ThermAtlantic™
ENERGY PRODUCTS INCORPORATED

Hydronic Air Source Heat Pump

DX2W MODULE

CONTROLS MANUAL

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PREFACE

This document is intended for installers and customers. It goes over the various controller menu options available. If you have any questions do not hesitate to call us toll-free at 1-888-757-2210 or email us at support@thermatlantic.com.

INDICATORS & SWITCH

The ON/OFF Switch controls power to the DX2W controller, the HP Defrost Board and the Internet Gateway. Only use this switch if any of these seems to have locked-up or if maintenance is being carried out on the system. Note that the OFF setting has no effect on the Aux Boiler and is only meant to shut down the heat pump.

The green indicator on top represents a call for the heat pump to come on. Note that the heat pump may not actually come on immediately because it has an internal anti-short-cycle delay timer which prevents it from cycling on more often than every 5 minutes.

The yellow indicator lets you know when the AUX Boiler is running. It is important that the boiler's settings be setup correctly, that the Boiler Suppression Relay has been installed and that the Aux Balance Point be setup correctly since these will affect how often the boiler cuts in.

The red indicator lets you know when a compressor delay or stall condition is present. It may come on for up to 5 minutes before or after a defrost cycle to allow for improved pressure equalization but will stay on longer than that in the event that the outdoor heat pump has tripped-out on an error condition. The controller will attempt to recover from soft lockout conditions but a hard reset of the outdoor control power is required to clear any hard lockout conditions. Before resetting any hard lockout conditions you should check the error codes stored on the outdoor unit's defrost board and consult with the manufacturer's documentation to determine the cause in case it is something that needs to be remedied in order to protect the compressor from undue wear and to ensure optimum efficiency.

DISPLAY ICON LEGEND

The following icons displayed on the LCD screen represent the following conditions:

A call for heat or cooling when combined with the HP outdoor unit running icon will signify correct operation whereas a call without the HP running indicates either an anti-short-cycle delay of up to 5 minutes or a stall condition which should be confirmed by the red indicator. The boiler delay should be confirmed with the red LED on the external boiler suppression relay mounted to the boiler. Warm weather shutdown (WWSD) will ignore heat calls when the outdoor temperature is higher than the WWSD temperature.

USAGE LEVEL: USER or ADMIN

Options Highlighted in Grey represent advanced settings which can only be changed if the controller has been switched to ADMIN mode. To switch between USER and ADMIN modes, simply hold the two outside buttons together until the usage level changes on the LCD. It is recommended that installers use ADMIN and that homeowners restrict themselves to the default USER level of access unless they understand what they are doing.

1. DX2W V# Software Revision & Power ON/OFF EDIT

This is the first menu option which displays the software revision and allows you to turn the heat pump operation on or off. It is recommended that this option be used to disable the heat pump rather than switching the power off using the manual switch since auxiliary boiler power metering, internet monitoring and remote control are still enabled as long as the controller switch is ON.

2. HP MODE HEAT : COOL : TSTAT EDIT

This option allows you to set the operating mode of the heat pump. If the TSTAT option is selected it allows an external thermostat to set the mode. This requires the "O" terminal of the thermostat to be wired into the TSTAT O-IN terminal. If no thermostat connection is present in TSTAT mode heating mode will be enabled.

3. BUF TANK Temperature Display VIEW

Displays the current mean buffer tank temperature and is not meant to change the setpoint.

4. OUTDOOR Temperature Display VIEW

Displays the current outdoor temperature. Ensure outdoor sensor is located outside of direct sunlight and snow. If the sensor was installed inside or near the heat pump you can expect outdoor temp to rise during defrost and be a little colder during operation in heating mode and a little warmer during operation in cooling mode.

5. INDOOR Temperature Display VIEW

Displays the current indoor temperature assuming the sensor has been installed. We recommend that the sensor be installed in a central area of the home. It can be mounted separately or the sensor probe can be tucked into an existing thermostat if desired.

6. BUF SETPOINT Target Buffer Tank Temperature VIEW

Displays the current target buffer tank temperature and is not meant to be adjusted directly. In heating mode this value may change depending on outdoor temperature.

7. ENT WT Entering Water Temperature VIEW

Displays the current entering water temperature from the bottom of the buffer tank and into the heat exchanger. Note that displayed temperature is only meaningful when the circulator is running since the rest of the time the value shown represents standing water temperature in the pipes.

8. EXIT WT Exiting Water Temperature VIEW

Displays the current exiting water temperature from the heat exchanger to the top of the buffer tank. Note that displayed temperature is only meaningful when the circulator is running since the rest of the time the value shown represents standing water temperature in the pipes.

9. DELTA-T Temperature Differential VIEW

Displays the difference between exiting and entering water temperatures when the heat pump is running. The rest of the time this value is set to Zero since it is meaningless unless the heat pump is running. Note that a negative number is indicative of a defrost cycle in heating mode. It is also possible for small negative values to exist during the start of a cycle in the event that

the existing water pipe has cooled down more rapidly than the entering water pipe. Always wait 2-3 minutes before using values for diagnostic purposes since it takes a while for copper pipes and sensors to report accurately.

Delta-T is one of the most important variables to watch since it will reflect how much work is being done. It is important that the HP circulator be correctly sized and running at the recommended speed in order to achieve an optimal Delta-T of between 3-6°F. Lower values will indicate excessive flow through the HP circulator or inadequate heat output most likely caused by improper refrigerant charge. Higher values will reflect low flow rates through the heat exchanger but can also occur during mild weather due to increased heat output. Note that although a higher Delta-T may seem like a good thing it can result in premature compressor failure and should therefore not be ignored.

10. HP-IN Input Power from Heat Pump (kW/H) VIEW

Displays power being used by outdoor condenser. This calculation uses the voltage entered at the time of installation and also applies a compressor power factor of 0.9. With two stage heat pumps you will see a drop or rise in power depending on how many stages are running. It is also normal to see input power rise as the entering water temperature rises. Input power is an important diagnostic values in that higher values may indicate an improper refrigerant charge.

11. AUX BOIL Aux Boiler Input/Output (kW/H) VIEW

Displays power being used and output by the Auxiliary Electric Boiler. This calculation uses the voltage entered at the time of installation at an efficiency of 100%. This feature requires the use of an electric boiler and will not work with combustible fuel boilers. If you will be using an oil or gas boiler let us know and we can provide you with a software patch will estimate the amount of fuel consumed instead.

12. HP-OUT Output Power from Heat Pump (kW/H) VIEW

Displays power being output by the heat pump. Note that it takes a few minutes for temperatures to build-up and sensors to register correctly. The output power is based the Delta-T and the internal circulator's flow rate so make sure the flow is measured at the time of installation (covered later in this document). HP Output is one of the most important values used to determine if a heat pump has been correctly charged with refrigerant.

13. NET COP Net Coefficient of Performance VIEW

Displays the net or effective COP of the entire system. This means that both the heat pump and auxiliary boiler input power are taken into consideration during the calculation. If the value seems low, check to see if the yellow indicator is illuminated since this will tell you that the AUX boiler is running, thereby explaining the reduced NET COP. Efficiency percent is COP x 100.

During a cold start (when the buffer tank is cold in heating mode or hot in cooling mode) you may experience unbelievably high COPs. These are accurate but reflect the benefit of increased heat transfer when temperature differences are high. You should be reading COP's of 3-4 above freezing and values between 3-2 as it gets progressively colder. Defrost cycles are expressed in negative COPs since the heat pump is temporarily cooling the tank by extracting heat energy from the tank to melt ice on the outdoor coils. In cooling mode you will see a higher range of COPs than in heating mode and this is normal.

14. HP RUN Heat Pump Runtime VIEW

Displays how long the heat pump has been running in hours since the time it was installed. Note that this value is based on actual heat pump running time and not just on duration of call for the heat pump to come on. This value can only be reset remotely over the internet by the factory.

15. RTSL DEF Run-Time Since Last Defrost VIEW

Displays how much compressor run-time has passed since the last defrost cycle was detected. Defrost detection is dependent on proper calibration of the Defrost Delta-T value which is set to -2° by default. Note that most heat pumps will only defrost regularly when the outdoor temperature is cooler than 4°C / 39°F and that a defrost cycle may be forced every 6 hours of compressor run-time to re-circulate compressor between the Condenser and Evaporator. Prolonged durations during cold weather may indicate improper reversing valve operation.

16. OD DES Outdoor Design Temp (Heating) EDIT

This is the coldest outdoor temperature normally experienced in your climate. The DX2W controller will raise the buffer tank target temperature based on the slope of the line between an ambient indoor temperature of 20°C / 70°F and the outdoor design temperature. (This setting should also be used with the electric boiler)

17. HW DES Hot Water Design Temp EDIT

This is the temperature you want the hot water to be when the winter outdoor design temperature is reached. Outdoor design refers to the coldest normal temperature experienced during the winter in your climate. (This setting should also be used with the electric boiler)

18. HW MIN HP Hot Water Min Temp EDIT

This is the minimum hot water temperature setting for the buffer tank. The next few parameters will allow the target temperature to modulate based on outdoor temperature but this minimum water temperature is critical in ensuring reasonable thermal transfer and response times and should be set at least 5° higher than the Aux Boiler minimum temperature setting to prevent the boiler from wanting to come on once it gets colder than the balance point.

19. HW MAX HP Hot Water Max Temp EDIT

This is the maximum hot water temperature that the heat pump will try to produce. Although it is possible to heat water up to 50°C / 122°F it is strongly recommended that the max temp be kept no higher than 48°C / 118°F in order to prevent the outdoor heat pump condenser from tripping out on high pressure or high temperature.

20. HW DIF Hot Water Differential EDIT

This represents how many degrees the buffer tank temperature must fall below setpoint before the heat pump will be engaged to heat up the tank. It is recommended that this value be between 2-3°C / 4-5°F. If the heat pump is short cycling or coming on more often than necessary you should consider increasing this value.

21. DIV DIF Hot Water Diversion Differential EDIT

This represents how many degrees the buffer tank hot water target temperature has to fall before the DX2W internal 3 way mixing valve closes and diverts the system loop from the buffer

tank. This is a unique innovation of the DX2W module which allows buffer tank recovery in the event of defrost cycles, heavy heating loads and when it is colder than the outdoor balance point. It is recommended that this value be set between 9-13°C / 12-20°F depending on the thermal storage capacity of the heating system. Use a lower value for joist heating, forced air or convection and a higher value for concrete slabs and overpours. Note that the Diversion Valve setpoint is automatically set to within 2° of the Buffer Tank Setpoint which means the valve will open once the water temperature is within 2° of target so as to avoid unnecessary off cycling under high load conditions.

22. TT DLY Boiler Suppression Delay Period EDIT

Sets the delay period in minutes for how soon the boiler suppression relay should be deactivated. Signal to deactivate occurs when the buffer tank temperature drops below the Diversion Setpoint temperature (explained later). The purpose of the TT Delay is to filter out un-necessary boiler usage. For example, in heating mode when the heat pump goes into defrost it will temporarily cool down the buffer tank in order to melt the ice off the outdoor coil. Once the buffer tank temperature drops below the Diversion Setpoint the internal 3-way valve will close and divert the System Loop away from the buffer tank. The TT Delay period determines how long Boiler Suppression will continue once this occurs. The intent is to allow the heat pump to recover from temporary drops in buffer tank temperature without automatically allowing the Aux Boiler from coming. For most installations 10 minutes is a good starting value. Installations where PEX pipe is embedded in concrete throughout the home can use higher values such as 20-30 minutes given the higher thermal mass of the floor system.

23. AUX BPT Auxiliary Boiler Balance Point EDIT

Until this outdoor temperature is reached the DX2W controller will suppress the Aux Boiler from coming as long as nominal water temperatures are maintained. This variable should be determined in advance through the use of a heat loss calculation and compared with the expected heat output of the heat pump. During the first winter season this value can be changed to reflect the actual point at which the heat loss and heat pump output are equal.

24. Y2 BPT HP 2nd Stage Balance Point EDIT

For 2-stage heat pumps, this setting makes it possible to suppress unnecessary 2nd stage operation during mild winter weather. Note that the controller will engage 2nd stage regardless of outdoor temperature if the buffer tank temperature differential exceeds 1.5 times the hot or cold water differential setting. It is also possible that the outdoor heat pump may choose to go into 2nd stage on its own depending on Y2 Lock jumper settings. Note that the ODU ON Fan icon will switch from a slow to high fan speed to reflect when the controller calls for 2nd stage.

25. WWSD Warm Weather Shutdown Outside Temp EDIT

This setting allows you to suppress heat pump call for heating when the outdoor temperature is higher than the WWSD setting. The factory value is purposely set higher than it should be to reduce the chance of the heat pump refusing to come on during summer installations. If you are installing a system during warm weather you should either set it to cooling mode or raise the WWSD setting to force heat pump operation. Once the system has been commissioned this setting should be reduced to around 18°C / 65°F. Note that this value has no effect when cooling mode is enabled.

26. CW SETP Chilled Water Setpoint Temp EDIT

This is the coldest temperature setting for the buffer tank in cooling mode. If forced air is being used for cooling then you will want to use condensing water temperatures 2-5℃ / 35-40℉. However, if you have purchased the floor cooling option and will not be using forced air cooling or dehumidification you will want to raise this minimum temperature to 10-12℃ / 50-55℉. Note that in floor cooling mode the digital humidistat determines the dew point and modulates floor temperatures using the 3 way mixing valve so as not to allow condensation to form on the pipes. It should also be noted that the controller will report a Stall Condition if the existing water temperature drops below freezing. If your application requires colder water temps you will need to use glycol and let us know since we can patch your software to allow a lower setpoint.

27. CW DIF Chilled Water Differential EDIT

This represents how many degrees the buffer tank temperature must rise above setpoint before the heat pump comes back on to cool the tank. It is recommended that this value be between 3-5℃ / 5-8℉. If the heat pump is short cycling or coming on more often than necessary you should consider increasing this value.

28. COOL MV Open Mixing Valve in Cooling Mode EDIT

This setting is set to OFF by default so that chilled water is prevented from flowing through the floors in cooling mode. Enabling it with ON will allow floor cooling to occur using the chilled water temperatures in the buffer tank. This is not the same as using the optional dew point thermostat to modulate the mixing valve but is ideal for concrete embedded floor cooling applications in climates with relatively low indoor relative humidity. When using this mode be sure to set the chilled water setpoint above the lowest expected dew point temperature which is normally in the 60℉ range.

29. HP STALL Concurrent HP Delays or Stalls VIEW

Displays how many concurrent compressor delay or stall conditions have occurred. This value is cleared automatically once the heat pump restarts normally. Note that a nuisance value of 1 can sometimes occur as a result of compressor delays before or after defrost. Therefore do not be alarmed by the occasional value of 1 but look into possible issues with the outdoor heat pump should this value be greater than 2 or 3. With ThermAtlantic's internet monitoring service, technicians can be alerted by email when 3 or more concurrent stalls have been encountered.

30. LL TEMP Liquid Line Temperature VIEW

Displays liquid line temperature as it exits the heat exchanger in condensing mode but before the TXV in evaporator mode. This value is used to perform sub-cooling calculations used for determining proper refrigerant charge.

31. LL PRES Liquid Line Pressure VIEW

Displays liquid line pressure or high pressure as it exits the heat exchanger in condensing mode but before the TXV in evaporator mode. This value is used to perform sub-cooling calculations used for determining proper refrigerant charge.

32. SATURATION High Pressure Saturation Temp VIEW

Displays the saturation temperature of the liquid line or high pressure. This value is used to perform sub-cooling calculations used for determining proper refrigerant charge.

33. SUBCOOL Liquid Sub-Cooling VIEW

Displays liquid sub-cooling in degrees F and is calculated by deducting the LL Temp from the LL Saturated Temp. This value is used to perform sub-cooling calculations used for determining proper refrigerant charge and should ideally be somewhere between 8-10°F. Consult the installation manual for more information on how to use this information when charging your system with refrigerant.

34. MAN DEF Manual Defrost EDIT

This setting should allow operator to force a manual defrost as long as the heat pump's defrost board supports this function when the SVC jumpers are shorted. In order for this feature to work the two SVC terminals on the control panel must be attached to the SVC terminals on the defrost board. Note that not all heat pump manufacturers support this capability using a jumper. Turning if ON should start a defrost cycle which will last only as long as the maximum allowed by the heat pump or 15 minutes, whichever is lowest. Setting should be turned back OFF when done but leaving it ON will not result in a continuous defrost cycle.

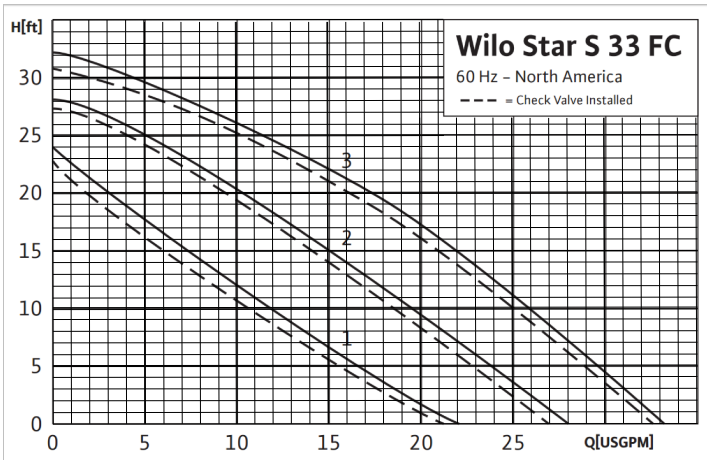
35. HP RESET HP Control Board Reset EDIT

This setting will allow you to disengage power to the heat pump's defrost board in the event that a hard lockout condition needs to be cleared. This is a convenient feature for technicians to use since it allows remote resetting of a heat pump's defrost board over the internet.

36. BUF FLOW DX2W to Buffer Tank Flow Rate (GPM) EDIT

In order to calculate the energy output of the heat pump it is necessary to determine the flow rate to and from the buffer tank. This is accomplished by reading the two 30 PSI pressure gauges on each end of the internal circulator in order to determine the pressure drop in PSI. Before reading the pressure drop, ensure that the system pressure has been raised between 15-20 PSI. When the system is at rest, record the pressure on both small gauges so that readings can be calibrated. Should you get different readings on both gauges at rest, record this difference and deduct it when determining pressure drop once the circulator is running. With the heat pump ON and the internal circulator running you should now be able to determine the pressure drop on each side of the pump. To do this deduct the lower value from the higher value and use this pressure drop value to lookup the flow rate using the circulator's pump curve.

PSI DROP	FEET HEAD	Speed 2 GPM	Speed 3 GPM
12.0	27.7		7.0
11.5	26.6		9.0
11.0	25.4		11.0
10.5	24.3		12.0
10.0	23.1		14.0
9.5	21.9	8.0	15.0
9.0	20.8	9.5	16.0
8.5	19.6	10.5	18.0
8.0	18.5	11.5	18.8
7.5	17.3	13.0	20.0
7.0	16.2	14.0	21.0



Sample Pump Curve & Table for Wilo Star 33-FC Circulator (shaded areas show required flow range)

Most installations should have the internal circulator set to highest speed in which case the Speed 3 GPM column should be read. Our new canister style heat exchangers are designed for target flow rates in the 10-13 GPM range. Switch between speed 2 & 3 to find the ideal flow rate for the installation. Ensuring that you have recorded the correct flow rate is essential so that the controller can accurately calculate Output and COP.

37. WT CAL Water Temperature Calibration EDIT

This value allows installer to adjust the exiting water temperature sensor up or down in the event that Delta-T is not being reported accurately. To calibrate sensors you should turn the DX2W ON with a call for heating or cooling but with the outdoor unit temporarily powered OFF for 5 minutes. This will force the heat pump circulator ON and circulate the buffer tank water through the heat exchanger and past the temperature sensors in a continuous cycle. After 5 minutes both sensors should be reading the same temperature within +/- 0.2°F. Entering and Exiting water temps can be viewed using the LCD display to verify this. If there is a greater discrepancy than this then you may adjust the WT CAL setting to correct the exiting water temp only. Contact us if the discrepancy is much greater than a degree since this may signify a loose or damaged sensor. Spare sensors are shipped with each unit for such situations.

38. LLP COEF Liquid Line Pressure Coeficient EDIT

This value is used if necessary to calibrate the high pressure sensor value and is expressed in percentage where 100% represents no calibration. It is recommended that this value only be changed if you have an accurate and recently calibrated set of gauges attached to the liquid line closest to the pressure sensor inside the DX2W and that it be done when pressures are over 300 PSI. The pressures do not have to be exactly the same but should be within +/-1%.

39. KW RST Reset All kWH Counters EDIT

This feature will reset the DX2W controller's internal kilowatt counters to zero. It is recommended that this be done once the system has been commissioned and may be exercised once a year at the start of the heating season in order to track year to date figures.

40. MODBUS Modbus Address (for monitoring) EDIT

This value should be set to 200 by default and is used to identify the DX2W controller on a building automation network and on ThermAtlantic's internet monitoring web service. This address may be changed in the event that there is a conflicting Modbus device on the local network and when more than one DX2W controller exists on the same site or network.

Contact ThermAtlantic if you intend on interfacing the DX2W controller to an existing building automation system so that you can be given communication settings and register addresses.

41. HP ASD HP Anti-Short-Cycle Delay Cancelation EDIT

If your outdoor heat pump condenser's control board has been wired to the SVC jumper outputs on the DX2W control board you may be able to cancel the heat pump's anti-short-cycle delay using this option. This is convenient when testing or servicing the heat pump since it eliminates the need to wait 5 minutes before the heat pump comes on after the last cycle.

For convenience during setup or servicing this setting can be reached quickly by entering into ADMIN mode and then pressing the left cursor button once to reach the last setting.