Feeder/Motor Protection Relay

VAMP 40

VAMP 40 – Background, Why?

Microprocessor based relays often too complex and costly.

Many times only fraction of available functions in use.

→Need for a relay with:

1) low cost
2) high performance
3) easy to use

VAMP 40 – Background, How?

- Single PCB solution - optimal production cost
- Modern technology allows high functionality in low cost relay
- Efficient firmware implementation
- No software options – one price
- Based on proven Vamp relay platform – high availability
- KEMA & SGS tested

VAMP 40 – Solution

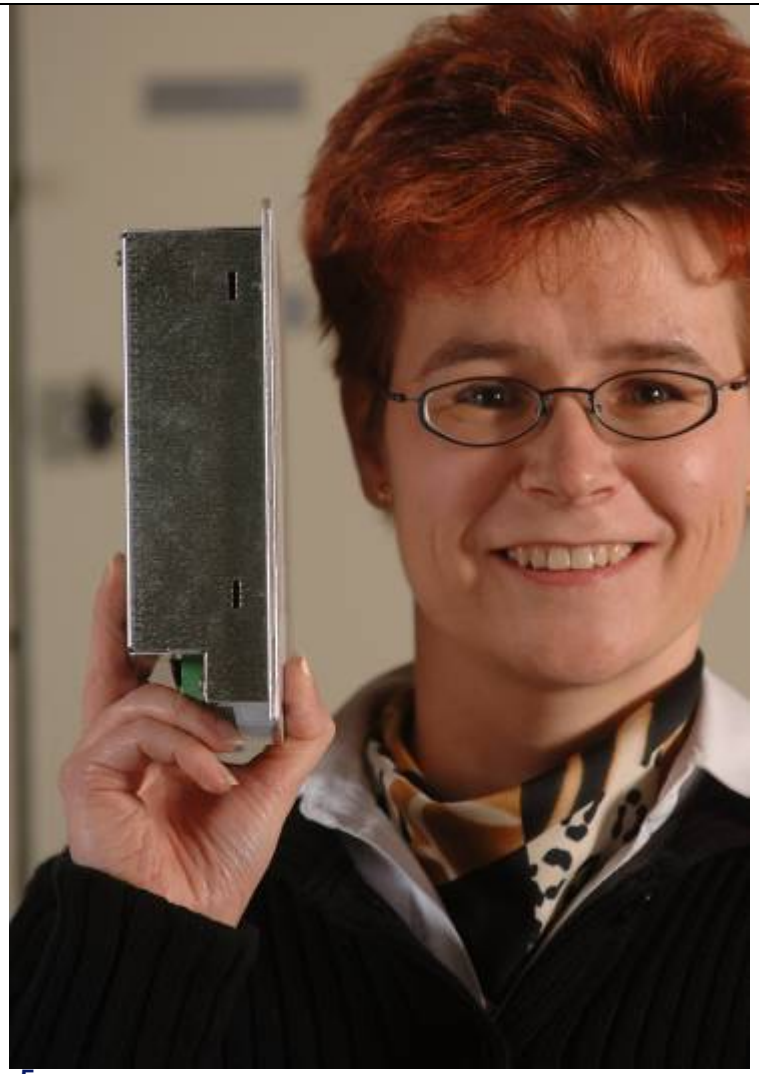
Utility, industrial, marine & off-shore applications,

when traditional multi-function relay is too costly and over-dimensioned for the application

Low budget relay upgrades

→ Value for money proposition

VAMP 40 – Key features



- Limited in depth
- 18...265 VDC/VAC power supply
- 1/5 amp phase current
- 0.2/1/5 amp residual current
- Lots of protection functions
- IEC, ANSI and programmable curves
- Programmable protection stages
- Measurements: I,V,P,Q,S,pf,E+,E...
- CB control
- Condition monitoring
- Trip circuit supervision
- Power quality functions
- Programmable logic
- Disturbance recorder, fault registers
- Local and remote communication
- Optional Arc protection

VAMP 40 – Added value for Utility

- Complete current protection including:
  - Directional Earth-Fault (67N)
  - Inrush blocking (68)
  - Auto-reclosing (79)
  - Sophisticated capacitor bank protection
  - Programmable protection stages

- Limited depth, suitable even for recloser control and other space critical applications
- Open protocols, such as IEC 103 and DNP 3.0 etc.,
- DR upload using IEC 103 and DNP 3.0
- Cost effective relay upgrades

- ARC protection can be added in the field → increased switchgear life cycle

VAMP 40 – Added value for Industry

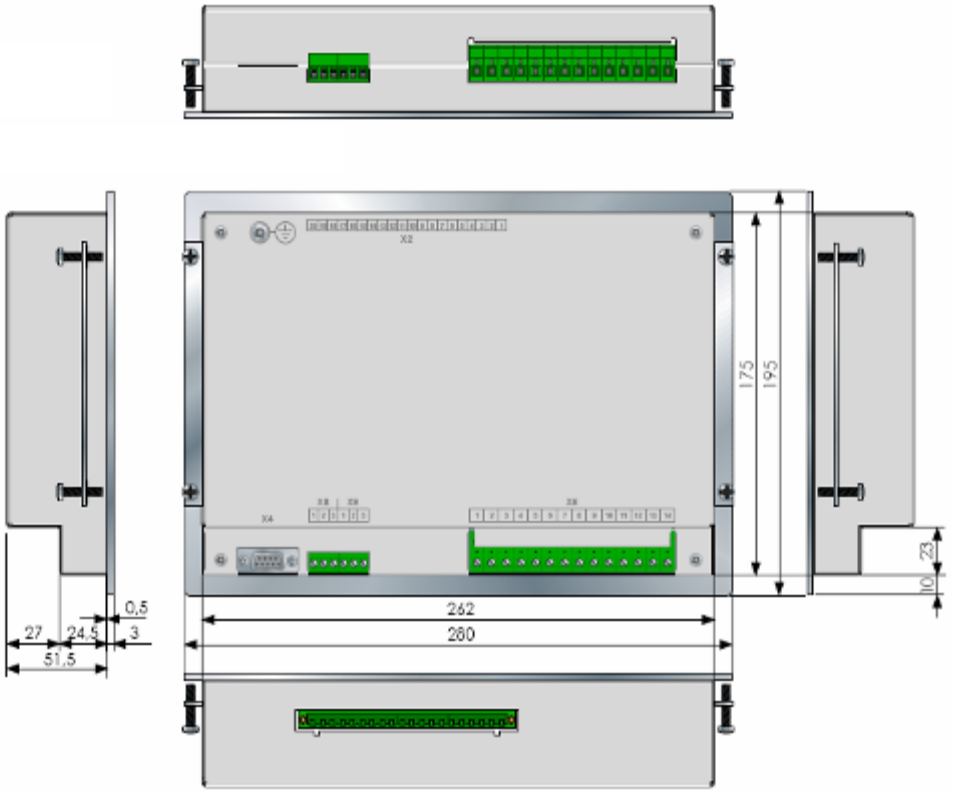
- Feeder and Motor protection modes – less spare parts, less training
- Directional earth-fault protection for motors in high-resistance earthed systems, more sensitive setting
- External RTD inputs, less wiring
- Disturbance recorder trend mode → motor start up register
- Complete measurement possibility (P, Q, S, pf, E)
- THD alarm function + other programmable protection stages
- Open protocols, such as Modbus, Profibus DP, etc.
- Cost effective relay upgrades
- Arc protection can be added in the field→ increased switchgear life cycle

VAMP 40 – Added value for Marine & Off-shore

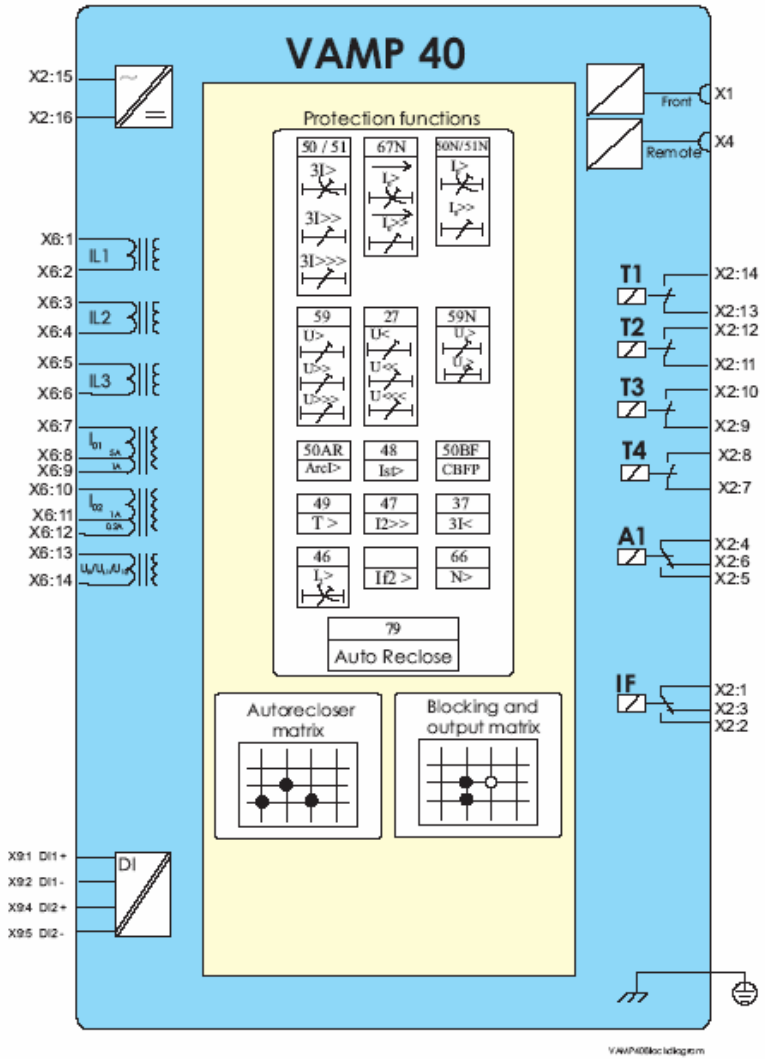
- Feeder and Motor protection modes – less spare parts, less training
- Directional earth-fault protection for motors in high-resistance earthed systems, more sensitive setting
- External RTD inputs, less wiring
- Disturbance recorder trend mode → motor start up register
- Limited installation depth in space critical applications
- Complete measurement possibility (P, Q, S, pf, E)
- THD Alarm function + other programmable protection stages
- Open protocols, such as Modbus, Profibus DP, etc.
- Arc protection can be added in the field→ increased switchgear life cycle

- DNV, Lloyds, GL approvals ongoing

VAMP 40 – Dimensions

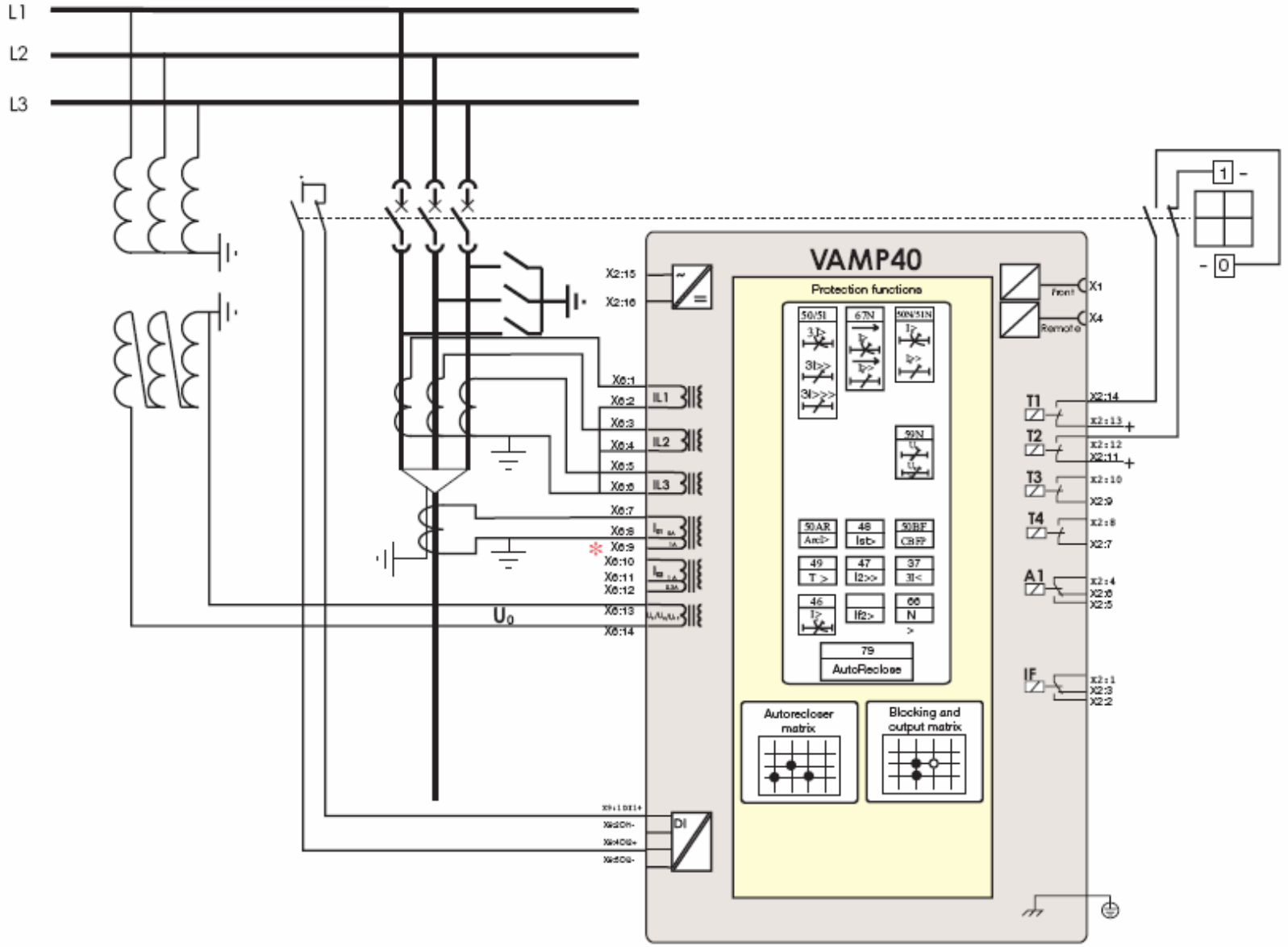


VAMP 40 – Connections

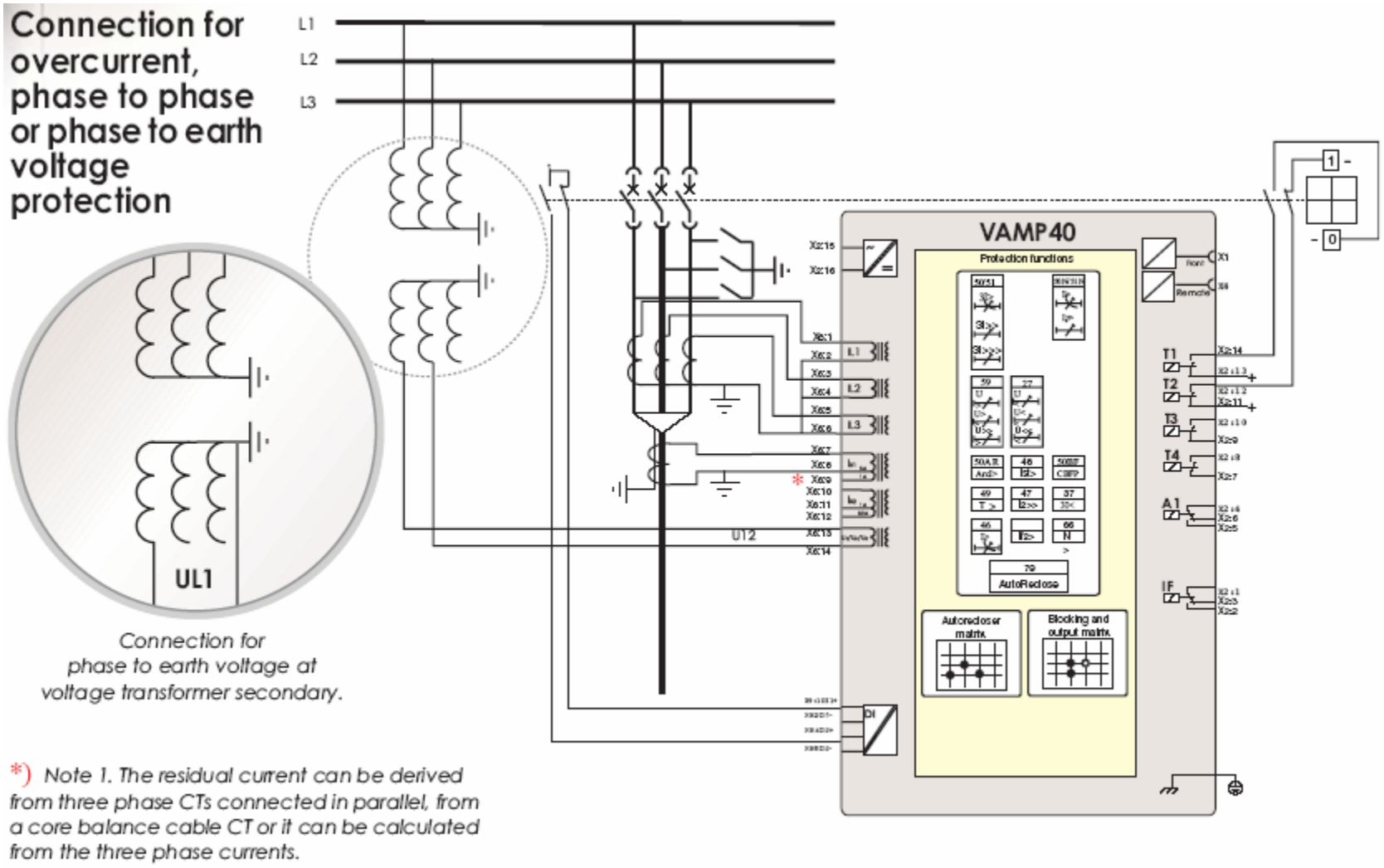


- Three phase currents and two independent residual current inputs
- One voltage input: residual, phase-to-earth or phase-to-phase voltage
- 2 digital inputs, potential free
- 4 power outputs (NO/NC with software)
- 1 alarm output (NO/NC with software)
- self supervision output (IRF)
- Local communication port, Front
- Remote communication port, TTL, RS232, RS485, Profibus, plastic or glass optic , TCP/IP as option

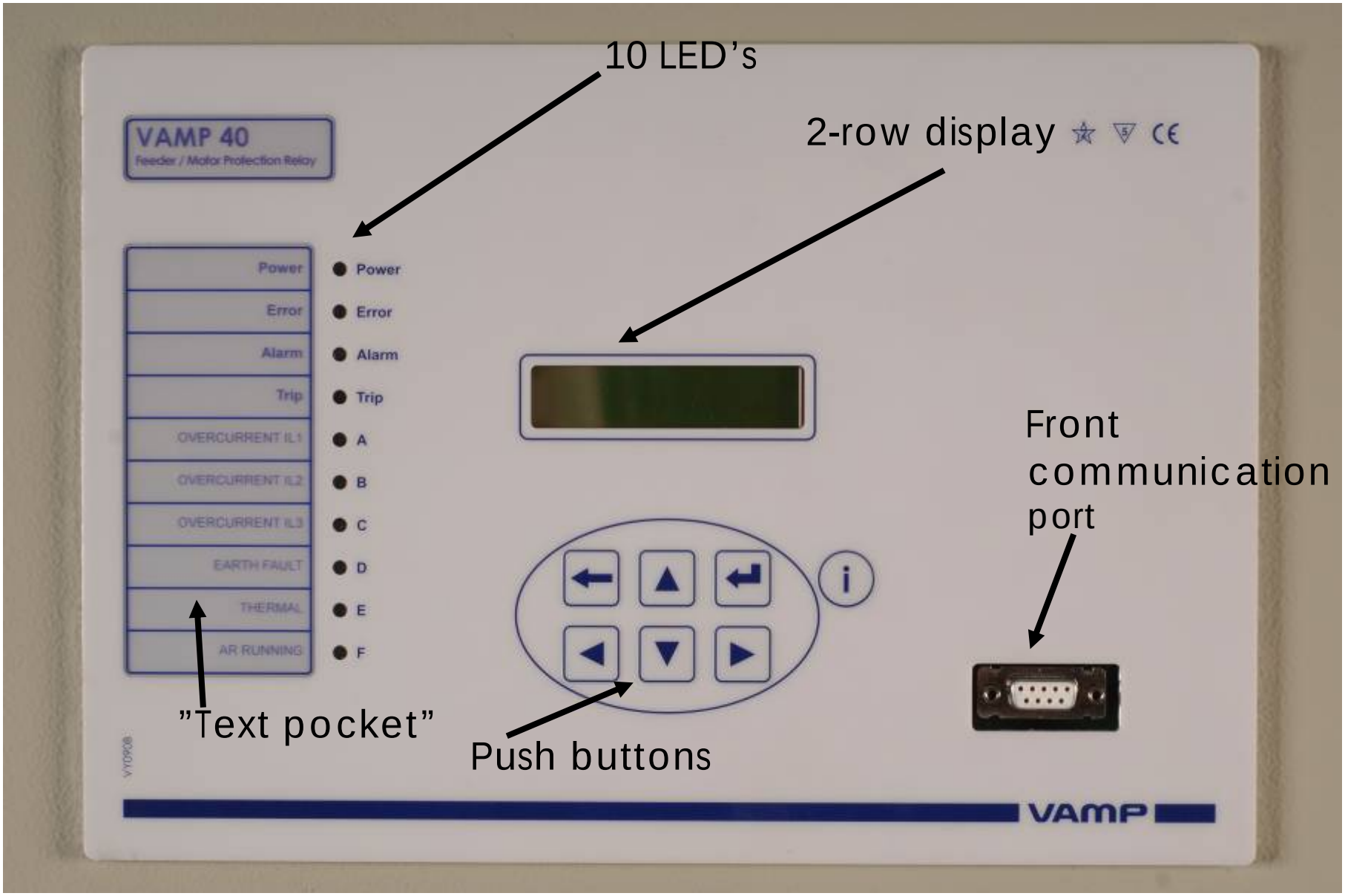
VAMP 40 – Connection diagram



VAMP 40 – Connection diagram



VAMP 40 – HMI


10 LED's
2-row display
VAMP 40
Feeder / Motor Protection Relay
Power
Error
Alarm
Trip
OVERCURRENT IL1
OVERCURRENT IL2
OVERCURRENT IL3
EARTH FAULT
THERMAL
AR RUNNING
A
B
C
D
E
F
Front communication port
"Text pocket"
Push buttons
VAMP

VAMP 40 – protection functions

Protection functions in feeder mode:

- 3-phase overcurrent, three stages (50/51)
- Non-directional earth-fault, two stages (50/51N)
- Directional or non-directional earth-fault, two stages (67N or 50/51N)
- Residual voltage, two stages(59N)
- broken conductor I2/I1 (46)
- Inrush detection (68)
- Thermal overload (49)
- Undercurrent (37)
- 5 shot auto-reclosing (79)
- Circuit breaker failure protection(50BF)
- Latched trip(86)
- Arc protection (50AR) (OPTIONAL)
- Capacitor bank protection

Settings in both primary and p.u. values

IEC, ANSI, programmable curves

8 fault logs in every function

VAMP 40 – protection functions

Protection functions in motor mode:

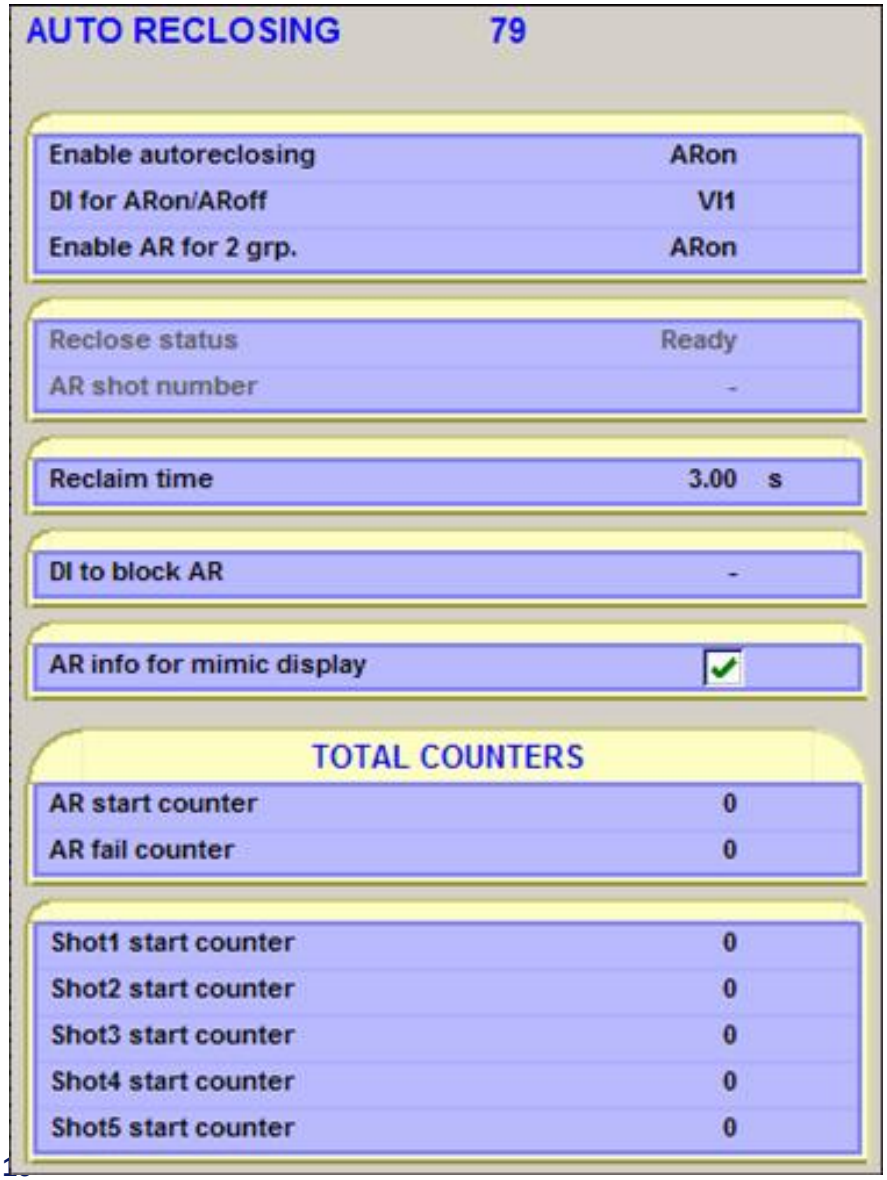
- Overload/short-circuit, three stages (50/51)
- Non-directional earth-fault, two stages (50/51N)
- Directional or non-directional earth-fault, two stages (67N or 50/51N)
- Residual voltage, two stages (59N)
- Unbalance/single phasing (46)
- Phase reversal/incorrect phase sequence (47)
- Thermal overload with ambient temperature compensation (49)
- Undercurrent / loss of load (37)
- Stall / blocked rotor (48)
- Frequent starts (66)
- Circuit breaker failure protection (50BF)
- Latched trip (86)
- Arc protection (50AR) (OPTIONAL)
- External RTD inputs (38,49) (OPTIONAL)

Settings in both primary and p.u. values

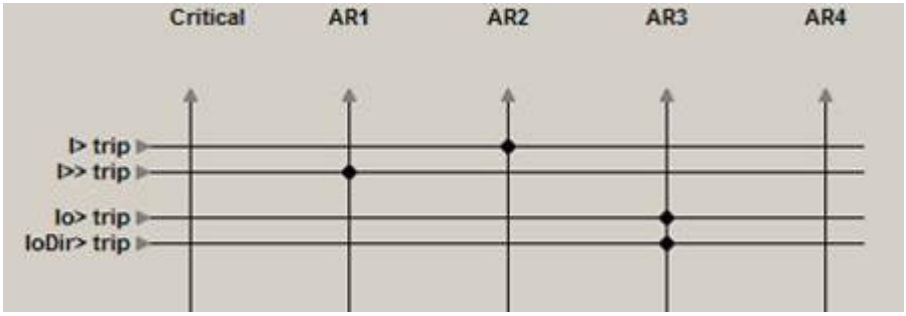
8 fault logs in every function

IEC, ANSI, programmable curves

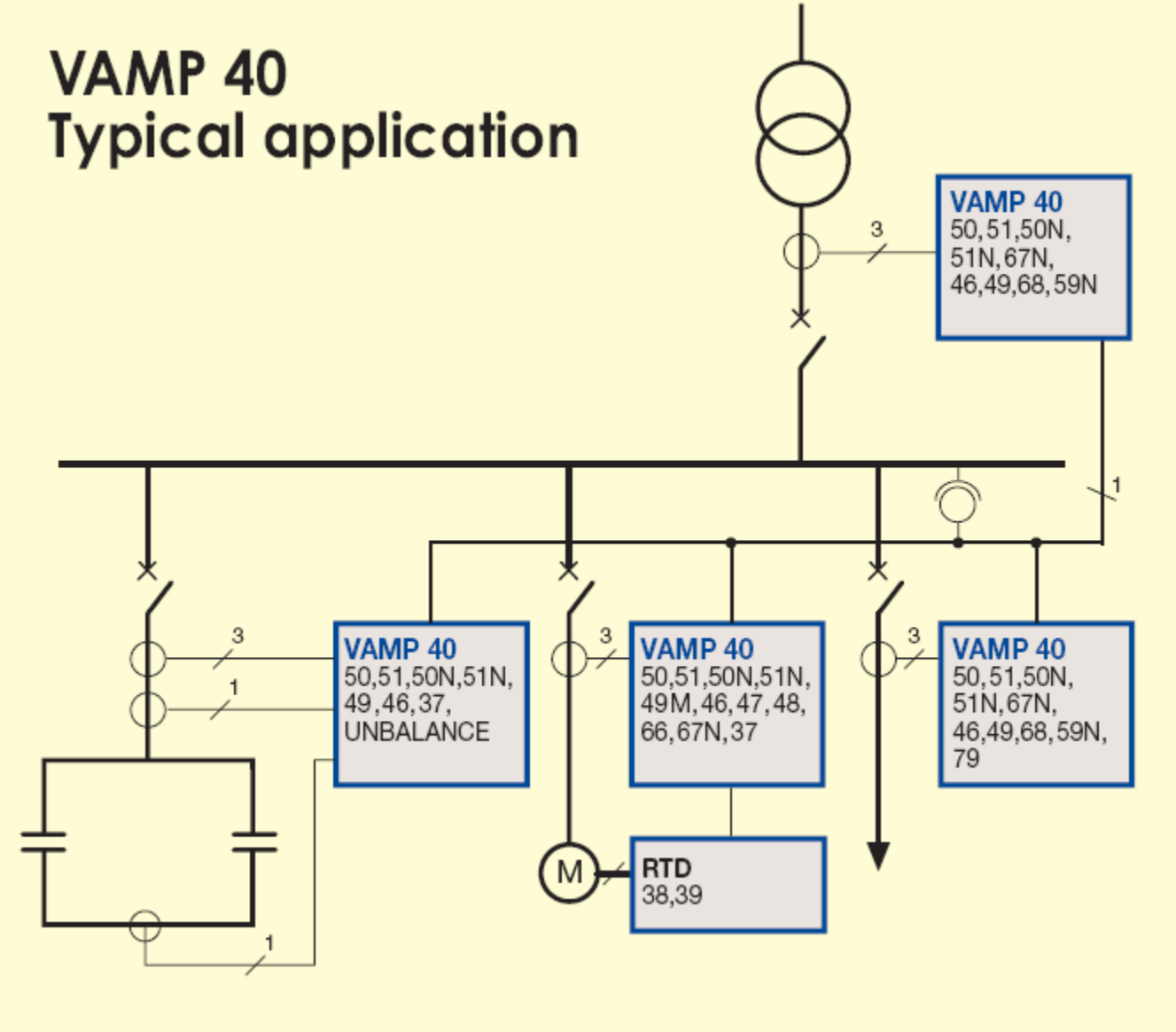
VAMP 40 – Auto-reclose



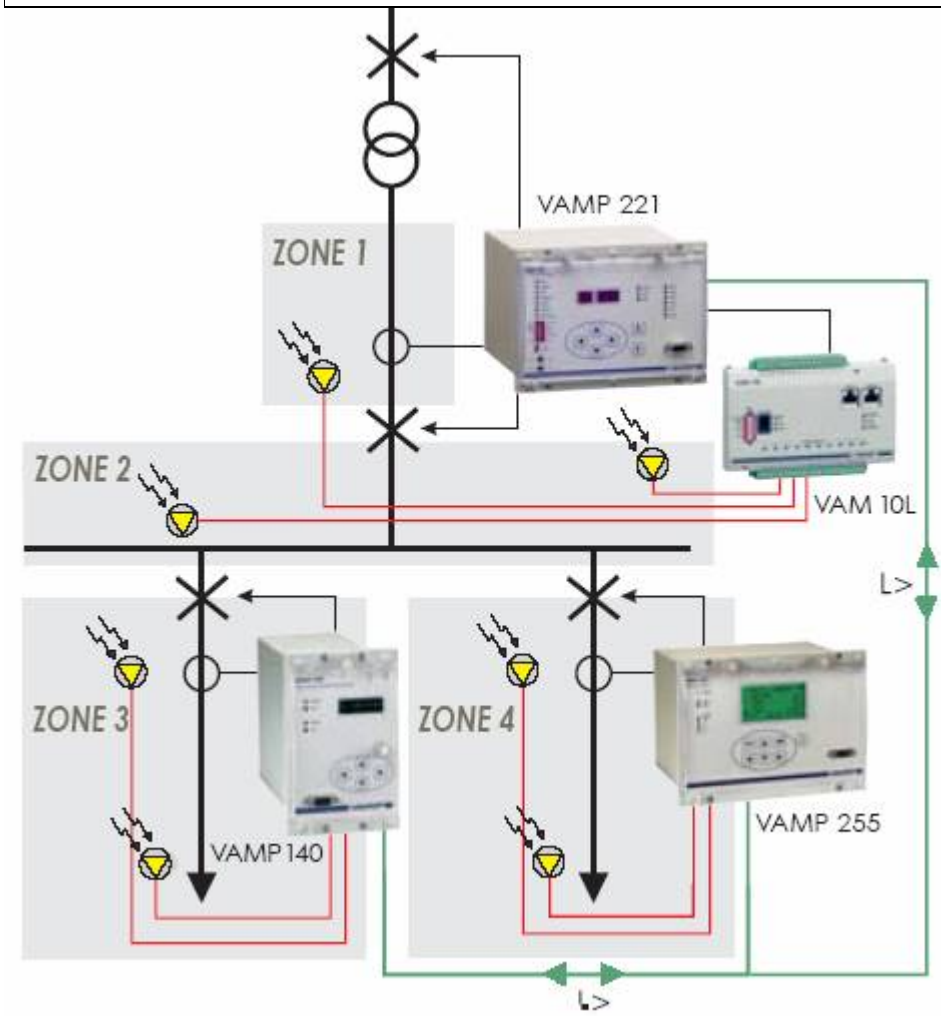
- Up to 5 shots
- 4 different sequences, e.g.
  - Inst. overcurrent
  - Time delayed OC
  - Earth-fault
- Every shot has different settings



VAMP 40 – Application



VAMP 40 – integrated arc protection

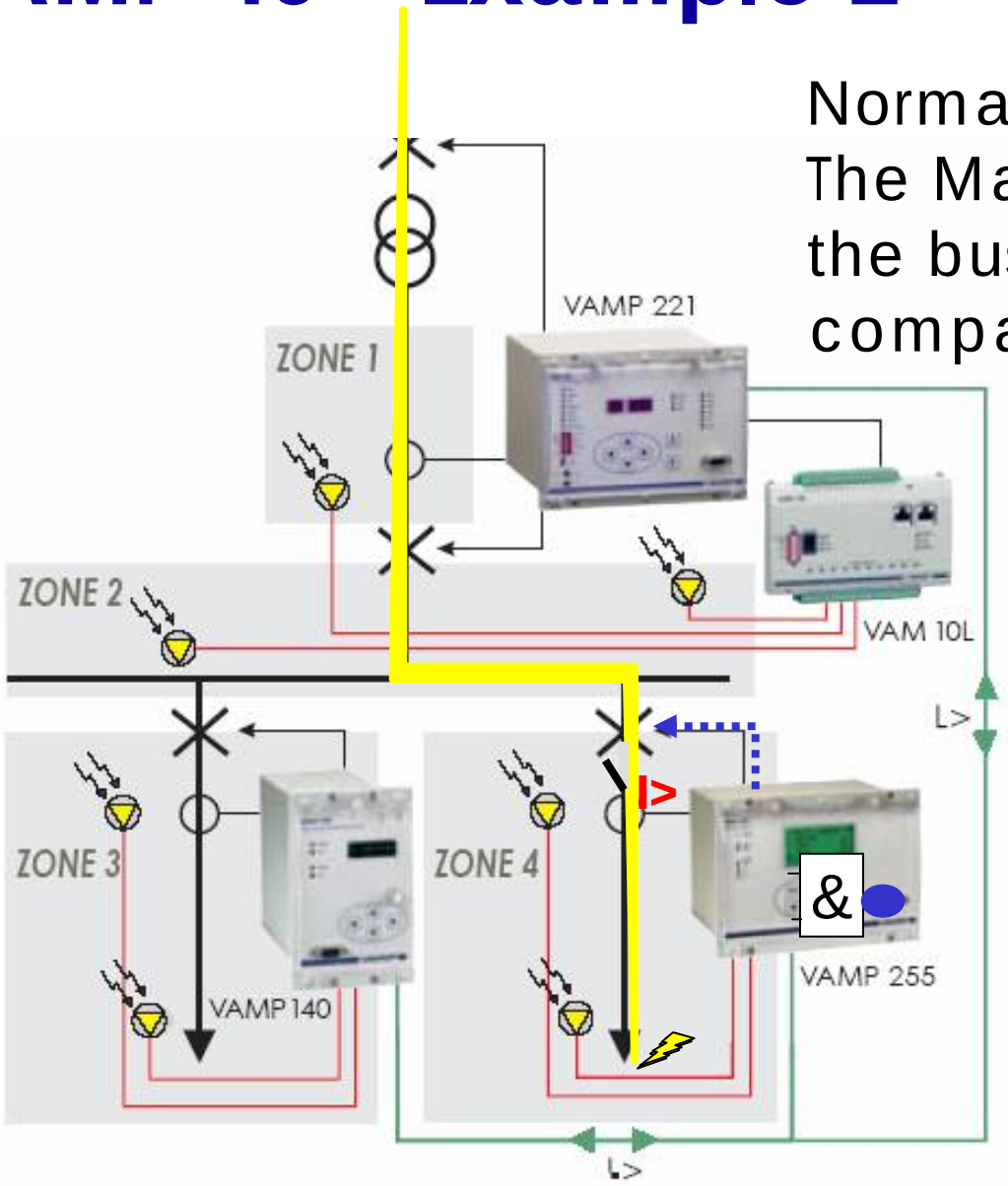


- Integrated
- 2 channels

=> up to 4 sensors

- Dedicated arc stages, trip <= 15 ms
- OC and EF
- Communicates with VAMP arc protection system
- Economical arc protection
- Selective tripping possibilities

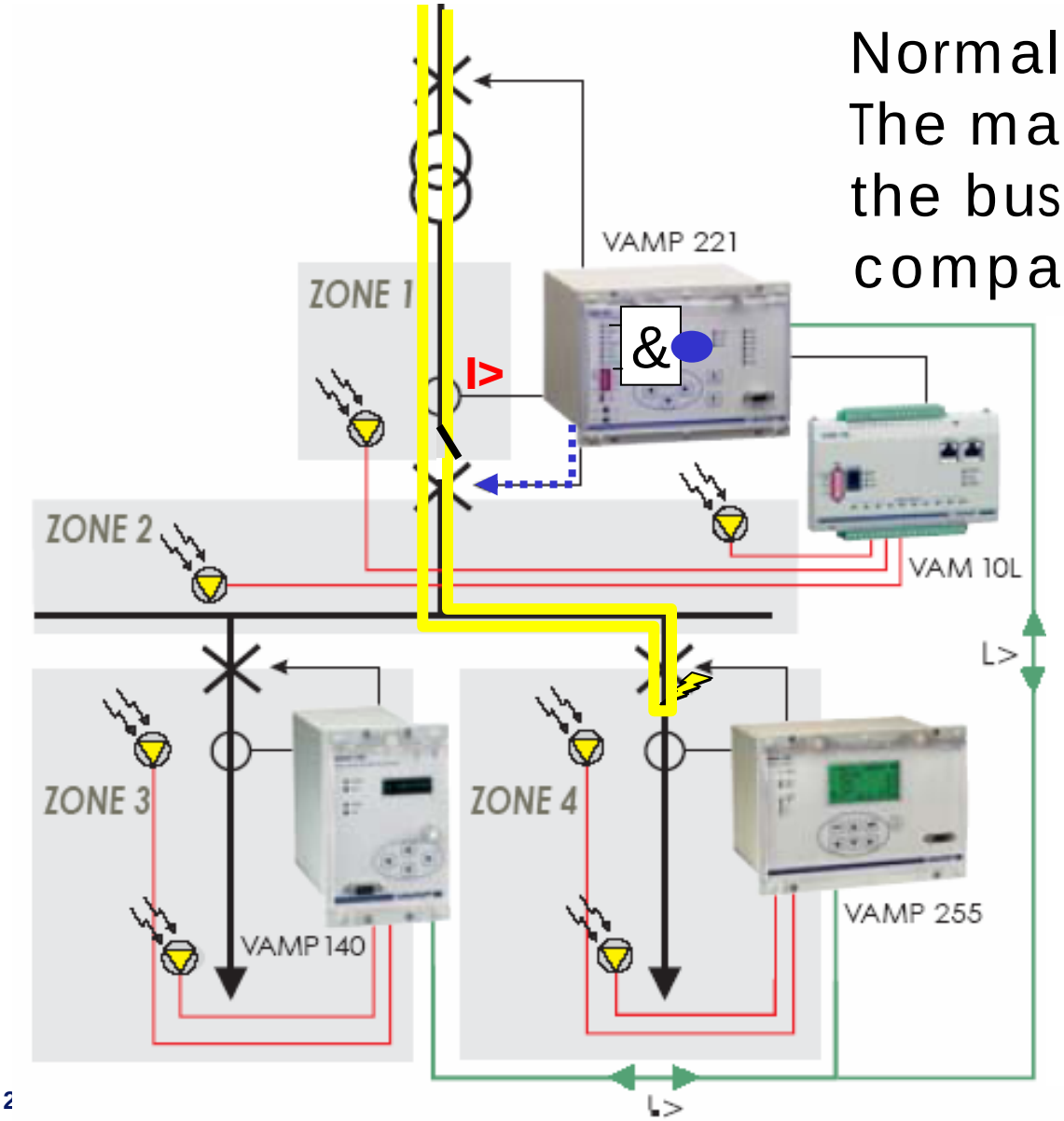
VAMP 40 – Example 1



Normal situation:
The Main transformer feeds the busbar. A fault in the cable compartment.

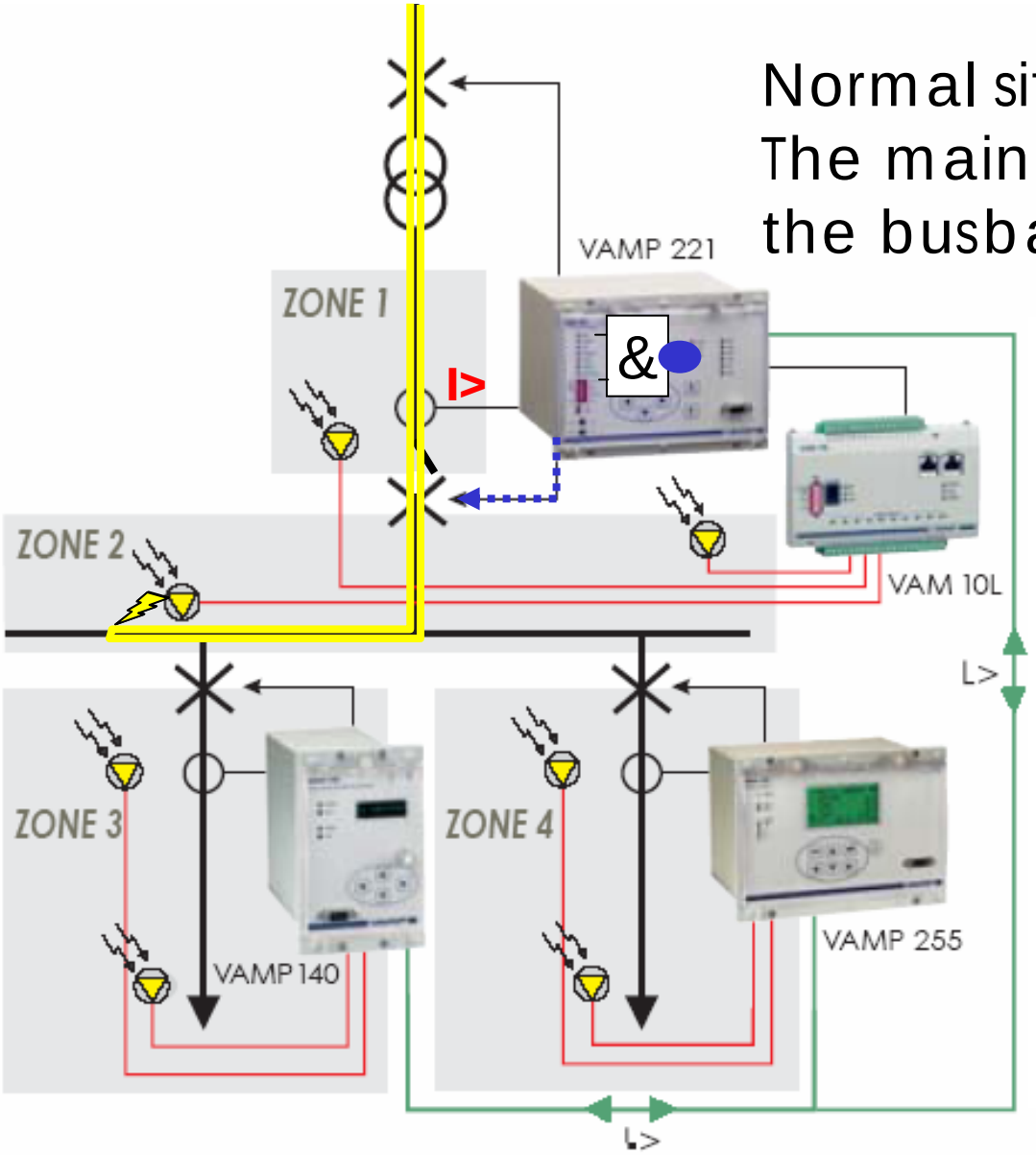
Only the faulted outgoing feeder tripped. Busbar and other feeders still in service.

VAMP 40 – Example 2



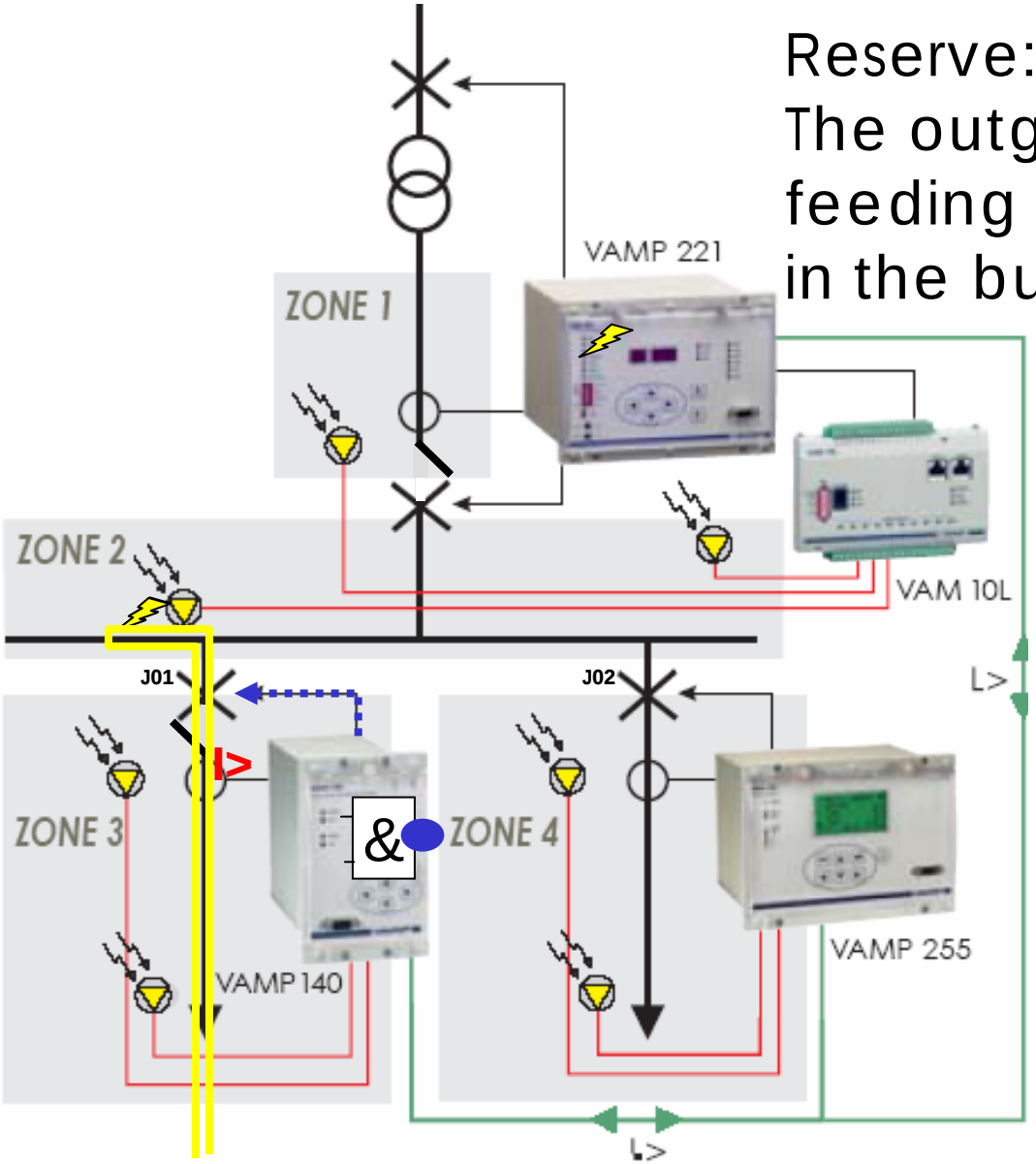
Normal situation:
The main transformer feeds the busbar. A fault in the CB compartment.

VAMP 40 – Example 3



Normal situation:
The main transformer feeds the busbar. A fault in the busbar.

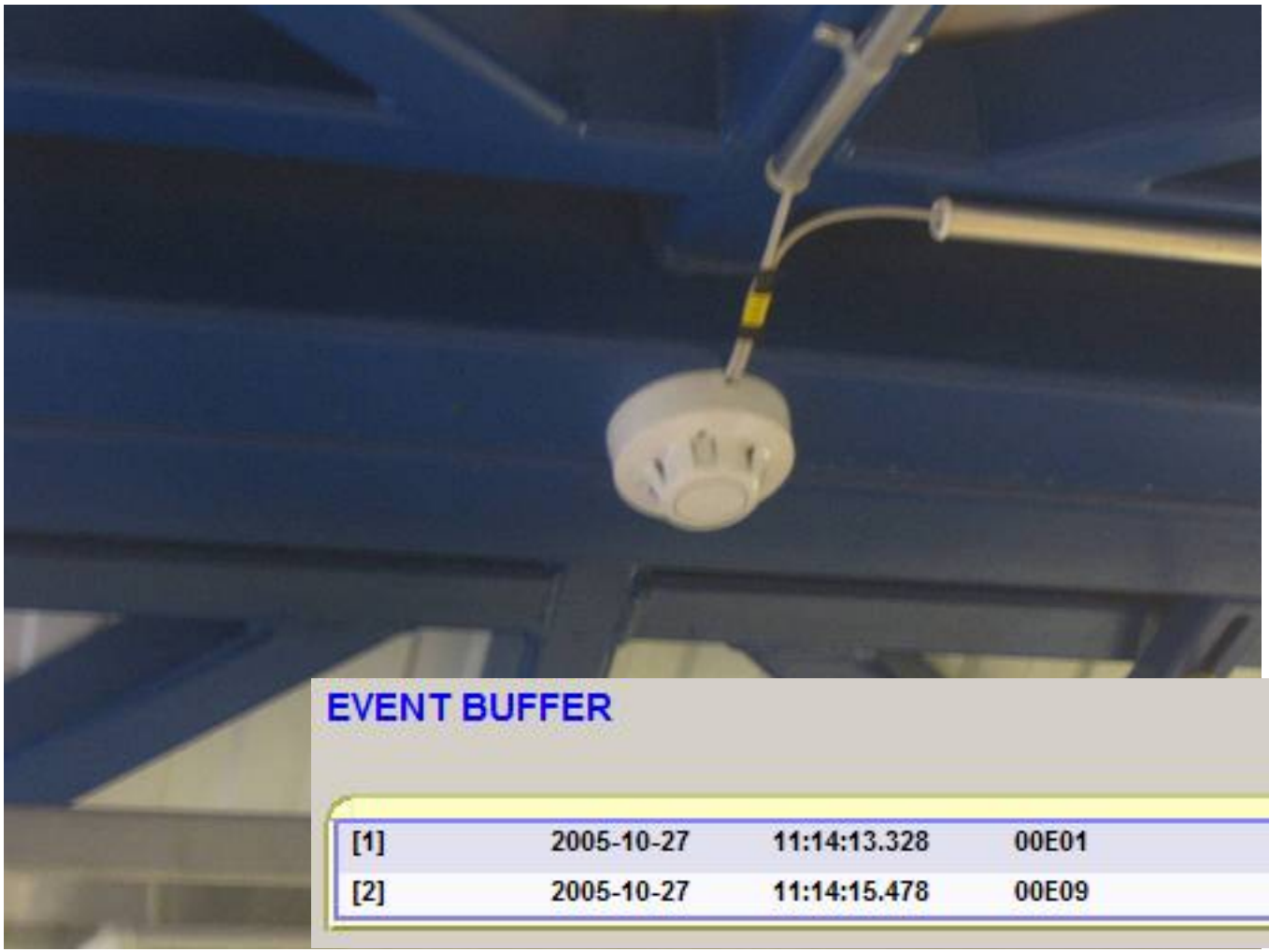
VAMP 40 – Example 4



Reserve:
The outgoing feeder J01 is feeding the busbar. The fault in the busbar section.

The fault cannot be measured.
Therefore, the light information is sent to all the relays in the outgoing feeders.

VAMP 40 – Smoke sensors



EVENT BUFFER

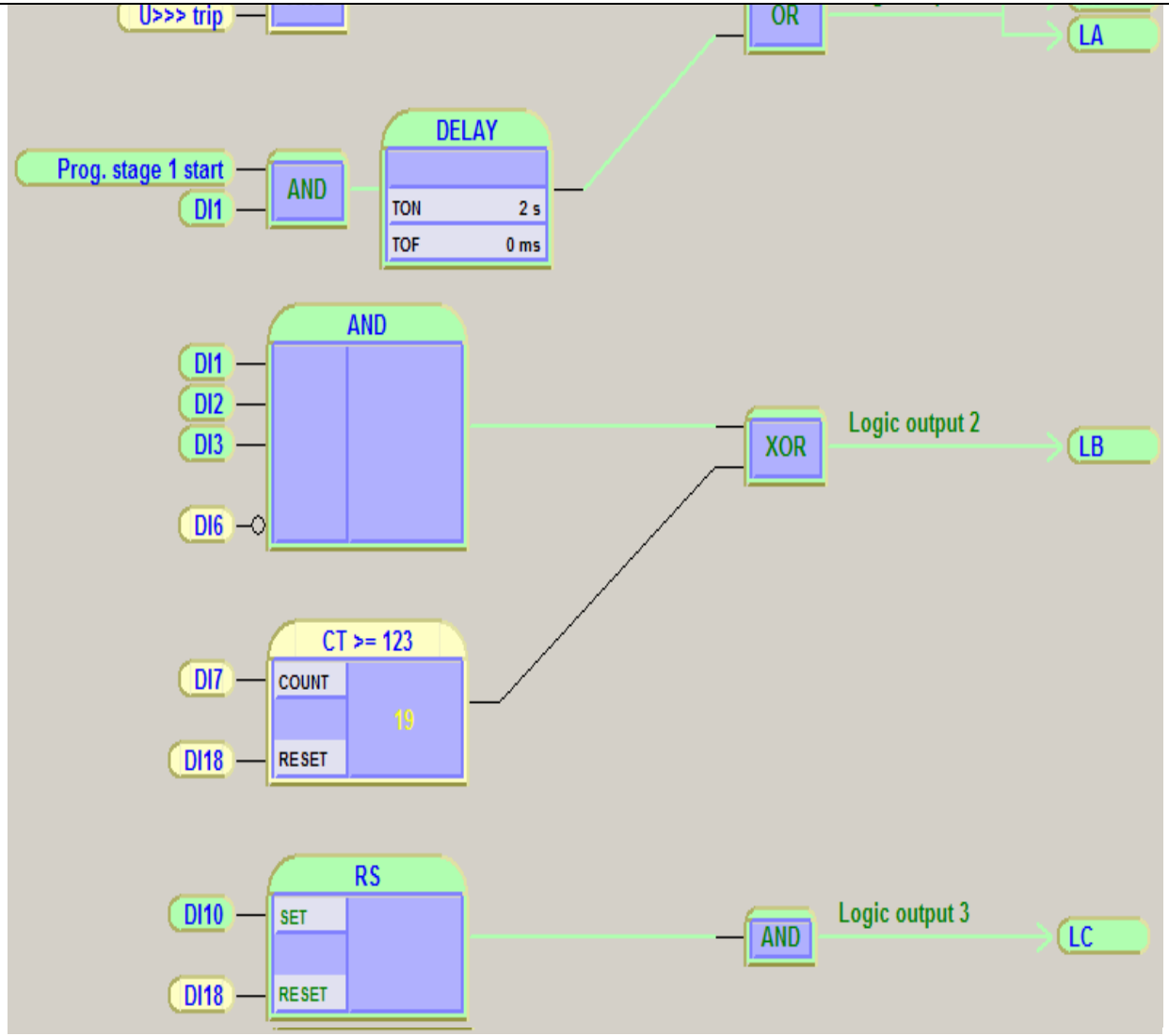
[1]	2005-10-27	11:14:13.328	00E01	DI1 on
[2]	2005-10-27	11:14:15.478	00E09	Smoke alarm ON

Smoke sensors can be connected to the same channel as arc sensors.

VAMP 40 – measurements

- Very accurate measurements:
  - Technology based on meter
  - Every relay is calibrated
  - Even every harmonic component is calibrated.
- inaccuracies:
  - currents 0.3 %
  - voltages 0.3%
  - power 1.0 %
- The most inaccuracy becomes from CT's (protection winding)

VAMP 40 – programmable logic



- Graphical logic
- AND, OR, NOT, XOR, TIMERS, Memory
- Configuration, download and upload to/from relay using VAMPSET
- On-line updating, useful, for example, debugging

VAMP 40 – Communication

VAMP 40 –SPA-bus

Category M

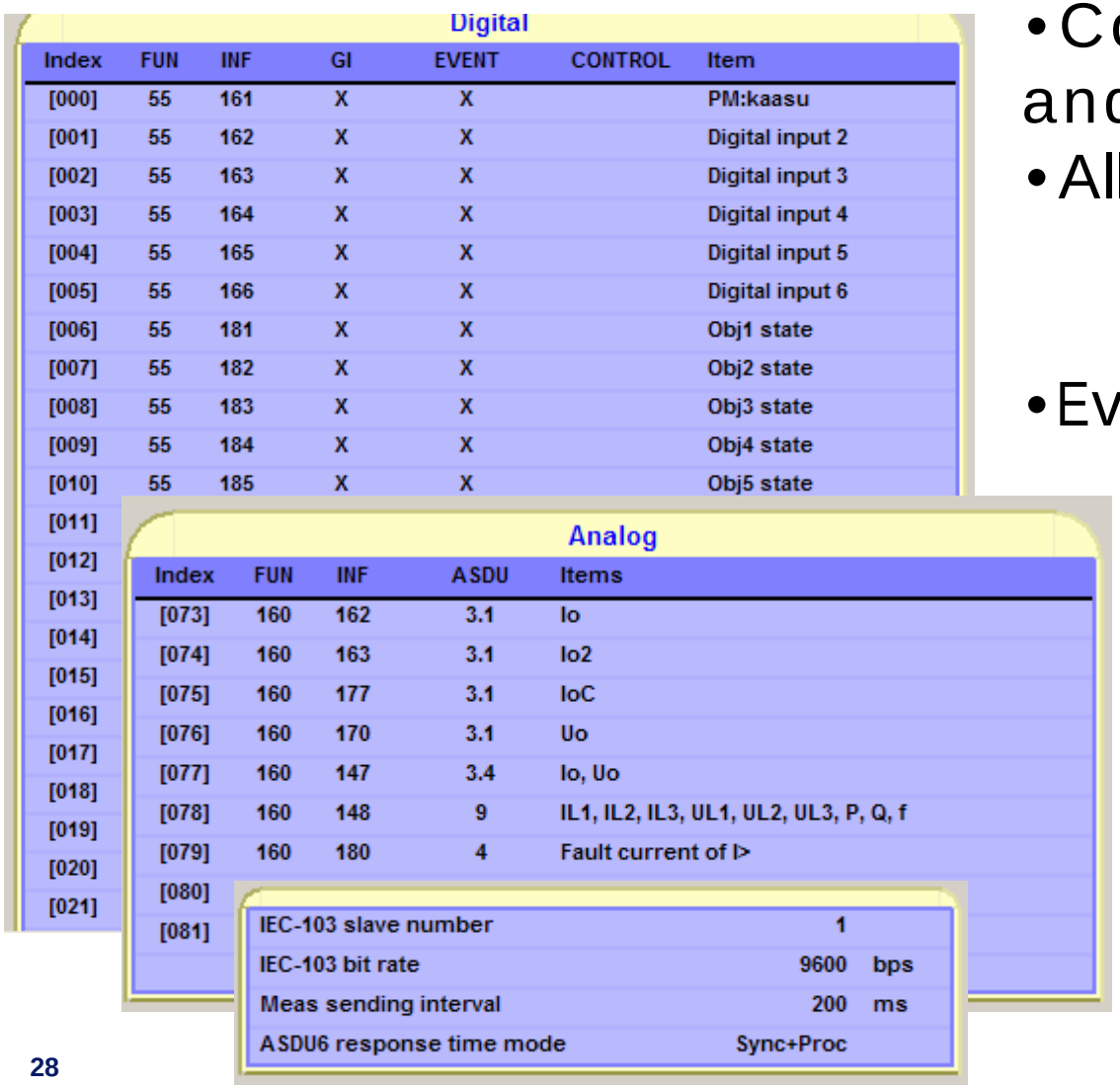
	Channel	Data number	Stage	Item
[1]	0	1	-	Virtual COM port
[2]	0	2	-	Virtual COM port
[3]	0	10	-	Fault reactance
[4]	0	11	-	Fault type
[5]	0	12	-	Current before fault
[6]	0	13	-	Fault current
[7]	0	14	-	Current after fault
[8]	0	15	-	Voltage drop
[9]	0	16	-	Fault duration
[10]	0	17	-	Number of faults
[11]	0	18	-	Distance to fault
[12]	1	10/17	I>	Time stamp
[13]	1	20/27	I>	Fault current
[14]	1	30/37	I>	Elapsed delay
[15]	1	40/47	I>	Fault type
[16]	1	50/57	I>	Pre-fault current
[17]	1	80/87	I>	Fault type
[18]	1	90/97	I>	Active group
[19]	2	10/17	I>>	Time stamp
[20]	2	20/27	I>>	Fault current
[21]	2	30/37	I>>	Elapsed delay
[22]	2	40/47	I>>	Fault type
[23]	2	50/57	I>>	Pre-fault current

- All parameters listed
  - Always up-to-date
  - Easy to find
- Known protocol
- Also settings and DR

SPABUS CONFIGURATION

SPABUS address	1	
SPABUS bit rate	9600	bps
Event mode	Channel	

VAMP 40 – IEC-60870-5-103



Digital

Index	FUN	INF	GI	EVENT	CONTROL	Item
[000]	55	161	X	X		PM:kaasu
[001]	55	162	X	X		Digital input 2
[002]	55	163	X	X		Digital input 3
[003]	55	164	X	X		Digital input 4
[004]	55	165	X	X		Digital input 5
[005]	55	166	X	X		Digital input 6
[006]	55	181	X	X		Obj1 state
[007]	55	182	X	X		Obj2 state
[008]	55	183	X	X		Obj3 state
[009]	55	184	X	X		Obj4 state
[010]	55	185	X	X		Obj5 state
[011]						
[012]						
[013]						
[014]						
[015]						
[016]						
[017]						
[018]						
[019]						
[020]						
[021]						

Analog

Index	FUN	INF	ASDU	Items
[073]	160	162	3.1	Io
[074]	160	163	3.1	Io2
[075]	160	177	3.1	IoC
[076]	160	170	3.1	Uo
[077]	160	147	3.4	Io, Uo
[078]	160	148	9	IL1, IL2, IL3, UL1, UL2, UL3, P, Q, f
[079]	160	180	4	Fault current of I>
[080]				
[081]				

IEC-103 slave number	1	
IEC-103 bit rate	9600	bps
Meas sending interval	200	ms
ASDU6 response time mode	Sync+Proc	

- Configurable function and information numbers
- All parameters listed
  - Always up-to-date
  - Easy to find
- Even settings and DR

VAMP 40 – ModBus

MODBUS SLAVE: 402001->

Read-only items 402001->

	Name	Access	Scaling	Setting for scaling	Address
[1]	Alive indicator	R -	1 = 1	-	402001
[2]	Digital inputs	R -	1 = 1	-	402007
[3]	DIs after DI16 for ModBus	R -	1 = 1	-	402008
[4]	Phase current IL1	R -	1 A = 1	-	402009
[5]	Phase current IL2	R -	1 A = 1	-	402010
[6]	Phase current IL3	R -	1 A = 1	-	402011
[7]	Io residual current	R -	1.00 A = 100	-	402012
[8]	Io2 residual current	R -	1.000 A = 1000	-	402013
[9]	Line voltage U12	R -	1000 V = 1000	Voltage scaling	402014
[10]	Line voltage U23	R -	1000 V = 1000	Voltage scaling	402015
[11]	Line voltage U31	R -	1000 V = 1000	Voltage scaling	402016
[12]	Phase voltage UL1	R -	1000 V = 1000	Voltage scaling	402017
[13]	Phase voltage UL2	R -	1000 V = 1000	Voltage scaling	402018
[14]	Phase voltage UL3	R -	1000 V = 1000	Voltage scaling	402019
[15]	Residual voltage	R -	1.0 % = 10	-	402020
[16]	Frequency	R -	50.000 Hz = -15536	Frequency scaling	402021
[17]	Active power	R -	1000 kW = 1000	Power scaling	402022
[18]	Reactive power	R -	1000 kvar = 1000	Power scaling	402023
[19]	Apparent power	R -	1000 kVA = 1000	Power scaling	402024

- All parameters listed
  - Always up-to-date
  - Easy to find
- Even time stamping

VAMP 40 – Profibus

PROFIBUS: REQUEST MODE 1/4

PROFIBUS: REQUEST MODE 1/4

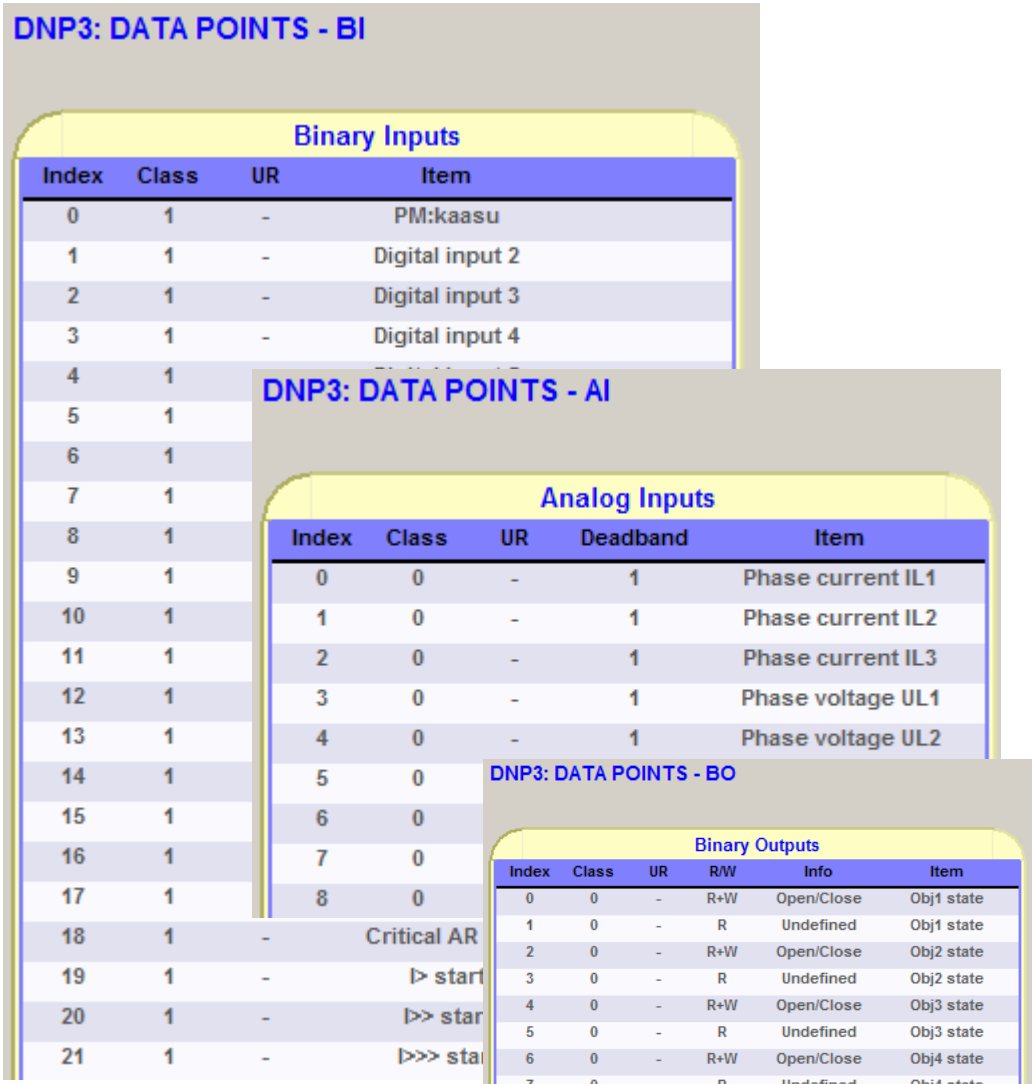
	Name	Length	Access	Cont.mode	Scaling	Setting for scaling	Data number
[1]	Phase current IL1	2	R -	X	1 A = 1	-	000
[2]	Phase current IL2	2	R -	X	1 A = 1	-	001
[3]	Phase current IL3	2	R -	X	1 A = 1	-	002
[4]	Frequency	2	R -	X	50.000 Hz = -15536	Frequency scaling	003
[5]	Digital inputs	3	R -	X	1 = 1	-	004
[6]	Output relays	2	R -	X	1 = 1	-	005
[7]	Io residual current	2	R -	X	1.000 pu = 1000	-	006
[8]	Io2 residual current	2	R -	X	1.000 pu = 1000	-	007
[9]	Residual voltage	2	R -	X	1.0 % = 10	-	008
[10]	Alive indicator	1	R -	X	1 = 1	-	009
[11]	Active power	2	R -	X	1000 kW = 1000	Power scaling	010
[12]	Reactive power	2	R -	X	1000 kvar = 1000	Power scaling	011
[13]	Apparent power	2	R -	X	1000 kVA = 1000	Power scaling	012
[14]	Events	4	R -		1 = 1	-	013
[15]	Line voltage U12	2	R -	X	1000 V = 1000	Voltage scaling	014
[16]	Line voltage U23	2	R -	X	1000 V = 1000	Voltage scaling	015
[17]	Line voltage U31	2	R -	X	1000 V = 1000	Voltage scaling	016
[18]	Exported energy	4	R W	X	1.000 MWh = 1000	-	017
[19]	Imported energy	4	R W	X	1.000 MWh = 1000	-	018
[20]	Exp. reactive energy	4	R W	X	1.000 Mvarh = 1000	-	019
[21]	Imp. reactive energy	4	R W	X	1.000 Mvarh = 1000	-	020
[22]	Power factor	1	R -	X	1.00 = 100	PF and cos scaling	021

PROFIBUS MAIN CONFIGURATION

ProfiBus profile	Reqst	
Bit rate to converter	2400	bps
Profibus Tx buffer	8	bytes
Profibus Rx buffer	8	bytes
Profibus address	1	
Profibus converter type	-	
Event mode	Channel	

- All parameters listed
  - Always up-to-date
  - Easy to find
- Object control in both Request and Continuous mode

VAMP 40 – DNP 3.0



DNP3: DATA POINTS - BI

Binary Inputs

Index	Class	UR	Item
0	1	-	PM:kaasu
1	1	-	Digital input 2
2	1	-	Digital input 3
3	1	-	Digital input 4
4	1		
5	1		
6	1		
7	1		
8	1		
9	1		
10	1		
11	1		
12	1		
13	1		
14	1		
15	1		
16	1		
17	1		
18	1	-	Critical AR
19	1	-	I> start
20	1	-	I>> star
21	1	-	I>>> sta

DNP3: DATA POINTS - AI

Analog Inputs

Index	Class	UR	Deadband	Item
0	0	-	1	Phase current IL1
1	0	-	1	Phase current IL2
2	0	-	1	Phase current IL3
3	0	-	1	Phase voltage UL1
4	0	-	1	Phase voltage UL2
5	0			
6	0			
7	0			
8	0			

DNP3: DATA POINTS - BO

Binary Outputs

Index	Class	UR	R/W	Info	Item
0	0	-	R+W	Open/Close	Obj1 state
1	0	-	R	Undefined	Obj1 state
2	0	-	R+W	Open/Close	Obj2 state
3	0	-	R	Undefined	Obj2 state
4	0	-	R+W	Open/Close	Obj3 state
5	0	-	R	Undefined	Obj3 state
6	0	-	R+W	Open/Close	Obj4 state
7	0	-	R	Undefined	Obj4 state
8	0	-	R+W	Open/Close	Obj5 state
9	0	-	R	Undefined	Obj5 state
10	0	-	R+W	Open/Close	Obj6 state
11	0	-	R	Undefined	Obj6 state

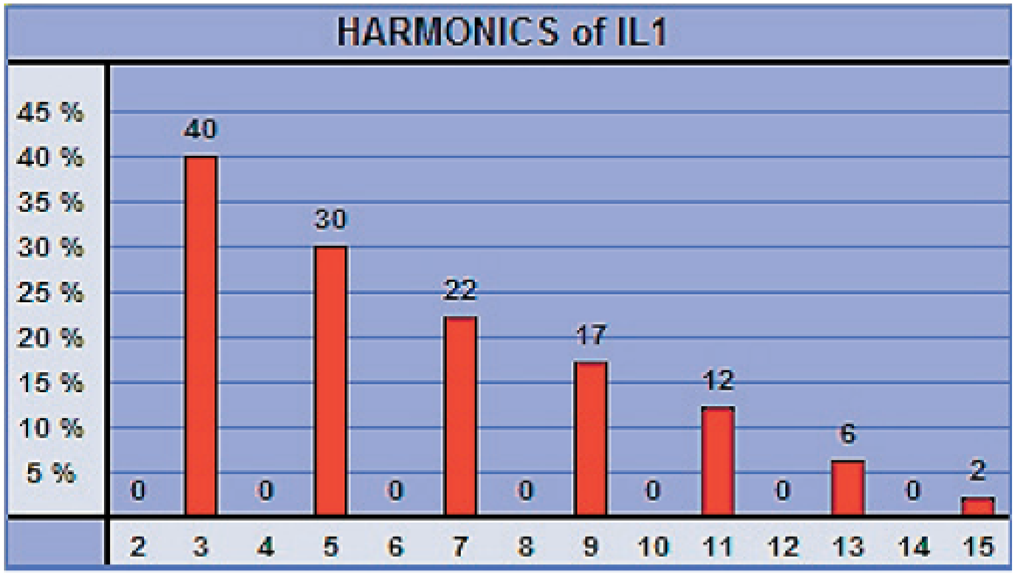
DNP3 CONFIGURATION

Bit rate	9600	bps
Parity	None	
Slave unit	1	
Master unit	255	
Linklayer Confirmation Timeout	0	ms
Linklayer Retry Count	1	
Appl.layer Confirmation Timeout	5000	ms
Appl.layer Confirmation Mode	EvOnly	
Double-Bit Input Support	☐	
ClockSync Mode	0	s

Default Variation BI	1
Default Variation BI event	2
Default Variation BO	2
Default Variation DBI	1
Default Variation DBI event	1
Default Variation Counter	2
Default Variation AI	2

- All parameters listed
  - Always up-to-date
  - Easy to find
  - DNP TCP

VAMP 40 – power quality



Harmonics

- Currents
- THD (Total Harmonic distortion)
- 2. – 15.

Voltage quality

- interrupts
- Sags and swells

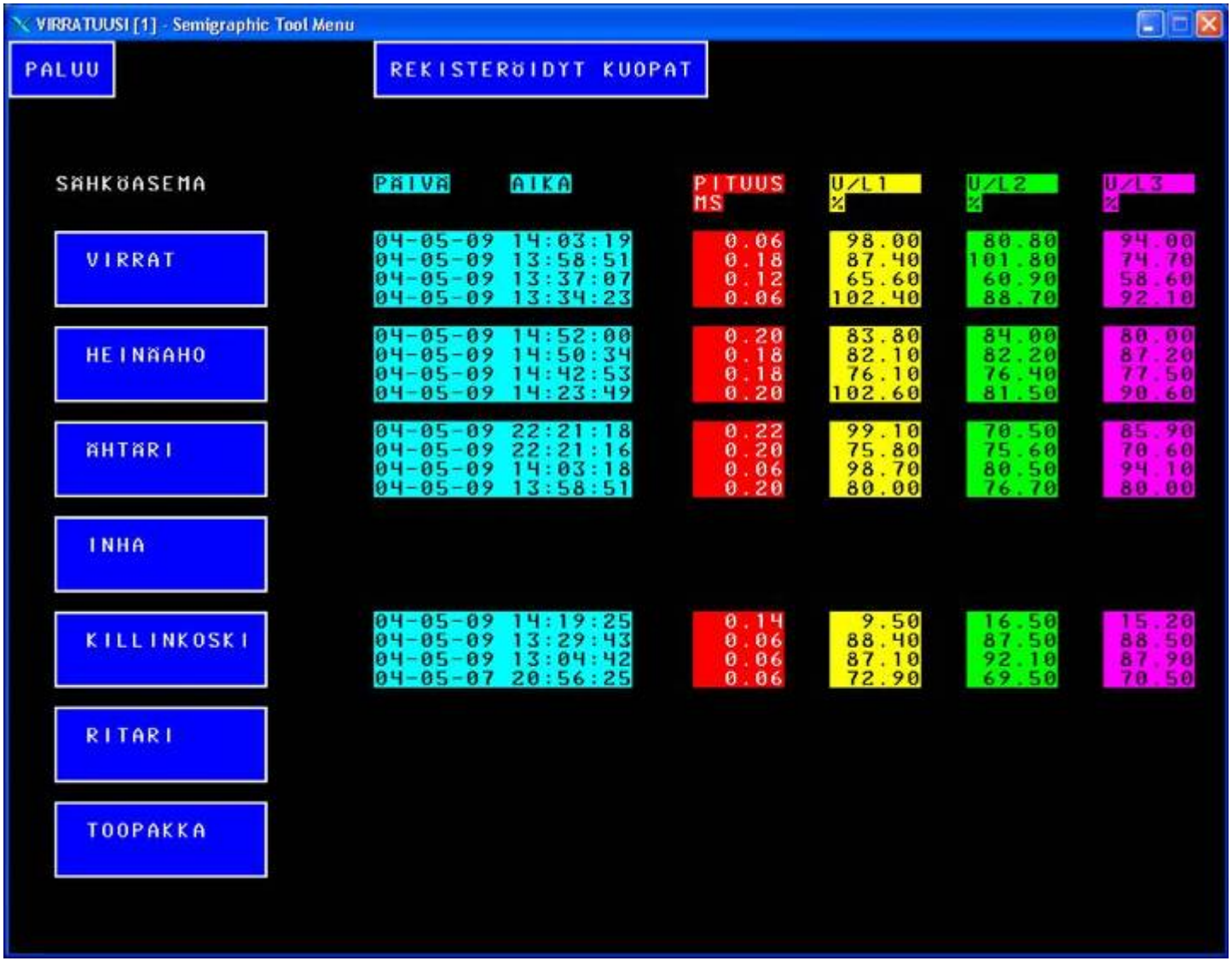
– duration and time stamps

- Max, min, average values

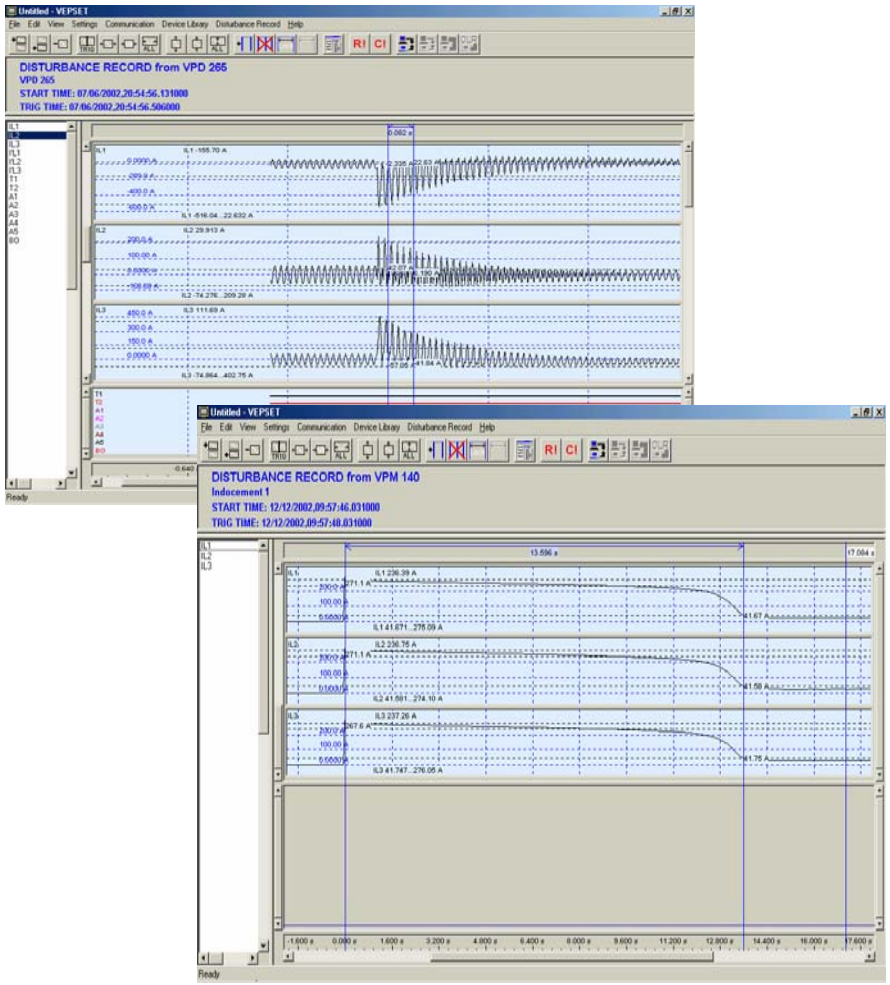
SAG LOG

Date	hh:mm:ss.ms	Type	Duration	Min1	Min2	Min3	Mean1	Mean2	Mean3	Max1	Max2	Max3
-	-	-	0.00 s	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un
-	-	-	0.00 s	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un
-	-	-	0.00 s	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un
-	-	-	0.00 s	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un	0.0 %Un

VAMP 40 – voltage sags in SCADA

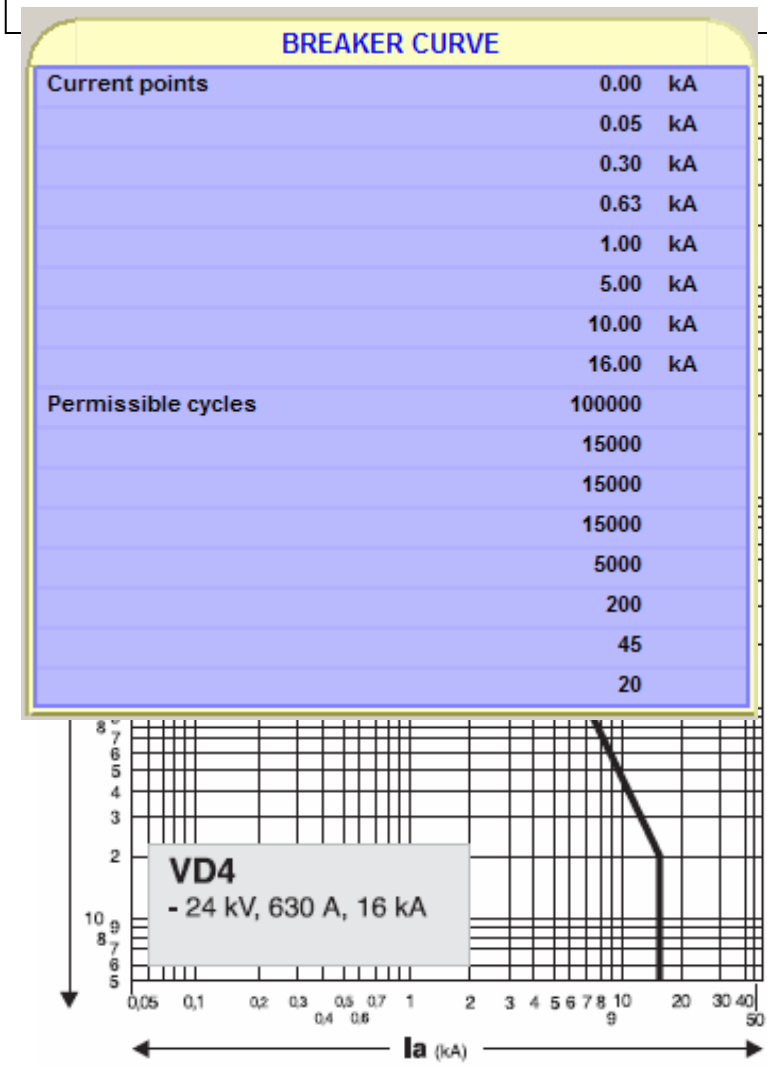


VAMP 40 – disturbance recording



- ~~12 channels~~
- Waveform or trend
- Easy to configure
- supports COMTRADE format
- freeware VAMPSET includes an analysing program

VAMP 40 – condition monitoring



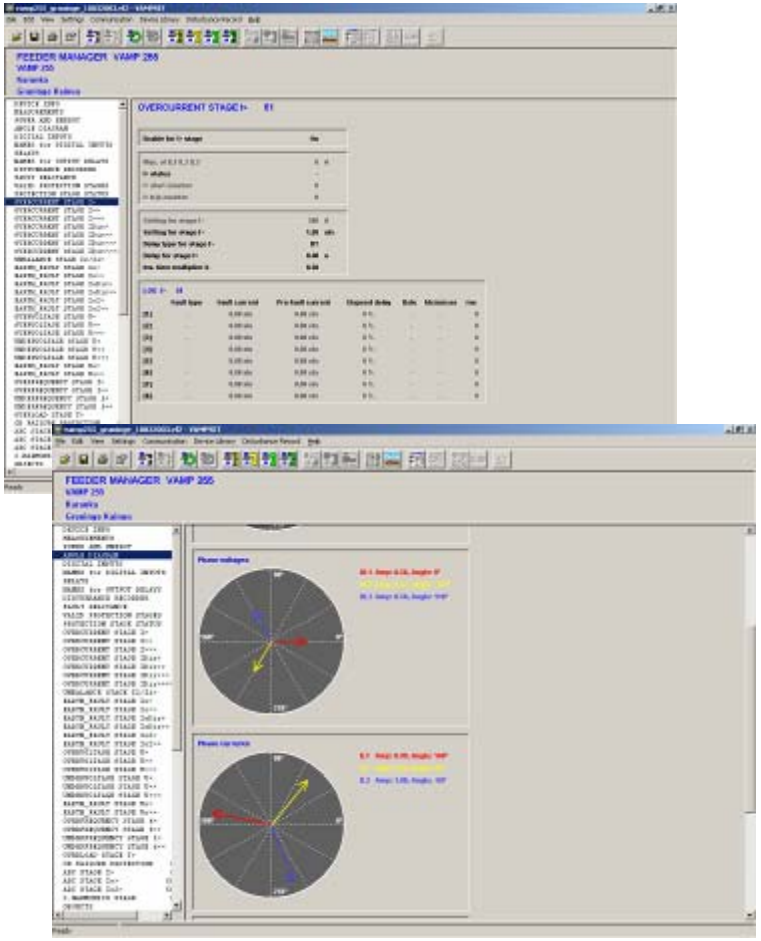
External wiring

- CT supervision
- VT supervision
- Trip circuit supervision

Circuit-breaker

- wearing, breaking currents
- Logic counters (e.g. openings)
- CB failure protection (CBFP)

VAMP 40 - with VAMPSET



- Integrated, all information from relays
- Freeware, the file size about 1MB, download from www.vamp.fi
- Front communication port
- Graphical views, on-line updated
- Disturbance recording uploading and analysing
- Windows XP/2000/NT/Windows98/95
- Standard RS-232 cable
- No setup nor install program => just copy/paste
- Automatically supports new products

VAMP 40 – user-friendly

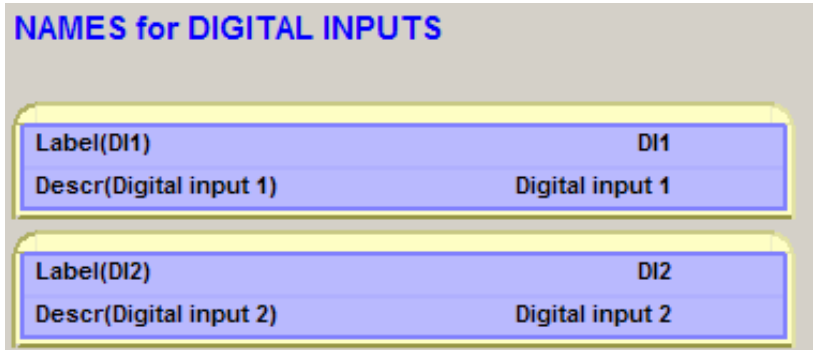
Features

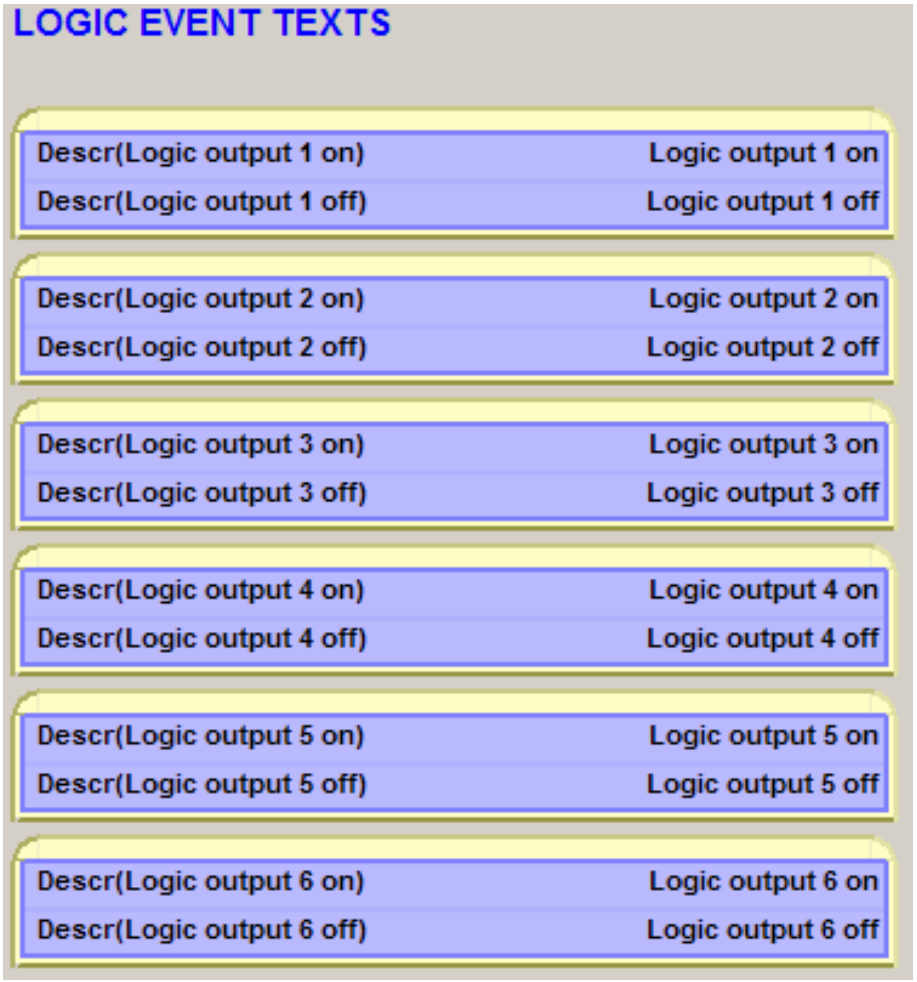
- Menu items clear text, not abbr.
- No codes nor checksums
- Both the relay and the software can be translated to local language
- Some parameters can be renamed
- Only one software: VAMPSET

Experience

- No need for extensive training
- Users regard using easy and simple
- Support questions mainly about applications

VAMP 40 – rename parameters!





VAMP 40 – native language support

```
**
**   FILE MENU
**
*/
TAG_MENU(File)   "Tiedosto"

(Open)           "Avaa..."
(Save)           "Tallenna"
(Save )          "Tallenna Nimellä..."
(Close)          "Sulje tiedosto"

(Print Active)       "Tulosta näyttö paperille"
(Pre&view)           "Näytön esikatselu"
(Print All)          "Tulosta kaikki näytöt paperille"
(Print Selected)     "Tulosta valitut näytöt paperille"
(P&rint Set)         "Tulostimen asetukset"

(Open Dist)          "Avaa häiriötallenne"
(Save Dist)          "Tallenna häiriötallenne"
(Generate SerCom)    "Luo Vamp-scripti valituista näytöistä"


/***********
**
**   EDIT MEN
**
*/
TAG_MENU(Edi
```

VAMP 40 – brochure

VAMP Feeder/Motor Protection Relay VAMP 40

Vaasa Electronics Group VAMP

Technical Data, Tests and Environmental Conditions

Measuring circuitry

Rated current In	1...10 A (software parameter)
- Current measuring range	0...250 A (0...50 x In [In=5 A]; 0...250 x In [In=1 A])
- Thermal withstand	20 A (continuously) 100 A (for 10 s) 500 A (for 1 s)
- Burden	< 0.2 VA
Rated current Ion	5/1 A
- Current measuring range	0...10 A (0...10 x Ion)
Rated current Iocbn	1/0.2 A
- Current measuring range	0...50 A (0...10 x Iocbn)
Rated voltage Uon / Un	50 - 120 V (configurable)
- Voltage measuring range	0 - 175 V (100 V/110 V)
- Continuous voltage withstand	250 V
- Burden	< 0.5 V A
Rated frequency fn	50 / 60 Hz (45 - 65 Hz)
- Frequency measuring range	16 - 75 Hz
Terminal block:	Maximum wire dimension:
- Solid or stranded wire	4 mm² (10-12 AWG)

Auxiliary voltage

Rated voltage Uaux	18 - 265 V ac/dc 110/120/220/240 V ac 24/36/48/60/110/125/220 V dc
Power consumption	< 7 W (normal conditions) < 15 W (output relays activated)
Max. permitted interruption time	< 50 ms (110 V dc)
Terminal block:	Maximum wire dimension:
- Phoenix MVSTBW or equivalent	2.5 mm² (10-14 AWG)

Digital inputs

Qty	3 pcs
Rated voltage	18 - 265 Vdc

Digital outputs

Trip relays	4 pcs
Alarm relays	1 pc
Internal fault relay	1 pc

Casing

Dimensions (W x H x D)	260 x 226 x 65
Weight (Terminal, Package and Manual)	5 kg

Disturbance tests

Emission	
- Conducted EN 55022B	0.15 - 30 MHz
- Emitted (CISPR 11)	30 - 1 000 MHz
Immunity	
- Static discharge (ESD)	IEC 60255-22-3, class III 6 kV contact discharge 8 kV air discharge
- Fast transients (EFT)	IEC 60255-22-4, class B 2 kV, 5/50 ns, 5 kHz, +/-
- Surge	IEC 60255-22-5 2 kV, 1.2/50 µs, line-to-earth 1 kV, 1.2/50 µs, line-to-line
- Conducted RF field	IEC 60255-22-6 0.15 - 80 MHz, 10 V/m
- Emitted RF field	IEC 60255-22-3 80 - 1000 MHz, 10 V/m
- GSM test	ENV 50204 900 MHz, 10 V/m, pulse modulated

Test voltages

Insulation test voltage	IEC 60255-5, class III 2 kV, 50 Hz, 1 min
Surge voltage	IEC 60255-5, class III 5 kV, 1.2/50 µs, 0.5 J

Mechanical tests

Vibration	IEC 60255-21-1, class I
Shock and bump	IEC 60255-21-2, class I

Environmental conditions

Operating temperature	-10 to +55 °C
Transport and storage temperature	-40 to +70 °C
Relative humidity	< 75% (1 year, average value) < 90% (30 days per year, no condensation permitted)

CE

Vaasa Electronics Group VAMP 7

VAMP 40 – ordering

Order Code	Explanation	Note
VAMP 40	Feeder / motor protection relay	VAMP Ltd

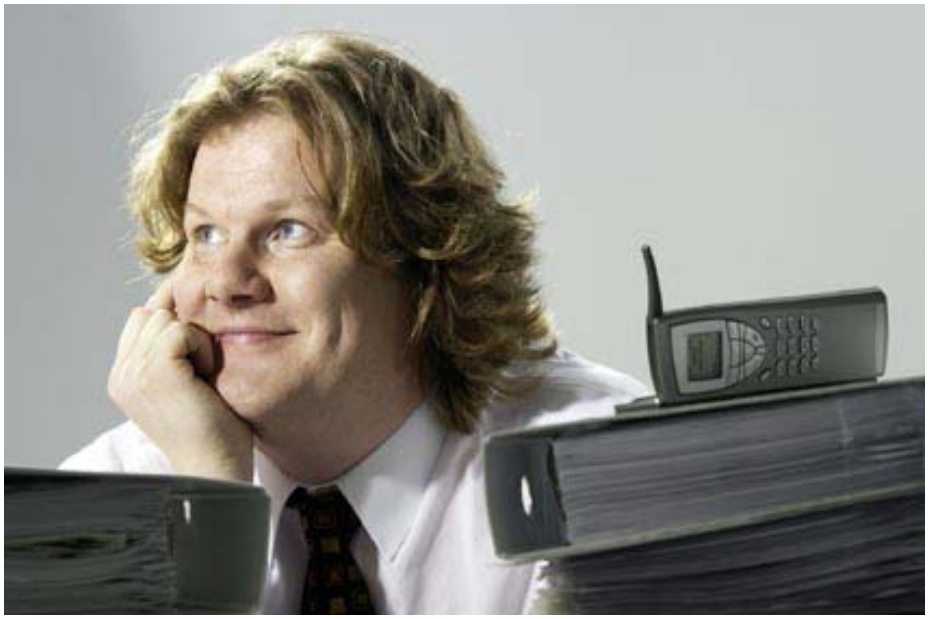
Accessories

VEA 3 CG	Ethernet Interface Module	VAMP Ltd
VPA 3 CG	Profibus Interface Module	VAMP Ltd
VSE001	Fiber optic Interface Module	VAMP Ltd
VSE002	RS485 Interface Module	VAMP Ltd
VX003-3	Programming Cable (VAMPSet, VEA 3 CG+200-series)	Cable length 3m
	Arc Interface (1	Vamp Ltd
VA1DA-6	Arc Sensor, cable lenght 6 m	VAMP Ltd
DI-934MB	RTD Input module (2	DataQ Instruments Inc.
Adam 4015-B	RTD Input module (2	Advantech Co., Ltd

VAMP 40 – support 24 h

VAMP offers all its customers, 24h technical support
free of charge!

- By e-mailing: vampsupport@vamp.fi
(link included inVAMPSET)
- By calling: +358 20 7533 264



Thank you

Re-VAMP your protection

www.vamp.fi