Carl Öhlén

A modular and future proof IED concept

Rio de Janeiro
April 23-25, 2006

© ABB Power Technologies AB

A global activity

- Global Center HV SA Products
  - Västerås, Sweden (IEDs & Cx)
  - Vaasa, Finland (MicroSCADA)
  - Mannheim, Germany (RTU)
- Global Center MV SA Products
  - Vasa, Finland (DA)
- Global Center SA System
  - Baden Switzerland
- Local centers
  - Allentown, U.S. (ANSI)
  - Coral Springs, U.S. (EM)
  - India, China, Russia (LP)
  - Local Engineering Centers
- Local Sales, Service & Support

© ABB Group - 2 -
20-Apr-06

A modular & future proof IED concept

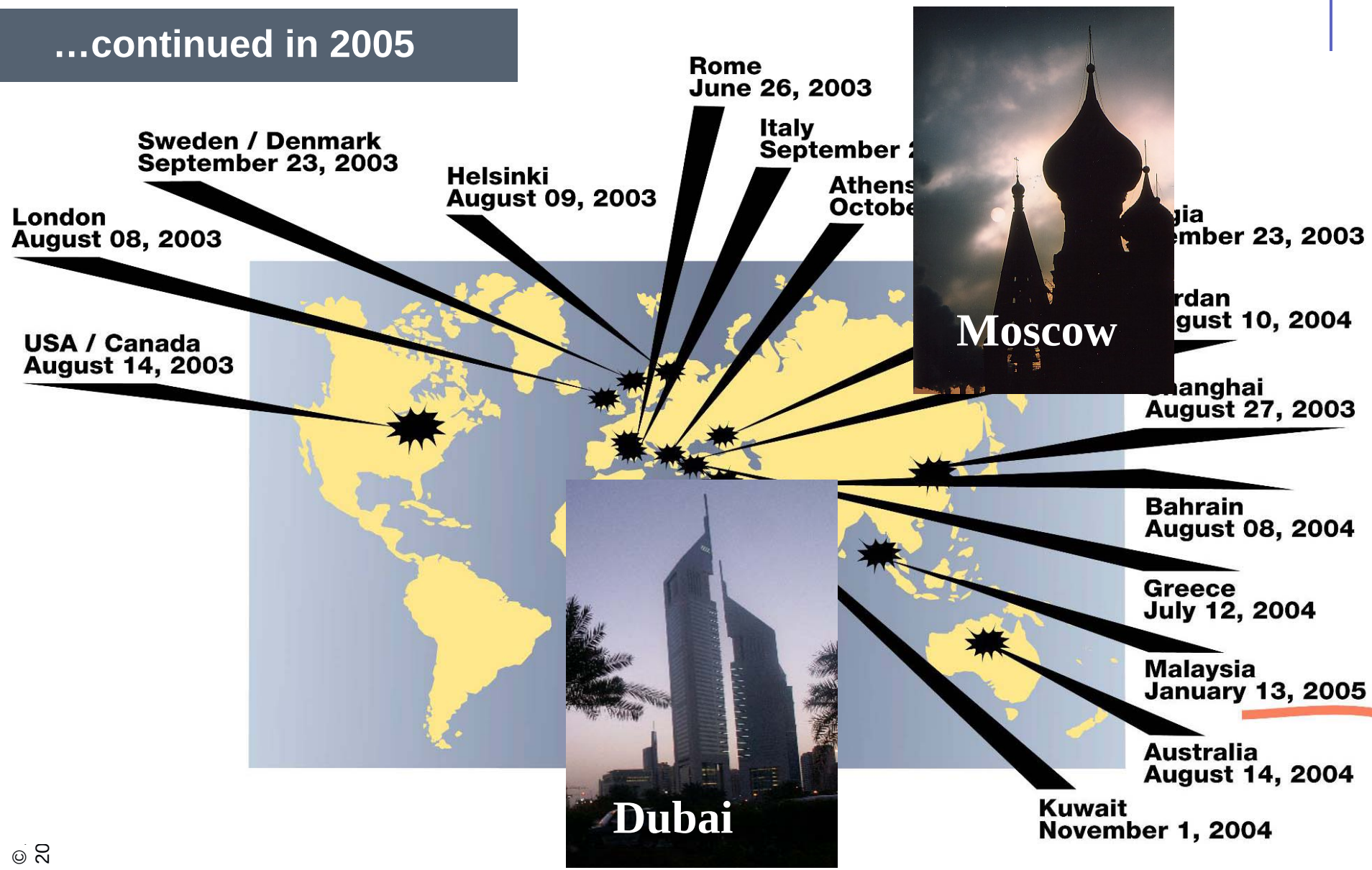
- Why do we need protection and control
- Introducing the ABB application of IEC 61850
- Advantages for an open and modular concept
  - Reliable - Improving the grid reliability
  - Efficient - More than just a relay
  - Flexible - Exactly what you need
  - User friendly - Easy to select, set, install and use
  - Informative - Designed to communicate
  - Forever young - Futurproof migration

© ABB Group - 3 -
20-Apr-06

Imagine a world
without electricity

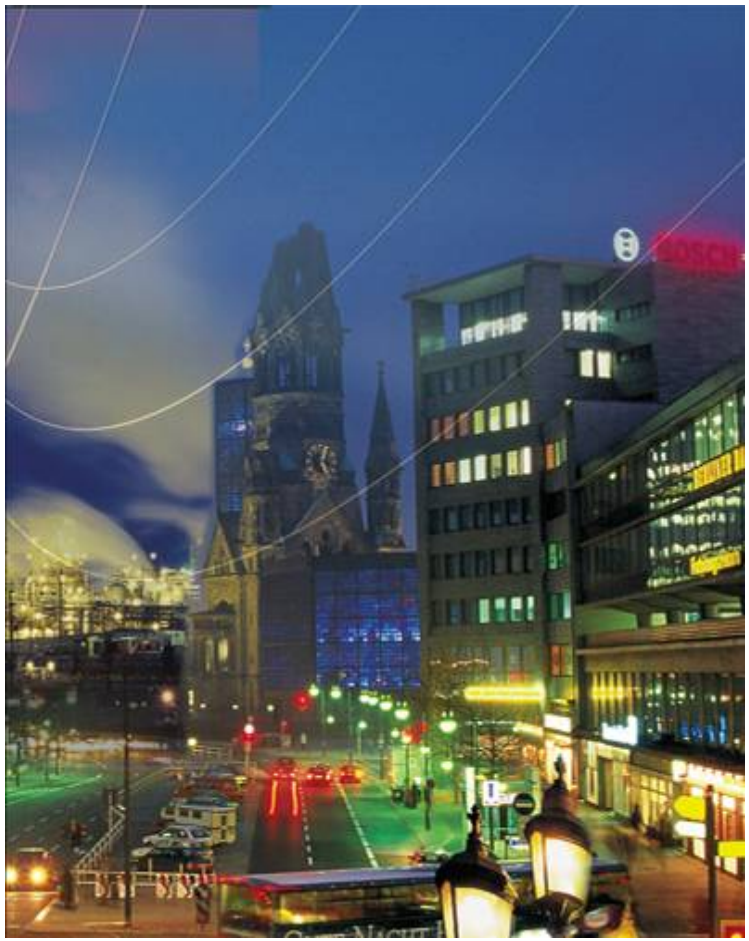
Hot summer blackouts 2003…2004…

…continued in 2005



© 20

Why do we need reliable protection & control?

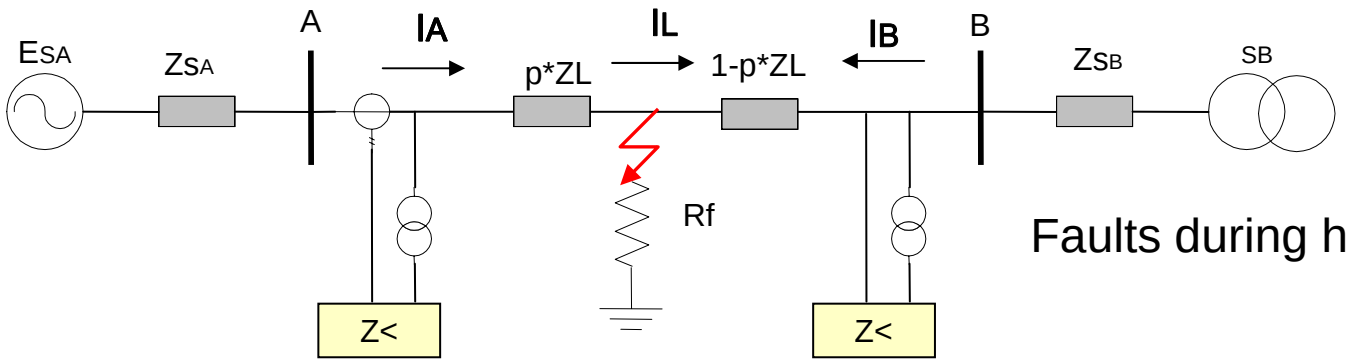


- To rapidly detect and clear all faults with minimum effect to the grid operation
- To inform about all abnormal operating conditions and initiate necessary actions
- To rapidly facilitate the automatic and/or manual restoration to normal operation
- To provide overview, information and control for efficient operation, maintenance & asset management

To detect all types of faults

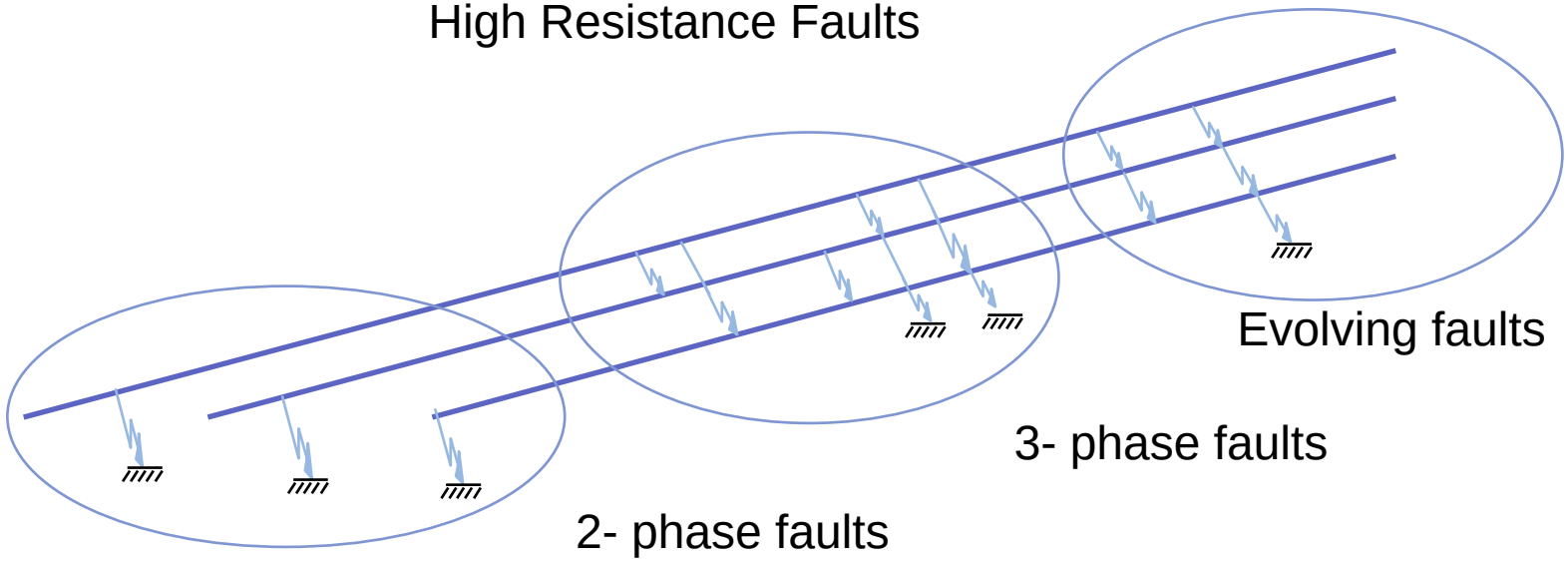
High Current & Faults with large DC component

Weak End Infeed Faults



Faults during high load (I_L)

High Resistance Faults



Evolving faults

3- phase faults

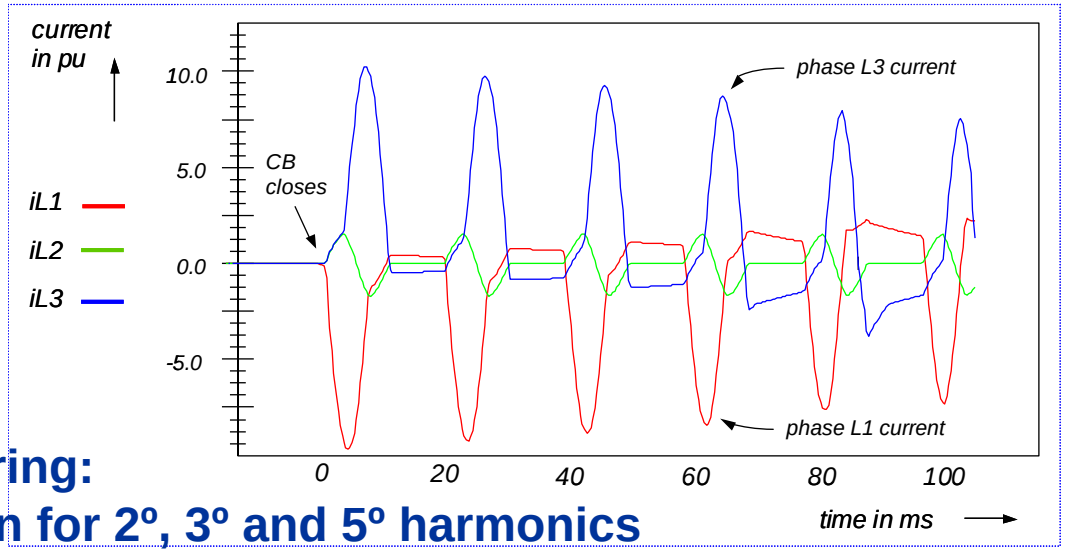
2- phase faults

1- phase faults

© ABB Group - 7 -
20-Apr-06

To operate correctly independent of transients

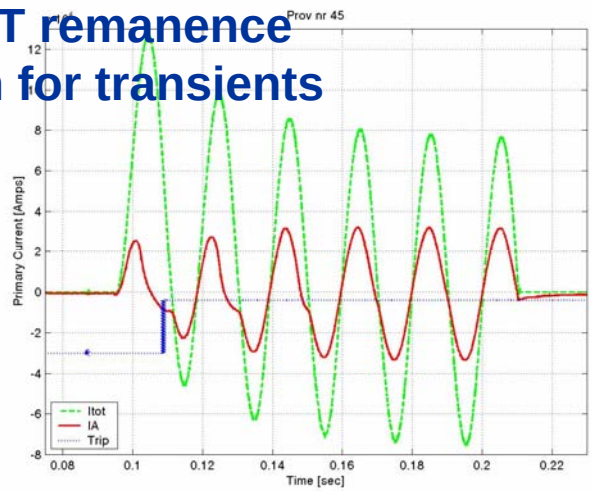
Primary Transients
e.g.Transformer Inrush current and Power Swings



Advanced filtering:

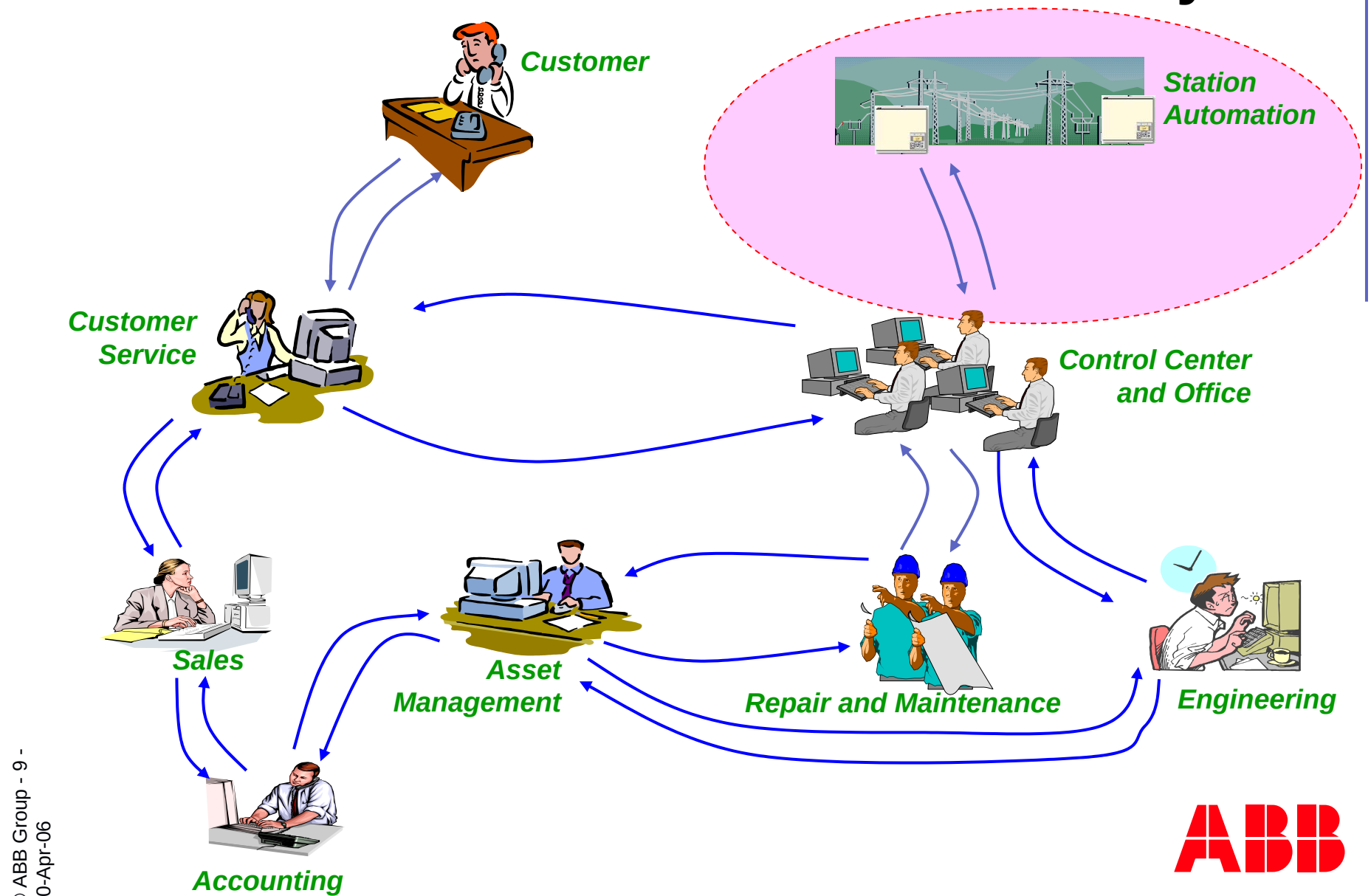
- **Compensation for 2º, 3º and 5º harmonics**
- **Detection of CT saturation**
- **Detection of CT remanence**
- **Compensation for transients**

Secondary Transients
e.g. CT saturation and CVT transients



© ABB Group - 8 - 20-Apr-06

Correct information to act correctly



© ABB Group - 9 - 20-Apr-06

But why do we need so many protocols?

IEC61970 (CIM)

IEC60870-6 (TASE2)

Control Center

Control Center

SCADA
IEC60870-5-101
IEC60870-5-104

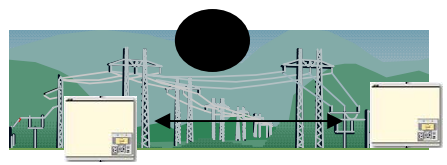
Metering & Billing
IEC61107
IEC62056
IEC60870-5-102
YYY

Windfarms
IEC51400-25
= IEC 61850

IEC 61850

IEC G703
IEEE C37.94
WWW

Station Automation



Station Automation

IEC 61850

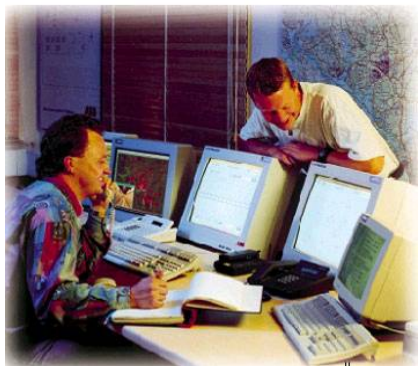
© ABB Group - 10 - 20-Apr-06

What? Where? When? Who? Which?- then How?

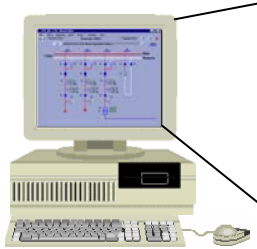
Information and control access

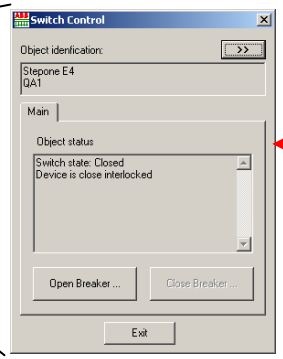
Control Center
(On line)

Office **Home** **Anywhere**
(On request)

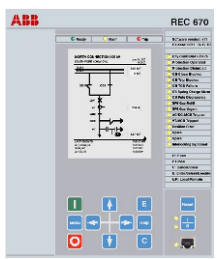


Station HSI





IED HMI

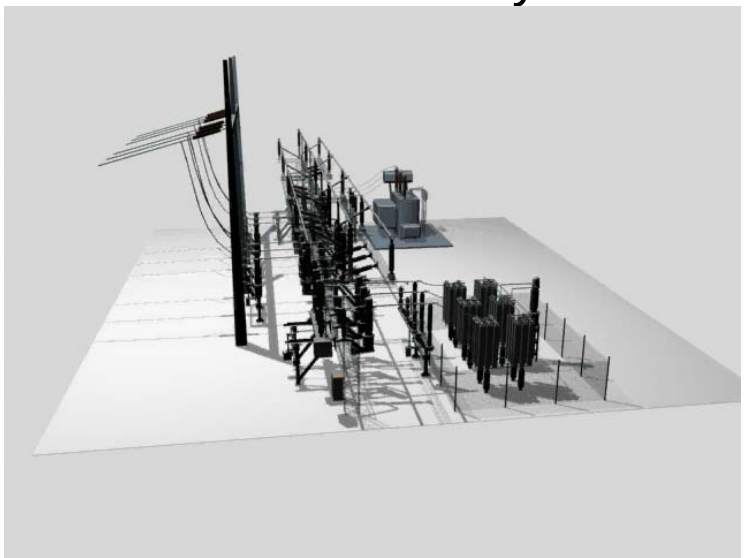


Substation
(Automatic)

© ABB Group - 11 -
20-Apr-06

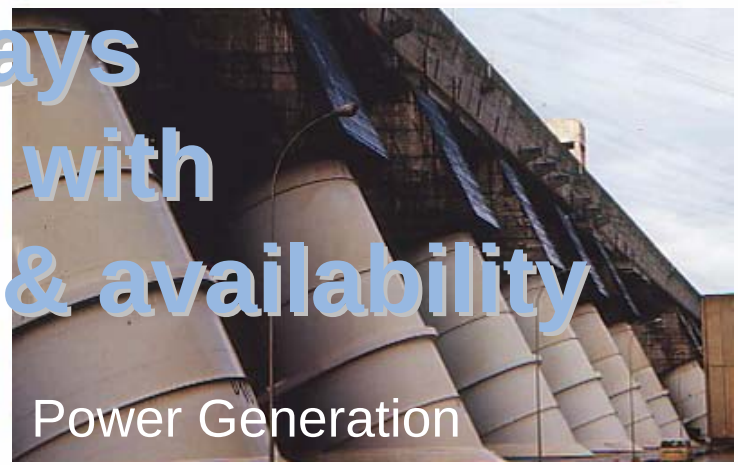
Protect your assets and personnel & ensure reliable power supply

AIS industrial and utility substations



High Voltage Power Systems

The objective is always protection & control with maximum reliability & availability



GIS industrial and utility substations

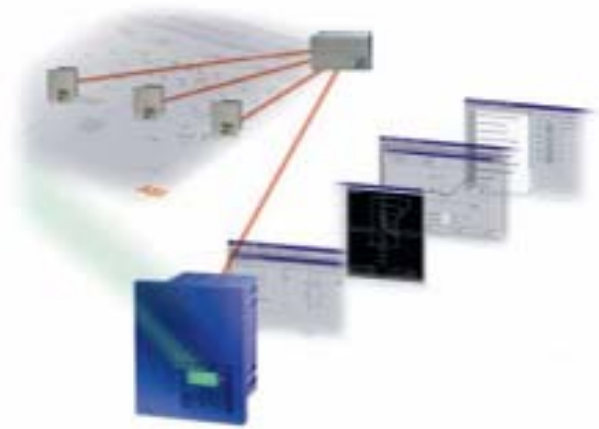
© ABB Group - 12 - 20-Apr-06

A modular & future proof IED concept

- Why do we need protection and control
- Introducing the ABB application of IEC 61850
- Advantages for an open and modular concept
  - Reliable - Improving the grid reliability
  - Efficient - More than just a relay
  - Flexible - Exactly what you need
  - User friendly - Easy to select, set, install and use
  - Informative - Designed to communicate
  - Forever young - Futurproof migration

© ABB Group - 13 - 20-Apr-06

The next step in technology for ABB



IED = Intelligent Electronic Device

- Products for protection, monitoring and control of distribution and transmission networks & electrical processes in industries and power plants
  - Today's protection and control products are an evolution from more than 100 years of experience of relays and more than 20 years experience of numerical protection, digital communication & substation automation
  - ABB has delivered more than 10 millions relays and 500 000 IEDs to more than 100 countries on all continents
- We now introduce a unique and open concept based on the new standard = IEC 61850
- IED 670, PCM 600 e MicroSCADA Pro

© ABB Group - 14 - 20-Apr-06

The next step in our IED evolution

- 100 – series
- 200 – series
- 300 – series
- 500 – series

\+ Further enhanced algorithms

\+ Further increased functionality

\+ Further improved tools

\+ New user friendly HMI

\+ Full IEC 61850 implementation

= Introducing IED 670

ONE powerful and open IED

for ALL transmission applications

© ABB Group - 15 -
20-Apr-06

One Future proof IED for ALL applications

© ABB Group
20-Apr-06

A major leap in Substation Automation

IED = Intelligent Electronic Device
IED 670 for ALL protection and control of transmission applications

REL670 = Lines and cables
RET670 = Transformers and Multple objects
RED670 = Multi terminal networks
REC670 = Control for one or several bays
REB670 = Bus & Breaker
PCM 600 = Configuration & Monitoring
MicroSCADA Pro, Gateway & RTU

ABB introduce the first open concept for protection and control of transmission applications designed for the new IEC 61850 standard

© ABB Group - 17 - 20-Apr-06

Introducing IEC 61850 for protection and control

Interoperability

The ability for IED's from one or several manufacturers to exchange information and use the information for their own functions

Free configuration

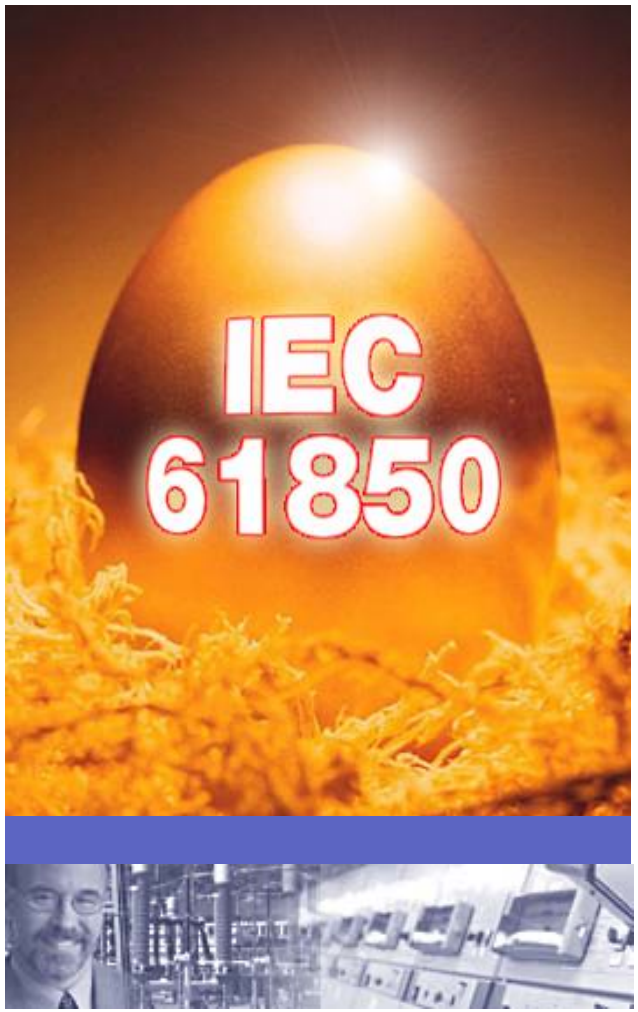
The standard shall support different architecture and allow a free allocation of functions. E.g. it must work equally well for centralized or decentralized systems.

Long term stability

The standard shall be future proof, i.e. it must be able to follow thed progress in communication technology as well as evolving system requirements

© ABB Group - 18 - 20-Apr-06

What is 61850 Open Communication?



"Combining the best properties in a new way..."

Basics:

- Ethernet 100 MBps
- Station Bus 61850 8-1
- Process Bus 61850 9-2
- Bay-to-bay communication (Goose)
- Common Object Modeling (logical nodes) and Configuration Language (SCL)

Much more than a protocol:

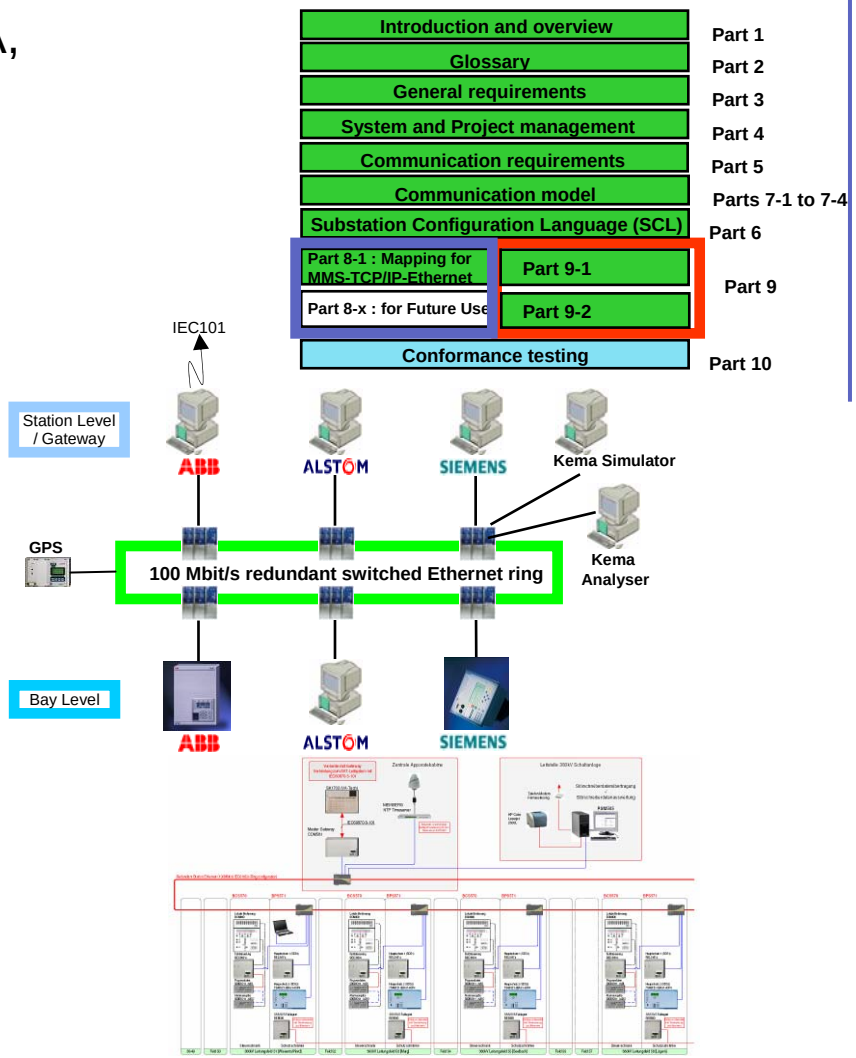
- Modularization and structuring of data
- Standardized Logical Nodes
- Allocation of functions to any IED
- Structured engineering & services

A reliable, simple and fast way to build YOUR future proof Substation Automation

© ABB Group - 19 - 20-Apr-06

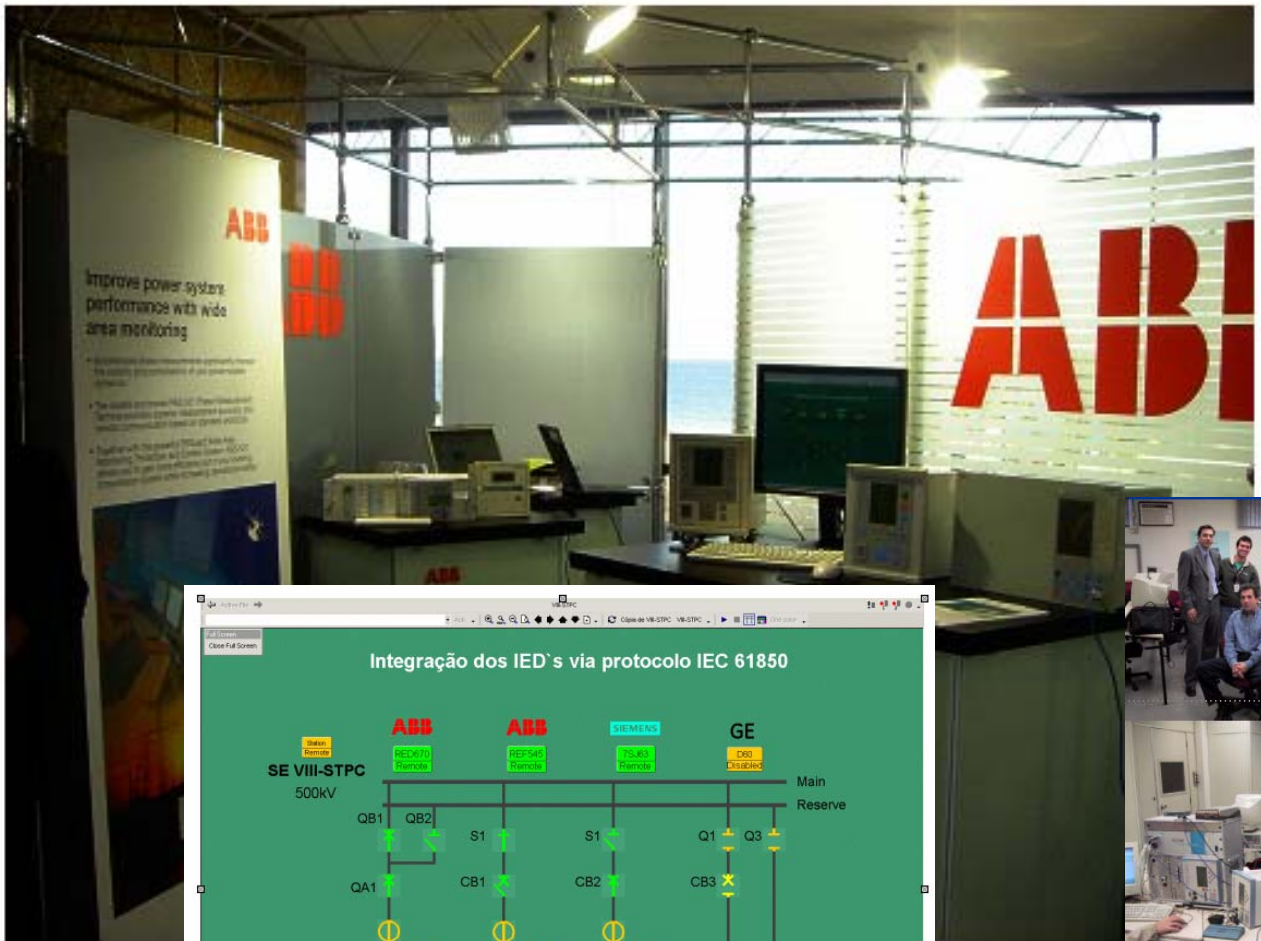
ABB's Experience and Status

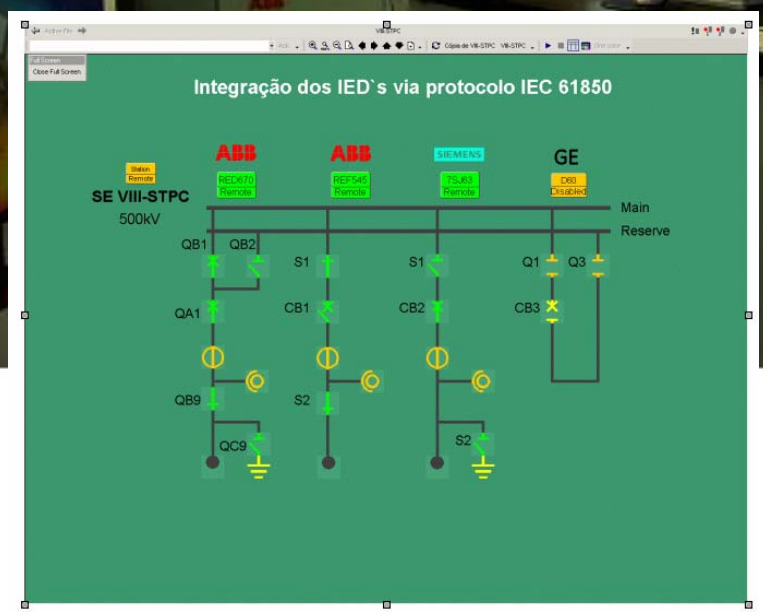
- > 20 years experience of EMS, SCADA, SA and DA solutions
  - ABB is global leader in automation
  - First Ethernet SA system & SPA 1984
  - First LON SA system 1994
- Driving force in standardization committees
  - 13 permanent members in TC57 !
- Extensive interoperability testing with Areva, Siemens and Omicron
- IEC61850 References
  - First High Voltage IEC61850 multi-vendor installation in service
  - > 50 stations on order
  - > 200 project proposals



© ABB Group - 20 -
20-Apr-06

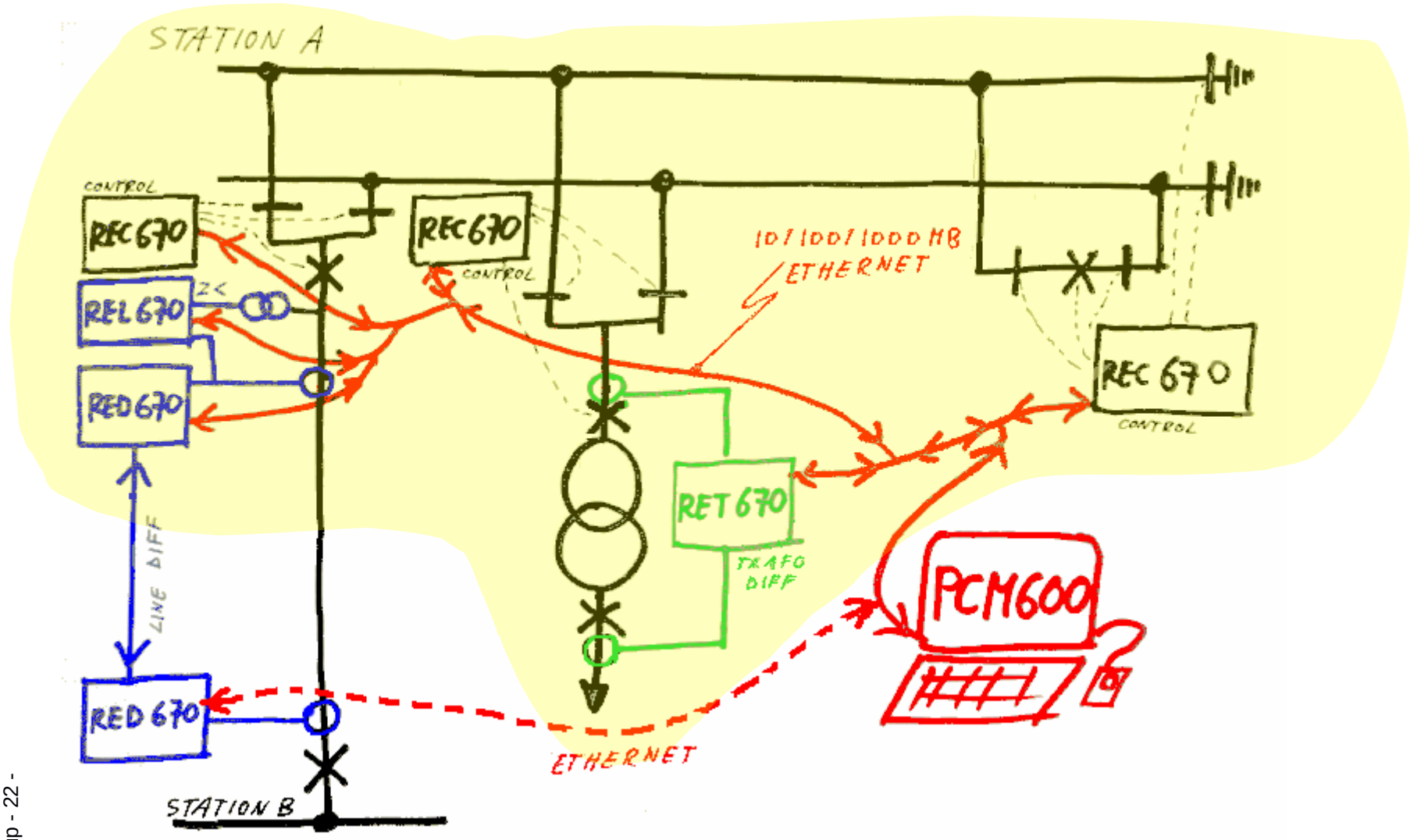
Interoperability demo (June 2005 Brazil)





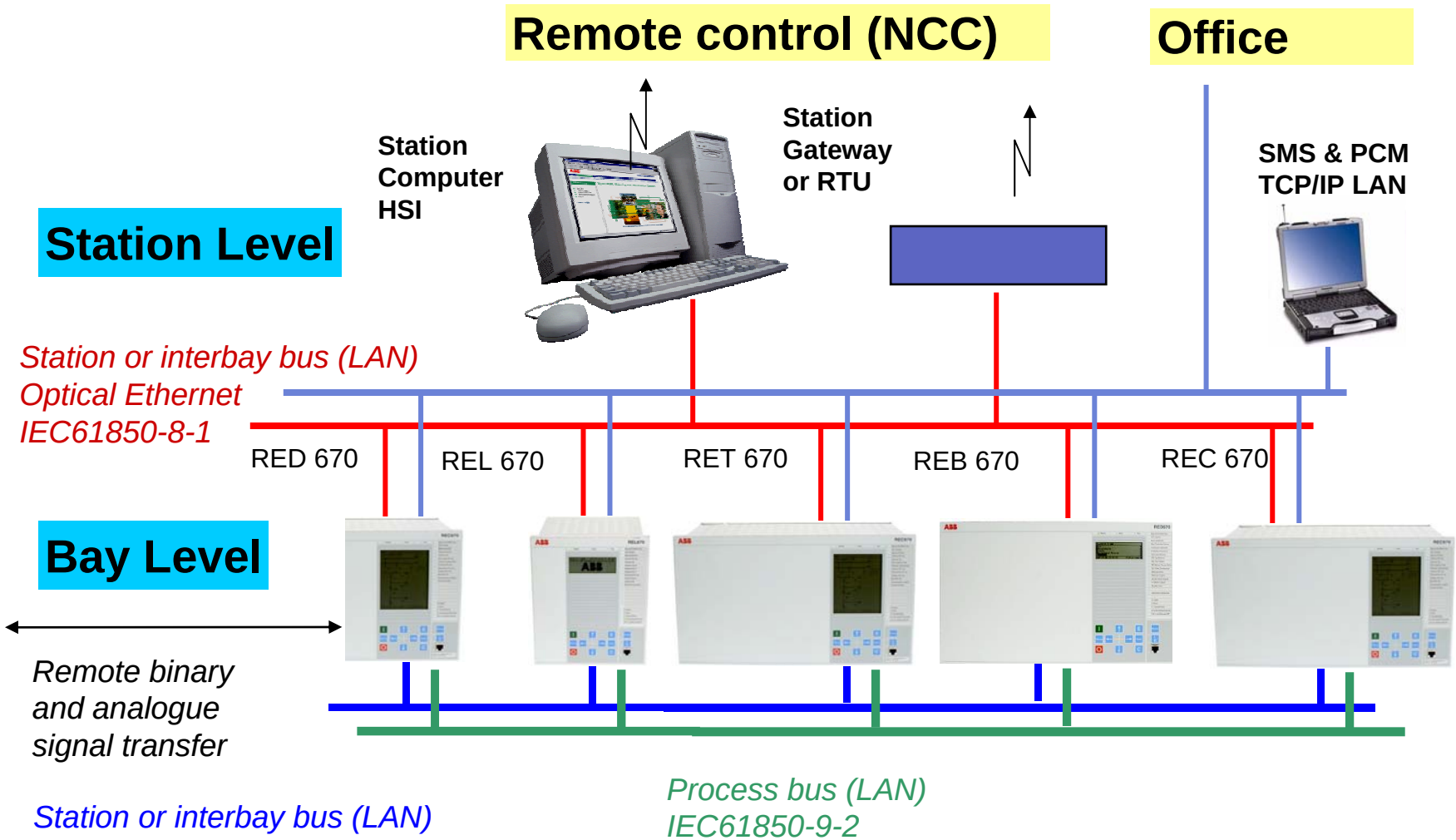
© ABB Group - 21 - 20-Apr-06

Now are we ready



© ABB Group - 22 -
20-Apr-06

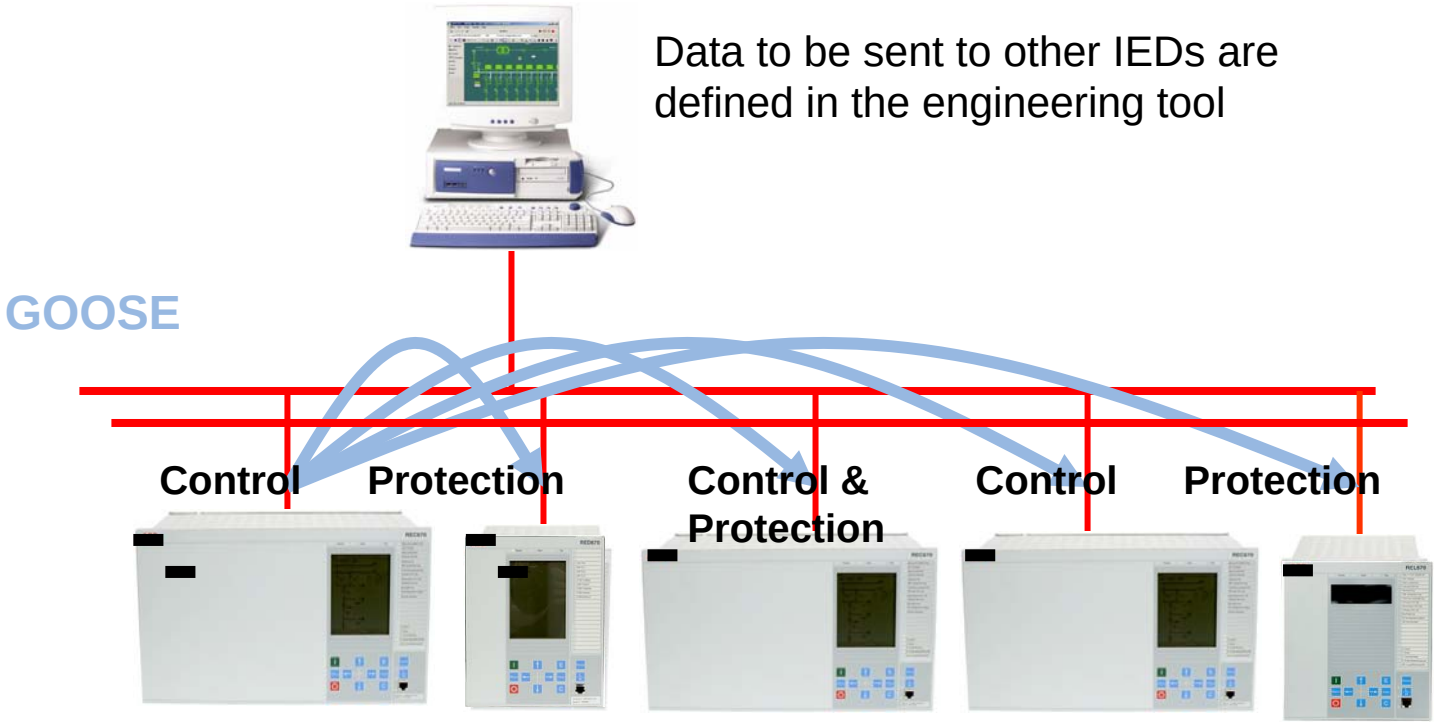
Substation Automation designed for IEC 61850



© ABB Group - 23 - 20-Apr-06

GOOSE - Horizontal communication for ALL IEDs

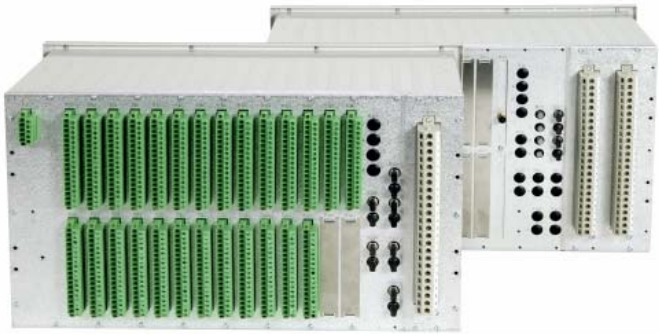
GOOSE = Generic Object Oriented System-wide Events



- Peer to peer communication
- An IED sends information by multicasting
- Only IEDs which are defined to listen (subscribers) receive this message

© ABB Group - 24 - 20-Apr-06

Modular I/O in different “boxes” and HMI



MIM (max 4)

6 Transducer inputs, setting range ± 20 mA

IOM (max 6)

12 binary outputs and 8 binary inputs

BOM (max 4)

24 binary outputs

BIM (max 11/14)

16 binary inputs

1/1 Case

Option 1:
- **1TRM = 12 AI**
- **≤ 14 I/O modules**

Option 2:
- **2TRM = 24 AI**
- **≤ 11 I/O modules**

The same I/O modules as in the REx5xx series

© ABB Group - 25 - 20-Apr-06

Hardware independent function library

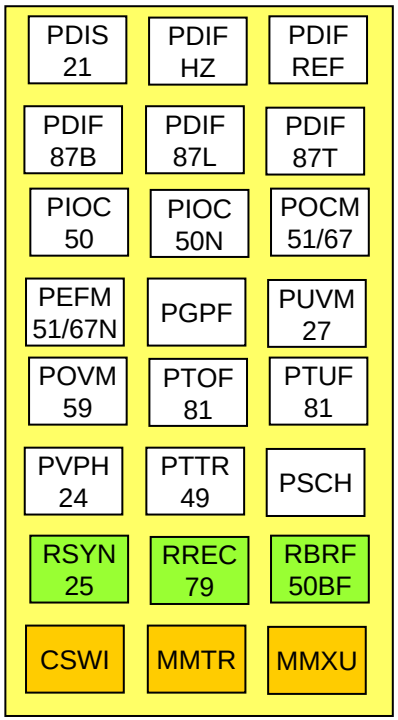
PDIS 21	PDIF HZ	PDIF REF	
PDIF 87B	PDIF 87L	PDIF 87T	
PIOC 50	PIOC 50N	POCM 51/67	
PEFM 51/67N	PGPF	PUVM 27	
POVM 59	PTOF 81	PTUF 81	
PVPH 24	PTTR 49	PSCH	
RSYN 25	RREC 79	RBRF 50BF	
CSWI	MMTR	MMXU	

B24PDIF	87B	Bus differential protection	24 bays
L6CPDIF	87L	Line differential protection	6 x 3 inputs
T3WPDIF	87T	Transformer differential protection	3 x 2 x 3 inputs
REFPDIF	87N	Low impedance differential protection	
HZ PDIF	87	High impedance differential protection	
ZMQPDIS	21	Distance protection	5 or 2 x 2 zones Full scheme
PH4POCM	51/67	Overcurrent protection	4 steps x 6
EF4PEFM	51N/67N	Overcurrent protection	4 steps x 6
POVM	27/59	Overcvoltage protection	
PTUF	81	Under frequency protection	
PTOF	81	Over frequency protection	
PVPH	24	Over excitation protection	
LPTTR	26	Overload protection	
PGPF	XXX	Programmable general current/voltage function	Customized
CRBRF	50BF	Breaker failure protection	
RSYN	25	Synchro check	
RREC	79	Auto reclosing	
CSWI		Control	6 bays / 30 objects
RFLO		Fault locator	
RADR		Disturbance reporting	100 x 40
MMXU		Measurement	
MMTR		Pulse counter	

This is an example of functions included in the library. For full details please consult the buyer's guide.

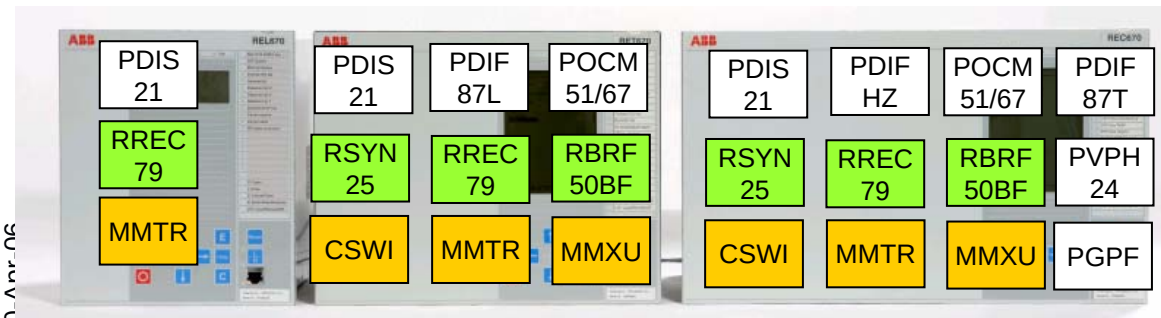
© ABB Group - 26 - 20 Apr 06

Flexible allocation of functions to any IED



B24PDIF	87B	Bus differential protection	24 bays
L6CPDIF	87L	Line differential protection	6 x 3 inputs
T3WPDIF	87T	Transformer differential protection	3 x 2 x 3 inputs
REFPDIF	87N	Low impedance differential protection	
HZ PDIF	87	High impedance differential protection	
ZMQPDIS	21	Distance protection	5 or 2 x 2 zones Full scheme
PH4POCM	51/67	Overcurrent protection	4 steps x 6
EF4PEFM	51N/67N	Overcurrent protection	4 steps x 6
POVM	27/59	Overcvoltage protection	
PTUF	81	Under frequency protection	
PTOF	81	Over frequency protection	
PVPH	24	Over excitation protection	
LPTTR	26	Overload protection	
PGPF	XXX	Programmable general current/voltage function	Customized
CRBRF	50BF	Breaker failure protection	
RSYN	25	Synchro check	
RREC	79	Auto reclosing	
CSWI		Control	6 bays / 30 objects
RFLO		Fault locator	
RADR		Disturbance reporting	100 x 40
MMXU		Measurement	
MMTR		Pulse counter	

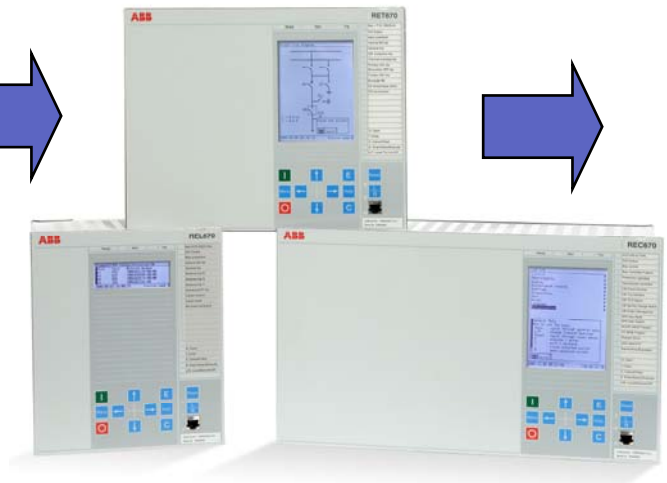
This is an example of functions included in the library. For full details please consult the buyer's guide.

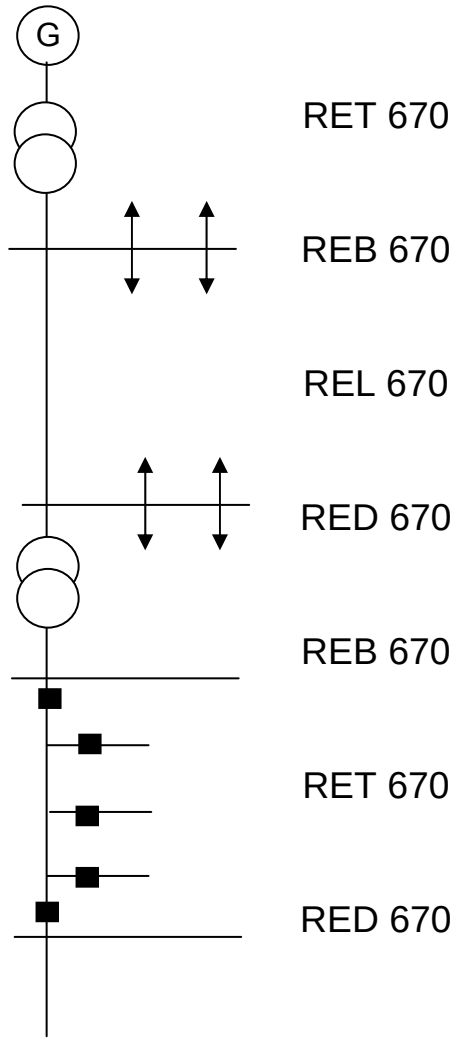


© ABB Group - 27 - 20 Apr 06

Configure your “best” IED from the library

PDIS 21	PDIF HZ	PDIF REF
PDIF 87B	PDIF 87L	PDIF 87T
PIOC 50	PIOC 50N	POCM 51/67
PEFM 51/67N	RBRF 50BF	PUVM 27
POVM 59	PTOF 81	PTUF 81
PVPH 24	PTTR 49	PSCH
RSYN 25	RREC 79	RBRF 50BF
CSWI	MMTR	MMXU



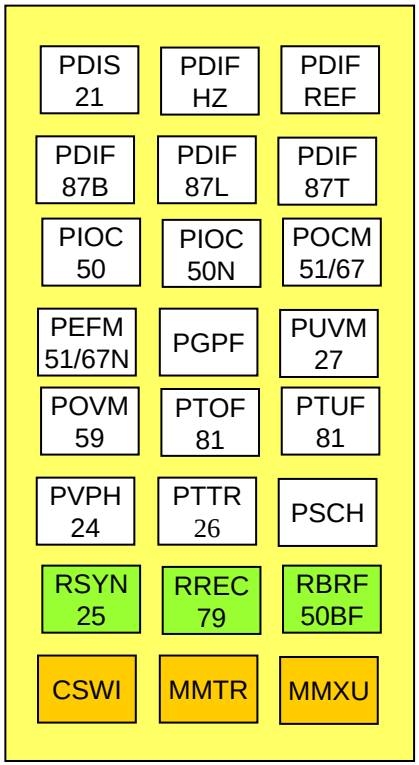


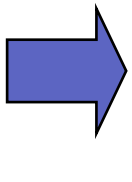
You can even configure ONE IED for transformer protection, line protection, bus protection and control at the same time

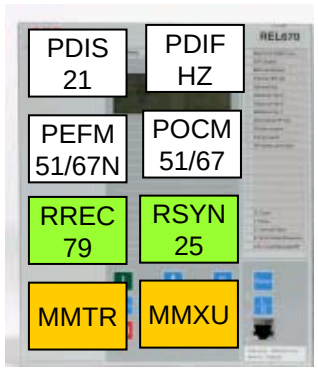
You can upgrade and change the IED at any time (even on-line over LAN/Ethernet)

© ABB Group - 28 - 20-Apr-06

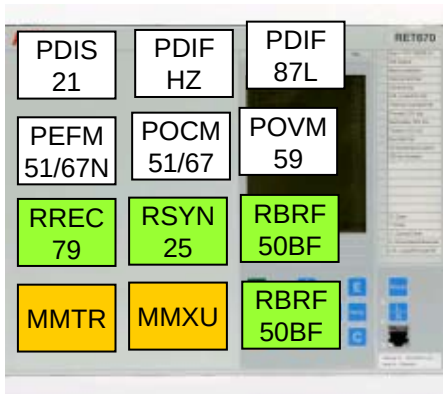
Configure your “best” IED from the library



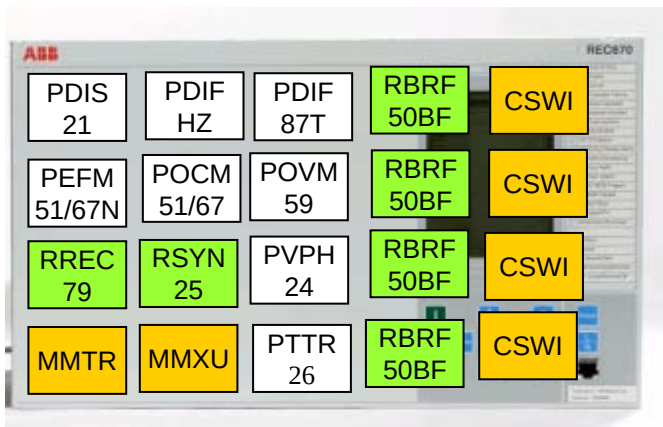




REL 670



RED 670

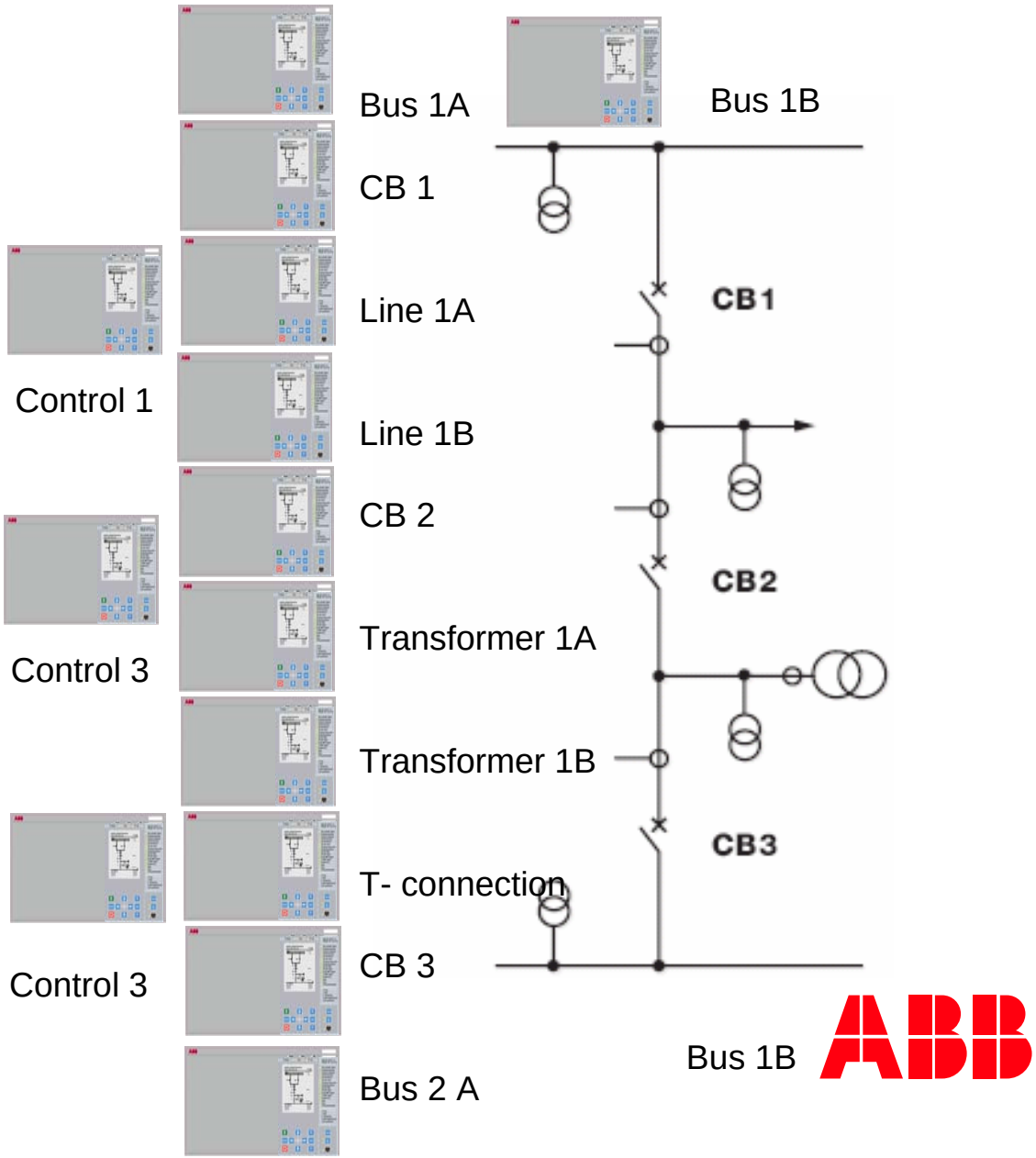


RET 670

© ABB Group - 29 -
20-Apr-06

Optimize with free allocation of functions to any IED

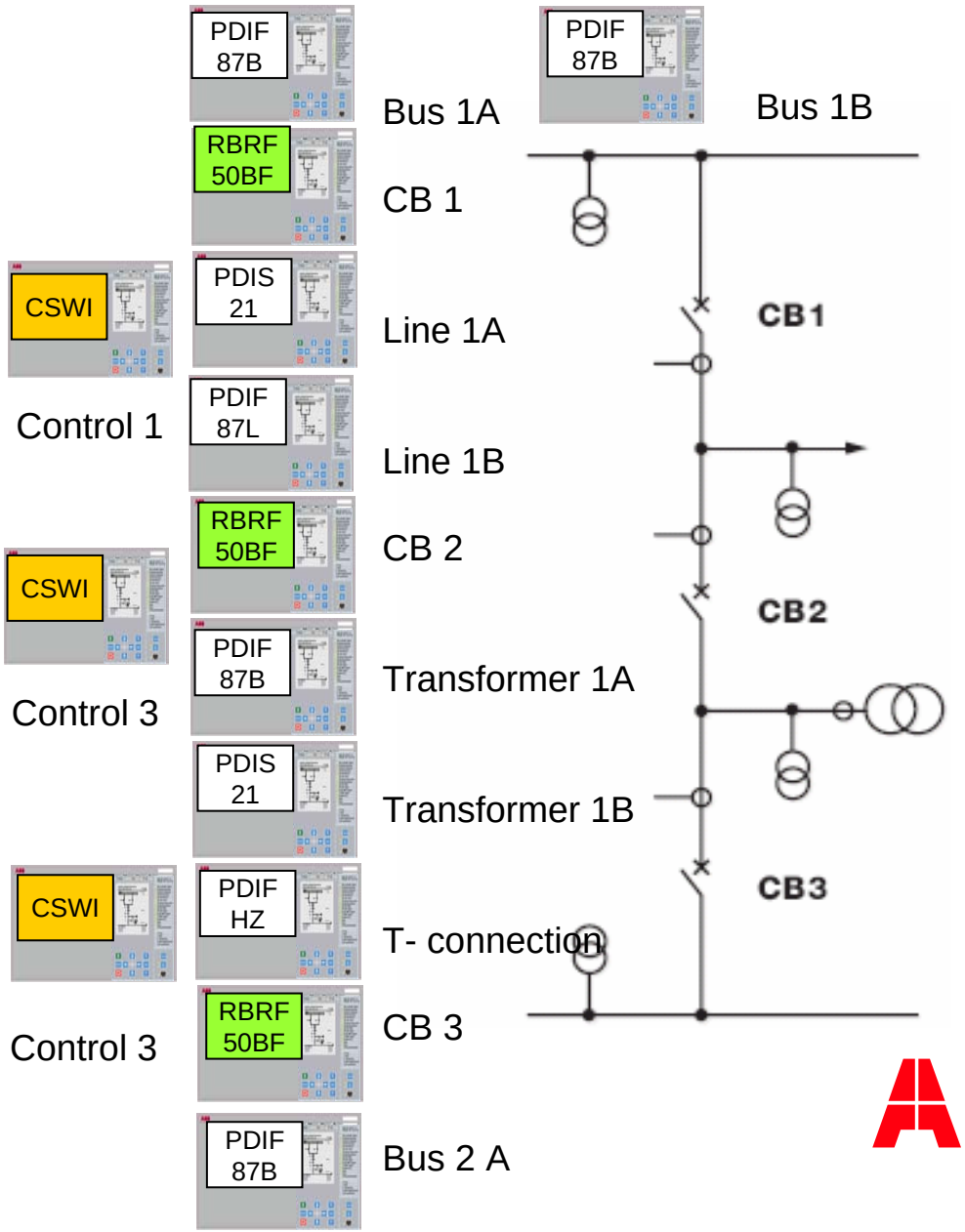
PDIS 21	PDIF HZ	PDIF REF
PDIF 87B	PDIF 87L	PDIF 87T
PIOC 50	PIOC 50N	POCM 51/67
PEFM 51/67N	RBRF 50BF	PUVM 27
POVM 59	PTOF 81	PTUF 81
PVPH 24	PTTR 26	PSCH
RSYN 25	RREC 79	RBRF 50BF
CSWI	MMTR	MMXU



© ABB Group - 30 - 20-Apr-06

Optimize with free allocation of functions to any IED

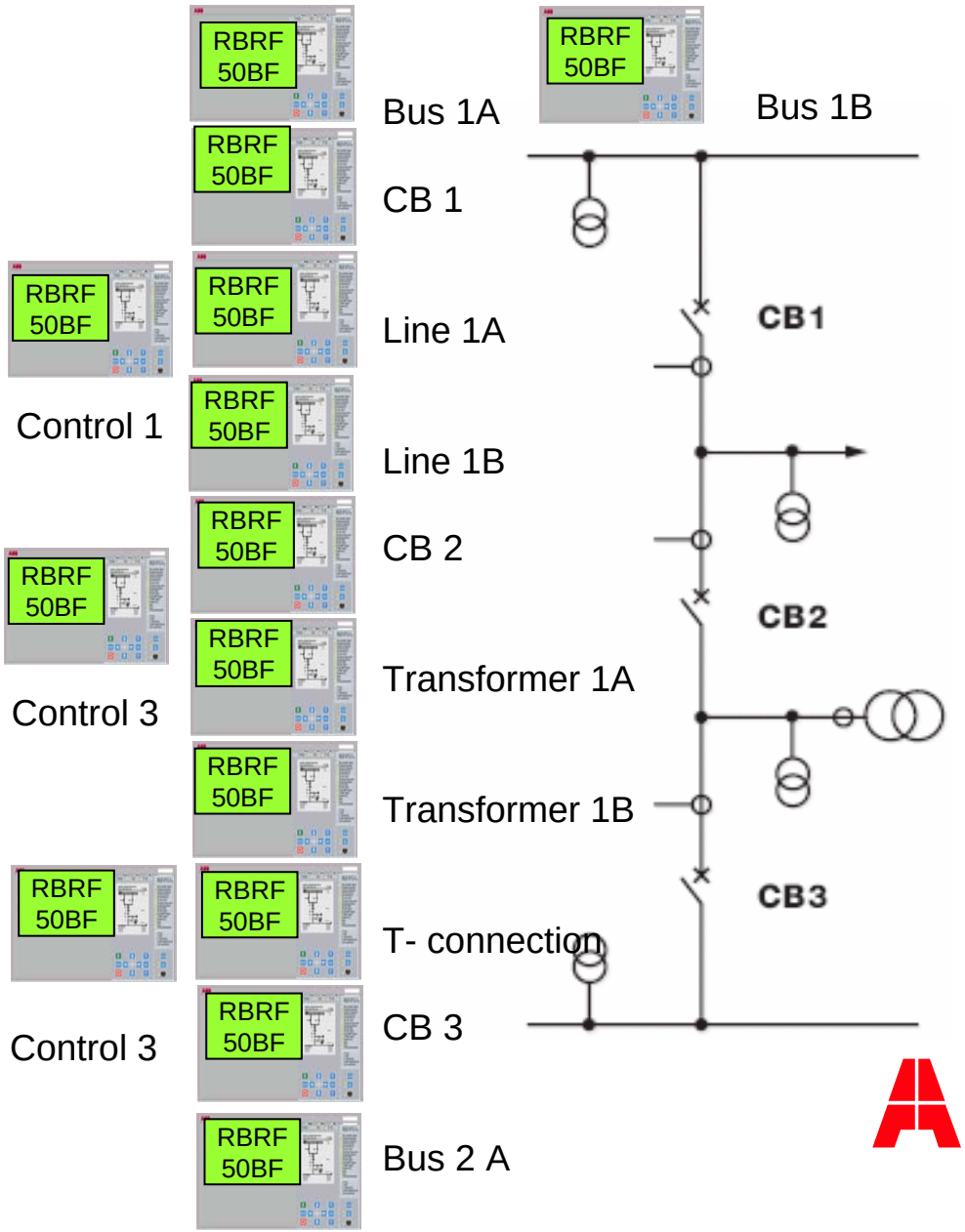
PDIS 21	PDIF HZ	PDIF REF
PDIF 87B	PDIF 87L	PDIF 87T
PIOC 50	PIOC 50N	POCM 51/67
PEFM 51/67N	RBRF 50BF	PUVM 27
POVM 59	PTOF 81	PTUF 81
PVPH 24	PTTR 26	PSCH
RSYN 25	RREC 79	RBRF 50BF
CSWI	MMTR	MMXU



© ABB Group - 31 - 20-Apr-06

E.g. RBRF (50BF) andPIOC (50) in all IEDs

PDIS 21	PDIF HZ	PDIF REF
PDIF 87B	PDIF 87L	PDIF 87T
PIOC 50	PIOC 50N	POCM 51/67
PEFM 51/67N	RBRF 50BF	PUVM 27
POVM 59	PTOF 81	PTUF 81
PVPH 24	PTTR 26	PSCH
RSYN 25	RREC 79	RBRF 50BF
CSWI	MMTR	MMXU

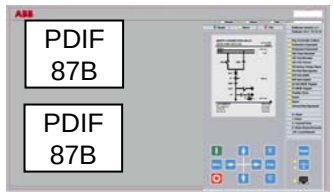


© ABB Group - 32 -
20-Apr-06

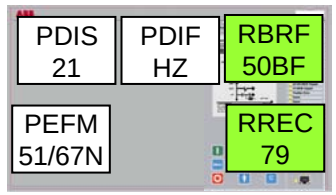
Functional integration in any IED

PDIS 21	PDIF HZ	PDIF REF	
PDIF 87B	PDIF 87L	PDIF 87T	
PIOC 50	PIOC 50N	POCM 51/67	
PEFM 51/67N	RBRF 50BF	PUVM 27	
POVM 59	PTOF 81	PTUF 81	
PVPH 24	PTTR 26	PSCH	
RSYN 25	RREC 79	RBRF 50BF	
CSWI	MMTR	MMXU	

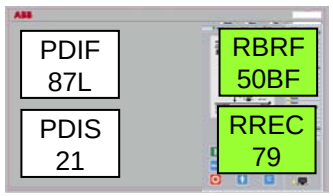
REB 670



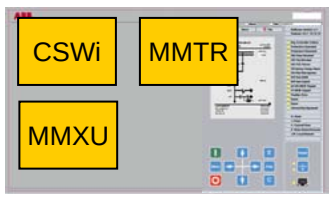
REL 670



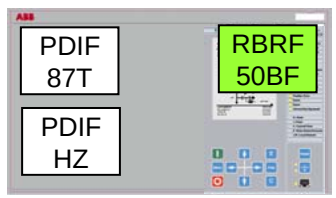
RED 670



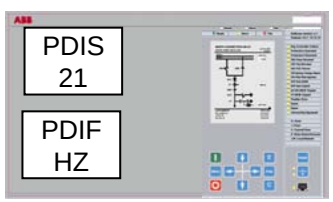
REC 670

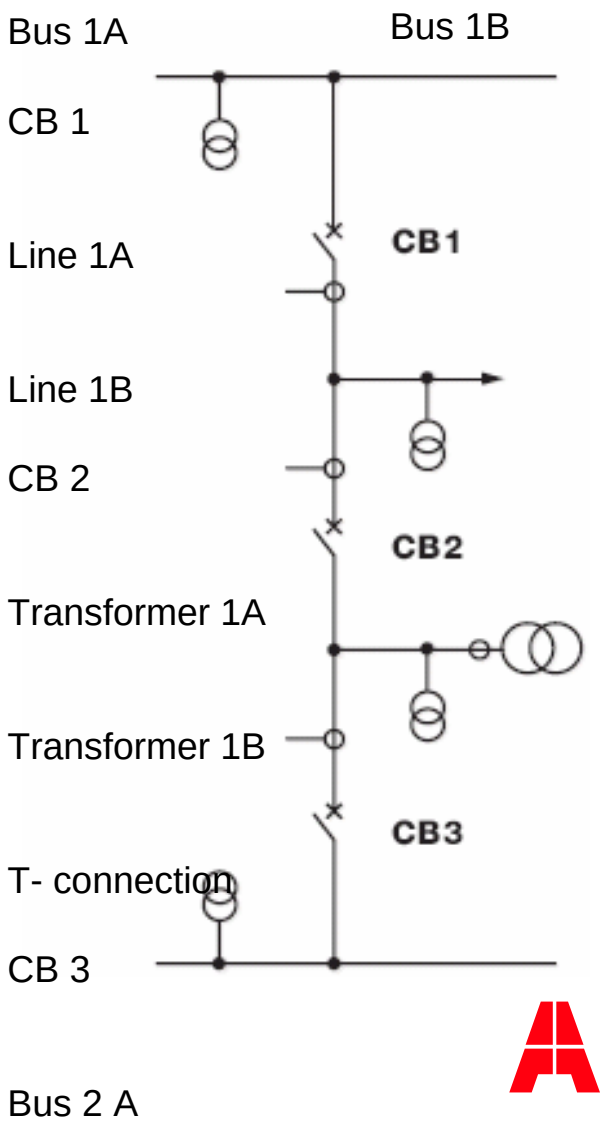


RET 670



REL 670



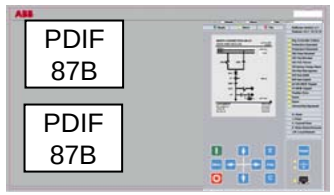


© ABB Group - 33 -
20-Apr-06

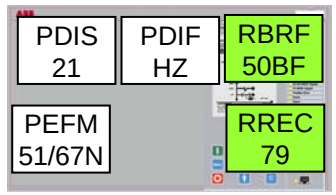
You can move, change and upgrade at any time

PDIS 21	PDIF HZ	PDIF REF
PDIF 87B	PDIF 87L	PDIF 87T
PIOC 50	PIOC 50N	POCM 51/67
PEFM 51/67N	RBRF 50BF	PUVM 27
POVM 59	PTOF 81	PTUF 81
PVPH 24	PTTR 26	PSCH
RSYN 25	RREC 79	RBRF 50BF
CSWI	MMTR	MMXU

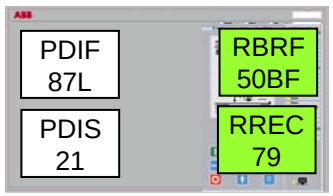
REB 670



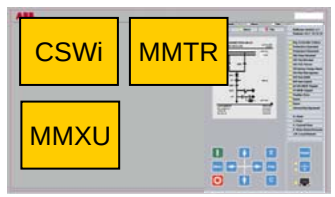
REL 670



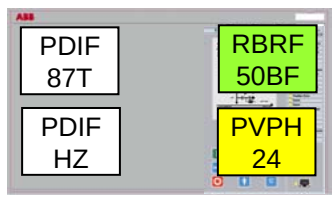
RED 670



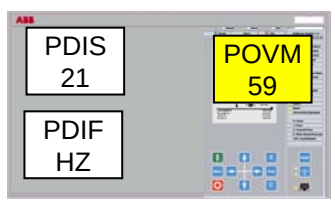
REC 670

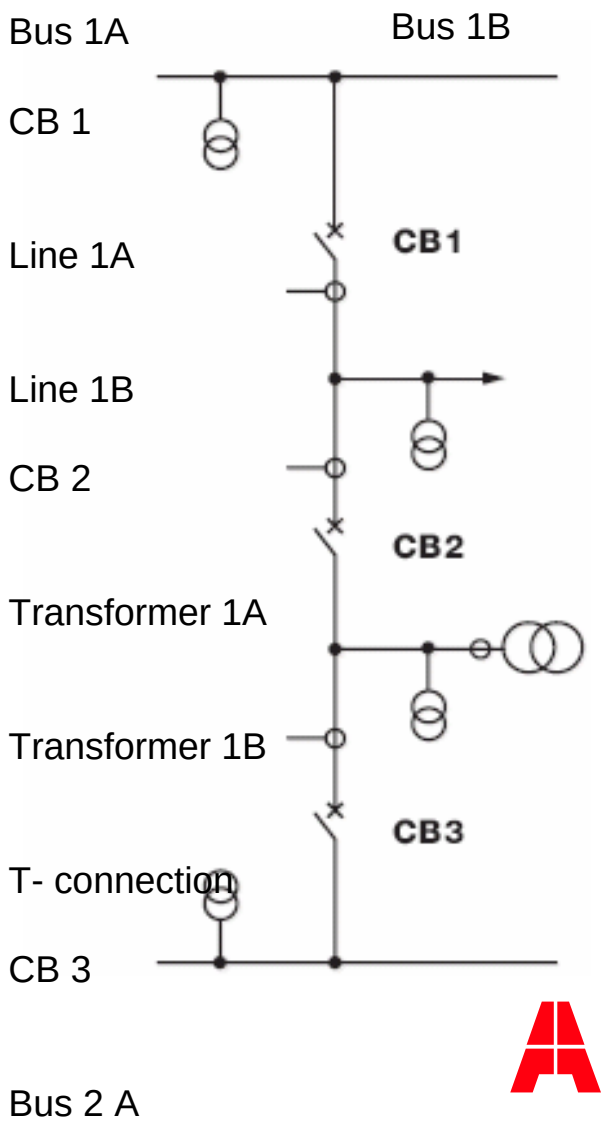


RET 670



REL 670





© ABB Group - 34 -
20-Apr-06

The old way with many “Boxes”

- Different hardware
- Different software
- Different protocol converters
- Different spare parts
- Different tools
- Different maintenance
- A lot to learn and manage

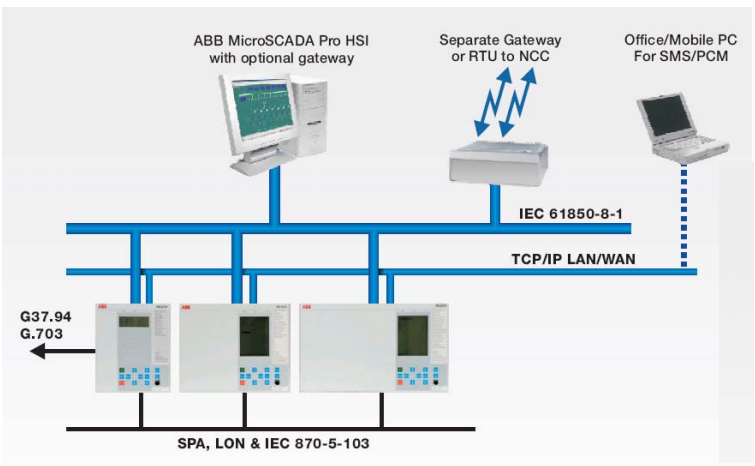
© ABB Group - 35 -
20-Apr-06

A major leap in Substation Automation

- ABB introduces the first IED concept for protection & control of transmission grids fully designed for IEC 61850 open standard
- ONE common IED of transmission class for all protection & control applications
- ONE common Application Function Library with high performing algorithms which is hardware independent
- ONE common concept for ALL transmission applications

© ABB Group - 36 - 20-Apr-06

The first SA concept designed for IEC 61850



- ONE IED 670 for ALL Transmission
  - REL 670 (Lines & Cables)
  - RED 670 (Multi terminal Networks)
  - RET 670 (Transformers & Multi objects)
  - REB 670 (Bus & Breakers)
  - REC 670 (Switchgear Bays)
- ONE PCM 600 IED tool
  - Configuration & Setting
  - Monitoring & Disturbance upload
- ONE MicroSCADA Pro
  - Substation Automation & HSI
  - Integrated or separate Gateway
- ONE SA concept designed for the IEC 61850 open standard

© ABB Group - 37 -
20-Apr-

We can deliver what you want

- The same old Protection & Control design..
  - Separate primary and secondary protection
  - Separate control in RTU or bay controller
- ..but with improved selectivity & functionality
  - Parallel algorithms (E.g. 87T, 87, 21, 4x 51/ 67)
  - Up to 6 x 3 Restrained Inputs (87T, 87L)
- Integrated Protection & Control
  - All bay protection & control in one IED 670
  - Connected to metering & protection cores
- Optimized Protection & Control
  - Functionality requirements
  - Redundancy & service requirement,
  - HMI requirement

© ABB Group - 38 -
20-Apr-06

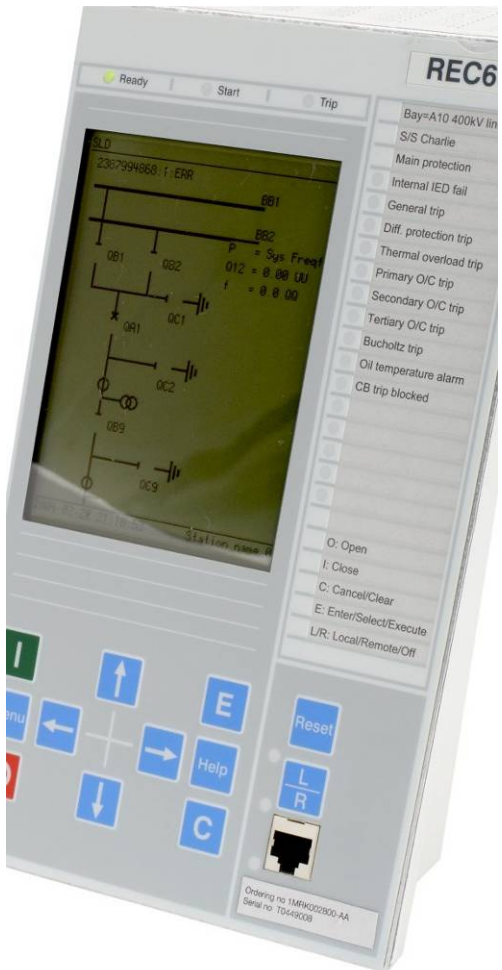
A modular & future proof IED concept

- Why do we need protection and control
- Introducing the ABB application of IEC 61850
- Advantages for an open and modular concept
  - Reliable - Improving the grid reliability
  - Efficient - More than just a relay
  - Flexible - Exactly what you need
  - User friendly - Easy to select, set, install and use
  - Informative - Designed to communicate
  - Forever young - Futurproof migration

© ABB Group - 39 -
20-Apr-06

Presenting the magic IED

More than just a device

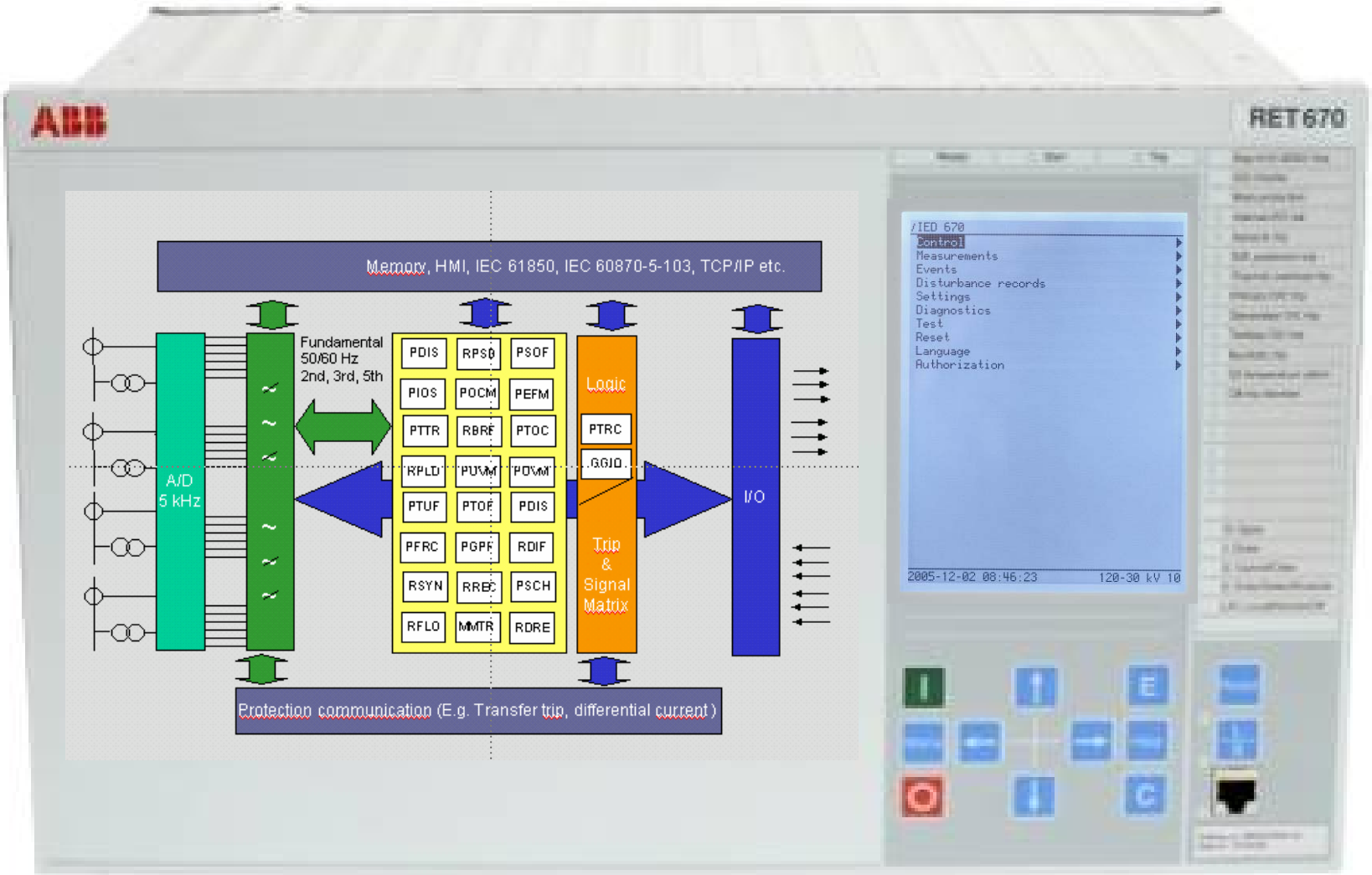


- Unique modular solution provider with ONE extensive function library & ONE expandible I/O for protection and control
  - Hardware independent modular concept for ALL applications in Power Transmission Systems
  - IED670 is fully designed for IEC 61850, TCP/IP and high speed Ethernet
  - Can handle multiple objects and algorithms in parallel
- Provides efficient substation automation solutions for any high voltage application

It is efficient

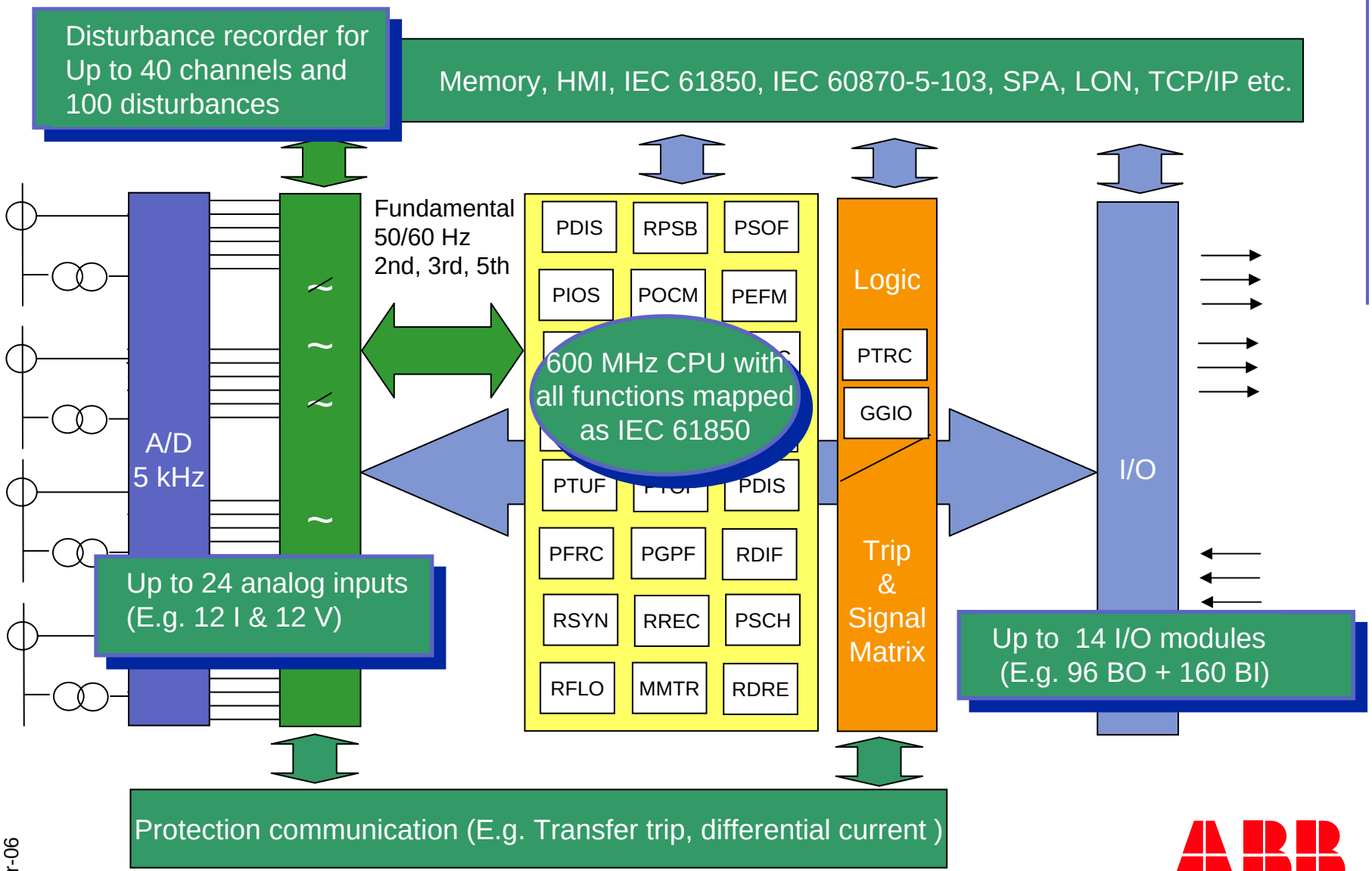
© ABB Group - 40 - 20-Apr-06

The most powerful “relay” ever designed



© ABB Group - 41 -
20-Apr-06

The most powerful “relay” ever designed



© ABB Group - 42 -
20-Apr-06

ONE open IED designed for IEC 61850

We are stepping
out of the box.....

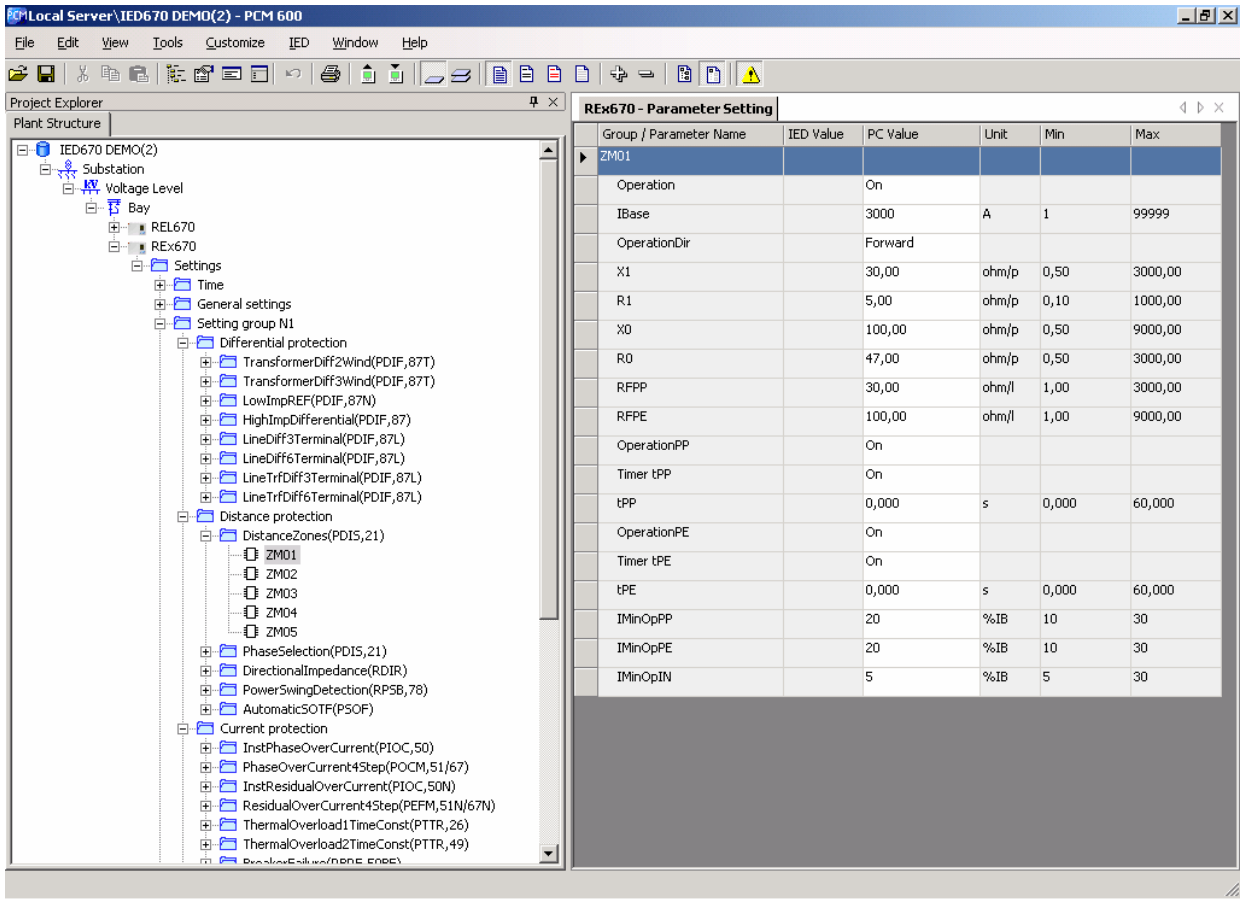
- State-of-the-art 600 MHz CPU
  - Fast and accurate execution of high performance algoritms
  - Possibility to run several high performing algorithms in parallel
- Up to 24 Analog Inputs
  - Can handle multi breaker, multi feeder and multi winding inputs
  - Can be connected to both protection and metering cores
- Multi page HMI & scalable I/O
  - Can handle up to 6 bays/6 pages
  - Can handle up to 250 BI/BO
  - Can integrate both protection and control

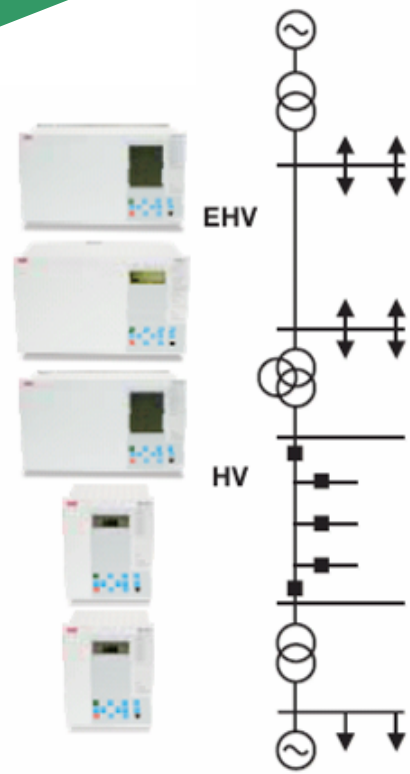
© ABB Group - 43 -
20-Apr-06

Select from the Application Function Library

.....to give you
the magic IED!

For any application!





© ABB Group - 44 -
20-Apr-06

Introducing the most reliable IED ever designed

A major leap In Grid Reliability

- Unique high performance concept for ALL transmission applications in ONE IED
  - Global power system & substation know how “Made in ABB” ensures reliable algorithms
  - Powerful Transmission Standard IED/CPU gives faster and more accurate operation
  - Unique multiple & adaptive algorithms ensures maximum dependability and security with speed and selectivity.
  - Evolution from the well proven 316 & 500 series ensures quality
- Ensures grid reliability through innovation, experience and commitment
  - Made in ABB

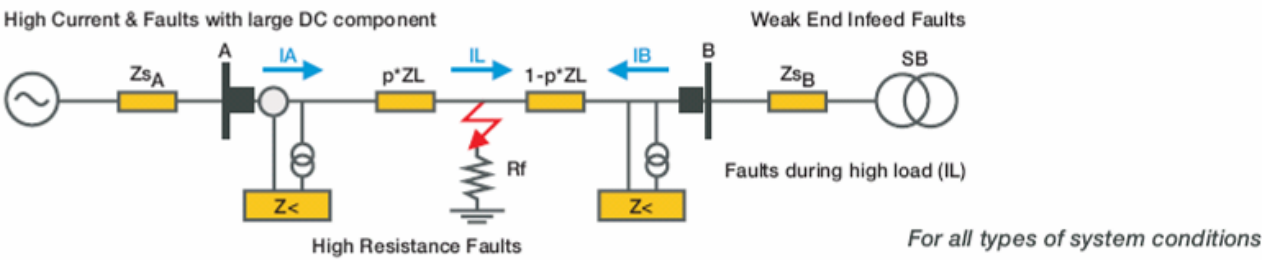
It is reliable

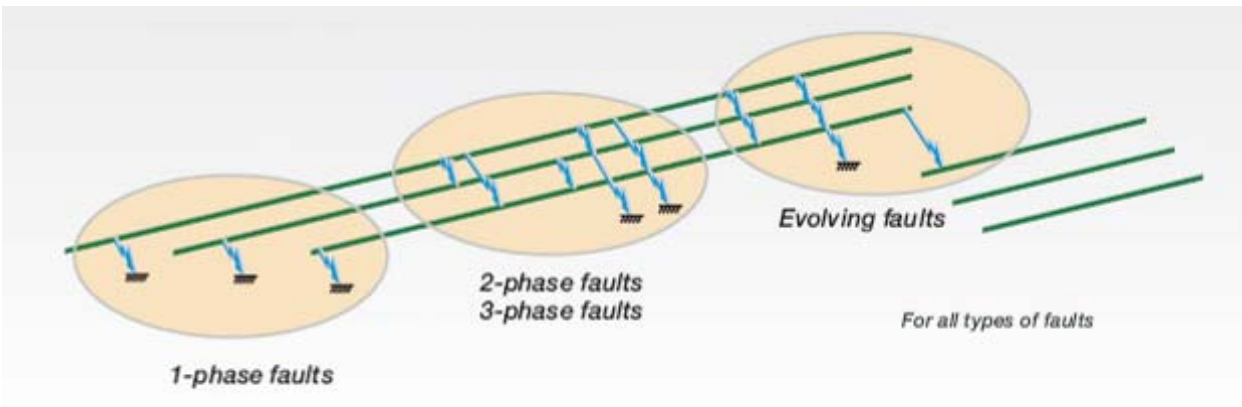
© ABB Group - 45 - 20-Apr-06

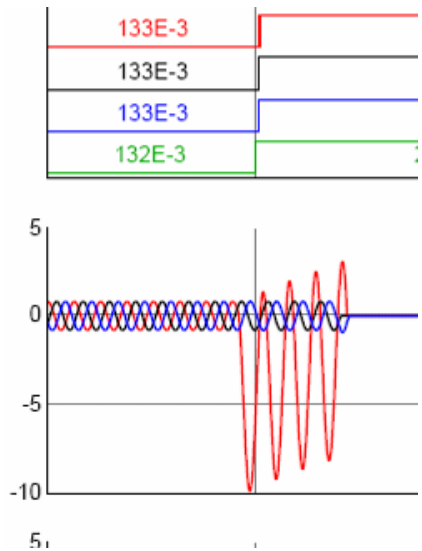
Based on Power System Know-how and experience

For maximum
grid reliability

- Reliability = Dependability + Security
- Dependability = Speed + Senstivity
- Security = Selectivity + Stability







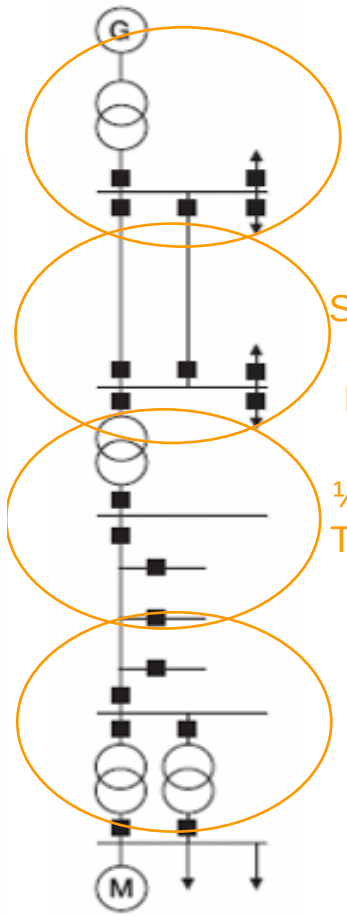
REB 670 RTDS simulation
10 ms operating time

© ABB Group - 46 -
20-Apr-[illegible]

Optimizing the protection of your network

IED 670 = Perfecting **your selectivity plan**

IED 670 Main functionality and applications	REB 670	RED 670	REL 670	RET 670	REC 670	Op. Time ms
Full-scheme distance protection with advanced phase selection & load enchroachment		■	■	■		20
Phase segregated line differential protection with adaptive communication		■				20
High speed & high sensitivity transformer differential protection with adaptive stabilization				■		10
High speed phase segregated bus differential protection with extremely low CT requirements	■					10
High speed summation type bus differential protection with extremely low CT requirements	■					10
High speed high impedance differential protection		■	■	■		10
High speed and high sensitivity restricted earthfault differential protection				■		20
High speed instantaneous phase and earth over current protection		■	■	■	■	10
4-step phase over current protection	■	■	■	■	■	n.a.
4-step residual over current protection		■	■	■	■	n.a.
4-step directional phase and earth over current protection		■	■	■	■	n.a.
Adaptive breaker failure protection	■	■	■	■	■	n.a.
Over/Under frequency		■	■	■	■	n.a.
Over/Under voltage		■	■	■	■	n.a.
Rate of change frequency		■	■	■	■	n.a.
General Voltage/Current Protection		■	■	■	■	n.a.
Auto reclosing	■	■	■		■	n.a.
Synchrocheck		■	■	■	■	n.a.
High performance disturbance recorder (40 analog channels/100 disturbancies)	■	■	■	■	■	n.a.
High accuracy fault locator		■	■		■	n.a.
Bay control with interlocking and select before execute		■	■	■	■	n.a.
Measuring and event recording	■	■	■	■	■	n.a.
Programmable logic	■	■	■	■	■	n.a.
Maximum number of breakers/bays	24	2	2	6	6	n.a.
24 analog input channels	■	■	■	■	■	n.a.



Inter turn faults and CT saturation

Single-pole, high load high resistance Parallel algorithms

½ Cycle for Bus & Transformer Faults

1 Cycle for Line faults and ½ cycle for close-in faults

© ABB Group - 17 - 2C

Exactly what you want

Exactly what you need

- Unique open system which can be configured for integrated or distributed protection & control architecture
  - Pre configured for all protection and control applications....
  - ...or freedom to distribute all functions & logical nodes in any IED
  - Unique library of optimized algorithms + “customizer” to solve special functions
- You can tailor the protection & control of your substation for the performance, redundancy and cost you want to have

It is flexible

© ABB Group - 48 -

Select your perfect hardware

Maximum quantity of I/O boards per type

Basic quantity defined in application table for available products.

Case *(TRM= Transformer module)*	BIM/BIMp	IOM	BOM	MIM	GSM	Total max in case	Restriction
1/2 19" case	3	3	3	0	1	3	
3/4 19" case with 1TRM	8	6	3	1	1	8	
3/4 19" case with 2 TRMs	5	5	3	1	1	5	
1/1 19" case with 1 TRM	14	6	4	4	1	14	BOM+MIM max 4
1/1 19" case with 2 TRMs	11	6	4	4	1	11	BOM+MIM max 4

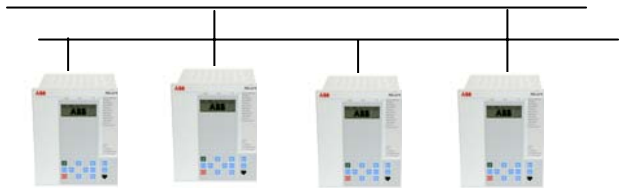
BIM Binary Input Module	16 binary inputs, 24-30, 48-60, 110-125 or 220-250 VDC
BIMp Binary Input Module with enhanced pulse counting capabilities	16 binary inputs, 24-30, 48-60, 110-125 or 220-250 VDC, 40 pulses/s
IOM Binary In/Output Module	8 binary inputs, 24-30, 48-60, 110-125 or 220-250 VDC, 10 trip + 2 fast signal output relays
BOM Binary Output Module	24 trip and signal output relays
MIM mA Input Module	6 channels, ± 5, ± 10, ± 20 mA, 0-5, 0-10, 0-20 or 4-20 mA
GSM GPS Synchronization Module	Provides accuracy better than 1 microsecond

As pre-configured or open configuration

Application	Arrangement	Sub-arrangement	Busbar					Bay						Line Differential					Line Distance						Transformer								
			REB 670-A20	REB 670-A31	REB 670-B20	REB 670-B21	REB 670-B31	REC 670	REC 670-A10	REC 670-A20	REC 670-A30	REC 670-B30	REC 670-C30	RED 670	RED 670-A31	RED 670-A32	RED 670-B31	RED 670-B32	REL 670	REL 670-A10	REL 670-A31	REL 670-A32	REL 670-B31	REL 670-B32	RET 670	RET 670-A10	RET 670-A11	RET 670-A20	RET 670-A30	RET 670-A31	RET 670-A40	RET 670-B30	RET 670-B40
Busbar	4 bays/2 zones	3 phase	■																													
	8 bays/2 zones	3 phase		■																												
	12 bays/2 zones	1 phase			■																											
	12 bays/2 zones	1 phase				■																										
	24 bays/2 zones	1 phase					■																									
	12 bays/2 zones	3 phase Summation			■																											
	12 bays/2 zones	3 phase Summation				■																										
	24 bays/2 zones	3 phase Summation					■																									
Bay control	Open options	To be customized						■																								
	1 Circuit Breaker	Breaker Protection							■																							
	1 Circuit Breaker	Bay Control								■																						
	1 Circuit Breaker	Control & Protection									■																					
	2 Circuit Breakers	Control & Protection										■																				
	1 ½ Circuit Breaker	Control & Protection											■																			
Transmission Line	Open options	To be customized												■					■													
	Station	Back up																		■												
	1 Circuit Breaker	3 phase trip													■						■											
	1 Circuit Breaker	1 phase trip														■						■										
	2 Circuit Breakers	3 phase trip															■						■									
	2 Circuit Breakers	1 phase trip																■						■								
Transformer	Open options (24 AI)	To be customized																							■							
	Station (12AI)	Back up																								■						
	Station (12 AI)	Load shedding																									■					
	2 winding (12/24 AI)	1 Circuit Breaker																										■				
	2 winding (24 AI)	2 Circuit Breakers/W																													■	
	3 winding (12I)	1 Circuit Breaker																											■			
	3 winding (9I+3U)	1 Circuit Breaker																												■		
	3 winding (24 AI)	1 Circuit Breaker																													■	
	3 winding (24 AI)	2 Circuit Breakers/W																														■
Casing	1/2 19"		■		■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
	3/4 19"							□			□	□	□	□	□	□	□	□	□		□	□	□	□	□				□		■	■	■
	1/1 19"			■		■	■	□			□	□	□	□	□	□	□	□	□		□	□	□	□	□				□		■	□	□
HMI	Text only		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Large graphic display	15 object /page	□	□	□	□	□	□		□	□	□	□	□	□	□	□	□	□		□	□	□	□	□				□	□	□	□	□
Analog inputs	6 Analog inputs							□			□	□	□	■											■								
	12 Analog inputs		■		■	■		□	■	□	□	□	□	□	■	■	■	■	■	■	■	■	■	■	□	■	■	■	■	■			
	24 Analog inputs			■			■	□			□	□	□	□	□	□	□	□	□		□	□	□	□	□				□		■	■	■

© ABB Group - 50 - 20-Ap

ONE modular concept for ALL applications



- **Select your prefered architechture**
  - **Integration, Redundancy etc.**
- **Establish type & number of IEDs**
  - **REL, RED, RET, REC, REB**
- Decide IED functionality
- Identify the need for I/O
- Select the size (½ , ¾, $^{1}/_{1}$)
- Select type of HMI
- Select communication
- Download your configuration
- Set I/O input to you primary circuits
- Adjust setting & commission

Ready to operate but you can change and update at any time

© ABB Group - 51 -

Right information in right time for right actions

Designed to communicate

- Unique information management of data, disturbances and events with seamless integration to TCP/IP, MicroSCADA Pro and via ABB powerful gateway concept
  - Monitoring communication for up to 40 analog channels and 100 disturbances per IED
  - Protection communication with built in analog and binary remote communication (transfer trip + Id)
  - Control communication with built in optical Ethernet ports (2 + 2) for IEC 61850
- Improved availability and asset management through right information, in right time, to the right user, for right decisions

It is informative

© ABB Group - 52 - 20-Apr-06

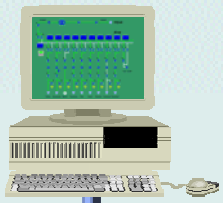
IEC 61850 Made in ABB

Remote SMS workplace with PCM 600

Operators workstation MicroSCADA Pro SYS 600 (with GW)

Separate Gateway/RTU COM 500, COM 610, COM 581 or RTU 560

NCC



IEC 61850-8-1

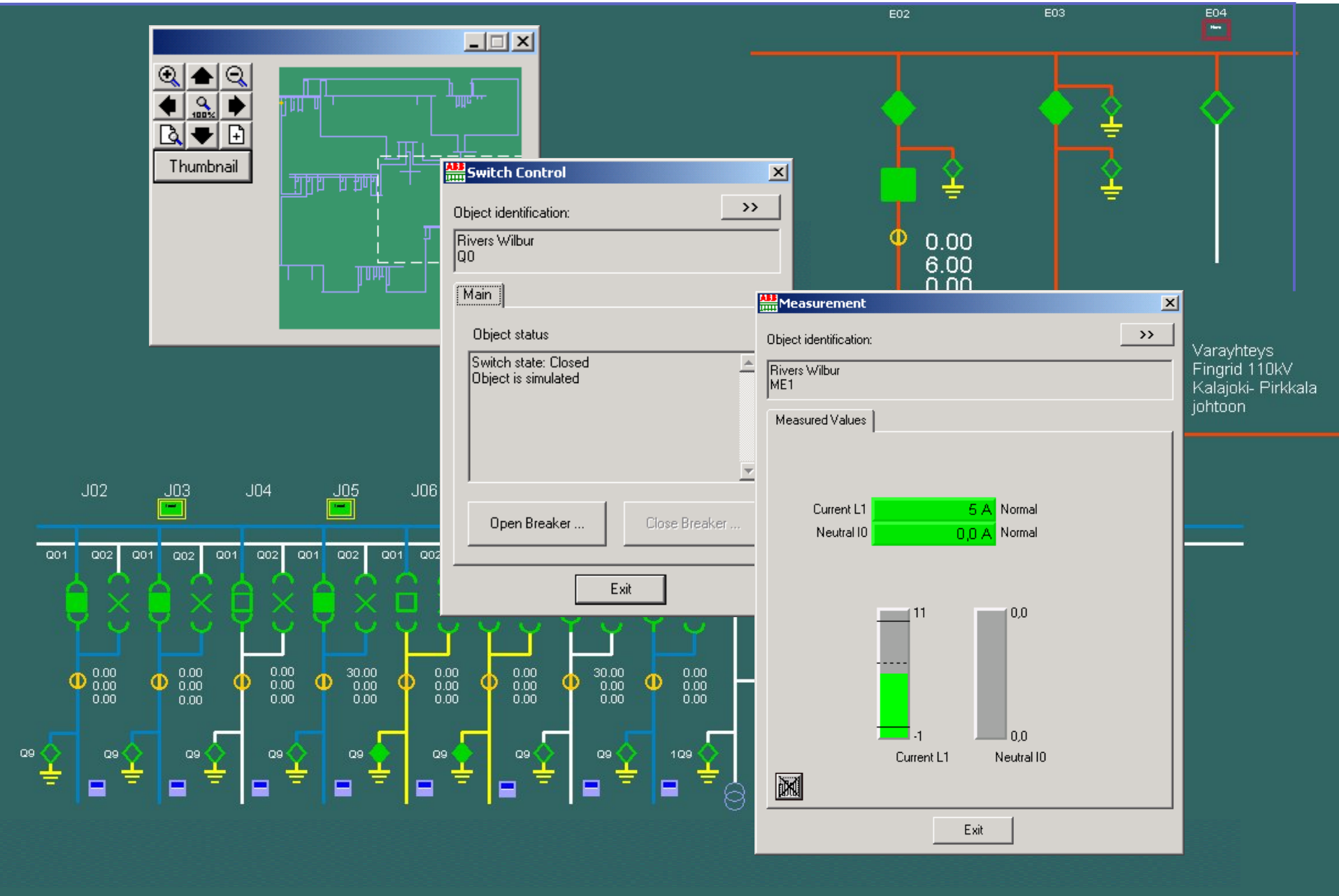
TCP/IP

Remote Binary and Analog communication

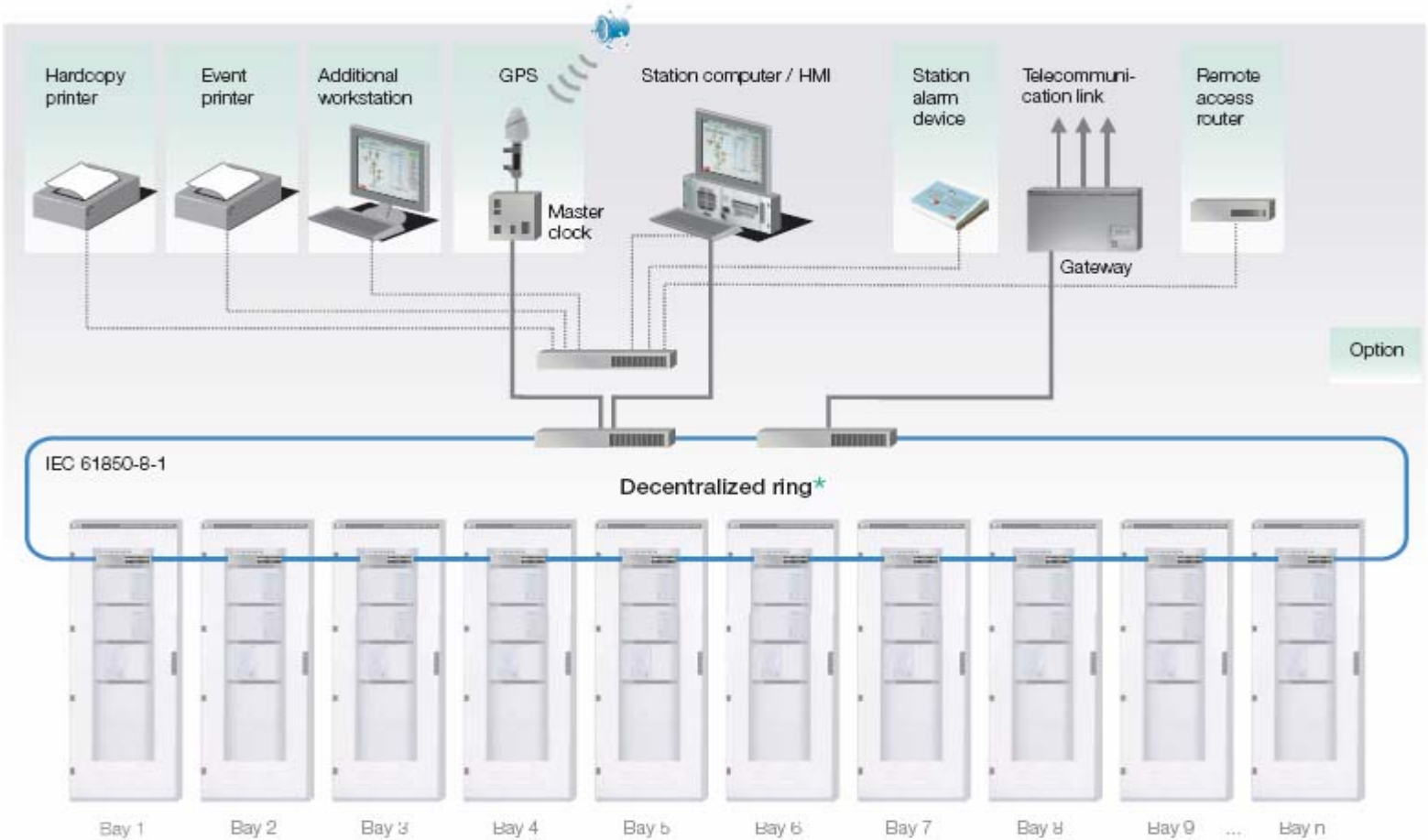
Optional SPA/LON IEC 870-5-103

Heikkilän-kangas | Iinatti | Kivi-harju | Joutsen-kaari | Vara | Kivi-niemi | Hätälä | Kuurna-puisto | Oma-käyttö | Kaakkurin-polku | Höyhen-kuja | Mittaus

MicroSCADA Pro with new graphics



Example of ABB SA solution



© ABB Group - 55 -
20-Apr-06

IED 670 Communcation options

■ = Basic ● = Basic, 1-of □ = Optional 3 = Number of modules/Maximum no. of options

Application / Control & Supervision	Arrangement	Sub-arrangement	Busbar					Bay						Line Differential					Line Distance						Transformer									
			REB 670-A20	REB 670-A31	REB 670-B20	REB 670-B21	REB 670-B31	REC 670	REC 670-A10	REC 670-A20	REC 670-A30	REC 670-B30	REC 670-C30	RED 670	RED 670-A31	RED 670-A32	RED 670-B31	RED 670-B32	REL 670	REL 670-A10	REL 670-A31	REL 670-A32	REL 670-B31	REL 670-B32	RET 670	RET 670-A10	RET 670-A11	RET 670-A20	RET 670-A30	RET 670-A31	RET 670-A40	RET 670-B30	RET 670-B40
SPA communication protocol			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
LON communication protocol			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IEC 60870-5-103 communication protocol			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
IEC 61850 generic communication I/O functions, parameter setting			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Horizontal communication via GOOSE for interlocking			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
FTP access with password			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Single command			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Multiple command and transmit			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
SPA/IEC 60870-5-103 and LON (SLM) communication ports	2 channels	plastic, plastic/ glass or glass	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
IEC 61850-8-1 (OEM) communication ports	1 channel or 2 channels	glass	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Binary signal transfer			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Analog data transfer								■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Scheme communication logic	Distance													□	□	□	□	□	□		■	■	■	■										
Scheme communication logic	DEF													□	□	□	□	□	□	■	■	■	■	■										
Line data communcation module C37.94	3/65/130 km	basic												1	1	2	1	2															
		optional	2	2	2	2	2	2	1	1	1	1	1	3	3	2	3	2	2	1	1	1	1	1	2	1	1	1	1	1	1	1	1

© ABB Group - 56 - 20-Apr-06

IED 670 Control options

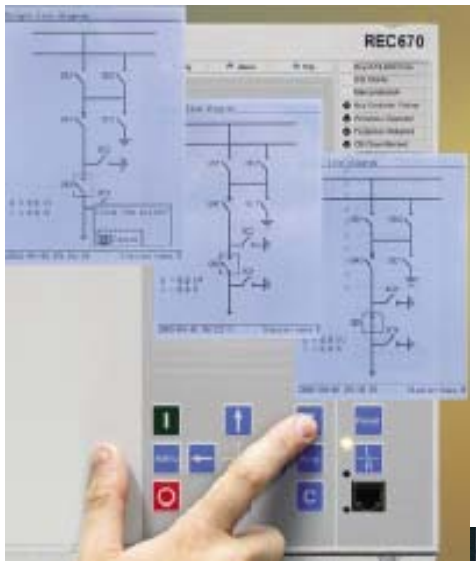
■ = Basic ● = Basic, 1-of □ = Optional 3 = Maximum no. of options

Application / Control & Supervision	Arrangement	Busbar					Bay						Line Differential					Line Distance						Transformer								
		REB 670-A20	REB 670-A31	REB 670-B20	REB 670-B21	REB 670-B31	REC 670	REC 670-A10	REC 670-A20	REC 670-A30	REC 670-B30	REC 670-C30	RED 670	RED 670-A31	RED 670-A32	RED 670-B31	RED 670-B32	REL 670	REL 670-A10	REL 670-A31	REL 670-A32	REL 670-B31	REL 670-B32	RET 670	RET 670-A10	RET 670-A11	RET 670-A20	RET 670-A30	RET 670-A31	RET 670-A40	RET 670-B30	RET 670-B40
Current circuit supervision							5			■	■	■	2	■	■	■	■	2		■	■	■	■	5			■	■	■	■	■	■
Fuse failure supervision							4	■		■	■	■	3	■	■	■	■	3	■	■	■	■	■	4	■	■		■	■	■	■	■
Synchrocheck and energizing check							6	■		■	■	■	2	■	■	■	■	2	□	■	■	■	■	6	■			■	■	■	■	■
Autorecloser		2	□	□	□	□	6	■		□	□	□	2	■	■	■	■	2	□	■	■	■	■									
Apparatus control for single bay	max. 8 apparatuses						●		■	■			□	□	□			□		□	□			□								
Apparatus control for single bay	max 15 apparatuses						●				■		□			□	□	□				□	□	□			□	□	□	□	□	
Apparatus control for up to 6 bays	max 30 apparatuses						●					■												□								□
Logic rotating switch for function selection and LMHI presentation		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Tripping logic		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Trip matrix logic							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Configurable logic blocks		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Fixed signal function blocks		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Event counter		■	■	■	■	■	□	■	■	■	■	■	□	■	■	■	■	□	■	■	■	■	■	□	■	■	■	■	■	■	■	■
Fault locator							□			□	□	□	■	■	■	■	■	■		■	■	■	■									
Measurements		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Event function		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Disturbance report		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Logic signal status report		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Pulse counter logic		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

© ABB Group -
20-Apr-06

IED 670 is designed for YOU

Easy to handle



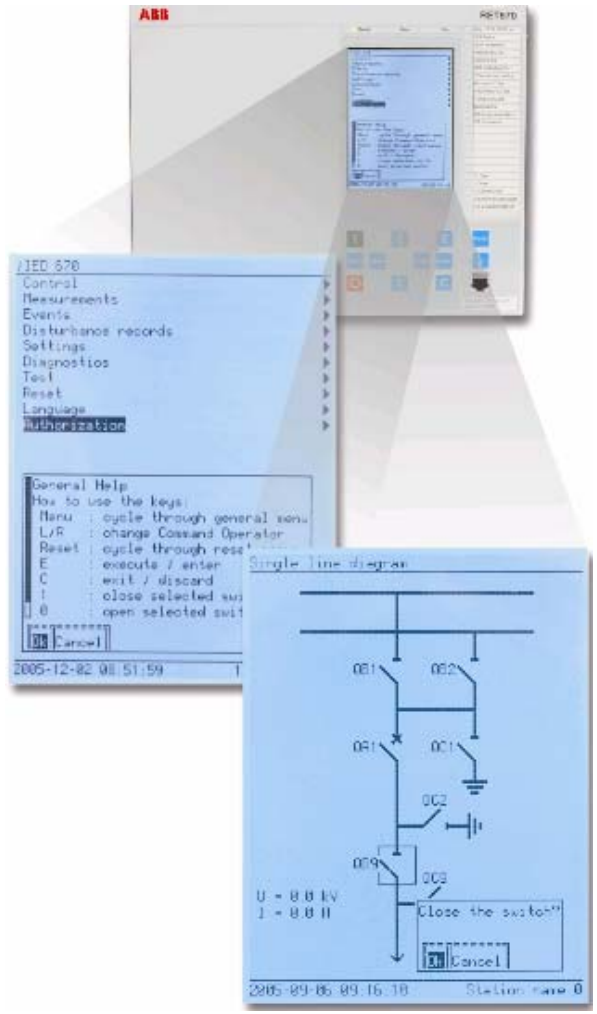
- Unique, simple and fast interaction via built in multi page HMI, Ethernet connection & LAN TCP/IP with different user access
  - Ready to use & fast to deliver products with simple setting and signal matrix tool
  - ONE common Protection & Control IED Manager (PCM 600) and one common MicroSCADA Pro
  - ONE IED to learn, ONE IED to apply, ONE IED to operate , ONE IED to maintain
- Simple to manage for all users

It is user friendly

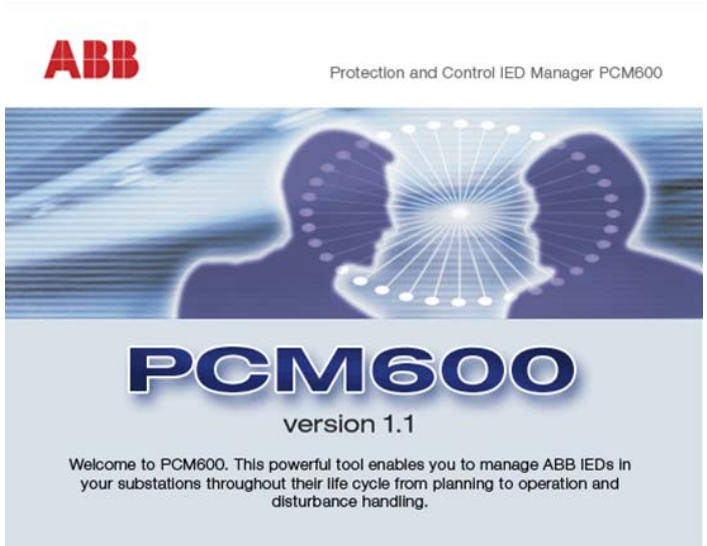
© ABB Group - 58 - 20-Apr-06

Local HMI and local/remote PC access

Function	HMI (Text display)	HMI (Large display)	PCM 600 IED Manager 1MRK003395-AA	PCM 600 Engineering 1MRK003395-BA	PCM 600 Engineering Pro 1MRK003395-CA
Read on-line measuring values	✓	✓	✓	✓	✓
Read stored events (1000)	✓	✓	✓	✓	✓
Read stored fault locator values	✓	✓	✓	✓	✓
Read stored disturbance recorder values			✓	✓	✓
Upload stored disturbarce recorder values (Manual)			✓	✓	✓
Upload stored disturbarce recorder values (Automatic)			✓	✓	✓
Disturbance report generation (Automatic)			✓	✓	✓
Read setting groups parameters (6)	✓	✓	✓	✓	✓
Change setting groups	✓	✓	✓	✓	✓
Write setting group parameters	✓	✓	✓	✓	✓
Change lock (Block via BI)	✓	✓			
Test mode selection (Block/Activate functions)	✓	✓			
IED diagnostics (Internal events)	✓	✓	✓	✓	✓
Object status (closed, open, value)		✓			
Object control (close, open)		✓			
Authorization (Password for Local/Remote)	✓	✓			
Bay graphical display		✓			
Multi page (6) bay graphical display		✓			
Multi page (6) bay graphical display editor			✓	✓	✓
Signal matrix tool (Link I/O)			✓	✓	✓
IEC 61850-8 communication configuration (CCT)					✓
IEC 61131-3 graphical configuration				✓	✓



Protection & Control IED Manager PCM 600



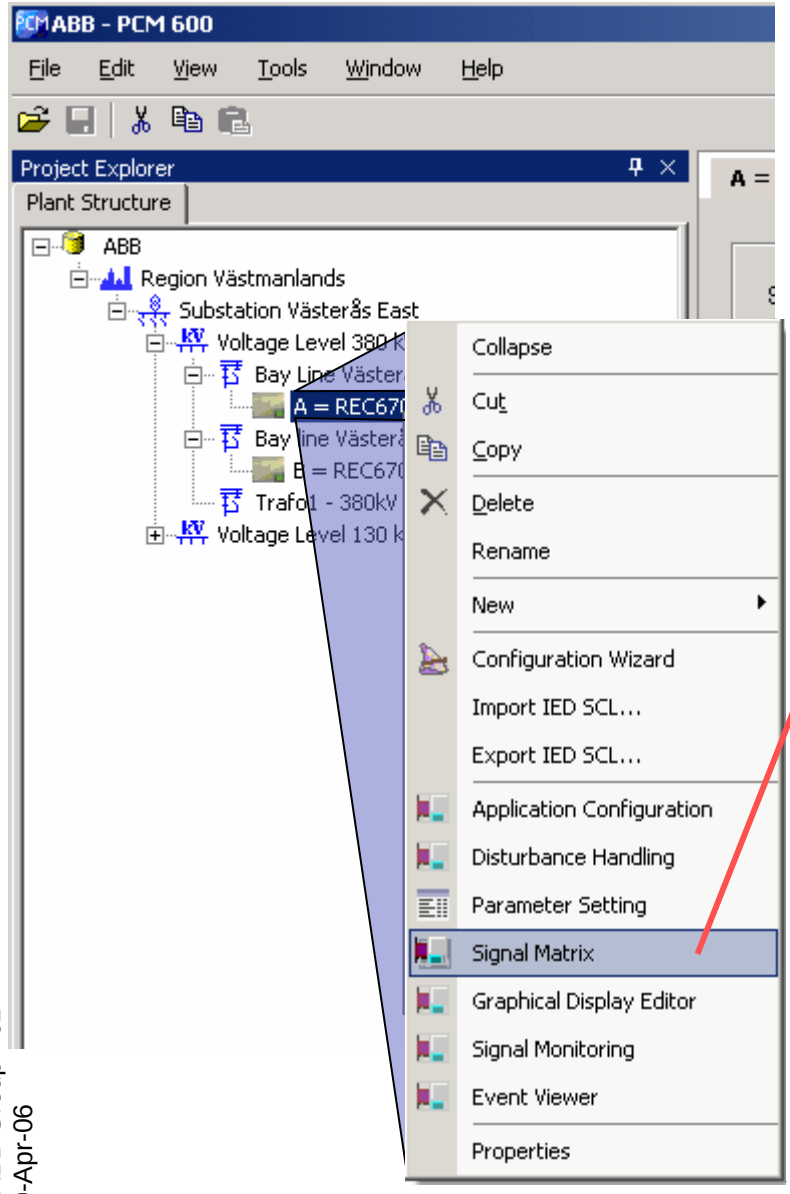
- Project Manager

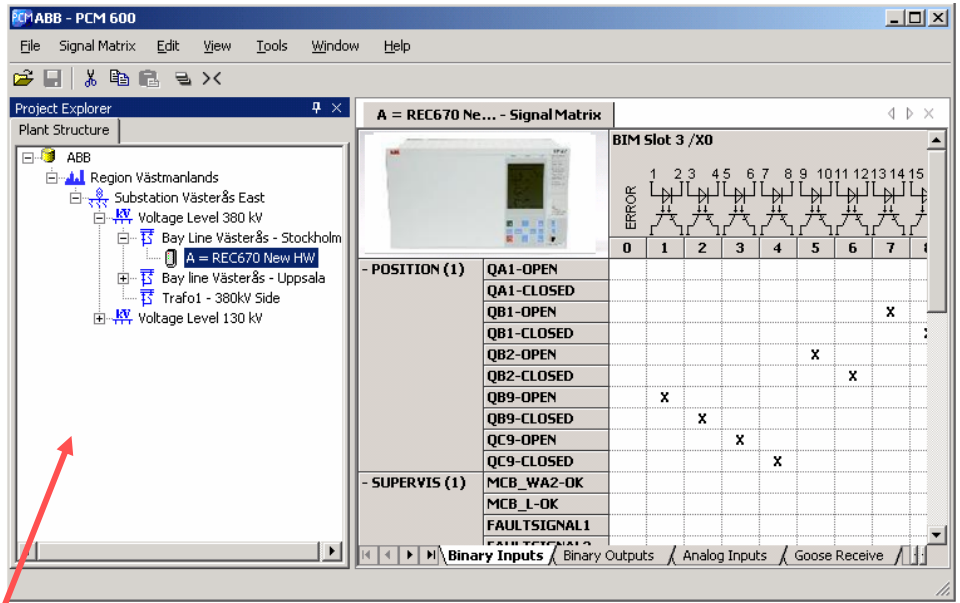
- Application Configuration (CAP)
- SCL file export/import
- Parameter Setting (PST)
- Signal Matrix (SMT)
- Graphical Display Editor (GDE)

- Disturbance Handling (DH)
- Task Scheduler (Scheduler)
- Monitoring (MON)
- Event Viewer (EV)

© ABB Group - 60 - 20-Apr-06

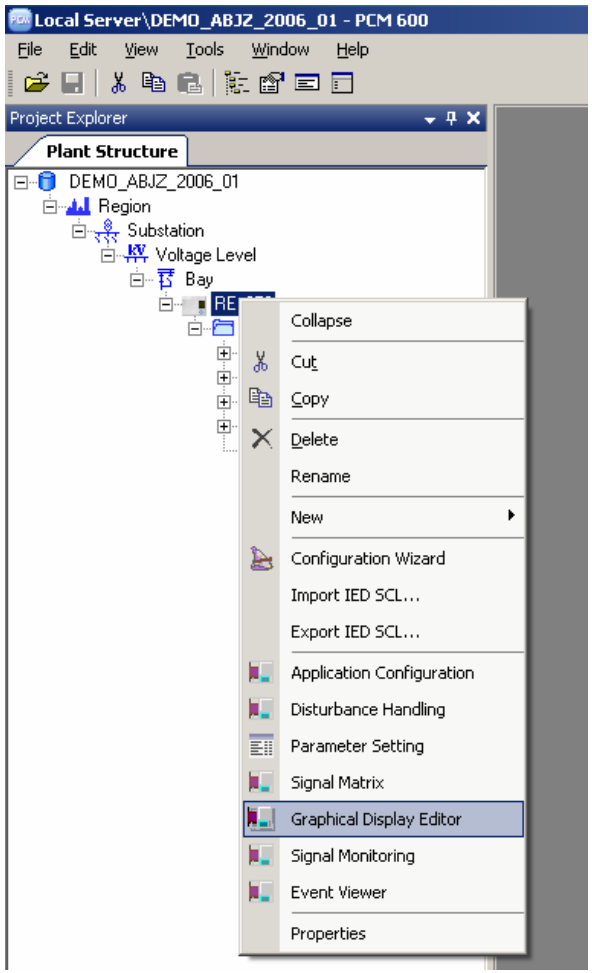
Protection & Control IED Manager PCM 600

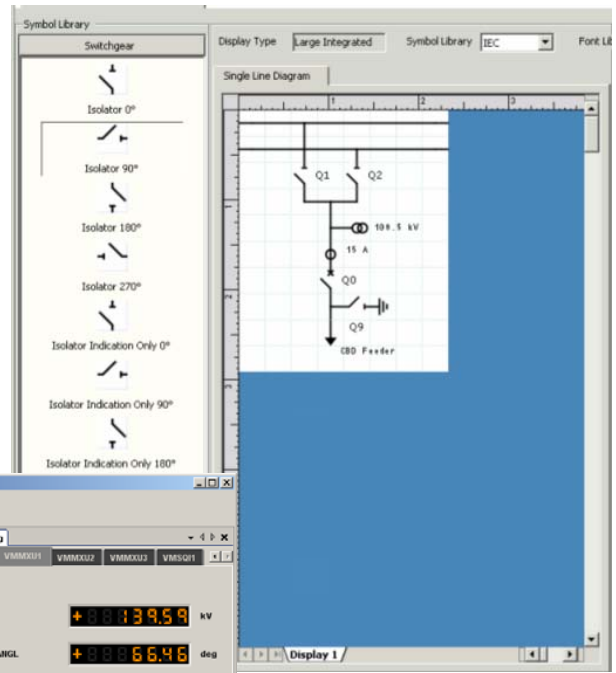


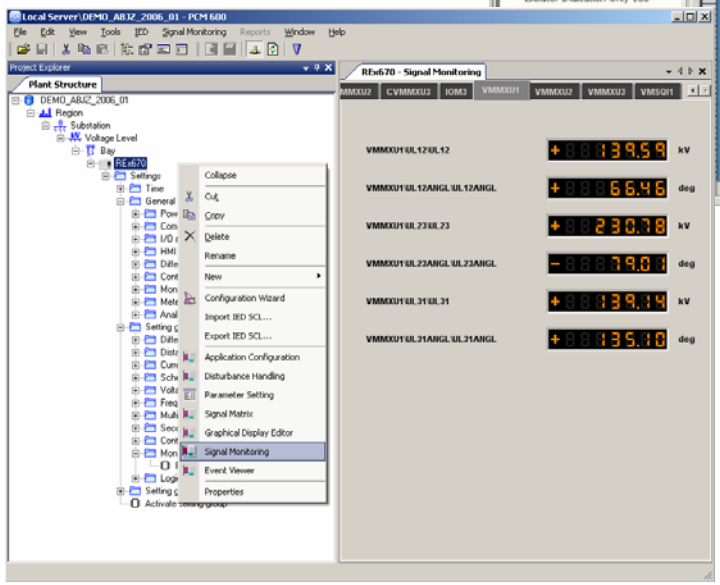


© ABB Group - 61 - 20-Apr-06

Protection & Control IED Manager PCM 600

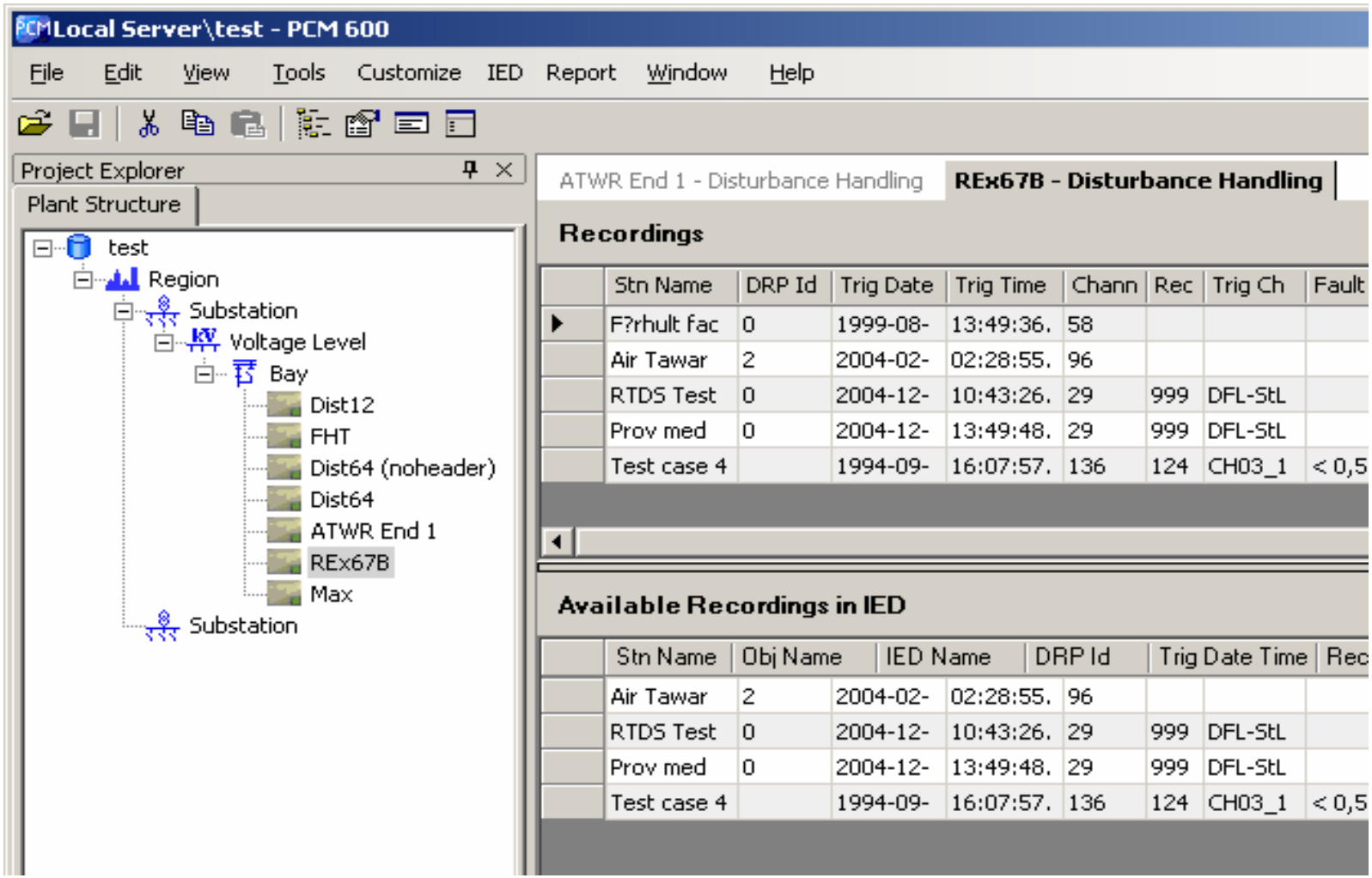






© ABB Group - 62 -
20-Apr-06

PCM 600 Disturbance Handling Tool



© ABB Group - 63 -
20-Apr-06

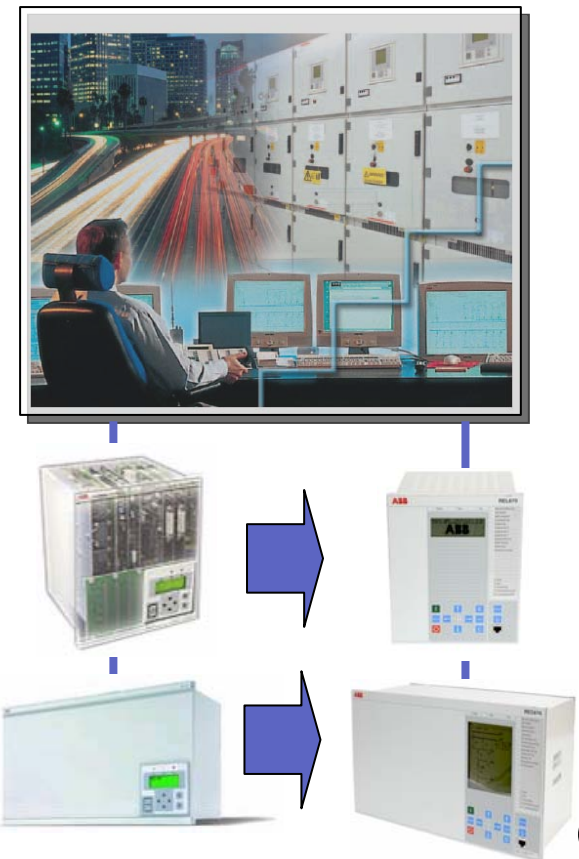
IED 670 pre-configured for transmission

- REL670 – Line/Cable
  - 1 or 2 CB – 1 or 3 phase
- RED670 – Multi terminal
  - 1 or 2 CB – 1 or 3 phase
  - 3 or 5 line ends
- RET670 – Transformer
  - 2 Winding - 1 or 2 CB/w
  - 3 Winding – 1 or 2 CB/w
- REC670 – Bay
  - 1 or 2 Breaker
  - 1 ½ Breaker
- REB670 - Bus
  - 3-phase for 8 feeders
  - 1-phase for 24 feeders
  - Summation for 24 feeders

© ABB Group - 64 - 20-Apr-06

State-of-the art IED “Made in ABB”

Future proof concept



- A unique & open concept with ONE IED, ONE library, ONE MicroSCADA Pro and ONE common tool fully designed for IEC 61850 open standard
  - Designed for 61850 from the start – and not an after thought
  - Unique application function library independent of hardware & mapped in IEC61850 allows future upgrades
  - Clear migrartion path for IEDs and MicroSCADA Pro with SPA, LON, IEC 60850-5-103, OPC, TCP/IP
- Adds value to your investment for the total life cycle

It is forever young

© ABB Group - 65 - 20-Apr-06

Comparing communication protocols

■ = Basic ▣ = Available as option with process bus

Information management	IEC 61850	IED 670 implementation	IEC 60870-5-101	IEC 60870-5-103	IEC 60870-5-104	DNP 3.0	LON
Basic real time values	■	■	■	■	■	■	■
Protection	■	■		■			■
Control	■	■	■		■	■	■
Real time sampled values	■	▣					
Real time bay-to-bay commands	■	■					■
Fixed functionality			■	■	■	■	■
Free allocation of functions to any IED	■	■					
Data modelling	■	■					
Self description	■	■					
Vendor independent data interoperability	■	■	■	■	■	■	
Vendor independent application interoperability	■	■					
Parameter group setting	■	■		■			■
Parameter setting	■	■					■
Disturbance recorder upploading	■	■					■
IEC open standard	■	■	■	■	■		
Future proof	■	■					

© ABB Group - 66 -
20-Apr-06

KEMA Certificate and inter operability

IEC 61850 Certificate Level A[1]

No. 30530055-Consulting 2006-0139

Issued to:
ABB Power Technology AB
SA Products
S-721 59 Västerås
Sweden

For the product:
IED 670 1.0
Software version 1p1r12
Hardware version 1MRK002800-AA

Issued by: KEMA

The product has not shown to be non-conforming to:

IEC 61850-6, 7-1, 7-2, 7-3, 7-4 and 8-1

Communication networks and systems in substations

The conformance test has been performed according to IEC 61850-10 with product's protocol and model implementation conformance statements: "1MRK114-320, rev D; IED 670 PICS - IEC 61850 Protocol Information Conformance Statement; 1MRK114 – 210, rev H; IED 670 series - IEC 61850 MICS, and technical issue (TICS) and extra information for testing (PIXIT) "1MRK114-318, rev J; IED 670 PIXIT - IEC 61850 Protocol Extra Information".

The following IEC 61850 conformance blocks have been tested with a positive result (number of relevant and executed test cases / total number of test cases as defined in the UCA International Users Group Device Test procedures):

1	Basic Exchange (15/23)	9ab	GOOSE (14/20)
2	Data Sets (2/5)	12a	Direct Control (4/11)
3	Substitution (3/3)	12d	Enhanced SBO Control (0/18)
4	Setting Group Selection (2/3)	13	Time Synchronization (4/4)
6	Buffered Reports (13/15)		

This Certificate includes a summary of the test results as carried out at ABB Västerås, Sweden with UniCAsim 61850 version 2.12.03 test system running test suite "61850 Conformance Test v2.12.01", UniCA 61850 analyzer version 4.13.0.0. The test is based on the UCA International Users Group Device Test Procedure version 1.1. This document has been issued for information purposes only, and the original paper copy of the KEMA report No. 30530055-Consulting 2006-0140 will prevail.

The test have been carried out on one single specimen of the products as referred above and submitted to KEMA by ABB Power Technology. The manufacturer's production process has not been assessed. This Certificate does not imply that KEMA has certified or approved any product other than the specimen tested.

Arnhem, March 2, 2006

S.J.L.M. Janssen
Managing Director KEMA Consulting

R. Schimmel
Certification Manager

1) Level A – Independent Test Lab with certified ISO 9000 or ISO 17025 Quality System

Copyright © KEMA Nederland BV., Arnhem, the Netherlands. All rights reserved. Please note that any electronic version of this KEMA certificate is provided to KEMA's customer for convenience purposes only. It is prohibited to update or change it in any manner whatsoever, including but not limited to dividing it into parts. In case of a conflict between the electronic version and the original version, the original paper version issued by KEMA will prevail.

KEMA Nederland B.V.
Utrechtseweg 310, 6812 AR Arnhem, P.O. Box 9035, 6800 ET Arnhem, The Netherlands.
Telephone +31 26 356 2142, Telefax +31 26 445 456, Email sales@kema.com

BKW FMB Energie AG ABB SIEMENS

To Whom It May Concern

29th August 2005

Reference: Substation Automation and Protection Project for
Substation Meiringen 50kV with IEC 61850-8-1

Dear Sirs,

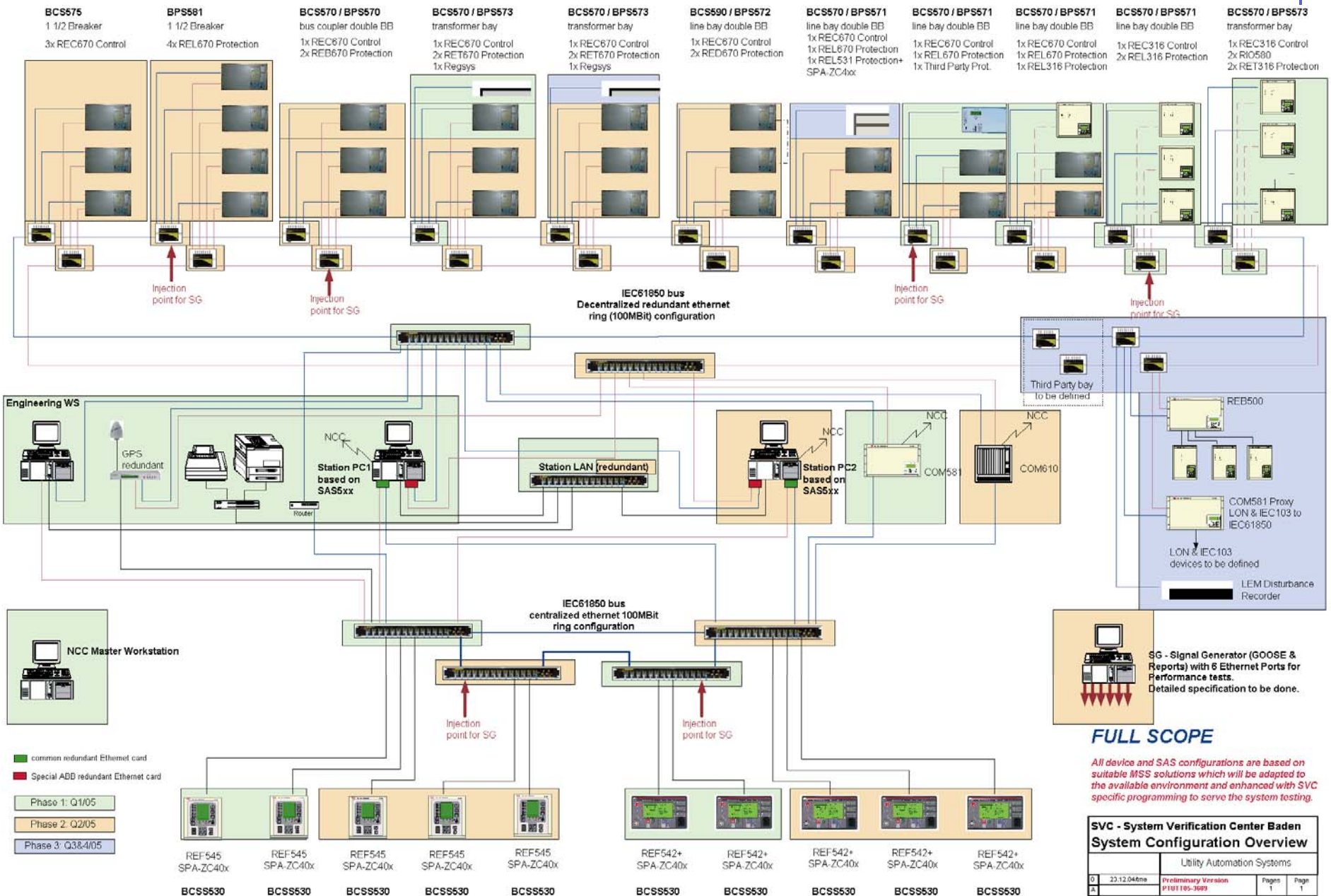
This serves to confirm that BKW FMB Energie AG, Switzerland, is building the 50kV substation Meiringen with a ABB decentralized numerical busbar protection type REB500 and the Siemens type SICAM PAS substation automation system, both with IEC 61850-8-1 communication protocol.

The tests conducted have shown that the busbar protection and the substation automation system communicate properly via the established link according to the new IEC 61850-8-1 standard.

Yours faithfully,

Luigi Scoca	Jürgen Westerfeld	Kai Kühl
BKW FMB Energie AG	ABB Schweiz AG	Siemens Schweiz AG

ABB System Verification Center



FULL SCOPE

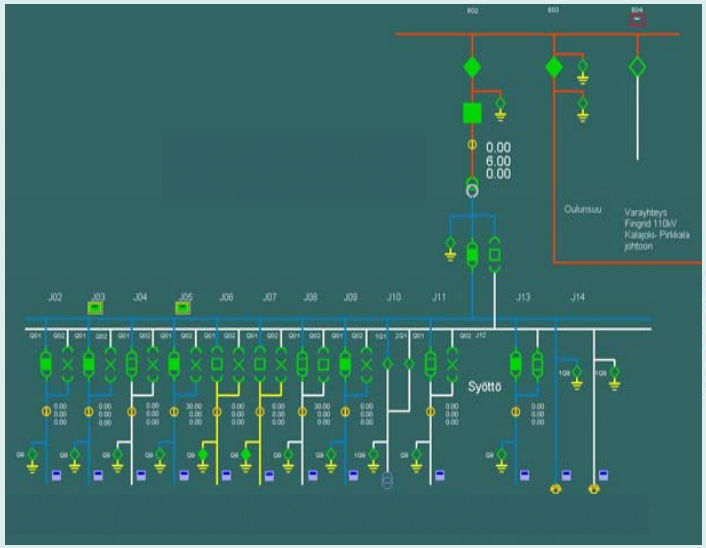
All device and SAS configurations are based on suitable MSS solutions which will be adapted to the available environment and enhanced with SVC specific programming to serve the system testing.

SVC - System Verification Center Baden
System Configuration Overview

Utility Automation Systems

0	23.12.04/tna	Preliminary Version PTUT105-3089	Pages 1	Page 1
A				

Migration Made in ABB with LON



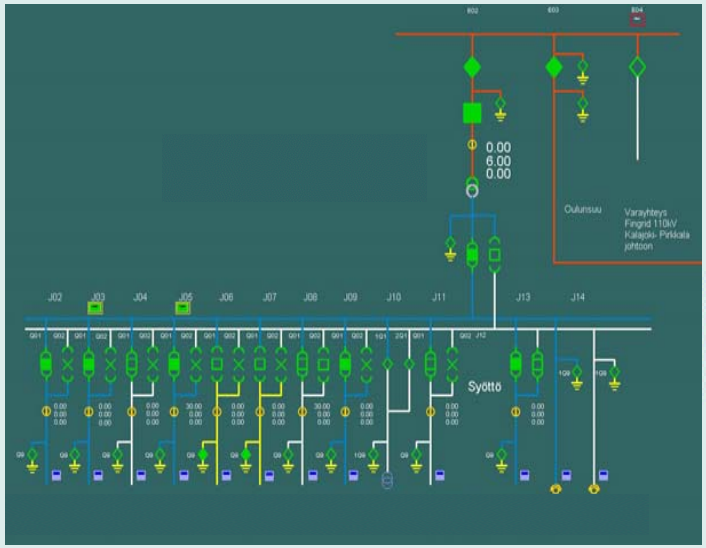
LON

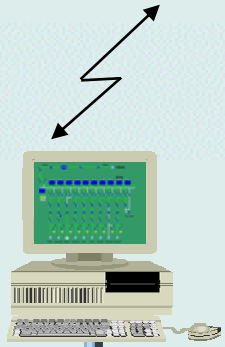
TCP/IP

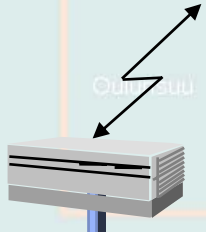
Optional SPA
IEC 870-5-103

Heikkilän-
kangas
linatti
Kivi-
harju
Joutsen-
kaari
Vara
Kivi-
niemi
Hätälä
Kuurna-
puisto
Oma-
käyttö
Kaak
polku
hen-
kuja
Mittaus

Migration Made in ABB with IEC 61850







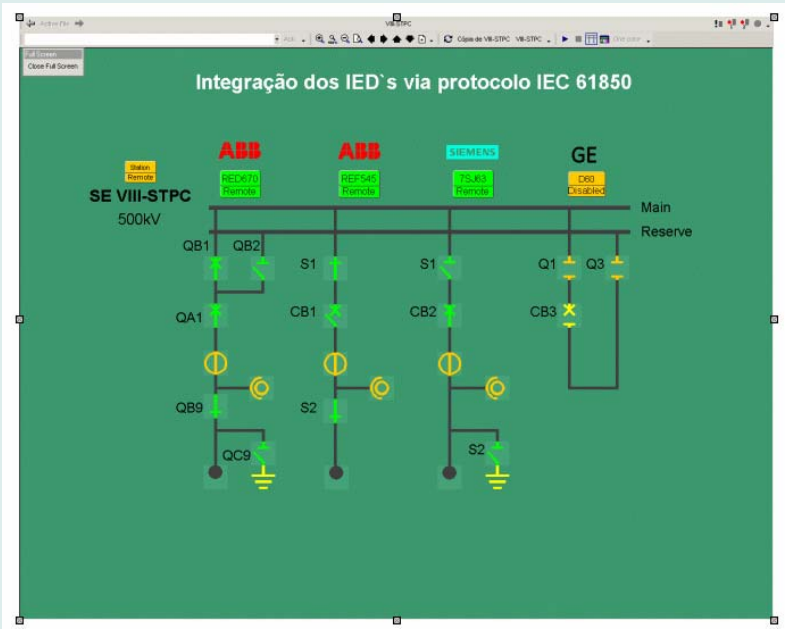
IEC 61850-8-1

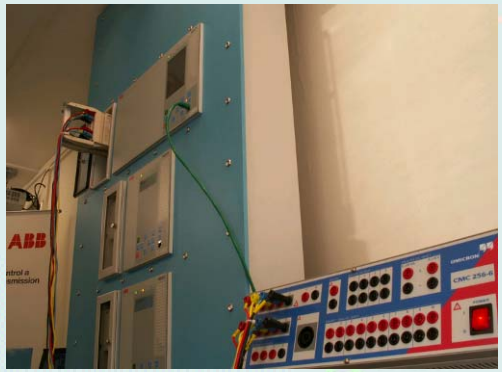
TCP/IP

Optional SPA/LON
IEC 870-5-103

Heikkilän-kangas
Iinatti
Kivi-harju
Joutsen-kaari
Vara
Kivi-niemi
Hätälä
Kuurna-puisto
Oma-käyttö
Kaak polku
Mittaus

Interoperability Made in ABB





Omicron test plan with Goose

IEC 61850-8-1

TCP/IP

Optional SPA/LON
IEC 870-5-103

Other protocol (IEC 870-5-103, DNP 3.0 etc.)

Third party IED

IED 670 deliveries and FAT

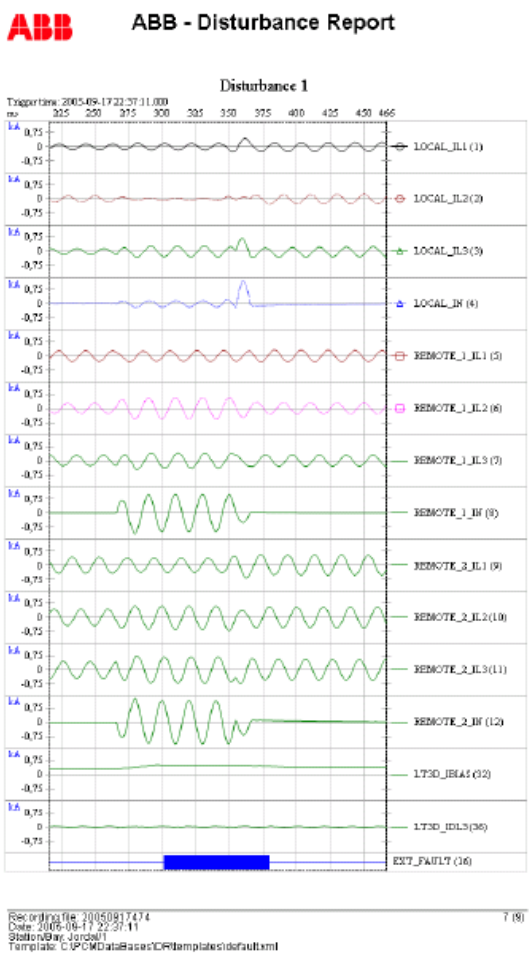
Brazil: IED 670, MicroSCADA Pro and LON

India: IED 670, MicroSCADA Pro and IEC 61850

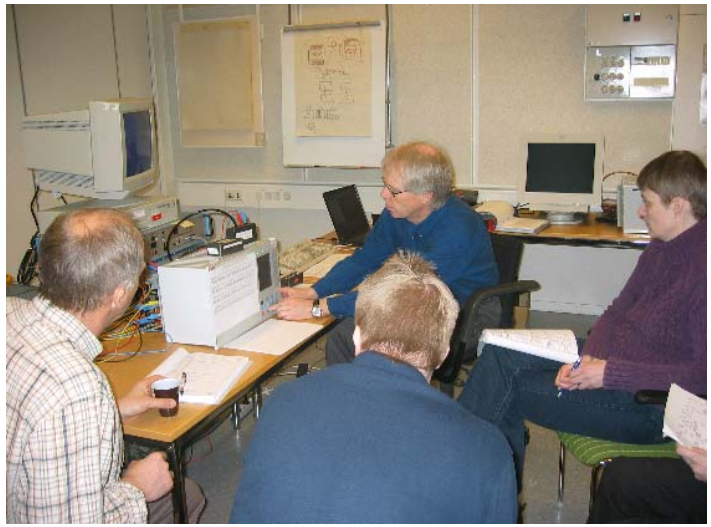
© ABB Group - 72 - 20-Apr-06

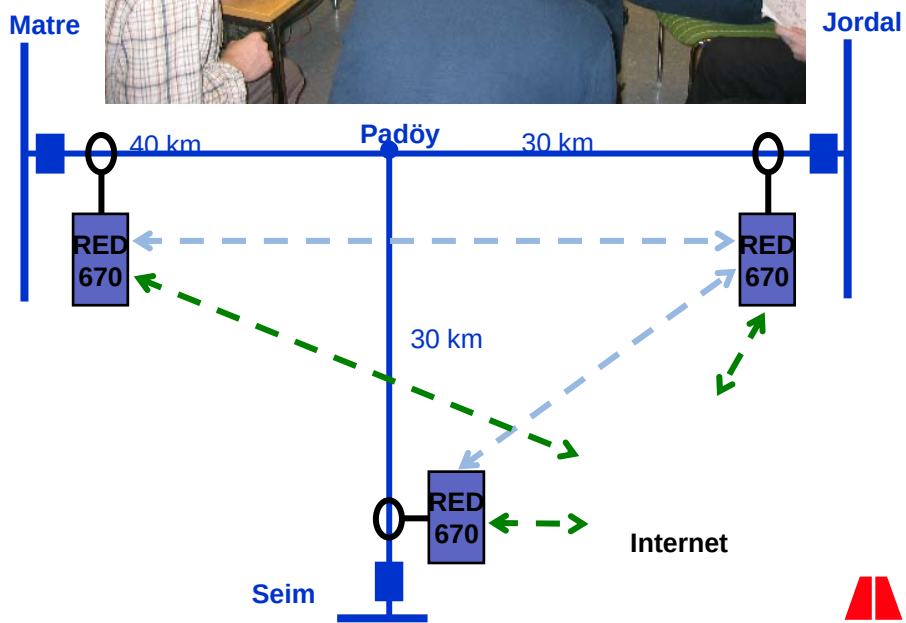
IED 670 deliveries and FAT

Norway RED 670 installation



Finland REB 670 FAT





© ABB Group - 73 - 20-Apr-06

Two Gold medals

ДИПЛОМ

МЕЖДУНАРОДЕН ПАНАИР
ПЛОВДИВ

УДОСТОВЕРЯВА, ЧЕ

експонатът „REL 670 - Многофункционална цифрова релейна защита за електропроводни линии"
Производител: „ABB Automation Technologies AB" – Sweden
Изложител: „АББ България" ЕООД – София

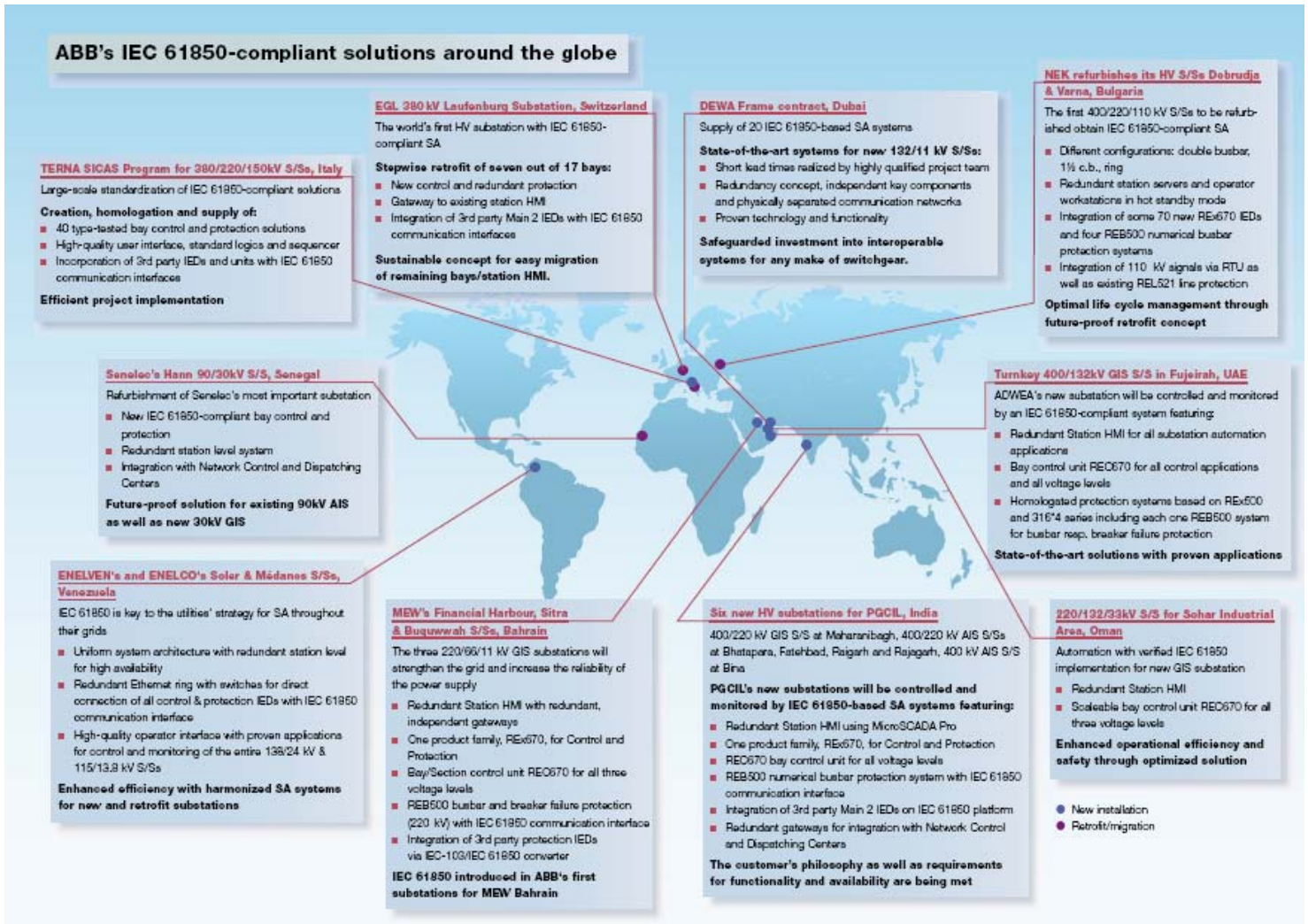
Е НАГРАДЕН С ОТЛИЧИЕТО

ЗЛАТЕН МЕДАЛ

на 61 Международен технически панаир
26.09. - 1.10.2005 г.
Пловдив

© ABB Group - 74 -
20-Apr-06

Selected ABB IEC 61850 References



© ABB Group - 75 - 20-Apr-06