Correlation With Multibit Data Using The HSP45256

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For single bit data, the output of the correlator, that is, the correlation score, represents the total number of data bits that match the reference at time n. At time n+1, the data slides past the reference by one sample, a new data sample is input into the device, and the new sum is calculated. When the data matches the reference most closely, a correlation peak is obtained. Figure 1 shows a stream of data being correlated with a reference and the corresponding peak in the output score.

The maximum possible correlation score (corresponding to a perfect match) equals the number of bits in the data stream. Assuming that the reference pattern occurs only once in the data, the correlation score will build slowly until it reaches the peak. Assuming random input data, most of the time about half of the data samples will match the reference. The minimum correlation score for a given configuration will then be one half of the peak score.

This example is ideal; the received pulse is not corrupted by noise, so correlation is perfect. In the real world, noise on the input data will lower the correlation peak, making it more difficult to determine its position in the data. Quantizing the data using more than one bit helps to alleviate this problem. In the example shown in Figure 2, two bit quantization is used to illustrate this point. In this case, calculation of the maximum possible score must take into account the bit weighting. The output scores are shown normalized to their respective maximums so that a fair comparison is achieved. Note that using more data bits sharpens the peak of the score.

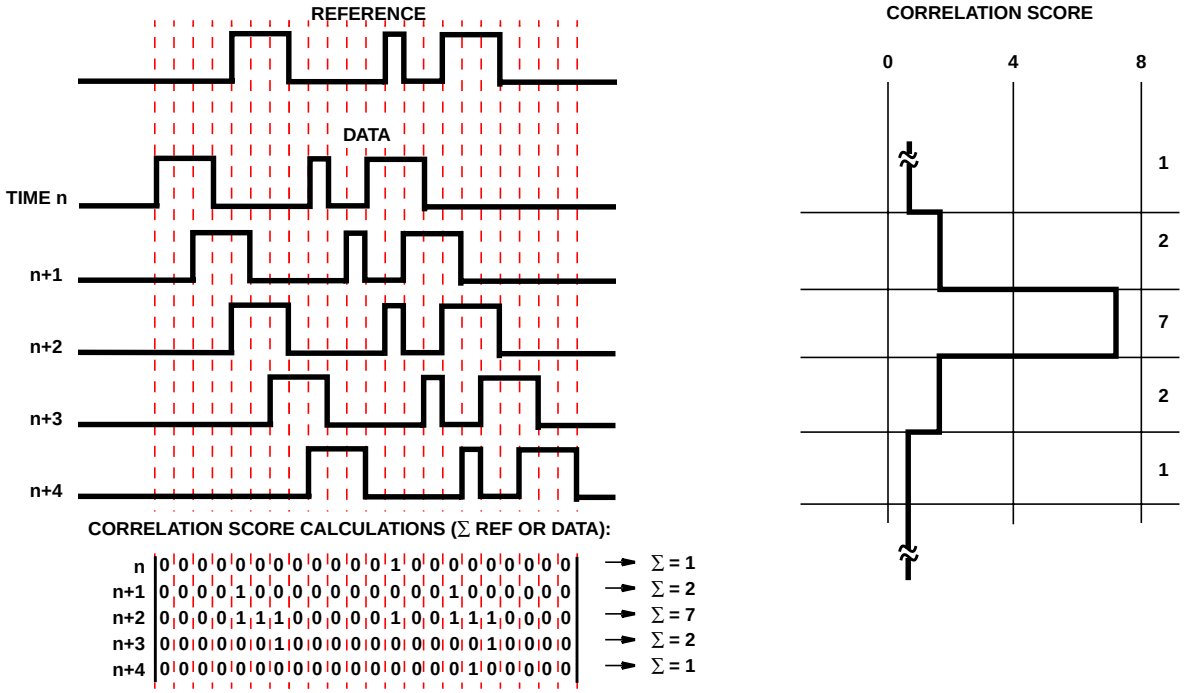

FIGURE 1. CONCEPTUAL DIAGRAM OF CORRELATION OF SINGLE BIT DATA AND REFERENCE

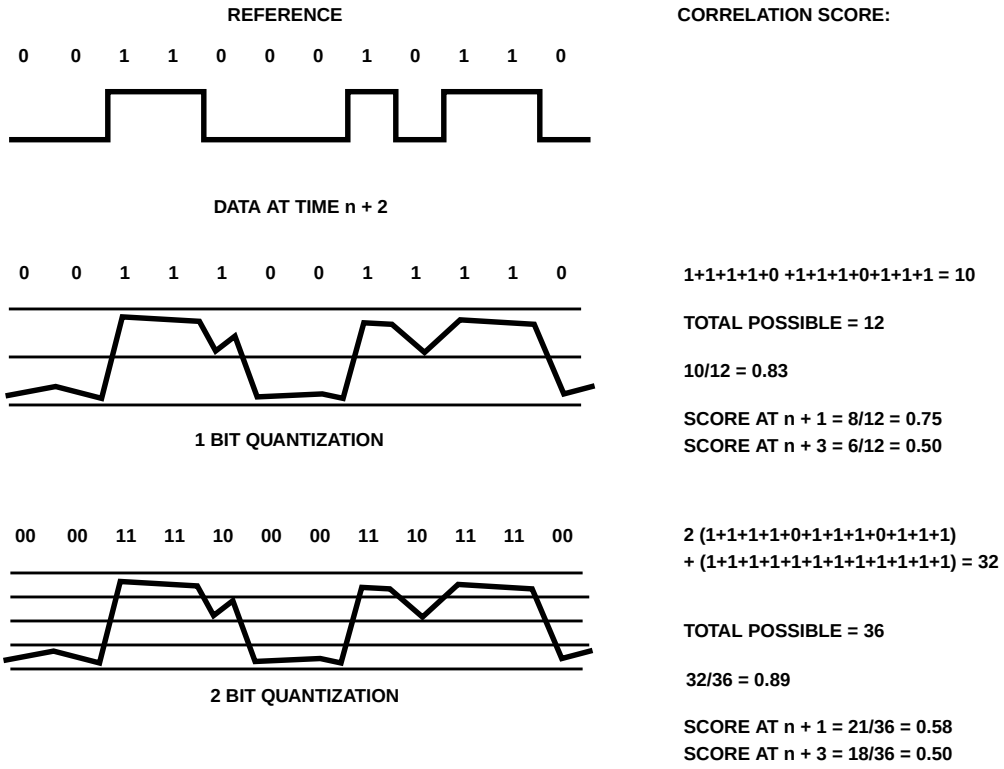

FIGURE 2. COMPARISON OF CORRELATION RESULTS USING ONE BIT AND TWO BIT DATA

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