

Ethernet / IP Protocol

1 Overview

Ethernet/IP protocol is available on VAMP relay with an optional embedded Ethernet card. The protocol can be used to read / write data from the relay using request / response communication and via cyclic IO messages transporting data assigned to assemblies (sets of data). VAMP relay with the EtherNet/IP protocol selected on the Ethernet port serves as an adapter which means that it is not able to initiate communication with other devices in the network.

2 Main configuration

Main configuration parameters of the EtherNet/IP interface are as follows:

Parameter	Range	Description
IP address		IP protocol address identifying the device in the network
Multicast IP		Multicast IP address used for sending IO messages
Multicast TTL	1-100	Time to live of the IO messages sent to multicast address
Vendor ID	1-65535	Identification of a vendor by number
Device Type	0-65535	Indication of general type of product
Product Code	1-65535	Identification of a particular product of an individual vendor
Major Revision	1-127	Major revision of the item the Identity Object represents
Minor Revision	1-255	Minor revision of the item the Identity Object represents
Serial Number	0-4294967295	Serial number of a device
Product Name	32 chars	Human readable identification

2.1 IP address

Each device in each subnetwork must have a unique IP address. Valid Class A, B or C IP address needs to be assigned to the device to allow it to serve as a TCP/IP node. Assigned IP address will be used by the EtherNet/IP scanner to find the device in the network and start a communication with it.

2.2 Multicast IP

Multicast IP address is a parameter used by the device to send EtherNet/IP multicast packets, if requested to do so by the scanner. Multicast IP should be a valid Class D IP address. In VAMP relay there is only one possible I/O connection at a time and therefore only single Multicast IP is used. Multicast IP parameter is ignored when scanner requested T->O (target-to-originator, i.e. adapter to scanner) communication to be point-to-point. The default value of this parameter is 239.0.0.1.

2.3 Multicast TTL

Multicast TTL value should be used for the IP header Time-to-live field when sending EtherNet/IP multicast packets. This value is ignored for the unicast packets and TTL as configured for the TCP/IP stack is used instead. The default value of this parameter is 1 (the number of network hops over which the multicast packet is propagated – datagrams limited to the local subnet).

3 Required objects

EtherNet/IP implementation on VAMP relay supports all required standard objects with their required attributes. The required objects are:

- Identity Object (Class Code 0x01)
- Message Router Object
- Connection Manager Object
- TCP/IP Interface Object (Class Code 0xF5)
- Ethernet Link Object (Class Code 0xF6)
- Assembly Object (Class Code 0x04)

4 Data model

VAMP process data are mapped into 2 standard objects (Control Supervisor Object and Overload Object) and 2 private objects (VAMP Digital Object and Vamp Analog Object). All attributes of these objects are available to be included in assemblies. Object definitions are as follows:

Overload Object, Class Code 0x2C:

Attribute ID	Access Rule	Name	Data Type	Description of Attribute
5	GET	AvgCurrent	INT	Average of the three phase current
6	GET	%PhImbal	USINT	% Phase Imbalance
7	GET	%Thermal	USINT	% Thermal Capacity
8	GET	CurrentL1	INT	Actual motor phase current L1
9	GET	CurrentL2	INT	Actual motor phase current L2
10	GET	CurrentL3	INT	Actual motor phase current L3
11	GET	GroundCurrent	INT	Ground Current

Control Supervisor Object, Class Code 0x29:

Attribute ID	Access Rule	Name	Data Type	Description of Attribute
10	GET	Faulted	BOOL	1 = Fault Occurred (latched); 0 = No Faults present
12	SET	FaultRst	BOOL	0->1 = Fault Reset 0 = No action To make possible standard assembly content (FaultReset bit is 3rd), this item shall be written as 0x04 instead of 0x01
13	GET	FaultCode	UINT	If in Faulted state, FaultCode indicates the fault that caused the transition to Faulted state. If not in Faulted state, FaultCode indicates the fault that caused the last transition to the Faulted state. Power up state of fault code is 0.
22	GET SET	CycleCount	UDINT	Number of operations (motor starts) on the equipment. Note: Vamp variable used for this attribute is UINT (unsigned 16 bit integer)
23	GET	Fault/Warning Code Style	USINT	Identifies the error and warning codes produced by this instance of Control Supervisor. Default = 0

VAMP Digital Object, Class Code 0x64 (private object):

Attribute ID	Access	Name	Data Type	Scaling
1	GET	DI	UDINT	1 = 1
2	GET	Output relays	UINT	1 = 1
3	GET	Alive indicator	BOOL	1 = 1
4	GET	Events	STRUCT OF: UDINT – secSinceGenesis UINT – milliseconds UINT – event code	1 = 1
5	GET	Obj1 state	USINT	Open=0,Close=1, Undef=2
6	GET	Obj2 state	USINT	Open=0,Close=1, Undef=2
7	GET	Obj3 state	USINT	Open=0,Close=1, Undef=2
8	GET	Obj4 state	USINT	Open=0,Close=1, Undef=2
9	GET	Obj5 state	USINT	Open=0,Close=1, Undef=2
10	GET	Obj6 state	USINT	Open=0,Close=1, Undef=2
11	GET SET	Remote/Local State	BOOL	REMOTE=0, LOCAL=1
12	GET SET	Open select Obj1	BOOL	1 = 1
13	GET SET	Close select Obj1	BOOL	1 = 1
14	SET	Execute operation Obj1	BOOL	1 = 1
15	SET	Cancel selected operation	BOOL	1 = 1
16	GET SET	Max ctrl pulse length of Obj1	USINT	1.00 s = 100
17	GET SET	Open select Obj2	BOOL	1 = 1
18	GET SET	Close select Obj2	BOOL	1 = 1
19	SET	Execute operation Obj2	BOOL	1 = 1
20	GET SET	Max ctrl pulse length of Obj2	USINT	1.00 s = 100
21	GET SET	OM_MB_ResetLatches	BOOL	1 = 1
22	GET SET	Synchronize minutes	BOOL	1 = 1
23	GET SET	Open select Obj3	BOOL	1 = 1
24	GET SET	Close select Obj3	BOOL	1 = 1
25	SET	Execute operation Obj3	BOOL	1 = 1
26	GET SET	Max ctrl pulse length of Obj3	USINT	1.00 s = 100
27	GET SET	Open select Obj4	BOOL	1 = 1
28	GET SET	Close select Obj4	BOOL	1 = 1
29	SET	Execute operation Obj4	BOOL	1 = 1
30	GET SET	Max ctrl pulse length of Obj4	USINT	1.00 s = 100
31	GET	Pos. sequence I1	INT	1 A = 1
32	GET	Neg. sequence I2	INT	1 A = 1
33	GET	Current -seq./+seq.	INT	1.0 % = 10
34	GET	Current phase seq.	USINT	??=0,OK=1, Reverse=2
35	GET	Pos. sequence U1	INT	1000 V = 1000
36	GET	Neg. sequence U2	INT	1000 V = 1000
37	GET	Voltage -seq./+seq.	INT	1.0 % = 10
38	GET	Voltage phase seq.	SINT	??=0,OK=1, Reverse=2
39	GET	DI1 counter	UINT	1 = 1

Attribute ID	Access	Name	Data Type	Scaling
40	GET	DI2 counter	UINT	1 = 1
41	GET	DI3 counter	UINT	1 = 1
42	GET	DI4 counter	UINT	1 = 1
43	GET	DI5 counter	UINT	1 = 1
44	GET	DI6 counter	UINT	1 = 1
45	GET	DI19 counter	UINT	1 = 1
46	GET	DI20 counter	UINT	1 = 1
47	GET	Shot1 start counter	UINT	1 = 1
48	GET	Shot2 start counter	UINT	1 = 1
49	GET	Shot3 start counter	UINT	1 = 1
50	GET	Shot4 start counter	UINT	1 = 1
51	GET	Shot5 start counter	UINT	1 = 1
52	GET	AR start counter	UINT	1 = 1
53	GET	AR fail counter	UINT	1 = 1
54	GET	Stage start state	BOOL	Start=1
55	GET	Stage trip state	BOOL	Trip=1
56	GET	AR shot number	USINT	1,2,3,4,5,END=6
57	GET	Critical AR req.	BOOL	1 = 1
58	GET	Reclose locked	BOOL	1 = 1
59	GET	Reclose running	BOOL	1 = 1
60	GET	Final trip	BOOL	1 = 1
61	GET	Autoreclose on	BOOL	1 = 1
62	GET	N> alarm	BOOL	1 = 1
63	GET	Motor start disabled	BOOL	1 = 1
64	GET	Motor starting	BOOL	1 = 1
65	GET	Motor running	BOOL	1 = 1
66	GET	Voltage interrupt	USINT	LOW=0,ok=1
67	GET	Timer 1 status	BOOL	0=1,1=2
68	GET	Timer 2 status	BOOL	0=1,1=2
69	GET	Timer 3 status	BOOL	0=1,1=2
70	GET	Timer 4 status	BOOL	0=1,1=2
71	GET	Voltage status	USINT	OK=0, LOW=1, HIGH=2, LOW/HIGH=3, (OK)=4, (LOW)=5, (HIGH)=6, (LOW)/HIGH=7
72	GET	Logic output states 1...10	BOOL	1 = 1
73	GET	Alarm 2	BOOL	1 = 1
74	GET	Alarm 2	BOOL	1 = 1
75	GET	Alarm L1..L3	BOOL	1 = 1
76	GET	Fault L1..L3	BOOL	1 = 1
77	GET	SetGrp common change	BOOL	1=0,2=1
78	GET SET	Open select Obj5	BOOL	1 = 1
79	GET SET	Close select Obj5	BOOL	1 = 1
80	SET	Execute operation Obj5	BOOL	1 = 1
81	GET SET	Max ctrl pulse length of Obj5	USINT	1.00 s = 100
82	GET SET	Open select Obj6	BOOL	1 = 1
83	GET SET	Close select Obj6	BOOL	1 = 1
84	SET	Execute operation Obj6	BOOL	1 = 1

Attribute ID	Access	Name	Data Type	Scaling
85	GET SET	Max ctrl pulse length of Obj6	USINT	1.00 s = 100
86	GET	Sync1 req.	BOOL	1 = 1
87	GET	Sync1 OK	BOOL	1 = 1
88	GET	Bypass	BOOL	1 = 1
89	GET	Sync1 fail	BOOL	1 = 1
90	GET	Phase angle difference	INT	1 ° = 1
91	GET	Sync2 req.	BOOL	1 = 1
92	GET	Sync2 OK	BOOL	1 = 1
93	GET	Bypass	BOOL	1 = 1
94	GET	Sync2 fail	BOOL	1 = 1
95	SET	DirectO1O	BOOL	1 = 1
96	SET	DirectO1C	BOOL	1 = 1
97	SET	DirectO2O	BOOL	1 = 1
98	SET	DirectO2C	BOOL	1 = 1
99	SET	DirectO3O	BOOL	1 = 1
100	SET	DirectO3C	BOOL	1 = 1
101	SET	DirectO4O	BOOL	1 = 1
102	SET	DirectO4C	BOOL	1 = 1
103	SET	DirectO5O	BOOL	1 = 1
104	SET	DirectO5C	BOOL	1 = 1
105	SET	DirectO6O	BOOL	1 = 1
106	SET	DirectO6C	BOOL	1 = 1
107	GET SET	Virtual input 1	BOOL	0,1
108	GET SET	Virtual input 2	BOOL	0,1
109	GET SET	Virtual input 3	BOOL	0,1
110	GET SET	Virtual input 4	BOOL	0,1
111	GET	Obj7 state	USINT	Open=0, Close=1, Undef=2
112	GET	Obj8 state	USINT	Open=0, Close=1, Undef=2
113	GET	Logic output states 9...16	USINT	1 = 1
114	GET	Logic output states 17...20	USINT	1 = 1
115	GET	Virtual outputs	USINT	1 = 1
116	GET	Diagnostic register 1	UINT	1 = 1
117	GET	Diagnostic register 2	UINT	1 = 1
118	GET	Diagnostic register 3	UINT	1 = 1
119	GET	Diagnostic register 4	UINT	1 = 1
120	GET	Engine running hours	UDINT	1 h = 1
121	GET	Engine running seconds	UINT	1 s = 1
122	GET	Start counter	UINT	1 = 1
123	GET SET	Reset diagnostics	BOOL	RESET=1
124	GET	Clear min & max	BOOL	Clear=1
125	GET	Pos. sequence I'1	INT	1 A = 1
126	GET	Neg. sequence I'2	INT	1 A = 1
127	GET	Current I' -seq./+seq.	INT	1.0 % = 10
128	GET	Current I' phase seq.	SINT	??=0, OK=1, Reverse=2

VAMP Analog Object, Class Code 0x65 (private object):

Attribute ID	Access	Name	Data Type	Scaling
1	GET	Phase current IL1	INT	1 A = 1
2	GET	Phase current IL2	INT	1 A = 1
3	GET	Phase current IL3	INT	1 A = 1
4	GET	Frequency	INT	50.000 Hz = 5000
5	GET	Io1 residual current	INT	1.000 pu = 1000
6	GET	Io2 residual current	INT	1.000 pu = 1000
7	GET	Zero sequence voltage	INT	1.0 % = 10
8	GET	Active power	INT	1000 kW = 1000
9	GET	Reactive power	INT	1000 kvar = 1000
10	GET	Apparent power	INT	1000 kVA = 1000
11	GET	Line-to-line voltage U12	UINT	1000 V = 1000
12	GET	Line-to-line voltage U23	UINT	1000 V = 1000
13	GET	Line-to-line voltage U31	UINT	1000 V = 1000
14	GET	Exported energy	UDINT	1.000 MWh = 1000
15	GET	Imported energy	UDINT	1.000 MWh = 1000
16	GET	Exp. reactive energy	UDINT	1.000 Mvarh = 1000
17	GET	Imp. reactive energy	UDINT	1.000 Mvarh = 1000
18	GET	Power factor	USINT	1.00 = 100
19	GET	Phase-to-earth voltage UL1	UINT	1000 V = 1000
20	GET	Phase-to-earth voltage UL2	UINT	1000 V = 1000
21	GET	Phase-to-earth voltage UL3	UINT	1000 V = 1000
22	GET	Tan phii	INT	1.000 = 1000
23	GET	Phase current IL	INT	1 A = 1
24	GET	Average line voltage	UINT	1000 V = 1000
25	GET	Average phase voltage	UINT	1000 V = 1000
26	GET	Phase current THD	INT	1.0 % = 10
27	GET	IL1 THD	INT	1.0 % = 10
28	GET	IL2 THD	INT	1.0 % = 10
29	GET	IL3 THD	INT	1.0 % = 10
30	GET	HARMONICS of IL1	SINT	1 % = 1
31	GET	HARMONICS of IL2	SINT	1 % = 1
32	GET	HARMONICS of IL3	SINT	1 % = 1
33	GET	Min. of IL1 IL2 IL3	INT	1 A = 1
34	GET	Max. of IL1 IL2 IL3	INT	1 A = 1
35	GET	Phase current ILRMS	INT	1 Arms = 1
36	GET	Phase current IL1RMS	INT	1 Arms = 1
37	GET	Phase current IL2RMS	INT	1 Arms = 1
38	GET	Phase current IL3RMS	INT	1 Arms = 1
39	GET	Temperature rise	INT	1.0 % = 10
40	GET SET	Ambient temperature	SINT	1 °C = 1
41	GET	IL1da demand	INT	1 A = 1
42	GET	IL2da demand	INT	1 A = 1
43	GET	IL3da demand	INT	1 A = 1
44	GET	IoCalc demand	INT	1.00 pu = 100
45	GET	Io1 demand	INT	1.000 pu = 1000
46	GET	Io2 demand	INT	1.000 pu = 1000
47	GET	Voltage THD	UINT	1.0 % = 10
48	GET	Ua THD	UINT	1.0 % = 10

Attribute ID	Access	Name	Data Type	Scaling
49	GET	Ub THD	UINT	1.0 % = 10
50	GET	Uc THD	UINT	1.0 % = 10
51	GET	HARMONICS of Ua	USINT	1 % = 1
52	GET	HARMONICS of Ub	USINT	1 % = 1
53	GET	HARMONICS of Uc	USINT	1 % = 1
54	GET	Min of line voltages	UINT	1000 V = 1000
55	GET	Max of line voltages	UINT	1000 V = 1000
56	GET	Min. of phase voltages	UINT	1000 V = 1000
57	GET	Max. of phase voltages	UINT	1000 V = 1000
58	GET	Voltage mean	UINT	1000 Vrms = 1000
59	GET	Input voltage Ua	UINT	1000 Vrms = 1000
60	GET	Input voltage Ub	UINT	1000 Vrms = 1000
61	GET	Input voltage Uc	UINT	1000 Vrms = 1000
62	GET	U12 demand	UINT	1000 V = 1000
63	GET	U23 demand	UINT	1000 V = 1000
64	GET	U31 demand	UINT	1000 V = 1000
65	GET	UL1 demand	UINT	1000 V = 1000
66	GET	UL2 demand	UINT	1000 V = 1000
67	GET	UL3 demand	UINT	1000 V = 1000
68	GET	Cosine phii	USINT	1.00 = 100
69	GET	Cosine of phase L1	USINT	1.00 = 100
70	GET	Cosine of phase L2	USINT	1.00 = 100
71	GET	Cosine of phase L3	USINT	1.00 = 100
72	GET	Power angle	INT	1 ° = 1
73	GET	Phase L1 active power	INT	1000 kW = 1000
74	GET	Phase L2 active power	INT	1000 kW = 1000
75	GET	Phase L3 active power	INT	1000 kW = 1000
76	GET	Phase L1 reactive power	INT	1000 kvar = 1000
77	GET	Phase L2 reactive power	INT	1000 kvar = 1000
78	GET	Phase L3 reactive power	INT	1000 kvar = 1000
79	GET	Phase L1 apparent power	INT	1000 kVA = 1000
80	GET	Phase L2 apparent power	INT	1000 kVA = 1000
81	GET	Phase L3 apparent power	INT	1000 kVA = 1000
82	GET	RMS active power	INT	1000 kW = 1000
83	GET	RMS reactive power	INT	1000 kvar = 1000
84	GET	RMS apparent power	INT	1000 kVA = 1000
85	GET	Active power demand	INT	1000 kW = 1000
86	GET	Reactive power demand	INT	1000 kvar = 1000
87	GET	Apparent power demand	INT	1000 kVA = 1000
88	GET	Power factor demand	INT	1.00 = 100
89	GET	RMS active power demand	INT	1000 kW = 1000
90	GET	RMS reactive power demand	INT	1000 kvar = 1000
91	GET	RMS apparent power demand	INT	1000 kVA = 1000
92	GET	Calculated Io	INT	1.000 pu = 1000
93	GET	Fault current of I>	INT	1.00 = 100
94	GET	Fault current of I>>	INT	1.00 = 100
95	GET	Fault current of I>>>	INT	1.00 = 100
96	GET	Fault reactance	UINT	1.00 ohm = 100
97	GET	Frequency fy	UINT	50.000 Hz = 5000
98	GET	Line-to-line voltage U12y	INT	1000 V = 1000

Attribute ID	Access	Name	Data Type	Scaling
99	GET	Frequency fz	UINT	50.000 Hz = 5000
100	GET	Line-to-line voltage U12z	INT	1000 V = 1000
101	GET	Phase angle difference	INT	1 ° = 1
102	GET SET	Minimum frequency	INT	50.000 Hz = 50000
103	GET SET	Minimum active power	INT	1 kW = 1
104	GET SET	Minimum react. power	INT	1 kvar = 1
105	GET SET	Minimum apparent power	INT	1 kVA = 1
106	GET SET	Min power factor	INT	1.000 = 1000
107	GET SET	Minimum of Io	INT	1.0 % = 10
108	GET SET	Minimum of Io2	INT	1.0 % = 10
109	GET SET	Minimum active power	INT	1 kW = 1
110	GET SET	Minimum react. power	INT	1 kvar = 1
111	GET SET	Minimum apparent power	INT	1 kVA = 1
112	GET SET	15 min minimum power factor	INT	1.000 = 1000
113	GET SET	Minimum active power	INT	1 kW = 1
114	GET SET	Minimum react. power	INT	1 kvar = 1
115	GET SET	Minimum apparent power	INT	1 kVA = 1
116	GET SET	Minimum of IL1	INT	1 A = 1
117	GET SET	Minimum of IL2	INT	1 A = 1
118	GET SET	Minimum of IL3	INT	1 A = 1
119	GET SET	RMS minimum of IL1	INT	1 Arms = 1
120	GET SET	RMS minimum of IL2	INT	1 Arms = 1
121	GET SET	RMS minimum of IL3	INT	1 Arms = 1
122	GET SET	Minimum of IL1	INT	1 A = 1
123	GET SET	Minimum of IL2	INT	1 A = 1
124	GET SET	Minimum of IL3	INT	1 A = 1
125	GET SET	RMS minimum of IL1	INT	1 Arms = 1
126	GET SET	RMS minimum of IL2	INT	1 Arms = 1
127	GET SET	RMS minimum of IL3	INT	1 Arms = 1
128	GET SET	Minimum of U12	INT	1 V = 1
129	GET SET	Minimum of U23	INT	1 V = 1
130	GET SET	Minimum of U31	INT	1 V = 1
131	GET SET	Maximum frequency	INT	50.000 Hz = 50000
132	GET SET	Maximum active power	INT	1 kW = 1
133	GET SET	Maximum react. power	INT	1 kvar = 1
134	GET SET	Maximum apparent power	INT	1 kVA = 1
135	GET SET	Max power factor	INT	1.000 = 1000
136	GET SET	Maximum of Io	INT	1.0 % = 10
137	GET SET	Maximum of Io2	INT	1.0 % = 10
138	GET SET	Maximum active power	INT	1 kW = 1
139	GET SET	Maximum react. power	INT	1 kvar = 1
140	GET SET	Maximum apparent power	INT	1 kVA = 1
141	GET SET	15 min maximum power factor	INT	1.000 = 1000
142	GET SET	Maximum active power	INT	1 kW = 1
143	GET SET	Maximum react. power	INT	1 kvar = 1
144	GET SET	Maximum apparent power	INT	1 kVA = 1
145	GET SET	Maximum of IL1	INT	1 A = 1

Attribute ID	Access	Name	Data Type	Scaling
146	GET SET	Maximum of IL2	INT	1 A = 1
147	GET SET	Maximum of IL3	INT	1 A = 1
148	GET SET	RMS maximum of IL1	INT	1 Arms = 1
149	GET SET	RMS maximum of IL2	INT	1 Arms = 1
150	GET SET	RMS maximum of IL3	INT	1 Arms = 1
151	GET SET	Maximum of U12	INT	1 A = 1
152	GET SET	Maximum of IL2	INT	1 A = 1
153	GET SET	Maximum of IL3	INT	1 A = 1
154	GET SET	RMS maximum of IL1	INT	1 Arms = 1
155	GET SET	RMS maximum of IL2	INT	1 Arms = 1
156	GET SET	RMS maximum of IL3	INT	1 Arms = 1
157	GET SET	Maximum of U12	INT	1 V = 1
158	GET SET	Maximum of U23	INT	1 V = 1
159	GET SET	Maximum of U31	INT	1 V = 1
160	GET	Z12 primary impedance	INT	1.00 ohm = 100
161	GET	Z23 primary impedance	INT	1.00 ohm = 100
162	GET	Z31 primary impedance	INT	1.00 ohm = 100
163	GET	Z12 secondary impedance	INT	1.00 ohm = 100
164	GET	Z23 secondary impedance	INT	1.00 ohm = 100
165	GET	Z31 secondary impedance	INT	1.00 ohm = 100
166	GET	Z12 angle	INT	1 ° = 1
167	GET	Z23 angle	INT	1 ° = 1
168	GET	Z31 angle	INT	1 ° = 1
169	GET	Phase current I'L1	INT	1 A = 1
170	GET	Phase current I'L2	INT	1 A = 1
171	GET	Phase current I'L3	INT	1 A = 1
172	GET	IL1 difference	INT	1.00 xln = 100
173	GET	IL2 difference	INT	1.00 xln = 100
174	GET	IL3 difference	INT	1.00 xln = 100
175	GET	Phase current I' THD	INT	1.0 % = 10
176	GET	I'L1 THD	INT	1.0 % = 10
177	GET	I'L2 THD	INT	1.0 % = 10
178	GET	I'L3 THD	INT	1.0 % = 10
179	GET	HARMONICS of I'L1	USINT	1 % = 1
180	GET	HARMONICS of I'L2	USINT	1 % = 1
181	GET	HARMONICS of I'L3	USINT	1 % = 1
182	GET	Min. of I'L1 I'L2 I'L3	INT	1 A = 1
183	GET	Max. of I'L1 I'L2 I'L3	INT	1 A = 1
184	GET	Phase current I'LRMS	INT	1 Arms = 1
185	GET	Phase current I'L1RMS	INT	1 Arms = 1
186	GET	Phase current I'L2RMS	INT	1 Arms = 1
187	GET	Phase current I'L3RMS	INT	1 Arms = 1

Additionally, the interface implementation includes 4 private objects with the configuration parameters of VAMP relay protection stages (VAMP StgProtCurrent Object, VAMP StgProtEF Object, VAMP StgProtOther Object, VAMP StgGeneral Object). Attributes of these objects are not available for including in the assemblies. Their definitions are as follows:

VAMP StgProtCurrent Object, Class Code 0x66 (private object):

NOTE: Whenever in consecutive rows there are two attributes with the same names, the first attribute is for Setting Group 1 and the second for Setting Group 2. In the EDS file there will be also two attributes with the same description for first and second setting group respectively. This concerns group dependent parameters in all four objects.

Attribute ID	Access	Name	Data Type	Scaling
1	GET SET	Enable for l>	BOOL	Off=0,On=1
2	GET SET	Group	USINT	1=0,2=1
3	GET SET	Pick-up setting	UDINT	1.00 xln = 100
4	GET SET	Pick-up setting	UDINT	1.00 xln = 100
5	GET SET	Delay curve family	USINT	DT=0,IEC=1,IEEE=2,IEEE2=3,RI=4, Prg1=5,Prg2=6,Prg3=7
6	GET SET	Delay curve family	USINT	DT=0,IEC=1,IEEE=2,IEEE2=3,RI=4, Prg1=5,Prg2=6,Prg3=7
7	GET SET	Delay type	USINT	DT=0,NI=1,VI=2,EI=3,LTI=4,LTEI=5, LTVI=6,MI=7,STI=8,STEI=9,RI=10,RX IDG=11,
8	GET SET	Delay type	USINT	DT=0,NI=1,VI=2,EI=3,LTI=4,LTEI=5, LTVI=6,MI=7,STI=8,STEI=9,RI=10,RX IDG=11,
9	GET SET	Inv. time coefficient k	UDINT	1.00 = 100
10	GET SET	Inv. time coefficient k	UDINT	1.00 = 100
11	GET SET	Include harmonics	BOOL	Off=0,On=1
12	GET SET	Constant A	UDINT	1.000 = 1000
13	GET SET	Constant B	UDINT	1.000 = 1000
14	GET SET	Constant C	UDINT	1.000 = 1000
15	GET SET	Constant D	UDINT	1.000 = 1000
16	GET SET	Constant E	UDINT	1.000 = 1000
17	GET SET	Enable for l>>	BOOL	Off=0,On=1
18	GET SET	Group	USINT	1=0,2=1
19	GET SET	Pick-up setting	UDINT	1.00 xln = 100
20	GET SET	Pick-up setting	UDINT	1.00 xln = 100
21	GET SET	Operation delay	UDINT	1.00 s = 100
22	GET SET	Operation delay	UDINT	1.00 s = 100
23	GET SET	Enable for l>>>	BOOL	Off=0,On=1
24	GET SET	Group	USINT	1=0,2=1
25	GET SET	Pick-up setting	UDINT	1.00 xln = 100
26	GET SET	Pick-up setting	UDINT	1.00 xln = 100
27	GET SET	Operation delay	UDINT	1.00 s = 100
28	GET SET	Operation delay	UDINT	1.00 s = 100
29	GET SET	Enable for lDir>	BOOL	Off=0,On=1
30	GET SET	Group	USINT	1=0,2=1
31	GET SET	Pick-up setting	UDINT	1.00 xln = 100
32	GET SET	Pick-up setting	UDINT	1.00 xln = 100
33	GET SET	Direction mode	USINT	Dir=0,Undir=1
34	GET SET	Direction mode	USINT	Dir=0,Undir=1
35	GET SET	Angle offset	UINT	1 ř = 1
36	GET SET	Angle offset	UINT	1 ř = 1
37	GET SET	Delay curve family	USINT	DT=0,IEC=1,IEEE=2,IEEE2=3,RI=4, Prg1=5,Prg2=6,Prg3=7

Attribute ID	Access	Name	Data Type	Scaling
38	GET SET	Delay curve family	USINT	DT=0,IEC=1,IEEE=2,IEEE2=3,RI=4, Prg1=5,Prg2=6,Prg3=7
39	GET SET	Delay type	USINT	DT=0,NI=1,VI=2,EI=3,LTI=4,LTEI=5, LTVI=6,MI=7,STI=8,STEI=9,RI=10,RX IDG=11,
40	GET SET	Delay type	USINT	DT=0,NI=1,VI=2,EI=3,LTI=4,LTEI=5, LTVI=6,MI=7,STI=8,STEI=9,RI=10,RX IDG=11,
41	GET SET	Inv. time coefficient k	UDINT	1.00 = 100
42	GET SET	Inv. time coefficient k	UDINT	1.00 = 100
43	GET SET	Constant A	UDINT	1.000 = 1000
44	GET SET	Constant B	UDINT	1.000 = 1000
45	GET SET	Constant C	UDINT	1.000 = 1000
46	GET SET	Constant D	UDINT	1.000 = 1000
47	GET SET	Constant E	UDINT	1.000 = 1000
48	GET SET	Enable for IDir>>	BOOL	Off=0,On=1
49	GET SET	Group	USINT	1=0,2=1
50	GET SET	Pick-up setting	UDINT	1.00 xIn = 100
51	GET SET	Pick-up setting	UDINT	1.00 xIn = 100
52	GET SET	Direction mode	USINT	Dir=0,Undir=1
53	GET SET	Direction mode	USINT	Dir=0,Undir=1
54	GET SET	Angle offset	UINT	1 ř = 1
55	GET SET	Angle offset	UINT	1 ř = 1
56	GET SET	Delay curve family	USINT	DT=0,IEC=1,IEEE=2,IEEE2=3,RI=4, Prg1=5,Prg2=6,Prg3=7
57	GET SET	Delay curve family	USINT	DT=0,IEC=1,IEEE=2,IEEE2=3,RI=4, Prg1=5,Prg2=6,Prg3=7
58	GET SET	Delay type	USINT	DT=0,NI=1,VI=2,EI=3,LTI=4,LTEI=5, LTVI=6,MI=7,STI=8,STEI=9,RI=10,RX IDG=11,
59	GET SET	Delay type	USINT	DT=0,NI=1,VI=2,EI=3,LTI=4,LTEI=5, LTVI=6,MI=7,STI=8,STEI=9,RI=10,RX IDG=11,
60	GET SET	Inv. time coefficient k	UDINT	1.00 = 100
61	GET SET	Inv. time coefficient k	UDINT	1.00 = 100
62	GET SET	Constant A	UDINT	1.000 = 1000
63	GET SET	Constant B	UDINT	1.000 = 1000
64	GET SET	Constant C	UDINT	1.000 = 1000
65	GET SET	Constant D	UDINT	1.000 = 1000
66	GET SET	Constant E	UDINT	1.000 = 1000
67	GET SET	Enable for IDir>>>	BOOL	Off=0,On=1
68	GET SET	Group	USINT	1=0,2=1
69	GET SET	Pick-up setting	UDINT	1.00 xIn = 100
70	GET SET	Pick-up setting	UDINT	1.00 xIn = 100
71	GET SET	Direction mode	USINT	Dir=0,Undir=1
72	GET SET	Direction mode	USINT	Dir=0,Undir=1
73	GET SET	Angle offset	UINT	1 ř = 1
74	GET SET	Angle offset	UINT	1 ř = 1
75	GET SET	Operation delay	UDINT	1.00 s = 100
76	GET SET	Operation delay	UDINT	1.00 s = 100
77	GET SET	Enable for IDir>>>>	BOOL	Off=0,On=1
78	GET SET	Group	USINT	1=0,2=1

Attribute ID	Access	Name	Data Type	Scaling
79	GET SET	Pick-up setting	UDINT	1.00 xln = 100
80	GET SET	Pick-up setting	UDINT	1.00 xln = 100
81	GET SET	Direction mode	USINT	Dir=0,Undir=1
82	GET SET	Direction mode	USINT	Dir=0,Undir=1
83	GET SET	Angle offset	UINT	1 ř = 1
84	GET SET	Angle offset	UINT	1 ř = 1
85	GET SET	Operation delay	UDINT	1.00 s = 100
86	GET SET	Operation delay	UDINT	1.00 s = 100
87	GET SET	Enable for I2>	BOOL	Off=0,On=1
88	GET SET	Group	USINT	1=0,2=1
89	GET SET	Pick-up setting	UDINT	1 % = 1
90	GET SET	Pick-up setting	UDINT	1 % = 1
91	GET SET	Delay type	USINT	DT=0,INV=1
92	GET SET	Delay type	USINT	DT=0,INV=1
93	GET SET	Operation delay	UDINT	1.0 s = 10
94	GET SET	Operation delay	UDINT	1.0 s = 10
95	GET SET	Enable for I2>>	BOOL	Off=0,On=1
96	GET SET	Enable for Ist>	BOOL	Off=0,On=1
97	GET SET	Motor start detection current	UDINT	1.00 xln = 100
98	GET SET	Nom motor start current	UDINT	1.00 xln = 100
99	GET SET	Delay type	USINT	DT=0,INV=1
100	GET SET	Operation delay	UDINT	1.0 s = 10
101	GET SET	Enable for N>	BOOL	Off=0,On=1
102	GET SET	Max motor starts/hour	UDINT	1 = 1
103	GET SET	Min time between motor starts	UDINT	1.0 min = 10
104	GET SET	Alarm on event	BOOL	Off=0,On=1
105	GET SET	Alarm off event	BOOL	Off=0,On=1
106	GET SET	Motor start disabled	BOOL	Off=0,On=1
107	GET SET	Motor start enabled	BOOL	Off=0,On=1
108	GET SET	Enable for I<	BOOL	Off=0,On=1
109	GET SET	Group	USINT	1=0,2=1
110	GET SET	Pick-up setting	UDINT	1 %ln = 1
111	GET SET	Pick-up setting	UDINT	1 %ln = 1
112	GET SET	Operation delay	UDINT	1.0 s = 10
113	GET SET	Operation delay	UDINT	1.0 s = 10
114	GET SET	Enable for ArcI>	BOOL	Off=0,On=1
115	GET SET	Pick-up setting	UDINT	1.0 pu = 10
116	GET SET	Arc inputs in use	USINT	S1=1,S2=2,S1/S2=3,BI=4,S1/BI=5,S2/BI=6,S1/S2/BI=7
117	GET SET	Enable for ΔI>	BOOL	Off=0,On=1
118	GET SET	dI> pick-up (Ibias < 0.5Ign)	UDINT	1 %ln = 1
119	GET SET	Slope1	UDINT	1 % = 1
120	GET SET	Ibias for start of slope 2	UDINT	1.00 xln = 100
121	GET SET	Slope2	UDINT	1 % = 1
122	GET SET	dI> 2.harm. block enable	BOOL	Off=0,On=1

Attribute ID	Access	Name	Data Type	Scaling
123	GET SET	dl> 2.harm. block limit	UDINT	1 % = 1
124	GET SET	Enable for ΔI>>	BOOL	Off=0,On=1
125	GET SET	Pick-up setting	UDINT	1.0 xln = 10
126	GET SET	Enable for I'2>	BOOL	Off=0,On=1
127	GET SET	Group	USINT	1=0,2=1
128	GET SET	Pick-up setting	UDINT	1 % = 1
129	GET SET	Pick-up setting	UDINT	1 % = 1
130	GET SET	Delay type	USINT	DT=0,INV=1
131	GET SET	Delay type	USINT	DT=0,INV=1
132	GET SET	Operation delay	UDINT	1.0 s = 10
133	GET SET	Operation delay	UDINT	1.0 s = 10
134	GET SET	Enable for I'>	BOOL	Off=0,On=1
135	GET SET	Group	USINT	1=0,2=1
136	GET SET	Pick-up setting	UDINT	1.00 xln = 100
137	GET SET	Pick-up setting	UDINT	1.00 xln = 100
138	GET SET	Delay curve family	USINT	DT=0,IEC=1,IEEE=2,IEEE2=3,RI=4, Prg1=5,Prg2=6,Prg3=7
139	GET SET	Delay curve family	USINT	DT=0,IEC=1,IEEE=2,IEEE2=3,RI=4, Prg1=5,Prg2=6,Prg3=7
140	GET SET	Delay type	USINT	DT=0,NI=1,VI=2,EI=3,LTI=4,LTEI=5, LTVI=6,MI=7,STI=8,STEI=9,RI=10,RX IDG=11,
141	GET SET	Delay type	USINT	DT=0,NI=1,VI=2,EI=3,LTI=4,LTEI=5, LTVI=6,MI=7,STI=8,STEI=9,RI=10,RX IDG=11,
142	GET SET	Inv. time coefficient k	UDINT	1.00 = 100
143	GET SET	Inv. time coefficient k	UDINT	1.00 = 100
144	GET SET	Constant A	UDINT	1.000 = 1000
145	GET SET	Constant B	UDINT	1.000 = 1000
146	GET SET	Constant C	UDINT	1.000 = 1000
147	GET SET	Constant D	UDINT	1.000 = 1000
148	GET SET	Constant E	UDINT	1.000 = 1000
149	GET SET	Enable for I'>>	BOOL	Off=0,On=1
150	GET SET	Group	USINT	1=0,2=1
151	GET SET	Pick-up setting	UDINT	1.00 xln = 100
152	GET SET	Pick-up setting	UDINT	1.00 xln = 100
153	GET SET	Operation delay	UDINT	1.00 s = 100
154	GET SET	Operation delay	UDINT	1.00 s = 100

VAMP StgProtEF, Class Code 0x67 (private object):

Attribute ID	Access	Name	Data Type	Scaling
1	GET SET	Enable for lo>	BOOL	Off=0,On=1
2	GET SET	Group	USINT	1=0,2=1
3	GET SET	Pick-up setting	UDINT	1.000 pu = 1000
4	GET SET	Pick-up setting	UDINT	1.000 pu = 1000
5	GET SET	Delay curve family	USINT	DT=0,IEC=1,IEEE=2,IEEE2=3,RI=4, Prg1=5,Prg2=6,Prg3=7
6	GET SET	Delay curve family	USINT	DT=0,IEC=1,IEEE=2,IEEE2=3,RI=4, Prg1=5,Prg2=6,Prg3=7
7	GET SET	Delay type	USINT	DT=0,NI=1,VI=2,EI=3,LTI=4,LTEI=5, LTVI=6,MI=7,STI=8,STEI=9,RI=10,RX IDG=11,
8	GET SET	Delay type	USINT	DT=0,NI=1,VI=2,EI=3,LTI=4,LTEI=5, LTVI=6,MI=7,STI=8,STEI=9,RI=10,RX IDG=11,
9	GET SET	Operation delay	UDINT	1.00 s = 100
10	GET SET	Operation delay	UDINT	1.00 s = 100
11	GET SET	Intermittent time	UDINT	1.00 s = 100
12	GET SET	Constant A	UDINT	1.000 = 1000
13	GET SET	Constant B	UDINT	1.000 = 1000
14	GET SET	Constant C	UDINT	1.000 = 1000
15	GET SET	Constant D	UDINT	1.000 = 1000
16	GET SET	Constant E	UDINT	1.000 = 1000
17	GET SET	Enable for lo>>	BOOL	Off=0,On=1
18	GET SET	Group	USINT	1=0,2=1
19	GET SET	Pick-up setting	UDINT	1.00 pu = 100
20	GET SET	Pick-up setting	UDINT	1.00 pu = 100
21	GET SET	Operation delay	UDINT	1.00 s = 100
22	GET SET	Operation delay	UDINT	1.00 s = 100
23	GET SET	Enable for loDir>	BOOL	Off=0,On=1
24	GET SET	Group	USINT	1=0,2=1
25	GET SET	Direction mode	USINT	ResCap=0,Sector=1,Undir=2
26	GET SET	Direction mode	USINT	ResCap=0,Sector=1,Undir=2
27	GET SET	Char ctrl. in ResCap mode	USINT	Res=0,Cap=1,DI1=2,DI2=3,DI3=4, DI4=5,DI5=6,DI6=7,DI7=8,DI8=9, DI9=10,DI10=11,
28	GET SET	Char ctrl. in ResCap mode	USINT	Res=0,Cap=1,DI1=2,DI2=3,DI3=4, DI4=5,DI5=6,DI6=7,DI7=8,DI8=9, DI9=10,DI10=11,
29	GET SET	Pick-up setting	UDINT	1.000 pu = 1000
30	GET SET	Pick-up setting	UDINT	1.000 pu = 1000
31	GET SET	Uo setting for loDir> stage	UDINT	1 % = 1
32	GET SET	Uo setting for loDir> stage	UDINT	1 % = 1
33	GET SET	Angle offset	UINT	1 ř = 1
34	GET SET	Angle offset	UINT	1 ř = 1
35	GET SET	Pick up sector size	UINT	1 řř = 1
36	GET SET	Pick up sector size	UINT	1 řř = 1
37	GET SET	Delay curve family	USINT	DT=0,IEC=1,IEEE=2,IEEE2=3,RI=4, Prg1=5,Prg2=6,Prg3=7
38	GET SET	Delay curve family	USINT	DT=0,IEC=1,IEEE=2,IEEE2=3,RI=4, Prg1=5,Prg2=6,Prg3=7
39	GET SET	Delay type	USINT	DT=0,NI=1,VI=2,EI=3,LTI=4,LTEI=5, LTVI=6,MI=7,STI=8,STEI=9,RI=10,RX IDG=11,

Attribute ID	Access	Name	Data Type	Scaling
40	GET SET	Delay type	USINT	DT=0,NI=1,VI=2,EI=3,LTI=4,LTEI=5,LTVI=6,MI=7,STI=8,STEI=9,RI=10,RXIDG=11,
41	GET SET	Operation delay	UDINT	1.00 s = 100
42	GET SET	Operation delay	UDINT	1.00 s = 100
43	GET SET	Constant A	UDINT	1.000 = 1000
44	GET SET	Constant B	UDINT	1.000 = 1000
45	GET SET	Constant C	UDINT	1.000 = 1000
46	GET SET	Constant D	UDINT	1.000 = 1000
47	GET SET	Constant E	UDINT	1.000 = 1000
48	GET SET	Enable for loDir>>	BOOL	Off=0,On=1
49	GET SET	Group	USINT	1=0,2=1
50	GET SET	Direction mode	USINT	ResCap=0,Sector=1,Undir=2
51	GET SET	Direction mode	USINT	ResCap=0,Sector=1,Undir=2
52	GET SET	Char ctrl. in ResCap mode	USINT	Res=0,Cap=1,DI1=2,DI2=3,DI3=4,DI4=5,DI5=6,DI6=7,DI7=8,DI8=9,DI9=10,DI10=11,
53	GET SET	Char ctrl. in ResCap mode	USINT	Res=0,Cap=1,DI1=2,DI2=3,DI3=4,DI4=5,DI5=6,DI6=7,DI7=8,DI8=9,DI9=10,DI10=11,
54	GET SET	Pick-up setting	UDINT	1.00 pu = 100
55	GET SET	Pick-up setting	UDINT	1.00 pu = 100
56	GET SET	Uo setting for loDir> stage	UDINT	1 % = 1
57	GET SET	Uo setting for loDir> stage	UDINT	1 % = 1
58	GET SET	Angle offset	UINT	1 ř = 1
59	GET SET	Angle offset	UINT	1 ř = 1
60	GET SET	Pick up sector size	UINT	1 řř = 1
61	GET SET	Pick up sector size	UINT	1 řř = 1
62	GET SET	Delay curve family	USINT	DT=0,IEC=1,IEEE=2,IEEE2=3,RI=4,Prg1=5,Prg2=6,Prg3=7
63	GET SET	Delay curve family	USINT	DT=0,IEC=1,IEEE=2,IEEE2=3,RI=4,Prg1=5,Prg2=6,Prg3=7
64	GET SET	Delay type	USINT	DT=0,NI=1,VI=2,EI=3,LTI=4,LTEI=5,LTVI=6,MI=7,STI=8,STEI=9,RI=10,RXIDG=11,
65	GET SET	Delay type	USINT	DT=0,NI=1,VI=2,EI=3,LTI=4,LTEI=5,LTVI=6,MI=7,STI=8,STEI=9,RI=10,RXIDG=11,
66	GET SET	Operation delay	UDINT	1.00 s = 100
67	GET SET	Operation delay	UDINT	1.00 s = 100
68	GET SET	Constant A	UDINT	1.000 = 1000
69	GET SET	Constant B	UDINT	1.000 = 1000
70	GET SET	Constant C	UDINT	1.000 = 1000
71	GET SET	Constant D	UDINT	1.000 = 1000
72	GET SET	Constant E	UDINT	1.000 = 1000
73	GET SET	Enable for lo>>>	BOOL	Off=0,On=1
74	GET SET	Group	USINT	1=0,2=1
75	GET SET	Pick-up setting	UDINT	1.00 pu = 100
76	GET SET	Pick-up setting	UDINT	1.00 pu = 100
77	GET SET	Operation delay	UDINT	1.00 s = 100
78	GET SET	Operation delay	UDINT	1.00 s = 100
79	GET SET	Compensation mode	BOOL	Off=0,On=1
80	GET SET	Compensation current	UDINT	1.000 pu = 1000

Attribute ID	Access	Name	Data Type	Scaling
81	GET SET	Save unbalance current	USINT	Get=1
82	GET SET	'Saving unbal' event	BOOL	Off=0,On=1
83	GET SET	'Unbal saved' event	BOOL	Off=0,On=1
84	GET SET	Enable for lo>>>>	BOOL	Off=0,On=1
85	GET SET	Group	USINT	1=0,2=1
86	GET SET	Pick-up setting	UDINT	1.00 pu = 100
87	GET SET	Pick-up setting	UDINT	1.00 pu = 100
88	GET SET	Operation delay	UDINT	1.00 s = 100
89	GET SET	Operation delay	UDINT	1.00 s = 100
90	GET SET	Compensation mode	BOOL	Off=0,Normal=1,Location=2
91	GET SET	Compensation current	UDINT	1.000 pu = 1000
92	GET SET	Save unbalance current	USINT	Get=1
93	GET SET	Max allowed faults	UINT	1 = 1
94	GET SET	Clear location counters	USINT	Clear=1
95	GET SET	'Saving unbal' event	BOOL	Off=0,On=1
96	GET SET	'Unbal saved' event	BOOL	Off=0,On=1
97	GET SET	Enable for loInt>	BOOL	Off=0,On=1
98	GET SET	Group	USINT	1=0,2=1
99	GET SET	Uo pick-up	UDINT	1 % = 1
100	GET SET	Uo pick-up	UDINT	1 % = 1
101	GET SET	Operation delay	UDINT	1.00 s = 100
102	GET SET	Operation delay	UDINT	1.00 s = 100
103	GET SET	Intermittent time	UDINT	1.00 s = 100
104	GET SET	Enable for Uo>	BOOL	Off=0,On=1
105	GET SET	Group	USINT	1=0,2=1
106	GET SET	Pick-up setting	UDINT	1 % = 1
107	GET SET	Pick-up setting	UDINT	1 % = 1
108	GET SET	Operation delay	UDINT	1.0 s = 10
109	GET SET	Operation delay	UDINT	1.0 s = 10
110	GET SET	Enable for Uo>>	BOOL	Off=0,On=1
111	GET SET	Group	USINT	1=0,2=1
112	GET SET	Pick-up setting	UDINT	1 % = 1
113	GET SET	Pick-up setting	UDINT	1 % = 1
114	GET SET	Operation delay	UDINT	1.0 s = 10
115	GET SET	Operation delay	UDINT	1.0 s = 10
116	GET SET	Enable for Arclo1>	BOOL	Off=0,On=1
117	GET SET	Pick-up setting	UDINT	1.00 pu = 100
118	GET SET	Arc inputs in use	USINT	S1=1,S2=2,S1/S2=3,BI=4,S1/BI=5,S2/BI=6,S1/S2/BI=7
119	GET SET	Enable for Arclo2>	BOOL	Off=0,On=1
120	GET SET	Pick-up setting	UDINT	1.00 pu = 100
121	GET SET	Arc inputs in use	USINT	S1=1,S2=2,S1/S2=3,BI=4,S1/BI=5,S2/BI=6,S1/S2/BI=7

VAMP StgProtOther, Class Code 0x68 (private object):

Attribute ID	Access	Name	Data Type	Scaling
1	GET SET	Enable for U>	BOOL	Off=0,On=1
2	GET SET	Group	USINT	1=0,2=1
3	GET SET	Pick-up setting	UDINT	1 %Un = 1
4	GET SET	Pick-up setting	UDINT	1 %Un = 1
5	GET SET	Operation delay	UDINT	1.00 s = 100
6	GET SET	Operation delay	UDINT	1.00 s = 100
7	GET SET	Release delay	UDINT	1.00 s = 100
8	GET SET	Hysteresis	UDINT	1.0 % = 10
9	GET SET	Enable for U>>	BOOL	Off=0,On=1
10	GET SET	Group	USINT	1=0,2=1
11	GET SET	Pick-up setting	UDINT	1 %Un = 1
12	GET SET	Pick-up setting	UDINT	1 %Un = 1
13	GET SET	Operation delay	UDINT	1.00 s = 100
14	GET SET	Operation delay	UDINT	1.00 s = 100
15	GET SET	Hysteresis	UDINT	1.0 % = 10
16	GET SET	Enable for U>>>	BOOL	Off=0,On=1
17	GET SET	Group	USINT	1=0,2=1
18	GET SET	Pick-up setting	UDINT	1 %Un = 1
19	GET SET	Pick-up setting	UDINT	1 %Un = 1
20	GET SET	Operation delay	UDINT	1.00 s = 100
21	GET SET	Operation delay	UDINT	1.00 s = 100
22	GET SET	Hysteresis	UDINT	1.0 % = 10
23	GET SET	Enable for U<	BOOL	Off=0,On=1
24	GET SET	Group	USINT	1=0,2=1
25	GET SET	Pick-up setting	UDINT	1 %Un = 1
26	GET SET	Pick-up setting	UDINT	1 %Un = 1
27	GET SET	Operation delay	UDINT	1.00 s = 100
28	GET SET	Operation delay	UDINT	1.00 s = 100
29	GET SET	Low voltage blocking	UDINT	1 %Un = 1
30	GET SET	Low voltage blocking	UDINT	1 %Un = 1
31	GET SET	Release delay	UDINT	1.00 s = 100
32	GET SET	Hysteresis	UDINT	1.0 % = 10
33	GET SET	Enable for U<<	BOOL	Off=0,On=1
34	GET SET	Group	USINT	1=0,2=1
35	GET SET	Pick-up setting	UDINT	1 %Un = 1
36	GET SET	Pick-up setting	UDINT	1 %Un = 1
37	GET SET	Operation delay	UDINT	1.00 s = 100
38	GET SET	Operation delay	UDINT	1.00 s = 100
39	GET SET	Low voltage blocking	UDINT	1 %Un = 1
40	GET SET	Low voltage blocking	UDINT	1 %Un = 1
41	GET SET	Hysteresis	UDINT	1.0 % = 10
42	GET SET	Enable for U<<<	BOOL	Off=0,On=1
43	GET SET	Group	USINT	1=0,2=1
44	GET SET	Pick-up setting	UDINT	1 %Un = 1
45	GET SET	Pick-up setting	UDINT	1 %Un = 1
46	GET SET	Operation delay	UDINT	1.00 s = 100
47	GET SET	Operation delay	UDINT	1.00 s = 100
48	GET SET	Low voltage blocking	UDINT	1 %Un = 1

Attribute ID	Access	Name	Data Type	Scaling
49	GET SET	Low voltage blocking	UDINT	1 %Un = 1
50	GET SET	Hysteresis	UDINT	1.0 % = 10
51	GET SET	Enable for fX	BOOL	Off=0,On=1
52	GET SET	Group	USINT	1=0,2=1
53	GET SET	Pick-up setting	UDINT	50.00 Hz = 5000
54	GET SET	Pick-up setting	UDINT	50.00 Hz = 5000
55	GET SET	Operation delay	UDINT	1.00 s = 100
56	GET SET	Operation delay	UDINT	1.00 s = 100
57	GET SET	Low voltage blocking	UDINT	1 %Un = 1
58	GET SET	Enable for fXX	BOOL	Off=0,On=1
59	GET SET	Group	USINT	1=0,2=1
60	GET SET	Pick-up setting	UDINT	50.00 Hz = 5000
61	GET SET	Pick-up setting	UDINT	50.00 Hz = 5000
62	GET SET	Operation delay	UDINT	1.00 s = 100
63	GET SET	Operation delay	UDINT	1.00 s = 100
64	GET SET	Low voltage blocking	UDINT	1 %Un = 1
65	GET SET	Enable for f<	BOOL	Off=0,On=1
66	GET SET	Group	USINT	1=0,2=1
67	GET SET	Pick-up setting	UDINT	50.00 Hz = 5000
68	GET SET	Pick-up setting	UDINT	50.00 Hz = 5000
69	GET SET	Operation delay	UDINT	1.00 s = 100
70	GET SET	Operation delay	UDINT	1.00 s = 100
71	GET SET	Low voltage blocking	UDINT	1 %Un = 1
72	GET SET	Enable for f<<	BOOL	Off=0,On=1
73	GET SET	Group	USINT	1=0,2=1
74	GET SET	Pick-up setting	UDINT	50.00 Hz = 5000
75	GET SET	Pick-up setting	UDINT	50.00 Hz = 5000
76	GET SET	Operation delay	UDINT	1.00 s = 100
77	GET SET	Operation delay	UDINT	1.00 s = 100
78	GET SET	Low voltage blocking	UDINT	1 %Un = 1
79	GET SET	Enable for df/dt	BOOL	Off=0,On=1
80	GET SET	Group	USINT	1=0,2=1
81	GET SET	Pick-up setting	UDINT	1.0 Hz/s = 10
82	GET SET	Pick-up setting	UDINT	1.0 Hz/s = 10
83	GET SET	Operation delay	UDINT	1.00 s = 100
84	GET SET	Operation delay	UDINT	1.00 s = 100
85	GET SET	Minimum delay	UDINT	1.00 s = 100
86	GET SET	Minimum delay	UDINT	1.00 s = 100
87	GET SET	Enable for P<	BOOL	Off=0,On=1
88	GET SET	Group	USINT	1=0,2=1
89	GET SET	Pick-up setting	UDINT	1.0 %Sn = 10
90	GET SET	Pick-up setting	UDINT	1.0 %Sn = 10
91	GET SET	Operation delay	UDINT	1.0 s = 10
92	GET SET	Operation delay	UDINT	1.0 s = 10
93	GET SET	Enable for P<<	BOOL	Off=0,On=1
94	GET SET	Group	USINT	1=0,2=1
95	GET SET	Pick-up setting	UDINT	1 %Sn = 1
96	GET SET	Pick-up setting	UDINT	1 %Sn = 1
97	GET SET	Operation delay	UDINT	1.0 s = 10

Attribute ID	Access	Name	Data Type	Scaling
98	GET SET	Operation delay	UDINT	1.0 s = 10
99	GET SET	Enable for T>	BOOL	Off=0,On=1
100	GET SET	Maximum continuous current	UDINT	1.00 xIn = 100
101	GET SET	Alarm setting	UDINT	1 % = 1
102	GET SET	Time constant tau	UINT	1 min = 1
103	GET SET	Rel. cooling time constant	UDINT	1.0 x tau = 10
104	GET SET	Max overload at +40C	UDINT	1 %In = 1
105	GET SET	Max overload at +70C	UDINT	1 %In = 1
106	GET SET	Ambient temperature	UINT	1 řC = 1
107	GET SET	Ambient temp. sensor	USINT	ExtAI1=1,ExtAI2=2,ExtAI3=3,ExtAI4=4,ExtAI5=5,ExtAI6=6,ExtAI7=7,ExtAI8=8,
108	GET SET	Enable for CBFP	BOOL	Off=0,On=1
109	GET SET	Monitored Trip relay	USINT	T1=1,T2=2,T3=3,T4=4,T5=5,T6=6,T7=7,T8=8,T9=9,T10=10,T11=11,T12=12,T13=13,
110	GET SET	Operation delay	UDINT	1.00 s = 100

VAMP StgGeneral, Class Code 0x69 (private object):

Attribute ID	Access	Name	Data Type	Scaling
1	GET SET	CT primary	UDINT	1 A = 1
2	GET SET	CT secondary	UINT	1 A = 1
3	GET	Nominal input	UINT	1 A = 1
4	GET SET	Io1 CT primary	UDINT	1 A = 1
5	GET SET	Io1 CT secondary	UDINT	1.0 A = 10
6	GET	Nominal Io1 input	UDINT	1.0 A = 10
7	GET SET	Io2 CT primary	UDINT	1 A = 1
8	GET SET	Io2 CT secondary	UDINT	1.0 A = 10
9	GET	Nominal Io2 input	UDINT	1.0 A = 10
10	GET SET	VT primary	UDINT	1 V = 1
11	GET SET	VT secondary	UINT	1 V = 1
12	GET SET	VTo secondary	UDINT	1.000 V = 1000
13	GET SET	Motor nom current	UDINT	1.0 A = 10
14	GET SET	Generator nom voltage	UINT	1 V = 1
15	GET SET	Generator nom power	UDINT	1 kVA = 1
16	GET SET	Nominal shaft power Pm	UDINT	1 kW = 1
17	GET SET	Is there a unit trafo?	BOOL	Off=0,On=1
18	GET SET	Bus bar nominal voltage	UDINT	1 V = 1
19	GET SET	Genrtr side nom voltage	UDINT	1 V = 1
20	GET SET	Connection group	USINT	Yy0=0,Yy6=1,Yd1=2,Yd5=3,Yd7=4,Yd11=5,Dy1=6,Dy5=7,Dy7=8,Dy11=9,Dd0=10,

5 Assemblies

EtherNet/IP implementation on VAMP relay includes one consuming assembly (Rx) and one producing assembly (Tx). Assemblies have to be configured during the device setup. By default both assemblies are configured with one byte of data each. Consuming assembly by default is configured with Control Supervisor Object / FaultRst attribute and producing assembly is by default configured with Control Supervisor Object / Faulted attribute.

Main configuration parameters of the assemblies are as follows:

Parameter	Range	Description
Producing Instance	1-1278	Instance number of producing assembly
Include Run/Idle Header (Producing)	On/Off	Include (On) or exclude (Off) Run/Idle Header in outgoing IO messages
Consuming Instance	1-1278	Instance number of consuming assembly
Include Run/Idle Header (Consuming)	On/Off	Expect presence (On) or absence (Off) of Run/Idle Header in incoming IO messages

5.1 Producing Instance

Instance number of producing assembly. This value is available in the EDS file and is used by the configuration tool as a reference path during I/O connection opening. Default value of Producing Instance is 100. Every change to this parameter requires restarting the device and generation of the new EDS file.

5.2 Include Run/Idle Header (Producing)

An I/O connection can be established with or without the Run/Idle Header in the T->O direction (adapter to scanner). Including Run/Idle Header in the producing assembly adds additional 4 bytes to the beginning of the data part of an IO message. Run bit is always set in the outgoing messages if VAMP relay is configured to send IO messages with the Run/Idle Header. Information about whether the Run/Idle Header is included in the outgoing messages is available in the EDS file and can be used by the configuration tool to properly establish I/O communication. Every change to this parameter requires generation of the new EDS file. Default value of this parameter is Off.

5.3 Consuming Instance

Instance number of consuming assembly. This value is available in the EDS file and is used by the configuration tool as a reference path during I/O connection opening. Default value of Consuming Instance is 150. Every change to this parameter requires restarting the device and generation of the new EDS file.

5.4 Include Run/Idle Header (Consuming)

An I/O connection can be established with or without the Run/Idle Header in the O->T direction (scanner to adapter). Setting this value to On informs the configuration tool that VAMP relay expects the consuming assembly to contain additional 4 bytes of data. If the Run/Idle Header is included and the Run bit is set in the incoming IO messages then VAMP relay processes received data, and if the Run bit is cleared then VAMP relay ignores received data. If the Run/Idle Header is not included in the incoming IO messages then the received data is always processed. Information about whether the Run/Idle Header is expected in the incoming IO messages is available in the EDS file and can be used by the configuration tool to properly establish I/O communication. Every change to this parameter requires generation of the new EDS file. Default value of this parameter is On.

NOTE: VAMP relay does not allow changing of both Include Run/Idle Header parameters while the I/O connection is running.

There are also two additional items available to be added to assemblies:

- 1 byte padding
- 2 bytes padding

They can be used when the configuration tool requires assembly data to be word or double-word aligned, to appropriately align the assembly contents.

I/O connections with VAMP relay should be opened with the RPI (Requested Packet Interval) no less than 50 ms.

6 EDS file

The Electronic Data Sheet (EDS) is a specially formatted ASCII file that provides information about device configuration data. It mainly contains:

- device's identity information – main configuration parameters described in section 2,
- parameters list – all of the attributes available in the data model; see section 4,
- assemblies info – current configuration of producing and consuming assemblies.

Every change to main configuration parameters or assemblies configuration requires a new EDS file to be generated (once all changes are made and the device is about to be used in the network).

Some of the configuration tools are capable of simplifying device configuration based on the EDS file. In the current implementation the EDS file can only be generated from Vampset tool – EDS file extraction over the EtherNet/IP network is not supported in VAMP relay.

7 Communication

EtherNet/IP implementation in VAMP relay supports three types of communication:

- Unconnected Explicit Requests and Responses – used mainly for establishing explicit and I/O connections, but can also be used for one time requests to attributes of data model objects.
- Explicit Messaging (Class 3) connections – these are strictly point-to-point connections used to cyclically query the adapter for some data or to cyclically write data to the adapter (transmitted using TCP)
- I/O Messaging (Class 1) connections – can be point-to-point or multicast. Used for very frequent exchange of process data. VAMP relay supports only cyclic I/O connections. Transmitted using UDP.

Connection limits:

- Class 3 connections – there can be maximum two Class 3 connections at the same time
- Class 1 connections – there can be only one Class 1 connection at the same time

8 Supported services

Supported services for data model objects (see section 4) are only Set Attribute Single (SAS) and Get Attribute Single (GAS). GAS service is available for all attributes with the GET or GET | SET access type and the SAS service is available for all attributes with the GET | SET or SET access type.

Standard objects support the following services:

- Identity Object – Get Attributes All (GAA) and Get Attribute Single (GAS)
- TCP/IP Interface Object – Get Attribute Single (GAS)
- Ethernet Link Object – Get Attribute Single (GAS)
- Assembly Object – Get Attribute Single (GAS) and Set Attribute Single (SAS)

9 Events

VAMP events are available under the 4th attribute of the VAMP Digital Object (0x64), called Events. The attribute is a structure of:

- secSinceGenesis (UDINT) – seconds since 01.01.1996 00:00:00, first part of the timestamp
- milliseconds (UINT) – second part of the timestamp
- event code (UINT) – presented as: (channel << 6) & event number

Events are read starting with the oldest one in the Event Buffer. When there are no more events in the Event Buffer the structure is filled with zeroes.

Reading of Events depends from the communication type:

- Unconnected request – VAMP responds with the oldest available event. Next request will result in next oldest event (the one previously read is not available any more).
- Class 3 connection – VAMP sends the oldest available event until PLC triggers incrementing of transport sequence count of EtherNet/IP

protocol, then VAMP moves to the next event in the Event Buffer.

- Class 1 connection – consecutive event is sent in each transmitted message (without retransmissions) as long as there are events in the Event Buffer pending for transmission, in case of no events a structure filled with zeroes will be sent.

In case of using Unconnected request and Class 3 connection, the PLC controls the flow of events by allowing the transmission of the next event. In case of using Class 1 connection events are spontaneously transmitted by VAMP.

10 Fault codes

Translation table of VAMP protection states to EtherNet/IP Fault Codes:

Fault Code	Description	VAMP protection stage
20	CURRENT TRIP	Overcurrent Stage I> 50/51
		Overcurrent Stage I>> 50/51
		Overcurrent Stage I>>> 50/51
21	THERMAL OVERLOAD	Thermal Overload Stage T> 49
26	PHASE IMBALANCE	Unbalance Stage I2> 46
27	GROUND FAULT	Earth Fault Stage Io> 50N/51N
		Earth Fault Stage Io>> 50N/51N
		Earth Fault Stage Io>>> 50N/51N
		Earth Fault Stage Io>>>> 50N/51N
29	UNDERLOAD	Under Current Stage I< 37
31	STALL	Stall Protection Ist> 48
51	UNDERVOLTAGE	U<, U<<, U<<<
52	OVERVOLTAGE	U>, U>>, U>>>
54	PHASE REVERSAL	Unbalance Stage I2>> 47
55	FREQUENCY	f<, f<<, f><, f>><<
73	START/HOURS EXCEEDED	Frequent Start Protection 66 N>

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