Controls User Manual

Combo-pac™
hot water air handler
with iStat6 electronic controller

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This document describes proper setup and use of the electronic controller for the Vortex Combo-pac™ air handler with the iStat6 controller. Although the system will function when left at factory default settings, it is recommended that the installer read through this short manual in order to ensure the system has been setup to match the required heating and cooling loads and air-conditioning equipment installed, and to take advantage of the various features available.

Controller Basics

The controller automatically adjusts blower motor speeds and engages relays for control of the system components. Through its LCD display and keypad, important system parameters may be configured and operating conditions may be monitored.

When the controller keypad has not been pressed for a few minutes, the backlight will turn off and the display may go blank. Simply press any one of the buttons to wake up the controller. By default, the controller will display a short message describing the operating status of the system. *Table 1* provides a list of the different possible status messages and their meaning. There are also a number of small icons that may appear around the edges of the display according to the current operating status. *Table 2* gives an explanation of the different icons.

Table 1 - status messages

| Message	Meaning
NO CALL	System is not currently receiving a call, all functions are off.
HEATING	There is currently a call for heating
COOLING	There is currently a call for cooling
FanOnly	There is currently a call for continuous fan only and no heating or cooling
TST ERR	Thermostat error (simultaneous heating & cooling calls). Check wiring & ensure heat/cool thermostats are used
FROZEN	Supply air is too cold, freeze protection has been activated. Compressor calls will be suspended until temperature rises and time delays are satisfied
TEST	Pressing the button on the bottom of the control will operate the fan and pump for 20 seconds to verify operation. After 20 seconds, it returns to normal.

Table 2 - display icons

Icon	Meaning
Flame	system is in heating mode
Snowflake	system is in cooling mode
4-blade fan	blower is running at or below 50%
8-blade fan	blower is running above 50%

Controller Keypad

By using the *option* and *setting* keys, different parameters and their current settings may be displayed and modified. Use the outer *option* keys to scroll through the available parameters, and use the inner *setting* keys to modify the parameter's current setting (if available). By default, the control will remain in 'user' mode, in which a limited selection of parameters may be accessed. By entering 'admin' mode, additional parameters may be made available. Please exercise caution while in 'admin' mode, as these settings are meant to be accessed by the experienced user or installing contractor. A description of each of the modes is found below.
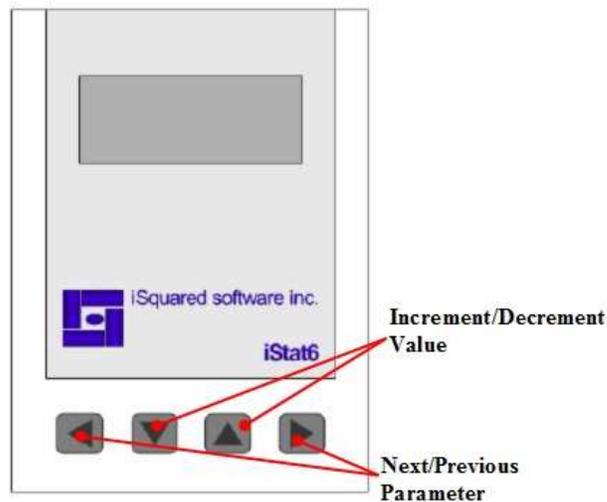
USER MODE

This is the basic display and operating mode, in which only a limited selection of parameters may be displayed. Refer to *Table 3* for a description of each item displayed.

ADMIN MODE

This is the advanced display and configuration mode. It is intended only for the properly trained contractor. To enter 'admin' mode, press any button to illuminate the display backlight, then press and hold the two *option (outer)* buttons at the same time ('user' will be displayed at first, hold until 'admin' is displayed). You can now scroll through the display items by using the outer two *option* buttons, and adjust certain values using the inner two *setting* buttons. To return the control to 'user' mode simply wait a few minutes or press and hold both *option* buttons.

Use *Table 4* as a quick reference on the items available in this mode. Detailed descriptions on important parameters are found below.

Initial Controls Setup

When first powering up the Combo-pac air handler during commissioning, enter 'admin' mode on the controller and adjust the following settings to match the installed equipment.

MODEL – the model number of the Combo-pac air handler. Options are CP30, CP63, CP70, CP80 and CP100. This is used to set maximum airflow based on fan and motor capacity. This will be preset in the factory but should be verified by the installer. Refer to the table below.

Model	Max. Tonnage	Max. Airflow (cfm)
CP30	2	800
CP63	3	1200
CP70	3 1/2	1400
CP80, CP100	5	1800

AC_Size – the capacity (in tons) of the air-conditioning equipment. This setting impacts the amount of airflow when the system is in cooling mode. If a two-stage air-conditioner is installed, use the nominal (full capacity) tonnage. If air-conditioning is not installed, it is recommended to set this to match the maximum capacity of the Combo-pac air handler (i.e. CP30 = 2 tons, CP80 = 5 tons). Refer to the table above. **Caution!:** An improper setting may result in coil freeze, excess noise or poor performance.

ContFan – the amount of airflow used for a continuous fan call, as a percentage of the maximum system airflow. The default setting is 50%.

HeatSpd – Heating speed control mode, options are "**fixed**" and "**auto**". In **fixed** mode, heating calls will always run at **HeatMax**. In **auto** mode, heating will vary between **HeatMin** and **HeatMax** depending upon the previous heating call speed and time to satisfy the heating call.

HeatTim – Target length of time of a heating cycle. The default is 15 minutes. Longer time will reduce fan speed for typical heating calls.

HeatMAX – maximum heating airflow, as a percentage of the maximum system airflow. Lower settings will mean longer heating cycles and improved air distribution throughout the home but reduces total heating capacity. Default setting is 100%.

HeatMIN – minimum heating airflow, as a percentage of the maximum system airflow. Default is 25%. Used only when heating is in automatic mode. Note that

a low value can improve comfort and reduce noise but may cause insufficient heating at the farthest duct runs.

PreHeat – Length of time in seconds that the fan will run at half speed at the start of each heating cycle. Default is 30 seconds. This can improve comfort by pre-heating the coil with hot water.

PstHeat – Length of time in seconds that the fan will run at half speed at the end of each heating cycle. Default is 30 seconds. This can improve efficiency by delivering residual heat in the water coil to the rooms.

Cycle Timer (Pump Exerciser)

The Combo-pac includes an optional cycle timer or pump exerciser feature which may need to be enabled depending on the hot water source and local regulations. When enabled, the cycle timer will run the heating circulating pump for 30 seconds every 24 hours.

PumpExr – Pump Exerciser (Cycle timer) mode. Set to 1 to enable, 0 to disable. Pump exerciser is disabled by default.

Cooling Control Mode

There are two modes of operation available for controlling cooling airflow: "**fixed**" and "**auto**". Descriptions for each mode are found below.

CoolSpd – Cooling speed control mode, options are "**fixed**" and "**auto**". Controls are in "**fixed**" mode by default.

In **"fixed"** mode, the cooling airflow will operate at 420cfm per ton for single stage AC.

In **"auto"** mode, the airflow will adjust to maintain the supply air temperature at the chosen cooling setpoint (**CoolTmp**). This mode can provide better control of indoor comfort, helping to ensure adequate dehumidification is taking place. **Caution**: for proper operation, the supply air temperature sensor must be installed downstream of the cooling coil and measuring well-mixed air. Note that the cooling airflow will always be maintained between 270 and 420 cfm per ton of air-conditioner capacity (**AC_Size**).

CoolTmp – The cooling setpoint temperature for **auto** cooling mode. Default setting is 11°C (52°F). Lower setpoint temperatures will lead to lower airflow, increased dehumidification and comfort, but may decrease overall cooling capacity and efficiency.

PreCool – Length of time in seconds that the fan will run at half speed at the start of each

cooling cycle. Default is 10 seconds. This can improve comfort by pre-cooling the AC coil. **Caution -** excessive time may cause coil freeze-up.

 PstCool – Length of time in seconds that the fan will run at half speed at the end of each cooling cycle. Default is 30 seconds. This can improve efficiency by using residual cooling in the AC coil.

PID_PROP, PID_INT, PID_DB, PID_RAMP – These settings are the proportional, integral, deadband, and ramp rate used for the P.I.D. cooling speed control when in **auto** mode. It is recommended that these settings only be changed by someone who has a firm understanding of P.I.D. control schemes and only if the response rate of the fan is unsatisfactory. Contact Vortex if you believe there's an issue with these settings.

Two-Stage Air-Conditioning

An output is available on the low-voltage terminal strip for the control of a two-stage air-conditioner. When a cooling call is present, the air conditioning compressor will initially be activated in first stage (low). If the cooling call continues beyond time **AC2Time**, second stage will be activated for the remainder of the cooling call. Note that maximum and minimum airflows are automatically reduced to 2/3 during first stage operation whether cooling is in **fixed** or **auto** mode.

AC_2STG – Turn ON if a 2-stage air conditioner is present.

AC2Time – The time, in minutes, in which 2nd stage is activated, set by default to 20 minutes. Decreasing this value will cause 2nd stage to be activated sooner, leading to full capacity.

Freeze Protection

In order to prevent the heat exchanger coils from freezing during cooling, the air handler includes a freeze protection feature. If the measured supply air temperature drops below the freeze protection temperature **FRZ_TMP**, the signal to the air-conditioner contactor is interrupted. In order to prevent short-cycling of the compressor, this feature includes two settable delay intervals: **FrzDly1** sets the amount of time the supply air temperature has to remain below **FRZ_TMP** before the alarm is triggered; and **FrzDly2** sets the amount of time until the compressor is allowed to come back on, once the supply air temperature has returned to above **FRZ_TMP**. **Note**: This feature will only turn off the AC compressor signal. It will not protect the home or air handler from freezing house temperatures or improper fresh air connections such as from a heat recovery ventilator.

FRZ_TMP – The freeze protection setpoint temperature. Default value is 3 °C. Lowering this value will decrease sensitivity of the freeze protection feature.

FrzDly1 – Amount of time (in minutes) to wait before acknowledging a freeze protection condition. Default setting is 3 minutes. Increasing this value will decrease

sensitivity of the freeze protection feature.

FrzDly2 – Amount of time in minutes to wait before bringing the A/C compressor back on, once the measured supply air temperature has returned to a safe value. Default setting is 2 minutes.

Troubleshooting

Warning: The homeowner can diagnose many issues from the main controller on the front of the air handler but any diagnostics or servicing inside the air handler (blower compartment) should only be performed by a qualified service person. **High voltages are present**.

No Display – If pushing one of the four front buttons does not refresh the display, there may be no power to the air handler, or the transformer has failed or the controller has failed.

Thermostat calls – The status screen (default) will show heating, cooling or continuous fan calls detected from the thermostat (Table 1). Using the outer keys, the user can scroll through the screens to see individual thermostat calls and fan speed (Table 3).

If a thermostat is calling but not detected by the control:

1. Check the thermostat and its connections
2. Check thermostat wiring at the thermostat and air handler.
3. Check the 4/8gang relay indicator lights.
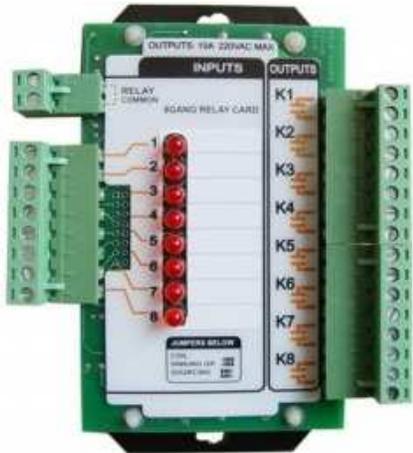
W1, Y1 and G1 are connected directly from the thermostat terminal strip. The 4/8 gang relay converts 24vac thermostat signals to digital signals for input to the iStat6 controller. If the lights are on but the controller does not respond, the problem is the wiring to the control or the control has failed.

No Heating – Try Test Mode first – pushing the button on the bottom (underneath) of the control will run the pump and fan for 20 seconds. Pipes should get warm and fan should run. No pump – check the pump relay for a 24vac signal from the control, wiring and pump.

No Cooling - Check for 24vac at the terminal strip Y1-OUT. If not, check wiring to and from control and control.

No Blower - The fan can be tested from 0-100% by placing the primary thermostat in FAN ON (or jumper R to G) with no heat or cool call. Then, adjust **ContFan** up and down within ADMIN mode. It should modulate smoothly from 1% to 100% and off completely at 0%. If it

fails to run, check wiring from controller to motor speed control, motor speed control, wiring to motor and motor.

Blower motor never fully stops, even with no demand signal

Ensure control displays NO CALL. If not, check thermostat settings and thermostat wiring.

Ensure the blower motor speed control board has a jumper installed across the terminals labeled "P". The motor speed control board and the jumpers are shown below.

Note: The green signal light of the EVO motor control flashes according to its speed output to the motor. Ex. 5 long 3 short blinks = 53%

Note: Newer combo-pac models do not use the EVO control (p/n XELK710 + harness XELK712). The new wire harness (p/n XECM77) is sealed, no lights and not serviceable.

Too much airflow, causing noise

This can occur due to undersized ductwork, dirty filter or improper setup of the air handler heating/cooling loads. Note that **Model, HeatMAX** and **AC_Size** determine airflows. Installing a 2-stage air conditioner will reduce the cooling airflow most of the time.

Alarm message "TST ERR"

There is a simultaneous call for heating and cooling, indicating an error with thermostat wiring or setup. Ensure that the thermostat is wired as per the Installation Instructions, and configured for 1 heat / 1 cool systems. Combo-pac air handlers that will run on 2 heat/ 2 cool thermostats are available by special order.

Not enough humidity removal in cooling mode

The air handler controls humidity during cooling through use of the "**auto**" cooling speed mode (set **CoolSpd** to "auto"). See the Cooling Control Mode section above.

Supply or return air temperature (SA_TMP or RA_TMP) reads -50 °C

This indicates the supply air temperature sensor is not properly connected to the controller. Ensure that the sensor is connected as per the wiring diagram found in the Installation Instructions and that no wires have become loose. **RA_TMP** is not used and can be ignored. A failed supply air temperature sensor will put the system into freeze protection.

Freeze protection errors (alarm message "FROZEN")

This usually occurs when there is inadequate airflow for a given air-conditioner.

- Ensure that the air filter is not plugged and all ductwork is open
- Ensure the setting **Model** matches the air handler model and **AC_Size** has been selected to match the installed air-conditioner capacity
- Ensure supply air temperature sensor is located after cooling coil and in the supply air stream, not touching the coil, heat source, plumbing, etc.
- Ensure the cooling setpoint temperature **CoolTmp** is not set too high
- Decrease sensitivity of the freeze protection feature (see Freeze Protection above)

Table 3 User Mode (default)

Line 1	Line 2	Set.	Type	Description	Default
ComboPac	####	D	Display	Display status of system	NO CALL
W1_Heat	(0)Off/(1)On	D	Input	Thermostat heating input (ON/OFF)	
Y1_Cool	(0)Off/(1)On	D	Input	Thermostat cooling input (ON/OFF)	
SA_TMP	###.# C	D	Input	Supply air temperature	
RA_TMP	###.# C	D	Input	Return air temperature (display only, not used in calcs.)	
FAN_Spd	#### %	D	calc	Fan speed as a percentage	
ComboPac	##.## REV	D	Display	Program name and revision number	1.10

* note: "D" in set. indicates variable is for display only and is not settable

Table 4 Admin Mode

Line 1	Line 2	Set.	Type	Description	Default
ComboPac	####	D	Display	Display status of system	NO CALL
W1_Heat	(0)Off/(1)On	D	Input	Thermostat heating input first stage (ON/OFF)	
Y1_Cool	(0)Off/(1)On	D	Input	Thermostat cooling input first stage (ON/OFF)	
MODEL	####		Setting	Set air handler model. Select from list.	CP30
AC_SIZE	####		Text Setting	Capacity of air-conditioner in tons, select from available choices.	1
SA_TMP	###.# C	D	Input	Supply air temperature	
RA_TMP	###.# C	D	Input	Return air temperature (display only, not used in calcs.)	
FAN_Spd	#### %	D	calc	Fan speed as a percentage	
ContFan	#### %		Setting	Continuous Fan airflow as a percent of maximum.	50
HeatSpd	####		Setting	Set heating fan speed as fixed or automatic	FIXED
HeatTim	#### min.		Setting	Ideal heating cycle time in minutes	15
HeatMAX	#### %		Setting	Maximum heating airflow as a % of blower maximum	100
HeatMIN	#### %		Setting	Minimum heating airflow as a % of blower maximum	25
PreHeat	#### sec		Setting	Time fan runs at half speed at beginning of heating call in seconds	30
PstHeat	#### sec		Setting	Time fan runs at half speed at the end of a heating call in seconds	30
PumpExr	(0)Off/(1)On		Input	Daily pump exerciser ON/OFF	OFF
CoolSpd	####		Setting	Set cooling fan speed as fixed or automatic	FIXED
CoolTmp	#### C		Setting	Supply air temperature setting for automatic cooling mode	11
PreCool	#### sec		Setting	Time fan runs at half speed at beginning of cooling call in seconds	10
PstCool	#### sec		Setting	Time fan runs at half speed at the end of a cooling call in seconds	30
AC_2STG	(0)Off/(1)On		Text Setting	Is the air conditioner condenser 2 stage?	0
AC2Time	#### min		Setting	Time to activate 2nd stage cooling.	20
FRZ_TMP	#### C		Setting	Freeze alarm setpoint temperature	2
FrzDly1	#### min		Setting	Freeze Delay 1 - wait time to activate freeze alarm	3
FrzDly2	#### min		Setting	Freeze Delay 2 - wait time to restore operation after a freeze alarm	2
PID_PROP	###.# %/C		Setting	Cooling PID Proportional value	3
PID_INT	##.## %/sec/C		Setting	Cooling PID Integral value	0.2
PID_DB	###.# C		Setting	Cooling PID Deadband value	0.5
PID_RAMP	###.# %/sec		Display	Cooling PID Ramp Rate value	5
ComboPac	##.## REV	D	Input	Program name and revision number	1.10
Modbus	####		Setting	Modbus address	136