

UltraWave BR100TM

Microwave Detection Sensor

Product Guide

E5DA0102-001, Rev A
July 23, 2020

SENSTAR®

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E5DA0102-001, Rev A

July 23, 2020

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The figures included in this document are for illustration purposes only, and may differ from the actual equipment.

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Compliance:

Canada: Industry Canada Identification Number: transmitter 1454B-BR100

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Ce dispositif est conforme aux normes CNR d'Industrie Canada applicables aux appareils radio exempts de licence. Son fonctionnement est sujet aux deux conditions suivantes : 1) le dispositif ne doit pas produire de brouillage préjudiciable; et 2) il doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

Tout changement ou modification non expressément approuvé par la partie responsable de la conformité peut annuler le droit de l'utilisateur à utiliser l'équipement.

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED définies pour un environnement non contrôlé. Cet émetteur ne doit pas être colocalisé ou fonctionner en conjonction avec une autre antenne ou un autre émetteur. Cet équipement doit être installé et exploité à une distance minimale de 20cm entre le radiateur et le corps.

USA: FCC Identification Number: I5T-BR100

FCC Certification - This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Europe:

This device complies with ETSI standard EN 300 440 for European operation. The use of shielded cables is required for compliance.

Service statement - We ensure that our products are correctly applied to achieve the maximum benefits for the end-user. We work hand-in-hand with our customers and remain accessible through all stages of a project - from concept to deployment to long-term support. We provide design assistance, site surveys, installation support, comprehensive documentation, training, post-installation annual calibration and maintenance visits, electronics and software extended warranty, rapid factory repair service and on-call/emergency service. Contact Senstar Corporation to inquire about how a package can be customized for your unique applications.

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1

System planning

The BR100 Microwave Detection Sensor is designed for outdoor perimeter intrusion detection. BR100 consists of a microwave transmitter unit and receiver unit, which detect motion in a defined area (see [Figure 1](#)). The transmitter emits microwave energy, which the receiver constantly monitors. Any motion in the detection zone causes a variation in the received signal. The signal variations are processed by the receiver, which declares a sensor alarm when the received signal meets the criteria for a valid target.

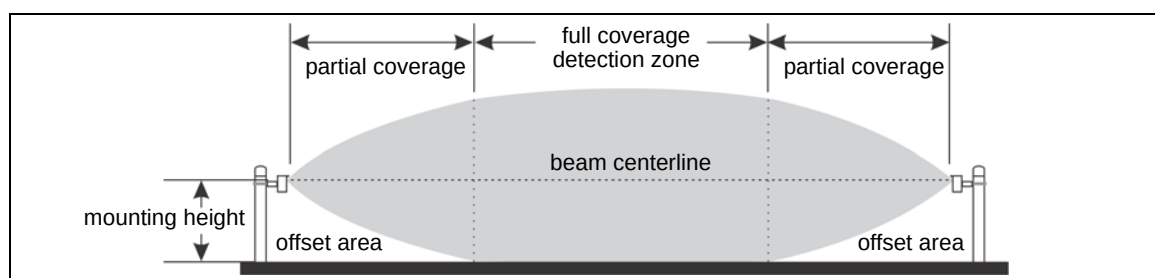


Figure 1 BR100 microwave detection zone

Site design

To achieve the narrowest detection zone with the highest probability of detection (Pd) the BR100 requires a straight, flat, detection zone free of obstacles and depressions. The zone must be completely free of standing and running water. The minimum distance between the beam centerline and any object (fences, buildings, vehicles, trees, bushes, shrubs, etc.) is outlined in [Table 1](#). These numbers are typical conditions and can vary depending on site conditions including zone length, unit mounting height, ground cover, type of obstacle and its mobility, etc. The following separation distances are the minimum requirements. Increase the separation distance between the beam centerline and any objects whenever possible.

transmitter/receiver separation	minimum clearance (centerline to object)	midpoint zone width
10 m (33 ft.)	0.2 m (0.66 ft.)	0.4 m (1.3 ft.)
25 m (82 ft.)	0.5 m (1.6 ft.)	1.0 m (3.3 ft.)
50 m (164 ft.)	1.0 m (3.3 ft.)	2.0 m (6.6 ft.)
75 m (246 ft.)	1.5 m (5 ft.)	3 m (10 ft.)
100 m (328 ft.)	2.0 m (6.6 ft.)	4.0 m (13.2 ft.)

Table 1 Unit separation/minimum clearance

Note	Certain obstacles with large cross sections such as loose fences and large sheets of metal (e.g., a tractor trailer) require additional clearance. For this kind of obstacle, double the recommended separation distance.
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Zone conditions

The detection sensitivity of each zone depends on several factors:

- the required level of security
- an acceptable nuisance alarm rate (NAR)
- microwave unit alignment
- the ground conditions
- physical constraints (terrain, trees, fences, buildings, etc.)
- available space for the detection zone

For the highest level of detection sensitivity and the narrowest beam-width, the terrain must be level to grade ± 7.5 cm (3 in.) and the surface must be free of vegetation and either paved, or covered with a 10 cm (4 in.) layer of crushed stone (2 cm {0.75 in.} max.). (At ranges up to 100 m the BR100 shall detect a 35 kg (77 lb) human walking, running, hands and knees crawling, prone crawling, rolling, or jumping.)

For mid-level detection sensitivity the terrain must be level to grade ± 15 cm (6 in.) and the surface must be paved, or covered with crushed stone, or hard packed dirt or clay, or closely mowed grass. (At ranges up to 100 m the BR100 will detect a 35 kg (77 lb) human walking, running, hands and knees crawling or jumping.)

For low level detection sensitivity (beam break alarm) the terrain must be level to grade ± 23 cm (9 in.) and the surface must be paved, or covered with crushed stone, or hard packed dirt or clay, or closely mowed grass. (At ranges up to 100 m the BR100 will detect a 35 kg (77 lb) human walking, running or jumping.)

Zone height

The height of the microwave field at midspan is approximately equal to the minimum required clearance between the beam centerline and an object (see [Table 1](#)) plus the unit mounting height. There are two recommended mounting heights for the BR100: 55 cm (22 in.) and 95 cm (37 in.). (e.g., for a microwave pair with a unit separation of 50 m and a mounting height of 55 cm the zone height is approximately $1 \text{ m} + 0.55 \text{ m} = 1.55 \text{ m}$ or 5.1 ft.). For applications that require additional zone height it is possible to stack two, or three BR100 units on one mounting post. [Table 2](#) provides approximate zone height comparisons between single stack and double stack configurations. [Figure 2](#) illustrates a double stacked BR100 configuration.

Tx/Rx separation	configuration	approximate zone height
50 m (164 ft.)	single stack	1.55 m (5.1 ft.)
	double stack	1.95 m (6.4 ft.)
100 m (328 ft.)	single stack	2.55 m (8.4 ft.)
	double stack	2.95 m (9.7 ft.)

Table 2 Extended zone height examples

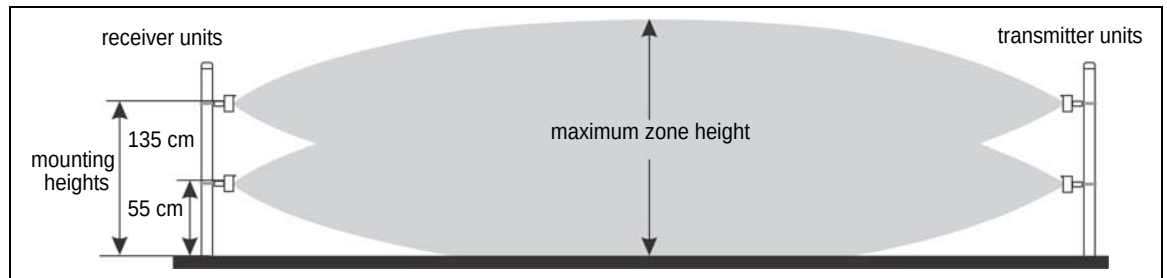


Figure 2 Stacking BR100 units

Mounting angle

For microwave pairs with a unit separation of 50 m or less, the microwave units are mounted with a 5° pitch (toward the ground). This provides the optimum signal strength, when combining the direct signal and the reflected signal at the receiver unit (see [Figure 6](#)).

Microwave offsets

The areas immediately above and below the transmitter and receiver antennas are not exposed to the microwave energy. The microwave offset area describes the distance from the unit's mounting position to the point where the beam reaches the ground. For a mounting height of 55 cm, the coverage is effectively right up to the mounting post. For a 95 cm mounting height there is an approximate offset area of 1.35 m (4.4 ft.). Only partial coverage is provided in the offset area. Full coverage begins where the offset area ends (see [Figure 3](#)). The offset distances in the example drawings are based on a mounting height of 95 cm (37 in.). As the mounting height increases, the offset increases. Different types of offsets are shown in [Figure 4](#).

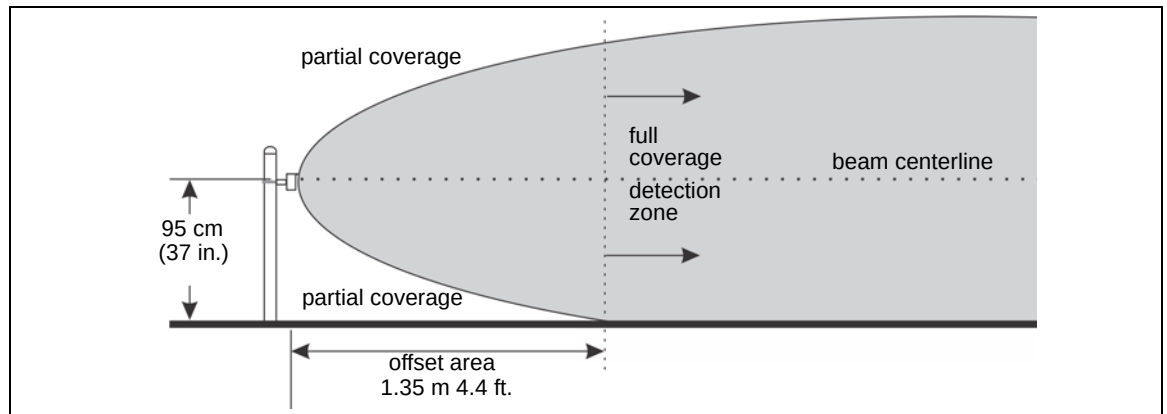


Figure 3 Offset area

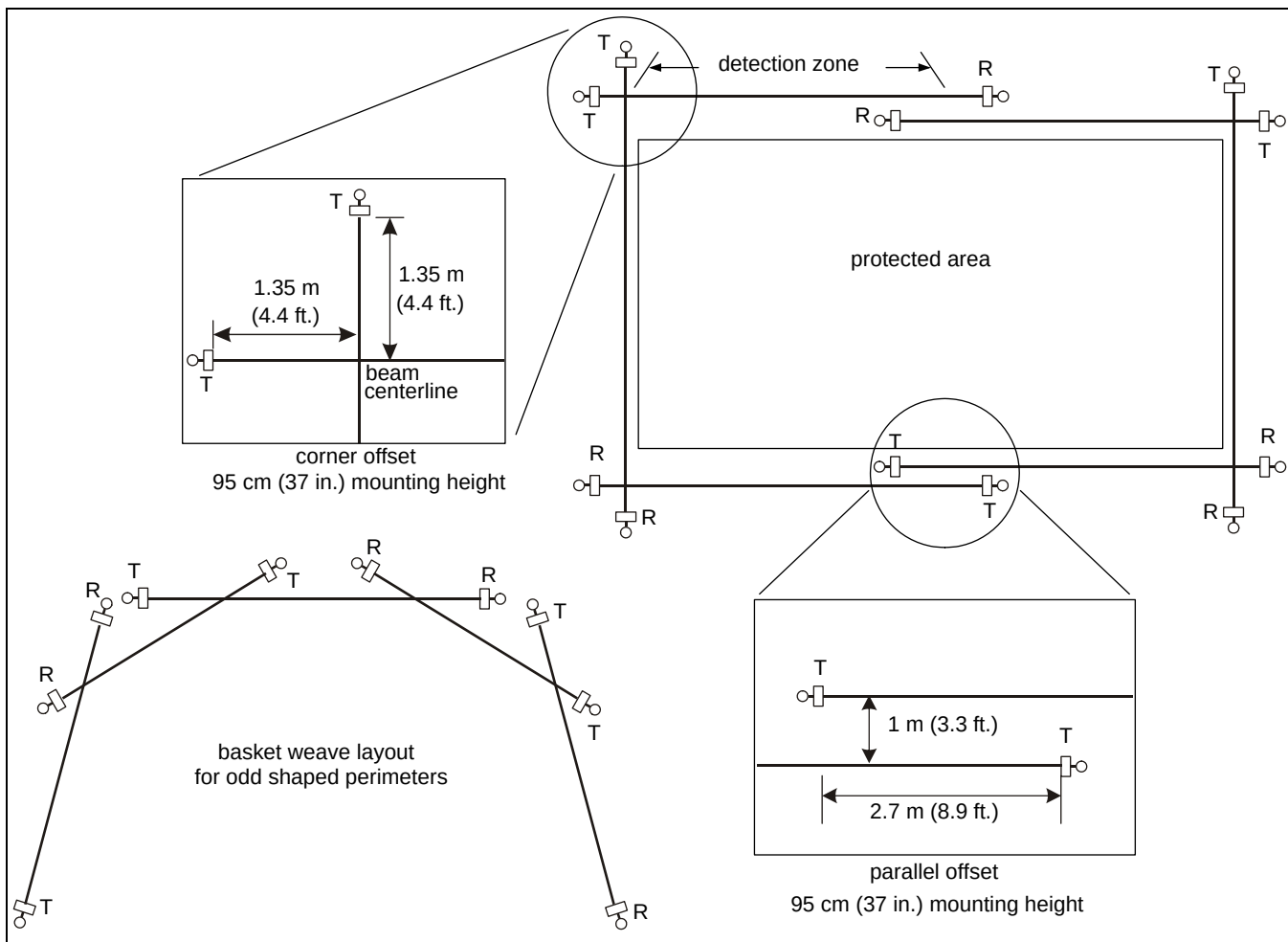


Figure 4 Offset arrangement examples

Power requirements

CAUTION

Senstar strongly recommends the use of external lightning protection devices for all outdoor cable runs (i.e., power, I/O, Ethernet, RS-422).

The BR100 sensor (transmitter and receiver) consumes 2 W (nominal). Both the transmitter and receiver can operate on a wide range of input voltages (12 to 48 VDC). The required gauge of the power cable depends on the power supply capacity, the number of BR100 units being powered and the lengths of the power cable runs. In locations where AC power may not be stable or reliable, an uninterruptable power supply (UPS) is recommended for primary power.

Power over Ethernet

Both the transmitter and receiver units can receive power over Ethernet (PoE). Silver Network based BR100 pairs have the option of using Ethernet communications. To use this powering option requires a PoE class 3 switch that is located within 100 m (328 ft.) of the transmitter/receiver, and minimum Category 5 shielded network cable.

Note

Senstar recommends using a fully managed PoE switch to supply power to the BR100 transmitter/receiver.

Alarm data communications

BR100 alarm data communications can be provided in two ways, via relays in Local control mode and over the Silver Network in Remote control mode. Each BR100 unit (transmitter and receiver) has two user-configurable relay outputs and one input. The relay contacts are held in the closed position during normal operation and open to signal an event, or if power is lost.

Local control mode

In Local control mode, the receiver's two outputs can be configured to signal Microwave Alarm, Input Power Fail, Enclosure Tamper, Hardware Faults and Fail Safe (system fail). A momentary switch input to the unit's Aux input is used to activate an electronic self-test of the transmitter/receiver unit. [Figure 5](#) shows the selectable input/output (I/O) parameters for Local control mode.

CAUTION Input Power Fail, and Fail Safe conditions indicate that the BR100 sensor is not operational.

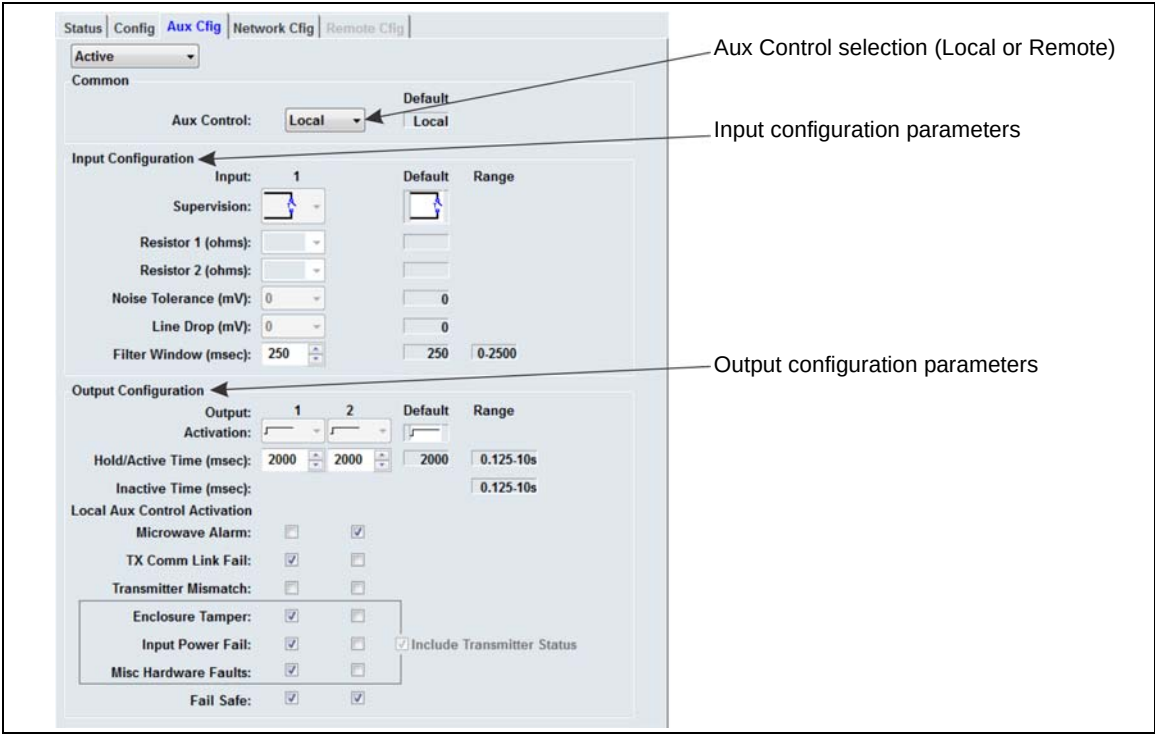


Figure 5 Local control mode I/O configuration parameters

Remote control mode

In Remote control mode, alarm and supervision data is carried over the network cables and each unit's two relays are available as output control points for the security management system (SMS). The supervised input on each unit can be used to report the status of an auxiliary security device to the SMS. In Remote control mode, a self-test is initiated by a command from the SMS. To communicate on the Silver Network requires either RS-422 or Ethernet (PoE) cable.

Note You can setup a Silver Network to enable calibration, maintenance and diagnostic access to your BR100 units from a central control facility, and select Local control mode to use the receiver's two relay outputs to signal alarm and supervision conditions.

Relay contact ratings

The solid state relays are Form A (N.O.) rated for 60 V @ 100 mA maximum, non-inductive load. In Remote control mode, you can configure the relays as steady ON, flash mode (ON-OFF-ON-OFF, etc.), or pulse mode (ON for a period, then OFF). For flash and pulse modes, the relay Active/Inactive times are selectable. In Local control mode the relays remain active for the event's duration or for the selectable Hold Time, whichever is longer. The relay contacts are held in the closed position during normal operation and open to signal an event, or if power is lost.

Silver Network specifications

- Data rate - fixed 57.6 k bps
- Maximum 60 devices spread over up to 4 independent network loops
- Two communication Channels (Side A, Side B)
- Response time - 1 second, or less from alarm source to Network Manager (per loop)
- Network termination - not required
- Transmission media/maximum separation distances between sensors:
 - RS-422 copper wire - 1.2 km (0.75 mi.) - 2 pairs per Channel
 - Ethernet - Category 5 shielded cable, 100 m between PoE switch and microwave unit

Cable ports

Each BR100 unit includes a single 22 mm (0.875 in.) cable port fitted with a compression gland, and two provisional rear entry cable ports (requires removal of circuit card and drilling the plastic enclosure at the locations identified with alignment marks). The compression gland is for cable sizes 4.3 mm to 11.4 mm (0.17 in. to 0.45 in.). If required, the enclosure can be fitted with 13 mm (1/2 in.) conduit (not included) in place of the compression gland.

Mounting posts/surfaces

The BR100 units mount easily on posts with an outside diameter ranging between 4.8 cm and 11.4 cm (1.875 in. and 4.5 in.). The posts must be plumb, firmly set in the ground, and unable to rotate or move. For areas where the ground freezes, the posts must be protected against potential frost heaving. A 2.5 m (8 ft.) post is generally used with 1 m (3.3 ft.) of the post buried in a concrete footing. [Figure 6](#) is an illustration of a post-mounted BR100 unit.

Note	Senstar recommends hiring a local fencing contractor to install the BR100 mounting posts. Consult the local building code for information on installing mounting posts.
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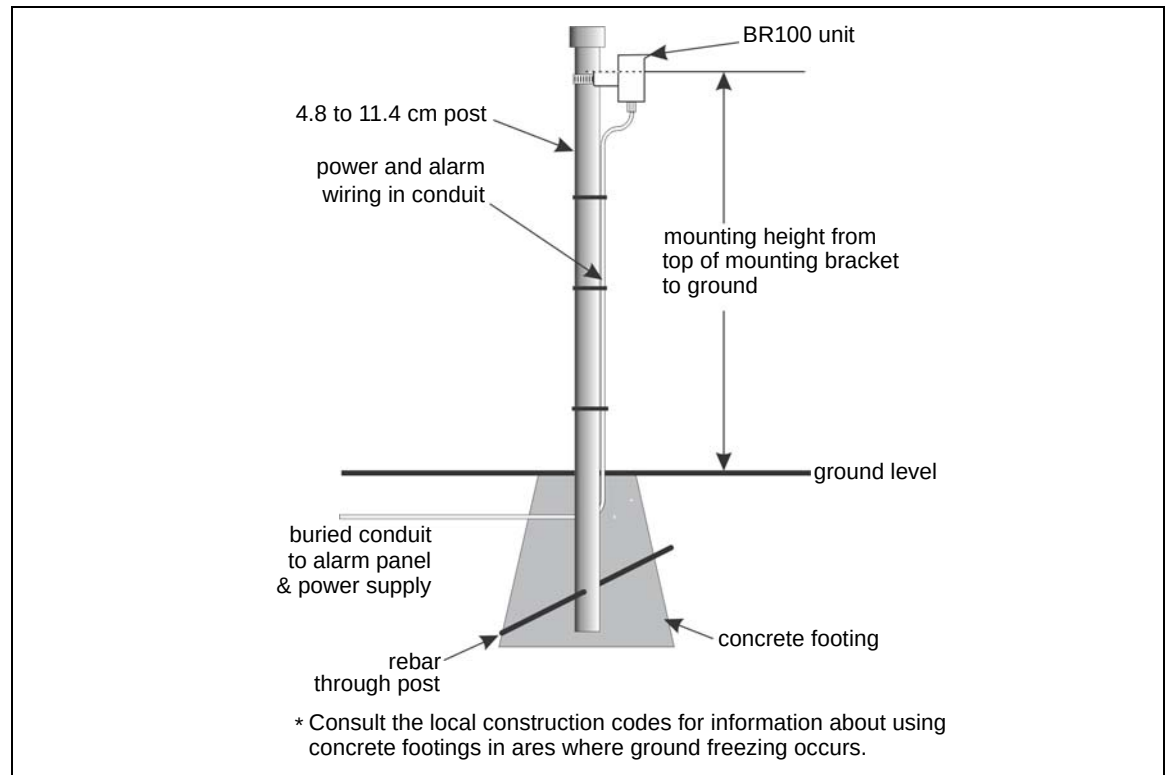


Figure 6 Post installation and unit mounting

Surface-mount applications

The post-mount bracket can also be used to mount a BR100 unit on a fixed stable surface. If you are considering a surface mount application, the transmitter receiver alignment must be carefully planned, as the mounting bracket cannot be easily adjusted in the horizontal plane for surface mount applications. The hardware required for fastening the bracket to the surface is not included. [Figure 7](#) illustrates a surface mounted BR100 unit.

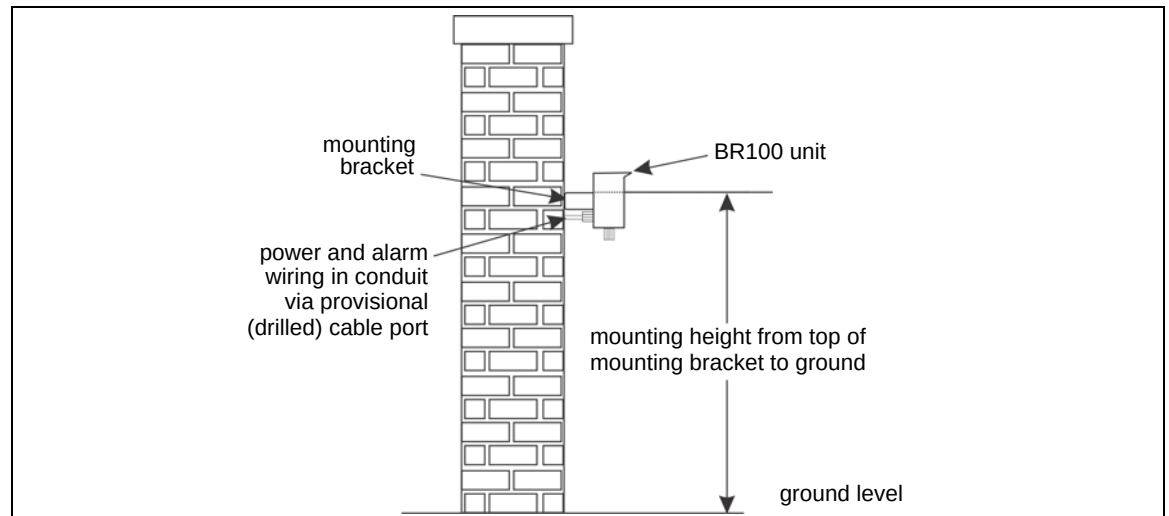


Figure 7 Surface mounting example

BR100 alarm reporting

The BR100 system reports a sensor alarm when a target disturbs the microwave field. If a large target (e.g., a vehicle) enters the microwave field and blocks the beam, the BR100 sensor goes into alarm and continues the alarm until the object leaves the field. If the calibration parameters are outside the valid range at startup, or during operation, the BR100 system goes into constant alarm until the calibration problem is corrected. The receiver unit also signals an alarm if it does not see the transmitter on startup.

Note

If the BR100 signal is blocked continuously for a period that exceeds 30 seconds, the system may be prone to nuisance alarms or have a reduced probability of detection for 30 seconds after the blocking object leaves the microwave field.
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The transmitter and receiver units are housed in weatherproof enclosures. Each enclosure contains electronic circuitry and an antenna. Both units include tamper switches and can be configured to report enclosure tamper alarms.

Fast Alarm Response

The BR100 receiver includes a Fast Response channel that bypasses the sensor's advanced signal processing algorithms when enabled. This causes the BR100 receiver to function like a classic analog microwave sensor. With Fast Response enabled, BR100 will trigger an alarm as soon as the microwave signal exceeds the Threshold setting. The Fast Response channel provides early alarm notification, but can also cause an increase in the nuisance alarm rate (NAR). Fast Response is intended for use in high-security applications that include a sterile zone. However, Fast Response should NOT be used in Sally Port areas.

Automatic gain control

The BR100 microwave sensor employs automatic gain control (AGC) to ensure the received signal remains at an optimal level. If the receiver detects an increase, or attenuation of the transmitted signal the AGC gradually adjusts the signal gain to maintain proper detection.

2

Installation

The cover on each BR100 unit enclosure is secured with two captive screws that are factory installed to a finger-tight torque specification. There are no user-serviceable components inside the compartment. The cover should only be removed:

- to access the circuit card assembly for setup and calibration purposes (via a UCM connection)
- to make the wiring connections
- if the unit will be fitted with conduit
- if the provisional rear entry ports are required

To access the circuit card assembly, remove the two screws on the enclosure cover. When replacing the cover, tighten the screws until finger-tight. Do not over-tighten the screws.

The BR100 transmitter and receiver units are almost identical, with no visual difference in circuitry. Each unit is identified by labels on the enclosure and the PCB. [Figure 8](#) shows a BR100 receiver and illustrates the unit's features. The receiver's diagnostic activity LEDs are listed in [Table 3](#).

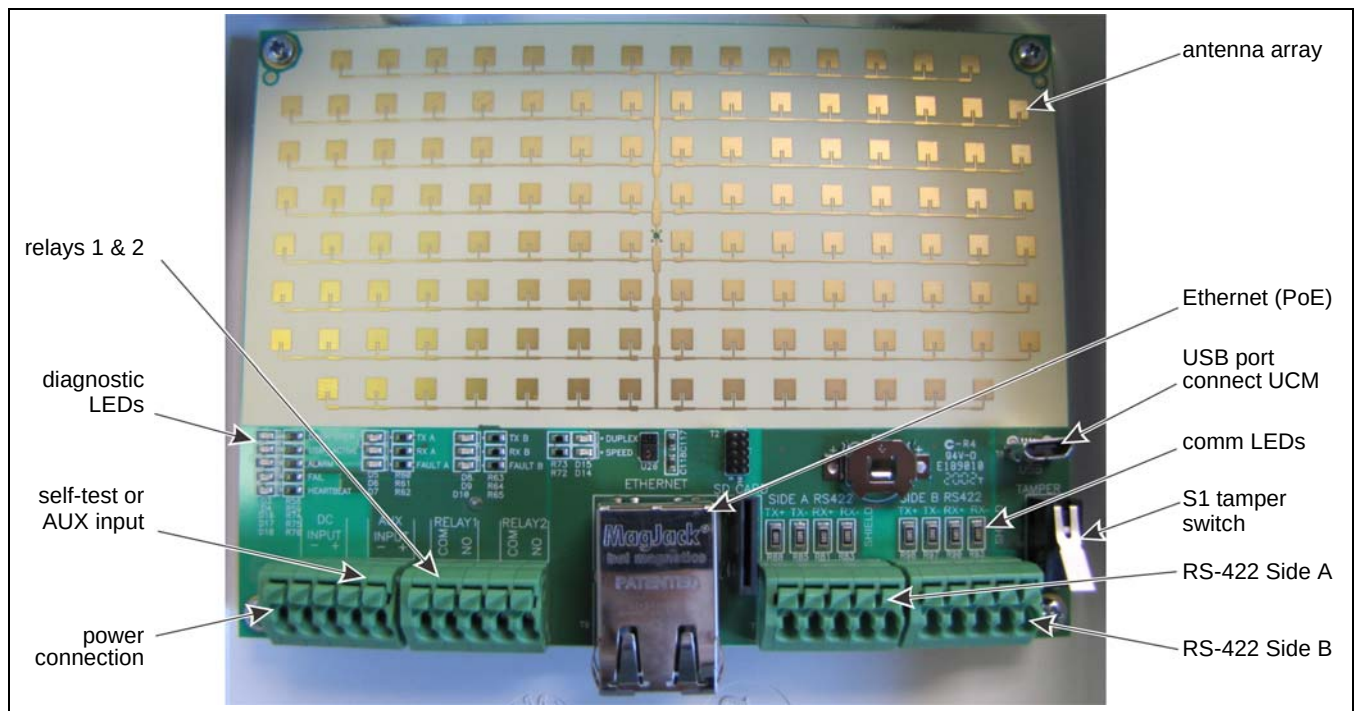


Figure 8 BR100 receiver unit

LED #	Description	LED #	Description
D3	door open: enclosure door open	D10	fault: comm fault on B-side
D4	USB active: active UCM connection	D14	speed: communication speed
D5	TXA: transmitting data on A-side	D15	duplex: 2-way communications
D6	RXA: receiving data on A-side	D16	alarm: microwave sensor alarm active
D7	fault A: comm fault on A-side	D17	fail: major malfunction no detection
D8	TXB: transmitting data on B-side	D18	heartbeat: indicates health of system
D9	RXB: receiving data on B-side		

Table 3 BR100 diagnostic LEDs

Mounting the BR100 units

Mount the transmitter and receiver units on their respective posts using the hardware provided. The mounting height of the transmitter and receiver units is measured from the top of the mounting bracket to the ground's surface. The initial recommended mounting height is either 55 cm (22 in.) or 95 cm (37 in.). The BR100 units can also be mounted on a wall or other flat stable surface. Both the transmitter and receiver units must be mounted at the same height above ground. During mounting, the two units must be aligned to point directly at each other.

Mounting angle

For microwave pairs that are separated by 50 m (164 ft.) or less, adjust each BR100 unit to have a 5° pitch (toward the ground). The 5° pitch combines the reflected signal and the direct signal to create the strongest received signal possible for short range applications. The calibration testing will determine if the mounting angle is correct for your installation.

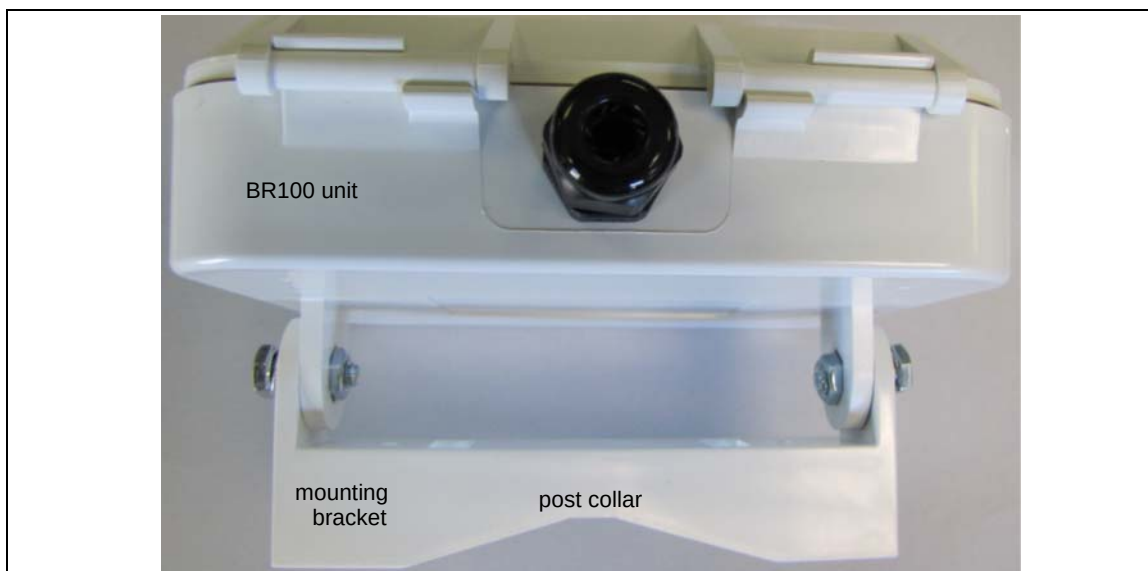


Figure 9 Mounting bracket

Post-mounting procedure

1. Pass the gear clamp through the slots in the mounting bracket.
2. Tighten the mounting bracket assembly on the BR100 unit.
3. On the mounting post, measure the mounting height of the BR100 unit and mark the post at that point.
4. Wrap the gear clamp around the post and tighten until snug against the post so that the BR100 unit is at the correct height (top of mounting bracket is at the measured mark).
5. Aim the BR100 unit at the second mounting post, and using an 8 mm (5/16 in.) nut driver or socket, finish tightening the gear clamp with the BR100 unit at the specified height.
6. Verify the mounting height.
7. For BR100 units that are separated by 50 m or less, adjust the pitch of each unit to a 5° angle toward the ground.
8. Repeat for the second BR100 unit.

Initial post-mount alignment

For optimal performance, ensure that the BR100 transmitter and receiver are aimed directly at each other, and that the mounting height is correct for both units.

Note	The UCM includes a received signal strength indicator (RSSI) which serves as an aid during final alignment.
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1. Verify the mounting height of each unit (ground to top of mounting bracket).
2. If required, loosen the transmitter's gear clamp slightly, and then carefully aim the transmitter directly at the receiver.
3. Tighten the transmitter's gear clamp.
4. If required, loosen the receiver's gear clamp slightly, and then carefully aim the receiver directly at the transmitter.
5. Tighten the receiver's gear clamp.
6. If required, loosen the bolts that attach the mounting bracket and tilt the units (in the vertical axis) toward each other. Re-tighten the bolts.
7. For BR100 units that are separated by 50 m or less, adjust the pitch of each unit to a 5° angle toward the ground.

Surface mounting

CAUTION	For surface mount applications, the two mounting surfaces must face toward each other. Surface mounted BR100 units cannot be rotated in the horizontal axis. If required, use shims to adjust the horizontal alignment of surface mounted units.
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The BR100 mounting bracket can be used to surface mount the transmitter and/or receiver. The mounting bracket is removed from the unit and is attached to the surface. The microwave unit is then reattached to the mounting bracket. Customer-supplied hardware (7 mm, 1/4 in.) is used to attach the assembly to the mounting surface.

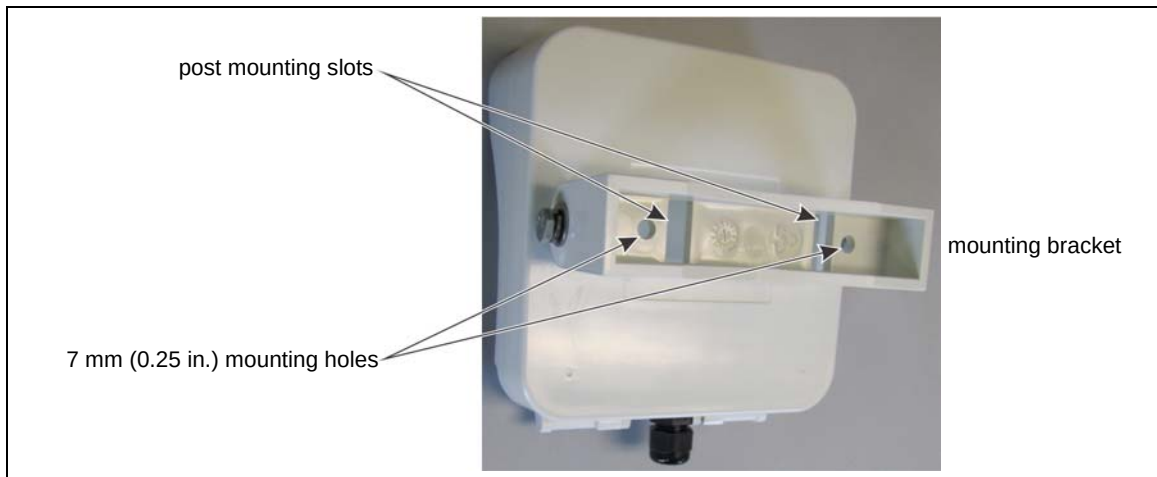


Figure 10 Mounting setup

Surface mounting procedure

1. Measure the mounting height of the unit from the ground and mark the surface at that point.
2. Using an 11 mm (7/16 in.) wrench, remove the hardware attaching the mounting bracket to the unit.
3. Hold the mounting bracket against the mounting surface so the top of the bracket is level with the mounting height mark and then mark the two holes on the mounting surface.
4. Drill two holes in the mounting surface.
5. Attach the mounting bracket to the surface using appropriate fasteners.
6. Measure and verify the mounting height.
7. Re-attach the BR100 unit to the mounting bracket.
8. Mount the second BR100 unit.

Initial surface-mount alignment

To ensure optimal performance, it is critical that the BR100 transmitter and receiver are aimed directly toward each other, and that the mounting height is correct for both units.

1. Verify the mounting height of each unit.
2. If required, loosen the mounting hardware on the post collars, and use shims so that the BR100 transmitter and receiver point directly at each other (horizontal adjustment).
3. Tighten the mounting hardware.
4. If required, loosen the bolts attaching the mounting bracket and aim the units toward each other (in the vertical axis). Re-tighten the bolts.

Note

If the microwave pair is separated by 50 m or less, adjust the pitch of both units to a 5° angle (toward the ground).

Transmitter/receiver wiring connections

The BR100 wiring connections are made on 45° spring terminal blocks. The spring terminals accept wire sizes from 16 to 24 AWG with a 9 mm (0.35 in.) strip length. The DC power input is made on T4 and the input/output (I/O) connections are made on T4 and T5. Each unit's auxiliary (AUX) input is available when using Remote control mode (network alarm data communications). The self-test input is available in Local control mode (relay output alarm signaling).

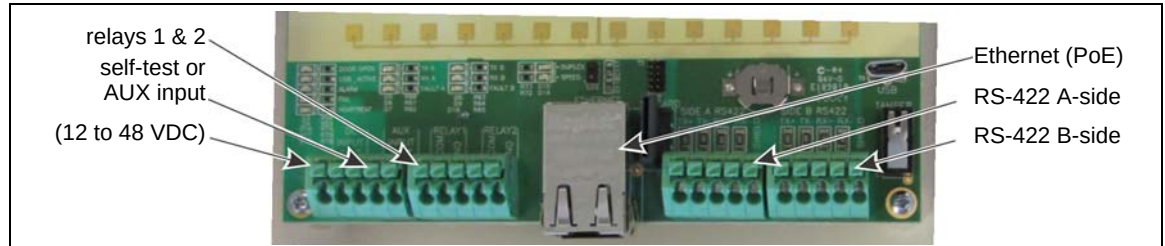
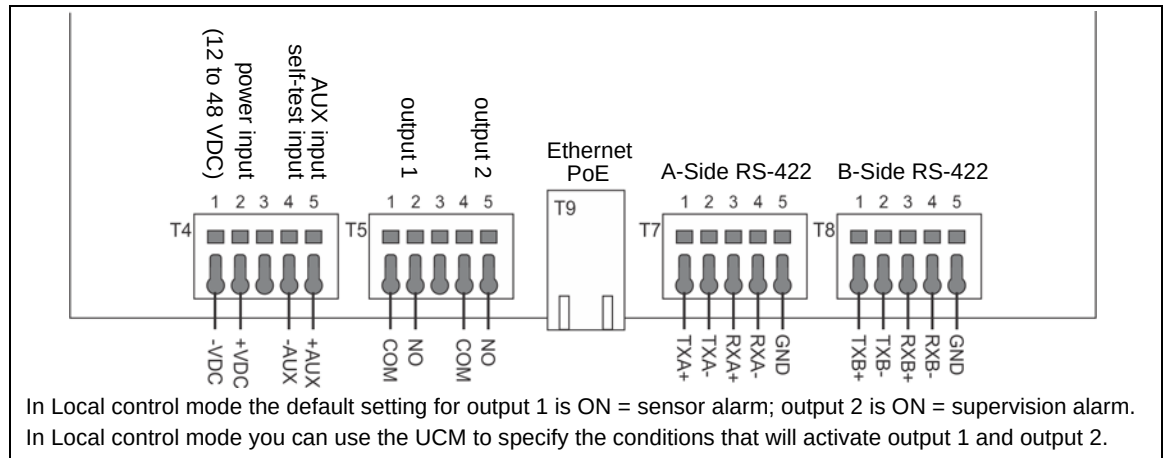


Figure 11 Wiring connections



In Local control mode the default setting for output 1 is ON = sensor alarm; output 2 is ON = supervision alarm. In Local control mode you can use the UCM to specify the conditions that will activate output 1 and output 2.

Figure 12 Transmitter/receiver wiring connections

T4 - power input

The BR100 units require 12 to 48 VDC to operate. Connect DC power to T4 pin 1 (-VDC) and T4-2 (+VDC) or use PoE (T9).

T4, T5 - input/outputs

T5 connects to output 1 and output 2, and T4 connects to the auxiliary (AUX) or self-test input (see [Figure 12](#) for connection details).

In Local control mode, the two outputs can be configured via the UCM to report user-specified alarm and supervision conditions (see [Alarm data communications on page 9](#)). A momentary switch input to the self-test input activates an electronic test. Self-test activation requires a normally open, unsupervised momentary switch input. The momentary switch input must be closed for a minimum of the time specified in the Filter Window parameter (via the UCM). See [Table 4](#) for example input wiring diagrams and supervision resistor values.

In Remote control mode, the two outputs are used by the security management system (SMS) as output control points. The AUX input is available to report the status of an auxiliary security device to the SMS. The input's status is determined via an internal reference voltage, and the configuration of the contact closures and supervision resistors. Any change in the input's status is reported to the SMS.

Note	The contact closure input to the AUX input must be voltage-free.
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Relay contact ratings

The solid state relays are Form A (N.O.) rated for 60 V @ 100 mA maximum, non-inductive load. The relay contacts are held in the closed position during normal operation and open to signal an event, or if power is lost.

Cable ports

Each BR100 unit includes one 22 mm (0.875 in.) cable port fitted with a compression gland. Pull the cables through the compression gland, into the enclosure and through the locking nut. Then install the compression gland in the cable port. After making the wiring connections, tighten the compression gland to provide weather protection and strain relief.

Alternatively, there are two provisional cable entry ports that are indicated on the back of the unit. To use the provisional ports you must remove the unit's circuit card assembly (CCA) and drill the holes in the plastic enclosure. The cable glands or conduit fittings required for the rear ports are customer supplied.

Making the I/O wiring connections

1. Pull the data cable into the enclosure.
2. Prepare the data cable leads - strip length = 9 mm (0.35 in.).
3. Make the wiring connections on the appropriate terminals (see [Figure 12](#)).

Enclosure tamper switch

Each BR100 unit includes a tamper switch to indicate if the enclosure cover is removed (closed = secure, open = tamper).

Power supply connection

WARNING!	DO NOT bring AC mains power into the BR100 enclosure. If a local power supply is being used, it must be installed in its own weatherproof enclosure. Consult the local electrical code for information about the connection of AC mains to your power supply.
-----------------	---

When a central low voltage power supply is being used for primary power, it should be powered from an uninterruptible power source.

- To power the system from a central source, run the power distribution cable around the perimeter and tap off to each BR100 unit.
- In a weatherproof junction box near each BR100 unit, splice the power cable to a lighter gauge pigtail. Connect the negative lead to T4-1 (-) and connect the positive lead to T4-2 (+) (see [Figure 12](#)).

Local power supply

To use a local DC power supply, the power supply must be outdoor rated and installed in its own weatherproof enclosure. The local power supply can be mounted on the same post as the BR100 unit to keep the wire run to a minimum. Connect the negative lead to T4-1 (-) and connect the positive lead to T4-2 (+) (see [Figure 12](#)).

Power over Ethernet

For power over Ethernet, a fully managed class 3 PoE switch is recommended. In this configuration, minimum Category 5 shielded Ethernet cable is also required and the maximum distance between the BR100 transmitter/receiver and the PoE switch is 100 m (328 ft.). To use PoE, connect the PoE switch to the Ethernet port on the CCA.

Silver Network alarm data communications

Note	The BR100 units can use either Ethernet or RS-422 for network communications.
CAUTION	Senstar strongly recommends the use of external lightning protection devices for all outdoor cable runs (i.e., power, I/O, PoE, RS-422).

Silver Network connections

[Figure 13](#) illustrates the data flow directions for an RS-422 based Silver Network. [Figure 14](#) shows an RS-422 based Silver Network using the loop configuration and [Figure 15](#) illustrates an Ethernet based Silver Network using the Star configuration.

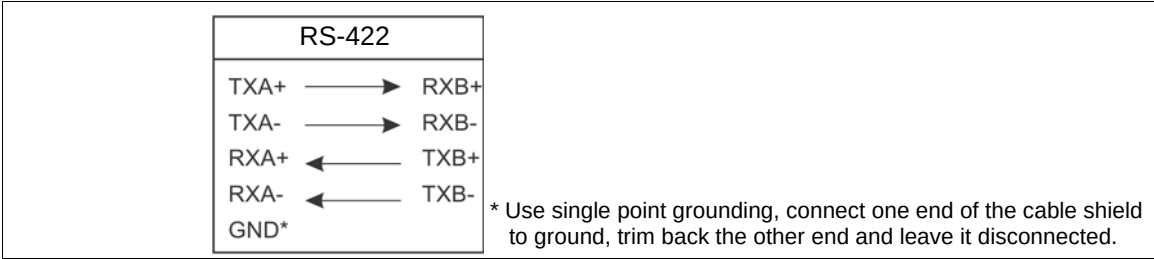


Figure 13 Silver Network RS-422 data flow

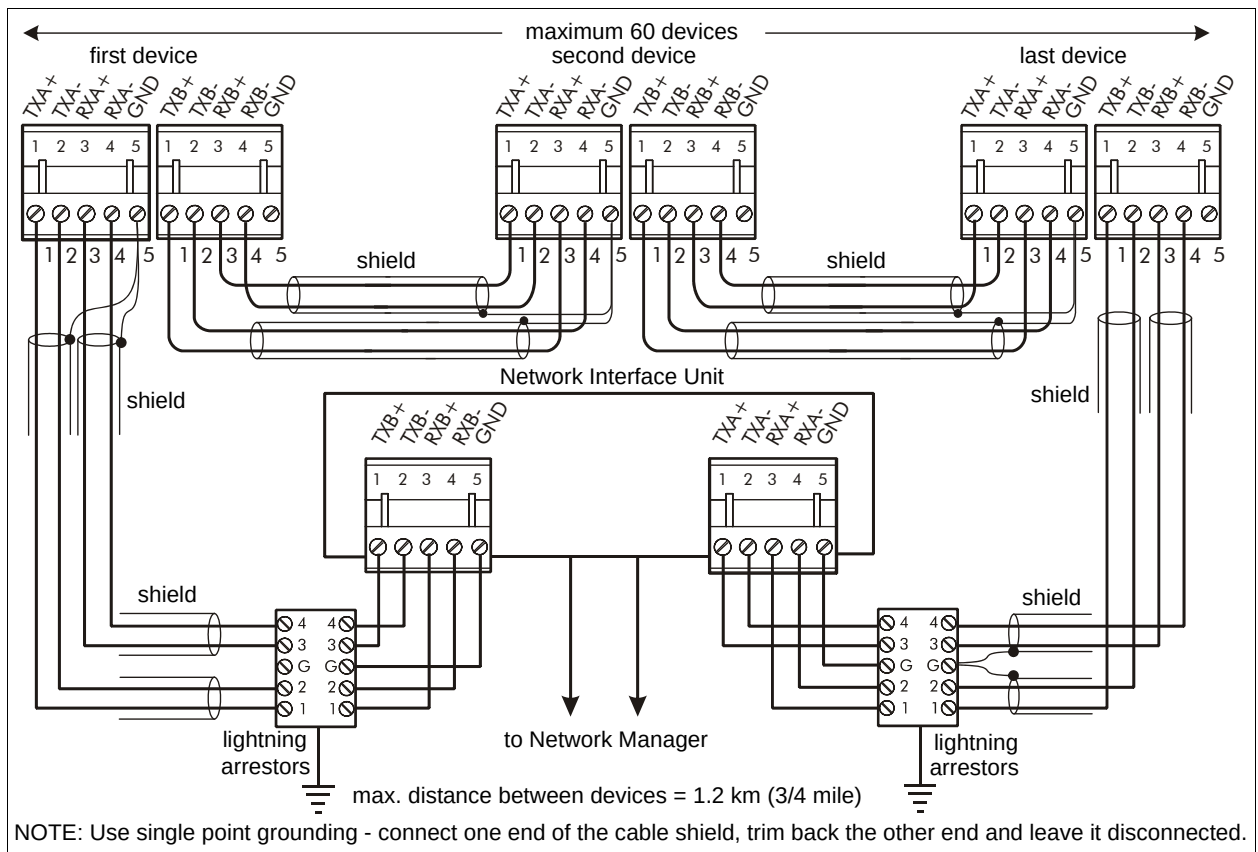


Figure 14 Silver Network RS-422 wiring diagram

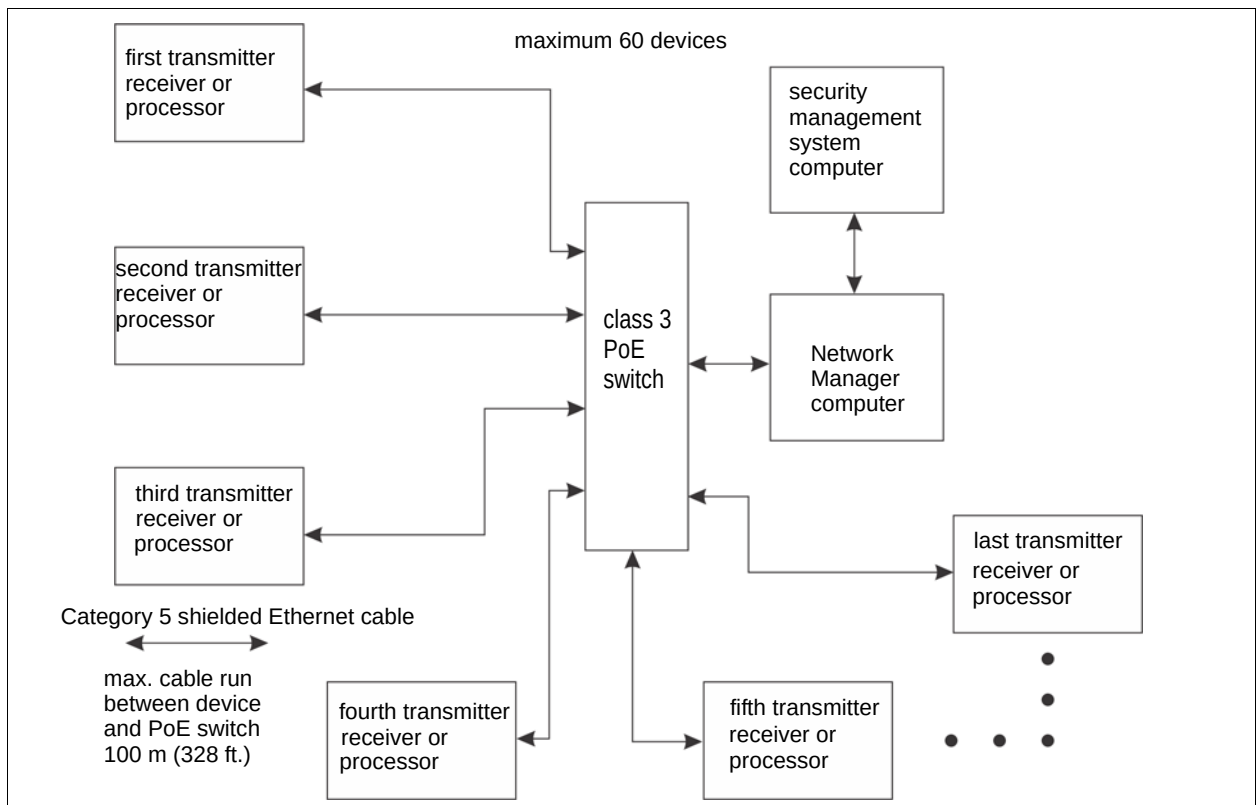


Figure 15: Silver Network Ethernet wiring diagram

Stacking BR100 units

To increase the height of the microwave field, it is possible to stack two units on one mounting post. The initial mounting height of the lower unit is 55 cm (22 in.) and the upper unit is 1.35 m (4.4 ft.) Each BR100 sensor must use a different Frequency Pair. To ensure maximum signal isolation, use Frequency Pairs that are at least two numbers apart. Do not use Frequency Pairs that are adjacent, consecutive numbers (e.g., use Frequency Pairs 1, 3 rather than 1, 2). To facilitate the wiring connections, it is recommended that the receivers be mounted on one post, and the transmitters be mounted on another post. [Figure 16](#) illustrates the wiring connections for a double stacked BR100 configuration. [Figure 2](#) illustrates a double stack BR100 system.

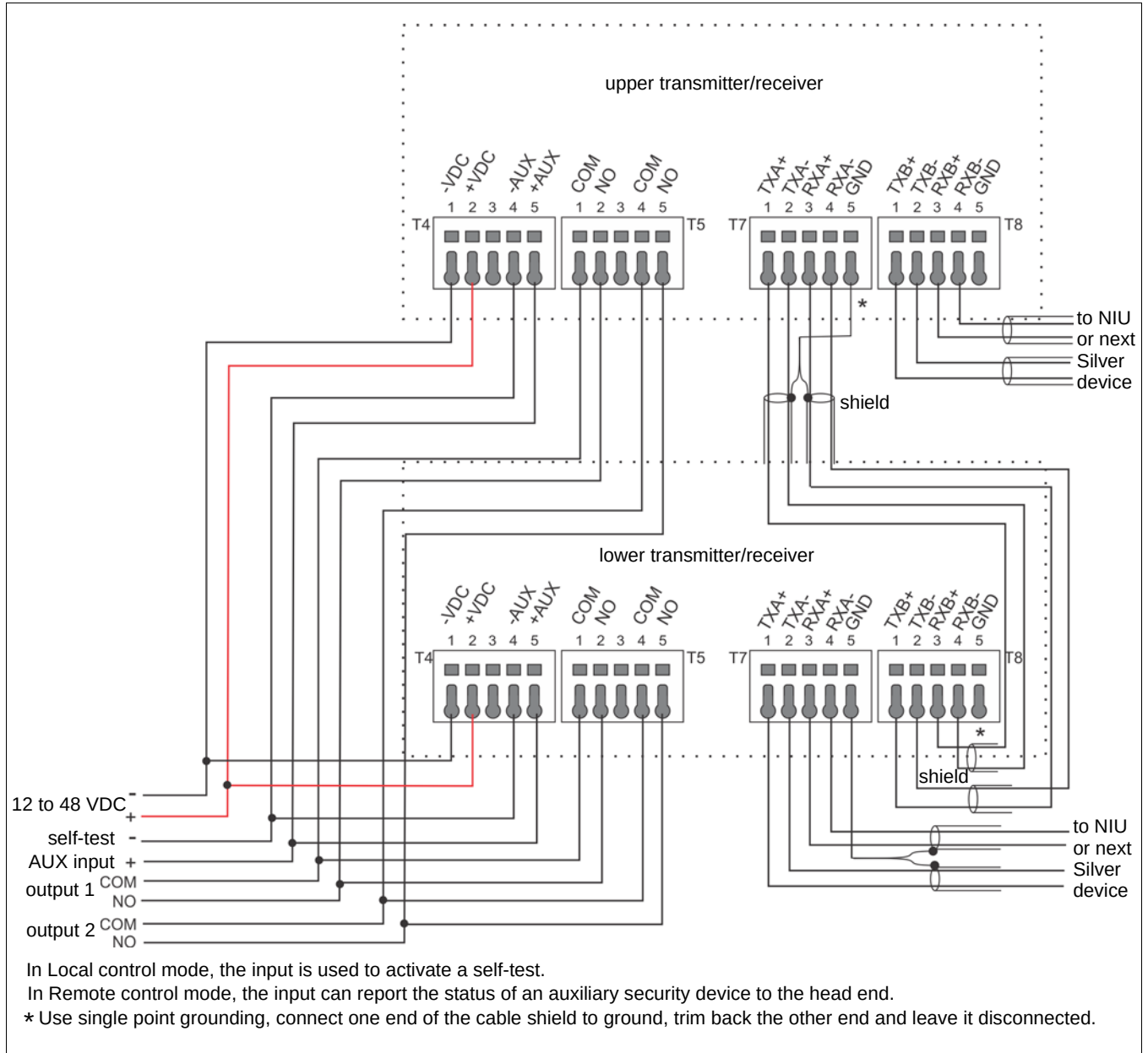


Figure 16 Double stacked BR100 wiring diagram

3 Setup and calibration

Setup

Note	BR100 setup and calibration should be performed by a qualified technician.
-------------	--

BR100 setup and calibration is done using Senstar's Universal Configuration Module (UCM). The UCM is a Windows-based software application that performs the calibration, setup, maintenance and diagnostic functions for Senstar's line of intrusion detection sensors. The UCM connects directly to the BR100 unit via USB. Network based BR100 units can also connect remotely via the Silver Network Manager.

Note	Senstar recommends that the initial calibration be done at the BR100 unit using a direct USB connection to the UCM. Consult the online help for detailed information on UCM operation.
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The BR100 transmitter setup requires the following configuration settings:

- specify the **Locale** - **FCC** for North American applications, **ETSI** for European applications (transmitter and receiver settings must match)
- specify the **Frequency Pair** (transmitter and receiver settings must match)

- set a unique network **Address** for Silver Network based sensors

The BR100 receiver setup requires the following configuration settings:

- specify the **Locale** - **FCC** for North American applications, **ETSI** for European applications (transmitter and receiver settings must match)
- specify the **Frequency Pair** (transmitter and receiver settings must match)
- set a unique network **Address** for Silver Network based sensors
- set the detection **Thresholds** (use the UCM to determine the optimum detection Thresholds)

Once the BR100 transmitter and receiver are properly installed and configured, you can calibrate the receiver unit. On the receiver's UCM Status tab, select the recalibrate button and the BR100 receiver will auto-calibrate to provide the best possible received signal strength (see [Receiver calibration on page 30](#)).

Transmitter setup

1. Remove the cover from the BR100 transmitter unit enclosure and use the USB cable to connect the UCM computer to the USB port on the PCB.
2. Start the UCM application and establish a connection.

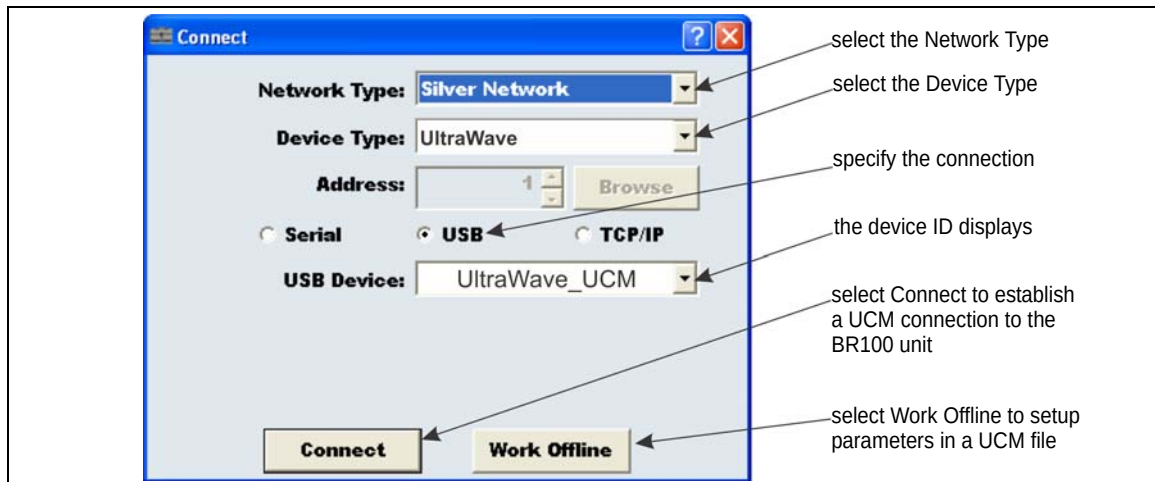


Figure 17 Direct connection to UCM

Note

It is also possible to connect the UCM to the BR100 unit remotely through the Silver Network Manager (see [Figure 18](#)).

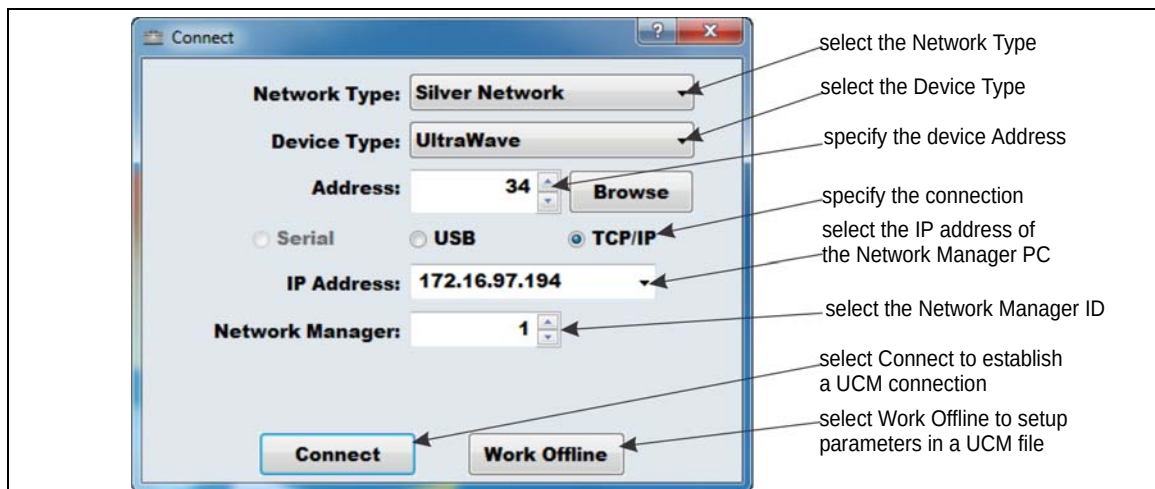


Figure 18 Network connection to UCM

Note

The first time the UCM connects to the transmitter/receiver unit, you are prompted to select the unit's Locale (region of operation - FCC for North American operation, or ETSI for European operation). Make the selection based on the country in which the unit is installed. The BR100 will not operate until both the transmitter and receiver have the Locale specified.

3. Select the Config tab and specify the Locale (FCC or ETSI).
4. Save and download the configuration changes to the transmitter unit.

Setting the transmitter unit's Frequency Pair

1. With the UCM connected to the transmitter unit, select the Config tab.

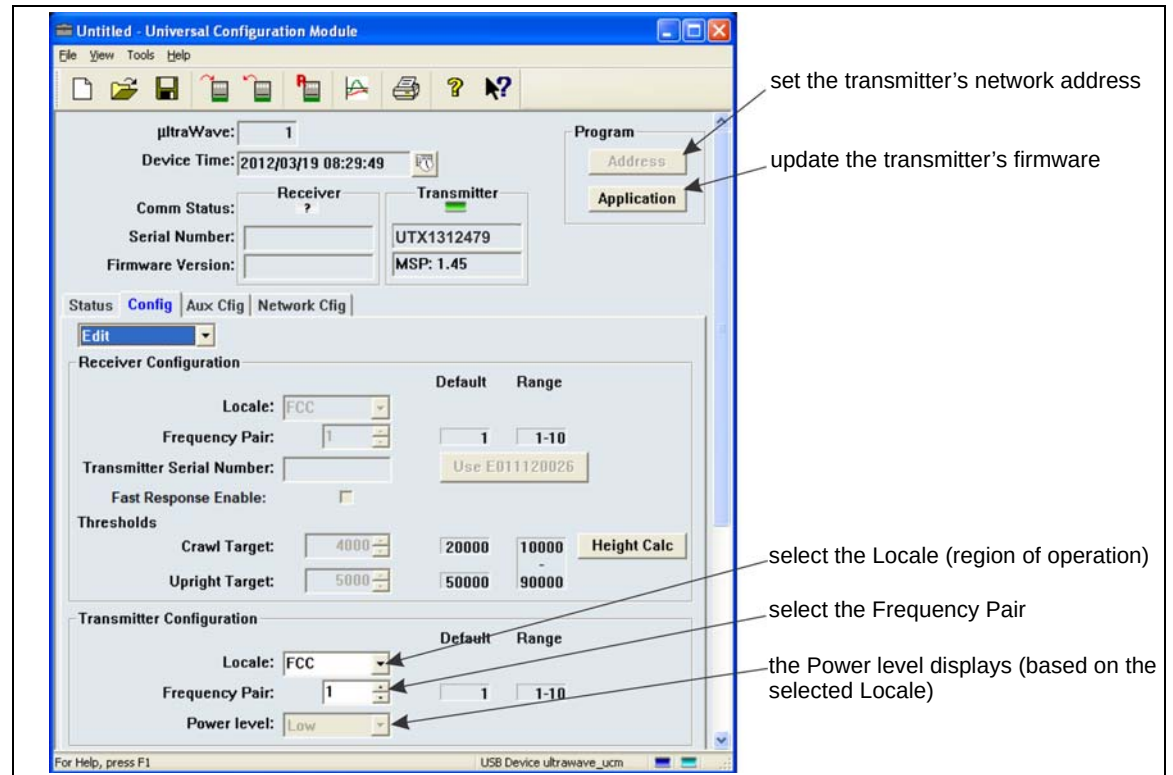


Figure 19 UCM Config tab (transmitter unit)

2. If required, use the arrows to specify the Locale for this BR100 transmitter.

Note

Both the transmitter and receiver must use the same Frequency Pair and Locale. Nearby BR100 sensors and stacked configurations must use different Frequency Pairs.

Do not assign consecutive Frequency Pairs to BR100 sensors that are in close proximity to other BR100 sensors (e.g., use Frequency Pairs 1, 3, 5, rather than 1, 2, 3).

3. In the Frequency Pair field, use the arrows to specify the Frequency Pair that will be used for this BR100 sensor (transmitter and receiver).
4. Save and download the configuration changes to the transmitter unit.

Setting the address

The transmitter address can be set only through a direct USB connection between the UCM PC and the USB port on the unit. Only network-based BR100 sensors require unique address settings. Systems that do not use network communications can use the default address (1).

1. In the Program field select the Address button.
The change Device Address dialog displays.
2. In the Change Device Address dialog, specify the New Address for the transmitter.
3. Select the Program button.
The New Address takes effect when communications are re-established.
4. Save and download the configuration changes to the transmitter unit.

Receiver setup

After setting the transmitter's Locale and Frequency Pair, the receiver can be setup and calibrated.

1. Connect the UCM to the receiver unit, and then select the Config tab.
2. Set the receiver's Locale and Frequency Pair to match the transmitter's settings.
3. For a Silver Network based receiver, set a unique network Address.
4. Enter the paired transmitter's serial number (or click the button).
5. Download the configuration changes to the receiver unit.

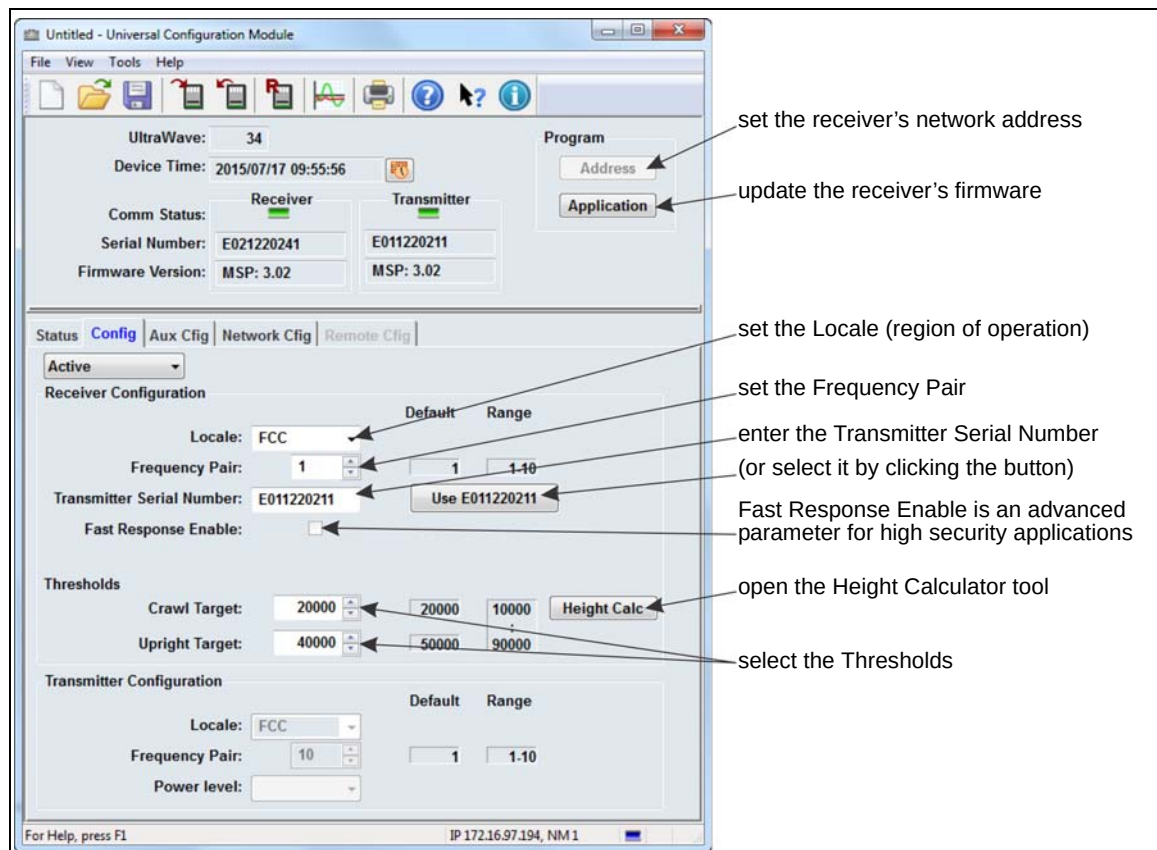


Figure 20 UCM Config tab (receiver unit)

Note

See [Fast Alarm Response on page 12](#) for information on Fast Response Enable.

6. If desired, select the Fast Response Enable checkbox to increase the speed at which the BR100 sensor reports a microwave alarm.
7. Specify the Thresholds (Crawl Target and Upright Target). Use the UCM to determine the optimal detection Thresholds. The Thresholds can be adjusted later, if required, during the system verification tests.

Note

You raise an alarm Threshold to decrease the sensitivity to the specified type of intrusion, or you lower a Threshold to increase the sensitivity. To determine the settings that are appropriate for your site, adjust the Thresholds, and then perform detection tests.

8. Save and download the configuration changes to the receiver unit.

Network configuration

For BR100 units that use network alarm data communications, you must define the network type under the Network Cfig tab. The network configuration can be set only by using a direct USB connection between the UCM computer and the USB port on the unit.

1. Specify the type of alarm data network (Silver Loop, or Silver Star).
2. For the Silver Star (Ethernet) you specify the IP Address, the Subnet Mask and the Gateway IP Address (if required).
3. Save and download the configuration changes to the BR100 unit.
4. Repeat this procedure for the second BR100 unit.

Specify the Auxiliary I/O control mode

Specify the control mode for the BR100 unit (Local control or Remote control).

1. Select the Aux Cfig tab.
2. Use the Aux Control arrow to specify the control mode (Local or Remote).
3. Save and download the configuration changes to the BR100 unit.
4. Repeat this procedure for the second BR100 unit.

Auxiliary device/self-test input

In Remote Control mode, the AUX input is used to report the status of an auxiliary device to the security management system. In Local control mode, the input is used to activate an electronic self-test of the unit. The unit determines the input's status via an internal reference voltage, and the configuration of the contact closures and supervision resistors. Input contact closures must be voltage-free.

For Remote control mode, you define the input as normally open (NO) or normally closed (NC) with single resistor supervision, dual resistor supervision, or unsupervised. For Local control mode, the input requires a normally open unsupervised momentary switch input. The Filter Window parameter allows you to set the time period for which an input must be active before the unit reports an event, or activates a self-test. [Table 4](#) includes the selectable Remote Control input wiring configurations, and [Table 5](#) includes the selectable supervision resistor values.

Input option	UCM selection	Alarm relay	Supervision relay	R1	R2
unsupervised		NO	---	---	---
single resistor supervision		NO	NC	5.1 k	---
dual resistor supervision		NO	NO/NC	4.3 k	820
unsupervised		NC	---	---	---
single resistor supervision		NC	NO	5.1 k	---
dual resistor supervision		NC	NO/NC	5.1 k	820

Table 4 Selectable input configurations

R1 values (single resistor supervision)	R1 values (dual resistor supervision)	R2 values (dual resistor supervision)
820	1.1 k	820
1 k	2.2 k	1.1 k
1.1 k	4.3 k	2.2 k
1.2 k	4.7 k	3.3 k
1.5 k	5.1 k	5.6 k
2.2 k	5.6 k	
3.3 k		
4.7 k		
5.1 k		
5.6 k		

Table 5 Selectable resistor values

Input configuration procedure (Local control mode)

1. Select the Aux Cfig tab on the UCM window.
2. Set the Filter Window.
3. Save and download the configuration changes to the unit.
4. Repeat this procedure for the second BR100 unit.

Input configuration procedure (Remote control mode)

1. Select the Aux Cfig tab on the UCM window.
2. From the Supervision drop down, select the desired supervision scheme for the input.
3. Select the Resistor 1 value, if applicable.
4. Select the Resistor 2 value, if applicable.
5. Set the Noise Tolerance, if required.
6. Set the Line Drop, if required.
7. Set the Filter Window.
8. Save and download the configuration changes to the unit.
9. Repeat this procedure for the second BR100 unit.

Output relays

Output relay setup (Local control mode)

In Local control mode, the two relays are setup via the Local Aux Control Activation check boxes to report alarm and supervision conditions. The relays are then controlled by the BR100 unit to activate on the user-specified conditions. The relays remain active for an event's duration or for the selectable relay Active Time, whichever is longer.

Note	Senstar recommends that the relay outputs be configured to report Input Power Fail, and Fail Safe conditions, in addition to Microwave Alarms.
-------------	--

1. Select a relay (the parameters listed below a relay apply only to that relay).
2. Specify the Hold/Active Time parameter.
3. Specify the conditions from the Local Aux Control Activation field under which this relay will activate.
4. Repeat this procedure for the second relay.
5. Save and download the configuration changes to the BR100 unit.
6. Repeat this procedure for the second BR100 unit.

Output relay setup (Remote control mode)

Note

An external control relay may be required for some applications.

In Remote control mode, the relays are controlled by the security management system to operate auxiliary equipment as output control points (e.g., to activate lights, doors, sirens, CCTV equipment, etc.). You configure the relays response to commands from the host computer. You can configure the relays as steady ON, or in flash mode (ON-OFF-ON-OFF etc.) or in pulse mode (ON for a period, then OFF). For flash and pulse modes, the ON-OFF time duration is configurable.

1. Select a relay (the parameters listed below a relay apply only to that relay).
2. Select the type of relay Activation (steady ON, or flash mode, or pulse mode).
3. Select the Hold/Active Time parameter, if applicable.
4. Select the Inactive Time parameter, if applicable.
5. Repeat this procedure for the second relay.
6. Save and download the configuration changes to the unit.
7. Repeat this procedure for the second BR100 unit.

Receiver calibration

Once the BR100 transmitter and receiver are setup and configured, perform the receiver calibration.

CAUTION

Ensure that the microwave detection zone is not disturbed during the calibration process.

1. On the receiver's UCM Status tab, select the Recalibrate button.
The receiver performs a self-calibration.

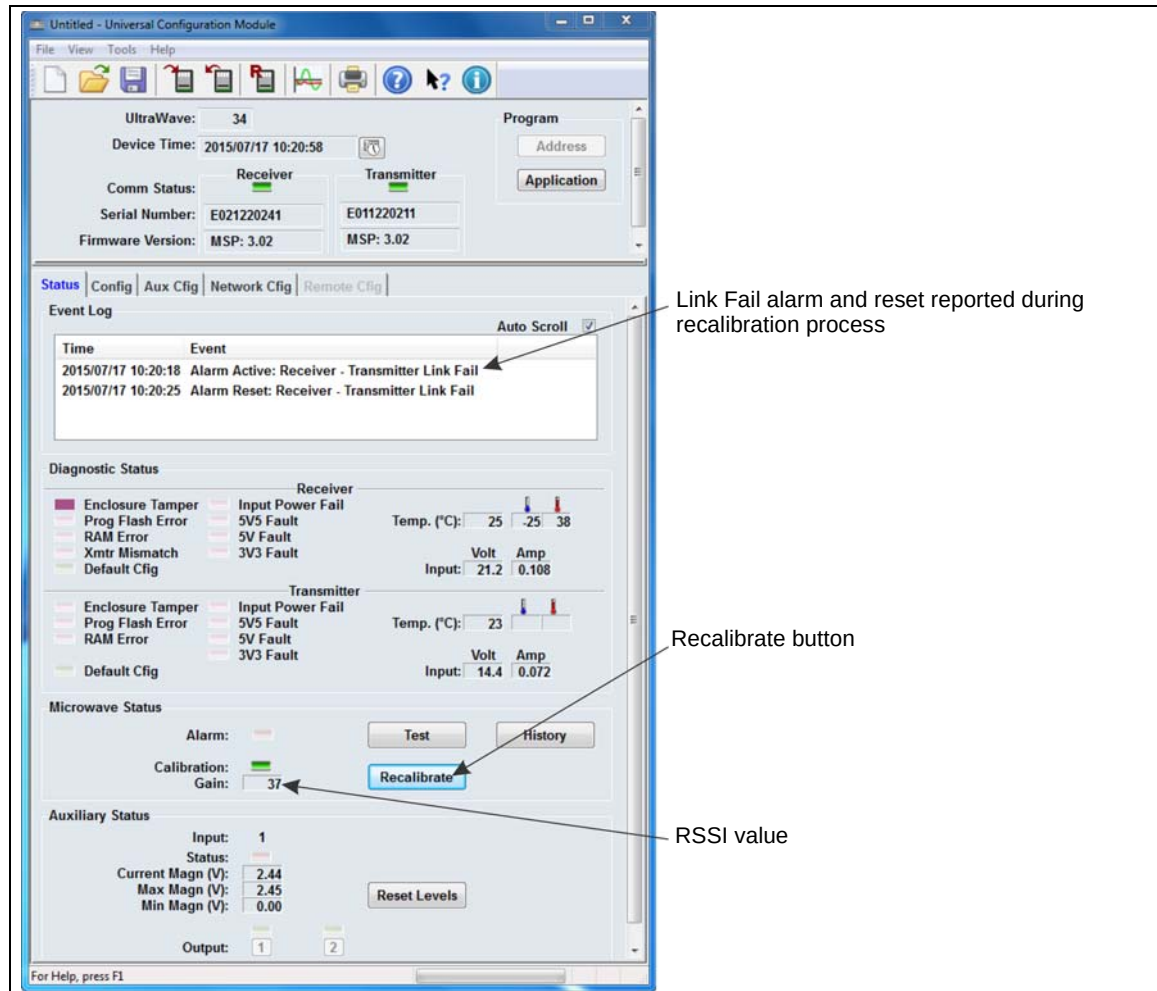


Figure 21 UCM Status tab

Optimizing the alignment

Typically, the initial alignment of the BR100 sensor provides a strong received signal and good detection sensitivity. However, it may be possible to improve the received signal by adjusting the transmitter and receiver units' alignment and mounting height.

Note	See Verifying the BR100 alignment on page 37 for information about using the UCM plot display to determine the received signal strength. The following procedure is best done with two people (one at the receiver and one at the transmitter). However, it can also be done by one person walking back and forth.
1. Connect the UCM to the receiver and select the Recalibrate button. Note the displayed RSSI value once the self-calibration is complete. 2. Verify that each unit is at the correct mounting height, and that they are both parallel to the ground and aimed directly at each other. 3. Adjust the mounting height and if required, the horizontal and vertical alignment of the receiver unit slightly to attain the maximum RSSI possible. 4. Measure the adjusted mounting height of the receiver and adjust the mounting height of the transmitter to 1/2 the change of the receiver's mounting height. 5. Adjust the mounting height of the receiver to the same height as the transmitter. e.g., For a receiver mounted at 95 cm the maximum RSSI is attained at an adjusted mounting height of 105 cm. Take the change in mounting height (10 cm) and divide by 2 (5 cm). Increase the transmitter's mounting height by 5 cm (to 100 cm). Reduce the receiver's mounting height to the same value as the transmitter (100 cm). 6. See if the receiver's RSSI can be increased by making minor adjustments to the receiver's mounting height and alignment. 7. Repeat step 6 for the transmitter unit. 8. After the final adjustments, select the receiver unit's Recalibrate button on the UCM. Once the self-calibration is complete, check the RSSI value to verify that it is at a higher level than the original value. A higher displayed RSSI value indicates an improved received signal strength.	
Note	Ensure that the final displayed RSSI value is greater than or equal to the initial RSSI value (step 1).

System verification tests

Once the setup and calibration procedures are completed, test and verify the BR100 sensor. The type of tests recommended to verify the proper operation of the BR100 system depends on the type of installation, and your site specific security requirements (see [Site design on page 5](#)). The following table lists the recommended types of tests and the levels of security to which they apply:

Test	Speed	high security	medium security	low security
log roll parallel to the beam and through the zone	Slow	✓	X	X
	Fast	✓	X	X
military style stomach crawl perpendicular to the beam and through the zone	Slow	✓	X	X
	Fast	✓	X	X
hands and knees crawl or duck walk (low crouch) through the zone	Slow	✓	✓	X
	Fast	✓	✓	X
upright walk	Slow	✓	✓	✓
upright run	Fast	✓	✓	✓

Table 6 Recommended tests

Running a UCM Response plot during the testing will provide a record of the test results along with an indication of the signal magnitude created by the test subject. Typically, the Crawl Target Threshold is exceeded first as the test subject enters the microwave field. The Upright Target Threshold may also be exceeded, depending on the type of test. [Figure 22](#) is a flow chart of BR100 calibration testing.

1. Start the UCM and establish a connection to the BR100 receiver.
2. Start a UCM Response plot.
3. Perform the tests recommended for your level of security while recording the plot.
If each test results in an alarm, use the current Threshold settings and monitor the system for nuisance alarms.
If the nuisance alarm rate (NAR) is acceptable use the current settings.
4. If any test does not cause an alarm, reduce the Crawl Target Threshold 1 level (500 units per level) and then repeat the tests.
If any subsequent test does not cause an alarm, reduce the Upright Target Threshold 1 level and then repeat the tests.
5. Continue this process until you get an alarm with each test.
6. When each test results in an alarm, use the current Threshold settings and monitor the system for nuisance alarms.
If the NAR is acceptable, use the current Threshold settings.

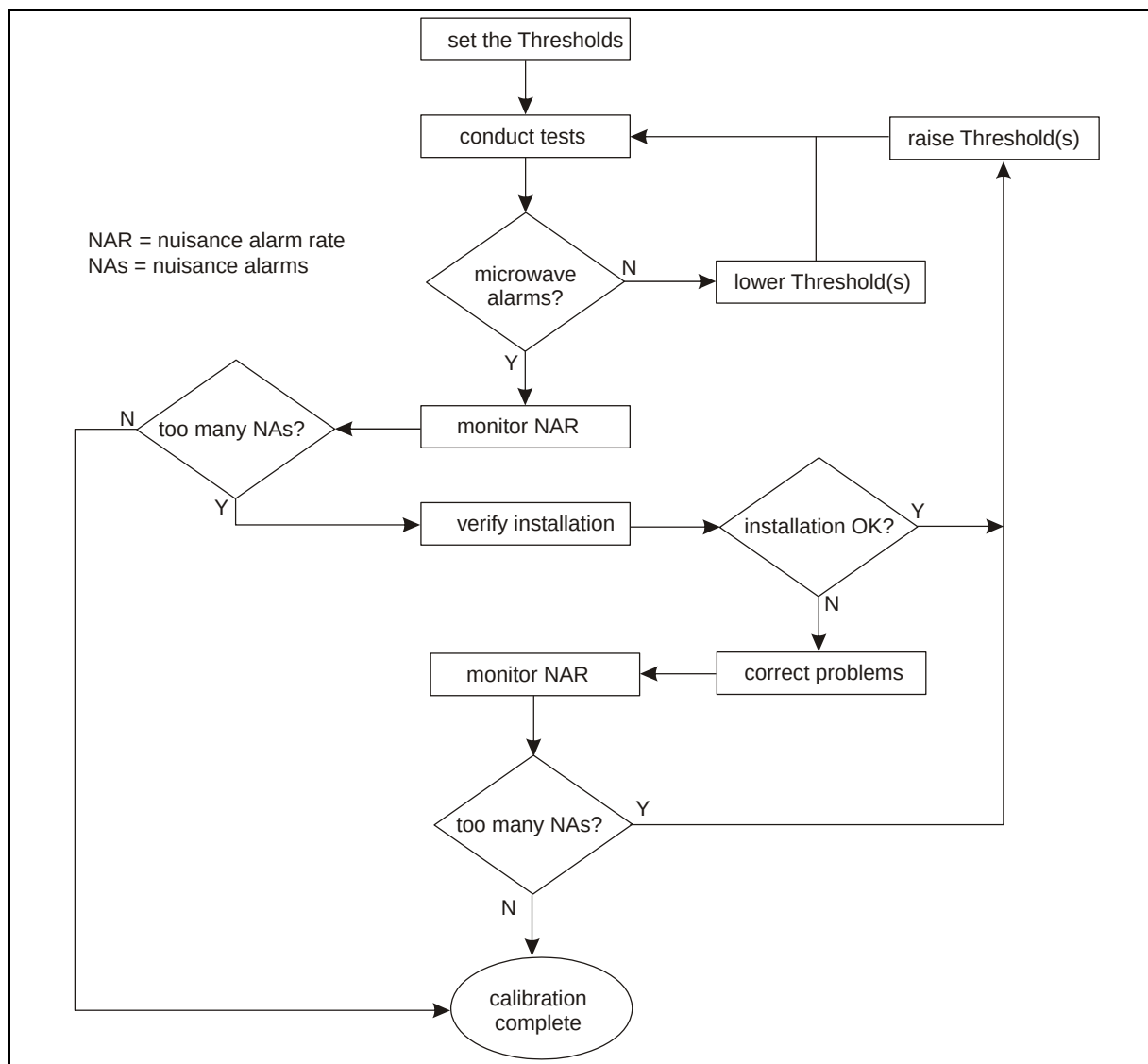


Figure 22 BR100 verification test flow chart

4

Maintenance

This section details the recommended BR100 unit maintenance, site maintenance and testing required to ensure proper operation.

BR100 unit maintenance

Twice per year following major seasonal changes, inspect and clean the microwave units:

- Use a soft damp cloth to wipe off the antenna covers.
- Verify the mounting hardware is tight and corrosion free.
- Ensure that the mounting post is firmly anchored and plumb.
- Open the enclosure and verify that there is no contamination or moisture inside.
- Ensure that all wiring connections are tight and corrosion free.
- Connect a PC running the UCM application and perform a recalibration of the receiver unit (select the Recalibrate button).

BR100 site maintenance

After major seasonal changes, and following periods of severe weather:

- Verify that there are no objects within the microwave zone, or inside the required area of clearance.
- Ensure that standing water cannot accumulate within the microwave zone (i.e., puddles) and that running water cannot flow through the zone.
- Check the line of sight to ensure there are no significant deviations from level grade, and that the microwave units are aimed directly at each other.
- Inspect the perimeter fences to verify that there are no access points that would allow ingress to small animals.

As often as site conditions require:

- Keep any vegetation within the microwave zone cropped to a maximum height of 7.5 cm (3 in.).
- For sites with significant snowfall, ensure that the snow is cleared to prevent the possibility of a burrowing intruder gaining undetected access.

BR100 testing

The amount and type of testing depend on your security requirements and installation.

- High Security Zone - detection of an intruder stomach-crawling perpendicular to the beam, and log rolling parallel to the beam.
- Medium Security Zone - detection of an intruder crawling on hands and knees.
- Low Security Zone - detection of an upright walking intruder (beam-break alarm).

To ensure the required level of detection, you should simulate the worst case scenario for your type of installation following the semi-annual recalibration (see [System verification tests on page 32](#)).

Beam-break alarm test

Depending on your site-specific security requirements, Senstar recommends conducting a beam-break alarm test:

- daily for high security applications,
- weekly for medium security applications,
- monthly for low security applications.

To conduct a beam-break alarm test, walk through the BR100 zone at any point in the zone. The test is successful if the receiver unit signals a microwave alarm in response to the test.

Remote self-test

If your BR100 system is configured for remote self-test, the self-test should be activated at least once per day.

For BR100 systems that operate in Local control mode, press and hold the momentary switch input for approximately two seconds (the switch must be closed for a minimum of the time specified in the Filter Window parameter). The self-test is successful if the receiver signals a microwave alarm.

For BR100 systems that operate in Remote control mode, use the security management system to activate the self-test input. The self-test is successful if the receiver signals a microwave alarm.

Note

The BR100 self-test verifies alarm communications. However, it does not verify antenna operation. Conduct a beam-break alarm test to verify the antenna operation of the BR100 units.

Correcting nuisance alarm problems

If a BR100 system is encountering a high nuisance alarm rate (NAR) you need to determine the source of the alarms and correct the problem. Begin by reviewing the site planning and design section in Chapter 1. Ensure that the installation recommendations have been followed, and the mounting height, mounting angle, and required area of clearance for the detection zone are correct.

After verifying that installation problems are not the source of the nuisance alarms, connect the UCM to the receiver unit and record a magnitude response plot. Review the plot to determine the signal levels at which the nuisance alarms are occurring and raise the Crawl Target Threshold to prevent the alarms. After adjusting the Threshold, repeat the recommended system verification tests to ensure adequate detection, and continue monitoring for nuisance alarms.

Verifying the BR100 alignment

If the BR100 sensor is encountering detection problems it is possible that one of the unit's may be out of alignment. The UCM includes a received signal strength indicator (RSSI) that indicates the signal strength at the receiver unit. Make minor adjustments to the alignment of both units to see if the RSSI can be increased.

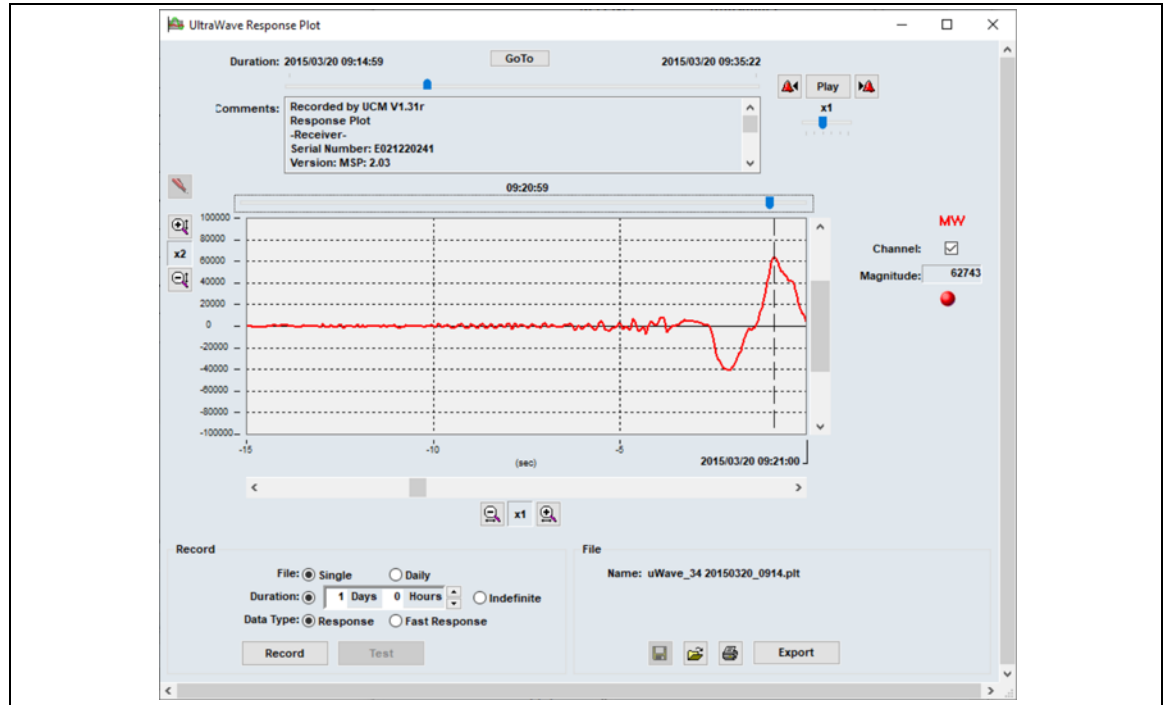


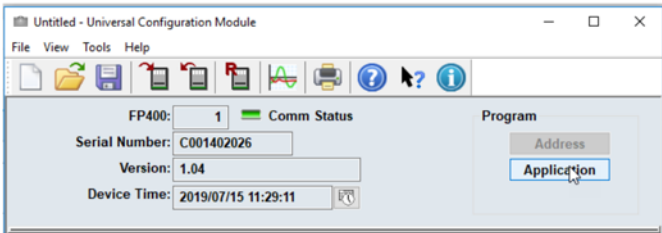
Figure 23 UCM response plot

1. Remove the cover from the receiver unit.
2. Connect the UCM and note the RSSI value.
3. Select the alignment plot and start recording.
4. Adjust the horizontal and vertical alignment of the receiver unit slightly to determine if the received signal can be improved. Recheck the RSSI level.
5. Adjust the horizontal and vertical alignment of the transmitter unit slightly to determine if the received signal can be improved. Recheck the RSSI level at the receiver unit.
6. Once the alignment is complete, connect the UCM to the receiver and select the Recalibrate button.
7. Verify that the RSSI is higher or the same as it was in step 2.
8. Replace the cover on the receiver unit, and conduct appropriate tests.

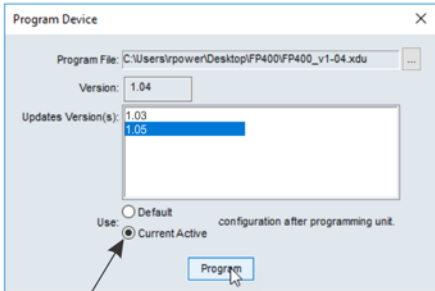
Updating the firmware

To update the BR100 unit's firmware, begin by establishing a UCM connection.

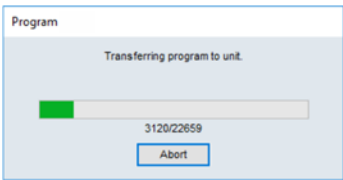
① In the Program field, select the Application button.



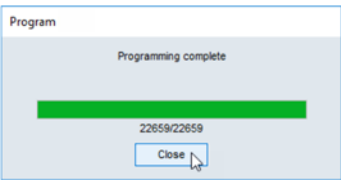
② Select the Browse button, then navigate to the location of the .XDU file.



③ Wait while the UCM downloads the .XDU file to the processor. Select abort to cancel the update.



④ Once the programming is complete, select Close.



To keep the processor's current calibration data select the Current Active radio button Select the .XDU file, and then select the Program button.

Figure 24: Updating the firmware

a

Specifications

General	Power consumption	• 1.2 W per unit (max.)
	Operating range	• 5 m to 100 m (16.4 ft. to 328 ft.)
	Beam width	• 20 cm to 4 m (8 in. to 13.1 ft.)
	Velocity response	• 3 cm/sec to 15 m/sec (1.2 in./sec to 50 ft./sec)
	Dimensions	• height - 15.6 cm (6.1 in.) • width - 15.5 cm (6.1 in.) • depth - 5.6 cm (2.2 in.)
	Mounting post size (OD)	• 4.8 to 11.4 cm (1 7/8 to 4 1/2 in.)
	Weight	• 0.34 kg (0.75 lb) each unit
Transmitter/Receiver	Operating voltage	• 12 - 48 VDC
	Microwave carrier frequency	• ETSI - 24.150 - 24.250 GHz • FCC - 24.075 - 24.175 GHz
	Detection zone length (max.)	• 100 m (328 ft.)
	Antenna pattern	• 3.5° (horizontal) • 3.5° (vertical)
	Operating temperature	• -40° to +70°C (-40° to +158° F)
	Output relays (2 per unit)	• 2 Form A (normally open) relay outputs 60 V @ 100 mA maximum, non-inductive load (the relays are held open during normal operation and close to signal an event or on loss of power)
	Auxiliary input (1 per unit)	• Local control mode - self-test input • Remote control mode - auxiliary device input to SMS

b

Parts list

Component	Part Number	Description
BR100 microwave sensor system		
BR100 sensor system	E5FG0101	BR100 transmitter and receiver pair
BR100 transmitter unit		
transmitter unit	E5EM0101	replacement transmitter unit
BR100 receiver unit		
receiver unit	E5EM0102	replacement receiver unit
BR100 accessories		
UCM	00SW0100	Universal Configuration Module software, Windows-based application, setup, calibration and diagnostic tool
UCM cable	GE0444	UCM interface cable, 3 m, USB (connects PC running UCM to microwave unit)
Network accessories		
Network Manager	00FG0220	Network Manager CD containing Network Manager software for the Silver, Crossfire, MX, VoE, and Sennet networks (Windows service)
Alarm Interface Module	00SN0230	Security Management System (Windows application) for use with Network Manager requires USB security key
BR100 documentation		
documentation CD	00CD0100	Universal documentation CD, includes BR100 product documentation