

# INSTRUCTION BOOKLET

AQ SAS™ Standard Arc Schemes

AQ 100 Series

Revision	1.2
Date	August 2011
Changes	<ul style="list-style-type: none"><li>- Add trade mark to SAS.</li><li>- AQ SAS™ scheme 0A is added into this booklet.</li><li>- The dipswitches texts of AQ 110P and AQ101 are updated.</li><li>- All named as incoming feeder 1 are changed to incoming feeder A. All named as incoming feeder 2 are changed to incoming feeder B.</li><li>- The AQ101 dipswitch SW1-2 (Fast/CBFP) is changed to turn ON and set as Fast mode in all schemes. The AQ110P dipswitch SW1-8 (S1: L&gt;/L&gt;+I&gt;) is changed to turn ON and set as only light mode in scheme IA1, IB1, IIA1 and IIB1.</li><li>- In scheme IB1 and IIB1 figures, HSO1 is in parallel with T1 to trip the main breaker CB1. The text (HSO1/T1) is changed to HSO1+T1.</li><li>- In the AQ101 signals description of scheme IB1 and IIB1, BI1 is changed to NOT IN USE.</li><li>- The amount of outgoing feeders of scheme IIB1 is changed to 4 feeders.</li></ul>

This booklet describes only the Standard Arc Schemes (AQ-SAS™) for AQ 100 series arc protection system. It is important to read through instruction manuals of AQ 100 series units before applying the system.

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# 1. STANDARD ARC SCHEMES (AQ SAS™)

AQ SAS™ is a fully tested and documented preconfigured arc protection solution library. The AQ SAS™ approach save engineering time even in the most complex applications and secure effective commissioning of the AQ 100 arc protection system.

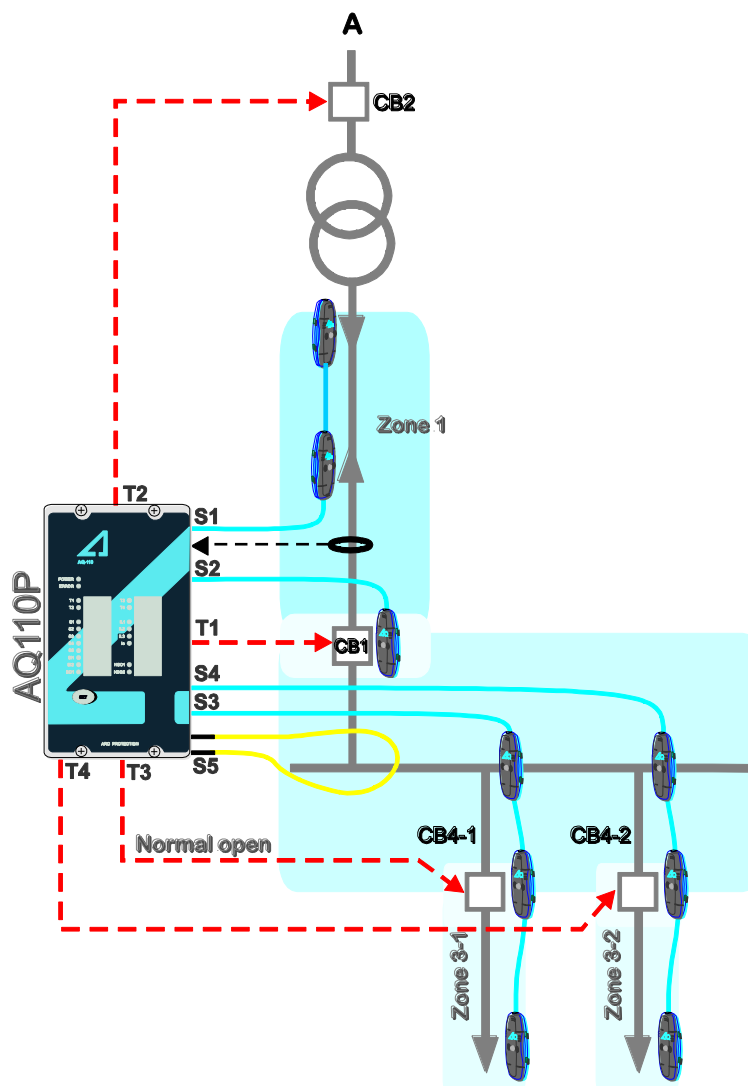
To apply the AQ SAS™ the wiring and dipswitch settings of the applied scheme shall be implemented as described in this chapter. The amount of outgoing feeders does not impact the settings but only the quantity of the units applied. The amount of arc sensors per Zone may vary and does not impact the settings. Therefore the schemes may be extended or reduced by adding or removing units with identical settings and wiring. Different amount or type of arc sensors per Zone may be utilized as well. Also the protected Zones may be reduced by simply not connecting the sensors and/or trip signals of respective protected Zone(s). In all schemes there are a set of user selectable parameters such as current measurement nominal values, enable/disable the CBFP function and choose the trip criteria, i.e. trip on arc light only or simultaneous arc light and overcurrent condition.

The AQ 100 series is applicable for other type of schemes as well. If your particular application is not included in AQ SAS™ library consult your nearest Arcteq representative for a solution.

## 1.1 SCHEME AQ 0A (ONE MAIN)

### 1.1.1 SCHEME CHARACTERISTICS

Number of incoming feeders	1
Number of tie breakers	0
Selective trip of feeder circuit breaker	No
Master trip function	No
Units applied	AQ 110P



Scheme 0a.cdr

Figure 1-1: Scheme 0A single-line diagram

### 1.1.2 I/O DESCRIPTION

AQ 110P :

I/O	Function
IL1,IL2,IL3	Monitoring of phase overcurrent threshold level at incoming feeder 1
Io	Monitoring of residual current threshold level at incoming feeder 1
S1	Monitoring of arc light in incoming feeder 1 cable compartment and bus-duct (Zone 1)
S2, S5	Monitoring of arc light in incoming feeder 1 breaker compartment and incoming feeder busbar compartment. (*)
S3, S4	Monitoring of arc light in outgoing feeder breaker compartments and busbars compartment (Zone 2) (*)
T1	Trip of incoming main circuit breaker CB1 in case of fault in Zones 1 and 2 and in case of FAST trip of CB4-x.
T2	Trip of upstream circuit breaker CB2 in case of fault in Zone 1 and in case of FAST trip of CB1
T3	Trip of outgoing feeder circuit breaker CB4-x in case of fault in Zone 2.
T4	Trip of outgoing feeder circuit breaker CB4-x in case of fault in Zone 2.
SF	System failure dry contact for alarming

\*FAST dipswitch (SW2-4) can be set to ON position in order to activate the FAST function on T2 and T3.

### 1.1.3 TRIP LOGIC, CONNECTION DIAGRAM AND DIPSWITCH SETTINGS

	CB1	CB2	CB4-x
Zone 1	x	x	x
Zone 2	x	x	x
Zone 3	x	x	x
AQ 110	T1	T2	T3,T4

Table 1-1: Scheme 0A trip logic

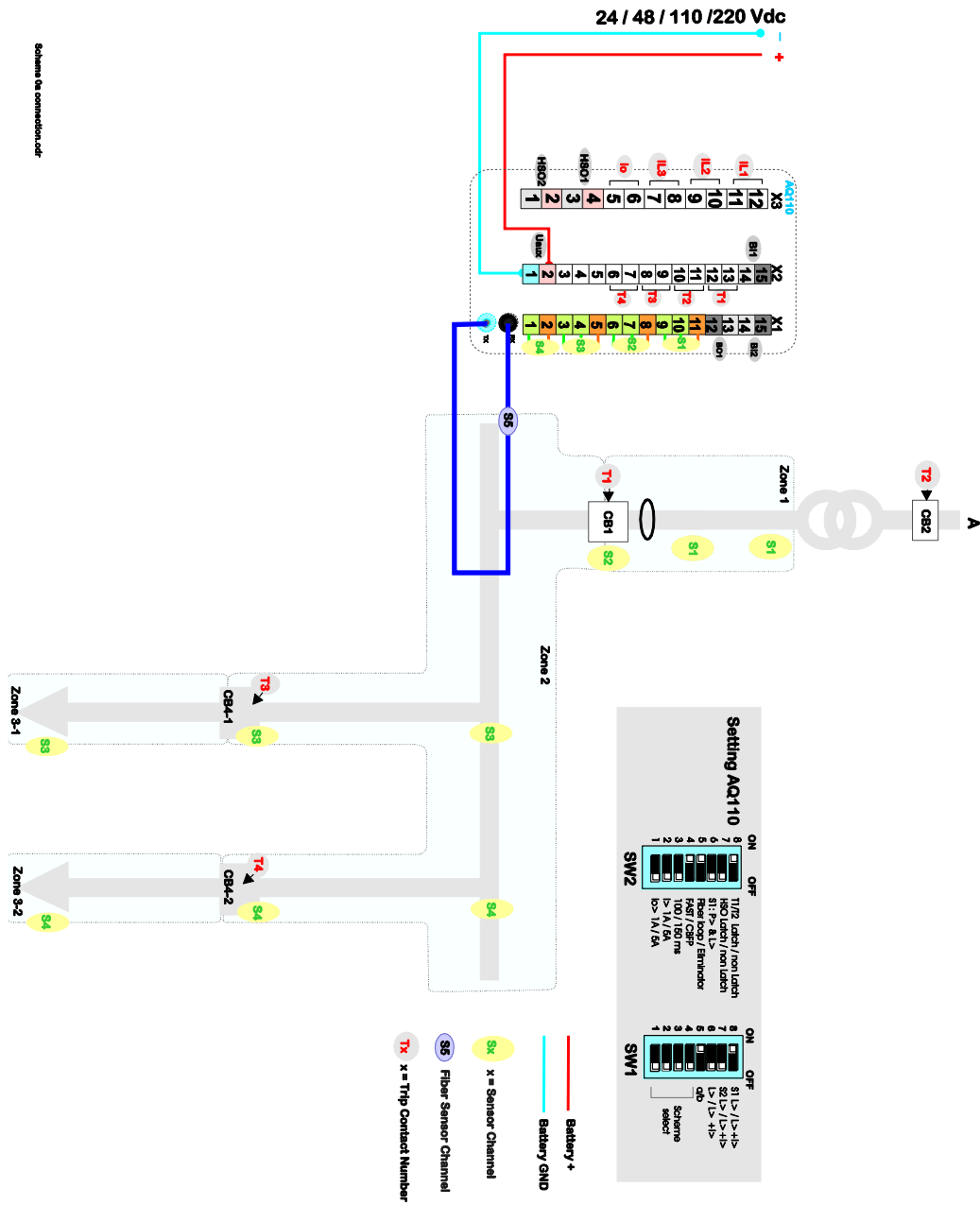
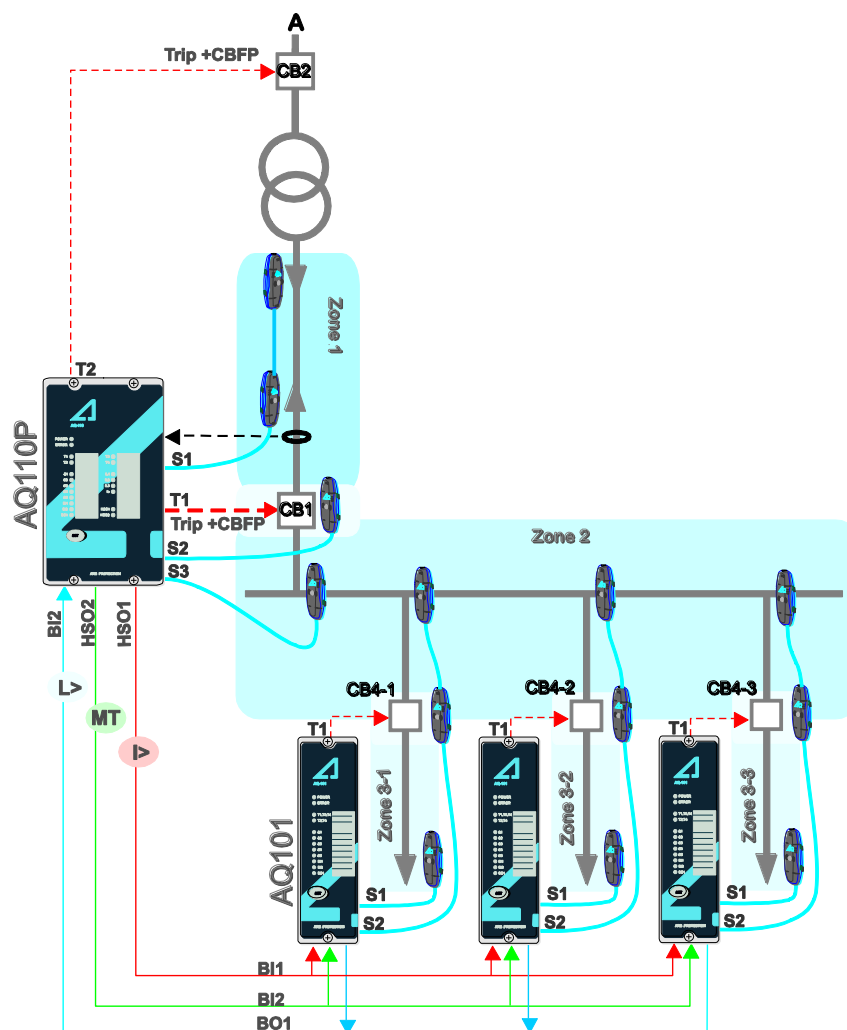


Figure 1-2: Scheme IA1 system connection diagram and dipswitch settings

## 1.2 SCHEME AQ IA1 (ONE MAIN)

### 1.2.1 SCHEME CHARACTERISTICS

Number of incoming feeders	1
Number of tie breakers	0
Selective trip of feeder circuit breaker	Yes
Master trip function	Yes
Units applied	AQ 110P and AQ 101



Scheme Ia1.cdr

Figure 1-3: Scheme IA1 single-line diagram



### 1.2.2 I/O DESCRIPTION

AQ 110P:

I/O	Function
IL1,IL2,IL3	Monitoring of phase overcurrent threshold level at incoming feeder A
Io	Monitoring of residual current threshold level at incoming feeder A
S1	Monitoring of arc light in incoming feeder A cable compartment and bus-duct (Zone 1)
S2, S3	Monitoring of arc light in incoming feeder A breaker compartment and incoming feeder busbar compartment (Zone 2)*
HSO1	Sending overcurrent information to AQ101 units
HSO2	Sending master trip information to AQ101 units
BO1	Not in use
BI1	Not in use
BI2	Receiving light information from AQ 101 units of busbar
T1	Trip of incoming main circuit breaker CB1 in case of fault in Zones 1 and 2 and in case of CBFP(**) of CB4-x.
T2	Trip of upstream circuit breaker CB2 in case of fault in Zone 1 and in case of CBFP(**) of CB1
T3	Not in use
T4	Trip alarm (if in use)
SF	System failure dry contact for alarming

\*Sensor channels S4 and S5 may be utilized if more sensors are required in Zone 2.

\*\*CBFP dipswitch (SW2-4) must be set to ON position in order to activate the CBFP function.

AQ101 (all units):

I/O	Function
S1	Monitoring of arc light in outgoing feeder cable compartment for selective trip (Zone 3)
S2	Monitoring of arc light in outgoing feeder breaker compartment and busbar compartment (Zone 2) (*)
BO1	Sending light information to AQ 110 unit of incoming feeder A
BI1	Receiving overcurrent information from AQ 110 unit of incoming feeder A
BI2	Receiving master trip information from AQ 110 unit of incoming feeder A
T1	Trip of outgoing feeder circuit breaker CB4-x in case of activation of S1 and BI1. Also performing master trip in case of fault in Zone 2.
T2	Not in use
T3	Not in use
T4	Not in use
SF	System failure dry contact for alarming

\*Sensor channels S3, S4 and S5 may be utilized if more sensors are required in Zone 2.

### 1.2.3 TRIP LOGIC, CONNECTION DIAGRAM AND DIPSWITCH SETTINGS

	CB1	CB2	CB4-x
Zone 1	x	x	
Zone 2	x		x(MT)
Zone 3			x
CBFP of CB1		x	
CBFP of CB4-x	x		
AQ 110	T1	T2	
AQ 101-x			T1

Table 1-2: Scheme IA1 trip logic

Scheme IA1 connection cdf.

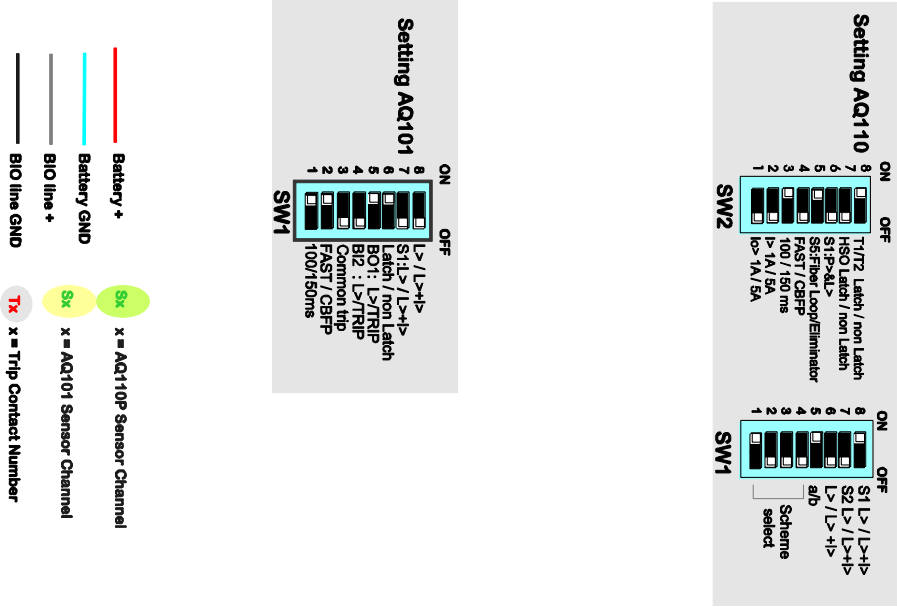
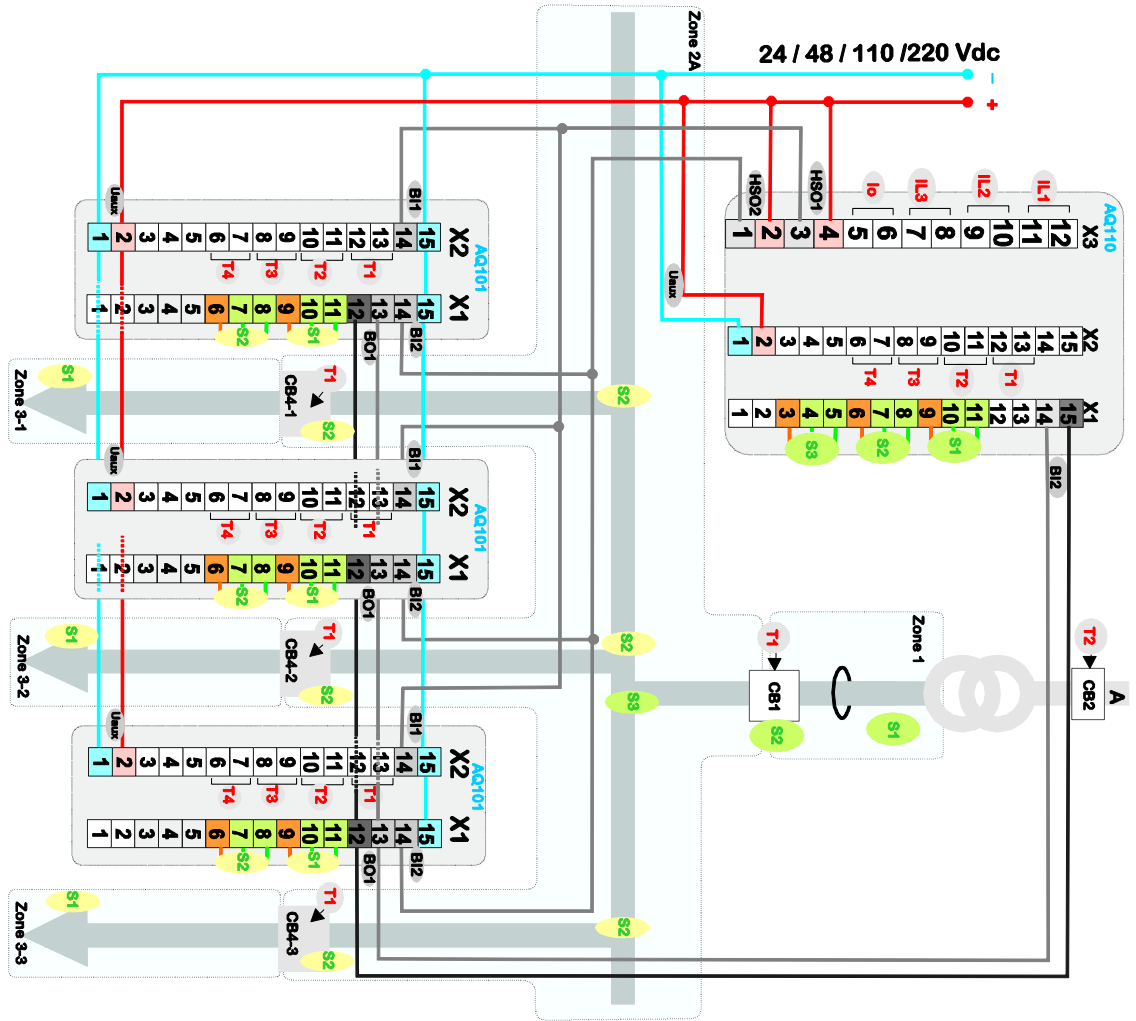
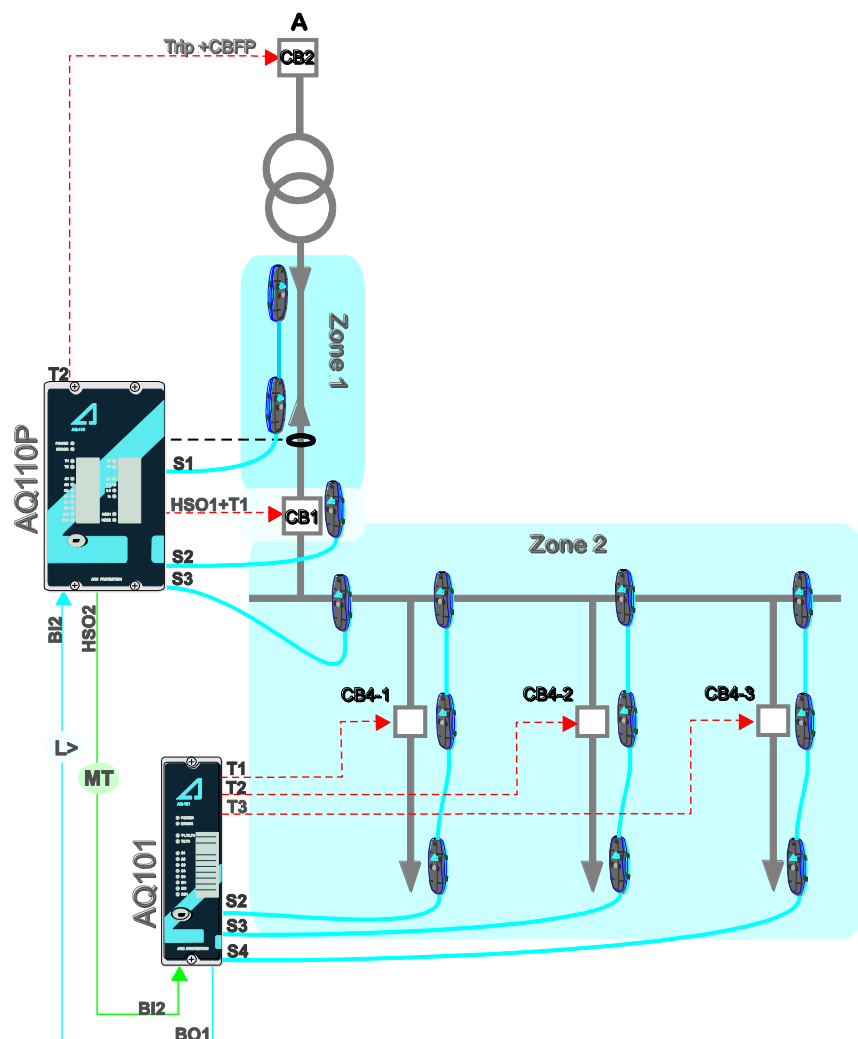


Figure 1-4: Scheme IA1 system connection diagram and dipswitch settings

### 1.3 SCHEME AQ IB1 (ONE MAIN)

#### 1.3.1 SCHEME CHARACTERISTICS

Number of incoming feeders	1
Number of tie breakers	0
Selective tripping of feeder circuit breaker	No
Master trip function	Yes
Units applied	AQ 110P and AQ 101



Scheme Ib1.cdr

Figure 1-5: Scheme IB1 single-line diagram

### 1.3.2 I/O DESCRIPTION

AQ110P :

I/O	Function
IL1,IL2,IL3	Monitoring of phase overcurrent threshold level at incoming feeder A
Io	Monitoring of residual current threshold level at incoming feeder A
S1	Monitoring of arc light in incoming feeder A cable compartment and bus-duct (Zone 1)
S2, S3	Monitoring of arc light in incoming feeder A breaker compartment and incoming feeder busbar compartment (Zone 2)*
HSO1	Trip of incoming main circuit breaker CB1 in parallel with T1
HSO2	Sending master trip information to AQ101 units
BO1	Not in use
BI1	Not in use
BI2	Receiving light information from AQ 101 units of busbar
T1	Trip of incoming main circuit breaker CB1 in case of fault in Zones 1 and 2
T2	Trip of upstream circuit breaker CB2 in case of fault in Zone 1 and in case of CBFP(**) of CB1
T3	Not in use
T4	Trip alarm (if in use)
SF	System failure dry contact for alarming

\*Sensor channels S4 and S5 may be utilized if more sensors are required in Zone 2.

\*\*CBFP dipswitch (SW2-4) must be set to ON position in order to activate the CBFP function.

AQ101:

I/O	Function
S1	Not in use (*)
S2,S3,S4	Monitoring of arc light in outgoing feeder breaker compartments and busbars compartment (Zone 2) (*)
BO1	Sending light information to AQ 110 unit of incoming feeder A
BI1	Not in use
BI2	Receiving master trip information from AQ 110 unit of incoming feeder A
T1	Master trip to CB4-x in case of fault in Zone 2.
T2	Master trip to CB4-x in case of fault in Zone 2
T3	Master trip to CB4-x in case of fault in Zone 2
T4	Not in use (**)
SF	System failure dry contact for alarming

\*Sensor channel S1 may be applied if more sensors are needed in Zone 2. For more information refer to AQ 101 Arc protection unit instruction manual. Sensor channel S5 may be applied as well.

\*\*T4 may be applied in case of more CB's

### 1.3.3 TRIP LOGIC, CONNECTION DIAGRAM AND DIPSWITCH SETTINGS

	CB1	CB2	CB4-x
Zone 1	x	x	
Zone 2	x		x(MT)
CBFP of CB1		x	
AQ 110	T1,HSO1	T2	
AQ 101-x			Tx(*)

\* Tx indicates T1, T2 and T3 of AQ101.

Table 1-3: Scheme IB1 trip logic

Scheme IB1 connection.cdr

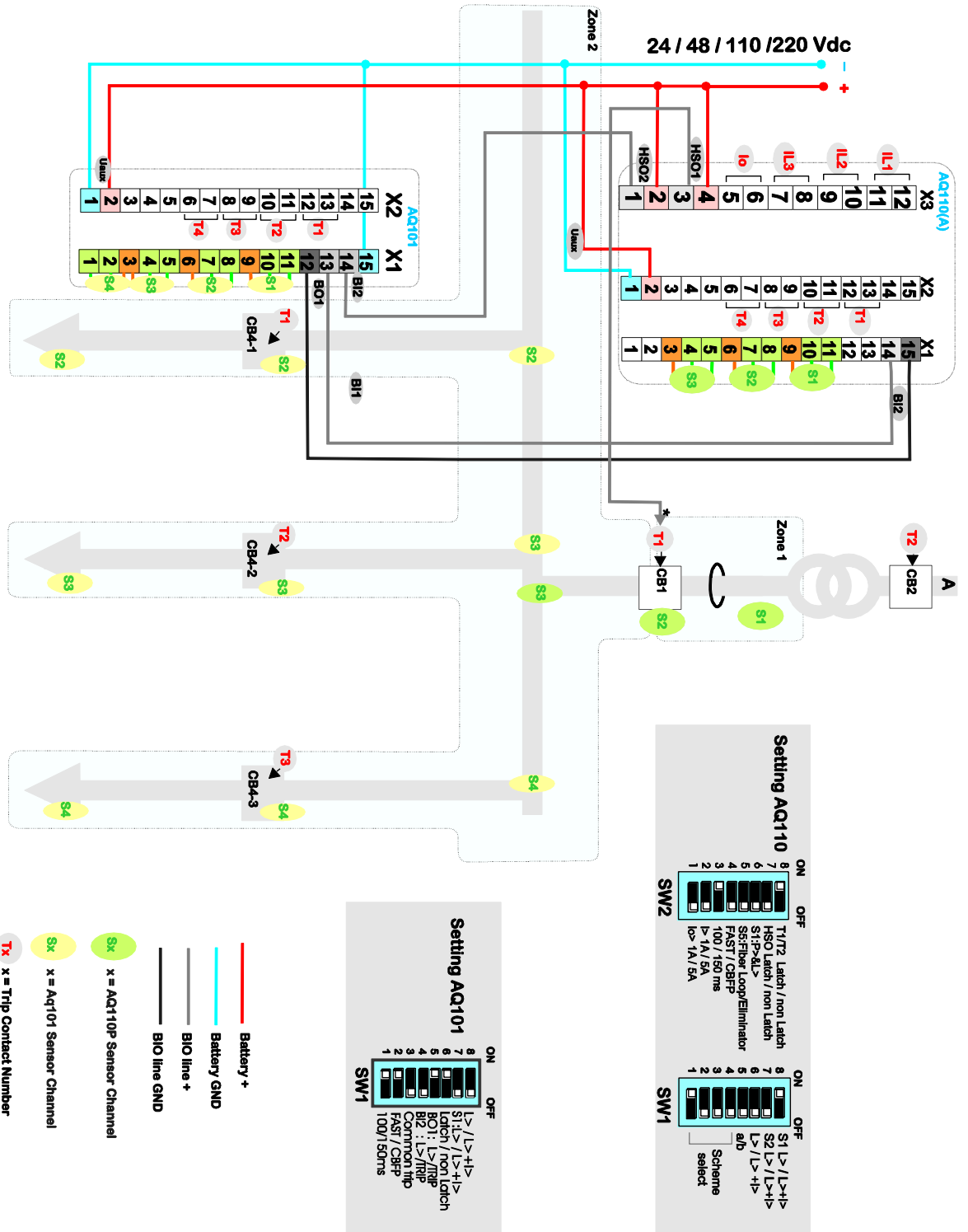
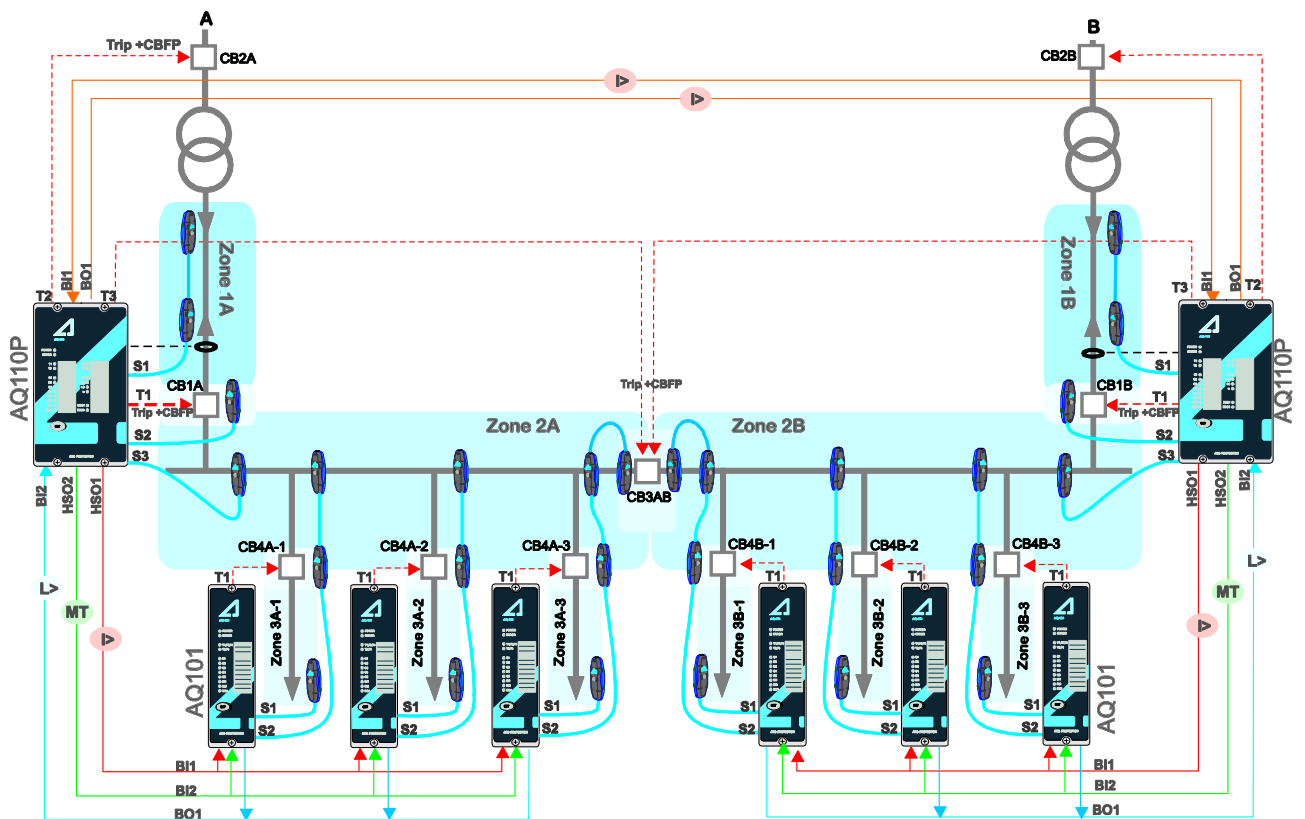


Figure 1-6: Scheme IB1 system connection diagram and dipswitch settings

## 1.4 SCHEME AQ- IIA1 (MAIN-TIE-MAIN)

### 1.4.1 SCHEME CHARACTERISTICS

Number of incoming feeders	2
Number of tie breakers	1
Selective trip of feeder circuit breaker	Yes
Master trip function	Yes
Units applied	AQ 110P and AQ 101



Scheme IIA1.cdr

Figure 1-7: Scheme IIA1 single-line diagram.



### 1.4.2 I/O DESCRIPTION

AQ110P (Busbar A):

I/O	Function
IL1,IL2,IL3	Monitoring of phase overcurrent threshold level at incoming feeder A
Io	Monitoring of residual current threshold level at incoming feeder A
S1	Monitoring of arc light in incoming feeder A cable compartment and bus-duct (Zone 1A)
S2, S3	Monitoring of arc light in incoming feeder A breaker compartment and incoming feeder busbar compartment (Zone 2A)*
HSO1	Sending overcurrent information to AQ101 units at busbar A
HSO2	Sending master trip information to AQ101 units at busbar A
BO1	Sending overcurrent information to AQ 110 unit at incoming feeder 1B
BI1	Receiving overcurrent information from AQ 110 unit at incoming feeder 1B
BI2	Receiving light information from AQ 101 units of busbar A
T1	Trip of incoming main circuit breaker CB1A in case of fault in Zones 1A and 2A and in case of CBFP(**) of CB4A-x or CBFP(**) of circuit breaker CB3AB .
T2	Trip of upstream circuit breaker CB2A in case of fault in Zone 1A and in case of CBFP(**) of CB1A
T3	Trip of tie breaker CB3AB in case of fault in Zone 2A and CBFB(**) of CB4A-x
T4	Trip alarm (if in use)
SF	System failure dry contact for alarming

\*Sensor channels S4 and S5 may be utilized if more sensors are required in Zone 2A.

\*\*CBFP dipswitch must be set to ON position in order to activate the CBFP function.

## AQ110P (Busbar B):

I/O	Function
IL1,IL2,IL3	Monitoring of phase overcurrent threshold level at incoming feeder B
Io	Monitoring of residual current threshold level at incoming feeder B
S1	Monitoring of arc light in incoming feeder B cable compartment and bus-duct (Zone 1B)
S2, S3	Monitoring of arc light in incoming feeder B breaker compartment and incoming feeder busbar compartment (Zone 2B) (*)
HSO1	Sending overcurrent information to AQ101 units at busbar B
HSO2	Sending master trip information to AQ101 units at busbar B
BO1	Sending overcurrent information to AQ 110 unit at incoming feeder A
B11	Receiving overcurrent information from AQ 110 unit at incoming feeder A
B12	Receiving light information from AQ 101 units of busbar B
T1	Trip of incoming main circuit breaker CB1B in case of fault in Zones 1B and 2B and in case of CBFP(**) CB4B-x or CBFP(**) of circuit breaker CB3AB .
T2	Trip of upstream circuit breaker CB2B in case of fault in Zone 1B and in case of CBFP(**) of CB1B
T3	Trip of tie breaker CB3AB in case of fault in Zone 2B and CBFB(**) of CB4B-x
T4	Trip alarm (if in use)
SF	System failure dry contact for alarming

\*Sensor channels S4 and S5 may be utilized if more sensors are required in Zone 2B.

\*\*CBFP dipswitch must be set to ON position in order to activate the CBFP function.

AQ101 (all units at busbar A):

I/O	Function
S1	Monitoring of arc light in outgoing feeder cable compartment for selective trip (Zone 3A)
S2	Monitoring of arc light in outgoing feeder breaker compartment and busbar compartment (Zone 2A) (*)
BO1	Sending light information to AQ 110 unit of incoming feeder A
BI1	Receiving overcurrent information from AQ 110 unit of incoming feeder A
BI2	Receiving master trip information from AQ 110 unit of incoming feeder A
T1	Trip of outgoing feeder circuit breaker CB4A-x in case of activation of S1 and BI1. Also performing master trip in case of fault in Zone 2A.
T2	Not in use
T3	Not in use
T4	Not in use
SF	System failure dry contact for alarming

\*Sensor channels S3, S4 and S5 may be utilized if more sensors are required in Zone 2A.

AQ101 (all units at busbar B):

I/O	Function
S1	Monitoring of arc light in outgoing feeder cable compartment for selective tripping (Zone 3B)
S2	Monitoring of arc light in outgoing feeder breaker compartment and busbar compartment (Zone 2B)(*)
BO1	Sending light information to AQ 110 unit of incoming feeder B
BI1	Receiving overcurrent information from AQ 110 unit of incoming feeder B
BI2	Receiving master trip information from AQ 110 unit of incoming feeder B
T1	Trip of outgoing feeder circuit breaker CB4B-x in case of activation of S1 and BI. Also performing master trip in case of fault in Zone 2B.
T2	Not in use
T3	Not in use
T4	Not in use
SF	System failure dry contact for alarming

\*Sensor channels S3, S4 and S5 may be utilized if more sensors are required in Zone 2B.

### 1.4.3 TRIP LOGIC, CONNECTION DIAGRAM AND DIPSWITCH SETTINGS

	CB1A	CB2A	CB4A-x	CB3AB	CB1B	CB2B	CB4B-x
Zone 1A	x	x					
Zone 2A	x		x (MT)	x			
Zone 3A			x				
Zone 1B					x	x	
Zone 2B				x	x		x (MT)
Zone 3B							x
CBFP of CB1A		x					
CBFP of CB4A-x	x			x			
CBFP of CB3AB	x				x		
CBFP of CB1B						x	
CBFP of CB4B-x				x	x		
AQ 110A	T1	T2		T3			
AQ 101A-x			T1				
AQ 110B				T3	T1	T2	
AQ 101B-x							T1

Table 1-4: Scheme IIA1 trip logic

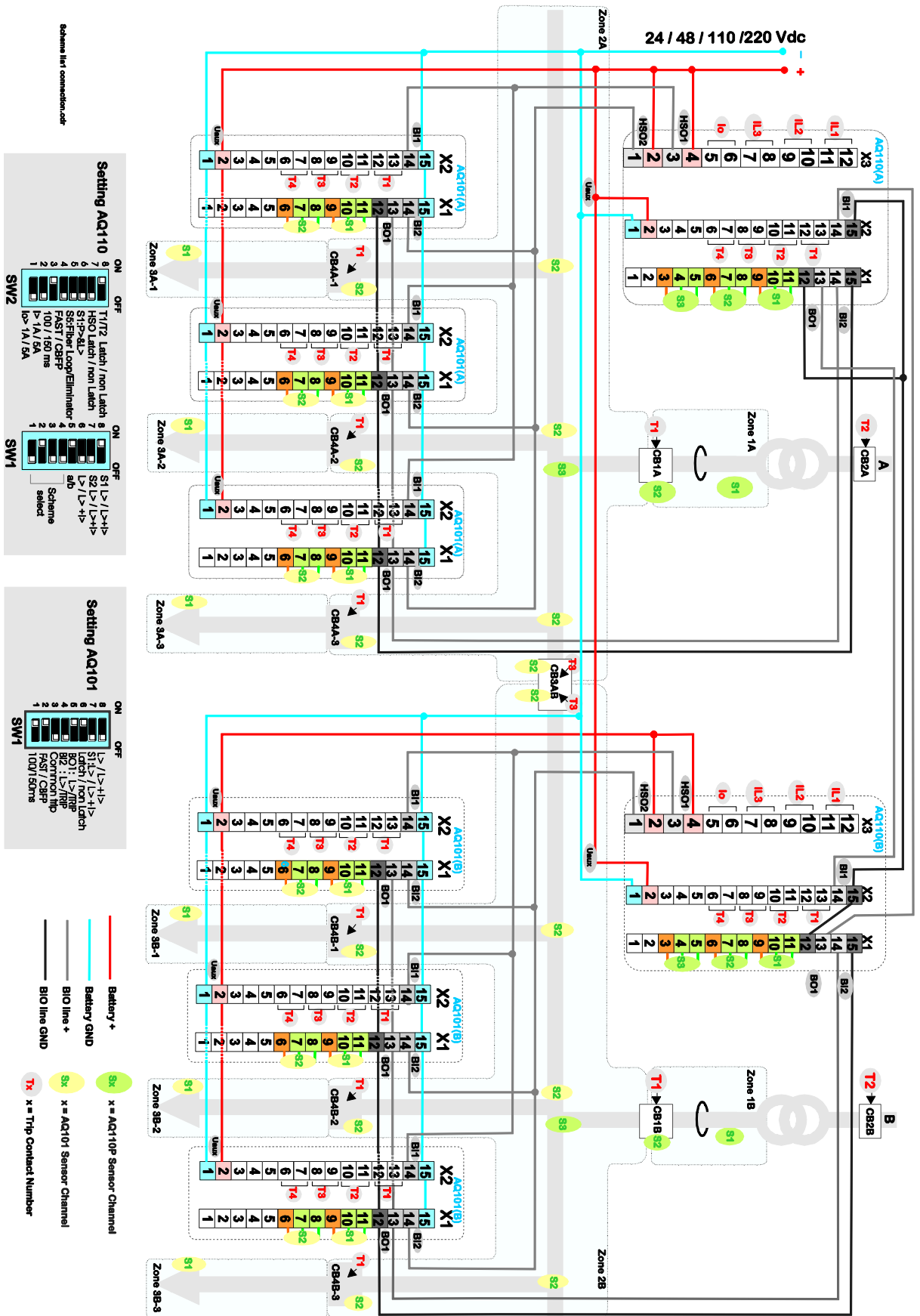
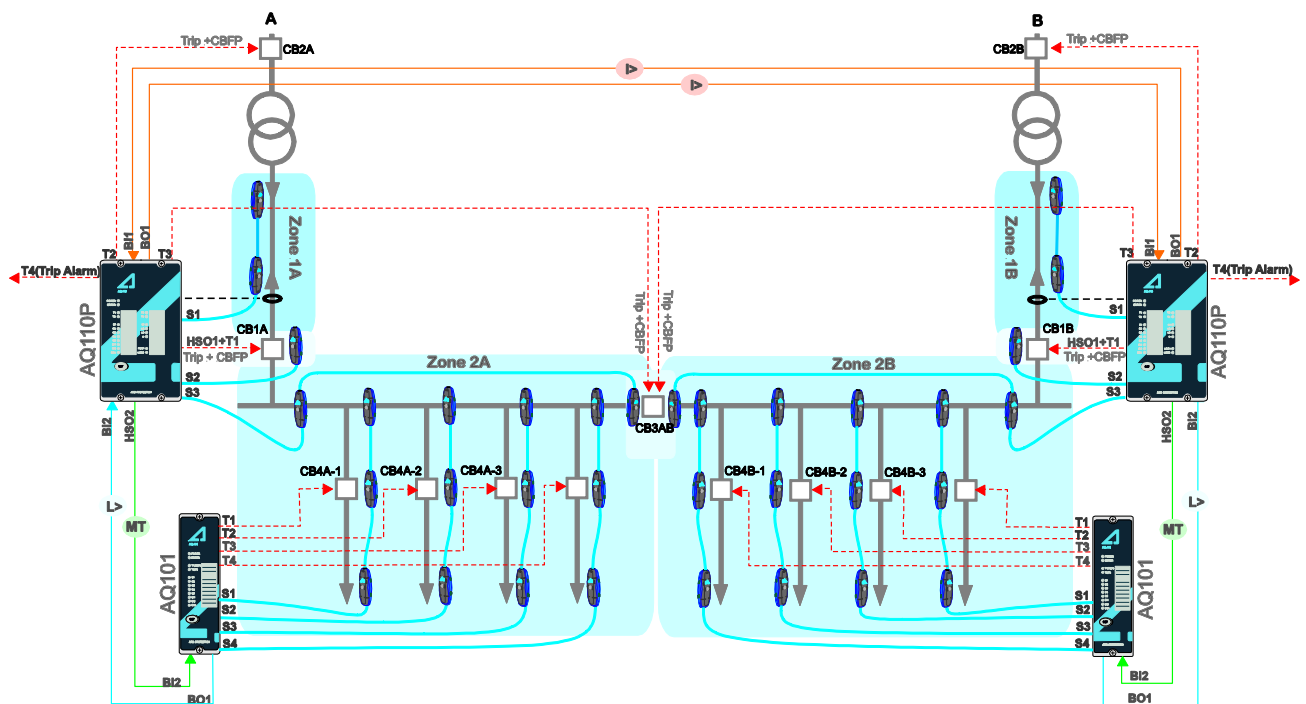


Figure 1-8: Scheme IIA1 system connection diagram and dipswitch settings.

## 1.5 SCHEME AQ-IIB1 (MAIN-TIE-MAIN)

### 1.5.1 SCHEME CHARACTERISTICS

Number of incoming feeders	2
Number of tie breakers	1
Selective trip of feeder circuit breaker	No
Master trip function	Yes
Units applied	AQ 110P and AQ 101



Scheme IIB1.cdr

Figure 1-9: Scheme IIB1 single line diagram.

### 1.5.2 I/O DESCRIPTION

AQ110P (Busbar A):

I/O	Function
IL1,IL2,IL3	Monitoring of phase overcurrent threshold level at incoming feeder A
Io	Monitoring of residual current threshold level at incoming feeder A
S1	Monitoring of arc light in incoming feeder A cable compartment and bus-duct (Zone 1A)
S2, S3	Monitoring of arc light in incoming feeder A breaker compartment and incoming feeder busbar compartment (Zone 2A)*
HSO1	Trip of incoming main circuit breaker CB1A in parallel with T1.
HSO2	Sending master trip information to AQ101 unit at busbar A
BO1	Sending overcurrent information to AQ 110 unit at incoming feeder B
BI1	Receiving overcurrent information from AQ 110 unit at incoming feeder B
BI2	Receiving light information from AQ 101 unit of busbar A
T1	Trip of incoming main circuit breaker CB1A in case of fault in Zones 1A and 2A and in case of CBFP (** ) of circuit breaker CB3AB.
T2	Trip of upstream circuit breaker CB2A in case of fault in Zone 1A and in case of CBFP(**) of CB1A
T3	Trip of tie breaker CB3AB in case of fault in Zone 2A
T4	Trip alarm (if in use)
SF	System failure dry contact for alarming

\*Sensor channels S4 and S5 may be utilized if more sensors are required in Zone 2A.

\*\*CBFP dipswitch (SW2-4) must be set to ON position in order to activate the CBFP function.

## AQ110P (Busbar B):

I/O	Function
IL1,IL2,IL3	Monitoring of phase overcurrent threshold level at incoming feeder B
Io	Monitoring of residual current threshold level at incoming feeder B
S1	Monitoring of arc light in incoming feeder B cable compartment and bus-duct (Zone 1B)
S2, S3	Monitoring of arc light in incoming feeder B breaker compartment and incoming feeder busbar compartment (Zone 2B) (*)
HSO1	Trip of incoming main circuit breaker CB1B in parallel with T1.
HSO2	Sending master trip information to AQ101 units at busbar B
BO1	Sending overcurrent information to AQ 110 unit at incoming feeder A
BI1	Receiving overcurrent information from AQ 110 unit at incoming feeder A
BI2	Receiving light information from AQ 101 units of busbar B
T1	Trip of incoming main circuit breaker CB1B in case of fault in Zones 1B and 2B and in case of CBFP(**) of circuit breaker CB3AB .
T2	Trip of upstream circuit breaker CB2B in case of fault in Zone 1B and in case of CBFP(**) of CB1B
T3	Trip of tie breaker CB3AB in case of fault in Zone 2B
T4	Trip alarm (if in use)
SF	System failure dry contact for alarming

\*Sensor channels S4 and S5 may be utilized if more sensors are required in Zone 2B.

\*\*CBFP dipswitch (SW2-4) must be set to ON position in order to activate the CBFP function.



## AQ101 (Busbar A):

I/O	Function
S1	Not in use (*)
S2,S3,S4	Monitoring of arc light in outgoing feeder breaker compartments and busbar compartments (Zone 2A)
BO1	Sending light information to AQ 110 unit of incoming feeder A
BI1	Not in use
BI2	Receiving master trip information from AQ 110 unit of incoming feeder A
T1	Master trip to CB4A-x in case of fault in Zone 2A
T2	Master trip of CB4A-x in case of fault in Zone 2A
T3	Master trip of CB4A-x in case of fault in Zone 2A
T4	Master trip of CB4A-x in case of fault in Zone 2A
SF	System failure dry contact for alarming

\*Sensor channel S1 may be applied if more sensors are needed in Zone 2A. For more information refer to AQ 101 Arc protection unit instruction manual. Sensor channel S5 may be applied as well.

AQ101 (Busbar B):

I/O	Function
S1	Not in use (*)
S2,S3,S4	Monitoring of arc light in outgoing feeder breaker compartments and busbar compartments (Zone 2B)
BO1	Sending light information to AQ 110 unit of incoming feeder B
BI1	Not in use
BI2	Receiving master trip information from AQ 110 unit of incoming feeder B
T1	Master trip of CB4B-x in case of fault in Zone 2B
T2	Master trip of CB4B-x in case of fault in Zone 2B
T3	Master trip of CB4B-x in case of fault in Zone 2B
T4	Master trip of CB4B-x in case of fault in Zone 2B
SF	System failure dry contact for alarming

\*Sensor channel S1 may be applied if more sensors are needed in Zone 2A. For more information refer to AQ 101 Arc protection unit instruction manual. Sensor channel S5 may be applied as well.

### 1.5.3 TRIP LOGIC, CONNECTION DIAGRAM AND DIPSWITCH SETTINGS

	CB1A	CB2A	CB4A-x	CB3AB	CB1B	CB2B	CB4B-x
Zone 1A	x	x					
Zone 2A	x		x (MT)	x			
Zone 1B					x	x	
Zone 2B				x	x		x (MT)
CBFP of CB1A		x					
CBFP of CB3AB	x				x		
CBFP of CB1B						x	
AQ 110A	T1,HSO1	T2		T3			
AQ 101A-x			T1,T2,T3				
AQ 110B				T3	T1,HSO1	T2	
AQ 101B-x							T1,T2,T3

Table 1-5: Scheme IIB1 trip logic

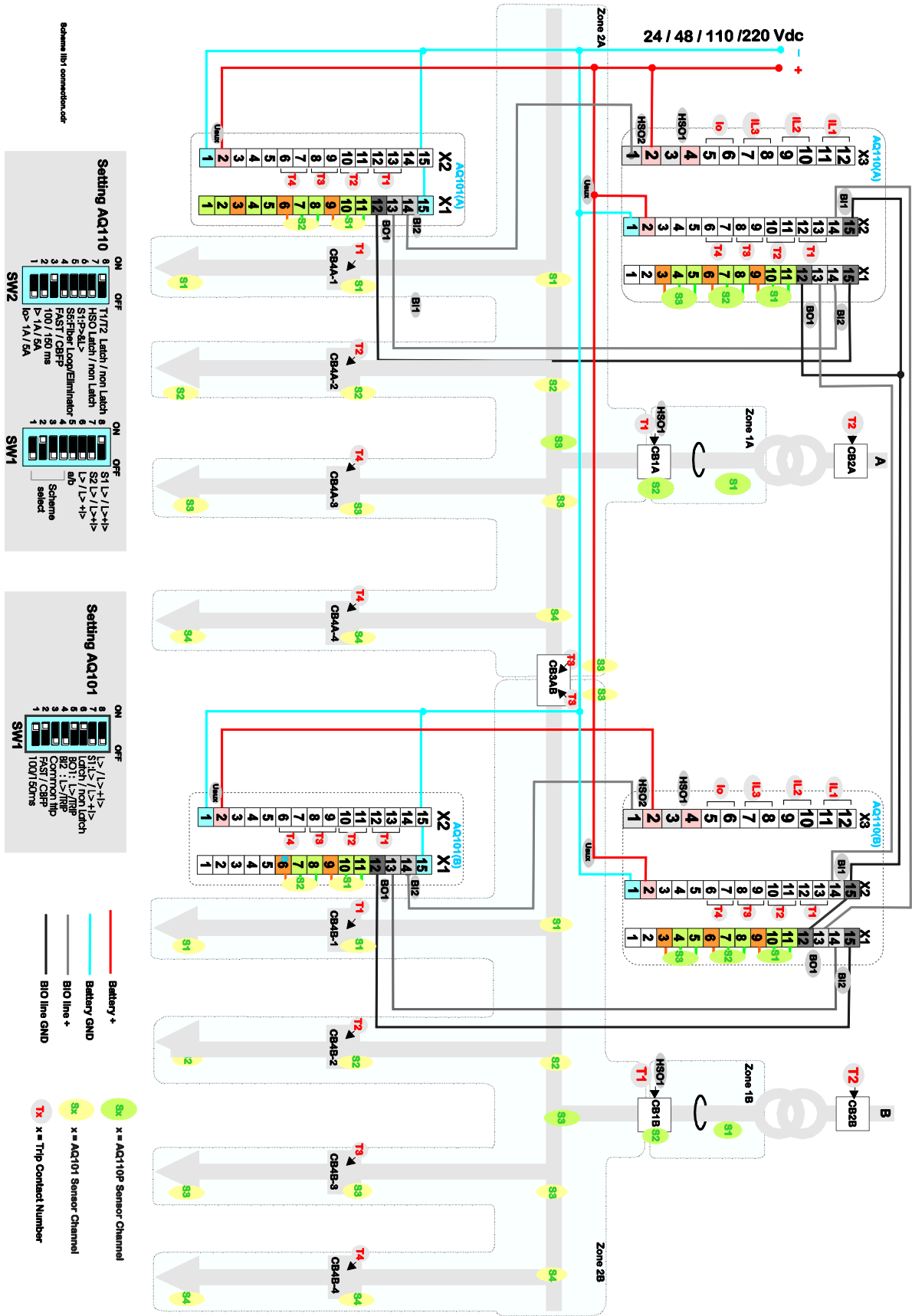


Figure 1-10: Scheme IIB1 system connection diagram and dipswitch settings.

## 2. REFERENCE INFORMATION

**Manufacturer information:**

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