

SENSORS

MANUAL – WM-III A WIND SPEED/WIND DIRECTION SENSOR P/N M102083 Rev A

1.0 INTRODUCTION

The Wind Mark III Wind Sensor is a rugged and accurate system for measuring the speed and direction of the wind. Wind speed is measured by a 3-cup anemometer coupled to a light chopper which converts the speed of rotation of the cups to a frequency proportional to the wind speed. Wind direction is measured by a wind vane coupled to a precision low-torque potentiometer. The wiper voltage of the potentiometer is a measure of wind direction.

1.1 SPECIFICATIONS

WM-III WIND SPEED

Accuracy: 0.25 mph (± 0.11 m/s) or $\pm 1.5\%$, whichever is greater

Threshold: <1.0 mph (0.45 m/s)

Distance Constant:

Lexan: <2.4 m (8.0 ft)

HD Aluminum: <4.6 m (<15.0 ft)

Operating Range: 0-125 mph (0-55 m/s)

Operating Temp: -40° to 140°F (-40° to 60°C)

Power Requirement: +5 to +7 Vdc @ 1 mA

Signal Output: 4 Vpp freq. proportional to WS

Dimensions:

Weight: less than 2 lbs. (0.9 kg)

Turning Radius: 3.75 in (9.5 cm)

Cup Transfer Function: $V_{\text{mph}} = (f/6.95) + .3$

WM-III WIND DIRECTION

Accuracy: + 3°

Threshold: <1.0 mph (0.45 m/s)

Distance Constant:

Standard: <2.4 m (8.0 ft)

Heavy Duty: <4.5 m (<15.0 ft)

Damping Ratio: >0.4 to 0.6 at 10° initial angle of attack

Operating Range: 0° - 360°

Operating Temp: -40° to 140°F (-40° to 60°C)

Power Requirement: 5 mA max, through 2K ohms

Signal Output: Variable DC voltage, magnitude proportional to wind direction

Dimensions:

Weight: less than 2 lbs. (0.9 kg)

Turning Radius: 17.5 in (44.4 cm)

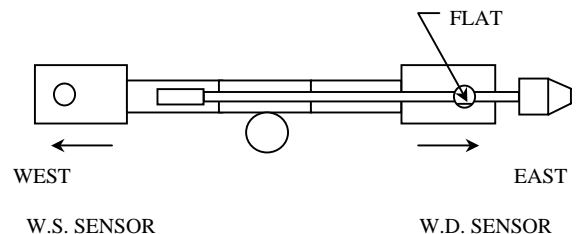
2.0 INSTALLATION

NOTE: MAKE ALL CONNECTIONS WITH THE POWER OFF.

Carefully unpack the wind set and place the wind speed and direction sensor (one unit) on a flat surface. Connect the sensor mating connector end of the cable to the crossarm and the opposite end of the cable to the signal conditioner. The signal conditioner may be housed in a mainframe, environmental enclosure, or recorder depending upon the system selected. Some systems require making individual connections on the translator/datalogger end of the cable. In these cases, refer to the translator manual or system wiring diagram for proper connections. After making and checking all connections turn the unit ON. The wind speed sensor is located at the end of the crossarm with the connector, and the wind direction sensor at the opposite end. Rapidly spin the wind speed shaft and note that the translator/datalogger output increases. Slowly rotate the wind direction shaft and note that the wind direction output changes. The wind direction has been aligned at the factory; however, it should be checked at this time using the alignment procedure below.

2.1 WIND VANE ALIGNMENT PROCEDURE

Align the crossarm as in the figure below. The flat on the wind direction cap should be as indicated. Place the vane on the shaft and align the flats so they are parallel. A small coin placed against the flats will insure proper orientation of the vane on the sensor (see figure below). Tighten the set screws in the vane hub. With the vane as shown in the figure below, the wind direction on the recorder will indicate 90°. Place the cup set on the wind speed sensor and tighten the set screws.



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Turn the wind set off and remove the connector from the sensors.

2.2 SENSOR ORIENTATION

The wind speed and direction sensors mount on any 3/4 inch pipe (1.05 inch OD). The sensors should be located far enough from any obstruction so the actual local wind conditions are measured, not the turbulent wind conditions caused by some nearby structure. The sensors should be located a minimum of 10 meters above the ground or the roof of a building if they are located on a building. The translator or datalogger monitoring device can be located up to 500 feet from the sensors.

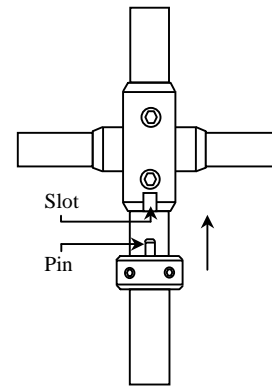
In order to obtain accurate wind direction readings, it is necessary that the sensor be oriented with relation to true north. The crossarm provides a long axis with which to align the wind direction sensor. As long as the crossarm pipe is aligned in a true east-west plane, the wind direction sensor will automatically be aligned.

To find the correct true north orientation of a site, one must first find the magnetic angle of declination. Several sources contain this information, such as topographic or aeronautical navigation maps of the area. For example, Bohemia, New York, which is located on the eastern coast of the United States, has a magnetic angle of declination of approximately 13 degrees west. This indicates the magnetic north is 13 degrees west of true north. In this case, 13 degrees would be added to 360 degrees. Moving to the west coast, Seattle Washington has a declination of approximately 22 degrees east. This indicates the magnetic north is 22 degrees east of true north. For this reading, 22 degrees should be subtracted from 360 degrees. A compass sighting perpendicular to the crossarm in Seattle should read 338 degrees for true east-west orientation. When a crossarm has been properly aligned, the wind speed sensor should be oriented west while the wind direction sensor should be facing east.

2.3 SENSOR INSTALLATION

Install the cable in its final location and wire the recorder as before. Slide the collar over 3/4 inch mounting pipe and loosely tighten one set screw. Mount the crossarm on the 3/4 inch pipe and rotate the crossarm until the wind speed sensor points toward the orientation you have selected. Tighten the set screws in the crossarm mount and connect the cable

to the crossarm. Loosen the collar and slide it up so the pin in the collar is in the slot on the crossarm. Tighten set screws in collar. If crossarm is removed for maintenance, simply loosen the set screws holding the crossarm onto the mast and remove it leaving the collar installed. When replacing the crossarm, make sure the pin on the collar slides into the slot on the crossarm and the sensor will be aligned as originally installed.



After a crossarm and sensors have been installed, it is wise to rotate the wind direction vane in 45 degree increments starting at 90 degrees and moving in a clockwise direction while checking the corresponding data output on the particular data collection equipment being used. This insures that the entire wind direction system is installed and working properly.

The unit is now ready for use.

3.0 I/O CONNECTIONS

The input/output connections are made to the crossarm via an MS style connector which has been supplied. The connector is wire to the cable as follows:

<u>PIN</u>	<u>WIRE COLOR</u>	<u>SIGNAL DESCRIPTION</u>
A	Black	Ground
B	Red	+V
C	Black	N/C
D	White	Wind Speed Out
E	Black	Pot +V
F	Green	Wind Direction Out

Refer to drawing number 100609 Wind Cable Assembly.

4.0 MAINTENANCE

4.1 Wind Speed Transmitter Bearing Replacement

The transmitter requires no calibration and the only maintenance required is to periodically check to see that the shaft is free to rotate.

Should it become necessary to replace the bearings, proceed as follows. Both bearings should be replaced if replacement is necessary. Drawing Number 102083 will help procedure through before starting.

1. Remove the cups by loosening the two set screws that hold them to the shaft and lifting the cups off the shaft.
2. Remove the wind direction cover (item 28). Loosen the two set screws holding the wind direction transmitter to the crossarm and remove the wind direction transmitter from the crossarm by pulling on it with a slow twisting motion.
3. Disconnect the wind direction potentiometer connector. Loosen the set screws holding the wind speed transmitter to the crossarm and remove the wind speed transmitter in the same manner as the wind direction transmitter.
4. Remove the nylon cable ties that restrain the cable service loop to the board. Remove the two screws holding the printed circuit board and remove the P.C. Board from the transmitter being careful not to damage the shutter or light chopper assembly.
5. Remove the four screws holding the connector to the wind speed transmitter and pull the connector through the access hole a short distance.
6. Remove the retaining ring from the shaft with retainer ring pliers or a small pen knife. If the retaining ring is bent, it must be replaced.
7. Allow the shaft to slide out through the open end of the column being careful not to damage the shutter. In some cases, the wires will impede removal. In this case, carefully remove the shutter from the shaft.

8. Remove and discard the old bearings. It may be necessary to push the bearing out from the bottom of the seats with a long thin rod or the shaft assembly. Pushing lightly all around the bearing is better than too much pressure on one side of the bearing.

9. Replace the spacer that was closest to the shutter on the shaft.

10. Place a new bearing on the shaft and guide the shaft back in to its hole from the bottom until the bearing is seated. When the bearing is seated, the retainer ring groove will be visible at the top of the transmitter. If the shutter was removed in Step 7 above, replace it at this time.

11. Hold the shaft in place from the bottom, being careful not to damage the shutter, place the new bearing over the top of the shaft and press it down into its seat.

12. Replace the spacers on top of the bearing and then replace the retainer ring.

13. Reassemble the crossarm, transmitter assembly by reversing steps 1 through 5.

NOTE: If the shaft assembly is to be replaced, the procedure is the same as outlined above.

4.2 Wind Direction Transmitter Bearing Replacement

Should it become necessary to replace the bearing, proceed as follows. Drawing number 102083 will help in locating the parts described below. Read the whole procedure through before starting.

1. Remove the cups and vane by loosening the two set screws that hold them to the shaft and lifting them off the shaft.
2. Remove the wind direction cover (item 28).
3. Remove the cap on the top of the wind direction transmitter.
4. Try lifting the bearing off the shaft. If the bearing is frozen into the column, unscrew the stainless steel nut at the base of the column taking care not to let the pot terminals get crushed. Once removed, slide a thin object down the column and gently tap the bearing out.

5. Replace the bearing at the top of the column and reassemble the transmitter.

NOTE: Once the cap on the wind direction sensor has been removed it will be necessary to realign the cap with reference to the crossarm. Follow the procedure outlined below:

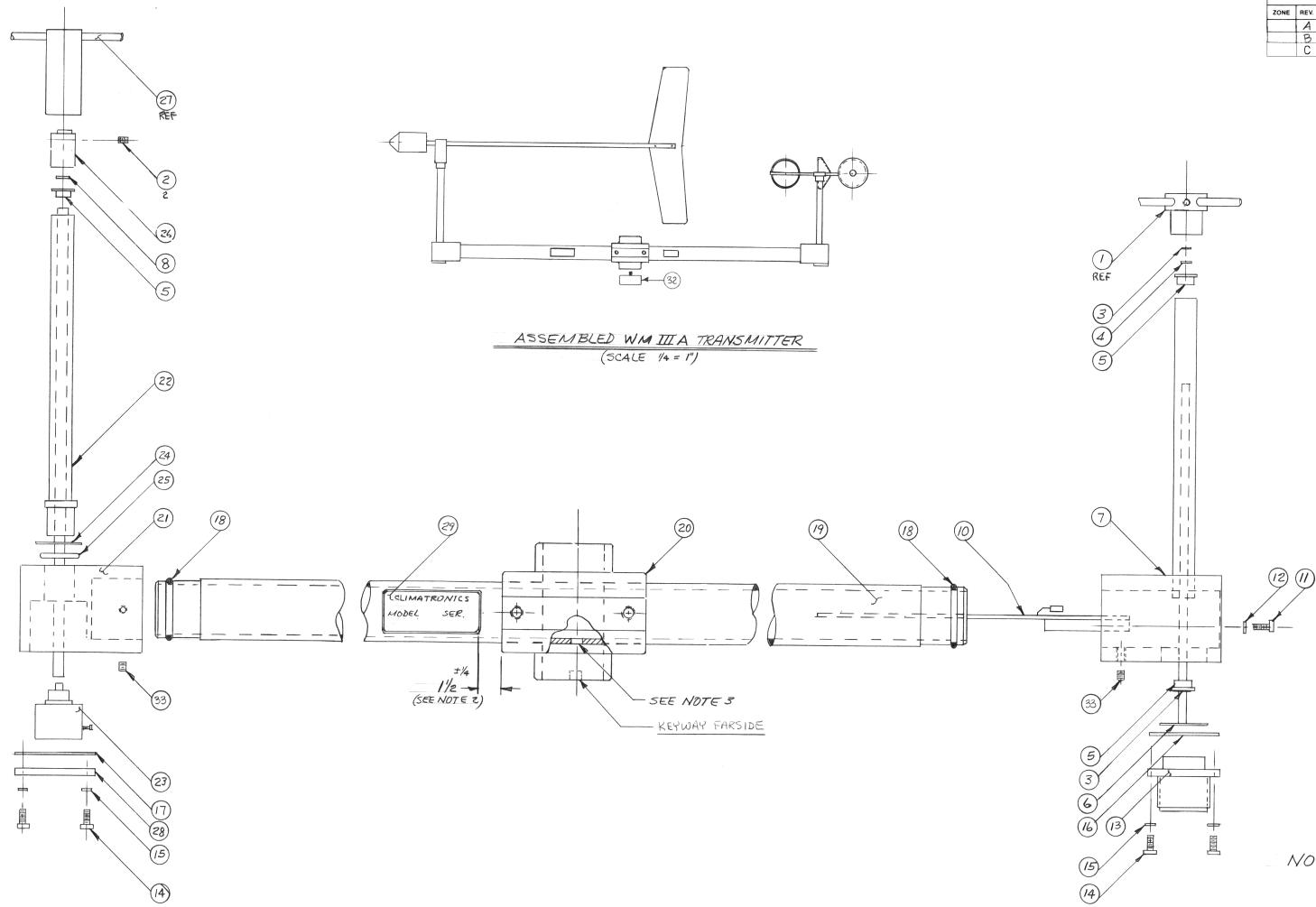
1. Plug the sensor cable into the crossarm and turn the unit on.

2. Place the wind vane onto the shaft and align the vane along the crossarm. (See diagram in Section 2, Installation.)

3. Slowly turn the wind direction cap until a reading of 90° is obtained on the recorder and tighten the set screws on the vane hub.

4. Loosen the set screws in the wind direction cap and rotate it until the flats are aligned. Retighten the set screws on the cap. The flats are now realigned.

DWG NO		102083	SH	1	REV	C	1
REVISIONS							
ZONE	REV	DESCRIPTION	DATE	APPROVED			
	A	SEE ECN 4346	8-27-92	S.F.			
	B	SEE ECN 5416	3-17-05	DA			
	C	SEE ECN 5707	1-9-08	DA			



ASSEMBLED WM III A TRANSMITTER
(SCALE 1/4" = 1")

- NOTES:
- 1) FOR WIRING DIAGRAM, REFER TO DRAWING 400849.
 - 2) INSTALL ITEM 29 TO ITEM 19 PER DIM'S SHOWN.
 - 3) WHEN ASSEMBLING ITEM 19 TO ITEM 20, HOLE LOCATION TO BE AS SHOWN.

QTY	FSCM	PART OR	NOMENCLATURE	MATERIAL
REQD	NO	IDENTIFYING NO.	OR DESCRIPTION	SPECIFICATION
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES		CONTRACT NO.		
		CLIMATRONICS		
MATERIAL		APPROVALS	DATE	WM III A, TRANSMITTER ASSY.
FINISH		DRAWN S. Franko	6-28-91	
NEXT ASSY	USED ON	CHECKED	7-9-91	
APPLICATION		ISSUED	7-18-91	
DO NOT SCALE DRAWING		SIZE FSCM NO.	D 52332	DWG. NO. 102083
		SCALE Full	SHEET 1 OF 3	

WM-III A WIND SPEED/DIR SENSOR
P/N 102083 Rev C
PARTS LIST
Sheet 2 of 3

ITEM	SYM. NO	QTY	PART NO.	DESCRIPTION
1		0.0	102083G	SEE G LIST
2		2.0	SC8-17	SET SCREW 6-32 x 5/32 NO-MAR
3		2.0	Q2-12	RING RETAINER
4		1.0	SS1	SPACER KIT
5		3.0	500790	BEARING, RADIAL
6		1.0	100103	WIND SPEED SHAFT ASSEMBLY
7		1.0	100104	WIND SPD COLUMN & SUP ASSY
8		1.0	SS1-27	SPACER .008
10		1.0	102153	WIND SPEED AMPLIFIER, WM-III
11		2.0	MS51957-3	SCREW 2-56 x 1/4
12		2.0	MS35338-134	WASHER LOCK SPLIT #2
13		1.0	MS3102R14S-6P	CONNECTOR, RECEPTACLE
14		8.0	MS51957-15	SCREW 4-40 x 3/8 PH
15		8.0	MS35338-135	WASHER, LOCK SPLIT #4
16		1.0	10-40450-14	GASKET, CONNECTOR #14
17		1.0	10-40450-20	GASKET, CONNECTOR #20
18		2.0	2-018	O-RING, BUNA N, 60 DUROMETER
19		1.0	500135	CROSSARM - WM-III
20		1.0	1552-1	CROSS, ALIGNMENT 3/4 X 3/4
21		1.0	500130	WIND DIRECT SUPPORT WMIII
22		1.0	100105	WIND DIR COLUMN ASSEMBLY
23		1.0	102084	WM-III A POT AND SHAFT ASSY.
24		1.0	AN960-CB16	WASHER FLAT 1/2

Notes: ITEM 30 TO BE USED AS REQUIRED
ITEMS 9 AND 31 NOT USED

WM-III A WIND SPEED/DIR SENSOR
P/N 102083 Rev C
PARTS LIST
Sheet 3 of 3

ITEM	SYM. NO	QTY	PART NO.	DESCRIPTION
25		1.0	2-014	O-RING, BUNA N, 60 DUROMETER
26		1.0	500070	CAP, DIRECTION WM-III
27		0.0	102083H	SEE H LIST
28		1.0	500131	COVER WIND DIRECT WMIII
29		1.0	500827	LABEL, SERIAL NO/PART NO
30		0.0	PVC-105-10	TUBING, CLEAR AWG#10
32		1.0	3544	ALIGNMENT COLLAR ASSEMBLY
33		4.0	SC8-11	SET SCREW 8-32 x 15/64 NO-MAR
		0.0	400849	SCHEMATIC

SEE G LIST
P/N 102083G Rev A
PARTS LIST
Sheet 1 of 1

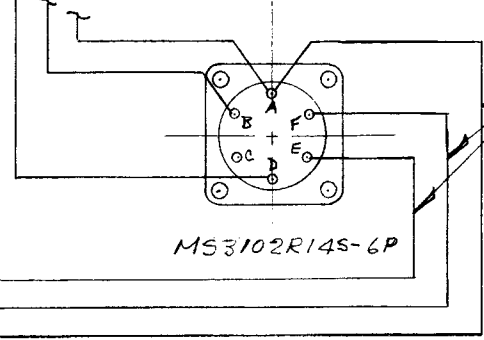
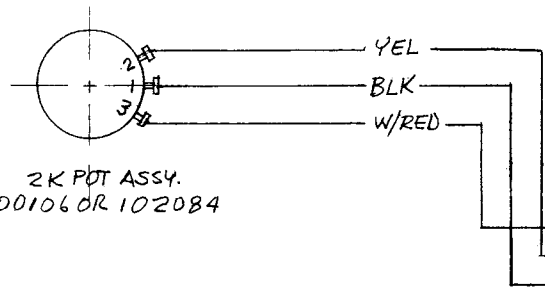
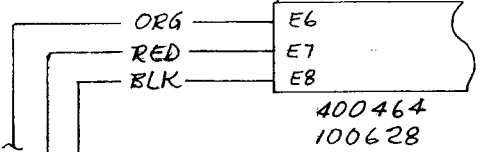
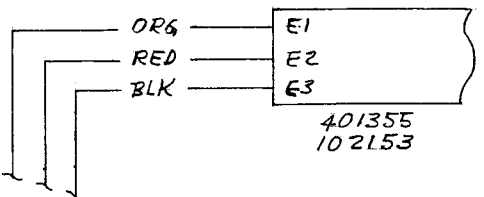
ITEM	SYM. NO	QTY	PART NO.	DESCRIPTION
		1.0	102083G0	102138 LEXAN CUPSET
		1.0	102083G1	101286 HEAVY DUTY CUPSET
		1.0	102083G2	101053 VINYL CUPSET

SEE H LIST
P/N 102083H Rev
PARTS LIST
Sheet 1 of 1

ITEM	SYM.NO	QTY	PART NO.	DESCRIPTION
		1.0	102083H0	101944 FAST RESPONSE VANE
		1.0	102083H1	101292 HEAVY DUTY VANE

DWG. NO. 400849 SH 1 REV. A

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	REDRAWN & REVISE ECN 4431	5-3-93	S.F.



- NOTES:
- 1) ALL WIRE TO BE 22 GAUGE.
 - 2) TWIST WIRES TOGETHER APPROX. 1" FROM ENDS.
 - 3) AFTER ASSEMBLY OF CONNECTOR TO BLOCK, TRIM WIRES TO 8 1/4" & 31" RESPECTIVELY FROM EDGE OF BLOCK.

WIRE RUN LIST 100108

FROM	TO	COLOR	LENGTH
PIN A	E8	BLK	12"
PIN A	PIN 1 (POT)	BLK	36"
PIN B	E7	RED	12"
PIN D	E6	ORG	12"
PIN E	PIN 3 (POT)	W/RED	36"
PIN F	PIN 2 (POT)	YEL	36"

WIRE RUN LIST 102083

FROM	TO	COLOR	LENGTH
PIN A	E3	BLK	12"
PIN A	PIN 1 (POT)	BLK	36"
PIN B	E2	RED	12"
PIN D	E1	ORG	12"
PIN E	PIN 3 (POT)	W/RED	36"
PIN F	PIN 2 (POT)	YEL	36"

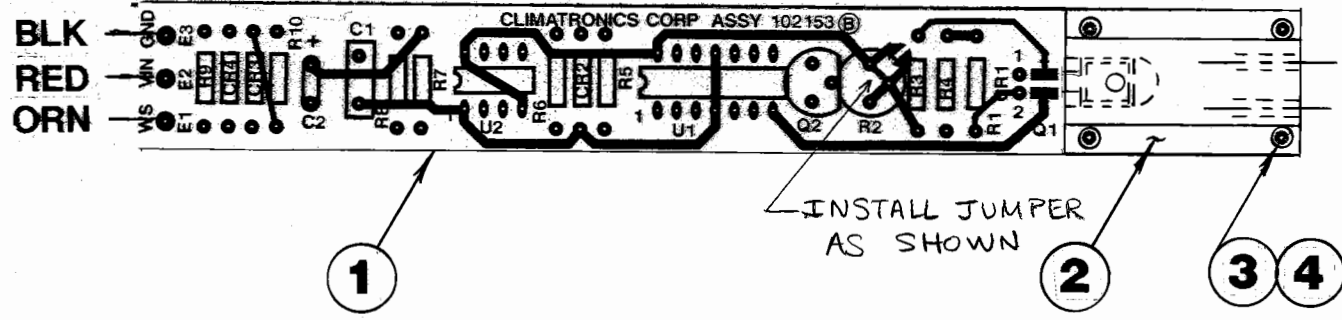
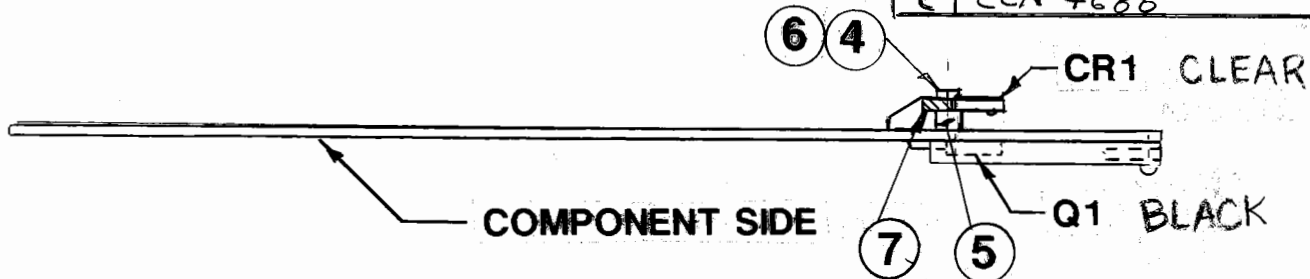
	102083
	100108
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		
FRACTIONS	DECIMALS	ANGLES
±	.XX ±	±
	.XXX ±	±
MATERIAL	CONTRACT NO.	
FINISH	APPROVALS	DATE
	DRAWN KC	6-1-81
	CHECKED T.H.	6-12-81
	ISSUED T.S.	6-12-81

WIRING, WM-III CROSSARM.			
SIZE	FSCM NO.	DWG. NO.	REV.
B	52332	400849	A
SCALE	SHEET		1 OF 1

DRAWING 7837 FORM

				REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED				
F	ECN 5343	9-30-04					
G	ECN 5684	9-17-07					
H	ECN 5688	10-10-07	DA	A	ECN 4363	10-14-92	SC
				B	ECN 4485	9-16-93	SC
				C	ECN 4622	12-9-94	S.F.
				D	ECN 4644	1-31-95	CC
				E	ECN 4688	7-5-95	S.F.



NOTES:
1. USE FIXTURE SK002107 TO BEND AND MOUNT CR1.

102083		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES = .XX = .XXX =		CONTRACT NO.					
100108-1		MATERIAL		APPROVALS					
100108		FINISH		DRAWN JFS		8/92		SIZE A FSCM NO. 52332 DWG. NO. 102153 REV. H	
NEXT ASSY		USED ON		CHECKED RVN		8/92			
APPLICATION		DO NOT SCALE DRAWING		ISSUED		9/10/92			

WIND SPEED AMPLIFIER, WM-III
P/N 102153 Rev H
PARTS LIST
Sheet 2 of 3

ITEM	SYM. NO	QTY	PART NO.	DESCRIPTION
1		1.0	401355	BOARD, PRINTED CIRCUIT
2		1.0	501203	WM-III MOUNTING PLATE
3		2.0	MS51957-3	SCREW 2-56 x 1/4
4		4.0	MS35338-134	WASHER LOCK SPLIT #2
5		2.0	4000	SPACER, INSULATED ROUND
6		2.0	MS51957-6	SCREW 2-56 x 7/16
7		1.0	501425	LED HOLDER
C1		1.0	CK05BX102K	CAP .001 UF 200V
C2		1.0	41DS226B015K	CAP 22 UF 15V
CR1		1.0	QEE113	INFRARED LED
CR2, CR3		2.0	SA7.0CA	TRANSIENT SUPPRESSOR
Q1		1.0	QSE113	INFRARED PHOTOTRANSISTOR
Q2		1.0	2N2925	TRANSISTOR, NPN
R1		1.0	RN55C7500F	RES 750 OHM 1% 1/10W
R3, RB		2.0	RN55C1502F	RES 15K 1% 1/10W
R4		1.0	RN55C1003F	RES 100K 1% 1/10W
R5		1.0	RN55C3921F	RES 3.92K 1% 1/10W
R6		1.0	RN55C4750F	RES 475 OHM 1% 1/10W
R7		1.0	RN55C3323F	RES 332K 1% 1/10W
R9		1.0	RN55C1000F	RES 100 OHM 1% 1/10W
R10		0.0	JUMPER	JUMPER
U1		1.0	CD4013BE	I. C. DUAL-D FLIP FLOP
U2		1.0	ICM7555IPA	I. C. TIMER, LOW POWER

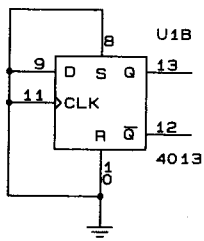
Notes: CR4 AND R2 ARE NOT USED.

WIND SPEED AMPLIFIER, WM-III
P/N 102153 Rev H
PARTS LIST
Sheet 3 of 3

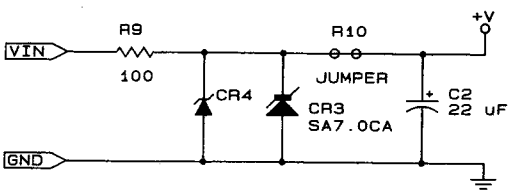
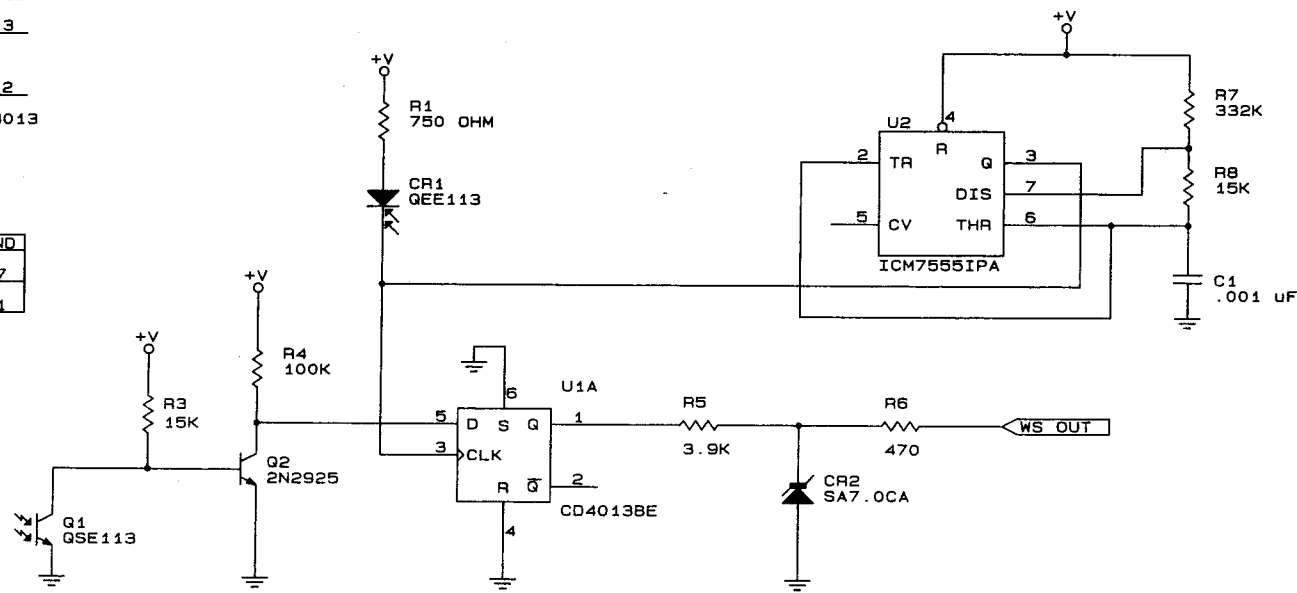
ITEM	SYM. NO	QTY	PART NO.	DESCRIPTION
		0.0	401354	SCHEMATIC, WM-III SPEED AMPL

DWG. NO. 401354 SH REV.

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	ECN No. 4363	10/14/92	
B	ECN No. 4485	09/16/93	
C	ECN No. 4599	08/16/94	
D	ECN No. 5343	09/30/04	



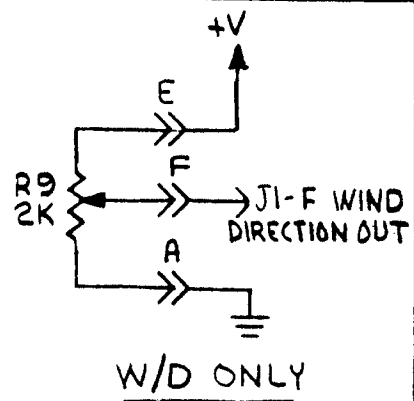
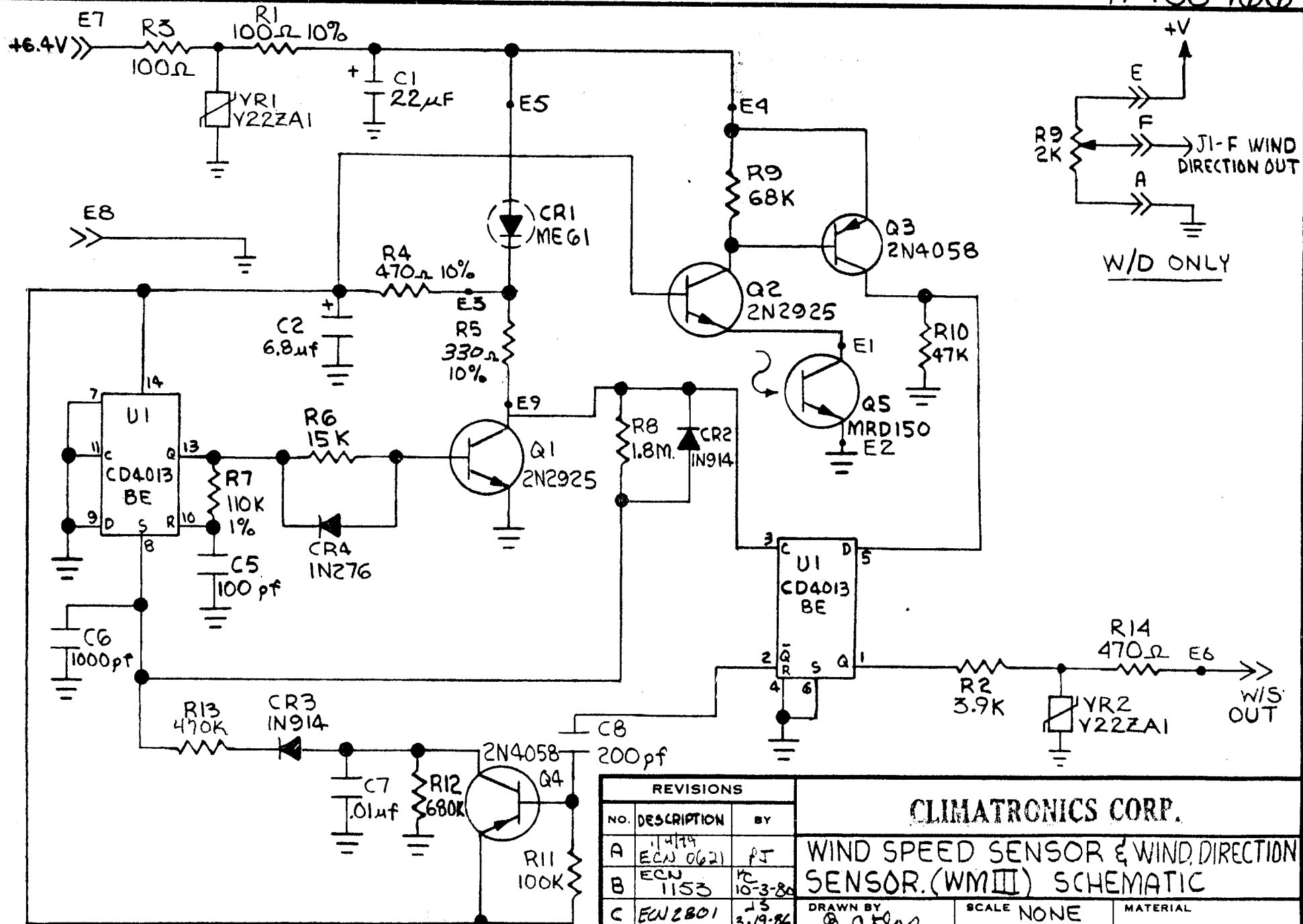
REF	+V	GND
U1	14	7
U2	8	1



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± .XX ± .XXX ±		CONTRACT NO.			
MATERIAL NOT APPLICABLE		APPROVALS			
102153		DRAWN RVN		8/92	WM-III WIND SPEED AMPLIFIER SCHEMATIC
NEXT ASSY		CHECKED JCS		8/92	
USED ON		ISSUED TJS		9/92	SIZE B FSCM NO. 52332
APPLICATION		DO NOT SCALE DRAWING		SCALE	DWG. NO. 401354 REV. D
				SHEET	

10/6/05

A 400466 C



REVISIONS			CLIMATRONICS CORP.		
NO.	DESCRIPTION	BY			
A	1474 ECN 0621	PJ	WIND SPEED SENSOR & WIND DIRECTION		
B	1153	10-3-86	SENSOR. (WMIII) SCHEMATIC		
C	ECN 2801	13 3-19-86	DRAWN BY G. Atlas	SCALE NONE	MATERIAL
D			CHK'D	DATE 11/22/76	DRAWING NO.
E			TRACED	APP'D	A400466 C