

The Phoenix Controls Theris® BACnet® Valves are specifically designed for healthcare critical space ventilation requirements where infection control, energy savings, and reduced maintenance costs are important considerations.

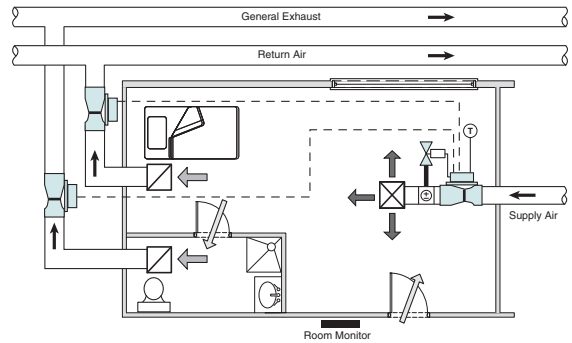
Theris provides constant volume (CV) and variable air volume (VAV) solutions for directional airflow, climate control, and overall ventilation balance.

**System Benefits**

- Factory characterization reduces system commissioning time.
- Pressure-independent valves avoid rebalancing costs.
- No flow sensors to maintain.
- High turndown ratios contribute to reducing energy costs.
- Room-level communication via BACnet® MS/TP.

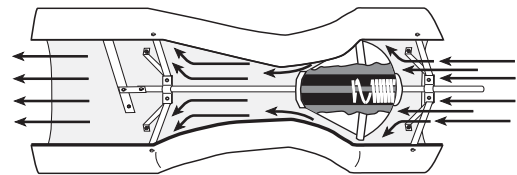
**PRODUCT MODELS**

MODEL	DESCRIPTION
<b>Theris TP</b>	To meet the need of directional airflow, Theris-TP features tracking valve pairs that maintain a prescribed CFM offset enabling accurate space pressurization and complete room climate control.
<b>Theris TX</b>	For tracking pair applications in demanding spaces that require some additional features like humidity control and shut-off capabilities. TX also provides additional multi-use inputs to support a pressure sensor and valve alarming.
<b>Theris TX-EXH</b>	Along with many of the standard TX tracking pair features, TX-EXH provides the ability to locally control an additional exhaust valve without an additional controller (3 valves - 1 controller). This is an ideal solution for spaces that have an additional BSC or 2-state hood.
<b>Theris TX-RTN</b>	Similar feature set to the TX-EXH. The TX-RTN provides the ability to add an optional return valve (Ratio metric) without an additional controller (3 Valves - 1 controller). This is an ideal solution for common areas near a lab or for use in a lab being monitored by IAQ with pandemic switch.
<b>Theris SO</b>	In VAV applications where ducted exhaust is sufficient to meet local codes and engineering guidelines, Theris SO provides a cost effective main valve when no tracking valve is required.
<b>Theris EO</b>	Theris EO provides an additional exhaust valve with controller to allow 2 state LED control from a switch (Min or Max flow limits), shut-off and alarming for a 2 state hood, snorkel or Bio Safety Cabinet. This functionality also lends itself to green-Ready/red-Unoccupied indicator lights outside an OR.
<b>Theris CV</b>	For fixed-flow operation and stable airflow throughout the facility, Theris-CV provides a solution for constant volume supply and exhaust applications.



Theris-TX-RTN Supply with Return and Exhaust Tracking

**Pressure Independence**



Phoenix Controls venturi valves use a simple mechanical regulator to compensate for changes in static pressure, assuring accurate flow control at all times.

Unlike commercial controls using velocity pressure sensors mounted in the airstream, venturi valves are impervious to lint, dust, dirt, and sensor drift. Phoenix Controls venturi valves continue to work even in the event of a power failure; ensuring that correct room pressurization and directional airflow are maintained at all times.

Before valves leave the factory, every Theris room controller's on-board microprocessor is downloaded with unique flow characterization coefficients for the supply and exhaust valves serving the installation. The controller uses this flow data to accurately control flow-tracking between the two or three valves, virtually eliminating the need for field calibration and rebalancing.

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## Theris VALVE SPECIFICATIONS

### Construction

- 16 ga. spun aluminum valve body with continuous welded seam
- Composite Teflon® shaft bearings
- Spring grade stainless steel spring and PPS slider assembly
- Supply valves insulated with 3/8" (9.5 mm) flexible closed-cell polymer-based foam. Flame/smoke rating 25/50. Density is 1.5 lb/ft<sup>3</sup> (24.0 kg/m<sup>3</sup>)

### Operating Range

- 32-122 °F (0-50 °C) ambient
- 10-90% non-condensing RH

### Performance

- Pressure independent over a 0.3"-3.0" WC (74-747 Pa) drop across valve
- Volume control accurate to ±5% of airflow command signal
- No additional straight duct runs needed before or after valve
- Available in flows from 35-5000 CFM (59-8495 m<sup>3</sup>/hr)
- Response time to change in command signal: <1 minute

### Sound

Designed for low sound power levels to meet or exceed ASHRAE noise guidelines

## Theris BACnet Controllers

### Inputs:

See Available Inputs and Outputs tables to determine whether I/O is Field Configurable or Factory Configured.

Theris TP/TX

- 11 universal inputs with 10-bit resolution
- 8 binary outputs - 24 VAC, 0.5 A
- 8 analog outputs with 8-bit resolution
  - Selectable 0-10 or 2-10 Vdc, or 4-20 mA
- Three 24 Vdc outputs - up to 250 mA of 24 Vdc to power trans devices or other devices

See chart on pages 6 and 7 for usage.

Theris SO/EO

- 8 universal inputs with 10-bit resolution
- 5 binary outputs - 24 Vac, 0.5 A
- 3 analog outputs with 8-bit resolution
  - Selectable 0-10 or 2-10 Vdc, or 4-20 mA
- Two 24 Vdc outputs - up to 250 mA of 24 Vdc to power trans devices or other devices

See chart on pages 4 and 5 for usage.

### Power:

- 24 Vac (±15%)
- Binary output loads:
  - TP, TX, TX-EXH, TX-RTN: 110 VA max
  - SO, EO: 80 VA max
- Power consumption (singles and duals)
  - SO, EO (one controller/one actuator): 10 VA
  - TP, TX (one controller/two actuators): 12 VA
  - TX-EXH, TX-RTN (one controller/three actuators): 15 VA

Notes:

1. All power consumption VA ratings listed here are based on fully-loaded I/O except for floating point reheat actuators.
2. VA ratings for floating point reheat actuators must be factored in separately.

### Input accuracy:

- Voltage, current, resistance: ±1% full scale

### Output accuracy:

- 0 to 10 Vdc: ±1% full scale into 10 KΩ minimum
- 4 to 20 mA: ±1% full scale into 500 Ω +0/-50 Ω

### Interoperability:

- BACnet® compliant on MS/TP LAN at up to 76.8 Kbps

### Agency compliance:

Controller:

- UL for Open Energy Management ((PAZX) UL 916 - US & Canada)
- CE (EMC Directive 89/336/EEC)
- FCC COMPLIANCE
  - This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
  - 1. This device may not cause harmful interference.
  - 2. This device must accept any interference received, including interference that may cause undesired operation.
- B-ASC level device
  - See Protocol Implementation Conformance Statement (PICS)



BACnet® is a registered trademark of ASHRAE

Valve Assembly:

- CSA
- CE



## FEATURES

Feature	Model	Description
Pressure independence	All	CFM airflow maintained regardless of changes in duct static pressure.
No flow sensors	All	Factory flow characterization eliminates the need for flow sensors.
Airflow offset maintained	TP, TX, TX-EXH, TX-RTN	Supply and exhaust CFM offset settings maintain accurate pressurization.
Temperature and occupancy control	TP, TX, TX-EXH, TX-RTN, SO	Primary and secondary loops. Occupied or Unoccupied. Building Management System (BMS) or local set point input.
HVAC emergency modes	All	Four emergency modes available. Custom setup for each mode.
Multi-Use inputs	TP, TX (4 inputs) TX-EXH, TX-RTN (2 inputs)	<ul style="list-style-type: none"> <li>Humidity Sensor (TX, TX-EXH, TX-RTN)</li> <li>Discharge Air Sensor (All)</li> <li>Local Offset Selection Switch (All)</li> <li>Emergency Switch (All)</li> <li>Additional Flow Input (All)                             <ul style="list-style-type: none"> <li>Supply Flow Input (All)</li> <li>Exhaust Flow Input (All)</li> <li>Exhaust Flow 2 Command (TX-EXH)</li> </ul> </li> <li>Pressure Monitoring (All)</li> <li>IAQ Control (TP, TX, TX-EXH)</li> <li>Local Cooling Override (All)</li> <li>Local Occupancy Sensor (All)</li> </ul>
	SO (3 inputs) EO (5 inputs)	SO provides 3 Multi-Use Inputs. EO provides 5 Multi-Use Inputs. Multi-Use Inputs are selectable as follows: <ul style="list-style-type: none"> <li>SO Only IAQ Control, Local Cooling Override, Local Occupancy Sensor</li> <li>SO and EO Additional Flow Input, Emergency Mode 1, Emergency Mode 2, Emergency Mode 3, Emergency Mode 4, , Discharge Air Sensor, Pressure Sensor</li> </ul>
Reheat (modulating)	TP, TX, TX-EXH, TX-RTN, SO	
Reheat (floating point)	TP, TX, TX-EXH, TX-RTN, SO	
Auxiliary temperature (modulating)	TP, TX, TX-EXH, TX-RTN	
Auxiliary temperature (two-state)	TP, SO	
Humidity control	TX, TX-EXH, TX-RTN	
Humidity monitoring	All except SO, TP	
Pressure monitoring	All	
Shut off	TX, TX-EXH, TX-RTN, EO	
IAQ Control	TP, TX, TX-EXH, SO	Volumetric IAQ sensor input
Zone Balance Control	TP, TX, TX-EXH, TX-RTN	<ul style="list-style-type: none"> <li>Supply with tracking exhaust, CV, or additional supply or exhaust (TP, TX)</li> <li>Supply with tracking exhaust, locally controlled exhaust, CV, or additional supply or exhaust (TX-EXH)</li> <li>Supply with tracking exhaust, Ratio Metric RTN/Exhaust Control, CV, or additional supply or exhaust (TX-RTN)</li> </ul>
Accommodates 2- or 3-state switch	EO	<ul style="list-style-type: none"> <li>Nomal</li> <li>Min</li> <li>Shutoff/Alarm</li> </ul>
Local Flow Control	EO TX-EXH (Exhaust 2)	

TP = Tracking pair VAV  
 SO = Supply-only VAV  
 EO = Exhaust-only VAV  
 CV = Constant Volume

TX = Enhanced tracking pair VAV  
 TX-EXH = 3-valve set, tracking pair with locally controlled exhaust  
 TX-RTN = 3-valve set, tracking pair with return valve

## AVAILABLE INPUTS AND OUTPUTS

### FOR USE WITH BACNET CONTROLLERS TP\*

Type	Terminal #	I/O	Description / Function	Signal Format	Factory or Field Wired
Binary Input	1	BI 0	Momentary contact switch (Bypass Switch)	Dry contact	Field
Analog Input	3	AI 1	Room Temperature thermistor	Thermistor (Type 2)	Field
Analog Input	4	AI 2	Room temperature set point slider	0-20 K $\Omega$	Field
Analog Input	6	AI 3	Multi-use input. Choose from options list below this table.	Selectable	Field
Analog Input	9	AI 4	Multi-use input. Choose from options list below this table.	Selectable	Field
Analog Input	11	AI 5	Supply valve vPot	0-5 Vdc	Factory
Binary Input	12	BI 6	Supply valve DP switch	Dry contact, open=alarm	Factory
Analog Input	14	AI 7	Exhaust valve vPot	0-5 Vdc	Factory
Binary Input	17	BI 8	Exhaust valve DP switch	Dry contact, open=alarm	Factory
Analog Input	19	AI 9	Multi-use input. Choose from options list below this table.	Selectable	Field
Analog Input	20	AI 10	Multi-use input. Choose from options list below this table.	Selectable	Field
Binary Output	27	BO 0	Supply valve FP actuator control CW (Close)	24 Vac Triac	Factory
Binary Output	29	BO 1	Supply valve FP actuator control CCW (Open)	24 Vac Triac	Factory
Binary Output	30	BO 2	Exhaust valve FP actuator control CW (Close)	24 Vac Triac	Factory
Binary Output	32	BO 3	Exhaust valve FP actuator control CCW (Open)	24 Vac Triac	Factory
Binary Output	34	BO 4	Auxiliary 2-state auxiliary Temperature Output	24 Vac Triac	Field
Binary Output	36	BO 5	Alarm (flashes on-off at 2-second intervals)	24 Vac Triac	Field
Binary Output	37	BO 6	Floating point reheat CW (Close)	24 Vac Triac	Field
Binary Output	39	BO 7	Floating point reheat CCW (Open)	24 Vac Triac	Field
Analog Output	40	AO 0	vPot reference voltage	5 Vdc	Factory
Analog Output	42	AO 1	Available for Modulating Reheat Actuator	0-10 or 2-10 Vdc, or 4-20 mA	Field
Analog Output	43	AO 2	Auxiliary Temperature Control (Modulating)	0-10 or 2-10 Vdc, or 4-20 mA	Field
Analog Output	45	AO 3	Total flow outputs (feedback) - Supply	0-10 Vdc	Field
Analog Output	46	AO 4	Total flow outputs - Exhaust	0-10 Vdc	Field
Analog Output	48	AO 5	Unavailable		
Analog Output	49	AO 6	Unavailable		
Analog Output	51	AO 7	Unavailable		

\*The flow tracking function does not use any of the inputs or outputs in this table. For details, see the Wiring section of this document. Choose up to four of the following options. Assign a selection to either AI 3, AI 4, AI 9, or AI 10. Unused I/Os can be left unassigned.

- Discharge Temp Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Emergency Switch: Dry contact for Emergency Modes 1, 2, 3, 4
- Additional flow input: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA (Supply or Exhaust)
- Local Offset Selection Switch (Dry Contact)
- Pressure Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Local Cooling Override: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Local Occupancy Sensor (Dry Contact)
- IAQ Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA

**AVAILABLE INPUTS AND OUTPUTS (CONTINUED)**

**FOR USE WITH BACNET CONTROLLERS TX\***

Type	Terminal #	I/O	Description / Function	Signal Format	Factory or Field Wired
Binary Input	1	BI 0	Momentary contact switch (Bypass Switch)	Dry contact	Field
Analog Input	3	AI 1	Room Temperature thermistor	Thermistor (Type 2)	Field
Analog Input	4	AI 2	Room temperature set point slider	0-20 K $\Omega$	Field
Analog Input	6	AI 3 <sup>1</sup>	Multi-use input. Choose from options list after this table.	Selectable	Field
Analog Input	9	AI 4 <sup>1</sup>	Multi-use input. Choose from options list after this table.	Selectable	Field
Analog Input	11	AI 5	Supply valve vPot	0-5 Vdc	Factory
Binary Input	12	BI 6	Supply valve DP switch	Dry contact, open=alarm	Factory
Analog Input	14	AI 7	Exhaust1 valve vPot	0-5 Vdc	Factory
Binary Input	17	BI 8	Exhaust1 valve DP switch	Dry contact, open=alarm	Factory
Analog Input	19	AI 9	Multi-use input. Choose from options list below this table.	Selectable	Field
Binary Input	20	AI 10	Multi-use input. Choose from options list below this table.	Selectable	Field
Binary Output	27	BO 0	Supply valve FP actuator control CW (Close)	24 Vac Triac	Factory
Binary Output	29	BO 1	Supply valve FP actuator control CCW (Open)	24 Vac Triac	Factory
Binary Output	30	BO 2	Exhaust1 valve FP actuator control CW (Close)	24 Vac Triac	Factory
Binary Output	32	BO 3	Exhaust1 valve FP actuator control CCW (Open)	24 Vac Triac	Factory
Binary Output	34	BO 4	Supply Shut-off/Alarm	24 Vac Triac	Field
Binary Output	36	BO 5	Exhaust Shut-off/Alarm	24 Vac Triac	Field
Binary Output	37	BO 6	Floating point reheat CW (Close)	24 Vac Triac	Field
Binary Output	39	BO 7	Floating point reheat CCW (Open)	24 Vac Triac	Field
Analog Output	40	AO 0	vPot reference voltage	5 Vdc	Factory
Analog Output	42	AO 1	Available for Modulating Reheat Actuator	0-10 or 2-10 Vdc, or 4-20 mA	Field
Analog Output	43	AO 2	Auxiliary Temperature Control (Modulating)	0-10 or 2-10 Vdc, or 4-20 mA	Field
Analog Output	45	AO 3	Total flow outputs (feedback) - Supply	0-10 Vdc	Field
Analog Output	46	AO 4	Total flow outputs - Exhaust	0-10 Vdc	Field
Analog Output	48	AO 5	Unavailable		
Analog Output	49	AO 6	Available for humidification (modulating)	0-10 or 2-10 Vdc, or 4-20 mA	Field
Analog Output	51	AO 7	Available for dehumidification (modulating)	0-10 or 2-10 Vdc, or 4-20 mA	Field

\*The flow tracking function does not use any of the inputs or outputs in this table. For details, see the Wiring section of this document. Choose from the following options. Assign a selection to AI 3, AI 4, AI 9, or AI 10. Unused I/Os can be left unassigned.

- Pressure Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Humidity Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Discharge Temp Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Emergency Switch: Dry Contact for Emergency Modes 1, 2, 3, 4
- Additional flow input: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA (Supply, Exhaust)
- IAQ Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Local Offset Selection Switch (Dry Contact)
- Local Cooling Override: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Local Occupancy Sensor (Dry Contact)

**AVAILABLE INPUTS AND OUTPUTS (CONTINUED)**

**FOR USE WITH BACNET CONTROLLERS TX-EXH\***

Type	Terminal #	I/O	Description / Function	Signal Format	Factory or Field Wired
Binary Input	1	BI 0	Momentary contact switch (Bypass Switch)	Dry contact	Field
Analog Input	3	AI 1	Room Temperature thermistor	Thermistor (Type 2)	Field
Analog Input	4	AI 2	Room temperature set point slider	0-20 K $\Omega$	Field
Analog Input	6	AI 3 <sup>1</sup>	Multi-use input. Choose from options list below this table.	Selectable	Field
Analog Input	9	AI 4 <sup>1</sup>	Multi-use input. Choose from options list below this table.	Selectable	Field
Analog Input	11	AI 5	Supply valve vPot	0-5 Vdc	Factory
Binary Input	12	BI 6	Supply valve DP switch	Dry contact, open=alarm	Factory
Analog Input	14	AI 7	Exhaust1 valve vPot	0-5 Vdc	Factory
Binary Input	17	BI 8	Exhaust1 valve DP switch	Dry contact, open=alarm	Factory
Analog Input	19	AI 9	Exhaust2 valve vPot	0-5 Vdc	Factory
Binary Input	20	BI 10	Exhaust2 valve DP switch	Dry contact, open=alarm	Factory
Binary Output	27	BO 0	Supply valve FP actuator control CW (Close)	24 Vac Triac	Factory
Binary Output	29	BO 1	Supply valve FP actuator control CCW (Open)	24 Vac Triac	Factory
Binary Output	30	BO 2	Exhaust1 valve FP actuator control CW (Close)	24 Vac Triac	Factory
Binary Output	32	BO 3	Exhaust1 valve FP actuator control CCW (Open)	24 Vac Triac	Factory
Binary Output	34	BO 4	Exhaust2 valve FP actuator control CW (Close)	24 Vac Triac	Factory
Binary Output	36	BO 5	Exhaust2 valve FP actuator control CCW (Open)	24 Vac Triac	Factory
Binary Output	37	BO 6	Floating point reheat CW (Close)	24 Vac Triac	Field
Binary Output	39	BO 7	Floating point reheat CCW (Open)	24 Vac Triac	Field
Analog Output	40	AO 0	vPot reference voltage	5 Vdc	Factory
Analog Output	42	AO 1	Available for Modulating Reheat Actuator	0-10 or 2-10 Vdc, or 4-20 mA	Field
Analog Output	43	AO 2	Auxiliary Temperature Control (Modulating)	0-10 or 2-10 Vdc, or 4-20 mA	Field
Analog Output	45	AO 3	Total flow outputs (feedback) - Supply	0-10 Vdc	Field
Analog Output	46	AO 4	Total flow outputs - Exhaust1	0-10 Vdc	Field
Analog Output	48	AO 5	Total flow outputs - Exhaust2	0-10 Vdc	Field
Analog Output	49	AO 6	Available for modulating humidification	0-10 or 2-10 Vdc, or 4-20 mA	Field
Analog Output	51	AO 7	Available for modulating dehumidification	0-10 or 2-10 Vdc, or 4-20 mA	Field

\*The flow tracking function does not use any of the inputs or outputs in this table. For details, see the Wiring section of this document.

1. Choose from the following options. Assign a selection to AI 3 or AI 4. Unused I/Os can be left unassigned.

- Pressure Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Humidity Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Discharge Temp Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Emergency Switch: Dry Contact for Emergency Modes 1, 2, 3, 4
- Additional flow input: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA (Supply, Exhaust)
- Exhaust2 Local Flow Command: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, 4-20 mA, or Dry Contact
- IAQ Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Local Offset Selection Switch (Dry Contact)
- Local Cooling Override: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Local Occupancy Sensor (Dry Contact)

## AVAILABLE INPUTS AND OUTPUTS (CONTINUED)

### FOR USE WITH BACNET CONTROLLERS TX-RTN\*

Type	Terminal #	I/O	Description / Function	Signal Format	Factory or Field Wired
Binary Input	1	BI 0	Momentary contact switch (Bypass Switch)	Dry contact	Field
Analog Input	3	AI 1	Room Temperature thermistor	Thermistor (Type 2)	Field
Analog Input	4	AI 2	Room temperature set point slider	0-20 K $\Omega$	Field
Analog Input	6	AI 3	Multi-use. Choose from options list below this table.	Selectable	Field
Analog Input	9	AI 4	Multi-use. Choose from options list below this table.	Selectable	Field
Analog Input	11	AI 5	Supply valve vPot	0-5 Vdc	Factory
Binary Input	12	BI 6	Supply valve DP switch	Dry contact, open=alarm	Factory
Analog Input	14	AI 7	Exhaust valve vPot	0-5 Vdc	Factory
Binary Input	17	BI 8	Exhaust valve DP switch	Dry contact, open=alarm	Factory
Analog Input	19	AI 9	Return Air valve vPot	0-5 Vdc	Factory
Binary Input	20	BI 10	Return Air valve DP switch	Dry contact, open=alarm	Factory
Binary Output	27	BO 0	Supply valve FP actuator control CW (Close)	24 Vac Triac	Factory
Binary Output	29	BO 1	Supply valve FP actuator control CCW (Open)	24 Vac Triac	Factory
Binary Output	30	BO 2	Exhaust valve FP actuator control CW (Close)	24 Vac Triac	Factory
Binary Output	32	BO 3	Exhaust valve FP actuator control CCW (Open)	24 Vac Triac	Factory
Binary Output	34	BO 4	Return Air valve FP actuator control CW (Close)	24 Vac Triac	Factory
Binary Output	36	BO 5	Return Air valve FP actuator control CCW (Open)	24 Vac Triac	Factory
Binary Output	37	BO 6	Floating point reheat CW (Close)	24 Vac Triac	Field
Binary Output	39	BO 7	Floating point reheat CCW (Open)	24 Vac Triac	Field
Analog Output	40	AO 0	vPot reference voltage	5 Vdc	Factory
Analog Output	42	AO 1	Available for Modulating Reheat Actuator	0-10 or 2-10 Vdc, or 4-20 mA	Field
Analog Output	43	AO 2	Auxiliary Temperature Control (Modulating)	0-10 or 2-10 Vdc, or 4-20 mA	Field
Analog Output	45	AO 3	Total flow outputs (feedback) - Supply	0-10 Vdc	Field
Analog Output	46	AO 4	Total flow outputs - Exhaust	0-10 Vdc	Field
Analog Output	48	AO 5	Total flow outputs - Return	0-10 Vdc	Field
Analog Output	49	AO 6	Available for humidification (modulating)	0-10 or 2-10 Vdc, or 4-20 mA	Field
Analog Output	51	AO 7	Available for dehumidification (modulating)	0-10 or 2-10 Vdc, or 4-20 mA	Field

\* The flow tracking function does not use any of the inputs or outputs above. For more details, see the Wiring section of this document. Choose from the following options. Assign a selection to AI 3 or AI 4. Unused I/Os can be left unassigned.

- Pressure Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Humidity Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Discharge Temp Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Pandemic Switch: Dry Contact
- Emergency Switch: Dry Contact for Emergency Modes 1, 2, 3, 4
- Additional flow input: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA (Supply, Exhaust, Return)
- Local Offset Selection Switch (Dry Contact)
- Local Cooling Override: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Local Occupancy Sensor (Dry Contact)

**AVAILABLE INPUTS AND OUTPUTS (CONTINUED)**

**For use with BACnet Controllers SO**

Type	Terminal #	I/O	Description / Function	Signal Format	Factory or Field Wired
Binary Input	1	BI 0	Momentary contact switch (Bypass Switch)	Dry contact	Field
Analog Input	3	AI 1	Room temperature thermistor	Thermistor (Type 2)	Field
Analog Input	4	AI 2	Room temperature set point slider	0-20 K $\Omega$	Field
Analog Input	6	AI 3	Multi-use input 1. Choose from options list below this table.	Selectable	Field
Analog Input	7	BI 4	Multi-use input 2. Choose from options list below this table.	Selectable	Field
Analog Input	10	AI 5 <sup>1</sup>	Supply valve vPot	0-5 Vdc	Factory
Binary Input	12	BI 6	Supply valve DP switch	Dry contact, open=alarm	Factory
Analog Input	13	AI 7	Multi-use input 3. Choose from options list below this table.	Selectable	Field
Binary Output	21	BO 0	Supply valve FP actuator control CW (Close)	24 Vac Triac	Factory
Binary Output	23	BO 1	Supply valve FP actuator control CCW (Open)	24 Vac Triac	Factory
Binary Output	24	BO 2	Floating point re-heat CW (Close)	24 Vac Triac	Field
Binary Output	26	BO 3	Floating point re-heat CCW (Open)	24 Vac Triac	Field
Binary Output	27	BO 4	Auxiliary temperature control (2-state)	24 Vac Triac	Field
Analog Output	29	AO 0	vPot reference voltage	5 Vdc	Factory
Analog Output	31	AO 1	Available for Modulating Reheat Actuator	0-10 or 2-10 Vdc, or 4-20 mA	Field
Analog Output	33	AO 2	Total Flow Output (supply feedback)	0-10 Vdc	Field

Choose from the following options. Assign the selection to either AI 3, AI 4, AI 7.

- IAQ Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Discharge Temp Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Additional Flow Input (Supply): 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Pressure Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Local Cooling Override: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Local Occupancy Sensor (Dry Contact)
- Emergency Modes 1, 2, 3, 4 (Dry Contact)

**AVAILABLE INPUTS AND OUTPUTS (CONTINUED)**

**For use with BACnet Controllers EO**

Type	Terminal #	I/O	Description / Function	Signal Format	Factory or Field Wired
Binary Input	1	BI 0	Multi-Use Input 1. Choose from options list below this table.	Selectable*	Field
Analog Input	3	AI 1	Multi-Use Input 2. Choose from options list below this table.	Selectable	Field
Analog Input	4	AI 2	Multi-Use Input 3. Choose from options list below this table.	Selectable	Field
Analog Input	6	AI 3	Multi-Use Input 4. Choose from options list below this table.	Selectable	Field
Analog Input	7	AI 4	Multi-Use Input 5. Choose from options list below this table.	Selectable	Field
Analog Input	10	AI 5	Exhaust Valve vPot	0-5 Vdc	Factory
Analog Input	12	AI 6	Exhaust Valve DP Switch	Dry Contact Open = Alarm	Factory
Analog Input	13	AI 7	Local Flow Command	0-10 Vdc	Field
Binary Output	21	BO 0	Exhaust valve FP actuator control CW (Close)	24 Vac Triac	Factory
Binary Output	23	BO 1	Exhaust valve FP actuator control CCW (Close)	24 Vac Triac	Factory
Binary Output	24	BO 2	Normal Operation	24 Vac Triac	Field
Binary Output	26	BO 3	Minimum Flow	24 Vac Triac	Field
Binary Output	27	BO 4	Shut-Off/ Alarm Shut-off = ON if active. Alarm = flashes on-off at 2-second intervals.	24 Vac Triac	Field
Analog Output	29	AO 0	vPot Reference Voltage	5 Vdc	Factory
Analog Output	31	AO 1	Unused		
Analog Output	33	AO 2	Total Flow Output (Total Exhaust feedback)	0-10 Vdc	Field

\*Dry Contact ONLY.

Choose from the following options. Assign a selection to either - AI 1, AI 2, AI 3, or AI 4. Unused I/O's can be left unassigned.

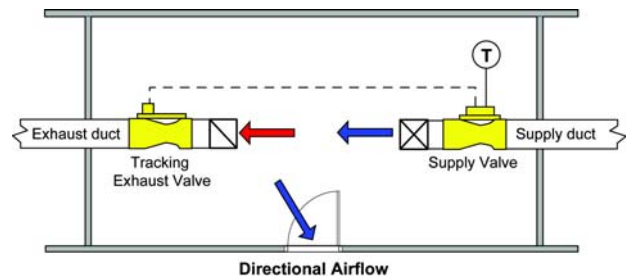
- Emergency Modes 1, 2, 3, 4 (Dry Contact)
- Humidity Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Discharge Temp Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Additional flow input: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA (Exhaust)
- Pressure Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA
- Tri-State Mode (Min, Max, Shutoff): Dry Contact, requires BI0 and AI1.
- IAQ Sensor: 0-5 Vdc, 0-10 Vdc, 2-10 Vdc, or 4-20 mA

## APPLICATIONS

### Theris TP VAV isolation or patient room

VAV tracking pair - one supply and one exhaust valve.

This patient room has a Theris-TP valve on the supply and exhaust sides. Supply and exhaust valves track airflow rates to maintain room pressure and offset. The Theris-TP supply valve can have an associated temperature sensor and control a hot water valve, as well as a second stage of heating, if needed. An optional duct temperature sensor can be placed in the ductwork on either the supply or exhaust side to monitor or control temperature.

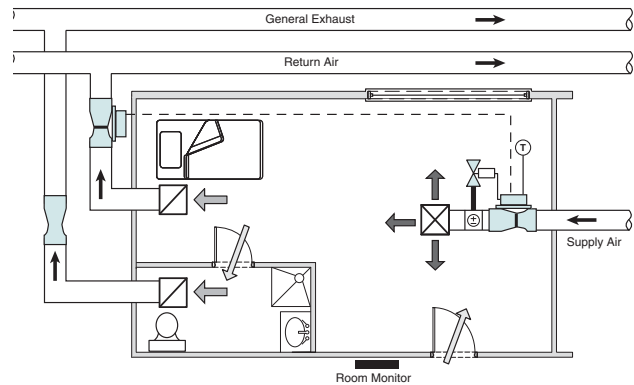


### Theris TX Enhanced VAV tracking pair

Operating rooms and other critical pressurized spaces.

A single Theris TX tracking pair can be used in a patient room, isolation room, operating room, or other critical healthcare space. Theris TX has sufficient I/O for the room pressure monitoring and humidity control used in operating suites.

In the example to the right, a constant volume valve is used in the bathroom and a tracking pair used in the patient room.

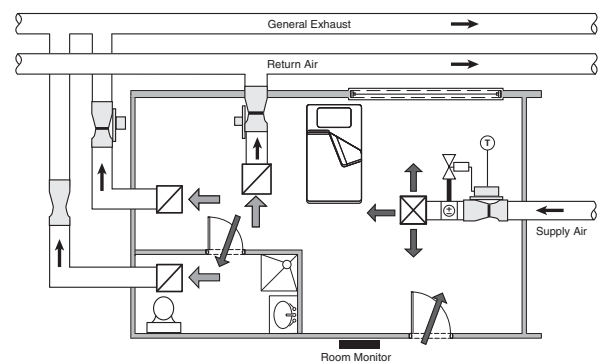


### Theris TX-RTN Enhanced Tracking Pair

Pandemic-ready patient room

A single bed patient room can be converted to an isolation room on-demand in the event of a pandemic incident. On the exhaust side, this is done by designating one valve for return air and a second valve for exhaust to outdoor air. A supply valve serves the room and a constant volume exhaust valve is used in the bathroom.

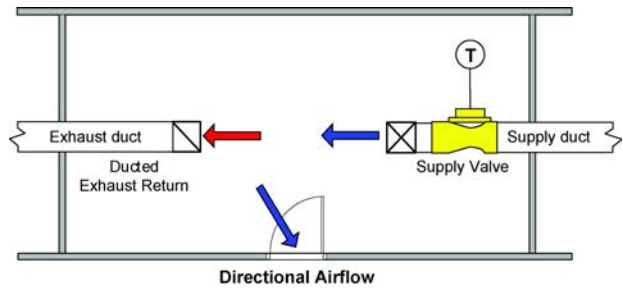
Under normal patient use, the exhaust air valve is in shut-off position and the return air valve tracks the supply valve to maintain neutral offset condition to the corridor. In pandemic mode, a panic button on the floor or BMS command initiates an emergency mode sequence which drives the return air valve to shut-off position and opens the exhaust air valve to a flow that achieves negative room offset.



### Theris SO VAV patient room

Standalone supply with ducted return.

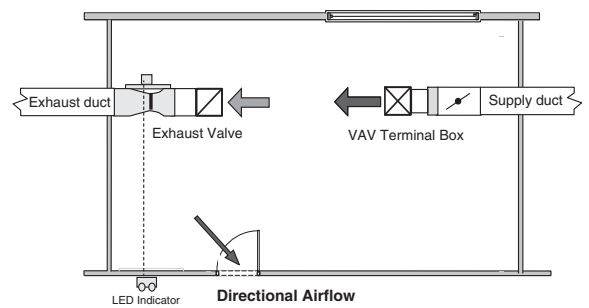
This patient room has a standalone Theris-SO valve on the supply side and a ducted return on the exhaust side. The Theris-SO valve can have an associated temperature sensor and control a hot water valve. An optional temperature sensor can be placed in the ductwork to monitor duct temperature either on the supply or exhaust side.



### Theris EO

Standalone exhaust.

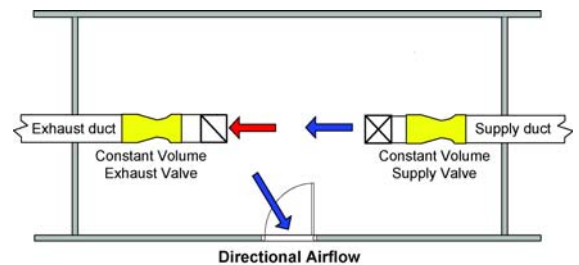
This patient room has a standalone Theris-EO valve on the exhaust side. An optional temperature sensor can be placed in the duct work to monitor duct temperature. In a healthcare setting, EO can be used as a direct replacement for VAV terminal boxes to address the problem of clogging cross flow sensors. An LED can also be used to signal via an indicator light outside the door whether the room is in low-flow Unoccupied mode (red) or a higher flow Occupied mode (green).



### Theris-CV Constant volume patient room

Constant volume with supply and exhaust.

This patient room has a Theris-CV (constant volume) valve on the supply and exhaust sides. Temperature control can be managed by a separate controlling thermostat. Equipment can be set and left alone. No maintenance is required and valves will keep these flow settings indefinitely.



# ORDERING GUIDE

## HSV A 2 10 M - A L B H Z - PSL

### VALVE FAMILY

**HSV** = Theris Supply valve  
(comes standard with insulation)  
**HEV** = Theris Exhaust valve

### VALVE CONSTRUCTION

**A** = Body and cone uncoated aluminum;  
shaft uncoated 316 stainless steel

### NUMBER OF VALVE BODIES

**F** = One valve body with welded circular flange  
**1** = One valve body, no flange  
**2** = Two valve bodies as one unit (dual); *available for 10", 12" and 14" valves only*  
**3** = Three valve bodies as one unit (triplet); *constant volume only, 12" and 14" valves only*  
**4** = Four valve bodies as one unit (quad); *constant volume only, 12" and 14" valves only*

### VALVE SIZE

**08** = 8" valve (7.88"/200mm actual diameter); *see Note 1*  
**10** = 10" valve (9.67"/246mm actual diameter)  
**12** = 12" valve (11.84"/301mm actual diameter)  
**14** = 14" valve (13.88"/353mm actual diameter); *see Note 2*

### FLOW/PRESSURE OPERATING RANGE

See the *Flow/Pressure Operating Range* tables in this section.

**M** = Medium pressure operation; pressure independent over a range of 0.6 to 3.0" WC (150 to 750 Pa),  
**L** = Low pressure operation; pressure independent over a range of 0.3 to 3.0" WC (75 to 750 Pa)

### VALVE OPTIONS

**EVI** = Exhaust valve with insulation and blocks  
**IBO** = Insulation blocks only, no insulation  
**PSL** = Pressure switch, low limit  
**REI** = Remote electronics - indoor; *see Note 5*  
**SFB** = Square flanges on each end of single body valve  
**SFX** = Single square flange on single body valve, mounted on either the inlet of exhaust valves or discharge of supply valves

### FAIL SAFE POSITION

**Z** = Fails to last position

### VALVE ORIENTATION

**H** = Horizontal  
**U** = Vertical upflow  
**D** = Vertical downflow

### VALVE CONTROLLER DESIGNATION

**A** = Theris TP Supply (controlling valve of tracking pair)  
**B** = Theris TX Supply (controlling valve of tracking pair with expanded features)  
**C** = Theris SO Supply only (no tracking pair ability)  
**D** = Theris EO Exhaust only (no tracking pair ability)  
**Y** = Theris TX-RTN (supply controlling primary exhaust and return valves)  
**Z** = Theris TX-EXH (supply controlling primary exhaust and locally controlled exhaust)  
**N** = No electronics (tracking valve or constant volume)

### CONTROL TYPE

**C** = Constant volume  
**I** = IP54 electric actuator; *available for single-body 8-, 10-, and 12-inch valves only*  
**L** = Low-speed electric actuation powered by the valve controller

### VALVE DESIGN

**A** = Conical-shaped diffuser (Accel II)  
**S** = Standard shut-off valve (metal-on-metal seal): TX, TX-EXH, TX-RTN, or EO; *see Note 3*  
**L** = Low-leakage shut-off valve (gasketed seal): TX, TX-EXH, TX-RTN, or EO; *see Note 4*

### NOTES:

- 8-inch Shut-off Valves (Design = S or L) are available ONLY in Construction A (uncoated).
- 14-inch Valves are currently NOT available as Low Leakage Shut-off (Design = L) with Medium Pressure (Range = M).
- Low Pressure (Range = L), Standard Shut-off (Design = S) valves are NOT available in Orientation = U (vertical upflow).
- Low Pressure (Range = L), Low Leakage (Design = L) valves are currently NOT available in any size.
- Option REI: Remote Electronics, Indoor installations ONLY. The distance to the valve controller is limited to: 150 feet (45.7 meters) of 22 gauge cable for low-speed electric actuators (Control Type = L or I).

## ORDERING GUIDE (CONTINUED)

### Flow/Pressure Operating Range Tables

**FLOW/PRESSURE OPERATING RANGE FOR VALVE DESIGN A**

Designation	Size	Operating Range in CFM (m <sup>3</sup> /hr)		Pressure Drop Across Valve
		Single	Dual	
M = Medium pressure	08"	35-700 (60-1185)	—	0.6-3.0" WC (150-750 Pa)
	10"	50-1000 (85-1695)	100-2000 (170-3390)	
	12"	90-1500 (155-2545)	180-3000 (310-5090)	
	14"	200-2500 (340-4245)	400-5000 (680-8490)	
L = Low pressure	08"	35-500 (60-845)	—	0.3-3.0" WC (75-750 Pa)
	10"	50-550 (85-930)	100-1100 (170-1860)	
	12"	90-1050 (155-1780)	180-2100 (310-3560)	
	14"	200-1400 (340-2375)	400-2800 (680-4750)	

**FLOW/PRESSURE OPERATING RANGE FOR SHUT-OFF VALVE DESIGNS S AND L**

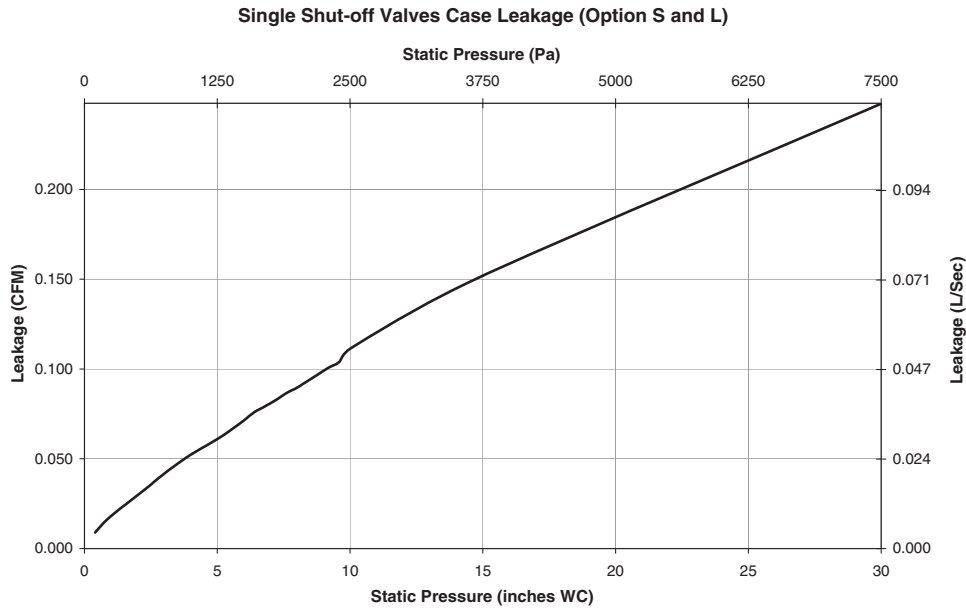
Designation	Size	Operating Range in CFM (m <sup>3</sup> /hr)		Pressure Drop Across Valve
		Single	Dual	
M = Medium Pressure	08"	35-600 (60-1015)	—	0.6-3.0" WC (150-750 Pa)
	10"	50-850 (85-1440)	100-1700 (170-2880)	
	12"	90-1300 (155-2205)	180-2600 (310-4410)	
	14"	200-1600 (340-2715)	400-3200 (680-5430)	
L = Low Pressure	08"	35-400 (60-675)	—	0.3-3.0" WC (75-750 Pa)
	10"	50-450 (85-760)	100-900 (170-1520)	
	12"	90-900 (155-1525)	180-1800 (310-3050)	
	14"	200-1000 (340-1695)	400-2000 (680-3390)	

## SHUT-OFF LEAKAGE PERFORMANCE

Shut-off Valves are available in two designs: Standard (Option S) and Low Leakage (Option L). The shut-off can be initiated locally through an analog input (AI) emergency switch (dry contact) from the building management system (BMS).

In the following graphs, the term, *shut-off leakage*, refers to the expected airflow through the valve in the shut-off position. The term, *casing leakage*, refers to the expected airflow through the penetrations of the valve body.

### Casing Leakage: Shut-off Valves Options S and L



#### NOTE:

- Leakage rates shown in this graph are for all four valve sizes: 8-, 10-, 12-, and 14-inch. A 14-inch low leakage valve is not available at this time.
- Exceeds Eurovent Class A, B, C and D specifications (Eurovent Committee of Air Handling and Equipment Manufacturers) when valve duct surface areas noted in Table 4 (this page) are taken into account.
- Option S leakage rates are for all four valve sizes (8", 10", 12", 14").
- Option L leakage rates are for 8-, 10-, and 12-inch valves only. A 14-inch low-leakage valve is not available at this time.

### Calculating Valve Area

To calculate leakage areas that take into account valve and duct area, use the Casing Leakage graph and the following table. Select the valve leakage at the appropriate design pressure and the related valve area from the table. For example:

$$\text{Leakage Specification} = \text{Leakage/Valve Area} = 0.150 \text{ CFM}/3.60 \text{ ft}^2 = 0.42 \text{ CFM per ft}^2$$

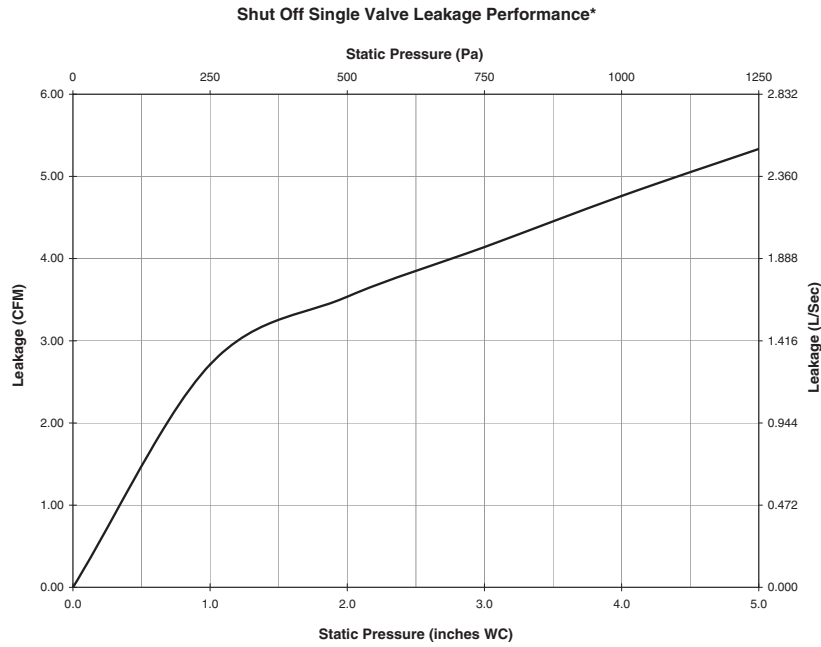
#### Valve Area Specifications:

Valve Size	Area (ft <sup>2</sup> )	Area (m <sup>2</sup> )
8-inch	3.60	0.33
10-inch	4.26	0.40
12-inch	6.28	0.58
14-inch	8.52	0.79

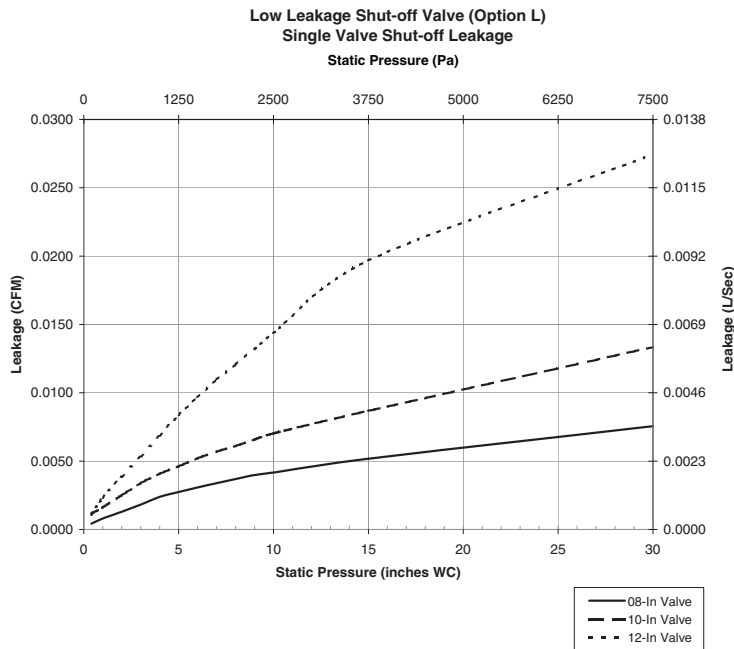
## SHUT-OFF LEAKAGE PERFORMANCE (CONTINUED)

### Shut-off Leakage: Standard Shut-off Valve (Option S)

Leakage rates shown in this graph are for all four valve sizes: 8, 10, 12, and 14-inch.



### Shut-off Leakage: Low Leakage Shut-off Valve (Option L)

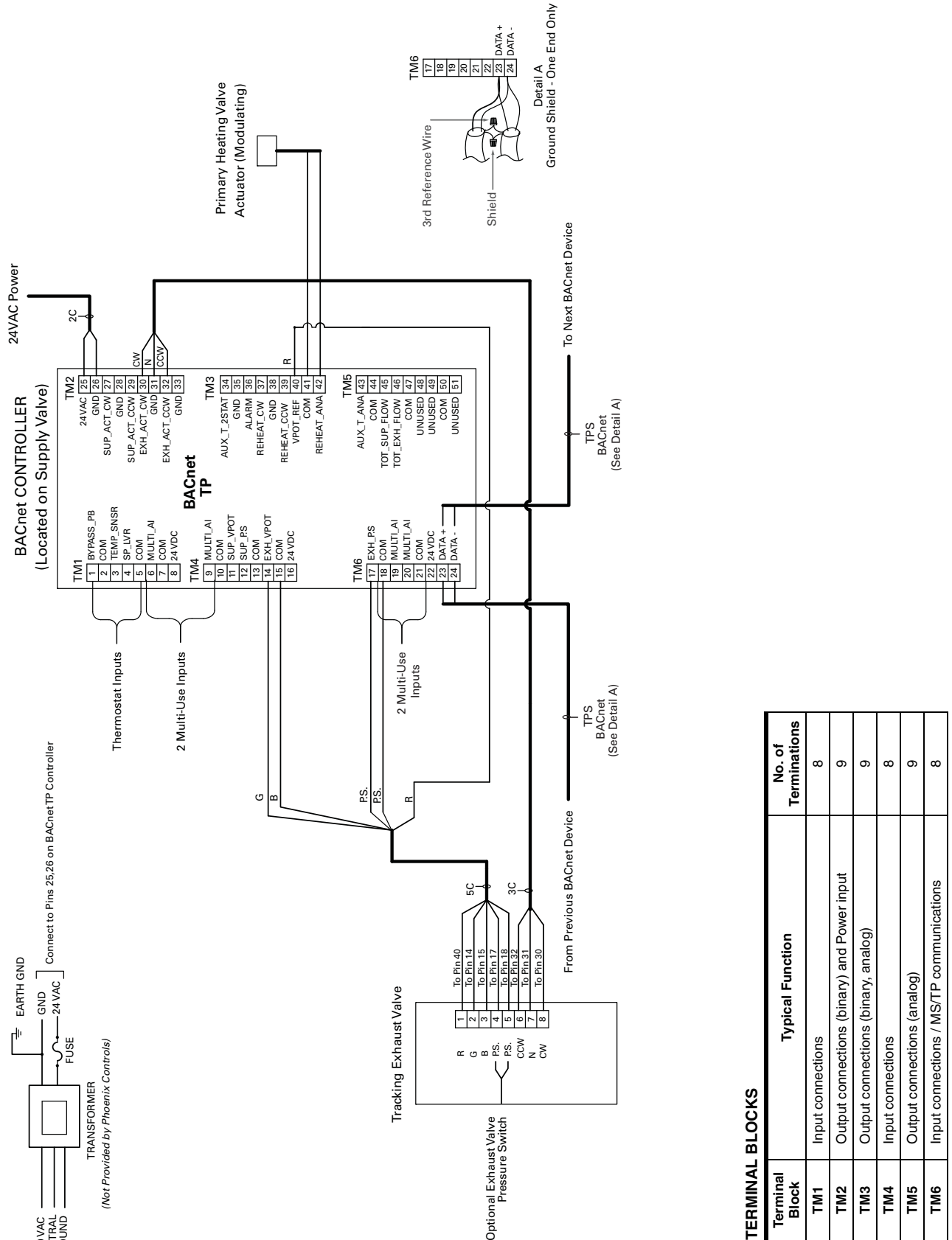


## Recommended Valve Construction for Decontamination Agents

<b>Gaseous Decontamination Agent</b>	<b>Recommended Valve Constructiton</b>
Hydrogen peroxide vapor	A
Ammonium chloride	A
Chlorine dioxide	A**
Paraformaldehyde	A
NOTE: <ul style="list-style-type: none"><li>• See <i>Ordering Guide: Valve Construction</i> for details about valve construction codes.</li><li>• Chemical resistance data acquired from Compass Corrosion Guide.</li><li>• **For concentrations up to 800 ppm. To achieve higher concentrations during decontamination, use construction B valves.</li></ul>	

**WIRING—For use with BACnet Controller** (See submittal wiring diagram for project-specific details.)

**Theris - TP Main Valve BACnet Controller**

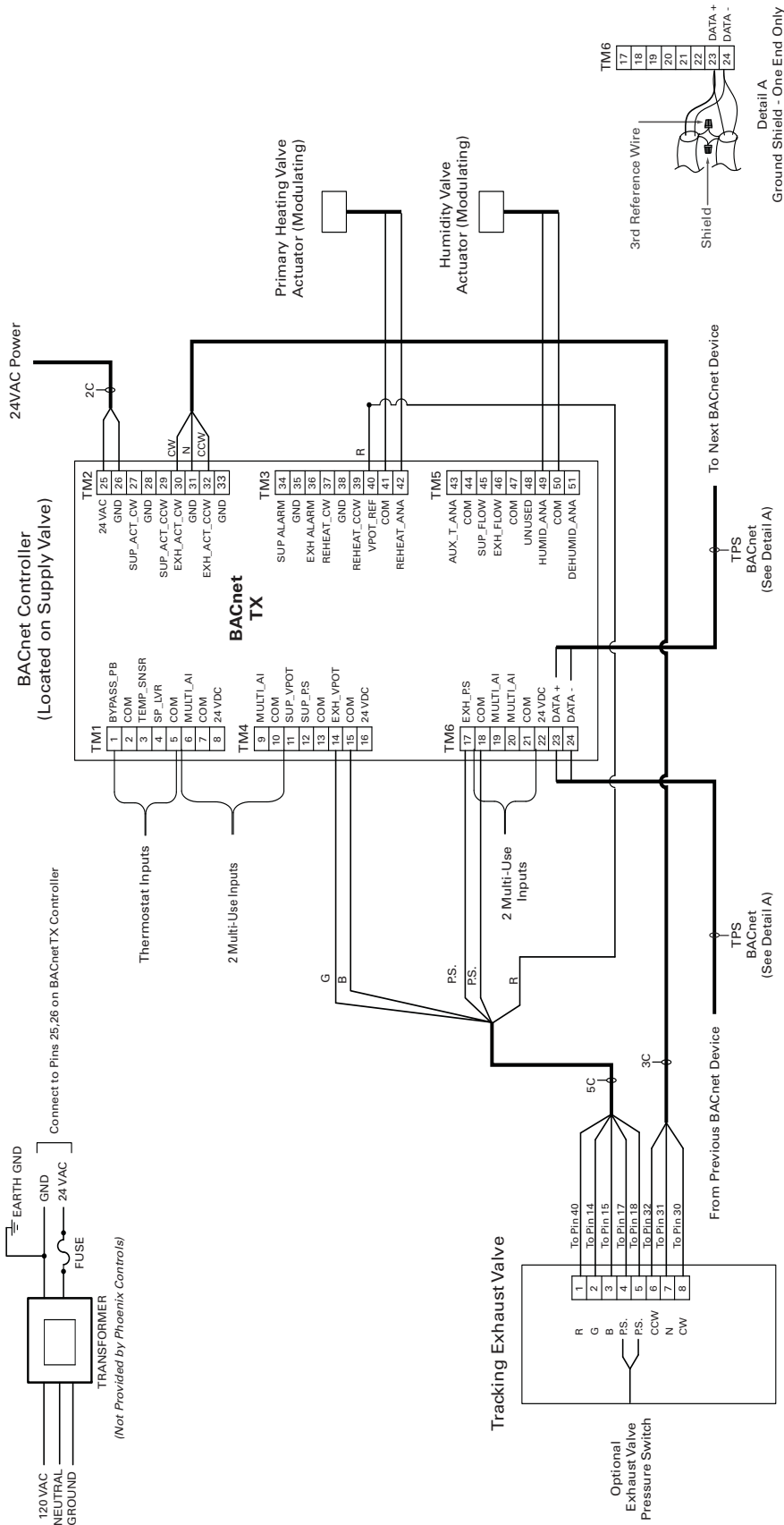


**TERMINAL BLOCKS**

Terminal Block	Typical Function	No. of Terminations
TM1	Input connections	8
TM2	Output connections (binary) and Power input	9
TM3	Output connections (binary, analog)	9
TM4	Input connections	8
TM5	Output connections (analog)	9
TM6	Input connections / MS/TP communications	8

**WIRING—For use with BACnet Controller** (See submittal wiring diagram for project-specific details.)

**Theris - TX Main Valve BACnet Controller**

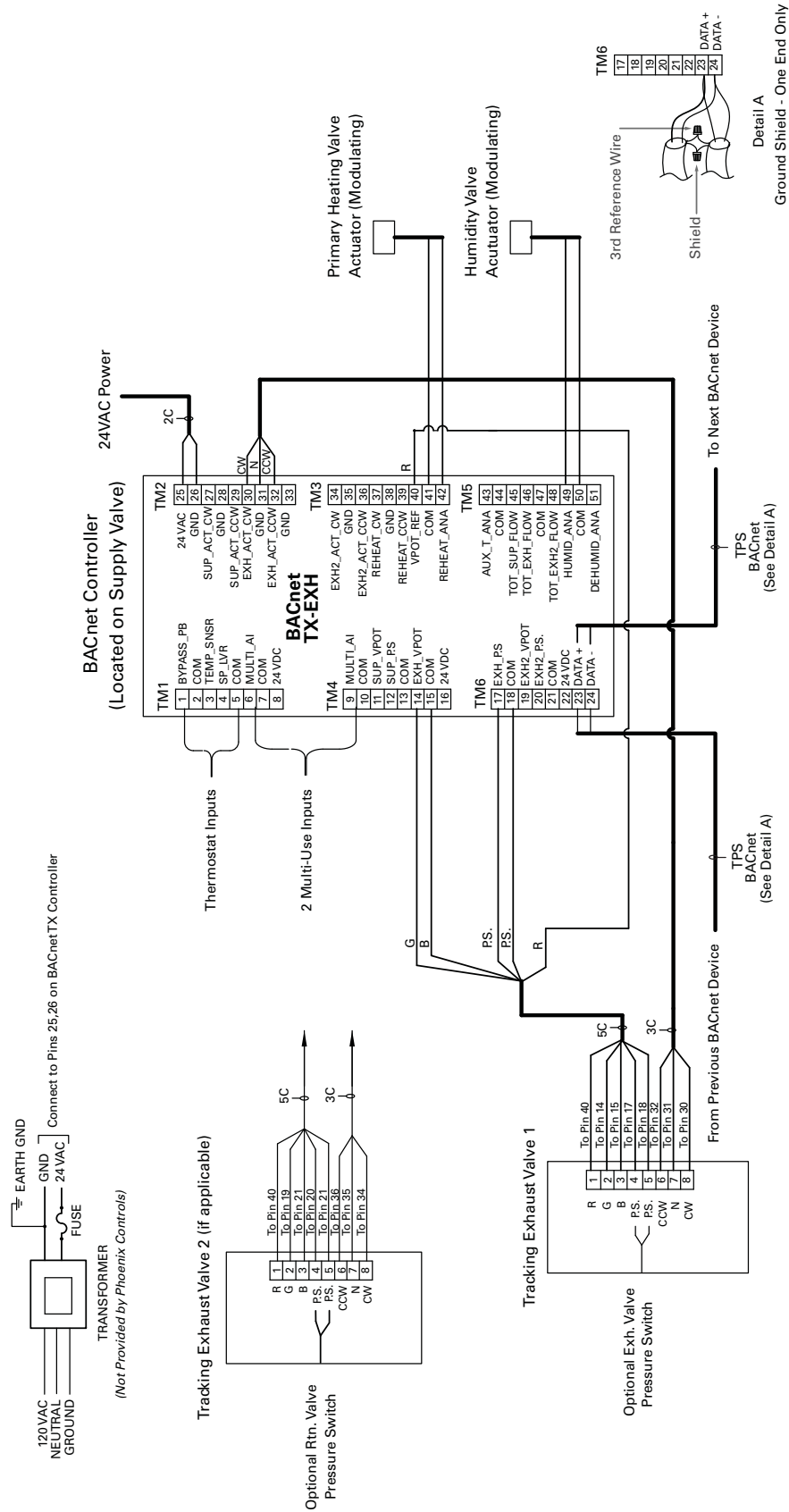


**TERMINAL BLOCKS**

Terminal Block	Typical Function	No. of Terminations
TM1	Input connections	8
TM2	Output connections (binary) and Power input	8
TM3	Output connections (binary, analog)	8
TM4	Input connections	8
TM5	Output connections (analog)	8
TM6	Input connections / MS/TP communications	8

**WIRING—For use with BACnet Controller** (See submittal wiring diagram for project-specific details.)

**Theris - TX-EXH Main Valve BACnet Controller**

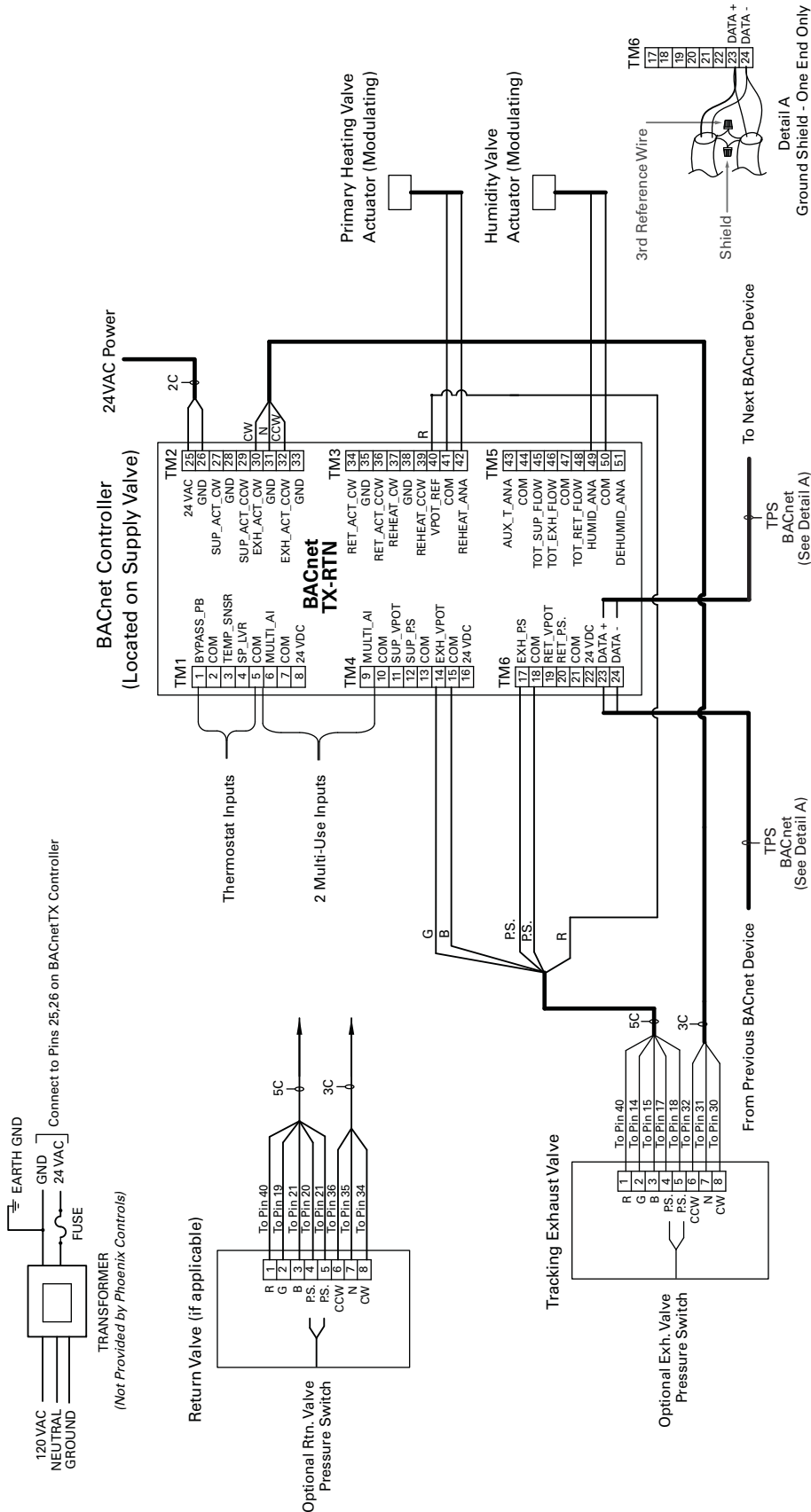


**TERMINAL BLOCKS**

Terminal Block	Typical Function	No. of Terminations
TM1	Input connections	8
TM2	Output connections (binary) and Power input	8
TM3	Output connections (binary, analog)	8
TM4	Input connections	8
TM5	Output connections (analog)	8
TM6	Input connections / MS/TP communications	8

**WIRING—For use with BACnet Controller** (See submittal wiring diagram for project-specific details.)

**Theris - TX-RTN Main Valve BACnet Controller**

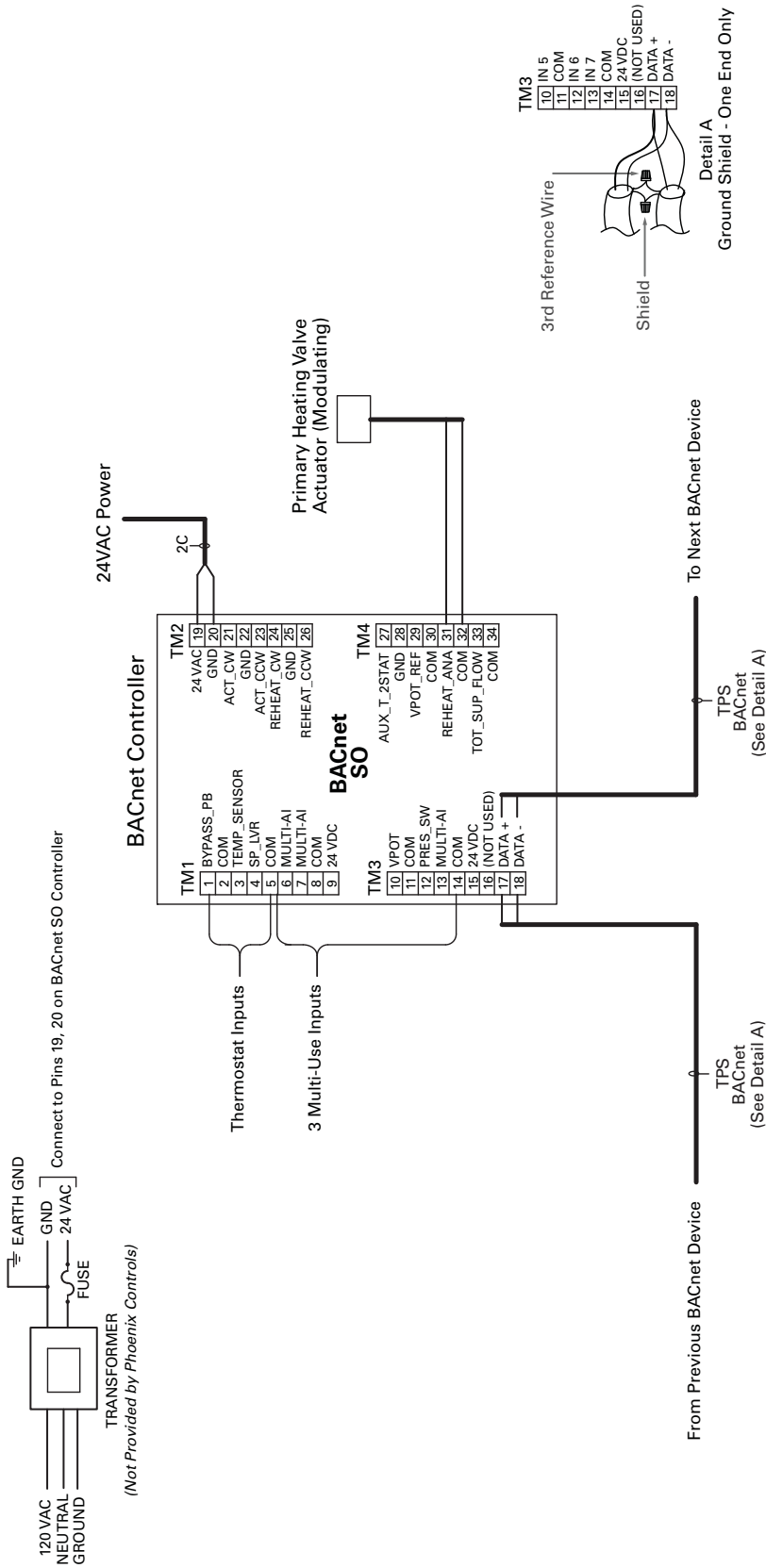


**TERMINAL BLOCKS S**

Terminal Block	Typical Function	No. of Terminations
TM1	Input connections	8
TM2	Output connections (binary) and Power input	9
TM3	Output connections (binary, analog)	9
TM4	Input connections	8
TM5	Output connections (analog)	9
TM6	Input connections / MS/TP communications	8

**WIRING—For use with BACnet Controller (continued)** (See submittal wiring diagram for project-specific details.)

**Theris - SO Main Valve BACnet Controller**

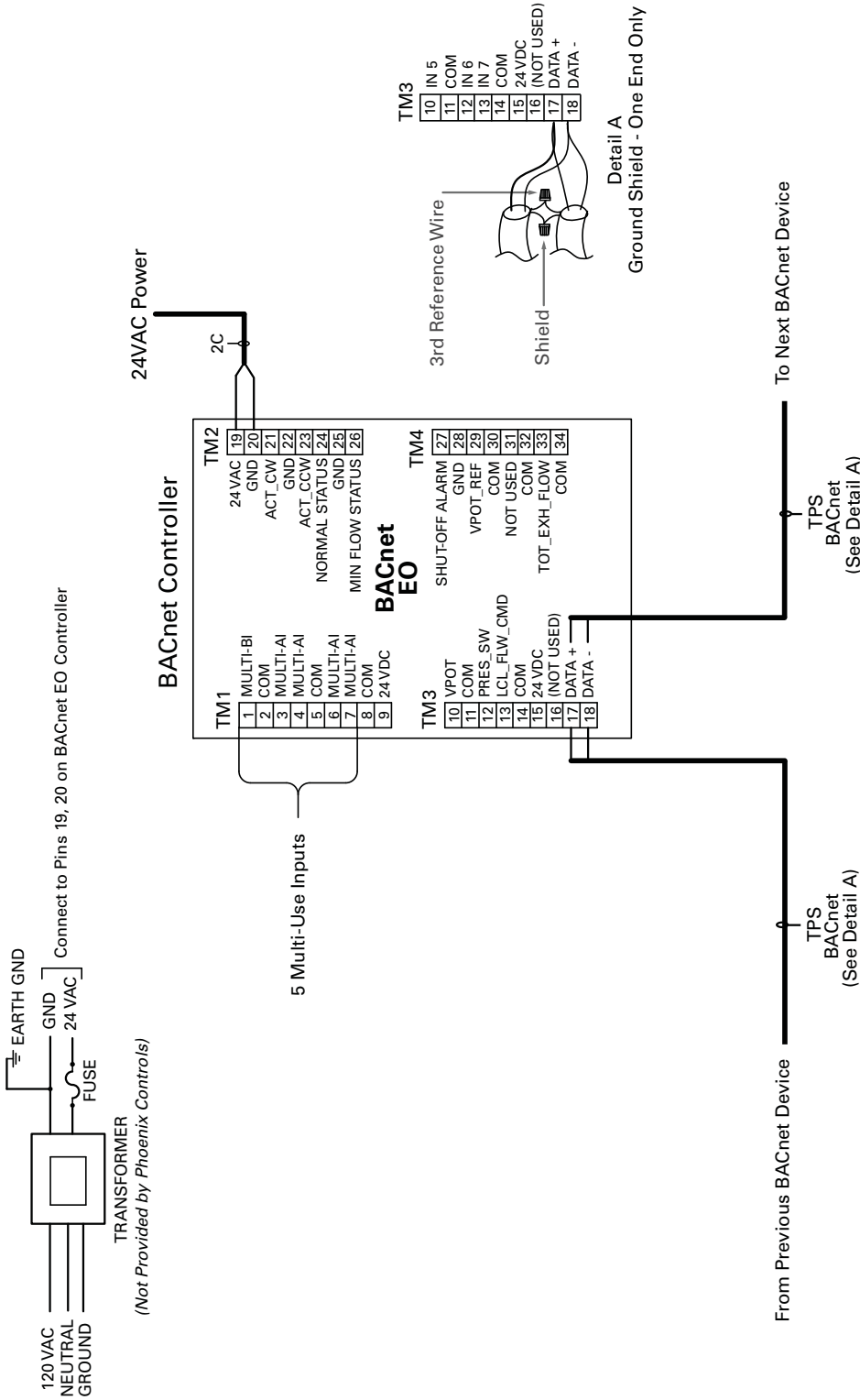


**TERMINAL BLOCKS**

Terminal Block	Typical Function	No. of Terminations
TM1	Input connections	9
TM2	Output connections (binary)	8
TM3	Input / BACnet communications	9
TM4	Output connections (analog, binary)	8

**WIRING—For use with BACnet Controller (continued)** (See submittal wiring diagram for project-specific details.)

**Theris - EO Main Valve BACnet Controller**



**TERMINAL BLOCKS**

Terminal Block	Typical Function	No. of Terminations
TM1	Input connections	9
TM2	Output connections (binary)	8
TM3	Input / BACnet communications	9
TM4	Output connections (analog, binary)	8

**Transformers**

The Theris Valve Controller requires the use of a step-down transformer (either 120/24 volt or 240/24 volt). Any transformer used to power these valve controllers must meet the requirements of an NEC Class 2 circuit or UL Listed, Class 2.

- The secondary of the transformer must be limited to a maximum of 30 Vac.
- Secondary power shall be current limited with either internal circuit breaker protection or with a four-amp slow blow fuse, in accordance with NEC Class 2 power requirements.

Phoenix Controls offers the following recommendations; however, designers, installers and owners should always consult their national and local electrical codes before selecting transformers for their systems.

- Transformers should not exceed 100 VA. Use multiple transformers, rather than larger transformers, when more than 100 VA is required.
- Each pressurization zone should have either a dedicated single-phase primary circuit or a secondary circuit disconnect.
- If an earth ground is provided, it should not be connected to the valve controllers, even though there is a three-terminal connector on the control board.

*NOTE: AC line voltage polarity must be maintained on all valve controllers and AC powered ancillary devices.*

**Power Conductor Sizing**

For low-speed valves in a bus configuration:

As a rule of thumb for loads up to 100 VA, use 18 AWG cable with a maximum length of 110 feet (33 meters) between the transformer and the last daisy-chained device.

For a more exact length per load number, refer to this chart.

<b>Maximum wire length (in feet) given a wire gauge and VA delivery by transformer</b>					
<b>VA Delivered</b>	<b>Wire Gauge</b>				
	<b>14 AWG</b>	<b>16 AWG</b>	<b>18 AWG</b>	<b>20 AWG</b>	<b>22 AWG</b>
10	2880	1743	1095	695	433
20	1440	871	548	347	216
30	960	580	365	213	144
40	720	435	274	174	108
50	576	348	219	139	86
60	480	290	182	115	72
70	411	249	156	99	61
80	360	217	136	86	54
90	320	193	121	77	48
100	288	174	110	69	43

### Network Wiring (Room-level Network)

The quality of the cable and the cable installation, the number of devices, and the amount of data to be passed influence the practical cable length and communications speed (baud rate). Cabling has the greatest influence on the quality of communications. Depending on the quality of the installation, it may be necessary to reduce the baud rate to avoid intermittent communications. Using a larger gauge wire will not allow you to exceed the maximum recommended cable length.

**Layout:** Bus topology.

**Cabling:** Three-conductor, stranded, twisted-shield cable with the following electrical characteristics:

- Impedance between 100 and 130  $\Omega$ .
- Distributed capacitance between conductors less than 30 pF/ft (100 pF/m).
- Distributed capacitance between conductors and shield less than 60 pF/ft (200 pF/m).
- Phoenix Controls recommends 22 AWG (.65 mm) cable. Alternate wire sizes which meet these specifications may be used, but will not extend the maximum cable length per segment.

**Segment Length:** 4000 ft. (1219 m) maximum per segment using recommended wire.

**Devices per Segment:** A maximum of 50 devices is recommended.

**Repeaters:** Repeaters are required when making runs longer than 4000 ft (1219 m). Available from other vendors.

**Terminating Resistors:** Matched resistors required at each end of segment bus wired across (+) and (-). Use matched resistors rated 120 ohm 1/4W +/-5%.

**Shield Grounding:** Ground shield drain wire at single point earth (panel) ground, and not the TBC ground. Tape off shield drain wire at other end. Tie shield drain wire through at each TBC.

- Each controller counts as a 1/8 unit, up to 127 controllers can be on a single segment. Phoenix Controls recommends not placing more than 50 devices on a single physical network segment.
- At the last device on each end of the MS/TP segment, matched terminating resistors wired across Data+ and Data- are required for signal integrity. The resistors are not included.
- For more detailed information, refer to *Phoenix Recommended Cables* - the last page of this document.

### Phoenix Controls TP, TX, and SO/EO Controllers

- Each controller counts as a 1/4 unit, up to 64 controllers can be on a single segment.
- The TP/TX controllers support two TP or two TX valves and a single return valve.
- The SO/EO controller supports a single stand-alone valve.
- At the last device on each end of the MS/TP segment, matched terminating resistors wired across Data+ and Data- are required for signal integrity.

### Phoenix Controls Wiring Recommendations

- Use cables recommended by Phoenix Controls.
- Stranded wire is strongly recommended for ease of installation.
- Follow good wiring practices:
  - Do not run the communications cable in the same conduit or wire way as the power cables.
  - If the communications cables must cross power cables, it is best to do so at a 90-degree angle.
  - Shield or drain wires, if present, should be wrapped with insulating tape to prevent contact with exposed conductors or contacts.
  - Maintain a consistent color code or polarity all the way through the wiring system.
  - All connections must meet the requirements of an NEC Class 2 circuit.
  - Local and national electrical codes take precedence.

## POINTS

The table in this section contains points available for integration in a building management system (BMS). The following table is a list of points for open BACnet integration.

### BACnet Points Available for Integration

Object Instance	Functional Description	Read or Write	TX-EXH	TX-RTN	TX	TP	SO	EO
<i>Alarms</i>								
BO5	Supply/Exhaust Alarm LED	Read Only				X		
BV0	Supply Flow Alarm	Read Only	X	X	X	X	X	
	Flow Alarm	Read Only						X
BV1	Exhaust1 Flow Alarm	Read Only	X	X	X	X		
BV2	Exhaust2 Flow Alarm/Return Flow Alarm	Read Only	X	X				
BV3	Supply Jam Alarm	Read Only	X	X	X	X	X	
	Jam Alarm	Read Only						X
BV4	Exhaust1 Jam Alarm	Read Only	X	X	X	X		
BV5	Exhaust2 Jam Alarm/Return Flow Alarm	Read Only	X	X				
BV46	Sensor Fail Alarm	Read Only	X	X		X	X	
<i>Temperature Control</i>								
AI1	Effective Room Temperature	Read Only	X	X	X	X	X	
AV21	Heating Demand Signal	Read Only	X	X	X	X	X	
AV22	Cooling Demand Signal	Read Only	X	X	X	X	X	
AV23	Auxiliary Temperature Independent Set Point	Read/Write	X	X	X	X	X	
AV27	Primary Heating Coil Command	Read Only	X	X	X	X	X	
AV28	Auxiliary Temperature Control %	Read Only	X	X	X	X	X	
AV52	Occupied Temperature Set Point	Read/Write	X	X	X	X	X	
AV93	Occupied Temperature Deadband	Read/Write	X	X	X	X	X	
AV94	Heating Set Point Offset	Read/Write	X	X	X	X	X	
AV95	Unoccupied Cooling Set Point	Read/Write	X	X	X	X		
AV96	Unoccupied Heating Set Point	Read/Write	X	X	X	X		
AV99	Effective Cooling Set Point	Read Only	X	X	X	X		
AV100	Effective Heating Set Point	Read Only	X	X	X	X		
AV101	Setpoint Lever Range	Read/Write	X	X	X	X	X	
BV48	Heating Enable	Read/Write	X	X	X	X	X	
BV49	Cooling Enable	Read/Write	X	X	X	X	X	
BV50	Optimum Start Heating and Cooling	Read/Write	X	X	X	X	X	

## BACnet Points Available for Integration (Continued)

Object Instance	Functional Description	Read or Write	TX-EXH	TX-RTN	TX	TP	SO	EO
<i>Valve Flow Control</i>								
AV36	Low Limit (selectable units)	Read Only						X
	Supply Airflow Low Limit	Read Only	X	X	X	X	X	
AV37	High Limit (selectable units)	Read Only						X
	Supply Airflow High Limit	Read Only	X	X	X	X	X	
AV38	Exhaust Airflow Low Limit	Read Only	X	X	X	X		
AV39	Exhaust High Limit (selectable units)	Read Only						X
	Exhaust Airflow High Limit	Read Only	X	X	X	X		
AV40	Return Low Limit (selectable units)	Read Only		X				
	Exhaust2 Airflow Low Limit	Read Only	X					
AV41	Return High Limit (selectable units)	Read Only		X				
	Exhaust2 Airflow High Limit	Read Only	X					
AV53	Total Supply Flow	Read Only	X	X	X	X	X	
AV54	Total Exhaust Flow	Read Only	X	X	X	X		X
AV55	Current Min Flow	Read Only			X	X	X	
AV57	Supply Airflow Command	Read Only	X	X	X	X	X	
AV58	Exhaust Airflow Command	Read Only	X	X	X	X		X
AV59	Targeted Exhaust2 Airflow Command	Read Only	X					
	Targeted Return Airflow Command	Read Only		X				
AV60	Effective Supply Airflow	Read Only	X	X	X	X	X	
	Effective Airflow	Read Only						X
AV61	Effective Exhaust Airflow	Read Only	X	X	X	X		
AV62	Effective Exhaust2 Airflow	Read Only	X	X				
AV63	Override Commanded Exhaust Flow %	Read/Write	X	X	X	X		X
<i>Zone Balance Control</i>								
AV10	Additional VAV Supply/Exhaust Flow	Read Only					X	
	Scaled Flow Command	Read Only						X
AV15	Effective Offset Status	Read Only	X	X	X	X		
AV33	Constant Volume Supply Airflow	Read/Write	X	X	X	X	X	
	Constant Volume Exhaust Airflow	Read/Write						X
AV34	Constant Volume Exhaust Airflow	Read/Write	X	X	X	X		
AV35	Constant Volume Return Airflow	Read/Write		X				
AV48	Minimum Airflow - Occupied	Read/Write	X	X	X	X	X	
AV49	Minimum Airflow - Unoccupied	Read/Write	X	X	X	X	X	

## BACnet Points Available for Integration (Continued)

Object Instance	Functional Description	Read or Write	TX-EXH	TX-RTN	TX	TP	SO	EO
AV55	Effective Minimum Airflow	Read Only	X	X	X	X	X	
AV56	Effective Offset	Read Only	X	X	X	X		
AV63	Exhaust1 Override Command Flow %	Read/Write	X	X	X	X		X
AV64	Exhaust2/Return Override Command Flow %	Read/Write	X	X				
AV65	Offset Setpoint	Read/Write	X	X	X	X		
BV54	Exhaust1 Override Enable	Read/Write	X	X	X	X		X
BV55	Exhaust2/Return Override Enable	Read/Write	X	X				
<i>Occupancy Control</i>								
AV97	Bypass Time (hours)	Read Only	X	X	X	X	X	
AV98	Bypass Time Remaining (hours)	Read/Write	X	X	X	X	X	
BI0	Bypass Switch Input (momentary)	Read Only	X	X	X	X	X	
BV9	Enable Occupied Mode if Comm Failure	Read Only	X	X	X	X	X	
BV40	Occupancy Command	Read/Write	X	X	X	X	X	
BV66	Bypass Mode Status (after-hours)	Read Only	X	X	X	X	X	
BV67	Occupied Status	Read Only	X	X	X	X	X	
<i>Humidity Control</i>								
AV17	Humidification Set Point	Read/Write	X	X	X			
AV18	Dehumidification Set Point	Read/Write	X	X	X			
<i>Emergency Mode Control</i>								
AV11	Emergency Mode 1 Override Supply Flow %	Read/Write	X	X	X	X	X	X
AV12	Emergency Mode 2 Override Supply Flow %	Read/Write	X	X	X	X	X	X
AV13	Emergency Mode 3 Override Supply Flow %	Read/Write	X	X	X	X	X	X
AV14	Emergency Mode 4 Override Supply Flow %	Read/Write	X	X	X	X	X	X
AV16	Pandemic Offset	Read/Write		X				
BV18	Emergency Switch to Zero Offset	Read Only	X	X	X	X		
BV20	Emergency Mode 3 Status	Read Only	X		X	X	X	X
	Emergency Mode 1 Shutoff Return	Read Only		X				
BV21	Emergency Mode 4 Status	Read Only	X		X	X	X	X
	Emergency Mode 2 Shutoff Return	Read Only		X				
BV22	Emergency Mode 3 Shutoff Return	Read Only		X				
BV23	Emergency Mode 4 Shutoff Return	Read Only		X				
BV28	Emergency Mode 1 Remote Command	Read/Write	X	X	X	X	X	X
BV29	Emergency Mode 2 Remote Command	Read/Write	X	X	X	X	X	X
BV30	Emergency Mode 3 Remote Command	Read/Write	X	X	X	X	X	X

## BACnet Points Available for Integration (Continued)

Object Instance	Functional Description	Read or Write	TX-EXH	TX-RTN	TX	TP	SO	EO
BV31	Emergency Mode 4 Remote Command	Read/Write	X	X	X	X	X	X
BV32	Pandemic Mode Remote Command	Read/Write		X				
BV33	Pandemic Mode Status	Read Only		X				
BV34	Emergency Mode 1 Status	Read Only	X	X	X	X	X	X
BV35	Emergency Mode 2 Status	Read Only	X	X	X	X	X	X
BV36	Emergency Mode 1 Shut Off Enable	Read/Write	X	X	X			X
BV37	Emergency Mode 2 Shut Off Enable	Read/Write	X	X	X			X
BV38	Emergency Mode 3 Shut Off Enable	Read/Write	X	X	X			X
BV39	Emergency Mode 4 Shut Off Enable	Read/Write	X	X	X			X
BV41	Return Shut-Off	Read Only		X				
BV62	Emergency Mode 3 Status	Read Only		X				
BV63	Emergency Mode 4 Status	Read Only		X				
<i>Device Configuration</i>								
AV0	AI0 Input Selection	Read Only						X
AV1	AI1 Input Selection	Read Only						X
AV2	AI3 input selection	Read/Write	X	X	X	X	X	
	AI2 Input Selection	Read Only						X
AV3	AI4 input selection	Read/Write	X	X	X	X	X	
	AI3 Input Selection	Read Only						X
AV4	AI4 Input Selection	Read Only						X
AV9	Scaled value of AI3	Read Only	X	X	X	X	X	
AV10	Scaled value of AI4	Read Only	X	X	X	X	X	
AV32	AI7 Input Selection	Read Only					X	
	AI9 Input Selection	Read Only			X	X		
AV35	AI10 Input Selection	Read Only			X	X		
AV39	Scaled Value of AI1	Read Only						X
AV40	Scaled Value of AI2	Read Only						X
	Scaled Value of AI7	Read Only					X	
	Scaled Value of AI9	Read Only			X	X		
AV41	Scaled Value of AI10	Read Only			X	X		
	Scaled Value of AI3	Read Only						X
AV42	Scaled Value of AI4	Read Only						X
	IAQ Minimum Set Point	Read/Write	X		X	X	X	
AV43	IAQ Maximum Set Point	Read/Write	X		X	X	X	

## BACnet Points Available for Integration (Continued)

Object Instance	Functional Description	Read or Write	TX-EXH	TX-RTN	TX	TP	SO	EO
AV46	Units Displayed	Read Only	X	X	X	X	X	X
BV13	Metric Airflow Units Select	Read/Write	X	X	X	X	X	X
BV52	IAQ Enable/Disable	Read/Write	X		X	X	X	
BV69	English/Metric Mode Select	Read/Write	X	X	X	X	X	X

### MAINTENANCE

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Theris valves require no ongoing preventive maintenance. Once the field engineer has completed the field startup, the valves will provide years of continuous operation.

## PHOENIX RECOMMENDED CABLES

Cable Type	Plenum Rated	Function	Wire Gauge	Primary Vendor/Part #	Alternate Vendor/Part #	Color Code	Notes
2C Round	No	24 Vac power	18	Belden 9409		1: Red 2: Black	Must be stranded
			14	Belden 9411			
2C Round	Yes	24 Vac power	18	Belden 82740	Windy City NP002360	1: Red 2: Black	Must be stranded
			14	Windy City NP007960			
TSP	No	I/O signal wiring	22	Belden 9501		1: Black&Red	Twisted Shielded Pair
2 TSP	No	I/O signal wiring	22	Belden 9502		1: Black&Red 2: Black&White	Two Twisted Pair, Shielded
3C Round	No	Signal	22	Belden 8443		1: Red 2: Black 3: Green	Must be stranded
3C or 4C Round	Yes	Signal	22	Belden 88444	Windy City 004380	1: Red 2: Black 3: Green 4: White (not used as 3C)	Must be stranded
4C Round	No	Signal	22	Belden 8444	Manhattan M13304	1: White 2: Green 3: Black 4: Red	Must be stranded
5C Round	No	Signal	22	Belden 8445	Manhattan M13305	1: White 2: Brown 3: Black 4: Red 5: Green	Must be stranded
8C	No	Signal	22	Belden 9421	Manhattan M13308	1: White 2: Orange 3: Black 4: Red 5: Green 6: Yellow 7: Blue 8: Brown	No substitutes
8C	Yes	Signal	22	Comtran 4956		1: White 2: Orange 3: Black 4: Red 5: Green 6: Yellow 7: Blue 8: Brown	No substitutes
3C MS/TP	No	Shielded	22	Belden 3106A (120 ohm)		1: White with Orange stripe 2: Orange with White stripe 3: Blue with White stripe	Shielded with drain
3C MS/TP	Yes	Shielded	22	Connect-Air W223C-2060YPC		1: Black 2: White 3: Red	Foil shield with drain wire