Indicators.
The unit is equipped with 5 indicators (LEDs) which indicate to the user the condition of the unit:
1. Load. Lit continuously when the measurement exceeds 5% of the range. If the current flows the wrong way through the unit or is below 5% the indicator is **flashing.**
2. Ts. Illuminated when the measurement crosses 5% and is turned off when Ts expires.
3. High. Illuminated when the High Trip point is exceeded and the Tr timer is started.
4. Low. Illuminated when the Low Trip point is exceeded and the Tr timer is started.
5. Relay. Indicates the relay state; The LED is illuminated when the relay is ON, i.e. during normal operation.
When a Trip has occurred, the relay is OFF and the High Trip or Low Trip LED is flashing showing which Trip point was exceeded and tripped.

Max power range
The unit is constructed for measuring currents up to 65A. In the table below the recommended maximum ranges for standard supply voltages are shown.

U [V]	230	380	400	415	460	500	575
P[kW]	25.9	43.8	45.0	46.7	51.8	56.3	64.7

The internal current sensor is linear up to 130A, but the current should be limited to 65A due to the thru' hole diameter of 10mm (Ø0.39" = 6AWG max).
The built-in current sensor is protected against current peaks of up to 500A

Supply voltage
The unit needs separate supply voltage 1x120Vac or 1x230Vac. Connect 1x120Vac between terminals 9 and 11, or 1x230Vac between terminals 7 and 11.

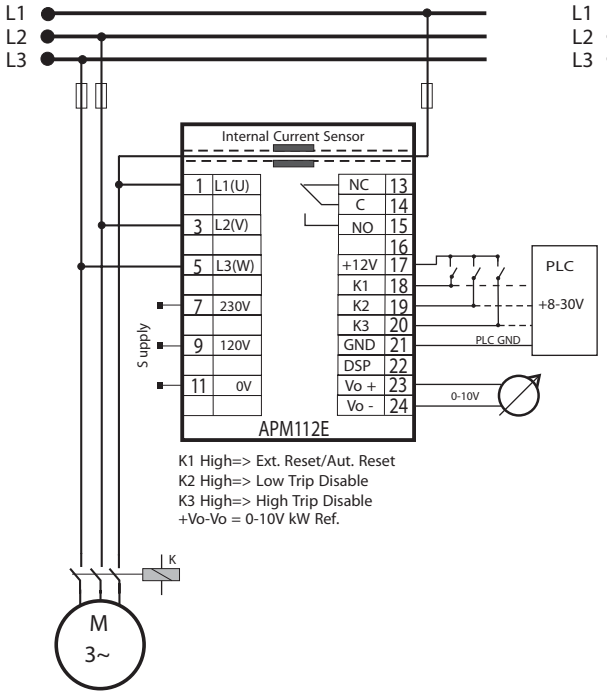

Fig.4 Typical connection with internal sensor

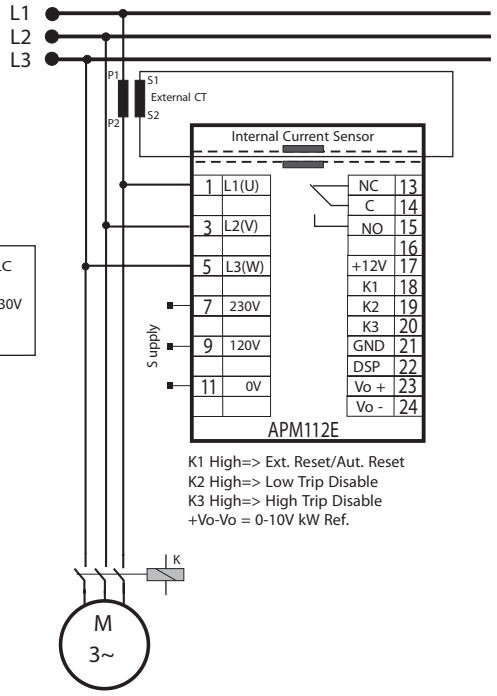

Fig.5 Typical connection with external CT

Unipower® APM112E

External supply: 1 x 120V / 230VAC 3x230-3x575VAC

Technical Specifications

Mechanical spec.
Housing
Upper part: Lexan UL94V-0
Lower part: Noryl UL94V-0
Mounting
M36 for 35mm DIN rail
CT dim: Max 10 mm lead-in
Terminals
Max 16 A. Max 2,5 mm^2
Use 60/75 copper (CU) wire only
Terminal tight torque: 7lbs/in, 0,79Nm
Protection class
IP40 (housing).
IP20 (connector).
Temperature range
-15 - +50 °C.
Weight: Approx. 300g.
Dimensions
D 58 x B 70 x H 86 mm.

Electrical spec.
Supply
1x120VAC or 1x230VAC ± 10%
Voltage Range
3x230 to 3x575VAC
Current range
Internal max. 0-65 A, Ext. N/5A C.T.
Power range
Max 65 kW using internal current sensor
Cosφ range: 0 - 1
Frequency range: 50 / 60 Hz.
Consumption: 3VA
Relay spec.: 250 VAC/5A.
Control inputs
+8-30VDC Galvanic isolated
Reference output
0-10VDC, for test only
Ext. DSP output: 10V/50mA max

CE EN61326/A2, EN61010-1 (EU)

c UL us Listed UL508, File E194022 (USA & Canada)

General

Unipower APM112E is a ***„low-cost"*** member of the **Unipower family**. The unit measures power from the formula:

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

The primary function of the unit lies in the supervision of machinery driven by 3-phase AC-motors - specifically the APM112E includes extended start- and resonse timers for pumping applications. It integrates programmable High and Low Trip points plus the support functions necessary to establish the efficient and compact supervision or control of various types of machinery such as pumps, fans and conveyor belts.
Besides the functions Ts, Tr and hysteresis, the APM112E has a built-in current sensor that measures currents up to 65A.
Option: External display via 2-wire connection, see PCU D12.

Overview

The basis of the unit is a specially developed 4-quadrant multiplier which together with a precision current sensor makes it possible to use the unit for measuring loads from 0.01kW to 65kW. For larger loads an external CT must be used. The unit accepts crest factors up to 5 and is therefore applicable for measuring before frequency inverters. The built-in limits and timers etc. will be described in the following paragraphs.

Different from most units in the Unipower family the APM112E is programmed directly in kW. Since the unit is externally supplied with 1x120Vac or 1x230Vac and measures voltages from 230Vac to 575Vac and currents up to 65A directly, the unit is applicable in most of the world without special modifications.

The setting up of the unit and its functionality is described in the following.

Measuring range internal sensor

By means of a 3-digit switch [kW Range/High Trip] a measuring range from 0.01kW to 9.99kW may be selected. If a larger range is needed, the chosen range may be multiplied by 10 by setting the switch [x10]. Using only the internal current sensor the maximum range is 65kW (See table on page 4). If a larger range is wanted an external CT (N/5A) is needed - N being the CT's primary current.

Measuring range ext. CT

To set up the measuring range when using an ext. CT, a simple calculation is necessary:

Ex: A measuring range of 100kW is wanted with a measuring voltage of 3x400V. Choose a CT of 200A. The winding ratio of a 200/5A CT is 40. The unit must be set to 100kW/40 = 2.5kW for a measuring range of 100kW, i.e:

[Range] = Measuring range/CT winding ratio

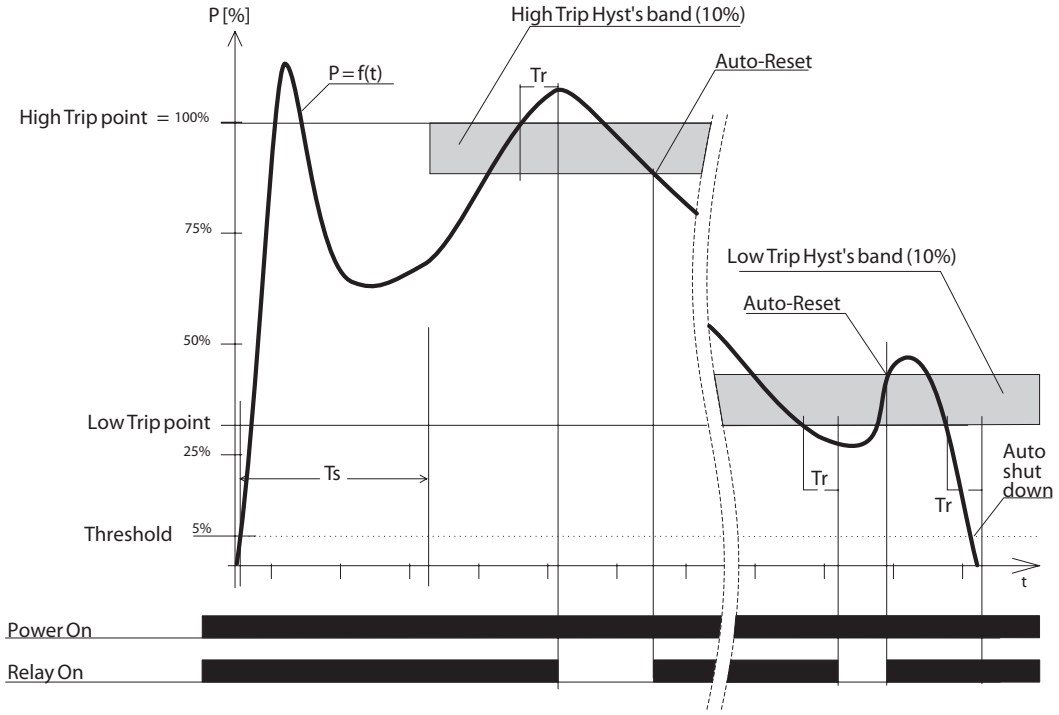

Figure 1

Functions

Figure 1 shows a typical AC-motor power consumption curve (ex. pump) immediately after power has been applied to the motor. At the bottom of the figure a bar is shown indicating the position of the relay (On/Off). The figure also shows the meaning of Ts, Tr and hysteresis.

High Trip

The High Trip point is always the same as the measuring range.

Low Trip

The Low Trip point is set from 20% to 80% of the measuring range. The Trip point is set in steps of 4% with the switch [Low Trip]. By normal shut down of the motor no alarm is generated (Auto shut down).

Ts: Start timer

The start timer (Ts) is used for avoiding alarms at motor start. The Ts delay function is activated after the power consumption reaches 5%. When Ts expires, Trip points, hysteresis and Tr become active. If the consumption drops below 5%, the supervision is switched off again.

Tr: Reaction timer

When a Trip point is exceeded the corresponding Tr is activated. The Trip point must be exceeded for the duration Tr before the relay position is changed to Off. If the measurement no longer exceeds the Trip point before Tr expires the timer is reset.

Auto Reset, Hysteresis

Figure 1 shows how possible High and Low Trip point hysteresis bands are placed relatively to the Trip points. The hysteresis equals 10% of the range and is fixed. Hysteresis is activated when a Trip is generated and the external reset is active (Input K1, Auto reset mode)

Manual Reset

An alarm may be reset either by pressing the key [Reset] or connecting the input K1 to 12V.

Alarm blocking

Ts blocks alarms during startup; blocking of alarms after startup may be done by connecting K2 and/or K3 to 12V.

Ex. 1: If a short overload is expected a PLC-output or the like may be used to block alarms for a given time.

Ex. 2: If only one Trip point is needed, the other may be blocked using K2 (Low Trip) or K3 (High Trip).

Choosing setpoints

Deciding the setpoint for the High Trip point [P1] may be done in two ways: Theoretically or by measuring the actual load.

Theoretically

Md = P2 x 60 / 2πn, where

Md: Torque where alarm should be given.

P2: Corresponding shaft power.

n: Revolutions in rev./min.

P1 = P2 + Po. Po is the idle power of the motor.

Measuring

Choose a range larger than the expected consumption at the given load.

1. Measure Vref (0-10Vdc) with a voltage meter and calculate the actual kW value, or

2. Set Tr Max to 10 sec. Decrease the range gradually until the High Trip indicator is flashing. Start by decreasing the first digit and end with the last digit.

When the actual load is known the setpoint for High Trip is set as required for the given application. The Low Trip point is set in % of the High Trip point and may be determined the same way.

Installation

The unit is installed as shown in the schematics on page 4

Voltage connection

The unit automatically adapts to measuring voltages from 3x230Vac to 3x575Vac. The phase order is of no importance, but it is **IMPORTANT** to measure the current in the same phase as connected to the units Terminal 1. Pay attention to the direction of the current.

Control inputs

The inputs K1, K2, K3 are isolated via opto-couplers and are activated by means of a dc-voltage of 8-30V. The control voltage may be taken from Terminal 17. The inputs may also be activated from PLC outputs as shown in the schematics.

Reference output

Terminals 23 and 24 supply a voltage of 0-10Vdc proportional to the measured power (kW). 10Vdc equals the range.

Note: Terminal 24 is connected to measuring Gnd formed by 3 pcs. 1Mohm resistors connected to the phases. I.e. no High Voltage, but connecting Terminal 24 to external equipment may result in measuring errors.