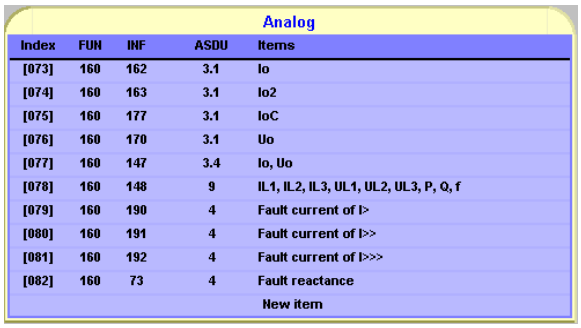
Measurement values in IEC-60870-5-103

Analog measurements are transferred in two different formats in IEC-103 protocol. Value format is depended on application message type, ASDU. The following ASDU types are available for measurement values:

ASDU	Number of measurements in one message	Format
3.1	1	Integer
3.2	2	
3.3	4	
3.4	2	
3.9	9	
4	1	Float

1 Selecting ASDU type

ASDU type can be selected for each measurement with Vampset. Here is an example analog value configuration for VAMP 255 Feeder Manager:



2 Integer value scaling

ASDU 3 measurements are transferred in 12 bit + sign integer format. The raw 12 bit values (-4096 … +4095) are relative to 2.4 x nominal values. The following table shows the scaling for different measurements:

Type	Meas.	Scaling	Nominal settings
Current	IL1…IL3, IoCalc	$2.4 \times I_N$	CT primary 500 A CT secondary 5 A
Resudual current	Io1	$2.4 \times I_{01\,N}$	Io CT primary 50 A Io CT secondary 5.0 A

	Io2	$2.4 \times I_{02N}$	Io2 CT primary 50 A Io2 CT secondary 5.0 A
Voltage	UL1 … UL3, U12 … U31	$2.4 \times U_N$	VT primary 11000 V VT secondary 100 V
Residual voltage	Uo	$2.4 \times U_{0N}$	VTo secondary 100.000 V
Type	**Meas.**	**Scaling**	**Nominal settings**
Power	P, Q, S	$2.4 \times I_N \times U_N \times \sqrt{3}$	CT primary 500 A CT secondary 5 A VT primary 11000 V VT secondary 100 V
Other	DI counters	1:1	
	PF, CosFii	2.4:1	

Example 1: IL1

Device transfers IL1 in ASDU 3.1. CT settings are:

Ctprimary: 500 A
Ctsecondary: 5 A

The protocol master receives a measurement value:

Value: 1234
OVF: No
Valid: Yes

Measurement value is scaled to primary and secondary currents:

Primary: $1234 \times \frac{2.4 * 500\,A}{4096} = 362\,A$

Secondary: $1234 \times \frac{2.4 \times 5\,A}{4096} = 3.62\,A$

Example 2: IL1 with OVF

Device transfers IL1 in ASDU 3.1. CT settings are:

Ctprimary: 500 A

Ctsecondary: 5 A

The protocol master receives a measurement value:

Value:	4095
OVF:	Yes
Valid:	Yes

Measurement value gives positive overflow. The largest 12 bit value is 4095, thus the overflow means a value of 4096 or more. This can be scaled to primary and secondary currents:

Primary:	$2.4 \times 500\,A = 1200\,A$
Secondary:	$2.4 \times 5\,A = 12\,A$

Thus the measured values are:

Primary:	>= 1200 A
Secondary:	>= 12 A

Example 3: P

Device transfers P in ASDU 3.1. CT and VT settings are:

Ctprimary:	500 A
Ctsecondary:	5 A
Vtprimary:	11000 V
Vtsecondary:	100 V

The protocol master receives a measurement value:

Value:	1234
OVF:	No
Valid:	Yes

Measurement value is scaled to power:

$$1234 \times \frac{2.4 \times 500\,A \times 11000V \times \sqrt{3}}{4096} = 6888\,kW$$

Example 4: DI1 counter

Device transfers DI1 counter in ASDU 3.1. DI counters are 16 bit rising edge counters. DI counter values don't have any scaling, but as the integer values are only 12 bits in IEC-103, only the LSB 12 bits of DI1 counter are transferred. This means that the counter wraps around in 4096. Here are some example counter values and how they are transferred in IEC-103:

Device	IEC-60870-103
1	1
2048	2048
4095	4095
4096	0
6096	2000
8192	0

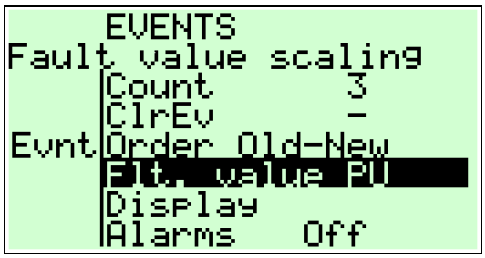
Float values

Values transferred in ASDU 4 don't need any extra scaling. Most of the measurements are sent in primary scaled values but some can also be sent as PU values. Here are some examples of float measurements:

Measurement	Format
Fault current I>	PU or A
Fault current I>>	PU or A
Fault current I>>>	PU or A
Fault reactance	Ω
Exported energy	MWh
Exp. Reactive energy	Mvarh

Primary or PU (float only)

Selection between PU and primary values is controlled by event scaling mode. Here is a screen shot of the local panel setting:



Sending interval

Measurements are sent in regular intervals. The ‘MeasInt’ setting defines a delay between two analog value messages and can be used for limiting bus traffic.

Keywords: Measurement values in IEC 60870-5-103, ASDU in IEC 103, integer value

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