MCDLV4
Line Differential

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MCDLV4 – A new HighPROTEC Family Member

MCDLV4 Naming

- MCDLV4
- MRU4
- MRI4
- MRA4
- MCA4
- MRM4
- MRMV4
- MRDT4
- MCDTV4
- MCDGV4

Legend:
C=6 controllable devices (large display)
G=Generator
I=Current
M=Multiple Protection Elements included
M=Motor
T=Transformer
A=Feeder
DG=Differential Generator
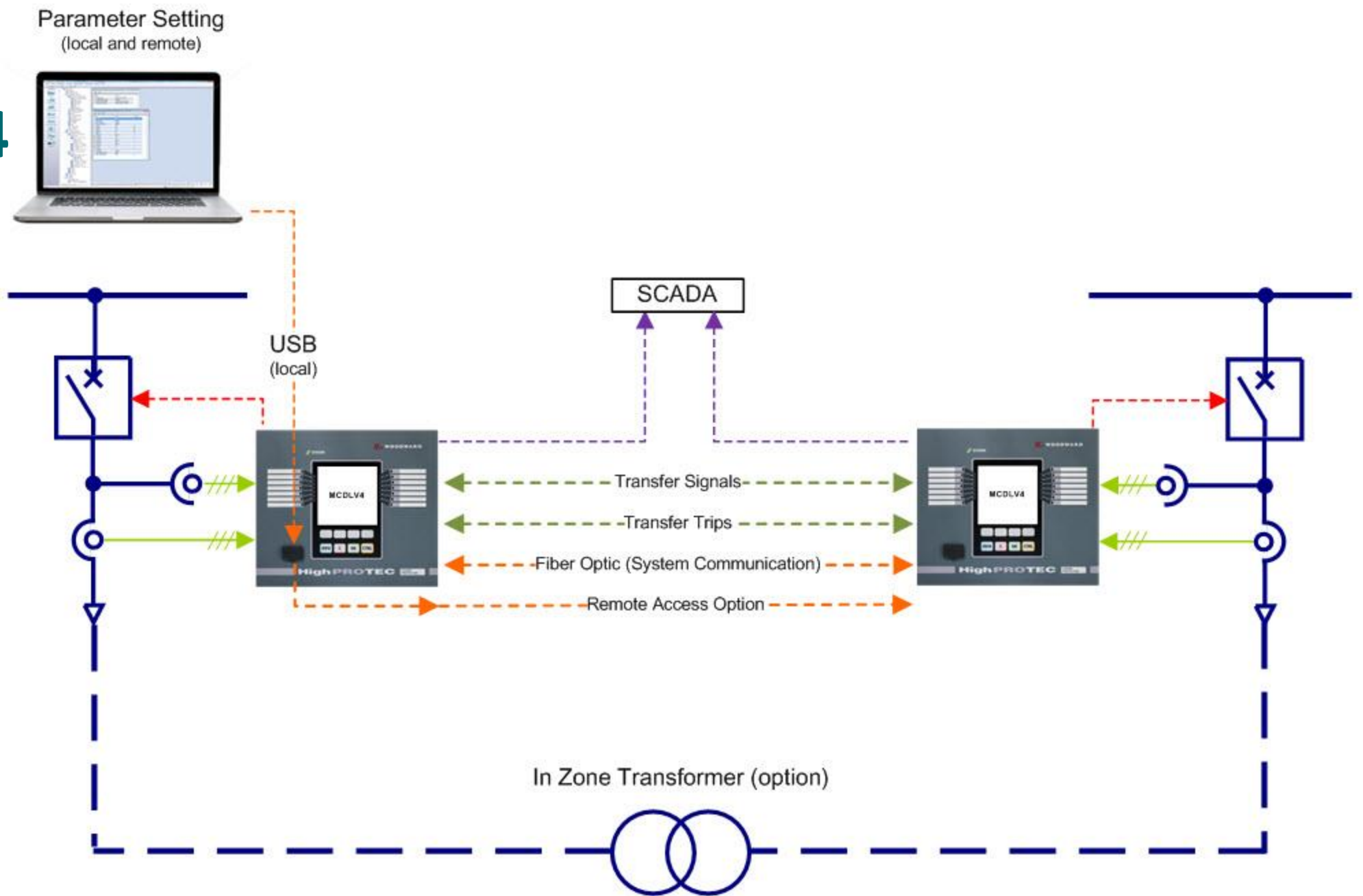DL=Differential Lines (and Cables)
DT=Differential Transformer
R=1 controllable device/2 for transf. (small display)
V=incl. Voltage Measurement
U=Voltage and frequency device

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MCDLV4 System

Parameter Setting (local and remote)

SCADA

USB (local)

Transfer Signals

Transfer Trips

Fiber Optic (System Communication)

Remote Access Option

In Zone Transformer (option)

Cable or Overhead Line up to 24 km (depending on quality of FO)

MCDLV4 Benefits - Overview

- Minimizing cost of failures and outages

- Limiting thermal and mechanical damages

- Cost benefit: The MCDLV4 system covers up to six devices

- Less installation efforts by copperless* transfer signals and trips

- Unmanned parameter setting and monitoring of remote end

*copperless = Breaker states of remote end and trips are transferred via fiber optic. No need for additional copper wirings.

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The 2 golden Rules of Protection

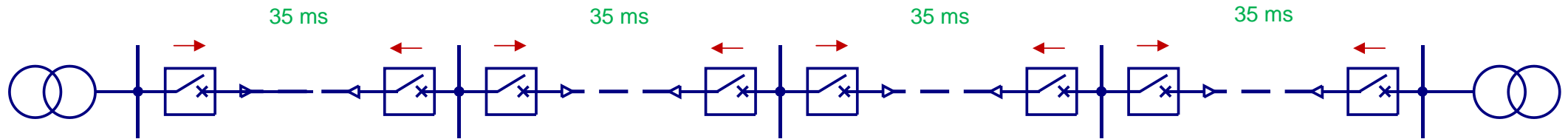|	1. Be Fast	2. Be Selective
Overcurrent Protection	no	yes
Differential Protection	yes	yes

Legend:
Fast = The longer the tripping decision/delay takes (e.g. in time grading) the larger the potential damage.
Selective = Minimize dark-time, shut off only what is really needed in order to eliminate the failure.
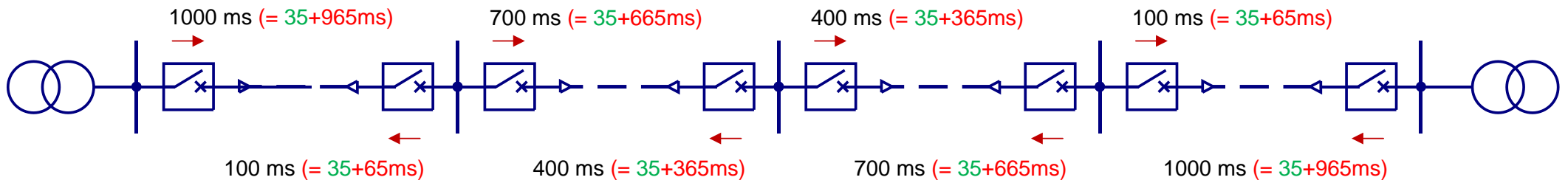
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MCDLV4 – Differential versus Time Grading

Line Differential protection (fast and selective)

35 ms   35 ms   35 ms   35 ms

Time graded directional overcurrent protection (selective but slow)

<<<Backward Direction   Forward Direction>>>

1000 ms (= 35+965ms)   700 ms (= 35+665ms)   400 ms (= 35+365ms)   100 ms (= 35+65ms)

100 ms (= 35+65ms)   400 ms (= 35+365ms)   700 ms (= 35+665ms)   1000 ms (= 35+965ms)
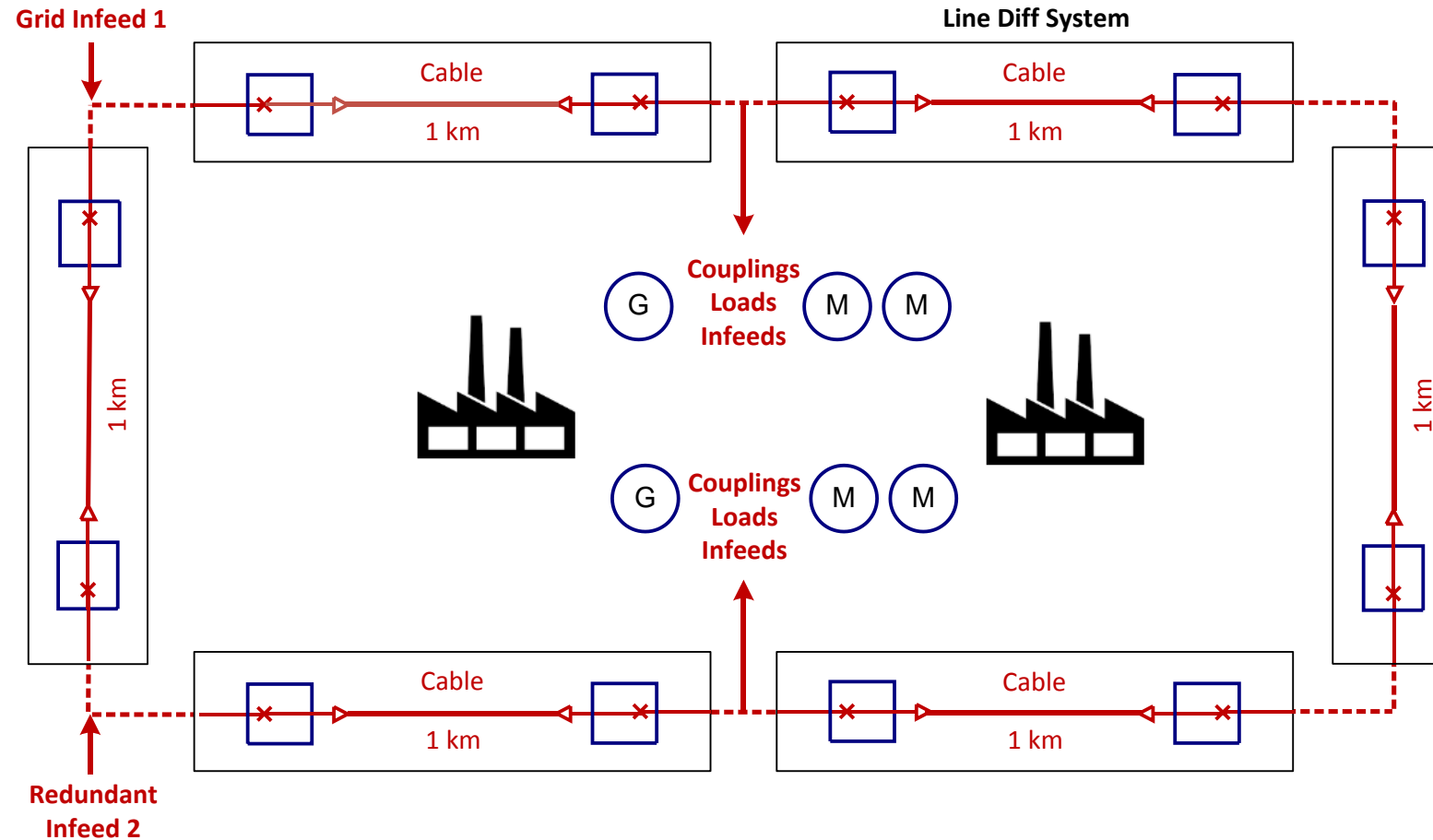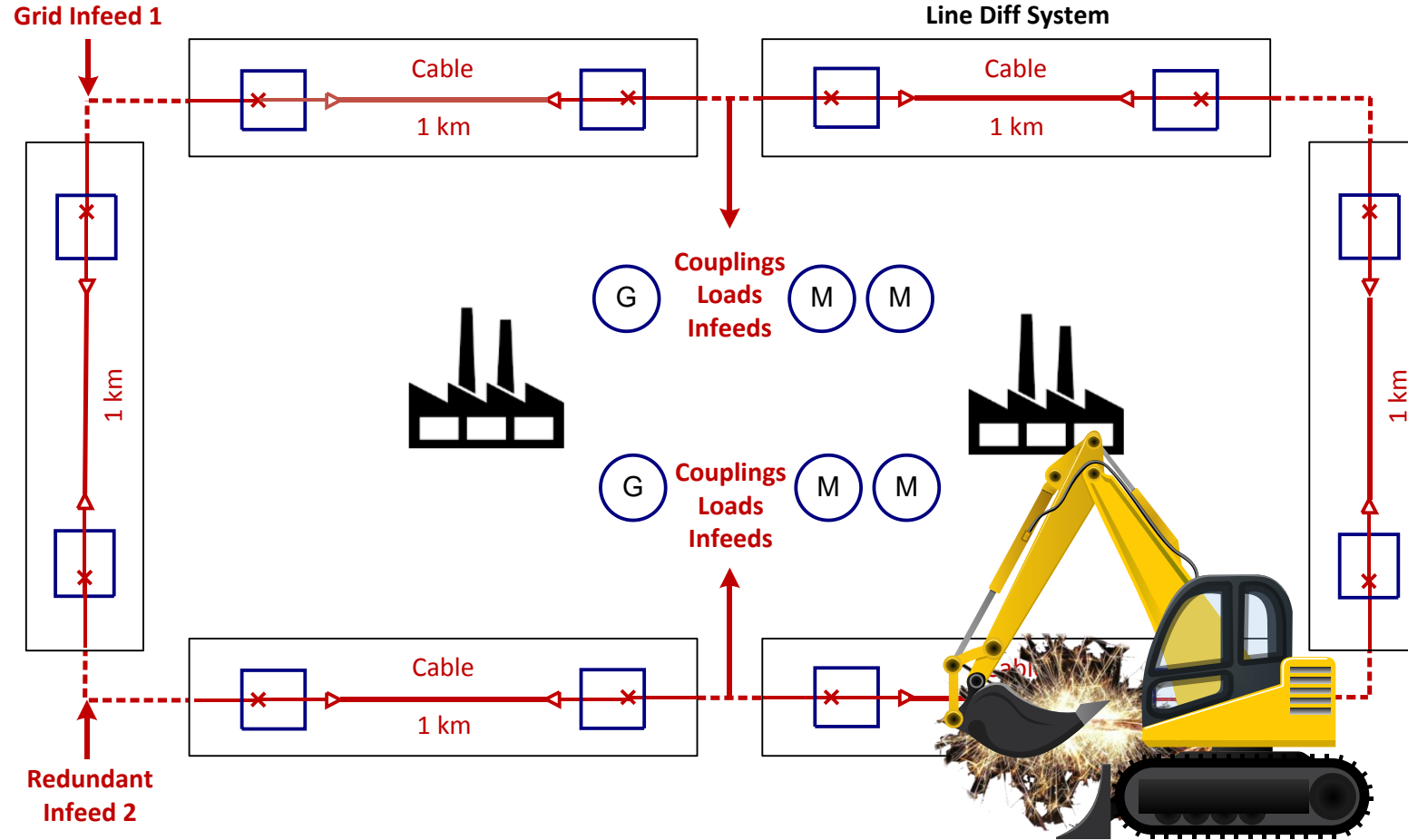
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Just another boring day in a large industrial facility…

- Where data in a data center could get lost…

- Where transactions in a bank could be interrupted in the middle of transaction…

- Where a hospital could get dark…

- Where plastics could get solidified in tubes

- Where liquid glas could get solidified in industrial process tubes

- Where bacteriums could die in a waste water station

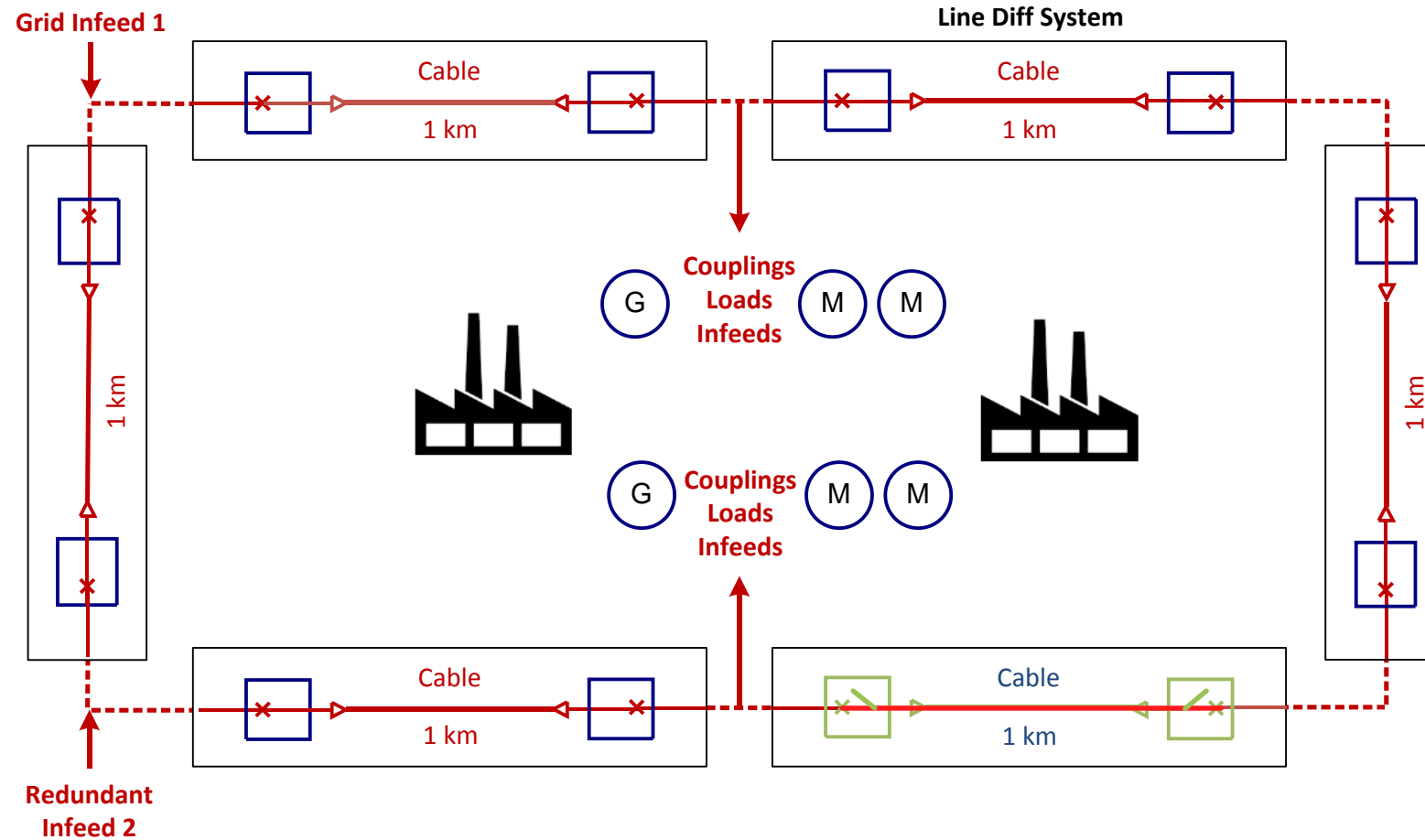- Where…you think electrical power supply is sure as sunrise…

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When Outage is not an Option – Industrial Rings

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When Outage is not an Option – Industrial Rings

When Outage is not an Option – All Lights are still on...

Alternatives to excavators

- Poor quality cables (water treeing)   https://www.youtube.com/watch?v=cygycewb7-Q

- Leakage in oil filled cables   https://www.youtube.com/watch?v=YpLNpeJXQYU

- Flying animals - birds in overhead lines   https://www.youtube.com/watch?v=tN9vZcAN0co

- Climbing animals – on pole towers   https://www.youtube.com/watch?v=egWkCcJJZ8M

- Creeping animals – Snake/Mouse creeping into In-Zone Transformer
  https://www.youtube.com/watch?v=iAedKPBAXRk

- Icicle on overhead lines   https://www.youtube.com/watch?v=HFmrFdssFTo

- Swinging lines in the wind, swinging tree comes to close to a line
  https://www.youtube.com/watch?v=mllzqSLK9iU

- Poor Quality Power Poles breaking under snow   https://www.youtube.com/watch?v=jfKeGHqrip8

- Roots / trees growing into a line   https://www.youtube.com/watch?v=xbsGOl7QPsw

- Not knowing what they are doing   https://www.youtube.com/watch?v=GL1yX2nuh_8
  https://www.youtube.com/watch?v=GpGAGIXwL24

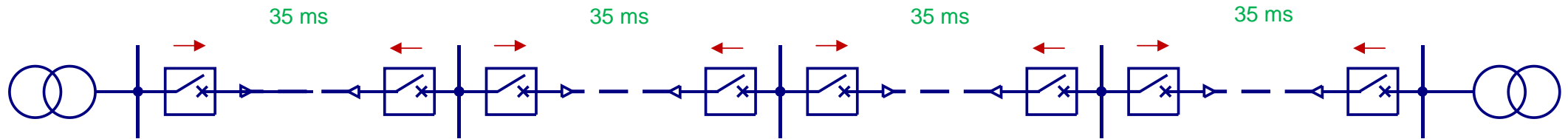# MCDLV4 - Minimizing cost of failures and outages

- Selectivity of protection is independent of tripping times and values.

  - Too many substations in between? Getting in trouble with tripping time coordination? The Line Differential system detects failures independent of tripping coordination times. No damaging delays due to tripping coordination.

  - Differential protection is the most selective (intrinsic) protection. No uncertainties like in distance protection (overlapping zones). Differential protection clearly indicates which cable or overhead line (zone) is faulty.

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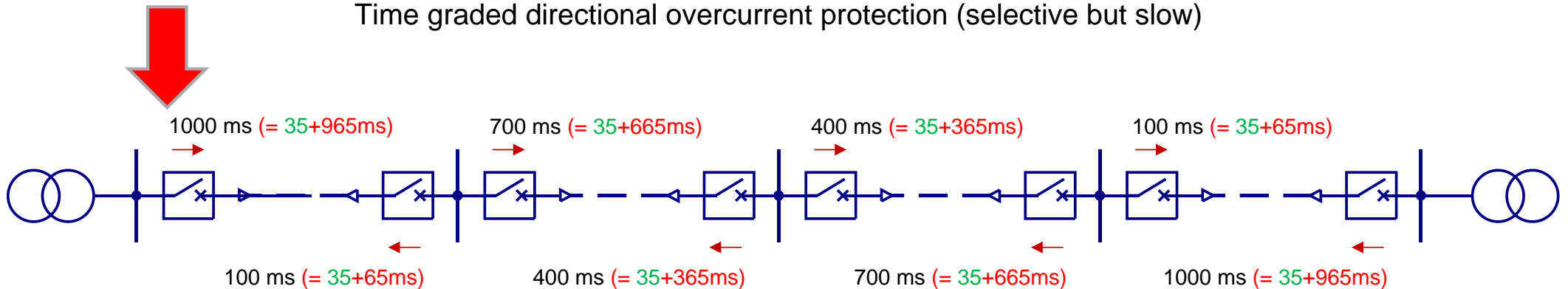# MCDLV4 - Limiting thermal and mechanical damages

- Fast tripping

  - Tripping independent of time grading, current grading or time-current grading.

  - Tripping signals in approx. 35 ms possible.
    Less thermal stress to electrical equipment in case of failures.

What if you need to extend the grid (wait>1s)?

Line Differential protection (fast and selective)

35 ms   35 ms   35 ms   35 ms

Time graded directional overcurrent protection (selective but slow)

1000 ms (= 35+965ms)   700 ms (= 35+665ms)   400 ms (= 35+365ms)   100 ms (= 35+65ms)

100 ms (= 35+65ms)   400 ms (= 35+365ms)   700 ms (= 35+665ms)   1000 ms (= 35+965ms)

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Cost benefit: The MC**DL**V4 system covers up to six devices

How to get a price reduction from 13195 Euros to 4980 Euros?*

*Prices might be object to change

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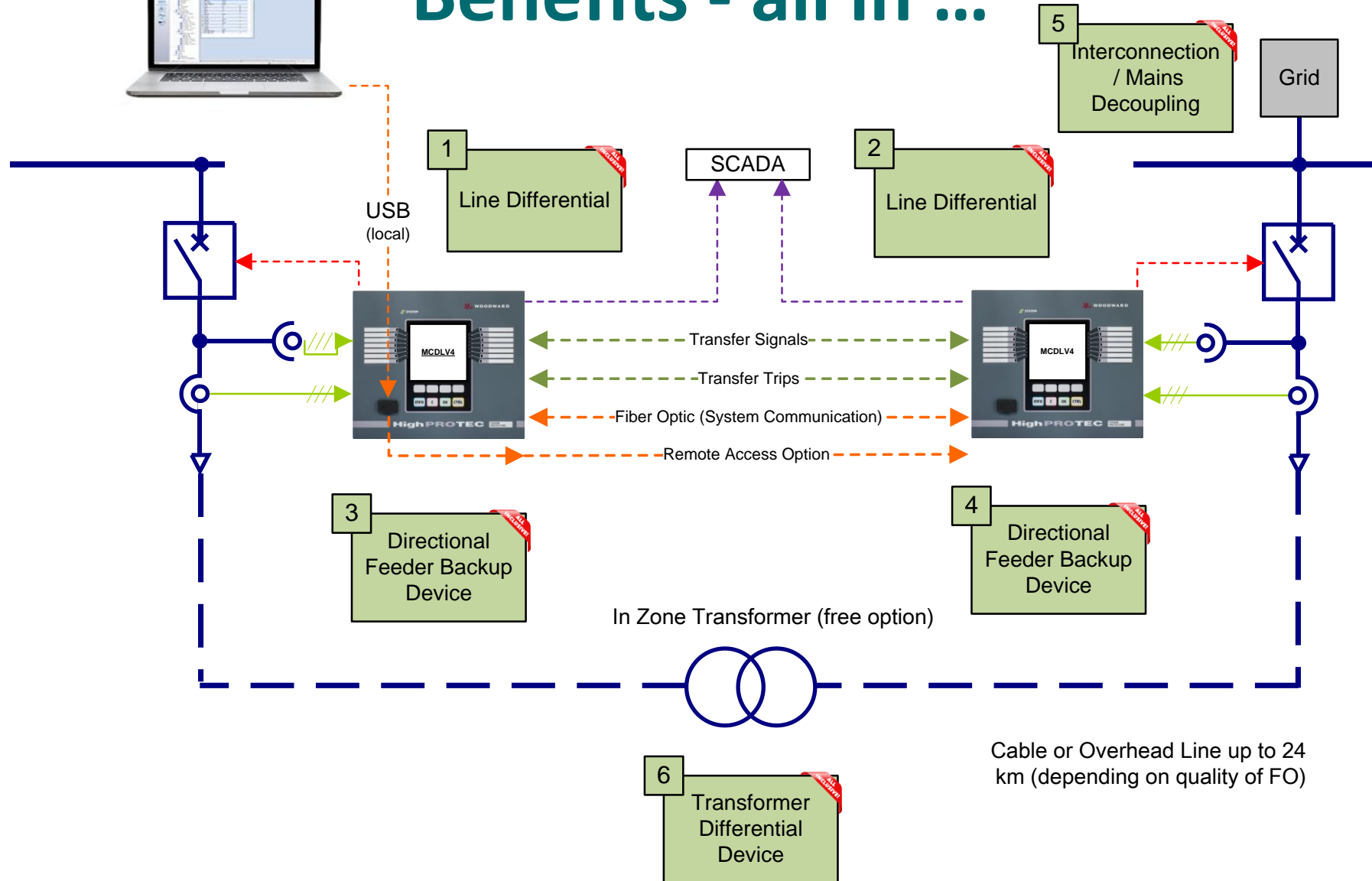# Cost benefit: The MC**DL**V4 system covers up to six devices

- A MCDLV4 system makes up to six devices redundant at no extra charge*

  - 2 Cable and Line Differential Devices   + 4980 Euros (+options)

  - 2 Directional Feeder Devices (Backup)   + ~~3750 Euros (+options)~~

  - In Zone-Transformer Differential Device   + ~~2680 Euros (+options)~~

  - Interconnection Device   + ~~1785 Euros (+options)~~

                                                   = 4980 Euros (+options)

  - *Prices might be object to change

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Benefits - all in …

Parameter Setting
(local and remote)

USB
(local)

1 Line Differential

SCADA

2 Line Differential

5 Interconnection / Mains Decoupling

Grid

Transfer Signals

Transfer Trips

Fiber Optic (System Communication)

Remote Access Option

3 Directional Feeder Backup Device

4 Directional Feeder Backup Device

In Zone Transformer (free option)

6 Transformer Differential Device

Cable or Overhead Line up to 24 km (depending on quality of FO)

Further Cost Savings...

- Take a look at total cost, total cost is more than just the devices*...

  - Parameter Setting Software License   + 0 Euros

  - Disturbance Evaluation Software   + 0 Euros

  - Protection Packages Upgrade Fees   + 0 Euros
             ———————
             = 0 Euros

  - *Prices might be object to change

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Less installation efforts

- Transfer signals and trips make costly long distance copper wirings obsolete.

  - Up to _16 digital states_ can be transferred through the inter-devices fiber optic communication cable. For all these signals a copper wiring in parallel (up to 24 km) to the fiber optic is obsolete (e.g. for control, breaker failure, status indication...).

  - Up to _4 trip signals_ can be transferred through the inter-devices fiber optic communication cable. For all these signals a copper wiring in parallel (up to 24 km) to the fiber optic is obsolete (e.g. for intertripping, indication,...).
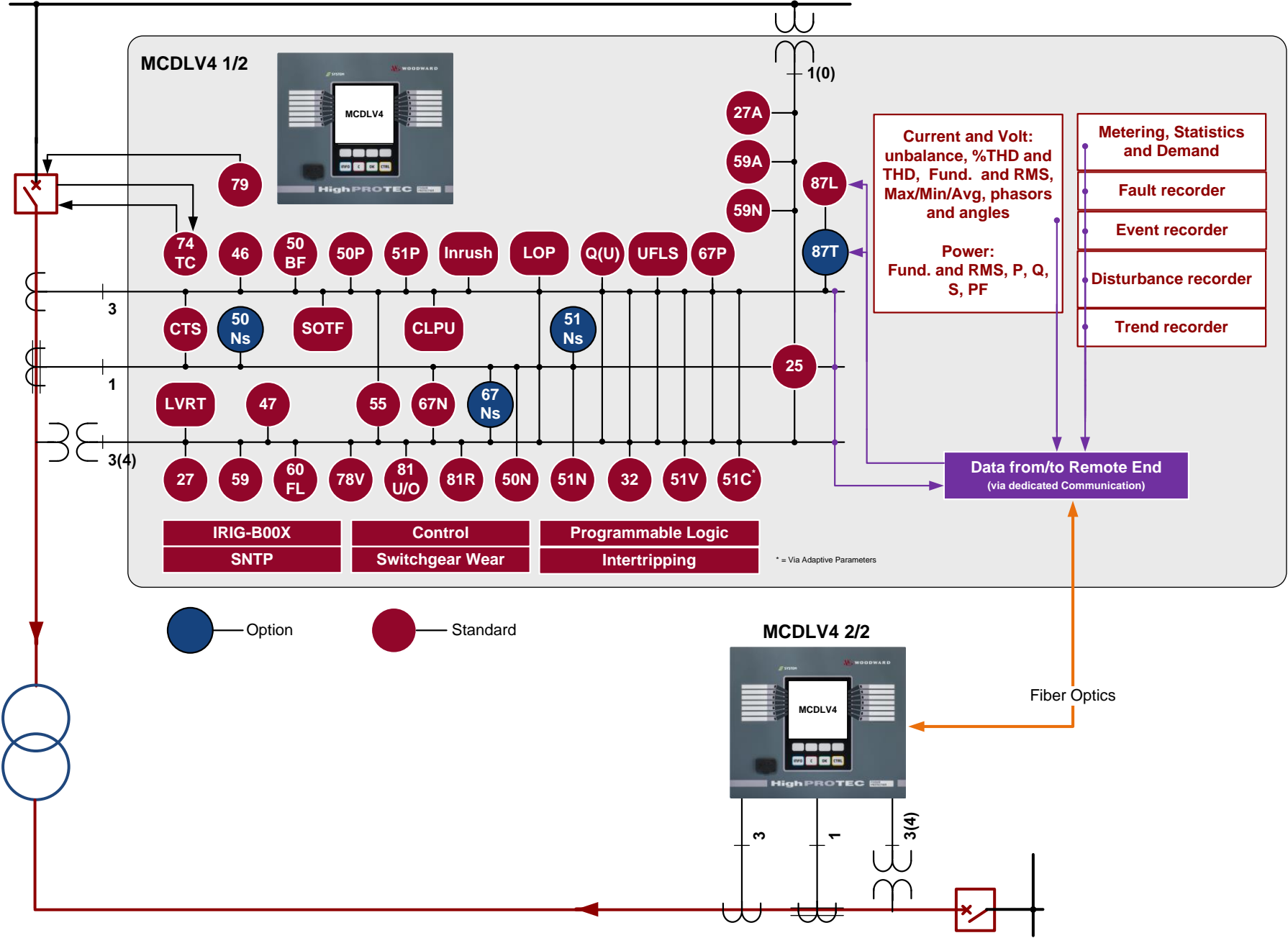
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Unmanned parameter setting and monitoring of remote end

- Remote parameter setting and monitoring
  - _Unmanned_ remote end (up to 24 km distance) _parameter setting_ is possible.
  - _Unmanned_ substations (up to 24 km distance) at remote end can be _monitored_.
  - _Failures and Disturbances_ at remote end in _unmanned_ substations (up to 24 km distance) can be analyzed without physical presence.

Order Code

Line differential protection					MCDLV4	-2						

Version 2 with USB, enhanced communication and user options

Voltage measuring	Digital Inputs	Binary output relays	Housing	Large display								
X	8	7	B2	X	A							
X	16	13	B2	X	D							
X	24	20	B2	X	E							

Hardware variant 2

Phase Current 5 A/1 A, Ground Current 5 A/1 A	0
Phase Current 5 A/1 A, Sensitive Ground Current 5 A/1 A	1

Housing and mounting

Door mounting	A
Door mounting 19" (flush mounting)	B

Interdevice Communication

LC duplex connector, mono mode (up to 24 km), multi mode (up to 4 km)	0
ST connector, BFOC2.5, multi mode (up to 2 km)	1

Communication protocol

Without protocol	A
Modbus RTU, IEC60870-5-103, DNP3.0 RTU | RS485/terminals	B*
Modbus TCP, DNP3.0 TCP/UDP | Ethernet 100 MB/RJ45	C*
Profibus-DP | optic fiber/ST-connector	D*
Profibus-DP | RS485/D-SUB	E*
Modbus RTU, IEC60870-5-103, DNP3.0 RTU | optic fiber/ST-connector	F*
Modbus RTU, IEC60870-5-103, DNP3.0 RTU | RS485/D-SUB	G*
IEC61850, Modbus TCP, DNP3.0 TCP/UDP | Ethernet 100MB/RJ45	H*
IEC60870-5-103, Modbus RTU, DNP3.0 RTU | RS485/terminals Modbus TCP, DNP3.0 TCP/UDP | Ethernet 100 MB/RJ45	I*
IEC61850, Modbus TCP, DNP3.0 TCP/UDP | Optical Ethernet 100MB/LC duplex connector	K*
Modbus TCP, DNP3.0 TCP/UDP | Optical Ethernet 100MB/LC duplex connector	L*

Harsh Environment Option

None	A
Conformal Coating	B

Available menu languages (in every device)

Standard English/German/Spanish/Russian/Polish/Portuguese/French

ANSI Overview

MCDLV4 1/2

1(0)

27A
59A
59N

87L
87T

79

74 TC | 46 | 50 BF | 50P | 51P | Inrush | LOP | Q(U) | UFLS | 67P

CTS | 50 Ns | SOTF | CLPU | 51 Ns

25

LVRT | 47 | 55 | 67N | 67 Ns

27 | 59 | 60 FL | 78V | 81 U/O | 81R | 50N | 51N | 32 | 51V | 51C*

IRIG-B00X | Control | Programmable Logic
SNTP | Switchgear Wear | Intertripping

* = Via Adaptive Parameters

3
1
3(4)

Current and Volt:
unbalance, %THD and THD, Fund. and RMS, Max/Min/Avg, phasors and angles

Power:
Fund. and RMS, P, Q, S, PF

Metering, Statistics and Demand

Fault recorder

Event recorder

Disturbance recorder

Trend recorder

Data from/to Remote End
(via dedicated Communication)

● —— Option   ● —— Standard

MCDLV4 2/2

Fiber Optics

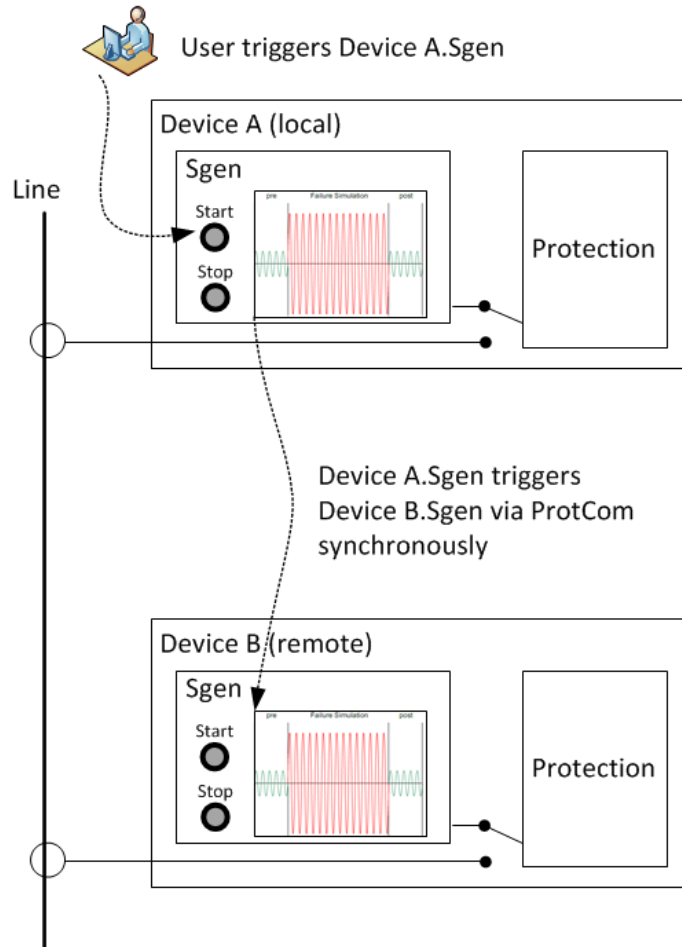3   1   3(4)

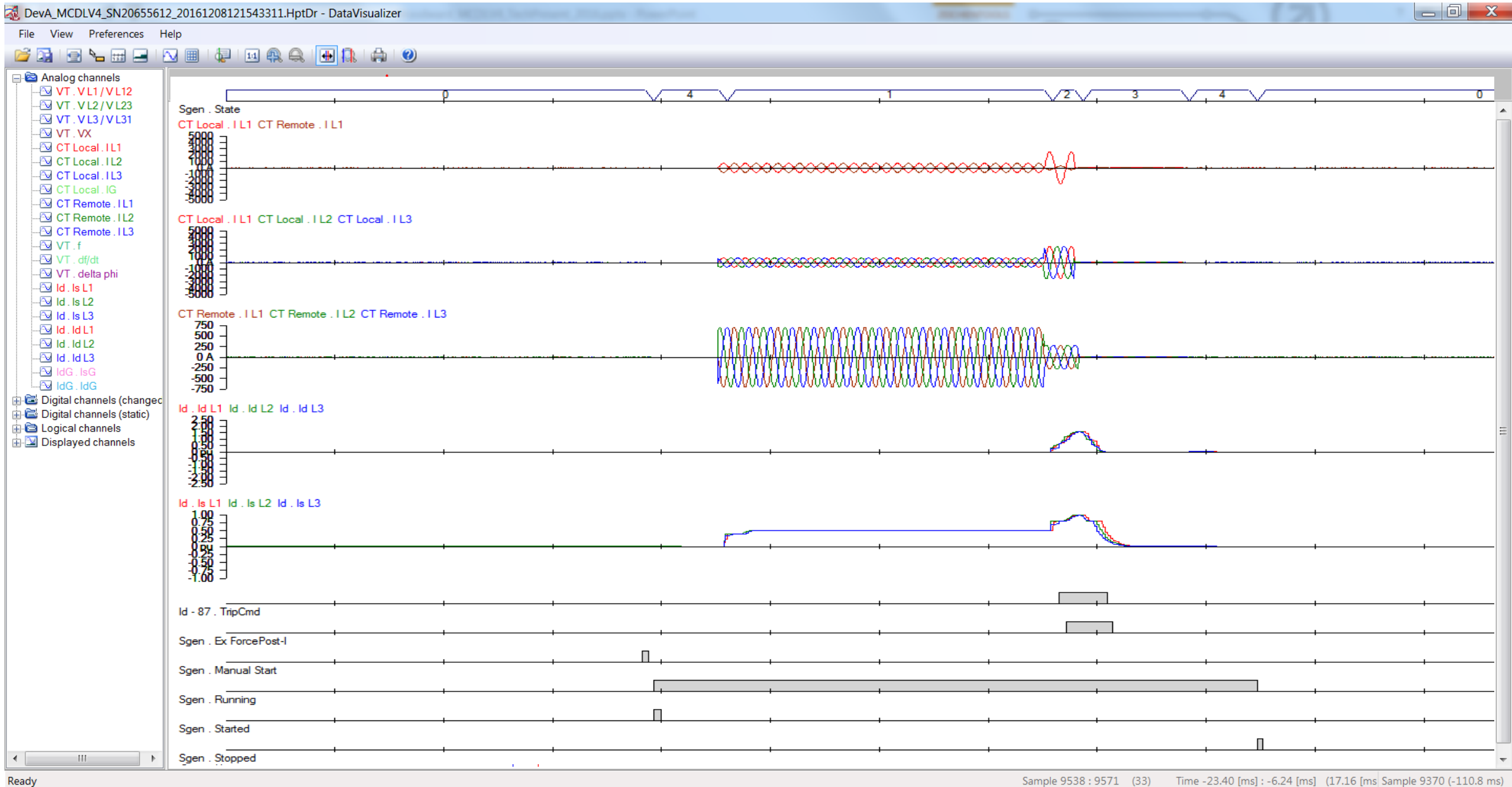# Appendix

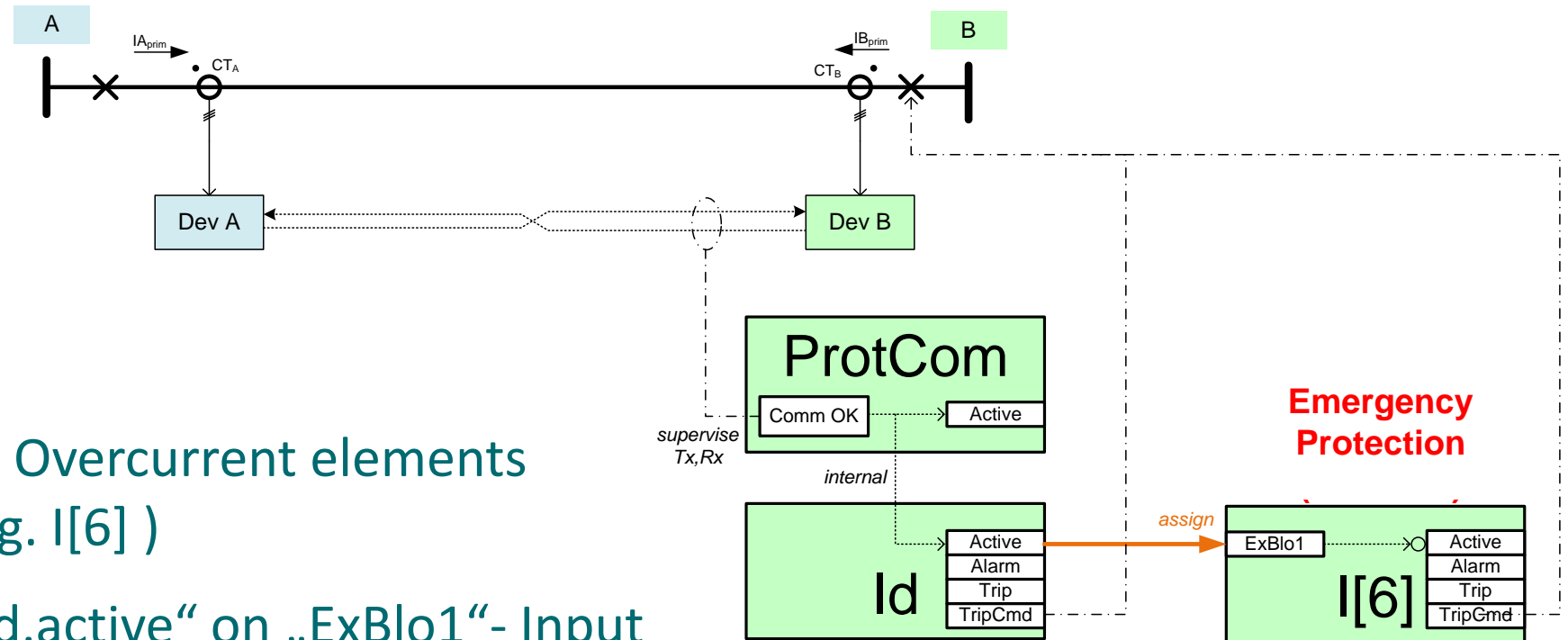**WOODWARD**
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Testing on a Desk (Integrated Sgen)

- Basic testing can be done via the integrated Failure Generator from one end.

- Sequence times have to be the same at both ends.

- Testing with In-Zone Transformer is also possible. Phase shift of transformer has to be set in Failure simulator

Integrated Emergency Backup Option

1. One of the free Overcurrent elements can be used (e.g. I[6])

2. Assign signal „Id.active" on „ExBlo1"- Input

3. In case of device communication issues the Emergency Overcurrent Element will be released.