Micro Response Vane Model 2020

User's Manual

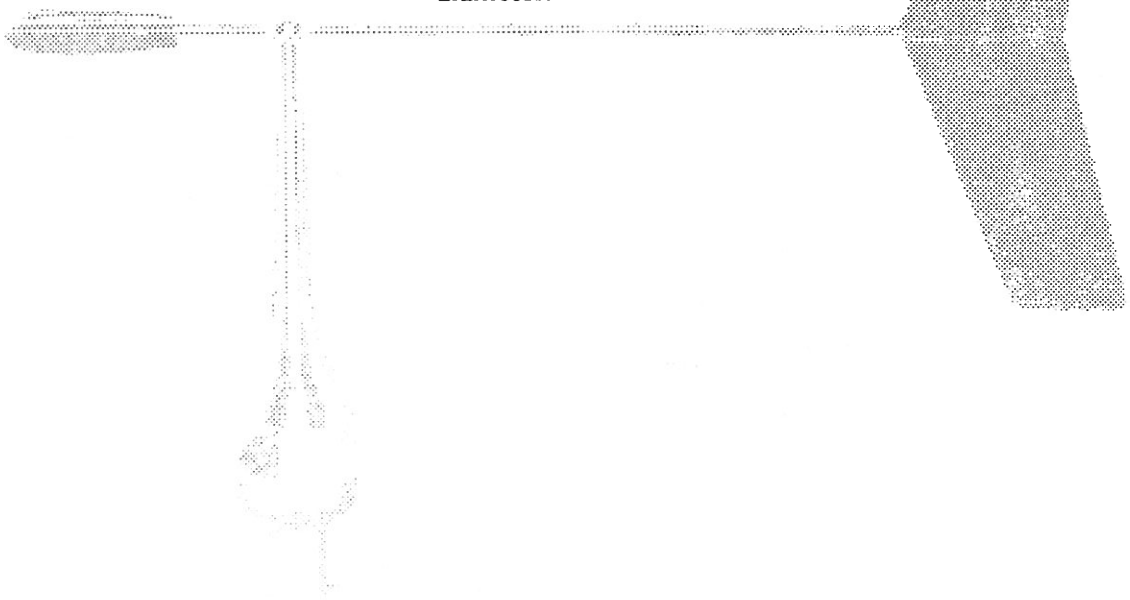
QUALIMETRICS, INC.

Introduction

The Model 2020 Micro Response Vane is a highly responsive analog output wind vane. The vane body is a precision machined aluminum housing with a clear anodized finish. The structural plastic tail is protected with a durable aluminum-filled plastic coating. Stainless steel shafts, bearings, and fittings are used throughout.

A precision potentiometer is coupled to the vane shaft to provide an analog output proportional to wind direction. An airfoil-style counterweight provides precision balancing of the tail assembly on the shaft. A quick release waterproof connector is provided for cable terminations.

A mounting collar on the base of the sensor fits onto the Model 20231 Mast Adapter or the Model 2023 Crossarm. The 20231 Mast Adapter is used to install a single sensor, while the 2023 Crossarm allows the Model 2020 Vane to be installed in combination with an anemometer, such as the Model 2030. Both the Crossarm and Mounting Adapter fit onto a pipe stub or mast with a 1" outside diameter.



Contents

Installation

This instrument is thoroughly tested and fully calibrated at the factory and is ready for installation. Please refer to the return authorization card included in the packing box if damage has occurred. Also, notify Qualimetrics, Inc.

The sensor is shipped complete with a tail assembly, counterweight, and mating electrical connector. The mating connector will be attached to the cable if cable was included with the order. The vane will mount directly onto the Model 2023 Crossarm Assembly. The accessory Model 20231 Mast Adapter may be ordered to allow the vane to be mounted onto a 1" outside diameter mast.

Assembly

With the exception of installing the tail and counterweight, the Model 2020 Micro Response Vane is ready for mounting. The counterweight is generally shipped unattached and is packed in the 2020 housing's packing carton. The tail is packed inside a folded cardboard container taped to the side of the 2020 carton. Install the tail and counterweight as explained in the steps below.

❶ Slide the vane tail shaft into the vane hub, entering the hub at the side opposite the scribe mark. Do not tighten the set screw on the hub yet.

❷ Install the counterweight, making certain the vane tail shaft is fully engaged. Tighten the counterweight set screw.

❸ Hold the vane in a horizontal position and slide the tail shaft through the hub until the counterweight exactly balances the tail and the vane does not turn when held in a horizontal position. When balance is achieved, tighten the hub set screw, making certain the tail is aligned with the axis of the vane. This procedure must be performed in an area free of drafts and air currents.

Site Selection

Location of the sensor is critical for accurate wind measurements. The standard exposure of an anemometer or vane over open, level terrain is 10 meters above the ground. Open, level terrain is defined as level ground with no obstruction within 300 meters. In locations where obstructions are not large, such as residential areas, and are distributed more or less evenly, the sensor may be placed at an effective height of $h + 10$ *meters*, where h is the approximate height (in meters) of the various obstacles. As an example, in a location where trees and buildings reach to about 5 meters, the sensors must be placed on a 15 meter mast to avoid erroneous results.

Distance to obstruction	Minimum height above ground level of anemometer
h	1.75h to 2.25h
5h	1.67h
10h	1.50h
20h	1.25h
25h	1.13h
30h	h

Table 1[1]

[1] Handbook of Meteorological Instruments, 2nd Edition. Measurement of Surface Wind, Volume 4. London, HMSO: 1981

In areas where large obstructions do exist within 300 meters of the sensor, the following table can be used to calculate the proper height of the sensor (*h* is the height of the obstruction).

Example: If there is a building 10 meters high and 50 meters away, the anemometer should be at least 16.7 meters above the ground. But, if the same building is 200 meters away, the sensor could be lowered to 12.5 meters.

When the sensor is mounted on a building, the building itself disturbs the wind flow and must be taken into account before installation. For large buildings, other than buildings such as lighthouses and skyscrapers, the sensor must be mounted as far away from the edge of the building as possible and at a height at least 3/4 the height of the building. Thus, with a building 28 meters high, a rooftop tower at least 21 meters high should be used.

Mounting

The Model 2020 Micro Response Vane mounts directly to the Model 2023 Crossarm without any additional accessories. The crossarm is generally used to mount a Model 2030 Anemometer in combination with the Model 2020 Vane to form a wind speed and direction measurement set. If the Model 2020 Vane is to be mounted separately, a Model 20231 Mast Adapter should be ordered as an accessory. Both the Model 2023 Crossarm and the Model 20231 Mast Adapter will mount to a mast with an outside diameter of 1" (25.4 mm) or 3/4" Schedule 40 pipe.

Orientation

The Model 2020 Micro Response Vane must be correctly oriented as to direction . The axis of the vane should be as close to vertical as possible. Orient the vane to direction (azimuth) as described in the steps below.

❶ The crossarm and/or mast should be locked into the operating position. To aid in sensor orientation, the crossarm can be set in a North-South orientation using the mounting pins as targets.

❷ Install the vane on the mast adapter with the dowel pin aligned with the mating hole in the vane housing. Once alignment is properly attained, the housing will slide onto the adapter. An identical dowel pin arrangement is found on the crossarm.

❸ Tighten the clamp screw at the base of the vane. Align the scribe mark on the body with the scribe mark on the hub by rotating the hub and tail assembly. Hold the two marks in alignment. An easy way to accomplish this task is to use the Model 1249-A Wind Direction Calibrator.

❹ Loosen the clamp set screw at the end of the crossarm to allow the vane and pin to turn as a unit. Loosen the mast set screws on the mast adapter.

❺ Using a reference point with a transit or compass, rotate the vane body until the vane counterweight points to true North. Tighten the cap screw on the crossarm clamp or the set screws on the mast adapter. Remove the calibrator from the cane hub and body to allow free rotation of the tail.

When removing the vane assembly, do not disturb the position of the pin on the crossarm; when using a mast adapter, do not move the adapter. This will allow you to remove and re-install the sensor without repeating the orientation procedure.

Connection

Install a three-wire 20 AWG cable in the mating connector using care in soldering and cable dressing. Replace the connector back shell to form a waterproof assembly. The connector is a quick release type and requires only a quarter turn of the nut to lock it in place. Do not tighten with a wrench. Connections are as shown in drawing 2020-004 at the back of this manual. If cable is ordered with the sensor, the connector will be attached at the factory. To order cable, specify part number T600503.

Theory of Operation

Definition

Wind direction is defined as the direction of the source of the wind flow measured in degrees from true North in a clockwise increasing angle. *Example: A west wind (270°) originates in the West and move in an eastward direction.*

Theory of Operation

Changes in wind direction are sensed mechanically by a balanced vane assembly. The mechanical motion is transformed into an electrical signal through a shaft coupling the vane to a potentiometer. The potentiometer is a 5K ohm conductive plastic resistive element with a long electrical angle.

Protective zener diodes are attached across the excitation lead and the wiper lead to the common lead to help quench transients induced by external sources.

The potentiometer is excited by a +5 VDC regulated source. A 2500 ohm resistor is placed in series with the +5 VDC source to protect the potentiometer element against a dead short in the +5 VDC power source. The voltage generated at the potentiometer wiper varies from 0-3.333 VDC as a direct function of wind direction variations.

Calibration

Refer to the appropriate signal conditioning manual for system calibration instructions. Check the Model 2020 for correct operation prior to making any adjustments to the system electronics.

Checking Sensor Operation

To check sensor operation, follow the steps below.

1. Measure the total resistance of the potentiometer by measuring across the white wire (+) and black wire (-). The value should be 5000 ohms, ±5%.
2. Use a voltmeter to measure across the potentiometer. *Use Caution—Observe polarity of the test leads.* Using the sensor cable supplied by Qualimetrics, place the (+) test probe onto the red wire and the (-) test probe onto the black wire. Rotate the vane in a clockwise direction (as viewed from the top). The voltage should increase as the vane is rotated.

Alignment

The potentiometer is aligned with the North alignment marks on the sensor housing by rotating the potentiometer body while monitoring the output.

1. Loosen the two clamping screws on the potentiometer mounting plate.
2. Align the tail assembly to South. The two North marks will be 180° apart.
3. While holding the North alignment marks stationary, rotate the potentiometer body until the signal output reads 1.6665 VDC (one half the total voltage across the potentiometer).
4. Tighten the clamping screws and re-measure the output to check for changes during tightening of the screws. Repeat Step 3 if necessary.

Verify sensor operation prior to re-installing the sensor. Always verify sensor operation after each realignment and especially after any service requiring disassembly of the housing is performed.

CALIBRATION CERTIFICATE

Instrument Micro Response Vane

Model Number 2020 Serial Number _____

Range	Calibration Points	Output (Typical)	Output (Actual)
0-360° Azimuth	180° AZ	1.665 VDC*	

* with excitation voltage of 3.333 VDC

Cable T600503 Length _____ Shield Yes ■ No ☐

☐ Refer to enclosed Calibration Sheet. Figure _____

☐ Must be used in conjunction with:

Instrument _____

Model Number _____ Serial Number _____

Technician _____ Date _____

Maintenance

Periodic maintenance must be performed on the sensor to prevent severe corrosion build-up and to check the bearings and sensor operation.

Checking the Bearings

The vane shaft coupled to the potentiometer should turn freely at all times. Rough motion indicates worn bearings either in the potentiometer or in the sensor body. Determine which bearings are faulty by decoupling the potentiometer from the main shaft.

Replace the bearings as required. The potentiometer is not serviceable and must be replaced if the bearings are faulty or the resistive element is worn.

Disassembly and Potentiometer Replacement

The potentiometer must be unsoldered from the housing connector before it can be removed from the housing. Refer to drawing 2020-003 for parts identification as needed while following the steps below.

❶ Remove the allen-head set screw securing the sensor cap to the main shaft.

❷ Remove the three screws from the base of the housing and remove the base.

❸ Remove the two screws and flat washers securing the potentiometer inside the housing and gently lower the potentiometer and shaft.

Use great care in disassembly and re-assembly of the sensor. Never use excessive force to make parts fit together. Over-tightening of fasteners will either break the fastener or damage the machined threads of the sensor.

Since corrosion is the main problem associated with wind sensors, apply a thick coating of silicon lubricant to the connector shell after the connector is attached and in place. Also, use a non-corrosive lubricant such as bee wax on all screws and fasteners whenever disassembly of the sensor is required. The use of these lubricants will make servicing of the sensor easier and will prevent seizure of the fastening hardware. It is also advisable to apply lubricant to the mounting adapter surfaces prior to final sensor installation. A commercial grade lubricant recommended for use is DOOR-EASE, available at hardware and automotive stores. In addition to these precautions, check that the drain hole in the base of the sensor is free of debris so that water drains away rather than collecting within the sensor.

Any difficulties encountered during servicing that are not correctable by the user should be referred to the Qualimetrics Customer Service Department.

Warranty

Unless specified otherwise, Qualimetrics (the Company) warrants its products to be free from defects in material and workmanship under normal use and service for one year from date of shipment, subject to the following conditions:

a. The obligation of the Company under this warranty is limited to repairing or replacing items or parts which have been returned to the Company and which upon examination are disclosed, to the Company's satisfaction, to have been defective in material or workmanship at time of manufacture.

b. The claimant shall pay the cost of shipping any part or instrument to the Company. If the Company determines the part to be defective in material or workmanship, the Company shall prepay the cost of shipping the repaired instrument to the claimant. Under no circumstances will the Company reimburse claimant for cost incurred in removing and/or reinstalling replacement parts.

c. This warranty shall not apply to any Company products which have been subjected to misuse, negligence, or accident.

d. This warranty and the Company's obligation thereunder is in lieu of all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose, consequential damages, and all other obligations or liabilities.

No other person or organization is authorized to give any other warranty or to assume any additional obligation on the Company's behalf, unless made in writing and signed by an authorized officer of the Company.

Specifications

Sensor type	Rotating vane
Transducer	Potentiometer, 5000 ohm, single wiper
Threshold	0.5 mph
Dead band	5.0° at 0°
Resolution	Less than 1.0°
Distance constant	3.5 feet (1.07 m)
Damping ratio	0.4
Potentiometer linearity	0.5%
Bearing	Sealed stainless steel with synthetic lubricant
Turning radius	18" (457 mm)
Operating temperature range	-40 to +60° C
Body size	12"H x 2¾" diameter (305 x 70 mm)
Weight/Shipping	2.5 lbs/7 lbs (1.13 kg/3.18 kg)
Mounting	Direct to crossarm or with adapter to 1" (25.4 mm) O.D. mast

Parts Lists and Drawings

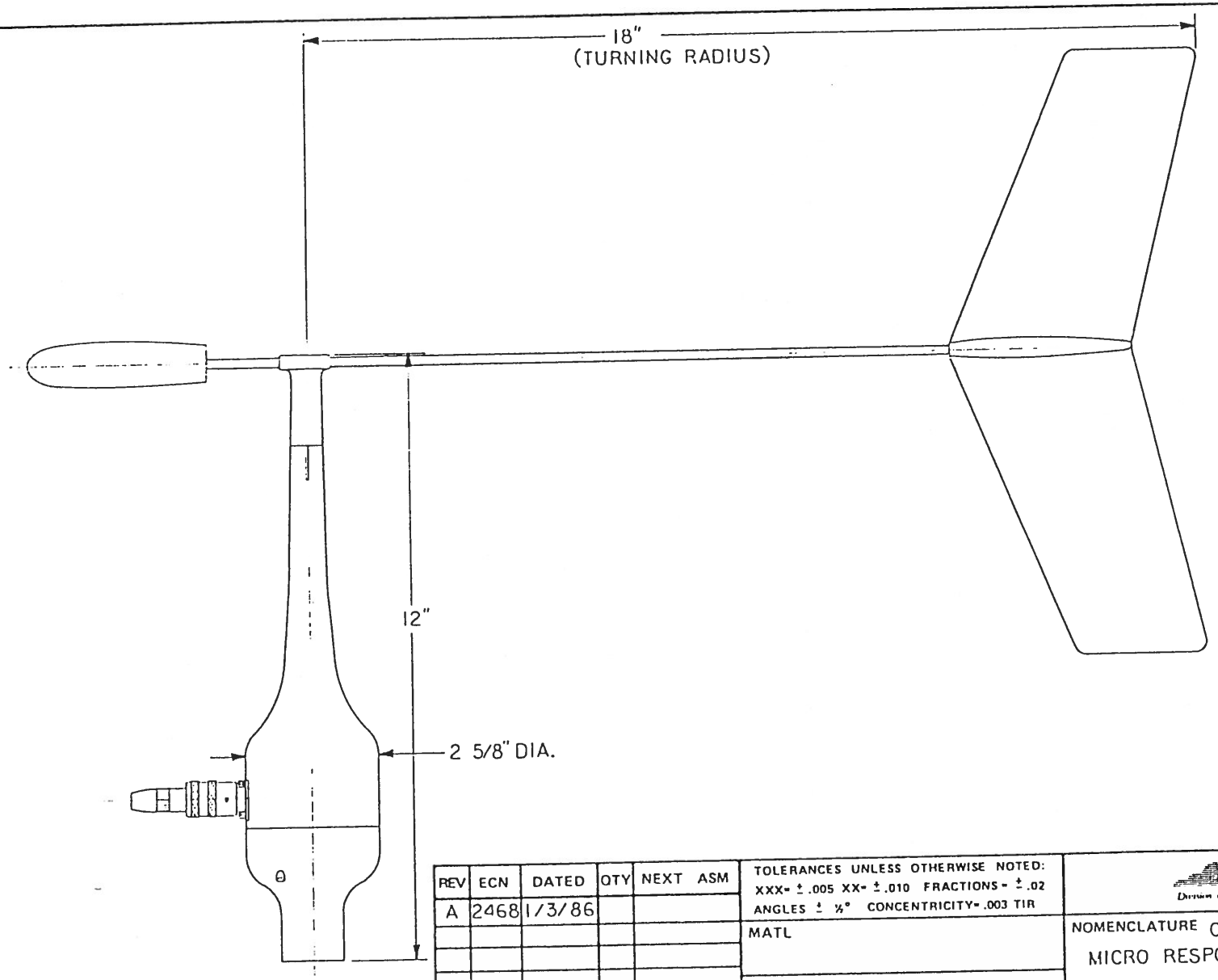
The following pages include a parts list and reference drawings to assist in installation and maintenance of this instrument.

Parts List

2020	MICRO RESPONSE VANE			
COMPONENT	QTY	UOM	DESCRIPTION	ITEM NO.
2020-001	1	EA	MANUAL	
T800301	1	EA	COUNTERWEIGHT-AIRFOIL	17
T800200	1	EA	TAIL, VANE	18
T721460	2	EA	SCREW, SET, ALLEN 6-32 X 3/16 SS	19
ECN			ENGINEERING CHANGE NUMBER	4153
T170522	1	EA	POT/SHAFT ASSY	1
T210000	1	EA	RECEPTACLE	2
T210001	1	EA	PLUG	3
T710100	1	EA	BEARING, .25 B X .375	4
T712507	1	EA	O-RING 2 X .070	5
T712508	1	EA	O-RING 15/16 X .070	6
T721000	6	EA	SCREW 4-40 X 3/8 PHILLISTER HD	7
T721010	3	EA	SCREW 6-32 X 1/2 PHILLISTER HD	8
T721460	4	EA	SCREW, SET, ALLEN 6-32 X 3/16 SS	9
T721880	1	EA	SCREW, 10-32 X 5/8 SOCKET HD SS	10
T723020	2	EA	WASHER, FLAT NO. 4 SS	11
T723410	6	EA	WASHER, LK SPLT NO. 4 SS	12
T724000	1	EA	PIN DOWEL SS.156DX.5	13
T800200	1	EA	BODY, UPPER PER DRAWING	14
T800201	1	EA	BODY, LOWER PER DRAWING	15
T800801	1	EA	HUB, VANE ALUM U/O 2020	16

TT170522	POT/SHAFT ASSEMBLY			
COMPONENT	QTY	UOM	DESCRIPTION	ITEM NO.
M463072	2	EA	DIODE, ZENER IN4735A 6.2V 1W	2
M492010	6	IN	WIRE HOOKUP 26 GA STRND	3
M492002	6	IN	WIRE HOOKUP 26 GA STRND	4
M492009	6	IN	WIRE HOOKUP 26 GA STRND	5
T724201	1	EA	ROLL PIN, .0625 DIA X 3/16 L S	6
T801916	1	EA	SHAFT, VANE	7
ECN			ENGINEERING CHANGE NUMBER	4153
M480114	1	EA	POTENTIOMETER, 5K	

DWG. NO. 2020-005



REV	ECN	DATED	QTY	NEXT ASM
A	2468	1/3/86		

TOLERANCES UNLESS OTHERWISE NOTED:
XXX= ± .005 XX= ± .010 FRACTIONS= ± .02
ANGLES ± ½° CONCENTRICITY= .003 TIR

MATL

FINISH

ENGR		DT 1/3/86
APPRO		DT 1/3/86

WeatherMeasure WEATHERtronics
Division of QUALIMETRICS, Inc.

B

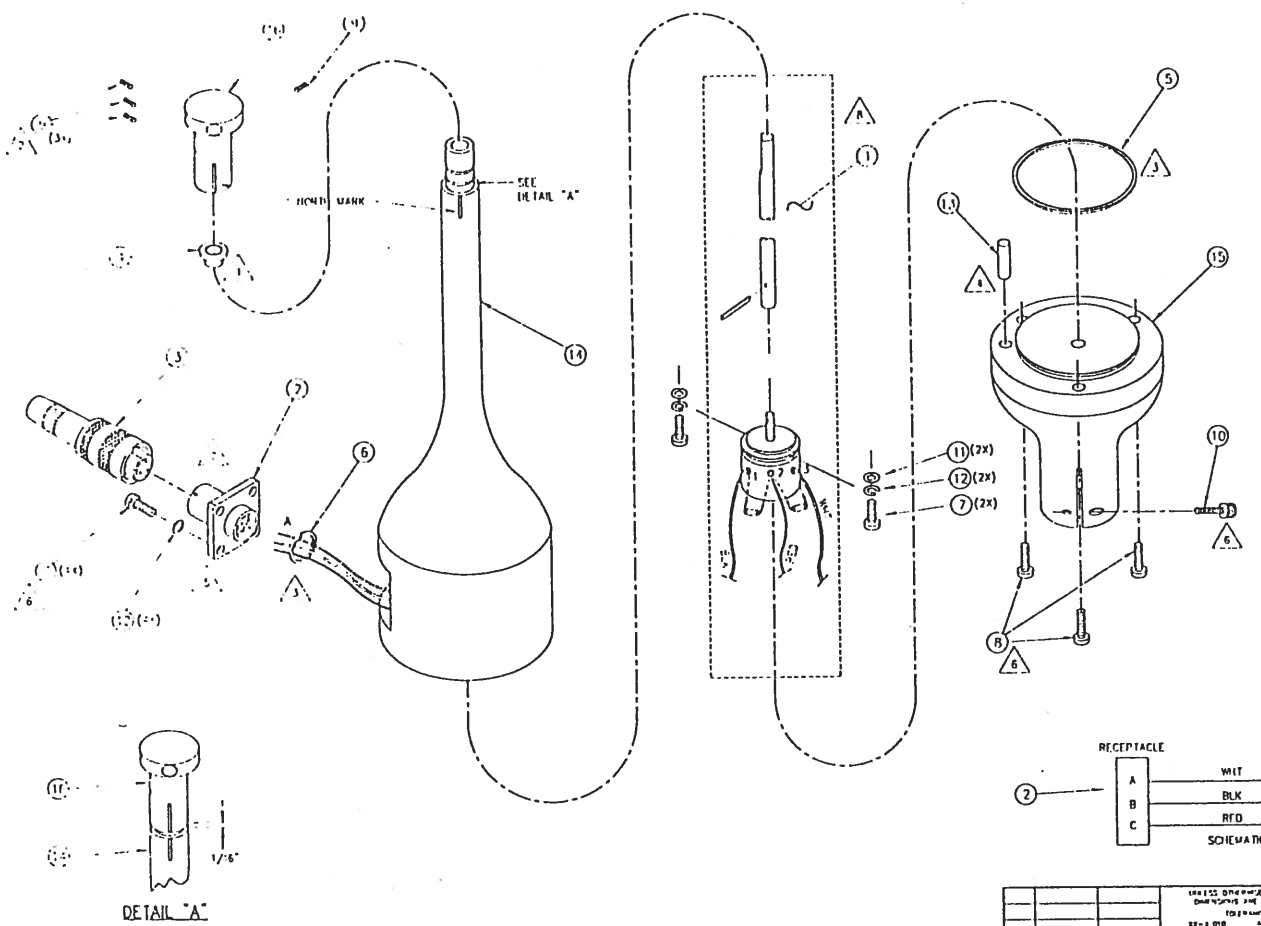
NOMENCLATURE OUTLINE DRAWING
MICRO RESPONSE VANE

MOD. USAGE 2020 | SHEET 1 OF 1

BY K.WEBER | SCALE 1/2 | DWG. NO. 2020-005

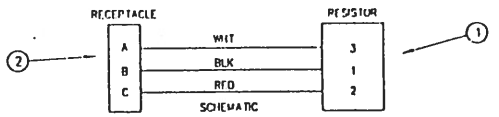
DT 1/3/86

REVISIONS			
REV	ECN	DESCRIPTION	DATE
A	4153	INITIAL RELEASE	



NOTES: UNLESS OTHERWISE SPECIFIED

1. SECURE BEARING (ITEM 4) TO UPPER BODY (ITEM 14) WITH "LOCKTITE" 222. DO NOT ALLOW "LOCKTITE" TO CONTAMINATE BEARING SURFACES OF BEARING.
2. WHEN INSTALLING HUB, (ITEM 18) PINCH DIAL SCREWS (ITEM 9), AGAIN WITH FLAT AREA OF SHAFT (PART OF ITEM 1).
3. APPLY SILICONE GREASE TO O-RING
4. PRESS FIT PIN (ITEM 13)
5. SOLDER WIRES FROM POT/SHAFT ASSY (ITEM 1) TO RECEPTACLE (ITEM 2). APPLY EPOXY "HUMISEAL" OR EQUIV. TO SOLDER CONNECTIONS
6. COAT SCREWS WITH "DOPSEASE" OR EQUIV. (THREAD)
7. INSTALL RECEPTACLE (ITEM 2) TO UPPER BODY (ITEM 14) WITH LARGE KEY WAY OF RECEPTACLE TOWARD TOP OF ASSEMBLY.
8. DIODES, PART OF ITEM (1) NOT SHOWN FOR CLARITY
9. SEE 2020-001 FOR VANE AND COUNTER WEIGHT ASSEMBLY (SECTIONS 3.3 THRU 3.7)



REV	SHEET	OF
A	1	1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
DO NOT SCALE DRAWING

DRAWN BY	PETE SANCHEZ
CHECKED BY	
ENGR. ENGINEER	
PROGRAM MANAGER	
APPROVALS	
ISSUED	12-16-92
DATE	

MATL: SEE BILL OF MATERIALS
FINISH: AS ISSUED
TREATMENT:

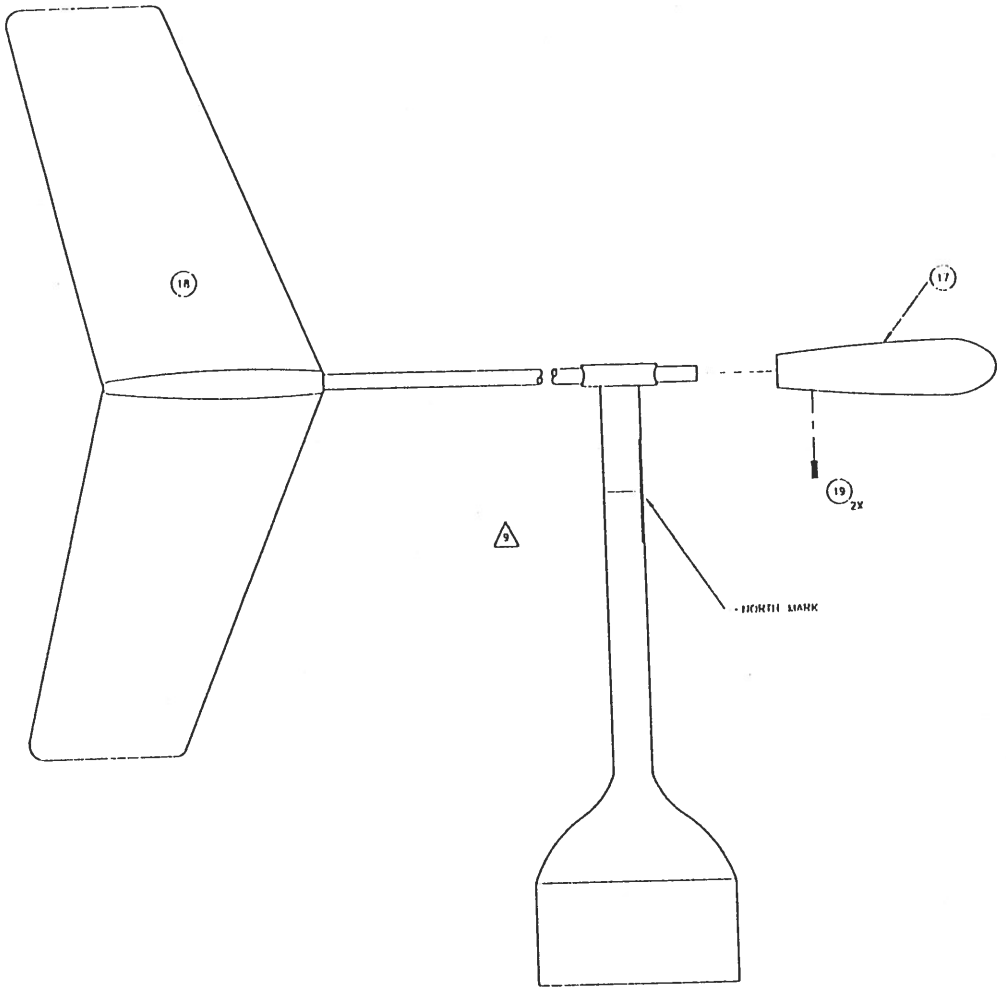
NEXT ASSY	USED ON
APPLICATIONS	

QUALIMETRICS, Inc.

ASSEMBLY, MICRO RESPONSE VANE SENSOR BODY

SIZE: D | DWG NO: 2020-003

SCALE: NONE | WEIGHT: | SHEET 1 OF



D 2020-003

REVISIONS			2020-004	
REV	ECN	DESCRIPTION	DATE	APPROV
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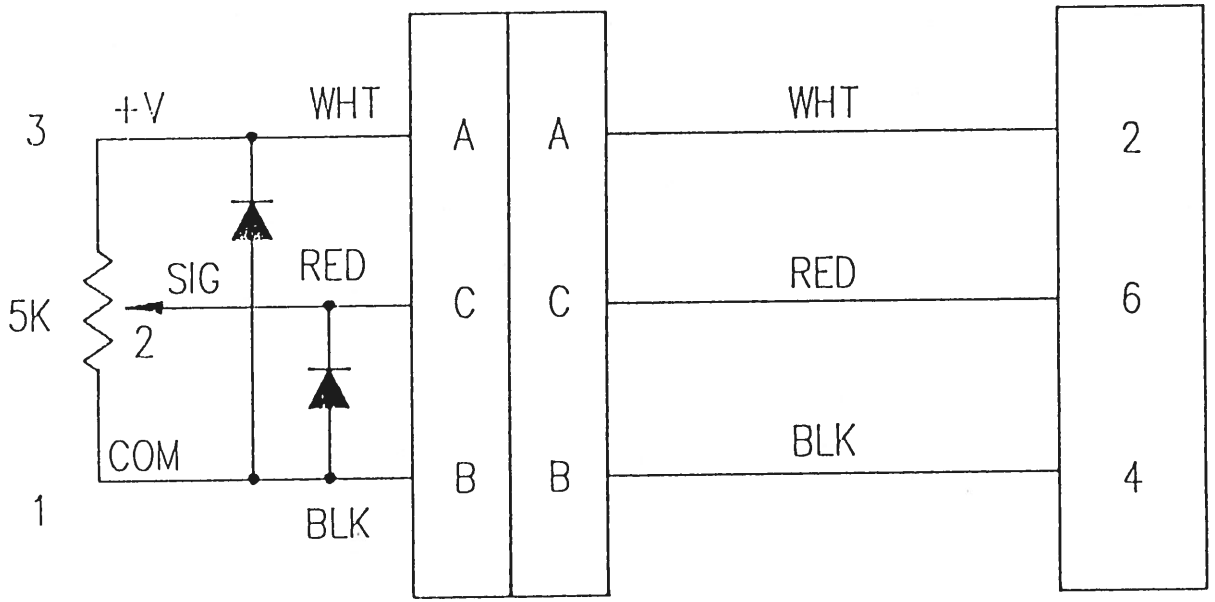
C	4153	ADD 1,2,3 & ADD WHT, RED, BLK		



			UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES XX=±.010 ANGLES ±1/2° XXX=±.005 FRACTIONS=±.02 DO NOT SCALE DRAWING	DRAWN BY: PETE SANCHEZ	25JUNE92	QUALIMETRICS, Inc	
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			MATL SEE BILL OF MATERIALS	DESIGN ENGINEER:	12-16-92		
			FINISH AS ISSUED	PROJECT MANAGER:		SIZE A	DWG NO. 2020-004
NEXT	NEXT ASSY	USED ON	TREATMENT	PROGRAM MANAGER:	12-16-92		
QTY REQD	APPLICATIONS			APPROVALS	DATE	SCALE NONE	RELEASE DATE / SHEET 1 OF