MANUAL
FOR
TIPPING BUCKET RAIN GAGE

WeatherMeasure Division
Model P501-I/PN 648001
Manual PN 552139

WEATHERtronics Division
Model 6010
Manual PN 6010-01

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TIPPING BUCKET RAIN GAGE

1.0 INTRODUCTION

1.1 The Tipping Bucket Rain Gage is a precision sensor used to measure rainfall volume and/or rate. Rain drops enter the gage through a machined orifice and fill one of two buckets located inside the gage. Each tip of the bucket represents 0.01 inches (0.25 mm) of rainfall. As the bucket tips, a mercury switch makes a momentary closure that can be used to trigger an event accumulator.

1.2 Materials used in construction of the instrument are corrosion resistant. All external openings of the gage are protected from insects and foreign material by mesh screens.

2.0 SPECIFICATIONS

2.1

Type	Tipping Bucket
Sensitivity	0.01" (0.25 mm)
Resolution	0.01" (0.25 mm)
Orifice opening	.8" dia. (20 cm)
Accuracy	0.5% at 0.5"/hr.
Insect protection	Mesh screens
Capacity	Unlimited
Output	100 mS switch closure
Switch type	Form A mercury
Size	8" dia. x 18"H(203 mm dia. x 457 mm H)
Weight/Shipping	8 lbs./15 lbs. (3.6 kg/6.8 kg)

3.0 INSTALLATION

3.1 General: This instrument is thoroughly tested and fully calibrated at the factory and is ready for installation. Please follow Sections 3.2 through 3.4 if any damage has occurred.

3.2 Receiving Instructions: Upon receipt all items must be carefully inspected to assure no damage has occurred during shipment. Do not discard any packing materials until you are certain no freight damage exists and all items are accounted for including any cables, small parts and accessories.

3.3 Freight Damage: If any items have been damaged during shipment, contact a representative of the freight company that delivered the merchandise and file a claim for loss. The claim must be filed at the receiving location. Keep instruments in "as received" condition until the freight handler has finished the inspection.

3.4 If damage has occurred, notify Qualimetrics, Inc. for repair. We will provide a return authorization number to expedite your repair. When returning instrument, please enclose complete details of damage, name, address and return authorization number.

3.5 Two prime considerations must be evaluated when locating an installation site for this rain gage. The gage must be mounted level and the gage must be adequately protected from high winds. Errors of more than 5% can occur from the wind, due to rainfall blowing over the lip of the orifice.

3.6 Consider the height of surrounding obstacles. Install the rain gage at a distance away from the obstacles two to four times the obstacle's height. Although the obstacle makes an ideal wind shield, it may block the normal rainfall path into the gage or rainfall may blow off the obstacle and into the gage.

3.7 A recommended method of mounting the gage is to pour a 12" square concrete pad at the site with three anchor bolts set for the hole pattern of the mounting feet. If strong winds prevail, a wind screen, is recommended. Mount the wind screen as described in its manual.

3.8 Remove the three bolts attaching the outer housing of the rain gage to the tipping bucket mechanism.

3.9 Using the bulls-eye level on the tipping bucket mechanism, level and securely mount the gage.

3.10 Connect a two conductor cable between the two terminal posts on the gage and the event accumulating device.

3.11 Be sure to remove any packing material and the bucket retaining clips from the instrument.

3.12 Verify correct calibration before reinstalling the outer housing.

4.0 THEORY OF OPERATION

4.1 The eight inch diameter orifice was chosen as a trade-off between the sampling area and the size of the tipping bucket mechanism. The large funnel at the orifice helps prevent evaporation inside the instrument.

4.2 Precipitation enters the small funnel inside the instrument and is directed to one of two tipping buckets. When one bucket fills, its weight tips the next bucket into position, and empties the first. At the same time, a 100 millisecond momentary contact closure occurs. This closure increments an event accumulating device. The water is drained out the bottom of the instrument.

4.3 If it is desired, a tank can be designed to catch the water draining out of the instrument for further evaluation.

5.0 CALIBRATION

5.1 The instrument was calibrated before leaving the factory and should not require any further calibration unless maintenance is performed on the instrument.

5.2 For this instrument 7.98 milliliters of water is equivalent to 0.01" of rainfall and 7.85 milliliters of water is equivalent to 0.25 mm of rainfall.

5.3 To calibrate the tipping bucket rain gage, remove the outer cover by first removing the three screws at the base. BE SURE THE GAGE IS LEVEL, using the built-in bulls-eye level as an indicator.

5.4 Devise a source of water with a uniform flow rate of approximately 400 milliliters per hour. Direct this flow onto a wall of the small funnel.

5.5 Set up a counting device to count the number of tips of the bucket assembly. An event recorder or a solenoid counter may be used or a manual counting system can be employed.

5.6 After the gage has tipped several times and the buckets are wet, collect the water in two containers, one under each drain tube. Carefully insert the collection containers between tips and allow at least 10 tips of each bucket (20 counts on the recorder). Remove the containers, between tips, after an even number of tips. Measure the amount of water in each container either by weight or volume. Divide each quantity by the number of tips of each bucket. The value should be within 0.5% of the value listed in Section 5.2.

5.7 Adjustments may be made to the stops located under the buckets. Raising the stop of the bucket will reduce the catch for that bucket and consequently lowering the stop will increase the catch. NOTE: The stop for a bucket is located under the opposite bucket. Make only small corrections at a time and repeat the calibration procedure until the gage is within specifications.

5.8 The above procedure is for a rate of 0.5"/hour. The gage may be calibrated at other rates of interest.

5.9 After calibration, note date and place of calibration and reinstall the outer cover and three screws. Be sure the cover is correctly lined up.

5.10 If the gage has been removed from a field location for calibration be sure the gage in installed and leveled properly.

5.11 To check for calibration in the field, make sure the buckets are empty and add the amount of water specified in Section 5.2. If the buckets tip too soon or do not tip at all, the instrument requires a laboratory calibration as previously described. A standard 10 milliliters pipet or a Model 60101 Calibration Bottle can be used as a field test device.

6.0 MAINTENANCE

6.1 Maintenance is limited to cleaning debris out of the orifice and periodically oiling the pivot point with a light silicon oil.

7.0 SCHEMATIC AND PARTS LIST

7.1 The following pages include assembly drawings and parts lists for this instrument. Please note that the parts lists are arranged in assembly/subassembly form. Each subassembly is listed on a separate page. Subassemblies and parts are listed in the smallest economical size available from Qualimetrics.

8.0 WARRANTY

8.1 All instruments are warranted for one year, unless otherwise specified, against defects in material or workmanship. Should any instrument prove to be defective within the warranty period, upon written notice and return of the instrument freight prepaid, Qualimetrics, Inc.will at its option repair or replace the defective unit and return it freight collect. Instruments abused, improperly used or installed, and modified or altered by others may cancel the warranty.

DWG. NO. 60103-025

ORIFICE DIA.	MODEL	RAINFALL PER TIP	WATER VOLUME PER TIP	CALIBRATION INFORMATION		
				FIELD CHECK	LABORATORY CALIBRATION	
				NO. OF TIPS WHEN FILLED TO MIDDLE OF REFERENCE LINE	WEIGHT OF WATER PER NO. OF TIPS AT WATER TEMP. OF 10°C	
					METRIC	ENGLISH
8.214" (20.864cm)	6011–A 6021–A 6021–C 6041–A P501–A P501–AE P511–A P511A–EE	.01"	8.6834ml	100	868.1g PER 100 TIPS	1.914lbs. PER 100 TIPS
	6011–B 6021–B 6021–D 6041–B P501–AM P511A–ME	0.1mm	3.4186ml	254	854.7g PER 250 TIPS	1.884lbs. PER 250 TIPS
7.874" (20.000cm)	6010 6011 6020 6021 6040 P501–I P511–E P511P	.01"	7.9794ml	109	797.7g PER 100 TIPS	1.759lbs. PER 100 TIPS
	6030	.02"	15.9588ml	54	797.7g PER 50 TIPS	1.759lbs. PER 50 TIPS
12.000" 30.480cm	6018–A 6028–A 6028–C	.01"	18.5328ml	47	926.4g PER 50 TIPS	2.042lbs. PER 50 TIPS
	6018–B 6028–B 6028–D	.25mm	18.2410ml	48	911.8g PER 50 TIPS	2.010lbs. PER 50 TIPS
	6018–C	1mm	72.9638ml	12	729.4g PER 10 TIPS	1.608lbs. PER 10 TIPS

REV	ECN	DATED	QTY	NEXT ASM
A	2552			

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

MATL

FINISH

ENGR Terry A Vann DT 11-13-86

APPRO DT 11-13-86

Weathermeasure WEATHERtronics

C

NOMENCLATURE
TIPPING BUCKET GAGES
CALIBRATION INFORMATION

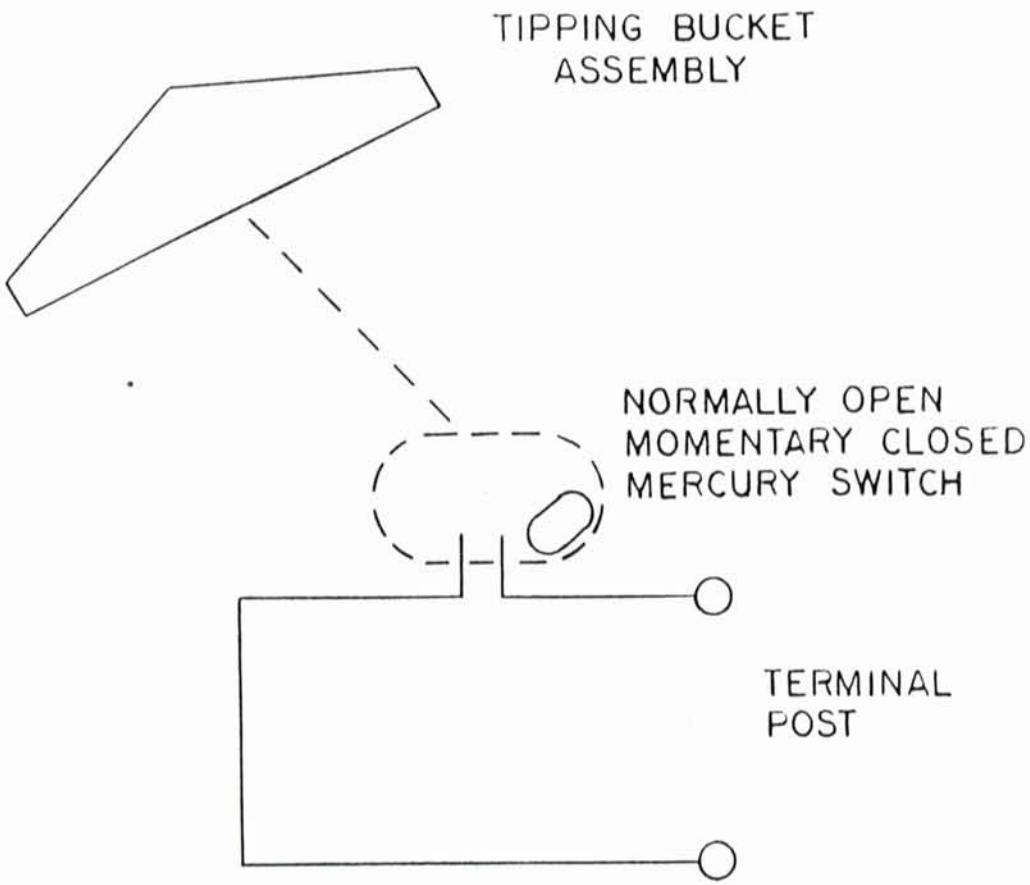
MOD. USAGE

SHEET 1 OF 1

BY K. WEBER DT 11/13/86

SCALE Ø

DWG NO. 60103-025



REV	ECN	DATED	QTY	NEXT ASM

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

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ENGR		DT
APPRO		DT

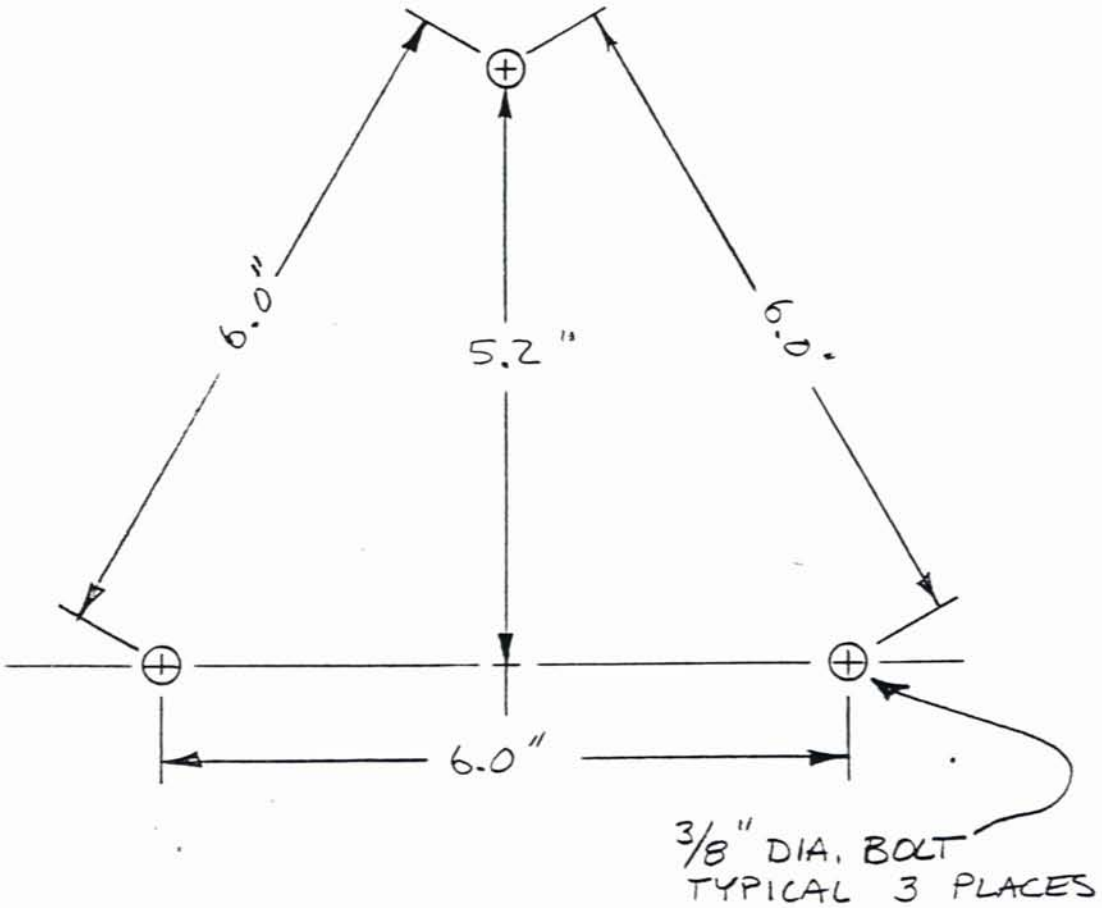
QUALIMETRICS, Inc.

WEATHERMEASURE / WEATHERTRONICS
Instruments and Systems Division
3213 Orange Grove Avenue
Sacramento California 95660 U S A

NOMENCLATURE SCHEMATIC
TIPPING BUCKET RAIN GAGE

MOD. USAGE 6010 | SHEET 1 OF 1

BY GT | DT 3 - 8 - 83 | SCALE Ø | DWG NO. 6010-04 | A



ITEM	PART NO.	SUFFIX	QTY.	UNIT	DESCRIPTION	REFERENCE NO.

BILL OF MATERIALS

WEATHERtronics INCORPORATED
2777 Del Monte St.
West Sacramento, CA 95691
Telephone (916) 371-2660

TITLE: BASE MOUNTING HOLE PATTERN FOR RAIN GAGE MODELS 6010 & 6020

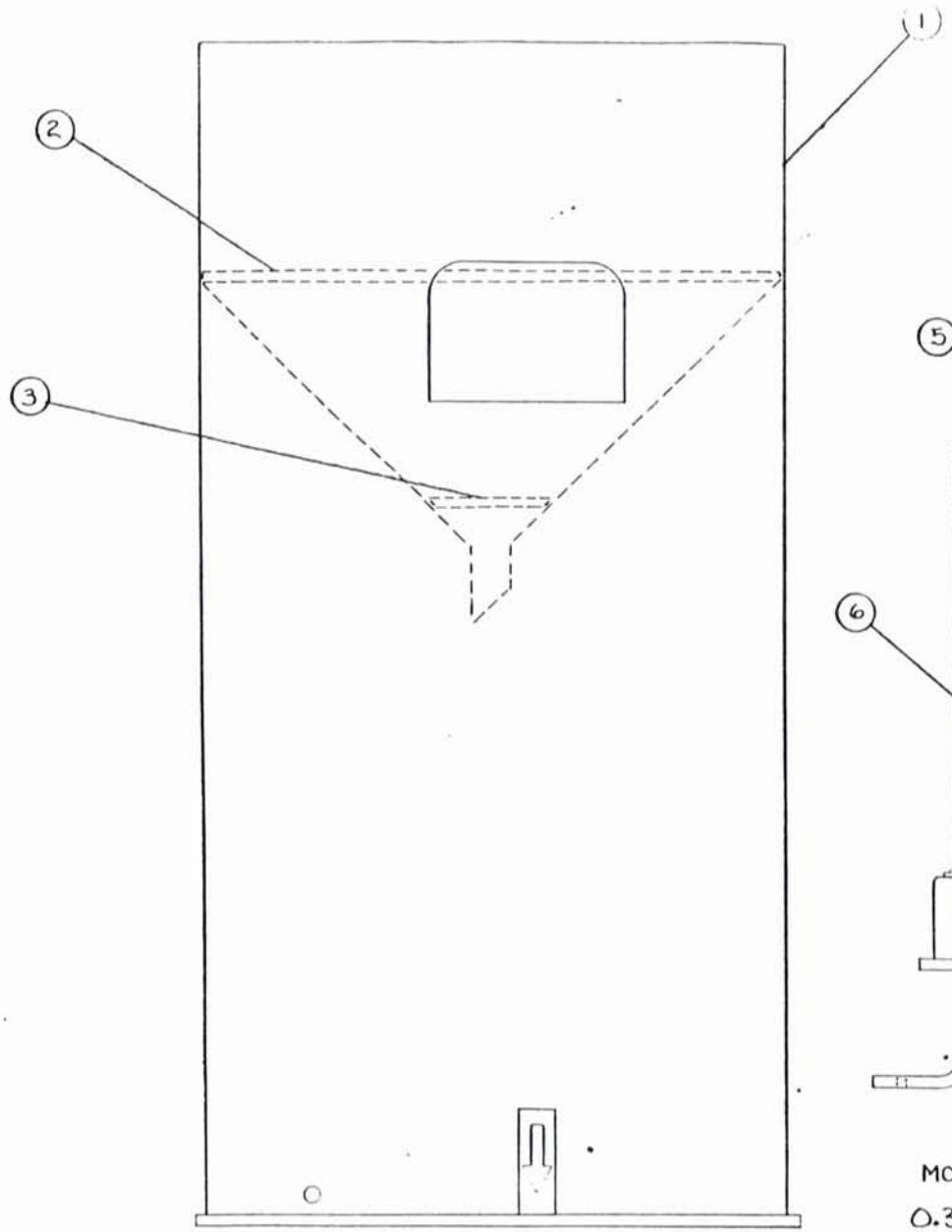
△ PC CONNECTOR
○ TERMINAL STRIP
○ SOLDER TERMINATION
▽ TEST POINT

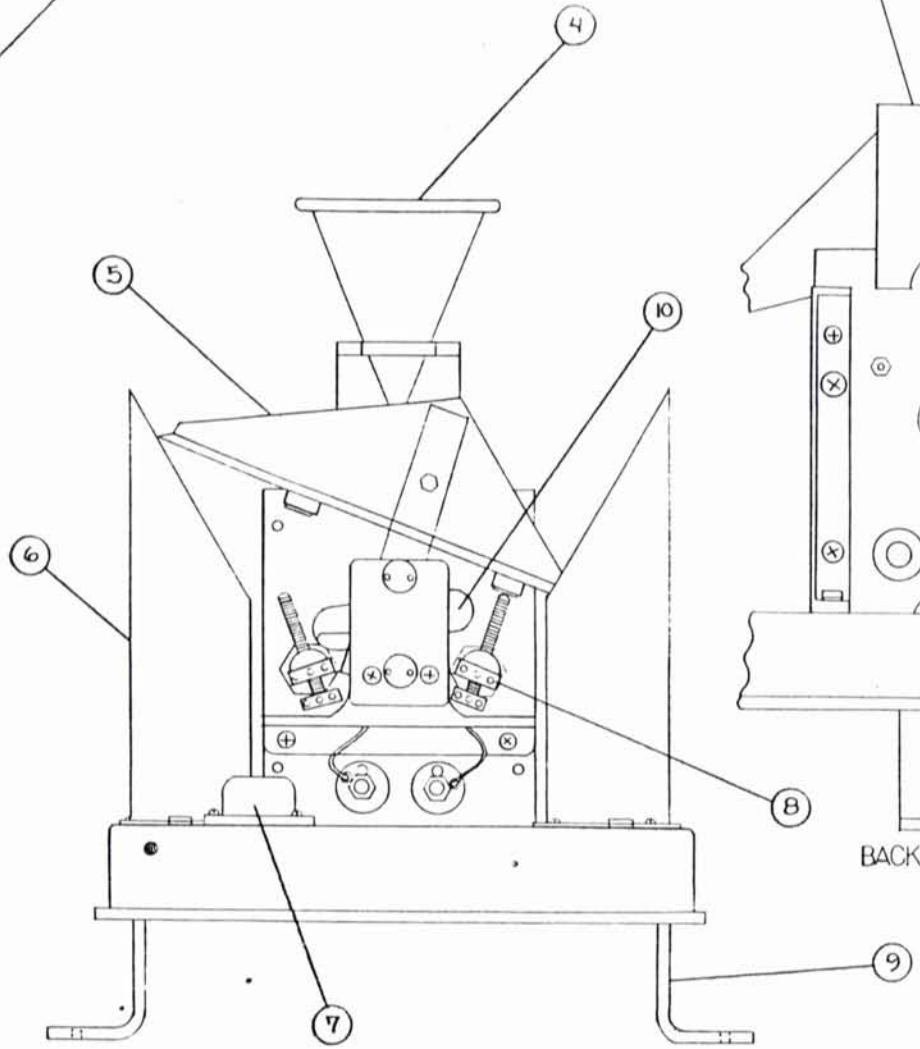
Unless otherwise specified
Decimal XX ± .030
XXX ± .010
Fraction ± 1/16
Angle ± 1°
All dimensions in inches

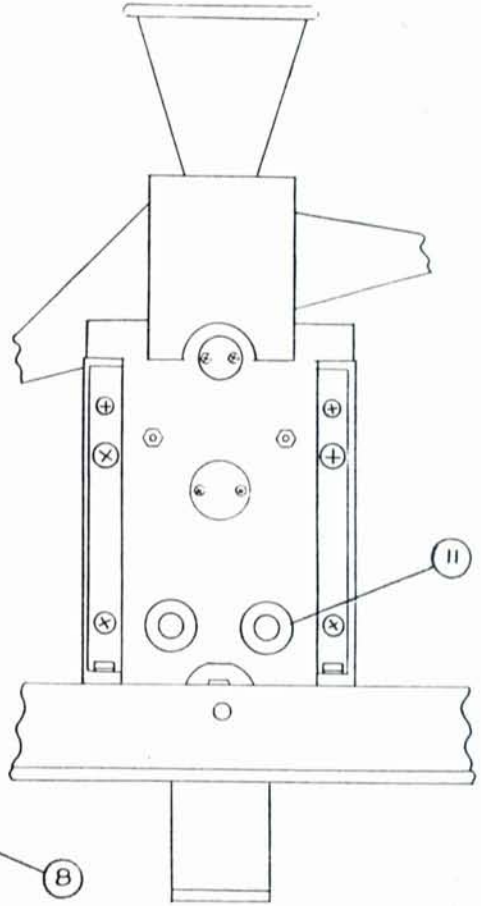
DO NOT SCALE DRAWING

NEXT ASSY.	REV.	DATE

SCALE	ENGR. APPV.	RELEASE DATE
HALF	RDH	8-9-78
DRAWN BY: RDH	MFG. APPV.	DOCUMENT NO. 6010-06-A SIZE
	MGT. APPV.	SHEET 1 OF 1







BACK VIEW

MOUNTING HOLES (3 EACH)
0.313" DIA., 120° APART
ON 3.4" RADIUS

REV	ECN	DATED	QTY	NEXT ASM

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

MATL

FINISH

ENGR		DT
APPRO		DT

QUALIMETRICS, Inc.

WEATHERMEASURE / WEATHERTRONICS
Instruments and Systems Division
3213 Orange Grove Avenue
Sacramento California 95660 U.S.A.

NOMENCLATURE OUTLINE
TIPPING BUCKET RAIN GAGE

MOD. USAGE 6010 | SHEET 1 OF 1

BY GT | SCALE Ø | DWG NO. 6010-05 | C

DT 3-9-83

BILL OF MATERIALS

MODEL/PART NUMBER 6010

DESCRIPTION Tipping Bucket Rain Gage

DATE January 31, 1978

Item No.	Part No.	Suffix	Qty.	Unit	Description	Reference No.
1.	960001		1	ea	Outer Case	
2.	960002		1	ea	Large Collection Screen	
3.	960003		1	ea	Small Collection Screen	
4.	960004		1	ea	Funnel Assembly	
5.	960005		1	ea	Tipping Bucket Assembly	
6.	960006		2	ea	Outlet Orifice Assembly	
7.	960007		1	ea	Level	
8.	960008		2	ea	Bucket Stop Assembly	
9.	960009		3	ea	Mounting Foot	
10.	960010		1	ea	Momentary Closed Mercury Switch	
11.	960011		2	ea	Terminal Post	

				Rev.	Date
A	6010	01	MANUAL		
B	6010	03	ASSY. DWG.	A	12/80
C	6010	04	SCHEMATIC		
D					

Orig. WSH

Engr. WSH

Appv.

Doc. No. 6010 -02

Sheet 1 of 1

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