

BLAXTAIR® 3

USER MANUAL

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2 Foreword

BLAXTAIR® is a pedestrian's detection device for industrial vehicles.

Combined with usual safety practices, it will help you to improve the safety in the vicinity of dangerous industrial, earthmoving or mining machines by providing relevant and reliable information to the driver.

In order to get the best from this high-tech equipment implementing a breakthrough technology, and before starting using **BLAXTAIR®**, it is strongly recommended to read this manual. It indicates the precautions, scope of use and basic maintenance procedures of **BLAXTAIR®**, to maintaining the equipment at its best level of performance.



BLAXTAIR® is designed to providing the operator with additional information which could help them when manoeuvring. It is not an alarm system and it does not reduce the responsibility of the operator or his/her manager in case of a collision. **BLAXTAIR®** is designed to supplement the usual safety practices already implemented. It must be integrated into a comprehensive safety policy taking into account the risk factors that are specific to the activity of the company.

Vehicle control and safety of operations remains the responsibility of the Operator and the authorities in charge.

BLAXTAIR® does not detect pedestrians lying on the ground.

BLAXTAIR® is not designed to detect small objects. As with any detection system, an object or a pedestrian may not be detected.

The current version of **BLAXTAIR®** does not detect squatting pedestrians.



Most collisions between industrial vehicles and pedestrians occur when setting off or after a sudden change of direction.

BLAXTAIR® is optimized to provide pertinent information to the driver during these critical phases.

When the vehicle is operational, it is the driver's responsibility to adapt the speed to the environment and remain observant at all times.

BLAXTAIR® is not designed to detect pedestrians when the vehicle is travelling at high speeds.

Each year plant accidents result in the loss of life, significant personal injuries and damages to products and property. Most plant accidents are the result of driver error.



Basic operator training should be carried out prior to operators using any equipment installed with BLAXTAIR® systems. Followed by periodic training to ensure awareness of usage and limits.

Optimal performance of a BLAXTAIR® systems is subject to the compliance with recommendations for use and maintenance as described in this manual.



BLAXTAIR® shall not be interfaced with the command or control devices of machinery. Output signals of BLAXTAIR® shall not be used for controlling automatically, directly or indirectly, machinery control devices.

3 BLAXTAIR® presentation

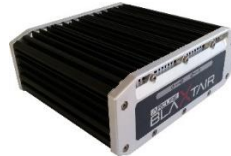
3.1 Overview

BLAXTAIR® is composed of:

- One or more stereoscopic sensor heads



- One or more rugged processing units



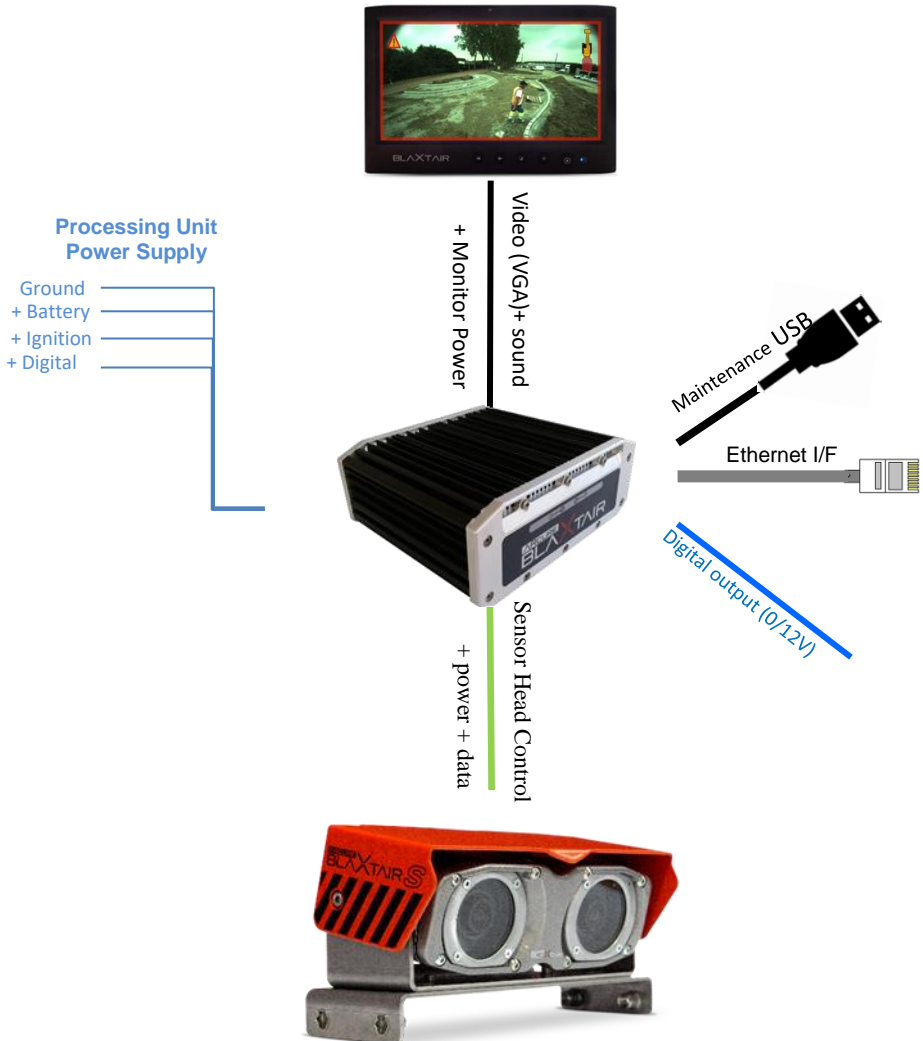
As options, BLAXTAIR® may include:

- One or more 7" monitors with accessories
- One or more multicolour alarm LEDs
- One or more audible warning devices
- The cap is included in « Standard » and « Rugged » versions only
- The housing may differ according to the protection requirements

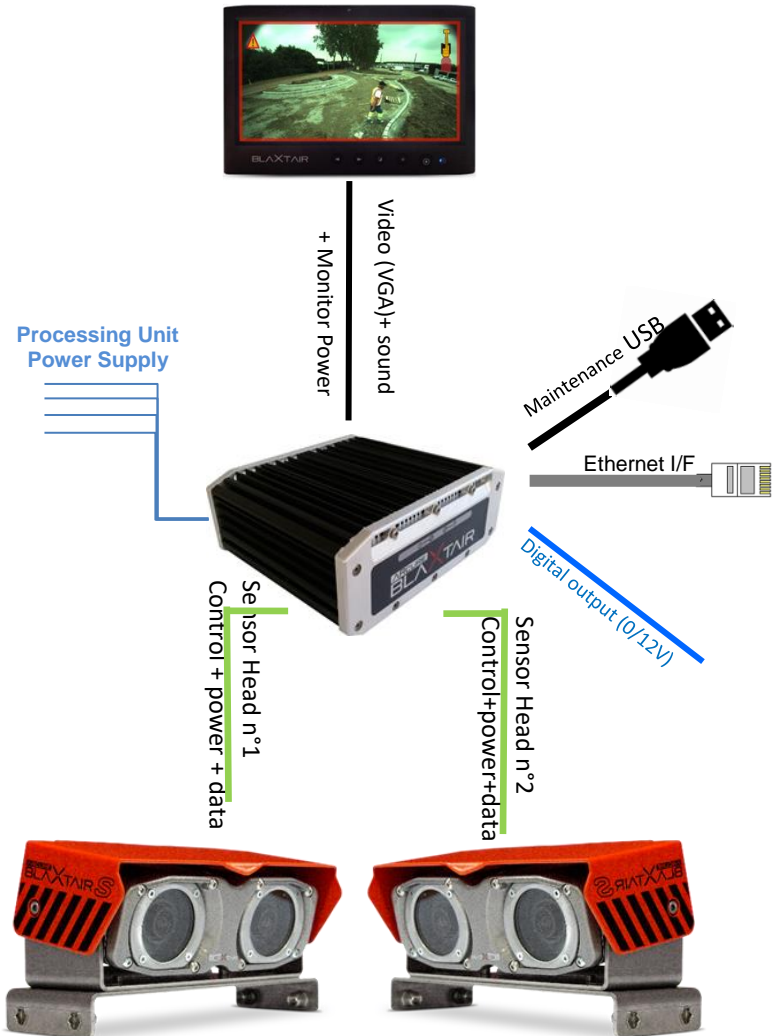


3.2 Connection overview

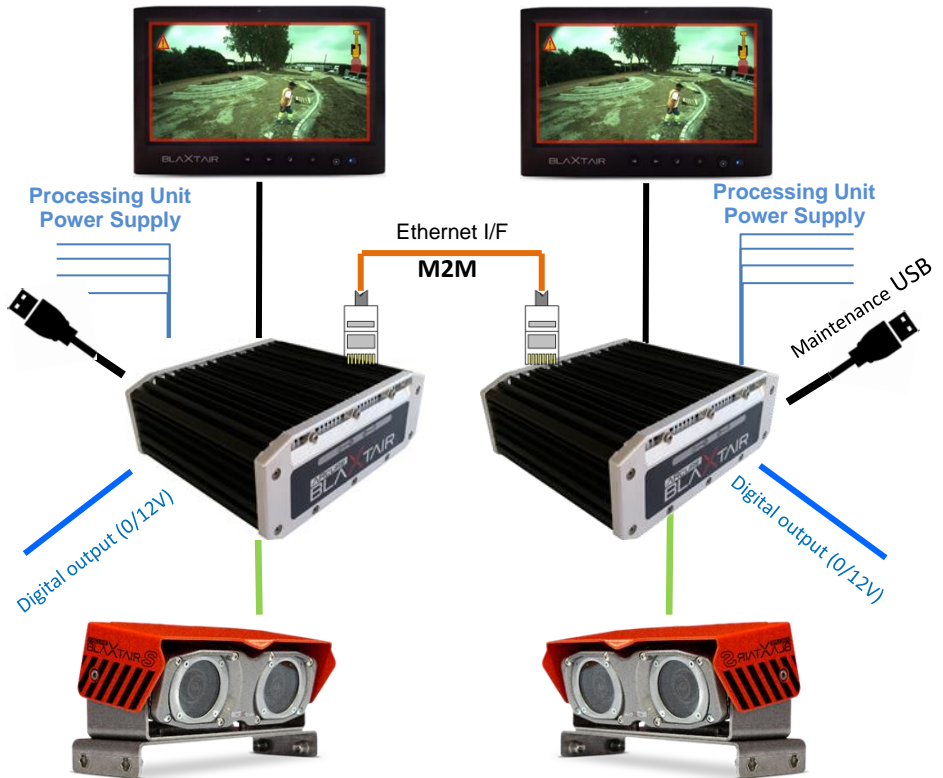
3.2.1 Basic configuration: BLAXTAIR® MR90



3.2.2 Alternate configuration: BLAXTAIR® MR90-A



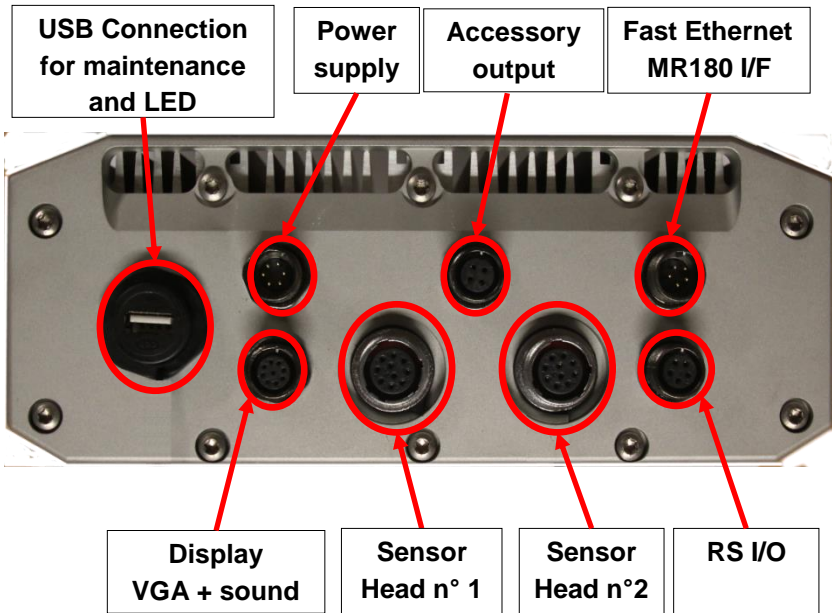
3.2.3 Dual configuration: BLAXTAIR® MR180



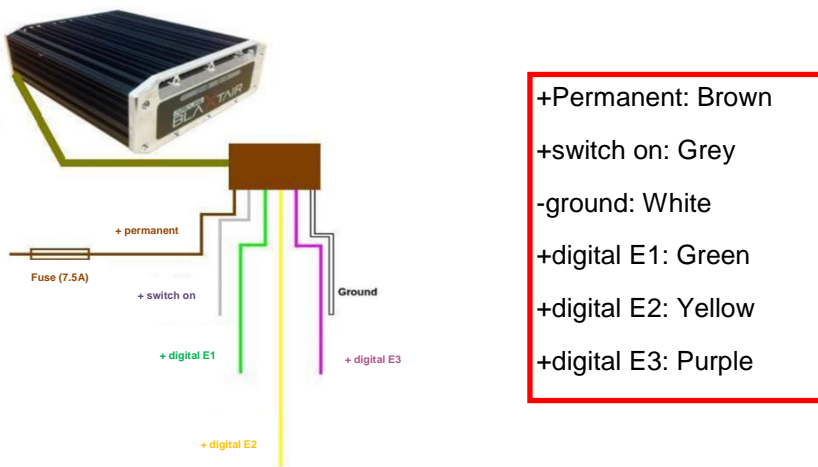
Important notice:

- Accessory outputs of both Processing Units are identical and linked together: i.e. if one Processor detects a pedestrian, outputs of the other Processor are triggered simultaneously.
- USB for maintenance give access only to the Processor it is connected to.
- Ethernet I/F is not available in this configuration as it is used for communication between both Processing Units.
- Inputs (power and digital inputs) of both Processors should be connected identically.

3.3 Processing unit connections



3.4 Power connection and analog inputs



The inputs (E1, E2 and E3) are normally used for activating the detection (e.g. reverse gear). See Installation Manual.

3.5 Head connection

The Blaxtair 3 Sensor Head has one single external connector. It is connected to the Processing Unit through the specific connection harness. This link provides power and control messages from the Processing Unit to the Sensor Head and the data flow from the Sensor Head to the Processing Unit.

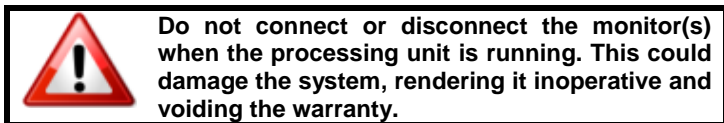


4 Operational use

4.1 Precautions for use

BLAXTAIR® processing unit(s) shall be handled with care:

- Do not install the processing unit(s) near heating equipment;
- Do not install the processing unit(s) near equipment generating electromagnetic interference;
- Do not pull on harnesses;
- Do not cover or place anything over the processing unit(s);
- Make sure that a free air flow around the processing unit(s) is maintained. If not, it could prevent proper heat dissipation and lead to the processing unit shutting down.
- Keep the sensor head windows clean;
- Never open or tamper with a sensor head or processing unit as warranty will be void.
- Do not alter sensor head(s) or processing unit(s) locations. Only Blaxtair trained engineers are authorised to do so;
- Do not unplug any connector on the processing unit(s) or on the sensor head(s) unless requested to do so by a Blaxtair support engineer;



4.2 Installation and start

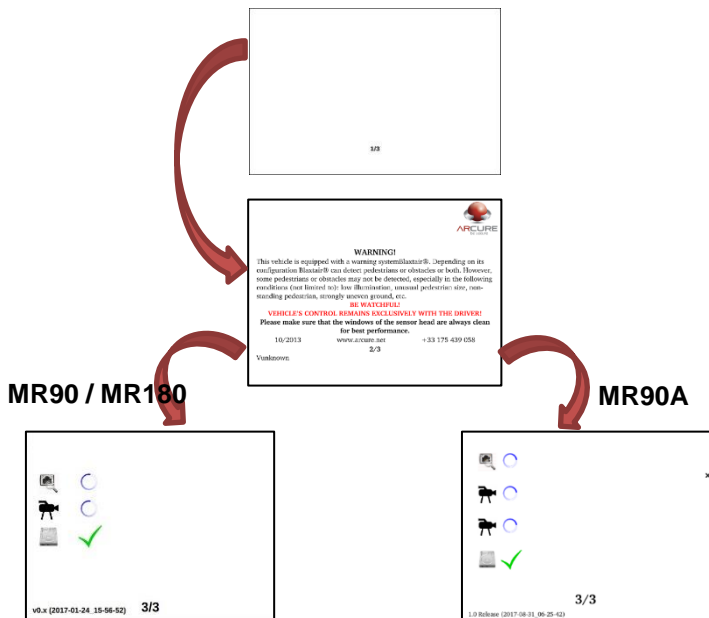
Your BLAXTAIR® system has been installed by an authorised engineer.

To remain operational with optimal performance, the equipment should not be disconnected or moved. The positioning of the sensor head(s) and processing unit(s) have been set to achieve the best possible performance and the system has been calibrated accordingly.

As soon as the driver switches on the vehicle, the BLAXTAIR® system starts automatically.

The processing unit emits a 'beep' after 5 seconds (+/- 1 second) to confirm power up.

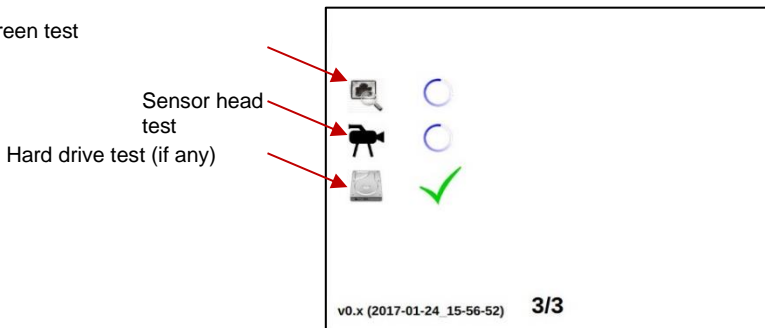
The picture below shows the different screens that are successively displayed by the monitor during the initialization process.



The system performs a 'self-test' sequence. Once all the ticks of this page turn green, the video is displayed on the monitor, with a green boarder, and the LED (if installed) will turn green indicating that Blaxtair system is now fully operational.




Screen test



Do not shut down the processing unit during initialisation. The complete initialisation process can last from 30 to 70 seconds.

The frame displayed on the screen is green if BLAXTAIR® is operational AND does not detect any danger.



If the frame is red, the BLAXTAIR® is operational and detecting obstacles or pedestrians.

If the frame is orange, the BLAXTAIR® requires calibrating.

If there is no frame, the BLAXTAIR® is initialising.

If the frame is purple, the BLAXTAIR® has a problem. Please contact the after sales service.

When the ignition is turned off the BLAXTAIR® system will automatically shut down (similar to a laptop). A delayed shutdown option is available and may have been set up by the installation engineer.

Do not disconnect the power supply (e.g. battery isolator) of the vehicle until the BLAXTAIR® system has shut down.

4.3 Maintenance operations

4.3.1 Starting the machine: verification of detection

At the beginning of each working day, before starting working with a vehicle equipped with BLAXTAIR®, the operator should check that the BLAXTAIR® is operational. Below is a more detailed procedure to verify correct operation during the usual periodic checks of the machine.

Before performing the test, the operator should ensure that all safety conditions are fulfilled and that he/she won't endanger anyone. With the assistance of a second person, the driver should carry out the following procedure:

- Park the vehicle in a flat open area, surrounded by barriers. Make sure that the vehicle cannot move;
- Draw the detection area on the ground;
- Turn on the ignition without starting the engine;
- Wait until the camera view is displayed on the screen and its frame (and LED if fitted) is green;
- Make sure that the vehicle cannot move then engage reverse gear, or any other signal needed to enable detection;
- Ask the assistant to move across the detection zone. Check that the system detects the pedestrian as soon as they are in the danger area. The screen frame should turn red immediately and the alarm should sound as long as they stay or move within the detection area;
- If the test fails, contact Blaxtair hotline.

4.3.2 Sensor head cleaning (at least once a day)

To ensure optimum performance, both lenses of the sensor heads should be cleaned at least once a day (If the mirrors need cleaning, so will the sensor heads!).

Clean the lenses at least once a day with a soft cloth. Products for washing windows and water may be used.


After cleaning, make sure that the windows are:

- Dry, free of dirt and drops;
- Without scratches. In case of significant scratches, contact your installer or Blaxtair's customer support.

4.3.3 System setup (if necessary)

During installation, the system was set up for optimum performance.

If the sensor head has been moved from its initial position or suffered an impact, performance will be degraded.

	<p>If the sensor head has received an impact of any kind, the system must be checked ref: section 4.3.1 .</p> <p>It in any doubt the system must be inspected by a Blaxtair certified engineer.</p>
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4.4 Driver Periodical training

Before working with a machine equipped with BLAXTAIR®, operators should be specifically trained as to its use and maintenance.

He/she shall be updated on a regular basis regarding:

- His/her own responsibilities (see warning. chapter 2);
- System operation and limitations (chapter 4);
- Precautions for use (section 4.1);
- Maintenance operations he/she is responsible for (section 4.3).

5 Blaxtair® functions

5.1 Display presentation



5.2 Display of the captured video

MR90	MR90A	MR180
<p>One monitor installed in the cabin provides continuous footage captured by the sensor head.</p>	<p>Two sensor heads are activated alternatively by the same processing unit, the display shows the view in the direction of travel.</p>	<p>Two sensor heads are activated simultaneously. Each processor/head has its own monitor which provides continuous footage from its respective sensor head</p> <p>As an option, it is possible to have only one monitor displaying the videos according to §5.5.2.2.</p>

The horizontal field of view of a sensor head is about 120°.

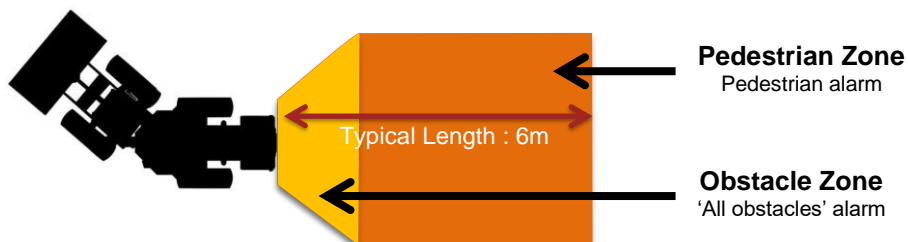
The mirror display mode is enabled or not during installation, according to the positioning of the sensor head.

5.3 Detection/danger area

The detection area (also called danger area), has been defined by your installer according to your needs and constraints.

It is generally composed of two separate sub-zones:

- an « obstacle » sub-zone where any obstacle, pedestrian or not, triggers an alarm;
- a « pedestrian » sub-zone where only pedestrians trigger alarms.



5.4 Alarm trigger

The BLAXTAIR® System is unique in its ability to detect only pedestrians

Combined with the set detection zones, only active in the direction of travel, it dramatically reduces the constant 'nuisance' alarms encountered by other systems

The alarm will only sound if there is a person in the 'Pedestrian Zone' with the option of a small 'Obstacle Zone' to protect the rear of the vehicle, if required

The main complaint expressed by operators is of constant warnings emitted by so called 'safety systems'. Apart from the fact that an operator will choose to ignore these constant alarms they can also cause mental fatigue which can lead to loss of concentration, promoting the likelihood of accidents as opposed to reducing them.

















5.5 Alarm

5.5.1 MR90

When a pedestrian and/or an obstacle is detected in the relevant detection zone, BLAXTAIR® triggers:

- a visual alarm and audible alarm on the screen
- a visual alarm with the LED and/or an audible alarm with an external buzzer (option)
- 1 or 2 accessory outputs.

The option installed may differ from the following standard alarm, which is given as an example:

	Monitor			Additional LED (option)	Additional Buzzer (option)
	Visual alarm	Sounding alarm	Icon		
No obstacles or pedestrians in the zones		None	None		None
No obstacles or pedestrians in the "obstacle" zone. No pedestrians in the "pedestrian" zone		None	None		None
Obstacles or pedestrians in the « obstacle » zone					
No obstacles in the "obstacle" zone. Pedestrians in the "pedestrian" zone					
Software or hardware technical problem		None	Ref. Chapter 8		None

RED = DANGER**THE DRIVER SHOULD STOP THE VEHICLE IMMEDIATELY!**

After having stopped the vehicle, and before moving again, the driver should identify the cause of the alarm and check carefully that there are no pedestrians or obstacles in the danger area.



Example of obstacle detection: red frame and warning icon. In the top right corner, a radar view shows the detection zone (in red) and the approximate position of the detected obstacle (white dot).






















Example of pedestrian detection: red frame and pedestrian icon. In the top right corner, a radar view presents the detection zone (in red) and the approximate position of the detected pedestrians (white dots).

When BLAXTAIR® encounters a technical problem, one or more icons may be displayed on the top left of the screen (refer to Chapter 8).

5.5.2 MR180

5.5.2.1 Twin monitor configuration

Both monitors have the same status (except in the case of failure). The table below sums up the possible situations.

Head 1	Head 2	Monitor 1	Monitor 2	Additional Led/buzzer
				
				 + 
				 + 
				 + 

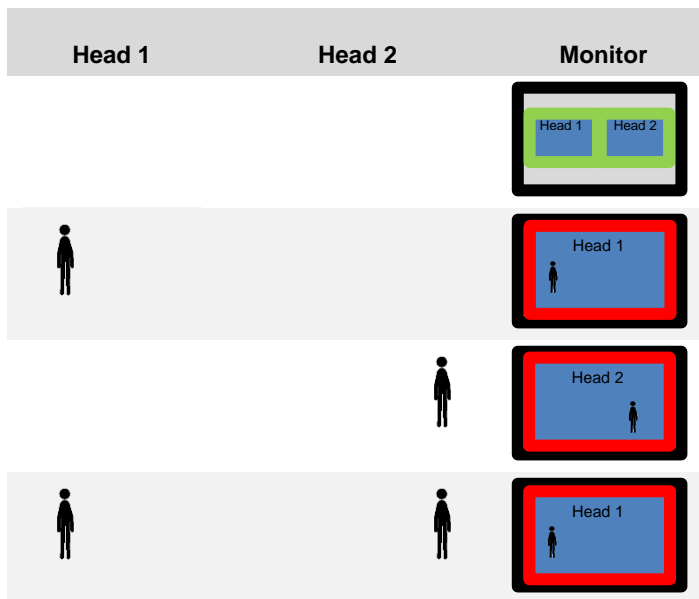
5.5.2.2 Optional configuration: single monitor for MR180

Both videos are displayed simultaneously on a single split screen.

When a detection occurs, the video of the Sensor Head in alarm mode is displayed in full screen automatically.

Once the alarm stops, both videos are displayed again in split screen mode.

The following table sums up the different views on the screen during detections.






5.5.3 External alarm (output) - Option

Customers may require an external alarm on the vehicle (beacon, strobe, audible alarm, etc.). Two different external alarms can be setup. Generally, the following setup is implemented:

- Output 1: **All Obstacles**. External alarm is triggered when an obstacle is detected in the 'obstacle zone' or when a pedestrian is detected in the 'pedestrian zone' and detection is active (e.g. reverse selected);
- Output 2: **Pedestrian Only**. External alarm is triggered when a pedestrian is detected in the 'pedestrian zone' and detection is active (e.g. reverse selected). No obstacle detection.

5.5.4 Alarm priority

Priority	Colour	Alarm	Comment
1		Detection	Highest priority.
2		System Fault	If a problem occurs during operation. The visible alarm will be 'purple' for as long as the failure exists (except in the case of a detection when it turns 'red')
3		No alarm	No detection / No Faults.

5.6 Recording (optional)

If the BLAXTAIR® system has been ordered 'with a recorder', the Processing Unit will have a built in 120GB hard drive which will record the footage from all alarm events.

This data can be used to analyse the BLAXTAIR®'s performance and can prove invaluable in diagnosing any problems 'remotely' without the need for an engineer visiting site.

The footage may also prove valuable if an incident has occurred, to ascertain the cause, etc. of an incident.

Many customers analyse the footage to develop better working practices

The hard drive will record approximately 2hrs of accumulated footage which equates to approximately one week of normal use. When the hard drive is full, the oldest data is overwritten.

Data includes:

- Raw video
- Processed video

- Log information (date, status of the system and components, alarm status, etc.)

Important note

Footage is recorded upon alarm: if an alarm is triggered the hard drive will record for as long as the alarm is active plus 5 seconds post alarm. Customers may request a different set up available as a 'customer configuration'.

To download and view this data a 'configured' external hard drive or 'Download Tool' is available from your supplier. For user guide refer to section 9.1.

6 Nominal conditions for detection

6.1 Postures

Due to the complex algorithms employed in the BLAXTAIR® system, detection will be extremely accurate. However, the following guidelines highlight the basic levels of detection

BLAXTAIR® typically **detects** following postures:



BLAXTAIR® has limited detection performance in following cases:



With the current version of BLAXTAIR® squatting persons are detected in 'obstacles' zone only.

6.2 Clothing

BLAXTAIR® detects pedestrians whatever their clothing. Nevertheless, under degraded lighting conditions, it detects pedestrians wearing high visibility clothing more accurately.

6.3 Latency and localization accuracy

BLAXTAIR® triggers an alarm between 200 and 300 ms after a pedestrian or an obstacle has entered the detection zone.

Near the detection zone and depending on the distance of the pedestrian (or obstacle) to the sensor head, the localization accuracy may vary from up to 30cm between 1 and 3 meters, and up to 50cm between 3 and 5 meters.

6.4 False detections

Specific obstacles may cause false pedestrian detections.

These false detections are highly dependent on lighting conditions and image quality in general (cleanliness of sensor head windows, angle and height of the sensor head, proximity of the object, reflections, strong backlighting, very low visibility, etc...).

False detections are generally caused by following objects:

- Gas cylinders,
- Poles,
- Coat hangers,
- Bushes.
- Life size pictures of people!

6.5 Influence of lighting conditions

Optimal detection and classification performance of BLAXTAIR® is achieved with good lighting conditions.

Working lights must be utilized to flood the areas to be protected for the BLAXTAIR® to function correctly in low light conditions, such as night time



Strong backlight (sun in the field) as well as very homogeneous lighting (local glare, halo of light, etc.), may significantly degrade detection performance.

6.6 Smoke, darkening, soiling of the sensor head windows

The current version does not implement the algorithms for detecting smoke or dirty windows. Therefore, phenomena such as temporary or permanent masking are not addressed in this release.

It is the responsibility of the driver to ensure that conditions for good detection performance are met.

In particular, operators should clean the lenses of the sensor heads at least once a day and turn on the lights when necessary (see chapter 4.3.2).

7 Characteristics and conformity

7.1 Physical characteristics

Weight	Sensor head (with fixation kit and cap)	4,3 kg
	Processing Unit (IP67)	3,7 kg

7.2 Electrical characteristics

Input voltage	DC 12V to 24V		
Power	MR90	MR90A	MR180
Nominal mode			
- battery +	25W	30W	50W
- ignition	1W	1W	1W
Sleeping mode	10mA @ 24V	10mA @ 24V	20mA @ 24V
Transient acceptable input voltage	DC 10V to 34 V		

7.3 I/O

Digital I/O	2 outputs: 0/12V – Max Amps=100mA 3 inputs: 0/36V
Ethernet	1 Fast Ethernet
Serial bus	1 RS232
USB	1 USB3

7.4 Environment

Operational temperature

Sensor head	-40°C / +75°C
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Display - standard	-20°C / +70°C
- IP67	-10°C / +60°C

Processing Unit	-40°C / +68°C
-----------------	---------------

Storage temperatures

Sensor head	-40°C / +75°C
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Display - standard	-30°C / +80°C
- IP67	-20°C / +70°C

Processing Unit	-40°C / +75°C
-----------------	---------------

Cold / hot start

Sensor head	-40°C / +75°C
-------------	---------------

Display	-20°C / +70°C
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Processing Unit	-40°C / +68°C
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Vibrations according to IEC 60068-2-64

Sensor head	ISO 16750 § 4.4 g=57,9m/s ²
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Processing Unit	ISO 16750 § 4.4 g=57,9m/s ²
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Shocks according

Sensor head	ISO 16750 IEC 60068-2-29: 500m/s ² during 6ms IEC 60068-2-27: Bump, test Eb : 40g for 6ms
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Processing Unit	ISO 16750 IEC 60068-2-29: 500m/s ² during 6ms IEC 60068-2-27: Bump, test Eb : 40g for 6ms
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Protection

Sensor head	IP69K
Display	IP67 in option
Processing Unit	IP67

EMC

ISO 13766:2006-05	Earth-moving machinery – EMC
EN 12895:2015-09	Industrial trucks – EMC
EN 13309:2010-09	Construction machinery - EMC of machines with internal power supply
ISO 14982:2014-12	Agricultural and forestry machines – EMC
EN 55016-2-3:2010 + A1:2011 + A2:2014	Specification of radio disturbance and immunity measuring apparatus and methods
EN 55012:2008-06 + A1:2009	Vehicles, boats and internal combustion engines: Radio disturbance characteristics
ISO 11452-2:2004-11	Road vehicles: Electrical disturbances from narrowband radiated electromagnetic energy
ISO 7637-2:2011-03	Road vehicles: Electrical disturbances from conduction and coupling
ISO 16750-2:2012-11	Road vehicles: Environmental conditions and testing for electrical and electronic equipment

7.5 Other features

Display characteristics

Brightness	400 cd/m ²
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Contrast	500:1
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Start / stop

Starting duration	40s. (typical for MR90)
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Switch off delay (soft Off)	5 seconds
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Recording (option)

Capacity	120Gb
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Recording duration	2h10 max
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7.6 Performances

Detection Latency	< 300 ms (according to ISO16001)
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Detection update frequency	8 fps (typical)
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Operational Illumination range	100 Lux to 80000 Lux >300 Lux recommended
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Field of view / detection

Field of View (displayed on the monitor)	120°(H) x 90° V
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Field of obstacle detection	105° (H)
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Field of pedestrian classification	90° (H)
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Size of pedestrian detected (full perfo)	150cm min
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8 Troubleshooting

8.1 BLAXTAIR® does not start

- Turn on the ignition and wait a few seconds;
- Check that the vehicle powers the radio, the lights, night lights and/or any other electronic equipment on board;
- Turn off the ignition;
- Turn off the general power of the vehicle;
- Check BLAXTAIR®'s supply fuse and replace it if necessary;
- Turn on the general power of the vehicle;
- Turn on the ignition.

If the problem persists, contact your installer or Arcure's customer support.

8.2 The alarm flashes purple

Switch off BLAXTAIR® and restart it.

If the problem persists, contact your installer or Arcure's customer support. Note the messages and/or icons displayed on the screen.

8.3 The detection performance is degraded

1. Check if an icon is displayed on the screen. An icon on the screen may reveal a technical problem impacting detection performance. Refer to section 8.4 to identify the meaning of the icons;
2. Check that the view of the detection zone captured by the sensor head is properly displayed on the screen;
3. Check that the installed equipment (processing unit, sensor head) has not been moved from their initial position (intentionally or following a shock);
4. Check that the detection conditions described in section 6 are met : There is no partial or complete obstruction of one or both windows of






the sensor head, dry and clean windows, correct lighting conditions, detection distances, etc.

5. Check that the reverse gear is engaged if detection is enabled by this condition (which is generally the case, except on excavators).

After having performed these checks and having made relevant corrections if necessary, if detection performance remains degraded, contact your installer or Arcure's customer support.

8.4 An icon is displayed on the screen

When BLAXTAIR® meets a technical problem, one or more icons may be displayed in the top left of the screen.

Icons	Significations
	<p>Technical problem related to communication between processing units (MR180 configuration only).</p>
	<p>Technical problem related to the sensor head(s)</p>
	<p>Technical problem related to the LED: either communication is broken or PU requests are not properly taken in account</p>
	<p>Sensor Head temperature approach the limit.</p>
	<p>PU temperature approach the limit</p>

Explicit messages may be displayed on the bottom of the screen to help with the diagnostic.

The colour of the text defines the type of information:

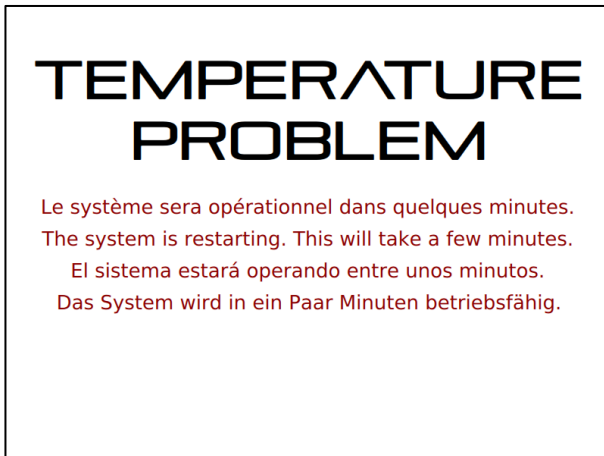
- failure messages are displayed in red colour;
- warning messages are displayed in blue colour;
- informative messages are displayed in white colour.

If an icon is displayed persistently on the screen, turn off BLAXTAIR®, wait a few minutes and restart it.

If the problem persists, contact your installer or Arcure's customer support.

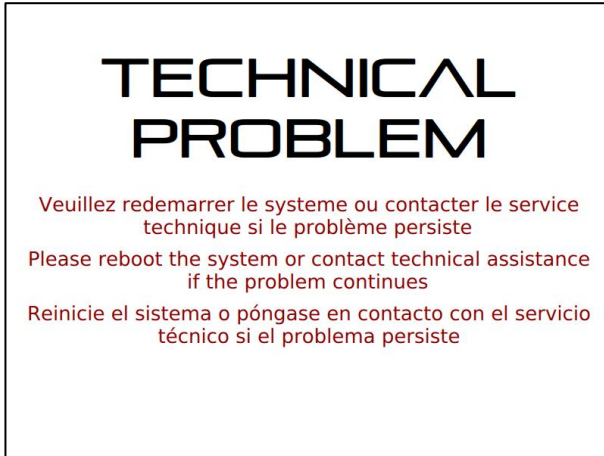
8.5 Temperature problem

If the Sensor Head or Processor temperatures are out of the range (after the icon 'temperature'), this message will appear on the screen in order to reboot the system and cool down the temperature.



8.6 Technical problem

If “technical problem” message appear on the screen, please reboot the system.



If the problem continues, make a backup (following step on paragraph 9.1.1) and contact technical assistance.

8.7 Customer support

For any support required or for any technical questions concerning BLAXTAIR®, its installation or maintenance, do not hesitate to contact us at

hotline@blaxtair.com

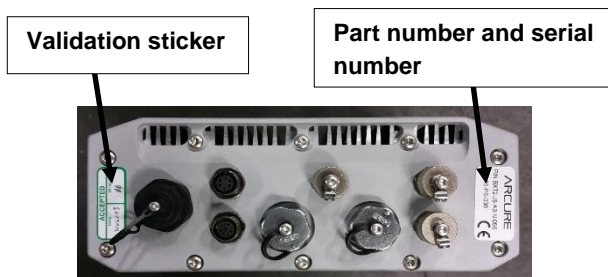
or see our web page <http://arcure.net/arcure-throughout-the-world> for the contact details of BLAXTAIR® for your country.

For any support request, Arcure’s technical team will ask you the product and serial numbers indicated on the processing unit.

The technical team may also request :

BXT3 - V2.3

- the messages or icons displayed on the screen if any;
- the status/colour of the visual alarm.



9 Appendices

9.1 Data recorded by BLAXTAIR®

9.1.1 Download to an external hard drive

To download the data recorded by BLAXTAIR®, including video, only a storage device provided by Arcure can be used.

- Switch on BLAXTAIR®;
- Once the screen displays the camera view, plug the backup device into the USB port on the Processor (If optional LED is fitted, remove the connector on the processor to allow access for the 'download tool'). After few seconds, a maintenance page will be displayed on the screen with messages in the right top corner, indicating the progress of the backup;
- Wait until the backup is complete. You will be warned by a message displayed on the screen inviting you to disconnect the storage device. The transfer may take from a few minutes to a couple of hours depending on the volume of data to be transferred;
- Unplug the backup device. BLAXTAIR® restarts automatically in detection mode; (If the LED option was disconnected , the system must be rebooted to restore the LED function)
- Return the backup device to Arcure's customer support.

9.1.2 Viewing Downloaded Data

Plug the external hard drive containing the downloaded data into a PC. On the HDD, video files are stored in the file data.

📁 Serial_number_Date_time

📁 system info

📁 log

📁 data

They can be displayed by using VLC software



9.2 Automatic software update

To perform the update, you need an update device provided by Arcure.

Be sure to maintain a good power supply to the BLAXTAIR® system during the update. A low voltage or a power failure may cause irreversible damage to the processing unit.

- Start up BLAXTAIR®;
- Once the monitor displays the camera view, plug the update device to the USB maintenance connector. After few seconds, a maintenance page is displayed on the screen with messages in the right top corner, indicating the progress of the update;
- Wait until the update is complete. You will be warned by a message displayed on the screen inviting to disconnect the update device. The update may take several minutes (rarely more than ten minutes);
- Unplug the update device. BLAXTAIR® restarts automatically in detection mode. Verify the detection according to the procedure detailed in section 4.3.1 ;
- Return the update device to Arcure's customer support.

9.3 Declaration of conformity

Declaration of Conformity EU

The Manufacturer undersigned ARCURE SA Tour Essor, 14 rue Sandicci,
93500 Pantin (France)

Certifies that the equipment Equipment Name: Blaxtair
Equipment Reference: BXT3

Complies with the relevant regulation requirements as per hereunder :

European Council Directives

93/68/EEC CE Marking

2014/30/EU Electromagnetic Compatibility

2011/64/EU RoHS Directive

Harmonized Standards

ISO 13766:2006-05 Earth-moving machinery - EMC

EN 12895:2015-09 Industrial trucks - EMC

EN 13309:2010-09 Construction machinery - EMC of machines with internal power supply

ISO 14982:2014-12 Agricultural and forestry machines - EMC

√ 55016-2-3:2010 + A1:2011 + A2:2014 Specification of radio disturbance and immunity measuring apparatus a
methods

EN 55012:2008-06 + A1:2009 Vehicles, boats and internal combustion engines: Radio disturbance
characteristics

ISO 11452-2:2004-11 Road vehicles: Electrical disturbances from narrowband radiated
electromagnetic energy

ISO 7637-2:2011-03 Road vehicles: Electrical disturbances from conduction and coupling

ISO 16750-2:2012-11 Road vehicles: Environmental conditions and testing for electrical and
electronic equipment

ISO16001:2017 Earth-moving machinery -- Object detection systems and visibility aids ·
Performance requirements and tests



Pantin, 22nd of March, 2018

Loïc Pérochon

Quality Manager

A handwritten signature in blue ink, appearing to read 'Loïc Pérochon', is written over the printed name and title.