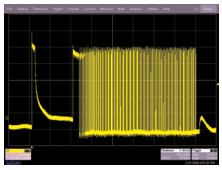
LeCroy



A P P L I C A T I O N B R I E F

CAN Sensor Characterization

CAN Specific Parameters Measure Sensor Performance (No. LAB WM_444)

CANbus TDM is a revolutionary Trigger, Decoding, and Measurement/Graphing tool that will greatly increase your ability to debug and validate CAN ECU or network performance. The latest addition to this tool, CAN Measure/Graph, adds five CAN specific measurement parameters to a list of over 150 parameters already available in LeCroy oscilloscopes. Additionally, the ability to histogram, trend, and track these parameters is included, as are histogram parameters. The new CAN parameters are summarized below:

CANLoad – Computes CANbus load, in percent, for each acquisition with the ability to filter messages used to compute the load.

CANtoAnalog – Measures the time elapsed between a specific transition of an analog signal and a specified CAN message.

CANtoCAN – Time between two specified CAN messages.

CANtoValue – Computes the value embedded in the data bytes of a CAN message.

t@CAN – Computes the time from trigger to a specified CAN message.

CANtoValue enables the scope to read the CAN sensor data content. By combining the measurement with LeCroy's Track function, the user can plot the sensor data values as a function of time. These plots can be compared to analog source data, if available, as shown in Figure 1.

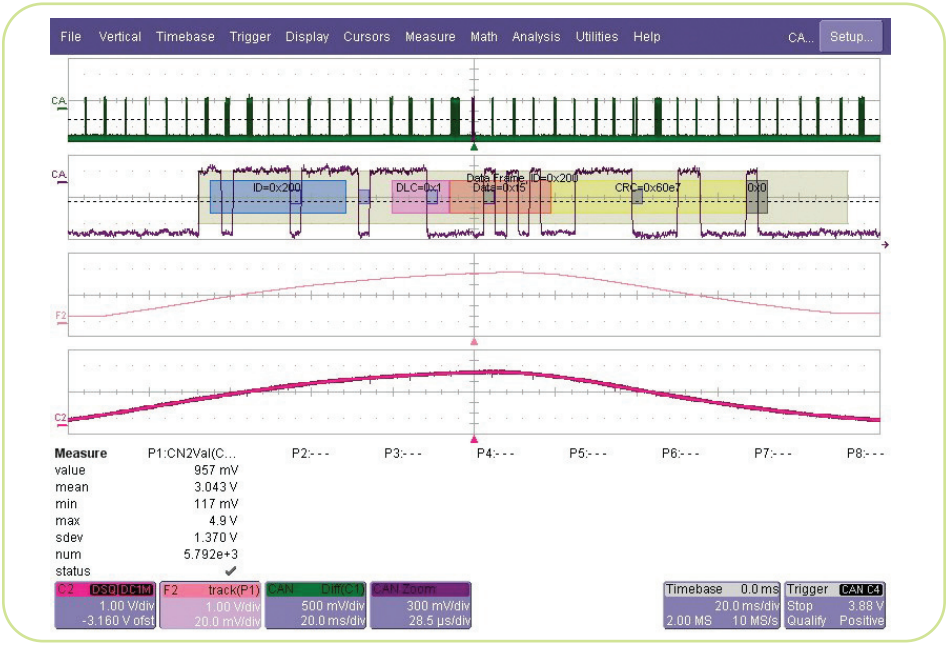


Figure 1. *Comparing the track of CANtoValue to the analog source.*

In the example, the LeCroy oscilloscope has captured 200 ms of CANbus activity. The CANtoValue parameter, P1, is decoding the data content of CAN messages with ID=200. The setup for the CANtoValue parameter is shown in Figure 2. The setup dialog allows the user to select the specific message ID, the byte location within the data field, and the calibration coefficient of the sensor. In this case the sensor is calibrated in units of volts. The track of parameter P4 shows a time correlated record of sensor data values taken from the acquired CAN data. The Channel 2 trace shows the actual analog input to the sensor for comparison purposes. This analysis permits characterization of

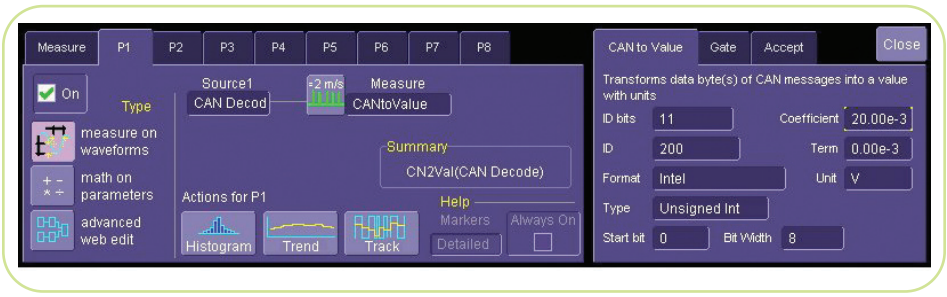


Figure 2. *The setup for the CANtoValue parameter*

sensor performance in a vehicle environment, allowing the user to see the total performance of the sensor from input to encoded data.

CANtoAnalog is particularly useful in validating CAN ECU performance with analog input signals, or vice versa. CANtoValue is particularly useful in understanding CAN sensor data. The CANtoAnalog parameter measures the time from an analog threshold crossing to a specified CAN message ID. This parameter is useful for statistically validating the ECU's CAN message response to analog input, or vice-a-versa,or for measuring time latency of sensors. Thousands or millions of measurements in mixed signal environments can be quickly made. In Figure 3 the time between an analog pulse (trace C2) and the appearance of the related CAN message with ID=300 is measured using the CANtoAnalog parameter, P1. Figure 4 shows the parameter setup. In Figure 3 multiple measurements have been made and the parameter statistics are used to show the minimum, maximum, and mean value after 82 measurements. Trace F1 is the histogram of parameter P1, which graphically shows a uniform distribution. It shows the time from the analog input to CAN bus activity for a sensor.

Figure 5 illustrates the analysis of a steering wheel angle sensor. The device produces two data outputs, which you can see annotated on the track displays of the parameter CANtoValue. The track function produces a graph of the parameter values that is time synchronous with the source waveform. Trace F1 is the track of steering wheel angle. Trace F3 is the track of angular velocity. This is a practical illustration of the power of these CANbus parameter measurements.

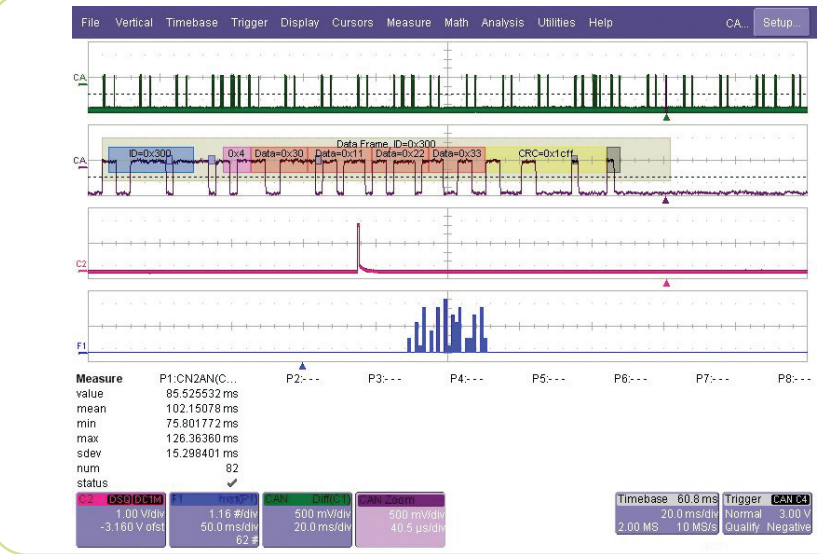


Figure 3. *Using the CANtoAnalog parameter to determine sensor latency*

Figure 4. *The set up dialog box for the CANtoAnalog parameter*

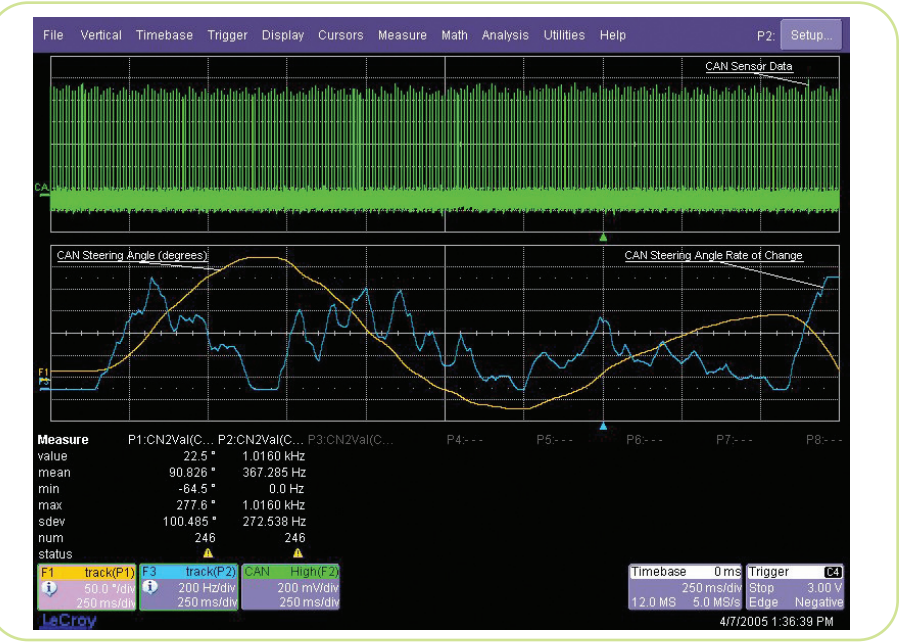


Figure 5. *Analysis of a steering angle sensor with three outputs.*