



User Guide
For

MD23-342

Digital
Attitude Indicator

powered by



Rev	Date	Detail	Approved
1	10/11/22	Initial release.	BAW
2	11/01/23	Added capability and interface details for: - Heading via MD32 Magnetometer. - Slip and Turn Rate display options - Backup power via TS6 Emergency Battery Power Supply	LB

This manual provides information intended for use by persons who, in accordance with current regulatory requirements, are qualified to install this equipment. It is a supplement to the MD23 Installation Manual and Operating Instructions, p/n 9019161.

If further information is required, please contact Mid-Continent Instruments and Avionics.

Mid-Continent Instruments and Avionics

User Guide UG342
Revision 2

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1.1 INTRODUCTION

The model MD23-342 digital attitude Indicator is a standard 2-inch (2-¼”) panel-mounted instrument that displays aircraft attitude related functions. Based on Mid-Continent Instruments and Avionics patented FLEX™ Custom Function Display, this FAA and EASA TSO-approved instrument brings a highly capable and modern addition to the cockpit to display required information and provide useful supplementary functions.

This User Guide is a supplement to the Installation Manual and Operating Instructions (IM), MCIA part number 9019161. The IM contains all information associated with the standard product, including installation procedures, product specifications, operating instructions, certification data, and maintenance requirements. This User Guide provides additional information associated with the specific features of the multifunction digital attitude Indicator. It addresses product identification, electrical pinout, initial configuration setup, and in-flight user operation.

1.2 PRODUCT IDENTIFICATION

Each MD23 is comprised of certified hardware and certified software. Within the context of the certified software is a set of data items that can configure and customize the behavior of the unit. This set of data is referred to as a Custom Instrument Definition, or a CID file. The CID file for this instrument is pre-loaded and may be available for future updates via a standard USB flash drive through the programming port on the rear of the unit.

A unique CID number has been assigned specifically to this application. The CID is identified by its two-digit number and an alphabetic character representing the CID version, starting with “A”.

The identification of the hardware, software, and CID configurations are listed below. Both the software version and the CID can be viewed on the Introduction Screen during the first few seconds of applying power to the unit. This information can also be accessed on the Info page of the Options Menu during Flight Mode.

Unit Versions		
Hardware Part Number	Software Version	CID
6420023-3 or -23	1.1.1, or later	42B, or later

1.3 PRODUCT FUNCTION

The Multifunction Digital Attitude Indicator provides an artificial horizon display of the aircraft pitch and roll attitude. It also displays aircraft slip and turn rate, and heading (optionally, if connected to an external source of heading data via ARINC labels 320 or 014 or an MD32 Magnetometer).

The unit can be configured by the installer to account for panel tilt, roll offset, roll scale, aircraft symbol and heading display options.

Additionally, the unit can be installed with a backup battery using the TS6 Emergency Battery Power Supply.

2.1 CONNECTOR PINOUT

For standard pre-installation and installation instructions, including location, cable harness assembly, pneumatic inputs (if applicable), mounting, and others, please refer to the IM.

Pinout identifications specific to this CID are listed in the tables below. A brief description is provided.

Connector Pinout – No TS6 Battery		
Pin	Description	Function
1	Ground	Power return; connect to a/c ground
2	ARINC Out (A)	Labels 325, 324, and 320
3	ARINC Out (B)	(paired with pin 2)
4	Dimmer Input	5, 14, or 28VDC input (if used)
5	ARINC In (A)	Label 320 or 014 (if used) or MD32 pin 6/7
6-13	Reserved	
14	ARINC In (B)	(paired with pin 5)
15-18	Reserved	
19	Power Input	+10-32VDC from Aircraft Power bus
20 - 26	Reserved	

Table 1 Unit Connector Pin Identification – No TS6 Battery

Connector Pinout – With TS6 Battery		
Pin	Description	Function
1	Ground	Power return; connect to a/c ground
2	ARINC Out (A)	Labels 325, 324, and 320
3	ARINC Out (B)	(paired with pin 2)
4	Dimmer Input	5, 14, or 28VDC input (if used)
5	ARINC In (A)	Label 320 or 014 (if used) or MD32 pin 6/7
6-11	Reserved	
12	SoC	Backup battery state of charge, connect to TS6 pin 4
13	Reserved	
14	ARINC In (B)	(paired with pin 5)
15-18	Reserved	
19	Power Input	Connect to TS6 J1 pin 7
20	Aircraft Power Monitor	+10-32VDC Aircraft Power bus - to monitor loss of power
21-24	Reserved	
25	Batt Disable	Battery disable output, connect to TS6 pin 6
26	Reserved	

Table 2 Unit Connector Pin Identification – With TS6 Battery

The Digital Attitude Indicator provides high speed ARINC outputs of the following data:

Label	Parameter	Units	LSB	MSB	Resolution	Min	Max	Xmit period
0325	Roll	deg	15	29	0.010986328	-180.0	180.0	0.02 sec
0324	Pitch	deg	16	29	0.021972656	-180.0	180.0	0.02 sec
0320	Heading	deg	17	29	0.043945312	-180.0	180.0	0.05 sec

3.1 CONFIGURATION AND SETUP

Enter Configuration Mode by pressing and holding the Control Knob while applying power to the unit. For configuration and setup of standard unit functions, including dimming control options and dimming curve definition, please refer to the IM.

Configuration settings specific to this unit are found within the User Configuration menu option. The User Configuration items include two functions:

3.1.1 USER CONFIGURATION

Within the User Configuration Menu, the user can select to either configure aircraft installation related options or instrument display options

Turn the Control Knob to highlight the desired option and press to select it.



3.1.2 CONFIGURE AIRCRAFT

The Configure Aircraft Menu contains aircraft installation related options. If the unit is receiving data from a connected MD32 magnetometer, the CALIBRATE MD32 menu item will be white and available for selection. If it is not receiving MD32 data, that option will be greyed out and will do nothing if selected.

Turn the Control Knob to highlight the desired option and press to select it.



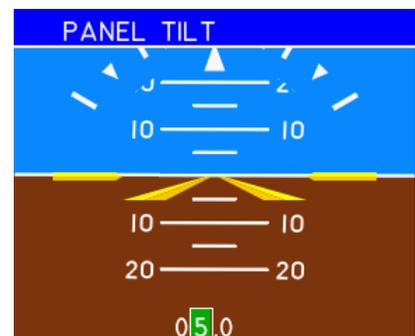
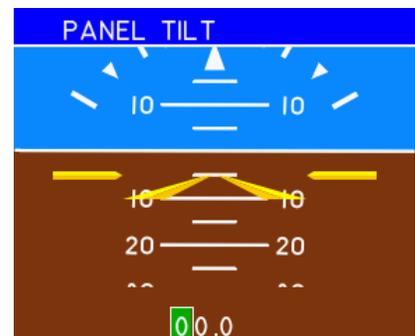
3.1.2.1 PANEL TILT

Use the panel tilt adjustment to compensate for any front-to-back tilt of the instrument as installed in the instrument panel.

This screen will appear (for example) as shown in the first illustration on the right when initially selected, before any adjustment is made. The actual measured pitch angle is displayed by the artificial horizon display.

The current panel tilt setting is shown at the bottom of the screen in degrees. When the Control Knob is turned, the digit that is highlighted in green will be changed and the displayed pitch angle will change accordingly. Press the Control Knob to advance to the next digit. The second illustration on the right shows the panel tilt adjustment display after the adjustment has been made.

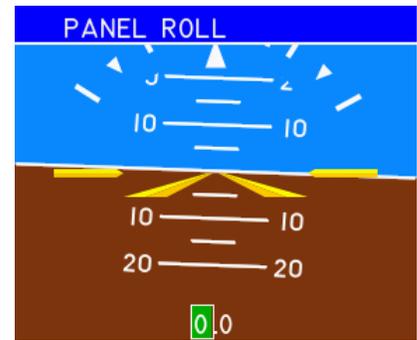
The display will return to the Configure Aircraft menu when the knob is pressed with the last digit highlighted.



3.1.2.2 PANEL ROLL

The panel roll adjustment screen functions basically the same as the panel tilt adjustment screen. An example of this screen before adjusting to compensate for a slight roll misalignment in the instrument installation is shown at the right. Press the Control Knob to select the digits and turn to adjust.

The display will return to the Configure Aircraft menu when the knob is pressed with the last digit highlighted.



3.1.2.3 BATT INSTALLED

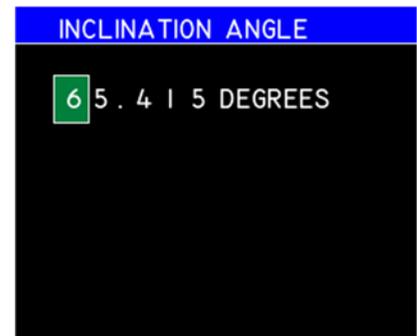
If the installation includes a TS6 Emergency Battery Power Supply, you should activate the battery interface features by changing the BATT INSTALLED menu item from NO to YES.



3.1.2.4 CALIBRATE MD32

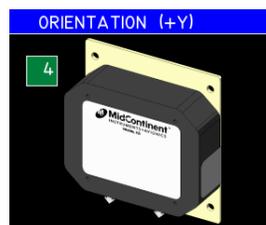
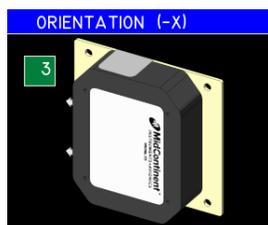
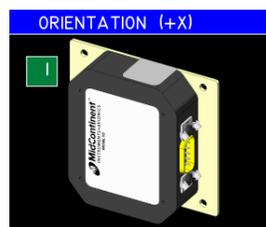
If the aircraft installation includes an MD32 magnetometer, the installation needs to be calibrated. This is done by selecting the CALIBRATE MD32 menu item from the Configure Aircraft menu.

The first screen that will appear is the INCLINATION ANGLE screen. Enter the magnetic field inclination angle at your location. This can be obtained from the following link/NOAA website: www.ngdc.noaa.gov/



Turn the Control Knob to change the highlighted digit; press the knob to advance to the next digit. The display will advance to the ORIENTATION options when the knob is pressed with the last digit highlighted.

Turn the knob to change screens to select one of the six numbered baseplate orientations (in the green boxes below) of the MD32 that corresponds most closely to the MD32 in your aircraft installation and then press the knob to select the correct one.



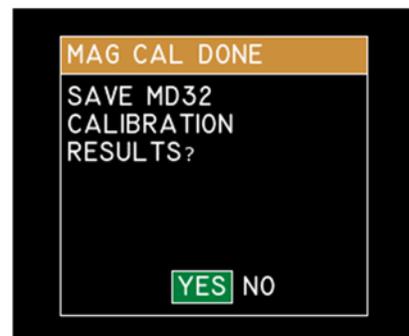
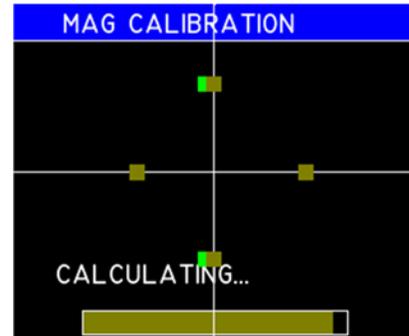
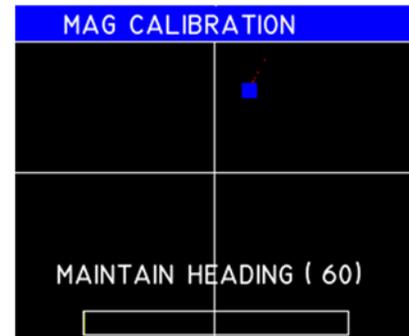
The next screen that will be displayed contains instructions to orient the aircraft to a magnetic heading of 360 degrees. When that has been completed, turn the knob, if necessary, to highlight YES and press the knob to continue. If you wish to abort the calibration procedure, select NO, and press the knob to return to the CONFIGURE AIRCRAFT menu.

When you select YES to proceed, the next screen to be displayed will be a progress display with a 60 second countdown while the unit collects the magnetometer data needed for the calibration calculations at this orientation.

When the countdown is complete, another screen will be displayed with instructions to orient the aircraft at 90 degrees. Again, you can choose to proceed after re-orienting the aircraft or abort. These steps will repeat for orientations of 180 degrees and 270 degrees.

When the countdown is completed at the orientation of 270 degrees, a “CALCULATING...” screen will be displayed while the calibration coefficients are calculated from the data collected at the four orientations. When that process is done, the MAG CAL DONE screen will be displayed, prompting the user to decide whether they wish to save the results of the calibration or not. Highlight YES or NO by turning the knob, then press the knob to select.

If you select YES, the calibration coefficients will be saved in non-volatile memory for use in determining the heading from the magnetometer data. If you select NO, the calibration results will be discarded and the coefficients that were previously in non-volatile memory (if any) will be retained.



3.1.2.5 EXIT

The last menu item on the Configure Aircraft Menu is EXIT. Highlighting and selecting the Exit menu item will close the Configure Aircraft Menu and return to the User Configuration Menu.

3.1.3 CONFIGURE DISPLAY

The Configure Display menu allows the user to select various options that affect the appearance of the display. It is illustrated on the right. The current setting for each of these options is shown on the right side of the screen in grey text. Each of these options is described in the following subparagraphs.

CONFIGURE DISPLAY	
HEADING	OFF
TURN RATE	OFF
SLIP	ON
SYMBOL	SPLIT DELTA
ROLL	FIXED SCALE
EXIT	

Turn the Control Knob to highlight the option you wish to change and press the knob to select that option.

3.1.3.1 HEADING

This option controls whether the heading digital display and tape are displayed at the bottom of the screen. If this option is set to OFF, the heading will not be displayed and the slip indicator will be displayed at the bottom of the screen. If this option is set to ON, the slip indicator will be smaller and moved just above the heading tape on the left side of the screen.

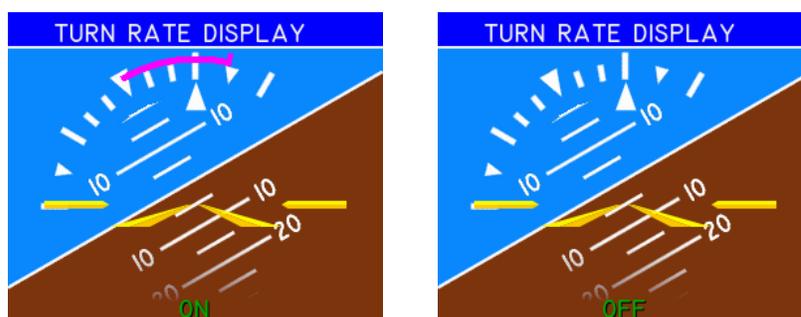
Turn the Control Knob to change the heading display option and the display will change accordingly. Press the knob to select the desired heading display option and the screen will return to the Configure Display Menu.



3.1.3.2 TURN RATE

This option controls whether the turn rate arc is displayed on the roll scale.

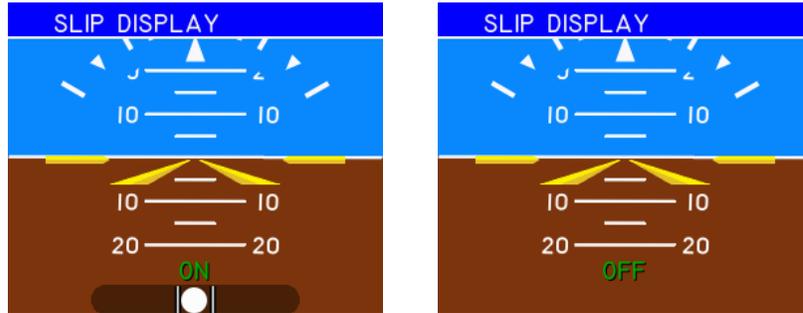
Turn the Control Knob to change the turn rate display option and the display will change accordingly. Press the knob to select the desired turn rate display option and the screen will return to the Configure Display Menu.



3.1.3.3 SLIP

This option controls whether the slip indicator is shown on the display.

Turn the Control Knob to change the slip display option and the display will change accordingly. Press the knob to select the desired slip display option and the screen will return to the Configure Display Menu.

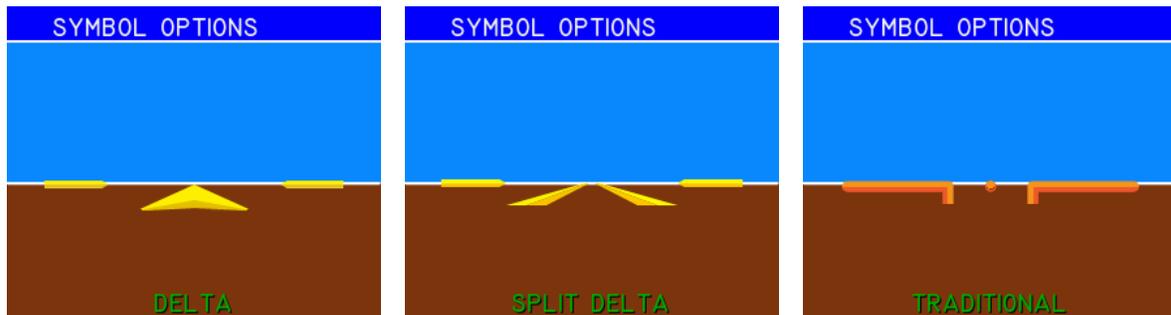


3.1.3.4 SYMBOL

If you select the SYMBOL option from the Configure Display Menu, the screen will show an example of the display appearance using the currently selected aircraft symbol.

The options are Delta, Split Delta, and Traditional as shown in the illustrations below.

Turn the Control Knob to change the aircraft symbol option and the display will change accordingly. Press the knob to select the desired symbol and the screen will return to the Configure Display Menu.

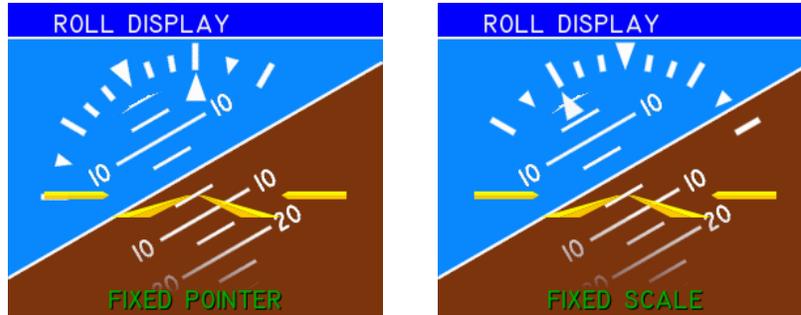


3.1.3.5 ROLL

If you select the ROLL option from the Configure Display Menu, the screen will show an example of the display appearance using the currently selected roll display option.

The options are Fixed Pointer, and Fixed Scale, as shown in the illustrations below.

Turn the Control Knob to change the roll display option and the display will change accordingly. Press the knob to select the desired option and the screen will return to the Configure Display Menu.



3.1.3.6 EXIT

The last menu item on the Configure Display menu is EXIT. Highlighting and selecting the Exit menu item will close the Configure Display Menu and return to the User Configuration Menu

3.1.4 EXIT

The last menu item on the User Configuration menu is EXIT. Highlighting and selecting the Exit menu item will close the User Configuration Menu and return to the Configuration Menu.

4.1 OPERATION

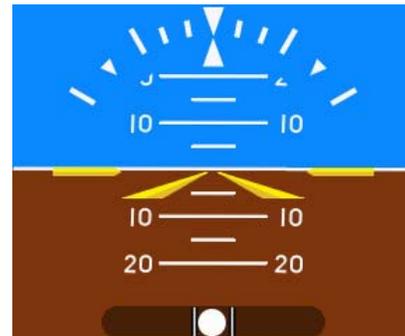
For operation of standard unit functions, including the Options Menu, manual brightness control, Info page, and others, please refer to the IM.

4.1.1 PRIMARY DISPLAY PRESENTATION

In Flight Mode, the display is presented as shown in the example figures below.



Power on screen

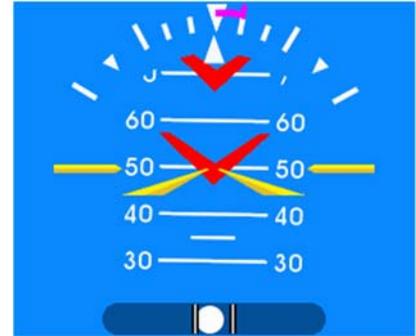


Normal Operation
(example)

Primary Function elements are defined as follows:

- Pitch Display

The pitch scale range is ± 90 degrees with 10 degree major graduations which have numeric labels and 5 degree minor graduations (up to ± 35 degrees) which are unlabeled. At extreme pitch attitudes where the display shows only the ground or the sky, chevrons are displayed which indicate the direction of the horizon (zero pitch).



- Roll Display

The roll display range is ± 180 degrees. The roll scale has minor graduations at ± 10 and ± 20 degrees and major graduations at 0, ± 30 , ± 45 , and ± 60 degrees. The 0 and ± 45 degree graduations are triangles, the others are linear.

- Slip Display (optional)

The slip display is a typical “ball in tube” display.

- Turn Rate Display (optional)

The turn rate is displayed as an arc and uses the roll scale graduations as follows:

- For a two minute turn, the arc extends to the 30 degree roll graduation.
- For a one minute turn, the arc extends to the 60 degree roll graduation.

- Heading Display (optional)

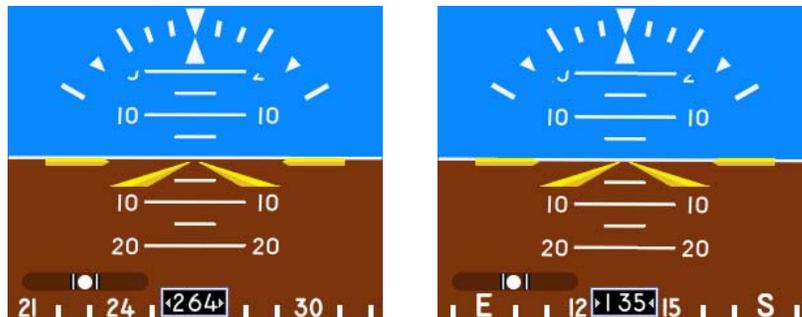
The heading is displayed as a numeric digital readout and a heading tape which scrolls left during right turns and right during left turns.

- With MD32 aiding

When MD32 magnetometer data is being received and is valid, the display will show triangular “sync” indicators on either side of the numeric heading display pointing outwards. The left illustration below shows an example of this.

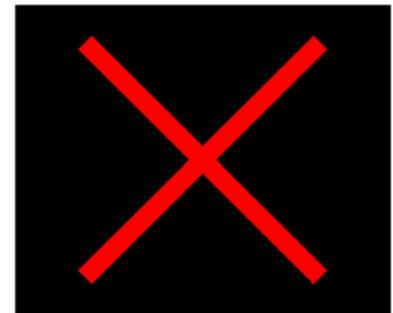
- With ARINC heading data (label 0320 or 014, low speed or high speed)

When ARINC heading data, label 0320 or 014 is being received and is valid, the display will show triangular “sync” indicators on either side of the numeric heading display pointing inwards. The right illustration below shows an example of this.



- Error Annunciations

- **Red X** – displayed if sensor input limits are exceeded or internal error limits are exceeded in the attitude calculations. When these limits are no longer exceeded, the unit will transition back to normal attitude display mode. It may take several seconds after the display transitions back to normal attitude display mode for the attitude to completely recover to full accuracy.



- **Loss of Heading Aiding**

If the MD32 or ARINC heading data is lost, the “sync” indicators will disappear. After several seconds, if the data is not recovered, the heading tape will disappear, and the heading digital display will show three grey dashes. See the illustrations below for examples.



4.1.2 TS6 EMERGENCY BATTERY POWER SUPPLY INTERFACE FEATURES

If the aircraft is installed with the TS6 Emergency Battery Power Supply and the BATT INSTALLED configuration option (see 3.1.2.3) is set to YES, the MD23 will monitor aircraft power and display a pop-up notification and option menu when power loss is detected as shown in the image to the right.

Note that when the TS6 is installed, the most significant bit of the Gillham code encoding outputs is not available and the altimeter can only encode altitudes up to 30,700 feet.

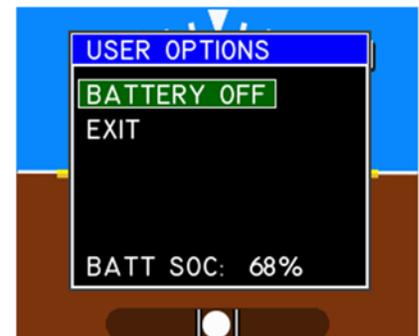


When this pop-up is displayed and you wish to power down the unit, either wait for the 60 second countdown to reach zero or turn the Control Knob to highlight the OFF option and press. This will send the Disable signal to the battery, thus removing power from the instrument.

To maintain operation on battery power, press the Control Knob while the ON option is highlighted. This will stop the countdown and remove the pop-up. If aircraft power is restored, the unit will continue operation and the battery icon will be removed.

To turn the unit off while operating on battery power, press and hold the Control Knob to access the User Options (battery status/control) menu page, and then select the BATTERY OFF option.

Selecting EXIT will return to the Options menu and continue operation on battery power.



BATTERY STATE OF CHARGE

The TS6 battery state of charge can be viewed at any time by accessing the User Options menu. The battery state of charge (BATT SOC) will be displayed in percent at the bottom of the menu window.

If the unit is not currently operating on battery power, the BATTERY OFF option will be unavailable, but the BATT SOC will still provide the battery state of charge.

A high-level representation of the battery state of charge is also indicated on the main display. The battery icon will be displayed when operating on battery power, or if the state of charge of the battery is less than 50%.

If above 50%, the icon will be green when operating on battery power and off (not visible) when operating on normal aircraft power. Whether operating on normal aircraft power or battery power, if the battery state of charge is below 50% and above 20%, the icon will be shown and will be amber. Under the same conditions, the icon will be shown and will be red if the battery state of charge is less than 20%.

4.1.3 USER OPTIONS

The artificial horizon display instrument does not have any in-flight configurable user options unless the BATT INSTALLED configuration option (see 3.1.2.3) is set to YES.

If the aircraft is installed with the TS6 Emergency Battery Power Supply and the BATT INSTALLED configuration option (see 3.1.2.3) is set to YES, there will be an active User Options menu item which allows access to a battery status/control menu page.



Pressing and holding the Control Knob for three (3) seconds will activate the User Options Menu. The manual brightness adjustment and info page are described in the IM. The Options Menu or User Options items will close and return to the active display after ten (10) seconds if no knob activity is recorded.

When highlighted and selected, the User Options item will open the battery status/control page. See 4.1.2 for the description of the User Options (battery status/control) page.

Highlight and select Exit or simply wait ten (10) seconds and the unit will return to the active Flight Mode display.

5.1 CONFORMANCE

For standard conformance items such as qualification levels and software updates, please refer to the IM.

5.1.1 INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

For this application, the MD23 is configured to process and display data associated with a temperature and altitude compensated inertial measurement unit. Some aviation regulations may apply to inspect and test for accuracy on a regular basis. (for example, 14 CFR §91.411 for altimeters) Please identify and/or refer to the appropriate maintenance procedures for your aircraft in the pilot operating handbook or flight manual supplement.

For additional information regarding instructions for continued airworthiness, refer to the MD23 Installation Manual and Operating Instructions, p/n 9019161 and TS6 Installation Manual and Operating Instructions, p/n 9019857 (if applicable).

5.1.2 COMPONENT MAINTENANCE AND REPAIR

No periodic scheduled maintenance or calibration is necessary for continued airworthiness of the MD23 Custom Function Display, unless specified in the aircraft maintenance procedures, as referenced above in 5.1.1.

The unit display can be cleaned using a lint-free cloth moistened with water. No chemicals should be used to clean the display.

If the unit fails to perform to specifications, the unit must be removed and serviced by Mid-Continent Instruments and Avionics or their authorized designee. Other than software version updates or in-field calibration, there are no repairable parts or processes available to be performed in the field.

For component maintenance and repair of the TS6 Emergency Battery Power Supply (if applicable), refer to the TS6 Installation Manual and Operating Instructions, p/n 9019857.