

UNCLASSIFIED

EL/M 2127

USER MANUAL

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1. GENERAL DESCRIPTION

1.1 SCOPE

This chapter provides general description of the ELM-2127 system and its main components.

1.2 INTRODUCTION

The Smart Miniature Detection Radar (ELM-2127) is small ground surveillance radar used for anti-intruder operations. It detects and tracks the intruder movements in and out of any fenced area (Figure 1-1 and Figure 1-2) or selected zone such as: borders (terrorism, drug smuggling etc.), army bases, power stations, prisons, mines, governmental buildings, nuclear facilities, airports, oil reservoirs.

The ELM-2127 is tailored to the customer site type, terrain constraints, environmental conditions, type of threats to guard from, nature of law enforcement roles and concept and many other parameters.

The ELM-2127 utilizes an advanced waveform with signal processing techniques for high resolution and high probability of target detection, coupled with low radiated power.

The ELM-2127 low power consumption, small volume, and full solid state design enables deployment in almost any area, terrain and weather conditions, while featuring high Mean Time between Failures (MTBF).

The ELM-2127 is comprised of an RF transceiver module, digital receiver and signal processor, antenna modules, and DC-DC converter.

Detected targets are displayed on a separate PC display. The radar display may be deployed at large distance from the system via LAN or wireless network.

The ELM-2127 power is supplied by an external 24 VDC power source, converted internally to the required power supply.

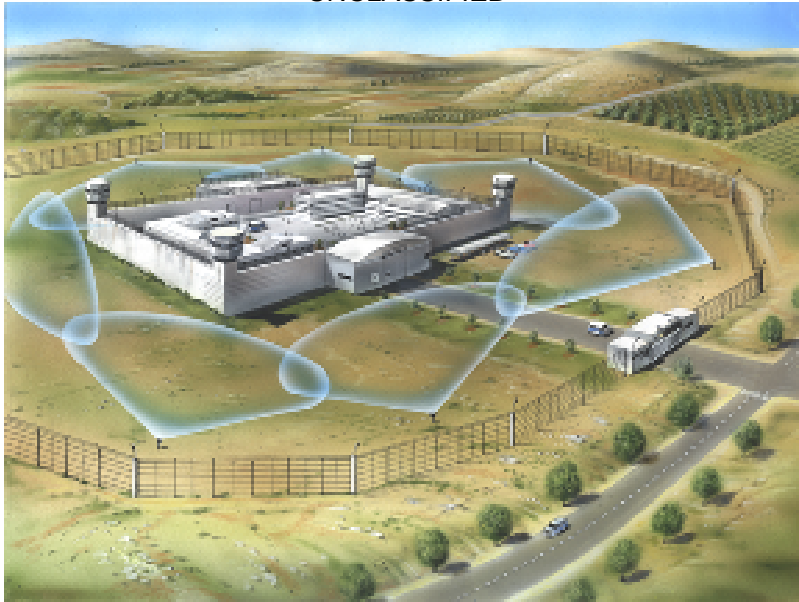


Figure 1-1. ELM-2127 Deployment - Internal Surveillance (Example)

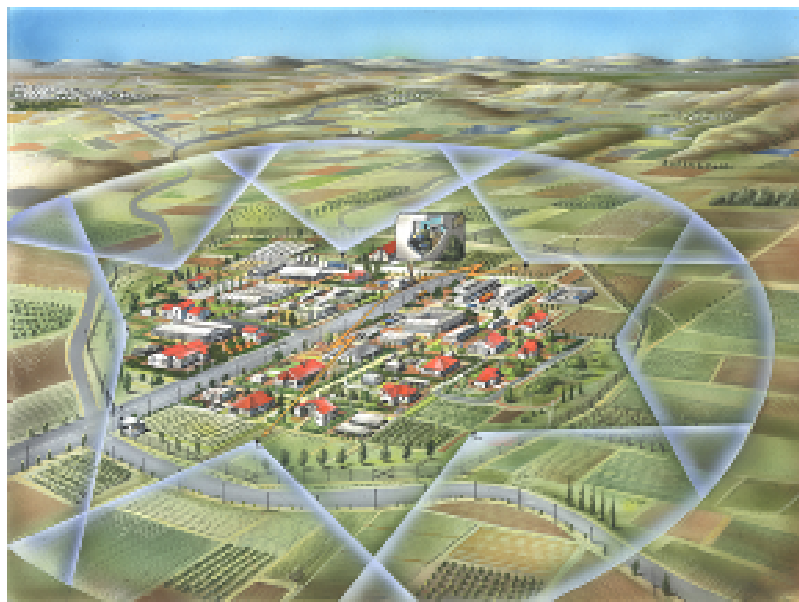


Figure 1-2. ELM-2127 Deployment - Perimeter Protection (Example)

1.3 ELM-2127 MAIN FEATURES

- High resolution pulse-Doppler radar operating in the upper X- frequency band.
- Consists of two printed-patch array mono-pulse antennas. No moving parts; target area is scanned using phased array techniques.
- The phased array antennas divide the coverage area into discrete, smaller sectors. Each antenna covers $\pm 30^\circ$ in azimuth providing overall coverage of 120° in azimuth and 10° in elevation.
- Low power dissipation.
- Provides automatic detection and tracking for the alert phase. The system alerts that a movement is detected and indicates the alert on a map.
- Built in a compact case that may be installed on any building, fence, or tower and is easily transportable (by light vehicle or carried by a single person).
- Enables operation as stand-alone by local operator in a fixed installation or portable.
- Enables integration with other systems via Ethernet or WLAN to a host system.
- Operates in bad weather conditions. ELM-2127 performs well under adverse weather conditions: rain, fog, high and low temperature extremes.
- Classifies the detected target. Classification is usually done without operator assistance.

1.4 SYSTEM ARCHITECTURE

The ELM-2127 system consists of the following subunits:

- Multiple ELM-2127 sensors - connected to operator computer (tactical center) or other systems using Ethernet.
- Operator indoor or outdoor post - based on PC or laptop computer with dedicated ELM-2127 application, providing ELM-2127 Human Machine Interface (HMI).
- Remote Command & Control (C&C) interface via Ethernet communication.

NOTE

In the current application, only one sensor is connected to each tactical center.

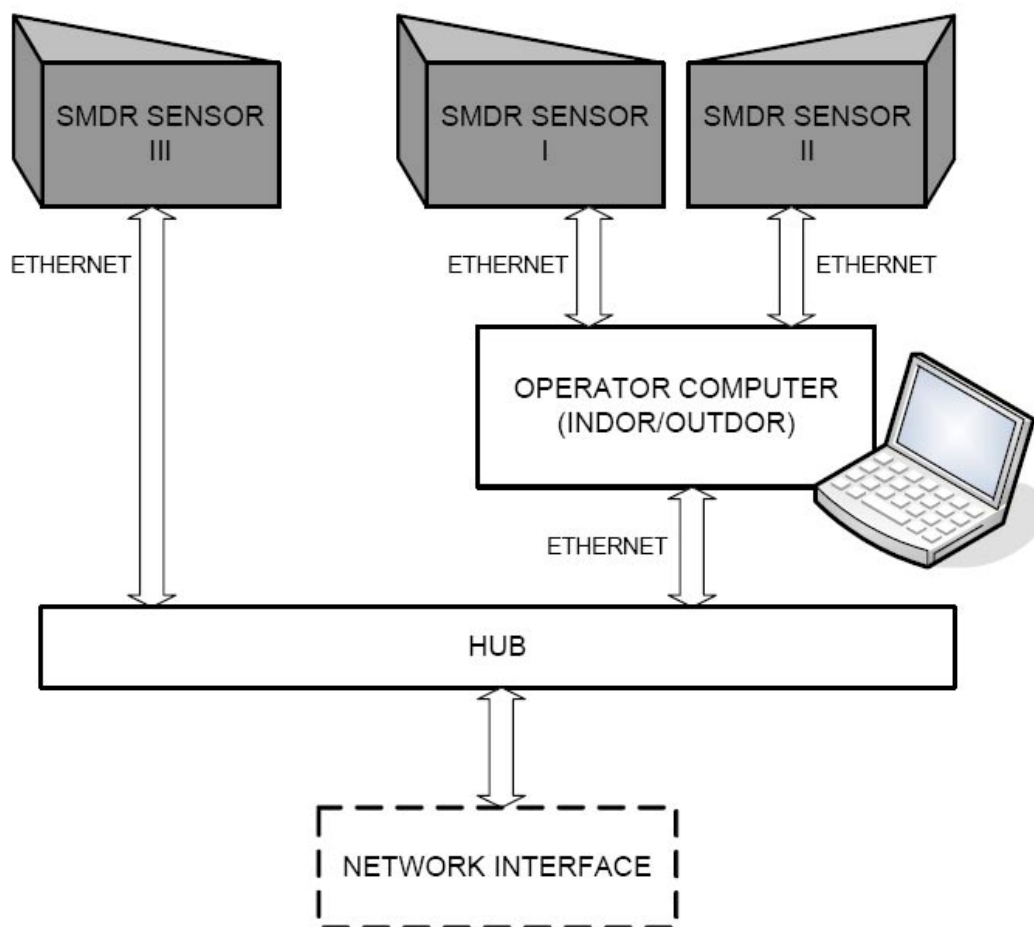


Figure 1-3. ELM-2127 System Architecture

1.4.1 ELM-2127 Sensor

The ELM-2127 is composed of one or more sensors (Figure 1-4), connected using Ethernet to operator post.

The ELM-2127 sensor consists of the following:

- A/D Timing (A1) module - includes two main sections:
 - Digital receiver - performs A/D conversion and digital reception.
 - Single Board Computer - performs signal processing, communication with the tactical center via Ethernet and sensor timing and control.
- Two Antenna modules (A3, A4) - perform RF signal transmission and reception using phased array technology. Each antenna provides sigma and delta channels for reception.
- RF Transceiver module (A2) - generates RF signal for transmission, and during reception, down converts RF signals to IF and sends them to A/D Timing module.
- Power conversion module - DC to DC converters, which converts 24 VDC input power to power supplies for sensor models.

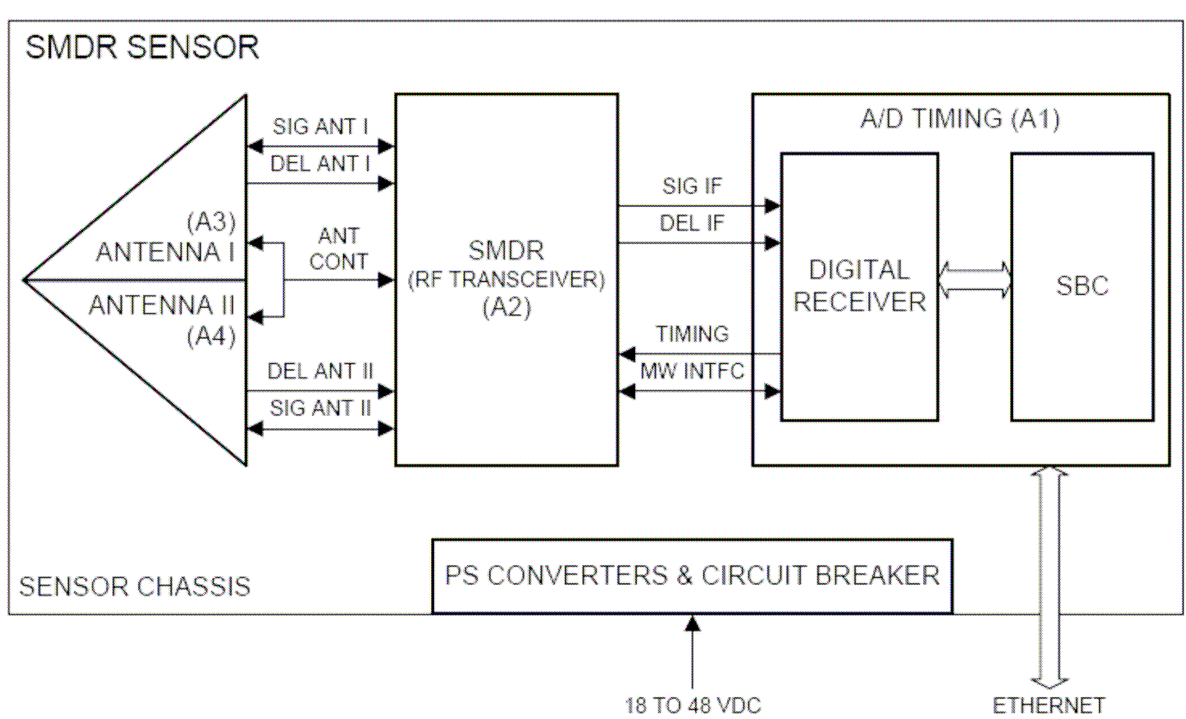


Figure 1-4. ELM-2127 Sensor Block Diagram

1.4.2 Tactical Center

The ELM-2127 application provides stand alone C&C Graphic User Interface (GUI) and tactical display.

NOTE

The tactical center PC is also named Control and Display Unit (CDU).

The C&C GUI provides the following functions:

- Communication with the sensor
- Sensor control
- HW status monitoring and display.

The tactical display provides the following functions:

- Background map (2D, 3D)
- Raster and vector layers and user sketches objects (icons, lines, polygons, texts)
- Scanning sector display
- Detections display, including plots, tracks, zones (alarm zones, ignoring zones, etc.)
- Data display, including clutter data, lines of sights, orientation global map.

1.4.3 Remote C&C

The ELM-2127 system can be controlled from distance via Ethernet communication.

The remote control supports control over several sensors, and radar networking.

NOTE

The current application is provided in stand alone configuration.

1.4.4 System Connections

The power is supplied to the system from a 24 VDC power source.

The tactical center is connected to the ELM-2127 sensor via Ethernet, using LAN cable.

1.5 ELM-2127 PHYSICAL DESCRIPTION

1.5.1 System Physical Description

The ELM-2127 system (Figure 1-5) comprises the following units:

- ELM-2127 sensor - installed on ELM-2127 tripod or stationary pole.
- Tactical center - based on standard PC or laptop, with ELM-2127 dedicated applications.
- Power and communications cable - provides 24 VDC power supply to ELM-2127 sensor and communication between the sensor and the tactical center, via Ethernet.
- Telescope - used for during operational deployment to set system azimuth relative to north.
- Tripod - used for system deployment.

NOTE

In case that ELM-2127 sensor is installed on a stationary pole, the tripod is not used.

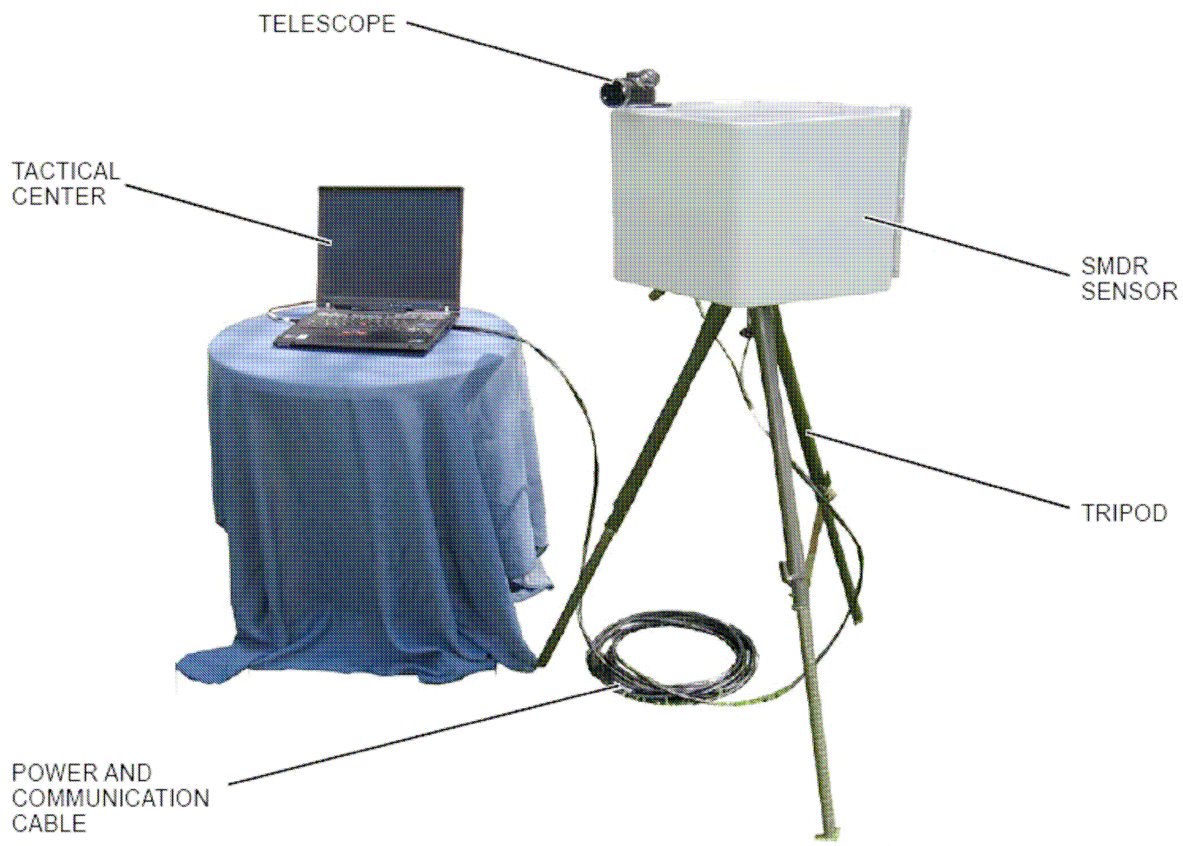


Figure 1-5. ELM-2127 General View

1.5.2 Sensor Physical Description

The ELM-2127 sensor (Figure 1-6) includes the radar transceiver, antennas and processing modules. The ELM-2127 sensor has a single motherboard, which hosts all modules.

NOTE

The ELM-2127 mechanical design has two configurations:

- 1018E170-001 - includes a single connector for power and communication.
- 1018E220-001 - includes two connectors: J1 - power and J2 - communication.



Figure 1-6. ELM-2127 Sensor Elements

Table 1-1 details ELM-2127 sensor elements.

Table 1-1. ELM-2127 Sensor Elements

| No. | Name | Function |
|------------|-------------------------------------|---|
| 1 | Tripod Mounting Thread | Single-mounting thread for installation on tripod |
| 2 | Pole Mounting Threads | Four-mounting threads for installation on pole (using a mounting adaptor) |
| 3 | Carrying Handle | Use to carry the ELM-2127 sensor. |
| 4 | ON/OFF | ELM-2127 sensor power on/off switch. |
| 5 | Connector (1018E170-001 only) | Provides ELM-2127 sensor power supply and communication. |
| 6 | Telescope Mounting | Used to mount the telescope during system deployment. |
| 7 | Top Cover | Provides access to RF Transceiver and A/D timing modules. |
| 8 | Front Cover | Provides access to the ELM-2127 antennas. |
| 9 | J2 Connector (1018E220-001 only) | Provides ELM-2127 sensor communication. |
| 10 | J1 Connector (1018E220-001 only) | Provides ELM-2127 sensor power supply. |

1.5.3 ELM-2127 Cable Physical Description

The ELM-2127 cable (Figure 1-7) connects the ELM-2127 sensor to power source and tactical center.

NOTE

The ELM-2127 cable has two configurations:

- 1018E051-001 (for 1018E170-001) - includes a single connector for power and communication.
- 1018E247-001 (for 1018E220-001) - includes two connectors, J1 - power and J2 - communication.

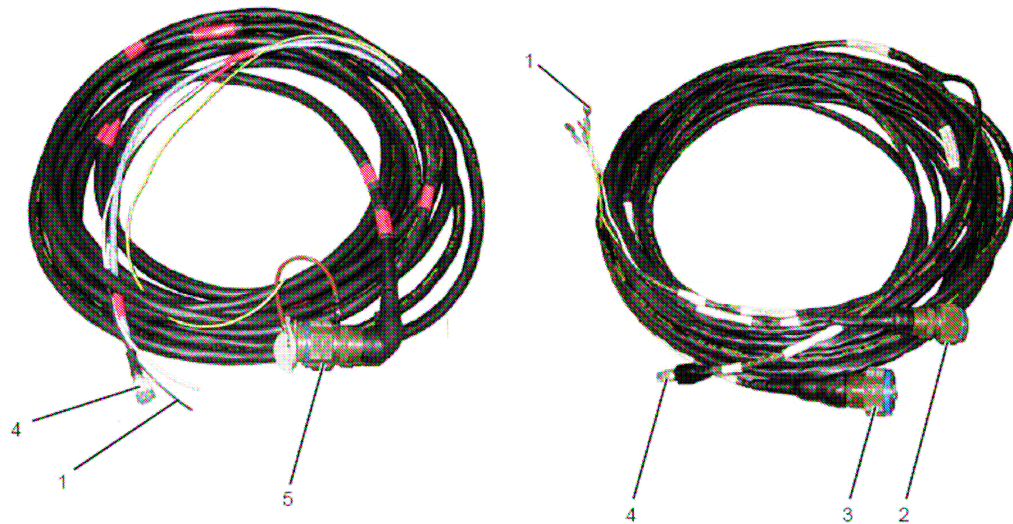


Figure 1-7. ELM-2127 Cable

Table 1-2 details ELM-2127 cables elements.

Table 1-2. ELM-2127 Sensor Cables

| No. | Name | Type | Function |
|-----|---------------------------|-----------------------|--|
| 1 | Power | Wires | Connecting wires for 24 VDC power source |
| 2 | P1 (1018E247-001 only) | Circular Connector | Provides ELM-2127 sensor power supply. |
| 3 | P2 (1018E247-001 only) | Circular Connector | Provides ELM-2127 sensor communication. |
| 4 | Ethernet | RJ45 | Ethernet connector to tactical center. |
| 5 | P1 (1018E051-001 only) | Circular Connector | Provides ELM-2127 sensor power supply and communication. |

1.5.4 ELM-2127 Tripod Physical Description

The ELM-2127 tripod (Figure 1-8) is used to mount the ELM-2127 sensor. The tripod is collapsible for transportation.

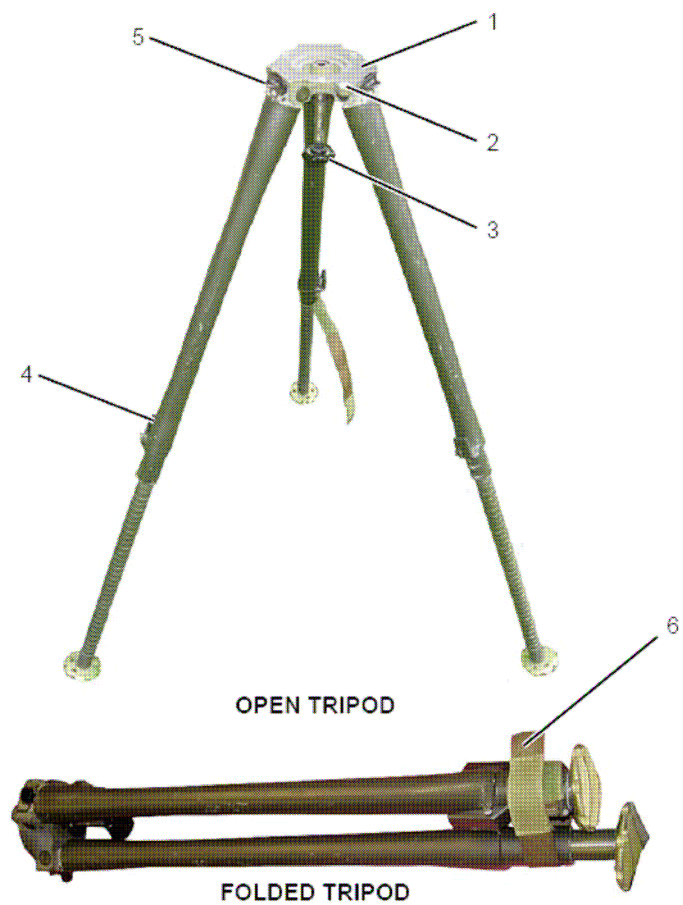


Figure 1-8. ELM-2127 Tripod

Table 1-3 details ELM-2127 tripod elements.

Table 1-3. ELM-2127 Tripod Elements

| No. | Name | Function |
|-----|------------------|---|
| 1 | Mounting Surface | Used to mount ELM-2127 sensor |
| 2 | Level | Used to level the tripod. |
| 3 | Securing Screw | Provides ELM-2127 sensor power supply. |
| 4 | Latches (3) | Three latches used to locks tripod legs, in open or collapsed position. |
| 5 | Top latches | Three latches use to maintain tripod legs in open position. |
| 6 | Securing strip | Use to secure the tripod when in collapsed position. |

1.6 ELM-2127 MAIN CHARACTERISTICS

Table 1-4. ELM-2127 Technical Characteristics

| Parameter | Characteristics |
|---------------------------|--|
| Frequency band | "X" 10.4 \pm 0.1 GHz |
| Transmitted peak power | 700 mW maximum |
| Transmitted average power | 70 mW maximum |
| Azimuth coverage | 120° |
| Azimuth beam width | 15° |
| Azimuth side lobes | <ul style="list-style-type: none"> 1st: -20 dB Average: -35 dB |
| Azimuth accuracy | 1.5° |
| Elevation beam width | 10° |
| Antenna gain | 23.5 \pm 0.5 dB |
| Digital signal processing | <ul style="list-style-type: none"> Digital matched filter LFM pulse compression FFT (Doppler), IFFT (range), CFAR, Monopulse Azimuth TWS |
| External Communication | Ethernet 10/100 BaseT |
| Input power | 24 VDC nominal |
| Power consumption | 60W |
| MTBF | 5,000 h calculated |

Table 1-5. ELM-2127 Physical Characteristics

| Parameter | Characteristics |
|-------------------------------|--|
| Weight | ~16KG |
| Dimensions | L=50, D=32, H=30 cm |
| Operation ambient temperature | -30 to +45 °C |
| Storage temperature | -40 to +85 °C |
| Rain | The equipment is sealed and designed to operate in rainy conditions. |
| Humidity | 88% relative humidity. |

CHAPTER 2

DEPLOYMENT

2.1 SCOPE

This chapter details ELM-2127 system preparation for use, including deployment and installation.

2.2 SENSOR LOCATION SELECTION

- NOTE: This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The ELM-2127 sensor is located at a point from which there is a free line of sight from the radar to the entire transmission area around the radar. Verify ELM-2127 sensor is positioned as far as possible from fixed or mobile radio emitting equipment such as communication sets of any type or other radars.

The ELM-2127 sensor should not be deployed near high power electrical cables. Verify that no high power electrical cables are located within 30 m around the sensor or 10 m above the sensor.

Operator post can be located at a remote location or close to the ELM-2127 sensor.



ELM-2127 sensor emits electromagnetic radiation. Verify no personnel are located within the danger area of **1m** from the front sector of the sensor and **0.5m** from the rear sector of the sensor (Figure 2-1). To comply with FCC RF exposure requirements, this radar must be installed to provide a separation distance of at least **2 meters** from all persons. See FCC ID and Warning Label on the top access cover of the radar.

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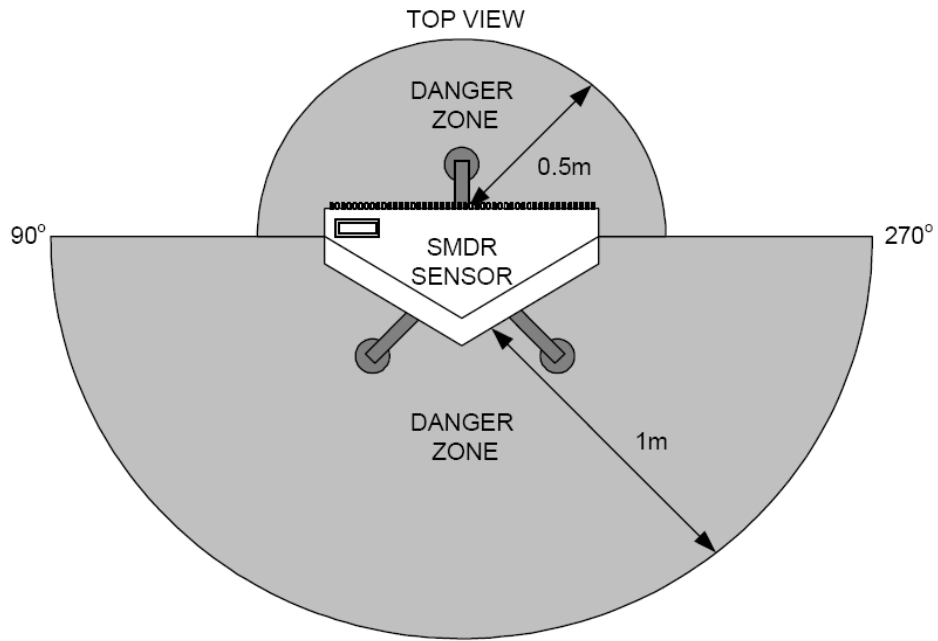


Figure 2-1. ELM-2127 Sensor RF Radiation Danger Area



Changes or modifications to this equipment not expressly approved by ELTA Systems, Ltd. could void the user's authority to operate the equipment.

2.3 ELM-2127 DEPLOYMENT

2.3.1 Unpacking ELM-2127 Sensor

To unpack ELM-2127 sensor, proceed as follows:

CAUTION

ELM-2127 sensor radome is sensitive to mechanical damage. While moving the ELM-2127 sensor, verify radome does not come in contact with sharp or abrasive objects. Do not rest the ELM-2127 sensor with the radome facing down, on the radome corners or edges. Failure to comply may cause damage to ELM-2127 sensor radome.

- 1) Verify ELM-2127 storage box [1] is intact and without any visible damage.
- 2) Release ELM-2127 storage box locking strips [2] and open the box.
- 3) Using ELM-2127 sensor carrying handles, carefully remove ELM-2127 sensor (3) from the storage box.
- 4) Visually inspect ELM-2127 sensor and verify its exterior is intact and clear of dust or dirt. If required, clean it using soft dry cloth.

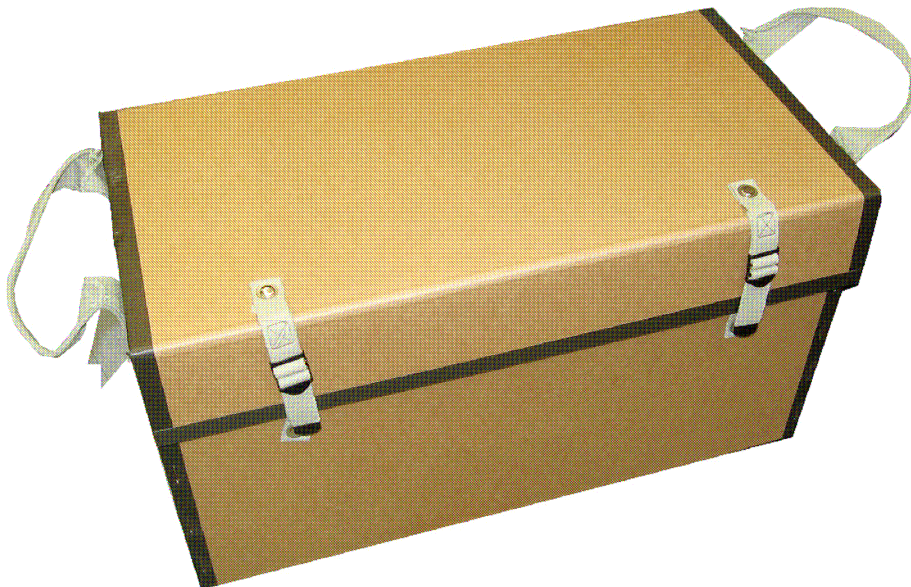




Figure 2-2. ELM-2127 Sensor Unpacking

2.3.2 ELM-2127 Installation on Tripod

To install ELM-2127 sensor on the tripod, proceed as follows (Figure 2-3):

- 1) Open tripod securing strip [1] and spread tripod legs. Verify leg top latches [2] are locked.
- 2) Release tripod legs latches [3] and adjust tripod legs [4] height.
- 3) Position the tripod and level it by adjusting legs height. Verify tripod level bubble [5] is positioned at the center of the circle in the leveling window.

CAUTION

Verify three leg latches are properly locked before installing ELM-2127 sensor. Failure to comply may cause damage to ELM-2127 sensor.

- 4) Mount ELM-2127 sensor [6] on the tripod so that three protrusions [7] on the sensor mounting surface fit into three depressions [8] on the tripod.
- 5) Using securing screw [9], secure ELM-2127 sensor to tripod.

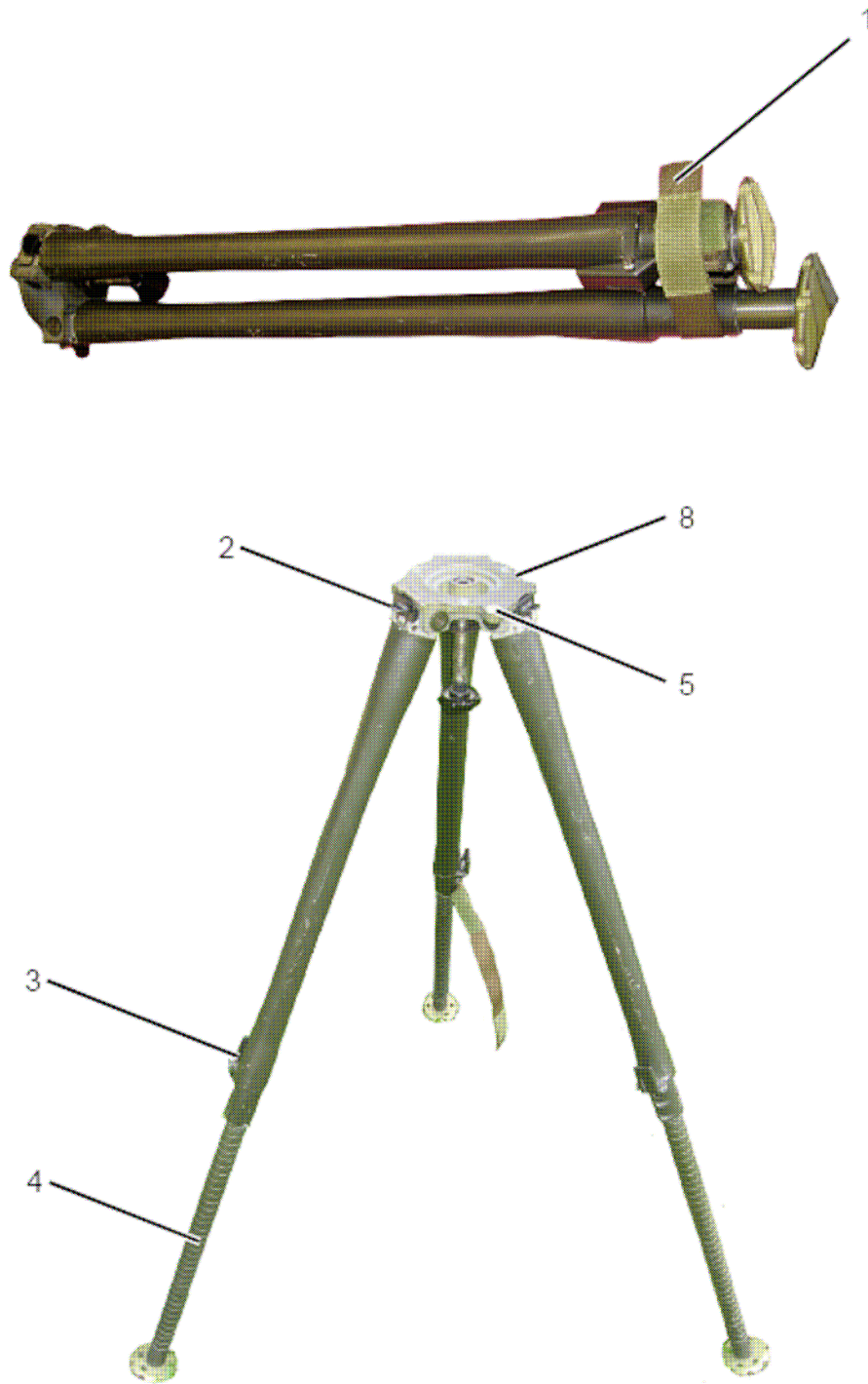


Figure 2-3. ELM-2127 Sensor Installation on Tripod (1 of 2)

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Figure 2-3. ELM-2127 Sensor Installation on Tripod (2 of 2)

2.3.3 ELM-2127 Installation on Pole

To install ELM-2127 sensor on the pole, proceed as follows:

- 1) Verify pole mounting jig is installed on the pole, and adjust its height and azimuth.

| |
|----------------|
| CAUTION |
|----------------|

Pole mounting jigs should be design to support ELM-2127 sensor weight and to prevent vibration in azimuth and elevation.

- 2) Mount ELM-2127 sensor on the pole mounting jig, and secure it using four screws.

2.3.4 ELM-2127 Sensor Northing

To align ELM-2127 sensor to required azimuth, proceed as follows (Figure 2-4):

- 1) Install telescope [1] on ELM-2127 sensor telescope base [2] and secure it using securing screw [3].
- 2) Remove lens protective covers.
- 3) Aim the telescope an object in the horizon, whose azimuth is known.

CAUTION

Use the carrying handles to move the ELM-2127 sensor or to adjust its direction. Do not apply any force on the telescope or radome. Failure to comply may cause damage to ELM-2127 sensor or telescope.

- 4) Record the ELM-2127 sensor azimuth for further use.



Figure 2-4. Aligning ELM-2127 Sensor Azimuth

2.3.5 ELM-2127 Connecting to Tactical Center and Power

To connect ELM-2127 sensor to the tactical center and power, proceed as follows (Figure 2-5):

NOTE

- 1018E220-001 - includes two connectors:
J1 - power and J2 - communication (using 1018E247-001 cable).

The following description refers to 1018E220-001 configurations.

- 1) Connect cable power connector P1 to ELM-2127 sensor J1 [1].
- 2) Connect cable communication connector P2 to ELM-2127 sensor J2 [2].
- 3) Connect cable Ethernet connector (RJ45) to tactical center Ethernet connector.
- 4) Connect cable power wires to 24 VDC power source.

CAUTION

Verify 24 VDC power source output is stable without interruption or power drops. Failure to comply may cause damage to the ELM-2127 sensor.



Figure 2-5. Connecting ELM-2127 Sensor to Tactical Center and Power