

HORIZON CLOCK

clock, humidity and temperature EFIS* display
(*Electronic Flight Information System)



www.horizoneclock.com

User Manual

Thank you!

This is the *installation and operation manual* of your glass cockpit clock. This clock is easy to use, so please do not be intimidated by the large amount of pages.

This document *may seem a bit strange* if you are not an aviation enthusiast. You have been warned; thank you again, have fun! 😊



Not to be used in Real Life Aviation



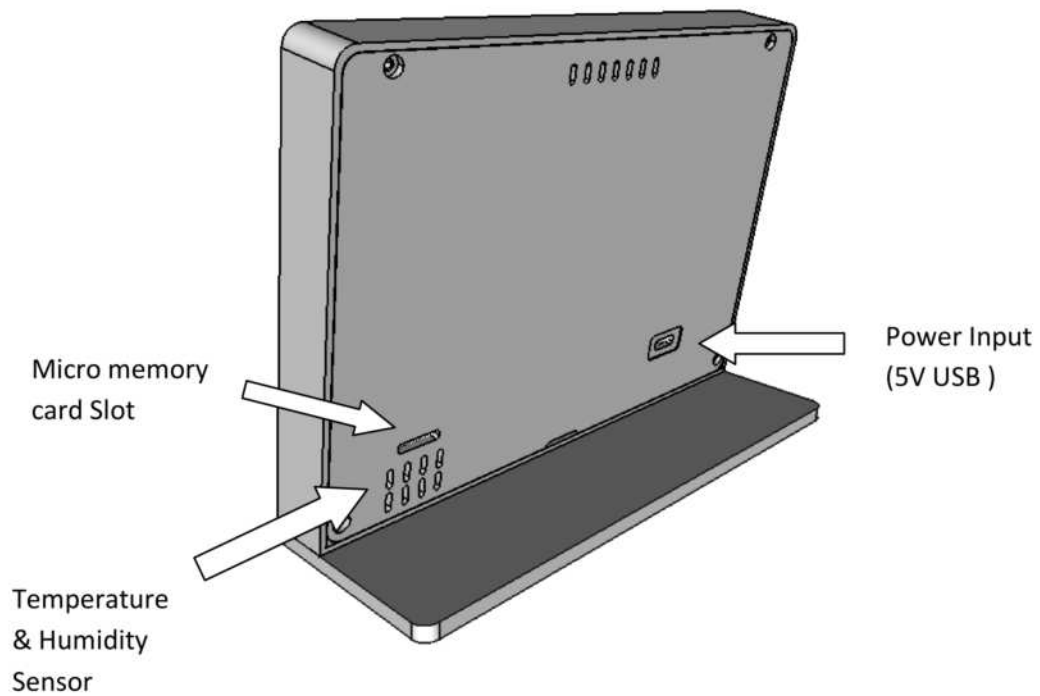
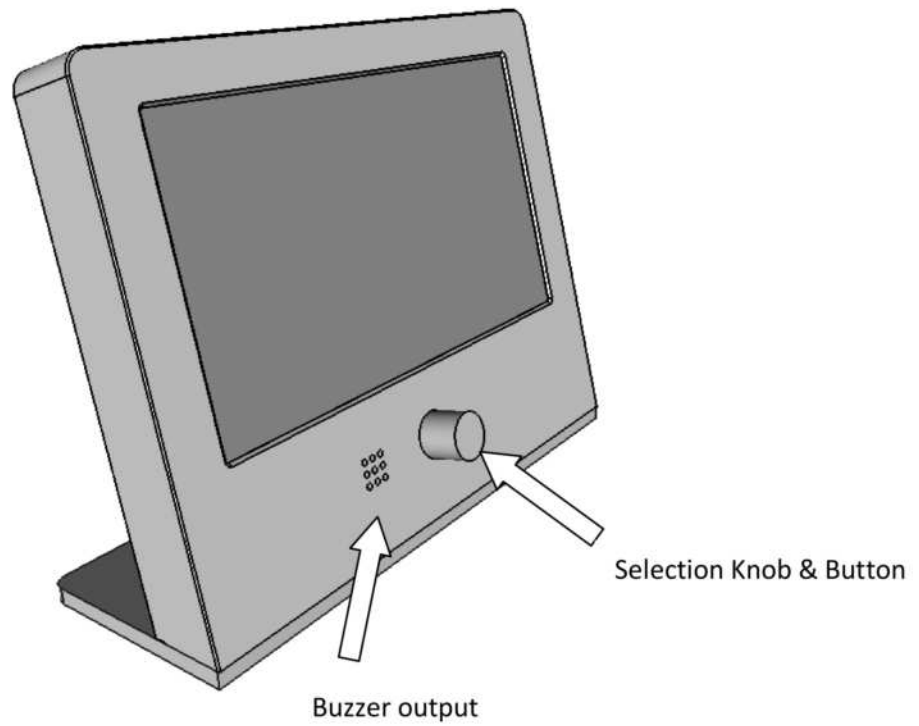
Remember, actual real life data on screen is Time, Temperature and Relative Humidity. The rest is simulated.

Extra and not device specific information in this document is presented with a light blue background.

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Device overview



Installation



This device is intended for indoor use only and is not waterproof. Choose a flat, stable surface near your power source. Do not install the clock near heaters, ovens or other heat issuing devices. Make sure the screen is not under direct sunlight as this may reduce its lifetime and/or readability.

Connect your power source to the USB connector (this could either be a power adaptor or a computer's USB port). When power is applied, the display should automatically turn on. (If it does not, the power supply may not be appropriate. For more information see "Power Source" below and the "Trouble Shooting" section).



The TFT/LCD display is made of glass; do not subject it to mechanical shock by dropping it. Also, make sure not to apply force to the display while holding/ picking up the device.

The screen has a protective film on its surface to avoid any damage during storage and transport. This film can now be removed.



This is not a touch screen! Avoid touching the display.

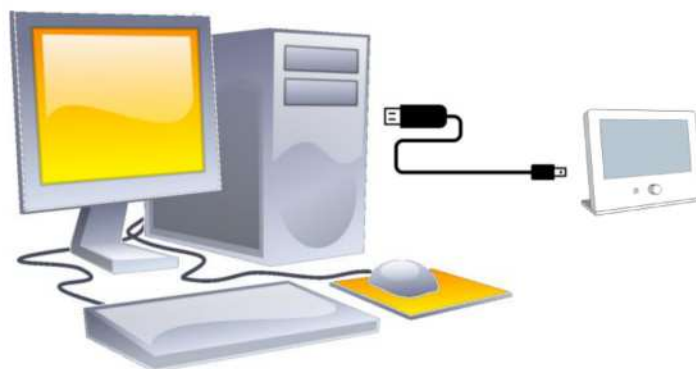


Proper installation is very important for the safety of the aircraft.

Power source

The nominal power source requirement is 5V/500mA. The device may not function properly and/or be damaged if connected to a not suitable power source. Most good quality USB power sources will be adequate.

Another device with USB port support (like a typical personal computer) could provide power as long as it is able to source the required current. In order to continue operation when the host device is turned off, additional settings may be required. Some computers keep USB power on at some ports even when the system is powered off (for external device charging purposes). This behavior is usually controlled within BIOS setup; please refer to the manufacturer's guidelines. Also, most operating systems allow the user to select if USB power will be turned off or not during sleep. Some USB ports may not be able to supply enough current although they claim to. Usually found in portable computers (laptops etc), these USB ports can only source up to 100mA or less. In this case, please use another port.



This is a very low power device, operating with minimum resources. It will consume very little electricity- equivalent to that of a night light- and can be programmed to daily turn off (for example, when there is no one around) for even more consumption reduction. More information about power is found later in this document (see [“Reducing power consumption”](#)).

Low power consumption during flight results in less engine alternator overhead, reduced fuel consumption, increased battery life and lower operating costs.

Precautions & Cleaning

The display surface is sensitive and needs to be handled carefully or it can be easily scratched. The screen is NOT a touch screen. Avoid touching the display surface with bare hands. Do not apply excessive force to the display surface since this may cause the color tone to vary. To clean, gently wipe with a soft and dry cloth. If required, breathe on the display surface and then gently wipe it with a soft and dry cloth. If the display is very dirty, moisten the cloth with one of the following: isopropyl or alcohol. Other solvents may damage the screen. Especially, do not use water. Wipe off saliva or water drops immediately; contact with water over a long period of time may cause deformation or color fading. This device is not water resistant! Also, avoid using the device on sandy areas.

Do not attempt to disassemble the Liquid Crystal Display (LCD). If the LCD is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

Electrostatic discharge may damage the device. Ground yourself by touching a grounded metal surface like the back/ unpainted metal part of a computer case, especially previous to installing/replacing the backup battery.

Do not remove the memory card or remove the power supply during memory card read operations. In rare cases, this may cause system crash or data corruption.

Disposal of electrical waste



All electrical appliances and old appliances must be disposed off separately from the household waste and are to be returned to the state authorities designed for that purpose. By correctly disposing of electrical old appliances environmental damage may be prevented. Please remove and properly recycle the internal backup battery.

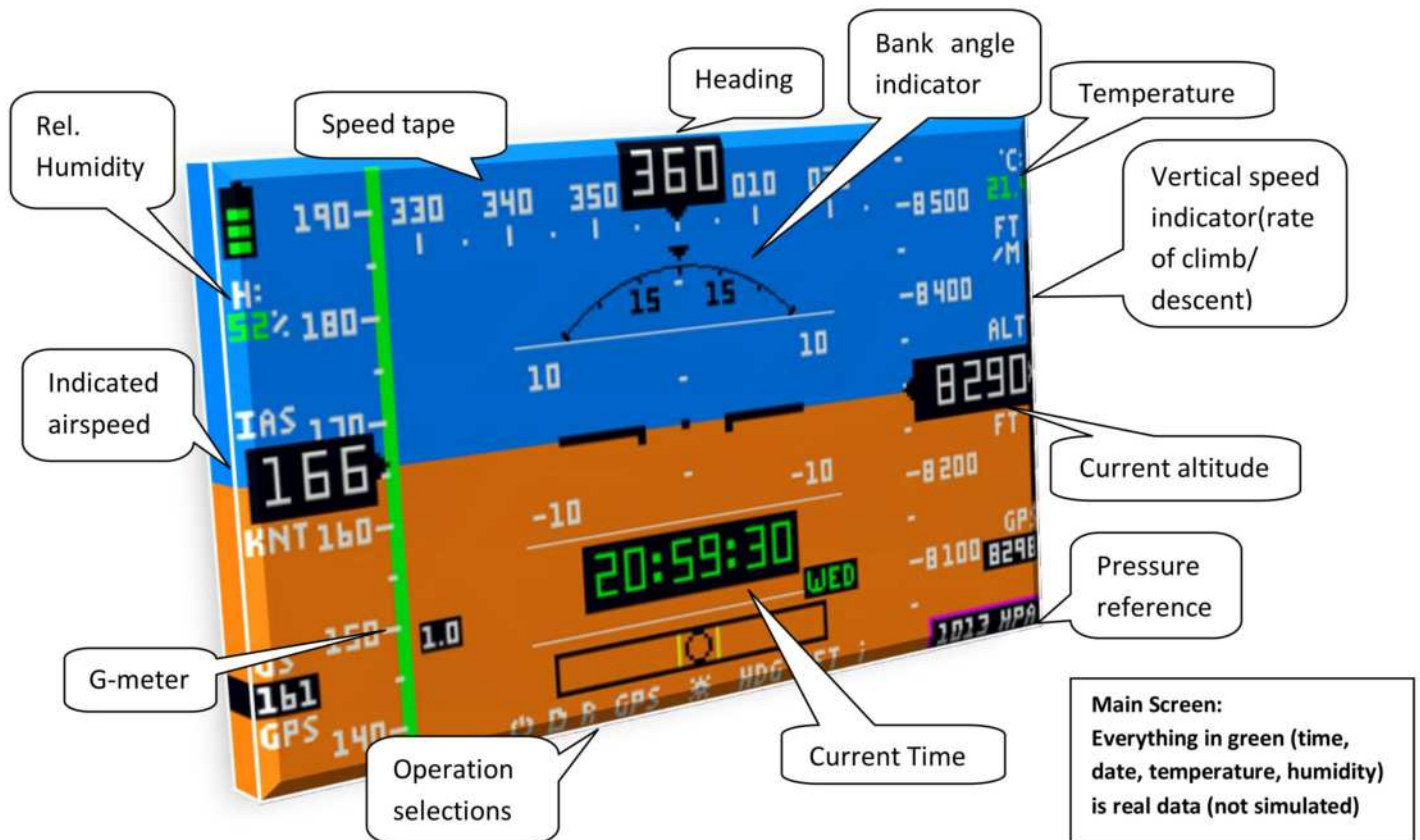
Disclaimer

Every care has been taken for the information in this document to be accurate when published, however errors might still exist. Also, the content of this manual is subject to change without notice due to alterations in software/hardware or other factors as the device is continually improved. Even if small inaccuracies or differences might exist, they shall not affect overall performance. Exclusion of liability: The firmware and/or hardware may be changed at any time without prior notice. All points described in these instructions only serve the purpose of clarification and must not inevitably correspond to a certain situation. Legal claims cannot be made on the basis of these instructions.

Flight data simulation under clock display is far from precise; it is designed to provide the aesthetic feel of flight only and is not by any means intended to realistically reproduce real world flight parameters. This has no effect when receiving PC simulator flight data through USB.

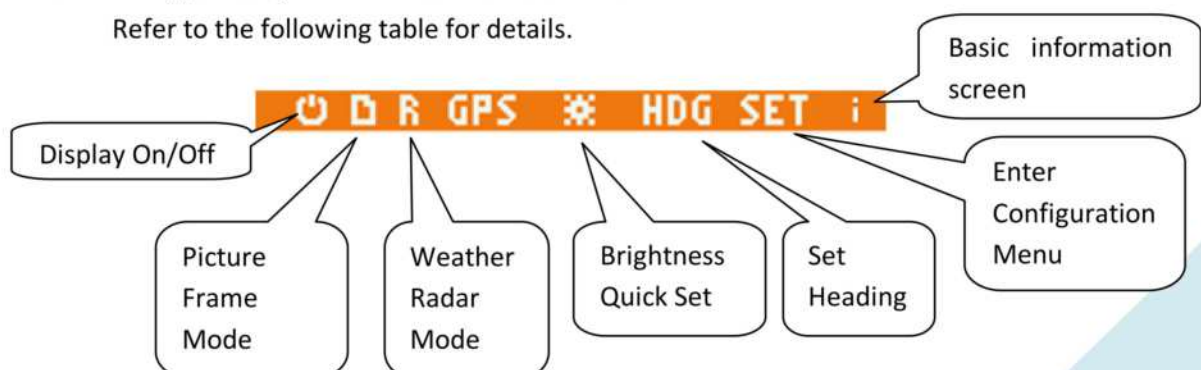
Main Operation

The AHRS/AHARS (=Attitude Heading and Reference System) screen provides important flight information and also includes current time, humidity and temperature. *In addition to the attitude indication and depending on the sensory modules installed in your aircraft, the screen will provide airspeed data, altitude data, magnetic heading, g-force and GPS information.* The following picture shows a typical configuration. Many of these options are configurable through the configuration menu system discussed later.



Rotate the knob to either navigate to a selection (left/right) or change a value (increase/decrease). A magenta rectangle is drawn around the selected item. Also, the knob can be pressed like a button. Possible selections while in AHARS screen are from left to right: Display On/Off, Picture Frame, Weather Radar, GPS/MAP, Brightness, Heading, Set Config., Information (i) Screen, Altitude Pressure Reference.

Refer to the following table for details.



Operation Button/Selection:	Description:
On/Off	Use this to manually turn off the screen. This minimizes power consumption too. Note that if automatic power control is pre-set, the clock will turn itself on at the pre configured time even if it was manually turned off.
Picture Frame	Enters picture frame mode. Pressing the button again will exit this mode. Rotating right/left will load the next/previous picture.
Weather Radar	Changes the display from AHARS to Weather Radar mode.
GPS (MAP)	Outputs global positioning data. <i>GPS sensor installation is required.</i> It will also provide access to a global map with the current position shown as a red cross. Rotate to randomly change the current position.
Brightness	Press on the brightness button to quickly alter the brightness level of the screen. <i>Brightness reduction may be required during night flying.</i> Choose an appropriate level for comfortable viewing. More detailed screen settings (brightness, contrast, saturation) can be set through the configuration menu discussed later in this document.
Heading	Sets the heading indicator mark. The pilot in command will try to turn to this heading when possible, depending on current air traffic control restrictions.
Set [Config.]	Press on this to enter setup mode. Use the configuration menu to change device parameters. <i>It is not generally recommended to enter setup mode while flying the aircraft.</i> Use the setup during system installation or servicing.
i [information mode]	Turns the screen into a generic simple clock with temperature and humidity display. Rotate to change display combinations. The text will move around every few minutes to protect the LCD like a screen-saver does. Under default setup, the information and AHARS screens will alternate every 5 minutes.
Altitude Pressure Reference	When current altitude is derived from the pressure sensor, this sets the altitude pressure reference used for calculations. If altitude data is provided by a GPS sensor, this will directly set a reference altitude instead of a pressure level. Altitude data source is selected at aircraft installation time from within the according configuration setup menu. Altitude pressure measurement units can also be set to either hectoPascals or inches of Mercury.

Quick clock setup

How to setup time

1. Rotate the knob until "SET" is highlighted.
2. Click/Press the knob as if it was a button. You will enter Configuration Setup mode. The first option is "Clock" and should be already selected (The selected option has a rectangle drawn around it). If it is not, rotate to select it.
3. Click to enter "Clock" sub menu.
4. Click "Set Time".
5. Rotate the knob to set the current hour (00 to 23). Click to save the hour setting.
6. Rotate the knob to set current minutes (00-59). Click again to save the new time.
7. Rotate to "Back" and click to return to main menu.
8. Rotate to "Exit" and click to exit configuration mode*.

How to setup date

1. Enter Configuration Setup mode (rotate until "SET" is highlighted and click).
2. Click on main menu "Clock".
3. Rotate to "Set Date" and click.
4. Rotate to select the current year, click to move on to month and day of month.
5. Rotate to "Back" and click to return to main menu.
6. Rotate to "Exit" and click to exit configuration mode*.

How to setup the alarm

1. Enter Configuration Setup mode (rotate until "SET" is highlighted & press/click).
2. Click on main menu "Clock".
3. Rotate to "Alarm" and click to enter alarm sub menu.
4. Rotate to option "Set Alarm" and click.
5. Rotate the knob to set the alarm hour (00 to 23). Click to save the hour setting.
6. Rotate the knob to set the alarm minutes (00-59). Click again to save.
7. Rotate to option "Alarm Days" and click to select which of the weekdays the alarm will be active.
8. Rotate to select a day (M:Monday, T:Tuesday etc.) and click to enable or disable the alarm for this day of the week. When alarm is disabled for the day, an underscore (" _ ") is displayed instead of the weekday letter. When finished, select "<" to save. A minimum of at least one day of the week must be selected.
9. Rotate to "Back" and click until you reach the main menu.
10. Rotate to "Exit" and click to exit configuration mode*.

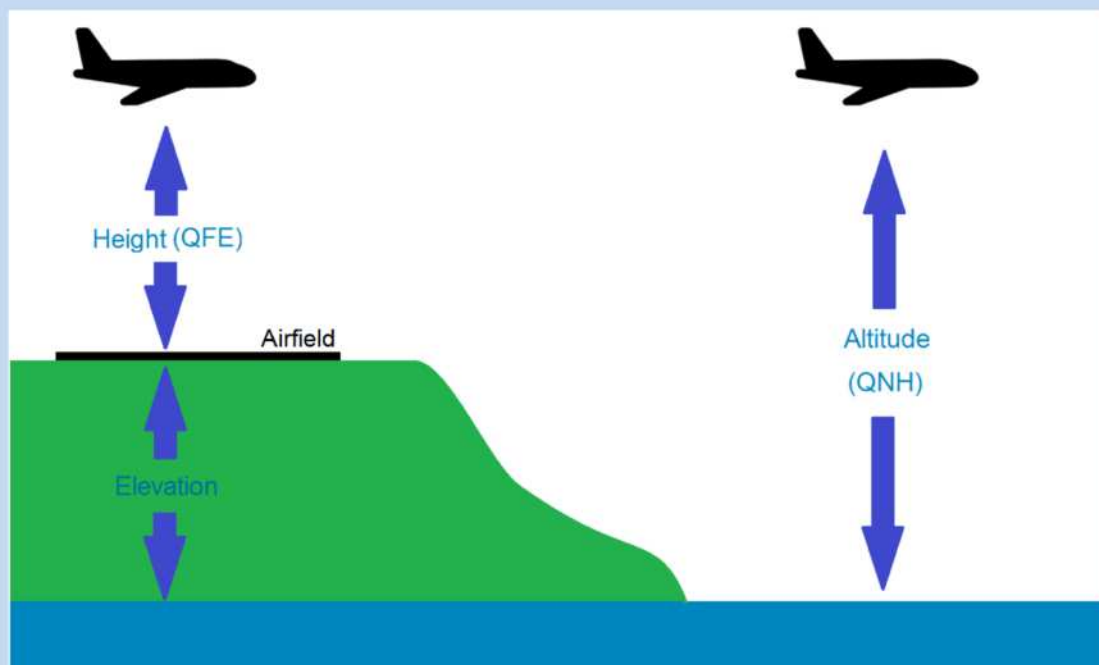
*Note: If there is no user interaction for some time (over a minute), the device will automatically exit configuration mode.

Altitude Pressure Reference

In order to change the altitude pressure reference, rotate to highlight it (if it is not already) and press the knob. When selected, the digits of the current value are drawn larger and rotating the knob increases or decreases the value. The displayed altitude is updated immediately based on the new reference value.

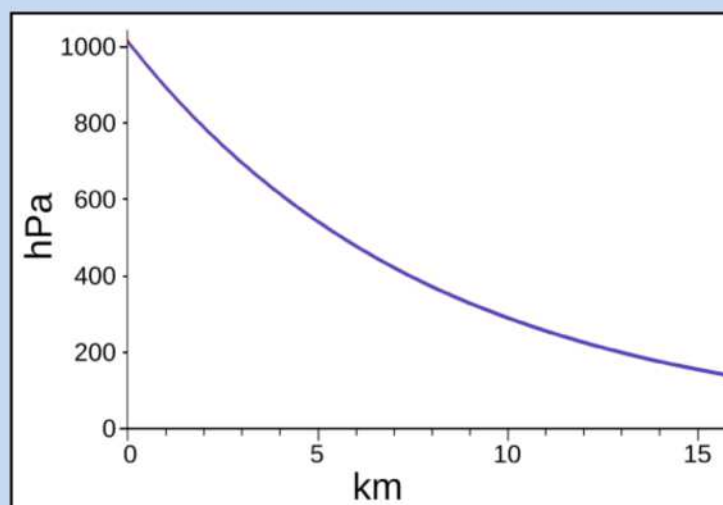
While the aircraft is on the ground if the current pressure at ground level is set, then the altimeter will output zero (0). This “calibrates” the altimeter to show height above the airfield’s/ airport’s level (Traditionally this is called the QFE pressure; this is an aeronautical code). If the pilot inputs the current sea level pressure as the pressure reference, then the altimeter will display height above sea level. In this case, if the aircraft is on the ground the displayed altitude will not be 0 but it will be equal to the airfield’s /airport’s elevation above sea level (The pressure reference based on sea level is called QNH). Airports maintain facilities which measure the current pressure in order to inform pilots. The current QNH may be transmitted over radio to all aircraft in the area, along with other weather data. Air traffic controllers also inform pilots directly.

When the reference pressure increases, the displayed altitude will increase also. When the reference pressure decreases, the displayed altitude will decrease also.



Here are some more technical details. Altitude data is derived from atmospheric pressure measurements. Atmospheric pressure is not only affected by altitude but also by other factors like temperature and air density, so the climate will greatly affect measurements. To simplify (and standardize) calculations, standard atmospheric conditions are used. The following table shows example values of how air pressure changes (is reduced) as altitude increases and vice versa.

Altitude (feet)	Altitude (meters)	Pressure (hPa)	Pressure (inHg)
0	0	1013.25	29.92
364	111	1000	29.53
1773	540	950	28.05
3243	989	900	26.58
4781	1457	850	25.10
6394	1949	800	23.62
8091	2466	750	22.15
9882	3012	700	20.67
11780	3591	650	19.19
13801	4206	600	17.72
15962	4865	550	16.24
18289	5574	500	14.76
20812	6344	450	13.29
23574	7185	400	11.81
26631	8117	350	10.34
30065	9164	300	8.86
33999	10363	250	7.38
38632	11775	200	5.91



So, generally speaking, air pressure decreases as altitude increases. For example, let's suppose that at sea level our pressure sensor measures 1013hPa of pressure. This value decreases as we move to higher altitudes. From 1013 hPa the reading goes down to 950 hPa when we go up about 1770 feet and down to 800hPa at about 6400 feet. As a result, knowing the current pressure is equal to knowing the current altitude. In this example, we assumed that the pressure at 0 altitude was 1013 hPa. If this reference altitude is the sea level, then all measured pressures provide the "distance" or "height" from this level.

The only information provided to the altimeter by the pressure sensor is the pressure at our current position/altitude level. If the pressure at another altitude is known (as a "reference"), then the distance (=height difference) of the two can be calculated. So, in order to get an altitude reading from the altimeter, it is required to set a pressure reference. This is the pressure value the pilot inputs to the device. This pressure corresponds to a reference altitude level. (=is the pressure the sensor would measure if it was placed at that altitude). The altimeter will use this value and the currently measured pressure to calculate how far away the current height level is from the reference. The calculated distance is displayed as altitude (in feet or meters). For the record, the mathematical formula used by this device to calculate current altitude is this:

$$Alt = \frac{10^{\frac{\log_{10}\left(\frac{P}{P_o}\right)}{5.2558797}} - 1}{-6.8755856 * 10^{-6}}$$

Where:

P: measured pressure at current altitude

P_o: reference pressure

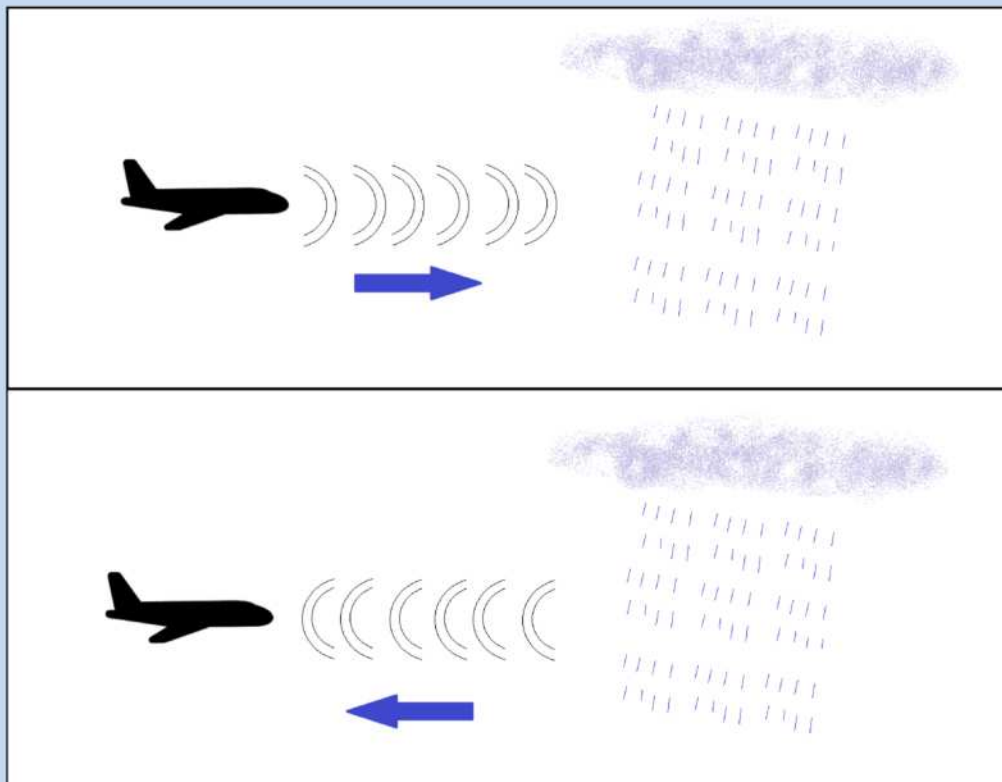
Alt: calculated altitude (in feet)

Other Operation Modes

Weather Radar Mode

Under weather radar mode the display provides weather information derived from the weather radar.

Not to be confused with ground weather station radars, this radar is installed on the aircraft and –being airborne- will operate independently to any ground based weather systems. The weather radar operation is based on microwave reflection detection. There are two main categories of radars, the ones that emit pulses of radio energy and the ones that emit continuous waves. Both detect the wave's reflections on objects. The one used in this system broadcasts pulses of radio waves and detects reflections which are mainly caused by the presence of water drops (rain) or hail in the atmosphere. The radar can also provide rain drop intensity information since dense precipitation creates a stronger wave return than light precipitation. The time it takes for a reflection to be received is also measured in order to calculate the distance of the reflecting water mass. The more time it takes for a signal to be received, the more distance it has travelled and thus the further away the reflecting mass is located. Note that clouds are not detected, only water masses. Sometimes other objects could be detected, like flocks of birds. Also, atmospheric phenomena could affect radar performance and/or produce noise.



The display uses black color to output detection-clear areas or green, yellow, red and magenta colors to display detected intensity from light (green) to heavy (magenta). Use the weather radar information to avoid potentially dangerous weather (like heavy rain, thunder storms etc).

Color	Intensity Level	Description
Black	0	No detections
Green	1	Light precipitation
Yellow	2	Medium precipitation
Red	3	High precipitation
Magenta	4	Extra heavy precipitation

This specific W.R. is capable of a 120 degree scan in front of the aircraft. It emits ~10Ghz microwave (X-Band) pulses, 1us (microsecond) wide and then “listens” for returns. The pilot must understand the capabilities and limitations of the radar. For example, note that this particular radar is frequently affected by noise. Also, sometimes there just isn’t enough power for the waves to penetrate a heavy storm. In this case, climate information “behind” the storm may not be available. Other considerations when interpreting the radar display include the shape of storm (shapes like a hook or U-shape are indicators of strong vertical draft) and packs of small areas of different colors indicate strong turbulence. Also note that black areas mean “nothing detected” but this does not necessarily mean the weather there is calm.

If current weather is not desirable, the user can simply roll the input knob to “load” a different weather. Weather can largely change fast and randomly and (of course) is out of our control, but in this case, we can change it at will! (*since this is our indoor universe*). The weather picture is automatically updated every few seconds. Use the image slideshow duration setting under picture frame mode to set the interval of weather updates from 5 seconds to a maximum of 30 seconds (any setting over 30 seconds is meaningful only for picture frame use and will have no effect to the W.R. display which, in this case, will be updated every 30 seconds).

Photo Frame Mode

Your clock can also function as a picture frame. This is a secondary function of the device, so it has very basic functionality. It would rather be flying, but if you absolutely have to display pictures then it will happily display them, preferably aviation related ones 😊

Pictures are displayed as a slideshow (a new one loads at a specified time interval). You need to consider that if pictures are large in resolution (for example 1000x1000 pixels or larger) it will take some time for them to load on screen (about 1 minute).

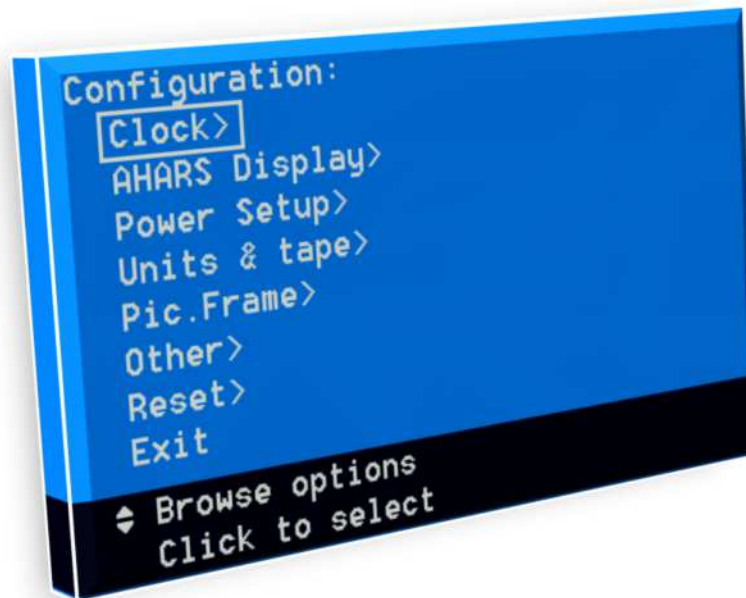
The best way to use your clock as a picture frame is to first prepare the pictures for optimized loading and viewing. For example, some images may need to be previously rotated to the proper display orientation. Also, the screen is generally small for large pictures, so it will help (=load faster) if they are sized to match the screen's native resolution (800x480 pixels). Using computer software to do this is very easy. You can download a free application that can do this and many other operations to many picture files at once. Check out www.horizonclock.com for more information and links to free software.

The clock can be setup to look for picture files in a folder named "picframe", so you can store the processed photos in this folder and keep the originals elsewhere. Alternatively, through the configuration options you can instruct the device to ignore large resolution pictures.

By default, while in photo frame mode, clock time is displayed. Set "pic.:Off" in menu *Clock* → *Display*, for the current time to be hidden under photo frame mode. When enabled, time is displayed at the lower left of the screen using small fonts.

Configuration Menu

To enter the configuration menu select and press “SET” under AHARS display. The system’s configuration screen will appear.



Main configuration menu

Navigate to the option you would like to set/change by rolling the knob. Select and press “Exit” to return to AHARS display. Options are categorized into Folders/Sub menus. All folders/submenus end with a “>” character. Clicking on a Folder opens it up and shows the options it contains. Click “Back” to return to the previous folder. Directions or information about each highlighted option is displayed at the bottom of the screen.

Please refer to the following table for an explanation of each menu/submenu settings. Note that after approximately 90 seconds of user inactivity, the screen will automatically return to AHRS display (simply because it prefers flying).

Configuration Menu Reference Table

Menu Item/ Sub Item	Values/ Options	Description
Clock		
Clock> Set Time	HH:MM	Set current time. Time is set in 24-hour format. Enter hours (HH) and minutes (MM). Seconds are reset to 0
Clock> Set Date	YYYY-MM-DD	Select the current year, month and day of month. The day of the week is automatically set.
Clock>Alarm		
Alarm> Gen.Status	Enabled Disabled	Arm (Enable) or disarm (disable) the alarm functionality. This can be also done quickly while in AHARS mode: First, navigate (if necessary) to a selection that does not change the operation mode (like the QNH setting) and then press and hold the button for a few seconds. A “bell” indicator near the current time is displayed when the alarm is armed.
Alarm> Set Alarm	HH:MM	Set the time that will generate the alarm. Time is set in 24hour format. Whenever the time is set, the “Gen.Status” of the alarm is set to “Enabled” by default.
Alarm> Alarm Days	MTWTFSS	Set the day(s) of the week that will trigger the alarm. Each day is represented by its first letter. The alarm will be disabled for each day that appears as an underscore “_” For example this selection: “MTWTF_” will enable the alarm only on Monday to Friday, and will disable it on weekends. Click on the return symbol “<” to store the selections
Alarm> Audio& Visual	basic simple up-down urgent gradual other custom random	Select the sound to playback when the alarm is triggered and the alarm message (if any) to display. Sound option “custom” is only available if the user has previously loaded a custom sound from an external memory card. At every power reset, the alarm sound will default to “basic” and visual will default to “random”. Note that audio alarm is disabled under PC simulator data display, in which case text “TIME ALARM” is displayed.

Menu Item/ Sub Item	Values/ Options	Description
	stall fuel caution none custom random	Options for the visual alarm include: <i>none</i> : No message is displayed during an alarm. <i>custom</i> : Will display the text defined under <i>Set Custom</i> → <i>Text</i> <i>random</i> : Will display one of these messages: stall, fuel or caution.
Alarm> Set Custom		
Alarm> Set Custom> Text	< (Save) x (Cancel)	User-defined alarm text. Only capital letters A to Z, numbers, space and symbols @ : ; < = > ? ! are allowed. Scroll to select a character position and click to edit. For this to display as the alarm text message, select “ <i>custom</i> ” under “ <i>Audio & Visual</i> ” visual setting.
Alarm> Set Custom> Sound	Load Delete Return	<i>Load</i> : Copies a custom alarm sound from a memory card to internal device memory <i>Delete</i> : Removes a previously stored alarm sound from internal memory <i>Return</i> : Cancel and return to menu list For more information on custom sounds see “ Custom Alarm Sound ”
Alarm> Set Custom> AutoSnooze	Enabled Disabled	When there is no user input, the alarm sound output will always stop automatically after about 60 seconds. If <i>AutoSnooze</i> is disabled (default), the alarm will not trigger again after the timeout. Enable <i>AutoSnooze</i> to automatically enter snooze mode after the initial alarm timeout. In this case, the alarm will trigger one extra time after the snooze period.

Menu Item/ Sub Item	Values/ Options	Description
Alarm> Set Custom> T-RH	Off T RH T&RH	Choose to trigger the alarm when the selected temperature and/or rel. humidity thresholds are reached or crossed. This function is enabled regardless of the clock time alarm being active or not and regardless of the clock time alarm's weekly schedule. Please note, there may be failures to detect and/or false alarms since the sensors could potentially fail or produce erroneous results, even if this happens only for a small amount of time. Use this alarm to monitor the environment (like for example, the temperature in your home or office) but <u>do not rely on it</u> for critical tasks, as in medical or other harm-involving situations. Also, temperature and humidity are not monitored while on internal battery power, so this alarm will not sound when there is no mains power. When power is back on, monitoring is resumed. Sensitivity and re-arming: After the alarm is triggered by temperature, there must be at least a $\pm 0.5^{\circ}\text{C}$ variation in measured temperature for the alarm to be able to trigger again. After the alarm is triggered by rel. humidity, there must be at least a $\pm 1\%$ variation in measured rel. humidity for the alarm to be able to trigger again. Note that when displaying PC simulator data, T-RH alarms are halted.
Clock> Volume		Set audio volume. This is a global setting which will affect alarm sounds and chime output. Defaults to maximum.

Menu Item/ Sub Item	Values/ Options	Description
Clock> Display	small (digits) large huge	Multiple display options: a) choose size of clock digits, b) select time and date display format, and c) set whether clock time will be visible when showing pictures under picture frame mode. <i>small</i>: time is displayed at the bottom left corner of the screen. Small, standard font digits are used. <i>large</i>: time is displayed at the center of the screen while in AHARS (under the nose indicator) or W.Radar modes. Fonts can be selected under "AHARS Display" menu. <i>huge</i>: This option affects only AHARS mode and is meant for time to be visible from a distance. While in AHARS mode, time is displayed at the center of the screen with standard huge fonts. Under W. Radar mode, large digits are used.
	12h 24h	<i>12h</i> : 12 hour time format <i>24h</i> : 24 hour time format When 12h is selected, indicators "AM" and "PM" are used when displaying time in all operation modes/screens.
	MM-DD DD-MM	<i>MM-DD</i> : Month is displayed first, then day <i>DD-MM</i> : Day is displayed first, then month The date selection alters the way month and day is displayed in the AHARS screen. (Please note that this option does not affect the way time and date is entered while inside the configuration menu)
	pic:On pic:Off	<i>pic:On</i> : Time is displayed when showing pictures <i>pic:Off</i> : Time is not displayed when showing pictures

Menu Item/ Sub Item	Values/ Options	Description
Clock> Chime	off 20m 30m 1h	<i>off</i>: Chime is disabled (default) <i>20m</i>: The device will beep shortly every 20 minutes (at every hour change and every 20 and 40 minutes of the hour) <i>30m</i>: The device will beep shortly every 30 minutes (at every hour and half an hour change) <i>1h</i>: The device will beep shortly every 1 hour (at every hour change) Chime will not disturb you whenever the screen is off (=device is in power off condition).
AHARS Display		
AHARS Display> Digit Fonts	thin thin2 digital simple alternative	Select the font for digits. Default selection is "thin".
AHARS Display> Heading	disabled from sens from GPS GPS + sens	Select an option according to the sensory systems installed in your aircraft: <i>disabled</i>: no heading information is displayed. There is no heading sensor installed. <i>from sens</i>: heading information is displayed by acquiring data from the installed magnetic sensor <i>from GPS</i>: heading information is displayed by acquiring data from the installed GPS <i>GPS + sens</i>: heading data is derived from GPS (primary) and magnetic sensor (secondary). When one of the two fails, the display uses the other.

Menu Item/ Sub Item	Values/ Options	Description
AHARS Display> Speed	disabled sensor from GPS sens + GPS	Select an option according to the sensory systems installed in your aircraft: <i>disabled</i> : no speed information is displayed. There is no speed sensor installed. <i>sensor</i> : speed information is displayed by acquiring data from the installed aircraft speed sensor (Indicated Airspeed) <i>from GPS</i> : speed information is displayed by acquiring data from the installed GPS <i>sens + GPS</i> : speed data is primarily derived from airspeed sensor and secondarily from GPS.
AHARS Display> Altitude	disabled sensor from GPS sens + GPS	Select an option according to the sensory systems installed in your aircraft: <i>disabled</i> : no altitude information is displayed. There is no altitude sensor installed. <i>sensor</i> : altitude information is displayed by acquiring data from the installed aircraft altitude pressure sensor <i>from GPS</i> : altitude information is displayed by acquiring data from the installed GPS <i>sens + GPS</i> : altitude data is primarily derived from altitude sensor and secondarily from GPS.
AHARS Display> GPS	enabled disabled	Enable or disable GPS data display. Enable this when a GPS is installed in the aircraft and connected to the system
AHARS Display> Pitch Lines	On On +hor Off Off +hor	Enable or disable pitch lines. Also selects whether a white line will be drawn on the horizon (0° pitch). <i>On</i> : Pitch lines are drawn, excluding the horizon (default). <i>On +hor</i> : All lines are drawn. <i>Off</i> : No lines are drawn. <i>Off +hor</i> : Only the horizon is drawn.

Menu Item/ Sub Item	Values/ Options	Description
Operation Setup		
Operation Setup> Auto On/Off Mode	screen disabled br.to 0% br.to 5% br.to10% br.to15%	Enables automatic power on or power off of the device depending on pre-selected times. This functionality is used to reduce power consumption of the device by turning off when no one is around. Alternatively, the screen brightness could be reduced to the pre-set percentage instead of turning completely off. The brightness will not change if it is already set at a lower than the defined level. Any user interaction will bring brightness back to its previous level.
Operation Setup> Off at	HH:MM	Sets the time (in 24hour format) to automatically turn off (or reduce brightness). Whenever this is set, the automatic on/off functionality is enabled by default.
Operation Setup> On at	HH:MM	Sets the time (in 24hour format) to automatically turn on (or recover the brightness level). Whenever this is set, the automatic on/off functionality is enabled by default.
Operation Setup> Day Schedule	M T W T F S S	Selects which days of the week the power control schedule (on and off times) will be active. Click on the return symbol "<" to store the selections
Operation Setup> Power Save	disabled 30min 1hour 2hours 4hours	If no user activity is detected for the selected amount of time, the device will turn itself off, to reduce electrical power consumption. This feature is independent of the automatic power on/off schedule.

Menu Item/ Sub Item	Values/ Options	Description
Operation Setup> Operation Mode	AHARS W. Radar P. Frame Info cycle2m cycle5m info5m (def.) info2m	Choose the device's operation mode. <i>AHARS (*)</i>: Display AHARS at power on and remain in this mode. <i>W. Radar (*)</i>: Display Weather Radar at power on and remain in this mode. <i>P. Frame</i>: Enter picture frame mode at startup. If no memory card is found, the device will automatically enter "<i>info5m</i>" mode. <i>Info (*)</i>: Display basic information screen at startup. <i>cycle2m/ cycle5m</i>: Select "cycle2m" or "cycle5m" to force mode cycling every 2 or 5 minutes respectively. In this case the device starts up in AHARS mode and -if the user is idle- cycles through AHARS, W. Radar and Information mode. <i>info5m</i>: Select this mode to cycle through AHARS and info mode every 5 minutes, provided that there is no user interaction. <i>info2m</i>: Cycle through AHARS and info mode every 2 minutes.
(*) Please note that when the screen remains in modes: "AHARS", "W. Radar" and "Info" for a lot of time (more than a few hours), <u>image retention will occur</u> (some static display elements will be imprinted on the screen). Image retention may be prevented or minimized when "LCD Saver" is enabled (under menu: <i>Other</i>→ <i>Hardware</i>). For more information see section "<i>About Image Sticking</i>".		
Units & Colors		
Units & Colors > Speed	km/h miles/h knots	Choose speed unit. <i>km/h</i>: kilometers per hour <i>miles/h</i>: miles per hour <i>knots</i>: nautical miles per hour

Menu Item/ Sub Item	Values/ Options	Description
Units & Colors > Altitude	feet meters	Choose altitude unit
Units & Colors > Vert. Speed	feet/min meters/min	Choose vertical speed unit
Units & Colors > Pressure	hPA inHG	Choose pressure unit
Units & Colors > Temperature	°C °F.d °F	Choose temperature unit (Celsius or Fahrenheit). Celsius degrees are always shown with one decimal digit. For Fahrenheit, display of one decimal digit is optional.
Speed Tape & Land		
Green		
From	0-999 (*)	Choose the speed from which the speed tape will be green.
To	0-999 (*)	Choose the speed up to which the speed tape will be green.
White		
From	0-999 (*)	Choose the speed from which the speed tape will be white.
To	0-999 (*)	Choose the speed up to which the speed tape will be white.
Yellow		
From	0-999 (*)	Choose the speed from which the speed tape will be yellow.
To	0-999 (*)	Choose the speed up to which the speed tape will be yellow.
Red		
From	0-999 (*)	Choose the speed from which the speed tape will be red.
(*) Set the correct values based on your aircraft specifications/performance. Consult your aircraft's operation manuals. Please note the device will not force any limits to these values (even incorrect or not logical ones). For example, for every colour the "To" value should be greater than the "From" value or the speed tape may not appear properly. It is your responsibility to set up these values correctly.		

Menu Item/ Sub Item	Values/ Options	Description
Land	Orange, d.Orange, Brown, Sand, Grass, etc. t:On t:Off	Custom colour for land. Standard values are “d.Orange” (dark Orange) or “Orange”. Set speed and altitude tape background drawing mode: <i>On</i> : tapes are drawn darker <i>Off</i> : tapes are transparent
Pic.Frame		
Pic.Frame> Image	Note: Options under the Image group will affect the screen in all modes (not only under Picture Frame mode)	
Pic.Frame> Image> Contrast	0-100	Sets screen contrast.
Pic.Frame> Image> Brightness	0-100	Sets screen brightness. Brightness can also be altered directly from the operation menu under AHARS display.
Pic.Frame> Image> Saturation	0-100	Sets screen saturation.
Pic.Frame> Image> Grey Level	25-75	Screen grey level adjustment. Applicable only when Backlight is set to <i>Energy Save</i> . When Backlight is set to <i>Always ON</i> the grey level is used by software to set current brightness.
Pic.Frame> Image> Reset		Click on this to reset the previous values (Contrast, Brightness and Saturation) to their default values
Pic.Frame> Zoom	fit original	<i>fit</i> : Smaller pictures are increased and larger pictures are decreased <i>original</i> : Smaller pictures are centered to screen, larger ones are still reduced to screen size

Menu Item/ Sub Item	Values/ Options	Description
Pic.Frame> Large res.	load skip	Choose what to do with large resolution pictures. <i>load</i> : pictures larger than 800x480 are displayed (reduced to fit) <i>skip</i> : pictures larger than 800x480 are not displayed Please note that displaying pictures is not the main usage of this device. In order to be a reduced power consumption device it will load large pictures slowly (1+ minutes)
Pic.Frame> Interval	5sec. to 10min.	Select the slideshow duration (how much time each picture will be shown)
Pic.Frame> Pic.Selection	sequential random	Select sequential or random display of pictures
Pic.Frame> Folder Scan	subfolders picframe only root	Choose where to look for pictures. <i>subfolders</i> : search for files everywhere <i>picframe</i> : load only files under the folder named "picframe" <i>only root</i> : remain in root folder only
Other		
Other> T-RH min max	Clear	Displays minimum and maximum temperature and relative humidity measurement values. Temperature units are set from "Units & tape" menu. Click to reset (clear) stored values.
Other> T-RH mem.card log	Off On 2m On 5m On 10m	Store temperature and relative humidity measurements in memory card. Choose a sampling rate of 2, 5 or 10 minutes. When sampling every 2 minutes, up to 1 year's data is stored in a 7MB file. Always turn off logging before ejecting the memory card in order to avoid data corruption. The data is stored into a "csv" (comma separated values) file that is required to pre-exist in the card in one of 3 formats (compatible with Linux, Windows or Mac). For more information see " Measurement Logging ".

Menu Item/ Sub Item	Values/ Options	Description
Other> Sim Mode	Disabled Manual! X-Plane X-Plane (p) FS2020 FS2020 (f) External	<i>Disabled:</i> Sim Mode is off, in which case the auto pilot is engaged and all external USB communications are discarded. <i>Manual:</i> Choose <i>Manual</i> mode to enable manual control of the flight. In manual mode pressing the knob will pull up. Roll by rotating left or right. Auto pilot is re-engaged after 30 seconds of user inactivity. Simulator modes: <i>X-Plane:</i> Direct serial/com connection to X-Plane Simulator. <i>X-Plane (s):</i> Connect to X-Plane (special/reserved screen mode through plugin software). <i>FS2020:</i> Connect to FS2020 (with external application). <i>FS2020 (s):</i> Connect to FS2020(special/reserved screen mode). Choose one of the above options to enable communications over USB with supported simulator software. The device will automatically respond to data presence. While displaying simulator data, <u>press and hold</u> the button to disable Sim Mode and exit to normal clock operation. Check online for updated simulator software setup details. <i>External:</i> USB communications are activated and control by a computer application is enabled. This is also true for <i>X-Plane</i> and <i>FS2020</i> options.
Other> Backlight	Energy Save Always ON	Choose how back light is controlled. <i>Energy Save:</i> This is the default setting. Backlight is controlled by the current level of brightness. At 90% or more brightness level, the screen will consume its maximum supply power. At 10% or less brightness level, the screen will consume its minimum amount of energy. <i>Always ON:</i> Used for device display purposes or special occasions. The backlight stays on at 100% power. The brightness level setting does not affect power consumption in this case.

Menu Item/ Sub Item	Values/ Options	Description
Other> Screen Flip	Normal Reversed	Turn screen upside down. Used in rare cases to allow mounting of the screen upside down. Default is "Normal". This is a global setting that is retained in memory even if power is cycled.
Hardware		
Other> Hardware> LCD Saver	On Off	In order to protect the TFT Liquid Crystal Display from image retention, this feature will deliberately "scroll" static text on the screen in regular intervals when the operation mode (under Power menu) is not set to rotate between modes. By default LCD Saver is enabled at power on.
Other> Hardware> Screen Test	-	Press to go through black, white/gray and green screens. This is useful for inspections to identify screen problems or false pixels.
Other> Hardware> Memory Test	-	Press to perform a memory test. The internal memory unit will test its capability to store user configuration settings and report an error if such occurs.
Other> Hardware> Calibrations>		
Other> Hardware> Calibrations> T-RH Calibration	$\pm 5.0^{\circ}\text{C}$ $\pm 20\%$	User-defined calibration values to adjust/align temperature and relative humidity readings. These are constant values added or subtracted to the actual sensor data. These values are stored in memory and reloaded at every device start up. A system-wide reset (activated from within "Reset" menu) will set these values to 0 (default).
Reset		
Back/Cancel	-	Used to easily exit this menu and prevent an accidental reset
Reset All to defaults		Resets all configuration options to their factory default settings. Rotate until "YES" is displayed to confirm the reset action.
About	-	Displays general version information

Using chime and alarm

The clock has an alarm function, set up as described in “*How to setup the alarm*” section. The Alarm is always set using **24-hour** time format. When the alarm is triggered, rotate the knob either way to enter snooze mode. In this case, the alarm sound will stop temporarily and will be triggered again after about 4 minutes. The alarm can be postponed like this for a total of 3 times maximum (the 4th time it will stop instead of snoozing). Whenever the alarm is in snooze mode, there is an indicator on the top right of the screen. In any case, pressing the knob (like a button) will stop the alarm completely and cancel snooze mode. By default, alarm sound output stops automatically after 60 seconds without any user input. When *AutoSnooze* is enabled (through menu: *Clock*→ *Alarm*→ *Set Custom*), the alarm will enter snooze mode once after the initial 60 sec. timeout.

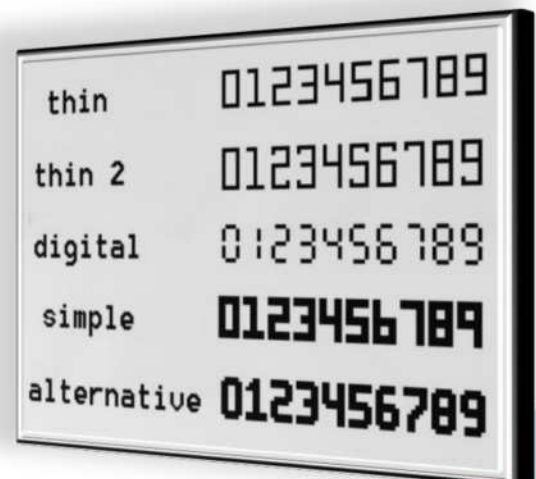
Although the alarm is a high priority function of the clock and will always output the predefined alarm sound no matter what mode the device is on (AHARS, Weather Radar, etc), it can never be absolutely guaranteed to work, so always have failsafe backups for really important flights/meetings etc. If a power failure occurs and the alarm is triggered, the clock will “try” to output simple beeps when under backup battery power. Refer to section “Backup Battery” for more information.

When setting up the automatic power on/off feature, in order to increase the reliability of the alarm, it is recommended not to schedule the device to turn on or off at the exact time the alarm is set. Make sure to set the device to turn on/off at least one minute before or after the alarm time.

Chime functionality is enabled through menu: *Clock*→ *Chime*. Chime is useful as a regular short reminder of time passing. It outputs short beeps in pre-defined intervals. It will be turned off when the screen is also turned off (either manually or by power scheduling). Use chime to remind you to take small breaks off work, rest your eyesight when spending time in front of a monitor (by looking away for a while) etc.

AHARS Fonts

A lot can be said about the readability of fonts while flying. Usually, “fat” white fonts are easier to see at high brightness conditions. In the end, it is just simple preference. Use the ones you like best. They can be set up under menu: *AHARS Display* → *Digit Fonts*. The same fonts will be used to display large clock digits.



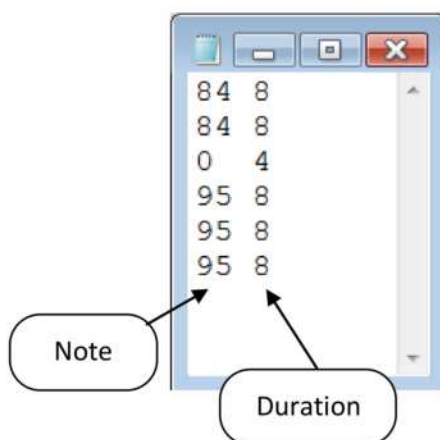
Custom Alarm Sound

Modern aircraft use various alarm sounds for a large number of emergencies. It is not feasible to include all kinds of possible alarm sounds in this device, but the user can define a custom alarm sound and store it in internal memory. The definition of the sound requires knowledge of the sequence of sound frequencies (or notes if you prefer) that make up the alarm sound and their duration. “Composing” an alarm sound is easier than said. This part of the document will describe how to do this. Of course, any music melody can be defined and used as an alarm sound. Whether the result will sound “ok” is something *the pilot* will need to test.

You will need to use a memory card for the custom alarm sound to be loaded into internal device memory. After this, the memory card can be removed and is no longer required. This is done through configuration menu: *Clock* → *Alarm* → **Custom Sound**. The card must contain a file named “**AUDIO.TXT**”, placed in the root folder of the card. Make sure you use capital letters for the file name. Every time a new sound file is loaded, it replaces any previous one already in the device.

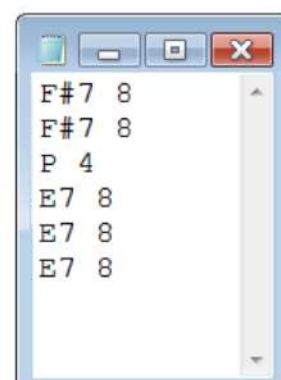
The file which contains our custom alarm sound is a simple text file and it can be build with any text editor (like notepad etc). It follows some basic syntax rules described below.

For example, let’s define a new alarm sound that will simply “beep” fast twice, wait a while and then beep again three times. Our text file will contain these lines:



Every line in the file corresponds to a separate frequency (or note) to be “played” and its duration separated by a space. The first number in each line is the frequency (note). It can range from about 10 (lowest) to about 190 (highest). When the note is 0, it is a pause (nothing is played for its duration). The second number (separated by one or a few spaces) is the duration. Possible values for the duration are 1 (longest) to 16 (shortest). Empty lines are ignored.

Instead of using numbers for the frequencies, you can also use note characters (two sets of A to F) or combinations of the two. The above sound could also be written like this:



The letter “P” defines a pause and is equivalent to 0.

Notes that are recognized in text form are shown in the following table:

Note Text	Note Text	Equivalent freq. number
C6	c6	16
C#6	c#6	29
D6	d6	42
D#6	d#6	54
E6	e6	65
F6	f6	76
F#6	f#6	86
G6	g6	95
G#6	g#6	104
A6	a6	112
A#6	a#6	120
B6	b6	128
C7	c7	135
C#7	c#7	142
D7	d7	148
D#7	d#7	154
E7	e7	160
F7	f7	165
F#7	f#7	170
G7	g7	175
G#7	g#7	179
A7	a7	183
A#7	a#7	187
B7	b7	191
P	p	0

In total, there can be a minimum of 2 and a maximum of 100 notes and pauses in the file. Any line or text in the file starting with a semicolon “;” is ignored, so you can put short text comments if you like. The file’s total size should not exceed 3000 bytes. In case of file syntax error, copying the sound file to internal memory will fail. Always test playback a loaded custom sound to make sure it sounds properly (if it doesn’t, you can always make corrections and reload it). Lastly, please note that when an alarm is triggered the selected alarm sound (including a custom melody) will be repeated up to a typical time limit of 60 seconds total after which the sound output is halted.

Measurement Logging

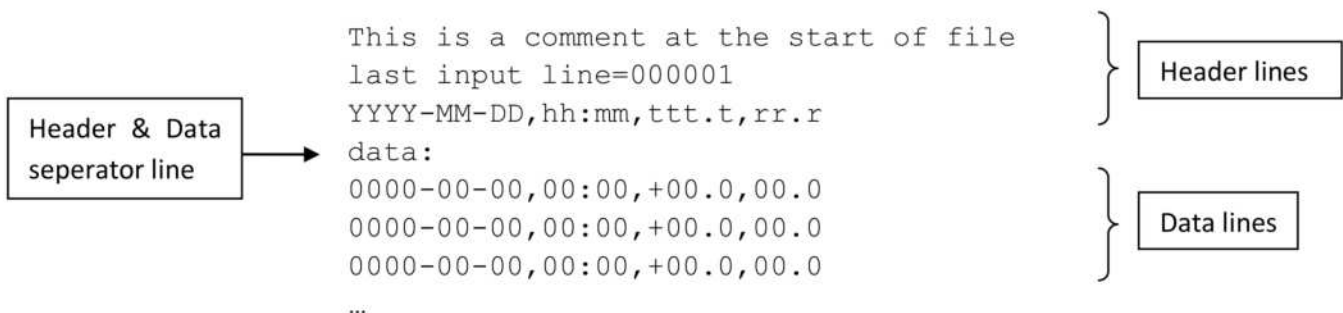
Temperature and humidity measurements can be stored in a memory card for data logging purposes. The data can then be extracted and processed by, for example, a spreadsheet application. Available sampling rates include one measurement of both temperature and humidity at 2, 5 or 10 minute intervals. A typical 7MByte file stores up to one year of measurements at a rate of 2 minutes per measurement. The year, month, day of month, hour and minute of each measurement is stored using a simple text representation for each value.

Always turn off logging (from the configuration menu) before ejecting the memory card in order to avoid data corruption and to make sure the most recent measurements are flushed to the card. In case power is lost and then restored, there will be an attempt to recover and continue logging. If the card is removed from the device and then plugged in again there will also be an attempt to continue logging data. In these cases, file system and/or data integrity is not guaranteed.

The card must be properly formatted (FAT32 file system). All measurements will be stored in a single log file named "THLOG.CSV" (comma separated values file) in the root folder of the card. If the file doesn't exist, there will be an attempt to create it and pre-allocate data space in the card (space pre-allocation increases reliability). Depending on the specific card, this will take about 20 seconds to complete and by default creates a Windows compatible file which is big enough for 1 month of measurements at a rate of 1 sample per 2 minutes. A larger file and/or a file compatible with a different operating system can be used but must pre-exist in the card's root folder. You can download the appropriate platform-compatible file (for Linux, Windows or Mac) from www.horizonclock.com or prepare one manually (with a simple text editor) following the technical details below.

Logging technical details:

The log file can be formatted as text for processing under Linux (=line feeds at end of lines), Windows (carriage returns and line feeds) or Mac (carriage returns). The specific file format in use will be recognized automatically and be preserved while logging data. This way the data can be easily imported later to a compatible desktop application for further processing. When opened with a text editor, a typical log file will look like this:



Within the first lines of the file (within about the first 500 characters) there must be a single line with the text "data:" (without the quotes). All measurements will be placed

after this line. Each measurement will be written as a separate line. Each measurement line will contain:

- the date of measurement (year-month-day),
- the time of measurement in 24-hours (hours:minutes),
- the temperature in degrees Celsius, and
- the rel. humidity %

Please note that on the example above, the empty measurement lines could simply be made of spaces and not actual comma separated text like "0000-00-00,... etc" . Spaces or dummy text must be covering the rest of the file up to the desired file size.

The first few lines up to the line "data:" can contain text with general information about the file which is ignored by the data logging mechanism. The only text that is absolutely required before the "data:" line is the text "last input line=000001" (without the quotes). This text will be updated during logging as a counter of lines (=measurements) saved. For example, this is the absolute minimum empty log file contents:

```
last input line=000001
data:
... ..
... ..
```

The file's size determines the limit amount of total data that can be stored. Several Mbytes will be enough for thousands of measurements. When end of file is reached measurement lines continue to be logged by overwriting the ones at the start of the file. Under normal circumstances, logging will only edit storage space confined within the limits of the log file, thus increasing the robustness of the process.

To reduce stress to the storage medium, the measurements are buffered (=kept in RAM/temporary memory) and written in blocks of about 6 measurements at a time. When the sampling rate is 2 minutes, data will be "actually" written in the card every approximately 12 minutes. When the sampling rate is 5 minutes, data will be written every approximately 30 minutes and when the sampling rate is 10 minutes data will be written every approximately 60 minutes.

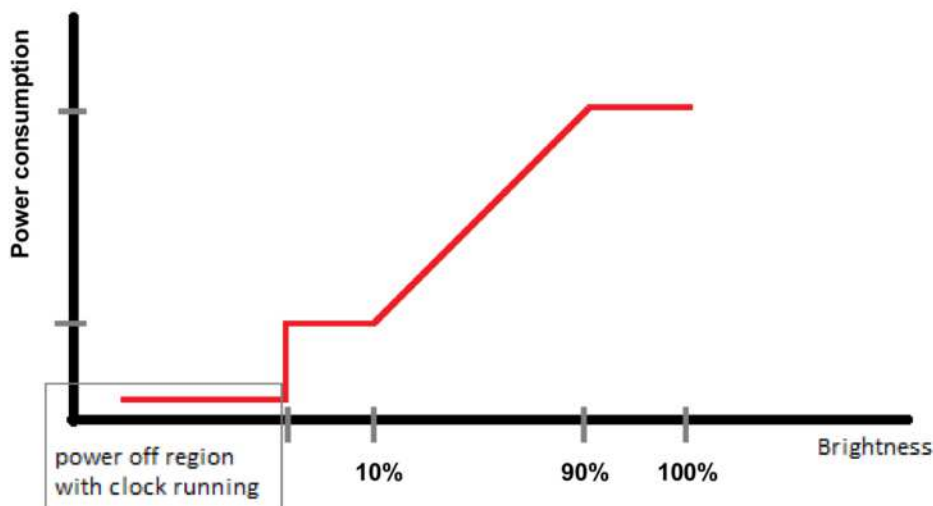
Please note that measurement logging is halted when PC simulator software data is actively displayed.

Reducing power consumption

Regulations on operating and stand-by power consumption for consumer devices that are connected to the mains 24/7 are becoming stricter worldwide. The idea behind minimizing power consumption is to be more effective, economical and environmentally friendly. The idea behind *Horizon Clock* is to have a beautiful color desktop display with a relatively large screen as a fun artificial horizon system, happily flying around without consuming extra power 😊. So, the largest amount of consumed energy is spent on the screen itself, and only a very small percentage is left for computing & other resources. This results in a very low power device without making large sacrifices on picture quality.

The power consumed is proportional to the screen's brightness level. A lower brightness level will reduce power consumption, but it should be high enough for the display to be clearly visible under ambient lighting conditions.

You can further decrease the power consumption through clever setting up of power options. Under configuration menu "Operation Setup" you can instruct the device to turn off during periods of time no one is watching the display; for instance, when you are away or sleeping. This can be enabled for specific week days, so you can exclude the weekend or any other day you like. If the device turns off for 8-hours each day, there is an overall 33% power reduction. You can also have the display turn off when no user interaction is detected for 30minutes to 4 hours. This works independently of the power schedule and is set from option "Power Save" under the "Operation Setup" menu. When the device is powered off like this, the chime function is disabled. On the other hand, the alarm functionality –if enabled- will remain active.

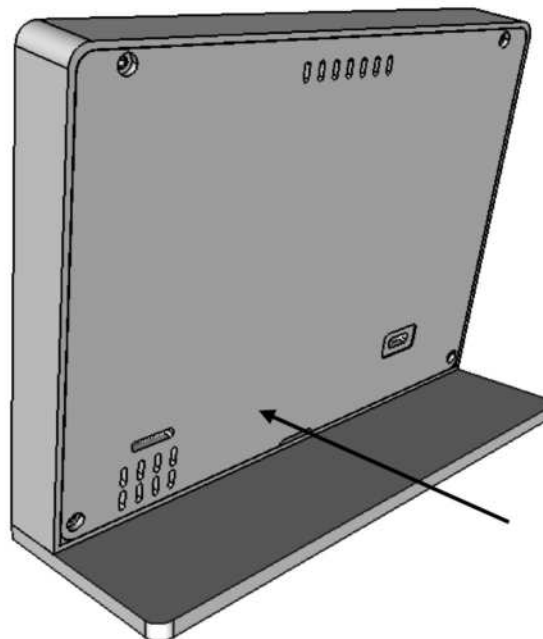


Refer to specifications table for exact power consumption values

Backup Battery

An optional backup battery is used to maintain clock time during power failures. It is also convenient if you need to briefly unplug the clock for some reason, (move it to a different room, use the power supply for other devices/charge a phone etc).

Follow the instructions below to install/ replace the backup battery.



Battery position
inside the unit

CR2032

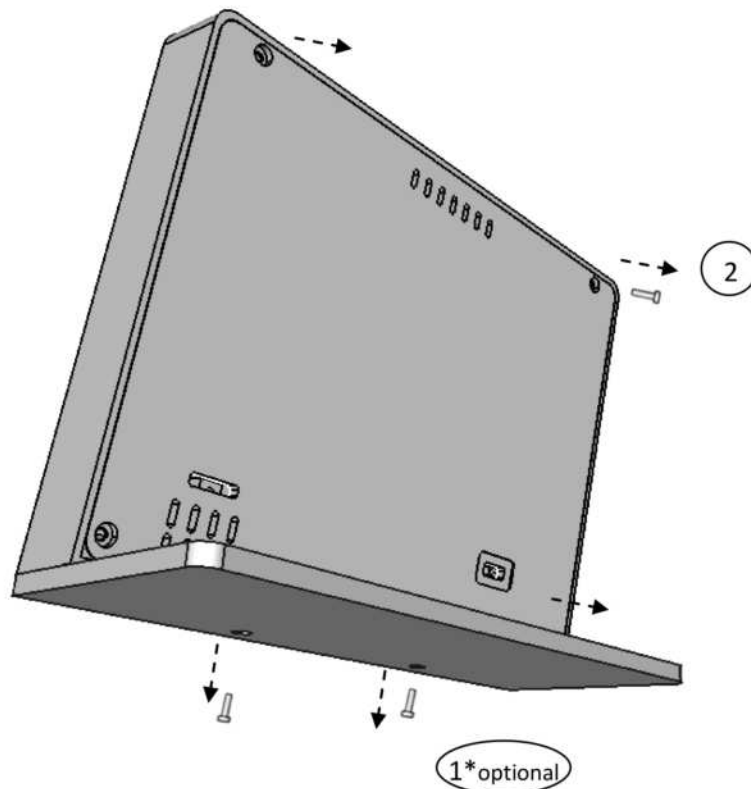


Safety:



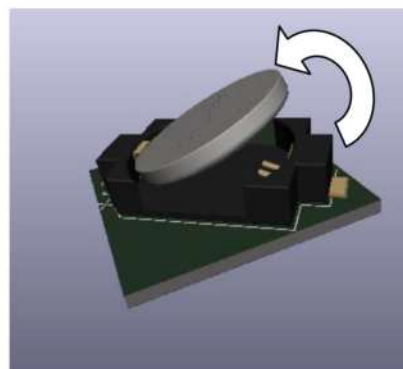
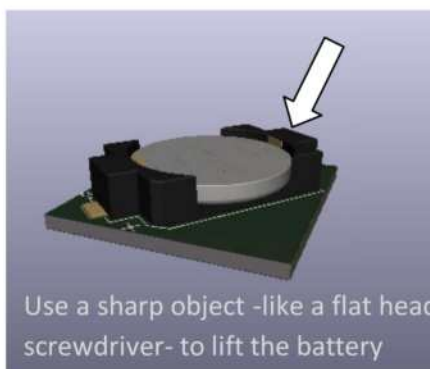
WARNING

KEEP OUT OF REACH OF CHILDREN. Swallowing may lead to serious injury or death in as little as 2 hours due to chemical burns and potential perforation of the esophagus. **Immediately see doctor**



Make sure to unplug the clock from the power supply first. To access the battery compartment follow these steps: Detach the metal base by unscrewing the two screws (1) from the bottom of the unit (this step is optional). Remove the back plate of the housing by unscrewing the 4 screws that hold it in place (2). At this point, ground yourself to avoid any static electricity damage (an easy way to do this is to briefly touch a grounded metal surface like the back of your desktop computer). Be careful not to damage the electronics inside the main unit when installing or replacing the battery.

When installing the battery, push it gently into the battery holder. To remove the battery from the battery holder use a sharp object (a small flathead screwdriver or a toothpick) to lift the battery off the battery holder by gently applying force to preferably its positive (+) holding bracket (the lower one). Never force the battery out as damage may occur. When finished, replace the back plate and screw it in place. Then screw the metal base back in place. Try not to over-tighten the screws.



Always make sure the battery is out of reach of children (it looks like candy and is very dangerous). The type of battery used should be rated at 3.0V (type CR2032 or equivalent). Depending on the frequency and duration of power failures, the battery will last for years. Depleted batteries should be disposed of properly.

Please note that frequent power failures may affect time keeping precision. In rare cases a power failure could result in loss of correct current time. Also, unstable or fluctuating operation of the power supply may have similar effects or could even completely reset the clock. In these extreme cases use an uninterrupted power supply (UPS) or other protective gear for electrical appliances.

An indicator of battery status may be displayed on the top left corner of the screen. If you want to update this indicator, unplug the device, wait for a few seconds (~10) for the device to stabilize operation under battery power and then re-plug the device. The battery indicator will re-set every Monday. Alternatively, a memory test (from within the configuration menu, *Other*→ *Hardware*→ *Memory Test*) will erase the last battery status measurement and remove the battery status icon. The indicator provides only a general approximation of current battery capacity. Actual remaining capacity of the battery will vary depending on its quality, expiration date and usage. Replace the battery when near its expiration date or simply when the clock is unable to maintain current time when cycling power.

Under battery power (and if the battery level allows it), the clock will output a basic alarm sound when the alarm is active. Press the button to stop/ acknowledge the alarm. The screen is always off under backup battery power.

Trouble Shooting

Power Input

Some computers have USB ports that are “low power” ones that can source up to 100mA or less current. These will not be able to power your clock. Make sure to choose a true 5V/500mA USB port to power your clock. Refer to the specific computer’s manual/instructions. The power supply is particularly stressed at startup; if the screen does not turn on within 10-20 seconds, first try to unplug the power cord, wait for a couple of seconds and then re-plug the power cord. If there is a memory card installed, remove it. Also, try to plug in the device while keeping the button pressed. Trying this more than a few times without success probably means the power input is not up to the task ☹. Choose a bigger or better quality power source. Also, some USB cables are too thin for the required current. Normally, any USB cable meant to charge a cell phone will be able to support power input with no problems.

About white pixels/ non-responsive pixels

There is a small chance you may get a “bad” pixel on the screen. Usually this is not a problem as it will not otherwise affect the operation of the clock. Unfortunately there is not much we can do about this ☹

About Image Sticking (also referred as “image retention” or “ghosting”)

This is considered a normal operation characteristic of TFT LCD screens. After many hours of usage, areas of the screen that remain unchanged may retain their specific pattern even when the screen is updated. Image sticking is an intrinsic behavior of TFT LCD displays due to susceptibility to polarization of the interior materials (liquid crystals) when used under static, charged conditions (continuously displaying the same image). This may happen at areas close to elements that do not change much under operation (like digit display frames). To avoid this phenomenon use the automated power on/off schedule to power off the device (which will turn the screen off) when it does not need to be operating. Also, alternate the operating mode (manually or automatically by setting “Operation Mode” under menu “Operation Setup”). Image sticking could be reversed by displaying an all black screen for 4 to 6 hours (especially under warmer environment temperatures). To display a black screen use menu *Other* → *Hardware* → *Screen Test*.

Specifications*

Time keeping	Hours, Minutes, Seconds, Date & Weekday. Daily alarm, programmable based on day of the week
--------------	--

Sensors:

Time Sensor	MEMS (Micro Electro-Mechanical System)
Time accuracy	Typical: $\pm 3\text{sec/month}$ @25°C Maximum deviation: Less than $\pm 52\text{sec/month}$
Temperature sensor range	-20.0 to +80.0°C (-4 to 176°F) [device operating temp. should not exceed 70°C]
Temperature accuracy	< 1°C
Rel. Humidity sensor range	2% to 98%
Rel. Humidity accuracy	< 5%
Temperature & Humidity update rate	3 updates/minute

Display:

Display Type	TFT LCD
Screen Diagonal	7 inches
Max. Colors	16.7M
Contrast	500:1
Brightness	200cd/m ²
Screen Native Resolution	800x480 pixels
Operating temperature	-20 to +70°C (-4 to 158°F)

Power:

Power Input	5V, ≥400mA
Power Input Voltage tolerance	4.8V - 5.2V
Nominal power consumption levels (not including power supply consumption)	approx. 1.6Watt Max. (@ 100% brightness) approx. 1Watt Typical (@ 40-50% brightness) approx. 0.6Watt Min. (@ ≤10% brightness) <0.1Watt (@ screen off)
Backup battery type	CR2032
Backup battery expected service time	Match to battery exp. date; Typical duration on battery power with no alarm set: 5 years

Picture display:

Image type support (in picture frame mode)	Basic JPEG/JPG compressed picture files. No support for progressive/lossless formats
Maximum Image Resolution (in picture frame mode)	6400x3800 pixels
File system type support	FAT32

Other:

Airspeed indicator range	0-999kt
Altitude indicator range	-2000 – 27000ft
Flight simulator support	X-Plane MSFS2020

*All values are typical parameters for guidance only and are not tested during production.