

User Manual

AC-2000 Plus/SE Pigs



AC-2000

Climate Controller for Pigs

AC-2000 Pigs

User manual

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This manual for use and maintenance is an integral part of the apparatus together with the attached technical documentation.

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1 Introduction

1.1 Disclaimer

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1.2 Introduction

Congratulations on your excellent choice of purchasing an AC-2000!

In order to realize the full benefit from this product it is important that it is installed, commissioned and operated correctly. Before installation or using the fan, this manual should be studied carefully. It is also recommended that it is kept safely for future reference. The manual is intended as a reference for installation, commissioning and day-to-day operation of the Munters Controllers.

1.3 Notes

Date of release: June 2009

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2 Introduction to the AC-2000

This section introduces the AC-2000 Pig unit.

- Features
- Principles, Options, and Operation

2.1 Features

- 12 output relays (AC-2000 SE)
- 20 output relays (AC-2000 Plus)
- Up to eight additional relays
- Up to six temperature sensors
- Up to two electronic humidity sensors (inside and outside)
- Up to one CO2 sensor (Version 8.11 Plus only)
- Variable speed output (0 to 10 volts)
- Light dimmer (0 to 10 volts)
- Digital pulse inputs (water, feed, wind direction)
- Unique static pressure sensor (optional)
- PC communication
- Alarm output
- Flexibility in add-on capacity
- Water meter

2.2 Principles, Options, and Operation

The following sections provides example of AC-2000's main functions.

- Summary ventilation settings
- Examples: Fan groups, curtains, and levels
- Heaters
- Additional Systems

2.2.1 Summary ventilation settings

1. Assign ventilation fans to groups. The groups can use multiple output relays, so that several outputs make up a group. Different groups cannot share the same relay. There is no information to enter into the control at this point. Simply write the group numbers down with the assigned fans in the installation record, **Menu 92** (page 16). The **AC-2000** supports up to 12 groups (version 8.07)

2. Fill in the Ventilation Level Table, **Menu 92**. This is a part of the system installation menu, which does not appear on the front panel of the control.

WARNING! Be careful to set the maximum ventilation level number correctly in configuration, **Menu 91**, item 2. If the higher unused ventilation levels are at zero, the control turns off all fans when it

reaches those levels on a hot day. It is a good practice to duplicate the last line for the rest of the table.

3. Fill in the Curtain Level Table, **Menu 95** to correspond with the Ventilation Level Table, **Menu 92**. Note that the levels in both tables correspond with each other. Fill in the Temperature Table. Choose convenient growth days, and set appropriate target, heating and cooling temperatures. The **AC-2000** can automatically ramp these temperatures at intermediate growth dates; simply enable 'auto temp reduction,' item 6 in installation, **Menu 91**. The control will regulate the ventilation and heating equipment to maintain these temperatures.
4. Fill in the Minimum-Maximum Level Table by animal growth dates. This table limits the ventilation levels the **AC-2000** can use. The minimum settings are your winter handle on air quality in the house.
5. Set the Target Humidity and Cooling Tables when using these systems.
6. If using static pressure controlled inlets, enter the static pressure settings.

2.2.2 Examples: Fan groups, curtains, and levels

In this section we consider two different houses. One is curtain sided with cross ventilation and exhaust fans. The other has only tunnel fans. All of the fans in the first example are in the sidewalls. In the second, they are all at one end of the house.

The **AC-2000** organizes the main ventilation fans in up to 12 groups of various sizes. It turns on combinations of up to 12 of these groups at a time to provide the correct amount of ventilation.

- Example A: Typical Fan Grouping (No Tunnel)
- Example B: Typical Fan Grouping Side Wall and Tunnel Fans with Static Pressure Control
- Example B, Part 2: Typical Ventilation Level Table
- Example B, Part 3: Curtain Level Table

2.2.2.1 Example A: Typical fan grouping (no tunnel)

The example here, Typical Fan Grouping, Example A, demonstrates a common organization pattern. The **AC-2000** can also use a variable speed fan, and timers to cycle fans on/off.

Table 1: Typical Fan Grouping, Example A

Group 1	Fan 1 on Timer
Group 2	Fan 2 on Timer
Group 3	Fan 3
Group 4	Fan 4
Group 5	Fans 5 and 6
Group 6	Fans 7 and 8
Group 7	Fans 9 and 10

Example A uses no tunnel ventilation, but has two independent side curtains. The fans are all in the side walls. An air inlet controlled by static pressure allows minimum fresh air into the building when the exhaust fans operate. A possible ventilation table is on the next page.

Example A uses exhausts fans for minimum ventilation when the weather is cold, enabling the Air Inlet open by static pressure. Ventilation level 1 is for one day old chicks, and moves a minimum amount of air into the house. Level 9 has three exhaust fans going to provide air for animals on very cold days. Levels 10 through 15 are various degrees of natural ventilation, and level 16 and above turn on more ventilation fans with Air Inlet static pressure for additional cooling during extremely hot conditions.

Table 2: Typical Ventilation Level Table, Example A

Ventilation Level	Ventilation Groups	On Min	Off Min	Diff	Var**
1	1 0 0 0 0 0 0 0 0 0 0 0	0.5	4.5	0	0
2	1 0 0 0 0 0 0 0 0 0 0 0	1.0	4.0	0	0
3	1 0 0 0 0 0 0 0 0 0 0 0	2.0	3.0	0	0
4	1 0 0 0 0 0 0 0 0 0 0 0	3.0	2.0	0	0
5	1 0 0 0 0 0 0 0 0 0 0 0	1.0	0.0	0	0
6	1 2 0 0 0 0 0 0 0 0 0 0	1.0	4.0	0	0
7	1 2 0 0 0 0 0 0 0 0 0 0	2.5	2.5	0	0
8	1 2 0 0 0 0 0 0 0 0 0 0	4.0	1.0	0	0
9	1 2 3 0 0 0 0 0 0 0 0 0	1.0	0.0	0	0
* Natural Levels → 10...15	0 0 0 0 0 0 0 0 0 0 0 0	0.0	0.0	0	0
16	1 2 3 4 0 0 0 0 0 0 0 0	1.0	0.0	0	0
17	1 2 3 4 5 0 0 0 0 0 0 0	1.0	0.0	0	0
18	1 2 3 4 5 6 0 0 0 0 0 0	1.0	0.0	0	0
19	1 2 3 4 5 6 7 0 0 0 0 0	1.0	0.0	0	0
20	1 2 3 4 5 6 7 0 0 0 0 0	1.0	0.0	0	0

NOTE The above table shows one variable fan. Version 8.11 supports two variable fans.

NOTE 10 - 15 is the natural level.

NOTE Ventilation level 6 has fan groups 1 and 2 active. The cycle timer is set at 1.0 minutes on and 4.0 minutes off. The cycle timer always applies to the highest numbered group in the ventilation level, so in this case group 1 is on steady, group 2 cycles 1.0 minute on and 4.0 minute off.

NOTE The AC-2000 displays either the On/Off minutes at each level, or the variable speed setting. It does not display both at once, although all data remains correctly in computer memory. **Menu 91**, item 3, controls which data shows on screen.

WARNING! Example A repeats ventilation level 19 to 20 (recommended for safety purposes).

Maximum ventilation level should be set to 19 in Configuration, **Menu 91**, and item 3 for this example. However, if the maximum ventilation level was at 20, with levels 20 blank, the AC-2000 turns off all fans at ventilation levels 20. You may duplicate these levels to prevent this, or program the maximum number of ventilation levels.

The curtain level table works with the ventilation level table.

Table 3: Curtain Level Table, Example A

Ventilation Level	Curtain 1 % Open	Curtain 2 % Open
1...9	0	0
10	15	10

Ventilation Level	Curtain 1 % Open	Curtain 2 % Open
11	25	20
12	40	30
13	60	50
14	80	70
15	100	100
16...20	0	0

Example A has two side curtains for ventilation past ventilation level 9. For this example, Curtain 1 is normally to the lee side of prevailing winds. Example A has it open slightly ahead of Curtain 2. If the **AC-2000** has a wind direction indicator, it automatically switches Curtain 1 and Curtain 2 levels according to the wind direction.

Referring to the **Ventilation Table**, from level 16, seven cross ventilation fans blow air across the herd for more cooling. With System Variable 4 set to 15, "Maximum level when inside temperature is below cooling," the **AC-2000** does not use level 16 or above unless the temperature is above the cooling system set point. Alternatively, set the differential to account for the cooling effect and cost of these fans, as shown.

2.2.2.2 Example B: Typical fan grouping side wall and tunnel fans with static pressure control

Table 4: Typical Fan Grouping, Example B - Part 1

Group 1	Fan 1 on Timer (Side Wall)
Group 2	Fan 2 on Timer (Side Wall)
Group 3	Fan 3 on Timer (Side Wall)
Group 4	Fans 4 and 5 (Tunnel)
Group 5	Fans 6 and 7 (Tunnel)
Group 6	Fans 8 and 9 (Tunnel)
Group 7	Fans 10 and 11 (Tunnel)

In Example B there is a single vent machine and a tunnel curtain machine. **All the fans are 48" tunnel fans.** The **RPS-1** static pressure sensor controls sidewall/ceiling inlets independently from the ventilation table.

For ventilation under cold conditions, one, two or three of the tunnel fans provide minimum ventilation. These blow fresh air through the side inlets, providing uniform fresh air throughout the house. Many growers would insist on using stir fans out for reasons of safety. Tunnel ventilation with cooling pads (levels 16...19) provides ventilation for animals during hot weather.

2.2.2.4 Example B, Part 3

Table 6: Curtain Level Table

Ventilation Level	Tunnel Curtain % Open
1 through 14	0
15	25
16	50
17	75
18	100
19	100
20	100

NOTE *The air inlets are controlled by pressure only. The Tunnel Curtain % sets the minimum opening if controlled by pressure*

The Curtain Level Table, Example B, coordinates with the ventilation table. Note how the tunnel curtain remains open. The **AC-2000** enters tunnel ventilation at the cooling set point, not target temperature. System Variable 21 enforces a minimum time in tunnel and out of tunnel to prevent oscillating. System Variable 6 sets the degrees above target temperature to leave tunnel mode.

Tunnel ventilation begins at level 16, which one goes to **Menu 91**, Configuration > item 5. The side and tunnel fans operate with the vent machine until level 15. At level 16 the vents close while the tunnel curtain remains open for tunnel ventilation. Enter the time for tunnel curtain opening and closing in **Menu 91**, Configuration > item 10, so the **AC-2000** can account for the curtain movement rates.

2.2.3 Heaters

The **AC-2000** supports several kinds of heaters. Standard low and high-level heaters and radiant heaters work in up to six zones.

- Standard automatic heaters
- Radiant heaters
- Variable Heaters

2.2.3.1 Standard automatic heaters

Each of the zones can have low and high-level standard heaters. The low level heaters turn on first, and if they cannot maintain the set temperature, the high level heaters turn on. For data collection, the **AC-2000** records the run time for the low level heaters only. It does not record the times for the high level or radiant heaters.

If you use a single zone, the **AC-2000** uses the average of the zone temperature sensors to control the heating. If using multiple zones, the **AC-2000** uses the specific zone sensor designated for each zone.

Refer to **Menu 91**, item 5 and **Menu 94**.

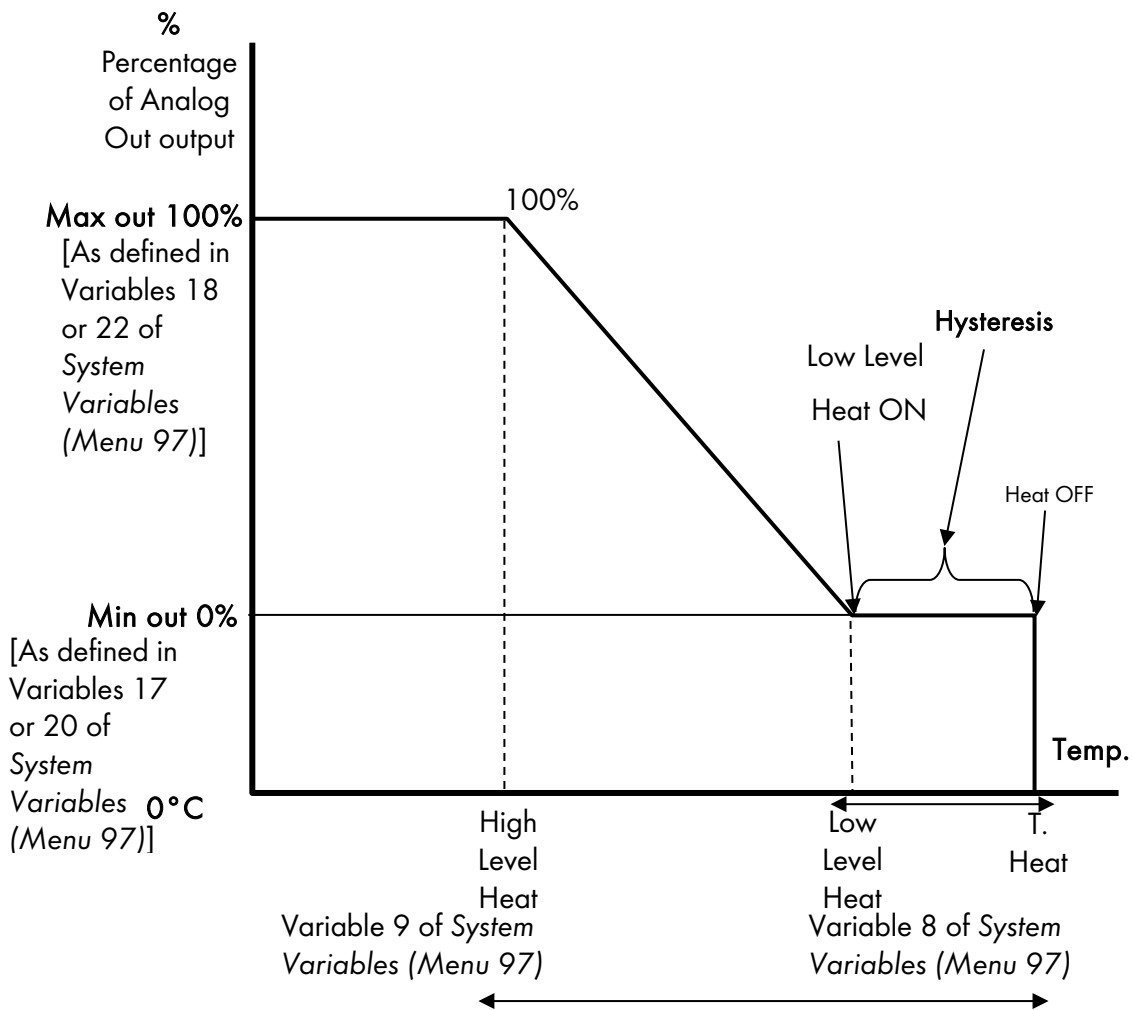
NOTE *When AC-2000 turns on any of the standard heaters, it immediately returns to minimum ventilation.*

2.2.3.2 Radiant heaters

Many brooders use radiant heater. The AC-2000 enables the radiant heaters to have individual temperature sensors to control the brooder heat.

Some radiant heaters require one relay to turn on the ignition and another relay for the high level burner. System Variable 10 sets the ignition relay on time. System Variable 38 enables setting a higher set temperature for radiant heaters which is higher than the standard heater setting.

2.2.3.3 Variable Heaters



2.2.4 Additional systems

The **AC-2000** runs lighting, feeding and extra systems. The feeding and lighting systems can coordinate for dark-out and periodic operation. Extra systems can run according to time, temperature sensor, or cycle timer.

- Water meter and alarm
- Feed overtime alarm and shutoff
- Wind direction sensor
- Remote communication

2.2.4.1 Water meter and alarm

A standard pulse output water meter can be attached to **AC-2000**. It saves water consumption information and generates alarms in the event of too little or too much water flow. A decrease in water consumption may be the first indicator of a problem with the herd, allowing corrective action before a serious situation develops.

System Variable 32 sets the overtime alarm limit, variable 33 the shortage limit, and variable 34 the delay time for reporting water alarms. Use **Menu 46** to calibrate the amount of water per pulse of the water meter. Test **Menu 37** reports live counts to test the water meter; while **Menu 24** gives water consumption data.

The shortage alarm applies only during 'light' conditions if the light table (Menu 5) turns the lights on and off. Moreover, this is disabled when water calibration is zero.

2.2.4.2 Feed overtime alarm and shutoff

If System Variable 24 is one, the **AC-2000** assigns the digital input 1 to the feed overtime sensor. System Variable 25 sets a delay between activation of a feed overtime alarm input, and activation of the alarm relay. Use System Variable 43 to shut down the feed system on an alarm.

2.2.4.3 Wind direction sensor

If System Variable 24 is zero, the wind direction input, digital input 1, can switch the curtain level tables for curtains 1 / 2 and 3 / 4 based on wind direction. System Variable 19 sets the time period for the wind direction check. After each time period, the **AC-2000** averages the wind direction to either a '0' or a '1'. If the average reaches '1' (contact closed), curtains 1 / 2 and 3 / 4 ventilation table settings are switched for the next period; otherwise each curtain keeps its own settings.

2.2.4.4 Remote communication

One of the most important capabilities of the **AC-2000** is remote communications. A personal computer can connect locally, or by modem, to an **AC-2000** anywhere in the world. Password protection prevents unauthorized access.

3 Operating instructions

The following sections describe how to use the AC-2000 unit.

- Display
- Keypad
- Factory Reset (Cold Start)
- Hot Keys
- Menu Structure

3.1 Display

Figure 1 illustrates the **AC-2000** standard display. If an **alarm** occurs, the screen alternately shows the alarm message and this display. If the sensors are disconnected the word "Fail" appear in place of the temperature.

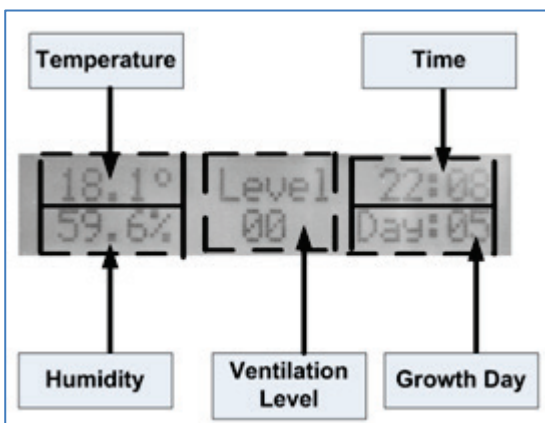


Figure 1: Standard Display

3.2 Keypad

- **MENU**: Used to display the main menu from the standard screen, and exit menus.
- **SHIFT**: In long tables press **Shift** and
 - **3** to jump up 10 steps
 - **9** to jump down 10 steps
 - **7** to go to the top of the table
 - **1** to go to the bottom of the table
- **ENTER**: Used for:
 - Going into a menu
 - Setting values such as temperatures, times, etc. This occurs only after you press the **ENTER** key
- **DEL**: Used to
 - Erase typing mistakes
 - Perform 'Cold Start' function

- **ARROW:** Navigate through menus, make selections and in some cases used for changing values.
- **NUMBERS:** Enter numbers and make choices in numbered menus.

3.3 Factory reset (Cold Start)

A Cold Restart returns all data tables and settings to factory default settings.

To perform a Cold Restart:

1. Turn controller power off.
2. Press and hold the **DEL** key and turn controller power on.
3. Keep holding the **DEL** key until ***COLD START*** appears on the screen.

3.4 Hot keys

The **AC-2000** has seven hot keys for quick information.

To use the Hot Keys:

1. Go to the Main Menu.
2. Press the required key number.

The screen appears.

NOTE *The hot keys functions are available only from the Main screen.*

- **Hot Key 0:** Displays the calculated wind chill temperature (see Wind Chill, page 43)

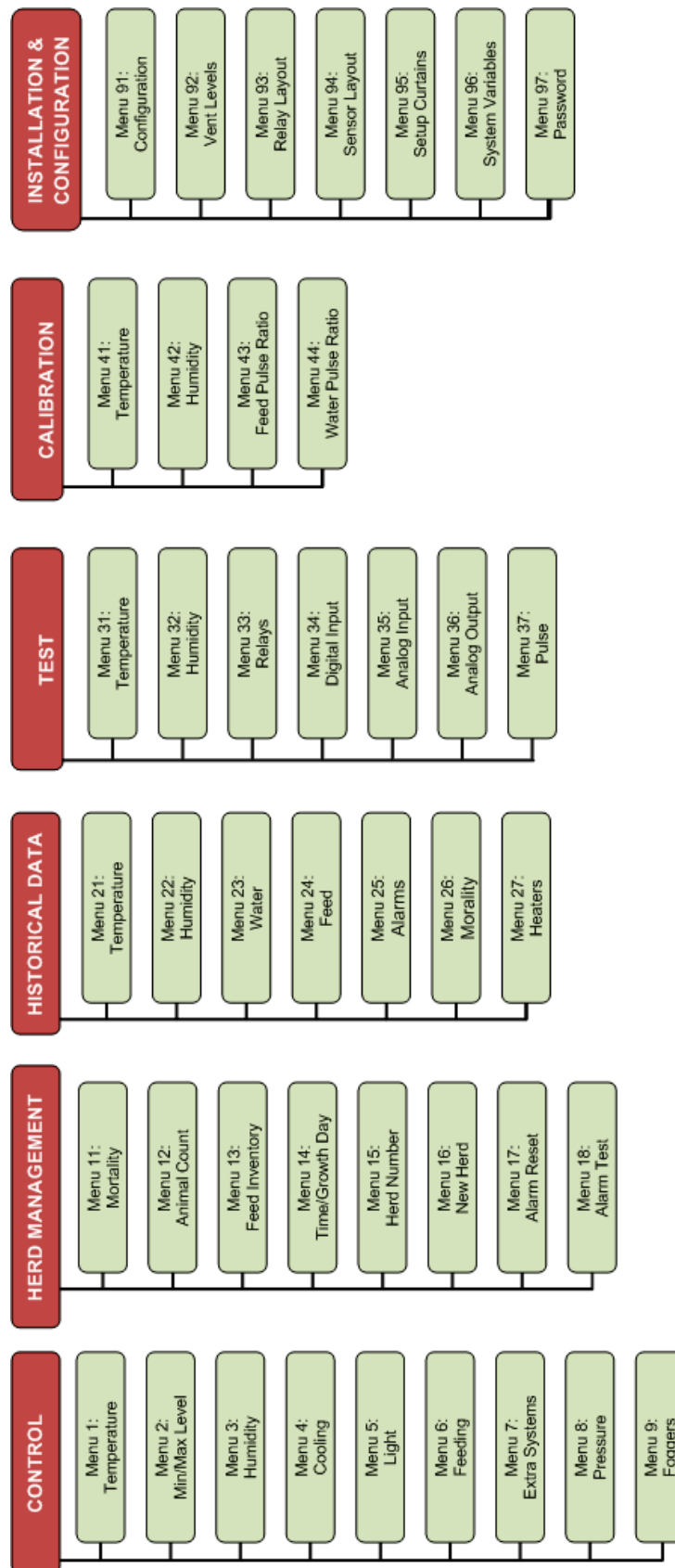
NOTE *Versions 8.09 and higher support the wind chill feature. The calculated temperature is displayed even if the wind chill feature is disabled.*

- **Hot Key 1:** Displays the current target, heat and cooling (tunnel) temperature
- **Hot Key 2:** Current relay status
- **Hot Key 3:** Outside temperature and humidity
- **Hot Key 4:** Displays the temperature according to heat zones (A, B, and C)
- **Hot Key 5:** Current pressure and the pressure target

NOTE *This hot screen is not displayed unless a pressure sensor is defined in Sensor Layout.*

- **Hot Key 6:** Displays the current minimum and maximum levels of ventilation
- **Hot Key 7:** Displays the temperature according to heat zones (D, E, and F)
- **Hot Key 9:** Controller version

3.5 Menu structure



Note: The above diagram illustrates the actual menu items. The product lexan shows items not found in the actual software. In Version 8.09, Menu 98 is Wind Chill.

4 Control menu

The following section describes how to use the Control menu.

- Accessing Menu Items, page 17
- Temperature (Menu 01), page 17
- Min/Max Levels (Menu 02), page 18
- Humidity (Menu 03), page 19
- Cooling (Menu 04), page 20
- Lighting (Menu 05) 21
- Feed (Menu 06), page 21
- Extra System (Menu 07), page 22
- Static Pressure (Menu 08), page 22
- Foggers (Menu 09), page 25

4.1 Accessing Menu Items

* CONTROL MENU *
01 TEMPERATURE

There are two digits, '01', beside the '**TEMPERATURE**'. This number is from the Quick Menu printed on the front of the **AC-2000**, to the left of the display and keypad.

Enter any menu number and press the **ENTER** key to reach that section. You can also browse Quick Menu items with the arrow keys. The blinking line under the '1' is the cursor. It marks the point at which your typing appears.

4.2 Temperature (Menu 01)

Table 7: Temperature Menu

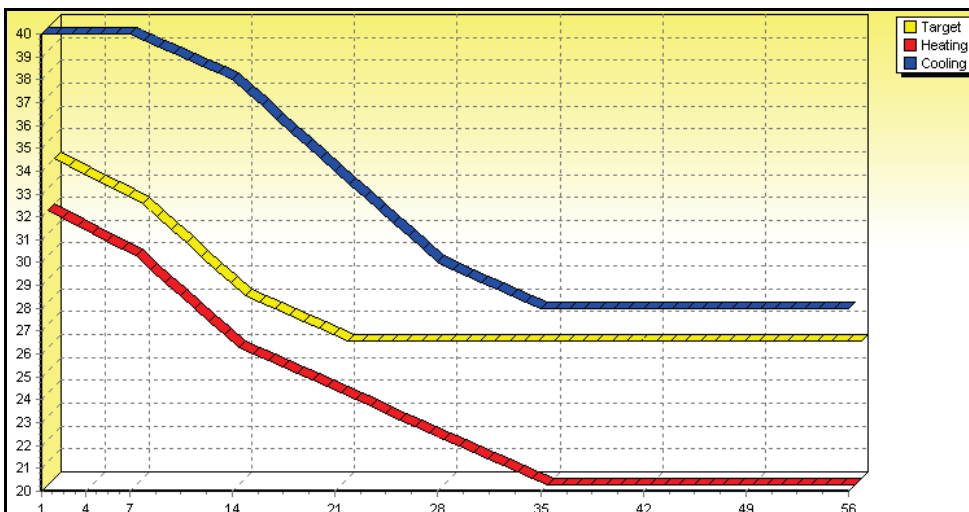
	Day	Target	Heating	Cooling/Tunnel
1	1	32	30	40
2	7	30	28	38
3	14	28	26	32
4	21	26	23	29
5	28	25	21	28
6	35	24	18	26
7	42	24	16	26

The Temperature Menu is used to set temperatures according to animal age. The AC-2000 enables defining up to ten growth dates along with.

- **Target temperature:** ideal animal temperature
- **Heat temperature:** controls heater operation
- **Cooling:** determines the point at which the AC-2000 switches into **tunnel ventilation** or uses evaporative cooling equipment

To set the Temperature:

1. In the Control Menu, press 1.
2. Press **Enter**.
3. Type the required days and temperatures.
4. Press **Enter**.



Configuration, **Menu 91**, item 6, "automatic continues daily temperature adjustment," controls whether the AC-2000 interpolates between lines of the temperature table, or uses the exact set points from the table. The interpolation results in temperature ramping with smooth continuous changes, rather than sudden jumps. This item is good for herds with changing target set points.

4.3 Minimum-Maximum Level (Menu 02)

Table 8: Ventilation and Curtain Levels

Growth Day	Minimum	Maximum
1	1	5
7	2	10
14	4	14
21	5	17
28	6	17
35	6	18
42	7	20
0	0	0
0	0	0

Growth Day	Minimum	Maximum
0	0	0

The Minimum/Maximum Level Table limits the **AC-2000** ventilation and curtain levels by animal age. The **AC-2000** provides space for up to ten growth dates with corresponding minimum and maximum values. In the example above, the **AC-2000** does not exceed Ventilation Level 5 until Growth Day 6. From Growth Day 7 through Growth Day 13, the **AC-2000** uses at least Ventilation Level 2 (even if the heaters are on), but does exceed level 10.

The 'Minimum' column of this table is the usual place to adjust air quality in your pig house. If the house requires more air, increase the minimum level. If less airflow decreases the minimum ventilation level.

It is possible to draw a curve by using **Menu 91, parameter 6** both for the temperature and the Minimum / Maximum levels.

To set the ventilation levels:

1. In the Control Menu, press **2**.
2. Press **Enter**.
3. Type the required days and temperatures.
4. Press **Enter**.

The ventilation levels are set.

4.4 Humidity & CO2 (Menu 03)

Humidity & CO2
Target Humidity: 65%
Target CO2: 365

The Humidity and CO2 menu sets the permitted relative humidity /CO2 level. When the humidity or CO2 goes above the permitted level, AC-2000 operates the treatment system.

If the **AC-2000** has a humidity sensor, it can run the ventilation system to meet target humidity. To disable humidity treatment, set the target humidity to 100%.

To set the humidity and CO2:

1. In the Control Menu, press **3**.
2. Press **Enter**.
3. Type the required humidity.
4. Press **Enter**.

The humidity and CO2 are set.

AC-2000 has various optional variables used to configure the humidity and CO2 parameters.

To set the variables:

1. In the Control menu, press **97**.
2. Press **Enter**.
3. Scroll down to the following variables:
 - 13: specifies the delay between increases in ventilation level to reduce humidity/CO2 or provide more fresh air
 - 27: sets the length of time to remain at the new ventilation level at each increase

- 36: specifies the minimum temperature for humidity/CO2 treatment. This is heating temperature minus this setting.
 - variable 37 sets the excess humidity differential, at which the **AC-2000** uses the heaters to treat humidity.
4. After typing in the required parameters in each variable, press **Enter**.

4.5 Cooling (Menu 04)

Table 9: Cooling Table

From Time	To Time	Tun. Diff	To %RH	On (Min)	Off (Min)
09:00	21:30	-1.0	85.0	1	10
09:00	21:30	2.0	85.0	1	5
09:00	21:30	3.0	82.5	1	2
12:30	16:00	4.0	75.0	1	0
00:00	00:00	0	00.0	0	0

The Cooling menu defines the conditions when AC-2000 begins to reduce the temperature. Temperature reduction begins when the temperature exceeds the **Cooling/Tunnel** (Table 4) **plus** the **Tun. Diff** parameter.

For example, if:

- The Cooling/Tunnel temperature is 29° C
- Tun. Diff is -1° C

between 9:00 to 21:30, AC-2000 operates cooling pads for one minute if the temperature **is above 28° C** and the humidity **is less than 85%**. After one minute there is a 10 minute break before cooling can restart. If the temperature rises to 31° C, then cooling remains on for one minute and then there is a five minute break.

Additional information:

- The **AC-2000** provides space for up to five growth days.
- **Tunnel Diff** value cannot be less than -18.0° C / -32.4° F or more than 20.0° C / 36.0° F.
- The **AC-2000** automatically sorts the table in order of 'From Temperature' after you enter the data. The sorting is done according to the following order: temperature (low to high), humidity and hour.
- A line can be active only when all the following conditions are fulfilled: time, temperature and humidity.

To configure the Cooling parameters:

1. Set the Temperature settings (Temperature (Menu 01), page 17).
2. In the Control Menu, press **4**.
3. Press **Enter**.
4. Type the required parameters.
5. Press **Enter**.

The Cooling parameters are set.

NOTE After entering the Tun. Dif parameter, press **Alt** to make the number a negative factor (if required).

4.6 Lighting (Menu 05)

Table 10: Lighting Table

Day	From Time	To Time	Intensity
1	01:00	03:00	100%
1	05:00	07:00	100%
1	05:30	03:00	20%
1	22:00	23:00	100%
7	09:00	14:00	20%
20	00:00	23:59	100%
*	*	*	*

The Lighting menu sets the time when the pig coop is lit. You can enter up to 50 time periods, with single or multiple periods each day. The **AC-2000** sorts the table by 'day,' then by 'from time.' It turns lights on and off using relays, or accepts 0 to 10 Volt controlled light dimmers. In this example, the Day 1 settings apply until Day 7.

To configure the Lighting schedule:

1. In the Control Menu, press **5**.
2. Press **Enter**.
3. Type the required parameters.
4. Press **Enter**.

The Lighting parameters are set.

4.7 Feed (Menu 06)

Table 11: Feeding Table

From	To	Qt/bird
06:00	14:00	1.000
13:00	07:00	1.000
*	*	*
*	*	*

The Feeding Menu **configures** the feeding schedule and quantity. It can run up to ten feeding periods per day. For full feeding, set times to cover the entire day. The **AC-2000** stops delivering feed when it has supplied the amount of feed specified in Qt/animal (in grams). The **AC-2000** takes into account the mortality, initial animal population, and the feed delivery rate.

If desired, the **AC-2000** sends an alarm and shut off the feed system for feed overruns.

To configure the Feeding schedule:

1. In the Control Menu, press **6**.
2. Press **Enter**.
3. Type the required parameters.
 - Enter "0" to turn the system off.
4. Press **Enter**.

The Feeding parameters are set.

To send an alarm and shut of the feed system:

1. In the Control menu, press **97**.
2. Press **Enter**.
3. Scroll down to the following variables:
 - 24: enables feed overtime alarm
 - 25: enables a feed overtime alarm delay
 - 43: enable feed shutoff if feed overtime alarm is activated
4. After typing in the required parameters in each variable, press **Enter**.

4.8 Extra System (Menu 07)

Table 12: Extra System Table

System	From Time	To Time	From Temp	To Temp	On	Off	Sensor
1	00:00	23:59	0	50.0	5	5	0
2	06:35	07:00	0	50.0	0	0	0
3	04:00	20:00	25.0	50.0	1	4	5

The **AC-2000** provides three extra systems to use for various purposes. Each system has a clock time during which it runs, high and low temperature set points with selectable sensor, and a cycle timer. If the sensor is '0', the extra systems use the average temperature the ventilation system uses. To ignore temperature, enter 0 for the low, and a large temperature, such as 50.0° C for the high temperature.

4.9 Static Pressure (Menu 08)

Table 13: Static Pressure Table

Out Temp (Low): 10.0
Press (Low T): 0.12
Out Temp (High): 25.0
Press (High T): 0.08
Low Alarm: 0.01
High Alarm: 0.6
Open Stage (sec): 0
Close Stage (sec): 0

Delay (sec): 2
Hysteresis: 0.04

Note: Versions 8.09 and higher do not support the Open Stage, Close Stage and Delay functions.

The Static Pressure menu enables manual configuration of the controlled air inlets and Tunnel curtains in Tunnel mode to ensure proper barn ventilation. When connected to an optional static pressure sensor, the AC-2000 automatically adjusts the air vents / inlets / tunnel for proper ventilation.

If there is no static pressure sensor, input fixed positions for curtains for the inlets (inlets only work by static pressure) and minimal tunnel openings in Menu 95. Refer to the Installation manual for information on this menu).

To configure the Static Pressure parameters:

1. In the Control Menu, press **8**.
2. Press **Enter**.
3. Configure the following parameters:
 - **Low Outside Temperature:** To prevent cold outside air from descending directly on the herd, AC-2000 mixes cooler air with warm air. This temperature setting specifies the temperature at which the **low temperature pressure set point** is in effect. The AC-2000 will interpolate between the low and high settings. Default: 10° C.
 - **Low Temperature Pressure Set Point:** 0.12 inches of water column. The pressure set point determines the size of the window opening. The higher the pressure, the greater the mixing of cold and warm air.
 - **High Outside Temperature:** When the outside temperature is warmer, greater air flow is required; there is less of a need to mix the inside and outside air. This temperature setting specifies the temperature at which the **high temperature pressure set point** is in effect. Default: 25° C.
 - **High Temperature Pressure Set Point:** Default: 0.08 inches of water column.
 - **Low Pressure Alarm:** Default: 0.01 inches of water column.
 - **High Pressure Alarm:** Default: 0.14 inches of water column.
 - **Open Stage:** This sets the maximum length of open run time to reduce the pressure. Setting to '0' will run the vent machine all the way to reach the target. Default: 1 second.
 - **Close Stage:** This sets the maximum length of close run time to increase the pressure. Setting to '0' will run the vent machine all the way to reach the target. Default: 1 second.
 - **Run Delay:** This is the delay after an open or close run to allow the house time to stabilize after a change in pressure setting. This delay allows for stabilization. System Variable 31 is a start up delay. It sets the time for validating a pressure change to prevent reacting to wind gusts. Default: 10 Seconds.
 - **Hysteresis:** This sets the total dead band about the set point, in which it does not adjust the inlets. Default: 0.02 inches of water column.

4. Press **Enter**.

The Feeding parameters are set.

AC-2000 has various optional variables used to configure the static pressure.

To set the static pressure variables:

1. In the Control menu, press **97**.
2. Press **Enter**.
3. Scroll down to the following variables:

- **28:** Selects millibars, inches of water column or Pascal as the pressure unit.
- **29:** Stops the fans during operation of the curtains. This is useful in the case of a curtain inlet that cannot move under static pressure.
- **30:** Disables the low-pressure alarm for low ventilation levels.
- **31:** Forces a minimum delay before responding to changes in static pressure readings. The **AC-2000** bypasses this delay during ventilation level changes and when it turns the group fans on or off.
- **26:** Prevents momentary pressure loss from opening doors, and high pressure pulses due to wind gusts, from setting off nuisance alarms.
- **44:** Opens inlet before fans begin operating.

4. Press **Enter**.

The Pressure parameters are set.

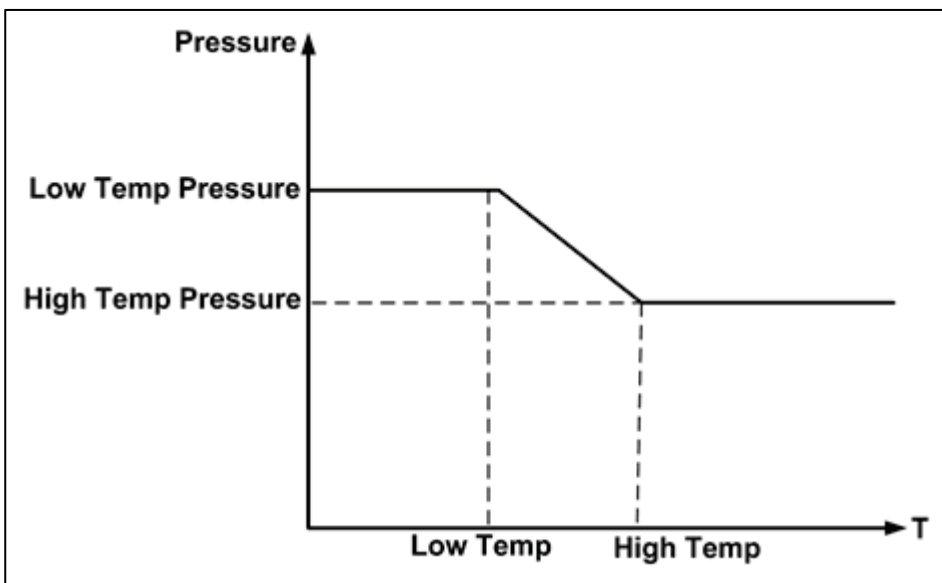


Figure 14: Static Pressure Graph

Parameters 1 - 4 define the pressure curve according to the temperature. If a curve is not wanted, insert identical values to parameters 2 and 4.

4.10 Foggers (Menu 09)

Table 15: Foggers Menu

From Time	To Time	Trg Dif	To %RH	On (Min)	Off (Min)
09:00	21:30	-1.5	85.0	1	10
09:00	21:30	0	85.0	1	5
09:00	21:30	1	82.5	1	2
12:30	16:00	2	75.0	1	0
00:00	00:00	00.0	00.0	0	0

The Foggers menu defines the conditions when AC-2000 begins to operate foggers. Fogging begins when the temperature exceeds the **Target temperature** (Table 4) plus the **Trg. Dif** parameter.

For example, if:

- The Target temperature is 25° C
- Trg. Dif is -1.5° C

between 9:00 to 21:30, AC-2000 operates cooling pads for one minute if the temperature **is above 23.5° C** and the humidity **is less than 85%**. After one minute there is a 10 minute break before cooling can restart.

If the temperature rises to 25° C and humidity drops to 82.5%, then cooling remains on for one minute and then there is a two minute break.

Additional information:

- The **AC-2000** provides space for up to five growth days.
- The **AC-2000** automatically sorts the table in order of 'From Temperature' after you enter the data. The sorting is done according to the following order: temperature (low to high), humidity and hour.
- A line is active only when the time, temperature and humidity conditions are met.

To configure the Fogging parameters:

1. Set the Temperature settings (Temperature (Menu 01), page 17).
2. In the Control Menu, press **9**.
3. Press **Enter**.
4. Type the required parameters.
5. Press **Enter**.

The Fogging parameters are set.

NOTE After entering the Trg Dif parameter, press **A/#** to make the number a negative factor (if required).

5 Herd Management menu

- Mortality (Menu 11)
- Animal Count (Menu 12)
- Feed Inventory (Menu 13)
- Time / Growth Day (Menu 14)
- Herd Number (Menu 15)
- New Herd (Menu 16)
- Alarm Reset (Menu 17)
- Alarm Test (Menu 18)

5.1 Mortality (Menu 11)

Add Mortality	0
Daily Sum	12
Add Culled	0
Daily Culled	2

To keep the herd count current, use the Mortality menus to record the number of dead and culled animals.

To update the Mortality figures:

1. In the Control Menu, press **11**.
2. Press **Enter**.
3. In the Add Mortality or Add Culled fields, type the required numbers.
4. Press **Enter**.

The numbers are updated. The next time that you open this menu, the new totals appear.

NOTE: *If you only enter the quantity once per day, you can type it directly in the daily line.*

5.2 Animal Count (Menu 12)

Initial count	10,000
Updated count	9988

The Animal Count menu shows the initial and current herd count. As you enter daily mortality counts, the **AC-2000** updates the estimated animal population in the Updated count field. The feeding system (**Menu 6**) uses these numbers for restricted feeding schedules.

To set the Animal Count number:

1. In the Control Menu, press **12**.
2. Press **Enter**.

3. Enter the animal population when you receive a new herd.

NOTE: *If the animal count becomes zero, the feeding system automatically stops operation.*

5.3 Feed Inventory (Menu 13)

Feed supply	1000
Feed inventory	5000

The **AC-2000** provides a convenient feed inventory.

To update the Feed Inventory figures:

1. In the Control Menu, press **13**.
2. Press **Enter**.
3. Each time feed arrives; enter the quantity in the Feed supply field.

The Feed inventory field (which shows the remaining supply) is updated automatically.

4. If required, edit the Feed Inventory field.
5. Press **Enter**.

5.4 Time / Growth Day (Menu 14)

The Time/Growth day menu displays and edits the current time and growth day. Various **AC-2000** functions use these specifications.

The growth day works with the ventilation tables to change the settings as your animals grow. Normally the new herd function, **Menu 16**, sets the growth cycle day.

The internal clock uses a precision crystal, and should rarely need adjusting. The time is in 24-hour format.

To update the Time/Growth specification:

1. In the Control Menu, press **14**.
2. Press **Enter**.
3. Edit the day and time.
4. Press **Enter**.

The number set here is the first feed cycle day and if changed the cycle begins again from this day. Edit the growth day for the present herd if needed. Day of Cycle is the feed cycle day.

5.5 Herd Number (Menu 15)

Use **Menu 15** to enter the herd number. This number saves the management information for each group separately in your personal computer.

5.6 New Herd (Menu 16)

The New Herd menu determines if a new herd has entered the system. When a new herd is entered, **AC-2000** begins using the ventilation settings for growth day 1, and collect new management data for the new herd.

To enter a new herd:

1. In the Control Menu, press **16**.
2. Press **Enter**.
3. Type **1** for to register a new herd.
4. Press **Enter**.

AC-2000 begins a new growth cycle, erases the old management data, and sets the date in Menu 14 to 1.

5.7 Alarm Reset (Menu 17)

The Alarm Reset menu cancels all AC-2000 alarms. The reset function enables you to clear the alarm relay (code 40). You can clear the alarm relay to silence the alarm siren or bell, while working on the problem.

To cancel alarms:

1. In the Control Menu, press **17**.
2. Press **Enter**.
3. Select:
 - 0: cancel
 - 1: reset alarm siren relay only
 - 2: reset all alarms and message. These return after a period of time (see System Parameter 16, page 36)
4. Press **Enter**.

5.8 Alarm Test (Menu 18)

The Alarm Test menu enables testing the alarms at a specific time and for a specific of time.

To test alarms:

1. In the Control Menu, press **18**.
2. Press **Enter**.
3. Type the required time and length.
4. Press **Enter**.

6 History menu

The History menus enable viewing herd statistics.

- Temperature (Menu 21)
- Humidity & CO2 (Menu 22)
- Water (Menu 24)
- Feed (Menu 25)
- Alarms (Menu 26)
- Mortality (Menu 27)
- Heaters (Menu 28)

6.1 Temperature (Menu 21)

Day	Min.	Avg.	Max.
*	*	*	*
20	25.0	25.5	26.5
21	24.5	25.8	26.5
*	*	*	*
Today	23.0	24.3	26.0

Menu 21 displays the minimum, average and maximum temperature history from Growth Day 1 to the current growth day. The controller calculates a true continuous average over the entire 24-hour period for each day. These data points used for the calculations are the average of the zone sensors.

6.2 Humidity & CO2 (Menu 22)

Menu 22 displays the minimum, average and maximum humidity history from Growth Day 1 to the current growth day. The controller calculates a true continuous average over the whole 24-hour period using the average of the zone humidity sensors.

6.3 Water (Menu 24)

Menu 24 shows the daily water consumption, with percent change from the previous day for each growth day. Use the up/down arrow keys to move forward or backwards to see other growth days.

6.4 Feed (Menu 25)

Menu 25 shows the daily feed consumption, with percent change from the previous day for each growth day. Use the up/down arrow keys to move forward or backwards to see other growth days.

6.5 Alarms (Menu 26)

Table 16: Alarms Codes

Code	Alarm
1	Low Temperature
2	High Temperature
3	Temp Failure, Zone A
4	Temp Failure, Zone B
5	Temp Failure, Zone C
6	Feeder Overtime
7	Low Static Pressure
8	High Static Pressure
9	Water Overflow
10	Water Shortage
11	Sensor Failure, Zone D
12	Sensor Failure, Zone E
13	Sensor Failure, Zone F
14	Alarm Test
15	Incompatible card
16	Pressure Failure

Menu 26 displays the alarms history. The **AC-2000** stores the last 99 alarm events with growth date, time and alarm codes. Table 15: Alarms Codes shows the meaning of each alarm code.

To silence the alarm refer to **Menu 17**, page 28.

6.6 Mortality (Menu 27)

Menu 27 displays the mortality history. The **AC-2000** shows the present growth day data first. To view other growth days, use the up and down arrow keys.

6.7 Heaters (Menu 28)

Menu 28 shows the on time for the low level heaters in each zone. The values are in minutes for each growth day. Note that the **AC-2000** maintains heater on times only for heaters with relay codes 9, 11 and 13. If you run your heaters with other relay codes, their time is not recorded.

7 Test menu

The Test Menu enables testing and configuring various AC-2000 functions.

- Temperature (Menu 31)
- Humidity / CO2 (Menu 32)
- Relays (Menu 33)
- Digital Inputs (Menu 34)
- Analog Input (Menu 35)
- Analog Output (Menu 36)
- Pulse (Menu 37)

7.1 Temperature (Menu 31)

Menu 31 shows the individual readings of the temperature sensors. The **AC-2000** averages the zone sensors (see Sensor Layout, **Menu 94**) to determine the house temperature for ventilation.

- A disconnected sensor shows **DIS**.
- A shorted sensor shows **SHR**.

7.2 Humidity / CO2 (Menu 32)

Menu 32 shows the individual humidity readings of each humidity sensor. See Analog Inputs, **Menu 35**.

7.3 Relays (Menu 33)

The Relays menu turns individual relays on and off.

To change the Relay status:

1. In the Control Menu, press **33**.
2. Press **Enter**.
3. Move the cursor to the relay number.
4. Press **Enter**.

NOTE See *Manual Relay Operation in the installation section for a method of extending manual relay operation to arbitrarily long times.*

7.4 Digital Inputs (Menu 34)

The Digital Inputs menu displays the status of the following digital inputs:

- Wind direction/Feed overtime alarm (depending on the card installed)
- Feed pulse system

The displayed value shows the input open or shorted state.

- 1: Short
- 0: Open

7.5 Analog Inputs (Menu 35)

The Analog Input menu displays the humidity/static pressure analog inputs. The values shown represent the internal digital numbers used by the **AC-2000**. The **AC-2000** calculates actual values using calibration factors and other formulas for humidity or static pressure.

NOTE *The (p) column displays the A/D values of the internal pressure sensor and not on the analog inputs.*

7.6 Analog Output (Menu 36)

The Analog Output menu controls a variable speed fan and a light dimmer via the activation voltage. The menu activates them at the same time.

To change the change the activation voltage:

1. In the Control Menu, press **36**.
2. Press **Enter**.
3. Type the approximate output voltage.
4. Press **Enter**.

The AC-2000 checks the variable speed fan and the light dimmer at this voltage.

7.7 Pulse (Menu 37)

Menu 37 displays the current pulse count.

8 Calibration menu

The following menus are used to calibrate **AC-2000** sensors.

- Temperature (Menu 41)
- Humidity (Menu 42)
- Feed Pulse Ratio (Menu 45)
- Water Pulse Ratio (Menu 46)
- CO2 (Menu 47)

8.1 Temperature (Menu 41)

Menu 41 checks and calibrates each temperature sensor.

To calibrate a temperature sensor:

1. In the Control Menu, press 41.
2. Press **Enter**.
3. Stabilize the sensors at a known temperature.
4. Type that temperature.
5. Press **Enter**.

NOTE *The calibration base value is fixed upon entering **Menu 41**. Therefore, do not enter **Menu 41** until after the sensors are at a stable temperature.*

The **AC-2000** calculates the calibration factor. The sensors are factory tested to be accurate to within 2° F. Note that the calibration is precise only at the calibration temperature. Errors tend to increase as the temperature deviates from the calibration temperature.

It may be simpler to measure the temperature of a pail of water. Air temperature changes rapidly in small regions by several degrees as air currents move, making calibration difficult.

- Ensure the water temperature is near ambient air temperature to prevent warm up or cool down while calibrating.
- Stir the water while measuring it to eliminate warmer and cooler regions.

8.2 Humidity (Menu 42)

Menu 42 checks and calibrates each sensor.

To calibrate a humidity sensor:

1. In the Control Menu, press **42**.
2. Press **Enter**.
3. Measure the current humidity using an external independent sensor.
4. Change the humidity level in the controller to match the independent sensor.
5. Press **Enter**.
 - A disconnected sensor shows DIS. and a shorted one shows SHR.

- The factor value is automatic and cannot be changed.

8.3 Feed Pulse Ratio (Menu 45)

Menu 45 calibrates the feed delivery measurement system.

To calibrate the delivery system:

1. In the Control Menu, press **45**.
2. Press **Enter**.
3. Select a pulse based system (**0**), or time based system (**1**).
4. Enter the pounds of feed delivered per pulse or per minute.
5. Press **Enter**.

8.4 Water Pulse Ratio (Menu 46)

Menu 46 configures the quantity that the water meter measures per pulse. Refer to your water meter instructions for this value. Entering '0' disables all water alarms, both shortage and overflow.

8.5 CO2 (Menu 47)

AC-2000 measure CO2 levels based on an 1 – 5 VDC analog device. This menu maps the required levels to the voltage output.

To calibrate the CO2 sensor:

1. In the Control Menu, press **47**.
2. Type the required level at 1 VDC.
3. Press **Enter**.
4. Type the required level at 5 VDC.
5. Press **Enter**.
6. Type the correction factor.
7. Press **Enter**.

9 Configuration

Table 17: Configuration (Version 8.07)

91	Configuration
92	Ventilation Levels
93	Relay Layout
94	Sensor Layout
95	Setup Curtains
96	System Variables
97	Password

Configuration (Version 8.10)

91	Configuration
92	Ventilation Levels
93	Relay Layout
94	Sensor Layout
95	Setup Curtains
96	System Variables
97	Password
98	Wind Chill

The installation menus are not shown on the front panel of the control. They are not used in the day-to-day operation of the control, but only during initial installation.

To get to these menus from the default display:

1. Press **MENU**.
2. Enter the menu number from the Installation Menu.
3. Press **ENTER**.

NOTE For information on Menus 91 - 95, refer to the Installation Manual.

- System Variables (Menu 96)
- Password (Menu 97)

9.1 System variables (Menu 96)

The following sections details Menu 96, which contains the AC-2000 variables used to determine menu values.

Note: Versions 8.08 and above do not support Variables 29, 37, and 38.

Table 18: Menu 96 Variables

Var.	Description	Default	Range
1	Target Temperature Hysteresis (Degrees)	0.5° C 0.9° F	0.3 – 20° C 0.5 – 36° F
2	Ventilation Level Increase, Time Delay (Minutes)	3	0.2 – 10 Min
3	Ventilation Level Decrease, Time Delay (Minutes)	1.0	0.2 – 10 Min
4	Max Ventilation Level Below Cooling Temp.	20	0 - 20 Levels
5	Tunnel Mode Exit, Amount Above Target (Degrees)	0° C 0° F	0 – 20° C 0 – 36° F
6	Out Temperature As Diff. Above Target Temp. To Allow Tunnel Mode Exit (Degrees)	0° C 0° F	0 – 20° C 0 – 36° F
7	High Temp Alarm, Amount Above Target (Degrees)	4° C 7.2° F	0 – 20° C 0 – 36° F
8	Low Level Heater Hysteresis, Amount Below Heat Set Temperature (Degrees)	0.5° C 0.9° F	0.3 – 20° C 0.5 – 36° F
9	High Level Heater Hysteresis, Amount Below Heat Set Temperature (Degrees)	2° C 3.6° F	0 – 20° C 0 – 36° F
10	Radiant Heater Ignition Time (Sec)	60	0 – 99 Sec
11	Low Temp Alarm, Amount Below Heat (Degrees)	3° C 5.4° F	0 – 20° C 0 – 36° F
12	Cooling Hysteresis (Degrees)	0.5° C 0.9° F	0.3 – 20° C 0.5 – 36° F
13	Humidity Treatment Main Delay (Minutes)	5	0 - 99.9 Min
14	Zone A, B Temp Diff for Re-circulation Fan (Degrees)	5° C 9° F	0.3 – 20° C 0.5 – 36° F
15	Curtain Position Calibration	1	0 - 24
16	Delay time for returning from alarm reset	30	0-99 Min
17	Output Voltage At 0 % AN-1. Choose one of four options (none, variable fan, light, variable heat) as seen in Menu 91.	3	0 – 10 V out
18	Output Voltage At 100 % AN-1	10	0 – 10 V out
19	Wind Direction Averaging Period (Minutes)	30	0 - 99.9 Min.

Var.	Description	Default	Range
20	Output Voltage At 0% AN-2. Choose one of four options (none, variable fan, light, variable heat) as seen in Menu 91.	3	0 - 10 V out
21	Tunnel Mode Exit Lockout Time (Minutes)	60	0 - 99.9 Min
22	Output Voltage At 100 % AN-2	10	0 - 10 V out
23	Minimum Curtains 1+2 Opening for Group Fans Run (%)	0	0 - 99.9 %
24	Wind Direction Or Feed Overtime Alarm Selection For Digital Input 1: <ul style="list-style-type: none"> • 0 = Wind Direction • 1 = Feed Overtime Alarm 	0	0-1
25	Feed Overtime Alarm Delay (Minutes)	0	0 - 99.9 Min
26	Alarm Relay Output Delay (Minutes)	0.5	0 - 99.9 Min
27	Humidity Treatment Duration (Minutes)	1	0 - 99.9 Min
28	Pressure Units for static pressure option: <ul style="list-style-type: none"> • 0 = Millibar • 1=Inch Wate • 2=Pascal • 3=Cm. Water • 4=Mm. Water 	1 Inch Water	0 - 4
29	Static Pressure Interlock (Group Fans Off During Pressure Adjustment): <ul style="list-style-type: none"> • No = 0 • Yes = 1 	0	0-1
30	Minimum Level for Low Static Pressure Alarm	1	0 - 20 Levels
31	Static Pressure Wind Gust Delay (Seconds)	10	0 - 99 Sec
32	Water Overflow Alarm Quantity per Minute (Units)	99	0 - 99 Units
33	Water Shortage Alarm Quantity per Hour (Units)	0	0 - 99 Units
34	Water Overflow Alarm Delay (Minutes)	10	0 - 99.9 Min
35	Water overflow during dark (Quantity per Hour)	0	0-99 Units
36	Humidity Treatment, Heater Use Limit (Degrees)	1° C 1.8° F	0 - 20° C 0 - 36° F
37	Humidity Treatment, Heater Use Humidity Start Point	99.9	0 - 99.9 %.
38	Radiation Heater, Set Point Above Heat (Degrees)	0° C 0° F	0 - 20° C 0 - 36° F
39	Tunnel mode transition (Minutes)	3	0 - 99.9 Min
40	Absolute High Temperature Alarm (Degrees)	50° C 122° F	0 - 50° C 32 - 122° F

Var.	Description	Default	Range
41	Sunrise/Sunset Duration (Minutes)	1	0 - 99.9 Min
42	Delay time to ignore water overflow at sunrise (Minutes)	10	0-99.9 Min
43	Enable Feed Shutoff if Feed Overtime Alarm: No = 0 Yes = 1	0	0-1
44	Advanced Air Inlet Open (Seconds)	6	0 - 99 Sec
45	Level Differential High Temp Alarm Option (Degrees)	0° C 0° F	0 - 20° C 0 - 36° F
46	Not in use	30	0 - 99.9 %
47	Not in use	30	0 - 99.9 %
48	Not in use	12	0 - 99 A/D
49	Weighing Sensitivity 0% to 100%	30	0 - 99.9 %
50	Not in use	0	0 - 24 (Hours)
51	Not in use	24	0 - 24 (Hours)
52	Munters Use Only		
53	Temp change to be considered as quick drop in degrees, to reduce a level to reach below target temp (Degrees)	0.5° C 0.9° F	0.3 - 20° C 0.5 - 36° F
54	Temp change to be considered as quick drop in degrees, to reduce a level to reach above target temp (Degrees)	1° C 1.8° F	0.3 - 20° C 0.5 - 36° F
55	Delay for ignition time (Seconds)	10 Sec	0-99 Sec
56	Cool Down Factor (%)	0	0-20%
57	Temperature differential for 2nd fogger	0	0 - 99.9
58	Operate cool pad according to average temperature or wind chill temperature	1	1 - Wind chill 0 - Average temperature

Note: Versions 8.09 and higher support Variable 58.

System Variable Guide

The following details the variables listed in Table 17.

- 1. Target Temperature Hysteresis (Degrees):** Sets the dead band above target temperature. The ventilation level increases at the target temperature plus the hysteresis, and decreases at the target temperature. *Factory default: 0.5° C / 0.9° F*
- 2. Ventilation Level Increase Time Delay (Minutes):** Sets the minimum delay time before a ventilation level increase, when rising temperatures call for higher ventilation. *Factory default: 3.0 minutes*
- 3. Ventilation Level Decrease Time Delay (Minutes):** Sets the minimum delay time before decreasing a ventilation level, when declining temperatures call for lower ventilation. *Factory default: 1.0 minute.*

- 4. Max Ventilation Level Below Cooling Temp.:** Sets the maximum ventilation level the controller uses at any time the temperature is below the cooling set point. It is a convenient way of limiting the use of extra ventilation fans to a second set point, namely the cooling temperature. *Factory default: 20*
- 5. Tunnel Mode Exit, Amount Above Target (Degrees):** Sets the degrees above target temperature that the **AC-2000** may leave tunnel ventilation, once it has entered tunnel mode. *Factory default: 0.0° C / 0.0° F.*
- 6. Out Temperature as Diff. Above Target Temp. to Allow Tunnel Mode Exit (Degrees):** Define the differential above the target temperature to permit the exiting from Tunnel Mode when the outside temperature is warmer than the inside temperature. *Factory default: 0.0° C / 0.0° F*
- 7. High Temp Alarm, Amount Above Target (Degrees):** Sets the degrees above the target temperature to generate an alarm. *Factory default: 4.0° C / 7.2° F*
See also system variables **40** and **45**.
- 8. Low Level Heater Hysteresis, Amount Below Heat Set Temperature (Degrees):** Sets the difference between heaters turned on and heaters turned off. This hysteresis is to the low side of the set point. *Factory default: 0.5° C / 0.9° F*
- 9. High Level Heater Hysteresis:** Set the relative temperature difference for high-level heaters, or amount below the heat set temperature to turn on high-level heaters. *Factory Default: 2.0° C / 3.6° F*
- 10. Radiant Heater Ignition Time:** Sets the length of time the radiant heater ignition is held on. *Factory default: 60 seconds (See also System Variable 55)*
- 11. Low Temp Alarm, Amount Below Heat (Degrees):** Sets the degrees below the Heat Temperature to generate an alarm. *Factory default: 3.0° C / 5.4° F*
- 12. Cooling Hysteresis:** Sets the difference between cooling system turned on and cooling system turned off temperatures. *Factory default: 0.5° C / 0.9° F*
- 13. Humidity Treatment Main Delay (Minutes):** Sets OFF time for the humidity treatment cycle. *Factory default: 5 minutes*
- 14. Zone A, B Temp Diff. for Re-circulation Fan (Degrees):** Sets the temperature difference between Zone A and Zone B, at which the re-circulation fans turn on. *Factory default: 5.0° C / 9.0° F*
- 15. Curtain Position Calibration. 0-24 Times a Day:** Set the number of times in a day you would like to run a curtain position calibration (If you set this variable to 2, the controller will calibrate every 12 hours; 3-every 8 hours; etc.) The calibration program runs the curtain to the nearest of fully open or fully closed positions. The duration of the calibration is the same as the time taken to go fully open or fully closed, as entered in configuration, **Menu 91**.
- 16. Delay Time for Returning from Alarm Reset (Minutes):** If the alarm after a reset is not solved during the delay time set by the user, the alarm continues. If the alarm has been solved, it won't continue any longer. *Factory default: 30 minutes*
- 17. Output Voltage At 0 % AN-1:** Set analog output minimum voltage level. The analog output is defined as one of four options. *Factory default: 3.0 Fog*
- 18. Output Voltage At 100 % AN-1:** Set analog output maximum voltage level *Factory default: 10.0*
- 19. Wind Direction Averaging Period (Minutes):** The **AC-2000** can switch curtain tables between curtains 1 and 2 based on wind direction. This parameter sets the period for checking average wind direction, before deciding which way the wind is blowing. *Factory default: 30.0 minutes*

20. Output Voltage At 0% AN-2: Set analog output minimum voltage level. The analog output is defined as one of four options. *Factory default: 3.0 volts*

21. Tunnel Mode Exit Lockout Time (Minutes) Sets the minimum time the AC-2000 remains locked in Tunnel Mode after entering Tunnel Mode.

Factory default: 60.0 minutes

22. Output Voltage At 100 % AN-2: Set analog output maximum voltage level

Factory default: 10.0 volts

23. Minimum Curtains 1+2 Opening for Group Fans Run (%): Exhaust fans may create static pressure pulling the curtains against the house when they are almost closed. Set the point to which you want the fans to stop when the curtains move. The AC-2000 uses the sum of curtain 1 and curtain 2 openings to determine whether to turn the fans off briefly while moving the curtains.

Factory default: 0%

24. Wind Direction/Feed Overtime Alarm Input Selection: Setting this to 1 makes the second digital input function as feed overtime alarm input. If it is 0, the second digital input causes the AC-2000 to use it as a prevailing wind direction indication.

25. Feed Overtime Alarm Delay: Set the amount of time in minutes to wait before alarms are activated (prevents tripping on short alarms). *Factory default: 0.0 minutes*

**Requires activation of the Feed Overtime Alarm (see System Variable 24).*

26. Alarm Relay Output Delay (Minutes): This delay applies to all alarms, except of the Feed Overtime Alarm (See system variables 24 and 25). The alarm relay activates after this delay.

Factory default: 0.5 minutes

27. Humidity Treatment Duration (Minutes): Set the ON time for the Humidity Treatment cycle.

Factory default: 1 minute

28. Pressure Units for Static Pressure Option: *Factory default: 1 - "Inches of water column"*

Input #	Unit
0	Millibar
1	Inches of water column
2	Pascals
3	Cm. Water
4	Mm. Water

29. Static Pressure Interlock: Factory default is NO interlock or code '0'. A code of '1' turns on the static pressure interlock, which turns off all ventilation groups during static pressure adjustment.

30. Minimum Level for Low Static Pressure Alarm: Factory default of '1' allows low static pressure alarms at all ventilation levels.

31. Static Pressure Wind Gust Delay (Seconds): Length of time of delay before making pressure adjustments to unexpected pressure changes. *Factory Default: 10 seconds.*

**See Menu 8 for other parameters related to static pressure operation.*

NOTE *The AC-2000 bypasses this delay for ventilation level changes and cycle timer fans, since it knows that the pressure change is not due to a wind gust.*

32. Water Overflow Alarm Quantity per Minute (Units): Sets the water quantity per minute from the water meter that will trigger an overflow alarm. Calibration Menu 46 scales the quantity, so enter the scaled quantity instead of the number of pulses from the water meter.

Factory default: 99

33. Water Shortage Alarm Quantity per Hour (Units): Sets the minimum water quantity per hour that the AC-2000 must detect to prevent generating a water shortage alarm. Note that the lights must be on during the time this alarm can occur. This alarm is disabled when lights are out.
Factory default: 0.

34. Water Overflow Alarm Delay (Minutes): Sets the minimum amount of time that water overflow must be active before the AC-2000 generates an alarm.
Factory default: 10.0 minutes.

3. **35. Water Overflow During Dark (Quantity per Hour):** Sets the water quantity per Hour from the water meter that will trigger an overflow alarm when it is **dark**. *Factory default: 0*

36. Humidity Treatment, Heater Use Limit (Degrees): Sets the number of degrees above the target temperature at which humidity treatment with the heaters stops.
Factory default: 1.0° C / 1.8° F

37. Humidity Treatment, Heater Use Humidity Start Point: Sets the relative amount above requested humidity at which heater use to reduce humidity begins.
Factory default: 99.9% (disabled)

38. Radiation Heater, Set Point Above Heat. (Degrees): This is the relative number of degrees above heater set point, at which the radiant heaters turn on. They stay on for all temperatures below this. *Factory default: 0.0° C / 0.0° F*

39. Tunnel Mode Transition (Minutes): This parameter determines when to transit to Tunnel mode. During this time, the Tunnel curtain opens and neither pressure control nor pressure alarm occur, even if the pressure is low. After half of the time set, Inlet closing occurs. At the end of this time, the controller begins pressure control and returns to dealing with the pressure alarms. For example, if the time defined is 3.0 minutes, the Tunnel open occurs during all these 3.0 minutes. After 1.5 minutes Inlet Close occurs.
Factory default: 3.0 minutes

40. Absolute High Temperature Alarm (Degrees): Sets an absolute high temperature alarm point, which remains at the place you set it. *Factory Default: 50° C / 122° F*

41. Sunrise/Sunset Effect Duration (Minutes): Sets the length of time to change light levels from one setting to another. *Factory default: 1.0 minute*

NOTE *When defining 100% sunrise, the controller reaches 0 - 100% during the time defined. If less than 100% sunrise is defined, the time will be divided according to its relative percentage.*

42. Delay Time to Ignore Water Overflow at Sunrise (Minutes): This parameter allows an extra delay during light up. At lights up there will be this delay time to ignore water overflow. *Factory default: 10 minutes*

43. Enable Feed Shutoff if Feed Overtime Alarm: Select yes (1) to turn off feed relays for feed overtime alarm. *Factory default: 0 (NO) NO = 0 YES = 1*

44. Air Inlet Open Advance (Seconds): This is the number of seconds prior to turning on fans that the inlets will begin to open when fans cycle according to the ventilation table settings. It is significant for minimum ventilation settings, where a total run time of 0.5 minutes might not allow the inlets to get open and set before the fans turn off again. *Factory default: 6 seconds*

45. Level Differential High Temp Alarm Option (Degrees): This option instructs the AC-2000 to consider the ventilation level temperature differential in the relative high temperature alarm setting. The alarm will occur at the target temperature plus the current ventilation level differential temperature plus System Variable 7. If you leave this at zero (no level differential option) the high temperature alarm occurs at target temperature plus System Variable 7. *Factory default: 0.0° C / 0.0° F*

NOTE: *If there is no airflow in the house, the temperature differential from Menu 92 will cause the alarm temperature to be higher than normal. This can result in animal loss; use this option only with adequate back up and other means to ensure adequate air flow at all times.*

46. Percentage Above Reference Weight (%):Not in use

47. Percentage Below Reference Weight (%):Not in use

48. Tare Sensitivity, 0-A/D to 99-A/D: Not in use

49. Weighing Sensitivity, 0%to 100%: Not in use

50. Birds Weighing Start Time (Daytime): Not in use

51. Birds Weighing End Time (Daytime): Not in use

52. Feed Cycle Length Limitation. (Days): *Factory default: 7 days*

53. Temp Decrease BELOW Target for Level Decreasing (Degrees):

- **IF:**
 - The average temperature is **below** the Target Temperature
 - AND IF the Outside temperature is below the Heat Temperature (or no temperature sensor exists)
 - AND IF the average temperature drops more than this setting (*Factory default: 0.5 °C / 0.9 °F*) in one minute,
- **Then:** the AC-2000 decreases one level.

54. Temp Decrease ABOVE Target for Level Decreasing (Degrees):

- **IF:**
 - The average temperature is **above** the Target Temperature
 - AND IF the Outside temperature is below the Heat Temperature (or no temperature sensor exists)
 - AND IF the average temperature drops more than this setting (*Factory default: 1.0 °C / 1.8 ° F*) in one minute,
- **Then:** the AC-2000 decreases one level.

55. Delay Ignition Time (Seconds): This is the delay between ignition relay on to heater on.
Default: 10 seconds.

NOTE: *See also System Variable 10.*

56. Cool Down Factor (%): The minimum percentage correction towards target during each increase ventilations delay. If the temperature does not improve by this amount, the AC-2000 increases it in one level after the delay time. Default: 15%.

57. Temperature differential for 2nd fogger: The second fogger stage is triggered when the temperature increases the amount set in this variable from "Cooling/Tunnel" specified in Temperature (Menu 01)(page 17). *Factory default: 0.0.* To disable this stage, set the differential to 0.0.

Note: Versions 8.07 or higher support a second fogger.

58. Operate Cool Pad based on the average temperature or the calculated wind chill temperature. *Factory default: 1*

- 1 – Wind chill
- 0 – Average temperature

Note: Version 8.09 supports the Wind Chill feature

9.2 Password (Menu 97)

To protect the integrity of the **AC-2000** settings, use a password. For the communications programs to access all the **AC-2000** controls on one line, they need to have the same password. You can enter a high password to provide complete access, and/or a low password that allows reading the information on the controller but not making changes.

9.3 Wind Chill

Note: Versions 8.09 and above support this feature.

AC-2000 can take into consideration the wind chill factor when making certain calculations related to the temperature. In effect, the wind chill factor acts as the temperature differential. When enabled, AC-2000 determines the "**calculated temperature** (actual temperature - wind chill temperature) and uses this temperature:

- When calculating the Tunnel Mode level up/down algorithms
- When operating the Cool Pad (if enabled in System Variables; refer to [Operate Cool Pad](#), page 38).

The Wind Chill factor influences controller operation from the 1st tunnel level.

Note: The actual temperature: 1) determines the entry and exit into Tunnel Mode 2) controls the fogger.

Parameters:

- **Wind Chill:** Select '0' for no, '1' for yes. Default is '1'.
- **Cross Section (sg.):** House dimension in square meters or feet (set the unit in Menu 91).
- **Fan# 1 - 12:** The fan group capacity in square meters or square feet per minute.
- **Wind Chill Limit:** Maximum wind chill factor value. Default = 8° C.
- **RH Effect:** The decrease in temperature caused by an increase in relative humidity. Default is 0.26° C. Refer to the following section for details.

9.3.1 Relative Humidity Effect

The Relative Humidity Effect parameter enables including the relative humidity (RH) in the wind chill factor calculations. A rise in relative humidity reduces the wind chill factor. How does it work?

- There is no effect below 40% relative humidity.
- The user determines the increase in temperature for every 5% increase in relative humidity.
 - The default increase is 0.26° C; meaning that between 40.1% - 45% relative humidity, the wind chill factor **decreases** by 0.26° C. Between 45.1% - 50%, the wind chill factor decreases by 0.52° C, twice the default level. Between 50.1% - 55%, the decrease is 0.78° C, three times the default level, and so on.
 - The user can set the temperature increase as required.
 - To disable this feature, enter '0'.

9.3.2 Example of Wind Chill Factor and Relative Humidity Effect

A farmer sets up the Wind Chill features as follows:

- Wind Chill factor: 8° C
- Relative Humidity effect: 0.5° C

At 35° C, the calculated temperature is: 35 - (Wind Chill factor - RH effect). For example, if the relative humidity is 52%, the calculated temperature is: 35 - (8 - 1.5) = 28.5° C. Table 19 lists the calculated temperatures according to the input factors.

Table 19: Calculated Temperatures

RH (%)	Actual Temperature	Wind Chill Factor	Relative Humidity Effect	Calculated Temperature
0 - 40	35	8	0	27
40.1 - 45	35	7.5	0.5	27.5
45.1 - 50	35	7	1	28
50.1 - 55	35	6.5	1.5	28.5
55.1 - 60	35	6	2	29
60.1 - 65	35	5.5	2.5	29.5
65.1 - 70	35	5	3	30
70.1 - 75	35	4.5	3.5	30.5
75.1 - 80	35	4	4	31
80.1 - 85	35	3.5	4.5	31.5
85.1 - 90	35	3	5	32
90.1 - 95	35	2.5	5.5	32.5
95.1 - 100	35	2	6	33

10 Warranty

Warranty and technical assistance

Munters products are designed and built to provide reliable and satisfactory performance but cannot be guaranteed free of faults; although they are reliable products they can develop unforeseeable defects and the user must take this into account and arrange adequate emergency or alarm systems if failure to operate could cause damage to the articles for which the Munters plant was required: if this is not done, the user is fully responsible for the damage which they could suffer.

Munters extends this limited warranty to the first purchaser and guarantees its products to be free from defects originating in manufacture or materials for one year from the date of delivery, provided that suitable transport, storage, installation and maintenance terms are complied with. The warranty does not apply if the products have been repaired without express authorisation from Munters, or repaired in such a way that, in Munters' judgement, their performance and reliability have been impaired, or incorrectly installed, or subjected to improper use. The user accepts total responsibility for incorrect use of the products.

The warranty on products from outside suppliers fitted to AC-2000, (for example AC-2000's, sensors, cables, thermostats, etc.) is limited to the conditions stated by the supplier: all claims must be made in writing within eight days of the discovery of the defect and within 12 months of the delivery of the defective product. Munters has thirty days from the date of receipt in which to take action, and has the right to examine the product at the customer's premises or at its own plant (carriage cost to be borne by the customer).

Munters at its sole discretion has the option of replacing or repairing, free of charge, products which it considers defective, and will arrange for their despatch back to the customer carriage paid. In the case of faulty parts of small commercial value which are widely available (such as bolts, etc.) for urgent despatch, where the cost of carriage would exceed the value of the parts, Munters may authorise the customer exclusively to purchase the replacement parts locally; Munters will reimburse the value of the product at its cost price.

Munters will not be liable for costs incurred in demounting the defective part, or the time required to travel to site and the associated travel costs. No agent, employee or dealer is authorised to give any further guarantees or to accept any other liability on Munters' behalf in connection with other Munters products, except in writing with the signature of one of the Company's Managers.

WARNING! In the interests of improving the quality of its products and services, Munters reserves the right at any time and without prior notice to alter the specifications in this manual.

The liability of the manufacturer Munters ceases in the event of:

- dismantling the safety devices;

- use of unauthorised materials;
- inadequate maintenance;
- use of non-original spare parts and accessories.

Barring specific contractual terms, the following are directly at the user's expense:

- preparing installation sites;
- providing an electricity supply (including the protective equipotential bonding (PE) conductor, in accordance with CEI EN 60204-1, paragraph 8.2), for correctly connecting the equipment to the mains electricity supply;
- providing ancillary services appropriate to the requirements of the plant on the basis of the information supplied with regard to installation;
- tools and consumables required for fitting and installation;
- lubricants necessary for commissioning and maintenance.

It is mandatory to purchase and use only original spare parts or those recommended by the manufacturer.

Dismantling and assembly must be performed by qualified technicians and according to the manufacturer's instructions.

The use of non-original spare parts or incorrect assembly exonerates the manufacturer from all liability.

Requests for technical assistance and spare parts can be made directly to the nearest Munters office. A full list of contact details can be found on the back page of this manual.

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