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Introducing IED 670 REL 670 and RED 670

Rio de Janeiro
April 23-25, 2006

A Major Leap In Grid Reliability

- Introduction
- IED 670 hardware and software
- Line distance protection IED REL 670
- Line differential protection IED REL 670
- Summary

IED 670 is an evolution

Evolution from 316 and 500 series

- Most Protection and Control functions identical
- Identical Input/Output modules

316 and 500- series

670 - series

IED 670 for All Major Applications

- Overhead lines
- Underground cables
- Multi terminal Circuits
- Transformers & Reactors
- Generators & Large Machines
- Busbar & Breaker
- Composite Objects
- High Voltage Switchgear

IED 670

- A generic name for all protection and control devices with IEC61850
- All products named according the application
  - REL for line
  - RET for transformer
  - RED for differential
  - REB for busbar
  - REC for controler

Intelligent Electronic Device = IED

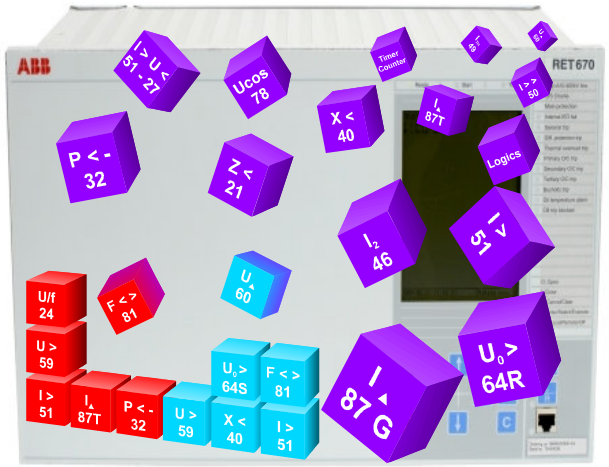
Life cycle for hardware

Electronic componets:

- Standard components tested bu millions of users
- Life time for hardware is 20-30 years
- MTTF>100 years

Life cycle for delivery of electronic components are 1-3 years!

Life cycle for software

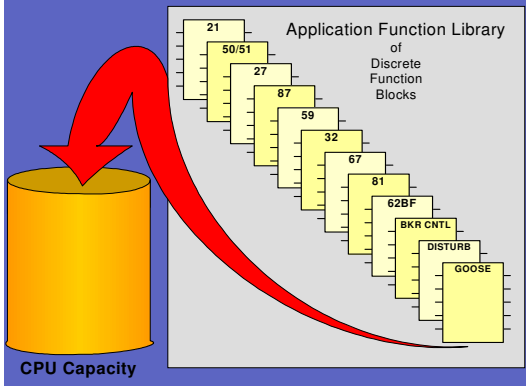


Protection and Control functions:

- Application requirements
- Improved performance and functionality
- > 10 years field service in the 500-series

Life cycle for functions is > 20 year!

Function library as logical nodes



- IED 670 has a common library for protection, control, monitoring and measuring functions
- This library is modeled as logical nodes according to IEC 61850
- All functions are available for all protection and control devices

This library is independent of hardware

LN: Time Overcurrent Name: PTOC

PTOC class				
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)		
Data				
Common Logical Node Information				
		LN shall inherit all mandatory data from Common Logical Node Class		M
OpCntRs	INC	Resetable operation counter		O
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M
TmASt	CSD	Active curve characteristic		O
Settings				
TmACrv	CURVE	Operating Curve Type		O
StrVal	ASG	Start Value		O
TmMult	ASG	Time Dial Multiplier		O
MinOpTmms	ING	Minmum Operate Time		O
MaxOpTmms	ING	Maximum Operate Time		O
OpDlTmms	ING	Operate Delay Time		O
TypRsCrv	ING	Type of Reset Curve		O
RsDlTmms	ING	Reset Delay Time		O
DirMod	ING	Directional Mode		O

T = Transient, M = Mandatory, O = Optional

Application Function Library (AFL)

- Type tested functions with long service expierences
- Possible to use in future hardware

If you know ONE product you also know ALL IED 670!

Hardware Structure – IED 670

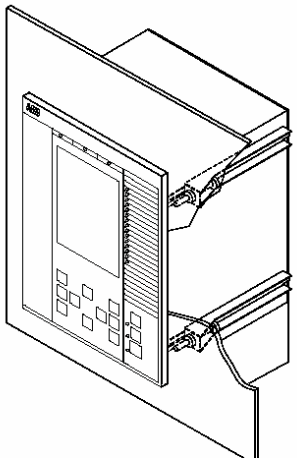
New in 670- series

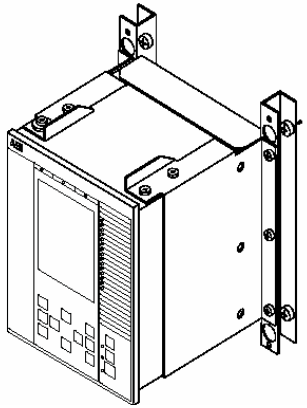
19” rack, 6U high

Same as 500- series

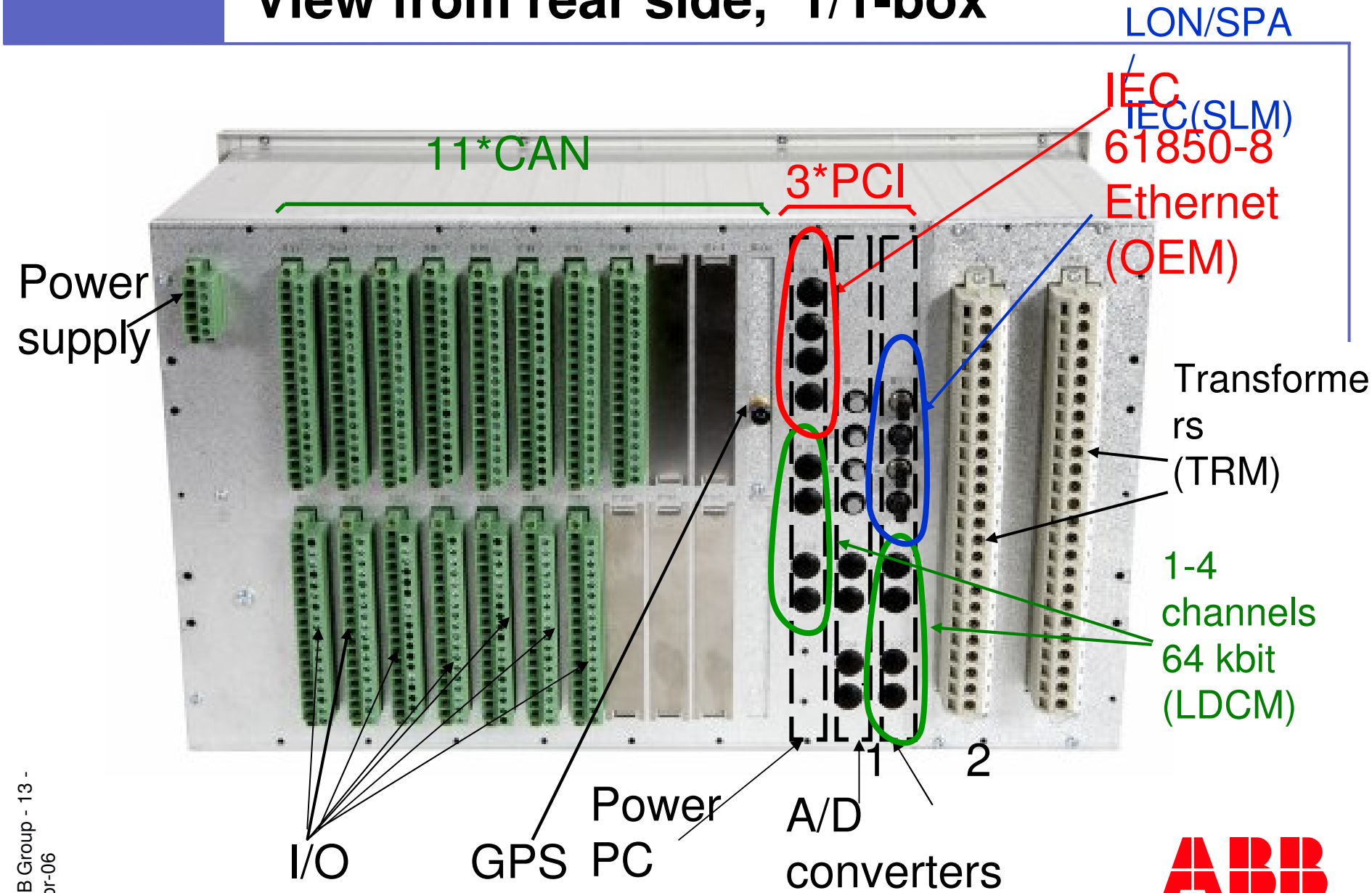
- Transformer Input Module (One or two with 12 inputs each)
- Analog Digital Conversion module (One or two
- Central Processing Unit
- Power supply module PSM
- GPS time synchronization module
- Binary Input / Output modules
  - Binary inputs stabilized against capacitive discharges, DC faults
  - Inrush current characteristic to improve interference immunity
- Transducer input module (mA inputs)

1/2 3/4 and 1/1 19” casings



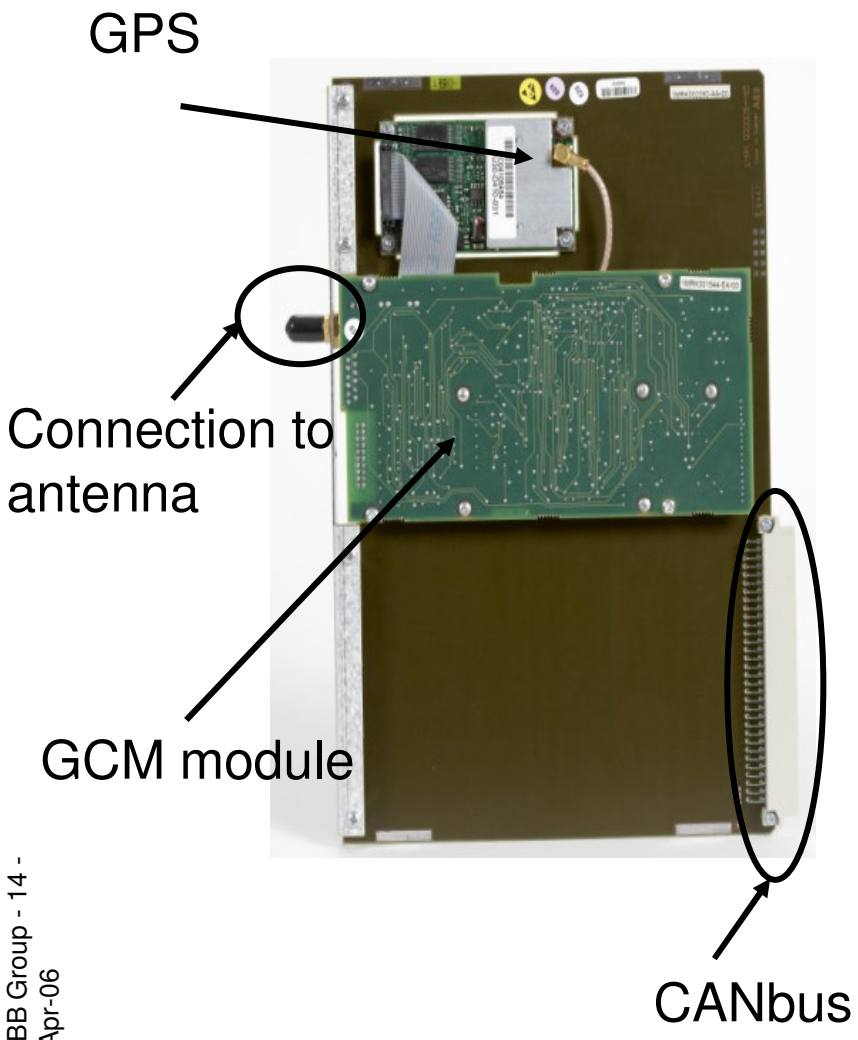


View from rear side, 1/1-box



GPS time Synchronization Module (GSM)

For multiterminal current differential



- 1 Mhz High Accuracy output; < 1µs
- Minute pulse / IREG B-
  - Accuracy <<1ms (Not suitable for differential protection)
- IEC 61850-8 synchronization
  - Accuracy < 1 ms
- LON synchronization
  - Accuracy < 2 ms

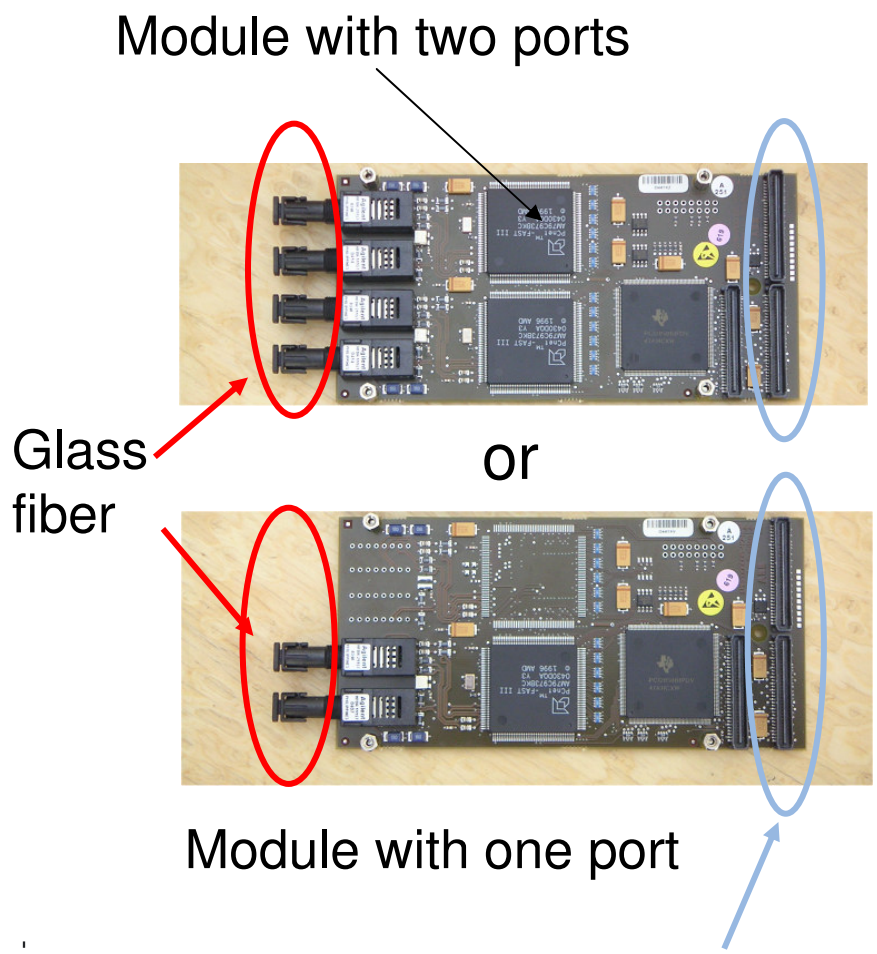
64 kbit Communication Module (LDCM)

64 kbit communication for differential protection or binary transfer

Up to 4 modules per IED670

- Multimode fiberoptic 50/125 µm or 62,5/125 µm
- Optical budget - 9 dB or 13 dB
  - Typical distance 3 or 2 km back to back or to telecommunication multiplexer

Optical Ethernet Module (OEM)



- One or two optical ports
- Placed on A/D converter 1
- Ethernet 100 Mbit/second link
- Available interfaces (max 2 simultaneously)
  - IEC 61850-8-1
  - DNP 3.0
  - TCP/ IP
- Max 1 module (on A/D 1 module)
- ST fiberoptic connector
- Multimode fiber 62,5/125 µm
- Optical budget 13 dB
  - Typical maximum distance between nodes, 1 km

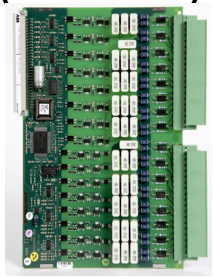
I/O-modules 1/1 19” case

1/1 Case

Option 1:
- 1 transformer module
- ≤14 I/O modules

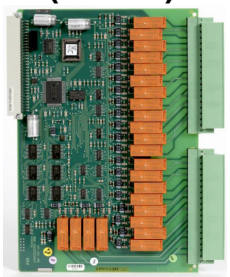
Option 2:
- 2 transformer modules
- ≤11 I/O modules

BIM (max 11/14)



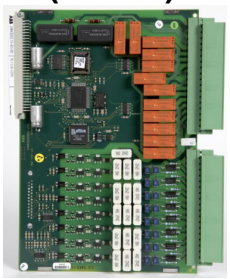
16 binary inputs

BOM (max 4)



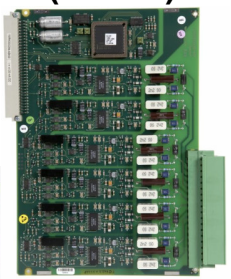
24 binary outputs

IOM (max 6)



10/2 binary outputs and 8 binary inputs

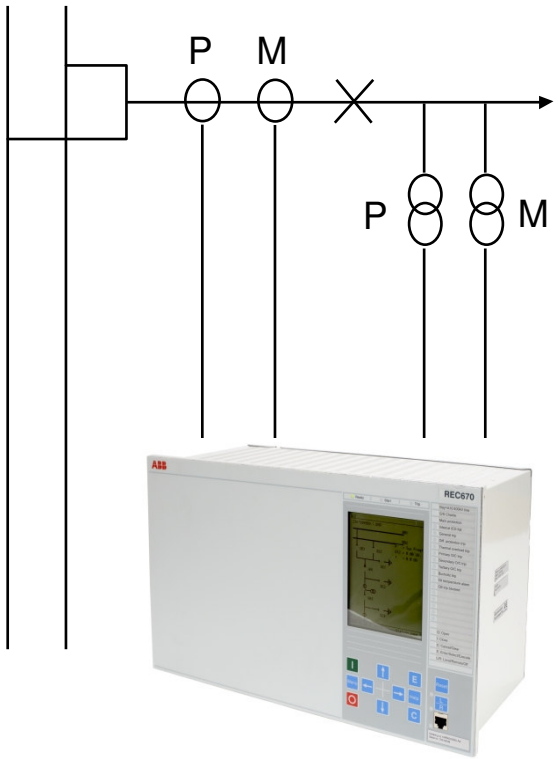
MIM (max 4)



6 Transducer inputs, setting range ± 20 mA

Up to 160 BI and 96 BO

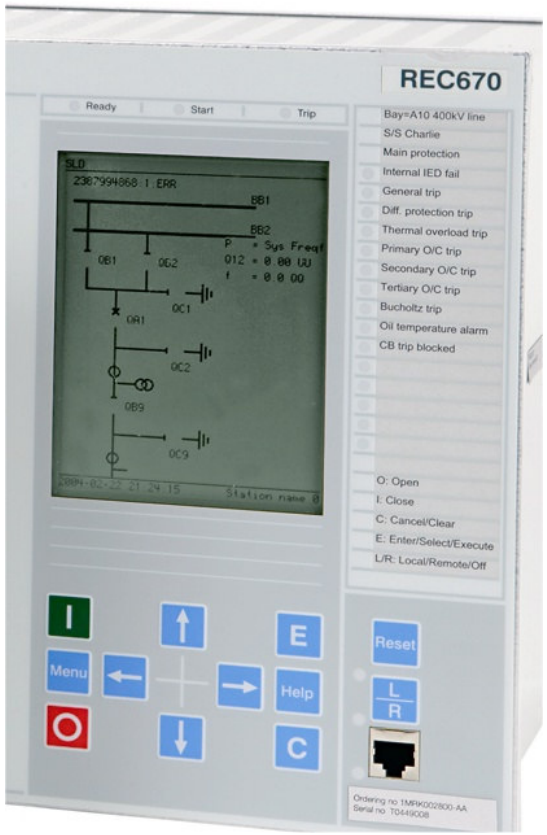
Transformer module with high accuracy



- 12 current/voltages per module
- Up to 24 analogues per IED
- High accuracy for measurements
- Callibration at site

You can connect your IED to a measurement core!

IED 670 Human Machine Interface, HMI

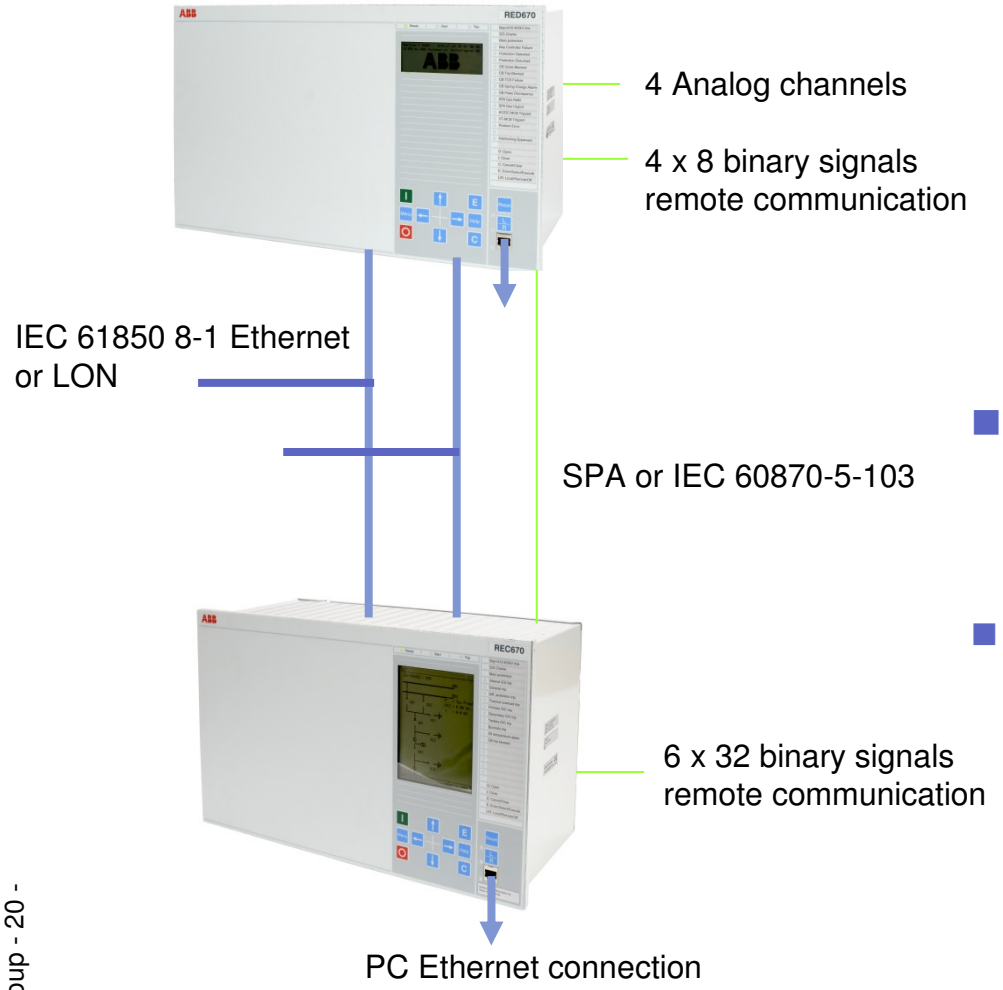


The local HMI gives a quick, yet detailed overview of the process

- Configuration
- Settings
- Single line diagram
- Measurements
- Events
- Fault and Disturbance records
- Diagnostics & Test
- Blocking of settings via Binary input
- Parameter update
- Control actions

Communication Capabilities

REL 670 is Designed to Communicate



- SA communication
  - Bay-to-bay communication via IEC 61850-8-1 or LON
  - Bay level to station level communication via IEC 61850-8-1, LON, SPA or IEC 60870-5-103
  - Disturbance reporting via IEC 61850-8-1, WAN or Modem
- Protection communication
  - Inter trip signalling
  - Communication scheme logic
- HMI
  - User friendly HMI on IED front

Connect and Operate

- REL 670s are delivered
  - Pre-configured proven solutions
  - Getting started guide
  - Complete user documentation
  - Short delivery time
- Only setting of power system characteristics

….ready to operate

Protection and Control Manager PCM 600

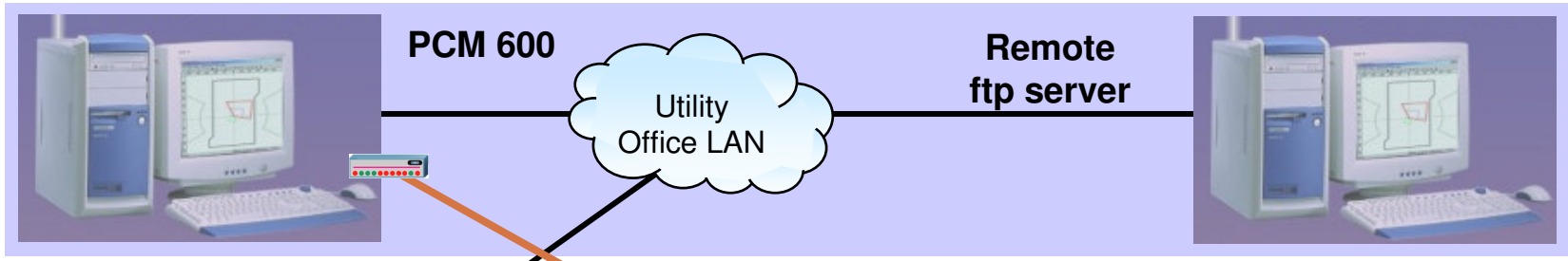
PCM 600

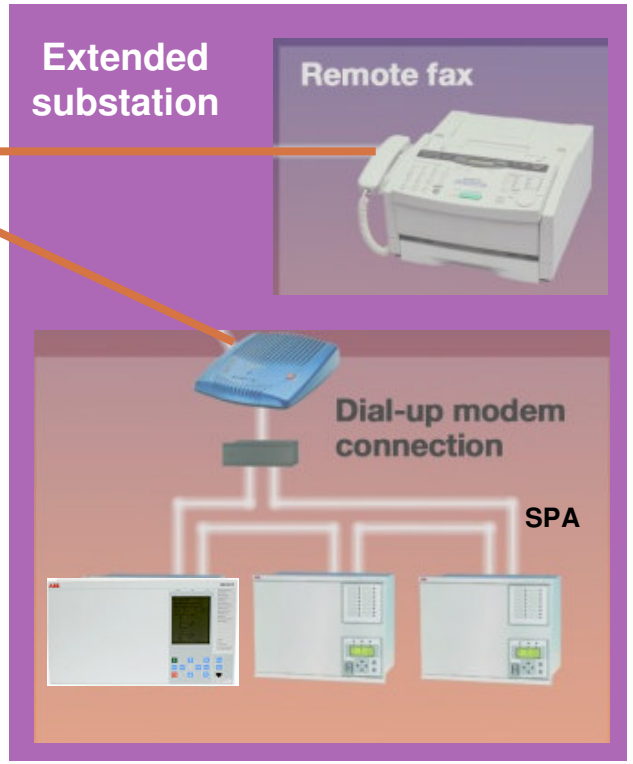
The ultimate IED manager for

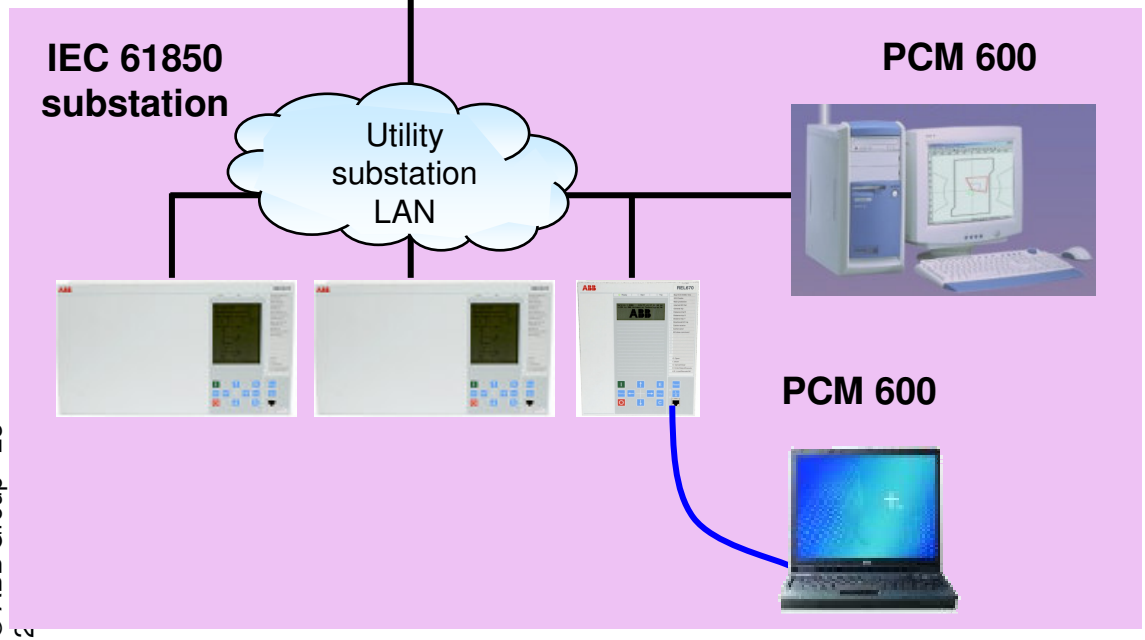
- Engineering
- Commissioning
- Test
- Operation
- Function analysis
- Future upgrades

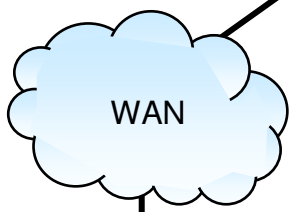
PCM 600 will be backwards compatible with previous products

PCM 600 – Anyware for all users

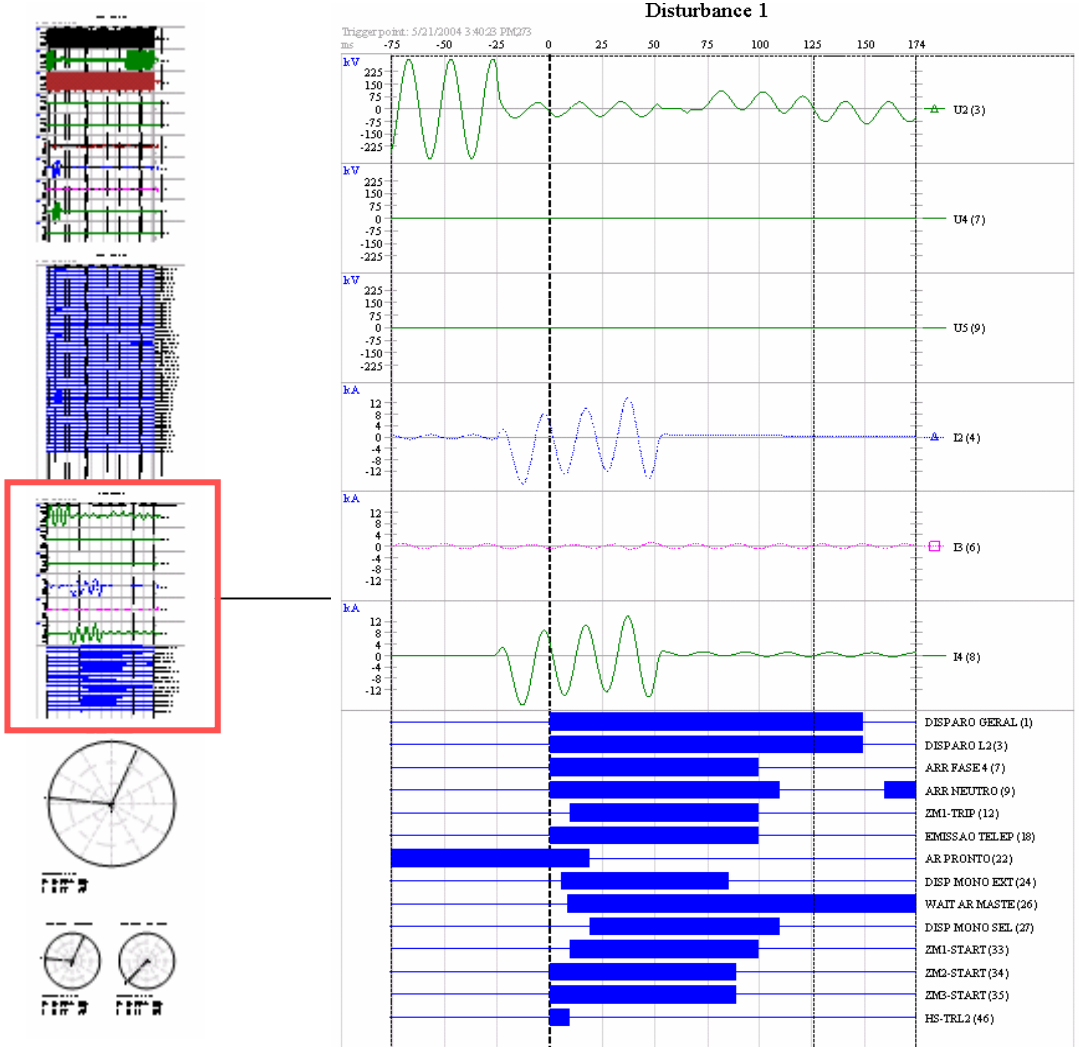








Disturbance Report Tool – The report



Automatic

- Detection
- Scaling
- Visualisation of binary signals
- Estimation of fault quantities

Extensive Disturbance recorder

- Analogue channels 40
  - channels via inputs 30
  - derived analogue signal or channels from mA transducers 10
- Binary channels 96
- Typical recording time sec >600 *)
- Typical number of recordings 40

***) for 40 Analogue plus 96 Binary inputs**

Components of PCM 600

PCM 600 consists of:

- Configuration (CAP531)
- Signal Matrix (SMT)
  Configuration of:
  I/O cards,
  Analog Input Cards
  Serial Ports (GOOSE)
  64 kbit communication
- Parameter Setting (PST)
- Disturbance Handling
- Grid Based Display Editor
  (LCD Mimic Editor)
- Time scheduler
- CCT communicator configurator

Easy and extensive integration

- Many library functions
- Extensive & extendable I/O
- 12-24 analogue channels
- Many logic function blocks
- High performance
- Goose messages
- Extensive communication alternatives

REL 670 Line distance protection

- Line distance protection terminal for:
  - All voltage levels
  - Directly earthed networks
  - OH-lines
  - Cables
  - Double circuit lines
  - Single-, two- or three pole trip

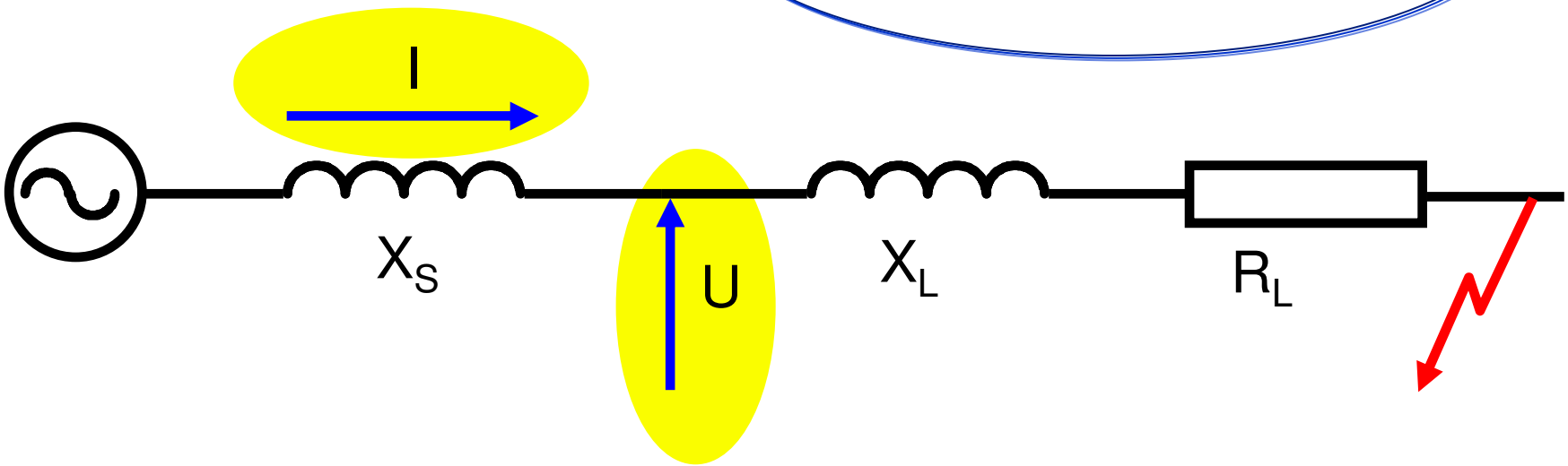
Main features of REL670

- Fast operate time
- Full scheme
- Advanced phase selection
- Very low CT requirements
- Complete software library for all applications
- Full bay control functionality

Distance Protection algorithm

Measuring algorithm

Further improved algorithm



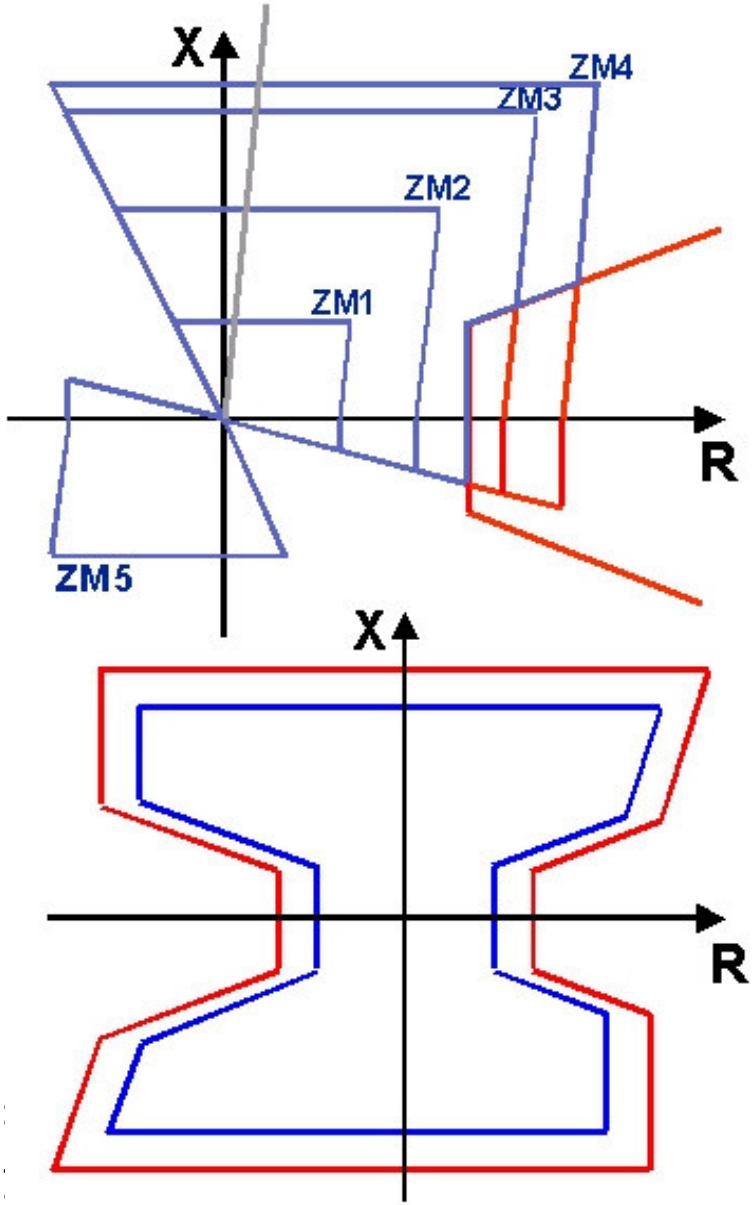
$$u = i \cdot R + \frac{X \cdot di}{\omega_o \cdot dt}$$

Superior Functionality

Full Scheme Distance Protection

- Full scheme measurement
- Evaluation of different fault loops each 1 ms
- Separate PS measuring elements
- Separate PSD measuring elements
- Up to five independent distance zones
- Selective operation for complex faults
- CVT-filtering

Full scheme distance protection



- Full scheme measurements for all five shaped zones
- Single phase operation for parallel line applications and high load conditions
- Load compensation
- Load encroachment compensation
- Enhanced power swing detection

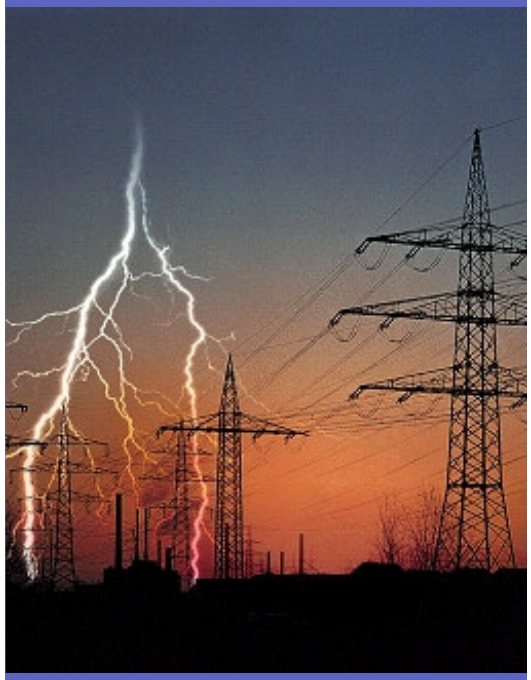
Pre-configured REL 670 Ready To Use

- Single pole breaker – three phase tripping (A31)
- Single pole breaker – single phase triping (A32)
- Multi-breaker – three phase tripping (B31)
- Multi-breaker – single phase tripping (B32)
- Station back-up (A10)

RED 670 Line differential protection

- Line differential terminal for:
  - All voltage levels
  - OH-lines
  - Cables
  - Double circuit lines
  - Series compensated lines
  - Single and two/three pole tripping
  - Optional protection functions
  - Digital communication between line ends
  - Route switched communication networks
  - Easy upgrading from 2 terminal to tapped line protection

Main features RED 670

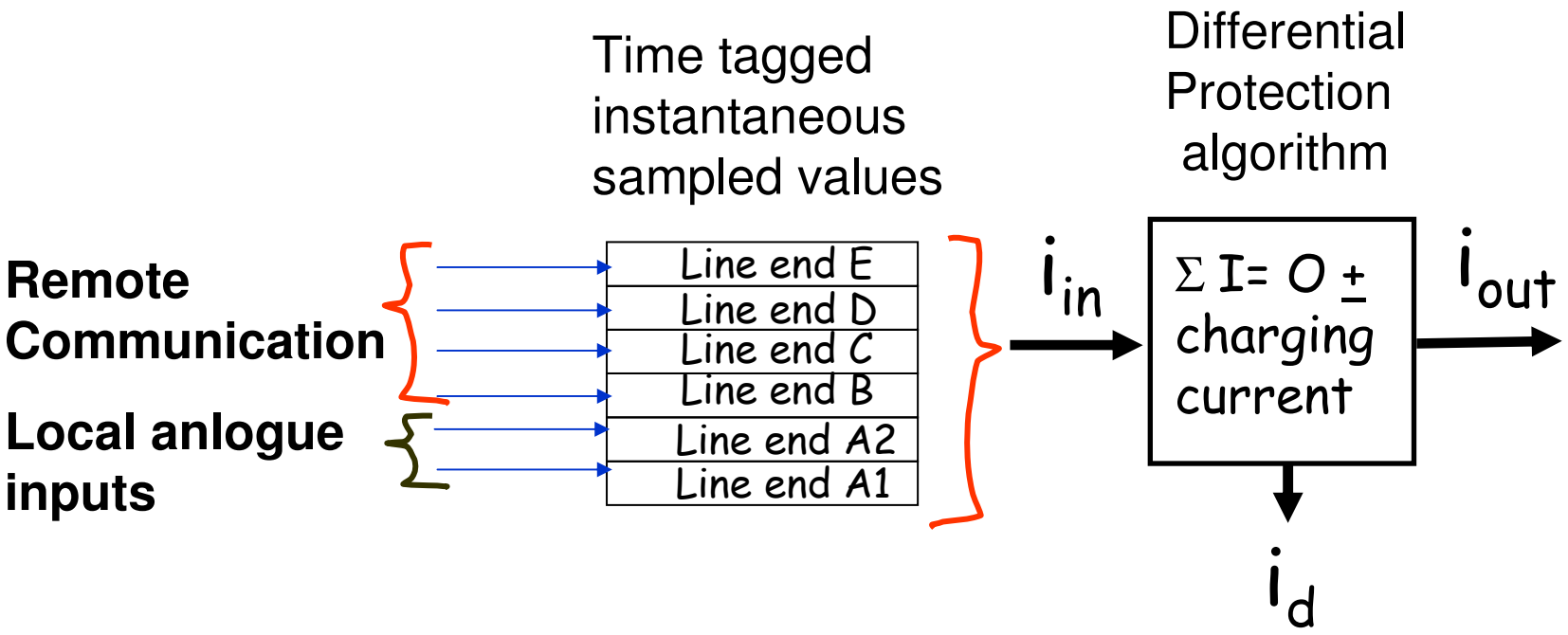


- Excellent tripping time <25 ms
- Completely phase segregated measurement
- Extremely stable for external faults
- Very good sensitivity for internal faults
- Flexible communication configuration

Main features RED 670

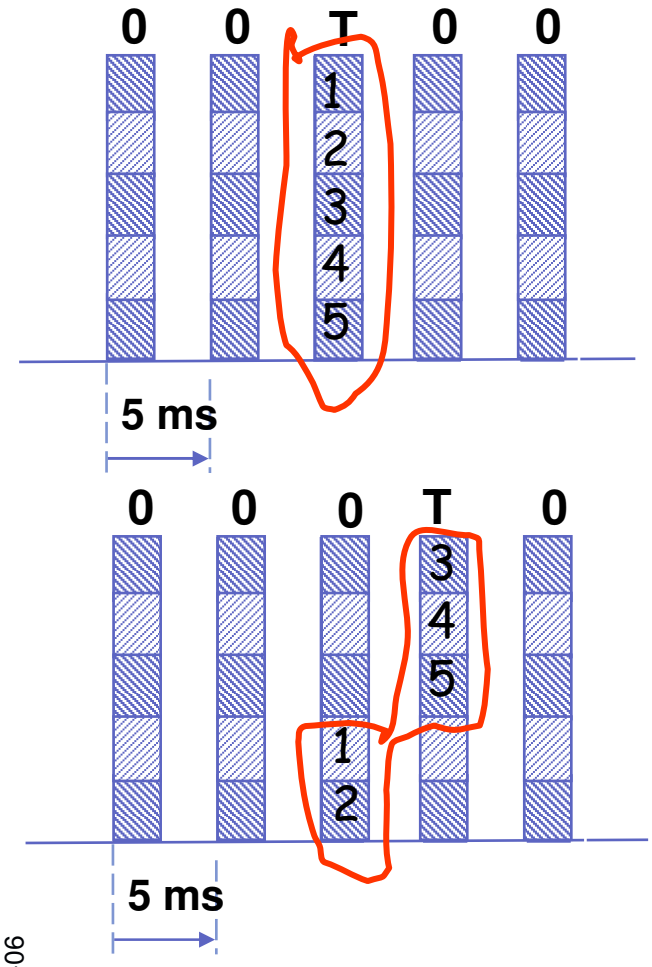
- Low CT requirements,
- Allowed CT ratio difference < 30:1
- The differential algorithm not dependent on the number of connected lines
- Dual slope stabilisation

Differential protection principle



All currents i_{in} , i_{out} & i_d are calculated from phase current values from all line ends

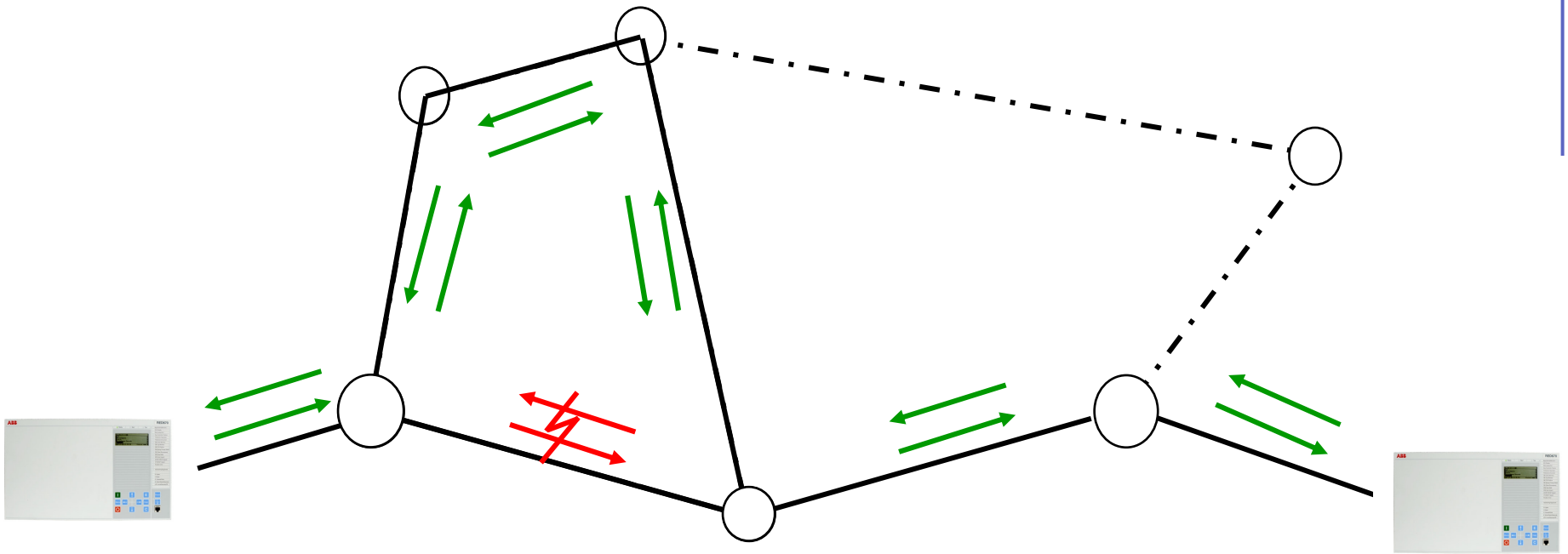
Differential Trip Security



- Sampled values 1 ms
- Message sent every 5 ms
- Message contains 5 sets of sampled values
- Trip enabled with 5 consecutive sample sets calculated to trip
- 1 or 2 messages required depending on fault incidence point

Route Switched Networks

The echo method allows for route switching with equal delay times for send and receive directions

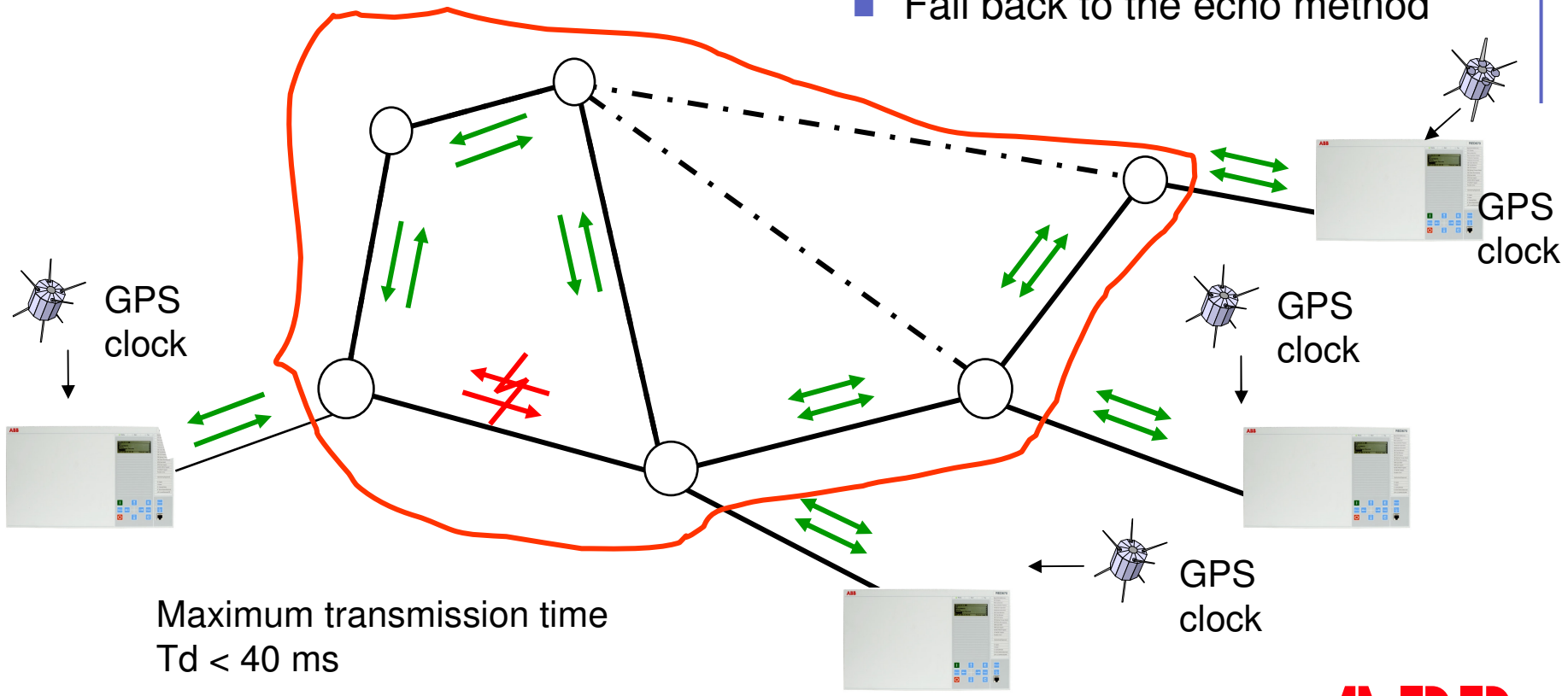


Maximum transmission time $T_d \leq 40$ ms
Route switching must be completed within 2 seconds

Route Switched Network

without delay symmetry:

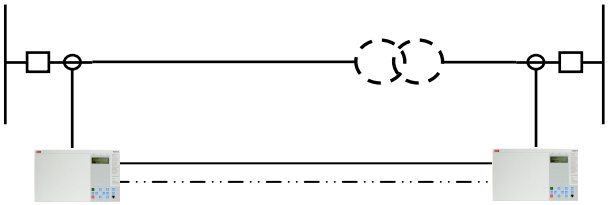
- GPS system required for set up
- GPS loss tolerated with:
  - Free-wheeling IED clocks
  - Fall back to the echo method



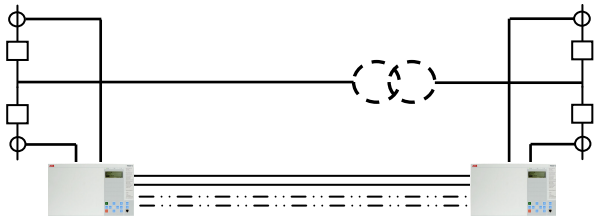
Maximum transmission time
Td < 40 ms

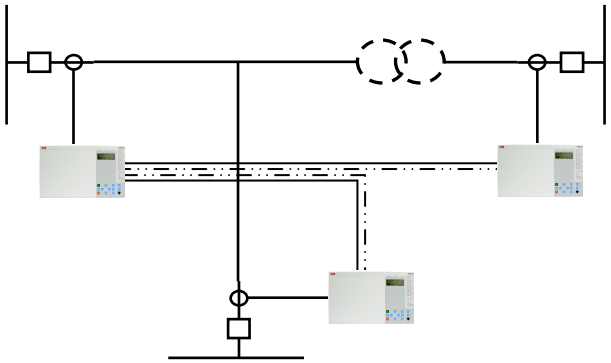
RED 670 Multi Terminal Line Differential

For 2, 3, 4 or 5 line ends of overhead lines or cables

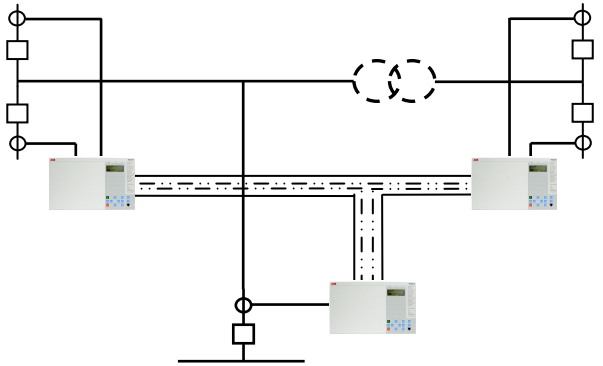


Single or redundant channels

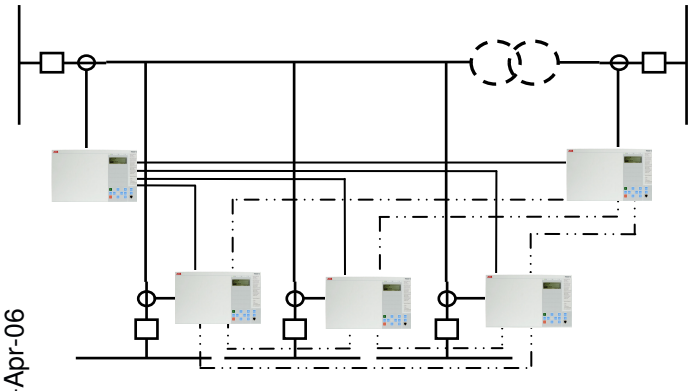




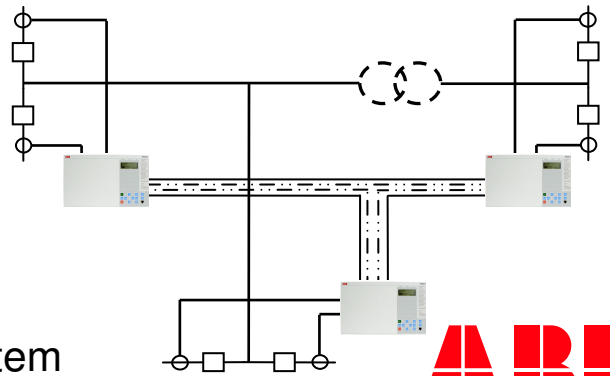
Single or 1½ breaker



With or without transformer



Master-master or Master-slave com. system

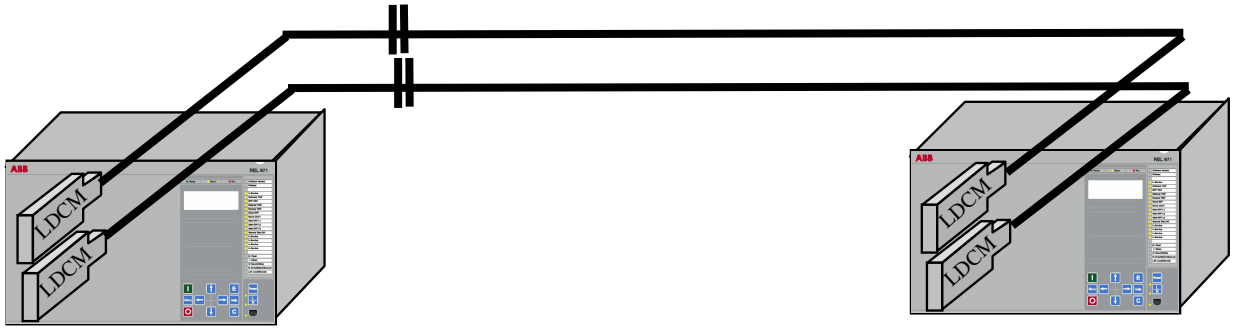


Communication hardware solutions

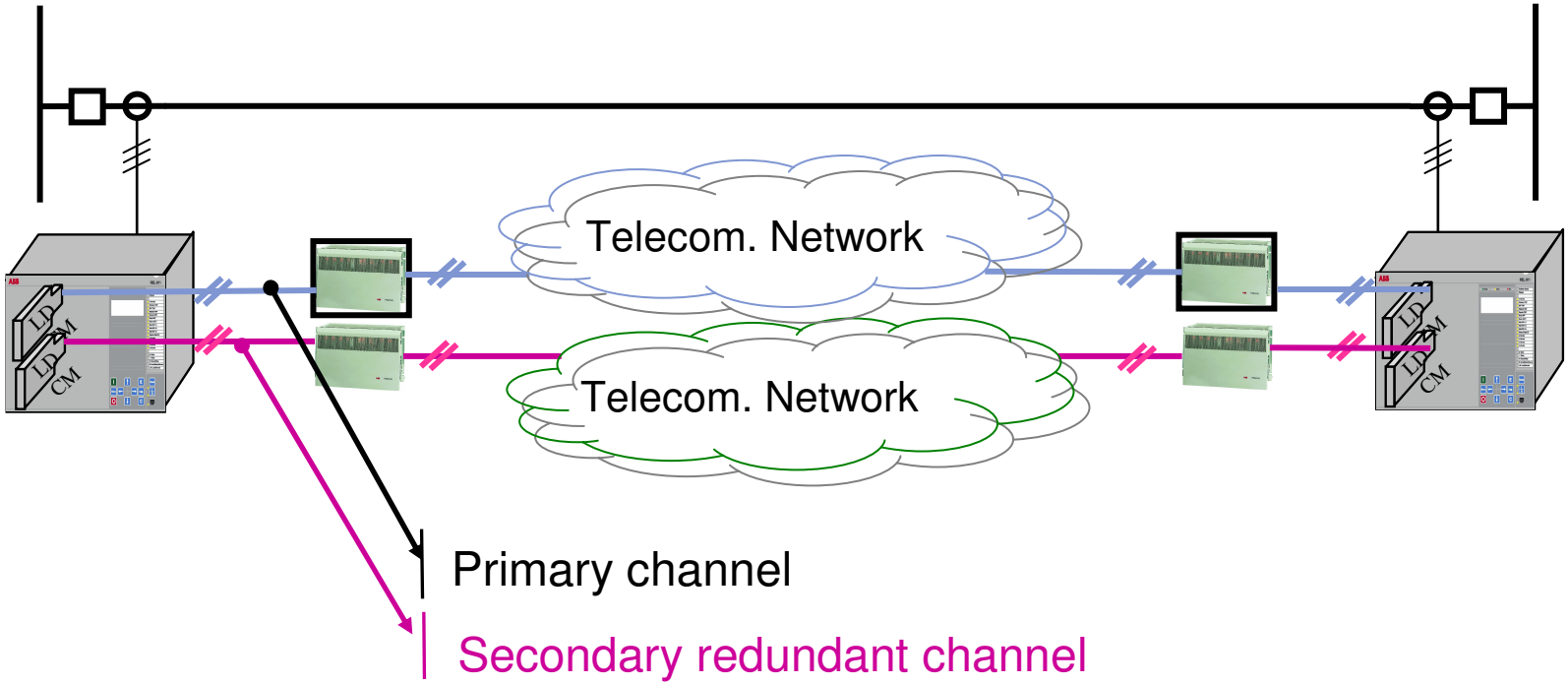
Direct fiber

Single-mode approximately 150 km

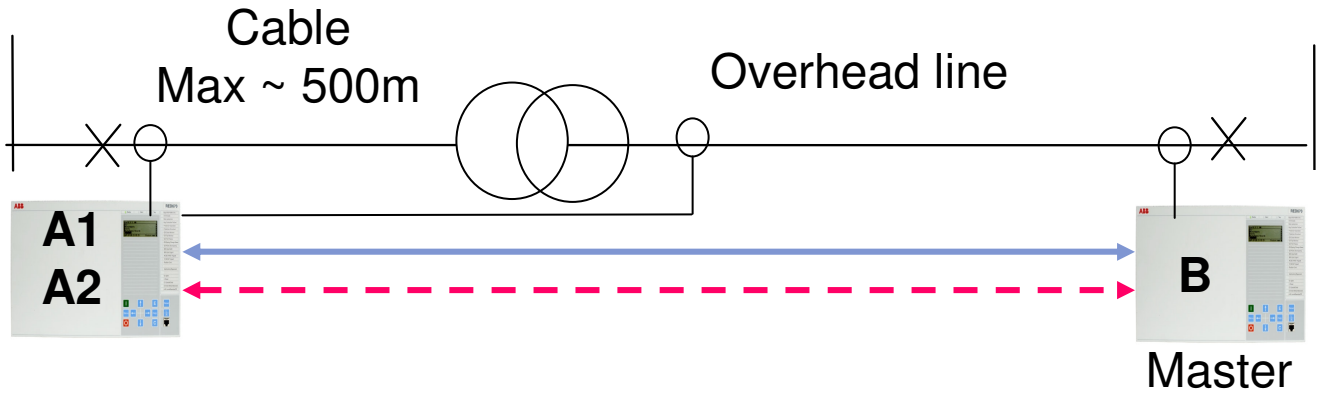
Multi-mode 3km



Redundant communication channels



Transformer & overhead line



Optimal solution with RED 670

Pre-configured RED 670 Ready to Use

- Single breaker – Three phase tripping (A31)
- Single breaker – Single phase tripping (A32)
- Multi-breaker – Single phase tripping (B31)
- Multi-breaker – Three phase tripping (B32)

Summary IED 670 hard and software

- New fast IED 670 technology fully based on IEC61850
- More functions in the same IED
- Extensive I/0 capacity
- New common tool for all ABB IED's

Summary REL 670 & RED 670

- REL 670 line distance protection with full scheme and many functions
- RED 670 line differential protection for up to five terminals
- Many new solutions for line applications are now availble

Power and productivity
for a better world™