MidContinent™
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Meet SAM™

MD302 Standby Attitude Module

Pilot's Guide

REV. A December 17, 2012 Manual Number 9017846

Congratulations on selecting one of the newest and most advanced aviation products. The design team at Mid-Continent Instruments and Avionics has incorporated nearly five decades of experience to bring you unparalleled reliability and value in aviation. We are proud to offer you the finest standby indicator in its class — SAM,™ the MD302 Standby Attitude Module.

SAM is the industry's first digital standby instrument to provide attitude, altitude, airspeed and slip information in an advanced, 2-inch format. The compact design and selectable orientation (horizontal and vertical) ensures a perfect fit within any panel. The self-contained, rechargeable, emergency battery offers pilots an increased level of safety. All this is backed by Mid-Continent's world-class reputation for high quality and responsive service.

J. Todd Winter
President and CEO
Mid-Continent Instruments and Avionics

REV. A December 17, 2012 Manual Number 9017846

FORWARD

This manual contains information regarding the use and interpretation of information presented to the pilot and crew during normal and emergency operation of SAM™ — The MD302 Standby Attitude Module. Operational instructions are intended for persons who operate aircraft in accordance with applicable Federal Aviation Regulations (Title 14 CFR).

We welcome your comments concerning our product and this manual. Although every effort has been made to keep this manual free of errors, some may occur. When reporting a specific problem, please describe it briefly and include the manual part number, the paragraph or image number and page number.

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IMPORTANT:

Read this entire guide prior to operating the MD302 Standby Attitude Module in flight.

The MD302 Standby Attitude Module is designed for simple, intuitive operation for ease of use and quick interpretation of the information displayed.

The central Control Knob can be located at the bottom-center, middle-left or middle-right of the unit bezel depending on the installation orientation. This is the only user interface device on the unit.

The Control Knob has two functions: Push and Turn.

The Control Knob provides 16-detents per revolution and typically changes the information it is controlling on the display one unit per detent or click.

The Push function is used to select the highlighted option in a menu or to enter and exit menus and control functions. The Push function can also perform certain operations with a push-and-hold action.

In Pre-flight Mode, power is applied to the unit and the Introduction Screen appears during startup (Image 1).

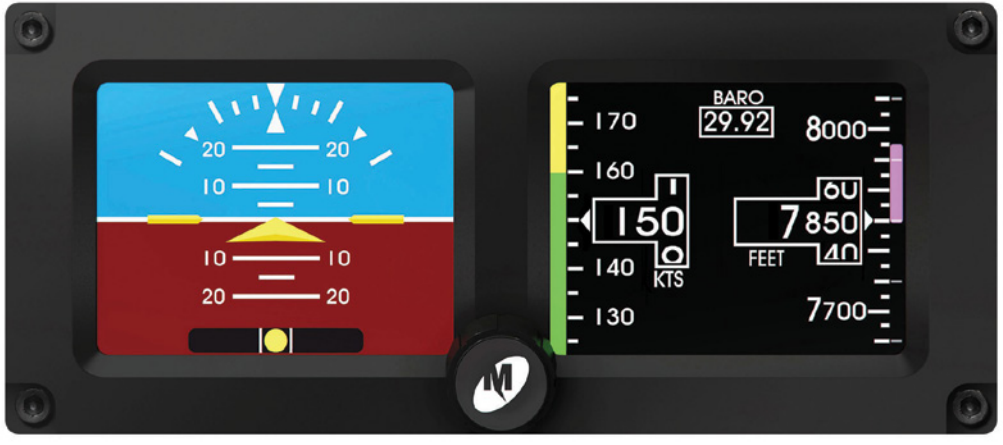
During Pre-flight Mode, the Introduction Screen will be displayed while the unit conducts an initial Power-up Built-in Test (PBIT) of the system to validate operational readiness. This includes, among others, a battery capacity measurement, an internal test to verify software and memory, and confirmation that the internal settings and identification of the unit match the Configuration Module installed in the aircraft cable harness.

The Introduction Screen will be displayed for approximately five seconds and will transition to Flight Mode when complete.

Image 1

PRE-FLIGHT MODE
INTRODUCTION SCREEN

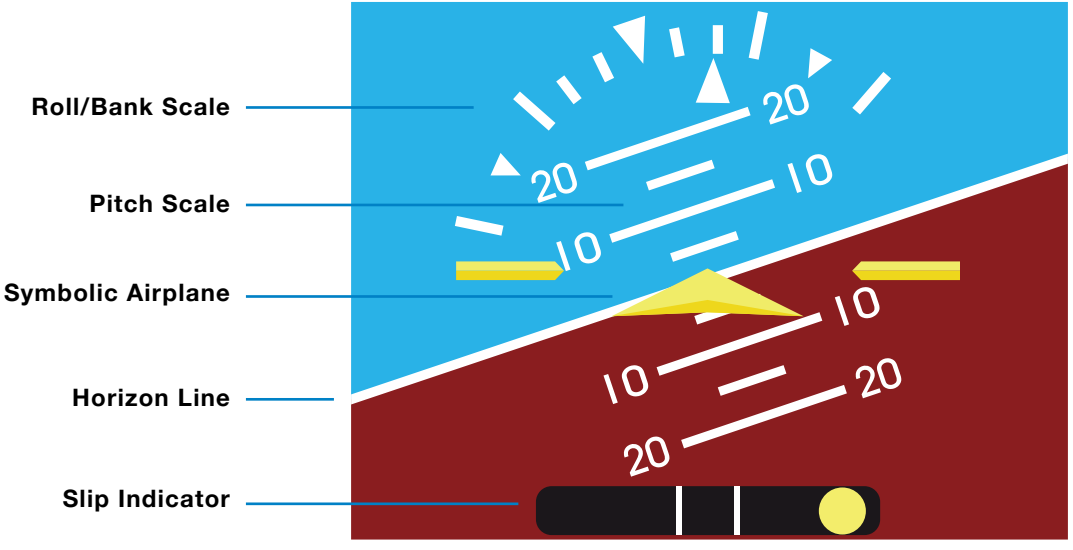
Image 2



FLIGHT MODE

In Flight Mode, the unit operates normally by displaying four major functions: Attitude, Altitude, Airspeed and Slip Information (Image 2).

Image 3



ATTITUDE OPERATION

The Attitude Indicator portion of the display (Image 3) will always appear on the left display when the unit is oriented horizontally and on the top display when oriented vertically.

The Attitude Indicator consists of seven parts: Horizon Line, Sky (blue), Ground (brown), Symbolic Airplane, Roll Scale, Pitch Scale and Slip Indicator.

The Roll Scale is depicted as an arc of graduations representing bank angles of 0° (triangle), 10°, 20°, 30°, 45° (small triangle) and 60°. The Roll Scale can be configured during installation to be fixed to the sky/horizon or fixed to the top of the display. The unit is operable and usable in a continuous and unlimited roll range of 360°+.

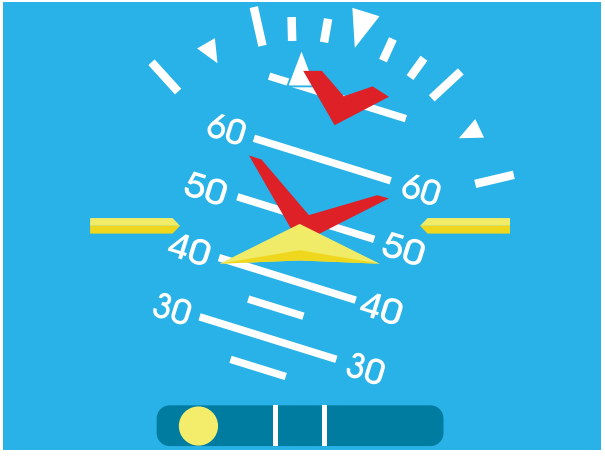
CAUTION: The Roll Scale must be configured to match other attitude indicators in your panel.

The Roll Pointer is the triangle just below the Roll Scale and represents the aircraft in relation to its bank angle. It is configured, by definition, to operate conversely to the Roll Scale behavior. That is, a rotating Roll Scale produces a fixed Roll Pointer and a fixed Roll Scale produces a rotating Roll Pointer.

The Pitch Scale is depicted as a series of graduations representing pitch angles of every 5°, with every 10° graduation being wider and numbered. The unit is operable and usable in a continuous and unlimited pitch range of 360°+. A series of chevrons (^) will appear overlaid on the Pitch Scale at attitudes greater than ± 45°. This is to indicate to the pilot the direction of the horizon for quick reference when in unusual pitch attitude (Image 4). The chevrons always point toward the horizon line.

The Symbolic Airplane will always remain in the center of the display, with the background elements moving behind it to represent the aircraft's relative position. The symbol that represents the airplane can be selected during Flight Mode using the Options Menu (see Options Menu, page 15).

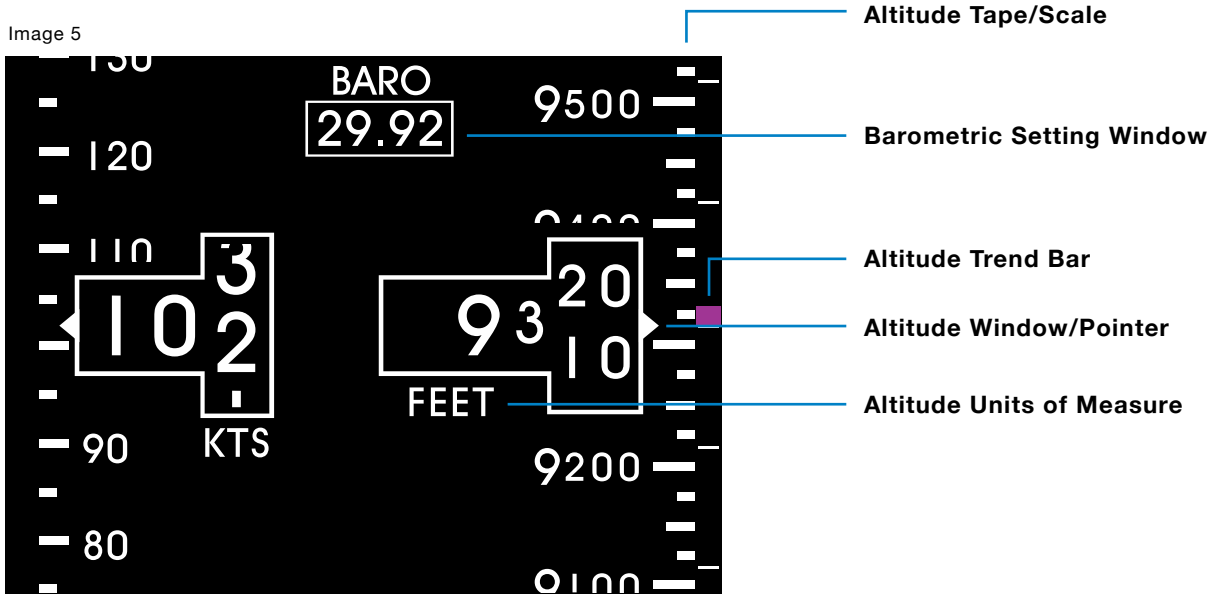
Image 4



ATTITUDE OPERATION

This image demonstrates 45° pitch up and 18° right turn. Red chevrons point to the horizon line.

Image 5



ALTITUDE OPERATION

Right side of display shown above.

The Altimeter portion of the display will always appear on the right side of the display when mounted horizontally. The Altimeter will appear on the bottom display when mounted vertically (Image 5).

The Altimeter consists of four parts: Altitude Window, Altitude Tape, Barometric Setting Window and optional Altitude Trend Bar.

The Altitude Window displays the current, barometric corrected altitude. The digits of the display are in increments of ten and the window is expanded over this portion of the number to display a minimum spread of twenty units. The numbers will 'roll' or scroll to assist in quick reference to the increasing or decreasing nature of the aircraft's altitude. The hundreds, thousands and ten-thousands digits appear to the left of the tens digits with the thousands and ten-thousand digits slightly larger than the others. The Altitude Pointer (triangle) to the right of the window points to the associated position on the Altitude Tape of the current altitude. Altitude units of measure appear below the Altitude Window and can be changed during Flight Mode using the Options Menu (see Options Menu, page 15). The pilot may select feet or meters.

The Altitude Tape is a vertical scale along the right margin of the display. The current altitude is always in the middle of the tape and indicated by the Altitude Pointer on the right side of the Altitude Window. The tape has numeric indications every one-hundred units with minor graduations every fifty units and sub-graduations every twenty-five units. In horizontal installations, the tape spans approximately 400 units from top to bottom and in vertical installations, the tape spans approximately 500 units from top to bottom. The tape will 'roll' or scroll to assist in quick reference to the increasing or decreasing nature of the aircraft's altitude.

The Barometric Window shows the currently set barometric pressure. It is identified by the abbreviation BARO and is located at the top center of the Airspeed/Altitude Display. Setting the current barometric pressure compensates the altitude for the appropriate environmental conditions. The barometric setting can be adjusted by turning the Control Knob while in Flight Mode. When adjusting the barometric pressure, the window will increase in size and the digits will turn green (Image 6). When finished setting the pressure, the window will return to its original size and color. Barometric pressure units can be selected during Flight Mode using the Options Menu (see Options Menu, page 15).

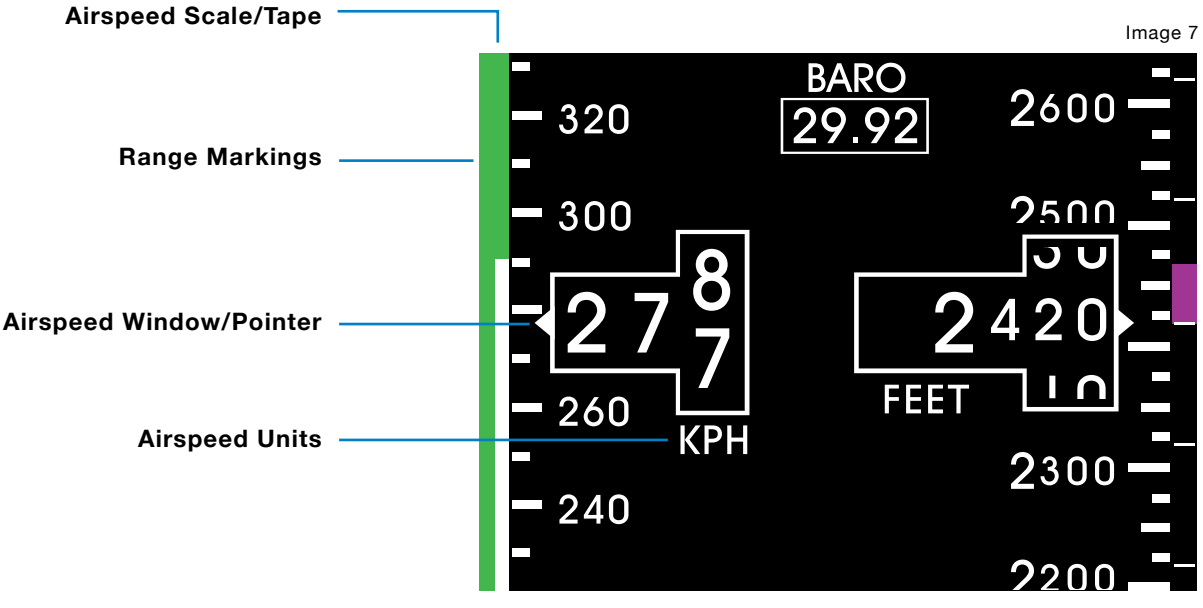
The Altitude Trend Bar is located along the right margin of the Altitude Display. This feature is optional and can be turned ON or OFF using the Options Menu (see Options Menu, page 15). The Altitude Trend Bar is magenta in color and originates at the current altitude on the Altitude Tape — always from the middle of the display, directly across from the Altitude Pointer. The height of the Trend Bar, above or below the current altitude, indicates the altitude of the aircraft on the Altitude Tape if the current vertical speed or 'altitude trend' is maintained over a period of six seconds. For example, as seen in Image 5 on page 7, the current altitude is approximately 9,315 feet. The Trend Bar is at approximately 9,325 feet, indicating that the aircraft's altitude will be 9,325 feet in six seconds if the current vertical speed or climb is maintained constant. The length of the Trend Bar will increase with increased dive or climb rates and approach zero or disappear entirely as the vertical speed reaches zero in level flight.

Image 6

Barometric Setting (active)

ALTITUDE OPERATION

The Barometric Setting will enlarge and turn green during adjustment.



AIRSPEED OPERATION

The Airspeed Indicator portion of the display will always appear on the left side of the right display when mounted horizontally and on the left side of the bottom display when mounted vertically (Image 7).

The Airspeed Indicator Display consists of three parts: Airspeed Window, Airspeed Tape and Airspeed Limitations or Range Markings.

The Airspeed Window displays the current indicated airspeed (IAS). The digits of the display are enlarged for visibility and increment by one unit. The units will 'roll' or scroll to assist in quick reference as to the increasing or decreasing nature of the aircraft's airspeed. The Airspeed Pointer (triangle) to the left of the window points to the associated position on the Airspeed Tape of the current airspeed. Airspeed units appear below the airspeed window and can be selected during installation in Configuration Mode.

The Airspeed Tape is a vertical scale along the left margin of the display. The current airspeed is always in the middle of the tape and indicated by the Airspeed Pointer on the left side of the Airspeed Window. The Airspeed Tape has numeric indications every ten or twenty units depending on the unit type selected. Minor graduations appear every five or ten units, respectively. In horizontal installations, the tape spans approximately 50 or 100 units from top to bottom, depending on unit type. In vertical installations, the tape spans approximately 80 or 160 units from top to bottom, depending on unit type. The Airspeed Tape will 'roll' or scroll to assist in quick reference as to the increasing or decreasing nature of the aircraft's airspeed.

The Airspeed Limitations, also known as "V-speeds", are indicated with colored range marking bands placed vertically along the left margin next to the Airspeed Tape. The colors and values of each bar can be set during installation in Configuration Mode by the installer. Colors must be selected based on industry-defined colors and V-speed limits as defined by the aircraft's specific Pilot's Operating Handbook (POH). Range markings are represented by full-width bars, half-width bars and/or radial marks. A traditional 'barber pole' may also be displayed if the aircraft requires and provides the appropriate V_{ne}, V_{mo} and/or M_{mo} values.

The Slip Indicator portion of the display will always appear at the bottom of the Attitude Display (Image 3).

The Slip Indicator is represented by a shaded translucent background with two white lines around center and a yellow ball. The ends of the indicator represent ±7° of bank with no centripetal acceleration. No further indication is provided for angles greater than 7°. When the ball is maintained between the vertical lines during banking maneuvers, the turn is considered “coordinated” without slip. Electronic damping of the ball movement is provided to prevent overly sensitive response and comply with regulatory requirements.

The Slip Indicator’s background becomes semi-transparent if the Roll Scale or Roll Pointer pass behind the indicator. All other elements remain visible.

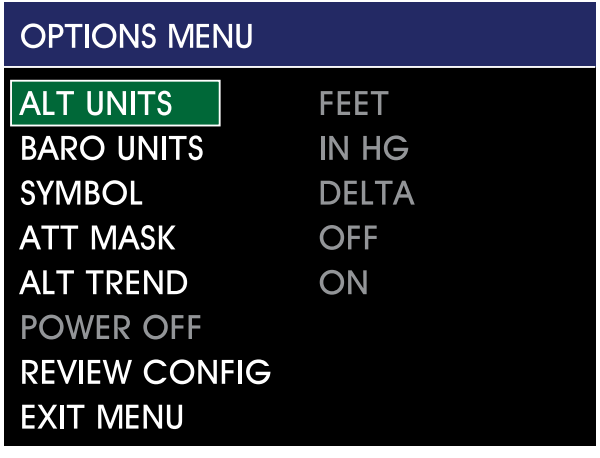
While in Flight Mode, the Options Menu is available to the pilot or cockpit crew members. It offers multiple selections that do not affect the aircraft-specific configuration of the unit. Options are provided for convenience, preference or potentially necessary in-flight adjustments (Image 8).

The Options Menu can be accessed by pushing and holding the Control Knob for approximately two seconds.

The brightness adjustment bar will appear briefly before the menu is visible. The menu will appear in place of the Attitude Display and will revert to the active Attitude Display if no activity occurs for ten seconds.

The Options Menu root menu includes: ALT Units, BARO Units, Symbol, ATT Mask, ALT Trend, Power OFF, Review Config and Exit Menu.

Image 8



OPTIONS MENU

Menu operation throughout the MD302 Standby Attitude Module is simple and intuitive.

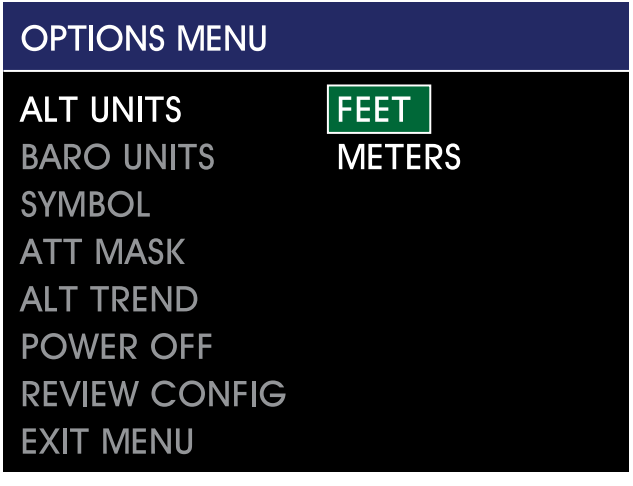
Menu Title	White text on a blue background at the top of each menu and sub-menu
Current Item Cursor	Highlighted by a white box and green background
Selectable Items	Any selectable item on the menu is indicated in white text
Unavailable Items	Information only — options that are unavailable are indicated in gray text

Turning the Control Knob will scroll the green cursor highlight over the available options within the current menu. By default, the currently set value of each menu option is displayed in gray directly to the right of each setting. Pressing the Control Knob for any highlighted item will activate the selection, allowing adjustment to the right. Scroll to the desired option and press the Control Knob to select it. The green highlight will return to the menu options on the left and the new value will be displayed in gray to the right.

After confirming any setting by selecting it, that setting will immediately become active and be saved in memory, regardless of whether the Exit Menu command is selected or if it times out and automatically reverts to the Attitude Display.

The ALT Units setting allows the user to select the altitude units to either feet or meters. This feature is provided during flight in the event that the aircraft crosses airspace boundaries that require or report different altitude units (Image 9).

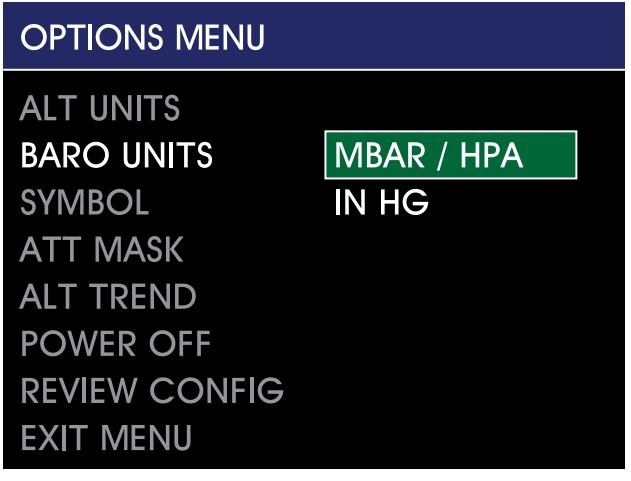
Image 9



ALT UNITS

The BARO Units setting allows the user to select the altitude barometric adjustment units to either inHg (inches of mercury) or MBAR/HPA (millibars/hectopascals). This feature is provided during flight in the event that the aircraft crosses airspace boundaries that require or report different barometric pressure units (Image 10).

Image 10



BARO UNITS

The Symbol setting allows the user to select the type of symbolic airplane on the Attitude Display to either delta-wing or traditional. This feature is provided for pilot preference and to match other instruments in panel (Images 11, 12, 13).

Image 11

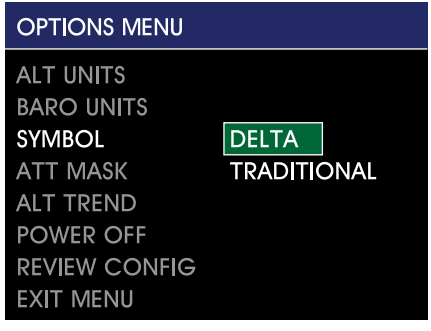
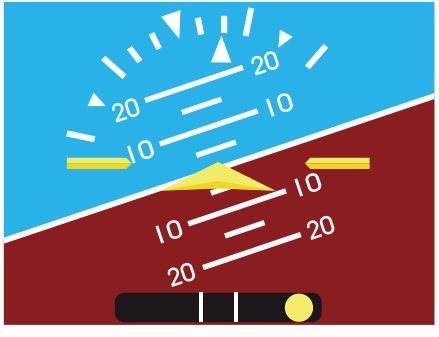
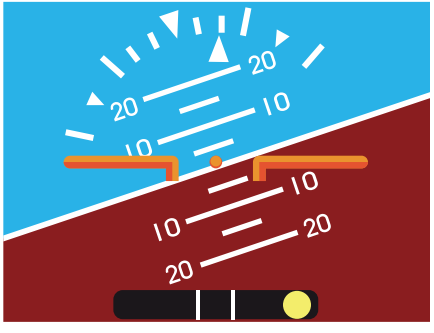


Image 12



DELTA-WING SYMBOL

Image 13



TRADITIONAL SYMBOL

The ATT Mask setting allows the user to turn the Attitude Mask ON or OFF. The Attitude Mask provides gradient dimming of the corners of the Attitude Display to give the aesthetic look of a round instrument (Images 14, 15, 16).

Image 14

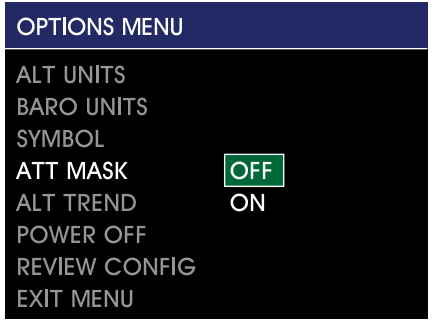
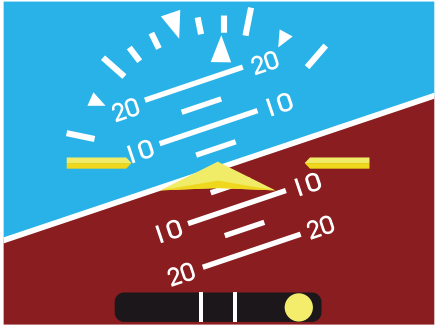
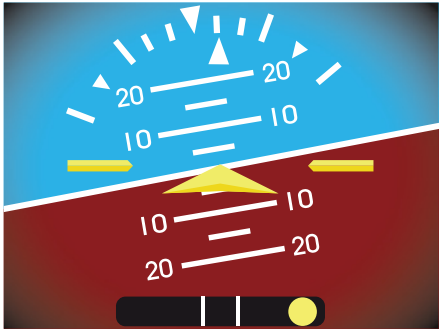


Image 15



ATT MASK OFF

Image 16



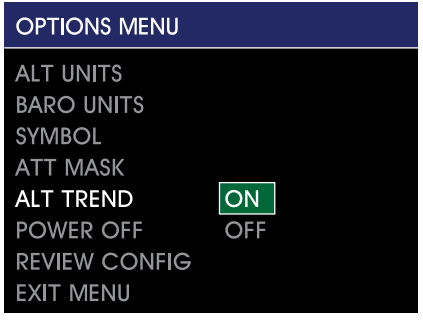
ATT MASK ON

The ALT Trend setting allows the user to turn the Altitude Trend Bar ON or OFF. The Altitude Trend Bar provides a graphical representation of vertical speed near the Altitude Tape (see Altitude Operation, page 7). This feature is provided for pilot preference and convenience (Image 17).

The Power OFF action allows the user to immediately turn the unit OFF when it is operating on its internal battery and there is no airspeed (<20 kts) detected. There are no selectable options. This item is typically grayed out and unavailable in Flight Mode (Image 18). This feature is provided to manually turn the unit OFF when on the ground or if inadvertently left on internal battery power.

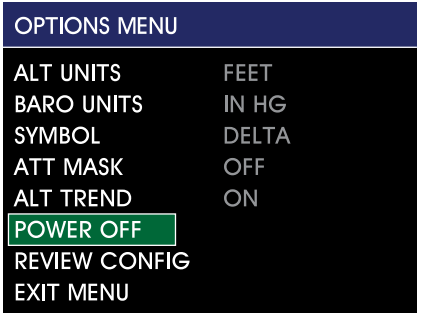
See Emergency Operation or more information on Emergency Operation when operating on battery power (page 25).

Image 17



ALT TREND

Image 18



POWER OFF

The Review Config action allows the user to view all the values which are saved in unit memory and are set in Configuration Mode during installation or maintenance. There are no selectable options and this feature provides a view-only verification of information only. When selected, a new menu (Review Config) will appear that allows the user to scroll through all the set values in the Configuration Menu. Push the Control Knob to return to the Options Menu (Images 19, 20).

Image 19

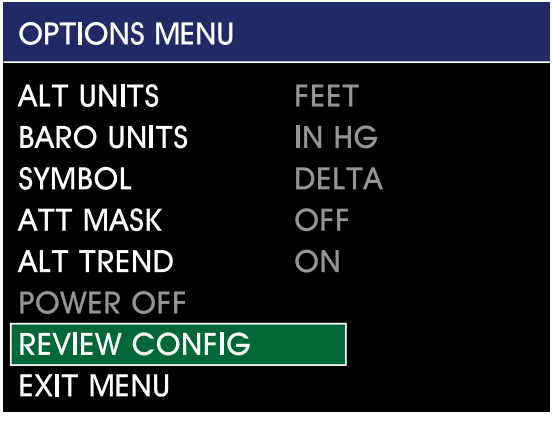
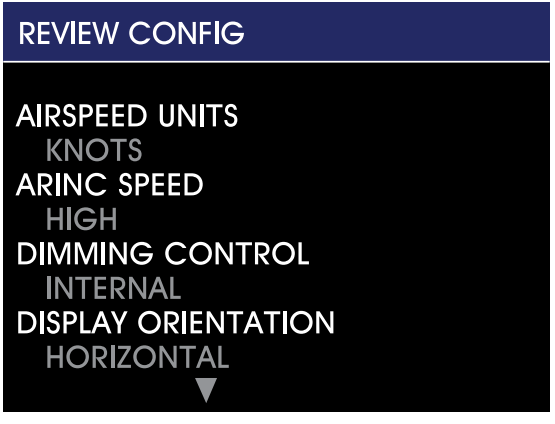


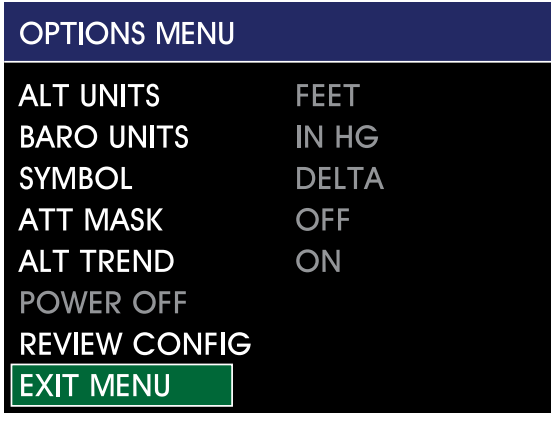
Image 20



REVIEW CONFIG

The Exit Menu action allows the user to manually exit the Options Menu and return to the active Attitude Display. There are no selectable options. After confirming any setting by selecting it, that setting will become active and it will be saved in memory. This will occur regardless of whether the Exit Menu command is selected or should it time out after approximately ten seconds of inactivity and automatically revert to the Attitude Display (Image 21).

Image 21



EXIT MENU

The MD302 Standby Attitude Module can be configured to adjust its brightness based on the aircraft's manual lighting bus control or automatically based on the ambient lighting conditions using the photocell sensor on the unit. For either option, the pilot or crew member can temporarily override the current brightness and manually increase or decrease it. To do this, briefly press the Control Knob. The brightness bar will appear overlaid on the attitude display and turning the Control Knob will increase or decrease the current setting.

While the unit remains powered, the manual adjustment will remain saved and any change in the lighting bus or photocell sensor will increase or decrease the brightness from the newly set manual adjustment.

When the unit is powered OFF, the manual adjustment will be reset and default to the lighting response curve programmed into memory per the settings in the Configuration Mode setup by the installer.

The MD302 Standby Attitude Module is designed to operate reliably and provide the critical situational awareness needed, even if the aircraft power systems fail. Should this occur, the unit provides emergency operation by continuing to perform seamlessly and uninterrupted in Flight Mode.

The MD302 contains an internal and field-replaceable True Blue Power® Nanophosphate® lithium-ion battery which recharges during normal flight, contains a heater for low temperature conditions and provides a minimum of one hour of operation — 2.5 hours when new. **If aircraft power to the unit is lost in flight, the unit will immediately begin operating on internal battery power. This is indicated by a green battery icon displayed in the top right of the Attitude Display (Image 22).**

Should the battery power become low while in operation, the battery icon will display the low battery icon. This is identified by a black battery icon with a red X on it. This indicates that there is less than 20% of battery capacity left and may represent as little as ten minutes of backup power available (Image 23).

Image 22

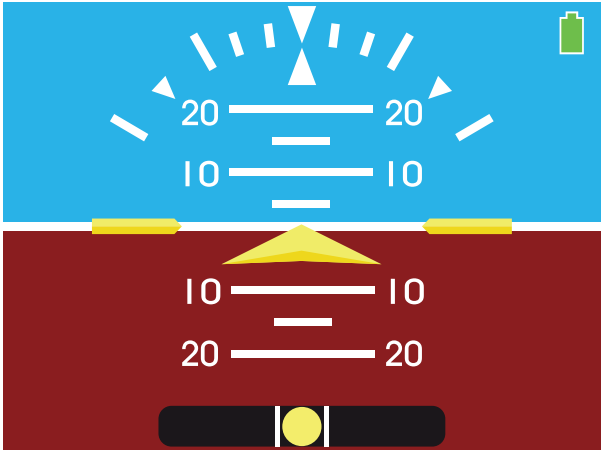
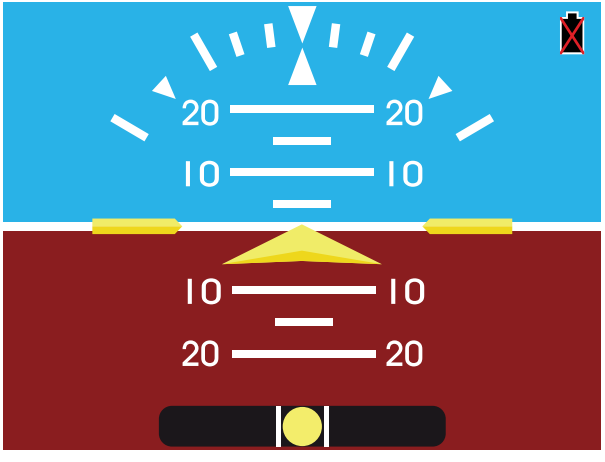


Image 23



BATTERY CAPACITY INDICATIONS

Fully charged battery.
Approximately one hour of operation remaining.

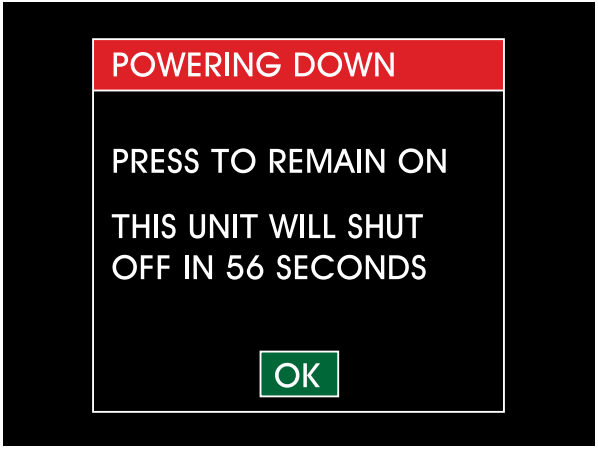
Battery almost depleted.
10 minutes or less of operation remaining.

If primary aircraft power to the unit is lost, the unit will immediately begin operating on internal battery power. Should this occur as a result of normal landing and shut-down procedures, the unit will recognize that there is minimal airspeed and determine that the aircraft is on the ground. Under these conditions, the unit will then display a warning message (Image 24).

The unit will begin counting down for 60 seconds and turn OFF automatically.

If continued operation is desired, press the Control Knob to select OK. If you would like to turn the unit OFF after acknowledging the 'Remain On' option, enter the Options Menu and select the Power OFF action (see Power OFF, page 21).

Image 24



EMERGENCY OPERATION

Loss of power and no airspeed is sensed. Shut down in progress.

PRODUCT SPECIFICATIONS

Power Input	10-32 VDC; 10W normal, 40W max	
Output	ARINC 429 (see installation manual for specific labels)	
Operating Range	Attitude	300° per second pitch, roll and yaw (max)
	Altitude	-1,500 to +55,000 ft (-457 m to 16,764 m)
	Airspeed	0 to 500 knots (0 to 575 mph) (0 to 926 kph)
Units of Measure	Altitude	Feet or meters
	Barometric Setting	Inches of mercury, millibars/hectopascals
	Airspeed	Knots, miles per hour or kilometers per hour
Panel Tilt	Configurable	-10° to +90° pitch
Lighting	5, 14 and 28 VDC input	
Pilot Interface	16-detent, push and turn knob	
Weight	1.6 lbs (0.73 kg)	
Battery	Rechargeable, field-replaceable, internal battery	
	Technology	Nanophosphate® lithium-ion
	Run time	60 minutes minimum when fully charged and properly maintained
Mounting	Front panel mounted	
Mating Connectors	Mid-Continent P/N 9017646 kit contains custom DB15 connector with configuration module, pitot and static connectors	
Certification	FAA TSO certified to C2d, C3e, C4c, C10b, C106, C113a, C179a	
	RTCA DO-178B and DO-254 Design Assurance Level (DAL) A	
	RTCA DO-160 qualified	
	RTCA DO-311 qualified	

LIMITED WARRANTY

Mid-Continent Instruments and Avionics understands customer satisfaction is the cornerstone of our business. If you are dissatisfied for any reason, let us know. For assistance, contact a customer service representative at either of our two locations.

We provide a limited warranty for all new MD302 Standby Attitude Modules for two (2) years after date of original sale. We will repair or replace a unit under warranty once the unit is returned and we verify the malfunction. After repair or replacement, items under warranty retain the unused portion of the original limited warranty period.

Mid-Continent Instruments and Avionics warrants that all articles we furnish will conform to applicable specifications at time of shipment and be free from defects in workmanship and in materials. Our obligation will be limited to replacement or repair. Except for a warranty of title and the limited warranty set forth above, no other warranties, express or implied, or other obligations or liabilities shall apply. In no event will seller be liable for any incidental damages, consequential damages, special damages, indirect damages, loss of profits, loss of revenues, or loss of use, even if informed of the possibility of such damages. Seller's liability for damages arising out of, or relating to a product or order, is limited to the lower of catalog or contract price for the specific product that gives rise to the claim. To the extent permitted by applicable law, these limitations and exclusions will apply regardless of whether liability arises from breach of contract, warranty, tort (including but not limited to negligence), by operation or law, or otherwise.

For complete warranty details, contact a Mid-Continent Instruments and Avionics customer service representative.

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