TN100 System Installation and Troubleshooting

General Overview

Daniels radio systems are designed for operation in highly varied conditions. Your application may require high performance radio systems (intermod and selectivity) for operation in congested radio sites, or operation over wide temperatures using battery solar powered systems (low current drain). A synthesized radio may be appropriate for your emergency communications systems, or a crystal radio may be needed for your data application. Daniels manufactures a diverse range of radio products tailored to the type of operation you need.

The MT-3 radio system is characterized by high performance and reliability, whether it is a remote, low current repeater or a high performance base station. The total system is designed to provide dependable, low maintenance performance and great flexibility for expansion and servicing.

The MT-3 series of radio and control modules are packaged in the compact Eurostandard housing with anodized aluminum front panels, and are ruggedly designed for remote or transportable applications. All of the modules use high reliability components and corrosion resistant fasteners.

The MT-3 radio system is specifically designed to deliver high performance under adverse conditions. Voltage stress testing and a 24 hour burn-in is performed on the radio system and performance of the system at room temperature (25°C) is documented and measured. As an option, extensive environmental testing can be conducted over the temperature range - 40 °C to + 60 °C and the performance measured to ensure compliance with the design specifications.

A Daniels MT-3 radio system consists of seperate RF receiver and transmitter modules plugged into a standard 19” subrack. Each subrack also requires a control card and system monitor. External connections to the system (COR, PTT, audio, channel select, etc.) are made through an auxiliary connector on the rear of the subrack. An optional cable or terminal strip connector is available to connect externally through the auxiliary connector to the radio system. Most internal connections and control functions (audio routing, COR - PTT, CTCSS, hang timers) are controlled by the audio control card. Contact the factory for more information on the many custom configurations possible.

43 Erie Street
Victoria, B.C.
Canada V8V 1P8

Toll Free Canada & U.S.A.
Phone: 1-800-664-4066
Fax: 1-877-750-0004

International
Phone: 250-382-8268
Fax: 250-382-6139

Internet
e-mail: sales@danelec.com
web: www.danelec.com

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MT-3 Subrack

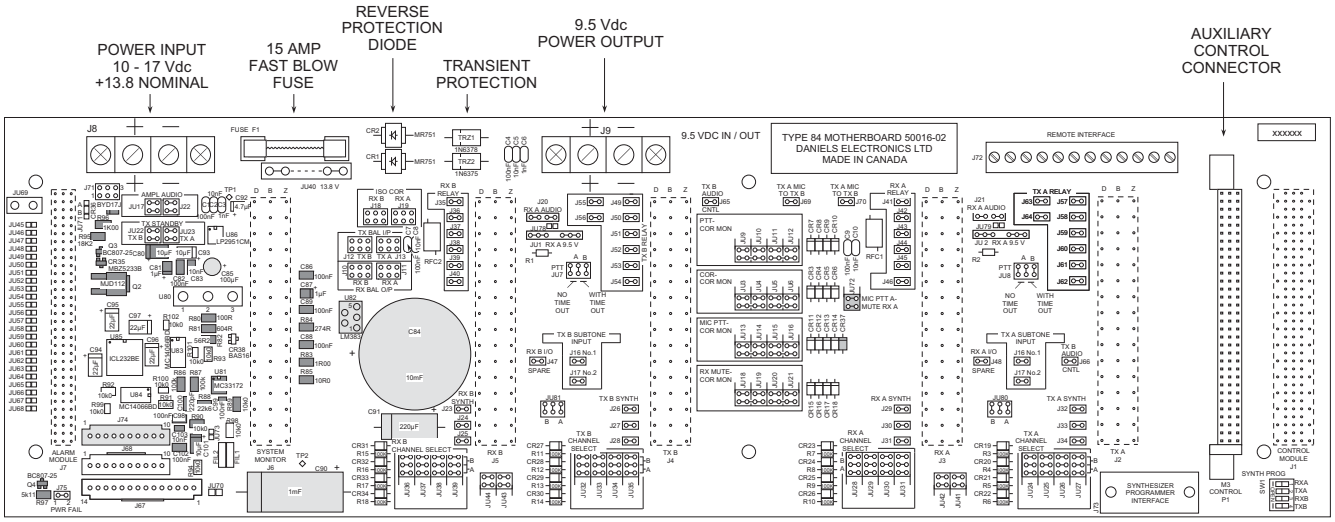
1. Ensure that the MT-3 Application Specific Manual is included with your system. This manual contains information specific to the configuration of the radio system. It includes test sheets for each transmitter, receiver and power amplifier, audio control card jumper lists, detailed instruction sheets for CTCSS and DTMF modules if purchased, and other specific information. Each custom sheet should have an Application number (Axxxx-xx) associated with that custom jumper setting, wiring, etc., as well as a Block diagram (Bxxxx-xx). Please use this number in any future orders for identical systems.

NOTE: If ordered as a system, instruction manuals for each module (subrack, system monitor, receiver, transmitter, etc.) are typically included with the equipment.

2. Ensure the main rack has enough room for the Daniels subrack to be installed. Each Daniels subrack requires 5 1/4" height (3 RU) and 13.5" (maximum) depth clearances.

3. Install the EIA standard 19" subrack units in main rack using four #10 x 3/4" screws. Use stainless steel screws if the equipment is to be placed in a corrosive environment. If necessary, remove the handles from the subrack to facilitate installation.

4. Interconnect primary power (10 - 16 Vdc, 13.8 Vdc nominal) to the Barrier Strip power input on the rear of the subrack (refer to drawing below). Use a wire gauge suitable for delivering the power required by the subrack(s).



5. If the subrack is using a DC - DC or AC Power Supply, refer to the specific manual supplied with the equipment for installation instructions.

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6. Interconnect +9.5 Vdc and +13.8 Vdc power between subrack units if one of the subracks does not include a system monitor (no system monitor is required for a second subrack with only power amplifiers mounted in it).

7. Install the modules in to the guide rail slots if not already configured. Adjust the guide rails for the correct module positions if required (see the SR-3 subrack instruction manual). When installing modules, ensure the quick release fasteners on the top and the bottom of the modules are in the unlocked (slot should be horizontal) position before insertion to the guide rails. To lock the quick release fasteners, push and turn the fastener 90 degrees with a flat screwdriver.

Note: MT-3 modules may be removed or inserted from the subrack while power is supplied without damaging the equipment.

8. Subrack and module operation is dependent on a series of shunts and jumpers throughout the RF modules, control modules and subrack. Review the Application Specific manual, and the receiver, transmitter and subrack manuals to confirm system operation.

9. If control of the radio system is handled by a third party controller, a terminal strip connector should be connected to the P1 auxiliary connector on the rear of the subrack. All wiring should be made to this screw-type terminal connector.

10. For some applications, a cable, not a terminal strip connector, is used to connect to the auxiliary connector. The cable must be plugged into the P1 auxiliary connector on the rear of the subrack. Ensure locking tabs on the connector are completely engaged.

Receiver and Transmitter Modules

1. Check the frequency label to confirm that the receiver or transmitter is set up to operate on the desired channel.

2. Connect the RF cables and ensure they are firmly screwed on.

3. Operate the transmitter with a 50 Ω load and confirm the power output is at the desired level. Adjust the internal RF power control (inside the transmitter) for the correct power level if required. This may be required for your nominal supply voltage if it is not 13.8 Vdc.

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4. Operate the receiver and ensure the sensitivity, squelch and squelch hysteresis are set to the desired levels. The point at which the squelch breaks is not necessarily the 12 dB SINAD sensitivity measurement for the receiver. The receiver has an internally adjustable squelch hysteresis control. This control allows a spread between the opening and closing of the squelch (i.e., the sensitivity of the receiver may be -117 dBm for 12 dB SINAD, but the squelch control could be set to unsquelch at -114 dBm and squelch at -120 dBm).

The hysteresis control, typically factory set to 6 dB, is located on the main receiver board. The purpose of this control is to allow a mobile or hand held radio to access the repeater with a "good" RF signal. The receiver will then hold the signal over the 6 dB range while the signal from the mobile or hand held radio is varying over this 6 dB range. This prevents the mobile or hand held radio from intermittently accessing the repeater in a marginal coverage area. To measure for 12 dBm SINAD sensitivity, press and hold the front panel squelch disable button while making the measurement. This opens the receiver for maximum sensitivity.

Daniels Power Amplifier Set-Up and Installation

1. Check the frequency label to confirm that the power amplifier is set up to operate at the desired frequency.

2. Install the power amplifier in the transmitter and receiver A or transmitter and receiver B slots as required. If the power amplifier is upgrading the power output of the radio system, ensure that the guide rails for the power amplifier are installed properly.

3. Connect the RF cables and ensure they are firmly screwed on.

4. Apply power to the subrack while measuring the RF power output. The RF output should be approximately 30 watts with a 13.8 Vdc supply voltage. If the power level must be changed adjust the exciter level (internal potentiometer) for the desired RF output (20 to 30 watts).

5. The VHF power amplifier has an 8 amp internal fuse. The fuse rating may be exceeded if the power amplifier is driven to levels of 40 to 50 watts output. Ensure the exciter output is set to the correct drive level and the VHF power amplifier is correctly tuned.

6. If the power amplifier is upgrading the power output of the radio system, check that the power feed to the subrack is able to handle the increased current.

7. Check that the exciter power output does not exceed the maximum power input to the amplifier. In some case the exciter may need to be replaced with a lower power version. VHF amplifier maximum power input is 4 Watts, and UHF maximum power input is 2 Watts.

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1.0 Motherboard

1.1 Modules Do Not Fit in Subrack

1. Check the guide rail positions (refer to the SR-3 subrack instruction manual). Relocate the guide rails if required.

2. Check the connectors on the back of the module for bent pins. Carefully straighten any bent pins if required.

1.2 No Supply Power

1. If a system monitor is part of the radio system, a quick check for power is to turn the audio switch to either A or B. If the LED turns on, power is present.

2. Inspect all power connections for continuity, polarity, etc.

3. Check the fuse on the M-3 Motherboard and replace if necessary (standard 15 amp fast blow). If fuse blows again go to section 1.3.

4. Check any fuses outside of the radio subrack(s) and replace if necessary. If fuse blows again go to section 1.3.

5. Check the subrack power input (terminal strip J8) and any batteries and/or power supplies for correct voltages. There should be +10 to +17 Vdc at the power input.

6. Measure the battery voltage at the system monitor if one is installed. Select the supply voltage function on the system monitor rotary switch and measure the voltage at the front panel test jacks. There should be +10 to +17 Vdc at this point.

7. If a system monitor is part of the radio system, jumper JU40 is usually not installed. Power is then routed through the system monitor. If the system monitor is not plugged in, the other modules will not have power. Ensure the system monitor is installed correctly.

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9. The system monitor has either a fuse (optional) or a fuse bypass jumper. Check the fuse if it is installed (rear panel). If no fuse is installed, remove the system monitor and test pins B2 and B4 on the rear of the monitor for continuity. There should be a connection between these pins to provide the power link.

10. Most modules require +9.5 Vdc power (internally regulated at the system monitor) as well as +13.8 Vdc (nominal supply voltage). If the system monitor is not functioning properly, this voltage may not be present. Check for +9.5 volts at the system monitor test jacks (select +9.5 Volts regulated). If +9.5 Vdc is not present, the system monitor fuse is good and +13.8 Vdc is present then a problem with the system monitor exists. Refer to the system monitor instruction manual for further information on troubleshooting.

1.3 M-3 Motherboard Fuse Keeps Blowing

1. If lightning has been reported in the area, check the transient protection diodes TRZ1 and TRZ2 on the motherboard. Replace if they are shorted or damaged.

2. Check the supply voltage for reversed connections. If the supply voltage was reversed, correct the situation and replace the fuse.

3. If a power amplifier is part of the system check that its output is at 30 watts maximum. It is possible to drive these units to an output of 50 watts. Under these conditions the fuse rating may be exceeded.

2.0 Transmitters

2.1 Low or No RF Output

1. Confirm all RF connectors are securely fastened.

2. Ensure the transmitter module(s) are fully plugged in to the subrack and the quick release fasteners are in the locked position.

3. Check power supplies by measuring them at the system monitor (section 1.2, step 6). Ensure there is no voltage drop across the DC power supply cables to the subrack when all transmitters are keyed (maximum current). Install heavier gauge wire if required.

4. If a power amplifier is installed, confirm the exciter level and the primary power are set for 30 watts power out (nominal supply voltage at +13.8 Vdc).

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5. If the VHF or UHF power amplifier O/T (Over Temperature) indicator is 'ON' this would indicate a severe power amplifier failure (refer to the service manual).

6. The TX indicator on the power amplifier indicates RF power is present in the module at the input to the low pass filter. If this LED is not on it may be due to:

a) Incorrect LED threshold setting (internal to the power amplifier).
b) Failed RF module. Check the supply current to the module (VHF requires approximately 5.5 A, UHF requires approximately 6.7 A).
c) Failed RF cable connector.
d) Failed antenna system.
e) Failed or incorrectly tuned duplexer or multi-coupler

Note 1: Be sure to consider connector, cable and Duplexer losses when measuring the RF power.
Note 2: The normal RF power levels are set at the factory with a nominal supply voltage of 13.8 Vdc. RF power will vary from +1 to -3 dB if your supply voltage is at the extreme higher or lower levels.
Note 3: Ensure the test equipment is calibrated correctly

2.2 Transmitter Modules Can Not Be Keyed by System

1. Ensure the transmitter module(s) are fully plugged in to the subrack and the quick release fasteners are in the locked position.

2. Make sure the PTT jumpers are installed on the MT-3 motherboard selecting PTT With Time Out (WTO) or PTT With No Time Out (NTO). Refer to the SR-3 subrack instruction manual for jumper options and locations.

3. Check the PTT system configuration on the audio control card.

3.0 Receivers

3.1 Receiver Squelch Does Not Break at 12 dB SINAD

1. The point at which the squelch breaks is not necessarily the 12 dB SINAD point. The receiver modules have an internally adjustable squelch hysteresis control. Refer to the receiver instruction manual for more information on this control.

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3.2 Receiver Has No Squelch Tail

1. The receive and transmit repeat is very fast. To create a squelch tail the transmitter PTT uses a hang timer to keep the transmitter keyed a moment longer after the input Tx key signal is removed. The hang timer circuitry is located on the audio contro cardl. Ensure that the hang timer is enabled and the hang timer adjustment potentiometer is set to an appropriate length of time. Refer to the audio control card manual for more information on this control.

3.3 Receiver(s) are Noisy and Exhibit Poor Sensitivity

1. Check the battery charging circuits and/or the power sources to determine that the DC charging circuits are not noisy. Try removing the battery charge source, then re-test the receiver. Repair or replace the charger if defective.

2. Examine all RF connectors thoroughly. Pull on the RF cables slightly and listen for any changes in the receivers performance. Check that the center pin of the RF connector is correctly mounted (captive center pin RF connectors should be used).

3. Check the duplexer alignment if the transmitter appears to de-sense the receiver module.

4. Review the installation area for any "data" or "clock" sources that may be causing harmful interference.

4.0 System Monitor

4.1 +9.5 Vdc Switching On and Off

1. Depending on the hysteresis settings in the SM-3 (factory standard is 8 Volts shut-off, 11 Volts turn-on - see system monitor instruction manual for different settings), the hysteresis circuits can oscillate if a battery cell fails (opens) and the subrack is in the receive mode. In the receive mode, the current drain is low and the "open" battery may still deliver the current required by the receiver circuitry. If the transmitter is activated when a receive signal is present (normal repeat), the battery may drop below the SM-3 hysteresis cutoff point, shutting the power (+9.5 Vdc) to the other subrack modules off, and reducing the load to the batteries. When the load is reduced, the battery voltage will increase and turn on the SM-3 hysteresis circuit. This condition causes the subrack modules to turn on and off which will not damage the radios but does indicate a serious failure in the battery system.

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5.0 Audio Control Cards

5.1 Deviation Between Receiver and Transmitter are Incorrect

1. Check the receiver output level using the extender card and note the impedance, either 600 Ω or 5 KΩ (refer to the MT-3 Application Specific Manual).

2. Check the transmitter input level using the extender card, and note the impedance, either 600 Ω or 5 KΩ.

3. Reset the audio level on the audio control card for the desired system deviation operation.

5.2 CTCSS Operation Incorrect

1. Check that the front panel switch is in the 'ON' position for CTCSS operation.

2. Encode / decode module can be selected for encode only, decode only or both. Check that the desired operation is selected (refer to the MT-3 Application Specific Manual).

3. The encode / decode frequency may be wrong. Use the DIP switches to select the correct frequency for encoding and decoding the same tone. To encode a tone different from the decoder a separate CTCSS module is used. Set this low current module using solder jumpers.

4. If a sub-audible tone appears on the repeat audio path check that the subtone filter on the audio control card is enabled or the receiver has its optional sub-tone filter installed.

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