Texas Electronics, Inc.

The Gold Standard in Weather Instrumentation Since 1957

220 WIND AND SPEED SYSTEM USER'S MANUAL

TEXAS ELECTRONICS, INC.

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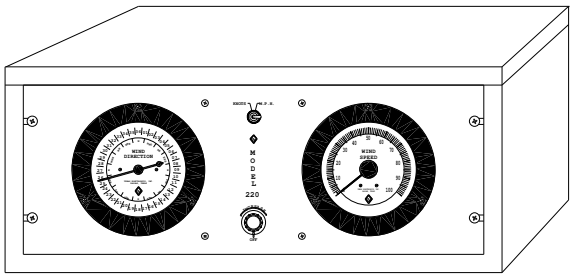
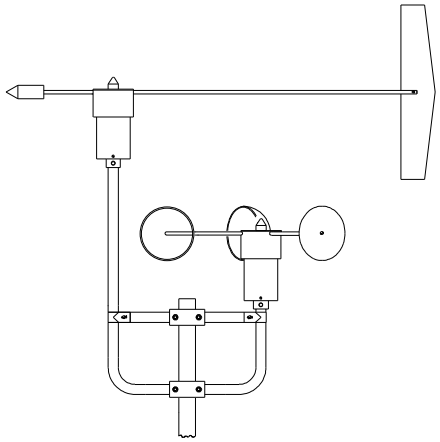
MODEL 220 WIND DIRECTION AND SPEED INDICATING SYSTEM





STANDARD FEATURES

- Internally Lighted Dials, Rheostat Control
- Calibration in Knots and MPH for Speed
- 10 Degree Incremented Direction Dial
- 19" Rack Mount Indicator Panel
- Brushless Non-contacting Wind Speed Generator
- Sensitive High Response Wind Sensors
- Printed Circuit Board Electronics

The Model 220 was originally designed specifically for use in airport control towers. Over the years, it has found application in many different fields. These instruments are manufactured in accordance with most exacting specifications and are used where accuracy and long service life are of paramount importance.

A front panel switch selects the wind speed range in either knots or MPH. The instruments are internally back lighted, and a panel rheostat controls the light intensity. The instruments are 5 ½ inches in diameter, resulting in a high degree of readability from a considerable distance.

Indicators plus electronics are mounted on a standard 19" x 7" rack panel for ease of mounting into a customer furnished rack or wall hole cut-out. An optional metal console is available, if required, so that the indicator panel can be table or shelf mounted. Other options include a slave (repeater) indicator, and a wind speed range-doubling switch. Sensors can be located up to 1000 feet away from indicator panel assembly.

Many years of design and manufacturing experience are reflected in these instruments. Today meteorological equipment manufactured by Texas Electronics, Inc. is in constant use throughout the world. Some of the present users of Texas Electronics, Inc. weather instruments include radio and television stations, airports, chemical and manufacturing plants, atomic energy laboratories, power and utility companies, city, state and federal governments, schools, marine applications, etc.

MODEL 220

AIRPORT WIND MEASURING SYSTEM, DIRECTION AND SPEED:

Basic Assembly: The basic wind measuring system comprises the following major assemblies and components:

A. Transmitter, Wind Direction, Model TD-105 with accessories

B. Transmitter, Wind Speed, Model TV-114 with accessories

C. Indicator (console or 19" X 7" rack mount type) assembly consisting of:

1. Meter, Indicating, Wind Direction
2. Meter, Indicating, Wind Speed
3. Power Supply, Inverter regulated

D. 10' mast along with mast hardware and 100' cable

General: The wind direction and wind speed transmitter assemblies will operate satisfactorily when subjected to ambient temperatures of -40 degrees C. to +50 degrees C. and with relative humidities of 0 to 100%. The indicator assembly will operate satisfactorily when subjected to ambient temperatures of +10 degrees C. to +50 degrees C. and with relative humidities of 0 to 95%. All components are made of suitable materials and in a workmanlike manner and are sufficiently rugged to withstand normal shipment and service. Both indicators are provided with adjustable dial lighting.

Wind Direction Indicating Meter: The wind direction indicator consists of an A.C. synchro follower motor mounted in a case matching the wind speed indicating meter. Standard wind direction scale markings are for sixteen cardinal points with major marks each ten degrees of azimuth. The indicating meter movement is balanced so that positional error is less than 1% through vertical to horizontal mounting. The case material is a suitable non-magnetic material.

Wind Speed Indicating Meter: The wind speed indicating meter consists of a circular linear scale D.C. millivolt meter housed in a case which matches the wind direction indicator. Standard indicating range is 0 to 100 mph or knots manually selectable, with one increment equal to 1 mph or knot (100 divisions). An optional range doubling switch can be made available such that 200 mph or knots full scale can be indicated. The indicating meter is balanced so that positional error is less than 1% through vertical to horizontal mounting. The case material is suitable non-magnetic material.

The basic indicating meter movement has a nominal full scale current of 1.0 milliampere. The accuracy is less than 2.0 percent of the full scale value, the response time does not exceed 2½ seconds and the over-shoot does not exceed 15%.

PERFORMANCE SPECIFICATIONS

Wind Direction Transmitter Assembly: The wind direction transmitter assembly includes a wind direction transmitter body, a single-tail wind vane, a cap nut, and mounting base. The wind direction transmitter body consists essentially of a synchro transmitter, coupled to the wind vane shaft, mounted in an appropriate housing. Power requirement for the system is 120 VAC, 50/60 Hz. which is inverter regulated to approximately 24 VAC, 400 Hz. for normal operating voltage.

The wind vane shaft is fabricated of corrosion-resistant metal and is supported by two radial ball bearings which are permanently lubricated and double sealed.

The design of the vane is such that a five-knot wind will align it within ±5 degrees of the wind direction as determined by the wind direction indicating meter. All parts of the vane are made of corrosion-resistant aluminum which has been heavily gold-anodized. No painting of the transmitter assemblies is ever needed.

Wind Direction System Accuracy: The overall accuracy of the wind direction transmitter and indicator assembly is ±5 degrees at an air speed of 5 knots or greater, for any horizontal direction, at 20 degrees to 25 degrees C.

Wind Speed Transmitter Assembly: The wind speed transmitter assembly is composed of a wind speed transmitter body, a three-cup rotor, a cap nut, and mounting base. The wind speed transmitter consists of a precision brushless A.C. generator mechanically coupled to the rotor shaft, and mounted in an appropriate housing. The generator does not require any type of maintenance or periodic calibration checks.

The output voltage of this unit is directly proportional to the rate of cup wheel rotation when connected to the remotely located indicator assembly. The wind speed system is self-contained and requires no external power source.

The bearings and bearing arrangement are the same as those specified for the wind direction transmitter assembly.

Wind Speed System Accuracy: The overall accuracy of the wind speed transmitter and indicator assembly is ±2 knots from 2 - 100 knots, at 20 degrees to 25 degrees C.

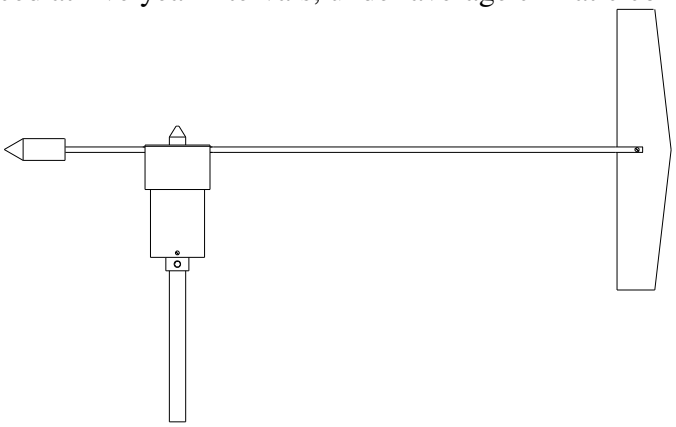
Cup Rotor Starting Speed: The cup rotor will start to turn at a wind speed not greater than 3.0 knots, with any position of the rotor cups with respect to wind direction, at 20 degrees to 25 degrees C.

Wind Speed Transmitter Assembly Life Test: The wind speed transmitter is capable of withstanding a life test of 100 days continuous running at 1800 RPM. The sensor features a brushless, non-contacting, no maintenance A.C. tachometer generator.

High Wind Exposure: The wind speed and direction transmitter assemblies are capable of withstanding exposure to a 130 knot wind for a period of five minutes without damage to the equipment.

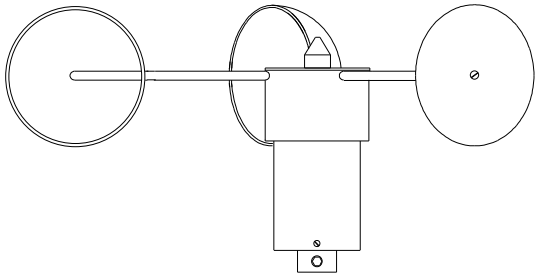
MAINTENANCE

Bearings: There is no requirement to oil or lubricate any portion of this system. The main rotor bearings (W502) are sealed and pre-packed with a low temperature grease. It is recommended that they be discarded and replaced at five year intervals, under average climatic conditions.



MODEL TD-105 WIND DIRECTION SENSOR

The TD-105 is a synchro type sensor for operating a 360º dial indicator, either the 300 Series or 500 Series. It has the same physical size and response as the TD-104D. This type of sensor may be preferred if an additional output is not needed to operate other equipment.



MODEL TV-114 WIND SPEED SENSOR

DESCRIPTION

The Texas Electronics, Inc. TV-114 Wind Speed Sensor is a mechanical style anemometer that measures the horizontal velocity of wind. The sensor is intended for general long-term maintenance free operation.

The TV-114 wind speed sensor is a freestanding device for measuring air velocity. The sensor consists of a lightweight 3-cup anemometer, which is mechanically coupled to an AC generator. As the cup mechanism rotates the AC generator produces an AC sine wave where the amplitude and frequency are proportional to wind speed.

SPECIFICATIONS

Operating Range:	0-100 mph
Signal Presentation:	AC frequency 10 rpm = 1.0 mph = 1.33 Hz 1000 rpm = 100.0 mph = 133.33 Hz
Excitation:	None (self-generating)
Performance:	
Accuracy:	+/- 2.0 mph (0.90 m/s) over entire range m/s)
Distance Constant:	> 21.7' (6.6 m)
Starting Threshold:	2.0 mph (0.90 m/s)
Environmental:	
Operational Envelope:	0-135 mph (0 to 60 m/s)
Temperature:	-40 to 160° F (-40 to 70° C)
Relative Humidity:	0-100%
Physical:	
Height:	7.5" (19.0 cm)
Cup Diameter:	4" (10 cm)
Cup Wheel Diameter:	18" (46 cm)
Finish:	Gold Anodized Aluminum
Cable:	60' (18 m) supplied with sensor
Weight:	3.75 lbs. (1.7 kg) with cable
Bearings:	APEC 3 or better
Mounting Pole:	0.75" I.D. (1.9 cm)
Warranty:	3 year

FEATURES & BENEFITS

- Non-contacting brushless AC generator for long-term maintenance free operation
- No plastic parts for extremely long life
- Precision stainless steel bearings for stability and repeatability
- Crossarm included with purchase of matching wind direction sensor
- Easy installation and maintenance
- Over 25 years in production
- Lightweight and rugged anodized aluminum exterior

INSTALLATION & MAINTENANCE

Installation consists of attaching the unit to a mast via the supplied mounting pole. If a crossarm is used, the entire unit can be bolted to a mast or attached via U-bolts.

The sensor is dynamically calibrated at the factory and due to the nature of its operation should not require field calibration. Field maintenance should include occasional cleaning of the cup assembly and inspection of the internal mechanism to make sure it is free from insects and debris. In some applications users may need to occasionally verify and document sensor accuracy with a synchronous test motor. Possible bearing and AC generator replacement every three to five years.

ORDERING INFORMATION

Model #	Description
TV-114	Wind Speed Sensor, Heavy Industrial
TV-114A	Wind Speed Sensor, 4-20mA

* Sensor is designed to work with TD-104-5D wind direction sensor.

Optional Parts / Accessories

CA-1	Crossarm, pre-wired
T-8011M	Synchronous motor for calibration
Cable	Additional Cable

TV-114 WIND SENSOR

G-114 GENERATOR

The chart below shows the maximum output obtainable from this generator, under a no load condition. This signal may be scaled down to fit many customer requirements.

R. P. M. VS. OUTPUT

RPM	MPH	KNOTS	G-114 AC GENERATOR	
			AC VOLTS	DC VOLTS
0	0	0.000	0.00	0.0
50	5	4.345	0.22	0.35
100	10	8.684	0.45	0.78
200	20	17.368	0.95	1.65
300	30	26.052	1.43	2.38
400	40	34.736	1.92	3.12
500	50	43.420	2.38	3.83
600	60	52.104	2.86	4.60
700	70	60.788	3.32	5.35
800	80	69.472	3.79	6.11
900	90	78.156	4.25	6.90
1000	100	86.840	4.70	7.65

M. P. H. VS. FREQUENCY

M.P.H.	FREQ.	M.P.H.	FREQ.
5	6.66Hz	55	73.315Hz
10	13.33Hz	60	80 Hz
15	20Hz	65	86.645
20	26.66Hz	70	93.31
25	33.325Hz	75	100 Hz
30	40Hz	80	106.64Hz
35	46.655Hz	85	113.305Hz
40	53.32Hz	90	120 Hz
45	60Hz	95	126.635Hz
50	66.65Hz	100	133.33Hz

NOTES:

1. Calibration may be checked by rotating the anemometer head at a known RPM. The above table shows the value that should be displayed on the indicator.
2. The AC Volts column shows the output directly out of the transmitter.
3. The DC Volts column shows the open circuit voltage out of the AC to DC adaptor.

PROPER EXPOSURE OF METEOROLOGICAL INSTRUMENTS

Generally recognized guidelines follow which depict "ideal" sensor mounting locations. These guidelines or "rules of thumb" are only suggestive in nature in an attempt to aid the user to selecting optimum representative sampling locations for a particular sensor.

Reference was made to US Weather Bureau Installation criteria in preparing this data (See Reference 1).

WIND EQUIPMENT:

So far as available sites permit, wind sensors should be placed above the ground on a freely-exposed tower (20 feet or higher) and over terrain that is relatively level and free from obstructions to wind flow. When a compromise must be made, sensing units should be exposed at least 12 feet above any obstruction within 100 feet and at least as high as any obstruction within 100 to 200 feet of the wind equipment. Support towers or masts should not be of such bulk or shape as to create an appreciable obstruction to wind flow. Avoid sites where local obstructions may create up-or-down drafts, eddy currents or jet-flow effects. When sensors are roof-mounted, they should be installed at least 10 feet (or greater) from the roof surface depending upon the particular installation site. Turbulence and other local effects can be reduced somewhat by mounting sensors on the upwind and of the building (that end of the building exposed to the most common local prevailing winds). Horizontal-mount booms which extend from existing towers should be fabricated so that sensors will extend a distance of 5 to 10 feet from the tower assembly (dependent on tower thickness).

Wind direction sensors are oriented upon installation in reference to either true north or magnetic north. True north is obtained by applying a local magnetic variation correction factor to a magnetic north compass indication (magnetic variation for a particular locality is obtainable from the nearest Weather Bureau Branch Office). Indicator readings for a true north sensor orientation will then be in terms of true geographic compass points. All U.S. Weather Bureau surface wind data used for observational network reporting purposes and general public use is given in reference to this true north format. Indicator readings for a magnetic north sensor orientation will be in terms of actual readings as would be obtained from directly viewing a magnetic compass instrument. Wind direction data at Federal Aviation Agency and other aircraft reporting facilities (for direct control tower-to-pilot utilization) is always made in reference to this magnetic north format.

REMOTE TEMPERATURE/HUMIDITY SENSORS AND INSTRUMENT SHELTERS:

Whenever possible, instrument shelters* as well as remote temperature and/or humidity sensors should be installed at a height of 4 feet (or greater) over earth or sod at least 100 feet from any concrete or other hard-surfaced area and not closer to any other object than four times the height of the object above the instrument shelter or remote sensors. Avoid roof installations if possible. If it is necessary to roof-mount shelters and sensors, they should not be closer than 30 feet to any large, vertical reflecting surface (walls, etc.), exhaust fans, or cooling towers. Electronic remote sensors when roof-mounted should be at least 9 feet (or greater) above the roof surface. To minimize radiation effects from the roof, they can also be mounted on a horizontal boom so that they will extend from the side of a building roof or existing tower. Horizontal booms should extend approximately 5 to 10 feet from the side of the building roof or tower assembly.

PRECIPITATION GAUGES:

Rain gauges should be installed on a level plot of ground, at a distance from any object of at least two and preferably four times the height of the object above the top of the gauge. All types of gauges must be exposed with the rim of the receiver in a horizontal plane and at a level well above the average level of snow surfaces.

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* Standard U.S. Weather Bureau cotton-region shelter (Spec. No. 450.0615, Rev. 8/67)

Roof-mounting of rain gauges should be avoided when possible. Air currents at heights other than at ground level have been observed to cause an apparent decrease in rainfall catch commensurate with the increase in mounting height above ground level.

Objects which individually or in small groups constitute a "windbreak" reduce prevailing wind speed in the vicinity of the gauge. This reduction of wind speed will, as a consequence, also reduce possible eddy currents and turbulence around the gauge. The presence of such objects is usually beneficial in providing a more accurate rainfall catch. Ideally, the "windbreak" objects (fences, bushes, etc.) should be generally uniform in height and distance from the gauge. Height above the gauge should not exceed about twice their distance from the gauge.

ANEROID BAROMETERS - SELF-CONTAINED MECHANICAL INSTRUMENTS AND ELECTRONIC REMOTE BAROMETRIC PRESSURE SENSORS:

Select a site where the instrument will not be subject to rapid fluctuations of temperature or to jarring and continuous vibration. Avoid exposing the instrument to direct sunlight or radiant heaters and to direct drafts such as open windows and doors.

Reference 1:

U.S. Department of Commerce - National Weather Service Bulletin
LS 5927 Revised, 0-4.12, January, 1963.

SOLAR RADIATION SENSORS:

The Solar Radiation Sensor is normally mounted on a level surface totally remote from trees, poles, or power lines that might cast a shadow on the sensor at any time of the day. However, there may be occasions, because of extreme latitudes, when it is desired to mount the sensor at some angle other than level.

The sensors may also be mounted on a sun tracking mechanism or behind a shadow band if diffuse sky radiation is to be measured.

WIND DIRECTION & SPEED SENSORS
INSTALLATION

These instructions apply to roof-top installation. We advise that you first read over these instructions before beginning assembly as several referenced items are not supplied with your weather equipment (this is because most every installation is unique thus these parts are best obtained by the installer). Reference to the "U-Tube Cross-Bar Installation" figure and ".Sensor Installation" figure may be helpful.

Step 1: Attach the three anemometer cups to the speed sensor head.
Loosen the three set screws on the top of the anemometer (lower unit).
Insert the anemometer cup arms into the holes. Be sure to press the arms all the way in and make sure that the flat areas on the arms face toward the set screws.
Tighten the set screws.

Step 2: Attach wind vane and counter-weight to the direction sensor head.

Loosen the two set screws on the top of the wind vane (upper unit).
Insert the vane and counter-weight into the holes. Be sure to press both parts all the way in and make sure the flat areas on each arm face the set-screws.
Tighten the set screws.

Note: For optimum performance and maximum bearing longevity you may wish to fine-tune the balance of both wind sensors. Place the U-tube flat on a table such that the sensors hang over the edge. Rotate the vane and the cup in 10 degree increments. After positioning the vane and cups verify that there is no movement after releasing your hold (this must be done in a wind-free environment). Balance adjustments are made by loosening the set screw to the lighter cup, counter-weight or fin and shifting it slightly away from the sensor head.

Step 3: Attach cross-bar to U-tube.

Spread end clamps and slide over the U-tube.
Insert cross-bar into the ends of both clamps.
Fasten cross-bar in a level position with screws, nuts and washers.

Step 4: Attach U-bolts to cross-bar and U-tube.

Remove the two nuts and reinforcing plate from both U-bolts (do not remove the toothed bracket).
Insert one U-bolt through the two holes in the cross-bar and the other through the two holes in the bottom of the U-arm (be careful not to damage the wires inside the U-arm).
Replace the tube reinforcing plate on the U-bolt and replace the U-bolt nuts.

Step 5: Slip the U-bolts over the mast and tighten.

Make certain that the anemometer cups do not hit the mast.

Step 6: Attach guy wire clamp just below the U-tube assembly.

Step 7: Attach base mount to the roof or side wall.

Note that the base mount U-bolt will rotate to fit any angle.

Step 8: Install guy wire anchors (not included) or locate secure points for guy wire attachment.

Step 9: Erect mast and install guy wires (not included) and turn-buckles (not-included).

Step 10: Ground the mast to help protect the sensors and structure from lightning hits.

Supplies needed: mast wire clamp, grounding wire, wire supports and grounding rod.

Step 11: Run the sensor wire inside to the console.

Lead in wire is permanently attached to the sensor unit.
Attach to console according to wire color code.
If necessary the cable may be cut down in length or wire may be added with negligible effect on the calibration. If changing cable lengths more than a few hundred feet you may wish contact the factory to determine the severity of the effect on calibration.
Additional cable lengths are available from Texas Electronics if needed.

Step 12: Calibrate the Wind Vane.

Be sure console is operating properly first.
This is normally a two man job with one individual watching the direction indicated by the weather station and the other adjusting the sensor while watching a compass.

Two methods of aligning the vane are available. The first method involves loosening the large set screw at the bottom of the wind direction sensor so that it will rotate on the U-arm. Turn the bottom half of the sensor until the compass readings and the indication match then retighten the set screw. The second method involves rotating the entire mast assembly until proper orientation is achieved; this technique is usually easier because of the heights involved but will usually necessitate repositioning (rotating) of the guy-wire clamp.
If winds are creating rapid fluctuations in the vane making calibration difficult, the vane can be temporarily secured in a fixed position by carefully wedging a thickly folded piece of paper or cardboard into the gap between the upper and lower halves of the direction sensor. An alternative technique is to lap a string over the vane and carefully hold it in position (be careful not to bend the vane when using this approach).

SERVICE & MAINTENANCE OF THE TEXAS ELECTRONICS, INC. MODEL 220-19R WIND INDICATING SYSTEM

WIND DIRECTION SYSTEM:

The wind direction system consists of 3 major components:

1. Sensing unit, Model TD-103 or TD-105
2. Indicating unit
3. Power supply

To check the sensor, disconnect the 5 wires that connect the sensor to the back of the indicator/power supply panel.

With a precision digital volt/ohm meter, measure the DC resistance as follows:

Across the black and red (the rotor) you should read 55 to 60 ohms, if not, most likely the synchro has been hit by lightning and is open.

NOTE: If one of the synchro's rotors is open, (either the sensor or indicator) this could cause the system to appear to work properly except a sudden wind gust could make the indicator jump 180° out of phase then another gust could make it go back in phase.

NOTE: If the brown wire on the synchros are not marked properly, it is the black wire that comes out of the hole in the bottom of the synchro with the 3 wires in it.

The yellow, blue and brown wires are the stator windings of the synchro and any combination of these wires should read 20 ohms at all times.

A visual inspection of the sensors is also recommended. For instance, make sure that the drive coupling is in tact and is turning the shaft of the synchro.

To check the indicating unit, use the same procedure as you do for the sensor, and make sure that the indicator needle turns freely. Remember all wires must be disconnected before resistance measurements are made.

POWER SUPPLY:

The two synchros, sensor and indicator are connected in parallel with each other, red to red, black to black , yellow to yellow , blue to blue and brown to brown. 26 VAC, 400 Hz is applied to the red and black rotor wires.

Measure the voltage and frequency across the black and red wires with everything connected to make sure power supply is working properly.

By making these simple resistance and voltage checks you will also check the cabling to the sensors. Hopefully, this will enable you to pinpoint the problem with the wind direction system and will allow you to make the proper decision on what component to send in for repairs.

WIND SPEED SYSTEM:

The wind speed system consists of 3 basic components:

1. Sensor, Model TV-114
2. Signal Conditioner
3. Indicator

The Model TV-114 is an AC Generator connected to the cup wheel that produces an AC voltage depending on wind speed. The output in voltage and frequency is as follows:

MPH	RPM	AC VOLTS	FREQUENCY HZ
10	100	.45V	13.33 Hz
20	200	.95V	26.66 Hz
30	300	1.43V	40.00 Hz
40	400	1.92V	53.32 Hz
50	500	2.38V	66.65 Hz
60	600	2.86V	80.00 Hz
70	700	3.32V	93.31 Hz
80	800	3.79V	106.64 Hz
90	900	4.25V	120.00 Hz
100	1000	4.70V	133.33 Hz

The DC resistance of the generator when not turning is between 68-72 ohms.

Check the sensor to make sure the bearings are free and the generator coupling is attached to the drive shaft of the anemometer.

SIGNAL CONDITIONER:

The signal conditioner is a very simple one; it consists of a germanium transistor used in the circuit to convert the AC signal to DC so it can be fed into the indicator. Through a series of resistors, pots and a smoothing capacitor the proper gain to the indicator is reached. It is very important that the germanium (2N-404) transistor be used because of its low forward voltage drop. The most common reasons that can cause a failure in the wind speed system is:

#1. The diode (2N-404 transistor) can be damaged by a voltage surge, most common by lightning. When this happens, if you look very closely to the wind speed indicator needle, you will see it pulsing and quivering around the 1-3 MPH range. If so, simply change the transistor.

#2. A direct lightning strike at or near the sensor which can burn the coil pick up to where it will completely open; thus producing no voltage output.

#3. A lightning strike can also de-magnetize the magnet in the sensor, thus producing lower levels of output.

The Model 220-19R is made up of very sensitive indicators, synchros, etc. We recommend that once a component is found to be defective that it be returned to us for repair and calibration at:

TEXAS ELECTRONICS, INC.
5529 Redfield Street
Dallas, TX 75235

Attention: Repair Dept.

Texas Electronics does not require RMA's for equipment being returned. Please make sure all information, return address, purchase order numbers, or any special instructions to us are included. The turn around time is usually less than 5 working days. If your system is used in very critical situations, please call us for estimates at:

Telephone: 214-631-2490

Warranty

Texas Electronics, Inc. (hereafter TEI) warrants the equipment manufactured by it to be free from defects in material and workmanship. Upon return, transportation charges prepaid to TEI, within three (3) years of original shipment of sensors and one (1) year of original shipment of electronics, recorders and indicators, TEI will repair or replace, at its option, any equipment which it determines to contain defective material or workmanship, and will return said equipment to purchaser, F.O.B., TEI. Texas Electronics shall not be obligated however to repair or replace equipment which has been repaired by others, abused, improperly installed, altered or otherwise misused or damaged in any way. TEI will not be responsible for any dismantling, re-assembly, or reinstallation charges.

This warranty is in lieu of all other warranties, expressed or implied. TEI shall not be liable for any special, indirect, incidental or consequential damages claimed in connection with any rescission of this agreement by purchaser.

For a list of specific items covered by the extended warranty, see the ***Three-Year Warranty Equipment List***.

Three-Year Warranty Equipment List

Effective February 1, 1992 all of Texas Electronics, Inc. sensors will carry a Three-Year warranty instead of the previous One-Year. The remainder of terms and conditions of the warranty remains unchanged. A specific list of items follows.

Sensors Covered by Three-Year Warranty

Parameter	Model No.
Wind Direction	TD-105 (Synchro) TD-104D (Potentiometer) TD-110-L2 (Photo-Chopper) TD-106 (Potentiometer)
Wind Speed	TV-110-L2 (Photo-Chopper) TV-110-L3 (Photo-Chopper) TV-114 (A.C. Generator)
Barometric Pressure	TB-2012
Relative Humidity	TH-2013 TH-2013V
Rainfall	TR-525 TR-6118
Temperature	TT-101 (Outdoor) TT-103R (Surface Mount) TT-103R-W (Water Probe) TT-309I (Indoor)
Solar Radiation	TS-100

Systems Covered by Three-Year Warranty

Model No.	Description
WSC-5-S	Wind Speed Controller Single Set Point
WSC-5-ST	Wind Speed Controller Single Set Point with Time Delay
WSC-5-D	Wind Speed Controller Dual Set Point
WSC-5-DT	Wind Speed Controller Dual Set Point with Time Delay
WDC-2	Wind Direction Controller