offset to the calibration. If the E3A is externally powered, this effect will not occur.

Board Details

Schematic Diagram

Please refer to the schematic diagram in this guide.

Batteries

Use a 9 Volt Alkaline for best performance.

Remove batteries when using external power!

External Power Connections

Connector J1 can be used to power the board. The voltage should be between +8 and +12 volts DC. Power should be free from switching noise and short-term fluctuations for best performance.

WARNING: External power - please note! Be sure to remove the batteries first, or you may cause an explosion and leakage hazard as the batteries will try to charge up from the external supply!

Device Jumper

Ensure that the jumper is set to the QT300 device (see the note in Overview, page 1 about the nonavailability of the QT301).

Mode Jumper

This jumper allows you to switch the LCD controller to either the 'active' or 'passive' mode.

Active mode: The LCD controller will drive the QT300 and display the data on the LCD. To work correctly the QT300 needs to be set to 'slave' mode using setups from a PC (using a QTM300CA board + QT3View software for example).

Passive mode: In this mode the LCD controller 'sniffs' data transfers on the SPI lines. If the E3A is connected to an external host (like a QTM300CA board, or your own host microcontroller), the LCD will display data as requested by the host.

Sensor Circuit

C1 Capacitor (referred to generically as the Cs or 'sample' capacitor) is socketed and can be replaced for experimentation. Higher values of Cs increase sensitivity, in direct proportion. Use decent grade capacitors (avoid cheap ceramic capacitors in favor of plastic film types or at worst, ceramic X7R 5% types for best results). A typical minimum usable value of Cs is 2nF (0.002uF, or 2,000pF).

'Ext' Sense Connector provides a way to connect the chip to an external sensing electrode or fluid level probe. The load should have low baseline capacitance (Cx) for best results. High Cx will decrease apparent sensitivity, perhaps requiring an increase in Cs to compensate. Shielded cable can be used over limited distances, usually with an increase in Cs to compensate for the increased Cx loading.

Sensor Select Switch connects the sense pin of the device to either the sense pad or the external connector. **UP** = internal pad; **DOWN** = external connector.

Calibration Switches (Lower, Upper)

QT300: The QT300 requires no calibration; the buttons are only used to calibrate the LCD bargraph display range between two endpoints (see LCD display below). The calibration occurs in the display controller microcontroller located under the LCD.

LOWER Switch: Calibrates the lower range endpoint when the electrode is at minimum load.

UPPER Switch: Calibrates the upper range endpoint when the electrode is loaded.

SPI / CLONE PORT Connector

The pins on this connector are described in Table 1, page 4

This connector is also used to connect the QTM300CA to the E3A for Setups cloning and to allow QT300 signals to be monitored with QT3View. To use the E3A in this mode the *MODE* switch (bottom right corner) must be set to *PASSIVE.* The LCD display controller will then 'sniff' the data transfers.

LCD Display

Display Mode

The LCD display shows four different types of information.

On the top line, the LCD displays the raw signal counts (left), the signal deviation in counts (center) and the signal deviation in percent (right). The bottom line is the signal deviation bargraph.

The QT300 only sends raw signal data (left). The other numbers and the bargraph are computed by the E3A's microcontroller from data recorded during calibration.
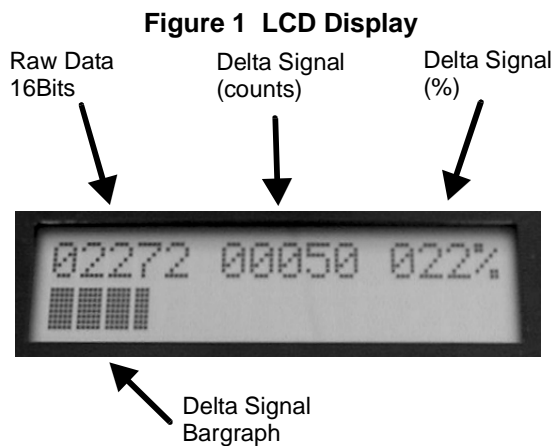
Figure 1 LCD Display
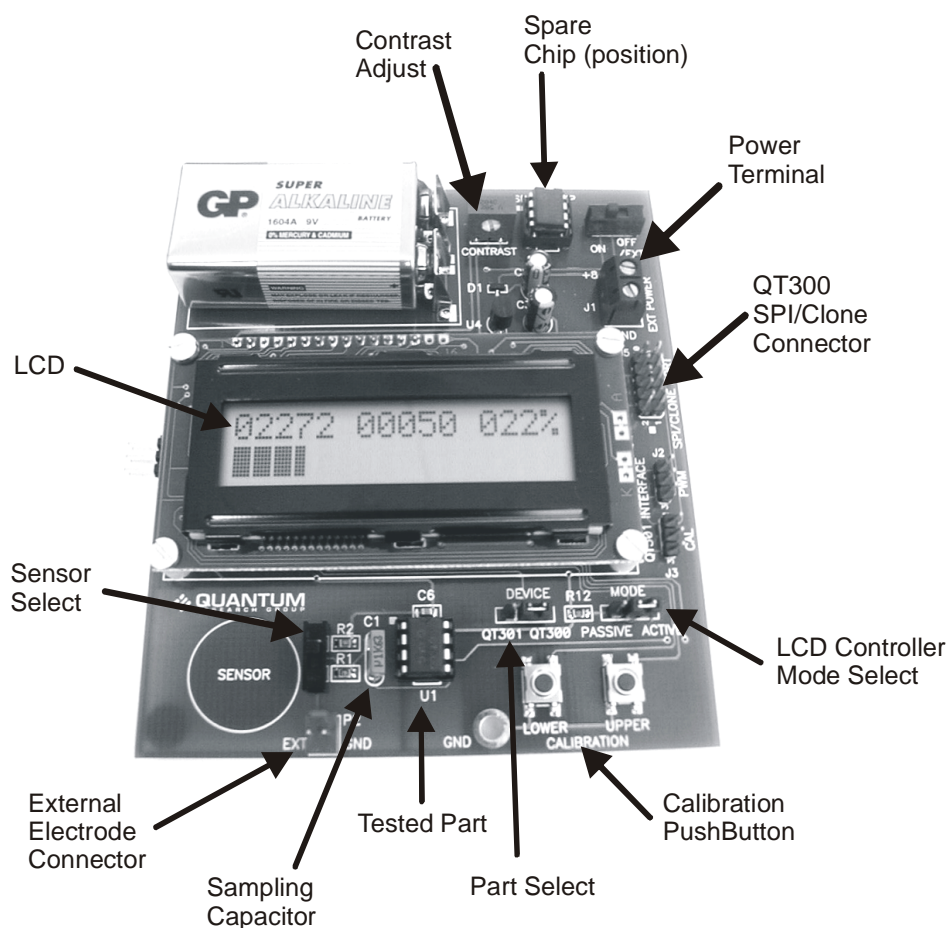

Raw Data 16Bits — Delta Signal (counts) — Delta Signal (%)

02272 00050 022%

Delta Signal Bargraph

Figure 2   Board Layout

Table 1: J5 - SPI/Clone Port Connector Pinout

Pin	Description	Pin	Description
1	n/c	6	SDO
2	GND	7	/REQ
3	/DRDY	8	Vcc
4	n/c	9	SCK
5	n/c	10	n/c

Table 2 J2 / J3 - Cal Connector Pinouts

Pin	J2	Pin	J3
1	Analog	1	Cal_lower
2	GND	2	GND
3	PWM	3	Cal_upper

Figure 3 Schematic Diagram

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