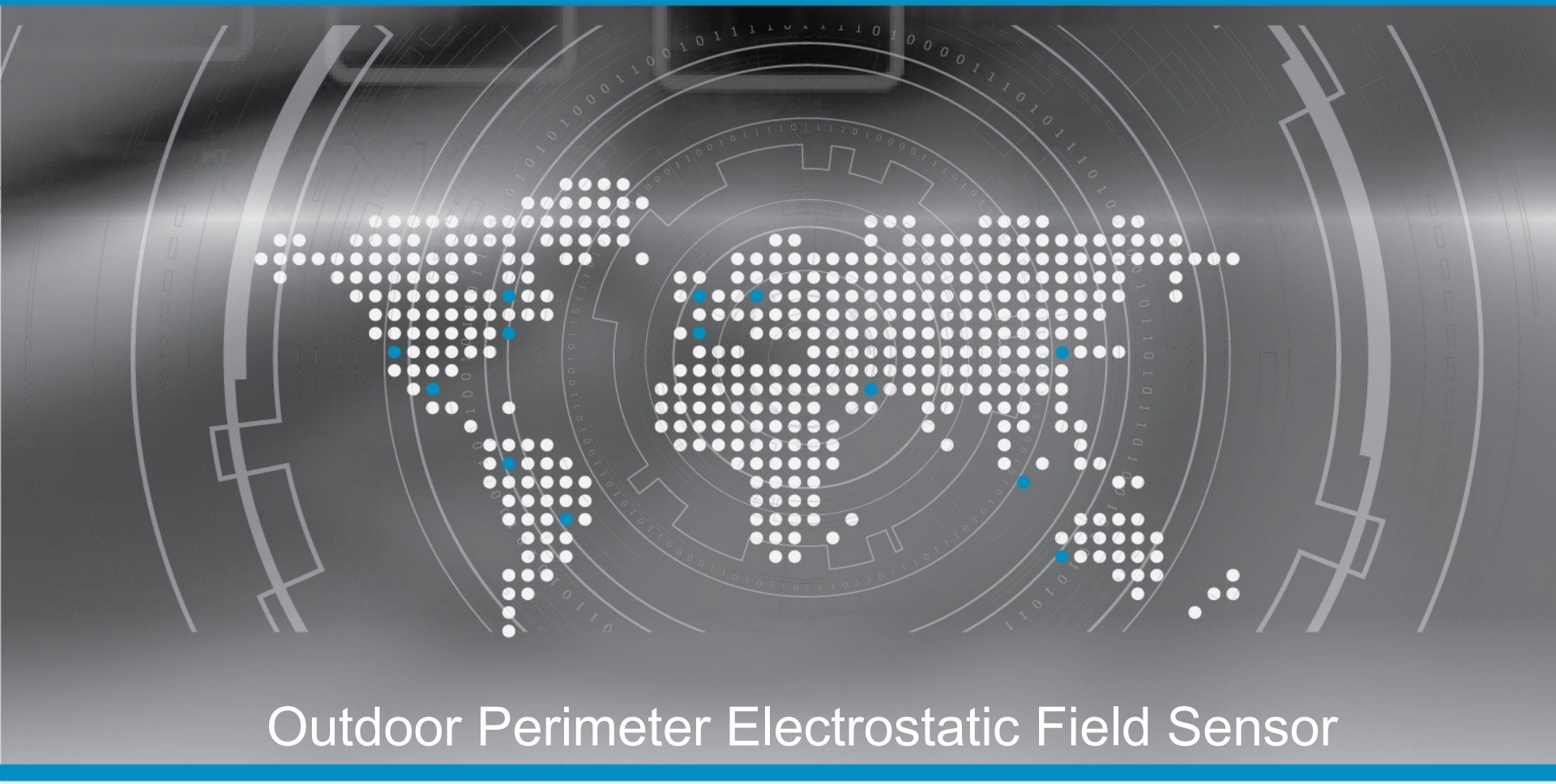
XField®



Outdoor Perimeter Electrostatic Field Sensor

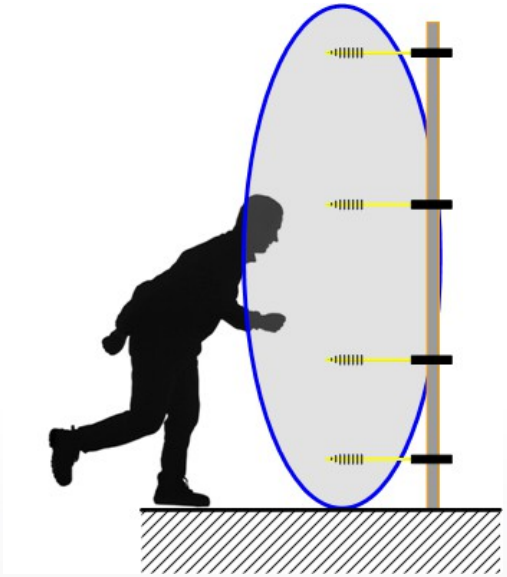
SENSTAR

March 2012

XField

Electrostatic sensor basics

- High, narrow field pattern
  - Up to 2.44 m (8 ft.) high and 1 m (3.3 ft.) wide for a 4-wire system
  - Up to 3 m (9.8 ft.) for a 5-wire configuration
- Well contained volumetric detection area
- Terrain-following
- Detects intruders that pass through and disturb the field
- Xfield is Senstar's 3rd generation of electrostatic sensor



XField

Deployment configurations

- Free standing
  - Detection wires are mounted away from free-standing posts, creating a standalone detection structure

XField

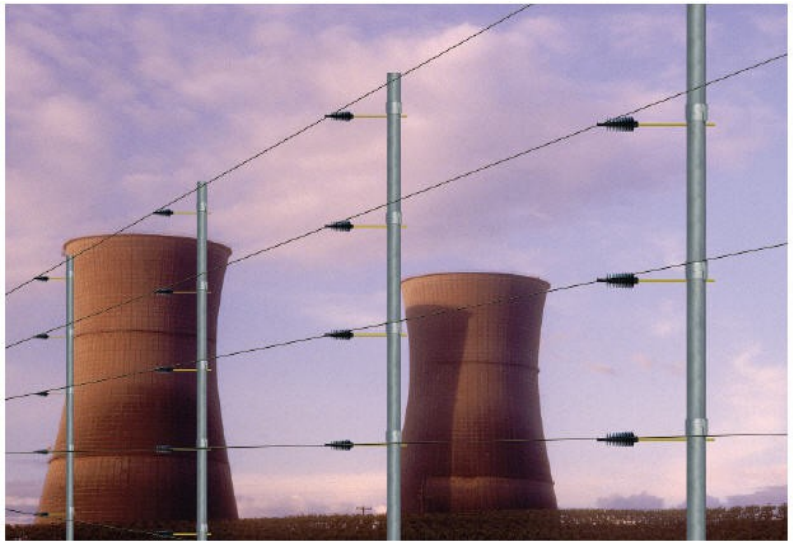
Deployment configurations (con't)

- Fence-mounted
  - Detection wire are mounted away from fence posts, creating a barrier / detector

XField

Applications

- Government regulated security specifications (i.e., Nuclear Power and Research)
- High, volumetric detection pattern required by specifications



XField

Applications (con't)

- Industrial complexes
  - Limited space available
- Wall and building edge applications
  - Where aesthetics are NOT a factor

XField

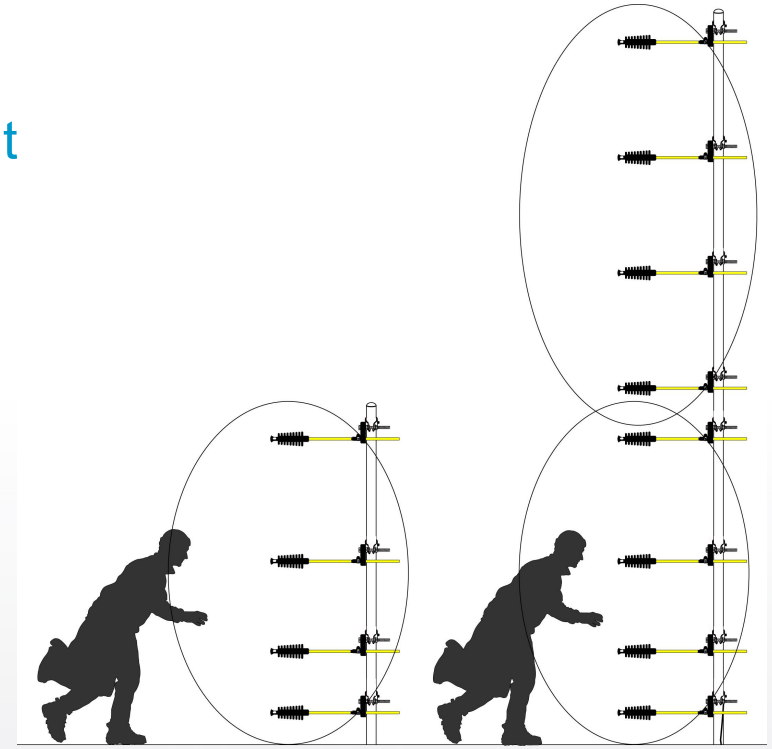
Applications (con't)

- Whenever volumetric detection is needed in a space restricted area

XField

4-wire, 5-wire & 8-wire deployment

- A second 4-wire system can increase field height to 5.65 m (18.5 ft.)



XField

Simplified explanation

- XField detects changes in capacitance
  - For given frequency and capacitor dimensions, the resulting signal depends on the material between the plates (the dielectric material)
  - Place different dielectric material between the capacitor plates and the signal level changes
  - Problem – how to make the capacitor large enough to fit a human body between the plates!

XField

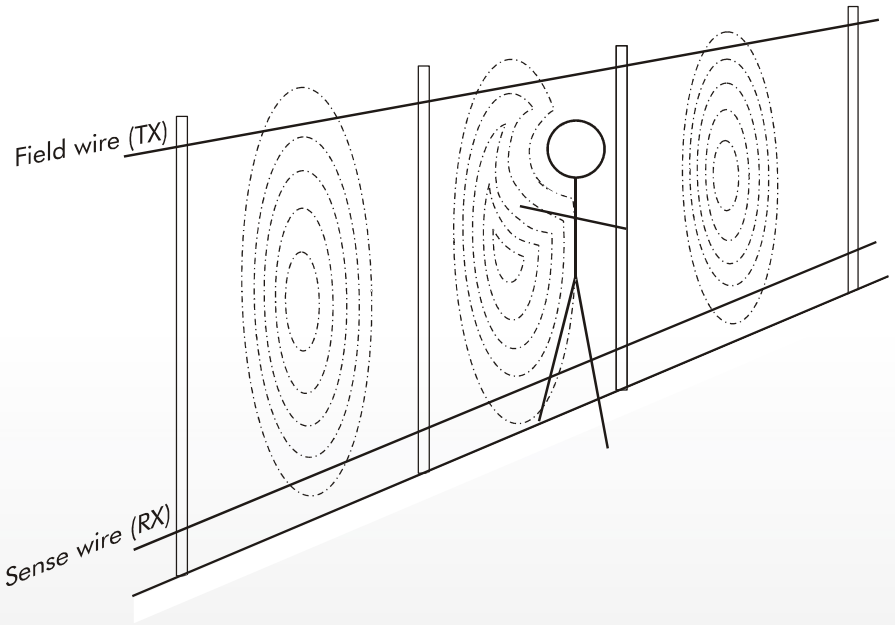
Simplified explanation (con't)

- XField detects changes in capacitance
  - To detect people, we stretch the capacitor's plates out using long lengths of steel wire
  - To human body moving between the wires displaces the air and creates a small change in the dielectric constant and hence in the capacitance
  - The result – a small measurable change in the resulting voltage as measured back at the processor, whenever a human target passes the wires

XField

Simplified explanation (con't)

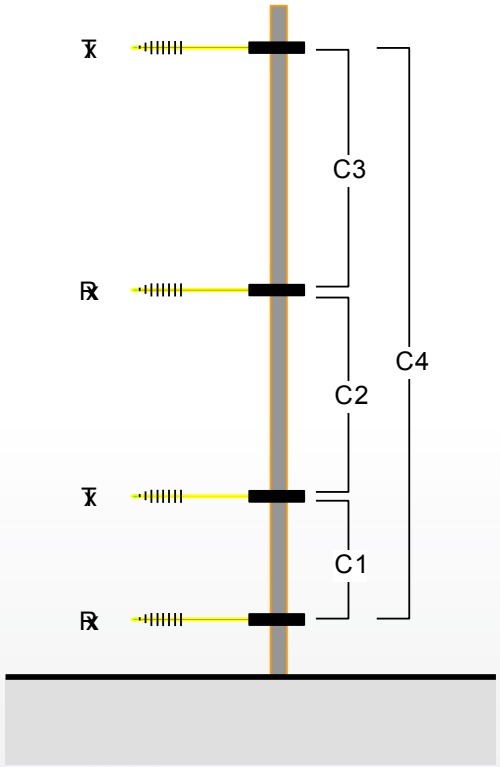
- A human intruder changing the capacitance coupling between a field wire and a sense wire



XField

Multi-wire processing

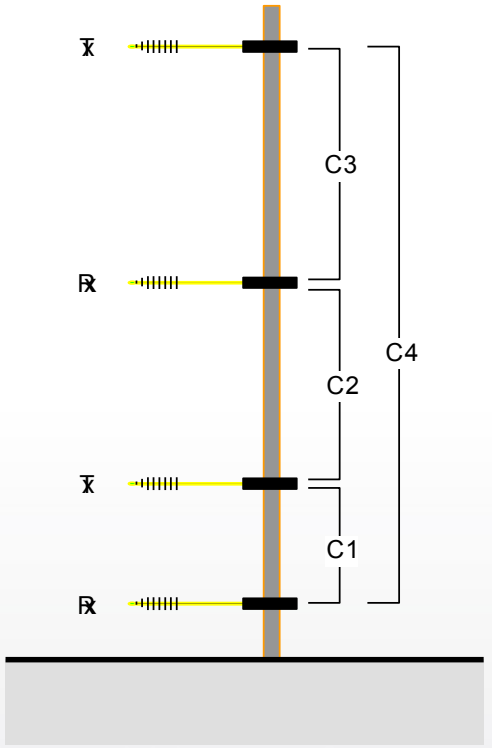
- Moving objects between the wires changes the capacitive coupling between Tx and Rx wires
- Advanced processing allows for 4 capacitance values to be measured simultaneously and used in determining an intrusion



XField

Multi-wire processing (con't)

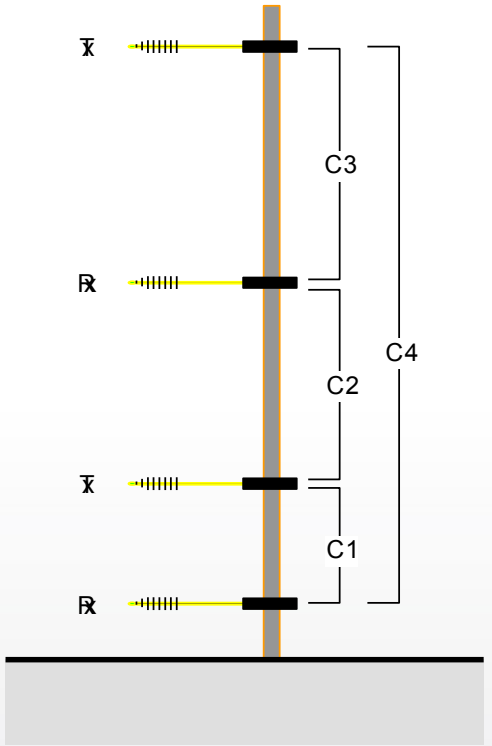
- XField looks at each of the 4 capacitance values to determine movement using:
  - Amplitude change (mass of intruder)
  - Rate of change (movement of intruder)
  - Duration of disturbance (time the intruder is in the field)



XField

Detection signal measurements

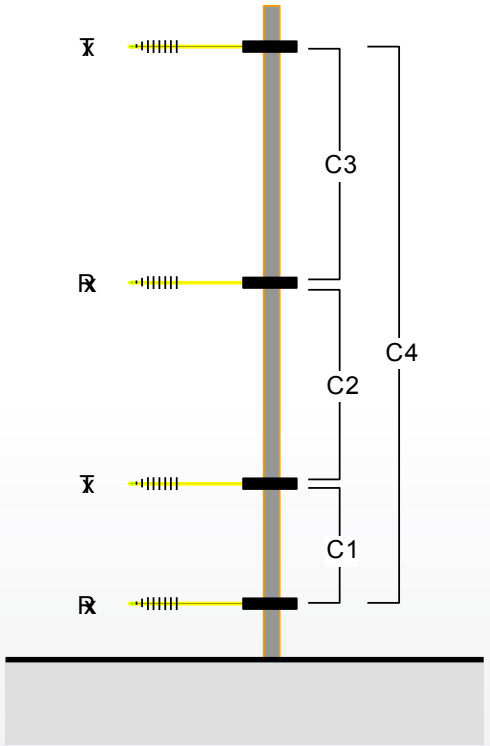
- The 4 capacitance values are continuously sampled to see if the measurements are within a detection window indicating a valid intrusion
- 4 separate sets of measurement windows exist; 1 for each intrusion profile



XField

Detection signal measurements (con't)

- 4 separate sets of measurement windows exist; 1 for each intrusion profile
  - Profile 1 – crawl under
  - Profile 2 – crouch through
  - Profile 3 – walk through
  - Profile 4 – bridge through
- An alarm is created if there is a match in 1 or more detection profiles



XField

Sensor wire supervision

- A method is needed to detect tampering or accidental cutting of the wires
- A resistor is added at the end between the Tx and Rx wires to provide a constant “resistive coupled” signal, which can be easily distinguished from the signal resulting from the capacitive coupling
- Broken (open circuit), or shorted sensor wires are reported as “Supervision” alarms

XField

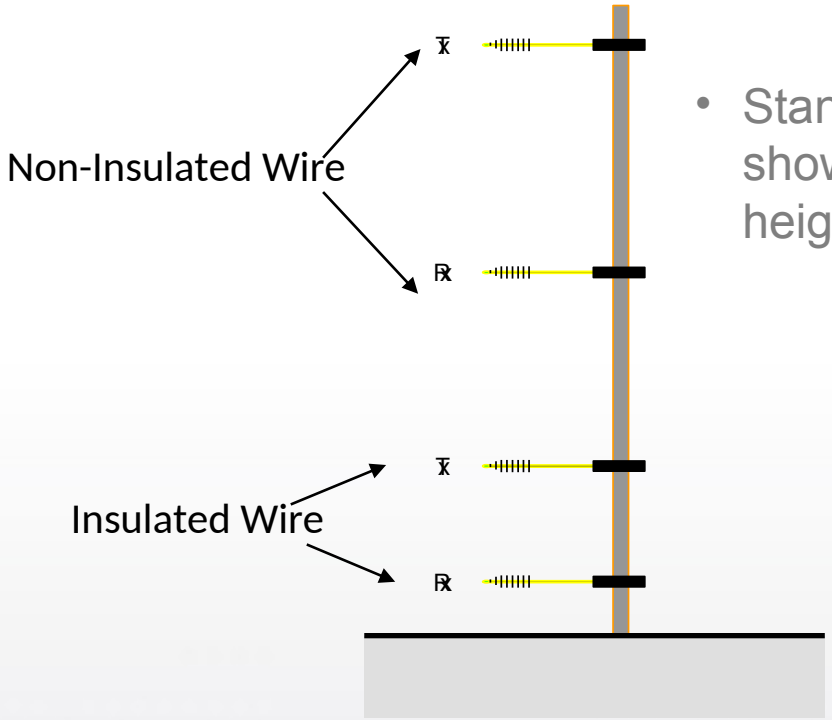
Fence vs free-standing height (standard deployment)

XField free-standing four-wire separations	
Wire	**From Ground**
Top field wire	200 cm (6.6 ft.)
Upper sense wire	120 cm (3.9 ft.)
Lower field wire	60 cm (2.0 ft.)
Bottom sense wire	20 cm (0.7 ft.)

XField fence-mounted four-wire separations	
Wire	**From Ground**
Top field wire	245 cm (8.0 ft.)
Upper sense wire	145 cm (4.8 ft.)
Lower field wire	70 cm (2.3 ft.)
Bottom sense wire	20 cm (0.7 ft.)

XField

Fence vs free-standing height (standard deployment)



- Standard deployments shown are maximum height values

XField

8-wire spacing (standard deployment)

XField free-standing eight-wire separations	
Wire	**From Ground**
Top field wire B	460 cm (15.1 ft.)
Upper sense wire B	380 cm (12.5 ft.)
Lower field wire B	300 cm (9.8 ft.)
Bottom sense wire B	220 cm (7.2 ft.)
Top field wire A	200 cm (6.6 ft.)
Upper sense wire A	120 cm (3.9 ft.)
Lower field wire A	60 cm (2.0 ft.)
Bottom sense wire A	20 cm (0.7 ft.)

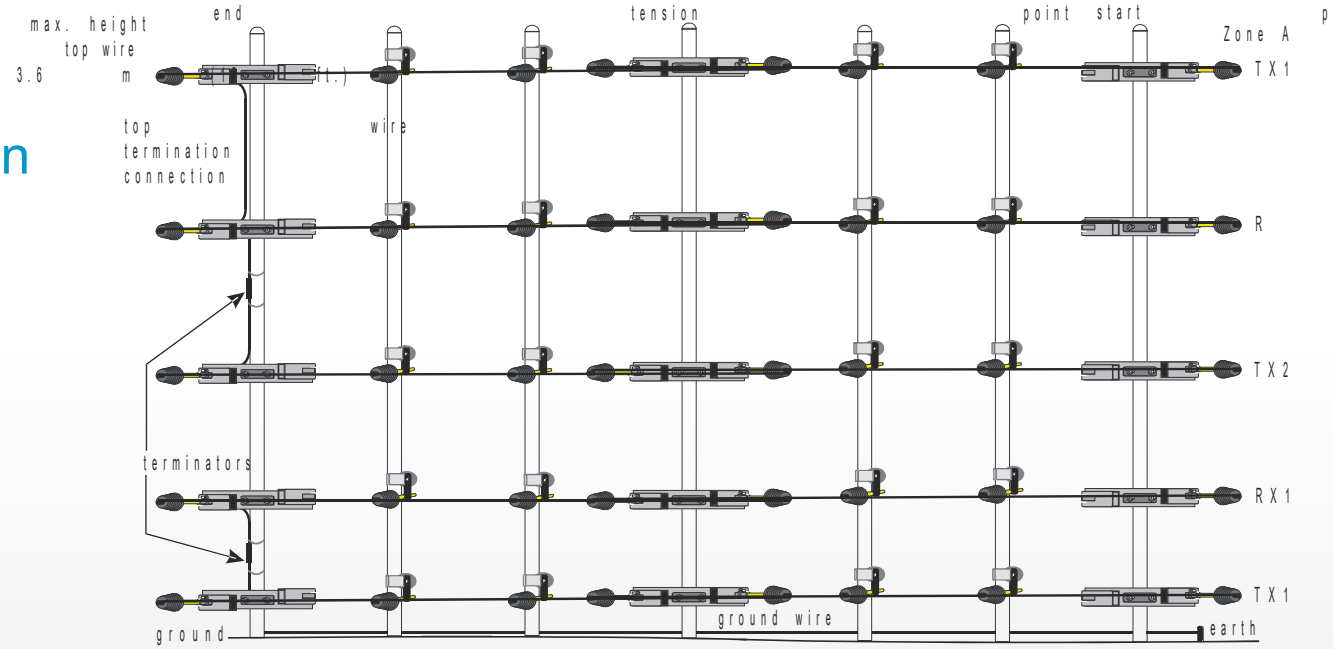
XField

8-wire spacing (standard deployment)

- The 2 lower wires are insulated, all others are non-insulated

XField

5-wire configuration



XField

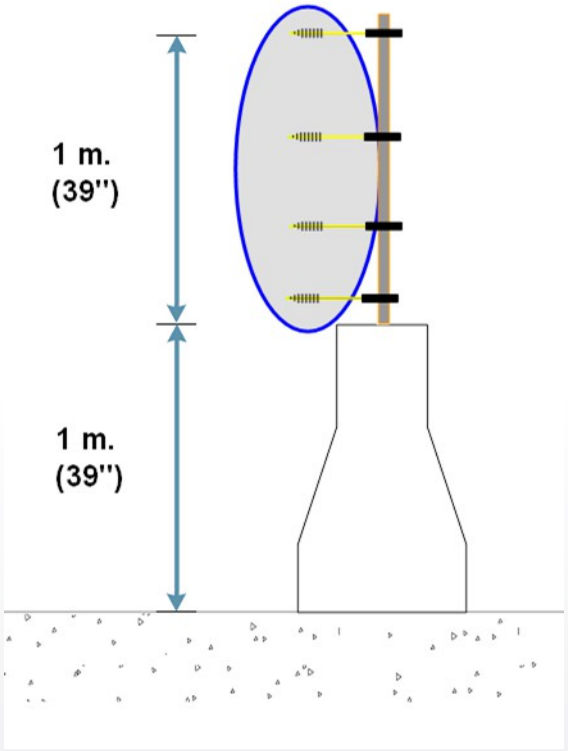
Free-standing minimum height

- Roof-top or barrier applications
- An Excel calculator is available for other heights

Xfield free-standing four-wire separations	
Wire	**From Ground**
Top field wire	100 cm (39.5 in.)
Upper sense wire	64 cm (25.5 in.)
Lower field wire	38 cm (15 in.)
Bottom sense wire	20 cm (8 in.)

XField

Free-standing minimum height (con’t)



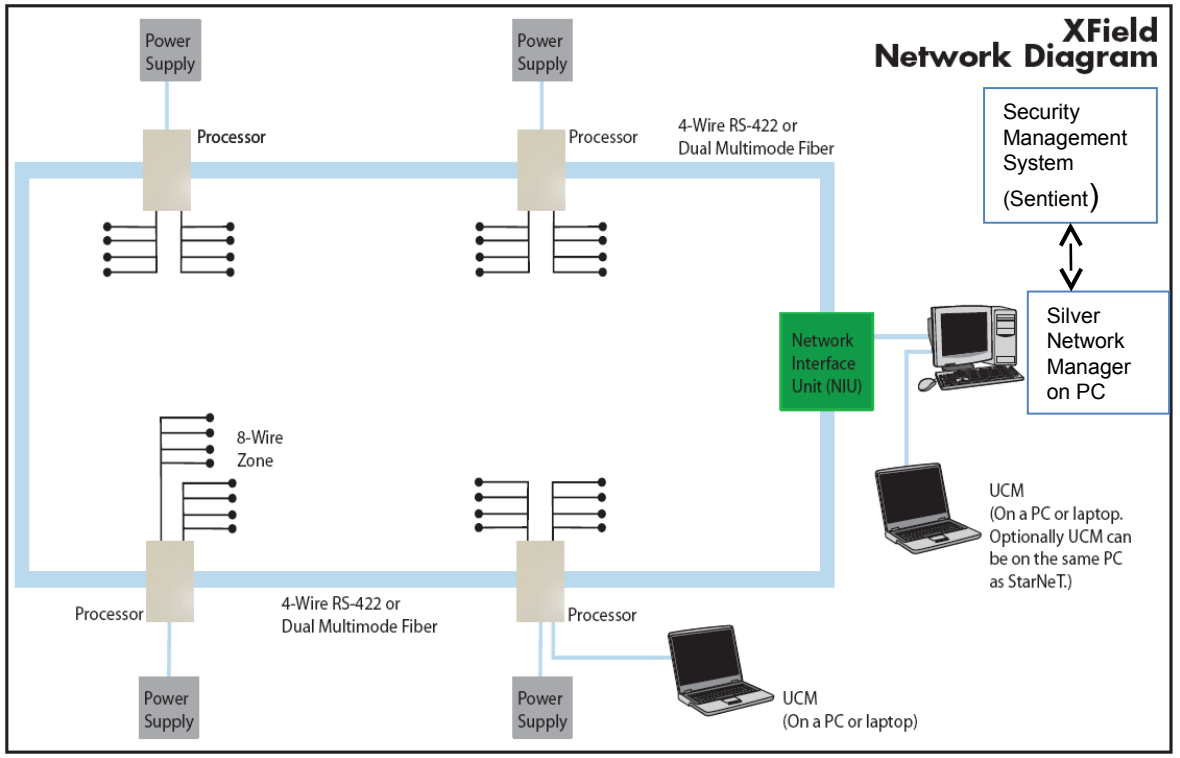
XField

- Specified Pd performance is based on passing completely through the wires

Specifications	
Minimum detection mass	35 kg (77 lbs.)
Maximum non-detection mass	10 kg (22 lbs.), provided there is no contact with any wire
Maximum zone length	150 m (500 ft.) two zones per processor
Minimum detection velocity	Adjustable down to 5.0 cm / sec (2 in. / sec)
Maximum detection velocity	Up to 8 m / sec (26 ft. / sec)
Maximum field width from the plane of the wires	Adjustable up to 0.5 m (19 in.)

XField

Network



XField

Hardware

- Totally new insulator hardware
  - Common insulator assembly for the entire perimeter
  - Self-cleaning insulators free of insects
  - Simplified wire tensioning procedure
  - More rugged mechanical design
- New 316 stainless steel sensor wire
- New simplified spacing at the start and at the end of the zone
  - Simple resistor terminator
  - Factory assembled lead-in cable 8 m (26 ft.) long

XField

Hardware (con't)

- New simplified connection to the processor
  - The isolation transformer (sense filter) has been eliminated
  - Simple Phoenix terminals on the processor card for power and data
  - BNC coaxial connectors for the field and sense wires
- All inputs and outputs have lightning protection
- All aluminum enclosure

XField

Electronics

- New more powerful Digital Signal Processor (DSP) uses a single Field Programmable Gate Array (FPGA) and high speed Analog to Digital Converter (ADC) technology
  - Direct-to-digital front-end
  - Part of a whole new family of perimeter security products
  - More stable performance over the long term

XField

Electronics (con't)

- New full independent monitoring of each sense wire
  - Minimizes environmental effects
  - Distinguishes between faulty insulators and intruders
- New lower field voltage and frequency
  - Four operating frequencies (8000, 8320, 8640 and 8960) notch filters at both 50 Hz and 60 Hz to reject power line pickup
- New local and remote maintenance using the UCM software

XField

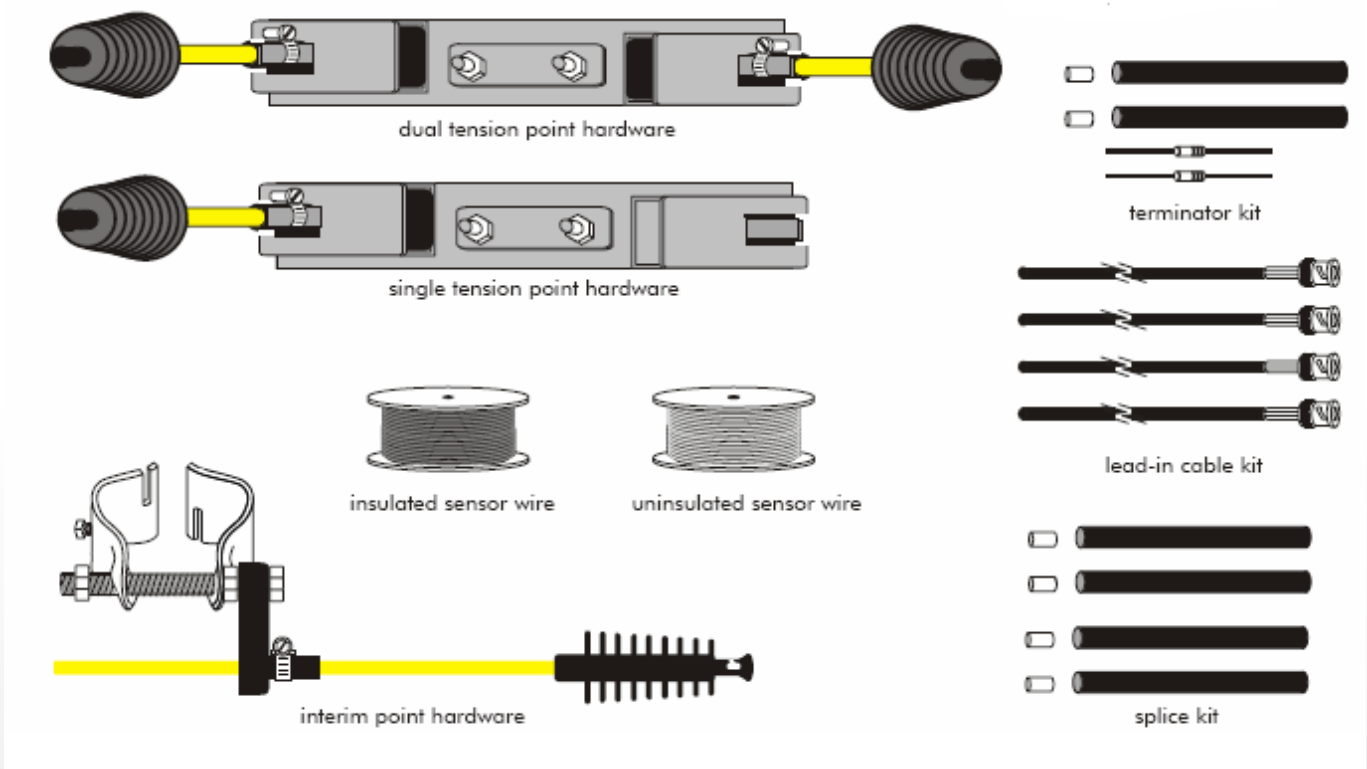
Insulator improvements

Old method

New method

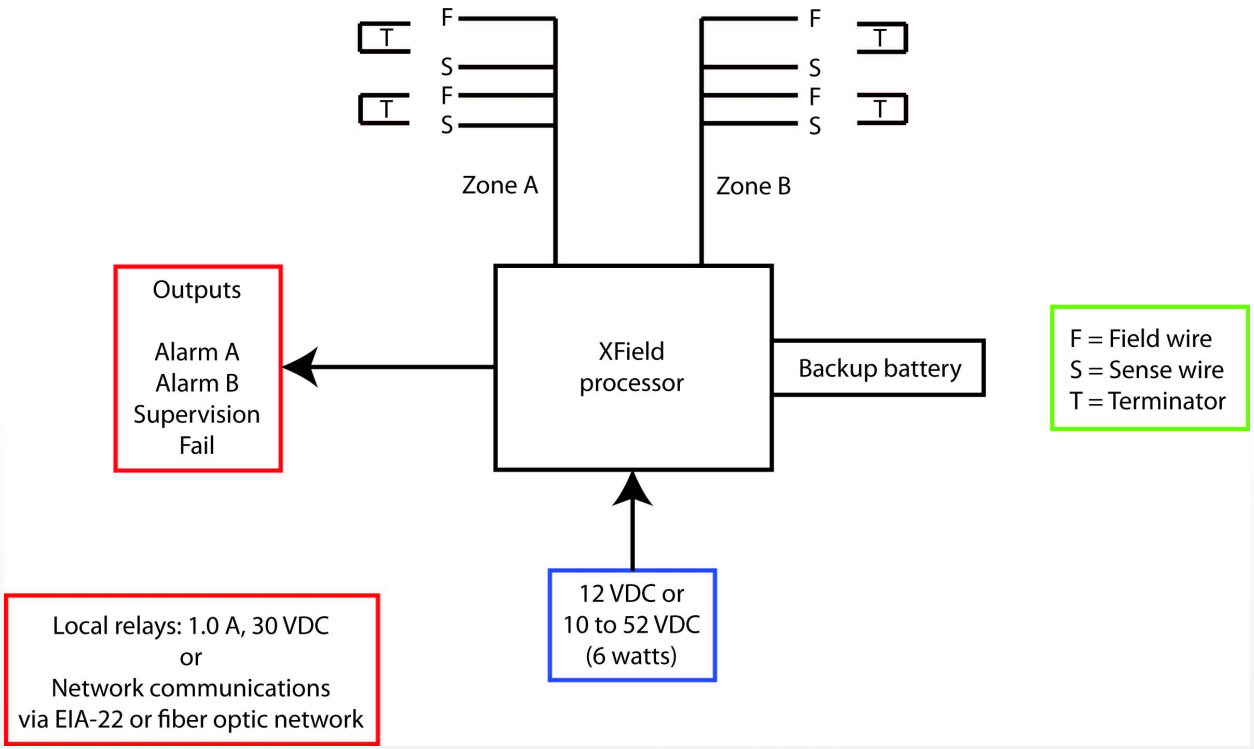
XField

"Wet-end" parts



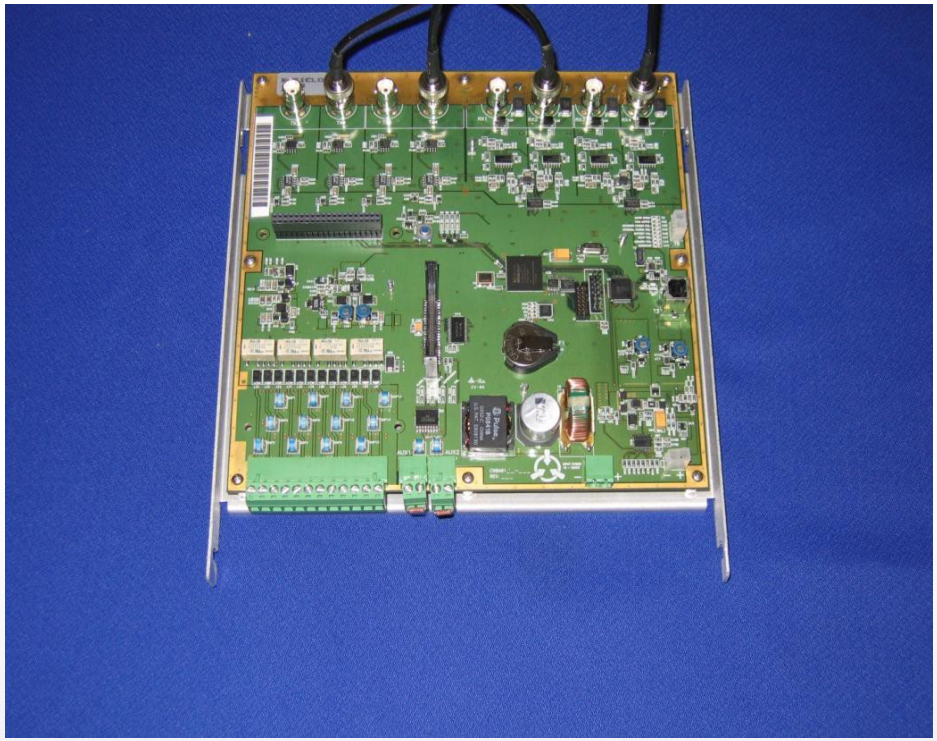
XField

Block diagram



XField

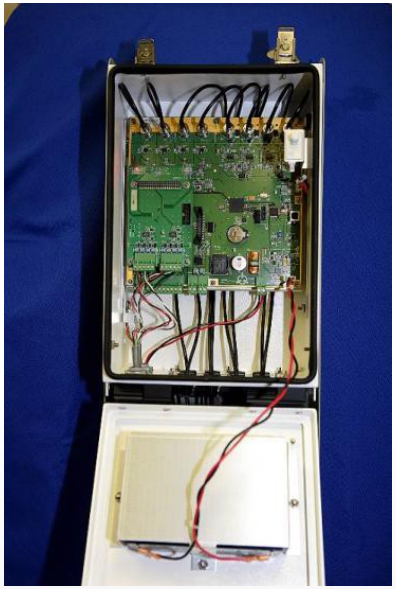
Processor



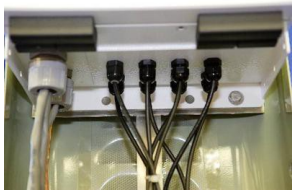
XField

Processor (con't)

- The enclosure is rated to NEMA 4 and does not need any further weather protection
- Will fit into a new wider Telecom enclosure:
  - To increase covertness
  - To provide additional heat shielding and weather protection



With cover opened

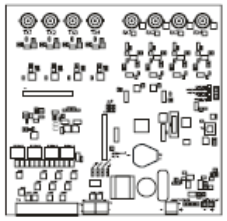


Detail of the cable feed-through on the bottom of the enclosure

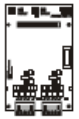
XField

Processor parts

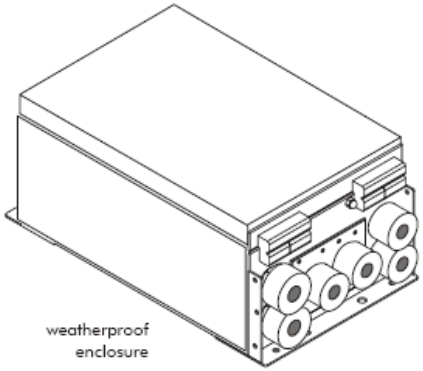
- Each processor has all 4 operating frequencies available



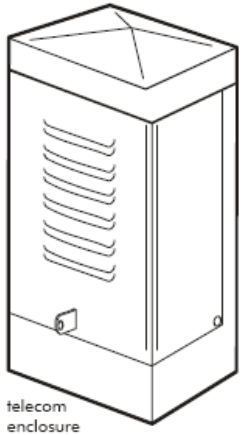
XField processor



network interface card (EIA-422)



weatherproof enclosure



telecom enclosure

Frequency	Operating Frequency
frequency 1	8.000 kHz
frequency 2	8.320 kHz
frequency 3	8.640 kHz
frequency 4	8.960 kHz

XField

Alarm outputs

- Relay outputs are Form C, rated at 30 VDC, 1.0 A maximum, non-inductive load
- There are 4 output relays per processor:
  - 2 alarm relays (one per zone)
  - 1 supervision relay
  - 1 fail relay

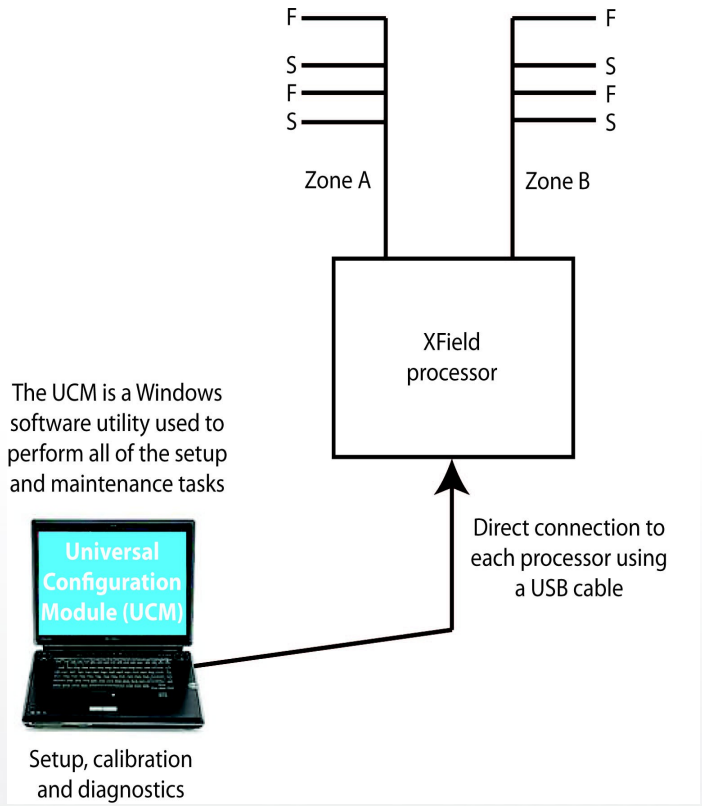
XField

Alarm outputs (con't)

- Alternatively, the processor can be configured for networking over the Senstar Silver Network
  - All alarms are reported over the network
  - All parameters can be set and adjusted for each processor from the UCM connected to the processor, or via the Network Manager
  - An option card (EIA-422 or fiber optic) is required on all processors
- New local and remote maintenance using the UCM software

XField

Setup and calibration



XField

UCM software

- A Windows® based software utility
  - Laptop or desk top PC
  - USB direct connection to the sensor processor or via LAN to the Network Manager
- System setup and configuration
  - Sensitivity profile recording
  - Cable segmentation and zoning
  - Detection threshold setting
  - Relay output assignments
  - Aux I/O conditioning

XField

UCM software (con't)

- Maintenance and diagnostic tools
  - Real-time monitoring of sensor performance
  - Detection signal plot recorder
  - Seasonal adjustment of sensitivity profile
  - Pinpoint cause of nuisance alarms

XField

Alarm outputs (con't)

- Alternatively, the processor can be configured for networking over the Senstar Silver Network
  - All alarms are reported over the network
  - All parameters can be set and adjusted for each processor from the UCM connected to the processor, or via the Network Manager
  - An option card (EIA-422 or fiber optic) is required on all processors
- New local and remote maintenance using the UCM software