Contact Information

Monaco Enterprises, Inc. P.O. Box 14129, Spokane, WA 99214-0129; 14820 E. Sprague Ave, Spokane, WA 99216-2191
Phone: (509) 926-6277, Fax: (509) 924-4980 E-mail: service@monaco.com, Web: www.monaco.com

Document Information

Identification

I-O-M Manual
001-204-00 Revision D 04/02

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Copyright Notice

Content

These instructions are not intended to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. If further information is needed or a particular problem arises that needs to be further described, contact Monaco.

Suggestions

If you have comments or suggestions on how we may improve this document, send them to:
Monaco Enterprises, Inc.; Attention: Technical Publications; P.O. Box 14129; Spokane, WA 99214-0129

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You assume full responsibility for whether or not the equipment and any programs meet your specifications, capacity, capabilities, versatility, and other requirements; the installation and the condition and effectiveness of the operating environment in which the equipment and software are to function; and maintaining the equipment as specified.

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- This warranty shall be construed in accordance with and governed by the laws of the State of Washington.
- This warranty gives you specific legal rights and you may also have other rights that may vary from state to state.

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Replacement and/or repair is subject to review by Monaco and will be done in accordance with this warranty. If the equipment is not under warranty or if the warranty is not in effect because of the Exceptions and Conditions, you will be asked to provide a purchase order for payment of the repair when the Return Authorization number is given. The amount of the purchase order will be based on an estimate of the cost of the repair. If a repair is not feasible, either because of cost or performance reliability of the repaired equipment, Monaco will contact you.

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How to Get Assistance

If you need help with your Monaco products, contact one of our Customer Service Representatives at (509) 926-6277. For other methods of contacting us, see "Contact Information" on page ii.

Product Summary

The BT2-7 is a narrowband radio transceiver that provides a radio interface between fire alarm control panels and conventional devices and a central receiving system. The BT2-7 uses Frequency Shift-Keying (FSK) radio protocol to communicate with a Monaco Central Receiving System. It can be configured to operate in either the VHF or UHF frequency range.

Document Description and Organization

The following table identifies the sections of this document with a brief description of the content of each section. Refer to "Contents" on page v for specific information on the contents of the sections.

Section	Description
1	**System Description** Identifies BT2-7 hardware components and describes their functionality.
2	**Installation** Explains how to install the BT2-7 and Remote Expansion Modules (RXMs).
3	**Operation** Describes how to operate the BT2-7.
4	**Maintenance** Specifies scheduled maintenance and explains test procedures.
Appendix A	**Specifications**
Appendix B	**Diagrams**
Appendix C	**Spare Parts List**
Appendix D	**Glossary of Terms**

For Use With

This document is for use with the following products: The "xx" in the part numbers refers to system frequency.

- **BT2-7 Building Transceiver P/N 227-206-xx** four-zone BT2-7 in a 20-inch-high by 12-inch-wide by 4-inch-deep surface-mount enclosure.
- **BT2-7 Building Transceiver P/N 227-231-xx** four-zone BT2-7 in a 20-inch-high by 12-inch-wide 4-inch-deep flush-mount enclosure.
- **BT2-7 Building Transceiver P/N 227-207-xx** four-zone BT2-7 in a 20-inch-high by 25-inch-wide by 4-inch-deep surface-mount enclosure; expandable to 8, 12, or 16 zones.
- **RXM Expansion Module P/N 227-220-00** four-zone RXM in a 20-inch-high by 12-inch-wide 4-inch-deep surface-mount enclosure; expandable to 8 or 12 zones.
- **RXM 4-zone Expansion Field Assembly P/N 176-178-01** four-zone RXM, mounting hardware, terminating resistors, and data label for installation in P/N 227-207-xx or P/N 227-220-xx, or mounting in a fire alarm control panel.

Contents

Section 1
System Description

This section identifies BT2-7 hardware components and describes their functionality.

Contents

Introduction

The BT2-7 is a microprocessor-controlled radio transceiver that monitors local alarm equipment and reports alarms and status changes to the Central Receiving System. The BT2 communicates with the Central Receiving System via FSK encoded RF in a pre-configured VHF or UHF frequency.

Features

The BT2-7 provides the following features:

- Four standard alarm and trouble reporting zones, with an expansion capacity for up to sixteen zones, using a single RF Module and antenna.
- Zone inputs may be enabled or disabled at the Central Receiving System for maintenance test purposes.
- The BT2 number is set by the user in binary code on DIP switches; zone addressing is do at the Central Receiving System.
- Current zone status is stored in a nonvolatile, transferable Data Module.
- Tamper, battery fault, and ac power failure are reported with the BT2-7 address; the ac f transmission feature can be deactivated.
- Reports status on command from the Central Receiving System; continues to send alarm and status changes at programmed intervals until acknowledged by the Central Receivin System.
- Responds to continuous, scheduled, or operator-initiated Central Receiving System inter gations.
- LEDs identify ac power status, battery fault, carrier detection, communication with the Central Receiving System, message transmission, and current zone status.
- On-board audible alert provides local signaling of alarms/troubles, but can be deactivate
- Ground fault detection generates a trouble report while zone supervision remains active.
- Buttons permit checking RXM zone status, initiating tests, and silencing audible alerts.
- Maintenance personnel can run diagnostics to assist in troubleshooting.
- Four watts RF output power.
- Available in VHF and UHF frequencies for operation on an assigned channel.
- Battery backup and onboard charger provide for 60 hours of operation during ac power f ure; battery connection and battery discharge are monitored.
- Battery disconnect circuit averts battery damage by preventing complete battery discharg during extended ac power failure.
- Radio-interrupt circuitry turns off the RF Module if it transmits continuously for 30 secon

Options

- **RXM Expansion Module (P/N 227-220-00)** Four-zone RXM in a 20-inch-high x 12-inch-wi x 4-inch-deep surface-mount enclosure, expandable to 8 or 12 expansion zones using one two additional RXMs (P/N 176-178-01). For remote connection to 227-206-xx or 227-231-xx use Expansion Field Assembly 176-178-01.

- **RXM (P/N 176-178-00)** Adds four expansion zones in an existing BT2-7 enclosure (if space is available), a separate enclosure, or a fire alarm control panel.
- **RXM 4-Zone Expansion Field Assembly (P/N 176-178-01)** Provides RXM, mounting hardware, terminating resistors, and data label for installation in enclosures for transceivers P/N 227-207-xx or P/N 227-220-xx, or mounting in a fire alarm control panel.
- **BT 2-7 to RXM Communication Cable (P/N 621-025-00)** For communication between the BT2-7 and RXM(s), in a 1000-foot roll.

Component Identification

The BT2-7 consists of an Electronic Assembly, battery, optional RXMs, and connecting cables.

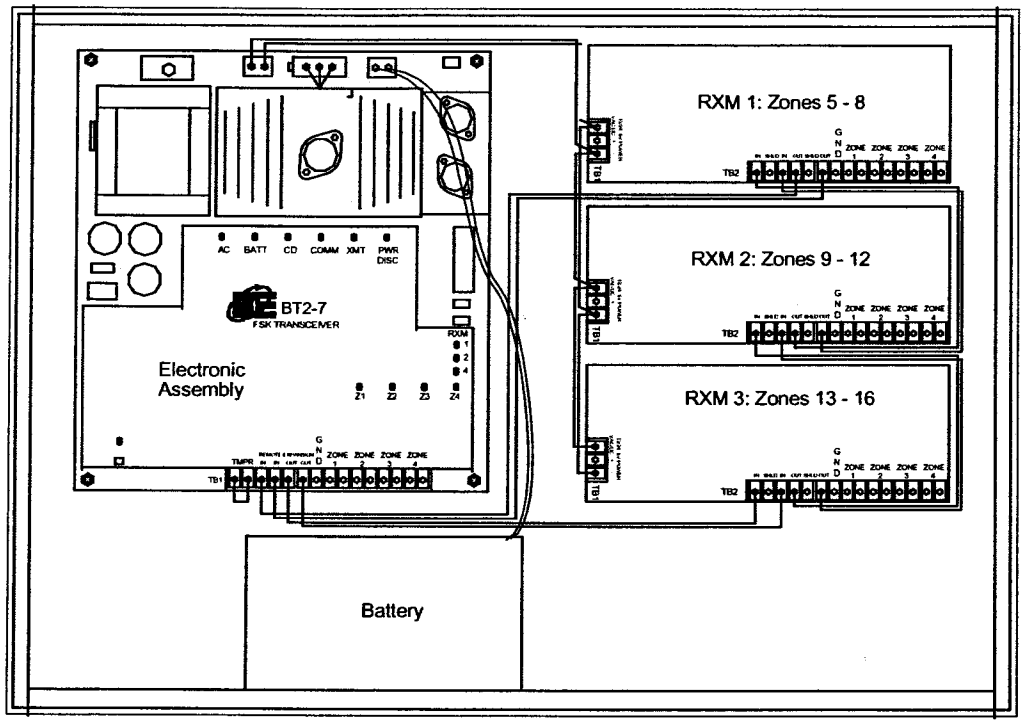


Figure 1-1 *BT2-7 Components with optional RXMs, in wide enclosure*

Electronic Assembly

The Electronic Assembly consists of a CPU and Power Supply. The CPU handles electrical supervision of connected circuits and the panel, and manages communication between zones and the RF module. The Power Supply includes the transformer and voltage regulators, which step-down ac power to the panel's operating voltage. A metal cover plate on the front of the Electronic Assembly protects the components and provides identification of LEDs, buttons, and terminal connections.

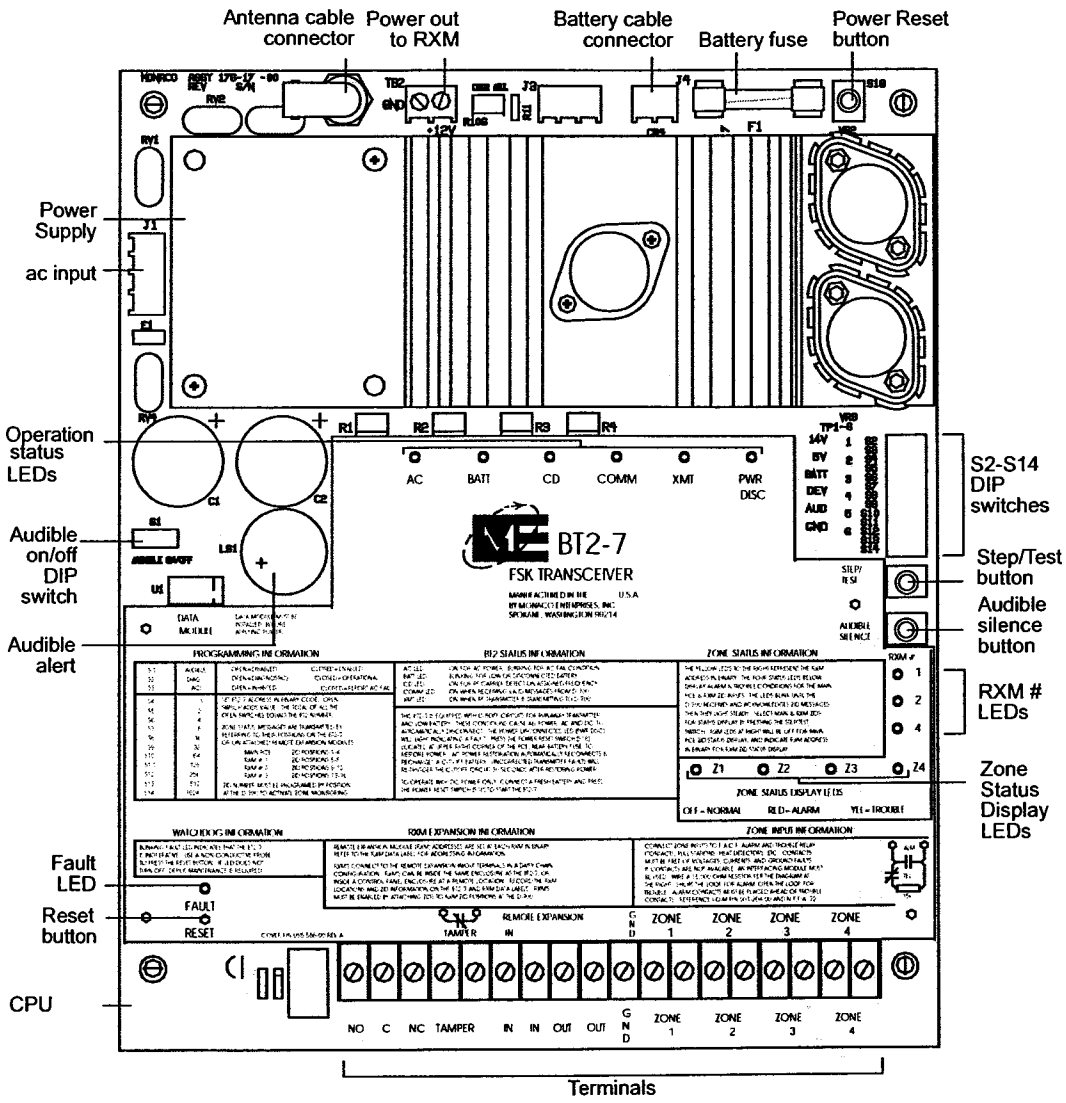


Figure 1-2 *BT2-7 electronic assembly*

Indicators

Indicators include the audible alert, operation status LEDs, and zone status LEDs.

- **Audible alert** Provides audible notification at the panel when a zone alarm, zone trouble, or BT2 trouble occurs, if the **AUDIBLE ON/OFF** DIP switch is closed. The audible alert pulses on every one-half second for alarms, and every one-and-one-half seconds for troubles. Press **AUDIBLE SILENCE** to quiet. If transmission of ac power failure is inhibited, the audible alert will not sound for an ac fail condition or a zone trouble, but will sound for any zone alarm or BT2 trouble.

- **BT2-7 status LEDs**
  - **AC** Illuminates green when the BT2-7 is operating on ac power. Flashes to indicate the panel is operating on backup battery, but extinguishes if battery voltage drops below approximately 11 Vdc.
  - **BATT** Flashes red if the battery cable is disconnected while the BT2-7 is operating on ac power. When the BT2-7 is operating on battery, flashes if the voltage drops below approximately 11.2 Vdc, and extinguishes if the voltage drops below 10.5 Vdc. Illuminates steady if charger output drops below approximately 13 Vdc.

  NOTE *The flashing BATT LED takes precedence over the steady illuminated condition. If either a low or disconnected battery and a charger failure are present at the same time, the BATT LED will flash. If the low or disconnected battery problem is corrected and the charger failure is still present, the BATT LED will illuminated steady.*

  - **CD** Flashes red to indicate that RF carrier, modulated or unmodulated, has been detected on the assigned frequency.
  - **COMM** Illuminates green during reception of valid encoded RF signal from a Central Receiving System. This LED is not illuminated when the BT2-7 is in diagnostic mode, the Central Receiving System is set to Receive Only mode, or the BT2-7 has lost communication with the RFM 7000. The BT2-7 responds only to messages that include its address and to open air commands. If the BT2-7 does not receive a signal from the Central Receiving System for 30 seconds, the COMM LED turns off. The BT2-7 will continue to transmit any unacknowledged alarms or new alarms that occur at programmed intervals without waiting for a command from the Central Receiving System.
  - **XMT** Flashes red when the BT2-7 is transmitting.
  - **PWR DISC** Illuminates red when the panel has shutdown due to activation of the transceiver disconnect circuitry, or when battery voltage drops below approximately 10 Vdc while the panel is operating on battery power. Transceiver disconnect occurs when the transceiver has transmitted continuously for more than 30 seconds; this feature prevents jamming of Central Receiving System communication, and protects the transceiver overheating.
- **Zone Status Display LEDs** Illuminate red for alarms or yellow for troubles. Flash until the condition is acknowledged by the Central Receiving System, then illuminate steady. The LED automatically turns off when the zone input is restored to normal. If none of the RXM # LEDs are illuminated, the Zone Status Display LEDs indicate the status of onboard zones. Illuminated RXM LEDs indicate the RXM for which the Zone Status Display LEDs report:
  - **RXM #1 LED** RXM 1
  - **RXM #2 LED** RXM 2
  - **RXM #1 and RXM #2 LEDs** RXM 3
- **RXM # LEDs** Indicate the RXM for which the Zone Status Display LEDs are reporting. See the Zone Status Display LEDs explanation directly above for information on how the RXM LEDs and Zone Status Display LEDs work together. See the **STEP/TEST** button explanation below for information on how that button works with the RXM # LEDs.
  - All three RXM LEDs flash when an alarm or trouble, acknowledged or unacknowledged, has occurred on an RXM zone input. They stop flashing when all zone inputs are returned to normal.
  - All three RXM # LEDs illuminate if the BT2-7 fails an internal self-test. A self-test occurs on power up, when the **RESET** button is pressed, and when the BT2-7 is returned

from diagnostic to normal mode. If the LEDs remain illuminated after the **RESET** switch has been pressed, press **RESET** on each connected RXM. If this does not correct the fault, contact Monaco. See "How to Get Assistance" on page iii.

An illuminated RXM address LED remains so until **STEP/TEST** is pressed again.

- **FAULT LED** Flashes red when a microprocessor fault condition exists and automatic reset has failed. The panel cannot communicate with the Central Receiving System in this condition. Pressing **RESET** may correct the problem. If the FAULT LED illuminates steady after **RESET** has been pressed, contact Monaco for assistance. See "How to Get Assistance" on page -iii.

Controls

Controls include DIP switches and buttons.

- **POWER RESET (S18) button** Returns power to the RF Module after it has been deactivated by the radio interrupt circuitry. Also, press this button to operate the panel on battery power at startup.
- **STEP/TEST (S15) button** Chooses which zones are represented by the Zone Status Display LEDs.
  - When **STEP/TEST** is pressed once, the RXM #1 LED illuminates and the Zone Status Display LEDs show the statuses for RXM 1 zones.
  - When **STEP/TEST** is pressed twice, the RXM #2 LED illuminates and the Zone Status Display LEDs show the statuses for RXM 2 zones.
  - When **STEP/TEST** is pressed a third time, the RXM #1 and RXM #2 LEDs illuminate and the Zone Status Display LEDs show the statuses for RXM 3 zones.
  - When **STEP/TEST** is pressed a fourth time the Zone Status Display LEDs show the statuses for onboard zones. If an alarm or trouble condition exists on an RXM zone, all three RXM # LEDs return to the flashing state.
- **AUDIBLE SILENCE button** Silences the audible alert. See "Selecting Operating Options" on page 2-15.
- **RESET button** Pressing **RESET** restarts the microprocessor and initiates a self-test. This may correct a microprocessor fault indicated by the flashing of the FAULT LED. If the FAULT LED illuminates steady after **RESET** has been pressed, contact Monaco for assistance. See "How to Get Assistance" on page -iii.

  NOTE *It is not necessary to press the RESET button when zone, address or option changes are made to the BT2-7 or to RXMs. Since the BT2-7 automatically follows the state of the zone inputs, it is not necessary to press the RESET switch after alarm or trouble conditions have been corrected.*

- **AUDIBLE ON/OFF DIP switch** Enables or disables the audible alert. See "Selecting Operating Options" on page 2-15.
- **S2 DIP switch** Puts the BT2-7 in diagnostic or normal (monitoring) mode. See "Selecting Operating Options" on page 2-15.
- **S3** Determines whether an ac failure condition is transmitted to the Central Receiving System. See "Selecting Operating Options" on page 2-15.
- **S4–S14** Specify the BT2-7 address. See "Setting the BT2-7 Address" on page 2-13.

Connections

- **ac input (J1)** Connects to the ac power line. See "Wiring diagram" on page B-2.
- **Terminals** For information on terminal connections, see "Connections" on page 2-8, and "Wiring diagram" on page B-2.
  - **NO, C, and NC** Connect to an RSA (Remote Signal Activation) relay. RSA terminals may be used to control an auxiliary device or to provide for remote testing of the BT2-7.
  - **TAMPER** Connect to an optional enclosure tamper switch.
  - **REMOTE EXPANSION** Connect to RXMs.
  - **GND** Connect to a ground wire.
  - **ZONE 1-4** Connect to zone circuits.
- **Antenna** Connects to the antenna via the Electronic Assembly-to-Antenna Cable.
- **Battery (J4)** Connects to the Electronic Assembly-to-Battery Cable.

Fuse

The BT2-7 uses a single 1.5A/250V Slow Blow fuse for the battery.

RF Module

The RF Module (P/N 227-444-xx) is mounted at the back of the Electronic Assembly. Monaco has tuned the RF Module to the assigned VHF or UHF frequency; no user adjustment is necessary.

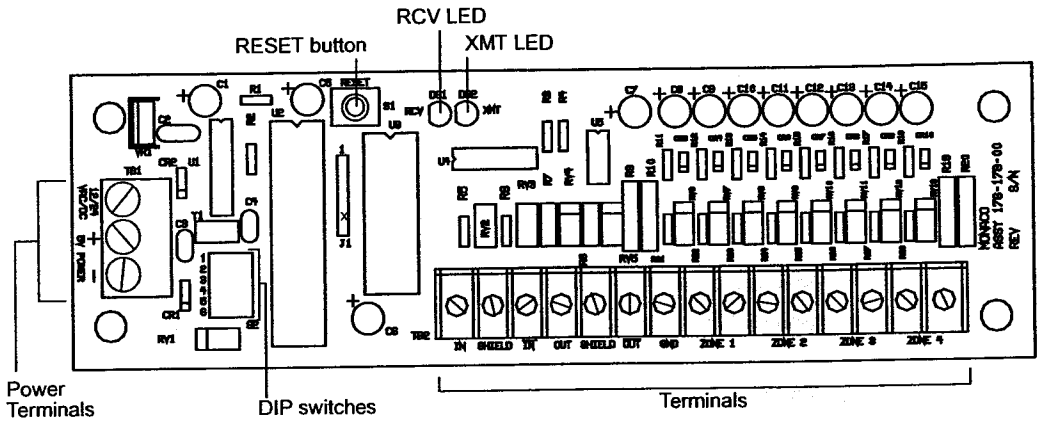
Batteries

The BT2-7 uses two 12V/7.7Ah batteries in parallel. The batteries provide 60-hour backup capability for a four-zone BT2-7. If 60-hour backup is required for a BT2-7 with up to three RXMs, use a single 18Ah battery.

RXM

Each RXM (P/N 176-178-00) provides four additional input zones. Up to three RXMs may be added to a BT2-7.

Figure 1-3
RXM



Each RXM includes DIP switches for specifying its address. Communication with the BT2-7 is indicated by the RXM RCV and XMT LEDs. Each RXM monitors its own zones.

Indicators

Each RXM includes two red LEDs, which flash when the RXM is operating correctly. If these LEDs illuminate steady, the RXM is in a fault condition; press the RXM's **RESET** button to reset the RXM.

- **RCV LED** Flashes red when the RXM is receiving a zone status query from the BT2-7. Illuminates steady to indicate a fault.

  IMPORTANT *The RCV LED may not illuminate on the RXM with the fault, but both LEDs on RXM connected next in the series will illuminate steady.*

- **XMT LED** Flashes red when the RXM is sending zone status data to the BT2-7. Illuminates steady to indicate a fault.

Controls

- **RESET button** Press to reset the RXM when the RCV and XMT LEDs illuminate steady, or if they do not illuminate at all. When this switch is pressed, the RXM address is reset so that the BT2-7 can communicate with the RXM.

  NOTE *It is not necessary to press* **RESET** *when the RXM address has been changed or when a zone input is returned to normal.*

- **DIP switches** Specify the RXM address. See "Setting an RXM Address" on page 2-14.

Connections

- **Power Terminals** Connect power to these terminals. See "Wiring diagram" on page B-2.
- **Terminals** For information on terminal connections, see "Connections" on page 2-8, and "Wiring diagram" on page B-2.

- **IN/SHIELD/$\overline{\text{IN}}$, OUT/SHIELD/$\overline{\text{OUT}}$** Connect to other RXMs and the Electronic Assembly.
- **GND** Connect to a ground wire.
- **ZONE 1-4** Connect to zone circuits.

- **J1** Connects to an optional BT2-7 Interface Module. See the BT2-7 Interface Module I-O-M P/N 001-204-02.

Functional Description

The BT2-7 links local protective equipment to a Central Receiving System. It converts data from up to 16 hardwired zone inputs to radio signals. These signals are decoded, displayed, and logged at the Central Receiving System. The BT2-7 also reports ac power status, battery fault, and activation of the optional enclosure tamper switch.

The BT2-7 continuously monitors its zone inputs and queries its expansion modules (if any) for zone alarm and trouble conditions. The BT2-7 encodes a transmission identifying the type of message and zone input and sends the message to the Central Receiving System. When a zone input is restored to normal condition, the BT2-7 transmits `END ALARM` or `END TROUBLE` for that zone. All transmissions are repeated by the BT2-7 until acknowledged by the Central Receiving System.

Buffer

The buffer holds unacknowledged messages. The order in which conditions are reported is determined by the BT2-7 software and commands from the Central Receiving System; alarm processing has top priority. When multiple messages for the same zone are in the buffer, a higher priority message eliminates the lower priority message, to prevent a trouble or restoration condition that occurred before an alarm from being transmitted after the alarm. If when a status change enters the buffer an earlier message for the same status already exists there, the previous message is removed and the new one is inserted at the end of the transmission queue. For example, if a `TROUBLE` and an `END TROUBLE` message for zone 1 are waiting to be transmitted when a trouble is again detected on the zone, the earlier messages are removed from the buffer.

Zones

Each BT2-7 has four on-board zones, and expansion capacity for up to 12 additional zones. See "Zone Inputs" on page 2-9.

RSA Relay

RSA relay terminals are labeled NO, C, and NC. When a BT2-7 receives an `Activate RSA Relay for BT2` command from the Central Receiving System, it activates the RSA relay for 20 seconds. Connections may be made to an external relay for such functions as turning on emergency lights, activating door releases, or placing a local control panel in alarm for evacuation signaling. The auxiliary device cannot be powered by the BT2-7. Because activation of the RSA relay is temporary, you must install a latching relay for auxiliary devices that should be activated for more than 20 seconds.

RXM

Each RXM adds the capability to report for four zones. RXMs communicate with the BT2-7 via supervised hardwired connections. To connect an RXM to a BT2-7, see "BT2-7 to RXM" on page 2-8. To set the address of an RXM, see "Setting an RXM Address" on page 2-14.

The BT2-7 continuously polls all connected RXMs; each RXM replies with its current zone status. The zone information stored in the Data Module is updated and the BT2-7 transmits new conditions to the Central Receiving System.

RXM zones are reported as BT2-7 input positions 5-8 (RXM 1), 9-12 (RXM 2), and 13-16 (RXM 3). An extended poll reply includes the status of the RXM zones.

Indicators

LEDs and an Audible Alert indicate BT2-7 and RXM conditions. See "Indicators" on page 1-8.

Controls

Buttons and DIP switches are used to configure the BT2-7 and RXMs. See "Controls" on page 1-6.

Data Module

Current zone statuses, including the status of RXM zones, are stored in the Data Module. A Data Module must be present for a BT2-7 to operate.

▼ **CAUTION** *Do not remove or insert a data module while the BT2-7 is powered.*

The Data Module stores the zone information saved on the BT2 and ZID cards at the Central Receiving System and the current zone input status. The BT2-7 reads the Data Module for its zone status on power up, upon return from diagnostic mode, after **RESET** or **POWER RESET** is pressed, and when the zone state is downloaded from the Central Receiving System. Zone alarm and trouble LEDs and BT2 status LEDs illuminate in accordance with data stored in the Data Module. If the data is invalid, the BT2-7 cannot respond to Central Receiving System polls or commands. Invalid data is indicated by RXM # LEDs 1, 2 and 4 illuminating steady; if pressing **RESET** does not correct the condition, contact Monaco. See "How to Get Assistance" on page iii.

Communication with the Central Receiving System

The BT2-7 is in continual communication with the Central Receiving System, responding to commands from the RFM 7000. If a BT2-7 does not receive a signal for 30 seconds, it transmits unacknowledged or new alarm messages at programmed intervals without waiting for a command.

Section 2
Installation

This section explains how to install the BT2-7 and Remote Expansion Modules (RXMs).

Contents

Unpacking and Inspection

The BT2-7 was carefully tested and packaged at the factory and is ready for installation and operation when it is unpacked. If the shipping cartons show evidence of rough handling, inspect the equipment carefully for shipping damage. If damage is found, notify the carrier immediately.

Warnings and Cautions

WARNING The BT2-7 may be damaged and the warranty voided if:

- Assemblies or components (including cables and expansion cards) are connected or disconnected while power is applied to them
- Voltage is applied to the zone input terminals
- Incorrect wire connections are made
- Battery polarity is reversed
- Battery voltage rating is too high
- Antistatic precautions are not observed
- Power is applied before the antenna is connected

The following precautions must be observed during all phases of installing the equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment.

Type of Precaution	Precaution
General Safety	**Proper Ground** The equipment must be connected to an electrical ground to minimize shock hazard. Consult NFPA 70 (NEC) and local codes for grounding requirements.
	Explosive Atmosphere Do not operate the equipment in the presence of flammable gases, fumes, or dust. Operation of this equipment in such an environment constitutes a safety hazard.
	Live Circuits Operation personnel must not remove equipment covers or panels. Component replacement and internal adjustments must be made only by qualified Maintenance Personnel. Do not replace components with power applied. To avoid injuries, always disconnect power and allow the circuit to discharge before performing repair procedures.
	Lightning Storms Equipment should not be serviced or repaired during a lightning storm.
	Service or Adjustments It is recommended that a second person be present when internal service or adjustments are done to render assistance if necessary.

Type of Precaution	Precaution
Equipment	**Removing Assemblies or Components** Removal of individual assemblies or components must be done only after power is removed. This includes both ac line power and backup battery power.
	Specifications The equipment is designed to operate within specified design parameters such as input voltage and environmental conditions. Do not exceed the specifications.
	Substituting Parts or Making Modifications Do not install substitute parts or perform any modifications to the equipment without written permission from Monaco Enterprises, Inc.
	Antistatic The following precautions must be observed to protect static sensitive components whenever BT2-7 assemblies or components are handled: ▪ Avoid touching or handling ICs ▪ Use antistatic foam mats to transport or work on assemblies and/or ICs ▪ Discharge static before handling assemblies or ICs by touching a grounded metallic surface such as a rack or cabinet ▪ Do not slide assemblies or ICs on any surface

Installing the Antenna

Proper installation of the antenna is critical. If you have not installed an antenna before, then contact Monaco to receive the Antenna I-O-M (P/N 001-364-00) which describes in detail how to cut and install an antenna and how to reterminate coaxial cable properly. See "How to Get Assistance" on page iii.

Before mounting the antenna, assemble and cut it for the appropriate frequency (omnidirectional antennas only) according to the instructions provided with the antenna. *If an antenna is not cut correctly, communication may not be reliable between the Central Receiving System and the BT2-7, and the transceiver may be damaged.*

The following table lists the other components required to install an antenna:

Antenna Components for Installation	Description
Antenna Mounts	Antennas can be mounted on a tripod or an antenna mast. Antenna masts are typically made of Electrical Metallic Tubing (EMT) or rigid conduit and can be anchored to a roof, clamped to the eaves, or mounted on a wall or tower. Antenna masts must be well secured and able to withstand the local environmental conditions. Monaco sells antenna mounting hardware; however, some conditions may require mounting hardware not available from Monaco. Alternate mounting hardware may include galvanized steel channel or specially fabricated brackets. Anchoring materials should be suitable for the mounting surface; bolts, screws, studs, etc. used for support should be no less than 1/4 inch in diameter.
Coaxial Cable	Coaxial cable connects the antenna to the lightning arrestor and the lightning arrestor to the BT2. Monaco provides three different types of coaxial cable: mini RG-8/X 50 ohm coaxial cable (mini RG-8), low-loss 50 ohm coaxial cable (low-loss), and Heliax coaxial cable.
Conduit	Monaco recommends that all coaxial cable be enclosed in conduit. Conduit can be rigid conduit or Electrical Metallic Tubing (EMT) and should be no less than 3/4 inch in diameter. Conduit used as an antenna mast must be rigid enough to withstand the local environmental conditions.
Lightning Arrestor	A lightning arrestor is a gas surge arrestor that protects electronic equipment from damage by discharging excess voltages or currents generated by nearby lightning or static buildup. It has a field-replaceable Arc-Plug Cartridge that consists of two metal electrodes sealed in a gas-filled ceramic cylinder.

Article 810-20 of the National Electrical Code (NEC) provides guidance about grounding of lead-ins from antennas. The following additional guidelines must be observed:

- The coaxial cable should be installed entirely in conduit. Where the conduit penetrates the building, the conduit should be a minimum of 3/4-inch rigid conduit or IMC. This penetrating conduit should directly enter the lightning arrestor enclosure on the inside of the building. If this is not possible, the lightning arrestor enclosure should be as near as possible to the conduit penetration.
- The 3/4 inch rigid conduit extending from the antenna to the lightning arrestor enclosure should be terminated with a conduit grounding bushing.
- Non-metallic fittings in the antenna mast or conduit connections should not be used.
- The conduit grounding bushing and the lightning arrestor grounding bolt should be bonded with a minimum 10 AWG solid copper bare wire.
- The lightning arrestor grounding bolt should be connected to the nearest NEC qualified locations:
  - The building or structure grounding electrode system
  - The grounded interior metal cold-water piping system
  - The metallic power service raceway
  - The service equipment enclosure
  - The grounding electrode conductor or the grounding electrode metal enclosures
- A ground rod should be installed only if none of the above items are available for grounding. This ground rod must be bonded with #6 copper wire to the building power system grounding electrode. Installation must be in accordance with NEC Section 250-52.
- The connection between the lightning arrestor grounding bolt and the building grounding electrode system should be bonded with a minimum 10 AWG solid copper bare wire. The grounding conductor does not need to be installed in conduit except if required for mechanical protection, but it must be properly supported and run in as straight a line as possible.

Refer to NEC Article 810 for guidelines on the installation of radio equipment before proceeding if you are not familiar with the latest regulations. These instructions do not duplicate the information provided in NEC Article 810.

WARNING For both safety and noise interference considerations, do not mount the antenna where it may contact power lines, power drops, power poles, or other transmitting antennas.

When installing an antenna, follow these guidelines:

- If you have concerns about the viability of your signal strength or you are installing a directional antenna, use a Signal Receiving Device (SRD) to determine the installation site for the antenna.
- Use a lightning arrestor when installing an antenna outdoors for additional equipment protection from nearby lightning strikes or static buildup. You can install the lightning arrestor inside the building, preferably at the building penetration point. A lightning arrestor will not protect equipment from a direct lightning strike.
- Ensure that the omnidirectional antenna whip is cut to the proper length for the system frequency. If you are using a directional antenna, ensure that the elements are spaced according to the factory-supplied markings.

- Locate the antenna as close to the transceiver as practical, to minimize coaxial cable length. Do not locate the antenna within four feet of power lines or service entrance cables. Do not install the antenna any higher than necessary to prevent tampering and provide clearance for any vehicle or equipment traffic unless distance or other loss factors warrant it. Maintain as much vertical and horizontal distance between this and other transmitting antennas as possible.
- Install the coaxial cable entirely in metallic conduit, penetrating the building with rigid conduit terminating in the lightning arrestor enclosure.
- Follow proper grounding procedures for both the antenna conduit and the grounding terminal of the lightning arrestor.
- Ensure the antenna mount will support the antenna during high wind and icing conditions.
- Keep the length of the coaxial cable to a minimum. If long lengths (over 100 feet) cannot be avoided, use low-loss type coaxial cable. If factory terminated coaxial cables are too long, cut them to length and re-terminate with new PL-259 connectors at the arrestor location. *Do not attempt to re-terminate BNC type connectors in the field unless absolutely necessary.*
- Seal the connection between the coax and the antenna, then seal the top of the mast to prevent water from entering the mast. If the lightning arrestor is installed outside the building, seal the connections to the lightning arrestor. Sealant material is provided with the lightning arrestor. Also be sure to repair and then seal the building penetration. That is, after the coax is installed, the hole around the conduit and the conduit must be sealed to prevent air flow through the conduit.
- Test the installed antenna for VSWR and the transmitter for output power. Verify that the transceiver is in communication with the Central Receiving System and signals are being properly sent and received.

A typical antenna and lightning arrestor installation is shown in Figure 2-1. The BT2-7 is labeled "transceiver" in the diagrams.

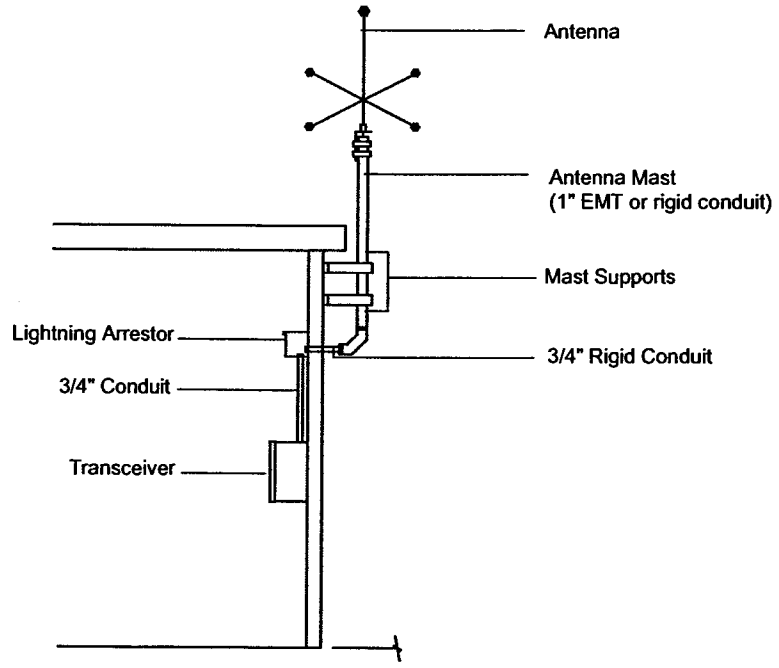


Figure 2-1 *Typical antenna and lightning arrestor installation*

A mounted lightning arrestor enclosure and the conduit connections are shown in Figure 2-2:

Figure 2-2 *Lightning arrestor enclosure and conduit*

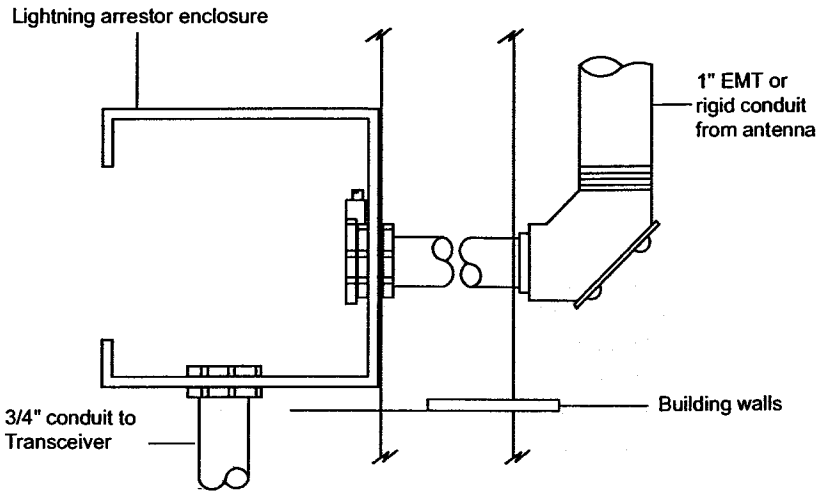
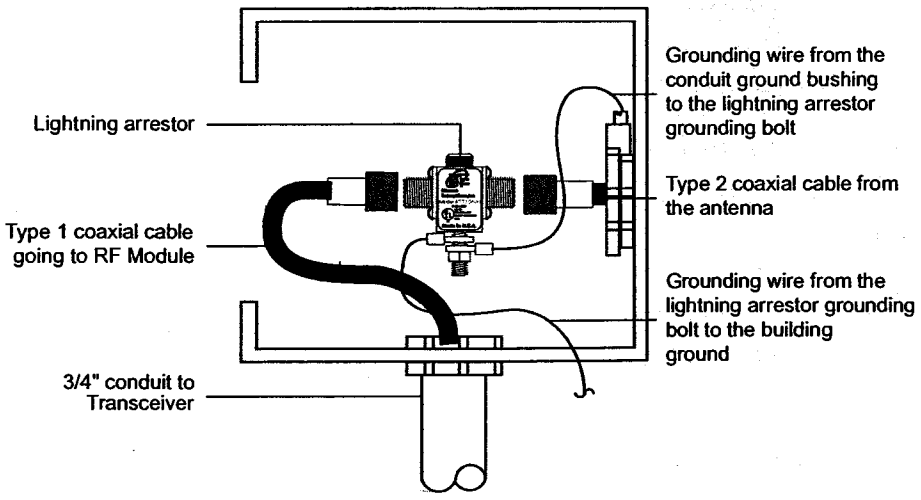


Figure 2-3 illustrates the lightning arrestor in the enclosure, the coaxial cable connections, and the grounding wire connections:

Figure 2-3 *Lightning arrestor*



Enclosure and Conduit

Enclosure Site Selection

The BT2-7 enclosure (and RXM enclosure, if used) should be positioned to be accessible for maintenance. Do not mount the enclosure in direct sunlight or near a heat source which may cause the internal temperature to exceed specified environmental limitations. Keep the enclosure away from moisture or steam. Power supply considerations are outlined in the section titled "Power" on page 2-10. Interconnections and conduit recommendation are covered in the section titled "BT2-7 to RXM" on page 2-8.

Enclosure Mounting

The BT2-7 Assembly and RXMs are configured in two enclosure sizes: a 12-inch wide enclosure is used to house a stand-alone BT2-7 or up to three separately-housed RXMs; a 25-inch wide enclosure houses a BT2-7 and up to three RXMs. Door keys are provided with each panel; the keys are common to all BT2 enclosures. Two conduit knockouts are included on each side of each enclosure. Conduit entry shall only be at the knockout locations or in the bottom of the enclosure. Space must be left for the battery at the bottom of the BT2-7 enclosure.

IMPORTANT *If conduit holes are drilled in the bottom of the enclosure, all components must be removed before drilling. Metal filings can damage Assemblies, resulting in malfunction, impaired performance, shortened life, and voided warranty.*

To mount the enclosure

1. Select a site for the enclosure following these guidelines:
   - Locate the enclosure inside a building where it can be easily maintained.
   - Do not mount the enclosure in direct sunlight or near a heat source that may cause the internal temperature to exceed specified environmental limitations.
   - Keep the enclosure away from exposure to moisture (including steam).
2. Remove the contents of the enclosure:
   - If the panel includes both an Electronic Assembly and RXMs, label and disconnect the wires connecting them.
   - Remove the electronic components by removing the four mounting screws near the corners of each. Do not remove the BT2-7 cover plate. Be careful not to bump the transceiver mounted on the back of the Electronic Assembly. Set the components on an anti-static mat or bag.
3. Prepare the wall for mounting the enclosure by marking and predrilling holes for the mounting hardware.

   NOTE *Mounting bolts are not provided; ensure the mounting hardware can support up to 50 pounds.*

4. Remove the conduit knockouts where needed. Follow these guidelines when removing the conduit knockouts:
   - Use a screwdriver to carefully remove the knockouts.

- Vacuum the inside of the enclosure to remove all metal chips.
- Ensure that there is enough space for the batteries; conduit entry must not interfere with battery placement.

5 Mount the enclosure. Keyhole mounting holes are provided in the upper corners, and standard mounting holes are predrilled in the lower corners. Use mounting hardware appropriate to the mounting surface and strong enough to support the weight of the enclosure and its contents. For example:

- Use expansion anchors in cinder block walls and solid concrete walls.
- Use toggle bolts for sheet rock.
- Use wood screws for wood walls.

6 Install the conduit and pull the wiring through the conduit. Wiring must comply with NFPA 70 (NEC) and all local codes or requirements of Authorities Having Jurisdiction.

7 Reinstall the components in the enclosure.

- Fasten the components to the enclosure by tightening the four mounting screws near the corners of each.
- If the panel includes both an Electronic Assembly and RXMs, reconnect the labeled wires connecting them.

8 Place the batteries in the bottom of the enclosure. (Batteries are provided only with the BT2-7. RXMs are powered by a battery-backed source such as the BT2-7 or a fire alarm control panel.)

IMPORTANT *Do not connect the batteries yet.*

Connections

See "Appendix B: Diagrams."

BT2-7 to RXM

If RXMs are to be connected to a BT2-7 already in operation, disconnect the BT2-7 from all power sources. The BT2-7 does not need to be reset after RXM additions are addressed and connected, and ac power has been reapplied. When the ZID cards are input and the BT2 Card is updated at the Central Receiving System and downloaded to the BT2-7 (see "Functional Description" on page 1-9), the new zone status is set in the Data Module.

The RXMs are connected on a serial (RS-422) loop for communication with the BT2-7. If the RXMs are housed in the same enclosure as the BT2-7, standard 22-gauge wiring may be used. If the RXMs are in a separate enclosure (either their own, or with a fire alarm control panel) but near the BT2-7, use a four-conductor jacketed cable (P/N 621-025-00). If a BT2-7 and an RXM are to be mounted more than three feet apart, enclose cable in conduit.

RXMs may be located up to two miles from the BT2-7. In such cases, telephone cable pairs, either aerial or buried, may be used. When RXMs are housed separately from the BT2-7 connect the GND terminals at both the BT2-7 and the RXMs to earth ground, and connect the shield conductors to the SHIELD terminals at the RXMs, and the GND terminal at the BT2-7. When the BT2-7 and RXM are more than 100 feet apart, install a 100-ohm, .25-watt, 5% resistor (Monaco P/N 471-101-00) on the receiving (IN and $\overline{\text{IN}}$) terminals at each end.

Connect the communications wiring between the BT2-7 and RXMs as follows.

BT2-7 TB1 Terminal	RXM #1 TB2 Terminal	RXM #2 TB2 Terminal	RXM #3 TB2 Terminal	BT2-7 TB1 Terminal
5 OUT to:	1 IN			
	4 OUT to:	1 IN		
		4 OUT to:	1 IN	
			4 OUT to:	3 IN
6 $\overline{\text{OUT}}$ to:	3 $\overline{\text{IN}}$			
	6 $\overline{\text{OUT}}$ to:	3 $\overline{\text{IN}}$		
		6 $\overline{\text{OUT}}$ to:	3 $\overline{\text{IN}}$	
			6 $\overline{\text{OUT}}$ to:	4 $\overline{\text{IN}}$

Zone Inputs

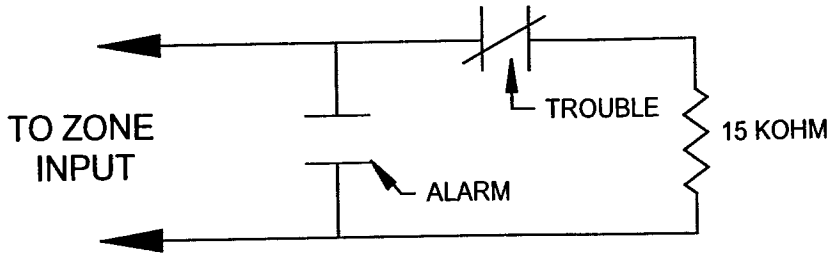
The BT2-7 and RXMs provide electrically supervised (for open and ground conditions) connections to manual pull stations, or such supervisory devices as local fire alarm control panels and sprinkler water flow detectors. Zone input terminals are visible below the BT2-7 cover plate, and at the bottom of each RXM. Used zone inputs must be terminated with a 15,000-ohm resistor at the initiating contacts to provide supervision of the line pair from the control panel or other supervisory device. Resistors are provided with the BT2-7 Assembly; RXM zone input terminating resistors are included in the RXM Field Kit (P/N 176-178-01). Connect the zone input line pairs to the terminals. To prevent them from being in a trouble condition, resistors must be installed on the terminals of any unused BT2-7 or RXM zone inputs. The unused zones can be disabled at the Central Receiving System as described in the Central Receiving System I-O-M Manual.

Local control panels or devices which have isolated dry contacts for alarms (normally open) and troubles (normally closed) may be connected directly to the BT2-7 or RXM.

▼ **NOTE** *No voltage or current may be applied to the zone inputs from external sources. If the local control panel or devices do not provide isolated contact arrangements for transmission of alarm and trouble signals, an interface such as Monaco's TM Module (P/N 176-099-00) must be used. The TM Module also provides required supervisory resistance. If the local control panel does not provide a supervised alarm output for operation of the interface panel, the interface panel must be located within 20 feet of the control panel and all interconnecting wire must be in conduit.*

Connect zone input line pairs as needed to the terminals on the BT2-7 and RXMs used. The input circuits should be configured as shown on the cover plate and in Figure 2-4.

Figure 2-4
Input circuit wiring



Strip the wiring about 1/2 inch. Loosen the screw of the terminal to be connected. Place the wire end underneath the plate in the terminal pair, then tighten the screw until snug.

RSA Relay

To use the RSA relay for remote testing of the BT2-7, the RSA NO and C terminal pair is wired to one of the BT2-7 zone inputs. Place a 15 kohm resistor across the zone input terminal pair to prevent a continual open (trouble) condition. The closure of the RSA relay terminal is recognized as a short on the zone input loop and treated as an alarm by the BT2-7. After 20 seconds the RSA relay resets, and the zone is no longer in alarm. When performing this test, the BT2-7 should transmit `alarm` and `end alarm` messages to the Central Receiving System.

Tamper

A normally closed tamper or tilt switch may be connected to the terminal labeled TMPR at the far left of the terminal block. If the tamper input is not used, it must be looped off. When the tamper device is activated, the audible alert sounds (if enabled), and the BT2-7 sends a report to the Central Receiving System. The audible alert may be manually silenced, and automatically turns off when the tamper condition is corrected. (For additional information, see the section titled "Indicators" on page 1-4.)

Power

IMPORTANT *Ensure the antenna is connected to the BT2-7 before ac or dc power is applied.*

BT2-7 Power

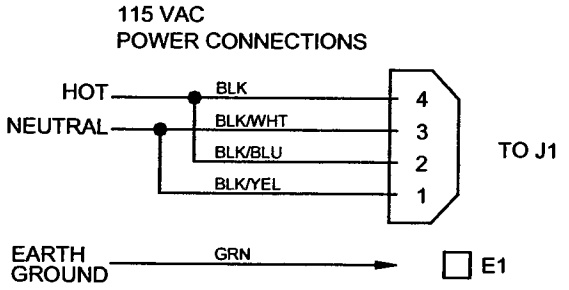
The BT2-7 will accept ac power from either a 115- or 230-Vac source. The ac input is stepped down and converted to operational voltage by the Power Supply.

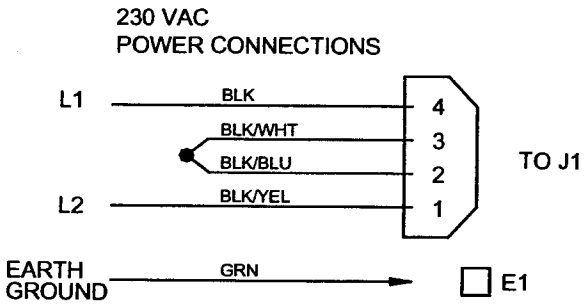
CAUTION *Data and/or equipment can be damaged if connections are not made correctly.*

To wire ac power to the BT2-7

1 Ensure the antenna, lightning protection, and coaxial cable are installed and all connections between the components are made, before connecting ac power.

2 Connect the ac input wiring to the BT2-7 pigtail on J1 as indicated below.





3 Provide a good earth ground connection by connecting the green wire from E1 to earth ground. This allows the built-in ac-line transient-protection circuitry to function properly.

4 Obtain primary power input from one of the following:

- the same source as the local fire alarm system
- the input side of the building main supply through a separately fused disconnect switch
- a dedicated separately fused branch circuit

IMPORTANT *The disconnect should be clearly identified "Fire Alarm Equipment."*

RXM Power

When RXMs are housed in the same enclosure as a BT2-7, ac and battery power are supplied to the RXM via the BT2-7. Wire TB2 terminals 1 (12 Vdc) and 2 (ground) on the BT2-7 to TB1 terminals 1 and 3 on the RXM. Power may be daisy-chained to additional RXMs.

RXMs that are housed in a fire alarm control panel may be powered by the panel. A 12 or 24 volt ac or dc source may be connected to TB1 terminal 1 on the first RXM and then daisy-chained to additional RXMs. A 5-Vdc source may be connected to TB1 terminal 2 on the first RXM. RXM TB1 terminal 3 provides connection for the ground wire. RXMs housed separately may be powered by either the BT2-7 or a fire alarm control panel.

The RXM power source must have battery backup to provide a continuous power supply to the in the event of ac failure. A voltage regulator on the RXM provides regulated 5 Vdc for IC and LED operation.

Applying Power

After all connections have been made, apply ac power.

To power up the BT2-7

1. Visually inspect the BT2-7 and all installed components. Ensure all components are secure.
2. Verify that all connections are secure and correct.
3. Apply ac power. The green AC LED illuminates after the BT2-7 has completed its start-up sequence. The red BATT LED flashes.
4. Note the color-coding and polarity labels on the battery cable.
5. Connect the battery cable to the batteries. (The two 12 Vdc batteries are connected in series.)
   - The orange wire attaches to the positive terminal on one battery.
   - The black wire attaches to the negative terminal on the other battery.
   - The brown wires attach to the remaining two terminals.

   NOTE *If using a single 18Ah battery to power a BT2-7 with up to three RXMs, secure the unused brown wires to prevent shorting.*
6. Plug the battery cable into the battery port (J4) on the Electronic Assembly.

IMPORTANT *If the battery is connected before ac power is connected, the BT2-7 remains in its unpowered state until ac power is supplied or until* **S18** *is pressed. See "Controls" on page 1-6.*

Self-test

The BT2-7 automatically performs an internal self-test on power up, indicated by all LEDs on the BT2-7 illuminating momentarily. If the unit passes the self-test, all LEDs reset to their normal state. (See "Indicators" on page 1-4.) If the self-test fails, the three yellow LEDs labeled RXM 1, 2, and 4 remain lit. The FAULT LED may or may not illuminate. If a self-test failure or processor fault occurs, the BT2-7 cannot respond to polls or commands from the Central

Receiving System. In this situation, press **RESET**. If the BT2-7 remains in a fault condition (RXM 1, 2, and 4 and/or the FAULT LED is on), press the **RESET** switches on connected RXMs. If the problem continues, call Monaco. See "How to Get Assistance" on page iii.

Programming Addresses/Selecting Operating Options

Address information and option settings are set with DIP switches. These settings are not stored in the Data Module; if the BT2-7 is replaced, the DIP switches on the replacement BT2-7 must be set to match those of the BT2-7 being replaced. It is not necessary to press **RESET** on the BT2-7 when its DIP switches are changed or set for the first time, since these settings are read as needed during operation.

A small screwdriver, preferably with a notched end, is needed for latching and unlatching the DIP switches.

Setting the BT2-7 Address

The BT2-7 must be assigned an address before it can receive and respond to Central Receiving System commands, and report alarms and status changes. The address is a unique number between 1 and 2047 that is not used for any other device in the system. If an address is used more than one time in a system, transmissions will be misdirected, provide erroneous information, or be identified as invalid.

The BT2-7 is addressed using the DIP switches labeled S4–S14. The address is set by latching or unlatching the switches to the binary equivalent of the BT2-7 number. RXMs are addressed to the BT2-7 in the same way, using DIP switches on the RXM.

The following instructions assume that you start with the BT2-7 unaddressed, i.e., with all of the address DIP switches in the latched (closed) position. This is the equivalent of a 0. A BT2-7 left unaddressed defaults to the address of 1. If you already have a device addressed as 1, information received at the Central Receiving System for that address may be for any of the zones attached to the devices sharing that address.

To specify the address of a BT2-7

1. Determine the desired BT2-7 address, then convert the decimal number to its binary equivalent. The binary number system uses two digits (0, 1) to represent all values. Many calculators offer a decimal-to-binary conversion function. (Select the Scientific view from the menu of the calculator included with Microsoft Windows for access to the binary feature.) If such a calculator is not available, follow the conversion instructions below.
2. Convert the decimal address to binary.
   - Find the largest binary value that is less than the decimal number and subtract it from the decimal number.
   - Find the largest binary value that is less than the remainder and subtract that.
   - Continue subtracting binary values from remainders until zero is reached.
   - For every binary value that is used, place a one in that position.
   - For every binary value that is not used, place a zero in that position.

Example: Address of 2010 Since there is no individual switch value equaling 2002, subtract 1024, the largest switch value that is less than 2002, from 2002. The remaining amount is 978. The largest binary value that is less than 978 is 512, so subtract 512 from 978, and so on.

Table showing binary representations and switch positions for example address 2002

Binary Value	Subtracted from Decimal Value		Remaining Amount	Binary Representation	Switch	Switch Position
1024	2002-1024	=	978	1	S14	open
512	978-512	=	466	1	S13	open
256	466-256	=	210	1	S12	open
128	210-128	=	82	1	S11	open
64	82-64	=	18	1	S10	open
32	unused			0	S9	closed
16	18-16	=	2	1	S8	open
8	unused			0	S7	closed
4	unused			0	S6	closed
2	2-2	=	0	1	S5	open
1	unused			0	S4	closed

3 Use a small screwdriver or a notched tool to latch or unlatch switches for the desired address. The binary values of the switches are identified on the left side of the cover plate under PROGRAMMING INFORMATION. Open the switches for the binary values to be used (1); close the switches for values that are not used (0). See the above table for how the switches would be set for an address of 2002.

4 After the BT2-7 has been addressed and the BT2 Card has been created at the Central Receiving System, verify the address with the tests described in the section titled "Initial Test" on page 2-16

Setting an RXM Address

The first RXM on the serial loop is addressed as 1; the second RXM is addressed as 2, and the third is addressed as 3. Use the following table to position the DIP switches.

RXM 1	RXM 2	RXM 3
1 open	1 closed	1 open
2 closed	2 open	2 open
3 closed	3 closed	3 closed
4 closed	4 closed	4 closed
5 closed	5 closed	5 closed
6 closed	6 closed	6 closed

Selecting Operating Options

Operating options are set by opening or closing three DIP switches. **AUDIBLE ON/OFF (S1)** is located on the left side of the BT2-7 above the Data Module; **DIAG (S2)** and **ACI (S3)** are located with the address DIP switches. They are also identified in the table on the left side of the cover plate. Use a small screwdriver or a notched tool to latch or unlatch switches.

Switch Name	Function	Operation
S1	Specifies whether the audible alert will sound for alarms and troubles.	Open the switch to prevent the audible alert from sounding.
S2	Specifies diagnostic or normal operating mode.	Open the switch for diagnostic mode. **Important** The BT2-7 does not monitor zone inputs or communicate with the Central Receiving System when it is in diagnostic mode. Polls of the panel are met with `No Reply`.
S3	Specifies whether the BT2-7 transmits ac power failure conditions. When the inhibit mode is selected, the BT2-7 is also prevented from transmitting any zone trouble conditions and end-of-alarm or end-of-trouble conditions that occur during an ac power failure. Zone alarms and tamper and low-battery messages are sent as usual. When ac power is restored to the BT2-7, it reports any trouble conditions that remain on the zone inputs. It also report any end-of-alarm conditions that occurred during the ac power failure, and any end-of-trouble conditions for troubles transmitted before the ac power failure occurred.	Open the switch to prevent transmission of ac failure. **NOTE** The BT2 will always include an existing ac power failure condition in poll replies.

Initial Test

After the connections have been made, addressing is complete, and the BT2 and ZID Cards have been entered in the Central Receiving System, the following tests should be conducted to ensure that the BT2-7 is installed and operating correctly.

Transmit/Receive

To test radio signal transmission and reception

1 Manually poll the BT2-7 from the Central Receiving System as described in the Central Receiving System I-O-M Manual.

- If the BT2-7 responds, continue to "To test BT2-7 operation" on page 2-17.
- If the BT2-7 does not respond, continue to step 2.

2 If the BT2-7 fails to respond, check the following. After correcting all user-correctable conditions described in this step, perform the manual poll again. If the BT2-7 responds, continue to "To test BT2-7 operation" on page 2-17; otherwise, contact Monaco. See "How to Get Assistance" on page iii.

- **The BT2-7 has power, is in normal operating mode, and is not in a fault condition:**

  The AC LED is illuminated, indicating that the BT2-7 has power. If the AC LED is not illuminated, check that power is on and properly connected.

  DIP switch S2 is closed, so that the BT2-7 is in the normal operating mode. If S2 is closed, open it.

  The PWR DISC LED is not illuminated. An illuminated PWR DISC LED indicates a battery or transmitter fault condition. If the PWR DISC LED is illuminated, press **POWER RESET (S3).**

  The BT2-7 FAULT or RXM LEDs are not illuminated. If any of these LEDs are illuminated, press **RESET.**

- **The Central Receiving System is transmitting to the BT2-7.** Verify that the BT2 number is included in the Central Receiving System BT2 polling range setup; if it is, perform another extended poll. Watch to see if any messages are displayed to indicate that the Central Receiving System is unable to send the interrogation. If no messages (e.g., BT2 disabled, RFM is in Receive Only mode) are displayed, perform another extended poll and observe the RFM 7000 to verify that the poll is being transmitted (indicated by the XMT LED lighting). If the poll is not being transmitted then the fault is with the RFM 7000; refer to the Central Receiving System I-O-M Manual troubleshooting procedures.

- **The BT2-7 is receiving the signal**

  If the CD LED illuminates, the BT2-7 is receiving the signal. The XMT LED should immediately illuminate to indicate the BT2-7 is sending a reply. If it does not, verify that the DIP switches are properly positioned for the desired BT2-7 address. See "To specify the address of a BT2-7" on page 2-13. If the switches are set to the desired address, verify that the address is not used by another device in communication with the Central Receiving System. If it is, change the address for one of the devices.

If the CD LED does not illuminate, the BT2-7 is not receiving a signal. This may indicate that the antenna is not properly configured. The location of the antenna may need to be changed or a directional antenna may be needed. Other possible sources of this problem include interference on the frequency, or a BT2-7 transceiver and Central Receiving System modem with frequencies that do not match.

- **The BT2-7 is transmitting to the Central Receiving System.** If the XMT LED illuminates, but the Central Receiving System does not receive a transmission from the BT2-7, the problem may be due to transmission power or antenna configuration. Perform the tests described in "Forward and Reflected Power" on page 4-5 and "Antenna/Coaxial VSWR" on page 4-6. The location of the antenna may need to be changed or a directional antenna may be needed.

BT2-7 Operation

The following procedures test BT2-7 operation and BT2-to-Central Receiving System communications. However, in order to test the complete fire alarm system and check the zone input connections to the BT2-7 and any RXMs used, it is necessary to activate alarms and troubles at the local control panel or supervisory device. Inform the proper authorities that alarm and trouble conditions will be reported to the central receiving station.

IMPORTANT *A short (including a double ground fault) on an input loop signals an alarm condition; an open or single ground fault signals a trouble condition.*

To test BT2-7 operation

1 Test operation in an ac power failure:

- Interrupt ac input to the BT2-7. The AC LED should change from steady illumination to flashing. This indicates the BT2-7 is being powered by the battery. The BATT LED does not illuminate for this condition.

  If DIP switch S3 is closed, the unit is set for ac fail transmission. (See "Selecting Operating Options" on page 2-15.) The ac fail condition must exist for 60 seconds before it will be reported to the Central Receiving System. The CD and XMT LEDs should illuminate to indicate transmission of the ac fail condition, and the audible alert, if enabled, will sound at the trouble rate. The audible alert may be manually silenced by pressing **AUDIBLE SILENCE**. Verify that the message is received at the Central Receiving System. (If the BT2-7 is not in communication with the Central Receiving System, it will send only alarm conditions, so the `ac fail` message will not be sent.)

  If DIP switch S3 is open, ac fail transmissions are not sent to the Central Receiving System, and the audible alert is not activated.

- Restore ac power and observe that the AC LED returns to steady illuminated. If DIP switch S3 is closed, `End AC Fail` is sent to the Central Receiving System; verify that the message is received at the Central Receiving System. The audible alert, if enabled, turns off if not previously silenced.

2 Verify battery fault operation:

- Disconnect the battery leads. The BATT LED flashes. Observe that a Battery Fault status change is transmitted (the CD and XMT LEDs light) by the BT2-7 and received by the Central Receiving System. The audible alert (if enabled) sounds at the trouble rate and can be manually silenced by pressing **AUDIBLE SILENCE**. Restore battery power and observe that the BATT LED turns off. The audible alert, if enabled, turns off if not previously silenced. Observe that the CD and XMT LEDs indicate transmission of `End Battery Fault`; verify that the message is received at the Central Receiving System.

3 Verify zones are functioning correctly:

IMPORTANT *This step will cause an alarm to be sent to the Central Receiving System. Notify the proper authorities before proceeding.*

- Each active zone may be checked at the BT2-7 by shorting across the zone input wire pair to simulate an alarm signal, or by opening one side of the loop to simulate a trouble. Observe that the appropriate zone LED (Z1-Z4) flashes and, if enabled, the audible alert sounds. RXM zone alarms and troubles are indicated on the BT2-7 as described in the section titled "Indicators" on page 1-4. Observe that the CD and XMT LEDs light to indicate transmission of the alarm or trouble. After the Central Receiving System acknowledges the transmission, the zone LED changes from blinking to lighted steady. Verify that the correct message was received at the Central Receiving System.

4 Verify alarms are sent during ac failure:

- Remove ac power and initiate several alarms to verify communications while the BT2-7 is operating on battery power. Reapply ac power when the testing is complete and correct operation is confirmed.

Section 3
Operation

This section describes how to operate the BT2-7.

Contents

Communication with the Central Receiving System

The Central Receiving System interprets radio signals from the BT2-7, displaying one of the following messages in an alert dialog, with the associated user-configured ZID number and data from the ZID card:

Text Displayed	What this Means
ALARM	The zone associated with displayed ZID number is in Alarm.
TROUBLE	The zone associated with the displayed ZID number is in Trouble.
BATTERY FAULT	One of the following: ▪ Battery has been disconnected ▪ The BT2-7 has been operating on battery power continuously for six hours ▪ Battery voltage has dropped below 11.2 Vdc (the panel will shutdown when battery voltage drops below approximately 10 Vdc while operating on dc power)
END BATTERY FAULT	The condition causing the BATTERY FAULT (see the table cell above) has been corrected
AC-FAIL	ac power is unavailable to the panel
END AC-FAIL	ac power is again available to the panel
TAMPER	The enclosure tamper switch has been activated
END TAMPER	The condition causing the TAMPER message (see the table cell above) has been corrected
INVALID CONFIG	The configuration of the BT2-7 does not match the configuration in the Central Receiving System database. This can be because the BT2-7 database has been erased, or the data module has been switched. Downloading the configuration data from the Central Receiving System generally solves the problem.
END INVALID CONFIG	The condition causing the INVALID CONFIG message (see the table cell above) has been corrected.
NO REPLY	One of the following: ▪ The BT2-7 did not receive the Central Receiving System message ▪ Faulty BT2-7 transceiver operation ▪ BT2-7 self-test failure ▪ The BT2-7 is in diagnostic mode ▪ More than one device in the system has the same address ▪ BT2-7 shutdown due to low battery disconnect

Indicators

LEDs indicate the status of the panel and its connected zone circuits. The Audible Alert, if configured to be on, activates in case of trouble or alarm. For more information on indicators, see "Indicators" on page 1-4.

Controls

Press **AUDIBLE SILENCE** to silence the Audible Alert.

Additional BT2-7 buttons and DIP switches are for configuration and troubleshooting. For more information, see "Controls" on page 1-6.

Operation During ac Failure

When ac power becomes unavailable, the BT2-7 automatically switches to battery power. Battery voltage may fluctuate due to variations in power requirements of the BT2-7. Transmitter activation, for instance, requires additional power. Sometimes this can cause the battery voltage level to oscillate below the low battery trip value. When ac failure is detected, `ac fail` is sent to the Central Receiving System after a 60-second delay. If a low battery condition occurs before ac power is restored, `Battery Fault` will also be sent. Once ac power is restored, `End AC Fail` will be sent after a 60-second delay. If a low battery condition occurred during the ac failure, `End Battery Fault` will also be sent once the battery voltage has recovered above the low battery trip value. This message may occur either before or after the End ac fail message is received.

If a fresh battery is used to replace a low battery during an ac fail and low battery condition, no additional `Battery Fault` or `End Battery Fault` messages can be sent until after ac power is restored.

Low battery, battery disconnect, and charger failure are all reported to the Central Receiving System as a battery fault. Examine the BATT LED at the BT2-7 to determine which cause is the source of the message. See the description of the BATT LED in the section titled "Indicators" on page 1-4.

Section 4
Maintenance

This section provides preventive maintenance guidelines for the BT2-7. Troubleshooting, assembly replacement guidelines, and detailed operation of the built-in diagnostics are provided in the BT2-7 I-O-M Level II Manual.

Contents

Preventive Maintenance

IMPORTANT *Before performing any tests that will result in a transmission, advise central receiving personnel.*

Battery Maintenance

Inspect and test the battery periodically to ensure the reliability of the BT2-7. A dynamic battery analyzer is preferred (P/N 297-300-00).

To check the battery

1. Remove ac power from the BT2-7 by disconnecting the ac cable at the fuse housing.
2. Interrogate the BT2-7 from the Central Receiving System while operating on battery.
3. Measure the voltage. Replace the battery if the voltage is below 10.5 volts or if physical damage or deterioration is observed.

Preventive Maintenance Procedures

Type of Maintenance	Tasks
Daily	▪ Check the Central Receiving System Printer log for BT2s listed as No Reply. A BT2-7 that does not reply to a poll or command must be investigated immediately since it may not be able to report alarms. ▪ Check the Central Receiving System Extended Poll report for ac power failure reports. If the BT2-7 has been operating on battery power for some time, the battery can deplete; a battery in this condition indicates that it will soon become discharged to the point where the BT2-7 can no longer operate. ▪ Check battery fault reports at the Central Receiving System. If the BT2-7 has been in an ac power failure condition, the battery must be replaced or ac power restored so that the BT2-7 can continue to operate. If the BT2-7 has not reported an ac power failure, a battery fault could indicate high or low charging voltage, an open fuse, or that the battery has been removed.
Monthly	▪ Inspect all BT2-7 units and antenna/lightning arrestor/coax assemblies for battery leakage, corrosion, vandalism, electrical storm damage, water damage, loose connections, frayed wires, or burned or discolored components ▪ Disconnect ac input power by removing the ac fuse in the fuse housing on the ac cable, and allow the BT2-7 to operate on the backup battery. ▪ If DIP switch S3 is closed, verify that the ac fail message is correctly sent and received at the Central Receiving System. ▪ Measure the battery voltage under load and replace the battery if voltage is below 10.5 volts. ▪ Secure any loose wiring or cable connections.
Semiannual	▪ Measure and record ac line voltage. The Vac should range between 110 and 120 volts. ▪ Measure and record battery charging voltage. ▪ Measure transmitter power. See "Forward and Reflected Power" on page 4-5. ▪ Calculate the Voltage Standing Wave Ratio (VSWR). See "Antenna/Coaxial VSWR" on page 4-6. ▪ Perform the daily and monthly tests.
Annual	Inspect the antenna system for damage or corrosion. Measure and record the Power Supply Voltages. See "BT2-7 Power Supply Voltages" on page 4-4 and "RXM Voltage" on page 4-5. Perform the daily, monthly, and semiannual tests.

Adjustments and Measurements

There are several adjustments that can be made on the BT2-7 if test equipment is available for use by qualified personnel. Test points are provided for making measurements to determine if the adjustable functions are out of tolerance. These measurements can help identify parts that should be adjusted or replaced. Performing these measurements as part of scheduled preventive maintenance can identify a potential problem early, allowing correction before a malfunction occurs.

Test Equipment

Basic test equipment is required to perform the measurements described. The following equipment is available from Monaco. (See "How to Get Assistance" on page iii.)

- **Wattmeter Kit (P/N 290-050-01)** Measures RF output of BT2-7 Transceivers.
- **Digital Multimeter (P/N 290-701-01)** Provides for ac and dc power voltage measurements.
- **Programmable Scanner (P/N 196-100-00)** Though not specifically referenced in the measurement procedures, a scanner can pick up possible interference on the system frequency.
- **Dynamic Battery Analyzer (P/N 297-300-00)** Measures the reliablity of a 12 Volt battery.

Procedures

The following test and adjustment procedures require the test equipment identified in the previous section.

▼ **IMPORTANT** *Before making any adjustments during the warranty period, contact Monaco's Product Support Department. (See "How to Get Assistance" on page iii.) Regardless of warranty status, these adjustments should be made only by qualified personnel, after confirming the adjustment will correct a problem.*

BT2-7 Power Supply Voltages

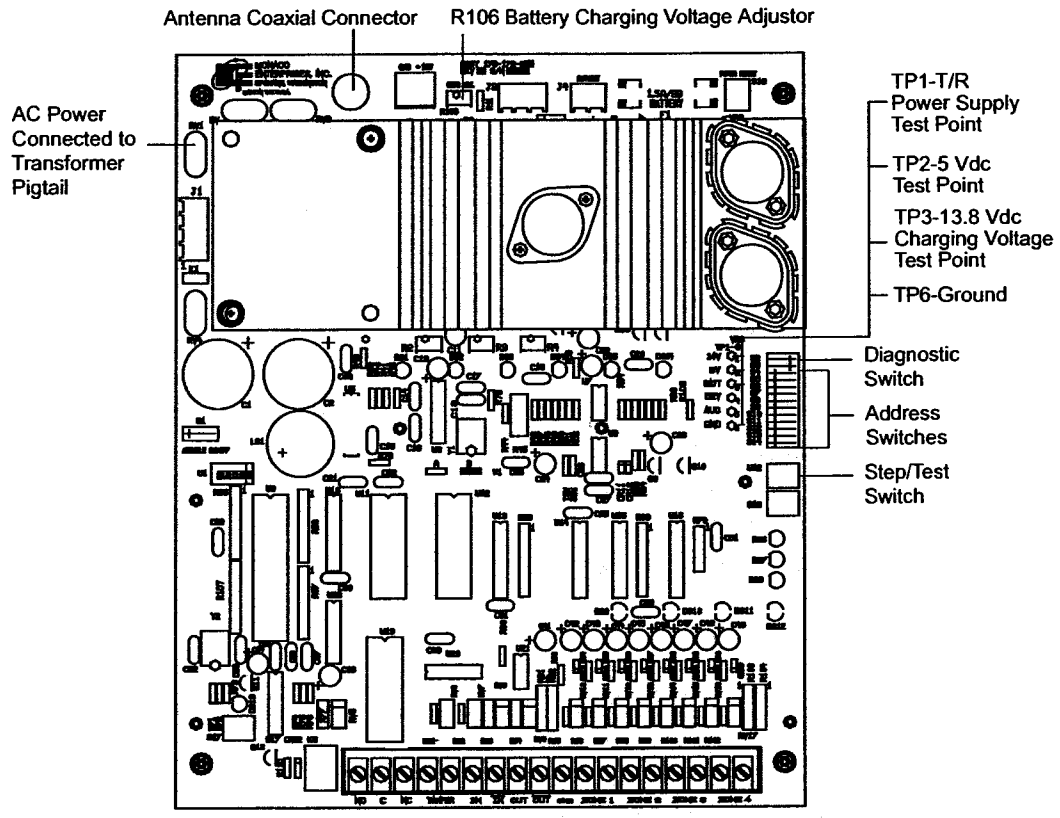


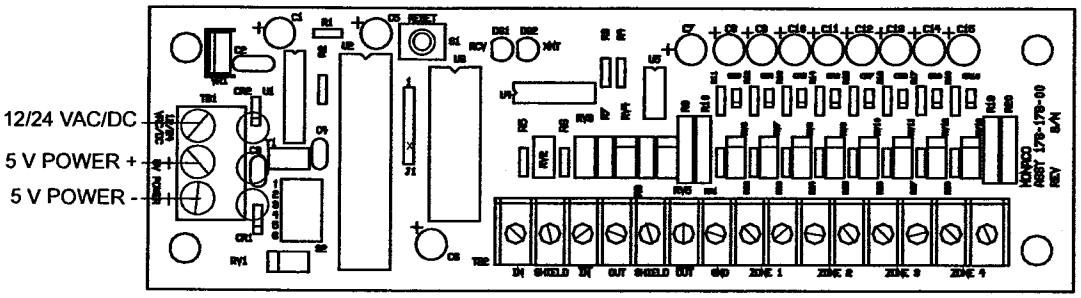
Figure 4-1 *BT2-7 test points, connections, and switches*

Both input and output voltages at the power supply must be correct for proper operation of the BT2-7.

- The input voltage should be between 103.5 and 126.5 Vac for 115V-input or between 207 and 253 Vac for 230-Vac input.
- The power supply provides 13.8 Vdc to the battery charger circuitry. This output can be measured at TP3 (BATT) and TP6 (GND) with a digital multimeter. A variance of ± 0.05 V is acceptable. If the voltage is outside of this range, it may be adjusted at R106 (CHGR ADJ).
- 14 Vdc is supplied to the Transmitter and Receiver. The voltage is not adjustable, but may be checked to verify that the supply is correct with a digital multimeter. It can be measured between TP1 (14V) and TP6 (GND).
- 5 Vdc is supplied to logic circuits. The voltage is not adjustable, but may be checked to verify that the supply is correct. It can be measured with a digital multimeter between TP2 (5V) and TP6 (GND).

RXM Voltage

Figure 4-2



The input voltage of the RXM must be correct for proper operation.

- A 12/24 Vac or dc input voltage supplied to an RXM can be measured with a multimeter between the terminals labeled 12/24 VAC/DC and 5 V POWER -. When 12/24 Vac is supplied, a reading between 6.3 Vac and 25 Vac is acceptable. When 12/24 Vdc is supplied, a reading between 8 Vdc and 35 Vdc is acceptable. Power supplied by a BT2-7 is not adjustable; other sources may be.
- A 5 Vdc input voltage supplied to an RXM can be measured with a multimeter between the terminals labeled 5 V POWER - and 5 V POWER +. The voltage may not be adjusted, but may be checked to verify that the supply is correct. A reading between 4.95 Vdc and 5.05 Vdc is acceptable.

Forward and Reflected Power

To measure the Transmitter RF power out

1. Place the BT2-7 in diagnostic mode by opening DIP switch **S2**. Only the ac LED remains illuminated.
2. Set the BT2-7 address to 9:
   - Write down the current settings of the switches.
   - Open switches **S4** and **S7**, close switches **S5**, **S6**, and **S8** through **S14**.
3. Connect the dummy load (50 ohms) to the wattmeter.
4. Measure forward power:
   - Rotate the wattmeter switch to the forward power position. Disconnect the coaxial cable from the antenna at the BNC connector on the BT2-7 and connect a jumper cable from the BNC connector to the input of the wattmeter.
   - Press **STEP/TEST** to turn on the transmitter and observe the measurement on the wattmeter. Forward power should be 4 watts nominal.

   NOTE *Certain UHF transceivers are licensed for 2.5 watts nominal.*

   - Stop the transmission within 30 seconds by pressing the Step/Test pushbutton again. (If the transmitter remains on longer than 30 seconds, the radio interrupt circuitry will shut it down. It will then be necessary to press switch S18 to reactivate the transmitter.)

5 Measure reverse power:

- Rotate the wattmeter switch to measure reverse power.
- Press **STEP/TEST** to turn on the transmitter and observe the measurement on the wattmeter. It should be negligible. If reverse power is high, it indicates a problem with the coaxial cable from the BNC connector to the transmitter/receiver, or the transmitter/receiver interconnecting cables, or the transmitter.

6 Calculate VSWR as described below; or, if you do not want to calculate VSWR, return the address DIP switches to the BT2 address, then close DIP switch **S2** to return the BT2-7 to the normal monitoring mode.

NOTE *If the BT2-7 is left in the diagnostics mode, it cannot respond to the Central Receiving System or report alarms and troubles.*

Antenna/Coaxial VSWR

A VSWR measurement takes the RF output measurement one step further by indicating the efficiency of the Transmitter-Coax-Antenna signal delivery. VSWR compares output and reflected power and expresses it as a ratio.

To calculate VSWR

1 Measure the forward and reflected power. See "To measure the Transmitter RF power out" on page 4-5.

2 Use the following formula to calculate VSWR:

$$\text{VSWR} = \frac{1+\sqrt{x}}{1-\sqrt{x}}, \text{ where } x = \frac{\text{reflected power}}{\text{forward power}}$$

Example 4 watts forward power; 0.2 watts reflected power

$$x = \frac{0.2}{4.0} = 0.05, \text{so VSWR} = \frac{1+\sqrt{0.05}}{1-\sqrt{0.05}} = \frac{1.22}{0.78} = 1.56{:}1$$

NOTE *The ideal VSWR ratio is 1:1. VSWR above 2:1 is unacceptable.*

If Transmitter reverse power is low but the VSWR measurement is high, this indicates a need for maintenance of the coaxial/lightning arrestor/antenna system.

3 Return the address DIP switches to the BT2 address, then close DIP switch **S2** to return the BT2-7 to the normal monitoring mode.

NOTE *If the BT2-7 is left in the diagnostics mode, it cannot respond to the Central Receiving System or report alarms and troubles.*

Data Module Replacement

Data Modules are not interchangeable between BT2s (including BT2-7s) since the zones connected, enabled or disabled and current alarm or trouble status are specific to each device. However, if a BT2-7 is replaced for repair, the Data Module on it may be transferred to the replacement BT2-7.

If a Data Module is being reused, or traded between BT2s which have been in operation, they should be initialized first (see the following paragraph). If the Dada Module is not cleared, there may be some discrepancies between the status stored in the Data Module and actual BT2/zone status. After the BT2-7 verifies the contents of the Data Module with the Central Receiving System, it checks the ac power and battery status and the tamper and zone inputs. The BT2-7 will recognize conditions that are different from the status in the Data Module as changes and report them to the Central Receiving System. The number of zones attached and zones enabled/disabled is updated in the Data Module by downloading the zone state from the Central Receiving System.

The Data Module should not be initialized if programming is simply being changed or added to, since doing so erases all of the current information. Changes automatically overwrite the previous programmed data for that memory location but leave the other zone information intact.

To initialize the data module

1. Set the DIP switches to the initialization position.
   - Write down the current settings of the switches.
   - Open DIP switches **S2**, **S5**, and **S6**; close DIP switches **S3**, **S4**, and **S7** through **S14**.
2. Press **STEP/TEST**; the Zone LEDs light green.
3. Return the DIP switches to the settings you wrote down in step 1; ensure that **S2** is closed to return the BT2-7 to normal operation.

Forcing the BT2-7 to Restart in Diagnostic Mode

A corrupt Data Module is indicated by all three RXM LEDs illuminating steady when the BT2-7 is powered up. In this situation attempts to initialize the Data Module according to the instructions above will fail. If this occurs, follow the instructions below to force the BT2-7 to start in diagnostic mode.

To force the BT2-7 to restart in diagnostic mode

1. Set the DIP switches to the initialization position.
   - Write down the current settings of the switches.
   - Open DIP switch **S2**; close DIP switches **S3** through **S14**.
2. Press **RESET** to force the CPU to restart.
3. Leave **S2** open, and open **S5** and **S6**.
4. Press **STEP/TEST** to initialize the Data Module; the Zone LEDs will illuminate green if the Data Module is successfully initialized.
   - If the Zone LEDs do not illuminate green, replace the Data Module with a known good module, or contact Monaco. See "How to Get Assistance" on page iii.

5 Return the DIP switches to the settings you wrote down in step 1; ensure that **S2** is closed to return the BT2-7 to normal operation.

6 Download the configuration data from the Central Receiving System to the BT2-7.

Appendix A Specifications

RF Module

Specification	Description
Type	Synthesized, narrowband, FM
RF Frequency Range	FCC assigned, factory programmed to single channel
Required Signal Strength	5 µV minimum
Duty Cycle	(-30°C to 60°C) 50%, 30 second maximum transmit
RF Input/Output Impedance	50 ohms nominal
RF Connector	SMA with BNC adapter
Modulation	Frequency Shift Keying (FSK)
Temperature Range	-30 to +60°C (–22 to +140°F)

CPU

Specification	Description
Microprocessor	8-bit, 80C31, CMOS
BT2-7 Programmed IC	32k x 8
RAM	8k x 8
Data Module	1024 bits nonvolatile (10-year data retention)

Power Supplies

Component	Specification	Description
BT2	Power Input	115 or 230 Vac 50/60 Hz
	Internal Outputs	14 Vdc non-adjustable
		13.8 Vdc adjustable (battery charger)
		5 Vdc non-adjustable (logic circuits)
		5 Vdc non-adjustable (reference supply)
	Nominal Current	130 mA normal 780 mA transmit
	Battery backup	Two Gel-Type, 12V/7.7Ah batteries in parallel
	Low Battery Signal	11 Vdc
	Low Battery Shutdown	10 Vdc
	Fuse (F1-Battery)	1.5A/250V Slow Blow
RSA Relay	Form C	2 amps @ 30 Vdc
RXM	Power Input	12/24 Vdc/Vac or 5 Vdc
	Internal Output	5 Vdc non-adjustable logic circuits
	Nominal Current	50 µA

Enclosure

Specification	Description
Type	16-gauge steel
Color	red
Key	Common to BT2 enclosures
Stand-alone enclosure	16" high x 12" wide x 4" deep (40.6 x 30.5 x 10.2 cm)
BT2-7 Assembly/3 RXM Boards	16" high x 12" wide x 4" deep (40.6 x 55.9 x 10.2 cm)
RXM Enclosure	8" high x 12" wide x 6" deep (20.3 x 30.5 x 15.2 cm)

Environmental

Specification	Description
Temperature	-30 to +60° C (–22 to +140° F)
Humidity	0 to 90% relative, noncondensing

Appendix B Diagrams

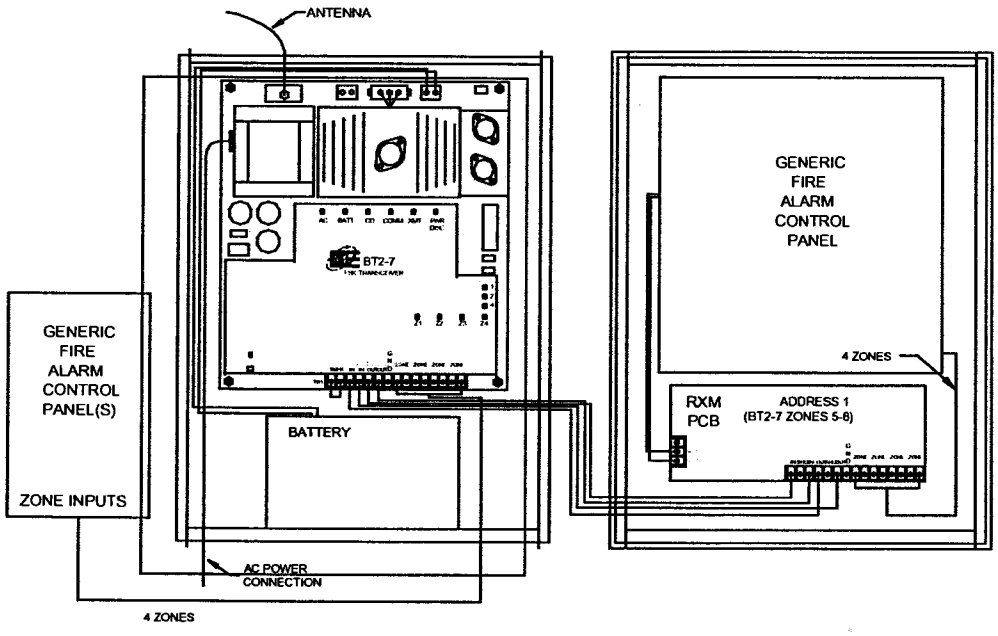


Figure B-1
RXM mounted in a fire alarm control panel

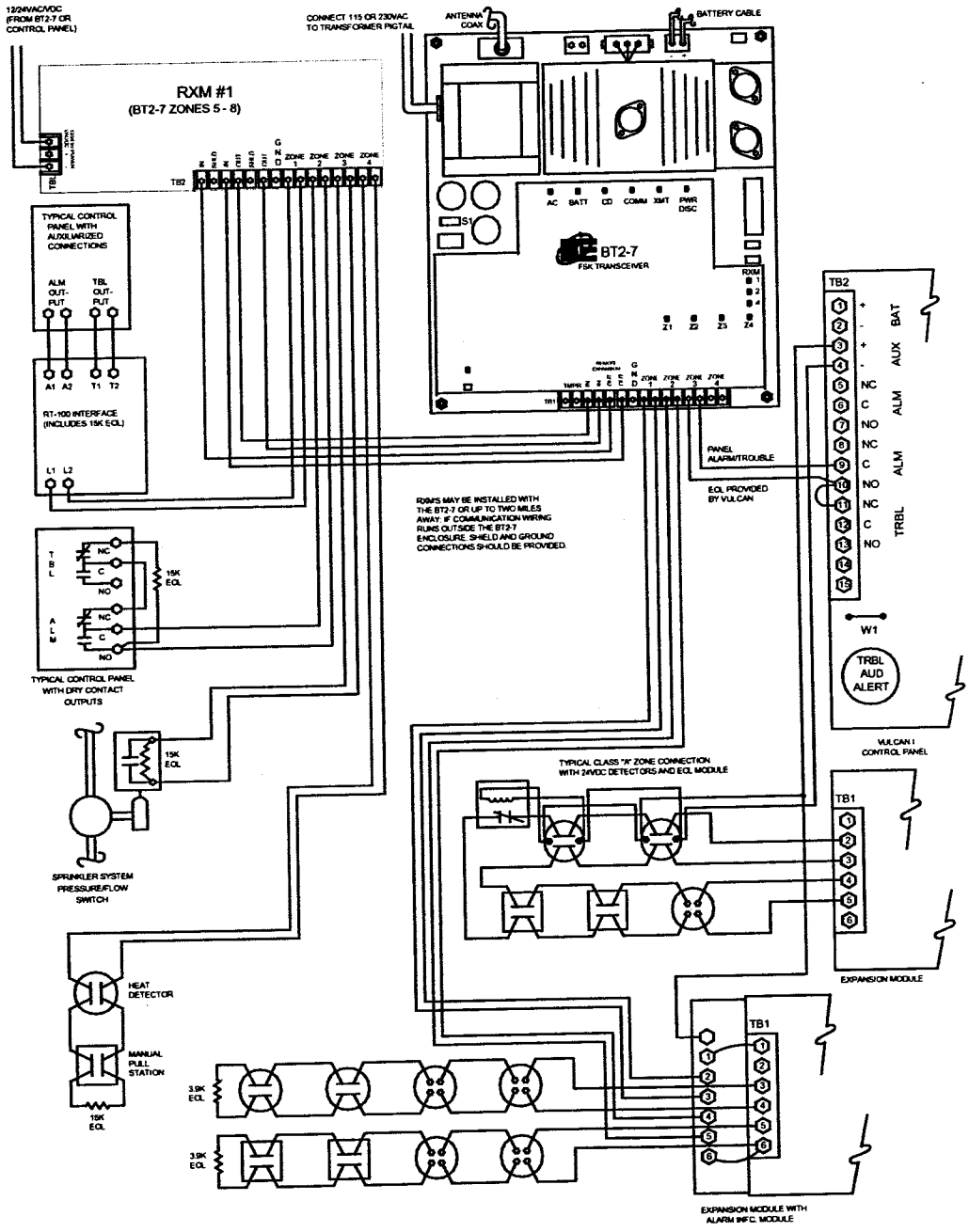


Figure 4-3 *Wiring diagram*

Figure 4-4
RXMs in separate enclosure

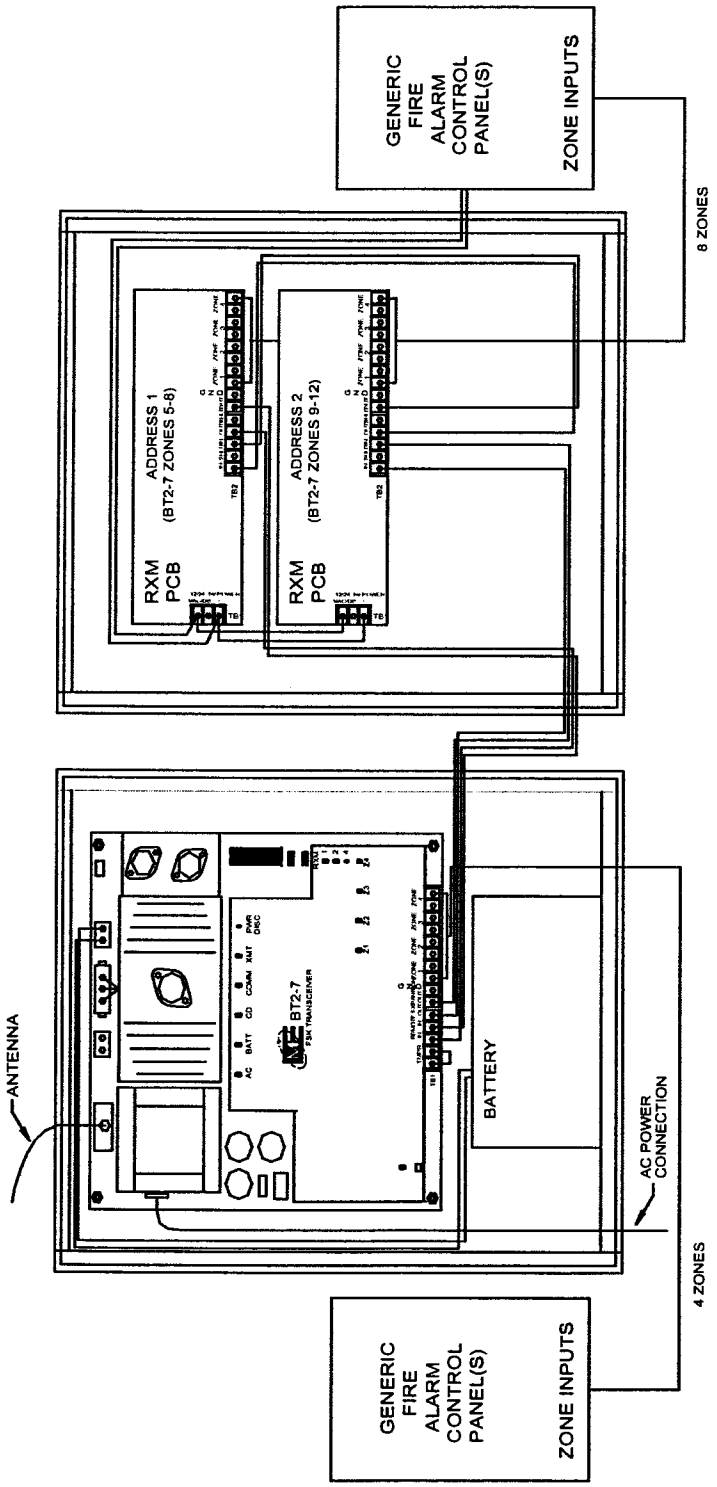


Figure 4-5
BT2-7 data label

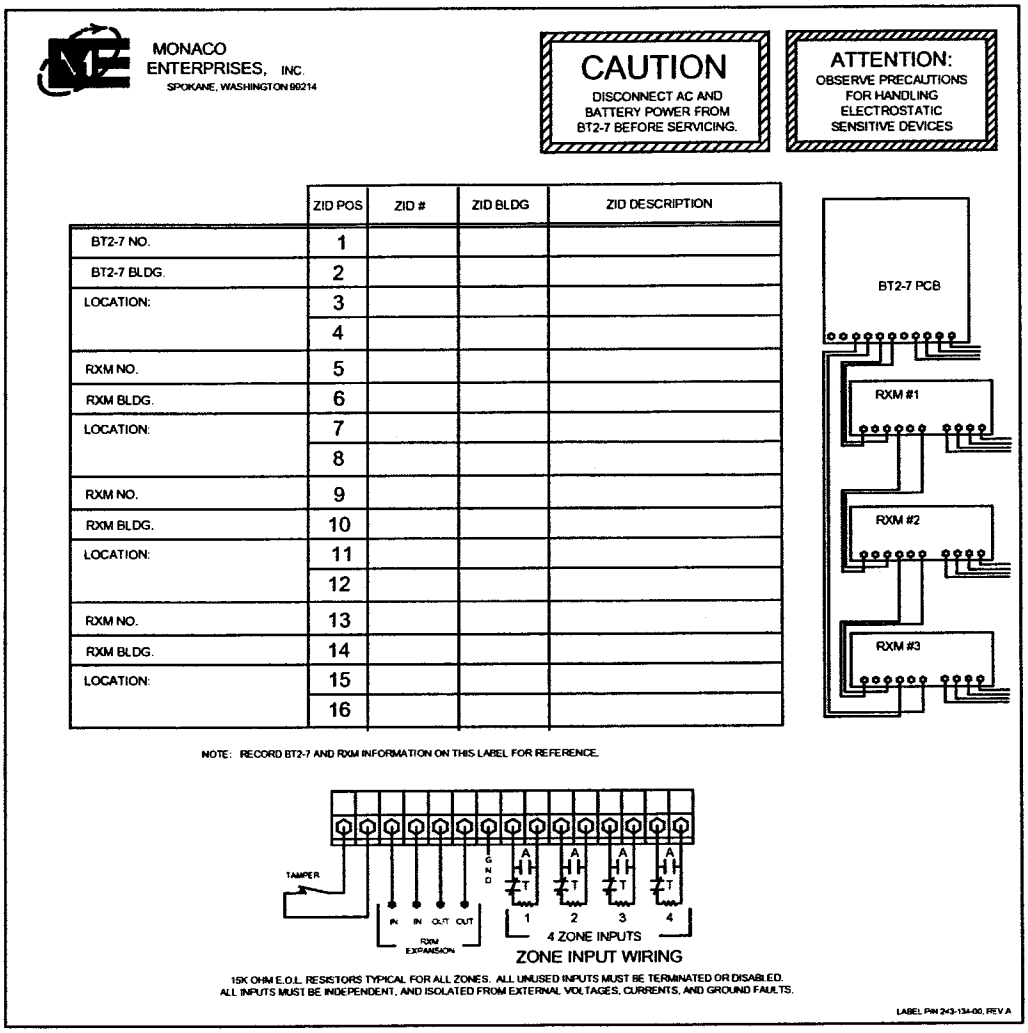
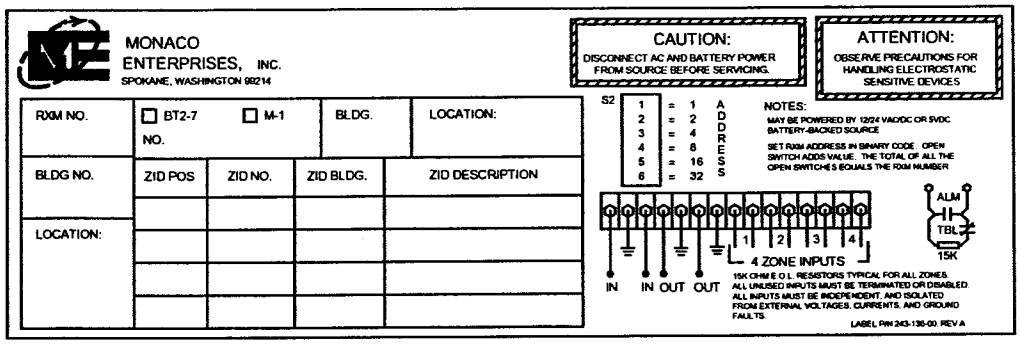


Figure 4-6
RXM data label



Appendix C
Spare Parts List

Part Number	Description
001-204-00	I-O-M Manual, Level I
001-204-01	I-O-M Manual, Level II
176-178-00	RXM
176-178-01	RXM Field Kit (RXM, mounting hardware, data label, and terminating resistors)
176-179-00	Electronic Assembly
196-100-00	Scanner Kit
227-444-01	RF Module
243-134-00	BT2-7 Data Label
243-136-00	RXM Data Label
290-050-01	Wattmeter Kit
290-701-01	Multimeter Kit
297-002-00	Service Monitor Kit
325-026-00	Data Module, Unprogrammed
400-704-00	Battery, Immobile Electrolyte, 12V/7.7Ah (two required)
400-712-00	Battery, Immobile Electrolyte, 12V/18Ah
501-126-00	Fuse, Slow Blow, 1.5A/250V
621-025-00	Four-conductor/22 AWG Communication Cable, 1000-foot Roll
625-064-00	ac Power Cable
625-071-00	Dual Battery Cable Assembly, for use in 12-inch-wide enclosure
625-084-00	RF Module-to-Electronic Assembly Cable
625-086-00	Extended Dual Battery Cable Assembly, for use in 25-inch-wide enclosure
626-072-01	RF Module-to-Antenna Connector Cable

Appendix D
Glossary of Terms

Name	Description
A	See AMPERE
ac	See ALTERNATING CURRENT
Alternating Current	A flow of electricity which reaches maximum in one direction, decreases to zero, then reverses itself and reaches maximum in the opposite direction. The cycle is repeated continuously.
Amp	See AMPERE
Ampere	A unit of electrical current or rate of flow of electrons. One volt across one ohm of resistance causes a current flow of one ampere.
Binary	Pertaining to a characteristic or property involving a selection, choice, or condition in which there are two possibilities; pertaining to a number system with a base of two (0, 1). (Compare DIGITAL SIGNAL)
Binary Digit	A character used to represent one of the two digits in the numeration system with a base of two. Abbreviated bit.
Card	Record for a single BT2 unit (BT2-7 Card) or zone (ZID Card) in a Central Receiving System database.
CD	Carrier Detect
Central Processing Unit	The part of a computer that does most of the data processing, interpreting and executing instructions.
COMM	Communication
CPU	See CENTRAL PROCESSING UNIT
dc	See DIRECT CURRENT
Direct Current	An essentially constant-value electrical current that flows in only one direction.
DIP	See DUAL IN-LINE PACKAGE
Dual In-Line Package	A type of housing for integrated circuits or switches normally of molded plastic with two rows of pins. It is usually soldered into a printed circuit board but may also plug into a socket.
EPROM	Erasable Programmable Read Only Memory; an integrated circuit memory array with a specific pattern written into it to provide instructions for processing information. EPROM chips are typically replacable, allowing for device updates.

Name	Description
Frequency Shift Keying	A form of frequency modulation used to represent digital data on a carrier frequency.
FSK	See FREQUENCY SHIFT KEYING
Hertz	A unit of frequency equal to one cycle per second.
hz	See HERTZ
IC	See INTEGRATED CIRCUIT
Integrated Circuit	An electronic device containing several elements, active or passive, that perform all or part of a circuit function.
Input/Output	The transmission of information from an external source to the MPU or from the MPU to an external source.
Interrogation	The triggering of one or more transponders by transmitting a radio signal or combination of signals.
I/O	See INPUT/OUTPUT
kHz	See KILOHERTZ
Kilohertz	1,000 hertz
Kilohm	1,000 ohms
kOhm	See KILOHM
LED	See LIGHT EMITTING DIODE
Light Emitting Diode	A semiconductor device which illuminates when voltage is applied.
mA	See MILLIAMPERE
Milliampere	One thousandth (0.001) ampere
Megahertz	One million hertz
MHz	See MEGAHERTZ
Microprocessor Unit	The control and processing portion of a microprocessor that can be built with LSI circuitry, usually on one IC.
MPU	See MICROPROCESSOR UNIT
Ohm	The unit of resistance; one ohm is the value of resistance through which a potential difference of one volt will maintain a current of one ampere.
PCB	See PRINTED CIRCUIT BOARD
Printed Circuit Board	An insulated board onto which an interconnection of a number of devices, in one or more closed paths to perform a desired electronic function, has been printed; an etching of conductive strips is used instead of wires.
Polling	Periodic interrogation of each of the devices sharing a communication link, to determine whether a device requires servicing. The control device sends a poll that, in effect, asks, "Do you have anything to transmit?"
PWR DISC	Power disconnect
Queue	A line of items waiting for service in a system, e.g., messages in a buffer, waiting to be transmitted.
RAM	Random access memory
RCV	Receive
RSA	Remote Signal Activation

Name	Description
RXM	Remote expansion module
Supervision	A method of checking the integrity of a communication link to determine that it is unimpaired. Supervision is usually automatic and provides a condition indication; it may be supplemented by manual means. Interrogation/reply is a method of supervision.
V	See VOLT
Vac	Volts ac
Vdc	Volts dc
Volt	The unit of measurement of electromotive force. It is equivalent to the force required to produce a current of one ampere through a resistance of one ohm. Commonly identified as alternating current (ac) or direct current (dc).
Voltage Standing Wave Ratio	In a transmission line, the ratio of maximum to minimum voltage in a standing wave pattern. The VSWR is a measure of impedance mismatch between the transmission line and its load. The higher the VSWR, the greater the mismatch. It serves as a measurement of the quality of the radio system components. A VSWR of 1:1 is perfect.
VSWR	See VOLTAGE STANDING WAVE RATIO
w	See WATT
Watt	A unit of electrical power which expresses the power expended when one ampere of direct current flows through a resistance of one ohm.
XMT	Transmit
ZID	Zone Identification