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## *Technical Note*

# Scalar and Vector Wind Speed and Direction

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Wind velocity is a vector because it is described by both speed (magnitude) and direction, but speed and direction can be treated separately as scalar values. Wind data is typically collected frequently and averaged over a period of time. The data can be vector averaged, scalar averaged, or averaged using both techniques.

### Vector and Scalar Averaging

When computing scalar averages of wind data, instruments such as a cup or propeller anemometer and a wind vane measure wind speed and direction independently. The instruments are sampled at regular intervals and simple arithmetic averages are calculated over a time period. ESC data loggers take zero crossover into account when data values are averaged.

Vector, or resultant, averages use both speed and direction to derive orthogonal components. Components are summed and vector averaged, using algorithms, by the data logger.

The difference between vector and scalar averages is usually small when wind direction is nearly constant, typically when wind speeds are moderate to high. Vector averaged wind speeds will never be larger than the scalar-averaged values. Larger differences occur with greater wind direction variance, which occurs more often at lower wind speeds. For example, if the wind speed was 5 meters per second from the north for five minutes followed by a constant wind from the south for 5 minutes, the scalar-averaged speed would be five meters per second and the vector-averaged speed would be zero. Situations like that example are rare, however, and wind direction variability is usually much less extreme.

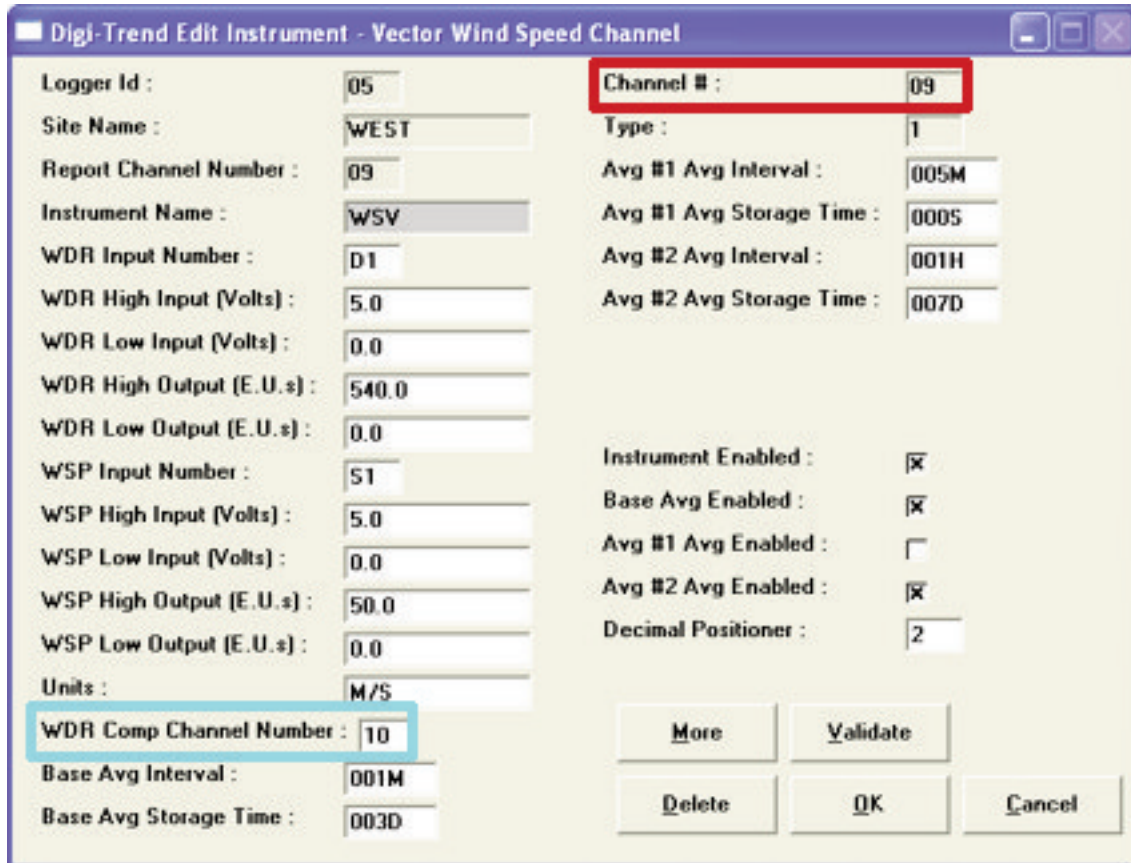
### Configuring E-DAS Ambient for Wind Speed and Direction

E-AS Ambient software users should be aware that vector wind speed and direction data are not interchangeable with scalar wind speed and direction data. Wind data is processed every minute by the data logger according to the configuration in the instrument editor (Figure 1). Once the E-DAS Ambient software receives vector or scalar wind data from the data logger it can only configure reports for vector or scalar data as the data was received from the logger.

When vector wind speed or direction is configured in the instrument editor it is important to enter the companion channel number (**WSP Comp Channel Number** or **WDR Comp Channel Number**). If the channel is left as the default value of 00 reports will be generated

incorrectly and monthly reports will be blank. E-DAS software suppresses monthly reports if the companion channel is incorrect.

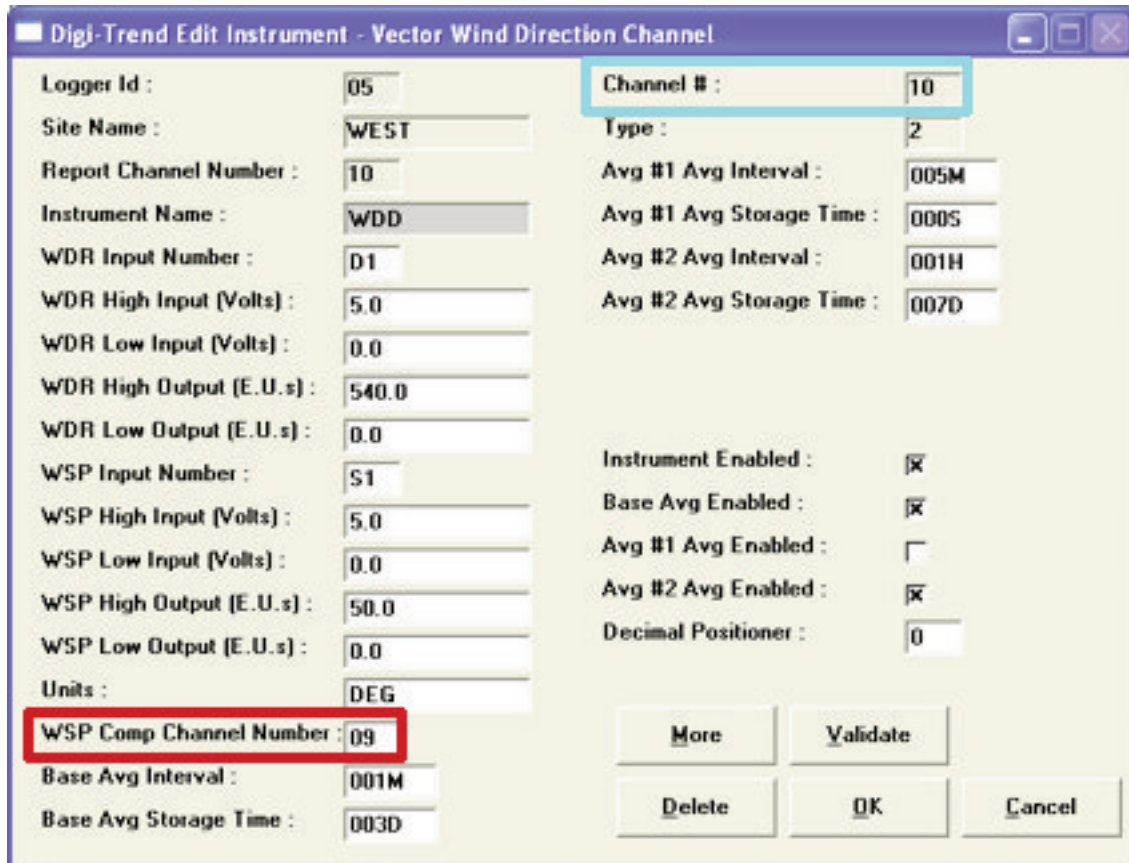
Figure 1 illustrates a vector wind speed channel that is configured correctly. The **Vector Wind Speed Channel** in Figure 1 is **Channel # 09**, outlined in red. The companion channel, **WDR Comp Channel Number** outlined in blue, is **Channel 10**, which is the Vector Wind Direction Channel illustrated in Figure 2.



**Figure 1** Vector Wind Speed Channel # 09, companion channel to Vector Wind Direction Channel # 10

Figure 2 shows the **Vector Wind Direction Channel # 10**. The **Channel number** is outlined in blue. The companion Vector Wind Speed Channel, **WSP Comp Channel Number 09** outlined in red in Figure 2, is the located on channel 09, as illustrated in Figure 1.

If you like you can assign vector wind speed and scalar wind speed to the same channel. You can also assign vector wind direction and scalar wind direction to the same channel.



**Figure 11** Vector Wind Direction Channel # 10, companion channel to Vector Wind Speed Channel # 9