Determining Wind Speed and Direction
In the *ULTIMETER*® PRO Anemometer

Confidential and Proprietary (Revised 1/22/06)

The following information is preliminary guidance for those using *ULTIMETER* PRO Anemometers in systems other than *ULTIMETER* Weather Stations. Although we believe the information below to be correct, Peet Bros. makes no representation as to the accuracy or suitability of its *ULTIMETER* PRO Anemometers used in systems not of its own design. Peet Bros. warranty on these sensors is limited to repairing or replacing, at our option, any sensor returned to us, shipped prepaid, within one year of purchase, because of a defect in materials or workmanship. Neither Peet Bros. nor its dealers and distributors shall be liable for any consequential damage.

The *ULTIMETER* PRO Anemometer is a patented, all-digital design for measuring both the speed and direction of wind. The anemometer houses two magnetically-actuated reed switches. Both open and close once each revolution of the anemometer assembly. We call the lower reed switch, "the speed reed," and the upper reed switch, "the direction reed." The wind speed measurement is derived from the speed reed, and the wind direction measurement is derived from the speed reed and direction reed (both signals must be present).

In *ULTIMETER* Weather Stations, speed is determined by measuring the time interval between two successive closures of the speed reed. Calibration is done as follows (RPS = revolutions per second):

$0.010 < RPS < 3.229$ (approximately $0.2 < MPH < 8.2$):
$MPH = -0.1095(RPS^2) + 2.9318(RPS) - 0.1412$

$3.230 < RPS < 54.362$ (approximately $8.2 < MPH < 136.0$):
$MPH = 0.0052(RPS^2) + 2.1980(RPS) + 1.1091$

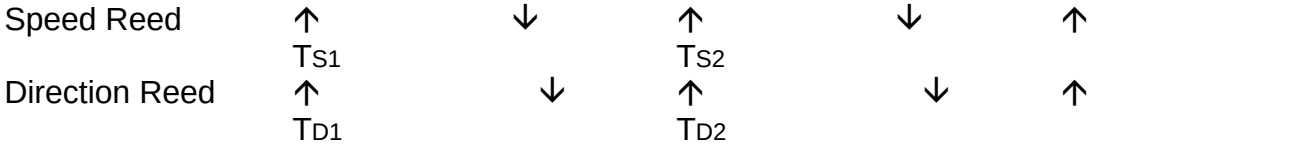
$54.363 < RPS < 66.332$ (approximately $136.0 < MPH < 181.5$):
$MPH = 0.1104(RPS^2) - 9.5685(RPS) + 329.87$

Conversions used are: mph $*$ 0.86897 = knots; mph $*$ 1.6094 = kmph; mph $*$ 0.48037 = m/s

Direction is calculated as the relative timing (phase relationship) between contact closures of the two reed switches. This is a non-linear, sinusoidal relationship. We regard repeated actuation of the speed reed as the reference and arbitrarily define "North" as the vane orientation that causes the two reed switches to close at the same time. "South" is the vane orientation that causes the direction reed to close exactly halfway between two closures of the speed reed. Note that the open and closed intervals are not necessarily equal and may differ between the two switches.

NORTH (both reeds close simultaneously)

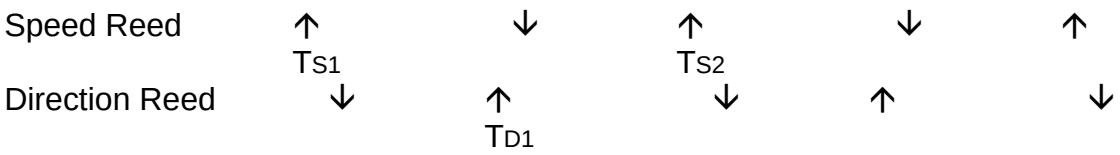
↑ DENOTES TIME THE CONTACT CLOSES ↓DENOTES TIME THE CONTACT OPENS



NOTE: T_{S1} AND T_{D1} OCCUR SIMULTANEOUSLY, AS DO T_{S2} AND T_{D2}

SOUTH (contact closures are 180° out of phase)

↑ DENOTES TIME THE CONTACT CLOSES ↓DENOTES TIME THE CONTACT OPENS



NOTE: THE TIME FROM T_{S1} TO T_{D1} EQUALS THE TIME FROM T_{D1} TO T_{S2}

We include several data checks in our systems:

1. We require that there be one and only one contact closure from one reed switch between two successive closures of the other reed switch. This involves some special treatment when the closures are nearly coincident.
2. At speeds above 10 mph, we measure speed twice, through two successive revolutions of the anemometer. The two readings must agree within preset limits that vary with speed.
3. We likewise measure direction twice, through two successive revolutions of the anemometer. If the two readings do not agree within preset limits that vary with speed, we do not display the new direction reading in the output. This is done to emphasize the predominant wind direction and minimize excessive display fluctuation, without sacrificing responsiveness.

In *ULTIMETER* Weather Stations, the reed switches operate at 5 vdc. Electrical ratings for the reed switches are as follows:

Contact Rating:	10 watts
Switching Voltage (max.):	200 vdc
Breakdown Voltage (min.):	250 vdc
Switching Current (max.):	0.5 amp
Carry Current (max):	1.2 amp
Contact Resistance (max):	0.1 Ω
Capacitance:	0.2 pF