

Leica iCON PA10



Introduction

Purchase

Congratulations on the purchase of the Leica iCON PA10.



This manual contains important safety directions as well as instructions for setting up the product and operating it. Refer to "1 Safety Directions" for further information.

Read carefully through the User Manual before you switch on the product.

To ensure safety when using the system, please also observe the directions and instructions contained in the User Manual and Safety Handbook issued by the Machine manufacturer.

Product identification

The model and serial number of your product are indicated on the type plate. Always refer to this information when you need to contact your agency or Leica Geosystems authorised service centre.

Available documentation

Name	Description/Format		
iCON PA10 Quick Guide	Provides an overview of the product together with technical data and safety directions. Intended as a quick reference guide.	✓	✓
iCON PA10 User Manual	All instructions required in order to operate the product to a basic level are contained in the User Manual. Provides an overview of the product together with technical data and safety directions.	-	✓
iCON PA10 Installation Manual	System installation information for trained technicians and other qualified specialists.	-	✓

Refer to the following resources for all iCON PA10 documentation/software:

- the supplied data storage device
- <https://myworld.leica-geosystems.com>

Leica Geosystems address book

On the last page of this manual, you can find the address of Leica Geosystems headquarters. For a list of regional contacts, please visit http://leica-geosystems.com/contact-us/sales_support.



myWorld@Leica Geosystems (<https://myworld.leica-geosystems.com>) offers a wide range of services, information and training material.

With direct access to myWorld, you are able to access all relevant services whenever it is convenient for you.

Service	Description
myProducts	Add all products that you and your company own and explore your world of Leica Geosystems: View detailed information on your products and update your products with the latest software and keep up-to-date with the latest documentation.

Service	Description
myService	View the current service status and full service history of your products in Leica Geosystems service centres. Access detailed information on the services performed and download your latest calibration certificates and service reports.
mySupport	Create new support requests for your products that will be answered by your local Leica Geosystems Support Team. View the complete history of your support requests and view detailed information on each request in case you want to refer to previous support requests.
myTraining	Enhance your product knowledge with Leica Geosystems Campus - Information, Knowledge, Training. Study the latest online training material on your products and register for seminars or courses in your country.
myTrustedServices	Add your subscriptions and manage users for Leica Geosystems Trusted Services, the secure software services, that assist you to optimise your workflow and increase your efficiency.

DRAFT

Table of Contents

1	Safety Directions	5
1.1	General Introduction	5
1.2	Definition of Use	6
1.3	Limits of Use	6
1.4	Responsibilities	6
1.5	Hazards of Use	7
1.6	Electromagnetic Compatibility EMC	11
1.7	FCC Statement, Applicable in U.S.	12
2	Description of the System	15
2.1	Overview	15
2.2	System Components	16
2.3	Available kits	17
2.4	User Interface	21
3	Hardware Installation	23
4	Operation	24
4.1	Pedestrian Tag	24
4.1.1	General Working Information	24
4.1.2	Status Indicators	25
4.1.3	The Acknowledge Key	27
4.1.4	Batteries	27
4.1.5	Firmware update	29
4.2	Machine Anchor	32
4.2.1	General Working Information	32
4.2.2	Status Indicators	33
4.3	CRS113 LED Display Unit	33
4.3.1	Status Indicators	33
4.3.2	The Acknowledge Key	36
5	Care and Transport	37
5.1	Transport	37
5.2	Storage	37
5.3	Cleaning and Drying	37
6	Technical Data	39
6.1	Dimensions	39
6.2	Weight	39
6.3	Environmental Specifications	39
6.4	Electrical Data	40
6.5	Other Technical Data	41
6.6	Conformity to National Regulations	41
6.6.1	General	41
6.6.2	Radio Transmitter RS9110N1122 and NRF905	41
6.6.3	Dangerous Goods Regulations	43

1 Safety Directions

1.1 General Introduction

Description

The following directions enable the person responsible for the product, and the person who actually uses the equipment, to anticipate and avoid operational hazards.

The person responsible for the product must ensure that all users understand these directions and adhere to them.

About warning messages





Warning messages are an essential part of the safety concept of the instrument. They appear wherever hazards or hazardous situations can occur.

Warning messages...

- make the user alert about direct and indirect hazards concerning the use of the product.
- contain general rules of behaviour.

For the users' safety, all safety instructions and safety messages shall be strictly observed and followed! Therefore, the manual must always be available to all persons performing any tasks described here.

DANGER, WARNING, CAUTION and **NOTICE** are standardised signal words for identifying levels of hazards and risks related to personal injury and property damage. For your safety, it is important to read and fully understand the following table with the different signal words and their definitions! Supplementary safety information symbols may be placed within a warning message as well as supplementary text.

Type	Description
 DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	Indicates a potentially hazardous situation or an unintended use which, if not avoided, could result in death or serious injury.
 CAUTION	Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in appreciable material, financial and environmental damage.
	Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.

1.2

Definition of Use

Intended use

- Provide 360° line-of-sight awareness for machine drivers of heavy construction machinery in order to prevent them from not noticing pedestrians or other vehicles around the machinery.
 - Provide 360° line-of-sight awareness for pedestrians in order to prevent them from not noticing nearby heavy construction machinery.
 - Provide the option to set out avoidance zones or mark sensitive areas or items.
-

Reasonably foreseeable misuse

- Use of the product without instruction.
 - Use outside of the intended use and limits.
 - Disabling safety systems.
 - Removal of hazard notices.
 - Opening the product using tools, for example screwdriver, unless this is permitted for certain functions.
 - Modification or conversion of the product.
 - Use after misappropriation.
 - Use of products with recognisable damages or defects.
 - Use with accessories from other manufacturers without the prior explicit approval of Leica Geosystems.
 - Inadequate safeguards at the working site.
 - Deliberate dazzling of third parties.
-

1.3

Limits of Use

Environment

Suitable for use in an atmosphere appropriate for permanent human habitation: not suitable for use in aggressive or explosive environments.

WARNING

Working in hazardous areas, or close to electrical installations or similar situations.

Life Risk.

Precautions:

- ▶ Local safety authorities and safety experts must be contacted by the person responsible for the product before working in such conditions.
-

WARNING

Altered function and safety of the machine

Unauthorised modification of building and constructions machines by mounting or installing the product may alter the function and safety of the machine.

Precautions:

- ▶ Follow the instructions of the machine manufacturer. If no appropriate instruction is available, ask machine manufacturer for instructions before mounting or installing the product.
-

1.4

Responsibilities

Manufacturer of the product

Leica Geosystems AG, CH-9435 Heerbrugg, hereinafter referred to as Leica Geosystems, is responsible for supplying the product, including the User Manual and original accessories, in a safe condition.

Person responsible for the product

The person responsible for the product has the following duties:

- To understand the safety instructions on the product and the instructions in the User Manual.
- To ensure that it is used in accordance with the instructions.
- To be familiar with local regulations relating to safety and accident prevention.
- To inform Leica Geosystems immediately if the product and the application becomes unsafe.
- To ensure that the national laws, regulations and conditions for the operation of the product are respected.

1.5

Hazards of Use

WARNING

Unqualified installation on building or construction machinery

This may result in personal and material damage.

Precautions:

- ▶ Only an appropriately trained and qualified specialist may install this product on building or construction machinery.

WARNING

Distraction or loss of attention

During dynamic applications there is a danger of accidents occurring if the user does not pay attention to the environmental conditions around, for example obstacles, excavations or traffic.

Precautions:

- ▶ The person responsible for the product must make all users fully aware of the existing dangers.

WARNING

Inadequate securing of the working site.

This can lead to dangerous situations, for example in traffic, on building sites and at industrial installations.

Precautions:

- ▶ Always ensure that the working site is adequately secured.
- ▶ Adhere to the regulations governing safety, accident prevention and road traffic.

CAUTION

Unsuitable installation location

Installing near mechanically moving machine components may damage the product.

Precautions:

- ▶ Deflect the mechanically moving machine components as far as possible and define a safe installation zone.

CAUTION

Not properly secured accessories.

If the accessories used with the product are not properly secured and the product is subjected to mechanical shock, for example blows or falling, the product may be damaged or people can sustain injury.

Precautions:

- ▶ When setting up the product, make sure that the accessories are correctly adapted, fitted, secured, and locked in position.
- ▶ Avoid subjecting the product to mechanical stress.

DANGER

Risk of being struck by lightning

If the product is used with accessories, for example on masts, staffs, poles, you may increase the risk of being struck by lightning. Danger from high voltages also exists near power lines. Lightning, voltage peaks, or the touching of power lines can cause damage, injury and death.

Precautions:

- ▶ Do not use the product in a thunderstorm as you can increase the risk of being struck by lightning.
- ▶ Be sure to remain at a safe distance from electrical installations. Do not use the product directly under or close to power lines. If it is essential to work in such an environment contact the safety authorities responsible for electrical installations and follow their instructions.
- ▶ If the product has to be permanently mounted in an exposed location, it is advisable to provide a lightning conductor system. A suggestion on how to design a lightning conductor for the product is given below. Always follow the regulations in force in your country regarding grounding antennas and masts. These installations must be carried out by an authorised specialist.
- ▶ To prevent damages due to indirect lightning strikes (voltage spikes) cables, for example for antenna, power source or modem should be protected with appropriate protection elements, like a lightning arrester. These installations must be carried out by an authorised specialist.
- ▶ If there is a risk of a thunderstorm, or if the equipment is to remain unused and unattended for a long period, protect your product additionally by unplugging all systems components and disconnecting all connecting cables and supply cables, for example, instrument - antenna.

WARNING

Missing attention of operators or malfunctions

While steering or navigating the machine accidents may occur due to:

- The operator not paying attention to the surroundings (persons, ditches, traffic, etc.), or
- Malfunctions (...of a system component, interference, etc).

Precautions:

- ▶ The operator assures that the machine is operated, guided and monitored by a qualified user (e.g. driver).
- ▶ The user has to be able to take emergency measures, for example an emergency stop.

⚠ WARNING

Incorrect fastening of the external antenna

Incorrect fastening of the external antenna to vehicles or transporters poses the risk of the equipment being broken by mechanical influence, vibration or airstream. This may result in accident and physical injury.

Precautions:

- ▶ Attach the external antenna professionally. The external antenna must be secured additionally, for example by use of a safety cord. Ensure that the mounting device is correctly mounted and able to carry the weight of the external antenna (>1 kg) safely.

⚠ WARNING

Exposure of batteries to high mechanical stress, high ambient temperatures or immersion into fluids

This can cause leakage, fire or explosion of the batteries.

Precautions:

- ▶ Protect the batteries from mechanical influences and high ambient temperatures. Do not drop or immerse batteries into fluids.

⚠ WARNING

Inappropriate mechanical influences to batteries

During the transport, shipping or disposal of batteries it is possible for inappropriate mechanical influences to constitute a fire hazard.

Precautions:

- ▶ Before shipping the product or disposing it, discharge the batteries by the product until they are flat.
- ▶ When transporting or shipping batteries, the person in charge of the product must ensure that the applicable national and international rules and regulations are observed.
- ▶ Before transportation or shipping, contact your local passenger or freight transport company.

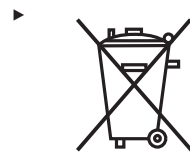
WARNING

Improper disposal

If the product is improperly disposed of, the following can happen:

- If polymer parts are burnt, poisonous gases are produced which may impair health.
- If batteries are damaged or are heated strongly, they can explode and cause poisoning, burning, corrosion or environmental contamination.
- By disposing of the product irresponsibly you may enable unauthorised persons to use it in contravention of the regulations, exposing themselves and third parties to the risk of severe injury and rendering the environment liable to contamination.

Precautions:



The product must not be disposed with household waste. Dispose of the product appropriately in accordance with the national regulations in force in your country. Always prevent access to the product by unauthorised personnel.

Product-specific treatment and waste management information can be received from your Leica Geosystems distributor.

WARNING

Improperly repaired equipment

Risk of injuries to users and equipment destruction due to lack of repair knowledge.

Precautions:

- ▶ Only authorised Leica Geosystems Service Centres are entitled to repair these products.

For the AC/DC power supply and the battery charger:

WARNING

Unauthorised opening of the product

Either of the following actions may cause you to receive an electric shock:

- Touching live components
- Using the product after incorrect attempts were made to carry out repairs.

Precautions:

- ▶ Do not open the product!
- ▶ Only Leica Geosystems authorised service centres are entitled to repair these products.

For the AC/DC power supply and the battery charger:

WARNING

Electric shock due to use under wet and severe conditions

If unit becomes wet it may cause you to receive an electric shock.

Precautions:

- ▶ If the product becomes humid, it must not be used!
- ▶ Use the product only in dry environments, for example in buildings or vehicles.



- ▶ Protect the product against humidity.

1.6

Description

Electromagnetic Compatibility EMC

The term Electromagnetic Compatibility is taken to mean the capability of the product to function smoothly in an environment where electromagnetic radiation and electrostatic discharges are present, and without causing electromagnetic disturbances to other equipment.

WARNING

Electromagnetic radiation

Electromagnetic radiation can cause disturbances in other equipment.

Precautions:

- ▶ Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that other equipment may be disturbed.

CAUTION

Use of the product with accessories from other manufacturers. For example field computers, personal computers or other electronic equipment, non-standard cables or external batteries

This may cause disturbances in other equipment.

Precautions:

- ▶ Use only the equipment and accessories recommended by Leica Geosystems.
- ▶ When combined with the product, they meet the strict requirements stipulated by the guidelines and standards.
- ▶ When using computers, two-way radios or other electronic equipment, pay attention to the information about electromagnetic compatibility provided by the manufacturer.

CAUTION

Intense electromagnetic radiation. For example, near radio transmitters, transponders, two-way radios or diesel generators

Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that function of the product may be disturbed in such an electromagnetic environment.

Precautions:

- ▶ Check the plausibility of results obtained under these conditions.

WARNING

Use of product with radio or digital cellular phone devices

Electromagnetic fields can cause disturbances in other equipment, in installations, in medical devices, for example pacemakers or hearing aids and in aircraft. It can also affect humans and animals.

Precautions:

- ▶ Although the product meets the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that other equipment can be disturbed or that humans or animals can be affected.
- ▶ Do not operate the product with radio or digital cellular phone devices in the vicinity of filling stations or chemical installations, or in other areas where an explosion hazard exists.
- ▶ Do not operate the product with radio or digital cellular phone devices near to medical equipment.
- ▶ Do not operate the product with radio or digital cellular phone devices in aircraft.

1.7

FCC Statement, Applicable in U.S.

WARNING

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 the 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.

⚠ CAUTION

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

Labelling of iCON PA10 components

CRS101 machine anchor



18154_001

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.

Model: CRS101

FCC ID: US123456

IC: CA123456

IP67

Power:
12V-24V DC
1 A max.

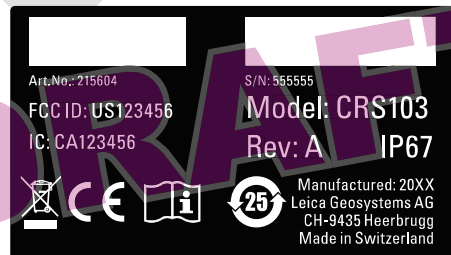
Leica Geosystems AG
CH-9435 Heerbrugg
Manufactured: 20XX
Made in Denmark



CRS103 pedestrian tag



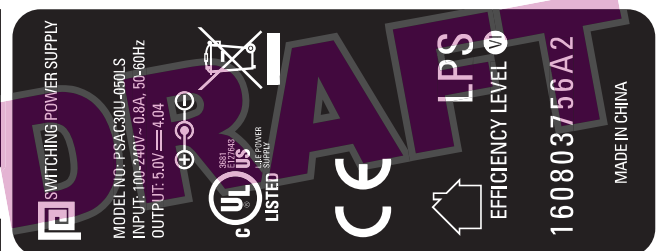
18166_001



CRS125 power adapter



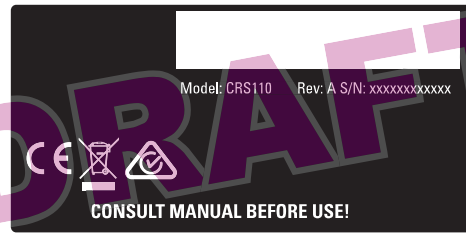
18167_001



CRS110 main unit



18197_001



CRS113 display unit



18198_001



CRS145 antenna



18324_001



2

Description of the System

2.1

Overview

Personal alert system

The main purpose of all machine control products of the Leica iCON PA series is to support machine drivers in recognizing pedestrians or other vehicles moving around their vehicle, thus reducing the risk of accidents.

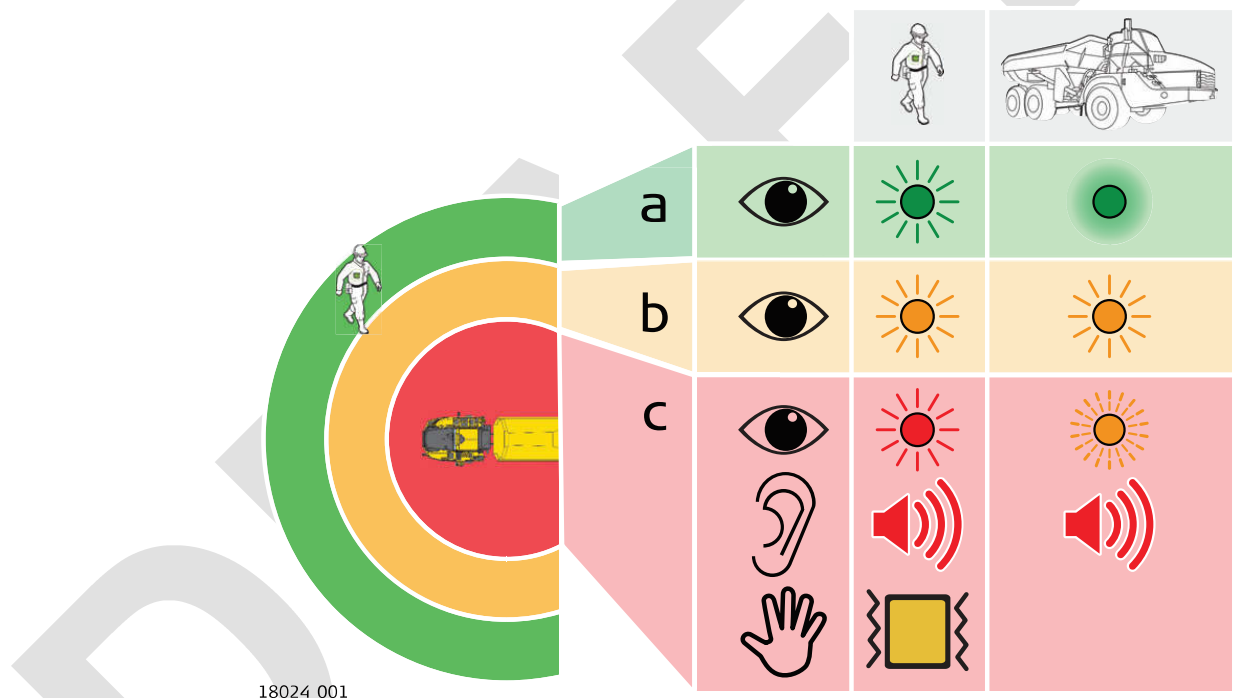
Leica iCON PA is an advanced personal alert system for machine drivers and on-site personnel based on the Time-of-Flight principle (ToF) for distance ranging.

Detection zones

iCON PA allows you to configure proximity limits for three different detection zones around a machine (Fig. 1):

- Far
- Near
- Close (danger zone)

As soon as a pedestrian enters one of these zones, both the pedestrian and the machine driver are alerted by the alarm signal specified for this zone.

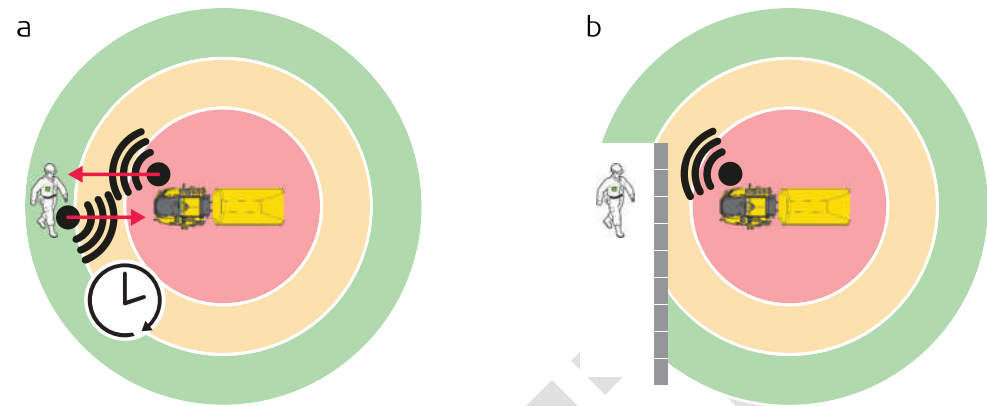


18024_001

Fig. 1: Detection zones and corresponding alarm signals

Distance detection

iCON PA operates on Ultra-Wideband based on the IEEE802.15.4-2011 standard. The maximum range for detection is 50 m with an accuracy of ± 20 cm and a repeatability of less than 5 cm.



18025_001

Fig. 2: Time-of-Flight principle and distance detection

- A machine anchor on the vehicle sends out a signal to which a pedestrian tag responds. The distance between anchor and tag is calculated based on the time it takes for the returning tag signal to reach the anchor.
- The distance ranging functionality requires a free line of sight between the cooperating system components, that is, between machine anchor and pedestrian tag.

2.2

Leica iCON PA systems

System Components

Main system components

The main components of all Leica iCON PA systems are tags worn by pedestrians and machine anchors mounted to vehicles and construction machines. These main components perform the distance ranging. In addition to these main components, a complete system consists of a display unit and, depending on the system configuration, a multipurpose antenna and a separate main unit.

Anchor configurations

Each iCON PA system supports various anchor configurations, depending on the target vehicle.

- A single-anchor configuration can be suitable for light vehicles and compact construction machines like skid steers or forward-facing dumpers.
- A two-anchor configuration is more suitable for medium-size articulated dump-trucks.
- When the size and complexity of the host machine increase, more than two anchors are needed to ensure true 360° visibility around the vehicle and to avoid blind-spots.

Leica iCON PA10

Leica iCON PA10 is a standalone personal alert system for vehicles without MCP80/MC1-based system.

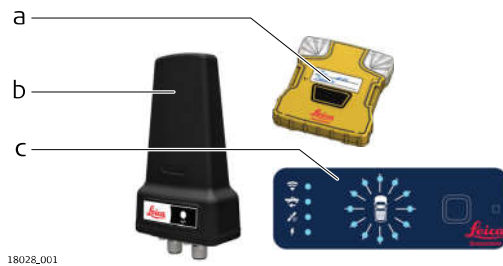


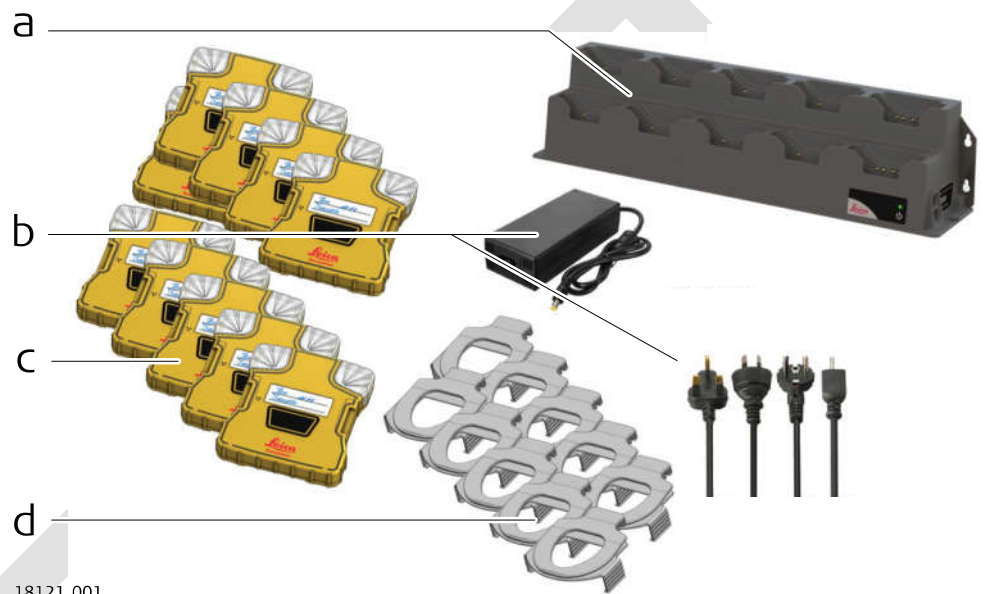
Fig. 3: iCON PA10 main components

- a CRS103 pedestrian tag
- b CRS101 machine anchor
- c CRS113 LED display unit

2.3

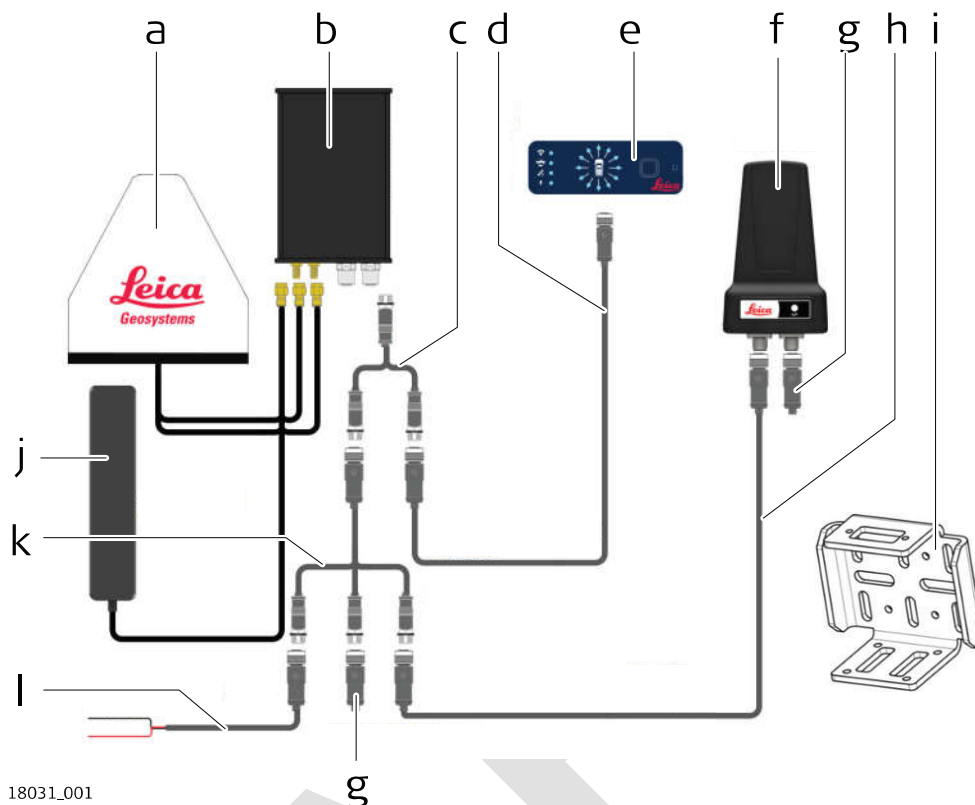
CRS130 pedestrian tag kit

Available kits



- CRS106 10-bay gang charger (874522)
- CRS125 power adapter for gang charger (874539), including area-specific plugs (787857)
- 10x CRS103 pedestrian tag (874455)
- 10x CRS104 clip for pedestrian tag (874520)

**CRS151 single-anchor
kit for iCON PA10**



18031_001

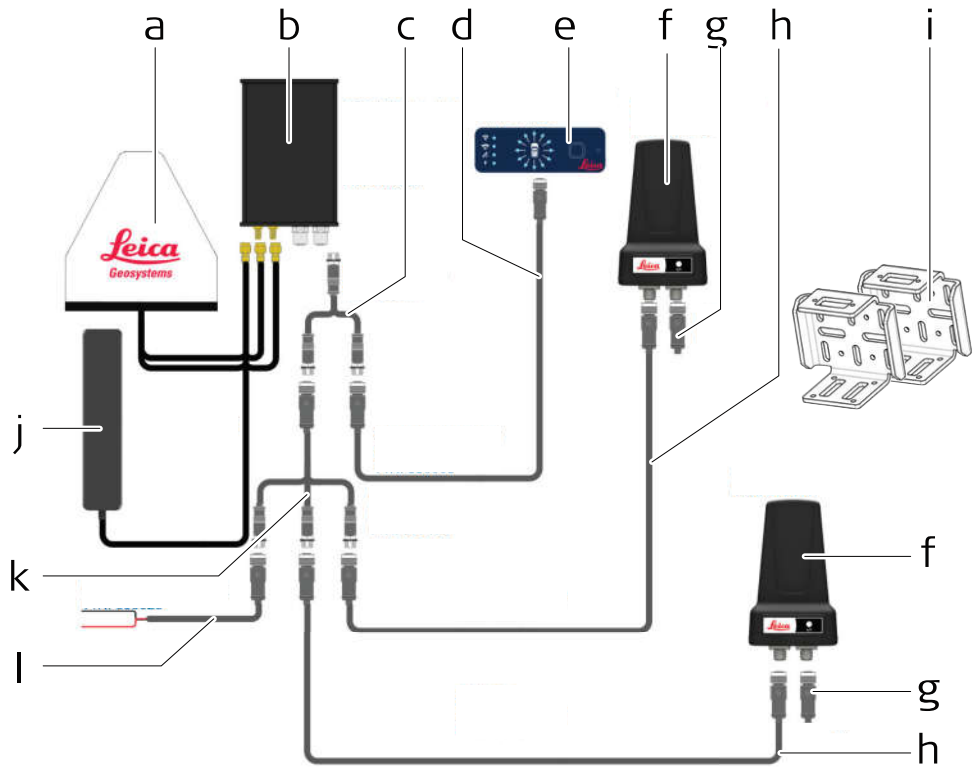
Fig. 4: Single-anchor configuration for iCON PA10

- a CRS145 antenna (XXXXXX)
- b CRS110 main unit (874526) OR CRS111 main unit (874527)
- c QM106 Y-cable (874535)
- d QD222 LED-display cable, 5 m (836803)
- e CRS113 LED display unit (874528)
- f CRS101 machine anchor (870410)
- g 2x QT375 CAN Terminator (869677)
- h Not included: CAN cable, different lengths available (851348)
- i CRS102 mounting bracket for machine anchor (874378)
- j CRS139 antenna (XXXXXX)
- k QT376 4-branch cable harness (873174)
- l QM1040 Power cable (874534)



Use this kit for light and compact vehicles such as small trucks, track-loaders or asphalt rollers. The kit includes the necessary licences.

CRS152 two-anchor
kit for iCON PA10



18118_001

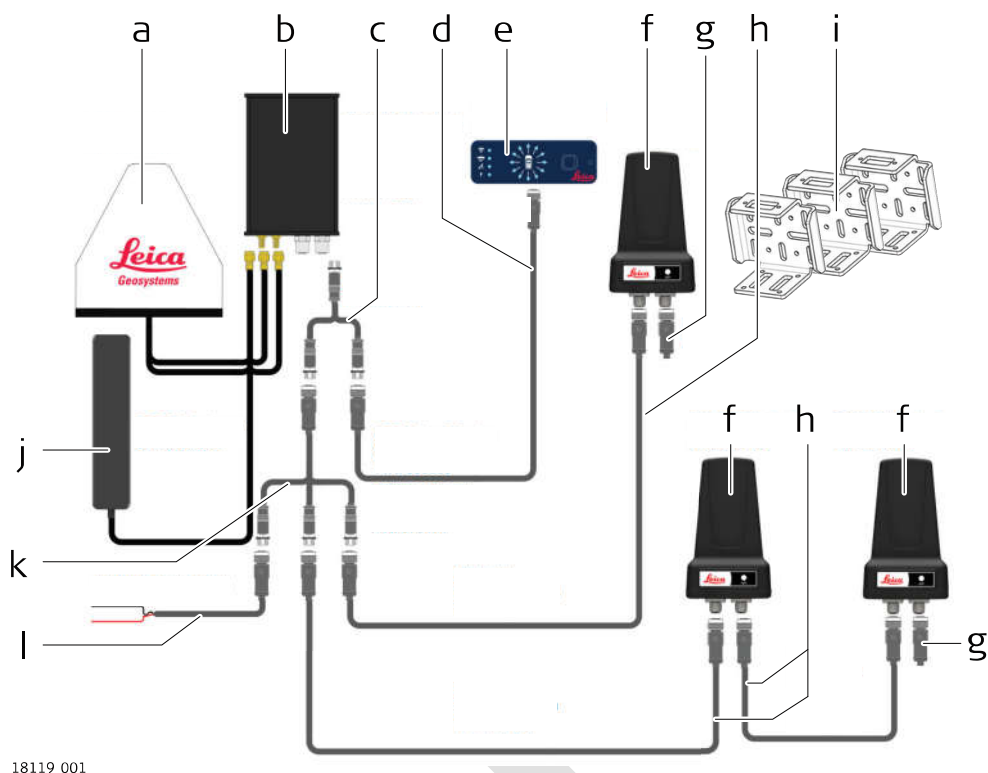
Fig. 5: Two-anchor configuration for iCON PA10

- a CRS145 antenna (XXXXXX)
- b CRS110 main unit (874526) OR CRS111 main unit (874527)
- c QM106 Y-cable (874535)
- d QD222 LED-display cable, 5 m (836803)
- e CRS113 LED display unit (874528)
- f 2x CRS101 machine anchor (870410)
- g 2x QT375 CAN Terminator (869677)
- h Not included: CAN cable, different lengths available (851348)
- i 2x CRS102 mounting bracket for machine anchor (874378)
- j CRS139 antenna (XXXXXX)
- k QT376 4-branch cable harness (873174)
- l QM1040 Power cable (874534)



Use this kit for articulated dump-trucks, haul trucks, larger compactors, graders or bulldozers. The kit includes the necessary licences.

**CRS153 three-anchor
kit for iCON PA10**



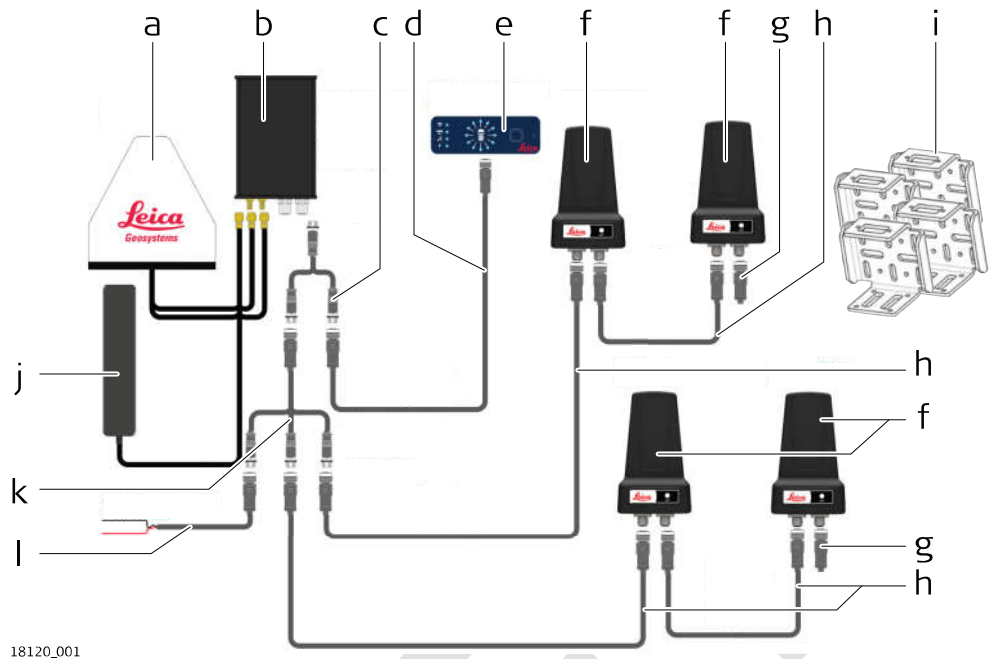
18119_001

Fig. 6: Three-anchor configuration for iCON PA10

- a CRS145 antenna (XXXXXX)
- b CRS110 main unit (874526) OR CRS111 main unit (874527)
- c QM106 Y-cable (874535)
- d QD222 LED-display cable, 5 m (836803)
- e CRS113 LED display unit (874528)
- f 3x CRS101 machine anchor (870410)
- g 2x QT375 CAN Terminator (869677)
- h Not included: CAN cable, different lengths available (851348)
- i 3x CRS102 mounting bracket for machine anchor (874378)
- j CRS139 antenna (XXXXXX)
- k QT376 4-branch cable harness (873174)
- l QM1040 Power cable (874534)

☞ Use this kit for drill rigs, asphalt pavers or milling machines. The kit includes the necessary licences.

**CRS154 four-anchor
kit for iCON PA10**



18120_001

Fig. 7: Four-anchor configuration for iCON PA10

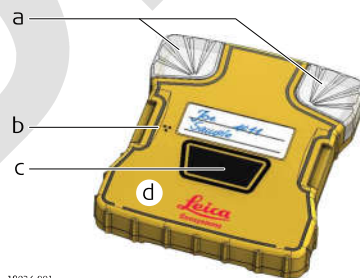
- a CRS145 antenna (XXXXXX)
- b CRS110 main unit (874526) OR CRS111 main unit (874527)
- c QM106 Y-cable (874535)
- d QD222 LED-display cable, 5 m (836803)
- e CRS113 LED display unit (874528)
- f 4x CRS101 machine anchor (870410)
- g 2x QT375 CAN Terminator (869677)
- h Not included: CAN cable, different lengths available (851348)
- i 3x CRS102 mounting bracket for machine anchor (874378)
- j CRS139 antenna (XXXXXX)
- k QT376 4-branch cable harness (873174)
- l QM1040 Power cable (874534)

Use this kit for excavators, pavers or larger drillers and pilers. The kit includes the necessary licences.

2.4

User Interface

Pedestrian tag



18034_001

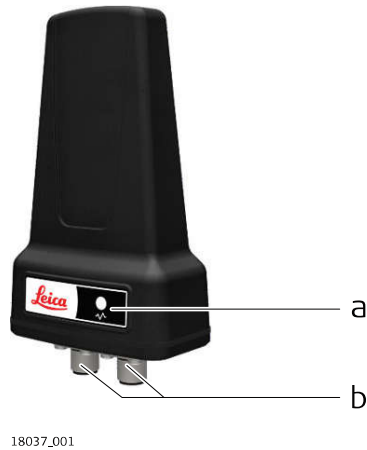
- a Multi-colour LED
- b Buzzer
- c Acknowledge key
- d Built-in vibration generator

The Leica iCON PA tag is a battery-powered compact device to be worn on a person. The tag is designed to work up to 14 hours on a single charge, assuming continuous operation at normal conditions.

The pedestrian tag can generate visual, audible and haptic alarm signals.

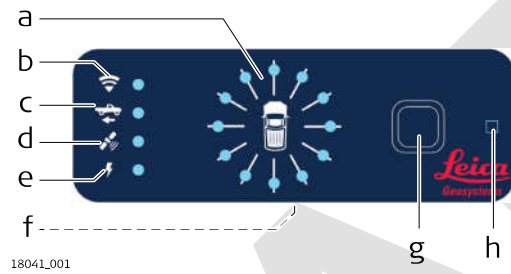
CRS101 machine anchor

The machine anchor can be connected along other standard Leica Machine Control sensors through CAN bus connections.



- a Multi-colour LED indicating power and anchor status
- b CAN/Power connectors

CRS113 LED display unit



- a Indicator for tag position and proximity
- b WiFi status indicator
- c Vehicle reversing indicator
- d GNSS status indicator
- e Power status indicator
- f Serial connector (4-pin M8 male)
- g Acknowledge key
- h Buzzer

The LED brightness is automatically controlled by an ambient light sensor; during night operation, the LEDs are dimmed. The maximal volume of the buzzer is 85 dB at 10 cm distance. The volume is also automatically controlled based on ambient noise.

CRS110/CRS111 main unit



- a GPS connector
- b RF connector
- c WiFi connector
- d GNSS status indicator
- e I/O connector (8-pin M12 male)
- f Main connector (8-pin M12 male)