## PRODUCT OVERVIEW

### THERMOMETERS

- **Wet Bulb Range**: N/A
- **Humidity Range**: N/A
- **Temperature Range**: ±0.5°F (±0.28°C)
- **Volume Flow**: Supply: ±3% of reading ±10 CFM

### AIR FLOW HOODS

- **Air Volume Range**: ±2% RH
- **Temperature Accuracy**: ±1°F (±0.6°C)
- **Air Velocity Accuracy**: ±3% of reading ±20 FPM

### PRESSURE MANOMETERS

- **K-Factor**: N/A
- **Humidity Range**: 0 to 99.9% RH
- **Air Velocity Range**: 5/16˝ (8 mm) [standard] or 7/16˝ (11 mm)

### PITOT TUBES

- **Volume Flow**: Exhaust: ±3% of reading ±10 CFM
- **Temperature Range**: 50 to 5000 FPM
- **Air Velocity Range**: 40 to 5000 FPM
- **Surface speed**: 0.05 to 19,999 RPM

### THERMO-ANEMOMETERS

- **Humidity Range**: 0 to 100% RH
- **Air Velocity Range**: 25 to 350 in w.c.
- **Flow Rate**: 2 to 350 in w.c.
Air Balancing Test Instrument Kits

Air Balancing HVAC Systems

Use of air balancing in HVAC systems improves system efficiency and comfort for building occupants. Air balancing ensures that the quantity of air delivered to the room is correct, which is essential for maintaining acceptable indoor air quality.

The Predictive Balancing method uses PredictAir software to calculate the optimal flow set point for each terminal. This method is more efficient than traditional proportional balancing and provides a more even air flow that minimizes backpressure.

SMART Air Hood Balancing Instrument

The SMART Air Hood Balancing Instrument includes PredictAir software, which reduces the number of steps in the air flow balancing process using Predictive Balancing’s Express Balance mode. This method predicts the optimal flow setting for each terminal, enabling accurate readings and reducing the time required for balancing.

Air Quality Test Instrument Kits

The SMART Air Hood Balancing Instrument is a versatile, hand-held, battery-operated manometer available in several models. It is ASME design compliant and meets AMCA and ASHRAE codes. The kit also includes a field-adjustable damping damper load and a rugged carrying case to prevent damage during transport.

New features added to the Series 490A are a field-adjustable damping damper load and a rugged carrying case to prevent damage during transport. Each kit comes with the SMART Air Hood Balancing Instrument, Application Software, and travel case.
AIR BALANCING HVAC SYSTEMS

METHODS OF AIR BALANCING

There are several methods of air balancing. The two most common are proportional and predictive balancing. For systems with terminal damper closures, sequential balancing can also be used. The method chosen depends on the system configuration and the available diagnostics tools.

PROPORTIONAL BALANCING

In proportional balancing, the technician balances the system by adjusting the individual terminal dampers to achieve the correct system air flow. This method is used for systems with fixed terminal damper closures.

PREDICTIVE BALANCING

Predictive balancing is used for systems with variable terminal damper closures. This method allows the technician to balance the system by adjusting the blower/fan speed and the terminal damper closures.

SEQUENTIAL BALANCING

Sequential balancing is used for systems with terminal damper closures that can be adjusted. This method involves setting the zone damper closures to a fixed position and adjusting the terminal damper closures to achieve the correct system air flow.

AIR BALANCING TEST INSTRUMENT KITS

The 477AV line of digital manometers can be combined with a traditional or wired test instrument platforms into an all-in-one balancing solution. For lower air velocities, our Model AP1 hot wire thermo-anemometer probe or Mobile Gateway can be used.

SMALL AIR HOOD™ BALANCING INSTRUMENT

The SAH™ Smart Air Hood™ technology allows the technician to remotely balance the system by setting the optimal flow set point for each sequential terminal. With the PredictAir™ application software, the balancing process takes much less time and effort.

AIR QUALITY TEST INSTRUMENT KITS

The AQTIA KITS provide a mobile gateway in hard carrying case with NIST certificate.
Air quality test instrument kit with UHH2 base.

**FEATURES/BENEFITS**

- Rugged, extruded aluminum housing protects the device from damage.
- Rugged IP68 weather-proof housing withstands 1.5 meter drop test.
- High resolution 0.5% accuracy.
- Automatic resolution adjustment for finer control.
- Stores up to 40 readings for later recall.
- Seven user-selectable English and metric units.
- Up to 0.5% accuracy.
- ASME design meets AMCA and ASHRAE codes.
- Protective carrying case prevents damage during transport.
- Positive indication for easy readout.
- High volume acoustical design meets ANSI S12.1 standards.
- 304SS differential pressure sensors.
- Limit switches for high and low pressure.
- 100 psi pressure range.
- 0.01 psi resolution.
- 10-point calibration curve.
- Full range of 0-200 psi.
- Manual zero and span adjustment.
- Integral 3 way manifold valve and complete hose kit in a hard carrying case.

**APPLICATION SOFTWARE**

- Enables remote display, data capture, and data storage.
- Stores and displays air flow, pressure, and temperature readings.
- Adjusts flow and pressure in real-time.
- Stores up to 40 readings for later recall.
- Seven user-selectable English and metric units.
- Up to 0.5% accuracy.

**POPULAR MODELS**

- **A-SA-12** 2-way manifold (0-5000 psi)
- **A-SA-24S** 2-way manifold (0-200 psi)
- **A-SA-48** 4-way manifold (0-200 psi)
- **A-SA-120** 12-way manifold (0-200 psi)
- **A-SA-24S** 2-way manifold (0-200 psi)
- **A-SA-48** 4-way manifold (0-200 psi)
- **A-SA-120** 12-way manifold (0-200 psi)
- **A-SA-24S** 2-way manifold (0-200 psi)
- **A-SA-48** 4-way manifold (0-200 psi)
- **A-SA-120** 12-way manifold (0-200 psi)

**AIR QUALITY TEST INSTRUMENT KITS**

- **AIR QUALITY**
  - **SMART Air Hood**: The most popular test instrument used to take air flow readings. Traverse air balancing is called proportional balancing.
  - **Application Software**: Balancing Instrument and guides balancers through the balancing process using Predictive Balancing. Predictive Balancing is designed to be a faster and easier method of taking accurate air flow measurements.

**SMART AIR HOOD™ BALANCING INSTRUMENT**

- **DESCRIPTION**: The SMART Air Hood is a high-technology, easy to operate air flow hood on the market. By using the SMART Air Hood and the Application Software, the balancing process takes much less time than traditional air balancing methods.

- **APPLICATION SOFTWARE**: The Application Software displays flow measurements from the terminal being balanced, as well as all other terminals in the system. It can also be used to display pressure, temperature, and humidity readings.

- **AIR BALANCING**
  - **PROPORTIONAL BALANCING**: Proportional balancing is a method of predicting the optimal flow set point for each terminal in the system. It is used to achieve a balanced system where all terminals are delivering the design flow.

- **AIR BALANCING HVAC SYSTEMS**
  - **METHODS OF AIR BALANCING**
    - **Partial Terminal Balancing**: This method involves balancing only a portion of the system, such as a zone or a room. It is used when the system is too large to balance as a whole.
    - **Whole System Balancing**: This method involves balancing the entire system at once. It is used when all of the system components are available.

- **AIR QUALITY TEST INSTRUMENT KITS**
  - **AIR QUALITY**
    - **SMART Air Hood**: The SMART Air Hood is a high-technology, easy to operate air flow hood on the market. By using the SMART Air Hood and the Application Software, the balancing process takes much less time than traditional air balancing methods.
Air balancing a distribution system is needed to properly direct the air flow through a building's HVAC system. This process ensures that each terminal receives the appropriate amount of air, which is crucial for maintaining comfortable indoor conditions and ensuring efficient operation of the system.

### Methods of Air Balancing

There are several methods for air balancing, each with its own benefits and drawbacks. The two most common methods are sequential balancing and proportional balancing.

**Sequential Balancing**
- Involves setting the zone damper on each terminal to the same percentage of the full open position.
- The terminal flows are determined by the terminal and zone dampers, and the controller, if available, should provide a display of the terminal flows.
- This method is straightforward but may not be as accurate as proportional balancing.

**Proportional Balancing**
- Requires calculating the ideal flow set point for each terminal based on the terminal's design flow percent.
- The terminal flows are determined by the terminal and zone dampers, and the controller, if available, should provide a display of the terminal flows.
- This method is more complex but can provide more accurate results than sequential balancing.

### Predictive Balancing

Predictive balancing is a more advanced method that uses mathematical calculations to predict the ideal set point for each terminal. This method can save time and effort compared to traditional balancing methods.

**Predictive Balancing Process**

1. **Terminal 2 is the first damper adjusted in the system, and Terminal 1 is the key.** Predictive Balancing calculates the ideal flow set point for Terminal 2 and predicts flows for Terminals 1, 3, and 4.
2. **Terminal 3 is the next terminal adjusted.** The key terminal's flow changes when the TUA damper is adjusted down to 525 CFM, delivering 95% of the design flow. This will meet the design requirements.
3. **Terminal 4 is the last terminal adjusted.** The terminal under-adjustment (TUA) to the key to gain the correct flow can be measured using the Model RP1 thermo-hygrometer probe. Our Series AP1 hot wire thermo-anemometer probe or Series VP1 universal base unit, vane thermo-anemometer probe, hot-wire thermo-anemometer probe, and calibrated pressure module can tolerate most liquid media compatible with 304 SS.

### Predictive Balancing Example

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Design Flow Percent</th>
<th>Actual Flow Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal 1</td>
<td>60%</td>
<td>62%</td>
</tr>
<tr>
<td>Terminal 2</td>
<td>57%</td>
<td>59%</td>
</tr>
<tr>
<td>Terminal 3</td>
<td>54%</td>
<td>56%</td>
</tr>
<tr>
<td>Terminal 4</td>
<td>51%</td>
<td>53%</td>
</tr>
</tbody>
</table>

### SMART Air Hood Balancing Instrument

The SMART Air Hood balancing instrument is designed to make balancing a distribution system easier and more efficient. It uses Predictive Balancing to calculate the ideal set point for each terminal and predicts flows for all terminals.

**PredictAir**
- Determines terminal flows for Terminals 1, 2, and 4.
- Calculates the ideal set point for Terminal 3 and predicts the new flows.
- The SMART Air Hood can accept connections from the terminal to the handheld test instrument.

**Predictive Balancing**
- Calculates the ideal flow set point for Terminal 2 and predicts flows for Terminals 1, 3, and 4.
- The SMART Air Hood can accept connections from the terminal to the handheld test instrument.

### Predictive Balancing Benefits

- Faster balancing process compared to traditional proportional balancing.
- More accurate results than traditional proportional balancing.
- Can use PredictAir to determine terminal flows for Terminals 1, 2, and 4.

### Predictive Balancing Drawbacks

- Requires advanced mathematical calculations.
- May not be accessible to all balancing technicians.

### Predictive Balancing Conclusion

Predictive balancing is a powerful tool for balancing a distribution system. It can save time and effort compared to traditional methods and can provide more accurate results. However, it requires advanced mathematical calculations and may not be accessible to all balancing technicians.
### HVAC TEST & BALANCING EQUIPMENT

#### OVERVIEW

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temperature</strong></td>
<td>Type J, K, T thermocouples</td>
</tr>
<tr>
<td><strong>Air Flow</strong></td>
<td>DC Voltage: 0.1 mV to 600 V</td>
</tr>
<tr>
<td><strong>Humidity</strong></td>
<td>AC Current: 0.1 uA to 10 A</td>
</tr>
<tr>
<td><strong>Gas Sensing</strong></td>
<td>AC Voltage: 0.1 mV to 600 V</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>DC Current: 10 mA to 400 A</td>
</tr>
<tr>
<td><strong>Combustion</strong></td>
<td>Resistance: 0.1 to 40 MΩ</td>
</tr>
<tr>
<td><strong>Sound</strong></td>
<td>Resistance: 0.1 to 2000 MΩ</td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td>Resistance: 0.1 V to 600 V</td>
</tr>
<tr>
<td><strong>Rotation</strong></td>
<td>Resistance: 0.1 to 40 MΩ</td>
</tr>
</tbody>
</table>

#### Accessories

- **Pipe Size**: 3 to 20˝ (0.75 to 50 cm)
- **Measuring Distance**: 2 to 20˝ (5 to 50 cm)
- **Combustible Gases**: 2 to 350 in w.c.
- **Non-corrosive Dry Gases**: 1 in w.c. to 150 psi

#### Pressure

- **Accuracy**: ± (1.0% + 3 digits)
- **Gauge Range**: 0.1 mV to 750 V
- **Input**: 0.1 V to 600 V ± (1.0% + 3 digits)
- **Protection**: 600 Vrms
- **Service**: Non-corrosive dry gases

#### DC Voltage

- **Accuracy**: ± (1.5% + 5 digits)
- **Gauge Range**: 0.1 mV to 750 V
- **Input**: 0.1 mV to 600 V ± (1.0% + 3 digits)
- **Protection**: 600 Vrms
- **Service**: Combustible gases

#### AC Voltage

- **Accuracy**: ± (1.5% + 5 digits)
- **Gauge Range**: 0.1 mV to 750 V
- **Input**: 0.1 mV to 600 V ± (1.0% + 3 digits)
- **Protection**: 600 Vrms
- **Service**: Non-corrosive dry gases

#### DC Current

- **Accuracy**: ± (2.0% + 10 digits)
- **Gauge Range**: 0.1 A to 400 A
- **Input**: 0.1 mA to 400 A ± (1.0% + 3 digits)
- **Protection**: 600 Vrms
- **Service**: Combustible gases

#### AC Current

- **Accuracy**: ± (2.0% + 10 digits)
- **Gauge Range**: 0.1 A to 400 A
- **Input**: 0.1 mA to 400 A ± (1.0% + 3 digits)
- **Protection**: 600 Vrms
- **Service**: Non-corrosive dry gases

#### Resistance

- **Accuracy**: ± (1.0% + 3 digits)
- **Gauge Range**: 0.1 to 40 MΩ
- **Input**: 0.1 to 2000 MΩ ± (1.0% + 3 digits)
- **Protection**: 600 Vrms
- **Service**: Combustible gases

#### MULTIMETERS

- **Accuracy**: ± (2.0% + 10 digits)
- **Gauge Range**: 0.1 A to 400 A
- **Input**: 0.1 mA to 400 A ± (1.0% + 3 digits)
- **Protection**: 600 Vrms
- **Service**: Non-corrosive dry gases

#### THERMOMETERS

- **Accuracy**: ± (0.8% + 2 digits)
- **Gauge Range**: 0.1 V to 600 V
- **Input**: 0.1 V to 600 V ± (1.0% + 3 digits)
- **Protection**: 600 Vrms
- **Service**: Non-corrosive dry gases

#### PRESSURE MANSFOLDERS

- **Accuracy**: ± (0.8% + 2 digits)
- **Gauge Range**: 0.1 V to 600 V
- **Input**: 0.1 V to 600 V ± (1.0% + 3 digits)
- **Protection**: 600 Vrms
- **Service**: Non-corrosive dry gases

#### SERIES MM-1

- **Accuracy**: ± (0.05% + 1 digit)
- **Gauge Range**: 0.5 to 4.5˝ (13 to 115 mm)
- **Input**: 0.1 mV to 600 V
- **Protection**: 600 Vrms
- **Service**: Non-corrosive dry gases

#### SERIES MM-2

- **Accuracy**: ± (0.05% + 1 digit)
- **Gauge Range**: 0.5 to 4.5˝ (13 to 115 mm)
- **Input**: 0.1 mV to 600 V
- **Protection**: 600 Vrms
- **Service**: Non-corrosive dry gases

#### SERIES CM-2

- **Accuracy**: ± (0.05% + 1 digit)
- **Gauge Range**: 0.5 to 4.5˝ (13 to 115 mm)
- **Input**: 0.1 mV to 600 V
- **Protection**: 600 Vrms
- **Service**: Non-corrosive dry gases