

## Standard Operating Instruction

Operation and management of verification instrumentation for wind, temp/humidity, rainfall and air pressure at weather offices

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## Standard Operating Instruction: Equipment Conformance

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### SECTION A - Preliminary Informative Elements

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### Document Control

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### Scope

This document has been drafted to instruct the meteorological technicians at weather offices to utilise the certification/verification instrumentation for wind, temperature humidity, air pressure, rainfall and voltage/resistance correctly. These instrumentations are supplied and annually certified/verified by Technical Service.

### Objectives & Purpose

#### Objectives

- Correctly verify RM Young model 05103 wind sensors at the weather office and in the field.
- Correctly verify Station Raingauge at the weather office and in the field utilising the Field Verification Unit
- Correctly verify AWS pressure sensors by utilising the Vaisala PA11 pressure sensor.
- Correctly verify AWS temp/humidity sensors by utilising the Vaisala HMI41 calibrator with HMP45 probe
- Correctly verify weather office multi meter

#### Purpose

- To ensure that the AWS sensors operates according to required standards.
- **NB.:** Should the readings of the instrument being tested be out of the specified range the instrument must be sent to Technical Services for verification and possible calibration by an accredited company.

### Support Information

#### Pre-Knowledge

- Basic electronics
- Basic hand skills
- Knowledge of the manual R.M. Young Meteorological Instruments Wind Sensor Calibration
- Knowledge of the manual HMI41 Indicator and probes Operating Manual
- Knowledge of the pressure sensor PA11 manual
- Knowledge of the manual Automatic Weather Station- Users Guide.
- Knowledge of the Hydrological Service tipping bucket rain gauge TB3 manual
- Knowledge of the Hydrological Service mini logger manual.

#### Equipment & Tools

Full electronics tool box

Automatic Weather Station - Users Guide.

Certified Vaisala HMI41 Indicators with HMP45 probe for travelling standard, and HMP48 probe for office standard. Done by Technical Service.

Externally calibrated Vaisala PA11 pressure sensor for the office standard and verified travelling standard. Done through Technical Service.

Model 18802/18811 selectable speed anemometer drive (RM Young)

RM Young anemometer torque disc

RM Young vane torque gauge

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Previously certified RM Young model 05103 wind monitors  
Weather office laptop computer  
Hydrological Service field calibration kit and mini data logger

### Warnings & Precautions

Protocols

## Terms and Definitions

Weather Station – means

- Rainfall station
- AWS Stations
- Weather Offices
- ARS station

## Symbols and Abbreviations

<b>AWS</b>	Automatic Weather Station
<b>ARS</b>	Automatic Rain Station
<b>MetCap</b>	Meteorological Data Capturing System
<b>SA</b>	South Africa
<b>WO</b>	Weather Office
<b>WMO</b>	World Meteorological Organisation
<b>TS</b>	Technical Service

## Assumptions

That the person doing the verification of the aforementioned instrumentation has been trained in their operation, understands the function of the different sensors, and the operation of the verification instrumentation.

## Normative References, Standards and Related Documents

**WMO Regulation – CIMO IX**

## Maintenance Authority

Document Content

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- The content of this document shall be maintained by the Training Technician: Electronic Maintenance and Support

### Document Structure

The structure of this document shall be maintained by the Management Quality Representative

### SECTION B - Normative Elements



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### PROCEDURE SHEET FOR ANNUAL VERIFICATION OF RM YOUNG 05103 WIND SENSOR (MONITOR)

Step No.	Details of Procedure Step	Supporting Document/s
1.	<p><b>PROCEDURES AT THE WEATHER OFFICE (ANNUALLY FOR EACH AWS)</b></p> <ol style="list-style-type: none"> <li>1. Make sure that the certified RM Young wind sensor/monitor received from Technical Service is in a good physical condition.</li> <li>2. This must be done at the office, on a level flat area</li> <li>3. All results are to be recorded on form NTL-WIND-CFRM-001.2.</li> <li>4. This step is to verify that the vertical shaft bearings are in good condition. Install the RM Young vane torque gauge at the top of the RM Young wind sensor/monitor with target directly over the bearing centre line. Pull the string attached to the leaf spring steadily. It should start moving at around 30 gm-cm if not the vertical shaft bearings are faulty. Remove the vane torque gauge from the monitor.</li> <li>5. This step is to verify that the flange bearings are still in good condition. Attach the RM Young anemometer torque disc to the monitor front end. Move the side with screws to the top and let it fall anti-clockwise. The side must fall and be in line with the shaft. Repeat the step again with the side falling clockwise. If it does not lie in line with the shaft during any of the steps; the flange bearing are faulty. Remove the vane gauge disk from the monitor.</li> <li>6. Connect the wind monitor wires to the logger appropriately.</li> <li>7. Install the selectable speed anemometer drive to the wind monitor.</li> <li>8. The wind speed values must be checked on the CR10 keypad/laptop and must be accurate according to values supplied by TS.</li> <li>9. Set the drive to 1000 – Speed must be between 4,8 to 5,1m/s</li> <li>10. Set the drive to 2000 – Speed must be between 9,7 and 10,0m/s</li> <li>11. Set the drive to 3000 – Speed must be between 14,6 and 15,0m/s</li> <li>12. Remove the selectable speed anemometer drive from the monitor.</li> <li>13. Put the wind monitor on a flat surface</li> <li>14. Move the monitor to face south (directly in line to the arrow on the wire junction box on sensor) – Wind direction readings should be 180 degrees.</li> <li>15. Move the monitor to face east– Wind direction readings should be 90 degrees</li> <li>16. Move the monitor to face north – Wind direction readings should be 0 or 360 degrees</li> <li>17. Move the monitor to face west – Wind direction readings should be 270 degrees.</li> <li>18. Remove the monitor from the logger.</li> <li>19. Clean the sensor.</li> <li>20. If the monitor/wind sensor passes the verification it must be used for the next verification at a following else it must sent to TS.</li> </ol>	<p><b>Manual RM Young wind monitor Model 05103</b></p> <p><b>MODEL 18860-90 Manual Wind System calibration RM Young</b></p> <p><b>Form NTL-WIND-CFRM-001.2</b></p>

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	21. Complete the record and send to Observations and keep one in your calibrators certificates file.	
2.	<p><b>PROCEDURES TO BE FOLLOWED AT THE AWS</b></p> <ol style="list-style-type: none"> <li>1. Drop the mast and replace the station wind sensor with the one certified and tested at the office.</li> <li>2. Connect the sensor wiring appropriately on the system.</li> <li>3. Now turn the wind sensor to 180 degrees (directly showing to the arrow on the wire junction box on sensor) check with keypad. Turn the opposite 360 degrees, then 90 and 270 degrees, checking with keypad at mode 6 line 13. Tolerance to be 3 degrees</li> <li>4. Turn the propeller, and check if there is a wind speed at mode 6 line 14.</li> <li>5. If satisfied erect the mast again.</li> <li>6. Verify the visual wind observations with the logger readings.</li> </ol>	<p><b>Manual Automatic Weather Station- Users Guide.</b></p> <p><b>Manual RM Young wind monitor Model 05103</b></p> <p><b>AWS quick reference guide</b></p>
3.	<p><b>PROCEDURES TO BE FOLLOWED AFTER RETURNING FROM THE AWS (AT THE WEATHER OFFICE)</b></p> <ol style="list-style-type: none"> <li>1. Repeat Step 1</li> </ol>	<p><b>Manual RM Young wind monitor Model 05103</b></p>

**End of annual wind verification procedure**

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### PROCEDURE SHEET FOR ANNUAL VERIFICATION OF THE HYDROLOGICAL SERVICE AND OGAWA SEIKI TIPPING BUCKET RAIN GAUGES

Step No.	Details of Procedure Step	Supporting Document/s
1.	<p><b>Connecting the Logger to the Laptop (to be done during each session)</b></p> <ol style="list-style-type: none"> <li>Go to Start Menu then press Devices and Printers</li> <li>Connect the USB to serial connector to the laptop and logger</li> <li>On the Device and Printers window right click on the USB icon</li> <li>Press hardware and click properties</li> <li>Note which Comm port is assigned to the cable</li> </ol>	NONE
2.	<p><b>PROCEDURES AT THE WEATHER OFFICE INITIALLY:</b></p> <ol style="list-style-type: none"> <li>Install the software called <b>WINCOMLOG ADVANCED VER 4.03</b> on the office laptop using the CD/DVD provided. The initial factory password is <b>BOMM</b>. To bypass the password requirement Type <b>passwd=BOMM the passwd=****</b></li> <li>The following is of high importance when utilizing the software program. To change time. Time is for example <b>t=12:00:00</b>. To change date. Date is for example <b>d= 18/12/14</b></li> </ol>	<p><b>Instruction manual – Minilog Digital Data Logger Model ML1-FL.</b></p> <p><b>FCD-Instruction Manual FCD-653 100MM/HR IN 200MM FUNNEL</b></p>
3.	<p><b>PROCEDURES TO BE FOLLOWED PRE-VERIFICATION AT THE SITE/OFFICE</b></p> <ol style="list-style-type: none"> <li>Connect the logger to the laptop using the USB to serial connector</li> <li>Open <b>WinComLog</b> terminal emulation program</li> <li>For communication: Confirm the COMM port, baud rate 9600, and 8/N/1 (bits/parity/stop), handshake off, and "local echo on".</li> <li>Type CLR the logger captured data</li> <li>Type ST to confirm configurations and the status of the logger</li> <li>Type SI (Site Information) which is a user definable 16 character string that allows each logger to have a unique location name.</li> <li>Type SI=(site name)</li> <li>Type T to check time and T=hh:mm:ss to change time if required</li> <li>Type D to check date and D=dd/mm/yyyy to change date if required</li> </ol>	
4.	<p><b>PROCEDURES TO BE FOLLOWED DURING VERIFICATION AT THE SITE (1)</b></p> <ol style="list-style-type: none"> <li>Open rainfall knife switches 2 and 16 on the junction box (AWS)</li> <li>Disconnect the rain connectors from the board (ARS)</li> <li>Open funnel and disconnect the two wires on the reed switch connector</li> <li>Dismantle and clean the following: Catch filter, Syphon, Interior of bucket, enclosure locking screws - lightly lubricate after cleaning, and all insect screens</li> <li>Ensure Rain Gauge is level using the bubble level fitted to the base.</li> <li>Connect the two rain logger wires on the reed switch connectors</li> <li>Place the logger inside the funnel.</li> <li>Close the funnel</li> <li>Follow procedures A to F as depicted on the verification unit</li> </ol>	

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	drawing FCD SHT303	
5.	<p><b>PROCEDURES TO BE FOLLOWED DURING THE FIRST VERIFICATION AT THE SITE (2)</b></p> <ol style="list-style-type: none"> <li>1. Open the funnel and disconnect the logger from the reed switches connectors</li> <li>2. Connect the logger to the laptop using the USB to serial connector</li> <li>3. Open WinComLog terminal emulation program</li> <li>4. Confirm the COMM port, baud rate 9600, and 8/N/1 (bits/parity/stop), handshake off, and "local echo on".</li> <li>5. Press <b>Start Capture</b> button and create a file in a known location on your computer</li> <li>6. Select <b>RA, CSV1 or CSV2</b></li> <li>7. Type DUR to dump the logged data</li> <li>8. Wait until the scrolling stops</li> <li>9. Press <b>Stop Capture</b> button for logged data to save the data on the created file.</li> <li>10. Type ST to check status and rain logged.</li> <li>11. Print the file contents and attach to the Raingauge Conformance record</li> </ol>	
6	<p><b>COMPLETE THE RAINGAUGE CONFORMANCE FORM</b></p> <ol style="list-style-type: none"> <li>1. Attach the file as evidence and send to Observations and keep one in your calibrators certificates file.</li> </ol>	NTL-RAIN-CFRM-001.1
7.	<p><b>PROCEDURES TO BE FOLLOWED FOR SECOND VERIFICATION AT THE SAME SITE</b></p> <ol style="list-style-type: none"> <li>1. Connect the logger to the laptop using the USB to serial connector</li> <li>2. Open <b>WinComLog</b> terminal emulation program</li> <li>3. For communication: Confirm the COMM port, baud rate 9600, and 8/N/1 (bits/parity/stop), handshake off, and "local echo on".</li> <li>4. Type CLR to clear the logger captured data.</li> <li>5. Type ST to confirm configurations and the status of the logger (Total Rain must be =0)</li> <li>6. Type SI (Site Information) which is a user definable 16 character string that allows each logger to have a unique location name.</li> <li>7. Type SI=(site name) <b>give it a different name</b></li> <li>8. <b>Follow Steps 4.6 to 6</b></li> </ol>	
8.	<p><b>PROCEDURES TO BE FOLLOWED DURING TO CONCLUDE THE VERIFICATION</b></p> <ol style="list-style-type: none"> <li>1. Remove the logger from the funnel (cover one (1) logger wire with insulation tape so that they don't touch each other.</li> <li>2. Connect the raingauge power wires back to the reed switches connectors.</li> </ol>	

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	<ol style="list-style-type: none"> <li>3. Connect these wire back to the board (ARS)</li> <li>4. Connect these wires back to the raingauge connectors in the junction box (AWS).</li> <li>5. Check if there is 5Vdc available on the raingauge reed switches connectors.</li> <li>6. Confirm if the bridge between the reed switches connectors is still intact.</li> <li>7. Close the raingauge.</li> <li>8. Return all verification equipment in their respective travel enclosures.</li> </ol>	
<p><b><i>End of annual raingauge verification procedure</i></b></p>		

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### PROCEDURE SHEET FOR ANNUAL CONFORMANCE TESTING OF THE VAISALA PA11 PRESSURE SENSOR WHICH IS OUT OF CALIBRATION PERIOD CURRENTLY (ANNUAL)

**NB. THE PA11 WHICH IS PRESENTLY OUT OF CALIBRATION SHOULD HAVE BEEN USED AS THE OFFICE STANDARD AND CALIBRATED THE YEAR BEFORE. NOW THIS WILL BE USED AS TRAVELLING STANDARD.**

**NB. THE PA11 WHICH IS PRESENTLY IN CALIBRATION SHOULD HAVE BEEN USED AS THE TRAVELLING STANDARD BEFORE AND IS PRESENTLY COMING BACK FROM CALIBRATION (TS). NOW THIS WILL BE USED AS OFFICE STANDARD.**

Step No.	Details of Procedure Step	Supporting Document/s
1	<p><b>PROCEDURES TO BE FOLLOWED ANNUALLY</b></p> <ol style="list-style-type: none"> <li>Switch on the PA11 barometer that is currently out of calibration. Switch on the recently calibrated PA11 and place them next to each other on a level surface at the same height in the office. It must not be in a doorway where the airflow can influence the readings.</li> <li>Wait for ten minutes for them to stabilise, and then take 4 readings at 5 minutes interval as per instruction in the conformance form for pressure, supplied.</li> <li>If the readings of the two instruments must be within a tolerance of <math>\leq 0,2</math> hPa.</li> <li>If not, contact Technical Service Irene to confirm that the instrument needs to be sent to Irene for verification.</li> <li>Remember to identify them correctly. The newly calibrated (previously travelling) as office standard and one calibrated (previous year previously office) as travelling.</li> <li>Complete the record <b>NTL-PRESS-CFRM-001.2</b> and send to Observations and keep one in your calibrators certificates file.</li> </ol>	<p><b>Manual Automatic Weather Station- Users Guide.</b></p> <p><b>Manual Vaisala PA11 pressure sensor</b></p> <p><b>NTL-PRESS-CFRM-001.2</b></p>

***End Of Annual Pressure Conformance Procedure***

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### PROCEDURE SHEET FOR VERIFYING BOTH THE TRAVELLING AND OFFICE MULTIMETERS (ANNUALLY) WITH THE BENCH MULTIMETER

Step No.	Details of Procedure Step	Supporting Document/s
1.	<p>PROCEDURES AT THE WEATHER OFFICE: ANNUALLY</p> <ol style="list-style-type: none"> <li>1. Use the externally calibrated multimeter to verify the travel or office standard multimeter.</li> <li>2. Get a known power source and verify the voltage with a calibrated standard. Get the highest and lowest available Voltage. (230Vac, 12Vdc and 5Vdc)</li> <li>3. Verify the source with the travel/office standard (tolerance 0,5 voltage).</li> <li>4. Get a known resistance source (different known resistors) and verify with the calibrated standard.</li> <li>5. Verify with the travel/office standards (tolerance 3%).</li> <li>6. Complete the relevant forms NTL-MULT-CFRM-001.1 and send to Observations and keep one in your calibrators certificates file.</li> </ol>	NTL-MULT-CFRM-001.1
<b>End Of Annual Multimeter Conformance Procedure</b>		

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### PROCEDURE SHEET FOR PRESSURE SENSOR QUARTERLY VERIFICATION AT THE OFFICE AND SITES

Step No.	Details of Procedure Step	Supporting Document/s
1.	<p><b>PROCEDURES AT THE WEATHER OFFICE: PRE-INSPECTION</b></p> <p><b>THIS MUST BE DONE IN CONJUNCTION WITH RECORD (NTL-AWS-INSPFRM-001.3)</b></p> <ol style="list-style-type: none"> <li>1. Before leaving the weather office; the travelling standard PA11 must be verified against the office standard. The office standard must stay in the office, and not utilised in the field</li> <li>2. The pressure standards must be in a well ventilated room without air conditioning, and must be switched on for at least 20 minutes before a reading is taken.</li> <li>3. Take both readings at five (5) minutes intervals.</li> <li>4. Difference between two sensors not to be more than 0.3Hpa.</li> </ol>	<p><b>Automatic Weather Station-Users Guide.</b></p> <p><b>Manual Vaisala PA11 pressure sensor</b></p> <p><b>NTL-AWS-INSPFRM-001.3</b></p>
2.	<p><b>PROCEDURES TO BE FOLLOWED AT THE AWS</b></p> <ol style="list-style-type: none"> <li>1. Place the PA11 next to the control box (same height)</li> <li>2. The PA11 must be switched on for at least 20 minutes before a reading is taken. The outlet pipes of the sensors must be kept away from strong wind blowing into it as much as possible.</li> <li>3. Take pressure loggers and PA11 readings simultaneously at five (5) minutes intervals.</li> </ol>	<p><b>Manual Vaisala PA11 pressure sensor</b></p>
3.	<p><b>PROCEDURES TO BE FOLLOWED AFTER RETURNING FROM THE AWS (AT THE WEATHER OFFICE): POST- INSPECTION</b></p> <ol style="list-style-type: none"> <li>1. The travelling standard PA11 must be compared to the office standard after returning from the field.</li> <li>2. Repeat Step 1</li> </ol>	<p><b>Manual Vaisala PA11 pressure sensor</b></p>
<b>End Of Quarterly Pressure Verification Procedure</b>		



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### PROCEDURE SHEET FOR THE TEMPERATURE AND HUMIDITY QUARTERLEY VERIFICATION AT THE OFFICE AND SITES

Step No.	Details of Procedure Step	Supporting Document/s
1.	<p><b>PROCEDURES AT THE WEATHER OFFICE; PRE-INSPECTION THIS MUST BE DONE IN CONJUNCTION WITH RECORD (NTL-AWS-INSPFRM-001.3)</b></p> <ol style="list-style-type: none"> <li>1. Install both the office standard and travelling standard of the Vaisala HMI41 temperature/humidity probes into beehive screens supplied for comparison before leaving for AWS's.</li> <li>2. The instrument with the HMP45 probe is the travelling standard and the one with the HMP46 probe is the office standard.</li> <li>3. This must be done outside at AWS mast where there is free airflow.</li> <li>4. The instruments must be left for twenty minutes to stabilise.</li> <li>5. Take both readings and standards readings simultaneously in 5-minutes intervals.</li> <li>6. The difference for temperature must be within 0,3 degrees C and for humidity within 3 percent RH.</li> </ol>	<p><b>Automatic Weather Station-Users Guide.</b></p> <p><b>Manual Vaisala HMI41 temperature calibrator</b></p>
2.	<p><b>PROCEDURES TO BE FOLLOWED AT THE AWS</b></p> <ol style="list-style-type: none"> <li>1. The probe of the Vaisala HMI41 calibrator must always be in a radiation shield when performing the verification.</li> <li>2. This must be done outside at AWS mast where there is free airflow.</li> <li>3. The instruments must be left for twenty minutes to stabilise.</li> <li>4. Take logger and travelling standards readings simultaneously in 5-minutes intervals.</li> <li>5. The difference for temperature must be within 0,3 degrees C and for humidity within 3 percent RH</li> </ol>	<p><b>Manual Vaisala HMI41 temperature calibrator</b></p> <p><b>Automatic Weather Station-Users Guide.</b></p>
3.	<p><b>PROCEDURES TO BE FOLLOWED AFTER RETURNING FROM THE AWS (AT THE WEATHER OFFICE)</b></p> <ol style="list-style-type: none"> <li>1. Repeat Step 1</li> </ol>	<p><b>Manual Vaisala HMI41 temperature calibrator</b></p>
<b>End Of Quarterly Temperature and Humidity Verification Procedure</b>		

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### PROCEDURE SHEET FOR QUARTERLEY VERIFICATION OF THE MULTIMETERS AT OFFICES AND SITES

Step No.	Details of Procedure Step	Supporting Document/s
1.	<p><b>PROCEDURES AT THE WEATHER OFFICE: PRE-INSPECTION</b></p> <ol style="list-style-type: none"> <li>1. Before leaving the weather office; the travelling standard multimeter must be verified against the office standard. The office standard must stay in the office, and not utilised in the field</li> <li>2. Known power sources must then be used to verify the travelling standard against the office standard.(either 12VDC, 13.6VDC and 220VAC)</li> <li>3. Known resistance sources must then be used to verify the travelling standard against the office standard.</li> </ol>	<p><b>Automatic Weather Station-Users Guide.</b></p> <p><b>Manual Vaisala PA11 pressure sensor</b></p>
2.	<p><b>PROCEDURES TO BE FOLLOWED AT THE AWS</b></p> <ol style="list-style-type: none"> <li>1. The verified travelling standard is then used for measurements.</li> </ol>	<p><b>Manual Vaisala PA11 pressure sensor</b></p>
3.	<p><b>PROCEDURES TO BE FOLLOWED AFTER RETURNING FROM THE AWS (AT THE WEATHER OFFICE): POST- INSPECTION</b></p> <ol style="list-style-type: none"> <li>1. Repeat Step 1</li> </ol>	<p><b>Manual Vaisala PA11 pressure sensor</b></p>

### SECTION C - Supplementary Informative Elements

#### 3.0 References

- Knowledge of the manual R.M. Young Meteorological Instruments Wind Sensor Calibration

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- Knowledge of the manual HMI41 Indicator and probes Operating Manual
- Knowledge of the pressure sensor PA11 manual
- Knowledge of the manual Automatic Weather Station- Users Guide.

### 14.0 Annexure

None

*End of Document*