Motivair ™

Engineered cooling solutions for all applications

ChilledDoor® Rack Cooling System

INSTALLATION <> OPERATION <> MAINTENANCE GUIDE

Models: MCD-M4 thru M16

Motivair Corporation
85 Woodridge Drive Amherst, NY 14228
716-691-9222 (Ph) 716-691-9229 (fax)

Email: info@motivaircorp.com
Website: www.chilleddoor.com
Website: www.motivaircorp.com

ABOUT THIS DOCUMENT

ATTENTION

Read this page before proceeding

This document may be updated without notice at any time. Motivair reserves the right to update and or change product specifications and performance without notice as design improvements occur. Please contact the factory to ensure that your version is the most up to date.

Disclaimer

The manufacturer shall not be liable for any damages resulting from misapplication or misuse of its products.

Product Standards and Compliance

All products conform to industry standards and ratings; contact Motivair for a complete list and certificates for specific models.

Important Caution and Danger Warnings in this Document

The following notices and statements are used in this document:

- **Note**: These notices provide important tips, guidance, or advice.
- **Important**: These notices provide information or advice that might help you avoid inconveniences or problem situations.

- **Attention**: These notices indicate potential damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.

CAUTION: These statements indicate situations that can be potentially hazardous to you. A caution statement is placed just before the description of a potentially damaging procedure, step, or situation.

DANGER: These statements indicate situations that can be potentially lethal or extremely hazardous to you. A danger statement is placed just before the description of a potentially hazardous procedure, step, or situation.

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Section 1 **SAFETY INSTRUCTIONS**

WARNING

Operation of this equipment involves potentially lethal dangers (HIGH VOLTAGE POWER and High water Pressures.) Therefore, ALL safety precautions and warnings described in this manual must be precisely observed. Failure to follow these precautions and warnings can result in severe or fatal injury

General Safety

Temperature control equipment, pump stations, and electrical devices contained in this system presents various electrical, mechanical, sound and vibration hazards. For this reason, operation and service procedures should only be performed by qualified, fully trained and technically competent personnel.

This equipment contains:

- High pressure water
- Electrically energized components
- Rotating parts such as fan impellers, wheels and valves
- Sharp coil fins and metal surfaces

Owner's Responsibility

This equipment must be installed, maintained and operated by a person or persons qualified for this equipment. This system contains water/air circulation equipment and electrical components. The person most suited to perform any operations or service on this equipment is a qualified industrial technician and or electrician with experience and qualifications to work with water systems and electrical systems.

Installation

Installation and operation should always be conducted in compliance with local, state and national codes and industry best practices. When moving or installing the unit, CAUTION must be observed at all times to ensure the safety and well being of personnel. Follow all local, state, and national codes for moving equipment. Only appropriate and approved moving equipment should be used.

Application

This unit must only be used in the application for which it was designed. Do not use this product in any hazardous environment.

Electrical

WARNING – This unit is powered by HIGH VOLTAGE. Serious injury or death can occur. Power being supplied to the unit must be isolated with an electrical disconnect. Any and all electrical connections or procedures should only be performed by a certified electrician. All electrical work or procedures should be in accordance with local, state and national electrical codes and regulations. NEVER make any electrical connections to this unit unless the power supply is OFF at the power supply disconnect switch.

General Product Description

The ChilledDoor® is a water-cooled door that is mounted on the back of an IT enclosure or any standard or OEM server rack and is used to cool the air that is heated and exhausted by devices mounted inside. The cooling effect is accomplished by using an aluminum finned copper coil heat exchanger, Electrically Commutated (EC) motor fans, a water supply valve and a high powered PLC control system that is built into the door. Supply and return water hoses (available separately) deliver conditioned water or glycol to the ChilledDoor® and remove the heated water from it. A ChilledDoor® can easily be adapted for use on server racks and IT enclosures that are mounted either at grade or on a raised floor. A ChilledDoor® or a series of chilled doors can be used as the primary cooling system for a data center or can be used as a retrofit solution to increase cooling capacity of an existing facility.

Heat extracted from the ChilledDoor® is transferred to a CDU heat exchanger or to the building's own cooling loop where the heat is exchanged to the Primary Loop and removed.

Various set points and operating parameters can be monitored and controlled within the ChilledDoor®. These can be adjusted by the operator via an integrated BMS system.

ChilledDoor® are manufactured in various configurations, heights, widths, and kW capacities to accommodate a wide range of popular server racks . Make sure to check specific product specifications and design criteria for each specific ChilledDoor® Consult Motivair with any questions.

Technical Data

Technical Data such as fan curves, electrical loads and sound data for any specific ChilledDoor® that is not included in this general manual may be obtained from the nameplate or from the product specification or submittal. Consult Motivair with any questions or document requests.

Electrical Data

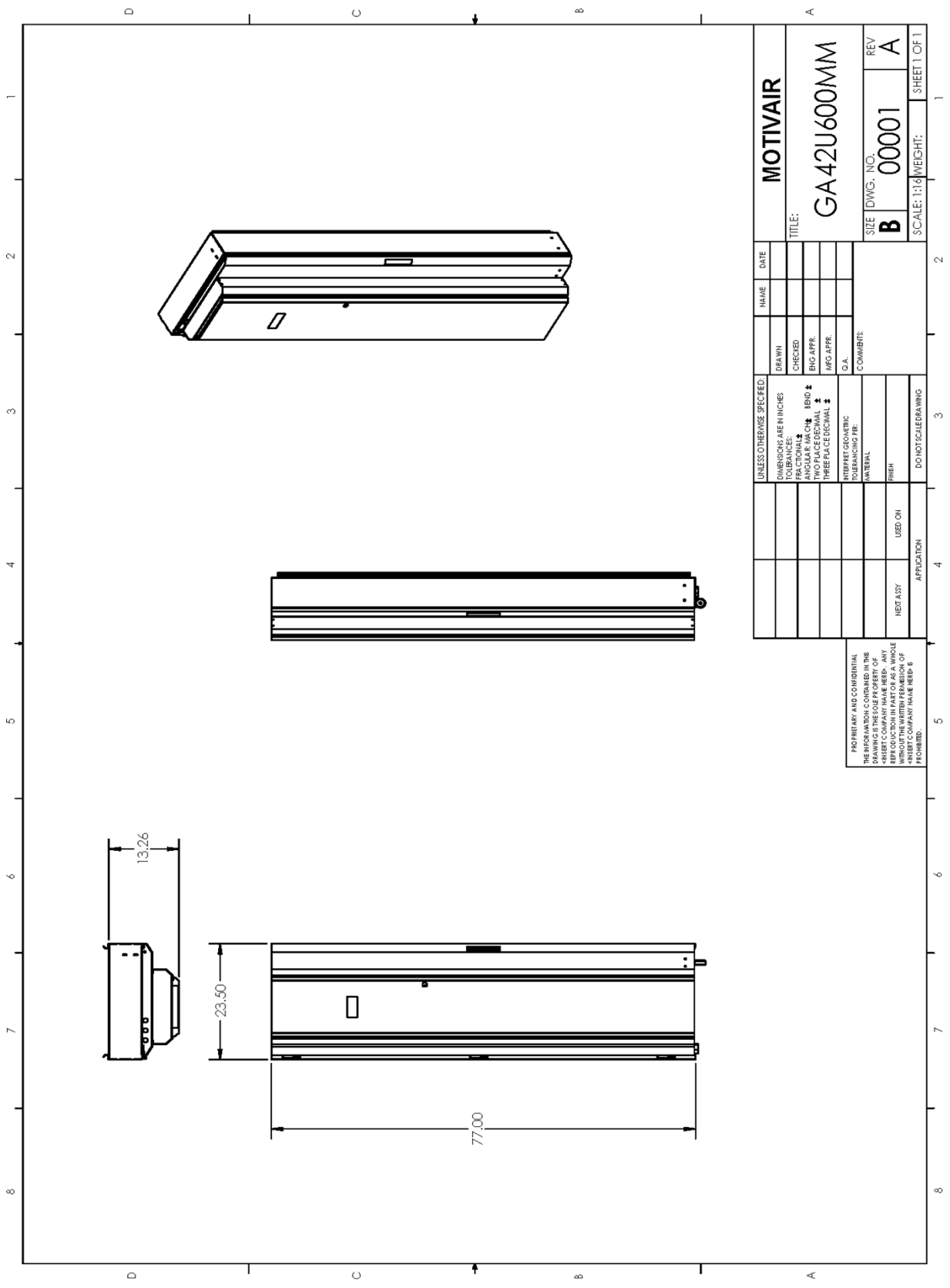
Standard Available Power Options: 115/1/60Hz and 208-230/1/50-60Hz

Design Capacities

MCD-M4-12 Typical Design Data:		
Unit Height:	U	42U-48U Racks
Unit Width:	mm	600-800mm
Unit Depth:	In	12"- 16" with interface adapter
		Primary
Fluid Type:	-	100% Water or Glycol %
Design Fluid Flow:	GPM	0-20
Max Fluid Flow:	GPM	23
Estimated Total Fluid Pressure Drop:	PSID	0-15
Design Fluid Inlet Temp:	°F	65°
Design Fluid Outlet Temp:	°F	75°- 85°
Design Cooling Capacity:	kW	5-75
MAX Cooling Capacity:	kW	As Spec'd
Total power consumed at design	kW	As Spec'd
Available Air flow	CFM	3500 - 5500
Approximate Shipping Weight:	Lbs.	500-700
Approximate Operating Weight:	Lbs.	300-450
Specifications are subject to change without notice.		
Power 230/3/60 FLA: 7 Amps	MCA: 10 Amps	MOP: 15 Amp

The above sample design specifications are based on average load conditions.
Capacity and performance will vary based on flow, water temps, and fluid type.

Note:
For your specific design and application, refer to your Motivair engineering selection.


MOTIVAIR
TITLE:
GA42U600MM
SIZE B
DWG. NO. 00001
REV A
SCALE: 1:16
WEIGHT:
SHEET 1 OF 1
DRAWN
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
NAME
DATE
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH
DO NOT SCALE DRAWING
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USED ON
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PROPRIETARY AND CONFIDENTIAL
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF <INSERT COMPANY NAME HERE>. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF <INSERT COMPANY NAME HERE> IS PROHIBITED
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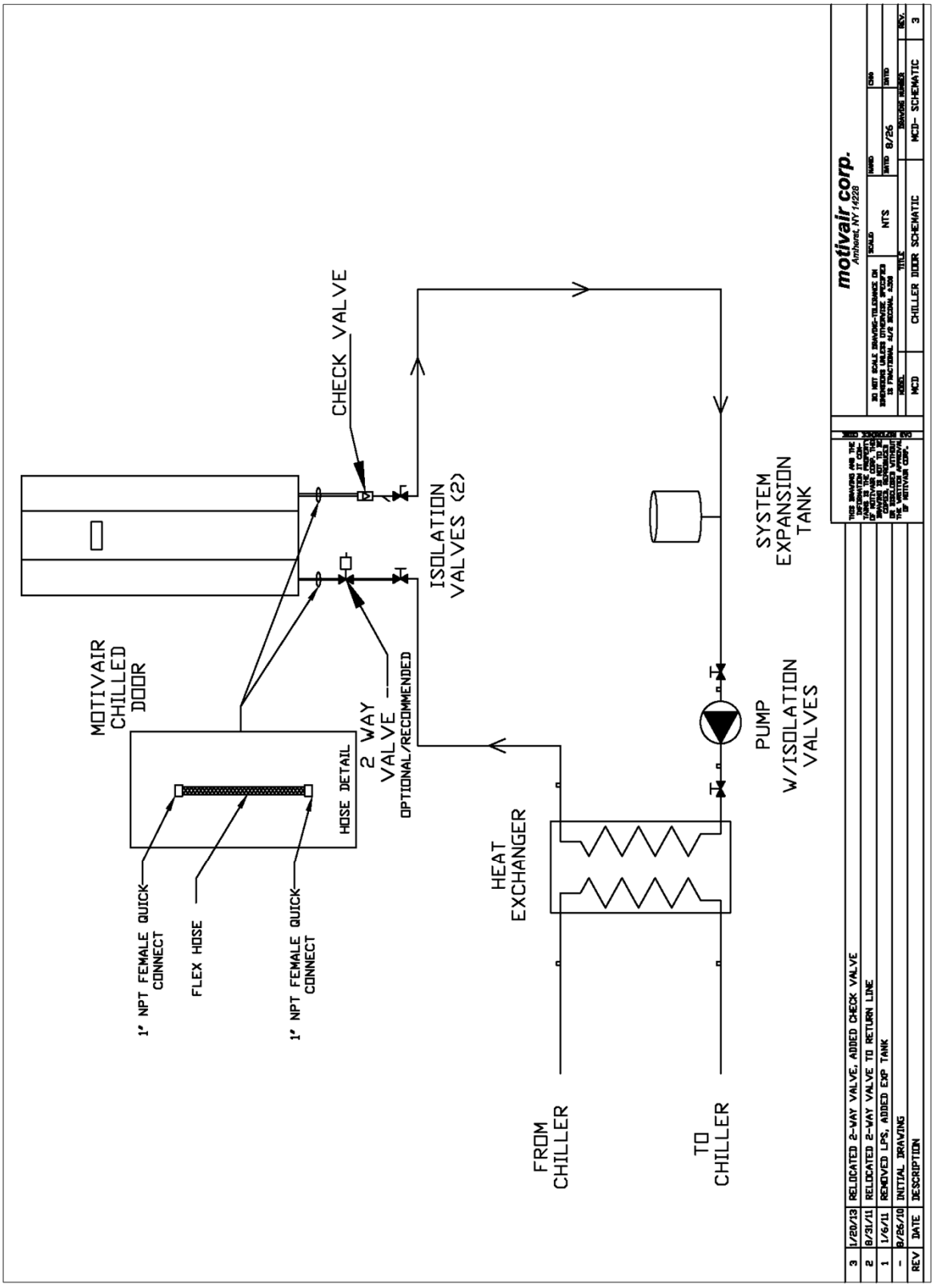

CHECK VALVE
ISOLATION VALVES (2)
SYSTEM EXPANSION TANK
MOTIVAIR CHILLED DOOR
HOSE DETAIL
2 WAY VALVE
OPTIONAL/RECOMMENDED
PUMP W/ISOLATION VALVES
1" NPT FEMALE QUICK CONNECT
FLEX HOSE
1" NPT FEMALE QUICK CONNECT
HEAT EXCHANGER
FROM CHILLER
TO CHILLER
motivair corp.
Amherst, NY 14228
SCALE: NTS
DRWN: BMD 8/26
CHK'D:
TITLE: CHILLER DOOR SCHEMATIC
MCD: MCD- SCHEMATIC
REV: 3
3 1/20/13 RELOCATED 2-WAY VALVE, ADDED CHECK VALVE
2 8/31/11 RELOCATED 2-WAY VALVE TO RETURN LINE
1 1/6/11 REMOVED LPS, ADDED EXP TANK
- 8/26/10 INITIAL DRAWING
REV DATE DESCRIPTION

Pre-Installation requirements of the ChilledDoor®

The ChilledDoor® requires a specific flow (gpm) and coolant supply temperature based on the model kW size and number of Chilled Doors to be installed. The CDS (Coolant Distribution System) provided by the customer or a Motivair CDU (Coolant Distribution Unit) must provide adequate flow and temperatures to perform as specified.

The proper layout, pump and pipe sizing requirements are beyond the scope of this manual. Please consult your IT room design consultant and engineer for this information and installation requirements. Engineering documents for the ChilledDoor® specifying flow and temperature requirements for the model and size are available from Motivair application and engineering upon request.

The CDS should be installed, tested and ready to accept the 1" supply and return hose connection and any accessories within the specified hose lengths provided with the ChilledDoor®.

The Installation of the ChilledDoor® on a raised floor requires a planned layout of each server rack to accommodate the opening in a floor tile for the passing through and the 90° door swing of the supply and return hoses to the coil connection and the wiring raceway to the various accessories i.e. valve and temperature probes.

Non raised floor (Bottom Feed) installations vary greatly and require special 90° coil connection fittings and under server rack space to accommodate the hoses and movement please contact Motivair with your specific installation requirements. Top feed overhead piping models are also available.
The opening cutout in the raised floor tile is located on the hinged side of each ChilledDoor® and is approximately 6"x 8", most of which is located inside the interface frame of the ChilledDoor®. The floor opening should be kept as small as possible and not interfere or obstruct the free movement of the door or hoses. The floor opening should be made in only one floor tile and must not compromise the structural integrity of the raised floor support system. It is a good practice to position the server racks to cut the corner edge of one floor tile to provide the opening; this is not always possible with varying rack widths and existing layouts.

Caution: Do not remove and or cut any cross members or corner stanchions for the floor opening.

NOTE: It is recommended that the hose cut-out in the raised floor tile should be on the tile edge so that the tile can be removed without having to disconnect the supply and return hoses. Should this not be an available option, then the hose cut out will need to be made in the interior of the tile. If the hose cut out is in the middle of the tile, make sure the hoses are run through the hose cut out before mounting the ChilledDoor®.

Receiving and uncrating

The chilled doors are individually shipped in returnable/reusable wooden crates in stacks of 1 to 3 doors. The doors are packaged in a horizontal position attached to the interface frame and secured inside the crates with removable blocking and packing foam.

1. Upon receiving the chilled doors, inspect the crates for any visible damage. Report any damage to the shipper immediately and document on the "bill of lading" (take photos if possible) failure to do so could result in a loss of claim.

2. If stacked crates, remove the metal banding straps from the crates and carefully separate the crates with a fork lift.

3. Remove screw fasteners from the top covers and inspect the ChilledDoor® and contents of the crate. Remove any "shipped loose" accessory i.e. hoses, valves, hardware packages, etc.…

4. Remove the screw fasteners from the hold down boards and other packing foam and spacers and remove these items. Remove the lower screw fasteners from the crate sides and lift crate off the shipping base. (see pics page 12)

Do not disassemble or destroy the crate they are returnable!

5. The ChilledDoor® are heavy and bulky, use enough manpower or material lifting equipment to lift the ChilledDoor® from the crate.

6. The 2 methods of installing a chilled door are door and interface frame as one assembly or separate the door from the frame and install separately (see 7.)

Caution: The chilled doors are heavy: use caution and enough man power to lift and move.

7. The door will need to be separated from the interface frame for installation. Locate the door latch key unlock and swing open the latch. Carefully, with a minimum of 4 people on all 4 sides of the assembly raise and swing the door open from the interface frame to 90°. Then move the door toward the top of the interface frame off the hinge pins. Lift and place coil side down on the foam covered boards. Do not place on side, ends, or the fan side of the door.

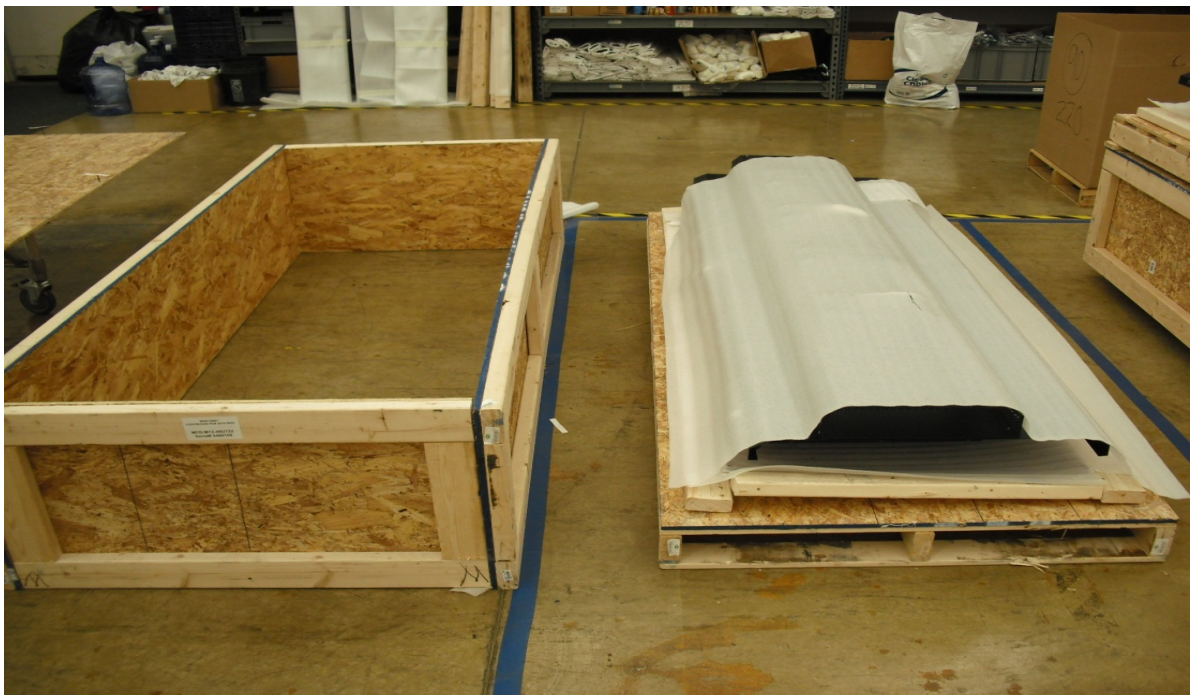
9. Return all packaging materials and boards to the crate and replace cover for return to Motivair.

10. Repeat as necessary until all doors and frames are removed and separated for installation.

PREVENT BREAKAGE - NEVER STORE OR LEAVE KEY IN DOOR LATCH

Remove the screws and top of crate

Remove the screws from the shipping boards and the lower sides of the crate, remove boards and lift middle section off and set aside as shown.



PREVENT BREAKAGE - NEVER STORE OR LEAVE KEY IN DOOR LATCH

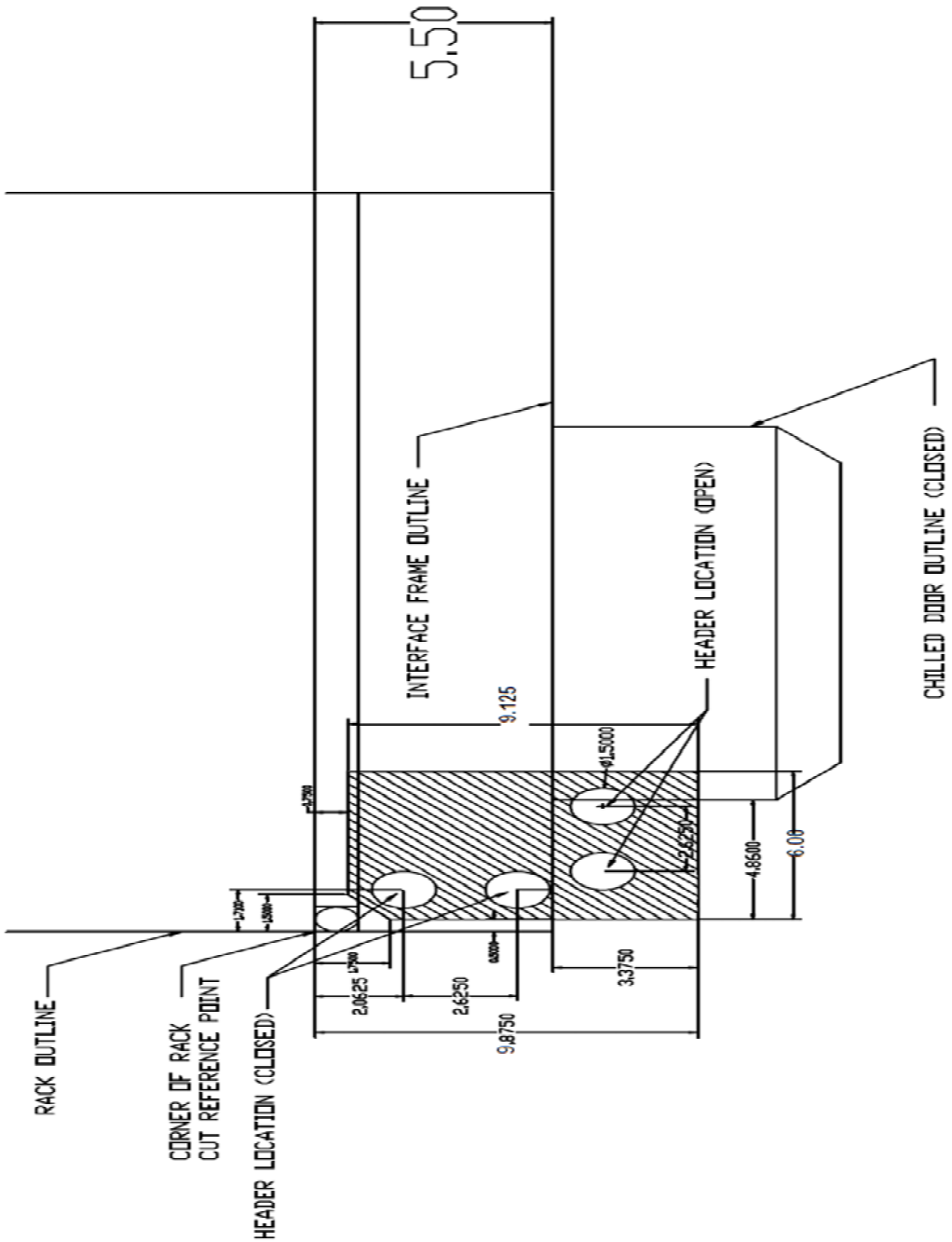
Floor opening cutout

Example floor cutout opening drawing

Caution: Reference only: actual opening will vary based on server rack model and interface frame width.

The area directly below this opening must be free and clear of any and all obstructions i.e. piping, valves, supports, braces, wire troughs, etc…

Contact Motivair if specific floor cutout opening dimensions and drawings for your installation are required.



Installing a ChilledDoor®

Make sure you have followed and completed all recommended tasks and procedures in Pre-Installation requirements of the ChilledDoor® section of this manual before attempting to install a ChilledDoor®.

Chilled doors can be installed on active IT enclosures if necessary, however, it is recommended that they be installed during a scheduled IT shut down period.

Installing the ChilledDoor® consists of the following Installation Steps:

1. Remove the existing IT enclosure's rear door, hinges and door latch (if installed).
2. Attach the Interface Frame to the server rack.
3. Attach the ChilledDoor® to the Interface Frame.
4. Connect the supply and return hoses from the chilled water source to the ChilledDoor®.
5. Fill the ChilledDoor® with water or glycol and vent air from the system.
6. Have a qualified electrician or technician connect power to the ChilledDoor®.

Tools and Components Required for Installation

1. ChilledDoor® assembly
2. ChilledDoor® Installation Guide
3. Interface Frame
4. Air Purging hose (1/4" flare w/valve depressor)
5. Hose Assemblies (1 supply + 1 return)
6. Raised Floor Grommet

Customer supplied tools for ChilledDoor® installation:

1. Tools necessary to remove the existing IT enclosure rear door hinges and latch (See the Enclosure Installation Manual provided by the enclosure vendor for details)
2. Tools necessary to attach the "Interface Frame" to the IT enclosure rear frame.
3. A bucket or collection device (approximately 5 gallons) to capture water that escapes as you vent air from the ChilledDoor® while filling the system.
4. For raised floor installations, a tool to cut a free area out of the raised floor for the supply and return hoses to pass through.

NOTE: Although the likelihood of water exposure is extremely small, you might prefer to place some water-absorbent material beneath the ChilledDoor® as a general practice when performing procedures on the ChilledDoor®.

Installation Procedures

Attaching the Interface Frame to the IT Server rack.

1. The IT server rack rear doors and hinges and any rack ties should have been removed per the rack manufacturer's IOM. If not remove them now.

2. The Motivair ChilledDoor® interface frames have been custom designed and built to fit and attach to your specified server rack with your order. The existing threaded bolt holes will be used to attach the interface frame to the rack without drilling or modification (in most cases).

3. Locate the hardware package and the top splice plate (if provided) and attach to the top of the interface frame. Not all models use a top plate.

4. The server rack should be level and square and all adjustable leveling legs should be set to the floor and locked.

5. Lift and place the Interface frame against the server rack hanging from the splice plate. Locate and line up the pre-drilled screw holes in the interface frame with the existing threaded hole in your server rack and insert the screws hand tight until all are in place. Insert the screws and nuts in the top splice plate (if used). Check for square and tighten all mounting fasteners.

6. Raise floor installations check the position of the server rack with the Interface frame installed for proper alignment over floor opening for the hoses. The floor opening should be cut out per the instruction in *Pre-Installation requirements* section of this manual. If not it will need to be cut out before installing the door on the Interface frame. (Not applicable to top feed door installations)

Attaching the ChilledDoor® to the Interface Frame

1. To install the door on the interface frame hinge, the door must be in a 90° open position before lifting onto the hinges.

2. Carefully lift the door from the horizontal position with a minimum of 4 people and move to the hinge side of the server rack interface frame. Stand the door upright and align the door hinge with the interface hinges as close as possible. Lift the door up from the bottom and sides and align hinge pins and lower onto all three pins. (Hint: Three people should lift and a forth should visually direct the alignment position).

Caution: Do not use coil guard for lifting. Do not touch coil while installing ChilledDoor® as it may cause permanent damage to the coil.

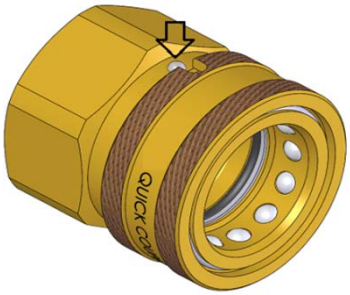
Caution: The chilled doors are heavy: use proper lifting methods and enough man power to lift and move. It is recommended that three (3) or more people perform the work required to mount a ChilledDoor® to the Interface Frame. This will prevent damage to the ChilledDoor®.

3. The ChilledDoor® should swing freely on its hinges and close into the interface frame without obstruction. Check for plumb and square on interface frame/rack.

4. Close the door and recheck for a good square fit into the interface frame and close the latch to check alignment with the latch catch plates at the top and bottom of the door. Adjust the latch catch plates on their slide brackets as necessary for a smooth latching action and closed door positioning, tighten latch plates locking screws.

5. Locate the 2 male (plug) brass quick connect fittings installed on the ChilledDoor® coil header pipes at the lower hinge side of the door over the floor cutout area. Note: For top feed models these will be located at the top of the door on the hinge side.

6. Locate the supply and return hoses and feed them either down through the floor opening or if already connected to a CDS (coolant distribution system) under the floor feed them up to the coil plug fittings Insert the female supply and return hose quick connectors one at a time into the male plug connections that are installed on the ChilledDoor® coil header. Make sure that the male connections are lined up for an easier connection. Slide the collar on the female quick connect down to allow the male hose connection to enter.



NOTE: There is a locking safety mechanism on the female collar. Rotate the female collar until the locking pin lines up with its designated groove in the collar. Only when the pin and its groove channel are aligned will the collar be able to move down enough to allow the mating of the two connectors

NOTE: From the door open position the header connection closest to you (return grill side air inlet to the coil) is the return hose connection and the back connection (door fan air outlet side) is the supply hose connection.

7. Insert the female supply hose coupling. Press upward until the female collar moves upward and locks in place. Twist the female collar 180° to engage the safety locking mechanism.

8. Carefully test the swing of the door by closing from a 90° position to fully closed position while observing the hose and fitting clearance of the floor opening. If any resistance or obstruction is observed or felt STOP! and remove it. The hoses must move freely without any resistance or obstruction and should not come in contact with either edge of the floor cut out through its entire 0°- 90° swing. A grommet must be used to cover any sharp edges in the floor opening

Note: The floor opening should be trimmed with a suitable edge grommet and brushes (if necessary) consult your raised floor contractor for assistance in cutting methods and trim accessories.

Connecting the Coolant Distribution System to a ChilledDoor®.

The ChilledDoor® Coolant Distribution System (CDS) consists of a supply and return header piping system under the raised floor or located elsewhere in a non- raised floor installation. (Reference the Pre-Installation requirements of the ChilledDoor®) The CDS can vary greatly depending on the design and source. The CDS must have a 1" supply and a 1" return branch connection available for each ChilledDoor® for the hose connections and other components. The components to be installed at the CDS branch connections will vary depending on installation requirements and options selected.

If installing your ChilledDoor® to a Motivair preassembled "Header Assembly" see "Header Installation" section of this manual.

The following is a list of components that will need to be field installed on the Coolant Distribution System if supplied.

ChilledDoor® field installed components:

1. Honeywell valve installation.
   a. The Motivair supply chilled water control valve is a 1" NPT 2 way cartridge type valve (see the Honeywell valve installation manual for complete details in appendix).
   b. The valve is field installed in the chilled water supply piping to the coil normally at the inlet of the 1" supply hose at the customers supply piping feeding the coil under the raised floor.
   c. The valve should be installed following standard piping practices and local plumbing codes, an inlet strainer is recommended.
   d. The valve wiring is routed along the hoses to the attached Molex plug.
   e. The 1" check valve is to be installed in the return piping at the header.

2. ChilledDoor® coil return water probe
   The return water temperature probe is to be installed on the return piping and should be securely attached to a clean straight section of the return piping and insulated. ("W" labeled probe)

ChilledDoor® field installed components: (cont…)

3. Room temperature probe (optional) routing and location.

a. The room or server rack entering air temperature probe (supplied) should be located in the general area of the server rack entering air or any location that will sense the room ambient temp. The probe may be routed out the top or bottom raceways from the customer connection terminal strip to your selected location. ("R" labeled probe) Connect to the appropriate terminals (see wiring/connections diagram in appendix).

Note: The installation and use of the room probe is not mandatory and the function can be switched off. However this will also turn off high and low room temperature monitoring

4. Leak detection (WDS) sensor installation.

a. The leak detection sensor tape and wiring must be field located under the raised floor below the door at the low point around the piping and hoses and may be secured to the floor using a suitable non-conductive adhesive (Silicone). The Motivair supplied sensor kit includes 10’ of sensor tape

5. Flow-meter (optional) installation.

a. A flow meter (Customer supplied) is recommended in the main chilled water supply piping to the chilled doors to insure adequate flow to all chilled doors and accurate gpm and balancing values. An inline digital flow meter is a good option for this application

Following the installation of all required and optional components on the ChilledDoor®, and connecting the supply and return hoses to the Coolant Distribution System and ChilledDoor®. Then pressurize and test all field piping and connections for leaks with air or nitrogen (50psi Max) before filling and venting of the system. Only when the system pressure testing is complete and leak free should you continue to the filling and venting section.

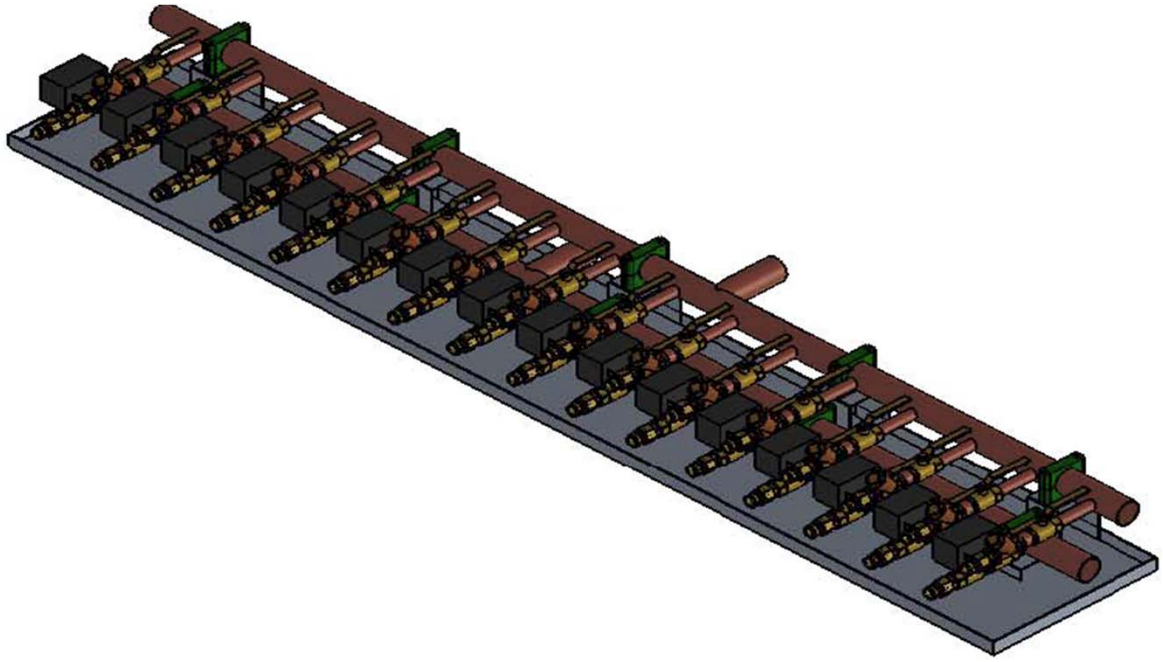
6. Header distribution assembly (optional) installation.

a. An optional Motivair supplied distribution header assembly is installed under the raised floor and should be centrally located in close enough proximity to the chilled doors being connected for the chilled door supply and return hoses to connect to the header assembly without being stretched or stressed. (Hoses can be ordered and supplied in varying lengths please consult your Motivair representative).

b. The header assembly consists of a pre-piped manifold with the 2 way control valves and stop valves in place. The supplied hoses must be field connected (Quick Connect) to the header assembly (see hose installation section of this manual).

c. Field connect the 2 way control valves and install return water temperature probes per paragraph #2 above.

16 Port Distribution Header



Note: Distribution headers are available in 6 to 16 ports assemblies and come in a variety of connection options to facilitate most distribution applications. These pre-assembled headers mounted on a drip pan complete with all necessary components and quick connections make installations quick and easy. Please contact your ChilledDoor® representative for configurations and details.

ChilledDoor® Filling and Venting Procedure

Cleaning and Flushing

Good installation practice must include Initial system flushing

Cleaning and flushing of any field installed piping that may be required must be completed before connecting to any Motivair equipment. Motivair supplied ChilledDoor®, CDU's, Underfloor Distribution Headers, and all hoses are shipped clean and new, these require no cleaning or flushing.

Minimum Water Quality standard for Motivair ChilledDoor

To insure long term reliability and operation of the sealing components of the Motivair Chilled doors and coolant loop distribution components clean water with a low to no suspended solids level is required for closed loop systems. Suspended Particles can damage O-rings, mechanical pump seals and cartridge valve seals and operation. Excessive suspended solids will leave deposits in system piping, including critical sealing and heat transfer surfaces. The following recommendations are a minimum for and closed loop distribution system utilizing the Motivair Chilled door, CDU or header distribution system.

Water testing and filtration must employed to ensure a system is filtered to <50 microns (High limit of a closed loop system per industry standards) The recommendation by Motivair is to utilize a 5 micron or less bag/cartage type filter in the closed loop or other suitable method of removing suspended solids to a minimum 5 microns or less. Iron levels less than <2.0 ppm - Copper levels less than <0.1 ppm - Suspended solids <1 mg/L.

The following table is a guide for initial fill water for all closed loop system using Motivair Chilled Doors and components. Potable water is a good source and starting point for initial filling.

Motivair Water Quality	
Mineral	**Recommended Limit**
Chloride	< 25 ppm
Calcium	< 15 ppm
Magnesium	< 15 ppm
Total Water Hardness	<30 ppm
Sulfate	< 25 ppm
pH	7.3-8.3
softened water should be used	

A water treatment professional should be consulted regarding the testing and proper chemical treatment for a closed loop system's composition and fluid requirements. Proper levels of all loop and makeup water must be maintained per industry standards and best practices. Proper levels of pH, Alkalinity, Chlorides, Nitrite, and Conductivity, along with other chemicals and metals in the system must be tested for and monitored. A treatment program should be implemented at the time of initial system commissioning to provide long term system reliability. This testing is outside this documents scope.

Water Quality

Warning: Do not use deionized water (DIW) in chilled door closed loop systems as DIW is corrosive to certain metals.

The use of Propylene and Ethylene glycol mixtures and water treatment additives that are compatible with the piping and wetted materials used in the coolant distribution system are acceptable. A qualified water treatment contractor should be consulted for recommendations and water analysis testing that meet your specific requirements.

Fill and Vent Sequence

To fill the ChilledDoor® with water for the first time, complete the following step:

Caution: always wear safety goggles or other eye protection whenever filling, draining or venting air from the ChilledDoor®.

The fill point of the closed loop Coolant Distribution System will vary depending on your particular layout and components, but most systems provide a hose bib valve connection point to connect to for filling. If using a special mixture, a transfer pump will be necessary to fill the system. During filling and venting, the system pressure will need to be constantly monitored and maintained to provide pressure to purge air from the closed loop while also avoiding over-pressurization of the system.

The bottom feed chilled door coil headers located on the hinge side of the door have a 1/4" Schrader bleed valve at the top of each header to facilitate air purging from the chilled door coils. Top feed chilled doors do not have bleed valves as they are not the high point of top feed system layout.

1. Locate and remove the safety caps from the Schrader vents on the top of the ChilledDoor® headers to attach a purge hose to both vent valves.

NOTE: Air Purging hose tool available separately from Motivair or local supply house. Use a hose of adequate length (6ft) with a combination stop valve attached (as shown)for better control of the venting process.

2. Place other end of the purge hose into a 5 gallon bucket to catch the water that escapes while filling and venting the ChilledDoor®

3. Attach the other end of the long hose to both the vents, one at a time at the top of the ChilledDoor®. As the air purging tool is screwed onto the valve, air will begin to vent out.

Fill and Vent Sequence (Cont…)

4. Maintain pressure and flow of the system make-up water to the ChilledDoor®. Air that is entrained in the water and other air from the system will exit the ChilledDoor® via the venting tool into the collection bucket

Note: If no flow or pressure at vent: be sure all manual isolation valves are open and the 2 way control valve is in open position.

5. When there is a constant stream of water (no air) leaving the air purging hose into the bucket, disconnect and remove the air purging tool from the top of the ChilledDoor®.

Attention: If water drips from the Schrader valve (Purge Vent at the top of the ChilledDoor®) after you remove the air-purging hose reattach the hose and disconnect it again to exercise and seat the seal.

Note: Water will spray or spit into the bucket during this procedure. If air remains in the coil it will cause a splashing or gurgling sound. Repeat the air-purging procedure on both valves if this sound is present.

6. Feel both vertical headers of the ChilledDoor® that feed water to the coil. If they are cold, then flow is confirmed through the ChilledDoor®.

7. Screw the valve caps onto the air-purging valves and hand-tighten them to provide a secondary safety seal

8. Check all connection points to the ChilledDoor® and vents to ensure all connections are tight and leak free.

10. Following the completion of the purging and air venting of all the chilled door coils and system components circulate the water in the closed loop system and recheck system high points for trapped air and vent.

11. Complete the filling process insuring the closed loop low side (pump return) pressure is maintained in a positive pressure. A minimum of 7 psi to 15 psi is a normal range for a low pressure closed loop system.

Electrical Connections to the ChilledDoor®

WARNING: Risk of electric shock. Connecting the ChilledDoor® to the building power source should be performed by a qualified technician or skilled electrical contractor. Ensure all electrical connection points are DRY before connecting power.

Electrical Connections (Cont…)

Note: Make sure that all local and national electrical safety requirements and codes are strictly adhered to during the installation process. Motivair accepts no responsibility under any circumstance for failure to adhere to these requirements. It is the customer's responsibility to know, understand and comply with any and all local electrical codes and safety rules.

The ChilledDoor® is an "Active" rear door heat exchanger that includes an array (Qty 2-5) of electronically commutated (EC) motor fans and an integrated PLC controller. All power for these features is provided from the main electrical connection made to the building power supply. A ChilledDoor® may be specified to run with 115/1/60 power, 208-230/1/60 power or 230/1/50 power.
NOTE: Confirm that the building power being applied to the ChilledDoor® is the same as that which the ChilledDoor® was designed for. A shipped loose, 2-way water control valve is also a powered device. The 24v power for the 2-way valve and 0-10v control wiring are supplied from the ChilledDoor®.

1. Check to ensure that the correct power and amperage is available to run the ChilledDoor®. ChilledDoor® power requirements can be found on the electrical Name tag provided.

2. Only a certified technician or electrical contractor should wire from the building power to the designated power location on the ChilledDoor® terminal strip.

3. Access to all electrical instruments (Fans, PLC, and 2-way valve) and power terminals is located behind the stainless steel vanity panel on the front of the ChilledDoor®.

WARNING: Risk of electrical shock. Disconnect power before opening vanity panel.

CAUTION: There are moving parts inside the ChilledDoor®. Be sure to keep hands or other appendages and any loose clothing away from the fans if they are turning.

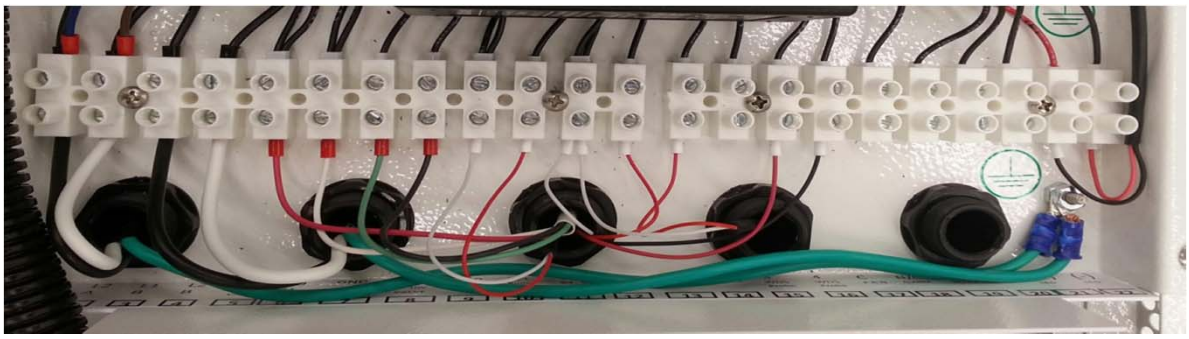
4. A factory installed and connected power cord(s) with C14 or C20 plugs are prewired from the terminal strip in the ChilledDoor® to be plugged into a power strip in the server rack or building supplied power.

Verify enough power is available before connecting power cords to any rack power strip feeding internal servers. DO NOT OVERLOAD POWER STRIPS.

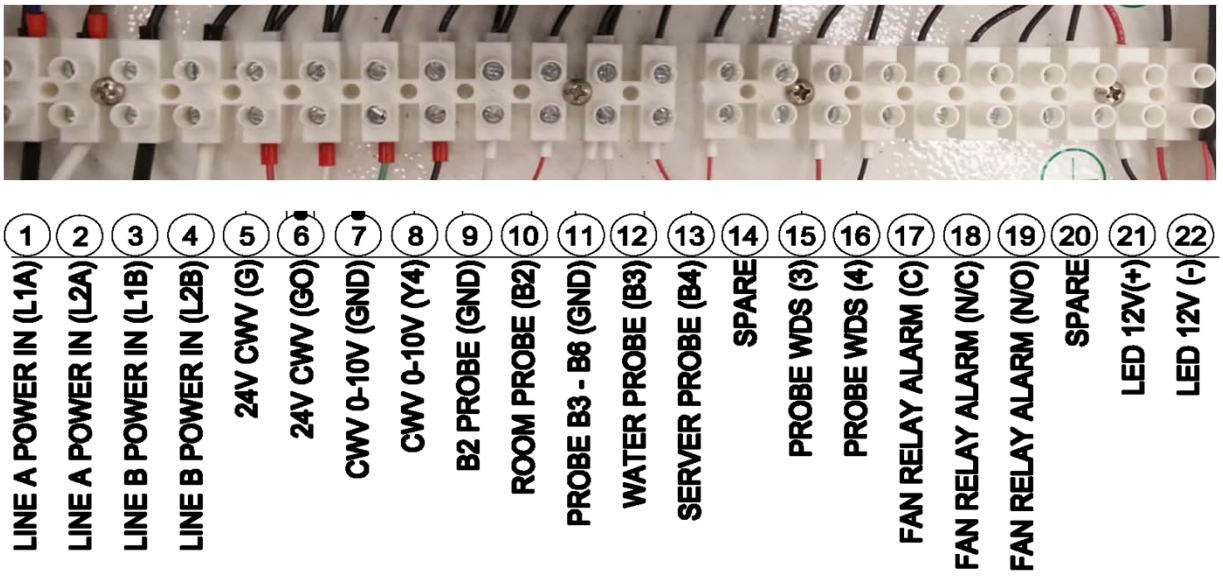
Electrical Connections (Cont…)

5. If hard wiring to a building power source remove the pre-wired plug and connect power wires to the designate power terminals on the customer connection terminals inside the ChilledDoor®.

Note: There are power and control wiring conduit raceways that enter from both the top and bottom of the ChilledDoor® that lead to the customer connection terminals inside the ChilledDoor®. These are use for either top feed or bottom power and control feeds to the ChilledDoor®® (shown below)



Customer connections terminal strip



Warning: Terminal strip layout is subject to change, above example is accurate at the time of this manual publishing for standard doors. ALWAYS reference the schematic shipped and attached to the chilled door panel.

6. Check that all wiring connections are secure before applying power to the ChilledDoor®

7. Confirm that all wiring connections to valve, probes, water sensor, and all other optional components have been made and terminated correctly. All terminal strip connections have been factory terminated to the proper probes and water valve harness for ease of installation.

8. Close stainless steel vanity door on the front of the ChilledDoor®. Make sure that vanity plate lock is closed and secure.

9. Turn on power to the ChilledDoor®. Once power has been applied, the PLC display will light up indicating that power has been connected correctly. There will be a 30 second system diagnostic check before the PLC takes control during which the fans will operate at full speed. After that, the ChilledDoor® is ready for operation

NOTE: Your ChilledDoor® PLC is pre-programmed with factory software to enable smooth operation. Many client and factory set points can be adjusted per the ChilledDoor® Start-up and Operation section of this manual.

Completing the Installation

Complete the following steps:

1. Replace any raised floor tiles removed for installation and floor grommets.

2. Make sure that the supply and return hoses are free and unobstructed in the hose cut out in the raised floor (bottom feed). Hoses should run straight down below the raised floor to the Coolant Distribution System.

3. Close the ChilledDoor® and close latching and locking handle. Recheck the latch rod alignment latching to the catch plates and adjust as necessary.

4. Recheck the ChilledDoor® after several hours of pump and flow operation. If all air has not been removed from the system or ChilledDoor® during the filling and venting procedure, you will hear a gurgling, splashing, turbulent noise. This is an indication that air is still trapped in the ChilledDoor®. Repeat the air purging and venting procedure. This should also be checked again in 30 days.

5. Perform visual inspection of all field installed probes and wiring for neat and proper attachment points and to prevent snagging or pinching with door movements.

6 Finish the installation with proper house-cleaning procedures and site cleanup.

Managing Air Flow in an IT Enclosure

Each IT enclosure will always be different and have an infinite arrangement of IT equipment located inside. Industry best practice should always be followed with respect to air flow management inside the rack and your IT rack provider should be able to assist with general guidelines and ancillary equipment used to achieve this affect. The following industry best practices should be used as a minimum:

1. A good practice is to use brush strips to enclose any open areas in the raised floor, such as the chilled door hose cut away area.

2. Always use solid roof and base panels on the IT enclosure to ensure that hot air is kept within the IT enclosure.

3. If cable or cords are running through panels, try to fill excess space around the wire to prevent air leaking by at those points. Brush strips may be useful

4. Side panels and/or divider panels should always be used to prevent hot air from leaving the IT enclosure through the sides.

5. If a rack has empty “U” slots available, a blank off plate should be used for each opening. Additionally, make sure any side openings at the front of the IT enclosure are also filled with blank off plates to ensure that hot air is not lost from the IT enclosure and all hot air is directed towards the rear of the rack to the ChilledDoor®.

6. Following these best practices and others provided by your IT enclosure specialist will ensure good air flow management in the ChilledDoor®.

PLC control HMI introduction

HMI Screen Navigation

The Human Machine Interface (HMI) is a 6 button built-in display screen The 6 button functions on bottom as follows:

“Alarm “ – press to view current alarm & clear alarms

“Program” – press to enter the programming menu screen

“Escape” – press to go back one screen or one space

“Down arrow” – press to scroll down or lower a setting

“Up arrow” – press to scroll up or raise a setting

“Enter” – press to navigate to changeable parameters and confirm/save changes

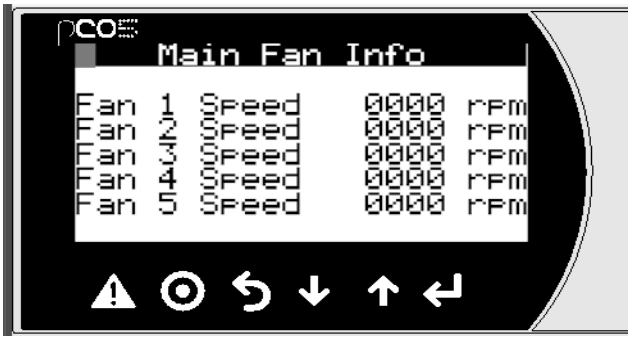
The HMI screens are a scrolling menu style. The up and down arrows will scroll through all available screens in a sub menu; i.e. press alarm and scroll through all active alarms.

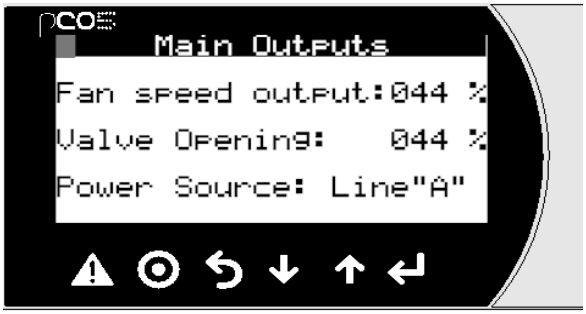
The above Display is the main screen or “Home Screen”. It displays the controlled points and the state of the PLC, i.e. *"Unit off By Keyboard".*

HMI Screen Navigation

The home screen is displayed when you press the ESC key or after a few minutes of inactivity. The home screen displays the temperature readings of the chilled door. The "I" Icon for information is a reminder to scroll down for additional info screens.

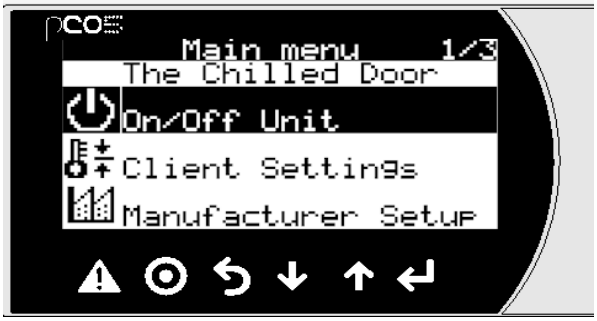
Pressing the DOWN ARROW key will scroll to the next information screen first is the fan RPM I/O display showing the actual RPM reading of each fan and is used for monitoring and alarm functions.

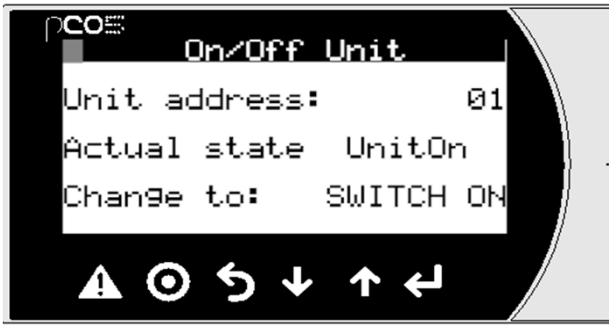




The next info screen shown by pressing the DOWN ARROW key contains the actual output % to the fans and the chilled water valve. Also the power source for dual power feed option

Press the "PRG" key for access to the programming menu. The programming menu contains three sub menus as shown use the UP & DOWN ARROW keys to highlight your selection then press the ENTER key to confirm your selection.





Pressing the ENTER key enters the "On/Off Unit" screen as shown. Press ENTER key to highlight "SWITCH OFF" then press the UP or DOWN ARROW key to change to "SWITCH ON". Press ENTER key to confirm your selection. The chilled door is now ON.

HMI Screen Navigation (Cont…)

Highlight “Client Settings”. Press ENTER for “User Password “ screen. Press ENTER to highlight the first digit and use the UP ARROW to enter the PW. (Default PW=1234)
Press ENTER to move to the second digit to insert “2-3-4” Press ENTER etc…

On "Main Menu" (above): Highlight “Manufacturer setup” press ENTER for “Manufacturer Password “ screen. Press ENTER to highlight the PW number 0000 - Contact Motivair for password to this area of the menu.

Client Settings Screen

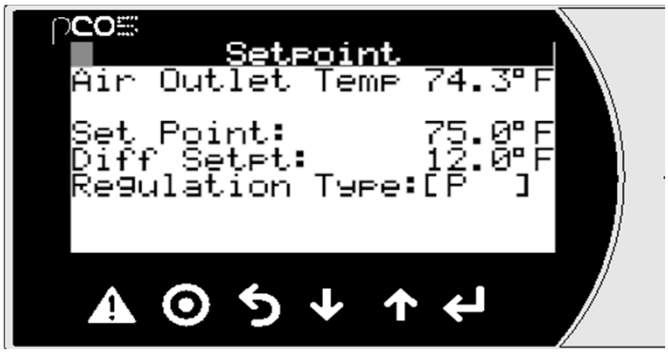
The following Client setup screens are provided to allow the client/end-user to make adjustments and changes to the default settings if necessary to facilitate an operating parameter or site specific condition. Set points for outlet air temp and server air outlet temps or pressures and all alarm thresholds are available on the following screens.

Client Set Point Setup

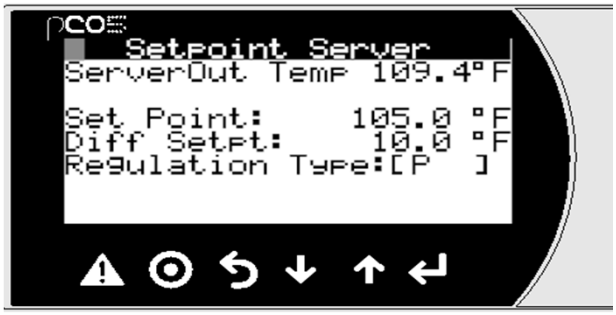
The Client/User programming submenus contain all the Set-point/alarm setting screens accessed by scrolling with the UP/DOWN ARROW keys. The first screen (shown) is the air outlet set-point screen. Press ENTER to highlight the parameter to change and use the UP/DOWN ARROW to change setting then press ENTER to confirm change.

Air Outlet Temperature set point screen

Set Point of the air outlet temperature and differential band: The regulation type is also selectable between Proportional "P" and Proportional and Integral time "PI". This screen also displays the current air outlet temp. This parameter controls the CWV % opening to maintain a constant air temperature at varying loads.



Client Set Point Setup (cont…)

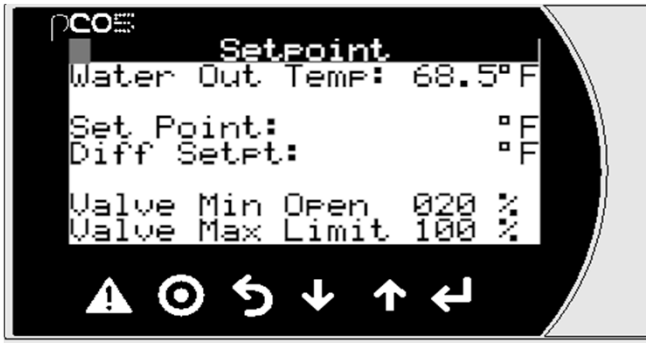


Server Outlet Temperature set point

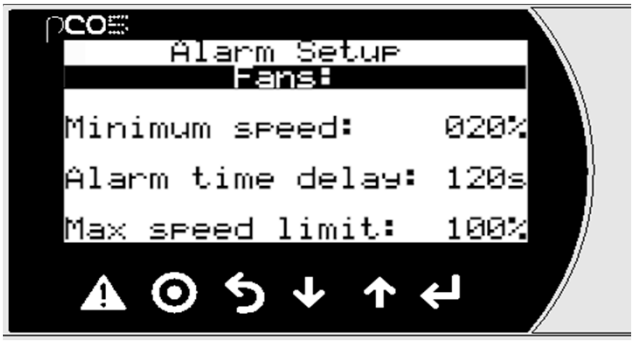
Set Point of the server outlet air temperature and differential band. The regulation type "P" or "PI". Also displays the current server air outlet temp. This parameter controls the fans speed to maintain a constant coil air on temp at varying loads

Water Valve Min and Max set points

Set points to limit the CW Valve opening and closing limits. Also displays water out temp. A Min open % may be required to prevent dead heading of a pump or low load may require a 0% setting. Max limit % for balancing only if necessary. (note: Set & Diff not used)



Client Alarm Setup

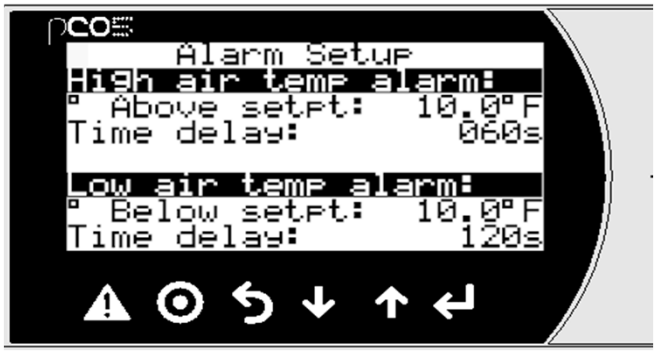


Fan alarm delay Min/Max set points

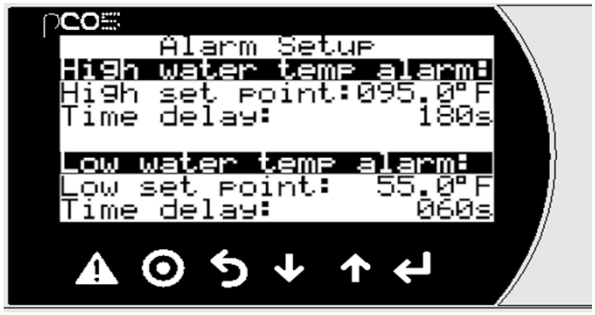
Set point for fan min speed and fan alarm activation time delay. Also max fan speed limit. These set points should not be adjusted without a good understanding of the effect on the operation. Consult motivair if adjustment is necessary.

High and Low outlet air temp alarm set points

The high and Low air out temp alarm is a differential setting from "Air Outlet" set point i.e. the set point (above) of 75°F + the ° above setpt 10°F = 85°F alarm point temp delayed 60 sec. The Low air outlet alarm 10°F below setpt - 10°F = 65°F delayed 120 sec.



Client Alarm Setup (cont…)

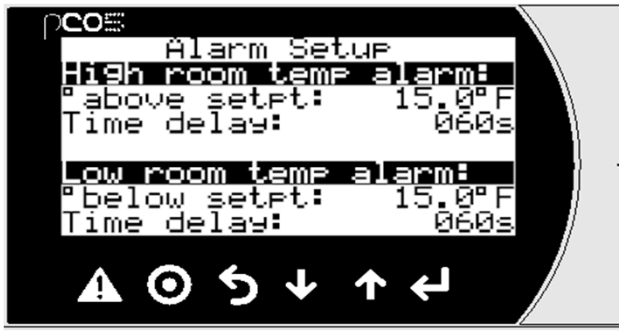


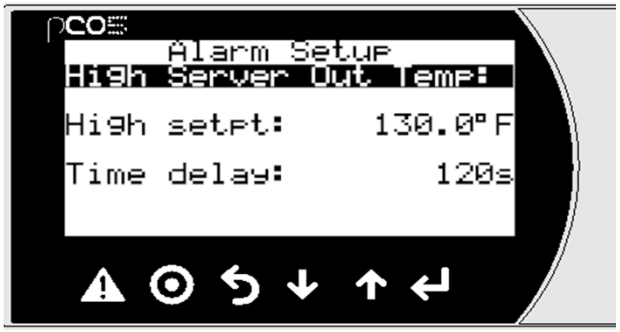
High & Low water temp alarm set points

Set point for alarm activation on high or low return water temperature and corresponding time delay

High & Low Room air temp alarm set points

The high and Low **ROOM** temp alarm is a differential setting from "Air Outlet" set point. The Air Out set point of 75°F + the ° above set point of 15°F = 90°F alarm point temp, delayed 60 sec. The Low room temp alarm of 15°F below set point 75F - 15°F = 60°F alarm point, delayed 60 sec. This parameter based on the ROOM temp probe.





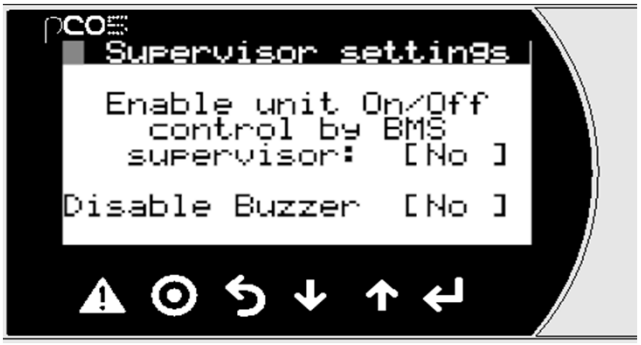
High server out temp alarm set point

Set point for alarm activation on high server out temperature and corresponding time delay.

Water Detection alarm enable

The alarm set-up for the Water Detection System (WDS) must be enabled. The “Enable WDS Valve close” option can be set to “yes” or “No” If set to “yes” the valve will close all chilled water flow to the chilled door coil to isolate and minimize any leak that may occur between the valve and the return check valve on a WDS alarm signal.

Client Misc. Setup

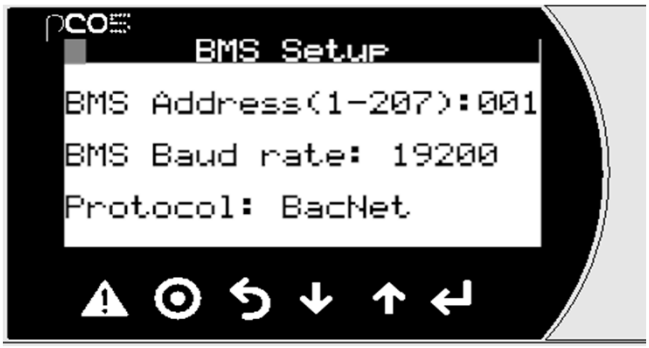


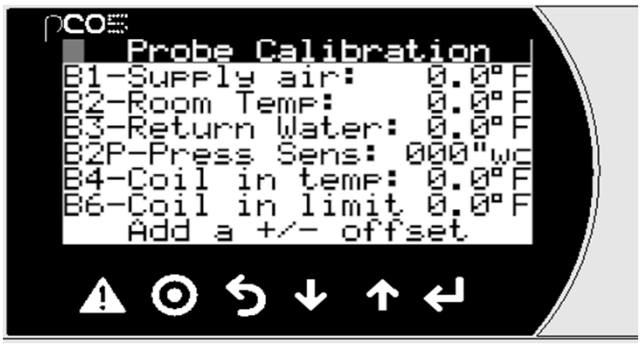
BMS set up screen

Client set up parameters for enabling On/Off control by the BMS system as an added layer of protection to prevent accidental off signal to chilled door. Also the ability to disable the local buzzer.

BMS set up screen

The BMS set-up is to select your protocol BacNet - Modbus - Lon based on your selected communication option. The Baud rate is fixed based on protocol selected. The BMS address is for Modbus only.



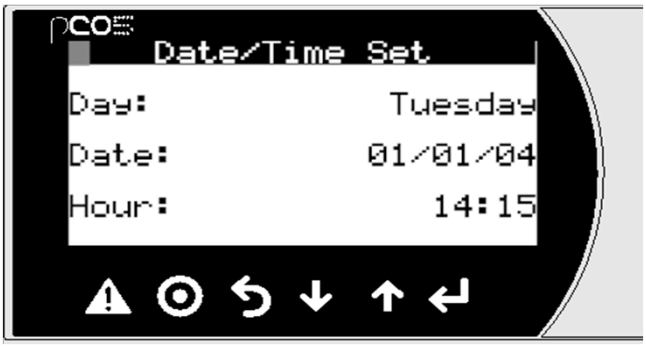


Probe Calibration settings

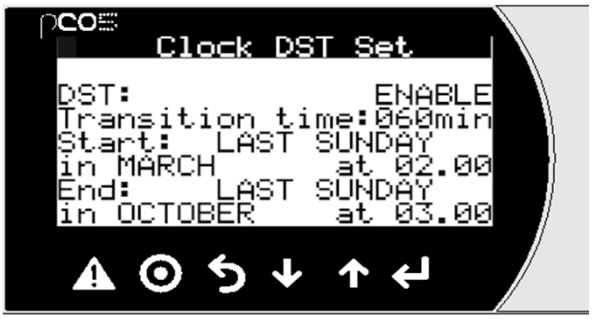
The probe calibration screens are for adding an offset to exact a probe reading max offset is +/- 9.9°F. Probes more than 5°F out of calibration should be replaced.

Date And Time input screen

Date and time input screen is to set the current date and time to display on the "Home screen" and history logs. Note: This screen is not a clock screen only a set up page and will not display the correct time or date.



Client Misc. Setup (cont…)



Daylight Savings Time setup

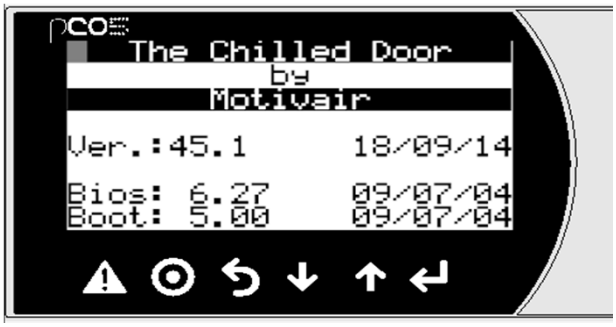
Enable and disable DST per your geographic location.

Alarm History log screen

Client alarm history log used to review previous alarms with time and date stamp. Press enter and use arrows to scroll through logs.

Manufacturer Setup

The Manufacturer setup area of the menu is password protected and should only be accessed with Motivair permission. All parameters in this section are preset per the specified ChilledDoor® and should rarely need change.

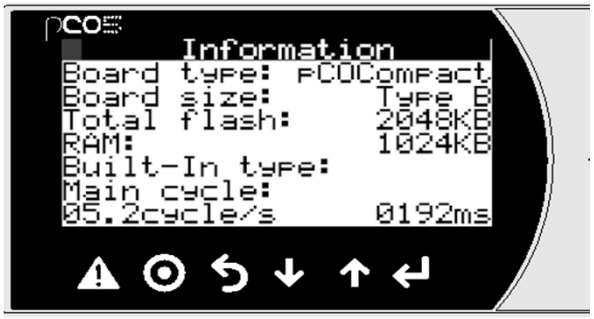


Program info screen

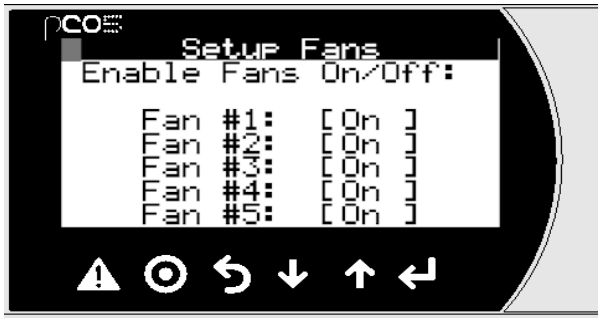
Displays the program version along with the PLC boot and bios versions and dates.

Program info screen

Displays the PLC type along with the PLC memory sizes and cycle speed for diagnostics.



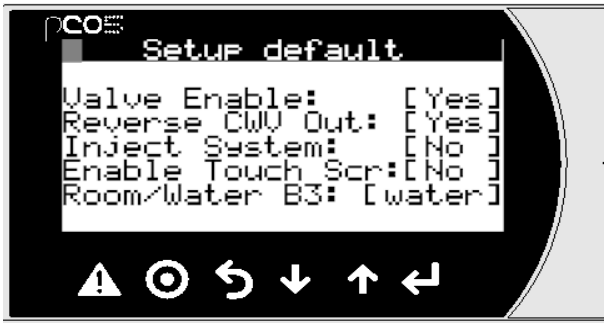
Manufacturer Setup (cont…)



Fan setup enable screen

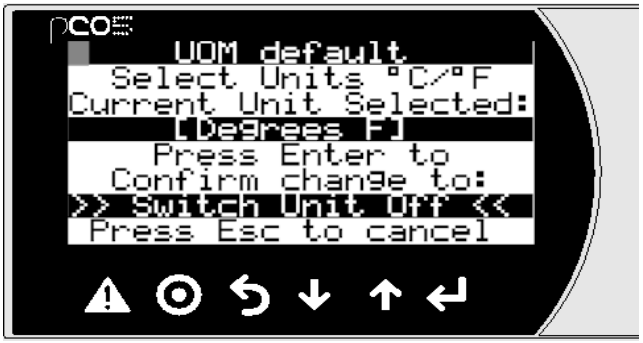
Enable and disable parameter for chilled door fan monitoring and alarm functions. This will not stop fan's operation only the monitoring of them.

Default setup parameter screen
Parameters to set manufacturer defaults for different chilled door control configurations

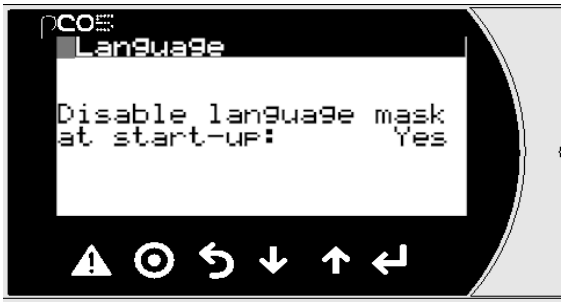


Default setup parameter screen
Parameters to set manufacturer defaults for different chilled door control configurations

Unit Of Measure Selection screen
Select unit of measure °C or °F Note: unit must be switched off to change unit of measure.



Manufacturer Setup (cont…)



Language Selection screen

Currently program is only available in English - language selection disabled

Input/output configuration screens
I/O setup parameters for all analog inputs - next 4 screens

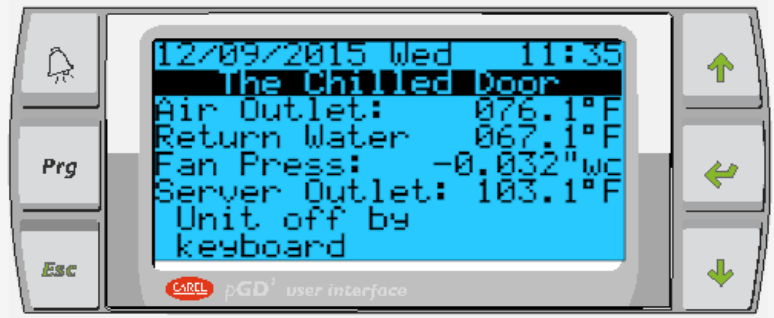
Program Defaults install screen
This parameter screen reboots the PLC controller and installs all manufacturers default settings into the memory.

Password Change screen

PW change screen.

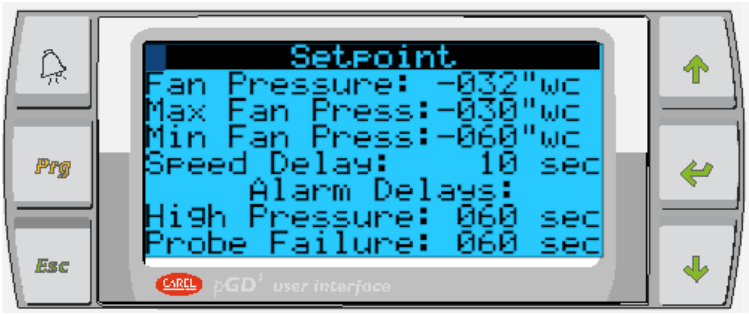
G2 Client Set Point Setup

The Motivair G2 version is both physically larger and increased kW capacity ChilledDoor® with the same operating principles and characteristics as the standard door but uses a slightly different PLC and has a pressure operating function with the main HMI screen shown below.



The main screen shows the operating pressure of the fans in W.C." in place of the room temp.

The pressure set point screen shows the actual fan pressure and the set points for the min and max pressures and the associated alarm time delay



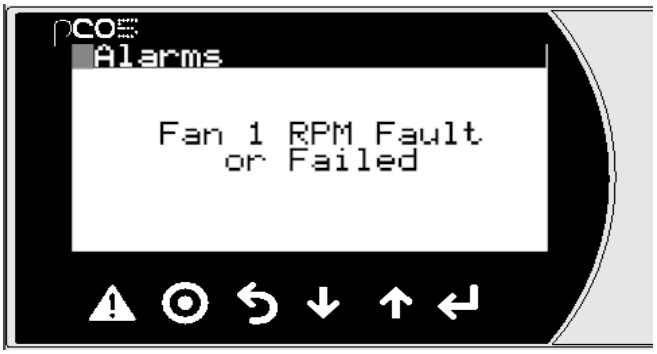
All of the HMI screens for the G2 version are the same or very similar to the screens shown on the preceding pages.

Alarms and warnings

The "ALARM" warning screen appears when any alarm is triggered. This screen along with a buzzer is to alert an alarm condition is present.

Alarms and warnings (cont…)

Pressing the alarm key **1 time** will silence the alarm buzzer and display the current alarm. Pressing the alarm button a second time will acknowledge and clear the alarm if the condition has cleared.



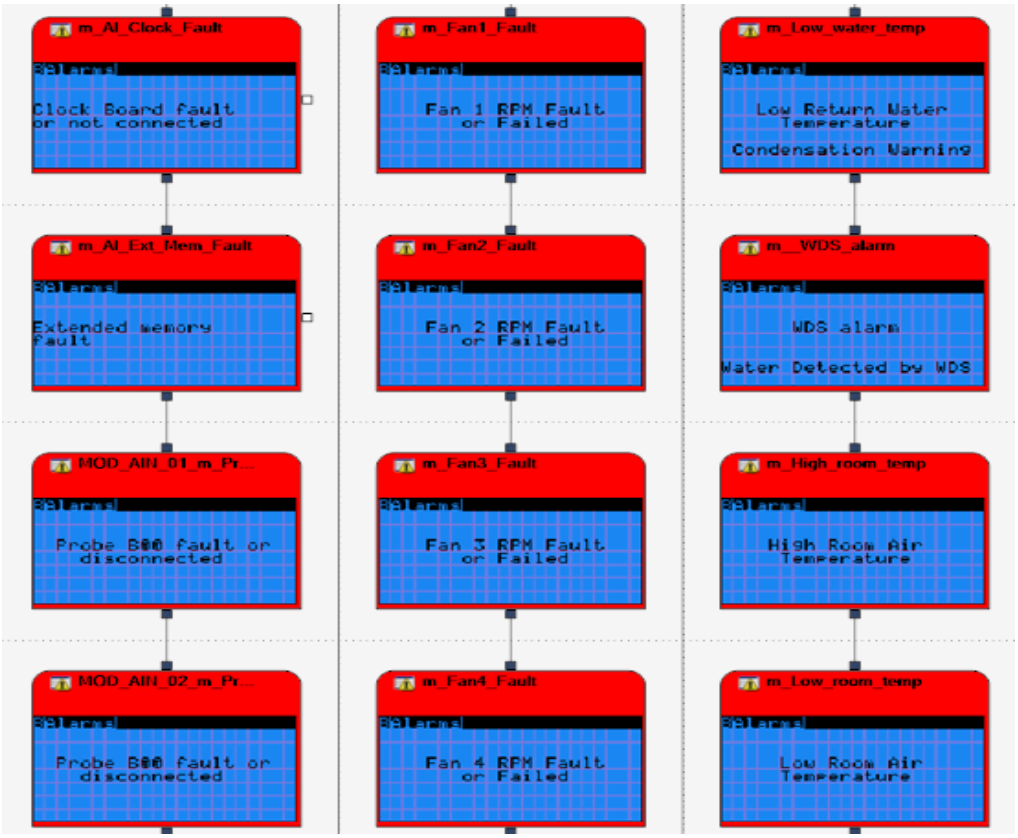
Following the acknowledgement of the alarm (2nd press) the "No active alarms" screen will appear and direct you to the alarm history log. If the alarm condition has not been cleared (i.e. overload not reset) the alarm screen will re-trigger another alarm.

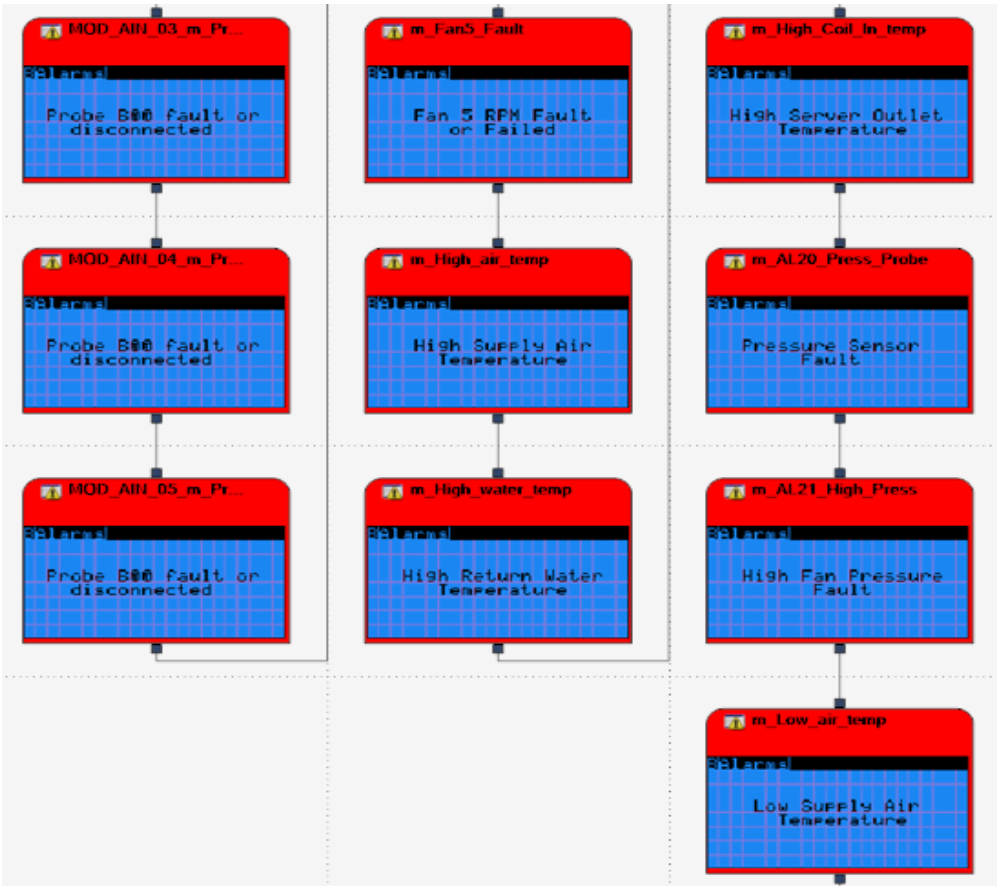
Press "Enter" while on the above screen to enter the alarm log area. The alarm log entry is recorded at every alarm and will store each alarm. The log records the alarm number sequence 001, 2, 3…, Time, date, and the alarm description.

Alarms and warnings are to signal a problem or issue with the ChilledDoor® or an associated system connected to the ChilledDoor®. Refer to the Troubleshooting section of this manual for information on alarm causes and system checks

The screens shown below are a list of possible alarms generated by the ChilledDoor®.

Alarms and warnings (cont…)





Initial Setup Parameters:

The ChilledDoor® PLC controller is set up and shipped preprogrammed to the customer's specification based on the size of the ChilledDoor® and the options and accessories specified. The common adjustments needed at start-up and commissioning are the air outlet and server outlet set-points to match your data room temperature requirements. The minimum fan speed is factory set at 20% default to always provide a minimum air flow to ensure the server generated heat is conducted to the chilled water coil and to provide sufficient air flow at low load to maintain a reliable outlet temperature reading. Note: more air flow is always better and safer.

Note: The PLC is programmed with multiple redundant alarms and warnings, high outlet air temperature, high water outlet temperature, high room temperature, high coil inlet temperature, PLC failure, all of which will force the ChilledDoor® to operate at 100% fan and valve operation to protect the servers.

ChilledDoor® Sequence of Operation

The Motivair ChilledDoor® control sequence is based on the outlet air temperature of the server rack. The controlled points of the ChilledDoor® are the fans and the chilled water control valve (CWV). The overall sequence of operation is the PLC maintains a constant outlet air temperature by varying the speed of the fans in combination with the flow of chilled water through the valve. The PLC controller is programed with multiple combinations of control options and parameters to meet the need of most applications.

Outlet air control = Yes (default) -The fans are controlled by the server outlet temperature as the server outlet temp rises, the fans increase their speed in direct response to the temperature rise. In unison, the increased air flow and higher temperature raise the coil air out temperature (measured at the air outlet probe) and the chilled water valve opens in response to maintain the outlet air set point.

"swap air/water" control = No (special use only) -The fan speed is controlled by the air outlet temperature and the chilled water valve is controlled by the coil return water maintaining a constant delta T across the coil based on a varying air flow and load.

Pressure Control - The fan pressure control option (ordered separately), the minimum fan speed is controlled by the differential air pressure. The air pressure of the chilled door fans is compared to the server outlet fans to maintain a slightly negative pressure behind the chilled door coil. The pressure control resets the fan min speed every 10 seconds (adjustable) to maintain a negative pressure between the Min and Max set points -0.03" and -0.06"w.c. The chilled water valve control point is the air outlet temperature. The server outlet temperature control function is still monitoring the server outlet temperature and controls the fan speed in parallel with the pressure control.

ChilledDoor® Sequence of Operation(cont…)

Example: Outlet air set point = 74°F when the outlet temperature is equal to or below set point the CWV will operate at the minimum setting. As the outlet temperature increases in direct proportion to the server's kW usage, the fans controlled by the server outlet temperature will increase their speed, drawing larger volumes of air through the server rack and across the chilled door coil. The increased heat and air flow across the coil will increase the outlet air temperature as measured by the control probe and thus proportionally signal the water valve to open to maintain the proper delta T and outlet temperature.

The above example demonstrates the ChilledDoor® ability to quickly identify an increase in server heat output (load) and react quickly to satisfy the load by drawing on the data room's reserve of cool air. The control then increases the total BTU capacity of the ChilledDoor® by increasing the water flow through the coil thus meeting the room's outlet temperature set point at a higher water & air flow rate capacity.

Control Set up example

The PLC controller uses two analog outputs for the control of the fans and the chilled water valve. Fan and valve outputs are 0-10v signal based on the set point and inputs from their temperature probes.

Set point Air Outlet: (CWV) The outlet air temperature probe – "Air outlet temperature". This set point is usually at the design data room temperature, for this example 74°F. When the set point equals the air outlet probe temp, the CWV will be at the 50% open position. The differential set point is set at 12°F the CWV will open from 50% to 100% at set point + 1/2 Differential and close to the "Min open" position at set point (-) 1/2 differential.

Set point Server Outlet: (Fans) The Server outlet set point is based on the chilled door design spec Delta T and the server cooling requirements. The higher the server outlet temperature delivered to the door coil, the greater the Kw capacity of the coil/door. The default set point is 105°F with a 10°F differential. The fans will operate at minimum speed % when equal to set point and will increase speed to maximum at set point + differential (105 +10 = 115°F). The advantage is the fan speed will correspond to immediate changes in server outlet temperature and the air outlet temperature will be maintained at a constant temperature, regardless of the air flow at any load or fan speed modulating the CWV. This mode will also allow lower fan speeds during low load times as the server outlet temperature falls, thus saving energy.

ChilledDoor® Sequence of Operation(cont…)

The PLC control is programmed with a server air outlet temperature safety limit (adjustable) control and warning alarms. If the coil air inlet temperature rises above the limit set point (130°F Default) the control will override the fan speed and operate 100% in a purge cycle for 20 seconds to clear the server rack heat. If the temperature does not fall below this set point within the alarm delay time period (120 seconds default), the controller will send a warning alarm and remain at 100% fan speed. If the coil inlet temperature falls within its normal range before the alarm delay expires, the control will resume its normal operation without alarm.

Motivair default setup parameters settings:

Air outlet set point = 75°F
Air outlet Differential = 12°F
Server outlet set point = 105°F
Server outlet Differential = 10°F
Water outlet set point = N/A
Minimum Valve open = 20%
Minimum fan speed = 20%

Pressure controlled fan option:

Max Pressure set point = -0.03”w.c.
Min Pressure set point = -0.06”w.c.
Reset time delay = 10 sec.

Note: For a complete list of all default set points see BMS table in this manual

Note: Reversed 0-10v Chilled Water Valve output (default) is selectable by parameter for valve open on control failure if required. Set Dip switch #1 to “off” on CWV (see appendix Honeywell valve manual) if reverse mode is selected.

Alarms setup:

The ChilledDoor® has alarm functions that will default the controlled component to 100% upon activation. That is if the server outlet temperature probe fails the fans will run at 100% and the alarm will sound. If the air outlet temperature probe fails the CWV will open 100%, and the alarm will sound. All alarm parameters are adjustable with alarm activation delay timers. Please refer to their respective screen masks for setting and adjusting.

LED alarm indication:

Motivair chilled doors are equipped with color changing LED indicator lighting. The normal door operation is indicated by the color "Blue" LED light. If in an alarm condition the LED color will change to "RED". This provides a quick visual of all the chilled door operating conditions while scanning a row of server racks.

Note: The LED lights turn off if line "A" power fails and the door is on "B" power as an indicator of this operating mode. Always check any door not lit by LED.

TROUBLESHOOTING - General

High Voltage Warning:

Serious injury or death could result from High voltage present in this equipment. Disconnect (open) all electrical safety switches and disconnects before attempting to open, troubleshoot, test or repair any components in this unit.

Troubleshooting of electrical/mechanical equipment must be performed only by qualified and trained service technicians. Factory technical support is available please refer to "support" section of this manual.

TROUBLESHOOTING - Non Alarms

Problem	Check/Corrective action
No display - No power	{1} Check building power supply and ChilledDoor is plugged in an active power strip.
No display - with power	{1} Check PLC 24v power connection din plug {2} Check Fuses F1A, F1B and F2 {3} Check transformer for 24v secondary voltage
Chilled door fans off	{1} Unit "Off by keyboard" Switch unit "On"
Display active press alarm key & read alarm	See "troubleshooting alarms"

TROUBLESHOOTING - Alarms

Current alarm condition	Alarm trigger event	Check/Corrective action
WDS alarm (water detection sensor)	Water on sensor or open sensor circuit	{1} Check for leak or wet sensor strip. {2} Check for open circuit wire or end resistor.
Clock board alarm	Failed clock board	Replace PLC
Fan 1 - 5 RPM Fault or Failure	Fan RPM reading dropped below 50% of minimum fan speed set point and remained low for the alarm time delay period	{1} Fan not turning - check F3 fuse and Molex plug {2} Swap out fan with known good spare fan. {3} Fan turning - check fan # wiring and input connector at PLC. {4} Check fan Molex plug connection at fan motor. {5} To test PLC input, swap input tach wire with known good input. Replace fan or PLC per results.

TROUBLESHOOTING - Alarms

Current alarm condition	Alarm trigger event	Check/Corrective action
Alarm High supply air temp	Outlet air temp higher than the set point + the alarm differential set point also exceeding the delay time. (Example 75°F + 10°F = 85°F)	{1} Check chilled coolant supply loop flow and temperature for min 65F {2} Check 24v power or failed actuator/cooling valve CWV. (see CWV section for more valve info) {3} Check PLC 0-10v output to CWV (10v=0%open) {4} Check loop or door coil for trapped air (re-vent)
B1 Probe Air Outlet B2 Probe Rm temp B3 Probe Water out B4 probe Server out B6 probe (if used)	All probe alarms are triggered by a failed or disconnected probe (electrically open or shorted).	{1} check probe connection to PLC connector {2} Replace Probe
Fan Pressure Probe alarm (if option selected)	Pressure transmitter failed out of range or disconnected	{1} Check connection to PLC connector and connection at the pressure transmitter. {2} Check sensing tubes for restriction or loose/open connection
Alarm high return water temp	Outlet water temp higher than the alarm set point also exceeding the delay time.	{1} Building primary chilled water supply too warm {2} Insufficient chilled water pump/flow to doors {3} CWV valve restricting flow or stuck {4} Room temperature too high causing overload of chilled door coil capacity.
Alarm low return water temp (con-densation warning)	Outlet water temp lower than the alarm set point .	{1} Check chilled coolant supply loop temperature for below 50°F {2} Water probe in a to low ambient (underfloor)
High room temp/Low room temp alarm	Data room temp higher/lower than the set point +/- the alarm differential set point also exceeding the delay time.	{1}High room temperatures are caused by insufficient cooling by the chilled coolant loop or other room cooling sources {2} Low room temps are due to low load operation or over cooling by other room located cooling units
High server outlet temp alarm	Outlet server temp higher than the alarm set point .	{1} Check low or no air flow from chilled door fans. {2} Check for excessive server loads or very high room temps
Low supply air temperature	Outlet air temp lower than the set point (-) the alarm set point	{1} Check chilled coolant supply loop temperature for temperature too low. {2}Check min valve % set point to high for low load
High Fan Pressure fault alarm (if option selected)	Fan pressure to high at coil inlet causing low server air flow	{1} Check low or no air flow from chilled door fans. {2} Check sensing tubes for restriction or loose/open connection

ChilledDoor® Maintenance procedures and schedule.

The ChilledDoor® should be inspected and maintained at regular intervals biannually to provide reliable long term operation.

Service and maintenance of electrical/mechanical equipment must be performed only by qualified and properly trained service technicians.

This maintenance document and the items and procedures listed are a minimum requirement relating to the Motivair ChilledDoor® and should by no means be considered complete system maintenance manual. The chilled doors are only one part of a Server rack cooling system that includes a chilled water distribution system and a server rack installation that may have their own maintenance requirements and procedures.

Electrical Maintenance:

Warning: High voltages are present at the electrical components of the chilled door. Power off the chilled door before performing electrical security maintenance (follow all required lock out/ tag out procedures and requirements).

Warning: Check with site operations personnel and open the main chilled door before powering down, server damage and overheating may result if door is closed while powered off.

1. Check and tighten all terminals wiring connections on the customer connection terminal strip and the PLC connectors.
2. Check that all ground lug nuts and wires are secure and tight.
3. Check that all quick connect terminals are in place and tight.
4. Check all fan Molex connectors are secure.
5. Check that the main power feed cables to the door for any damage, proper slack and connection to main power strips.
6. Check power fail over if connected by disconnecting line "A" power.

Coil/Door Maintenance:

1. Clean inlet air side of coil with a vacuum and soft brush being careful not to damage or bend the coil finned surface.
2. Check the coil inlet header that bleed and fill valve caps are in place and hand tight.
3. Check coil inlet hoses and connections for any damage or sign of water leaks. Also check for any hose rubbing or restriction to door swing motion.
4. Check that the server inlet probe on coil guard is securely attached and free of damage.

ChilledDoor® Maintenance procedures and schedule (cont…)

Coil/Door Maintenance: (cont…)

5. Check all door hinge fasteners and interface frame screws are secure.
6. Check that latching plates are in proper alignment with latch rods and door closes and latches securely.

Operational Maintenance:

1. Read and record all current set points, alarm set points, fan speed RPM, and Valve/Fan output signal. The BMS list in this manual contains all factory default set points and names for use as a reference.

Warning: Some or all set points may have been altered from factory default as site and operational conditions require. Do not alter or change any set points without site personnel authorization.

2. Read and record any current alarm history and verify cause and solution of any unknowns.
3. Check and calibrate all temperature and/or pressure probes using a known calibration thermometer. Add +/- offset if necessary in the "probe calibration screen".
4. Test water detection probe operation by shorting the leads or using a wet sponge. Verify alarm condition by LED lights (red) with the alarm screen active and remote monitoring BMS system if used.
5. Measure and record amperage of 5 fan motors and total amperage of chilled door.
6. Measure and record the main supply voltage and control voltage.
7. Record chilled door model & serial # on service documentation.
8. Clean SS panel and latch door.

A copy of all maintenance check lists and documentation should be left on site with the owner.

Other site specific maintenance may be required, which is outside the scope of this manual, be sure to consult with the proper personnel.

ChilledDoor® Maintenance procedures (cont…)

Fans, fuses and electrical components.

Danger: Disconnect all sources of power to the ChilledDoor® before opening the stainless vanity door. High voltage danger is present behind this door!

Open main chilled door before performing any electrical maintenance or troubleshooting. This will allow the servers to operate on their own cooling fans and allow for safe de-energizing of the electrical power to the door.

Fan replacement

After disconnecting the power sources, locate the fan to be replaced, numbered 1 – 5 from the top down. Disconnect the 2 "Molex" plugs from the fan and cut any wire ties from the harness to the fan frame. Use a magnetic Philips head screw driver to remove the 4 mounting screws and remove the fan. Installation is the reverse of the above procedure. Replace any cut wire ties. Close the electrical door reenergize and test fan operation.

Fuses replacement.

All fuses are in a touch safe fuse holder. However disconnecting of power is recommended. Grip, press, and rotate counterclockwise to remove fuse cap containing fuse. Remove and insert new fuse into cap and reinstall in reverse order.
Note: Cause of blown fuse must be determined before replacement .
Warning: Only use replacement fuse of the same current rating size for replacement to prevent damage to electrical components

Other electrical components

After disconnecting all the power sources and opening the chilled door any other electrical component may be safely replaced. Probes are connected to the customer terminal strip or the PLC terminal. Most components are din rail mounted or have a fastener attached. Relays plug into bases. All are designed to be easily removed and replaced. Refer to the appropriate wiring diagram for terminal locations.

Draining a ChilledDoor®

This procedure must be performed before attempting to remove a ChilledDoor® from the Interface Frame. Note the location of the drain connection at the bottom of the ChilledDoor®.

Caution: Follow all local safety procedures. Wear protective eyewear or goggles whenever filling, draining, or venting air from the ChilledDoor®.

Draining a ChilledDoor®

Note: You may prefer to place water-absorbent material beneath the ChilledDoor® when performing this procedure to minimize water exposure to surrounding equipment.

Steps for draining a ChilledDoor®:

1. Turn off water flow to the ChilledDoor® by isolating it from the main chilled water system.
2. Open the ChilledDoor® so it is perpendicular to the IT enclosure (90°).
3. Place one end of the air purging hose in the 2 gallon collection container and then connect other end to the vent at the top of the ChilledDoor®. This prevents an air lock.
4. Remove (if applicable) the raised floor through which the hoses run.
5. Place a 2-gallon empty container below the supply and return hoses, directly under where they connect to the ChilledDoor®.
6. Place one end of the drain hose into the 2 gallon collection container. Then attach the other end to the ChilledDoor® drain.
7. Water will begin to flow into the collection container as the ChilledDoor® begins to drain.
8. When water stops flowing out of the ChilledDoor® into the collection container, the majority of the water has been removed.
9. Check that the 2-gallon collection container is still under the ChilledDoor® where the hoses connect.
10. Disconnect one hose at a time, using both hands.
11. There will still be water in the hoses so use the collection container to contain that water.
12. After ensuring all water from the ChilledDoor® has been removed, use the same collection container to drain the hoses.

NOTE: there will still be water in the supply and return hoses.

13. Repeat steps 5-12 above for the second hose.
14. Move the hoses and bucket of water away from the ChilledDoor®.

Removing an installed ChilledDoor®

Caution: It is recommended that two (2) or more people perform the work required to mount or remove a ChilledDoor® on or off the Interface Frame. This will prevent the ChilledDoor® from falling.

1. Motivair strongly recommends draining a ChilledDoor® before attempting to remove it from an IT enclosure. Follow the directions in this manual for "Draining a ChilledDoor®".
2. Turn OFF Power to the ChilledDoor®.
3. Have a qualified electrical contractor or technician disconnect power and control wires from the ChilledDoor®
4. Open the ChilledDoor® so it is perpendicular to the IT enclosure (90°)
5. Disconnect the water supply and return hoses from the ChilledDoor® and move them out of the work area.

Remove the guide wheel (if present) located on the bottom of the latch side of the door and the brass plug fittings from the coil headers to prevent coil damage.

Note: Any additional water still in the hoses should be collected in bucket or collection device.

6. Each person (2) should gently lift up, using the sides and bottom only, and remove the ChilledDoor® from its hinges. NOTE: Do not touch coil or use coil guards for lifting.
7. Store the ChilledDoor® in a safe and secure location, making sure not to damage the coil or front vanity plate.
8. Cover or place appropriate warnings at raised floor opening to prevent accident or injury.

Removing an interface Frame

1. To remove an interface frame first remove the chilled door per above.
2. Remove the splice plate at the top of the frame/rack and set aside.
3. Remove mounting screws attaching frame to server rack on both sides.
4. Lift interface frame from server rack and set aside.

Note: If storing or shipping the chilled door reattach to interface frame and store or ship together to better protect the assembly.

Contact Motivair if you require shipping crates for a ChilledDoor® assembly

Spare Parts

Recommended spare parts orders should consider individual site tolerance for any down time, geographic location and site access requirements.

The following list of spare parts and recommended quantities is a minimum for any application. This is not a complete list of all parts used or required please contact your local distributor or Motivair if you require a complete list of your model's spare parts and pricing.

Total Used	Qty Recommended	Item Description
1	1	LED 12v DC Relay Finder
1	0	LED Relay base w/clip
1	0	5 Fan Harness (Revision B)
2	5	10 amp 250v 1.25 x .25 fuse
1	5	2 amp 250v 1.25 x .25 fuse
5	10	3.5 amp 250v 1.25 x .25 fuse
8	0	Fuse holder 1.25 x .25
5	1 per 10 doors	220mm 230v Fan Black Frame
5	1 per 10 doors	280mm 230v Fan Black Frame ***(G2/M16 ONLY)***
1	1	PCO Compact w/Built in Display PLC
1	1	PCO 5 Plus w/Built in Display PLC ***(G2/M16 ONLY)***
1	0	Tri Key for ChilledDoor®
2	1	Relay 3PDT 24v
3	1 per 10 doors	Temperature Probe 15'
1	1	Temperature Probe 1.5'
1	1	Toroidal Transformer 63va
1	0	WDS leak detect control
1	1	Water Detection Sensor Kit
1	1 per 50 doors	CWV valve 24v actuator
1	1	CWV valve cage seat repair kit
1	1 per 50 doors of your specific comm platform	BacNet IP Comm Interface
1		BacNet MSTP Comm Interface
1		Modbus Comm Interface
1	1	Power Failover Relay 230v

Pre-packaged ***Spare Parts Kits*** are available containing the recommended quantity listed above, contact Motivair Parts and Service Dept. or your local distributor for details.

BMS Variables Table

Chilled Door

BMS parameters table

*=Std Door only **= Gen2 Door only

Analog variables **R=Recommended monitoring points**

BMS Address	Description	Default	UOM	Min	Max	Read/ Write	Variable name	ModBus Register
1	Air Outlet temp (supply)		°C/°F	-999.9	999.9	R	Air_Out_Temp	40002
2	**Set Point** - Outlet Air Temp (supply)	75	°C/°F	-99.9	99.9	R/W	Setpt_AirOut	40003
3	**Set Point** - Air Out Control band	12	°C/°F	0.2	99.9	R/W	Setdiff_AirOut	40004
4	0-100% output to the fans	0	%	0	100	R	Fan_output_signa	40005
5	Return water coil temp***	0	°C/°F	0	200	R	Water_Out_Temp	40006
8	0-100% output to the Valve	0	%	0	100	R	Valve_output_sig	40009
9	Room Temperature*	0	°C/°F	0	9.9	R	Room_Temp_outp	40010
10	Calibrate B1 Air out probe	0	°C/°F	-9.9	9.9	R/W	Calibrate_B1	40011
11	Calibrate B3 Water probe*	0	°C/°F	-9.9	9.9	R/W	Calibrate_B3	40012
12	Calibrate B2 Water probe**	0	°C/°F	-9.9	9.9	R/W	Calibrate_B2	40013
12	Calibrate B2 Room probe*	0	°C/°F	-9.9	9.9	R/W	Calibrate_B2	40013
13	**Set Point** - High room temp alarm	15	°C/°F	-99.9	99.9	R/W	SetAlm_HighRoom	40014
14	**Set Point** - Low room temp alarm	0	°C/°F	-99.9	99.9	R/W	SetAlm_LowRoom	40015
15	Calibrate B4 Server out probe	0	°C/°F	-9.9	9.9	R/W	Calibrate_B4	40016
16	Server Outlet Air Temp	0	°C/°F	-999.9	999.9	R	Server_Out_Temp	40017
17	**Set Point** - High Server Out temp alarm	130	°C/°F	0	999.9	R/W	SetAlm_HighServe	40018
19	Injection inlet temp probe B6* ****	0	°C/°F	-999.9	999.9	R	Inject_inlet_temp	40020
20	**Set Point** - Low inlet limit injection pump	55	°C/°F	-99.9	99.9	R/W	Low_limit_setpt	40021
22	Calibrate B6 Limit probe*	0	°C/°F	-9.9	9.9	R/W	Calibrate_B6	40023
23	Calibrate B2P Press probe*	0	"wc	-9.9	9.9	R/W	Calibrate_B2P	40024
23	Calibrate B3P Press probe**	0	"wc	-9.9	9.9	R/W	Calibrate_B3P	40024
26	**Set Point** - Max Pressure	-0.03	"wc	-3276.8	3276.7	R/W	Max_Press_SetPt	40027
27	**Set Point** - Min Pressure	-0.06	"wc	-3276.8	3276.7	R/W	Min_Press_SetPt	40028
28	Fan Pressure in wc	0	"wc	-3276.8	3276.7	R	FanPressure_wc_(	40029
31	**Set Point** - Server out air	105	°C/°F	-999.9	999.9	R/W	SetPt_ServerTemp	40032
32	**Set Point** - Differential server out air	10	°C/°F	-999.9	999.9	R/W	Setdiff_ServerTem	40033
33	**Set Point** - Low air out temp alarm	10	°C/°F	-999.9	999.9	R/W	SetAlm_lowAir	40034

*** May be used for room or return water temperature monitoriing on Gen2 doors

**** May be used as room probe alternate

BMS Variables Table

Chilled Door

Integer Variables **R=Recommended monitoring points**

BMS Address	Description	Default	UOM	Min	Max	Read/ Write	Variable name	ModBus	TCP/IP*
1001	**Set Point** - Minimum fan speed %	20	%	10	100	R/W	Min_Fan_Speed	40130	45003
1002	**Set Point** - Fan alarm delay	120	s	0	999	R/W	Fan_Alarm_Delay	40131	45004
1005	**Set Point** - Minimum valve opening %	20	%	0	100	R/W	Min_Valve_Open	40134	45007
1006	**Set Point** - High temp alarm (Diff)	15	°C/°F	-99.9	99.9	R/W	SetAlm_HighAir	40135	45008
1007	**Set Point** - High air temp alarm delay	120	s	-999	999	R/W	SetDelay_HighAir	40136	45009
1008	**Set Point** - High water Temp Alm (Diff)	15	°C/°F	-99.9	99.9	R/W	SetAlm_HighWate	40137	45010
1009	**Set Point** - High water Temp Alm delay	120	s	-999	999	R/W	SetDelay_HighWa	40138	45011
1010	**Set Point** - Low water temp alarm	15	°C/°F	-99.9	99.9	R/W	SetAlm_LowWate	40139	45012
1011	**Set Point** - Low water temp alarm delay	120	s	-999	999	R/W	SetDelay_LowWat	40140	45013
1012	**Set Point** - High room temp alarm delay	60	s	-32768	32767	R/W	SetDelay_HighRoo	40141	45014
1013	**Set Point** - Low room temp alarm delay	60	s	-32768	32767	R/W	SetDelay_LowRoo	40142	45015
1014	Fan 1 rpm read and store	0	rpm	-32768	32767	R	Fan1_rpm_last	40143	45016
1015	Fan 2 rpm read and store	0	rpm	-32768	32767	R	Fan2_rpm_last	40144	45017
1016	Fan 3 rpm read and store	0	rpm	-32768	32767	R	Fan3_rpm_last	40145	45018
1017	Fan 4 rpm read and store	0	rpm	-32768	32767	R	Fan4_rpm_last	40146	45019
1018	Fan 5 rpm read and store	0	rpm	-32768	32767	R	Fan5_rpm_last	40147	45020
1019	**Set Point** - High server out temp delay	60	s	-32768	32767	R/W	SetDelay_High_Se	40148	45021
1020	**Set Point** - Fan press delay time	5	s	0	99	R/W	TimeDelay_FanPr	40149	45022
1022	**Set Point** - Fan pressure alarm delay	30	s	-32768	32767	R/W	Press_alarm_dela	40151	45024
1023	**Set Point** - Low Air temp alarm delay	120	s	-32768	32767	R/W	SetDelay_lowAir	40152	45025
1024	**Set Point** - Press Probe alarm delay**	120	s	-32768	32767	R/W	SetDelay_Press_p	40153	45026
1025	**Set Point** - Fan Max speed limit	100	%	LL	100	R/W	Fan_Max_limit	40154	45027
1026	**Set Point** - Valve Max opening limit	100	%	0	100	R/W	Valve_Max_limit	40155	45028
1027	**Set Point** - Door open alarm delay**	120	s	0	999	R/W	SetDelay_Door	40156	45029
1030	Clock Day	---	---	1	31	R	BMS_Day	40159	45032
1031	Clock Month	---	---	1	12	R	BMS_Month	40160	45033
1032	Clock Year	---	---	0	99	R	BMS_Year	40161	45034
1033	Clock Hour	---	---	0	23	R	BMS_Hour	40162	45035
1034	Clock Minute	---	---	0	59	R	BMS_Minute	40163	45036

* Note on TCP/IP: Interger registers are reallocated to 45003 and above with PcoWeb interfaces 1.5 version. The older Version 1.4 or below subtract 1 from the register address i.e. 45003 -1 = 45002

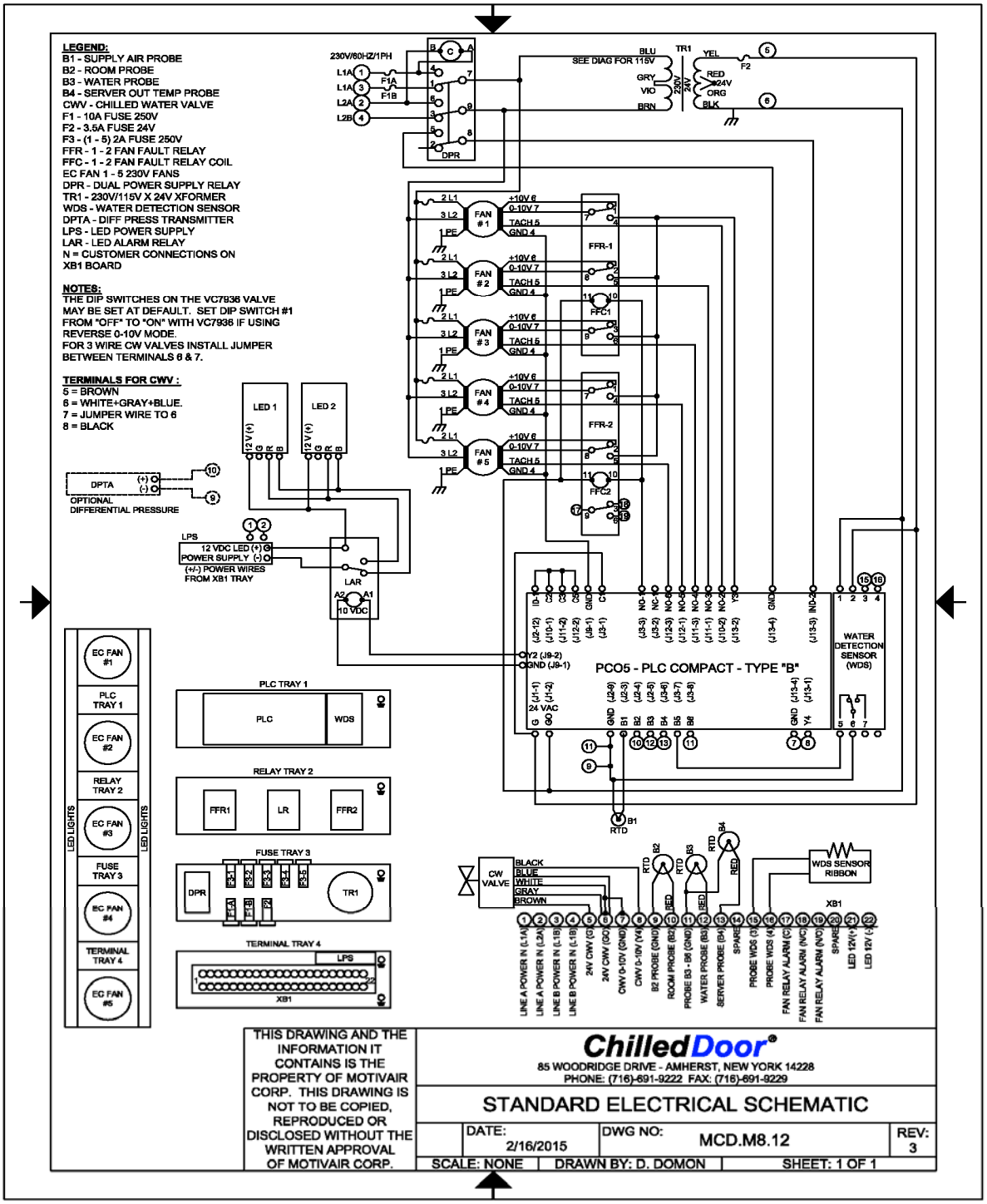
BMS Variables Table

Chilled Door

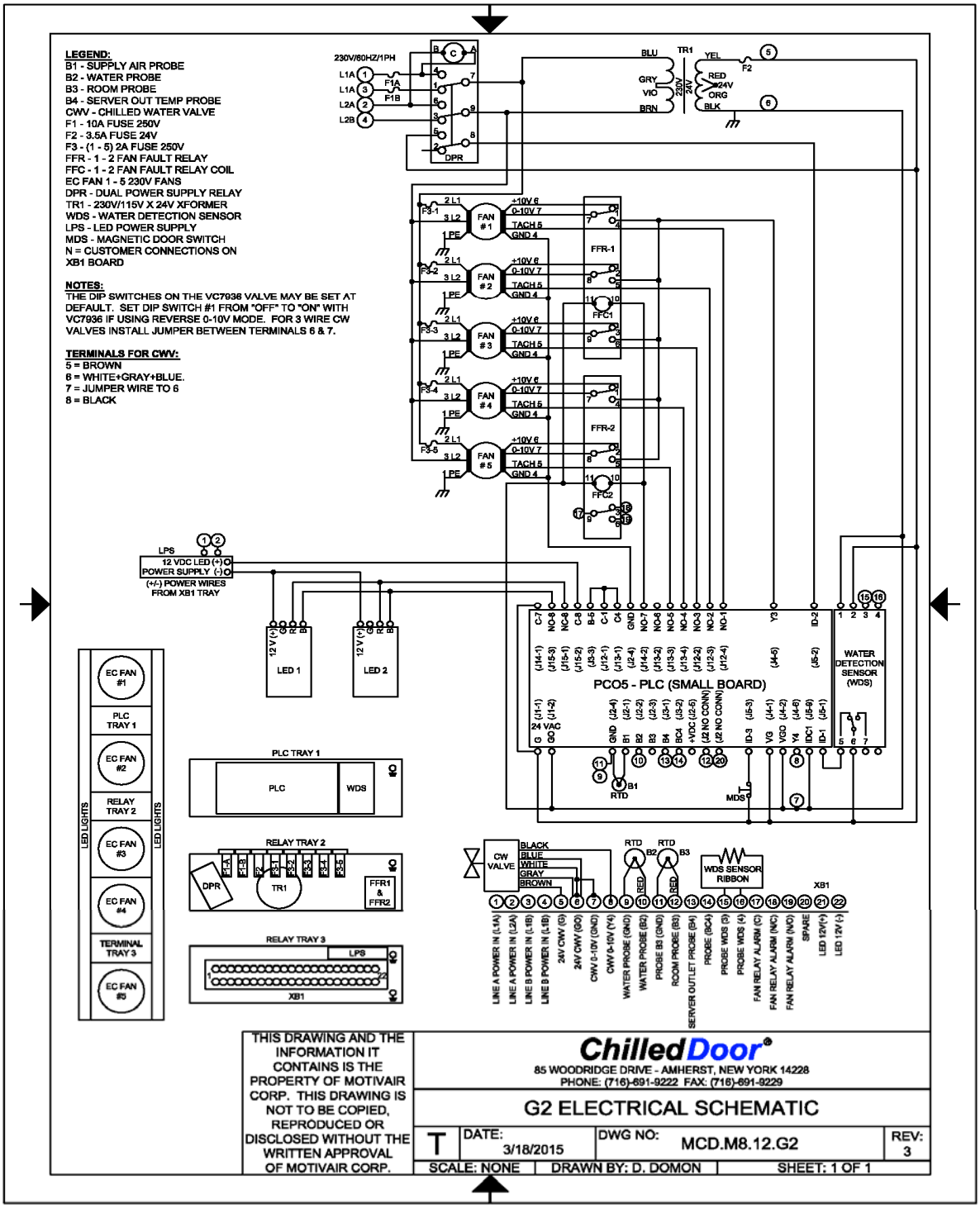
Digital Variables **R=Recommended ALARM monitoring points**

BMS Address	Description	Default	UOM	Min	Max	Read/ Write	Variable name	ModBus
6	**On/Off** - Select P or P+I outlet air	0	---	0	1	R/W	Enable_PI	10007
7	**On/Off** - Fan 1 Alarm	1	---	0	1	R/W	Fan_1_Enable	10008
8	**On/Off** - Fan 2 Alarm	1	---	0	1	R/W	Fan_2_Enable	10009
9	**On/Off** - Fan 3 Alarm	1	---	0	1	R/W	Fan_3_Enable	10010
10	**On/Off** - Fan 4 Alarm	1	---	0	1	R/W	Fan_4_Enable	10011
11	**On/Off** - Fan 5 Alarm	1	---	0	1	R/W	Fan_5_Enable	10012
12	**On/Off** - Select P or P+I Valve	0	---	0	1	R/W	Enable_PI_Valve	10013
13	**Alarm** - High air temp	0	---	0	1	R	Alarm_High_Temp	10014
14	**Alarm** - High Water Temp	0	---	0	1	R	Alarm_High_Wate	10015
15	**Alarm** - Low Water Temp	0	---	0	1	R	Alarm_Low_Wate	10016
16	Unit state (0: Off; 1: On)	0	---	0	1	R	Sys_On	10017
17	Status of the power relay (0: contact	0	---	0	1	R	Power_Relay	10018
19	**On/Off** - Enable WDS alarm	1	---	0	1	R/W	Enable_WDS_alar	10020
20	Alarm Reset by BMS	0	---	0	1	R/W	Reset_Alarm_BMS	10021
21	**On/Off** - Water detected alarm	0	---	0	1	R	Alarm_WDS_In	10022
22	**Alarm** - General alarm output	0	---	0	1	R	General_Alarm	10023
23	**Alarm** - Clock board	0	---	0	1	R	Al_Clock	10024
24	**Alarm** - high room temp*	0	---	0	1	R	Alarm_high_room	10025
25	**Alarm** - low room temp*	0	---	0	1	R	Alarm_low_room	10026
26	**Alarm** - B1 Probe	0	---	0	1	R	Al_Probe_1	10027
27	**Alarm** - B2 Probe	0	---	0	1	R	Al_Probe_2	10028
28	**Alarm** - B3 Probe	0	---	0	1	R	Al_Probe_3	10029
29	**Alarm** - Fan 1 RPM	0	---	0	1	R	Alarm_Fan1	10030
30	**Alarm** - Fan 2 RPM	0	---	0	1	R	Alarm_Fan2	10031
31	**Alarm** - Fan 3 RPM	0	---	0	1	R	Alarm_Fan3	10032
32	**Alarm** - Fan 4 RPM	0	---	0	1	R	Alarm_Fan4	10033
33	**Alarm** - Fan 5 RPM	0	---	0	1	R	Alarm_Fan5	10034
34	**On/Off** - Enable motivair logo	1	---	0	1	R/W	LogoMA_Enable	10035
35	**On/Off** - Enable WDS alarm to close	1	---	0	1	R/W	En_WDS_valve_cl	10036
36	**Alarm** - High Server outlet temp	1	---	0	1	R	Alarm_High_Serve	10037
38	**Alarm** - B3P Probe**	0	---	0	1	R	Al_Probe_3P	10039
39	**Alarm** - High fan pressure	0	---	0	1	R	Alarm_High_Press	10040
41	41-55 Enable # of doors for PGD Touch	0	---	0	1	R/W	N_Doors_1	10042
55	41-55 Enable # of doors for PGD Touch	0	---	0	1	R/W	N_Doors_15	10056
56	**On/Off** - Reverse 0-10v CWV output	1	---	0	1	R/W	Reverse_0_10v	10057
57	**Alarm** - Probe B4 (Server out temp)	0	---	0	1	R	Al_Probe_4	10058
58	**Alarm** - Low Supply Air Temp	0	---	0	1	R	Alarm_Low_Temp	10059
59	**On/Off** - Enable door open alarm**	1	---	0	1	R/W	Enable_Door_Alar	10060
60	**Alarm** - Door Open**	0	---	0	1	R	Alarm_Door_Ope	10061

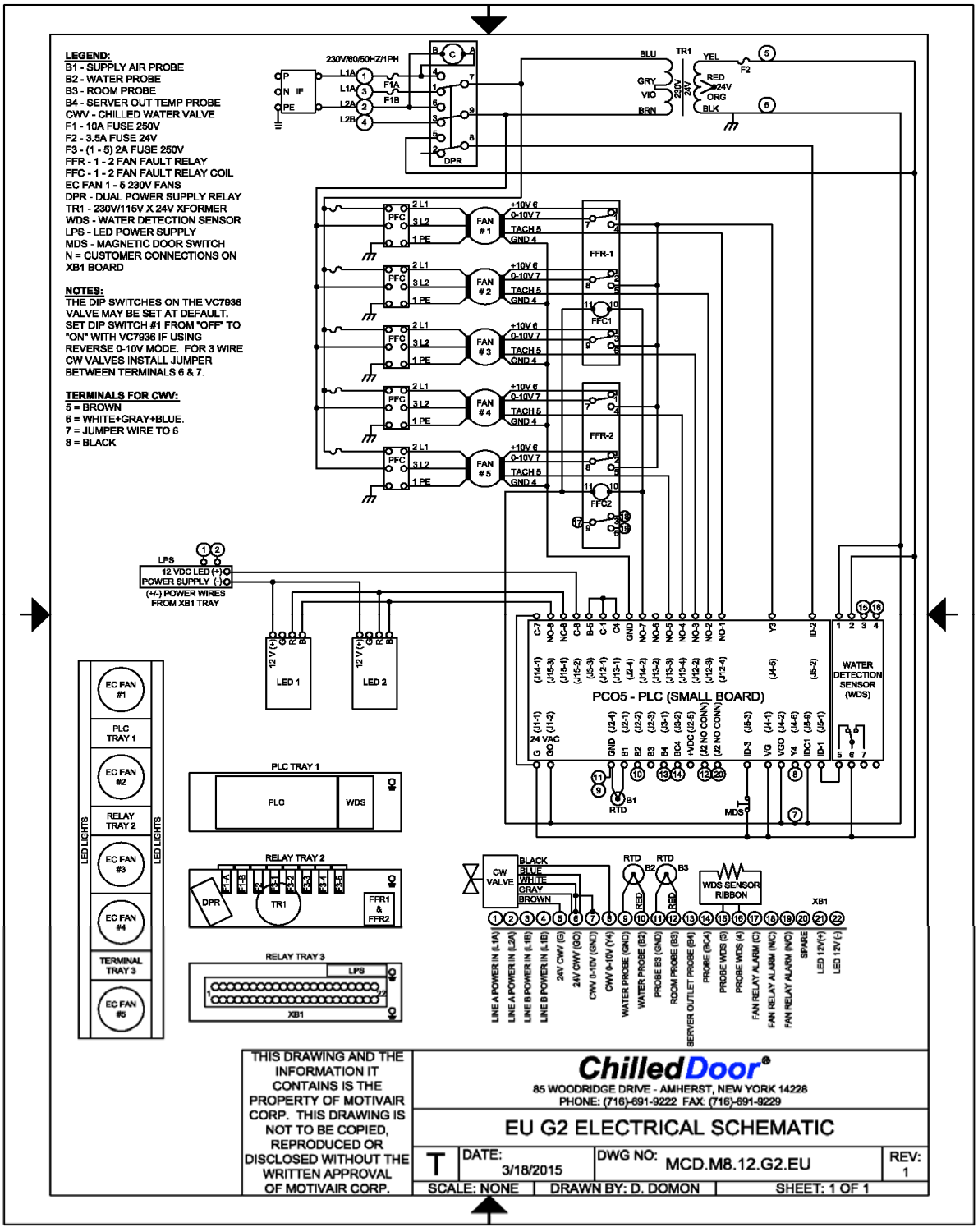
Electrical Schematics



Electrical Schematics (G2)



Electrical Schematics (EU-G2)



Support <> Contact <> Warranty Information

Factory Service & Support:

Motivair Corporation
85 Woodridge Drive
Amherst, New York, 14228
716-691-9222 Phone
716-691-9229 Fax

Additional information on this product may be found at

www.motivaircorp.com
www.chilleddoor.com

Parts <> Service <> Technical support Email

A service support portal is available at the following link **www.motivaircorp.supportsystem.com** also available through our web site link at **www.motivaircorp.com/service-support**

Visit the Motivair service portal at

https://motivaircorp.supportsystem.com/account.php?do=create to create an account. Once an account is created, you can create support tickets from your email account using **support@motivaircorp.supportsystem.com**

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NOTES:

Honeywell

VC7936

Floating Cartridge/Cage Valve

PRODUCT DATA

The VC7936 Fail Safe Modulating Control Valve provides proportional control of hot or chilled water in commercial heating and cooling applications, such as unit ventilators. On a power failure, this patented actuator design drives the valve to the fail safe position, either fully open or closed, according to the installer's wiring connections.

The VC7936 uses a microprocessor-controlled, low voltage stepper motor with a supercapacitor-based power supply that stores sufficient power to drive the valve to its fail safe position when 24V power is removed from the actuator. DIP switches are used to select actuator response time, flow characterization, motor timing, and control signal type.

A VC hydronic valve consists of a valve body and replaceable characterized cartridge assembly. When used with a Honeywell VC6900 or VC7900-series actuator, the valve provides proportional flow control. Three-way bodies may be used in either diverting or mixing applications. VC valves use cam-operated cartridge travel to resist water hammer. Limit switches prevent motor overrun. These actuators have engineered plastic housing and conformally coated printed circuit boards for humidity resistance. Multiple actuators may be operated by a single controller.

Specifications

The specifications following are nominal and conform to generally accepted industry standards. Honeywell is not responsible for damages resulting from misapplication or misuse of its products.

Power:

24 V, 50-60 Hz, 12 W. Class 2 circuit

18 VA maximum (during start up).

Analog Control Signal:

0–10 or 2–10 Vdc, proportional signal into polarity-protected, 19 kilo-ohm input impedance.

4–20 mA dc proportional signal with external 499 ohm 1% dropping resistor (not included).

Digital Control Signal:

24 Vac, 1.5mA Floating Signal (two mutually-exclusive momentary contacts for open and close, with minimum 0.5 seconds on and off timing.)

24 Vac, 1.5mA Pulse Width Modulated Signal (repeating voltage pulse up to 30 second period, with minimum 0.5 seconds on and off timing.)

24 Vac, 1.5mA on-off control (contact closure over 30 seconds in duration, not suitable for use with power stealing thermostats or thermostats with anticipators)

Annunciation: red LED on cable end.

Nominal Control Timing:

60 or 120 seconds full stroke depending on DIP switch setting.

Electrical Termination:

5 feet [1.5 m] plenum-rated cable per UL94-5V.

Flexible conduit (3/8") clamp included.

Operating Ambient:

32 to 150°F [0 to +65 C].

5-95% RH (non-condensing)

Shipping and Storage Temperature:

-40 to 150°F [-40 to +65 C]

Atmosphere: Non-corrosive, non-explosive.

Approvals:

UL (plenum rating), CE (pending)

FCC Part 15 Class B

Fluid temperatures: 34 to 203°F [1 to 95 C]

Pressure Rating:

Static - 300 psi [20 Bar] maximum.

Burst - 1500 psi [100 Bar]

Operating Differential and Close-off:

60 psi maximum [4 bar]

Stem Travel: 0.4 inches [10 mm]

Flow Characteristics:

Linear or equal percentage, per Table 3 and DIP switch setting.

MODELS:

Actuator: VC7936ZZ11, see Table 1

Bodies (order separately) : VCZ..., see table 3

Model Series	Voltage (50/60 Hz)	Action	Control Signal	Flow Characteristic	Nominal Stroke Timing
VC7936	24 Vac	Direct Acting	0-10 or 2-10 Vdc	Linear	120 seconds. *Fail Safe Return: 12 seconds*

Table 1. VC7936 Actuator factory settings

VC Valve assembled dimensions for reference (Fig. 1 & Table 2)

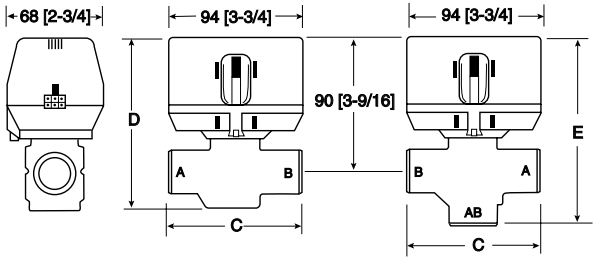


Figure 1: Nominal dimensions in inches [millimetres].

[4] Dimension / Pipe Fitting Sizes	C mm	C Inches	D mm	D Inches	E mm	E Inches
1/2" BSPP (int.) [2]	98	3-7/8	111	4-3/8	136	5-11/32
1/2" BSPT (int.)						
3/4" BSPP (int.)	94	3-11/16	113	4-7/16	130	5-1/8
3/4" BSPT (int.)						
3/4" BSPP (ext.)						
22mm Compression [3]	112	4-7/16			140	5-1/2
1" BSPP (int.)	94	3-11/16			136	5-11/32
1" BSPP (ext.)	95	3-11/17	114	4-7/17	137	5-11/33
1" BSPT (int.)	94	3-11/16	113	4-7/16	136	5-11/32
28mm Compression [3]	116	4-9/16			147	5-13/16
NORTH AMERICA STANDARD MODELS						
3/8" FLARE [1]	98	3-7/8	111	4-3/8	136	5-11/32
1/2" SWEAT	89	3-1/2			130	5-1/8
1/2" FLARE [1]	98	3-7/8			136	5-11/32
1/2" INVERTED FLARE [1]						
1/2" NPT (int.)						
3/4" NPT (int.)	94	3-11/16	113	4-7/16	130	5-1/8
3/4" SWEAT					132	5-3/16
1" NPT (int.)					136	
1" SWEAT						5-11/32
1-1/4" SWEAT	110	4-5/16	118	4-5/8	142	5-5/8
1-1/4" NPT (int.)						

[1] No adapters
[2] Suitable for use as15 mm compression fitting
[3] Dimensions shown with nuts and olives installed
[4] **Some models not available in all countries**

Table 2: VC valve assembled dimensions

2-way Valve Number / [5] Cartridge / Pipe Fitting Sizes	1000	1100 [4]	1400	1500	1600
	Nominal **kvs** Rating [8]				
VCZ**AF** 1/2" BSPP (int.) [2]	3.0	2.6		0.6	1.1
VCZ**AB** 1/2" BSPT (int.)		2.9		0.6	1.1
VCZ**AJ** 3/4" BSPP (int.)	5.3	4.5	3.3	0.7	1.3
VCZ**AK** 3/4" BSPT (int.)				0.7	1.3
VCZ**AH** 3/4" BSPP (ext.)					
VCZ**AG** 22MM Compression [3]		4.6	3.7		
VCZ**AP** 1" BSPP (int)	6.0	5.7	3.6	0.7	1.3
VCZ**AQ** 1" BSPP (ext.)		5.3			
VCZ**AT** 1" BSPT (int.)		5.7			
VCZ**AN** 28 MM Compression [3]		5.4			
NORTH AMERICA STANDARD MODELS	Nominal **Cv** Rating				
VCZ**AC** 3/8" FLARE [1]		2.1			
VCZ**AA** 1/2" SWEAT		3.2	2.9	0.7	1.3
VCZ**AD** 1/2" FLARE [1]		3.1			
VCZ**AE** 1/2" INVERTED FLARE [1]		3.2			
VCZ**BB** 1/2" NPT (int.)		3.4	2.9	0.7	1.3
VCZ**AL** 3/4" NPT (int.)		4.7	3.9	0.8	1.5
VCZ**AM** 3/4" SWEAT		4.6			
VCZ**AR** 1" NPT (int.)		6.6	4.2		
VCZ**AS** 1" SWEAT		6.2			
VCZ**BE** 1-1/4" SWEAT		7.0			
VCZ**BD** 1-1/4" NPT (int.)					

3-way Valve Number / [5] Cartridge / Pipe Fitting Sizes	6000	6100	6400	6500	6600
	Nominal **kvs** Rating [8]				
VCZ**ME** 1/2" BSPP (int.) [2]	3.4	3.2			
VCZ**MN** 1/2" BSPT (int.)		3.3			
VCZ**MH** 3/4" BSPP (int.)	7.0	5.9			
VCZ**MJ** 3/4" BSPT (int.)		5.3			
VCZ**MG** 3/4" BSPP (ext.)	6.9	5.7			
VCZ**MF** 22 mm Compression [3]	7.1	5.9			
VCZ**MP** 1" BSPP (int)	7.7	6.4			
VCZ**MQ** 1" BSPP (ext.)		6.8			
VCZ**MT** 1" BSPT (int.)		6.9			
VCZ**MM** 28 mm Compression [3]		6.4			
NORTH AMERICA STANDARD MODELS	Nominal **Cv** Rating				
VCZ**MB** 3/8" FLARE [1]		2.7			
VCZ**MA** 1/2" SWEAT		3.8			
VCZ**MC** 1/2" FLARE [1]					
VCZ**MD** 1/2" INVERTED FLARE [1]		4.2			
VCZ**NB** 1/2" NPT (int.)		3.7			
VCZ**MK** 3/4" NPT (int.)		6.6			
VCZ**ML** 3/4" SWEAT		5.9			
VCZ**MR** 1" NPT (int.)		8.6			
VCZ**MS** 1" SWEAT		6.6			
VCZ**NE** 1-1/4" SWEAT		8.6			
VCZ**ND** 1-1/4" NPT (int.)					
FLOW CHARACTERISTIC	Quick Open	Linear	Equal Percentage		
APPLICATION	On-Off			[7]	
	[6]	Modulating			

[1] No adapters
[2] Suitable for use as 15 mm compression fitting
[3] Includes compression nuts and olives
[4] "**1200**" series cartridge has the same Cv/kV rating as "1100" series. Suitable for use in potable water appications.
[5] Model availability is country specific. Some models are not available in all countries
[6] Can be used for modulating with appropriate software
[7] Use balancing valve for very low flow on-off applications
[8] Multiply the kv rating by 1.167 to obtain Cv rating
Example: 2-way, 3/4" BSPT (internally threaded) valve number VCZAJ1400 has a **kv** rating of 3.9; 3-way 1/2" Sweat valve number VCzMA6100 has a **Cv** rating of 3.8.

Table 3: VC Series Valve Bodies

INSTALLATION

WHEN INSTALLING THIS PRODUCT:

1. Read these instructions carefully. Failure to follow them could damage the product.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. Always conduct a thorough check-out when installation is completed.
5. While not necessary to remove the actuator from the body, it can be removed for ease of installation. The actuator can be installed in any of the four orientations to suit the most convenient wiring direction. Actuator latching mechanism works only when the lengths of the actuator and the valve body are parallel to each other.
6. An extra 1" (25 mm) head clearance is required to remove the actuator.

IMPORTANT:

For trouble-free operation of the product, good installation practice must include *initial system flushing, chemical water treatment,* and the use of a *50 micron* (or finer) system *side stream filter(s).*

The manual lever is used both as a position indicator and as a manual opener to allow initial system flushing.

Alternatively, reusable flush caps, part # 272866B, may be purchased separately for use in initial flushing of dirty hydronic systems.

IMPORTANT:

Do not use boiler additives and wetted materials which are petroleum based or contain mineral oil, hydrocarbons, or ethylene glycol acetate. Compounds which can be used, with minimum 50% water dilution, are diethylene glycol, ethylene glycol, and propylene glycol (antifreeze solutions).

PLUMBING

The valve may be plumbed in any angle but preferably not with the actuator below horizontal level of the body. Make sure there is enough room around the actuator for servicing or replacement. Refer to installation & instruction sheet 95C-10919 for valve installation instructions.

TO INSTALL ACTUATOR

Installation of a new actuator does not require draining the system, provided the valve body and valve cartridge assembly remain in the pipes. Wiring may be done either before or after the actuator is installed.

1. The actuator head is automatically latched to the valve. Align the coupling hole in the bottorı of the actuator with the valve stem. Press the actuator down towards the body with moderate hand force and turn the actuator counter-clockwise by 1/8 turn (45 degrees) to line up the actuator with the piping. The latch will click when engaged. See Figure 5.

Note: The actuator can also be installed at right angles to the valve body but in this position the latch mechanism will not engage.

2. Connect lead wires. See figure 6 for flexible conduit installation with plenum-cable models.

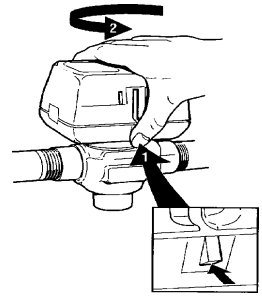


Fig. 5 - Latch Mechanism to detach Actuator

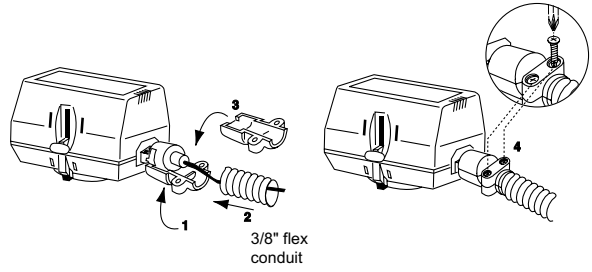


Fig. 6 - Flexible Conduit Attachment

WIRING

CAUTION

1. Disconnect power supply before connecting wiring to prevent electrical shock and equipment damage.
2. Never jumper the supply wires or actuator terminals even temporarily. This may damage the controller.
3. Verify wiring connections of the **brown and blue** lead wires with respect tot he controller. The actuator will not operate if these are wrong. The blue lead must connect to the controller's common terminal when using analog inputs. However, digital inputs are switched from the "hot" side of the controller's power supply.
4. Multiple valves may be connected in parallel to a single controller and transformer, up to the current rating of the controller and transformer.

OPTION SWITCH SETTINGS

The VC 7936 has four DIP switches for setting operating characteristics. These are accessible through the slots in the upper part of the case on the end of the actuator with the wiring connections, and may be operated with the tip of a mechanical pencil, or a straightened paper clip. A DIP switch is ON when the switch lever has been moved UP, away from the valve body. They number 1 to 4 from left to right. See table 4.

DIP SWITCH	1	2	3	4
ON ↑	REV	0-10V	EQUAL %	60 S
OFF ↓	DIR	FLOATING	LINEAR	120 S

Table 4: Dip switch on/off selection for operating characteristics

Sw.1 sets the actuator response.
OFF = direct (normal) operation: A port open with 10 Vdc input (factory setting).
ON = reverse operation, A port closed with 10 Vdc input. This is useful, for example, for correcting plumbing errors with 3-way valves. This setting affects all control modes.

Sw.2 sets control signal type.
OFF = floating, PWM, or on-off (digital) inputs.
ON = analog voltage modulating input (factory setting). The VC7936 accepts a variety of control inputs.

Sw.3 sets valve flow characterization.
OFF = linear response, where the stem position is a linear function of the input voltage, and flow is solely a function of the valve body (factory setting).
ON = equal percentage, where the stem position is a 50% equal percent function of input voltage. Equal percentage response improves comfort control during mild weather in heating systems with constant, high temperature supply water, or in chilled water systems in arid desert climates. Please refer to the Honeywell Engineering Manual of Automatic Control, publication #77-1100, for a detailed explanation.

Sw.4 sets actuator timing.
OFF = 2 minute end-to-end valve travel (factory setting).
ON = 1 minute travel. The faster response may be needed in lower mass systems.

OPERATION

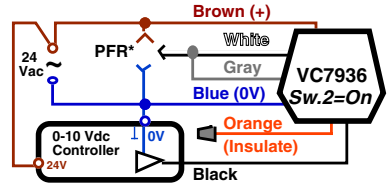
WITH SERIES 70 MODULATING CONTROLLER

Refer to figure 7, DIP switch #2 must be ON (factory default)

The controller output may be either 0 to 10 Vdc or 2 to 10 Vdc, but the VC7936 will be closed at 2 V to minimize false control signals caused by induced electrical noise on the wiring.

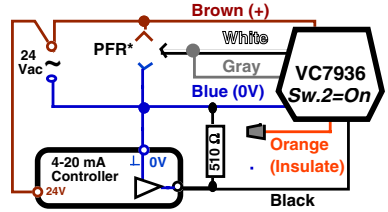
In direct acting mode (DIP switch #1 off), the valve will be fully closed with a 2 V or lower signal, and fully open with a 10 V signal. In reverse acting mode, 10 V is closed and 2 V is open.

For a 4-20 mA control signal, wire a 499 ohm, 1/2 W resistor between the black and brown actuator input leads to develop a 2–10Vdc signal. If the controller is nearby, the resistor may be installed on the controller's terminal block. See figure 8.



*Valve PFR Position	Connect Wires
Close "port A"	White + Gray + Brown
Open "port A"	White + Gray + Blue

Fig. 7 - Wiring Color Code for Cable Models for Modulating (0-10V or 2-10V) Controller



*Valve PFR Position	Connect Wires
Close "port A"	White + Gray + Brown
Open "port A"	White + Gray + Blue

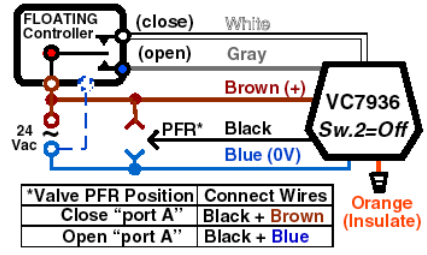
Fig. 8 - Wiring Color Code for Cable Models for Modulating (4-20mA) Controller

WITH SERIES 60 FLOATING (TRISTATE) CONTROLLER

Refer to figure 9, DIP switch #2 must be OFF, switch #1 = OFF.

A Series 60 floating controller has SPDT contact closure outputs with a center-off position. On a change in temperature from the set point, the controller will close either the Open or Close contacts creating a momentary voltage pulse on the gray or white input leads, driving the valve to a new position. The pulse must be at least 1/2 second long in order to be detected by the VC7936. The pulse can be held as long as necessary.

For control stability, the stroke time of the actuator while powered has been simulated at either 120 or 60 seconds, depending on DIP switch #4. In fail safe and testing operation, the actuator travels through its stroke in 12 seconds.



*Valve PFR Position	Connect Wires
Close "port A"	Black + Brown
Open "port A"	Black + Blue

Fig. 9 - Wiring Color Code for Cable Models for Floating (Series 60 or "tristate) Controller

WITH SERIES 70 PWM CONTROLLER

Refer to figure 10, DIP switch #2 must be OFF

A Pulse Width Modulating controller has a SPST contact closure output that supplies a repetitive voltage pulse. The duty cycle of the pulse (percentage on time) is proportional to the position of the valve. This control signal was originally developed for use with electromechanical thermal actuators.

If the VC7936 sees the a voltage pulse simultaneously on the gray and white input leads, it automatically interprets this as a PWM signal, and changes the valve to the new position on the second pulse.

PWM pulses must be at least 1/2 second long in order to be detected by the VC7936. A 1/2 second pulse is interpreted as an Off signal. The pulse period may be up to 30 seconds, and pulses must be separated by an off period no shorter than 1/2 second. The VC7936 will automatically synchronize to the period of the pulse train.

If DIP switch #1 is on, valve position is proportional to the off time percentage of the pulse train.

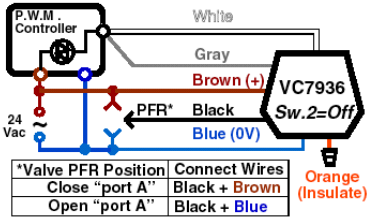


Fig. 10 - Wiring Color Code for Cable Models for Pulse Width Modulating (PWM) Controller

WITH SERIES 80 ON-OFF CONTROLLER

Refer to figure 11, DIP switch #2 must be OFF

A Series 80 controller has a SPST contact closure output that supplies 24V power to the controlled device. VC7936 wiring is identical to the PWM installation, above. If a "PWM" pulse extends longer than 30 seconds, the VC7936 interprets this as an on-off control signal, and opens the valve at its 12 second speed. Note that the valve response is delayed by 42 seconds from application of the controller signal. If DIP switch #1 is on, the valve closes when the signal is received.

NOTE: the current draw of the control inputs of the VC7936 is not high enough to operate either a power stealing electronic thermostat, or the anticipator of an electromechanical low voltage thermostat.

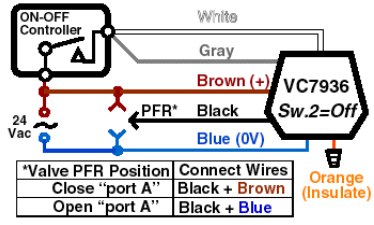


Fig. 11 - Wiring Color Code for Cable Models for ON-Off (Seroes 80) Controller

POWER FAILURE REPOSITION (FAIL SAFE OPERATION)

On a loss of power, the actuator will drive to its stand-by position using energy stored in the super-capacitors, and will resume normal operation on power up. On loss of signal, a VC7936 wired for PFR-Open will open the A port fully. A VC7936 wired for PFR-Close will open the A port fully. The motor can drive the valve through its full stroke in 12 seconds.

PFR position is chosen during installation. In analog mode (DIP switch #2 ON), the white and gray wires are connected to signal common (blue) to fail safe open, or to 24 V (brown) to fail safe closed. In digital mode (DIP switch #2 OFF), the black wire is connected to common (blue) to fail safe open, or to 24 V (brown) to fail safe closed.

The PFR position can be controlled dynamically with a SPST signal by applying 24 V power to the appropriate PFR direction selection lead(s) while power is present. Applying 24 V will cause the valve to close the A port when power is lost. Not applying power will cause the valve to open the A port when power is lost. This can be useful in 2-pipe systems where both hot and chilled water may be used depending on the season, and a different fail safe mode is required for each condition.

Because of the soft close off characteristic of the VC valve, initial (and final) movements of the actuator do not cause significant changes in the valve stem position.

START UP

On initial power-up, the capacitors will take about 60 seconds to charge. When ready, the actuator will drive the valve through one full stroke cycle over 24 seconds to calibrate its position, and exercise the valve cartridge.

The self-calibration compensates for motor tolerance and lets one controller operate multiple VC7936. This self-calibration action repeats daily. If anything interferes with the self-calibration process, the LED will flash rapidly and the actuator will not respond to control signals.

CHECK-OUT

1. Raise the set point of the thermostat above room temperature to initiate a call for heat.
2. Observe all control devices - 2 way valve should open. Port A in 3-way valve should open, and port B should close in 90 seconds.
3. Lower the set point of the thermostat below room temperature.
4. Observe the control devices. 2 way valve should close. Port A in 3-way valve should close, and port B should open in 90 seconds.
5. Remove power from actuator. Actuator waits 3 seconds then drives valve to default position, i.e.: open (or closed), in 12 seconds or less.
6. Restore power to actuator. Valve should drive to the position required by the thermostat or controller in 90 seconds or less.

SERVICE

This valve should be serviced by a trained, experienced service technician.

1. If the valve is leaking, drain system OR isolate valve from the system. Do not remove valve body from plumbing.
2. Check to see if the cartridge needs to be replaced.
3. If the motor or other internal parts of the actuator is damaged, replace the entire actuator assembly.

NOTE: Honeywell hydronic valves are designed and tested for silent operation in properly designed and installed systems. However, water noises may occur as a result of excessive water velocity. Piping noises may also occur in high temperature (over 212°F [100°C]) systems with insufficient water pressure.

TO REPLACE ACTUATOR

Replacement of an actuator does not require draining the system, provided the valve body and valve cartridge assembly remain in the pipeline.

1. Check replacement part number and voltage ratings for match with old device.
2. Disconnect power supply before servicing to avoid electrical shock or equipment damage.
3. Disconnect leadwires to actuator and remove. Where appropriate, label wires for rewiring.
4. The actuator head is automatically latched to the valve. To remove, press up on the latch mechanism with your thumb. It is located directly below the white manual open lever (see figure 5 below). Simultaneously press the actuator down towards the body with moderate hand force and turn the actuator counter-clockwise by 1/8 turn (45 degrees). Lift the actuator off the valve body.
5. Install the new actuator by reversing the process in (4).
6. Reconnect leadwires.
7. Restore power, and check out operation.

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Honeywell

Automation and Control Solutions
Environmental Control Products
1985 Douglas Drive North
Golden Valley, MN 55422-3992

In Canada:
Honeywell Limited-Limitee
35 Dynamic Drive
Toronto, ON M1V 4Z9

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