

Roger Hedding, Automation Power World, 19th April 2011

# Relion® Latest technology for Protection, Control, Measurement, and Supervision of T&D systems

# Introduction to Relion®

- Contents
  - The Relion® product family



# Introduction to Relion®

- Relion®...A strong family name as an identifier for the new generation of Protection and Control IEDs from ABB
- From interconnected transmission grids to secondary distribution networks
- Relion is the globally recognizable product family name, firmly placing ABB protection and control products on top of the customers mind
  - History of strong products from Westinghouse, Brown Boveri, Asea, ITE Imperial Corporation.
  - ABB's identifier for all new protection and control products

# Relion Product Family



# Relion Series Family

- **670** - Optimized for transmission applications
- **650** - Optimized for transmission and subtransmission applications
- **620** - Optimized for High end distribution applications
- **615** - Standard series for distribution applications

# Relion® family products

## Family Highlights



- One common tool for all Relion® products, Protection and Control Manager PCM600
- Covers all applications, from intercontinental transmission grids to secondary distribution networks



- The performance of Relion protection and control IEDs meet the comprehensive IEC 61850 communication tasks, for example, GOOSE messaging for peer-to-peer communication



- The Relion IEDs utilize ABB's unique connectivity package concept



- The Relion product family provides configured, pre-configured or fully customized IEDs

# Relion® Protection and Control

## 670 and 650 Series



- 670 series –optimized for generation and transmission applications provide versatile functionality, maximum flexibility and performance to meet the highest requirements of any application in generation and transmission protection systems.



- 650 series –your best choice for transmission and sub-transmission applications providing “off-the-shelf”, ready to use solutions for line, bus, breaker, generator and transformer protection as well as bay control applications primarily in transmission and sub-transmission networks.

# Relion® 650 series

- **Your best choice for transmission/sub-transmission applications**

- **650 series**

- Product portfolio addresses functionality in sub-transmission applications
  - REC650 Bay control IED
  - REL650 Line distance protection
  - RET650 Transformer protection
  - REB 650 Bus Bar Protection
  - REQ 650 Breaker control
  - REG 650 Generator Protection
- Powerful and flexible hardware that is common for the 650 series
- Protection and control function types are identical in the 650 series
- Efficient engineering, parameter setting, test, commissioning, and operation
- PCM600 tool platform is used





# Relion® 650 series

## ▪ Features



### ▪ Off-the-shelf, ready to use solutions

- Pre-defined functionality, application configuration ready-made at the factory
- Support for user defined names for signal and function engineering
  - Minimal number of parameters & settings
  - ABB new global base value concept
  - Four setting groups
  - IEDs deployment faster than ever before

# Relion® 650 series

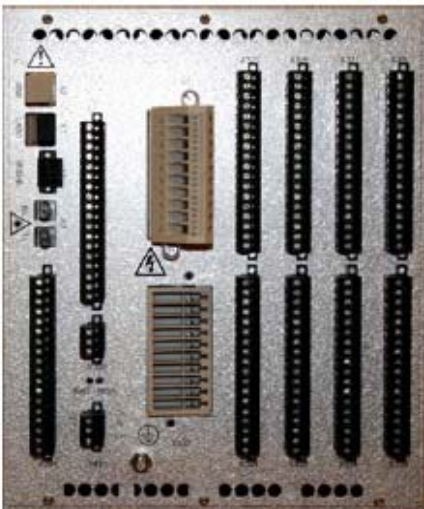
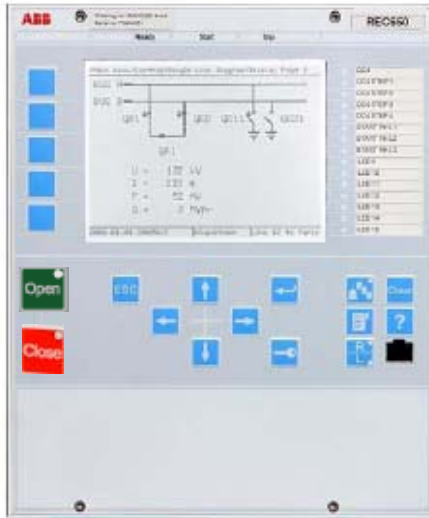
## ▪ Features



- Advanced local HMI functionality
  - 15 dynamic and configurable LED in 3 colors and 3 pages
  - 5 configurable pushbuttons
- Extensive condition monitoring
  - Circuit Breaker monitoring
  - Insulation / Gas monitoring
  - Trip Circuit Supervision
  - IED Power Supply monitoring
- One application specific main protection function
- Unified back-up protection functionality
- Supports 3-phase tripping

# Relion® 650 series

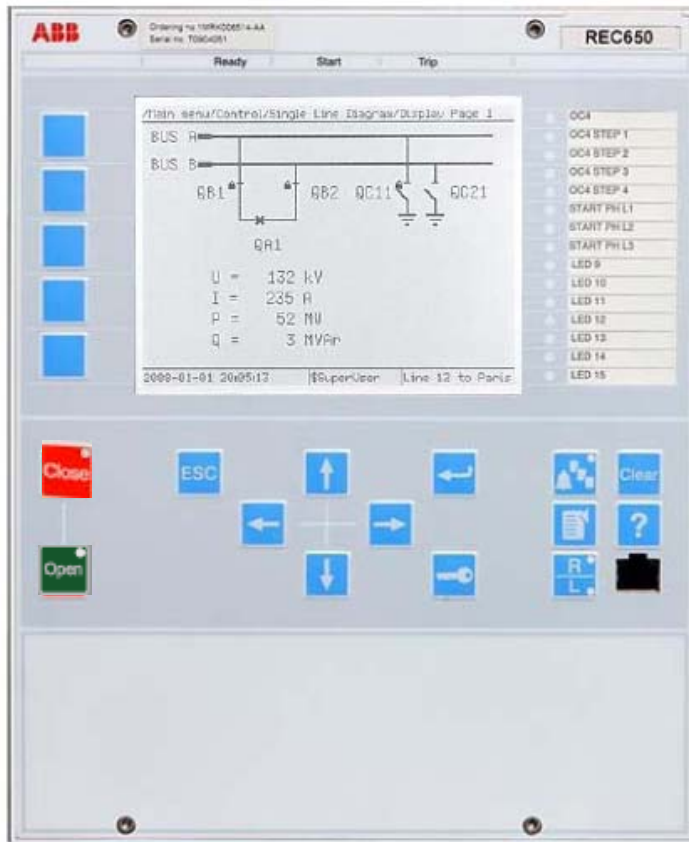
## Hardware



- Platform based
  - Few spare parts needed on module level
  - Common module firmware
  - Easy future hardware addition possibilities
  - Minimized cost for maintenance and training
- I/O flexibility
  - 10 or 20 keyed analog inputs in different configurations
  - CT connections have short-circuits
  - 1A or 5A settable on the same CT inputs
  - Up to 220V on the settable VT inputs
  - 14 –50 binary inputs, 9 –45 binary outputs
  - Compression type or ring lug cable termination

# Relion® 650 series

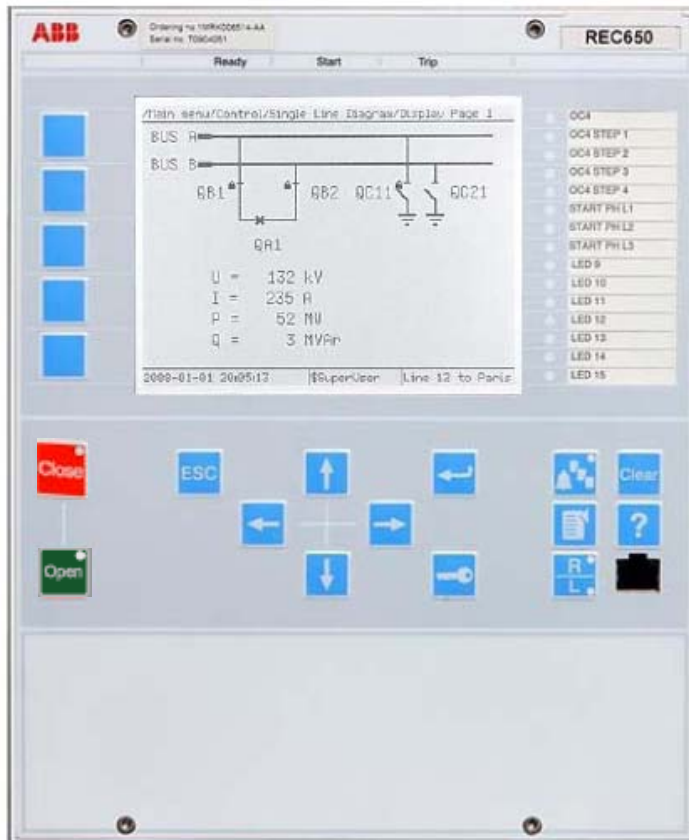
## Local HMI



- Efficient interaction with the IED
  - Direct interaction with IEDs from LHMI
  - Graphical display and measurement adapted to the application
  - Control screen can be default
  - National language support, unicode
  - Forcing of binary output when in test mode
- Monitoring
  - IED status indication LEDs
  - Measurements
  - Binary signals via indication LEDs
  - Disturbances and events

# Relion® 650 series

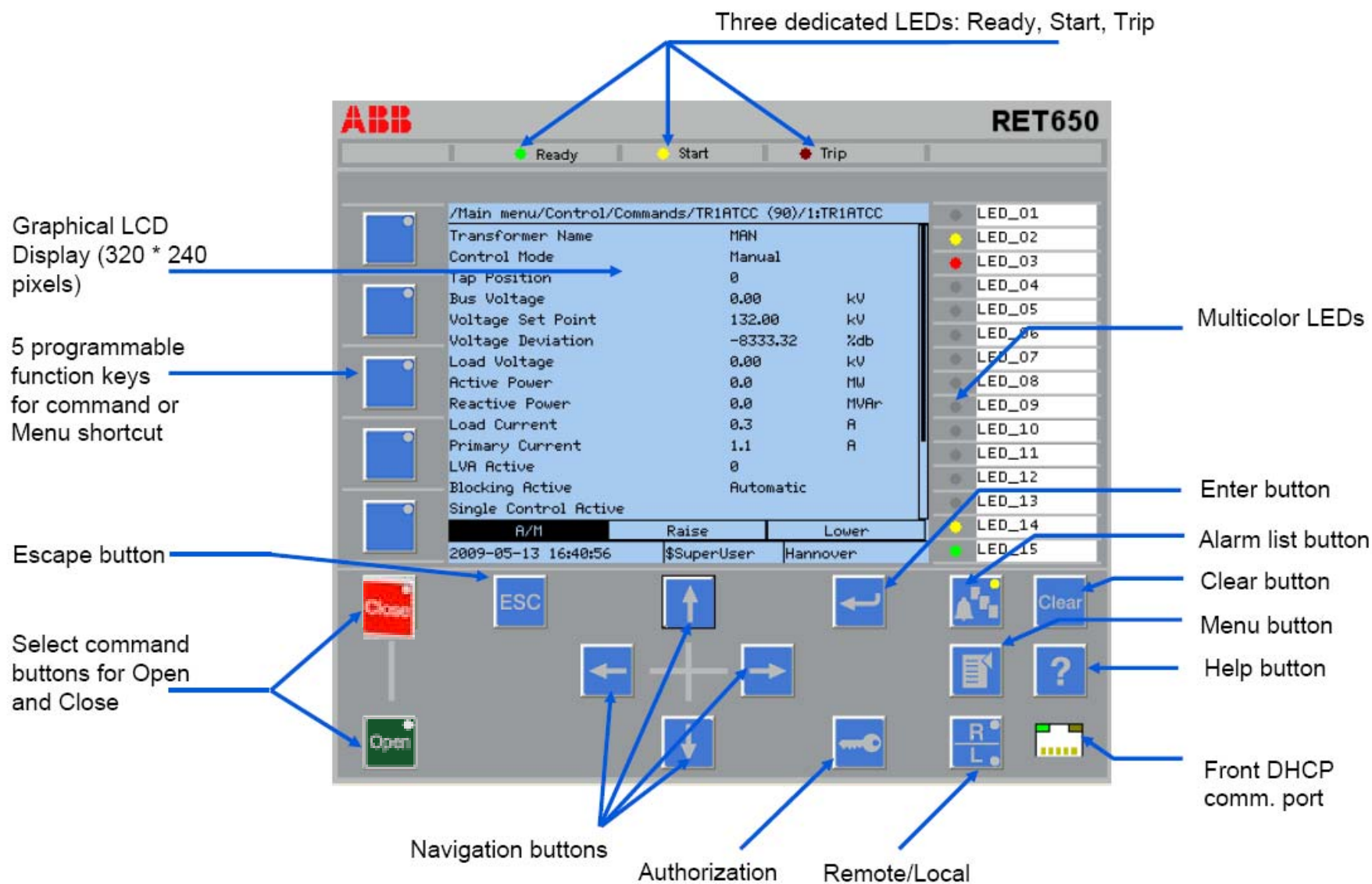
## Local HMI



- Control in REC650
  - Control of up to 8 apparatus in 1 bay, select before operate
  - The exact presentation of the configured switchgear arrangement on LCD with IEC or ANSI symbols
  - Commands with override operations
- Settings
  - All parameters can be read and set via the local HMI
- Five configurable push button shortcuts with labels presented on the display for different actions, menu shortcut or commands

# Relion® 650 series

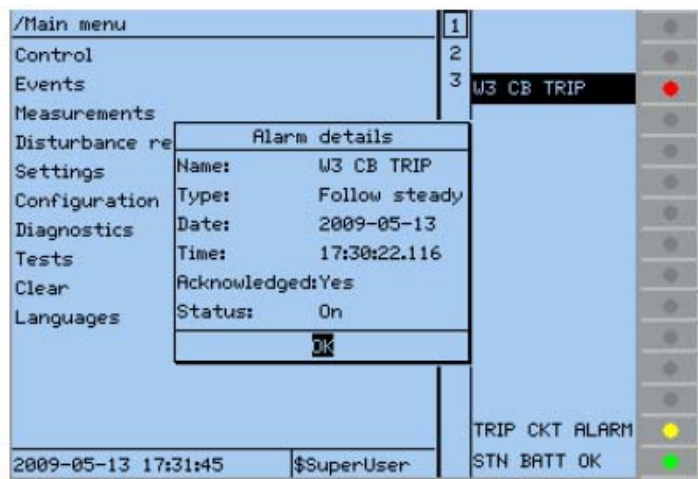
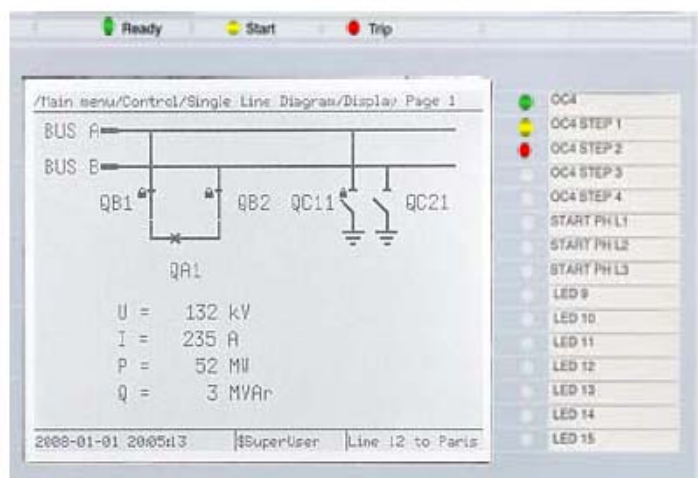
## Local HMI





# Relion® 650 series

## Local HMI



- Status indication LEDs indicate the status of the IED:
  - Green
    - Steady: In service
    - Flashing: Internal failure
  - Yellow:
    - Steady: Disturbance recorder triggered
    - Flashing: IED in test mode
  - Red:
    - Steady: Trip command issued
    - Flashing: IED blocked
- Indication of binary signals via 15 three-color-state indication LEDs on up to three pages. Therefore, 45 LEDs with three colors gives 135 active state indications. Steady, flashing, latched, signal following
- Detailed information window on LEDs

# Relion® 650 series

## Main function



- Each product in the 650 series has 1 main function
  - REC650 main function is bay control
  - REL650 main function is distance protection
  - RET650 main function is differential protection
  - REB 650 main function is bus bar protection
  - REQ 650 main function is breaker control
  - REG 650 main function is generator protection



# Relion® 650 series

## Other functions

### **Backup protection and general functions**

Instantaneous phase overcurrent protection

Instantaneous residual overcurrent protection

Four step directional phase overcurrent protection

Four step directional residual overcurrent protection

Scheme communication logic for distance or overcurrent protection

Scheme communication logic for residual overcurrent protection

Sensitive directional residual overcurrent and power protection

Stub protection

### □ Pole discordance protection

Thermal overload protection one time constant

Thermal overload protection two time constant

Directional Under-power protection

Directional Over-power protection

Directional negative sequence overcurrent protection

Two step undercurrent protection

Broken conductor check

Breaker failure protection

Fuse failure supervision

Current circuit supervision

Breaker close/trip circuit monitoring

Synchrocheck, energizing check and synchronizing

Autorecloser

# Relion® 650 series

## Other functions

### Backup protection and general functions

Two step overvoltage protection

Two step residual overvoltage protection

Two step undervoltage protection

Over excitation protection

Over frequency function

Under frequency function

Rate-of-change frequency function

Loss of voltage check

Tripping logic

Logic rotating switch for function selection and LHMI presentation

Selector mini switch

Measurements

Event counter

Event list

Indication

DR & Event recorder

General Logics

Additional Logics with QT

Trip Circuit Supervision

Insulation / Gas Monitoring

Station Battery Supervision

Metering (Pulse, Energy)

# Line protection with REL650

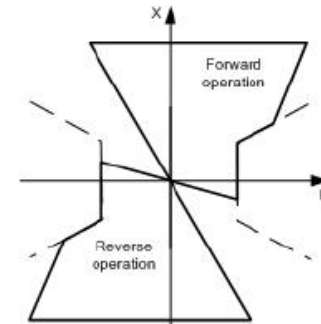


- Fast and reliable distance protection
  - Reliable earth fault protection, for both solid-grounded and high impedance grounded systems.
    - The selection between the two different grounding systems can be made by settings
- Reliable back-up protection over current, over voltage, thermal overload
- Autorecloser with synchrocheck
- Scheme communication
- Three-phase tripping

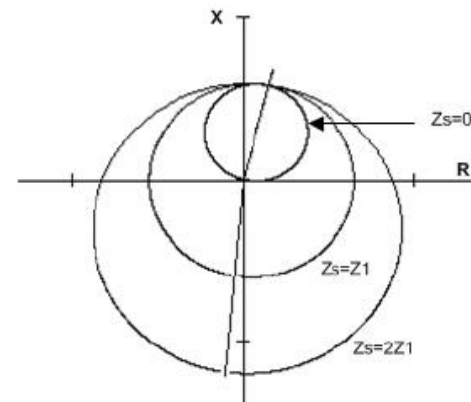
# Line protection with REL650



- Ready made application configurations for:
  - Single breaker, double busbar, quadrilateral distance protection



- Single breaker, double busbar, Mho distance protection



# Line protection with REL650



With quadrilateral or mho characteristics



- 1/2 of 19" rack
- One 4I+1I\*+5V TRM
- 2 BIO cards, each with 9 Binary Inputs and 9 Binary Outputs
- Power Supply Module with 9 Binary Outputs
- COM module with 14 Binary Inputs\*one sensitive current input

# REL670/RED670 and REL650

- 650 has single pole tripping

	 REL670 / RED670	 REL650
Line distance protection	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Line differential protection	<input checked="" type="checkbox"/>	
Series compensated networks distance protection	<input checked="" type="checkbox"/>	
Single-phase tripping	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Three-phase tripping	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
IEC61850-8-1 and DNP3.0	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Other protocols LON, SPA, IEC 60870-5-103	<input checked="" type="checkbox"/>	

# Line protection - REL670 and RED670 highlights



- High speed and reliable line protection functions
- Excellent for series compensation and HVDC vicinity
- Multi-object and multi-terminal capability
- Autorecloser and synchrocheck
- Apparatus control integrated in the line protection
- Full compatibility in scheme communications between 670 series and 650 series
- Full IEC 61850 compatibility
- Full engineering capability to the customer needs

# Line protection - REL650 highlights



Fast and reliable line distance protection

Back-up protection included

Autorecloser and synchrocheck

Full compatibility in scheme communications between 670 series and 650 series

Advanced Human Machine Interface

User defined names

Settable CT, VT ratings and binary input pick up voltage

Full IEC 61850 compatibility

- Easy ordering of the product as all functionality is available as standard
- Ready to use for the application with full configuration

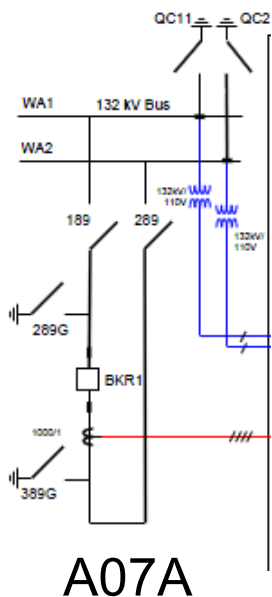
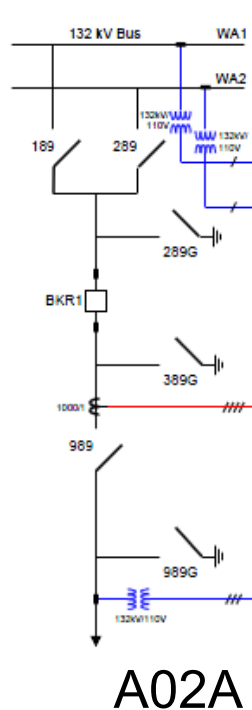
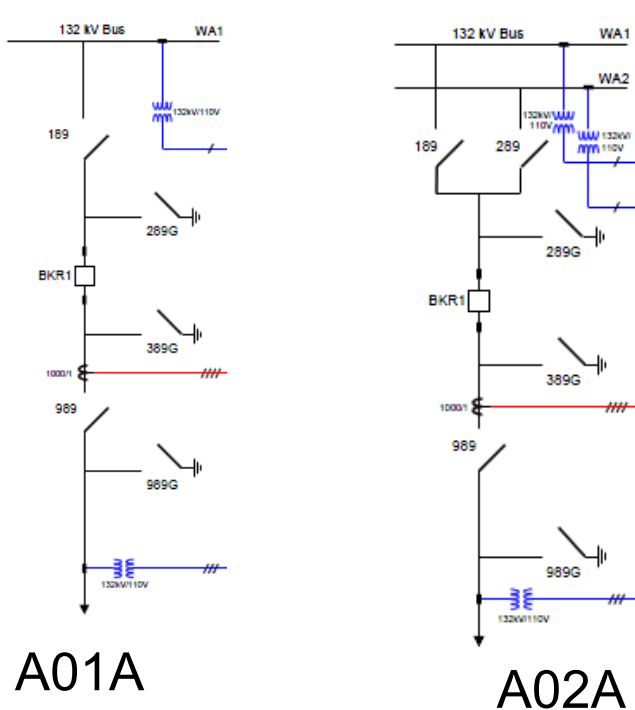


# Bay control with REC650



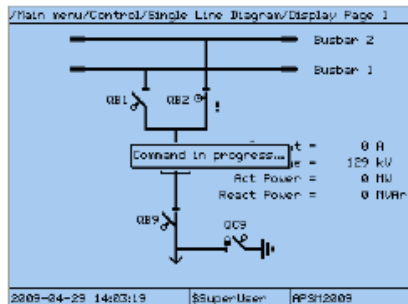
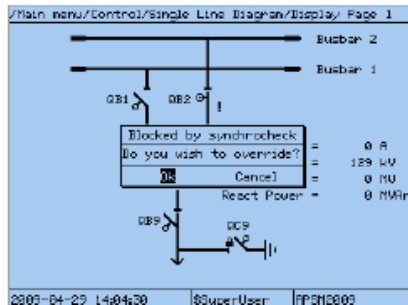
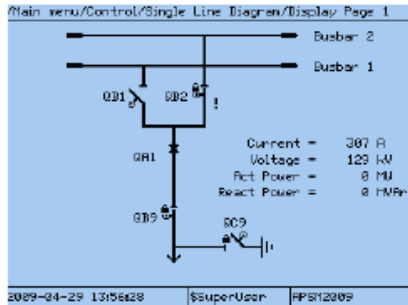
- Local and remote control of up to 8 primary apparatus
- Modeled according to IEC 61850
- Select before operate procedure with enhanced security
  - Interlocking:
    - Bay interlocking
    - Station wide interlocking using GOOSE
- Safe and easy-to-use reservation method between apparatus and bays
- Ready made application configurations available and additional glue logics can be added when required

# REC650 offering





- Ready made application configurations for:
  - Single busbar single breaker arrangement (REC650 –A01A)
  - Double busbar single breaker arrangement (REC650 –A02A)
  - Bus coupler single breaker arrangement (REC650 –A07A)
- All application configurations include backup protection
- All application configurations include interlocking and by-pass
- Available in ½19”rack 6U height

# REC650 apparatus control



- Clear indications of apparatus states on the IED HMI
  - Positions
  - Clear messages to operators
  - Interlocked padlock shown
  - Substituted exclamation shown
- Commands with overrides from IED HMI
  - Interlock override
  - Synchrocheck override
  - Password protected

# REC670 and REC650

	 <b>REC670</b>	 <b>REC650</b>
Up to 8 apparatus in single IED	☒	☒
>8 up to 15 apparatus in single IED	☒	
Up to 30 apparatus in single IED	☒	
Multi bays in single IED and complex network topologies	☒	
Reservation between bays	☒ <b>basic, advanced</b>	☒ <b>basic</b>
IEC61850-8-1 and DNP3.0	☒	☒
Other protocols LON, SPA, IEC 60870-5-103	☒	

# Bay control - REC670 highlights



- Apparatus control for up to 30 apparatus with integrated backup protection
- Available as pre-configured or can be completely customized to your needs
- Multi-object (CB) and Multi-bay control capability for handling several bays with a single IED
- Modeled according to IEC61850 with full compatibility
- Select before operate with enhanced security
- Unique fail safe reservation methods for apparatus control
- Well proven standard interlocking functions
- Transformer tap control and voltage control

# Bay control - REC650 highlights



- Apparatus control for up to 8 apparatus with integrated backup protection
- Ready-to-use configured IEDs for 3 network configurations
- Modeled according to IEC61850 with full compatibility
- Safe and dependable reservation method for apparatus control
- Select before operate with enhanced security
- Well proven standard interlocking functions
- Powerful and extensive local HMI functionality eliminates the need for external mimic boards
- User defined names
- Easy ordering of the product as all functionality is available as standard

# Transformer protection and voltage control with RET650



- Reliable transformer differential protection function
  - for 2-windings with 2-restraint inputs
  - for 3-windings with 3-restraint inputs
- Reliable low impedance restricted earth fault protection.
- Integrated back-up protection(OC, EF, OV, THOL, OVEX, etc.)
- Automatic voltage control for one or two transformers within one IED
- Single line diagram on the local HMI for presentation of apparatus status

# Sensitive transformer differential protection in RET650

- Sensitive negative sequence differential protection
  - Unique capability to detect and trip low-level internal faults such as turn-to-turn faults
- On-line reading and automatic compensation for On-Load Tap-Changer position
- Zero-sequence current elimination settable for every winding





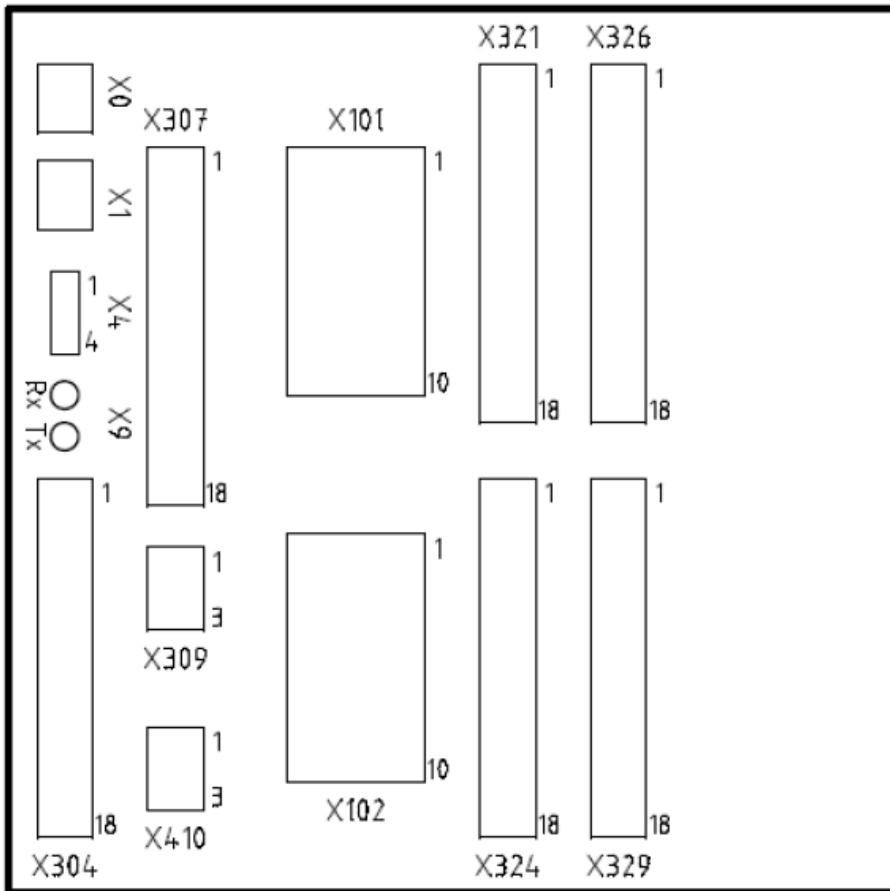
# RET650 offering



- Configured products with ready made application configurations for single breaker station arrangements:
  - Two-winding transformers including protection and voltage control for a single transformer
  - Three-winding transformers including protection and voltage control for a single transformer
  - Advanced voltage control for two transformers operating in parallel

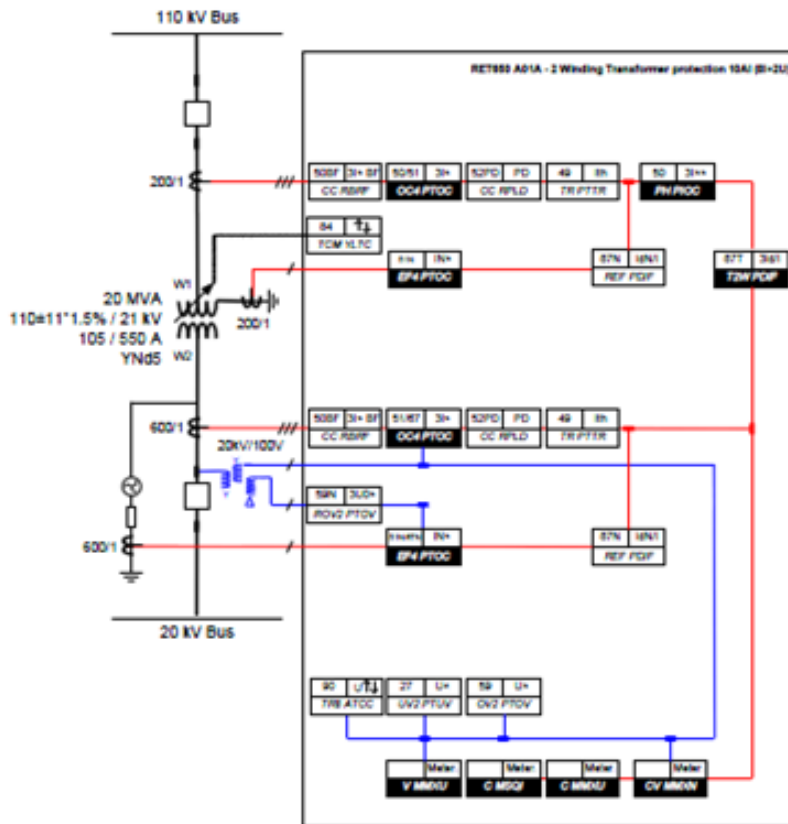
# RET650 for two-winding power transformer

Rear view terminals



- ½ of 19" rack
- One 8I+2V TRM
- Power supply module with 9 binary outputs
- COM module with 14 binary inputs
- 2 BIO cards, with 9 binary inputs and 9 binary outputs
- Tap-changer position via BCD code

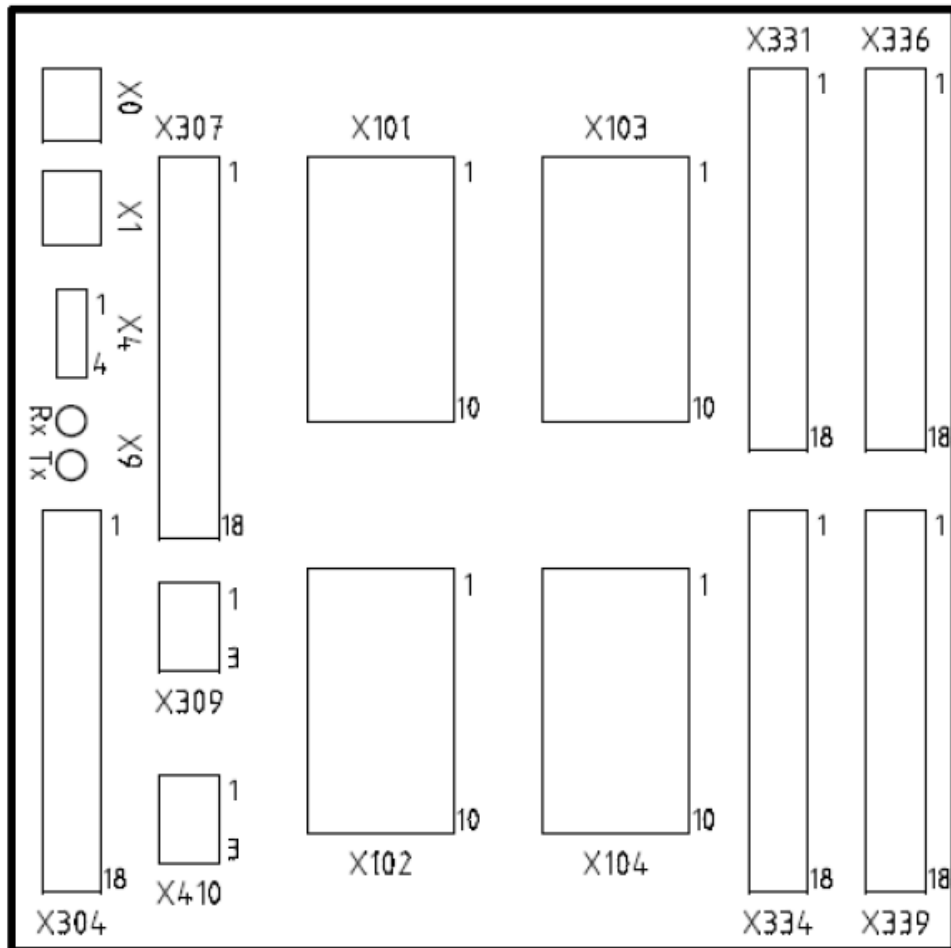
# RET650 for two-winding power transformer



- 1/2 of 19" rack
- One 8I+2V TRM
- Power supply module with 9 binary outputs
- COM module with 14 binary inputs
- 2 BIO cards, with 9 binary inputs and 9 binary outputs
- OLTC position via BCD code

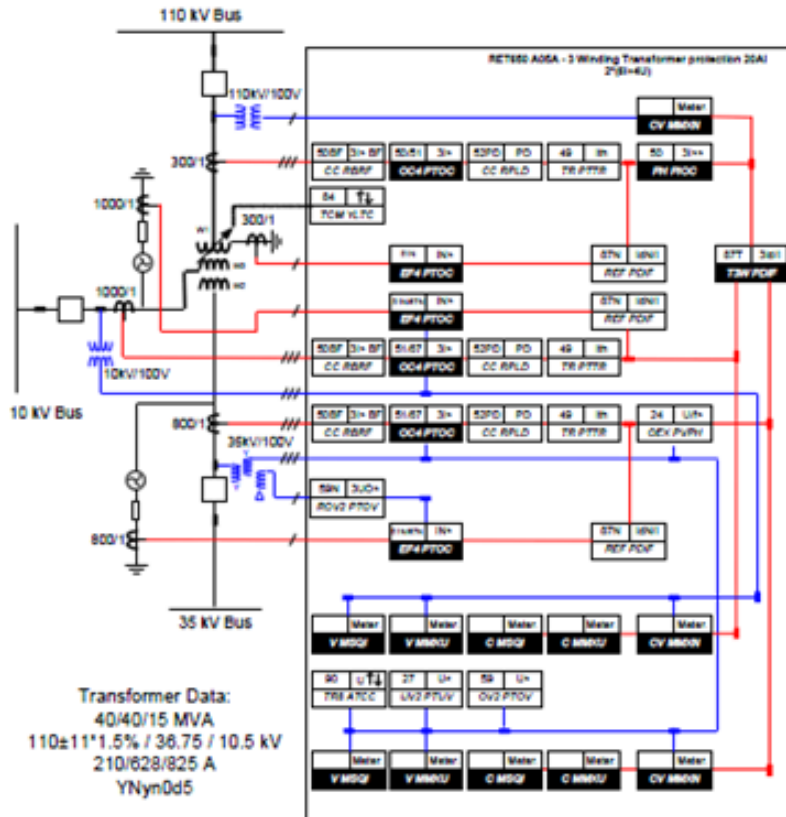
# RET650 for three-winding power transformer

Rear view terminals



- 1/2 of 19" rack
- Two 6I+4V modules (TRM+AIM)
- Power supply module with 9 binary outputs
- COM module with 14 binary inputs
- 2 BIO cards, with 9 binary inputs and 9 binary outputs
- Tap-changer position via BCD code

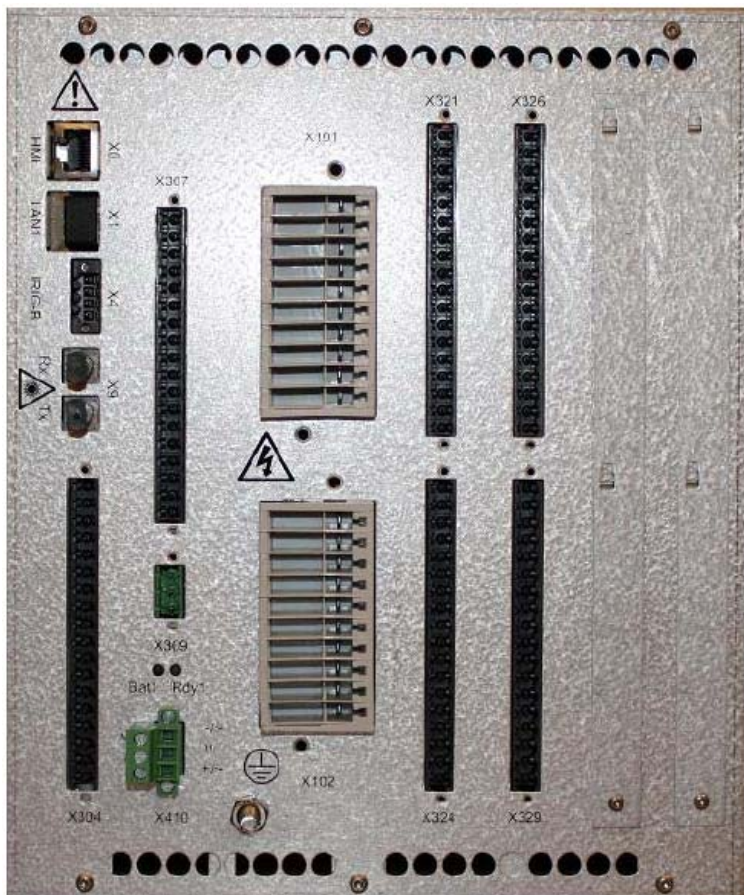
# RET650 for three-winding power transformer



- ½ of 19" rack
- Two 6I+4V modules (TRM+AIM)
- Power supply module with 9 binary outputs
- COM module with 14 binary inputs
- 2 BIO cards, with 9 binary inputs and 9 binary outputs
- OLTC position via BCD code

# RET650 for voltage control Two parallel transformers

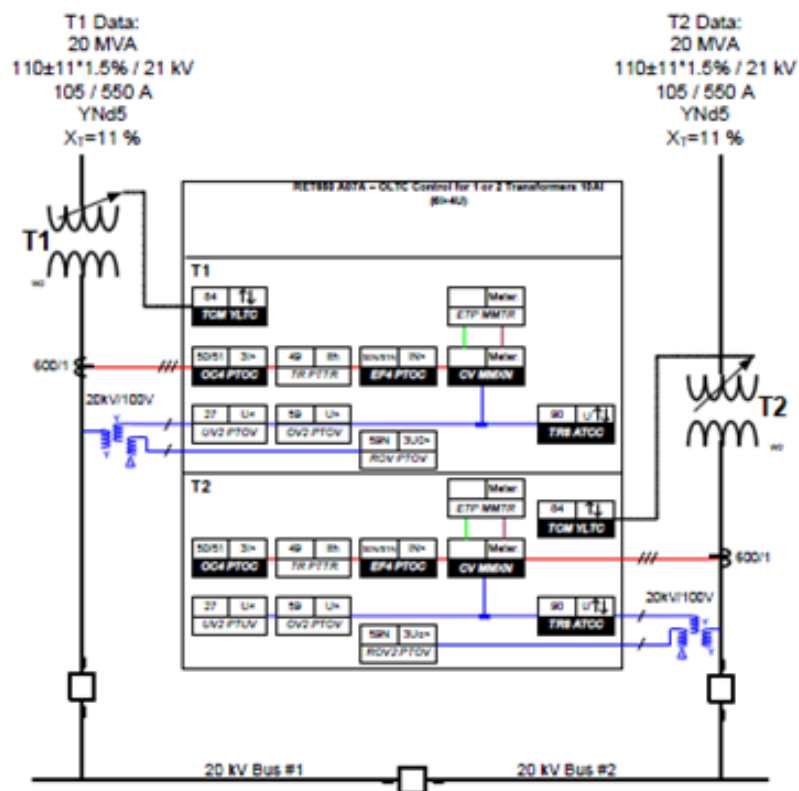
## Two parallel transformers



- 1/2 of 19" rack
- One 6I+4V TRM
- Power supply module with 9 binary outputs
- COM module with 14 binary inputs
- 2 BIO cards, with 9 binary inputs and 9 binary outputs
- Tap-changer positions via BCD code
- Single control for one or two transformers
  - Parallel control based on:  Master-follower or
  - Circulating current
- Backup protection for both W2

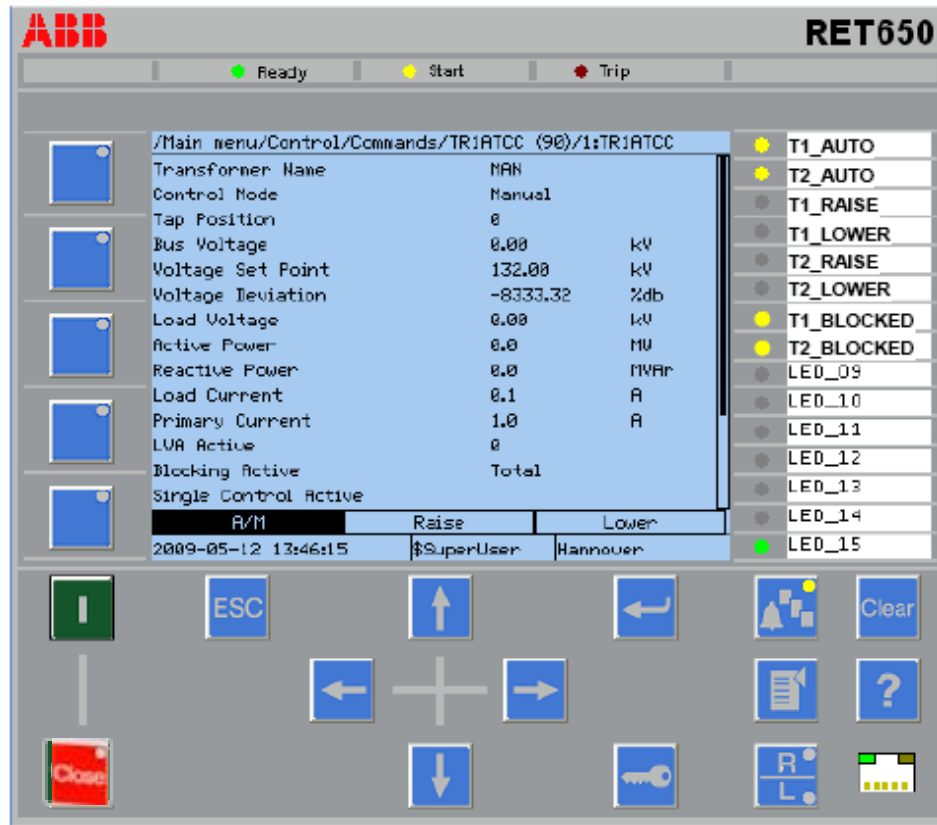
# RET650 for voltage control Two parallel transformers

## Two parallel transformers



- ½ of 19" rack
- One 6I+4V TRM
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- OLTC positions via BCD code
- Single control for one or two transformers
  - Parallel control based on:
    - Master-follower or
    - Circulating current
- Backup protection for both W2



# RET650 voltage control



- Dedicated LHM screen per transformer/VCTR function
- Complete overview about transformer/tap-changer status
- All required measurements
- Single / parallel control info
- Auto/man selection
- Raise/lower commands



# RET670/650

	 <b>RET670</b>	 <b>RET650</b>
Auto-transformers (all sizes)	<input checked="" type="checkbox"/>	
2- and 3-winding transformers	>100MVA <input checked="" type="checkbox"/>	<100MVA <input checked="" type="checkbox"/>
Railway transformers (50/60 Hz)		<input checked="" type="checkbox"/>
Special transformers (Phase shifters, HVDC converter transformers)	<input checked="" type="checkbox"/>	
SVCs and FACTS devices	<input checked="" type="checkbox"/>	
Shunt reactors and Shunt capacitors	Transmission <input checked="" type="checkbox"/>	Sub-transmission Transmission <input checked="" type="checkbox"/>

# High impedance differential busbar protection with Relion<sup>®</sup> 650 series



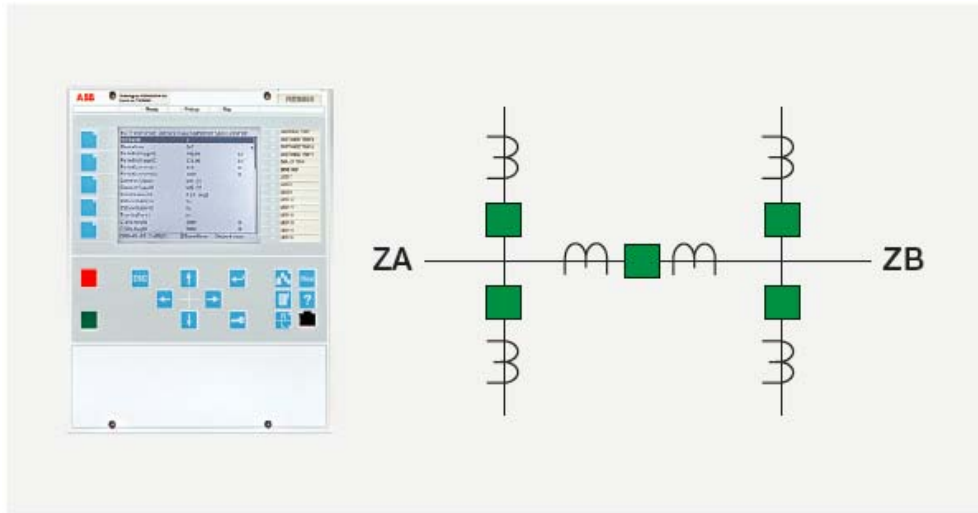
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  - Introduction - Relion<sup>®</sup> 650 series
  - High impedance differential busbar protection with Relion 650 series
  - Applications
  - Technology Summary

# High impedance differential busbar protection with Relion 650 series

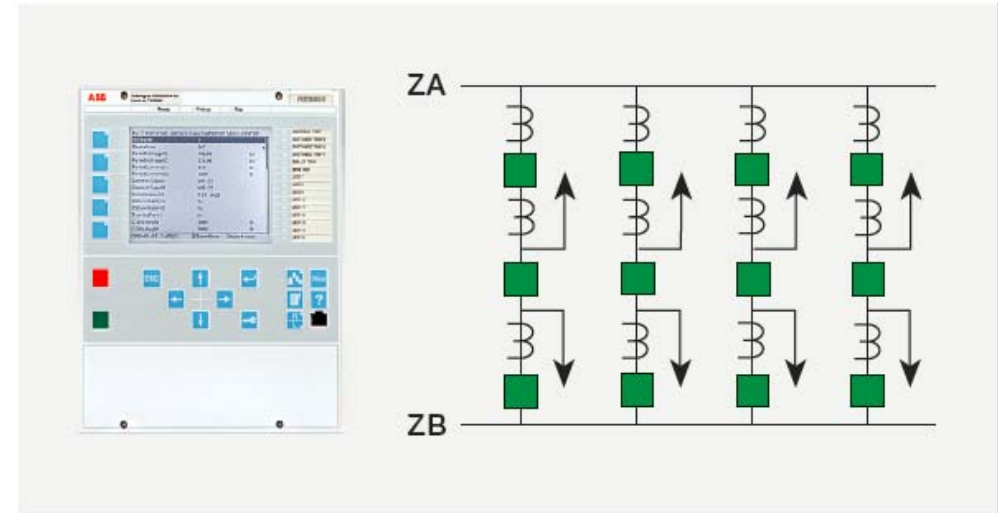


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  - Introduction - Relion® 650 series
  - High impedance differential busbar protection with Relion 650 series
  - Applications
  - Relion – Complete Confidence
  - Technology Summary

# REB650 application examples



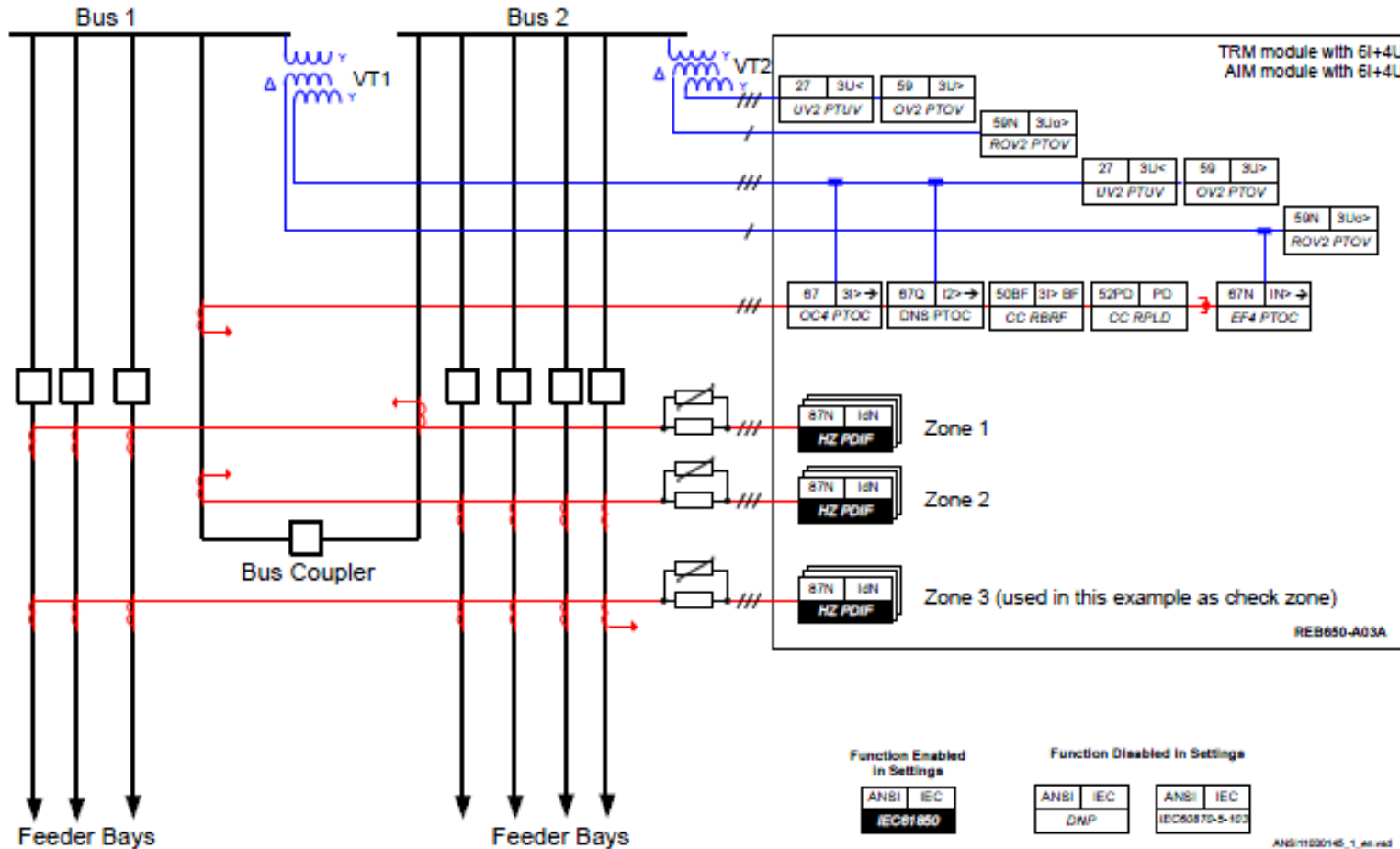
H-type station



1 1/2 breaker station

# Ease of use from ready-to-use solutions

## REB650 – A03



# High impedance differential busbar protection with Relion<sup>®</sup> 650 series



- Contents
  - Introduction - Relion<sup>®</sup> 650 series
  - High impedance differential busbar protection with Relion 650 series
  - Applications
  - **Technology Summary**

# Features

## REB650 - Technology summary



- Fully IEC 61850 compliant
- Protection and monitoring integrated in one IED
- Extensive self-supervision including analog channels
- Four independent parameter setting groups
- Large HMI for visualization of single line diagrams and on-line measurements

# Features

## REB650 - Technology summary



- Integrated or detachable HMI with 1-5 m cable for flexible panel mounting
- Ethernet interface for fast and easy communication with PC
- Accurate time synchronization via SNTP, DNP 3.0, IEC 60870-5-103 and IRIG-B serial interface
- Signal matrix for easy configuration of binary and analog signals
- User management and authority handling



# Long life with high availability

## Replacement and partial retrofit of existing systems



- Easy and cost-efficient way to replace remote back-up protection with local back-up protection.
  - The original main protection can remain in operation
  - Integrated disturbance recorder improve your disturbance information handling.
- Partial replacement and retrofit
  - Combine REQ650 with well-functioning existing relays.
  - Replace the breaker failure protection relay with one REQ650 per bay
  - Additional functionalities will become available
    - Extensive back-up protection functionality, basic control functionality and a disturbance recorder.
  - Saves both time and money

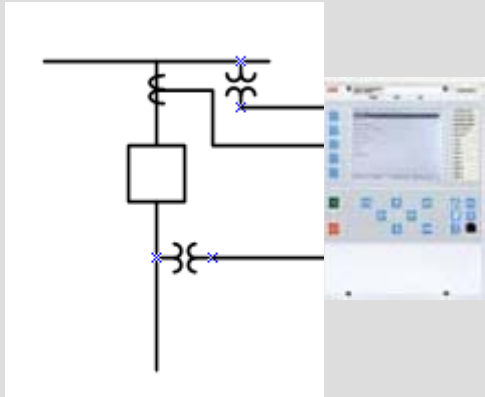
# Breaker protection with Relion<sup>®</sup> 650 series

## Contents

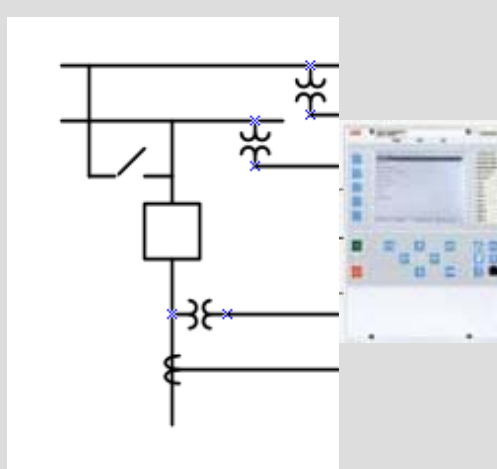


- Introduction - Relion<sup>®</sup> 650 series
- Breaker protection with Relion 650 series
- **Applications**
- Relion – Complete Confidence
- Technology Summary

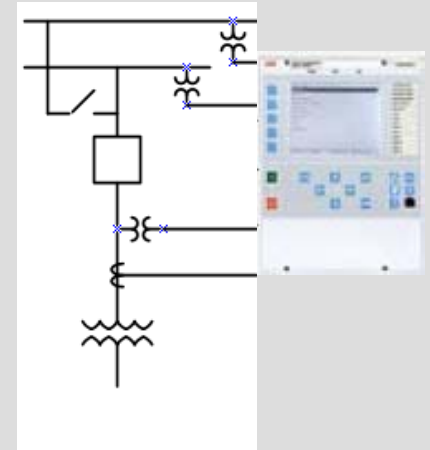
# REQ650 application examples



Line bay in a solidly grounded network, connected to single busbar switchyard



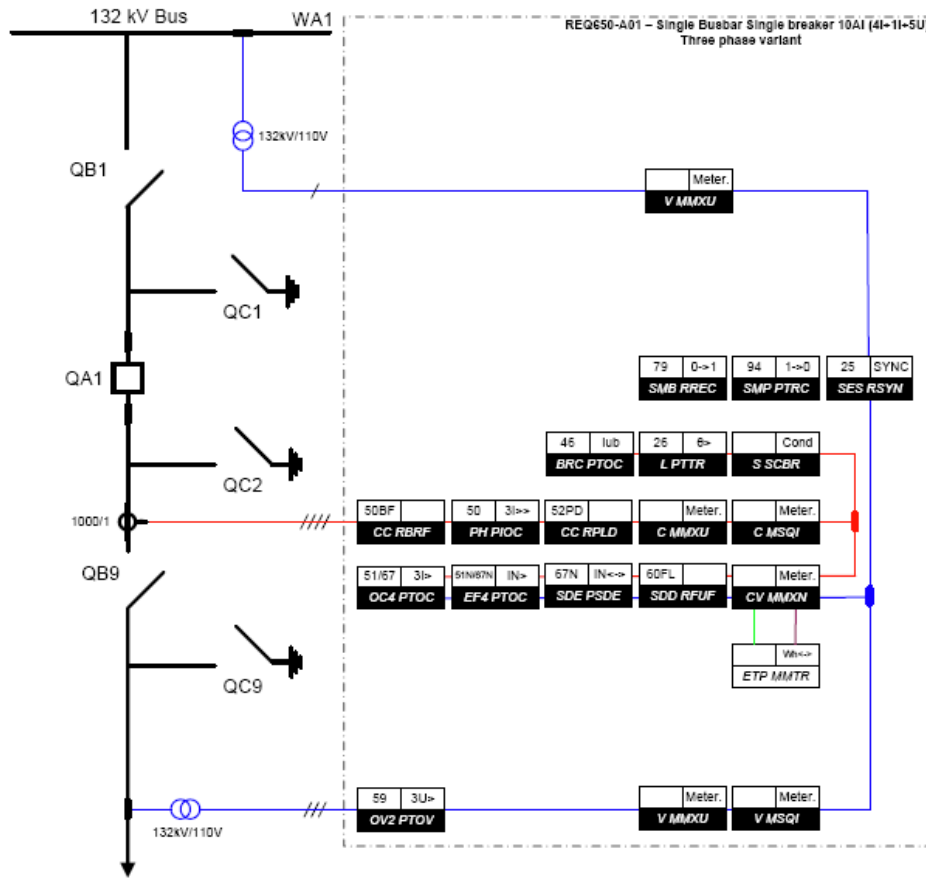
Line bay in a solidly grounded network, connected to double busbar switchyard.



Transformer bay in a solidly grounded network, connected to double busbar switchyard

# Ease of use from ready-to-use solutions

## REQ650 - A01A



Other configured functions

Cond	Cond	Mont.	63
TCS SCBR	SPVN ZBAT	DRP RDRE	S SIMG

Function Enabled  
In Settings

ANSI	IEC
IEC01850	

Function Disabled  
In Settings

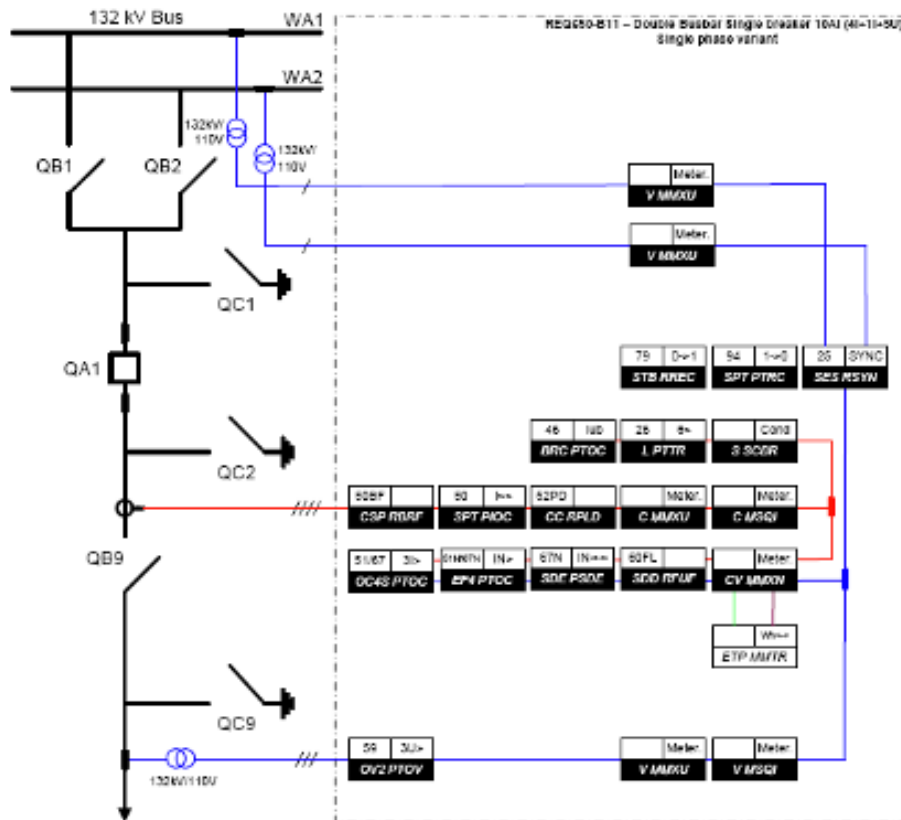
ANSI	IEC
IEC01850	

- Single busbar single breaker 10AI (4I+1I+5U)
- Binary Input/Output modules
  - 1 basic
  - 3 optional
- Three phase variant



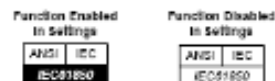
# Ease of use from ready-to-use solutions

## REQ650 – B11A



- Double busbar single breaker 10AI (4I+1I+5U)
- Binary Input/Output modules
  - 2 basic
  - 2 optional
- Single phase variant

other configured functions



# Breaker protection with Relion<sup>®</sup> 650 series

## Contents



- Introduction - Relion<sup>®</sup> 650 series
- Breaker protection with Relion 650 series
- Applications
- **Relion – Complete Confidence**
- Technology Summary

# Relion®

## Complete confidence



The Relion® product family offers widest range of products for protection, control, measurement and supervision for power systems. To ensure interoperable and future-proof solutions, Relion products have been designed to implement the core values of the IEC 61850 standard. With ABB's leading-edge technology, global application knowledge and experienced support network, you can be completely confident that your system performs reliably - in any situation.



# Relion® protection and control

## Highlights in the family



- One common tool for all Relion® products, Protection and Control IED Manager PCM600
- Covers all applications, from generation and interconnected transmission grids to secondary distribution kiosks
- The performance of protection and control IEDs meet the comprehensive IEC 61850 communication tasks, for example, GOOSE messaging for horizontal communication
- The IEDs utilize ABB's unique connectivity package concept
- The Relion product family provides configured, pre-configured or fully customized IEDs

# Breaker protection with Relion<sup>®</sup> 650 series

## Contents



- Introduction - Relion<sup>®</sup> 650 series
- Breaker protection with Relion 650 series
- Applications
- Relion<sup>®</sup> – Complete Confidence
- **Technology Summary**

# Features

## REQ650 - Technology summary



- Fully IEC 61850 compliant
- Protection and monitoring integrated in one IED
- Extensive self-supervision including analog channels
- Four independent parameter setting groups
- Large HMI for visualization of single line diagrams and on-line measurements

# Features

## REQ650 - Technology summary



- Integrated or detachable HMI with 1-5 m cable for flexible panel mounting
- Ethernet interface for fast and easy communication with PC
- Accurate time synchronization via SNTP, DNP 3.0, IEC 60870-5-103 and IRIG-B serial interface
- Signal matrix for easy configuration of binary and analog signals
- User management and authority handling

# Configured solutions

## REQ650 - Technology summary



- Breaker bay with back-up protection functions, three-phase tripping
- Breaker bay connecting a sub-transmission/transmission line, with back-up protection functions, single-phase tripping, single busbar section
- Breaker bay connecting a sub-transmission/transmission line, with back-up protection functions, single-phase tripping, two busbar sections

# Most important protection functions REQ650 - Technology summary

- Current
  - Instantaneous phase overcurrent protection
  - Four step directional phase and residual overcurrent protection
  - Four step phase overcurrent protection
  - Instantaneous residual overcurrent protection
  - Sensitive directional residual overcurrent and power protection
  - Thermal overload protection
  - Breaker failure protection
  - Stub protection
  - Pole discordance protection
  - Broken conductor check
  - Directional under- and overpower protection
  - Two step negative sequence based overcurrent protection

# Most important protection functions

## REQ650 - Technology summary



- Power functions
  - Directional under- and over power protection
- Voltage
  - Two step under- and overvoltage protection
  - Two step residual overvoltage protection
  - Loss of voltage check
- Frequency protection
  - Under- and overfrequency protection
  - Rate-of-change frequency protection
- Secondary system supervision
  - Current circuit supervision
  - Fuse failure supervision
  - Breaker close/trip circuit monitoring

# Monitoring

## REQ650 - Technology summary

- Disturbance recorder
  - 100 disturbances
  - 40 analog channels (30 physical and 10 derived)
  - 96 binary channels
- Event list for 1000 events
- Disturbance report
- Event and trip value recorders
- Event counters
- Supervision of AC input quantities
- Insulation gas monitoring function
- Insulation liquid monitoring function
- Circuit breaker condition monitoring
- Station battery supervision
- Indication of up to 135 binary signals via 15 three-color-state
- Indication LEDs on up to three pages



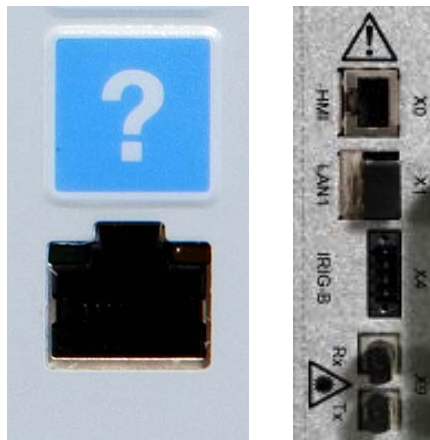
# Measurements, metering and communication REQ650 - Technology summary

/Main menu/Control/Single Line Diagram/W1 Measurands

W1 Voltage =	110.00 kV
W1 Current =	1605.03 A
W1 Active Power =	274.56 MW
W1 Reactive Power =	204.15 MVar
W1 Power Factor =	0.80
W1 Frequency =	50.00 Hz

2009-11-12 13:55:42 | \$SuperUser

- Measurements
  - U, I, P, Q, S, f, and  $\cos \phi$
  - AC input quantities with accuracy better than 0.5%
- Metering
  - Energy metering function for energy statistics
  - Pulse counting support for energy metering
- Communication
  - IEC 61850-8-1 including GOOSE messaging
  - DNP 3.0 slave protocol
  - IEC 60870-5-103 serial communication



# Tools and hardware

## REQ650 - Technology summary



- Setting, configuration and disturbance handling
  - Protection and control IED manager PCM600
- Hardware
  - 1/2 x 19", 6U height case
  - 10 analog inputs (5 CT and 5 VT inputs)
  - Universal 1A/5A CT inputs
  - Communication and processor module with 14 inputs
  - Binary input/output modules with 9 inputs and 9 outputs
  - Possibility to add up to two optional binary input/output modules depending on the selected configuration
  - Power supply modules from 48 to 250 V DC or 100 to 240 V AC with 9 outputs, 3 of which with trip circuit supervision

# Relion® 620 series

## RER620

### Introduction

Application examples

Hardware and options

Functionality

Communication

Mechanical design

Front panel HMI

Tools

Conclusions



- RER620 is a member of ABB's Relion® product family and part of its 620 protection and control product series
- The 620 series IEDs are characterized by their compactness and withdrawable design

# RER620

## Description

### Introduction

Application examples

Hardware and options

Functionality

Communication

Mechanical design

Front panel HMI

Tools

Conclusions



- RER620 is a dedicated IED designed for the protection, measurement, control and supervision of ABB GridShield reclosers

# RER620

## Recloser Protection and Control

### Introduction

Application examples

Hardware and options

Functionality

Communication

Mechanical design

Front panel HMI

Tools

Conclusions



- Designed for general applications calling for over-current and ground/earth-fault protection
- Main application area: Recloser installed on overhead line feeders or cables in solidly grounded/earthed, resistance grounded/earthed, isolated or compensated networks
- Designed for IEC 61850
- Integrated Loop Control Scheme for improved Feeder reliability

# RER620

## Functional overview

### Introduction

Application examples

Hardware and options

Functionality

Communication

Mechanical design

Front panel HMI

Tools

Conclusions

- Directional overcurrent and directional ground/earth-fault protection with phase and sequence-voltage based protection, under/ overvoltage, under/over frequency, load shed & restoration, High Impedance Detection protection available
- Possibility to add, delete and change signal connections for binary inputs, binary outputs and between function blocks using PCM600
- The number and type of function blocks is fixed

# RER620

## Functional overview

<b>Introduction</b>	<b>Protection</b>
Application examples	Three-phase non-directional time overcurrent protection with 1-ph trip option, low stage
Hardware and options	Three-phase non-directional time overcurrent protection with 1-ph trip option, high stage, instance 1 & 2
Functionality	Three-phase non-directional instantaneous overcurrent protection with 1-ph trip option
Communication	Non-directional time overcurrent ground-fault protection, low stage
Mechanical design	Non-directional time overcurrent ground-fault protection, high stage, instance 1 & 2
Front panel HMI	Non-directional instantaneous time overcurrent ground/earth-fault protection
Tools	Non-directional sensitive earth-fault
Conclusions	Negative sequence non-directional time overcurrent protection, instance 1 & 2
	Phase discontinuity protection
	Three-phase inrush detector
	Three-phase directional overcurrent protection, low stage, instance 1 & 2
	Directional ground-fault protection, low stage, instance 1 & 2
	Three-phase overvoltage , source 1 low stage, instance 1 & 2
	Three-phase overvoltage , source 2 low stage
	Three-phase undervoltage , source 1 low stage, instance 1 & 2
	Three-phase undervoltage , source 2 low stage
	Positive sequence overvoltage protection, source1

# RER620

## Functional overview

### Introduction

Application examples

Hardware and options

Functionality

Communication

Mechanical design

Front panel HMI

Tools

Conclusions

### Protection

Positive sequence overvoltage protection, source 2

Negative sequence overvoltage protection, source1

Negative sequence overvoltage protection, source 2

Zero sequence overvoltage protection, source1

Zero sequence overvoltage protection, source 2

Underfrequency, Overfrequency, Frequency rate of change, source1

Underfrequency, Overfrequency, Frequency rate of change, source 2

Load Shed & Restoration, source1

Load Shed & Restoration, source 2

High Impedance Fault Detector

Circuit breaker failure protection

Directional positive sequence power protection

Directional negative/zero sequence power protection

### Control

Autoreclosing, 1ph and/or 3-ph

Synchro-check/voltage check

Circuit Breaker 1 (3 state inputs / 3 control outputs)

Loop control



# RER620

## Functional overview

### Introduction

Application examples

Hardware and options

Functionality

Communication

Mechanical design

Front panel HMI

Tools

Conclusions

### Condition monitoring

Recloser condition monitoring

Fuse failure supervision

### Measurements

Three-phase current

Demand metering, Max/Min metering

Sequence current

Ground current

Three-phase voltage, source

Three-phase voltage, load

Sequence Voltages, Source

Sequence Voltages, Load

Three-phase power and energy (incl.  $\cos \phi$ )

Frequency

### Recorders

Disturbance recorder

Sequence of Events (SER)

Fault Recorder

# RER620

## Application example 1(4)

Introduction

**Application examples**

Hardware and options

Functionality

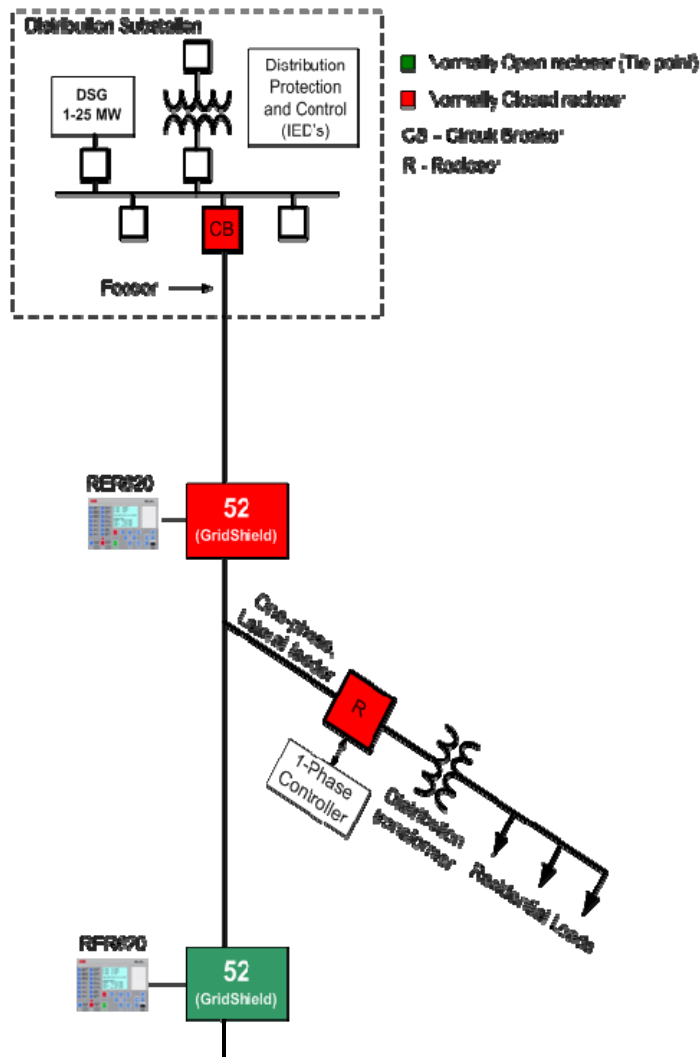
Communication

Mechanical design

Front panel HMI

Tools

Conclusions



- Designed for GridShield recloser applications calling for **over-current, ground/earth-fault protection and automatic reclosing**
- Main application areas:
  - **Recloser in overhead line feeders** in solidly grounded, resistance grounded, isolated or compensated networks
  - GridShield recloser as **substation breaker** in solidly grounded, resistance grounded, isolated or compensated networks



# RER620

## Application example 3(4)

Introduction

### Application examples

Hardware and options

Functionality

Communication

Mechanical design

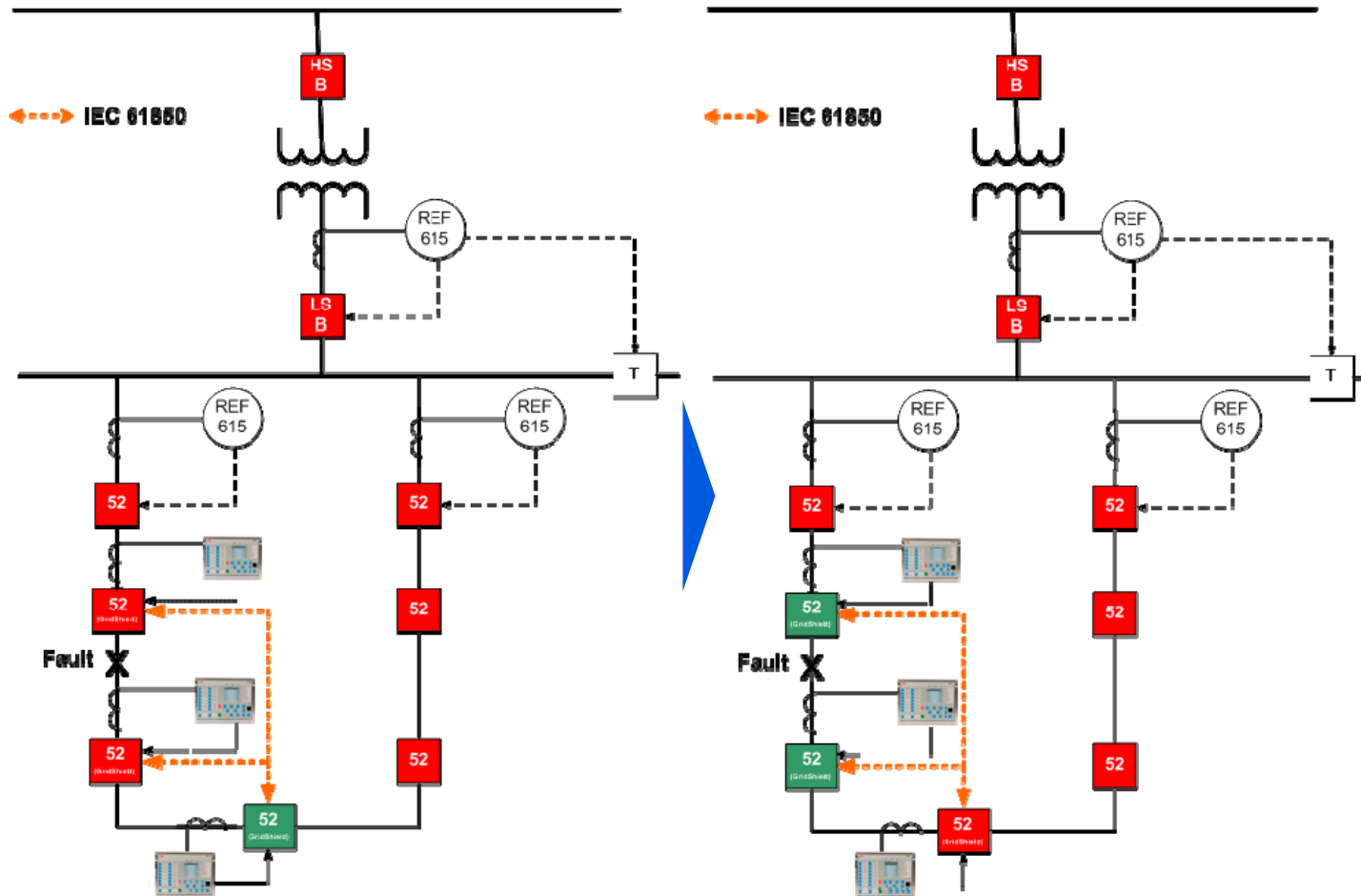
Front panel HMI

Tools

Conclusions

Peer-to-peer relay  
"Fault Detection  
Isolation and  
Restoration

(FDIR) control using  
IEC61850 GOOSE  
messaging



# RER620

## Application example 4(4)

Introduction

**Application examples**

Hardware and options

Functionality

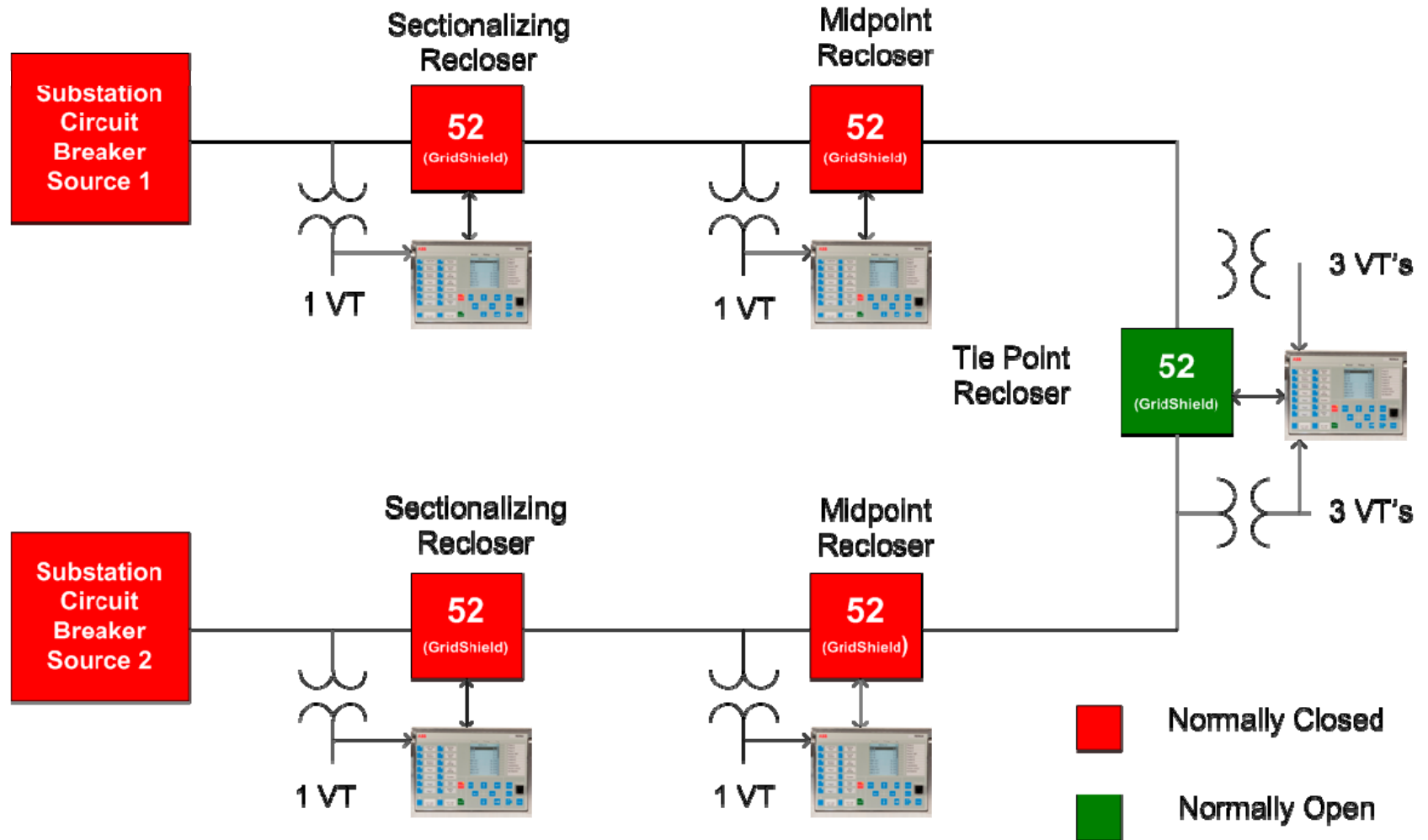
Communication

Mechanical design

Front panel HMI

Tools

Conclusions



# RER620

## Application with ABB GridShield recloser

Introduction

**Application examples**

Hardware and options

Functionality

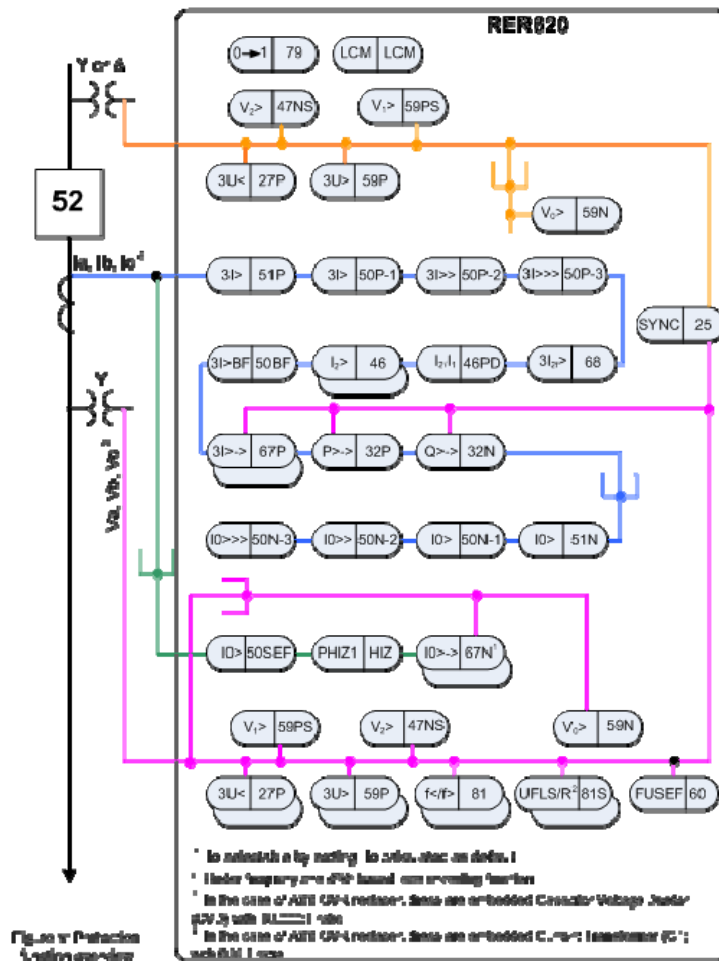
Communication

Mechanical design

Front panel HMI

Tools

Conclusions





# Feeder protection and control REF615 V4.0 ANSI

# REF615 V4.0 ANSI product release

## Functions and features



- Five functional application configurations:

### **4) Functional Appl**

A: Non-directional phase and ground overcurrent protection for single breaker

B: Non-directional phase and ground overcurrent protection for two breakers

C: Directional phase and ground overcurrent, voltage and frequency protection and power system metering for one breaker

D: Directional phase and ground overcurrent, voltage and frequency protection, synch check and power system metering for one breaker

E: Non-directional phase and ground overcurrent, voltage and power directional protection and power system metering for two breakers



# REF615 V4.0 ANSI product release

## Functions and features (2)



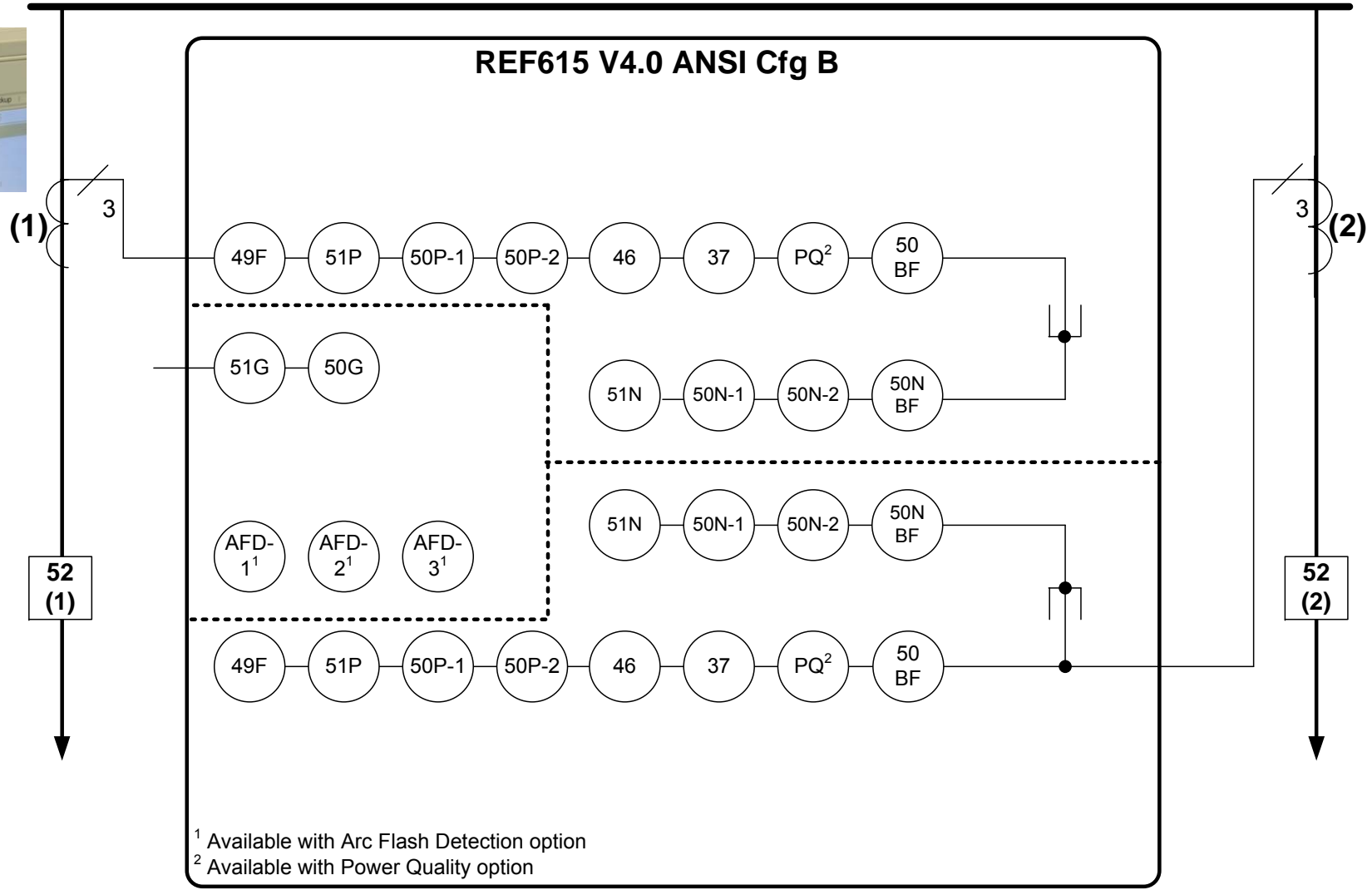
- Power quality
  - Available for all five functional applications A – F
- Load profile
  - Available for functional applications A, C and D
- Fault location
  - Available with VT Inputs for protection



# REF615 V4.0 ANSI product release

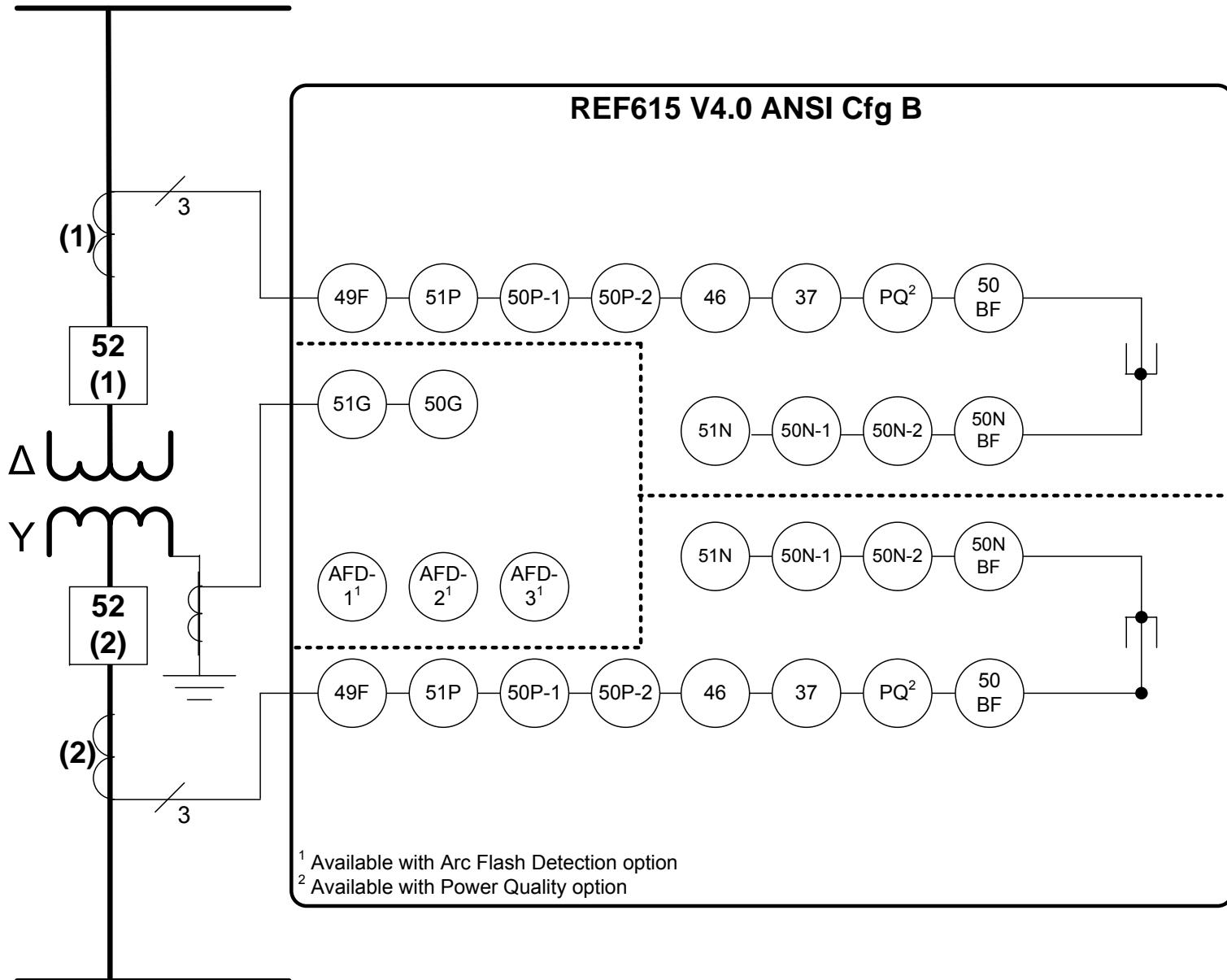
## Functional application B – example 1

Bus A



# REF615 V4.0 ANSI product release

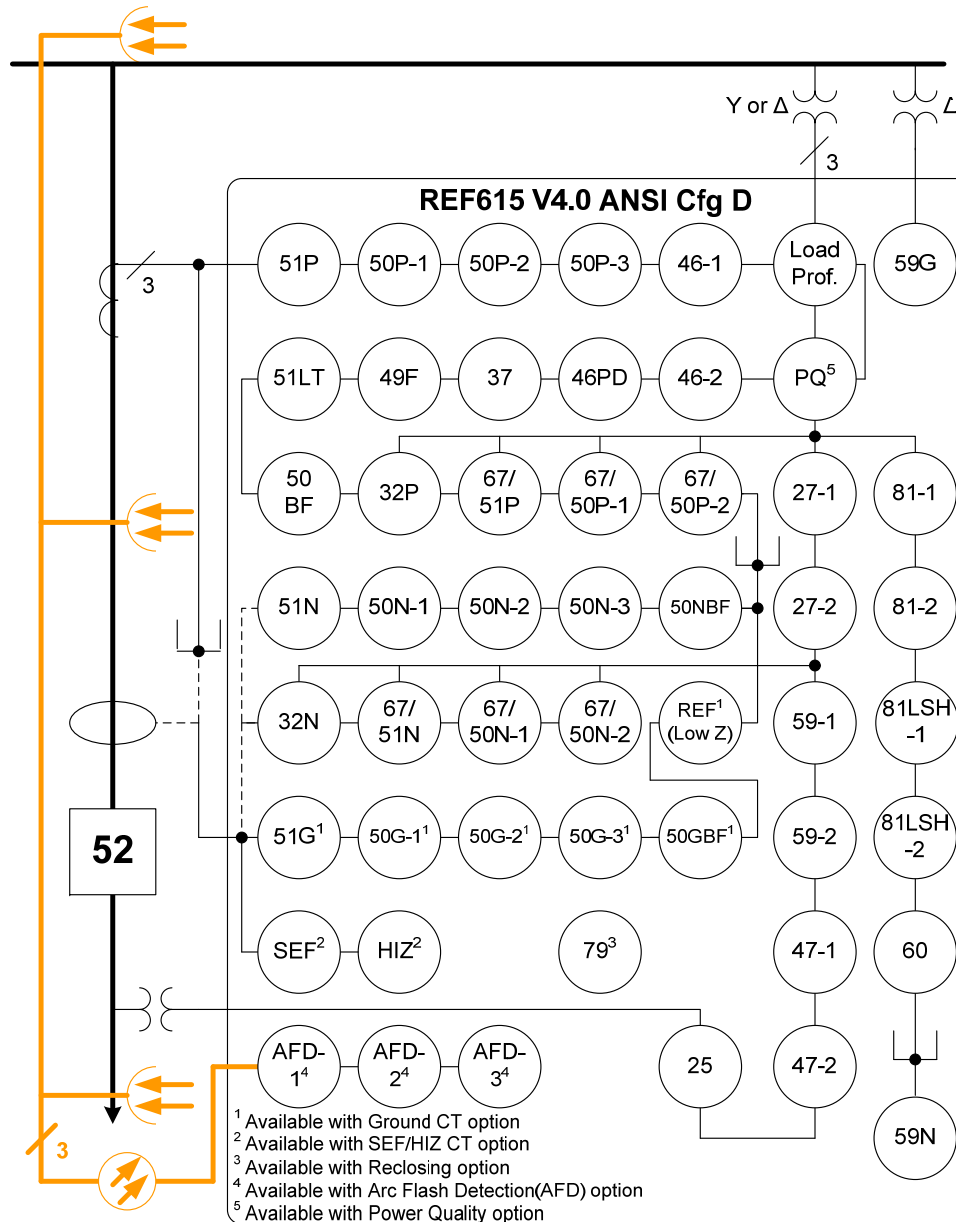
## Functional application B – example 2





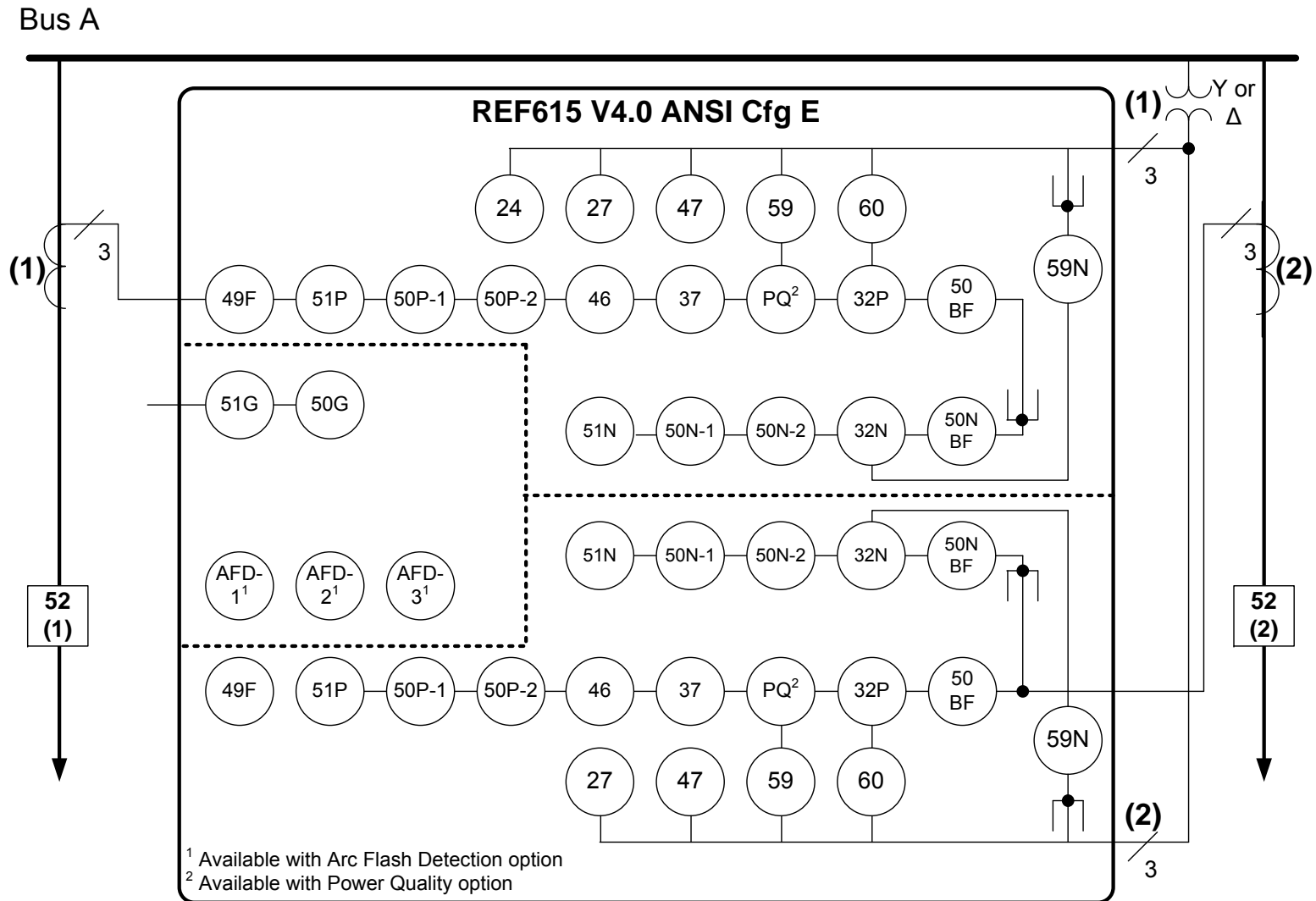
# REF615 V4.0 ANSI product release

## Functional application D



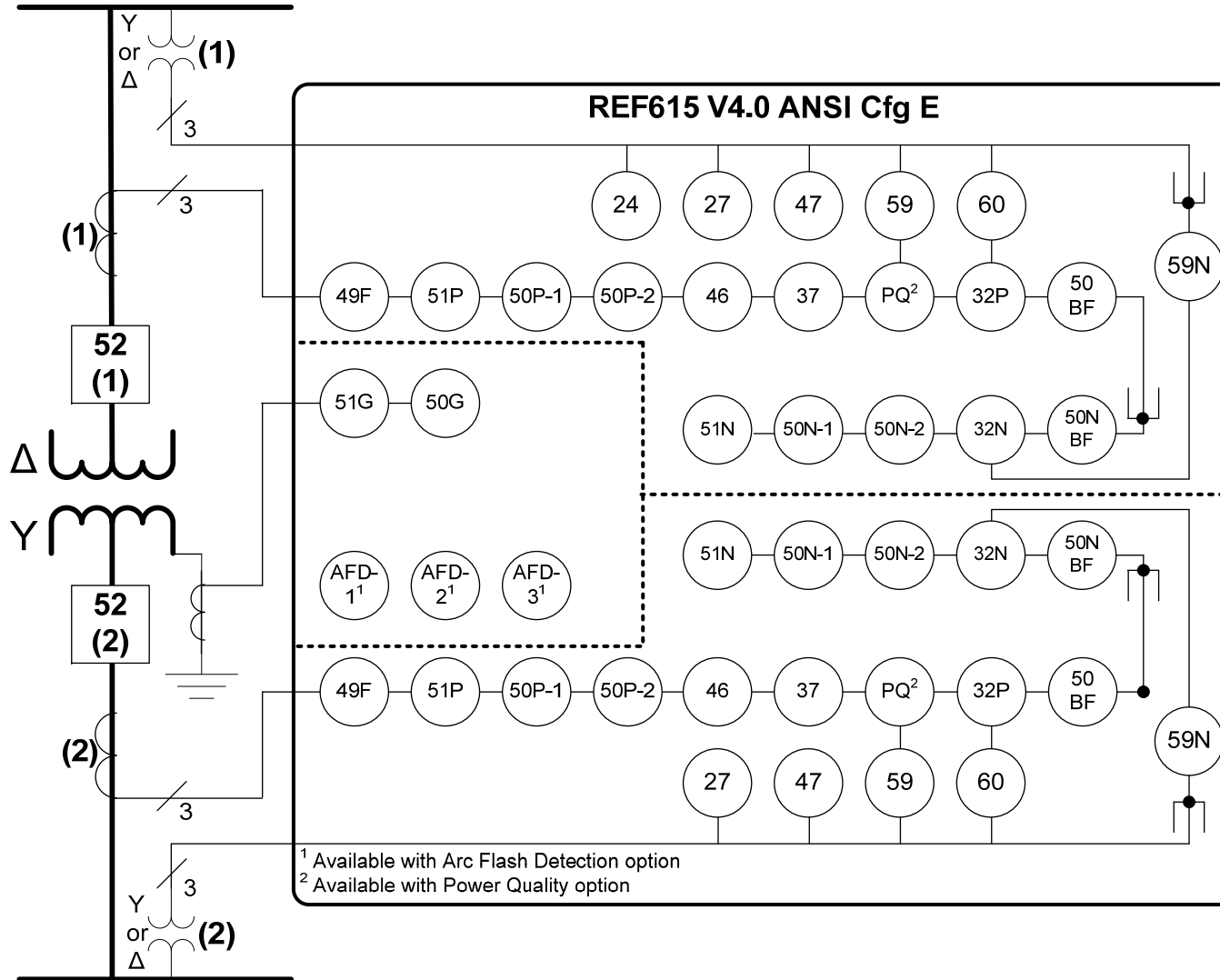
# REF615 V4.0 ANSI product release

## Functional application E – example 1



# REF615 V4.0 ANSI product release

## Functional application E – example 2







# Motor protection and control REM615 V4.0 ANSI

# REM615 V4.0 ANSI product release

## Functions and features



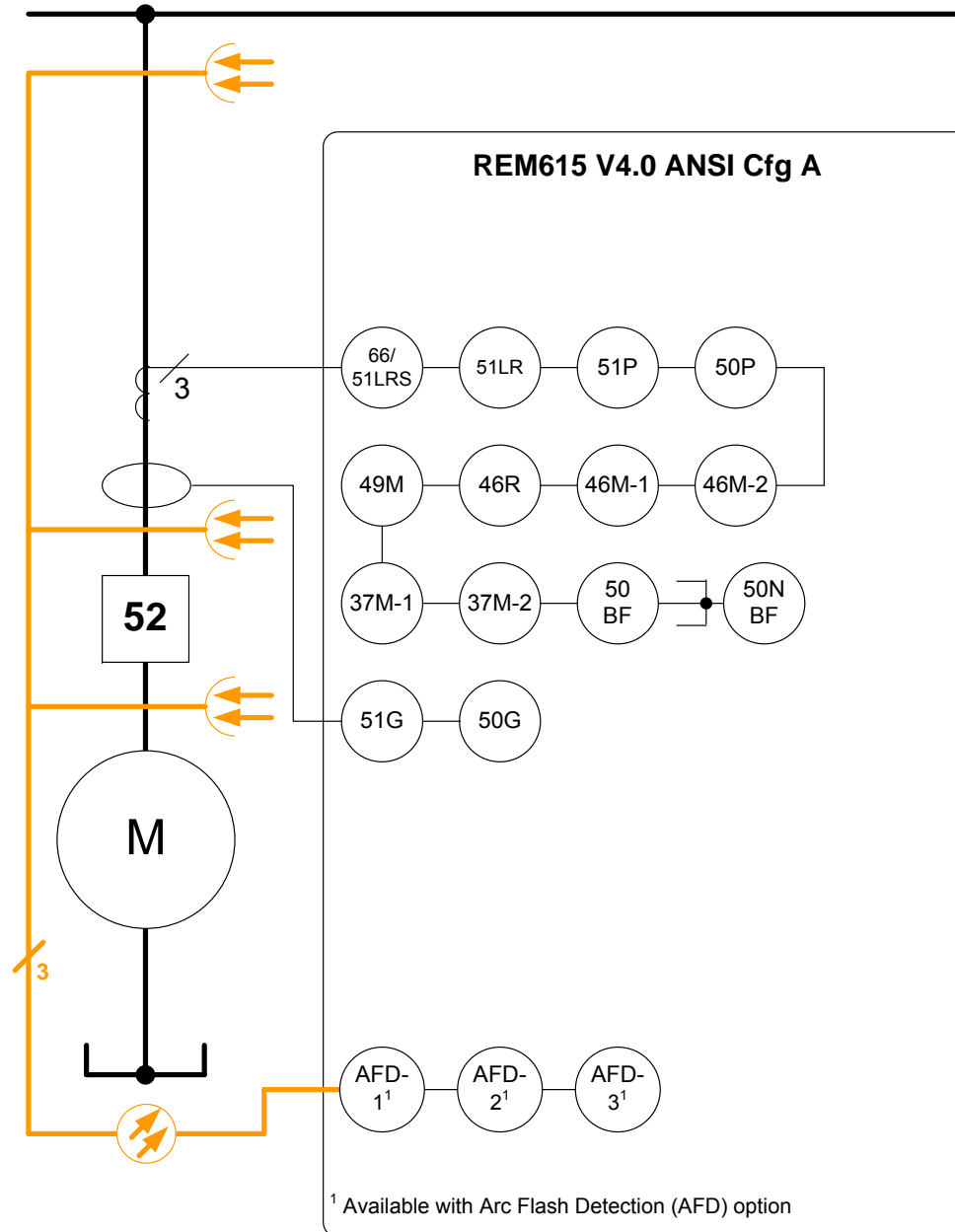
- Six functional application configurations

#### 4) *Functional Appl*

A: Overcurrent and load loss protection for small motors	A
B: Differential, overcurrent, load loss and RTD protection for medium to large motors	B
C: Overcurrent, load loss, phase and ground voltage and frequency protection and power system metering for medium motors	C
D: Overcurrent, load loss, phase and ground voltage, frequency and RTD protection and power system metering for medium motors	D
E: Overcurrent, load loss, phase and neutral voltage and frequency protection and power system metering for medium motors	E
F: Overcurrent, load loss, phase and neutral voltage, frequency and RTD protection and power system metering for medium to large motors	F

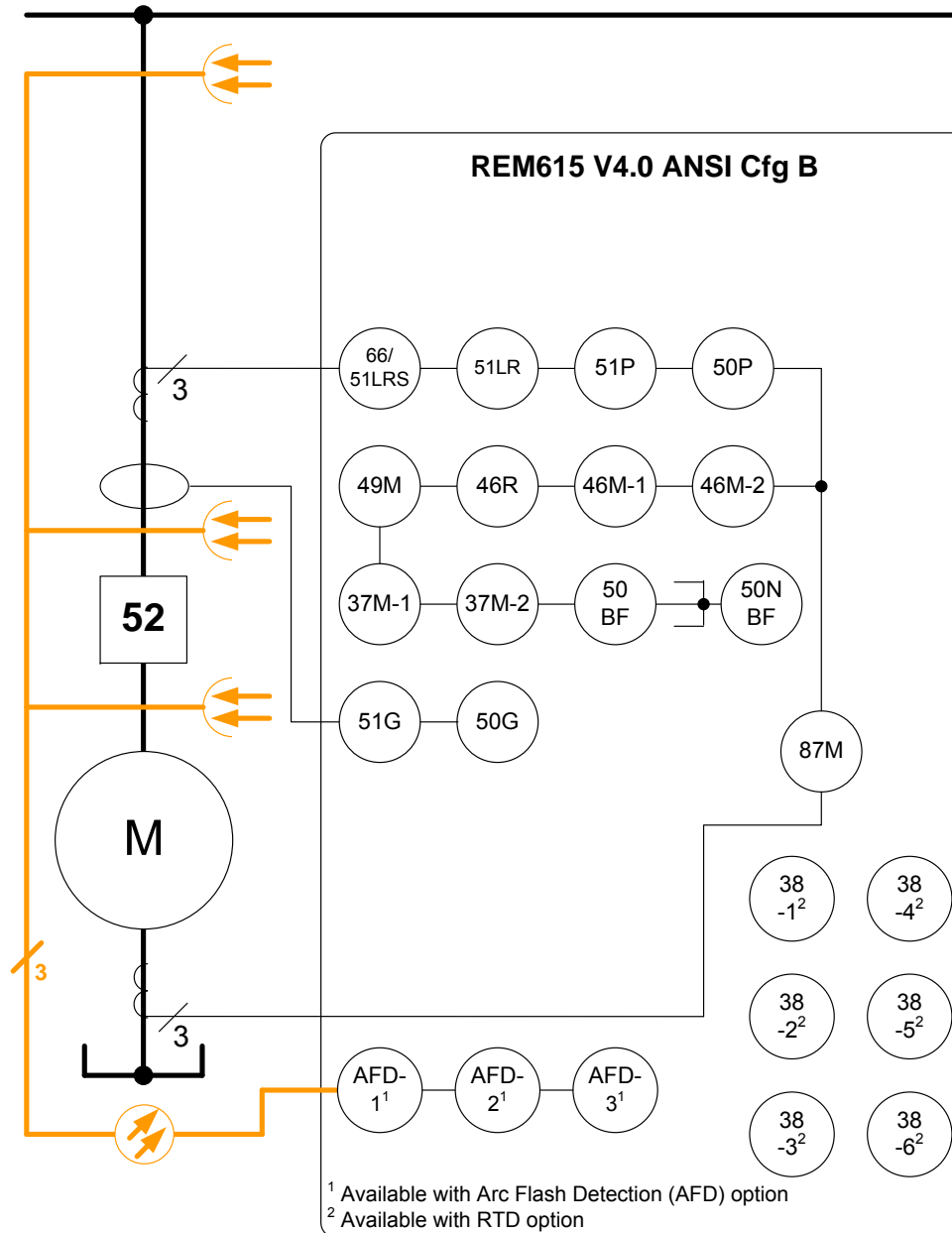
# REM615 V4.0 ANSI product release

## Functional application A



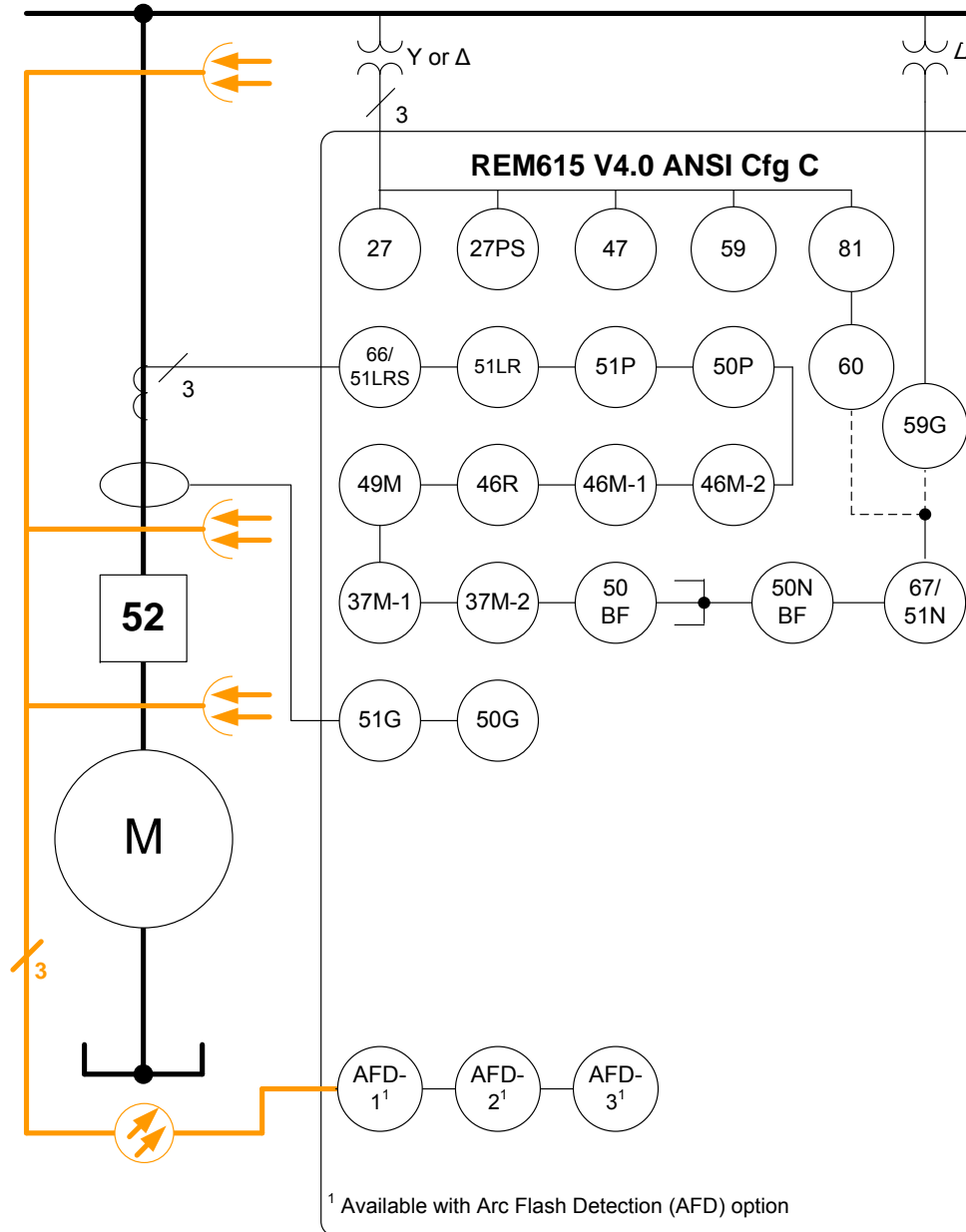
# REM615 V4.0 ANSI product release

## Functional application B



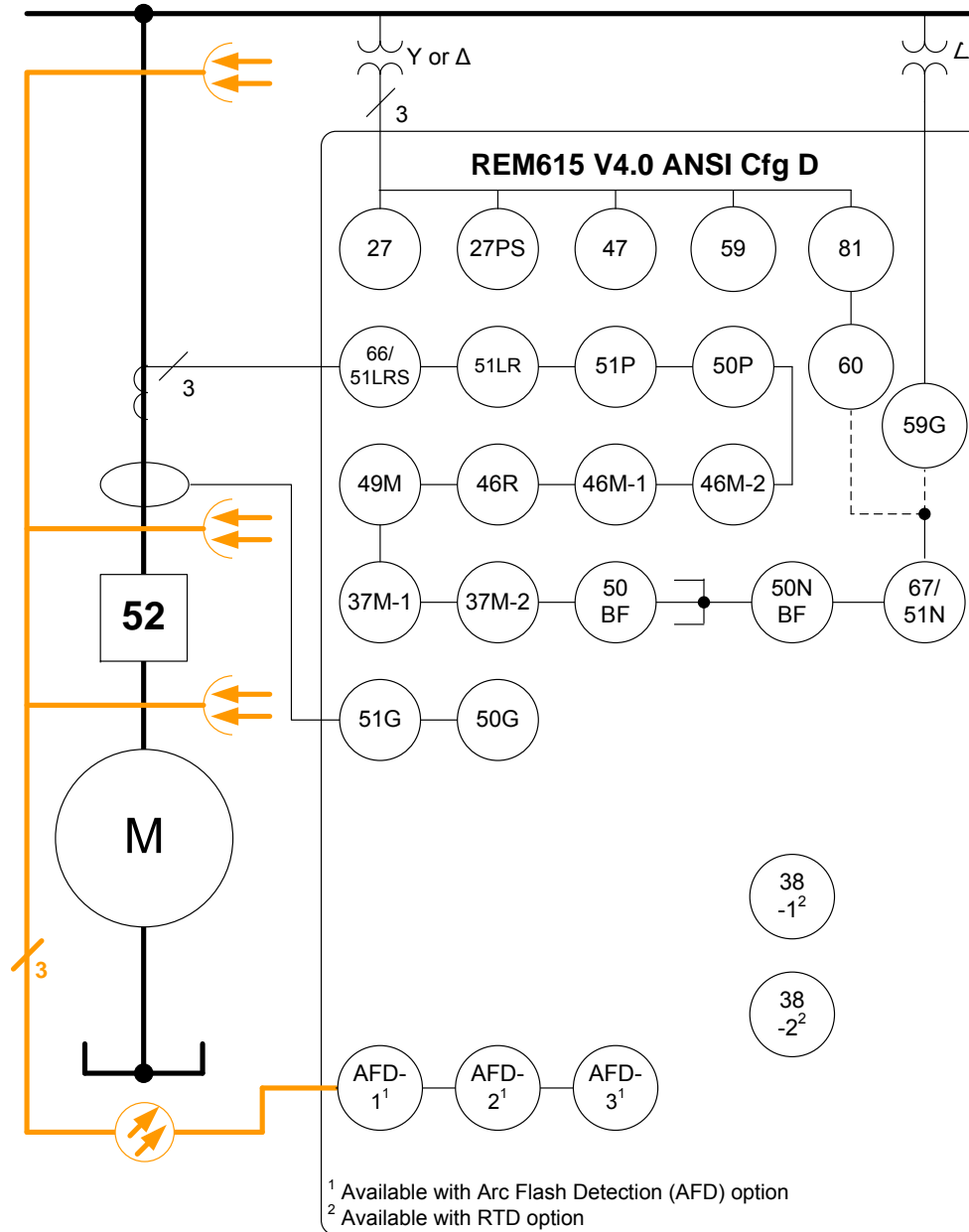
# REM615 V4.0 ANSI product release

## Functional application C



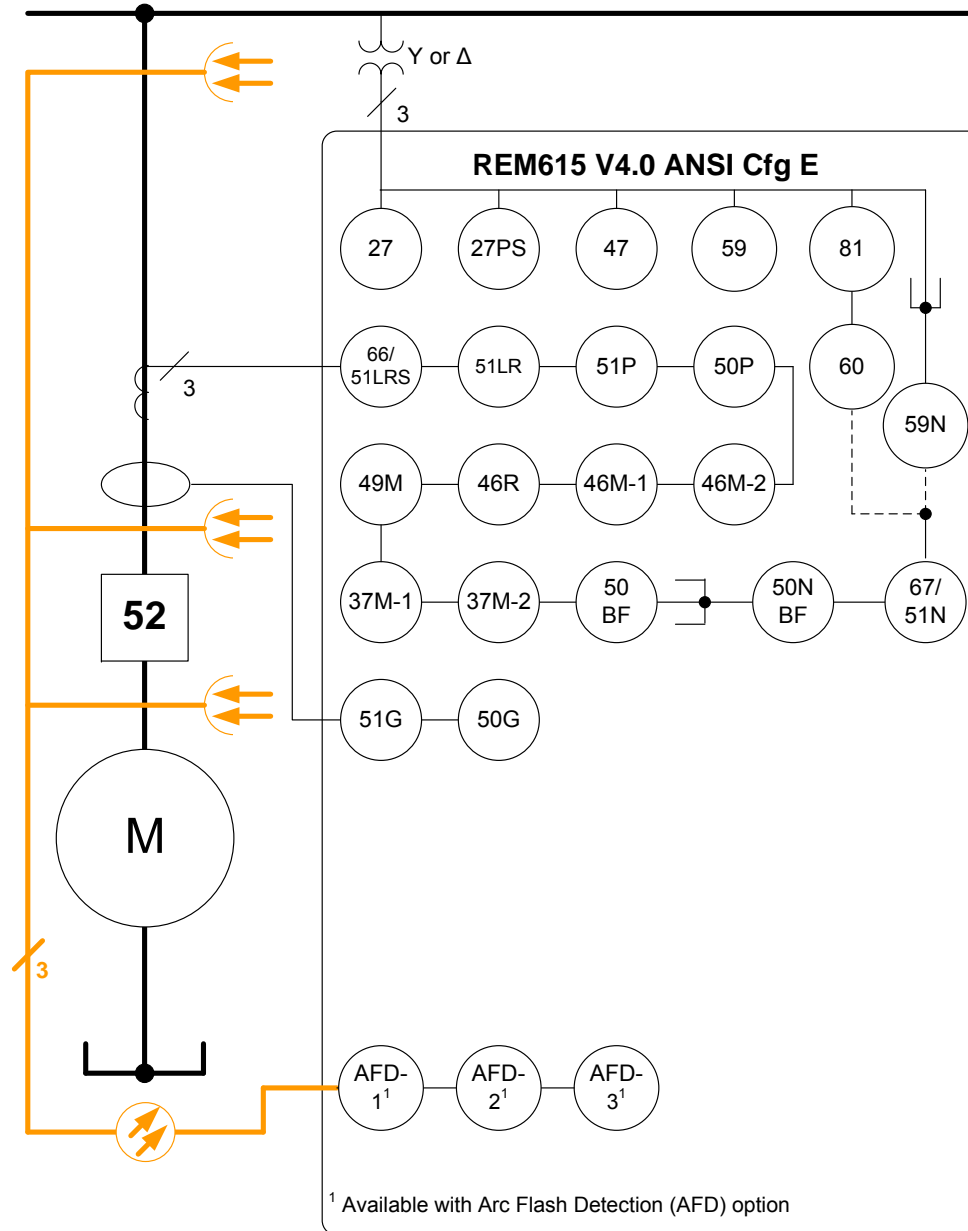
# REM615 V4.0 ANSI product release

## Functional application D



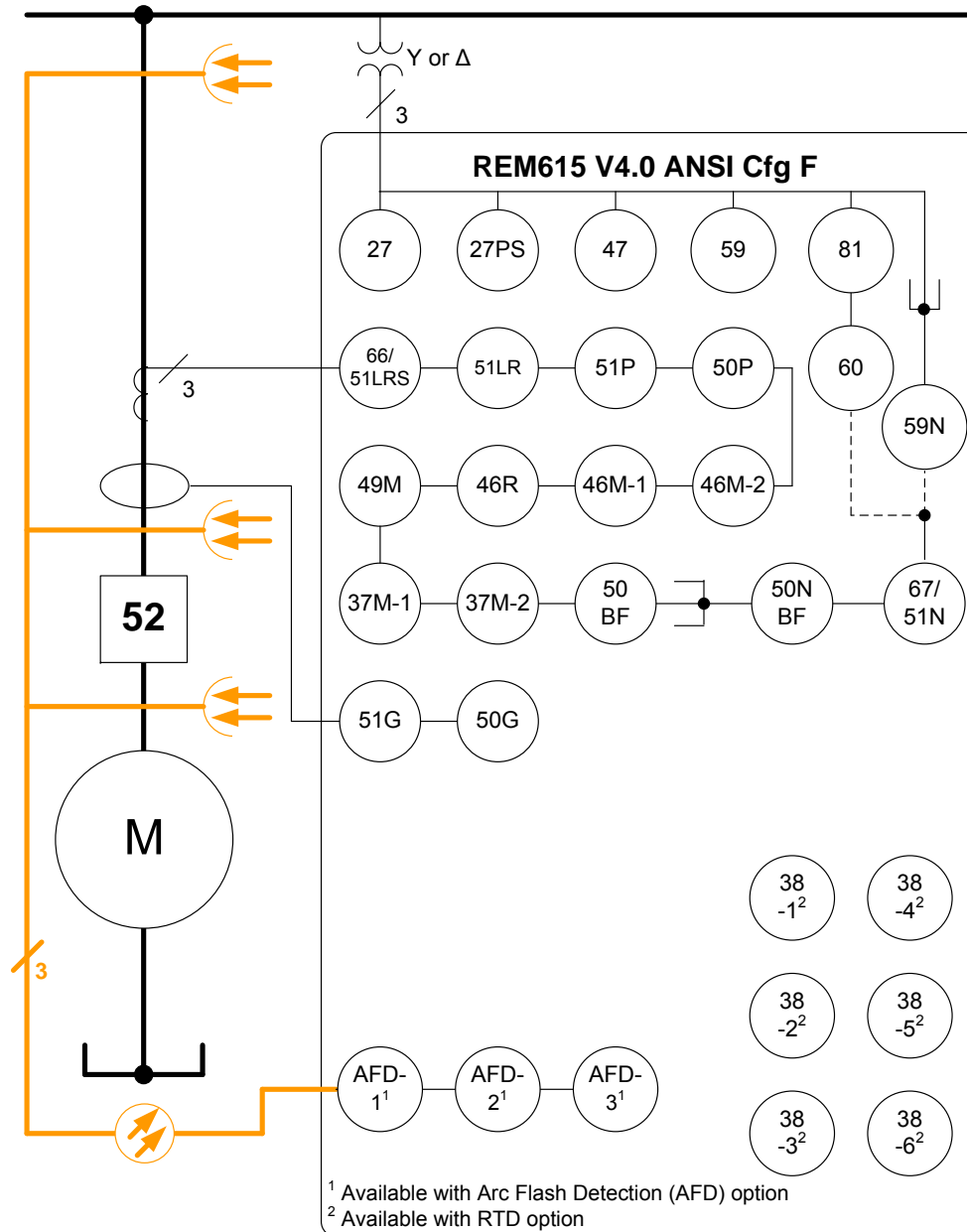
# REM615 V4.0 ANSI product release

## Functional application E



# REM615 V4.0 ANSI product release

## Functional application F







# Power transformer protection and control RET615 V4.0 ANSI

# RET615 V4.0 ANSI product release

## Functional applications



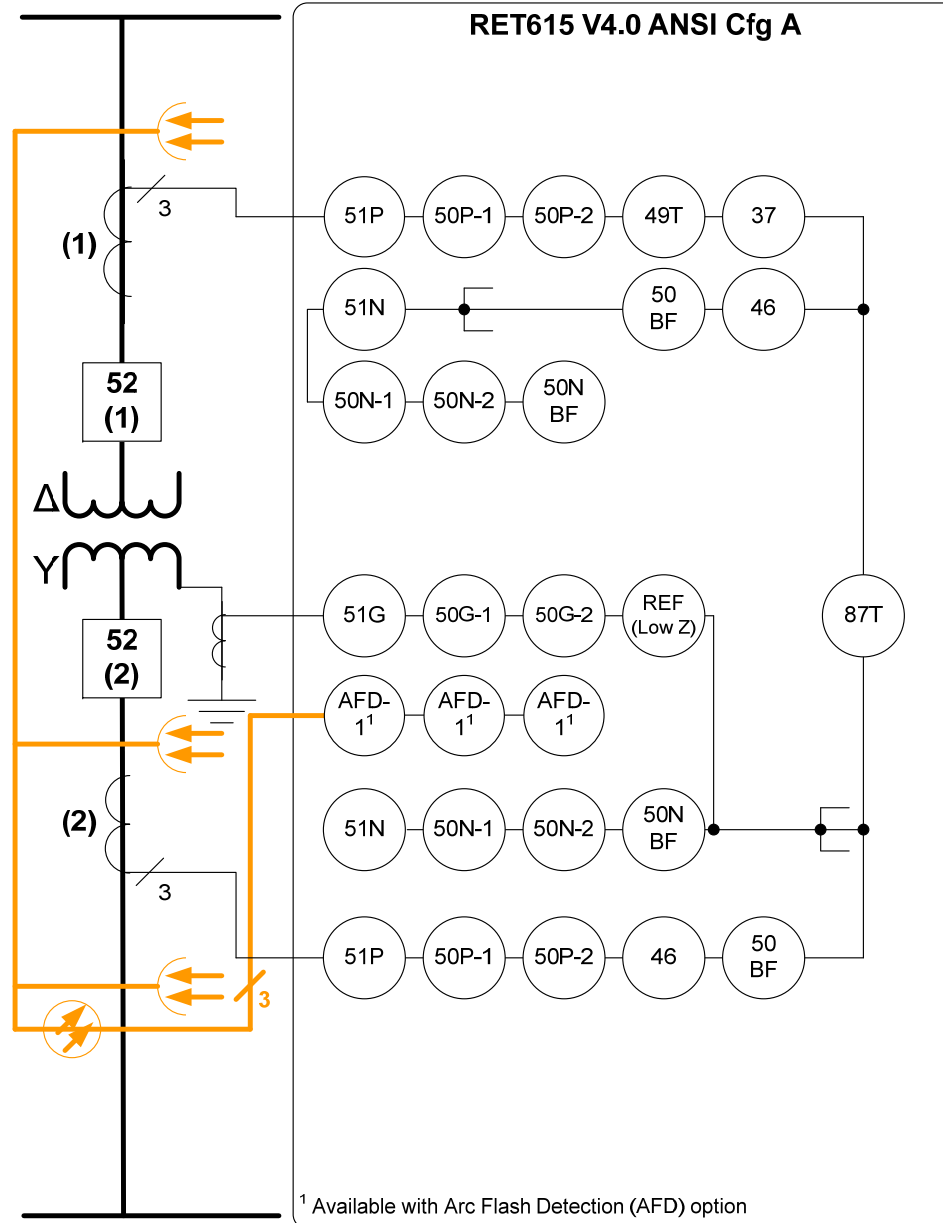
- Four functional application configurations

### 4) *Functional Appl*

A: Differential and overcurrent protection for two-winding transformers	A
B: Differential, overexcitation, overcurrent, voltage (winding 1 or 2) and frequency protection and power system metering for two-winding transformers	B
C: Differential, overexcitation overcurrent, voltage (winding 1 or 2), frequency and RTD protection and power system metering for two-winding transformers	C
D: Differential, overexcitation, overcurrent, voltage (windings 1 and 2) and frequency protection and power system metering for two-winding transformers	D

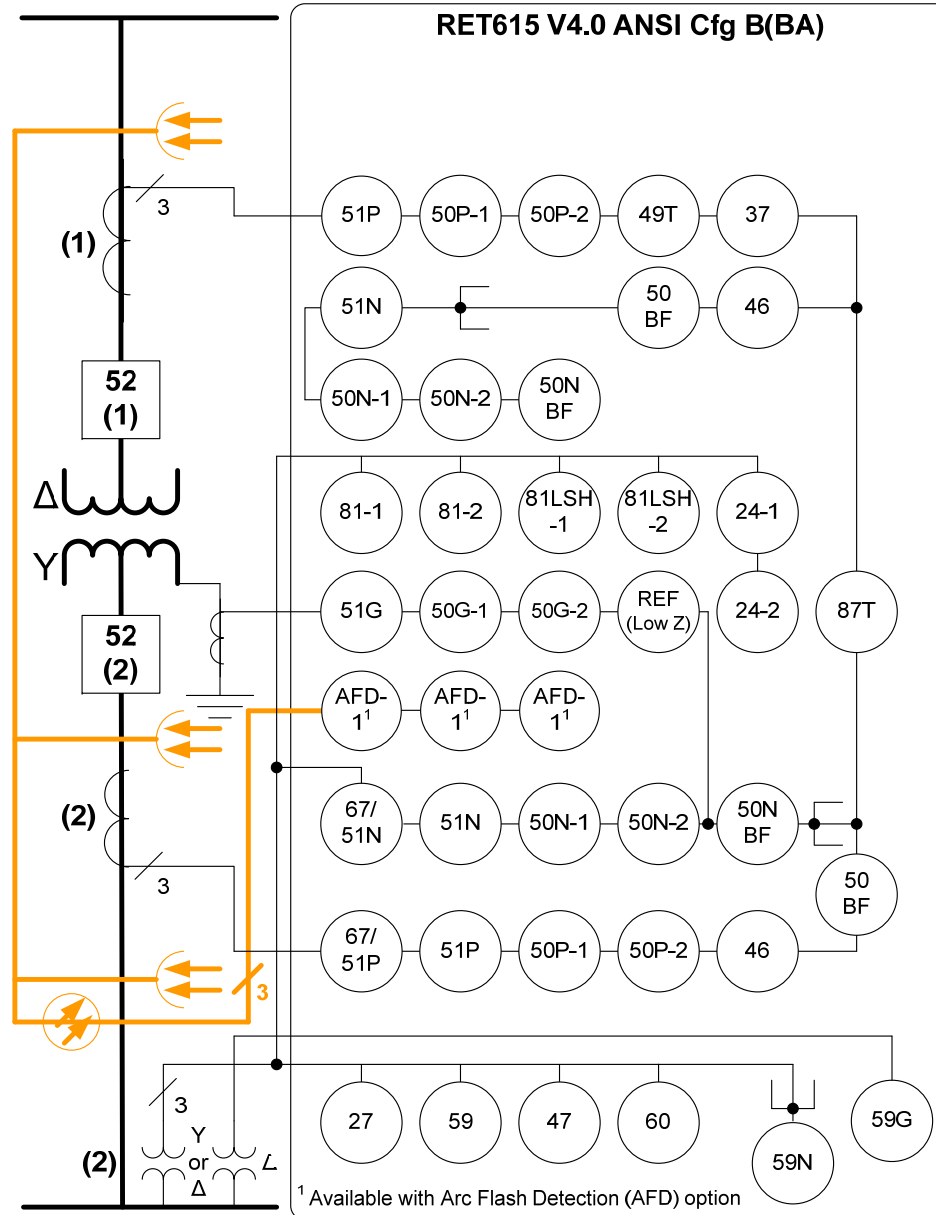
# RET615 V4.0 ANSI product release

## Functional application A



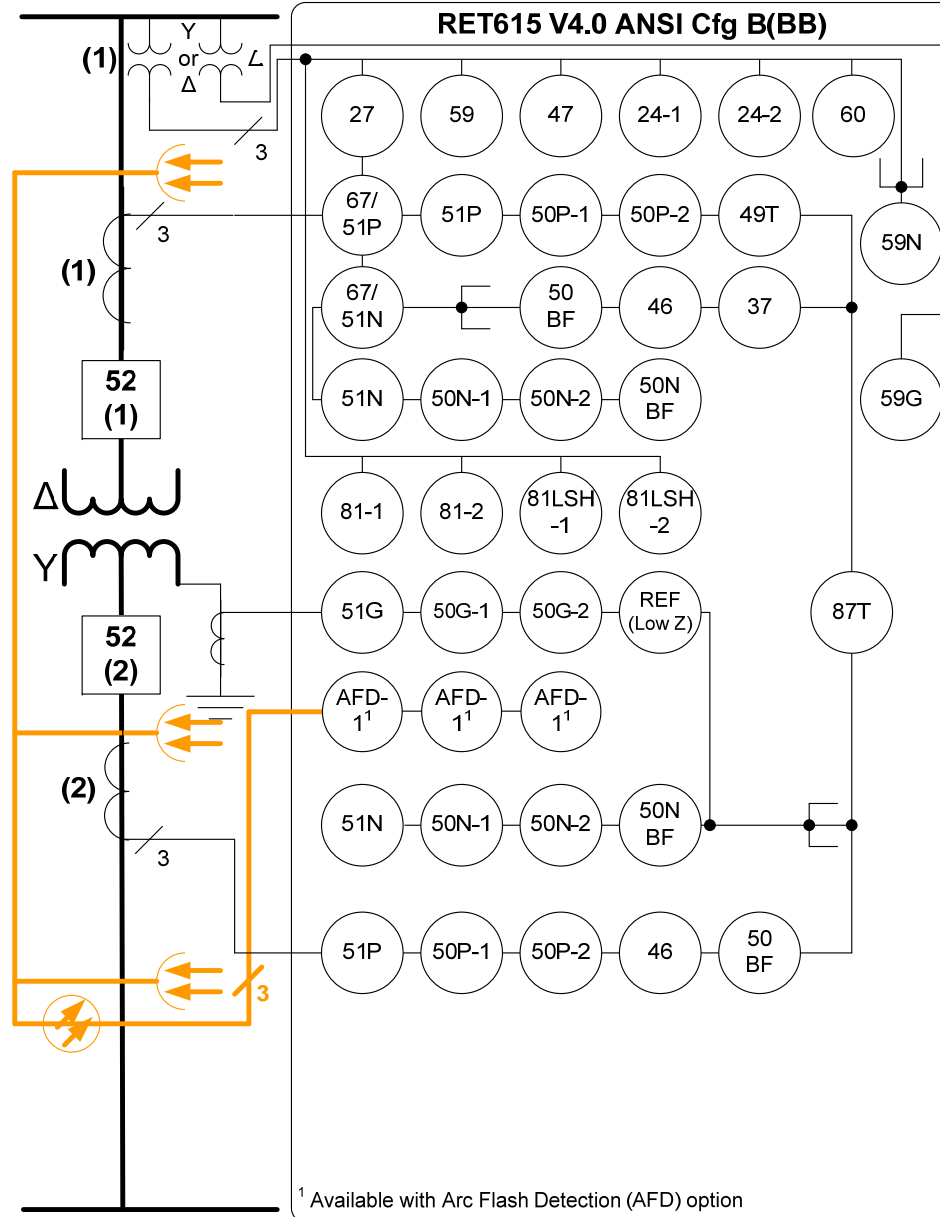
# RET615 V4.0 ANSI product release

## Functional application B – VTs on LV-side



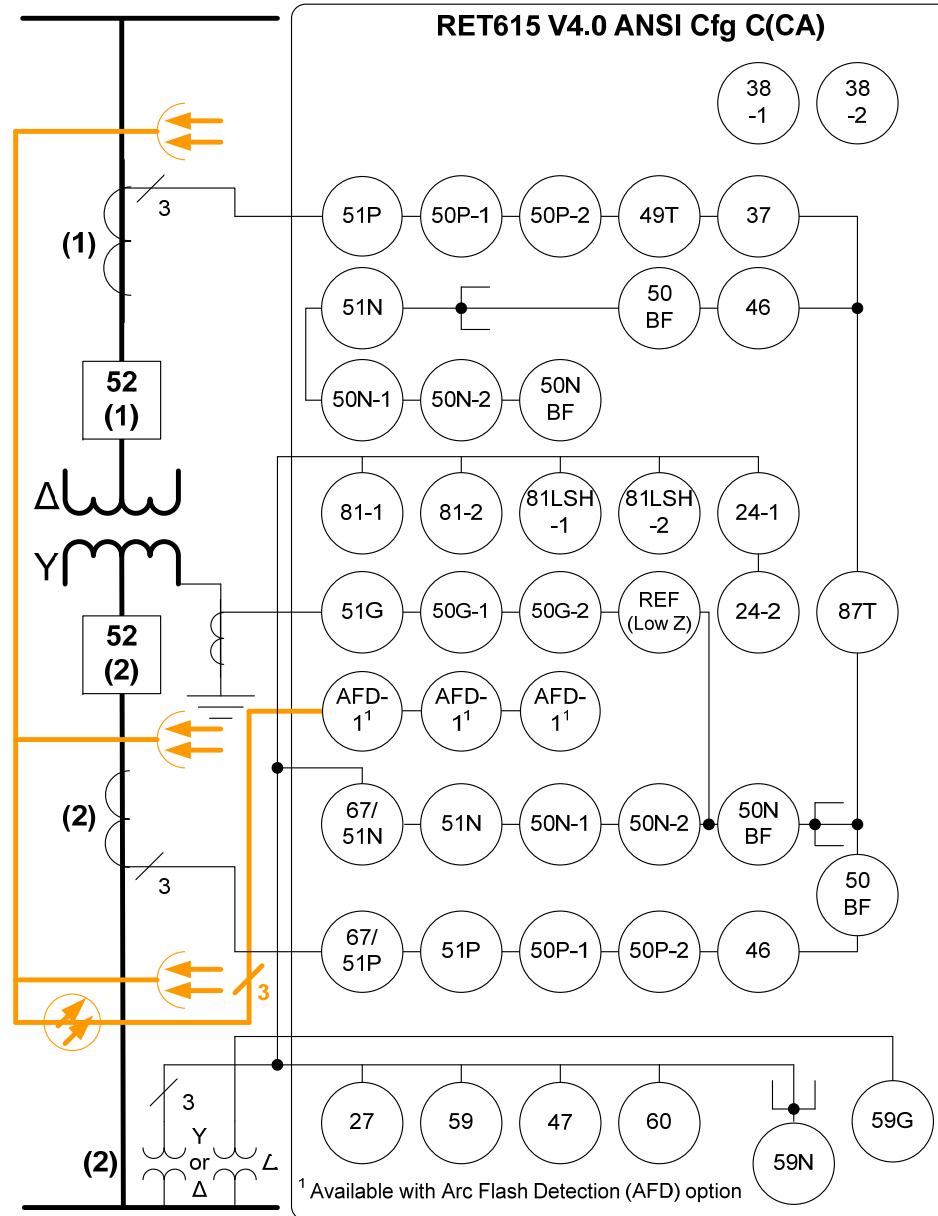
# RET615 V4.0 ANSI product release

## Functional application B – VTs on HV-side



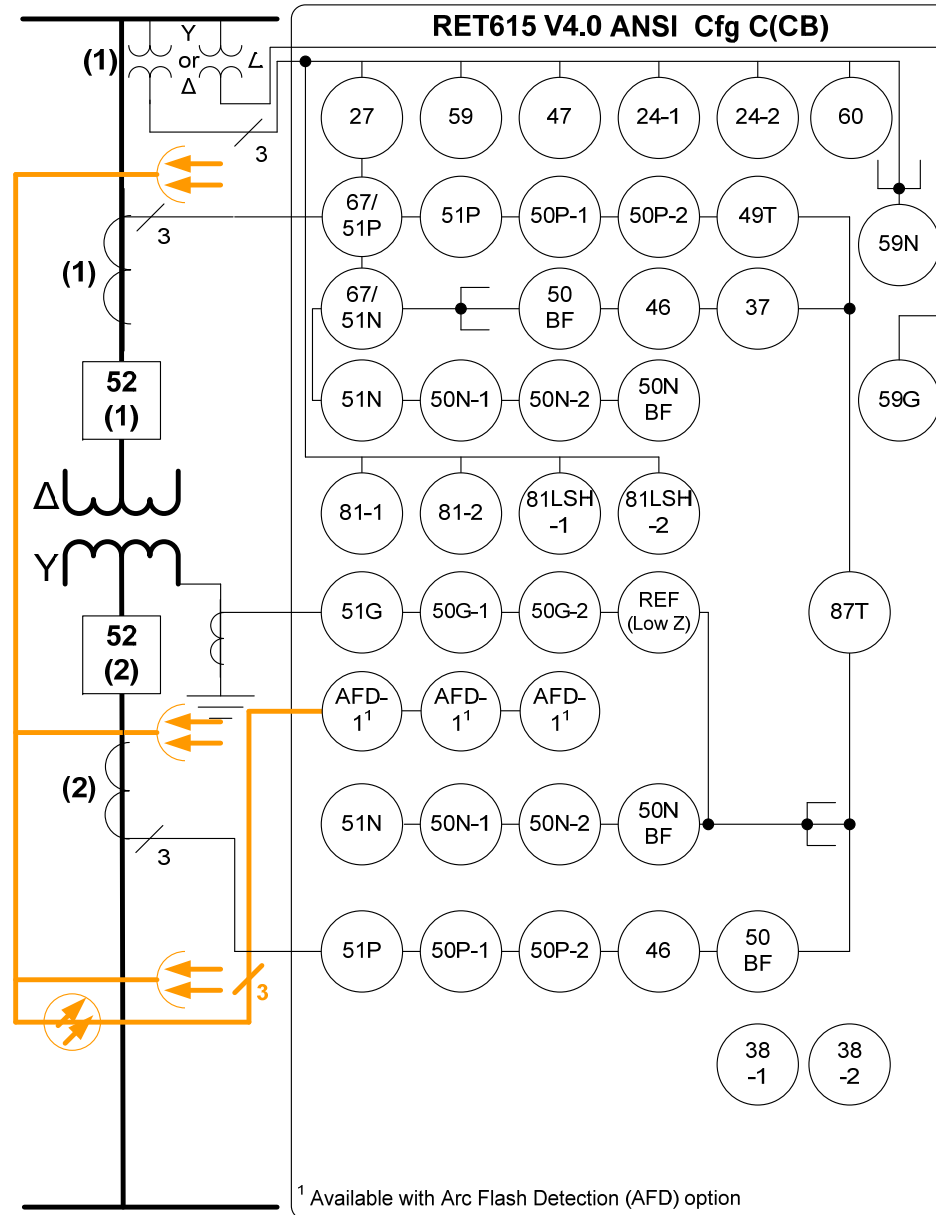
# RET615 V4.0 ANSI product release

## Functional application C – VTs on LV-side w/RTDs



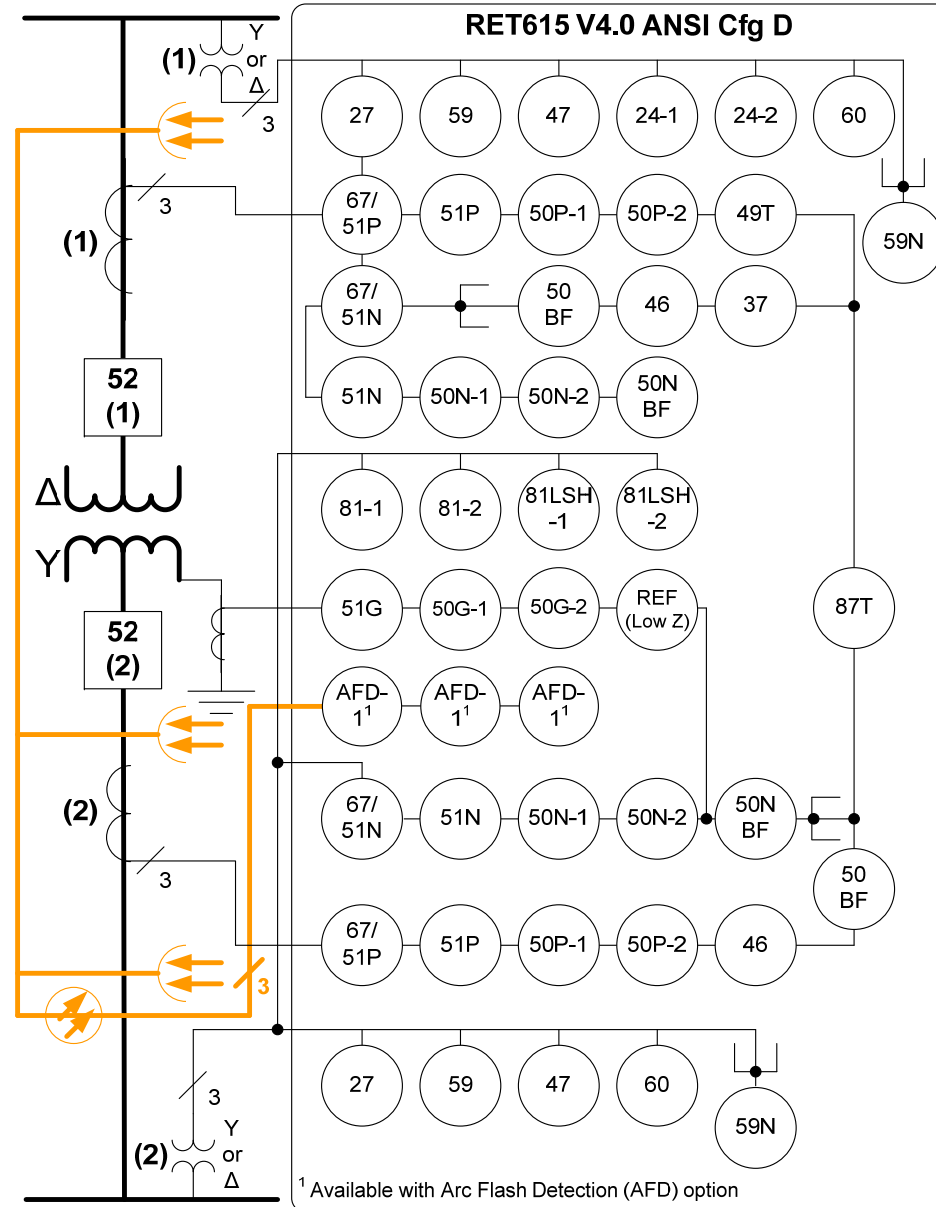
# RET615 V4.0 ANSI product release

## Functional application C – VTs on HV-side w/RTDs



# RET615 V4.0 ANSI product release

## Functional application D – VTs on LV- and HV-sides





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