ARCTEQ
PART OF ENSTO GROUP

AQ-0x

Arc sensors

Instruction manual

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Disclaimer

Please read these instructions carefully before using the equipment or taking any other actions with respect to the equipment. Only trained and qualified persons are allowed to perform installation, operation, service or maintenance of the equipment. Such qualified persons have the responsibility to take all appropriate measures, including e.g. use of authentication, encryption, anti-virus programs, safe switching programs etc. necessary to ensure a safe and secure environment and usability of the equipment. The warranty granted to the equipment remains in force only provided that the instructions contained in this document have been strictly complied with.

Nothing contained in this document shall increase the liability or extend the warranty obligations of the manufacturer Arcteq Relays Ltd. The manufacturer expressly disclaims any and all liability for any damages and/or losses caused due to a failure to comply with the instructions contained herein or caused by persons who do not fulfil the aforementioned requirements. Furthermore, the manufacturer shall not be liable for possible errors in this document.

Please note that you must always comply with applicable local legislation and regulations. The manufacturer gives no warranties that the content of this document is in all respects in line with local laws and regulations and assumes no liability for such possible deviations.

You are advised to notify the manufacturer in case you become aware of any errors in this document or of defects in the equipment.

The manufacturer reserves the right to update or amend this document at any time.

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1 Document information

Table. 1 - 1. History of Revision 1.

Revision	1.00
Date	July 2010
Changes	- The first revision of the manual.
Revision	**1.01**
Date	July 2012
Changes	- The sensor chapter revised (fiber pictures and point sensor connections added).
Revision	**1.02**
Date	July 2012
Changes	- Order code updated. - Point sensor max. wiring length updated to 200 meters.
Revision	**1.03**
Date	January 2020
Changes	- Content completely rewritten to improve grammar and readability. - The AQ-02 point sensor chapter added to the "Arc sensors" chapter, and AQ-02's technical data added to the "Technical data" chapter. - Sensor–unit type dependency list updated. - The "Connecting sensors" chapter moved to the AQ-0x instruction booklet from the AQ-101 and AQ-110x instruction manuals. The chapter on how to connect fiber loop sensors added. - All technical data checked and updated where necessary. - Ordering information updated. - Images updated where necessary.
Revision	**1.04**
Date	October 2022
Changes	- Added the front cover image. - Changed " the AQ-100 series" to "the AQ 100 series" throughout the manual. - Added the note of AQ-103 variants only accepting one sensor per sensor channel where relevant. - AQ-02: added that both pressure and light detection required for sensor activation. - Removed the on-site cutting from the manual. - Removed the tubing paragraph from AQ-06 and AQ-08. - Removed the entire "Tubing" section from the "Connecting sensors" chapter. - Removed all fiber sensor images. - Technical data: updated the IP classifications for AQ-01 and AQ-02, corrected the AWG measurements. - Updated the order codes.
Revision	**1.05**

Date	December 2022
Changes	- Separated the sensor types into their own subchapters in the "Technical data" chapter.
Revision	**1.06**
Date	January 2023
Changes	- Updated the Arcteq logo on the cover.
Revision	**1.07**
Date	April 2023
Changes	- Small changes to visual style. - Small improvements to descriptions.
Revision	**1.08**
Date	November 2024
Changes	- Updated the logo on the front page. - Added the "Using the sensor bracket" chapter, and integrated sensor bracket information to other relevant chapters. - Updated the "Connecting sensors" chapter to include two- and three-cable wiring for point sensors. - Added the "Dimensions" chapter.

NOTICE!
This booklet only describes the AQ-0x series sensors used in the arc protection system in conjunction with other units from the AQ 100 series. It is important to read the instruction manuals for the individual AQ-100 units as well!

2 Safety information

This document contains important instructions that should be saved for future use. Read the document carefully before installing, operating, servicing, or maintaining this equipment. Please read and follow all the instructions carefully to prevent accidents, injury and damage to property.

Additionally, this document may contain four (4) types of special messages to call the reader's attention to useful information as follows:

NOTICE!
"Notice" messages indicate relevant factors and conditions to the the concept discussed in the text, as well as to other relevant advice.

CAUTION!
"Caution" messages indicate a potentially hazardous situation which, if not avoided, **could** result in minor or moderate personal injury, in equipment/property damage, or software corruption.

WARNING!
"Warning" messages indicate a potentially hazardous situation which, if not avoided, **could** result in death or serious personal injury as well as serious damage to equipment/property.

DANGER!
"Danger" messages indicate an imminently hazardous situation which, if not avoided, **will** result in death or serious personal injury.

These symbols are added throughout the document to ensure all users' personal safety and to avoid unintentional damage to the equipment or connected devices.

Please note that although these warnings relate to direct damage to personnel and/or equipment, it should be understood that operating damaged equipment may also lead to further, indirect damage to personnel and/or equipment. Therefore, we expect any user to fully comply with these special messages.

3 Arc sensors

The AQ 100 series suppors arc sensing point sensors and fiber optic loop sensors. These sensors can be used with different devices and different switchgear types according to specific application requirements.

Point sensors are typically installed in metal-clad compartments, and they provide a quick and accurate location of the fault area. Fiber loops typically cover a wider protected area with one fiber, when there is no need to pinpoint the exact location of a fault.

3.1 Arc light point sensor AQ-01

AQ-01 is an point sensor with a light-sensitive photodiode element activated by arc light. Its light detection radius is 180 degrees. The default light intensity threshold for an AQ-01 sensor is 8,000 lux. Depending on the demand of the application, light point sensors can be ordered with 25,000 lux or 50,000 lux thresholds.

Figure. 3.1 - 1. The AQ-01 arc light point sensor.

The AQ-01 sensors should be mounted in the switchgear cubicles in such a way that the light-sensitive part covers the protected area as completely as possible. In most cases one sensor per closed metal-clad compartment is sufficient. In open spaces (such as a busbar section) the sensors should be mounted no more than two (2) meters apart.

An AQ-01 is installed either inside or outside the compartment wall. When mounting inside the wall, the sensor is placed on the wall with the colored side against the wall. When mounting outside the wall the sensor is placed on the wall with the grey side against the wall and the eye is pushed into the drilled compartment hole. No external mounting plates are needed regardless of the mounting type. However, you can use mounting brackets, such as Arcteq's sensor bracket accessory, for installation. See the Using the sensor bracket chapter for more information.

Up to three (3) sensors can be connected in series per channel, with the exception of AQ-103 which can handle only one point sensor per channel. Installing a connection cable is simple as each end of the sensor has a detachable cover over the cable connectors. Reattach the cover once the wires have been installed. See the Wiring of point sensors chapter for more information.

NOTICE!
The AQ-01 point sensor does **not** come with a connection cable!

3.2 Arc light and pressure point sensor AQ-02

AQ-02 is an arc light and pressure point sensor that comes with arc light detection and ambient pressure detection. AQ-02 point sensor activates when both light and pressure are detected. The default light intensity threshold for an AQ-02 sensor is 8,000 lux. Depending on the demand of the application, AQ-02 can also be ordered with 25,000 lux or 50,000 lux thresholds. Its light detection radius is 180 degrees. The pressure threshold is fixed at 0.2 bar above ambient pressure.

Figure. 3.2 - 2. AQ-02 arc light and pressure point sensor.

The AQ-02 sensors should be mounted in the switchgear cubicles in such a way that the light-sensitive part covers the protected area as completely as possible. In most cases one sensor per closed metal-clad compartment is sufficient. The AQ-02 sensors cannot be installed in open spaces.

An AQ-02 can only be installed inside the compartment wall as not to block pressure detection located next to "the eye". The sensor is placed on the wall (with the colored side against the wall), and then fixed to the wall with two screws. No external mounting plates are needed regardless of the mounting type. However, you can use mounting brackets, such as Arcteq's sensor bracket accessory, for installation. See the Using the sensor bracket chapter for more information.

Up to three (3) sensors can be connected in series (with the exception of AQ-103 which can take only one point sensor per channel). Installing a connection cable is simple as each end of the sensor has a detachable cover over the cable connectors. Please remember to reattach the cover once the wires have been installed. See the Wiring of point sensors chapter for more information.

NOTICE!
The AQ-02 point sensor does not come with a connection cable!

3.3 Arc light fiber optic loop sensor AQ-06

AQ-06 is an arc light fiber optic loop sensor, which is a plastic fiber optic cable. Fiber sensors are distributed through the protected switchgear cells. The light intensity threshold of an AQ-06 sensor is 8,000 lux. The sensor's detection radius is 360 degrees.

AQ-06 sensors can be ordered in pre-manufactured lengths of 3…40 meters (3 m, 5 m, 10 m, 15 m, 20 m, 25 m, 30 m, 35 m, 40 m).

3.4 Arc light fiber optic loop sensor AQ-07

AQ-07 is an arc light fiber optic loop sensor, which is a robust fiber optic cable with a practically unlimited bending radius. The sensor contains hundreds of glass fiber drains covered by a plastic tube, thus making it extremely strong and durable. Fiber sensors are distributed through the protected switchgear cells.

AQ-07 sensors can be ordered in pre-manufactured lengths of 3…50 meters (3 m, 5 m, 10 m, 15 m, 20 m, 25 m, 30 m, 35 m, 40 m, 45 m, 50 m).

The light intensity threshold of an AQ-07 sensor is 8,000 lux. The sensor's detection radius is 360 degrees.

If necessary, the ends of an AQ-07 cable can be ordered with heat shrinking tubing to avoid light detection outside the protected zone. The covered area can be one (1) or two (2) meters by default; if other lengths are required, please consult the Arcteq sales team. You can find the Contact and reference information chapter at the end of this manual.

3.5 Arc light fiber optic loop sensor AQ-08

AQ-08 is an arc light fiber optic loop sensor. It is designed to withstand temperatures up to 125 ºC, which makes it suitable for e.g. wind turbine windings. AQ-08 is a robust fiber optic cable with a practically unlimited bending radius. The sensor contains hundreds of glass fiber drains that are covered by a plastic tube, thus making it extremely strong and durable. Fiber sensors are distributed through the protected switchgear cells.

AQ-08 sensors can be ordered in pre-manufactured lengths of 3…15 meters (3 m, 5 m, 10 m, 15 m).

The light intensity threshold of an AQ-08 sensor is 8,000 lux. The sensor's detection radius is 360 degrees.

3.6 Sensor dependencies

Compatibility of arc sensor types depend on the hardware available in the AQ 100 series device. The tables below describe those dependencies.

Table. 3.6 - 2. Sensor dependencies (AQ 100 MV devices).

	Point sensors (AQ-01 & AQ-02)	Fiber loops (AQ-06, AQ-07 & AQ-08)
AQ-101	Yes	Order option
AQ-101D	Yes	Order option
AQ-101S	Yes	No
AQ-102	No	Yes
AQ-103	Yes	Order option
AQ-110P	Yes	Order option
AQ-110F	No	Yes

Table. 3.6 - 3. Sensor dependencies (AQ 100 LV devices).

	Point sensors (AQ-01 & AQ-02)	Fiber loops (AQ-06, AQ-07 & AQ-08)
AQ-101LV	Yes	Order option
AQ-101DLV	Yes	Order option

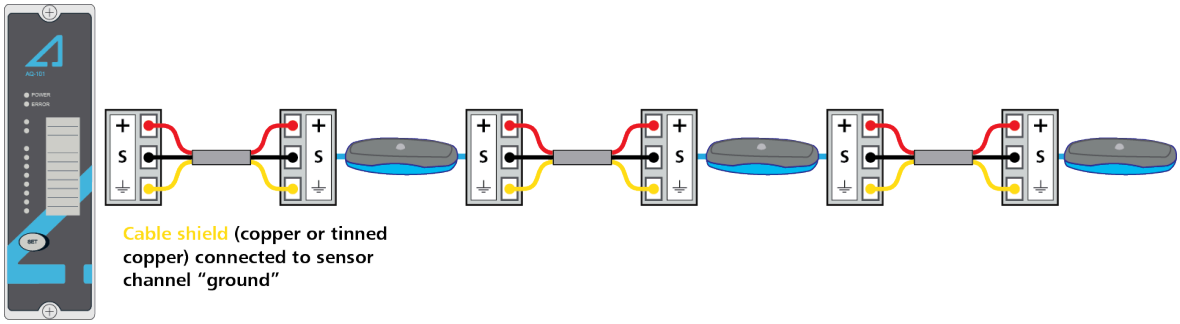
	Point sensors (AQ-01 & AQ-02)	Fiber loops (AQ-06, AQ-07 & AQ-08)
AQ-102LV	No	Yes
AQ-103LV	Yes	Order option
AQ-110PLV	Yes	Order option
AQ-110FLV	No	Yes

4 Connecting sensors

4.1 Wiring of point sensors

Point sensor connection with two-wire cable

Figure. 4.1 - 3. Point sensor connection with a two-wire cable.



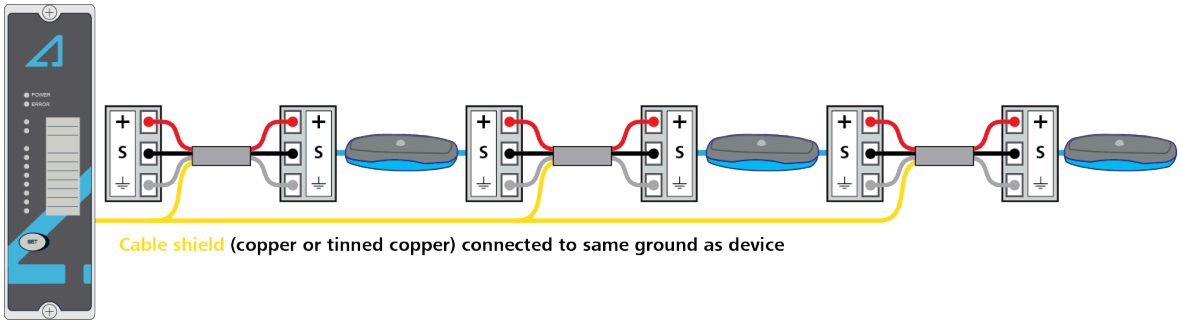
1. Open the sensor covers and detach the connectors.
2. Attach the cable to the connector and to the arc protection device.
3. Reattach the connectors to the sensor.
4. Run the auto-configuration procedure (see the "System setup" chapter in the device manual for further details).

WARNING!
Only connect the cable shield to the "ground" connector of the point sensor channel. Do not connect the cable shield to the same earth as the device!

NOTICE!
The shield of the cable must be either copper or tinned copper.

Point sensor connection with three-wire cable

Figure. 4.1 - 4. Point sensor connection with a three-wire cable.



1. Open the sensor covers and detach the connectors.
2. Attach the cable to the connector and to the arc protection device.
3. Reattach the connectors to the sensor.
4. Run the auto-configuration procedure (see the "System setup" chapter in the device manual for further details).

NOTICE!
If the cable has a shield (copper or tinned copper), it is recommended to connect it to same ground as the device.

4.2 Using the sensor bracket

WARNING!
An AQ-01 light sensor can be installed both inside and outside the compartment wall, whereas an AQ-02 light and pressure sensor can only be installed inside the compartment wall!

Arcteq offers a plastic sensor bracket for easier installation of point sensors to compartment walls.

When using the sensor bracket, begin by situating the bracket correctly with regards to the arc-protected space. An AQ-01 light sensor can be installed both inside and outside the compartment wall: the sensor's eye can be towards the bracket (the first figure below) or facing away from the bracket (the second figure below). However, an AQ-02 light and pressure sensor can only be installed inside the compartment wall with the sensor's eye facing away from the bracket.

To install a point sensor with the sensor bracket, screw the bracket in place by the two holes on the side and then snap the point sensor in the bracket hooks.

Figure. 4.2 - 5. Installing a point sensor outside the wall, with the eye towards the bracket.

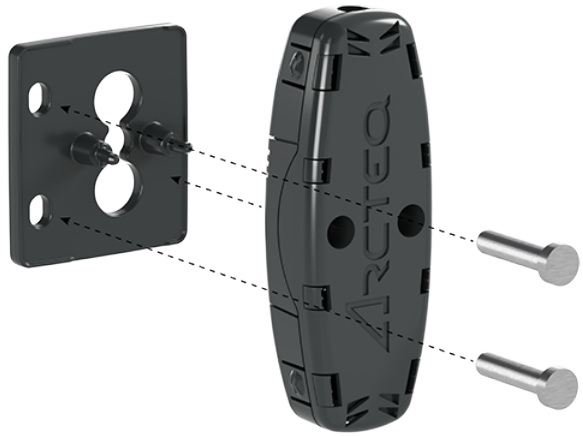
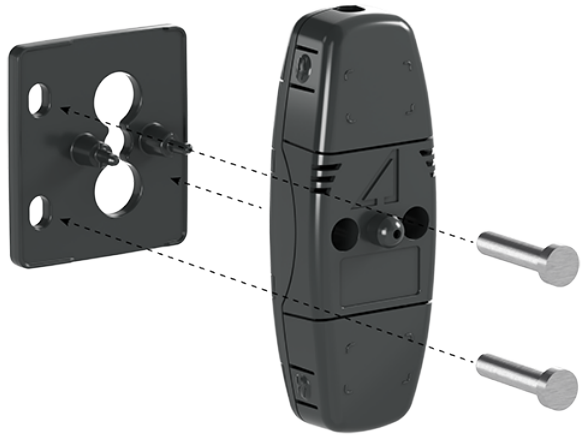
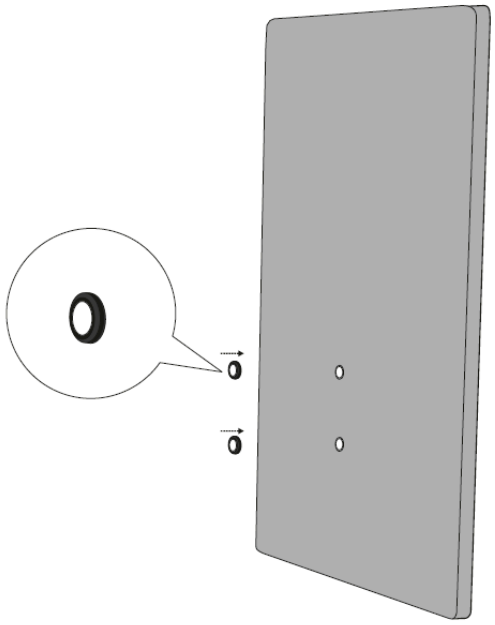


Figure. 4.2 - 6. Installing a point sensor inside the wall, with the eye facing away from the bracket.

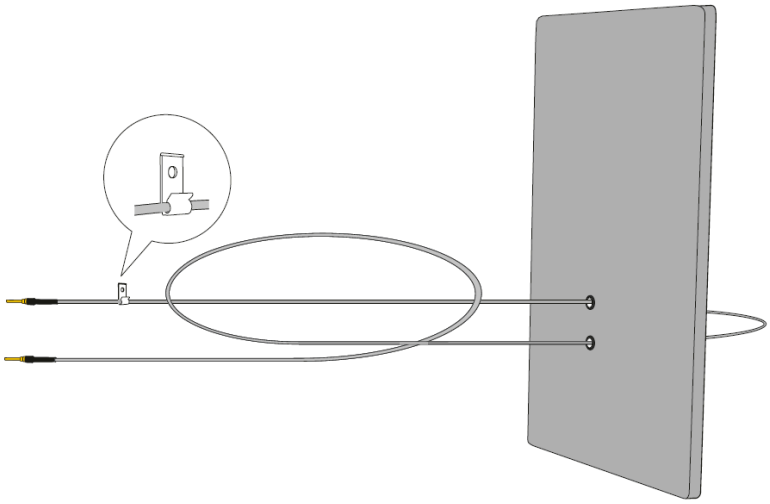


4.3 Installation of fiber loop sensors

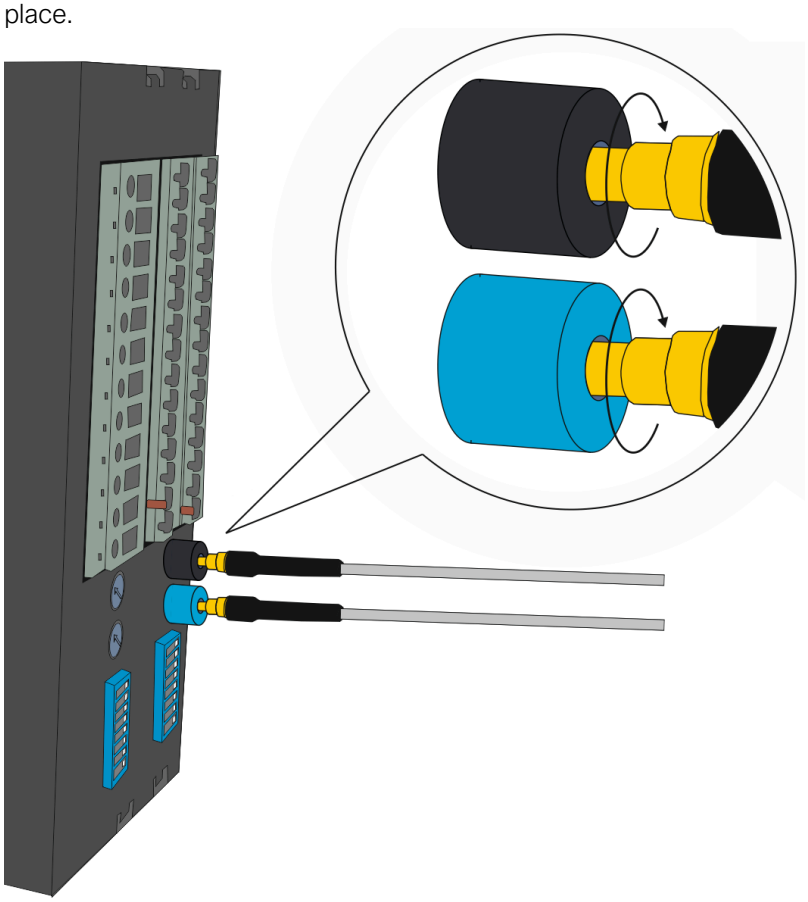
1. Drill holes on the wall for the sensor cable to enter the protected compartment.
2. Install protective covers in the holes to ensure the sensor cable remains unharmed by rough edges.



3. Run the sensor cable through the holes and along the protected area. Fasten it to the compartment walls with cable clips or some other appropriate anchoring method.



4. Turn the black and blue receiver (“Rx”) and transceiver (“Tx”) screws counter-clockwise and plug in the sensor cable terminals. Then turn the screws clockwise to secure the terminals in their place.



5 Dimensions

Figure. 5 - 7. Dimensions of Arcteq point sensors.

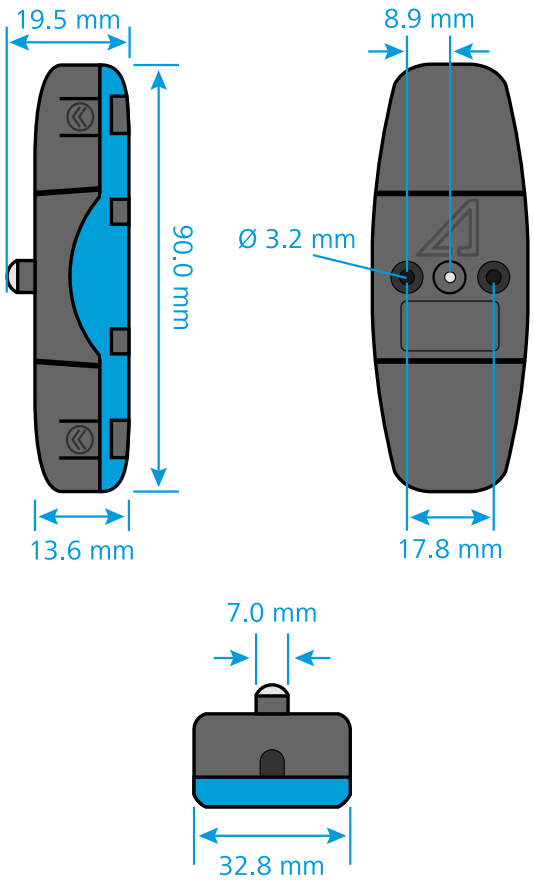
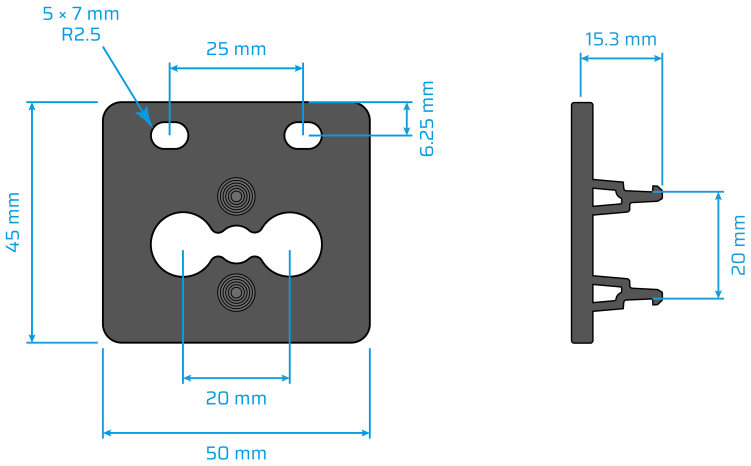


Figure. 5 - 8. Dimensions of the Arcteq sensor bracket.



6 Technical data

6.1 Point sensors

AQ-01 point sensor

Table. 6.1 - 4. Technical data for the AQ-01 light point sensor.

Light intensity threshold	8,000 lux 25,000 lux 50,000 lux
Detection radius	180º
Mechanical protection	IP 20
Sensor cable specification	Shielded twisted pair 0.75 mm^2 (AWG: 18)
Maximum sensor cable length (per channel)	200 m
Operating temperature	–20…+85 ºC

AQ-02 point sensor

Table. 6.1 - 5. Technical data for the AQ-02 light and pressure point sensor.

Light intensity threshold	8,000 lux 25,000 lux 50,000 lux
Pressure threshold (fixed)	0.2 bar above ambient pressure
Pressure measuring accuracy	±1.8 % (of full scale)
Detection radius	180º
Mechanical protection	IP 20
Sensor cable specification	Shielded twisted pair 0.75 mm^2 (AWG: 18)
Maximum sensor cable length (per channel)	200 m
Operating temperature	–20…+85 ºC

6.2 Fiber optic loop sensors

AQ-06 fiber optic loop sensor

Table. 6.2 - 6. Technical data for the AQ-06 fiber optic loop sensor.

Material	Plastic fiber
Light intensity threshold	8,000 lux
Cable length (min…max)	3…40 m
Cable diameter	1.0 mm
Detection radius	360º
Bending radius	5 cm
Operating temperature	–40…+85 ºC

AQ-07 fiber optic loop sensor

Table. 6.2 - 7. Technical data for the AQ-07 fiber optic loop sensor.

Material	Covered glass fiber
Light intensity threshold	8,000 lux
Cable length (min…max)	3…50 m
Cable diameter	1.2 mm
Detection radius	360º
Bending radius	1 cm
Operating temperature	–40…+85 ºC

AQ-08 fiber optic loop sensor

Table. 6.2 - 8. Technical data for the AQ-08 fiber optic loop sensor.

Material	Covered glass fiber
Light intensity threshold	8,000 lux
Cable length (min…max)	3…15 m
Cable diameter	1.2 mm
Detection radius	360º
Bending radius	1 cm
Operating temperature	–40…+125 ºC

7 Ordering information

AQ-0x point sensors

AQ - 0 X X

Sensor function

1 Light point sensor
2 Light and pressure point sensor

Light activation level

A 8,000 lx
B 25,000 lx
C 50,000 lx

AQ-0x fiber optic loop sensors

AQ - 0 X - X - X - X

Sensor function

6 Plastic fiber optic loop sensor
7 Glass fiber optic loop sensor
8 Glass fiber optic loop sensor (high temperature)

Cable length

(see the available options in the "Arc sensors" chapter of this manual)

End 1 covering length (AQ-07 only!)

0 None
1 1 meter
2 2 meters

(for other lengths please consult Arcteq sales at sales@arcteq.fi)

End 2 covering length (AQ-07 only!)

0 None
1 1 meter
2 2 meters

(for other lengths please consult Arcteq sales at sales@arcteq.fi)

Accessories

Order code	Description	Note	Manufacturer
AX033	Sensor bracket		Arcteq Relays Ltd.

8 Contact and reference information

Manufacturer

Arcteq Relays Ltd.

Visiting and postal address

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65300 Vaasa, Finland

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