

**Where showed in the one line diagram the Automatic Transfer Scheme (ATS) should be based on ABB's Relion Microprocessor Protective relays and provide the following features:**

The ATS Scheme shall take advantage of IEC-61850 GOOSE messages by limiting the number of cross unit wiring between cubicles.

The ATS Scheme shall be based on two relays, one relay for each incoming breaker.

It shall be possible to operate all breakers via its respective control switch when ATS scheme is in manual mode.

An external lockout relay shall be used to indicate if there is a fault in the bus and to prevent automatic transfer operation

It shall be possible to adjust timers and under voltage settings through the Human Machine Interface (HMI) of the relay.

It shall be possible to adjust timers and under voltage settings through the Web HMI without the need of any external software other than a web browser.

To increase the reliability of the GOOSE communications between the devices the Microprocessor relays shall support either HSR or PRP redundancy communications.

The ATS shall have 4 selector switches as indicated in the sequence of operations.

**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

#### *43P M1/M2 Preferred Switch*

When 43 M/A switch is in "Manual", used to indicate what breaker should be opened automatically 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"

When 43 M/A switch is in “Automatic” indicates what incoming line is preferred in case both incoming lines are available.

### **Initial startup**

Place selector switch (DEV 43) in 'Manual' mode. Close the preferred main breaker and open alternate main breaker by their respective control switch (DEV CS).  
Place selector switch in 'Automatic' mode.

### **Normal Mode of Operation**

Normal plant operation is with preferred main breaker closed and selector switch (DEV 43) in 'Automatic' mode.

### **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 monitored by device 43P. Please refer to manual/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.

### **Manual /Maintenance Operation**

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

#### *Maintenance of Main 1*

Device 43P shall be placed on “Main 2” and device 43 shall be placed in “Manual”.  
To perform maintenance on Main 1, close both incoming lines subject to electrical interlock above described. Once both incoming breakers are closed, the Main 1 will be open automatically.

#### *Maintenance of Main 2*

Device 43P shall be placed on “Main 1” and device 43 shall be placed in “Manual”.  
To perform maintenance on Main 2, close both incoming lines subject to electrical interlock above described. Once both incoming breakers are closed, the Main 2 will be open automatically.

#### *Return to Normal*

To return the system to normal conditions with preferred main breaker closed and alternate main breaker open. With device 43 in “Manual” mode, place device 43P on preferred main breaker, and then close the opened incoming line subject to electrical above. As soon as the opened incoming line is closed and both incoming breakers are closed at the same time, the alternate main will be open automatically.

## **Automatic Mode**

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

(a)

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

When the voltage is restored to the preferred line, the preferred main breaker would after a time delay automatically close and then the alternate 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.

Return of voltage to the preferred line first will after a time delay cause its main breaker to close, returning the system back to normal.

Return of voltage to the alternate line first will after a time delay cause its main breaker to close. When voltage returns to the preferred line, the preferred breaker will after a time delay close, and then the alternate breaker will open, restoring the system to normal.

(c)

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

## **Automatic Mode**

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

(a)

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

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

Return of voltage to the preferred line first will after a time delay cause its main breaker to close, returning the system back to normal.

Return of voltage to the alternate line first will after a time delay cause its main breaker to close. When voltage returns to the preferred line, the alternate breaker will after a time delay open, and then the preferred breaker will close, restoring the system to normal.

(c)

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

### **Automatic Mode**

#### **Selector switch device 43 in “Auto”, and device 43R in “Manual”**

(a)

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

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

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.

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 the preferred incoming line closed and alternate breaker open.

(d)

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

## **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

43P M1/M2 Preferred/Maintenance switch

(2) Lockout Relays

(2) REF615 Ordering Code: HAFDDADAFHE5BBN12E for the Mains

(1) Ethernet Switch\*