Operators Manual for M.A.R.V.E.L.

Manual provides Installation, Operation, and Maintenance Instructions

Model: M.A.R.V.E.L.
(Model-based Automated Regulation of Ventilation Exhaust Levels)
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M.A.R.V.E.L. System Overview

General Description
Halton’s M.A.R.V.E.L. (Model based Automated Regulation of Ventilation Exhaust Levels) system offers a demand control ventilation (DCV) solution. M.A.R.V.E.L. builds upon the existing Halton product line, such as the Capture Jet™ technology, to deliver a product that reduces energy costs by scheduling and adjusting exhaust airflow based on hours of operation and appliance use.

Halton’s M.A.R.V.E.L. delivers:

- Hood exhaust airflow adjustment depending on cooking activities
- Control of common exhaust fan for minimum energy consumption at all times
- Automatic or on schedule start/ stops
- Automatic balancing dampers
- Direct appliance communication (where available)
- Early fire warning signals
- Internet monitoring and programming

M.A.R.V.E.L. Unique Design
Starting with the Halton extensive product line of commercial foodservice ventilation solutions, M.A.R.V.E.L. adds the following four unique components:

IRIS™ infrared temperature sensors: Used to measure the rate of change of the cooking surface temperature, the sensor acquires a “heat signature” of the equipment positioned below each sensor. The thermopile-based device is placed in the ball socket fixture in the Capture Jet™ plenum. An air jet exits the plenum around the sensor to protect the optic sensor from dirt and cooking debris. The sensor can be easily moved and re-aligned as needed using the provided Laser Alignment Tool.
MC8 Controller: The heart of the system, the controller features 22 inputs/outputs and is designed to collect real time information and to implement various automation control algorithms. The MC8 Controller responds to the infrared sensor(s) and duct temperature sensor to measure changes in cooking status.

Example:

Differential Pressure Transducer: Used in conjunction with the value from the temperature sensor and IR Index to measure and control the airflow thru each hood.

Temperature Sensor: Located in the hood collar, the temperature sensor is used in conjunction with the pressure transducer value and IR Index to control the airflow.
M.A.R.V.E.L. System Components

Overview

A key feature of the M.A.R.V.E.L. system is flexibility. It can be applied to a single hood – or over multiple hoods – depending on the requirements.

Figure 1: Single Hood M.A.R.V.E.L. Installation
Components

NOTE: Refer to Figure 1+2

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Description</th>
<th>Power + Connection Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR1, IR2, IR3, IR4</td>
<td>• Mount 1 to 4 IRIS™ sensors per hood depending on the length of the hood.</td>
<td>Power source: 5 volt DC power supply located behind a cover on the Capture Jet™ plenum.</td>
</tr>
<tr>
<td></td>
<td>• Calculates an index which averages the temperature radiation over the sensor’s field-of-view.</td>
<td>Connection: at terminal block located behind a cover on the Capture Jet™ plenum.</td>
</tr>
<tr>
<td></td>
<td>• Used to detect when one or more pieces of cooking equipment are turned on and it is necessary to start the hood fan in idle mode.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Used to measure a rapid change in temperature of cooking surfaces (for example, cooking activities) and adjust the air flow in the hood to the required level.</td>
<td></td>
</tr>
<tr>
<td>TS</td>
<td>• Measures the temperature of the exhaust air.</td>
<td>Connection: at terminal block located behind a cover on the Capture Jet™ plenum.</td>
</tr>
<tr>
<td></td>
<td>• Located in the hood collar.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Used (in conjunction with the IR Index) to detect the event of cooking equipment start-up.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Duct temperature is often a better indicator of start-up in the case of certain types of equipment such as a gas fryer.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Used to activate the early fire detection alarm, activated before the fire system is triggered.</td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td>Description</td>
<td>Power + Connection Details</td>
</tr>
<tr>
<td>----------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>PT</strong></td>
<td><strong>Hood plenum pressure sensor</strong></td>
<td><strong>Power source:</strong> 24 V DC power supply located behind a cover on the Capture Jet™ plenum. <strong>Connection:</strong> at terminal block located behind a cover on the Capture Jet™ plenum.</td>
</tr>
<tr>
<td><strong>ABD</strong></td>
<td><strong>Automatic balancing damper</strong></td>
<td><strong>Power source:</strong> 24 V AC transformer located behind a cover on the Capture Jet™ plenum <strong>Connection:</strong> at terminal block located behind a cover on the Capture Jet™ plenum</td>
</tr>
</tbody>
</table>
| **Alarm light status on a touch screen** | • Activated when any alarm condition is detected.  
• Common alarm conditions include: filter missing, filter clogged, fire suppression system activated, duct temperature dangerously high, sensor failed, or VFD is in fault.  
**NOTE:** To easily diagnose the alarm, use the remote Konsole™ Diagnostic Software. | - |
| **Override push button**   | • Used to override pre programmed operation, push button illuminated when activated.  
• Two modes:  
  1. Press and hold for 1 second to accelerate the exhaust rate to 100% of the design air flow for a pre programmed period of time (default 5 minutes.)  
  2. Press and hold for 3 seconds to accelerate the exhaust rate to 100% of the design air flow for a pre programmed period of time (default 1 hour.) Starts the hood if it has been overridden by a schedule or an ‘off’ state. | **Connection:** at terminal block located behind a cover on the Capture Jet™ plenum. |
| **Room temperature sensor** | • Mounted on a kitchen wall close to a thermostat.                          | **Connections:** to the control panel with 2 wires |
| **VFD**                    | **Variable Frequency Drive**                                                 | **Power source:** varies as per fan’s voltage requirement **Connection:** at terminal block in VFD control panel to main control panel **Speed reference:** 0-10 VDC |

**NOTE:** For multiple hood installations with a single exhaust fan only
• Adjusts air flow with motorized balancing dampers attached to a collar at each hood.  
• Damper controlled by a 0-10 V DC position reference signal generated by a controller.  
• Upon power failure, the automatic balancing damper fully opens.
### Equipment Description Power + Connection Details

| Control Panel | • Mounted on top of each hood with access from the bottom.
NOTE: For multiple units with a single fan, a separate control panel (see below) is also required.
• Provides permanent Ethernet connection (optional).
• Provides temporary Ethernet connection for service.
• Provides USB B Serial connection for on-site service. | **Power source:** 120 VAC, 5 amp. fuse, grounded |

### Central control panel (for multiple units with single fan)

| • Separate control panel mounted at a convenient location to link that individual control panels on the hoods with the VFD controller. | **Power source:** 120 VAC, 5 amp. fuse, grounded |

### Safety

Only authorized personnel should have access to the control panel.

In case of occurrence of any problem please call an authorized agency to help you.

### Warnings

To reduce risk of electric shock do not expose control panel to any water.

Disconnect the power from the mains before accessing the control panel.

To provide protection against electric shock connect to a properly grounded power supply.

Improper grounding can result in a risk of electric shock.

Consult a qualified electrician if the grounding instructions are not properly understood, or if any doubt exists as to whether the control panel is properly grounded.

Only authorized and qualified personnel should work on the control panel in event of a problem.
M.A.R.V.E.L. Sequence of Operations

Overview

A sequence of operations is a series of steps required to perform a given task. The DCV system uses the following sequence of operations to control the exhaust hood operation.

Sequence of Operations

Startup & Shutdown

<table>
<thead>
<tr>
<th>Operation Step</th>
<th>Details</th>
</tr>
</thead>
</table>
| **Startup**    | • Turns exhaust system on.  
• Can be started by:  
  • 24/7 pre-programmed schedule.  
  • The building management system or via an internet connection remotely.  
  • Using a locally mounted on/off switch.  
  • Reaching a pre-determined IR Index or duct temperature level.  
  • Pressing the override button.  
  • After startup, enters Idle mode. |
| **Shutdown**    | • Turns system off.  
• Can be shutdown by any of the parameters listed in the Startup step (above) except the override button. |
| **Idle Mode**   | • System starts up in Idle mode (after startup).  
• Pending until signs of cooking activity sensed from IRIS™ sensor(s).  
• Minimal exhaust flow captures any appliance-generated heat. Default is 40% of design air flow or as adjusted to meet requirements.  
• After idle mode, enters Active mode. |
| **Cooking Mode**| • System moves into cooking mode when an IRIS™ sensor detects cooking activities under the hood.  
• Exhaust fan speed increased to design air flow and balancing dampers (if present) adjusts the airflow in the hood to design level to assure sufficient capture and containment.  
• Air flow in the hood is maintained for a predetermined cooking time before returning to the Idle mode.  
**NOTE:** If during this time more cooking activities are detected, the cooking timer will be restarted. |
| **Override Mode**| • Used to override pre programmed operation.  
• Two modes:  
  1. Press and hold for 1 second to accelerate the exhaust rate to 100% of the design air flow for a pre programmed period of time (default 5 minutes).  
  2. Press and hold for 3 seconds to accelerate the exhaust rate to 100% of the design air flow for a pre programmed period of time (default 1 hour.) Starts the hood if it has been overridden by a schedule or an ‘off’ state. |
<table>
<thead>
<tr>
<th>Operation Step</th>
<th>Details</th>
</tr>
</thead>
</table>
| **Fire Mode**                        | • If a fire signal is detected in the kitchen, the system triggers a fire alarm and stops the make-up air fan.  
• The exhaust fan will either stop or continue running depending on the local fire code requirements.                                 |
| **Off Mode**                         | • Exhaust and make-up air fans stop when no appliances are operating (e.g., turned off and cooled down).                                                                                                     |
| **Airflow Reporting and Replacement**| • System continuously monitors exhaust airflow at each hood and generates a signal 0 to 10 V proportional to total exhaust airflow as fraction of total design. 0 V - system is off; 7 V - system operates at 70% of design airflow, etc. This signal is used to control Replacement air to maintain building pressurization. |
| **Air Control**                      |                                                                                                                                                                                                          |
| **Alarm and Fault Conditions**       | • System constantly monitors various parameters.  
• If any unusual or abnormal condition is detected, an alarm is activated.  
• An alarm indicator can include:  
  • Indication on HMI (Touch Screen).  
  • Email or text message sent to a computer or a mobile device, pager, visual display on a computer screen or through a SCADA interface. |
M.A.R.V.E.L. Touch Screen Operation

The central control panel features a user friendly touch screen interface. The following illustrations depict the navigation and features of the touch screen.

Note: Touch screen samples shown below are for the basic M.A.R.V.E.L. system, for all other M.A.R.V.E.L. systems including UV, Water Wash, Ecology & KGS or combination thereof, please refer to the Quick Reference Guides.

**Main Screen**

This screen will allow you to jump ahead to any of the below screens.

**Menu Option Screen**

This screen will allow you to jump ahead to any of the below screens.
**Individual Hood Selection Screen**

This screen will allow you to move to your choice of Individual Hood Status screen.

**Individual Hood Status Screen**

This screen will display all the information pertaining to each individual hood separately.
Hood Summary Screen

The Hood Summary screen shows the overall performance of the current hood.

System Check Screen

The System Check screen will be used by your service agent only.
**Alarm History Screen**

This screen will display your current alarms along with the alarm history.

**Information Screen**

This Technical Information screen provides our USA and Canadian phone numbers for technical help.
**Security Features Screen**

This screen will be used by your service agent only.

If you are a Halton Certified Service Agent that requires a password for the screen above, please contact Halton Service Network at 1 (800) 442-5866 (USA) or 1 (800) 565-2981.

**General Maintenance Instructions**

These screens will provide general maintenance instructions for your system.
These screens will give an overview of each screen and their functions.
M.A.R.V.E.L. System Operation

**NOTE:** Refer to the Capture Jet™ Hood IO&M Manual for complete details on operating the hoods.

The following steps ONLY apply to the M.A.R.V.E.L. components (IRIS™ Sensor, MC8 Control Panel, Pressure Transducer and Temperature Sensor).

**NORMAL OPERATION**

Monitor space temperature (Tspace), IR sensor temperature (IRT) and exhaust air temperature, (Tex) for each hood. Calculate and report hood exhaust airflow Q to the exhaust fan controller.

1. **Tex > Tex_max**
   - NO
   - Open ABD damper

2. **IRT > Tspace + dTcook**
   - NO
   - ABD damper fully open

3. **IRT fluctuation detected**
   - NO

   Report Warning “Hood #N is operating at dangerously high temperature Tex!”

4. **Tex > Tex_min**
   - NO

5. **IRT > Tspace + dTcook**
   - NO

   Report appliance status COOKING
   - Reset cooking timer

6. **Tex > Tex_min**
   - NO

   Report appliance status IDLE

7. **Tex > Tex_max**
   - NO

   Report appliance status OFF

8. **IRT fluctuation detected**
   - NO

   Report appliance status IDLE

   **Maintain hood exhaust airflow Q as function of (Tex – Tspace) but not less than Qidle**

9. **Tex > Tex_min**
   - NO

   Report appliance status OFF

   **Maintain hood exhaust airflow Q = Qdesign**

   **For pre-set period = CookingTime**

   **Close ABD damper**

Halton
M.A.R.V.E.L. System Installation

The following installation steps ONLY apply to the M.A.R.V.E.L. components (IRIS™ Sensor, MC8 Control Panel, Pressure Transducer and Temperature Sensor).

Refer to the Capture Jet™ Hood IO&M Manual for complete details on installation of the hoods.

Refer to the Halton engineering drawings for additional details.

Refer to the Halton wiring drawings for configuration details.

Refer to the fan manufacturer’s manual for detailed instructions on the fan installation.

It is the responsibility of the installing contractor to see that the system installation is completed in accordance with the project plans and specifications and that it meets all specific requirements of local code officials. The local authority having jurisdiction could over rule some of the installation details written in this manual.

The installation shall be in accordance with NFPA-96. All electrical systems shall be installed following local and national codes.

If questions or complications should arise during the installation of the Halton hood(s) that cannot be solved using the instructions provided, please contact the Halton office at 1-800-442-5866, or (1-800-4-HALTON).

If a problem cannot be corrected through verbal or written communication with Halton support, the system can be connected to the Internet for remote access to Halton engineers through the KONTAR-Konsole™ Commissioning and Diagnostic Software Interface.

If the site doesn't have reasonable access to the Internet, a wireless CDMA router can be shipped by Halton to the facility for temporary (or permanent) access.

Check all local codes prior to installation as special requirements may be necessary depending on local building material construction.

1. Mount the central control panel (for multiple units with a single fan)

   **NOTE:** For all units, there is a pre-mounted control panel behind a cover on the Capture Jet™ plenum

1. The central control panel is supplied with mounting tabs that extend from the back wall up and down and provide at least four points of attachment. The appropriate mounting hardware is to be used depending on the unit size and the type of wall to be attached to.

2. Locate the central control panel at an appropriate mounting height (e.g., access to the control in the front door of the panel).

3. Attach the central control panel using the four mounting holes:

   - For concrete block walls, solid block and brick surfaces: Use sleeve stud anchors (recommended).
     
     Example: 3/8 “ dia. thread: 5/16-18; washer OD: 7/8 “ (Drill size 3/8 “)
   
   - For Plaster, Wallboard and Plywood: Use sleeve screw anchors (drive or drill style) (recommended).
Example: 1/4” - 20 drill size 7/16”

**NOTE:** If more than one control panel is used in a M.A.R.V.E.L. system with a single exhaust fan, connect them together to ensure that proper operation of the exhaust fan. Refer to the Halton supplied wiring diagram for details.

2. **Make central control panel connections (for multiple units with a single fan)**

Make the following connections at the central control panel:

a. 120 VAC, 5 amp power to control panel.

b. Space temperature sensor to control panel (2 wires).

c. VFD terminal block to control panel (8 wires shielded).

d. Connection to individual hood (2 wires shielded) (cable provided by Halton).

e. Connection to kitchen fire system (2 wires)

f. Permanent Ethernet connection (if specified).

g. UV or Water Wash control.
3. Connect VFD controller

Connect VFD controller as per instructions provided. This includes:

a. Main power connection for the fan motor.

b. Connection to central control panel.

4. Connect hood control panel to central control panel (for multiple units with a single fan)

Using 2 wire shielded cable provided by Halton, connect each unit to the central control panel. This includes:

1. Attach the wire to the terminal block in the box on top of the hood.

2. Run the wire to the central control panel and connect the marked terminal block (identified by hood number)

3. Connections can be also made between hoods with 2 wire shielded cable and connect the hood closest to the control panel to terminals in the panel.

5. Check pressure transducer

1. Check the condition of the pressure transducer tubing on the top of the Capture Jet™ hood. The tubing should be free from kinks.
6. Calibrate the Capture Jet™ exhaust air flows

Calibrate the Capture Jet™ exhaust air flows using the T.A.B.™ (Testing and Balancing Ports). To determine the correct T.A.B. port reading for the exhaust hoods, follow these steps:

1. Ensure that the equipment is operating to create a thermal plume prior to the air balancer.

2. Determine the correct T.A.B. port reading (IWC) based on the Capture Jet™ hood model.

<table>
<thead>
<tr>
<th>Capture Jet Hood Model</th>
<th>T.A.B. Port Readings Design T.A.B. (inches WC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KVE/KVC</td>
<td>0.25</td>
</tr>
<tr>
<td>KVW</td>
<td>0.25</td>
</tr>
<tr>
<td>KVR</td>
<td>0.25</td>
</tr>
<tr>
<td>KVL</td>
<td>0.28</td>
</tr>
</tbody>
</table>

“Example Only”

3. Using the T.A.B. Port, take a reading in IWC.

4. Using the table below, confirm the design airflow (e.g., 1700 cfm), based on the T.A.B. Reading (e.g., 0.19 IWC).
M.A.R.V.E.L. System Maintenance

General

NOTE: A preventive maintenance program is an important aspect of an effective safety program. Consult your manufacturing or other qualified consultant with questions concerning changes observed during periodic inspections and routine maintenance.

Refer to the Capture Jet™ Hood IO&M Manual for complete details on maintaining the hoods.

The following maintenance steps ONLY apply to the M.A.R.V.E.L. components (IRIS™ Sensor and Temperature Sensor).

IRIS™ Sensor Cleaning

NOTE: The IRIS™ Sensor is mounted on the Capture Jet™ plenum door to allow an air jet to protect the sensor optics from contaminants. However, periodic cleaning may be required to keep the optics clear.

Gently clean the IRIS™ socket with isopropyl alcohol on a cotton swab (Q-tip™), as required.

Take care not to move the position of the optic; see below on how to realign the IRIS™ Sensor.

IRIS™ Sensor Alignment (Quarterly or as required)

To align the IRIS™ Sensor, follow these steps:

1. Insert the Laser Alignment Tool into the socket at the bottom of the IRIS™ sensor.

2. Press the laser button, located on the side of the Laser Alignment Tool.

3. Gently move the IRIS™ sensor to position the laser beam point at the center of the cooking surface. NOTE: The actual field of view for most applications will be 60 degrees.

4. Remove the Laser Alignment Tool.
IRIS™ Sensor Removal/Replacement

To remove the IRIS™ Sensor, follow these steps:

1. Disconnect the IRIS™ sensor from the terminal block located in the Capture Jet™ hood. Refer to the terminal block diagram on the Halton-supplied wiring diagram for the correct terminations points.
2. Remove the face plate of the sensor by removing the 4 face plate screws.
3. Lift out the face plate and sensor and gently pull out the sensor wires.
4. Remove the sensor bracket from the face plate by removing the 2 screws on the faceplate.
5. Remove the sensor from the sensor bracket by removing the 3 screws.
6. Reverse the steps when replacing the IRIS™ sensor (Halton Part # 18037).
Temperature Sensor Removal/Replacement

To remove the temperature sensor located in the hood collar, follow these steps:

1. Disconnect the temperature sensor from the terminal block located in the Capture Jet™ hood. Refer to the terminal block diagram on the Halton-supplied wiring diagram for the correct terminations points.

2. Loosen the compression fitting securing the temperature sensor in the hood collar.

3. Remove the temperature probe.

4. Replace the defective temperature probe with a replacement (Halton Part # 17641)

5. Reconnect wiring.
Balancing Damper Actuator Removal/Replacement

To remove and replace the actuator on the balancing damper, follow these steps:

1. Remove exterior metal cover by removing the 6 mounting screws around the perimeter.
2. Remove the actuator cover by removing the 1 screw on the side.
3. Disconnect the power to the actuator.
4. Record the DIP switch values, located in the red holder on the bottom of the actuator.

Dip switch settings

5. Note the position of the stop screws.

6. Remove the U-bolt that attaches the actuator to the balancing damper shaft. Refer to the Actuator Specification and Installation instructions with the replacement part.
7. Replace with a replacement actuator (Halton Part # 16012). Tighten the U-bolt on the drive shaft.

8. Reset the DIP switches.
9. Reset the stop screws.
10. Reconnect the power.
11. Calibrate the new actuator by pressing the **Reset** button. The dampers will open and close.
12. Replace the actuator housing and the exterior metal cover as before.

**Pressure Transducer Removal/Replacement**

To remove the pressure transducer, follow these steps:

1. Turn off power to transducer.
2. Remove covering on pressure transducer mounting bracket.
3. Disconnect wires.
4. Disconnect ¼” tubing fitting from LOW port on transducer.
5. Remove side mount screws (2 screws).
6. Replace with Halton Part # 18028.
7. Reconnect wires and tubing as before. Check that the tubing is not kinked.
M.A.R.V.E.L. System Monitoring and Support

Types of Monitoring

<table>
<thead>
<tr>
<th>Type of Mounting</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent Ethernet-connection for 24/7 monitoring</td>
<td>• Optional.</td>
</tr>
<tr>
<td></td>
<td>• Permanent internet monitoring using SCADA graphical interface.</td>
</tr>
<tr>
<td></td>
<td>• By using a unique password and ID, user can check system status and,</td>
</tr>
<tr>
<td></td>
<td>depending on access levels, change parameters and alarms.</td>
</tr>
<tr>
<td>Temporary Ethernet connection, as required, for support</td>
<td>• Temporary Ethernet connection for startup/troubleshooting by Halton</td>
</tr>
<tr>
<td>Temporary cable to laptop connection, as required, for support</td>
<td>Technical Support only</td>
</tr>
<tr>
<td></td>
<td>• USB cable connection to laptop pre loaded with KONSOLE™ software for</td>
</tr>
<tr>
<td></td>
<td>diagnostic support.</td>
</tr>
</tbody>
</table>

Connection to Third Party Devices

- Able to communicate natively to Modbus RTU slave devices over RS232 or RS485.
- Able to communicate via BACnet MSTP, BACnet IP, Modbus RTU as a Slave or JCI N2 protocols via optional gateway.
**KONTAR-Konsole™ Software**

The KONTAR-Konsole™ Commissioning and Diagnostic Software Interface displays set operating parameters and actual values. When accessed and reviewed by a trained Halton technician, support and troubleshooting can be offered.

**NOTE:** Only Halton trained technicians should access this software.

For additional details and support with KONTAR-Konsole™ software, use the on-line help from the toolbar.

For example:
### Display Field
- **IR1_Index**
- **IR2_Index**, etc
- **Duct_Temp**

#### Recommended Value and Action
- **Appliance OFF** - 59 - 80 °F
- **Appliance ON**: > 80 °F
- **Power supply off**: -220 °F

**NOTE**: if more than 1 IRIS™ sensor, check each IR_Index value. If all values are -220 check that power supply.

- **Cooking**: 50 to 150 °F
- **Not cooking**: ambient room temperature

### FAQ’s (Frequently Asked Questions)

<table>
<thead>
<tr>
<th>Problem</th>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser on Alignment Tool does not work</td>
<td>Battery low</td>
<td>Replace battery. Unscrew end of tool, remove the battery and replace with same type.</td>
</tr>
<tr>
<td>Exhaust damper blades do not open or close</td>
<td>Loose set screws</td>
<td>Tighten</td>
</tr>
<tr>
<td></td>
<td>In-operable motor</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>VFD tripped</td>
<td>Check for error code, reset</td>
</tr>
<tr>
<td></td>
<td>Surface and duct temperature sensors not activated</td>
<td>Push override button</td>
</tr>
</tbody>
</table>

### M.A.R.V.E.L. Parts List

The following is the recommended parts list for proper care and maintenance of the M.A.R.V.E.L. equipment. Parts indicated with a * should be kept readily on hand, the amount depending on the number of hoods in the system.

**NOTE**: Contact Halton for information on other replacement parts as required

<table>
<thead>
<tr>
<th>Part</th>
<th>Halton Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure transducer* (for each hood)</td>
<td>18081</td>
</tr>
<tr>
<td>Temperature sensor*</td>
<td>18024</td>
</tr>
<tr>
<td>IRIS™ sensor*</td>
<td>18037</td>
</tr>
<tr>
<td>Actuator* (for balancing damper) (optional)</td>
<td>16012</td>
</tr>
<tr>
<td>MC8 Controller (optional)</td>
<td>18035</td>
</tr>
</tbody>
</table>
Contact Information

United States
Halton Company
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