

Ventobacco®
Smart Curing control
VK 981(RH)TWIN



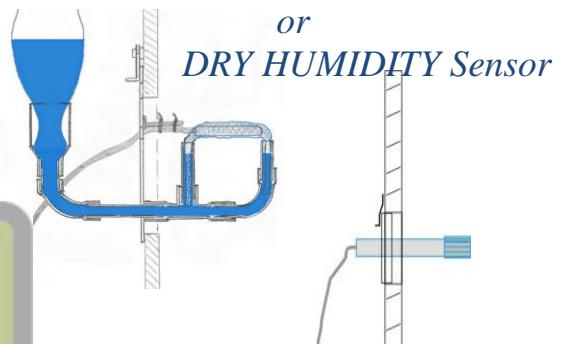
2015 s.version 2.01

Operator's manual

USA Client's REV 1 May, 2015

Degrees F in this manual.

With **WET BULB** sensor



With extra DB (SECURE) processor-relay-sensor.

What's new
in our 2015 model VK 981(RH) Twin.

- **VK 981(RH) Twin** has 1 extra built-in processor, 1 extra burner's relay and 1 extra DB sensor , (all called **SECURE DB**) &
- **VK 981(RH) Twin** monitors burner's on –off cycles & operating time .(to help operator fine tune the burner & calculate approximate fuel consumption during curing).

The **SECURE DB** sensor is designed to be placed in the upper barn's plenum ,on top of the air furnace in order to check & monitor the DB temp at this point and act as a safety DB sensor-relay-processor to cut off power to the burner's relay in case of any of the following undesirable conditions :

- If Secure's DB sensor is not connected *immediately will cut off power to burner's relay.*
- If Secure's processor receives data that main processor 's DB sensor is "err" *immediately.*
- If Secure's processor does not receive data from the main control's processor..... *for > 10 sec.*
- If Secure's sensor reads "err" (damaged) *immediately.*
- If Secure's sensor measures DB temp> 185 F *for >30 sec.*
- If Secure's sensor measures DB temp> 20 F from control's sensor DB actual *for >120 sec.*
- If Secure's sensor measures DB temp> 20 F from main control's DB floating *for..... >120 sec.*
- If Secure's sensor measures DB temp> 20 F from main control's DB set *for..... >120 sec.*

The burner will fire again when the undesirable condition returns to normal.

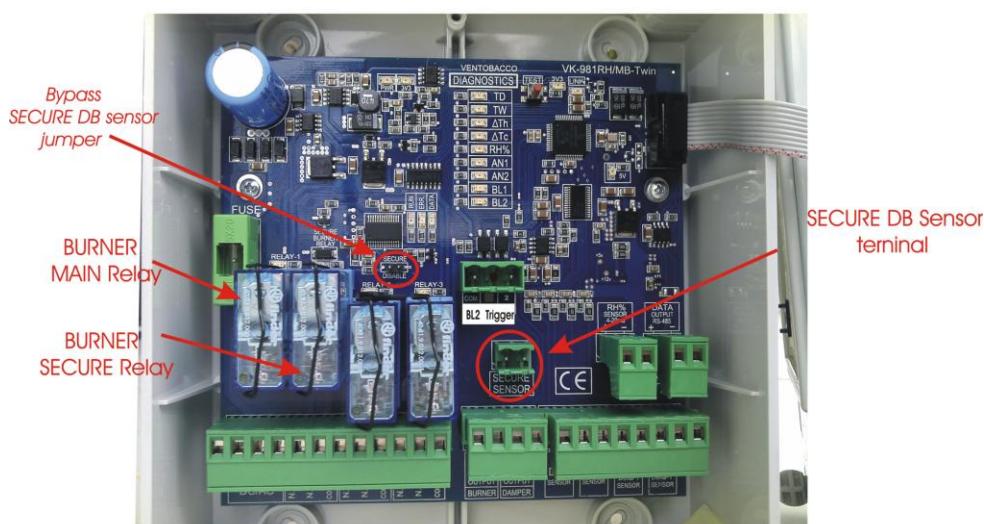
If any of the undesirable conditions repeatedly occur during an hour, the control will automatically reboot.

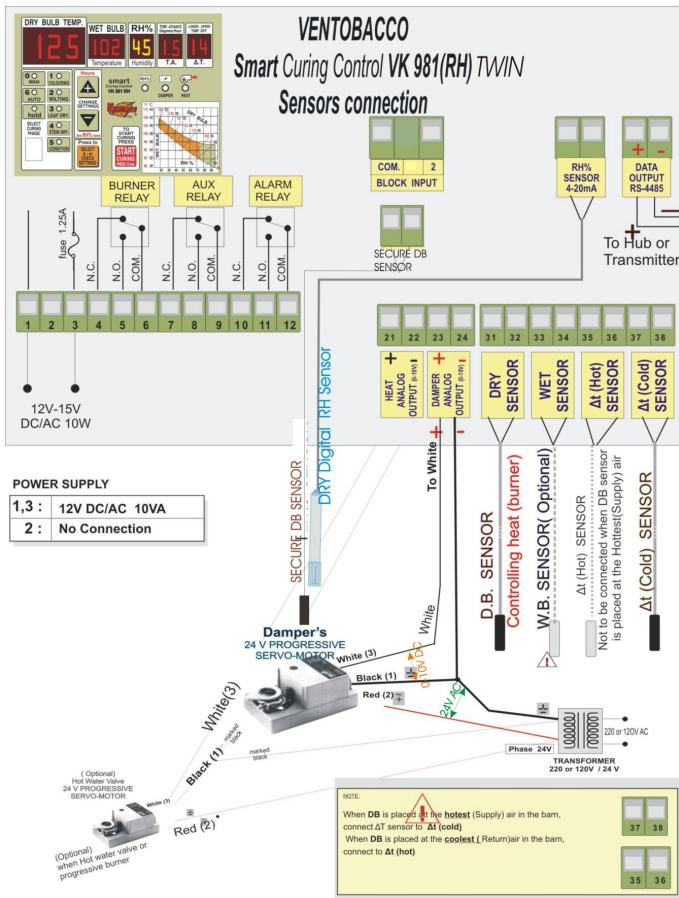
When power is supplied to the **VK 981(RH) TWIN** control, it's Secure processor-relay-sensor will not allow power to the burner's relay if any of the following occur:

- If Secure's DB sensor is not connected .(*Note: if you do not want to use the Secure sensor you can bypass it with a jumper on the terminals as show hereunder).*
- If Secure's processor receives data that main processor 's DB sensor is damaged "err"
- If Secure's processor does not receive data from the main control's processor.
- If Secure's sensor reads "err" (damaged) .
- If Secure's sensor measures DB temp> 185 F
- If Secure's sensor measures DB temp> 20 F from control's sensor DB actual temp.
- If Secure's sensor measures DB temp> 20 F from main control's DB floating temp
- If Secure's sensor measures DB temp> 20 F from main control's DB set temp.

NOTE: The SECURE DB is not intended to replace your barn's Safety HI temp Limit switch or the Safety airflow Switch .

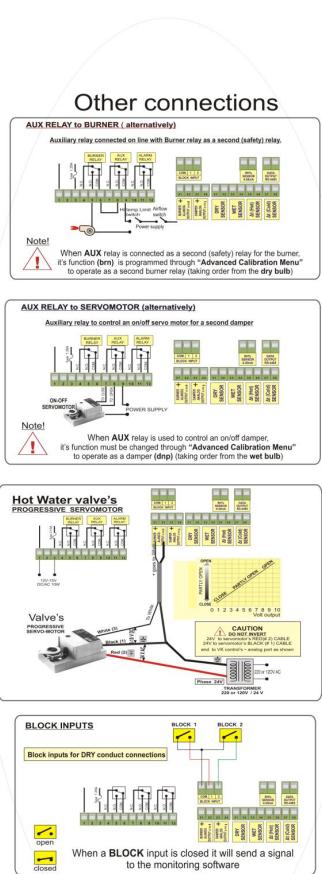
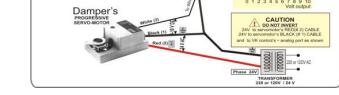
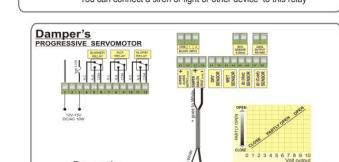
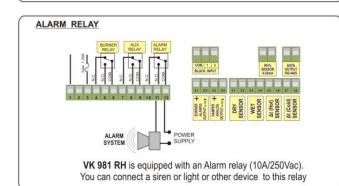
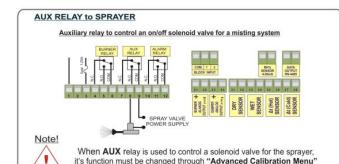
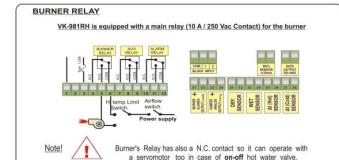
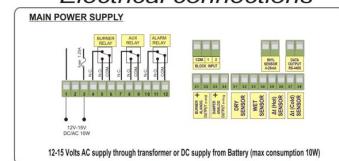
CAUTION : Never run a tobacco barn without a Hi temp Limit switch set at 180 F and without a Safety Airflow switch both connected on burner's line.





Follow your **LOCAL REGULATIONS** when connecting the control.
ALWAYS Install a High temperature Limit switch set at 180°F & an Airflow switch on Burner's line.

VK 981(RH) schematic Electrical connections



GENERAL information:

VK 981 SMART Controls include our previous **VK 981(A)**, **VK 981(RH)** models & our latest **VK 981(RH) TWIN**

- An **RH % interface** is also available to retrofit the VK 981(A) and Honeywell W.B. controls from WB sensors with wet wick to dry RH% sensors.

Burner control (Heat Control):

All versions control Heat (Dry.Bulb temp., Dry.Bulb.Temperature Advance and ΔT (D.B. temp.difference between top & bottom of the barn)) through 2 dry D.B. temperature sensors + 1 extra dry DB sensor (secure) on the **VK 981(RH) TWIN** model.

one DB placed under the lower tobacco and the other 1 or 2 above the upper tobacco mass in the barn.

Fresh air intake damper Control (Ventilation control):

Damper operation is controlled by a progressive (analog) 24 V servomotor taking order from: either a **Dry Relative humidity sensor** or a **Wet bulb sensor**.

- **VK 981 (A)** version controls and displays W.B temp **with a Wet bulb sensor**
- **VK 981(RH)& TWIN** versions control humidity **with either Wet bulb or dry Relative humidity** and displays both **W.B. temperature and RH%** humidity.
- **VV RH% interface** is designed to retrofit the VK 981(A)(& Honeywell)controls which are measuring Wet bulb temperature with a wet wick sensor **to dry Relative humidity sensor** . **VV RH% Interface** includes an RH% display and a dry Relative Humidity sensor .

The interface can be connected through a 2 wire cable on the old control's W.B terminals and retrofits the old W.B. Wet wick sensor to dry Relative humidity sensor.

Vk 981(A) controls retrofitted with the VV RH Interface are now showing the RH % on the display of the interface and the W.B (calculated) temp. on the control's display. They keep controlling the damper servomotor's operation through the W.B. control .

- **Relative Humidity % dry sensor**

VV RH % sensor used on the above Curing controls and on the Interface is a state of the art reliable & accurate humidity sensor with ~2-3% accuracy and a condensation filter built in, resisting temperatures up to 185°F .



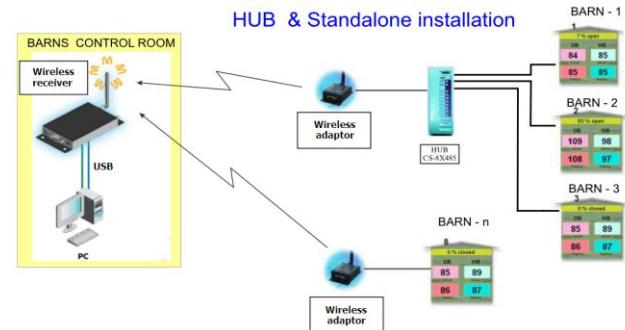
- **Data Monitoring**

Both versions of **Ventobacco's** curing controls are equipped with a data port allowing data transfer either through wires or wirelessly to a PC.

Curing data can be accessed through cell phone , sms messages or through the Internet from any place in the world.

- **VK 981 (RH) TWIN** version includes the following specs:

- Automatic detection of WB or RH sensor .
- up to 4 Sensors (high resolution 18 bits - 262.143 steps) .
- 3 DB Temperature sensors (one DB sensor is the main Heat controlling sensor +one extra D.B.sensor (secure) sensor + one ΔT sensor & one dry RH% electronic sensor or a Wet bulb sensor)
- 2 Analog(progressive) exits - (for a progressive Damper & a progressive Hot water valve or progressive Burner) Progressive Heat control (besides the progressive ventilation control) is ideal to ensure a smooth heat curve with minimum fuel consumption when firing biomass with progressive feeders or hot water boilers.
- 3 On-off Relays – 1 main for Burner , 1 auxiliary for sprayer , 1 auxiliary for alarms .
- 1 Block (alarm) input to transmit to a monitoring P/C blocks (malfunctions) of barn's fan and (or) burner or other connected device
- **1 input transmitting to a monitoring P/C the burner's on-off cycles & burner's running time.**
- an RS-485 data port for HUB - MUX – WIRELESS data transmission
- & connection of a barn Auto Shut down relay device (optional) triggering the barn's main relay .
- a USB port for P/C communication and diagnostic option access.
- 2 sets of diagnostic leds for easy troubleshooting.



Operator can upgrade control's FIRMWARE (software) .

He can read curing data and he can down load curing data & graphs even wirelessly.

*For detailed information on remote setup & monitoring consult our **Ventomonitor 15™** quick guide .*

VV reserves the right to make changes on the control's specs in order to upgrade its performance & appearance.

Ventobacco®

Smart Control's Operating philosophy .

Ventobacco® Smart_curing controls are controlling Heat & Humidity in a tobacco curing barn.

- **Heat** is controlled through one main Dry Bulb sensor ,(+one extra secure Dry Bulb sensor) and a Δ .T.sensor (which is also a D.B sensor).

Main controlling Dry bulb sensor is usually placed at the hottest air in the barn (lower part when upflow barns) ,**Secure Dry bulb sensor** is usually placed at the upper cooler part of the barn ,on top of the air furnace) and the **Δ T sensor** is placed at the upper cooler part .

- **Humidity** is controlled through a Humidity digital dry sensor or through a Wet bulb sensor or both.(placed preferably at the upper part of the barn).

The desired rate of DB temperature advance (in order to be smooth) is controlled through the DB sensor , the DB temperature advance control & the Δ T sensor .

(*The other DB (Secure) sensor is an extra safety sensor .*)

The desired rate of Humidity decrease (in order to be smooth) is controlled through the humidity sensor or through the Wet bulb sensor with the aid of control's software which relates humidity levels to the DB temperature levels throughout the whole cure .

Ventobacco® Smart controls are equipped with a well proven curing software ensuring the best possible cure with the minimum fuel consumption protecting & alerting operator for curing alerts.

Ventobacco® Smart_curing controls can cure :

- **Manually** like any classical curing control , where operator changes temperature& humidity settings whenever he wants , **or**
- **Semiautomatically** where operator changes only the curing phases and the control advances the phase supported by it's extra devices & software ,**or**
- **Automatically** where the control advances the whole cure automatically following the programmed curing schedule fine tuning it with the support of the extra devices and it's software.

What makes the Ventobacco® controls “Smart”.

The simple type (dummy) curing controls will advance curing according to schedule (either manually or automatically) without relating this advance to leaf's condition & behavior during curing (temperature areas where leaf releases moisture freely and risks to turn brown if heat supply is not limited or it is increased faster than ideally) .

Ventobacco® Smart controls are equipped with Δ T supporting device which makes them “smart” making them capable of “understanding ” the leaf condition , avoiding sudden temperature & humidity changes , measuring and controlling the rate of water evaporation from the leaves (which is different according to leaf position, growing conditions etc.) in order to follow an ideal rate of DB temperature increase to ensure safe water evaporation(avoiding breaking leaf cell) during the critical curing stages.

- Δ T control measures and controls the DB temp. difference between the lower and upper tobacco in the barn (created by water evaporating from the leaves) through the two D.B . sensors (one at the hottest part of the barn and the other on the coolest) and
- An advanced curing software prevents curing mistakes and alerts operator in case of dangerous curing conditions minimizing the risk of tobacco browning or scalding etc.

Ventobacco® Smart control's displays show the Dry bulb temperature (upper & lower) in the barn, the Relative humidity (upper & lower) , the Wet .Bulb temperature in the barn ,the rate of temperature advance together with several other curing info .

Ventobacco® Smart VK 981(RH)&TWIN description.

-BASIC CONTROLS

D.B. Dry bulb control (thermostat) controls the **burner.(Heat supply)**

T.A . Temperature Advancing control (thermostat) controls the **burner. (Heat supply)**

RH % . Humidity control (hygrostat) controls the **fresh air damper. (moisture removal)**
and (or)

W.B. Wet bulb control (thermostat) controls the **fresh air damper. (moisture removal)**

-ASSISTING CONTROL

ΔT . Dry bulb Temperature Difference control (differential) controls the **burner. (Heat supply)**

- When power is ON, you can see the temperature and humidity in the barn (where the sensors are located) as well as the settings (limits) set by the operator.

You can also see the temperature and humidity in the opposite side of the sensors .

- When the  button is pressed, all the displays operate as thermostats and all displays show the temperature & humidity settings (limits) selected by the operator.

NOTE: TA is always indicating the set value of the temperature increase in degrees per hour..

- Each time you press the  button, one display at a time flashes (first is DB, then RH% or WB, TA ,ΔT followed by Duration).

Press  to increase the value.

Press  to decrease the value.

After 15 seconds (without pressing any buttons), the display(s) stop flashing and return to indication mode (thermometers).The settings are now stored in control's memory.

Note 1: no matter if you are using a dry RH% sensor you can keep controlling the fresh air damper operation through the W.B. control (if you prefer it)or use the RH% control .

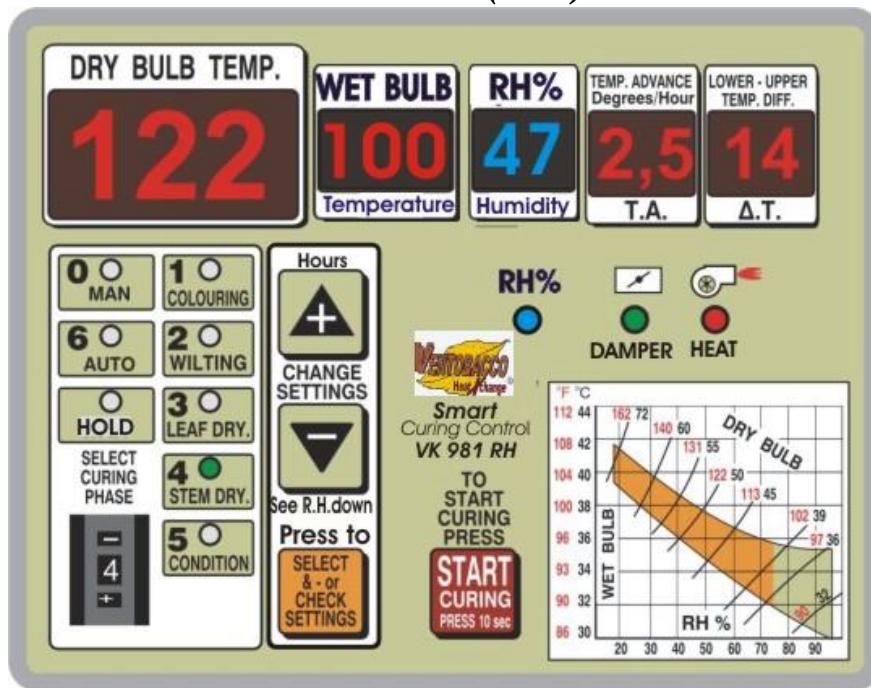
Note 2: Where you see “ Burner” on this manual it means “ Heat supply” .

DB thermostat controls the Heat supply (i.e. a Burner or a Hot water Valve).

Heat Supply on a tobacco curing barn can be either through:

- **an on-off Diesel or Gas burner (taking power through VK's on –off (burner) relay) or**
- **an on off Hot water valve (taking power through VK's on –off (burner)relay) or**
- **a progressive Hot water valve (taking power through VK's progressive (analog) port) .**

What you see on *Smart VK 981(RH)&TWIN Curing Control*



VK 981 (RH) TWIN Control displays

- The **Actual Dry.Bulb** temp & the Set limit ((go to) when you press button.)
- The **Actual Wet Bulb Temp.** & the Set limit ((go to) when you press button.) either directly measured (if a WB wet wick is connected) or calculated (if a dry RH sensor is connected)
- The **Actual RH%** and the Set limit ((go to) when you press button.) on the **Upper barn part** (& on the Lower barn part when you press button.)
- The **D.B. Temperature Advance** .
- The **Δ.T.** (DB temp difference Upper-Lower barn part)

No matter if you are using a dry RH% sensor or a Wet bulb sensor (with a wet wick) , you can keep controlling fresh air damper's operation through the W.B. control (if you are more familiar with it) or you can control it through the RH% device.

You have only to inform the control which device you want to use (RH% or W.B.) to control your fresh air damper operation (#8 on the selector to select the control and whether you want VK 981(RH) to display both W.B. temp and RH% or just the directly measured one . (see detailed description on SETUP menu).

SELECTOR enables Operator to:

- 1) **Quickly switch** from Manual operation to operation in Curing phases or Automatic operation (described in details in following chapter)
 - No. 0 for Manual operation
 - No. 1 for coloring,
 - No. 2 for wilting,
 - No. 3 for leaf drying,
 - No. 4 for stem drying
 - No. 5 for conditioning
 - No. 6 for Automatic operation



- & 2) **Quickly access** certain functions that may be useful during curing :

- **No. 7 : to enable or disable "Auto shut down " function.**

This function is useful only when a " Ventobacco autoshut down relay device" (optional) is connected on the control's RS 485data port .

This device may cut off the barn's main relay certain hrs after the stem dry conditions (as programmed on the control) are met as well as stop the sprayer's solenoid valve (optional) certain hrs after the conditioning programmed parameters are met .

Note: No matter if **autoshut down** is turned **on** or **off** if a Ventobacco autoshut down relay device is not connected on the barn's main relay the barn will not shut down automatically. When **autoshut down** is turned **on** and a Ventobacco autoshut down relay device is connected on the barn's main relay ,then this device will autoshut down the barn at the end of Stem drying .

This device will not turn on the sprayer automatically after the autoshut down of the barn at the end of Stem drying.

This device will Auto shut down barn at the end of conditioning .(see description hereunder).

Select no 7 on the selector :

Displays show **Auto Shut dn** . Then they turn black and "hold" light starts blinking quickly. (so you do not forget to switch back to the curing phase you were in) .



Pressing **you can see :**

Shutdn ... on meaning : Shut down function is activated.



With **or** **buttons you can turn this function on or off .**



Pressing again **you can see one at a time;**

Db „hr „ni meaning :Auto shut down the barn's main switchhrs and „,minutes after the Stem drying parameters (as programmed in Stem drying phase) are met and D.B has reached the temp. programmed for at leasthrs andminutes.

Rh ...hr...ni meaning :Auto shut down the barnhrs andminutes after the Stem drying parameters (as programmed in Stem drying phase) are met and R.H% has reached the relative humidity programmed for at leasthrs andminutes.

Sprni means : Auto shut down the barn minutes after the Conditioning parameters (as programmed in Condition phase) are met and R.H% has reached the relative humidity programmed and remained there for at least.....minutes.

- **No. 8** . to Change the control of the Fresh air damper's operation from W.B. control to RH% control (i.e. which control(display) you want to use & the W.B. or the RH% ?
- to select whether you want the displays to show both W.B. temp and RH% or just the directly measured from the sensor you are using (wet bulb with wick or RH dry sensor) .

Select no 8 on the selector : Displays show :

Danper ctrl . Then they turn black .



Pressing **SELECT & - or CHECK SETTINGS** and **Up arrow** or **Down arrow** which **control (W.B. or RH%) you want to use to control the fresh air damper's operation**).

USE u.b. , , ctrl means Use W.B. control

USE .., rh ctrl means Use R.H.% control



Pressing again **SELECT & - or CHECK SETTINGS** and **Up arrow** or **Down arrow** buttons you can select:

See All meaning display both W.B. temperature **and** RH% humidity

See ctr meaning display only the controlling sensor's W.B. temp **or** RH% humidity

You can change the selected control or the display of temp & RH at any time during curing. To get back to the curing phase you were in just select the proper # on the selector .

- **No. 9** . Allows operator to Insert up to 9 "Hold " points on his curing schedule at temperature areas where he wants to stop advancing the cure for certain time .

Select no 9 on the selector : Displays show :

Hold points . Then they turn black .



Pressing **SELECT & - or CHECK SETTINGS** button you see& set at a time **Act ive hold** or **Do not hold**



With **Up arrow** & **Down arrow** buttons you can see and set one at time the programmed hold points:

You see on the displays an image like this:

..... **hL1 hr on** : meaning at DB.....degF **HoLd point 1** , hold forhrs this hold point **on** (active) or **Off** (deactivated)



With **SELECT & - or CHECK SETTINGS** button you can set at a time the blinking display i.e. Hold point's # , then the D.B temp where you want the hold point ,then the hrs (duration) of the hold point and last the on or off (activate or deactivate) this hold point.First hold point **hL1**



Pressing **SELECT & - or CHECK SETTINGS** you can set the 1st hold point as the example:

135 hL1 hr 4 on : meaning at DB 135 degF **hold point 1** hold for 4 hrs hold On (active)



Pressing **Up arrow** button you move to hold point 2 .With **SELECT & - or CHECK SETTINGS** you can set at a time the DB temp where you want the hold, the duration of the hold & to have this specific hold active or deactivated .

NOTE: If you want all hold points to be active or deactivated then select **Act ive hold** or **Do not hold** .

If you want only some hold point to be active or inactive go to this hold point's # & turn it **on** or **of** .

REMINDING : Never forget to put the selector back to the proper curing phase after finishing your hold points programming.If you forget to do so ,control's displays will turn black (to alert you) but the control will keep processing curing.

DRY BULB CONTROL (DB)

DB is controlling the burner.

It is connected in line with the TA & ΔT controls.

The operator sets the DB Control to the desired DB temperature limit that he wants his barn to reach. The computer will give the order to the burner to fire long enough to increase the DB temperature to this limit.

The burner will fire long enough to keep the DB temperature constant at this point.

HOW FAST THE DB TEMPERATURE WILL REACH THE SET POINT ON THE DB CONTROL IS CONTROLLED BY:

- The **TA** Control (Temperature Advancer (or increase) in degrees/hour)
- The **ΔT** Control (Delta Temperature difference between lower and upper tobacco in the barn)

The operator can use both controls to manage the rate of temperature increase, one of the controls or none (if he wants to increase the DB temperature as fast as possible).

Any of these two controls can be bypassed as follows:



Press  until the TA starts blinking, then press..



to set '---' on the TA display. The TA has now been bypassed.



Press  until the ΔT starts blinking, then press..



to set '---' on the ΔT display. The ΔT has now been bypassed.

NOTE 1: DB ,TA & ΔT controls are connected in line to the burner.

The burner will fire only if all 3 controls give the order to fire.(unless a control is bypassed). If one or more controls do not give the order to fire , burner will not fire.

NOTE 2: Where you see "Burner" on this manual it means "Heat supply" .

DB thermostat controls the Heat supply (i.e. a Burner or a Hot water Valve).

Heat Supply on a tobacco curing barn can be either through:

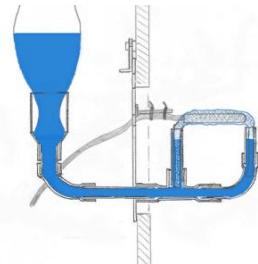
- an on-off Diesel or Gas burner (taking power through VK's on -off (burner) relay) or
- an on off Hot water valve (taking power through VK's on -off (burner)relay) or
- a progressive Hot water valve (taking power through VK's progressive (analog) port) .

WET BULB CONTROL

VK 981(RH) controls the operation of a servocontrolled fresh air damper (progressive or on-off) either through a wet bulb with wet wick, or a dry relative humidity sensor, or both of them.

WB is controlling the fresh air damper servomotor.

The operator sets the WB control to the desired WB temperature limit that he wants his barn *not* to exceed. The computer will give the order to the servomotor to open the fresh air damper long enough to keep the WB below this limit.



HOW FAST THE WB TEMPERATURE WILL REACH THE SET POINT ON THE WB CONTROL IS CONTROLLED BY:

- The operator only (when he selects No. 0 MANUAL on the selector.)
- The operator and the VK 981(A) (when he selects any other mode on the selector).

The operator is setting the limit on the WB control.

What is he really doing?

He is drawing the curve of the WB increase and temperature limit.

The WB temperature will start advancing to reach the WB setting limit

- If the operator has selected **No. 0** for manual operation on the selector, the WB control will activate the fresh air damper long enough to reach the WB setting **without relating WB and DB values**.
- If the operator has selected any other curing mode or phase on the selector, **the WB control will be related through the VK 981(A) to the DB control** as to keep a predetermined safe difference between WB and DB in order to decrease (steadily and perfectly) relative humidity in the barn.

In other words, when the DB temperature starts increasing from the starting point to reach the DB setting (limit) of each phase following the rate of temperature advance which is set by the operator on the T.A.control, the WB temperature also starts increasing from the Start point (which is the start W.B. in the barn (as described in details in the "Advanced calibration menu" when START button was pressed) at a slower rate to reach the WB setting (limit) of the phase following an automatically set by the control temperature advance rate keeping a progressively increasing difference with the DB.

The ideal rate of WB temperature increase will automatically be set by VK 981(A) according to the WB set limit.

Relative Humidity Control (RH%)

RH% is controlling the fresh air damper servomotor.

Operator sets on the **RH%** control the desired humidity limit that he wants his barn *not* to exceed. The computer will give the order to the servomotor to open the fresh air damper long enough to keep the RH % below this limit.

HOW FAST THE RH% humidity WILL REACH THE SET POINT ON THE RH% CONTROL (i.e. What will be the Rate of Humidity decrease)
IS CONTROLLED BY:

A.The operator only (when he selects No. 0 MANUAL on the selector.)

B.The operator and the Smart control ((when he selects any other mode on the selector).

The operator is setting the limit on the **RH%** control.

What is he really doing?

He is drawing the curve of the Humidity decrease and the humidity limit where the humidity will stop decreasing(hold) till the operator (or the control) gives the order to keep decreasing further more.

The Humidity will start decreasing down to the set limit on the RH% control.

- A. If operator has selected **No. 0** for manual operation on the selector, the RH% control will activate the fresh air damper long enough to reach the RH% setting **without relating RH% values to the DB values.**
- B. If operator has selected any other curing mode or phase on the selector, **the RH% control will be related to the DB control** as to keep progressively decreasing the humidity in the barn simultaneously with the D.B increasing temperature in the barn.

In other words,

When DB temperature starts increasing from the starting point to reach the DB setting (limit) of each phase following the rate of temperature advance which is set by the operator on the T.A.control , the humidity will start decreasing from the Start point ("detailed description in Advanced calibration menu") at a smooth rate to reach the RH % setting (limit) of the phase following an automatically set by the control humidity decrease rate.

NOTE: if the tobacco leaves were dry when first got in the barn i.e. at 85% RH ,and you have set on the RH control a set limit of 95% RH ,then the RH curve (RH in the barn) will not start decreasing ,but it will be increasing to reach the set limit of 95% . (i.e. the damper will be kept close so the heat building in the barn will drive the humidity up to the set(floating) limit.

The ideal rate of Humidity decrease will automatically be set by the Smart control according to the RH% set limit.

VK 981(RH) controls the operation of a servo-controlled fresh air damper (progressive or on-off) either through a wet bulb with wet wick, or a dry relative humidity sensor, or both of them.



TEMPERATURE ADVANCER (TA)

TA is controlling the burner.

It is connected in line with the DB and ΔT controls.

The operator sets the TA control for the **desired rate of the DB temperature increase (in degrees per hour)** during the curing. The control gives the order to the burner to fire long enough to increase(advance) the DB temperature at the selected (set) rate. The DB temperature will keep advancing at this rate until the limit (setting) on the DB control is reached. As soon as the DB temperature limit is reached, the TA will stop increasing the DB temperature and the burner will just fire long enough to keep the DB temperature constant at this point.

What is the TA and how does it operate?

The **TA is an electronic “temperature advancing” thermostat**. It is designed to constantly advance the temperature setting at a prescheduled rate.

In other words, when we set the TA at 1 degree per hour, the TA will give the order to the burner to fire just long enough to increase the temperature (from the beginning) one degree per hour.

If the DB temperature in the barn is 70°F and the TA is set at 1°F per hour, the TA will automatically advance its memory temperature setting to 71°C for the first hour, 72°C after two hours, 73°C after 3 hours and so forth.

The DB advancing temperature in the TA's memory (71, 72, 73, etc.) is called **“advancing”** or **“floating”** temperature.

This **“floating”** temperature will keep advancing at the TA set rate and will stop advancing when the DB temperature reached the DB setting on the DB control.

REMEMBER: The DB ,TA & ΔT controls are connected in line to the burner.
The burner will fire only if all 3 controls give the order to fire.(unless a control is by-passed).
If one or more controls do not give the order to fire the burner will not fire.

DELTA T (ΔT) CONTROL

ΔT is controlling the burner.

It is connected in line with the DB and TA controls.

DELTA T we call the **D.B.Temperature Difference** between Lower and Upper tobacco in a barn.

The operator sets the ΔT control to the desired (**maximum permitted**) Dry Bulb temperature difference between the lower and upper tobacco mass in the barn.

What is the operator really doing when he uses this control?

He is adding one more “clever” parameter to control the rate of DB temperature increase.

The ΔT control will allow the burner to fire as long as the temperature difference between lower-upper tobacco is **anywhere below the set value**.

If the temperature difference becomes greater than the set on the ΔT control, the burner will stop firing.

When the temperature difference becomes smaller than the set, the burner will fire again.

What is the ΔT ?

During the curing process, the hot air coming from the air furnace in the barn is pushed through the wet tobacco evaporating some water from the leaves.

The air temperature drops as it travels around the wet leaves and the minimum temperature is when it has passed through all tobacco mass in the barn. The cooler air is entering again in the air furnace, heated from the Heat exchanger and pushed again in the barn. This is the warmest air in the barn.

By controlling the Temperature difference (ΔT) between the warmer and cooler air in the barn (upper-lower tobacco), we indirectly control the rate of water evaporation from the leaves.

It is well known to experienced operators that if the air temperature difference between lower-upper tobacco in the barn exceeds ~ 10°F during Coloring they may set green color.

It is well known too that if this difference is greater than ~25°F during Wilting-Leaf drying stage the tobacco may “lock out” in the cooler part of the barn complicating and delaying the cure resulting inferior leaf quality.

If we set a low setting on the ΔT control (such as 10°F during Coloring), we permit only this small temperature difference between the warmer and cooler air. The burner fires (as long as DB and TA give order to fire too) only till the ΔT of 10°F is reached and stops.

If we set a higher setting on the ΔT control (such as 20°F during Wilting-Leaf drying), we permit a greater temperature difference between the warmer and cooler air and the burner will fire longer.

ΔT control will not allow the burner to fire if the Temperature difference between lower-upper tobacco is greater than the set value, no matter if the DB and TA controls are ordering the burner to fire.

REMEMBER: The DB ,TA & ΔT controls are connected in line to the burner.

The burner will fire only if all 3 controls give the order to fire.(unless a control is by-passed).

If one or more controls do not give the order to fire the burner will not fire

A FEW MORE WORDS ON THE ΔT DEVICE

ΔT device add a clever & advanced way of controlling & refining the rate of D.B. temperature advance (increase) during curing .

ΔT is not directly controlling the D.B .temperature increase in degrees per hour as the TA does (advancing the DB temperature at a pre-selected rate).

ΔT is indirectly controlling the D.B. temperature increase by controlling the D.B. temp.difference between the lower and upper tobacco mass in the barn .

This difference both in D.B temp and Relative humidity is created by the water evaporating from the leaves when the air passes through the wet tobacco in the barn .

Why do we need to control these differences?

- To avoid setting green on the lower tobacco tier close to the hot air supply in the barn .
- To avoid tobacco" locking out " during Wilting- Leaf drying stage.
- To ensure more uniform cure , avoid browning , avoid curing delays & save fuel .
- To avoid resetting temperatures after a long power cut.

When we have a power failure or a fan stop for several hours , the DB temp.in the barn will drop.

When power comes back, the TA will order burner to fire to raise the DB temp.to where it was before (to reach the advancing temperature).

If tobacco is too wet after the long power cut , this fast D.B.temp. increase may cause some or more browning if damper's opening is not sufficient to exhaust surplus moisture or slow down the temperature increase.

If there is no ΔT on the curing control , when power comes back on, operator should go to the barn and increase the D.B temperature manually in steps, or turn back the advancing temperature to meet the ambient temperature in the barn.

If there is ΔT on the curing control the burner will start firing to reach the advancing temperature.

But, if tobacco is wet, it will create a big temperature difference (ΔT) between top & bottom.

If this temperature difference exceeds the set value on the control, the burner will stop (when it exceeds the set value) and restart when difference becomes smaller than set value.

i.e. ΔT acts as a brake during curing by controlling rapid and dangerous D.B temp. increase while leaves are still wet. *And.....*

- operator may set a faster than ideal rate of DB temperature increase on the TA control for a specific kind of tobacco that gives freely its moisture at some temperature.
If D.B. temperature advances too fast when leaves give out a lot of water from their cells and dampers cannot get rid of this moisture, tobacco may scald or turn brown.

ΔT will measure bigger than allowed differences between incoming and outgoing air and will stop - restart the burner in steps thereby securing a safe D.B. temperature increase.

ΔT is a clever device relating the rate of DB temperature increase to the tobacco condition.

T.A. is a strong, but not clever device advancing the DB temperature progressively at a pre-selected rate without relating this advance to the tobacco condition.

Ventobacco's Smart curing controls combine the ΔT device with the DB and TA devices to form the perfect instrument to control ideally the rate of D.B. temperature increase during curing.

NOTE: ΔT fine settings depend on your barn and it's recirculating air amount.

Ventobacco's basic recommended settings(max allowed) :

Coloring	$\Delta T \sim 8^{\circ}\text{F} (~4^{\circ}\text{C})$,
Wilting	$\Delta T \sim 16^{\circ}\text{F} (~8^{\circ}\text{C})$,
Leaf Drying	$\Delta T \sim 20^{\circ}\text{F} (~10^{\circ}\text{C})$,
Stem Drying	$\Delta T \sim 15^{\circ}\text{F} (~7^{\circ}\text{C})$,

Above settings are indicative.

Use your own experience to determine the maximum allowable temperature differences between the lower and upper tobacco mass.

Avoid using too low settings because control may keep cutting off burner and you will delay your cure.

SMART CONTROL operates in 3 different ways.

1. MANUAL OPERATION



Operator sets the selector (No. 0) for manual operation.

Then he sets the desired **DB, WB, or RH% ,TA and/or ΔT** temperature limits.

Whenever he wants, he can change one or more of the settings.

The control will reach the DB set value, increasing the DB temperature gradually according to the TA and/or ΔT settings, keeping the WB or RH% where it is set.

Example:

The power is ON and the displays show the temperatures in the barn (thermometers).



- Press .

The thermometers turn into thermostat mode.

First the DB display starts blinking, which means that you can now set this control.

Set the desired DB temperature at i.e.100°F .



- Press  again and the WB or RH% display starts blinking.

NOTE: if you have already selected on Selector's #8 for the W.B control to control your damper ,then the W.B display will be blinking and will allow you to set some value on it.

Set the desired WB temperature at 98°F .

if you have selected on Selector's #8 to use the RH% control ,then the W.B display will not be blinking and will not allow you to set any value on it.

The RH% will be blinking and will allow you to set some value on it.

Set the desired RH% humidity at 95%)



- Press  again and the T.A display starts blinking.

Set the desired DB temperature at 0,5°F/h



- Press  again and the ΔT starts blinking.

Set the maximum allowable ΔT temperature to be maintained between upper and lower tobacco in the barn, such as 10°F .

After 15 seconds, the displays will stop blinking and will return to indication mode (thermometers –hygrometers). All of the settings are stored in controls memory.

The control will fire the burner to progressively advance the DB temperature to reach the set values of DB = 100°F advancing at TA = 0,5°F /hr allowing temperature difference between lower –upper tobacco up to ΔT = 10°F maximum and will remain at 100°F until the operator changes the DB setting to a new one.

The RH% (or WB) control will activate the fresh air damper servomotor long enough to maintain the RH% at 95% (or the WB temperature at 98°F).

2. SEMIAUTOMATIC OPERATION or OPERATION IN CURING PHASES



The operator sets the selector (the number corresponding to the desired curing phase).

No. 1 for coloring

No. 2 for wilting

No. 3 for leaf drying

No. 4 for stem drying

No. 5 for conditioning

The programmed settings of every curing phase are stored in the control's memory. The operator can check or change the settings, to adapt the curing schedule to his technique or the tobacco condition, by pressing the.....



button. One display at a time will start blinking. Then press the



button to increase the settings or press the



button to decrease the settings.

HOW THE VK 981(RH) OPERATES IN THE SEMI- AUTOMATIC MODE



The power is on. The operator selects the (No. 1) selector for coloring. The LED light of the selected curing phase will start blinking for 10 seconds and then remains on. The control will give the necessary orders to follow the settings of the coloring phase.

The DB and WB temperature settings will automatically change and advance to the programmed limits and remain there waiting for the operator to change the curing phase. When the operator feels the coloring phase is complete and it is time for wilting, he should go to the next phase.



Select the (No. 2) button. The LED light will start blinking for 10 seconds and then remains on. The control will automatically give the necessary orders to follow the settings of the wilting phase. When the operator feels the wilting phase is complete, he may start the next phase of curing.



Select the **(No. 3)** button. The LED light will start blinking for 10 seconds and then remains on. The computer will automatically give the necessary orders to follow the settings of the leaf-drying phase. When the leaf-drying phase is over, start the next phase.



Select the **(No. 4)** button. The LED light will start blinking for 10 seconds and then remains on. The computer will automatically give the necessary orders to follow the settings of the stem-drying phase. **When the stem-drying phase is over, the operator will turn off the burner** to allow the barn to cool. The operator can now start the sprayers if he desires.



Select the **(No. 5)** button. The control will give the necessary orders to close the fresh air damper in order for the barn to recirculate the humidity from the sprayers through the tobacco and to keep the DB temperature at the DB setting.

NOTES:

When the operator changes the selector from one curing phase to a new one, the new phase's LED lamp will start blinking for 30 seconds and then remain on. These 30 seconds of blinking is a delay permitting the control to understand that the change was deliberate and not an operator check.

After 30 seconds without any new handling, the control will start the process of the new phase's parameters starting from the actual DB temperature in the barn.

If the actual DB temperature in the barn is lower than the minimum DB temperature of the new curing phase, the DB temperature will start advancing from the maximum DB temperature of the previous curing phase.

HOW TO PROGRAM EACH CURING PHASE OR CHANGE THE EXISTING SETTINGS (PROGRAM)

GENERAL INFORMATION

Each curing phase's settings are by default set at certain typical values as shown hereunder . The operator can easily change these settings whenever he wants.

The following is a description of the operating philosophy of the control to aid the operator in understanding how the VK 981(RH) operates.

A New Curing Cycle Starts



When a new curing cycle starts, the operator must **press the ** button for 10 seconds.

During this time, the display will show “**START**” and after 10 seconds the display will show “**READY**”.

The VK 981(RH) is now at the beginning of a new curing cycle.

The operator has ordered the T.A control to start advancing from the ambient temperature & humidity in the barn to reach the set limits on the DB, WB, or RH controls .

The **DB setting** is the temperature **limit** where the DB temperature will progressively arrive starting from the Start point (which is the actual DB temp in the barn +~1 F) (controlled by the TA and/or ΔT), and where it will stop advancing and remain there for as long as the operator wants.

The **WB setting** is the temperature **limit** where the WB temperature will progressively arrive starting from the Start point (following an automatically set by the control rate of W.B. temp. advance) (i.e. the curve of W.B increase is automatically drawn by the control) and where it will stop advancing and remain there for as long as the operator wants.

The **RH% setting** is the humidity **limit** where the humidity will progressively arrive starting from the Start point (following an automatically set by the control rate of RH% humidity . advance) (i.e. the curve of RH advance(decrease or maybe increase at the beginning of the cure only) is automatically drawn by the control) and where it will stop advancing and remain there for as long as the operator wants.

REMINDER:

When no buttons are pressed, the displays indicate the actual temperatures in the barn (thermometers).



When  is pressed, the displays start blinking (one at a time) indicating the set temperature on each display (thermostats).

The TA always indicates the set temperature increase in degrees per hour.

NOTE : In order to save curing time (coloring time at the beginning of the cure) (because there is not any significant coloring taking place below 30C(86F)) if the Starting D.B. temperature is lower than ~30 C(86 F) , the control will not take in account what is set on the T.A. but it will advance faster at the beginning .If the value set on the TA is lower than 1C/hr(2F/hr) but it will advance the D.B till the 30 C(86 F) is reached with 1C/hr (2F/hr) and after 30C(86F) is reached it will follow the value set on the TA control .

PROGRAMMING THE COLORING PHASE

EXAMPLE

Operator wishes to color the tobacco by slowly advancing the DB temperature to 100°F(38C) with a Temp. Advance rate of 0.6°F per hour(0,3C/hr) , keeping the humidity to 95% , (or let the WB go up to 97°F(36C)).

He does not want the DB temp. difference between lower and upper tobacco (ΔT) to exceed 8°F(4C) .



Select **1** for coloring phase.



Press the **SELECT & or CHECK SETTINGS** button and the **DB** display will start blinking.

Set the DB temperature display at 100°F(38C).



Press the **SELECT & or CHECK SETTINGS** button again and the **WB** will start blinking.

Set the WB temperature display at 97°F.(36 C)



Or Press the **SELECT & or CHECK SETTINGS** button again and the **RH%** will start blinking.

Set the RH humidity display at 95%.



Press the **SELECT & or CHECK SETTINGS** button again and the **TA** will start blinking.

Set the TA temperature display at 0.6°F /hr.(0,3 C/hr)



Press the **SELECT & or CHECK SETTINGS** button again and the **ΔT** will start blinking.

Set the ΔT at 8°F on the display.



Press the **SELECT & or CHECK SETTINGS** button again and “**hrs**” with a value next to it appears.

This is how long the operator wants the phase to last.



The phase's duration can be programmed now by pressing **+** or **-** buttons to increase or decrease the time in hours the operator wants the phase to last (such as 48 hours).

NOTE: *This duration set time will only be useful for automatic mode (#6) , where the change of every curing phase to the next one will automatically take place according to the programmed duration.*

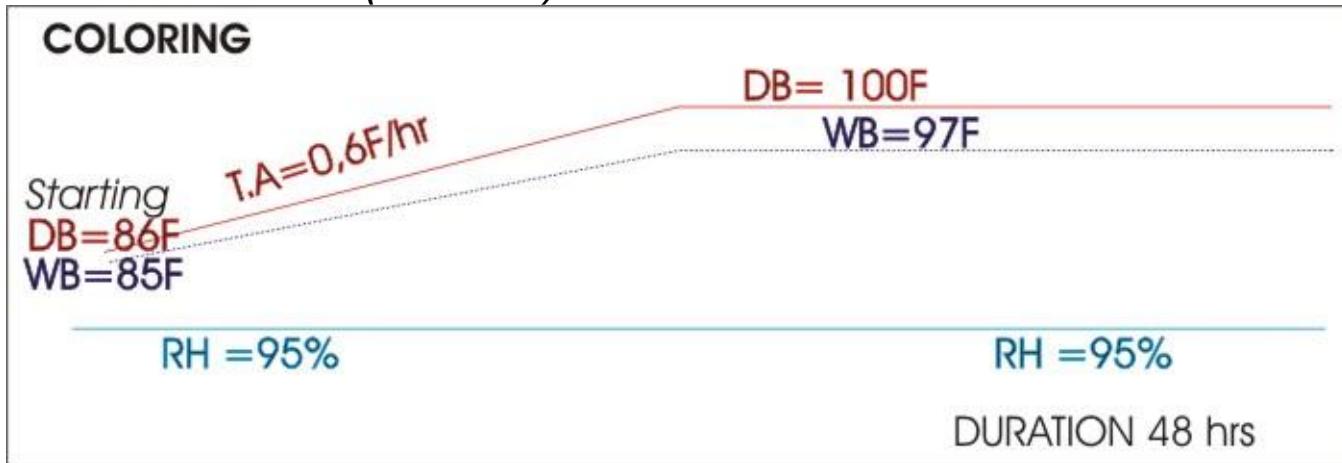
When curing in manual or semi automatic operation mode (#0 or #1, #2,#3and #4) it is the operator who changes the curing phase when he wants to and not the control.



By pressing the **SELECT & or CHECK SETTINGS** button again, the display will return to indication mode.

The display will also return to indication mode after 15 seconds without pressing any buttons.

GRAPHIC PRESENTATION OF THE OPERATORS SETTINGS (PROGRAM) FOR THE COLORING PHASE



DRY BULB

If the starting DB temperature was 86°F (starting DB is the DB temperature in the barn where curing phase starts) the DB temperature will start from 86°F advancing at 0.6°F/h to reach 100°F. The temperature will reach the DB limit in ~ about 24 hours(0,6F/hr) and will remain there until the operator changes the curing phase to the next one.

WET BULB

The WB setting of 97°F will progressively be reached when the DB reaches the set value of 100°F. During the DB temperature advancement from the starting point (**which is the same point of the DB start**), the WB temperature will also advance progressively from the starting point by keeping a progressively increasing difference with the DB.

The difference between DB and WB during the entire curing process progressively increases to the set limits and is automatically controlled by the SMART CONTROL.

Alternatively RELATIVE HUMIDITY

The RH% setting of 95% will progressively be reached when DB reaches the set value of 100°F.

During the DB temperature advancement from the starting point, the Humidity in the barn will either start falling (if the leaves when got in the barn were more humid than 95%) or increasing (if the leaves were dryer than 95% when got in the barn) till it reaches 95% and will remain there.

The humidity % during the entire curing process progressively reaches the set limits automatically controlled by the SMART CONTROL.

NOTE: The duration, which is programmed for 48 hours for this phase, will only be useful if the operator turns the computer to automatic mode(#6) .

PROGRAMMING THE WILTING PHASE

EXAMPLE

Operator wishes to wilt the tobacco by increasing the DB temperature 1,5°F per hour to the limit of the DB = 120°F dropping the humidity down to 70% (or let the WB go up to 100°F) when DB has reached the limit. ,

He does not want :

the DB temp. difference between lower and upper tobacco (ΔT) to exceed 12°F .



Select  for **wilting** phase.



Press the  button and the **DB** display will start blinking.

Set the DB temperature display at 120°F.



Press the  button again and the **WB** will start blinking.

Set the WB temperature display at 99°F.



Or Press the  button again and the **RH%** will start blinking.

Set the RH% humidity display at 70%.



Press the  button again and the **TA** will start blinking.

Set the TA temperature display at 1,5 °F /hr.



Press the  button again and the ΔT will start blinking.

Set the ΔT at 12°F on the display.



Press the  button again and “**hrs**” with a value next to it appears.

This is how long the operator wants the phase to last.

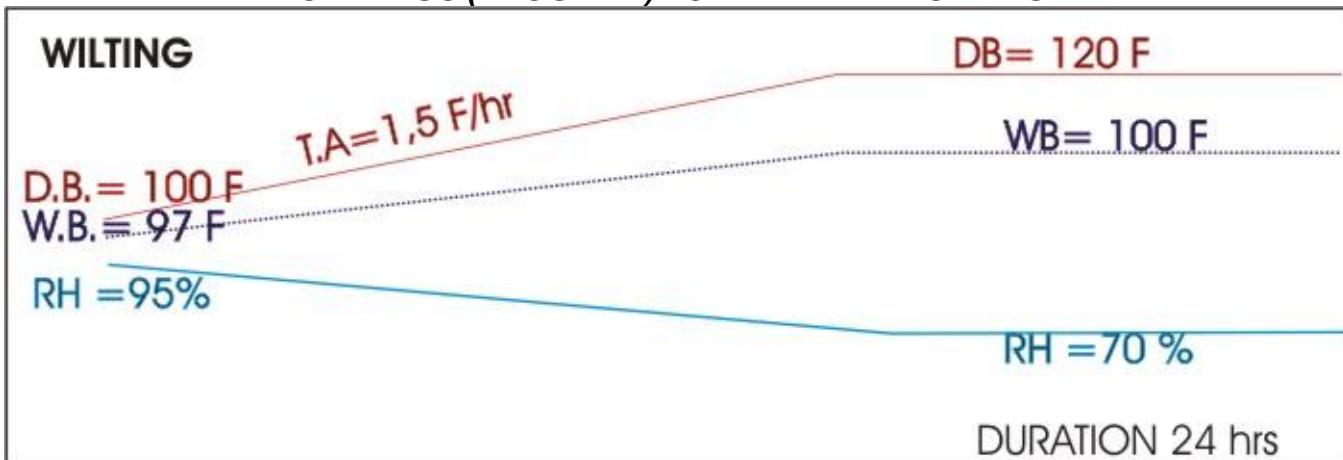


The phase's duration can be programmed now by pressing  or  buttons to increase or decrease the time in hours the operator wants the phase to last (such as 24 hours).

The wilting phase is now programmed.

Remember: Duration (which is programmed for 24 hours for this phase) will only be useful if the operator turns the computer to Automatic mode (#

GRAPHIC PRESENTATION OF THE OPERATORS SETTINGS (PROGRAM) FOR THE WILTING PHASE



DRY BULB

The starting DB temperature now is the previous coloring DB limit of 100°F. The DB temp. will start from that point advancing at 1,5°F/h to reach the set DB limit of 120°F. It will reach the DB limit in ~14 hours and will remain there until operator changes the curing phase to the next one .

WET BULB

The WB setting of 99°F will progressively be reached when the DB reaches its set value of 120°F. During the DB temperature advance from the starting point, the WB will keep advancing too to the limit (99 F) in order to insure the progression of smooth moisture removal from the barn.

Or

RELATIVE HUMIDITY

The humidity RH% will progressively fall from 95% down to 70% simultaneously with the DB climbing to the set value of 120°F.

During the DB temperature advancement from the starting point, the humidity in the barn will keep steadily falling down to the set limit precisely controlled by the Smart control.

Once it reaches 70% it will remain there .

NOTE: Duration (which is programmed for 24 hours for this phase) will only be useful if operator turns the computer to Automatic mode(#6).

PROGRAMMING THE LEAF DRYING PHASE

EXAMPLE

Operator wishes to dry the leaves by advancing the DB temperature to 135°F at a rate of 2 F per hour ,dropping the humidity down to 50% (or let the WB go up to 102°F) when DB has reached the limit.

He does not want :

the DB temp. difference between lower and upper tobacco (ΔT) to exceed 16°F .



Select the  button.



Set the temperature limits by pressing  and the buttons as described previously.

DB setting 135°F

WB setting 102°F Or **RH%** setting 50%

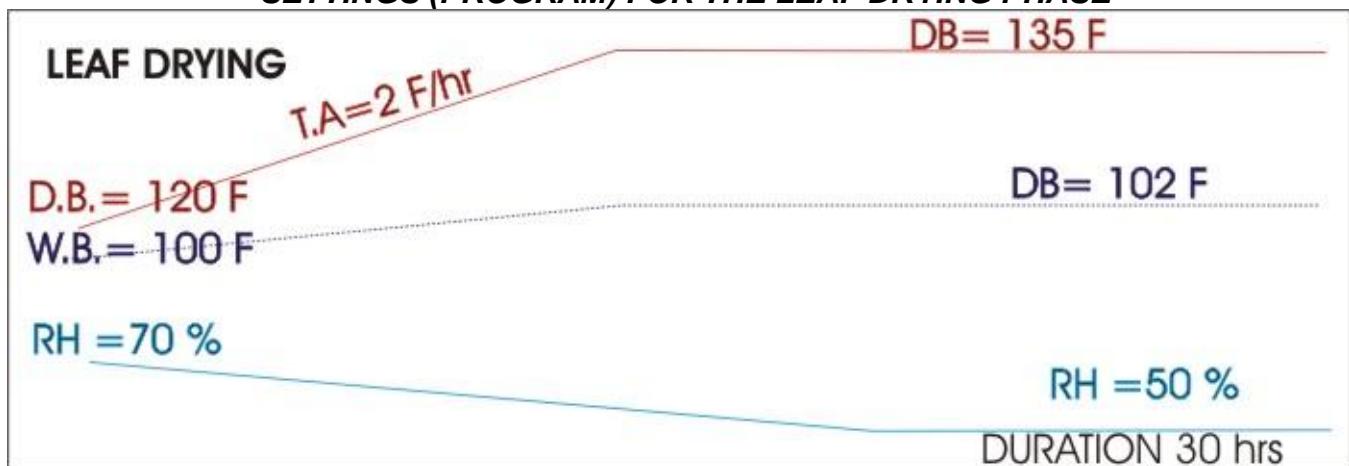
TA setting 2°F/h

ΔT setting 16°F

Hr (duration) 30 hours

The leaf-drying phase is now programmed.

GRAPHIC PRESENTATION OF THE OPERATORS SETTINGS (PROGRAM) FOR THE LEAF DRYING PHASE



REMEMBER: The duration, which is programmed for 30 hours, will only be useful if the operator turns the computer to automatic mode.

NOTE:

Operator can insert "Hold" points at any time or curing phase (either exceptional or permanent hold points) as described on page 7 and hereunder .

PROGRAMMING THE STEM DRYING PHASE

EXAMPLE

Operator wishes to dry stem by increasing the DB temperature 3°F per hour to the limit of the DB = 165 F dropping the humidity down to 15% (or let the WB go up to 110°F) when DB has reached the limit. ,

He does not want :

the DB temp. difference between lower and upper tobacco (ΔT) to exceed 12°F .



Select the  button.



Set the temperature limits by pressing  and the buttons as described previously.

D.B. setting 165°F

W.B. setting 110°F or **RH%** setting 15%

T.A. setting 3 °F/h

ΔT setting 12°F

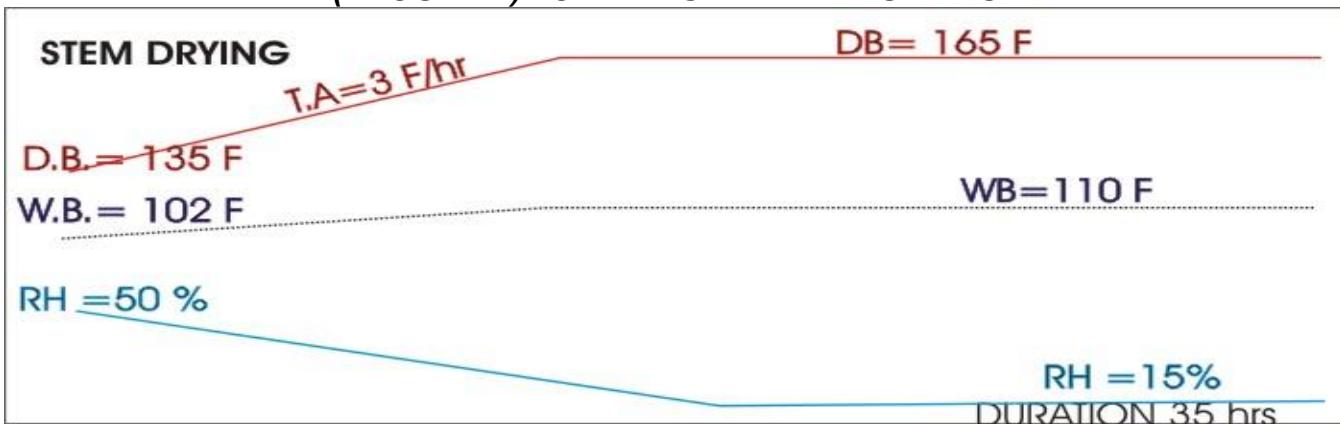
Hr (duration) 35 hours

Stem-drying phase is now programmed.

NOTE: The operator will stop the barn when the stems are completely dry.

Optional : the barn can be equipped with "Ventobacco autoshutdown" relay device which when enabled (on selector's #7) may shut off the barn when Stem drying programmed parameters are met and certain extra time has passed without any serious fluctuations of those parameters during this extra time .(see page 7)

GRAPHIC PRESENTATION OF THE OPERATORS SETTINGS (PROGRAM) FOR THE STEM DRYING PHASE



NOTE:

Operator can insert up to 9 D.B.advancing temp. "hold" points in temperature areas where he feels some extra "hold" points refine his curing technique.

Stops can be either exceptional through "Hold" function as described in special functions paragraph or

Permanent which can be activated or deactivated one by one (at any time) , by selecting #9 on the selector and setting the DB temp, and hrs (duration) of each hold" point as described on page 7.

+

PROGRAMMING THE CONDITIONING PHASE

- If operator wants to condition the tobacco with outside air he can turn on the fan & open the fresh air intake damper manually.



- If he wants to condition with the aid of the control, select  button (Conditioning)

Operator can set :

the desired DB temperature he wants for conditioning , turn on the water to the sprayers and close manually the fresh air damper so the humidity from sprayers stays in the barn . He has to check frequently at 1-2 hrs intervals the tobacco so it is not over conditioned. Once tobacco is well conditioned , close the sprayers and let the fan recirculate humidity in the barn with fresh air damper closed to uniform all tobacco leaves.

WATER SOLENOID VALVE CONTROL.

If there is a solenoid valve connected on the water line ,the operation of this valve can be controlled from the control's RH% display to spray water till the RH% of the air in the barn reaches the set RH% limit on the control.

Once the set RH% limit is reached the control will order the valve to close to stop spraying water. The burner will be firing just enough to keep the DB set temperature constant.

Set for Conditioning :

DB : 100 °F or the desired DB temperature during conditioning.

RH% : 90% or 95% or according to your practice ,using your experience and test results .

Hrs : 3 - 5 or according to your practice ,using your experience and test results .

Note: TA & ΔT are bypassed during conditioning.

These settings mean :

Keep the Dry bulb temp to 100 degF

Drive the humidity of the air in the barn to 90% or 95% (or whatever you have set).

Close the water solenoid valve after 3 (or whatever) hrs .

Note 1 : During Conditioning you can set the required RH% (not the W.B.temp) because setting RH% allows more accurate control of the solenoid valve's operation.

During Conditioning VK 981(RH) automatically displays the RH% and the controlling control is automatically set to RH control.

Note 2. *If you want solenoid valve to keep spraying continuously set on the RH% control 99%.*

Note 3 . *if for some reason the humidity of the air in the barn reaches 100%, for some time period ,in order to avoid condensation & water drops on leaves, the solenoid water valve will stop spraying and the fresh air damper will start opening (a little or more as programmed on adv.calibration menu) .*

Optional : *the barn can be equipped with " Ventobacco autoshutdown" relay device which when enabled (on selector's #7) may shut off the barn when Coditioning programmed parameters are met and certain extra time has passed without any serious fluctuations of those parameters during this extra time .(see page 7)*

3. AUTOMATIC OPERATION

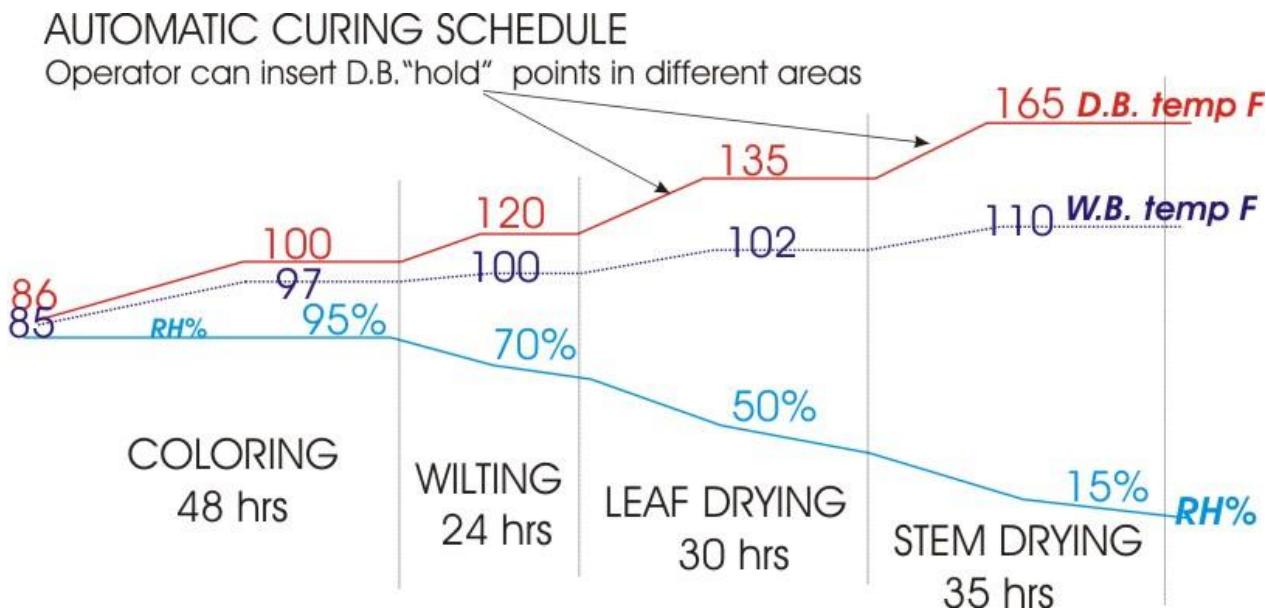


The **6** button, or “**AUTO**” select, turns the control into **AUTOMATIC mode**.

The control will now cure automatically following the program of each curing phase .

It will follow **the settings and duration** of each curing phase, as programmed previously, by automatically changing curing phases.

The SMART CONTROL will follow the curing schedule that was previously programmed as follows:



When you want to cure automatically, you have to first check if you are satisfied with the existing program.

As long as you have programmed each curing phase’s parameters, you can turn the computer to **auto** mode and the computer will start following the curing program.

CAUTION: Never forget to put the selector back to the proper curing phase after finishing your programming.

REMEMBER : You can insert up to 9 permanent D.B.advancing temp. “hold” points (stops) in temperature areas where you feel some extra “hold” points refine your curing technique.

Optional : the barn can be equipped with “Ventobacco autoshutdown” relay device which when enabled (on selector’s #7) may shut off the barn when Stem drying programmed parameters are met and certain extra time has passed without any serious fluctuations of those parameters during this extra time .(see page 7)

DETAILED DESCRIPTION AND NOTES ON HOW THE SMART CONTROL OPERATES IN AUTO MODE



The power is ON. The operator selects the **6** button. The LED light # 6 AUTO will come on.

NOTE: When #6 red light is on, a curing phase light is blinking. This indicates in which curing phase the control is operating.

When a new curing cycle starts:



the operator must press the **START CURING** button for about 10 seconds until the “**ready**” appears. The computer will now start curing from the ambient temperature in the barn.

We call this action **START** or **FLOATING ZERO** or **ADVANCING ZERO** adjustment.

The computer will now start from the **actual DB temperature** following the curing program until the end of the curing cycle.

REMEMBER:

- **All the displays are indicating the actual temperatures in the barn.** (the TA indicates the pre-selected rate of temperature increase.)
- As the curing advances, the **coloring** LED light is blinking first, then the **wilting, leaf drying** and last the **stem drying** LED lights indicating in which phase the computer is operating.

The operator can change at any time to **auto** mode after having operated in another curing phase or manual mode. The control will keep on advancing the cure starting from where the DB temperature is presently. When the operator changes to **auto** mode, the displays will show “**check**” for 15 seconds. This is a reminder to check where the temperature settings are.



By pressing and holding the **SELECT & CHECK** button, the operator can see **the advancing DB temperature** exactly as the computer has entered it in auto mode, and **how many hours are remaining to finish the present curing phase**.

Explanation:

The Temperature Advance (TA) control is constantly advancing the **DB advancing (or floating) temperature** from the Start point to reach the **DB set limit**,

The burner will fire long enough to increase the **DB actual** temperature in the barn to where the **DB advancing** temperature is.

The **DB actual** temperature in the barn should be the same with the **DB advancing** temperature at any moment.

But there are cases in which the burner cannot increase the actual DB temperature in the barn as fast as the TA orders. For example if the burner is set to low thermal output or if the fresh air intake damper has been left wide open etc... the DB actual temperature in the barn may remain constant or even drop although the burner is firing trying to reach the DB advancing temperature which keeps advancing to reach the DB set limit.

In such cases, the DB actual temperature in the barn is lower than the floating (advancing) DB temperature.

REMINDER:

*The displays constantly show the **actual temperatures** & humidity in the barn .
Not the advancing temperatures (or the set limits).*

To see where the DB advancing temperature is automatically set by the control at this precise



moment (on its way to the DB set limit) press & hold.

Now you see where the DB advancing temperature is and how many hours remain to finish the present curing phase.



By pressing and holding the  and  at the same time, operator can see the DB, , WB and RH% advancing temperatures & humidity.

These advancing temperatures (& RH %humidity) are automatically set at this time by the computer and are the temperatures & humidity that the barn is ordered to follow at this precise moment.



NOTE: If operator presses the  button(for 10 seconds) at any time during auto mode, the computer readjusts the advancing temperature setting according to the actual temperature in the barn.

If operator realizes at some point that the floating DB temperature has advanced faster than



the barn could follow, and the actual DB temperature is lower, he can press  if he wants to drop the advancing temperature back to the DB actual temperature.



If operator wants to speed up the curing process, he can press the  and  buttons at the same time and can see on the display the DB advancing temperature increasing and the remaining hours decreasing.



If he wants to delay, he can press the  and  buttons at the same time and he can see the DB advancing temperature decreasing and the remaining hours increase.

NOTE: When curing in Manual operation (#0) or Semi automatic (#1 or 2 or 3 or 4) when operator wants to change the DB floating temperature, he can do so by pressing:



and  at the same time and to increase or decrease the DB advancing temperature by pressing:



or .

The corresponding WB floating (advancing) temperature and floating (advancing) RH% humidity are automatically changed throughout the SMART CONTROL .

OTHER SMART CONTROL FUNCTIONS



Through the selector

• **AUTO SHUT DOWN FUNCTION (Optional)**

Select No. 7 on the selector : to enable or disable "Auto shut down" function.

This function is useful only when a " Ventobacco autoshut down relay device" (optional) is connected on the control's RS 485data port .

This device may cut off the barn's main relay certain hrs after the stem dry conditions (as programmed on the control) are met as well as stop the sprayer's solenoid valve (optional) certain hrs after the conditioning programmed parameters are met .

Note: No matter if **autoshut down** is turned **on** or **off** if a Ventobacco autoshut down relay device is not connected on the barn's main relay the barn will not shut down automatically. When autoshut down is turned on and a Ventobacco autoshut down relay device is connected on the barn's main relay ,then this device will autoshut down the barn at the end of Stem drying .

This device will not turn on the sprayer automatically after the Autoshut down of the barn at the end of Stem drying.

This device will Auto shut down barn at the end of conditioning .(see description hereunder).

Select no 7 on the selector :

Displays show **Auto Shut dn** .

Then they turn black and "hold" light starts blinking quickly. (so you do not forget to switch back to the curing phase you were before) .



Pressing  you can see ;

Shutdn ... on meaning : Shut down function is activated.

With  or  buttons you can turn this **function on or off** .



Pressing again  you can see one at a time;

Db „,hr „,ni meaning :Auto shut down the barn's main switchhrs and „,minutes after the Stem drying parameters (as programmed in Stem drying phase) are met and D.B has reached the temp. programmed for at leasthrs andminutes

Rh „,hr...ni meaning :Auto shut down the barnhrs and „,minutes after the Stem drying parameters (as programmed in Stem drying phase) are met and R.H% has reached the relative humidity programmed for at leasthrs andminutes

Sprni means : Auto shut down the barnhrs and „,minutes after the Conditioning parameters (as programmed in Condition phase) are met and R.H% has reached the relative humidity programmed for at least.....minutes

- **SELECT THE CONTROL DEVICE For YOUR FRESH AIR DAMPER'S SERVOMOTOR operation.**

Select No. 8 on the selector _ to Change the control of the Fresh air damper's operation from W.B. control to RH% control and

- to select whether you want the displays to show both W.B. temp and RH% or just the directly measured from the sensor you are using (wet bulb with wick or RH dry sensor) .

Displays show : **Danper ctrl** . Then they turn black .



Pressing **SELECT & - or CHECK SETTINGS** and **Up arrow** or **Down arrow** which **control (W.B. or RH%) you want to use to control the fresh air damper's operation**).

USE u.b. , , ctrl means Use W.B. control

USE .. , rh ctrl means Use R.H.% control



Pressing again **SELECT & - or CHECK SETTINGS** and **Up arrow** or **Down arrow** buttons you can select:

See All meaning display both W.B. temperature **and** RH% humidity

See ctr meaning display only the controlling sensor's W.B. temp **or** RH% humidity.

You can cure with any of those 2 controls and you can switch from one to the other at any time during curing by selecting #8 on the selector and choosing the control you want to use for your remaining cure.

CAUTION: Never forget to put the selector back to the proper curing phase after finishing your selection.

To get back to the curing phase you were in just select the proper # on the selector .

NOTE 1 : you can use either or both - A WET BULB WICK with RESERVOIR for the W.B display .
An RH% DRY RELATIVE HUMIDITY SENSOR for the RH display.

NOTE 2: -When you are using a Wet Bulb sensor connected on the control's W.B terminals , Smart control automatically understands that there is a W.B sensor connected, so it will display the (direct) W.B temp. taken from this W.B.sensor and will display the (calculated) RH% humidity on the RH%.

-When there is no W.B sensor connected on the control's W.B terminals, but there is an RH% dry sensor connected on the RH control's terminals , the Smart control understands that you do not have a direct W.B sensor so it will show on the WB display the (calculated) W.B. temp. taken from the RH% humidity sensor and the DB (or ΔT) sensor next to it .

It will show the (directly measured) humidity on the RH% display.

-When there are both W.B sensor and RH% dry Relative humidity sensor connected on control's terminals , the control will understand it and will display the (direct) W.B. temp taken from the W.B sensor and the (direct) RH% humidity taken from the RH% sensor.

NOTE3 : If you have programmed on the control's (Selector 's #8) to " see all" the displays will also show the calculated W.B temp (when only an RH% dry sensor is mounted) and the RH% calculated (when only a W.B. sensor with a wick is mounted) .

NOTE 4: The display that shows the calculated value has a small blinking dot next to the displayed value to remind you that this displayed value is calculated and not directly measured .

NOTE 5 : When you have a dry RH% sensor connected to control your fresh air damper's servomotor the control's yellow RH% light is on

- **INTRODUCE HOLD POINTS (which can be repeated on every curing)**

Insert up to 9 permanent hold (stop) points (for certain hours) on your curing schedule .

Select No. 9 on the selector _

No. 9 allows operator to Insert up to 9 "Hold " points on his curing schedule at temperature areas where he wants to stop advancing the cure for certain time .

Displays show :**Hold points** . Then they turn black .



Pressing **button you select at a time Act ive hold or Do not hold .**

Once you leave No9 with the display showing Act ive hold , the control will hold at the programmed hold points which are enabled (on) .

If you leave no9 with the display showing Do not hold It will not hold any of the programmed hold points no matter if these are enabled (on) or disabled(oF).



With **With  & ** buttons you can see and set one at time the programmed hold points:

You see on the displays an image like this:

..... **hL1 hr on** : meaning at DB.....degF hold point1 hold forhrs this hold point ON (active) or Of (deactivated) .



With **button you can set at a time the blinking display i.e. Hold point's # , then the D.B temp where you want the hold point ,then the hrs (duration) of the hold point and last the on or off (activate or deactivate) this hold point.**First hold point **hL1**



Pressing **you can set the 1st hold point as the example:**

135 hL1 hr 4 on : meaning at DB 135 degF hold point 1 hold for 4 hrs hold On (active)



Pressing **button you move to hold point 2 .With ** you can set at a time the DB temp where you want the hold, the duration of the hold & to have this specific hold active or deactivated .

NOTE: If you want all hold points to be active or deactivated then select **Act ive hold or **Do not hold** .**

If you want only some hold point to be active or inactive go to this hold point's # & turn it on or of .

OTHER SMART CONTROL FUNCTIONS

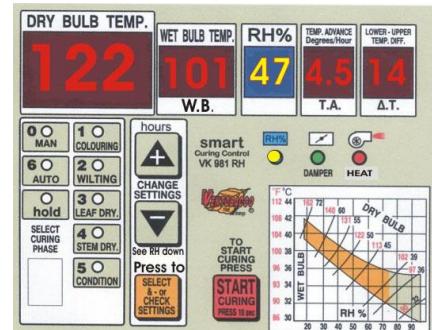
Through the keyboard

- **hold (stop) (exceptional stop)**

This function allows operator to insert an exceptional stop (hold) point during any curing phase without having to change the parameters of the curing phase or get in selector's # 9.

This stop will not be stored in control's memory for the next curing.

If operator during his regular visit to the barns feels that he should hold the temperatures where they are for some more hours and then let the cure advance as programmed , he can use this function to enter a stop. How to use this function:



Press the **▲** and **▼** buttons **together for 10 seconds** until "hr" appears on the display. The "hr" is how long the stop should be.(in hours)

The operator can set from 1 to 10 hours maximum waiting time with **▲** and **▼** to increase or decrease the waiting time in hours.

10 seconds after setting the time, the displays return to indication mode and the "hold" LED light will start blinking to remind you that the control is waiting and not advancing the cure.

As soon as time is over, "hold" light stops blinking and the curing will advance automatically.

- **Hourmeter**

SMART CONTROL starts counting operating hours (curing time elapsed) from the

moment **START CURING PRESS 10 sec** has been pressed.



You can see how long the barn has been running by pressing **▲** button.

REMEMBER : START button is pressed for 10 seconds every time a new curing cycle starts to inform the Smart control that you are starting a new curing (i.e. drive back the floating temp. to the leave's temp in the barn).

- **See the Relative humidity at the lower part of the barn .**

▼ Press the **▼** button at any time during curing & you can see what is the RH% at the lower barn part (hotter – supply air) .

(to display the RH% at this part of the barn (although there is no RH% sensor at this part) the control will calculate the RH% through its software.

- **See the floating temperatures & humidity in the barn .**

Press simultaneously **START CURING PRESS 10 sec** & **SELECT & - or - CHECK SETTINGS** buttons to see where are the floating DB and WB temp & RH% in the barn (i.e. where the control has ordered at this specific moment the temp & humidity to be .

VK 981(RH) TWIN Smart Control's technical specs

- Automatic detection of WB or RH sensor .
- up to 4 Sensors (high resolution 18 bits - 262.143 steps) .
- 3 DB Temperature sensors (one DB sensor is the main Heat controlling sensor +one extra D.B.sensor (secure) sensor + one ΔT sensor & one dry RH% electronic sensor or a Wet bulb sensor)
- 2 Analog(progressive) exits - (for a progressive Damper & a progressive Hot water valve or Burner)

Progressive Heat control (besides the progressive ventilation control) is ideal to ensure a smooth heat curve with minimum fuel consumption when firing biomass with progressive burners or hot water boilers.

- 3 On-off Relays – 1 main for Burner , 1 auxiliary for sprayer , 1 auxiliary for alarms .
- 1 Block (alarm) input to transmit to a monitoring P/C blocks (malfunctions) of barn's fan and (or) burner or other connected device
- **1 input transmitting to a monitoring P/C the burner's on-off cycles & burner's running time.**
- an RS-485 data port for HUB - MUX – WIRELESS data transmission & connection of a barn Auto Shut down relay device (optional) triggering the barn's main relay .
- a USB port for P/C communication and diagnostic option access.

Operator can upgrade control's FIRMWARE (software) .

He can read curing data and he can down load curing data & graphs even wirelessly.

For detailed information on remote setup & monitoring consult our Ventomonitor 15™ quick guide .

Extra functions .

- **Automatic control of a progressive servocontrolled heating valve** when hot water heating coil is installed in the air furnace .

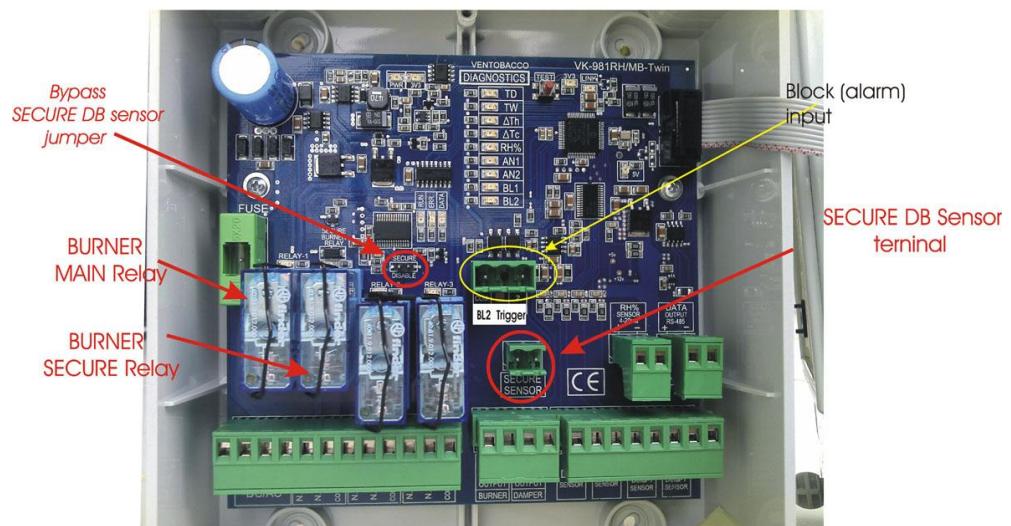
The operation of smart control's other analog (progressive) port is designed to power a progressive valve .It can be precisely programmed by entering into *advanced calibration menu (only for experienced operators)*.

- **Automatic control of a spraying system .**

The SMART CONTROL's on –off auxiliary relay can be used to control a solenoid valve for a water sprayer taking order from the **RH%** control (or WB control to spray when the **RH% actual humidity** (or WB actual temperature) drops below the **RH% -advancing- humidity** (or WB advancing temperature).

The operation of the sprayer can be precisely programmed to hold the humidity to the required level by entering into advanced calibration menu (only for experienced operators).

- **Or alternatively Automatic control of a second servo-controlled damper** .The on -off auxiliary relay can alternatively used to control a second on-off servo-controlled damper (besides the progressive one) if and when needed(instead of controlling a sprayer) .
(by entering the function into advanced calibration menu (only for experienced operators)).
- **Automatic control of a an Alarm system** .The other auxiliary relay is the alarm relay that can be used to connect a siren or alarm system.
(by entering set up function menu (for experienced operators)).





VK 981(RH) SMART CONTROL default settings.

VK 981 (RH) is factory delivered for USA (where DB sensor(controlling heat) is always placed at the low (hottest) air plenum) as follows:

TYPICAL smart Control SETTINGS for USA

	COLORING	WILTING	LEAF DRYING	STEM DRYING	CONDITION
DB hot	100°F	118°F	135°F	165°F	100°F
RH%	~90%	~70%	~50%	~15%	~90%
WB	95°F	104°F	106°F	110°F	-
TA	0,5°F/hr	0,5°F/hr	1,5°F/hr	2°F/hr	-
ΔT cold	7°F	12°F	12°F	12°F	-
DURATION	48 hours	24hours	35 hours	35 hours	5 hours

NOTE: VK 981 (RH) may be factory delivered in the Ventobacco® barns with different default settings when DB sensor (controlling heat) is placed at the upper (cooler air) plenum and where the maximum DB temp at the lowest tier is controlled through the ΔT sensor .

TYPICAL Ventobacco® Smart Control SETTINGS in Celcius

	COLORING	WILTING	LEAF DRYING	STEM DRYING	CONDITION
DB	36°C	41°C	52°C	69°C	36°C
RH%	~95%	~70%	~50%	~15%	~95%
WB	35°C	35°C	36°C	43°C	-
TA	0,4°C/hr	0,7°C/hr	1°C/hr	1,2°C/hr	-
ΔT hot	4°C	12°C	12°C	12°C	-
DURATION	48 hours	24hours	35 hours	35 hours	5 hours

You can change any setting at any time to adapt curing schedule to your curing technique.

- Some more usefull information on your VK981 Curing control:**

Each time you supply power (12 Volts) to the control, the displays show :

Display check 888 888 88 8.8 88 etc

Led test Testing the leds

Ventobacco (this is a software check)

Ver (7.7 on the VK 981(A)) **or 2.01** on the VK981(RH)& TWIN (this is the 2014-2015 year's firmware's version)

SERIAL NO >>>>>>>>>>>>>>

REI spr (or **dnp**) (this indicates the auxiliary relay's programmed function to remind you about the function of this relay).

PASS (this is an eeprom test) If there is any problem on the memory displays will show **SERVIS** meaning that eeprom needs soon to be changed .

SET UP MENU

Limits & Alarms

By entering this menu you can:

- Setup the operation of the AUX relays & program sprayer's operation.
- Activate or inactivate and regulate the control's alarms.
- Activate or inactivate the Safety limits of the control.
- Activate or Inactivate the control's factory set curing safety stops

HOW TO ENTER

You can enter in any operating mode except "auto" by following the commands as follows:

Press and hold  and  and  at the same time. After ~10 seconds you are in the menu

“Set up” appears

And after a couple of seconds

- **“reL spr”** appears (factory delivered with **“reL spr”**)

Now the auxiliary relay operates as an ON-OFF relay for a solenoid or other spraying device.

With  or  button you can change to,

- **“reL brn”** appears

Now the AUXILIARY relay operates as a second safety relay for the burner.

Or

- **“reL dnp”** appears.

Now the auxiliary relay operates as an ON-OFF relay for a second ON-OFF damper.

(CAUTION: No longer a second safety burner relay.)

Once you leave this menu, the aux relay will operate according to the selected function.

*The control is factory delivered with the aux relay to: **rel spr**.
(to control a solenoid water valve for conditioning).*

SPRAYER's function:

Sprayer sprays till RH% reaches the RH% set point.

When RH% reaches RH set point the sprayer (water solenoid or humidifier) stops.

If RH% is set to 99% sprayer (water solenoid) stays On and sprays continuously.

If RH% actual exceeds the RH% set (offset of UB=+ 1F or offset RH=+3%) the damper starts opening.

CAUTION:

*If you want to connect the aux relay in line to the burner's relay (as a second safety relay), you must change its function to **rel Brn** and use a “jumper” connecting the 2 relays in line.*

If you want to change the function of the aux relay from burner to damper or sprayer do not forget to remove the jumper and connect the burner's line to burner's relay as shown on electrical connections page 37 “other connections”.



Press the **SELECT & - or CHECK SETTINGS** button again to get in the **Alarm menu**.

- **ALr on**..... with a value next to it ,or
- **ALr off** appears .

You can switch from **on** to **off** pressing button .

When **ALr on** ... the value next to it indicates time period in minutes after which the Alarm will be triggered .

ALr on 15 means : trigger the Alarm 15 minutes after a (Curing) Alarm condition occurred.

Which are the(Curing) Alarm conditions :



Press **SELECT & - or CHECK SETTINGS** again

- **ALr dif db** appears with a value next to it .

ALr dif db 6 means trigger the alarm if the DB temp differs from floating by 6 deg (F) for a period of time as set here above. (15 minutes)

ALr dif Ub 4 means trigger the alarm if the WB temp exceeds floating by 4 deg (F) for a period of time as set here above. (15 minutes)

ALr dif rh 10 means trigger the alarm if the RH% exceeds floating by 10% for a period of time as set here above. (15 minutes)

- a. When **DB actual temperature** differs from **DB floating(advancing) temperature** by more than Z(6° F as programmed) for a programmable period of time ("15" minutes as programmed), the SMART CONTROL's alarm output will activate any alarm system available (light siren or other connected on the Alarm relay) ,the DB display will start showing a blinking "AL" sign (alarm) and if VentoMonitor® software is installed operator will be alerted on his P/C.
- b. When **W.B. actual temperature** exceeds **W.B . advancing temperature** by more than Z(4 ° F for the programmed period of time ("15 " minutes), display will start showing a blinking "AL" sign (alarm) etc....
- c. When **RH% actual humidity** exceeds **RH% floating (advancing) humidity by Z (10 %)** for the "15 " minutes programmed, display will start showing a blinking "AL" sign (alarm) etc....

Note1:

If the RH% actual humidity in the barn (or WB actual temperature) drops below the RH% -- advancing- humidity (or W.B advancing temp), the SMART CONTROL will not give any alarm signal since it considers this condition satisfactory.

By pressing any button on SMART CONTROL the AL blinking sign will stop.

It will start blinking again after "X" minutes if the problem has not been fixed.

The period of time ("X minutes") after which the SMART CONTROL will activate the alarm system can be set from 5 to 20 minutes The alarm is factory default set ON at 15 minutes.

Note 2 (Only for Smart controls with Wet wick Wet bulb sensor):

If WB actual exceeds 120° F (48° C) (meaning that the wick is dry) the WB alarm will be activated to inform the operator about the situation and as soon as operator turns it off it will not be activated again till the end of the cure even if the WB reading (W.B. actual) keeps exceeding 120° F. (realizing that operator does not mind for the dry wick).



Press the button again.

"*Stp*" appears with "**on**" or "**off**" next to it. (factory default "**OFF**")

Now you can activate or inactivate a couple of hidden (factory programmed) temperature advance stops

during the cure, by pressing to activate or to inactivate them.

Those are 2 "safety" stops (factory programmed at 113 deg.F (~45 C) & 133 deg.F(~56 C), for 5 hours each stop) . Those stops insure that enough moisture has been removed from the tobacco leaves ,as Dry bulb temperature advances to the set limit.

If you do not need these stops simply set "**Stp off**"



Press the button again.

"*Lin*" appears with "**on**" or "**off**" next to it (factory default "**OFF**")

Now you can activate or inactivate the **Safety limits** of the control by pressing to activate or to inactivate them.

Note: The safety limits are **temperature setting limits** .

The control does not accept data entrance outside those limits.(for example when "*lin*" is "**on**" the operator can set any logical temperature in any curing phase but he cannot set any temperature outside certain limits which are considered by the control wrong .

The **Safety limits** are as shown hereunder:

Safety limits when "lin" is "on" (in degrees F)												
	(0) Manual mode		(1)Coloring		(2)Wilting		(3)Leaf Drying		(4)Stem drying		(5) Condition	
	min	max	min	max	min	max	min	max	min	max	min	max
Dry bulb	36	185	99	108	93	127	108	140	131	180	86	122
Wet bulb	36	185	99	108	86	108	90	113	95	115		
TA	0.3	9	0,3	5	0,3	5	0,3	5	0,3	5		
ΔT	5	36	5	11	9	25	9	25	9	18		

When "*lin*" is "**off**" operator can set temperatures outside the above limits.

For safety reasons:

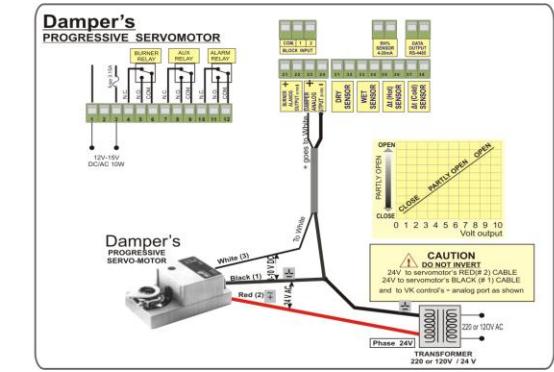
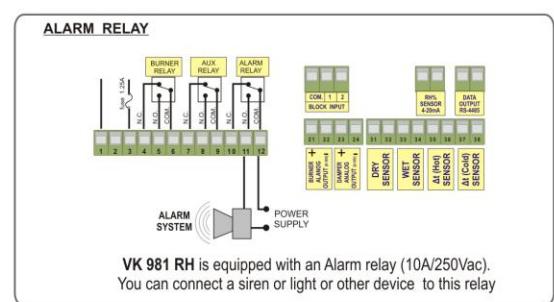
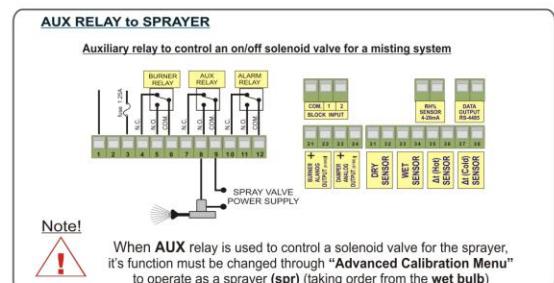
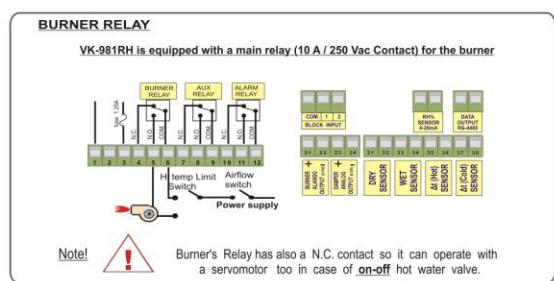
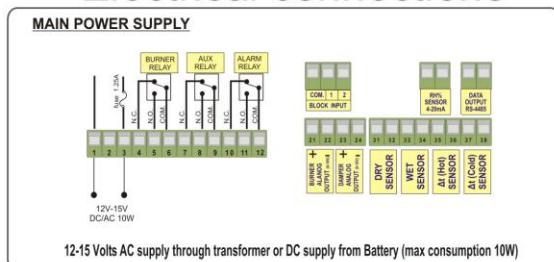
- the **maximum** temperature the control can accept (even with safety limits off) is 185 degrees F.
- the **minimum** temperature the control can accept (even with safety limits off) is 36 degrees F.
- the **maximum** temperature advance rate is 9 degrees F per hour.
- the **maximum** temperature difference (ΔT) is 34 degrees F.
- **If temperature in the barn drops below 36 degrees F** displays will show "**err**" and the burner will not fire unless DB sensor is heated to 36+ degrees F.

To leave this menu press **START** button once ,or

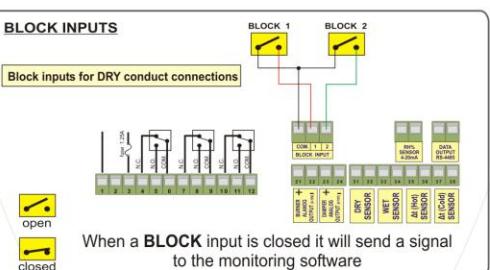
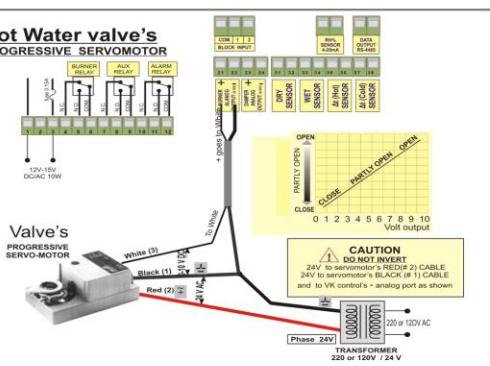
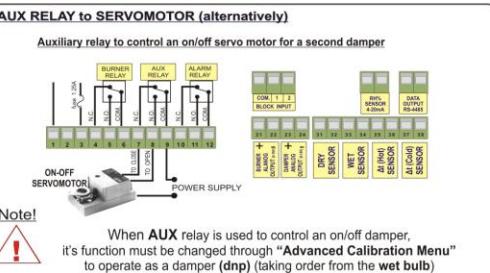
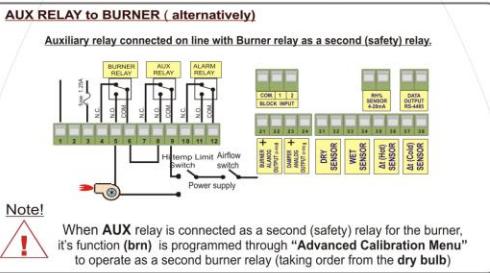
the displays return to readings (thermometers) after a few minutes even without pressing **START**.

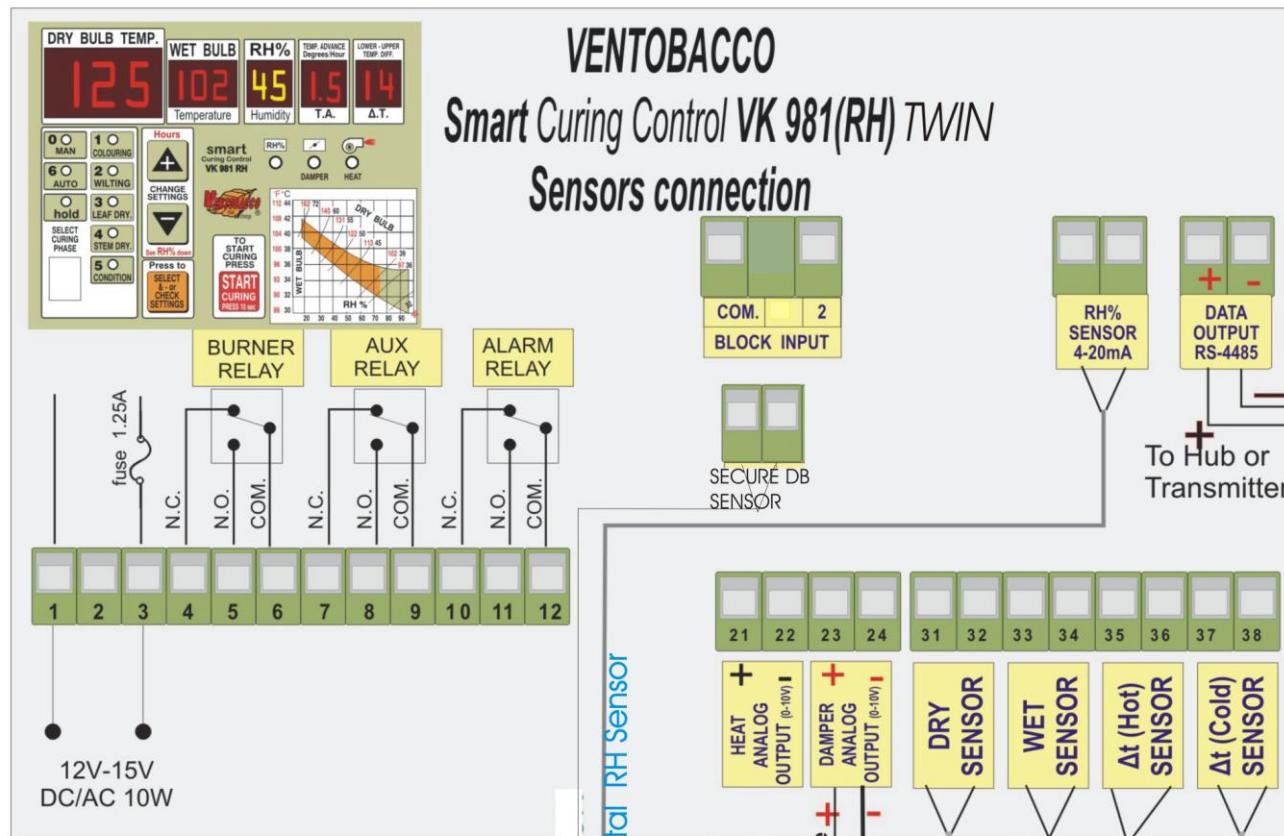
Follow your **LOCAL REGULATIONS** when connecting the control.
ALWAYS Install a High temperature Limit switch set at 180°F & an Airflow switch on Burner's line.

VK 981(RH) schematic Electrical connections



Other connections




POWER SUPPLY

1,3 :	12V DC/AC 10VA
2 :	No Connection

