MX20
Multi-Function Display
Installation Manual

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560-1025-09 Rev E

GARMIN®

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HISTORY OF REVISIONS

Part No.	Revision	Date	Description
560-1025-02	--	1/17/00	Add MX20 configuration procedure, expand post installation checkout procedures, add Appendix A.
560-1025-02	A	4/3/00	Clarify unit installation position. Correct wiring diagram. Incorporate changes for software version 1.2.
560-1025-02	B	7/25/00	Incorporate changes for software version 2.0.
560-1025-02	C	10/3/00	Add 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	Add I/O board option and SW to support traffic and radar.
560-1025-05	A	6/12/02	Add JTSO
560-1025-06	--	11/13/02	Add 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. Add 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. Add XM Satellite Weather and Audio information as well as support for Honeywell KMH 820 IHAS.
560-1025-09	A	2/10/05	Add information about limiting number of FIS sources. Add supported radar functions and sensors. Add 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	Correct pinout information for Figure 2-18.
560-1025-09	D	10/3/05	Add GWX 68 Setup Procedure.
560-1025-09	E	8/15/06	Add CD references (Rev page). Add AC 23-18 eval, clarify C151a (1.3). Clarify manual kit (1.5), interfaced FMS update (2.2), circuit protection guidance (2.5.5, 2.5.6, 3.1.5), software version (2.7.3.5, 2.7.3.6), GDL 90 control and squawk code entry (2.7.4 steps 9 & 10, 4.5), data display (2.9.3 step 11, 2.9.4 step 3, 2.9.5, 2.9.6 note, 2.9.7 note), procedures (2.9.9.1.2 note, 2.9.11, 2.9.12, 2.9.13). Correct GWX 68 p/n (3.1.15), L-3 name (2.5.2, 2.5.7, B.4), A-34 weight (3.3.2), filter bandwidth (3.3.1, 3.3.2), heli vibration levels (Table 7-1).

ORDERING INFORMATION

To receive additional copies of this publication, order part # **140-0059-000** Rev J or later, MX20 Product CD, which includes the **560-1025-09 Rev E,** *MX20 Multi-Function Display Installation Manual*.

OTHER PUBLICATIONS

MX20 Pilot's Guide*, P/N 560-1026-( )
MX20 Quick Reference Guide*, P/N 561-0263-( )
MX20 Helicopter Installation Supplement*, P/N 560-1054-( )
GX50/60 Installation Manual, P/N 560-0959-( )
WX-500 Installation Manual, Goodrich P/N 009-11500-001
SKY899 Installation Manual, Goodrich 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
GTX 330, GTX 330D Transponder Manual, Garmin P/N 190-00207-02
GDL 90 Installation Manual, Garmin AT P/N 560-1049-( )
GDL 69/69A Installation Manual, Garmin P/N 190-00355-02

**These documents, and others relating to MX20 installation, STC certification, and continued airworthiness/maintenance, are included in electronic form in the MX20 Product CD, part number 140-0059-( ).*

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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 and later may be one of multiple display devices for radar sensors and provides support for the GWX 68 radar sensor. The GWX 68 must be installed via a separate installation approval.

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.

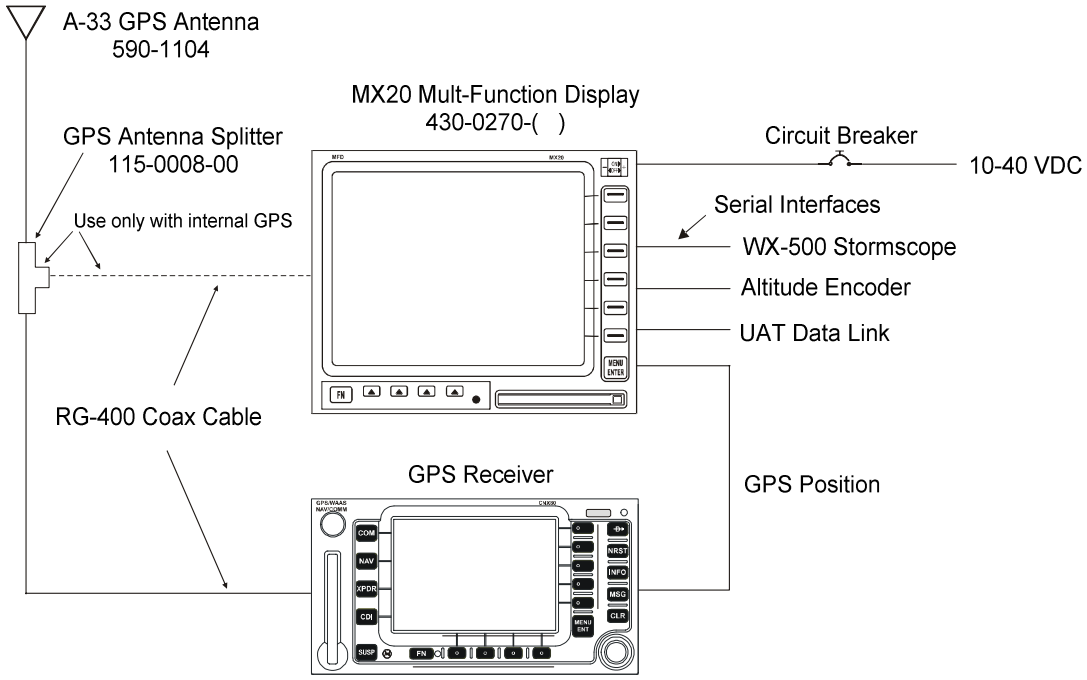
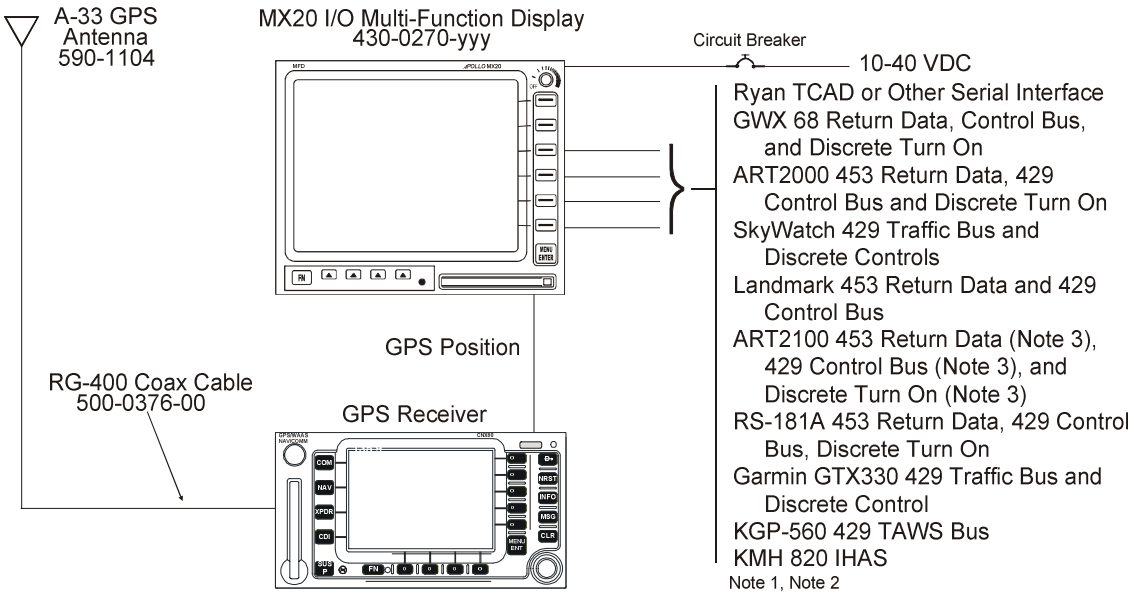


Figure 1-1. Example of a MX20 System Block Diagram

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

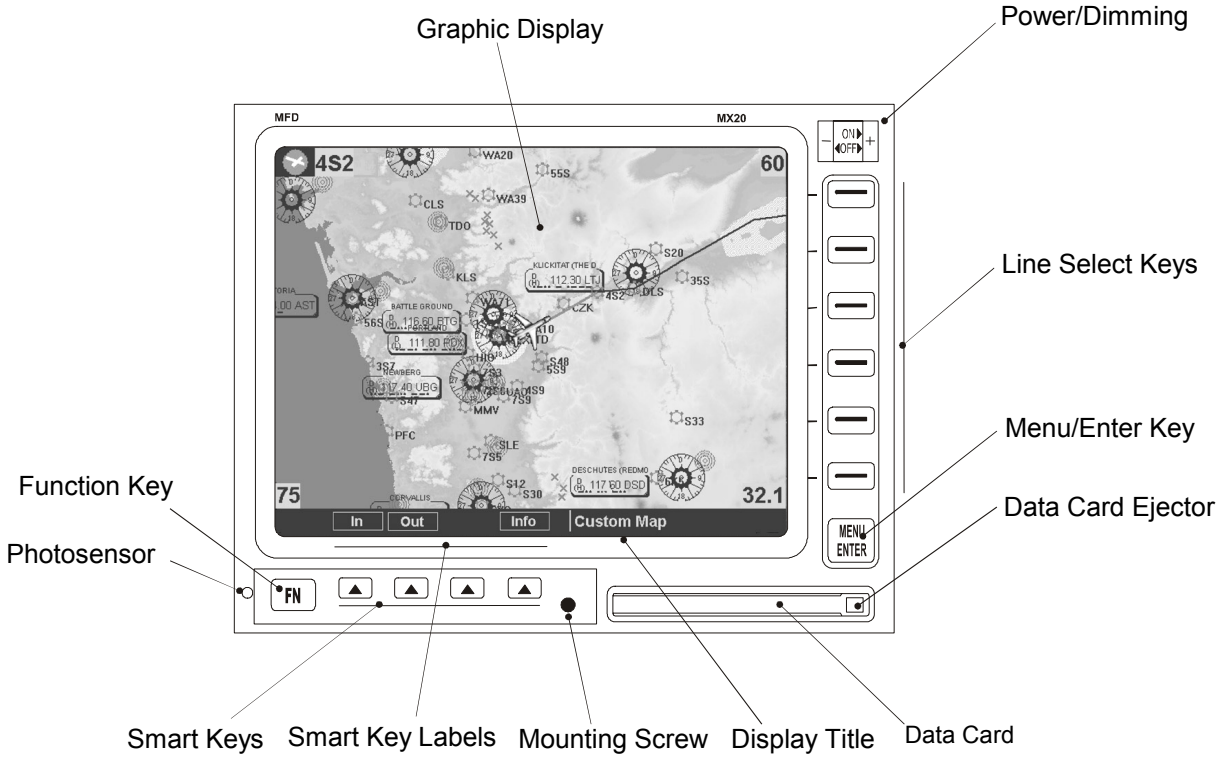


Figure 1-3. MX20 Front Panel Description

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 (see Section 3.1.13):

- 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)

Since FAA TSO-C151a "Terrain Awareness and Warning System (TAWS)" does not include display requirements, the MX20 does not have TSOA for TSO-C151a. However the MX20 is designed and tested to be compatible as a display device for the TSO-C151a TAWS sensors listed in Section B.6

Garmin AT has evaluated the MX20 with respect to the guidelines of AC 23-18, Installation of Terrain Awareness and Warning System (TAWS) Approved for Part 23 Airplanes. The MX20 display is not a requirement for Class B TAWS installations. The MX20 improves the pilot's situational awareness and complies with AC 23-18, paragraph 7.h for TAWS displays.

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
	MX20 Installation Kit			
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
	MX20 I/O Installation Kit			
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( )	**Manual Kit**	1	1	1
140-0059-0( )	MX20 & i-linc MFDs Product CD	1	1	1
560-1025-( )	MX20 Installation Manual	0*	0*	0*
560-1026-( )	MX20 Pilot's Guide	1*	1*	1*
561-0263	MX20 Quick Reference Guide	1*	1*	1*
564-0078-0( ) Or 560-1055-0( )	STC Kit (AFMS & MDL) Or STC Index (AFMS, RFMS, MDL, STC, AML, etc.)	0*	0*	0*

Notes:

* These documents are currently included in the product CD.

** 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
- Sixteen AN507 or MS24693 6-32 cadmium-plated carbon steel screws with 100° countersink flat heads to secure the mounting tube to the aircraft structure.

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. When data from previously installed equipment is displayed on the MX20, or control of that equipment is accomplished by the MX20, the installer should evaluate whether the AFMS/RFMS for the interfaced equipment needs update.

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 2-7. 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.

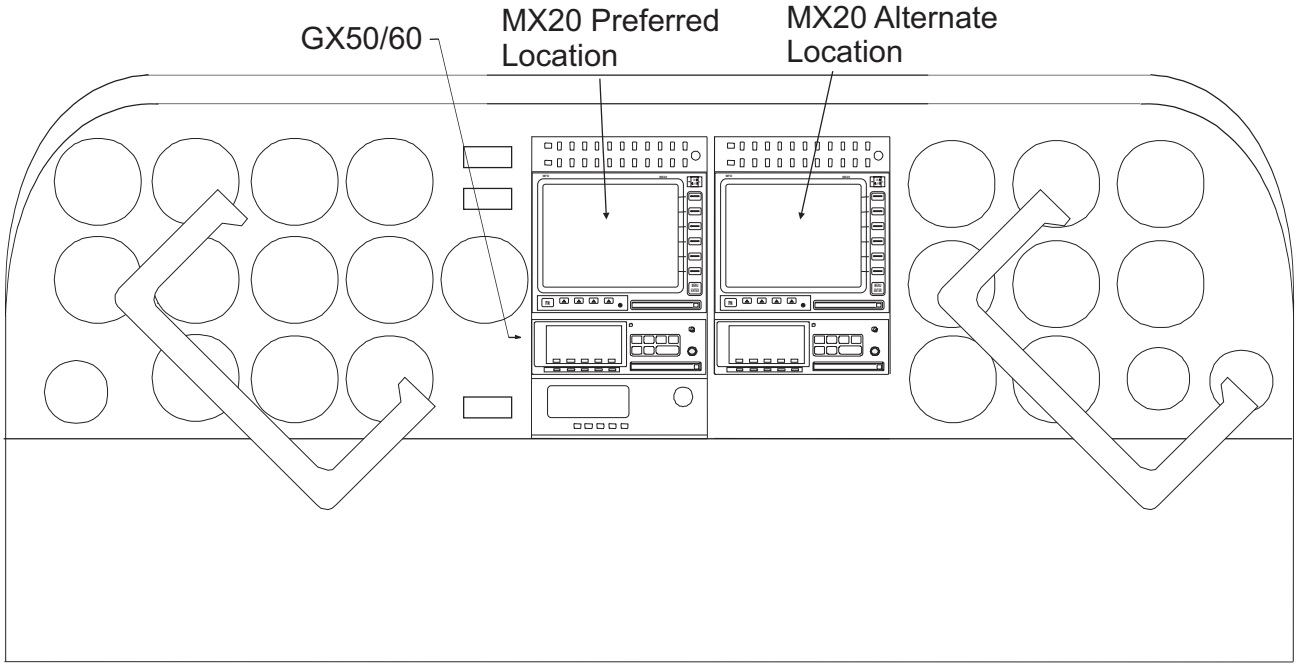


Figure 2-1. Cockpit Panel Configuration for a Large Panel

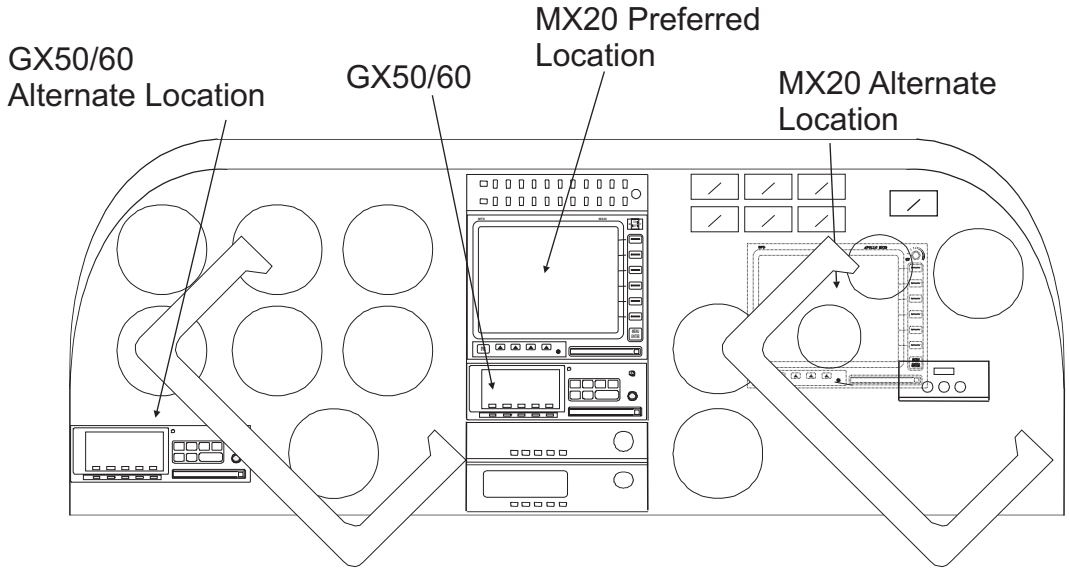


Figure 2-2. Cockpit Panel Configuration for a Small Panel

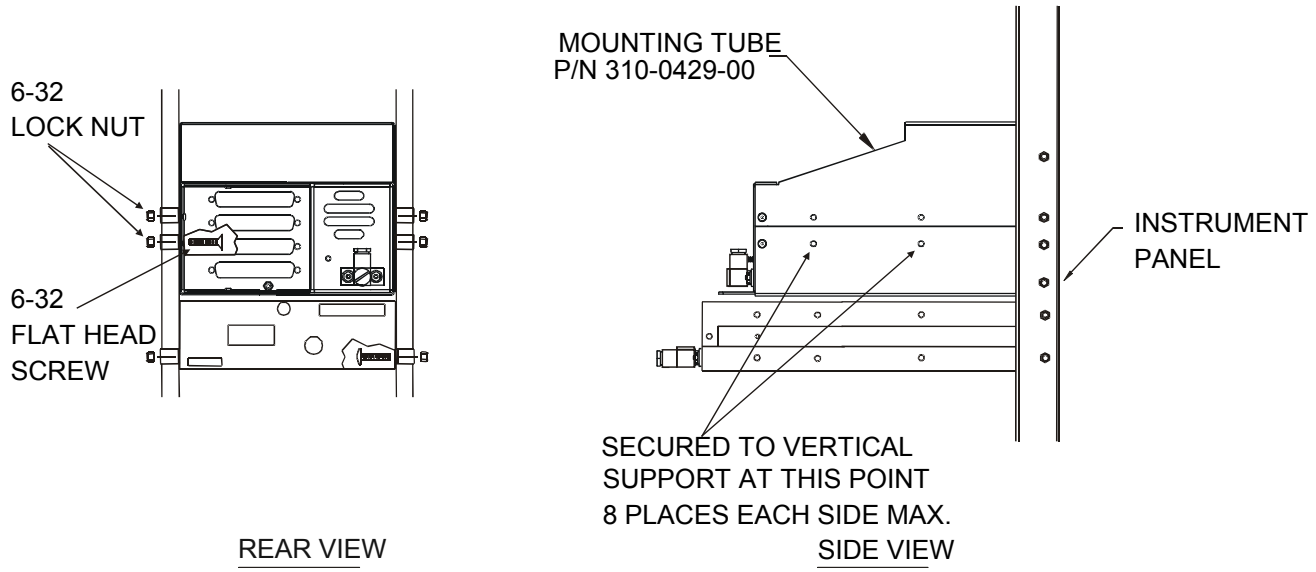


Figure 2-3. Sample GX60 & MX20 Mounting

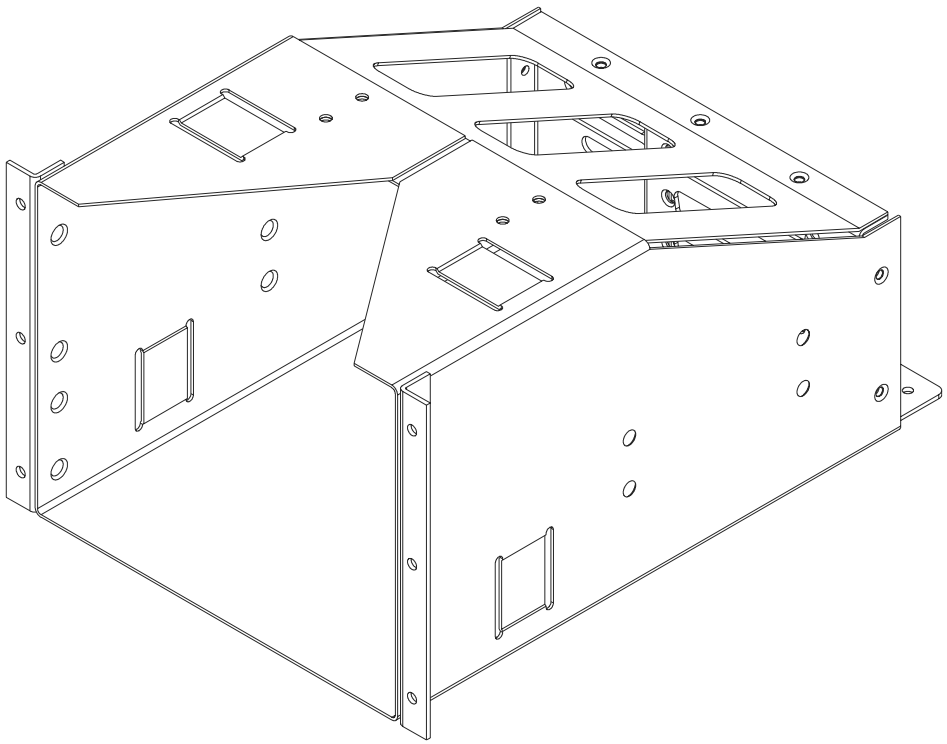


Figure 2-4. Alternate MX20 Mounting Configuration

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.

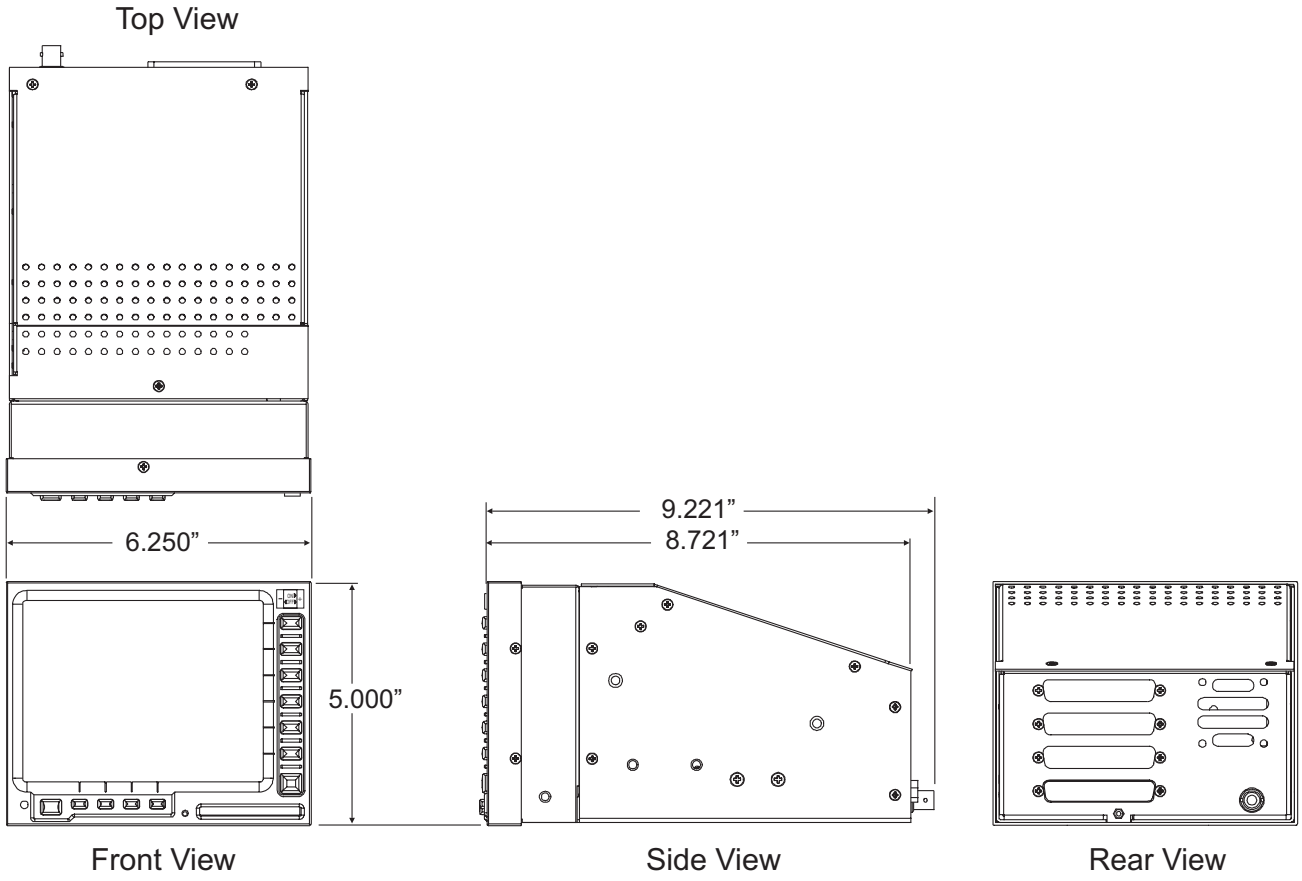


Figure 2-5. MX20 and MX20 I/O Unit Dimensions

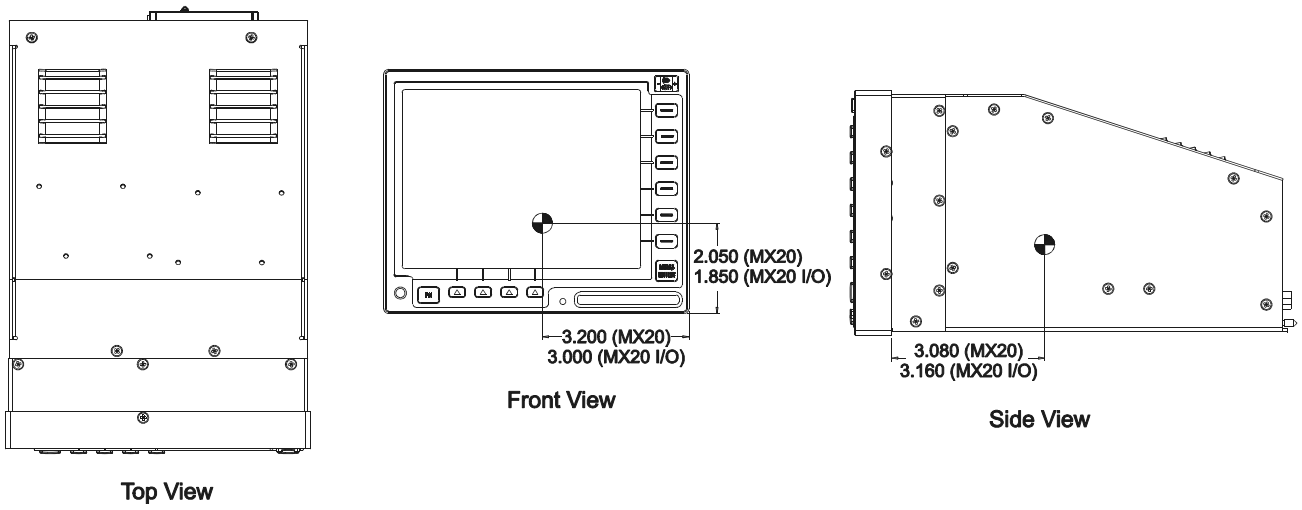


Figure 2-6. MX20 and MX20 I/O Center of Gravity

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.

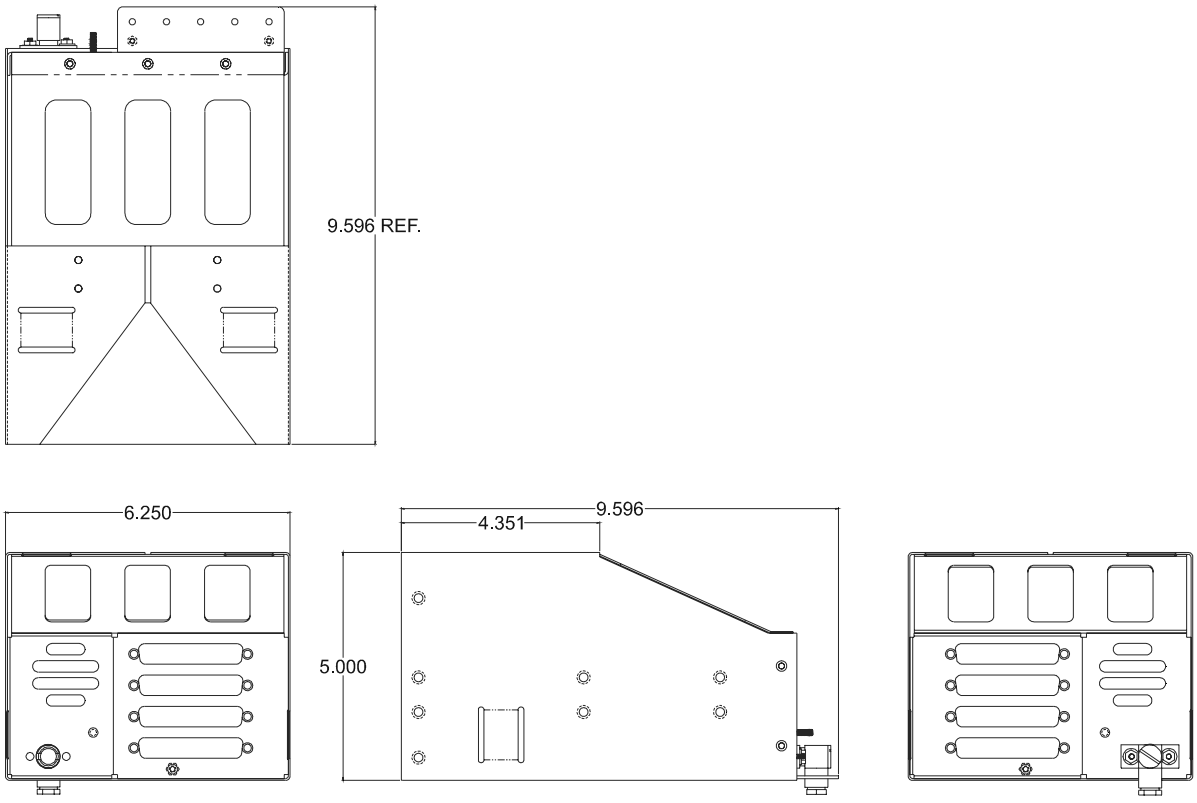


Figure 2-7. MX20 Mounting Tube Assembly Dimensions

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 2-8. 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 2-8. Connect the shield grounds directly to the grounding lug.

Mounting Tube
Secure the mounting tube to the instrument panel structure using the specified sixteen flat head screws. 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 the specified 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 2-8.

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.

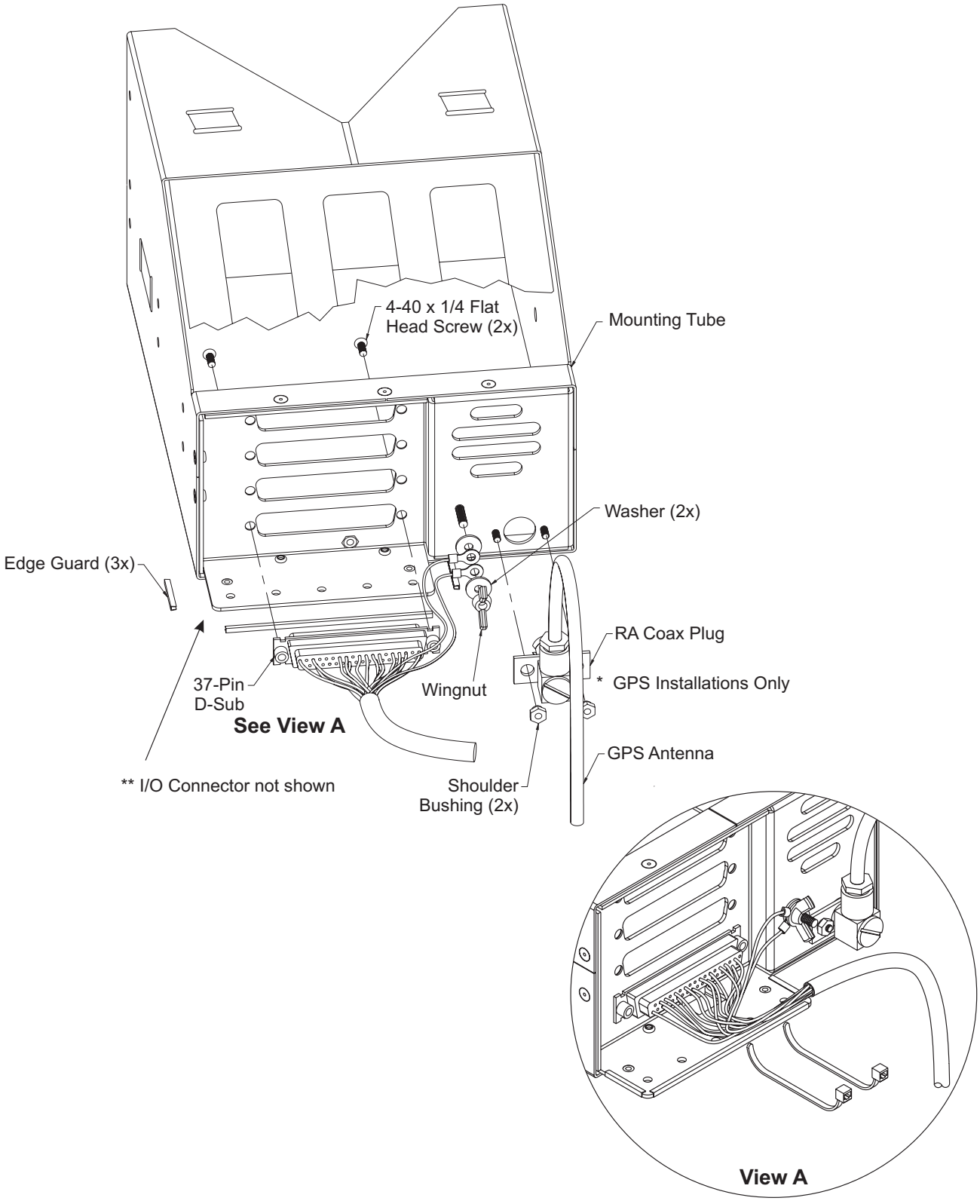


Figure 2-8. MX20 Typical Rear Panel Wiring Connections

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.

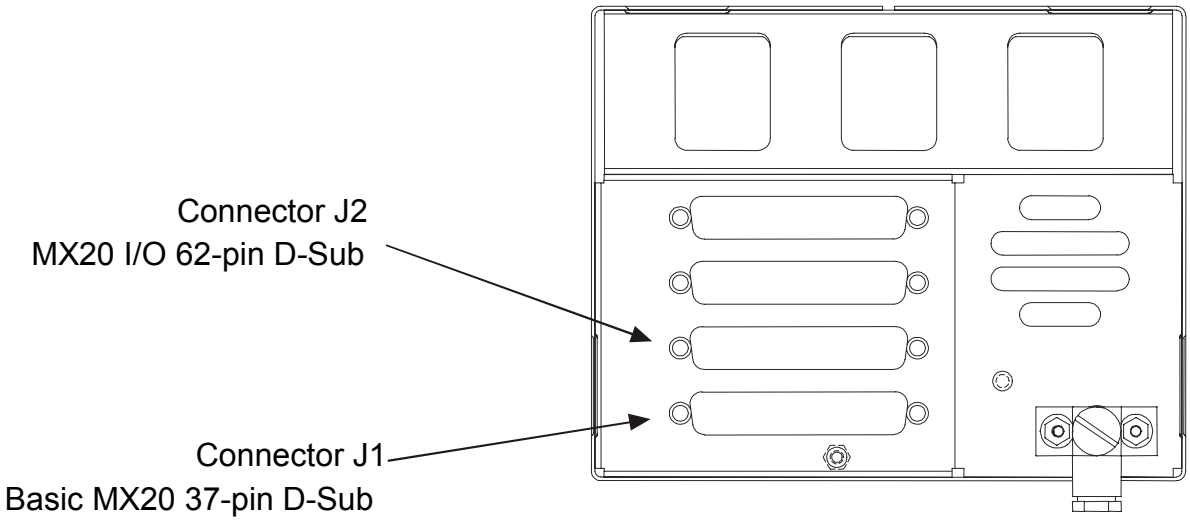


Figure 2-9. Data Port Location

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.

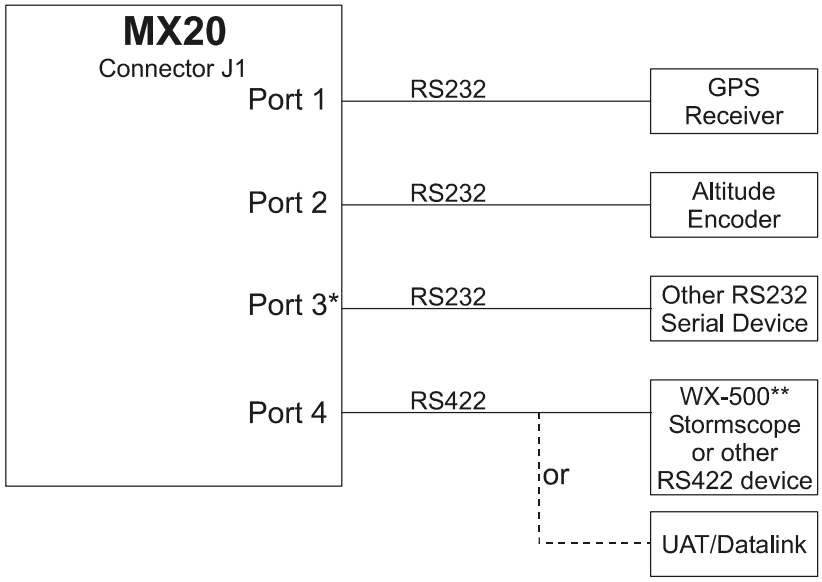
The following table shows the suggested port usage, however note that the software must be configured to match the installed MX20 wiring configuration. Note that only one traffic source may be connected to the MX20 I/O at one time. Only one FIS source may be connected to the MX20 or MX20 I/O at one time.

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 2-10. 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 2-11.

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, GWX 68, RS-181A
ARINC 429 (1)	Output	Weather Radar Control	ART2000 Radar, ART2100, GWX 68, RS-181A
Discrete (1)	Output	Weather Radar Power	ART2000 Radar, ART2100, GWX 68, RS-181A
ARINC 429 (1)	Input	Traffic Data	L-3 (Goodrich) SKY497, SKY899, GTX330, KMH820 IHAS
Discrete (2)	Output	SkyWatch Mode Control	L-3 (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

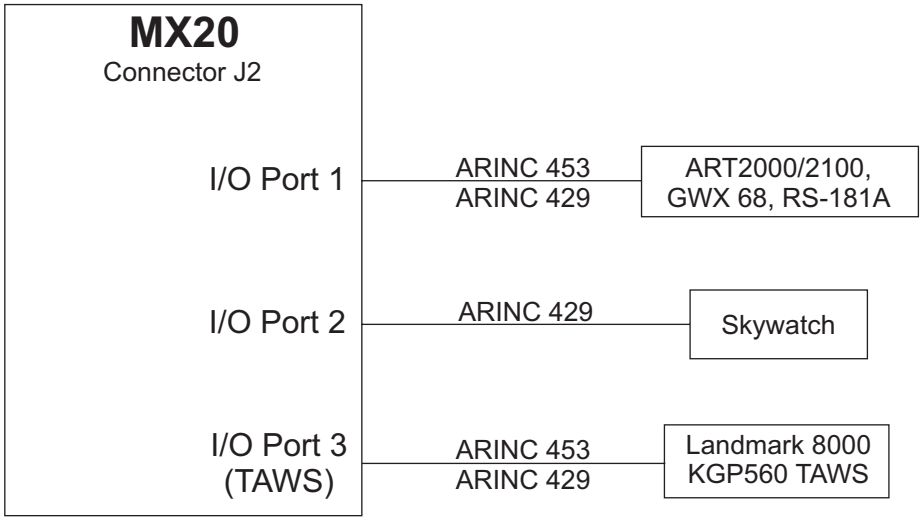


Figure 2-11. Data I/O Port Description

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 (see Section 3.2); 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.

Note: *Circuits should be protected in accordance with the approved data in this document and the guidelines in AC 43.13-1B, chapter 11, section 4. Power inputs should be across a minimum of all four specified input pins.*

2.5.6 Electrical Load Analysis

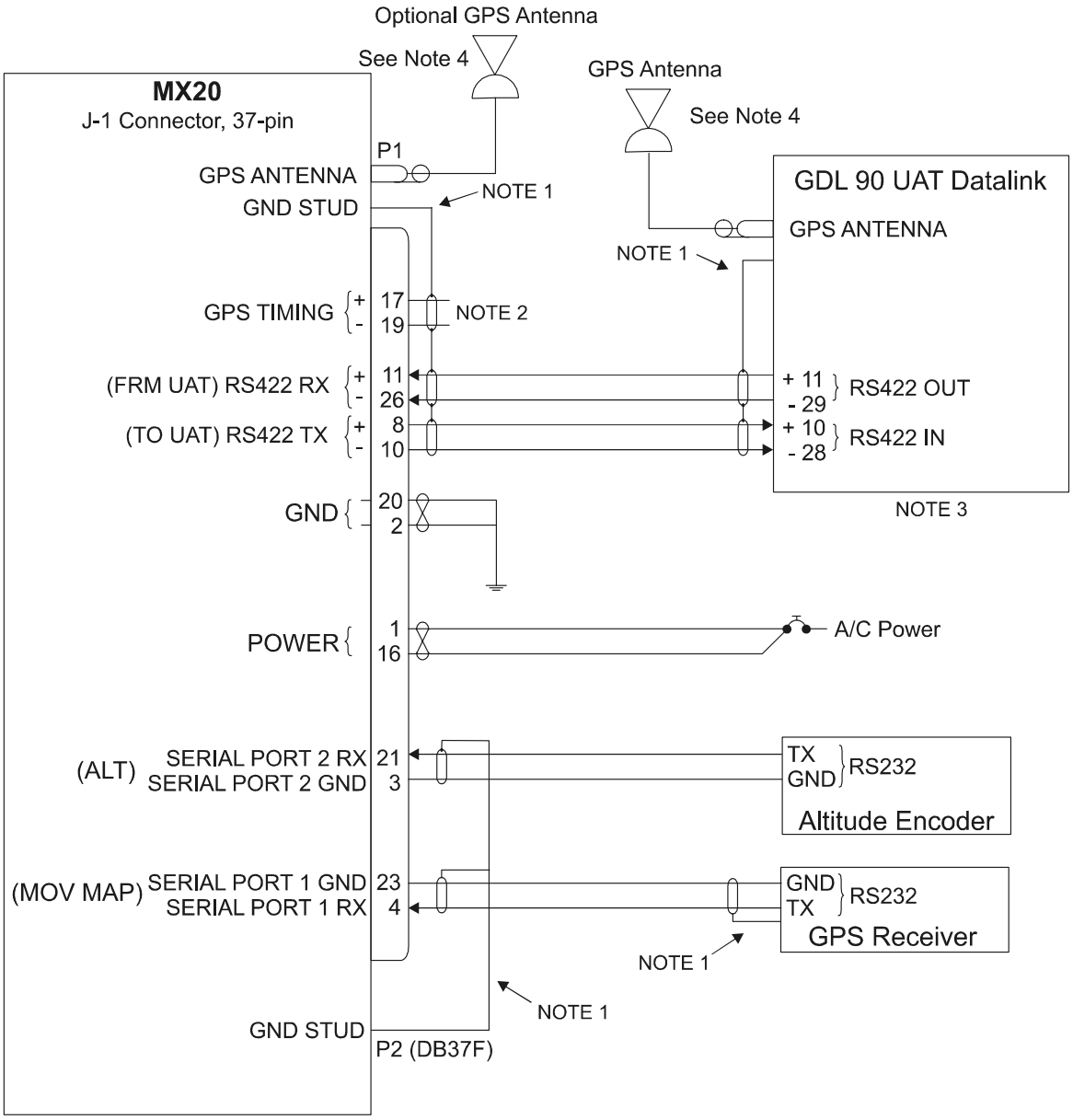
An electrical load analysis should be completed on each aircraft prior to installation in accordance with AC 43.13-1B, Chapter 11. Use the following values for computation:

Table 2-3. 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 (1)	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 (1)	3.5 A	4.5 A	1.75 A	2.25 A

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

2.5.7 Sample Wiring Diagrams



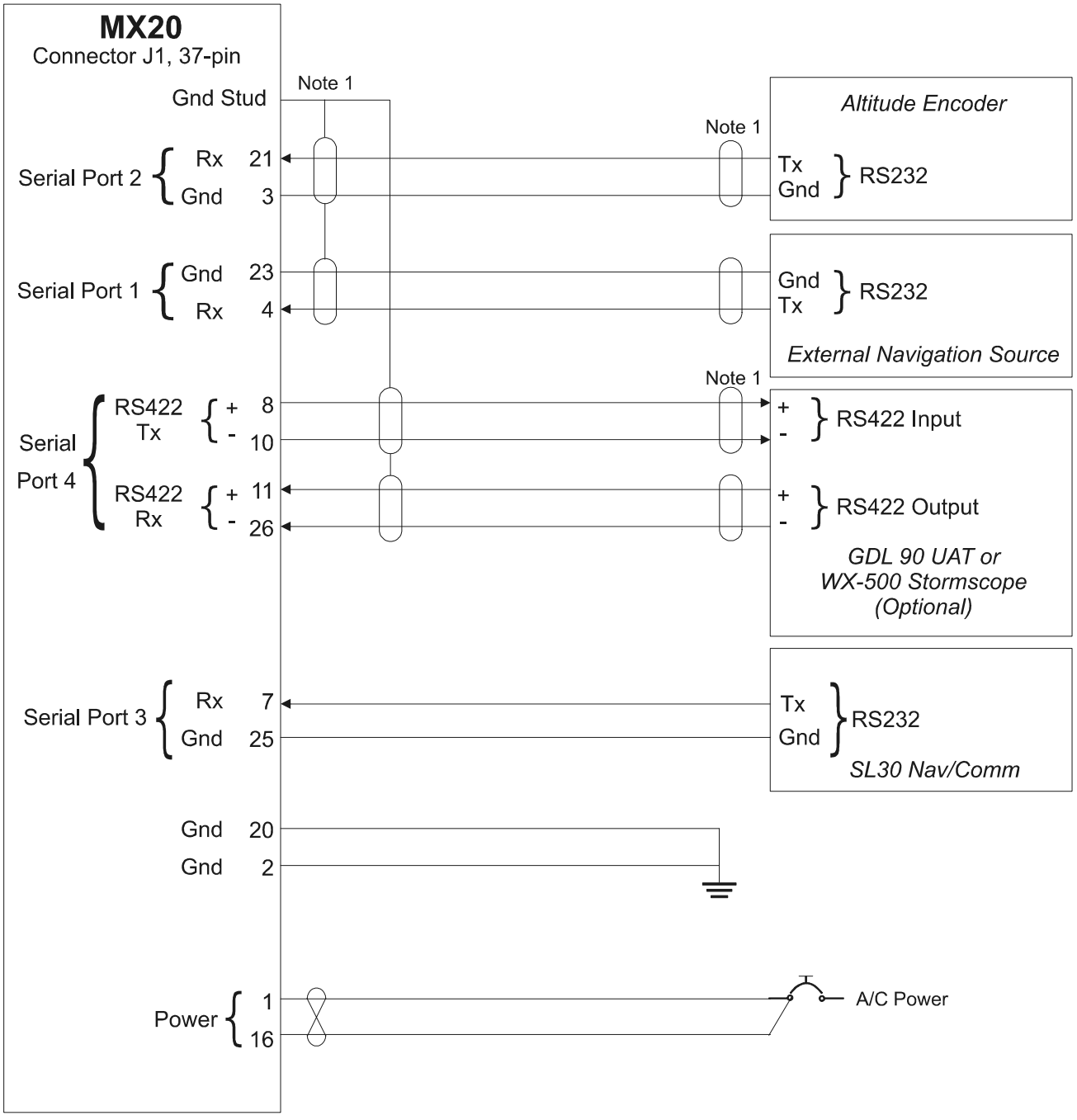
Note 1. Terminate shield to within 2” of connector. Grounding shields must be grounded to the mounting tube/tray. Pigtail 3” maximum length. Minimize pigtail length as much as possible.

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.

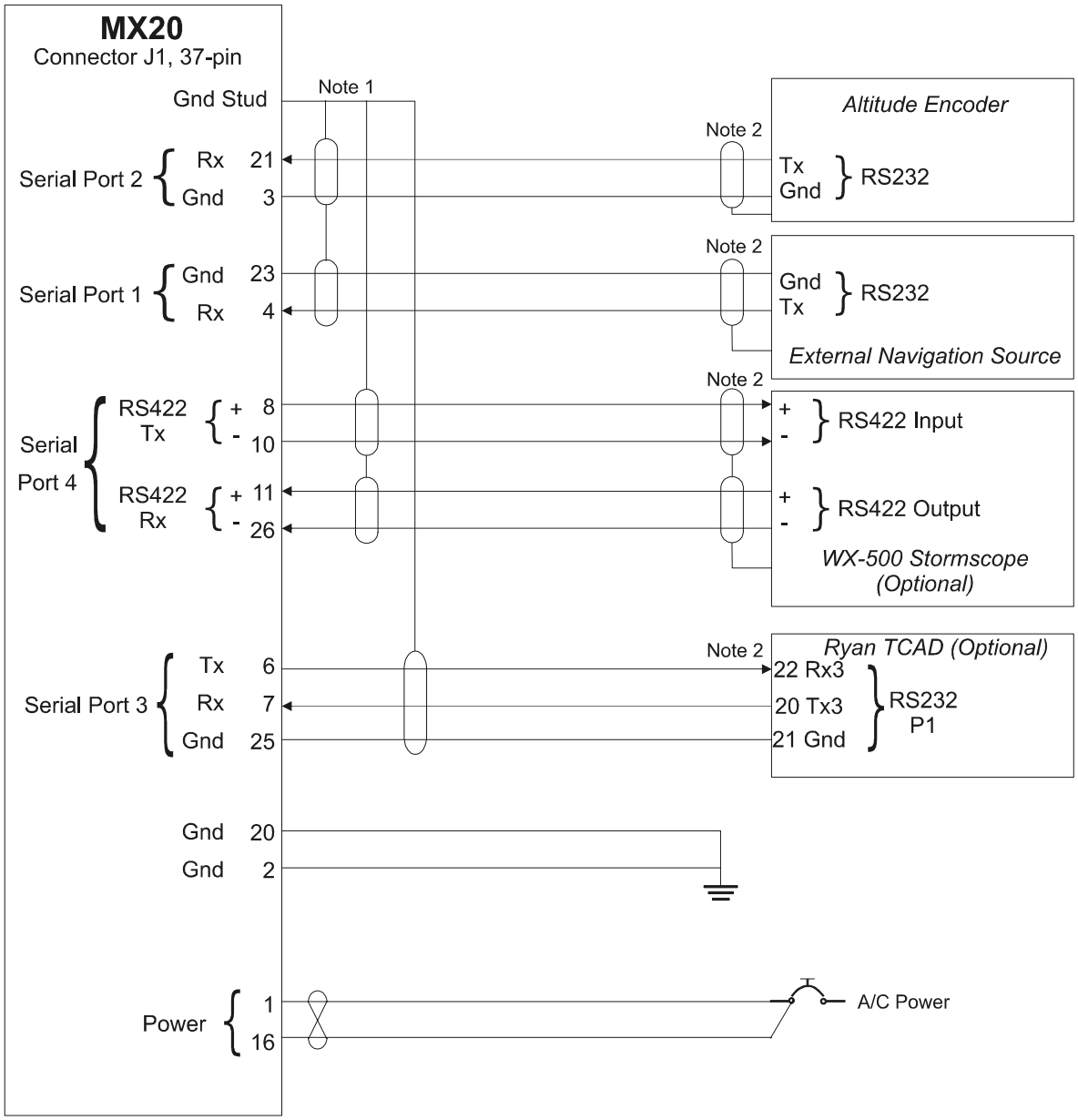
Note 4. Some installations may use the GPS antenna for the GDL 90 UAT instead of the MX20. Do not use a splitter to route the GPS signal to both the GDL 90 UAT and the MX20. It is acceptable to use two GPS antennas; one for the MX20 and one for the GDL 90 UAT.

Figure 2-12. Sample System Wiring Diagram with UAT (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 as much as possible.

Figure 2-13. 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 2-14. Sample System Wiring Diagram for TCAD and Stormscope

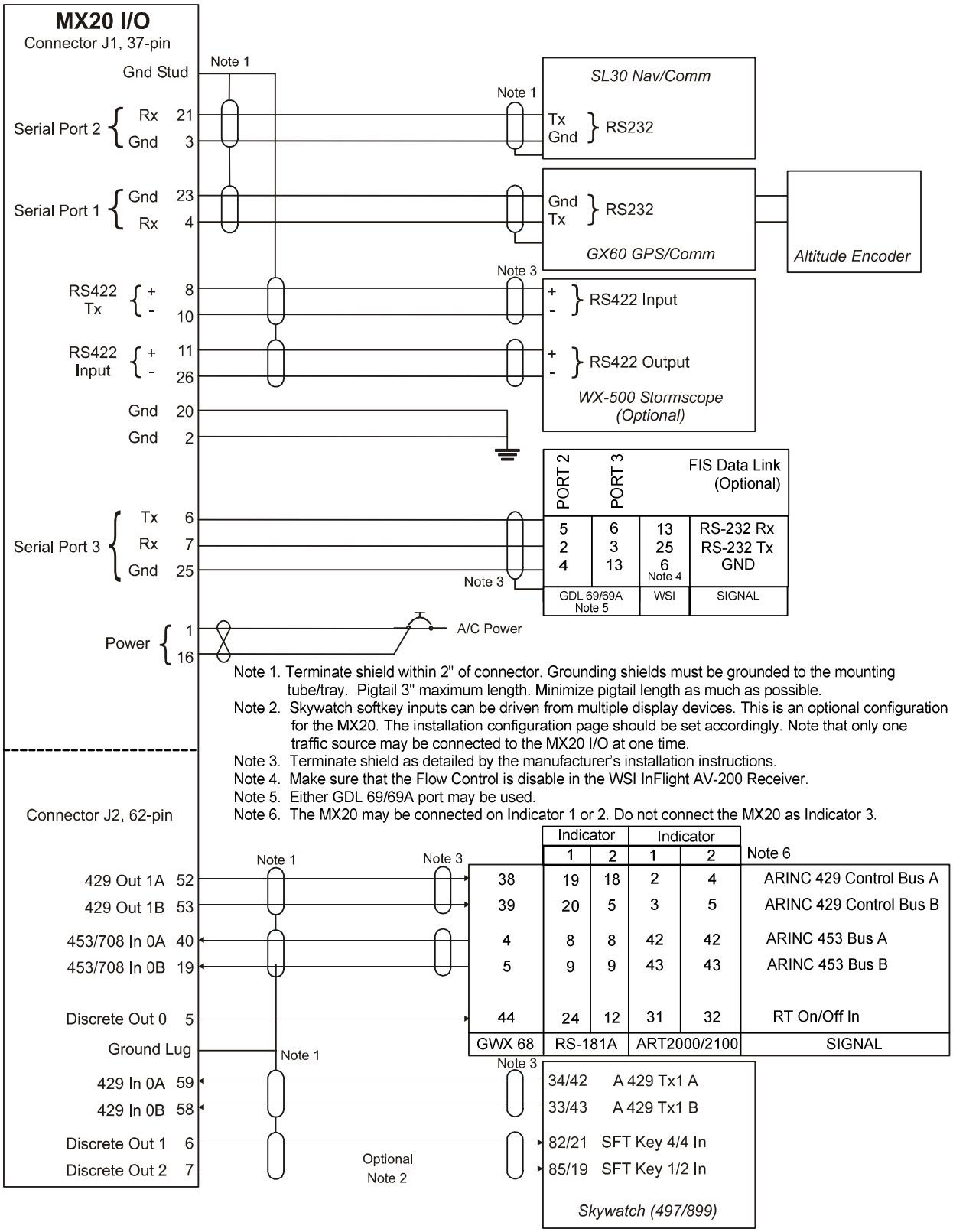
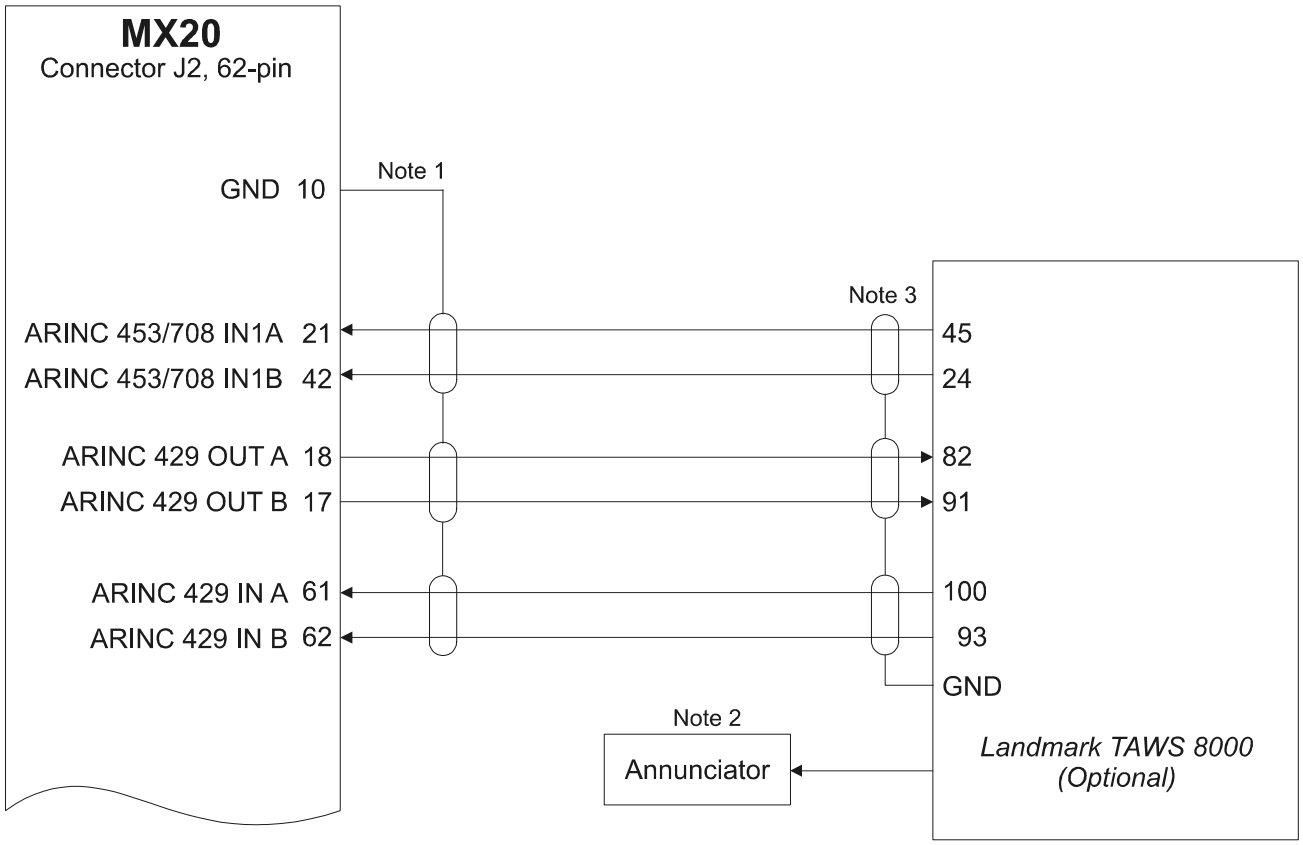
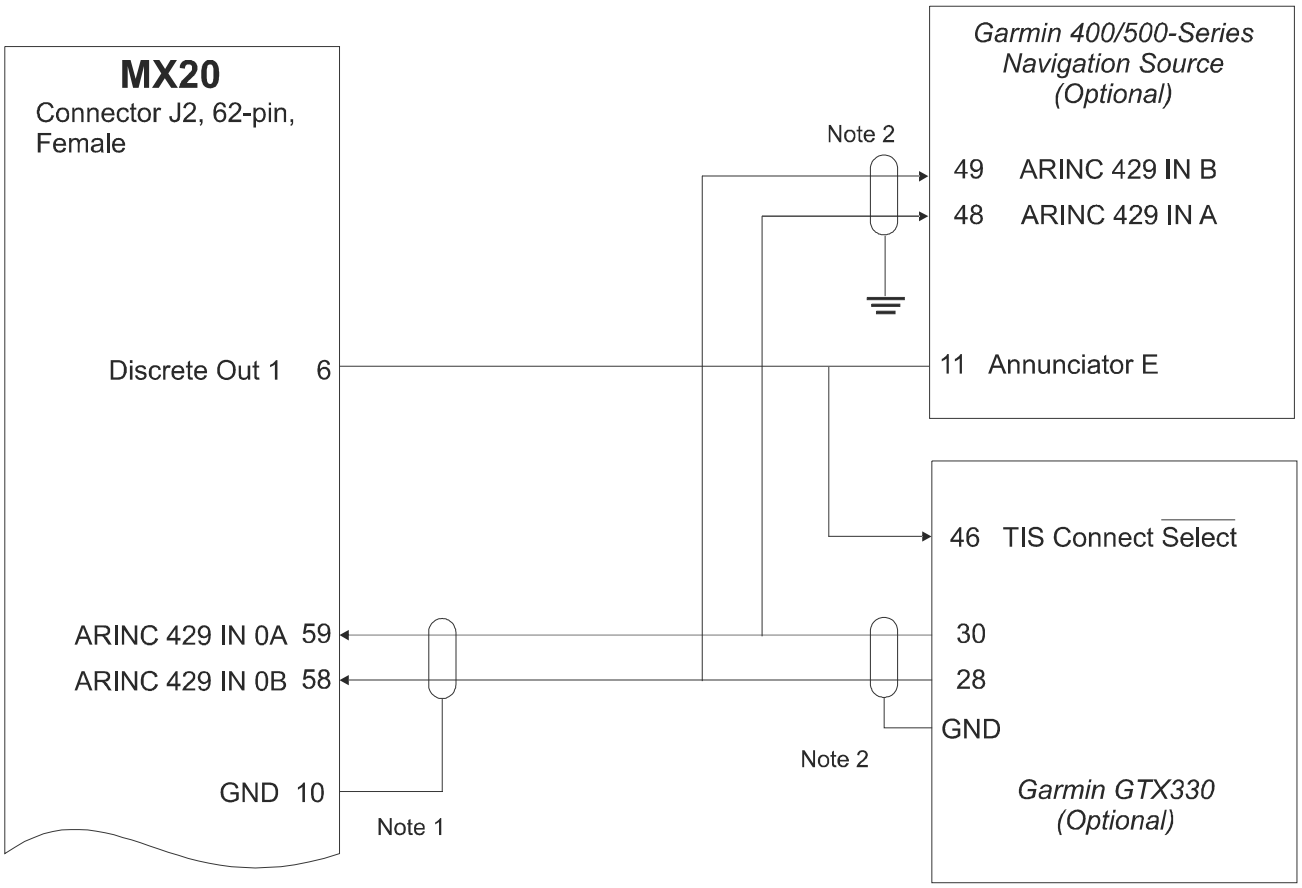


Figure 2-15. Sample System Wiring Diagram I/O model with Radar, L-3 (Goodrich) SkyWatch, GDL 69/69A and WSI InFlight Receiver



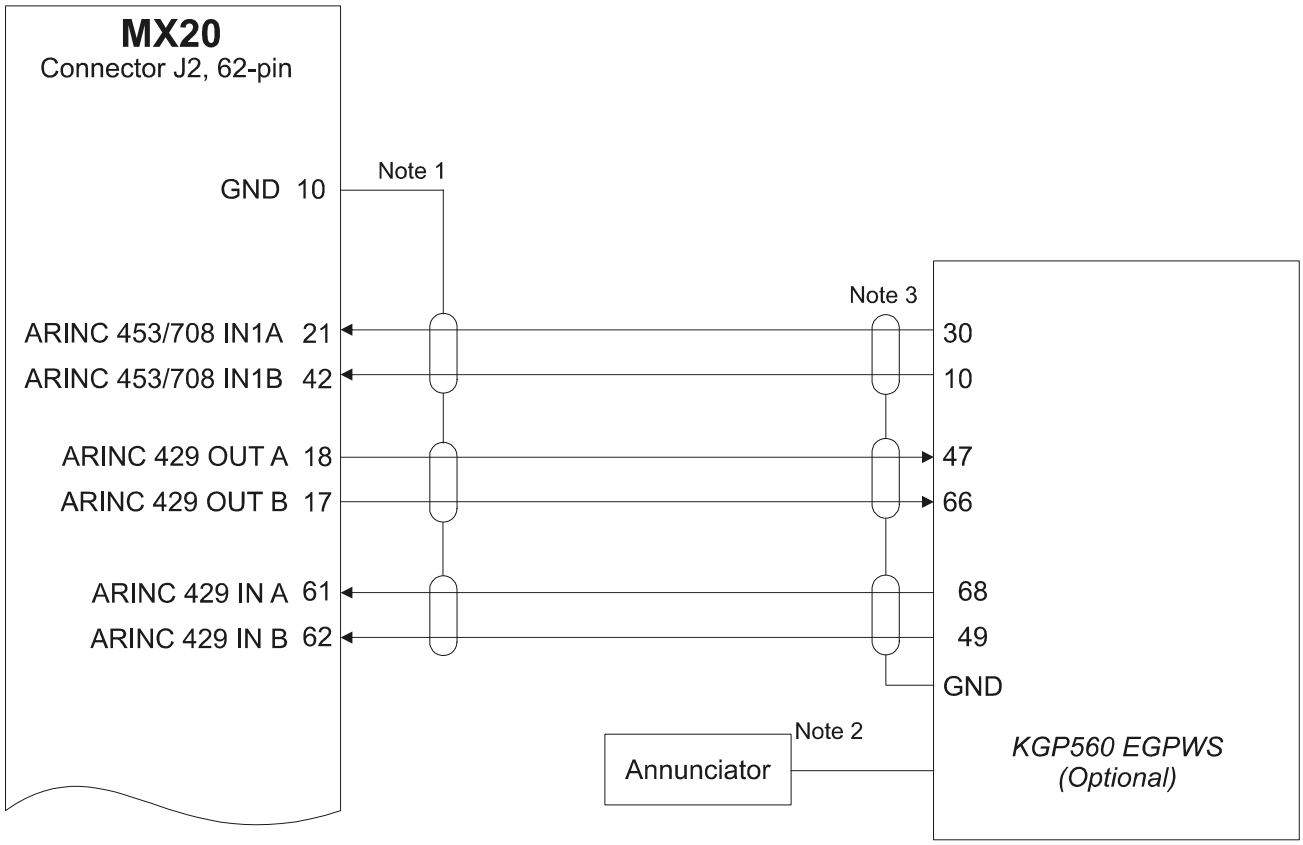
Note 1. Terminate shield to within 2" of connector. Grounding shields must be grounded to the mounting tube/tray. Pigtail 3" maximum length. Minimize pigtail length as much as possible.
Note 2. An external annunciator must be installed for terrain caution and warning lamps.
Note 3. Terminate shield as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

Figure 2-16. 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 2-17. 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 2-18. Sample System Wiring Diagram of MX20 I/O with KGP-560

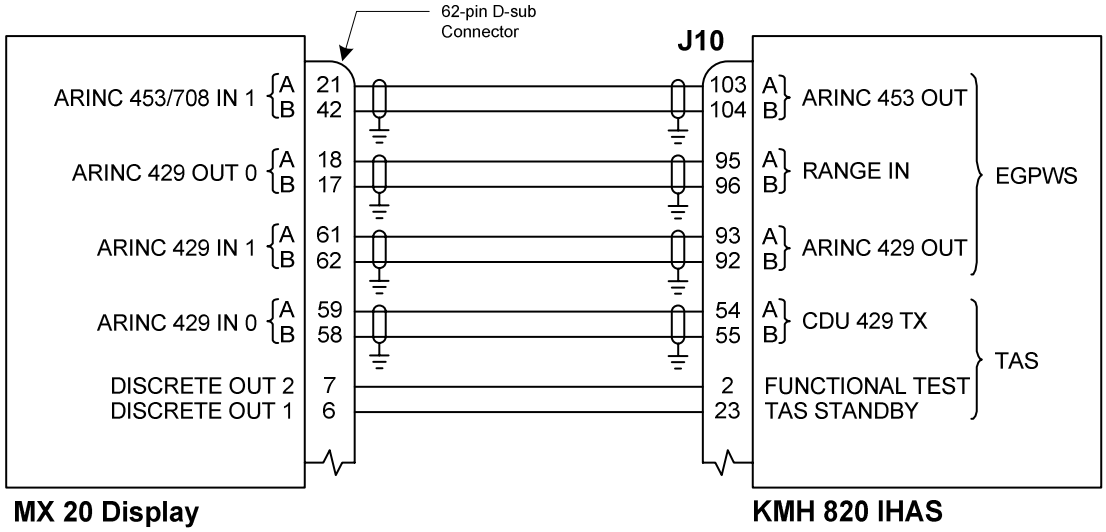


Figure 2-19. Sample Wiring Diagram - MX20 I/O with KMH 820 IHAS

2.6 Weight and Balance

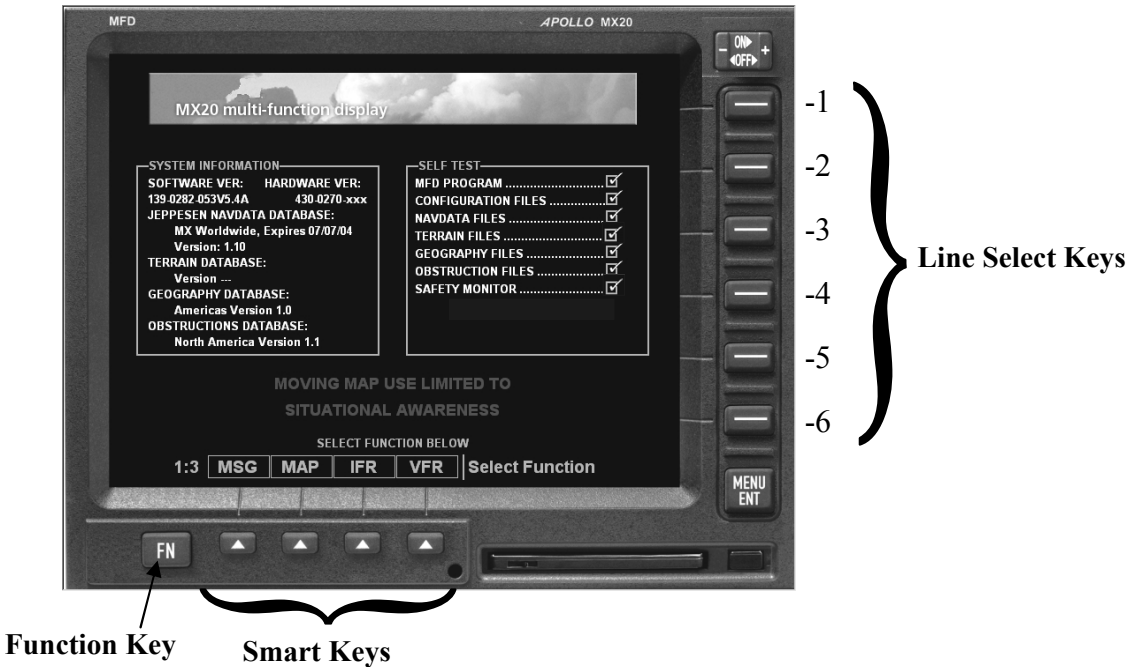
Weight and balance computation is required after the installation of the MX20. Follow the guidelines as established in AC 43.13-1B, Chapter 10, Section 2. Make appropriate entries in the equipment list indicating items added, removed, or relocated along with the date accomplished. Include your name and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

Table 2-4. Unit Weights

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.



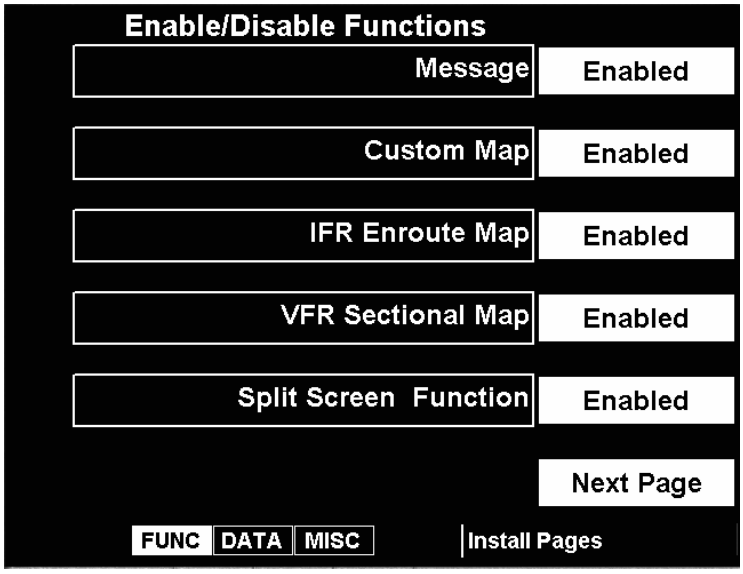
3. Press the function key until the **INSTL** function is present. If the **INSTL** function is not found, restart the unit. Carefully press line select keys 1, 4, and 6 in sequence. Do not press any other buttons before pressing the 1, 4, 6 line select key sequence.

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.



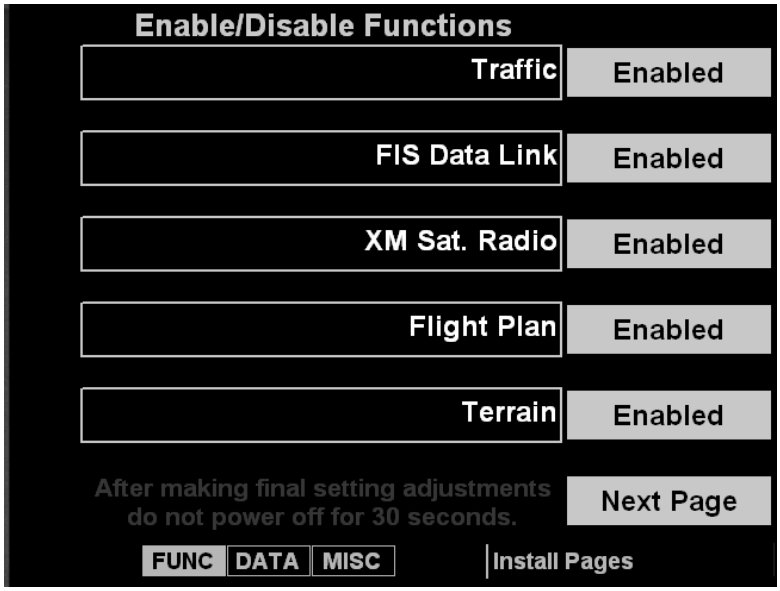
1. Ensure the Enable/Disable Functions page of the MX20 has the desired configuration. Modifications can be made using the line select keys.
   a. Enable Message to allow viewing of system messages.
   b. Enable Custom Map to allow viewing of the Custom Map function.
   c. Enable IFR En Route Map to 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.

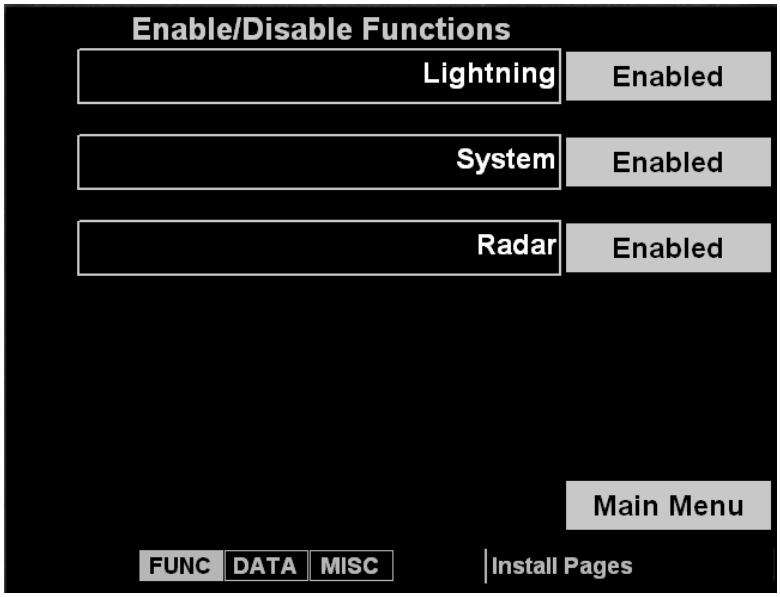
3. Press the Next Page line select key to view additional functions.

   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.



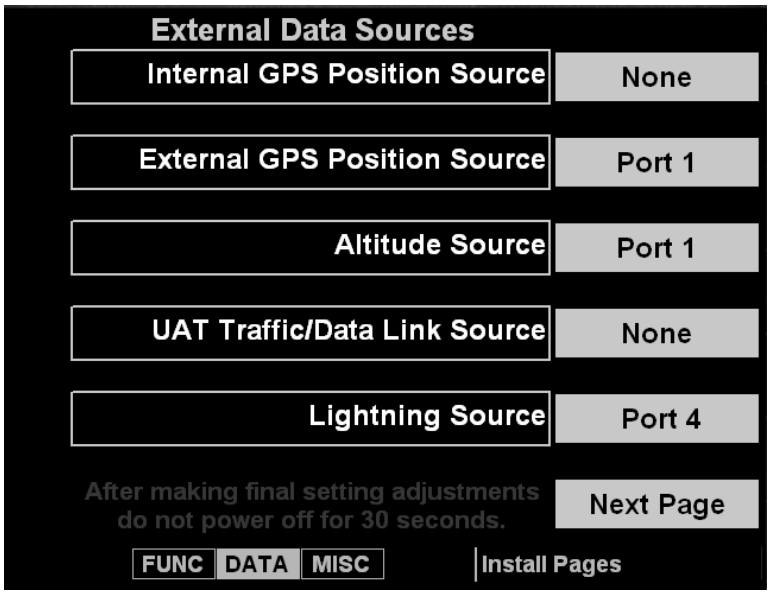


4. A typical installation will have all functions enabled except those noted above based on what hardware is installed in the aircraft.

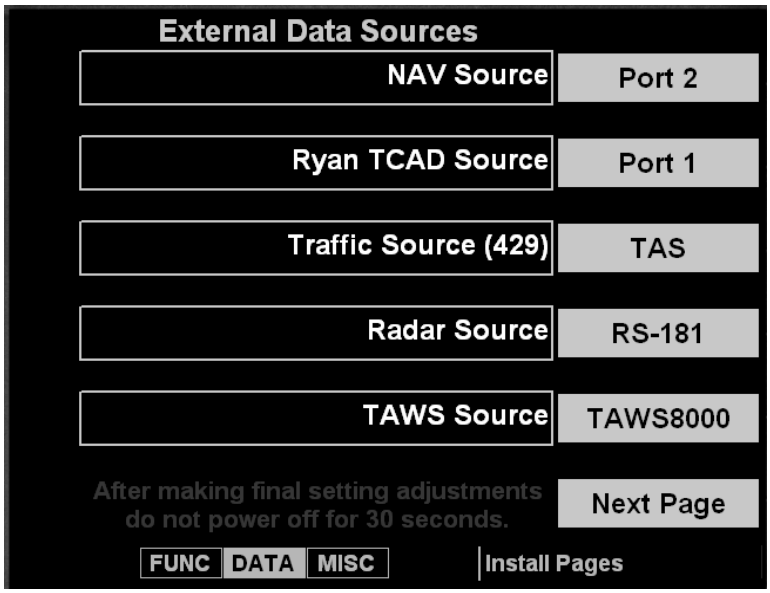
2.7.2 External Data Source

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

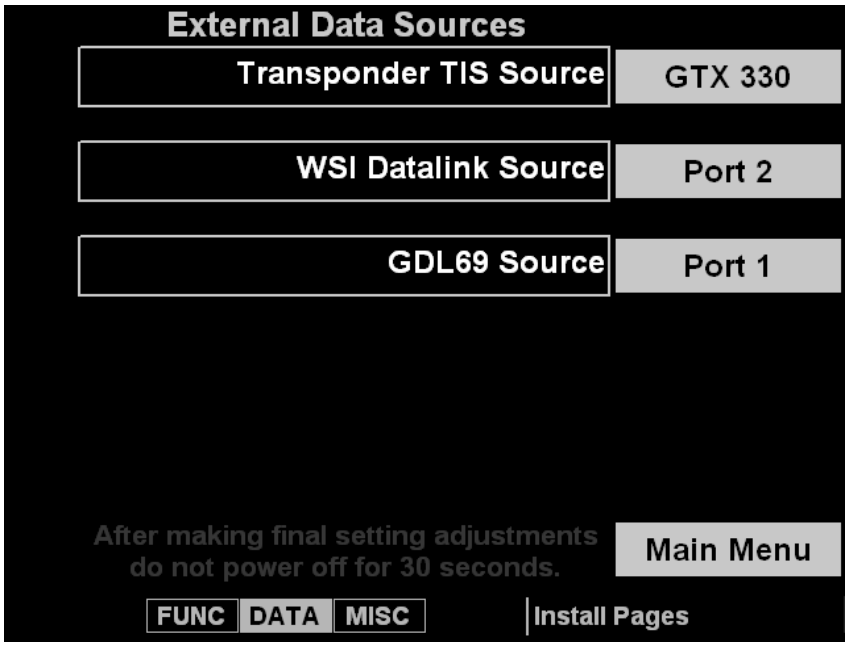
1. Press the DATA smart key while still in the INSTL function.
2. Ensure the External Data Sources pages of the MX20 have the desired configuration. Modifications can be made using the line select keys. Port allocations must match how the system is wired. Set port source to None if the hardware is not 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



Next Page



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 GWX 68, ART2000 and the RS-181A are supported. The ART2100 is supported if it is configured as an ART2000. Only ART2000 functions are available. GWX 68 installations require MX20 software version 5.6 or later.

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 (MX20 V5.2 or later)

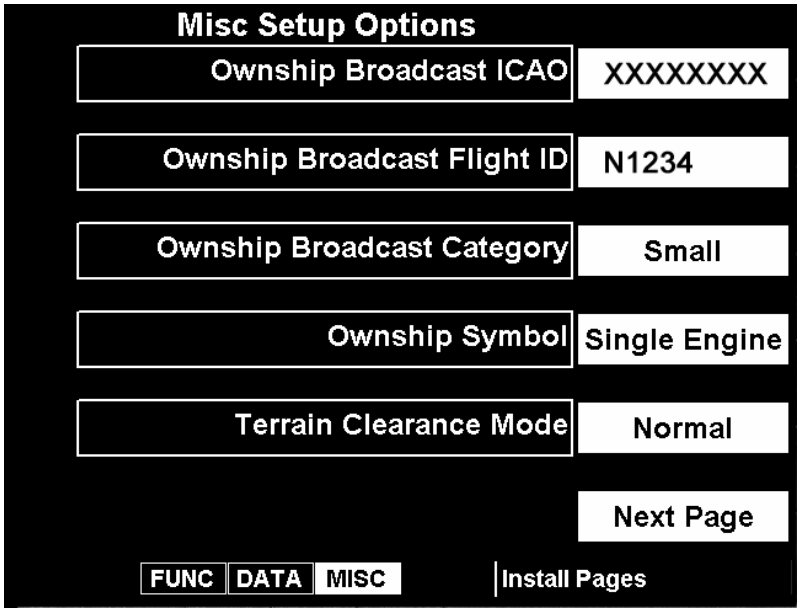
Select the model of the TIS data source selected. Currently, only the Garmin GTX330 is supported.

2.7.3.6 KMH 820 IHAS (MX20 V5.4 or later)

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 2-19 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.



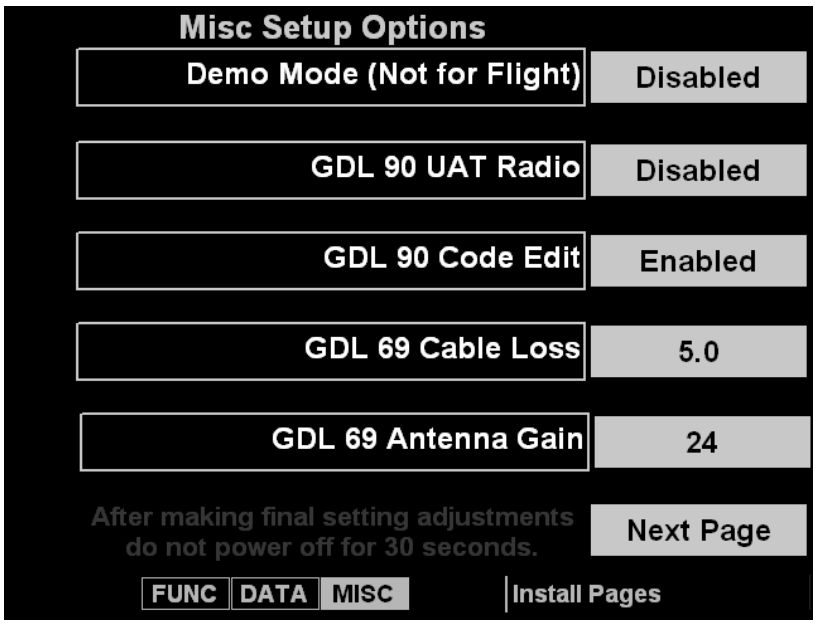
See Step 3

See Step 4

See Step 5

See Step 6

See Step 7



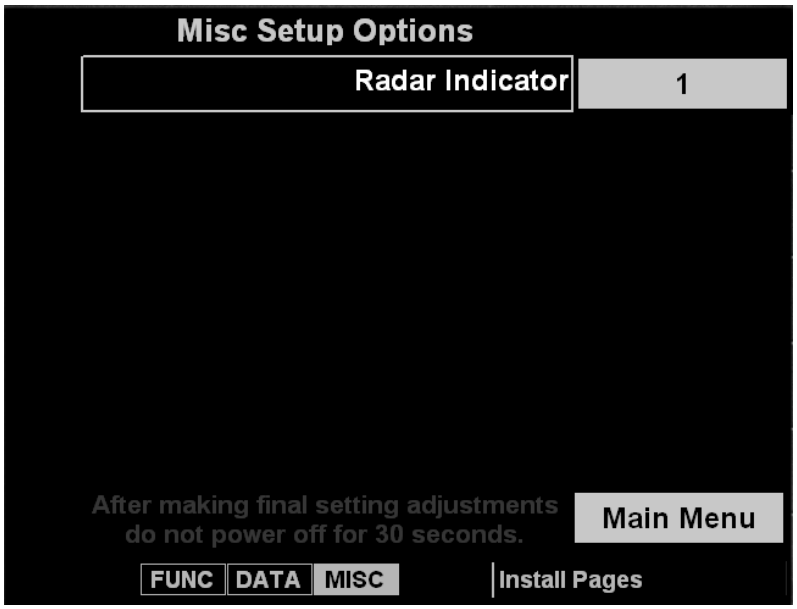
See Step 8

See Step 9

See Step 10

See Step 11

See Step 12



See Step 13

3. 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.

4. Enter in Flight ID. (Required if UAT/ADS-B system is installed.)
5. 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

6. Enter in Ownship Symbol (Single Engine, Twin, or Jet).
7. 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. A GDL 90 configuration setting establishes which device controls the GDL 90. Only one device (e.g., MX20, GSL 71, GNS 480 or other device) should control GDL 90 operation.
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. Only one device installed in the aircraft can be the entry point for ATC-assigned squawk codes.
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 must be selected when the MX20 is connected to a GWX 68. 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 2-19 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.

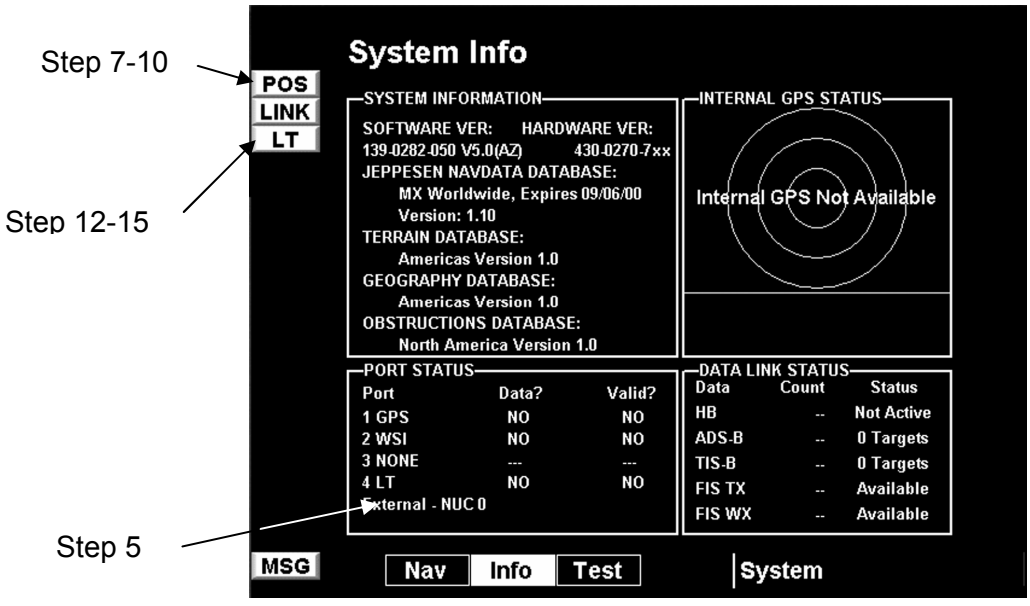
2.9.2 Software and Database Test

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.

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, if the FPL function is enabled.
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, if the terrain function is enabled.

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

NOTE
GPS unit must have a valid signal and active flight plan in order for Stormscope data to be displayed.

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

NOTE
GPS unit must have a valid signal and active flight plan in order for traffic data to be displayed.

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, Calibration & 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. Select All if the MX20 is the only display device connected to the ART. If more than one display device is connected to the ART, select 1 or 2, depending on which port on the ART is connected to the MX20 (See Figure 2-14 on page 22). 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.

NOTE

Turn off radar stabilization (STAB OFF) before calibrating the radar. Failure to do so will cause improper calibration.

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 MX20 GWX 68 Setup Procedure

2.9.9.2.1 Configuring the MX20

First configure the MX20 for the GWX 68 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. Then press the FN key until the INSTL smart key appears. Press the INSTL key. Enable RADAR in the FUNC menu-set, then select the DATA menu-set and select GWX 68. After this selection, wait 30 seconds then turn the power off and on again.

MX20 Version 5.6 or later is required for the GWX 68.

2.9.9.2.2 Calibration Procedures

The following procedure assumes that both analog and ARINC 429 stabilization inputs are present. If one or the other input is not available, that particular option need not be calibrated.

If the only stabilization source is from an AHRS via ARINC 429, proceed directly to Section 2.9.9.2.2.7.

If an analog stabilization input is used, the radar stabilization source must be removed from the aircraft and mounted on a tilt table for proper calibration.

Analog stabilization values for pitch and roll can only be adjusted if the GWX 68 senses a 400 Hz reference input. No adjustment is needed for ARINC 429 input from an AHRS since it is assumed the AHRS was previously calibrated for level attitude and is transmitting digital deviation values to the GWX 68.

The MX20 must be in the 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, verify that the radar function has been enabled as described in Section 2.7.1.
4. Press the smart key corresponding to the RADAR option.
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, 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 few seconds.

9. The MX20 will flash all faults briefly to indicate calibration mode has been entered. If this fails, turn power off and on and repeat the procedure.

2.9.9.2.2.1 Calibration of Analog Stabilization Inputs

When in Calibration mode, the MX20 is ready to calibrate the stabilization inputs. Each parameter can be calibrated as described in the sections below.

The GAIN adjustment is used to select the parameter being calibrated. The TILT adjustment is used to adjust the parameter's value.

2.9.9.2.2.2 400HZ Reference Gain

1. Set the tilt table to 0° pitch and roll.
2. Use the GAIN + and GAIN – keys to set the GAIN to -28. The AZIMUTH ANGLE field should also display 01.
3. Use the TILT ⬆ and TILT ⬇ keys to adjust the TILT SETTING. A TILT SETTING between 5 UP and 10 UP increases the 400 HZ REF field, while a TILT SETTING between 5 DOWN and 10 DOWN decreases the 400 HZ REF field. Use the TILT keys to set the 400 HZ REF field to 0.0 ± 1.0°. Upon reaching the desired 400 HZ REF setting, quickly set the TILT SETTING to between 5 UP and 5 DOWN to lock in the 400 HZ REF setting.

2.9.9.2.2.3 Pitch Offset

1. Check that the tilt table is set for 0° pitch.
2. Use the GAIN + and GAIN – keys to set the GAIN to between -17.5 and -19.5. The AZIMUTH ANGLE field should also display 04. Note that the pitch offset value is displayed in the PITCH ANGLE field.
3. Use the TILT ⬆ and TILT ⬇ keys to adjust the TILT SETTING. A TILT SETTING between 5 UP and 10 UP increases the PITCH ANGLE field, while a TILT SETTING between 5 DOWN and 10 DOWN decreases the PITCH ANGLE field. Use the TILT keys to set the PITCH ANGLE field to 0.0 ± 1.0°. Upon reaching the desired PITCH ANGLE setting, quickly set the TILT SETTING to between 5 UP and 5 DOWN to lock in the PITCH ANGLE setting.

2.9.9.2.2.4 Roll Offset

1. Check that the tilt table is set for 0° roll.
2. Use the GAIN + and GAIN – keys to set the GAIN to between -14 and -16. The AZIMUTH ANGLE field should also display 05. Note that the roll offset value is displayed in the ROLL ANGLE field.
3. Use the TILT ⬆ and TILT ⬇ keys to adjust the TILT SETTING. A TILT SETTING between 5 UP and 10 UP increases the ROLL ANGLE field, while a TILT SETTING between 5 DOWN and 10 DOWN decreases the ROLL ANGLE field. Use the TILT keys to set the ROLL ANGLE field to 0.0 ± 1.0°. Upon reaching the desired ROLL ANGLE setting, quickly set the TILT SETTING to between 5 UP and 5 DOWN to lock in the ROLL ANGLE setting.

2.9.9.2.2.5 Pitch Gain

1. Set the tilt table for 10° pitch up.
2. Use the GAIN + and GAIN – keys to set the GAIN to between -24.5 and -26.5. The AZIMUTH ANGLE field should also display 02. Note that the pitch gain value is displayed in the PITCH ANGLE field.

3. Use the TILT ⬆ and TILT ⬇ keys to adjust the TILT SETTING. A TILT SETTING between 5 UP and 10 UP increases the PITCH ANGLE field, while a TILT SETTING between 5 DOWN and 10 DOWN decreases the PITCH ANGLE field. Use the TILT keys to set the PITCH ANGLE field to 10.0 ± 1.0°. Upon reaching the desired PITCH ANGLE setting, quickly set the TILT SETTING to between 5 UP and 5 DOWN to lock in the PITCH ANGLE setting.
4. Set the tilt table to 10° pitch down. The PITCH ANGLE value should be 10.0D ± 1.0°. If the value is out of range, repeat steps in Sections 2.9.9.2.2.3 and 2.9.9.2.2.5 (this section).
5. Set the tilt table to 0° pitch. The PITCH ANGLE value should be 0.0 ± 1.0°. If the value is out of range, repeat steps in Sections 2.9.9.2.2.3 and 2.9.9.2.2.5 (this section).

2.9.9.2.2.6 Roll Gain

1. Set the tilt table for 10° roll right.
2. Use the GAIN + and GAIN – keys to set the GAIN to between -21 and -23. The AZIMUTH ANGLE field should also display 03. Note that the roll gain value is displayed in the ROLL ANGLE field.
3. Use the TILT ⬆ and TILT ⬇ keys to adjust the TILT SETTING. A TILT SETTING between 5 UP and 10 UP increases the ROLL ANGLE field, while a TILT SETTING between 5 DOWN and 10 DOWN decreases the ROLL ANGLE field. Use the TILT keys to set the ROLL ANGLE field to 10.0 ± 1.0°. Upon reaching the desired ROLL ANGLE setting, quickly set the TILT SETTING to between 5 UP and 5 DOWN to lock in the ROLL ANGLE setting.
4. Set the tilt table to 10° roll left. The ROLL ANGLE value should be 10.0L ± 1.0°. If the value is out of range, repeat steps in Sections 2.9.9.2.2.4 and 2.9.9.2.2.6 (this section).
5. Set the tilt table to 0° roll. The ROLL ANGLE value should be 0.0 ± 1.0°. If the value is out of range, repeat steps in Sections 2.9.9.2.2.4 and 2.9.9.2.2.6 (this section).

2.9.9.2.2.7 Save Configuration

1. Use the GAIN + and GAIN – keys to set the GAIN to between -3.5and -5.5. The AZIMUTH ANGLE field should also display 08.
2. Set the TILT SETTING to 15.0D. The fault fields will flash on indicating the save procedure is beginning. If the save procedure is successful, the GYRO fault will disappear.
3. If the GYRO remains unchanged, TILT to 0° and repeat step 2.

2.9.9.2.3 Roll Trim Adjustment

This procedure must be performed in flight with an operational, transmitting radar. This procedure should be performed over flat terrain or water if possible.

1. Turn the MX20 on.
2. After boot-up is complete, key-in the install sequence 1, 4, 6, on the smart keys.
3. Press the FN key until one of the options is RADAR.
4. Press the smart key corresponding to the RADAR option.
5. Press the STBY key to put the radar unit into standby mode. This may take up to twenty seconds.
6. Press the key labeled ON. The radar will enter WX mode and begin transmitting.

7. Adjust the range and tilt controls so that ground returns are painted past approximately half of the selected range.
8. Press they key labeled STBY. The radar will return to standby mode.
9. Once the MX20 is in standby mode, press the TEST key.
10. Once the MX20 is in Test mode, press the ENTER key to switch to the Setup page.
11. On the Setup page, press the key labeled CALB to enter calibration mode. This will take a few seconds.
12. The MX20 will flash all faults briefly to indicate calibration mode has been entered. If this fails, turn power off and on and repeat the procedure.
13. Press the key labeled ROLL TRIM.
14. Acknowledge the safety warning that appears. The radar will begin transmitting.
15. Adjust the roll trim setting until the range at which ground returns begin remains approximately constant across a full scan of the display.
16. Press the key labeled SAVE & EXIT. Wait until the warning disappears, then power cycle the MX20.

2.9.9.3 RS-181A Configuration and Calibration

2.9.9.3.1 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.

2.9.9.3.2 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.

2.9.9.3.3 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.

2.9.9.4 Ground Based Checkout Procedures

2.9.9.4.1 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.

2.9.9.4.2 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.

2.9.9.4.3 Tilt Test

Press the TILT line item and verify that the tilt can be adjusted from 15 UP to 15 DN: 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.

2.9.9.4.4 Vertical Test - GWX 68 and ART 2000 ONLY

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

2.9.9.4.5 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.

For all radar installations, press the Tilt "smart keys" and verify that the tilt can be changed from 15 DN to 15 UP.

For GWX 68 and ART 2000 installations, press the HORZ/VERT line item. The display should change to a vertical scan.

For GWX 68 and ART 2000 installations, press the TILT/BRG line item to select the BRG on mode.

For GWX 68 and ART 2000 installations, press the Brg "smart keys" and verify that the bearing angle can be changed from 45 L to 45 R.

For all radar installations, 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.

2.9.9.5 Final Radar Checkout

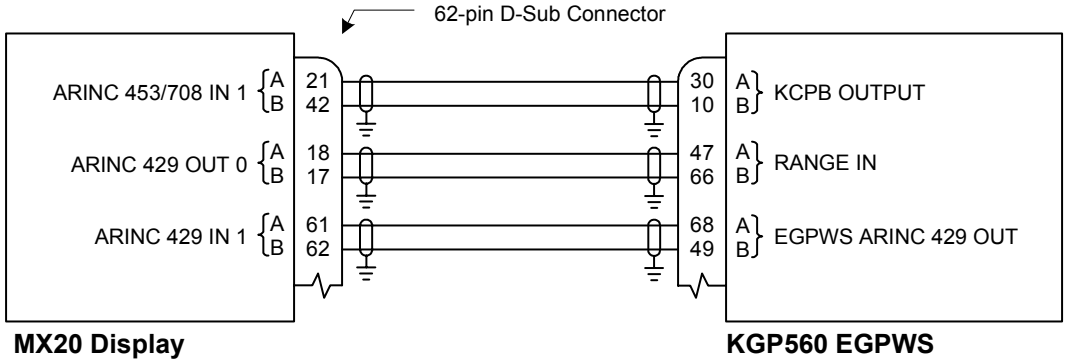
Ensure all ground checkout procedures are completed and verified prior to "open air" checkout.
With stabilization on, during takeoff or prolonged aircraft maneuvers, the displayed radar returns may not be accurate. Point the aircraft radar sensor across the airport and paint buildings and terrain.

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 perform the following steps:

1. Turn on the MX20.
2. After the MX20 self-tests are completed, enter the Traffic (TRAF) function by pressing the FN key until the TRAF menu option is available.
3. Press the corresponding TRAF “smart” key, followed by the Menu/Enter key.
4. Press the “Operate” Line Selection key. Verify that “TIS Standby” is displayed in the lower right corner.
5. 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.

1. Turn on the power to the MX20 and the GDL 69/69A receiver.
2. After the MX20 performs its self-tests, enter the FIS function by pressing the FN key until the FIS function is available.
3. Press the FIS corresponding smart key. Press the fourth smart key until the status page is displayed.
4. 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.

1. Turn on the power to the MX20, GDL 69A, and audio panel.
2. After the MX20 performs its self-tests, press the FN key until the XM function appears. Press the corresponding smart key.

NOTE

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.

3. Receiving channel information on the MX20 and changing channels verifies the communication link between the MX20 and GDL 69A.
4. 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.

1. Turn on the power to the MX20 and WSI InFlight AV-200 receiver.
2. After the MX20 performs its self-tests, enter the FIS function by pressing the FN key until the FIS function option is available.
3. 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.
4. 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.

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 (1)	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 (1)	3.5 A	4.5 A	1.75 A	2.25 A

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

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)
(Only one radar source may be connected to the MX20) WSI InFlight AV-200 (FIS)
(MX20 will communicate at 38,400 baud)
Garmin GWX 68 Radar (MX20 I/O Model Only)

	Bendix/King ART2000 Radar (Bendix/King P/N 071-01519-0101) (MX20 I/O Model Only)
Weather Source (Continued)	Bendix/King ART2100 (Bendix/King P/N 071-01550-0101) (MX20 I/O Model Only) Note 1
	Allied Signal RS-181A (King P/N 071-1315-00; Bendix/King P/N 3614077-8101) (MX20 I/O Model Only)
	L-3 (Goodrich) WX500
Terrain TAWS Source (Only one TAWS source may be connected to the MX20)	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:

Table 3-3. TSO Authorizations

JTSO	TSO	Manufacturer and Model	Part Number
JTSO 2C63c	TSO C63c	Bendix King ART2000 Bendix King ART2100 Bendix RS-181A King RS-181A Garmin GWX 68	071-01519-0101 071-01550-0101 3614077-8101 071-1315-00 011-00833-20
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.

Table 3-4. Radar Sensors and Supported Radar Functions

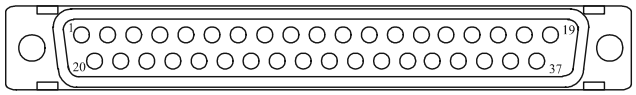
GWX 68 (Garmin PN 011-00883-20)	**RS-181A** (King PN 071-1315-00) (Bendix/King PN 3614077-8101)	**ART 2000** (Bendix/King PN 071-01519-0101) **ART 2100** (Bendix/King PN 071-01550-0101)
OFF	OFF	OFF
STANDBY	STANDBY	STANDBY
ON	ON	ON
TEST	TEST	TEST
HORIZONTAL SCAN	HORIZONTAL SCAN	HORIZONTAL SCAN
VERTICAL SCAN		VERTICAL SCAN
GAIN ADJUSTMENT	GAIN ADJUSTMENT	GAIN ADJUSTMENT
TILT ADJUSTMENT	TILT ADJUSTMENT	TILT ADJUSTMENT
BEARING ADJUSTMENT		BEARING ADJUSTMENT
RANGE SETTINGS	RANGE SETTINGS	RANGE SETTINGS
MAP SCAN	MAP SCAN	MAP SCAN
WX SCAN	WX SCAN	WX SCAN
ROLL TRIM	ROLL TRIM	ROLL TRIM
HOLD	HOLD	HOLD
SECTOR SCAN		
STABILIZATION	STABILIZATION	STABILIZATION
CALIBRATION	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 RxD
22	O	Port 2 OUT	Port 2 RS-232 TxD
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 RxD
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

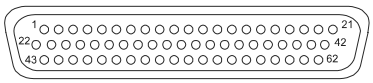
Table 3-6. MX20 I/O Connector Pin Out (J2)

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	ARINC 453/708 Input port 1A
22	SYNCHRO_2_REF_HI	I	Reserved
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	ARINC 453/708 Input port 1B
43	SYNCHRO_2_REF_LO	I	Reserved
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	Reserved
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

Elevation Angle	Minimum Gain
>15º	-2.0 dBic
10º	-3.0 dBic
5º	-4.5 dBic
0º	-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 ±2 dB

Noise Figure:.....2.5 dB Max

Impedance:.....50 ohms

VSWR (Dry):.....≤ 1.5:1

VSWR (Rain):.....≤ 2.0:1

Band Rejection: .....35 dB

Power Handling: .....1 Watt

Voltage:.....5 VDC ±10%

Current: .....35 mA nominal, 40 mA max.

L1 Filter Bandwidth.....1575 ±10 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
>15º	-2.0 dBic
10º	-3.0 dBic
5º	-4.5 dBic
0º	-7.5 dBic

Finish: .....Polyurethane Enamel

Weight: .....6.0 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 ±2 dB
Noise Figure:.....2.5 dB Max
Impedance:.....50 ohms
VSWR (Dry):.....≤ 1.5:1
VSWR (Rain):.....≤ 2.0:1
Band Rejection: .....35 dB
Power Handling: .....1 Watt
Voltage:.....5 VDC ±10%
Current: .....35 mA nominal, 40 mA max
L1 Filter Bandwidth.....1575 ±10 MHz (3 dB) +110, -210 MHz (60dB)

NOTES

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. If the MX20 is interfaced to the Garmin GDL 90, and the aircraft has an operating transponder, the GDL 90 Code Edit option must be disabled (see Section 2.7.4, Step 10). Only one device installed in the aircraft can be the entry point for ATC-assigned squawk codes.

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.

4.7 Radar Sensor

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

4.8 TAWS Sensor

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

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

Table 5-1. Troubleshooting Guide

Problem	Cause	Solution
Unit does not power up – blank screen.	1. Improper wiring; circuit breaker open.	1. Ensure power is properly wired to the MX20 and the circuit breaker is closed.
	2. Unit intensity turned down.	2. Ensure that unit is not in manual intensity control mode with the intensity turned down.
	3. Unit is cold.	3. If ambient temperature is below 10°C, allow unit to preheat for up to 60 seconds.
	4. Data card improperly installed.	4. Ensure that the data card is fully inserted in the front bezel (It should be flush with the ejector button).
Unit fails during power-on self-test (POST).	1. Data card improperly installed.	1. Ensure that the data card is fully inserted in the front bezel (It should be flush with the ejector button).
INST function not shown in install mode.	1. Improper key sequence entered.	1. Ensure that the proper installation key sequence is carefully entered after the power on self-test is complete.
	2. Too many keys pressed in key sequence.	2. Ensure that no other keys are pressed prior to entering the sequence.
	3. Cycle through functions not completed.	3. Cycle through the available functions by pressing the FN key – INST function is on last available function page.
Unit shows POS data flag.	1. Data port information not correct.	1. Ensure that the data port configuration is correct and matches how the unit is wired for the position source.
	2. Antenna cables improperly installed.	2. Ensure that the GPS antenna cables are correctly installed on the external GPS and the internal GPS (if equipped).
	3. Antenna is improperly installed.	3. Ensure that the GPS antenna is correctly installed on top of aircraft and aircraft is clear of hangars, buildings and trees.

Table 5-1. Troubleshooting Guide Cont'd		
Problem	**Cause**	**Solution**
Unit shows POS data flag (cont'd).	4. Waypoint not selected as the current destination.	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).
	5. Position source not configured on appropriate port.	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.
	6. External GPS not properly configured.	6. If other compatible external GPS is used, ensure it is configured to output serial position data on the appropriate lines.
	7. RF interference.	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.
Unit shows RTE data flag.	1. External position source does not have active route engaged.	1. Ensure that the external position source has an active route engaged.
Unit shows ALT data flag.	1. Data port configuration incorrect.	1. Ensure that the data port configuration is correct and matches how the unit is wired for the serial altitude source.
	2. Serial altitude encoder not powered up; not functioning properly.	2. Ensure that serial altitude encoder is powered up and functioning properly.
	3. System is configured to use GX unit as source for altitude data and GX is not turned on.	3. Ensure GX is turned on, shows a valid altitude, and has acquired position and valid waypoint.
	4. System is configured to use GX unit as source for altitude data and GX not configured properly.	4. Verify that GX has extended data output enabled.
Unit shows TER data flag.	1. Terrain database incorrect.	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.
	2. Invalid altitude supplied to unit.	2. Ensure that valid altitude is being supplied to the unit (an ALT data flag should not be present).

Table 5-1. Troubleshooting Guide Cont'd		
Problem	**Cause**	**Solution**
SL30 information is not displayed.	1. Data port configuration incorrect.	1. Ensure that the data port configuration is correct and matches how the unit is wired for the SL30.
	2. SL30 is not powered up.	2. Ensure the SL30 has power applied.
	3. Wiring connections are incorrect	3. Check wiring.
Unit shows DEMO data flag.	1. Demo mode enabled.	1. Disable demo mode in the install pages.
Unit posts message indicating 'Special' terrain clearance mode after power-up.	1. Incorrect terrain clearance mode improperly set.	1. This is normal for special 'Capstone' support. General aviation usage should have the terrain mode set to 'Normal' in the install pages.
Unit shows TCAD data flag.	1. Unit is not Traffic capable.	1. Ensure that the model MX20 is traffic capable.
	2. Data port configuration incorrect	2. Ensure that the data port configuration is correct and matches how the unit is wired for the serial interface.
	3. Traffic function not enabled.	3. Ensure that the traffic function is enabled.
	4. TCAD unit not powered up; not functioning properly.	4. Ensure that the TCAD unit has power applied and is functional.
	5. Wiring connections are incorrect.	5. Verify serial wiring and pin connections.
Unit shows RDR (Amber) data flag.	1. Unit is not radar capable.	1. Ensure that the model MX20 is radar capable.
	2. Data port configuration incorrect	2. Ensure that the data port configuration is correct and the model radar head is set correctly.
	3. Radar function not enabled.	3. Ensure that the radar function is enabled.
	4. Radar unit not powered up; not functioning properly.	4. Ensure that the radar unit has power applied and is functional.
	5. Wiring connects are incorrect.	5. Verify 453/708, 429 and discrete wiring and pin connections.
Unit shows XM data flag	1. Unit is not GDL 69/69A capable.	1. Ensure that the model MX20 is GDL 69/69A capable.
	2. Data port configuration incorrect.	2. Ensure that the data port configuration is correct and the GDL 69/69A is set correctly.
	3. GDL 69/69A function not enabled.	3. Ensure that the GDL 69/69A function is enabled.
	4. GDL 69/69A not powered up; not functioning properly.	4. Ensure that the GDL 69/69A has power applied and is functional.
	5. Wiring connects are incorrect.	5. Verify wiring and pin connections.

Table 5-1. Troubleshooting Guide Cont'd		
Problem	**Cause**	**Solution**
Unit shows LINK data flag.	1. Unit is not WSI sensor capable. 2. Data port configuration incorrect 3. WSI InFlight sensor function not enabled. 4. WSI InFlight sensor not powered up; not functioning properly. 5. Wiring connects are incorrect.	1. Ensure that the model MX20 is WSI sensor capable. 2. Ensure that the data port configuration is correct and the WSI sensor is set correctly. 3. Ensure that the WSI sensor function is enabled. 4. Ensure that the WSI sensor has power applied and is functional. 5. Verify wiring and pin connections.
Unit shows TRAF data flag.	1. Unit is not Traffic capable. 2. Data port configuration incorrect. 3. Traffic function not enabled. 4. Traffic unit not powered up; not functioning properly. 5. Wiring connections are incorrect.	1. Ensure that the model MX20 is traffic capable. 2. Ensure that the data port configuration is correct and matches how the unit is wired for the serial interface. 3. Ensure that the traffic function is enabled. 4. Ensure that the Traffic unit has power applied and is functional. 5. Verify serial wiring and pin connections.
Unit shows ADSB data flag.	1. The GDL 90 UAT internal GPS receiver is reporting an invalid position or is unable to compute a position. 2. The traffic unit is not a GDL 90 UAT.	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. 2. Disable the GDL 90 selections in the Install-Misc installation menu.
MX20 runs hot.	1. Arrangement of avionics and installation area does not provide sufficient airflow.	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 95-100ºF. If an internal fan is not present, one may be installed by the factory. Contact factory.

Table 5-1. Troubleshooting Guide Cont'd		
Problem	**Cause**	**Solution**
Unit shows XPDR data flag.	1. Unit is not GTX330 capable. 2. Data port configured incorrectly. 3. Traffic function not enabled. 4. GTX330 not powered up or not functioning properly. 5. Wiring connections are incorrect.	1. Ensure that the model MX20 is GTX330 capable. 2. Ensure that the data port configuration is correct and the GTX330 is set correctly. 3. Ensure that the GTX330 function is enabled. 4. Ensure that the GTX330 has power applied and is functional. 5. Verify wiring and pin connections
Split Screen function does not appear.	1. Split Screen function is not enabled.	1. Enable Split Screen function in INSTL mode function page.
Terrain annunciators do not light during TAWS8000 self-test.	1. ARINC 429 IN (J2-61 & J2-62) wires are reversed.	1. Ensure the ARINC 429 wires are connected to the proper pins.
Unit shows IDENT (Green)	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.	1. No action required.
No XM Satellite Radio Audio	1. Installed unit is a GDL 69, not GDL 69A. 2. The GDL 69A, audio panel, or both are not powered up. 3. Volume turned down or muted. 4. Headphone or speaker outputs on audio panel are disabled. 5. Wiring connections are loose or incorrect.	1. Only the GDL 69A has audio outputs. 2. Ensure GDL 69A and audio panel have power applied. 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). 4. Enable headphone or speaker outputs on audio panel (refer to audio panel documentation). Some audio panels may require software configuration changes. 5. Verify wiring and pin connections.

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 151st 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

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:	430-0270-0( )	430-0270-5( )	430-0270-6( )	430-0270-7( )	430-0270-8( )	430-0270-9( )
TSO/-JTSO No:	C110a C113	C110a C113	C110a C113 C118 C147	C63c/2C63c C110a C113 C118 C147	C110a C113 C118 C147	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	4.0	Equipment tested to Category A1 and C1 with
Operating Temp		-20°C to +55°C
Short Time High Temperature		+ 70°C
Ground Survival Temperature		-55°C to +85°C
In-flight Loss of Cooling	4.5.4	No cooling required
Altitude	4.6.1	Equipment tested to 35,000 feet
Decompression	4.6.2	Equipment tested 8K to 35K in < 15 seconds
Overpressure	4.6.3	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) [1]
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
Remarks:		

[1] Helicopter vibration tests performed with $W_0 = 0.0392\ g^2/Hz$ for curve F and $W_0 = 0.0785\ g^2/Hz$ for curve F1. These levels create the DO-160D Figure 8-7 values of 2.97 and 4.20 grms respectively.

NOTES

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	ddddd	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	**List Item Number:** Packed, unsigned binary values s = 1 End of list, 0 all other ddddddd = 1 – 20 list waypoint index sddddddd = 0xFF List Type is EMPTY **(BYTE *4* terminate Item)**
3	t	**Waypoint Type**: t = {a (airport) || v (VOR) || n (NDB) || i (INT) || u (USER)}
4	Cr	'\r' **Item Terminator** <0x0d> **(ONLY IF BYTE 3 = OxFF)**
4-8	ddddd	**ASCII Waypoint Identifier**
9 10 11	sddddddd xxmmmmmm xhhhhhhh	**Latitude of waypoint.** 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	**Longitude of waypoint.** 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

Byte	Data Format	Description
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	ddddd	ASCII waypoint identifier
10 11 12	sddddddd xxmmmmmm xhhhhhhh	Waypoint latitude - packed, unsigned binary s = sign: 0 for north, 1 for south ddddddd = degrees mmmmmm = minutes hhhhhhh = hundredths of minutes x = undefined
13 14 15 16	sxxxxxxx sddddddd xxmmmmmm xhhhhhhh	Waypoint longitude s = sign: 0 for east, 1 for west ddddddd = degrees mmmmmm = minutes hhhhhhh = hundredths of minutes x = undefined
17 18	nnnnnnnn 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.
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)

Example Moving Map Data Output (Extended Data Enabled)

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
tda	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	ddddd	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.

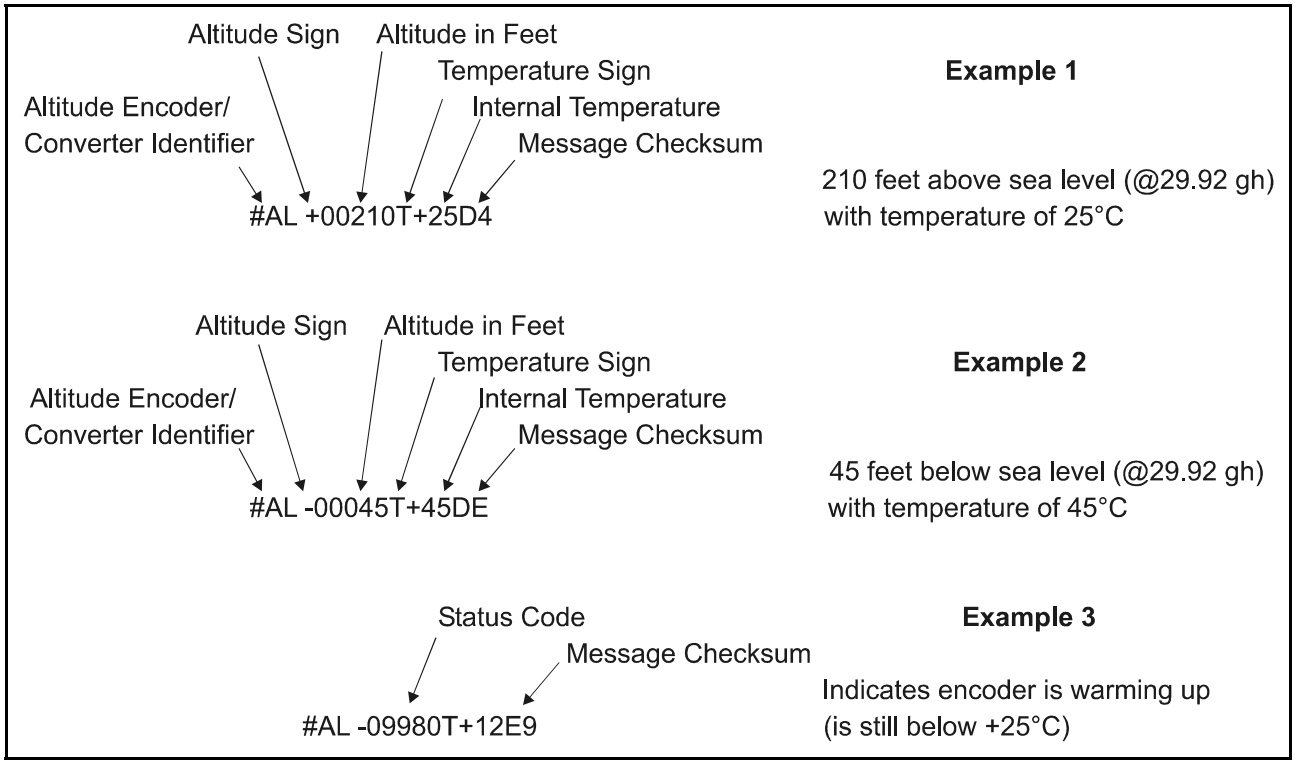


Figure A-3. Altitude Data Input

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

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	
L-3 Communications	SKY497	ARINC429	MX20 I/O Model only
L-3 Communications	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	GWX 68	ARINC708	MX20 I/O Model only
Garmin AT	Legacy UAT/GDL 90	RS-422	
Garmin AT	GDL 69/69A	RS-232	
L-3 (Goodrich)	WX500	RS-422	
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.