

### Generally

Unipower APM380 is an electronic measurement transducer that measures power in kW on 3-phased asymmetric loads, also after frequency inverters, according to the formula:

$$P = \sqrt{3} \times U \times I \times \cos\varphi$$

- \* Suitable for mains voltages from 3x230V to 3x575V
- \* Measures after frequency inverters; PWM 10Hz - 1kHz
- \* 10 ranges for currents up to 80A internally
- \* 0(4)-20mA and 0(2)-10V analogue outputs
- \* Programmable filter function
- \* kWh impulse output
- \* Galvanic isolation between mains net and I/O (incl. 24V)



### Features

#### Voltage measurement

APM380 is suitable for mains voltages from 3x230V to 3x575V. The measurement system in the unit is constructed for measuring after frequency inverters - i.e. between the frequency inverter and the motor. Hence the APM380 is not powered by the measuring voltage as opposed to the majority of the Unipower products, but by a 24Vdc. One of 7 mains voltage ranges is selectable from the front plate.

#### Current measurement

APM380 measures up to 80A with internal CTs. To take advantage of the large measurement range, the unit has 10 current ranges making APM380 suitable for nominal currents below 1A and up to 80A. The current range is set via a selector switch on the front plate.

#### Power measurement

The power measurement is performed by a specially developed circuit, which in principle is a 4-quadrant multiplier. The circuit is capable of handling the special voltage- and current signals coming from a frequency inverter. The unit contains a 4 step programmable analogue filter, which may be used with advantage on low frequencies.

#### Analogue output

APM380 integrates a voltage- and a current output configurable via input (S1) as 0-20mA (0-10V) or 4-20mA (2-10V). It is not possible to generate 0-10V and 4-20mA simultaneously. 20mA (10V) is generated at nominal current, nominal voltage and  $\cos\varphi=1$ . One of three digital filters may be used to dampen the analogue outputs. Selecting an invalid voltage range results in both outputs set to 0mA (0V).

#### Digital input

The unit is equipped with 6 digital inputs. S1 and S6 are read only during power up. S2 - S5 are read continuously and are used for filter selection (S2 & S3 select a digital filter and S4 & S5 select an analogue filter). All digital inputs are activated (On) when connected to +12-24V.

#### LED indicators

APM380 has 4 LED indicators. The LED marked „Load“ indicates that the unit is connected to mains supply. If the measurement is below 3% of the measurement range this LED flashes. The LED marked „kWh“ flashes 25 times faster than the kWh-output. The LEDs marked „Limit 1“ and „Limit 2“ flash, if an invalid voltage range is selected, but otherwise have no function.

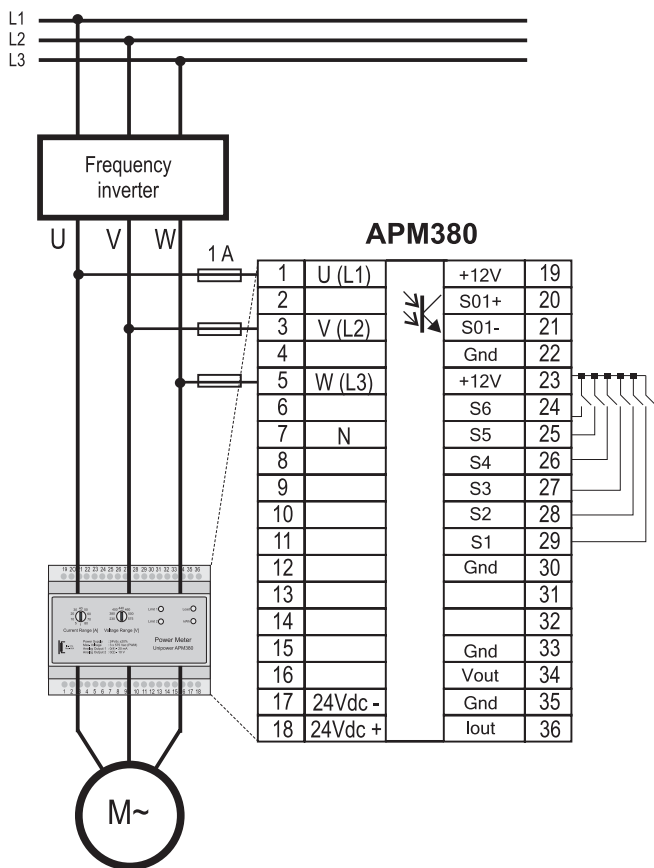
### Technical Specifications

#### Mechanical

Housing:	Lexan UL94V-0 (Top) Noryl UL94V-0 (Bottom)
Mounting:	M36 for 35 mm DIN rail
IP class:	Housing IP40. Terminals IP20
Terminals:	Max 16A. Max 2,5 mm <sup>2</sup> Terminal tight. torque: 7lbs/in, 0.79Nm Use 60/75 copper (CU) wire only
Temp.:	-15 to +50 °C surrounding air
Weight:	300 g
Dimens.:	D 58 x W 102 x H 86 mm

#### Electrical

Supply:	24Vdc ±10%, max 150mA
Measurement voltage:	Max. 3x600V (PWM)
Current input:	Nominal 80A, Max. 130A
Frequency:	10Hz - 1kHz
Accuracy:	Class 2%
Analogue output 1:	0(4)-20 mA max 300Ω
Analogue output 2:	0(2)-10V min load 10kΩ
Digital inputs:	12 - 24V DC
kWh output:	SO-1, 1 or 10 imp./kWh Pulse width: 300ms



### Measurement Range

Setting up the measurement range in the APM380 is done choosing nominal current and voltage. Based on this the power range may be calculated according to:

$$P_{\text{Range}} = \sqrt{3} * U * I$$

The following table shows the measurement ranges in kW:

U \ I	230	380	400	440	460	500	575
1	0.40	0.66	0.69	0.76	0.80	0.87	1.00
5	1.99	3.29	3.46	3.81	3.98	4.33	4.98
10	3.98	6.58	6.92	7.62	7.97	8.66	9.96
20	7.97	13.2	13.9	15.2	15.9	17.3	19.9
30	12.0	19.7	20.8	22.9	23.9	26.0	29.9
40	15.9	26.3	27.7	30.5	31.9	34.6	39.8
50	19.9	32.9	34.6	38.1	39.8	43.3	49.8
60	23.9	39.5	41.6	45.7	47.8	52.0	59.8
70	27.9	46.1	48.5	53.3	55.8	60.6	69.7
80	31.9	52.7	55.4	61.0	63.7	69.3	79.7

### Installation

The APM380 is connected to the mains and load as shown in the drawing to the left. Here an example is shown where a frequency inverter is used. If this is not the case, L1, L2 and L3 are connected directly to the mains. The three wires supplying the motor (live wires) are lead through the tubes mounted in the unit. Each tube is encircled by a special CT capable of measuring currents linearly up to 130A. The CTs can withstand start-up currents up to 500A. For correct measurement the live wires must be lead through the correct tube as shown in the drawing. The direction of the current is not important but must be the same for all three phases. The power supply, the analogue outputs and the digital inputs are connected to a PLC or other equipment specified by the user.

### kWh output

The APM380 has a kWh output which is configurable via the digital input S6 as 1 impuls/kWh or 10 impulses/kWh. The pulse width is 300ms. If the APM380 is used with external CTs, the kWh must be scaled with the ratio of the external CT:

Ex.: Three 100/5A CTs are connected to the APM380.

Each impulse is then 100/5=20 kWh at 1 impulse/kWh and 2 kWh at 10 impulses/kWh.

### Filters

To accommodate applications with fluctuating power consumption, the APM380 is equipped with two sets of filters - one analogue and one digital. Each set consists of four filters, where one may be selected with two digital inputs (S2 & S3 for the digital filter and S4 & S5 for the analogue filter - see figure 2 below). The numbers at each filter indicate the equivalent time constant. A „-“ indicate a non-active filter.

The analogue filter affects the measurement and with that the basis of the kWh-calculation, whereas the digital filter only affects the analogue outputs.

### Special editions

As always we are ready to develop software in co-operation with our customers, so if the APM380 is unable to solve your problem, please do not hesitate to contact us for a special edition. For applications requiring control functions please refer to our APM382.

#### Digital input

S1	4-20mA(2-10V)	Off
	0-20mA(0-10V)	On
S2	Digital filter (fig. 2)	
S3	Digital filter (fig. 2)	
S4	Analogue filter (fig. 2)	
S5	Analogue filter (fig. 2)	
S6	1 puls/kWh	Off
	10 puls/kWh	On

#### Filter

Filter	S4(26)	S5(25)
200 ms	On	On
80 ms	Off	On
40 ms	On	Off
20 ms	Off	Off

Filter	S3(27)	S2(28)
4 s	On	On
2 s	Off	On
1 s	On	Off
+	Off	Off

Fig.2

Fig.1