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MD23

FLEX Custom Function Display



FOREWORD

This manual provides information intended for use by persons who, in accordance with current regulatory requirements, are qualified to install this equipment. If further information is required, please contact:

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

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REVISION HISTORY

Rev	Date	Detail	Approved
A	09/09/2020	Production release.	BAW
B	10/18/2022	Added data for IMU (-3) configuration. Added NVIS versions. Added a feature cross reference table by unit version (1.3). Added QR code, page 2.	CAS
C	08/18/2023	Updated TSO compliance for addition of C6e. Corrected multiple Table references. Added note to clarify product version/'dash number' references at bottom of page 6.	CAS



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SECTION 1 GENERAL DESCRIPTION

1.1 INTRODUCTION

The model MD23 series FLEX Custom Function Display (“CFD”) is a panel-mounted instrument capable of displaying various inputs in a configurable graphical presentation. FLEX is an off-the-shelf solution that is FAA and EASA TSO-approved with Level A design assurance software certification. The power of FLEX is its ability to become exactly what your application requires without the time and cost of a product development and certification effort. This unique new breakthrough in avionics uses a Patent Pending software concept that allows it to be quickly customized to your requirements by Mid-Continent Instruments and Avionics without re-certification. With the ability to receive and send multiple types of inputs and outputs, allow user interface, and display custom designed graphics, FLEX is as flexible as it gets.

The MD23 is a general purpose CFD indicator in a standard 2-inch (2-1/4”) rear-mounted form-factor with a daylight readable color IPS-LCD display and a push-and-turn knob. The model series comes in three hardware platforms, each with a 26-pin electrical connector, one with quick-disconnect pitot and static pneumatic inputs, and one with integrated IMU sensing. A USB port is accessible behind a cover on the rear of the unit for field-loadable software updates and installation of a Custom Instrument Definition (CID) file.

The unique Multi-I/O (MIO) feature allows twelve of the unit’s electrical inputs to be configured per the CID file to either accept or output various types of signals and information. MIO pins can be defined to be an analog input, a discrete on/off input, an analog output, or a discrete output. In the indicator version of the unit (non-pitot/static), the unit is also capable of accepting up to three independent frequency inputs for tachometer or related use. There are two ARINC 429 serial inputs and one output. The ARINC labels can be defined as needed for each application. The ARINC output can combine both ARINC inputs, user selections, and translate MIO (analog/discrete) inputs into a single ARINC data stream. The remaining interface options include a thermocouple input, RS-232, RS-422, RS-485, an external dimming control, and 10-32VDC power.

An Inertial Measurement Unit (IMU) based on 6-axis of internal sensing gives FLEX the ability to function as a standalone solution to a variety of traditional inertial instruments, such as an attitude indicator, turn coordinator, g-meter, or AHRS data source. By combining internal IMU data with external data such as magnetic heading, FLEX can be further configured to display navigational information in a custom display that meets the unique needs of any aircraft.

The MD23 FLEX can add a new function to your panel, combine multiple data sources into a single display, or control external equipment. The FLEX is a great tool for any panel upgrade, STC, or forward-fit challenge. It brings a cost effective and certified product together with the flexibility to configure it to your custom requirements, making it the perfect value and solution for your specific cockpit display and control needs.



1.2 TECHNICAL SPECIFICATIONS

Electrical Attributes	
Input Voltage	10-32 VDC
Input Power	4 watts (0.14A @ 28VDC)
Lighting Input	5, 14, or 28VDC or automatic photocell control
Battery Backup (clock function only)	Rechargeable coin cell (qty 1)

Table 1.1

Data Inputs and Outputs*		
Analog	Input (-1, -2)	0V to 28VDC, $\pm 0.050V$ accuracy, impedance $>50Kohms$
	Input (-3)	-24V to 29VDC, $\pm 0.050V$ accuracy, impedance $>50Kohms$
	Output (-1, -2)	0V to 5VDC, $\pm 0.050V$ accuracy,
	Output (-3)	-8V to 8VDC, $\pm 0.050V$ accuracy,
Discrete	Input	Sensing of open or ground
	Output	Open, Ground, Pullup to 5V
Frequency	Input (-1)	0.5-100VDC pk-pk, input impedance $>50K$ ohms 10-20,000 Hz (3 input pairs; differential or single-ended)
ARINC 429	Input Output	Low/High Speed input; 2 input channels Low/High Speed output; 1 output channel
RS-232		Format per CID; 1 receive, 1 transmit
RS-422/485	(-3)	Format per CID; 2 channels / 4 wires, bidirectional
Thermocouple	(-1, -2)	1 pair; cannot be grounded
Pressure	Static (-2)	0-15 psi absolute (TSO accurate -1,500 to +55,000 feet)
	Pitot (-2)	± 15 psi differential (TSO accurate 20 to 500 knots)

Table 1.2

Available Features by Unit Version*	-1	-21	-2	-22	-3	-23
Standard Display	✓		✓		✓	
NVIS Display		✓		✓		✓
Analog / Discrete Multi-IO	✓	✓	✓	✓	✓	✓
ARINC 429	✓	✓	✓	✓	✓	✓
RS-232	✓	✓	✓	✓	✓	✓
RS-422 / RS-485					✓	✓
Pneumatic Inputs			✓	✓		
Frequency / Tachometer Inputs	✓	✓				
Inertial Sensors					✓	✓
Thermocouple Input	✓	✓	✓	✓		
External Dimming Input	✓	✓	✓	✓	✓	✓

Table 1.3

* NOTE: All references to -X throughout the document also apply to -2X respectively. -2X versions represent the NVIS display version of the respective -X version and are otherwise identical.



Physical Attributes	
Weight	0.4 pounds (0.17 kg)
Dimensions	2.43" x 2.43" x 1.0" (HxWxD)
Mating Connectors	26-pin D-Sub and backshell M CIA p/n 9019162-1 Pneumatic fittings M CIA p/n 9019162-2
Mounting	Rear Panel Mount with (4) #6-32 screws; Ø2.25 inch round bezel

Table 1.4

IMU Performance Limits (-3)		
Attitude (-3)	Pitch Angle	No limits (360°)
	Pitch Rate	500° per second max
	Roll Angle	No Limits (360°)
	Roll Rate	500° per second max

Table 1.5

Qualifications	
Certifications	FAA/EASA TSO-C2d (Type B), C3e, C4c, C6e, C8e, C10c, C106, C113b, C201 (A4H4T3)
Environmental Qualification	RTCA DO-160G (details listed in Section 5.2)
Software Qualification	RTCA DO-178C, Design Assurance Level A
Lithium-ion Qualification	UL 1642
NVIS Display (-21, -22, -23)	Verified for installations requiring NVIS White compliance with MIL-STD-3009 and RTCA/DO-275

Table 1.6

Exclusivity Rights	
Rights	U.S. Patent 11,038,389

Table 1.7



SECTION 2 PRE-INSTALLATION CONSIDERATIONS

2.1 COOLING

No external cooling is required. The unit will generate some heat as a function of normal operation. Installation in an area that is exposed to extreme heat or restricted airflow can reduce the expected life of the product. Mounting the unit to a metal surface can help reduce the effects of temperature on the unit but is not required.

2.2 EQUIPMENT LOCATION

The MD23 FLEX is designed primarily to be installed in the instrument panel of the aircraft. The unit has an extra-wide viewing angle allowing for flexible installation location. When selecting a panel location for the MD23, be sure to consider appropriate field-of-view with regard to pilot and/or co-pilot visibility and accessibility. Other locations may be acceptable if the environmental qualifications are considered with respect to the installation approval.

Additionally, consider what equipment is behind the panel that could impede the installation. Clearance for the unit as well as its electrical and pneumatic connections (if present) and routing must be allowed.

2.3 ROUTING OF CABLES

Be aware of routing cables near other electronics or with other wire bundles that may be susceptible to high energy flow. Avoid sharp bends in cabling and routing near aircraft control cables. Also avoid proximity and contact with aircraft structures, avionics equipment, or other obstructions that could chafe wires or hoses during flight and cause undesirable effects.

2.4 LIMITATIONS

The MD23 FLEX series of CFDs is certified to multiple FAA TSOs with the following limitations identified:

Deviations have been granted for the use of RTCA/DO-160G and RTCA/DO-178C rather than the environmental and software standards specified in the TSOs.

Applicable TSOs:

Technical Standard Order Authorization to FAA TSO C113b applies to all versions of the MD23. TSOs C2d, C8e, C10c, and C106 only apply to the version(s) of the MD23 with pneumatic inputs. TSOs C3e, C4c, C6e, and C201 only apply to the version(s) of the MD23 with IMU capability. Further, all TSOs are only applicable to customized configurations of the unit that represent the major functions of each TSO.

The MD23 contains a rechargeable manganese lithium coin cell for the purpose of maintaining non-volatile memory. Per RTCA/DO-311A, the cell is an Energy Category 1 (0.051Wh < 2 Wh) and is certified to UL 1642, thus certification to RTCA/DO-311A is not required. Specific STC limitations or ACO coordination is not required for product or installation qualification.

The conditions and tests for TSO approvals of this article are minimum performance standards. Those installing this article, on or in a specific type or class of aircraft, must determine that the



aircraft installation conditions are within the TSO standards, specification of the article, and deviations as listed above. TSO articles must have separate approval for installation in an aircraft. The article may be installed only according to 14 CFR part 43 or the applicable airworthiness requirements.

2.5 MODIFICATION

This product has a nameplate that identifies the manufacturer, part number, description, certification(s) and technical specifications of the unit. It also includes the “MOD” or modification number representing notable changes in the hardware design of the unit.

Modification (MOD) 0 is the initial release of the product and is identified on the nameplate by the lack of marking on the MOD numbers 1 through 9 (i.e. 1-9 are visible). All subsequent modifications are identified on the nameplate by the marking/blacking out of that particular MOD number (i.e. for MOD 1, the number 1 is not visible and 2-9 are visible - see Figure 2.1 for examples). MODs do not have to be sequentially inclusive and may be applied independent of each other.

For additional details regarding specific changes associated with each MOD status refer to the product published Service Bulletins at www.mcico.com.

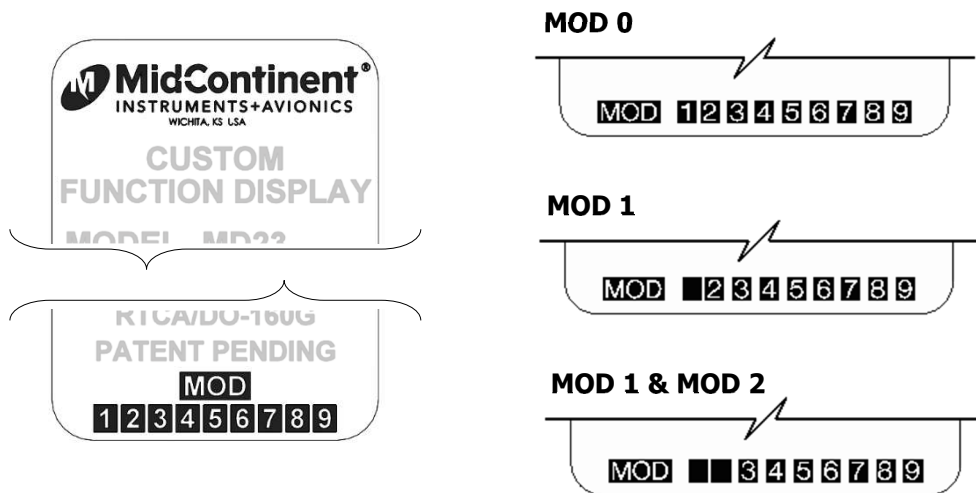


Figure 2.1 Nameplate and MOD Status Example



SECTION 3 INSTALLATION PROCEDURES

3.1 GENERAL INFORMATION

IMPORTANT: READ THIS ENTIRE SECTION PRIOR TO STARTING INSTALLATION!

This section contains interconnect diagrams, mounting dimensions and other information pertaining to the installation of the MD23 FLEX Custom Function Display. For specific pinout that uniquely applies to each custom application, please refer to your custom User Guide, or to the CID Requirements associated with your application.

3.2 PARTS LIST

When unpacking this equipment, make a visual inspection and notify the sender if there is any evidence that damage may have incurred during shipment. The following parts are included:

<u>Item Description</u>	<u>MCIA Part Number</u>
a. MD23 FLEX Custom Function Display	6420023-()
b. Installation Manual	9019161
c. Electrical Connector Kit	9019162-1
i. 26-pin d-sub	
ii. Size 22 contacts/sockets	
iii. Backshell kit, quick-disconnect	
iv. (4) #6-32 mounting screws	
d. Pneumatic Connector Kit *	9019162-2
v. (2) Pneumatic Connectors, quick-disconnect	

* pneumatic connector kit only included with the pitot/static version

Optional Equipment Available

a. Large Knob Kit (0.57" dia x 0.67" long)	9019749-1
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3.3 CABLE HARNESS

Construct the cable harness in accordance with the instructions below, including the Connector Pinout shown in Figure 3.1, Table 3.2 or Table 3.3, and Harness Assembly per Figure 3.2. Installers should follow industry-accepted practices regarding aircraft wiring and applicable regulatory requirements and guidance. The instructions for constructing the cable harness as listed within this manual were also used to construct the harness during environmental and electrical testing. Alterations may invalidate environmental qualification and/or performance results.

Refer to Section 2.2 and 2.3 for planning unit location and cable routing guidelines.



3.3.1 WIRE GAUGE SELECTION

Wire gauge should be 22 AWG. Use of PTFE, ETFE, TFE, Teflon, or Tefzel insulated wire is recommended for aircraft use per MIL-DTL-16878 or equivalent. Additionally, for data signals associated with ARINC 429 inputs and outputs, all MIO signals, and RS-232/422/485, shielded twisted pair wiring per M27500 or equivalent is recommended (and required to meet the qualifications associated with the product certification.)

3.3.2 CONNECTOR PINOUT

The supplied connector and backshell is required for proper installation and operation of the unit. The functions associated with the 26-pin high density D-subminiature connector are identified in Figure 3.1 and Table 3.2 or Table 3.3 below.

Note that for the -1 Indicator version of the unit (non-pitot/static), six of the MIO pins have different capabilities. These are referred to as “Frequency Inputs” and are identified as three separate pairs on pins 23/15, 24/25, and 17/26. Also described below as MIO #7/8, #9/10, and #11/12. The functions of these pins are detailed further in Section 4.



Figure 3.1 View from Rear of Mating Connector

Contact Tooling Reference			
Tool	Positronic P/N	Daniels P/N	Mil P/N
Hand Crimp	9507-0-0-0	AFM8	M22520/2-01
Positioner	9502-3-0-0	K-41	M22520/2-06
Insert/Removal	4811-2-0-0	91067-1	M81969/1-04

Table 3.1 Contact Tooling Reference



Connector Pinout (-1, -2)			
Pin	Description	Pin	Description
1	Power Return	14	ARINC In #1 B
2	ARINC Out A	15	Multi I/O #8
3	ARINC Out B	16	ARINC In #2 B
4	Dim Input	17	Multi I/O #11
5	ARINC In #1 A	18	Thermocouple +
6	ARINC In #2 A	19	Power In (+10-32VDC)
7	RS 232 In	20	Multi I/O #2
8	RS 232 Out	21	Multi I/O #4
9	Thermocouple -	22	Multi I/O #6
10	Signal Return	23	Multi I/O #7
11	Multi I/O #1	24	Multi I/O #9
12	Multi I/O #3	25	Multi I/O #10
13	Multi I/O #5	26	Multi I/O #12

Table 3.2 Unit Connector Pin Identification (-1, -2)

Connector Pinout (-3)			
Pin	Description	Pin	Description
1	Power Return	14	ARINC In #1 B
2	ARINC Out A	15	Multi I/O #8
3	ARINC Out B	16	ARINC In #2 B
4	Dim Input	17	RS485#2 A
5	ARINC In #1 A	18	RS485#1 A
6	ARINC In #2 A	19	Power In (+10-32VDC)
7	RS 232 In	20	Multi I/O #2
8	RS 232 Out	21	Multi I/O #4
9	RS485#1 B	22	Multi I/O #6
10	Signal return	23	Multi I/O #7
11	Multi I/O #1	24	Multi I/O #9
12	Multi I/O #3	25	Multi I/O #10
13	Multi I/O #5	26	RS485#2 B

Table 3.3 Unit Connector Pin Identification (-3)

3.3.3 CABLE HARNESS ASSEMBLY

To assemble the aircraft cable harness, refer to the following instructions and Figure 3.2:

- 1) Install a pin/socket as supplied in the Connector Kit using an appropriate crimping tool for each wire in the aircraft cable harness. Be sure to make the harness long enough to remove the unit from the panel without stressing the harness.
 - a. Crimp and insertion/removal tool references can be found in Table 3.1.
- 2) Wire shields should be exposed and peeled back from the pin/socket termination approximately 2".
- 3) Insert the pins of the cable harness into the rear of the 26-pin D-Sub connector (Item 1, as applicable, per Table 3.2 or Table 3.3 and Figure 3.1 using an appropriate pin insertion tool per Table 3.1 or similar.
- 4) Select one (recommended), two or three locations for routing the wire harness bundle into the Backshell (Item 2) and slide the Blanking Plates (Item 3) into the unused entry points.
- 5) Install the Backshell Spring Clip (Item 4) into the thin slot of the Backshell as shown.
- 6) Place the Backshell Slide Lock (Item 5) over the D-Sub connector.
- 7) Install the D-Sub connector with Slide Lock and cable harness attached into the Backshell and secure with (2) screws (Item 6). Verify that the Backshell Leaf Spring is between the Slide Lock and Backshell. Move the Slide Lock back and forth to verify free movement.
- 8) Bundle the exposed shields and wrap them around the harness for the length of the cable clamp.
- 9) Add a grounding wire or braid to the bundled shields which can be attached to nearby aircraft chassis ground.
- 10) Route the aircraft wire harness (with exposed shield bundle and chassis ground wire) between the two halves of the Cable Strain Relief Clamp (Item 7).
- 11) Connect the two halves of the Cable Strain Relief Clamp with (2) screws (Item 8).
- 12) Place the Cable Strain Relief Clamp in the Backshell as shown.
- 13) Secure the Backshell Cover (Item 9) onto the Backshell using (4) Screws (Item 10).
- 14) The completed assembly should look as shown. Verify that the Slide Lock operates freely and that no wires are pinched, nicked, or otherwise damaged.
- 15) Verify that power and ground signals are installed properly before connecting power.

Cable Harness Kit Parts		
Item	Qty	Description
1	1	DSub, 26pin HD, with #22 contacts
2	1	Backshell
3	2	Backshell blanking plate
4	1	Spring Clip
5	1	Slide Lock
6	2	Screw, Pan-head Phillips
7	2	Cable Clamp
8	2	Screw, Flat-head Phillips, Long
9	1	Backshell Cover
10	4	Screw, Flat-head Phillips, Short

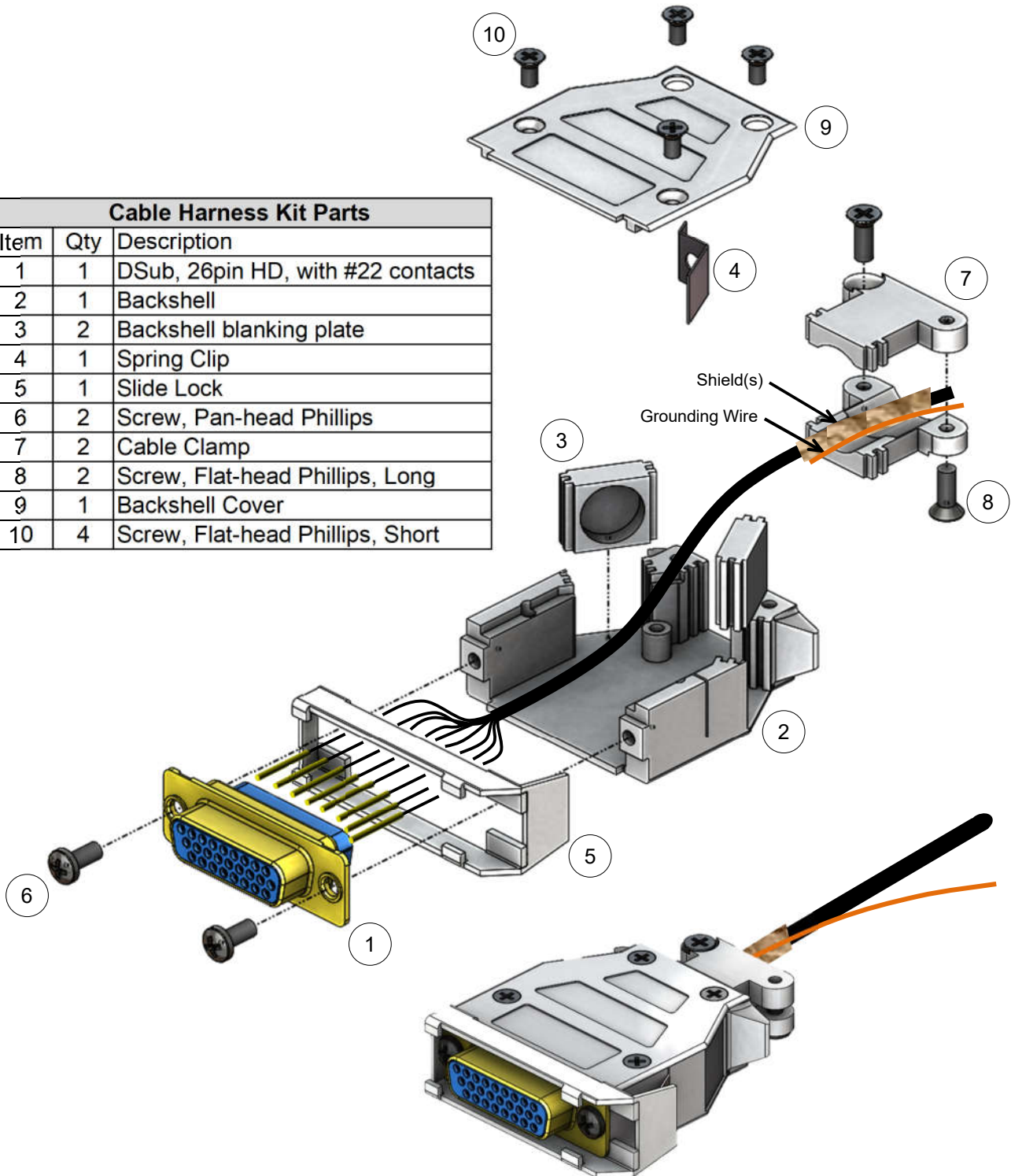


Figure 3.2 Mating Cable Harness Assembly

3.4 PNEUMATIC PRESSURE CONNECTIONS

For the MD23 versions with pneumatic inputs, the connector kit supplied with the unit contains two (2) pneumatic quick disconnect fittings. These fittings are specific to the connections on the rear of the unit and are required for proper operation. The two fittings are marked with “S” and “P” on the case. The “S” fitting, or Static, is for absolute pressure. The “P” fitting, or Pitot, is for positive pressure and provides a differential pressure in relation to the Static input.

Aircraft tubing that connects to the unit must be ¼” OD with an approximate 0.17” ID. When determining tubing length, be sure to include sufficient service length for insertion and removal without stressing the tubing.

NOTE: It is helpful to identify/label each tube (pitot or static) so that it can be connected to the correct port on the back of the unit during installation and so they do not get switched during maintenance or reconnection in the future.

WARNING: Engage the Lock by pressing the metal tab on the quick disconnect before connecting to the unit to avoid damaging the o-rings. The connectors will ‘snap’/lock into place once they are fully engaged.

3.5 MOUNTING

The MD23 FLEX is designed primarily to be rear mounted in an aircraft instrument panel. Refer to Section 2.2 for Equipment Location information. To install the unit in the instrument panel, follow the instructions below and refer to Figure 3.3 and Figure 3.4.

Some applications that utilize the IMU feature (such as an attitude indicator) may require specific mounting orientation. See the individual User Guide associated with each CID for more details.

Notes:

If using flat-head screws, minimum panel thickness is 0.050 inches (1.3mm). Thinner panels require a pan-head screw, or a spacer/washer between the unit and the rear surface of the panel to properly secure the unit.

If using screws other than those provided, ensure that they do not protrude more than ½-inch into the unit.

Remove burrs around the cutout and holes to allow the unit to mount flush with the panel. Electrical bonding between the aircraft and the unit chassis is NOT required.

1. Once a location is selected, cut the panel per the dimensions in Figure 3.4.
Either through-holes for pan-head or cap screws, or countersink holes for flat-head screws can be used. The installation kit includes flat-head screws.
2. Route the prepared cable harness and pneumatic tubing (if applicable) behind the panel and to the panel cutout.
3. VERIFY THAT AIRCRAFT POWER IS TURNED OFF.
4. Connect the cable harness and pneumatic fittings (if applicable) to the rear of the unit.
5. Insert the unit into the panel cutout and secure with four (4) #6-32 screws (provided).



3.6 INSTALLATION COMPLETION

After installation of cabling and before installation of the equipment, ensure that power is applied only to the pins specified in the interconnect diagram.

Prior to operating the unit in the aircraft, verify the basic operation of the unit and conduct a standard leak check of the pitot/static system per the aircraft maintenance manual or industry practice. Verify the proper CID number is installed for the application.

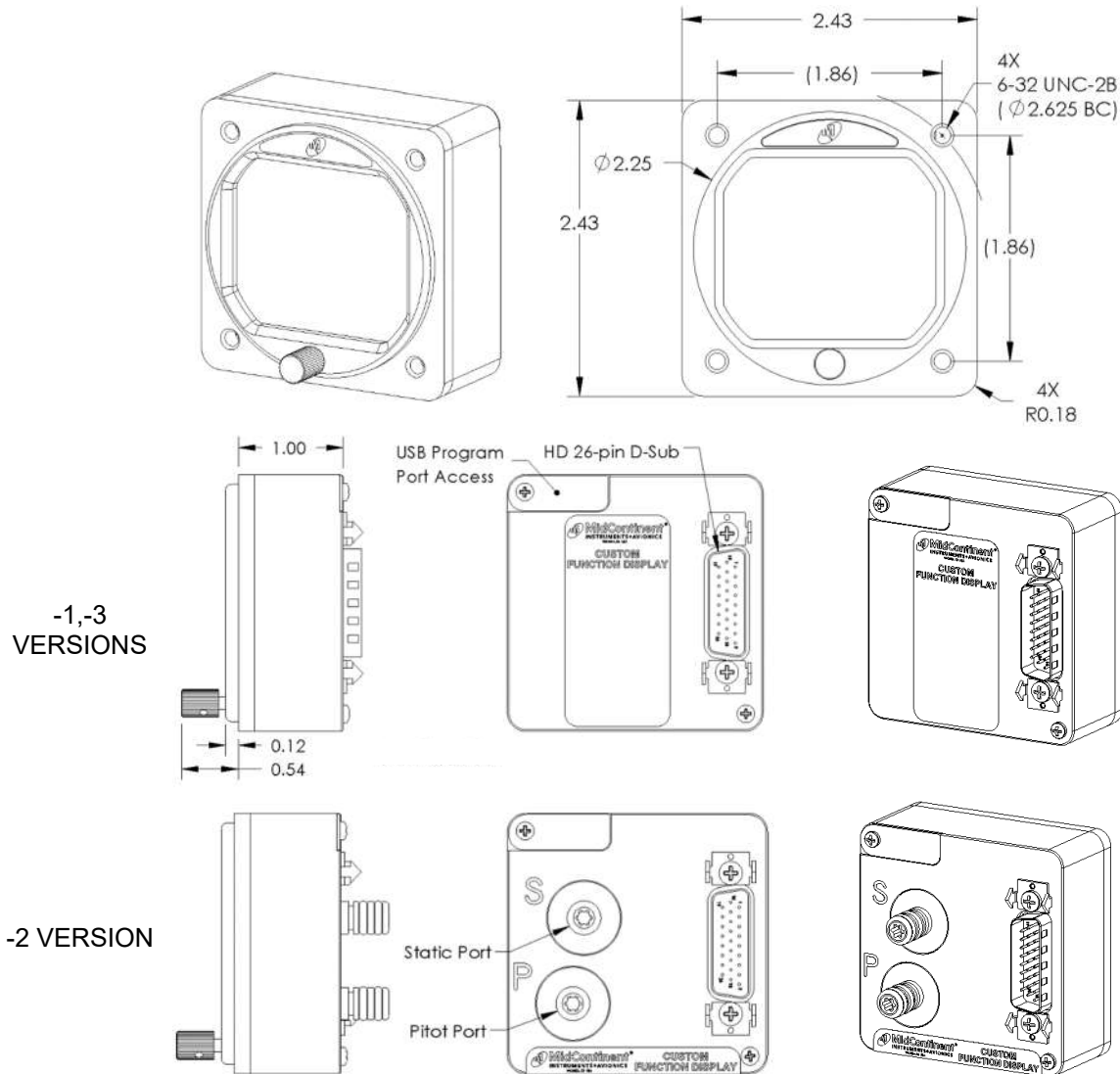


Figure 3.3 MD23 Outline Drawing

all dimensions apply to all versions

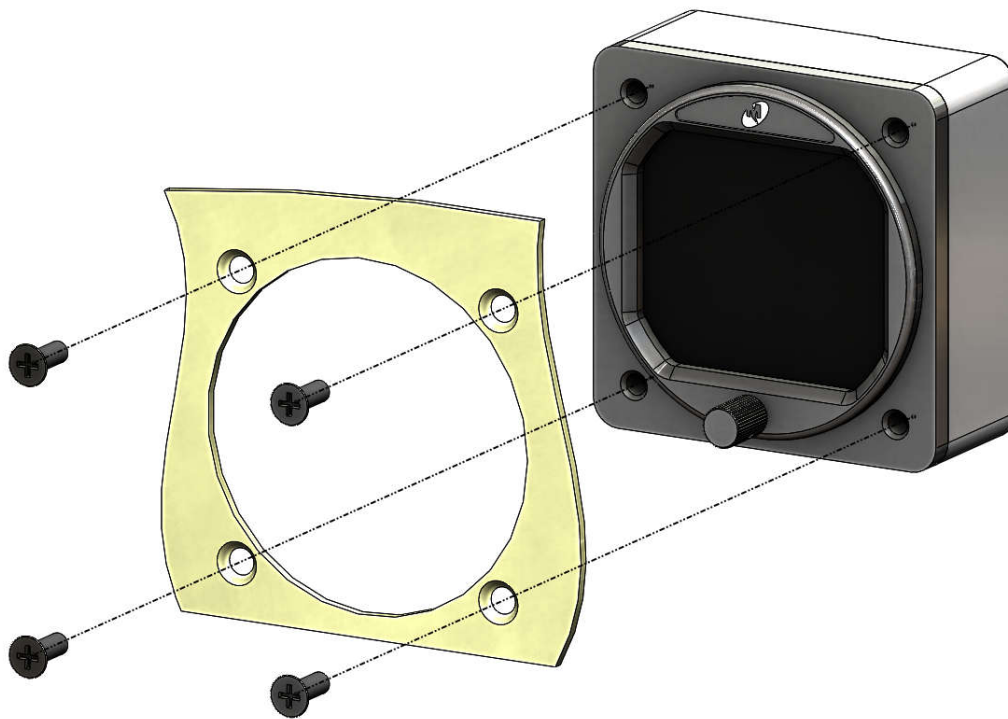
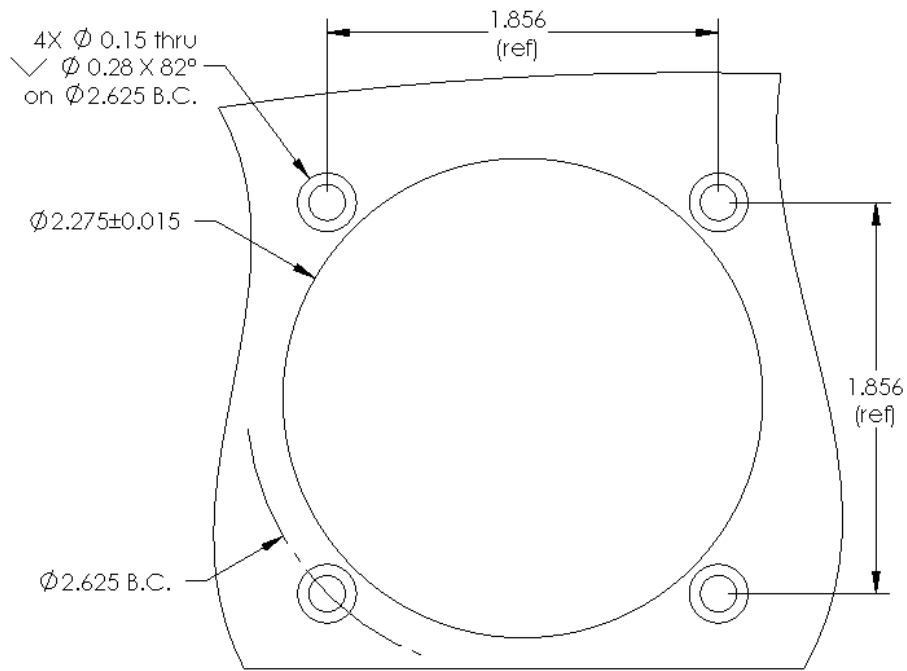


Figure 3.4 Panel Cutout



SECTION 4 OPERATION

IMPORTANT: READ THIS ENTIRE SECTION PRIOR TO OPERATING THE UNIT IN FLIGHT!

The MD23 FLEX Custom Function Display is a unique new type of avionics equipment with a Patent Pending software concept. It utilizes a highly capable and certified hardware and software platform that can be customized to receive, output, and display a wide array of information. Because FLEX can become almost anything, this section is designed to explain the functional capabilities, standard operation, and configurable defaults. Operational details of specific custom applications are provided separately as a User Guide that serves as a compliment to this manual.

4.1 GENERAL FUNCTION

4.1.1 CUSTOM INSTRUMENT DEFINITION (CID)

The Custom Instrument Definition, or CID, is a data file that describes the definition of the inputs, outputs, and graphical display for a specific application. The CID utilizes the certified functions of the MD23 and provides settings and variables to parameterize them to meet the requirements as requested.

The CID is provided as a single file that can be loaded onto the MD23 through the USB Type A data port on the rear of the unit. Each unique CID file is assigned an identification number and revision – typically in the format of 1###X, where # is a three-digit number and X is the revision, starting with “A”. The currently loaded CID version can be found on the startup screen during Pre-Flight Mode and in the Options Menu on the Info screen during Flight Mode.

Contact Mid-Continent Instruments and Avionics to inquire about the purchase and creation of a CID file to meet your specific application requirements.

4.1.2 SYSTEM NAVIGATION

All standard MD23 units have the same basic system structure. The system navigation map in the figure below demonstrates the basic functions and relationships between the various modes and menus. The user interface on how to maneuver between modes and menus is described in Section 4.2. The details associated with each mode and menu can be found further in Section 4.3, 4.4, and 4.5. (Figure 4.1)

4.1.3 USB FUNCTION

The MD23 CFD includes a USB Type-A Programming Port connector on the rear of the unit that is used for loading unit software and CID files. This feature makes it easy and convenient to perform updates with any standard USB flash drive. The Programming Port is only accessible when not in flight and shall only be used by authorized personnel in accordance with the instructions found within this manual.

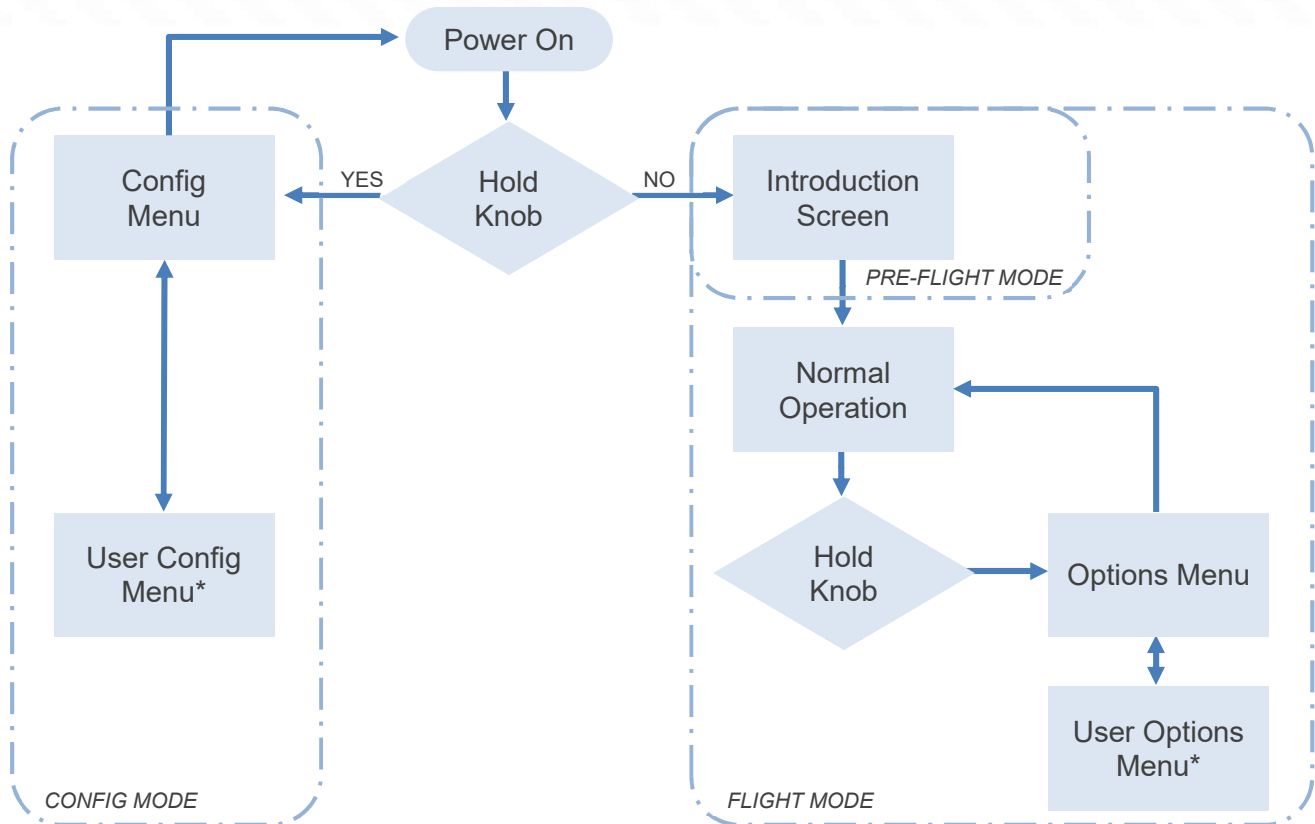


Figure 4.1 System Navigation Map

4.2 USER INTERFACE

The MD23 FLEXCFD is designed for simple, intuitive operation for ease of use for all custom applications. The Control Knob and Menu Operation are standard for all MD23 installations.

4.2.1 CONTROL KNOB

The central Control Knob is located at the bottom-center of the unit bezel. This is the only user interface on the unit.

The Control Knob has two functions: push and turn.

The knob provides 16-detents per revolution and typically increments whatever element it is controlling on the display one unit per detent. It can also be used to scroll between controllable elements, menu options, or pages.

The push function is typically used to select the highlighted option in a menu, on the display, and/or to enter and exit menus and control functions. The push function can also perform certain operations with a push-and-hold action as described herein.



4.2.2 MENU OPERATION

The menu parts are defined below:

Menu title	white text on a blue background at the top of each menu
Current item cursor	highlighted by a white box and green background
Selectable items	any selectable item on the menu is indicated with white text
Unavailable items	information only / unavailable options are indicated with gray text

Menu operation throughout the MD23 is simple and intuitive:

Turning the Control Knob will scroll the cursor over the available options within each menu. For items that can be changed without opening another page, the currently set value is displayed in gray directly to the right of each setting. Pressing the Control Knob for one of these items will make its options available 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 become immediately active and be saved in memory, regardless of whether the EXIT command is selected or it times out and automatically reverts to the active display.

4.3 PRE-FLIGHT MODE

In Pre-flight Mode, power is applied to the unit and the introduction screen appears during startup. The startup screen will display the manufacturer’s logo, model name and number, unit software version and CID version. It may also include additional graphics (such as a logo) or other information specific to the custom application.

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, an internal test to verify software and memory, and a check that the loaded CID file is valid. Inputs and outputs are not enabled during Pre-flight Mode.

The introduction screen will be displayed for approximately five (5) seconds and will transition to Flight Mode when complete. (Figure 4.2)

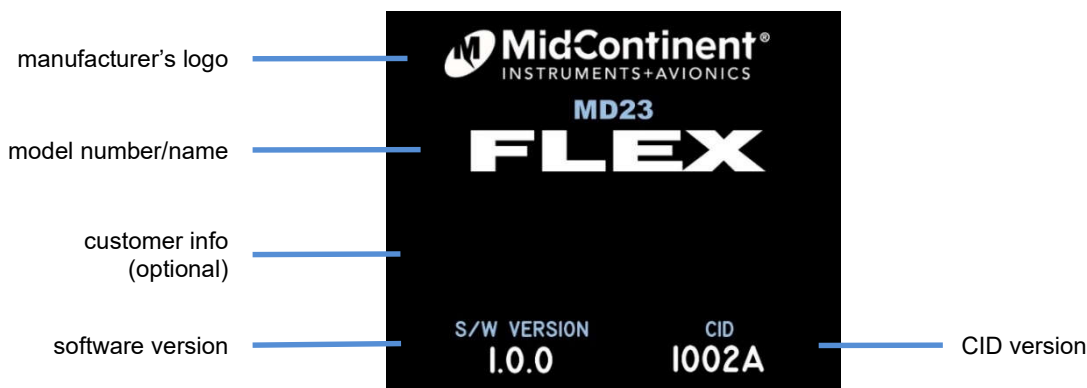


Figure 4.2 Pre-Flight Mode

4.4 FLIGHT MODE

In Flight Mode, the unit operates normally according to the function of the CID and displays the primary graphical presentation. Operational details of specific custom applications are provided separately as a User Guide that serves as a compliment to this manual. The Options Menu, with manual brightness adjustment and the User Options Menu, is accessible in Flight Mode.

4.4.1 OPTIONS MENU

While in Flight Mode, the Options Menu can be accessed at any time with a press-and-hold of the Control Knob for approximately three (3) seconds. The Options Menu offers selections that are available during flight but do not affect the aircraft specific configuration of the unit (these must be set in Configuration Mode by authorized personnel during installation and/or maintenance).

The Options Menu contains up to four standard options: Brightness, User Options, Info, and Exit. Any setting changed when navigating within the Option Menu or sub-menus will become active and saved to memory immediately upon selection. (Figure 4.3)



Figure 4.3 Options Menu Example



4.4.1.1 BRIGHTNESS

The display brightness can be controlled with either an external voltage or automatically using the integrated photocell. See Section 4.4 for further details. The Brightness feature in the Options Menu allows the user to manually adjust or offset the display brightness up or down regardless of the current level set by the External or Internal (automatic) brightness control method.

The Brightness adjust bar has the following elements: (Figure 4.4)

- Full Box: 0-100% brightness range
- Left Marker: Minimum brightness*
- Center Marker: Current unadjusted brightness level;
per the external input or photocell response, as configured
- Right Marker: Maximum brightness*
- Green bar: Current brightness per manual adjustment/offset

* as determined by the Dimming Curve in Configuration Mode



Figure 4.4 Manual Brightness Adjustment

After selecting the Brightness menu option, the Brightness adjust bar will appear. Turning the Control Knob will adjust/offset the display brightness (green bar) above or below the current brightness level (center marker). Once set, the brightness will continue to be controlled up or down with the preset control method, but with the adjusted offset applied. At no time can the brightness exceed the minimum or maximum values programmed into the Dimming Curve within Configuration Mode, regardless of the manual adjustment. The manual brightness adjustment will be saved into memory, even after a power cycle.

Pressing the Control Knob will revert to the active display. Inactivity for approximately five (5) seconds will also revert to the active display.

4.4.1.2 USER OPTIONS

The User Options menu is only available if the specific design of the loaded CID includes it. This menu will include user selectable options that can be changed by the pilot or crew during Flight Mode. See the applicable User Guide of the loaded CID for specific details.

4.4.1.3 INFO

While in Flight Mode, the Info menu is available to the pilot or cockpit crewmembers. It offers read-only information regarding the current software version and CID version. Pressing the Control Knob will revert to the active display. (Figure 4.5)



Figure 4.5 Info Menu

4.4.1.4 EXIT

The Exit action allows the user to manually close the Options Menu and return to the active display. There are no selectable options. The Options Menu or any function within it will also close automatically after five (5) seconds of inactivity and return to the active display.



4.5 CONFIGURATION MODE

Configuration Mode is used by the installer to configure aircraft specific requirements that are not accessible in flight. This includes critical flight parameters that contribute to the safe and certified operation of the unit and the aircraft as well as user preferences. Several safeguards are in place to prevent a user from ever accessing the Configuration Mode while in flight. Only authorized installers and trained personnel should access the Configuration Mode during initial installation or during maintenance, adjustments, and updates.

Enter the Configuration Mode by pressing and holding the Control Knob while powering up the unit. Continue to hold the Control Knob until the Configuration Menu appears.

The Configuration Menu contains up to four standard options: Configure Dimming, Update, User Configuration, and Exit. (Figure 4.6)

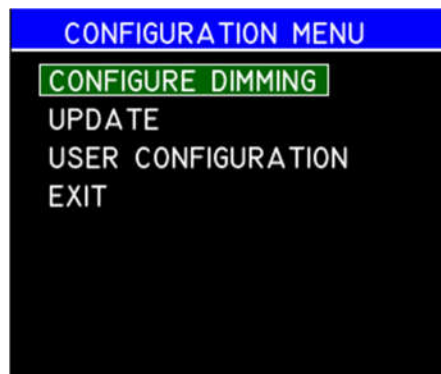


Figure 4.6 Configuration Menu

4.5.1 DIMMING CONFIGURATION

Within the Dimming Configuration Menu, there are two options: Dimming Control and Dimming Curve. The EXIT selection will revert to the Configuration Menu. (Figure 4.7)

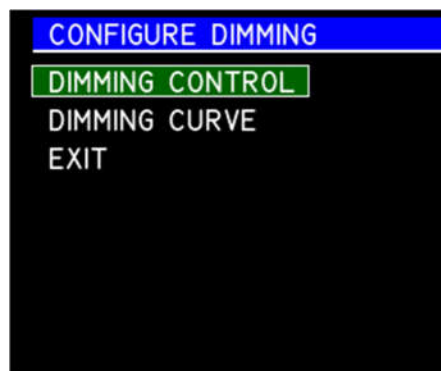


Figure 4.7 Configure Dimming

4.5.1.1 DIMMING CONTROL

The Dimming Control setting allows the installer to select the source of dimming control. It can be an “EXTERNAL” source, typically the aircraft’s adjustable lighting bus, or it can use the integrated photocell built into the unit (“INTERNAL” option) which senses the ambient light conditions and adjusts the display brightness/dimming automatically. If an external source is to be used, the EXT 5V, EXT 14V, and EXT 28V options represent the input voltage range the unit will accept (0-5VDC, 0-14VDC, and 0-28VDC, respectively). This feature is provided for maximum installation flexibility and control for the pilot. (Figure 4.8)

Selecting any option will save that setting and revert to the Dimming Configuration Menu.

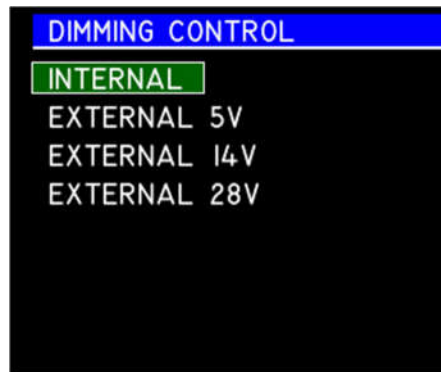


Figure 4.8 Dimming Control



4.5.1.2 DIMMING CURVE

The Dimming Curve feature allows the installer to customize the response to the Dimming Control input, whether Internal or External, over its range of operation.

To do this, a desired brightness can be assigned for multiple points across the input range to produce a unique dimming scheme that most closely matches the other instruments in the panel and the pilot's preferences. This feature is provided for maximum installation flexibility.

NOTE: When new, the display is daylight-visible at approximately 75% brightness. It may not be necessary to set the dimming curve to 100%. Setting the high-brightness side of the dimming curve to less than 100% will extend the life of the LED backlight and provide margin to increase brightness in the future as needed.

The dimming curve is comprised of the following elements: (Figure 4.9)

- X-axis: represents the input range from minimum to maximum (either external voltage or ambient light, whichever is selected in Dimming Control).
- Blue vertical line: represent the current Dimming Control input value
- Y-axis: represents brightness of the display
- Blue horizontal line: represent the current display brightness. The crossing of the two blue lines will track along the dimming curve in real time as the input changes
- Dimming Points: small squares that represent six adjustable values of brightness across the input range. When selected and able to adjust, each point will turn green.
- Dimming Point Value: the numeric value (0-100 percent) of each of the 6 (or 7) dimming points are listed along the vertical axis for reference. Each one turns green as its corresponding point is active.
- White vertical line: For units with an External dimming control, a vertical white line is provided as the minimum voltage threshold. When the input is below this value, the unit will switch to photocell/Internal control and track a dimming curve along a straight line from the minimum set point to the maximum set point. This is provided so that the unit will default to a dim or bright setting appropriately if the dimming input goes too low, is turned off, or fails open.

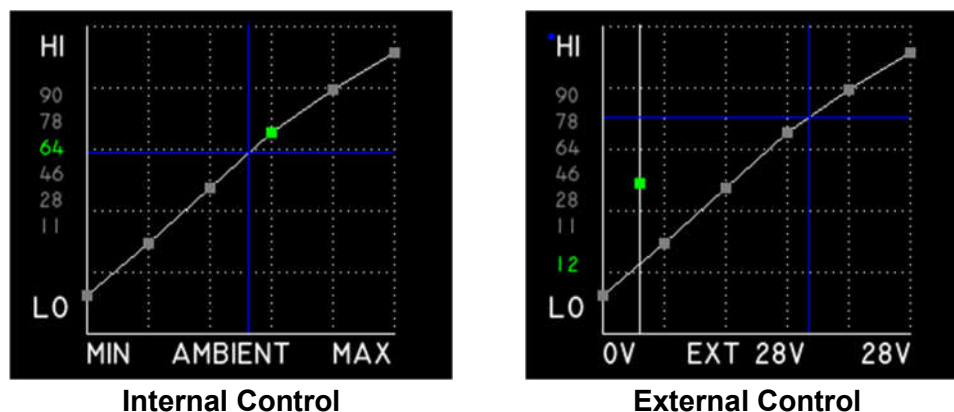


Figure 4.9 Dimming Curve



Dimming Curve (continued)

The best method for setting the dimming curve is to simulate the range of lighting conditions while adjusting the display brightness. This is best done after installation, in the actual aircraft instrument panel, but can be simulated in various environments.

Dimming Curve Programming Process: (after selecting the Dimming Curve menu item)

1. Provide a brightness input to the unit, starting with the lowest expected input
 - a. If using an external input, use a zero volt input (or off).
 - b. If using automatic dimming (“Internal”), this is like a nighttime cockpit
2. Adjust the Control Knob to increase or decrease the brightness of the display to the desired level at that lighting condition (the point will move up or down, respectively). The numeric value of the dimming point is displayed in green left of the vertical axis.
3. When satisfied, press the Control Knob.
4. The next point will be highlighted green.
5. Repeat Steps 1-4 for each point on the graph. For each point, change the lighting input (indicated by the vertical blue line) to approximately match the highlighted point on the graph. Then adjust up or down.
6. For units set to an External input, the final dimming point is the minimum input threshold. It is represented by a vertical white line. Turning the Control Knob will move it left or right. When satisfied, press the Control Knob.
7. After the last dimming set point, pressing the Control Knob will exit the Dimming Curve page and return to the Configure Dimming menu.



4.5.2 UPDATE

The Update action initiates a search on an USB flash drive installed in the USB Program Port on the rear of the unit. (Figure 3.3) Step-by-step instructions on performing an update can be found in Section 5.

The unit will search for a standard file name on the USB flash drive that represents either the unit operating software or a CID file. If a USB device is not detected, a valid update file is not found, or the update file already matches the loaded data, an error message will appear. Acknowledgement by pressing the Control Knob will revert to the Configuration Menu. If a valid update file is detected, an update progress screen will appear. If both a system software update and CID update are found on the USB drive, the unit will update both, in sequence. (Figure 4.10) If successful, the unit will reboot automatically and return to the Pre-flight Mode, followed by entering Flight Mode. The new unit software and CID versions can be verified on the introduction screen or in the Info page from the Options Menu.



Figure 4.10 Update Function

4.5.3 USER CONFIGURATION

The User Configuration Menu provides selectable options associated with the loaded CID that are intended to be configured during installation. It is only available and active if the specific design of the CID includes it (and gray/unavailable otherwise). See the applicable User Guide associated with the loaded CID for specific details. (Figure 4.11)

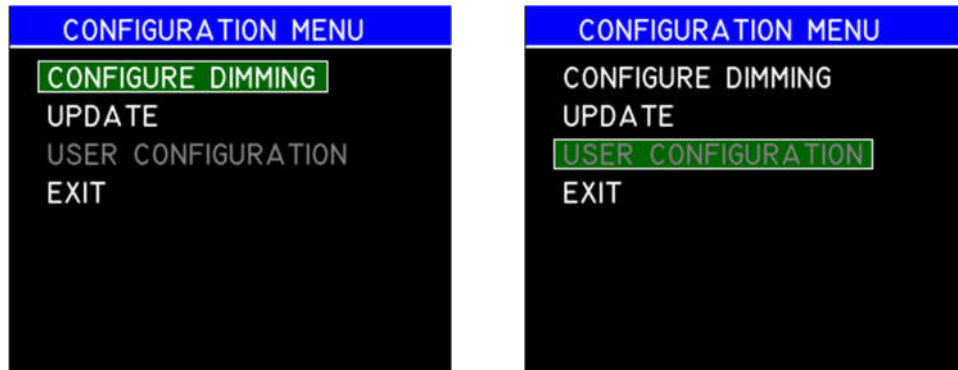


Figure 4.11 User Configuration

4.5.4 EXIT

The Exit action allows the user to manually exit Configuration Mode, reboot the unit, and return to Pre-Flight Mode, followed by Flight Mode. There are no further selectable options. Power cycling the unit will also exit Configuration Mode.



SECTION 5 CONFORMANCE

5.1 INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

5.1.1 PRESSURE SYSTEM VERIFICATION

If the MD23 is configured to accept and display data associated with a static, pitot, or other pressure source, some aviation regulations may apply to inspect and test for accuracy on a regular basis. (for example, 14 CFR §91.411 for altimeters) If the CID for the MD23 is designed specifically for this or similar function, identify appropriate maintenance in the pilot operating handbook or flight manual supplement. Corresponding actions of how to perform the appropriate maintenance can be found in the applicable User Guide associated with the loaded CID.

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 identified in the specific User Guide associated with the loaded CID.

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, there are no repairable parts or processes available to be performed in the field.

5.1.3 SOFTWARE UPDATES

Mid-Continent Instruments and Avionics will have, on occasion, the need to update the software of the MD23 to maintain, improve and/or enhance functionality or performance of the base operating software. Unless otherwise noted, these changes will not alter the performance of the CID, either present on the unit or loaded at a future time.

Software updates are typically communicated to the public via Service Bulletins issued by Mid-Continent Instruments and Avionics and can be found on the company website, www.mcico.com.

Using the easy field-upgrade process (section 4.5.2), the unit does not have to be returned to the factory. Below are general instructions on how to prepare the files for updating. Please read through all instructions before beginning.



PREPARATION

1. Download the approved software and/or CID file to the root directory of a USB flash drive. The drive must be formatted as FAT or FAT32, up to a maximum size of 32GB. The downloaded filename may be changed, but must retain the original extension (for example “.muf” or “.cid”).
2. Ensure that the unit is powered off.
3. Remove the unit from the instrument panel.
 - a. Remove the four mounting screws attaching the bezel of the unit to the panel.
 - b. Position the unit such that the rear face is accessible.

NOTE: This can be done without removing the electrical connector or pneumatic connections if the proper service lengths were applied during installation.

4. Loosen the screw of the USB access cover on the rear of the unit until the USB port is accessible.

LOAD SOFTWARE

1. Insert the USB flash drive with the approved file(s) into the USB port.
2. Enter the Configuration Mode by press and holding the Control Knob on the faceplate while applying external power to the unit.
3. Turn the Control Knob to highlight the UPDATE option.
4. Press the Control Knob to initiate the software load.

If the update is unsuccessful, an error message will display. Should this occur, remove the USB flash drive, power down the unit and try again. If error recurs, put the files on a different USB flash drive and try again. If the error message persists, contact Mid-Continent Instruments and Avionics.

5. When the software load is complete, the unit will automatically reboot.
6. When the unit reboots into Pre-Flight Mode, verify the correct software and CID version on the introduction screen.
 - a. The software and CID versions can also be verified on the Info screen within the Options Menu.

RETURN TO SERVICE

1. Remove the USB flash drive.
2. Close the USB Access Cover and tighten the screw in place.
3. Re-install the unit into the instrument panel in reverse order as described in PREPARATION Step 3 (above).

