



**EXTRACT FROM ACCUSPEED<sup>TM</sup>  
OPERATING INSTRUCTIONS FOR MRF 220  
MHz VHF TRANSCEIVER**



## WARNINGS



**WARNING:**

CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY CATTRON-THEIMEG™ COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT. FAILURE TO COMPLY WITH THIS WARNING MAY RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL AND DAMAGE TO EQUIPMENT.



**WARNING:**

TO SATISFY FCC RF EXPOSURE REQUIREMENTS FOR PORTABLE TRANSMITTING DEVICES, A SEPARATION DISTANCE OF 2.5 CM (APPROX. 1 INCH) OR MORE SHOULD BE MAINTAINED BETWEEN THE ANTENNA OF THE OCU AND PERSONS DURING DEVICE OPERATION. TO INSURE COMPLIANCE, OPERATION AT CLOSER THAN THIS DISTANCE IS NOT RECOMMENDED. THE ANTENNA USED FOR THIS TRANSMITTER MUST NOT BE CO-LOCATED IN CONJUNCTION WITH ANY OTHER ANTENNA OR TRANSMITTER. FAILURE TO COMPLY WITH THIS WARNING MAY RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL AND DAMAGE TO EQUIPMENT.



**WARNING:**

TO SATISFY FCC RF EXPOSURE REQUIREMENTS FOR MOBILE TRANSMITTING DEVICES, A SEPARATION DISTANCE OF 20 CM (APPROX. 8 INCHES) OR MORE SHOULD BE MAINTAINED BETWEEN THE ANTENNA OF THE LCU AND PERSONS DURING DEVICE OPERATION. TO INSURE COMPLIANCE, OPERATION AT CLOSER THAN THIS DISTANCE IS NOT RECOMMENDED. THE ANTENNA USED FOR THIS TRANSMITTER MUST NOT BE CO-LOCATED IN CONJUNCTION WITH ANY OTHER ANTENNA OR TRANSMITTER. FAILURE TO COMPLY WITH THIS WARNING MAY RESULT IN SERIOUS INJURY OR DEATH TO PERSONNEL AND DAMAGE TO EQUIPMENT.

## IMPORTANT NOTICE FOR CLASS 'A' UNINTENTIONAL RADIATORS:

*This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.*



## Radio Frequency (RF) Transceiver.

Depending upon the System Operating Frequency, the RCR 'Gold Box' may incorporate a **220 MHz or a R3HNX (450 MHz band) Transceiver Board.**

**The Transceiver Board** is a multi channel, synthesized RF receiver with a Liquid Crystal Display (LCD). Additionally, it has a built in RF transmitter for 'POLLING<sup>TM</sup>' data transmission. The receiver section incorporates a microprocessor and uses Digital Signal Processing (DSP) techniques to selectively recover digital messages using CATTRON-THEIMEG<sup>TM</sup> protocol. The receiver section also has LED indicators for:

- **Power ON**
- **Carrier Detect** (RF signal or carrier is present)
- **VCO Lock** (receiver locked on freq.)
- **Data** (received message data)
- **Q-sync** (synchronization pulse)

**The RF Power Amplifier Board** is a high power RF amplifier that connects between the R3HNX Transceiver Board and the Antenna Connector. An on-board LED indicator shows when transmitted digital RF 'POLLING<sup>TM</sup>' data from the transmitter section is being amplified and sent to the RCT. **Note that systems operating in the 220 MHz Band do not require this board.**

Opening the front door of the RCR enclosure and removing the 'Gold Box' lid will expose the Transceiver Board, and in the case of a R3HNX MHz transceiver board, the 'companion' **RF Power Amplifier Board**. Referring to Figure 1-1 and Table 1-1 below, transceiver and amplifier board LED indicators indicate system status and are particularly useful to the technician when troubleshooting and adjusting the transceiver.

## MP 96 GII LCU [RCR] – Functional Description.

### Radio Frequency (RF) Transceiver, continued.

Figure 1-1. Transceiver & RF Amplifier Board LED Indicators

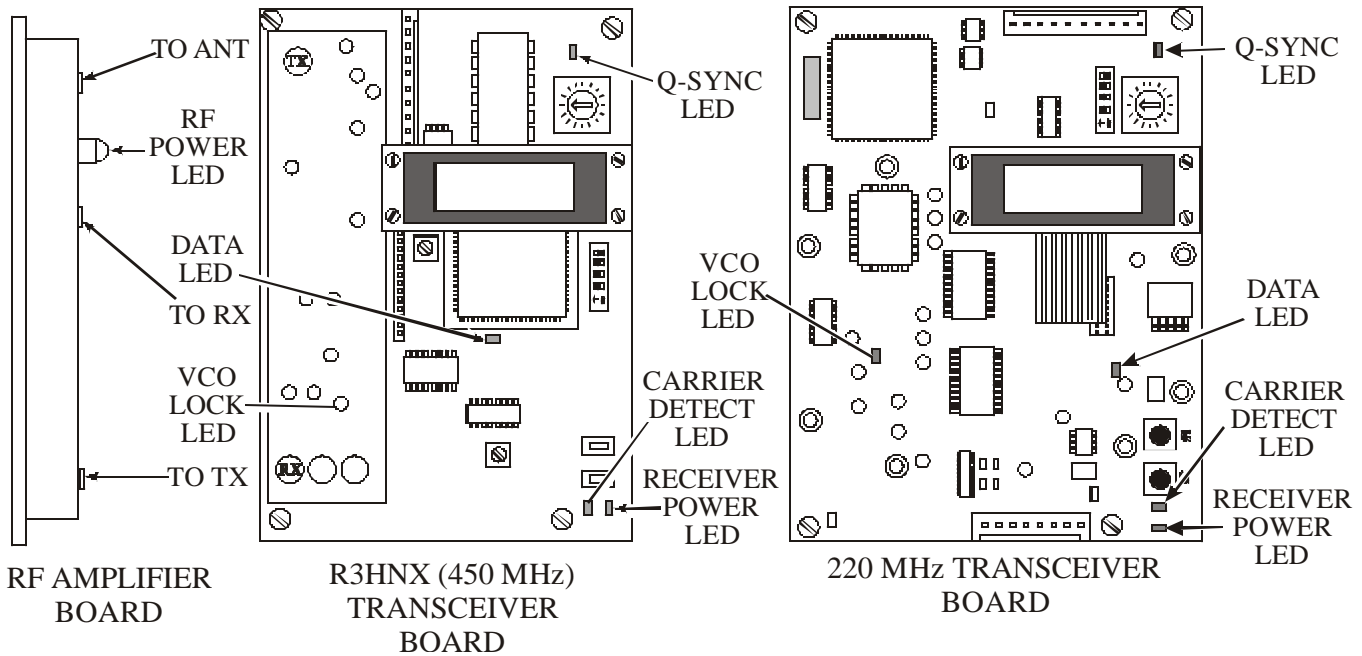


Table 1-1. Transceiver & RF Amplifier Board LED Indicators

LED	Description
Transceiver Power	This red LED indicates the presence of DC power on the transceiver circuit board.
Carrier Detect	The green Carrier Detect LED indicates that the receiver section is receiving a RF signal.
Data	This yellow LED indicates that the received RF message contains data.
Q-Sync	This orange LED indicates an interrupt that signifies the computer/decoder has received a new message.
VCO Lock	This red LED (located underneath the EMI/RFI shield on the R3HNX board) illuminates when the transceiver frequency synthesizer is unable to lock onto the required frequency.
RF Power LED	This red LED (located on the RF amplifier) flashes when the transmitted digital RF 'POLLING™' data from the transmitter is being amplified and sent to the RCT



## SYSTEM SUMMARY – Technical Specifications

### LCU [RCR]

Enclosure:	20"L x 20"H x 8"W (50.80cm x 50.80cm x 20.32cm), NEMA 4 (IP66) Steel.
Weight:	Approximately 70 lbs (31.75 kg)
Environment:	Outdoors, -22°F to 150°F (-30°C to 65°C), RH 0 to 95% non-condensing (-40°F units available – contact factory for details)
Electrical	
Input/Output connections:	Qty 4, quick connect/disconnect plugs and sockets
Solid State Digital Outputs:	Total of 96 rated at 100VDC with individual fusing at 5A
Solid State Digital Inputs:	Total of 48 rated at 74VDC with individual fusing at 5A
Electro-mechanical Outputs:	100VDC @ 10A
Output Termination:	2 screw terminals per I/O position
Receiver/Decoder Power Source:	DC-DC converter; 24-78 VDC Input/13.8 VDC output @ 0.8 A with Under/Over Voltage protection
Minimum Locomotive	
Battery voltage:	62VDC
Micro-controllers	Qty 3, Intel™ 8051 family microprocessors
Serial Communication Ports:	RS232 port for GPS Receiver/clock and external event recorder RS485 port for locomotive monitoring
Frequency Range:	VHF 220-222 MHz (FCC), 217-219 MHz (Industry Canada) or UHF 447-473 MHz
Channel Spacing:	UHF 12.5 kHz, VHF 12.5 kHz & 15 kHz
Emission/Modulation:	UHF 9K80F1D ±2.5 kHz deviation, VHF 8K50F1D ±1.85kHz deviation (12.5kHz channel spacing), VHF 10K1F1D ±2.66kHz deviation (15kHz channel spacing)
RF Transmit Power:	UHF 1.6W, VHF 2.5W (both options factory set)
Range:	1-mile line of site
Duty Cycle:	2.5875%
Antennas:	Qty 1, mounted vertically for receive and transmit. Gain: UHF 5dB, VHF 3dB
Approvals:	US FCC (Part 90) Industry Canada (RSS119)
Receiver Sensitivity:	0.5 µV (20 dB quieting) typical
Frequency Stability:	±0.0002% of reference frequency
Decoder Microprocessor Speed:	11.059 MHz
Axle Generator:	120 PPR Dual Phase.

**NOTE: As part of our ‘continuous improvement’ policy, CATTRON-THEIMEG™ reserves the right to change specifications without notice.**



## SYSTEM SUMMARY – Technical Specifications, continued

### OCU [RCT]

Case Material:	Cast Magnesium with high strength powder-coat finish
Environment:	Outdoors, -40°F to 140°F (-40°C to 60°C), RH 0 to 95% non-condensing Watertight NEMA 3S (IP65) (Heavy Rain, Dust, Oil Resistant)
Weight:	Less than 3.5 lbs (1.6 kg) including battery
Size:	Approx. 10"L x 3.5"W x 4.5"H (25.40 cm x 8.89 cm x 11.43 cm)
Battery:	Industry Standard 7.2VDC Rechargeable Nickel Metal Hydride (Ni-MH) Battery Pack mounted externally to bottom of OCU
Battery Life:	Ni-MH – approximately 12 hours continuous operation
Antenna:	Externally Mounted ‘stubby’ whip antenna for optimum signal transmission
Frequency Range:	VHF 220-222 MHz (FCC), 217-219 MHz (Industry Canada) or UHF 447-473 MHz
Channel Spacing:	UHF 12.5 kHz, VHF 12.5 kHz & 15 kHz
Emission/Modulation:	UHF 9K00F1D $\pm 2.5$ kHz deviation, VHF 8K50F1D $\pm 1.85$ kHz deviation (12.5kHz channel spacing), VHF 10K1F1D $\pm 2.66$ kHz deviation (15kHz channel spacing)
RF Transmit Power:	UHF 500 mW, VHF 500mW or 2.5W (factory set)
Range:	1-mile line of sight
Duty Cycle:	2.5875%
Approvals:	US FCC (Part 90) Industry Canada (RSS119)
Carrying Device:	Tear away harness meeting FRA Safety Advisory 2001-01

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