ARCTEQ®
PART OF ENSTO GROUP

AQ-AST-02

Arc sensor tester

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	August 2019
Changes	• First revision of this manual.
Revision	**1.01**
Date	August 2019
Changes	• Added more information to the introductory chapter. • The device ratings table updated. • Removed two subchapters ("Signals, inputs & outputs" and "Arc sensor variants"). • Added the following chapters: 1.2 ("Safety precautions"), 1.3 ("Device parts"), 3 ("Testing preparations") and 4.3 ("Light sensor testing"). • Chapter 2 (setup) rewritten and expanded. • Images added throughout the manual.

Table. 1 - 2. History of Revision 2.

Revision	2.00
Date	January 2022
Changes	• Content completely rewritten to improve grammar and readability. • A number of images added, updated or removed. • All references to the AQ-01 point sensor removed for the time being. • Order codes added.
Revision	**2.01**
Date	May 2023
Changes	• Updated the visual layout of the manual. • Added the safety information chapter and revised all the notes throughout the document to match the new categoriaztion. • Added hyperlinks to all internal references. • Updated all hyperlinks to the new Arcteq website. • Removed all references to the AQtivate 1000 software.

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 contains 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 Terminology and abbreviations

AC
: alterating current

AQ-02
: Arc sensor that is activated by light and pressure

AQ-AST-02
: Arcteq's arc sensor tester unit

Control unit
: The main part of the AST-02 tester

CBFP
: Circuit breaker failure protection

DC
: direct current

Injector
: The part of the AST-02 tester that connects to the control unit

L>
: Light activation criterion

LED
: Light emitting diode

LV
: Low-voltage

MV
: medium-voltage

P>
: Pressure activation criterion

SAS
: Standard Arc Schemes

4 Introduction

The AQ-AST-02 arc sensor tester makes it possible to test Arcteq's AQ-02 point sensors in the field. The tester can be used for commissioning tests of a complete arc protection system: it can follow the system's signal propagation and confirm that the system is wired and installed correctly.

The AQ-02 point sensor can be activated by both light and pressure (L> + P>). The tester allows you to test the sensors that have different light sensitivity thresholds: 8 klx, 25 klx, or 50 klx.

You can activate the tester locally by pressing the injector's push button, or by using any external testing equipment (such as Omicron) when commissioning protection relays. AQ-AST-02 can also test the circuit breaker failure protection (CBFP) in applications that use this feature.

NOTICE!
The tester works only with AQ-02 arc sensors! It is, however, compatible with all host units in the AQ 100 series in both LV and MV applications. If you are unsure whether your application is compatible with the tester, please contact your nearest Arcteq representative before testing.

4.1 Device ratings

Parameter	Minimum	Typical	Maximum
Auxiliary voltage input	80 V AC/DC	110 V AC/DC	265 V AC/DC
Pressure activation level	0.05 MPa (0.5 bar; 7.3 psi)	0.1 MPa (1 bar; 14.5 psi)	0.15 MPa (1.5 bar; 21.8 psi)
External input activation	-	20 ms	1,000 ms

4.2 Safety precautions

WARNING!
AQ-AST-02 features **a high-power LED** for sensor activation. DO NOT look directly at the light source! The LED emits a high-intensity light and it can damage your eyes! A sensor must be placed firmly onto the tester before testing to ensure safe and proper testing conditions! Use protective glasses if necessary!

WARNING!
AQ-AST-02 features **strong magnets** located at the bottom of the device. Keep any electronic equipment away from the magnets to avoid potential damage to the electronics!

4.3 Device parts

NOTICE!
Please check that your product includes all the parts listed below! If one or more parts are missing, please contact Arcteq support (see the Contact and reference information chapter for details).

The AQ-AST-02 arc sensor tester comes in a protective, waterproof field case. The case contains all the items necessary for testing, as listed below:

- One (1) control unit.
- One (1) injector.
- One (1) signal and pressure cable.
- One (1) auxiliary power cable.
- One (1) pressure pump with a hose.

See the figures below for what each of these parts looks like to identify the correct part easier.

Figure. 4.3 - 1. Protective field case for the tester.

Figure. 4.3 - 2. Control unit.

Figure. 4.3 - 3. Injector.

Figure. 4.3 - 4. Signal and pressure cable.

Figure. 4.3 - 5. Auxiliary power cable.

Figure. 4.3 - 6. Pressure pump with its hose.

5 Setting up the testing environment

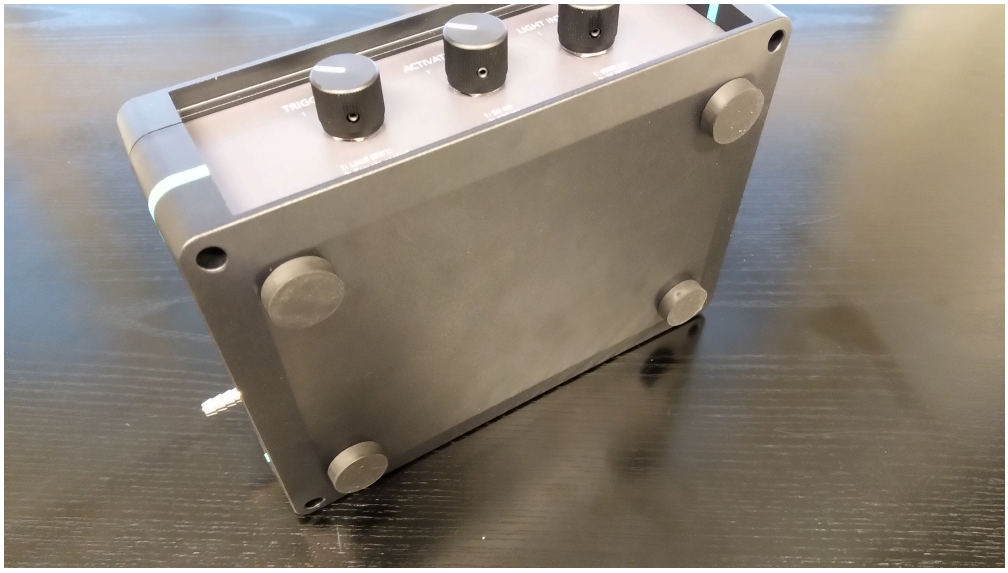
NOTICE!
Before you can begin testing, the full testing setup must be put together. Please make sure that the AQ-AST-02 arc sensor tester is connected correctly by following the instructions described below.

5.1 Setting up the tester

1. Mount the control unit

The AQ-AST-02 tester has rubberized and magnetic feet, and you can therefore mount it directly on most magnetic metal surfaces (such as a switchgear cabinet). If you prefer, you can also set the tester down on a non-metallic surface (such as an ordinary table).

Figure. 5.1 - 7. The magnetic "feet" of the tester.

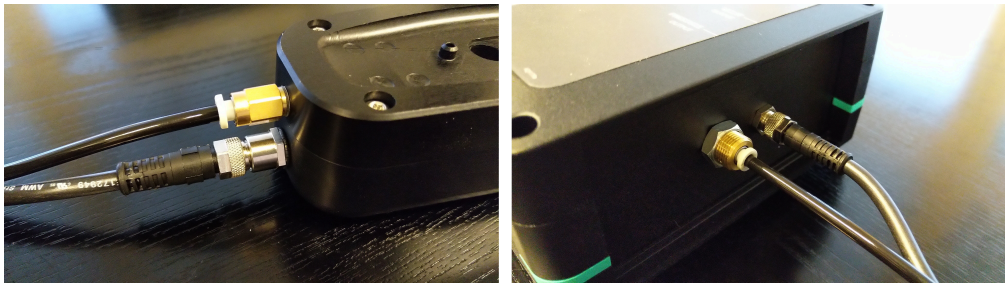


WARNING!
AQ-AST-02 features **strong magnets** located at the bottom of the device. Keep any electronic equipment away from the magnets to avoid potential damage to the electronics!

2. Connect the injector

The injector is connected to the control unit with the signal and pressure cable provided in the testing kit. One end of the cable connects to the injector (see the figure below, the image on the left). The cable's other end connects to the "Light output" and "Pressure output" terminals of the control unit (see the figure below, the image on the right).

Figure. 5.1 - 8. Connecting the injector to the control unit.



WARNING!
AQ-AST-02 features **a high-power LED** for sensor activation. DO NOT look directly at the light source! The LED emits a high-intensity light and it damage your eyes! A sensor must be placed firmly onto the tester before testing to ensure safe and proper testing conditions! Use protective glasses if necessary!

3. Connect the pressure pump

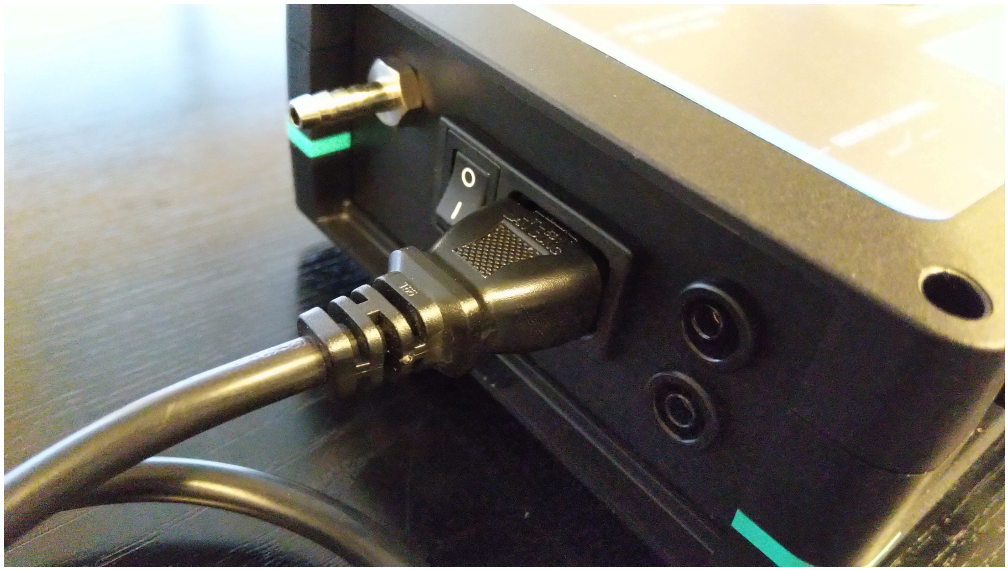
Connect the handheld pressure pump to the "Pressure input" terminal of the control unit with the provided pressure hose (see the figure below).

Figure. 5.1 - 9. Connecting the hose of the pressure pump to the control unit.

4. Connect the auxiliary power cable

Connect the auxiliary power cable to the auxiliary power input on the control unit's left side (see the figure below). Plug the other end of the cable in your power supply. A suitable auxiliary power supply ranges between 80 and 265 V AC/DC.

Figure. 5.1 - 10. Connecting the auxiliary power cable to the control unit.



5. Power up the tester

You now have all the relevant parts connected correctly for the testing to begin. Press the **Power** button located on the control unit's left side, located between the pressure input terminal and the auxiliary power input (see the figure below).

Figure. 5.1 - 11. The location of the **Power** button.

5.2 Setting up external testing equipment (optional)

NOTICE!
Please refer to the relevant manuals when using external testing equipment!

External testing equipment as current injector

Some arc protection devices, such as the AQ-110P unit, can be tripped by both overcurrent and light. For these units, you can use an external testing equipment (for example, Omicron) as the overcurrent source and AQ-AST-02 as the light source. Omicron feeds a current signal to AQ-110P, and when both the current and light criteria are present, the trip sequence of the arc protection device is triggered.

External testing equipment as remote control

When you test with external equipment (such as Ponovo, Omicron, or other test set), the external device is connected to AQ-AST-02 with the "Remote control" input. This allows for correct sequencing and time measurement between different activations. You can also activate the tester remotely. Connect the external device to the AQ-AST-02's "Remote control" input with standard banana connectors. The input features external pull-up circuitry. In order to activate the input, use the external testing equipment to short-circuit the connected cables.

WARNING!
Never activate (= short-circuit) the AQ-AST-02"s "Remote control" input for longer than one (1) second at a time! The internal LED resistors may overheat and damage the device.

6 Testing preparations

6.1 Checking the trip criteria

When you are testing an arc protection system, it is important to recognize what testing equipment is required and what level of verification is needed. In some cases a simple verification of sensors is enough: you only need to check that the sensors work. However, sometime a more comprehensive check is needed and a complete testing of the chosen arc protection scheme is required. In this case, the verification procedure not only checks that the sensors work but it also checks that a sensor activation actually activates the correct sensor channels in the correct arc protection unit. This ensures that all connections are wired correctly, that the sensors are in the correct locations, and that the correct settings have been selected for all units.

NOTICE!
Some arc protection devices may also require an overcurrent criterion for tripping! Please refer to the "Setting up external equipment" chapter for more information.

You can find descriptions for the most common MV and LV applications in our AQ-SAS instruction manuals. They describe the criteria that each application requires to be present before a trip sequence is activated. You can find these in the AQ-SAS instruction manuals at Arcteq's website (arcteq.fi/documents-and-software/).

6.2 Testing with AQ-1000

When an AQ-1000 arc quenching device is connected to the arc protection system, it is very important that this device is properly prepared before the system is tested. This means that it needs to be put in Commissioning mode using either the commissioning function or the blocking function.

CAUTION!
If AQ-1000 is not in prepared properly before testing, the device enters Maintenance mode prematurely and blocks all further operations! If this occurs, contact Arcteq's technical support.

Please refer to the AQ-1000 instruction manual for additional information concerning the testing procedure not presented in this manual (available at Arcteq's website at arcteq.fi/documents-and-software/).

Commissioning function

The commissioning function of AQ-1000 allows you to run a commissioning test on the arc protection system. This function is also used when you want to verify the closing time of the AQ-1000 device.

You can activate the commissioning function by energizing the binary input 2 ("BI2"). When BI2 is activated, the "Commissioning" LED in the AQ-1000 front panel becomes lit.

Figure. 6.2 - 12. The "Commissioning" LED of AQ-1000.

CAUTION!
The commissioning function MUST be de-activated within 24 hours! Otherwise, the device generates an error and AQ-1000 discharges its energy storage. If this happens, the error must be cleared before testing can continue. If the commissioning tests take longer than one day, you can de-activate the commissioning function at the end of one day and re-activate it the next day.

CAUTION!
Commissioning mode turns off immediately if the USB cable to the AQ-1000 device is disconnected or if the data link is broken! Make sure that the connection cable remains untouched during commissioining tests!

Blocking function

The blocking function allows you to do a commissioning test on the arc protection system without closing the AQ-1000 shorting terminals. This mode is useful when you want to verify the trip signal propagation without having to reset the device and waiting for it to recharge. In this mode, when AQ-1000 receives a trip signal from an AQ 100 series host relay, the "Trip" LED becomes lit but the quenching terminals do not move.

You can activate the blocking function only by energizing the binary input 4 ("BI4"). When the blocking function is in use, the "Blocked" LED becomes lit.

DANGER!
You must always de-energize the blocking function input BI4 after commissioning tests have been finished! If you do not, the blocking function prevents all operations, and the AQ-1000 device **cannot operate** if a real arc flash event occurs!

7 Testing procedure

7.1 Steps of the testing procedure

WARNING!
AST-02 features **a high-power LED** for sensor activation. DO NOT look directly at the light source! The LED emits a high-intensity light and it damage your eyes! A sensor must be placed firmly onto the tester before testing to ensure safe and proper testing conditions! Use protective glasses if necessary!

NOTICE!
You can repeat this test by resetting all affected AQ 100 series arc protection relays (press the **Set** button on their respective front panels)! You must also reset all the breakers that have tripped before commencing another test.

1. Configuration and assembly check

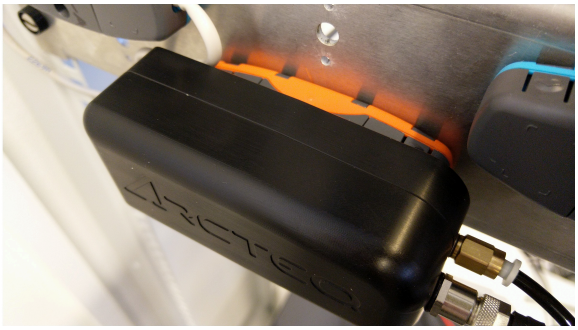
Make sure that the AQ 100 series host device is ready and configured properly before testing the system. Additionally, make sure that the AQ-AST-02 is assembled correctly (please refer to the "Setting up the tester" chapter in this manual).

Figure. 7.1 - 13. AQ-AST-02 ready for testing.

2. Injector placement

Place the injector on top of the arc sensor. Make sure that the injector hole aligns with the "eye" of the sensor.

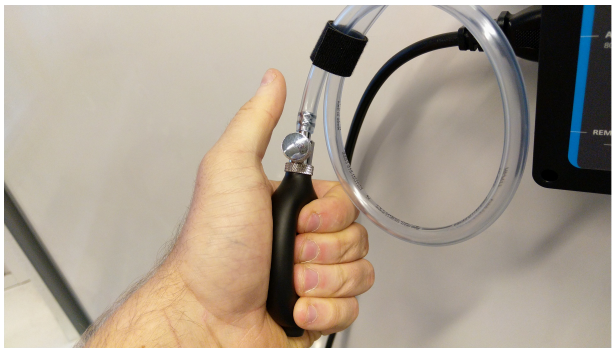
Figure. 7.1 - 14. Injector placement.

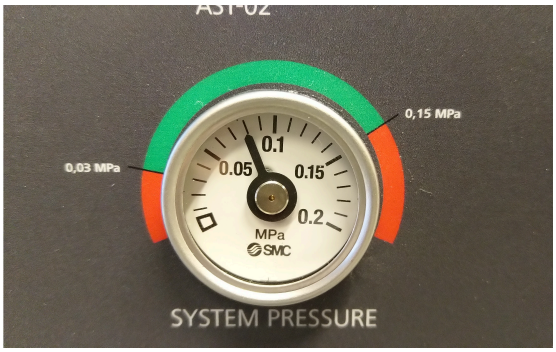


3. Applying pressure

Apply a minimum pressure of 0.05 MPa to the testing device with the provided pressure pump.

Figure. 7.1 - 15. Applying pressure.

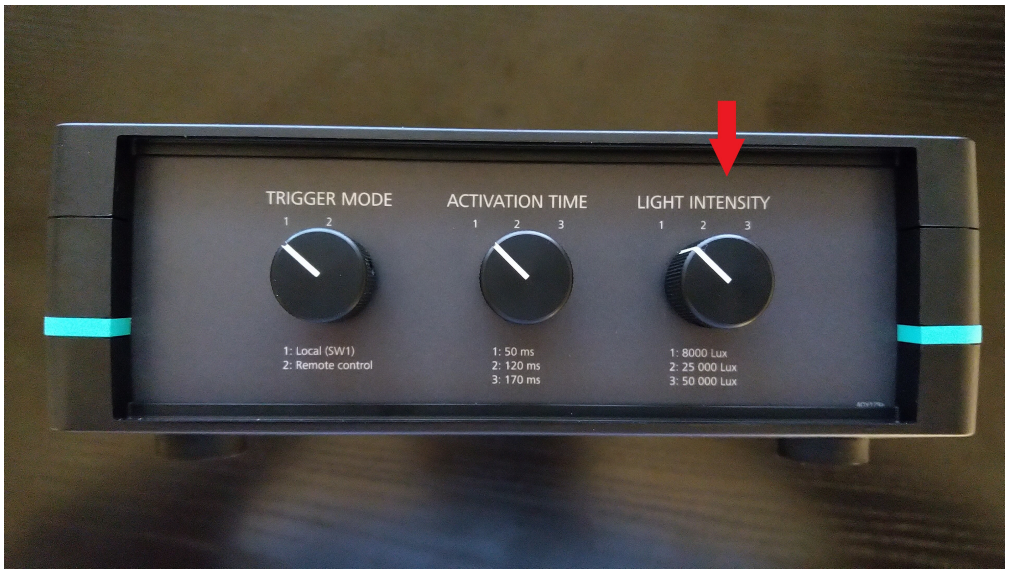




4. Light sensitivity selection

Select the correct light sensitivity value according to the sensor type being tested by turning the **Light intensity** knob located in the tester's front panel.

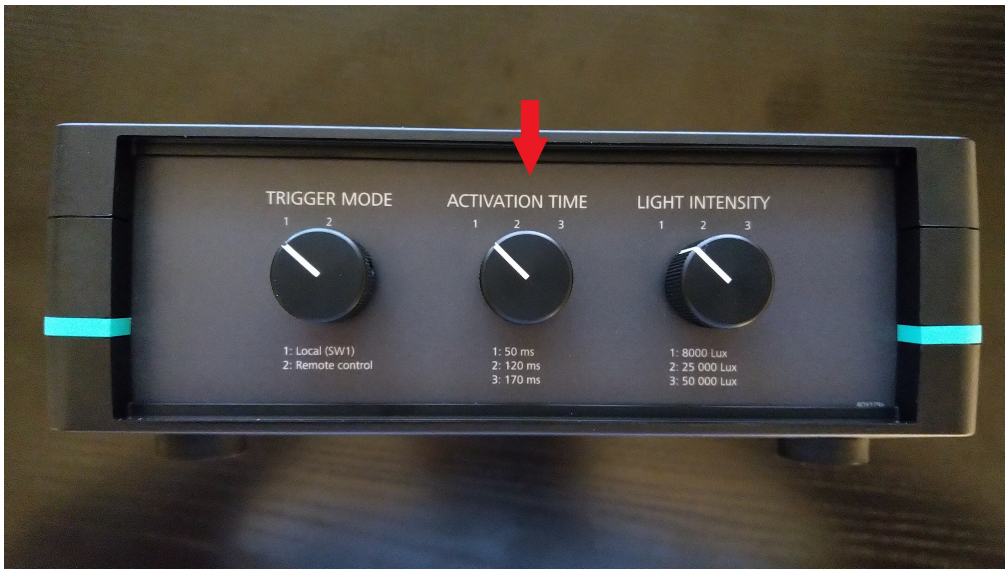
Figure. 7.1 - 16. Light sensitivity knob.



5. Activation time selection

For normal testing conditions, use the default 50-ms setting for "Activation time". For CBFP functions, use one of the other settings found on the **Activation time** knob.

Figure. 7.1 - 17. Activation time knob.



6. Tester activation

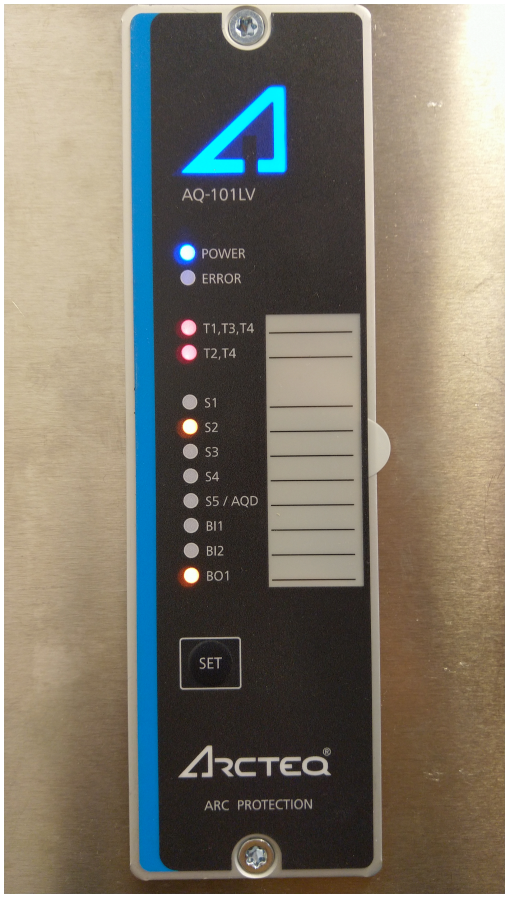
Activate the tester by pressing the push button on the injector.

Figure. 7.1 - 18. Push button in the injector.

7. Verification

Verify signal propagation by checking the indication LEDs on the AQ 100 series host device as well as other interconnected AQ 100 series devices.

Figure. 7.1 - 19. Verifying the activations.



7.2 Remote activation (optional)

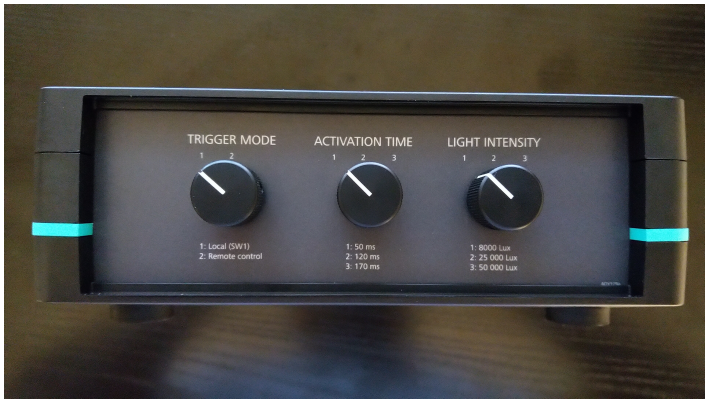
AQ-AST-02 can be activated with external testing equipment (such as Ponovo, Omicron, etc.). The external testing equipment is connected to the tester's "Remote control" input with standard banana connectors. When the tester is powered, the upper contact is at +24 V DC potential and the lower contact is the earth. The tester is then activated externally by shorting both contacts via the external control device.

CAUTION!
Shorting of the tester can only last up to one (1) second at a time!

When testing with a current-activated relay as part of your testing equipment, keep in mind that AQ-AST-02 generates an activation delay. Also, please note that selecting external control automatically overrides the "Activation time" selection since the external device now controls the activation hold time.

7.3 Testing the CBFP function

Figure. 7.3 - 20. The three knobs on the AQ-AST-02 unit's front panel.



When you test the CBFP function with local control, use the second knob on the AQ-AST-02's front panel to set the activation time. The 50-ms setting is used when there is no CBFP, the 120-ms setting is for faster breakers, and the 170-ms setting is for slower breakers. If you are using a remote control to test CBFP functions, use the external testing device to set the desired activation time. Please note that activating the remote control overrides and ignores any "Activation time" settings you may have done manually on AQ-AST-02's front panel knobs.

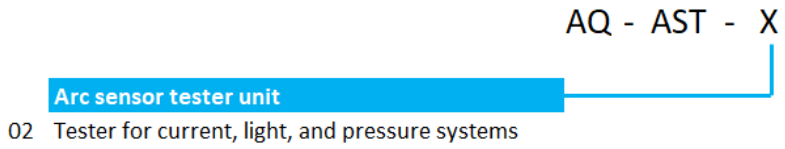
7.4 Testing the sensors

The AQ-02 point sensor has both light and pressure as its activation criteria, and therefore you must always remember to apply pressure to the pressure valve before activating the tester, be it locally or remotely. You can see the current pressure level in the pressure meter located at AQ-AST-02's top panel.

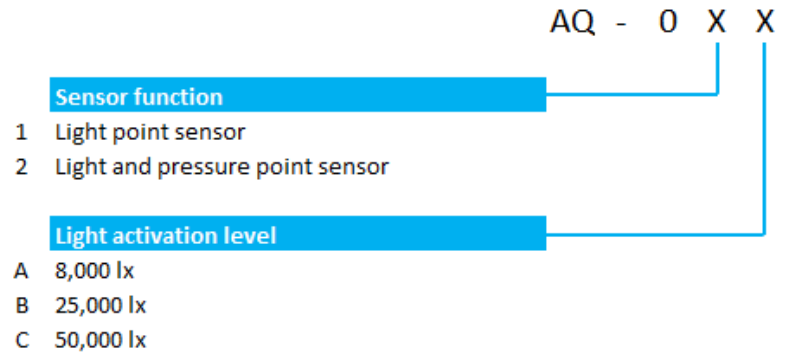
CAUTION!
The unit in the meter is pascal, not bar or psi!

8 Order codes

Arc sensor tester



Point sensors



9 Contact and reference information

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