



Texas Electronics, Inc.

The Gold Standard in Weather Instrumentation Since 1957



FC-2 WIND SPEED FOUNTAIN CONTROLLER USER'S MANUAL

TEXAS ELECTRONICS, INC.

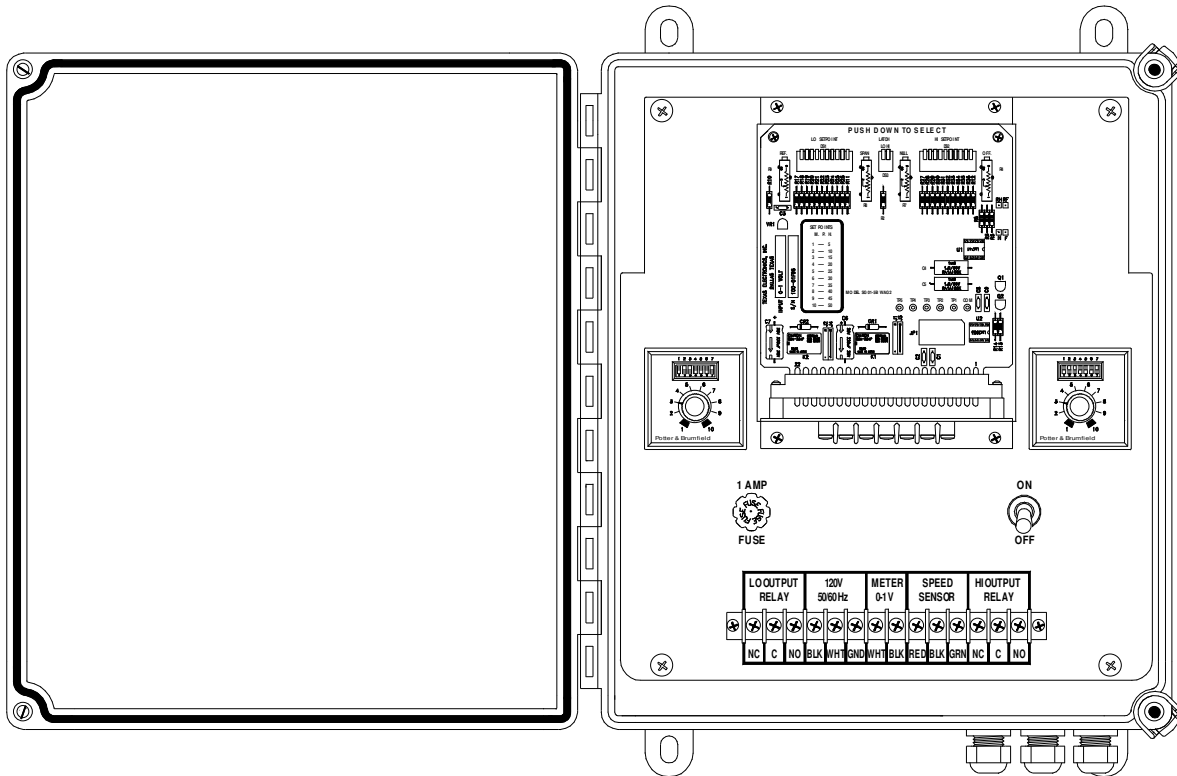
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MODEL FC-2 WIND SPEED FOUNTAIN CONTROLLER

DESCRIPTION

The Texas Electronics Series FC-1 and FC-2 Fountain Controller System are designed for switching on and/or off, various types of fountains and water features when wind speed exceeds a certain selectable value. The control output function can be set for activation at any desired speed value from 0-100 MPH (alternate ranges available). Single (FC-1) and dual (FC-2) set points are available depending on the requirements of the user. An adjustable time delay is used to minimize premature on-off cycling of the controlled equipment when wind speed is fluctuating around the selected set point. Time delays are programmable with time periods ranging from 1 to 1023 seconds. The Fountain Controller components are housed in a Nema-style enclosure for maximum environmental protection. Conduit connectors are mounted on the cabinet base for entry of respective cables. A terminal strip is provided within the enclosure for making the appropriate cable connections.

Wind Speed is measured by a 3-cup anemometer, which is remotely located from the fountain controller assembly. The rotating cup assembly is mechanically coupled to a 20-slot interrupter disc located within the lower sensor housing. A light beam, produced by a solid state light emitting diode (LED) passes through the interrupter disc and falls upon a photo detecting transistor assembly. The transistor switches on and off 20 items for each revolution of the anemometer shaft. A pulse-train results, which is directly proportional and linear to wind speed. A 3-conductor cable is utilized to transmit the pulsed signal to the Fountain Controller console in addition to providing sensor circuit excitation. Power for the internal LED light source is supplied on one conductor, the open-collector output of the photo-transistor is available on the second conductor. The third conductor is a common ground. Normally, sensors are supplied with a factory selected resistor value that provides maximum signal strength by using a 5 VDC LED supply and a 10K pull-up resistor to 5 VDC on the collector output. This resistor can be changed, by the customer or the factory, for different operating voltages and pull-up values.

SPECIFICATIONS – DISPLAY CONSOLE

Indicator Range:	0-100 mph
Indication/actuation accuracy:	+/-2% of full scale
Set Point adjustability:	Adjustable over full scale
Dual set point units:	Adjustable to within 0 mph of each other
Time Delay Relays:	Switch Settable Time Delays From 0.1s to 10,230 s +/- 2% Setting Accuracy +/- 0.1% Repeat Accuracy SPDT or DPDT 10 A Output Contacts
Operator Controls:	1) on-off switch 2) set point adjustment knob(s) 3) time delay set point knob(s) 4) latch & auto switch
Control Console size:	10" W x 12" H x 6.5" D
Enclosure type:	Covers: NEMA style 4X Mounting: Wall Type Finish: Gray Fiberglass throughout
Power Consumption:	Approximately 3 Watts
Warranty:	3 years
Cable:	60', 22 gauge 2 conductor

FEATURES & BENEFITS

- Controls over-spray and water loss caused by wind
- Enhances the enjoyment and safety of your water feature
- Automatically turns fountains on/off based on current wind conditions
- Compact sized anemometer responds quickly to wind speed changes
- Can be easily camouflaged so it does not detract from beauty of water feature
- Time delay prevents rapid on/off cycling during sporadic or gusty wind conditions
- Dual set points

INSTALLATION & MAINTENANCE

Console and wind speed sensor may be mounted at any desired location. The speed sensor should be mounted so that it will measure a true representative sample of wind speed affecting the equipment being monitored. It should be mounted high enough to clear all obstructions in a vertical position. The indicator/controller unit may be mounted either indoors or outdoors as required.

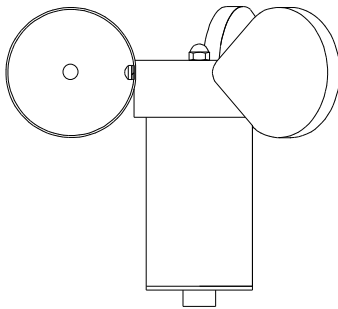
Field maintenance should include occasional cleaning of the cup assembly and inspection of the internal mechanism to make sure it is free of insects and debris. Possible bearing and/or photo-detector replacement at three to five year intervals, dependent upon environmental conditions.

ORDERING INFORMATION

Model #	Description
FC-2	Fountain Wind Speed Controller, Dual set point

Optional Parts / Accessories

Cable	Additional Cable
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MODEL TV-4 WIND SPEED SENSOR

DESCRIPTION

The Texas Electronics, Inc. TV-4 Wind Speed Sensor is a mechanical style anemometer that measures the horizontal velocity of wind. This unit combines small physical size with superior bearings to meet the EPA's Prevention of Significant Deterioration (PSD) starting threshold requirements.

The TV-4 wind speed sensor is a freestanding device for measuring air velocity. The sensor consists of a lightweight 3-cup anemometer, which electromechanically converts wind speed into a measurable electronic signal.

The output signal can be presented in 3 optional forms: a pulsed DC signal, an AC frequency, or a conditioned analog signal. Each output has a specific application. The pulsed DC signal is used where high-accuracy is needed and continuous power is not a problem. The AC frequency output is used in situations where power consumption is critical. And finally, the conditioned analog signal is used to easily and quickly communicate with virtually all digital control systems such as PLC's or SCADA systems.

SPECIFICATIONS

Operating Range:	0-100 mph		
Signal Presentation:	Pulsed DC output - light chopper AC Frequency, or Analog, 4-20 mA (Please specify)		
Pulsed DC output:	20-slot disc 1 MPH = 520 pulses/min. 100 MPH = 52000 pulses/min.	Input Power:	+5.0 VDC @ 5mA (typical) (Other voltages available upon request)
AC Frequency output:	26 mV/MPH (typical) 0.133 Hz/MPH	Input Power:	None (self-generating)
Analog 4-20 mA out:	4 mA = 0 MPH 20 mA = 100 MPH	Input Power:	10-36 VDC

Performance:

Accuracy:	+/- 2.0 mph (0.89 m/s)
Distance Constant:	> 21.7' (6.6 m)
Starting Threshold:	0.6 mph (0.27 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:

Cup Wheel Diameter:	6.0" (15.3 cm)
Overall Height:	4.75" (12.1 cm)
Turning Radius:	3.0" (7.6 cm)
Cup Diameter:	2.0" (5.1 cm)
Bearings:	APEC 3 or better
Mounting Base:	Screw attachment, 10-32 machine screw
Weight:	0.5 lbs (0.23 kg) less cable
Cable:	60' (18.3 m) 3 conductor 22 gauge

Warranty:	3 year
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FEATURES & BENEFITS

- Superior low starting threshold due to small physical size
- 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 5 years in production
- Lightweight and rugged anodized aluminum exterior

INSTALLATION & MAINTENANCE

Installation consists of threading the 10-32 mounting base into our crossarm or any other suitable beam. 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. Other possible routine maintenance is to replace the bearing housing assembly every three to five years to maintain low starting threshold.

ORDERING INFORMATION

<u>Model #</u>	<u>Description</u>
TV-4	Wind Speed Sensor, Light Industrial (Specify supply voltages other than 5 VDC)
TV-4AC	Wind Speed Sensor, AC Generator
TV-4A	Wind Speed Sensor, Analog 4-20 mA

*Sensor is designed to work with TD-4 wind direction sensor.

Optional Parts / Accessories

Cable	Additional Cable
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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.

* 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).

MODEL FC-1 AND 2 INSTRUCTIONS:

1. After sensor and control panel has been installed connect the sensor wires to the terminal strip, wind sensor, red, black and green.
2. Connect 120VAC to the terminal strip as marked.
3. The relay contacts are “FORM C DRY CONTACTS”, which means that there is no voltage present. The customer will wire these terminals according to the equipment that will be controlled. Equipment can either be turned on or off depending on the way it’s wired.
4. Apply power to the unit and if the sensor is connected and there is a wind you should see an indication on the LCD display.
5. Set Points: There are 10 dip switches per relay, 1 thru 10. The first switch will make the relay trip (after the time delay relay times out) at 5 MPH. And each switch thereafter will add 5 MPH. Example: switch 1 5 MPH, switch 2 10 MPH etc. Up to 50 MPH.
6. The time delay relays are programmable.

FC 1 AND 2 TIME DELAY CONTROLS

A universal adjustable time delay is used to minimize premature on/off cycling of the equipment being controlled when the wind speed is fluctuating around the selected set point. The time delays are programmable with time periods ranging from .1 to 6000 seconds.

THE RANGES ARE:

Delay period	Switch 5	Switch 6	Switch 7
.1 to 1 second	UP	UP	UP
1 TO 10 SECONDS	UP	UP	DOWN
.6 TO 60 SECONDS	DOWN	UP	UP
10 TO 100 SECONDS	UP	DOWN	DOWN
60 TO 600 SECONDS	DOWN	UP	DOWN
600 TO 6000 SECONDS	DOWN	DOWN	DOWN

Switches 1, 2, 3 and 4 are function switches and should be left set as received from the factory.

For delay on operate switches should be: **1 and 4 up-----2 and 3 down.**

For delay on release switches should be: **1 up ----- 2,3 and 4 down.**

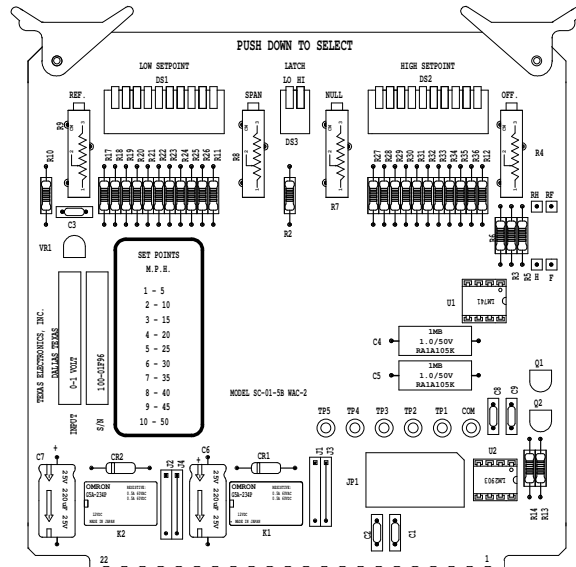
To change functions, wiring will also have to be changed, consult factory.

MODEL SC-01-5B WAC-2 RELAY BOARD

SENSOR INPUT
PIN 1 - NEGATIVE
PIN 2 - POSITIVE

CONTROL RELAYS

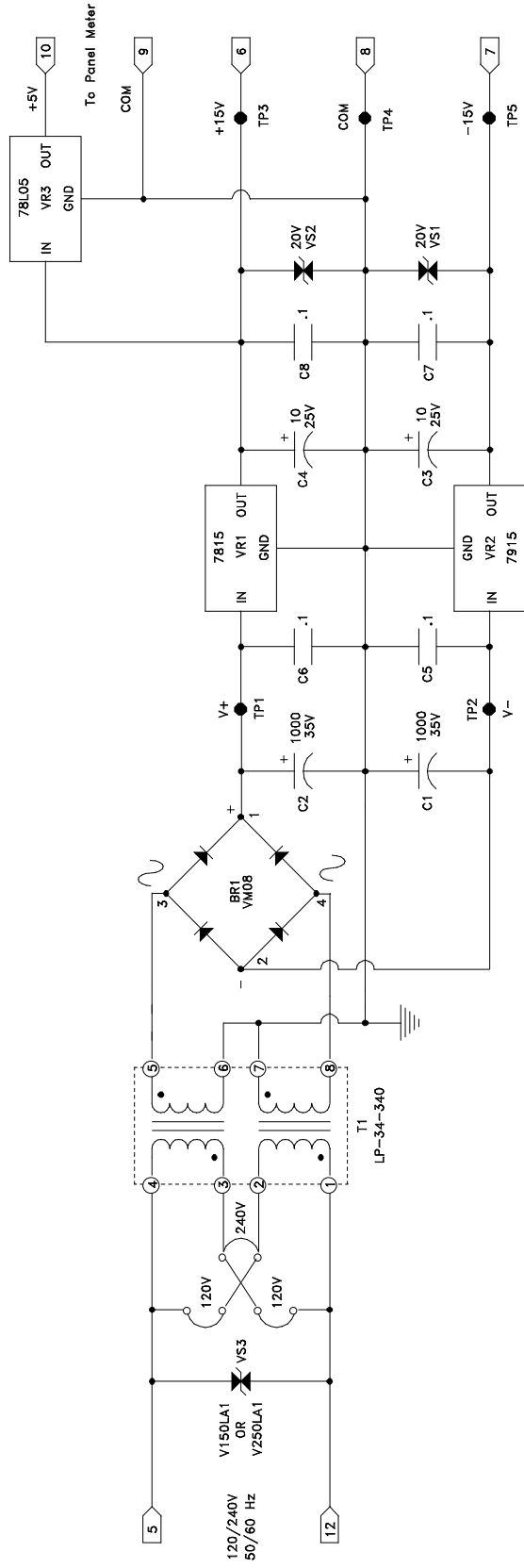
LOW RELAY	HIGH RELAY
PIN - 13 N.C.	PIN - 17 N.C.
PIN - 14 N.O.	PIN - 18 N.O.
PIN - 15 COM.	PIN - 19 COM.



The WAC-2 weather activated alarm/control module compliments the Texas Electronics, Inc. series 3000 modular plug in systems. The typical 0-1 volt input from any of the sensor signal conditioner cards, such as wind speed, wind direction, humidity or temperature can be fed into the WAC-2 to provide a wide variety of control setpoints and or alarms.

This board was designed primarily for wind speed control, but with simple modifications it can be configured for other applications. In the standard configuration the trip points are selectable in 5 MPH increments from 5 MPH to 50 MPH. The setpoints are made by simply closing one of the 10 position dip switches both for the low and the high setpoints. A latch mode is also provided for both low and high setpoints. In some cases a delay may be desired for rapidly varying sensors such as wind speed and wind direction. This can be accomplished by using the relay contacts on the WAC-2 board to trigger an industry standard time delay module either delay on make or delay on release.

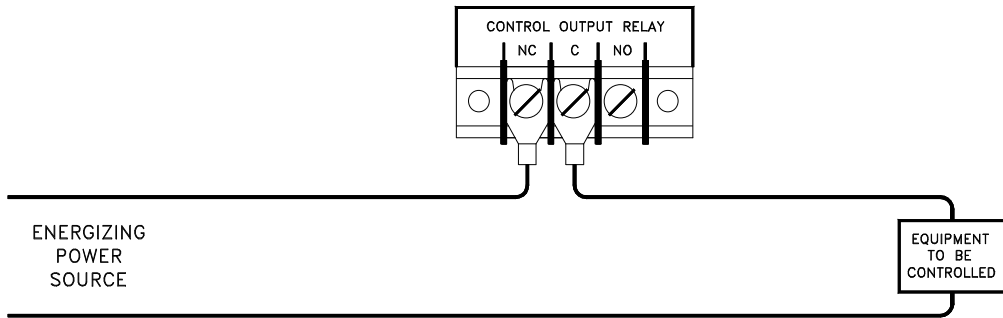
PS-01-2B POWER SUPPLY
 120/240V 50/60Hz to +/- 15V DC



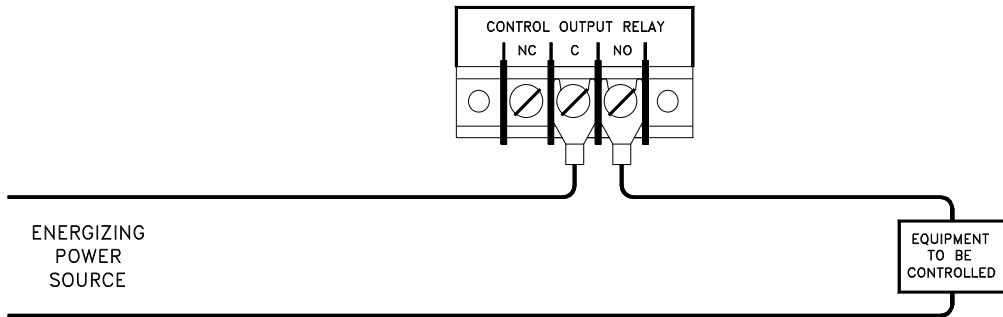
PARTS LIST

Component	T.E. P/N	Description
VS1, VS2	SS-102	Voltage Suppressor, 20V, P6KE20C
VS3	SS-177	Voltage Suppressor, 120V AC, V150LA1
	SS-206	Voltage Suppressor, 240V AC, V250LA2
T1	T3-132	Transformer, 12W, LP-34-340
BR1	SS-179	Bridge Rectifier, VM08
C1,2	C-148	Capacitor, 1000 MFD, 35V
C3,4	C-127	Capacitor, 10 MFD, 35V
C5-8	C-144	Capacitor, 1 MFD
VR1	SS-159	Regulator, 7815
VR2	SS-158	Regulator, 7815
VR3		Regulator, 78L05

TYPICAL APPLICATIONS FOR
MODELS FC1 & FC2 FOUNTAIN CONTROLLERS



EQUIPMENT IS ENERGIZED FOR WIND SPEEDS BELOW THRESHOLD
AND DE-ENERGIZED FOR WIND SPEEDS ABOVE THRESHOLD



EQUIPMENT IS DE-ENERGIZED FOR WIND SPEEDS BELOW THRESHOLD
AND ENERGIZED FOR WIND SPEEDS ABOVE THRESHOLD

THE CONTACT RATINGS ON THE CONTROL RELAY
ARE 10A RESISTIVE.

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