



Control Communicator MS-5012

Fire Alarm System Limitations

An automatic fire alarm system—typically made up of smoke detectors, heat detectors, manual pull stations, audible warning devices, and a fire alarm control with remote notification capability—can provide early warning of a developing fire. Such a system, however, does not assure protection against property damage or loss of life resulting from a fire.

The Manufacturer recommends that smoke and/or heat detectors be located throughout a protected premise following the recommendations of the current edition of the National Fire Protection Association Standard 72 (NFPA 72), manufacturer's recommendations, State and local codes, and the recommendations contained in the Guide for Proper Use of System Smoke Detectors, which is made available at no charge to all installing dealers. A study by the Federal Emergency Management Agency (an agency of the United States government) indicated that smoke detectors may not go off in as many as 35% of all fires. While fire alarm systems are designed to provide early warning against fire, they do not guarantee warning or protection against fire. A fire alarm system may not provide timely or adequate warning, or simply may not function, for a variety of reasons:

Smoke detectors may not sense fire where smoke cannot reach the detectors such as in chimneys, in or behind walls, on roofs, or on the other side of closed doors. Smoke detectors also may not sense a fire on another level or floor of a building. A second-floor detector, for example, may not sense a first-floor or basement fire.

Particles of combustion or "smoke" from a developing fire may not reach the sensing chambers of smoke detectors because:

- Barriers such as closed or partially closed doors, walls, or chimneys may inhibit particle or smoke flow.
- Smoke particles may become "cold," stratify, and not reach the ceiling or upper walls where detectors are located.
- Smoke particles may be blown away from detectors by air outlets.
- Smoke particles may be drawn into air returns before reaching the detector.

The amount of "smoke" present may be insufficient to alarm smoke detectors. Smoke detectors are designed to alarm at various levels of smoke density. If such density levels are not created by a developing fire at the location of detectors, the detectors will not go into alarm.

Smoke detectors, even when working properly, have sensing limitations. Detectors that have photoelectronic sensing chambers tend to detect smoldering fires better than flaming fires, which have little visible smoke. Detectors that have ionizing-type sensing chambers tend to detect fast-flaming fires better than smoldering fires. Because fires develop in different ways and are often unpredictable in their growth, neither type of detector is necessarily best and a given type of detector may not provide adequate warning of a fire.

Smoke detectors cannot be expected to provide adequate warning of fires caused by arson, children playing with matches (especially in bedrooms), smoking in bed, and violent explosions (caused by escaping gas, improper storage of flammable materials, etc.).

While a fire alarm system may lower insurance rates, it is not a substitute for fire insurance!

Heat detectors do not sense particles of combustion and alarm only when heat on their sensors increases at a predetermined rate or reaches a predetermined level. Rate-of-rise heat detectors may be subject to reduced sensitivity over time. For this reason, the rate-of-rise feature of each detector should be tested at least once per year by a qualified fire protection specialist. *Heat detectors are designed to protect property, not life.*

IMPORTANT! Smoke detectors must be installed in the same room as the control panel and in rooms used by the system for the connection of alarm transmission wiring, communications, signaling, and/or power. If detectors are not so located, a developing fire may damage the alarm system, crippling its ability to report a fire.

Audible warning devices such as bells may not alert people if these devices are located on the other side of closed or partly open doors or are located on another floor of a building. Any warning device may fail to alert people with a disability or those who have recently consumed drugs, alcohol or medication. Please note that:

- Strobes can, under certain circumstances, cause seizures in people with conditions such as epilepsy.
- Studies have shown that certain people, even when they hear a fire alarm signal, do not respond or comprehend the meaning of the signal. It is the property owner's responsibility to conduct fire drills and other training exercise to make people aware of fire alarm signals and instruct them on the proper reaction to alarm signals.
- In rare instances, the sounding of a warning device can cause temporary or permanent hearing loss.

A fire alarm system will not operate without any electrical power. If AC power fails, the system will operate from standby batteries only for a specified time and only if the batteries have been properly maintained and replaced regularly.

Equipment used in the system may not be technically compatible with the control. It is essential to use only equipment listed for service with your control panel.

Telephone lines needed to transmit alarm signals from a premise to a central monitoring station may be out of service or temporarily disabled. For added protection against telephone line failure, backup radio transmission systems are recommended.

The most common cause of fire alarm malfunction is inadequate maintenance. To keep the entire fire alarm system in excellent working order, ongoing maintenance is required per the manufacturer's recommendations, and UL and NFPA standards. At a minimum, the requirements of Chapter 7 of NFPA 72 shall be followed. Environments with large amounts of dust, dirt or high air velocity require more frequent maintenance. A maintenance agreement should be arranged through the local manufacturer's representative. Maintenance should be scheduled monthly or as required by National and/or local fire codes and should be performed by authorized professional fire alarm installers only. Adequate written records of all inspections should be kept.

Installation Precautions

WARNING - Several different sources of power can be connected to the fire alarm control panel. Disconnect all sources of power before servicing. Control unit and associated equipment may be damaged by removing and/or inserting cards, modules, or interconnecting cables while the unit is energized. Do not attempt to install, service, or operate this unit until this manual is read and understood.

CAUTION - *System Reacceptance Test after Software Changes.* To ensure proper system operation, this product must be tested in accordance with NFPA 72 Chapter 7 after any programming operation or change in site-specific software. Reacceptance testing is required after any change, addition or deletion of system components, or after any modification, repair or adjustment to system hardware or wiring.

All components, circuits, system operations, or software functions known to be affected by a change must be 100% tested. In addition, to ensure that other operations are not inadvertently affected, at least 10% of initiating devices that are not directly affected by the change, up to a maximum of 50 devices, must also be tested and proper system operation verified.

This system meets NFPA requirements for operation at 0-49° C/32-120° F and at a relative humidity of 85% RH (non-condensing) at 30° C/86° F. However, the useful life of the system's standby batteries and the electronic components may be adversely affected by extreme temperature ranges and humidity. Therefore, it is recommended that this system and all peripherals be installed in an environment with a nominal room temperature of 15-27° C/60-80° F.

Verify that wire sizes are adequate for all initiating and indicating device loops. Most devices cannot tolerate more than a 10% I.R. drop from the specified device voltage.

Adherence to the following will aid in problem-free installation with long-term reliability:

Like all solid state electronic devices, this system may operate erratically or can be damaged when subjected to lightning-induced transients. Although no system is completely immune from lightning transients and interferences, proper grounding will reduce susceptibility. *Overhead or outside aerial wiring is not recommended, due to an increased susceptibility to nearby lightning strikes.* Consult with the Technical Services Department if any problems are anticipated or encountered.

Disconnect AC power and batteries prior to removing or inserting circuit boards. Failure to do so can damage circuits.

Remove all electronic assemblies prior to any drilling, filing, reaming, or punching of the enclosure. When possible, make all cable entries from the sides or rear. Before making modifications, verify that they will not interfere with battery, transformer, and printed circuit board location.

Do not tighten screw terminals more than 9 in-lbs. Over-tightening may damage threads, resulting in reduced terminal contact pressure and difficulty with screw terminal removal.

Though designed to last many years, system components can fail at any time. This system contains static-sensitive components. Always ground yourself with a proper wrist strap before handling any circuits so that static charges are removed from the body. Use static-suppressive packaging to protect electronic assemblies removed from the unit.

Follow the instructions in the installation, operating, and programming manuals. These instructions must be followed to avoid damage to the control panel and associated equipment. FACP operation and reliability depend upon proper installation by authorized personnel.

FCC Warning

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

Canadian Requirements

This digital apparatus does not exceed the Class A limits for radiation noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

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This control panel has been designed to comply with standards set forth by the following regulatory agencies:

- Underwriters Laboratories Standard UL 864
- NFPA 72 National Fire Alarm Code for Local, Remote Station Fire Alarm Systems

Before proceeding, the installer should be familiar with the following documents.



NFPA Standards

Installation, Maintenance and Use of Central Station Fire Alarm Systems
Local Fire Alarm Systems
Use of Proprietary Fire Alarm Systems
Automatic Fire Detectors
Installation, Maintenance and Use of Notification Appliances for Fire Alarm Systems
Testing Procedures for Fire Alarm Systems.



Underwriters Laboratories Documents:

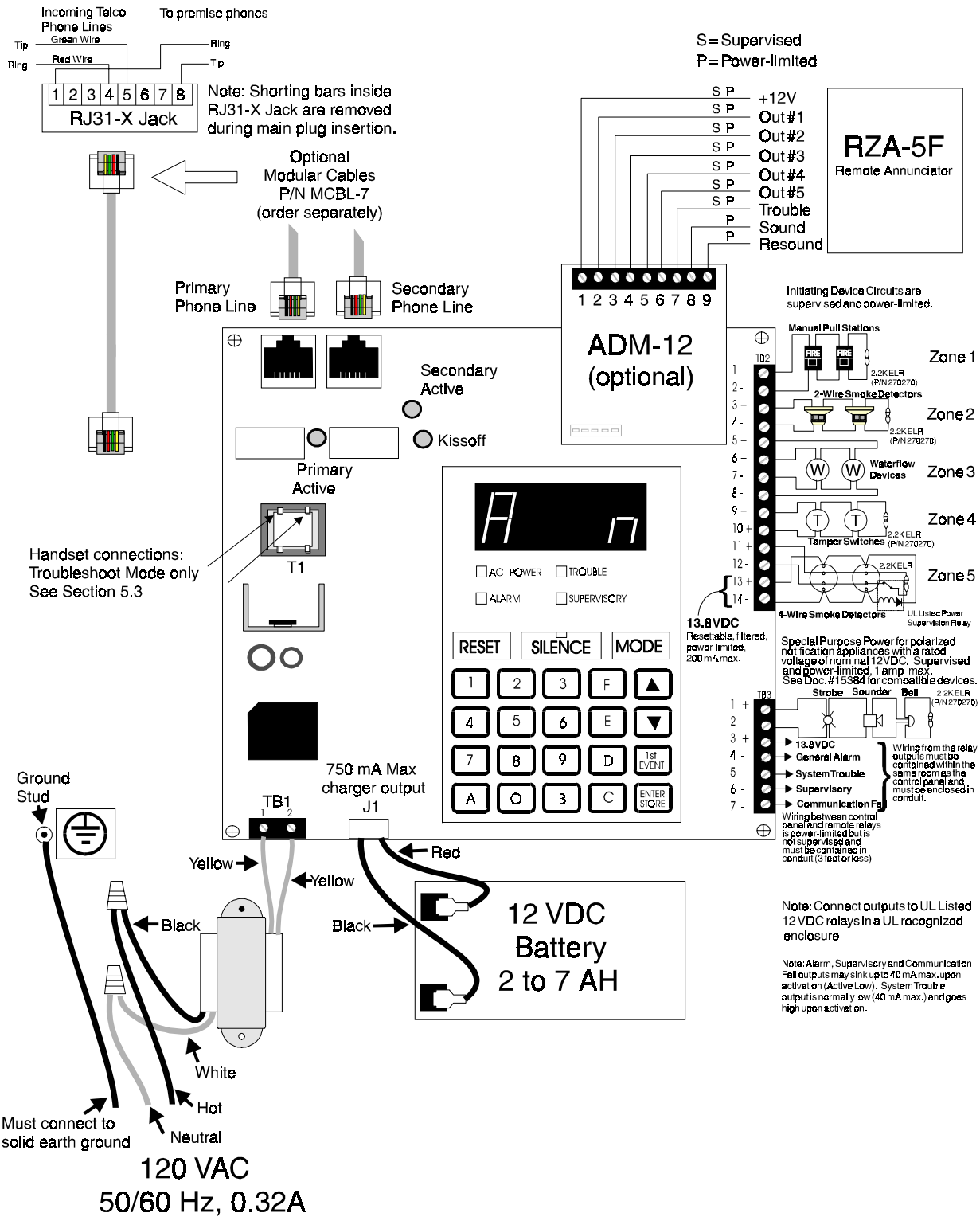
UL 38 Manually Actuated Signaling Boxes
UL 217 Smoke Detectors, Single and Multiple Station
UL 228 Door Closers–Holders for Fire Protective Signaling Systems
UL 268 Smoke Detectors for Fire Protective Signaling Systems
UL 268A Smoke Detectors for Duct Applications
UL 346 Waterflow Indicators for Fire Protective Signaling Systems
UL 464 Audible Signaling Appliances
UL 521 Heat Detectors for Fire Protective Signaling Systems
UL 864 Standard for Control Units for Fire Protective Signaling Systems
UL 1481 Power Supplies for Fire Protective Signaling Systems
UL 1638 Visual Signaling Appliances
UL 1971 Signaling Devices for Hearing Impaired

Other:

NEC Article 250 Grounding
NEC Article 300 Wiring Methods
NEC Article 760 Fire Protective Signaling Systems
ADA American with Disabilities Act
Applicable Local and State Building Codes
Requirements of the Local Authority Having Jurisdiction (LAHJ)

Fire•Lite Documents

Fire•Lite Device Compatibility Document Document #15384



The MS-500

Primary & Secondary Phone Lines

Connector for Annunciator
Driver Module



CHAPTER 1 *Product Description*

The MS-5012 is a combination FACP (Fire Alarm Control Panel) and digital communicator, all on one circuit board. It is a five-zone panel which uses conventional input devices. The panel accepts waterflow devices, two-wire smoke detectors, four-wire smoke detectors, pull stations and other normally open contact devices. Outputs include NACs (Notification Alarm Circuits), alarm relay, trouble relay, supervisory relay and communicator failure relay drivers.

The integral communicator transmits system status (alarms, troubles, AC loss, etc.) to a UL recognized Central Station via the public switched telephone network. The control panel has a built in programmer and may also serve as a slave communicator to a host panel. It also supervises all wiring, AC voltage, telephone line input voltage and battery level.

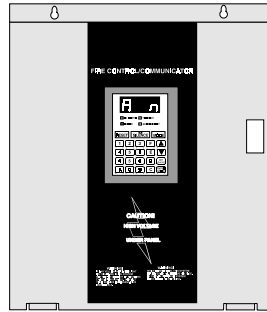
1.1 Product Features

- FACP (Fire Alarm Control Panel)
- Slave Fire Communicator
- 12 volt operation
- Real time clock
- Telephone line active indicators
- Trouble reminder
- One Style D (Class A) zone
- Four Style B (Class B) zones
- Programmable zone ID
- Alarm verification
- Optional annunciators
 - ✓ RZA-5F remote annunciator (requires ADM-12 Annunciator Driver Module)
 - ✓ LED type annunciators
- Small size [14.5" (36.83 cm) x 12.5" (31.75 cm) x 2.875" (7.303 cm)]
- Event history storage
- Silence inhibit
- Auto-silence
- Programmable event codes (all formats)
- Touchtone/rotary dialing
- Programmable make/break ratio
- Communication confirmation (kissoff) LED
- Fuseless
- AC loss report meets UL 864 requirements
- Number of dial attempts (5 minimum, 10 maximum)
- Programmable channel ID (slave)
- Programmable zone delay (waterflow only)
- Four open collector outputs
- Disable report by event
- Low AC voltage sense
- Walktest

Circuits

- Built-in voltmeter
- Built-in programmer
- One NFPA Style Y NAC (Notification Appliance Circuit)
- Optional Dead Panel cover available

FIGURE 1-1: DP-5012 Cover



1.2 Circuits

Input Circuits

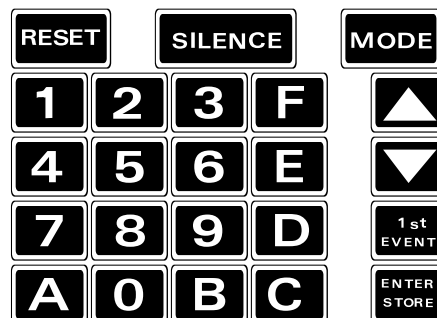
- ✓ Initiating Device Circuit #1 (Style B) Normally Open contact devices *only*
- ✓ Initiating Device Circuit #2 (Style B) Normally Open contact devices and 2-wire smoke detectors
- ✓ Initiating Device Circuit #3 (Style B/D) Normally Open contact devices, 2-wire smoke detectors (Style B only), waterflow devices
- ✓ Initiating Device Circuit #4 (Style B) Normally Open contact devices *only*
- ✓ Initiating Device Circuit #5 (Style B) Normally Open contact devices *only*

Output Circuits

- ✓ Notification Appliance Circuit
- ✓ Resettable Power Circuit
- ✓ Nonresettable Power Circuit
- ✓ Relay Driver Output - Alarm
- ✓ Relay Driver Output - Trouble
- ✓ Relay Driver Output - Supervisory
- ✓ Relay Driver Output - Communicator Failure
- ✓ Primary Telephone Line
- ✓ Secondary Telephone Line
- ✓ 12 Volt Battery Charger

1.3 Front Panel Switches

Reset	Digits 0 - 9
Silence	A
Mode	B
Up Arrow	C
Down Arrow	D
1st Event	E
Enter/Store	F



1.4 Displays

- ✓ Alarm - red LED
- ✓ Trouble - yellow LED
- ✓ Supervisory - yellow LED
- ✓ AC Power - green LED
- ✓ Four 7-Segment Displays - red
- ✓ Primary Phone Line Active - red LED
- ✓ Secondary Phone Line Active - red LED
- ✓ 'Kissoff' signal from Central Station - green LED
- ✓ Silence - yellow LED

1.5 Digital Communicator

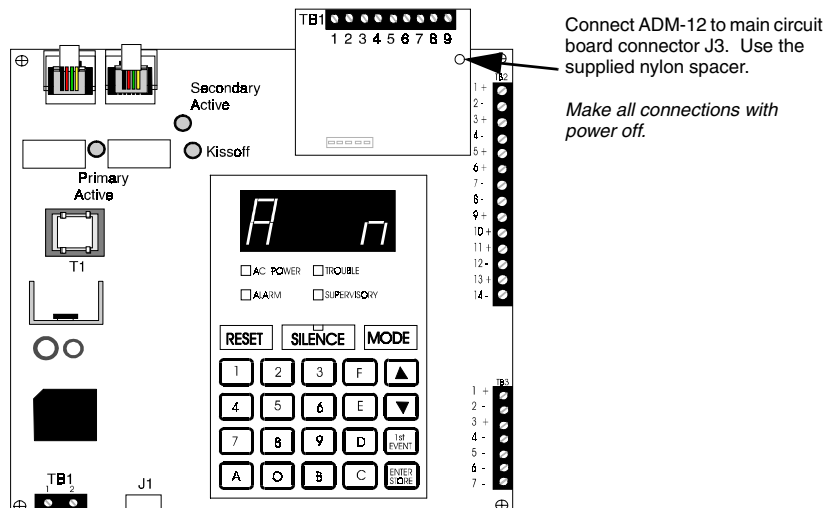
The integral communicator provides the following functions:

- ✓ Line Seizure - takes control of the phone lines disconnecting any premises phones
- ✓ Off/On Hook - perform on and off-hook status to the phone lines
- ✓ Listen for dial tone - 440 hertz tone typical in most networks
- ✓ Dialing the Central Station(s) number - default is Touch-Tone®, programmable to rotary
- ✓ Discern proper 'Ack' and 'Kiss-off' tone(s) - the frequency and time duration of the tone(s) varies with the transmission format. The control panel will adjust accordingly
- ✓ Communicate in the following formats:
 - 12 Tone Burst Types: 20 pps
 - (3+1, 4+1, 4+2, 3+1 Expanded, 4+1 Expanded, 4+2 Expanded)

1.6 ADM-12 Annunciator Driver Module - Optional

The ADM-12 Annunciator Driver Module permits connection of the RZA-5F Remote Annunciator module to the MS-5012 and supervises annunciator wiring for open conditions. The ADM-12 mounts to the MS-5012 main circuit board, occupying one of the two option connectors.

FIGURE 1-2: ADM-12/MS-5012



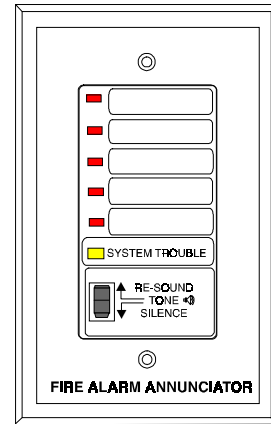
1.7 RZA-5F Remote Annunciator

The RZA-5F Remote Annunciator mounts on a standard single-gang electrical box and provides LED indications for:

- ✓ Alarm Zone 1 (red)
- ✓ Alarm Zone 2 (red)
- ✓ Alarm Zone 3 (red)
- ✓ Alarm Zone 4 (red)
- ✓ Alarm Zone 5 (red)
- ✓ System Trouble (yellow)

A local trouble sounder and tone silence switch are also provided. All LED wiring is supervised for open conditions. Any open will cause the System Trouble LED to turn on. Slide-in paper labels permit an easy change of zone information. *The RZA-5F requires the use of the ADM-12 Annunciator Driver Module.*

FIGURE 1-3: RZA-5F Annunciator



1.8 Specifications

AC Power Primary - TB1 Terminals 1 & 2

120 VAC, 50,60 Hz, 0.32 amps

15.0 VAC, 50/60 Hz, 2.0 amps, 25 VA

Battery (sealed lead acid only) - Connector J1

Maximum Charging Capacity: 14.3 volts, 0.08 amps

Maximum Battery Capacity: 7 AH

Initiating Device Circuits - TB2 Terminals 1-2, 9-10, 11-12

Normally Open Contact Zones 1, 4, 5

Power-limited Circuitry

Operation: NFPA Style B

Normal Operating Voltage: 13.8 VDC (ripple = 100 mV maximum)

Short Circuit Current: 4.46 mA maximum

Maximum Loop Resistance: 100 ohms

End-of-Line Resistor: 2.2K, ½ watt (P/N 27070 UL listed)

Standby Current: 2.66 mA

Initiating Device Circuits - TB2 Terminals 3-4, 5-8

Detector Zones 2, 3

Power-limited Circuitry

Operation: Zone 2 (NFPA Style B), Zone 3 (NFPA Style B, D)

Connecting 2-wire detectors on Zone 3 requires NFPA Style B only

Normal Operating Voltage: 13.8 VDC (ripple = 100 mV maximum)

Alarm Current: 12 mA

Short Circuit Current: 24 mA maximum

Maximum Detector Current in Standby: 2 mA

Maximum Loop Resistance: 30 ohms

End-of-Line Resistor: 2.2K, ½ watt (P/N 27070 UL listed)

Detector Loop Current is sufficient to ensure operation of one alarmed detector per zone

Standby Current: 5.17 mA (including ELR)

Specifications

Notification Appliance Circuit - TB3 Terminals 1 & 2

Power-limited Circuitry

Nominal Operating Voltage: 12 VDC

Requires minimum of 300 mA load

Total current available to external devices: 1 amp

End-of-Line Resistor: 2.2K, ½ watt (P/N 27070 UL listed)

Auxiliary Outputs - TB3 Terminals 4-7

Power-limited Circuitry

Type: Open Collector

Rating: 40 mA each @ nominal 12 VDC

TB3 Terminal 4 Alarm Relay Driver - normally high, active low, sinks up to 40 mA

TB3 Terminal 5 Trouble Relay Driver - normally low, active high, sinks up to 40 mA

TB3 Terminal 6 Supervisory Relay Driver - normally high, active low, sinks up to 40 mA

TB3 Terminal 7 Communicator Failure - normally high, active low, sinks up to 40 mA

Four-wire Smoke Detector Power - TB2 Terminals 13 (+) and 14 (-)

Power-limited Circuitry

Up to 200 mA is available for powering 4-wire smoke detectors

Maximum ripple voltage: 100 mV maximum

Normal Operating Voltage: 13.8 VDC

Nonresettable Power - TB3 Terminal 3 (+) and TB2 Terminal 14 (-)

Power-limited Circuitry

Available Current: 185 mA

Maximum ripple voltage: 100 mV maximum

Normal Operating Voltage: 13.8 VDC

Telephone Circuitry:

Ringer Equivalence Number (REN) = 0.0B

AC Impedance 10.0 Mega Ohm

Complies with FCC Part 68

Mates with RJ31X Male Connector

Supervision Threshold: less than 4.0 volts for 2 minutes

The REN is used to determine the quantity of devices which may be connected to the telephone line. Excessive RENs on the telephone line may result in the devices not ringing in response to an incoming call. In most areas (but not all), the sum of the RENs should not exceed five (5.0). To be certain of the number of devices that may be connected to the line, as determined by the total RENs, contact the telephone company to determine the maximum REN for the calling area.

Specifications

Digital Communicator:

Before connecting the control panel to the public switched telephone network, the installation of two RJ31X jacks is necessary. The following information is provided if required by the local telephone company:

Manufacturer: Fire•Lite Alarms, Inc.
One Fire-Lite Place
Northford, CT 06472

Product Model Number: MS-5012
FCC Registration Number: 1W6USA-74525-AL-E
Ringer Equivalence 0.0B

Note: The FCC ID label is located on the inside of the control panel door.

Piezo Sounder

An on-board piezo sounder will emit three distinctly different audible tones depending on system activity:

- ✓ Steady on for alarms
- ✓ One second on and one second off for trouble
- ✓ ½ second on and ½ second off for supervisory

NAC Fault

The NFPA Style Y circuit configuration allows for connection of polarized bells, strobes and horns. The wiring to these notification appliances is monitored for opens and shorts.

Telephone Company Rights and Warnings

The telephone company, under certain circumstances, may temporarily discontinue service and/or make changes in its facilities, services, equipment or procedures which may affect the operation of this control panel. However, the telephone company is required to give advance notice of such changes or interruptions.

If the control panel causes harm to the telephone network, the telephone company reserves the right to temporarily discontinue service. Advance notification will be provided except in cases when advance notice is not practical. In such cases, notification will be provided as soon as possible. The opportunity will be given to correct any problems and to file a complaint.

DO NOT CONNECT THIS PRODUCT TO COIN TELEPHONE, GROUND START OR PARTY LINE SERVICES.

When the control panel activates, premise phones will be disconnected.

Two separate phone lines are required. Do not connect both telephone interfaces to the same telephone line.

The control panel must be connected to the public switched telephone network upstream of any private telephone system at the protected premises.

An FCC compliant telephone cord must be used with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using a compatible RJ31X male modular plug which is Part 68 compliant.

CHAPTER 2 *Control Panel Operation*

The MS-5012 has six modes of operation:

- ✓ Normal Mode
- ✓ Program Mode
- ✓ Walktest Mode
- ✓ Lamp Test Mode
- ✓ Troubleshoot Mode
- ✓ History Mode

Upon initial power-up, the system will be in Normal Mode. This section discusses operation of the control panel in the Normal Mode. Programming is discussed in Chapter 4. Walktest, History and Troubleshoot Modes are discussed in “Servicing” on page 47.

FIGURE 2-1: Display and Keypad



2.1 Switch Functions in Normal Mode



The Reset Switch resets the system and any smoke detectors. Pressing the Reset Switch cause the control panel to:

- ✓ Clear the display and status LEDs
- ✓ Turn off the Notification Appliance Circuit
- ✓ Reset all zones by temporarily removing power
- ✓ Silence the on board piezo sounder
- ✓ Store 'Reset' message in the History file (see “History Mode” on page 48)
- ✓ Clear all relay driver outputs
- ✓ Temporarily remove power from the resettable power output (TB1 Terminals 13 & 14)

Any alarm, supervisory or trouble condition that exists after a system reset, will resound the system, reactivating normal system activity. Upon release of the Reset Switch, the display will **RES** read for six seconds.



If the Silence Switch is pressed:

- ✓ The Notification Appliance Circuit will be turned OFF
- ✓ The Silence LED will be turned ON
- ✓ The piezo sounder will be turned OFF
- ✓ 'System Silenced' message will be stored in the History file

Upon the occurrence of a subsequent event (alarm or trouble), System Silence is overridden and the control panel will respond to the new event. *The System Silence switch will be ignored for waterflow type alarms.*

Displays



Pressing the Mode Switch followed by a valid 4-digit numerical code selects one of the five modes of operation.

To enter Normal Mode from any other mode, press then followed by . spells NORM on a Touch-Tone® phone.



The 1st Event switch, along with the Up arrow and Down arrow switches, are used to display any **currently** active alarm and/or fault conditions present in the system. Press the 1st Event switch at any time to display the 1st event (alarm and/or trouble) that occurred.



Down arrow - use the Down arrow switch to view other events (older) that have occurred and are active (not yet cleared).



Up arrow - use the Up arrow switch to view other events (newer) that have occurred and are active (not yet cleared).



The switch is not used in Normal Mode.

2.2 Displays

Four 7-segment red LED characters provide visual annunciation of status, events and messages. The messages that may appear on the display in Normal Mode are listed below:

A 1	Alarm Zone 1
A 2	Alarm Zone 2
A 3	Alarm Zone 3
A 4	Alarm Zone 4
A 5	Alarm Zone 5
F 1	Trouble Zone 1
F 2	Trouble Zone 2
F 3	Trouble Zone 3
F 4	Trouble Zone 4
F 5	Trouble Zone 5
F A	Annunciator Fault

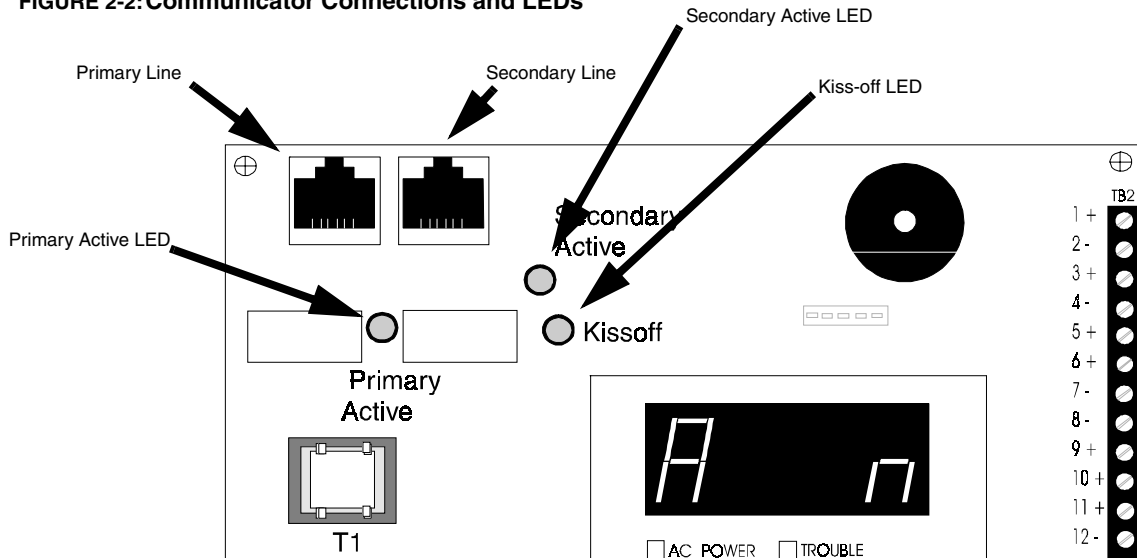
F E	Earth Fault
Lo b	Low Battery
no b	No Battery
PH 1	Primary Number Communication Fault
PH 2	Secondary Number Communication Fault
bELL	Bell Fault
no 1	Primary Phone Line Fault
no 2	Secondary Phone Line Fault
SUP 4	Supervisory Alarm
AC	AC Power Loss
rES	Reset

Operation

Individual LEDs are provided for:

- **System Alarm** - red LED that lights when an alarm condition is detected
- **System Trouble** - yellow LED indicates that a fault or abnormal condition exists and that the fire alarm system may be inoperative
- **AC Power ON** - green LED that remains on while the AC power supply is operating. If this indicator fails to light under normal conditions, service the system immediately
- **Supervisory** - yellow LED that indicates need for action in connection with the supervision or maintenance of sprinklers, extinguishing systems or other protective systems
- **System Silence** - yellow LED that indicates an Alarm or Trouble has been silenced
- **Primary Line Active** - red LED on the main circuit board that indicates the primary phone line is active
- **Secondary Line Active** - red LED on the main circuit board that indicates the secondary phone line is active
- **Kiss-off** - green LED on the main circuit board that indicates the Central Station has acknowledged receipt of transmitted message

FIGURE 2-2: Communicator Connections and LEDs



2.3 Operation

Normal Mode is the standard mode of operation. In this mode, the panel continuously monitors system status. When no alarm or fault conditions exist, the display will be blank and all LEDs will be off (except the AC Power LED). The Notification Appliance Circuit will be off, all relay drivers are deactivated and the on-board piezo sounder will be off. The communicator is not active, and the Primary and Secondary Active LEDs are off.

All alarm conditions and fault conditions are annunciated on the control panel's display. The control panel will maintain an 'active event list' as illustrated in "Displays" on page 17. The list will consist of all alarms, supervisory alarms and faults currently active and not cleared, requiring immediate service. When the system is cleared and restored to normal, the display will be blank. All alarms and faults are stored in a history file and may be recalled at any time. Refer to "History Mode" on page 48.

Operation

Higher priority events take precedence over lower priority events. Display of System Activity is accomplished on a priority basis. Priorities are, from highest to lowest:

1. Alarms
2. Supervisory alarms
3. Faults (troubles)

The highest priority event will be communicated to the Central Station first. It also is displayed, overriding any other displayed event. Only one event is displayed at a time. Whenever multiple events occur, an authorized user may view each event by pressing the Up and Down arrow switches on the keypad. At any time, the user may press the 1st Event switch to display the first event that occurred (that is, the first event that occurred after the panel was last reset, cleared of all active events and placed into Normal Mode).

If the events to be displayed are alarms only (no troubles), the control panel will scroll them on the display. Pressing the 1st Event switch will stop the scrolling and cause the display of the first alarm that occurred. Operation of the Up and Down arrow switches will display all remaining alarms in sequence.

Alarm Response

The MS-5012 will, upon detection of an alarm condition, perform the following functions:

- ✓ Turn the alarm LED on
- ✓ Activate the alarm relay driver (TB3-4)
- ✓ Display an alarm message as follows:

A	1	Alarm Zone 1
A	2	Alarm Zone 2
A	3	Alarm Zone 3
A	5	Alarm Zone 5

(Note that when Zone 4 is programmed as a supervisory zone, it will not be processed in the same manner as a conventional alarm one. See 'System Supervisory Condition' later in this section.)

- ✓ Communicate the alarm to the Central Station
- ✓ Store the alarm in the History file
- ✓ Turn the Notification Appliance Circuit on
- ✓ Turn the piezo sounder on

Alarm Restoral

The control panel returns to normal only after all alarms have been cleared (pull stations reset, smoke detectors reset and no smoke is present, waterflow has stopped) and the Reset switch has been pressed. The control panel will perform the following upon restoral of all active alarms:

- ✓ Turn off the alarm LED
- ✓ Deactivate the alarm relay driver (TB3-4)
- ✓ Clear the 4- character display
- ✓ Send all 'Zone Restoral' messages to the Central Station
- ✓ Turn off the Notification Appliance Circuit
- ✓ Turn off the piezo sounder

Operation

System Supervisory Condition

Zone 4 is factory programmed as a supervisory zone. This zone is primarily used in applications where a waterflow sensing device has been employed and the wiring to the waterflow valve and/or a tamper switch is monitored. If the wiring is cut, a trouble condition will occur. If the Normally Open tamper switch is activated, a supervisory condition will occur.

When a supervisory condition occurs, the control panel will:

- ✓ Turn on the supervisory LED
- ✓ Activate the supervisory relay driver (TB3-6)
- ✓ Display the following message - **SUP4**
- ✓ Communicate the supervisory condition to the Central Station
- ✓ Store 'supervisory' message in the History file
- ✓ Pulse the piezo sounder at ½ second On, ½ second Off rate

When the supervisory condition has been cleared (normal condition is restored and the Reset switch has been pressed), the MS-5012 will perform the following:

- ✓ Turn off the supervisory LED
- ✓ Deactivate the supervisory relay driver (TB3-6)
- ✓ Clear the display of the message - **SUP4**
- ✓ Communicate the 'supervisory restoral' message to the Central Station
- ✓ Shut off the piezo sounder

Trouble Conditions

The control panel will perform the following upon detection of a trouble condition:

- ✓ Turn on the trouble LED
- ✓ Activate the trouble relay driver (TB3-5)
- ✓ Display the appropriate trouble message. Following are the trouble messages shown in order of priority, from the highest priority to the lowest:

AC	AC Loss (must press Up arrow, Down arrow or 1st Event to view)
F 1	Trouble on Zone 1
F 3	Trouble on Zone 3
F 2	Trouble on Zone 2
F 5	Trouble on Zone 5
F 4	Trouble on Zone 4
F E	Ground Fault
L b	Low battery
no b	No battery
no 1	Primary Phone Line Fault
no 2	Secondary Phone Line Fault
bELL	Bell Circuit (NAC) Fault
PH 1	Primary Number Communication Fault
PH 2	Secondary Number Communication Fault
F A	Annunciator Fault
RES	Reset

Digital Communicator

- ✓ Communicate the trouble condition to the Central Station
- ✓ Store the trouble condition in the History file
- ✓ Sound the piezo sounder one second On, one second Off

Note: When AC Brownout occurs, the AC LED turns off and the Trouble LED turns on. Should the brownout condition remain, it will be transmitted to the Central Station after a delay (see Program Address 55 in “Programming” on page 36).

Trouble Condition Restoral

The control panel performs the following upon restoral of a trouble condition:

- ✓ Turn off the trouble LED
- ✓ Deactivates the trouble relay driver (TB3-5)
- ✓ Turn on the AC LED upon restoral, if the trouble was loss of AC power
- ✓ Clear the display of the trouble message
- ✓ Communicate the restored trouble condition to the Central Station

OFF Normal Reporting

Removing the panel from Normal Mode, and placing it into any other mode, causes a transmission of an 'Off Normal' fault message to the Central Station. Returning the panel to Normal Mode causes a transmission of a 'Return to Normal' restoral message.

2.4 Digital Communicator

The MS-5012 transmits zone and system status reports to the Central Station via the public switched telephone network. Two supervised telephone line connections are made to interface the control panel to the telephone lines. Two optional 7-foot telephone cords are available for this purpose. Refer to Figure 3-6, “Wiring Phone Jacks,” on page 30, for proper wiring.

The control panel supervises both telephone lines for proper voltage. A delay of two minutes will occur before a fault in either phone line connection is reported as a trouble. When a fault is detected, an audible trouble signal will sound, the yellow trouble LED will turn on, the 4-character display will show either **no 1** for Primary Line or **no 2** for Secondary Line, depending upon which telephone line has the fault, and the trouble condition will be reported to the Central Station over the remaining operational phone line.

The control panel comes with line seizure capability provided to both the primary and secondary telephone line interfaces. Any time the control panel needs to make a call to the Central Station, line seizure will disconnect any local premises phones sharing the same telephone line.

All transmissions to the Central Station will be sent over the Primary phone line. In the event of noisy phone lines, transmissions will be sent over the backup Secondary phone line.

Two phone numbers must be programmed, the primary phone number and the secondary phone number. See “Programming” on page 36. All system reports will be transmitted to the primary phone number. Reports will automatically be sent to the secondary phone number if attempts to transmit to the primary phone number are unsuccessful. If 10 attempts to communicate are unsuccessful, the Communicator Failure output will be turned on (TB3, Terminal 7). Note that as an option, *all* reports may be sent to the secondary phone number.

The MS-5012 meets NFPA 72 National Fire Alarm Code for Central Station Fire Alarm Systems and for Remote Station Protective Fire Alarm Systems reporting requirements for: (a) the type of signal (b) condition (c) location of the reporting premises. The general priority reporting structure is:

1. Zone Alarms and Restorals
2. Zone Troubles and Restorals
3. System Troubles and Restorals
4. 24-hour test

The control panel is capable of reporting detailed messages depending upon the communication format is use. Table 4-1 through Table 4-4 list these messages. Table 2-1 shows the reporting structure for all of the tone burst type formats.

TABLE 2-1: Format Selection Addresses (16 & 42)

	Format # 2, 4, 6, 8	Format # 3, 5, 7, 9	Format # A, C	Format # B, D
Report	3+1/4+1 Standard	3+1/4+1/Expanded	4+2/Standard	4+2/Expanded
Alarm	SSS(S) A	SSS(S) A AAA(A) Z	SSSS AA2	SSSS AZ
Alarm Restore	SSS(S) RA	SSS(S) RA RARARA(RA) Z	SSSS RARA2	SSSS RAZ
Zone Trouble (Zone Open)	SSS(S) TZ	SSS(S) TZ	SSSS TZTZ2	SSSS TZZ
Zone Trouble Restore	SSS(S) RTZ	SSS(S) RTZ RTZRTZRTZ(RTZ) Z	SSSS RTZRTZ2	SSSS RTZZ
System Trouble	SSS(S) TS	SSS(S) TS TSTSTS(TS) Y	SSSS TSTS2	SSSS TSY
System Trouble Restore	SSS(S) RTS	SSS(S) RTS RTSRTSRTS(RTS) Y	SSSS RTSRTS2	SSSS RTSY
Low Battery	SSS(S) L	SSS(S) L	SSSS LL2	SSSS LL2
Low Battery Restore	SSS(S) RL	SSS(S) RL	SSSS RLRL2	SSSS RLRL2
AC Loss	SSS(S) P	SSS(S) P	SSSS PP2	SSSS PP2
AC Loss Restore	SSS(S) RP	SSS(S) RP	SSSS RPRP2	SSSS RPRP2
Supervisory Condition	SSS(S) V	SSS(S) V VVV(V) Z	SSSS VV2	SSSS VV2
Supervisory Condition Restore	SSS(S) RV	SSS(S) RV RVRVRV(RV) Z	SSSS RVRV2	SSSS RVZ
Test Report	SSS(S) X	SSS(S) X	SSSS XX2	SSSS XX2

Digital Communicator

Following is a description of the terms used in the reporting structure in Table 2-1 .

SSS or	
SSSS	= Subscriber ID
A	= Alarm (1st digit)
A2	= Alarm (2nd digit)
Z	= Zone Number
RA	= Alarm Restore (1st digit)
RA2	= Alarm Restore (2nd digit)
TZ	= Zone Trouble (1st digit)
TZ2	= Zone Trouble (2nd digit)
RTZ	= Zone Trouble Restore (1st digit)
RTZ2	= Zone Trouble Restore (2nd digit)
TS	= System Trouble (1st digit)
TS2	= System Trouble (2nd digit)
RTS	= System Trouble Restore (1st digit)
RTS2	= System Trouble Restore (2nd digit)
L	= Low Battery (1st digit)
L2	= Low Battery (2nd digit)
RL	= Low Battery Restore (1st digit)
RL2	= Low Battery Restore (2nd digit)
P	= AC Loss (1st digit)
P2	= AC Loss (2nd digit)
RP	= AC Loss Restore (1st digit)
RP2	= AC Loss Restore (2nd digit)
V	= Supervisory Condition (1st digit)
V2	= Supervisory Condition (2nd digit)
RV	= Supervisory Condition Restore (1st digit)
RV2	= Supervisory Condition Restore (2nd digit)
X	= Test Report (1st digit)
X2	= Test Report (2nd digit)
Y	= 6 = AC Loss
	= 7 = Ground Fault
	= 8 = Low Battery
	= 9 = No Battery
	= A = Telco Primary Line Fault
	= B = Telco Secondary Line Fault
	= C = Main Bell (NAC) Fault, Annunciator Fault
	= D = Communication Fault to Primary Number
	= E = Communication Fault to Secondary Number
	= F = System Off Normal Fault/System Fault

(See "Slave Communicator Configuration" on page 51)

Note: For Expanded Reporting, the control panel automatically adds the digit corresponding to the zone number, and the second digit corresponding to any system trouble condition. Only the first digit is programmable.

Digital Communicator

Transmittal Priorities

The integral communicator transmits highest priority events first. Events in terms of priority are listed below in descending order:

1. Alarms (Highest Priority Level)

Pull Stations

Waterflow

Smoke Detectors

Other Alarm Types

2. Supervisory Zone

3. Faults

AC Fail

Zonal Faults

Earth Fault

Low Battery/No Battery

Telephone Line Fault

Bell Circuit (NAC) Fault

Communication Trouble

Annunciator Trouble

4. Restoral

AC

Zones

Earth

Battery

Telephone Line

Bell (NAC)

Communication

Annunciator Trouble

5. 24-Hour Test (Lowest Priority)

LED Indicators

Red LEDs are provided on the control panel circuit board to identify which telephone line is activated. A green LED labeled 'Kissoff', will turn on whenever the control panel has successfully transmitted reports to the Central Station. The 'Kissoff' LED may turn on several times during communications.

UL Listed Receivers Compatible with the MS-5012

The following table lists the UL listed receivers which are compatible with the MS-5012 Control Panel.

TABLE 2-2: Compatible UL Listed Receivers

	Format # (Addresses 16 & 42)	Ademco 685 (1)	Silent Knight 9000 (2)	ITI CS-4000 (3)	FBI CP220FB (4)	Osborne Hoffman Models 1 & 2	Radionics 6000/6500 (5)	Sescoa 3000R (7)	Surguard MLR-2 (8)
0	Not Used								
1	Not Used								
2	3+1/Standard/1800/2300	✓	✓	✓	✓	✓	✓ (5, 6)	✓	✓
3	3+1/Expanded/1800/2300	✓	✓	✓	✓	✓		✓	✓
4	3+1/Standard/1900/1400	✓	✓		✓	✓		✓	✓
5	3+1/Expanded/1900/1400	✓	✓		✓	✓		✓	✓
6	4+1/Standard/1800/2300	✓	✓	✓	✓	✓	✓ (5)	✓	✓
7	4+1/Expanded/1800/2300	✓	✓		✓	✓		✓	✓
8	4+1/Standard/1900/1400	✓	✓		✓	✓		✓	✓
9	4+1/Expanded/1900/1400	✓	✓		✓	✓		✓	✓
A	4+2/Standard/1800/2300	✓	✓	✓	✓	✓	✓ (5)	✓	✓
B	4+2/Expanded/1800/2300	✓	✓		✓	✓		✓	✓
C	4+2/Standard/1900/1400	✓	✓		✓	✓		✓	✓
D	4+2/Expanded/1900/1400	✓	✓		✓	✓		✓	✓
E	Not Used								
F	Not Used								

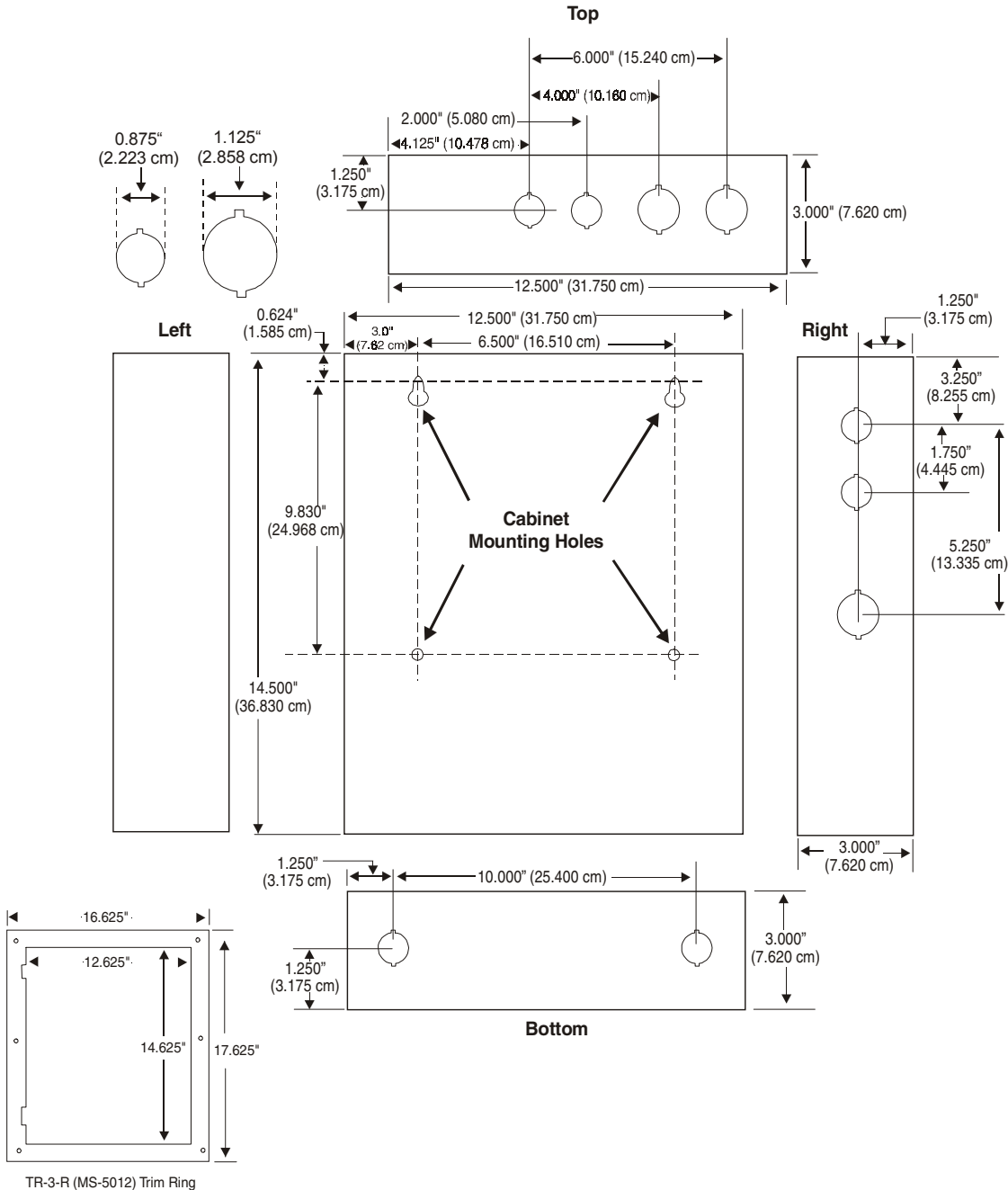
- (1) With 685-8 Line Card with REV. 4.4d software
- (2) With 9002 Line Card Rev. 9035 software or 9032 Line Card with 9326A software
- (3) Rev. 4.0 software
- (4) FBI CP220FB Rec-11 Line Card with Rev. 2.6 software and a memory card with Rev. 3.8 software
- (5) Model 6500 with Rev. 600 software
- (6) Model 6000 with Rev. 204 software
- (7) With Rev. B control card at Rev. 1.4 software and Rev. C line card at Rev. 1.5 software
- (8) Version 1.62 software

CHAPTER 3 *Installation*

3.1 Cabinet Mounting Options

The cabinet may be either semi-flush or surface mounted. The cover is removable during the installation period. The cabinet mounts using two key slots and two additional 0.250" diameter holes located in the backbox. The key slots are located at the top of the backbox and the two securing holes at the bottom. Refer to Figure 3-1 for cabinet dimensions.

FIGURE 3-1: Cabinet Dimensions and Knockout Locations



Draw wires through the respective knockout locations.

3.2 Input Circuits

The MS-5012 has five zone input circuits. The maximum loop resistance limit for each circuit is 100 ohms. All field wiring for each zone is supervised for opens and ground faults. Both conditions are visually and audibly annunciated as well as communicated to the Central Station.

- **Zone 1** is a Style B Initiating Device Circuit (IDC) designed to accept any Normally Open contact device on TB2, Terminals 1 & 2. It is power-limited to 2.66 mA in standby and 4.46 mA in alarm. The factory default is 'Pull Station'. Refer to "Programming Instructions" on page 35.
- **Zone 2** is a Style B Initiating Device Circuit designed to accept any Normally Open contact device and conventional 2-wire, 12 volt smoke detectors on TB2, Terminals 3 & 4. It is power-limited to 7.17 mA in standby and 24 mA in alarm. For a list of compatible 2-wire detectors refer to the Fire•Lite Device Compatibility Document. The factory default is '2-wire Detectors'. Refer to "Programming Instructions" on page 35.
- **Zone 3** is a Style D Initiating Device Circuit. It is designed to accept any Normally Open contact devices, 2-wire smoke detectors (Style B only) and waterflow sensing devices on TB2, Terminals 5 - 8. It is power-limited to 7.17 mA in standby and 24 mA in alarm. A maximum of five waterflow devices may be used per NFPA 71. For a list of compatible 2-wire detectors, refer to the Fire•Lite Device Compatibility Document. The factory default is 'waterflow'. Refer to "Programming Instructions" on page 35.

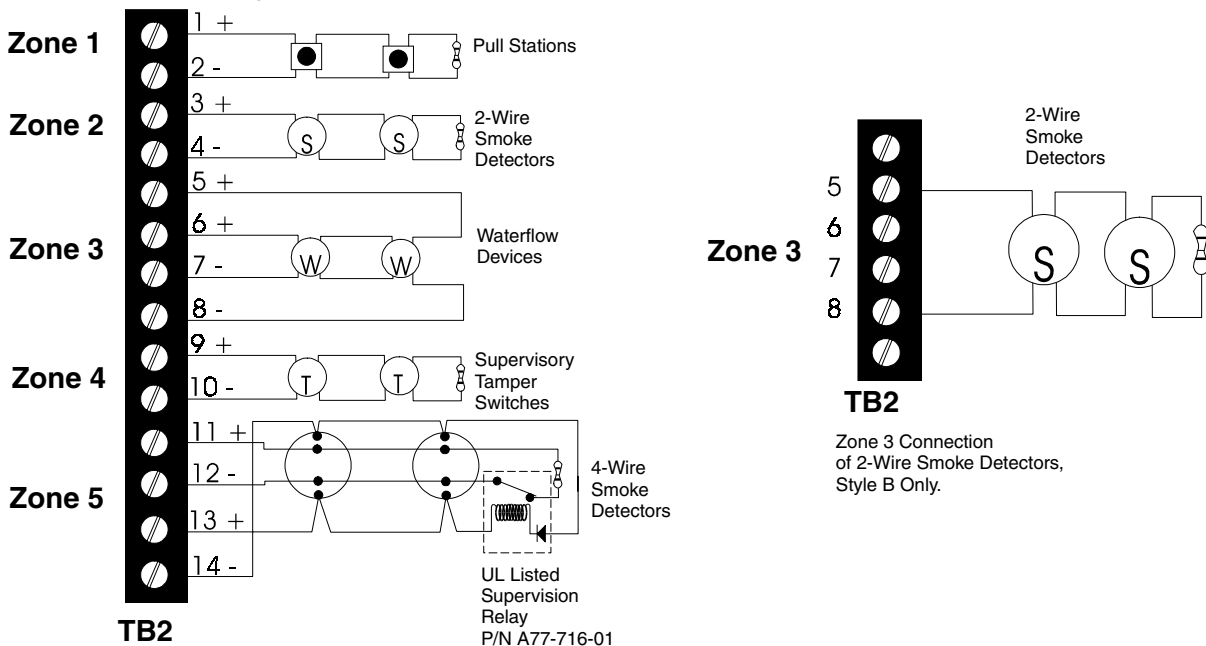
Note: When Zone 3 is programmed to accept 2-wire smoke detectors, it will only function as an NFPA Style B Initiating Device Circuit. See Figure 3-2.

- **Zone 4** is a Style B Initiating Device Circuit designed to function as a supervisory zone or may accept any Normally Open contact device on TB2, Terminals 9 & 10. As a supervisory zone, the circuit may or may not be able to detect a supervisory alarm condition after the occurrence of an open in the loop wiring. It is power-limited to 2.66 mA in standby and 4.46 mA in alarm. Factory default is 'Supervisory'. Refer to "Programming Instructions" on page 35.
- **Zone 5** is a Style B Initiating Device Circuit designed as a general purpose 'initiating zone'. It will accept any Normally Open contact device on TB2, Terminals 11 & 12. It's power-limited to 2.66 mA in standby and 4.46 mA in alarm. Factory default is '4-wire Smoke Detector'. Refer to "Programming Instructions" on page 35.

Four wire smoke detectors may be connected to any zone. Resettable power is provided via TB2, Terminals 13 & 14. See Figure 3-2 for proper connection of 4-wire detectors.

It is allowable to mix an assortment of device types on any zone, however, it is not recommended. By not mixing device types on one zone, messages sent to the Central Station may be very specific and detailed.

FIGURE 3-2: Initiating Device Circuits - TB2



Output Circuits

For example, default programming provides the following:

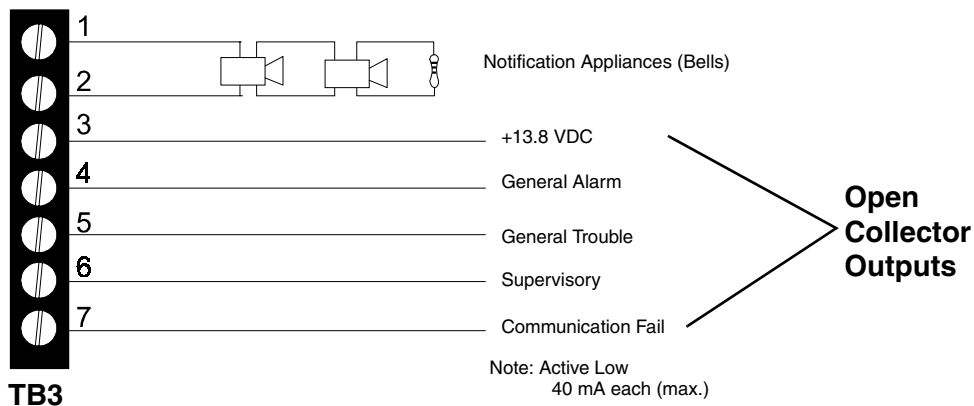
- Zone 1 activation will be reported to the Central Station as 'Manual Pull Station Alarm'
- Zone 4 activation will be reported to the Central Station as 'Supervisory Alarm'
- Zone activation, for reporting formats that do not allow for detailed reports, will be reported to the Central Station as 'Zone 1 Alarm' or 'Zone 4 Alarm'.

Refer to “Operation” on page 18 and “Programming” on page 36 for additional information.

3.3 Output Circuits

One Style Y Notification Appliance Circuit is provided. This supervised circuit allows for the powering of polarized bells, strobes and horns in an alarm condition. Up to one amp of special purpose power is available. For a list of compatible devices, refer to the Fire•Lite Device Compatibility Document. *A minimum 300 mA load is required.*

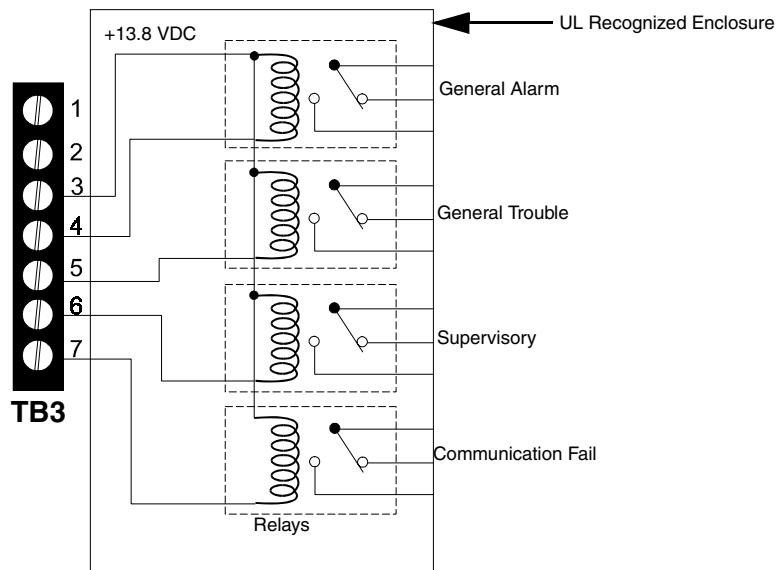
FIGURE 3-3: Output Circuits - TB3



Two RJ31X style phone jacks are provided for the connection of two independent telephone lines. Telephone line control/command is possible via double line seizure. Refer to Figure 3-6 on page 30.

Relay driver outputs, which can be used to drive UL-864 listed remote relays, are available for Alarm, Trouble, Supervisory and Communicator Failure. Refer to Figure 3-4

FIGURE 3-4: Driving Relays From Open Collector Outputs



UL Power-limited Wiring Requirements

The control panel's open collector outputs on Terminal TB3 can be used to activate UL-864 listed remote relays. Outputs are rated for 40 mA. The normal condition for each output is as shown below:

TABLE 3-1: Output Normal Conditions

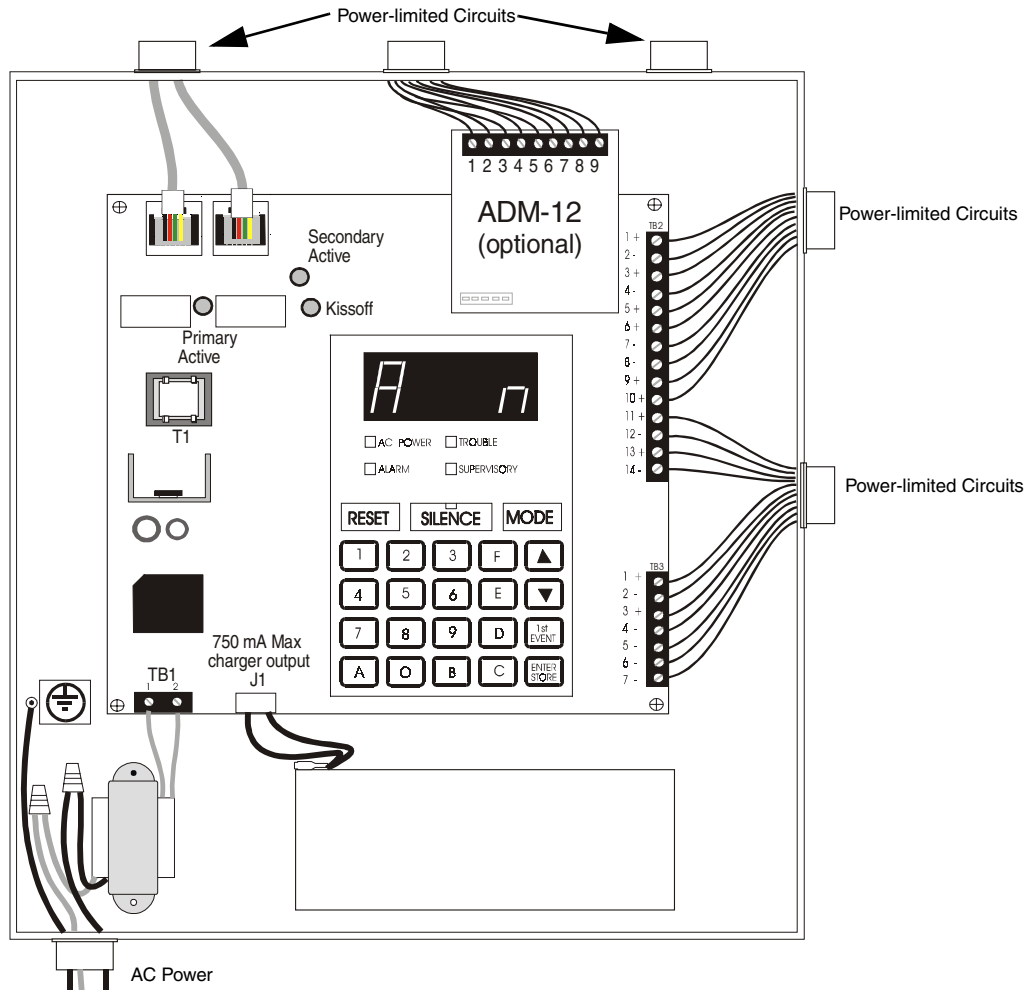
Output	Condition
TB3-4 Alarm	Off (deenergized)
TB3-5 Trouble	On (energized)
TB3-6 Supervisory	Off (deenergized)
TB3-7 Communications Failure	Off (deenergized)

Relays must be placed in a UL-864 recognized enclosure. Wiring from the control panel's terminals on TB3 to the relays must be less than 3 feet (90 cm) in length and enclosed in conduit. Wiring from the relay outputs must remain in the same room as the location of the relay enclosure and be enclosed in conduit.

3.4 UL Power-limited Wiring Requirements

Power-limited and nonpower-limited circuit wiring must remain separated in the cabinet. All power-limited circuit wiring must remain at least 0.25" (6.35 mm) away from any nonpower-limited circuit wiring. Furthermore, all power-limited circuit wiring and nonpower-limited circuit wiring must enter and exit the cabinet through different knockouts and/or conduits. A typical wiring configuration for the MS-5012 is shown in Figure 3-5.

FIGURE 3-5: Typical Wiring Diagram for UL Power-limited Requirements

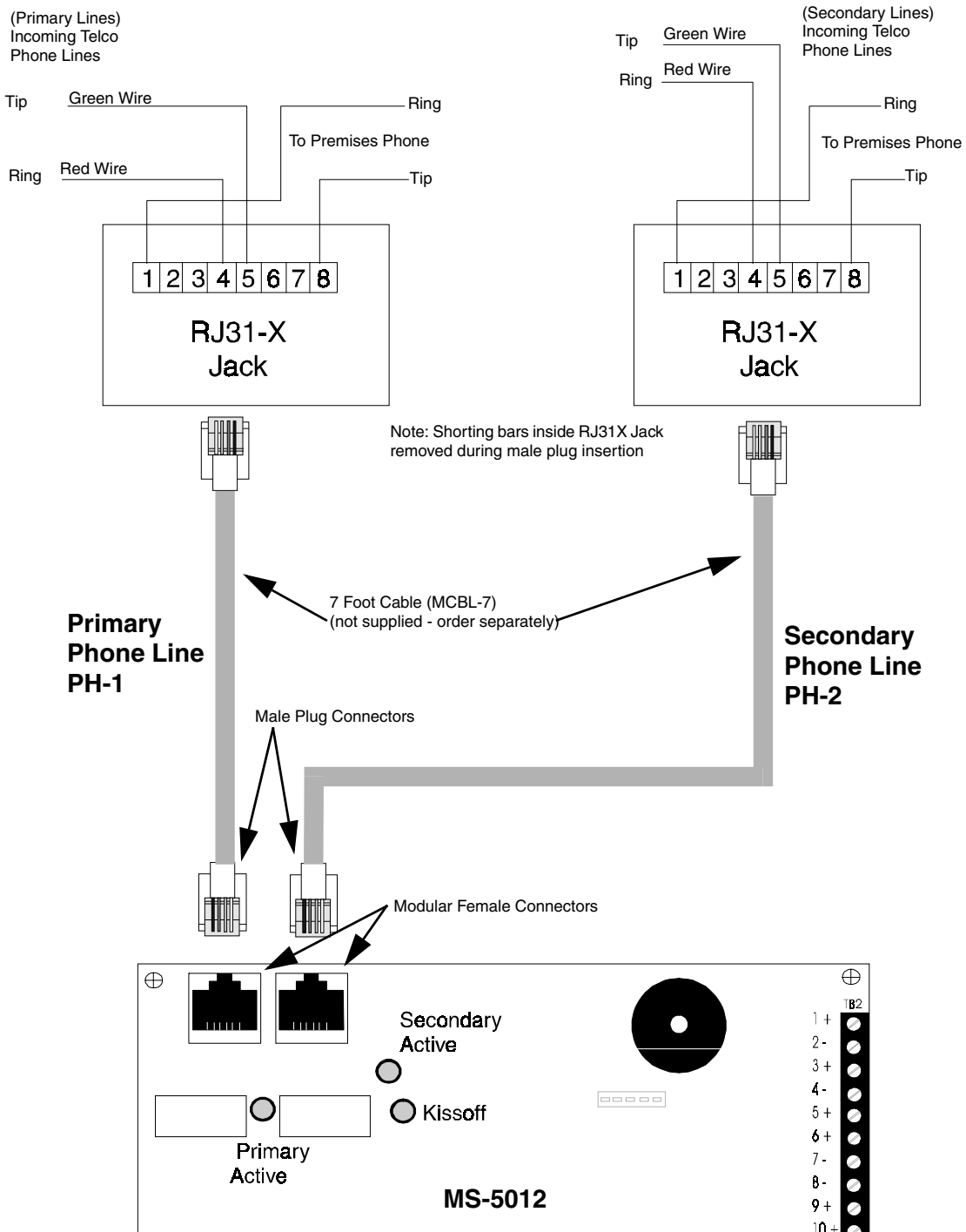


3.5 Digital Communicator

Two independent telephone lines can be connected to the MS-5012. Telephone line control/command is made possible via double line seizure as well as usage of RJ31X style interconnections. *Note: It is critical that the panel's digital communicator be located as the first device on the incoming telephone circuit to properly function.*

The control panel's digital communicator is built right into the main circuit board. All that is required to install the system is the connection and wiring of two phone lines as shown in Figure 3-6.

FIGURE 3-6: Wiring Phone Jacks



3.6 Operating Power

3.6.1 Primary Power Source (AC) and Earth Ground Connections

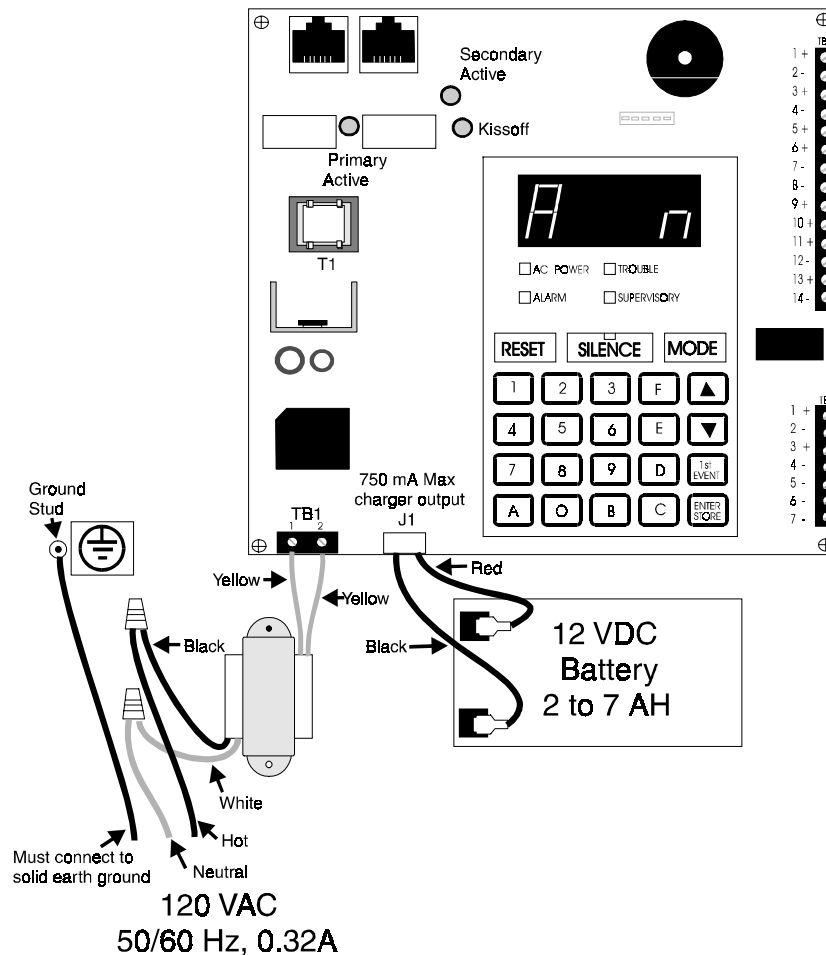
AC power connections are made inside the control panel cabinet. Primary power source is 120 VAC, 50/60 Hz, 0.32 amps. A pair of wires, with a ground conductor, should be connected from the protected premises main breaker box to the black and white primary leads of the MS-5012 system transformer. As per the National Electric Code, use 14 AWG (2.0 mm²) or heavier gauge wire with 600V insulation. No other equipment may be connected to this circuit. In addition, this circuit must be provided with overcurrent protection and may not contain any power disconnect devices.

Connect the backbox ground stud to a solid earth ground (a metallic cold water pipe may be suitable in some installations). This connection is vital for maintaining the control panel's immunity to unwanted electrical transients generated by lightning and electrostatic discharge.

3.6.2 Secondary Power Source (batteries)

Observe polarity when connecting the battery. Connect the battery cable to J1 on the main circuit board using the plug-in connector provided. The battery charger is current-limited and capable of recharging sealed lead acid type batteries. The charger shuts off when the system is in alarm. **CAUTION:** Battery contains sulfuric acid which can cause severe burns to the skin and eyes and can destroy fabrics. If contact is made with sulfuric acid, immediately flush the skin or eyes with water for 15 minutes and seek immediate medical attention.

FIGURE 3-7: MS-5012 Power Connections



3.6.3 Optional AC Terminal Block

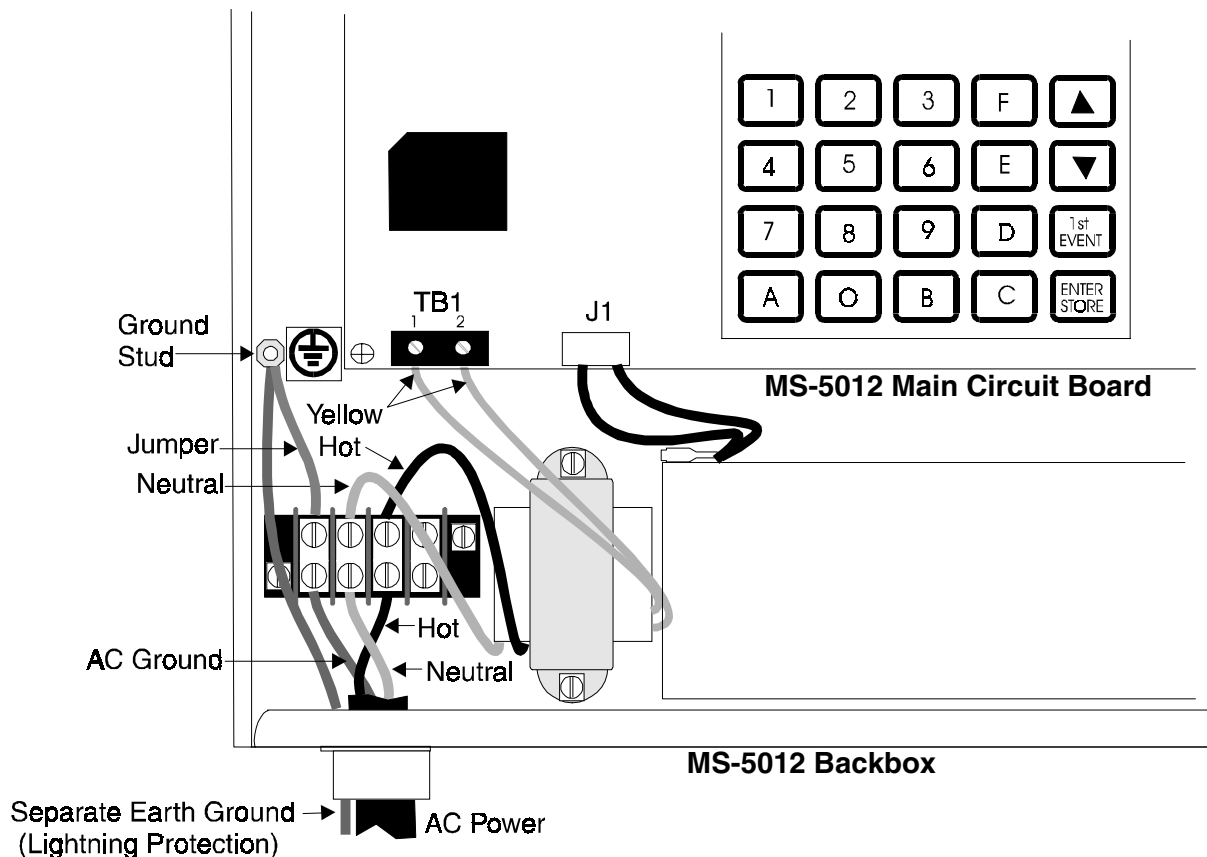
An optional AC terminal block is available for the MS-5012 Control Communicator. The terminal block can only be used on the larger backbox [14.5" (36.83 cm) x 12.5" (31.75 cm) x 2.875" (7.303 cm)]. It cannot be installed in the smaller backbox [12.0" (30.48 cm) x 9.0" (22.86 cm) x 2.75" (6.985 cm)].



WARNING: Make certain all power (AC and battery) is removed before any connections are made.

1. Mount the optional AC terminal block to the lower left of the MS-5012 backbox using the two supplied screws.
2. Connect AC power wiring to the optional terminal block as shown in Figure 3-8.
3. Connect the black and white wires (primary) from the MS-5012 system transformer to the optional terminal block as illustrated in Figure 3-8. Make certain the black AC wire (Hot) is connected opposite the black transformer wire and the white AC wire (Neutral) is connected opposite the white transformer wire.
4. Make certain that the yellow wires (secondary) from the MS-5012 system transformer are connected to Terminal Block TB1 located in the lower left corner of the MS-5012 main circuit board.
5. Install a jumper between the terminal block and the backbox ground stud as illustrated in Figure 3-8. This will be used to provide lightning protection to the panel. Make certain the jumper is connected opposite the green AC ground wire on the terminal block.
6. Install a solid earth ground connection to the backbox ground stud as illustrated below. This will be used to provide lightning protection to the panel.
7. Press the AC terminal cover firmly into place.
8. Reapply AC and battery power to the MS-5012 Control Communicator.

FIGURE 3-8: Optional AC Terminal Block Installation

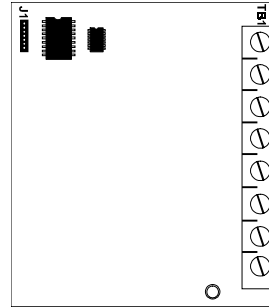


3.7 Optional Boards

3.7.1 ADM-12 Annunciator Driver Module

The Annunciator Driver Module supports the RZA-5F Remote Annunciator module. Annunciator wiring is supervised for open conditions by this module. The ADM-12 mounts to the MS-5012 main circuit board, occupying one of the two option connectors (refer to “ADM-12 Annunciator Driver Module - Optional” on page 12).

FIGURE 3-9: ADM-12 Module

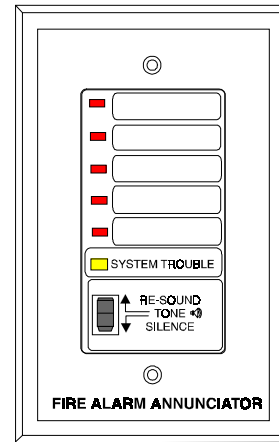


3.7.2 RZA-5F Remote Annunciator

The RZA-5F mounts on a standard single-gang electrical box and provides LED indications of the following:

- Alarm Zone 1 (red)
- Alarm Zone 2 (red)
- Alarm Zone 3 (red)
- Alarm Zone 4 (red)
- Alarm Zone 5 (red)
- System Trouble (yellow)

FIGURE 3-10: RZA-5F Remote Annunciator



In addition, the remote annunciator provides a local piezo sounder and a remote sounder shut off switch. All LED wiring is supervised for open conditions. Any open condition will cause the System Trouble LED to illuminate and the piezo to sound. *Note that the RZA-5F Remote Annunciator requires the use of an ADM-12 Annunciator Driver Module.*

The following figures illustrate the mounting of the RZA-5F and the wiring of the RZA-5F to the ADM-12.

FIGURE 3-11: Mounting the RZA-5F to Single-Gang Electrical Box

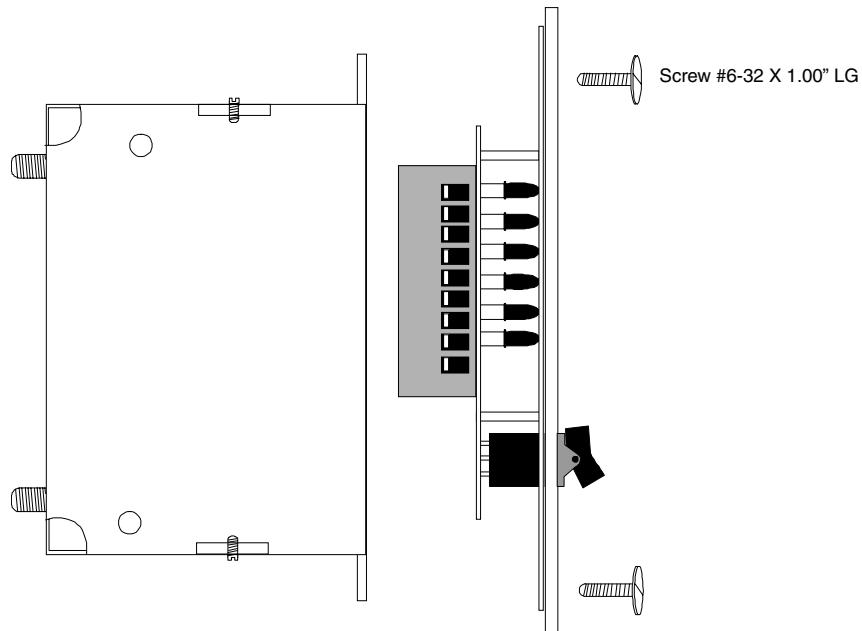
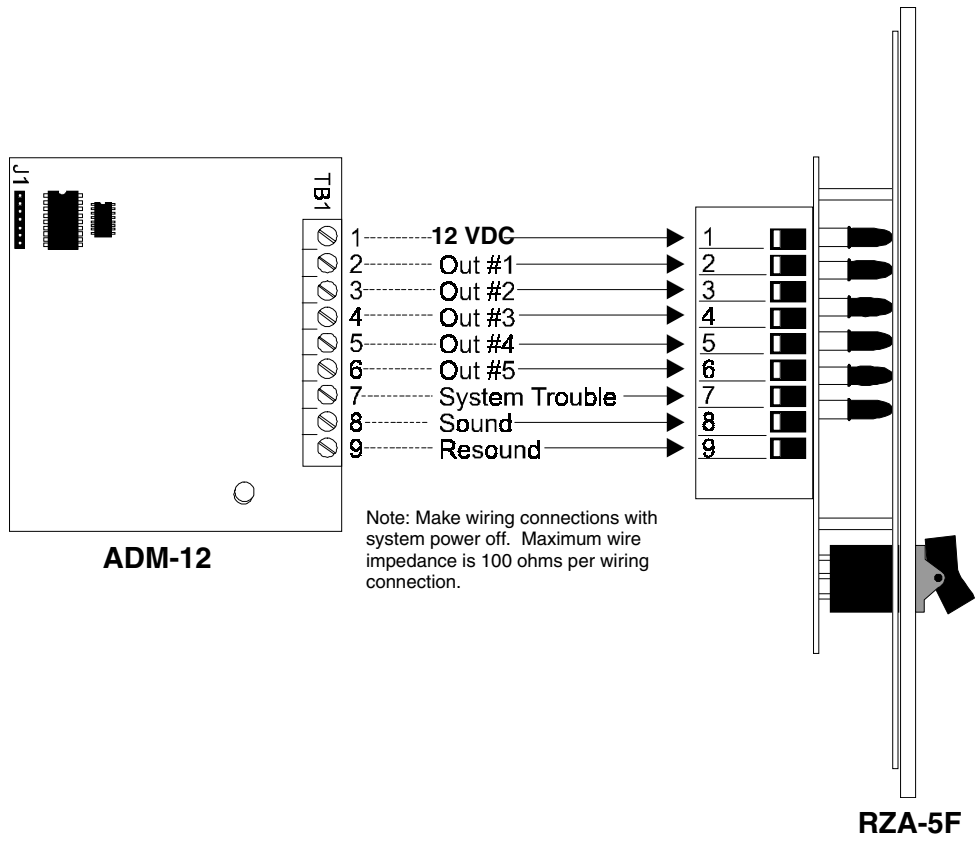


FIGURE 3-12:Wiring the RZA-5F to the ADM-12





CHAPTER 4 *Programming Instructions*

Programming of the MS-5012 is possible at any time except when an alarm condition is present in the Normal Mode of operation. The MS-5012 has been designed for many different types of applications. After examining your specific application, review the programming options and choose the entries best suited for your system.


The MS-5012 has a built-in programmer. All programming selections are stored in nonvolatile EEPROM (Electrically-Erasable Programmable Read-Only Memory). This ensures that the control panel will remember all entries in programming mode even if both AC and battery power are removed.

The user **must** program the primary and secondary phone numbers, account numbers and 24 hour test report times for each Central Station account and the current time. The control panel comes with factory chosen options/features already programmed. Alternate options/features may be programmed if desired. If all factory default settings are acceptable, programming is complete.

4.1 Entering Program Mode


To enter Program Mode, press the  key once (the display will go blank). The user then has ten seconds to start entering the Program Mode code .

  spells PROG on a Touch-Tone® phone.

If an incorrect key is entered, reenter the proper 4-digit code before pressing the  key. Note that as information is entered from the keypad, the digits will scroll across the display from right to left.

```

  7
 77
776
7764
    
```

You are allowed a pause of up to 10 seconds in between each number while entering the code. The control panel will then be in Program Mode with  in the display. A maximum delay of 10 minutes is allowed at this point, before beginning programming, otherwise, the control panel will return to Normal Mode. A maximum of 10 minutes is also allowed between key strokes.

While in Programming Mode, the trouble LED will be on, the trouble relay driver will be activated, but the communicator will not be activated to report this trouble. *Transmissions started before entering Program Mode will continue during programming.*

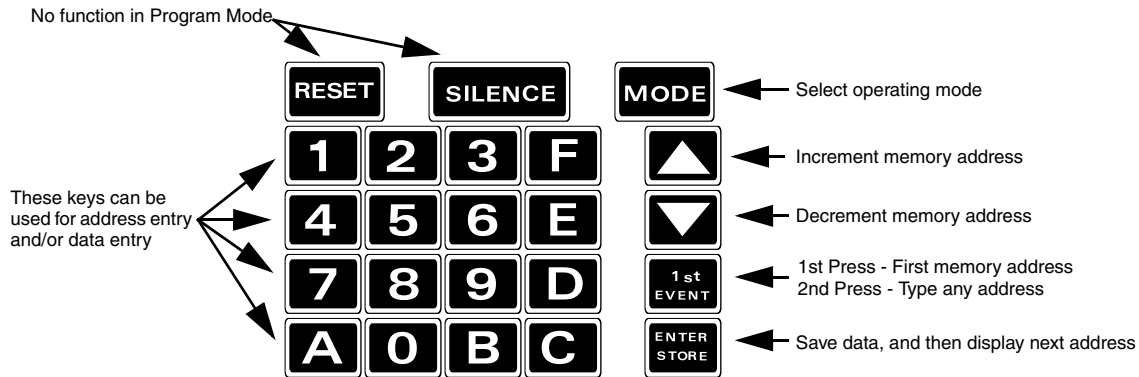
The first three locations from the left represent the memory address which can range from '00' to '243' (alpha characters are not used). The last location (digit farthest right) represents the contents of the memory address. The first address which will be displayed is illustrated in Figure 4-1.

FIGURE 4-1: First Address



4.2 Switch Functions in Program Mode

FIGURE 4-2: Switch Functions in Program Mode



4.3 Programming

4.3.1 Programming the Primary Phone Number (00 - 15)

Sixteen addresses are set aside for the primary phone number, with 'F' being the factory default. Programming is typically done as follows:

- ✓ If your phone number is 484-7161, press **4**
- ✓ The display will read **00_4**
- ✓ Press **ENTER STORE** to save the entry to memory and increment to the next address which is **01_F**
- ✓ Enter the remaining numbers in their respective addresses as shown below:

Entry	4	8	4	7	1	6	1	F	F	F	F	F	F	F	F	
Address	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15

Valid entries are 0 - F with the numeric digits as dialed numbers and the alpha digits indicating the following:

- A = * on a Touchtone phone keypad
- B = # on a Touchtone phone keypad
- C = look for secondary dial tone for up to two seconds (then dial anyway)
- D = three second pause
- E = five second pause
- F = end of phone number

4.3.2 Programming Primary Number Communication Format (16)

One location is needed to select the Communication Format for the primary phone number. Address 16 is used for this purpose. The default (factory setting) for this address is 'A', which is 4+2 Standard, 1800 Hz 'Carrier', 2300 Hz 'ACK'. Formats '2' through 'D' may be entered in place of the default value, followed by the [ENTER/STORE] key. '0' through 'F' represent the following formats:

- 0: Not used
- 1: Not used
- 2: 3+1 Standard 1800 Hz Carrier, 2300 Hz ACK
- 3: 3+1 Expanded 1800 Hz Carrier, 2300 Hz ACK
- 4: 3+1 Standard 1900 Hz Carrier, 1400 Hz ACK
- 5: 3+1 Expanded 1900 Hz Carrier, 1400 Hz ACK
- 6: 4+1 Standard 1800 Hz Carrier, 2300 Hz ACK
- 7: 4+1 Expanded 1800 Hz Carrier, 2300 Hz ACK
- 8: 4+1 Standard 1900 Hz Carrier, 1400 Hz ACK
- 9: 4+1 Expanded 1900 Hz Carrier, 1400 Hz ACK
- A: 4+2 Standard 1800 Hz Carrier, 2300 Hz ACK
- B: 4+2 Expanded 1800 Hz Carrier, 2300 Hz ACK
- C: 4+2 Standard 1900 Hz Carrier, 1400 Hz ACK
- D: 4+2 Expanded 1900 Hz Carrier, 1400 Hz ACK
- E: Not used
- F: Not used

Note: Consult your Central Station for proper selection or consult our factory representatives. For any format chosen, the MS-5012 automatically programs all of the event codes. Refer to Table 4-1 and Table 4-2 .

3+1 and 4+1 Standard and Expanded, 4+2 Expanded Formats

If '2, 3, 4, 5, 6, 7, 8, 9, B or D' are entered for address 16, the following data is automatically programmed for the Primary phone number event codes. Enter '0' for the Setting to disable the report.

TABLE 4-1: 3+1 and 4+1 Standard and Expanded, 4+2 Expanded Formats

Address	Description	Factory Settings
68	Primary # Zone 1 Alarm Code	1
69	Primary # Zone 2 Alarm Code	1
70	Primary # Zone 3 Alarm Code	1
71	Primary # Zone 4 Alarm Code	8
72	Primary # Zone 5 Alarm Code	1
73	Primary # AC Fault Code	F
74	Primary # Zone 1 Fault Code	F
75	Primary # Zone 2 Fault Code	F
76	Primary # Zone 3 Fault Code	F
77	Primary # Zone 4 Fault Code	F
78	Primary # Zone 5 Fault Code	F
79	Primary # Earth Ground Code	F
80	Primary # Low Battery Code	F
81	Primary # No Battery Code	F
82	Primary # Telco Primary Line Fault Code	F
83	Primary # Telco Secondary Line Fault Code	F
84	Primary # Bell Fault Code	F

TABLE 4-1: 3+1 and 4+1 Standard and Expanded, 4+2 Expanded Formats

Address	Description	Factory Settings
85	Primary # Communication Trouble Primary Number	F
86	Primary # Communication Trouble Secondary Number	F
87	Primary # Annunciator Fault Code	F
88	Primary # System Off Normal Code	F
89	Primary # Zone 1 Alarm Restoral Code	E
90	Primary # Zone 2 Alarm Restoral Code	E
91	Primary # Zone 3 Alarm Restoral Code	E
92	Primary # Zone 4 Alarm Restoral Code	E
93	Primary # Zone 5 Alarm Restoral Code	E
94	Primary # AC Fault Restoral Code	E
95	Primary # Zone 1 Fault Restoral Code	E
96	Primary # Zone 2 Fault Restoral Code	E
97	Primary # Zone 3 Fault Restoral Code	E
98	Primary # Zone 4 Fault Restoral Code	E
99	Primary # Zone 5 Fault Restoral Code	E
100	Primary # Earth Ground Restoral Code	E
101	Primary # Low Battery Restoral Code	E
102	Primary # No Battery Restoral Code	E
103	Primary # Telco Primary Line Fault Restoral Code	E
104	Primary # Telco Secondary Line Fault Restoral Code	E
105	Primary # Bell Fault Restoral Code	E
106	Primary # Communication Trouble Restoral Primary Number	E
107	Primary # Communication Trouble Restoral Secondary Number	E
108	Primary # Annunciator Fault Restoral	E
109	Primary # System Return to Normal Code	E
110	Primary # 24 Hour Test Code	9
111	Primary # System Abnormal Test Report	F

4+2 Standard Format

If 'A' or 'C' are entered for address 16, the following data is automatically programmed for the Primary phone number event codes. Enter '00' for the Setting to disable the report.

4.3.3 Programming the Primary Number Account Code (17-20)

A unique Account Code is provided by the Central Station. The Primary Number Account Code takes up four locations at addresses 17-20. The defaults are all '0s'. Valid entries are 0-9 and A-F. The number of digits entered must match the format selection. If programming '2, 3, 4 or 5' into address 16, enter the three digit Account Code provided by the Central Station (location 20 is ignored). If programming '6, 7, 8, 9, A, B, C or D' into address 16, enter the four digit Account Code.

TABLE 4-2: 4+2 Standard Formats

Address	Description	Factory Settings
68-69	Primary # Zone 1 Alarm Code	11
70-71	Primary # Zone 2 Alarm Code	12
72-73	Primary # Zone 3 Alarm Code	13
74-75	Primary # Zone 4 Alarm Code	84
76-77	Primary # Zone 5 Alarm Code	15
78-79	Primary # AC Fault Code	F6
80-81	Primary # Zone 1 Fault Code	F1
82-83	Primary # Zone 2 Fault Code	F2
84-85	Primary # Zone 3 Fault Code	F3
86-87	Primary # Zone 4 Fault Code	F4
88-89	Primary # Zone 5 Fault Code	F5
90-91	Primary # Earth Ground Code	F7
92-93	Primary # Low Battery Code	F8
94-95	Primary # No Battery Code	F9
96-97	Primary # Telco Primary Line Fault Code	FA
98-99	Primary # Telco Secondary Line Fault Code	FB
100-101	Primary # Bell Fault Code	FC
102-103	Primary # Communication Trouble Primary Number	FD
104-105	Primary # Communication Trouble Secondary Number	FE
106-107	Primary # Annunciator Fault Code	FC
108-109	Primary # System Off Normal Code	FF
110-111	Primary # Zone 1 Alarm Restoral Code	E1
112-113	Primary # Zone 2 Alarm Restoral Code	E2
114-115	Primary # Zone 3 Alarm Restoral Code	E3
116-117	Primary # Zone 4 Alarm Restoral Code	E4
118-119	Primary # Zone 5 Alarm Restoral Code	E5
120-121	Primary # AC Fault Restoral Code	E6
122-123	Primary # Zone 1 Fault Restoral Code	E1
124-125	Primary # Zone 2 Fault Restoral Code	E2
126-127	Primary # Zone 3 Fault Restoral Code	E3
128-129	Primary # Zone 4 Fault Restoral Code	E4
130-131	Primary # Zone 5 Fault Restoral Code	E5
132-133	Primary # Earth Ground Restoral Code	E7
134-135	Primary # Low Battery Restoral Code	E8
136-137	Primary # No Battery Restoral Code	E9

TABLE 4-2: 4+2 Standard Formats

Address	Description	Factory Settings
138-139	Primary # Telco Primary Line Fault Restoral Code	EA
140-141	Primary # Telco Secondary Line Fault Restoral Code	EB
142-143	Primary # Bell Fault Restoral Code	EC
144-145	Primary # Communication Trouble Restoral Primary Number	ED
146-147	Primary # Communication Trouble Restoral Secondary Number	EE
148-149	Primary # Annunciator Fault Restoral	EC
150-151	Primary # System Return to Normal Code	EF
152-153	Primary # 24 Hour Test Code	99
154-155	Primary # System Abnormal Test Report	91

4.3.4 Programming the Primary Number 24 Hour Test Time (21-24)

Use military time when entering the 24 hour 'test' time. The 24 hour test time over the primary phone number to the Central Station, takes up four locations at addresses 21-24. The default is 00:00 (12:00 midnight). The limits for each location are as follows (do not use A through F as entries):


- Address 21 - enter 0 through 2
- Address 22 - enter 0 through 9
- Address 23 - enter 0 through 5
- Address 24 - enter 0 through 9

4.3.5 Programming Primary Number 24/12 Hour Test Time (25)

The test message sent to the Primary phone number may be sent every 12 or 24 hours. If the message is to be sent every 24 hours, leave the factory default entry of '0'. If 12 hour test reports are needed, enter a '1' into address 25.

4.3.6 Programming the Secondary Phone Number (26-41)

Sixteen addresses are set aside for the secondary phone number, with 'F' being the factory default. Programming is typically done as follows:

- ✓ If your phone number is 484-7161, press **4**
- ✓ The display will read **26_4**
- ✓ Press  to save the entry to memory and increment to the next address which is **27_F**
- ✓ Enter the remaining numbers in their respective addresses as shown below:

Entry **4 8 4 7 1 6 1 F F F F F F F F**

Address **26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41**

Valid entries are 0 - F with the numeric digits as dialed numbers and the alpha digits indicating the following:

- A = * on a Touchtone phone keypad
- B = # on a Touchtone phone keypad
- C = look for secondary dial tone for up to two seconds (then dial anyway)
- D = three second pause
- E = five second pause
- F = end of phone number

4.3.7 Programming Secondary Number Communication Format (42)

One location is needed to select the Communication Format for the secondary phone number. Address 42 is used for this purpose. The default (factory setting) for this address is 'A', which is 4+2 Standard, 1800 Hz 'Carrier', 2300 Hz 'ACK'. Formats '2' through 'D' may be entered in place of the default value, followed by the [ENTER/STORE] key. '0' through 'F' represent the following formats:

- 0: Not used
- 1: Not used
- 2: 3+1 Standard 1800 Hz Carrier, 2300 Hz ACK
- 3: 3+1 Expanded 1800 Hz Carrier, 2300 Hz ACK
- 4: 3+1 Standard 1900 Hz Carrier, 1400 Hz ACK
- 5: 3+1 Expanded 1900 Hz Carrier, 1400 Hz ACK
- 6: 4+1 Standard 1800 Hz Carrier, 2300 Hz ACK
- 7: 4+1 Expanded 1800 Hz Carrier, 2300 Hz ACK
- 8: 4+1 Standard 1900 Hz Carrier, 1400 Hz ACK
- 9: 4+1 Expanded 1900 Hz Carrier, 1400 Hz ACK
- A: 4+2 Standard 1800 Hz Carrier, 2300 Hz ACK
- B: 4+2 Expanded 1800 Hz Carrier, 2300 Hz ACK
- C: 4+2 Standard 1900 Hz Carrier, 1400 Hz ACK
- D: 4+2 Expanded 1900 Hz Carrier, 1400 Hz ACK
- E: Not used
- F: Not used

Note: Consult your Central Station for proper selection or consult our factory representatives. For any format chosen, the MS-5012 automatically programs all of the event codes. Refer to Table 4-3 and Table 4-4.

3+1 and 4+1 Standard and Expanded, 4+2 Expanded Formats

If '2, 3, 4, 5, 6, 7, 8, 9, B or D' are entered for address 42, the following data is automatically programmed for the Secondary phone number event codes. Enter '0' for the Setting to disable the report.

TABLE 4-3: 3+1 and 4+1 Standard and Expanded, 4+2 Expanded Formats

Address	Description	Factory Settings
156	Secondary # Zone 1 Alarm Code	1
157	Secondary # Zone 2 Alarm Code	1
158	Secondary # Zone 3 Alarm Code	1
159	Secondary # Zone 4 Alarm Code	8
160	Secondary # Zone 5 Alarm Code	1
161	Secondary # AC Fault Code	F
162	Secondary # Zone 1 Fault Code	F
163	Secondary # Zone 2 Fault Code	F
164	Secondary # Zone 3 Fault Code	F
165	Secondary # Zone 4 Fault Code	F
166	Secondary # Zone 5 Fault Code	F
167	Secondary # Earth Ground Code	F
168	Secondary # Low Battery Code	F
169	Secondary # No Battery Code	F
170	Secondary # Telco Primary Line Fault Code	F
171	Secondary # Telco Secondary Line Fault Code	F
172	Secondary # Bell Fault Code	F

TABLE 4-3: 3+1 and 4+1 Standard and Expanded, 4+2 Expanded Formats

Address	Description	Factory Settings
173	Secondary # Communication Trouble Primary Number	F
174	Secondary # Communication Trouble Secondary Number	F
175	Secondary # Annunciator Fault Code	F
176	Secondary # System Off Normal Code	F
177	Secondary # Zone 1 Alarm Restoral Code	E
178	Secondary # Zone 2 Alarm Restoral Code	E
179	Secondary # Zone 3 Alarm Restoral Code	E
180	Secondary # Zone 4 Alarm Restoral Code	E
181	Secondary # Zone 5 Alarm Restoral Code	E
182	Secondary # AC Fault Restoral Code	E
183	Secondary # Zone 1 Fault Restoral Code	E
184	Secondary # Zone 2 Fault Restoral Code	E
185	Secondary # Zone 3 Fault Restoral Code	E
186	Secondary # Zone 4 Fault Restoral Code	E
187	Secondary # Zone 5 Fault Restoral Code	E
188	Secondary # Earth Ground Restoral Code	E
189	Secondary # Low Battery Restoral Code	E
190	Secondary # No Battery Restoral Code	E
191	Secondary # Telco Primary Line Fault Restoral Code	E
192	Secondary # Telco Secondary Line Fault Restoral Code	E
193	Secondary # Bell Fault Restoral Code	E
194	Secondary # Communication Trouble Restoral Primary Number	E
195	Secondary # Communication Trouble Restoral Secondary Number	E
196	Secondary # Annunciator Fault Restoral	E
197	Secondary # System Return to Normal Code	E
198	Secondary # 24 Hour Test Code	9
199	Secondary # System Abnormal Test Report	F

4+2 Standard Format

If 'A' or 'C' are entered for address 42, the following data is automatically programmed for the Secondary phone number event codes. Enter '00' for the Setting to disable the report.

4.3.8 Programming the Secondary Number Account Code (43-46)

A unique Account Code is provided by the Central Station. The Secondary Number Account Code takes up four locations at addresses 43-46. The defaults are all '0s'. Valid entries are (0-9 and A-F). The number of digits entered must match the format selection. If programming '2, 3, 4 or 5' into address 42, enter the three digit Account Code provided by the Central Station (location 46 is ignored). If programming '6, 7, 8, 9, A, B, C or D' into address 42, enter the four digit Account Code.

TABLE 4-4: 4+2 Standard Formats

Address	Description	Factory Settings
156-157	Secondary # Zone 1 Alarm Code	11
158-159	Secondary # Zone 2 Alarm Code	12
160-161	Secondary # Zone 3 Alarm Code	13
162-163	Secondary # Zone 4 Alarm Code	84
164-165	Secondary # Zone 5 Alarm Code	15
166-167	Secondary # AC Fault Code	F6
168-169	Secondary # Zone 1 Fault Code	F1
170-171	Secondary # Zone 2 Fault Code	F2
172-173	Secondary # Zone 3 Fault Code	F3
174-175	Secondary # Zone 4 Fault Code	F4
176-177	Secondary # Zone 5 Fault Code	F5
178-179	Secondary # Earth Ground Code	F7
180-181	Secondary # Low Battery Code	F8
182-183	Secondary # No Battery Code	F9
184-185	Secondary # Telco Primary Line Fault Code	FA
186-187	Secondary # Telco Secondary Line Fault Code	FB
188-189	Secondary # Bell Fault Code	FC
190-191	Secondary # Communication Trouble Primary Number	FD
192-193	Secondary # Communication Trouble Secondary Number	FE
194-195	Secondary # Annunciator Fault Code	FC
196-197	Secondary # System Off Normal Code	FF
198-199	Secondary # Zone 1 Alarm Restoral Code	E1
200-201	Secondary # Zone 2 Alarm Restoral Code	E2
202-203	Secondary # Zone 3 Alarm Restoral Code	E3
204-205	Secondary # Zone 4 Alarm Restoral Code	E4
206-207	Secondary # Zone 5 Alarm Restoral Code	E5
208-209	Secondary # AC Fault Restoral Code	E6
210-211	Secondary # Zone 1 Fault Restoral Code	E1
212-213	Secondary # Zone 2 Fault Restoral Code	E2
214-215	Secondary # Zone 3 Fault Restoral Code	E3
216-217	Secondary # Zone 4 Fault Restoral Code	E4
218-219	Secondary # Zone 5 Fault Restoral Code	E5
220-221	Secondary # Earth Ground Restoral Code	E7
222-223	Secondary # Low Battery Restoral Code	E8
224-225	Secondary # No Battery Restoral Code	E9

TABLE 4-4: 4+2 Standard Formats

Address	Description	Factory Settings
226-227	Secondary # Telco Primary Line Fault Restoral Code	EA
228-229	Secondary # Telco Secondary Line Fault Restoral Code	EB
230-231	Secondary # Bell Fault Restoral Code	EC
232-233	Secondary # Communication Trouble Restoral Primary Number	ED
234-235	Secondary # Communication Trouble Restoral Secondary Number	EE
236-237	Secondary # Annunciator Fault Restoral	EC
238-239	Secondary # System Return to Normal Code	EF
240-241	Secondary # 24 Hour Test Code	99
242-243	Secondary # System Abnormal Test Report	91

4.3.9 Programming the Secondary Number 24 Hour Test Time (47-50)

Use military time when entering the 24 hour 'test' time. The 24 hour test time over the secondary phone number to the Central Station, takes up four locations at addresses 47-50. The default is 00:00 (12:00 midnight). The limits for each location are as follows (do not use A through F as entries):

Address 47 - enter 0 through 2

Address 48 - enter 0 through 9

Address 49 - enter 0 through 5

Address 50 - enter 0 through 9

4.3.10 Programming Secondary Number 24/12 Hour Test Time (51)

The test message sent to the Secondary phone number may be sent every 12 or 24 hours. If the message is to be sent every 24 hours, leave the factory default entry of '0'. If 12 hour test reports are needed, enter a '1' into address 51.

4.3.11 Programming Zone 3 Functionality (52)

The following entries may be selected:

- 0 = nonsilenceable waterflow zone (program optional delay in addresses 53-54)
- 1 = normally open contact device zone or silenceable waterflow zone
- 2 = 2-wire smoke detector zone (Style B only)

The factory default setting is '0' for nonsilenceable waterflow zone.

4.3.12 Programming Waterflow Retard Timer (53-54)

A maximum delay of 89 seconds can be programmed into addresses 53-54. This will delay activation due to a 'waterflow alarm' if zone 3 is programmed as a nonsilenceable waterflow zone. The panel automatically provides a one second delay. The factory default setting for addresses 53-54 is '00' for no additional delay. Valid entries for address 53 are 0 through 8 and for address 54, 0 through 9. Addresses 53 and 54 should be changed from the default setting only if address 52 is programmed '0' for nonsilenceable waterflow zone and a delay is required. *Be careful to consider any built-in waterflow device delays.*

4.3.13 Programming AC Loss Reporting Delay (55)

Enter a digit of '1' through '6' corresponding to the number of hours to be delayed in reporting loss of AC power. The factory default setting is 6 hour delay. Valid entries are as follows:

- 0 = 6 hour delay
- 1 = 7 hour delay
- 2 = 8 hour delay
- 3 = 9 hour delay
- 4 = 10 hour delay
- 5 = 11 hour delay
- 6 = 12 hour delay

4.3.14 Programming Slave Communicator/Fire Panel Selection (56)

Leaving address 56 at the factory default setting of '0' means the MS-5012 is operating as a *fire panel only*. Selecting '1' will program the panel to operate as a *slave communicator only*. Refer to “Slave Communicator Configuration” on page 51. Selecting '2' will program the panel to operate as a *fire panel/communicator*.

4.3.15 Secondary Phone Number Reporting (57)

The factory default setting is '0' which means that reports will be transmitted to the secondary phone number only if calls to the primary number are unsuccessful. Programming a '1' causes all reports to be transmitted to the secondary phone number.

4.3.16 Alarm Verification on Detector Zones 2 and 3 (58)

Factory default setting for address 58 is '0' which means no alarm verification. Entering a '1' enables verification for zone 2 and zone 3. *Consult the local Authority Having Jurisdiction (AHJ) prior to altering this address.*

Alarm verification works only on zones programmed as 2-wire smoke detector zones. After detecting an alarm, the panel removes power from all zones for six seconds, resetting all 2-wire smoke detectors. Power is reapplied and a 12 second retard period allows detectors to stabilize. During the retard/reset period of 18 seconds, subsequent alarms by the same initiating zone are ignored. An alarm detected on any other 2-wire detector zone during the retard period will cause immediate verified alarms. A subsequent alarm on the initiating zone occurring within the confirmation time will cause a verified alarm.

Note: Mixing devices on zones designated as 2-wire smoke zones is not recommended.

During the alarm verification period, access to other modes of operation is prevented.

4.3.17 Silence Inhibit (59)

The factory default setting of '0' disables the silence inhibit feature. A '1' will enable the silence inhibit feature which will prevent the silencing of the Notification Appliance Circuit and piezo sounder for 1 minute following activation. *Consult the local Authority Having Jurisdiction (AHJ) prior to altering this address.*

4.3.18 Auto Silence (60)

The factory default setting of '0' disables the Auto Silence feature. A '1' will enable the Auto Silence feature which will cause the panel to automatically silence the Notification Appliance Circuit after 10 minutes of activation. *Consult the local Authority Having Jurisdiction (AHJ) prior to altering this address.*

4.3.19 Trouble Reminder (61)

The factory default setting of '0' disables the Trouble Reminder feature. Selecting '1' will enable the feature which causes a reminding 'beep' every 15 seconds during an alarm and every two minutes during a trouble condition (after the silence switch has been pressed). The 'beeps' from the onboard piezo sounder will continue until the alarm or fault is cleared. *Consult the local Authority Having Jurisdiction (AHJ) prior to altering this address.*

4.3.20 Bell Disable (62)

The factory default setting of '0' enables the Notification Appliance Circuit. Entering a '1' in address 62 will cause the Notification Appliance Circuit to be disabled during an alarm. In addition, the Trouble LED will turn on while the NAC is disabled and a bell fault message will be sent to the Central Station(s). *Consult the local Authority Having Jurisdiction (AHJ) prior to altering this address.*

4.3.21 Annunciator Present (63)

The factory default setting of '0' indicates that no annunciator is present on the system. Entering a '1' in address 63 indicates an annunciator is connected to the system.

4.3.22 Programming Zone 4 Functionality (64)

The factory default setting for address 64 is '0' for supervisory zone (accepts normally open supervisory devices). Changing address 64 to '1' allows Zone 4 to accept any normally open contact device. *Note that when address 64 is changed to '1', the messages transmitted to the Central Station(s) must be changed to reflect the new setting. If using 3+1, 4+1 or 4+2 Expanded Formats, address 71 must be changed to '1' and address 159 must be changed to '1'. If using 4+2 Standard Formats, address 74 must be changed to '1' and address 162 must be changed to '1'.*

4.3.23 Address (65) - Not used

4.3.24 Touchtone/Rotary Select (66)

The factory default setting for address 66 is '0' which enables Touchtone dialing over both phone lines. Entering a '1' will enable rotary dialing.

4.3.25 Make/Break Ratio (67)

An entry is required in address 67 only if address 66 has been programmed with a '1' for rotary dialing. The factory default setting for address 67 is '0' for a Make/Break Ratio of 67/33. Enter a '1' to change the ratio to 62/38.



4.3.26 Programming Event Codes (68-243)

Table 4-1 through Table 4-4 list messages of 'event codes' that are sent to the Central Station. The selections made for the Primary Number Communication Format (address 16) and the Secondary Number Communication Format (address 42) automatically program addresses 68-243 with factory selections.

Any of the event codes may be changed. *Consult your Central Station prior to altering the event codes.* Entering an event code of '0' will cause the communicator to NOT transmit the message. For the 3+1, 4+1 Formats or the 4+2 Expanded Format, enter a single zero '0'. For the 4+2 Standard Format, enter two zeroes '00'

Be certain to disable the reports in pairs. The pair should include both the activation of the event and the restoral of the event. For example, to disable Zone 1 Fault Code from being transmitted, enter a '0' or '00' for the Zone 1 Fault Code plus a '0' or '00' for the Zone 1 Restoral Code. The exception to this is for the 24 Hour Test Reports and the Abnormal Test Reports.

4.3.27 End Programming

Exit Programming Mode by pressing the  key, followed by the 4-digit code corresponding to an alternate mode of operation, then press the  key. During Program Mode, if no key is pressed within 10 minutes, the panel will revert to Normal Mode.

4.3.28 Programming the Real-Time Clock

Entering an address greater than 243 will cause a display of the current time. On initial power-up, the clock will start running from the factory setting of 00:00 (military time). The far left digit will be flashing, indicating that this will be the first digit to be programmed. Simply enter the correct digits of the current time, followed by



CHAPTER 5

*Servicing***5.1 Walktest Mode**

The MS-5012 provides the capability to perform a one-man walktest of the system without triggering the communicator or the alarm output relay driver. Walktest allows for testing of the five zones (initiating circuits). The first initiating device activated on a zone will cause the Notification Appliance (bell) Circuit to turn on for four seconds. Subsequent device activations on the same zone will cause the NAC to turn on for one second. Any smoke detectors that are activated will be reset. Zonal faults (open circuits) will cause the NAC to remain steadily on. Prior to entering Walktest Mode, check to be certain that all system faults have been cleared. *Note that the trouble relay will be activated while the control panel is in Walktest Mode. Placing the control panel in Walktest Mode will only be possible if the system has no active alarms.*

Pressing the **MODE** key followed by the 4-digit code **9 2 5 5** and then pressing the **ENTER STORE** key will place the control panel into Walktest Mode.

☛ **9 2 5 5** spells WALK on a Touch-Tone® phone.

Once in Walktest Mode, the MS-5012 will immediately:

- ✓ Turn on the trouble LED
- ✓ Activate/energize the trouble relay driver
- ✓ Turn on the Notification Appliance Circuit output for four seconds for the first alarm event on a zone. Subsequent alarms will sound for one second. Troubles cause the NAC to remain on until cleared
- ✓ Disable the alarm relay
- ✓ Display all alarm conditions as they occur
- ✓ Display ground faults as they occur
- ✓ Continue to communicate any events not yet acknowledged at the Central Station

During Walktest Mode, zonal activity is displayed in real-time as it occurs. At the end of Walktesting the system, the display will show the last event that occurred. To view all events stored during Walktest, use the **▲**, **▼** and **1st EVENT** keys. The **▼** key moves the Walktest list to show older (previous) events. The **▲** key moves the Walktest list to show newer (more recent) events. Pressing the **1st EVENT** key at any time will cause the display of the first event stored upon initial entry into Walktest Mode. While in Walktest Mode, the control panel will store up to 128 events in the Walktest File for later recall and display.

To return the MS-5012 to Normal Mode, press the **MODE** key, the code numbers **6 6 7 6** and the **ENTER STORE** key. Any delay between key entries greater than 10 seconds causes the control panel to remain in Walktest Mode.

The control panel will automatically revert back to Normal Mode if no system activity has occurred for 60 minutes. This would include pressing any keys or activity on any zone. Exiting Walktest Mode erases the Walktest File from memory.

5.2 History Mode

All Normal Mode events are stored in a History File list for future recall. Recall is possible via the 4-character display. The History File list is a first-in/first-out (FIFO). In this manner, only the most recent events may be called up from memory. Old events will be overwritten, i.e. pushed out of FIFO.

The number of stored events is 16. The History File is kept in EEPROM memory. Complete power loss will not erase the list.

Pressing the **MODE** key followed by the digits **4 4 7 8** and the **ENTER STORE** key places the control panel into History Mode. *This will not occur if there are any active alarm conditions present.* The event displayed, is the most recent event.

☛ **4 4 7 8** spells HIST on a Touch-Tone® phone.

Once in History Mode, the control panel will:

- ✓ Turn on the trouble LED
- ✓ Energize/activate the trouble relay driver
- ✓ Disable the Notification Appliance Circuit output
- ✓ Disable the alarm relay driver
- ✓ Display all events as they occurred since the last time the History File list was cleared. The most recent event will be displayed first
- ✓ Ignore all other keys other than those mentioned in this section
- ✓ Continue to communicate any events not yet acknowledged at the Central Station

The **▼** key moves the History File to show older (previous) events. The **▲** key moves the History File to show newer (more recent) events. Shown below is a list of messages as they will appear on the display:

DISPLAY	EVENT	DISPLAY	EVENT
A 1	Zone 1 Alarm	bELL	Bell Fault (open or short)
A 2	Zone 2 Alarm	F E	Earth Fault
A 3	Zone 3 Alarm	F A	Annunciator Fault
A 4	Zone 4 Alarm	no 1	Primary Phone Line Fault
A 5	Zone 5 Alarm	no 2	Secondary Phone Line Fault
SUP4	Supervisory Alarm	RES	Reset Switch Pressed
AC	AC Loss	PH 1	Primary Number Communication Fault
F 1	Zone 1 Fault	PH 2	Secondary Number Communication Fault
F 2	Zone 2 Fault	no b	No Battery
F 3	Zone 3 Fault	Lo b	Low Battery
F 4	Zone 4 Fault	SILE	Silence Switch Pressed
F 5	Zone 5 Fault		

To erase the list, press the Silence Key twice before exiting the History Mode. A lack of keyboard activity for a period of 10 minutes will cause the control panel to return to Normal Mode.

5.3 Troubleshoot Mode

In this mode, the voltage of the input zones, AC voltage and battery voltage will be displayed on the 4-character display. The internal voltmeter reads the voltage present at:

- zone inputs
- AC power input
- battery terminal leads

A lack of keyboard activity for a period of 20 minutes will cause the control panel to return to Normal Mode.

To enter Troubleshoot Mode, press the **MODE** key followed by the digits **8 7 6 8** and the **ENTER STORE** key.

☛ **8 7 6 8** spells TROU on a Touch-Tone® phone.

Once in Troubleshoot Mode, the MS-5012 will:

- ✓ Turn on the trouble LED
- ✓ Energize/activate the trouble relay driver
- ✓ Disable the Notification Appliance Circuit output
- ✓ Disable the alarm relay driver
- ✓ Continue to communicate any events not yet acknowledged at the Central Station

Pressing **A** and then **ENTER STORE** displays the AC input voltage. Pressing **B** and then **ENTER STORE** will display the Battery Voltage. Pressing **1** through **5** followed by **ENTER STORE** displays the zone voltage of the selected zone. The **▲**, **▼** and **1st EVENT** keys do not function in this mode.

Listed below are the 'nominal threshold voltages' for each zone:

Zone #	Normal w/E.O.L.	Shorted Ckt.	Open Ckt.
1	5.15V	0.15V	12.V
2	11.75V	8.7V	12.9V
3	11.75V	8.7V	12.9V
4	5.15V	.15V	12.9V
5	5.15V	.15V	12.9V

Readings will vary proportionately depending upon system load and AC line voltage. Listed below is the AC line voltage range. The AC ON indicator will turn off when the AC line voltage drops below the Low Line 'threshold', and the trouble LED will turn on.

	Low Line	Normal	High Line
AC Line Voltage	102VAC	115VAC	132VAC

Below is shown the critical battery threshold conditions:

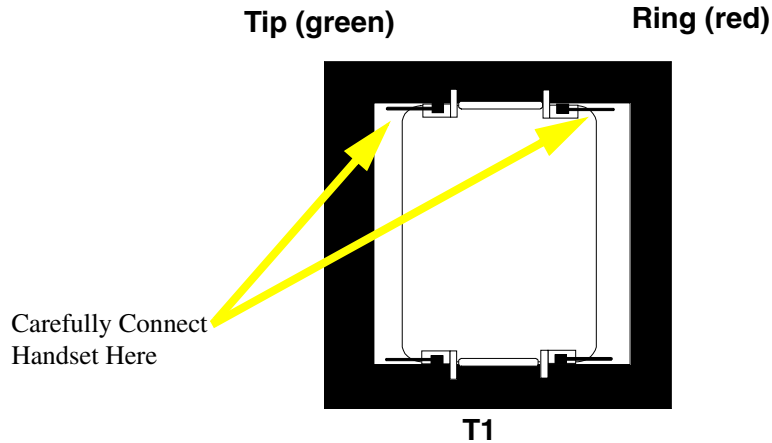
	Normal	Low Battery
Battery Voltage	13.7V	10.2V

Note: make measurements after allowing 48 hours to charge a depleted battery. If battery does not show normal reading, replace it.

Lamp Test

Pressing **C** and then **ENTER STORE** causes seizure of the Primary line and the red LED signifying Primary line active turns on. After a delay of three seconds, the control panel goes off hook to acquire a dial tone. Connecting a telephone handset across the telephone transformer, as illustrated in Figure 5-1, allows number dialing. Pressing **C** and then **ENTER STORE** a second time hangs up the call. Repeated entries of **C** places the phone on and off hook.

FIGURE 5-1: Handset Connection



5.4 Lamp Test

To perform a Lamp Test, press **MODE** then **5 2 6 7** followed by **ENTER STORE**. This will test all system LEDs except the Primary Active LED and Secondary Active LED. The LEDs will stay on for five seconds, then the control panel will return to Normal Mode.

• **5 2 6 7** spells LAMP on a Touch-Tone® phone.

CHAPTER 6 *Slave Communicator Configuration*

The MS-5012 may be used as a slave communicator to a host or 'Master' fire alarm control panel (FACP). All wiring between the Master and the MS-5012 is supervised. 2.2K ohm End-of-Line resistors must be connected as illustrated in the typical wiring diagram in illustrated in this chapter.

In slave configuration, the five zones become five channels that may be triggered by the relay outputs of any host FACP:

- Zone 1/Channel 1 is used for general alarm
- Zone 2/Channel 2 is used for general trouble
- Zone 3/Channel 3 may be programmed to match the FACP relay function
- Zone 4/Channel 4 is used for supervisory
- Zone 5/Channel 5 may be programmed to match the FACP relay function





The factory settings for Zone 2/Channel 2 activation and restoral are altered as follows:

- ✓ If '2, 3, 4, 5, 6, 7, 8, 9, B or D' is entered for address 16 or 42, the report code for Zone 2 Alarm Code (addresses 69 and 157) = F and Zone 2 Restoral Code (addresses 90 and 178) = E
- ✓ If 'A or C' is entered for address 16 or 42, the report code for Zone 2 Alarm Code (addresses 70-71 and 158-159) = FF and Zone 2 restoral code (addresses 112-113 and 200-201) = EF

It is important to note that activation of Zone 2 is Slave Communicator Configuration will cause the yellow trouble LED to flash and the trouble sounder to pulse, however, *the red alarm LED will not activate and the notification appliances will not sound.*

Location 56 must be programmed to a '1' to enable the control panel as a slave communicator. When programming the MS-5012 as a slave communicator, first program the communication formats (addresses 16 and 42), followed by the slave communicator selection at address 56. This sequence allows the MS-5012 to automatically program the proper report codes. *Do not program location 56 first and then alter the format selections at addresses 16 and 42.*

If any of the report codes are to be altered from the factory defaults, follow the steps above and exit Program Mode. Next, reenter Program Mode and alter any event codes.

After programming is complete, the ,  or  keys may be used to view programmed entries. Do not use the  key to view location 56, since it will reprogram the factory default event codes.

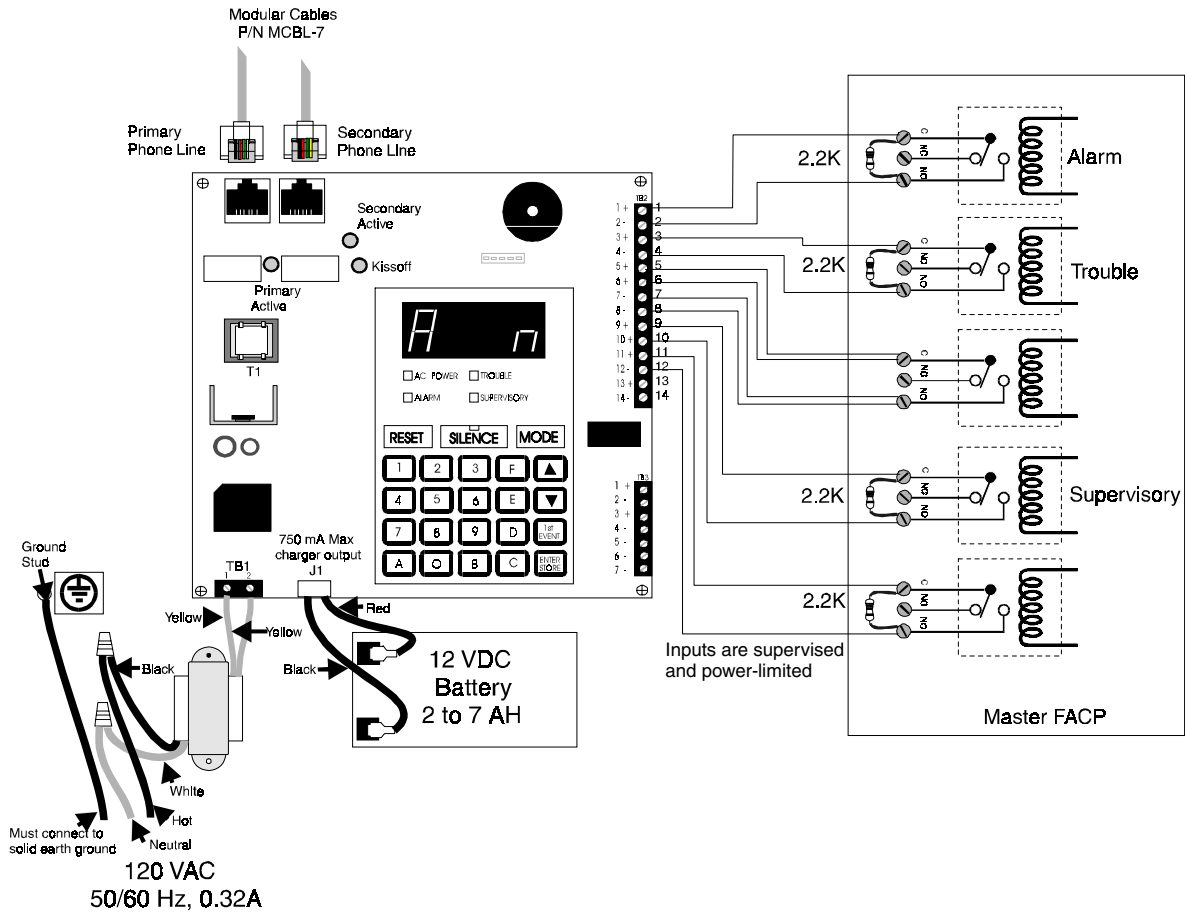
Be certain to connect the MS-5012 primary AC power to the same branch circuit as the host FACP.

Battery Connection

The MS-5012 contains a battery disconnect relay which has multiple purposes. The primary purpose is to disconnect the battery when the battery voltage is less the 7.0 volts during AC loss condition. This prevents the MS-5012 from transmitting erroneous data to the Central Station under unsafe operating power. Also, with AC power applied, the disconnect relay allows for battery voltage measurements in the Normal and Troubleshoot Modes.

Slave Communicator Configuration

Due to the presence of the disconnect relay, it is not possible to initially (out of the box) power up an MS-5012 from the battery. AC power must be applied for six seconds. Once AC power is applied, do not connect a low capacity battery (less than 7.0 volts) to the system. When replacing a bad battery, turn off AC power before connecting the new battery.



Relays in the Master FACP activate various input circuits on the MS-5012. Messages (event codes) programmed for a particular input circuit (channel) will be transmitted to the Central Station upon relay activation.

Appendix A *Power Calculations*

Use the Total Standby and Alarm Load Currents calculated in Table A-1 and Table A-2 for the following battery calculation.

TABLE A-1: Total Ampere Hours

Standby Load Current (Amps)	X	Required Standby Time in Hours (24 or 60 Hours)	=	_____
[]		[]		
Alarm Load Current (Amps)	X	Required Alarm Time in Hours (i.e. 5 min. = 0.084 hours)	=	_____
[]		[]		
Add Standby and Alarm Load for Required Ampere Hour Battery			=	_____
Multiply by the Derating Factor of 1.2			x 1.2	_____
Total Ampere Hours (AH) Required			=	_____

Select a battery with a greater Ampere Hour rating.

Notes:

1. NFPA 72 National Fire Alarm Code for Central Station, Local and Proprietary Protected Premises systems require 24 hours of standby.
2. NFPA 72 National Fire Alarm Code for Auxiliary and Remote Station systems require 60 hours of standby.

Power Calculations

The MS-5012 provides filtered power for operating the fire alarm control panel, external devices and the standby battery. The power for operating external devices is limited. Use Table A-1 (standby or nonalarm) and Table A-2 (alarm) to determine if external loading is within the capabilities of the power supply.

TABLE A-2: Regulated Load in Standby

Device Type	# of Devices		Current (Amps)	=	Total Current (Amps)
Main Circuit Board	1	X	0.074	=	0.074
ADM-12	(1 maximum)	X	0.012	=	
RZA-5F	(1 maximum)	X	0.012	=	
2-wire Detector Heads ¹	[]	X	[]	=	
4-wire Detector Heads	[]	X	[]	=	
Power Supervision Relays ²	[]	X	0.025	=	
Auxiliary Outputs:					
TB3-4 Alarm	(1 maximum)	X	0	=	
TB3-5 Trouble	(1 maximum)	X	0.040 ³	=	
TB3-6 Supervisory	(1 maximum)	X	0	=	
TB3-7 Comm. Fail	(1 maximum)	X	0	=	
Additional Current Draw from TB3 (nonalarm)				=	
Sum Column for Standby Load				=	Amps

1. Refer to Device Compatibility Document for 2-wire smoke detector standby current.
2. Use compatible listed power supervision relay only.
3. Current draw only if End-of-Line relay is installed between TB3-3 and TB3-5. Current shown is maximum available from TB3 Terminal 5

Power Calculations

TABLE A-3: Regulated Load in Alarm

Device Type	# of Devices		Current (Amps)	=	Total Current (Amps)
Main Circuit Board	1	X	0.170	=	0.170
ADM-12	(1 maximum)	X	0.032 ¹	=	
RZA-5F	(1 maximum)	X	0.030 ¹	=	
4-wire Detector Heads	[]	X	[]	=	
Power Supervision Relays ²	[]	X	0.025	=	
Auxiliary Outputs:					
TB3-4 Alarm	(1 maximum)	X	0.040	=	
TB3-5 Trouble	(1 maximum)	X	0.040	=	
TB3-6 Supervisory	(1 maximum)	X	0	=	
TB3-7 Comm. Fail	(1 maximum)	X	0	=	
Notification Appliances	[]	X	[]	=	
Notification Appliances	[]	X	[]	=	
Additional Current Draw from TB3 (nonalarm)				=	
Sum Column for Alarm Load				=	Amps

1. Current shown is with all LEDs illuminated.
2. Use compatible listed power supervision relay only.

Appendix B *Programming Reference Sheets*

B.1 Blank System Programming Reference Sheets

To enter Programming Mode, press the **Mode** key followed by the keys **7764** and then the **[ENTER/STORE]** key.

₀₀ ₀₁ ₀₂ ₀₃ ₀₄ ₀₅ ₀₆ ₀₇ ₀₈ ₀₉ ₁₀ ₁₁ ₁₂ ₁₃ ₁₄ ₁₅

Addresses 00 to 15 store the Primary Phone Number. Enter 'F' to represent the end of the number.

₁₆ Primary Communication Format: Enter '0 - F'.

₁₇ ₁₈ ₁₉ ₂₀ Primary Account Code: Valid entries are '0 - F'.

₂₁ ₂₂ ₂₃ ₂₄ Primary 24-Hour Test Time. Enter military time (i.e. 1400 for 2:00 PM).

₂₅ Primary 24/12 Hour Test Time. Enter '1' for 12 hour; '0' for 24 hour.

₂₆ ₂₇ ₂₈ ₂₉ ₃₀ ₃₁ ₃₂ ₃₃ ₃₄ ₃₅ ₃₆ ₃₇ ₃₈ ₃₉ ₄₀ ₄₁

Addresses 26 to 41 store the Secondary Phone Number. Enter 'F' to represent the end of the number.

₄₂ Secondary Communication Format: Enter '0 - F'.

₄₃ ₄₄ ₄₅ ₄₆ Secondary Account Code: Valid entries are '0 - F'.

₄₇ ₄₈ ₄₉ ₅₀ Secondary 24-Hour Test Time. Enter military time (i.e. 1400 for 2:00 PM).

₅₁ Secondary 24/12 Hour Test Time. Enter '1' for 12 hour; '0' for 24 hour.

₅₂ Zone 3 Function Select ('0' = waterflow, '1' = normally open contact devices, '2' = 2-wire smoke detectors)

₅₃ ₅₄ Waterflow Reporting Delays. Valid keys for field 53 are '0 - 8' and for field 54 are '0 - 9'.

₅₅ AC Loss. Enter number of hours to delay reporting of AC loss. ('0' = 6 hours, '1' = 7 hours, '2' = 8 hours, '3' = 9 hours, '4' = 10 hours, '5' = 11 hours, '6' = 12 hours).

₅₆ Slave Communicator Selection. '0' for panel only; '1' for slave operation; '2' for fire control/communicator operation.

₅₇ Secondary Phone Number. Enter '0' for secondary as a backup; '1' to transmit to secondary always.

₅₈ Alarm Verify. Enter '0' for no verification; '1' for verification.

₅₉ Silence Inhibit. Enter '0' to disable silence inhibit; '1' to enable silence inhibit.

₆₀ Auto Silence. Enter '0' to disable auto silence; '1' to automatically silence notification appliances 10 minutes after activation.

₆₁ Trouble Reminder. Enter '0' to disable trouble reminder; '1' to enable trouble reminder 'beep' (sound every 15 seconds for alarm and every 2 minutes for trouble).

₆₂ Bell Disable. Enter '0' to enable the panel Notification Appliance Circuit (NAC); '1' to disable the NAC.

₆₃ Annunciator Present. Enter '0' if no annunciator is wired to system; '1' if annunciator is wired to system.

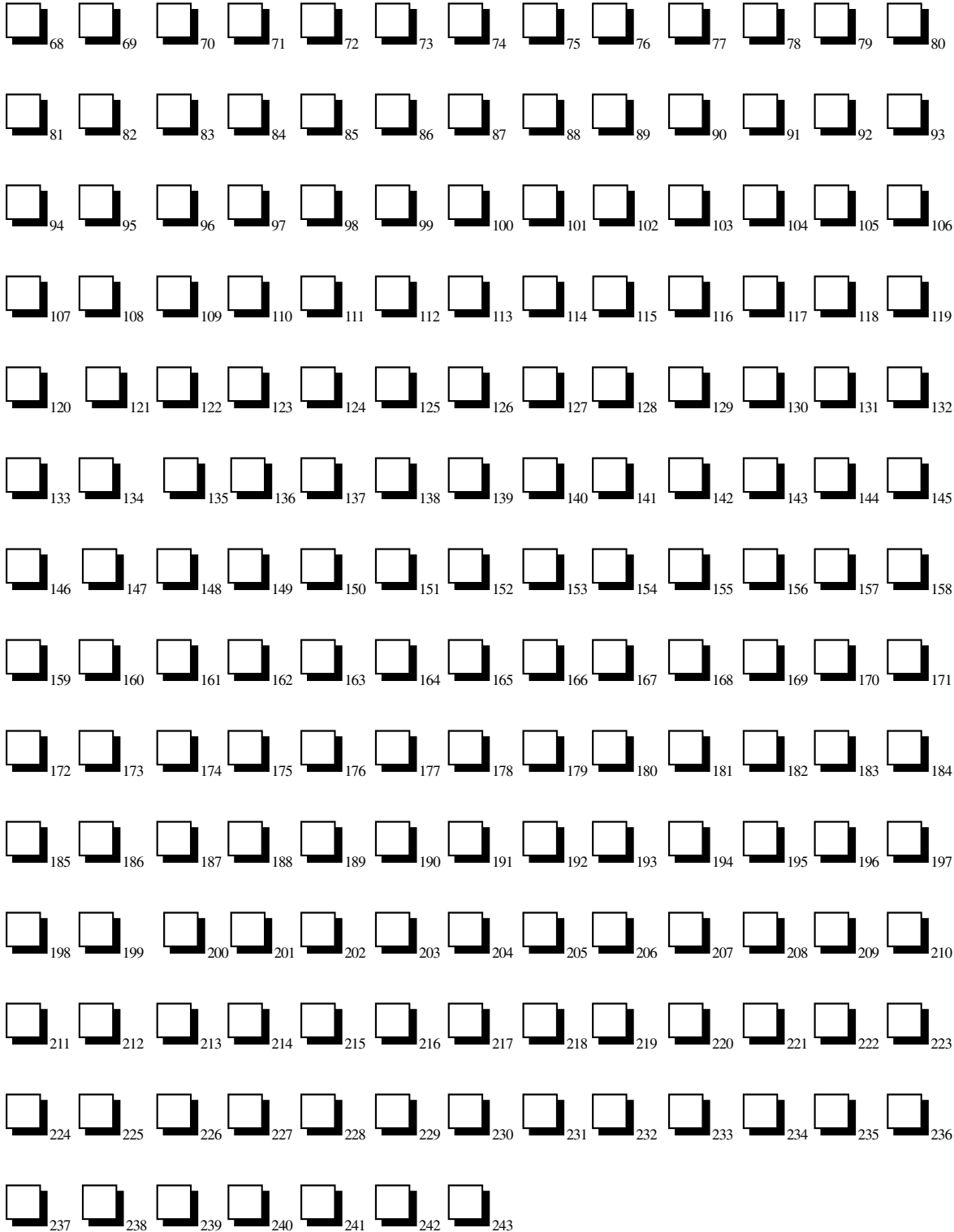
₆₄ Zone 4 Function Select. Enter '0' for supervisory service; '1' for normally open contact devices.

₆₅ Not used.

₆₆ Touchtone/Rotary Select. Enter '0' for touchtone dialing; '1' for rotary dialing.

₆₇ Make/Break Ratio. Enter '0' for 67/33 make/break ratio; '1' for 62/38 ratio.

B.2 Blank Format Programming Reference Sheet



B.3 Programming Reference Sheet Factory Default Settings

To enter Programming Mode, press the **Mode** key followed by the keys **7764** and then the **[ENTER/STORE]** key.

F₀₀ **F**₀₁ **F**₀₂ **F**₀₃ **F**₀₄ **F**₀₅ **F**₀₆ **F**₀₇ **F**₀₈ **F**₀₉ **F**₁₀ **F**₁₁ **F**₁₂ **F**₁₃ **F**₁₄ **F**₁₅

Addresses 00 to 15 store the Primary Phone Number. *Enter 'F' to represent the end of the number.*

A₁₆ Primary Communication Format: A = 4+2 Standard, 1800/2300.

0₁₇ **0**₁₈ **0**₁₉ **0**₂₀ Primary Account Code.

0₂₁ **0**₂₂ **0**₂₃ **0**₂₄ Primary 24-Hour Test Time. 0000 = 12:00 midnight.

0₂₅ Primary 24/12 Hour Test Time. '0' for 24 hour.

F₂₆ **F**₂₇ **F**₂₈ **F**₂₉ **F**₃₀ **F**₃₁ **F**₃₂ **F**₃₃ **F**₃₄ **F**₃₅ **F**₃₆ **F**₃₇ **F**₃₈ **F**₃₉ **F**₄₀ **F**₄₁

Addresses 26 to 41 store the Secondary Phone Number. *Enter 'F' to represent the end of the number.*

A₄₂ Secondary Communication Format: A = 4+2 Standard, 1800/2300.

0₄₃ **0**₄₄ **0**₄₅ **0**₄₆ Secondary Account Code.

0₄₇ **0**₄₈ **0**₄₉ **0**₅₀ Secondary 24-Hour Test Time. 0000 = 12:00 midnight.

0₅₁ Secondary 24/12 Hour Test Time. '0' for 24 hour.

0₅₂ Zone 3 Function Select: '0' = waterflow.

0₅₃ **0**₅₄ Waterflow Reporting Delays. 00 = No delays.

0₅₅ AC Loss. '0' = 6 hours.

0₅₆ Slave Communicator Selection. '0' for panel only.

0₅₇ Secondary Phone Number. '0' for secondary as a backup.

0₅₈ Alarm Verify. '0' for no verification.

0₅₉ Silence Inhibit. '0' to disable silence inhibit.

0₆₀ Auto Silence. '0' to disable auto silence.

0₆₁ Trouble Reminder. '0' to disable trouble reminder.

0₆₂ Bell Disable. '0' to enable the panel Notification Appliance Circuit (NAC).

0₆₃ Annunciator Present. '0' for no annunciator wired to system.

0₆₄ Zone 4 Function Select. '0' for supervisory service.

0₆₅ Not used.

0₆₆ Touchtone/Rotary Select. '0' for touchtone dialing.

0₆₇ Make/Break Ratio. '0' for 67/33 make/break ratio.

B.4 Format Programming Reference Sheet Factory Default Sheet

1₆₈ **1**₆₉ **1**₇₀ **2**₇₁ **1**₇₂ **3**₇₃ **8**₇₄ **4**₇₅ **1**₇₆ **5**₇₇ **F**₇₈ **6**₇₉ **F**₈₀
1₈₁ **F**₈₂ **2**₈₃ **F**₈₄ **3**₈₅ **F**₈₆ **4**₈₇ **F**₈₈ **5**₈₉ **F**₉₀ **7**₉₁ **F**₉₂ **8**₉₃
F₉₄ **9**₉₅ **F**₉₆ **A**₉₇ **F**₉₈ **B**₉₉ **F**₁₀₀ **C**₁₀₁ **F**₁₀₂ **D**₁₀₃ **F**₁₀₄ **E**₁₀₅ **F**₁₀₆
C₁₀₇ **F**₁₀₈ **F**₁₀₉ **E**₁₁₀ **1**₁₁₁ **E**₁₁₂ **2**₁₁₃ **E**₁₁₄ **3**₁₁₅ **E**₁₁₆ **4**₁₁₇ **E**₁₁₈ **5**₁₁₉
E₁₂₀ **6**₁₂₁ **E**₁₂₂ **1**₁₂₃ **E**₁₂₄ **2**₁₂₅ **E**₁₂₆ **3**₁₂₇ **E**₁₂₈ **4**₁₂₉ **E**₁₃₀ **5**₁₃₁ **E**₁₃₂
7₁₃₃ **E**₁₃₄ **8**₁₃₅ **E**₁₃₆ **9**₁₃₇ **E**₁₃₈ **A**₁₃₉ **E**₁₄₀ **B**₁₄₁ **E**₁₄₂ **C**₁₄₃ **E**₁₄₄ **D**₁₄₅
E₁₄₆ **E**₁₄₇ **E**₁₄₈ **C**₁₄₉ **E**₁₅₀ **F**₁₅₁ **9**₁₅₂ **9**₁₅₃ **9**₁₅₄ **1**₁₅₅ **1**₁₅₆ **1**₁₅₇ **1**₁₅₈
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A₁₈₅ **F**₁₈₆ **B**₁₈₇ **F**₁₈₈ **C**₁₈₉ **F**₁₉₀ **D**₁₉₁ **F**₁₉₂ **E**₁₉₃ **F**₁₉₄ **C**₁₉₅ **F**₁₉₆ **F**₁₉₇
E₁₉₈ **1**₁₉₉ **E**₂₀₀ **2**₂₀₁ **E**₂₀₂ **3**₂₀₃ **E**₂₀₄ **4**₂₀₅ **E**₂₀₆ **5**₂₀₇ **E**₂₀₈ **6**₂₀₉ **E**₂₁₀
1₂₁₁ **E**₂₁₂ **2**₂₁₃ **E**₂₁₄ **3**₂₁₅ **E**₂₁₆ **4**₂₁₇ **E**₂₁₈ **5**₂₁₉ **E**₂₂₀ **7**₂₂₁ **E**₂₂₂ **8**₂₂₃
E₂₂₄ **9**₂₂₅ **E**₂₂₆ **A**₂₂₇ **E**₂₂₈ **B**₂₂₉ **E**₂₃₀ **C**₂₃₁ **E**₂₃₂ **D**₂₃₃ **E**₂₃₄ **E**₂₃₅ **E**₂₃₆
C₂₃₇ **E**₂₃₈ **F**₂₃₉ **9**₂₄₀ **9**₂₄₁ **9**₂₄₂ **1**₂₄₃

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