MX-7000 Series

Command and Control Center

Installation & Operation Manual

SENSTAR

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Section 1   Introduction

The MX series is a modular, microprocessor-based communications and control center designed to monitor and control Senstar's line of FPS fence protection sensors, SAT and SAFT I/O transponders, MPS-4100 microwaves systems as well as interface to Psycon or other security management systems (SMS). The MX series also supports Senstar's Silver Network based fence sensors FlexPS, FlexZone-4, Senstar LM100, the UltraWave microwave sensor, and the UltraLink I/O processor.

The MX series includes the MX-7000 (copper wire network) and the MXF-7500 (fiber optic network). Each MX series includes three models. The 7020 supports a maximum of 20 alarm zones, the 7040 supports 40, and the 7060 supports 60 (see Figure 1). Regardless of which model is selected, the MX series supports up to 30 Silver devices via 2 of its 4 USB ports.
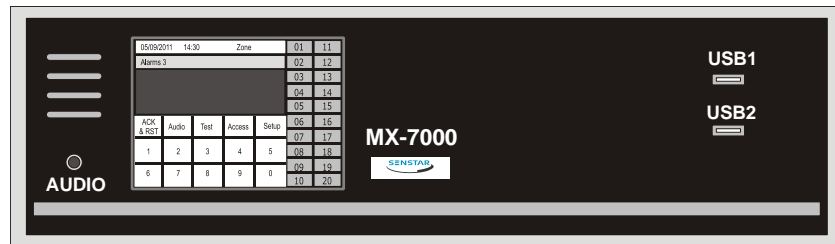
Figure 1   MX-7000 Front Panel (single screen model)

System Description

Alarms generated by field-mounted sensors are processed and displayed by the MX-7000, while providing operator control of the security system. The MX-7000 main board is bus-architecture based, meaning that the microprocessor communicates to peripheral devices using a common set of wires (a bus) inside the MX-7000. Figure 2 is a block diagram of the MX-7000 internal bus connections. Figure 3 shows the main board layout, followed by Table 1 which includes descriptions of the main boards LEDs. Figure 4 shows the audio card followed by Table 2 which includes descriptions of the audio card's features. Figure 5 shows the power card layout. See Figure 14 for a block diagram of the Silver Network connections to the MX-7000.
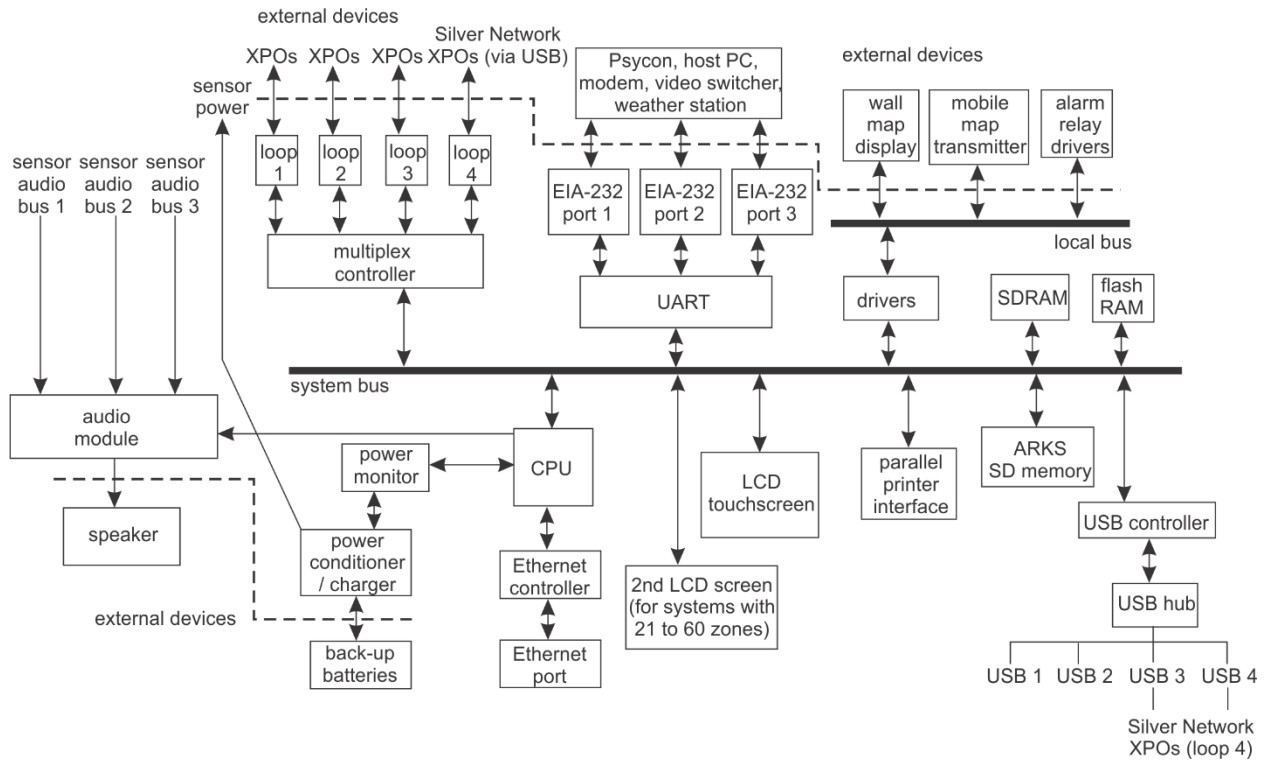
Figure 2   MX-7000 block diagram
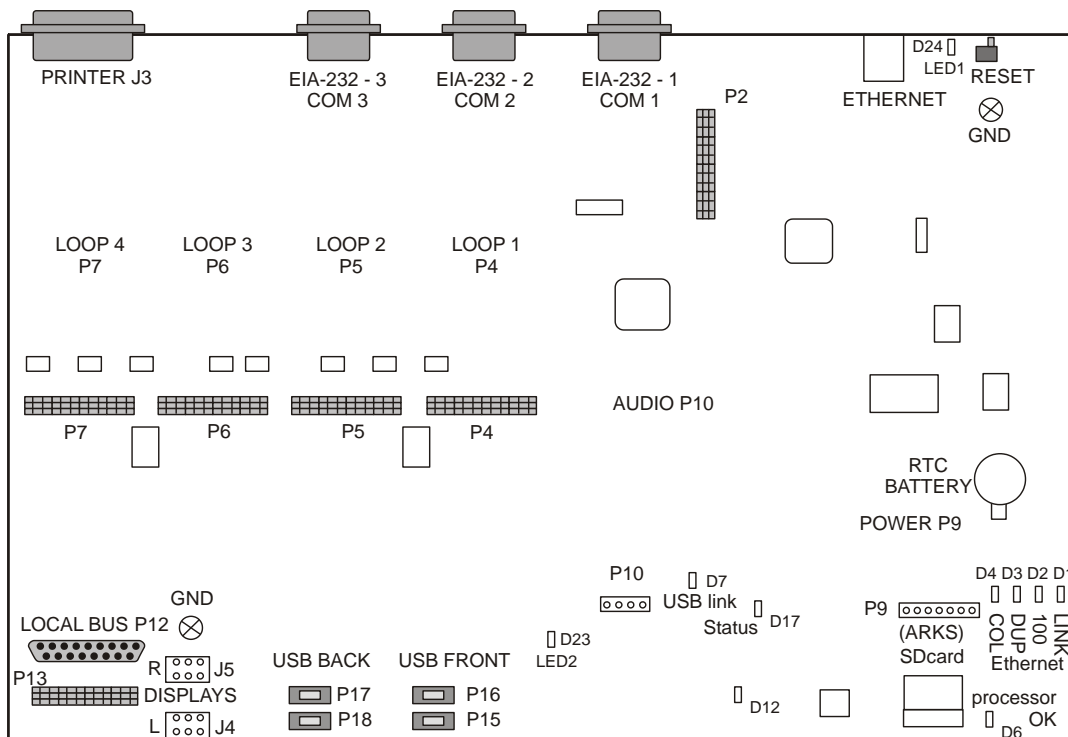
Figure 3   MX-7000 Main board layout

LED	Description
LED 1 - D24	Steady when system is ready
D1 - LINK	Ethernet communications
D2 - 100	Ethernet communications
D3 - DUP	Ethernet communications
D4 - COL	Ethernet communications
D6 - Processor OK	LED steady on o/s load, pulsates to indicate that the o/s is operating
D17 - Status	LED steady on application load, flashes to indicate application is operating

Table 1 Main board LED descriptions
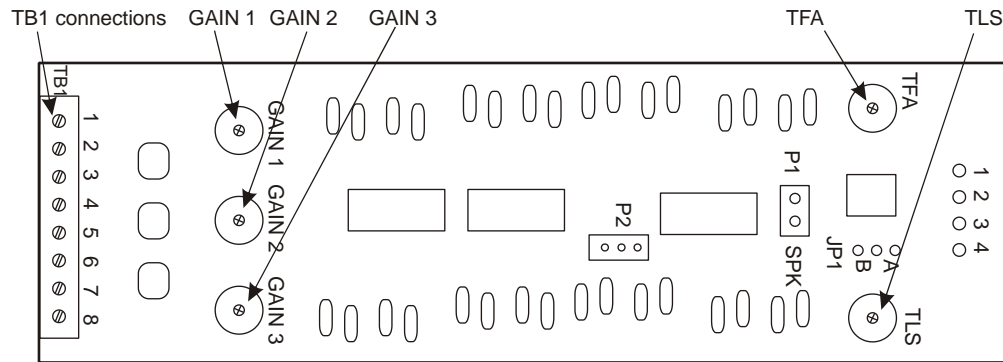
Figure 4   Audio card

TB1 Pins 1 & 2	Audio input 1
TB1 Pins 3 & 4	Audio input 2
TB1 Pins 5 & 6	Audio input 3
TB1 Pins 7 & 8	External speaker connection
GAIN 1	use GAIN 1 to adjust the input signal volume for audio input 1
GAIN 2	use GAIN 2 to adjust the input signal volume for audio input 2
GAIN 3	use GAIN 3 to adjust the input signal volume for audio input 3
TFA	Use TFA to adjust the frequency of the alert tone
TLS	Use TLS to adjust the volume of the alert tone

Table 2 Audio card features

place jumper on NO Btry position
to disable low battery alarm

place jumper on Btry position
to enable low battery alarm

JP1

NO
Btry

Btry

POWER
D11

+15V
150 mA

Battery

GND

Transformer

TB1

J1
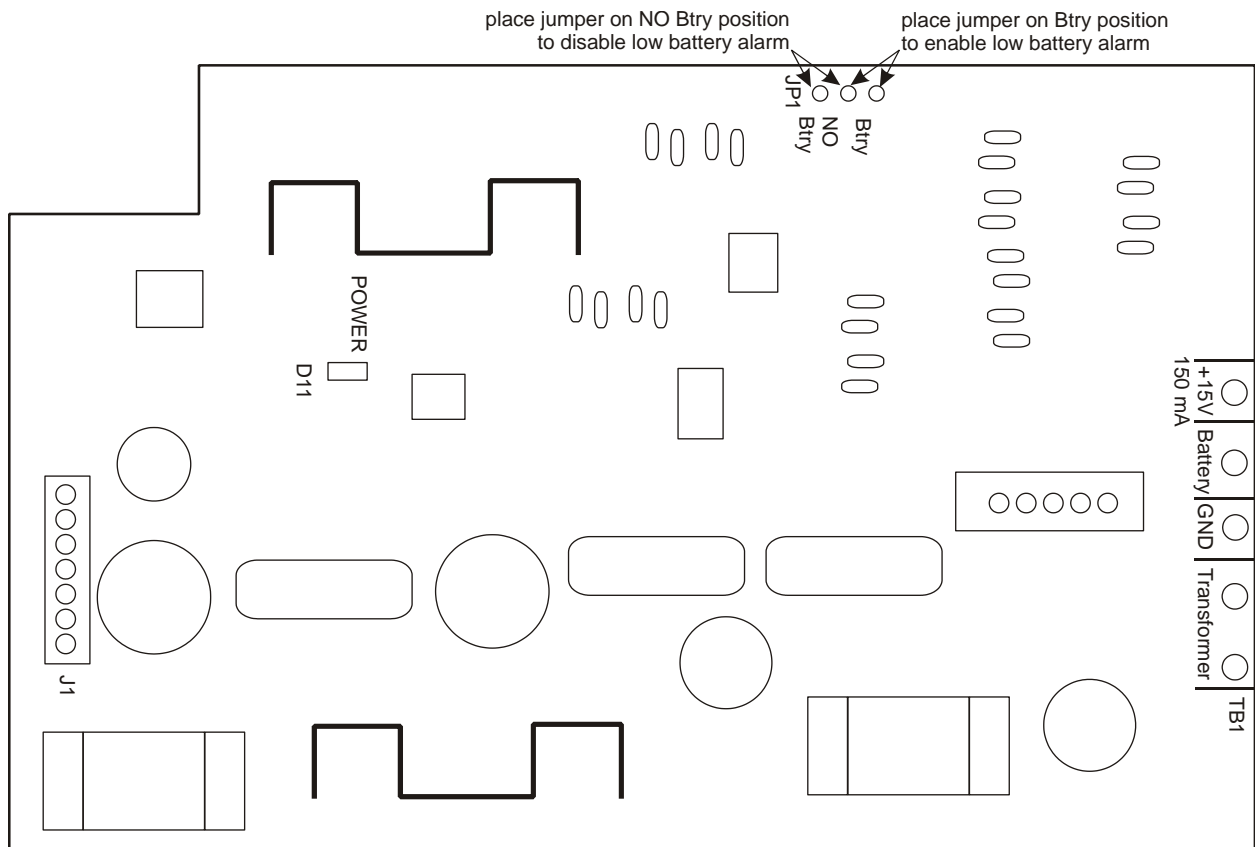
Figure 5   Power card

Reference documents

The MX-7000 operates with other Senstar systems and with third party security devices. Refer to the manufacturers' documentation when installing and setting up the connected equipment.

Section 2 Quickstart FPS-2-2M/MPS-4100

Qualified technicians may follow these simplified procedures to install and test an MX-7000 controlled Fence Protection System, including the installation of the MX-7000 Command and Control Center, the FPS-2-2M fence protection sensors, and the MPS-4100 microwave protection system. Prerequisites for using the quick-start procedures are:

- Attendance at one or more Senstar training courses.
- Prior MX-7000 field installation experience.

Before proceeding, verify that you have a complete site layout showing zone extents, processor locations, and conduit interconnections. If you are not familiar with any of the procedures described in this section, refer to the appropriate manual for more detailed information.

Important installation procedures

Throughout the installation it is very important that the following procedures are observed:

- *Ensure the MX-7000 is connected to a proper electrical ground.*
- *Install ground rods and proper grounding at outdoor device locations, all FPS processors, and all MPS-4100 microwave locations.*
- *Use the approved multiconductor shielded cable, or equivalent, for connecting the MX-7000 to the FPS and MPS units.*
  (The Senstar Interconnect Cable (p/n SP3922-TUV) is a three-pair, 18 AWG, individually shielded twisted pair cable, with overall foil shield, braided shield, and high density polyethylene jacket.)
- *The interconnect wiring should be run in conduit, either underground or along the base, or top, of the fence.*
- *Terminate wiring and shields exactly as shown. Improper terminations will cause system noise and degrade performance.*

FPS 2-2 installation

Mount each FPS processor as shown in Figure 7.

- Use metal brackets or Unistrut-type mounting material to mount the FPS processor(s) on a fence post.
- Arrange the conduit/control wiring entrance at the bottom of the enclosure, as shown.
- Install an approved ground rod at each processor location and connect a minimum 8 AWG ground wire to the processor bolt as shown.
  IMPORTANT: Connect the ground wire directly to the processor bolt as indicated.
  NOTE: Consult the local electrical code for information about earth grounding requirements.

Figure 6 shows the typical copper wire loop interconnection of MX-7000 system components.
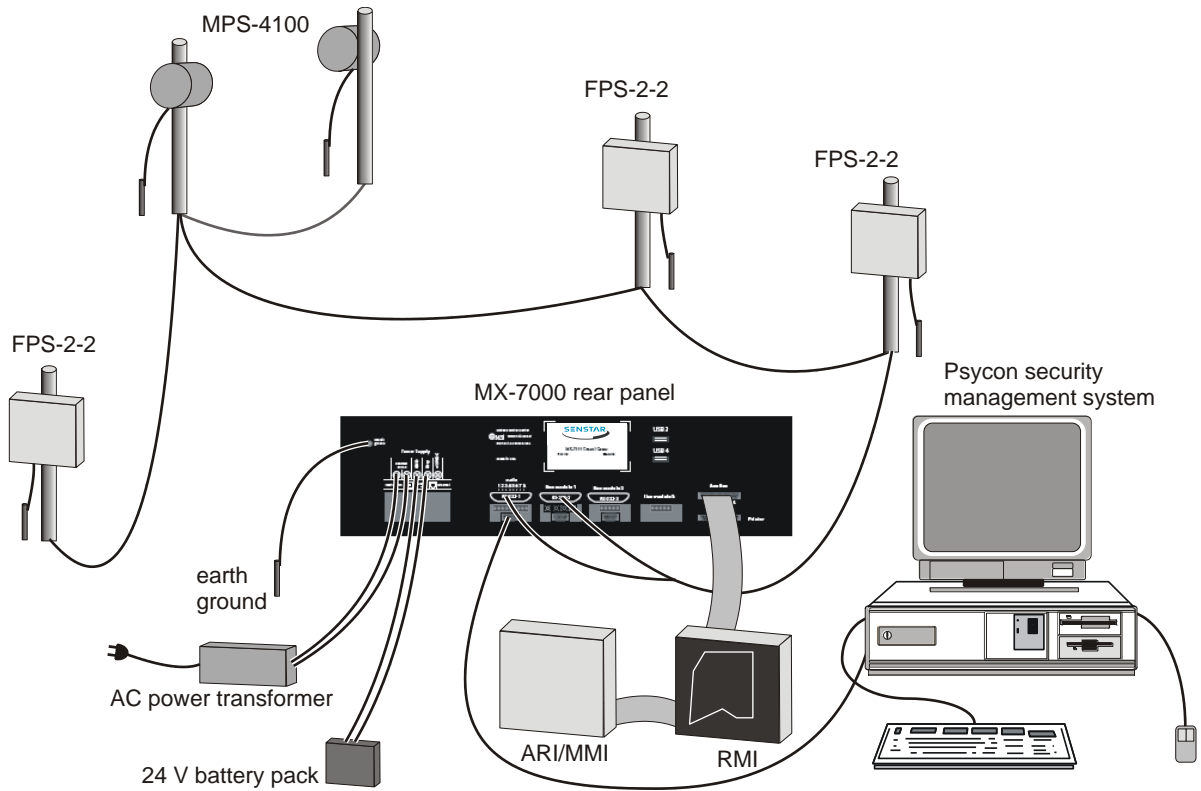
Figure 6   Typical MX-7000 FPS/MPS-4100 system connections
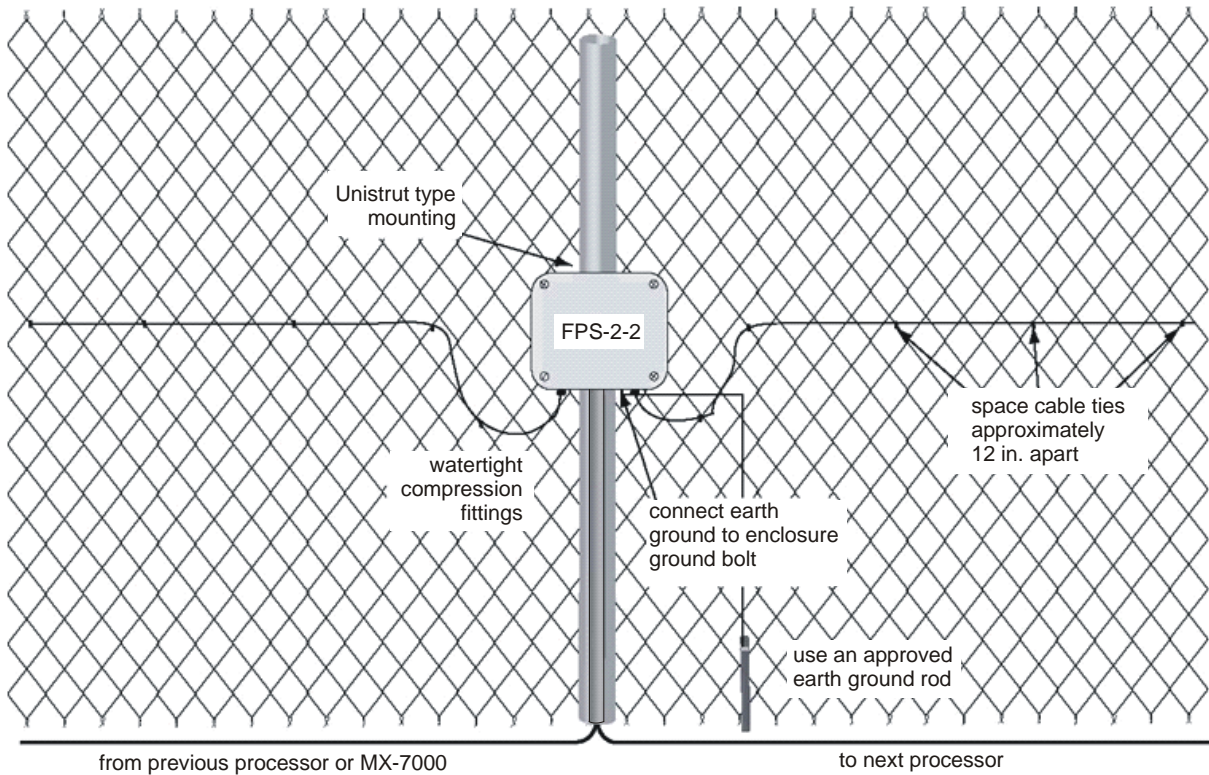
Figure 7   Fence mounted FPS processor

Run the sensor cable from each FPS processor as shown in Figures 7 and 9.

NOTE: Your installation may utilize either standard MEX sensor cable or Helisensor. Observe special requirements for each type of sensor cable.

Attach the sensor cable to the fence at approximate 12-inch intervals with black UV cable ties as shown in Figure 8. Use ONLY the approved black UV-protected cable ties.
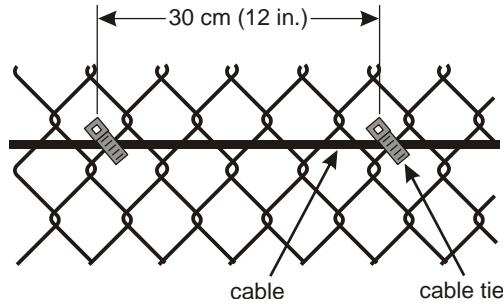
Figure 8   Cable tie installation

Provide a loop at each fence post and sensitivity loops at each corner or end post. Create cable overlaps at adjacent zones. Install TSK termination boxes at each sensor cable end-of-line and any splices, if necessary.

Connect each sensor cable to the processor as shown in Figure 9.

NOTE: Refer to the FPS system manual for detailed setup information and jumper settings.
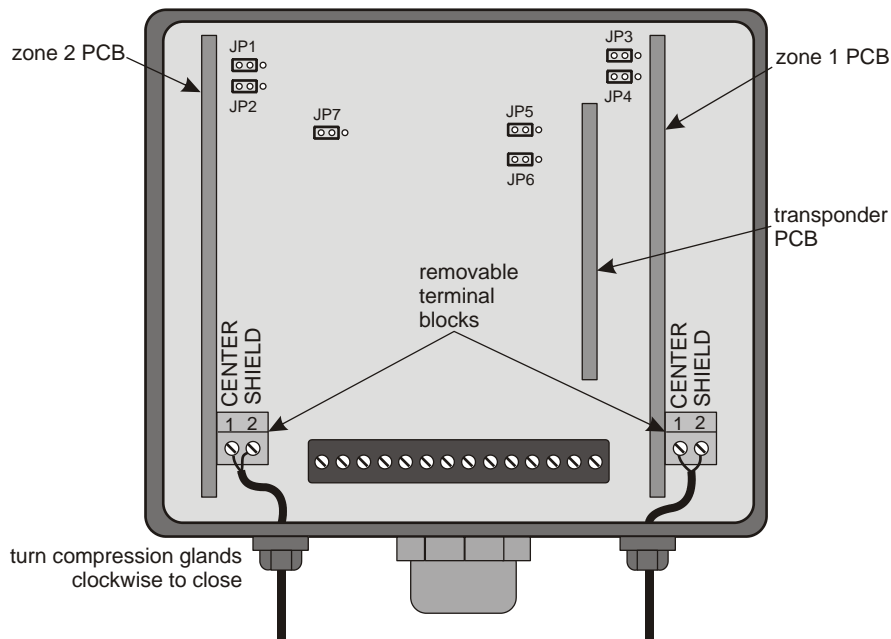
Figure 9   Transducer Cable Connections

Connect the control wiring to each processor as shown in Figure 10.

- Verify that all shields are connected as indicated. Keep the shields separate, do not connect the individual cable shields to one another.
- Install a short jumper wire between terminals 1 and 3.

- Set the transmit and receive address for each processor on the transponder PCB. Refer to Figure 24 or the FPS processor installation manual for address switch settings.
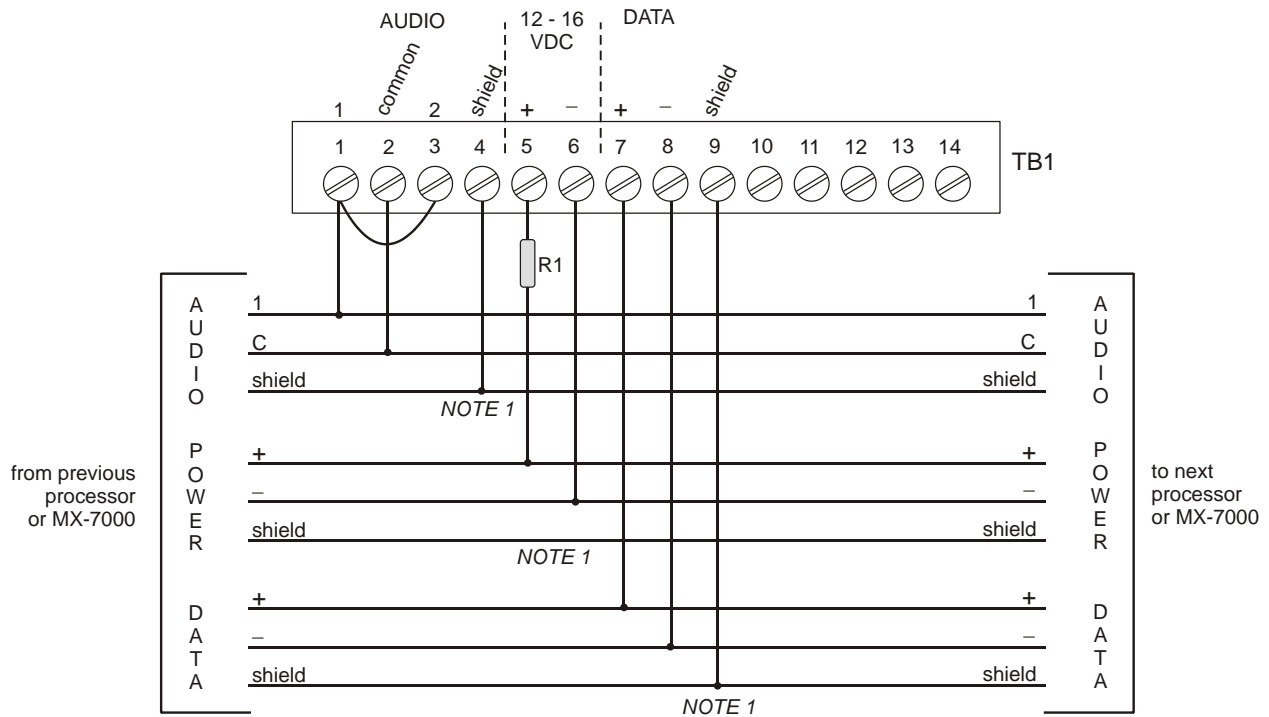
Figure 10   FPS Processor Wiring Connections

NOTE 1: Tie shields as shown. Never tie audio, data and power shields together. Make sure no shields are shorted or grounded.

Determine value of resistor R1 (if required) individually for each processor. See Appendix A for additional information.

MPS-4100 installation

Mount each MPS-4100 microwave unit (pair) as shown in Figure 11 (refer to the MPS-4100 product guide for installation details). For MPS-4100 transponder card address switch settings refer to Figure 25.

MPS-4100

transmitter

from previous
transponder or
MX-7000

receiver

to next transponder
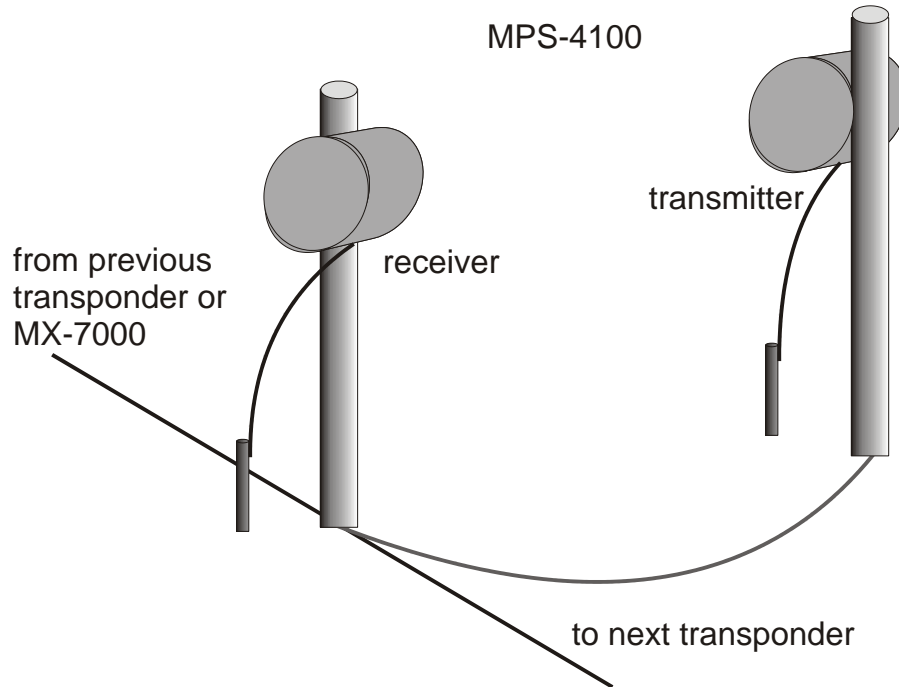
Figure 11   MPS Microwave Installation

Run the interconnect cables and connect the MPS-4100 to the multiplex loop as *shown i*n Figure 12.

MPS-4100
Microwave Receiver

connect return
wires to either
common terminal

Alarm I/P from
Slave Receiver

Tamper I/P from
Slave Receiver

Test O/P to
Slave Receiver

Audio I/P from
Slave Receiver

audio shield
to common

Tamper O/P
from Transmitter

12 to 24 VDC O/P to
Transmitter and Slave Receiver

S1   1 2 3 4 5 6   ON

OFF

COM
ALM 2
TMPR
TEST 2
COM
AUD 2

TB3   TB2

TMPR
-
PWR
+

XMTTR
CONNECT

AUD   PWR   DATA/
TEST
+ -   + -   + -   TMP ALM

CH6
CH5
CH4
CH3
CH2
CH1

JP1   JP2

S2   1 2 3 4 5 6   ON

OFF

P1

XPNDR
CONNECT

TB1

MX-7000 network
transponder card
installed on PI
XPNDR CONN

Audio O/P
to MX-7000

tape shield

12 to 24 VDC I/P
from power supply

Data communication
bus (I/O to MX-7000)

tape shield

Figure 12   MPS-4100 Connections

Connecting the MX-7000

1. Refer to Section 6 for installation details for the MX-7000 unit. Connect the MX-7000 to its power supply transformer and battery pack as shown in Figure 21. Apply power to the MX-7000 by connecting the AC power first, and then the battery pack.
2. Connect the FPS/MPS MX copper transponder loop cable to the MX-7000 rear panel as shown in Figure 6 and Figure 22. If there are multiple loops, connect each to the appropriate MX loop card.
3. Enter setup, acknowledge all alarms and perform the MX-7000 initial configuration.
4. Each FPS2-2M field processor supply voltage must be between 12-16 VDC. If the end of line processor supply voltage is below 12 VDC, the MX-7000 copper loop card output voltage at TB1, pins 4, 5 (see Figure 20) can be increased by trimming R40 on the loop card. If the end of line processor supply voltage cannot be brought to 12 VDC without exceeding 16 VDC at the first in line processor then voltage dropping supply resistors must be added as described in appendix A.
5. Complete the MX-7000 configuration by performing the steps required for your system (see Section 7).
6. Adjust the count and gain switches on each FPS processor to provide the required climb and cut detection. Align each MPS-4100 microwave pair to optimize the detection zones.
7. Perform detection and nuisance alarm testing in each zone and perform fence quieting procedures and microwave re-alignment if necessary.
8. Perform final testing, including the climb test, in each zone as required by the system specifications.

Section 3   Quickstart FPS-5 MXF-7500 series

Qualified technicians may follow these simplified procedures to install and test the typical MX-7500 Fence Protection System, including installation of the MX-7500, FPS-5 fence protection and MPS-4100 microwave system. Prerequisites for using the quick start procedures are:

- Attendance at one or more Senstar MX-7500 training class.
- Prior MX-7500 field installation experience.

Before proceeding, verify that you have a complete site layout showing zone extents, processor locations, and conduit interconnections. If you are not familiar with any of the procedures described in this section, refer to the appropriate manual for more detailed information.

Important procedures

Throughout the installation it is very important that the following procedures are observed:

- *Ensure the MX-7000 is connected to a proper electrical ground.*
- *Install ground rods and proper grounding at outdoor device locations, all FPS processors, and all MPS-4100 microwave locations.*
- *Terminate fiber according to accepted practices. Improper terminations will cause communications errors and degraded performance.*

Installation

Figures 13 and 23 show the typical fiber optic interconnection of components. The interconnect cable should be run in conduit, either underground or along the base of the fence.

Optical fiber requirement:

Multimode, 62.5 µm/125µm with a maximum loss of 3.5 dB/km at 850 nm wavelength of light.

Senstar recommends breakout style of cable with each fiber individually enclosed in aramid yarn and a 2 mm elastomer jacket.

An approved cable type is from Optical Cable Corp. (800) 622-7711 www.occfiber.com, part numbers: BX02-070D-WLS/900-OFNR for 2 fibers in cable, BX04-080D-WLS/900-OFNR* for 4 fibers in cable. Use ST connectors with 2 mm strain reliefs.

*OFNR signifies indoor and outdoor riser. Use OFNP for indoor and outdoor plenum.
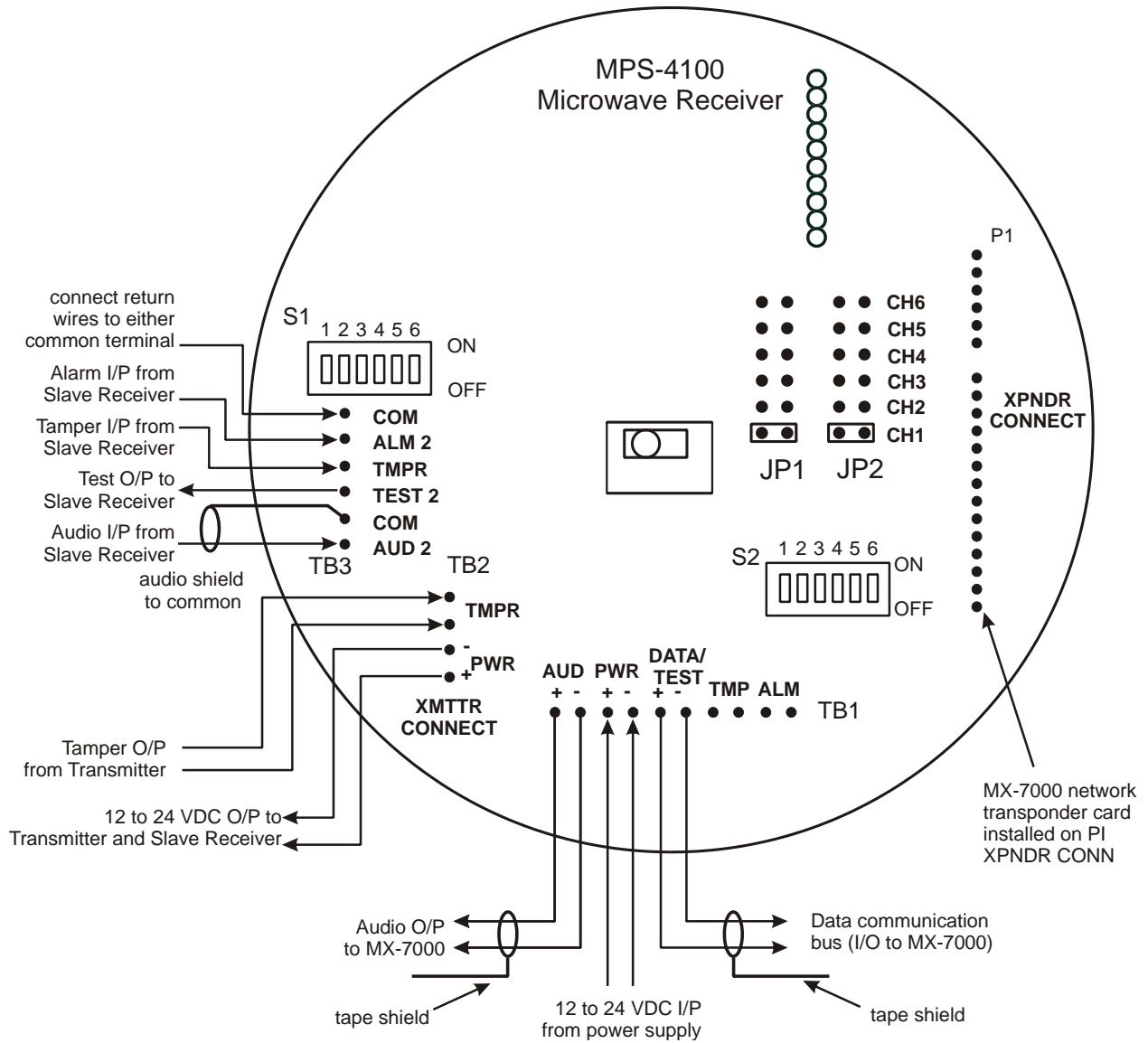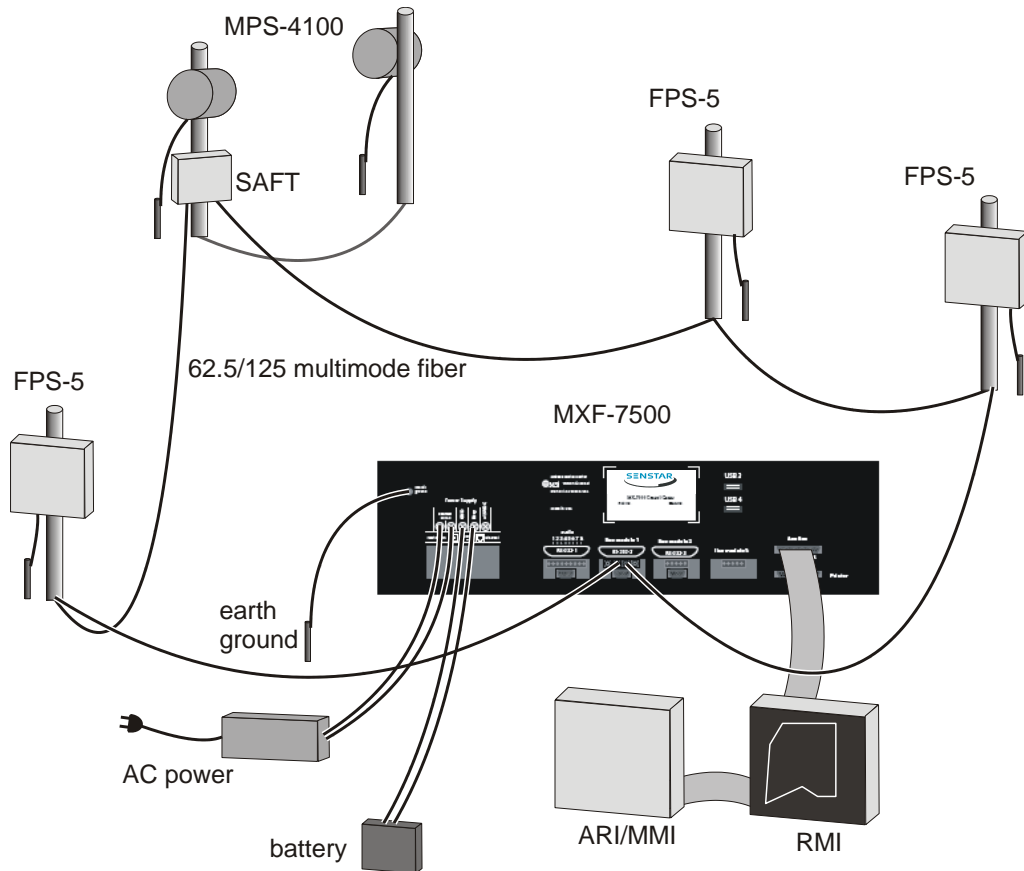
Figure 13   MXF-7500 FPS-5 and SAFT fiber optic system connections

Connecting the MXF-7500

1. Refer to section 6 for installation details for the MXF-7500 unit. Connect the MXF-7500 to its power supply transformer and battery pack as shown in Figure 21. Apply power to the MXF-7500 by connecting the AC power first, and then the battery pack.

2. Connect the FPS-5 / SAFT fiber transponder loops to the MXF-7500 rear panel as shown in Figure 13 and Figure 23. If there are multiple loops, connect each to the appropriate MX fiber loop card.

3. Apply power to the FPS-5 and SAFT devices.

4. Enter setup, acknowledge all alarms and perform the MXF-7500 initial configuration.

5. Complete the MXF-7500 configuration by performing the steps required for your system (see Section 7).

6. Adjust the count and gain switches in each FPS processor to provide the required climb and cut detection. Align each MPS-4100 microwave pair to optimize the detection zones.

7. Perform detection and nuisance alarm testing for each zone and perform fence quieting procedures and microwave re-alignment if necessary.

8. Perform final testing, including the climb test, in each zone as required by the system specifications.

Section 4 Silver Network Support

The MX-7000 supports Silver Network based sensors via 2 of its 4 USB ports and Silver network interface units (USB to fiber/422 converters). The supported sensors include fence sensors FlexPS, FlexZone-4, Senstar LM100, plus the UltraWave microwave sensor, and the UltraLink I/O processor. Refer to the appropriate product manuals for installation and configuration details for specific Silver Network based devices. The MX-7000 can monitor up to 30 Silver Network based devices in a single network loop. Audio monitoring and EDAPT processing are not available for devices on the Silver Network.

Note that the Silver Network devices on loop 4 do not affect loops 1 to 3 or any other peripheral device connections as illustrated in Figure 2.
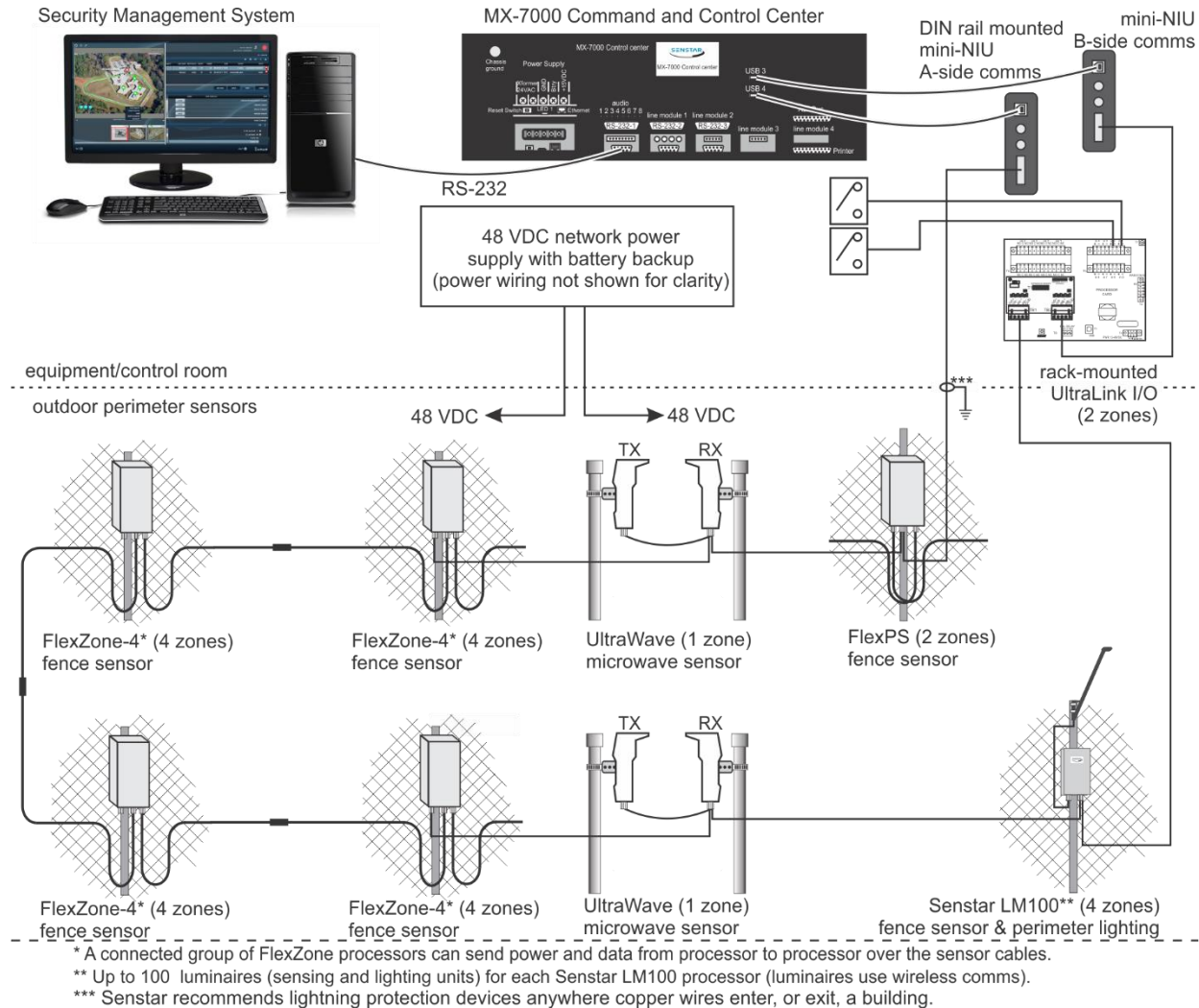
Figure 14   Silver Network diagram

Silver Network support requires MX-7000 software version J9SW0500-128 or above, plus the MX-7000 Silver Network drivers J9SW0501-001. No additional MX-7000 hardware is required. The Silver Network devices connect to the MX-7000 through 2 mini NIUs (p/n 00EM0200) or through a Network Interface Unit (NIU - p/n 00EM1301). Figure 14 illustrates an MX-7000 with a closed loop Silver Network. The Silver Network example shows 9 transponders and depending on the MX-7000 zone configuration, up to 26 alarm zones.

Transmission media/maximum separation distances between processors:

- RS-422 copper wire shielded twisted pair data cable (2 pairs per channel) - 1.2 km (0.75 mi.)
- 62.5/125 multi-mode fiber optic cable (820 nm) - 2.2 km (1.4 mi.) - 2 fibers per Channel - optical power budget 8 dB
- 9/125 single-mode fiber optic cable (1310 nm) - 10 km (6.2 mi.) - 2 fibers per Channel - optical power budget 8 dB
- FlexZone sensor cable - 600 m (1,970 ft.)

Silver Network device documentation

Detailed installation, setup and operation instructions are included in each devices Product Guide. The Product Guides also include communication options and powering requirements. Silver Network devices are typically powered from a centrally located 48 VDC Network Power supply. Alarm data communications can be over RS-422 wiring or fiber optic cable (single-mode or multi-mode). The MX-7000 supports only the Silver Network loop configuration. Go to the Senstar website (www.senstar.com) to request copies of the Silver device Product Guides.

Configuring Silver Network devices for MX-7000 implementation

Silver Network devices are configured via the Universal Configuration Module (UCM). The UCM is a Windows based software application, which communicates with the Silver devices locally via USB. The UCM can also communicate with the Silver based devices over the network if the MX-7000 is disconnected (requires Silver Network Manager software). If only local USB connections are anticipated, the configuration should be performed before each device is field installed.

For all Silver device types except the UltraLink I/O, the processor zone and device states are enabled using the remote configuration relay setup (also known as UltraLink I/O Network Manager mode). Table 3 shows how the remote configuration relays map to the MX-7000 display zones and states for each processor. The MX-7000 reports the device and zone states as indicated in Figure 18.

FlexPS, FlexZone-4, Senstar LM100, UltraWave (zone 1 only)		
Relay to set in Remote Cfig	MX-7000 XPO zone	MX-7000 display state
P1	1	Alarm
P2	1	Tamper
P3	1	Trouble
1-1	2	Alarm
1-2	2	Tamper
1-3	2	Trouble
P4	All XPO zones*	Tamper
P5	All XPO zones*	Trouble
* All zones defined for that processor in the MX-7000 display zones database.		
FlexZone-4 and Senstar LM100 have 4 zone capability (Alarm Zones 3 & 4)		
1-9	3	Alarm
1-10	3	Tamper
1-11	3	Trouble
1-17	4	Alarm
1-18	4	Tamper
1-19	4	Trouble

Table 3 Remote Cfig relay mapping to MX-7000 display zone and state

The UltraLink I/O processor accepts up to 6 dry contact inputs. These inputs are mapped to the MX-7000 display zones as follows:

UltraLink I/O processor		
UltraLink Input/State	MX-7000 XPO zone	MX-7000 display state
P1 Alarm	1	Alarm
P1 Tamper	1	Tamper
P3 Alarm or Tamper	1	Trouble
P5 Alarm	2	Alarm
P5 Tamper	2	Tamper
P7 Alarm or Tamper	2	Trouble

Table 4 UltraLink I/O input mapping to MX-7000 display zone and state

UltraLink I/O processor		
UltraLink Input/State	MX-7000 XPO zone	MX-7000 display state
P1 Alarm or Tamper	1	Alarm
P2 Alarm or Tamper	1	Tamper
P3 Alarm or Tamper	1	Trouble
P5 Alarm or Tamper	2	Alarm
P6 Alarm or Tamper	2	Tamper
P7 Alarm or Tamper	2	Trouble

Table 5 UltraLink I/O input mapping to MX-7000 display zone and state (separate tampers mode)

Silver device configuration details

Use the UCM to set each device configuration for use on the MX-7000 Silver Network:

1. Set the device's Silver Network address (1 – 30).
2. Set the device's network type to Silver Loop.
3. For transponders other than UltraLink I/O, set the Remote configuration (see Figure 15).

Figure 15 shows a typical UCM alarm zone setup for a FlexPS sensor.
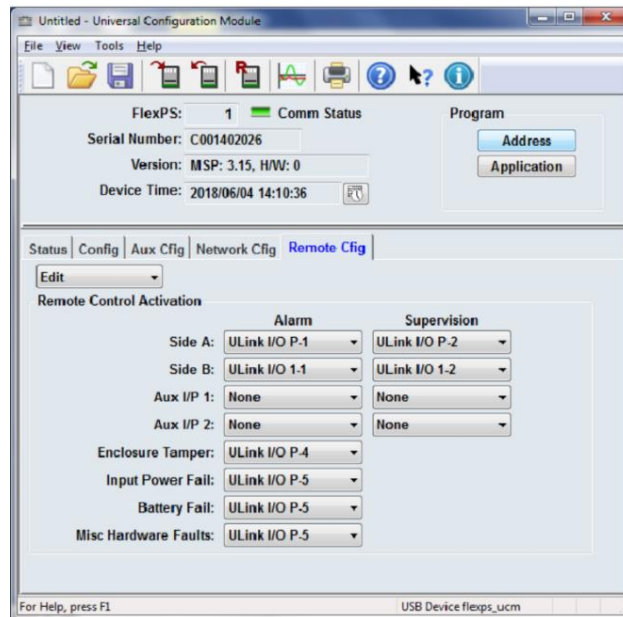
Figure 15   Typical FlexPS Remote Configuration

Note: To enable the Aux I/P 1, you could assign P-1 for its alarm, for it to also activate the XPO zone 1 display alarm. Or you could assign P-3 to activate the XPO zone 1 trouble alarm.

Silver Device Upgrades of Existing FPS Systems

Here are some points to keep in mind when replacing your perimeter devices with Silver devices.

- The FlexPS sensor can use existing MEX sensor cable. However, new Silver Network data cable must be deployed to the processor.
- If all devices in an MX-7000 comms loop are replaced, the existing comms (copper or fiber) can likely be repurposed for the Silver Network.
- It is possible to replace an FPS2 with an MX-7000 loop capable FlexPS (FlexPS with a Silver Network MX copper comm card, p/n J9BA0100).
- Silver Network based sensors operate on 12 to 48 VDC.
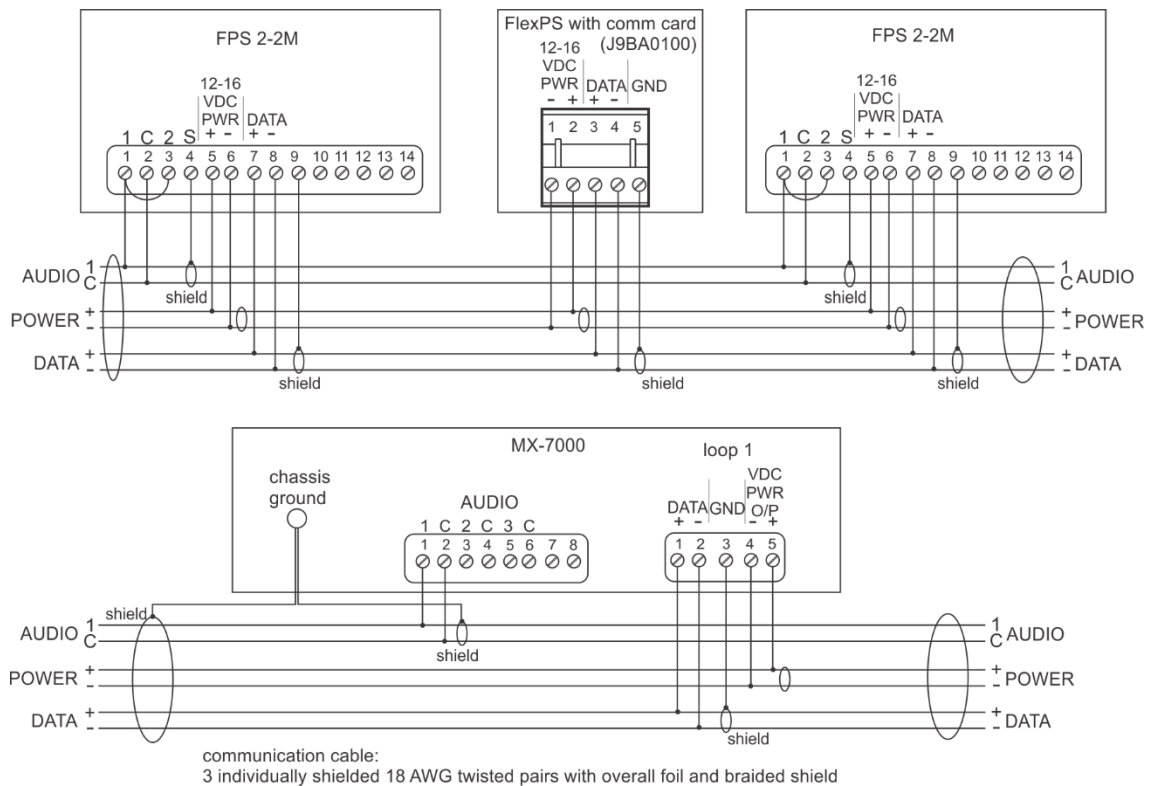
Figure 16   Wiring diagram - replacing an FPS 2-2M with a FlexPS processor

Section 5 Operator Interface

The MX-7000 annunciates alarms audibly and visually, provides control of each zone, allows listening to each zone, and provides an event record (digital if Alarm Record Keeping System-ARKS is installed, and hardcopy if a parallel printer is connected).

In host mode the MX-7000 serves as an interface between the MX network of security devices, and a Psycon or other host alarm display and control system. When the MX-7000 operates in host only mode, the command screen cannot be used to enter commands. Operator control is via the host system only. See Section 7 – Port Configuration for setting and description of host modes
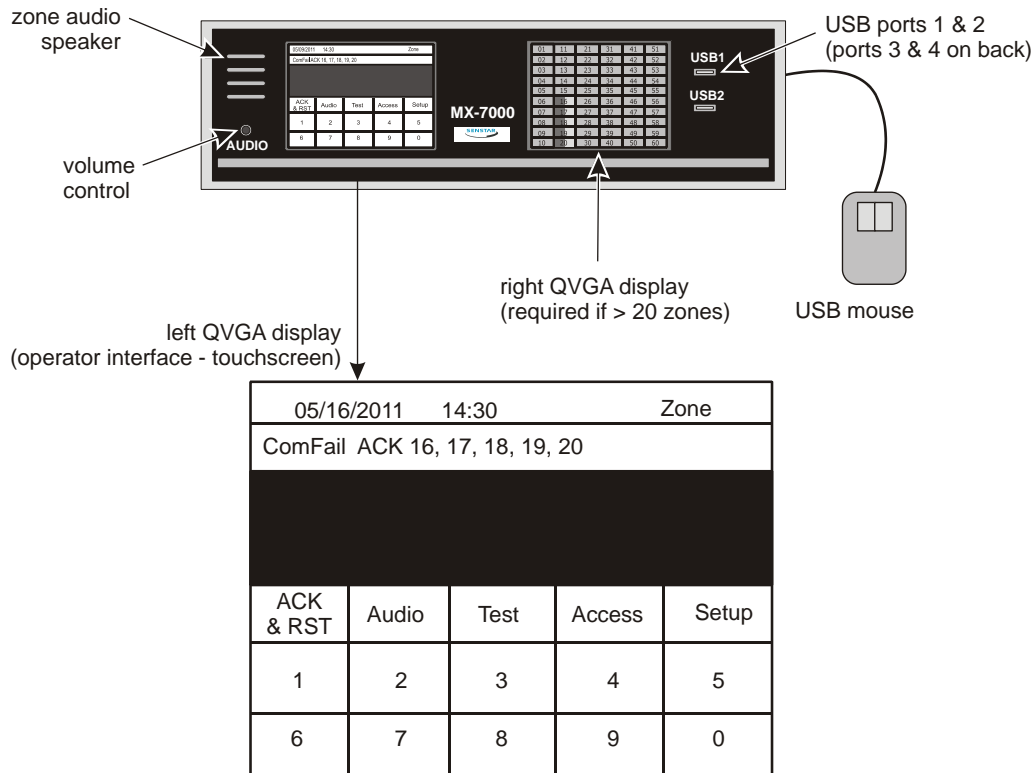
Figure 17   Front panel controls (dual screen unit)

Description

The MX-7000 operator interface is a 5.7 inch flat panel color touchscreen. A USB mouse or other pointing device can also be used as for operator input. For systems with more than 20 zones there are two VGA screens. The left touchscreen is the command interface and the right display shows the system zones status (see Figure 17). For systems with 20 zones or less, the single left panel touchscreen is divided into a command interface on the left, and a system zone status display on the right (see Figure 1 and 19). The command interface lists global status and provides operator control when local control mode is enabled.

Zone Status display

The status of each zone is displayed by a rectangular box with a 2-digit zone label in the center. Figure 18 illustrates the zone display states of an MX-7000. There is also a fast (2Hz) and slow (1Hz) alert tone.

zone status flash time scale:

	0.5 sec.	1.0 sec.	1.5 sec.	2.0 sec.
secure zone - steady green	04			
zone alarm - slow flash & slow alert tone red-red/white-white + slow alert tone	04	04	04	04
zone alarm acknowledged - steady red alert tone silenced	04			
zone alarm reset - steady green	04			
tamper alarm - fast flash & fast alert tone red/white/red/white + fast alert tone	04	04	04	04
tamper alarm acknowledged - fast flash red/white/red/white alert tone silenced	04	04	04	04
audio selected secure zone - left-most 20% of zone label is blue the remainder of the label displays the status of the zone	04			
zone alarm with audio - slow flash & slow alert tone left-most 20% blue + red-red/white-white + slow alert tone	04	04	04	04
tamper alarm with audio - fast flash & fast alert tone left-most 20% blue + red/white/red/white + fast alert tone	04	04	04	04
comm fail - fast flash & fast alert tone yellow/white/yellow/white + fast alert tone	04	04	04	04
comm fail acknowledged - steady red/yellow left 50% red right 50% yellow alert tone silenced	04			
access zone - slow flash & slow alert tone yellow-yellow/white-white + slow alert tone	04	04	04	04
access zone acknowledged - steady yellow alert tone silenced	04			
priority alarm (all zones) - fast flash & fast alert tone red & yellow/white/red & yellow/white + fast alert tone	04	04	04	04
acknowledged priority alarm (all zones) - fast flash red & yellow/white/red & yellow/white alert tone silenced	04	04	04	04
zone trouble/self-test fail - slow flash & slow alert tone red & yellow-red & yellow/white-white + slow alert tone	04	04	04	04
acknowledged zone trouble/self-test fail - slow flash red & yellow-red & yellow/white-white alert tone silenced	04	04	04	04

Figure 18   MX-7000 alarm display states

Operator commands

Operator commands are entered via the command touchscreen. A USB pointing device (e.g., a mouse) can also be used to enter operator commands. Figure 19 illustrates the MX-7000 command screen on a single display system with 10 alarm zones.
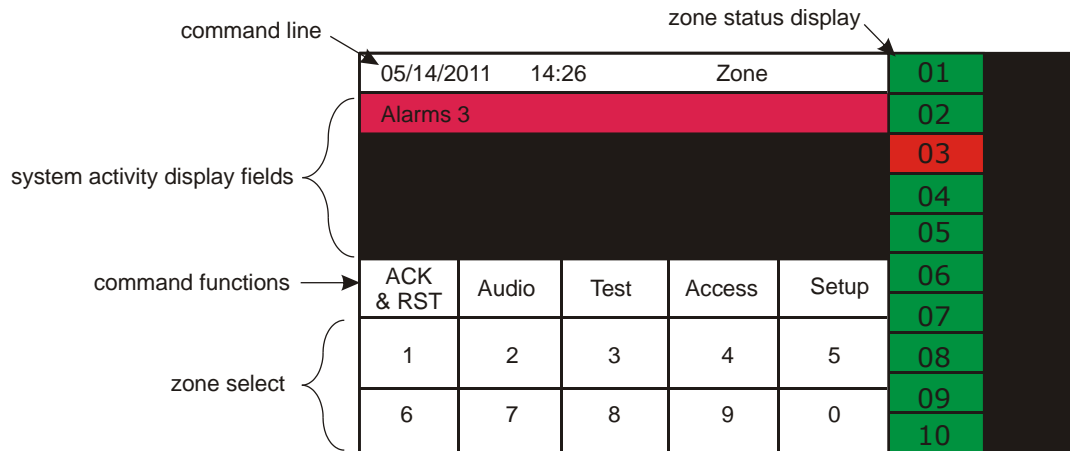
Figure 19   MX-7000 command screen (single display system)

Command Line

The command line displays the time, current system alarms and command error on the left and zone, password, alarm causes and test all confirm numerical input on the right. If there are no system alarms (ARKS fail, AC fail, Battery fail, Fiber loop fail) active or ACK then only the time and command error will be displayed. Command error is shown when the operator has entered invalid input. This can be zone number out of range, audio or test select of a zone with audio or test functions disabled, or attempt to RST a zone alarm condition that is still in the active state.

The right side of the command line displays operator input of zone number, password, test confirmation and category number.

ACK & RST (Acknowledge and Reset)

Acknowledge and reset are two separate commands invoked with the same button, which are required for alarm processing. For example, if an alarm occurs in a zone, the operator first enters the zone number on the command screen keypad, and then selects the ACK & RST function to acknowledge the alarm. To reset the alarm, the operator enters the zone number and then selects the ACK & RST function a second time. If alarm categories are enabled, the operator must also enter a Category number (1 to 6) to identify the cause of the alarm, before the alarm can be reset. Acknowledge and reset are required for zone intrusion alarms, tamper alarms, zone trouble/test fail alarms, communication fail alarms, and to put a zone into access.

1. Select the zone number.
2. Select the ACK & RST button to ACK.
3. Select the zone number.
4. Select the ACK & RST button to RST.
5. Select the Category number (optional).

The category number indexes into a list known to the operator and by a single number entry the cause can be logged. Here is sample category list: 1-Valid, 2-Wind, 3-Rain, 4-Debris, 5-Thermal, 6-Unknown.

Audio

Use the Audio function to activate or deactivate the audio signal from a zone with listen-in capability. The Audio is enabled automatically when an audio capable zone intrusion alarm or tamper occurs. Only one zone audio can be selected at any given time. To activate the audio function:

1. Select the zone number.
2. Select the Audio function.
3. Deactivate the zone Audio by selecting the Audio function a second time.

The audio selected zone will be blue in the left 20% of the zone status box.

Test

Use the Test function to activate self-tests for zones with the self-test capability enabled.

1. Select the zone number. Select 0 for test all.
2. Select the Test function.
3. For test all enter the Confirm code 00 and ACK.
   The test zone includes a T beside the zone number in the zone status box to indicate that a test is taking place. If the zone passes the test, the zone status will return to secure. If it fails the test, the system declares a zone trouble/self-test fail alarm in the selected zone.

Access

Use the Access function to disable intrusion alarm reporting for a zone that will be entered for maintenance or another authorized activity. Sensor alarms will be detected by the zone, but will not be reported. Tamper, fail, and other system alarms will continue to be annunciated.

1. Select the zone number.
2. Select the Access function.
   The access zone alert will be declared for the selected zone.
3. Select the ACK & RST button to ACK.
   The zone is placed in the access state.
4. To return the zone to the secure state, select the zone number then select the ACK & RST button to RST.

Setup

The Setup function is used to access the system setup and special functions menu.

1. Select the Setup function.
2. Enter the 4-digit password (default 0000).
3. Refer to Section 7 for details on MX-7000 Setup.

Section 6 Installation

NOTE: Before beginning field installation, the configured electronics (connections, DIPs and shunts) should be connected and tested in your shop. Outdoor security systems are often installed over thousands of feet, making troubleshooting in the field both time-consuming and expensive.

The MX-7000 integrates sensor and host systems and is installed in conjunction with one or more of the following systems. Review the manuals of the systems included in your installation as required before proceeding.

- FPS 2-2M copper wire and FPS 5 fiber optic Fence Protection Systems
- MPS-4100 Microwave Protection Systems
- Stand-alone Transponders (SAT and SAFT)
- Remote Display Unit (RDU)
- Super-Transponder
- Psycon Control Unit
- Alarm Recordkeeping System (ARKS)
- Alarm Relay Unit (ARU)
- Weather Station
- Video Switcher
- Silver Network devices (FlexPS, FlexZone-4, Senstar LM100, UltraWave, UltraLink I/O)

The MX-7000 comes in either rack-mount or desktop option. Desktop mounting is typically used to provide operator access and control. Rack-mounting is generally used in situations where the MX-7000 is serving as an interface to another display and control system. The other system is providing the operator interface to the security system (e.g. Psycon). If the MX-7000 will be used as the operator console, locate it in a position that:

- Provides operators with easy and comfortable access to the front panel controls or mouse.
- Allows the internal speaker to be clearly audible.
- Makes the LCD display easily visible.
- Provides an adequate MX-7000 operating environment.
- Allows for rear panel cabling access.

AVOID installing the MX-7000 in areas that:

- Are near heating systems, noise sources or in direct sunlight.
- Face direct sunlight that would make the display difficult to see.
- Restrict the top of unit ventilation.

Power connections

The system must be supplied with transient and interference-free prime power. Power conditioning transient suppressors suitable for computerized equipment must be employed between the MX-7000 and the prime power line as required by good commercial practice to provide the highest level of protection from power spikes and surges.

Transformer setup (120 V/220 VAC input)

The MX-7000 unit can be powered from either 120 volt 60 Hz or 220 volt 50 Hz power using the MX series power supply (p/n 02-190008). The unit is wired at the factory for 120 volt operation (see Figure 20).
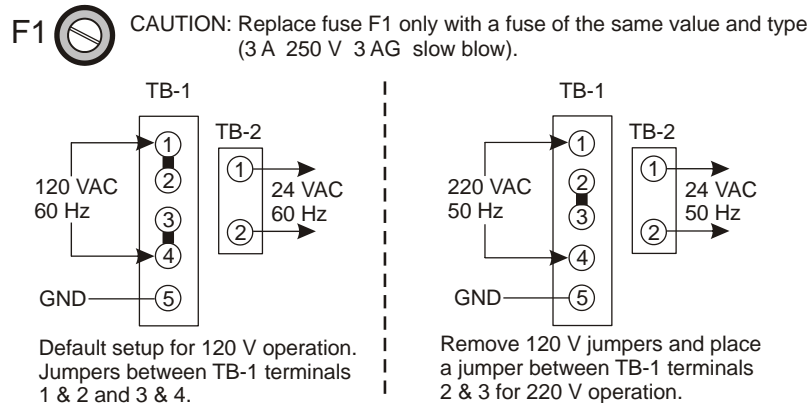
Figure 20   120 VAC/220 VAC power connections

To operate the system from 220-volt service:

1. Remove the jumper between terminals 1 and 2 of TB-1.
2. Move the jumper between terminals 3 and 4 of TB-1 to terminals 2 and 3 of TB-1.
3. All other connections are identical to the 120-volt operation arrangement.

Backup battery connections

The optional 24 VDC backup battery pack maintains MX-7000 operations if AC power is lost. Connect the battery as shown in Figure 21. Use 18 AWG minimum insulated wire. The battery pack should have sufficient capacity to power the MX-7000 and the devices it powers for the site-specific UPS run-time. Set the JP1 shunt on the power card (Figure 5) based on whether a battery is connected.

Grounding

The MX-7000 requires a low impedance, low noise earth ground to ensure proper system operation and transient protection. Connect the chassis ground lug on the rear panel of the MX-7000 to an electrical ground in accordance with the Local and National Electrical Codes. (For example, this may be provided by a ground rod, cold water pipe, or an isolated signal ground circuit. Use insulated, 10 AWG minimum wire for the ground connection.)
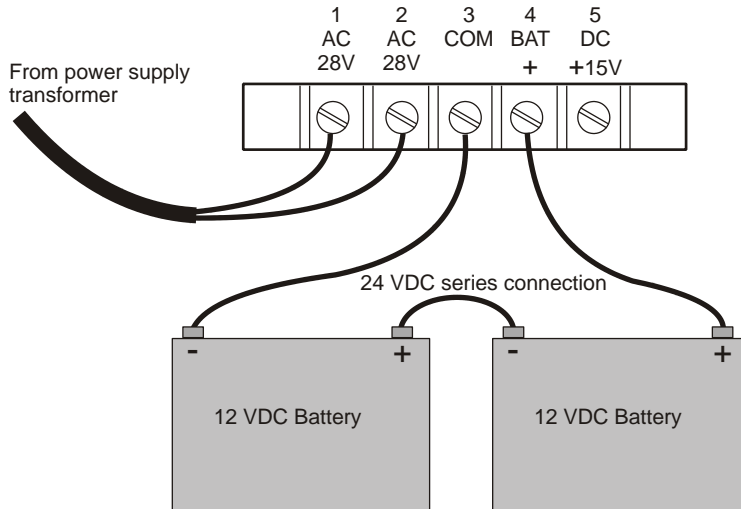
NOTE: The battery must have sufficient capacity to power the MX-7000 and its connected sensors to meet the runtime specification (site-specific).

Figure 21   MX-7000 backup battery connections

Connections to field equipment

All field connections to the MX-7000 are made via the plug-in connectors on the rear panel (see Figures 22 and 23).

NOTE: Use heatshrink or tape to insulate all bare wires and shields. Insulate individual mylar/foil jackets to prevent shields from shorting.
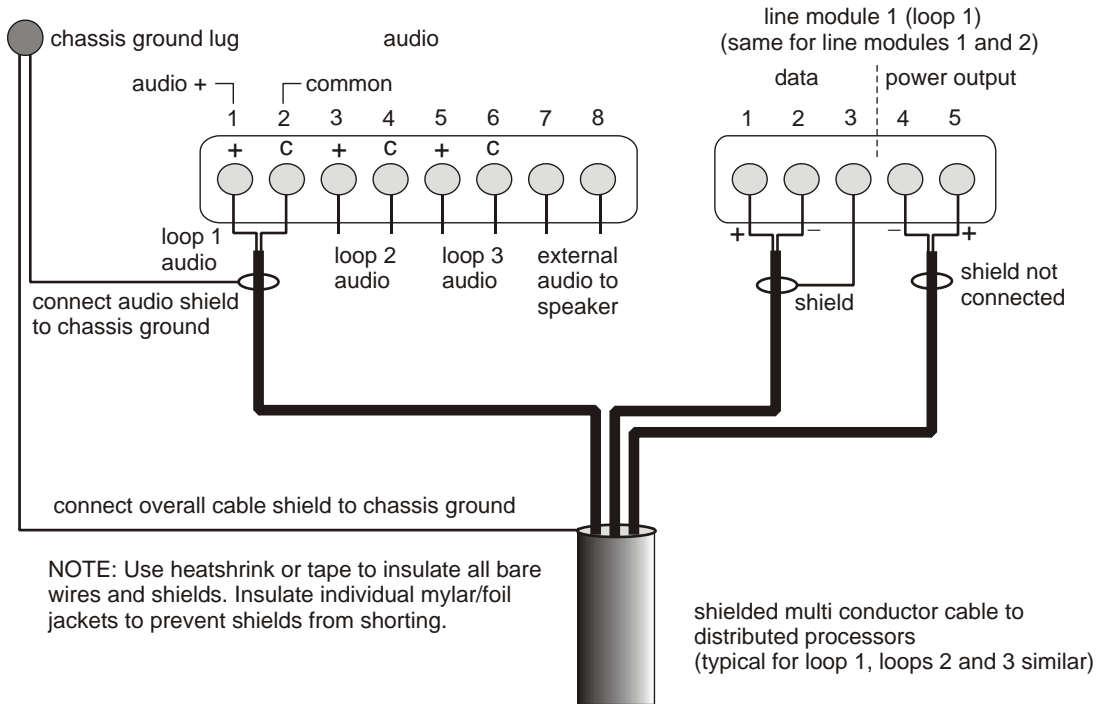
Figure 22   MX-7000 copper wire loop connections
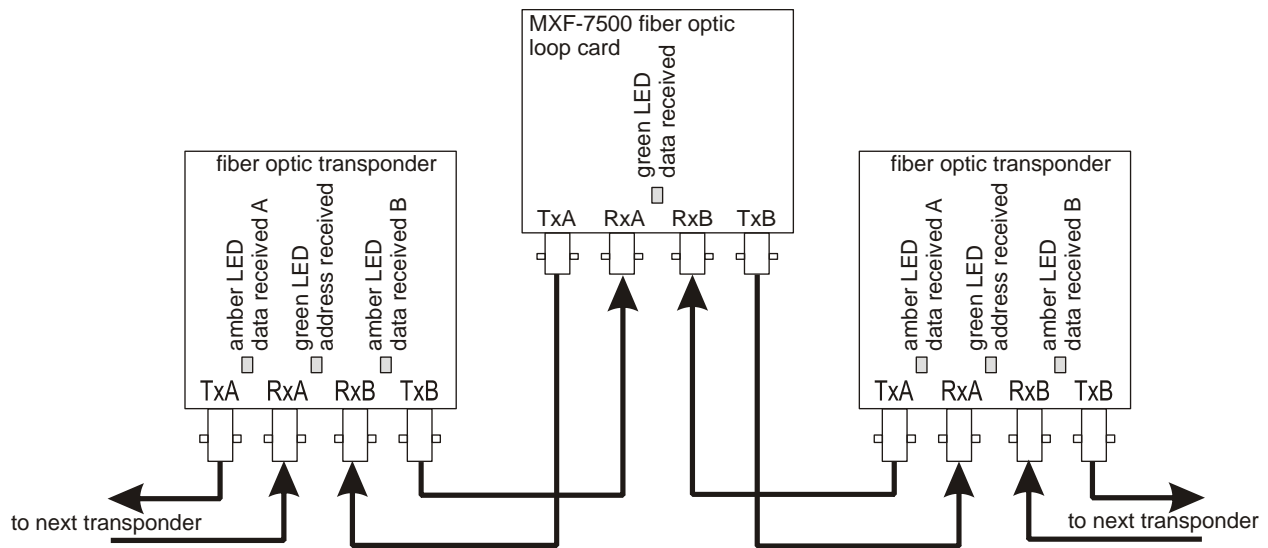
Figure 23   Fiber loop connections

Data/audio connections

A typical FPS-5 installation requires a pair of multimode fibers looped through all FPS-5 and SAFT processors (up to 30 transponders per fiber optic loop) and returning to the MXF-7500. This provides redundant paths for data and audio information (see Figures 13 and 23).

A typical FPS-2-2 installation requires two twisted shielded pairs from the back of the MX-7000 to each processor in the field (up to 10 per loop) (see Figures 6 and 22).

Power connections

All field equipment is powered either locally or by way of a separate centralized power supply. The wiring distances required by outdoor perimeter protection systems can cause a significant voltage drop between a central power supply and the distributed processors. Each FPS-2-2 processor requires 30 mA at 12-16 VDC and each FPS-5 and SAFT processor requires approximately 130 mA at 12-24 VDC. The central power supply and power cables must be sized accordingly.

> *NOTE: Use a separate power supply (not the MX unit) to power fiber optic communicating transponders.*

Figure 24   MX-7000 rear panel

Connecting and testing the processors

Connect the processors to the MX as follows:
Refer to Figure 22 for FPS 2-2 copper wire loop connections and Figure 23 for FPS-5 fiber optic loop connections.

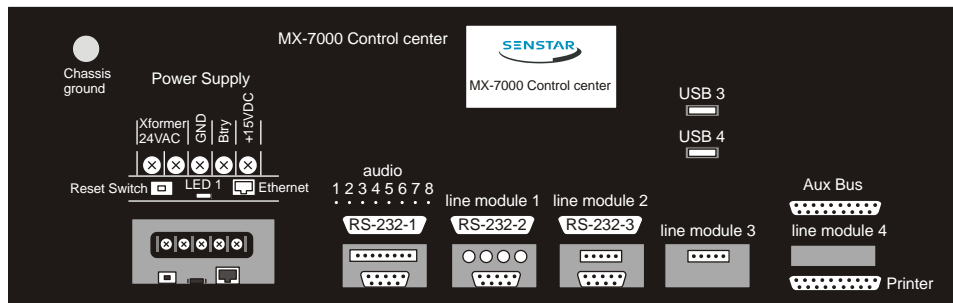- FPS 2-2: Using 18 AWG twisted shielded pair cable connect the data terminals of the MX-7000 multiplex copper loop card, terminals 1 (data+), 2 (data-), and 3 (shield) to the data terminals of the processor.
  Connect the audio bus wires for loop 1 to terminals 1 audio and 2 common of the audio connector.
- FPS 5: Using approved Fiber Optic cable, connect the fiber loop ST connectors to the MXF-7500 multiplex fiber loop card. Typically, Tx A and Rx A on the loop card connect to Rx B and Tx B respectively on the first processor on the loop. Then, Tx B and Rx B on the loop card connect to Rx A and Tx A at the last processor on the loop (see Figure 23).
- Verify that the correct address is set on each processor. Refer to Figures 25 and 26 for address switch setting.
- As shown in Figure 21, connect the MX transformer to the MX-7000. Apply 24 VAC by plugging in the MX transformer. If available, connect the 24 VDC battery pack.
- Apply power to the field processors.

Bench testing the processor addresses

Senstar recommends bench testing each processor on its multiplex loop before field-installing the equipment:

- Connect a processor to its designated loop card and then apply power to the MX-7000 and the connected processor.
- Make sure there are MX display zones assigned for this loop processor's zones. See Section 7 for setting the loop, transponder type and number and zone number to MX display zones.
- If the processor and transponder card are operating properly, the MX display zones assigned to this processor will be secure (steady green), not in communication fail.
- If the zones are in communication fail, verify the address switch settings on the transponder card, and check the power supply voltage and your connections. If the problem still exists, swap the processor's transponder card with another transponder card that has the same switch settings. If the problem continues, replace the processor with another. If the problem still exists, and there is more than one loop card, try another loop card. If the problem remains, contact Senstar Customer Service for assistance.
- Simulate an alarm and a tamper condition on one or both zones to verify operation.
- Repeat the tests for each processor, and for each multiplex loop in the system.

Transponder address switch settings
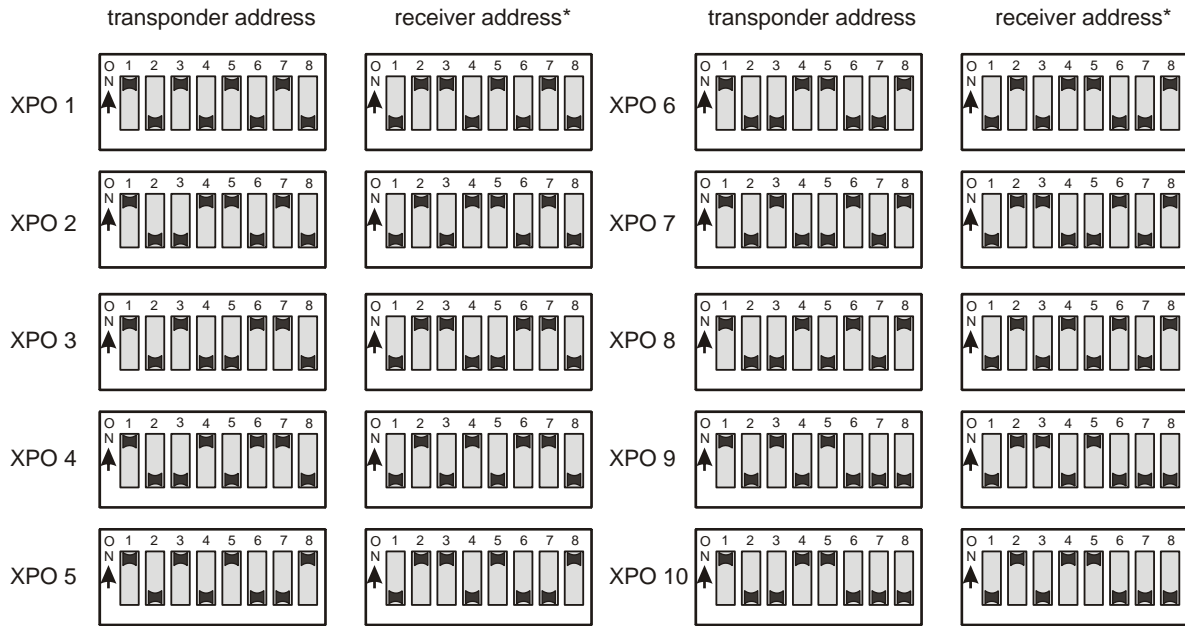
* Later revision transponders have only the transponder address switch. The receiver address is set automatically. Transponder addressing is the same on each copper loop (max. 10 transponders per loop).

Figure 25   Transponder address settings (copper wire loop)
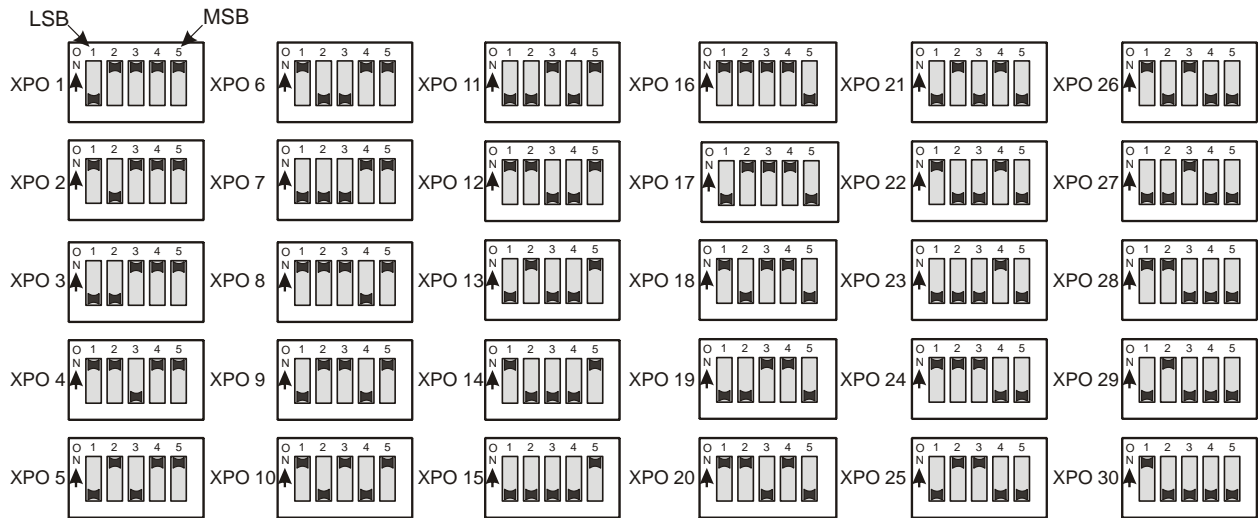
Transponder addressing is the same on each fiber optic loop (max. 30 transponders per loop).

Figure 26   Transponder Address Settings (fiber optic loop)

Section 7 MX-7000 Setup

A complete security system requires that the MX-7000 Multiplex Control Center be setup to work with the configuration of installed transponders and sensors. Since the layout and requirements of each facility are different, each installation requires some site-specific setup.

It is recommended that all initial setup, adjustments and testing be accomplished in your shop. Outdoor security systems are normally installed over large areas with fences and locked gates making access for adjustment and troubleshooting difficult and time consuming. Initial testing in your shop facilitates setup and adjustment since all equipment can be located in very close proximity.

The following initial setup and adjustment procedure assumes that the work is being accomplished in your shop. If initial setup and adjustment in the field is required, the procedure should be changed to match the field conditions.

> *NOTE: During these procedures, the words processor and transponder are often used to describe the field units. Processor describes the complete field-installed sensor device. The transponder is the addressable PCB inside the processor, which handles communications with the MX-7000.*

Initial procedures

- Check each unit for physical damage, and for loose parts and connectors.
- Remove the top cover of the MX-7000 by removing the two screws and sliding the cover toward the rear of the unit. Ensure that all modules, loop cards, audio and power cards are securely in place and that all connectors and wiring are in place.
- Remove the covers from the processors as applicable to your installation. Choose one processor that will be your primary test unit.
  NOTE: Refer to the manual of each type of processor for detailed instructions.
- Arrange enough workbench space for the MX-7000 and several of the processors side by side.
- For a copper wire loop, use the specified interconnect cable.
- For a fiber optic loop use approximately 10 feet of 18 AWG twisted-pair wire for power, and 10 foot fiber optic patch cables for data and audio connections.
- Make the MX-7000 power connections.

MX-7000 system setup

The MX-7000 setup functions control system operation and display. The MX-7000 contains a default configuration which can be used for most installations.

Initial power up

- Apply AC power to the MX-7000.
- Connect the backup battery (if used).

  NOTE: To power down the MX-7000, first disconnect the battery then the AC power.

Setting up the MX-7000

1. On the touchscreen, select Setup.
2. Enter the system password (default 0000) and then select Setup (Figure 27 illustrates the Setup screen).

Set clock	Get ARKS data
Zone configuration	System Settings
Set password access	
Port configuration	EDAPT Settings
Change all zones	
Diagnose comm fails	Acknowledge All
	Calibrate display
Save/Restore config	Load Software
Restart MX-7000	Return to control

Figure 27   Setup screen

Perform the initial MX-7000 system setup in this sequence:

1. Calibrate display.
2. Set system clock.
3. Change all zones (globally define certain settings for all zones).
4. Zone configuration (setup each zone at your site)
5. Port configuration (setup the three serial ports and the parallel printer port, as required).
6. System Settings (enable or disable operational settings for the MX-7000 system).
7. Save/Restore config (backup your configuration settings on a USB drive).

Calibrate display

Select Calibrate display and follow the onscreen prompts to calibrate the MX-7000 touchscreen.

Set clock

Select Set clock and then use the arrows to set the current date and time.

Change all zones

Change All Zones applies to all defined zones. You make the selections based on the most common type of processor and settings at the site, and the selections are applied to each zone. Changes to individual zones, are made later using the Zone Configuration function.

1. Select Change All Zones on the Setup screen.
2. Select Globally Change Zone Processor Type.
3. From the Processor list, select the type of processor which is the most common type at your site.
4. Select Globally Change Standard Relay Type. Standard relay setup uses one Alarm Relay Interface (ARI) relay per zone, zone 1 to relay 1, 2 to 2 etc. This function selects on what conditions that relay is driven.

5. From the relay drive type list, select:

   - **relay off:** the MX-7000 will not activate the standard relay in response to alarm conditions

   - **alarm only:** the MX-7000 will activate the standard relay in response to a sensor intrusion alarm condition

   - **alarm and tamper:** the MX-7000 will activate the standard relay in response to sensor alarm intrusion and tamper alarm conditions.

6. Select Globally Change Self Test. Self test enable or disable dictates to the MX whether it can perform a self test on the zone. This typically matches whether the zone is of a testable type.
   From the Change Self Test screen select yes or no for self test enabled.

7. Select Globally Change Zone Audio. Audio enable or disable dictates to the MX whether it can activate audio output of a zone, this typically matches whether the zone has audio available.
   From the Change Zone Audio screen select yes or no for Audio enabled.

8. Select Globally Change EDAPT Counts. EDAPT capable and enabled processors will use an EDAPT count setting not the processor DIP switch setting for event count.
   From the Change EDAPT Counts set the event count.

9. Select Globally Set Separate Tampers. EDAPT configured Rev D FPS processor main boards (and newer) can be set for combined or separate zone tamper alarm reporting. Previous revs provide only combined tampers.
   From the Set Separate Tampers screen select yes or no for separate tampers.

10. Select Globally Set Access Timeout. Accessed zones will re-secure after this time period.
    On the Set Access Timeout screen, enter the period of time in hours, minutes, seconds, 00:00:00 for disable access timeout.

Zone configuration

Select Zone configuration to setup and configure the individual zones at your site. Each zone will be configured identically as setup in Change All Zones.

1. Enter the total number of zones at the site (1 to 60). The total number of zones need only be entered once.
2. Select the MX Display Zone number.
3. If the type of processor is different from the one in the Change All Zones step, change the type of processor used for this zone. You may need to set the loop number to access different processor (XPO) types. To access Silver types, set the loop to 4 which signifies the USB interface.
4. Identify the mx loop (line module) on which the transponder is connected, 1 to 3. For Silver processors, use loop 4 which signifies the USB interface.
5. Identify the transponder's address (1 to 10 for copper loop, 1 to 30 for fiber loop and Silver loop).
6. Identify the transponder zone 1 or 2. For Silver devices FlexZone-4 and Senstar LM100 zones 1, 2, 3. or 4 and for UltraWave only zone 1.
7. If required, change the Standard Relay configuration for this zone.
8. If required, change the Audio enable setting for this zone. Silver Network devices do not have audio monitoring capability.
9. If required, change the Self-test enable setting for this zone.
10. If required, change the Access timeout setting for this zone.
11. If this zone will use zone associations, specify the period of time within which an alarm must occur on an associated zone to cause the MX-7000 to declare a high priority alarm. For zone associations, an alarm on a primary zone followed by an alarm on an associated zone within the time period results in a high priority alarm for both zones.
    Then specify one to three associated zones.

12. For EDAPT zones change the EDAPT count if desired and set separate tampers for processors so configured. Silver Network devices do not have EDAPT capability.
13. Select Next Zone and continue until all zones have been reviewed and configured, as required.

Port configuration

Use the Port configuration function to setup the MX-7000 serial ports and parallel printer port.

1. Select Port: and choose the port that you are configuring (COM1, COM2, COM3, LPT).
2. *Select Function: and specify the connected device (not used, host interface, weather, video switcher, printer).*

    NOTE: The Baud rate, Parity, Data bits and Stop bits are fixed for MX-7000 communications.

3. Status messages: Off-no status messages, On-status messages sent when state changes, or Automatic-a zone status message is sent every second.
4. Host Mode: Off-no host control, ON-host control only (no local operator control), Both-host and local operator control.
5. Select Next port and continue to setup the MX-7000 communication ports.

System Settings

The System Settings function allows you to specify general operating characteristics for the MX-7000.

1. Select ARKS fail alert (enabled or disabled).
2. Select Categories (enabled or disabled).
3. Select Auto acknowledge alarms (yes or no). Auto acknowledge and reset alarms when clear.
4. Select Auto rst tampers (yes or no). Auto reset tampers when clear.
5. Select Auto rst comfails (yes or no). Auto reset comm fails when clear.
6. Select Manu rst testfails (yes or no). Allow operator to manually reset test failures. Otherwise the test fail is only resettable by a successful re-test.
7. Auto reset delay: time in seconds after alarm before auto-ACK/RST is performed.
8. Select Test alarms to relays (yes or no). Test alarms activation of standard relays.
9. Set IP addr: Set the IP address of this MX-7000.
10. Set IP mask: Specify the subnet mask for the MX IP network.
11. Set IP gate: Specify the IP address for the gateway for the MX IP network.
12. Select Alert tone: (enabled or disabled).
13. Select Remote Map Interface (RMI): (enabled or disabled).

Other Setup functions

Set password access

The Set password access function allows the system administrator to specify up to five distinct levels of user access to MX-7000 system functions.

1. Beginning with Level 1, select Password:
2. Enter the old password, enter the new password, and then confirm the new password.
3. Select Access: and then specify the functions that this Level may access (touch the functions to include them for this access level). Select Done to return to the Set password access menu.
4. Select Next level and repeat the process for the next level of password access.
5. Continue this process until all required levels of password access have been specified.

Diagnose comm faults

Select Diagnose comm faults to troubleshoot network communication errors on the MX loops. A transponder display will be shown for the loop. Communications status is indicated by color: OK is light green, magenta indicates fail. Dark green indicates good comms to a device that has not been defined, or for a Silver loop device that is defined incorrectly. Light blue indicates fail to transponder which has not been assigned in the MX database. The fiber and Silver loop transponder display will additionally show both A and B comm path states.

Save/restore config

Use the Save/Restore config function to:

- Save configuration - backup the MX-7000 configuration settings to a USB storage device,
- Restore configuration - load a saved MX-7000 configuration from a USB storage device,
- Erase configuration - reset the MX-7000 configuration to its default settings,
- Print configuration – configuration settings will be sent to the printer to make a hardcopy
1. Select Save/restore configuration and follow the onscreen prompts.

Restart MX-7000

Use the Restart MX-7000 function to reboot the MX-7000. Rebooting the MX-7000 clears the temporary memory and provides a fresh start.

1. Select the Restart MX-7000 function and follow the onscreen prompts.
   NOTE: Pressing the reset switch on the rear panel also restarts the MX-7000 (see Figure 24).

Get ARKS data

This function allows you to save the MX-7000 Alarm Record Keeping System data to a USB storage device. The data can then be accessed and reviewed on a PC which runs the ARKS software.

1. Select Get ARKS data.
2. Use the arrows to specify the date range for the data being saved (Month and Year).
3. Follow the onscreen prompts to save the ARKS data to USB storage device.

EDAPT Settings

The MX-7000 Environmentally Derived Adaptive Processing Technique (EDAPT) enables the system to evaluate data from all EDAPT capable and enabled processors when making zone alarm decisions. With EDAPT the MX-7000 learns multi-zone environment patterns to discriminate between weather and environmental effects, which affect all zones, and a genuine intrusion, which affects a single zone. EDAPT settings are for advanced users such as factory technicians. Although listed here the EDAPT parameter definitions are beyond the scope of this manual.

EDAPT parameters, ranges and defaults:

1. Count History Period in seconds (1 to 30, 30).
2. Count Threshold Factor (1 to 60, 48).
3. Count Exceeded Zones Required (1 to 6, 3).
4. Correlations Clean Timeout in hours (1 to 60, 24).
5. Correlations Repeat Limit (1 to 30, 10).
6. Relations Expire Timeout in days (1 to 60, 60).

Acknowledge all

Use the Acknowledge all function to acknowledge all unacknowledged alarms at once.

1. Select Acknowledge all.
2. Select Yes.

Load Software

Use the Load Software function to load software packages to the MX-7000.
The current version of software will be displayed.

1. Select Load Software and follow the onscreen prompts.

Return to control

Select Return to control to exit the Setup screen and return to operator control and alarm processing mode.

Section 8 Network Connections

NOTE: This section uses the term MX to refer to both MX-7000 and DCU (Data Collection Unit) devices. The following instructions apply to both devices.

Connect the MX to a network bridge or switch port with an RJ-45 Ethernet cable to the RJ-45 jack on the MX-7000 back panel (see Figure 24). This can be direct to a PC if the PC Ethernet NIC is a bridge or by using a crossover cable. You can change the MX IP address to be on your LAN or use the default address.

If using the MX defaults: IP address 172.030.030.030, gateway 172.030.030.001, subnet 255.255.255.0, change the IP address of your PC by either step 1 or step 2.

1. If using a PC, go to network connections via the control panel. Right click on the Local Area Connection and select Properties. Click on TCP/IP settings and click on Properties. Select the Static option and enter the following IP address: 172.030.030.001. Click OK and close all windows.

2. If using a MAC, click on System Preferences and select Network. Click on Locations and select Edit Locations. Click on the + to add a location and name it MX-DCU. Click Done and then select the MX-DCU location. Select Ethernet on the left window and then click Configure IPv4 and select Manual. In the IP address window enter 172.030.030.001 and click apply. Close all open windows. This location will now be available any time for connection to the MX-DCU.

3. On your PC start your web browser and enter the MX IP address URL: http://172.030.030.030 (default).

4. If there is connectivity an MX log-in screen will be displayed (see Figure 28). Leave the name field blank and type four zeros (or the current password) in the password field and click OK.

5. The main page gives the options to upgrade s/w, retrieve ARKS, and configure the device. Note that the s/w upgrade function for releases prior to version 121 must be performed using the DCUFinder.jar java application.
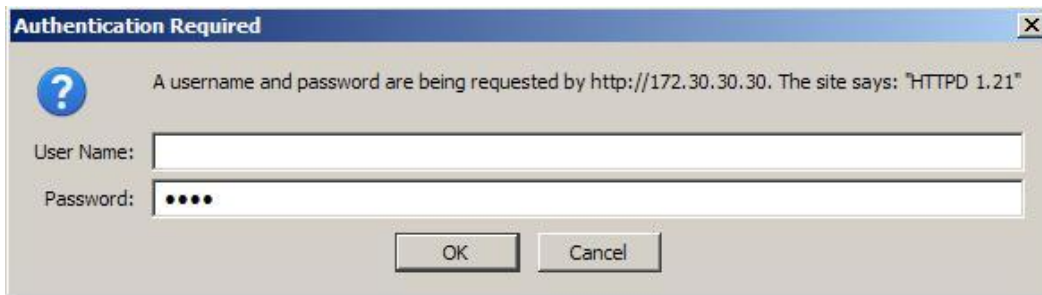

Figure 28   Web browser log in screen.

MX configuration using a Web browser over an IP connection

The device configuration web pages provide all setup functions for the MX. Refer to Section 6 for parameter information. For DCUs the web setup is the only setup interface available. The web page also provides the function to change a DCU into a supertransponder.

Additionally, the web setup provides advanced relay configuration. This feature overrides the standard relay setup and allows any relay to be driven by any or all of up to 15 user defined events. An event is any state of any display zone.

Software Upgrades over an IP connection using DCUFinder.jar

Software prior to version 121 must be upgraded using DCUFinder.jar java application. The process requires that the network PC has Java installed as well as the DCU Finder (Java application), and the MX upgrade package. You may want to copy these files to a separate folder on the computer. Depending on the package contents the o/s or application software can be upgraded.

1. Apply power to the MX and wait until it fully boots (status LED D17 is flashing).
2. Launch the DCUFinder.jar application on the PC.

   NOTE: If the PC opens a window to select a program to run DCUFinder then there is a problem with the Java software on the computer. Reinstall Java from the Internet.

3. From the DCUFinder application, click Find DCU.
   The MX will respond with its network address and its current software revision level. Record the address since it will be needed for web browser access. Record the version to track your upgrade information.

Upgrading the MX software

To upgrade the o/s or MX application software:

1. Select Upgrade DCU software from the DCUFinder application.
2. Select the upgrade file (e.g. mx_os_xxy, mx121_install.tar).
3. Select Open.
   This begins the upgrade process. The window will not be updated until the upgrade is completed. This can take up to five minutes.

   CAUTION: DO NOT INTERRUPT the process once it is started or factory service will be required.

4. When the message "Upgrade complete" is displayed (see Figure 29), restart the MX by pressing and releasing the reset switch.
5. After the MX restarts select Find DCU to verify the upgrade, the MX will respond with its address and version. Record this information to track your upgrade history.
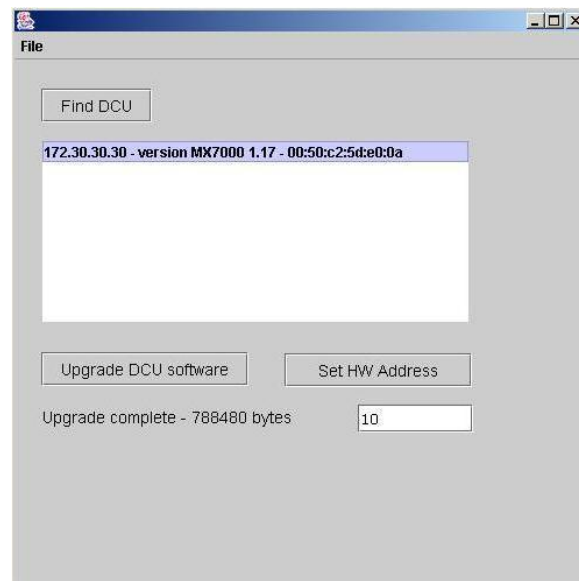

Figure 29   DCUFinder upgrade complete screen.

Software Upgrades over an IP connection using a web browser

Software versions 121 and later can be upgraded using the MX web page.

1. Apply power to the MX and wait until it fully boots (status LED D17 is flashing).
2. Connect to the MX via the web browser and login.
3. Select upgrade, select the upgrade file and send.
4. The tar file will be transferred, files extracted and loaded onto the MX.
5. After a short period, the success or failure of the upgrade will be displayed.
6. Restart the MX by pressing and releasing the reset switch.
7. Connect to the MX via the web browser and login. Verify that the upgrade version is displayed.

Section 9   Appendix A

Multiplex copper loop power distribution calculations

The MX-7000 can supply the power for its connected FPS2-2M processors. However, supplying the power to the distributed field units from a central location causes a voltage drop in the power cable due to the distances involved in a perimeter protection system. Although the system can compensate for the voltage drop over distances, voltage dropping resistors may be required at some processors on a long multiplex loop.

Each FPS2-2M field processor supply voltage must be 12-16 VDC. If the end of line processor supply is below 12 VDC, the MX-7000 copper loop card output voltage at TB1, pins 4, 5 (see Figure 22) can be increased by trimming R40 on the loop card. If the end of line processor voltage cannot be brought up to 12 V without exceeding 16 V at the first in line processor then voltage dropping resistors must be added. This section includes procedures to assist you in calculating the voltage drop, and for selecting appropriate voltage dropping resistors, if required.

The following calculations use engineering approximations to determine:

- resistor values to be installed at specific processors (one of three resistor values)

- the output voltage for the MX-7000 multiplex loop card

- the values of the calculated loop voltage at each processor

Rc = the resistance of the power cable between two processors

Dc = the distance between two processors in thousands of feet

Vc = the voltage drop between two processors

Ic = the current flow through a power cable segment ($Ic1$ is the farthest from the MX-7000, $Ic2$ is the second farthest; $Ic3$ is the third farthest, etc)
(30 mA is the typical current draw of an FPS2-2M processor)

Rc of 14 is the linear resistance factor used for calculations. This includes the source and return wire resistance based on 7 Ohms per 1000 ft. for 18 AWG wire.

$V1$ = the voltage at the transponder that is the farthest cable distance away from the MX-7000

$V2$ = the voltage at the second farthest transponder

$V3$ = the voltage at the third farthest transponder (etc.)

Rd is the voltage drop resistor installed at processors to limit the voltage to a value between 12 and 16 volts

The wire resistance (Rc) between two processors (XPO) depends upon the distance (Dc) between them (in thousands of feet) and the linear resistance of the power wires as follows:

For 18 AWG wire $Rc = (14) \times (Dc)$

For example, if the XPO locations are 2,000 feet apart, then $Rc = 14 \times 2$, therefore, $Rc = 28$ ohms.

Procedure

Assume that the voltage at the XPO which is the farthest cable distance away from the MX-7000, is at the minimum operating voltage of 12 VDC.

The voltage drop between the farthest cable distance XPO and next XPO (XPO2) is calculated using a current of 30 mA through the resistance of the cable (Rc). If there is 2,000 ft. (Dc1) of power wires between the two processors then:

Vc1 = 30 mA x 14 x Dc1

Vc1 = 0.03 x 14 x 2

Vc1 = 0.84 V

Therefore, the input voltage at XPO2 equals the voltage at XPO1 (12 V) + Vc1 (0.84 V) = 12.84 V

Shorter distances will result in a lower voltage drop. This process is repeated to calculate the voltage at each processor. Once known, the value of a voltage dropping resistor (Rd) connected between processor power input TB 1-5 and the field power wire can be determined that will reduce the processor input voltage to a value between 12 and 16 volts.

Selecting the voltage dropping resistor (Rd)

The value of the voltage dropping resistor (Rd) is determined as follows:

If the voltage at a processor is between 12 and 16 volts, no resistor is required.

If the voltage at a processor is between 16 and 18 volts, a 100 Ohm 1/4w resistor is required.

If the voltage at a processor is between 18 and 21 volts, a 200 Ohm 1/4w resistor is required.

If the voltage at a processor is between 21 and 24 volts, a 300 Ohm 1/2w resistor is required

Designing an MX-7000 power distribution network

The following example shows the power distribution of a typical maximum sector length system with 5 FPS processors (10 zones), spaced 2,000 cable feet apart. The MX-7000 is located 1,000 cable feet away from the closest processor.

The design for this system will establish the following:

1. The voltage at the power input to each processor (TB 1-5 + with respect to TB 1-6 -).
2. The value of the voltage dropping resistor (Rd) if required.
3. The voltage setting required at the output of the MX-7000 loop card.

The design routine is as follows:

1. Draw the equivalent resistance network (see Figure 30)
2. Set V1 = 12 volts
3. Calculate Vc1 (voltage drop between XPO 1 and XPO 2) with 30 mA (current flowing between XPO1 and XPO2) through 28 ohms (resistance of Cable #1 between XPO 1 and XPO 2)
   Vc1 = (I1) (Rc1) = (0.03) (28) = 0.84V
4. Calculate V2 (voltage at XPO2)
   V2 = V1+Vc1 = 12 + 0.84 = 12.84 V
5. Calculate lc2 (current through cable #2)
   lc2 = I1 + I2 = 0.03 + 0.03 = 60mA
6. Calculate Vc2 (voltage drop in cable #2)
   Vc2 = (lc2) (Rc2) = (0.06) (28) = 1.68V
7. Calculate V3 (voltage at XPO3)
   V3 = V2 + Vc2 = 12.84 + 1.68 = 14.52

8. Calculate lc3 (current through cable #3)
   lc3 = l1 + l2 + l3 = 0.03 + 0.03 + 0.03 = 90 mA

9. Calculate Vc3 (voltage drop in cable #3)
   Vc3 = (lc3) (Rc3) = (0.09) (28) = 2.52V

10. Calculate V4 (voltage at XPO4)
    V4 = V3 + Vc3 = 14.52 + 2.52 = 17.04V

11. Calculate lc4 (current through cable #4)
    lc4 = l1 + l2 + l3 + l4 = (4) (0.030) = 120 mA

12. Calculate Vc4 (voltage drop in cable #4)
    Vc4 = (lc4) (Rc4) = (0.12) (28) = 3.36V

13. Calculate V5 (voltage at XPO5)
    V5 = V4 + Vc4 = 17.04 + 3.36 = 20.4 V

14. Calculate lc5 (current through cable #5)
    lc5 = l1 + l2 + l3 + l4 + l5 = (5) (0.03) = 150 mA

15. Calculate Vc5 (voltage drop in cable #5)
    Vc5 = (lc5) (Rc5) = (0.15) (14) = 2.1V

16. Calculate the mx loop card output voltage from the MX-7000
    V = V5 + Vc = 20.4 + 2.1 = 22.5 V

17. According to the voltage drop resistor rules stated above: Rd1,Rd2,Rd3 are 0, Rd4=100, and Rd5=200.

    Note that if the voltage at a processor is near the maximum voltage value it is a good idea to install the next highest voltage dropping resistor value if the resulting XPO voltage remains above 12 VDC. In this way if an XPO fails open or is removed for service then the loss of the drop it caused will not result in raising the voltage of this processor above 16 VDC.
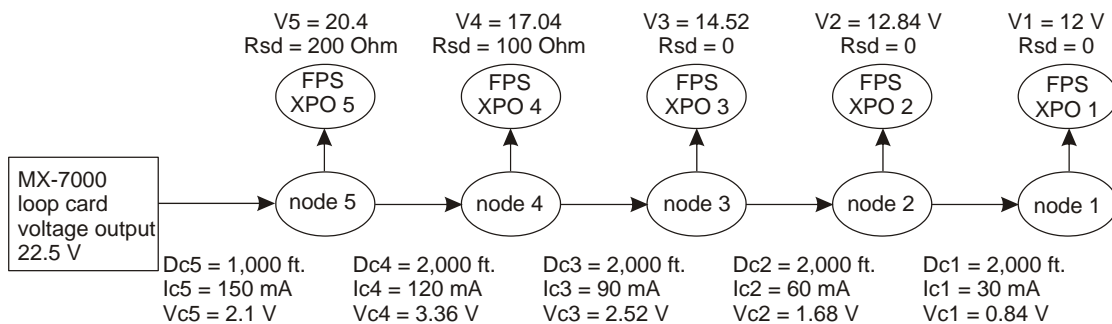

Figure 30   Power distribution plan