INSTRUCTION MANUAL

AQ 110 – Arc Protection Unit

Revision	1.2
Date	July 2011
Changes	- Sensor chapter revised. (Fiber pictures and point sensor connections). - Standard Arc System chapter revised. (e.g. scheme 0a added) - Dipswitch definition updated (e.g. HSO latch/non-latch) - LED description revised, (current channels LEDs will not blink during the auto-configuration.) - Partly AQ110F information added. - Dimensions and installation chapter, the depth of the unit is changed from 170mm to 175mm. - Casing and dimensions section, the unit size and the size with package have been added.

Revision	1.3
Date	April 2012
Changes	- AQ SAS™ chapter is removed from manual.

Revision	1.4
Date	July 2012
Changes	- Scheme Select Dipswitch Settings chapter is added. - The point sensor max. wiring length is up to 200 meters. System self-supervision chapter is revised.

Revision	1.5
Date	May 2019
Changes	- Move scheme selection content to dipswitch setting, refer to chapter 3.5. - Technical data update - Add application example, refer to chapter 6.

Revision	1.6
Date	November 2019
Changes	- Add information to Technical Data

Read these instructions carefully and inspect the equipment to become familiar with it before trying to install, operate, service or maintain it.

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. Local safety regulations should be followed. No responsibility is assumed by Arcteq for any consequences arising out of the use of this material.

We reserve right to changes without further notice.

CONTENTS

1 ABBREVIATIONS

CB – Circuit breaker

CBFP – Circuit breaker failure protection

CT – Current transformer

EMC – Electromagnetic compatibility

HW – Hardware

HSO – High speed output

LED – Light emitting diode

LV – Low voltage

MV – Medium voltage

NC – Normally closed

NO – Normally open

SAS – Standard arc scheme

SF – System failure

SW – Software

uP - Microprocessor

2 GENERAL

AQ 110 is a sophisticated micro-processor based arc flash protection unit with combined current and arc sensing. Combined current and arc sensing provides an integrated dual trip criteria. It is designed to minimize the damage caused by an arcing fault (arc flash) by tripping the circuit breaker sourcing the fault current. The AQ 110 complete system self-supervision function provides the highest level of dependability by continuously monitoring all internal system functions along with external connections.

AQ 110 is designed according to the latest protection relay standards and is hence suitable for installations in any environment, such as utility, traditional or renewable power plants, off shore, marine, oil and gas, mining, steel or any other heavy industry applications as well as commercial and institutional electrical systems. AQ 110 is suitable for either medium voltage or low voltage switchgear and motor control center applications in both new and retrofit installations.

AQ 110 is a multipurpose arc flash protection unit and can be applied for variety of applications. AQ 110 can be used as a stand-alone unit or as a main unit of a more complex arc protection system through the binary bus.

2.1 ARC PROTECTION UNIT AQ 110 FEATURES

AQ 110 comes in two versions. AQ110P supports 4 point sensor channels and optionally one fiber sensor channel. AQ 110F supports 3 fiber sensor channels. All other features are the same in both versions. Main features of AQ 110:

- 80-265Vac/dc auxiliary power supply or optional 18-72Vdc power supply
- 3 phase current inputs (1/5 amps nominal)
- 1 residual current input (1/5 amps nominal)
- 4 arc point sensor channels and 1 arc fiber loop channel optionally (AQ 110P) or 3 arc fiber loop channels (AQ 110F)
- 2 binary inputs (nominal voltage of 24 or 110 or 220Vdc)
- 2 high-speed semiconductor trip outputs (direct trip circuit rated)
- 2 normally open trip relay outputs (direct trip circuit rated)
- 1 normally open or optionally normally closed (electronic lock-out) trip relay output (direct trip circuit rated)
- 1 binary output (24Vdc)
- 1 system failure relay output

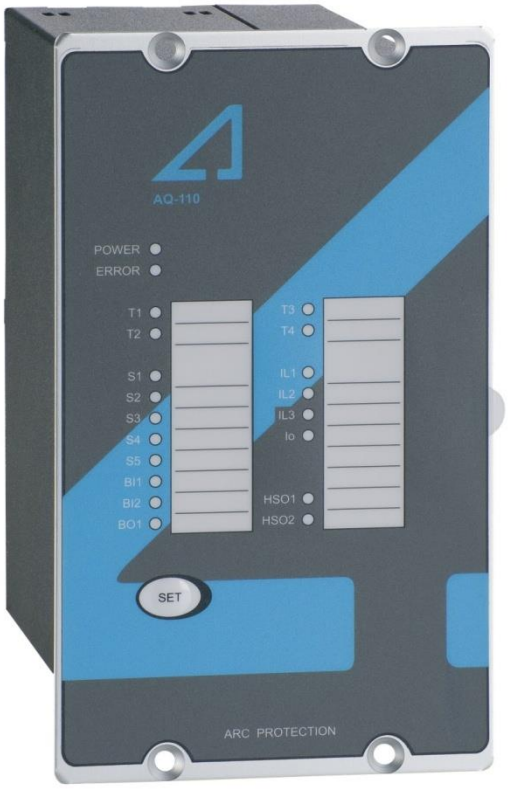


Figure 2-1 Arc protection unit AQ 110

2.2 SIMPLIFIED BLOCK DIAGRAM

Simplified block diagrams in Figure 2-2-2: AQ110P simplified block diagram and Figure 2-3: AQ 110F simplified block diagram show the main components of the AQ110 unit.

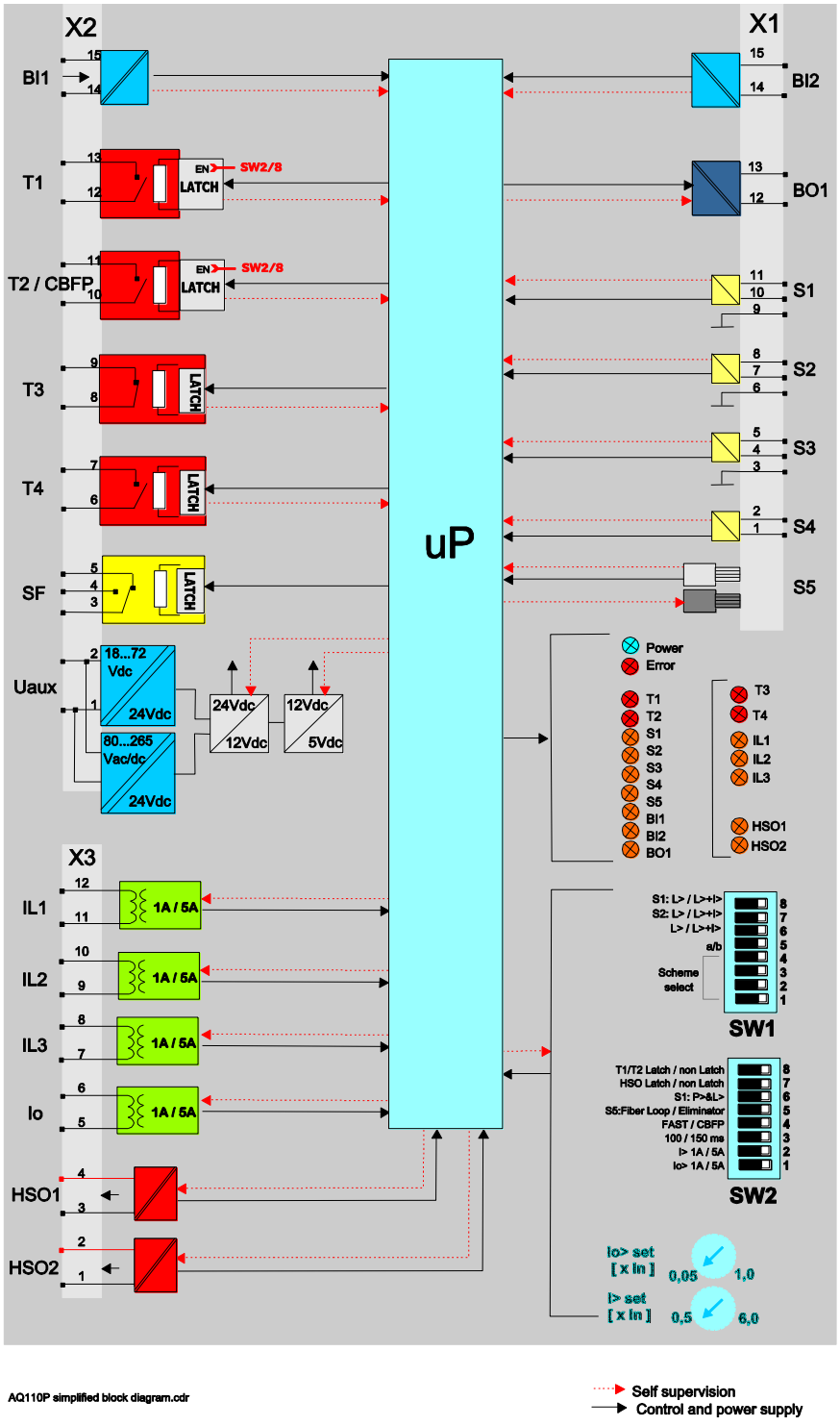


Figure 2-2-2: AQ110P simplified block diagram

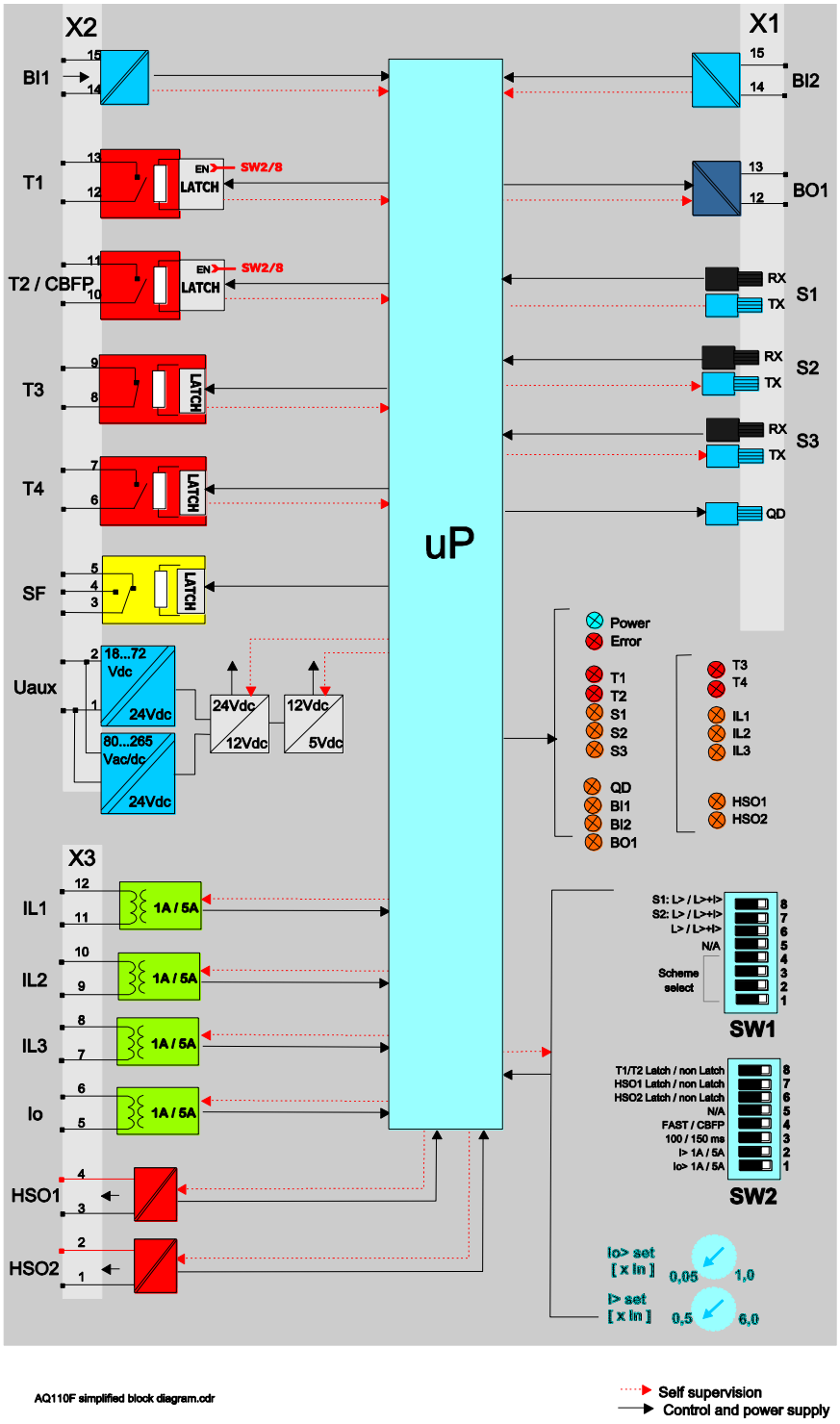


Figure 2-3: AQ 110F simplified block diagram

3 OPERATION AND CONFIGURATION

3.1 LED INDICATOR FUNCTIONS

AQ 110 contains 20 indication LEDs. A user definable text pocket can be slid in for identifying each LED function (except Power and Error LEDs). LEDs are located at the front plate of the unit for clear viewing without a need for opening doors.

During power up the unit performs a LED-test. All LEDs are turned on for 2 seconds and then back off. Only the blue power LED will remain on. When powered up, the unit goes in 50ms into protection mode even while the LED test is being performed.

In normal operation only the blue power LED is ON.

All current measuring channels (IL1, IL2, IL3 and Io) have indication LEDs. When any channel exceeds the set threshold value the indication LED is turned on until manual reset is performed. In an open CT condition a corresponding current channel indicator and Error LED are blinking.

The sensor LEDs in inactive condition are off. If arc sensor is activated the corresponding sensor channel LED will turn on if the activation is longer than 1.5ms. The sensor LED activation function is latched (steady light). To clear the LED the "SET" button should be pressed.

In case of loose sensor wire or configuration mismatch (new sensor attached without running auto-configuration system setup, see chapter 3.3.1) situation the corresponding LED will start flashing and ERROR LED will activate.

The Binary I/O LEDs are indicating the I/O-line status. If any of the lines become active for more than 1.5ms the corresponding LED will turn on (latch).

In trip situation the corresponding trip LED will turn on. Trip outputs are controlled by dipswitch settings, see chapter 3.5.

All activation and trip indication LEDs are latched, even if the dipswitch setting is in non-latched mode. They have to be cleared by pushing the "SET" -button.

LED indications are stored in non-volatile EPROM memory for identifying the trip information in case the auxiliary power is lost. When re-powering the unit after power supply loss the actual LED status can be visualized from the front of the unit.

3.2 LED OPERATION QUICK GUIDE

The table below describes the function of each indicator LED in front of the AQ 110 unit. Note that the use of sensor channels differs between AQ 110P and AQ 110F versions. Sensor channels S4 and S5 are not in use in AQ 110F version.

LED	OFF	STEADY ON	BLINKING	ACTION IF ABNORMAL
POWER **Blue**	Auxiliary supply disconnected	Auxiliary power connected	N/A	Check the power source
ERROR **Red**	System healthy	System failure	Configuration mismatch. Protection partly operational	Verify system condition. see chapters 11: Troubleshooting guide and 5: System self-supervision
T1 **Red**	Normal status	Trip relay T1 activated	N/A	Check the reason for trip. Clear the fault and reset indications by pushing SET button
T2 **Red**	Normal status	Trip relay T2 activated	N/A	Check the reason for trip. Clear the fault and reset indications by pushing SET button
T3 **Red**	Normal status	Trip relay T3 activated	N/A	Check the reason for trip. Clear the fault and reset indications by pushing SET button
T4 **Red**	Normal status	Trip relay T4 activated	N/A	Check the reason for trip. Clear the fault and reset indications by pushing SET button
S1 **Amber**	Normal status	Sensor channel 1 activated by light information	Sensor channel 1 discontinuity or system set-up not performed; also activated by pressure information	Check why sensor activated or check the sensor continuity or perform system set-up (see chapter:3.3.1 Auto configuration (system setup)
S2 **Amber**	Normal status	Sensor channel 2 activated by light information	Sensor channel discontinuity or system set-up not performed; also activated by pressure information	Check why sensor activated or check the sensor continuity or perform system set-up (see chapter:3.3.1 Auto configuration (system setup)
S3 **Amber**	Normal status	Sensor channel 3 activated by light information	Sensor channel 3 discontinuity or system set-up not performed; also activated by pressure information	Check why sensor activated or check the sensor continuity or perform system set-up (see chapter:3.3.1 Auto configuration (system setup)
S4 **Amber** **N/A in AQ 110F**	Normal status	Sensor channel 4 activated by light information N/A in AQ 110F	Sensor channel 4 discontinuity or system set-up not performed; also activated by pressure information	Check why sensor activated or check the sensor continuity or perform system set-up (see chapter:3.3.1 Auto configuration (system setup)

S5 **Amber** **N/A in AQ 110F**	Normal status	Sensor channel 5 activated N/A in AQ 110F	Fiber sensor discontinuity or system set-up not performed	Check why sensor activated or check the sensor continuity or perform system set-up (see chapter:3.3.1 Auto configuration (system setup)
BI1 **Amber**	Normal status	Binary input 1 activated	Binary input 1 loose connection	Check the binary input wiring.
BI2 **Amber**	Normal status	Binary input 2 activated	Binary input 2 loose connection	Check the binary input wiring.
BO1 **Amber**	Normal status	Binary Output activated	N/A	
IL1 **Amber**	Normal status, actual current below set point	IL1 current above setpoint	Open CT connection in channel IL1	Check the current setpoint levels or check the CT wiring.
IL2 **Amber**	Normal status, actual current below set point	IL2 current above setpoint	Open CT connection in channel IL2	Check the current setpoint levels or check the CT wiring.
IL3 **Amber**	Normal status, actual current below set point	IL3 current above setpoint	Open CT connection in channel IL3	Check the current setpoint levels or check the CT wiring
Io **Amber**	Normal status, actual current below set point	Residual current above setpoint	N/A	Check the residual current setpoint level
HSO1 **Red**	Normal status	HSO 1 activated.	N/A	Check the reason for activation. Clear the fault and reset indications by pushing SET button.
HSO2 **Red**	Normal status	HSO 2 activated.	N/A	Check the reason for activation. Clear the fault and reset indications by pushing SET button.

Table 3-1: LED operation quick guide

3.3 PUSH-BUTTON DESCRIPTION

AQ 110 contains one single push-button (SET) that can be used for all operational functions of the unit. The push-button is utilized for auto-configuration of the system (see chapter 3.3.1) and for resetting the indicators and latched output relays.

3.3.1 AUTO CONFIGURATION (SYSTEM SETUP)

When all current circuits, sensors and binary lines have been connected an auto-configuration procedure must be executed. The initialization sequence is performed by pressing the "SET" -button for 2 seconds, and the AQ 110 sensor LEDs and BI1/BI2 LEDs start blinking. The unit scans these inputs to see if they are connected and when input is detected the corresponding LEDs are lit up to mark that a connection was found. The inputs without connection continue blinking during the remaining 3 seconds. After total time of 5 seconds, all LEDs are turned off. During this system setup the dipswitch setting are also stored in non-volatile memory.

All sensor inputs will remain operational even when not auto-configured. The auto-configuration is only used for self-supervision purposes.

Note: in order to redo auto-configuration for a unit containing less connections (binary inputs/outputs or sensors) than in previous memorized set-up a dip-switch (anyone) must be moved back and forth prior to performing auto-configuration. Timeout allowing new configuration is 1 minute. Reconfiguration with more connections is allowed without moving the dip-switch.

3.3.2 RESET

All LED indications and latched trip relays are reset by pressing the "SET" -button for 1 second. Otherwise the latched trip relays will remain activated until auxiliary power is disconnected. All LED indications will remain active until reset is performed by operator even in case of disconnecting auxiliary power supply (see chapter 3.6 Non-volatile memory).

3.3.3 INPUT CONNECTION CHECK

After the auto-configuration procedure is completed, the connectivity of all sensors and binary input channels can be verified by pressing the push-button 3 times (in 2 seconds). The LED of corresponding sensors and binary input channels starts to blink while the POWER LED is blinking. The number of LED blinks are exact same as the number of connected sensors and connected binary output channels from other units.

3.4 CURRENT THRESHOLD SETTING

AQ 110 unit has 4 current measurement inputs utilized for 3 phase and residual current measurement. Both phase current and residual current measurements are utilized as second trip criteria in an arc protection system in order to avoid trip caused by natural light sources. Phase overcurrent threshold is typically set 50 % above the highest load current. Residual overcurrent is set very sensitive. Setpoints are set using trimmers, see Figure 3-1. An accurate setting is obtained by injecting desired set value using relay test set to phase and residual current inputs of AQ 110 simultaneously adjusting the trimmers until phase and residual current indication LEDs are lit.

Setting range for phase overcurrent stage is 0.5 to 6xIn. Setting range for residual overcurrent stage is 0.05 to 2xIn.

Figure 3-1 AQ110 overcurrent setting trimmers

3.5 DIPSWITCH SETTINGS

AQ 110 functionality such as tripping logic is configured using dipswitch settings. The unit contains two switch groups SW1 and SW2 (see Figure 3-12). Dipswitches are located at the back of the unit for easy access.

Different trip schemes can be easily programmed by selecting the appropriate dipswitch settings. The most convenient way to set the AQ 110 single unit or more complex arc protection system is to use standard arc schemes (SAS).

Tripping may be selected based on arc light only or current thresholds. Other tripping criteria such as undervoltage, or similar may be applied instead of overcurrent as well using binary inputs. Also the circuit breaker failure protection (CBFP) scheme may be enabled using the dipswitches. See Table 3-2 AQ 110 dipswitch SW 1 setting and Table 3-3: AQ 110 dipswitch SW 2 setting for details of settings.

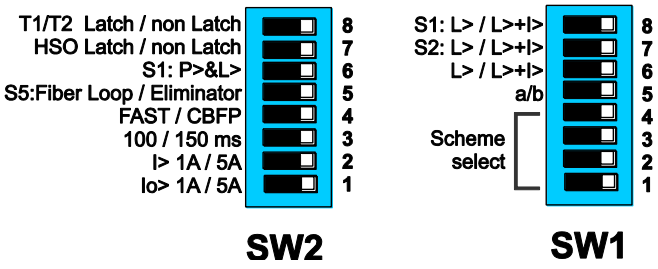


Figure 3-1 AQ 110 dipswitch SW1 and SW2

Dipswitch	Function selection	ON (LEFT POSITION)	OFF (RIGHT POSITION)
8 **S1: L> / L>+I>**	Sensor channel 1 trip criteria	Trip on light only (L>).	Trip on light and overcurrent (L> + I>). Both signals are required simultaneously to trip.
7 **S2: L> / L>+I>**	Sensor channel 2 trip criteria	Trip on light only (L>).	Trip on light and overcurrent (L> + I>). Both signals are required simultaneously to trip.
6 **L> / L>+I>**	Sensor channels 3-5 trip criteria (channel 3 in AQ 110F)	Trip on light only (L>).	Trip on light and overcurrent (L> + I>). Both signals are required simultaneously to trip.
5 **a/b**	Selection of standard arc scheme (SAS) type	SAS type a.	SAS type b.
4 **Scheme select**	Selection of standard arc scheme (SAS)	Scheme selection number is according to binary arithmetic.	Scheme selection number is according to binary arithmetic.
3 **Scheme select**	Selection of standard arc scheme (SAS)	Scheme selection number is according to binary arithmetic.	Scheme selection number is according to binary arithmetic.
2 **Scheme select**	Selection of standard arc scheme (SAS)	Scheme selection number is according to binary arithmetic.	Scheme selection number is according to binary arithmetic.
1 **Scheme select**	Selection of standard arc scheme (SAS)	Scheme selection number is according to binary arithmetic.	Scheme selection number is according to binary arithmetic.

Table 3-2 AQ 110 dipswitch SW 1 setting

Dipswitch	Function selection	ON (LEFT POSITION)	OFF (RIGHT POSITION)
8 **T1/T2 Latch/non-latch**	Latch or non-latch for trip relays T1 and T2	T1 and T2 operate as latched.	T1 and T2 operate as non-latched.
7 **HSO Latch/non-latch**	Latch or non-latch for HSO1 and HSO2	HSO1 and HSO2 operates as latched.	HSO1 and HSO2 operates as non-latched.
6 **S1:P>/L>**	Reserved for future use	N/A	N/A
5 **S5:Fiber Loop / Eliminator**	Selection of Fiber loop or Arc Quenching system (eliminator) control N/A in AQ 110F	S5 fiber sensor channel operates as fiber loop sensor function.	S5 operates as arc quenching system (eliminator) control. The Tx terminal of S5 channel sends test pulse signal to quenching system.
4 **FAST / CBFP**	Selection of Trip relay T2 function	Trip relay T2 will have 7ms trip time.	Trip relay T2 will work as CBFP relay. If any sensor or L> input (BI2) is activated for more than set CBFP time (100 or 150ms) the CBFP function activates trip relay T2 and binary output BO1. Note: Master trip command (BI2, see dipswitch 4) will not activate T2 when in CBFP mode.
3 **100 / 150ms**	CBFP time setting	CBFP time is set to 100ms.	CBFP time is set to 150ms.
2 **I> 1A / 5A**	Phase currents IL1,IL2,IL3 nominal current selection	1A nominal current	5A nominal current
1 **Io> 1A / 5A**	Residual current Io nominal current selection	1A nominal current	5A nominal current

Table 3-3: AQ 110 dipswitch SW 2 setting

3.5.1 SCHEME SELECTION

- Logic Scheme 0a

The AQ110P scheme 0a is designed for arc protection solution by a stand-alone unit. The arc fault is detected from any of four sensor channels will commonly trip all trip contacts. In the meantime, sends master trip signal and overcurrent signal to outgoing feeder AQ101 units if also used.

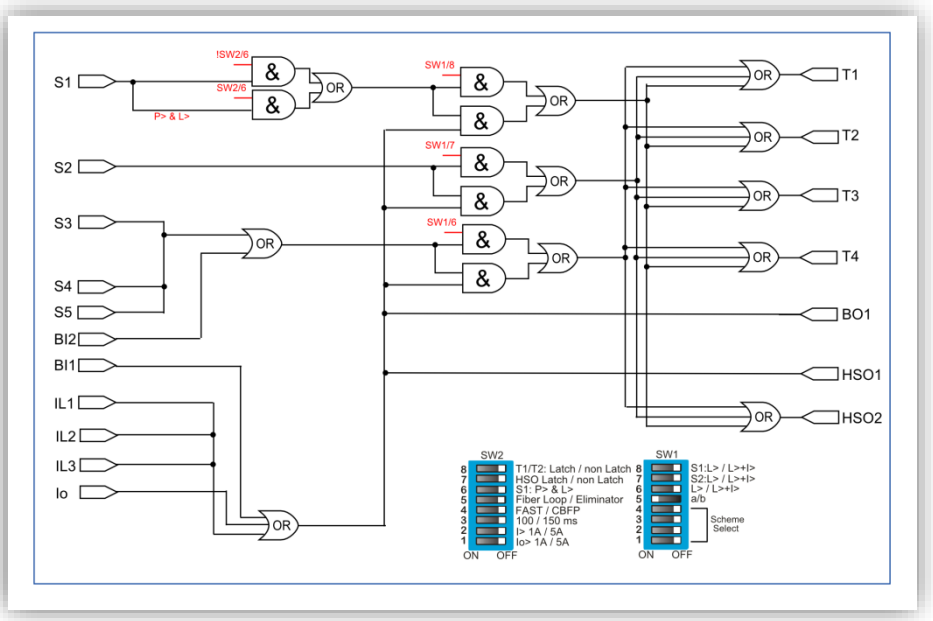


Figure 3-2: Logic Scheme 0a

General trip logic for AQ 110P (SS: 0a)

TRIPPING SIGNALS / FAULT LOCATION	T1	T2	T3	BO1	HSO1	HSO2
S1	×	×	×	×	×(I>)	×
S2	×	×	×	×	×(I>)	×
S3	×	×	×	×	×(I>)	×
S4	×	×	×	×	×(I>)	×

- Logic Scheme 1a

The AQ110P scheme 1a is typically designed for single incoming feeder single busbar selective arc protection solution. S1 is responsible for monitoring incoming cable compartment. S2 monitors the incoming feeder CB compartment. S3, S4 and S5 (fiber loop) are responsible for busbar compartment. The contact T1 is responsible for tripping the incoming feeder CB. T2 is used for tripping upstream CB. T3 is used for tripping busbar section CB.T4 acts as Trip Alarm. The overcurrent signal will be sent to outgoing feeder units within 2ms for tripping outgoing feeder CBs. If the arc fault is detected either incoming CB compartment or busbar compartment, master trip signal will be sent to all outgoing feeder AQ101 units if they are also used in protection.

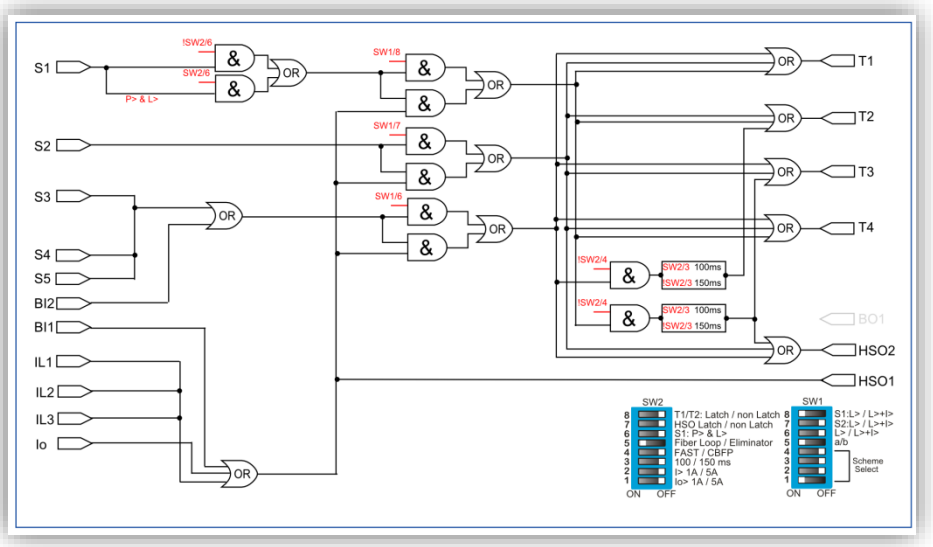


Figure 3-3: Logic Scheme 1a

General trip logic for AQ 110P (SS: 1a)

TRIPPING SIGNALS / FAULT LOCATION	T1	T2	T3	T4	BO1	HSO1	HSO2
S1	×	×		×		×(I>)	
S2	×	×	×	×		×(I>)	×
S3	×		×	×		×(I>)	×
S4	×		×	×		×(I>)	×

- Logic Scheme 1b

From AQ110P point of view, the design of scheme 1b is very similar to the scheme 1a. HSO1 is acting as additional trip contact in scheme 1b. If AQ101 is applied to protect outgoing feeders, the main responsibility of AQ110P is to send master trip signal to AQ101 for tripping all outgoing feeder CBs. The detailed application of scheme 1b is described in AQ SAS ™ Booklet.

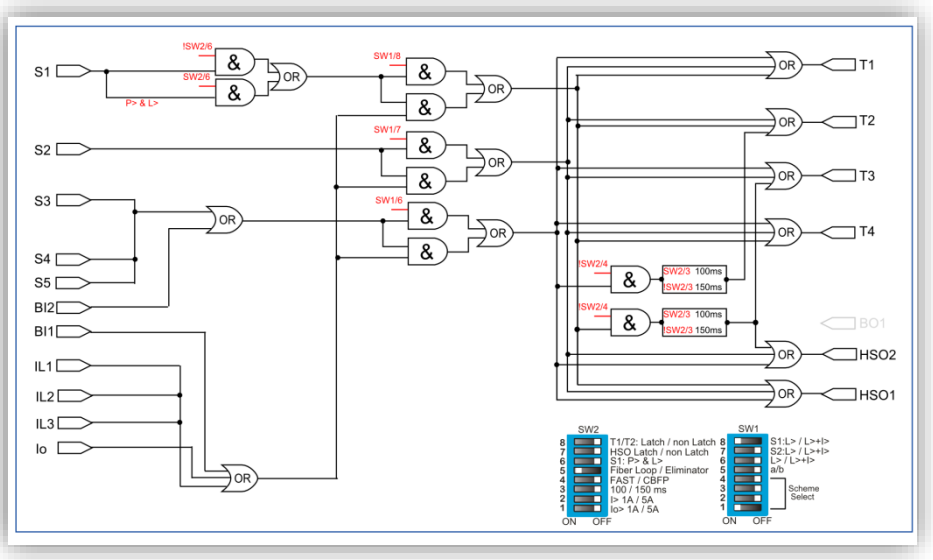


Figure 3-4: Logic Scheme 1b

General trip logic for AQ 110P (SS: 1b)

TRIPPING SIGNALS / FAULT LOCATION	T1	T2	T3	T4	BO1	HSO1	HSO2
S1	×	×		×		×	
S2	×	×	×	×		×	×
S3	×		×	×		×	×
S4	×		×	×		×	×

- Logic Scheme 2a

The AQ110P scheme 2a is typically designed for two incoming feeder single busbar selective arc protection solution. S1 is responsible for monitoring incoming cable compartment. S2 monitors the incoming feeder CB compartment. S3, S4 and S5 (fiber loop) are responsible for busbar compartment. The contact T1 is responsible for tripping the incoming feeder CB. T2 is used for tripping upstream CB. T3 is used for tripping busbar section CB.T4 acts as Trip Alarm. The overcurrent signal will be sent to outgoing feeder units within 2ms for tripping outgoing feeder CBs. If the arc fault is detected either incoming CB compartment or busbar compartment, master trip signal will be sent to all outgoing feeder AQ101 units if they are also used in protection.

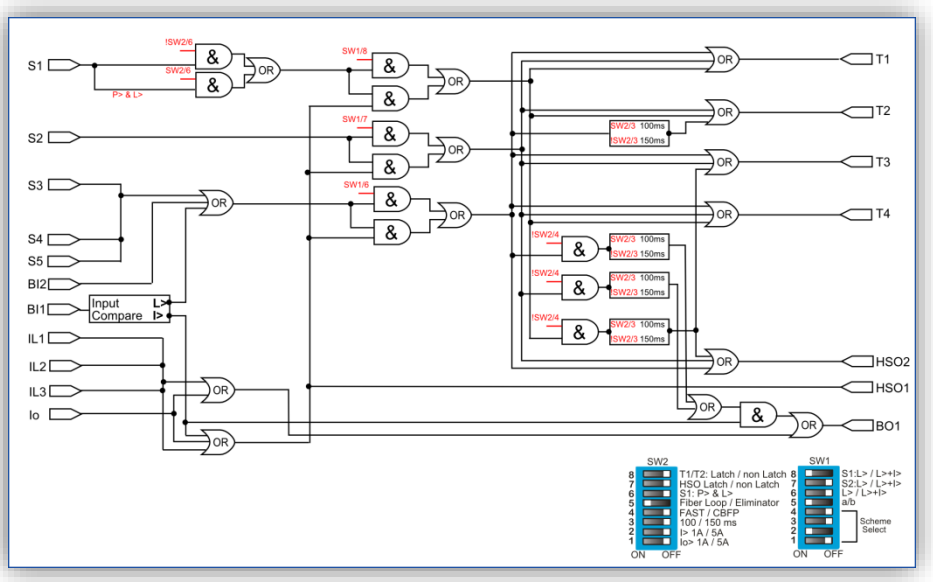


Figure 3-5: Logic Scheme 2a

General trip logic for AQ 110P (SS: 2a)

TRIPPING SIGNALS / FAULT LOCATION	T1	T2	T3	T4	BO1	HSO1	HSO2
S1	×	×	CBFP	×	×	×(I>)	CBFP
S2	×	×	×	×	×	×(I>)	×
S3	×	CBFP	×	×	×	×(I>)	×
S4	×	CBFP	×	×	×	×(I>)	×

- Logic Scheme 2b

Scheme 2b is also applied for two incoming feeder single busbar arc protection solution. From AQ110P point of view, the design of scheme 2b is very similar to the scheme 1b. HSO1 is acting as additional trip contact in scheme 2b. If AQ101 is applied to protect outgoing feeders, the main responsibility of AQ110P is to send master trip signal to AQ101 for tripping all outgoing feeder CBs. BO1 is responsible for sending overcurrent information to the AQ110P at another incoming feeder. The detailed application of scheme 2b is described in AQ SAS™ Booklet.

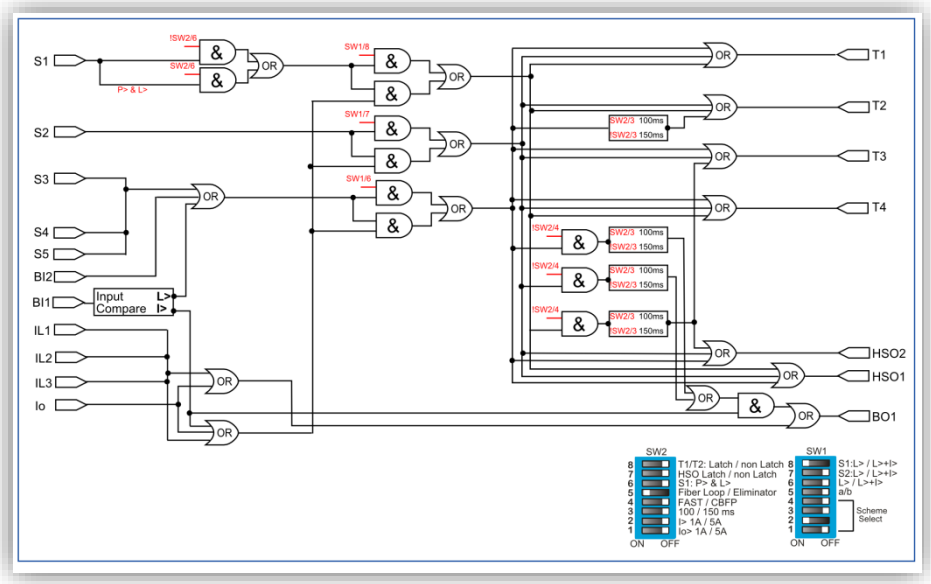


Figure 3-6: Logic Scheme 2b

General trip logic for AQ 110P (SS: 2b)

TRIPPING SIGNALS / FAULT LOCATION	T1	T2	T3	T4	BO1	HSO1	HSO2
S1	×	×	CBFP	×	×	×	×
S2	×	×	×	×	×	×	×
S3	×	CBFP	×	×	×	×	×
S4	×	CBFP	×	×	×	×	×

3.6 NON-VOLATILE MEMORY

All critical system data including dipswitch settings and auto-configuration file described in chapter 3.3.1 are stored in EPROM non-volatile memory to ensure correct operation and full self-supervision even if auxiliary power is lost temporarily.

Also all LED indications described in chapter 3.1 are stored in non-volatile memory in order to provide quick recovery of the system status indication even if auxiliary power is lost temporarily. This feature is especially important if auxiliary power is lost after tripping.

4 ARC SENSORS

AQ 100 series provides choice of different types of arc sensors to be utilized in different units and different switchgear types according to specific application requirements. Available sensor types are arc light point sensors and arc light fiber optic loop sensors.

Arc light point sensors are typically installed in metal clad compartments providing quick accurate location of the faulted area. Arc light fiber loop sensors are installed typically to cover a wider protected area with one fiber when no need for more exact fault location exists.

4.1 ARC LIGHT POINT SENSOR AQ 01

AQ 01 is an arc light point sensor with a light sensitive photodiode element activated by arc light. AQ01 arc 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. One sensor per closed metal clad compartment should be utilized. In open spaces, such as the bus bar section, arc sensors should be mounted maximum 2 meters apart.

The factory default set light sensitivity of AQ01 sensor is 8000 Lux. This default set can be also designed as 25000 Lux and 50000 Lux according to the demand of user’ s application. Sensor does not require user settings. Detection radius is 180 degrees.

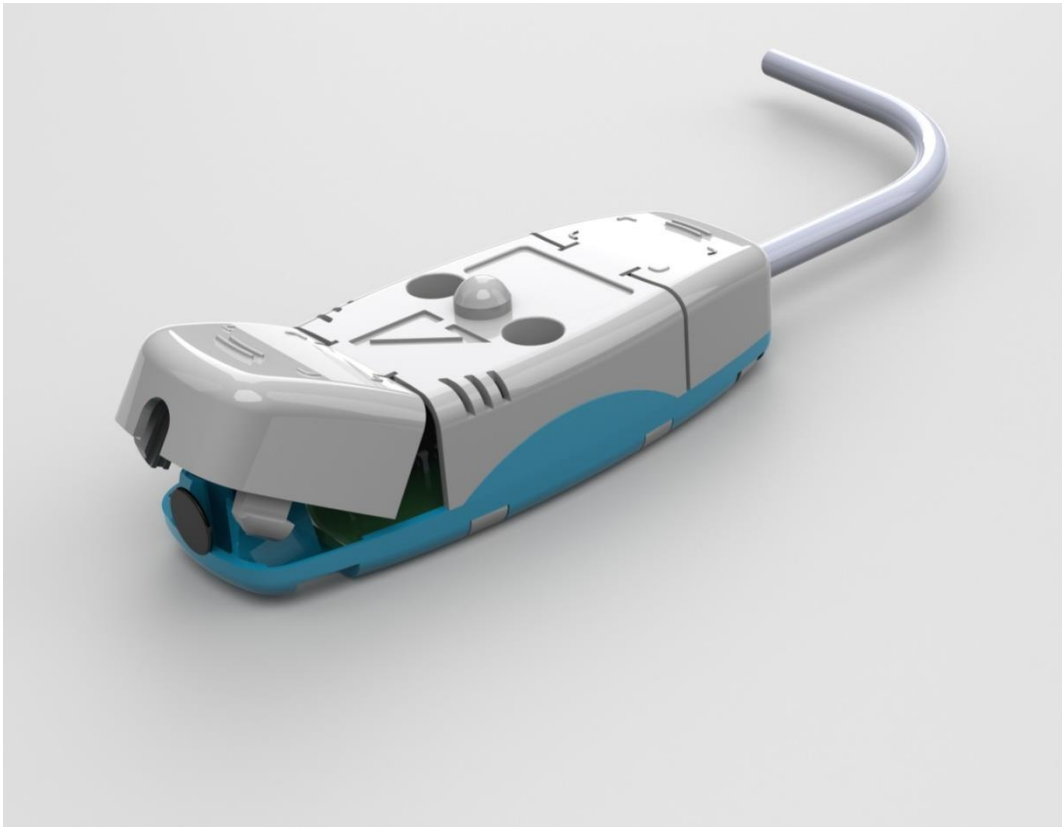


Figure 4-1: Arc sensor AQ 01

4.1.1 AQ 01 INSTALLATION AND WIRING

AQ 01 is installed either on the compartment wall or through wall. Example of wall mounting is seen in Figure 4-2. AQ 01 is fixed to the wall using two screws. The same screw pattern is utilized in through wall mounting arrangement as well. Unit is turned around and the eye is pushed to the compartment to be protected and two screws are attached from the back side of the sensor. No external mounting plates are needed in any case.

Figure 4-2: AQ 01 mounted to compartment wall.

AQ01 comes without connection cable. Connection cable installation at site is simple. Cable connectors are located beneath the covers that can be conveniently detached for fastening the sensor wires. Cover shall be attached after installing the wires. Cable connectors are located at both ends of the sensor for series connecting maximum three sensors in one line. See Figure 4-1.

4.1.2 AQ 01 TECHNICAL DATA

Light intensity threshold	8000Lux / 25000Lux / 50000 Lux
Detection radius	180 degrees
Mechanical protection	IP 64
Sensor wiring arrangement	2 wires and shield
Sensor cable specification	Shielded twisted pair 0.75mm²
Maximum sensor cable length per sensor channel	200 meters
Operating temperature	-20...+85 ℃

4.2 ARC LIGHT FIBER OPTIC LOOP SENSOR AQ 06

AQ 06 is an arc light fiber optic loop sensor. AQ 06 fiber is a plastic fiber optic cable. AQ 06 sensors can be ordered in pre-manufactured lengths of 1-40 meters. AQ 06 fiber sensors are distributed through the protected switchgear cells. AQ 06 is not recommended to be cut and/or spliced on site. If cutting/splicing is necessary due to accidental breakage please contact your nearest Arcteq representative.

The fixed light sensitivity of the AQ06 sensor is 8000 LUX. Sensor does not require user settings. Detection radius is 360 degrees. See figure 4.3

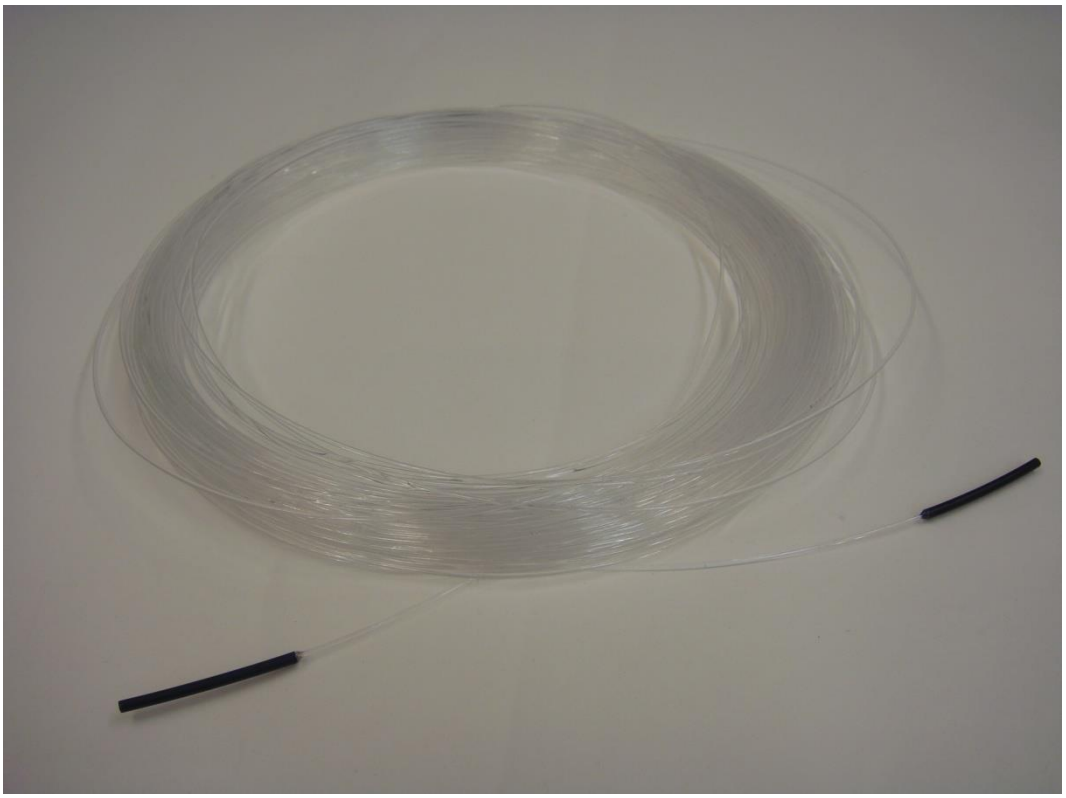


Figure 4-3 AQ 06 arc light fiber optic loop sensor

Note: On request AQ 06 ends can be covered with black rubber part for any requested portion to avoid light detection outside the protected zone. For more information consult your nearest Arcteq representative.

4.2.1 AQ 06 TECHNICAL DATA

Light intensity threshold	8000Lux
Detection radius	360 degrees
Maximum length	40 meters
Diameter	1 millimeter
Bending radius	5 centimeters
Operating temperature	-10...+85 ℃

4.3 ARC LIGHT FIBER OPTIC LOOP SENSOR AQ 07

AQ 07 is an arc light fiber optic loop sensor. AQ 07 fiber is a robust fiber optic cable providing practically unlimited bending radius. AQ 07 contains hundreds of glass fiber drains covered by a plastic tube making it extremely strong. AQ 07 sensors can be ordered in pre-manufactured lengths of 1-50 meters. AQ 07 fiber sensors are distributed through the protected switchgear cells. AQ 07 is not recommended to be cut and/or spliced on site. If cutting/splicing is necessary due to accidental breakage please contact your nearest Arcteq representative.

The fixed light sensitivity of the AQ07 sensor is 8000 LUX. Sensor does not require user settings. Detection radius is 360 degrees. See figure 4.4.

Figure 4-4 AQ 07 arc light fiber optic loop sensor

Note: On request AQ 07 ends can be covered with black rubber part for any requested portion to avoid light detection outside the protected zone. For more information consult your nearest Arcteq representative.

4.3.1 AQ 07 TECHNICAL DATA

Light intensity threshold	8000Lux
Detection radius	360 degrees
Maximum length	50 meters
Diameter	1.2 millimeters
Bending radius	1 centimeter
Operating temperature	-40...+85 ℃

4.4 ARC LIGHT FIBER OPTIC LOOP SENSOR AQ 08

AQ 08 is an arc light fiber optic loop sensor. It is developed to withstand temperatures of up to 125 degrees Celsius and is therefore suitable for installation in e.g. wind turbine windings. AQ 08 fiber is a robust fiber optic cable providing practically unlimited bending radius. AQ 08 contains hundreds of glass fiber drains covered by a plastic tube making it extremely strong. AQ 08 sensors can be ordered in pre-manufactured lengths of 1-40 meters. AQ 08 fiber sensors are distributed through the protected switchgear cells. AQ 08 is not recommended to be cut and/or spliced on site. If cutting/splicing is necessary due to accidental breakage please contact your nearest Arcteq representative.

The fixed light sensitivity of the AQ08 sensor is 8000 LUX. Sensor does not require user settings. Detection radius is 360 degrees. See figure 4.5.

Figure 4-5 AQ 08 arc light fiber optic loop sensor

Note: On request AQ 08 ends can be covered with black rubber part for any requested portion to avoid light detection outside the protected zone. For more information consult your nearest Arcteq representative.

4.4.1 AQ 08 TECHNICAL DATA

Light intensity threshold	8000Lux
Detection radius	360 degrees
Maximum length	40 meters
Diameter	1.2 millimeters
Bending radius	1 centimeter
Operating temperature	-40...+125 ℃

4.5 Sensor Type Dependencies

Different sensor types can be utilized in different arc flash protection units of the AQ 100 series. The table below describes the dependencies.

Table 4-1: Arc sensor dependencies

	AQ 01	AQ06	AQ07	AQ08
AQ101	Yes	Yes (with fiber option)	Yes (with fiber option)	Yes (with fiber option)
AQ102	No	Yes	Yes	Yes
AQ110P	Yes	Yes (with fiber option)	Yes (with fiber option)	Yes (with fiber option)
AQ110F	No	Yes	Yes	Yes

4.6 Sensor Connection

4.6.1 Arc light point sensor AQ01 connection

1) Open the sensor side-covers, then detach the pluggable connectors from the sensor PCB, and prepare the twisted shielded pair cable connecting. See Figure 4-6 .

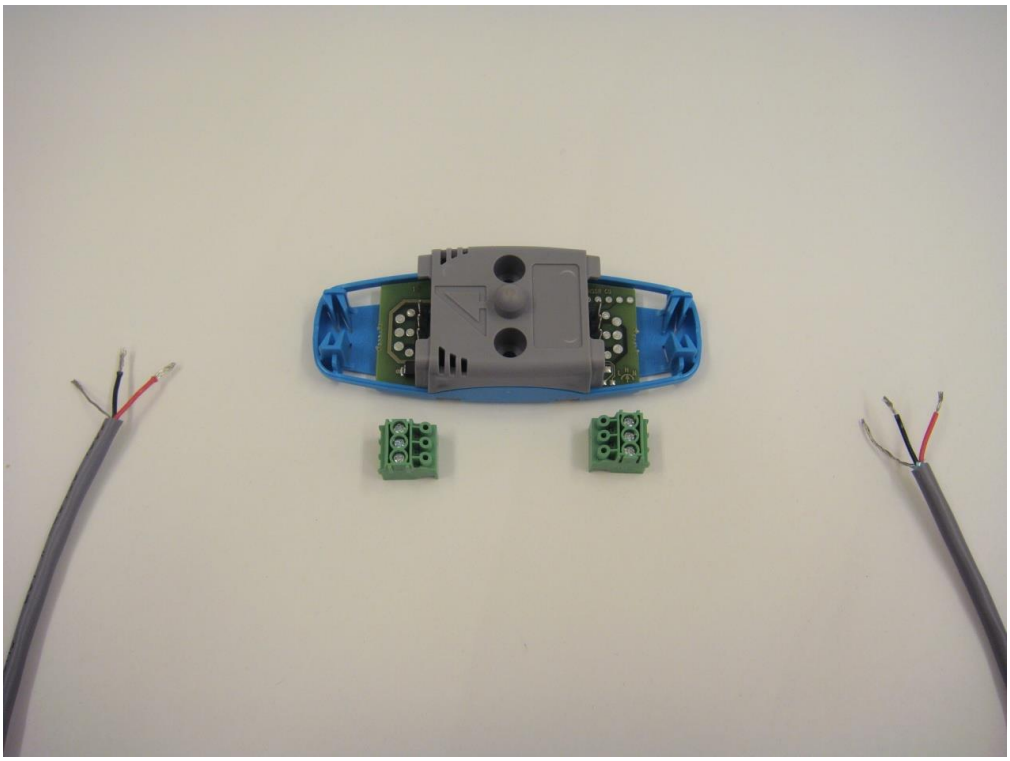


Figure 4-6: AQ01 sensor connection step 1.

2) Before connecting the cable to connector, make sure that the connecting order is right (+, signal, shield). The appropriate pins information is shown on the blue bottom part of the sensor. Plug the wires into connector and fasten them by using the screw driver. See.

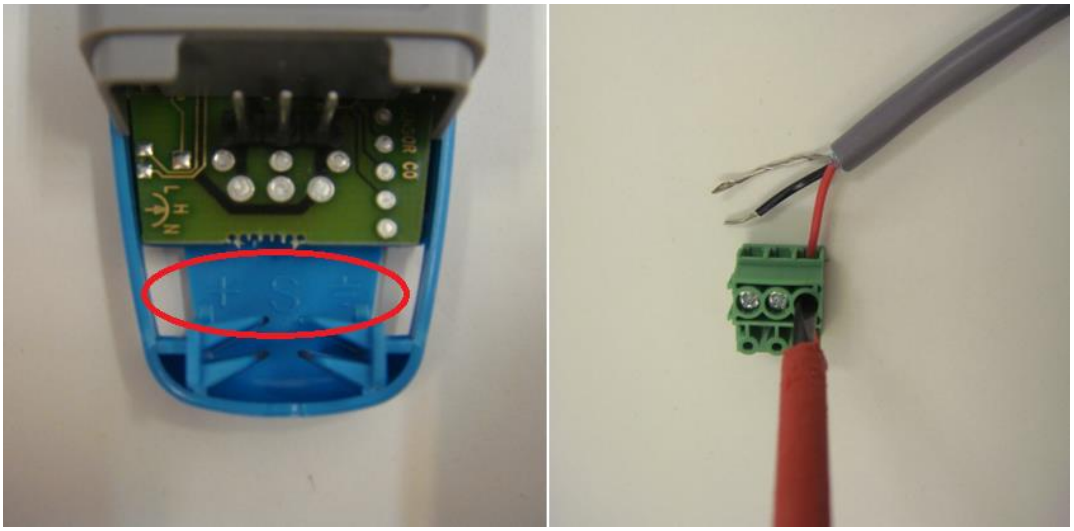


Figure 4-7: AQ01 sensor connection step 2.

3) Connect the other end of the cable to a sensor channel on the AQ101 or AQ110P unit. See Figure 4-8.

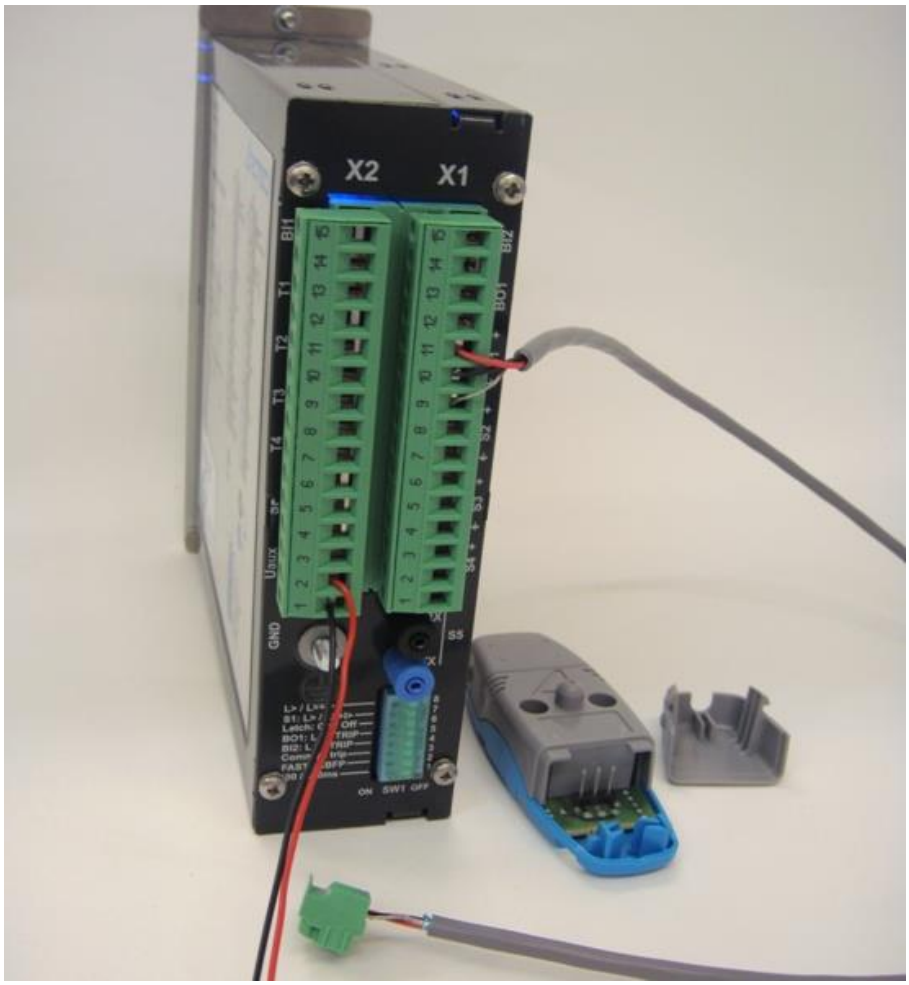


Figure 4-8: AQ01 sensor connection step 3.

4) Check the front panel of the unit, only POWER LED turns on at this moment. See Figure 4-9.

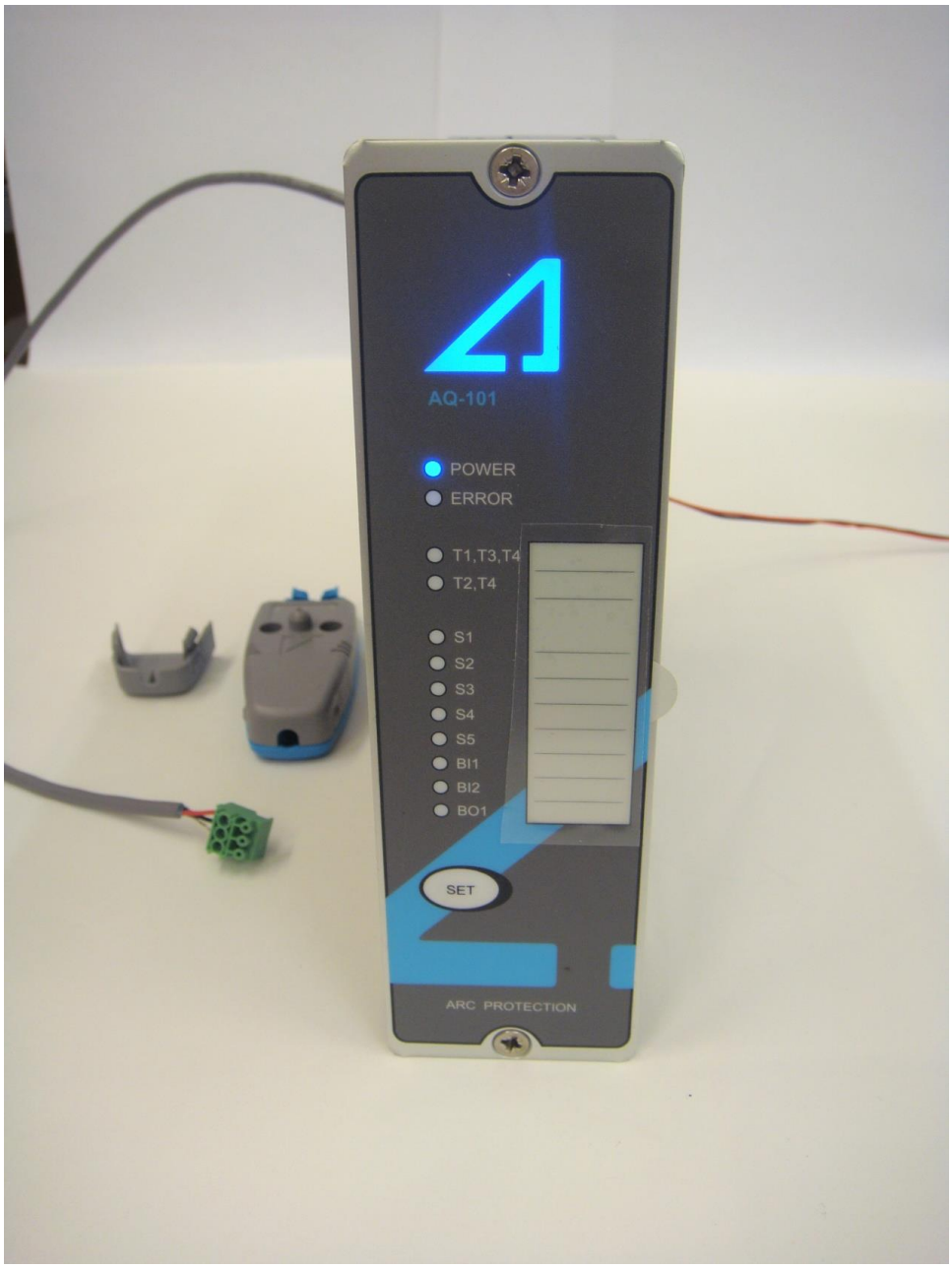


Figure 4-9: AQ01 sensor connection step 4.

5) Attach the connector back to the sensor PCB. See Figure 4-10.

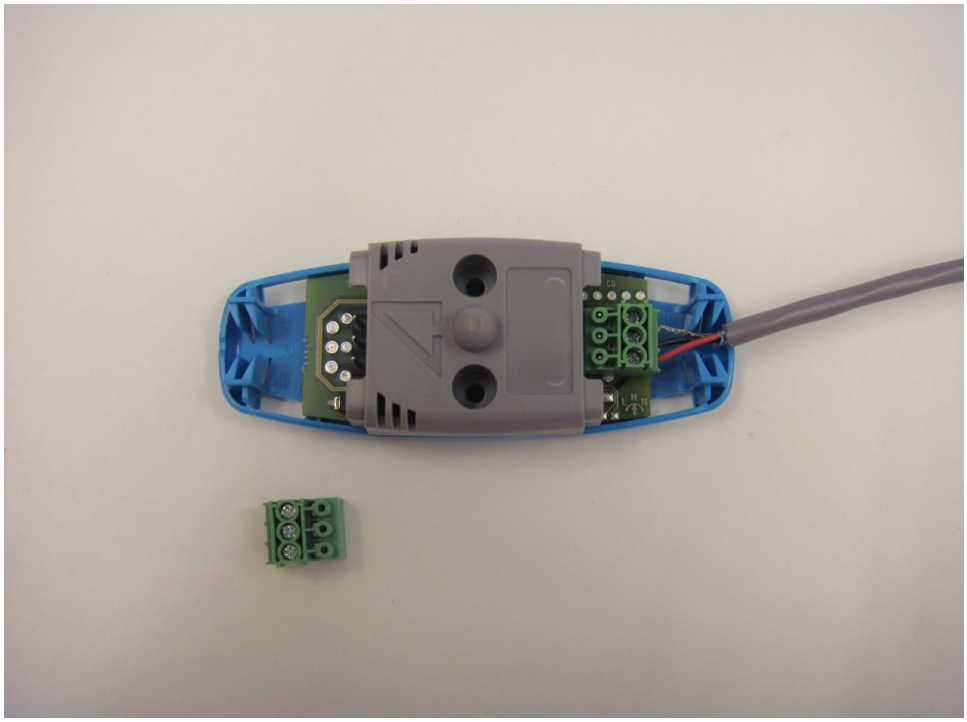


Figure 4-10: AQ01 sensor connection step 5.

6) After connecting the sensor to unit, the ERROR LED turns on, and the appropriate sensor channel LED starts to blink (e.g. S1 LED). See Figure 4-11.

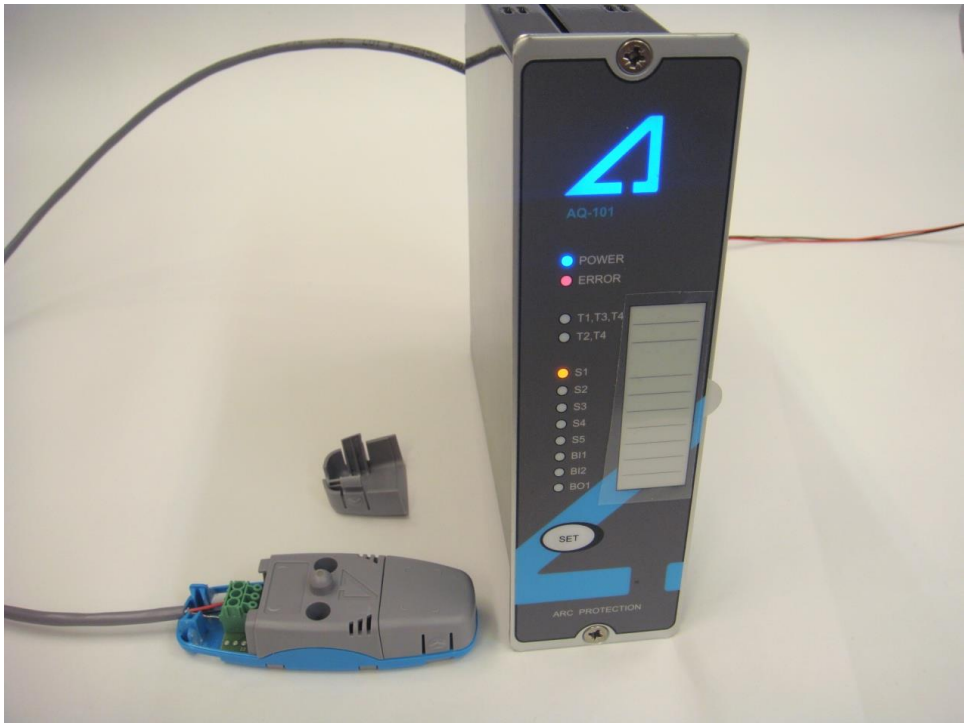


Figure 4-11: AQ01 sensor connection step 6.

7) Press and hold the SET push button on the front panel for 2 seconds in order to run system auto-configuration setting. See Figure 4-12.The unit memorizes the sensor amount and Binary input lines connected (if any).

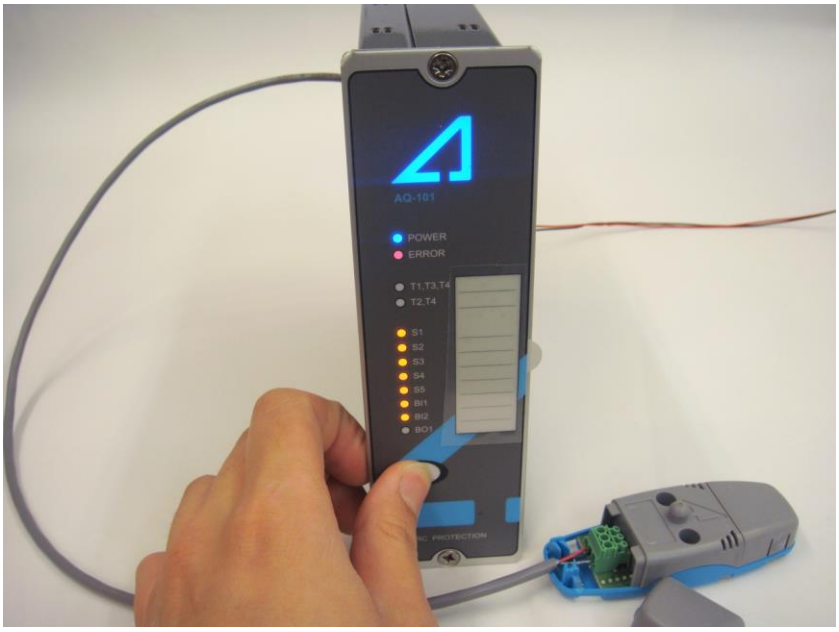


Figure 4-12: AQ01 sensor connection step 7.

8) After completing the system auto-configuration setting, close both end side-covers back. See Figure 4-13.

Figure 4-13: AQ01 sensor connection step 8.

9) A maximum amount of 3 arc sensors can be daisy-chained to the same sensor input on the AQ101 unit. See Figure 4-14.

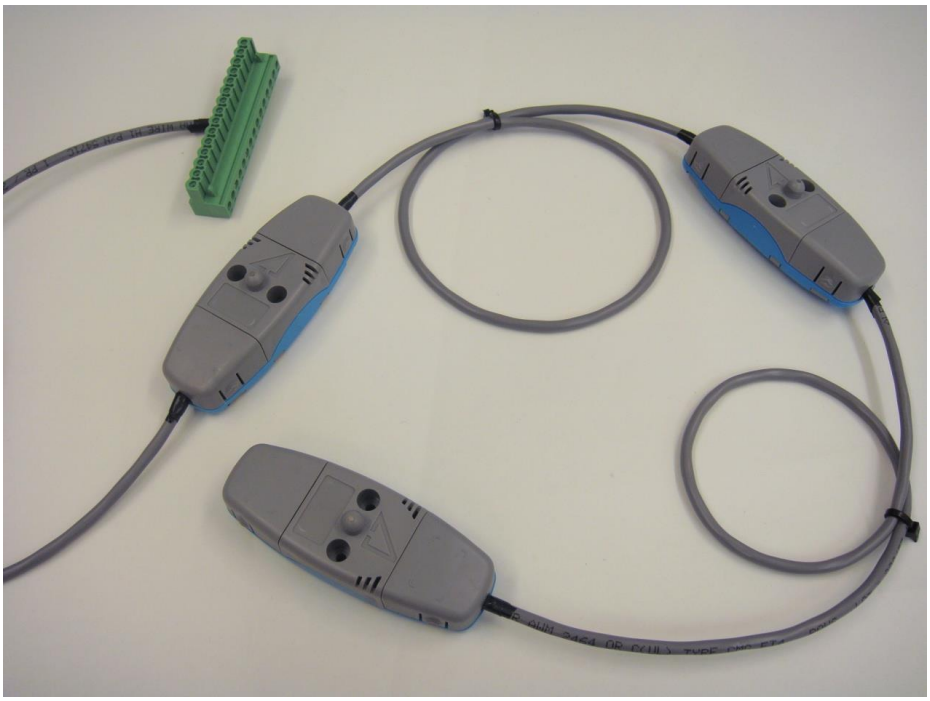


Figure 4-14: AQ01 sensor connection step 9.

The Auto Configuration is a part of the Self Supervision Function which is making sure that all connections and sensors at all time are fully functional and ready to operate.

5 SYSTEM SELF-SUPERVISION

AQ 110 includes extensive self-supervision feature. Self-supervision includes both internal functions and external connections. The self-supervision module monitors power supply, HW and SW malfunctions and binary input connection and sensor problems. CT circuit is monitored as well and an open circuit will cause an alarm. Dipswitch settings are also supervised by comparing actual value with stored Non-volatile memory data (see chapter 3.3.1 Auto configuration (system setup)).

In a healthy condition the power LED is on and the Self-supervision (SF) relay is energized. If the self-supervision function detects a faulty condition the self-supervision relay is released and the ERROR LED is lit.

If a sensor failure occurs, the unit will go into ERROR-mode. The error LED will turn on, the SF relay will release and the corresponding faulty sensor channel LED will start blinking. In this situation the unit is still in protection mode, but with the faulty sensor channel blocked. If the error is resolved, the error LED will automatically clear the SF-status and failed sensor channel LED will remain as blinking status. This means that SF-relay will energize and the error led will turn off. If one or more of the sensors are disconnected the healthy sensors remain in use and unit remains operational accordingly. The AQ 110 will remain in error mode until the disconnected sensors are repaired.

If a dip switch setting is changed after the auto-configuration function (see chapter 3.3.1 Auto configuration) has been executed, the unit will go into SF-alarm mode. The configured (stored) setting is however still valid and the unit is still operational.

5.1 OPEN CT MONITORING

If there is a current flow of more than 0.2xIn the unit assumes that the switchgear is energized. In this case phases IL1, IL2 and IL3 are monitored and supervised for open connection (no current flow).

If one or two of the three phases is 0 while the other(s) remain above 0.2xIn the unit will issue an open CT alarm.

When CT open alarm is issued, SF-relay is released, Error LED turned on and corresponding IL1>, IL2>, IL3 LED starts blinking.

6 APPLICATION EXAMPLE

6.1 MV – TWO INCOMERS WITH TIE BREAKER

The full selective arc flash protection for two incomers with tie breaker application usually require an AQ110P or AQ110F – arc fault detection with overcurrent measurement unit for each incoming feeder, an AQ101 or AQ102 - arc fault detection unit for each outgoing feeder. The arc fault can be detected by Arcteq point sensors or fibre loop sensors in each switchgear compartment.

This application example is based on a typical main-tie-main configured power distribution system. It consists of two independent incomers, four outgoing feeders and one a bus tie breaker. The relevant arc flash protection device bill of materials is listed below:

Device	Location	Qty	Note
AQ110P	Incomer	1	Left-hand side bus section incomer.
AQ101	Outgoing feeder	2	Left-hand side bus section outgoing feeders.
AQ01	Each compartment	9	Cable, CB and busbar compartments.
AQ01	Tie compartment	2	CB and busbar compartment.
AQ110F	incomer	1	Right-hand side bus section incomer.
AQ102	Outgoing feeder	2	Right-hand side bus section outgoing feeders.
AQ07	Cable and CB compartment	6	Cable and CB compartments.
AQ07	Busbar compartment	1	Whole right-hand side section busbar

Table 6-1: Device bill of materials for main-tie-main application.

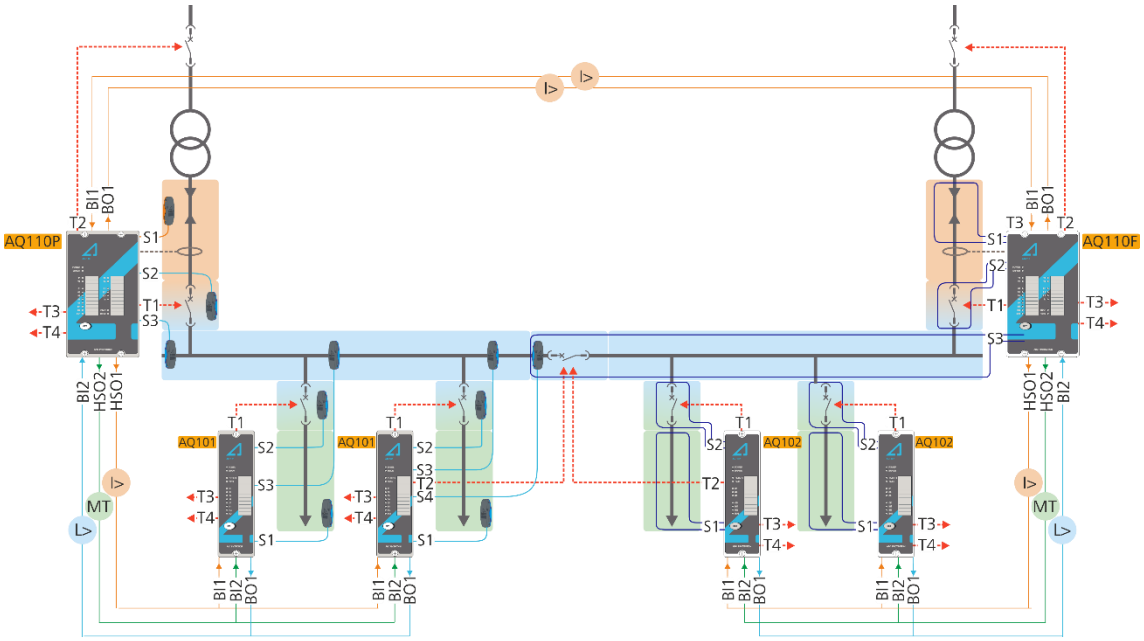


Figure 6-1: Main-tie-Main arc flash protection with AQ100 series products.

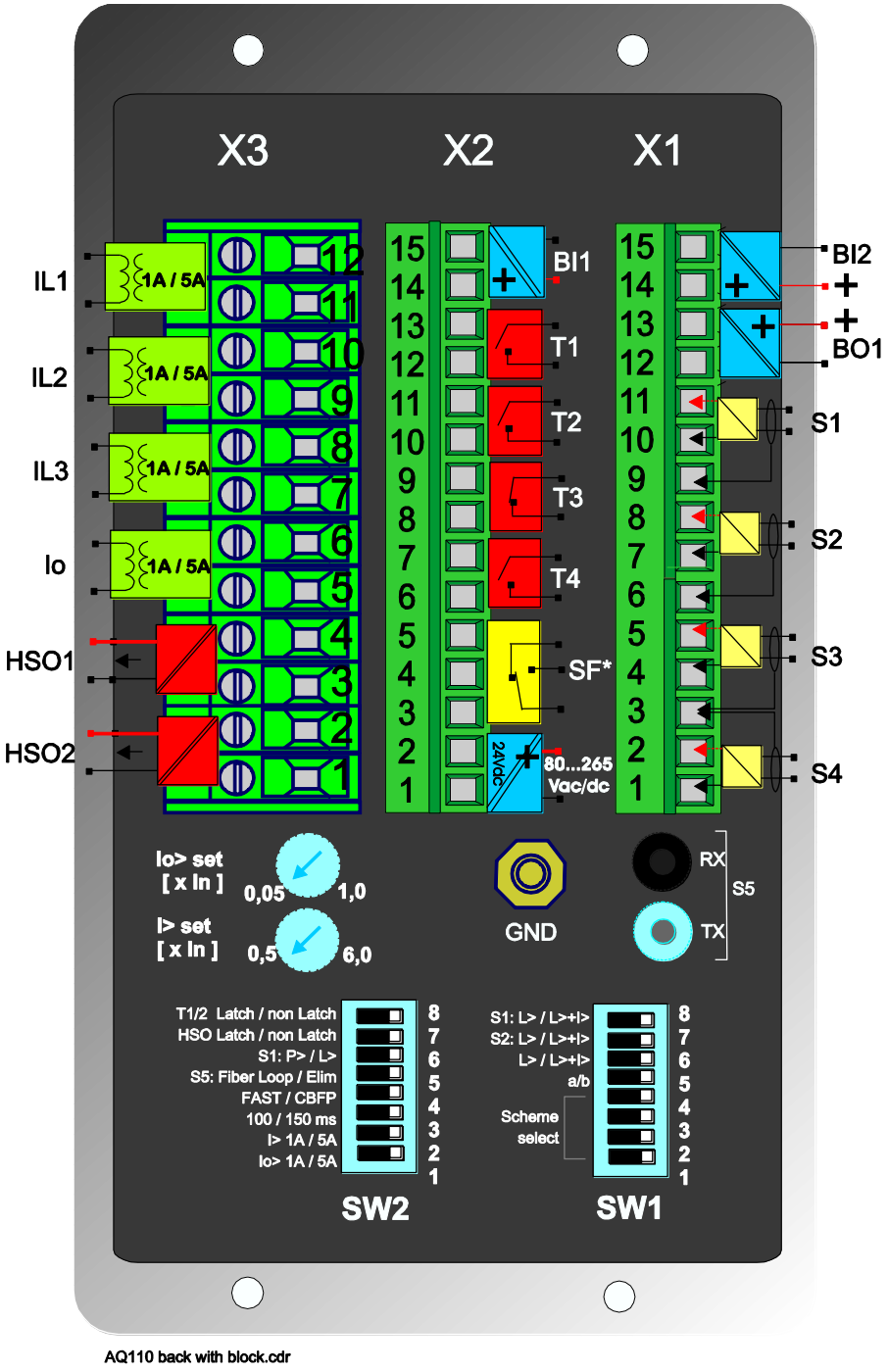
When arc fault is detected in cable compartment, it only trips local feeder circuit breaker. For incomer cable compartment arc fault, AQ110P or AQ110F can send trip signals to upstream circuit breaker.

When arc fault is detected in incomer breaker compartment, the incomer AQ110P or AQ110F will trip incomer CB and incomer upstream CB while sending the master trip signal to all connected AQ101 or AQ102 units in order to all bus section outgoing feeder breakers. When arc fault is detected in outgoing feeder breaker compartment, , the incomer AQ110P or AQ110F will trip incomer CB while sending master trip signal to all connected AQ101 or AQ102 units.

When arc fault is detected in busbar compartment, the incomer AQ110P or AQ110F will trip incomer CB while sending the master trip signal to all connected AQ101 or AQ102 units in order to all bus section outgoing feeder breakers.

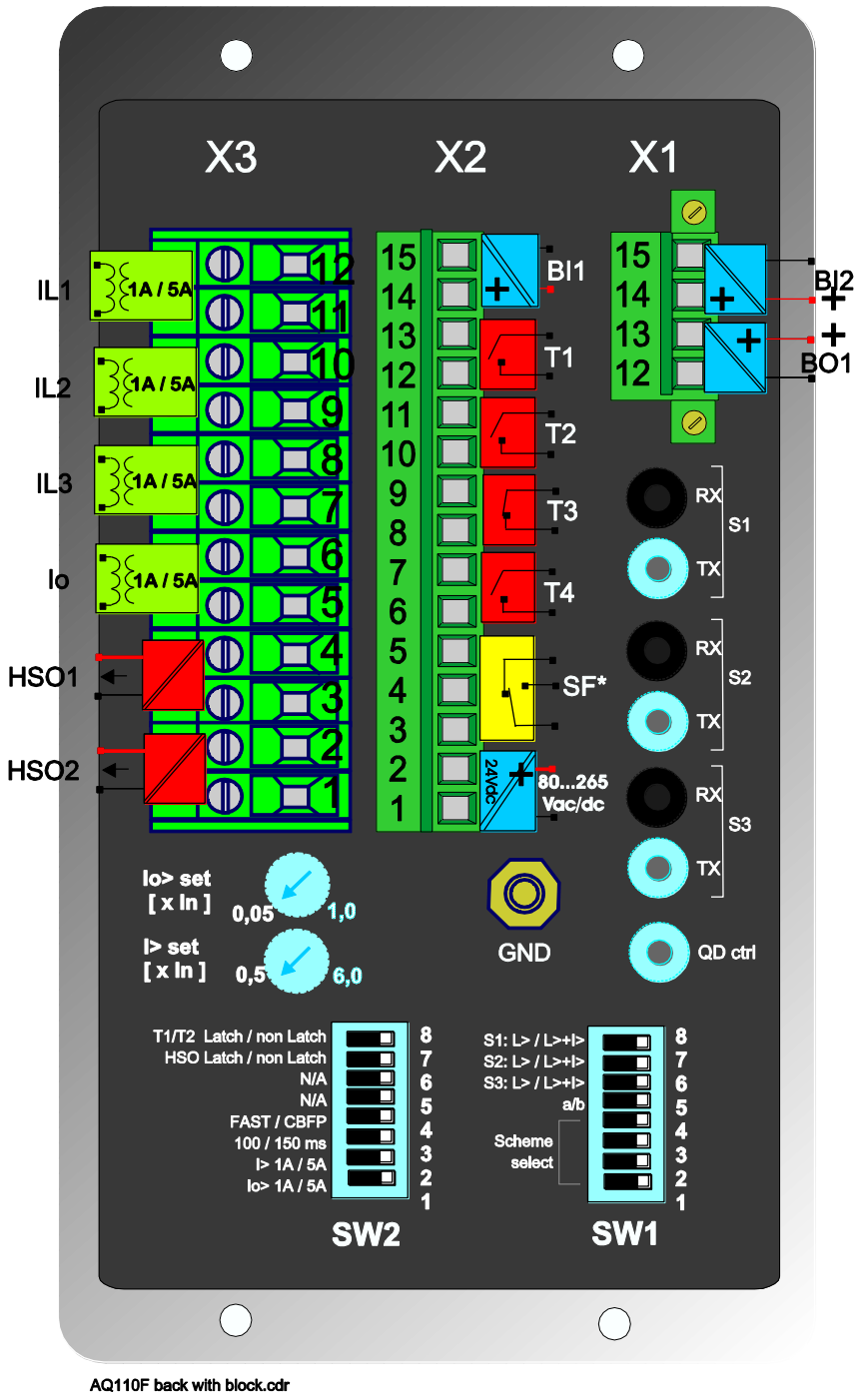
When arc fault happens in breaker or busbar compartment, the AQ110P/F trip contact T3 can be used to trip the tie breaker, alternatively the AQ101/AQ102 T2 can be also used to trip the tie breaker.

7 CONNECTIONS



*) In de-energized position

Figure 7-1 AQ 110P terminals at rear plate



*) In de-energized position

Figure 7-2 AQ 110F terminals at rear plate

7.1 OUTPUTS

7.1.1 TRIP RELAYS T1 AND T2

The AQ 110 unit has integrated trip relays T1 and T2 for tripping of the circuit-breakers. T1 and T2 relays are normally open type (NO).

7.1.2 TRIP RELAYS T3 AND T4

T3 relay output may act either as an electronic lock-out relay or as a trip relay. This option must be specified when ordering. When T3 is factory configured as an electronic lock-out relay it is normally closed type (NC) and will hold its position until manual reset command or until auxiliary power supply is lost. When re-applying the auxiliary power supply the electronic lock-out relay will return to the contact condition prior loosing the auxiliary power. Normally closed trip relay T3 can be used for tripping contactor controlled devices.

Alternative T3 can be ordered as normally open (NO) type relay from the factory.

T3 relay follows the operation of T1 and activates whenever T1 is activated.

Trip relay T4 is a common trip relay that operates anytime T1 or T2 relay operates and can be used either for tripping one more disconnecting device or for trip alarm to local or remote monitoring and alarming system.

7.1.3 HIGH SPEED OUTPUTS (HSO1 AND HSO2)

AQ 110 contains two high speed semiconductor outputs HSO1 and HSO2. These outputs may be utilized either for direct tripping of circuit breaker or as a heavy duty signaling outputs. Due to high current carrying capacity HSO1 and HSO2 are capable of supplying current or light information to maximum 20 pieces of AQ 100 series units without a need for signal amplifiers. HSO1 operation is dependent on scheme select dipswitches, for details see chapter 3.5.

7.1.4 Binary output BO1

One binary output is available (+24V dc). Binary output function can be configured using dipswitches (see chapter 3.5 Dipswitch settings).

Note: the binary output is polarity sensitive (see chapter 8 Wiring diagram).

7.1.5 System failure relay SF

System failure relay SF is a changeover type (NO/NC) and is energized in healthy condition. Whenever AQ 110 detects a system error or disconnection of the auxiliary power supply the contact changes its state. The state of the SF relay remains the same until the unit returns to a healthy condition and SF relay is energized again.

7.2 Inputs

7.2.1 Current measurement inputs

AQ 110 has 4 CT inputs for 3 phase current and residual current measurement. Both phase current and residual current inputs may be configured to 1 or 5 amps nominal current using dipswitches (see chapter 3.5). For setting current threshold levels refer to chapter 3.4 Open CT monitoring. An open circuit detection feature is included, for more details refer to chapter 5.1.

7.2.2 Arc sensor channels S1, S2, S3, S4 and S5

AQ 110P has 4 arc point sensor channels (S1, S2, S3, S4). Maximum three arc point sensors (type AQ 01) may be connected to each channel.

AQ 110P has an option of one fiber optic loop sensor channel (S5) with transceiver and receiver (Tx, Rx). The function of S5 channel is controlled by dipswitches (see chapter 3.5). When S5 is configured as fiber optic loop sensor the unit one end of the fiber sensor is connected to Tx and another to Rx. This sensor loop is then continuously monitored by means of test light pulse travelling through the loop. In case of discontinuity in the loop the

unit goes into error mode and activates the error LED and SF relay output. Alternatively channel S5 can be configured to control the arc quenching system (eliminator. In this case Tx shall be utilized to control the arc quenching system. The unit is sending a continuous light pulse to arc quenching system for self-supervision purposes.

AQ 110F version has 3 arc fiber loop sensor channels (S1, S2, S3) with transceiver and receiver (Tx, Rx) in each channel. Additionally one transceiver (Tx) is available for arc quenching system (eliminator) control.

For details on sensors refer to chapter 4 Arc Sensors.

7.2.3 Binary inputs BI1 and BI2

AQ 110 contains two binary inputs. The function of binary inputs is selected using dipswitches according to SAS applications (see chapter 3.5). Typically binary inputs are utilized for receiving the arc light information from AQ 101 and AQ 102 units and receiving the overcurrent information from other AQ 110 devices.

The inputs are activated by connecting a dc signal exceeding the specified nominal threshold level of the corresponding input. There are three different nominal threshold levels available, 24 or 110 or 220 Vdc. The desired threshold value has to be specified when ordering. The actual activation of the binary input occurs at 80% of the specified nominal threshold value (i.e. 16 Vdc, 88 Vdc or 178 Vdc).

7.3 Auxiliary voltage

The auxiliary power supply voltage is 80….265Vac/dc. Optionally a 24…72Vdc version is available.

After powering up the unit protection is active and operational within 50ms.

8 WIRING DIAGRAMS

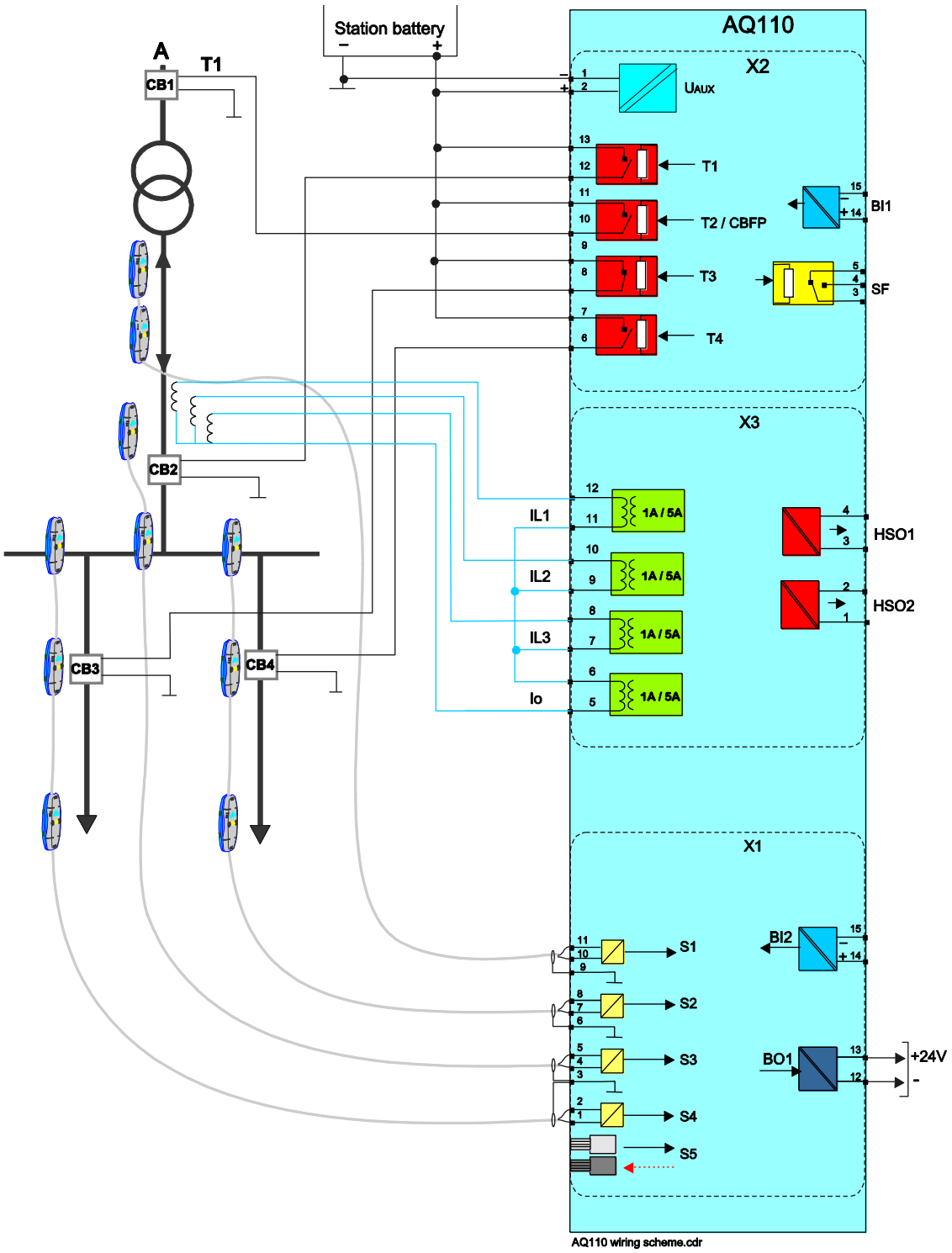


Figure 8-1: AQ 110P Wiring diagram

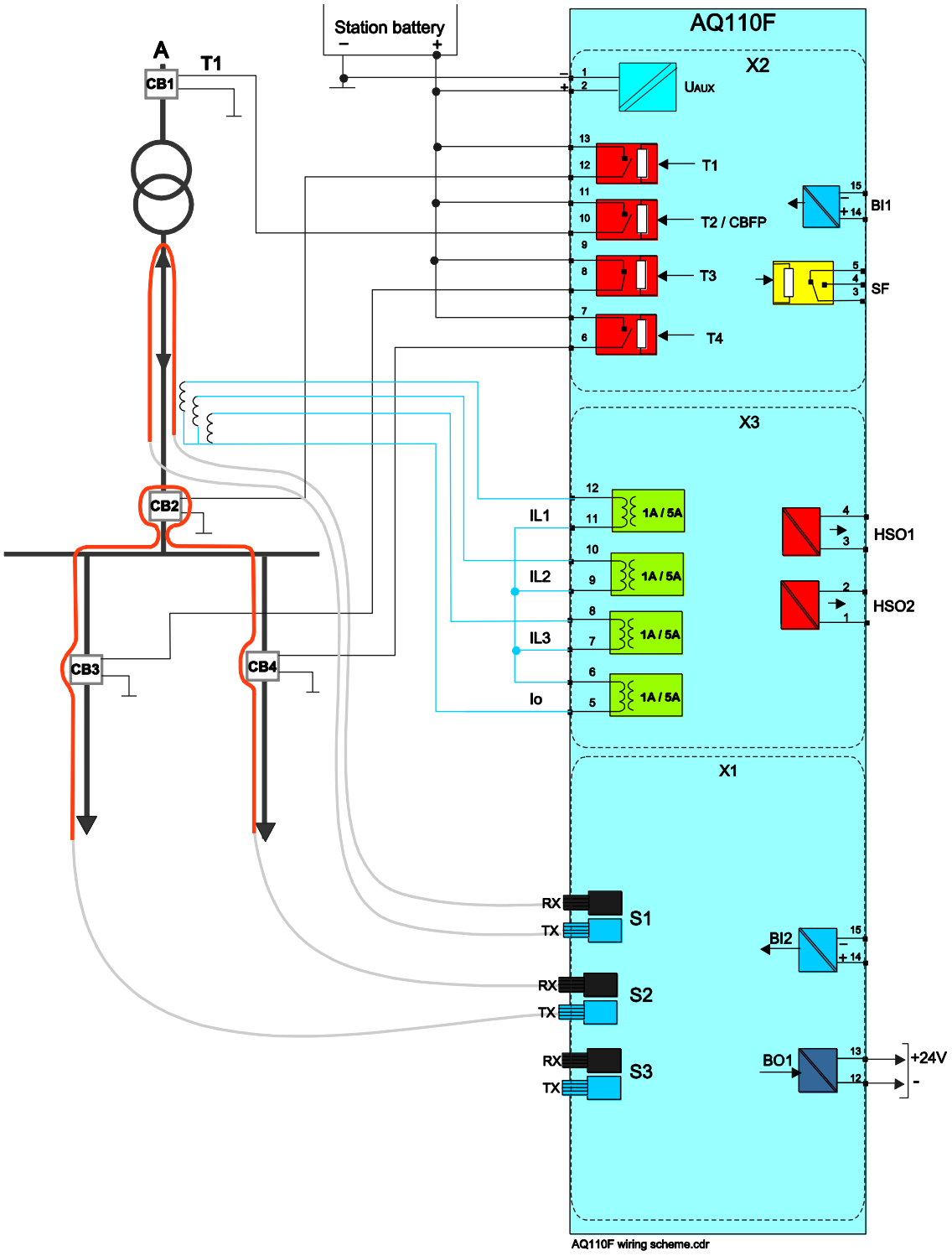


Figure 8-2: AQ 110F Wiring diagram

9 DIMENSIONS AND INSTALLATION

AQ 110 is either door mounted or panel mounted in standard 19 inch rack (height of 4U and 1/4 of a unit wide).

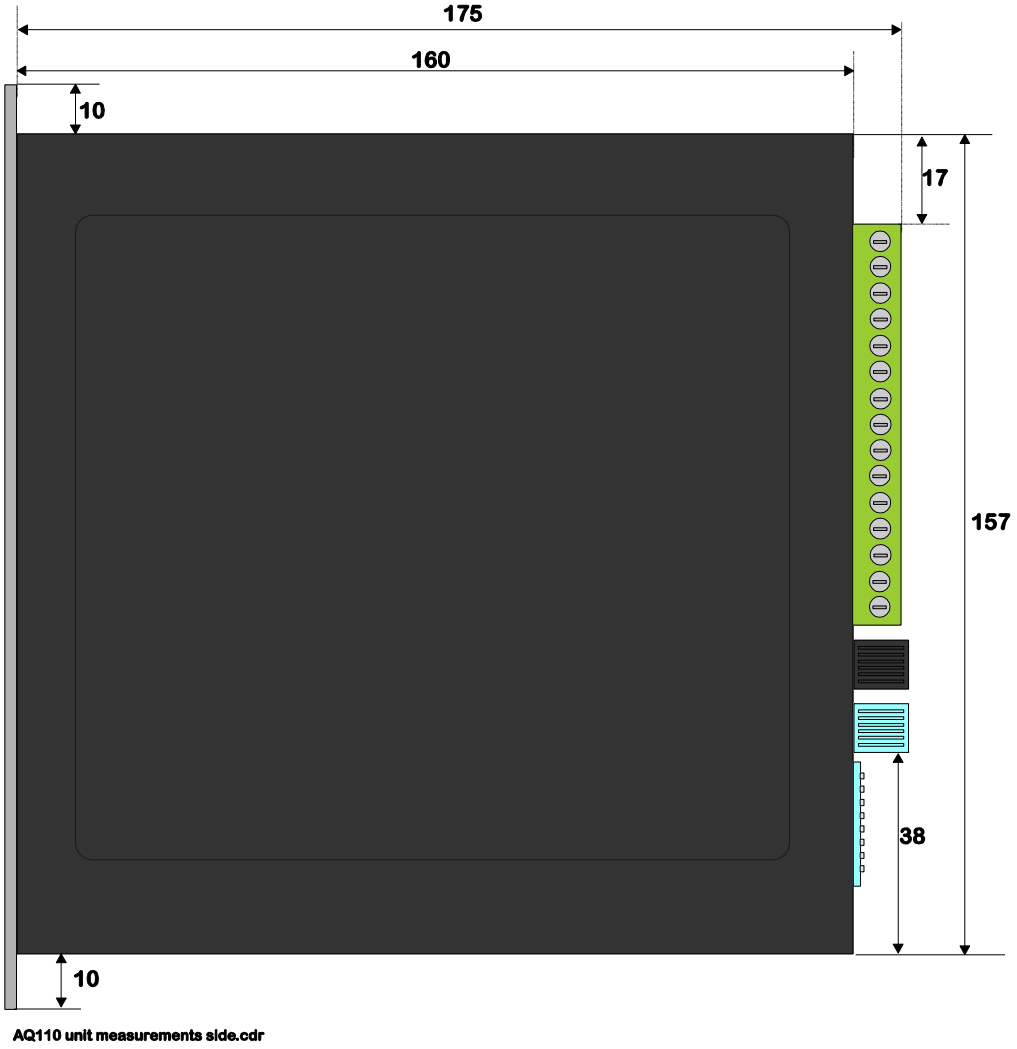


Figure 9-1: AQ 110 dimensions in millimeters (side view)

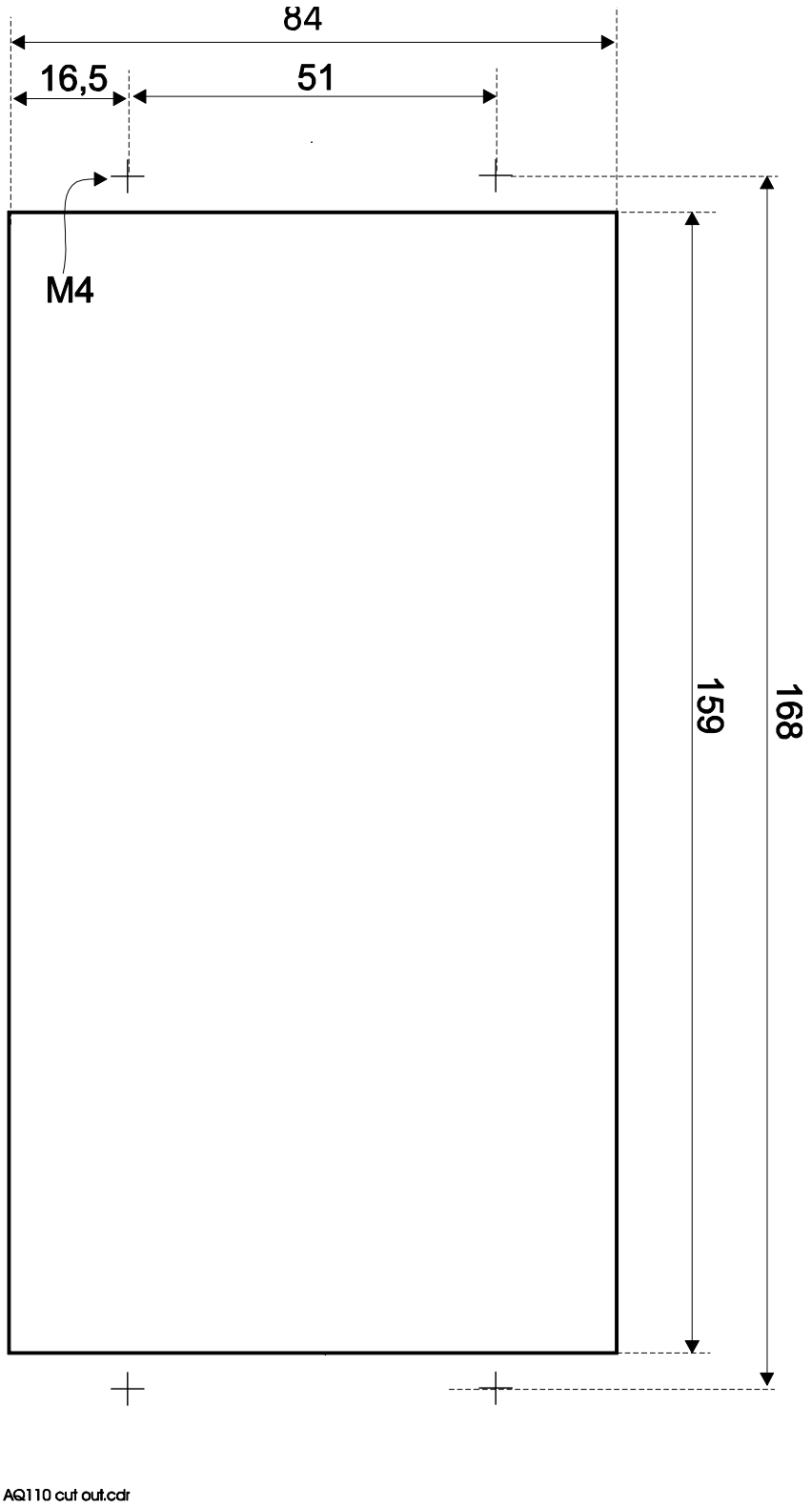


Figure 9-2: AQ 110 cut out for panel mounting (millimeters)

10 TESTING

It is recommended that the AQ 110 unit is tested prior to substation energizing. Testing is carried out by simulating arc light to each sensor and verifying the tripping and LED indication. For arc light simulation, use a superior camera flash type: Canon Speedlite 430EX or equivalent. For testing of non-latched signals and CBFP function use Mini Maglite 2 CELL AAA or equivalent type of flashlight. Check that camera flash or flashlight has fully charged battery when testing.

10.1 CARRYING OUT TESTING IN LIGHT ONLY MODE

1) Check that the dipswitch setting positions are in accordance to your application
2) Activate the camera flash within 20cm (12 inches) of the AQ01 sensor unit or AQ07 fiber loop sensor if in use.
3) Verify that the corresponding sensor channel indication LED status is changed to ON.
4) Verify the relay output(s) activation(s) by checking the circuit breaker status or by monitoring trip contact status. The circuit breaker should open or contacts operate. Note: A best practice is to operate the circuit breaker at testing.
5) Verify that the corresponding relay output(s) LED(s) indication status is changed to ON
6) If binary output (BO1) or high speed output (HSO) signal is utilized verify the BO1 or HSO signal activation by status change of relevant input where the output signal is connected or by measuring the signal output voltage. Note that BO1 signal is a non-latched type.
7) If binary output or high speed output (HSO) signal is utilized verify that BO1 LED or relevant HSO LED is lit.
8) Press SET push-button to reset all indications and latches.
9) If binary input BI2 is utilized for master trip activate the corresponding binary input and verify that trip has occurred by repeating 4 and 5.
10) Press SET push-button to reset all indications and latches.
11) Repeat the testing procedure for all sensors.

10.2 CARRYING OUT TESTING IN LIGHT AND CURRENT MODE

1) Check that the dipswitch setting positions are in accordance with your application
2) Activate the camera flash within 20cm (12 inches) of the AQ01 sensor unit and activate the binary input BI1 used for overcurrent condition simultaneously.
3) Verify that the sensor channel indication LED status is changed to ON
4) Verify that the binary input indication LED status is changed to ON
5) Verify the relay output(s) activation(s) by checking the circuit breaker status or by monitoring trip contact status. Note: A best practice is to operate circuit breaker at testing. The circuit breaker should open or contacts operate.
6) Verify that the corresponding relay output(s) LED(s) indication status is changed to ON.
7) If binary output BO1 signal is utilized verify the BO1 signal activation by status change of relevant input where binary output signal is connected or by measuring the signal output voltage.
8) If binary output or high speed output (HSO) signal is utilized verify that BO1 LED or relevant HSO LED is lit. Note that BO1 signal is a non-latched type.
9) If other binary input BI2 is in use verify correct operation by activating the input.
10) Activate the camera flash within 20cm from the AQ01 sensor unit and do not activate the binary input used for overcurrent condition.
11) Verify that no trip has occurred and only sensor activation indication LED is ON.
12) Verify that BO1 signal is activated (if in use and configured to send light information)
13) Press SET push-button to reset all indications and latches.
14) If binary input BI2 is utilized for master trip activate the BI2 and verify that trip has occurred by repeating 4 and 5.
15) Press SET push-button to reset all indications and latches.

16) Repeat the testing procedure for all sensors.

10.3 TESTING THE CBFP FUNCTION

Circuit breaker failure function is tested by leaving light signal and second trip criteria signal (e.g. overcurrent) if applicable active for above set CBFP time of either 100 or 150ms. Those trip relays binary outputs configured to operate as CBFP contacts shall be active after set time delay.

10.4 TESTING ARC FLASH PROTECTION UNIT OPERATION TIME

The AQ 110 operation time test is not required at commissioning as it is performed by the manufacturer as a type test and routine production test. Refer to routine test reports sent with AQ 110 unit and consult your nearest Arcteq representative for type test reports.

However, if it is deemed necessary a site timing test may be conducted using below instructions.

1) Use a calibrated relay test set
2) Connect an output from the relay test set to camera flash type Canon xxx or equivalent input for initializing the flash and configure a relay test set timer to be started simultaneously with flash.
3) Connect AQ 110 trip output T1, T2, T3 or T4 or high speed outputs HSO1 and HSO2 to relay test set input and configure the input to stop the timer.
4) Place camera flash to maximum 20cm (12 inch) distance of the AQ01 or AQ 07 sensor.
5) Initiate flash and timer using relay test set output.
6) Read the measured time between simulated arc and trip contact operation.
7) Subtract the digital input delay of the relay test set from the final measured time if applicable. For specific test instructions consult the manufacturer of the relay test set.

10.5 TEST PLAN EXAMPLE

Date:	
Substation	
Switchgear:	
AQ 110 serial number:	

Preconditions	**Light only**	**Light + current**	**Remark**
Sensor channel 1 setting			
Sensor channel 2,3,4 setting			
Circuit breaker failure protection in use (Yes / No):			

Object activated		**LED indication**	**T1,T2,T3,T4 active**	**BO1 active**	
Sensor channel 1	Sensor 1				
	Sensor 2				
	Sensor 3				
Sensor channel 2	Sensor 1				
	Sensor 2				
	Sensor 3				
Sensor channel 3	Sensor 1				
	Sensor 2				
	Sensor 3				
Sensor channel 4	Sensor 1				
	Sensor 2				
	Sensor 3				
Fiber sensor channel (option)					
BIN 1					
BIN 2					
Phase current IL1, IL2, IL3					
Residual current Io					

Tested by :	
Approved by:	

11 TROUBLESHOOTING GUIDE

Problem	Check	Cross reference
Sensor does not activate when testing	Sensor cable wiring	Chapter 4.6 of this manual
	Camera (or other test equipment) flash intensity	Chapter 10 of this manual
Trip relay(s) does not operate even if sensor is activated	Dipswitch settings and current threshold set-points	Chapter 3.5 of this manual
Current measurement indicator LED is continuously on	Current threshold set-points	Chapter 3.4 of this manual
Current measurement indicator LED is blinking	Proper connection of three phase currents	Chapter 5.1 of this manual

Table 11-1Troubleshooting guide

12 TECHNICAL DATA

12.1 PROTECTION STAGES

Trip time using HSO	2ms*
Trip time using mechanical trip relays	7ms*
Reset time (light stage)	1ms
Reset time (overcurrent stages)	50ms
Protection operational after power up	50ms

*total trip time using arc light (L>) or phase/residual overcurrent (I>) and arc light (L>)

12.2 AUXILIARY VOLTAGE

Us	80...265Vac/dc (order code: A) 24...72Vdc (order code: B)
Maximum interruption	100ms
Maximum power consumption	5W, <10mΩ
Standby current	90mA

12.3 CURRENT MEASURING CIRCUITS

Nominal current	1 or 5A
Rated Frequency	2...1000Hz
Number of inputs	3 (phase) + 1 (residual)
Thermal withstand continuous	30A
Thermal withstand 1s	500A
Thermal withstand 10s	100A
Phase overcurrent setting range	0.5...6*In
Residual overcurrent setting range	0.05...2*In
Measurement accuracy	10%
Rated AC Burden (VA)	Input resistance 10mΩ
Power consumption of current inputs circuit	<10mΩ

12.4 TRIP RELAYS T1, T2, T3, T4

Number	4 NO (order code: A) 3 NO + 1 NC (order code: B)
Rated voltage	250V ac/dc
Continuous carry	5A
Make and carry for 0.5s	30A
Make and carry for 3s	16A
Breaking capacity DC, when time constant L/R=40ms	40W; 0.36A at 110 Vdc
Contact material	AgNi 90/10

12.5 System failure relay SF

Number	1
Rated voltage	250V ac/dc
Continuous carry	5A
Make and carry for 0.5s	30A
Make and carry for 3s	16A
Breaking capacity DC, when time constant L/R=40ms	40W; 0.36A at 110 Vdc
Contact material	AgNi 90/10

12.6 High Speed Outputs HSO1, HSO2

Number	2
Rated voltage	250Vdc
Continuous carry	2A
Make and carry for 0.5s	15A
Make and carry for 3s	6A
Breaking capacity DC, when time constant L/R=40ms	1A / 110W
Contact material	Semiconductor

12.7 Binary Output BO1

Rated voltage	+24V dc (internally wetted)
Rated current	20mA (max)
Number of outputs	1

12.8 Binary Inputs BI1, BI2

Rated voltage	5...265 Vdc
Pick up voltage	16Vdc (order code: A) 88Vdc (order code: B) 178Vdc (order code: C)
Drop off voltage	15Vdc (order code: A) 75 Vdc (order code: B) 155Vdc (order code: C)
Rated current	3 mA
Number of inputs	2

12.9 DISTURBANCE TESTS

EMC test	CE approved and tested according to EN 50081-2, EN 50082-2
Emission - Conducted (EN 55011 class A) - Emitted (EN 55011 class A)	 0.15 - 30 MHz 30 - 1 000 MHz
Immunity - Static discharge (ESD) (According to IEC244-22-2 and EN61000-4-2, class III) - Fast transients (EFT) (According to EN61000-4-4, class III and IEC801-4, level 4) - Surge (According to EN61000-4-5 [09/96], level 4) - RF electromagnetic field test (According. to EN 61000-4-3, class III) - Conducted RF field (According. to EN 61000-4-6, class III)	 Air discharge 15 kV Contact discharge 8 kV Power supply input 4kV, 5/50ns other inputs and outputs 4kV, 5/50ns Between wires 2 kV / 1.2/50µs Between wire and earth 4 kV / 1.2/50µs f = 80....1000 MHz 10V /m f = 150 kHz....80 MHz 10V

12.10 VOLTAGE TESTS

Insulation test voltage acc- to IEC 60255-5	2 kV, 50Hz, 1min
Impulse test voltage acc- to IEC 60255-5	5 kV, 1.2/50us, 0.5J

12.11 MECHANICAL TESTS

Vibration test (IEC 60255-21-1)	10...150Hz,0.07mm,0.5g_n(60...150Hz) 10...150Hz, 1g_n(10...150Hz)
Shock/Bump test acc. to IEC 60255-21-2	20g, 1000 bumps/dir.

12.12 CASING AND PACKAGE

Protection degree (front)	IP 50
Protection degree (back)	IP 20
Dimensions (W x H x D mm)	102(w) x 157(h) x 164(d) mm
Package dimensions(W x H x D mm)	230(w) x 120(h) x 210(d) mm
Weight	1.2kg 1.5kg (with package)

12.13 ENVIRONMENTAL CONDITIONS

Specified ambient service temp. range	-35...+70°C
Transport and storage temp. range	-40...+70°C
Relative humidity	Up to 97%
Altitude	Up to 2000m above the sea level

13 ORDERING CODES

13.1 AQ 110X CURRENT MEASUREMENT AND ARC SENSING UNIT

AQ - 1 1 0 x - X X X X

Sensor card version
- P Point sensor unit
- F Fiber sensor unit

Auxiliary power supply
- A 80...265 Vac/dc
- B 18...72 Vdc

Trip relay T3 characteristic
- A Normally open (NO) type
- B Normally closed (NC) type

Additional sensor channels
- A None
- B Fiber optic sensor channel (only in AQ 110P)

Binary inputs nominal threshold voltage
- A 24 Vdc
- B 110 Vdc
- C 220 Vdc

13.2 AQ 0X ARC SENSORS

AQ - 0 X x - xxx

Sensor function
- 1 Light point sensor unit
- 2 Pressure & light point sensor unit
- 3 Reserved for future use
- 4 Reserved for future use
- 5 Reserved for future use
- 6 Plastic fiber optic loop sensor
- 7 Glass fiber optic loop sensor
- 8 Glass fiber optic loop sensor (high temperature)
- 9 Reserved for future use

Light intensity threshold (only for AQ01 and AQ02)
- a 8000 Lux
- b 25000 Lux
- c 50000 Lux

Cable length
- x See the min and max lenghts in the instruction manual

14 REFERENCE INFORMATION

Manufacturer information:

Arcteq Relays Ltd. Finland

Visiting and postal address:

Wolffintie 36 F 12

65200 Vaasa, Finland

Contacts:

Phone: +358 10 3221 370

Fax: +358 10 3221 389

url: www.arcteq.fi

email sales: sales@arcteq.fi
Technical support site: https://arcteq./support-landing/
Technical support: +358 10 3221 388 (EET 8:00 – 16:00)