



Installation Manual

XMD076 XM WX Datalink Receiver

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Installation Manual

XMD076 XM WX Receiver

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Installation Manual

XMD076 XM WX Receiver

Revision Record

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-	8/5/04	Initial Release	JH	DG	8/5/04
A	9/27/04	Section 2.2.3: Corrected reference from App. B top App. C. Changed wiring diagram from "install terminator" to "verify terminator is installed".	JH	JH	9/27/04
B	7/7/05	ECN # 955: All references to XMRANT-02 removed. (discontinued)	CP	CP	07/07/05
C	9/27/05	1. Updated customer service and pre-activation info. 2. Improved sat antenna cable loss info.	JH	DG	09/29/05
D	04/03/06	Added specific cable loss requirements to Section 2.3 and Appendix C. Updated XM Radio phone number.	JH	DJG	04/05/06



Installation Manual XMD076 XM WX Receiver

Table of Contents

Section	Description	Page
1.0	General Information	1
1.1	Equipment Description	1
1.2	Technical Specifications	2
1.2.1	Environmental Qualification Identification	2
2.0	Installation Instructions	3
2.1	Unpacking and Inspection	3
2.2	XMD076 Receiver Installation	3
2.2.1	Installation Considerations	3
2.2.1.1	Location	3
2.2.1.2	Orientation	4
2.2.1.3	Cooling	4
2.2.2	Mounting the XMD076	4
2.2.3	Electrical Interface Wiring	4
2.2.3.1	Wiring Notes	5
2.2.4	Electrical Load Analysis	5
2.2.4.1	Power Circuit Protection	5
2.3	Antenna Installation Considerations	6
2.3.1	Antenna Coaxial Cable Installation	6
2.3.2	Interference from VHF and SATCOM Transmitters	7
2.4	Weight and Balance	8
3.0	System Checkout	9
3.1	Initial Installation Validation Test	9
3.2	System Test	9
3.2.1	Service Activation	9
3.2.2	Power System and Initial Test	9
3.3	Ground EMI Check	10
4.0	Factory Service Policies	12
4.1	Technical Support	12
4.2	General Service Procedures	12
Appendix A. Environmental Qualification Form		13
Appendix B. Mechanical Installation Diagrams		14
Appendix C. Electrical Installation Diagrams		15



Installation Manual

XMD076 XM WX Receiver

1.0 General Information

This manual provides product description and installation reference information for the XMD076 XM Weather (XM WX) Data Receiver System manufactured by Heads Up Technologies, Inc. of Carrollton, Texas.

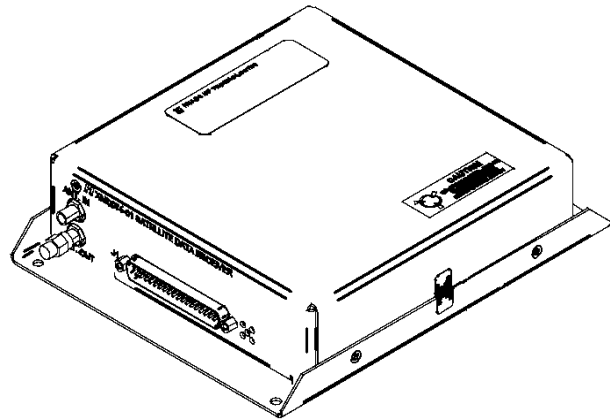
This installation manual applies to the Heads Up Technologies XMD076-01 XM WX Receiver for use with specific Avidyne XM WX software equipped Multi-Function Displays (MFD's). Please refer to the MFD documentation for software configuration requirements and operating instructions.

1.1 Equipment Description

The XMD076 XM WX System is a broadcast datalink for the cockpit MFD to access streaming weather data transmitted from XM Satellite Radio, Inc. It is a remote mounted "sensor" which requires power, ground and a connection to an external antenna. It interfaces to the MFD over a single receive/transmit pair of RS232 signals.

The complete XMD076 system consists of the following components, sold separately:

- Heads Up Technologies XMD076 XM WX Receiver (illustrated here)



- Many options of XM Satellite Radio certified antennas are available and manufactured by Comant Industries. Single and combination function antennas are available. For a complete listing of available antennas, contact the Heads Up Technologies sales department at:

Email: info@heads-up.com **Web:** www.heads-up.com

Voice: 972-980-4890 **Fax:** 972-980-4843

- Optional system installation kit including necessary connectors and installation documentation



Installation Manual

XMD076 XM WX Receiver

1.2 Technical Specifications

STANDARD FEATURES	
Display	None.
WX Interface	RS232, 115.2Kbaud, No parity, 8-bit, 1 stop bit
PHYSICAL CHARACTERISTICS	
Receiver Weight	1.4 lbs.
Receiver Dimensions H, W, L	1.8 X 6.5 X 7.8 Inches
Antenna Weight	Refer to specific antenna installation drawing
OPERATING LIMITS	
Power Input Voltage	11-32VDC, negative ground
Steady State Current	0.35A at 8.0VDC abnormal power input voltage 0.22A at 14VDC power input voltage 0.12A at 28VDC power input voltage

1.2.1 Environmental Qualification Identification

IAW RTCA DO-160D Ch. 2, Appendix A and Heads Up Technologies document XMD076-34, the following environmental category identification applies to the XMD076:

“DO-160D Env. Cat.,[(A2)(F2)X]BAB[HBR]EXXXXXZ(B)(Z)AZZ[TT]M[A2E2X]XXA”

For a description of the equipment categories, refer to Environmental Qualification Form included in Appendix A.



Installation Manual

XMD076 XM WX Receiver

2.0 Installation Instructions

2.1 Unpacking and Inspection

Verify all ordered parts listed above were received and sustained no shipping damage. Where evidence of shipping damage exists, save the shipping carton and packing material to help substantiate your claim to the shipping company. Retain the original shipping carton and packing material in case you need to ship the unit for service.

2.2 XMD076 Receiver Installation

2.2.1 Installation Considerations

The XMD076 is intended for application as a “sensor” to the MFD, providing a datalink to the weather information transmitted by XM Satellite Radio. The software contained in the XMD076 meets the requirements of RTCA DO-178B, Level E.

2.2.1.1 Location

The XMD076 shall be installed in any interior location of the aircraft that is within the environmental limits specified in Section 1.2.1. The receiver location should be at least 12 inches away from transmitting radio equipment.



Installation Manual

XMD076 XM WX Receiver

2.2.1.2 Orientation

The XMD076 can be positioned in any orientation, however the effects of condensation that could develop in the selected area of the aircraft should be considered. If the XMD076 is located in such areas, the XMD076 should be positioned to prevent condensation from entering the D-Sub inter-connect as water wicks through the wire harness. Drip loops routed in the harness can usually prevent such action.

Another consideration to the orientation of the XMD076 is to allow easier viewing of the on-board power-on indicator during troubleshooting. The power LED is located next to the main interface connector, J1.

2.2.1.3 Cooling

The XMD076 is not equipped with air vents or fans, which can be blocked and therefore this consideration is not required.

2.2.2 Mounting the XMD076

The XMD076 should be securely mounted to the aircraft structure using the (4) provided #10 diameter mounting holes IAW AC 43.13-2A, Chapter 2. An interface bracket or plate can be fabricated to attach to the aircraft structure, as required, IAW AC 43.13-2A, Chapter 2.

The mounting of the XMD076 enclosure must provide a DC bond to airframe ground of 0.003 Ohms or less.

2.2.3 Electrical Interface Wiring

Refer to Appendix C for system wiring diagrams and wire type requirements. Wiring is to be performed IAW AC 43.13-1B, Chapter 11. The following connectors or similar, support the XMD076 and antenna installation:

Designation Box/Wiring	Vendor	Part Number	Description
P1	Military Specification	M24308/2-4F	D-Sub 37 Socket (Female) mates to the XMD076 J1
N/A	Tyco/Amp	225532-3	M39012 SMA Plug, Straight
N/A	Tyco/Amp	225609-3	M39012 SMA Plug, R/A



Installation Manual

XMD076 XM WX Receiver

2.2.3.1 Wiring Notes

The following notes apply to aircraft wiring to be used with the XMD076 and antenna installation:

1. Power, P1-19: Use 22AWG (M22759/16-22 or equivalent) wire fed from a 1-Amp circuit breaker for both 14V and 28V aircraft.
2. Power Enable, P1-18: Must be energized for system operation. Apply power through switch or jumper to P1-19.
3. RS-232: P1-22, 4 and 23: Use 22AWG shielded triple, M2750022TE3T14 or similar with a maximum length of 50-feet. Connect dedicated signal ground (J1-23) to the MFD signal ground. Terminate shield on both ends to the P1 backshell and the MFD connector shell or chassis ground.
4. Antenna: Refer to Section 2.3 for antenna installation information.
5. Ground Terminations: Wire ground straps used to terminate cable shields and equipment shall be as short as possible. All bonds shall be 0.003 Ohms or less.

2.2.4 Electrical Load Analysis

Prior to installation, an electrical load analysis should be performed specific to the aircraft. This analysis should be IAW AC 43.13-1B, Chapter 11. The following values may be used to support the analysis:

Equipment	14 VDC Aircraft Nominal/Maximum Load	28 VDC Aircraft Nominal/Maximum Load
XMD076	0.22 A	0.12 A

2.2.4.1 Power Circuit Protection

The power input to the XMD076 shall be circuit protected IAW the guidelines of AC 43.13-1B, Chapter 11, Section 2. A 1-Amp circuit breaker is required for use with the XMD076.



Installation Manual

XMD076 XM WX Receiver

2.3 Antenna Installation Considerations

The XMD076 is designed for use with various XM Radio type-certified antennas covering the S-Band from 2.332 GHz to 2.345 GHz. Due to the low signal levels inherent with satellite communications, the following guidelines and recommended practices should be adhered to for the design of the antenna installation:

- Install IAW AC 43.13-2A Chapter 3, AC 43.13-1B Chapter 11, antenna manufacturer instructions, and in a manner acceptable to the administrator.
- Mount the antenna on the top of the aircraft to an external surface such as the fuselage, away from vertical obstructions as to not “shadow” the antenna from line-of-sight reception of the satellites (Mount antenna as high on the fuselage as practical). Relocation of other less location-sensitive transmitters may be necessary to achieve optimal XM reception performance.
- The mounting of the antenna must provide an electrical bond of 0.003 Ohms or less the airframe ground.

2.3.1 Antenna Coaxial Cable Installation

The correct cable loss of the antenna feed cable is critical to the performance of the system operation. The design configuration of the receiver’s input is preset to expect a total gain range of 22dB (+/- 2dB).

Typical XM Radio type-certified aircraft antennas are configured with a total gain of 30-34dB where 10dB of total cable loss provides the correct gain to the receiver. Always refer to the antenna specifications to insure the correct gain. If desired, additional loss of 0.3dB for each SMA connector can be added but is not crucial to system performance.

Table 1 below provides reference information for lengths for various 50-ohm cable types that are commonly used with SMA connectors to produce the acceptable loss when used with antennas with 30-34dB of gain. When antennas of other gain values are installed, the cable length can be determined using the second column of Table 1 below as follows:

$$\text{Cable Length (Ft.)} = (\text{Antenna Gain} - 22) / \text{Loss Rating} \times 100$$

When the distance between the antenna and receiver is short, run the amount of cable required to meet the loss requirement and stow excess length. An alternative to stowing large amounts of excess cable is to install a low power RF attenuator in-line with the cable. This system requires a DC bias passing type attenuator that has a frequency rating that falls within the maximum satellite frequency of 2.345 GHz.



Installation Manual

XMD076 XM WX Receiver

Table 1 - Cable Length Chart

RG Type (Mil-C-17)	Loss Rating (dB/100-Ft.) @ 2.339GHz	Length Range (Ft.) @ 8 - 12dB Loss
142	20.6	38.8 – 58.3
400	23.41	34.2 – 51.3
316	40.87	19.6 – 29.4
178	68.82	11.62 – 17.4

2.3.2 Interference from VHF and SATCOM Transmitters

- Mount the antenna no closer than 36 inches to VHF-Comm transmitters of 15 Watts or less. For more powerful transmitting antennas, XM separation should be a minimum of 48-inches. Installation pre-testing (see note below) should be performed if the separation is less than 60-inches.

If a XM/VHF-Comm combo style antenna is being installed and replacing the operation of an existing approved antenna installation, the existing separations are acceptable.

- SATCOM antennas transmit at 40 Watts and should be separated by the largest distance possible. This distance will be a minimum of 36-inches.
- When routing the XM antenna cable, the maximum possible separation from transmitter antenna feed cables must be considered, especially with SATCOM and other high power transmitters. Antenna feed cables of VHF transmitters of 15 Watts or less should only require a minimal separation.
- Receive only antennas such as ADF and GPS do not produce interference and require little separation. The XM antenna should be placed as close as possible to these types of antennas to gain separation from transmitters.



Installation Manual

XMD076 XM WX Receiver

NOTE:

Installation pre-testing is advised if this installation is being performed on several similar aircraft such as a fleet. A pre-test can be performed by mounting the antenna on a piece of aluminum sheet, approximately 24" in diameter or square, to serve as a temporary ground plane. This antenna assembly would then lay on the aircraft skin near the proposed installation location for an active ground test prior to cutting mounting holes. This has proven both beneficial and cost effective in past fleet installations since all transmit equipment can be operated and tested for XM receiver interference prior to the actual installation.

NOTE:

This installation manual does not contain approved data for type specific aircraft antenna installations.

2.4 Weight and Balance

A Weight and Balance calculation of the aircraft is required as part of the installation approval process. Following the guidelines as established in AC 43.13-1B, Chapter 10, Section 2, the W/B of the aircraft can be calculated using the below weights of the system components.

Description	Weight (lbs.)
XMD076 Receiver	1.4
XMRANT-01 (standard XM Antenna)	0.26
For other XM antennas not listed, refer to the applicable antenna installation drawing.	



Installation Manual

XMD076 XM WX Receiver

3.0 System Checkout

The following XMD076 system checkout aides are intended to assure proper installation and interfacing to the MFD and antenna. Familiarize yourself with the MFD operational guide for explanations of using the MFD to communicate with the XMD076 system.

3.1 Initial Installation Validation Test

Before applying power to the system, verify and complete the following:

- 100% continuity check performed and satisfactory.
- All interconnects and ground connections are fully made and seated.
- The aircraft's power source is at the proper voltage, 11VDC - 16VDC for 14V aircraft and 22VDC - 32VDC for 28V aircraft.
- Move aircraft to an outdoor area with a clear view of the southern sky, free of buildings, trees or other obstructions.

3.2 System Test

3.2.1 Service Activation

The system requires XM WX subscription service activation from XM Satellite Radio Inc. For installation purposes only, a temporary XM WX Satellite Weather service is pre-activated from the factory. **This activation will terminate automatically without prior notice. To avoid unexpected deactivation, customers should contact XM Satellite Radio Inc. at 1-800-985-9200 to transfer the subscription immediately after installation.**

Please contact Heads Up Technologies via email at service@heads-up.com for additional information on the process to activate receivers if required.

3.2.2 Power System and Initial Test

1. Apply power to the XMD076 receiver and any other system applicable to the MFD equipment. Some installations may include a WX Data power switch and if equipped, toggle to the ON position. The receiver is equipped with an on-board red LED indicator to show the receiver is powered-on.

The MFD operations manual may be required to continue.



Installation Manual

XMD076 XM WX Receiver

2. Power up the MFD. Go into Maintenance Mode using the procedure in the MFD installation manual and select the RS232 port to which the XM Receiver is wired.
3. Restart the MFD. Select the Trip page on the MFD. Press the Display button until Broadcast (a down pointing arrow) Status is displayed in the Display button label.
4. The MFD will report the XM Serial Number and Signal Quality of the XMD076. If successful, the communication link between the MFD and receiver is operational. If the Signal Quality is reported as Good, the antenna and cabling are installed correctly and are operating normally and, the aircraft is in view of at least one of the XM satellites.

Note: The XM Serial Number must be presented to the aircraft owner, who will need it to acquire the subscription service and for other customer service needs with XM Radio.

5. If the Signal Quality is reported as Marginal, Weak, or None, reposition the aircraft away from obstructions to get a better view to the sky. After verification of the aircraft position and if the Signal Quality is still not Good, inspect the antenna and cable.
6. If the Signal Quality and Receiver ID are not reported, check the following:
 - The software configuration of the MFD. Verify the MFD is configured for use with the XMD076. Refer to the MFD documentation.
 - The RS232 data wiring to the MFD. Refer to Appendix C and Section 2.2.3 for wiring information.
 - Power to the XM receiver. Verify red power indicator (located next to J1) on the XM receiver is illuminated.

3.3 Ground EMI Check

The following procedure is to be performed to verify that no interference is noted through the use of the XMD076 system on other aircraft systems and vice-versa. The operation of the XMD076 system shall not result in NAV flags, constant location lightning strikes on any installed Stormscope, noise on COMM channels, or other phenomena.

A ground test should be adequate for the XMD076 since it operates the same in flight. If some aircraft systems cannot be verified on the ground, a flight test may be required.

Operate the aircraft systems as listed below and check the operation of both that system and the XMD076 system.

A. Comm Radios:

1. Scan through radio channels to ensure there is no interference caused by the XMD076.



Installation Manual

XMD076 XM WX Receiver

2. Check local ground and tower frequencies to ensure there is no break in squelch caused by the installation.
3. Monitor the signal strength values of the XMD076 on the MFD (refer to Sec. 3.2.2 above) and transmit on various frequencies.

B. GPS:

1. Ensure the correct position is displayed.
2. Verify no change in GPS signal strength with the XMD076 powered ON and OFF.

C. Autopilot:

1. Ensure the autopilot self-test passes OK with the XMD076 operating.

D. Other Aircraft Systems:

1. Verify that there is no adverse effect on flight instruments with the XMD076 operating.
2. Operate other aircraft systems, especially radio transmitters, while monitoring the signal strength values of the XMD076 on the MFD.



Installation Manual

XMD076 XM WX Receiver

4.0 Factory Service Policies

4.1 Technical Support

Technical support or service questions may be submitted to the following:

Email: service@heads-up.com

Voice: 972-980-4890

Fax: 972-980-4843

A Heads Up Technologies customer support representative will respond as soon as possible. Heads Up Technologies business hours are 8:00 AM to 5:00 PM Central Time, Monday through Friday.

Issues with the MFD must be resolved through the MFD manufacturer.

4.2 General Service Procedures

Service of a XMD076 component performed at the factory typically includes an overhaul consisting of a thorough inspection, repair as needed and functional tests. Antennas that are used in this system are not serviceable and can only be inspected and tested. Faulty or damaged antennas must be replaced.

Prepare a packing slip that includes the part number(s) and serial number(s) of the items to be returned, along with a complete description of the problem, requested service and special instructions. The packing slip must also include a contact name, daytime telephone number and return shipping address.

To return an item, securely pack it in the original shipping container, if possible. Ship it to the address provided by the Heads Up Technologies customer service representative.



Installation Manual

XMD076 XM WX Receiver

Appendix A. Environmental Qualification Form

RTCA/DO-160D ENVIRONMENTAL QUALIFICATION FORM

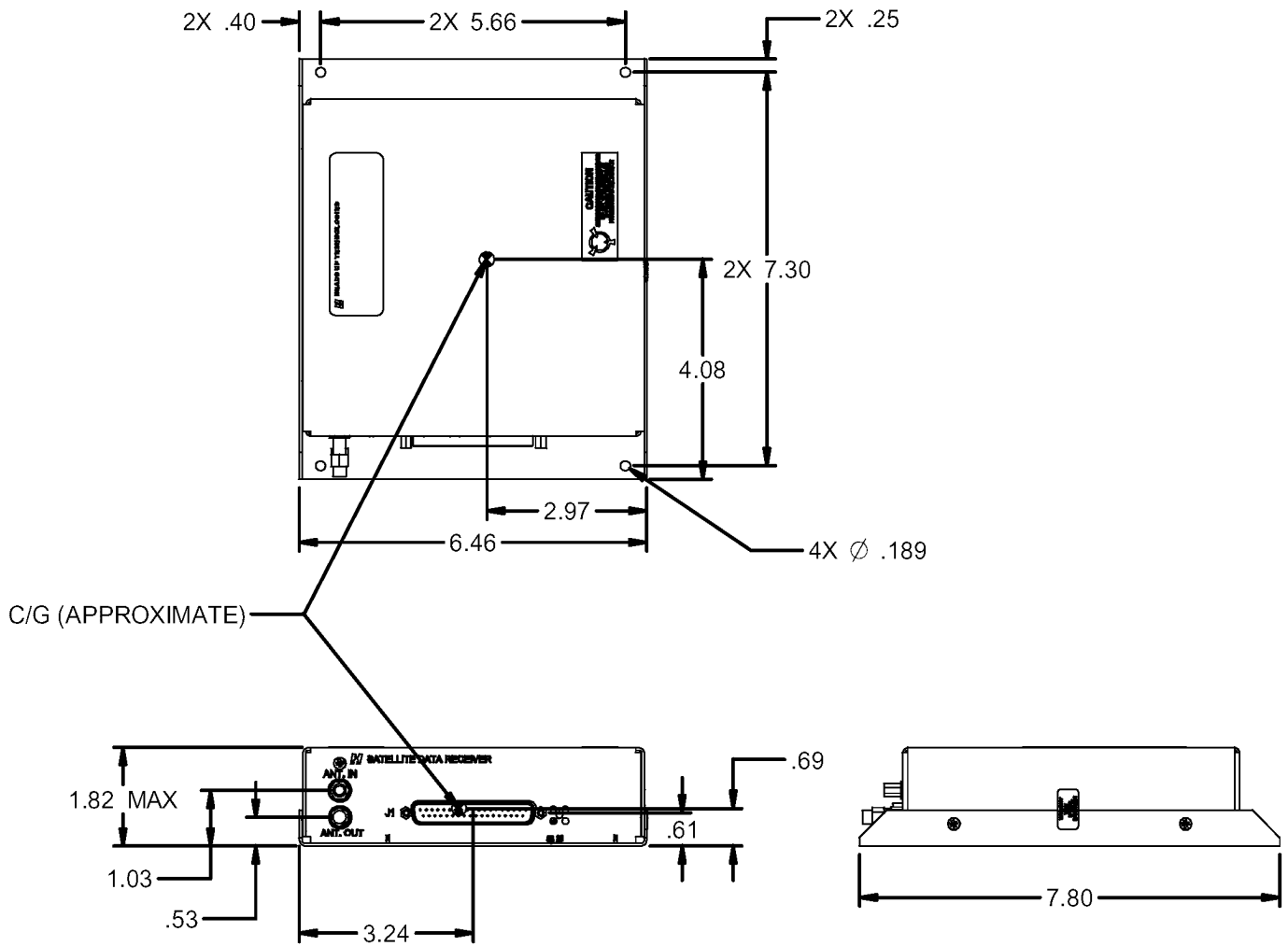
UUT NOMENCLATURE XM Weather Data Receiver, RS232 Type		
TYPE/MODEL/PART NO. XMD076-01	TSO NUMBER N/A	
MANUFACTURER'S SPECIFICATION AND/OR OTHER APPLICABLE SPECIFICATION XMD076-32, XMD076-01 Qualification Test Plan		
MANUFACTURER Heads Up Technologies, Inc, 2033 Chenault Dr. #100 Carrollton, TX 75006		
REVISION & CHANGE OF DO-160 D, Changes 1, 2 and 3 as required.	TESTING DATES 06-03-2004 and 06-21-04	
TEST CONDITION	SECTION	QUALIFICATION CATEGORY / DESCRIPTION
TEMPERATURE AND ALTITUDE	4.0	A2 F2 (-55°C-+70°C, up to 55Kft)
TEMPERATURE VARIATION	5.0	B (5°C/minute)
HUMIDITY	6.0	A (Standard Environment)
OPERATIONAL SHOCKS AND CRASH SAFETY	7.0	B (Crash: 20g random)
VIBRATION	8.0	H, Curves B and R (High-level short duration up to 2.5g-peak)
EXPLOSION	9.0	E (Env. II)
WATERPROOFNESS	10.0	X (Not qualified for this environment)
FLUIDS SUSCEPIBILITY	11.0	X (Not qualified for this environment)
SAND AND DUST	12.0	X (Not qualified for this environment)
FUNGUS	13.0	X (Not qualified for this environment)
SALT SPRAY	14.0	X (Not qualified for this environment)
MAGNETIC EFFECT	15.0	Z (0.3m separation)
POWER INPUT	16.0	B and Z 14V-28V (All A/C DC systems)
VOLTAGE SPIKE	17.0	A (600V)
AUDIO FREQUENCY SUSCEPIBILTY	18.0	Z (All A/C DC systems)
INDUCED SIGNAL SUSCEPTIBILITY	19.0	Z (Standard Coupling)
RF SUSCEPTIBILITY	20.0	TT (Well protected env.)
EMISSION OF RADIO FREQUENCY	21.0	M (meets Transport AC standards)
LIGHTNING INDUCED TRANSIENT SUSCEPTIBILITY	22.0	A2E2X (Partially protected env.)
LIGHTNING DIRECT EFFECTS	23.0	X (N/A)
ICING	24.0	X (N/A)
ELECTROSTATIC DISCHARGE	25.0	A (15KV Human Contact)



Installation Manual XMD076 XM WX Receiver

Appendix B. Mechanical Installation Diagrams

XMD076 RECEIVER DIMENSIONS

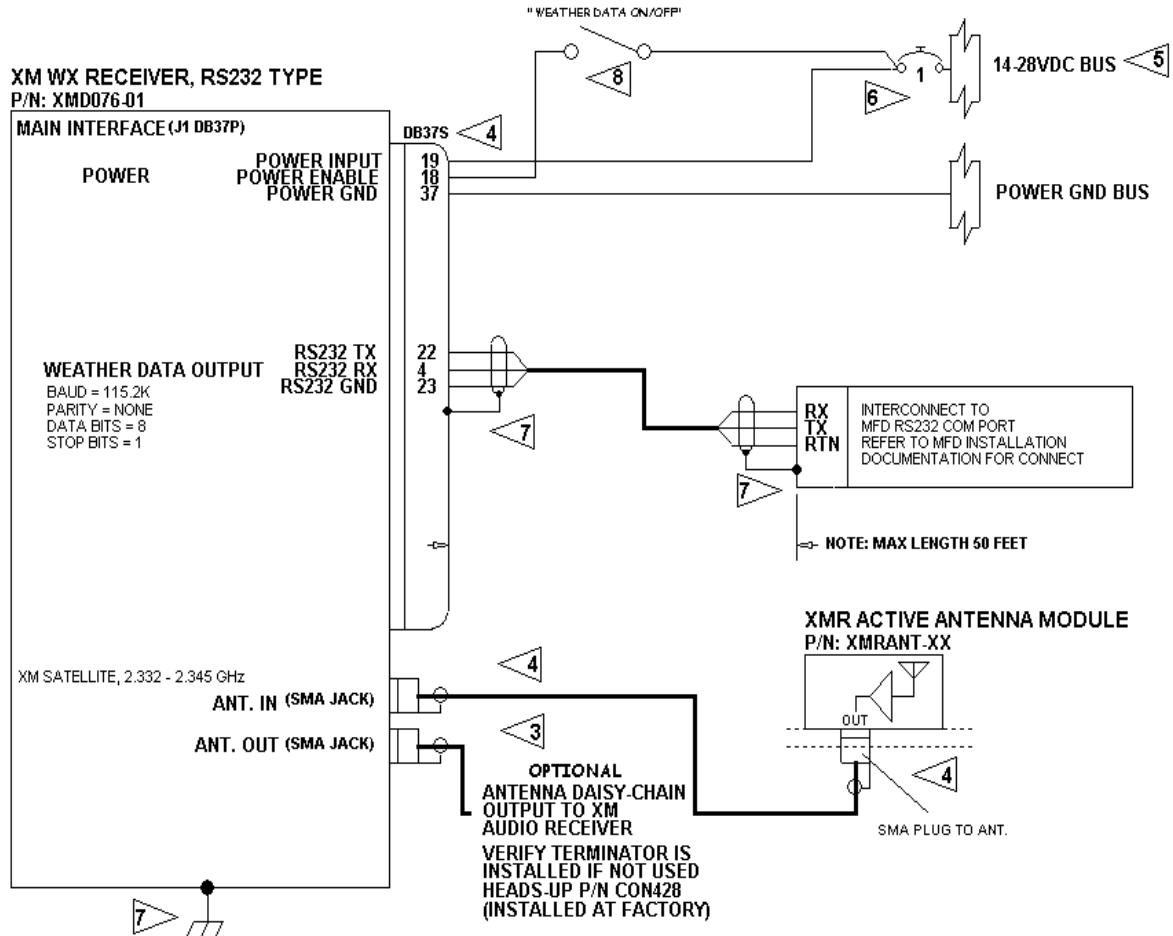




Installation Manual XMD076 XM WX Receiver

Appendix C. Electrical Installation Diagrams

XMD076 RECEIVER WIRING



NOTES: UNLESS OTHERWISE SPECIFIED

- 1. ALL EQUIPMENT AND WIRING TO BE INSTALLED PER A/C MANUFACTURER AND FEDERAL AVIATION REQUIREMENTS, AS REQUIRED.
- 2. ALL WIRE PER M22579/16-22 AND CABLE PER M27500 22TE3T14 OR AS REQUIRED BY AIRCRAFT REQUIREMENTS.
- 3. REFER TO "XM SATELLITE ANTENNA INSTALLATION CONSIDERATIONS" SECTION FOR ANTENNA AND COAXIAL CABLE INSTALLTION REQUIREMENTS.
- 4. RECOMMENDED MATING CONNECTORS:
(SMA PLUG, STRAIGHT) TYCO/AMP P/N 225532-3
(SMA PLUG, R/A) TYCO/AMP P/N 225609-3
(DB37S) M24308/2-4F
RECOMMENDED CONNECTOR CRIMPERS:
(SMA PLUG) TYCO/AMP P/N 220061-1
(DB) M22520/2-01 AND M22520/2-08 POSITIONER
OTHER CONNECTORS USED ARE TBD BY INSTALLER.
- 5. POWER BUS VOLTAGE SHALL NOT EXCEED RTCA/D0160D CATEGORY B AND Z.
- 6. ALL WIRE, CABLE AND EQUIPMENT SHOWN FOR REFERENCE ONLY. TO BE SUPPLIED BY INSTALLER/USER.
- 7. MOUNTING STRUCTURE SHALL PROVIDE CHASSIS GROUND CONNECTION TO AIRFRAME GROUND. CABLE SHIELDS TO BE TERMINATED TO CONNECTOR BACKSHELL.
- 8. ENERGIZE (APPLY 14.28VDC/30mA) POWER ENABLE FOR UNIT OPERATION. USE SWITCH AS SHOWN OR OR JUMPER DIRECT TO POWER WIRE.