



## M-T-T-M Universal

This document is intended to describe the components, required inputs and outputs, sequence of operations and the basic logic to implement ABB's transfer scheme for M-T-T-M applications.

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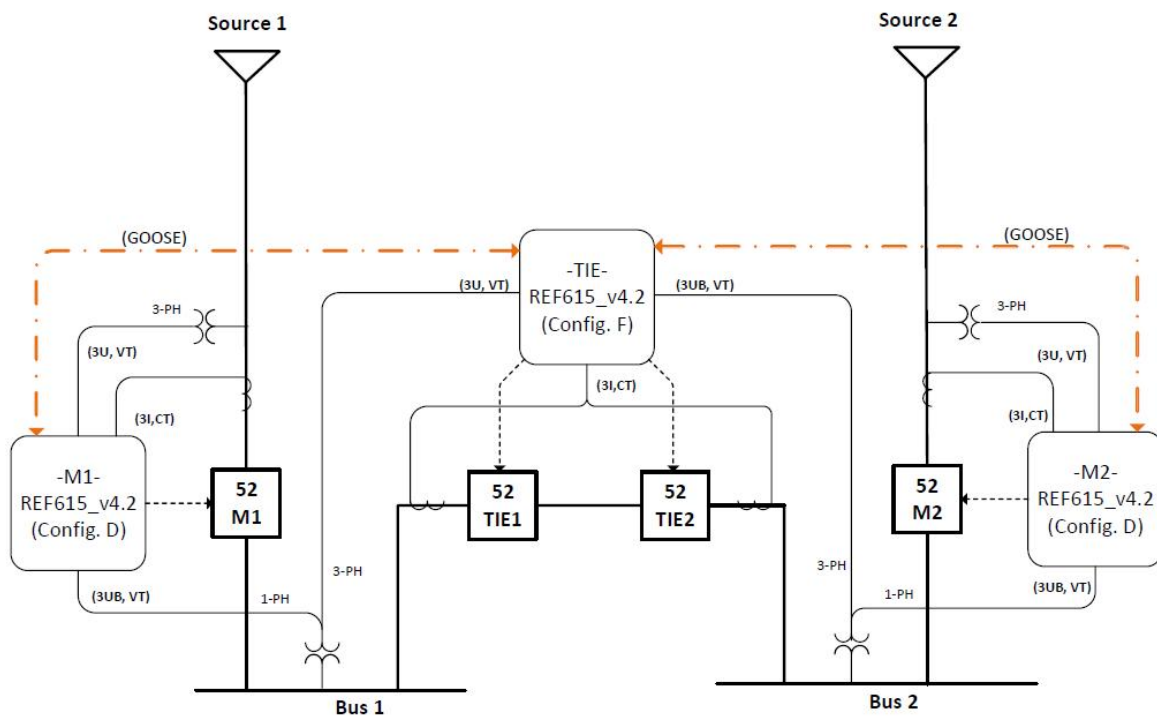
## Single Line Diagrams

The following is a one line diagram of the connections required to the relays for the implementation of the transfer scheme

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#### SINGLE LINE DIAGRAM



**Schemes:** M-T-T-M Universal

**Relays:** Main 1 Relay Order Code: HAFDDADAFHE5BBN12E  
Main 2 Relay Order Code: HAFDDADAFHE5BBN12E  
Tie Relay Order Code: HAFFFAFHE5BBN12E

#### Required Inputs

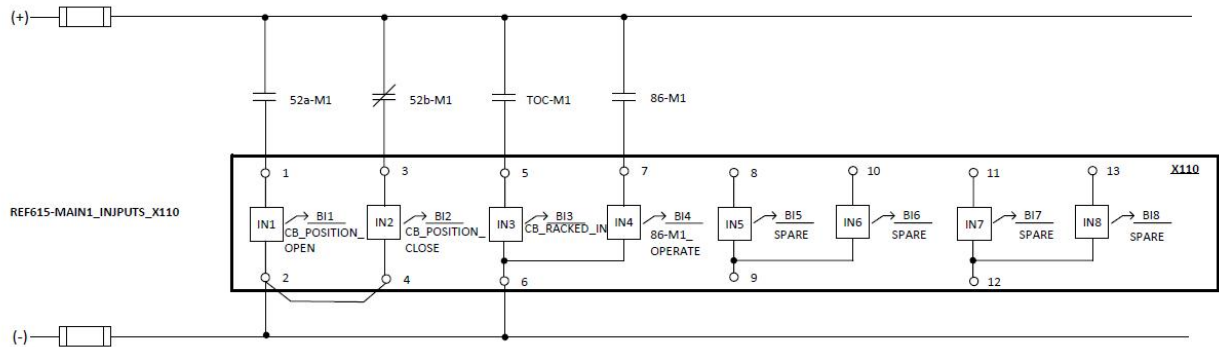
The following inputs to the each relays being used for the transfer scheme are required for the proper operation of this automatic transfer scheme.

Main 1 Relay

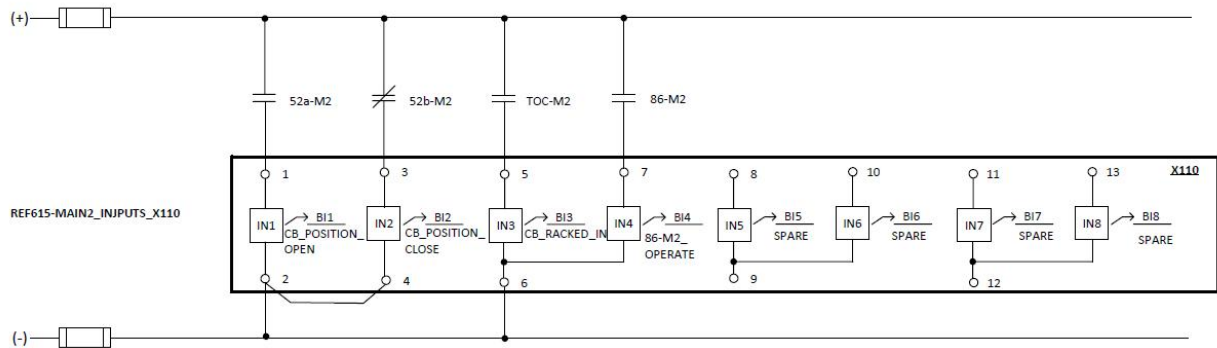
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### DC RELAY SCHEMATIC – MAIN1 (INPUTS)



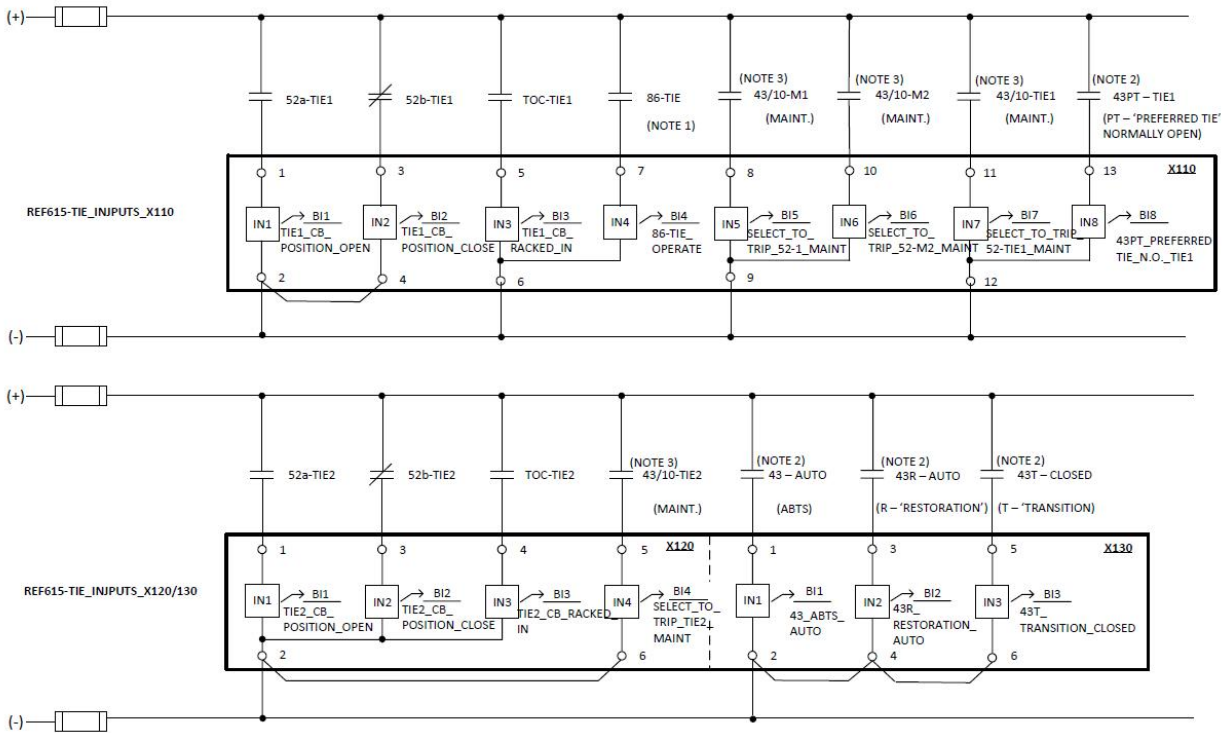
## Main 2 Relay



## Tie Relay

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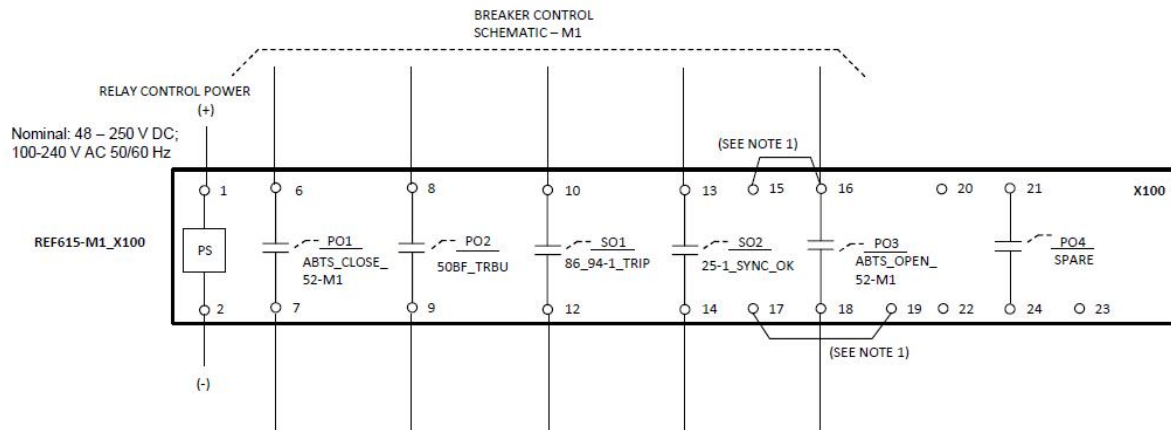


## Required Outputs

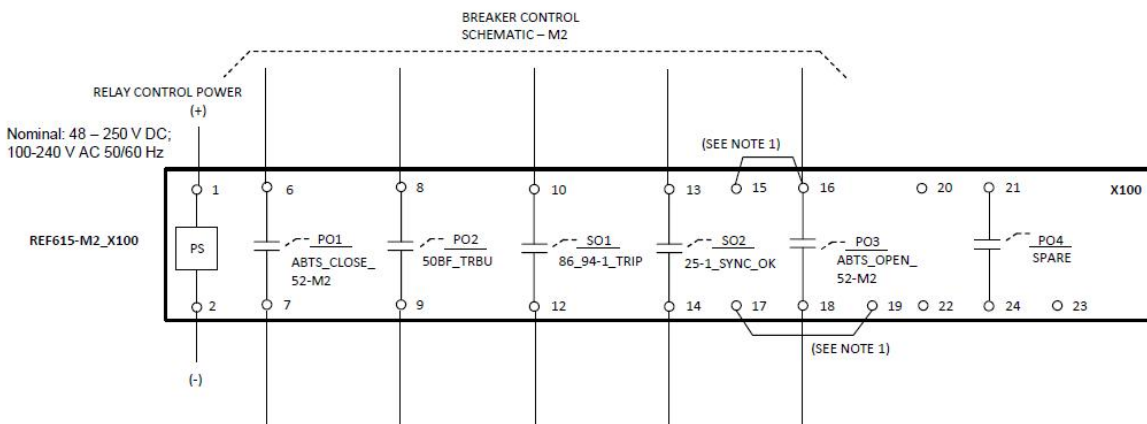
The following outputs from each of the relays being used for the transfer scheme are required for the proper operation of this automatic transfer scheme.

### Main Breaker 1

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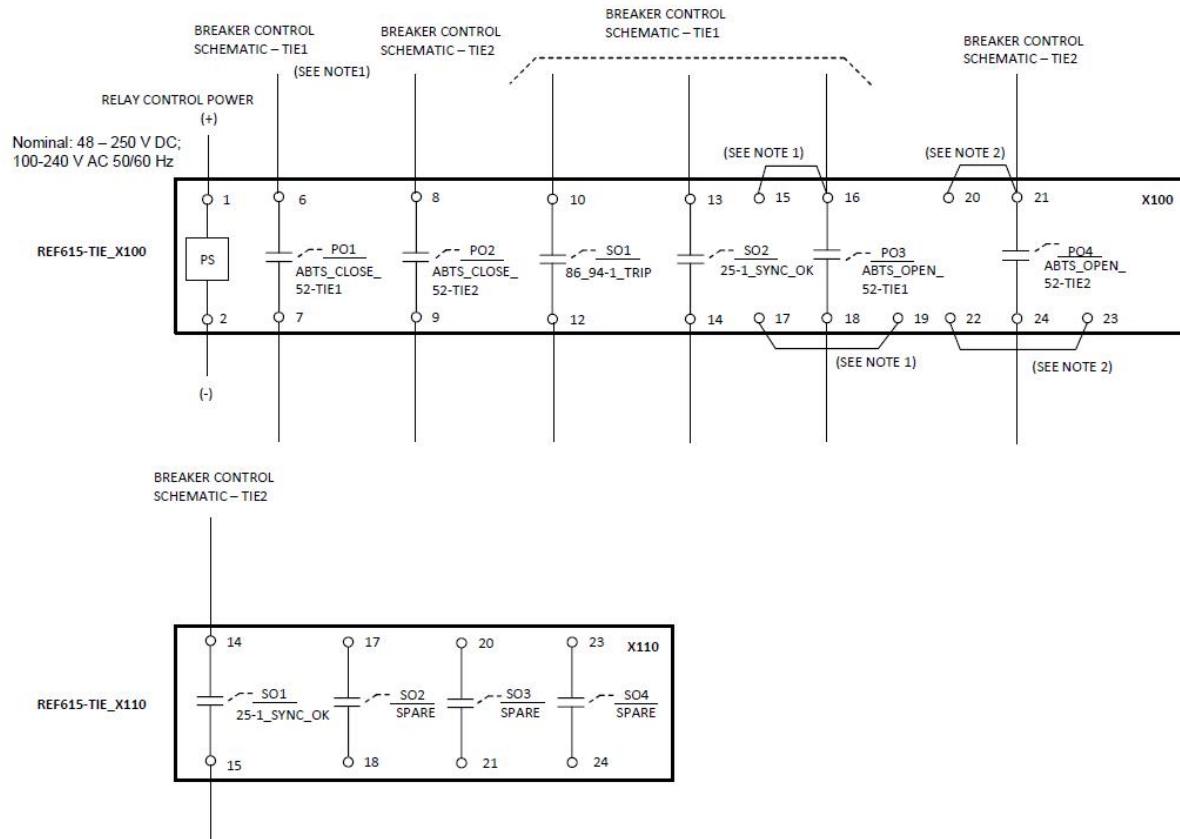


## Main Breaker 2



## Tie Breakers

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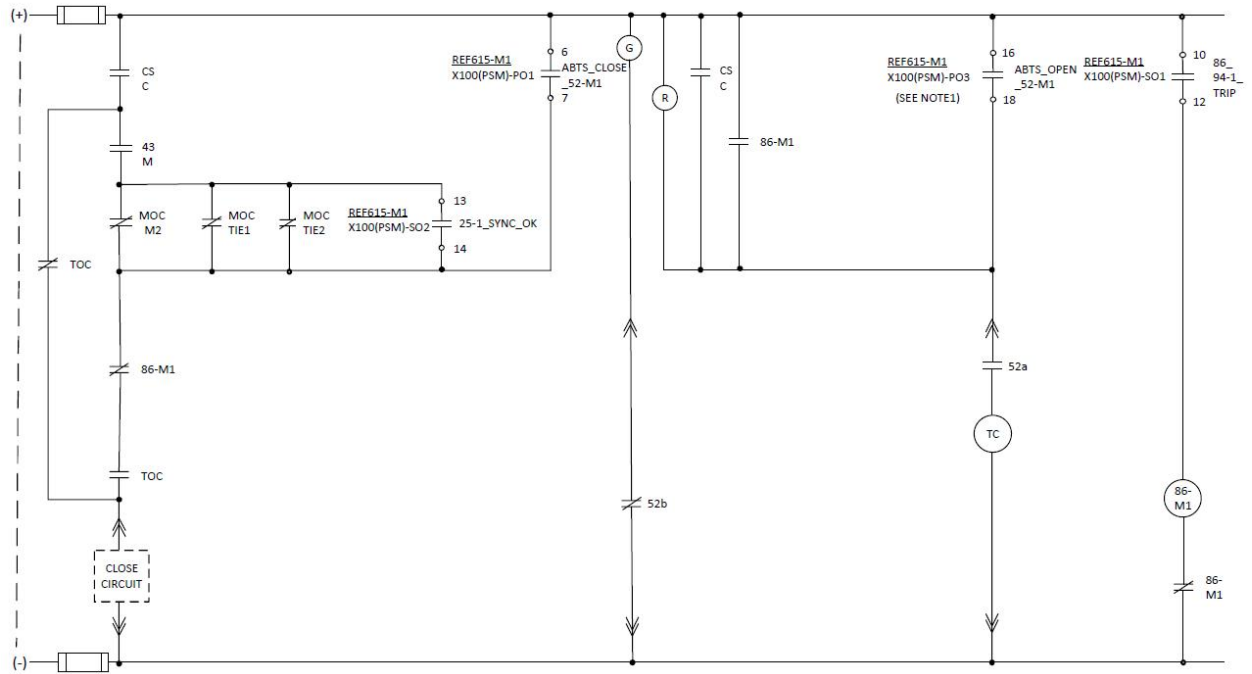
## Breaker Schematics

The following breaker schematics represent all the connections and electrical interlocks required for the proper operation of the Automatic Transfer Scheme

### Main Breaker 1

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## Main Breaker 2

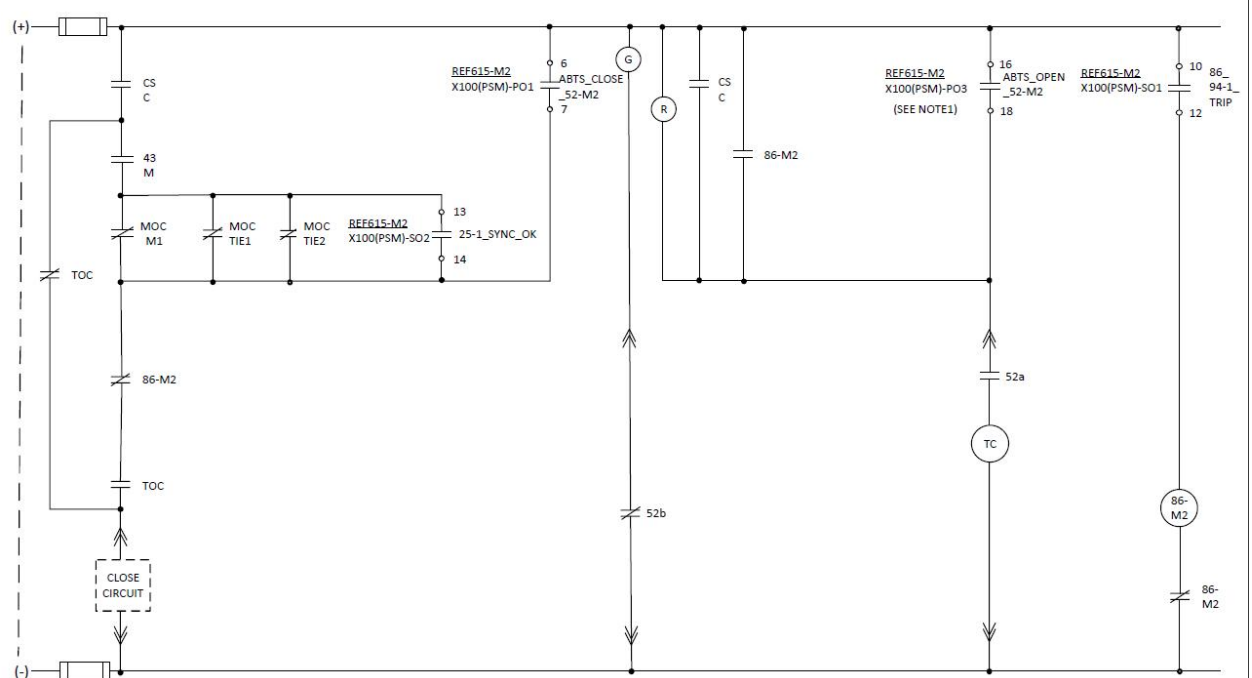


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**The sequence of operations for the ATS scheme would be as follows**

### **Selector Switches**

#### *43 M/A Manual/Auto Switch*

Describes manual or automatic operation for the transfer scheme

#### *43R M/A Manual/Auto Restoration Switch*

Only when 43 M/A switch is in "Auto", describes if restoration to normal condition would be done manually or automatically

#### *43T C/O Closed or Open Transition Switch*

Only when 43 M/A switch is in "Auto" and 43-R M/A is in "Auto", describes if restoration to normal condition would be through an open or closed transition

#### *43-10 M1/T1/T2/M2 Maintenance Switch*

Only when 43 M/A switch is in "Manual", used to indicate what breaker should be open when all breakers are closed at the same time to perform maintenance operations or to return system to normal when 43R M/A switch is in "Manual"

#### *43-PT T1/T2 Preferred Tie Switch*

Only when 43 M/A switch is in "Auto", used to indicate what tie breaker should be normally open when system is in "Auto" and both incoming lines are available

### **Normal Mode of Operation**

The normal mode of operation would be with device 43 M/A switch in "Auto" mode, both incoming lines will be normally closed, and preferred tie breaker will be open as indicated by 43-PT switch. The alternate (non-preferred) tie breaker shall always be closed when 43 M/A switch is in "Auto" in order for the Automatic Transfer Scheme to work properly.

### **Electrical interlocks**

Under manual operation there is an electrical interlock between all incoming sources to prevent paralleling unless sources are synchronized.

Incoming lines will only be paralleled momentarily as permitted by device 43/10. Please refer to maintenance operations.

Under automatic operation it would only be possible to parallel de resources momentarily if device 43T is in " Closed" and the lines are synchronized.

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## **Manual/Maintenance Operation**

It would be possible to perform maintenance to any of the incoming lines. Dev 43 shall be in “Manual”. Device 43/10 will indicate what breaker will be automatically open if both Main breakers and Tie breakers are closed at the same time under manual operation.

### *Maintenance of Main 1*

Device 43/10 shall be placed on “Main 1” and device 43 shall be placed in “Manual”.

To perform maintenance on Main 1, close both tie breakers subject to electrical interlock above described. Once the tie breakers close, the Main 1 will be open automatically.

### *Maintenance of Main 2*

Device 43/10 shall be placed on “Main 2” and device 43 shall be placed in “Manual”.

To perform maintenance on Main 2, close both tie breaker subject to electrical interlock above described. Once the tie breakers close, the Main 2 will be open automatically.

### *Return to Normal*

To return the system to normal conditions with both Main breakers closed and the preferred tie breaker open. With device 43 in “Manual” mode, place device 43/10 on the preferred tie breaker either “T1” or “T2”, and then closed the opened incoming line subject to electrical above. As soon as the opened incoming line is closed and all four breakers are closed at the same time, the preferred tie breaker will be open automatically.

## **Automatic Mode**

**In order for any of the Automatic mode described in this section to work properly, please make sure that the preferred tie breaker is open as indicated by selector switch 43PT, and the non-preferred tie breaker is always closed.**

**Selector switch device 43 in “Auto”, device 43R in “Auto”, and device 43T in “Closed”**

(a)

Loss of voltage (UV or NEG SEQ) on either incoming line will after a time delay cause its main breaker to open and then the preferred tie breaker will close, provided that voltage is present on the other incoming line.

When the voltage is restored, the main breaker would after a time delay automatically close and then the tie preferred breaker will open.

(b)

However, if the voltage is subsequently lost on the second line after the transfer has occurred as described in (a) above, the second line will after a time delay open and then the preferred tie would open.

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Return of voltage on either line will after a time delay cause its main breaker to close, and then the preferred tie would close. When voltage returns to the other line, the main breaker will after a time delay close, and then the preferred tie breaker will open, restoring the system to normal.

(c)

Simultaneous loss (or restoration) of both sources will after a time delay cause both main breakers to open (or close), leaving the preferred tie breaker open.

**Selector switch device 43 in " Auto" , device 43R in " Auto" , and device 43T in " Open"**

(a)

Loss of voltage (UV or NEG SEQ) on either incoming line will after a time delay cause its main breaker to open and then the preferred tie breaker will close, provided that voltage is present on the other incoming line.

When the voltage is restored, the preferred tie breaker will open after a time delay automatically and then the opened incoming line would close.

(b)

However, if the voltage is subsequently lost on the second line after the transfer has occurred as described in (a) above, the second line will after a time delay open and then the preferred tie would open.

Return of voltage on either line will after a time delay cause its main breaker to close, and then the preferred tie would close. When voltage returns to the other line, the preferred tie breaker will after a time delay open, and then the other line breaker will close, restoring the system to normal.

(c)

Simultaneous loss (or restoration) of both sources will after a time delay cause both main breakers to open (or close), leaving the preferred tie breaker open.

**Selector switch device 43 in " Auto" , and device 43R in " Manual"**

(a)

Loss of voltage on either incoming line will, after a time delay, causes its main breaker to open and then the preferred tie breaker will close provided that voltage is present on the other incoming line.

When the voltage is restored, the system will be restored to normal operation manually. Refer to manual/maintenance operation.

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However, if while waiting for manual restoration, the incoming line powering the load loses power, the failed incoming line will open and then the healthy incoming line will close provided that it has been healthy for the specified time

(b)

However, if the voltage is subsequently lost on the second line after the transfer has occurred as described in (a) above, the second line will stay close leaving the preferred tie breaker close.

Return of voltage to the open incoming line first will cause, the closed incoming line to open and then the open incoming line will close.

Return of voltage to the closed incoming line first will not cause any operation leaving the closed incoming line close and the open incoming line open.

Simultaneous restoration of both sources will not cause any operation leaving the closed incoming line close and the open incoming line open.

(c)

Simultaneous loss of both sources will not cause any operation, leaving both incoming lines closed and preferred tie breaker open.

(d)

Simultaneous restoration of both sources, after both sources were lost at the same time will not cause any operation, leaving both incoming lines close and preferred tie breaker open.

### **ATS Logic**

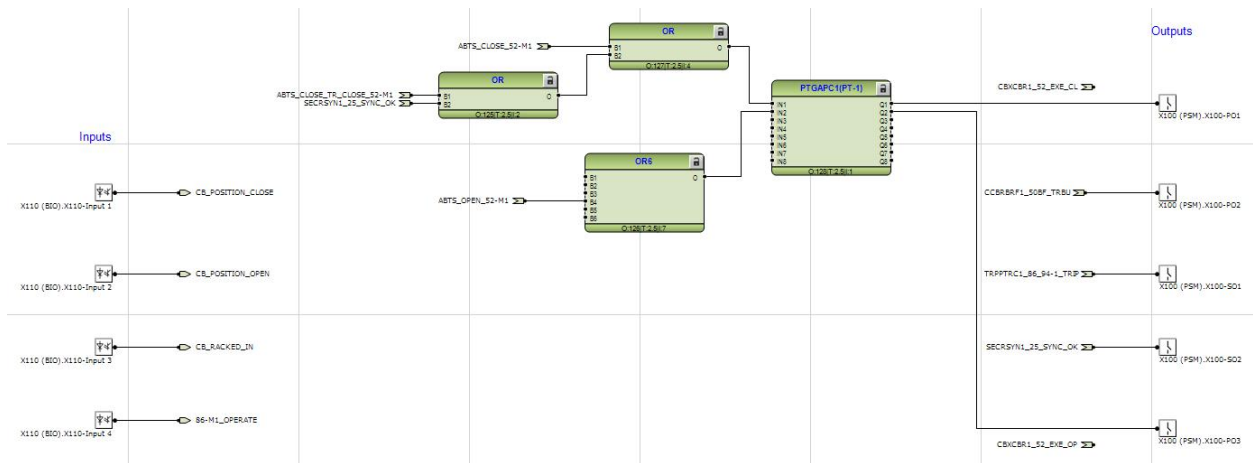
The following logic describes what it has been implemented within each of the protective to perform the sequence of operation, as described under the sequence of operation section

Main 1

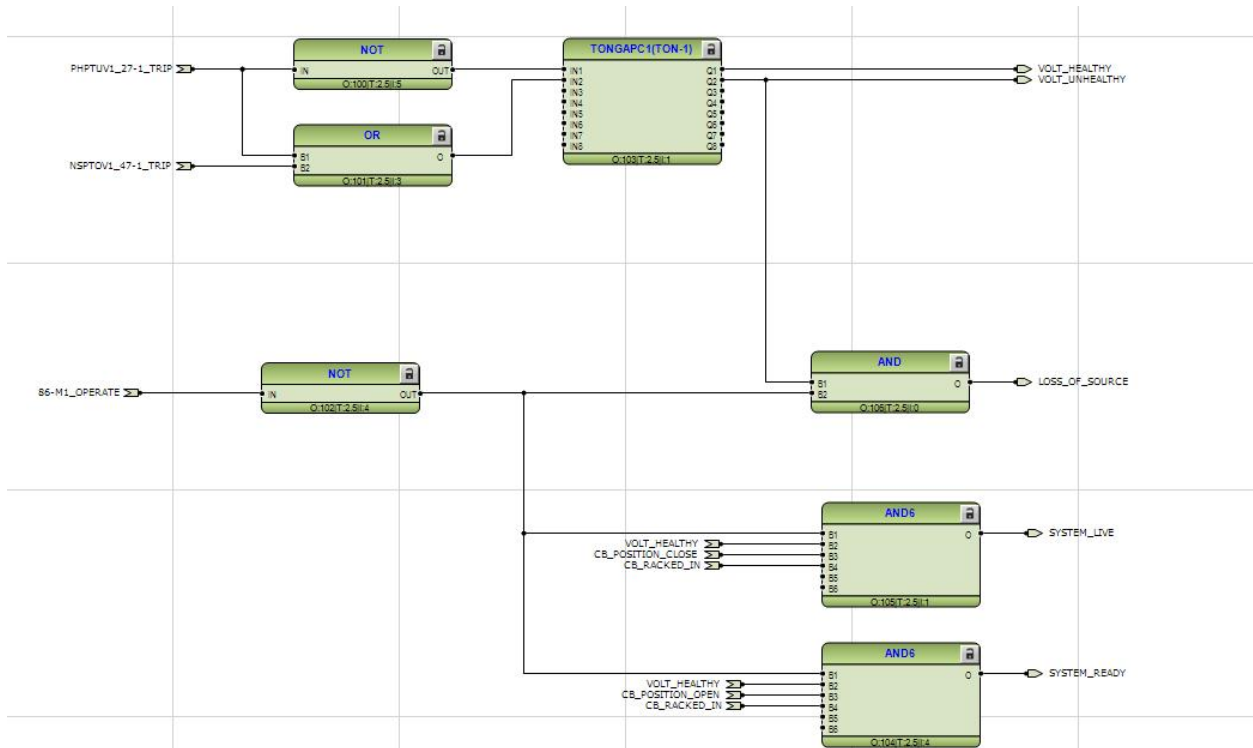
Close/Open Logic

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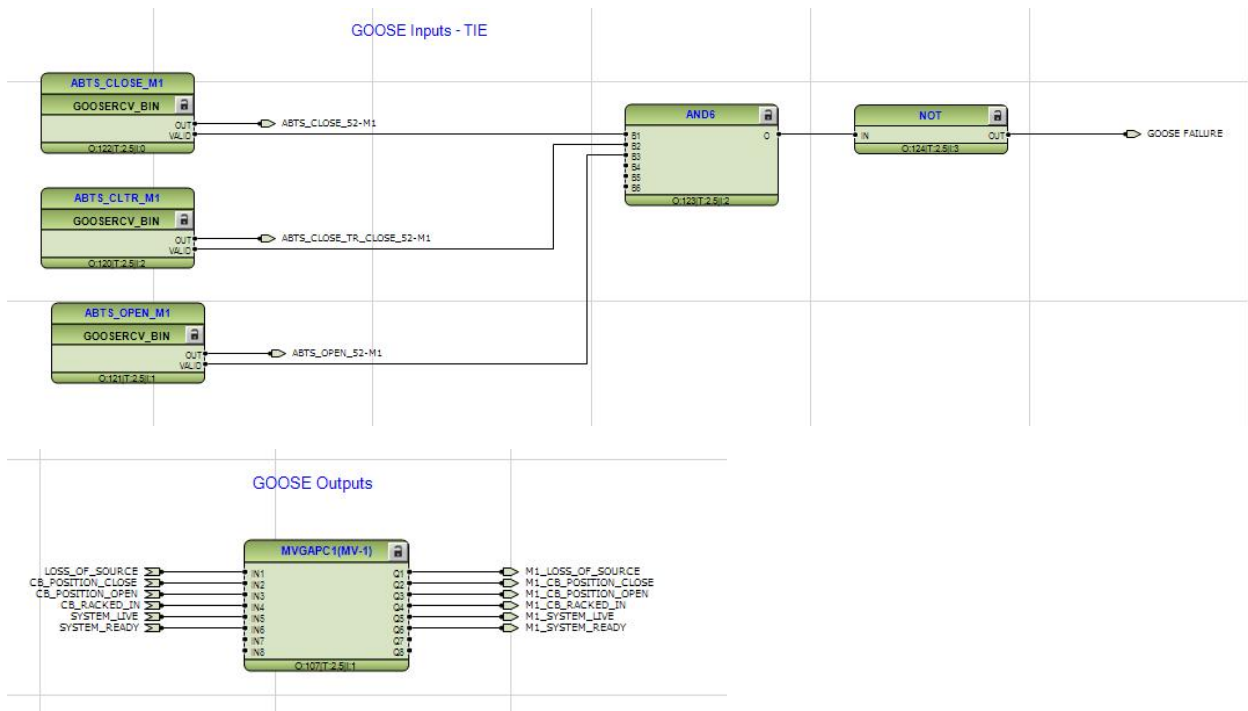
## ATS Logic



## Goose Signals

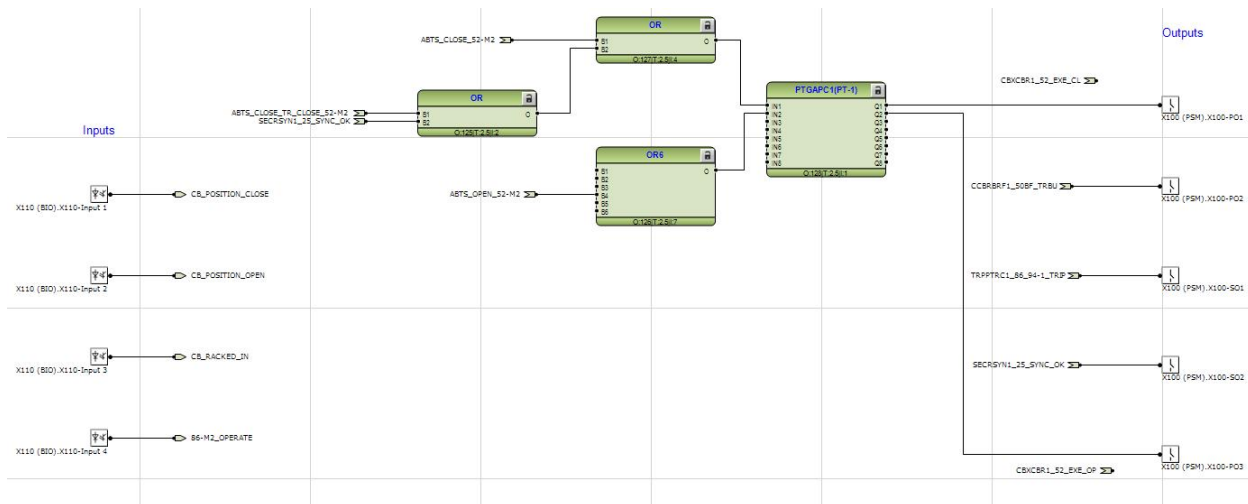
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## Main 2

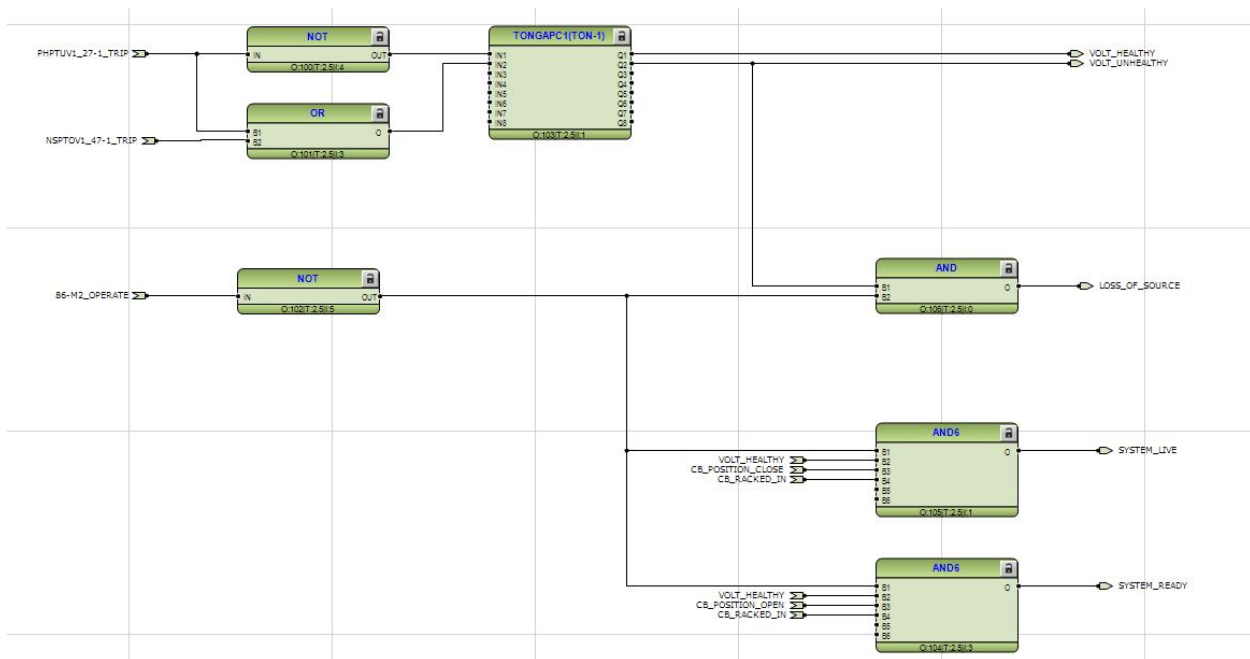
### Close/Open Logic



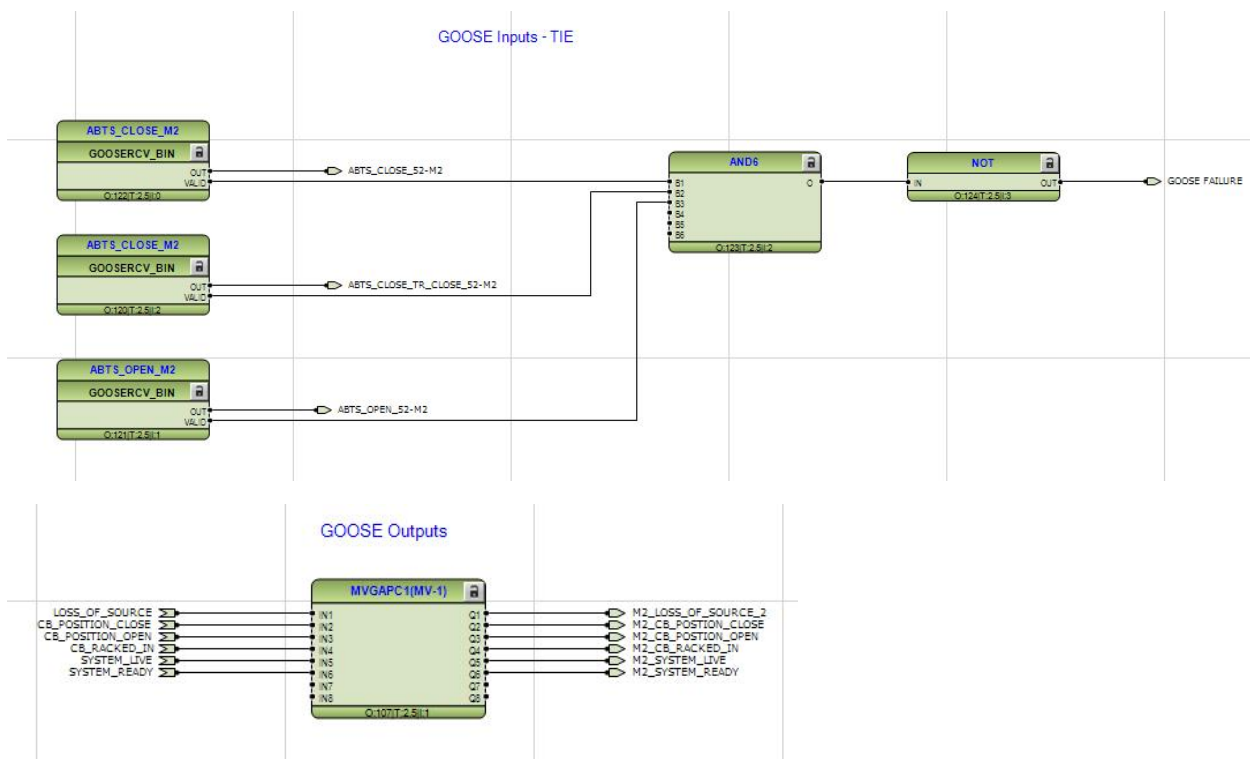
### ATS Logic

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## Goose Signals



## Tie

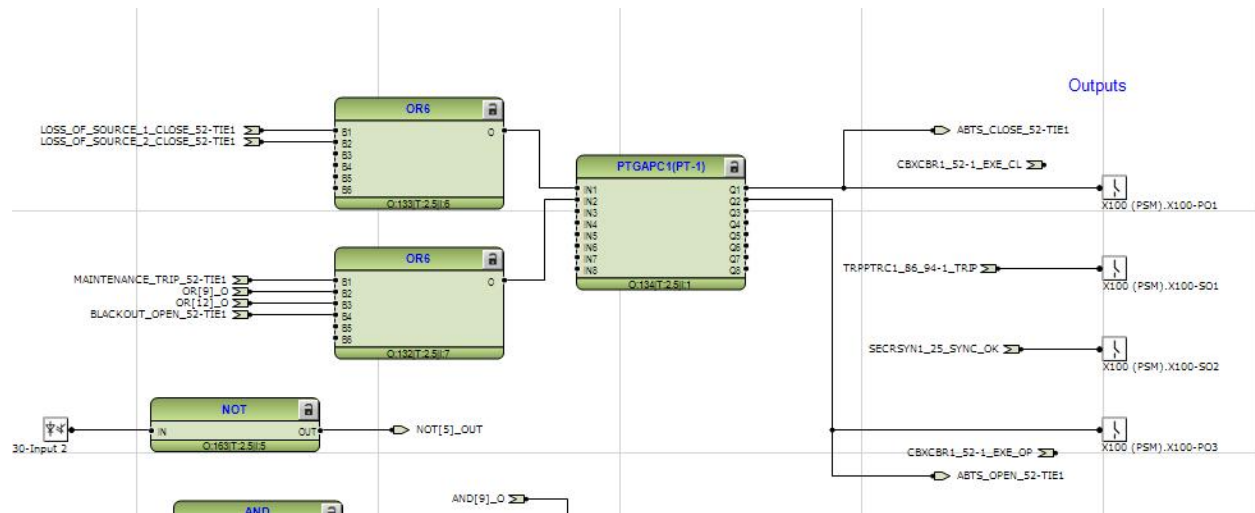
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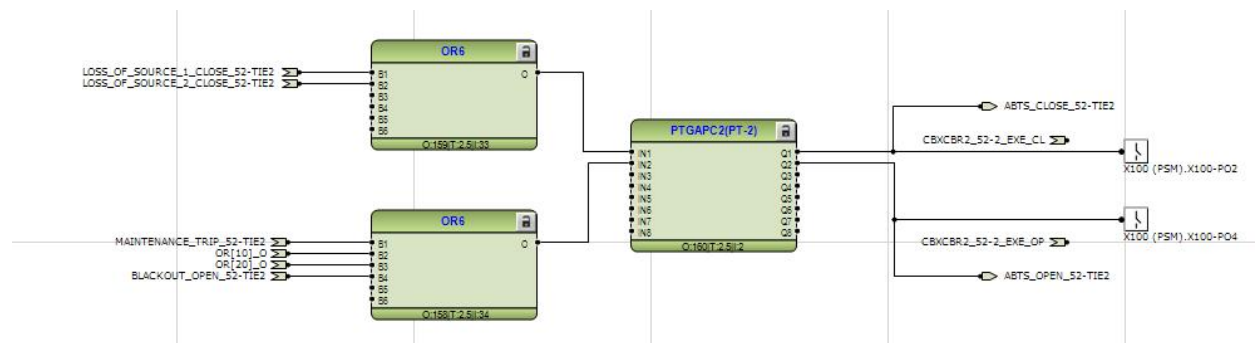


## Close/Open Logic

### Tie Breaker 1



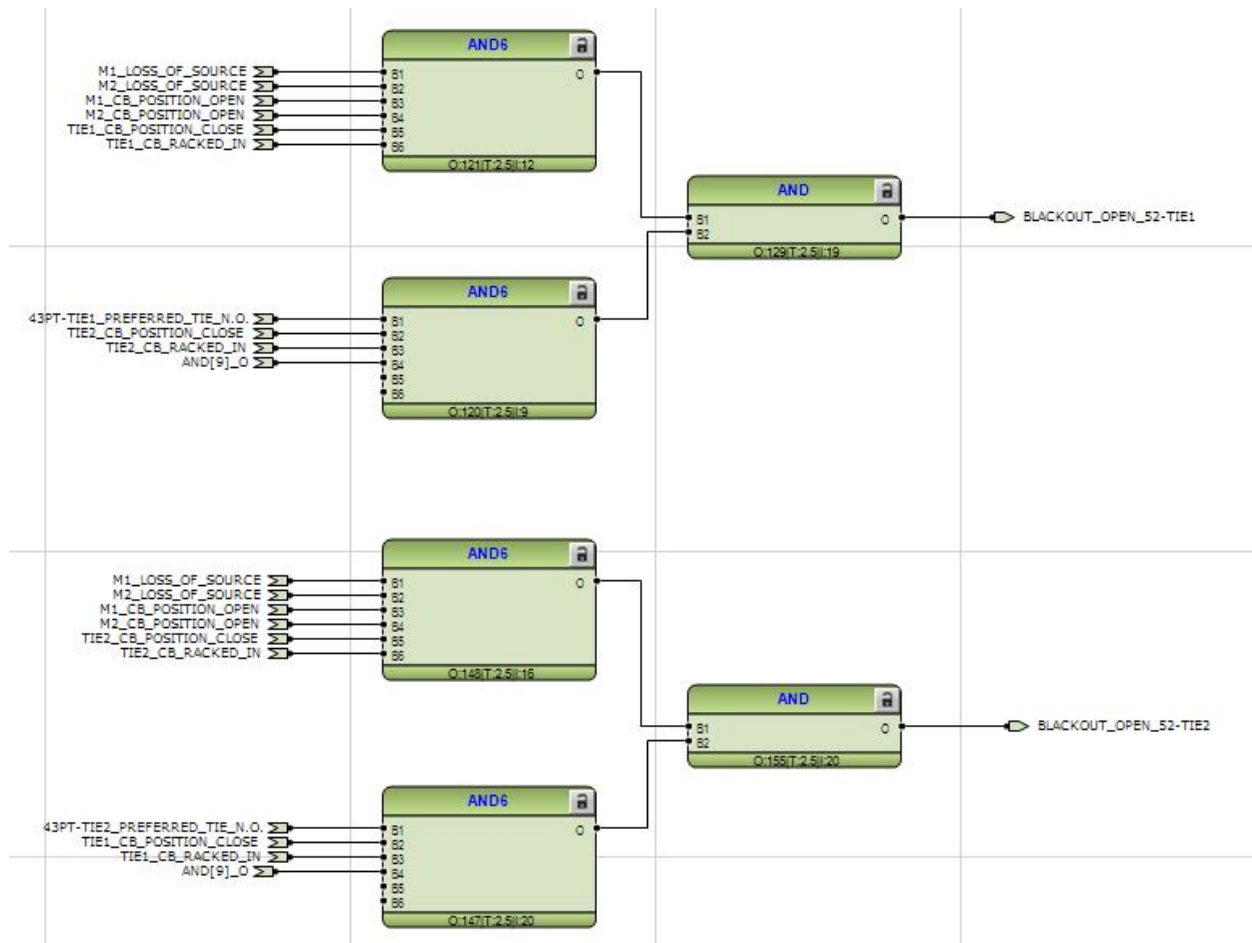
### Tie Breaker 2



### Blackout

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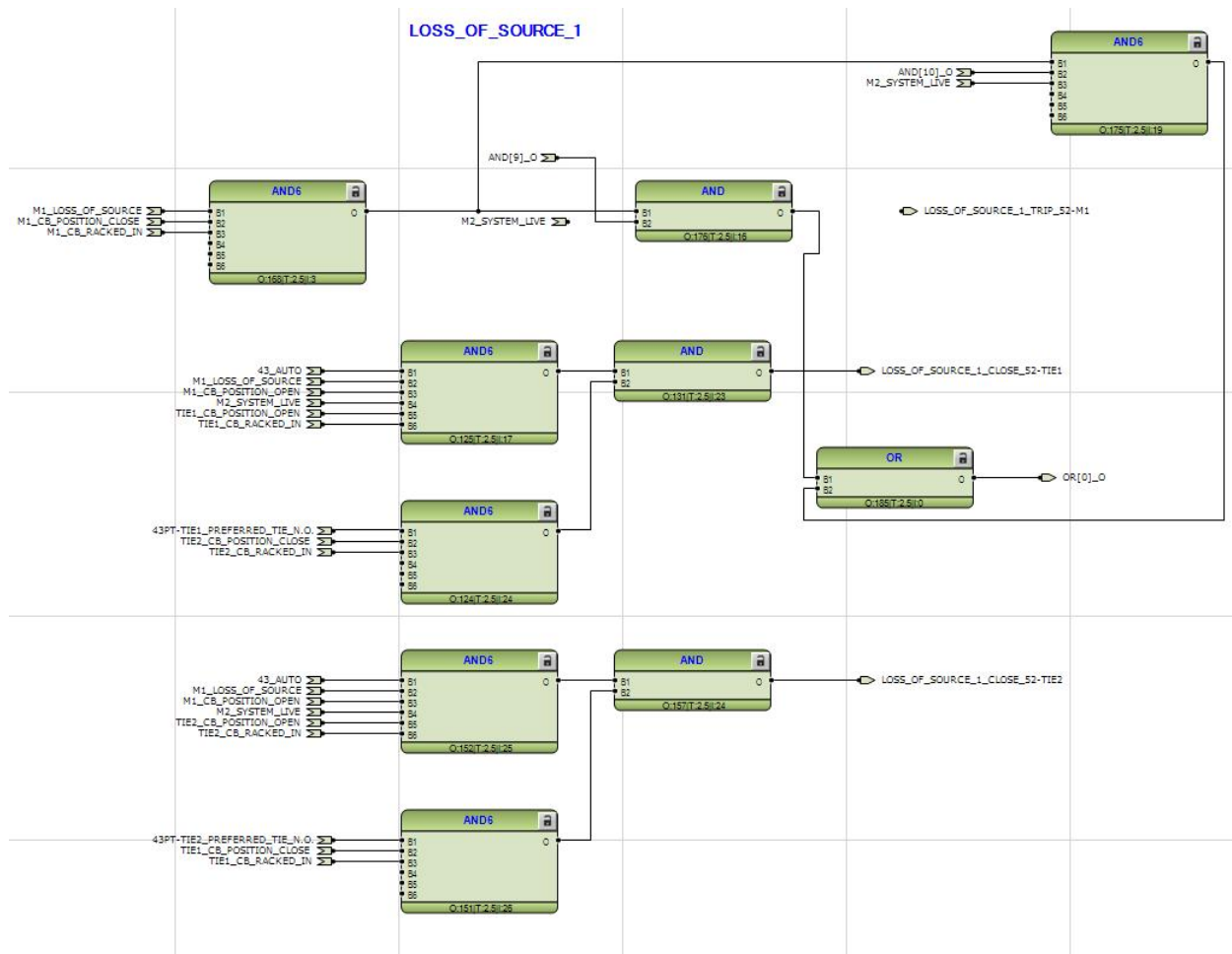
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Loss of Source 1

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Return of Source 1

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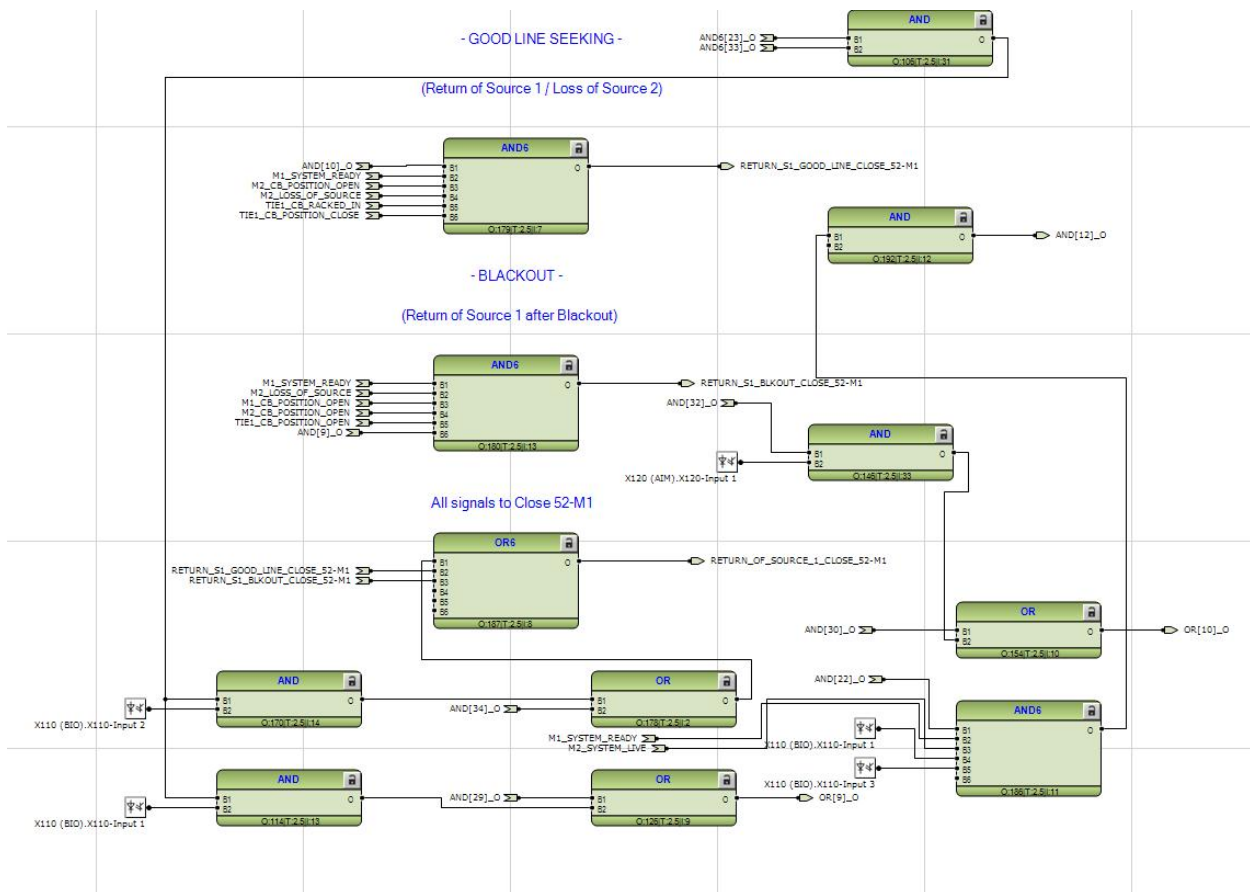


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## Loss of Source 2

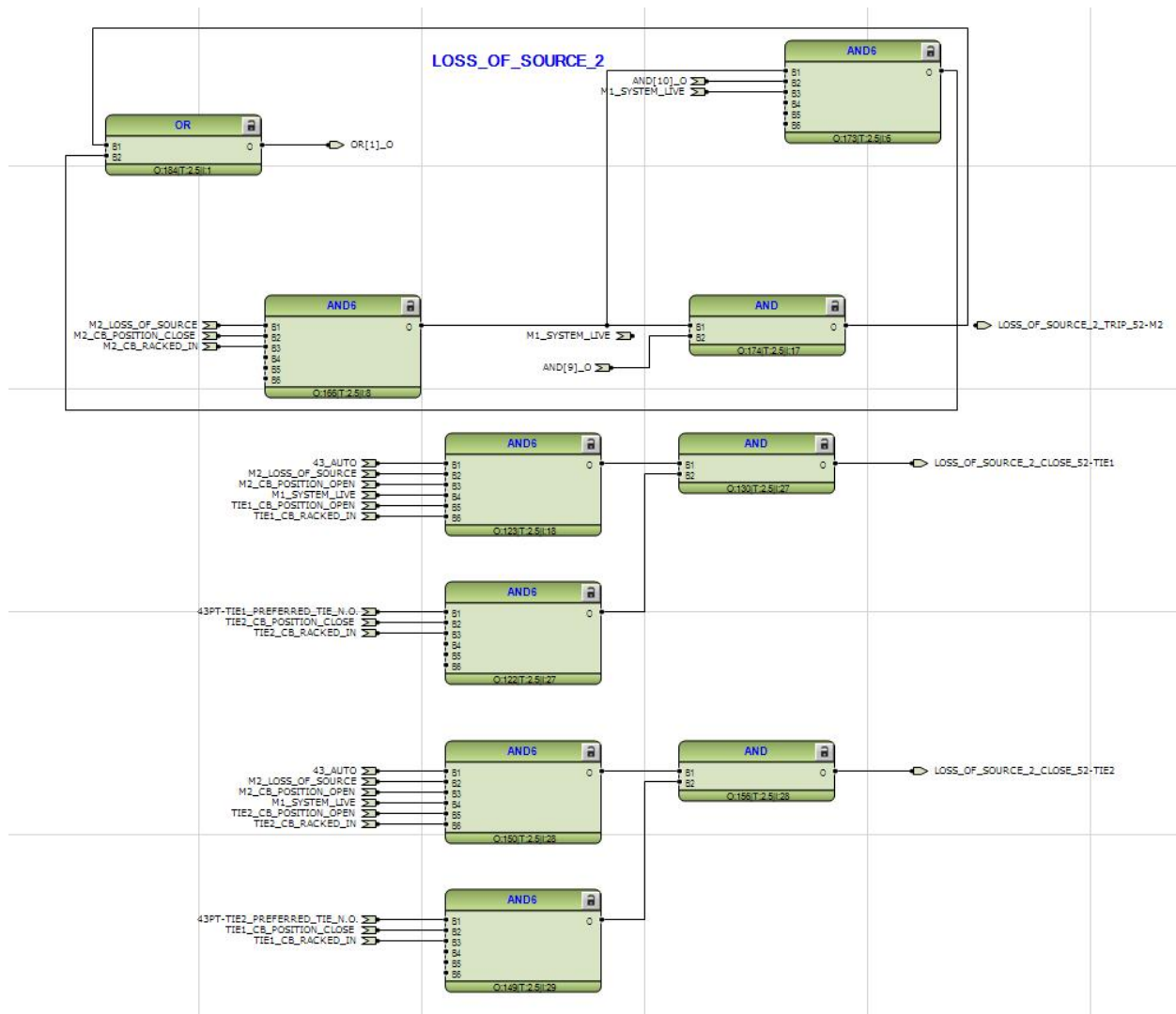
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## Distribution Automation

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Coral Spring, FL 33065

Telephone: (954) 752-6700  
Telefax: (954) 345-5329

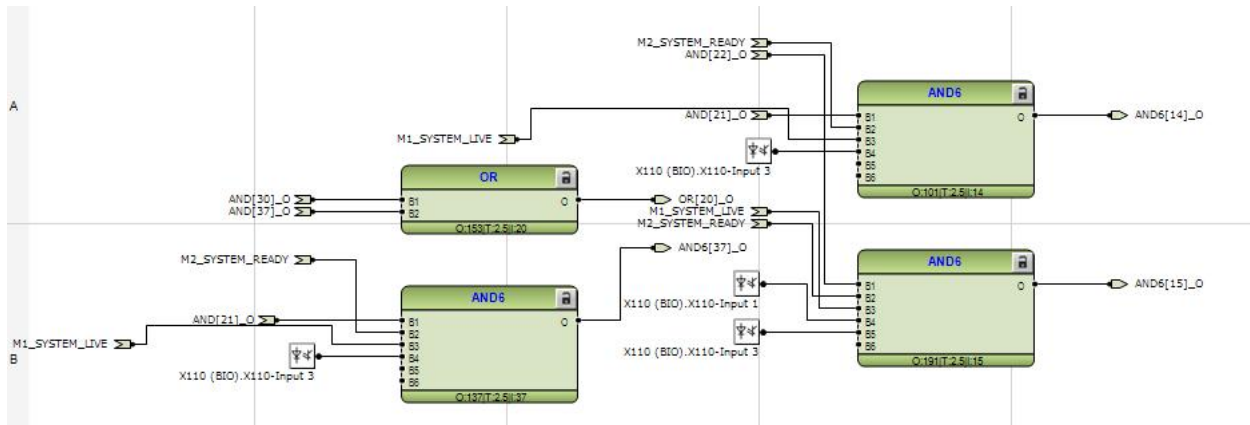
# ABB



Return of Source 2

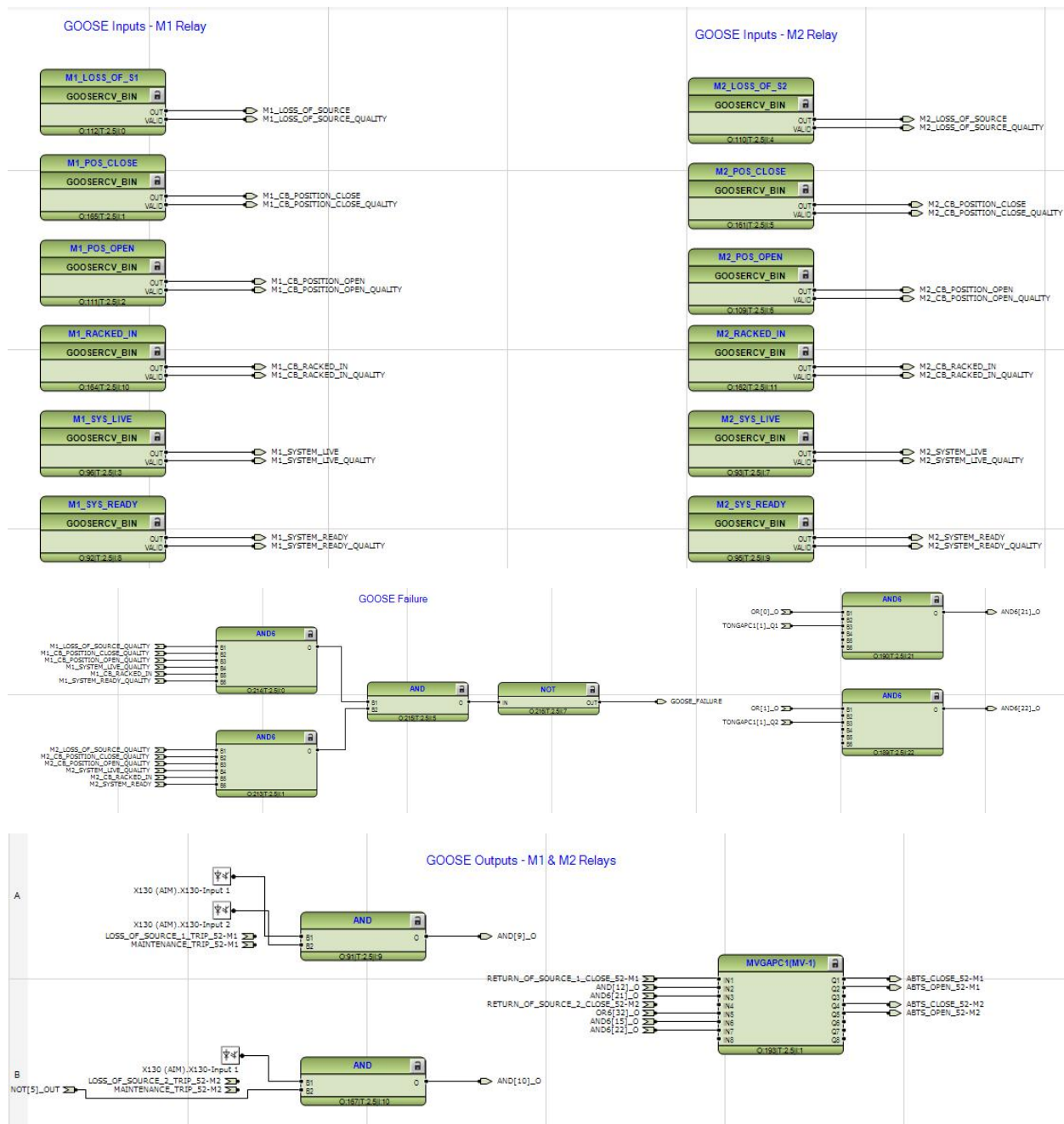
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RETURN\_OF\_SOURCE\_2



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## Ethernet Communications

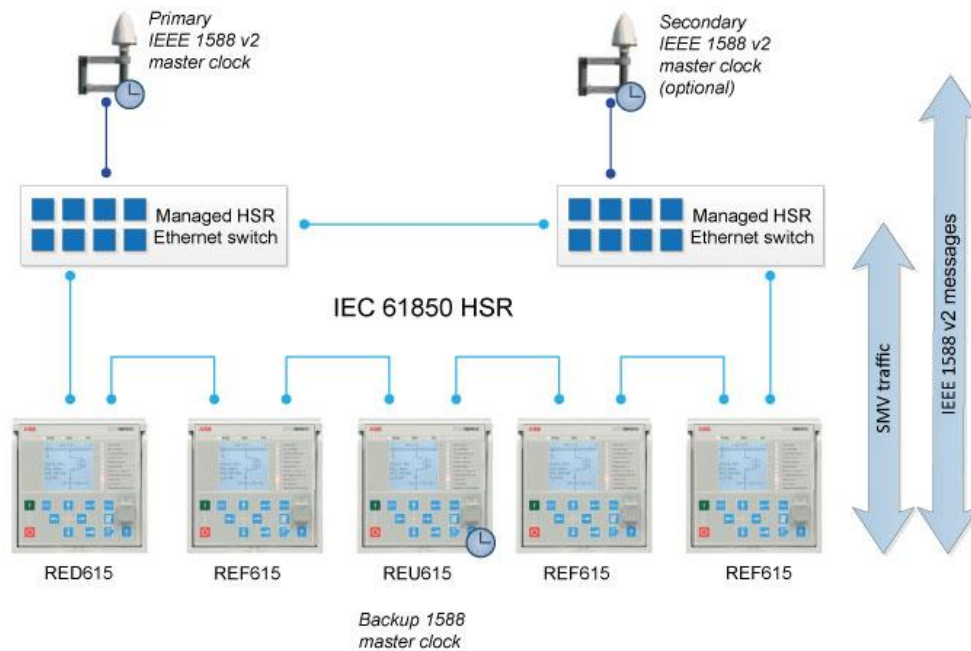
The following schemes represents the preferred communications between relays to transmit GOOSE signals and to ensure that reliable communications exist for the implementation of the transfer scheme

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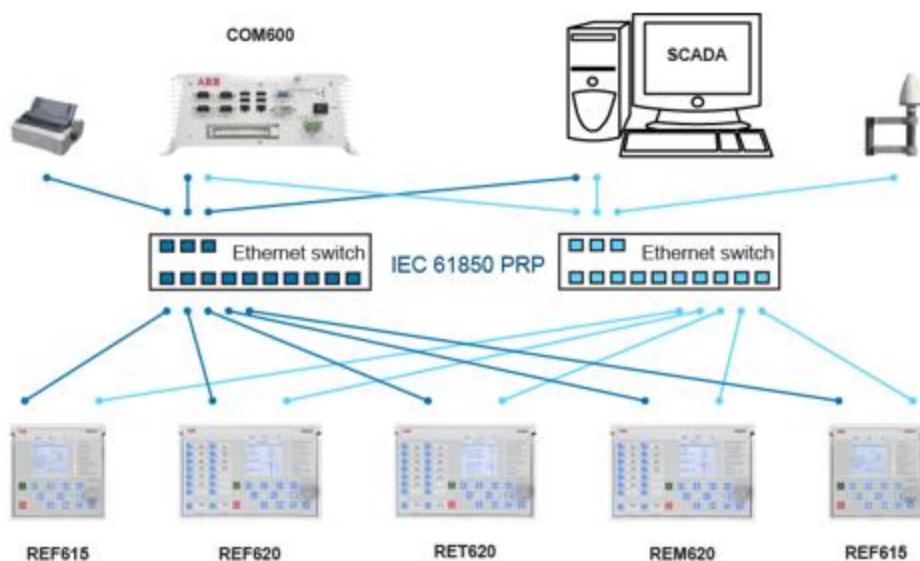
## HSR



## PRP

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## Bill of Material

43 M/A Manual/Auto switch

43R M/A Manual/Auto Re-transfer switch

43T C/O Close or Open Transition switch

43/10 M1/T1/T2/M2 Maintenance switch

43-PT T1/T2 Preferred Tie Switch

(3) Lockout Relays

(2) REF615 Ordering Code: HAFDDADAFHE5BBN12E for the Mains

(1) REF615 Ordering Code: HAFFFAFAFHE5BBN12E for the Ties

(1) Ethernet Switch\*

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