Always Innovating. Always Evolving.

REPLACING SINGLE-FUNCTION RELAYS WITH MULTIFUNCTION DIGITAL RELAYS

BE1-FLEX AND BE1-11D

Present Protection Market Conditions

Increasing System Complexity

- **Generation everywhere: Traditional Protection insufficient**
- **Protective Relay feature expansion**
- **Cybersecurity Issues**

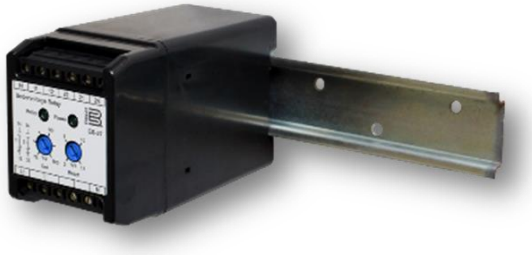
Decreasing Industry Experienced Personnel

Product Options: Application specific

- **100’s of models**
- **Minimal crossover capabilities**

Basler's Protective Relay Solutions

- Digital
- Single function
- Plug and play retrofit
- Low voltage and control



BE1-11 Protection System

BE1-11

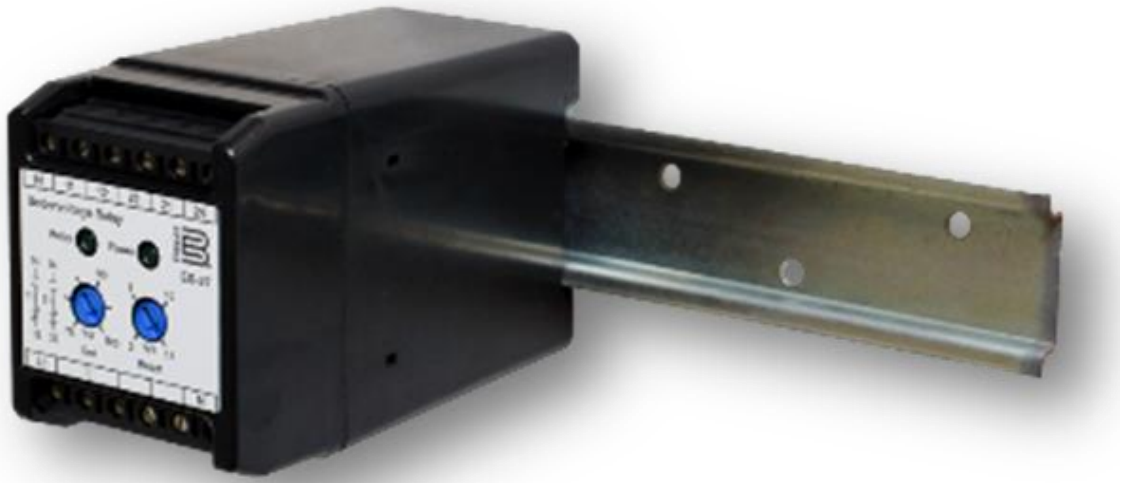
- **One Firmware**
- **Numerous Applications**
  - Feeder
  - Transformer
  - Motor
  - Generator
  - Intertie
  - and DC Power systems

Single Function Relays

- **Utilized where ease of use is top priority**
- **No software settings**
- **Common models**
  - Sync check (BE1-25)
  - Voltage (BE1-27/59, BE1-47N)
  - Reverse power (BE1-32R)
  - Overcurrent (BE1-50/51)
  - Field ground (BE1-64F)
  - Bus differential (BE1-87B)

Low Voltage and Control – ES Relay

- No software settings
- Cost effective
- Rugged design



Low Voltage and Control – ES Relay

Available Models

ES Models	Description
ES-25	Sync check
ES-27	Undervoltage
ES-59	Overvoltage
ES-27/59	Under/Overvoltage
ES-32	Power
ES-37	Undercurrent
ES-51	Overcurrent
ES-37/51	Under/Overcurrent
ES-47	Voltage Reverse Phase Rotation
ES-47N	Voltage Phase Unbalance
ES-47N/27	Voltage Phase Unbalance/Undervoltage
ES-49	Temperature
ES-55	Power Factor
ES-74S	Transducer/Shunt Sensing DC Millivolt
ES-74V	DC Voltage
ES-81O	Overfrequency
ES-81U	Underfrequency
ES-81O/U	Over/Underfrequency

Introducing the BE1-FLEX

Basler Digital Protection

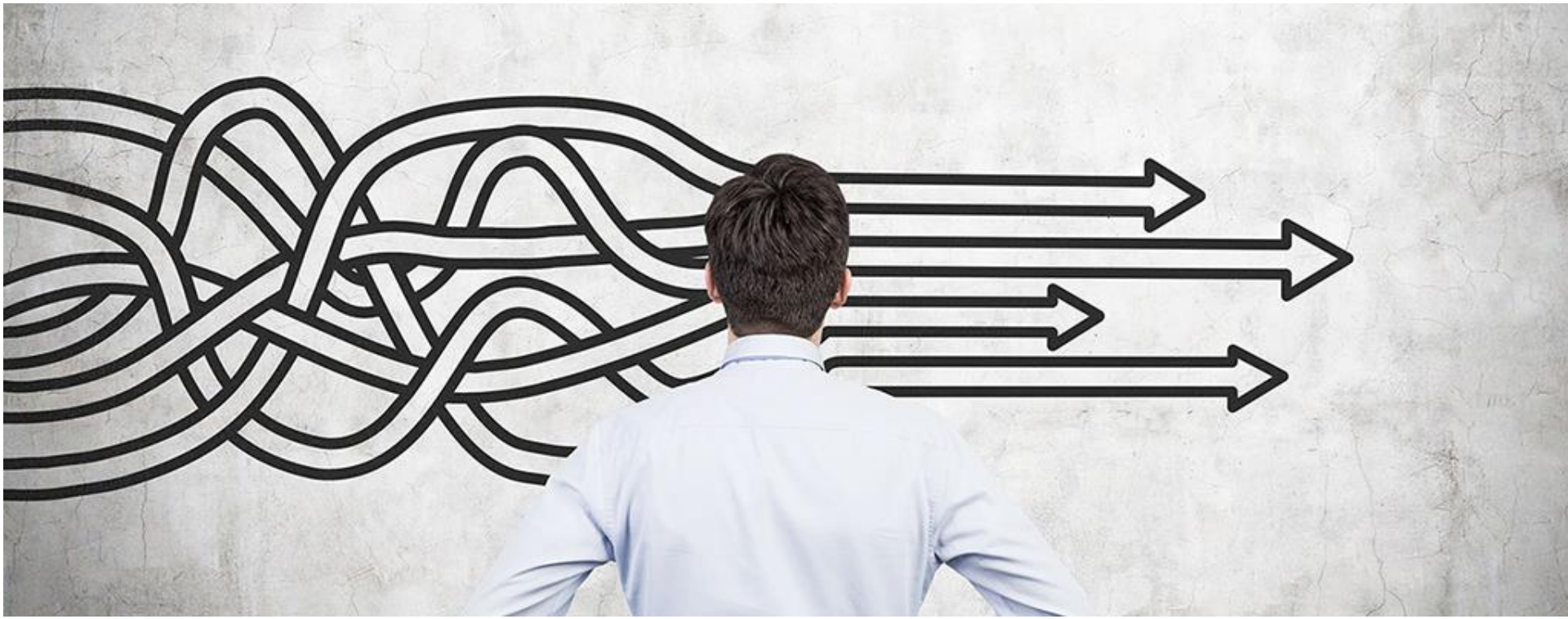
Utilized in every Medium and High voltage industry

Utilized in mission critical and unique low voltage

BE1-FLEX

- **One Device, Any Application**

Why is the BE1-FLEX Different?



TRACTION

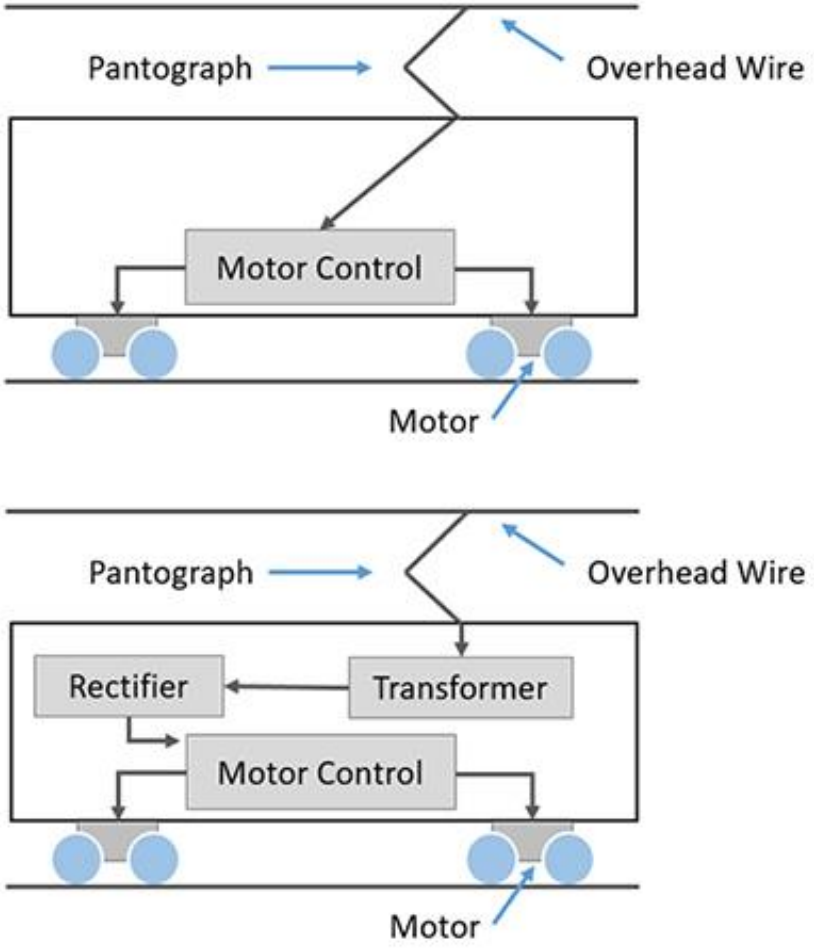
Traction Systems

DC to train

- AC Rectified at substation
  - Relays cannot see through rectifier
- BE1-FLEX, BE1-11*f*, BE1-11*t* and BE1-11*d* at substation

AC to train

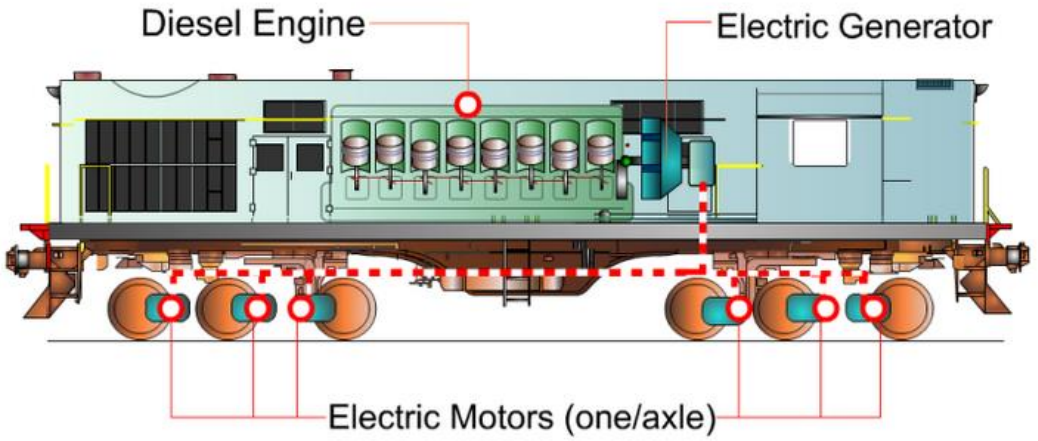
- Rectified on train
- **25, 50, 60, 93.3,100Hz**
- BE1-FLEX, BE1-11*f*, BE1-11*t* at substation



Traction Systems

Diesel Engine

- Power source onboard
- Does not require electrified network
- DECS-150, DGC-2020, BE1-FLEX, BE1-11



- Basler Electric now offers solutions for any system

Sensing at non-60Hz

Bandpass filters/Discrete Fourier Transform (DFT), nominal settings ranges, testing limit what equipment should be used

Lower frequencies require more instrumentation magnetism (more iron) for same performance

Opposite is true for higher frequencies

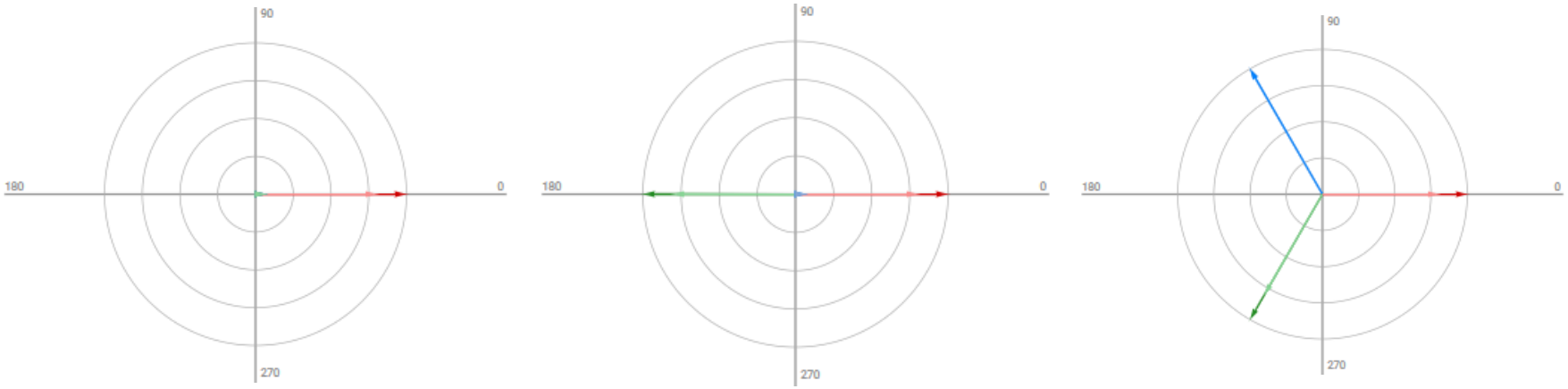
- Aircraft and others use 400Hz for lighter systems
- Higher frequencies have greater power losses over distance

DC Power

‘Simplified’ but different signal processing and sensing

…To be discussed in other sessions

1 phase, 2 phase vs 3 phase variables



Most Digital relays are designed for 3 phase

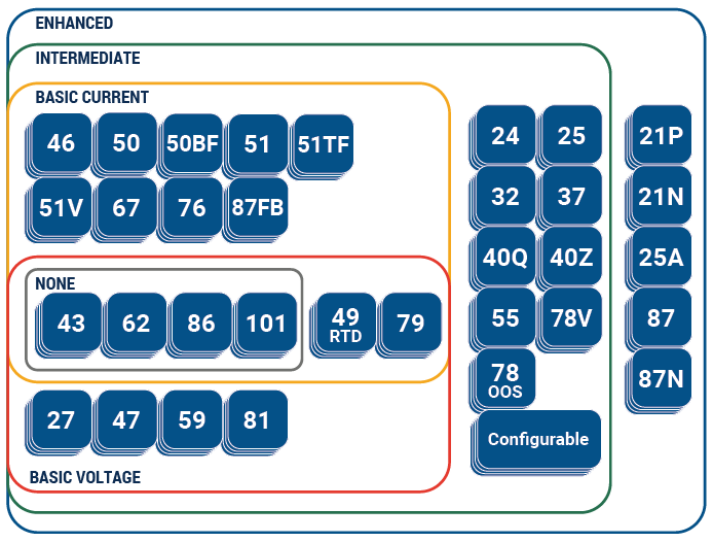
Details for consideration in 1 or 2 phase systems

- **Avoid or use 3 phase algorithms intentionally**
  - Negative sequence doesn't exist
  - Phase distance relies on 3 phase. Use single phase distance (21N)
- **Understand if missing phases read 0, noise or phantom 3 phase**

APPLYING BE1-FLEX FOR TRACTION

EXAMPLE: DUAL PHASE, 25HZ, MEDIUM VOLTAGE

FLEX Protection, Automation and Control



Any combination of Elements

Any number of Elements

Configurable Elements
- Math Elements (+,-,*,/)
- Emerging markets needs (THD…)
- Continual Analog and I/O Validation

No Protection Option
- Metering, Transducer, I/O…

Functions common in AC traction:
21, 25, 27, 50, 51, 50BF, 62, 67
All available

Why is the BE1-FLEX Different?

Historical Comparison

- Flip Phone and Blackberry
  - Fixed interface
  - Hundreds of models
  - Application specific

- Smartphone
  - Millions of app/layout/interface variances
    - No two users have the same interface
    - No two users have the same combination of apps and settings

The BE1-FLEX is the first to make the Smartphone era leap

Longevity by Intent

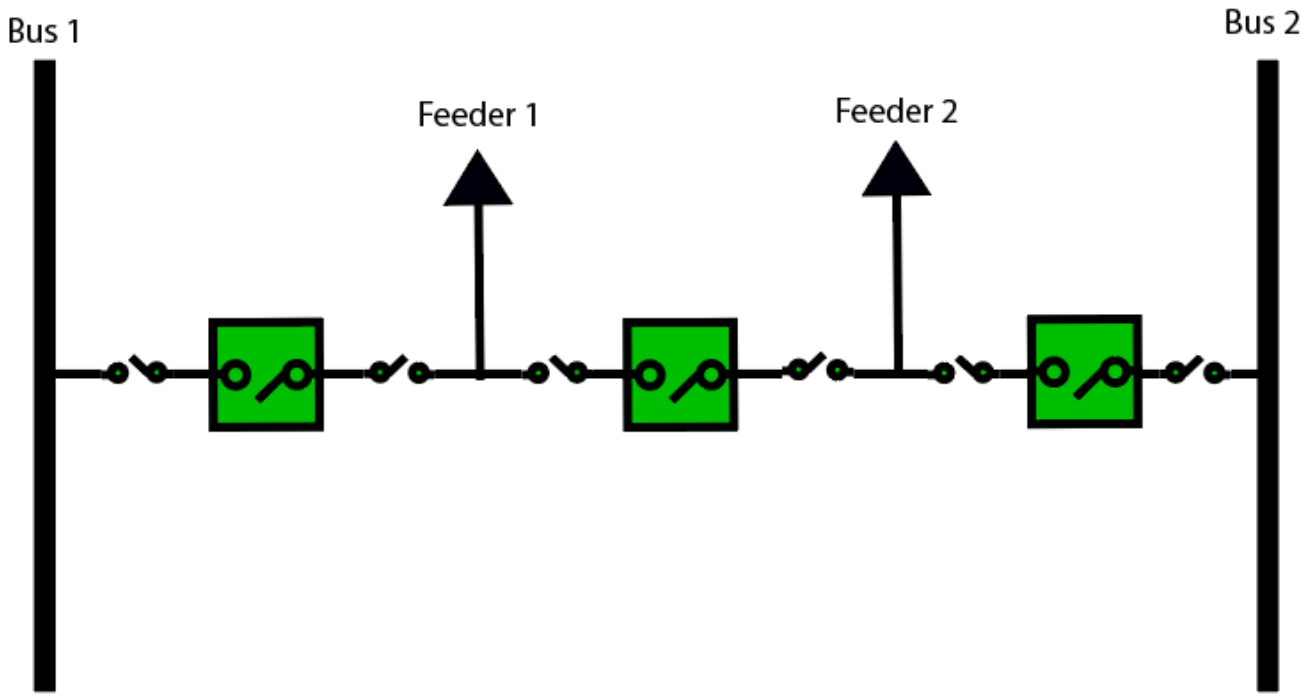
As Future needs change the BE1-FLEX can change

- Turn on Functions anytime

Basler development focused into one product for longevity

- Trunk vs. Leaf design
- Significantly increases time before end of life
- Easier to justify future modifications
- Branch focused is how we ended up with 100’s of relay models

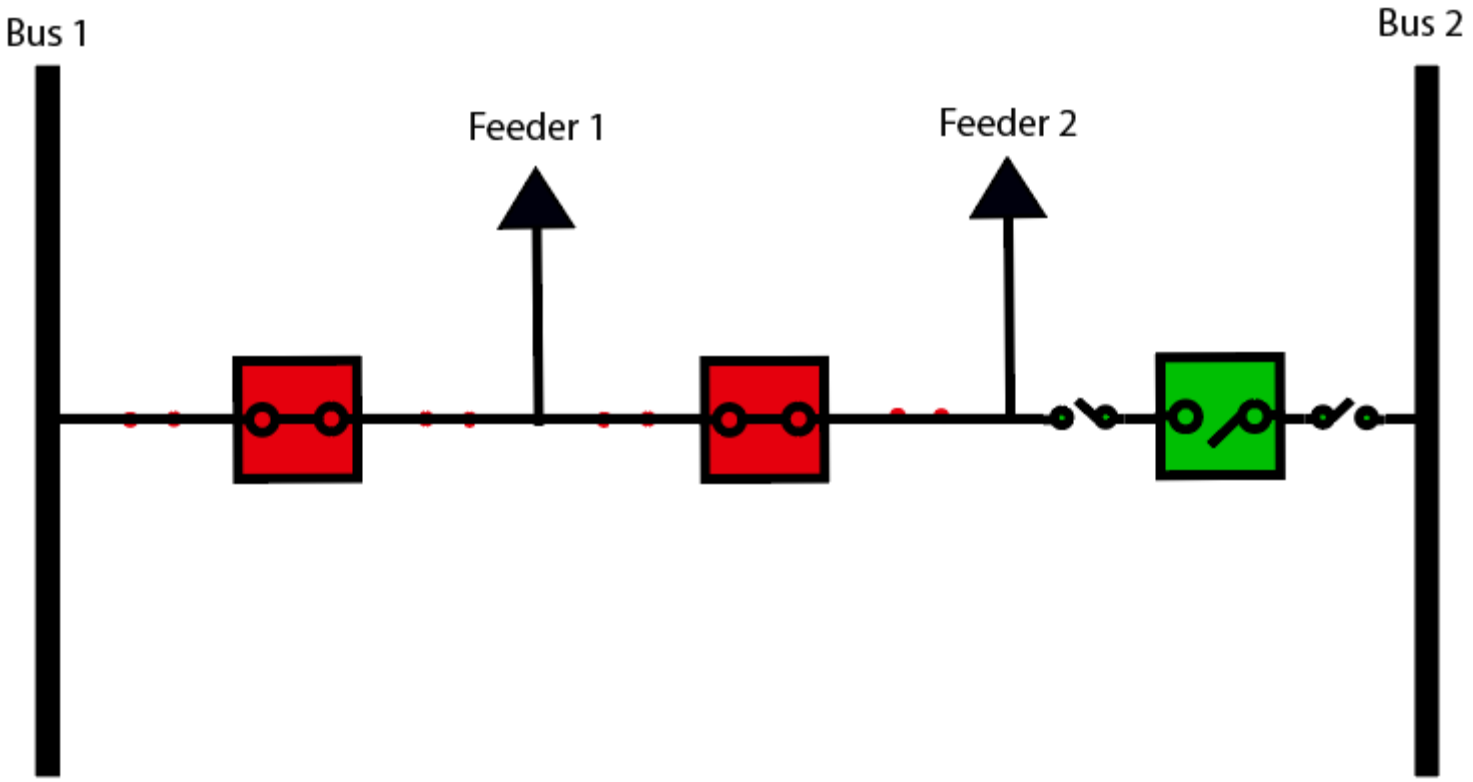
Breaker and a Half



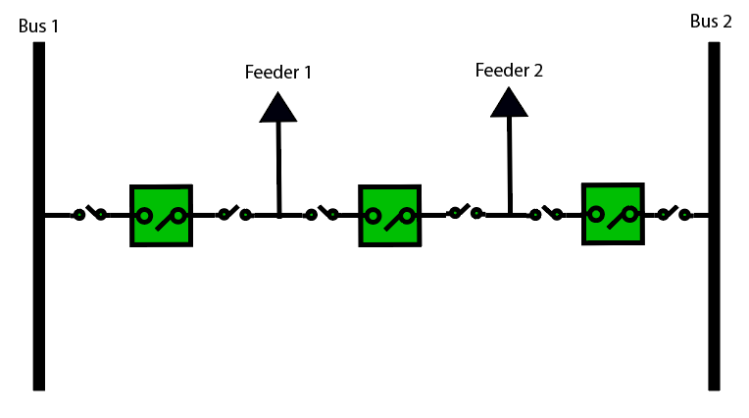
Benefits: Serviceability and reliability

Transit niche: Continuously power moving load

Servicing Breaker 3



Total General I/O Requirements



Breaker status (3 inputs)

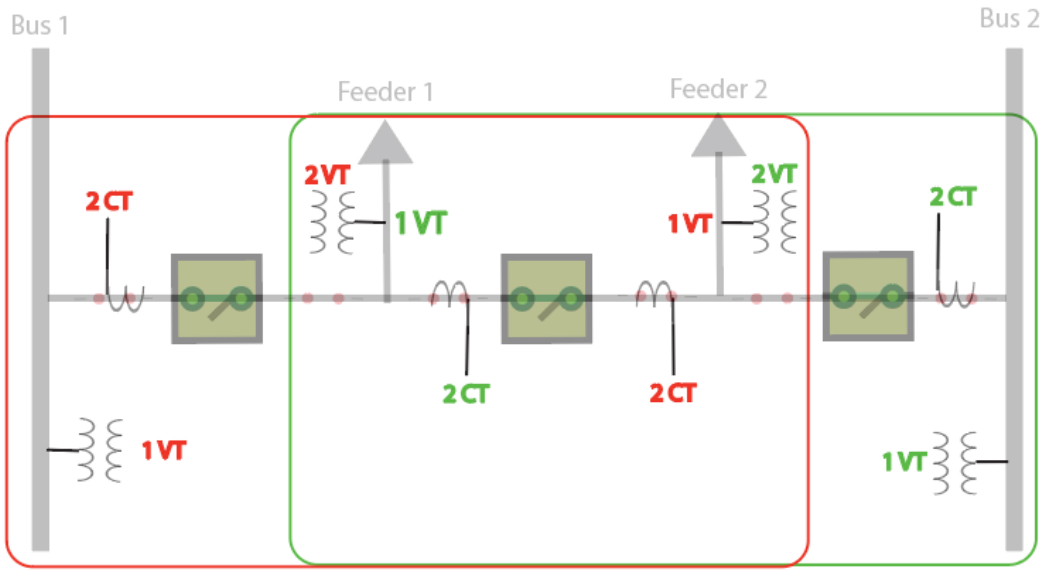
Breaker trip and close (6 outputs)

Switch status (6 inputs)

Relay Trouble Alarm (1 output)

Total: 7 DO + 9 DI

General Current and Voltage Sensing



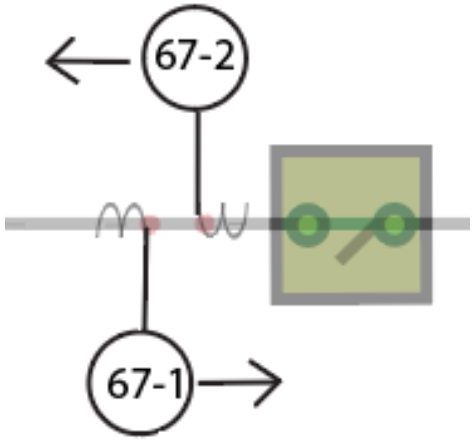
4 CT's and 4 VT's per side

- CT's: load and fault sensing…
- VT's: sync check and feeder protection…

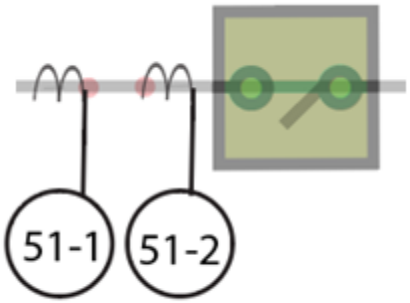
Commonly done with 2+ relays (red and green outlines)

Can be done with a single BE1-FLEX

Overlapping Zones and Redundancy



Overlapping Zone



Redundancy

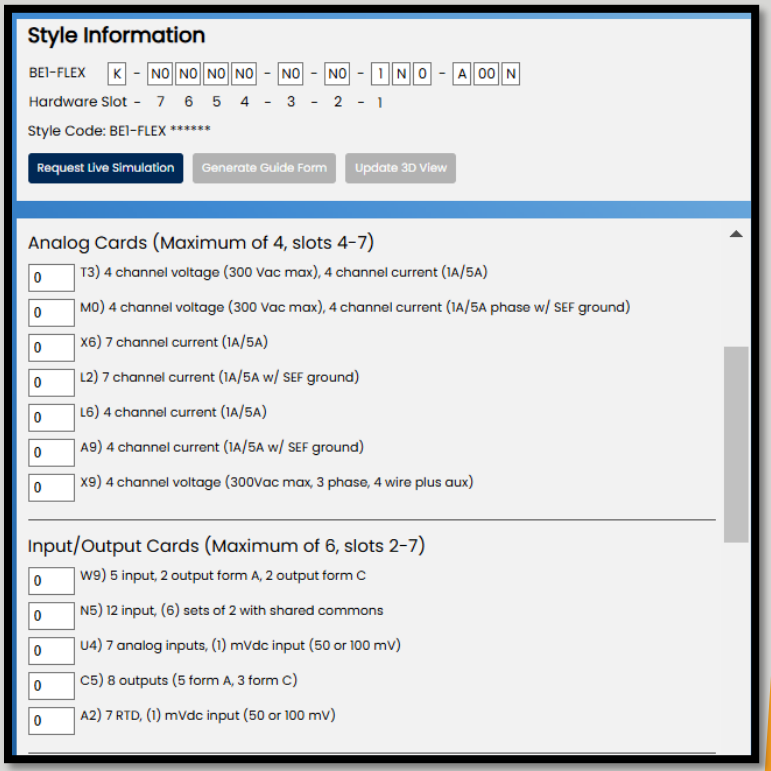
Important when modifying existing systems

Overlap covers faults at CT location

Redundancy may be/may have been required for:

- **CT and/or relay redundancy**
- **CT burden and performance requirements**
- **CT matching of differential circuits…**

Build the BE1-FLEX



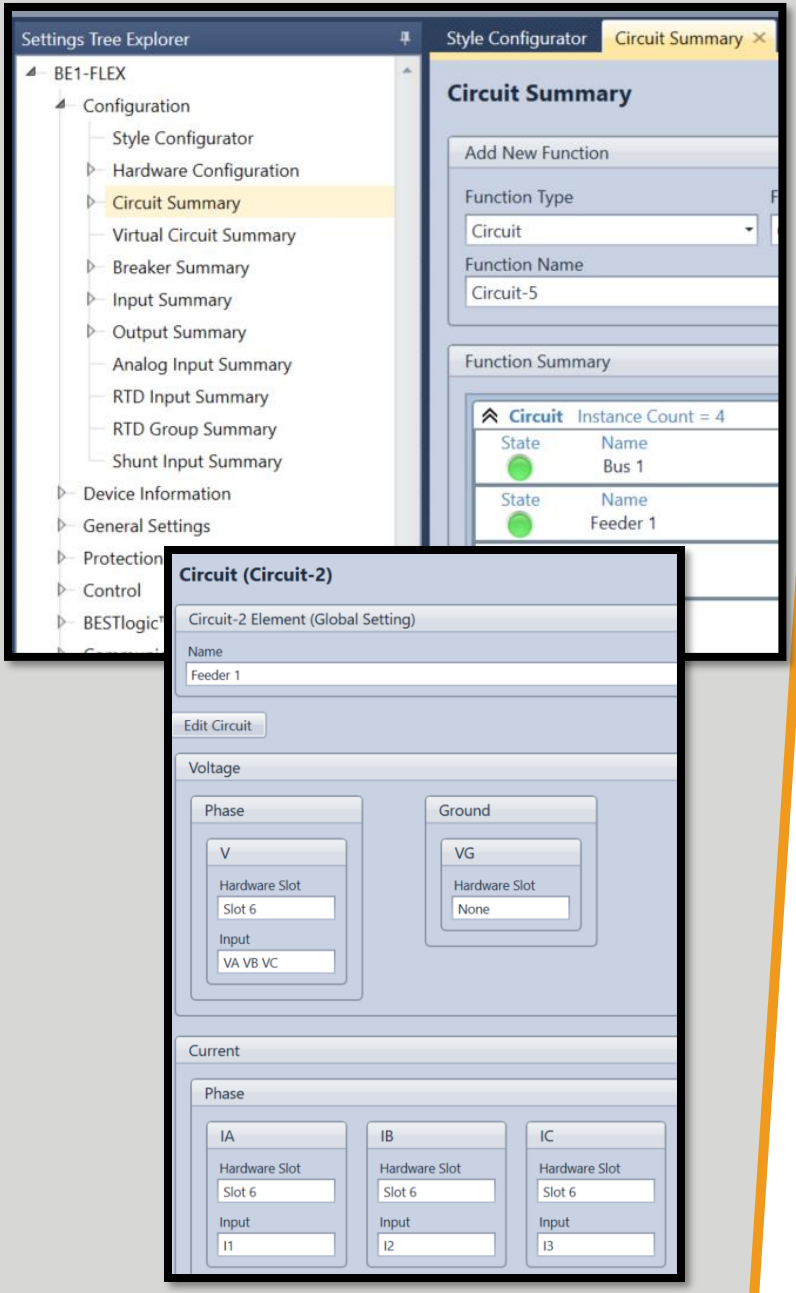
Flex.Basler.com

One relay for all Style Example:

BE1-FLEX-K-T3T3X6C5-N5-E5-1N0-E01N-00

- 8 VT, 15 CT, 15 DI, 11 DO
- plus communications, fault recording…
- options for bus differential, transformer differential

Or break protection into smaller segments as desired



Configure the BE1-FLEX

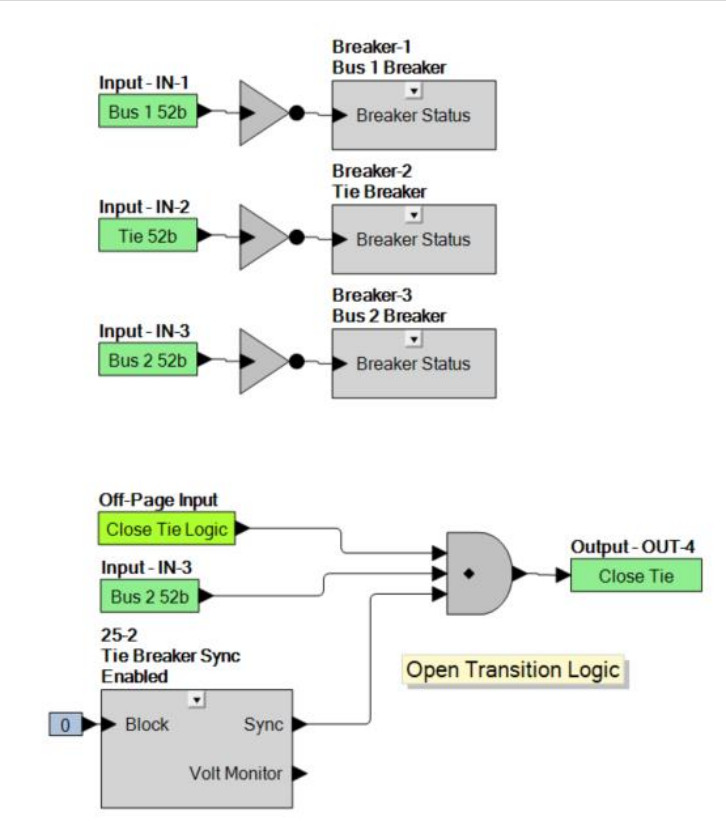
No cost BESTCOMSPlus software

Map hardware to Circuits, I/O, Breakers

User defined names makes utilization simple

Always Innovating. Always Evolving.

Logic Implementation



Done with external wiring/controllers in Single-Function relays

Closed vs. Open Transition

Manual vs. Flex controlled switches

Many options for automation, metering, recording, remote coms… with digital relays

MECHANICAL CONSIDERATIONS

Plug and Play Retrofit Solutions

Only for 50 or 60Hz for overcurrent options

Easy as 1, 2, 3:

1. Configure the Basler retrofit relay with the appropriate EM relay settings.
2. Insert the Basler relay cradle into the existing case.
3. Install the cover.

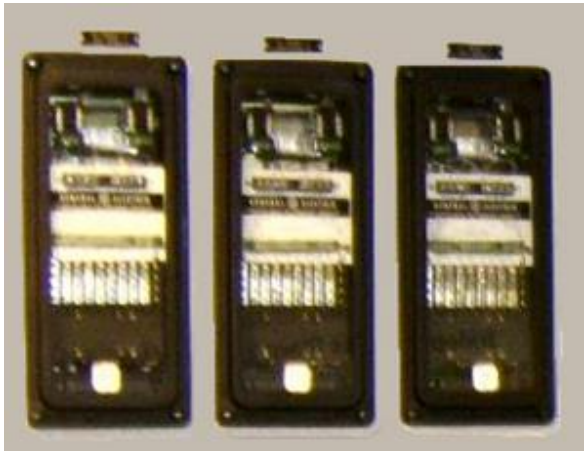
Walk away

Common retrofit options

- BE1-50/51B, BE1-79A, BE1-87B
- Options for IAC, CO, SFC, RC, ACR, NLR, PVD electromechanical relays

Retrofit Options

Retrofit into Existing Cutouts



- BE1-FLEX exactly fits S1 and S2 cutouts
- Many adapter plate options for other sizes

Retrofit – New Panel

- Utilizes Basler's Excitation cabinet manufacturing
- Door, cabinet, enclosure options

Basler's Perspective

Evolve the Market - Demystify Protection, Simplify

Longevity manufacturing and support

- BE1-700, BE1-11d, plug and plays, single phase

BE1-FLEX

- Continued development
- Address evolving markets
- Beyond Protection

ES proven reliability

Expect the Unexpected

FLEXIBILITY

- One device for any application
- Everything you need, nothing you don’t
  - Eliminate noise, confusion, visual stimulation fatigue
- Adapt system over time without new relaying
- Operators and Designers both get what they need

- Please visit flex.basler.com for more information

THANK YOU

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