Indicators.
The unit is equipped with 5 indicators (LEDs) which indicate to the user the condition of the unit:
1. Load. Illuminated when the measurement crosses 5% of the measurement range. If the current flows the wrong way through the unit the indicator is **NOT** lit.
2. Ts. Illuminated when the measurement crosses 5% and is turned off when Ts expires.
3. Max. Illuminated when the Max limit is exceeded and the Tr timer is started.
4. Min. Illuminated when the Min limit 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 an alarm is active, the relay is OFF and the Max- or Min- LED is lit showing which limit was exceeded and tripped.

Max power range
The unit is constructed for measuring currents up to 80 A. In the table below the recommended maximum ranges for standard supply voltages are shown.

U [V]	380	400	415	440	460	480	500
P[kW]	52.7	55.4	57.5	61.0	63.7	66.5	69.3

The internal current sensor is linear up to 130A, but the current should be limited to 80A due to the maximum cable diameter of 10mm.
The built-in current sensor is protected against current peaks of up to 500A

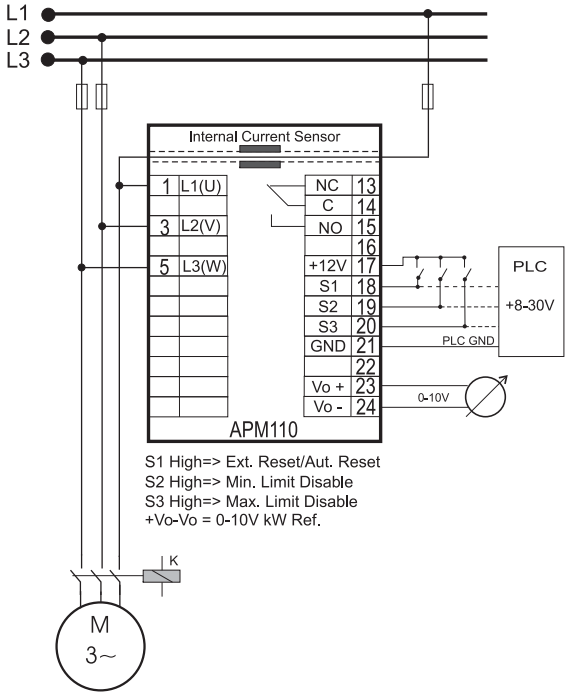

Fig.4 Typical connection with internal sensor

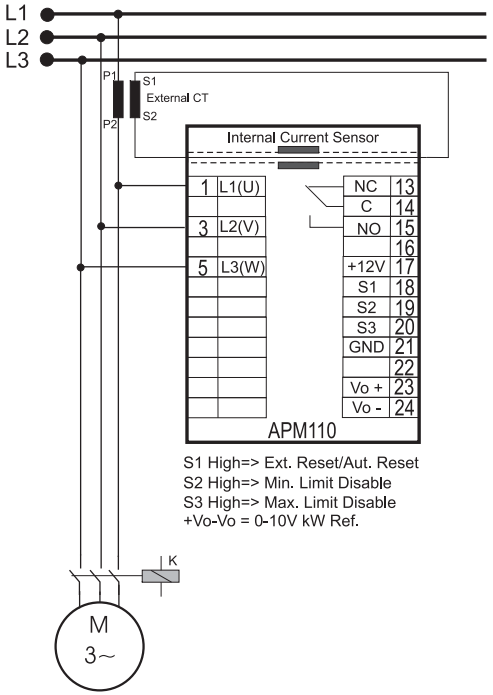

Fig.5 Typical connection with external CT

Unipower®

APM110

Technical information

3x380-3x500Vac

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
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 / Range
3x380 to 3x500Vac
Current range
Internal max. 0-80 A
(Surge: 500A/10sec.)
External: N/5 C.T.
Power range
Max 70 kW using internal current sensor
Cosφ range: 0.2-1
Frequency range: 50 / 60 Hz.
Consumption: 3VA
Relay spec.: 250 VAC/5A.
Control inputs: +8-30Vdc

CE mark to:
EN61326-1, EN61010-1

General

Unipower APM110 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. Unipower APM110 integrates a programmable Max. and Min. kW limit detector 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 APM110 has a built-in current sensor that measures currents up to 80A.

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 70kW. 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 other units in the Unipower family the APM110 is programmed directly in kW. Since the unit accepts supply voltages from 380Vac to 500Vac and measures currents up to 80A directly, the unit is applicable in most of the world without special modifications to the supply voltage.
The setting up of the unit and its functionality is described in the following.

Measurement range internal sensor

By means of a 3-digit switch [Range/Limit] a measurement 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 70kW (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.

Measurement range ext. CT

To set up the measurement range when using an ext. CT, a simple calculation is necessary:
Ex: A measurement range of 100kW is wanted with a supply 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 measurement range of 100kW, i.e:

[Range] = Meas'ment range/CT winding ratio

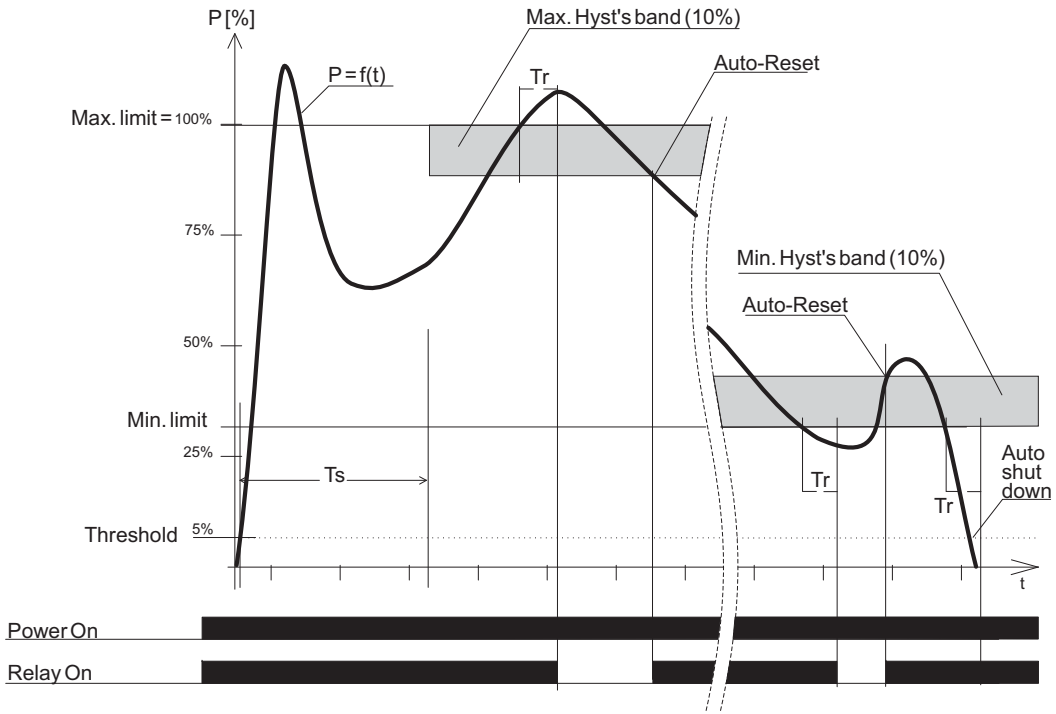

Fig. 1

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.

Max. Limit

The Max. limit is always the same as the measurement range.

Min. Limit

The Min. limit is set from 20% to 80% of the measurement range. The limit is set in steps of 4% with the switch [Min. Limit]. 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, limits, hysteresis and Tr become active. If the consumption drops below 5%, the supervision is switched off again.

Tr: Reaction timer

When a limit is exceeded the corresponding Tr is activated. The limit must be exceeded for the duration Tr before the relay position is changed to Off. If the measurement drops below the limit before Tr expires the timer is reset.

Auto Reset, Hysteresis

Figure 1 shows how possible Max. and Min. hysteresis bands are placed relatively to the limits. The hysteresis equals 10% of the range and is fixed. Hysteresis is activated when an alarm is generated and the external reset is active (Input S1, Auto reset mode)

Manual Reset

An alarm may be reset either by pressing the key [Reset] or connecting the input S1 to 12V.

Alarm blocking

Ts blocks alarms during startup; blocking of alarms after startup may be done by connecting S2 and/or S3 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 limit is needed, the other may be blocked using S2 (Max limit) or S3 (Min limit).

Choosing limits

Deciding the Max. limit [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 Max limit indicator is flashing. Start by decreasing the first digit and end with the last digit.
When the actual load is known the Max. limit is set as wanted for the given application. The Min. limit is set in % of the Max. limit and may be determined the same way.

Installation

The unit is installed as shown in the schematics on p. 4

Voltage connection

The unit automatically adapts to supply voltages from 3x380Vac to 3x500Vac. 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 S1, S2, S3 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 measurement 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 measurement errors.