

# **MX20**

## **Multi-Function Display**

# Installation Manual

May 2005  
560-1025-09 Rev C



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## HISTORY OF REVISIONS

Part No.	Revision	Date	Description
	--	11/1/99	Initial Release.
560-1025-01	--	11/11/99	Updated installation package contents and equipment mounting information.
560-1025-02	--	1/17/00	Added the MX20 configuration procedure, expanded post installation checkout procedures, added Appendix A.
560-1025-02	a	4/3/00	Clarified unit installation position. Corrected wiring diagram. Incorporated changes for software version 1.2.
560-1025-02	b	7/25/00	Incorporated changes for software version 2.0.
560-1025-02	c	10/3/00	Added mounting tube considerations
560-1025-03	--	12/1/00	Changes for class and category in environmental qualifications and new ADS-B messages.
560-1025-04	--	7/18/01	Changes to mounting tube and environmental qualifications for helicopters.
560-1025-05	--	4/12/02	Added I/O board option and SW to support traffic and radar.
560-1025-05	a	6/12/02	Added JTSO
560-1025-06	--	11/13/02	Added landmark support for the TAWS8000
560-1025-07	--	6/18/03	Changes for SW Ver 5.0. Radar and WSI.
560-1025-07	a	9/9/03	Changed UPS Aviation Technologies and logo to Garmin AT.
560-1025-07	b	1/5/04	SW Version 5.2. ART2000/2100 clarifications. Added support for LED backlighting.
560-1025-08	-	5/1/04	SW Version 5.3. GDL90 interface and WSI Canadian weather added.
560-1025-09	-	10/27/04	SW Version 5.5. Added XM Satellite Weather and Audio information as well as support for Honeywell KMH 820 IHAS.
560-1025-09	A	2/10/05	Added information about limiting number of FIS sources. Added supported radar functions and sensors. Added manufacturer's radar part numbers.
560-1025-09	B	4/22/05	SW Version 5.6. MX20 may be one of multiple radar display devices. GDL 90 control features may be enabled or disabled. Update EULA.
560-1025-09	C	5/25/05	Corrected pinout information for Figure 2-18.

## ORDERING INFORMATION

To receive additional copies of this publication, order part # **560-1025-09 Rev C**, *MX20 Multi-Function Display Installation Manual*.

## OTHER PUBLICATIONS

MX20 Pilot's Guide, P/N 560-1026-( )  
 MX20 Quick Reference Guide, P/N 561-0263-( )  
 GX50/60 Installation Manual, P/N 560-0959-( )  
 WX-500 Installation Manual, Goodrich Avionics P/N 009-11500-001  
 SKY899 Installation Manual, Goodrich Avionics P/N 009-11900-001  
 ART2000 Installation Manual, Allied Signal P/N 006-00643-0004  
 9900B Installation Manual, Ryan TCAD P/N 32-2301  
 9900BX Installation Manual, Ryan TCAD P/N 32-2351  
 WSI InFlight AV-200 Installation Manual, WSI P/N 305427-00  
 GTX330, GTX330D Transponder Manual, Garmin P/N 190-00207-02 Rev. A  
 GDL90 Installation Manual, Garmin AT P/N 560-1049-( ) Rev –  
 GDL 69/69A Installation Manual, Garmin P/N 190-00355-02

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# 1 Introduction

## 1.1 About This Manual

This manual describes the installation of the MX20 Multi-Function Display. It is intended for use by persons certified by the Federal Aviation Administration (FAA) to install aircraft devices. It includes installation and checkout procedures for the MX20 to standards described in 14CFR Part 43. This installation manual applies to MX20 part numbers: 430-0270-0( ), 430-0270-5( ), 430-0270-6( ), and 430-0270-7( ).

- Section 1** Provides an **Introduction** to the MX20. TSO certification information is also included in this section.
- Section 2** Includes **Installation** and **Checkout** procedures.
- Section 3** Includes complete **Specifications**.
- Section 4** Includes **Limitations** information.
- Section 5** Includes **Troubleshooting** information.
- Section 6** Includes **Continued Airworthiness Instructions** requirements.
- Section 7** Includes the **Environmental Qualification Form**.
- Appendix A** Includes **I/O Specifications**.
- Appendix B** Includes **Equipment Compatibility**.

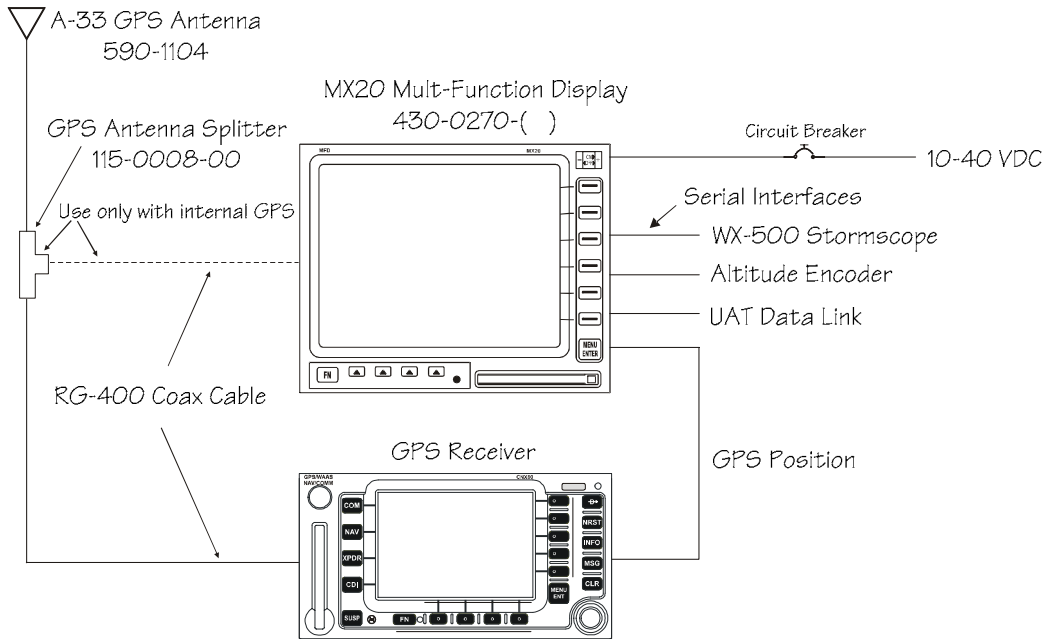
## 1.2 System Description

The MX20 is a multi-function display capable of displaying moving maps, terrain awareness, obstructions, and VFR/IFR charting functions. An optional UAT data link provides ADS-B traffic, FIS-B and TIS-B information. Interfacing to the WX-500 provides lightning strike information on the display. Interfacing to the Garmin AT GDL 69 or WSI Inflight sensor may provide NEXRAD images, graphic and text METARs, graphic and text TAFs, EchoTops, Sigmet, Airmet, and Temporary Flight Restriction (TFR), and other information, depending on the selected subscription. Interfacing to the Garmin AT GDL 69A provides XM Satellite Radio audio entertainment (with subscription) in addition to the information available with the GDL 69.

The MX20 I/O option includes additional interface capabilities that allow connection to the ARINC 453 bus for the display of radar, ARINC 429 support for Goodrich SkyWatch interfaces, RS-232 support for Ryan TCAD, Landmark TAWS8000, and the Honeywell KGP560 and KMH 820 IHAS. The MX20 with software versions V5.5 and below is intended to be the sole display device for radar sensors. Using additional display devices may not display the intended information. The MX20 with software version V5.6 may be one of multiple display devices for radar sensors.

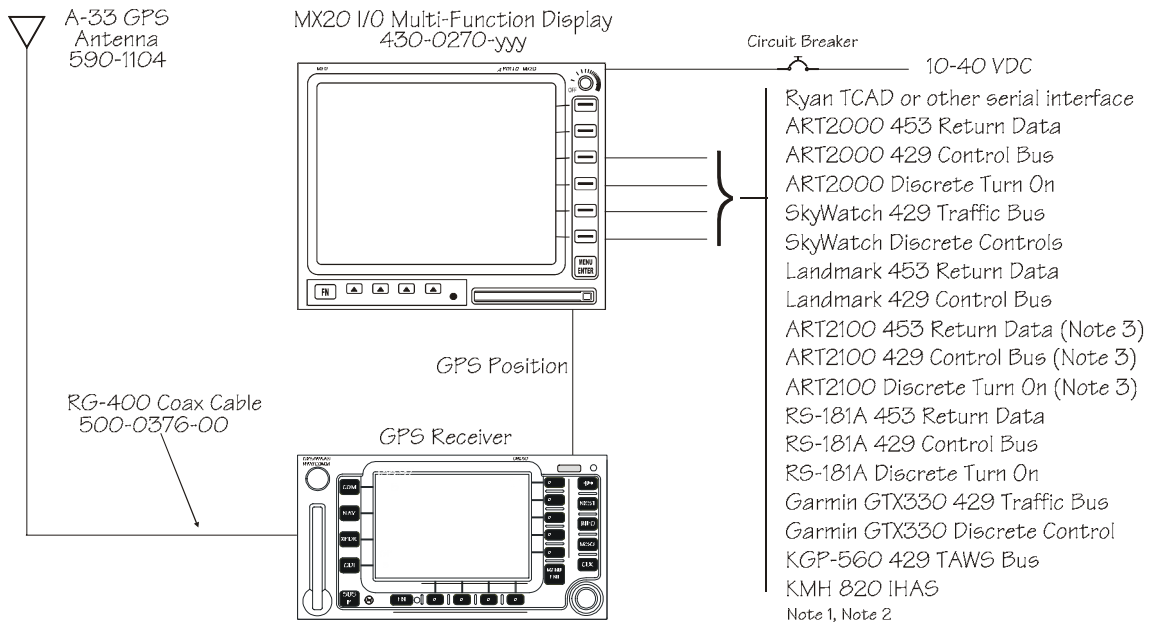
The MX20 must be connected to an external GPS navigation source, such as the Garmin AT GX or CNX-series (or GNS 480), to provide route and flight plan information. The MX20 must be connected to an external serial altitude source to provide terrain awareness information.

Interfacing to a Garmin GTX330 Mode S Transponder provides TIS-A traffic information.



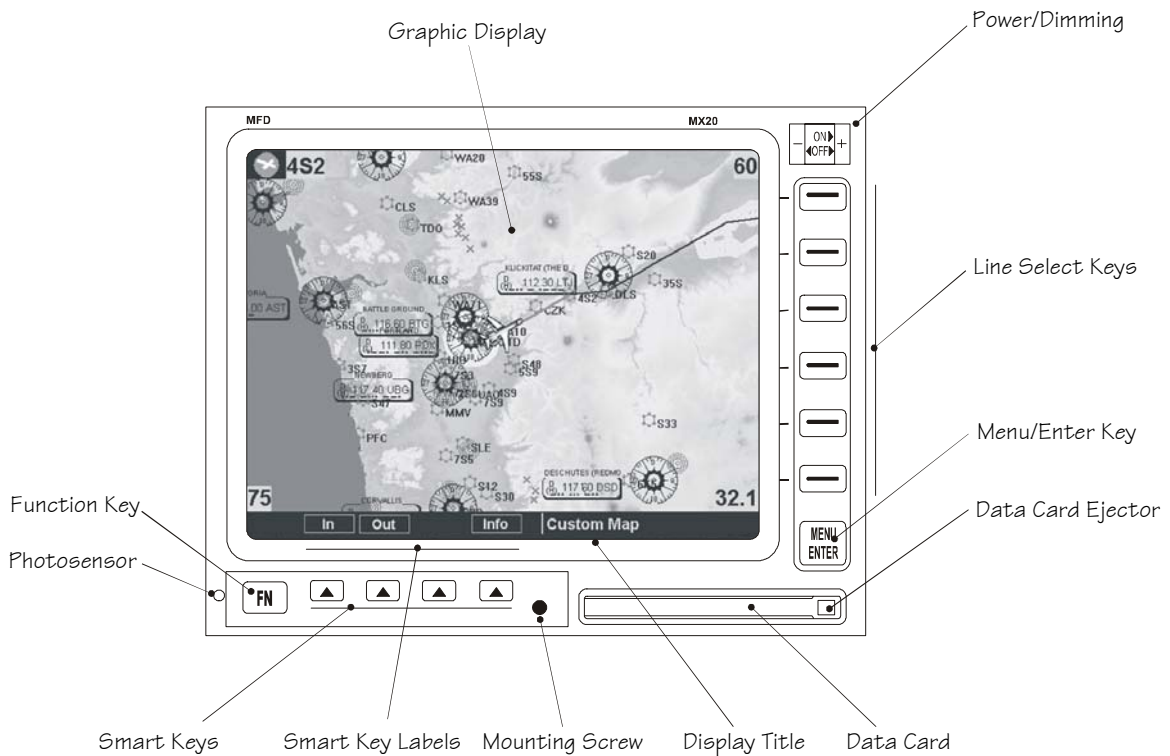
**Figure 1-1. Example of a MX20 System Block Diagram**

The MX20 display is also available with an internal GPS. The internal GPS position source permits a Navigation Uncertainty Category (NUC) value to be calculated and transmitted for ADS-B broadcast via the legacy UAT. The MX20 internal GPS data is ignored by the GDL 90 UAT since the GDL 90 UAT has an internal GPS receiver to generate the same data. Legacy UATs are those installed in original Capstone-equipped aircraft. The GDL 90 UAT is the next generation UAT data link radio. MX20 software version V5.6 provides an installation configuration parameter to enable or disable the GDL 90 UAT control functions. The MX20 I/O model is not available with the optional GPS engine.



Note 1: All other serial interfaces of the standard MX20 are supported, but are not shown for clarity.  
 Note 2: Only one traffic source may be connected to the MX20 I/O.  
 Note 3: The ART2100 is supported when configured to emulate an ART2000.

**Figure 1-2. Example of a MX20 I/O System Block Diagram**



**Figure 1-3. MX20 Front Panel Description**

**NOTE**  
 Earlier versions of the MX20 have a rotary knob to control power and dimming functions.

## 1.3 Regulatory Compliance

The MX20 is designed and tested to meet the following TSO/JTSOs when connected to the appropriate equipment:

- FAA TSO-C63c/JTSO 2C63c      Airborne Weather Radar
- FAA TSO-C110a/JTSO-C110a      Passive Thunderstorm Detection (Goodrich WX500)
- FAA TSO-C113/JTSO-C113      Multi-purpose Electronic Display
- FAA TSO-C118/JTSO-C118      Traffic Alert and Collision Avoidance (TCAS I)
- FAA TSO-C147      Traffic Advisory System (TAS)
- FAA TSO-C151a      Terrain Awareness and Warning System (TAWS)

The MX20 software is designed and tested to RTCA/DO-178B, levels C and D, and ED-12B, levels C and D.

**NOTE**

Unauthorized changes or modifications to the MX20 will void the compliance to required regulatory agencies and authorization for continued equipment usage.

"The conditions and tests required for TSO/JTSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO/JTSO standards. If not within the TSO standards, the article may be installed only if the applicant documents further evaluation for an acceptable installation and it is approved by the Administrator. The JTSO article may be installed only if the installation is performed in accordance with Part 43 or the applicable airworthiness requirements."

## 1.4 Unpacking the Equipment

Carefully unpack the equipment. Visually inspect the package contents for any evidence of shipping damage. Retain all shipping containers and packaging material in case reshipment is necessary.

## 1.5 Package Contents

As shipped from the Garmin AT factory, the MX20 Installation package includes most necessary items for installation other than supplies normally available at the installation shop. The items included in the package are listed in Table 1-1.

**Table 1-1. Installation Package Contents**

Part #	Description	Quantity w/o GPS 424-0751	Quantity w/ GPS	Quantity w/ I/O 424-0753
Unit				
430-0270-0( )	MX20 Multifunction Display with GPS		1	
430-0270-5( )	MX20 Multifunction Display without GPS	1		
430-0270-6( )	MX20 I/O Traffic Multifunction Display			1
430-0270-7( )	MX20 I/O Traffic/Radar Multifunction Display			1
	<b>MX20 Installation Kit</b>			
115-0007-00	GPS 1575 MHz 2:1 Splitter		1	
162-1008	Right Angle Coax Plug		1	
162-1060	TNC Connector		3	
162-1577*	37-Pin D-Sub	1	1	1
202-0001	Cable Tie	4	4	4
204-0037	Edge Grommet	6"	6"	6"
204-2100	Shoulder Bushing		2	
220-0637	6-32 Wing Nut	1	1	1
240-0615	#6 Washer	2	2	2
224-0404	4-40 X 1/4 SS Flat Head Phillips Machine Screw	2	2	2
245-0027*	Crimp Contact For D-Sub, 20 To 24 AWG Wire	30	30	40
310-0429-( )	MFD Mounting Tube	1	1	1
998-0048	3/32" Hex Driver	1	1	1
	<b>MX20 I/O Installation Kit</b>			
160-0138	62-Pin D-Sub, High Density			1
245-0059	Crimp Contact For High Density D-Sub, 22 To 30 AWG Wire			20
564-0076-0( )	<b>Manual Kit</b>	1	1	1
560-1025-( )	MX20 Installation Manual	1	1	1
560-1026-( )	MX20 Pilot's Guide	1	1	1
561-0263	MX20 Quick Reference Guide	1	1	1
564-0078-0( )	STC Kit (AFM & MDL)	1	1	1
<b>Notes:</b>				
* Pin has a barrel over the contact. Use ITT Cannon tools.				

#### Other Required Materials

The MX20 equipment is intended for use with standard aviation accessories. See Section 2.3.1 for a list of compatible equipment. The following items are required for the installation:

- Compatible position locating source, such as: GX50/55/60/65 GPS receiver, or CNX-series (or GNS 480) receiver
- Compatible Serial Altitude Encoder

## 1.6 Special Tools Required

### Crimp Tool

A crimp tool meeting MIL specification M22520/1-01 and a positioner/locator are required to ensure consistent, reliable crimp contact connections for the rear d-sub connectors. Examples of these tools are shown below:

For pin P/N 245-0027

ITT Cannon	Phone 714 261 5300
1851 E. Deere Ave.	Fax 714 575 8324
Santa Ana, CA 92705-6500	

Insertion tool:	ITT part # 274-7006-000 (Desc. CIET-20HD)
Regular-duty Crimp tool:	ITT part # 995-0001-585 (Desc. M22520/1-01)
Regular-duty Locator tool:	ITT part # 995-0001-244 (Desc. TH25)
Heavy-duty Crimp tool:	ITT part # 995-0001-584 (Desc. M22520/2-01)
Heavy-duty Locator tool:	ITT part # 995-0001-604 (Desc. M22520/2-08)

For pin P/N 245-0059 (High Density Connector – I/O Only)

Astro Tool Corp	Phone 503 642 9853
21615 SW TV Highway	Fax 503 591 7766
Beaverton, OR 97006	

Crimp tool:	Astro Tool part # 615708
Positioner:	Astro Tool part # 616356

## 1.7 License Requirements

There are no license requirements for the MX20.

## 1.8 Operating Instructions

The MX20 Pilot's Guide, Garmin AT P/N 560-1026-( ), covers operation and pilot interface. The MX20 Quick Reference Guide is P/N 561-0263-( ).



## 2 Installation

This section describes the installation of the MX20 including mounting, wiring, connections, and software configuration. A post-installation checkout procedure is included at the end of this section.

### 2.1 Pre-Installation Information

Always follow good avionics installation practices per FAA Advisory Circulars (AC) 43.13-1B, 43.13-2A, and AC 20-138, or later FAA approved revisions of these documents.

Follow the installation procedure in this section as it is presented for a successful installation. Read the entire section before beginning the procedure. Prior to installation, consider the structural integrity of the MX20 installation as defined in AC 43.13.2A, Chapter 1. Perform the post installation checkout before closing the work area in case problems occur.

Complete an electrical load analysis in accordance with AC 43.13-1B, Chapter 11, on the aircraft prior to starting modification to ensure aircraft has the ability to carry the MX20 load. Refer to Section 2.5.6 for the power consumption of each MX20 mode of operation (heater on). Document the results of the electrical load analysis on FAA Form 337.

### 2.2 Installation Overview

A successful installation should start with careful planning including determination of mounting location for the MX20, cable routing, and other required modifications. Once the mounting location has been determined, prepare the mounting frames for installation. It may be easier to complete the wiring harness and attach the connectors to the mounting frame before installing the mounting frame.

Carefully plan which external devices are to be connected to which MX20 ports observing the special characteristics of ports 3 and 4.

### 2.3 Installation Considerations

#### 2.3.1 External Sensors

External serial data sources intended for use with the MX20 should be checked for compatibility before installation. Devices from other manufacturers or unlisted models are supported if they adhere to the interface specifications provided in this manual. The list of supported devices is located in Section 3.1.10 of this manual.

When the MX20 is installed with external sensors, these sensors must be installed with manufacturer's data. This manual does not provide information for the installation of specific external sensors.

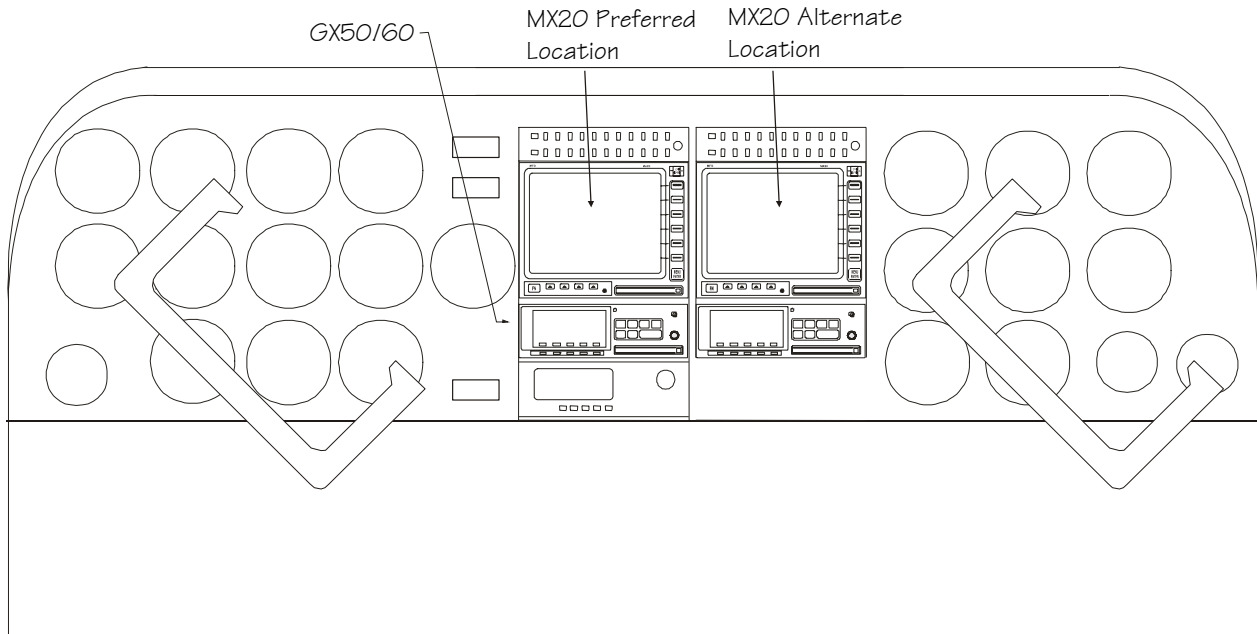
#### 2.3.2 Mounting Considerations

The MX20 is designed to mount in the avionics stack in the aircraft instrument panel within view and reach of the pilot. The MX20 must be located where the operator will have easy access to the controls and adequate viewing of the display. The preferred location would minimize pilot head movement when transitioning between looking outside of the flight deck and viewing and operating the MX20. Sample diagrams of typical cockpit front panel views of the MX20 are shown in Figure 2-1 and Figure 2-2.

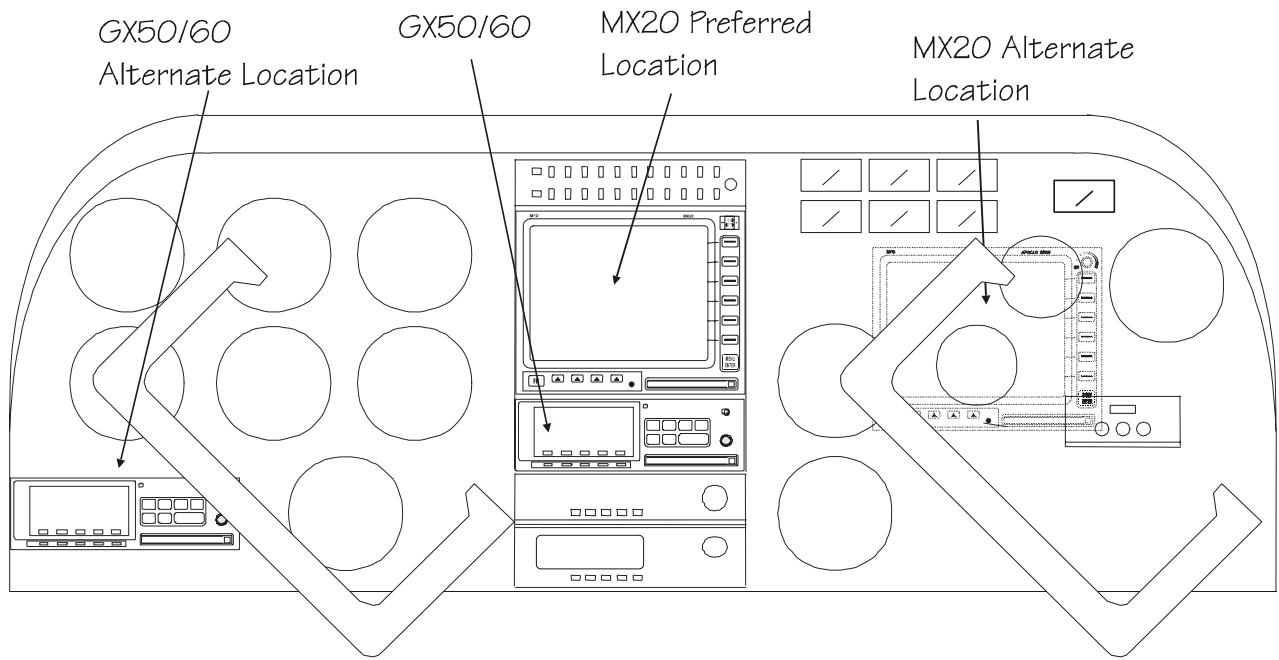
The standard package includes a mounting frame for ease of mounting, connections, and service of the unit. Allow an additional one-inch clearance to the rear of the mounting frame for connectors and cables. Mounting frame details are shown in Figure 2-3, Figure 2-4, Figure 2-5, and Figure 2-6. Use of mounting tube P/N 310-0429-01, or later FAA approved revision, is recommended for all installations and is required for helicopter installations.

The MX20 does not require external cooling. When mounting the MX20, leave a clearance of 1/8 to 1/4 inch between avionics to allow for air circulation.

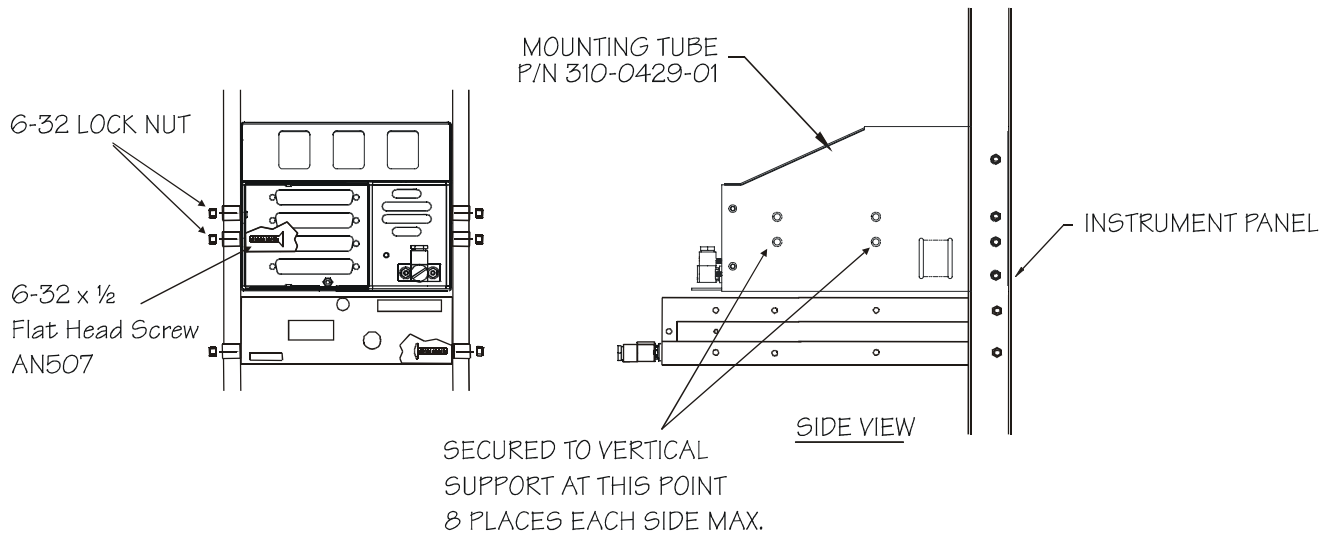
For installations where a stack is not already installed in the aircraft or the alternate mounting configuration depicted in Figure 2-4 is implemented, a separate structural approval is needed for installation of the stack. Any other alternate mounting configuration is beyond the scope of this STC.



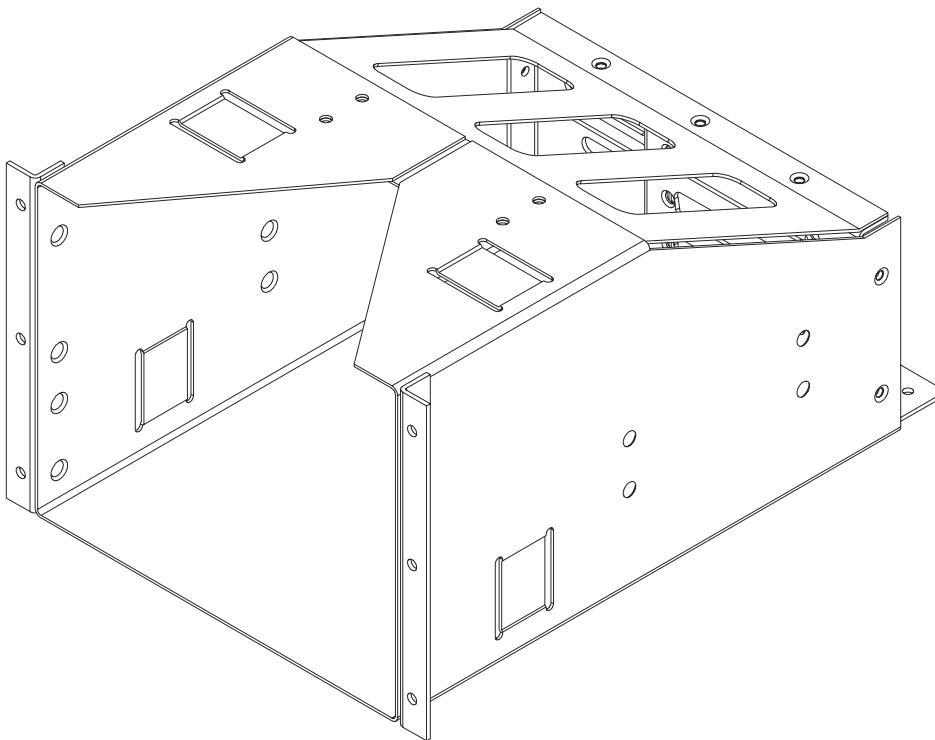
**Figure 2-1. Cockpit Panel Configuration for a Large Panel**



**Figure 2-2. Cockpit Panel Configuration for a Small Panel**



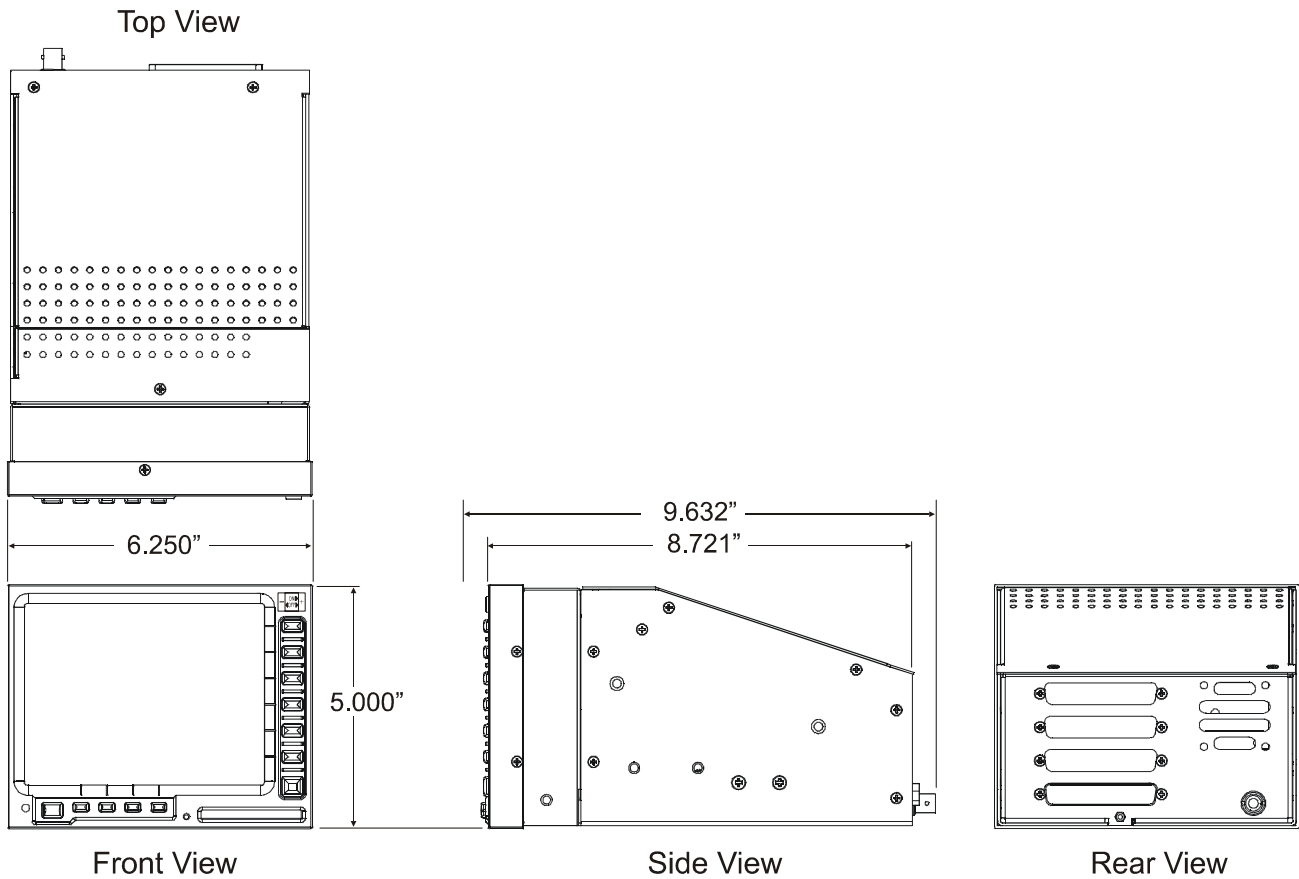
**Figure 2-3. Sample GX60 & MX20 Mounting**



**Figure 2-4. Alternate MX20 Mounting Configuration**

**NOTE**

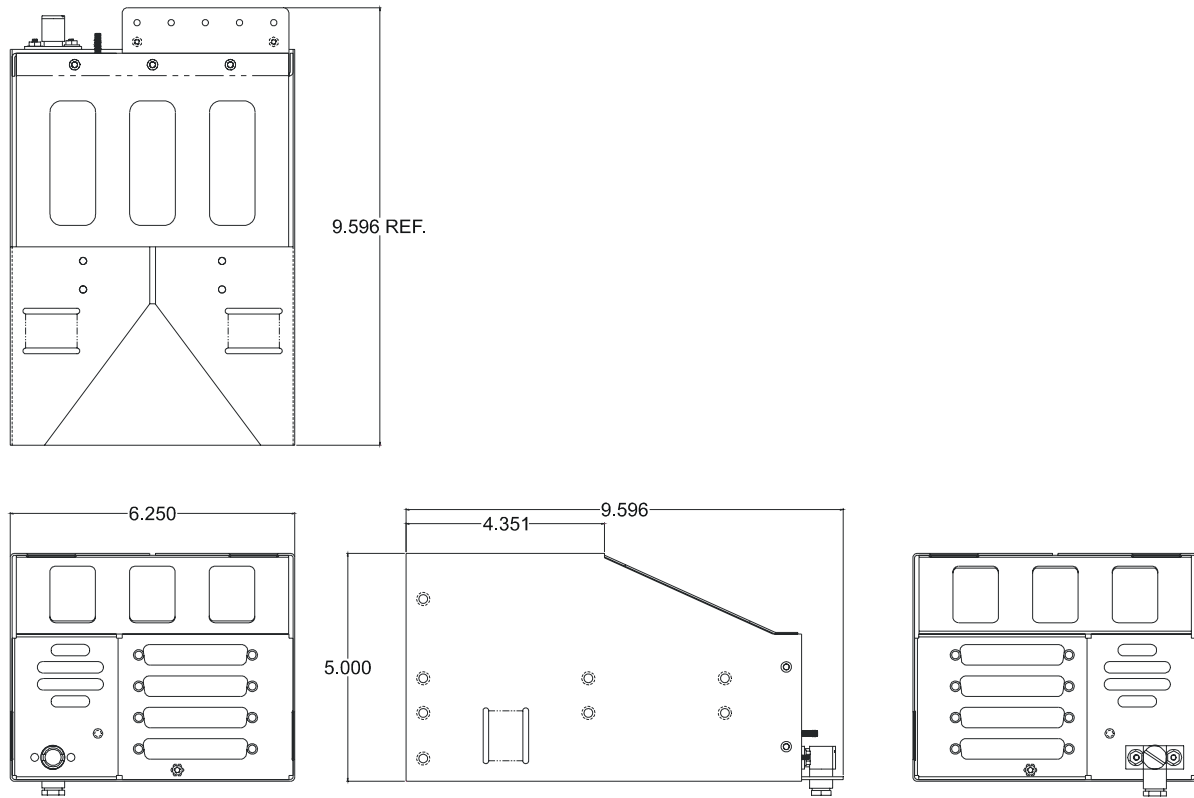
This configuration utilizes an angle bracket along each side of the mounting tube. The installer must consider the structural integrity of the installation as defined in AC43.13.2a Chapter 1.



**Figure 2-5. MX20 Unit Dimensions**

**NOTE**

Use of mounting tube P/N 310-0429-01, or later FAA approved revision, is recommended for all installations and is required for helicopter installations.



**Figure 2-6. MX20 Mounting Tube Assembly Dimensions**

**Note:** Use of mounting tube P/N 310-0429-01, or later FAA approved revision, is recommended for all installations and is required for helicopter installations.

### 2.3.3 Minimum System Configuration

The MX20 requires connections to the following equipment as a minimum, as appropriate for each unit:

- Power input
- Serial position input device (such as the GX60, CNX-series, GNS 480 or equivalent)
- Serial altitude encoder

The serial I/O requirements are located in Appendix A of this manual.

### 2.3.4 Air Circulation

No external cooling is required for the MX20. Newer units will have an internal fan installed. Previous units may be modified to include an internal fan, if desired. No special provisions are required during installation to accommodate the fan except to ensure the fan opening is not blocked.

### 2.3.5 Compass Safe Distance

After reconfiguring the avionics in the cockpit panel, if the MX20 is mounted less than seven inches from the compass, recalibrate the compass and make the necessary changes for noting correction data.

### 2.3.6 Viewing Angle

The MX20 shall be located such that the operator will have easy access to the controls and have adequate view of the display. The MX20 may be adequately viewed from the primary pilot's position when the following minimums are met:

Up:	20 degrees off pilot's eye center line
Down:	30 degrees off pilot's eye center line
Right:	50 degrees off pilot's eye center line
Left:	50 degrees off pilot's eye center line

## 2.4 Equipment Mounting

Once the cable assemblies have been made, attach each connector to the rear connector mounting plate and the mounting tube as illustrated in Figure 2-7. Route the wiring bundle as appropriate.

Use tie wraps to secure the cable to the rear connector plate to provide strain relief for the cable assembly as shown in View A of Figure 2-7. Connect the shield grounds directly to the grounding lug.

### Mounting Tube

Secure the mounting tube to the instrument panel structure using the sixteen screws. The AN507 6-32 screws have a 100° countersunk head. The mating holes in the instrument panel structure must also be countersunk to accept the screw head so that the screw head is flush with the inside surface of the mounting tube.

#### CAUTION

Failure to properly countersink the mounting holes will result in damage to the MX20. Mounting screw heads must not protrude into the mounting tube.

The mounting tube should be flush to the instrument panel and allow sufficient clearance for the back of the bezel of the MX20 to mount flush to the mounting tube. Sufficient clearance must exist in the instrument panel opening to allow ease of insertion and removal of the MX20.

#### CAUTION

If the back of the MX20 bezel does not mount flush to the mounting tube, the connector may not engage fully.

An alternate mounting configuration can be accomplished using locally-fabricated *L* brackets. Make the brackets from 20-24 T3 aluminum, 0.040", and form a 90° bend. When attaching the *L* brackets to the mounting tube, screw heads must not protrude into the mounting tube.

Once the cable assemblies are complete and the connectors are attached to the mounting frame, install the mounting frame assembly in the instrument panel. Be sure to use AN507 flat head screws so the unit will slide in and out freely. Attach the front of the mounting frame to the instrument panel. Use support brackets to attach the rear of the frame to the aircraft. Cable wiring to the mounting frame is shown in Figure 2-7.

Slide the unit into the frame and **hand-tighten** the threaded screw shaft using the 3/32" hex driver provided in the installation package. The unit will be pulled into the frame by the shaft and the connectors will fully engage. The back of the bezel must only be flush to the mounting tube.

To remove the unit from the mounting frame, unscrew the screw shaft. The unit will be loosened and then may be pulled from the frame. No special extraction tools are required.

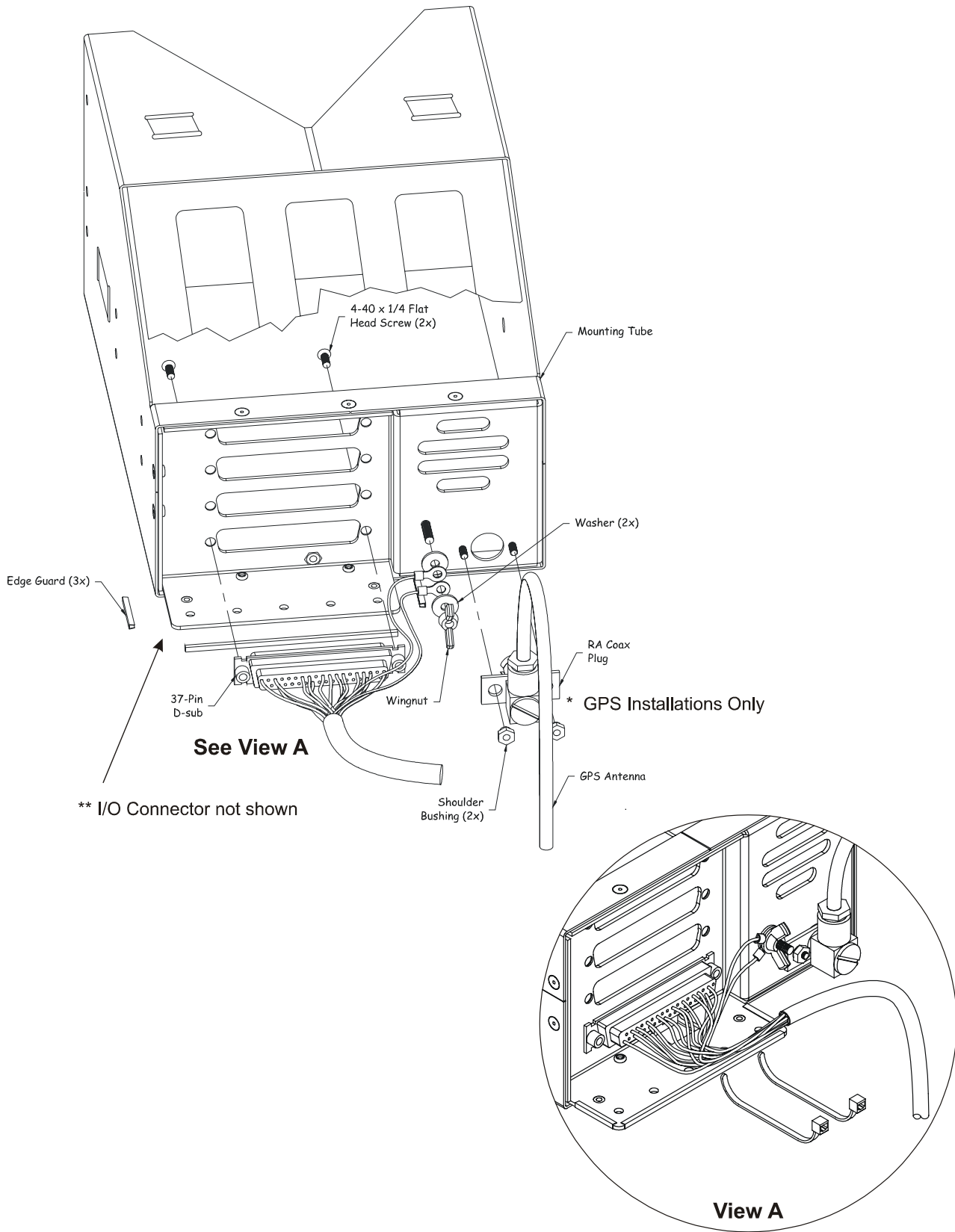


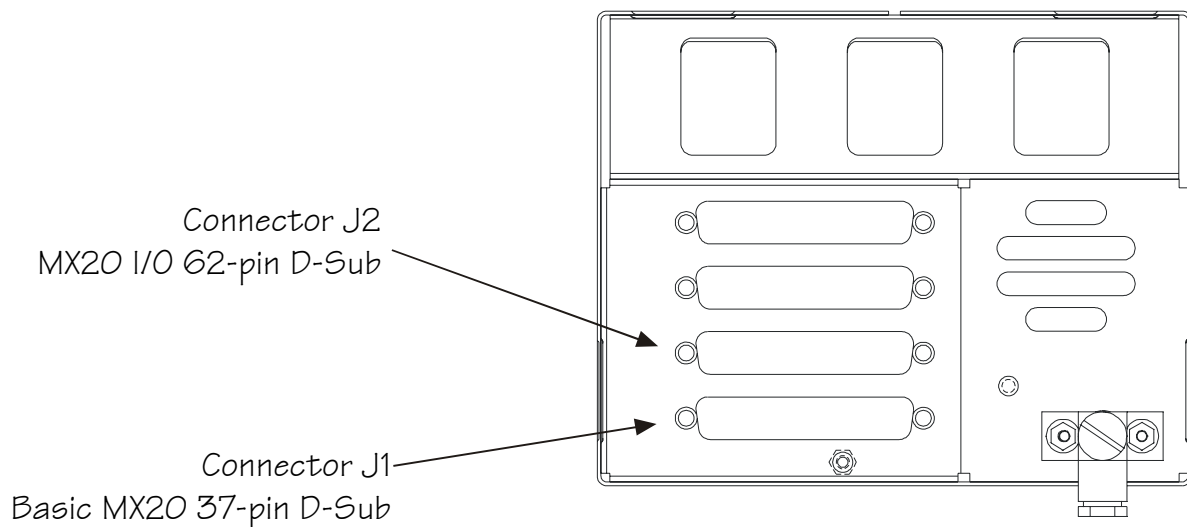
Figure 2-7. MX20 Typical Rear Panel Wiring Connections



## 2.5 Electrical Connections

The MX20 installation kit includes connectors and crimp contacts. Make the crimp connections with a crimp tool as specified in the Special Tools Required section on page 6. Wires should be 20 to 24 AWG for the 37-pin connector and 22-30 AWG for the 62-pin connector, unless otherwise specified. Power and ground wires should be 20 AWG. Shield grounds should be as short as possible and connected to the grounding lug on the back of the chassis with wire of three inches, or less.

- Wiring shall be in accordance with AC 43.13-1B.
- All RS-422 or RS-232 connections should be made with twisted pair shielded cable.
- All ARINC 453/708 connections should be made with 70 ohm, constant impedance, twisted pair shielded cable.
- All ARINC 429 connections should be made with twisted pair shielded cable.



**Figure 2-8. Data Port Location**

### 2.5.1 MX20 Basic Data Port Configuration

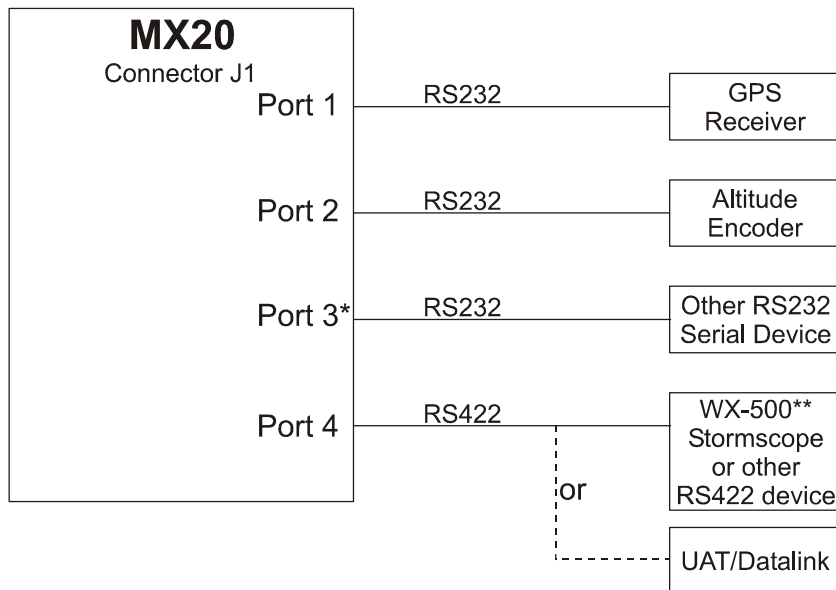
The basic MX20 supports four ports on connector J1. Three of the ports are RS-232 and one is RS-422. The usage of each port is assigned during the configuration procedure (see section 2.7). The diagram below provides an example of a configuration for the data ports. Samples of typical wiring configurations are shown in section 2.5.7.

The following table shows the suggested port usage, however note that the software must be configured to match the installed MX20 wiring configuration. Note that only one traffic source may be connected to the MX20 I/O at one time. Only one FIS source may be connected to the MX20 or MX20 I/O at one time.

Table 2-1. Preferred Basic Data Port Configurations			
		MX20 With GPS	MX20 Without GPS
PORT 1	RS-232	GX50/60* or equivalent	GX50/60* or equivalent
PORT 2	RS-232	Altitude Encoder* or option	Altitude encoder* or option
PORT 3	RS-232	Internal GPS**	SL30, or option
PORT 4	RS-422	Legacy UAT Data Link Radio, GDL 90 UAT Data Link Radio, or option	GDL90, WX-500, or option

\* A GX-series unit running software version 3.2 or higher and enabled for extended mode and a CNX-series (or GNS 480) unit is capable of receiving altitude data from the altitude encoder and passing the data to the MX20. This configuration opens up an MX20 port for other options. Only one NAV receiver (CNX-series, GNS 480 with NAV receiver or SL30, but not both) may be connected to the MX20.

\*\* If the MX20 is configured with an internal GPS engine (430-0270-0( )), Port 3 is not available for external connections.



\*If an internal GPS engine is present, Port 3 will be unavailable for external use.

\*\*The WX-500 can be connected via RS232 or RS422, but is shown here in RS422. The Northstar M3 must be connected to Port 4, as it is an RS422 device.

**Figure 2-9. Preferred Data Port Description**

## 2.5.2 MX20 I/O Data Port Configuration

The I/O product variation of the MX20 supports an array of additional I/O capabilities on connector J2 as shown below. Note that the hardware connected to the MX20 I/O ports must be connected as shown in Table 2-2, as reconfiguration by software is not available. See the sample wiring diagrams and connector pin outs in section 2.5.7 for detailed connections. One possible configuration is shown in Figure 2-10.

Table 2-2. MX20 I/O Data Port Configurations			
Port Type (Count)	Direction	Data	Allocation
ARINC 453 (1)	Input	Weather Radar Display	ART2000 Radar, ART2100, RS-181A
ARINC 429 (1)	Output	Weather Radar Control	ART2000 Radar, ART2100, RS-181A
Discrete (1)	Output	Weather Radar Power	ART2000 Radar, ART2100, RS-181A
ARINC 429 (1)	Input	Traffic Data	Goodrich SKY497, SKY899, GTX330, KMH820 IHAS
Discrete (2)	Output	SkyWatch Mode Control	Goodrich SKY497, SKY899, GTX330, KMH820 IHAS
J1 RS-232	Input	Ryan TCAD	Ryan 9900B/BX
ARINC 453 (1)	Input	Terrain Data	Landmark8000, KGP560 TAWS, KMH 820 IHAS
ARINC 429 (1)	Output	Terrain Control	Landmark8000, KGP560 TAWS, KMH 820 IHAS
ARINC 429 (1)	Input	Terrain Status	Landmark8000, KGP560 TAWS, KMH 820 IHAS

Note 1: The ART2100 is supported when configured to emulate an ART2000. Only ART2000 functions will be available.

Note 2: MX20 V5.4 or later is required for the KMH 820 IHAS

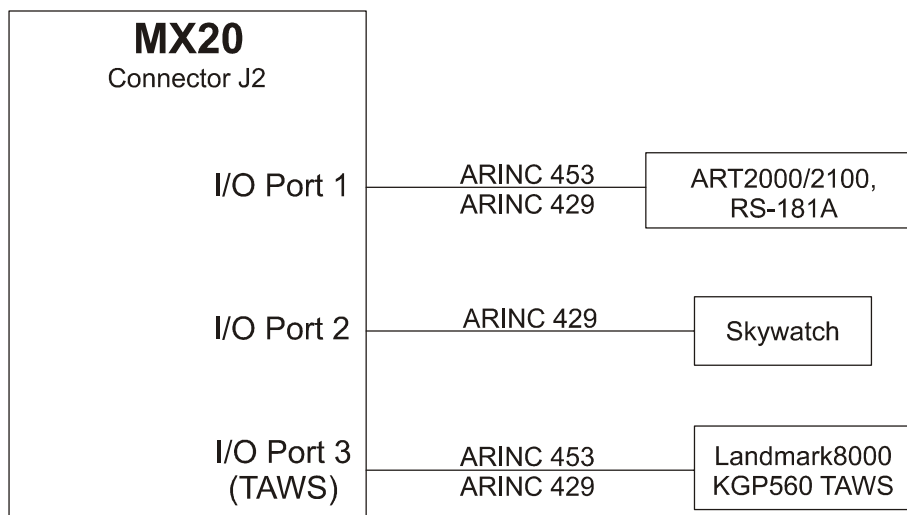


Figure 2-10. Data I/O Port Description

### 2.5.3 Data Card

The data card is a Compact Flash™ card that contains the database, operating software, and other information. The data card is required for MX20 operation.

**CAUTION**  
Do not remove the data card with power on.

### 2.5.4 Placard

The aircraft will have a placard identifying the MFD circuit breaker. The placard will be placed directly adjacent to the respective breaker.

### 2.5.5 Power

The power and fuse requirements for each external sensor are described in their respective installation manuals. The MX20 will operate on voltages between 10 and 40 VDC. Install a five amp circuit breaker for a 14 VDC aircraft and a three amp circuit breaker for a 28 VDC aircraft. Use separate wires for the heater and CPU power inputs; one wire to each pin. Power and ground wires should be 20 AWG. For preservation of essential equipment in aircraft with multiple power busses the MX20 should be powered from the non-essential bus.

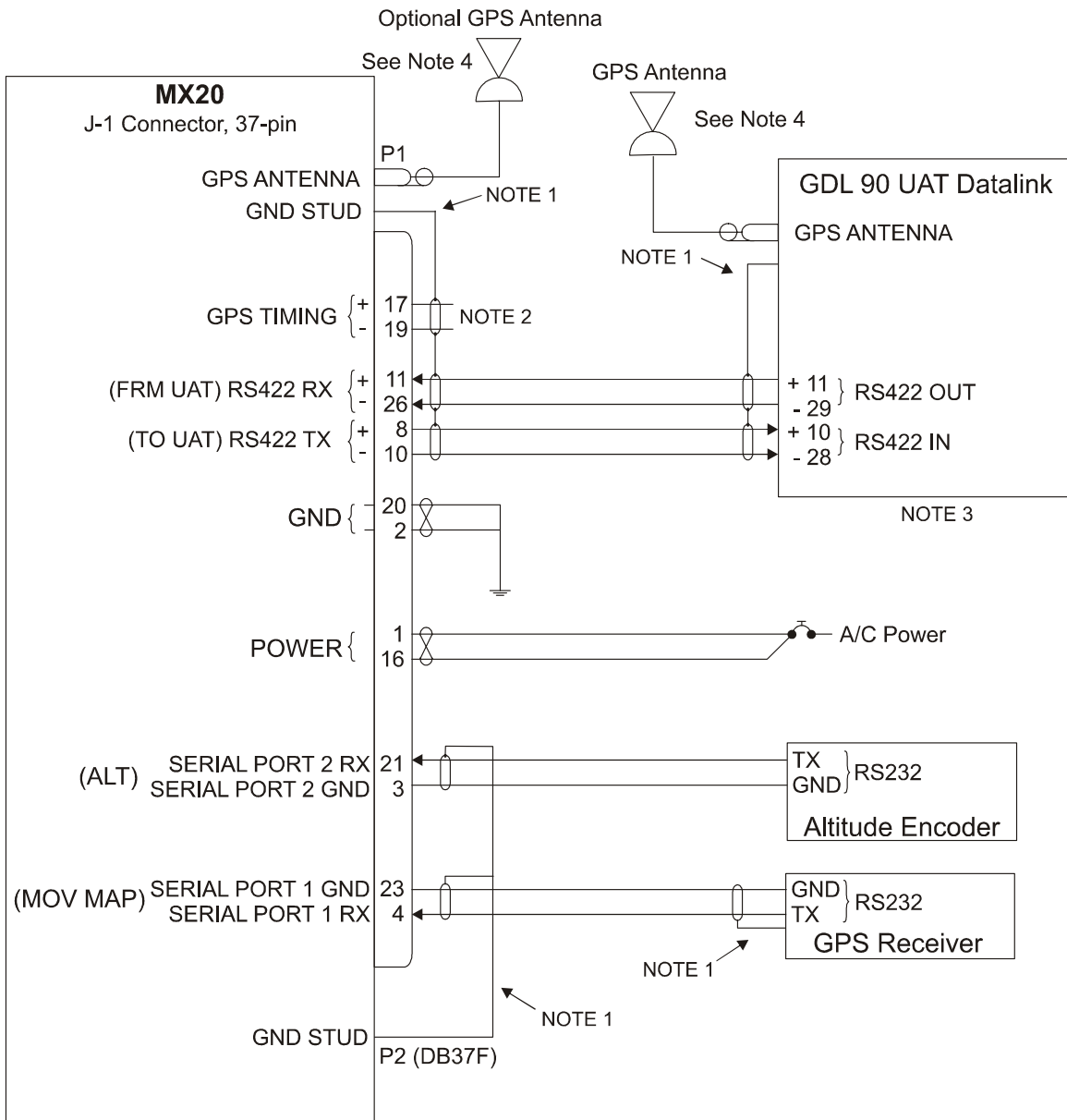
### 2.5.6 Electrical Load Analysis

An electrical load analysis should be completed on each aircraft prior to installation in accordance with AC 43.13-1B, Chapter 11. Use the following values for computation:

<b>Table 2-3. Unit Power Loads</b>				
Unit	14 Vac		28 VDC	
	Typical	Max	Typical	Max
MX20	2.0 A	3.0 A	1 A	1.5 A
MX20 with heater <sup>(1)</sup>	3.0 A	4.0 A	1.5 A	2.0 A
MX20 I/O	2.5 A	3.5 A	1.25 A	1.75 A
MX20 I/O with heater <sup>(1)</sup>	3.5 A	4.5 A	1.75 A	2.25 A
Notes: <sup>(1)</sup> Heater element turns on below approximately 30°C. MX20 with pushbutton power/brightness control does not have a heater.				

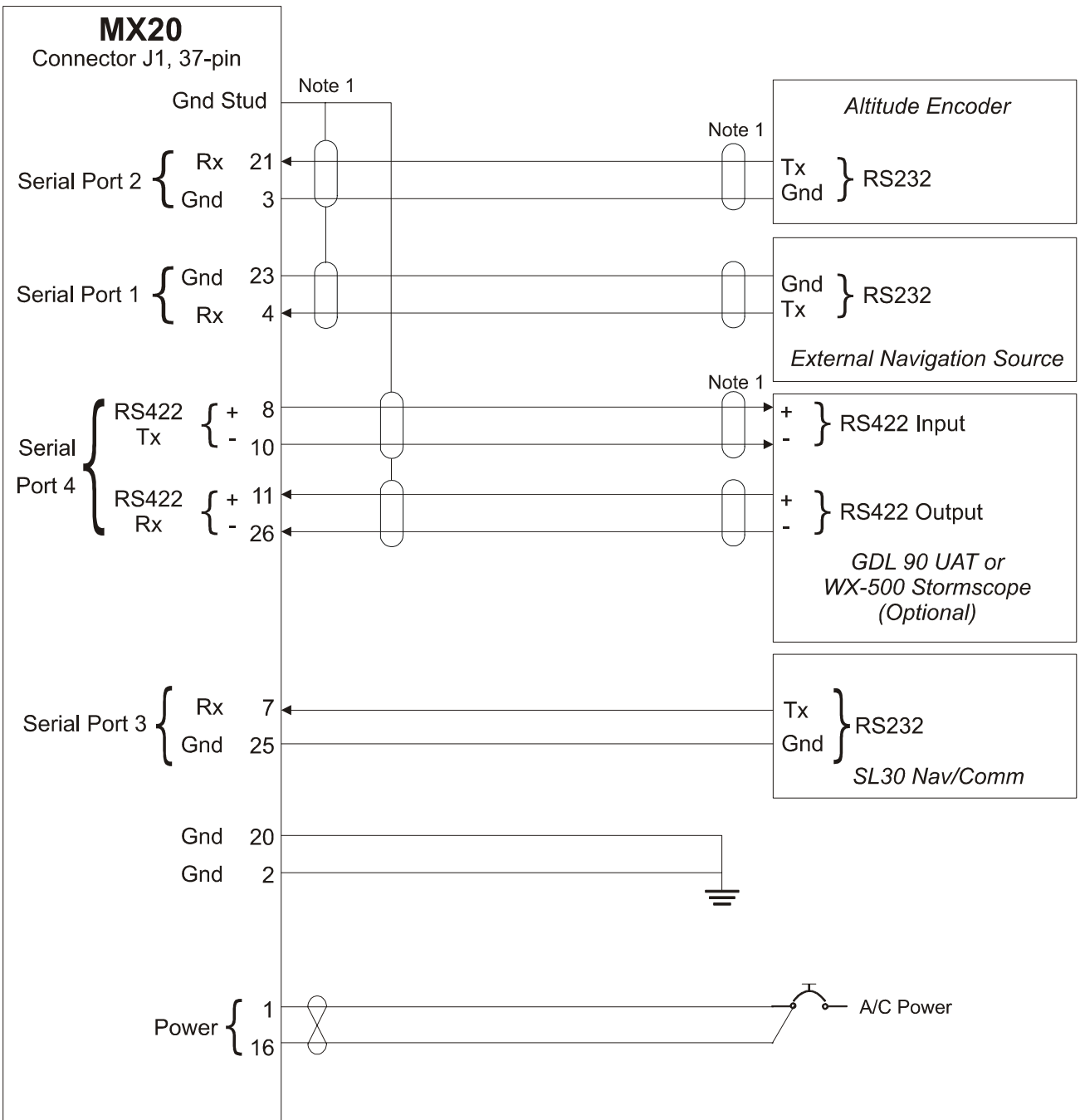
**Note:** Circuits should be protected in accordance with guidelines in AC 43.13-1B, chapter 11, section 2, paragraph 429. Power inputs should be across a minimum of all four specified input pins.

### 2.5.7 Sample Wiring Diagrams

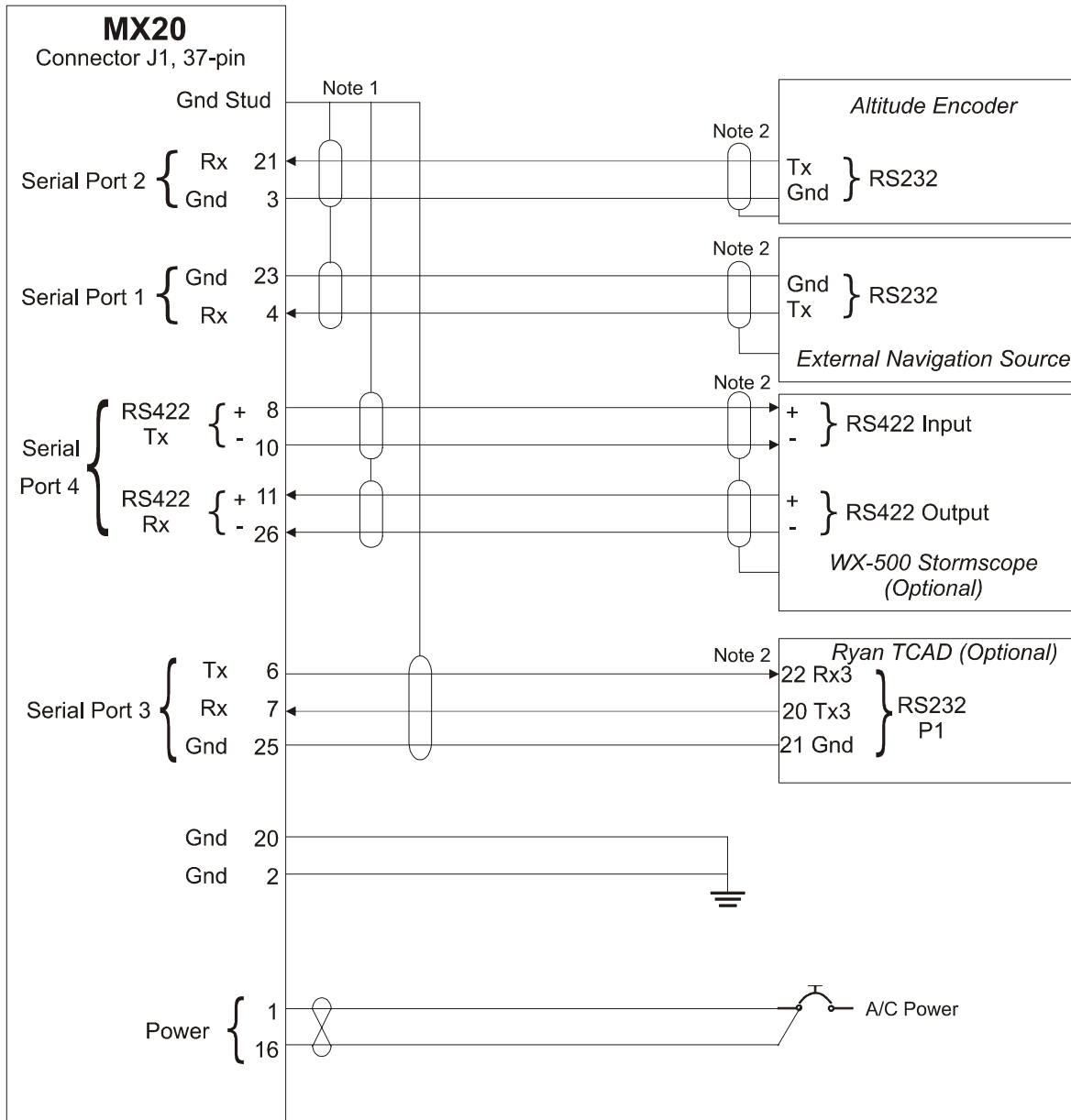


- Note 1. Terminate shield to within 2" of connector. Grounding shields must be grounded to the mounting tube/tray. Pigtail 3" maximum length. Minimize pigtail length as much as possible.
- Note 2. The GDL90 UAT has an internal GPS receiver and does not have or require a GPS timing input.
- Note 3. For a pinout of the legacy UAT, refer to the Capstone Installation Manual (p/n 560-1024-03), Appendix A, Drawing CD0009.
- Note 4. Some installations may use the GPS antenna for the GDL 90 UAT instead of the MX20. Do not use a splitter to route the GPS signal to both the GDL 90 UAT and the MX20. It is acceptable to use two GPS antennas; one for the MX20 and one for the GDL 90 UAT.

**Figure 2-11. Sample System Wiring Diagram with UAT (Internal GPS Version)**



**Figure 2-12. Sample System Wiring Diagram with WX500 or GDL 90 UAT (No Internal GPS Version)**



Note 1. Terminate shield to within 2" of connector. Grounding shields must be grounded to the mounting tube/tray. Pigtail 3" maximum length. Minimize pigtail length as much as possible.

Note 2. Terminate shield as detailed by the manufacturer's installation instructions. Note that only one traffic source may be connected to the MX20 I/O at one time.

**Figure 2-13. Sample System Wiring Diagram for TCAD and Stormscope**

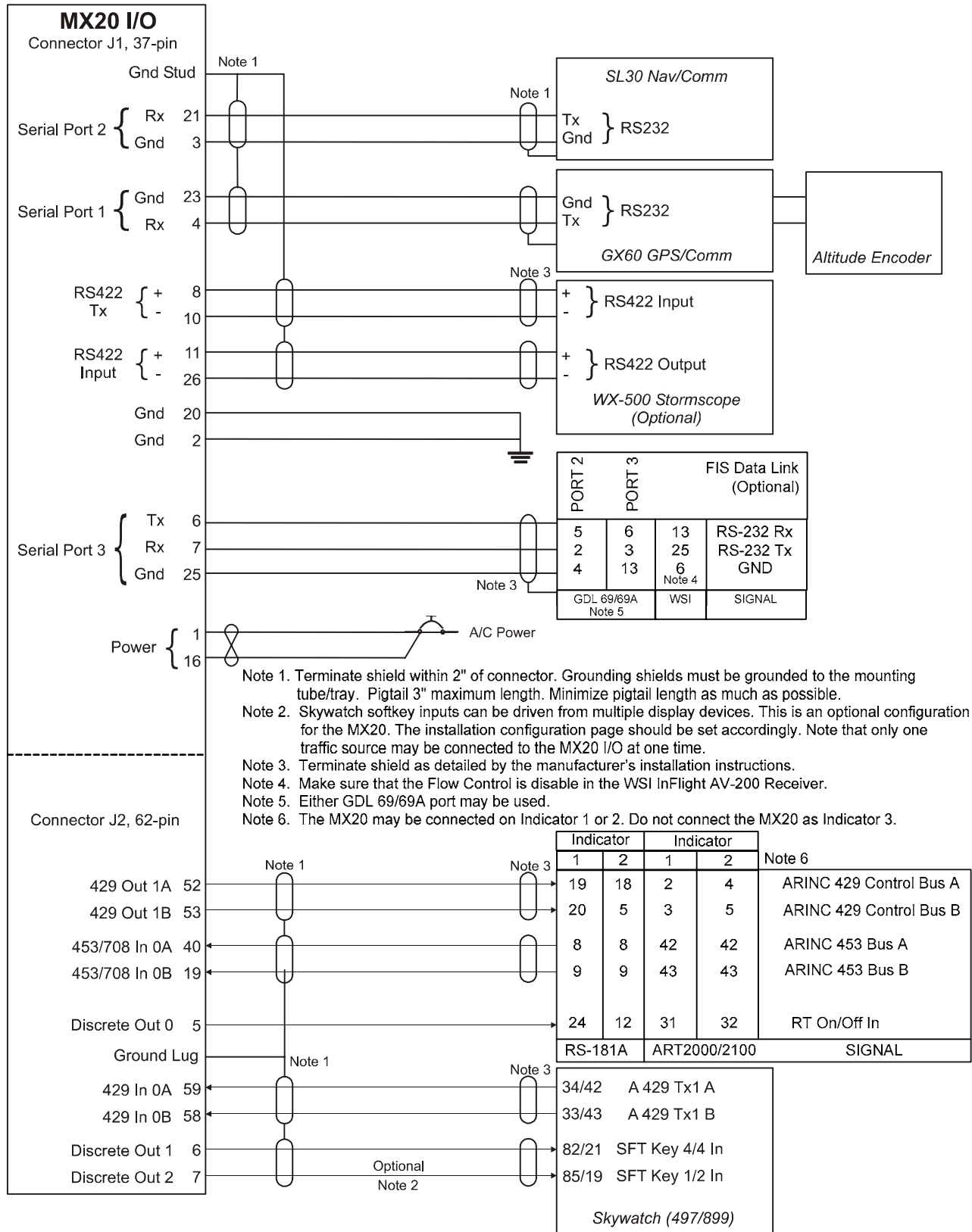
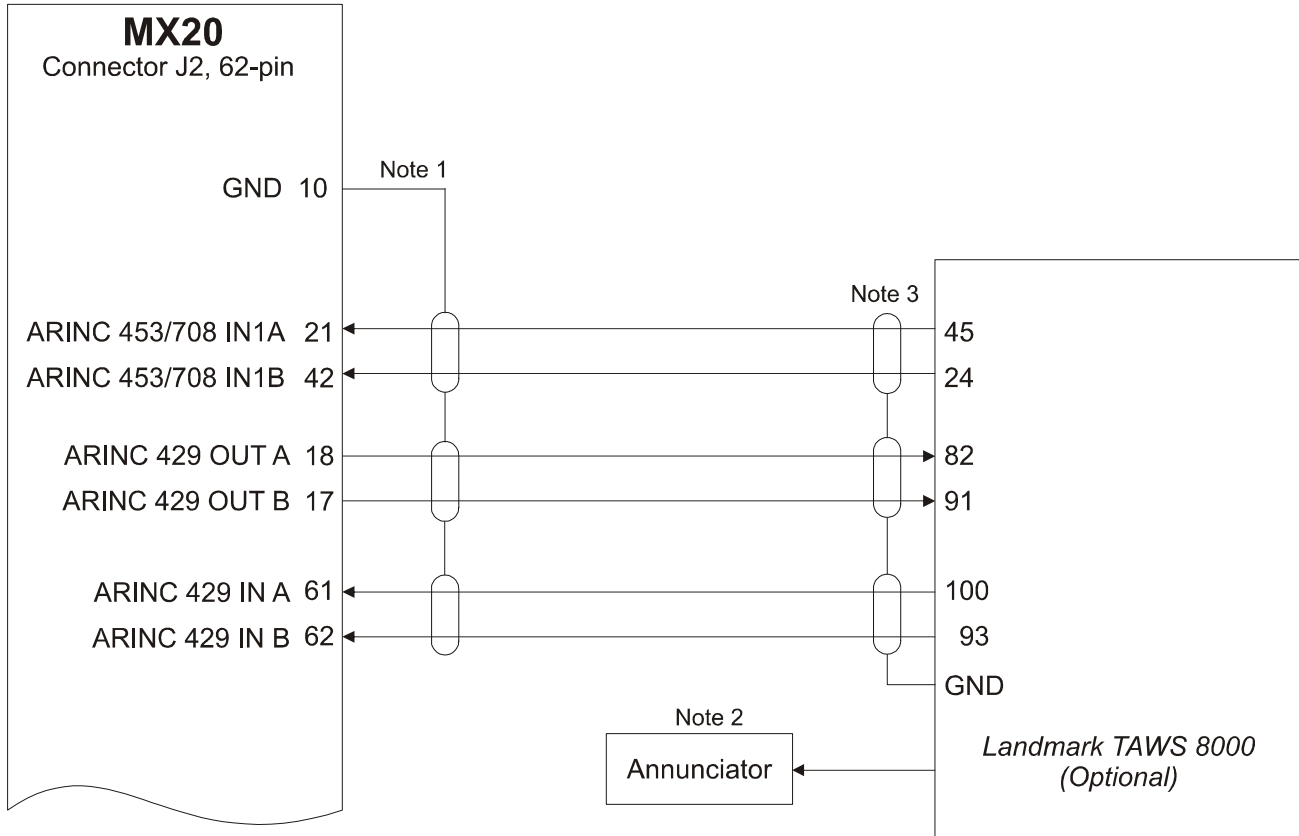


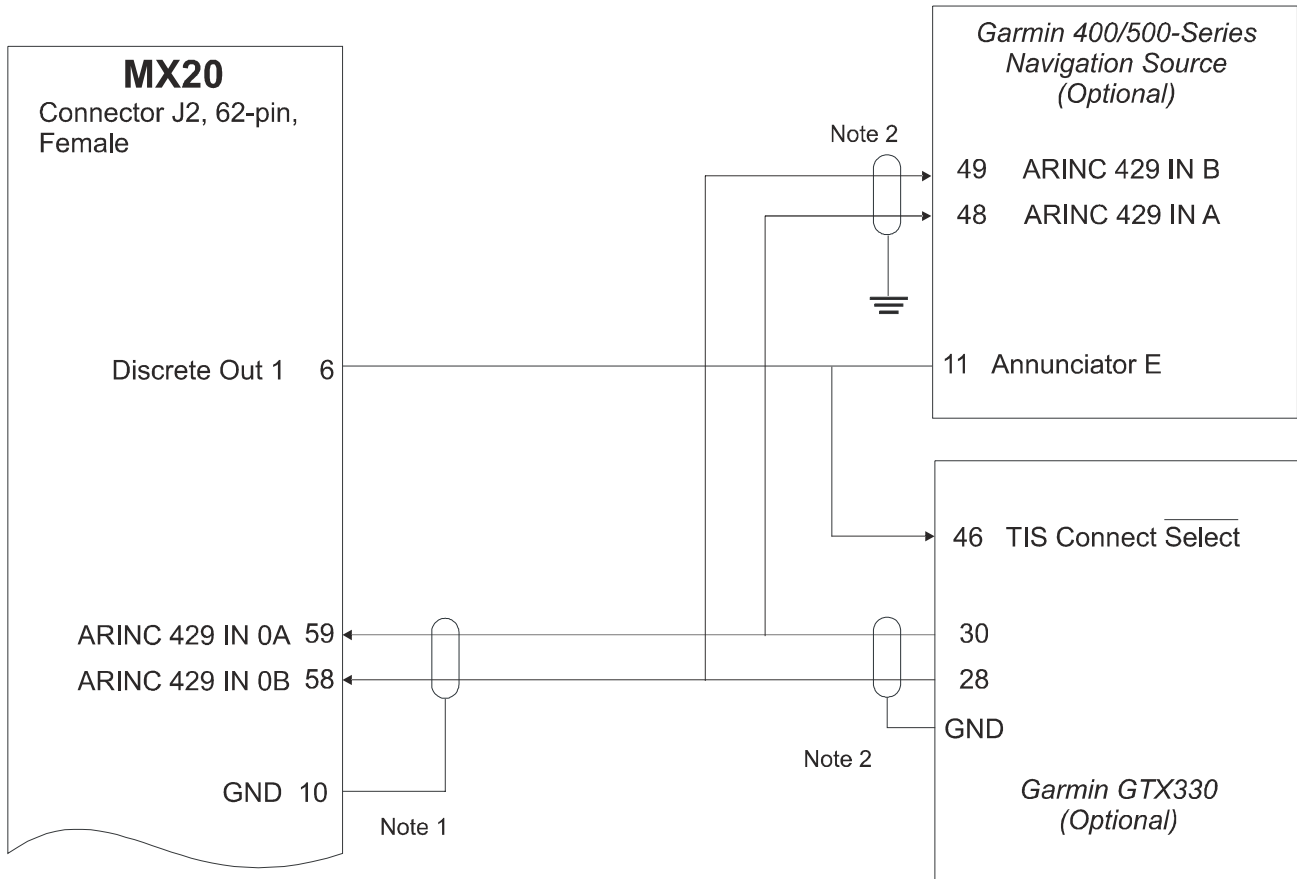
Figure 2-14. Sample System Wiring Diagram I/O model with Radar, Goodrich Skywatch, GDL 69/69A and WSI InFlight Receiver





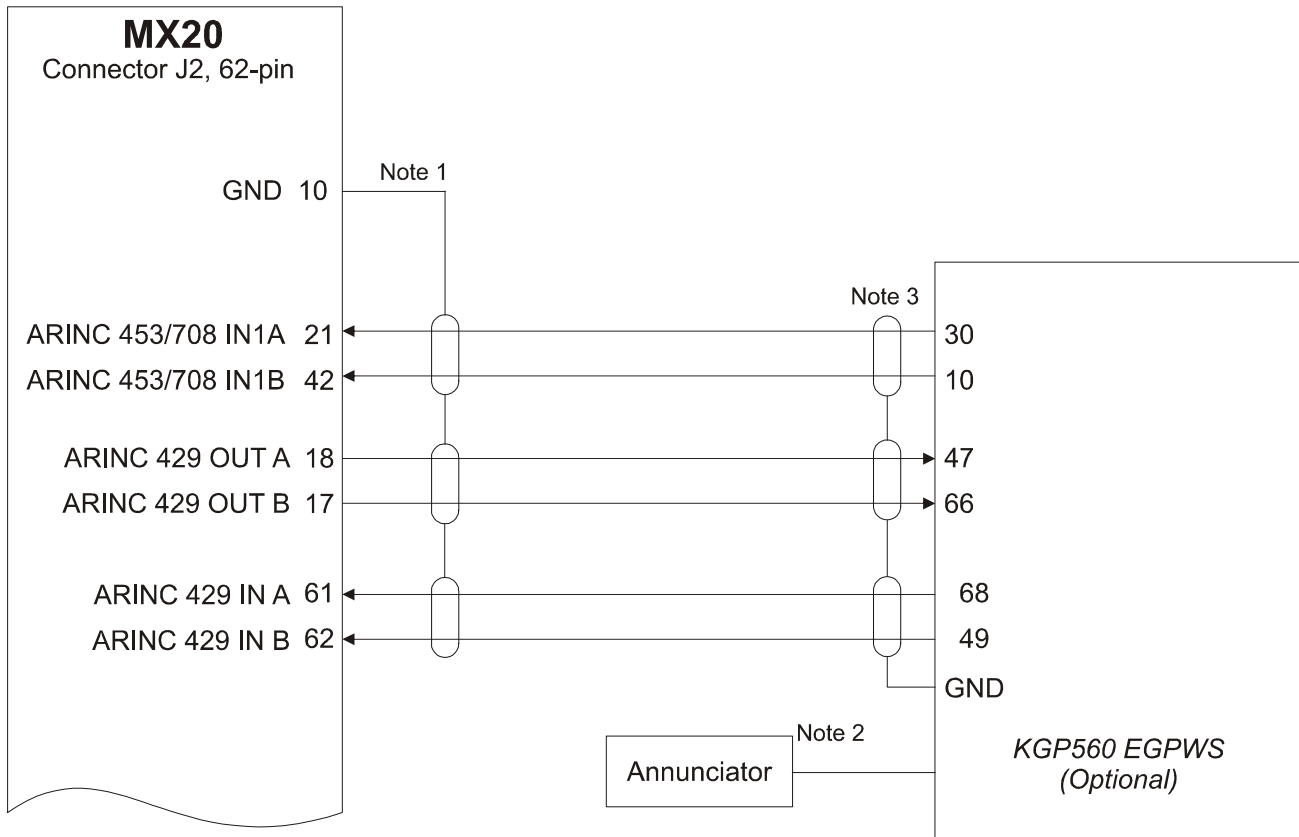
- Note 1. Terminate shield to within 2" of connector. Grounding shields must be grounded to the mounting tube/tray. Pigtail 3" maximum length. Minimize pigtail length as much as possible.
- Note 2. An external annunciator must be installed for terrain caution and warning lamps.
- Note 3. Terminate shield as detailed by the manufacturer's installation instructions.

**Figure 2-15. Sample System Wiring Diagram of MX20 I/O with Landmark TAWS**



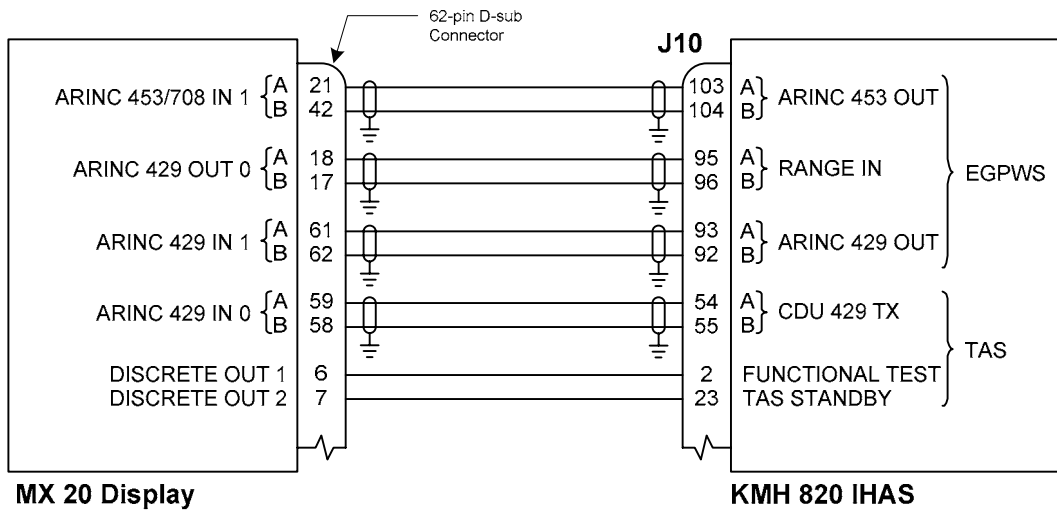
Note 1. Terminate shield to within 2" of connector. Grounding shields must be grounded to the mounting tube/tray. Pigtail 3" maximum length. Minimize pigtail length as much as possible.  
 Note 2. Terminate shield as detailed by the manufacturer's installation instructions.

**Figure 2-16. Sample System Wiring Diagram of MX20 I/O with Garmin GTX330**



- Note 1. Terminate shield to within 2" of connector. Grounding shields must be grounded to the mounting tube/tray. Pigtail 3" maximum length. Minimize pigtail length as much as possible.
- Note 2. An external annunciator must be installed for terrain caution and warning lamps.
- Note 3. Terminate shield as detailed by the manufacturer's installation instructions.

**Figure 2-17. Sample System Wiring Diagram of MX20 I/O with KGP-560**



**Figure 2-18. Sample Wiring Diagram - MX20 I/O with KMH 820 IHAS**

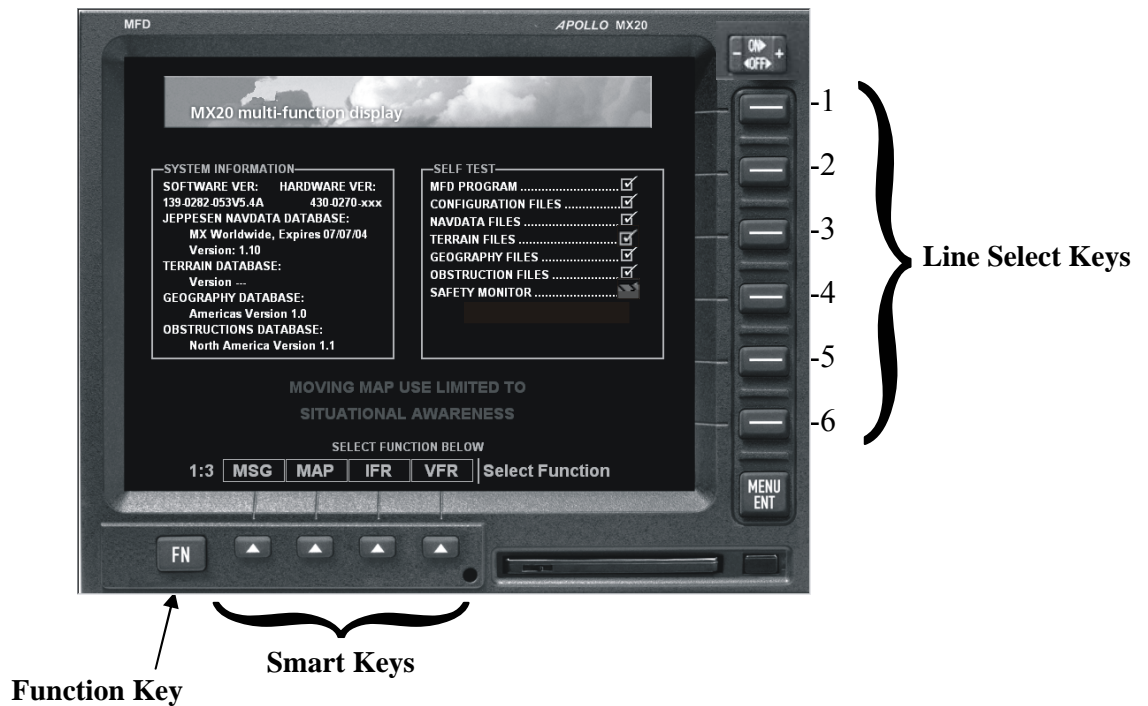
## 2.6 Weight and Balance

Weight and balance computation is required after the installation of the MX20. Follow the guidelines as established in AC 43.13-1B, Chapter 10, Section 2. Make appropriate entries in the equipment list indicating items added, removed, or relocated along with the date accomplished. Include your name and certificate number in the aircraft records. The following table identifies the weight of the new MX20 equipment.

Unit	Part No.	Weight
MX20 only, with GPS	430-0270-0( )	4.08 lb. (1.85 kg)
MX20 only, without GPS	430-0270-5( )	3.92 lb. (1.78 kg)
MX20 only, with I/O Option	430-0270-6( ), 7( )	4.07 lb. (1.85 kg)
MX20 mounting tray only	310-0429-( )	0.73 lb. (0.33 kg)

## 2.7 Configuring the MX20 & MX20 I/O

1. Turn on power to the MX20.
2. Immediately after the self-test is complete, press line select keys 1, 4, and 6 in sequence before pressing any other keys (where 1 is the top line select key, 4 is the fourth key down, and 6 is the lower most line select key). If other keys are pressed before or during this sequence, the MX20 will be in the normal operational mode. To enter the install mode, turn off the MX20 and start again at step 1.



3. Press the function key until the **INSTL** function is present. If the **INSTL** function is not found, restart the unit. Carefully press line select keys 1, 4, and 6 in sequence. Do not press any other buttons before pressing the 1, 4, 6 line select key sequence.
4. Select the **INSTL** function by pressing the smart key directly below the **INSTL** label. The Enable/Disable Functions will be the first screen to appear.

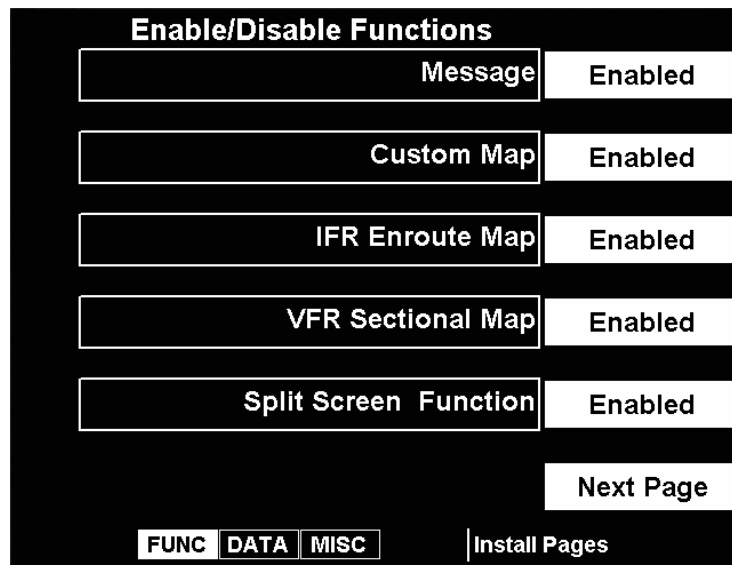
**NOTE**

MX20 power must be cycled before configuration changes will take affect.

After a configuration change, a message will appear on the screen telling you to wait 30 seconds before turning off power. You may continue to make configuration changes without pausing; however, do not turn off power to the MX20 until waiting 30 seconds after the last configuration/setting change. The message will disappear when it is safe to cycle power.

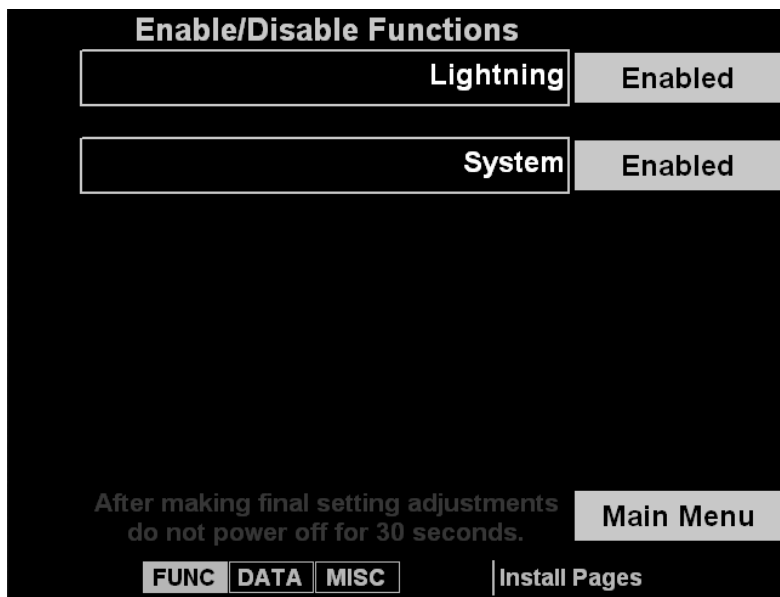
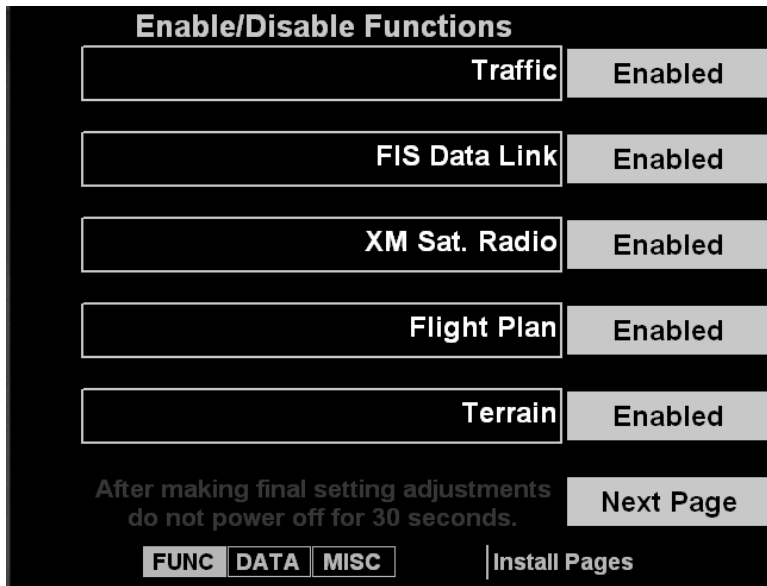
### 2.7.1 Enable/Disable Functions

This menu allows the activation or deactivation of MX20 functions.



1. Ensure the Enable/Disable Functions page of the MX20 has the desired configuration. Modifications can be made using the line select keys.
  - a. Enable Message to allow viewing of system messages.
  - b. Enable Custom Map to allow viewing of the Custom Map function.
  - c. Enable IFR En Route Map to allow viewing of the IFR Map function.
  - d. Enable VFR Sectional Map to allow viewing of the VFR Map function.
  - e. Enable the Split Screen function to allow viewing of two functions side by side.
2. Press the Next Page line select key to view additional functions.
  - a. Enable Traffic only if a traffic sensor is installed.
  - b. Enable FIS Data Link only if a UAT, GDL 69/69A, or WSI InFlight system is installed.

- c. Enable XM Satellite Radio if a GDL 69A is installed. This should be disabled if a GDL 69 is installed.
  - d. Enable Flight Plan to allow viewing of flight plan route lines on the display.
  - e. Enable Terrain only if an altitude encoder is installed, either directly or through a navigation source, or if a TAWS sensor is installed.
3. Press the Next Page line select key to view additional functions.
- a. Enable Lightning only if WX-500 is installed.
  - b. Enable the System function to allow viewing of the System function.
  - c. Enable Radar only if a unit is an I/O model and interfaced to a radar unit.

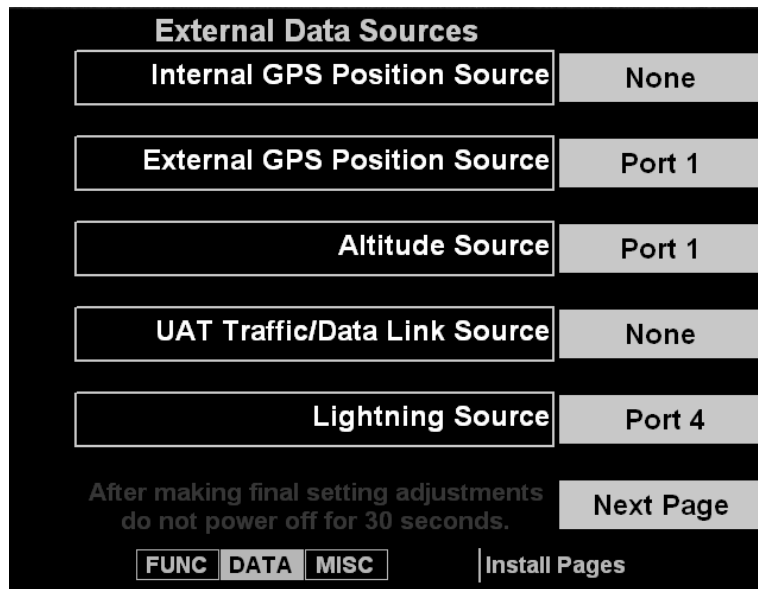


4. A typical installation will have all functions enabled except those noted above based on what hardware is installed in the aircraft.

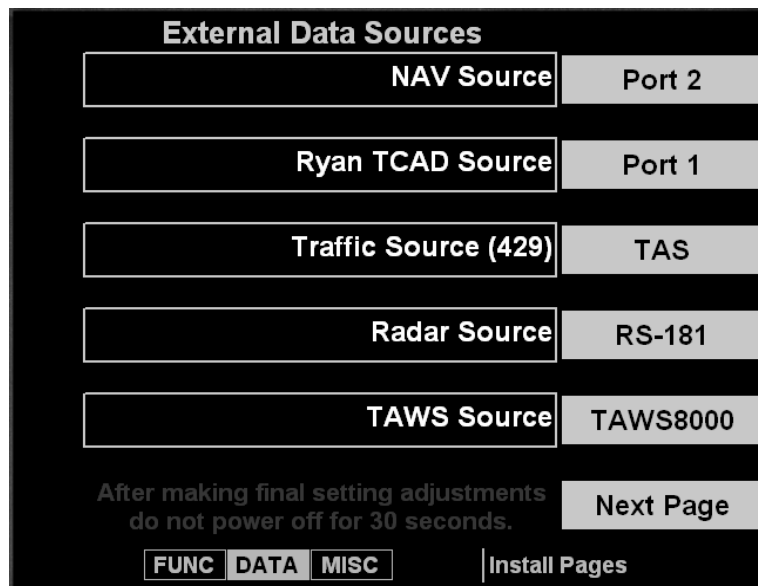
## 2.7.2 External Data Source

This menu allows the software to assign ports to the installed sensors.

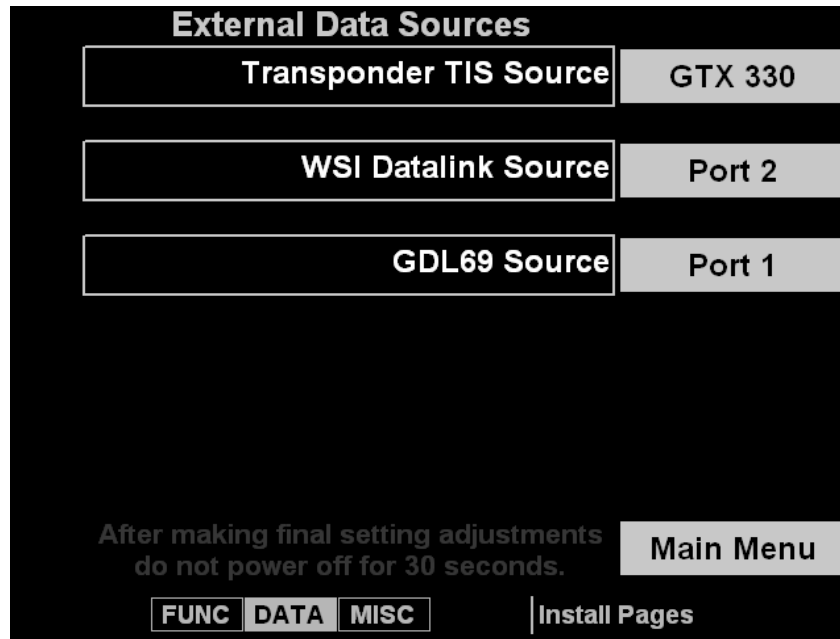
1. Press the DATA smart key while still in the INSTL function.
2. Ensure the External Data Sources pages of the MX20 have the desired configuration. Modifications can be made using the line select keys. Port allocations must match how the system is wired. Set port source to None if the hardware is not installed. The Internal GPS Position Source, when present, must always be configured to Port 3. If the altitude data is supplied from the GX model or CNX-series unit (or GNS 480), the Altitude Source port must be set to the same port number that the GX model or CNX-series (or GNS 480) unit is connected to (such as Port 1 in the example shown below). When the MX20 is connected to a CNX-series (or GNS 480) navigator with an internal NAV receiver, the NAV Data Source on the MX20 must be set to NONE.



Main Menu



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### 2.7.3 External Data Source for the MX20 I/O

The MX20 I/O allocates fixed data source ports for interface to the radar, TAWS, and traffic sensors. Software configuration is not required for SkyWatch (SW version 1.6, or greater), GTX330, or TCAD traffic sensors. The I/O version of the MX20 adds traffic and radar functionality. These data sources are configured in a similar manner as the basic MX20 external sensors. Note that only one traffic source may be connected to the MX20 I/O at one time.

#### 2.7.3.1 Ryan TCAD source

Select the RS-232 port 1-3 where the TCAD unit is connected. The 9900B must have software version 1.08, or later. The 9900BX must have software version 1.11, or later.

#### 2.7.3.2 SkyWatch

Select the configuration which matches the physical installation. The two models, SKY497 and SKY899, are supported by the TAS option for the Traffic Source (429) data source. Additionally, if the MX20 is not wired to drive the discrete inputs (when an additional display such as the WX1000 is being used), select the + DISP option. If the MX20 is wired to drive the SkyWatch discrete inputs, select just the basic TAS model without the + DISP option. Using the +DISP option indicates that an external display is responsible for driving the discrete inputs and the corresponding MX20 controls will be disabled on the MX20 Traffic page. SkyWatch SW version 1.6, or greater, is required for compatibility.

#### 2.7.3.3 Radar

Select the model of the Radar connected. Currently the ART2000 and the RS-181A are supported. The ART2100 is supported if it is configured as an ART2000. Only ART2000 functions are available.

#### 2.7.3.4 TAWS

Select the model of the TAWS sensor connected in the system. Currently only the L-3 (Goodrich) Landmark TAWS 8000 and KGP560 are supported. Select TAWS8000 for the Landmark 8000 and EGPWS for the KGP560.

#### 2.7.3.5 Transponder TIS

Select the model of the TIS data source selected. Currently, only the Garmin GTX330 is supported.



### 2.7.3.6 KMH 820 IHAS

The KMH 820 IHAS requires MX20 software version 5.4 or later in order to display terrain. External terrain caution and warning annunciator lamps are also required. See Figure 2-18 for connections. Select TAS for the Traffic Source (429) data source and KGP 560 for the TAWS Source data source.

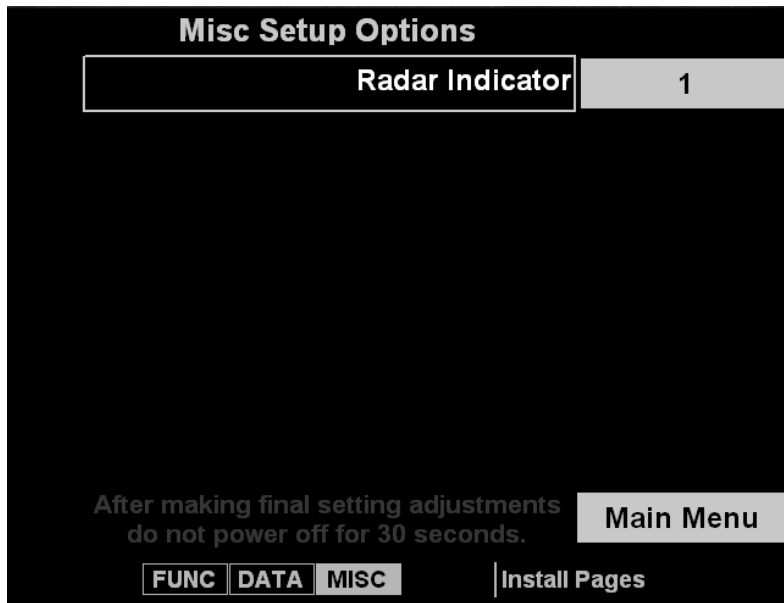
## 2.7.4 Miscellaneous Setup Options

1. Press the MISC smart key while still in the INSTL function.
2. Ensure the Misc Setup Options pages of the MX20 are configured with respect to the aircraft it is being installed in. Modifications can be made using the line select keys.

Misc Setup Options		
Ownship Broadcast ICAO	XXXXXXXX	See Step 3
Ownship Broadcast Flight ID	N1234	See Step 4
Ownship Broadcast Category	Small	See Step 5
Ownship Symbol	Single Engine	See Step 6
Terrain Clearance Mode	Normal	See Step 7
Next Page		
<span>FUNC</span> <span>DATA</span> <span>MISC</span>   Install Pages		

Misc Setup Options		
Demo Mode (Not for Flight)	Disabled	See Step 8
GDL 90 UAT Radio	Disabled	See Step 9
GDL 90 Code Edit	Enabled	See Step 10
GDL 69 Cable Loss	5.0	See Step 11
GDL 69 Antenna Gain	24	See Step 12
After making final setting adjustments do not power off for 30 seconds.		
Next Page		
<span>FUNC</span> <span>DATA</span> <span>MISC</span>   Install Pages		



See Step 13

- Obtain ICAO address of the aircraft from the FAA only if the UAT/ADS-B system is installed. The ICAO address is a unique eight number code assigned to each aircraft. For U.S. registered aircraft, it will be necessary to have a specific address code assigned. These address codes are presently issued by:

Federal Aviation Administration  
 FAA Aircraft Registry  
 P.O. Box 25504  
 Oklahoma City, OK 73125  
 Tel: 405 954 3116  
 Fax: 405 954 3548

If the aircraft is registered in a country other than the United States, please contact the local aviation authority of the country in which the aircraft is registered.

The ICAO information entered on the MX20 is not used by the GDL 90, but should match the ICAO information entered into the GDL 90 Aircraft Personality Module (APM). When connected to a GDL 90, the MX20 will display the ICAO information received from the GDL 90.

- Enter in Flight ID. (Required if UAT/ADS-B system is installed.)
- Enter Category Code. (Required if UAT/ADS-B system is installed.)

Category Code	Aircraft Weight
Small	< 15,500 lbs.
Medium	15,500 to 75,000 lbs.
Large	75,000 to 190,000 lbs.
Extra Large	190,000 to 300,000 lbs.
Heavy	> 300,000 lbs.
High Performance	> 5g acceleration and > 400 kts

- Enter in Ownship Symbol (Single Engine, Twin, or Jet).
- Set the Terrain Clearance Mode to Normal for **all** operations.

8. Demo Mode must be disabled for **all** aircraft installations.
9. If the GDL 90 UAT is installed, select **Disp/Ctrl or Disp Only** for the GDL 90 UAT Radio setting. The Disp Only setting should be selected when another device controls the GDL 90 UAT.
10. If the GDL 90 UAT is installed and you want to allow entering/editing the GDL 90 transponder squawk code, select **Enabled**. The squawk code is accessed from one of the Menu selections in Traffic mode. If the aircraft has an operating transponder, the GDL 90 Code Edit option must be disabled.
11. Enter GDL 69 cable loss. Refer to the GDL 69/69A Installation Manual (Garmin P/N 190-00355-02).
12. Enter in antenna gain. Refer to the GDL 69/69A Installation Manual (Garmin P/N 190-00355-02).
13. Enter the **Radar Indicator** number. This number should match the port number of the radar that the MX20's ARINC 429 control lines are connected. The ALL option is not recommended when there are multiple radar control/display devices being used.
14. Press **Enter/Menu** to confirm all settings.
15. After the 30-second waiting period, turn the MX20 power off **to apply all configuration settings**.

**NOTE**

MX20 power must be cycled before configuration changes will take effect. After a configuration change, a message will appear on the screen telling you to wait 30 seconds before turning off power. You may continue to make configuration changes without pausing; however, do not turn off power to the MX20 until waiting 30 seconds after the last configuration/ setting change. The message will disappear when it is safe to cycle power.

## 2.8 Configuring the KMH 820 IHAS for the MX20

Figure 2-18 shows the connections between the MX20 display and the KMH 820 IHAS. To work properly with the MX20, the KMH 820 IHAS must be configured as described below.

The EGPWS function of the KMH 820 IHAS must be configured as follows:

- Category 4: Terrain Display ID = 4
- Category 5: I/O Discrete ID = 1
- Category 9: Terrain Display Popup ID = 0

The remainder of the EGPWS configuration items are installation-specific and consequently not specified. Refer to the KMH 820 Installation Manual for configuration instructions.

NOTE: The MX20 will automatically range to 10nmi if a terrain pop-up occurs.

NOTE: With Terrain Display ID 4 the peaks data will be embedded in the terrain sweep.

For the TAS functions of the KMH 820 IHAS, the configuration module should be strapped as follows:

- Controller type: Discrete
- Display Valid: Ignore

The remainder of the TAS configuration items are installation-specific and consequently not specified. Refer to the KMH 820 Installation Manual for configuration instructions.

## 2.9 MX20 Post Installation Checkout

Once the unit is installed, complete the checkout procedure to verify proper operation. Refer to the MX20 Multi-Function Display Pilot's Guide, 560-1026-( ), for operating instructions.

### 2.9.1 Mounting / Wiring Check

Verify that all cables are properly secured and shields are connected to the rear of the mounting frame. Check the movement of the flight and engine controls to verify that there is no interference. Ensure wiring is installed in accordance with AC 43.13-1B, Chapter 11.

### 2.9.2 Software and Database Test

1. Turn on power to the MX20.
2. Verify all self-tests pass on the main startup screen.
3. Verify the expiration on the NavData database.
4. Verify the Terrain and Geography databases are applicable to the area of intended flight (CONUS, Alaska, etc.).
5. Press the MSG smart key and verify that "Unit configured for Special Terrain Mode" is **NOT** displayed.

### 2.9.3 External Data Source Tests

Verify that all external data sources are connected. See section 3.1.10 and 3.1.13 to check the compatibility of the external devices for use with the MX20.

1. Turn on power to the MX20 and the external data sources. Activate the Installation Mode (see section 2.7).
2. Verify that the MX20 data ports are configured properly. See sections 2.5.1 and 2.5.2 for details on the data port configuration. See section 2.7 for information on configuring the MX20 in Installation Mode.
3. Recycle power to the MX20 to reinitialize it with any changes made in the Install function settings.
4. Verify that the external data sources are properly configured to output the proper data to the MX20, i.e., the GX should be configured to output Moving Map data. If the altitude data is supplied from a GX model unit, it must have extended mode enabled.

The screenshot shows the 'System Info' screen with the following sections:

- POS LINK LT** (top left buttons)
- SYSTEM INFORMATION**
  - SOFTWARE VER: 139-0282-050 V5.0(AZ)
  - HARDWARE VER: 430-0270-7xx
  - JEPPESEN NAVDATA DATABASE: MX Worldwide, Expires 09/06/00, Version: 1.10
  - TERRAIN DATABASE: Americas Version 1.0
  - GEOGRAPHY DATABASE: Americas Version 1.0
  - OBSTRUCTIONS DATABASE: North America Version 1.0
- INTERNAL GPS STATUS**
  - Internal GPS Not Available
- PORT STATUS**

Port	Data?	Valid?
1 GPS	NO	NO
2 WSI	NO	NO
3 NONE	---	---
4 LT	NO	NO
External - NUC 0		
- DATA LINK STATUS**

Data	Count	Status
HB	--	Not Active
ADS-B	--	0 Targets
TIS-B	--	0 Targets
FIS TX	--	Available
FIS WX	--	Available
- MSG** (bottom left button)
- Nav Info Test** (bottom middle buttons)
- System** (bottom right label)

Annotations:

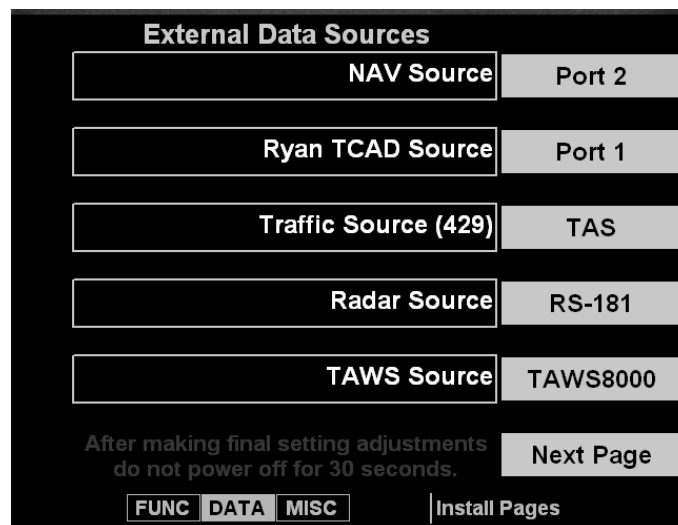
- Step 7-10 points to the POS LINK LT buttons.
- Step 12-15 points to the POS LINK LT buttons.
- Step 5 points to the External - NUC 0 text in the PORT STATUS table.

5. Check the System Info page on the MX20 to verify that the data is available to each port and that it is being processed properly.
6. Verify ALT data flag is not displayed in the lower left portion of the MX20 display.
7. With external navigation source off, the POS and RTE data flags should be present.

**NOTE**

- The external navigation source may need to be properly configured prior to this step.
- Direct To sequence may need to be entered for external navigation source to output POS and RTE.
- If an internal GPS exists, it can also provide a valid position to the MX20.

8. Turn the external navigation source power on. Verify that the navigation source acquires a position.
9. Create/activate a flight plan on the external navigation source.
10. Verify the RTE and POS data flags are not displayed.
11. Flight plan will be displayed on the MX20 on the FPL page.
12. Turn the traffic source power on. Verify the TCAD, XPDR, or TRAF data flags are not displayed. The ADSB data flag may be displayed if the GDL 90 is installed. The ADSB flag indicates that the GPS receiver in the GDU 90 does not have a valid position. This flag is acceptable for this check out procedure. If the ADSB flag appears when a traffic sensor other than the GDL 90 UAT is installed, verify that the GDL 90 options in the Install-Misc menu are disabled.
13. With the Lightning sensor turned off, verify that the LT data flag is displayed.
14. Turn the Lightning sensor power on. Verify that the LT data flag is not displayed.
15. With the GDL 69/69A sensor, if installed, turned off, verify that the XM data flag is displayed.
16. Turn the GDL 69/69A sensor is on. Verify that the XM data flag is not displayed.
17. With the WSI InFlight sensor, if installed, turned off, verify that the Link data flag is displayed.
18. Turn the WSI InFlight sensor on. Verify that the Link data flag is not displayed.



### 2.9.3.1 EMI/RFI Test

This test validates that interference does not exist between the MX20 and other systems on the aircraft. Turn off the power to all avionics devices.

### 2.9.3.2 Test without MX20

1. Start the aircraft engine(s) and switch to engine power, as appropriate.
2. Turn on power to the external GPS navigation source. Clear visibility to satellites is required.
3. Load a flight plan on the external GPS navigation source.
4. Test the function and/or observe for operation of each of the following if installed, or other appropriate systems.

- \_\_\_ Transponder (if equipped)
- \_\_\_ NAV/VOR/ILS unit and tune to a local frequency (VOR/DME)
- \_\_\_ Any other navigation source
- \_\_\_ Radio Altimeter
- \_\_\_ DME
- \_\_\_ ADF
- \_\_\_ VHF Comm Transceiver
- \_\_\_ Encoding Altimeter
- \_\_\_ Flight Director
- \_\_\_ Marker Beacon Receiver
- \_\_\_ Weather Radar
- \_\_\_ Ground Proximity Warning System
- \_\_\_ Autopilot
- \_\_\_ Directional Gyro/HSI
- \_\_\_ RMI
- \_\_\_ Garmin GTX330 TIS-A Traffic Sensor. TIS-A is available only in areas with a Terminal Approach Radar.
- \_\_\_ Garmin AT GDL 69/69A Data Link Sensor. Visibility to the southwestern or southeastern sky is required. The aircraft must be far enough from buildings to avoid multi-path effects. Note if the GDL 69/69A Data Link Sensor causes interference to other equipment. The MX20 must be turned on to see any effects on the GDL 69/69A Data Link Sensor caused by other equipment. The audio portion may be tested without the MX20 if the optional volume control switches and the GDL 69A are installed. The GDL 69A powers up with the volume muted. Press one of the volume switches or the mute switch to adjust the volume.
- \_\_\_ WSI InFlight Weather Sensor. Visibility to the southern sky is required. The aircraft must be far enough from buildings to avoid multi-path effects. Note if the InFlight sensor causes interference to other equipment. The MX20 must be turned on to see any effects on the WSI InFlight sensor caused by other equipment.
- \_\_\_ TAWS Sensor

5. Turn the power off to each of the avionics systems.

### 2.9.3.3 Test with MX20

While performing the following tests, observe the MX20, external GPS navigation source (signal reception), and the system under test for interference or abnormal operation.

1. Turn on power to the MX20.

2. Turn on the power to each avionics system. Observe for proper operation of the MX20 and the other avionics systems.
  - \_\_\_ Transponder (if equipped)
  - \_\_\_ NAV/VOR/ILS unit and tune to a local frequency (VOR/DME)
  - \_\_\_ Any other navigation source
  - \_\_\_ Radio Altimeter
  - \_\_\_ DME
  - \_\_\_ ADF
  - \_\_\_ VHF Comm Transceiver
  - \_\_\_ Encoding Altimeter
  - \_\_\_ Flight Director
  - \_\_\_ Marker Beacon Receiver
  - \_\_\_ Weather Radar
  - \_\_\_ Ground Proximity Warning System or Enhanced Ground Proximity Warning System (EGPWS)
  - \_\_\_ Autopilot
  - \_\_\_ Directional Gyro/HSI
  - \_\_\_ RMI
  - \_\_\_ TIS-A Sensor
  - \_\_\_ GDL 69/69A Data Link Sensor
  - \_\_\_ WSI InFlight Weather Sensor
  - \_\_\_ TAWS Sensor
  - \_\_\_ Traffic Sensor

#### 2.9.4 Altitude Test

1. Perform the installation and calibration tests in accordance with the altitude source manufacturer's installation manual.
2. Perform a flight check against the aircraft altimeter. Verify readings at ground level and at three additional altitude points.
3. The altitude will be displayed on the bottom right-hand corner of the MFD terrain page.

#### 2.9.5 Compass Test

If the MX20 is located within seven inches of any compass, the compass will require a compass calibration.

#### 2.9.6 Stormscope Interface Test

If a Goodrich WX-500 Stormscope® sensor has been connected to the MX20, the interface should be verified in the LT function on the MX20. Four standard Stormscope test screens are available to support system checkout. Refer to the WX-500 Stormscope Installation Manual, P/N 009-11500-001. These test screens are System Data, Self-Test, Noise Monitor, and Strike Test.

#### 2.9.7 SkyWatch Interface Test

If a Goodrich SKY497 or SKY899 SkyWatch® sensor has been connected to the MX20 I/O, the interface should be verified under the TRAF function on the MX20.

1. Turn power on to the MX20 I/O and SkyWatch Unit. After the MX20 I/O self-tests have completed, enter the Traffic Function by pressing the FN key until the TRAF menu option is available and press the corresponding traffic smart key.

2. (If the TRAF function is not available, verify that the MX20 is an I/O model and that the traffic function has been enabled as described in previous sections.)
3. From the traffic function, verify in the lower right corner of the screen that status of the SkyWatch unit. The unit should be either in the TAS Standby mode or no status should be presented. If a Data Timeout error is presented, re-check the wiring.
4. From any function, verify that no amber SKYW annunciator is present in the upper left corner of the display. If this is present, re-check the wiring.
5. From the traffic function, or from the SKY1000 display if connected, command a SkyWatch Self Test. The status presented in the lower left of the display should change to a white 'TAS Test' and clear after several moments.
6. From the Message function, verify that no error messages have been posted from the SkyWatch system.

### 2.9.8 Ryan TCAD Interface Test

If a Ryan TCAD 9900B or 9900BX sensor has been connected to the MX20 I/O, the interface should be verified under the TRAF function on the MX20.

1. Turn power on to the MX20 I/O and TCAD unit. After the MX20 I/O self-tests have completed, enter the Traffic Function by pressing the FN key until the TRAF menu option is available and press the corresponding traffic smart key.
2. If the TRAF function is not available, verify that the MX20 is an I/O model and that the traffic function has been enabled as described in previous sections.
3. Ensure that power is applied to the TCAD unit.
4. From the traffic function, verify that no amber TCAD Annunciator is present.
5. Perform additional checkout procedures in accordance to the TCAD installation manual.

### 2.9.9 RADAR Configuration & Checkout Procedures

The following steps are performed to verify the interface between the RADAR sensor and the MX20 I/O. The radome should NOT be installed during these tests as visual verification of antenna movement is required.

Note that the Antenna Receiver/Transmitter should be installed and calibrated in accordance to the manufacturer's specifications. This manual does not cover the installation or calibration of the actual ART unit.

#### **WARNING**

Configuration procedures include steps that require the radar antenna to be powered on. Please observe all safety precautions during these steps including: Do not perform in the vicinity of refueling operations; Do not perform while personnel are in the vicinity (approximately 20 feet) of the radar sweep area.



**NOTE**

See FAA AC20-68B "Recommended Radiation Safety Precautions For Airborne Weather Radar" for safety precautions to be taken by personnel when operating airborne weather radar on the ground.

**2.9.9.1 ART 2000 Configuration and Calibration****2.9.9.1.1 Configuring the MX20**

First configure the MX20 for the ART2000 option. Do this in the normal way by entering the install key sequence (1, 4, 6) on the menu keys after boot-up is complete. Enable "RADAR" under the "FUNC" menu-set, then select the "DATA" menu-set and select the "ART2000" choice. Note that the MX20 is compatible with the ART2100 when the ART2100 is programmed to emulate the ART2000. Only ART2000 functions will be available.

To configure the "Radar Indicator" push the "MISC" smart key and press "NEXT PAGE" line key twice. Press the line key next to "RADAR INDICATOR" until the desired selection is shown. The choices are 1, 2 or All. This number corresponds to the port number on the ART that is connected to the MX20. After selection, wait 30 seconds then turn the power off and on again.

**2.9.9.1.2 Calibration Procedures**

Refer to the Bendix/King ART2000 Color Weather Radar System Installation Manual, Revision 4 or later. Follow the instructions in "Stabilization calibration with Radar Indicator" or its equivalent.

Skip the description in the ART2000 manual on how to enter calibration mode. The MX20 allows a single button push to enter calibration mode. The MX20 MUST be in Install mode to calibrate the radar head. Follow the instructions below.

1. Turn the MX20 on.
2. After boot-up is complete, key-in the install sequence 1, 4, 6, on the menu keys.
3. Press the FN key until one of the options is RADAR. If the RADAR option is not available, see the section on "Configuring Radar".
4. Press the "smart key" corresponding to the RADAR option. You will now switch to the Radar page.
5. Press the STBY key to put the radar unit into standby mode. This may take up to twenty seconds.
6. Once the MX20 is in standby mode, one of the menu options will be "Test". Press the TEST key.
7. Once the MX20 is in Test mode, press the ENTER key to switch to the "Setup" page.
8. On the "Setup" page, press the key labeled CALB to enter calibration mode. This will take a couple of seconds.
9. The MX20 will flash all faults briefly to indicate calibration mode has been entered. If this fails, turn power off and try again.

At this point, follow directions in the ART2000 Installation Manual starting with "400 Hz Ref Gain" section. Selection of calibration parameters is done by adjusting the gain setting according to the values in the ART2000 Installation Manual. On the MX20, the "smart keys" labeled "Gain" are used to adjust the gain setting and select the parameter to be calibrated. Follow the ART2000 Installation Manual instructions for calibrating the selected parameters.

**2.9.9.2 RS-181A Configuration and Calibration****2.9.9.2.1 RS-181A Configuration**

First configure the MX20 for the RS181 option. Do this in the normal way by entering the install key sequence (1, 4, 6) on the menu keys after boot-up is complete. Enable "RADAR" under the "FUNC" menu-

set, then select the "DATA" menu-set and select the "RS181" choice. After selection, wait 30 seconds then turn the power off and on again.

To configure the "Radar Indicator" push the "MISC" smart key and press "NEXT PAGE" line key twice. Press the line key next to "RADAR INDICATOR" until the desired selection is shown. The choices are 1, 2 or All. This number corresponds to the port number on the ART that is connected to the MX20. After selection, wait 30 seconds then turn the power off and on again.

#### **2.9.9.2.2 RS-181A calibration and Roll/Trim**

1. Turn the MX20 on and wait until the startup page is completely drawn. When the green labels on the smart keys (buttons at bottom) appear, it's complete.
2. Press menu keys 1, 4, 6 to enable install mode. (buttons on right-hand side numbering from top to bottom)
3. Next press the "FN" key until the "RADAR" label appears, then press that key. This will cause a switch to the "RADAR" page.
4. Press the "STBY/ON" button (top right) on the RADAR page.
5. Wait until the unit has powered-up. 15 to 30 seconds.
6. Three choices should appear on the menu keys: ON, TEST, OFF. Select TEST.
7. A test pattern should appear within a few seconds.
8. Now press the "MENU/ENTER" key (bottom right) to get to the R/T Calibration SETUP page.
9. To enter calibration mode, press the "CALB" menu key. The "CALB" label should turn green and the text near the bottom of the display should read "Calibration Enabled."
10. From here you may follow the manufacturer's calibration instructions and procedure or set the roll/trim parameter. Remember that the antenna is radiating during the setting of roll/trim.
11. To return to test mode and the test-pattern display, press the "MENU/ENTER" key. Once you return to test mode, calibration mode is disabled.
12. So each time you return to test mode and the test pattern, and then return to the R/T Calibration SETUP page (by pressing the "MENU/ENTER" key, you will need to press the "CALB" key again to enter calibration mode.

#### **2.9.9.2.3 Setting Roll/Trim**

When setting roll trim, after returning to r/t calibration (setup) page, it is important to wait 30 seconds then power-off. Do not attempt to re-enter calibration mode or use the unit without cycling the power.

### **2.9.9.3 Ground Based Checkout Procedures**

#### **2.9.9.3.1 Radar Test Mode Checkout**

Turn power on to the MX20 I/O and radar antenna assembly. After the MX20 I/O self-tests are completed, enter the Radar Function by pressing the FN key until the RADAR menu option is available. Then, press the corresponding RADAR "smart key."

(If the Radar Function is not available, verify that the MX20 is an I/O model and that the radar function has been enabled as described in previous sections).

The RADAR should remain in the off state with no scanning occurring when the Radar Function is entered for the first time.

### 2.9.9.3.2 Test Pattern

Press the ON/STBY line item and allow approximately twenty seconds for the radar to power up. Verify at this point that the RADAR powers up and performs the antenna clearance test. Once the unit is powered-up, the radar will be in standby mode.

Press the TEST line item to place the unit in Test mode.

Verify that the test pattern is displayed. Press the range UP/DOWN keys if necessary until the test pattern can be seen.

### 2.9.9.3.3 Tilt Test

Press the TILT line item and verify that the tilt can be adjusted from +15 degrees up, to -15 degrees down: Pressing and holding the key will auto increment the value. Verify that both the RADAR antenna mechanically follows the commands and that the display tilt indicator value on the MX20 I/O screen corresponds to the actual angle of the antenna.

### 2.9.9.3.4 Vertical Test - ART 2000 ONLY

Press the VERT line item and verify that the antenna scan changes from the horizontal profile to the vertical profile.

### 2.9.9.3.5 Radar On Mode Checkout

#### **WARNING**

When in ON mode, the radar antenna will be radiating.

If the MX20 radar function is not in standby mode, place it in standby mode by pressing the STBY line item. Once in standby, press the ON line item (same key as STBY). The unit is now in "WX" mode. Verify that the mode can be changed to MAP mode by pressing the MAP line item. Now verify that the unit can be placed in vertical profile by pressing the HORZ/VERT line item (ART 2000 ONLY). The display should change to a vertical profile scan.

1. Press the Brg "smart keys" and verify that the bearing can be changed from 45 L to 45 R. ART 2000 ONLY.
2. Press the TILT/BRG line item to select the TILT on mode. ART 2000 ONLY
3. Press the Tilt "smart keys" and verify that the tilt angle can be changed from 15 DN to 15 UP.

The Radar Function should still be in MAP mode. If not in MAP mode, press the MAP line item. In map mode the bottom line item will have a second option: GAIN. Press the GAIN line item. A bar-gauge should appear in the bottom left of the display. Verify that the gain can be adjusted from minimum to maximum by pressing the Gain "smart keys." At minimum, the green bar in the gauge will not be present. At maximum, the green bar fills the entire gauge.

### 2.9.9.4 Final Radar Checkout

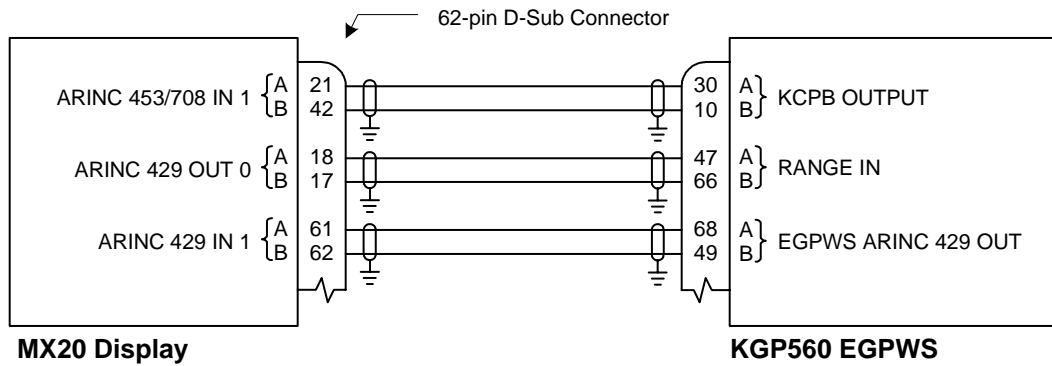
Ensure all ground checkout procedures are completed and verified prior to "open air" checkout.

With stabilization on, during takeoff or prolonged aircraft maneuvers, the displayed radar returns may not be accurate. Point the aircraft radar sensor across the airport and paint buildings and terrain.

## 2.9.10 Landmark TAWS8000 and KGP560 Checkout Procedure

### 2.9.10.1 KGP560 Configuration

The MX20 with I/O option and version 5.0 (or later) software is required in order to display terrain from the KGP-560 EGPWS. External terrain caution and warning annunciator lamps are also required. The figure below shows the connections between the MX20 display and the KGP560 EGPWS.



To interface with the MX20, the KGP560 must be configured as follows:

- Category 4: Terrain Display ID = 4
- Category 5: I/O Discrete ID = 1
- Category 9: Terrain Display Popup ID = 0

The remainder of the KGP560 configuration items is installation-specific and consequently not specified.

**NOTE**  
The MX20 will automatically range to 10 nmi if a terrain pop-up occurs.

**NOTE**  
With Terrain Display ID 4 the peaks data will be embedded in the terrain sweep. A future version of the MX20 will support Terrain Display ID 6 and display peaks data outside the terrain sweep area.

### 2.9.10.2 Goodrich Landmark TAWS and Honeywell KGP560 TAWS Checkout

If a Goodrich Landmark TAWS 8000 or Honeywell KGP560 TAWS system has been connected to the MX20 I/O, the interface should be verified under the TER (Terrain) function on the MX20.

1. Turn power on to the MX20 I/O and the TAWS system. After the MX20 I/O tests have completed, enter the Terrain Function by pressing the FN key until the TER menu option is available and press the corresponding terrain smart key.
2. If the TER function is not available, verify that the MX20 is an I/O model and that the terrain function has been enabled as described in previous sections.
3. After the TAWS has completed its self-tests, verify that an amber TAWS data-fail annunciator is not present on the left side of the screen. Other annunciators may be present.
4. From the TAWS 8000 control panel, execute a self-test. The MX20 display should present the TAWS8000 generated test pattern and annunciators. If the annunciators do not appear, check the wiring. Make sure the 429 input wires are not reversed.
5. After the self-test has completed, verify that the MX20 range up and range down keys change the corresponding range being presented by the TAWS.

## 2.9.11 Garmin GTX330 Checkout Procedure

First, perform the Post-Installation Checkout Procedure in Section 3.3 of the GTX330D Transponder Installation Manual. Once completed successfully, turn on the MX20. After the MX20 self-tests are completed, enter the Traffic (TRAF) function by pressing the FN key until the TRAF menu option is available. Then, press the corresponding TRAF “smart” key, followed by the Menu/Enter key. Press the “Operate” Line Selection key. Verify that “TIS Standby” is displayed in the lower right corner. Press the “Standby” Line Selection key. Verify that “TIS Operating” or “TIS Unavailable” are displayed in the lower right corner of the display.

## 2.9.12 Garmin AT GDL 69/69A Checkout Procedure

### 2.9.12.1 FIS Data Link Checkout Procedure (GDL 69/69A)

The checkout procedure involves verifying that the satellite signal is acquired and tracked. Locate the aircraft where there is a clear view of the southeastern or southwestern sky. XM Satellite Radio satellites are located above the equator over the eastern and western coasts of the continental United States. Turn on the power to the MX20 and the GDL 69/69A receiver. After the MX20 performs its self-tests, enter the FIS function by pressing the FN key until the FIS function is available. Press the FIS corresponding smart key. Press the fourth smart key until the status page is displayed. Perform the Post-Installation Checkout Procedure as described in the GDL 69/69A Installation Manual (Part Number 190-00355-02).

### 2.9.12.2 XM Satellite Radio Audio Checkout Procedure (GDL 69A only)

The checkout procedure involves verifying that the satellite signal is acquired and tracked and that audio can be heard through the audio panel. Locate the aircraft where there is a clear view of the southeastern or southwestern sky. Turn on the power to the MX20, GDL 69A, and audio panel. After the MX20 performs its self-tests, press the FN key until the XM function appears. Press the corresponding smart key. If the XM Satellite Radio audio subscription has not been activated, audio is available only on Channel 1. If the audio subscription has been activated, audio should be available on multiple channels. Refer to the MX20 Pilot’s Guide and the audio panel operator’s manual for instruction on changing channels and adjusting the volume. Receiving channel information on the MX20 and changing channels verifies the communication link between the MX20 and GDL 69A. Changing volume verifies proper audio connections between the GDL 69A and the audio panel.

## 2.9.13 WSI InFlight Checkout Procedure

The checkout procedure involves verifying that the satellite signal is acquired and tracked. Turn on the power to the MX20 and WSI InFlight AV-200 receiver. After the MX20 performs its self-tests, enter the FIS function by pressing the FN key until the FIS function option is available. Press the corresponding FIS “smart key” followed by the Menu/Enter key, and finally the “Status” Line Selection key. The top three lines indicate signal reception quality. Perform the Post-Installation Checkout Procedure as described in Section 4 of the WSI InFlight AV-200 Installation Manual.

## 2.9.14 Honeywell KMH 820 IHAS Checkout Procedure

Checkout of the TAWS function should be done according to the procedures in Section 2.9.10, which are those for the KGP 560.

Checkout for the TAS function should be done according to the procedures in Section 2.9.7, which are those for the SkyWatch sensors.

**NOTES**

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## 3 Specifications

This section includes detailed electrical, physical, environmental, and performance specifications for the MX20.

### 3.1 MX20 Features

#### 3.1.1 Display

6" Diagonal, Color AMLCD Display  
 640x480 Resolution (921,600 RGB Dots)  
 65,535 Simultaneous Colors  
 Direct Sunlight Readable  
 Auto/Manual Dimming

#### 3.1.2 User Interface

Back-lit, high tactile buttons  
 Six general purpose "line select keys"  
 Four general purpose "smart keys"  
 Dedicated Function and Menu/Enter keys  
 Front Panel Data-Card Access  
 Open Software Architecture  
 Field-Upgradeable Code

#### 3.1.3 Expansion/Internal Architecture

Open software architecture  
 Field-Upgradeable software  
 PC-104/PC-104L expansion bus  
 Four external high-speed serial I/O ports  
 Four general purpose input flags

#### 3.1.4 Position Source

Primary - External GPS or Loran via RS-232 serial input  
 Optional internal GPS

#### 3.1.5 Electrical

Table 3-1. Unit Power Loads				
Unit	14 VDC		28 VDC	
	Typical	Max	Typical	Max
MX20	2.0 A	3.0 A	1 A	1.5 A
MX20 with heater <sup>(1)</sup>	3.0 A	4.0 A	1.5 A	2.0 A
MX20 I/O	2.5 A	3.5 A	1.25 A	1.75 A
MX20 I/O with heater <sup>(1)</sup>	3.5 A	4.5 A	1.75 A	2.25 A

Notes:  
<sup>(1)</sup> Heater element turns on below approximately 30°C. MX20 with pushbutton power/brightness control does not have a heater.

**Note:** Circuits should be protected in accordance with guidelines in AC 43.13-1B, chapter 11, section 2, paragraph 429. Power inputs should be across a minimum of all four specified input pins.

### 3.1.6 Avionics Outputs

Serial Ports .....3 High Speed RS-232 (Ports 1, 2, 3)  
 1 High Speed RS-422 (Port 4)

### 3.1.7 Avionics Inputs

Serial Ports .....3 High Speed RS-232 (Ports 1, 2, 3)  
 1 High Speed RS-422 (Port 4)  
 Discrete Inputs .....4 General Purpose

### 3.1.8 Avionics Outputs (I/O Model)

Serial Ports .....2 ARINC 429 High/Low  
 Discrete Outputs.....3 General Purpose

### 3.1.9 Avionics Inputs (I/O Model)

Serial Ports .....2 ARINC 429 High/Low  
 2 ARINC 453/708 Radar

### 3.1.10 Serial Interface Data Sources

Position Source ..... GX50/55/60/65, CNX-series (or GNS 480), or internal GPS  
 SL50/60  
 Trimble 2000, 2000 Approach, 2000 Approach Plus, 2101,  
 2101 I/O, 2101 I/O Plus  
 Garmin GNC 250 XL, GNC 430/530, and equivalent  
 Bendix/King KLN 90B TSO and equivalent  
 Northstar Avionics M3 GPS Approach

NAV Source ..... SL30, CNX-series (or GNS 480)

Altitude Source ..... SL70  
 CNX-series (or GNS 480),  
 GX50/55/60/65 (with extended data enabled)  
 Trans-Cal SSD120-( ) (x)-RS-232-( )  
 ICARUS U3000  
 Sandia Aerospace Model SAE5-35

Traffic Source .....Garmin AT UAT (legacy)  
 Garmin AT GDL 90 UAT

(Only one traffic source may be connected  
 to the MX20) L-3 (Goodrich) SKY497 (MX20 I/O Model Only)  
 L-3 (Goodrich) SKY899 (MX20 I/O Model Only)  
 Honeywell KMH 820 (MX20 I/O Model Only)  
 Ryan TCAD 9900B (MX20 I/O Model Only)  
 Ryan TCAD 9900BX (MX20 I/O Model Only)  
 Garmin GTX330 (MX20 I/O Model Only)

Weather Source .....Garmin AT UAT (legacy) (FIS)  
 (Only one FIS source may be connected to  
 the MX20) Garmin AT GDL 90 UAT (FIS)  
 Garmin AT GDL 69/69A (FIS)  
 WSI InFlight AV-200 (FIS)  
 (MX20 will communicate at 38,400 baud)  
 Bendix/King ART2000 Radar  
 (Bendix/King P/N 071-01519-0101)  
 (MX20 I/O Model Only)  
 Bendix/King ART2100 (Bendix/King P/N 071-01550-0101)  
 (MX20 I/O Model Only) Note 1



- Weather Source (Continued) ..... L-3 (Goodrich) WX500  
 Allied Signal RS-181A (King P/N 071-1315-00; Bendix/King  
 P/N 3614077-8101) (MX20 I/O Model Only)
- Terrain TAWS Source ..... L-3 (Goodrich) Landmark TAWS 8000 (MX20 I/O Model  
 Only)  
 Honeywell KGP-560 EGPWS(MX20 I/O Model Only)  
 Honeywell KMH 820 (MX20 I/O Model Only)
- Audio Source ..... Garmin AT GDL 69A with XM Satellite Radio Subscription
- Note 1: The ART2100 is supported when configured to emulate an ART2000. Only ART2000 functions are available.

### 3.1.11 Physical Specifications

- Height ..... 5.00 inches (12.7 cm)  
 Width ..... 6.25 inches (15.88 cm)  
 Depth..... 8.00 inches (20.3 cm)

Table 3-2. Unit Weights	
Unit	Weight
MX20 only, with GPS	4.08 lb. (1.85 kg)
MX20 only, without GPS	3.92 lb. (1.78 kg)
MX20 only, with I/O Option	4.07 lb. (1.85 kg)
MX20 mounting tray only	0.73 lb. (0.33 kg)

### 3.1.12 Environmental Specifications

- Operating Temperature ..... -20°C to +55°C  
 Storage Temperature..... -55°C to +85°C  
 Temperature Variation..... 2°C per minute  
 Humidity ..... 95% at 50°C  
 Maximum altitude..... 35,000 ft  
 Cooling..... Not Required

### 3.1.13 TSO Authorizations

The MX20 meets the following TSO authorizations when connected to the following units:

<b>Table 3-3. TSO Authorizations</b>			
<b>JTSO</b>	<b>TSO</b>	<b>Manufacturer and Model</b>	<b>Part Number</b>
JTSO 2C63c	TSO C63c	Bendix King ART2000 Bendix King ART2100 Bendix RS-181A King RS-181A	071-01519-0101 071-01550-0101 3614077-8101 071-1315-00
JTSO C110a	TSO C110a	L-3 (Goodrich) WX 500 Stormscope L-3 (Goodrich) NY-163 Stormscope Antenna L-3 (Goodrich) NY-163 Stormscope Antenna	805-11500-001 805-10930-001 (White) 805-10930-002 (Black)
JTSO C113	TSO C113	All Configurations	
JTSO C118 (TCAS)	TSO C118 (TCAS)	L-3 (Goodrich) NY-156 Antenna L-3 (Goodrich) SkyWatch HP SKY899A or L-3 (Goodrich) SkyWatch HP SKY899 (non- JTSO) (SkyWatch SW version 1.6, or greater)	805-10003-001 805-11900-002 805-11900-001
	TSO C147  (TAS)	L-3 (Goodrich) SkyWatch SKY497 (SW Version 1.6, or later) L-3 (Goodrich) SkyWatch HP SKY899 L-3 (Goodrich) NY-156 Antenna L-3 (Goodrich) NY-164 Antenna RYAN TCAD Model 9900B RYAN TCAD Model 9900BX RYAN Antenna set (top and bottom mount)	805-10800-001  805-11900-001 805-10003-001 805-10800-001 70-2400 70-2420 70-2410
N/A	N/A	Honeywell KMH 820 IHAS	066-01175-0101
N/A	N/A	Garmin GTX 330 Mode S Transponder	011-00455-( )
N/A	N/A	Garmin AT GDL 69	011-00986-00
N/A	N/A	Garmin AT GDL 69A	011-00987-00
N/A	N/A	WSI InFlight AV-200 Sensor	305391-000
N/A	N/A	Garmin AT UAT (legacy)	430-6075-( )
N/A	N/A	Garmin AT GDL 90 UAT	430-6081-1( )-( )
N/A – Not Available.			

### 3.1.14 Internal GPS Receiver Performance

- Number of channels.....8
- Frequency.....1575.42 MHz L1, C/A code
- Sensitivity (acquisition).....-135 dBm
- Sensitivity (drop lock) .....-142 dBm
- Dynamic range .....> 20 dB
- Lat/Lon position accuracy .....15 meters RMS typical  
25 meters, SEP, without SA  
100 meters 2DRMS with SA
- Velocity.....1000 knots maximum

Acceleration.....	4G maximum
TTFF (time to first fix).....	25 seconds typical with current almanac, position, time, and ephemeris 55 seconds typical with current almanac, position, and time
Reacquisition .....	2.5 seconds typical
Position update interval .....	1 second typical
Datum .....	WGS-84

### 3.1.15 Weather Radar and Functions

Table 3-4 shows which radar sensors and radar functions are supported by the MX20.

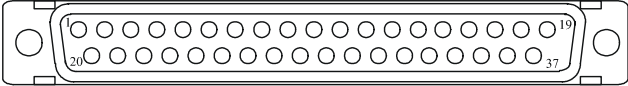
<b>Table 3-4. Radar Sensors and Supported Radar Functions</b>	
<b>RS-181A</b> (King PN 071-1315-00) (Bendix/King PN 3614077-8101)	<b>ART 2000</b> (Bendix/King PN 071-01519-0101) <b>ART 2100</b> (Bendix/King PN 071-01550-0101)
OFF	OFF
STANDBY	STANDBY
ON	ON
TEST	TEST
HORIZONTAL SCAN	HORIZONTAL SCAN
	VERTICAL SCAN
GAIN ADJUSTMENT	GAIN ADJUSTMENT
TILT ADJUSTMENT	TILT ADJUSTMENT
	BEARING ADJUSTMENT
RANGE SETTINGS	RANGE SETTINGS
MAP SCAN	MAP SCAN
WX SCAN	WX SCAN
ROLL TRIM	ROLL TRIM
HOLD	HOLD
CALIBRATION	CALIBRATION

NOTE: The ART 2100 is supported when configured to emulate an ART 2000. Only ART 2000 functions are available.

### 3.2 Rear Connector Pin Outs

**Table 3-5. MX20 Rear Panel Connector Pin Out (J1)**

Pin #	I/O	Name	Comment
1	I	Power +	Main Aircraft Power Input (+10 to +30 VDC)
2	I	Power ground	Main Aircraft Power Ground
3	I	Port 2 GND	RS-232
4	I	Port 1 IN	RS-232
5	O	Port 1 OUT	RS-232
6	O	Port 3 OUT	RS-232
7	I	Port 3 IN	RS-232
8	O	Port 4 OUT +	RS-422
9	-	NC	Reserved
10	O	Port 4 OUT -	RS-422
11	I	Port 4 IN +	RS-422
12	I	Power ground	
13	-	NC	Reserved
14	I	Input Flag 1	Discrete Input (Internally Pulled Up)
15	I	Input Flag 3	Discrete Input (Internally Pulled Up)
16	I	Heater Power +	Auxiliary Heater Input (+10 to +30 VDC)
17	O	1 PPS OUT +	1 Pulse Per Second Output (RS-422 Level). GPS timing is referenced to the falling edge of +.
18	-	NC	Reserved
19	O	1 PPS OUT -	1 Pulse Per Second Output (RS-422 Level). GPS timing is referenced to the rising edge of -.
20	I	Power ground	
21	I	Port 2 IN	Port 2 RS-232 Rx/D
22	O	Port 2 OUT	Port 2 RS-232 Tx/D
23	I	Port 1 GND	RS-232
24	O	Reserved (Power)	NC In Aircraft Install
25	I	Port 3 GND	RS-232
26	I	Port 4 IN -	Port 4 RS-422 Rx/D
27	I	Reserved (Ground)	NC In Aircraft Install
28	I	Reserved (Data)	NC In Aircraft Install
29	I	Reserved (Clock)	NC In Aircraft Install
30	-	NC	Reserved
31	-	NC	Reserved
32	-	NC	Reserved
33	I	Input Flag 2	Discrete Input (Internally Pulled Up)
34	I	Input Flag 4	Discrete Input (Internally Pulled Up)
35	-	NC	Reserved
36	I	External Power Switch	External Power Switch (Gnd to Turn On)
37	-	NC	Reserved



Viewed from rear of unit

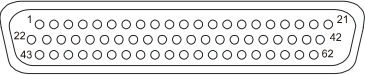
**Table 3-6. MX20 I/O Connector Pin Out (J2)***Some features listed are not supported at this time*

Pin	Name	I/O	Description
1	SYNCHRO 0 X	I	Reserved ↓
2	SYNCHRO 0 Z	I	
3	SYNCHRO 0/1 REF LO	I	
4	SYNCHRO 1 X	I	
5	DISCRETE OUT 0	O	Discrete Output number 0
6	DISCRETE OUT 1	O	Discrete Output number 1
7	DISCRETE OUT 2	O	Discrete Output number 2
8	DISCRETE IN 8	I	Reserved ↓
9	+12V	O	
10	GND	I	
11	SHIFT REG S/L	O	
12	561 DATA IN B	I	
13	429 IN 6B	I	
14	429 IN 5A	I	
15	429 IN 4A	I	
16	429 IN 2A	I	
17	429 OUT 0B	O	ARINC 429 Output port 0B
18	429 OUT 0A	O	ARINC 429 Output port 0A
19	453/708 IN 0B	I	ARINC 453/708 Input port 0B
20	5Vac	I	Reserved ↓
21	453/708 IN 1A	I	
22	SYNCHRO 2 REF HI	I	
23	SYNCHRO 0 Y	I	
24	SYNCHRO 0/1 REF HI	I	
25	SYNCHRO 1 Y	I	
26	SYNCHRO 1 Z	I	
27	DISCRETE IN 2	I	
28	DISCRETE IN 4	I	
29	DISCRETE IN 6	I	
30	DISCRETE IN 5	I	
31	SHIFT REG DATA OUT	I	
32	SHIFT REG CLK	O	
33	VREF 8V2 REARINT	I	
34	561 DATA IN A	I	
35	429 IN 6A	I	
36	429 IN 5B	I	
37	429 IN 4B	I	
38	429 IN 2B	I	
39	429 IN 3A	I	
40	453/708 IN 0A	I	ARINC 453/708 Input port 0A
41	5Vac	I	Reserved ↓
42	453/708 IN 1B	I	
43	SYNCHRO 2 REF LO	I	
44	SYNCHRO 2 X	I	
45	SYNCHRO 2 Y	I	
46	SYNCHRO 2 Z	I	
47	DISCRETE IN 0	I	
48	DISCRETE IN 3	I	
49	DISCRETE IN 7	I	

**Table 3-5 - MX20 I/O Connector Pin Out (J2) (Cont'd)**

*Some features listed are not supported at this time*

Pin	Name	I/O	Description
50	DISCRETE_IN_1	I	↓
51	+28V	I	
52	429_OUT_1A	O	ARINC 429 Output port 1A
53	429_OUT_1B	O	ARINC 429 Output port 1B
54	561_CLK_IN_B	I	↓
55	561_CLK_IN_A	I	
56	561_SYNC_IN_B	I	
57	561_SYNC_IN_A	I	
58	429_IN_0B	I	ARINC 429 Input port 0B
59	429_IN_0A	I	ARINC 429 Input port 0A
60	429_IN_3B	I	Reserved
61	429_IN_1A	I	ARINC 429 Input port 1A
62	429_IN_1B	I	ARINC 429 Input port 1B



View from rear of unit

### 3.3 Antenna Requirements

#### 3.3.1 A-33 Antenna

Early production runs of PN 590-1104 were marked with TSO-C129a. This antenna was re-qualified to TSO-C144 with no changes to the antenna. P/N 590-1104 antennas marked with TSO-C129a identification are identical to those marked with TSO-C144.

- Frequency: ..... 1575 MHz
- Polarization: ..... Right Hand Circular
- Axial Ratio: ..... 3 dB Max at bore site
- Radiation Coverage: ..... Elevation Angle      Minimum Gain
 

>15°	-2.0 dBic
10°	-3.0 dBic
5°	-4.5 dBic
0°	-7.5 dBic
- Finish: ..... Polyurethane Enamel
- Weight: ..... 3.9 oz. (0.11 kg)
- Height: ..... 0.61 inches (1.55 cm)
- Operating Temperature: ..... -55°C to +85°C
- Operating Altitude: ..... 55,000 feet (16,764m) max.

## Amplifier:

Gain .....	26.5 dB $\pm$ 2 dB
Noise Figure: .....	2.5 dB Max
Impedance:.....	50 ohms
VSWR (Dry):.....	$\leq$ 1.5:1
VSWR (Rain): .....	$\leq$ 2.0:1
Band Rejection: .....	35 dB
Power Handling: .....	1 Watt
Voltage: .....	5 VDC $\pm$ 10%
Current:.....	35 mA nominal, 40 mA max.
L1 Filter Bandwidth.....	1575 $\pm$ 20 MHz (3 dB) +110, -210 MHz (60dB)

**3.3.2 A-34 (590-1112)**

Early production runs of PN 590-1112 were marked with TSO-C129a. This antenna was re-qualified to TSO-C144 with no changes to the antenna. P/N 590-1112 antennas marked with TSO-C129a identification are identical to those marked with TSO-C144.

Frequency: .....	1575 MHz	
Polarization:.....	Right Hand Circular	
Axial Ratio: .....	3 dB Max at bore site	
Radiation Coverage: .....	Elevation Angle	Minimum Gain
	>15°	-2.0 dBic
	10°	-3.0 dBic
	5°	-4.5 dBic
	0°	-7.5 dBic
Finish: .....	Polyurethane Enamel	
Weight: .....	7.0 oz. (0.2 kg)	
Height: .....	0.66 inches (1.76 cm)	
Operating Temperature: .....	-55°C to +85°C	
Operating Altitude: .....	55,000 feet (16,764m) max.	

## Amplifier:

Gain .....	26.5 dB $\pm$ 2 dB
Noise Figure: .....	2.5 dB Max
Impedance:.....	50 ohms
VSWR (Dry):.....	$\leq$ 1.5:1
VSWR (Rain): .....	$\leq$ 2.0:1
Band Rejection: .....	35 dB
Power Handling: .....	1 Watt
Voltage: .....	5 VDC $\pm$ 10%
Current:.....	35 mA nominal, 40 mA max
L1 Filter Bandwidth .....	1575 $\pm$ 20 MHz (3 dB) +110, -210 MHz (60dB)

**NOTES**

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## **4 Limitations**

### **4.1 Operation**

There are no Part 23 aircraft type limitations. All functions of the MX20 meet the appropriate design assurance qualifications for a secondary system for airplanes in Class I, Class II, Class III, and Class IV in accordance with AC 23.1309-1C, Figure 2. The TSO authorizations with the RTCA/DO178B software levels by function are listed in Section 1.3.

### **4.2 Installation**

The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. TSO articles must have separate approval for installation in an aircraft. The article may be installed only if performed under 14 CFR Part 43 or the applicable airworthiness requirements.

If it is necessary to move any required instrumentation in an instrument panel to make room for the MX20, although the physical mounting of the MX20 is covered within this installation manual, the relocation of these instruments is beyond the scope of the STC.

For installations where a stack is not already installed in the aircraft or the alternate mounting configuration depicted in Figure 2-4 is implemented, a separate structural approval is needed for installation of the stack. Any other alternate mounting configuration is beyond the scope of this STC.

For preservation of essential equipment in aircraft with multiple power busses the MX20 should be powered from the non-essential bus.

### **4.3 GPS Antenna**

The MX20 with internal GPS receiver (430-0270-0( )) is compatible only with the Garmin AT A-33 (590-1104) or A-34 (590-1112) antennas, or those with equivalent specifications. Refer to section 3.3 for specifications.

### **4.4 Antenna Installation – General**

Antenna installation in the pressure vessel of pressurized aircraft is beyond the scope of the MX20 STC. Additional manufacturer's data may be necessary and FAA approval may be required to cover the installation of any antenna in the pressure vessel of a pressurized aircraft.

### **4.5 Traffic Sensor**

Only one traffic sensor may be connected to the MX20. Refer to Section 3.1.10 for a list of compatible sensors.

### **4.6 FIS Sensor**

Only one FIS sensor may be connected to the MX20. Refer to Section 3.1.10 for a list of compatible sensors.

*Limitations*

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**NOTES**

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## 5 Troubleshooting

This section provides information to assist troubleshooting if problems occur after completing the installation. Use Table 5-1 to assist in troubleshooting.

### 5.1 Troubleshooting Guide

<b>Table 5-1. Troubleshooting Guide</b>		
<b>Problem</b>	<b>Cause</b>	<b>Solution</b>
Unit does not power up – blank screen.	<ol style="list-style-type: none"> <li>1. Improper wiring; circuit breaker open.</li> <li>2. Unit intensity turned down.</li> <li>3. Unit is cold.</li> <li>4. Data card improperly installed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure power is properly wired to the MX20 and the circuit breaker is closed.</li> <li>2. Ensure that unit is not in manual intensity control mode with the intensity turned down.</li> <li>3. If ambient temperature is below 10°C, allow unit to preheat for up to 60 seconds.</li> <li>4. Ensure that the data card is fully inserted in the front bezel (It should be flush with the ejector button).</li> </ol>
Unit fails during power-on self-test (POST).	<ol style="list-style-type: none"> <li>1. Data card improperly installed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that the data card is fully inserted in the front bezel (It should be flush with the ejector button).</li> </ol>
INST function not shown in install mode.	<ol style="list-style-type: none"> <li>1. Improper key sequence entered.</li> <li>2. Too many keys pressed in key sequence.</li> <li>3. Cycle through functions not completed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that the proper installation key sequence is carefully entered after the power on self-test is complete.</li> <li>2. Ensure that no other keys are pressed prior to entering the sequence.</li> <li>3. Cycle through the available functions by pressing the FN key – INST function is on last available function page.</li> </ol>
Unit shows POS data flag.	<ol style="list-style-type: none"> <li>1. Data port information not correct.</li> <li>2. Antenna cables improperly installed.</li> <li>3. Antenna is improperly installed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that the data port configuration is correct and matches how the unit is wired for the position source.</li> <li>2. Ensure that the GPS antenna cables are correctly installed on the external GPS and the internal GPS (if equipped).</li> <li>3. Ensure that the GPS antenna is correctly installed on top of aircraft and aircraft is clear of hangars, buildings and trees.</li> </ol>

**Table 5-1. Troubleshooting Guide Cont'd**

<b>Problem</b>	<b>Cause</b>	<b>Solution</b>
Unit shows POS data flag (cont'd).	<ol style="list-style-type: none"> <li>4. Waypoint not selected as the current destination.</li> <li>5. Position source not configured on appropriate port.</li> <li>6. External GPS not properly configured.</li> <li>7. RF interference.</li> </ol>	<ol style="list-style-type: none"> <li>4. If a GX/SL series is used as the position source, ensure that a waypoint is selected as the current destination (Nav Flagged is not shown on primary Nav page).</li> <li>5. If a GX/SL series is used as the position source, ensure that it is configured to output serial data (MOV MAP) on the appropriate port.</li> <li>6. If other compatible external GPS is used, ensure it is configured to output serial position data on the appropriate lines.</li> <li>7. Ensure no RF interference at 1575 MHz from VHF Comm antenna – add 1575 MHz notch filter in Comm coax; Fix or replace Comm; Disconnect the ELT antenna coax to check.</li> </ol>
Unit shows RTE data flag.	<ol style="list-style-type: none"> <li>1. External position source does not have active route engaged.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that the external position source has an active route engaged.</li> </ol>
Unit shows ALT data flag.	<ol style="list-style-type: none"> <li>1. Data port configuration incorrect.</li> <li>2. Serial altitude encoder not powered up; not functioning properly.</li> <li>3. System is configured to use GX unit as source for altitude data and GX is not turned on.</li> <li>4. System is configured to use GX unit as source for altitude data and GX not configured properly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that the data port configuration is correct and matches how the unit is wired for the serial altitude source.</li> <li>2. Ensure that serial altitude encoder is powered up and functioning properly.</li> <li>3. Ensure GX is turned on, shows a valid altitude, and has acquired position and valid waypoint.</li> <li>4. Verify that GX has extended data output enabled.</li> </ol>
Unit shows TER data flag.	<ol style="list-style-type: none"> <li>1. Terrain database incorrect.</li> <li>2. Invalid altitude supplied to unit.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure the unit has the appropriate terrain database loaded for the area of operation. The terrain database is indicated on the power-up and system status pages of the MX20.</li> <li>2. Ensure that valid altitude is being supplied to the unit (an ALT data flag should not be present).</li> </ol>

**Table 5-1. Troubleshooting Guide Cont'd**

<b>Problem</b>	<b>Cause</b>	<b>Solution</b>
SL30 information is not displayed.	<ol style="list-style-type: none"> <li>1. Data port configuration incorrect.</li> <li>2. SL30 is not powered up.</li> <li>3. Wiring connections are incorrect</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that the data port configuration is correct and matches how the unit is wired for the SL30.</li> <li>2. Ensure the SL30 has power applied.</li> <li>3. Check wiring.</li> </ol>
Unit shows DEMO data flag.	<ol style="list-style-type: none"> <li>1. Demo mode enabled.</li> </ol>	<ol style="list-style-type: none"> <li>1. Disable demo mode in the install pages.</li> </ol>
Unit posts message indicating 'Special' terrain clearance mode after power-up.	<ol style="list-style-type: none"> <li>1. Incorrect terrain clearance mode improperly set.</li> </ol>	<ol style="list-style-type: none"> <li>1. This is normal for special 'Capstone' support. General aviation usage should have the terrain mode set to 'Normal' in the install pages.</li> </ol>
Unit shows TCAD data flag.	<ol style="list-style-type: none"> <li>1. Unit is not Traffic capable.</li> <li>2. Data port configuration incorrect</li> <li>3. Traffic function not enabled.</li> <li>4. TCAD unit not powered up; not functioning properly.</li> <li>5. Wiring connections are incorrect.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that the model MX20 is traffic capable.</li> <li>2. Ensure that the data port configuration is correct and matches how the unit is wired for the serial interface.</li> <li>3. Ensure that the traffic function is enabled.</li> <li>4. Ensure that the TCAD unit has power applied and is functional.</li> <li>5. Verify serial wiring and pin connections.</li> </ol>
Unit shows RDR (Amber) data flag.	<ol style="list-style-type: none"> <li>1. Unit is not radar capable.</li> <li>2. Data port configuration incorrect</li> <li>3. Radar function not enabled.</li> <li>4. Radar unit not powered up; not functioning properly.</li> <li>5. Wiring connects are incorrect.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that the model MX20 is radar capable.</li> <li>2. Ensure that the data port configuration is correct and the model radar head is set correctly.</li> <li>3. Ensure that the radar function is enabled.</li> <li>4. Ensure that the radar unit has power applied and is functional.</li> <li>5. Verify 453/708, 429 and discrete wiring and pin connections.</li> </ol>
Unit shows XM data flag	<ol style="list-style-type: none"> <li>1. Unit is not GDL 69/69A capable.</li> <li>2. Data port configuration incorrect.</li> <li>3. GDL 69/69A function not enabled.</li> <li>4. GDL 69/69A not powered up; not functioning properly.</li> <li>5. Wiring connects are incorrect.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that the model MX20 is GDL 69/69A capable.</li> <li>2. Ensure that the data port configuration is correct and the GDL 69/69A is set correctly.</li> <li>3. Ensure that the GDL 69/69A function is enabled.</li> <li>4. Ensure that the GDL 69/69A has power applied and is functional.</li> <li>5. Verify wiring and pin connections.</li> </ol>

**Table 5-1. Troubleshooting Guide Cont'd**

<b>Problem</b>	<b>Cause</b>	<b>Solution</b>
Unit shows LINK data flag.	<ol style="list-style-type: none"> <li>1. Unit is not WSI sensor capable.</li> <li>2. Data port configuration incorrect</li> <li>3. WSI InFlight sensor function not enabled.</li> <li>4. WSI InFlight sensor not powered up; not functioning properly.</li> <li>5. Wiring connects are incorrect.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that the model MX20 is WSI sensor capable.</li> <li>2. Ensure that the data port configuration is correct and the WSI sensor is set correctly.</li> <li>3. Ensure that the WSI sensor function is enabled.</li> <li>4. Ensure that the WSI sensor has power applied and is functional.</li> <li>5. Verify wiring and pin connections.</li> </ol>
Unit shows TRAF data flag.	<ol style="list-style-type: none"> <li>1. Unit is not Traffic capable.</li> <li>2. Data port configuration incorrect.</li> <li>3. Traffic function not enabled.</li> <li>4. Traffic unit not powered up; not functioning properly.</li> <li>5. Wiring connections are incorrect.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that the model MX20 is traffic capable.</li> <li>2. Ensure that the data port configuration is correct and matches how the unit is wired for the serial interface.</li> <li>3. Ensure that the traffic function is enabled.</li> <li>4. Ensure that the Traffic unit has power applied and is functional.</li> <li>5. Verify serial wiring and pin connections.</li> </ol>
Unit shows ADSB data flag.	<ol style="list-style-type: none"> <li>1. The GDL 90 UAT internal GPS receiver is reporting an invalid position or is unable to compute a position.</li> <li>2. The traffic unit is not a GDL 90 UAT.</li> </ol>	<ol style="list-style-type: none"> <li>1. The ADSB data flag is displayed at start-up during normal GPS receiver signal acquisition. If the data flag is displayed for more than five minutes after the GDL 90 UAT is turned on and the GPS antenna has a clear view of the sky, refer to the troubleshooting section of the GDL 90 Installation Manual.</li> <li>2. Disable the GDL 90 selections in the Install-Misc installation menu.</li> </ol>
MX20 runs hot.	<ol style="list-style-type: none"> <li>1. Arrangement of avionics and installation area does not provide sufficient airflow.</li> </ol>	<ol style="list-style-type: none"> <li>1. If an internal fan is present, verify that it is operational and that the opening is clear of obstructions. The fans should turn on when the unit's internal temperature is approximately 95-100°F. If an internal fan is not present, one may be installed by the factory. Contact factory.</li> </ol>

<b>Table 5-1. Troubleshooting Guide Cont'd</b>		
<b>Problem</b>	<b>Cause</b>	<b>Solution</b>
Unit shows XPDR data flag.	<ol style="list-style-type: none"> <li>1. Unit is not GTX330 capable.</li> <li>2. Data port configured incorrectly.</li> <li>3. Traffic function not enabled.</li> <li>4. GTX330 not powered up or not functioning properly.</li> <li>5. Wiring connections are incorrect.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure that the model MX20 is GTX330 capable.</li> <li>2. Ensure that the data port configuration is correct and the GTX330 is set correctly.</li> <li>3. Ensure that the GTX330 function is enabled.</li> <li>4. Ensure that the GTX330 has power applied and is functional.</li> <li>5. Verify wiring and pin connections</li> </ol>
Split Screen function does not appear.	<ol style="list-style-type: none"> <li>1. Split Screen function is not enabled.</li> </ol>	<ol style="list-style-type: none"> <li>1. Enable Split Screen function in INSTL mode function page.</li> </ol>
Terrain annunciators do not light during TAWS8000 self-test.	<ol style="list-style-type: none"> <li>1. ARINC 429 IN (J2-61 &amp; J2-62) wires are reversed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Ensure the ARINC 429 wires are connected to the proper pins.</li> </ol>
Unit shows IDENT (Green)	<ol style="list-style-type: none"> <li>1. This is not a problem. This is an indication that the GDL 90 UAT is in Identification mode. This should be a temporary indication.</li> </ol>	<ol style="list-style-type: none"> <li>1. No action required.</li> </ol>
No XM Satellite Radio Audio	<ol style="list-style-type: none"> <li>1. Installed unit is a GDL 69, not GDL 69A.</li> <li>2. The GDL 69A, audio panel, or both are not powered up.</li> <li>3. Volume turned down or muted.</li> <li>4. Headphone or speaker outputs on audio panel are disabled.</li> <li>5. Wiring connections are loose or incorrect.</li> </ol>	<ol style="list-style-type: none"> <li>1. Only the GDL 69A has audio outputs.</li> <li>2. Ensure GDL 69A and audio panel have power applied.</li> <li>3. The GDL 69A mutes volume on power up. Increase volume through the MX20 user interface or GDL 69/69A remote control switches. (See GDL 69/69A Installation Manual for details).</li> <li>4. Enable headphone or speaker outputs on audio panel (refer to audio panel documentation). Some audio panels may require software configuration changes.</li> <li>5. Verify wiring and pin connections.</li> </ol>

## 5.2 Integration Troubleshooting Procedure

Use this procedure to check the integration of external data sources with the MX20.

1. Remove power to all external data sources and power on just the MX20.
2. Verify the correct power up sequence and access to the different functions of the MX20.
3. Verify that amber data flags are presented and own-ship is 'X'd, indicating that external data sources are not available. Allow the system to operate for several minutes to verify correct basic operation.
4. Apply power to each external data source one at a time. Verify that the corresponding amber data flag extinguishes with each data source.
5. Verify that system operates correctly with the new data source by switching between different functions and allowing the system to operate for several minutes. Repeat with the next data source.  
**Note that the external GPS may need to acquire and set a destination waypoint before the ALT, POS, and RTE flags clear.**
6. If a given external data source causes a system error, verify compatibility and wiring. Re-verify port assignments.

## 5.3 Contacting the Factory for Assistance

If the MX20 fails to operate despite troubleshooting efforts, contact Customer Service for assistance.

GARMIN International, Inc.  
1200 East 151<sup>st</sup> Street  
Olathe, KS 66062-3426  
USA  
Phone: 913 397 8200  
FAX: 913 397 8282  
<http://www.garmin.com>

Be prepared to offer the following information about the installation:

- Installation configuration (accessories, antenna, ...)
- Model number, part number with mod levels, and serial number
- Software version
- Description of problem
- Efforts made to isolate the problem



## 6 Continued Airworthiness Instructions

The MX20 is designed to not require any regular maintenance except as included in this section:

### 6.1 Equipment Calibration

The MX20 design requires no adjustments or calibration to be made.

### 6.2 Cleaning the Front Panel

The front bezel, keypad, and display can be cleaned with a soft cotton cloth dampened with clean water. DO NOT use any chemical-cleaning agents. Care should be taken to avoid scratching the surface of the display.

### 6.3 Display Backlight

The display backlighting is rated by the manufacturer as having a usable life of over 10,000 hours. This life may be more or less than the rated time depending on the operating conditions of the MX20. Over time, the backlighting may dim and the display may not perform as well in direct sunlight conditions. The user must determine by observation when the display brightness is not suitable for its intended use. Contact Garmin AT when the backlighting requires service.

### 6.4 Lithium Battery Replacement

The internal keep-alive battery will require replacement after 5 years of service. The Li battery is only included in MX units with internal GPS (430-0270-0( )). The effect of battery failure is a loss of the real time clock in the GPS receiver. The unit will still work with loss of battery power; however, GPS acquisition may take considerably longer time (20 minutes). There is no hazard associated with such a failure.

To replace the battery, the MX20 must be removed from the aircraft and serviced by an appropriately rated Garmin AT service center. If the aircraft is to fly without the unit installed, placard the aircraft accordingly.

**Note: The battery is to be replaced ONLY with Garmin AT part number 148-0052-00, or a Garmin AT approved equivalent.**

#### CAUTION

The battery may explode if mistreated. Risk of fire, explosion, and burns. Do not recharge, disassemble, heat above 100°C, or incinerate.

### 6.5 Altitude Encoder

In this VFR non-essential system, it is recommended that the altitude encoder be calibrated every 24 months. Refer to the manufacturer's installation and calibration manual.

### 6.6 Manuals

Incorporate operational test and troubleshooting guides into Aircraft Maintenance manuals. Update the wiring diagram manual and equipment list as necessary. Add each component to the reliability program as necessary.

**NOTES**

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## 7 Environmental Qualifications

The MX20 has been tested to the following environmental categories per procedures defined in RTCA/DO-160D.

**Table 7-1. Environmental Qualification Form**

Part No: TSO/-JTSO No:	430-0270-0( ) C110a C113	430-0270-5( ) C110a C113	430-0270-6( ) C110a C113 C118 C147	430-0270-7( ) C63c/2C63c C110a C113 C118 C147	430-0270-8( ) C110a C113 C118 C147	430-0270-9( ) C63c/2C63c C110a C113 C118 C147
Manufacturer:     Garmin AT, Inc.     2345 Turner Road SE     Salem, Oregon 97302						
Conditions		Section	Description of Conducted Tests			
Temperature and Altitude Operating Temp Short Time High Temperature Ground Survival Temperature In-flight Loss of Cooling Altitude Decompression Overpressure		4.0    4.5.4 4.6.1 4.6.2 4.6.3	Equipment tested to Category A1 and C1 with -20°C to +55°C + 70°C -55°C to +85°C No cooling required Equipment tested to 35,000 feet Equipment tested 8K to 35K in < 15 seconds Equipment tested for overpressure			
Temperature Variation		5.0	Equipment tested to Category C, 2°C/minute			
Humidity		6.0	Equipment tested to Category A, standard humidity environment			
Operational Shocks and Crash Safety		7	Equipment tested to Category B5R for both operational and crash safety shocks. (Equipment operated normally after the crash safety shocks.)			
Vibration		8.0	Standard vibration Category S (curves M and B) Robust Helicopter Vibration Category U (curves F and F1)			
Explosion Proofness		9.0	Equipment identified as Category X, no test required			
Waterproofness		10.0	Equipment identified as Category X, no test required			
Fluids Susceptibility		11.0	Equipment identified as Category X, no test required			
Sand and Dust		12.0	Equipment identified as Category X, no test required			
Fungus Resistance		13.0	Equipment identified as Category X, no test required			
Salt Spray		14.0	Equipment identified as Category X, no test required			
Magnetic Effect		15.0	Equipment is Class Z, < 0.3 meters			
Power Input		16.0	Equipment tested to Category B for 14 and 28 VDC			
Voltage Spike		17.0	Equipment tested to Category A			
Audio Frequency Conducted Susceptibility - Power Inputs		18.0	Equipment tested to Category B			
Induced Signal Susceptibility		19.0	Equipment tested to Category C, Z			
Radio Frequency Susceptibility (Radiated and Conducted)		20	Equipment tested to Category V (Conducted) Equipment tested to Category V (Radiated)			
Emission of Radio Frequency Energy		21	Equipment tested to Category M			
Lightning Induced Transient Susceptibility		22.0	Equipment tested to Category A3 and B2			
Lightning Direct Effects		23.0	Equipment identified as Category X, no test required			
Icing		24.0	Equipment identified as Category X, no test required			
Electrostatic Discharge		25.0	Equipment tested to Category A			
<b>Remarks:</b>						



## APPENDIX A - I/O Specifications

This appendix includes the RS-232 serial port interface specifications.

### A.1 Moving Map Input

The format of the moving map data output is shown below. Definitions of the input data is included in Table A-1 and Table A-3. A sample output message is included in Figure A-1.

Baud rate: ..... 9600  
 Data bits: ..... 8  
 Stop bits: ..... 1  
 Parity: ..... none  
 Output rate: ..... approx. 1 seconds  
 Message length: ..... variable, approx. 83 to 484 characters

The serial output messages are in the following format.

<STX><id><data><it><id><data><it>...<id><data><it><ETX>  
 <STX> ..... ASCII “start of text” character (1 byte, 02h)  
 <id> ..... item designator (1 byte, from following table)  
 <data> ..... item data (format listed in following table)  
 <it> ..... item terminator (1 byte, 0Dh)  
 <ETX> ..... ASCII “end of text” character (1 byte, 03h)

**Table A-1. Moving Map ASCII Navigation Data**

ID	Data Format	Length	Description
A	sddmmhh	9	Present latitude s = sign: N for north, S for south dd = degrees mm = minutes hh = hundredths of minutes
B	sdddmmhh	10	Present longitude s = sign: E for east, W for west ddd = degrees mm = minutes hh = hundredths of minutes
C	ddd	3	Track (magnetic): ddd = degrees
D	ddd	3	Ground speed: ddd = knots
E	dddd	5	Distance to active waypoint: ddddd = nm x 10
G	sdddd	5	Cross track error: s = sign: R for right, L for left of course dddd = distance off course, hundredths of nm
I	dddd	4	Desired track (magnetic): dddd = degrees x 10
K	ddd[dd]	3 to 5	Active waypoint identifier: ddd[dd] = ASCII waypoint identifier
L	dddd	4	Bearing to active waypoint (magnetic): dddd = degrees x 10
Q	sddd	4	Magnetic variation: s = sign: E for east, W for west ddd = degrees x 10
T	---A----	9	Warnings: The 4th character will be an “A” when the navigation data is flagged, otherwise, all characters will be dashed. All other navigation data will be dashed when it is flagged.

## A.2 Binary Nearest List Data (when Extended Data is Enabled Only)

The nearest waypoints lists are sent one waypoint per data transmission set. The lists are sent in the following order:

- LFAC
- VOR
- NDB
- INT
- User

There is a maximum of twenty waypoints per type. The waypoints are a maximum of 600 nm from the current position. The waypoints are order by distance from current position nearest to farthest. The maximum time to send all lists is 100 second. Each list is updated just prior to the first waypoint in the list being sent. If a list is empty a shorter record will be sent with the List Item Number set to 0xFF.

**Table A-2. Nearest Waypoint List Data**

Byte	Format	Description
1	Z	'Z' Item Designator
2	sddddddd	<b>List Item Number:</b> Packed, unsigned binary values s = 1 End of list, 0 all other ddddddd = 1 – 20 list waypoint index sddddddd = 0xFF List Type is EMPTY ( <b>BYTE 4 terminate Item</b> )
3	t	<b>Waypoint Type:</b> t = {a (airport)    v (VOR)    n (NDB)    i (INT)    u (USER)}
4	Cr	'r' Item Terminator <0x0d> ( <b>ONLY IF BYTE 3 = 0xFF</b> )
4-8	dddd	<b>ASCII Waypoint Identifier</b>
9 10 11	sddddddd xxmmmmmm xhhhhhhh	<b>Latitude of waypoint.</b> Packed, unsigned binary values for degrees, minutes and hundredths of minutes. s = 0 North latitude, 1 South latitude x = undefined ddddddd = Latitude degrees mmmmmm = Latitude minutes hhhhhhh = Latitude hundredths of minutes
12 13 14 15	sxxxxxxx ddddddd xxmmmmmm xhhhhhhh	<b>Longitude of waypoint.</b> Packed, unsigned binary values for degrees, minutes and hundredths of minutes. s = 0 East longitude, 1 West longitude x = undefined ddddddd = Longitude degrees mmmmmm = Longitude minutes hhhhhhh = Longitude hundredths of minutes
16	Cr	'r' Item Terminator <0x0d>

**Table A-3. Moving Map Binary Route Data**

<b>Byte</b>	<b>Data Format</b>	<b>Description</b>
1	w	Item designator
2-3	dd	Current waypoint number in ASCII (01h to 20h)
4	xiannnnn	Sequence number x = undefined i = 1 if last waypoint a = 1 if active waypoint nnnnn = unsigned binary waypoint number
5-9	dddd	ASCII waypoint identifier
10	sddddddd	Waypoint latitude - packed, unsigned binary s = sign: 0 for north, 1 for south ddddddd = degrees mmmmmm = minutes hhhhhh = hundredths of minutes x = undefined
11	xxmmmmm	
12	xhhhhh	
13	sxxxxxxx	Waypoint longitude s = sign: 0 for east, 1 for west ddddddd = degrees mmmmmm = minutes hhhhhh = hundredths of minutes x = undefined
14	sddddddd	
15	xxmmmmm	
16	xhhhhh	
17	nnnnnnnn	Magnetic variation at waypoint LS byte (msbit...lsbit) MS byte (msbit...lsbit) Two's complement binary in sixteenths of degrees, easterly variation is positive.
18	nnnnnnnn	
19	<CR>	ASCII carriage return (0Dh)

### A.3 Flight Plan Waypoint Types (when Extended Data is Enabled Only)

The following data is only transmitted when preceded by flight plan data. There is one character per flight plan waypoint transmitted.

Table A-4. Flight Plan Waypoint Type			
Id	Item Format	Len	Description
t	nnn...	1-21	n = { a (airport)    v (VOR)    n (NDB)    i (intersection)    u (user)    p (parallel track)    d (direct to)    F (FAF)    I (IAF)    H (MAHP)    A (IFAF)    P (undefined approach waypoint type) }

Example Moving Map Data Output (Extended Data Disabled)	
AN 34 1570	34°15.70' latitude
BW 118 4390	118°43.90' longitude
C306	306° track angle
D210	210 knots
E02682	268.2nm to waypoint
GR0006	0.6nm right of course
I3059	305.9° desired track
KSFO	SFO waypoint ident
L3058	305.8° bearing to waypoint
QE140	14.0° east magnetic variation
T-----	No alarms, data not flagged
<binary data>	From Table 3-6

Figure A-1. Moving Map Data Output (Extended Data Disabled)



<b>Example Moving Map Data Output (Extended Data Enabled)</b>	
AN 34 1570	34°15.70' latitude
BW 118 4390	118°43.90' longitude
C306	306° track angle
D210	210 knots
E02682	268.2nm to waypoint
GR0006	0.6nm right of course
I3059	305.9° desired track
KSFO	SFO waypoint ident
L3058	305.8° bearing to waypoint
QE140	14.0° east magnetic variation
T-----	No alarms, data not flagged
<binary data>	From Table 3-2
a-O--F	Approach Enabled Off, Active Off, Message On, Parallel Track Off, Hold Off, and From/To is FROM
cvR001	CDI Valid, Needle Right, Deflection 001°
vC000	VDI Valid, Needle Centered, Deflection is 000°
<binary data>	From Table A-3
t da	Flight Plan Waypoint Type data, direct-to, airport type

**Figure A-2. Moving Map Data Output (Extended Data Enabled)**

## A.4 Altitude Encoder/Converter Input

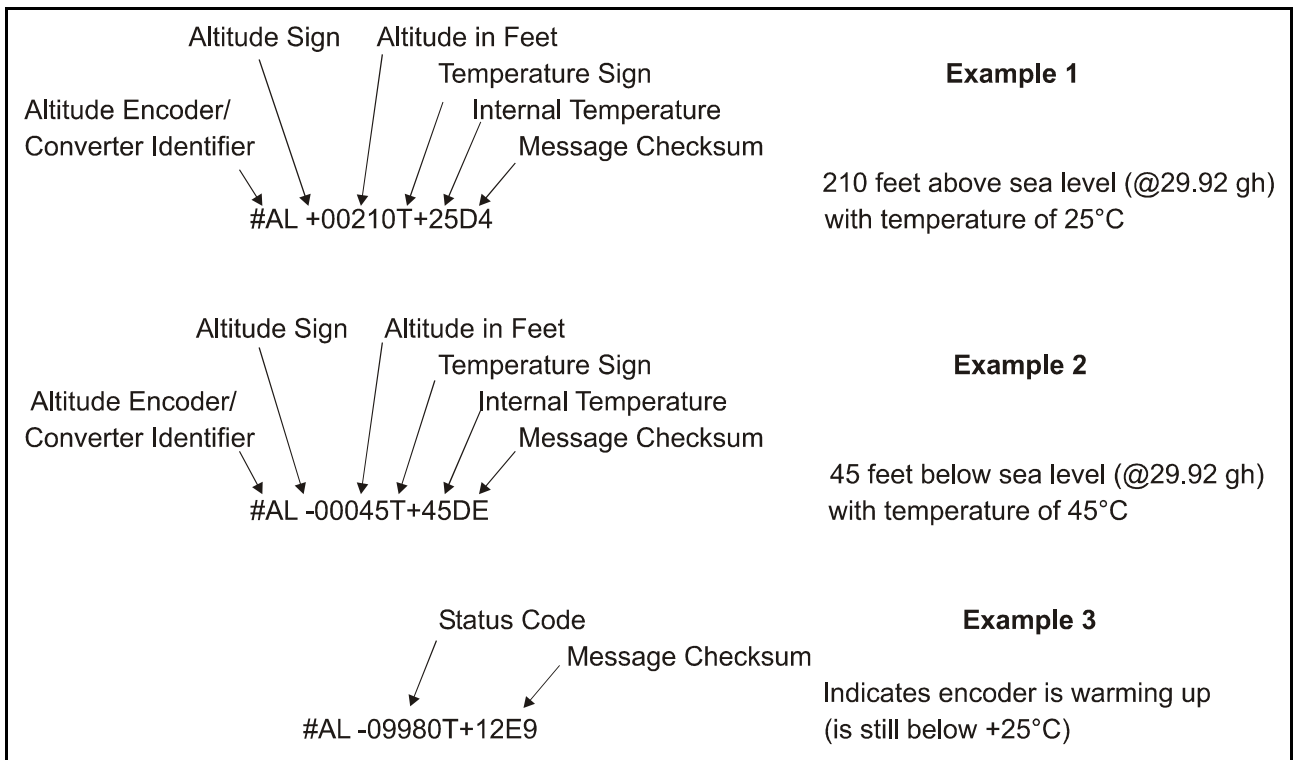
The format of the altitude input is as follows. Definition of the input message is included in Table A-5. Several sample messages are illustrated in Figure A-3.

Baud rate: .....1200  
 Data bits: .....8  
 Stop bits: .....1  
 Parity: .....none  
 Expected input rate: .....approx. 1 second  
 Message length: .....17 characters

Table A-5. Altitude Input Data		
Byte	Data Format	Description
1	"#"	ASCII "#" (023h)
2	"A"	ASCII "A" (041h)
3	"L"	ASCII "L" (04Ch)
4	" "	ASCII space (020h)
5	"+" or "-"	Altitude sign: ASCII "+" or "-" (02Bh or 02Dh)
6-10	dddd	Altitude in feet, right justified with leading zeros
11	"T"	ASCII "T" (054h)
12	"+" or "-"	Temperature sign: ASCII "+" or "-" (02Bh or 02Dh)
13-14	dd	Internal altimeter temperature
15-16	dd	Checksum of bytes 1 through 14, computed in hex, output in ASCII format (i.e., "FA" hex)
17	<CR>	ASCII carriage return (0Dh)

The altitude input can decode several status or error codes. These codes would be in place of the altitude data in characters 5 - 10 as follows.

"-09980" ..... Heater not ready: expected during encoder warm-up or if there is a loss of signal from the encoder.  
 "-09981" ..... Possible hardware problem: expected from encoder indicating a temperature greater than 55°C or if data is invalid.  
 "-09982" ..... Altitude out of range: expected from the encoder indicating that the altitude is outside specified range of the encoder.



**Figure A-3. Altitude Data Input**

## A.5 Stormscope Inputs

The WX-500 is the only Stormscope that the MX20 MFD interfaces with. It can be connected to RS-422 or RS-232.

### RS-232

Connection	TX	J3-20
	RX	J3-8
	RS-232_GND	J2-5
Cable	Twisted shielded triad 24 AWG wire	
Voltage	Logic 0 (space) Min: +5V, Max: +15V	
	Logic 1 (mark) Min: -15V, Max: -5V	
Baud Rate	9600	
Load Impedance	3KΩ Min.	

### RS-422

Connection	TX+	J3-25, TX- J3-13
	RX+	J3-24, RX- J3-12
	GND	CASE_GND
Cable	Twisted shielded pair 22 AWG	
Voltage	Logic 0 (space) Min (A-B): +2V, Max (A-B): +6V	
	Logic 1 (mark) Min (A-B): -6V, Max (A-B): -2V	
Baud Rate	9600	
Load Impedance	3KΩ Min.	

**NOTES**

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## APPENDIX B - Equipment Compatibility

### B.1 Position Source

The following position sources are compatible with the MX20. Other Position sources may be used provided they meet the serial specifications defined in section A.1 .

Manufacturer	Model	Data Format	Notes
Bendix/King	KLN 90B TSO	RS-232	
Garmin	GNC 250 XL, GNC 430/530	RS-232	
Garmin AT	GX50/55/60/65	RS-232	
Garmin AT	CNX80, GNS 480	RS-232	
Garmin AT	SL50/60	RS-232	
Northstar Avionics	M3 GPS Approach	RS-232	

### B.2 Nav Source

The following Nav sources are compatible with the MX20.

Manufacturer	Model	Data Format	Notes
Garmin AT	SL30	RS-232	
Garmin AT	CNX-Series (or GNS 480)	RS-232	

### B.3 Altitude Source

The following Altitude sources are compatible with the MX20. Other Altitude sources may be used provided they meet the serial specifications defined in section A.4 .

Manufacturer	Model	Data Format	Notes
Garmin AT	SL70	RS-232	
Garmin AT	CNX-Series	RS-232	or GNS 480
Garmin AT	GX50/55/60/65	RS-232	With extended data enabled
Icarus	U3000	RS-232	
Sandia Aerospace	SAE5-35	RS-232	
Trans-Cal	SSD120-(XX(x)- RS-232-(XX)	RS-232	

## B.4 Traffic Source

The following Traffic sources are compatible with the MX20.

Manufacturer	Model	Data Format	Notes
Garmin	GTX330	ARINC429	MX20 I/O Model only
Garmin AT	Legacy UAT/GDL 90 UAT	RS-422	
L3 (Goodrich)	SKY497	ARINC429	MX20 I/O Model only
L3 (Goodrich)	SKY899	ARINC429	MX20 I/O Model only
Ryan	TCAD 9900B	RS-232	MX20 I/O Model only
Ryan	TCAD 9900BX	RS-232	MX20 I/O Model only
Honeywell	KMH 820 IHAS	ARINC429	MX20 I/O Model only

## B.5 Weather Source

The following Weather sources are compatible with the MX20.

Manufacturer	Model	Data Format	Notes
Allied Signal	RS-181A (King P/N 071-1315-00, Bendix/King P/N 3614077-8101)	ARINC708	MX20 I/O Model only
Bendix/King	ART2000 (Bendix/King P/N 071-01519-0101)	ARINC708	MX20 I/O Model only
Bendix/King	ART2100 (Bendix/King P/N 071-01550-0101)	ARINC708	MX20 I/O Model only. The ART2100 is supported when configured to emulate an ART2000. Only ART2000 functions are available.
Garmin AT	Legacy UAT/GDL 90	RS-422	
Garmin AT	GDL 69/69A	RS-232	
L-3 (Goodrich)	WX500	RS-232	
WSI	AV-200	RS-232	MX20 will communicate at 38,400 baud

## B.6 Terrain TAWS Source

The following Terrain sources are compatible with the MX20.

Manufacturer	Model	Data Format	Notes
Honeywell	KGP-560 EGPWS	ARINC708	MX20 I/O Model only
Honeywell	KMH 820 IHAS	ARINC708	MX20 I/O Model only
L-3 (Goodrich)	Landmark TAWS 8000	ARINC708	MX20 I/O Model only

## B.7 Audio

The following audio component(s) are compatible with the MX20.

Manufacturer	Model	Data Format	Notes
Garmin AT	GDL 69A	RS-232	RS-232 is for command and control. Audio is routed directly to audio panel.



