Operation Manual

F Series Products

FSK Data

Transmitters & Receivers

FMT1 Transmitter

FSR1 Receiver

AMP Advanced Microwave Products

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1. INTRODUCTION

Thank you for choosing this AMP Wireless Product. Every effort has been made to design and manufacture a quality product that will meet your surveillance needs for many years. Please visit our website (www.advmw.com) for information on other products and for datasheets, quick start guides, model number builders, operation manuals, and other related materials.

If you have any questions regarding this product or if you require technical assistance, please feel free to contact us at (775) 345-9933.

1.1. Purpose and Function

F Series FSK Data Transmitters and Receivers are developed and manufactured by Advanced Microwave Products (AMP).

F Series transmitters/receivers are designed for data transmission. They must be operated with AMP's F Series receivers/transmitters. AMP's F Series products are not compatible with other FSK products on the market.

1.2. Capabilities

AMP Transmitters and Receivers are designed for harsh environments and feature robust packaging and connectors. Compact package sizes provide versatility in unit placement and system applications.

AMP Transmitters and Receivers require no tuning or adjustments. All units operate directly with any standard RS-232, TTL (3.3V), or RS-422 data source (depending on configuration). Power can be derived from batteries, simple power supplies, or vehicle power.

Whip or "rubber duck" antennas are adequate for most applications.

1.3. Environmental Requirements

AMP Transmitters and Receivers are designed for indoor or outdoor use. Precautions should be taken when exposing the products to the elements. Do not expose to 100% humidity.

Transmitters and Receivers should be located in areas where the ambient temperature does not exceed the maximum operating temperature indicated in the specifications. Placement in confined locations with minimal airflow, in direct sunlight in areas of temperature extremes, or in proximity to other devices that generate heat, such as power supplies, heating systems, etc., should be avoided. Temperatures exceeding +75°C may cause permanent damage to the equipment.

When not used for extended periods of time, external connections, including power/data cable and antenna, should be removed and the units covered, boxed, or crated and stored in a clean, dry place.

2. FMT1 TRANSMITTER

2.1. FMT1 Specifications

RF Characteristics

Frequency Range (Specify):	433.0-434.8 MHz	
(Other Ranges Available)	868.0-870.0 MHz	
	902.0-928.0 MHz	
	2400-2500 MHz	
Frequency Step Size:	< 1 GHz Models	100 kHz
	> 1 GHz Models	500 kHz
Frequency Selection (Specify):	Full Band Channelized - Remote Control Only or Remote/Programmable Switch	
Frequency Stability:	±5 ppm Over -20°C to +60°C	
Output Power (Specify):	20 mW or 250 mW Nominal	
Output Impedance:	50 Ohms Nominal, VSWR 2:1 Maximum	
Output Protection:	None – 20:1 VSWR Indefinitely	
Spurious Output:	-13 dBm Maximum	

FSK Modulator and Data Characteristics

Modulator Type:	BFSK, Positive Logic
Carrier Deviation:	50 kHz or 400 kHz Nominal, Dependent on Bit Rate
Incidental AM:	2% Maximum
Incidental FM:	2 kHz RMS Maximum
Bit Rate (Specify):	Up to 57600 bps or 115200 bps
Signalling Type (Specify):	RS232/3.3V TTL, or RS422
Input Impedance:	5 kΩ to Gnd (RS232, TTL), 120 Ω Differential (RS422), 12 kΩ Differential (RS485)
Port Settings:	8 Data Bits, Selectable Baud / Parity / Stop Bits

Configuration Interface Characteristics

Interface Type:	Two-Way UART
Signalling Type (Specify):	RS232, RS422, or 3.3V TTL
Interface Parameters:	9600/8/1/None/None (Baud/Data Bits/Stop Bits/Parity/Handshake)

Power Requirements

Input Voltage:	+9 to +16 Vdc, Reverse Polarity Protected	
Current Draw:	< 1 GHz Models*	70 mA for 20mW, 190 mA for 250 mW
(Specified Typical @ 12V Input)	> 1 GHz Models	130 mA for 20mW, 250 mA for 250 mW

** 433.0-434.8 MHz models with 115,200 bps bit rate have the same current draw as the > 1 GHz models.*

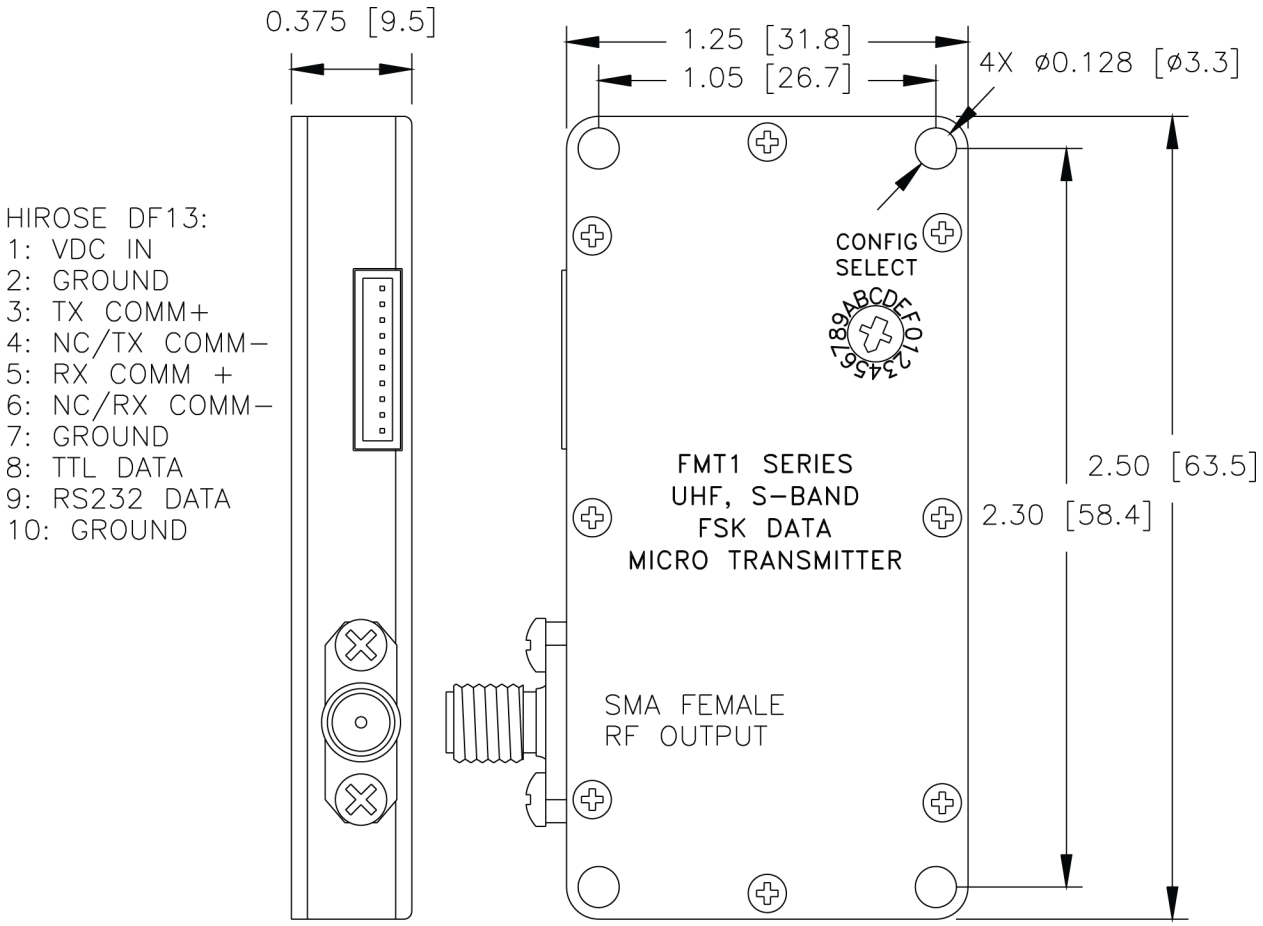
Mechanical

Material (Specify):	CNC Machined T6061-T6 Nickel Plated Aluminum or OEM PCB	
Finish (Specify):	Nickel Plated or Gold Iridite	
Dimensions:	1.25” W x 2.50” L x 0.375” H	
Weight:	1.2 oz. Typical	
Connectors:	RF Output:	SMA Female
	DC Supply, Data In, Comms:	Hirose DF13-10P-1.25DS, Mate Supplied

Environmental

Temperature (Operating):	-20°C to +60°C
Acceleration:	100 g, 3 Axes
Altitude:	Unlimited
Humidity:	Up to 95% @ Any Temperature Forming Frost or Condensation

2.2. FMT1 Mechanical Drawing and Connector Pin-Outs



2.3. FMT1 List of Items Furnished

- (1) FMT1 Transmitter (configured as ordered)
- (1) WHSFXX1-S10S0 Power, Data, and Comm connector

2.4. FMT1 List of Items Required

- Antenna, Type SMA Plug (Male) Connector
- Data input connector (if required)

3. FSR1 RECEIVER

3.1. FSR1 Specifications

RF Characteristics

Frequency Range (Specify):	433.0-434.8 MHz	
(Other Ranges Available)	868.0-870.0 MHz	
	902.0-928.0 MHz	
	2400-2500 MHz	
Frequency Step Size:	< 1 GHz Models	100 kHz
	> 1 GHz Models	500 kHz
Frequency Selection (Specify):	Full Band Channelized - Remote Control Only or Remote/Programmable Switch	
Maximum RF Input:	+10 dBm Without Damage	
Input Impedance:	50 Ohms Nominal, VSWR 2:1 Maximum	
Sensitivity:	-101 dBm Typical @ 57600 Baud for 10^{-3} BER	
	-96 dBm Typical @ 115200 Baud for 10^{-3} BER	
Image Rejection:	50 dB Minimum	

LO/IF Characteristics

LO Stability:	±5 ppm Over -20°C to +60°C	
IF Frequency:	< 1 GHz Models	DC or 200 kHz Single IF - Baud Dependent
	> 1 GHz Models	868 MHz First IF, DC or 200 kHz Second IF - Baud Dependent
IF Bandwidth:	< 1 GHz Models	200 kHz or 1200 kHz - Baud Dependent
	> 1 GHz Models	2 MHz First IF, 200 kHz or 1200 kHz Second IF - Baud Dependent
Harmonic and Spurious Level:	< -25 dBm	

FSK Demodulator and Data Characteristics

Demodulator Type:	BFSK Correlator, Positive Logic
Expected Deviation:	50 kHz or 400 kHz Nominal, Dependent on Bit Rate
Post-Demod Filter:	Digital LPF Set to 0.75 X Bit Rate
Bit Rate (Specify):	Up to 57600 bps (All Frequencies) or 115200 bps
Signalling Type (Specify):	RS232/3.3V TTL, or RS422
Output Impedance:	300 Ω (RS232 or TTL), 1 kΩ Differential (RS422), 12 kΩ Differential (RS485)
Port Settings:	8 Data Bits, Selectable Baud / Parity / Stop Bits

Configuration Interface Characteristics

Interface Type:	Two-Way UART
Signalling Type (Specify):	RS232, RS422, or 3.3V TTL
Interface Parameters:	9600/8/1/None/None (Baud/Data Bits/Stop Bits/Parity/Handshake)

Power Requirements

Input Voltage:	+9 to +16 Vdc, Reverse Polarity Protected	
Current Draw:	< 1 GHz Models*	40 mA
(Specified Typical @ 12V Input)	> 1 GHz Models	100 mA

** 433.0-434.8 MHz models with 115,200 bps bit rate have the same current draw as the > 1 GHz models.*

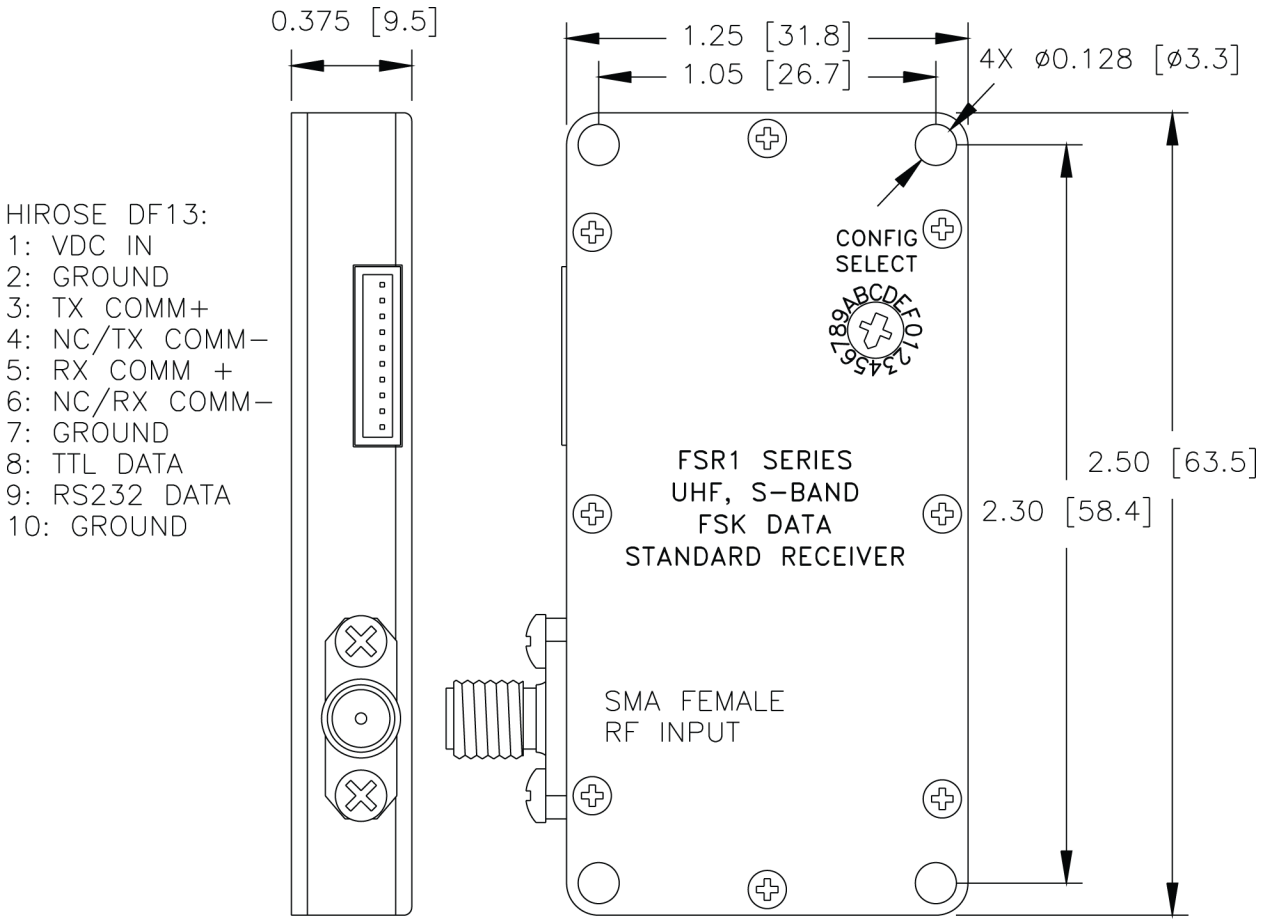
Mechanical

Material (Specify):	CNC Machined T6061-T6 Nickel Plated Aluminum or OEM PCB	
Finish (Specify):	Nickel Plated or Gold Iridite	
Dimensions:	1.25” W x 2.50” L x 0.375” H	
Weight:	1.2 oz. Typical	
Connectors:	RF Input:	SMA Female
	DC Supply, Data Out, Comms:	Hirose DF13-10P-1.25DS, Mate Supplied

Environmental

Temperature (Operating):	-20°C to +60°C
Acceleration:	100 g, 3 Axes
Altitude:	Unlimited
Humidity:	Up to 95% @ Any Temperature Forming Frost or Condensation

3.2. FSR1 Mechanical Drawing and Connector Pin-Outs



3.3. FSR1 List of Items Furnished

- (1) FSR1 Receiver (configured as ordered)
- (1) WHSFXX1-S10S0 Power, Data, and Comm connector

3.4. FSR1 List of Items Required

- Antenna, Type SMA Plug (Male) Connector
- Data output connector (if required)

4. SAFETY PRECAUTIONS

Transmitters and Receivers should be handled with caution like any electrical or electronic device. Do not handle the units or associated cabling with wet hands or materials.

Connections should be made only to previously-tested, active power sources (outlets or batteries) of the correct voltage, and each connector should be inserted only into its designated port. All connections should be checked to ensure they are firmly in place.

WARNING! RF RADIATION HAZARD

In order to keep the RF Exposure within the FCC 1.1310 limit, a safe personal distance from the antenna must be maintained according to the below tables. The first table is for transmitters operating 1500 MHz or higher where the Maximum Permissible Exposure (MPE) is 10 Watts/meter2. The second table is for transmitters operating in the 340-400 MHz range where the MPE is 2.27 Watts/meter2. See following page for details on calculation of safe personal distances.

Operating Frequency 1500 MHz and Higher (MPE = 10 W/m^2)										
	Transmitter Power 0.25 Watts		Transmitter Power 0.5 Watts		Transmitter Power 1 Watt		Transmitter Power 2 Watts		Transmitter Power 5 Watts	
Antenna Gain (dBi)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)
0	0.25	>0.20	0.5	>0.20	1	>0.20	2	>0.20	5	>0.20
2	0.4	>0.20	0.79	>0.20	1.58	>0.20	3.17	>0.20	7.9	0.25
5	0.79	>0.20	1.58	>0.20	3.16	>0.20	6.32	0.22	15.8	0.35
10	2.5	>0.20	5	>0.20	10	0.28	20	0.4	50	0.63
15	7.91	0.25	15.8	0.35	31.6	0.5	63.2	0.71	158.1	1.12
20	25	0.45	50	0.63	100	0.89	200	1.26	500	1.99
25	79.1	0.79	158.1	1.12	316.2	1.59	632.5	2.24	1581.1	3.55
30	250	1.41	500	1.99	1000	2.82	2000	3.99	5000	6.31

Operating Frequency 340 - 400 MHz (MPE = 2.27 W/m2)												
	Transmitter Power 0.25 Watts		Transmitter Power 0.5 Watts		Transmitter Power 1 Watt		Transmitter Power 2 Watts		Transmitter Power 5 Watts		Transmitter Power 10 Watts	
Antenna Gain (dBi)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)	EIRP (Watts)	Minimum Distance (Meters)
0	0.25	>0.20	0.5	>0.20	1	>0.20	2	0.26	5	0.42	10	0.59
2	0.4	>0.20	0.79	>0.20	1.58	0.24	3.17	0.33	7.9	0.53	15.8	0.75
5	0.79	>0.20	1.58	0.24	3.16	0.33	6.32	0.47	15.8	0.74	31.6	1.05
10	2.5	0.3	5	0.42	10	0.59	20	0.84	50	1.32	100	1.87
15	7.91	0.53	15.8	0.74	31.6	1.05	63.2	1.49	158.1	2.35	316.2	3.33
20	25	0.94	50	1.32	100	1.87	200	2.65	500	4.19	1000	5.92
25	79.1	1.66	158.1	2.35	316.2	3.33	632.5	4.71	1581.1	7.45	3162.3	10.53
30	250	2.96	500	4.19	1000	5.92	2000	8.37	5000	13.24	10000	18.72

MAINTAIN A SAFE PERSONAL DISTANCE FROM THE ANTENNA WHILE TRANSMITTER IS OPERATIONAL.

FAILURE TO MAINTAIN A SAFE PERSONAL DISTANCE FROM THE ANTENNA MAY RESULT IN PERSONAL INJURY.

5. PREPARATION FOR USE

5.1. Unpacking

Carefully remove the product from the shipping container and make sure all listed furnished items are included as noted in the respective section. Inspect all items for damage. If any item is omitted from the shipment or appears damaged, contact AMP with detailed description of problem.

5.2. Transmitter Pre-Test

Although each unit is thoroughly tested at the factory for both functional and environmental performance, a minimal amount of pre-testing should be done by the operator before placing the transmitter into service. The transmitter, an appropriate AMP receiver, transmit and receive antennas, data source, a data monitor, and DC power supplies are the only components required to perform a functional test of the transmitter.

The transmit and receive antennas should be situated at a distance of greater than 25 feet apart to prevent serious damage to or destruction of the receiver's front end. Set up the receiver and make all necessary adjustments in accordance with that unit's Operation Manual.

Verify DC power supplies are between +9 and +16 Vdc. With the WHSFXX1-S10S0 interface connector DISCONNECTED from the transmitter, connect DC power supply to WHSFXX1-S10S0 interface connector (Pin1 = positive DC input, Pin2 = negative DC input (ground)).

Connect the transmit antenna to transmitter RF output connector (SMA). Connect the data input and communication bus (if using). See Section 2.2 for FMT1 wiring diagram.

Connect WHSFXX1-S10S0 interface connector. Data should be observed on the receive end. If no data is present, refer to Section 7.2 for troubleshooting instructions.

5.3. Receiver Pre-Test

Although each unit is thoroughly tested at the factory for both functional and environmental performance, a minimal amount of pre-testing should be done by the operator before placing the receiver into service. The receiver, an appropriate AMP transmitter, transmit and receive antennas, data source, a data monitor, and DC power supplies are the only components required to perform a functional test of the receiver.

The transmit and receive antennas should be situated at a distance of greater than 25 feet apart to prevent serious damage to or destruction of the receiver's front end. Set up the transmitter and make all necessary adjustments in accordance with that unit's Operation Manual.

Verify DC power supplies are between +9 and +16 Vdc. With the WHSFXX1-S10S0 interface connector DISCONNECTED from the receiver, connect DC power supply to WHSFXX1-S10S0 interface connector with the correct polarity (Pin1 = positive DC input, Pin2 = negative DC input (ground)).

Connect the receive antenna(s) to receiver RF input connector(s) (SMA). Connect the data output to a data monitor. See Section 3.2 for FSR1 wiring diagram.

Connect WHSFXX1-S10S0 interface connector to the receiver. Data should be observed on the receive end. If no data is present, refer to Section 7.2 for troubleshooting instructions.

6. INSTALLATION AND OPERATING INSTRUCTIONS

6.1. Use and Function of Connectors

AMP F series products are simple to install, requiring only connection to the antenna, data, and DC power supply using the appropriate cables for transmitters and requiring only connection to the antenna, data source data monitor, and DC power supply using the appropriate cables for the receivers. The use and function of the connectors are in the respective product sections.

6.2. Use and Function of Switches

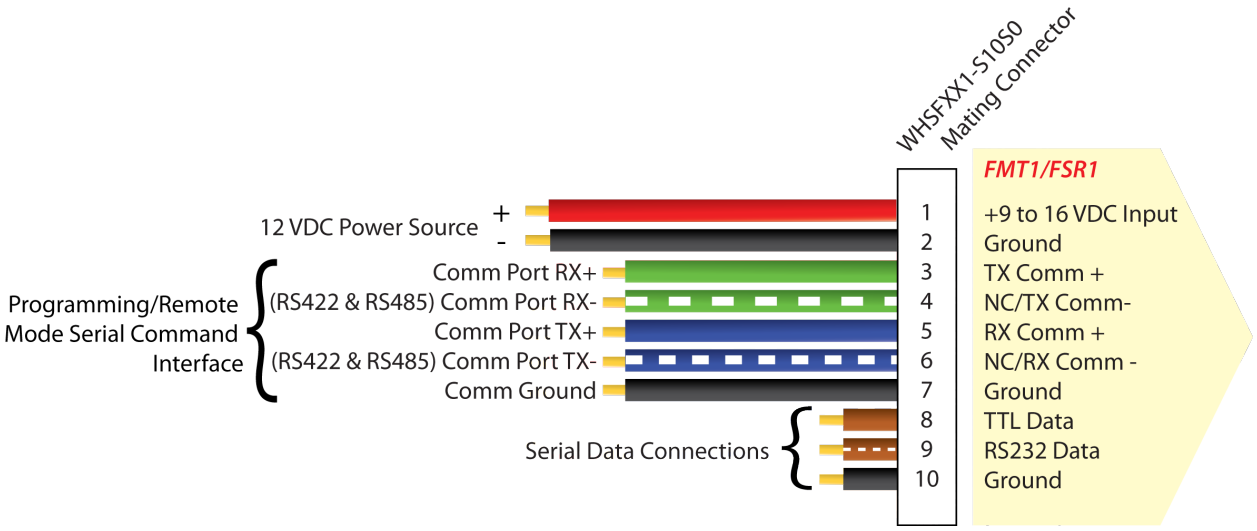
6.2.1. Frequency Selection Switches:

Frequency selectability is standard on all F Series products providing RF frequency control via presets though a rotary switch accessible through the chassis lid or through remote programming.

To program the desired RF frequency using rotary switch, position the rotary switch as shown in the Frequency Selection Chart in Section 9. To program the desired RF frequency using remote interface, refer to the communication Interface Control Document (ICD).

6.3. Mating Connectors

The F series transmitters and receivers use a Hirose DF13-10P-1.25DS connector for power, comm., and data connections. A mating connector is included with the unit. The mating connector is wired as shown below:



6.4. Initial Adjustments and Settings

There are no initial adjustments or settings necessary to use AMP products other than proper configuration of the switches as outlined above in Section 6.2.

6.5. Shut Down

If the transmitter or receiver is to be shut down only briefly, simply remove DC voltage from the WHSFXX1-S10S0 interface connector or disconnect WHSFXX1-S10S0 interface connector from transmitter or receiver. If the unit is to be shut down for an extended period, all external cabling including the antenna should be removed and the unit should be stored in a container and placed in a clean, dry environment.

7. MAINTENANCE INSTRUCTIONS

7.1. Cleaning

AMP Transmitters and Receivers should be periodically wiped off with a clean, damp cloth. For more thorough cleaning, dampen a clean cloth with glass cleaner and wipe off unit. Ensure units are completely disconnected from their power sources before cleaning.

7.2. Troubleshooting

To avoid poor performance, ensure all mating connectors are tightly fastened, clean, and have no pins bent or damaged.

Verify configuration of the rotary preset switch (refer to Section 6.2). Make sure the transmitter and receiver are set to the same frequency and data rate. By default, the transmitter and receiver presets come configured the same. So for example, you select Preset “B” on the transmitter, Preset “B” on the receiver will be the same. If you have reprogrammed your Presets, you must reprogram both the transmitter and receiver for the same settings, or the corresponding Presets will no longer work properly together.

If poor or no operation is observed, ensure the external DC voltage supply is between +9 and +16 Vdc with correct polarity. All AMP Transmitters and Receivers have over-voltage and reverse polarity protection circuits. If the input voltage is over +16 Vdc, remove the WHSFXX1-S10S0 interface connector from the unit, reduce the DC voltage to between +9 and +16 Vdc, and reconnect the WHSFXX1-S10S0 interface connector. If the input voltage is negative polarity, remove the WHSFXX1-S10S0 interface connector from the unit, reverse the connections between the DC voltage supply and WHSFXX1-S10S0 interface connector, and reconnect the WHSFXX1-S10S0 interface connector.

If all connections are adequate, switches are correctly configured, and DC voltage is correctly applied, check the antenna for damage. The data monitor may be connected directly to the data source to verify proper data operation.

If these efforts fail, do not attempt to repair the unit. Please contact AMP with a detailed description of the problem. Depending on the nature of the problem, AMP may provide further troubleshooting assistance or advise the entire system be returned for repair and retest.

Caution: Removal of the cover constitutes breaking the seal and VOIDS PRODUCT WARRANTY.

7.3. Preparation for Reshipment

If the transmitter, receiver, and/or any other purchased item(s) are to be shipped to another location or returned for repair or realignment, use the original packaging or a sturdy box with sufficient protective material to avoid damage from movement or exposure during transit. Remove all external connections (cables, antenna, etc.) prior to shipping.

7.4. Returning an Item

Please contact AMP customer service at (775) 345-9933 for a Return Authorization Number before returning an item. The AMP ship-to address is listed below. When returning an item, always include a contact name and phone number and a detailed description of the problem with your shipment.

Advanced Microwave Products
Advanced Microwave Products
PO Box 1437
2465 Old Highway 40 West, Suite 200
Verdi, NV 89439

8. WARRANTY STATEMENT

Advanced Microwave Products (AMP) warrants these products to be free from defects in material and workmanship for a period of one year from date of original shipment. AMP shall, at its option, either repair or replace products which prove to be defective.

No products may be returned to AMP without the permission of AMP. BUYER, after obtaining a return authorization from AMP, shall return the equipment to AMP accompanied by a report stating as completely as possible the reason for return, the defects, and the conditions under which they occurred. BUYER shall pay all shipping charges, duties, and fees for the return of products to AMP. All warranty services will be carried out at AMP's facility. AMP will pay for the return of products to the BUYER.

All articles are to be properly and carefully inspected by BUYER upon receipt. Shipping container damage may indicate equipment damage. All shipping damage must be promptly reported to the carrier. AMP is not liable for shipping damage.

Limitation of Warranty: The above warranty does not apply to defects of, or resulting from the following:

1) End items included as part of a system, but not designed by, AMP are subject only to warranty as may be obtained from the original manufacturers. Such items include, but are not limited to, batteries, cameras, monitors, cabling, etc.,
2) Operation outside of the environmental specifications of the product,
3) Unauthorized modifications, misuse, or mishandling,
4) Improper or inadequate maintenance by BUYER,
5) Improper or inadequate heat sinking by BUYER,
6) Improper installation or improper testing,
7) Malfunction of connected hardware.

THIS WARRANTY IS EXCLUSIVE AND NO OTHER WARRANTY, WHETHER WRITTEN OR ORAL, IS EXPRESSED OR IMPLIED. AMP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

The remedies set forth above are the purchaser's sole and exclusive remedies. In no circumstances shall AMP assume liability for loss, damage, or consequential expense (including loss of profits) whether based on contract, tort, or any other legal theory, arising directly or indirectly from the use of its equipment separately or in combination with other equipment.

9. FREQUENCY PROGRAMMING CHART

AMP F series transmitters and receivers have two modes for configuring the unit: Preset Mode and Remote Mode.

In Preset Mode, transmitters and receivers have 15 pre-set configurations available for local selection via the rotary switch located on the lid. Units ship from the factory with the 15 pre-sets configured with all options “ON” and set to their max settings with the frequencies set per the table below. Presets may be changed utilizing HyperTerminal or other devices connected to the communications port while the unit is set to Remote Mode. Presets are reprogrammable using Remote Mode, selected when the rotary switch is set to zero.

Remote Mode allows reprogramming of Presets or control of the unit in real time via the communications port per Section 2.2 (FMT1) or Section 2.2 (FSR1). To set the transmitter or receiver to Remote Mode, the rotary switch must be in the “0” position. See the F series ICD for details on programming your product.

“Remote Only” F series products do not have a rotary switch installed, are always in Remote Mode, and are only configurable through the communications port.

Frequency Band

“Config Select” Preset	43	86	91	S2
1	433.0 MHz	868.0 MHz	902 MHz	2400 MHz
2	433.1 MHz	868.1 MHz	904 MHz	2407 MHz
3	433.3 MHz	868.3 MHz	906 MHz	2414 MHz
4	433.4 MHz	868.4 MHz	908 MHz	2421 MHz
5	433.5 MHz	868.6 MHz	909 MHz	2428 MHz
6	433.6 MHz	868.7 MHz	911 MHz	2435 MHz
7	433.8 MHz	868.9 MHz	913 MHz	2442 MHz
8	433.9 MHz	869.0 MHz	915 MHz	2450 MHz
9	434.0 MHz	869.1 MHz	917 MHz	2457 MHz
A	434.2 MHz	869.3 MHz	919 MHz	2464 MHz
B	434.3 MHz	869.4 MHz	921 MHz	2471 MHz
C	434.4 MHz	869.6 MHz	922 MHz	2478 MHz
D	434.5 MHz	869.7 MHz	924 MHz	2485 MHz
E	434.7 MHz	869.9 MHz	926 MHz	2492 MHz
F	434.8 MHz	870.0 MHz	928 MHz	2499 MHz