# SCADA-Telemetry Series **MDS P70**



# **Universal Package Model**

MDS 05-3490A01, Rev. D JUNE 2005

industrial/wireless/performance



# QUICK START GUIDE

Below are the basic steps for installing the MDS P70 Packaged Radio System. Detailed installation instructions are given in this manual starting on Page 12.

#### 1. Install transceivers (if not already installed) and customer-supplied equipment, if any

- Open the P70 enclosure.
- Place the transceiver(s) in the mounting bracket (transceiver front panel and heatsink facing out).
- Secure the bracket.
- Install customer-supplied equipment. See "Product Specifications" on Page 4 for mounting plate dimensions.

#### 2. Connect wiring

• Connect ground, antenna feedline(s), data interface, power, and any alarm circuits. Installation wiring is described fully in *Cable Connections* on Page 17.

#### 3. Connect Backup Battery

- Battery is disconnected during shipment to avoid discharge.
- Plug battery cable into J3 on the Power Board.

#### 4. Apply primary power (see label on power supply for proper input voltage)

#### 5. Configure the P-70 for desired operation

- In many cases, the P70 is shipped with the internal radios already configured for customer requirements. If so, no further configuration is required.
- If radio configuration is required, program each transceiver with a terminal connected to the DIAG. modular connector (RJ-12) or the DATA INTERFACE (DB-25) connector. (If DB-25 is used, you must first remove the ribbon cable leading to the P70 Logic Board.) See transceiver manual for a list of radio commands.
- Set Logic Board DIP switches as required (See Field Configuration of the P70 on Page 25).
- Record all parameters on a label and affix to the chassis.

#### 6. Verify proper operation

- Observe LEDs on transceiver front panel(s).
- · Refer to the transceiver manual for a description of the status LEDs.
- Refine directional antenna headings for maximum received signal strength using the **RSSI** command. (Spread spectrum remotes must be synchronized with the master station for use of this command.)

Refer to the transceiver manual shipped with your P70 for radio-specific information.



# **TABLE OF CONTENTS**

1.0	INT	RODUCTION	1
2.0	PR	ODUCT DESCRIPTION	1
	2.1	Model Number Codes & Features	2
		Mounting Configurations	2
		Transceiver Complement	3
		Power Supplies	3
		Logic Boards	3
		Duplexer	3
	2.2	Options and Accessories	4
	2.3	Product Specifications	4
	2.4	Functional Configurations	5
		Single Remote	6
		Ouplex MAS Remote/Master/Polling Remote	7
		Duplex MAS Repeater	8
		Tail-End Link Repeater	9
		• • • • • • • • • • • • • • • • • • •	
		Dual RIU Interface	
		Redundant Remote	
3.0	INS	STALLATION	12
	3.1	Unpacking and Inspection	
	3.2	Installation Considerations	12
	3.3	Mounting the Enclosure	13
		Wall Mounting Instructions	14
		Pole Mounting Instructions	15
		Rack Mount Option	
	3.4	Cable Connections	17
		Ground Connection	
		Connections to the Power Board (03-3950A01)	
		Antenna Cable Connection	19
	3.5	Logic Board Connections	20
		Connections to Interface Logic Board (ILB)	20
		Connections to Redundant Logic Board (RLB)	23
	3.6	Field Configuration of the P70	
		Logic Board DIP Switch Settings (ILB)	
		SW1 & SW2 Switch Functions (ILB)	
		Data Synchronizer Board (03-1389A01)	
		VUX BOard (U3-1098A03)	
	07	Final Installation Table	
	3.7	Final Installation lasks	



4.0	.0 OPERATION				
	4.1	Introduction	35		
	4.2	Initial Power-up			
		Radio Selection Switch-Redundant units only			
		Battery Backup Operation-AC-powered units only			
	4.3	Logic Board Features and Indicators			
	4.4	Connecting an Orderwire Handset			
	4.5	Connecting a Hand-Held Terminal (HHT)			
		HHT Connection			
5.0	MA		40		
	51	Preventive Maintenance	40		
	52	Backup Battery—AC-powered units	40		
	0	Battery Test			
		Backup Battery Replacement			
		Battery Charging Check	41		
	5.3	Fuse Replacement			
	5.4	Troubleshooting	43		
	5.5	Interpreting Alarms			
		Interface Logic Board (03-3900A02)	44		
		Redundant Logic Board (03-3306A02)	44		
	5.6	P70 Interconnect Cabling	45		
	5.7	Replaceable Assemblies	46		

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# **Operational Safety Notices**



The radio equipment described in this guide emits radio frequency energy. Although the power level is low, the concentrated energy from a directional antenna may pose a health hazard. Do not allow people to come in close proximity to the antenna when the transmitter is operating. Refer to the transceiver manual supplied with your P70 for further recommendations.

This manual is intended to guide a professional installer to install, operate and perform basic system maintenance on the described radio.



# ISO 9001 Registration

Microwave Data Systems adheres to this internationally accepted quality system standard.

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- We appreciate our customer's patronage. They are our business.
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# **Revision Notice**

While every reasonable effort has been made to ensure the accuracy of this manual, product improvements may result in minor differences between the manual and the product shipped to you. If you have additional questions or need an exact specification for a product, please contact our Customer Service Team using the information at the back of this guide. In addition, manual updates can often be found on our Web site at **www.microwavedata.com**.

# FCC Warning

In the U.S.A., the 406 to 406.1 MHz band is reserved for use by distress beacons. Since some models of this product are capable of transmitting in this band, take precautions to prevent the radio from transmitting between 406 to 406.1 MHz for U.S. applications.



# **Environmental Information**

The manufacture of this equipment has required the extraction and use of natural resources. Improper disposal may contaminate the environment and present a health risk due to hazardous substances contained within. To avoid dissemination of these substances into our environment, and to diminish the demand on natural resources, we encourage you to use the appropriate recycling systems for disposal. These systems will reuse or recycle most of the materials found in this equipment in a sound way. Please contact MDS or your supplier for more information on the proper disposal of this equipment.





# **1.0 INTRODUCTION**

This guide explains how to install and operate the P70 Universal Package Model radio system. It is a companion to the transceiver instruction manual that is shipped with our Package Models. Following installation, we suggest that you keep this manual and the transceiver manual near the equipment for future reference.

**NOTE:** Remember that this is a *system level* guide to the Packaged Radio System. Radio model numbers, and information about specific radios installed in the P70 are *not* included unless there is an exception to installation or operation. For specific radio information, always refer to the transceiver manual shipped with your P70.

# 2.0 PRODUCT DESCRIPTION

The P70 (Figure 1) provides an ideal solution for radio systems that must to be used in harsh environments or in areas where space is limited. It supports a wide variety of mounting arrangements and radio/power supply configurations. All radio system elements are installed in a padlockable weathertight enclosure (or on a mounting plate, for a *rack-mountable* P70).

The P70 can house up to two radio transceivers, a power supply (with battery backup for AC-powered units), a logic board, duplexer (if required) and a power supply. Extra space is also provided at the top of the enclosure for customer-supplied equipment, such as a Remote Terminal Unit (RTU).



Figure 1. P70 packaged radio system



The only customer connections required for P70 operation are primary power, antenna and data cabling. These connections are made inside the P70 enclosure leaving no terminals exposed to rain, moisture or corrosive environments.

#### 2.1 Model Number Codes & Features

The configuration details of the P70 (as shipped from the factory) can be quickly determined from the model number label attached to the chassis plate. Figure 2 shows the significance of the model number characters printed on the label.



Figure 2. P70 Model Number Codes

#### **Mounting Configurations**

The equipment may be ordered housed in a corrosion-resistant gray fiberglass NEMA-approved cabinet (Figure 1) for mounting to a wall or a pole. See Specifications (Table 3 on page 4) for mounting dimensions.

Alternatively, the P70 may be ordered on an unenclosed plate designed for direct mounting to a standard 19 inch equipment rack (see Figure 14 on page 17).



#### **Transceiver Complement**

Table 1 lists the transceivers that may be ordered or installed in the P70 Package Model. Consult the factory for special requirements:

	<b>-</b>
MAS Remotes (5-watt digital transceivers)	Spread Spectrum Remotes (1-watt digital transceivers)
MDS 2310 Series	MDS 9810
MDS 2710 Series	MDS 24810 (no longer available for order)
MDS 4310 Series	
MDS 4710 Series	
MDS 9710 Series	

 Table 1. P70 Transceiver Complement

#### **Power Supplies**

The P70 may be ordered with a dc or ac power supply. The dc power supply is available in 12, 24 or 48 Vdc versions with a converter. (Note: The 12 Vdc power supply may be ordered with or without a converter.)

The ac power supply operates from 85–264 Vac. This same supply can also accept inputs of 120–370 Vdc.

AC-powered units may be ordered with or without a 4.5 or 12 AH backup battery installed. The battery provides continued operation during ac power outages.

#### **Logic Boards**

All configurations *except* the redundant station use the 03-3900A02 Interface Logic Board (ILB). The redundant model uses the 03-3306A02 Redundant Logic Board (RLB), which enables automatic switching between transceivers if the active transceiver should fail.

#### Duplexer

The P70 may be ordered with a variety of internal duplexers to support split-frequency operation (simultaneous transmit & receive) with one antenna. Figure 2 lists the available models at the time of publication.



#### 2.2 **Options and Accessories**

The P70 may be used with one or more of the accessories listed in Table 2. Contact the factory for ordering information.

Item	Description	Part Number
Handheld Terminal (HHT)	External keypad device used for radio programming, test and control. Includes connecting cable, manual and carrying case.	02-1501A01
Backup Battery	Sealed lead-acid battery. Provides	4.5 AH: 28-1575A02
units)	power loss.	12 AH: 28-1575A04
Pole-mount adapters	Allow mounting the P70 enclosure to a pole. Two adapters are required.	82-1743A01
Orderwire Handset	Allows temporary voice communication during installation and maintenance activities. (Not available for use on	12-1307A01
Orderwire Adapter Module	Required for orderwire operation on units equipped with a Redundant Logic Board (P/N 03-3306A02). Connects between J1 on the Logic Board and a standard orderwire handset. (See above.) Not for use with Spread Spectrum radios.	02-1297A01
Data Synchronizer Board	Subassembly that installs inside the P70 enclosure underneath the Logic Board. Improves transmission reliability in 4800 bps repeater configurations.	03-1389A01
VOX Board	Subassembly that installs inside the P70 enclosure underneath the Logic Board. Allows external 4-wire TX audio applied to J5 Pins 1 & 2 of the Interface Logic Board to key the transmitter.	03-1098A03

Table 2. Options & Accessories

#### 2.3 Product Specifications

Table 3 lists the specifications for the P70 Universal Package Model. For radio specifications, refer to the associated transceiver instruction manual shipped with your unit. Specifications are subject to change without notice.

Characteristic	Specification
Enclosure dimensions:	22 in. H x 18 in. W x 10 in. D
(excluding hardware)	(55.88 cm x 45.72 x 25.39 cm)
Approximate weight:	31 pounds (14.86 kg)
(with backup battery)	Without customer equipment installed

 Table 3. Product Specifications



Characteristic	Specification
Space available for customer equipment (RTU, PLC, etc.)	6.90 in. H x 14.37 in. W x 8.70 in. D (17.50 cm H x 36.50 cm W x 22.00 cm D)
Rack mount plate dimensions	19" W x 15" D x 9" (6RU) H 48.26 cm W x 38.1 cm D x 22.86 cm H
Enclosure type	NEMA 4X (Corrosion resistant) or 19" rack mount (no enclosure).
Enclosure impact resistance	MIL STD 810E (shipping and handling)
Compatible transceivers	Listed in Table 1 on page 3
Temperature range	DC Power: –30°C to 60°C AC Power: 0°C to 60°C AC Power (w/internal heater): –40°C to 60°C
Humidity:	95% at 40°C non-condensing
Primary power:	<ul> <li>12, 24, 48, 120–370 Vdc with converter</li> <li>12 Vdc without converter</li> <li>85–264 Vac, 47–440 Hz with optional battery backup (4.5 AH or 12 AH).</li> </ul>
Power connector	Barrier terminals for power input/output with built-in transient and over-current protection
Power available for customer-installed equipment	12 Vdc nominal @ 400 mA 24 Vdc nominal @ 300 mA
Lightning Protectors	Available with up to two protectors installed, bulkhead mounted, with external ground stud

 Table 3. Product Specifications (Continued)

#### 2.4 Functional Configurations

The P70 Universal Package Model is available in a range of configurations to suit customer needs. The configuration depends on the type of radio network in which the P70 will operate (i.e., spread spectrum, licensed MAS, full/half-duplex, etc.)



Table 4 lists the most common P70 configurations. In addition, it shows the data path through the P70, the number of antenna ports, and whether or not an internal duplexer is present. Each table entry is keyed to a corresponding paragraph by a numeric "tag" (i.e., ①, ②, ③). These paragraphs immediately follow the table and include typical system layout drawings.

P70 Configuration	Data Path To/From Logic Board	Ant. Ports	Internal Duplexer?
• Single Remote—One MAS transceiver (J1) or spread spectrum transceiver (J1). (Details, page 6.)	J3 RTU port	1	No
<b>Ouplex MAS</b> <b>Remote/Master/Polling</b> <b>Remote</b> —One MAS transceiver-receive only (J2). One MAS remote-transmit only (J1). (Details, page 7.)	J3 RTU port	1	Yes
• Duplex MAS Repeater—One MAS transceiver-receive only (J2). One MAS transceiver-transmit only (J1). (Details, page 8.)	J3 RTU port & RX (J2) to TX (J1) repeater	1	Yes
<b>G</b> Tail-end Link Repeater – One MAS transceiver (J1). One spread spectrum or MAS transceiver (J2). (Details, page 9.)	J3 RTU port & MAS (J1) to spread spectrum (J2) bi-directional repeater	2	No
• Spread Spectrum Peer-to-Peer Repeater — Two spread spectrum transceivers (J1 & J2). (Details, page 10.)	J3 RTU port & spread spectrum (J1)–spread spectrum (J2) bi-directional repeater	2	No
• Spread Spectrum Repeater – Two spread spectrum transceivers (J1 & J2). (Details, page 10.)	J3 RTU port to Radio 1, bi-directional repeat (J1)–(J2)	2	No
• Dual RTU Interface – Two transceivers. MAS or spread spectrum. (Details, page 11.)	Direct connection to each remote transceiver	2	No
<b>Bedundant Remote</b> —Two transceivers of the same type (MAS or spread spectrum). (Details, page 11.)	One RTU interface connected to the active transceiver.	1	No

#### **Table 4. Functional Configurations**

#### Single Remote

The basic Package Model configuration typically consists of just one remote—an MAS digital or analog transceiver, or a spread spectrum transceiver—and an RTU interface (Figure 3). An upgrade kit with a radio bracket, interconnecting cables and lightning protector is available to add a second radio to the P70 at a later time. Consult the factory for details.



Customers with a store-and-forward interface can use the basic single-remote configuration as a simplex repeater.

For P70 configuration settings, refer to *Section 3.6*, *Field Configuration of the P70*.



Figure 3. Single remote configuration

#### **Ouplex MAS Remote/Master/Polling Remote**

These configurations may be used for operation as a master station, polling remote, or as a full duplex remote as shown in Figure 4.

For use as a master station, the host computer is connected to the RTU port (J3) on the P70's Interface Logic Board. Switched Carrier Mode may be used to save power and heat build-up, or continuous key mode may be selected with Switch SW1-2.

This arrangement uses two MAS remotes (either digital synchronous/asynchronous or analog), a duplexer and antenna, and a single RTU interface as shown in Figure 5. RF output at the antenna is approximately 3.5 watts due to unavoidable duplexer loss.



Figure 4. System with full duplex remote





#### Figure 5. P70 full duplex configuration (MAS remotes)

#### **O Duplex MAS Repeater**

A Duplex MAS Repeater system is similar in many respects to the system just described in **2**. A typical Repeater system arrangement is shown in Figure 6.

The difference between mode **2** and this mode is that the repeater will key (transmit) on squelch breaks, but the remote system only keys when RTS is raised. The repeater configuration can be continuously keyed but this is usually not necessary.

The data path also changes between the two modes. Repeater mode re-transmits received data or uses RTU data, if present. The remote mode *only* transmits RTU port data.

To improve repeater system transmission performance in systems using 4800 bps with MDS x710A or MDS x710B remotes, an optional data synchronizer board (P/N 03-1389A01) can be installed in the P70.







#### **O** Tail-End Link Repeater

This configuration is typically used to link MAS and spread spectrum radios together in the same system, as shown in Figure 7. It can also be used with two MAS radios to provide a data path between radio systems with different modem types, or different frequencies.

An example would be an MDS 9710B remote transceiver as Radio 1 communicating with an MDS 2100 master station on a 24 MHz split with a 4800 bps modem, and an MDS 9710A as Radio 2 communicating with other MDS 9710A remotes on simplex at 9600 bps. The only requirements are that the Data port be set the same, and the station antennas be separated by an adequate distance to avoid interference.



Figure 7. Example system with tail-end link repeater

The configuration includes two digital asynchronous remotes for simultaneous transmission (see Figure 8). Each remote requires its own antenna. An RTU interface is provided for the MAS remote.

In configurations using 4800 bps digital transceivers (MDS x310A or MDS x710B), the data synchronization board is required (P/N 03-1389A01).





Figure 8. P70 tail-end link repeater configuration

#### & Ø Peer-to-Peer Repeater/Spread Spectrum Repeater

These configurations use two digital asynchronous spread spectrum remote transceivers, such as an MDS 9810 or MDS 24810. (See Figure 9.)

The Spread Spectrum Repeater configuration uses one RF link for communications between the Host Computer site and the P70 and a second link between the P70 and the other remotes in the system. The two separate RF links each use their own network address to avoid interfering with each other. This allows the Host Computer to talk to any other remote through the P70 repeater, and the remotes can talk to the Host Computer site without hearing each other.

Inside the P70, "Radio 1" communicates with the Host site (and RTU port) and "Radio 2" communicates with the Remote sites. At the Host site a directional antenna is typically used to communicate with the P70. The P70 typically uses a *directional* antenna on the radio communicating with the Host site and an *omnidirectional* antenna to communicate with the remote sites. All remote sites would use *directional* antennas aimed at the P70 repeater site.

If it is desirable for all remotes in a system to hear each other, a Peer-to Peer-Repeater is the best solution. In this system, all of the remotes including the Host Computer site will use the same RF link and Network Address to communicate through the P70 repeater. Inside the P70, "Radio 2" will Receive, and "Radio 1" will Transmit. The Interface board RTU port has connections for Radio 2 RXD and Radio 1 TXD. The P70 will require two omnidirectional antennas and the remote sites will use directional antennas aimed at the P70 repeater site.

Both systems utilize two antennas on the P70. It is important to minimize coupling between these antennas. The necessary isolation can be achieved by *vertical separation*. In this arrangement, one antenna is mounted directly over the other, separated by at least 4 feet (1.22 Meters). This takes advantage of the minimal radiation exhibited by ver-



tically polarized antennas directly above and below one another. Additional isolation can be achieved for the Spread Spectrum Repeater by changing the antenna polarization to horizontal for the link between the P70 and the Host site.



Figure 9. P70 full duplex repeater (spread spectrum remotes)

For P70 configuration settings, refer to *Section 3.6*, *Field Configuration of the P70*.

#### Dual RTU Interface

This mode is intended for customers who wish to construct a *Store and Forward* system by connecting their data equipment directly to the DB-25 DATA INTERFACE connectors on the P70 remote transceivers. In this arrangement, an Interface board is furnished, but its only purpose is to supply power to the remote transceivers.

For P70 configuration settings, refer to Section 3.6, Field Configuration of the P70.

#### Redundant Remote

A redundant station configuration uses two identical remote transceivers. One remote is active, and the other is used as a standby unit. The configuration is equipped with a single antenna and relay to switch between the two remotes. A single RTU interface is included (Figure 10) as well as a single power supply and optional battery. Redundant stations are typically used in critical applications where uninterrupted service is required.





Figure 10. P70 redundant station configuration

### 3.0 INSTALLATION

#### 3.1 Unpacking and Inspection

After opening the shipping container, check the contents against the packing list secured to the outside of the box. We recommend that all shipping materials be saved in case you need to ship the unit in the future.

The factory test data sheet is normally packed with the equipment. Check this sheet to ensure that the product has been configured to meet your requirements. Specific items to check include: primary power voltage, transmit and receive frequencies, modem speed (if applicable), and transmitter RF power output. If there are discrepancies, contact the factory for assistance.

#### 3.2 Installation Considerations

A short time spent planning the installation can help prevent performance problems later on. Select a location that provides a stable mounting surface, and also allows for convenient routing of the antenna, power and data cabling. All of these cables (but especially the antenna feedline) must be kept as short as possible to minimize losses. Refer to the transceiver manual for further recommendations.

Package Models are usually mounted in either a wall-mount or pole-mount configuration. If possible, install the unit in a location that can be easily reached while standing on the ground. This allows convenient access for test and servicing of the radio system.



If the unit must be installed in a location that is not easily accessible, it may be desirable to first operate the unit on a test bench to verify proper operation with customer-supplied equipment and to set any programmable parameters before final installation. However, installation tasks such as antenna aiming and SWR checks should be done with the unit in its permanent operating position.

**NOTE:** The use of stainless steel mounting hardware is recommended for outdoor installations.

#### 3.3 Mounting the Enclosure

There are two basic mounting arrangements for the P70—wall mount or pole mount. The steps below describe methods for mounting the unit in both of these standard configurations. When planning the installation, refer to Figure 11, which shows the mounting dimensions of the P70 Package Model.



Figure 11. P70 mounting dimensions (Hardware appearance may vary)



#### Wall Mounting Instructions

The steps below describe mounting of the P70 unit to a wall or other flat surface. Ordinary lag screws (with flat washers) can be used if the unit is to be mounted to a wooden surface. If it is to be mounted to a drywall, masonry or other non-wooden surface, suitable fasteners will be required that can support the weight of the unit.

To wall mount the unit, follow these instructions:

- 1. Hold the packaged unit up to the wall in the desired mounting position. Have an assistant mark the four mounting holes with a pencil or marker.
- 2. Prepare the mounting surface for the fasteners to be used. (If using lag screws, a small pilot hole at each mark will allow easier starting of the screw.)
- 3. Hold the packaged unit up to the wall again while an assistant installs the four mounting screws. Make sure the screws are tight-ened securely, but do not over-tighten.

Figure 12 shows a typical wall mount installation.







#### **Pole Mounting Instructions**

Pole mounting requires the use of *two* pole-mount adapters (P/N 82-1743A01). These brackets must first be bolted to the P70 enclosure. The complete assembly can then be mounted to a wooden utility pole with two lag screws *or* with two long bolts that extend through the pole. (Threaded rod can also be used for through-the-pole mounting.) In either case, it is important to use flat washers with the attaching hardware (fasteners are not supplied).

To pole mount the unit, follow these instructions:

- 1. Attach the two pole mount adapter brackets to the P70 enclosure with suitable nut and bolt assemblies, as shown in Figure 13.
- 2. With the help of an assistant, position the P70 enclosure on the pole at the desired mounting point.
- 3. Install the attaching hardware (with flat washers) in the center hole of the two brackets.
- 4. Tighten the fasteners securely, but do not over-tighten.

Figure 13 shows a typical pole-mount installation using lag screws.





Figure 13. Typical pole-mounted installation

Other pole-mount configurations are available for the P70, including a mounting bracket with a sun shield (for use in extremely hot climates), a tower mounting bracket, and other arrangements to meet special needs. Contact the factory for more information.

#### **Rack Mount Option**

In addition to wall and pole mounting, the internal chassis of the Package Model can also be mounted in a standard 19 inch equipment rack for indoor installations. The rack-mounted model is normally shipped *without* an enclosure and is supplied with hardware for mounting the chassis plate to the rack cabinet. Figure 14 shows a typical rack mount installation.



The electrical installation procedures given in this section apply fully to rack mounted units. The physical mounting instructions, however, will differ depending on the type of rack cabinet to be used. Contact the factory if additional assistance is required.



Figure 14. Typical rack mount installation

#### 3.4 Cable Connections

**NOTE:** A readily accessible disconnect device must be incorporated in the building installation wiring to control the P70's primary power.

This section describes the connection of external cabling to the P70 Package Model. Included are steps for connecting dc power, the station antenna, and the customer-supplied equipment.

For detailed information on *internal* P70 cabling, see *Section 5.6, P70 Interconnect Cabling*.



#### **Ground Connection**

A ground clamp is provided on the bottom of the P70 enclosure (outside edge). Connect an earth ground (ground rod or plate) to this point in accordance with local electrical codes. If the P70 is to be rack-mounted without an enclosure, an earth ground connection must be made to the mounting plate.

#### Connections to the Power Board (03-3950A01)

Refer to Figure 15 and the text that follows to make connections to the power board. The Power Board is located at the bottom-center of the P70 cabinet.



The P70 is available for operation on a wide variety of ac or dc supply voltages. Be sure to check the label near J1 and **make sure that the supply voltage you are using matches that specified on the label before applying power.** The use of an incorrect supply voltage can permanently damage the radio, power supply, or both.





**DC Input—J1** Connector J1 on the Power Board is used for primary power input on dc-powered models. **Pin 1 is the negative (–) connection. Pin 3 is the positive (+) connection.** Primary power wiring should be routed via conduit to the rear hole on the bottom of the enclosure. This hole is fitted with a standard 1-1/4" (3.37 cm) conduit coupling.



# AC Input—J1 Connector J1 on the Power Board is used for primary power input on ac-powered models. Pins 1 and 3 are the ac line inputs. The ac ground must be connected to Pin 2 (the chassis is grounded via conduit to the rear hole on the bottom of the enclosure). This hole is fitted with a standard 1-1/4" (3.37 cm) conduit coupling.

Accessory DC Power Out—J2 Connector J2 on the power board can be used to provide a total of 400 mA at 14 Vdc or 300 mA at 24 Vdc (negative ground) for accessories. Table 5 lists the pins available for accessory power use.

PIN	VOLTAGE	REMARKS
1	24 Vdc	300 mA max. current
2	Ground	
3	14V Fan	
4	Fan Ground	
5	+14 Vdc	200 mA max. current
6	Ground	
7	+14 Vdc	200 mA max. current
8	Ground	

 Table 5. J2 Accessory Power Pins

Resettable Fuse F4 provides over-current protection for accessory power. The fuse is rated at 6 Amperes for 14 Vdc, and 500 milliamperes for 24 Vdc. F4 can be reset by momentarily removing and re-applying power after a short cool-down period.

#### Backup Battery— Important information

Package Models wired for ac operation may have been ordered with a backup battery system. Before shipping, the factory disconnects the battery by unplugging its cable from the power board. This prevents accidental discharge of the battery and operation of any installed radios while the unit is in transit or storage. Plug the battery cable into J3 to enable battery power.

#### Antenna Cable Connection

A Type N coaxial connector on the bottom of the P70 enclosure serves as the antenna connection to the Package Model. This connector also serves as a lightning protector. (Note: Systems designed for use with two antennas will have two such connectors.) After attaching the antenna cable, apply a suitable weatherproofing compound to keep out moisture.

Refer to the transceiver manual for important information regarding antennas and feedlines.



#### 3.5 Logic Board Connections

The Logic Board serves as the connection point for all data interface cabling to the P70 Package Model. One of two Logic Boards will be installed; An **Interface Logic Board (ILB)**—P/N 03-3900A02, or a **Redundant Logic Board (RLB)**—P/N 03-3306A02. The ILB is installed unless the P70 is configured for redundant operation with two transceivers. The RLB is used for all redundant applications.

In either case, the Logic Board will be mounted at the lower left-hand side of the P70.

When making Logic Board connections, route the cabling to the board through the weathertight bushing at the bottom of the enclosure. Tighten the bushing after installing the interface cable(s).

#### Connections to Interface Logic Board (ILB)

Connectors J3 and J5 on the ILB are used for data cabling terminations to the P70. Figure 16 shows a detailed view of the board with callouts to these connectors.



Figure 16. Interface Logic Board (03-3900A02)

J3 Data Interface Connector J3 is a DB-25 female connector used for making data connections to the P70 packaged model. The required connections will vary depending on the application and the user's data equipment. Refer to Table 6 for a summary of pin connections. *Use only the required pins; Do not use a straight through, fully pinned cable for connection to J3*.



# Table 6. Interface Logic Board J3 (RTU Port) Connections As viewed from outside the P70



Pin Number	Input/ Output	Description
1		<b>Protective Ground.</b> Connects to ground (negative supply potential) on the radio's PC board and chassis.
2	IN	<b>TXD—Transmitted Data.</b> Accepts TX data from the connected device.
3	OUT	<b>RXD—Received Data.</b> Outputs received data to the connected device.
4	IN	RTS—Request-to-Send Input. Keys the transmitter on J1 when RTS is at logic high. Starts CTS delay.
5	OUT	CTS—Clear-to-Send Output. Goes "high" after the programmed CTS delay time has elapsed (DCE) controlled by Switch SW2.
6	OUT	<b>DSR—Data Set Ready.</b> Provides a +10 Vdc DSR signal through a 2.2 k $\Omega$ resistor.
7		<b>Signal Ground.</b> Connects to ground (negative supply potential) at radio's PC board.
8	OUT	<b>DCD—Data Carrier Detect.</b> Goes "high" when the selected radio detects a data carrier from the master station.
9		Do not connect—Reserved for future use.
10		Do not connect—Reserved for future use.
11		Do not connect—Reserved for future use.
12	IN	Sleep Mode. A ground or logic low on this pin puts both radios in low power sleep mode. Pulled to 5V through a 100 k $\Omega$ resistor.
13		Do not connect—Reserved for future use.
14		Do not connect—Reserved for future use.
15	OUT	TX Clock Out. Used in synchronous mode.
16		Do not connect—Reserved for future use.
17		RX Clock Out. Used in synchronous mode.
18		Do not connect—Reserved for future use.
19	OUT	<b>9.9 Vdc Regulated Output.</b> Provides a source of regulated voltage at 100 mA for low power accessories. Connects to J1-19. May vary with radio type.



# Table 6. Interface Logic Board J3 (RTU Port) Connections (Continued)

Pin Number	Input/ Output	Description
20		Do not connect—Reserved for future use.
21		Do not connect—Reserved for future use.
22		Do not connect—Reserved for future use.
23	-	Not used.
24	IN	TX Clock In. Used in synchronous mode.
25	OUT	<b>Alarm.</b> A logic low (less than 0.5 volts) on this pin indicates normal operation. A logic high (greater than 4 volts) indicates that some alarm condition is present. This pin can be used as an alarm output, provided the internal series resistance of 1 k $\Omega$ is considered.

#### J5 Analog Interface Connector

J5, a six pin connector, provides an Analog Interface to the P70. A removable plug is provided which has screw terminals for wire attachment. Pins 1 & 2 are the 600 ohm balanced Transmitter Input for Radio 1, and Pins 3 & 4 are the balanced 600 ohm output from the receiver selected by SW1-8. These are transformer coupled, floating interfaces. For best results, set the Transmitter analog input level to match the level supplied by the external modem or audio source. For the MDS x710 series radios the diagnostic command will typically be **TXLEVEL -10** for a -10 dBm source. The default receiver level is -10 dBm, but it can be set to match your application as required. Consult your radio manual for further details.

Pins 5 & 6 are the keyline input. For all boards up to Revision D, Pin 5 keys the transmitter when grounded. Pin 6 provides a convenient ground connection. For board revisions starting at E, an optional floating keyline input is available. It is controlled by two 3-pin jumpers J10 & J 12. With both jumpers installed on pins 1 & 2, grounding Pin 5 (to Pin 6) will key the radio as before. Moving *both* jumpers over to Pins 2 & 3 will change to the floating keyline mode. When a voltage is applied to Pins 5 (-) and 6 (+) Radio 1 will key. The voltage range is 10 to 25 Vdc with a corresponding current of approximately 5 to 15 mA. Remember to observe the voltage polarity and keep both J10 & J12 set the same.



VOX Option	For applications where a keyline is not available, an optional VOX board can be installed in the P70 to work with the Interface Logic Board. With the VOX option installed, Radio 1 will key when the modem tones are applied to J5 on the ILB. It can be ordered factory installed or added in the field (order part number 03-1098A03). The only connection to the VOX board is a ribbon cable from J202 to the ILB J4 (red stripe toward radios). The VOX GAIN adjustment is factory set, but may be changed to a different threshold if necessary. Adjustment procedures are given on Page 32.
	Connections to Redundant Logic Board (RLB)
Data Connections on J1	Connector J1 on the RLB is used for data cabling terminations. Figure 17 shows a detailed view of the board. Refer to Table 7 for a summary of J1 pin connections.
Analog Signals on J1	The Redundant Logic Board has analog capability, but the input and output are ground referenced, not balanced. J1-9 is the Transmitter audio input and J1-11 is the receiver audio output. Both radios should be set to match the level of the modem or audio source. For the MDS x710 series radios the diagnostic command will be typically <b>TXLEVEL -10</b> for a -10 dBm source. The default receiver level is $-10$ dBm, but it may be set to match your application. Consult your radio manual for further details.
	The transmitter may be keyed using one of three methods. Applying 5 volts to J1-14 or applying a ground to J1-16 will key the transmitter, forcing it into analog mode (equivalent to the diagnostic command <b>MODEM NONE</b> for MDS x710 radios). Also, the RTS input on J1-4 may also be used to key the radio, but it must be manually set to <b>MODEM NONE</b> using the diagnostics interface.





#### Table 7. Redundant Logic Board J1 Connections

As viewed from outside the P70



Pin Number	Input/ Output	Pin Description
1		<b>Protective Ground.</b> Connects to ground (negative supply potential) on the radio's PC board and chassis.
2	IN	<b>TXD—Transmitted Data.</b> Accepts TX data from the connected device.
3	OUT	<b>RXD—Received Data.</b> Supplies received data to the connected device.
4	IN	RTS-Request-to-Send Input.
5	OUT	<b>CTS – Clear-to-Send Output.</b> Goes "high" after the programmed CTS delay time has elapsed (DCE) or keys an attached radio when RF data arrives (CTS KEY).
6	OUT	<b>DSR—Data Set Ready.</b> Provides a +6 Vdc DSR signal through a 2.5 k $\Omega$ resistor.
7		<b>Signal Ground.</b> Connects to ground (negative supply potential) at radio's PC board.
8	OUT	DCD—Data Carrier Detect. A "high" indicates hopping synchronization.
9	IN	TX Audio.
10	OUT	<b>RUS</b> — <b>Receiver Unsquelched Sensor.</b> Provides +8 Vdc through a 1 k $\Omega$ resistor whenever the receiver squelch is open, and drops to less than 1 Vdc when the squelch is closed.)
11		RX Audio.
12		Unused.
13		Unused.
14		PTT—Push-to-talk (transmit).
15		Remote Reset.
16		/PTT—"Not" PTT.
17		Do not connect—Factory test point.
18	IN/OUT	<b>Accessory Power.</b> Unregulated Input/Output. Provides a source of power for low current accessories. The supplied voltage may be between 11.0 and 25 volts.

24



#### Table 7. Redundant Logic Board J1 Connections (Continued)



Pin Number	Input/ Output	Pin Description
19	OUT	<b>9.9 Vdc Regulated Output (Transceiver only).</b> Provides a source of regulated voltage at 100 mA for low power accessories.
20		Do not connect—Reserved for future use.
21	OUT	RSSI—Received Signal Strength Indication (Transceiver only). A DC voltmeter may be connected to this pin to read the relative strength of the incoming signal. See transceiver manual for details.
22		Unused.
23		Unused.
24		<b>Remote Switchover (Redundant Station only).</b> This pin is used for remote switchover of the active transceiver. An EIA-232 low (0.5 Vdc or less) toggles the station to the other transceiver.
25		Unused.

#### Alarm Connections—J9

Connector J9 provides a connection for alarm equipment (a lamp or sounding device, for example). If alarm equipment will be used, make the appropriate connections to J9 as shown in Figure 17. These are "dry" (isolated) alarm contacts which activate when *either* transceiver inside the P70 enclosure generates an alarm signal. Connections are provided for Normally Open (N.O.) and Normally Closed (N.C.) contacts. The contacts are rated at 0.5 ampere at 125 Vac or 1.0 ampere at 24 Vdc.

#### 3.6 Field Configuration of the P70

This section contains instructions specific to each P70 configuration. Configuration settings consist of three possible tasks; DIP switch settings on the P70 Logic Board, switch settings on the Data Synchronizer Board *or* VOX Board (if supplied), and radio configuration. When configuring the P70 for service, refer also to Appendix A at the back of this manual which contains application notes for common system arrangements.



#### Logic Board DIP Switch Settings (ILB)

SW1 and SW2 on the Interface Logic Board serve as the configuration switches for the P70. The switches can be moved with a small instrument, such as a pen point. (Note: The Redundant Logic Board has no configuration switches and requires no user attention during P70 setup.) Table 8 lists each P70 configuration and the required switch settings on the Logic Board. As a convenience, each entry in the table is keyed to its functional description (in Paragraph 2.4 starting on page 5) with a numeric "tag" (i.e., **1**, **2**, **3**).

P70 Configuration	Interface Board Type and Switch Settings
• Single Remote – One MAS transceiver (J1) or spread spectrum	Interface Logic Board (P/N 03-3900A02)
transceiver (J1). (Details, page 6.)	<u>SW1 switch settings:</u> 1-on, 2-on, 3-off, 4-on, 5-off, 6-off, 7-on, 8-on
	<u>SW2 switch settings:</u> 1-off, 2-off, 3-on, 4-off
<b>O</b> Duplex MAS <sup>5</sup> Remote/Master/Polling Remote—	Interface Logic Board (P/N 03-3900A02)
One MAS transceiver-receive only (J2). One MAS remote-transmit only (J1). (Details, page 7.)	<u>SW1 switch settings:</u> 1 1-on*, 2-on*, 3-on, 4-off, 5-off, 6-off, 7-on, 8-off
	<u>SW2 switch settings:</u> 1-off, 2-off, 3-on, 4-off

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P70 Configuration	Interface Board Type and Switch Settings
Ouplex MAS <sup>5</sup> Repeater − One MAS transceiver-receive only (J2).	Interface Logic Board (P/N 03-3900A02)
One MAS transceiver-transmit only (J1). (Details, page 8.)	Full duplex host or Radio 1 non-DSP type: <sup>4</sup>
	<u>SW1 switch settings:</u> 1 1-on*, 2-on*, 3-off, 4-off, 5-off, 6-off, 7-on, 8-off
	<u>SW2 switch settings:</u> 1-off, 2-off, 3-on, 4-off
	Half Duplex Host, Radio 1 DSP type: <sup>3</sup>
	<u>SW1 switch settings:</u> 1 1-on*, 2-on*, 3-off, 4-off, 5-off, 6-off, 7-on, 8-off
	<u>SW2 switch settings:</u> 1-off, 2-off, 3-off, 4-off
	Full duplex host; w/data sync. board: <sup>2</sup>
	<u>SW1 switch settings:</u> 1 1-on*, 2-on*, 3-off, 4-off, 5-on, 6-off, 7-on, 8-off
	<u>SW2 switch settings:</u> 1-off, 2-off, 3-on, 4-off
	Half duplex host; w/data sync. board: <sup>2</sup>
	<u>SW1 switch settings:</u> 1 1-on*, 2-on*, 3-off, 4-off, 5-on, 6-off, 7-on, 8-off
	<u>SW2 switch settings:</u> 1-off, 2-off, 3-off, 4-off

#### Table 8. P70 Configuration(Continued)



P70 Configuration	Interface Board Type and Switch Settings
<b>3</b> Tail-end Link Repeater—One MAS <sup>5</sup> transceiver (J1). One spread	Interface Logic Board (P/N 03-3900A02
spectrum transceiver (J2). (Details,	MAS to SS switch settings: <sup>5, 6</sup>
page 9.)	<u>SW1 switch settings:</u> 1 1-on*, 2-on, 3-on, 4-on, 5-off, 6-on, 7-on, 8-on
	<u>SW2 switch settings:</u> 1-on, 2-on, 3-on, 4-off
	MAS to MAS switch settings:
	<u>SW1 switch settings:</u> 1 1-on*, 2-on, 3-off*, 4-on, 5-off, 6-off*, 7-on, 8-on
	<u>SW2 switch settings:</u> 1-on, 2-on, 3-on, 4-off
	Switch settings w/data sync. board: <sup>2</sup>
	<u>SW1 switch settings:</u> 1 1-on*, 2-on, 3-off*, 4-on, 5-on, 6-off*, 7-on, 8-on
	<u>SW2 switch settings:</u> 1-on, 2-on, 3-on, 4-off
Spread Spectrum <sup>6</sup> Peer-to-Peer Repeater — Two spread spectrum	Interface Logic Board (P/N 03-3900A02)
transceivers (J1 & J2). (Details, page 11.)	<u>SW1 switch settings:</u> 1-on, 2-on, 3-on, 4-off, 5-off, 6-off, 7-off, 8-off
	SW2 switch settings: 1-off, 2-off, 3-off, 4-off
<b>③ Spread Spectrum<sup>6</sup> Repeater</b> —	Interface Logic Board (P/N 03-3900A02)
& J2). (Details, page 11.)	<u>SW1 switch settings:</u> 1-on, 2-on, 3-off, 4-on, 5-off, 6-off, 7-off, 8-off
	SW2 switch settings: 1-on, 2-off, 3-off, 4-off
Dual RTU Interface — Two transceivers. MAS or spread	Interface Logic Board (P/N 03-3900A02)
spectrum. (Details, page 11.)	<u>SW1 switch settings:</u> 1-off, 2-off, 3-off, 4-off, 5-off, 6-off, 7-off, 8-off
	SW2 switch settings: 1-off, 2-off, 3-off, 4-off

#### Table 8. P70 Configuration(Continued)



Table 8. Pro Configuration(Continued)	Table 8.	. P70 Co	nfiguration	(Continued)
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P70	Interface Board Type
Configuration	and Switch Settings
<b>O Redundant Remote</b> —Two	Redundant Logic Board
transceivers of the same type (MAS or	(03-3306A02)
spread spectrum). (Details, page 11.)	(No switches to set)

#### NOTES:

1. Switch settings marked with an asterisk (\*) may require changes in some applications. Consult factory if difficulty is encountered.

2. Data Synchronizer Board needed for 4800 bps using MDS x310 or x710B remote radios.

3. DSP-based radios include MDS 2710, 4710, 9710, 9810, 24810, with modem type A, C, D, E or M.

4. MDS 4310, 2310 and x710 remotes with "B" type modem are *not* DSP-based radios.

5. Multiple Address System (MAS) radios include MDS 4310, 2310, 2710, 4710, 9710 licensed remotes.

6. Spread spectrum (SS) radios include MDS 9810 and 24810 license-free remotes.

#### SW1 & SW2 Switch Functions (ILB)

In some cases it may be helpful to have an understanding of the switch functions of SW1 and SW2 so that specialized or non-standard configurations can be accommodated with the P70. Table 9 lists each switch section for SW1 and SW2 and describes their functions in both open and closed positions.

	SWITCH SECTION	OPEN (OFF)	CLOSED (ON)
	SW1-1	CTS delay for RTU on J3 set Long (20 ms).	CTS delay for RTU on J3 set Short (10 ms).
RADIO 1 KEYLINE CONTROL	SW1-2	Continuous RTS TX1 (for MDS x310 only—use CKEY command for MDS x710).	Normal, TX1 keys as needed (See SW1-3).
		With power-on delay; disable radio Time-out timer.	
	SW1-3	Key TX1 with RX2 Squelch or RTU Port RTS (MAS Repeater).	Key TX1 with CTS2 or RTU port (SS repeater, tail-end link, or full duplex remote).
	SW1-7	RTS1 hold timer—20 ms (MAS repeater with duplex host; MAS duplex).	RTS1 hold timer—1 ms (single remote; MAS repeater with half duplex host).
	SW2-3 (rev. C)	RTS1 disable, to allow DATAKEY mode only. MAS repeater with half duplex host (e.g., MDS x710A).	RTS1 enable (Normal).

Table 9. SW1 & SW2 Switch Functions



Table 9. S	W1 & SW2	Switch	<b>Functions</b>
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	SWITCH SECTION	OPEN (OFF)	CLOSED (ON)	
2 Cont.	SW1-6	Key TX2 with RX1 squelch (Tail-end link, squelch key).	Key TX2 with CTS1 (Tail-end link, CTS KEY).	
Radio Keyline (	SW2-2	RTS2 Disabled (MAS repeater, duplex remote)	RTS2 enabled (Tail-end link).	
s is	SW1-4	RXD2 to RTU (RXD3)	RXD1 to RTU (RXD3)	
73) 33)		DCD2 to RTU (DCD3)	DCD1 to RTU (DCD3)	
Vhen R -2, TXI		(MAS repeater, MAS duplex or SS peer-to-peer repeater.)	(Tail-end link, SS repeater, or single remote.)	
Data Control on Port J3 has priority; M adio-1 gets data from J3	SW1-5 Radio-1 repeater data from RXD2 (Radio-2)		Radio-1 repeater data from RXD2 using Data	
	Radio-2 repeater data from RXD1 (Radio-1) (Normal mode).	Radio-2 repeater data		
		(Normal mode).	Synchronizer board.	
			(MDS x310, x710B 4800 bps repeater.	
e RTU - high, F	SW2-1	TXD2 disabled (Radio-2 receive only)	TXD2 Enabled	
(Th		(SS peer-to-peer repeater)		
derwire & 4-wire audio control	SW1-8	RX audio 2 to orderwire & 4-wire audio.	RX audio 1 to orderwire & 4-wire audio	
Ō	014/4		N	
	SW1-4	No connection—unused	No connection—unused	
NOTES:				

1 is connected to J1 and has interface names such as RXD1, TXD1, etc.

2. Radio 2 is connected to J2 and has interface names such as RXD2, TXD2, etc.

3. The RTU interface is J3 and has interface names such as RXD3, TXD3, etc.

4. The Data Synchronizer interface is J4 and has interface names such as RXD4, TXD4, etc.

5. MAS = Multiple Address Systems (licensed radios).

6. SS = Spread Spectrum (license-free "frequency hopping" radios).

7. Settings shown are typical, and may vary for some installations.

#### Data Synchronizer Board (03-1389A01)

A P70 operated as a digital asynchronous 4800 bps repeater must have a Data Synchronizer Board installed when MDS x310 or x710B transceivers are used. The Synchronizer board removes "jitter" on the repeated data caused by noise or other effects and produces a clean-cut


signal going back out. If the Data Synchronizer Board is supplied, it is mounted beneath the logic board, and connects to the logic board via a short ribbon cable. Figure 18 shows a top view of the Data Synchronizer Board.



J1: To JJ4 on Logic Board via Ribbon Cable

#### Figure 18. Data Synchronizer Board (Required in 4800 bps digital asynchronous repeaters with MDS x310 or x710B Transceivers installed)

Before the Data Synchronizer Board is placed in service, it must be configured to match the peak baud rate and word length used in the system. These parameters are set using a DIP switch, SW1 on the Data Synchronizer Board (see Figure 18). The switch sections can be moved with a small instrument, such as a pen point.

The first section of SW1 is set to match the data word length used in the system. A word consists of the start bit, data bits, stop bit and parity bit. Table 10 lists the proper settings for 10 and 11 Bit words.

Table 10. Word Length Settings for Data Sync. Board

WORD LENGTH	SWITCH SW1-1
10 Bits	Closed
11 Bits	Open

The next three sections of SW1 are used to set the baud rate at which data will pass through the system. The P70 can be configured to pass data at one of seven speeds between 150 bps and 9600 bps. Table 11 lists the proper settings for these speeds.

DATA RATE	SW1-2	SW1-3	SW1-4
150 bps	С	С	С
300 bps	С	С	0
600 bps	С	0	С
1200 bps	С	0	0
2400 bps	0	С	С
4800 bps	0	С	0
9600 bps	0	0	С

Table 11. Data Sync. Baud Rate Switch Settings

Switch Legend: C = Closed O = Open

### VOX Board (03-1098A03)

The tone-activated transmit (VOX) assembly is used when there is no other method of keying the radio. This is frequently a requirement when the radio is used as a polling remote to communicate with a repeater. It senses the presence of an audio tone on the transmit audio line and keys the transmitter. When installed, the VOX board is mounted beneath the logic board, and connects to the logic board via a short ribbon cable. Figure 19 shows a top view of the Data Synchronizer Board.

**NOTE:** The VOX Board will not function with an MDS 9810 spread spectrum radio.



J202 TO J4 ON LOGIC BOARD

### Figure 19. VOX Board Assembly

Alignment of the VOX board consists of setting gain control R204 so that the transmitter keys with a transmit audio tone level which is 6 dB below normal (system) audio levels. If the external modem has no means of varying its transmit audio level, an audio oscillator with variable frequency and output level is required.



If adjustment of the VOX Board gain is required, proceed as follows:

- 1. Rotate R204 fully counterclockwise.
- 2. Apply a 1200 Hz tone to J5 Pins 1 & 2 on the Logic Board. Set the amplitude of the audio oscillator 6 dB lower than the normal system level.
- 3. Rotate R204 slowly clockwise until CR206 begins to flicker.
- 4. Carefully continue to adjust R204 until CR206 glows steadily without flickering. This completes the VOX gain adjustment.

### **Radio Configuration**

In many cases, the P70 is shipped with the internal radios already configured for customer requirements. If so, no further configuration will be needed. However, if a system change is being made, or a new transceiver is installed, changes may be required. Radio configuration is performed with a Hand-Held Terminal or PC connected to the radio. (See *Connecting a Hand-Held Terminal (HHT)* on page 39.)

The transceiver manual shipped with your P70 contains a detailed list of radio commands and explains their functions. Always consult the transceiver manual when making programming changes.

**NOTE:** All MDS x710 and x810 radios must have their alarm output set to respond to Major alarms, and ignore Minor alarms. This is set at the factory for radios installed in a P70 but not for radios shipped separately. The diagnostic command **AMASK FFFF0000** must be entered into a radio to set this mode. Refer to your radio manual for complete diagnostic information.

#### Settings for S.S. Peer-to-Peer and S.S Repeater Systems

Radios used for Spread Spectrum Peer-to-Peer (Mode **③**) or Spread Spectrum Repeater (Mode **④**) require specific settings when used in a P70. Tables 12 and 13 list the required settings and show the antenna types that should be used at each radio site.

Settings	Host Site	P70 Radio 1	P70 Radio 2	Remotes
Radio Use:	Transceiver	Transmitter	Receiver	Transceiver
Mode:	Remote	Master	R-M <sup>1</sup>	Remote
Network Address:	Address < 1 >	Address < 1 >	Address < 1 >	Address < 1 >
Antenna Type:	Directional	Omnidirectional	Omnidirectional	Directional

#### Table 12. Peer-to-Peer Radio Settings

1. By configuring the transceiver in remote-master (R-M) mode, it acts as a remote (it does not transmit synchronization messages), but operates on



master frequencies until synchronization time. At this point, it switches to the next synchronization frequency to obtain synchronization from the system master.

Settings	Host Site	P70 Radio 1	P70 Radio 2	Remotes
Radio Use:	Transceiver	Transceiver	Transceiver	Transceiver
Mode:	Remote	Master	Master	Remote
Network Address:	Address < 1 >	Address < 1 >	Address < 2 >	Address < 2 >
Antenna Type:	Directional	Directional	Omnidirectional	Directional

Table 13. Spread Spectrum Repeater Radio Settings

Radio Settings for P70 in Redundant Mode (Mode 🏵) When the P70 is operated as a redundant station (Redundant Logic Board installed), special settings are required for the radios. Use the A-AUTO-B switch in the P70 to select Radio A or B for programming, and enter the command INIT xx20, (where xx are the first two digits of the radio's model number—three digits for an MDS 24810). Typical command examples are INIT 9820, INIT 24810 or INIT 9720. This command inverts the sense of the Alarm pin (#25) on the radio's DATA INTERFACE connector and sets up other parameters for proper operation.

When both radios have been programmed, place the switch back to the AUTO position. If a Major alarm occurs in the active radio, the Interface board automatically switches operation to the backup radio.

### 3.7 Final Installation Tasks

Perform the following steps to complete the installation of the P70 and prepare the unit for service:

- 1. Dress and secure all external cabling in accordance with local electrical codes.
- 1. Apply primary power to the unit and check for normal transceiver operation. (Checks for the radio are described in the transceiver manual.)
- 2. If necessary, refine the antenna heading for maximum RSSI. (Refer to the transceiver manual for additional RSSI information.)

The latches on the P70 Package Model in the NEMA enclosure may be padlocked if desired.



## 4.0 **OPERATION**

### 4.1 Introduction

The P70 Package Model is designed for unattended field operation. The only normal operator interaction is to apply power at the time of installation and observe the unit for proper LED indications. This section discusses the steps for initial power-up and also describes the connection of accessory equipment to the Package Model.

These instructions assume that the unit has been installed in accordance with the installation procedures given in *Section 3.0, INSTALLATION*.

### 4.2 Initial Power-up

Follow these steps to begin operation of the P70 Package Model:

- 1. Apply primary power to the unit.
- 2. Observe LEDs for normal operation. Typically, the radio will be transmitting intermittently in response to polling signals from the master station. The transceiver instruction manual provides a detailed description of each LED on the Transceiver front panel.

### Radio Selection Switch-Redundant units only

SW1 on the battery bracket provides selection of the active radio transceiver in redundant configurations (Redundant Logic Board installed— P/N 03-3306A02).

Figure 20 shows a view of the selection switch. Select the active radio by setting the switch up for Radio A, down for Radio B or to the center for automatic switchover. Corresponding LEDs indicate selection of Radio A or B. Refer to Table 14 for a detailed explanation of the switch settings. Manually selecting A or B will keep that radio active so that alarms can be checked and corrected.





Figure 20. Radio Selection Switch (on battery bracket)

Table 14. Radi	o Selection	Switch	Positions
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Switch Position	Function
A (up)	Radio A is selected as the active unit. Switchover will <i>not</i> occur if a failure occurs in Radio A.
AUTO (center)	The most recently selected radio is active. If a failure occurs with that side, switchover automatically occurs to the other radio.
B (down)	Radio B is selected as the active unit. Switchover will <i>not</i> occur if a failure occurs in Radio B.

**NOTE:** The terms "Radio A" and "Radio B" used to describe redundant radio operation are equivalent to "Radio 1" and "Radio 2" used elsewhere in this manual.

### Battery Backup Operation – AC-powered units only

A backup battery may have been installed on an ac-powered unit. The battery provides several hours of continued operation in the event of a primary power failure. (Depending on the transmit duty cycle and how often the radio is polled, the battery may last much longer.) The battery is "float" charged by the power supply during normal P70 operation.

Low Voltage Disconnect Feature A Low Voltage Disconnect circuit is included in the P70 packaged radio system. It prevents battery damage that may be caused by allowing a backup battery to drop below 10.2 volts while powering a transceiver, such as might occur during a lengthy power outage.

When the battery voltage drops to 10.2 volts ( $\pm 0.2V$ ), the Low Voltage Disconnect circuit automatically disconnects the battery from the transceiver. This stops operation of the radio, but protects the battery from potential damage. When ac power returns, the battery is automatically connected to the power supply (for charging) and normal radio operation resumes immediately. To test the backup battery, see "Battery Test" on page 40.



- **NOTE:** For proper operation of the Low Voltage Disconnect feature, 14.10 Vdc (±0.1 V) must be present at the battery connector on the logic board (with the battery disconnected). If adjustment is required, see *Battery Charging Check* on page 41.
- **Battery Reset Switch** Normally, the operation of the Low Voltage Disconnect assembly is fully automatic. The only exception is when replacing a discharged battery with a charged battery *if AC power has not returned*. In this case, it is necessary to press the Battery Reset Switch, SW1 on the Power Board (03-3950A01) after installing the new battery. Use a pen or other pointed object to press the switch.



Figure 21. Location of Battery Reset Switch SW1 on Power Board (03-3950A01)



### 4.3 Logic Board Features and Indicators

Most user interaction with the P70 Package Model takes place at the Logic Board located at the lower left side of the enclosure. Depending on the model of the unit, a variety of features are available on this board that will assist you in monitoring and controlling the system. Table 15 contains a summary of the available features and indicators on each model configuration.

Model Configuration	Orderwire Jack	LED Indicators or Alarms
P70 w/Interface Logic Board	J9 (Modular)	CR7—AC power failure indicator (on with battery operation)
(P/N 03-3900A02)		CR8—Radio Alarm (lights if either radio has an alarm)
		CR9—Transmitter (on J1) keyed indicator
P70 w/Redundant Logic Board (P/N 03-3306A02)	J1 (DB-25) Requires use of Orderwlre Adapter Module (P/N 02-1297A01). Orderwire not available for Spread Spectrum units.	Connector J9 provided for alarm equipment (see <i>Alarm</i> <i>Connections—J9</i> on page 25)

Table 15. Logic Board Features and Indicators

### 4.4 Connecting an Orderwire Handset

**NOTE:** Orderwire (voice) operation over data frequencies is not permitted in all regions. Check the regulations before connecting an orderwire handset to your system.

The radio equipment installed in the Package Model is normally used for data (non-voice) transmission. Occasionally, however, it may be desirable to establish a temporary voice link to coordinate installation or maintenance activities. This is accomplished with an "orderwire" connection.

The P70 Logic Board includes a connector that will accept an orderwire handset or orderwire adapter. Table 15 shows the appropriate jack number to use for each type of logic board. Although many standard telephone handsets can be used for orderwire service, we offer a unit specifically intended for use with the P70 (P/N 12-1307A01).

**NOTE:** The orderwire facility is not available with spread spectrum units.



To use the orderwire feature:

- 1. Plug the orderwire handset into the appropriate connector on the logic board. (See Table 15.)
- 2. Key the transmitter by speaking into the handset (VOX).
- **NOTE:** Unintentional sound picked up by the orderwire handset may key the transmitter and interrupt the normal data flow through the transceiver. To prevent erratic operation of the system, remove the orderwire handset when the orderwire is not in use.

### 4.5 Connecting a Hand-Held Terminal (HHT)

A notable feature of our transceivers is the ability to accomplish many radio programming and diagnostic tasks through software commands issued from a Hand-Held Terminal (HHT). (See Figure 22.)

HHT control of the transceiver allows you to make several key measurements and adjustments without the need for removing the transceiver cover, or having to reconfigure internal switches or jumpers. The transceiver manual contains a list of HHT commands for the specific radio installed in your system.



#### (Kit P/N 03-1501A01)

### **HHT Connection**

The HHT is plugged directly into the transceiver's DIAG. modular connector. Follow these steps to connect the terminal:

1. Plug the HHT's coiled cord into the transceiver's DIAG. connector.



- 2. The HHT starts a self-check routine. When the test is finished, the HHT is ready to accept commands. Refer to the transceiver manual for radio-specific commands.
- **NOTE:** Some older transceivers (i.e., MDS x310 Series do not have a modular DIAG. connector. In these cases it will be necessary to connect the HHT to the transceiver's INTERFACE connector by temporarily disconnecting the ribbon cable. When testing is finished, be sure to re-install the ribbon cable.

### 5.0 MAINTENANCE

This section contains information for keeping the Package Model in peak operating condition, as well as procedures for performing minor field adjustments and troubleshooting. This service information is intended to augment the transceiver manual shipped with your system.

### 5.1 Preventive Maintenance

Package Models are designed for long life and trouble-free operation. However, because these units are frequently installed in outdoor environments, periodic inspection of the equipment is more important than it would be for equipment mounted indoors.

The unit should be checked occasionally for loose or corroded hardware, loose cable connections, and damage to the exterior housing. The door seals and cable entrances should also be checked for signs of leakage or other damage. When performing preventive maintenance, it is also a good idea to check related equipment, such as the antenna system and remote terminal unit, for signs of damage or loose connections. Consult the applicable instruction manual(s) for maintenance recommendations.

The transceiver instruction manual contains many transceiver maintenance checks that can be made with an HHT. Specific items to check include RF power output, received signal strength (RSSI) and supply voltage.

### 5.2 Backup Battery—AC-powered units

### **Battery Test**

Units equipped with a backup battery should be tested occasionally for proper backup operation. To do this, temporarily shut off the ac power to the station and check for continued radio operation. (If possible, the system should be tested for 30 minutes or more on backup power.) If a battery is found to be defective, refer to *Backup Battery Replacement* below for replacement instructions. Steps are also given later in this section for checking and adjusting the battery charging rate.



### **Backup Battery Replacement**

Backup batteries have a limited service life. The length of time a battery lasts depends on many factors, including the battery size (4.5 AH or 12 AH), charge rate, number of discharge cycles and the ambient temperature. If a backup battery is found to be defective, follow these steps to replace it:

- 1. Turn off the primary power to the station.
- 2. Unplug the battery cable from J3 (BATT.) on the Power Board.
- 3. Remove the battery bracket screws and the battery pack. Properly discard the defective battery.

When removing the battery bracket on Redundant units, use care not to damage the Radio Selection Switch (SW1) or its associated wiring harness. Also, be sure the switch remains set to the position it was originally in.

- 4. Install the new battery pack and re-install the battery bracket.
- 5. Connect the cable assembly between the battery and J3 on the Power Board.
- 6. Re-apply primary power to the station.

### **Battery Charging Check**

For proper charging of the battery, the power supply must be set at the correct output voltage. To check for the correct charger output, perform the following procedure:

- 1. Disconnect the positive (+) lead from the battery and connect a voltmeter to the lead. The voltage should be 14.10 Vdc.
- 2. If not, the power supply voltage should be adjusted to produce 14.10 Vdc on the battery lead. The voltage can be adjusted using a small flat blade tool at VR1 on the edge of the ac power supply—see Figure 23. (The chassis plate may need to be removed from the enclosure to gain access to VR1.







Figure 23. Location of voltage adjustment VR1

### 5.3 Fuse Replacement

The P70 Package Model is equipped with several fuses to guard against over-current conditions. When a fuse blows, you should try to find the cause of the problem before replacing it. A blown fuse could be caused by a short circuit, power surge or nearby lightning discharge.



Replaceable (Glass) Fuses Ensure that primary power is removed from the P70 before attempting fuse replacement or performing any other equipment service.

Table 16 lists the replaceable fuses used on the P70 Power Board (P/N 03-3950A01). For continued protection, replacement fuses must be of the same size and rating.

Table 16.	F1/F2 Fuse	e Values
-----------	------------	----------

P70 Input Power	Fuse Rating
12 Vdc	3A
12 Vdc w/converter	10A
24 Vdc	4A
48 Vdc	2A
85–264 Vac <i>or</i> 120–370 Vdc	3A



In addition, the AC Power Supply contains one 15 Ampere replaceable fuse on the left edge of the board. It is necessary to remove the protective covering from the power supply to access the fuse.

**Resettable Fuses** The Power Board also contains two *resettable* fuses, F3 and F4. To reset these fuses, correct the overload condition. The fuse will reset when it cools.

In addition, both the Interface Logic Board and the Redundant Logic Board contain two resettable fuses—F1 and F2.

### 5.4 Troubleshooting

If difficulties are experienced with the Package Model, Table 17 can be used to help isolate the fault condition. Refer also to the troubleshooting instructions given in the associated transceiver manual.

If troubles persist, technical assistance is available from the factory by using the contact information at the back of this manual. Please have the *complete* model number code of the Package Model ready when calling for assistance.

Symptom	Corrective Action
Unit does not operate	a) Check for primary power
	b) Check for blown fuses
	c) Check for secure cabling connections
Unit does not operate on backup battery, or runs only a short time	<ul> <li>a) Check to see that battery is being charged properly (see <i>Battery Charging Check</i> on page 41).</li> </ul>
	<ul> <li>b) Battery may need replacement. (see Backup Battery Replacement on page 41).</li> </ul>
Transmitter does not key	<ul> <li>a) Manually key the transmitter by setting SW1-2 to OFF. (Transmitter will not key if a radio alarm is present.)</li> </ul>
	b) Check cabling to external data equipment (RTU)
	c) Check for secure cabling connections
System transmits and receives, but overall	a) Check antenna system for damage or antenna misalignment
performance is poor	b) Check for secure cabling connections
	c) Check for proper supply voltage
	d) Check radio for proper RF output
	e) Check radio for proper frequency programming

#### Table 17. Package Model Troubleshooting Chart



### 5.5 Interpreting Alarms

### Interface Logic Board (03-3900A02)

AC LED	AC LED (CR7) indicates the loss of 14 V power from the Internal Power Supply Module, and shows that the system is operating on the battery power. System operation will continue until the battery is depleted. Check the power source and fuses.
RAD LED	RAD LED (CR8) Indicates that one of the radios is reporting a failure. The radio with the alarm may have a flashing PWR light. Use a Hand Held Terminal or computer terminal to check the radio status (see transceiver manual). Radio 1 RTS is disabled until the fault is corrected. The radio must have the Alarm Sense HIGH for alarm, and LOW for normal. Some radios allow this to be programmed. See the transceiver manual for details.
RTS LED	RTS LED (CR9) Indicates Radio 1 is receiving RTS from the Logic Board. The presence of a radio alarm from either radio will block Radio 1 RTS.
RTU Port (J3) Pin 25 Checks	RTU Port J3 pin 25: 5V CMOS logic level output with $1k\Omega$ series resistor. Low indicates normal operation. High indicates the presence of a Radio Alarm or an AC Fail alarm.
	Redundant Logic Board (03-3306A02)
LEDs	The LEDs on this board indicate the presence of DC power for Radio A (CR1) and Radio B (CR3).
Alarm Contacts (J9)	The Alarm connector J9 provides access to relay contacts. Pin 1 is nor- mally closed, Pin 2 is the common terminal, and Pin 3 is normally open. An alarm condition in either radio will activate the alarm. The radio must have the Alarm Sense set to LOW for alarm, and HIGH for normal. Some radios allow the alarm sense to be programmed. See the radio manual for details.



### 5.6 P70 Interconnect Cabling

During maintenance tasks that involve board removal, there is a possibility of making improper cable connections during re-assembly. The tables provided below list the connectors on each board and indicate what they connect to.

Connector	Function	Connects To
J1	Radio 1 data & control	Radio 1 DB-25
J2	Radio 2 data & control	Radio 2 DB-25
J3	RTU Interface	RTU / PLC
J4	Data Synchronization	Data Synchronization Board* J1 (at edge of board). Make sure red stripe on ribbon cable is towards the transceiver mtg. brackets. Note: J2 on Data Sync. Board is not used.
J4	VOX Board connection	VOX Board* J202 (at edge of board). Make sure red stripe on ribbon cable is towards the transceiver mtg. brackets. Note: J201 on VOX Board is not used.
J5	4 Wire Analog	User Analog Interface
J6	12V Power (Radio 1)	Radio 1 Power
J7	12V Power (Radio 2)	Radio 2 Power
J9	Orderwire	Orderwire Handset (optional)
J11	12V Power Input	Power Board (03-3950A01) J6

Table 18.	Interface	Loaic	Board	(P/N 03	3-3900A02)	Cabling
		3		(		

\* Optional Assemblies

Table 19. Redundant Lo	ogic Board (P/N	03-3306A01	) Cabling
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Connector	Function	Connects To
J1	RTU Interface	RTU / PLC
J2	Radio B, data & control	Radio B DB-25
J3	Radio A, data & control	Radio A DB-25
J4	Power Supply Module	AC or DC power supply
J5	Radio B, RF	Radio B, Antenna Jack
J6	DC Power A	Radio A Power
J7	DC Power B	Radio B Power
J8	A – B Select	Indicator PCB J1
J9	Alarm Relay	User alarm interface
J10	Radio A, RF	Radio A, Antenna Jack
J11	Antenna	Lightning protector & Antenna
J12	Battery Backup	Not used

Connector	Function	Connects To
J1	Input Power	User-supplied power
J2	Accessory Power Output	12V Fan, 24V & 12V options
J3	Battery Power Input	Battery Terminals +, -
J4	Heater Power Output	Heater (AC units)
J5	Power Supply Module	AC or DC power supply
J6	Logic Board Power	Logic Board J11

Table 20. Power Board (P/N 03-3950A01) Cabling

Table 21. Indicator Board (P/N 03-3307A01) Cabling

Connector	Function	Connects To
J1	A – B Select	Redundant Logic Board J8

### 5.7 Replaceable Assemblies

Table 22 lists replaceable parts for the P70 Package Model. The parts used in a given system depend on the configuration of the Package Model. Therefore, not all of the parts listed will be used in every model. Please have the complete model number code for your P70 ready when ordering any of these items.

Part Name	Description	Part Number
Transceiver	Standard MDS remote transceiver	Order by Transceiver model number
Power Supply Assemblies (AC and DC)	Converts primary power to level required by the radio system	85–264 Vac or, 120–370 Vdc: 28-2334A02
		12 VDC: 03-1212A05 24 VDC: 03-1212A02 48 VDC: 03-1212A03
Interface Logic Board	Provides system control and interfacing. Connection point for external accessories	03-3900A02

Table 22. P70 Replacement Assemblies



Part Name	Description	Part Number
Power Board	Connection point for AC or DC input power as well as the backup battery (if equipped). Also has outputs for the optional heater, fan, logic board and accessory power.	03-3950A01
VOX Board	Optional subassembly that installs inside the P70 enclosure underneath the Logic Board. Allows external 4-wire TX audio applied to J5 Pins 1 & 2 of the Interface Logic Board to key the transmitter.	03-1098A03
Data Synchronizer Board	Optional subassembly that installs inside the P70 enclosure underneath the Logic Board. Improves transmission reliability in 4800 bps repeater configurations.	03-1389A01
Redundant Logic Board	Provides system control and interfacing for redundant station using spread spectrum remotes. Connection point for external accessories	03-3306A02
Indicator	Indicates/selects active transceiver	Board: 03-3307A01
Board Assy. (Redundant models only)	in redundant configurations.	Ribbon Cable: 03-1726A01
Backup Battery Assembly	Provides backup power during ac power outage	4.5 AH: 28-1575A02 12 AH: 28-1575A04
Transceiver Data Interface Cable	Connects the transceiver data connector to the Interface/Utility Board	03-2160A02
Transceiver Coax Assy's (Redundant models only)	Connects the remote transceivers RF output to the Redundant Logic Board (Qty. 3). Type "N" to SMB.	03-3357A02
Power Board Cable	Connects between the Power Board and the Power Supply	03-1172A04
Power Input Connector	Connection point for primary power wiring	73-1194A18 (3 pin.) 73-1194A19 (12 pin.)
Fiberglass Enclosure	NEMA 4, weather resistant case with padlockable latches	82-3924A01
Radio Power Cable	Connects between the transceiver's DC input and the Power Board.	03-1846A09
Analog I/O Connector	Plug-in terminal block that mates with J5 on the Interface Logic Board	73-1194A27
Lightning Protector	Bulkhead-style coaxial connector with internal spark-gap lightning protector	97-1678A15

Table 22. P70 Replacement Assemblies (Continued)
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# APPENDIX A P70 APPLICATION NOTES

The following pages contain application notes with detailed information for configuring a P70 in a desired system. A review of the note(s) applicable to your system is recommended to assure proper operation and interfacing with external equipment.

These application notes are current as of the date of manual publication, however, you may wish to visit **www.microwavedata.com** on the World Wide Web to check for additional notes or revisions to this material.

### P70 Application Note 0 General Information

This covers information which is common to all versions.

This document provides information about the 03-3900A02 switch functions and other general information.

<u>Product Description</u>: The P70 Packaged Remote is one or two remote radios with a power supply, optional battery, control circuitry and space for a customer s RTU or PLC all on a 19 baseplate which can be rack mounted or supplied with a weather resistant NEMA 4x enclosure. This versatile package is ideal for Repeaters, Tail-End-Links or Redundant systems.

<u>Configurations Available</u>: Eight standard configurations are available. Types 1—7 use the 03-3900A02 Interface Logic Board, and type 8 uses the 03-3306A02 Redundant Interface Board. Types 2 & 3 are for Licensed MAS only and use duplexers. Type 4 can mix Licensed MAS radios with Spread Spectrum radios, or other MAS radios and can have different modem types for the two radios as long as the RS-232 port speeds match. Types 5 & 6 are for Spread Spectrum remotes only. The application notes are numbered the same way. Type 1 Single Remote can be upgraded to support 2 radios with kit 03-3923A01 or 03-3923A02. Call MDS for details.
1) Single Remote

- Duplex Remote / Master / Polling Remote (1 TX/RX frequency pair)
- 3) Duplex MAS Repeater (1 TX/RX frequency pair)
- 4) Tail End Link Repeater (2 TX/RX frequency pairs, or Licensed pair to Spread Spectrum)
- 5) Spread Spectrum Peer to Peer Repeater (1 network address)
- 6) Spread Spectrum Repeater (2 network addresses)
- 7) Dual RTU Interface
- 8) Redundant Remote

<u>Power Supplies</u>: The P70 utilizes a Switching Power Supply for AC (and 120-370 VDC) operation for improved efficiency, reduced heat dissipation, smaller size, less weight and reduced cost. The dis-advantage is their limited operating temperature range of 0-60° C (32-140° F). However most AC systems also utilize a backup battery which suffers from a similar problem; reduced performance at cold temperatures. To eliminate both of these limitations the P70 offers an optional heater to keep the battery and AC power supply at peak performance down to -40° C (-40° F). The heater can be ordered in 110V or 220V versions and is controlled by a thermostat so it is only active when needed.

The 12, 24 and 48VDC supplies are rated for a wider temperature range of -30 to +60C (-22 to  $+140^{\circ}$ F). DC powered P70s do not have an internal battery or heater option.

A 24 VDC power supply is built in to the P70 and available on the 03-3950A01 Power Board output connector J2 pin 1, with ground on pin 2. It operates off the 14 V radio power supply so if a battery is present the 24 V output will still be on during a power failure. It is rated at 300 mA and has a 500 mA fuse which is self resetting.

The 03-3950A01 Power Board also provides nominal +14 V on J2 pins 5 & 7 with ground on J2 pins 6 & 8. This is connected to the radio power supply and is protected by a 6 amp self-resetting fuse which is shared by the radios, 24 V supply and battery charger. The combined

current for these pins is rated at 400 mA, but with low power spread spectrum radios, and light load on the 24V supply, over one amp can safely be drawn from these accessory pins.

- <u>Fan Option</u>: The cooling fan is available for all P70 versions and essential for systems with 5 watt transmitters which are continuous keyed or high TX duty cycle. It is thermostat controlled and provides cooling for the AC power supply and radios. The power supply output current is derated at high temperatures, so the fan will allow the AC supply to provide a higher current when hot, and improve its reliability. P70 systems with DC supplies and spread spectrum radios or a single 5W MAS radio will be okay without the fan.
- Antenna Aiming & RSSI: The 03-3900A02 Interface Board provides test points for measuring the Received Signal Strength utilizing a DC voltmeter. Connect to RSSI-1 (near J1) for Radio 1, and RSSI-2 (near J2) for Radio 2. See your radio manual for a chart of voltage vs. signal strength. A higher reading indicates a stronger signal.

An alternate method would be to attach the Handheld Terminal or computer terminal to the radio's diagnostic port to read**RSSI** directly in dBm. This method only provides one reading per second and can be slower to use for antenna aiming.

- <u>J3 RS-232 Port CTS</u>: RTS must always be used to communicate with J3 even if Radio 1 is in DATAKEY mode. The CTS on pin 5 is derived from the RTS on J3 pin 4 and can be set to 10 or 20 mS.
- <u>Radio Alarm Output</u>: All MDS remote radios have an output pin on the DB-25 connector to alert the user of various alarm conditions in the radio. The P70 monitors this output to shutdown the transmitter in the event of a Major Alarm condition on either radio which may be due to frequency synthesizer out of lock or some other serious failure. It is important to have the P70 radios set to ignore *Minor* alarms on the new DSP radios to prevent an un-wanted shutdown of the P70. Minor alarms are used for less significant problems such as temperature or voltages slightly out of tolerance. These radios include the 2710, 4710, 9710, 9810 and 24810 in configurations 1 through 7. Configuration 8 (Redundant) is a special case, see application note 8 for details. The 4310 and 2310 are not affected. To set the radio to produce *Major Alarms* but not *Minor Alarms* the command AMASK FFFF0000 must be given to each radio. Use the Handheld Terminal or a computer to access the diagnostics for your radios. To check the current setting, send the command AMASK to the radio. See the radio manual for details on interfacing to diagnostics.
- Digital Data Mode: All digital modems are accessed with J3, the RTU port. RS-232 signal levels are used on all communications pins. Special purpose pins include #19 providing 10 volts at low current for the MDS option boards, #12 puts the radios into sleep mode when grounded, #25 is the Alarm output which is normally Low but goes to 5V for a Radio Alarm or AC Fail Alarm (The Redundant mode uses the opposite polarity for the alarm pin). A Data Synchronizer Board may be supplied for 4800 bps modems when the P70 is a Repeater or Tail End Link utilizing 2310/4310 or x790B radios.
- <u>4 Wire Analog Mode</u>: For 4 Wire Analog use, the interface is to J5 on the 03-3900A02 Interface Board. Pins 1 & 2 are the balanced 600 ohm Transmitter input to Radio 1, and pins 3 & 4 are the balanced 600 ohm Receiver output. The RX Audio is from Radio 1 with SW1-8 ON and from Radio 2 with SW1-8 OFF. This setting will depend on the application. The levels are

typically set for —10 dBm, but can be changed by resetting the Transmitter or the Receiver level on the radio(s). MDS x710 radios have the TXLEVEL set to AUTO, but should be set to TXLEVEL —10or other levels as needed for better performance if the level will remain constant. Keyline control (Radio 1) is accomplished by grounding Pin 5 (to Pin 6 or other suitable ground). An optional VOX board attached to J4 will key Radio 1 when audio is applied to J5-1&2. (03-1098A03 Kit, VOX Assy.) The radio will generally be set to MODEM NONE for a DSP series remote such as the x710.

- Interface Board Revisions: To check the revision of the 03-3900A02 Board, look at the corner of the board closest to the radios between J1 & J4. The revision is identified in the silk screen marking as REV A, REV B etc. The revision on the paper label is different.
- Radio Types: DSP radio types include the 4710 & 9710 with modem types A, C, D, E, & M. Spread Spectrum (SS) includes the 9810 & 24810. The Non DSP family includes the 4310, 2310, 4710 & 9710 with modem type B.

	SPECIFICATIONS				
Temperature Range	DC Power 12, 24, 48V: -30; C to 60; C *				
	DC Power 120-370V: 0; C to 60; C *				
	AC Power (without heater): $0_i C \text{ to } 60_i C^*$				
	AC Power (with internal heater): -40; C to 60; C *				
	*Requires fan option for 5 Watt				
	transmitter 50; C to 60; C				
Humidity	95% at 40; C				
Enclosure Type	NEMA 4X (Corrosion resistant)				
	Or 19 Rack Mount (no enclosure)				
<b>Enclosure Dimensions</b>	22 H x 18 W x 10 D				
	55.88 cm H x 45.72 cm W x 25.39 cm D				
<b>Rack Mount Plate</b>	19 W x 15 D x 9 H				
Dimensions	48.26 cm W x 38.1 cm D x 22.86 cm H				
Weight	31 lbs				
	14.86 kg				
Customer I/O Space	8 H x 14.25 W x 6.75 D				
	20.32 cm H x 36.19 cm W x 17.14 cm D				
Lightning Protectors	Available with up to 2 protectors installed, bulkhead				
	mounted, with external ground stud. Available for 19in				
	Rack Mount version un-mounted.				
Primary Power Options	DC 12V, 24V, 48V and 120-370V				
	AC 85-264V, 47-440 Hz with optional battery backup				
	4.5 AH or 12 AH				
Power for Customer I/O	24 VDC at 300 mA				
Equipment	12 VDC at 400 mA				
OPTIONS:	Lightning Protection for antenna				
	Battery backup 4.5 or 12 AH (AC only)				
	Heater for extended cold temperature operation to - 40; C				
	(AC only). Thermostat Controlled.				
	Fan for high temperature operation or 5 watt TX				
	continuous keyed. Thermostat controlled.				
	Order Radios separately				

OPERATING MODES with 03-3900A02 Interface Boards	OPERATING MODES with 03-3900A02 Interface Boards											
(Note: S2-3, 4 added for revision C)				<u>S1</u>	SE1	TIN	<u>GS</u>		<u>S2</u> :	SET	TIN	<u>35</u>
O <u>SINGLE REMOTE</u>												
Interface Board: Interface Logic Board (03-3900A02)	1	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
Switch Settings:	On	On	off	On	off	off	On	On	off	off	On	off
Description: One remote MAS (J1) or SS (J1)												
Data Path: J3 RTU port to Radio 1												
Radio Type: MAS: x310A, x710, SS: x810												
Antenna Ports: 1												
Duplexer: no												
<b>O DUPLEX MAS REMOTE / MASTER / POLLING REMOTE</b>												
Interface Board: Interface Logic Board (03-3900A02)	1	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
Switch Settings:	On	On	On	off	off	off	On	off	off	off	On	off
Description: One MAS remote receive only (12):	î	~										
Description. One WAS remote transmit only (J2),												
Data Dath: 12 DTL part Padia 2 DVD. Padia 1 TVD												
Padia Tupo: MAS: x210A x710												
Antonna Porte: 1												
DOFLEX MAS REFEATER	1	n	2	4	5	6	7	0	4	n	2	4
Full Dupley Heat or Padia 1 pap DSD type:		<u></u>	<u>ು</u> ್	<u>4</u>	<u>2</u> off	<u>o</u> ff	<u>1</u> 0n	<u>o</u>	<u> </u>	<b>∠</b>	<u> </u>	<u>4</u>
Full Duplex Host of Radio 1 non-DSP type.	0n *	*	OII	OII	011	011	On	011	011	011	On	011
Half Duplex Host, Radio 1 DSP type:	On	On	off	off	off	off	On	off	off	off	off	off
	*	*			• • •			• • •				
Full Duplex Host; with Data Sync Bd:	On	On	off	off	On	off	On	off	off	off	On	off
(see note 2)	*	*			_		_					
Half Duplex Host; with Data Sync Bd:	On *	On *	off	off	On	off	On	off	off	off	off	off
(See note 2)												
one MAS remote transmit only (12),												
Data Dath: 13 DTLL port Padio 2 DYD, Datio 1 TYD												
& repeat RX (12) to TX (11)												
Radio Type: MAS: x310A x710												
Antenna Ports: 1												
Dunlexer: ves												
Interface Board: Interface Logic Board (03-3900A02)	1	2	3	4	5	6	7	8	1	2	3	4
MAS to SS Switch Settings:	- On	_ <u>≜</u> On	<u>⊻</u> On	⊥ On	<u>⊻</u> off	<u>⊻</u> On	<u>′</u> On	<u>⊌</u> On	<u> </u>	≜ On	On	_ 
MAG to GG GWitch Gettings.	*	On	On	On	UII	On	On	On	OII	On	OII	OII
MAS to MAS Switch Settings:	On	On	off	On	off	off	On	On	On	On	On	off
	*		*			*						
Switch Settings with Data Sync Bd:	On	On	off	On	On	off	On	On	On	On	On	off
(see note 2)	*		*			*						
Description: One MAS remote transceiver (J1);												
Deta Dath: 12 DTU part to Dadia 1 (MAC)												
Data Path. Jo K I U port to Kadio T (MAS)												
Di-ulrectional repeat MAS (JT) - 55 (JZ)												
raulu Type. MAS. XSTUA, X/TU; SS: X8TU												
Antenna FUIIS. 2 Duplovor: po												
Duplexel. 10												

				<u>S1</u> :	SET	τινα	GS		S2 :	SET	τινα	GS
<b>O SPREAD SPECTRUM PEER TO PEER REPEATER</b>	1	<u>2</u>	<u>3</u>	4	<u>5</u>	<u>6</u>	7	<u>8</u>	1	2	3	4
Interface Board: Interface Logic Board (03-3900A02)	On	On	On	off	off	off	off	off	off	off	off	off
Description: One SS remote-receive only (J2);												
one SS remote-transmit only (J1)												
Data Path: J3 RTU port Radio 2 RXD, Radio 1 TXD												
& repeat RX (J2) to TX (J1)												
Radio Type: SS: x810 (One network address)												
Antenna Ports: 2												
Duplexer: no												
<b>O</b> SPREAD SPECTRUM REPEATER	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	1	<u>2</u>	<u>3</u>	<u>4</u>
Interface Board: Interface Logic Board (03-3900A02)	On	On	off	On	off	off	off	off	On	off	off	off
Description: Two SS remote transceiver (J1 & J2)												
Data Path: J3 RTU port to Radio 1												
bi-directional repeat (J1) - (J2)												
Radio Type: SS: x810 (Two network address)												
Antenna Ports: 2												
Duplexer: no												
Dual RTU Interface	<u>1</u>	2	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	1	2	<u>3</u>	4
Interface Board: Interface Logic Board (03-3900A02)	off	off	off	off	off	off	off	off	off	off	off	off
Description: Two remotes. MAS or SS												
Data Path: Direct connect to each remote												
Radio Type: MAS: x310A, x710; SS: x810												
Antenna Ports: 2												
Duplexer: no												
<b>8</b> <u>REDUNDANT REMOTE</u>												
Interface Board: Redundant Logic Board (03-3306A02)			(	(No S	Swite	ches	to s	set)				
Description: Two remotes of the same type. MAS or SS												
Data Path: One RTU interface to the active radio.												
Radio Type: MAS: x310A, x710; SS: x810												
Antenna Ports: 1												
Duplexer: no												
Notes: 1) * Switch settings may be changed for some	e ap	plica	ation	S								
<ol><li>Data Sync Bd needed for 4800 baud using x310 or x710B remotes</li></ol>												

3) DSP radios include 2710, 4710, 9710, 9810, 24810, with modem type A, C, D, E or M.

4) 4310, 2310 and x710 remotes with the "B" type modem are not in the DSP radio group.

5) MAS radios include 4310, 2310, 2710, 4710, 9710 licensed remotes.

6) Spread Spectrum (SS) radios include 9810, 24810 un-licensed remotes.

### P 70 Interface Board (3900A02) Settings

	OPEN {OFF}	CLOSED {ON}
Radio 1	Keyline Control	
SW1-1	CTS delay for RTU on port 3 set Long (20mS)	CTS delay for RTU on port 3 set Short (10mS)
SW1-2	Continuous RTS TX1 (for x310 only) (use CKEY for x710)	Normal, TX1 keys as needed.
	{With power-on-delay} (disable radio Time Out Timer)	{See SW1-3}
SW1-3	Key TX1 with RX2 Squelch or RTU port RTS	Key TX1 with CTS2 or RTU port
	{MAS Repeater}	{SS Repeater or Tail End Link or Full Duplex remote}
SW1-7	RTS1 Hold Timer 20 mS	RTS1 Hold Timer 1 mS
	{MAS Repeater with Duplex Host; MAS Duplex}	{single remote; MAS Repeater with Half Duplex Host}
SW2-3	RTS1 Disable (to allow DATAKEY mode only)	RTS1 Enable
	{MAS Repeater with Half Duplex Host like x710A}	{Normal}
(rev.C)		
Radio 4	<u>Keyline Control</u>	
SW1-6	Key TX2 with RX1 Squelch	Key TX2 with CTS1
	{Tail End Link, squelch key}	{Tail End Link, CTS KEY}
SW2-2	RTS2 Disabled	RTS2 Enabled
	{MAS Repeater, Duplex Remote}	{Tail End Link}
DATA (	Control (The RTU on Port-J3 has priority. When R	TS3 is high, Radio-1 gets Data from J3-2, TXD3)
SW1-4	RXD2 to RTU (RXD3)	RXD1 to RTU (RXD3)
	DCD2 to RTU (DCD3)	DCD1 to RTU (DCD3)
	{MAS Repeater or MAS Duplex or SS Peer to Peer Repeater}	{Tail End Link or SS Repeater or Single Remote}
SW1-5	Radio-1 Repeater Data from RXD2 (Radio-2)	Radio-1 Repeater Data from RXD2 using Data Sync.Bd
	Radio-2 Repeater Data from RXD1 (Radio-1)	Radio-2 Repeater Data from RXD1 using Data Sync.Bd
	{Normal Mode}	{x310, x710B 4800 baud Repeater}
SW2-1	TXD2 Disabled (Radio 2 Receive only)	TXD2 Enabled
	{SS Peer to Peer Repeater}	
Orderw	ire & 4 Wire Audio Control	
SW1-8	RX Audio 2 to Orderwire & 4-Wire Audio	RX Audio 1 to Orderwire & 4-Wire Audio

Notes:

1) Radio 1 is connected to J1 and has interface names like RXD1, TXD1, DCD1 etc.

2) Radio 2 is connected to J2 and has interface names like RXD2, TXD2, DCD2 etc.

3) The RTU interface is J3 and has interface names like RXD3, TXD3, DCD3 etc.

4) The Data Sync. interface is J4 and has interface names like RXD4, TXD4

5) MAS = Multiple Address System (Licensed Radios)

6) SS = Spread Spectrum (Unlicensed Frequency Hopping Radios)

7) Settings are typical and may vary for some installations.

### P70 Application Note 1 Single Remote

- <u>Product Description</u>: The P70 Packaged Remote is one or two remote radios with a power supply, optional battery, control circuitry and space for a customer s RTU or PLC all on a 19 baseplate which can be rack mounted or supplied with a weather resistant NEMA 4x enclosure. This versatile package is ideal for Repeaters, Tail-End-Links or Redundant systems.
- <u>Configurations Available</u>: Eight standard configurations are available. Types 1—7 use the 03-3900A02 Interface Logic Board, and type 8 uses the 03-3306A02 Redundant Interface Board. Types 2 & 3 are for Licensed MAS only and use duplexers. Type 4 can mix Licensed MAS radios with Spread Spectrum radios, or other MAS radios and can have different modem types for the two radios as long as the RS-232 port speeds match. Types 5 & 6 are for Spread Spectrum remotes only. The application notes are numbered the same way. Application Note 0 contains general information about the P70 and switch setting charts for all listed configurations.
  - 1) Single Remote
  - 2) Duplex Remote / Master / Polling Remote (1 TX/RX frequency pair)
  - 3) Duplex MAS Repeater (1 TX/RX frequency pair)
  - 4) Tail End Link Repeater (2 TX/RX frequency pairs)
  - 5) Spread Spectrum Peer to Peer Repeater
  - 6) Spread Spectrum Repeater
  - 7) Dual RTU Interface
  - 8) Redundant Remote
- <u>This Configuration</u>: This application discusses: **Mode 1**) **Single Remote.** It has one radio mounting bracket, and one set of interconnect cables. A second radio mounting bracket and cable set can be ordered if needed. Order 03-3923A01 Kit, Single to Dual Radio Conversion w/ Enclosure or 03-3923A02 Kit, Single to Dual Radio Conversion w/o Enclosure as needed. All x710 and x810 radio types should have the Alarm output set to produce Major alarms only, see P70 Application Note 0 for details. For 4 Wire Analog interfacing see P70 Application Note 0.

Block Diagram:



- <u>P70 Interface Board Settings</u>: For switch settings refer to P70 Application Note 0, General Information. The local RTU port (J3) CTS delay is not controlled by the radio, but has two settings controlled by SW1-1 of the Interface board. "On" gives 10 mS of delay and "Off" sets it to 20 mS.
- P70 Radio 1: 4310, 2310, 2710, 4710, 9710, 9810, 24810 remotes can be used. Note that the Radio 1 CTS setting is *not* used by the Local RTU port J3, the Interface board controls it as noted above.

- <u>P70 Radio 2</u>: none (To add a second radio and convert the P70 to a different configuration, order the 03-3923A01 or A02 conversion kit which includes the necessary radio bracket and cables.)
- Host Radio Settings: No special settings required.
- Antenna Considerations: Typically a Yagi directional antenna towards the Host system.
- Synchronous Data: The clock signals RXC, TXC and ETC are available on the RTU connector J3. Check your radio manual for supported modes.
- <u>Diagnostics</u>: Use your Handheld Terminal or Computer Terminal directly to the remote for Local diagnostics. See your radio manual for details. Over the air diagnostics are not affected by the P70 for this version.
- Orderwire Voice with VOX keying is supported on the x710 DSP series remotes, and the x310 MAS remotes. Plug the telephone handset into J9 and when you talk into the handset Radio 1 will key in Analog Mode to communicate with someone at the host site. To use the orderwire feature with the Revision A Interface Board, Radio 1 needs to set for Analog mode by typing MODEM NONE on the Handheld Terminal or PC Terminal. The Revision B 03-3900A02 Interface board will automatically switch the remote to Analog mode. The board revision can be identified by looking at the marking silk screened on the corner of the board near the radios. (The revision marked on the paper label is not the same.)
- <u>Sleep Mode</u>: Grounding J3 pin 12 will put the radio into the low power sleep mode. Pin 12 is pulled to +5V internally, but can be pulled as high as +14V, do not apply negative voltages. See your radio manual for details of the power used in sleep mode and the wake-up time required.

### **P70 Application Note 2 Duplex Remote / Master / Polling Remote**

- <u>Product Description</u>: The P70 Packaged Remote is one or two remote radios with a power supply, optional battery, control circuitry and space for a customer s RTU or PLC all on a 19 baseplate which can be rack mounted or supplied with a weather resistant NEMA 4x enclosure. This versatile package is ideal for Repeaters, Tail-End-Links or Redundant systems.
- <u>Configurations Available</u>: Eight standard configurations are available. Types 1—7 use the 03-3900A02 Interface Logic Board, and type 8 uses the 03-3306A02 Redundant Interface Board. Types 2 & 3 are for Licensed MAS only and use duplexers. Type 4 can mix Licensed MAS radios with Spread Spectrum radios, or other MAS radios and can have different modem types for the two radios as long as the RS-232 port speeds match. Types 5 & 6 are for Spread Spectrum remotes only. The application notes are numbered the same way. Application Note 0 contains general information about the P70 and switch setting charts for all listed configurations.
  - 1) Single Remote
  - 2) Duplex Remote / Master / Polling Remote (1 TX/RX frequency pair)
  - 3) Duplex MAS Repeater (1 TX/RX frequency pair)
  - 4) Tail End Link Repeater (2 TX/RX frequency pairs)
  - 5) Spread Spectrum Peer to Peer Repeater
  - 6) Spread Spectrum Repeater
  - 7) Dual RTU Interface
  - 8) Redundant Remote
- <u>This Configuration</u>: This application discusses: **Mode 2**) **Duplex Remote / Master / Polling Remote.** For this version Radio 2 is used as a Receiver and Radio 1 is used as a Transmitter. All Data passes through the J3 RTU port to the user's RTU or PLC. All x710 radio types should have the Alarm output set to produce Major alarms only, see P70 Application Note 0 for details. For 4 Wire Analog interfacing see P70 Application Note 0.

#### Block Diagram:



<u>P70 Interface Board Settings</u>: For switch settings refer to P70 Application Note 0, General Information. This configuration typically sets the CTS delay for the RTU port to 10 mS and the Transmitter to Switched-Carrier Mode. The transmitter can be continuous keyed if the optional cooling fan is installed, and the proper technique is used. For the 4310 & 2310 series radios SW1-2 can be set to OFF to apply continuous RTS to Radio 1. For the 4710 & 9710 with modem types A, C, D, E, or M, set SW1-2 to ON and use the diagnostic command CKEY ON instead of SW1-2 for keying.

- <u>P70 Radio 1</u>: x710 or x310 MAS remotes. Radio 1 is the Transmitter for this version. Operation in switched carrier mode is generally recommended to reduce the power consumption and heat generation. DSP series MAS radios like the x710 can key from J3-4 RTS or use DATAKEY mode. Older x310 radios only key on RTS for digital data. Continuous keying is possible, if the optional Fan is installed, by setting SW1-2 off for the x310 radios, or by the command CKEY ON for the x710 DSP series radios. Transmit Data is from J3-2 TXD. The TX frequency must match the installed Duplexer, the RX frequency is not important for Radio 1 as it is used for Transmit only. (For best performance with a 2310 series remote set the RX frequency 23 MHz higher than TX.)
- <u>P70 Radio 2</u>: Same type as Radio 1. Radio 2 is the Receiver for this version. Data is on J3-3 RXD, and carrier detect is on J3-8 DCD. The RX frequency must match the installed Duplexer, the TX frequency is not important for Radio 2 as it is used for Receive only.

Host Radio Settings: Compatible MDS Master Station or Remote with the same modem type.

Remote Radios: n/a for this version.

- <u>Antenna Considerations</u>: If the P70 is a Remote use a directional antenna aimed toward the Host radio site; If the P70 is a Master use an omnidirectional antenna.
- Synchronous Data: The clock signals RXC (Radio 2), TXC and ETC (radio 1) are available on the RTU connector J3. Check your radio manual for supported modes.
- <u>Diagnostics</u>: Use your Handheld Terminal or Computer Terminal directly to the remote for Local diagnostics. See your radio manual for details. Over the air diagnostics is not supported on this version P70.
- Orderwire Voice with VOX keying is supported on the x710 DSP series remotes, and the x310 MAS remotes. Plug the telephone handset into J9 and when you talk into the handset Radio 1 will key in Analog Mode to communicate with someone at the host site. To use the orderwire feature with the Revision A Interface Board, Radio 1 needs to set for Analog mode by typing MODEM NONE on the Handheld Terminal or PC Terminal. The Revision B 03-3900A02 Interface board will automatically switch the remote to Analog mode. The board revision can be identified by looking at the marking silk screened on the corner of the board near the radios. (The revision marked on the paper label is not the same.)
- <u>Sleep Mode</u>: Grounding J3 pin 12 will put both radios into their low power sleep mode. Pin 12 is pulled to +5V internally, but can be pulled as high as +14V, do not apply negative voltages. See your radio manual for details of the power used in sleep mode and the wake-up time required.

### P70 Application Note 3 Duplex MAS Repeater

- <u>Product Description</u>: The P70 Packaged Remote is one or two remote radios with a power supply, optional battery, control circuitry and space for a customer s RTU or PLC all on a 19 baseplate which can be rack mounted or supplied with a weather resistant NEMA 4x enclosure. This versatile package is ideal for Repeaters, Tail-End-Links or Redundant systems.
- <u>Configurations Available</u>: Eight standard configurations are available. Types 1—7 use the 03-3900A02 Interface Logic Board, and type 8 uses the 03-3306A02 Redundant Interface Board. Types 2 & 3 are for Licensed MAS only and use duplexers. Type 4 can mix Licensed MAS radios with Spread Spectrum radios, or other MAS radios and can have different modem types for the two radios as long as the RS-232 port speeds match. Types 5 & 6 are for Spread Spectrum remotes only. The application notes are numbered the same way. Application Note 0 contains general information about the P70 and switch setting charts for all listed configurations.
  - 1) Single Remote
  - 2) Duplex Remote / Master / Polling Remote (1 TX/RX frequency pair)
  - 3) Duplex MAS Repeater (1 TX/RX frequency pair)
  - 4) Tail End Link Repeater (2 TX/RX frequency pairs)
  - 5) Spread Spectrum Peer to Peer Repeater
  - 6) Spread Spectrum Repeater
  - 7) Dual RTU Interface
  - 8) Redundant Remote

### This Configuration: This application discusses: Mode 3) Duplex MAS Repeater.

For this version Radio 2 is used as a Receiver and Radio 1 is used as a Transmitter. All data received by Radio 2 will be simultaneously re-sent by Radio 1, and provided to the RTU port J3-3 RXD. The transmitter will key as needed by using "Key on Squelch", "Key on Data" or an RTS signal applied to J3-4 RTS. TX Data is only accepted from one source at a time. When the Transmitter is keyed by the RTU port J3-4 RTS, it activates a data switch, and Transmitter Data from J3-2 TXD will be used instead of Radio 2 RXD. After RTS drops, the normal repeater operation will resume.

All x710 radio types should have the Alarm output set to produce Major alarms only, see P70 Application Note 0 for details. For 4 Wire Analog interfacing see P70 Application Note 0.



### Block Diagram:

<u>P70 Interface Board Settings</u>: For switch settings refer to P70 Application Note 0, General Information. These set the CTS delay for the RTU port to 10 mS and the Transmitter to Switched-Carrier Mode. It is best to let the P70 key as needed to send data rather than operate continuously keyed to avoid the additional heat and power consumption. Operation with the transmitter continuously keyed is possible if the optional Fan is installed, and the proper keying method is used for the radio type.

SW1-1 controls the RTU port (J3) CTS Delay of 10 mS (on) or 20 mS (off) and will need to change for some applications.

SW1-2 sets the RTS for Radio 1 to Continuous (off) or Switched (on). Setting SW1-2 On will allow Radio 1 to key as needed when RTS at J3-4 is asserted, or when Radio 2 receives a signal. In this mode SW1-7 will provide an RTS hold time of either 1 mS (on) or 20 mS (off) to keep the transmitter keyed briefly after the keying source drops. This helps keep the RF link active and prevents short carrier dropouts between messages to reduce errors in P70 Repeaters using x310 or x710**B** radios.

Setting SW1-2 Off will provide continuous RTS to Radio 1. This is only valid with 2310, 4310 and x710**B** remotes and requires the optional cooling fan to prevent heat buildup in the AC supply and transmitter. (For x710**A**, **C**, **D**, **E** or **M** remotes see the discussion below.) Continuous RTS will keep the repeater continuously keyed after a short delay when power is first applied. The Time Out Timer must be disabled for this mode by issuing the diagnostic command DTOT to the radio. Refer to your radio manual for additional details.

SW1-2 must be On for MDS x710A, C, D, E or M DSP series remotes. The keying mode which works best for most installations is to "key on data". This setting is required if the P70 is communicating with a Half-Duplex Host such as an x710A remote. Radio 1 should be set to DATAKEY ON, and RTS1 disabled on the Interface board by setting SW2-3 off (revision C or later Interface Boards). In this mode, the RX data from Radio 2 will automatically key Radio 1 and be re-transmitted. The local RTU port J3 can also send data to Radio 1 but must use RTS/CTS handshaking to activate the RTU port.

When the P70 Repeater is used with a Full Duplex Master Station, another keying option would be to set Radio 1 DATAKEY OFF and enable the Radio 1 RTS input by setting SW2-3 On. (All board revisions support this mode.) Duplex Masters are compatible with RTS Hold (SW1-7) set for either 1 or 20 mS. Radio 1 will key when Radio 2 squelch opens.

The MDS x710A, C, D, E or M DSP series remotes can be continuously keyed if necessary by issuing the CKEY ON command for Radio 1 and requires the optional cooling fan to prevent heat buildup in the AC supply and transmitter. This command also disables the Time Out Timer. See your radio manual for diagnostic commands and procedures.

<u>P70 Radio 1</u>: Any x710 or x310 Licensed MAS remotes. Radio 1 is the Transmitter for this version. It will key when Radio 2 receives a signal, or from J3-4 RTS, or can be continuous keyed as described above if the optional fan is installed. Transmit Data is from Radio 2 RXD or if J3-4 RTS is high, from J3-2 TXD. The TX frequency must match the installed Duplexer, the RX frequency is not important for Radio 1 as it is used for Transmit only. It is typically set the same as Radio 2 to make them interchangeable. (For best performance with a 2310 series

remote set the RX frequency 23 MHz higher than TX.) The radio CTS is not used and can be set to 0.

- <u>P70 Radio 2</u>: Always the same modem type as Radio 1. (Radios could be mixed such a 4310 and 4710B as long as they have the same modem type.) Radio 2 is the Receiver for this version. Radio 2 data is available on J3-3 RXD, and is connected to Radio 1 TXD. Carrier detect is on J3-8 DCD. The RX frequency must match the installed Duplexer, the TX frequency is not important for Radio 2 as it is used for Receive only. It is typically set the same as Radio 1 to make them interchangeable. For radios with programmable RS-232 port rates, the two radios must be set the same. For x310 or x710B remotes, set the receiver to handle Switched Carrier signals. (See your radio manual for the command or switch setting)
- Host Radio Settings: This section will be divided into two parts, first the newer DSP based radios such as the x710A, C, D, E or M. Secondly, the x310 radios including the x710B will be covered. The Host radio will have the same TX & RX frequencies as the Remotes and the P70 Repeater will have the frequencies reversed from them. The Host must not be continuously keyed. It will only key to send data then unkey to allow another radio to use the P70 repeater.

1) Using a x790 Full Duplex Master Station as a Host, or Half Duplex x710, the CTS, PTT and SCD can be at the default of 0 mS with the P70 repeater either continuous keyed or switched carrier mode using modem types A, C, D, E or M.

2) To use the P70 repeater with a 2100 or 4100 Host system, there are several things to consider. First, the radios in the P70 must be either x310 type or x710B "Inter-operable" to have a compatible modem type of 9600, 4800 or 1200 bps. Set up your 2100/4100 Master as a "Polling Remote" with 10 mS CTS delay if the P70 is continuous keyed or use 20 mS CTS if the P70 is in switched carrier mode. See your Master Station manual — CTS is a jumper setting for the 9600 baud modem and a resistor change for the 4800 and 1200 bps modems.

<u>Remote Radios</u>: The remotes will typically be the same radio type as the P70 radios. If they are x710**A**, **C**, **D**, **E** or **M**, no special settings are needed.

If the system is utilizing the x310 or x710**B** radios, and the P70 is in switched carrier TX mode, the CTS delay must be set to 20 mS and the receiver must be set to handle switched carrier signals. (See your radio manual for the command or switch setting.) Also for x710**B** radios, 10 mS PTT delay is needed at the remotes. For a continuous keyed P70 repeater, 10 mS CTS delay, and 5 mS PTT delay is needed at the remotes and the receiver must be set for a "continuous keyed master". (See your radio manual for the command or switch setting.)

Data Synchronizer Board: This is a plug in addition to the 3900A02 Interface Board which removes any jitter or timing imperfections in the received data before sending it to the transmitter. The primary need for this is when the receiver is a 4800 baud x310 or x710**B**. (The Data Sync Bd. switches for 4800 bps 10 bits is: SW1-1&3 Closed, 2&4 open). To enable the 3900A02 Interface board to use the D.S. Bd. SW1-5 must be On. To compensate for the delay in the D.S. board additional CTS delay may be needed in the Host and Remotes. The Rev. A Interface board requires the Host Transmitter to have an additional 5 mS of SCD delay to keep the transmitter keyed for a brief time and allow the Data Sync board buffer to clear before dropping the carrier. The revision B and later boards will work with the default SCD of the Host.

Synchronous Data: Not supported on this configuration.

<u>4 Wire Analog</u>: With the receiver analog output jumpered to the transmitter input (J5-1&3, 2&4) the P70 will function as an analog repeater. Both radios must be set up for analog data (MODEM NONE for x710) and have the audio levels set compatible. For the x710 use the diagnostic command TXLEVEL –10 and RXLEVEL —10. If a local RTU is tied into the J5 audio jumpers, the TX level must be compensated to provide the proper transmitter deviation for both audio sources.

Antenna Considerations: Typically an omnidirectional antenna will be used.

- <u>Diagnostics</u>: Use your Handheld Terminal or Computer Terminal directly to the remote for Local diagnostics. See your radio manual for details. Over the air diagnostics is not supported on the full duplex P70.
- Orderwire Voice with VOX keying is supported on the x710 DSP series remotes, and the x310 MAS remotes. Plug the telephone handset into J9 and when you talk into the handset Radio 1 will key in Analog Mode to communicate with someone at the host site. To use the orderwire feature with the Revision A Interface Board, Radio 1 needs to set for Analog mode by typing MODEM NONE on the Handheld Terminal or PC Terminal. The Revision B 03-3900A02 Interface board will automatically switch the remote to Analog mode. The board revision can be identified by looking at the marking silk screened on the corner of the board near the radios. (The revision marked on the paper label is not the same.)
- <u>Sleep Mode</u>: Grounding J3 pin 12 will put both radios into their low power sleep mode. Pin 12 is pulled to +5V internally, but can be pulled as high as +14V, do not apply negative voltages. See your radio manual for details of the power used in sleep mode and the wake-up time required.

### **<u>P70 Application Note 4</u>** Tail End Link Repeater

- <u>Product Description</u>: The P70 Packaged Remote is one or two remote radios with a power supply, optional battery, control circuitry and space for a customer s RTU or PLC all on a 19 baseplate which can be rack mounted or supplied with a weather resistant NEMA 4x enclosure. This versatile package is ideal for Repeaters, Tail-End-Links or Redundant systems.
- Configurations Available: Eight standard configurations are available. Types 1—7 use the 03-3900A02 Interface Logic Board, and type 8 uses the 03-3306A02 Redundant Interface Board. Types 2 & 3 are for Licensed MAS only and use duplexers. Type 4 can mix Licensed MAS radios with Spread Spectrum radios, or other MAS radios and can have different modem types for the two radios as long as the RS-232 port speeds match. Types 5 & 6 are for Spread Spectrum remotes only. The application notes are numbered the same way. Application Note 0 contains general information about the P70 and switch setting charts for all listed configurations.
  - 1) Single Remote
  - 2) Duplex Remote / Master / Polling Remote (1 TX/RX frequency pair)
  - 3) Duplex MAS Repeater (1 TX/RX frequency pair)
  - 4) Tail End Link Repeater (2 TX/RX frequency pairs)
  - 5) Spread Spectrum Peer to Peer Repeater
  - 6) Spread Spectrum Repeater
  - 7) Dual RTU Interface
  - 8) Redundant Remote

### This Configuration: This application discusses: Mode 4) Tail End Link Repeater

For this version Radio 1 is used as a Transceiver to the Host and Radio 2 is used as a Transceiver to the Remotes. The local RTU port J3 interfaces with Radio 1 to the Host. This is one of the most versatile configurations of the P70 because the radios can be different types and act as an interface between incompatible systems such as Licensed MAS to Un-licensed Spread Spectrum, or between different modem types, data rates, or frequencies. All x710 and x810 radio types should have the Alarm output set to produce Major alarms only, see P70 Application Note 0 for details.

One important consideration for the Tail End Link is the isolation between the two antennas to avoid interference between the two radios since there is no duplexer. The amount of isolation will depend on the frequency difference between the transmitter and receiver for both directions, Radio 1 TX, to Radio 2 RX and Radio 2 TX to Radio 1 RX. Small splits less than 5 MHz will require special attention to antenna placement to achieve acceptable performance.

In the Tail End Link mode the P70 acts as a bi-directional repeater with receive data being retransmitted in both directions. This version has three basic operating modes whereby each transceiver can key the other one by squelch opening, by the use of the "CTS KEY" mode or "Key on Data" mode. The choice is often dictated by the type of radios being used, and may be different for Radio 1, and Radio 2. Setting the keying mode involves both the Interface Board switches and the radio settings. If they are not in the same mode, undesirable operation will result.

The x810 Spread Spectrum radios and the x710A, C, D, E and M generally use "CTS KEY" to activate the other transmitter. CTS KEY mode is a transceiver mode which needs to be activated by using the diagnostic command DEVICE CTS KEY. In this mode, a remote will raise its CTS line immediately after receiving a valid signal, and output data from the receiver data buffer a few milliseconds later. The interface board then raises RTS on the other remote and the data will be re-transmitted. The time delay for the data is controlled by the CTS delay.

The x310 and x710**B** remotes use "Key on Squelch" to activate the other transmitter unless it supports DATAKEY mode. For Key on Squelch mode the interface board will raise RTS on the other radio when the squelch on a receiver opens. Each radio in the P70 can be controlled independently, and may use a different technique to key the other remote. The Interface board switches and radios both must be set correctly for the P70 to work properly. See your transceiver manual for diagnostic commands, and P70 Application Note 0 "General Information" for switch settings.

Another option is to set the transmitters to DATAKEY mode. This is always used for Spread Spectrum remotes and can be used for the x710A, C, D, E and M. The x310 transmitter does not support this mode. With this mode a transmitter will key when data is applied to the TXD input. RTS is still required for the J3 RTU port to send data.

#### 

<u>P70 Interface Board Settings</u>: For switch settings refer to P70 Application Note 0, General Information.

- <u>P70 Radio 1</u>: This radio is intended to provide the link to the Host radio and has an interface to the RTU port J3. The modem type and frequencies must be compatible with the Host radio. The RS-232 port speed must match Radio 2. For x710 and x310 radios set the receiver to switched carrier mode. Use the diagnostic command SWC ON for the x710 radios.
- <u>P70 Radio 2</u>: This radio is intended to interface with the Remotes which the Host is unable to communicate with due to geographic location, modem type or frequency difference. The only parameter which must match Radio 1 is the RS-232 port speed. For x710 and x310 radios set the receiver to switched carrier mode. Use the diagnostic command SWC ON for the x710 radios.

<u>Host Radio Settings</u>: This section will be divided into two parts, first the newer 9790 & 4790 DSP based Master Stations. Secondly, the 2100 & 4100 Master Stations. The Host radio must have compatible frequencies and modem type for P70 Radio 1.

Using a x790 Master Station as a Host, the CTS, PTT and SCD delays can generally be at the default of 0 mS. The transmitter must operate in switched carrier mode with CKEY OFF.

To use the P70 with a 2100 or 4100 Host system, there are several things to consider. First, the radios in the P70 must be either x310 type or x710**B** "Inter-operable" to have a compatible modem type of 9600, 4800 or 1200 bps. Set up your x100 Master using Switched Carrier TX, not continuous keyed. The required CTS delay will vary depending on the radio types for the P70 and remotes, 20-25 mS will typically be needed. See your Master Station manual — CTS is a jumper setting for the 9600 baud modem and a resistor change for the 4800 and 1200 bps modems.

- <u>Remote Radios</u>: Same type as Radio 2. Depending on the radio types in the system the CTS delay may need to be increased to 20 mS or greater to allow time for the P70 repeater to key.
- Data Synchronizer Board: This is a plug in addition to the 3900A02 Interface Board which removes any jitter or timing imperfections in the received data before sending it to the transmitter. The primary need for this is when the receiver is a 4800 baud x310 or x710**B**. The data is buffered in both directions, from Radio 1 to 2 and Radio 2 to 1 automatically. (The D.S. Bd. switches for 4800 bps, 10 bits is: SW1-1, & 3 Closed). To enable the 3900A02 Interface board to use the D.S. Bd. SW1-5 must be On. The Rev. A Interface board requires the Host Transmitter to have an additional 5 mS of SCD delay to keep the transmitter keyed for a brief time and allow the Data Sync board buffer to clear before dropping the carrier. The revision B and later boards will work with the default SCD of the Host.

Synchronous Data: Not supported on this configuration.

- <u>Antenna Considerations</u>: Radio 1 should use a directional antenna to the Host and Radio 2 will use an omnidirectional antenna with vertical separation to avoid interference. The Host and Remotes use directional antennas toward the P70.
- <u>Diagnostics</u>: Use your Handheld Terminal or Computer Terminal directly to the remote for Local diagnostics. See your radio manual for details. This mode supports Network Wide Diagnostics from the Host to the P70 and Remotes when the diagnostic ports on Radio 1 and Radio 2 are connected utilizing the white Null Modem RJ11 Diagnostic cable (03-2198A15). DTMF diagnostics is not supported as used on the 2100 and 4100 Masters.
- Orderwire Voice with VOX keying is supported on the x710 DSP series remotes, and the x310 MAS remotes. Plug the telephone handset into J9 and when you talk into the handset Radio 1 will key in Analog Mode to communicate with someone at the host site. To use the orderwire feature with the Revision A Interface Board, Radio 1 needs to set for Analog mode by typing MODEM NONE on the Handheld Terminal or PC Terminal. The Revision B 03-3900A02 Interface board will automatically switch the remote to Analog mode. The board revision can

be identified by looking at the marking silk screened on the corner of the board near the radios. (The revision marked on the paper label is not the same.)

<u>Sleep Mode</u>: Grounding J3 pin 12 will put both radios into their low power sleep mode. Pin 12 is pulled to +5V internally, but can be pulled as high as +14V, do not apply negative voltages. See your radio manual for details of the power used in sleep mode and the wake-up time required.
#### **P70 Application Note 5** Spread Spectrum Peer to Peer Repeater

- <u>Product Description</u>: The P70 Packaged Remote is one or two remote radios with a power supply, optional battery, control circuitry and space for a customer s RTU or PLC all on a 19 baseplate which can be rack mounted or supplied with a weather resistant NEMA 4x enclosure. This versatile package is ideal for Repeaters, Tail-End-Links or Redundant systems.
- <u>Configurations Available</u>: Eight standard configurations are available. Types 1—7 use the 03-3900A02 Interface Logic Board, and type 8 uses the 03-3306A02 Redundant Interface Board. Types 2 & 3 are for Licensed MAS only and use duplexers. Type 4 can mix Licensed MAS radios with Spread Spectrum radios, or other MAS radios and can have different modem types for the two radios as long as the RS-232 port speeds match. Types 5 & 6 are for Spread Spectrum remotes only. The application notes are numbered the same way. Application Note 0 contains general information about the P70 and switch setting charts for all listed configurations.
  - 1) Single Remote
  - 2) Duplex Remote / Master / Polling Remote (1 TX/RX frequency pair)
  - 3) Duplex MAS Repeater (1 TX/RX frequency pair)
  - 4) Tail End Link Repeater (2 TX/RX frequency pairs)
  - 5) Spread Spectrum Peer to Peer Repeater
  - 6) Spread Spectrum Repeater
  - 7) Dual RTU Interface
  - 8) Redundant Remote
- <u>This Configuration</u>: This application discusses: Mode 5) Spread Spectrum Peer to Peer Repeater.
  For this version Radio 2 is used as a Receiver and Radio 1 is used as a Transmitter. They both communicate with all other radios in the system and utilize the same Network Address. This mode has the advantage that any of the remote sites could act as the Host, and all other sites will receive the data. All data received by Radio 2 will be simultaneously re-sent by Radio 1 to all radios in the system. The other common Spread Spectrum Repeater is mode 6 which would be a better choice for some applications where one Host Radio controls all communications. All x810 radios should have the Alarm output set to produce Major alarms only, see P70 Application Note 0 for details.

#### Block Diagram:



# <u>P70 Interface Board Settings</u>: For switch settings refer to P70 Application Note 0, General Information.

<u>P70 Radio 1</u>: 9810, 24810. Same Network Address as all remotes in the system. Set to Mode Master.

<u>P70 Radio 2</u>: Same type as radio 1. Same Network Address as radio 1. Set to Mode R-M.

Host Radio Settings: Same type as radio 1. Same Network Address as radio 1. Set to Mode Remote.

Remote Radios: Same type as radio 1. Same Network Address as radio 1. Set to Mode Remote.

<u>Antenna Considerations</u>: Radio 1 and Radio 2 each will use omnidirectional antennas with vertical separation to avoid interfering with each other. Host and Remotes use directional antennas toward the P70.

Synchronous Data: Not supported for this version.

Diagnostics: Not supported on this version.

<u>Sleep Mode</u>: Grounding J3 pin 12 will put both radios into their low power sleep mode. Pin 12 is pulled to +5V internally, but can be pulled as high as +14V, do not apply negative voltages. See your radio manual for details of the power used in sleep mode and the wake-up time required.

#### **P70 Application Note 6** Spread Spectrum Repeater

- <u>Product Description</u>: The P70 Packaged Remote is one or two remote radios with a power supply, optional battery, control circuitry and space for a customer s RTU or PLC all on a 19 baseplate which can be rack mounted or supplied with a weather resistant NEMA 4x enclosure. This versatile package is ideal for Repeaters, Tail-End-Links or Redundant systems.
- <u>Configurations Available</u>: Eight standard configurations are available. Types 1—7 use the 03-3900A02 Interface Logic Board, and type 8 uses the 03-3306A02 Redundant Interface Board. Types 2 & 3 are for Licensed MAS only and use duplexers. Type 4 can mix Licensed MAS radios with Spread Spectrum radios, or other MAS radios and can have different modem types for the two radios as long as the RS-232 port speeds match. Types 5 & 6 are for Spread Spectrum remotes only. The application notes are numbered the same way. Application Note 0 contains general information about the P70 and switch setting charts for all listed configurations.
  - 1) Single Remote
  - 2) Duplex Remote / Master / Polling Remote (1 TX/RX frequency pair)
  - 3) Duplex MAS Repeater (1 TX/RX frequency pair)
  - 4) Tail End Link Repeater (2 TX/RX frequency pairs)
  - 5) Spread Spectrum Peer to Peer Repeater
  - 6) Spread Spectrum Repeater
  - 7) Dual RTU Interface
  - 8) Redundant Remote

#### This Configuration: This application discusses: Mode 6) Spread Spectrum Repeater

For this version Radio 1 is used as a Transceiver to the Host and Radio 2 is used as a Transceiver to the Remotes. The local RTU port interfaces with Radio 1. One network address is used for Radio 1 and the Host Radio, and a different network address is used for Radio 2 and all Remotes in the system. To avoid interference, both P70 Remotes are set to Mode Master and the Host and Remotes are set to Mode Remote . All x810 radios should have the Alarm output set to produce Major alarms only, see P70 Application Note 0 for details.

The other common Spread Spectrum Repeater is mode 5 which would be a better choice for some applications where it is important for all radios to hear each other.

#### Block Diagram:



- <u>P70 Interface Board Settings</u>: For switch settings refer to P70 Application Note 0, General Information.
- P70 Radio 1: 9810, 24810. Same Network Address as the Host. Set to Mode Master .
- <u>P70 Radio 2</u>: 9810, 24810. Different Network Address from radio 1. Same Network Address as the Remotes. Set to "Mode Master".

Host Radio Settings: Same type as radio 1. Same Network Address as radio 1. Set to Mode Remote.

- Remote Radios: Same type as radio 2. Same Network Address as radio 2. Set to Mode Remote.
- <u>Antenna Considerations</u>: Radio 1 should use a directional antenna to the Host and Radio 2 will use an omnidirectional antenna with vertical separation to avoid interference. The Host and Remotes use directional antennas toward the P70.

Synchronous Data: Not supported for this version.

- <u>Diagnostics</u>: Use your Handheld Terminal or Computer Terminal directly to the remote for Local diagnostics. See your radio manual for details. This mode supports Network Wide Diagnostics from the Host to the P70 and Remotes when the diagnostic ports on Radio 1 and Radio 2 are connected utilizing the white Null Modem RJ11 Diagnostic cable (03-2198A15).
- <u>Sleep Mode</u>: Grounding J3 pin 12 will put both radios into their low power sleep mode. Pin 12 is pulled to +5V internally, but can be pulled as high as +14V, do not apply negative voltages. See your radio manual for details of the power used in sleep mode and the wake-up time required.

### P70 Application Note 7 Dual RTU Interface

- <u>Product Description</u>: The P70 Packaged Remote is one or two remote radios with a power supply, optional battery, control circuitry and space for a customer s RTU or PLC all on a 19 baseplate which can be rack mounted or supplied with a weather resistant NEMA 4x enclosure. This versatile package is ideal for Repeaters, Tail-End-Links or Redundant systems.
- Configurations Available: Eight standard configurations are available. Types 1—7 use the 03-3900A02 Interface Logic Board, and type 8 uses the 03-3306A02 Redundant Interface Board. Types 2 & 3 are for Licensed MAS only and use duplexers. Type 4 can mix Licensed MAS radios with Spread Spectrum radios, or other MAS radios and can have different modem types for the two radios as long as the RS-232 port speeds match. Types 5 & 6 are for Spread Spectrum remotes only. The application notes are numbered the same way. Application Note 0 contains general information about the P70 and switch setting charts for all listed configurations.
  - 1) Single Remote
  - 2) Duplex Remote / Master / Polling Remote (1 TX/RX frequency pair)
  - 3) Duplex MAS Repeater (1 TX/RX frequency pair)
  - 4) Tail End Link Repeater (2 TX/RX frequency pairs)
  - 5) Spread Spectrum Peer to Peer Repeater
  - 6) Spread Spectrum Repeater
  - 7) Dual RTU Interface
  - 8) Redundant Remote

### <u>This Configuration</u>: This application discusses: **Mode 7**) **Dual RTU Interface**

This version uses the Interface board only to provide DC power to the radios. The Data and Control connections are made directly to each radio's DB-25 Interface connector. This version is intended only for customers who need access to both radios for a special application. If ordered in this fashion it can be converted to any other mode 1-7 by hooking up the cables and setting the switches. All x710 and x810 radio types should have the Alarm output set to produce Major alarms only, see P70 Application Note 0 for details.

#### Block Diagram:



<u>P70 Interface Board Settings</u>: 3900A02 Rev. A. Switches are all off, unused. This version bypasses the Interface Board except for the radio power. User connections are to the individual radio DB-25 connectors. Refer to your radio manual for connections.

P70 Radio 1: x710, x810, x310

P70 Radio 2: x710, x810, x310

Host Radio Settings: No special settings.

Remote Radios: No special settings.

Synchronous Data: The clock signals RXC, TXC and ETC are available on the radio DB-25 connectors. Check your radio manual for supported modes.

Antenna Considerations: No special requirements.

<u>Diagnostics</u>: Diagnostics are the same as the individual remote. Orderwire not supported because the Interface board is not used.

<u>Sleep Mode</u>: As supported by the Remotes used.

### P70 Application Note 8 Redundant Remote

- <u>Product Description</u>: The P70 Packaged Remote is one or two remote radios with a power supply, optional battery, control circuitry and space for a customer s RTU or PLC all on a 19 baseplate which can be rack mounted or supplied with a weather resistant NEMA 4x enclosure. This versatile package is ideal for Repeaters, Tail-End-Links or Redundant systems.
- <u>Configurations Available</u>: Eight standard configurations are available. Types 1—7 use the 03-3900A02 Interface Logic Board, and type 8 uses the 03-3306A02 Redundant Interface Board. Types 2 & 3 are for Licensed MAS only and use duplexers. Type 4 can mix Licensed MAS radios with Spread Spectrum radios, or other MAS radios and can have different modem types for the two radios as long as the RS-232 port speeds match. Types 5 & 6 are for Spread Spectrum remotes only. The application notes are numbered the same way. Application Note 0 contains general information about the P70 and switch setting charts for all listed configurations.
  - 1) Single Remote
  - 2) Duplex Remote / Master / Polling Remote (1 TX/RX frequency pair)
  - 3) Duplex MAS Repeater (1 TX/RX frequency pair)
  - 4) Tail End Link Repeater (2 TX/RX frequency pairs)
  - 5) Spread Spectrum Peer to Peer Repeater
  - 6) Spread Spectrum Repeater
  - 7) Dual RTU Interface
  - 8) Redundant Remote

#### This Configuration: This application discusses: Mode 8) Redundant Remote

This version operates as a single remote with a backup radio. The active radio is connected to the antenna and RTU port, while the standby radio is powered off. Switch-over will occur when the active radio has a Major Alarm or when the manual switch is placed in the "A" or "B" position. The P70 power supply and antenna get switched to the active radio by the Interface Board. An optional second antenna connection is available for added redundancy.

Block Diagram:



P70 Interface Board Settings: 3306A02 Interface Board: No settings.

<u>P70 Radio 1</u>: Any MDS x710 or x810 remote. Special settings are required. Use the HHT or terminal to enter the command: INIT xx20 (Where xx are the first two digits of the MDS transceiver model number, three digits for the 24810) to invert the sense of the Alarm pin 25 on the DATA INTERFACE connector and set up other parameters. Use the "A-AUTO-B" switch to select radio A or B for programming, then place the switch back into AUTO. If a Major alarm occurs in the active radio, the Interface board will automatically switch operation to the backup radio. (Examples: INIT 9820 or INIT 24820 or INIT 9720)

P70 Radio 2: Same as radio 1.

Host Radio Settings: No special settings.

Remote Radios: n/a.

<u>Antenna Considerations</u>: Typically the Remote will use a directional antenna to the Host radio. As an option, this version can be ordered with two antennas for additional redundancy.

Synchronous Data: Not supported for this version.

<u>Diagnostics</u>: Diagnostics are the same as the individual remote. An Alarm output is available on J9 of the 3306A02 Interface Board. Pin 1 is the normally closed relay contact, Pin 3 is the normally open contact, and Pin 2 is common. These contacts are rated for 0.5 ampere at 125 VAC or 1.0 ampere at 24 VDC.

This version utilizes the 02-1297A01 Orderwire Module with the 12-1307A01 Handset for voice communications on radios which support analog audio such as the x710 and x310 series remotes. Not for use with x810 Spread Spectrum radio.

<u>Sleep Mode</u>: Not supported on this version.



# INDEX

## A

Alarm interface (Pin 25)—interface logic board 22 Application notes (see Appendix A) Assemblies, list of replaceable 46

### B

Battery backup operation 36 backup, replacement 41 backup, testing 40 charging check/adjustment 41 low-voltage disconnect feature 36

### С

Cable connections 17–25 antenna cable 19 ground 18 hand-held terminal 39 logic board 20 interface logic board (ILB) 20 redundant logic board (RLB) 23 orderwire handset 38 power board 18 CTS interface (Pin 5) interface logic board 21 redundant logic board 24

# D

DCD interface (Pin 8) interface logic board 21 redundant logic board 24 DSR interface (Pin 6) interface logic board 21 redundant logic board 24

### F

Fuses amperage ratings vs. P70 input voltage 42 replacement 42

## G

Ground Earth connection 18 signal ground (Pin 7) interface logic board 21 redundant logic board 24

### Η

Hand-held terminal

connecting to P70 39 illustrated 39

## 

Illustrations data synchronizer board 31 duplex mas repeater system 8 example system w/tail-end link rptr. 9 full duplex configuration (MAS remotes) 8 full duplex repeater (spread spectrum remotes) 11 hand-held terminal 39 interface logic board 20 loc. of battery reset switch SW1 37 loc. of voltage adjustment VR1 42 model number codes 2 P70 mounting dimensions 13 P70 Packaged Radio System 1 power board connection points 18 radio selection switch 36 redundant logic board connections 23 redundant station configuration 12 single remote configuration 7 system with full duplex remote 7 tail-end link repeater configuration 10 typical pole-mounted installation 16 typical rack mount installation 17 typical wall mount installation 14 vox board assembly 32 Installation 12-22 cable connections 17-25 final tasks 34 general considerations 12 mounting the P70 enclosure 13 pole mounting instructions 15 rack mount alternative 16 wall mounting instructions 14

### L

LEDs on interface logic board 44 on radio selection switch 35 on redundant logic board 44 on transceiver (see radio manual) Low-voltage disconnect feature 36

### М

Maintenance battery charging check/adjustment 41 battery replacement 41 fuse replacement 42 list of replaceable assemblies 46 preventive 40 Mounting dimensions 13



Mounting the P70 enclosure 13

# 0

Operation battery backup 36 battery reset switch 37 connecting an HHT 39 initial power-up 35 logic board features & indicators 38 radio selection switch 35 Orderwire connecting a handset 38

## Ρ

Pole mounting instructions 15 Power AC Input 19 accessory power out 19 backup battery 19 check supply voltage before applying (caution) 18 DC Input 18 initial power-up 35 low-voltage disconnect feature 36

### R

Rack mounting instructions 16 RTS interface connection (Pin 4) interface logic board 21 redundant logic board 24 RXD interface connection (Pin 3) interface logic board 21 redundant logic board 24

# T

Tables data sync. baud rate switch settings 32 F1/F2 fuse values 42 functional configurations 6 indicator board cabling 46 interface logic board cabling 45 interface logic board J3 (RTU port) connections 21 J2 accessory power pins 19 logic board features and indicators 38 options & accessories 4 P70 configuration 26 P70 replacement assemblies 46 P70 transceiver complement 3 peer-to-peer radio settings 33 power board cabling 46 product specifications 4 radio selection switch positions 36 redundant logic board cabling 45 redundant logic board J1 connections 24 spread spectrum repeater radio settings 34 SW1 & SW2 switch functions 29 troubleshooting chart 43 word length settings for data sync. board 31 Troubleshooting 43 table of symptoms and corrective actions 43 TXD interface connection (Pin 2)

interface logic board 21 redundant logic board 24

# U

Unpacking and inspection 12

### W

Wall mounting instructions 14

# IN CASE OF DIFFICULTY...

MDS products are designed for long life and trouble-free operation. However, this equipment, as with all electronic equipment, may have an occasional component failure. The following information will assist you in the event that servicing becomes necessary.

### FACTORY TECHNICAL ASSISTANCE

Assistance for MDS products is available from our Technical Services group during business hours (8:00 A.M.–5:30 P.M. Eastern Time). When calling, please give the complete model number of the radio, along with a description of the trouble symptom(s) that you are experiencing. In many cases, problems can be resolved over the telephone, without the need for returning the unit to the factory.

Please use the following telephone numbers for product assistance:

Phone: 585-241-5510	E-Mail: TechSupport@microwavedata.com
FAX: 585-242-8369	Web: www.microwavedata.com

### **FACTORY REPAIRS**

Component level repair of radio equipment is *not* recommended in the field. Many components are installed using surface mount technology, which requires specialized training and equipment for proper servicing. For this reason, the equipment should be returned to the factory for any PC board repairs. The factory is best equipped to diagnose, repair and align your radio to its proper operating specifications.

If return of the equipment is necessary, you will be issued a Service Request Order (SRO) number. The SRO number will help expedite the repair so that the equipment can be repaired and returned to you as quickly as possible. Please be sure to include the SRO number on the outside of the shipping box, and on any correspondence relating to the repair. *No equipment will be accepted for repair without an SRO number*.

A statement should accompany the radio describing, in detail, the trouble symptom(s), and a description of any associated equipment normally connected to the radio. It is also important to include the name and telephone number of a person in your organization who can be contacted if additional information is required.

The radio must be properly packed for return to the factory. The original shipping container and packaging materials should be used whenever possible. All factory returns should be addressed to:

Microwave Data Systems Inc. Customer Service Department (SRO No. XXXX) 175 Science Parkway Rochester, NY 14620 USA

When repairs have been completed, the equipment will be returned to you by the same shipping method used to send it to the factory. Please specify if you wish to make different shipping arrangements. To inquire about an in-process repair, you may contact our Product Services Group at 585-241-5540 (FAX: 585-242-8400), or via e-mail at ProductServices@microwavedata.com.

#### industrial/wireless/performance



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