

# GIGASENSE® II

## Intelligent Microwave Anti-Collision System










USA and CANADA

Relay box program version: 4502-0244 B013 and higher  
Antenna box program version: 5:36 2016-03-09 and higher

## SYMBOLS USED

The following symbols are used throughout this documentation, and/or marked on the product:

	CAUTION. This symbol on the equipment indicates that the manual must be consulted. In this manual it appears before instructions, which if not followed, may result in product damage or improper function.
	CE-mark. Indicates that we as a manufacturer declare that this product is in conformity with all relevant CE-marking Directives.
	Class 2 alert sign. Radio equipment is subject to restrictions of use.
	Caution, risk of electric shock.
	Direct current.
	Class 3 equipment.
	Follow local regulations regarding recycling at disposal of this product. This product must be disposed of separately, and not with normal household waste. See separate section in this manual.

To ensure safe operation, this manual, together with applicable local user industry's safety rules and regulations must be followed. It is also essential to follow the applicable country law, safety regulations and directives relevant for the use of this product.

Warranty is not valid if any sealed screws are adjusted, or if any other modifications not described in this manual are made.

## SOFTWARE

Gigasense continuously improves and optimizes the GII system, therefore upgrades and updates of the software will be necessary. In the event of necessary upgrades and updates, it is the end users' responsibility to ensure that the upgrades and updates are carried out.

## Revision history:

Rev 000_2021-06-14:	First edition
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### *Appendix 1: Frequency data and working range – Countries*

### *Appendix 2: WARNING - MAINS SUPPLY*

**GENERAL – INTENDED USE**

GIGASENSE II is an Anti-Collision System designed for Overhead Travelling (EOT) cranes or other machinery running on a common set of rails.

In the most common case, where two EOT-cranes on the same track both need to be protected from collision, two units are needed. When the crane should be protected from running into a wall or track end, one complete unit (antenna and relay box) in combination with one unit consisting of only the antenna and power supply (no relay box is needed) is required.

The antenna is mounted with the center axis in the direction of movement, always pointing towards the opposite antenna. The relay box is mounted apart from the antenna, normally nearby the crane control functions.

Each unit works according to the SFCW (Stepped Frequency Continuous Wave) radar principle, sensing the relative speed and distance to the reflecting transponder in the opposite antenna. By using a modulated “fingerprint” reflection in the opposite antenna, the system is not disturbed by undesired echoes from surfaces on the crane and other metal parts.

The antenna is powered by the relay box and data from the antenna is continuously received, every 128ms. The relay box has three potential free relay contact outputs which are controlled by Limit 1 and Limit 2 for braking and stopping the crane movement. One output relay is used for internal fault monitoring. The relays are held active by the electronics and any exceeded limit or alarm of the function will make them trigger. Settings and readout of parameters are easily accessible via a display and push buttons in the relay box.

The internal fault monitoring is performed continuously. If the opposite unit has been turned off or has a power failure, the modulated reflection remains active. This is because each antenna has a backup receiver (rechargeable supercapacitor) for the modulating fingerprint reflection and will continue to work for about 6-12 hours (depending on the temperature). When the backup receiver has unloaded in a unit, the opposite unit still senses a signal from the beam or other metal parts of the crane, which triggers an alarm to stop the movement of the crane. For correct detection of this function, it is necessary to have a surface of metal with minimum 1 m<sup>2</sup> behind the antennas.

GIGASENSE II contains a Microwave transmitter. Although it has very low output power, this system must conform to the local regulations set up by the Telecom Authority in the user country. This equipment operates in the 9.9 - 10.6 GHz frequency bands. See appendix 1 for detailed information.

## CONSTRUCTION

The antenna is made of cast, stove-enameled Aluminum which can be separated into two parts, the Reflector, and the Antenna box (IP56).

The relay box contains a micro controller, output relays, terminal connections, display and push buttons. The housing is an IP66/67 standard polycarbonate enclosure. The terminal blocks have easy access by pushing a screwdriver to connect the wires.



Reflector



Antenna box



Relay box



### SAFETY INFORMATION AND WARNINGS

#### **VERY IMPORTANT:**

**THE ANTI-COLLISION SYSTEM GII UNIT A AND UNIT B MUST ALWAYS HAVE THE POWER TURNED ON, EVEN IF THE CRANE POWER IS SHUT OFF.**

**LIMIT 1 AND LIMIT 2 WILL ONLY WORK IF THE UNIT A AND UNIT B ARE POWERED ON, THE BACKUP SUPER CAPACITOR IS ONLY INTENDED TO WORK FOR SHORT POWER FAILURES.**

**CONNECT MAINS SUPPLY OF THE ANTI-COLLISION SYSTEM GII BEFORE THE MAIN CONTACT ON THE CRANE.**



**Important: One Antenna A-unit must always work with an Antenna B-unit.  
The relay boxes can be used with either A-units or B-units.**



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

#### FCC statements:

**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."**

#### IC Statements:

**This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.**

**Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement**

- Pay attention to turn off all power before opening the antenna and relay unit. In some certain cases described in this manual, it is allowed to have the lid open while the system is working, but connections to the relays **MUST** be isolated or disconnected from hazardous voltage!
- It is only allowed to open the units in a controlled environment, for example during installation and maintenance. A controlled environment is when temperature is between 5° and 40°C, and max. relative humidity is 80% (up to 31°C, decreasing linearly to 50% at 40°C).
- Turn off all power if any work is to be done on the system. The GIGASENSE II is powered with 24VDC.
- Electrostatic discharge (ESD): be careful when opening the lids of the antenna box and the relay box.
- Microwave radiation: Within 5cm of the antenna output, the power density of the microwave radiation may exceed 10W/m<sup>2</sup> but is never more than 20 W/m<sup>2</sup>.
- Safety mechanisms must not be bypassed without evaluation of the risk assessment.
- Supplementary protective measures may be required based on the risk assessments for the application.
- If the system is operated in conjunction with other components, the corresponding user information must be followed.
- All external connections from this system must only be made to Class III. equipment/circuits. Only the relays are allowed for connections up to 250VAC.
- The installation of the system must be performed by authorized technical personnel.
- The system must be taken out of operation in the event of damage.
- The personnel who work, install, and operate the system are responsible for understanding the function and installation prescriptions described in this manual. If any questions or uncertainties occur, Gigasense AB must be informed before the system is put in operation.
- A correct assembly and alignment of the system is essential for the correct operation of the system.
- A correct function must be verified before the system is put in normal operation.
- The lids of the antenna box and the relay box must not be opened during operation. When adjusting, testing performance or logging data from the RS232 output, it is allowed to run the system without the lid of the relay box. **No hazardous Voltage connections to the relays are allowed!**

- If this equipment is used in a manner not specified in this manual, or by Gigasense AB personnel, protection or function normally provided by this equipment may be reduced.
- The analogue 4-20 mA output must **not** be used for decisions such as braking and stopping the crane. The analogue output is only intended for indication such as distance display via a remote display.

## SPECIFICATIONS

- Type designation: GII.
- Alarm limits' distance: 2 - 40m, the maximum working range varies for different frequencies from 25m to 50m due to restricted output power (EIRP, see appendix 1.
- Accuracy of limits: +/- 1m. To achieve 1 m accuracy for different speeds, the function SPD (Speed compensation) can be necessary to use.
- Sample frequency of the SFCW radar measurement: 128 ms.
- Speed range: 0.05 - 5 m/s relative speed between the cranes.
- Speed dependence: The alarm limits can be compensated (20 - 1500%) according to different speeds. *Minimum value is 10%.*
- Relay outputs: 3 switching potential free relay contacts (max. load 250VAC / 8 A). The Relay outputs are used for braking and stopping the crane movement and correspond to the alarm limits, Limit 1 and Limit 2. The third relay output is used for the failure alarm.
- The Limit 1 output relay can be given a pulsing function suitable for a warning lamp.
- Analogue output 4-20 mA: for example, a remote display, corresponding to the distance between the units. 4 mA = 2 m and 20 mA = 40 m (maximum range, see appendix 1). Normal load 250 Ohms. The output must **not** be used for decisions.
- Supply Voltage complete system: 24 VDC.
- Supply Voltage antenna box (should be powered via relay unit): 12 VDC.
- Supply Voltage Transponder unit: 12 VDC.
- Power consumption Antenna/Transponder unit: 200 mA.
- Power consumption Relay box: 100mA.
- Permitted ambient temperature: -25 ... +70 °C.
- Degree of protection: IP66/67 (Relay unit), IP56 (Antenna unit).
- Relative humidity: 10 to 80% (no condensation).
- Max. altitude: 2000 m.
- Transmitter frequency: 9.9 ... 10.6 GHz, see appendix 1.
- Radiated power defined as EIRP, see appendix 1.
- SFCW (Stepped Frequency Continuous Wave), see appendix 1.
- Dimension's antenna (H x W x D) 443 x 359 x 294 mm & weight 4.0 kg.
- Relay box (H x W x D) 175 x 125 x 75 mm 0.8 kg.
- GROSS WEIGHT/DIMENSION: 1 system incl. packing (Unit A + Unit B) = 12.5 kg / 370 x 370 x 330 mm.



Options:

- Parameter setting program, to set parameters and download/upload parameters via a PC. Cable with Molex RS232 connection required.
- Power supply box 100- 240 VAC (or other required voltages).
- Transponder Unit A or Unit B (crane to be protected from track end or wall).  
The Transponder Unit works against an active unit with relay box.
- Power bank backup of the modulated "fingerprint" reflection.
- Supplied cable pre-connected in the antenna box (max. 30m), ordered per meter.

#### **SAFETY & ENVIRONMENT**

- Protects property and production.
- Designed to work in the toughest conditions such as in steel works, harbors, mines etc.
- Fail Safe operation thanks to supervision of function, both in antenna box and relay box. The antenna unit is supervised by a watchdog. The relay box automatically puts the system in failure mode (all three relays in alarm position) if data is not received from the antenna box.
- The signal is very hard to disturb, the A- and B- units use different frequencies, different polarization of the Microwaves and a "fingerprint" radar reflection. The "fingerprint" radar reflection function has a backup super capacitor in case of short power failures.
- The Anti-Collision System is not disturbed by rain, dust/metal particles, fog, or sunlight.

#### **FUNCTION – two moving cranes**

By using SFCW (Stepped Frequency Continuous Wave) radar technique, the distance and relative speed are calculated.

The modulated (fingerprint) reflection to the opposite unit is made by a diode in the microwave head. The diode oscillate with 16 kHz. As long as the diode oscillates, the opposite unit recognize the unit.



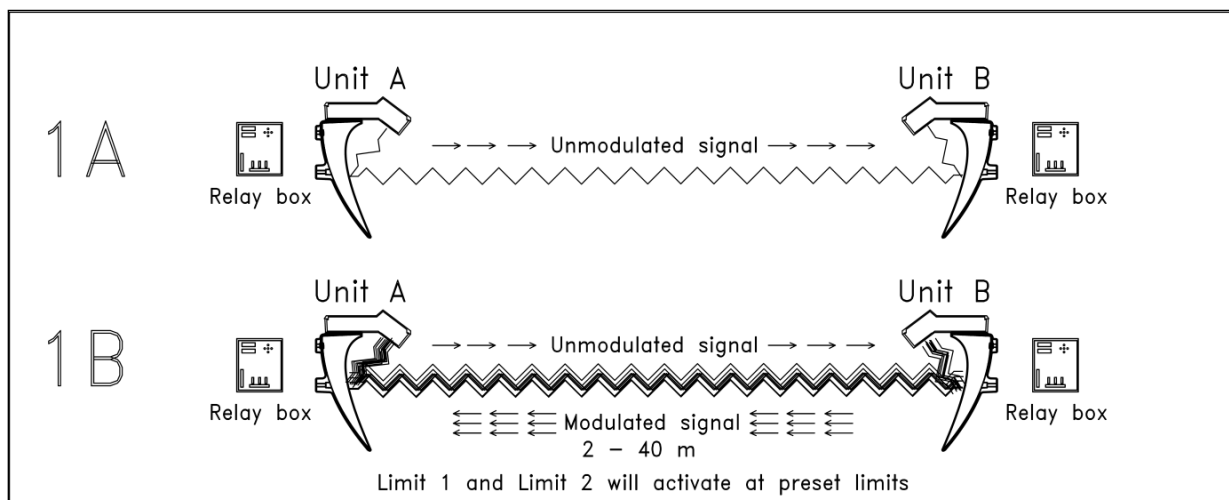
**NOTICE!** The maximum range is given as 40 m in the illustrations below. The range varies for different frequencies from 20 m to 50 m due to limited allowable output power (EIRP), see appendix 1.



The range is the distance between the Unit A and the Unit B, when the units having contact (signal) with each other. The limit 1 and limit 2 can be set in this range.  
If the distance between the Unit A and Unit B is longer than the range, the system "waits" for the signal from the opposite unit, therefore the distance between the Unit A and Unit B can be much longer than the range.

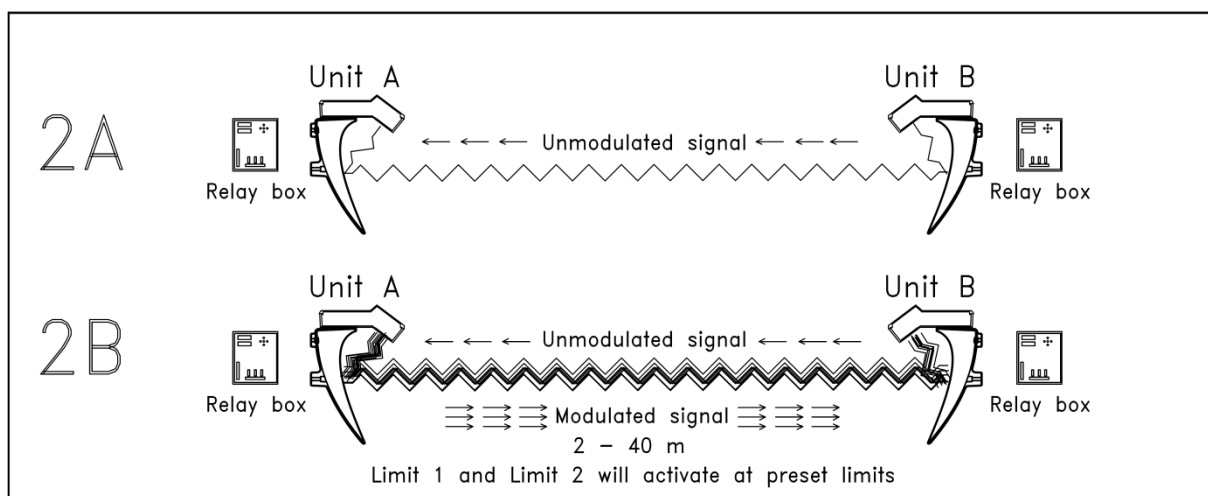
#### **Principle of the modulated signal (fingerprint) reflection in the Gigasense II system:**





**Figure 1A.** Unit A transmits an unmodulated Microwave signal to Unit B.

**Figure 1B.** Unit B modulates the Microwave signal and Unit A receives the modulated reflection. The modulated (fingerprint) reflection to the active unit is made by a diode in the microwave head in the opposite unit. The diode oscillates with 16 kHz. As long as the diode oscillates, the opposite active unit recognizes the unit.

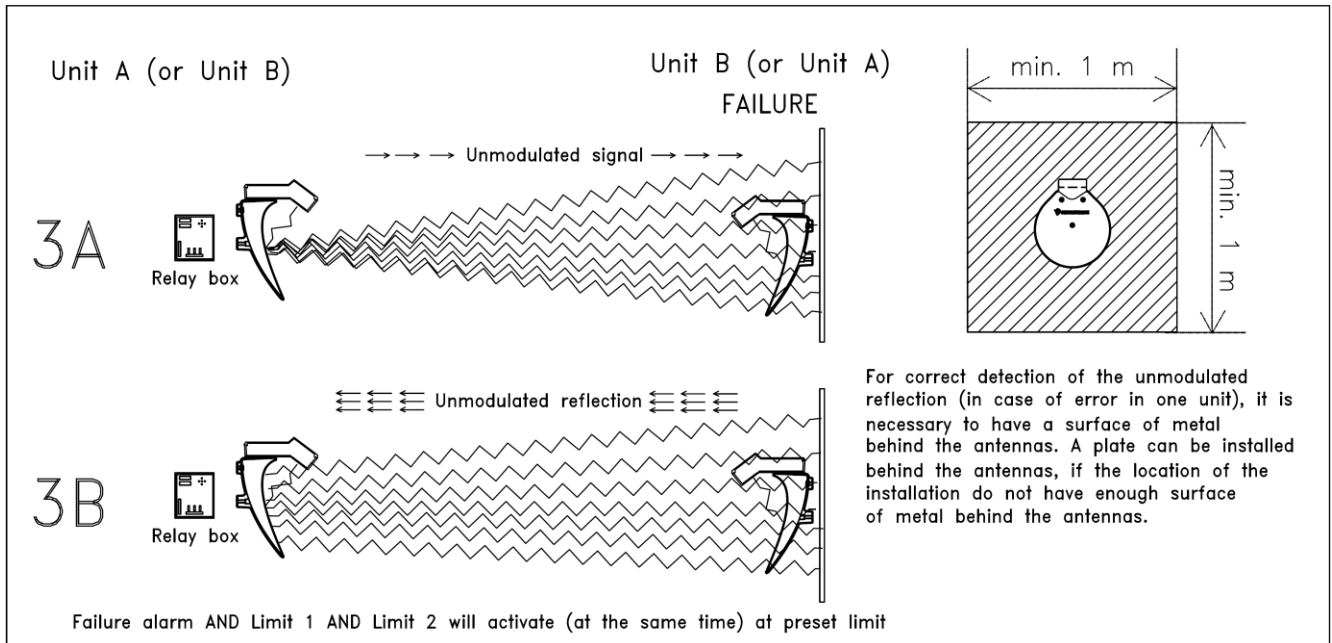


**Figure 2A.** Unit B transmits an unmodulated Microwave signal to Unit A.

**Figure 2B.** Unit A modulates the Microwave signal and Unit B receives the modulated reflection.

The Unit A and Unit B work independently of each other and continuously transmit their respective signals. When the units are in range for the modulated reflection, the Limit 1 and Limit 2 will activate at preset alarm limits.

### Principle of the unmodulated signal reflection in the Gigasense II system:



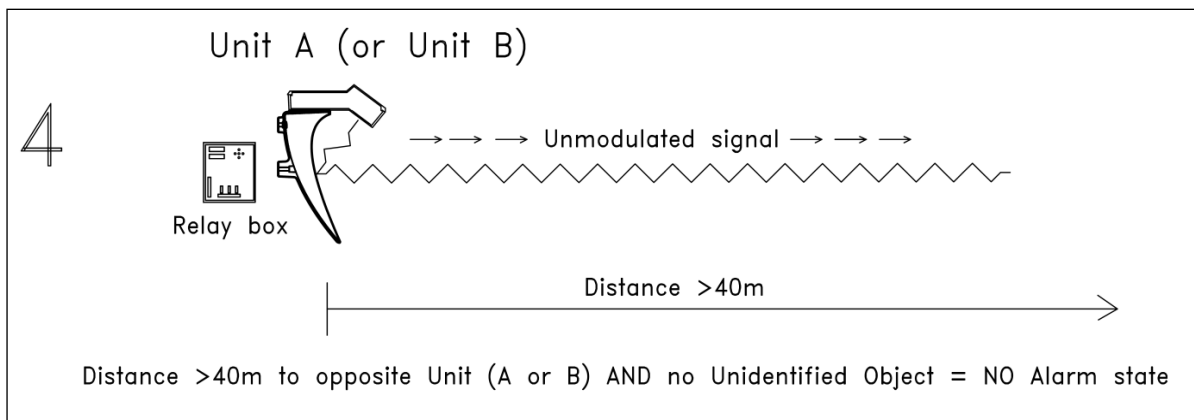
**Figure 3A.** Unit A (or Unit B) transmits an unmodulated Microwave signal towards the unidentified object.

**Figure 3B.** The Microwave signal is reflected unmodulated by the unidentified object and received in the Unit A (or Unit B) where it triggers an alarm.

Unmodulated signal reflection can occur when an identified object is suddenly detected in front of the antenna, if one unit (A or B) malfunctions or if unit (A or B) has power failure (the super capacitor is discharged after approx. 6-12 hours)

### DISTANCES OVER 40 METERS

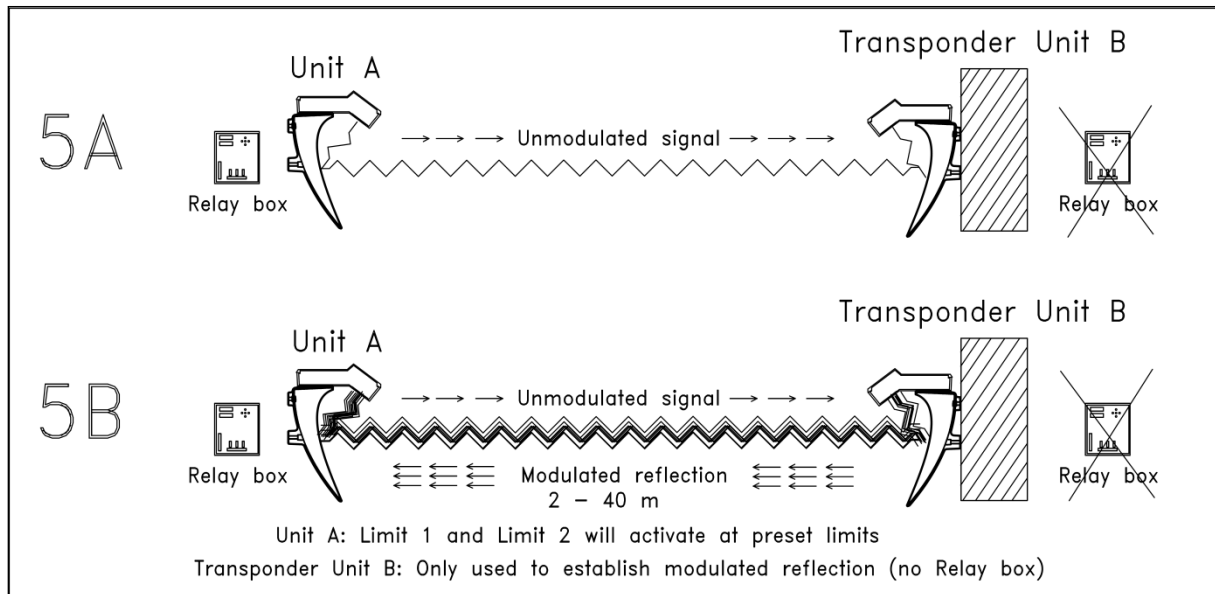
(see appendix 1 for working range details)



**Figure 4.** If the distance between unit A and unit B is over 40 meters and no unidentified object is present, unit A and unit B is in NO alarm state.

### FUNCTION – one moving crane

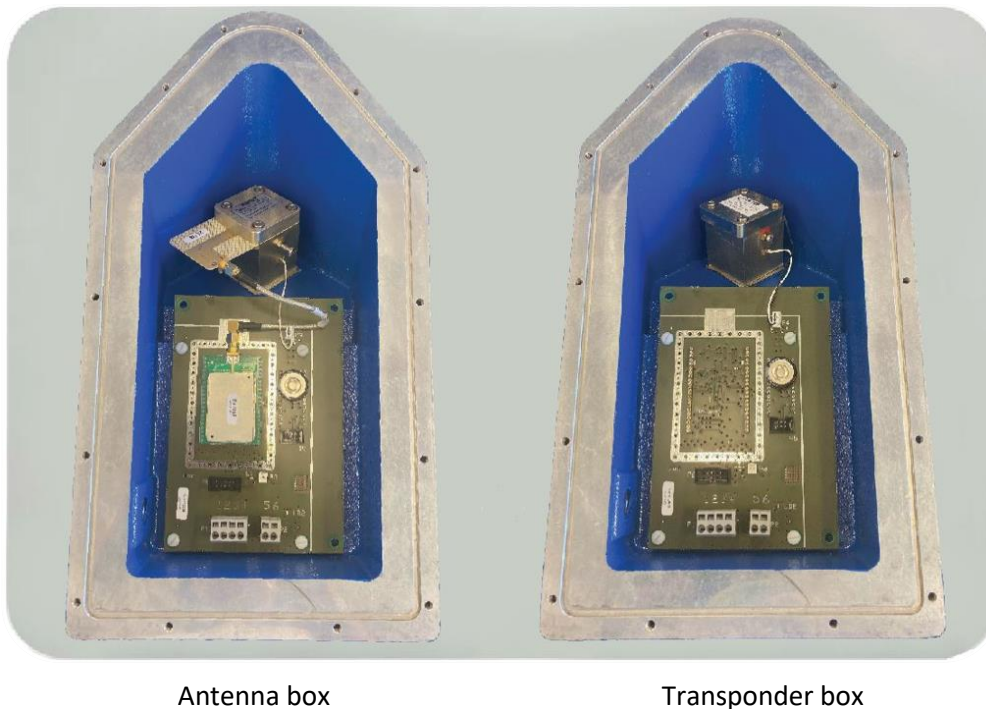
If there is only one moving crane to be protected from running into a wall or a track end, the configuration with one complete unit A and one transponder unit B can be used. The modulated (fingerprint) reflection to the active unit is made by a diode in the transponder microwave head. The diode oscillate with 16 kHz. As long as the diode oscillates, the opposite active unit recognize the unit.



**Figure 5A.** Unit A is a complete system with relay box. Unit A transmits an unmodulated Microwave signal to Transponder Unit B (no relay box needed).

**Figure 5B.** Transponder Unit B (without relay box) modulates the Microwave signal, Unit A receives the modulated reflection.

When unit A is in the range for the modulated reflection, Limit 1 and Limit 2 will activate at preset limits.



## INSTALLATION

The location and alignment of the antennas is important, the location of the Relay boxes is not critical. The antennas must be placed opposite of each other. The reflector has three fitting holes suited for 8 mm bolts (not included in delivery).

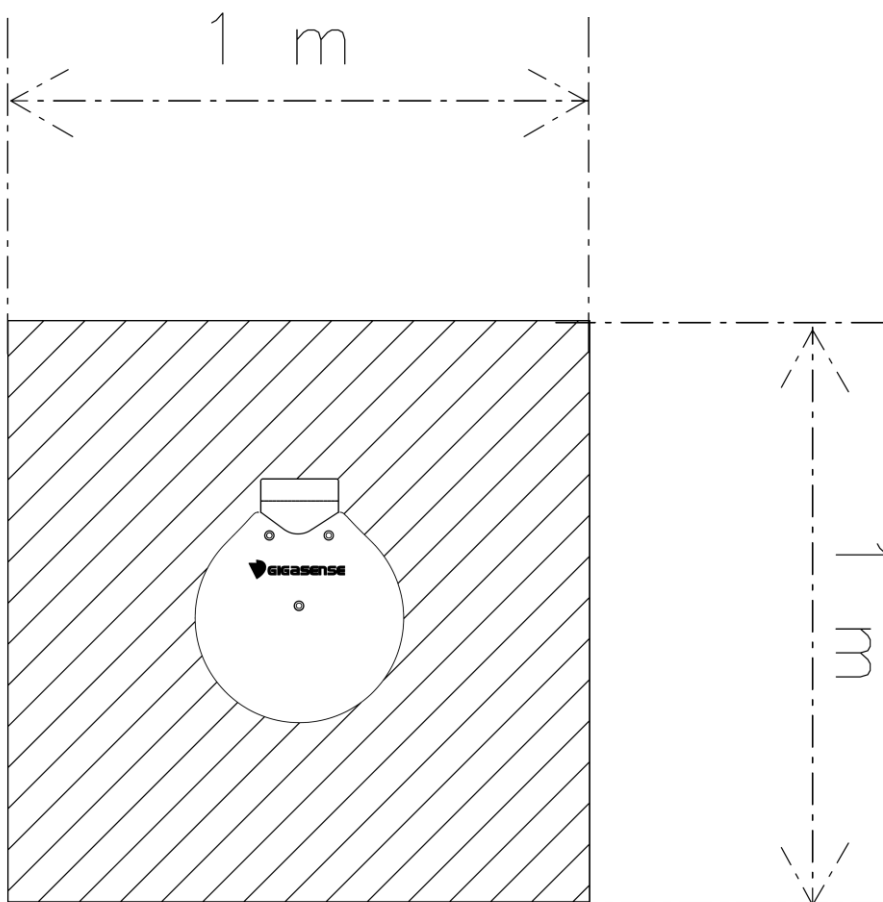
A good location is often the barrier of a platform or a ladder, the barrier of the girder etc. provided that they are rigid and not resonant when the crane moves.



**If the crane has the ground/earth terminated to the crane construction, the GII antenna (reflector) shall be isolated by rubber bumps or equal, when fixed with the three bolts in the crane.**



**For correct detection of the unmodulated signal reflection (in case of error in one unit), it is necessary to have a surface of metal with minimum 1 m<sup>2</sup> behind the antennas. A plate of 1 m<sup>2</sup> or larger can be installed behind the antennas, if the location of the installation do not have enough surface of metal behind the antennas. See figure below.**



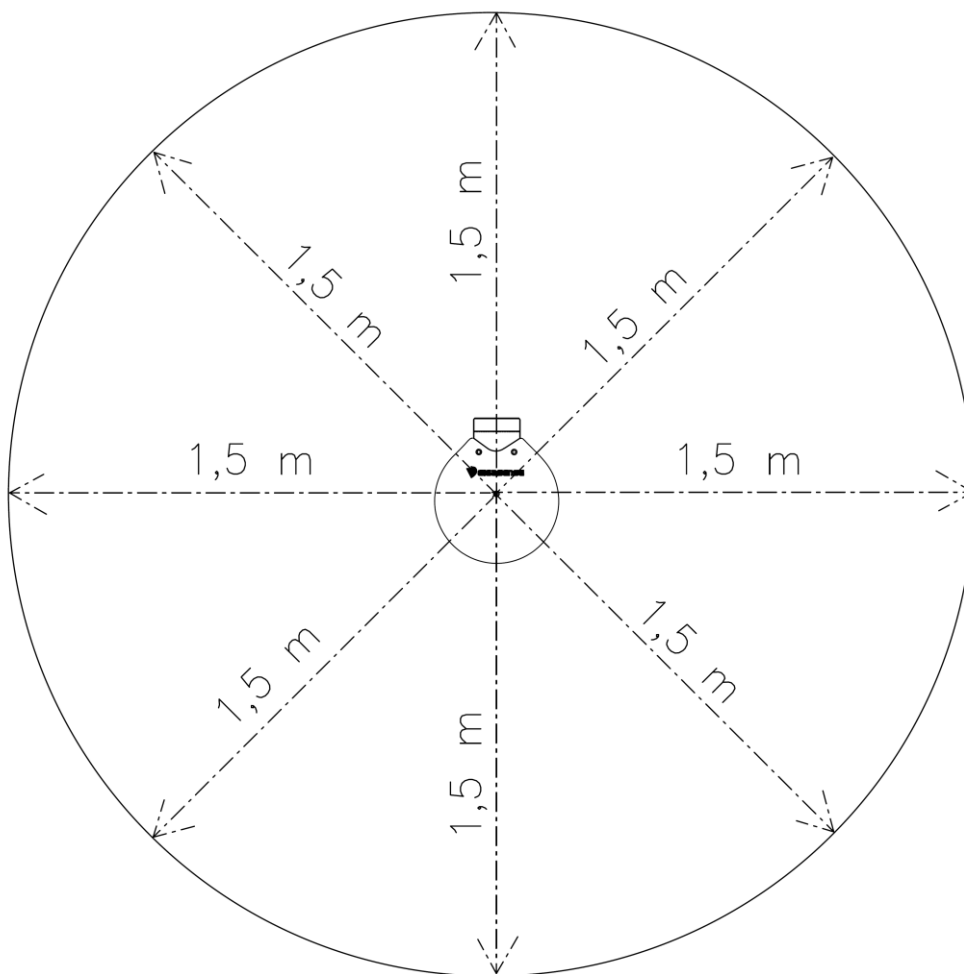
To have easy access to the antenna box is also recommended.

The antennas are to be mounted with their main-beam axis parallel to the crane travelling direction, and free from other fixed or moving objects within a radius of 1,5 m from the main-beam axis center.

The moving trolley or trolley cables must not cross the antenna beam.



**1,5 m free space around the antennas is necessary, both at the location for installation and along the crane travelling track, to get correct transmitting/receiving of the microwaves. See figure below.**



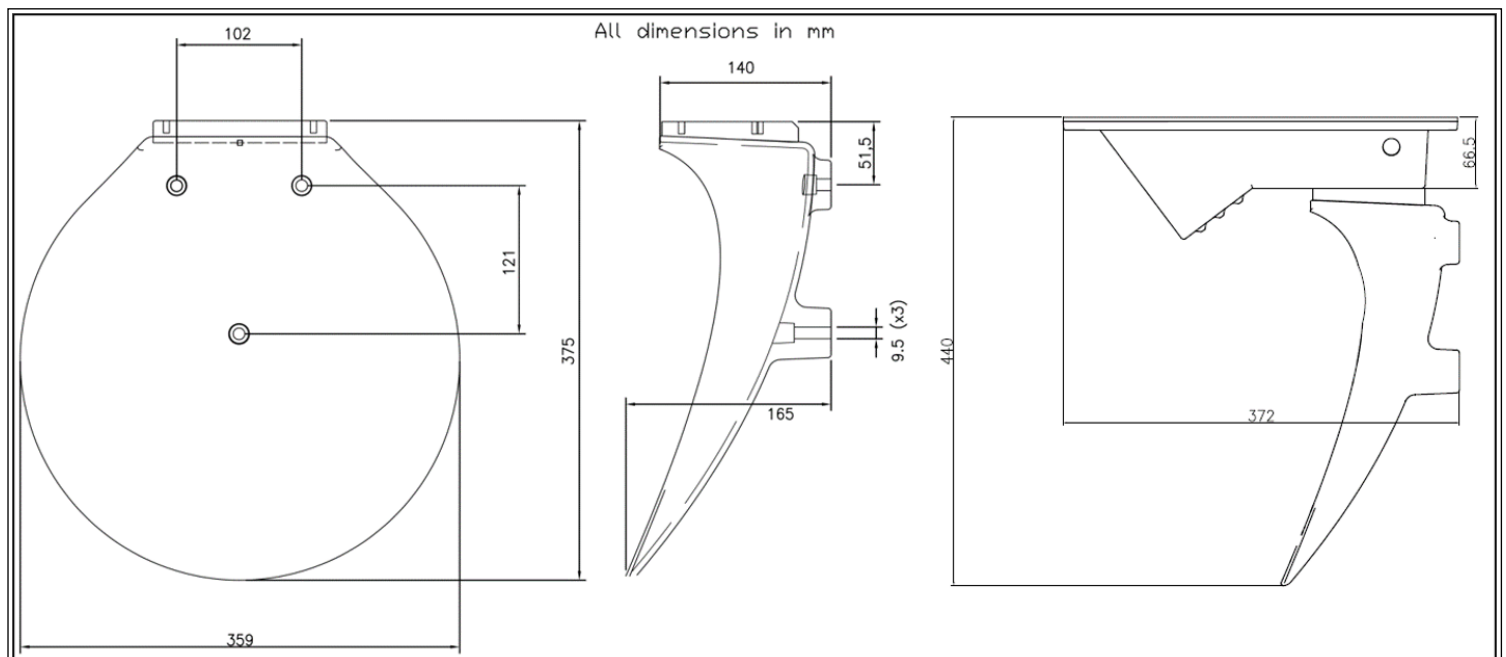
It is suitable to have the cranes close to each other when installing the antennas. To adjust the alignment of the antennas, washers or nuts can be used on the backside of the reflector (mounted on the three 8mm bolts). A laser water level pointer is a good tool to help up the alignment.

### Tools for the alignment procedure:

- A laser water level pointer
- A quick grip tool



### Dimensions of the antenna:



## INSTALLATION - ALIGNMENT PROCEDURE

### **REFLECTOR no. 1:**

#### **Step 1 (reflector no. 1)**

Fit the reflector no. 1 on the crane with three 8 mm bolts. Use a water level indicator to align the reflector (see figure 1).



Figure 1

#### **Step 2 (reflector no. 1)**

Use two of the assembly hex screws (intended for the antenna box) mounted on the reflector no. 1 to support and align the laser water level pointer (see figure 2).

Check the alignment of the reflector no.1. Use washers or adjust the nuts if needed to align correctly (see figure 3).



Figure 2

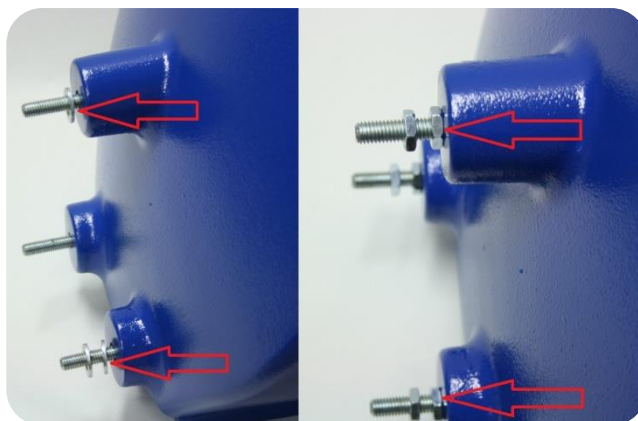


Figure 3



**Step 3 (reflector no. 1)**

Fit a piece of white A4 paper sheet on the other crane (or on the wall if a transponder unit is used), indicating the laser point from the laser water level pointer in the middle.

Run the cranes apart from each other and check that the laser point stays within the A4 paper sheet. Add/remove washers or adjust the nuts to align reflector no. 1 if needed.

Do not remove the laser water level pointer from reflector no. 1 yet!

**REFLECTOR no. 2:****Step 4 (reflector no. 2)**

Run the opposite crane close to the crane with the installed reflector no. 1.

Install the reflector no. 2 in the position indicated from the laser water level pointer (fitted on reflector no. 1). see figure 4.



Figure 4

**Step 5 (reflector no. 2)**

Use the water level indicator to align reflector no.2 (see figure 5).



Figure 5

### Step 6 (reflector no. 2)

Use two of the assembly hex screws (intended for the antenna box) mounted on the reflector no. 2 to support and align the laser water level pointer (see figure 6).

Check the alignment of the reflector no.2. Use washers or adjust the nuts if needed to align correctly (see figure 7).



Figure 6

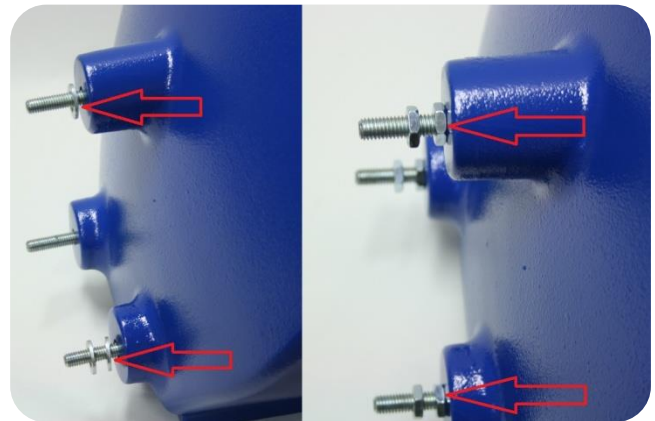


Figure 7

### Step 7 (reflector no. 2)

Run the cranes apart from each other and check that the laser point stays in the area of the opposite reflector no 1.

Add/remove washers or adjust the nuts to align the reflector no. 2 if needed.

### Step 8 *Final alignment of the reflectors to achieve the strongest possible signal* **This is a VERY IMPORTANT step!**

**Apply a washer (thickness 1 mm) on the left assembly point of reflector no. 1 and reflector no.2, alternatively adjust the nut on the left assembly point 1mm. (see figure 8)**

The Microwave spread is slightly to the left when the reflectors are pointed straight in line to each other. To achieve the strongest possible signal and to maintain the signal if the cranes are turning slightly along the rails, the reflectors should be aligned about 1,5 degrees to the right.

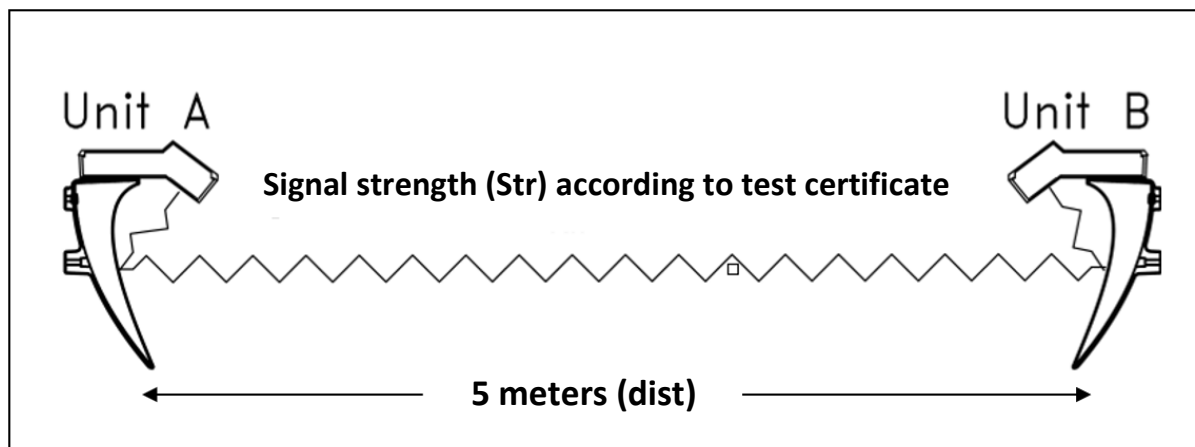
See figure 9 and 10, showing the Microwave spread.



Figure 8

### Step 9 Final control of signal strength.

Check that the reference value for the signal strength (Str) is reached according to the supplied test certificate. Position the cranes so that you can read 5m distance (dist) in the relay box. If the signal strength is lower than what is stated in the test certificate, the antennas need to be redrawn.



Microwave transmitting spread from A-unit to B-Unit and from B-Unit to A-Unit **with** a 1 mm washer assembled (see figure 9).

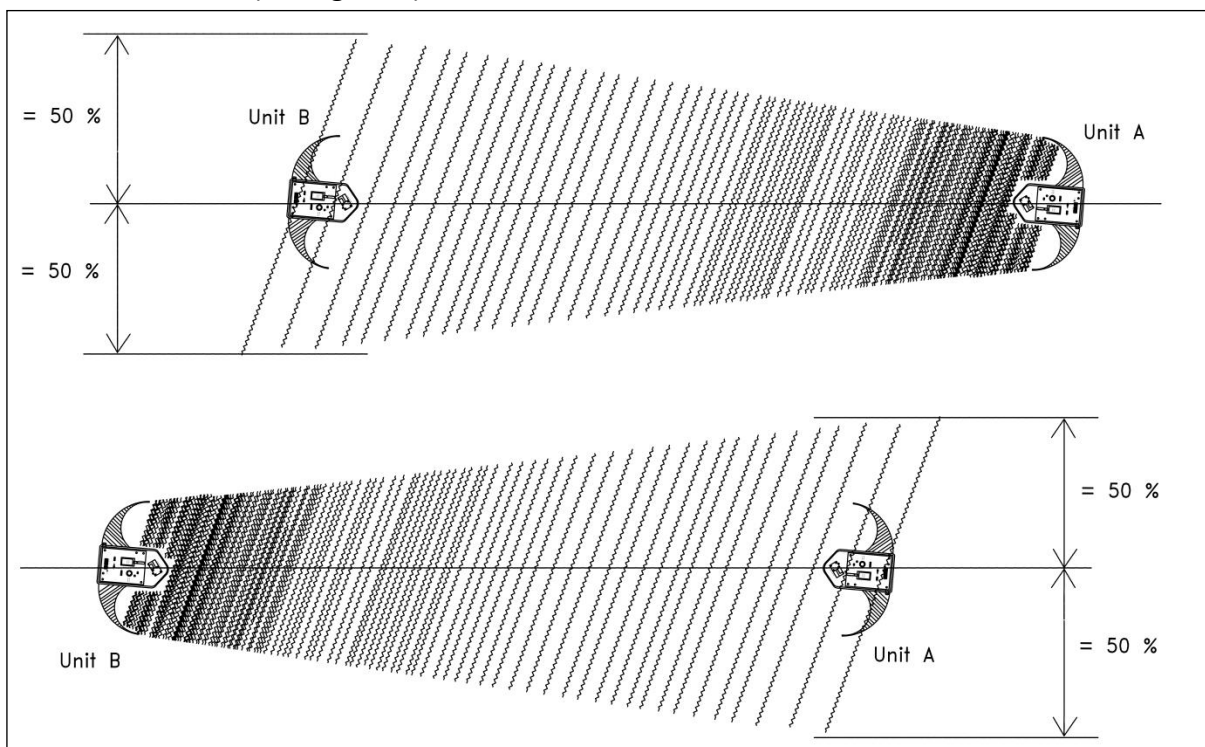


Figure 9

Microwave transmitting spread from A-unit to B-Unit and from B-Unit to A-Unit **without** a 1 mm washer assembled (see figure 10).

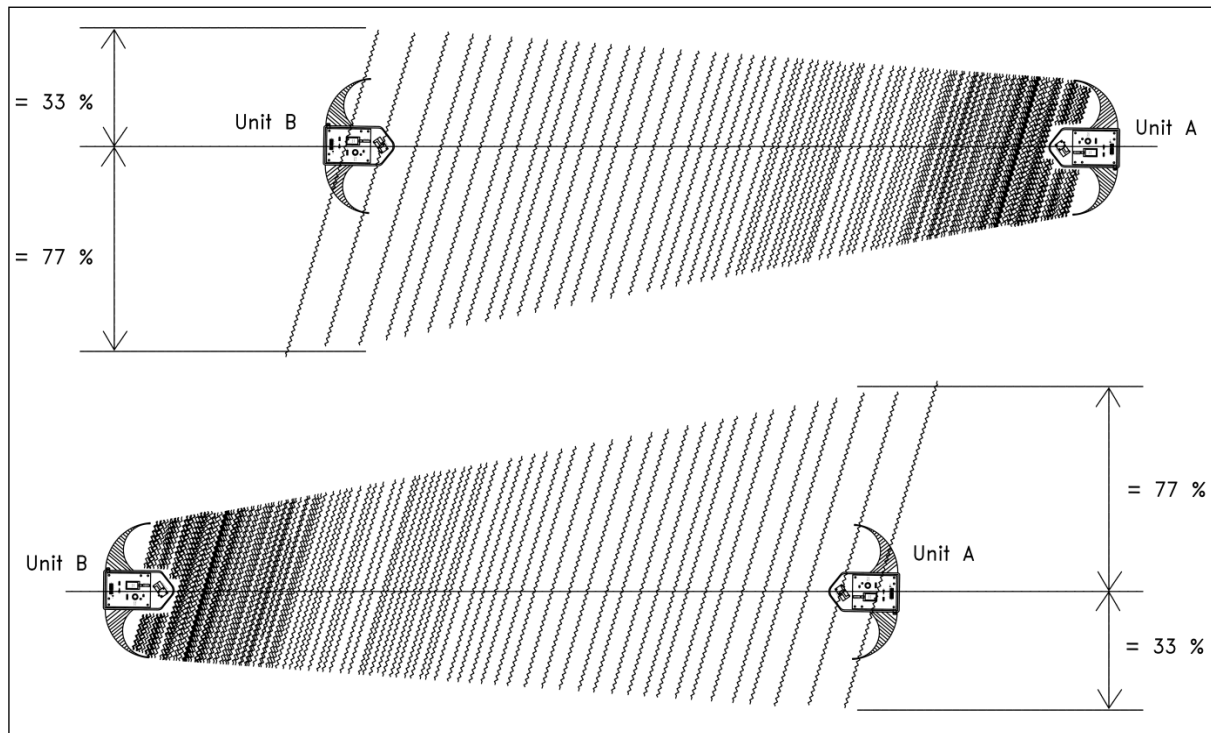


Figure 10

## INSTALLATION - WIRING



TURN OFF THE POWER SUPPLY (MAINS SUPPLY) BEFORE WIRING.

WIRING IS ONLY ALLOWED TO BE PERFORMED IN A CONTROLLED ENVIRONMENT AND BY AUTHORIZED PERSONNEL.

### Connection of the cable between the antenna and the relay box

Use a 4 - 6-wire cable approx. 0.5 mm<sup>2</sup> (stripped 8 - 9 mm), outer Ø 5 - 10 mm, max. cable length 30 meters. The lowest temperature rating for the cable should be 80 °C. The cable must be double shielded.

A 6-wire cable is required when installing battery backup (optional).



**The cable must have the same characteristics as ALPHA WIRE part number B955064. For full system performance and EMC class, it is very important to use equivalent cable and at least 5 meters cable length.**

As an option, cable can be ordered in any length (max. 30 meters) and is then pre-installed in the antenna box from the factory.

### Cable connection in the antenna box.

1. Measure 120mm cable.



2. Expose the cable sheath (10 mm).



3. Release 80mm of the conductors but keep the remaining cable sheath.



4. Place the cable in the screw connection until the screen reaches the contact position, see picture below.

**This step is important for the cable shield to have contact with the screw connection. Proper installation is also important to maintain the approved level of EMC radiation.**



5. Tighten the dome nut 11 Nm.
6. The screws for the antenna lid must be tightened by 2Nm.

### Cable connection in the relay box.

Mount and secure the cable to the relay box and connect it to terminals in the relay box (see chapter "Connections of the relay box").

The cable shield must be connected to the cable gland in the antenna box.

The relay outputs can be connected in Normally Open (NO) contacts or Normally Closed (NC), contacts depending on type of crane, see note in the connections for the relay box.



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**INSTALLATION - POWER SUPPLY****VERY IMPORTANT:**

**THE ANTI-COLLISION SYSTEM GII UNIT A AND UNIT B MUST ALWAYS HAVE THE POWER TURNED ON, EVEN IF THE CRANE POWER IS SHUT OFF.**

**LIMIT 1 AND LIMIT 2 WILL ONLY WORK IF THE UNIT A AND UNIT B ARE POWERED ON, THE BACKUP SUPER CAPACITOR IS ONLY INTENDED TO WORK FOR SHORT POWER FAILURES.**

**CONNECT MAINS SUPPLY OF THE ANTI-COLLISION SYSTEM GII BEFORE THE MAIN CONTACT ON THE CRANE.**



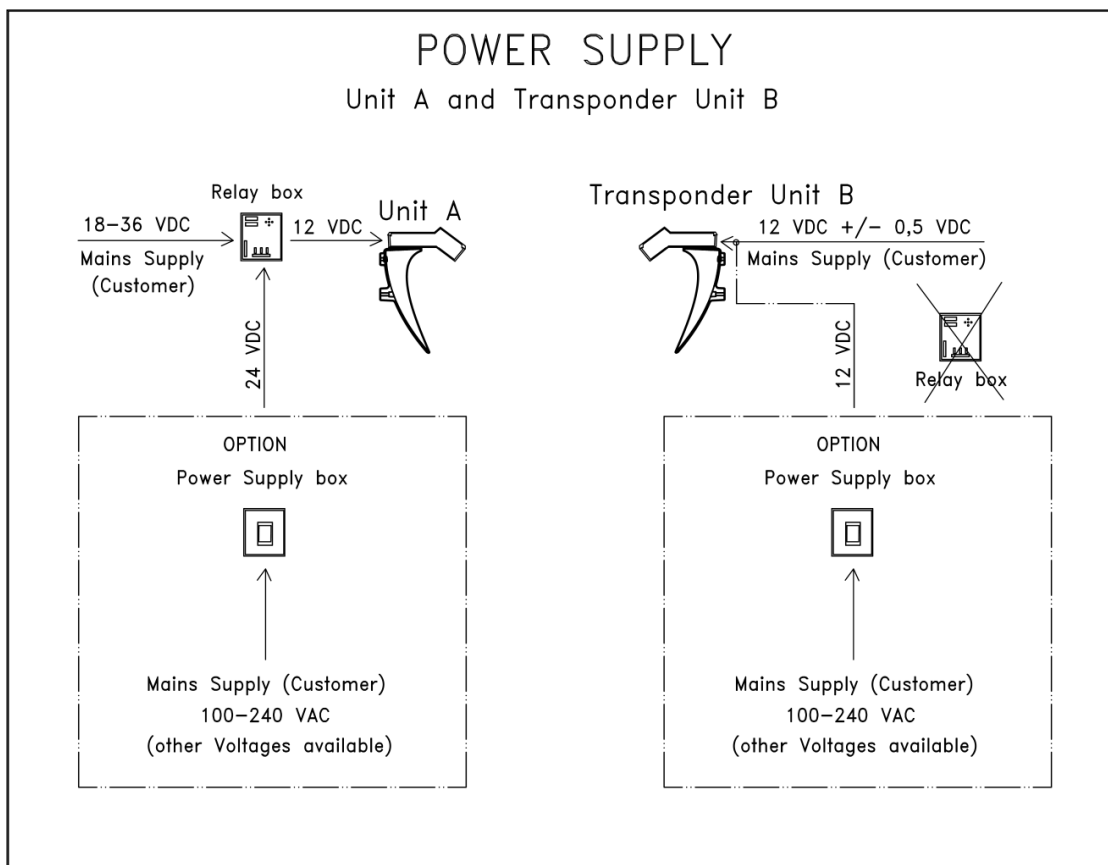
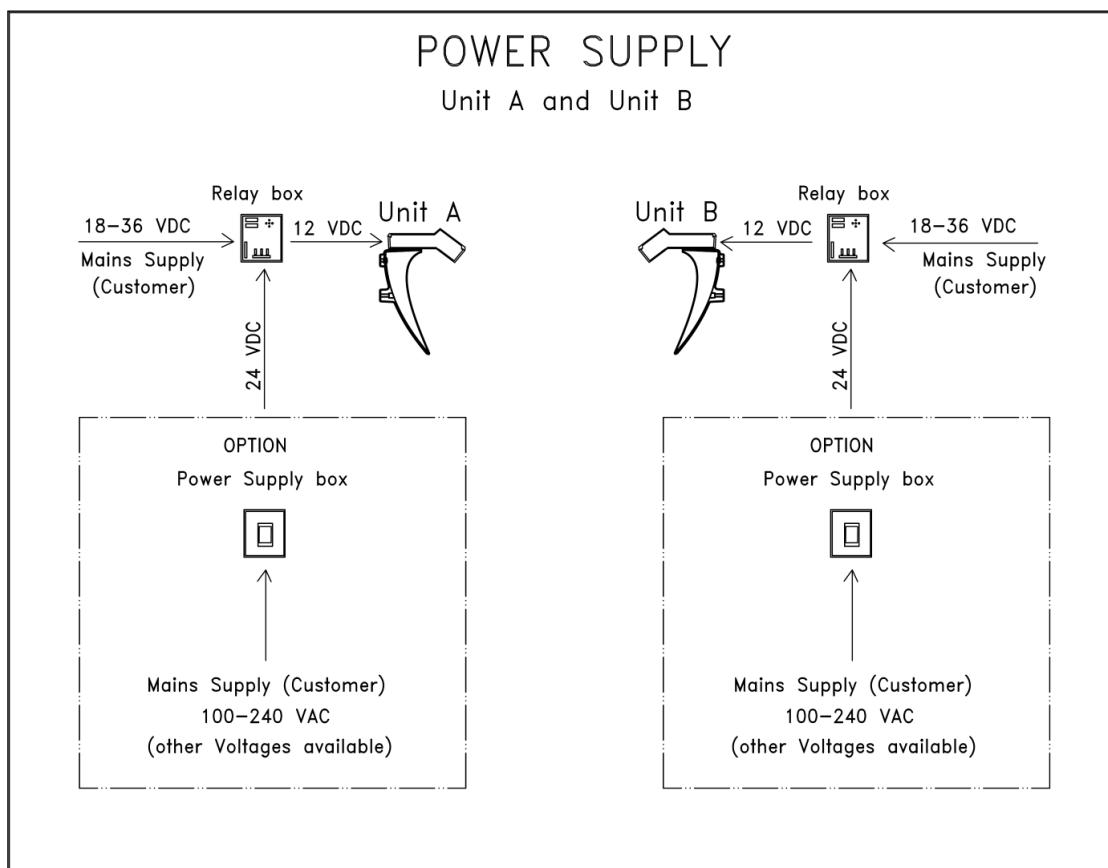
The power supply should include an all-pole switch according to local regulations for disconnection of the power supply. It must be suitably located and easily reached. Mark it as "Disconnecting device" for this equipment.

**Mains supply cord shall be a 2X0,75 mm<sup>2</sup> cable with outer diameter Ø5-9 mm and it must meet the requirements of IEC 60227 or IEC 60245. Minimum rated temperature shall be 80°C. Green/Yellow colours should not be used.**



**If the crane has the ground/earth terminated to the crane construction, the GII antenna (reflector) shall be isolated by rubber bumps or equal, when fixed with the three bolts in the crane.**

Supply voltage box (optional).





**OPTIONAL - POWER BANK BACKUP OF THE MODULATED SIGNAL**

The power shall, in normal cases, always be turned on, preferably the mains supply shall be connected before the main contact on the crane. The integrated backup super capacitor can only handle shorter power failures (a couple of hours, depending of temperature). In those cases, when a longer period of shut down of a crane or the transponder unit version is not possible to operate via mains supply 12 VDC, the external option, Power Bank backup of the modulated signal can be used (purchased separately).

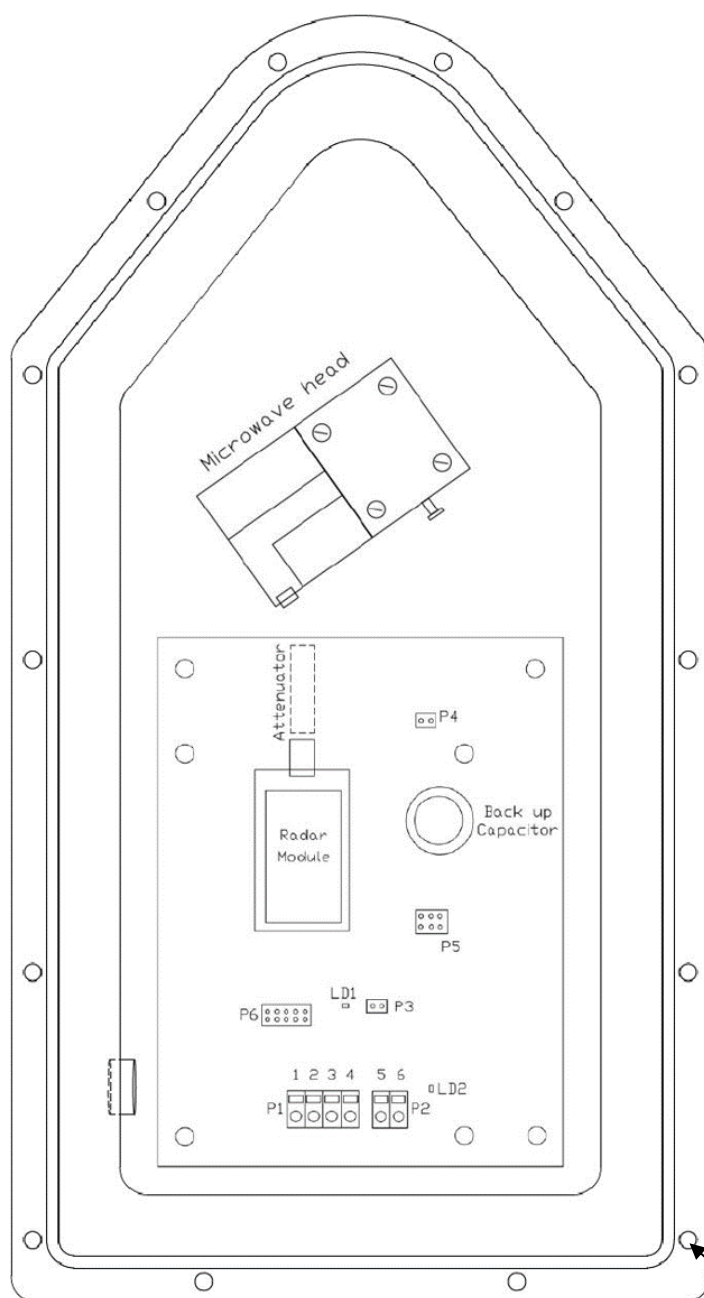
The modulated (fingerprint) reflection to the opposite unit is made by a diode in the microwave head. The diode oscillate with 16 kHz. As long as the diode oscillates, the opposite unit recognize the unit. The external Power bank feeds the diode with power and make it oscillate.



**Modification of antenna and transponder circuit boards for battery backup is necessary for all systems with S/N 0650 and earlier.**

**From system S/N 0651 and later, antenna and transponder circuit boards are pre-modified as standard.**

## INSTALLATION - CONNECTIONS OF THE ANTENNA BOX



### P1:

- 1 = Input + 12 VDC (from relay box)
- 2 = Input GND (from relay box)
- 3 = Input RS485+ (from relay box)
- 4 = Input RS485- (from relay box)

### P2 (applies to system S/N 0651 and later):

- 5 = Input + 5VDC (from battery backup)
- 6 = Input GND (from battery backup)

### P3:

Connection for external LED (signal indication), 5VDC

### P4:

Diode connection(to Microwave head)

### P5:

Programming connection (only accessed by Gigasense AB)

### P6:

Programming connection (only accessed by Gigasense AB)

**LD1** = LED "Heart beat" the radar module is transmitting when pulsing

**LD2** = LED for power supply of the antenna board

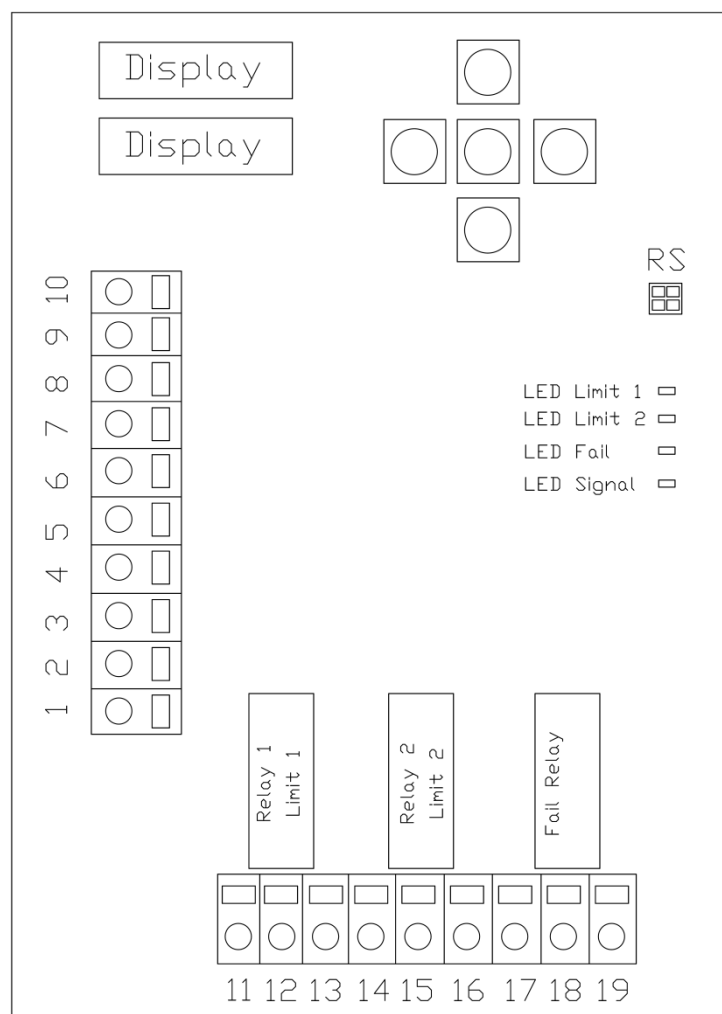
**Tighten the screws to the antenna lid by 2Nm.**



## WARNING!

**NEVER DISMANTLE THE MICROWAVE HEAD OR ADJUST THE SEALED SCREWS. THE MICROWAVE HEAD IS TUNED TO A CERTAIN FREQUENCY! ANY CHANGE WILL CAUSE THE SYSTEM NOT TO FUNCTION PROPERLY.**

## INSTALLATION - CONNECTIONS OF THE RELAY BOX



1. Mains supply +24 VDC
  2. Mains supply GND
  3. Output + 12 VDC (to antenna box)
  4. Output GND to (antenna box)
  5. RS485 + (to antenna box)
  6. RS485 - (to antenna box)
  7. Control signal to reset Limit 2 +24 VDC (in Mode 3)
  8. Control signal to reset Limit 2 0 VDC (in Mode 3)
  9. Output 4-20 mA + (distance between Unit A and Unit B, 4 mA = 2 m and 20 mA = 40 m)  
Normal load 250 Ohms
  10. Output 4-20 mA GND
  11. Relay 1 output (Limit 1) Common
  12. Relay 1 output (Limit 1) NC (Normally Closed)
  13. Relay 1 output (Limit 1) NO (Normally Open)
  14. Relay 2 output (Limit 2) Common
  15. Relay 2 output (Limit 2) NC (Normally Closed)
  16. Relay 2 output (Limit 2) NO (Normally Open)
  17. Relay output Fail Common
  18. Relay output Fail NC (Normally Closed)
  19. Relay output Fail NO (Normally Open)
- RS. Programming/setting connection RS232 (contact type Micro-Fit 3.0 SMD Straight 4Pol, Molex 43045-0418)



**Notice: Relay outputs terminals 11 to 19, max. load 8A/250 VAC.  
Connection of the relay outputs main wires must not cross secondary wires.**

When the mains supply is connected to the relay box and no alarms are active (the antenna box must be connected), the relays energize.

It is recommended to use a closed circuit to the crane control system. In case of internal failure or power failure the relays open the circuit and the crane will be stopped.

To use a closed circuit to the crane control system, connect to:

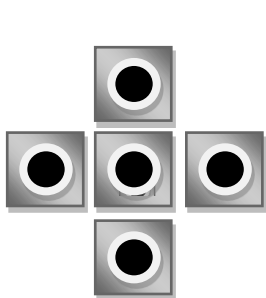
- Terminal 11 and 13 (Limit 1)
- Terminal 14 and 16 (Limit 2)
- Terminal 17 and 19 (Failure)



**Make sure to turn off the voltage to the relays when the lid is open! Only 12VDC and RS485 signals are allowed with the lid open! Operation with open lids is only allowed during installation and maintenance, and in a controlled environment (for specification of controlled environment, see chapter "SAFETY INFORMATION AND WARNINGS").**

## PUSH BUTTONS

- Left button decreases value, right button increases value.
- Upper/lower button scrolls menu.
- Middle button (confirm), a changed value will be stored in Eeprom when the button is pressed. If the confirm button is not pressed, the changed value will only be active until the mains supply is switched off.



### WARNING!

**If the middle button is not pressed, the values will not be saved. If the mains supply is switched off without saving, the values are set to previous saved settings when rebooted.**

## MENU STRUCTURE

0	2	4	4
B	1	2	

When the mains supply is switched on, the program version is displayed for 5 seconds:

If no button is pressed for 30 minutes, the selected mode and software version is displayed:

M	o		1
B	1	2	



OR:

S	Y	S	t
F	A	I	L



If the communication between the antenna box and the relay box fails or if there is an internal error, "SYSt FAIL" will be displayed:

L	1		
		1	2

Limit 1 alarm value (meter). Normally used to brake the crane.

Range 2 – 40 m.

It is recommended to set Limit 1 to at least 5 m less than the maximum range.

When distance is <5 meters, alarm limit L1 is constantly active, and will only be released when the crane is in reversing direction.

As the crane is within <5 meters distance, the physical crane speed will be higher than actual speed registered by the GII system.

The values for L1RS and L2RS may need to be increased in order for the crane to be operable without reaching the alarm limits (L1 and L2).



(Applicable when the crane operates in Mode 1 and Mode 3)

**NOTICE! the maximum working range varies for different frequencies from 20 m to 40 m due to restricted output power (EIRP), see appendix 1.**

L	1	b	
	O	F	F

Limit 1 relay function.

On = relay pulsing 1 Hz at active alarm. E.g. for connection to a warning lamp.

OFF = relay does not pulsing at active alarm.



L	2		
			8

Limit 2 alarm value (meter).

Range 2 – 40 m.

As the crane is within <5 meters distance, the physical crane speed will be higher than actual speed registered by the GII system.

The values for L1RS and L2RS may need to be increased in order for the crane to be operable without reaching the alarm limits (L1 and L2).



**NOTICE! the maximum working range varies for different frequencies from 20 m to 40 m due to restricted output power (EIRP), see appendix 1.**

## Control of the relay functions' output for modulated signal reflection

**Mode 1:** the alarms for Limit 1 (relay 1) and Limit 2 (relay 2) will activate if the speed exceeds the minimum speed limits L1rS and L2rS (see next page). The minimum speed limit settings make it possible for two cranes to operate at slow speed close to each other (under supervision of the crane driver) without triggering the alarms.

When the alarms for Limit 1 and Limit 2 have been activated (MSr = off), as the crane speed is less than the minimum alarm speed settings (L1rS and L2rS), the alarms will not deactivate until the speed is zero.

If menu “**MSr**” (Min Speed release) = **OFF**

When the alarms for Limit 1 and Limit 2 have been activated, the alarms will not deactivate until the speed is zero, even if the crane speed is lower than the minimum speed settings (L1rS and L2rS).

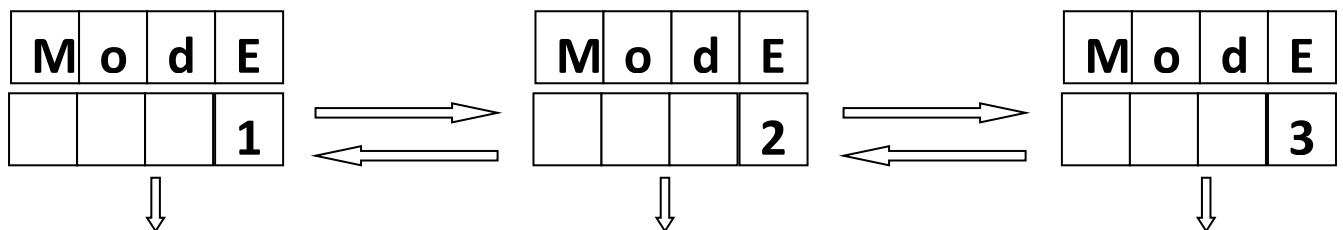
If menu “**MSr**” (Min Speed release) = **ON**

When the alarms for Limit 1 and Limit 2 have been activated, the alarms will deactivate as soon as the crane speed is lower than the minimum speed settings (L1rS and L2rS).

**Mode 2,** the alarms are NOT speed dependent (L1rS and L2rS are inactive). The alarms for Limit 1 and Limit 2 are active as long as the crane is within the range of the alarm limits. The cranes can only run apart from each other when the alarms are active.

**Mode 3:** same function as mode 1 except for Limit 2.

Limit 2 will not deactivate automatically and must be reset by a control signal (24 VDC) to the relay box.



(L1rS and L2rS are not shown in the display if Mode 2 is selected)

L	1	r	S
	0.	2	0



L	2	r	S
	0.	2	0



d	i	S	t
		2.	3



S	t	r	
		5	5



S	P	E	
	-	2.	9



**Limit 1 relay Speed:** Minimum speed limit for Limit 1 (**Mode 1** and **Mode 3**).  
Speeds below this value (meter/Second) will not activate alarms.  
Range 0,05 – 1,00 m/s.

As the crane is within <5 meters distance, the physical crane speed will be higher than actual speed registered by the GII system.

The values for L1RS and L2RS may need to be increased in order for the crane to be operable without reaching the alarm limits (L1 and L2).

If L2rs is less than L1rs, both L1 and L2 trigger at L2rs set value.

**Limit 2 relay Speed:** Minimum Speed limit for Limit 2 (**Mode 1** and **Mode 3**).  
Speeds below this value (meter / Second) will not activate alarms.  
Range 0,05 – 1,00 m/s.

As the crane is within <5 meters distance, the physical crane speed will be higher than actual speed registered by the GII system.

The values for L1RS and L2RS may need to be increased in order for the crane to be operable without reaching the alarm limits (L1 and L2).

If L2rs is less than L1rs, both L1 and L2 trigger at L2rs set value.

Distance in meter to opposite unit (modulated signal reflection).

**NOTICE!** the maximum working range varies for different frequencies from 25 m to 50 m due to restricted output power (EIRP), see appendix 1.

Signal strength in decibel (dB) to opposite unit (modulated signal reflection). When the LED (LD1) "Signal" does not lit (out of range), the display shows a dB value, which should be disregarded.

Actual speed in meter/Second to opposite unit.  
Minus sign indicates that the units move towards each other



S	P	d	1
			0

Speed compensation in percent for Limit 1.

Range: 10 – 1500 % (step of 10%).

Minimum value is 10%.



S	P	d	2
			0

Speed compensation in percent for Limit 2.

Range: 10 – 1500 % (step of 10%).

Minimum value is 10%.



**To compensate the Limit 1 and Limit 2 for different speeds, the SPd1 and SPd2 settings can be used. The higher the speed of the crane, the earlier the crane needs to brake and stop in order to not exceed the (physical) alarm limits for brake and stop.**

**The compensation is active in all 3 modes.**

This formula is used to calculate the compensation value:

The compensation value = **(ABS Speed – SpeedCompStart)\* SpeedCompLIM1)/100**

**ABS Speed** = actual speed

**SpeedCompStart** = The speed which must be exceeded to start the compensation. Default value is 0,1 m/s (can be changed by Gigasense AB).

**SpeedCompLIM1 (SPd1)** = Speed compensation value in percent, range 10 – 1500 % to be set by the user.

E.g. If Limit 1 is set to 12 m, SpeedCompLIM1 (Spd1) is set to 50% and the actual speed is 1,5 m/sec. The Limit 1 will be compensated according to the calculation:

Limit 1 compensation = (1,5-0,1) \*50)/100 = 0,7 m

**When the crane operates in a speed at 1,5 m/sec, the Limit 1 will be moved 0,7 m (to 12,7 m).**

**E.g. to get a longer braking distance.**

LIM1 (with compensation) = 12 m + 0,7 m = **12,7 m**

The same formula applies for Limit 2.

M	S	r	
	O	F	F



**MSr (Min Speed release)** Only valid in Mode 1 and Mode 3.

**OFF** = When the alarms for Limit 1 and Limit 2 has been activated, the alarms will not deactivate until the speed is zero, even if the crane speed is lower than the minimum speed settings (L1rS and L2rS).

**ON** = When the alarms for Limit 1 and Limit 2 has been activated, the alarms will deactivate as soon as the crane speed is lower than the minimum speed settings (L1rS and L2rS).

## Control of the relay functions' output for unmodulated signal reflection (unidentified object)

The unmodulated signal reflection uses individual settings according to the menus UoSt, UodI, dLr2, UoSP, UoFI, dbFI and Uodb.

Limit 1 relay, Limit 2 relay and Failure relay switches at the same time when the alarm (UodI) is exceeded. To avoid abrupt stop signal, the Lim 2 relay can be delayed

U	o	S	t
		7	5



Signal strength for the unmodulated signal reflection in decibel (dB).

This signal reflection is used to triggering unidentified objects, e.g. if the opposite unit is shut off or having failure.

It is normal to have a value of approx. 70 db (at frequency 10.54 GHz) when the unit has free line of sight (>50 meters to opposite unit).

U	o	d	I
		1	0



Alarm limit in meter to detect unidentified object.

At active alarm: relay 1, relay 2 and Fail relay switch at the same time.

Range 2 – 40 m.

**Note: Relay 2 can be delayed by setting “dLr2” to avoid abrupt stop signal to the crane, see next menu.**

d	L	r	2
	0.	2	0



Delay relay 2 (works only at unmodulated alarms). When an unidentified object is detected, or, the opposite unit having failure and the unmodulated alarm is triggering, the relay 2 is delayed by the set time in this menu. To avoid abrupt stop signal (Lim 1, brake signal is active before the time of the set delay).

Range 0,0 – 3,0 seconds.

U	o	S	P
	0.	2	0

Speed limit for unidentified object.  
Speed (meter/Sec) below set value will not activate alarms.  
Range 0,00 – 2,00 m/s.



U	o	F	I
		0.	0

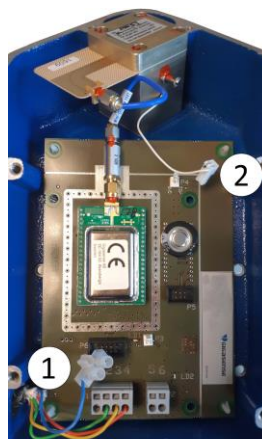
Filter for unidentified object.  
Resolution 0- 0,5 Sec (up to 0,5 sec, resolution 0,5 sec).  
From 0,5 – 3.0 sec, 0,1 sec resolution.  
Detection of unidentified object for shorter time than set value will not activate alarm.  
Range 0,0 – 3,0 Sec.



d	b	F	I
		7	0

Signal level (in decibels, dB) for unmodulated signal.  
Signal strength values (in menu UoSt) LOWER than the set dBFI value will shut off the decisions to triggering the unmodulated alarms.

**Recommendation to set the dbFI value. This requires a reflective metal surface of at least 1 m<sup>2</sup> behind the antennas, see chapter INSTALLATION.**



- Park the crane at the same distance as set value in the "UodI" menu to the opposite crane.
- Simulate the opposite unit as a dead unit:  
Disconnect the 12V power supply (1) protect the loose cable from short circuit, disconnect the diode (2).
- Notice the value shown in the display "UoSt" in the opposite (active) unit:  
Value pending between \_\_\_\_ dB and \_\_\_\_ dB
- Set the value in menu dbFI to 2 dB lower than the lowest noticed value in step "C".
- Reconnect the diode and the power cable.



#### Warning!

According to step "B", it is NOT ENOUGH to turn off the mains supply, to the opposite unit. The Super Capacitor operates the modulated reflection, if the diode is not disconnected. You must disconnect the connector from the diode on the antenna PCB.

U	o	d	b
		4	7



If the modulated signal strength (Str) is lower than the set Uodb value, the system takes into account unmodulated reflections and can give unmodulated alarm. At signal strength (Str) higher than the set Uodb value, unmodulated reflections are filtered, and unmodulated alarm cannot occur.

Recommended Uodb settings for the different frequencies:

9.9 GHz = uodb 45 dB

9.91 GHz = uodb 45 dB

10.475 GHz = uodb 47 dB

10.54 GHz = uodb 47 dB

T	E	M	P
	2	2.	5



Actual temperature (degrees Celsius) in relay box.

The menu scrolls to first menu "L1"

## ADJUSTMENTS & TEST OF PERFORMANCE

Decide in which mode for the modulated- and unmodulated signals the system will operate. Unless otherwise specified, the system is set to the following default settings at delivery:

- Mode 1

Set Limit 1 and Limit 2 to appropriate alarm distances.

Default settings are:

Limit 1 = 12 m

Limit 2 = 8 m

Set the minimum speed limits to the safe speed you want to use without being stopped by the Anti-Collision System (Mode 1 and Mode 3).

Default settings are:

L1rS 1 = 0,1 m/s

L1rS 2 = 0,1 m/s

Set the speed compensation value, if you need to compensate for different speeds.

Default settings are:

SPd1 = 10 %

SPd2 = 10 %

Run the cranes along the track and check that the Limit 1 and Limit 2 alarms triggering at the set distances. Check that no false alarm occurs.

## MAINTENANCE

GIGASENSE II is designed to be maintenance free, and checking of the performance can usually be made in the normal operation before the cranes are operated.

When the equipment is operated in severe environment, high temperature, high humidity etc, it is however recommended that ocular inspection inside and outside of all parts is done on a regular basis i.e. every 6 months.

In case of cleaning the equipment, this should be done by gently wiping it off with a dry or damp cloth.

## TROUBLESHOOTING

The screws on the microwave head in the antenna box are prohibited to adjust. The microwave head is tuned to a certain frequency and signal strength, and must not be adjusted.

### Error indication

### Cause

### Solution

#### Unit A or Unit B: the display does not light up in the relay box.

1. Damaged connection between relay box and mains supply.
2. Mains supply damaged.

1. Check the wiring between relay box and mains supply, measure (24 VDC) on terminals 1 and 2 in the relay box
2. Check the mains supply.

#### Unit A or Unit B indicating "SYST FAIL" in the relay box (LEDs Lim1, Lim2 and Failure are lit). The opposite (working) unit triggers Unidentified object alarm.

1. Damaged connection between relay box and antenna box. RS485 or 12VDC supply to antenna box.
2. Internal error in the relay board.
3. Internal error in the antenna board.
4. The antenna board is configured to "transponder".

1. Check the wiring between relay box and antenna box. Measure (12 VDC) on terminals 1 and 2 in the antenna box.
2. Check with another relay box.
3. Send the antenna box to the factory for repair.
4. Use an antenna box with correct configuration.

#### Limit 1 or Limit 2 is not triggering when short Limit distance settings (2-3 m) are used.

The scaling of the microwave signal at close ranges causes a measuring offset.

Increase the Limit settings in the relay box to trigger at the actual desired physical distances.

#### Unit A and/or Unit B showing low/high dB values randomly (e.g. 10 dB - 80dB - 100dB - 400dB).

The unit A and Unit B are positioned close beyond the maximum range limit where the echo of the modulated reflection is weak.

No action, these values are normal and will be filtered in the relay box to not affect the relay outputs.

**Unit A and/or Unit B show short/long distances randomly (e.g. 10 m - 200 m - 400 m).**

The unit A and Unit B are positioned close beyond the maximum working range limit where the echo of the modulated reflection is weak.

No action, these values are normal and will be filtered in the relay box to not affect the relay outputs.

**Unit A having a lower or unstable signal than Unit B (or vice versa). *Test at approx. 6 m distance!*****Unit B:**

1. Diode damaged in the microwave head.
2. Cable connection between circuit board and diode damaged or loose (antenna box).
3. Radar module is loose on the antenna board.
4. Attenuator and/or coax cable loose in the antenna box.
5. Modulating circuit on the antenna board is damaged.
6. Circuit board on the microwave head is damaged.
7. The sealed adjustment screw on the microwave head is adjusted.
8. Incorrect alignment of the antennas.

**Unit B:**

1. Send the antenna box to the factory for replacement and adjustment of the microwave head.
2. Send the antenna box to the factory for replacement of the diode cable.
3. Attach the radar module by pushing it, check that all 42 pins are correctly fitted before pushing it. Apply Silicone at each corner to fix the radar module.
4. Tighten the nuts carefully with maximum 0,5 Nm force. Use a torque wrench. Seal the nuts!
5. Send the antenna box to the factory for replacement of circuit boards.
6. Send the antenna box to the factory for replacement and adjustment of the microwave head.
7. Send the antenna box to the factory for adjustment.
8. Check the alignment of the antennas, see chapter "Installation". Check that the three bolts in the reflector are sufficiently tightened.

**Unexpected unmodulated trips (LEDs Lim1, Lim2 and Failure are lit randomly).**

Due to unexpected unmodulated reflections from fixed or moving objects close to the antenna.

- a) Check the (UodB) filter for unmodulated signal strength. See chapter "Menu structure".
- b) Check the environment along the track, is it minimum 3 m in diameter of free space from the centre of the main beam axis of the reflector?

**Unexpected Lim1 / Lim2 trips or the Lim1 / Lim2 do not trigger at expected distances.**

Lim1 / Lim2 set close to max. range.

- a) Check the (dBFI) filter for signal strength. See chapter "Menu structure".
- b) Decrease the levels for Lim1 and Lim2.



**Display in the relay box show values for signal strength and distance without a change and/or the relay box trigger unmodulated alarms (UOMO).**

Interference from wiring of other equipment, e.g. high voltage wiring from older type which induce more EMC radiation than allowed according to modern industry standard.

- Separate wiring to minimize EMC.

**The mains supply (24VDC) is still active when the 0 VDC is disconnected.**

The 0 VDC has the same potential as the crane ground/earth. The 0 VDC leads through the antenna box and feeds the relay box mains supply 0 VDC.

- The antenna (reflector) must be isolated by rubber bumps or equal to isolate the antenna from the crane metal.

**The isolation warning alarm is active on the crane.**

The 0 VDC has the same potential as the crane ground/earth. The 0 VDC leads through the antenna box and feeds the relay box mains supply 0 VDC.

- The antenna (reflector) must be isolated by rubber bumps or equal to isolate the antenna from the crane metal.

## IDENTIFICATION & SPARE PARTS

### Antenna box

On the label it is noticed:

**A/N** (Article Number) e.g. GII10525A. The article number should be used when ordering an antenna box spare part.

**HVIN** = Hardware identification number

**System S/N** = the complete system serial number.

**System A/N** = the complete system article number.

Equal for:

- Antenna box Unit A (or transponder box)
- Antenna box Unit B (or transponder box)
- Relay boxes

### Transponder box

The article number is added with "TR"

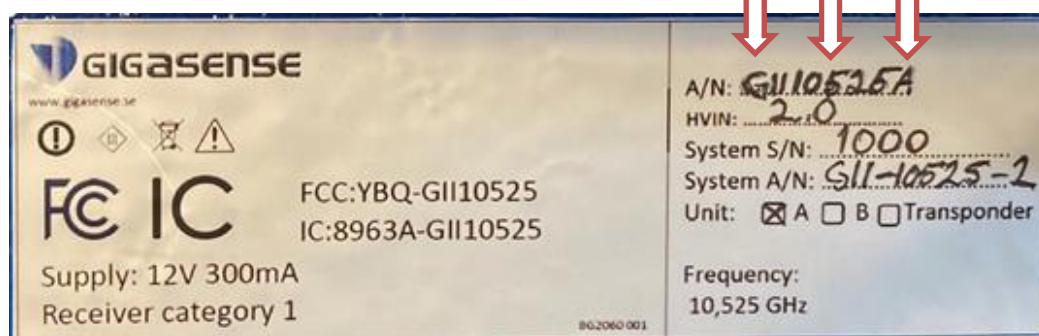
A/N = e.g. GIITR10525B



Gigasense II

10.525 GHz

A-Unit



## Relay box

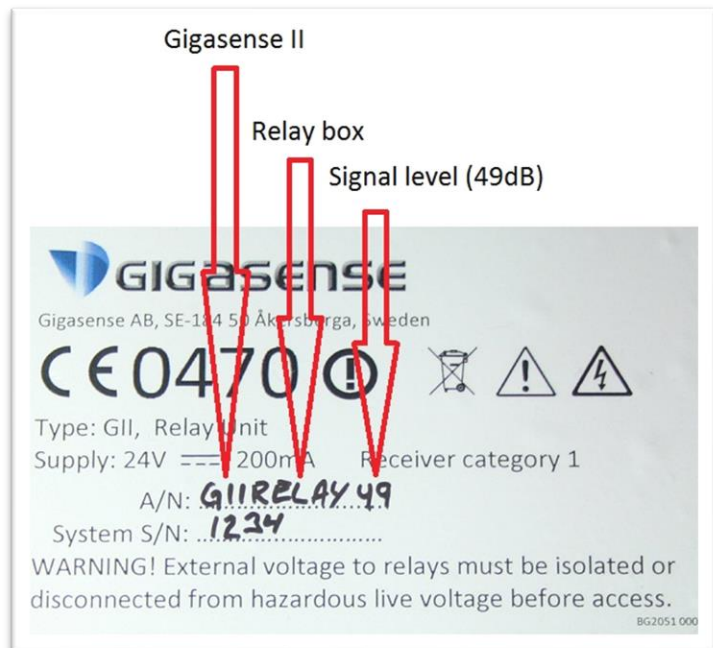
On the label it is noted:

A/N (Article Number) e.g. GIIRELAY50.

The article number should be used when ordering relay box spare parts.

The signal level is different for different frequencies (see appendix 1).

System S/N = the complete system serial number. Equal for relay boxes, antenna boxes (transponder box).

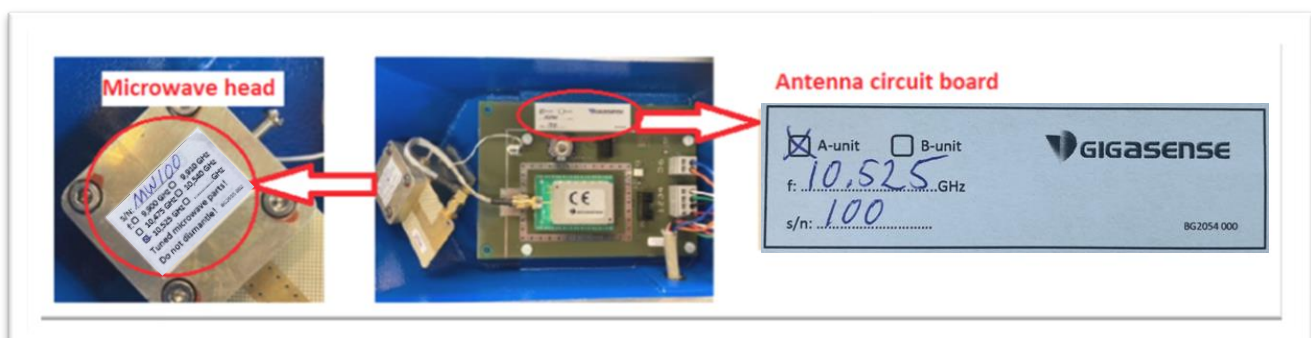


## Internal parts of the Antenna box

Individual serial numbers are used on the Microwave head and the antenna circuit board.

The tuned frequency is noted on the Microwave head. The Microwave head can be used with both A-units and B- Units.

The antenna circuit board is programmed to A Unit or B Unit and to work for a certain frequency.



## **REPLACEMENT OF PARTS & DISPOSAL**

If a failure should occur, it is recommended that parts are only changed at "board level" at the installation site, and that the replaced parts are returned to the manufacturer for repair.

Risk of electric shock! Make sure that connections to the relays are isolated, and the supply to relay box is disconnected.

Circuit boards and microwave heads must be handled with care. Only touch the edges of circuit boards.

After replacement of parts, and reconnection of mains supply, perform the steps in chapter "INSTALLATION" to verify proper function of the complete system. When proper function is verified, the system can be used again.

Replaced and disposed parts can be sent to Gigasense AB for destruction.

## **RECOMMENDED SPARE PARTS**

Complete system unit A and unit B:

1. One antenna box unit A
2. One antenna box unit B
3. One relay box (same for unit A and unit B)

Complete system unit A and transponder unit B:

1. One antenna box unit A
2. One transponder box unit B
3. One relay box

## HIGH RISK APPLICATIONS

The GII system has MTTFd values which allows, under certain circumstances, to use the GII system in high risk applications.

In this case, two Gigasense Systems operate in parallel (as two channels):

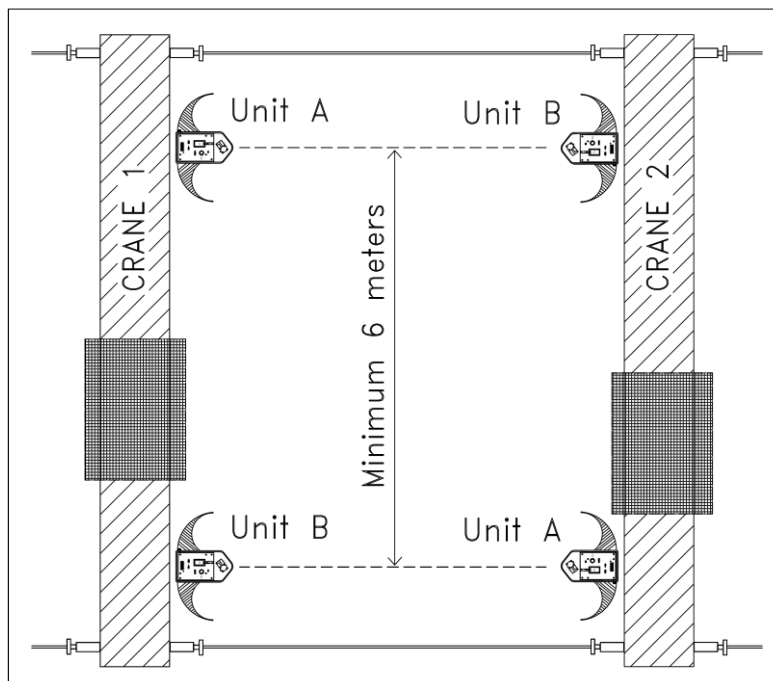
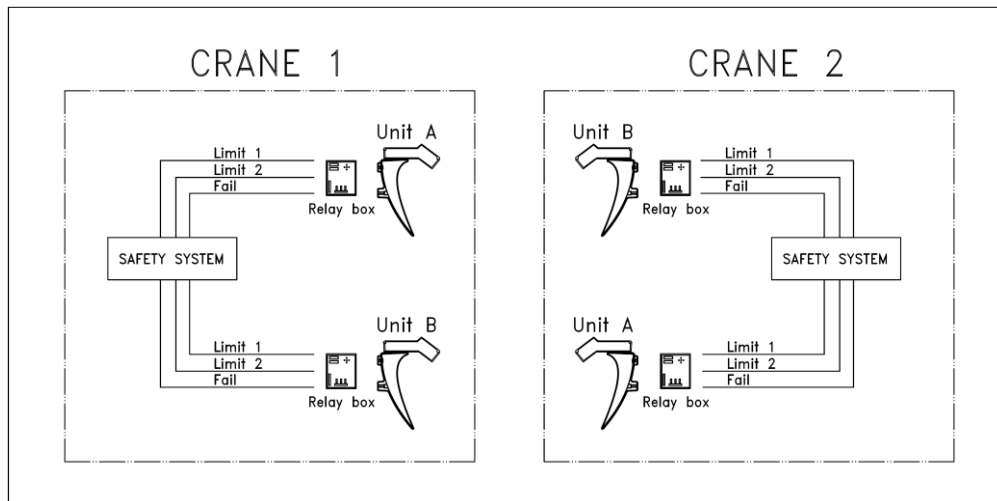
System 1: A-unit + B-unit

System 2: A-unit + B-unit.

The Gigasense Anti-Collision Systems are considered as sensors in the comprehensive safety system. The digital output signals from the relay boxes, shall be connected to a safety system.



**The machine supplier is responsible to follow the machinery directive, applicable standards and regulations for the complete system and installation.**



**Read chapter "INSTALLATION" for detailed information of the installation requirements.**

## MTTFd and DIAGNOSTIC COVERAGE



QUALITY AND SERVICE TAKEN SERIOUSLY

### MTTFd and DCavg calculations for GII - Gigasense Anti Collision System

2016-06-14

Input			
Microwave Head			
SRP/CS 1a	Σ FITd	16,7	
D.1	Σ MTTFd	6835,6	
DC Table E.1 EN ISO 13849-1		60	

Input			
Antenna Unit			
SRP/CS 1b	Σ FITd	886,0	
D.1	Σ MTTFd	128,8	
DC Table E.1 EN ISO 13849-1		60	

Logic			
Relay Unit			
SRP/CS 1c	Σ FITd	750,5	
D.1	Σ MTTFd	152,1	
DC Table E.1 EN ISO 13849-1		60	

SRP/CS	Σ FITd	1653,2
D.1	Σ MTTFd	69,1
DCavg		60,0

Formula D.1  
Parts count method  
EN ISO 13849-1

$$\frac{1}{MTTF_d} = \sum_{i=1}^n \frac{1}{MTTF_{di}} = \sum_{j=1}^m \frac{n_j}{MTTF_{dj}}$$

Formula D.2  
Substitution formula for  
two different redundant  
channels  
EN ISO 13849-1

$$MTTF_d = \frac{2}{3} \left[ MTTF_{dC1} + MTTF_{dC2} - \frac{1}{\frac{1}{MTTF_{dC1}} + \frac{1}{MTTF_{dC2}}} \right]$$

*MTTF<sub>dC1</sub> and MTTF<sub>dC2</sub> are the values for two different redundant channels*

Formula E.1  
Estimation of diagnostic  
coverage DCavg  
EN ISO 13849-1

$$DC_{avg} = \frac{\frac{DC_1}{MTTF_{d1}} + \frac{DC_2}{MTTF_{d2}} + \dots + \frac{DC_N}{MTTF_{dN}}}{\frac{1}{MTTF_{d1}} + \frac{1}{MTTF_{d2}} + \dots + \frac{1}{MTTF_{dN}}}$$

FIT to MTTF  
MTTF to FIT

$$\begin{aligned} \text{FIT to MTTF} &= ((1/(\text{FIT} \times 1 \times 10^{-9})) / (8760)) \\ \text{MTTF to FIT} &= 1 / ((1/(\text{MTTF})) \times 8760) \times 1 \times 10^9 \end{aligned}$$

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## CE-CERTIFICATION

Hereby, Gigasense AB, declares that this equipment complies with the essential requirements and other relevant provisions of Directive RED (Radio Equipment Directive) 2014/53/EU.

For a list of countries where this equipment may be used, see appendix 1.

**CE 0470** 

## FCC and IC-CERTIFICATION

Hereby, Gigasense AB, declares that this equipment complies with the FCC and IC regulations.

FCC: YBQ-GII10525

IC: 8963A-GII10525

## CONTACT

Sales and service

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