SERVICE INSTRUCTIONS

Variable Speed WH Series
Wall Mount Heat Pump

Models:

W3VHY-R	W3VHYDR	W5VHY-R	W5VHYDR
W3VHY-S	W3VHYDS	W5VHY-S	W5VHYDS
W3VHY-T	W3VHYDT	W5VHY-T	W5VHYDT

Bard® SINCE 1914
Climate Control Solutions

Bard Manufacturing Company, Inc.
Bryan, Ohio 43506
www.bardhvac.com

Manual: 2100-791
Supersedes: ***NEW***
Date: 11-28-23

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SAFETY INSTRUCTIONS

READ ALL INSTRUCTIONS BEFORE USE

Your safety and the safety of others are very important.

We have provided many important safety messages in this manual and on your appliance. Always read and follow all safety messages.

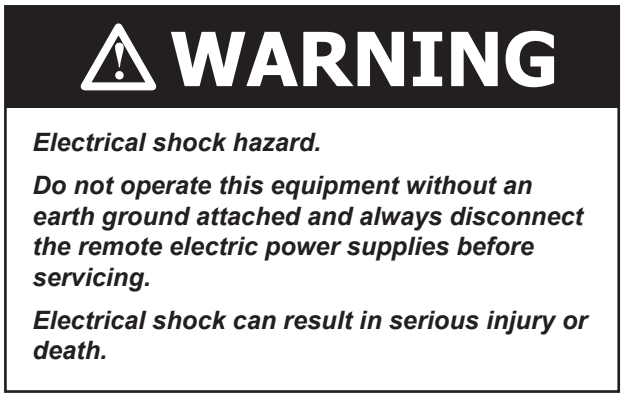
ANSI Z535.5 Definitions:

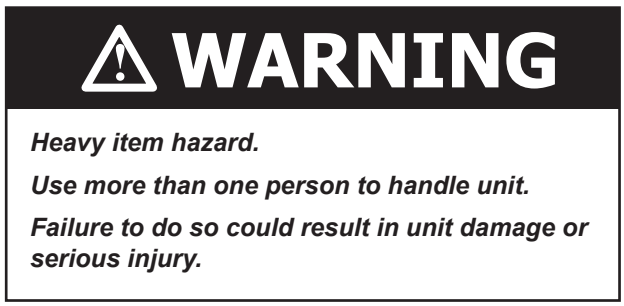
DANGER: Indicate[s] a hazardous situation which, if not avoided, will result in death or serious injury. The signal word "DANGER" is to be limited to the most extreme situations. DANGER [signs] should not be used for property damage hazards unless personal injury risk appropriate to these levels is also involved.

WARNING: Indicate[s] a hazardous situation which, if not avoided, could result in death or serious injury. WARNING [signs] should not be used for property damage hazards unless personal injury risk appropriate to this level is also involved.

CAUTION: Indicate[s] a hazardous situation which, if not avoided, could result in minor or moderate injury. CAUTION [signs] without a safety alert symbol may be used to alert against unsafe practices that can result in property damage only.

NOTICE: [this header is] preferred to address practices not related to personal injury. The safety alert symbol shall not be used with this signal word. As an alternative to "NOTICE" the word "CAUTION" without the safety alert symbol may be used to indicate a message not related to personal injury.





⚠ WARNING

Electrical shock hazard.

Have a properly trained individual perform these tasks.

Failure to do so could result in electric shock or death.

⚠ CAUTION

Sharp metallic edges.

Take care and wear appropriate protective devices to avoid accidental contact with sharp edges.

Failure to do so can result in personal injury.

The following symbols are displayed on units.

This symbol indicates that the Operation Manual should be read carefully.

This symbol indicates that a service personnel should be handling this equipment with reference to the Installation Manual.

This symbol indicates that information is available such as the Operation Manual or Installation Manual.

IMPORTANT SAFETY INSTRUCTIONS

⚠ WARNING

To reduce the risk of explosion, fire, death, electric shock, scalding or injury to persons when using this product, follow basic precautions, including the following:

GENERAL

- The equipment covered in this manual is to be installed by trained, experienced service and installation technicians.
- This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.
- The refrigerant system is completely assembled and charged. All internal wiring is complete.
- The unit is designed for use with or without duct work. Flanges are provided for attaching the supply and return ducts.
- These instructions explain the recommended method to install the air-cooled self-contained unit and the electrical wiring connections to the unit.
- These instructions and any instructions packaged with any separate equipment required to make up the entire air conditioning system should be carefully read before beginning the installation. Note particularly "Starting Procedure" and any tags and/or labels attached to the equipment.
- While these instructions are intended as a general recommended guide, they do not supersede any national and/or local codes in any way. Authorities having jurisdiction should be consulted before the installation is made. See Additional Publications for information on codes and standards.
- Size of unit for a proposed installation should be based on heat loss calculation made according to methods of Air Conditioning Contractors of America (ACCA). The air duct should be installed in accordance with the Standards of the National Fire Protection Association for the Installation of Air Conditioning and Ventilating Systems of Other Than Residence Type, NFPA No. 90A, and Residence Type Warm Air Heating and Air Conditioning Systems, NFPA No. 90B. Where local regulations are at a variance with instructions, installer should adhere to local codes.

INSTALLATION

- This product is not intended for use at altitudes exceeding 2,000 meters (6,561 feet). For appliances intended for use at altitudes exceeding 2,000 m (6,561 feet), the maximum altitude of use shall be stated.
- Before use, the appliance must be properly installed as described in this manual.
- Contact the authorized service technician for repair or maintenance of this unit.
- Contact the installer for installation of this unit.
- The air conditioner is not intended for use by young children or invalids without supervision.
- Young children should be supervised to ensure that they do not play with the air conditioner.
- Installation work must be performed in accordance with the National Electric Code by qualified and authorized personnel only.
- Connect to a properly rated, protected, and sized power circuit to avoid electrical overload.
- Adhere to all industry recommended safety procedures including the use of long-sleeved gloves and safety glasses.
- Use care when unpacking and installing. The edges of the product may be sharp.
- Keep packaging materials out of the reach of children. These materials can pose a suffocation risk to children.

OPERATION

- This appliance is not intended for use by persons (including children) with reduced physical, sensory, or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.
- Use this appliance only for its intended purpose.
- Never attempt to operate this appliance if it is damaged, malfunctioning, partially disassembled, or has missing or broken parts.
- Do not tamper with controls.

LIRE TOUTES LES INSTRUCTIONS AVANT UTILISATION

Votre sécurité et celle des autres sont très importantes.

Nous avons fourni de nombreux messages de sécurité importants dans ce manuel et sur votre appareil. Lisez et suivez toujours tous les messages de sécurité.

Définitions ANSI Z535.5 :

DANGER : Indique une situation dangereuse qui, si elle n'est pas évitée, entraînera certainement la mort ou des blessures graves. Le mot « DANGER » doit être limité aux situations extrêmes. Les indications « DANGER » ne doivent pas être utilisées pour les risques de dégâts matériels, à moins qu'il n'existe un risque concomitant de blessures corporelles.

AVERTISSEMENT : Indique une situation dangereuse qui, si elle n'est pas évitée, peut entraîner la mort ou des blessures graves. Les indications « AVERTISSEMENT » ne doivent pas être utilisées pour les risques de dégâts matériels, à moins qu'il n'existe un risque concomitant de blessures corporelles.

ATTENTION : Indique une situation dangereuse qui, si elle n'est pas évitée, peut entraîner des blessures mineures à modérées. Les indications « ATTENTION », sans symbole d'avertissement, peuvent être utilisées pour alerter sur des pratiques dangereuses pouvant entraîner des dégâts matériels uniquement.

REMARQUE : cet avis concerne les pratiques n'entraînant aucune blessure corporelle. Le symbole d'avertissement ne doit pas être utilisé avec ce mot. Comme alternative à « AVIS », le mot « ATTENTION » sans symbole d'avertissement peut être utilisé pour indiquer un message non lié à des blessures corporelles.

⚠ AVERTISSEMENT

Risque de choc électrique.

Ces tâches doivent être réalisées par une personne parfaitement qualifiée et formée.

Le non-respect de cette consigne peut entraîner des chocs électriques ou la mort.

⚠ ATTENTION

Arêtes métalliques vives.

Faites attention et portez des dispositifs de protection appropriés pour éviter tout contact accidentel avec des arêtes vives.

Le non-respect de cette consigne peut entraîner des blessures corporelles.

Les symboles suivants sont affichés sur les unités.

Ce symbole indique que le manuel d'utilisation doit être lu attentivement.

Ce symbole indique qu'un membre du personnel de service devrait manipuler cet équipement en se référant au manuel d'installation.

Ce symbole indique que des informations sont disponibles telles que le manuel d'utilisation ou le manuel d'installation.

INSTRUCTIONS DE SÉCURITÉ IMPORTANTES

AVERTISSEMENT

Pour réduire le risque d'explosion, d'incendie, de décès, de choc électrique, d'échaudure ou de blessures pour les personnes lors de l'utilisation de ce produit, suivez les précautions de base, notamment les suivantes :

GÉNÉRALITÉS

- L'équipement couvert dans ce manuel doit être installé par des techniciens de service et d'installation formés et expérimentés.
- Cet appareil n'est pas destiné à être utilisé par des personnes (y compris des enfants) ayant des capacités physiques, sensorielles ou mentales réduites, ou un manque d'expérience et de connaissances, à moins qu'elles n'aient reçu la supervision ou l'instruction concernant l'utilisation de l'appareil par une personne responsable de leur sécurité.
- Le système de réfrigérant est complètement assemblé et chargé. Tout le câblage interne est complet.
- L'unité est conçue pour être utilisée avec ou sans conduits. Des brides sont prévues pour fixer les conduits d'alimentation et de retour.
- Ces instructions expliquent la méthode recommandée pour installer l'unité autonome refroidie à l'air et les connexions de câblage électrique à l'unité.
- Ces instructions et toutes les instructions emballées avec tout équipement distinct requis pour constituer l'ensemble du système de climatisation doivent être lues attentivement avant de commencer l'installation. Notez en particulier « Procédure de démarrage » et les étiquettes et / ou étiquettes attachées à l'équipement.
- Bien que ces instructions soient conçues comme un guide général recommandé, elles ne remplacent en aucune façon les codes nationaux et/ou locaux. Les autorités compétentes devraient être consultées avant que l'installation ne soit effectuée. Voir d'autres publications pour obtenir des renseignements sur les codes et les normes.
- La taille de l'unité pour une installation proposée devrait être basée sur le calcul de la perte de chaleur effectué selon les méthodes de Air Conditioning Contractors of America (ACCA). Le conduit d'air devrait être installé conformément aux Normes de la National Fire Protection Association for the Installation of Air Conditioning and Ventilating Systems of Other Than Residence Type, NFPA No. 90A, et aux Systèmes de chauffage et de climatisation d'air chaud de type résidence, NFPA No. 90B. Lorsque les réglementations locales sont en contradiction avec les instructions, l'installateur doit respecter les codes locaux.

L'INSTALLATION

- Ce produit n'est pas destiné à être utilisé à des altitudes supérieures à 2 000 mètres (6 561 pieds). Pour les appareils destinés à être utilisés à des altitudes supérieures à 2 000 m (6 561 pieds), l'altitude maximale d'utilisation doit être indiquée.
- Avant utilisation, l'appliance doit être correctement installée comme décrit dans ce manuel.
- Communiquez avec le technicien d'entretien autorisé pour la réparation ou l'entretien de cette unité.
- Contactez le programme d'installation pour l'installation de cet appareil.
- Le climatiseur n'est pas destiné à être utilisé par de jeunes enfants ou des invalides sans surveillance.
- Les jeunes enfants devraient être surveillés pour s'assurer qu'ils ne jouent pas avec le climatiseur.
- Les travaux d'installation doivent être effectués conformément au Code national de l'électricité par du personnel qualifié et autorisé uniquement.
- Connectez-vous à un circuit d'alimentation correctement évalué, protégé et dimensionné pour éviter les surcharges électriques.
- Respectez toutes les procédures de sécurité recommandées par l'industrie, y compris l'utilisation de gants à manches longues et de lunettes de sécurité.
- Faites attention lors du déballage et de l'installation. Les bords du produit peuvent être tranchants.
- Gardez les matériaux d'emballage hors de la portée des enfants. Ces matériaux peuvent poser un risque d'étouffement pour les enfants.

OPÉRATION

- Cet appareil n'est pas destiné à être utilisé par des personnes (y compris des enfants) ayant des capacités physiques, sensorielles ou mentales réduites, ou un manque d'expérience et de connaissances, à moins qu'elles n'aient reçu une supervision ou une instruction concernant l'utilisation de l'appareil par une personne responsable de leur sécurité.
- Utilisez cet appareil uniquement aux fins prévues.
- N'essayez jamais de faire fonctionner cet appareil s'il est endommagé, défectueux, partiellement démonté ou s'il a des pièces manquantes ou cassées.
- Ne pas altérer les contrôles.

GENERAL INFORMATION

General

The equipment covered in this manual is to be installed by trained, experienced service and installation technicians.

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance.

The refrigerant system is completely assembled and charged. All internal wiring is complete.

The unit is designed for use with or without duct work. Flanges are provided for attaching the supply and return ducts.

These instructions explain the recommended method to install the air cooled self-contained unit and the electrical wiring connections to the unit.

These instructions and any instructions packaged with any separate equipment required to make up the entire air conditioning system should be carefully read before beginning the installation. Note particularly "Starting Procedure" and any tags and/or labels attached to the equipment.

While these instructions are intended as a general recommended guide, they do not supersede any national and/or local codes in any way. Authorities having jurisdiction should be consulted before the installation is made. See **Additional Publications** for information on codes and standards.

Size of unit for a proposed installation should be based on heat loss calculation made according to methods of Air Conditioning Contractors of America (ACCA). The air duct should be installed in accordance with the Standards of the National Fire Protection Association for the Installation of Air Conditioning and Ventilating Systems of Other Than Residence Type, NFPA No. 90A, and Residence Type Warm Air Heating and Air Conditioning Systems, NFPA No. 90B. Where local regulations are at a variance with instructions, installer should adhere to local codes.

Shipping Damage

Upon receipt of equipment, the carton should be checked for external signs of shipping damage. If damage is found, the receiving party must contact the last carrier immediately, preferably in writing, requesting inspection by the carrier's agent.

Additional Publications

These publications can help when installing the heat pump. They can usually be found at the local library or purchased directly from the publisher. Be sure to consult the current edition of each standard.

National Electrical Code .....ANSI/NFPA 70

Standard for the Installation of Air Conditioning and Ventilating Systems
.....ANSI/NFPA 90A

Standard for Warm Air Heating and Air Conditioning Systems
.....ANSI/NFPA 90B

Load Calculation for Winter and Summer Air Conditioning
..... ACCA Manual J Residential

Duct Design for Residential Winter and Summer Air Conditioning and Equipment Selection
..... ACCA Manual D

For more information, contact these publishers:

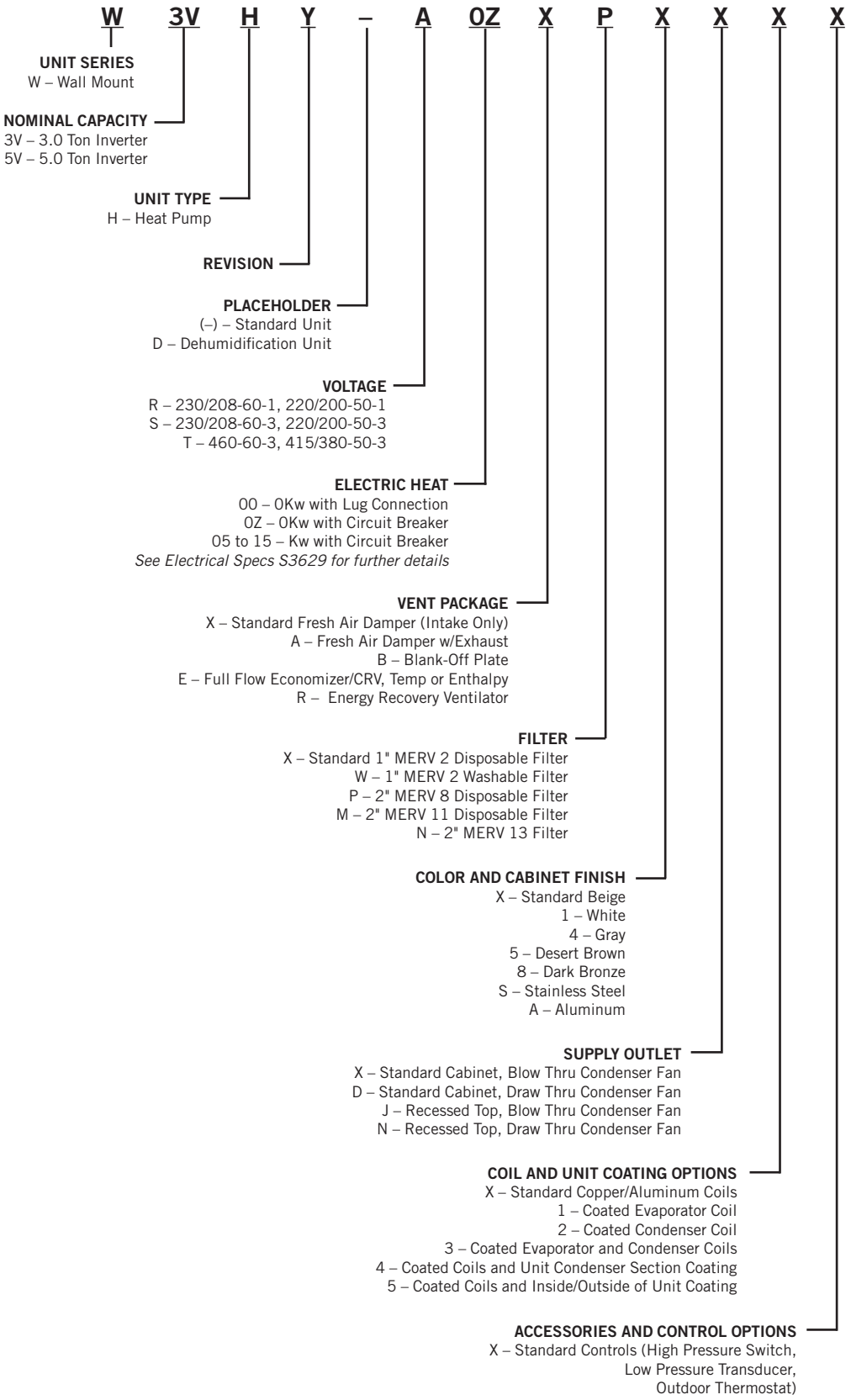
ACCA **Air Conditioning Contractors of America**
1712 New Hampshire Ave. N.W.
Washington, DC 20009
Telephone: (202) 483-9370
Fax: (202) 234-4721

ANSI **American National Standards Institute**
11 West Street, 13th Floor
New York, NY 10036
Telephone: (212) 642-4900
Fax: (212) 302-1286

ASHRAE **American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc.**
1791 Tullie Circle, N.E.
Atlanta, GA 30329-2305
Telephone: (404) 636-8400
Fax: (404) 321-5478

NFPA **National Fire Protection Association**
Batterymarch Park
P.O. Box 9101
Quincy, MA 02269-9901
Telephone: (800) 344-3555
Fax: (617) 984-7057

Variable Speed Heat Pump Wall Mount Model Nomenclature



REFRIGERANT INFORMATION

NOTICE

These units require R-410A refrigerant and polyol ester oil.

General

1. Use separate service equipment to avoid cross contamination of oil and refrigerants.
2. Use recovery equipment rated for R-410A refrigerant.
3. Use manifold gauges rated for R-410A (800 psi/250 psi low).
4. R-410A is a binary blend of HFC-32 and HFC-125.
5. R-410A is nearly azeotropic—similar to R-22 and R-12. Although nearly azeotropic, charge with liquid refrigerant.
6. R-410A operates at 40-70% higher pressure than R-22, and systems designed for R-22 cannot withstand this higher pressure.
7. R-410A has an ozone depletion potential of zero, but must be reclaimed due to its global warming potential.
8. R-410A compressors use polyol ester oil.
9. Polyol ester oil is hygroscopic; it will rapidly absorb moisture and strongly hold this moisture in the oil.
10. A liquid line dryer must be used—even a deep vacuum will not separate moisture from the oil.
11. Limit atmospheric exposure to 15 minutes.
12. If compressor removal is necessary, always plug compressor immediately after removal. Purge with small amount of nitrogen when inserting plugs.

Topping Off System Charge

If a leak has occurred in the system, Bard Manufacturing recommends reclaiming, evacuating (see criteria above) and charging to the nameplate charge. If done correctly, topping off the system charge can be done without problems.

With R-410A, there are no significant changes in the refrigerant composition during multiple leaks and recharges. R-410A refrigerant is close to being an azeotropic blend (it behaves like a pure compound or single component refrigerant). The remaining refrigerant charge in the system may be used after leaks have occurred. "Top-off" the charge by utilizing the pressure charts on the inner control panel cover as a guideline.

REMEMBER: *When adding R-410A refrigerant, it must come out of the charging cylinder/tank as a liquid to avoid any fractionation and to insure optimal system performance. Refer to instructions for the cylinder that is being utilized for proper method of liquid extraction.*

Safety Practices

1. Never mix R-410A with other refrigerants.
2. Use gloves and safety glasses. Polyol ester oils can be irritating to the skin, and liquid refrigerant will freeze the skin.
3. Never use air and R-410A to leak check; the mixture may become flammable.
4. Do not inhale R-410A—the vapor attacks the nervous system, creating dizziness, loss of coordination and slurred speech. Cardiac irregularities, unconsciousness and ultimately death can result from breathing this concentration.
5. Do not burn R-410A. This decomposition produces hazardous vapors. Evacuate the area if exposed.
6. Use only cylinders rated DOT4BA/4BW 400.
7. Never fill cylinders over 80% of total capacity.
8. Store cylinders in a cool area, out of direct sunlight.
9. Never heat cylinders above 125°F.
10. Never trap liquid R-410A in manifold sets, gauge lines or cylinders. R-410A expands significantly at warmer temperatures. Once a cylinder or line is full of liquid, any further rise in temperature will cause it to burst.

Important Installer Note

For improved start-up performance, wash the indoor coil with a dishwashing detergent.

R410-A Refrigerant Charge

This wall-mount unit was charged at the factory with the quantity of refrigerant listed on the serial plate. AHRI capacity and efficiency ratings were determined by testing with this refrigerant charge quantity.

Tables 1A and 1B show nominal pressures for the units. Since many installation specific situations can affect the pressure readings, this information should only be used by certified technicians as a guide for evaluating proper system performance. They shall not be used to adjust charge. If charge is in doubt, reclaim, evacuate and recharge the wall-mount unit to the serial plate charge.

Pressure Service Ports

High and low pressure service ports are installed on all units so that the system operating pressures can be observed. Pressures are shown in Tables 1A and 1B.

This unit employs high-flow Coremax valves instead of the typical Schrader type valves.

WARNING! Do NOT use a Schrader valve core removal tool with these valves. Use of such a tool could result in eye injuries or refrigerant burns!

To change a Coremax valve without first removing the refrigerant, a special tool is required which can be obtained at www.fastestinc.com/en/SCCA07H. See the replacement parts manual for replacement core part numbers.

TABLE 1A
Cooling Pressure – Rated Airflow

Air Temperature Entering Outdoor Coil °F

Model	Return Air Temp (DB/WB)	Pressure	75	80	85	90	95	100	105	110	115	120	125
W3VHY	75/62	Low Side	128	130	131	133	134	136	137	138	139	141	142
		High Side	298	320	343	367	391	416	442	468	495	523	551
	80/67	Low Side	137	139	140	142	143	145	146	148	149	150	152
		High Side	306	329	352	376	401	427	453	480	508	536	565
	85/72	Low Side	142	143	145	147	148	150	152	153	154	156	157
		High Side	316	340	364	389	415	442	469	497	525	555	585
W5VHY	75/62	Low Side	128	130	131	132	133	134	135	136	137	138	138
		High Side	314	333	353	374	397	421	446	472	500	529	560
	80/67	Low Side	137	139	140	141	143	144	145	146	147	147	148
		High Side	322	342	362	384	407	432	457	485	513	543	574
	85/72	Low Side	142	143	145	146	148	149	150	151	152	153	153
		High Side	334	354	375	397	421	447	473	502	531	562	594

Low side pressure ± 4 psig
High side pressure ± 10 psig

Tables are based upon rated CFM (airflow) across the evaporator coil. If there is any doubt as to correct operating charge being in the system, the charge should be removed and system evacuated and recharged to serial plate charge weight.

IMPORTANT: *This system is variable speed. Unit must be in test mode with overrides set according to service instructions. Unit must run at steady output to confirm pressures accurately. Set overrides to optimal demand settings as shown in Table 2.*

TABLE 1B
Heating Pressure – Rated Airflow

Air Temperature Entering Outdoor Coil °F

Model	Indoor	Heating	0	5	10	15	20	25	30	35	40	45	50	55	60	65
W3VHY	70	Low Side	33	41	48	55	63	71	78	86	94	102	110	118	126	135
		High Side	328	333	339	343	348	353	358	362	367	371	376	380	384	388
W5VHY	70	Low Side	41	46	51	56	62	68	74	81	88	95	103	110	118	127
		High Side	303	309	315	320	326	331	337	342	347	352	356	361	365	370

IMPORTANT: *This system is variable speed. Unit must be in test mode with overrides set according to service instructions. Unit must run at steady output to confirm pressures accurately. Set overrides to optimal demand settings as shown in Table 2.*

TABLE 2
Optimal Demand Settings

	W3HY-*	W3HYD*	W5HY-*	W5HYD*
Cooling	38%	38%	40%	40%
Heating	33%	33%	49%	49%

Mechanical Cooling

When the indoor temperature rises above the cooling setpoint, a cooling call is triggered. The PID algorithm within the PLC regulates the compressor, fan and blower based on the demand generated by the thermostat. In cooling mode, the indoor fan speed is correlated to the compressor output and the outdoor fan changes speed to maintain a discharge pressure setpoint. (See blower and fan sections for more information.)

Mechanical Heating (Heat Pump Mode)

When the indoor temperature falls below the heating setpoint, a heating call is triggered. The PLC board then sends a signal to the 24V solenoid coil on the reversing valve, which controls the heat cycle operation within the unit. The reversing valve will be energized anytime the unit is in heating mode and will remain energized until power is lost, a defrost cycle is initiated or the mode is changed to cooling. The PID algorithm within the PLC regulates the compressor, fan and blower based on the demand generated by the thermostat. In heat pump mode, the indoor fan changes speed to maintain a discharge setpoint and the outdoor fan is set to a specific speed based on the outdoor temperature. (See blower and fan sections for more information.)

Auxiliary Heat

If a heating demand rises above 95% and persists for more than 30 minutes, the unit will drop the heat pump output to rated speed—if boost mode is enabled. The first stage of electric heat (auxiliary heat) will then be engaged alongside the heat pump at rated speed to bring the indoor temperature up to the setpoint. Auxiliary heat will continue to run until the heating call is satisfied. If electric heat is not installed in the unit, the heat pump output will continue to run in cohesion with the demand in the space if boost mode is enabled. Otherwise, the unit will continue to run at rated speed.

Electric Heat

If the compressor is locked out by an alarm and mechanical heat is not available for a heating call, emergency heat will be available to warm the space instead. Emergency heat can also be enabled in the custom room controller (Brightstat) menu, which will disable the compressor during a heating call.

When the heating demand reaches 30% in emergency heat, the first stage of electric heat is used to warm the space. If the demand continues to climb and reaches 50%, the second stage of electric heat is used in conjunction with the first stage of electric heat if applicable. Both stages of electric heat remain on until the heating demand is satisfied. If only one stage of electric heat is available, the electric heat will continue to run until the heating demand is satisfied.

NOTE: *Emergency heat does not turn off unless it is disabled at the thermostat or there is a power cycle.*

Boost Mode

Boost mode allows for use of compressor capacity beyond the rated capacity of the unit. When boost mode is enabled, the compressor will be allowed to increase to its maximum RPM. This will allow for more cooling and heating capacity; however, the sound levels will also increase. This feature is disabled by default to keep the sound levels low.

Quiet Mode

Quiet mode will limit the RPM range of the compressor in an attempt reduce noise to minimal levels but allow for more compressor capacity if the space temperature cannot be achieved. When enabled, the compressor will be limited to approximately 50% of the rated cooling/heating capacity until the space demand either satisfies or the reaches 70%. If the demand reaches 70% before the space temperature is satisfied, the compressor will ramp up to rated capacity (boost disabled) or 70% (boost enabled) to satisfy the demand. Once the compressor has ramped up above the initial limitation, it will not return to quiet mode until the space temperature setpoint has been reached or the unit is turned off.

Mitigation and Foldbacks

The inverter drive in this unit has built in protections to prevent damage to the compressor or drive due to excessive compressor current, drive current, drive temperature, and head pressure. There are also additional protections that are built into the software to prevent the drive from folding back and locking out. If the compressor current, inverter drive current, head pressure or outdoor temperature exceeds internal thresholds (not adjustable), the software compressor demand to keep the drive from locking out. During foldback, the unit will run at a reduced capacity which will be displayed as “Reduced Capacity” in the status while active. The most common reduced capacity operation (under normal conditions) will be in response to outdoor air temperature. If the outdoor air temperature exceeds 90°F the compressor capacity will be limited to 77.5%, this percentage is not measured by the overall capacity of the unit but is a percentage of the available compressor RPM. The limitation is handled differently for the current and pressure

mitigation loops. In these situations, as the current or pressure rises, the percentage cap will be reduced. These mitigation loops can reduce the compressor output down as low as 6%.

The mitigation loop works by targeting a setpoint and using a PID loop to reduce output until the setpoint is reached or exceeded. These loops act as a cap for compressor output to keep the compressor and inverter operating in a safe range. This allows for cooling, heating or dehumidification to continue at a reduced capacity when conditions are excessive, or the unit is compromised. In many, but not all circumstances, frequent reduced capacity operation could indicate a need for service on the unit. For example, it would be normal for the unit to operate in reduced capacity when there is a high outdoor ambient condition. It would be abnormal for the unit to operate regularly in reduced capacity when there is a low cooling demand, and the outdoor temperature is below the high ambient threshold.

The current target limitation for the compressor changes with compressor output and is not intended to be measured in the field so it is not listed here. The overall current limitation setpoint is 20.5 amps for the 3-ton unit and 32.5 amps for the 5-ton unit. The head pressure limitation setpoint is 575 psi. These limits may be beneficial for diagnosis of a problem or cause for a reduced capacity operation event. A qualified service technician should be consulted if there is concern about unit operation.

BACnet Set Up

Once the unit is powered the room controller (Brightstat) and unit will need to be configured for BACnet communication. The default communication address (BACnet instance) the unit will look for is 86127. This will need to be configured in the room controller (Brightstat) or if another address is used will need to be configured in the room controller (Brightstat) and unit. The room controller (Brightstat) can be configured by either changing the communication address value or the BACnet instance number (see 2100-681). The unit can be configured by pressing enter on the home screen when the lower right corner shows the “BAC” icon. In the unit there are two configurable points for the BACnet communication. The “Controller Instance” is the address that must match the address in the room controller (Brightstat). This tells the unit which room controller (Brightstat) to communicate with. The “BARD Unit Instance” is the address of the unit and only needs to be changed if there are multiple units and room controller (Brightstat) s on the same network. When there are multiple units and room controllers on the same network, they all must have a unique address/instance. All unit and room controller (Brightstat) addresses/instances should be configured prior to connecting the communication wiring to prevent communication issues or uncontrolled unit operation.

Defrost

When the unit is operating in heat mode with the compressor, the temperature of the outdoor coil will be monitored. If the outdoor coil temperature falls below 28°F, a timer will begin. If the time accumulated exceeds the time setting (60 min. default), a defrost cycle will be triggered (minimum defrost cycle time 1 minute). If the coil temperature exceeds the exit temperature (57°F), the compressor is utilized for cooling, or a defrost cycle is completed, the accumulated time will be reset to 0. In the event that the outdoor coil temperature sensor fails, time will be accumulated anytime the compressor is used for heating.

During a defrost cycle, the compressor will operate at or close to unit rated capacity, the outdoor fan motor will stop, the indoor fan will ramp to Aux. heat speed and the first stage of electric heat will be turned on (if equipped). If the discharge pressure exceeds 500 psi, the outdoor fan will be turned on until the pressure falls below 425 psi. The defrost cycle will continue until the outdoor coil reaches the exit temperature for 1 minute, the call is satisfied or the defrost cycle has run for 8 minutes. After a defrost cycle, all defrost timers will be reset.

The time setting for triggering a defrost cycle is adjustable. It is not recommended that this time be change unless evaluated by a qualified service provider. The setting is available on screen B7 and requires a technician level password to be provided for adjustment. The range of adjustment is 30 to 120 minutes.

Electric Heat

Auxiliary and emergency heating will be available for units equipped with electric heat. If the demand for heating is above 95% for more than 30 minutes, auxiliary heat will be provided. In auxiliary heat mode, the compressor will operate at the rated capacity, the first stage of electric heat will turn on and the blower will operate at the rated speed for electric heat usage. Auxiliary heat will continue until the call is satisfied or terminated.

Emergency heat mode will be activated when selected by a user on the room controller (Brightstat) or the compressor is locked out by an alarm and there is a heat demand. When emergency heating is active, the first stage of electric heat (if equipped) will turn on at 30% heating demand and the blower will ramp to the rated electric heat speed. The second stage of electric heat (if equipped) will turn on at 50% demand. Once active, the electric heat will remain on until the call is satisfied or terminated. If emergency heat is selected on the room controller (Brightstat), the compressor will not be used for heating. The emergency heat toggle can be found in the custom menu of the room controller (Brightstat).

Dehumidification

If the unit is equipped with dehumidification capability, the unit will operate in dehumidification mode when space humidity is above the dehumidification setpoint. Cooling or heating will take priority over dehumidification. Dehumidification mode will begin only in the absence of a heating or cooling call and will end if a heating or cooling demand becomes present during the dehumidification operation. When the unit is in dehumidification mode, a reheat coil will be utilized to reheat the supply air after it passes through the evaporator coil to remove moisture from the air. This process provides a supply air temperature close to the return air temperature of the unit. If the temperature drifts to the heating or cooling setpoints, demand will build and the unit will move to heating or cooling mode to maintain space temperature and then if needed return to dehumidification mode.

If unit is equipped with dehumidification, the room controller (Brightstat) has a configuration option that allows for dehumidification to be disabled (see BrightStat manual 2100-681). This toggle will be defaulted to "enable" (locked out) by default on non-dehumidification equipped units and to "disable" on equipped units.

Variable Speed Compressor Control

With the many modes of operation, various methods are utilized to determine the speed of the variable speed compressor. The compressor has a range of 0-100%. This information is displayed on the information screens (EEV Compressor) that can be found on the home screen of the PLD Pro display mounted in the control panel. The compressor output percentage may match the cooling/heating demand percentages at times, but they are different calculations. In some scenarios, the cooling/heating demand percentage may be directly tied to the compressor output depending on the application, but often this will probably not be the case. Additionally, there are mitigation calculations that alter the compressor output when necessary (see **Mitigation and Foldbacks** on page 14.

In cooling mode, the demand percentage can be scaled in one of two ways. When freecooling is available, the first 30% of the cooling demand will be reserved for the economizer and the remaining 70% of the demand will be scaled to a 0-100% compressor demand. Note this is not the compressor output percentage; the compressor output percentage will be determined after additional considerations and may vary greatly from the demand. In heating mode, the heating demand is directly proportional to the compressor demand except when emergency heat is active. Again, this does not necessarily mean that the compressor output will match the heating demand percentage. In these modes, the compressor demand is scaled and varies as conditions change.

In other modes, such as dehumidification or defrost, the compressor will be commanded to a fixed percentage. In dehumidification and defrost mode, the percentage will be at or around the rated capacity of the unit. The compressor output may still be adjusted by the mitigation calculations or other factors that may limit the compressor output to safely maintain operation.

When evaluating the unit charge or operation, it is important to remember that the compressor is variable and has a broad range of operation that may impact temperatures and pressures in the unit devices. When necessary, there are overrides available to assist with troubleshooting and/or evaluation of the unit functionality. These overrides should only be utilized by qualified service technicians. The settings to override the heating or cooling demand can be found on screen C21 and require a technician level password to operate.

Default Settings

The table below outlines the default settings in the PLC for the product.

Name	Default	Range	Screen
System Configuration			
Boost Mode	OFF	ON-OFF	A4
Quiet Mode	ON	ON-OFF	A4
Dehumidification	ON (if equipped)	ON-OFF	A5
UOM	USA	USA, SI	A1
Economizer			
Control Type	Drybulb	Drybulb, TempHum, Enthalpy, None	A2
OD Temp Set	70°F	0-75°F	A2
Off Diff.	5°F	5-10°F	A2
Humidity Set	80%	10-100%	A2
Off Diff.	5%	0-20%	A2
Dew Pt. Set	55°F	0-100°F	A2
Off Diff.	5°F	5-10°F	A2
Mixed Air Temp.	55°F	45°F-OAT SP	A3
Min. Pos.	0%	0-100%	A3
Max Pos.	100%	0-100%	A3
Self Test			
Enable	OFF	ON-OFF	A6
Econ Time	120s	120-500s	A6
Heat/Cool Time	60s	60-500s	A6
Advanced System Configuration			
Compressor Safety Timers			
Min. On	120s	120-600s	B2
Min. Off	120s	120-600s	B2
Cooling Lockout	-40°F	-40-95°F	B3
Heating Lockout	-12°F	-40-95°F	B3
Damper Alr. Open Delay	60s	60-600s	B4
Damper Alr. Close Delay	180s	180-600s	B4
Low Pressure Alarm			
Delay	120s	120-300s	B5
Two Count Delay	3600s	3600-7200s	B5
Defrost Time Pin	60min	30-120min	B7
Defrost Reset	OFF	ON-OFF	B7
Freeze Alarm			
Alarm Setpoint	28°F	28-35°F	B6
Alarm Delay	600s	30-600s	B6
Hold Delay	300s	60-900s	B6
Date & Time			
Timezone	New York/Indianapolis	All timezones	Setting Menu: Date/Time

The table below shows defaults sent to the room controller (BrightStat) via BACnet.

Setpoint	Default	Min.	Max
Occupied Heat	68	40	90
Occupied Cool	73	54	100
Standby Heat	65	40	90
Standby Cool	75	54	100
Unoccupied Heat	62	40	90
Unoccupied Cool	80	54	100
Quiet Mode	(ON) 1	(OFF) 0	(ON) 1
Emergency Heat	(OFF) 0	(OFF) 0	(ON) 1
Boost Mode	(OFF) 0	(OFF) 0	(ON) 1
Temp. Sensor	Wired	**	**
Cool Lockout	-40°F	-40°F	95°F
User HMI	0	0	12
HMI Color	2(green)	**	**
Units	Imperial	**	**
Network Units	Imperial	**	**
RH display	Enable	**	**
CO2 display	Enable	**	**
Setpoint Function	Dual	**	**

Blower

The blower in this unit has a wide range of speed at which it can operate. Some speeds are fixed minimums and others are variable.

The unit is equipped with a blower that is driven by a variable electronically commutated motor (ECM). This blower is controlled by a 0-10vdc signal provided from the PLC.

If at any time the blower is commanded off (blower speed 0%), the previous blower speed is held for 1 minute before turning off.

If required, the blower output can be manually set in the Blower Override C17 screen for troubleshooting purposes (must have technician level password or higher). The override will last for 5 minutes or until the Enable value is set to OFF.

Cooling Mode

The indoor fan speed is correlated to the compressor output. As the compressor RPMs increase, the blower output increases and vice versa. See Graph 1 for the scaling of the blower output in relation to the compressor RPM.

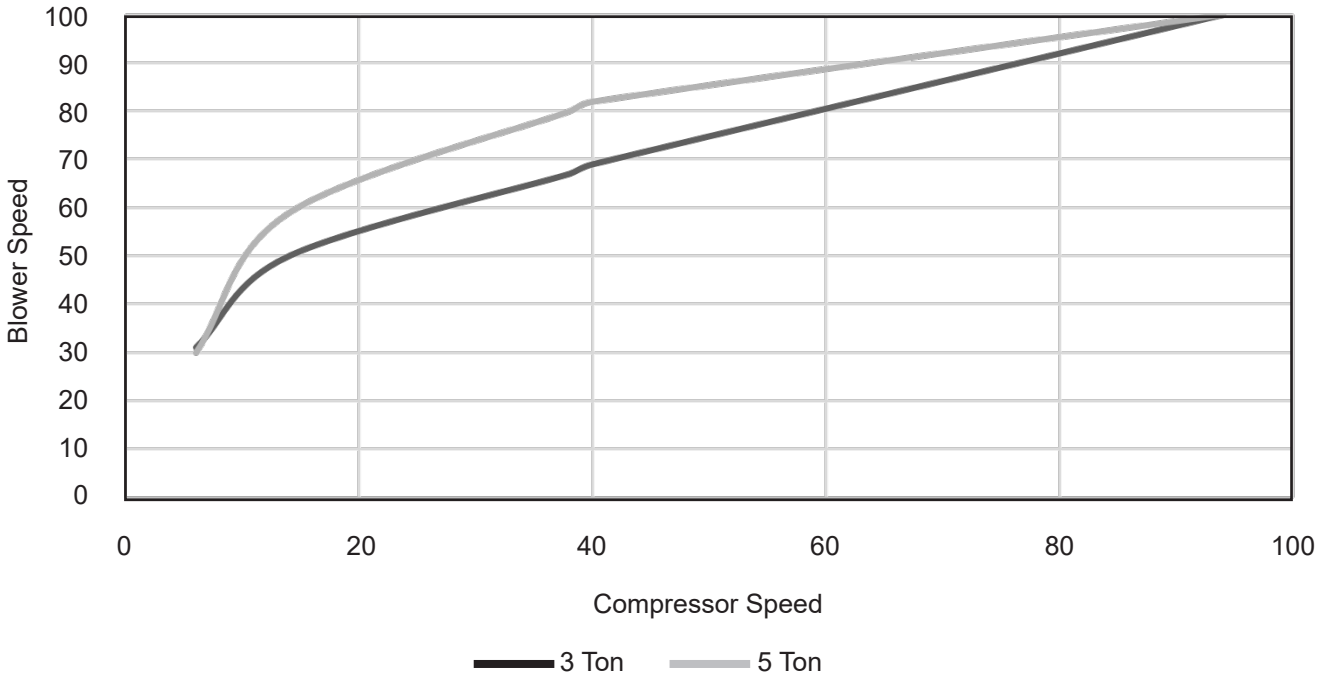
Heating Mode

The blower speed is adjusted to maintain a set discharge pressure during heating operation. A PID is used to target a specified head pressure, and a deadband of 8 psi is added to limit hunting. If the discharge pressure is above the setpoint, the blower increases in speed. Likewise, if the discharge pressure is below the setpoint, the blower decreases in speed. See the Table 3 for the target discharge pressure.

TABLE 3
Blower Target Heating (psi)

	Standard
W3VHY*	370
W5VHY*	360

GRAPH 1
Cooling Blower Speeds



Minimum Blower Speeds

In certain modes, the blower has a minimum speed at which it can run. While the unit is operating in a mode requiring a minimum speed, the blower speed may increase over the minimum speed but will be blocked from operating lower than the minimum speed. If multiple minimum speeds are active, the highest speed is considered the minimum speed.

TABLE 4
Blower Minimum Speeds

Mode	W3VHY	W5VHY
Ventilation	51%	45%
Continuous Blower	51%	45%
Dehumidification	43%	64%
Freecooling	67%	90%
Freeze	67%	90%
Defrost	70%	84%
Electric Heat 1	70%	84%
Electric Heat 2	70%	84%

Blow-Thru or Draw-Thru Condenser Fan

The variable speed products offer the condenser section in two configurations: The condenser discharge airflow can either be blow-thru or draw-thru.

Blow-Thru

Blow-thru models come with a condenser fan blade that "pulls" air in from the condenser section side grilles and "pushes" it through the condenser coil, to be discharged out the front of the unit.

Draw-Thru

The draw-thru option utilizes an alternative condenser fan blade that "pulls" air through the front of the condenser coil/front grille. The condenser air is then discharged out of the condenser side grilles. This option is not available with the energy recovery vent (ERV) option.

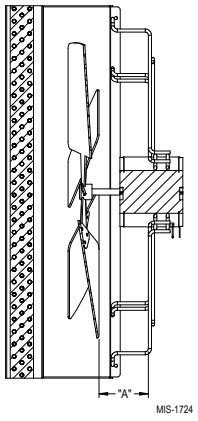
The unit is equipped with a condenser fan that is driven by a variable electronically commutated motor (ECM). This fan is controlled by a 0-10vdc signal provided from the PLC.

If required, the condenser fan output can be manually set in the Cond. Override C19 screen for troubleshooting purposes (must have technician level password or higher). The override will last for 5 minutes or until the Override value is set to "OFF".

The maximum output for the fan is limited to 73% to protect the fan blades from damage due to excessive RPM.

Due to design considerations of the condenser section of the wall-mount unit, placement/clearance of the motor/fan blade is critical to heat dispersal. Should a change of motor or fan blade be necessary, see Figure 1 for proper clearance adjustment.

FIGURE 1
Fan Blade Setting



Model	Dimension A
W3VHY W5VHY	1.5"

Cooling Mode

Discharge pressure is monitored to determine the speed of the condenser fan motor during cooling operation. As the outdoor temperature increases, the target discharge pressure will also increase. A PID is used to determine the speed of the outdoor fan motor to achieve the target discharge pressure setpoint. A deadband of 8 psi is added to prevent rapid oscillations of the outdoor fan motor. See Table 5 for the scaling of the fan output in relation to the discharge psi.

TABLE 5
Outdoor Fan Cooling

	W3VHY	W5VHY
Outdoor Temp	Discharge Target Pressure	Discharge Target Pressure
95°	405	400
82.5°	308	322
72°	260	260
69°	260	260

Heating Mode

The outdoor temperature is monitored to determine the speed of the condenser fan. The outdoor fan runs at a set speed in correlation to a specific range. As the air temperature goes down, the outdoor fan speed increases until it hits the upper limit and vice versa. See Table 6 for the fan speeds at set temperatures.

TABLE 6
Outdoor Fan Heating

OD Temp	Fan %
72°F	41%
47°F	48%
17°F	73%

LAC Sequence

At low ambient outdoor air temperatures, the fan motor will cycle as a means of controlling the system's head pressure to protect the system from evaporator coil freeze conditions. The process for this system is as follows: If the discharge pressure falls below 250 psi, the condenser fan will turn off. The fan will remain off while the compressor remains running, allowing the head pressure to build up. Once the head pressure reaches 350 psi, the fan will then turn back on at the appropriate speed. At lower ambient outdoor temperatures, this may cycle regularly as normal operation. In some cases, in higher wind prone areas, the condenser fan may stay off for prolonged durations due to low liquid pressures.

Electronic Expansion Valve (EEV)

The electronic expansion valve is a stepper motor that is controlled with a step output from the PLC. The valve is capable of 480 steps represented by a 0-100% signal on the PLC. The motor drives a needle valve that regulates the flow of refrigerant.

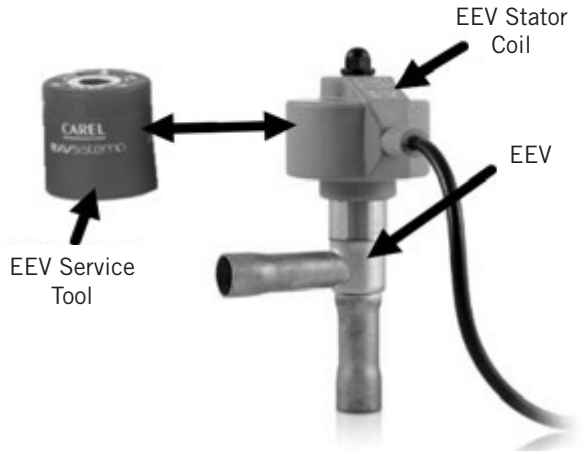
EEV Instructions for Vacuum, Reclaim, Charge Unit

The electronic expansion valve moves to the 40% open position when the unit is not actively cooling. The valve may need to be manually positioned for service or troubleshooting. The valve can be positioned by using a menu override (see ***EEV Override C20*** on page 40). Once the valve is placed into override, the EEV will remain in the Service Position Override for 5 minutes.

After the service or troubleshooting is completed, use PLD Pro to disable the EEV manual positioning override and turn unit back on. If EEV manual position override is not turned off, once 5 minutes has elapsed from the time the valve was placed into override, the override will expire and the valve will return to normal operation.

The valve can also be opened or closed using the EEV service tool (Bard Part # 2151-021). This magnetic EEV service tool (shown in Figure 2) is used to manually open the EEV. To do this, remove the EEV stator coil (red color with retaining nut on top), slide the magnetic tool over the shaft where the stator was removed and turn in a clockwise direction to open the valve to the full open position (directional arrows are provided on the tool). Opening the valve to the full open position will aid in the refrigerant reclamation and evacuation processes.

FIGURE 2
Electronic Expansion Valve (EEV) and Service Tool



With the stator removed, the resistance should be 40 ohms +/- 10%. There are sets of wires that will have this resistance (see Table 7).

TABLE 7
EEV Stator Connector

Contact Meter Lead Wire Colors		Resistance
White	Red	40Ω ±10%
Yellow	Purple	40Ω ±10%
Green	Red	40Ω ±10%
Blue	Purple	40Ω ±10%
White	Green	80Ω ±10%
Yellow	Blue	80Ω ±10%

Reapply the EEV stator coil and retaining nut. Upon powering the unit back up, the control board will automatically drive the EEV back to the fully shut position, and then back to the 40% open position prior to starting the compressor back up. Once the compressor starts, the control board will again modulate the EEV position to control the system superheat.

EEV Superheat Control

The electronic expansion valve (EEV) will open or close to maintain the superheat setpoint while the compressor is running (see Table 8 on page 22). When the compressor is not running, the valve will close to the 40% open default position.

TABLE 8
Superheat Targets

	W3VHY	W5VHY
Cooling	13°F	9°F
Heating	13°F	11°F

Low superheat protection will be active once the superheat value is at or below 5°F. At this point, the control will aggressively close the valve so that superheat is maintained.

Low Superheat Alarm

This alarm will become active when the calculated superheat goes below 5°F. This alarm will clear itself when the condition is no longer present.

This alarm cannot be adjusted.

Suction Pressure Transducer

The unit has a pressure transducer installed on the suction line between the evaporator coil and compressor. The transducer is used for system monitoring of suction system pressures. The sensor is used with the suction temperature sensor to provide a real time superheat calculation that determines the EEV position.

Troubleshooting the Suction Pressure Transducer

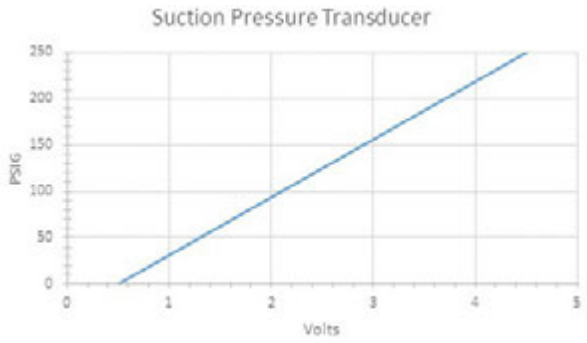
0-250 psig
-5 Vdc Nominal .5 – 4.5 Vdc Actual
4 Vdc/250 psig = .016 Vdc per 1 psig

Example: 125 psig x .016 + .5 Vdc = 2.5 Vdc

Formula for Tech:
Measured Pressure x .016 + Sensor Offset = Expected Transducer Signal Voltage (see Figure 3)

Refer also to pressure/DC voltage table on page 76.

FIGURE 3
Voltage to Pressure: Suction Pressure Transducer



Suction Pressure Alarm

When the suction pressure transducer value is out of range (0-250 psig) and the compressor is running, the controller will generate a sensor failure alarm to indicate the sensor is not working properly.

This alarm cannot be adjusted.

Suction Temperature Sensor

The suction temperature sensor is used to calculate superheat. The EEV uses this value to control the EEV. The temperature is measured with a 10k ohm NTC thermistor.

Suction Temperature Alarm

When the suction temperature sensor value is out of range (-41.0 to 303.0°F), the controller will generate a sensor failure alarm to indicate the sensor is not working properly.

This alarm cannot be adjusted.

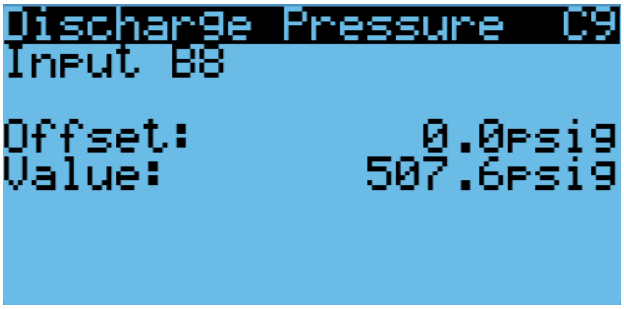
Discharge Line Pressure Transducer

The unit has a pressure transducer installed on the discharge line between the compresser and reversing valve. The transducer is used for system monitoring of the discharge pressure. The sensor is also used to adapt the condenser fan speed for high and low ambient conditions.

The discharge pressure sensor input can be verified and adjusted by:

1. Press MENU key to go to the Main Menu screen.
2. Press UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.
3. Press UP or DOWN keys to scroll to **I/O Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Discharge Pressure C9**.
5. Verify the measurement displayed on screen is accurate (see Figure 4).
6. If the measurement needs to be adjusted, apply an offset value by pressing the ENTER key to scroll to **Offset**.
7. Press UP or DOWN keys to adjust the offset. The update will not take effect until the cursor is moved out of the offset parameter.
8. Once adjusted, press the ESCAPE key several times to return to Main Menu screen.

FIGURE 4
Adjusting Discharge Pressure Transducer Values



Troubleshooting the DIscharge Pressure Transducer

0-650 psig
0-5 Vdc
4 Vdc/650 psig = .00615 Vdc per 1 psig

Example: 325 psig x .00615 + .5 Vdc = 2.5 Vdc

Formula for Tech:
Measured Pressure x .00615 + Sensor Offset =
Expected Transducer Signal Voltage (see Figure 5).

FIGURE 5
Voltage to Pressure:
Discharge Pressure Transducer

Discharge Pressure Transducer Alarm

When the discharge line pressure sensor value is out of range (0-650 psig), the controller will generate a sensor failure alarm to indicate the sensor is not working properly.

This alarm is fixed and cannot be adjusted.

Inverter Drive

Description/Operation

The inverter drive has been developed specifically for variable speed compressors utilizing non-flammable refrigerants. The drive will power the compressor, control the compressor running speed, provide compressor and drive protection and communicate with the master controller. The drive requires cooling through the use of its heatsink and is typically installed in a system near the compressor.

The primary purpose of the drive is to convert the 50/60 Hz AC input voltage into a variable frequency/ variable voltage output to power the variable speed scroll compressor. The drive conditions the AC input voltage through a series of conditioning processes to arrive at the desired output. The drive first converts the AC input voltage into a DC voltage. The DC voltage is then pulse-width modulated to replicate a sinusoidal current at the desired frequency and voltage.

Drive Protections

High Pressure Cut Out

CN610 is a 2-port connector. The output is a 3.3VDC signal. The high-pressure cutout switch must be normally closed. If the switch is open, the drive will not operate. The output current range for the high-pressure contact will range from 5mA – 10mA. To ensure correct functionality of the high pressure switch for the system's lifetime, typically gold-plated contacts are recommended. This port is hardware Protected Electronic Circuit (PEC) according to IEC 60335-1 and software is Class B.

Drive Cooling

Because of the power electronics used in the drive and the associated heat generation, drive cooling is required to keep the drive components in their design temperature range. The allowable temperature range of the drive (the ambient air surrounding the drive) is –13°F to 150°F. Drive temperature should be monitored during system development at system extreme conditions to ensure that the maximum allowable drive temperature isn't exceeded. The highest drive temperature will typically occur during high load conditions or during high drive ambient.

The minimum recommended thermal capacity removal should be approximately 270 watts and a maximum components temperature of 85˚C.

Drives cooled by the aluminum air cooled heat exchanger are designed to be in the air flow stream of the condenser. The air-cooled heat exchanger must be installed so that the heat exchanger fins are parallel to the cooling air flow. The airflow must be a minimum of 3 meters/secs measured at the outlet of the heat sink in the direction of airflow.

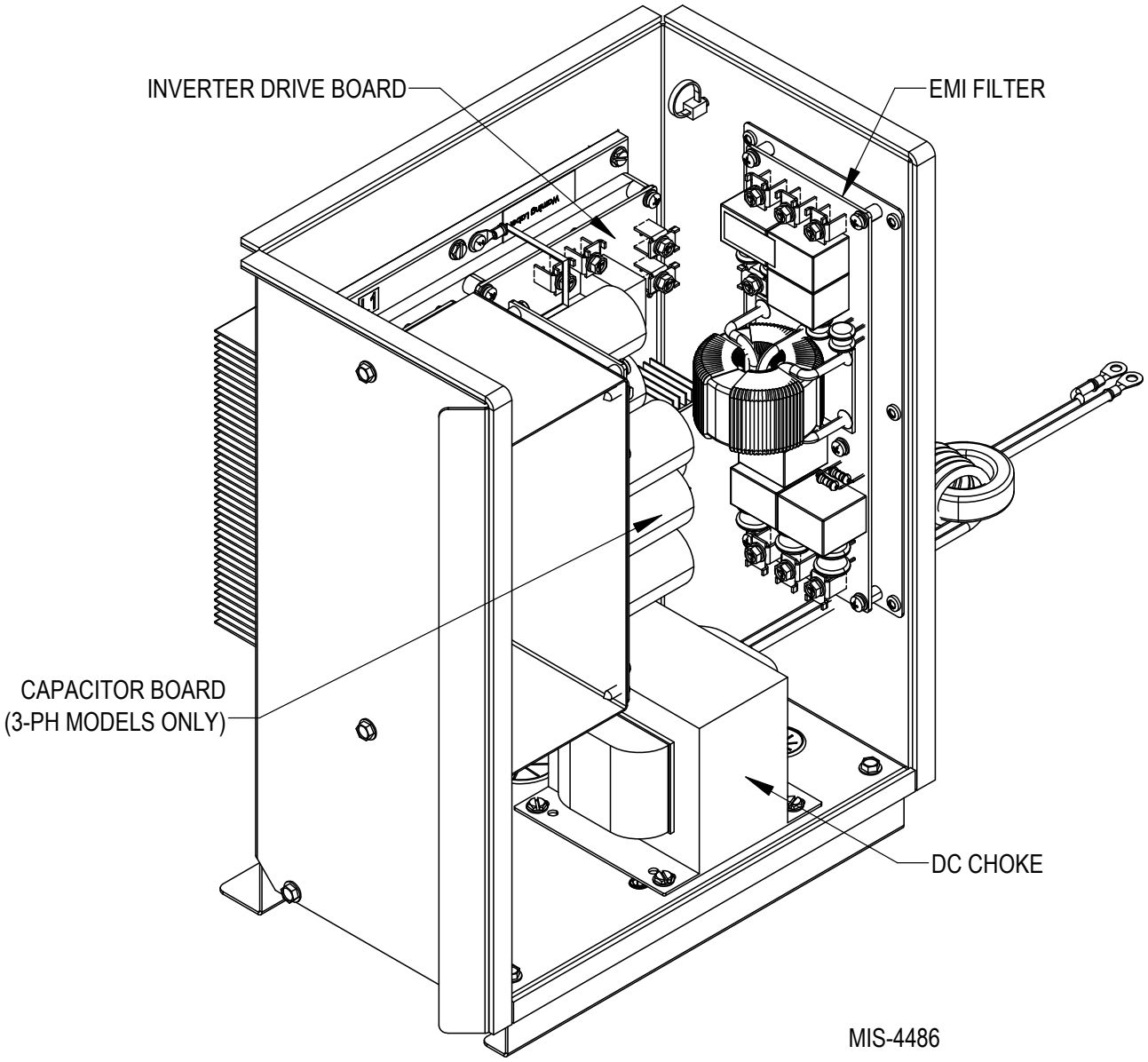
Drive Over Temperature Protection

The drive is self-protected against high internal temperatures. There are different modes of protection (temperature high and foldback). For temperature high, refer to Table 16 in **Drive Troubleshooting** (page 58). For foldback protection, see below.

Foldback

To protect the drive components and the compressor, the compressor speed will 'foldback' or slow down to help reduce risk to components. The foldback event(s) will be flagged in the drive's Modbus registers. This will

FIGURE 6
Inverter Assembly



allow the unit controller to respond and mitigate the conditions causing foldback.

Lockout Faults

There are specific faults that will cause the drive to 'lockout' after 10 consecutive occurrences. These faults are noted in Table 16 on page 58. These faults will not clear unless the power to the drive is fully cycled.

DC Choke

With the use of variable frequency drives (VFDs), inductors can also be placed after the drive's input diodes, between the input rectifier and the DC link. In this configuration, the inductive device is referred to as a DC choke.

The DC chokes is an impedance device on the input side of a variable frequency drive. The choke limits the peak value of the line (supply) current, which mitigates harmonics transmitted from the line. Certain harmonics that are not filtered out can impact proper control of the VFD. The benefit to using a DC choke is its ability to attenuate these harmonics without causing a noticeable drop in voltage. The DC choke also protects against the effects of voltage disturbances.

EMI Filter

Description/Operation

Component that receives incoming AC power and filters out electromagnetic interference. The electromagnetic interference (EMI) filter prevents disruption of functionality and communication between devices.

EMI filters protect sensitive electronics from damage caused by high levels of radiation emitted by other electronic equipment. They extract unwanted current conducted through wiring or cables that can interfere with signal and power lines, while allowing desirable currents to flow without restriction.

Purpose(s) of the EMI Filter

Minimize radiated and conducted noise on the input or output of the power supply

Minimize the effects of voltage transients applied to the input or output of the power supply

Minimize the input surge current when voltage is first applied to the input of the power supply

Protect the input power source and conductors if there is a failure of the power supply

Capacitor Board

Description/Operation

The inverter receives a 3 phase AC signal from the main grid and gives output in the form of a DC signal. This DC signal is stabilized by a DC bus which comprises a capacitor and a filter. Stable DC signal-output of DC-link or DC bus is fed to the inverter input terminals.

The inverter converts DC into AC which runs three phases electric motor. Control logic is developed in the controller part. Signals, generated from the controller, control switches both in the rectifier as well as an inverter.

Purpose(s) of Capacitor Board

As drive systems are used for motion applications (related to position and speed) and motion of the motor is controlled by varying input frequency and voltage to the inverter. So, frequency and voltage are control parameters. The voltage input to the motor is given by three phases of the inverter. As the inverter gets its input voltage from the DC link (voltage across the capacitor) so capacitor voltage is the reference voltage for the last stage (before it is fed to the motor) which needs to be stabilized for better performance of the motor.

Variable Speed Compressor

Description/Operation

Variable speed scroll compressors have a speed range of 900 to 7000 revolutions per minute and are intended for use in air conditioning, air-source heat pump and geothermal applications. The scroll compression technology is based on the ZP*K5 Copeland Scroll platform. The variable speed scrolls use a three-phase brushless permanent magnet (BPM) motor. The variable speed scroll and Emerson Motor Control drive combination has been designed for maximum efficiency and reliability.

Purpose(s) of Variable Compressor

The variable technology of the compressor allows for a broad range of heating or cooling BTUs based on demand in the space. If higher load is present in the space, the compressor will increase output in response to the load. Also, if demand is lower the compressor can run at a much lower output. This capability provides temperature stability, balance response and excellent efficiency.

Copper Vibration Absorbers

Vibration absorbers are designed to be installed on suction and discharge lines of a HVAC system to dampen the transmission of compressor vibration. This helps to isolate the compressor frequency from being transferred directly into the copper, coils and chassis of the unit mounted to the building.

Charge Compensator

The charge compensator is used to store extra refrigerant during heat pump operation to improve efficiency. The charge compensator is located on the suction line between condensing coil and reversing valve. During cooling operation, the refrigerant is returned to the system to improve cooling performance.

Discharge Limit Temperature (DLT) Sensor

The DLT sensor is used to monitor discharge line temperature during system operation. The senor is located on the discharge line. The sensor returns the temperature resistance value to the inverter drive board. If discharge temperature reaches 120°C/250°F, the drive will terminate compressor operation to protect the compressor components.

High Pressure Switch

The high-pressure switch is found on the discharge line and connected to the inverter drive. The switch is designed to trip when the discharge pressure reaches (635-665 psi). If the pressure switch is tripped, the drive immediately shuts down the system.

Filter Drier

The purpose of a refrigerant drier is to ensure the refrigerant system stays clean and dry. It removes contaminants including moisture, dirt, acid and solder flux, beads and filings.

Whenever the refrigerant system is opened for repair or to replace a component, always replace the filter drier. Filter drier must be replaced with the same model since the drier must be sized appropriately. A bi-directional filter drier must also be used in heat pump products to allow refrigerant flow in both directions.

Discharge Muffler

Discharge line mufflers are used to reduce the noise in the discharge line created from the high velocity flow of refrigerant. They are designed to be installed directly after the compressor discharge outlet of the pump.

Reversing Valve

The reversing valve is used in HVAC systems that offer heat pump operation. This valve allows for a mechanical AC unit to utilize the evaporator coil as a condenser to provide heating BTUs to the space. The valve re-directs refrigerant flow so that hot discharge gas can be routed to the evaporator coil. With the evaporator coil now acting as a condenser coil, heat is rejected into the supply.

Dehum Valve and Reheat Coil

For models equipped with mechanical dehumidification, there will be a dehumidification valve and reheat coil. The dehumidification valve is a 3-way valve that functions like the reversing valve. The dehumidification valve redirects refrigerant to a reheat coil that is in the evaporator section. The reheat coil now has hot discharge gas in it, and acts as a small condenser coil. The unit remains in cooling mode which allows the evaporator to remove moisture from the space without providing too much cooling. The air passes through the evaporator first which creates a cooling effect, then the reheat coil which warms the air and reduces sensible cooling.

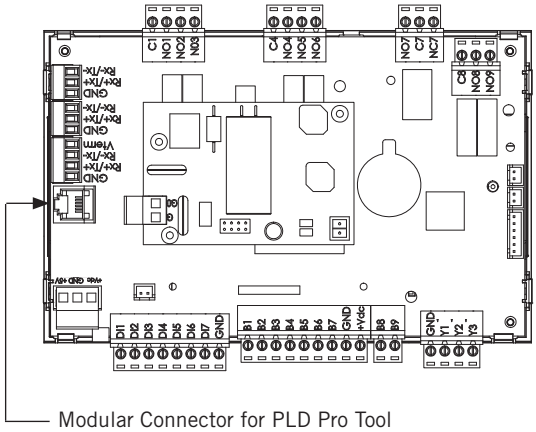
PLD Pro Display

The microprocessor control used in these wall-mount heat pumps allows for complete control and monitoring through the use of the provided PLD Pro hand-held monitor.

The menu driven interface provides users the ability to scroll through two menu levels: Quick Menu and Main Menu. The menus permit the user to easily view, control and configure the unit.

The PLD Pro connects to the wall-mount unit control board via an RJ11 modular connector as shown in Figure 7.

FIGURE 7
PLD Pro Connection to Unit Control



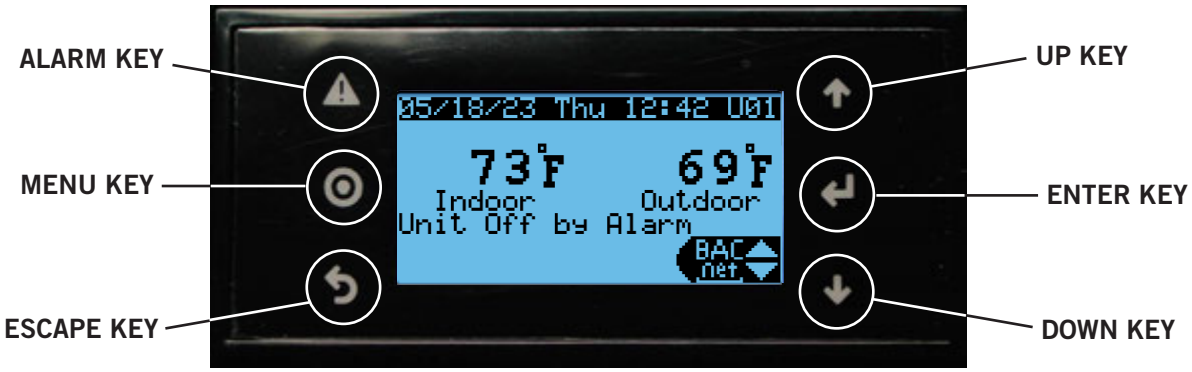
NOTE: *Screenshots shown in this manual reflect default settings (when applicable).*

PLD Pro Main Screen

The Main screen is the default start-up screen and also the return screen after 5 minutes of no activity. The screen can be accessed any time by pressing the ESCAPE key repeatedly.

The Main screen shows the current date, day, time, indoor temperature, outdoor temperature and unit status (see Figure 8). See Table 9 on page 28 for wall-mount unit status messages.

FIGURE 8
PLD Pro Display and Interface (Main Screen Shown)



ALARM KEY
Allows viewing of active alarms
Silences audible alarms
Resets active alarms

MENU KEY
Allows entry to Main Menu

ESCAPE KEY
Returns to previous menu level
Cancels a changed entry

UP KEY
Steps to next screen in the display menu
Changes (increases) the value of a modifiable field

ENTER KEY
Accepts current value of a modifiable field
Advances cursor

DOWN KEY
Steps back to previous screen in the display menu
Changes (decreases) the value of a modifiable field

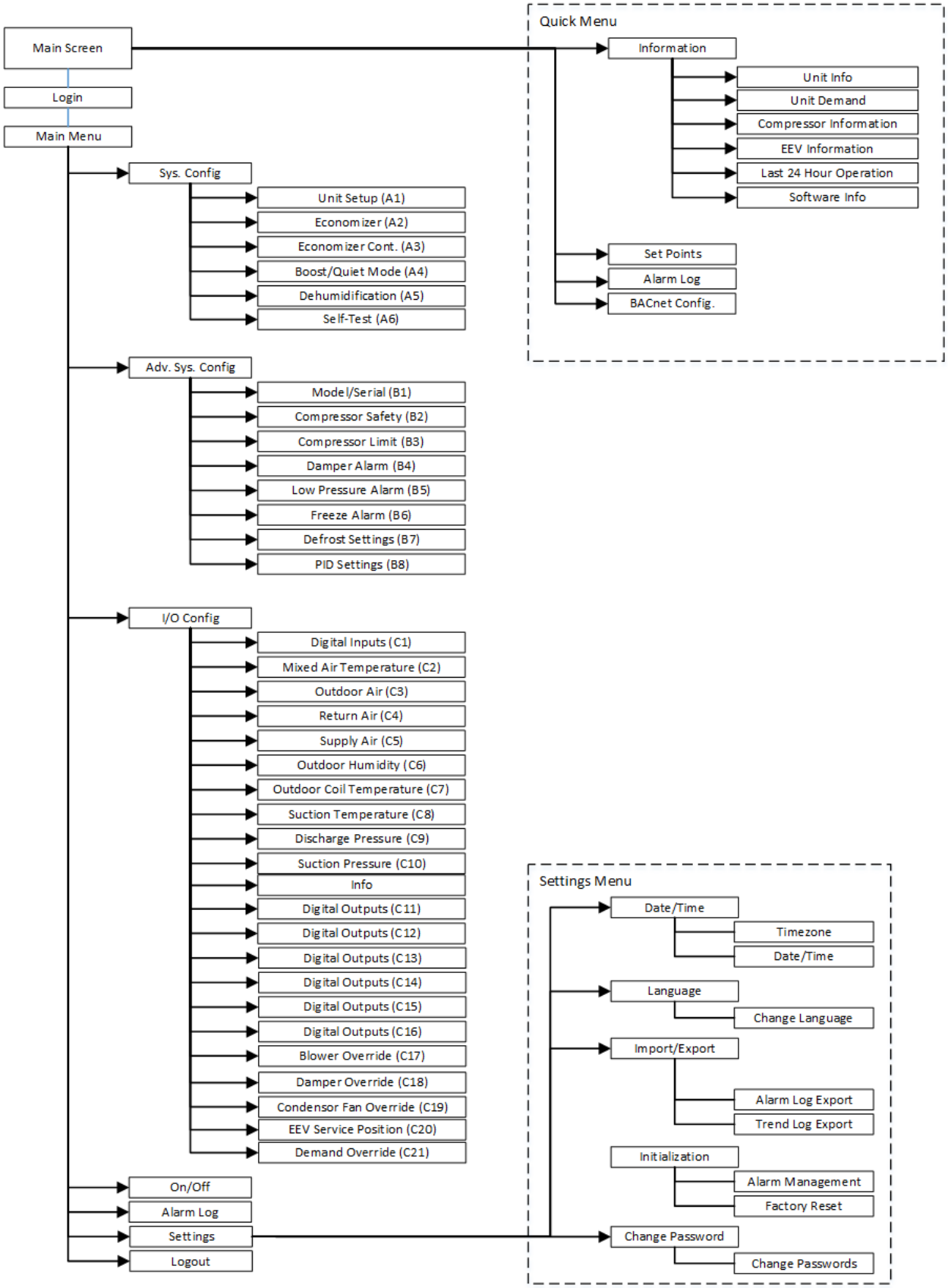
TABLE 9
Unit Status Messages

Message	Description
Standby	Unit has no commands and is online
Invalid Model Number	Unit is off due to invalid model number
Unit Off by Keypad	Unit is off due to PLD display setting
Unit Disable Active	Unit is off due to unit disable terminal activation
Unit Off by BMS	Unit is off due to command via BMS system (BACnet)
Unit Off by Alarm	Unit is off due to an active alarm
Cooling	Unit is operating compressor to cool the space
Freecooling	Unit is operating damper to cool space
Optimized Cooling	Unit is operating both the damper and compressor to cool the space
Heating HP	Unit is operating compressor to heat the space
Electric Heat Active	Unit is operating the first stage of electric heat to heat the space
Heating HP & Aux. Heat	Unit is operating both the compressor and the first stage of electric heat to heat the space
Emergency Heat	Either the compressor is disabled or by command of the room controller (Brightstat) only electric heat (all stages) is being used to heat the space
Defrost Active	Unit is defrosting the outdoor coil. Compressor and 1 stage of electric heat (if equipped) are active.
Dehumidification Active	Unit compressor and reheat coil are active
CO2 High	CO2 level has exceeded the Max. CO2 setpoint
Ventilation Alarms Present	Damper alarm(s) are active
Unit Alarm(s) Present	Any alarm is presently active
Override Active	An override has been set and is active
Self Test Active	Self test is in progress

TABLE 10
PLD Pro Passwords (Defaults)

User	2000
Technician	1313
Engineer	9254
Use UP or DOWN keys and ENTER key to enter password. The passwords listed above are the default passwords. End users can change these passwords if additional security is desired.	

FIGURE 9
PLD Pro Screen Map



The Quick Menu is accessible from the Main screen. BACnet, alarm log, setpoints and unit info screens are available through the Quick Menu. Pressing the UP or DOWN keys while on the main screen will change the Quick Menu icon displayed. Press the ENTER key when the desired icon is displayed.

Quick Screens

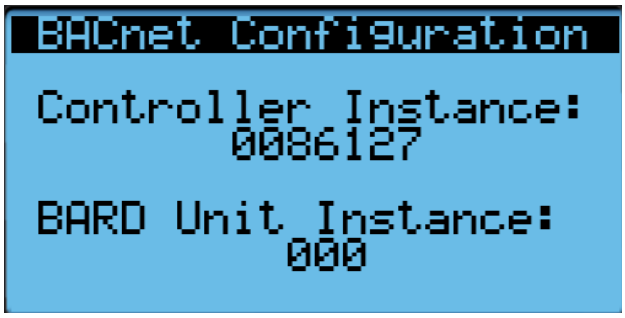
BACnet

Controller Instance: This is the address for the room controller (Brightstat). The Controller Instance needs to match the BACnet Instance on the room controller (Brightstat) to communicate (default is 86127). If more than one unit/controller combination is utilizing the same RS-485 line, they will need a unique instance number assigned.

BARD Unit Instance: This is the address for the unit communication. The Unit Instance is the address that is used to tell the room controller (Brightstat) which device it is communicating back to. The default is 000. If more than one unit/controller combination is utilizing the same RS-485 line, they will need a unique number assigned.

For more information, see **BACnet Set Up** on page 15.

FIGURE 10
Quick Screen: BACnet



Info

The information screens are used as a quick reference to show unit A/C circuit measurements and program version.

Unit Information

RAT: Return Air Temperature

MAT: Mixed Air Temperature

SAT: Supply Air Temperature

OAT: Outdoor Air Temperature

OAH: Outdoor Air Humidity

ODP: Outdoor Dew Point

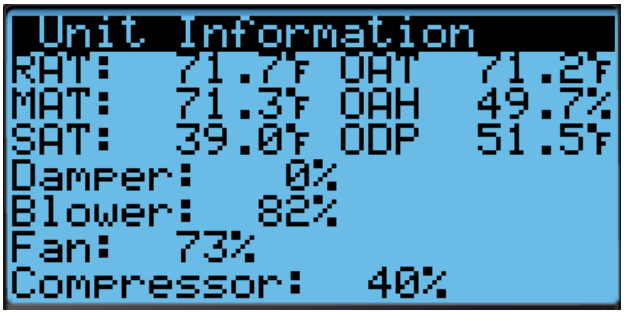
Damper: Displays the % demand the damper blade is opened to

Blower: Displays the % demand the blower is receiving from the PLC

Fan: Displays the % demand the fan is receiving from the PLC

Compressor: Displays the % demand the compressor is commanded to run

FIGURE 11
Quick Screen: Info



Unit Demand

FC Available: Displays whether freecooling is available or not

FC Status: Displays whether freecooling is active (ON) or inactive (OFF)

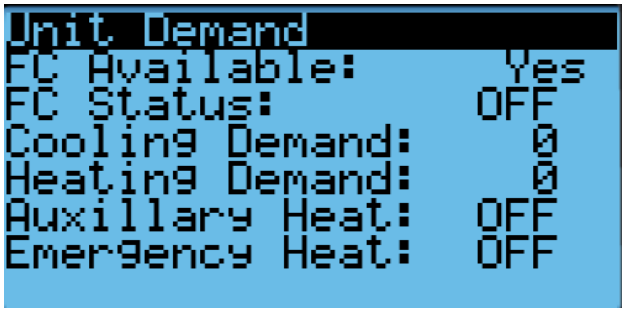
Cooling Demand: Displays the amount of cooling demand (0-100) in the space. This is based on the indoor sensor and setpoint at the thermostat.

Heating Demand: Displays the amount of heating demand (0-100) in the space. This is based on the indoor sensor and setpoint at the thermostat.

Auxiliary Heat: Displays whether the first stage of electric heat is active (ON) or inactive (OFF)

Emergency Heat: Displays whether the second stage of electric heat is active (ON) or inactive (OFF)

FIGURE 12
Quick Screen: Unit Demand



EEV Compressor

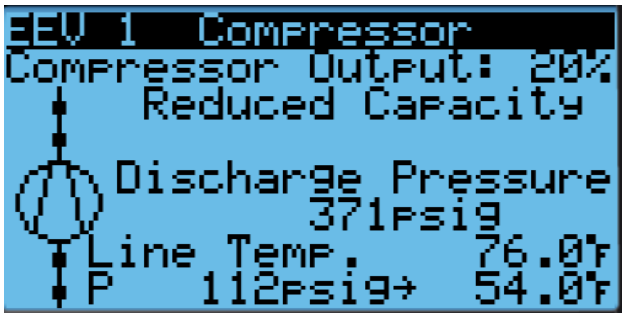
Compressor Output: Displays the % demand the compressor is running after foldback limitations are taken into consideration. This may not always be the same as the compressor demand.

Discharge Pressure: Displays the pressure of the discharge line

Line Temp: Displays the temperature of the suction line at the compressor

P: Displays the pressure of the suction line at the compressor. The temperature to the immediate right of the pressure is the converted saturated suction temperature of the refrigerant.

FIGURE 13
Quick Screen: EEV Compressor



EEV Circuit

The EEV has a pin inside that moves in small increments called steps to open and close the pathway between the high side and low side of the system. The top of this screen (see Figure 14) shows how many steps out of 480 the EEV has opened and converts the steps to a percentage opened (0-100%). The step position is communicated to the EEV by the PLC.

Status: Displays the current action of the EEV. The status messages are as shown in Table11.

Protection: The EEV has protective sequences in place for special circumstances to keep the system operating smoothly. The protective measures are as shown in Table 12.

Super Heat: Displays current ° of superheat in the system

FIGURE 14
Quick Screen: EEV Circuit

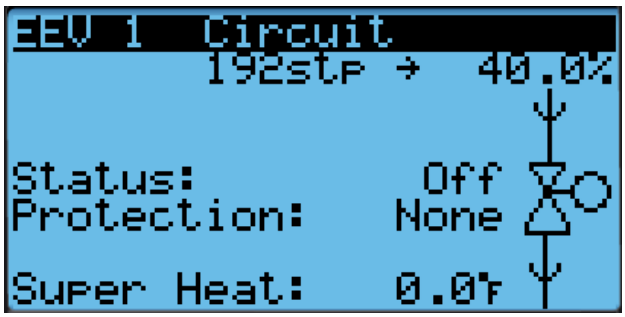


TABLE 11
EEV Status

Status	Description
Closing	The EEV has been commanded to close
Off	The EEV is offline and is not communicating with the PLC
Pos	The EEV is repositioning the pin to verify correct orientation is communicated to the PLC
Wait	The EEV is in the process of gaining communication with the PLC
On	The EEV is connected and communicating with the PLC
Standby	The EEV is conducting a “homing sequence” to verify step calibration

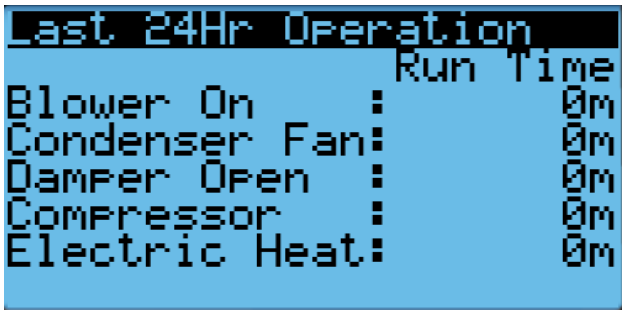
TABLE 12
EEV Protection

Protection	Description	Action
None	No protection	No special circumstances to trigger protection measures have been detected
LowSH	Low superheat	Immediate and intense closing of pathway
LOP	Low evaporation pressure	Immediate and intense opening of pathway
MOP	High evaporation pressure	Controlled moderate closing of pathway
HiTcond	High evaporator temperature conditions	Action is based on the evaporation pressure

Last 24 Hour Operation

This screen shows how long each component listed has been running in the past 24 hours.

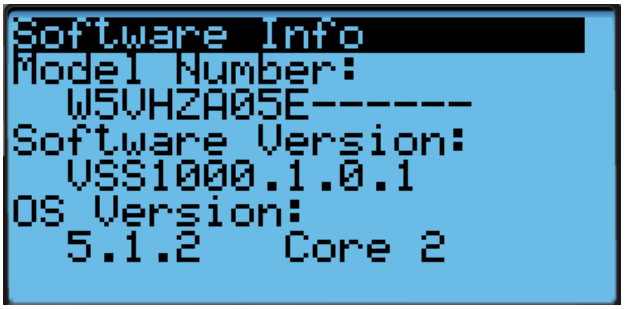
FIGURE 15
Quick Screen: Last 24Hr Operation



Software Info

This screen displays the model number the unit is currently set to, the software and OS version currently installed and what version PLC board is installed in the unit (only Core 2 available for variable speed units).

FIGURE 16
Quick Screen: Software Info



NOTICE

It is important to check the software version during installation to ensure that the latest version has been installed. Current software versions and installation instructions are available on the Bard website at http://www.bardhvac.com/software-download/

Setpoints

The setpoints screen shows the cooling and heating setpoints set at the thermostat. These cannot be adjusted at the PLD Pro and must be set at the thermostat.

FIGURE 17
Quick Screen: Setpoints

Alarm Log

Data Logger: Log of alarms unit has had in the past. Can also be accessed through the Alarm button (top left button on PLD Pro) and through the Main menu.

FIGURE 18
Quick Screen: Alarms

Executing a Self Test

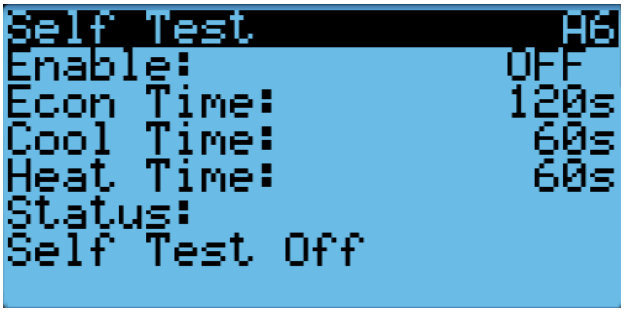
After a unit and room controller (Brightstat) has been installed, a self-test mode is available to check/verify the unit functionality. Self-test mode will open and close the damper (if equipped), operate the unit in cooling mode and operate the electric heat. The indoor blower and outdoor fan will operate as required throughout the test. If the unit is not equipped with electric heat, or a damper, or if the compressor is locked out, those portions of the test will be skipped. The self-test can be activated on screen A6. At the bottom of the screen a status will show what operation is active at that time. See ***Self Test A6*** on page 35 for more information.

Some unit parameters are adjustable.

To execute a self test:

1. Press MENU key to access the Main Menu screen.
2. Press UP or DOWN keys and ENTER key to enter TECHNICIAN password 1313.
3. Press UP or DOWN keys to scroll to **Sys Config**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Self Test A6** screen.
5. Press ENTER key to scroll to **Enable** parameter (see Figure 19).
6. Press UP or DOWN key to change value to ON. The self test will begin and the screen will display the status of the self test.

FIGURE 19
Executing Self Test



Self Test Parameter Descriptions

Econ Stage Time: Amount of time (in seconds) allowed for damper blade movement in each direction.

Cool Stage Time: Amount of time (in seconds) allowed for each stage of cooling.

Heat Stage Time: Amount of time (in seconds) allowed for heating stage.

Reset to Factory Defaults

To reset to factory default settings:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter ENGINEER password 9254.
3. Press UP or DOWN keys to scroll to **Settings**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Initialization**; press ENTER key.
5. Press UP or DOWN keys to scroll to the **Default Installation** screen.
6. Press ENTER key to scroll to **Reset to Factory Defaults** (see Figure 20).
7. Press UP or DOWN key to change value to **YES**; press ENTER key.
8. System will restart with default values.

FIGURE 20
Restoring Factory Default Settings

Screens

NOTE: *Screenshots shown in this manual reflect default settings (when applicable).*

Press MENU key to access the Main Menu screen.

Main Menu Structure
System Configuration (A1 - A6)
Advance System Configuration (B1 - B7)
I/O Configuration (C1 - C21)
On/Off
Alarm Logs
Settings
Logout

System Config Menu

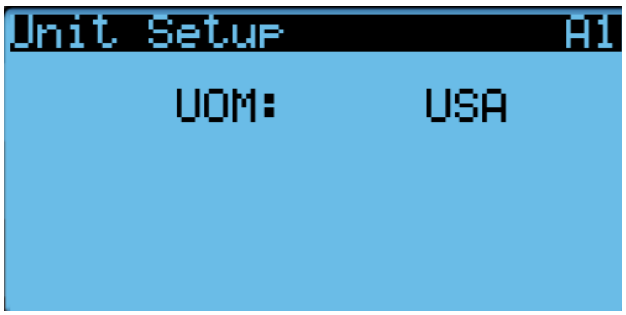
Unit Setup A1

The unit of measure (UOM) displayed for temperature and pressure can be set to USA, SI, CAN or UK.

TABLE 13
Unit of Measure

Name	Temperature	Pressure
USA	°F	psig
SI	°C	pag
CAN	°C	psig
UK	°C	barg

FIGURE 21
Screens: Unit Setup A1



Economizer A2

Control Type: Freecooling modes include none, dry bulb, temp/humidity and enthalpy. These modes are user selectable. Each mode has a setpoint and a differential, which can be adjusted.

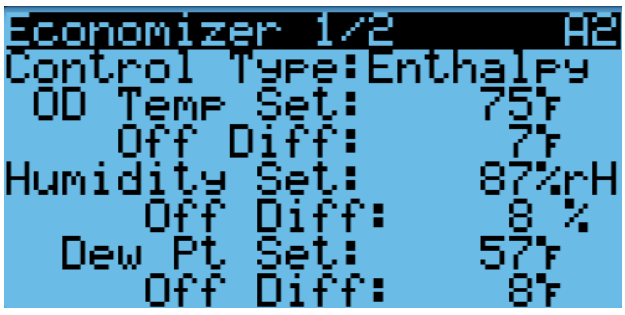
When the mode is set to none, freecooling will be disabled. However, the damper will still be available for ventilation.

When the mode is set to dry bulb, the outdoor air temperature is considered for freecooling availability. If the outdoor air temp is below the OD Temp setpoint, freecooling will be enabled. If the outdoor air temperature is above the OD Temp setpoint plus the off differential, freecooling will be disabled until the outdoor temperature falls below the OD Temp setpoint. Both OD Temp Setpoint and Off Differential are user adjustable.

When the mode is set to temp/humidity, both outdoor temperature and humidity will be considered for freecool availability. If the parameters for dry bulb are met and the outdoor relative humidity is below the humidity setpoint, freecooling will be enabled. If the outdoor air humidity is above the setpoint plus the off differential or if dry bulb parameters are not met, freecooling will be disabled. Both Humidity Setpoint and Off Differential are user adjustable.

When the mode is set to Enthalpy, the program will consider dry bulb and temp/humidity availability as well as dew point for freecooling availability. If parameters for both dry bulb and temp/humidity are met and the dew point is below the Dew Point setpoint, freecooling will be enabled. If the parameters for either dry bulb or temp/humidity are not met or the dew point is above the dew point setpoint plus the off differential, freecooling will be disabled. Both Dew Point setpoint and Off Differential are user adjustable.

FIGURE 22
Screens: Economizer A2



Economizer A3

Mixed Air Temp: Desired temperature of the MAT. This setpoint is only used during freecooling and is user adjustable.

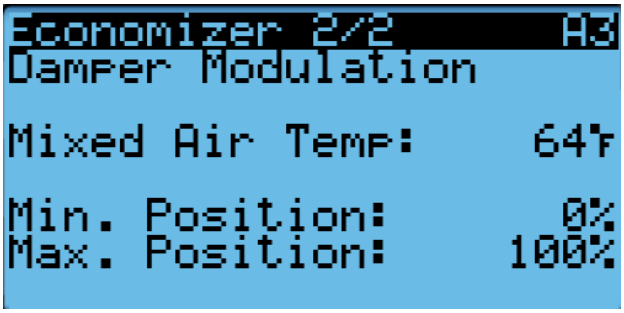
In optimized cooling (compressor and freecooling) the Mixed Air Temp setpoint is adjusted to 65°F (18°C) to prevent the indoor coil from freezing.

The damper also has a user-adjustable minimum and maximum position.

Min. Position: The minimum position prevents the damper blade from adjusting below the minimum setpoint in freecooling and ventilation operation.

Max. Position: The maximum position prevents the damper blade from adjusting above the maximum setpoint in ventilation. This limitation does not apply to freecooling or the ERV.

FIGURE 23
Screens: Economizer A3



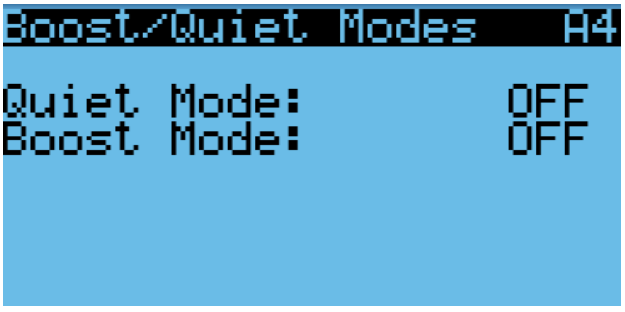
Boost/Quiet Modes A4

Quiet Mode: Enables and disables Quiet mode. This is enabled by default and can be disabled at the PLD Pro or the thermostat.

Boost Mode: Enables and disables Boost mode. This is optional and can be enabled at the PLD Pro or the thermostat.

See page 14 for more information on Quiet Mode and Boost Mode.

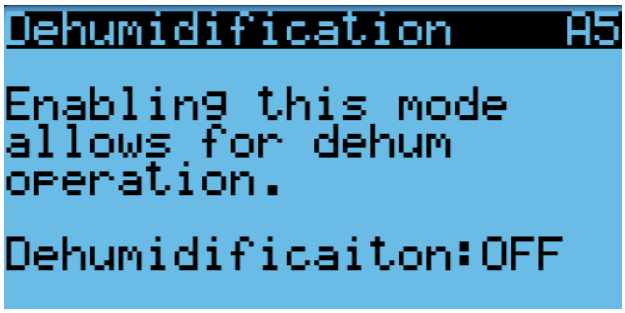
FIGURE 24
Screens: Boost/Quiet Modes A4



Dehumidification A5

Dehumidification: Availability is determined by the model number. When dehumidification is available, it can be enabled or disabled on this screen. See page 16 for more information on dehumidification.

FIGURE 25
Screens: Dehumidification A5



Self Test A6

Self Test runs through a series of functions to verify all components of the system are working properly. All functionality running outside of the test (e.g., ventilation, cooling call, etc.) will cease for the duration of the self test. All alarm functionality is retained for the duration of this test.

While the test is running, the status of the test will be displayed on the bottom of the screen (see Figure 26).

Enable: Toggle ON or OFF to start or stop the Self Test sequence. The value will remain ON for the duration of the test. When self test is complete, the value will change to OFF automatically. The Self Test can be terminated at any time by changing this value from "ON" to "OFF" during the test.

Econ Time: The damper blade is set to open 100% for the user-adjusted set of time. During this time, the status on the bottom of the screen reads "Opening Damper".

After the set time has lapsed, the damper is set to close (0%) for the same amount of time. During this time, the status on the bottom of the screen reads "Closing Damper". This is to verify the functionality of the damper blade.

If the model indicates no economizer is present, this step is skipped.

Cool Time: The compressor, fan and blower are set to run in cooling mode at two set speeds. The first speed is the rated speed and the second is at ½ rated speed. Each speed runs for the user-adjusted set of time. During this time, the status on the bottom of the screen reads "Comp. Cool Rated" and "Comp. Cool ½ Rated" respectively. This is to verify the functionality of all components related to cooling. When this section of testing is complete, the unit will transition directly over to heating mode.

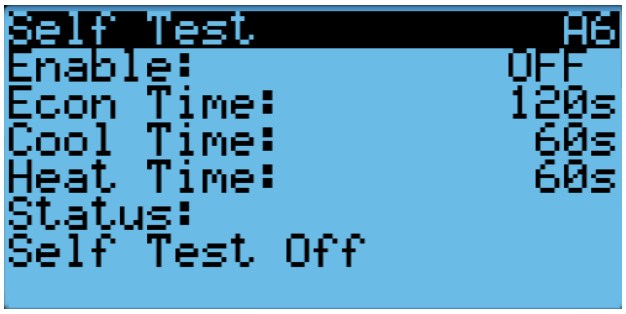
Heat Time: While the compressor, fan and blower are still running from the cooling portion of the self test, the reversing valve is engaged to flip the unit into heating mode. The unit continues to run at ½ rated for the user-adjusted set of time. During this time, the status reads "Comp. Heat ½ Rated". After this portion of testing, the compressor, fan and reversing valve disengage and are set to 0.

The blower continues to run and ramps up to electric heat speed and the first stage of electric heat is engaged (aux. heat) for the user-adjusted set of time. The status on the bottom of the screen reads "Electric Heat 1 (Aux.)". Then, the second stage of electric heat is engaged (emergency heat) for the same amount of time. The status on the bottom of the screen reads "Electric Heat 1&2 On". After this portion of the test is complete, the electric heat is disengaged and the blower continues to run for 1 minute afterwards to evacuate residual heat.

If the model indicates no electric heat is present, the electric heat portion of this test is skipped.

Self test will terminate automatically once all tests have been completed and the status will read "Self Test Off" once again.

FIGURE 26
Screens: Self Test A6

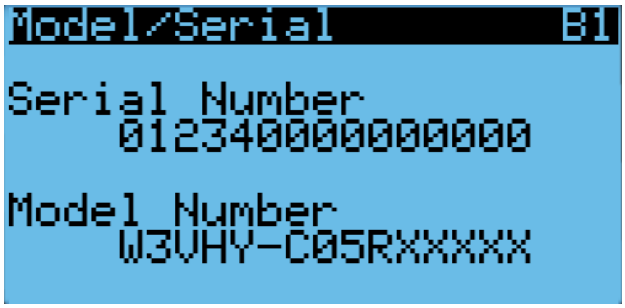


Adv. System Config Menu

Model/Serial B1

The serial number and model number can be modified as needed on this screen. Certain circumstances will require an update; for example, if an electric heat package was purchased after the original unit purchase to add or upgrade the current electric heat package. An Engineer level password must be entered in order to modify this page.

FIGURE 27
Screens: Model/Serial B1



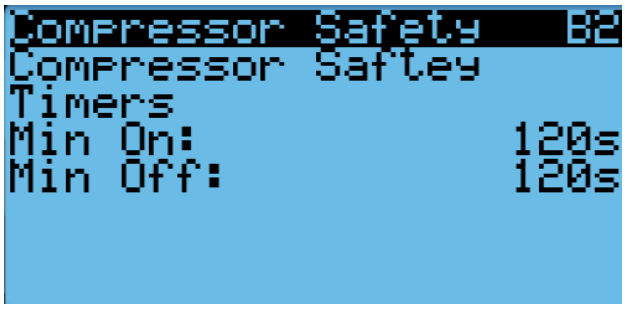
Compressor Safety B2

Min on/off times prevent the compressor from short cycling and prolongs the life of the compressor.

Min On: Minimum amount of time that the compressor is required to run before turning off again. Time is user adjustable.

Min Off: Minimum amount of time that the compressor is required to stay off before it can be demanded on again. Time is user adjustable.

FIGURE 28
Screens: Compressor Safety B2



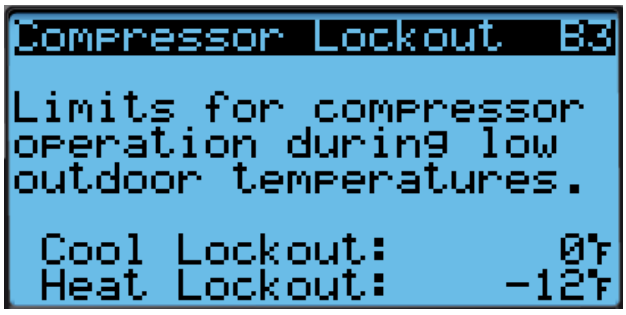
Compressor Lockout B3

Limits the operation of the compressor in low/high ambient conditions.

Cool Lockout: When the outdoor temperature falls below the cool lockout temperature (user adjustable), the compressor operation is limited.

Heat Lockout: When the outdoor temperature goes below the heat lockout temperature (user adjustable), compressor operation is turned off and unit runs electric heat, if equipped.

FIGURE 29
Screens: Cooling Lockout B3



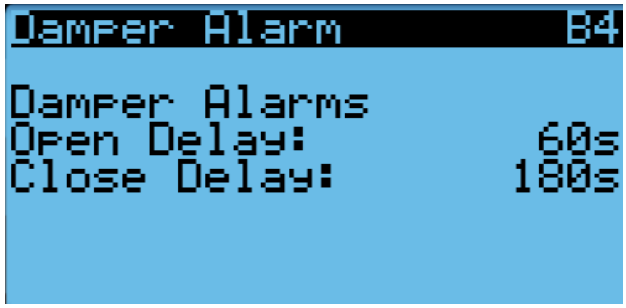
Damper Alarm B4

The damper blade can be adjusted to a N/O or a N/C relay to trigger an alarm (digital Inputs screen). Default is N/C.

Open Delay: A "Damper fail to open" alarm is delayed for a user-adjustable time to prevent false alarms. The damper must be commanded to a position greater than 40% and the damper switch doesn't open within the set time before an alarm is triggered. The relay must be set to N/C for this alarm to trigger. No functionality is blocked by the damper alarm.

Close Delay: A "Damper fail to close" alarm is delayed for a user-adjustable time to prevent false alarms. The damper must be commanded to 0% (closed) and the damper switch doesn't close within the set time before an alarm is triggered. The relay must be set to N/O for this alarm to trigger. No functionality is blocked by the damper alarm.

FIGURE 30
Screens: Damper Alarm B4



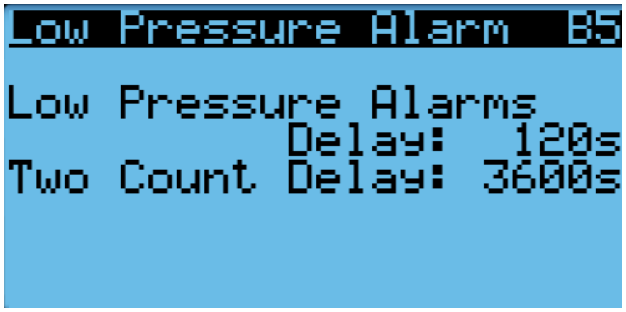
Low Pressure Alarm B5

Low Pressure Alarms Delay: The control has a configurable low pressure bypass time delay to ignore the low pressure input during the first 120 - 300 seconds of compressor operation.

If the suction pressure falls below the low pressure setpoint (40 psi) after the bypass time delay has elapsed, the compressor will turn off and a low pressure alarm will be triggered. Once the pressure rises above the low pressure setpoint, the alarm will auto reset and the unit will be able to resume normal functionality.

Two Count Delay: If the suction pressure falls below the low pressure setpoint (40 psi) twice within the user-adjustable time (1-2 hours), the compressor will turn off and will remain off until the pressure rises above the low pressure setpoint and the alarm is manually reset.

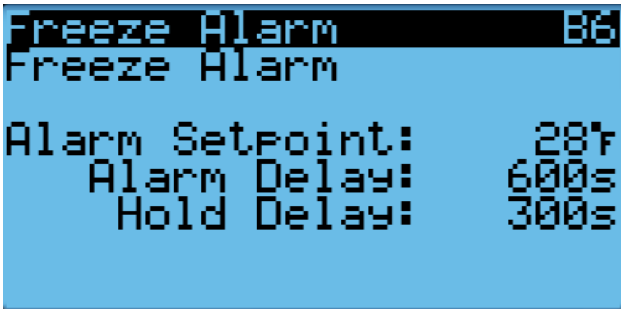
FIGURE 31
Screens: Low Pressure Alarm B5



Freeze Alarm B6

If the SAT falls below the user-adjustable temperature setpoint (Alarm Setpoint) for the user-adjustable time (Alarm Delay), a freeze condition is generated. The blower runs during the freeze condition for the user-adjusted time (Hold Delay) or when the freeze condition alarm is reset.

FIGURE 32
Screens: Freeze Alarm B6



Defrost Settings B7

The outdoor temperature sensor reads the temperature of the outdoor coil at the coldest part of the line. The unit begins to count how long the sensor reads a temperature below the Trigger Temp in the Time Accumulated. If the temperature rises above the Trigger Temp at any point, the Time Accumulated will reset back to 0. The Time Accumulated can also be reset to 0 manually by changing the Reset value from OFF to ON. After the Time Accumulated reaches the user-adjusted time set in the Time Pin, the unit enters a defrost cycle. See page 15 for more information on defrost.

Defrost Cycle: Shows if the unit is currently in a defrost cycle (ON) or not (OFF)

Time Pin: User-adjustable time between the temperature falling below the Trigger Temp and the beginning of a defrost cycle

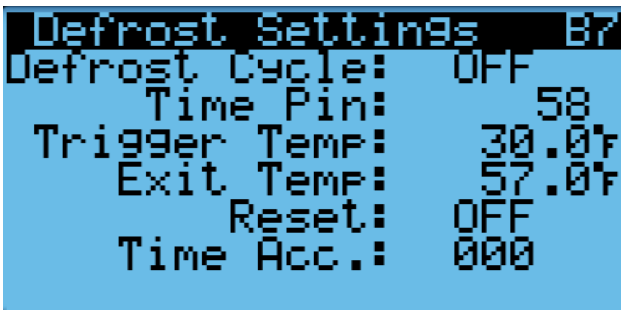
Trigger Temp: Temperature outdoor coil temp sensor must fall below before time is accumulated to trigger a defrost cycle

Exit Temp: Temperature outdoor coil temp sensor must rise above to exit defrost mode

Reset: Manual reset of time accumulated

Time Acc.: displays how long the temperature has been below the Trigger Temperature

FIGURE 33
Screens: Defrost Override B7



PID Settings B8

A PID loop is a calculation that continuously adjusts to provide a correction to a deviation from the desired condition. In this case, the PID is used to calculate how much output is required from the unit to control the space temperature. Three values are used: Proportional, integral and derivative and are commonly labeled as P, I and D respectively. The perfect values for any given application and environmental conditions can be difficult to determine. Because of the various applications of the unit, the PID parameters are available for adjustment by a qualified technician. Each of these values results in a calculated output that is then combined to determine the final output of the loop. If a parameter is not desired, it can be set to 0, essentially eliminating its contribution to the output. While a PID loop is available for this product, the default values limit it to a PI loop for this product out of the box. This resembles the configuration of multiple thermostats seen in the market today; however, the option is there for full functionality of the loop if desired. Below is a brief explanation of the values and the effects adjustments will have on the output of the product. Tuning should be done by a qualified technician and operation should be closely monitored following any adjustment of the PID values. The default values are provided on the adjustment screen.

Proportional (P)

The proportional value is used to determine how much output will be applied to a deviation from the target. The target is the setpoint and the deviation is the actual temperature above or below the setpoint for cooling or heating, respectively. The larger the deviation, the more the output is increased. Increasing the proportional value results in a larger output response and decreasing the proportional value results in a lower response to the same deviation.

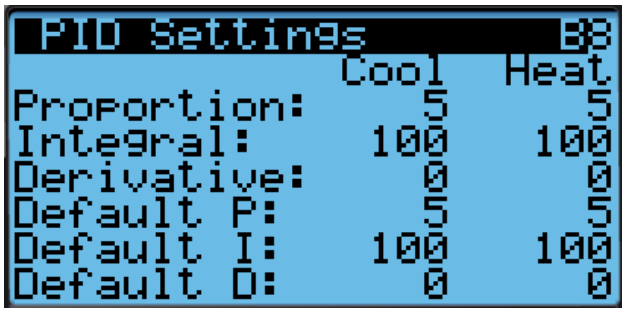
Integral (I)

The integral value is used to determine how much output will be applied to a deviation that persists for a given amount of time. The longer the deviation is present, the more output generated. Integral is sometimes looked at as the amount of time in which to consider a deviation. If the same deviation exists for a set time considered, the output is large; conversely, if the same deviation only exists for half that time, the output is less. Increasing the integral value slows the rate at which the output builds in respect to the amount of time the deviation is present. Decreasing the integral value means that a smaller amount of time will be considered, and the output will increase faster. An important consideration for integral values is that if the value is too small, oscillations will occur and if value is too large, the change in output will be slow.

Derivative (D)

The derivative value is used to compensate for the rate of change and dampen the output to not cause an overshooting of the target. The derivative value is sometimes looked at as the predictor or anticipator. Increasing derivative value increases the reduction in the output as the deviation shrinks. Decreasing the derivative value will lower the reduction in the output as the deviation shrinks at the same rate. Increasing the derivative value will reduce overshooting of the target, but if the derivative is too large it can cause oscillations. If overshooting is an issue, increasing the derivative value may help, but it will be beneficial to start small and increase as needed.

FIGURE 34
Screens: PID Settings B8



I/O Config Menu

When discussing inputs and outputs, it's important to have a common reference point. If this is not well defined, it could easily become confusing what value is considered an input and an output. For example, a sensor sends information to the PLC, so the value could be considered an output if the sensor was the reference point. Likewise, the PLC is receiving information from the sensor, so that same value could be considered an input if the PLC board is the reference point.

To reduce confusion, the PLC board will be used as the reference point as it contains all the logic to control the unit. Any information sent to the board is considered an input, and any information sent from the board is considered an output.

Analog & Digital I/O

The PLC can receive and send both digital and analog values. Digital values only consider if the value is On or Off. Analog values consider a range of values. The I/Os on the PLC are as follows:

Digital Inputs: DI1-DI7

Digital Outputs: NO1-NO9 & NC7

Analog Inputs: B1-B7

The screens in the I/O Config menu are used primarily for testing the functionality of components within the unit. **If a change has been made on screens C1-C10, they must be reverted back to their original values before leaving.** These offsets will not reset on their own and must be changed manually. **Screens C11-C21 contain overrides that do not retain the adjusted value and will revert back to the original value after 5 minutes.** These screens are used primarily for testing and troubleshooting components within the unit.

Digital Inputs C1

This screen shows the digital inputs used for the system (see Figure 35).

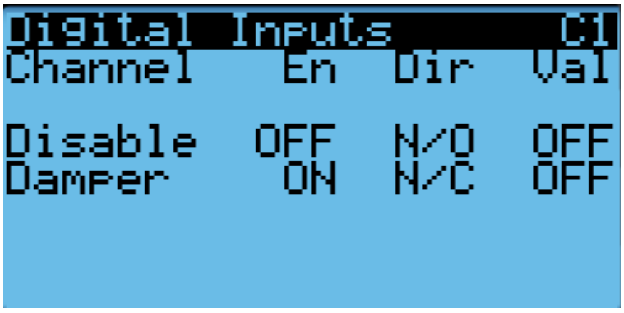
Channel: Lists the name of the input used on a specific channel

En: Displays whether the channel is enabled (ON) or disabled (OFF) by searching for continuity at the PLC input. This value can be adjusted for testing purposes.

Dir: Displays the direction of the relay as normally open (N/O) or normally closed (N/C). This value can be adjusted for testing purposes. Both Unit Disable and Damper are wired as N/O.

Val: Displays the value of the output as either enabled (ON) or disabled (OFF). This value is informative only and cannot be adjusted directly.

FIGURE 35
Screens: Digital Inputs C1



Screens C2-C10 display the input of various sensors. The following will be found on each of these screens:

Input: The input location on the PLC each sensor is connected to.

Offset: Additional °, % or pressure amount added to the sensor reading.

Value: Displays the value of the sensor reading + the offset applied. For example, if the sensor reading is 67.2°F, and the offset is adjusted to 3.8°F, the value would display 71°F. Likewise, if the sensor reading is 67.2°F, and the offset is adjusted to -2.5°F, the value would display 64.7°F. Once a value has been offset, all screens displaying the sensor reading, including the Main screen and Information screens, will display the adjusted value.

C2: Mixed Air Temp
C3: Outdoor Air
C4: Return Air
C5: Supply Air
C6: Outdoor Humidity
C7: Outdoor Coil Temp
C8: Suction Temp
C9: Discharge Pressure
C10: Suction Pressure

Screens C11-C16 display the digital outputs used in the system. The following will be found on each of these screens:

The output location on the PLC and name of the output channel

Current State: The current output value at the PLC

OV Value: The value that overrides the Current State output value. The OV Value must be enabled to affect the Current State.

Enable: Enables the OV Value. If the Enable value is "ON", the OV Value overrides the Current State. If the Enable value is "OFF", then the OV Value doesn't affect the Current State output value.

C11: D01 Reversing Valve
C12: D03 Reheat Valve
C13: D04 Electric Heat 1
C14: D05 Electric Heat 1
C15: D07 Unit Fail Relay
C16: D09 ERV Relay

Blower Override C17

Output: The location on the PLC that the output demand is generated

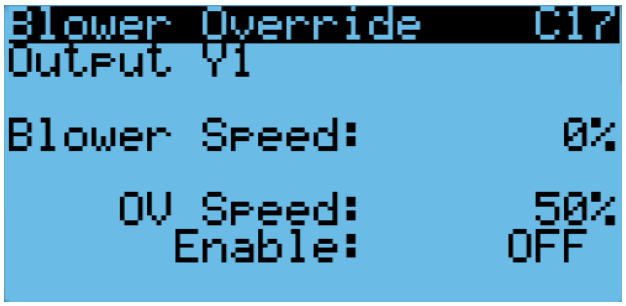
Blower Speed: Displays the % demand (0-100%) the blower is currently running. This output can be affected by the OV Speed.

OV Speed: The % value that overrides the Blower Speed output value. The OV Speed must be enabled to affect the Blower Speed.

Enable: Enables the OV Speed. If the Enable value is "ON", the OV Speed overrides the Blower Speed. If the Enable value of "OFF", the OV Speed doesn't affect the Blower Speed value.

Overrides must be disabled to return unit to normal operation and will time out and revert back to the original value after 5 minutes.

FIGURE 36
Screens: Blower Override C17



Damper Override C18

Output: The location on the PLC that the output demand is generated

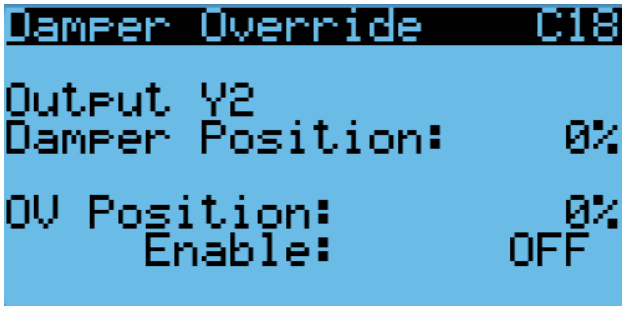
Damper Position: Displays the % demand (0-100%) the damper blade is currently set. This output can be affected by the OV Position.

OV Position: The % value that overrides the Damper Position output value. The OV Position must be enabled to affect the Damper Position.

Enable: Enables the OV Position. If the Enable value is "ON", the OV Position overrides the Damper Position. If the Enable value of "OFF", the OV Position doesn't affect the Damper Position value.

Overrides must be disabled to return unit to normal operation and will time out and revert back to the original value after 5 minutes.

FIGURE 37
Screens: Damper Override C18



Condenser Fan Override C19

Output: The location on the PLC that the output demand is generated

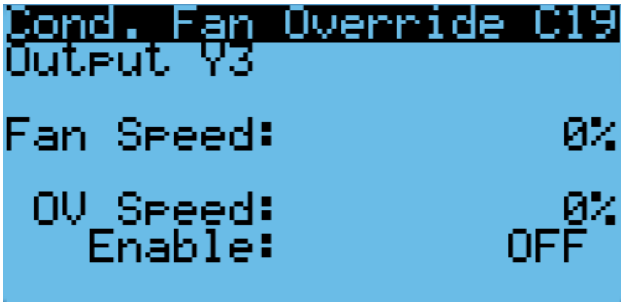
Fan Speed: Displays the % demand (0-100%) the fan is currently running. This output can be affected by the OV Speed.

OV Speed: The % value that overrides the Fan Speed output value. The OV Speed must be enabled to affect the Fan Speed.

Enable: Enables the OV Speed. If the Enable value is "ON", the OV Speed overrides the Fan Speed. If the Enable value of "OFF", the OV Speed doesn't affect the Fan Speed value.

Overrides must be disabled to return unit to normal operation and will time out and revert back to the original value after 5 minutes.

FIGURE 38
Screens: Cond. Fan Override C19



EEV Override C20

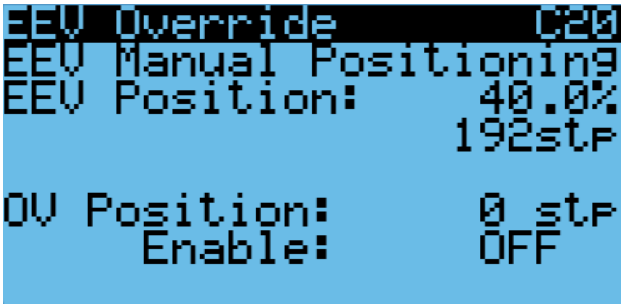
EEV Position: Displays the % demand (0-100%) the electronic expansion valve (EEV) is currently set. This output can be affected by the OV Position.

OV Position: The % value that overrides the EEV Position output value. The OV Position must be enabled to affect the EEV Position.

Enable: Enables the OV Position. If the Enable value is "ON", the OV Position overrides the EEV Position. If the Enable value of "OFF", the OV Position doesn't affect the EEV Position value.

Overrides must be disabled to return unit to normal operation and will time out and revert back to the original value after 5 minutes.

FIGURE 39
Screens: EEV Override C20



Demand Overrides C21

Mode: Toggles the unit demand override to either cooling mode or heating mode.

Cooling PI: The % of cooling demand on the unit

NOTE: *The cooling PI will not be considered unless the Mode is set to cooling and the override is enabled.*

Heating PI: The % of heating demand on the unit.

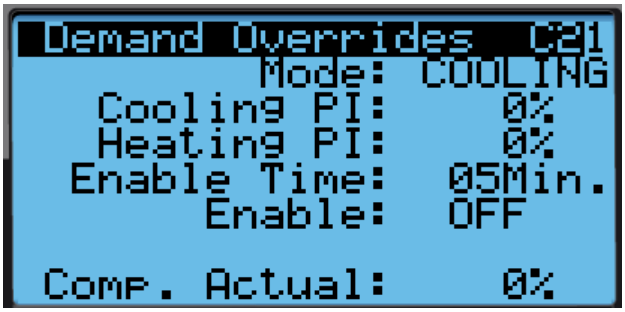
NOTE: *The heating PI will not be considered unless the Mode is set to heating and the override is enabled.*

Enable Time: The duration of time the override is enabled. The enable time is not considered until the override is enabled.

Enable: Enables the Demand Override. If the Enable value is "ON", the Demand Override is adjusted to the selected Mode and corresponding PI. Once the override has run for the duration of the Enable Time, the Demand Override is disabled. If the Enable value is "OFF", the demand is not affected by the overrides on this screen.

Overrides must be disabled to return unit to normal operation and will time out and revert back to the original value after 5 minutes.

FIGURE 40
Screens: Demand Overrides C21

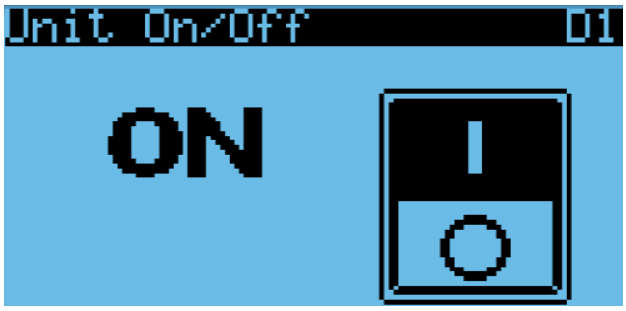


Unit On/Off

Unit On/Off D1

This screen allows the unit to be toggled “ON” or “OFF” by pressing either arrow on the right side of the screen. When the toggle is set to “ON”, it allows the unit to operate. When the toggle is set to “OFF”, all function of the unit is turned off and the unit status will read “Off by keypad” on the Main screen. The value does not automatically reset and must be manually toggled back to “ON” to resume unit operation.

FIGURE 41
Screens: Unit On/Off D1



Alarm Logs

Data Logger

Data Logger: Log of alarms unit has had in the past. This screen can also be accessed through the Alarm button (top left button on PLD Pro) and through the Quick Screens.

FIGURE 42
Screens: Data Logger

Settings

Date/Time

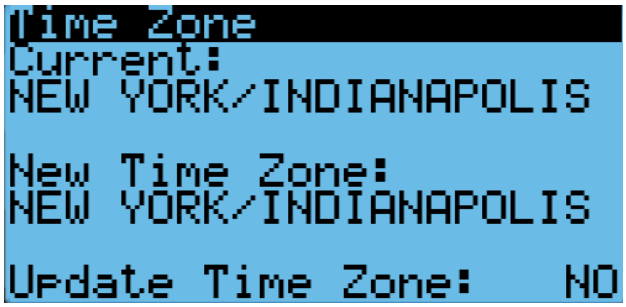
Time Zone

Current: Displays a location that is in the current time zone selected

New Time Zone: Provides a list of locations to scroll through to select the location that is closest and best represents the local time zone.

Update Time Zone: Change value from “NO” to “YES” to make the New Time Zone the Current Time Zone.

FIGURE 43
Screens: Time Zone



Date/Time

Time: Allows the time to be adjusted in hours, minutes and seconds.

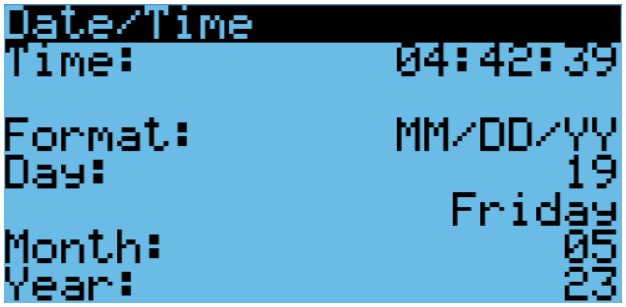
Format: Allows how the date is displayed to be adjusted in month (MM), day (DD) and year (YY).

Day: Allows the day of the month to be adjusted. The corresponding day of the week will adjust automatically.

Month: Allows the month of the year to be adjusted. The corresponding day of the week will adjust automatically.

Year: Allows the year to be adjusted. The corresponding day of the week will adjust automatically.

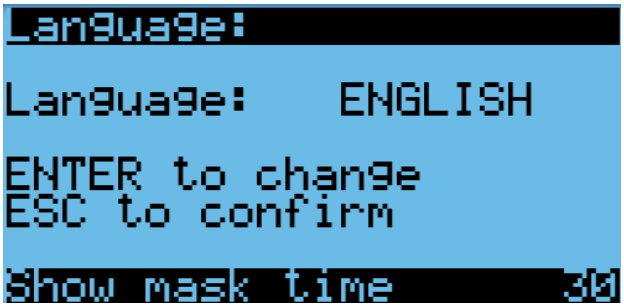
FIGURE 44
Screens: Date/Time



Language

The language displayed on the screen is the one selected. When the Enter button is pressed, the language selected is changed. Continue pressing the Enter button to scroll through the language selections. When the desired language is displayed on the screen, press the Escape button to confirm the language selection.

FIGURE 45
Screens: Language



Import/Export

Alarm Log Export

This screen allows a log of past alarms to be exported onto an Excel sheet.

File name: Name of the exported Excel file. If two files with the same name are exported, the most recent file exported will replace the old file. To prevent this, the numbers at the end of the file name can be incremented. Change the "Confirm?" value to "YES" to confirm the file name and to begin exporting the file.

For a more detailed explanation to export alarm logs, see the most recent version of supplemental manual 7960-825 (see Appendix section of this manual).

FIGURE 46
Screens: Alarm Log Export 1/2

3 Day Log Export

This screen allows a log of data for the past 3 days to be exported. Data points are logged every 30 seconds.

File name: Name of the exported Excel file. If two files with the same name are exported, the most recent file exported will replace the old file. To prevent this, the numbers at the end of the file name can be incremented. Change the "Confirm?" value to "YES" to confirm the file name and to begin exporting the file.

For a more detailed explanation to export 3 day logs, see the most recent version of supplemental manual 7960-826 (see Appendix section of this manual).

FIGURE 47
Screens: 3 Day Log Export 2/2

Initialization

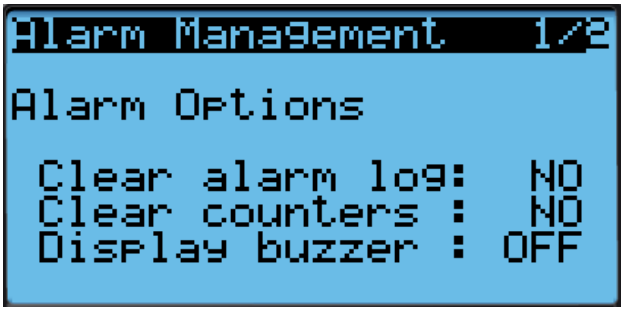
Alarm Management

Clear alarm log: Deletes log of alarms stored in the system. This will also affect the alarm export.

Clear counters: Clears the count for alarms that require more than one trip.

Display buzzer: Turns on and off the alarm noise.

FIGURE 48
Screens: Alarm Management 1/2



Factory Reset

Resets all configurable values to defaulted settings.

FIGURE 49
Screens: Factory Reset 2/2

Change Passwords

This screen allows the defaulted passwords to be changed, if desired.

User: User password level allows access to basic level material. This has the most limited access of all the password levels. When logged in as a User, only the User password will be displayed and is the only password that can be changed.

Technician: Technician password level allows more access than the User but is still limited in some areas. When logged in as a Technician, both the User and Technician passwords will be displayed and can be changed.

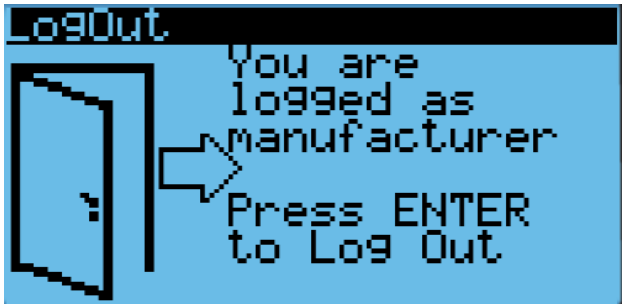
Engineer: Engineer password level allows access to all material displayed. This has the most access of all password levels. When logged in as a Technician, the User, Technician, and Engineer passwords will be displayed, and all password levels can be changed.

FIGURE 50
Screens: Change Passwords

Log Out

When done working with the PLD Pro display, log out of the password protected menus, if desired. Doing this will require log in again to gain access to the menus. If there is no activity for 5 minutes, log out is automatic and a password will be required to log back in.

FIGURE 51
Screens: LogOut



Alarms (General Functionality)

Name	Type
Return Air Temperature Sensor Alarm	User reset
Mixed Air Temperature Sensor Alarm	User reset
Mixed Air High Temperature	Auto reset
Mixed Air Low Temperature	Auto reset
Supply Air Temperature Sensor Alarm	User reset
Outdoor Air Temperature Sensor Alarm	User reset
Outdoor Air Humidity Sensor Alarm	Auto reset
Discharge Pressure Sensor Alarm	User reset
Suction Temperature Sensor Alarm	User reset
Suction Pressure Sensor Alarm	Auto reset
Low Pressure Alarm	Auto reset until counter
High Pressure Alarm	User reset
Damper Failed to Open	Auto reset
Damper Failed to Close	Auto reset
Freeze Condition	Auto reset
Unit Disable Alarm	Auto reset
Low SuperHeat	Auto reset
Outdoor Coil Temperature sensor out of range	Auto reset
EV2 Compressor Phase Over Current	Auto reset
EV2 AC Input Over Current	Auto reset
EV2 DC Bus Over Voltage	Auto reset
EV2 DC Bus Under Voltage	Auto reset
EV2 AC Input Over Voltage	Auto reset
EV2 AC Input Under Voltage	Auto reset
EV2 HPS Open	Auto reset
EV2 Power Module Over Temp	Auto reset
EV2 Lo st Rotor Position	Auto reset
EV2 DC Bus Voltage Low	Auto reset
EV2 Intermediate Compressor Phase Overcurrent	Auto reset
EV2 Compressor Phase Current Fold Back Timeout	Auto reset
EV2 Auto Config Communication Timeout	Auto reset
EV2 Thermistor High Temp	Auto reset
EV2 Power Module Temp High	Auto reset
EV2 Comms to DSP Lost	Auto reset
EV2 Compressor Phase Overcurrent	Auto reset
EV2 AC Input Over Current	Auto reset
EV2 DC Bus Over Voltage	Auto reset
EV2 DC Bus Undervoltage	Auto reset
EV2 AC Input Over Voltage	Auto reset
EV2 AC Input Under Voltage	Auto reset

Name	Type
EV2 HPS Open	Auto reset
EV2 Power Module Over Temp	Auto reset
EV2 Lost Rotor Position	Auto reset
EV2 DC Bus Voltage Low	Auto reset
EV2 Compressor Phase Current Imbalance	Auto reset
EV2 Drive EEPROM Fault	Auto reset
EV2 Compressor Model Config Error	Auto reset
EV2 High Pressure Sensor Config Error	Auto reset
EV2 Thermistor Low Temp	Auto reset
EV2 Power Module Temp Low	Auto reset
EV2 Fault Limit Lockout	Auto reset
EV2 Power module foldback time out	Auto reset
EV2 AC Input current foldback time out	Auto reset
EV2 Modbus Communication Lost	Auto reset
EV2 Communication Error	Auto reset
Standalone Device Offline	Auto reset

Standalone Device Offline Alarm

Description

- The standalone offline alarm will be triggered when the unit loses communication with the room controller (BrightStat).

Sequence

- If a BACnet error is present for more than 30 seconds, it will be assumed that the room controller (BrightStat) is no longer communicating properly with the unit.
- The standalone offline alarm will be triggered when this occurs.

Low Pressure Alarm

Description

- The low pressure alarm looks for low pressure conditions to protect against a loss of charge in the unit.

Sequence

- If the suction pressure falls below the low pressure setpoint 3 (40 psi) for more than 2 minutes (adjustable), a low pressure alarm will be triggered.
- The low pressure alarm will automatically reset once the pressure increases above the low pressure setpoint on the first trip.
- If two trips occur within a 1-hour period (adjustable), the alarm will require a manual reset.
- Low pressure alarms will disable the compressor while active.

High Pressure Alarm

Description

- The high pressure alarm protects the refrigeration system from excessive pressure.

Sequence

- If the HPS (high pressure switch) connected to the EV2 drive opens, notification will occur via Modbus.
- If notification of the HPS open is present for more than 5 seconds, a high pressure alarm will be triggered.
- High pressure alarms will disable the compressor while active.

Damper Fail to Open Alarm

Description

- The damper fail to open alarm is intended to provide notification of malfunctioning damper.

Sequence

- If the damper is commanded to a position of greater than 40% and the damper switch doesn't open within the damper open delay time, a damper fail to open alarm will be triggered.
- No functionality will be blocked by the damper fail to open alarm.

Damper Fail to Close Alarm

Description

- The damper fail to close alarm is intended to provide notification of malfunctioning damper.

Sequence

- If damper is commanded to 0% (closed) and the damper switch doesn't close within the damper close delay time, a damper fail to close alarm will be triggered.
- No functionality is blocked by the damper fail to close alarm.

Evaporator Freeze Protection Alarm

Description

- Evaporator coil will be monitored in cooling for freezing. If freezing is detected, then an alarm will be generated and the compressor will be disabled until the condition is cleared.

Sequence

- Freeze protection will utilize the saturated suction pressure to determine the evaporator coil temperature. If this temperature falls below the freezing point (28°F) for more than 10 minutes consecutively, the compressor will be disabled, an alarm will be generated and the blower will run. The blower and alarm will remain active until the alarm is reset or a 5-minute timer has expired.

Sensor Alarms

Description

- Alarms will be triggered when a sensor fails where possible.

Sequence

- When a sensor reads open, shorted or out of range, a sensor alarm will be triggered.

EV2 Alarms

Description

- When the drive is faulted, the fault will be communicated back to the PLC via Modbus.

Sequence

- When a drive fault is communicated, a corresponding alarm will be triggered.
- The alarm text will begin with EV2 to indicate that the alarm is a drive alarm with the exception of an open HPS. (See **High Pressure Alarm** sequence above)
- See Table 16 beginning on page 58 for a list of EV2 alarms.

NOTE: *Screenshots shown in this manual reflect default settings (when applicable).*

Unit On/Off

The wall-mount unit can be turned on and off from the PLD Pro. Turning the unit off with the following instructions will disable all unit operation.

To turn the unit on or off:

1. Press MENU key to go to the Main Menu screen.
2. Press UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **On/Off**; press ENTER key.
4. Press UP or DOWN keys to change value from On to Off or from Off to On.
5. Press ESCAPE key several times to return to Main Menu screen.

The wall-mount unit may also be turned off by certain alarms. Below is a list of conditions that will disable unit operation to prevent damage to unit or property:

- Unit Disable Input
- Invalid Model Number Size

NOTE: *The unit will operate if overrides are activated even when the unit is set to off.*

Alarm Adjustment

Acknowledging Alarms

Alarm conditions activate a red LED indicator that backlights the ALARM function key. As an option, an alarm condition may also be enunciated by an audible alarm signal. An alarm is acknowledged by pressing the ALARM key. This calls up alarm display screen(s) that provide a text message detailing the alarm condition(s).

Clearing Alarms

Alarms can only be cleared after the alarm condition has been corrected. To clear a single alarm, press and hold the ALARM key for 3 seconds while viewing a specific alarm screen. To clear all alarms, navigate to the screen at the end of the alarm list (shown in Figure 52) and press and hold the ALARM key for 3 seconds.

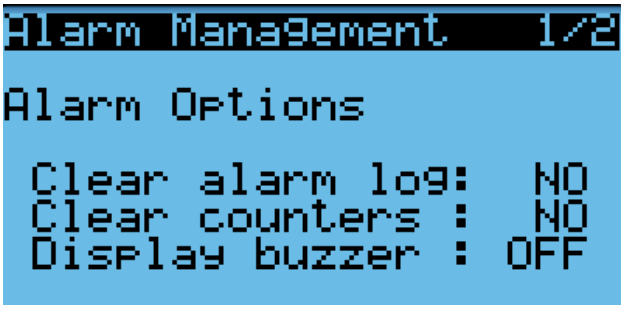
FIGURE 52
Clearing All Alarms

Clearing Alarm Logs and Counters

To clear the alarm log and alarm counters:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter USER password 2000.
3. Press UP or DOWN keys to scroll to **Settings**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Initialization**. (**Alarm Management 1/2** screen will be displayed.)
5. Press ENTER key to scroll to **Clear Alarm Log** (see Figure 53).
6. Press UP or DOWN key to change value to **YES**; press ENTER key.
7. Press ENTER key to scroll to **Clear Counters**.
8. Press UP or DOWN key to value to **YES**; press ENTER key.

FIGURE 53
Clearing Alarm Logs and Counters



Exporting Alarm Logs

See latest version of Supplemental Instructions manual 7960-825 for information on exporting alarm logs (see Appendix).

Exporting 3 Day Logs

See latest version of Supplemental Instructions manual 7960-826 for information on exporting 3 day I/O logs (see Appendix)..

Freecooling

If the unit is equipped with an economizer, and conditions are acceptable for economizer operation, the variable speed wall-mount unit will utilize freecooling operation before the use of any cooling operation requiring compressor operation to reduce the energy required to cool the indoor space.

Economizer Disable

There are three methods to disable the economizer if the use of freecooling is restricted. The first method is to select None as the economizer type within the **Sys Config** menu. The second method requires changing the model number within the **Adv Sys Config** menu to reflect a model installed with a blank-off plate (see model nomenclature on page 11). Changing the wall-mount unit model number to reflect a unit with a blank-off plate will not allow for an economizer type to be selected therefore defaulting to a disabled state, along with all sensors/alarms associated with it. The third method can be utilized via the room controller (Brightstat). If ventilation is required but economizing is not, the user can change the mode for the damper from economizer to CRV in the custom menu. The custom menu is accessed by pressing the Gear button on the room controller (Brightstat) home screen.

Economizer Enable

The economizer will be enabled for cooling operation if the model number reflects a wall-mount unit with an economizer installed, an economizer type other than None and the conditions for the economizer type are met. The following list explains the economizer types and the parameters required for operation. See also Figures 54 and 55.

FIGURE 54
Economizer A2 Screen

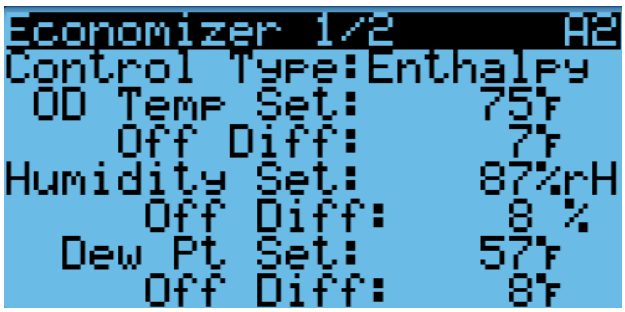
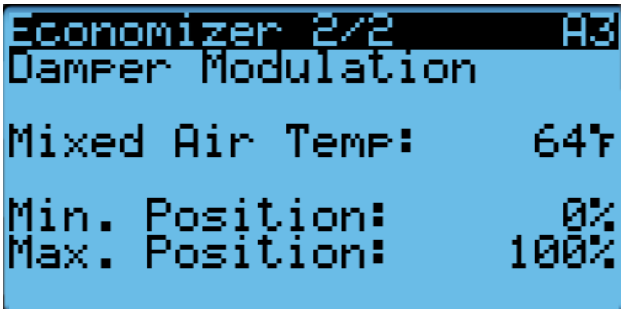


FIGURE 55
Economizer A3 Screen



None

Economizer will not be enabled for freecooling operation.

Drybulb Only

1. Outdoor air temperature is below the Outdoor Set outdoor temperature setpoint listed within the **Sys Config** menu. (Outdoor Set temperature setpoint is 70°F by default.)

Temperature and Humidity

1. Outdoor air temperature is below the Outdoor Set outdoor temperature setpoint listed within the **Sys Config** menu. (Outdoor Set temperature setpoint is 70°F by default.)
2. Outdoor relative humidity is below the OA Humid Set outdoor humidity setpoint listed within the **Sys. Config** menu. (OA Humid Set humidity setpoint is 80% RH by default.)

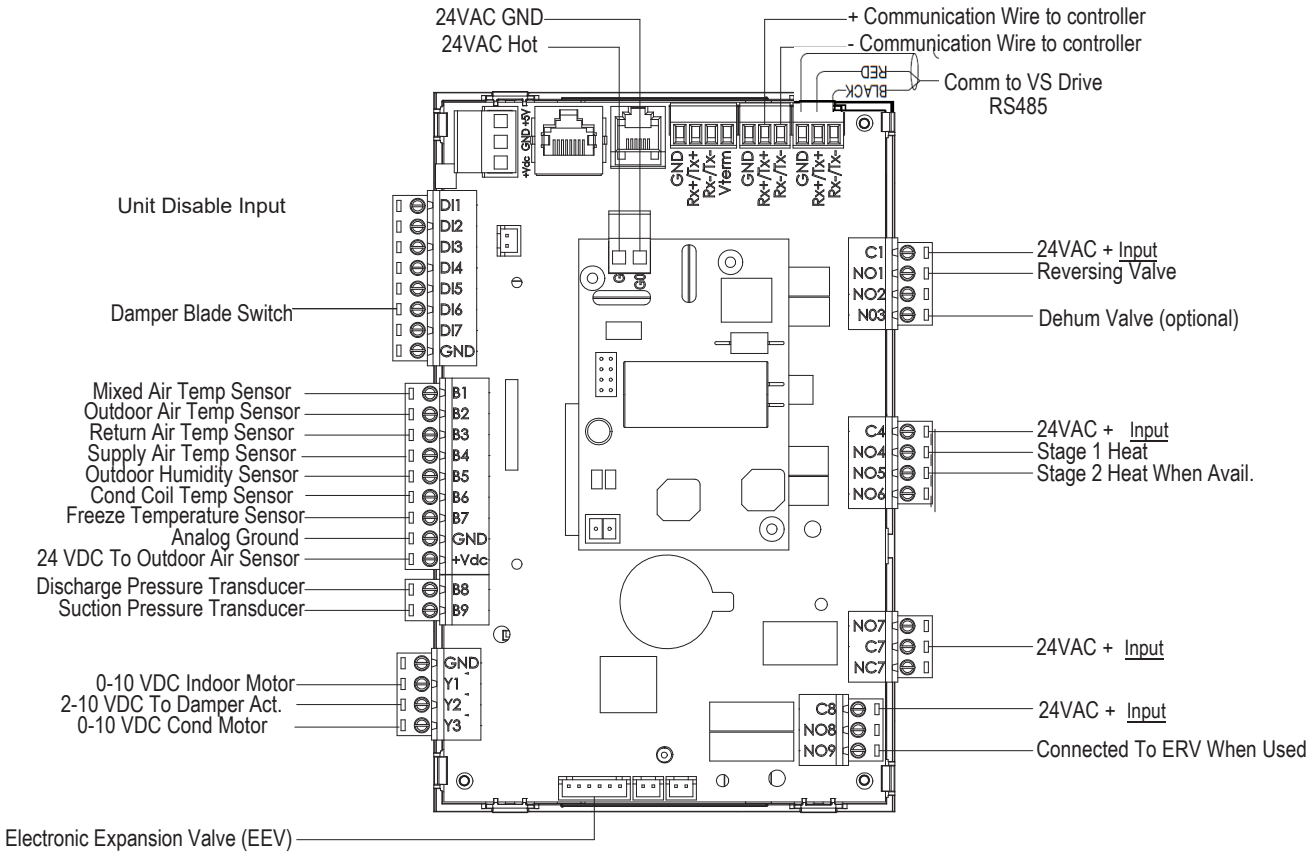
Enthalpy

1. Outdoor air temperature is below the Outdoor Set, outdoor temperature setpoint, listed within the **Sys Config** menu. (Outdoor Set temperature setpoint is 70°F by default.)
2. Outdoor relative humidity is below the OA Humid Set outdoor humidity setpoint listed within the **Sys. Config** menu. (OA Humid Set humidity setpoint is 80% RH by default.)
3. The outdoor air dewpoint is below the OA Dew Pt Set outdoor dewpoint setpoint, listed within the **Sys Config** menu. (OA Dew Pt Set dewpoint setpoint is 55°F by default.).

Unit Disable

The wall-mount unit can be disabled by opening the dry set of contacts connected to Input DI1 on the PLC board (low voltage strip terminal #5). This feature is disabled by default and must be enabled before the input will affect unit operation. When the input detects open contacts, all unit operation will stop and the dampers will close. This is an automatic reset feature that will resume operation as soon as the unit detects the contacts are closed again.

FIGURE 56
W*VHY Control Board I-O Use/Values



See Table 14 on page 50 for information on control board terminal functions.

TABLE 14
W*VHY Wall-Mount Unit Control Board Terminal Use

Terminal	Function	Type	Form
Rx+/Tx+ #1	Terminal Strip/Room Controller (Brightstat)	Analog I-O	Communication
Rx-/Tx- #1	Terminal Strip/Room Controller (Brightstat)	Analog I-O	Communication
DI1	Unit Disable	Digital	
DI2	Not Used		
DI3	Not Used		
DI4	Not Used		
DI5	Not Used		
DI6	Damper Blade Switch	Digital	N/C
DI7	Not Used		
GND	Not Used		
B1	Mixed Air Temperature Sensor	Analog Input	10K Ohm Curve J
B2	Outdoor Air Temperature Sensor	Analog Input	10K Ohm Type
B3	Return Air Temperature Sensor	Analog Input	10K Ohm Curve J
B4	Supply Air Temperature Sensor	Analog Input	10K Ohm Curve J
B5	Outdoor Humidity Sensor	Analog Input	4-20 mA
B6	Condenser Coil Temperature	Analog Input	10K Ohm Curve J
B7	Freeze Temperature Sensor	Analog Input	10K Ohm Curve J
GND	Analog Ground		
+VDC	24VDC to Outdoor Air Sensor		
B8	Discharge Pressure Transducer	Analog Input	0-5 Vdc
B9	Suction Pressure Transducer	Analog Input	0-5 Vdc
Y1	Indoor Blower Speed Signal	Analog Output	0-10 Vdc
Y2	Damper Actuator	Analog Output	2-10 Vdc
Y3	Condenser Fan Motor Speed Signal	Analog Output	0-10 Vdc
GND	Ground		
C1	24VAC+	Power	
NO1	Reversing Valve	Relay Output	24VAC
NO2	Not Used		
NO3	Reheat Valve	Relay Output	24VAC
C4	24VAC+	Power	24VAC
NO4	Stage 1 Heating	Relay Output	24VAC
NO5	Stage 2 Heating	Relay Output	24VAC
NO6	Not Used		
NO7	Not Used		
C7	24VAC+	Power	24VAC
NC7	Not Used		
C8	24VAC+	Power	24VAC
NO8	Not Used		
NO9	Connect to ERV when Used	Relay Output	24VAC
GO	24VAC Ground		
G	24VAC Hot	Power	

Standard Maintenance Procedures

⚠ WARNING

Electrical shock hazard.

Disconnect all power supplies before servicing.

Failure to do so could result in electric shock or death.

⚠ CAUTION

Cut hazard.

Wear gloves to avoid contact with sharp edges.

Failure to do so could result in personal injury.

1. Turn off AC breakers at wall-mount units.
2. Coils need to maintain proper airflow. Check condenser section inlet grilles for obstructions/ debris—clean grilles and remove debris. Inspect return and supply grilles to ensure evaporator coil isn't obstructed.
   - Condenser coil: Clean if necessary, using a quality manufactured coil cleaning product.
     - Access panel can be removed from the side of fan shroud (See Figure 57 on page 52) to allow for improved access.
     - Blow-thru models: Remove front condenser grille and clean through front of coil. Check back of coil.
     - Draw-thru models: Remove side condenser grilles and clean through back of coil.

     Follow the coil cleaner manufacturer's directions for necessary safety gear and precautions, as well as for application and use. More than one application may be necessary. Rinse thoroughly.
   - Evaporator coil: Clean if necessary, using a quality manufactured coil cleaning product.
     - Open filter access panels and remove filters. Apply specific evaporator cleaner directly to the inlet side of coil, being very careful not to overspray into insulation or surrounding panels and wiring. For outlet-side cleaning, remove the supply grille and clean from that direction. The residual cleaner and dissolved debris should drip into the drain pan and leave the unit through the condensate hose. More than one application may be necessary. Rinse thoroughly.

     Follow the coil cleaner manufacturer's directions for necessary safety gear and precautions, as well as for application and use. More than one application may be necessary. Rinse thoroughly.
     - Inspect evaporator drain hose for blockage that would prevent drainage from evaporator drain pan
3. Manually spin the fan and blower motors to ensure they turn freely. All motors are permanently lubricated, so no oil is necessary.
4. Inspect vent package (Econ/CRV, ERV, FAD) linkage, actuator and damper.
5. Install new air filters.
6. Inspect unit control panel.
   - Look for insect or rodent activity and remove nesting materials.
   - Check field and factory wiring for tightness and look for signs of overheating (discoloration of terminals or wire insulation)
7. Inspect inverter drive assembly.
   - Inspect aluminum heatsink fins that are facing outdoor fan assembly for dust/dirt. Airflow across heatsink is important for performance so fins must be cleaned out as needed. Assembly/drive does not need removed, cleaning can be done with a brush and cleaning solution that is safe for aluminum services.
8. Inspect outdoor temperature sensor (tube) extending below unit base.
   - Check outdoor air temp sensor (tube) for insects or any debris that may prevent accurate temp reading.
9. Re-assemble wall-mount unit.

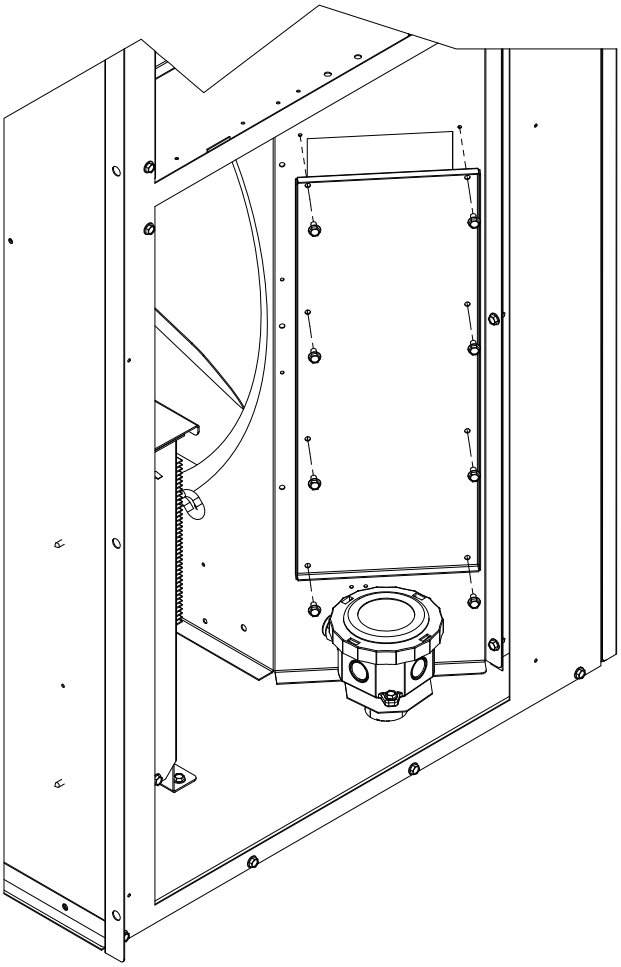
Repeat steps for additional wall-mount units.

Condenser Coil Access

Description

This model provides a removable access panel to clean the condenser coil surface (see Figure 57). The access panel can be found on the left side of the fan shroud (facing front of unit). The panel can be removed by taking out six (6) screws. ***CAUTION:*** *Be careful with any exposed sheet metal edges during service.*

FIGURE 57
Condenser Coil Access



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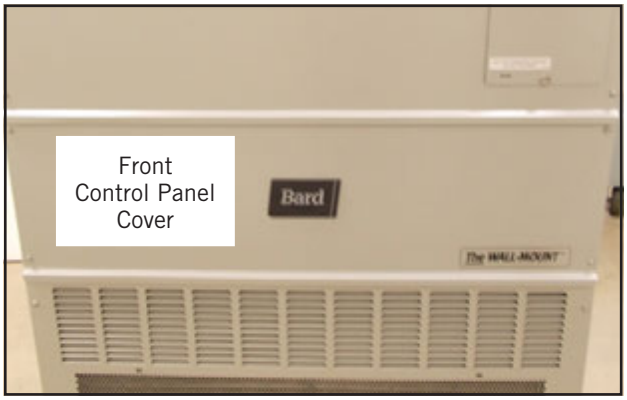
Service Hints

1. Caution owner/operator to maintain clean air filters at all times and also not to needlessly close off supply and return air registers. This reduces airflow through the system, which shortens equipment service life as well as increasing operating costs.
2. Check all power fuses or circuit breakers to be sure they are the correct rating.
3. Periodic cleaning of the outdoor coil to permit full and unrestricted airflow circulation is essential.

Filters

The filters can be serviced from the outside by removing the front control panel cover (see Figure 58). Two (2) 20" x 20" x 1" throwaway filters come standard with each unit. Additional 1" and 2" filter options are available as optional accessories.

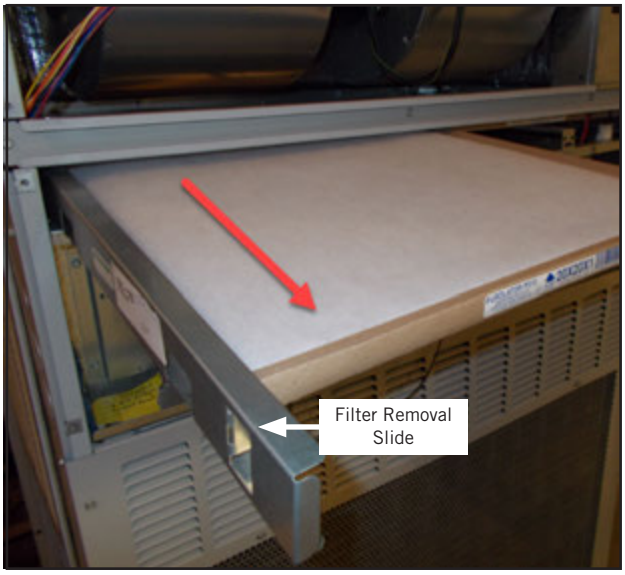
FIGURE 58
Front Control Panel Cover



Filter Removal/Installation

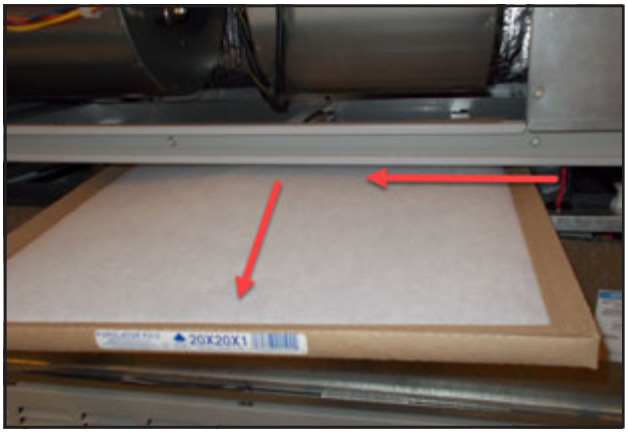
1. Remove left filter first by pulling filter removal slide out (see Figure 59).

FIGURE 59
Removing Left Filter



2. Slide second filter to the left around the wires and pull the filter out (see Figure 60).

FIGURE 60
Removing Second Filter



3. Reverse the order for new filter installation.

NOTE: *When installing new filters, make sure that airflow arrows on filters point up.*

Switching Filter Sizes

1. To switch from 1" to 2" filters, start by removing the filter slide and bend the tabs down out of the way (see Figures 61 and 62).

FIGURE 61
Filter Tabs in Up Position

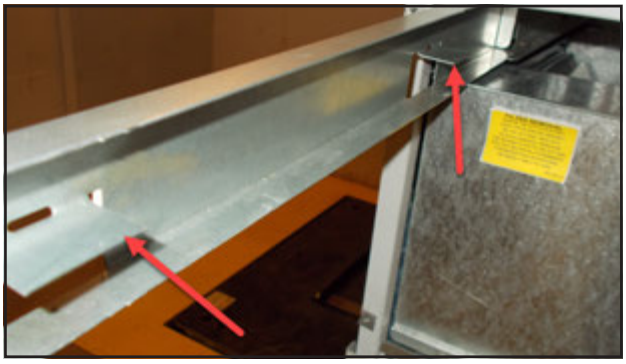
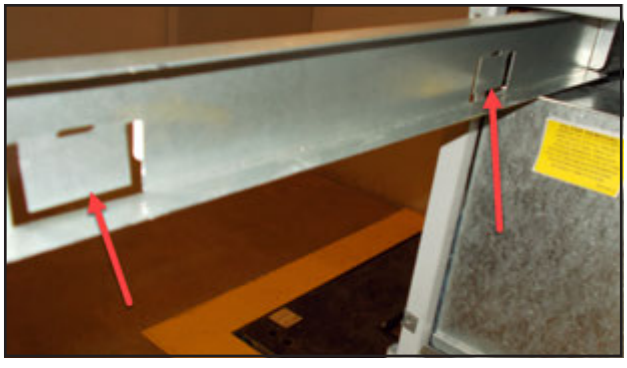


FIGURE 62
Bend Filter Tabs Down

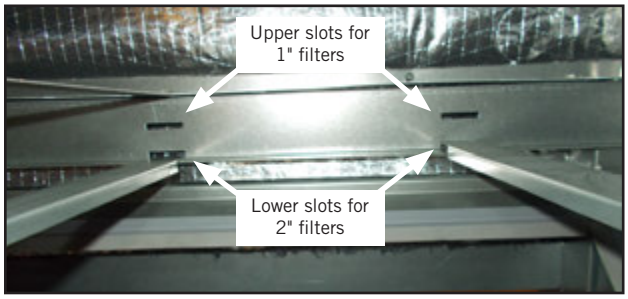


2. Locate the filter support brackets and remove the four (4) screws holding them to the top of the control panel (see Figure 63).

FIGURE 63
Remove Four Screws

3. Pull the brackets out towards the front of the unit. The back of the bracket will slip out of the upper slots at the back of the filter tray.
4. Re-install the filter support brackets into the lower slots at the back of the filter tray (see Figure 64).

FIGURE 64
Re-Install Filter Support Brackets into Lower Slots



5. Re-install the four (4) hex head screws into the upper screw holes on the filter support brackets. Then bend the tab up out of the way (see Figure 65).

FIGURE 65
Re-Install Screws and Bend Tabs Up

6. Install the right 2" filter first followed by the left filter (see Figures 66 and 67).

NOTE: *When installing new filters, make sure that airflow arrows on filters point up.*

7. Reverse the steps above to switch from 2" to 1" filters.

FIGURE 66
Install Right 2" Filter

FIGURE 67
Install Left 2" Filter

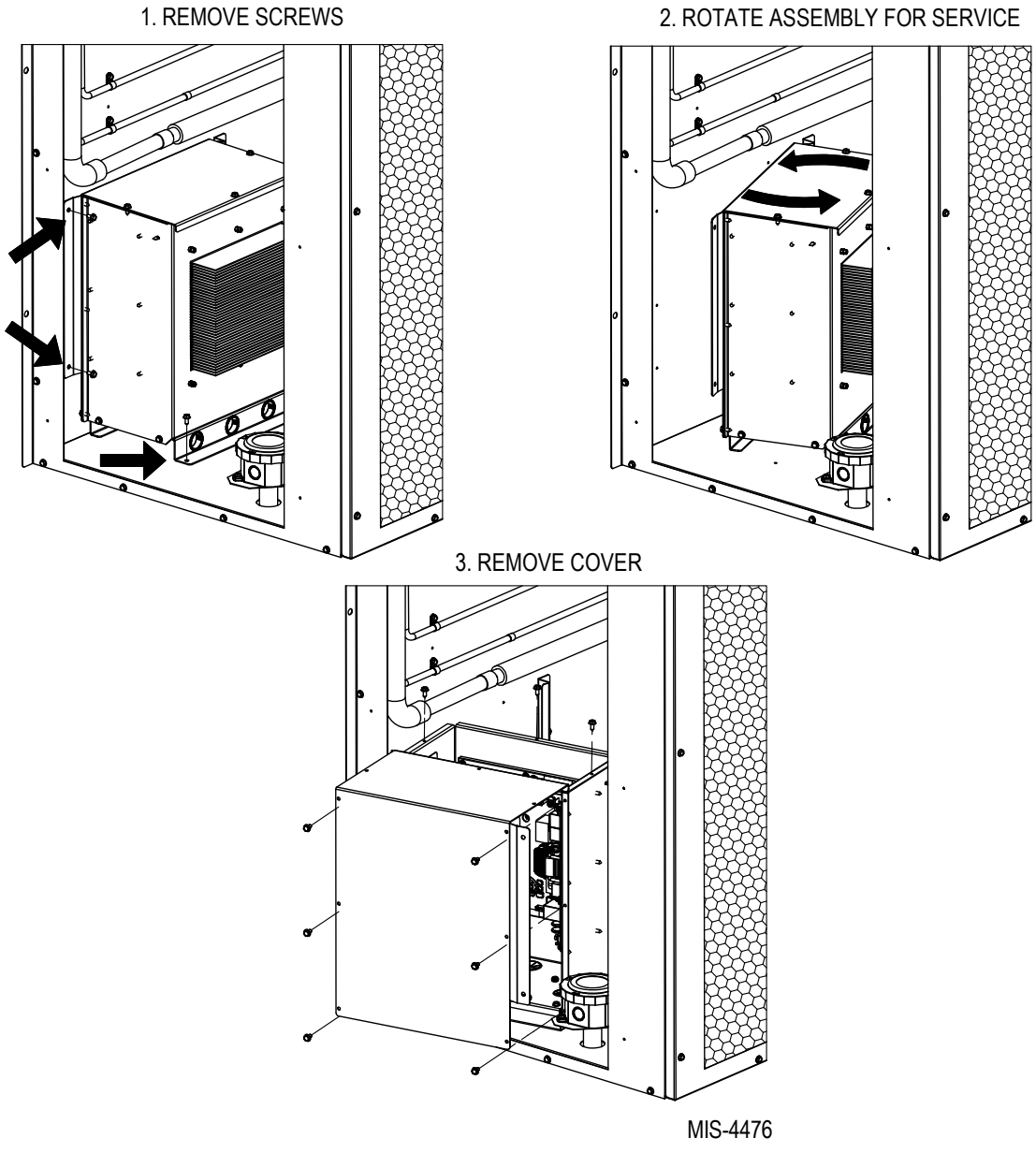
Inverter Drive Enclosure Service Access

The inverter drive assembly is located in the condenser section of the unit (opposite side of compressor). The inverter drive assembly includes inverter, choke, EMI filter and capacitor board (3 phase models only). The drive assembly is installed with cover towards unit back and heatsink towards condenser fan for airflow and heat exchange.

To service the drive components, the assembly must be removed from unit back. To remove the drive assembly:

1. Remove two (2) screws securing drive assembly to unit back (see Figure 68). Remove one (1) screw securing lower flange to unit base.
2. Assembly can now be rotated out from offset securing other side of drive assembly.
3. Rotate drive with heatsink facing compressor and cover facing out. Remove cover.

FIGURE 68
Inverter Drive Assembly Access



Variable Speed Drive Assembly

Prior to checking drive assembly components:

1. Ensure power to unit is OFF.
2. Allow 2 minutes for capacitors to discharge and LED board light to turn off.
3. Multimeter must be rated at 1,000-V CAT III (for diode checks)

Diagnosing drive:

1. VFD Rectification Input Check (Diode Forward Bias)
   A. Set multimeter to diode check ().
   B. Contact + (red) lead to input terminal (R/L1) and the – (black) lead on the DC (+) OUT terminal (see Figure 69).
   C. Meter should read around .5 Vdc.
   D. Move the + (red) lead to input terminals (S/L2) and (T/L3) while leaving the – (black) lead on the DC (+) OUT bus terminal.
   E. Meter should read around .5 Vdc for both (S/L2) and (T/L3).
2. VFD output check (diode forward bias)
   A. Set multimeter to diode check ().
   B. Contact + (red) lead to output terminal (U/T1) and the – (black) lead to the DC (+) IN terminal.
   C. Meter should read around .4 Vdc.
   D. Move the + (red) lead to output terminals (V/T2) and (W/T3) while leaving the – (black) lead on the DC (+) IN terminal.
   E. Meter should read around .4 Vdc for both (V/T2) and (W/T3).

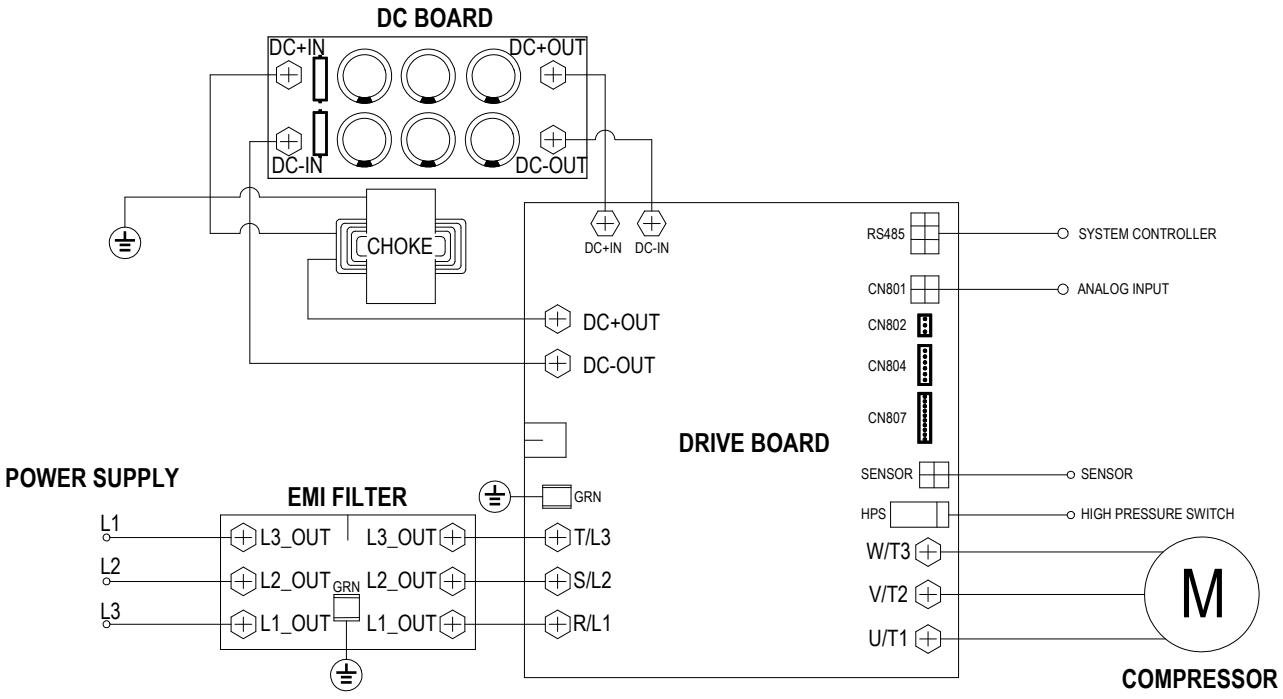
If any of these checks fail, that indicates the diodes may be shorted or damaged and the drive should be replaced.

3. Diagnosing capacitor board
   A. Capacitor troubleshooting is primarily a visual check for physical damage, leaking electrolytic fluid from the capacitors. Sometimes it is possible to smell if the capacitor is bad as the smell would be a strong scent.
      i. Replace capacitor board.
4. Diagnosing choke
   A. Using a meter set for continuity, contact both leads of the DC choke. If meter displays “OL”, this indicates short, open line and the choke is likely damaged.
      i. Replace choke.
5. Diagnosing EMI filter
   A. Using a meter set for continuity, contact T(IN) to T(OUT). (Start with R then S then T so single and three phase covered in order.)
   B. If meter displays “OL”, this indicates short, open line and the filter is likely damaged.
   C. Repeat for S(IN), S(OUT) and then R(IN), R(OUT).
      i. Replace EMI filter.

TABLE 15
Meter Check Table

Step	(+) Meter Lead	(–) Meter Lead	Meter Reading Diode Check
1	R/L1, S/L2, T/L3	DC (+) OUT	.5 Vdc
2	DC (+) IN	R/L1, S/L2, T/L3	"OL"
3	U/T1, V/T2, W/T3	DC (+) OUT	.5 Vdc
4	DC (+) IN	U/T1, V/T2, W/T3	"OL"

FIGURE 69
Inverter Drive Wiring Diagram



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Drive Troubleshooting

All alarms associated with the inverter drive will have a prefix of "EV2". The "EV2 Modbus Communication Loss" alarm has an auto retry feature and will reset itself within 2 minutes under normal circumstances. This alarm is expected after a software update or loss of power. Additional EV2 alarms will often require a power cycle if they do not reset after the compressor has stopped and 2 minutes has passed. Information on troubleshooting these specific alarms can be found in Table 16.

TABLE 16
EV2 Alarms

Alarm	
EV2 Compressor Phase Over Current	1. Check Connections from drive to compressor. 2. Check the compressor motor windings. 3. Verify unit/compressor is operating within specified parameters. 4. Replace the drive.
EV2 AC Input Over Current	1. Check line voltage. 2. Verify the unit is operating within specified parameters. 3. Replace Drive
EV2 DC Bus Over Voltage	1. Verify the unit is operating within specified parameters.
EV2 DC Bus Under Voltage	1. Verify the unit is operating within specified parameters.
EV2 AC Input Over Voltage	1. Verify the unit is operating within specified parameters.
EV2 AC Input Under Voltage	1. Verify the unit is operating within specified parameters.
EV2 HPS Open	1. Verify the unit is operating within specified parameters.
EV2 Power Module Over Temp	1. Verify proper airflow over drive. Clear any obstruction. 2. Replace drive.
EV2 Lost Rotor Position	1.Check Connections from drive to compressor. 2. Check the compressor motor windings. 3. Verify unit/compressor is operating within specified parameters. 4. Replace the drive.
EV2 DC Bus Voltage Low	1. Check line voltage. 2. Verify the unit is operating within specified parameters. 3. Restart drive (cycle power).
EV2 Intermediate Compressor Phase Overcurrent	1. Verify the unit is operating within specified parameters.
EV2 Compressor Phase Current Fold Back Timeout	1. Verify the unit is operating within specified parameters.
EV2 Auto Config Communication Timeout	1. Restart drive (cycle power).
EV2 Thermistor High Temp	1. Verify the unit is operating within specified parameters. 2. Check DLT connections to drive.
EV2 Power Module Temp High	1. Verify proper airflow over drive. Clear any obstruction. 2. Replace drive.
EV2 Comms to DSP Lost	1. Restart drive (cycle power). 2. Check communication cable connections to drive. 3. Contact Technical Service or replace drive.
EV2 Compressor Phase Current Imbalance	1. Check connections from drive to compressor. 2. Check the compressor motor windings. 3. Verify unit/compressor is operating within specified parameters. 4. Replace the drive.
EV2 Drive EEPROM Fault	1. Restart drive (cycle power). 2. If problem persists, contact Technical Service or replace drive.

Continued on page 60

TABLE 16 (cont.)

EV2 Compressor Model Config Error	1. Restart drive (cycle power). 2. If problem persists, contact Technical Service.
EV2 High Pressure Sensor Config Error	1. Restart drive (cycle power). 2. If problem persists, contact Technical Service.
EV2 Thermistor Low Temp	1. Verify the unit is operating within specified parameters. 2. Check DLT connections to drive.
EV2 Power Module Temp Low	1. Verify proper airflow over drive. Clear any obstruction. 2. Contact Technical Service or replace drive.
EV2 Fault Limit Lockout	1. Restart Drive (cycle power).
EV2 Power module foldback time out	1. Verify proper airflow over drive. Clear any obstruction. 2. Contact Technical Service or replace drive.
EV2 AC Input current foldback time out	1. Verify line voltage. 2.Verify the unit is operating within specified parameters. 3. Restart drive (cycle power). 4. Contact Technical Service or replace drive.
EV2 Modbus Communication Loss	This alarm is normal after a software update or cycle of power. Wait 2 min. to see if alarm persists before troubleshooting. 1. Restart drive (cycle power). 2. Check communication cable connections to drive. 3. Contact Technical Service or replace drive.
EV2 HPS Configuration Error	1. Restart drive (cycle power).
EV2 Communication Error	1. Restart drive (cycle power). 2. Check communication cable connections to drive. 3. Contact Technical Service or replace drive.

FIGURE 70
Wiring Diagram – 230V 1-Phase

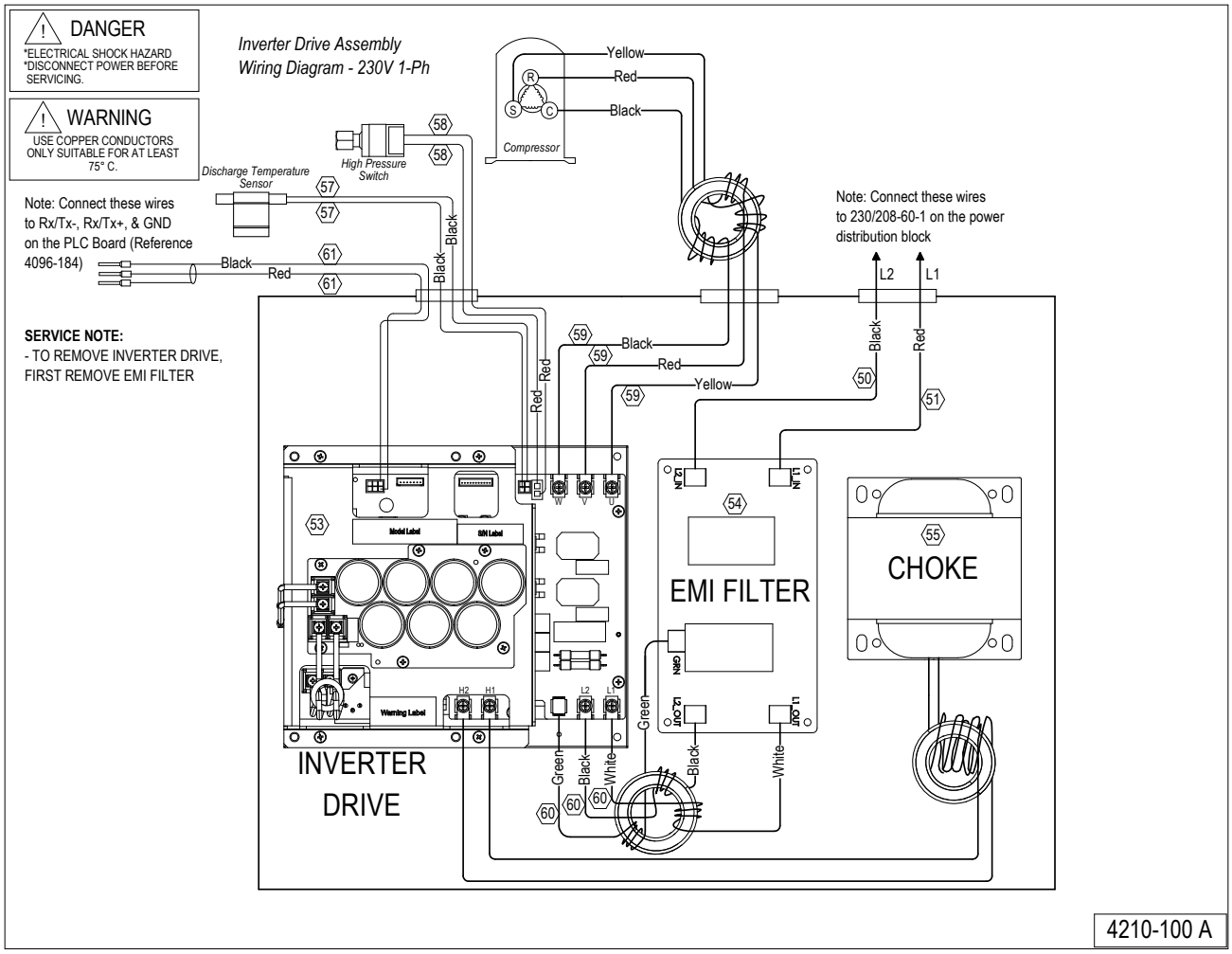


FIGURE 71
Wiring Diagram – 230V 3-Phase

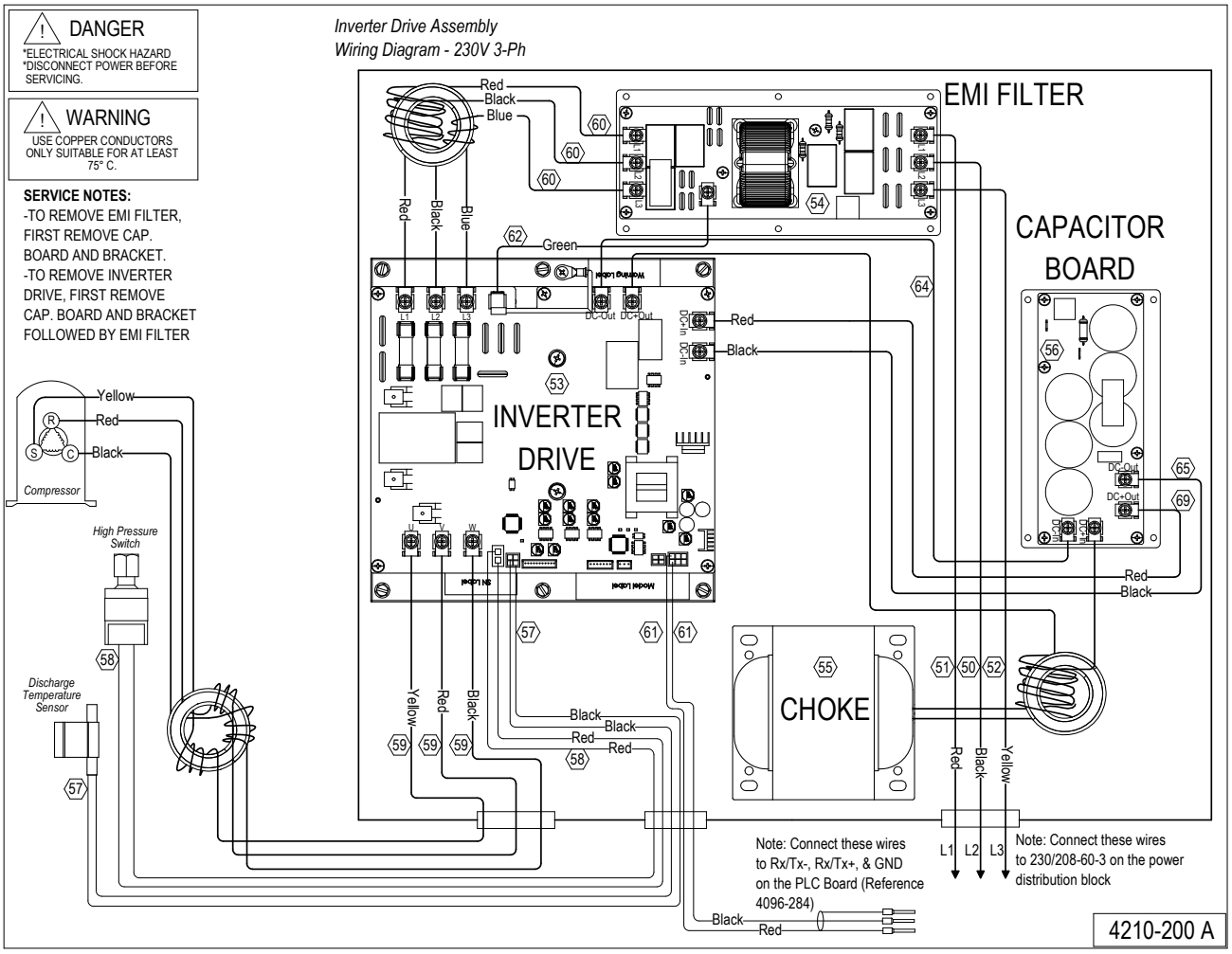
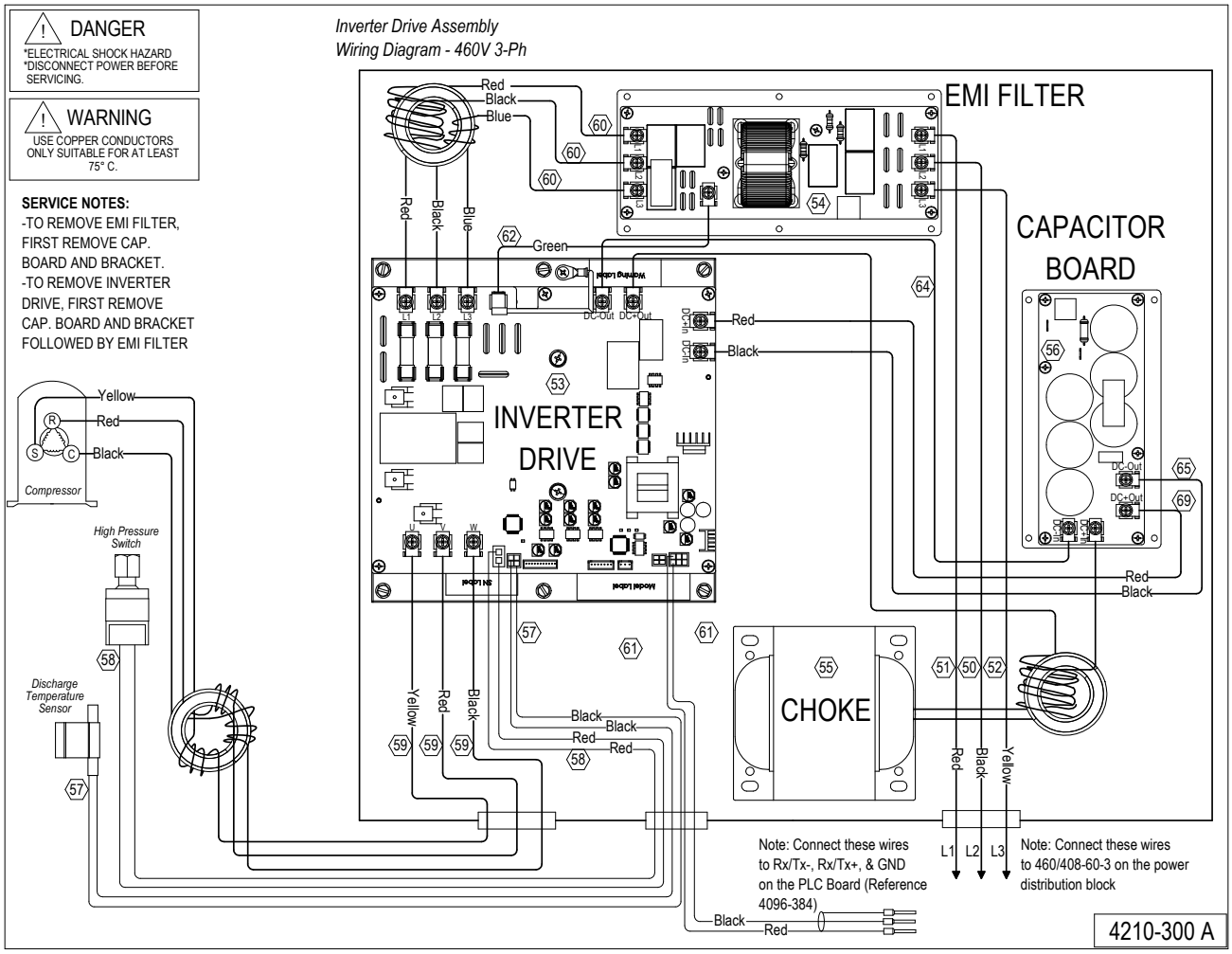


FIGURE 72
Wiring Diagram – 460V 3-Phase



Troubleshooting ECM™ 142R Outdoor Fan Motors

⚠ WARNING

- EXPOSED MOVING PARTS.
- DISCONNECT ALL ELECTRICAL POWER BEFORE SERVICING.
- FAILURE TO DO SO CAN RESULT IN SEVERE INJURY OR AMPUTATION.

⚠ WARNING

- HAZARD OF ELECTRICAL SHOCK.
- ELECTRICAL SHOCK CAN RESULT IN SERIOUS INJURY OR DEATH.
- DISCONNECT THE REMOTE ELECTRIC POWER SUPPLY OR SUPPLIES BEFORE SERVICING.

7961-755-1

⚠ CAUTION

Do not operate motor without fan blade attached. Such operations will cause the motor to oscillate up and down.

⚠ CAUTION

Only use the correct replacement motor from the manufacturer that is a direct replacement for the failed motor.

USING THE WRONG MOTOR VOIDS ALL WARRANTIES AND MAY PRODUCE UNEXPECTED RESULTS.

1. In normal operation, this motor may rock back and forth on start up. Do not replace if this is the only symptom identified.
2. If the system is operating properly, but the motor appears to run slower than it should, the motor is good. High efficiency systems with optimized fan blades are engineered to run slow to decrease noise. The Bard variable speed wall mount adjusts fan speed based upon varied outdoor ambient conditions or discharge pressure to optimize sound and unit efficiency.
3. If the system is noisy, freezing up, running a high head pressure, tripping the high pressure switch or compressor overload, check the following:
   a. Ensure cleanliness of condenser coil(s) and fan blade/shroud.
   b. Confirm the fan blade is not bent or deformed, isn't rubbing on the shroud and that it is tight on the motor shaft. Also ensure the motor is secure in its mounting system, and the mounting system is secure to the unit.
   c. The Bard variable speed wall mount is equipped with a low ambient control. This monitors discharge pressure to disable fan in cooling if discharge pressure falls below 240 psi, or if system is low on charge. (In heat pump {heating} mode, the low ambient fan cycling control is bypassed.)
   d. If motor is not running, go to next section.
4. If the motor does not appear to be running at the proper speed or does not shut off, refer to the next section for voltage checks to determine if the motor is getting the proper input signals.

   If the motor IS NOT receiving any communication, troubleshoot the communication issue using the diagnostic table for the fan logic control.
   a. Power is connected to motor leads:

      High voltage:

      Black connects to L1

      Red connects to L2

      Green/yellow connects to ground
   b. This motor uses a 0-10v signal to modulate fan operation:

      Blue connects to common on low voltage strip terminal #14

      Brown connects to Y3 on PLC

Replacing the Motor

This motor is replaced in one piece. The control cannot be replaced separately from the motor. Even if the control is remotely located, the replacement part will be a new control with harness and new motor.

The correct replacement motor from the manufacturer that is a direct replacement for the failed motor must be used.

Using the wrong motor voids all product warranties and may produce unexpected results.

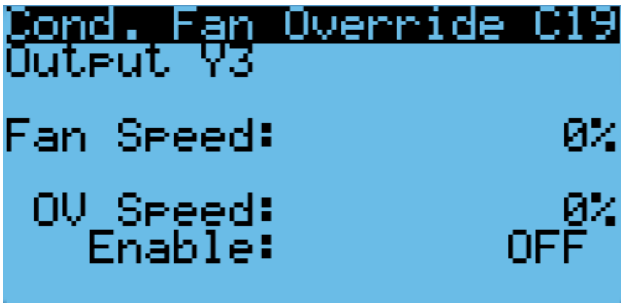
Always mount the replacement motor and control according to the manufacturers specifications using all required hardware to reduce vibration. Make sure all wires are free of the fan blade and not pinched in mountings or cabinet through points.

TABLE 17
Troubleshooting ECM™ 142R Outdoor Fan Motors

Check line power to motor	Check between black and red wires for line power.
	Verify ground by checking green/yellow wire to L1 and L2 line power.
Check for 0-10v Y3 on PLC to motor (against transformer "R" signal)	Check brown wire from Y3 on PLC, blue wire to terminal 14 common.
	Not energized in cooling mode until low ambient fan cycling control is closed by 240 psig refrigerant pressure.
	Fan should run when compressor is energized, unless low ambient control is open or target discharge pressure is not reached.

For troubleshooting, if a stable outdoor fan speed is required there is an override on screen C19 (see Figure 73). If an override speed is input and the enable is turned on, the speed of the outdoor fan will be set to the override speed for 5 minutes. If the enable is turned off or 5 min. has expired, the fan will return to normal operation.

FIGURE 73
Cond. Fan Override C19 Screen



Troubleshooting ECM™ Indoor Blower Motors

CAUTION: *Disconnect power from unit before removing or replacing connectors, or servicing motor. To avoid electric shock from the motor's capacitors, disconnect power and wait at least 5 minutes before opening motor.*

Symptom	Cause/Procedure
Motor rocks slightly when starting	This is normal start-up for ECM
Motor won't start: No movement	Check blower turns by hand Check power at motor Check low voltage 24 V TB to 24V COM Check low voltage connections 0-10v (Pin 10 to Pin 8) at motor (see Figure 77 on page 67) Check for unseated pins in connectors on motor harness Check motor for tight shaft Perform motor/control replacement check Perform **Moisture Check**
Motor won't start: Motor rocks but won't start	Check for loose or compliant motor mount Make sure blower wheel is tight on shaft Perform motor/control replacement check
Motor oscillates up and down while being tested off of blower	It is normal for motor to oscillate with no load on shaft
Motor starts but runs erratically: Varies up or down or intermittent	Check line voltage for variation or "sag" Check low voltage connections 0-10v (Pin 10 to Pin 8) at motor, unseated pins in motor harness connectors Check out system controls, thermostat Perform **Moisture Check**
Motor starts but runs erratically: "Hunts" or "puffs"	Does removing panel or filter reduce "puffing"? - Reduce restriction
Motor starts but runs erratically: Blower won't shut off	Current leakage from controls into Pins 10, 8 - Check for Triac-switched thermostat or solid-state relay
Excessive noise	Determine if it's air noise, cabinet, duct or motor noise; interview customer, if necessary
Excessive noise: Air noise	High static creating high blower speed? - Is airflow set properly? - Does removing filter cause blower to slow down? Check filter - Use low-pressure drop filter - Check/correct duct restrictions
Excessive noise: Noisy blower or cabinet	Check for loose blower housing, panels, etc. High static creating high blower speed? - Check for air whistling through seams in ducts, cabinets or panels - Check for cabinet/duct deformation
Evidence of Moisture: Motor failure or malfunction has occurred and moisture is present	Replace motor and **Perform Moisture Check**
Evidence of Moisture: Evidence of moisture present inside air mover	Perform **Moisture Check**

Do's and Dont's	
Do	**Don't**
Check out motor, controls, wiring and connections thoroughly before replacing motor	Automatically assume motor is bad
Orient connectors down so water can't get in - Install "drip loops"	Locate connectors above 8 and 4 o'clock positions
Use authorized motor and model #s for replacement	Replace one motor or control model # with another (unless an authorized replacement)
Keep static pressure to a minimum: - Recommend high efficiency, low static filters - Recommend keeping filters clean - Design ductwork for minimum static, maximum comfort - Look for and recommend ductwork improvement, where necessary	Use high pressure drop filters—some have ½" H2O drop! Use restricted returns
Size equipment wisely	Oversize system then compensate with low airflow
Check orientation before inserting motor connectors	Plug in power connector backwards Force plug

Moisture Check

- Connectors are oriented "down" (or as recommended by equipment manufacturer)
- Arrange harness with "drip loop" under motor
- Is condensate drain plugged?
- Check for low airflow (too much latent capacity)
- Check for undercharged condition
- Check and plug leaks in return ducts, cabinet

Comfort Check

- Check proper airflow settings
- Low static pressure for lowest noise
- Thermostat in bad location?

Replacing ECM Control Module

The following steps must be taken to replace the control module for the GE variable-speed indoor blower motor:

1. MUST have the correct replacement module. The controls are factory programmed for specific operating modes. Even though they look alike, different modules may have completely different functionality.

   Using the wrong control module voids all product warranties and may produce unexpected results.
2. Begin by removing AC power from the unit being serviced. **Do not work on the motor with AC power applied.** To avoid electric shock from the motor's capacitors, disconnect power and wait at least 5 minutes before opening motor.
3. It is not necessary to remove the motor from the blower assembly, nor the blower assembly from the unit. Unplug the two cable connectors to the motor control assembly. There are latches on each connector. **Do not pull on the wires.** The plugs remove easily when properly released.
4. Locate the screws that retain to the motor control bracket to the sheet metal of the unit and remove them. Remove two (2) nuts that retain the control to the bracket and then remove two (2) nuts that retain sheet metal motor control end plate (see Figure 74).
5. Using thumb and forefinger to squeeze the latch tab and the opposite side of the connector plug and gently pulling the connector, disconnect the three (3) wires interior of the motor control. **Do not pull on the wires; grip the plug only.** See Figure 74.
6. The control module is now completely detached from the motor. Verify with a standard ohmmeter that the resistance from each motor lead (in the motor plug just removed) to the motor shell is >100K ohms (see Figure 75). (Measure to unpainted motor end plate.) If any motor lead fails this test, do not proceed to install the control module; **the motor is defective and must be replaced.** Installing the new control module will cause it to fail also.
7. Verify that the replacement control is correct for the application. Refer to the manufacturer's authorized replacement list. **Using the wrong control will result in improper or no blower operation.** Orient the control module so that the 3-wire motor plug can be inserted into the socket in the control. Carefully insert the plug and press it into the socket until it latches. **A slight click will be heard when properly inserted.**
8. Reverse Steps #5, 4 and 3 to reconnect the motor control to the motor wires, securing the motor control cover plate, mounting the control to the bracket and mounting the motor control bracket back into the unit. **Make sure the orientation selected for replacing the control ensures the control's cable connectors will be located downward in the application so that water cannot run down the cables and into the control. Do not overtighten the bolts.**
9. Plug the 16-pin control plug into the motor. The plug is keyed. Make sure the connector is properly seated and latched.
10. Plug the 5-pin power connector into the motor. Even though the plug is keyed, **observe the proper orientation. Do not force the connector.** It plugs in very easily when properly oriented. **Reversing this plug will cause immediate failure of the control module.**
11. Final installation check. Make sure the motor is installed as follows:
    a. Motor connectors should be oriented between the 4 o'clock and 8 o'clock positions when the control is positioned in its final location and orientation.
    b. Add a drip loop to the cables so that water cannot enter the motor by draining down the cables (see Figure 76).

The installation is now complete. Reapply AC power to the HVAC equipment and verify that the new motor control module is working properly. Follow the manufacturer's procedures for disposition of the old control module.

Figure 74
Control Disassembly

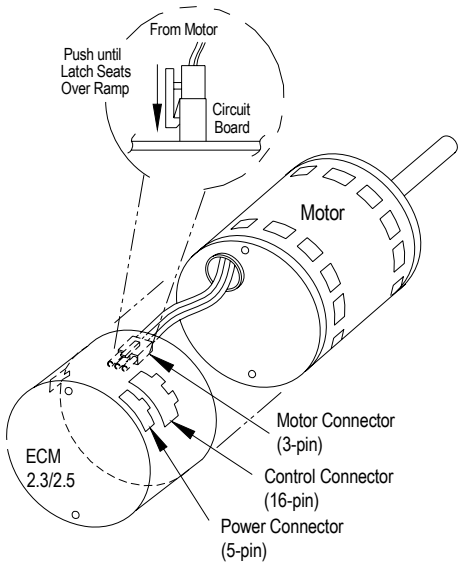


Figure 75
Winding Test

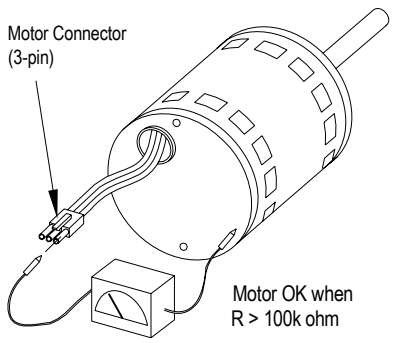


Figure 76
Drip Loop

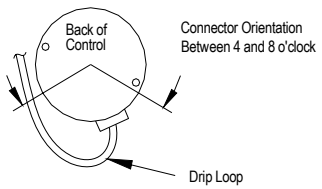
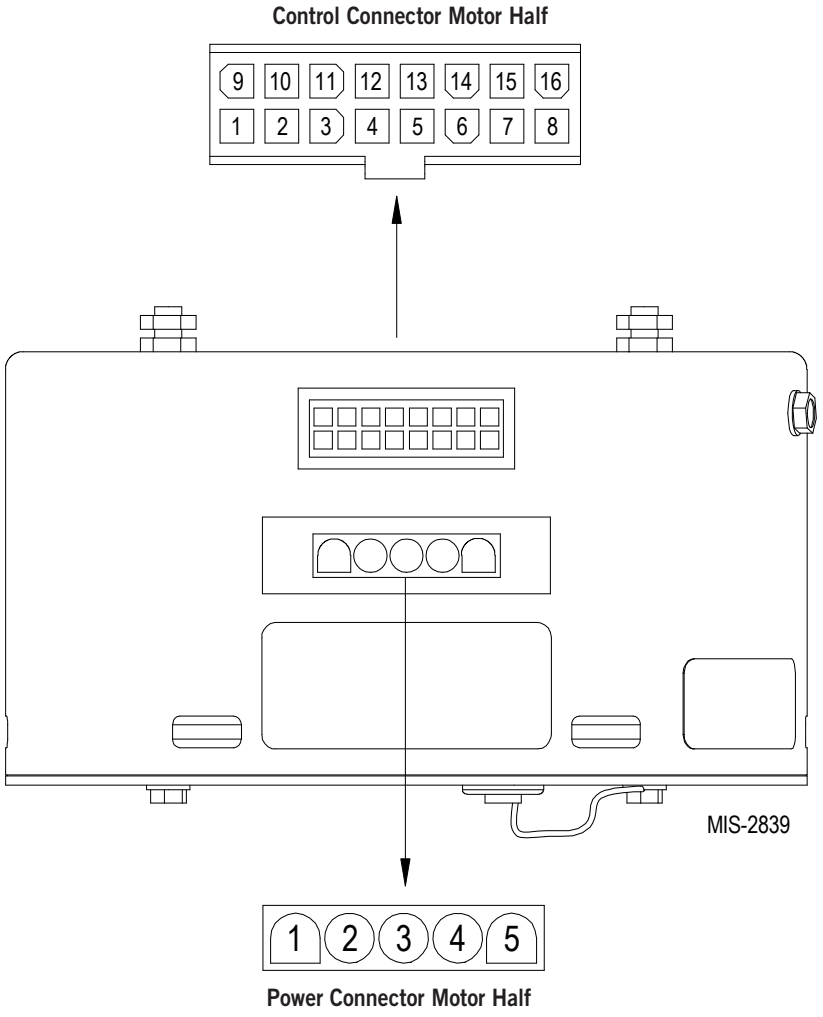


FIGURE 77
Blower Motor Connectors



Blower Motor Power Connector	
PWB Header	**AMP 1-350945-0**
PIN	**Description**
1	Jumper Pin 1 to Pin 2 for 120VAC Line Input Only ①
2	
3	Chassis Ground
4	AC Line
5	AC Line

Blower Motor Control Connector	
Control Connector	**AMP 770613-1**
1	Unused
2	24v common
3	24v
4	Unused
5	0-10v Input
6 – 16	Unused

Suggested mating connector:
Housing — AMP 350809-1
Contact — AMP 350537-1

① ***WARNING*** – *Applying 240VAC line input with PIN 1 to PIN 2 jumper in place will permanently damage unit.*

For troubleshooting, if a stable blower speed is required there is an override on screen C19 (see Figure 73 on page 64). If an override speed is input and the enable is turned on, the speed of the blower will be set to the override speed for 5 minutes. If the enable is turned off or 5 min. has expired, the blower will return to normal operation.

Modbus Communication Line

The communication wires are polarity sensitive; however, reversing the polarity on either end will not damage the devices. Before opening the drive cover, ensure the unit supply voltage has been turned off and locked out. Check the termination points of the communication wires by comparing them to the wiring diagram first if there is any chance that they have been altered. If there is any question about the polarity of the connections, reverse the connections on one of the devices (control panel or inverter drive) and see if communication is restored. To verify the wires are not damaged or broken, continuity of the wires should also be checked. Remove the wires from the devices and connect the two communication wires on one end and check for continuity on the two wires at the opposite end. If there is no continuity the wires will need to be repaired or replaced.

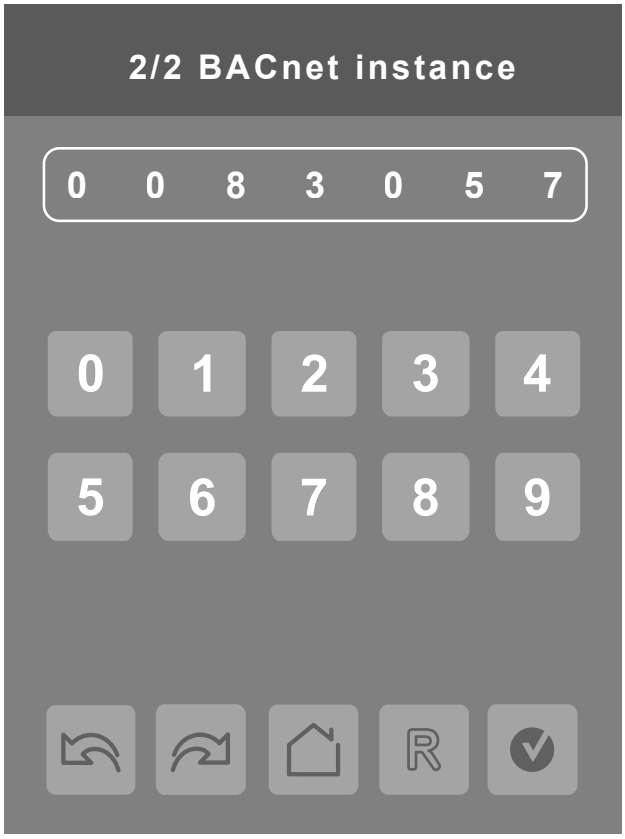
BACnet

In the event that there is a communication alarm/error between the unit and the room controller (BrightStat), the first thing to check is the device instance. (If the unit and controller are on a network with other devices, the first step should be to isolate them from the network.) The instance number is how the room controller (BrightStat) is identified and the same instance number must be present in the unit and controller. In the unit, the controller instance number can be seen or changed on the BACnet configuration screen shown in Figure 78.

FIGURE 78
BACnet Configuration

In the room controller (BrightStat), the instance number can be viewed or changed by navigating to the Network screens. Touch and hold the top middle of the screen for 3 seconds. In the menu, select Network and navigate to the screen shown in Figure 79.

FIGURE 79
BACnet Instance

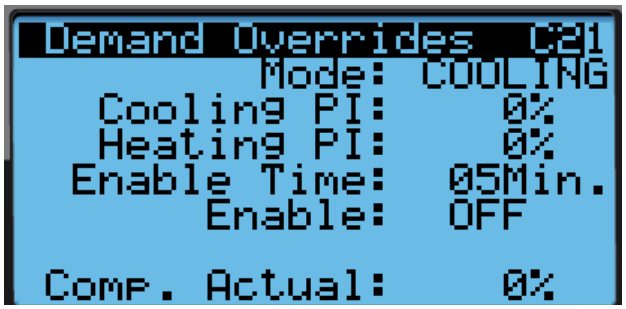


The controller instance number in the unit and the instance number in the controller must be the same for the devices to communicate. If the instance numbers are set correctly, the next step is to verify that the communication wiring is correct. The communication wires are polarity sensitive; however, reversing the polarity on either end will not damage the devices. Terminals 1 in the unit and terminal 13 in the controller should be connected. Terminal 2 in the unit should be connected to terminal 14 in the controller. If there is any question about the polarity of the connections, reverse the connections on one of the devices and see if communication is restored. To verify the wires are not damaged or broken, continuity of the wires should also be checked. Remove the wires from the devices and connect the two communication wires on one end and check for continuity on the two wires at the opposite end. If there is no continuity the wires will need to be repaired or replaced.

Compressor

To check the charge or troubleshoot the compressor, it may be necessary to lock the compressor into a steady state. When this is necessary, overrides for the heating/cooling can be found on screen C21 in the I/O configuration menu of the PLD Pro (see Figure 80). On this screen there are multiple settings that will need to be adjusted. Before adjusting these settings, make sure the room controller (Brightstat) is communicating with the unit and the mode is set to off. This will ensure that the compressor can be observed returning to 0 when Enable is turned off and not to a heating or cooling demand determined speed. These overrides should only be utilized by a qualified service provider.

FIGURE 80
Demand Overrides C21 Screen



The first setting is Mode, which will tell the unit whether heating or cooling is required. The next two settings are the demand percentages for heating and cooling. The heating and cooling demand can be set, but the compressor will only respond to the percentage that matches the mode setting.

The next setting is the Enable Time. This setting will determine how long the unit will remain in override once the enable toggle is set to “ON”. This setting can be set up to 30 minutes to allow for ample troubleshooting time. Remember that when this override is used, the unit will respond as if the room controller (Brightstat) is commanding the unit to heat or cool and all devices will respond as expected in a normal heating or cooling call. **Make sure to be clear of all mechanical and electrical hazards while troubleshooting with this override.**

The final setting is the Enable point and this enacts all the previous settings once toggled to "ON". The toggle can be turned off prior to reaching the time and should be set to "OFF" as soon as troubleshooting is complete. While using the override, it is important to check the Comp. Actual percentage at the bottom of the screen. Features such as boost mode, quiet mode, mitigation calculations, etc. will all be active while using the override. This may mean that the compressor may not move to the demand percentage without adjusting option(s) or if the conditions are adverse (for example, high outdoor ambient temperature). See Table 18 for the optimal demand settings for checking charge.

Refer to ***Demand Overrides C21*** on page 40 for more information.

TABLE 18
Optimal Demand Settings

	W3HY-*	W3HYD*	W5HY-*	W5HYD*
Cooling	38%	38%	40%	40%
Heating	33%	33%	49%	49%

8301-067 Outdoor Temperature/Humidity Sensor

8301-067 Sensor Connections

This unit utilizes a two wire 4-20mA signal from the 8301-067 sensor to communicate outdoor humidity and a 10KΩ Type III (AN) thermocouple from the 8301-067 sensor to communicate outdoor temperature. The humidity sensor is connected to the sensor control board via the J13 connector. The thermocouple wires are loose in the sensor housing and require a butt splice connector or wire nut to connect to the main unit wiring harness. See Figures 80 and 82 for sensor wiring and terminal location.

Table 19 (page 72) and Table 20 (page 74) are correlation charts for troubleshooting the sensor with a test meter:

Table 19: Temperature to Thermistor Resistance
Table 20: Relative Humidity to Humidity Sensor Current Output

FIGURE 81
8301-067 Sensor Electrical Connections

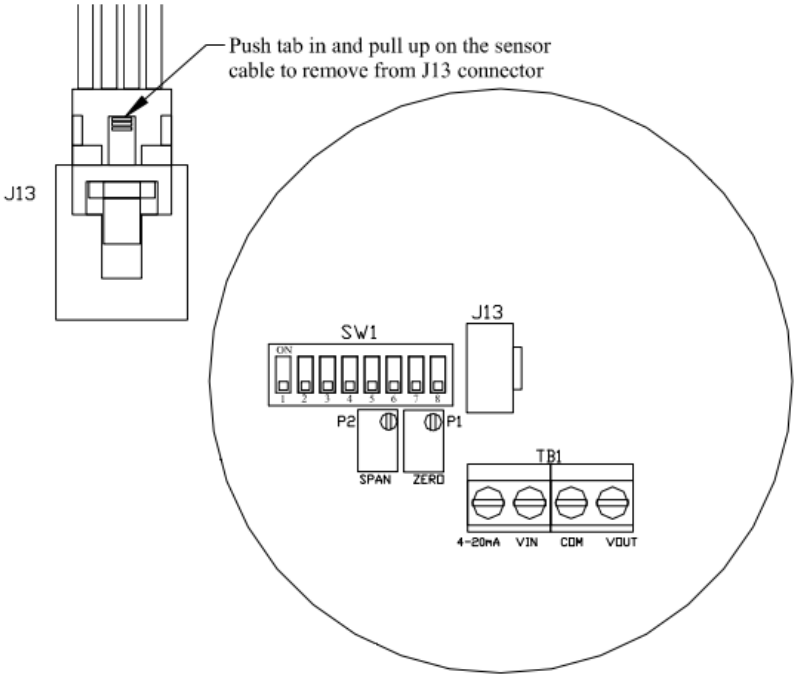
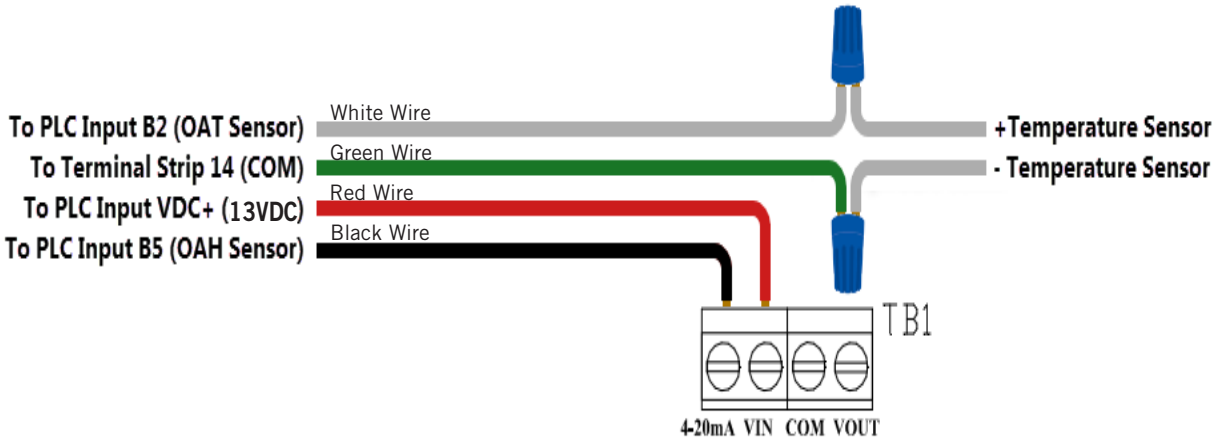


FIGURE 82
8301-067 Sensor Terminal Connections



8301-067 Outdoor Temperature Sensor Troubleshooting

To verify sensor operation:

1. Remove lid from outdoor temperature/humidity sensor.
2. Remove wire nuts from green and white wires (see Figure 82).
3. Use a temperature probe (preferred method) or local weather data to find ambient temperature conditions.
4. Using an ohmmeter or resistance mode on a multimeter, measure resistance across white leads leading to the temperature sensor (see Figure 83).
5. Cross reference readings with Table 19 on page 72.
   A. If readings are consistent with reference temperature, check wiring or offset in PLC if outdoor temp value on PLC does not match.
   B. If readings do not match, replace sensor.

FIGURE 83
8301-067 Sensor: Temperature Probe Troubleshooting

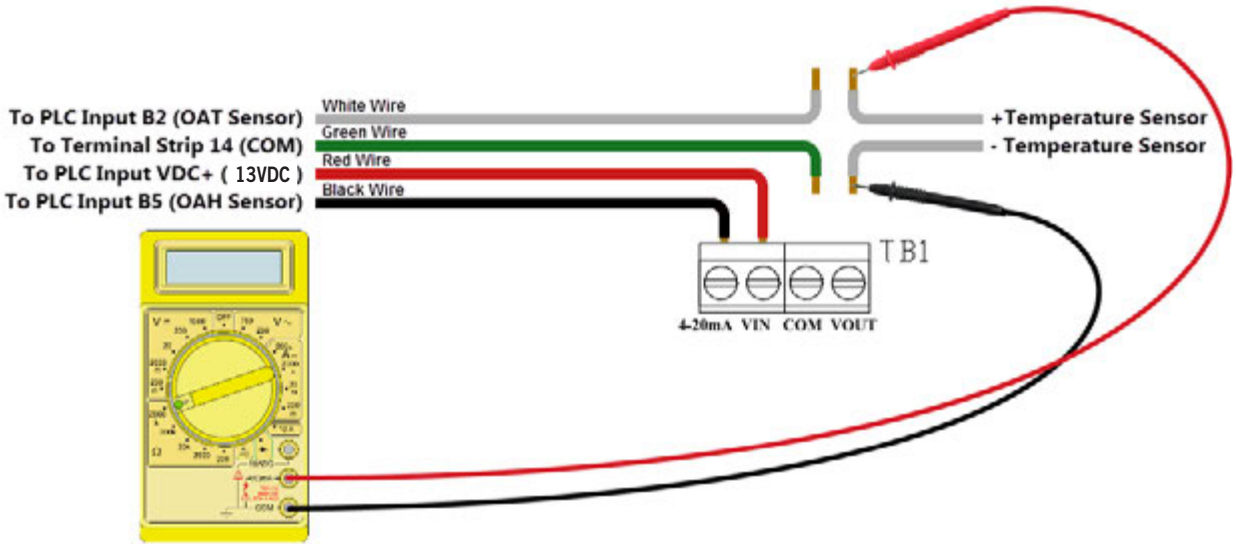


TABLE 19
8301-067 Sensor: Temperature to Thermistor Resistance

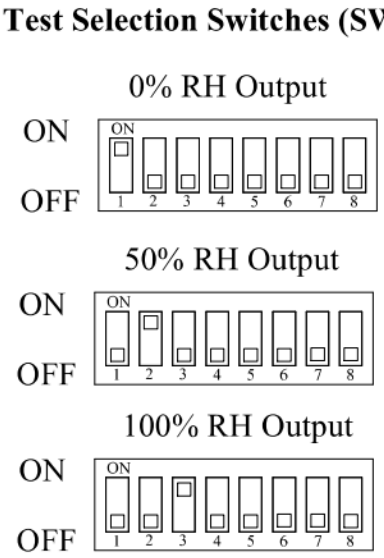
Temperature		Resistance
F	C	Ω
-25	-31.7	148,453
-24	-31.1	143,910
-23	-30.6	139,521
-22	-30.0	135,281
-21	-29.4	131,182
-20	-28.9	127,221
-19	-28.3	123,393
-18	-27.8	119,692
-17	-27.2	116,113
-16	-26.7	112,654
-15	-26.1	109,308
-14	-25.6	106,073
-13	-25.0	102,943
-12	-24.4	99,917
-11	-23.9	96,988
-10	-23.3	94,155
-9	-22.8	91,414
-8	-22.2	88,761
-7	-21.7	86,194
-6	-21.1	83,709
-5	-20.6	81,304
-4	-20.0	78,976
-3	-19.4	76,721
-2	-18.9	74,538
-1	-18.3	72,425
0	-17.8	70,377
1	-17.2	68,395
2	-16.7	66,474
3	-16.1	64,613
4	-15.6	62,811
5	-15.0	61,064
6	-14.4	59,372
7	-13.9	57,731
8	-13.3	56,142
9	-12.8	54,601
10	-12.2	53,107
11	-11.7	51,658
12	-11.1	50,254
13	-10.6	48,892
14	-10.0	47,572
15	-9.4	46,291
16	-8.9	45,049
17	-8.3	43,844
18	-7.8	42,675
19	-7.2	41,541
20	-6.7	40,441
21	-6.1	39,373
22	-5.6	38,336
23	-5.0	37,330
24	-4.4	36,354
25	-3.9	35,406
26	-3.3	34,486
27	-2.8	33,593
28	-2.2	32,725
29	-1.7	31,883
30	-1.1	31,065
31	-0.6	30,270
32	0.0	29,499
33	0.6	28,749
34	1.1	28,020
35	1.7	27,313
36	2.2	26,625
37	2.8	25,957
38	3.3	25,308
39	3.9	24,676
40	4.4	24,063
41	5.0	23,467
42	5.6	22,887
43	6.1	22,323
44	6.7	21,775
45	7.2	21,242
46	7.8	20,724
47	8.3	20,220
48	8.9	19,730
49	9.4	19,253
50	10.0	18,789
51	10.6	18,338
52	11.1	17,898
53	11.7	17,471
54	12.2	17,055
55	12.8	16,651
56	13.3	16,257
57	13.9	15,873
58	14.4	15,500
59	15.0	15,137
60	15.6	14,783
61	16.1	14,439
62	16.7	14,104
63	17.2	13,777
64	17.8	13,459
65	18.3	13,150
66	18.9	12,848
67	19.4	12,554
68	20.0	12,268
69	20.6	11,989
70	21.1	11,718
71	21.7	11,453
72	22.2	11,195
73	22.8	10,943
74	23.3	10,698
75	23.9	10,460
76	24.4	10,227
77	25.0	10,000
78	25.6	9779
79	26.1	9563
80	26.7	9353
81	27.2	9148
82	27.8	8948
83	28.3	8753
84	28.9	8563
85	29.4	8377
86	30.0	8196
87	30.6	8020
88	31.1	7848
89	31.7	7680
90	32.2	7516
91	32.8	7356
92	33.3	7200
93	33.9	7048
94	34.4	6899
95	35.0	6754
96	35.6	6612
97	36.1	6474
98	36.7	6339
99	37.2	6207
100	37.8	6079
101	38.3	5953
102	38.9	5831
103	39.4	5711
104	40.0	5594
105	40.6	5480
106	41.1	5368
107	41.7	5259
108	42.2	5153
109	42.8	5049
110	43.3	4947
111	43.9	4848
112	44.4	4751
113	45.0	4656
114	45.6	4563
115	46.1	4473
116	46.7	4384
117	47.2	4298
118	47.8	4213
119	48.3	4131
120	48.9	4050
121	49.4	3971
122	50.0	3894
123	50.6	3818
124	51.1	3744
125	51.7	3672

8301-067 Humidity Sensor Test Value Outputs

This sensor has the ability to output fixed test signals when testing/troubleshooting sensor operation. These settings are to be used for sensor testing/ troubleshooting only and need to be removed before unit can resume normal operation. These settings allow the sensor board to output 0% RH, 50% RH and 100% RH. When these settings are active, the actual humidity sensor is ignored. DIP switches 1, 2 and 3 are used to override the output to a test signal. See Figure 84 for DIP switch/output configuration.

NOTE: *If any DIP switches are disrupted, they will need to be returned to the off state in order for the humidity sensor to return to normal operation.*

FIGURE 84
8301-067 DIP Switch/Output Configuration



8301-067 Outdoor Humidity Sensor Troubleshooting

To verify sensor operation:

1. Remove lid from outdoor temperature/humidity sensor.
2. Loosen and remove black wire from the 4-20 mA input of TB1 (see Figure 82 on page 70).
3. Use an RH meter (preferred method) or local weather data to find accurate RH reading.
4. Using an ohmmeter or amperage mode on a multimeter, measure the amperage through the black 4-20 mA wire leading to the PLC (see Figure 85).
5. Cross reference readings with Table 20 on page 74.
   A. If readings are consistent with reference humidity, verify the DIP switches are all in the off position, check wiring or offset in PLC if outdoor humidity value on PLC does not match.
   B. If readings do not match, replace sensor.

FIGURE 85
8301-067 Sensor: Humidity Probe Troubleshooting

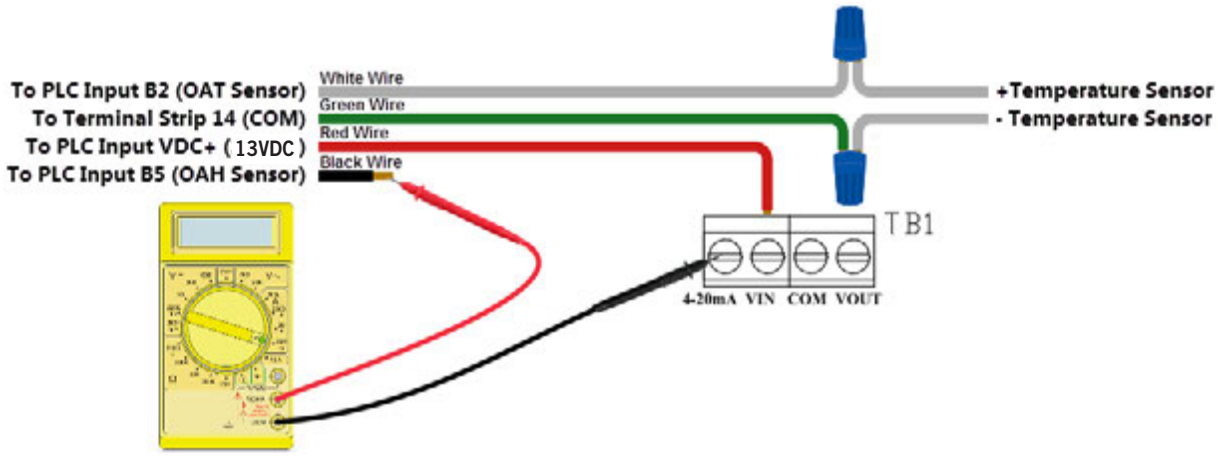


TABLE 20
8301-067 Sensor: Relative Humidity to Humidity Sensor Current Output

Humidity	Signal
% RH	mA
0	4.000
1	4.160
2	4.320
3	4.480
4	4.640
5	4.800
6	4.960
7	5.120
8	5.280
9	5.440
10	5.600
11	5.760
12	5.920
13	6.080
14	6.240
15	6.400
16	6.560
17	6.720
18	6.880
19	7.040
20	7.200
21	7.360
22	7.520
23	7.680
24	7.840
25	8.000
26	8.160
27	8.320
28	8.480
29	8.640
30	8.800
31	8.960
32	9.120
33	9.280

Humidity	Signal
% RH	mA
34	9.440
35	9.600
36	9.760
37	9.920
38	10.080
39	10.240
40	10.400
41	10.560
42	10.720
43	10.880
44	11.040
45	11.200
46	11.360
47	11.520
48	11.680
49	11.840
50	12.000
51	12.160
52	12.320
53	12.480
54	12.640
55	12.800
56	12.960
57	13.120
58	13.280
59	13.440
60	13.600
61	13.760
62	13.920
63	14.080
64	14.240
65	14.400
66	14.560
67	14.720

Humidity	Signal
% RH	mA
68	14.880
69	15.040
70	15.200
71	15.360
72	15.520
73	15.680
74	15.840
75	16.000
76	16.160
77	16.320
78	16.480
79	16.640
80	16.800
81	16.960
82	17.120
83	17.280
84	17.440
85	17.600
86	17.760
87	17.920
88	18.080
89	18.240
90	18.400
91	18.560
92	18.720
93	18.880
94	19.040
95	19.200
96	19.360
97	19.520
98	19.680
99	19.840
100	20.000

8406-157 Discharge Line Pressure Transducer

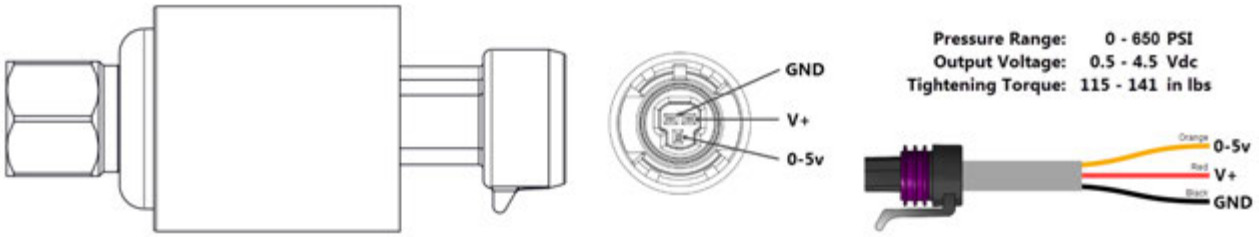


TABLE 21
8406-157 0-650 psi Pressure Transducer: Pressure/DC Voltage

Pressure		Signal
PSI	Bar	Vdc
0	0.0	0.500
5	0.3	0.531
10	0.7	0.562
15	1.0	0.592
20	1.4	0.623
25	1.7	0.654
30	2.0	0.685
35	2.4	0.715
40	2.7	0.746
45	3.1	0.777
50	3.4	0.808
55	3.7	0.838
60	4.1	0.869
65	4.4	0.900
70	4.8	0.931
75	5.1	0.962
80	5.4	0.992
85	5.8	1.023
90	6.1	1.054
95	6.5	1.085
100	6.8	1.115
105	7.1	1.146
110	7.5	1.177
115	7.8	1.208
120	8.2	1.238
125	8.5	1.269
130	8.8	1.300
135	9.2	1.331
140	9.5	1.362
145	9.9	1.392
150	10.2	1.423
155	10.5	1.454
160	10.9	1.485

Pressure		Signal
PSI	Bar	Vdc
165	11.2	1.515
170	11.6	1.546
175	11.9	1.577
180	12.2	1.608
185	12.6	1.638
190	12.9	1.669
195	13.3	1.700
200	13.6	1.731
205	13.9	1.762
210	14.3	1.792
215	14.6	1.823
220	15.0	1.854
225	15.3	1.885
230	15.7	1.915
235	16.0	1.946
240	16.3	1.977
245	16.7	2.008
250	17.0	2.039
255	17.4	2.069
260	17.7	2.100
265	18.0	2.131
270	18.4	2.162
275	18.7	2.192
280	19.1	2.223
285	19.4	2.254
290	19.7	2.285
295	20.1	2.315
300	20.4	2.346
305	20.8	2.377
310	21.1	2.408
315	21.4	2.439
320	21.8	2.469
325	22.1	2.500

Pressure		Signal
PSI	Bar	Vdc
330	22.5	2.531
335	22.8	2.562
340	23.1	2.592
345	23.5	2.623
350	23.8	2.654
355	24.2	2.685
360	24.5	2.715
365	24.8	2.746
370	25.2	2.777
375	25.5	2.808
380	25.9	2.839
385	26.2	2.869
390	26.5	2.900
395	26.9	2.931
400	27.2	2.962
405	27.6	2.992
410	27.9	3.023
415	28.2	3.054
420	28.6	3.085
425	28.9	3.115
430	29.3	3.146
435	29.6	3.177
440	29.9	3.208
445	30.3	3.239
450	30.6	3.269
455	31.0	3.300
460	31.3	3.331
465	31.6	3.362
470	32.0	3.392
475	32.3	3.423
480	32.7	3.454
485	33.0	3.485
490	33.3	3.515

Pressure		Signal
PSI	Bar	Vdc
495	33.7	3.546
500	34.0	3.577
505	34.4	3.608
510	34.7	3.639
515	35.0	3.669
520	35.4	3.700
525	35.7	3.731
530	36.1	3.762
535	36.4	3.792
540	36.7	3.823
545	37.1	3.854
550	37.4	3.885
555	37.8	3.915
560	38.1	3.946
565	38.4	3.977
570	38.8	4.008
575	39.1	4.039
580	39.5	4.069
585	39.8	4.100
590	40.1	4.131
595	40.5	4.162
600	40.8	4.192
605	41.2	4.223
610	41.5	4.254
615	41.8	4.285
620	42.2	4.315
625	42.5	4.346
630	42.9	4.377
635	43.2	4.408
640	43.5	4.439
645	43.9	4.469
650	44.2	4.500

8406-158 Suction Pressure Transducer

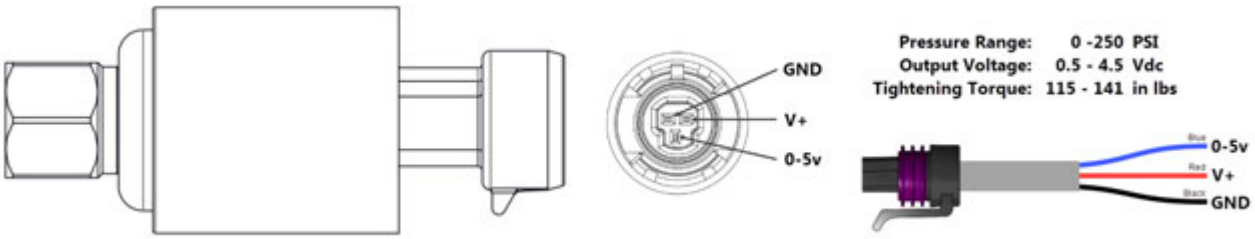


TABLE 22
8406-158 0-250 psi Pressure Transducer: Pressure/DC Voltage

Pressure		Signal
PSI	Bar	Vdc
0	0.0	0.500
2	0.1	0.532
4	0.3	0.564
6	0.4	0.596
8	0.5	0.628
10	0.7	0.660
12	0.8	0.692
14	1.0	0.724
16	1.1	0.756
18	1.2	0.788
20	1.4	0.820
22	1.5	0.852
24	1.6	0.884
26	1.8	0.916
28	1.9	0.948
30	2.0	0.980
32	2.2	1.012
34	2.3	1.044
36	2.4	1.076
38	2.6	1.108
40	2.7	1.140
42	2.9	1.172
44	3.0	1.204
46	3.1	1.236
48	3.3	1.268
50	3.4	1.300
52	3.5	1.332
54	3.7	1.364
56	3.8	1.396
58	3.9	1.428
60	4.1	1.460
62	4.2	1.492

Pressure		Signal
PSI	Bar	Vdc
64	4.4	1.524
66	4.5	1.556
68	4.6	1.588
70	4.8	1.620
72	4.9	1.652
74	5.0	1.684
76	5.2	1.716
78	5.3	1.748
80	5.4	1.780
82	5.6	1.812
84	5.7	1.844
86	5.9	1.876
88	6.0	1.908
90	6.1	1.940
92	6.3	1.972
94	6.4	2.004
96	6.5	2.036
98	6.7	2.068
100	6.8	2.100
102	6.9	2.132
104	7.1	2.164
106	7.2	2.196
108	7.3	2.228
110	7.5	2.260
112	7.6	2.292
114	7.8	2.324
116	7.9	2.356
118	8.0	2.388
120	8.2	2.420
122	8.3	2.452
124	8.4	2.484
126	8.6	2.516

Pressure		Signal
PSI	Bar	Vdc
128	8.7	2.548
130	8.8	2.580
132	9.0	2.612
134	9.1	2.644
136	9.3	2.676
138	9.4	2.708
140	9.5	2.740
142	9.7	2.772
144	9.8	2.804
146	9.9	2.836
148	10.1	2.868
150	10.2	2.900
152	10.3	2.932
154	10.5	2.964
156	10.6	2.996
158	10.8	3.028
160	10.9	3.060
162	11.0	3.092
164	11.2	3.124
166	11.3	3.156
168	11.4	3.188
170	11.6	3.220
172	11.7	3.252
174	11.8	3.284
176	12.0	3.316
178	12.1	3.348
180	12.2	3.380
182	12.4	3.412
184	12.5	3.444
186	12.7	3.476
188	12.8	3.508
190	12.9	3.540

Pressure		Signal
PSI	Bar	Vdc
192	13.1	3.572
194	13.2	3.604
196	13.3	3.636
198	13.5	3.668
200	13.6	3.700
202	13.7	3.732
204	13.9	3.764
206	14.0	3.796
208	14.2	3.828
210	14.3	3.860
212	14.4	3.892
214	14.6	3.924
216	14.7	3.956
218	14.8	3.988
220	15.0	4.020
222	15.1	4.052
224	15.2	4.084
226	15.4	4.116
228	15.5	4.148
230	15.7	4.180
232	15.8	4.212
234	15.9	4.244
236	16.1	4.276
238	16.2	4.308
240	16.3	4.340
242	16.5	4.372
244	16.6	4.404
246	16.7	4.436
248	16.9	4.468
250	17.0	4.500

8408-044 Return Air Sensor/Suction Sensor

TABLE 23
8408-044 Sensor: Temperature/Resistance Curve J

Temperature		Resistance	Temperature		Resistance	Temperature		Resistance	Temperature		Resistance
°F	°C	Ω	°F	°C	Ω	°F	°C	Ω	°F	°C	Ω
-25	-31.7	196,871	13	-10.6	56,985	53	10.6	19,374	89	31.7	7507
-24	-31.1	190,099	14	-10.0	55,284	52	11.1	18,867	90	32.2	7334
-23	-30.6	183,585	15	-9.4	53,640	53	11.7	18,375	91	32.8	7165
-22	-30.0	177,318	16	-8.9	52,051	54	12.2	17,989	92	33.3	7000
-21	-29.4	171,289	17	-8.3	50,514	55	12.8	17,434	93	33.9	6840
-20	-28.9	165,487	18	-7.8	49,028	56	13.3	16,984	94	34.4	6683
-19	-28.3	159,904	19	-7.2	47,590	57	13.9	16,547	95	35.0	6531
-18	-27.8	154,529	20	-6.7	46,200	58	14.4	16,122	96	35.6	6383
-17	-27.2	149,355	21	-6.1	44,855	59	15.0	15,710	97	36.1	6239
-16	-26.7	144,374	22	-5.6	43,554	60	15.6	15,310	98	36.7	6098
-15	-26.1	139,576	23	-5.0	42,295	61	16.1	14,921	99	37.2	5961
-14	-25.6	134,956	24	-4.4	41,077	62	16.7	14,544	100	37.8	5827
-13	-25.0	130,506	25	-3.9	39,898	63	17.2	14,177	101	38.3	5697
-12	-24.4	126,219	26	-3.3	38,757	64	17.8	13,820	102	38.9	5570
-11	-23.9	122,089	27	-2.8	37,652	65	18.3	13,474	103	39.4	5446
-10	-23.3	118,108	28	-2.2	36,583	66	18.9	13,137	104	40.0	5326
-9	-22.8	114,272	29	-1.7	35,548	67	19.4	12,810	105	40.6	5208
-8	-22.2	110,575	30	-1.1	34,545	68	20.0	12,492	106	41.1	5094
-7	-21.7	107,010	31	-0.6	33,574	69	20.6	12,183	107	41.7	4982
-6	-21.1	103,574	32	0.0	32,634	70	21.1	11,883	108	42.2	4873
-5	-20.6	100,260	33	0.6	31,723	71	21.7	11,591	109	42.8	4767
-4	-20.0	97,064	34	1.1	30,840	72	22.2	11,307	110	43.3	4663
-3	-19.4	93,981	35	1.7	29,986	73	22.8	11,031	111	43.9	4562
-2	-18.9	91,008	36	2.2	29,157	74	23.3	10,762	112	44.4	4464
-1	-18.3	88,139	37	2.8	28,355	75	23.9	10,501	113	45.0	4367
0	-17.8	85,371	38	3.3	27,577	76	24.4	10,247	114	45.6	4274
1	-17.2	82,699	39	3.9	26,823	77	25.0	10,000	115	46.1	4182
2	-16.7	80,121	40	4.4	26,092	78	25.6	9760	116	46.7	4093
3	-16.1	77,632	41	5.0	25,383	79	26.1	9526	117	47.2	4006
4	-15.6	75,230	42	5.6	24,696	80	26.7	9299	118	47.8	3921
5	-15.0	72,910	43	6.1	24,030	81	27.2	9077	119	48.3	3838
6	-14.4	70,670	44	6.7	23,384	82	27.8	8862	120	48.9	3757
7	-13.9	68,507	45	7.2	22,758	83	28.3	8653	121	49.4	3678
8	-13.3	66,418	46	7.8	22,150	84	28.9	8449	122	50.0	3601
9	-12.8	64,399	47	8.3	21,561	85	29.4	8250	123	50.6	3526
10	-12.2	62,449	48	8.9	20,989	86	30.0	8057	124	51.1	3452
11	-11.7	60,565	49	9.4	20,435	87	30.6	7869			
12	-11.1	58,745	50	10.0	19,896	88	31.1	7686			

8301-066 Supply Air Sensor

TABLE 24
8301-066 Sensor: Temperature/Resistance

Temperature		Resistance
°F	°C	Ω
32	0	29,490
33.8	1	28,157
35.6	2	26,891
37.4	3	25,689
39.2	4	24,547
41	5	23,462
42.8	6	22,431
44.6	7	21,450
46.4	8	20,518
48.2	9	19,631
50	10	18,787
51.8	11	17,983
53.6	12	17,219
55.4	13	16,490
57.2	14	15,797
59	15	15,136
60.8	16	14,506
62.6	17	13,906
64.4	18	13,334
66.2	19	12,788
68	20	12,268
69.8	21	11,771
71.6	22	11,297
73.4	23	10,845
75.2	24	10,413
77	25	10,000
78.8	26	9606
80.6	27	9229
82.4	28	8869
84.2	29	8525
86	30	8196
87.8	31	7882
89.6	32	7581
91.4	33	7293
93.2	34	7018
95	35	6754

Temperature		Resistance
°F	°C	Ω
96.8	36	6501
98.6	37	6260
100.4	38	6028
102.2	39	5806
104	40	5594
105.8	41	5390
107.6	42	5195
109.4	43	5007
111.2	44	4828
113	45	4656
114.8	46	4490
116.6	47	4332
118.4	48	4180
120.2	49	4034
122	50	3893
123.8	51	3759
125.6	52	3629
127.4	53	3505
192.2	54	3386
131	55	3271
132.8	56	3160
134.6	57	3054
136.4	58	2952
138.2	59	2854
140	60	2760
141.8	61	2669
143.6	62	2582
145.4	63	2498
147.2	64	2417
149	65	2339
150.8	66	2264
152.6	67	2191
154.4	68	2122
156.2	69	2055
158	70	1990
159.8	71	1928

Temperature		Resistance
°F	°C	Ω
161.6	72	1868
163.4	73	1810
165.2	74	1754
167	75	1700
168.8	76	1648
170.6	77	1598
172.4	78	1550
174.2	79	1503
176	80	1458
177.8	81	1414
179.6	82	1372
181.4	83	1332
183.2	84	1293
185	85	1255
186.8	86	1218
188.6	87	1183
190.4	88	1149
192.2	89	1116
194	90	1084
195.8	91	1053
197.6	92	1023
199.4	93	994
201.2	94	967
203	95	940
204.8	96	913
206.6	97	888
208.4	98	864
210.2	99	840
212	100	817
213.8	101	795
215.6	102	774
217.4	103	753
219.2	104	733
221	105	713
222.8	106	694
224.6	107	676

Checking Temperature Sensor Outside Unit Circuit

1. Disconnect temperature sensor from board and from outdoor coil.
2. Use an ohmmeter to measure the resistance of the sensor. Also use ohmmeter to check for short or open.
3. Check resistance reading to chart of resistance. Use sensor ambient temperature. (Tolerance of part is ± 10%.)
4. If sensor resistance reads very low, sensor is shorted and will not allow proper operation of the heat pump control.
5. If sensor is out of tolerance, shorted, open or reads very low ohms, it should be replaced.

TABLE 25
Temperature F vs. Resistance R of Temperature Sensor

F	R	F	R	F	R	F	R
-25.0	196871	13.0	56985	53.0	19374	89.0	7507
-24.0	190099	14.0	55284	52.0	18867	90.0	7334
-23.0	183585	15.0	53640	53.0	18375	91.0	7165
-22.0	177318	16.0	52051	54.0	17989	92.0	7000
-21.0	171289	17.0	50514	55.0	17434	93.0	6840
-20.0	165487	18.0	49028	56.0	16984	94.0	6683
-19.0	159904	19.0	47590	57.0	16547	95.0	6531
-18.0	154529	20.0	46200	58.0	16122	96.0	6383
-17.0	149355	21.0	44855	59.0	15710	97.0	6239
-16.0	144374	22.0	43554	60.0	15310	98.0	6098
-15.0	139576	23.0	42295	61.0	14921	99.0	5961
-14.0	134956	24.0	41077	62.0	14544	100.0	5827
-13.0	130506	25.0	39898	63.0	14177	101.0	5697
-12.0	126219	26.0	38757	64.0	13820	102.0	5570
-11.0	122089	27.0	37652	65.0	13474	103.0	5446
-10.0	118108	28.0	36583	66.0	13137	104.0	5326
-9.0	114272	29.0	35548	67.0	12810	105.0	5208
-8.0	110575	30.0	34545	68.0	12492	106.0	5094
-7.0	107010	31.0	33574	69.0	12183	107.0	4982
-6.0	103574	32.0	32634	70.0	11883	108.0	4873
-5.0	100260	33.0	31723	71.0	11591	109.0	4767
-4.0	97064	34.0	30840	72.0	11307	110.0	4663
-3.0	93981	35.0	29986	73.0	11031	111.0	4562
-2.0	91008	36.0	29157	74.0	10762	112.0	4464
-1.0	88139	37.0	28355	75.0	10501	113.0	4367
0.0	85371	38.0	27577	76.0	10247	114.0	4274
1.0	82699	39.0	26823	77.0	10000	115.0	4182
2.0	80121	40.0	26092	78.0	9760	116.0	4093
3.0	77632	41.0	25383	79.0	9526	117.0	4006
4.0	75230	42.0	24696	80.0	9299	118.0	3921
5.0	72910	43.0	24030	81.0	9077	119.0	3838
6.0	70670	44.0	23384	82.0	8862	120.0	3757
7.0	68507	45.0	22758	83.0	8653	121.0	3678
8.0	66418	46.0	22150	84.0	8449	122.0	3601
9.0	64399	47.0	21561	85.0	8250	123.0	3526
10.0	62449	48.0	20989	86.0	8057	124.0	3452
11.0	60565	49.0	20435	87.0	7869		
12.0	58745	50.0	19896	88.0	7686		

SUPPLEMENTAL INSTRUCTIONS

Exporting Alarm Logs on UPC3 Controller

These instructions detail the process for exporting alarm logs on all UPC3 controllers, including the LC6000-200, WVHY, MEGA-TEC®, MULTI-TEC® and FUSION-TEC® WR series. This will need to be completed when contacting Technical Service.

Tools and Supplies Needed

- Laptop computer
- USB cable
- Personal anti-static grounding strap

Instructions

IMPORTANT: *Bard recommends the use of personal grounding straps to prevent static electricity shorts to electronic controls.*

To export an alarm log:

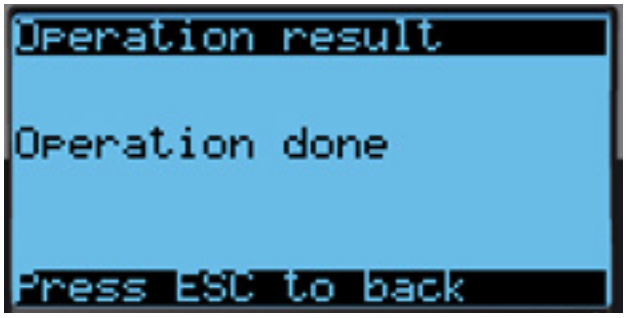
1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter USER password 1313.
3. Press UP or DOWN keys to scroll to **Settings**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Initialization**; press ENTER key.
5. Press UP or DOWN keys to scroll to **Alarm Export** (see Figure 1).
6. Press ENTER key to scroll to **File Name**.

NOTE: *Make sure **Memory type** is set as **INTERNAL FLASH MEMORY** to ensure proper download.*

FIGURE 1

7. Press UP or DOWN key to change the AL_EXPORT number, if desired.
8. Press ENTER key to scroll to **Confirm?**
9. Press UP or DOWN key to change value to **YES**; press ENTER key.
10. After download is complete, the **Operation done** screen will appear (see Figure 2).

FIGURE 2



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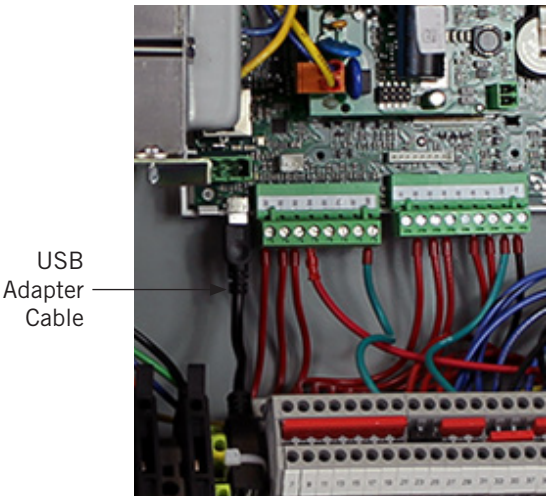
NOTE: *Do not connect the control board to the laptop using the USB cable before exporting as this will cause a* ***Cannot access file*** *message to appear and the log will not be saved. If this happens, remove USB connection, press ESCAPE key and redo Steps 8 and 9.*

11. Connect one end of USB cable to the short USB adapter cable on the bottom left corner of the control board (see Figure 3). Connect other end of USB cable to laptop.

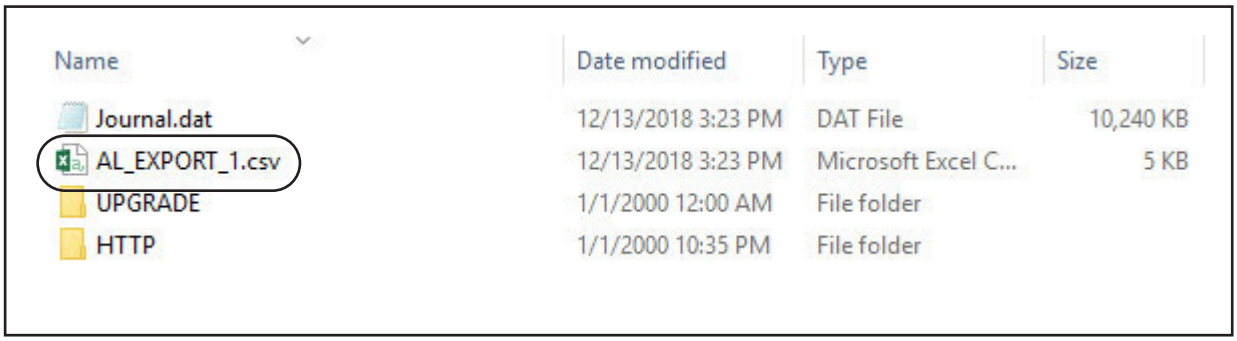
FIGURE 3



12. Once the connection has been made between control board and laptop, the laptop screen should display as shown in Figure 4. The unit will export the alarm log as an Excel file.

This completes the software update process.

FIGURE 4



SUPPLEMENTAL INSTRUCTIONS

Exporting I/O Logs on UPC3 Controller

These instructions detail the process for exporting 7 day I/O logs on all UPC3 controllers, including the LC6000-200, WVHY, MEGA-TEC®, MULTI-TEC® and FUSION-TEC® WR series. This will need to be completed when contacting Technical Service.

Tools and Supplies Needed

- Laptop computer
- USB cable
- Personal anti-static grounding strap

Instructions

IMPORTANT: *Bard recommends the use of personal grounding straps to prevent static electricity shorts to electronic controls.*

o export an alarm log:

1. Press MENU key to go to the Main Menu screen.
2. Use UP or DOWN keys and ENTER key to enter USER password 1313.
3. Press UP or DOWN keys to scroll to **Settings**; press ENTER key.
4. Press UP or DOWN keys to scroll to **Initialization**; press ENTER key.
5. Press UP or DOWN keys to scroll to **I/O Log Export**; (see Figure 1).

NOTE: *The screen descriptions may look slightly different depending on which controller is being accessed.*

6. Press ENTER key to scroll to **File Name**.

NOTE: *Make sure **Memory type** is set as **INTERNAL FLASH MEMORY** to ensure proper download.*

FIGURE 1

7. Press UP or DOWN key to change the file name number, if desired.

NOTE: *The first two letters of the file name will vary depending on which controller is being accessed.*

8. Press ENTER key to scroll to **Confirm?**
9. Press UP or DOWN key to change value to **YES**; press ENTER key.
10. After download is complete, the **Operation done** screen will appear (see Figure 2).

FIGURE 2

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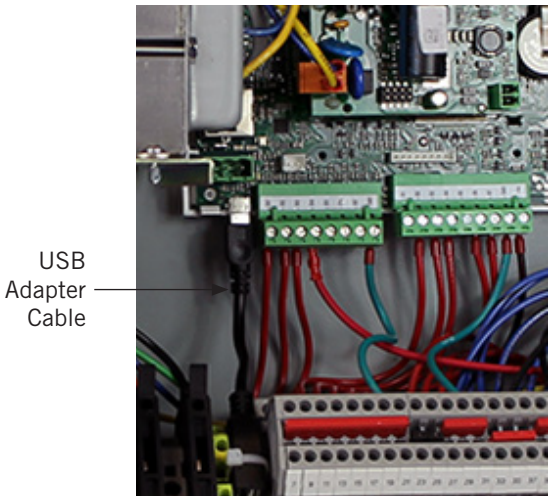
NOTE: *Do not connect the control board to the laptop using the USB cable before exporting as this will cause a* ***Cannot access file*** *message to appear and the log will not be saved. If this happens, remove USB connection, press ESCAPE key and redo Steps 8 and 9.*

11. Connect one end of USB cable to the short USB adapter cable on the bottom left corner of the control board (see Figure 3). Connect other end of USB cable to laptop.

FIGURE 3



12. Once the connection has been made between control board and laptop, the laptop screen should display as shown in Figure 4. The unit will export the I/O logs as Excel files.

This completes the software update process.

FIGURE 4