

## Examples.

The examples below show the **LM-6** used as a combined Max. and Min. load protection unit. When a Max. limit is exceeded the Max. relay (1) is toggled and when the Min. limit is exceeded the Min. relay (2) changes state. The drawing does not show how the alarm relay is used in the actual protection scheme (application specific). The alarm must be re-set, either using the reset key located on the front panel or from the external reset input, S1. For motors, where the current exceeds 8 Amp., an external current converter must be inserted as shown below. In these examples the **LM-6** is mounted directly

at the motor-switch after the fuses.

If the input S1 and Gnd are shorted (Auto-Reset), the alarm activates the hysteresis function implementing a four-point regulation. This is for instance used in a grinding mill where the HPL420 measures the power consumption of the mill, but the relay output controls the feeder mechanism (belt, screw etc). The input S2 is used to disable the Max. & Min. alarms and its primary function is to avoid the generation of a Min. power alarm when the motor is stopped intentionally (normal shut down).

# LINEMAN

# LM-6

## Technical Information

English Edition

### Technical Specification

#### Electrical

##### Voltage Range

See technical info on the unit.  
Also Available:  
3 x 120 VAC -> 3 x 575 VAC

##### Current Range

Internal: max. 8 A.  
External: N/1 or N/5 converter.

##### Cosφ Range: 0-1.

##### Frequency Range: 45-65 Hz.

##### Consumption

Supply = measuring voltage, 3 VA.

##### Relay spec.: 240 VAC/5 Amp.

##### Analog Output

4-20 mA, 0-500 Ohm, electrically isolated from the measuring system.

#### Mechanical

##### Housing

Makrolon 8020 (30% GV), UL94V-1 (house).

Makrolon 2800, UL94V-2 (connector + front).

##### Mounting

Snap-on construction for 35mm DIN rail mounting or panel mounting.

##### Protection Class

IP40 (house).

IP20 (connector).

##### Operating Temperature Range

-15 - +50 °C.

##### Weight: Approximately 500g.

##### Dimensions: D 110 x W 56 x H 75 mm.

Terminal tight. torque: 7lbs/in, 0.79Nm

Use 60/75 copper (CU) wire only

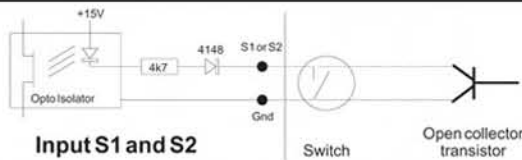
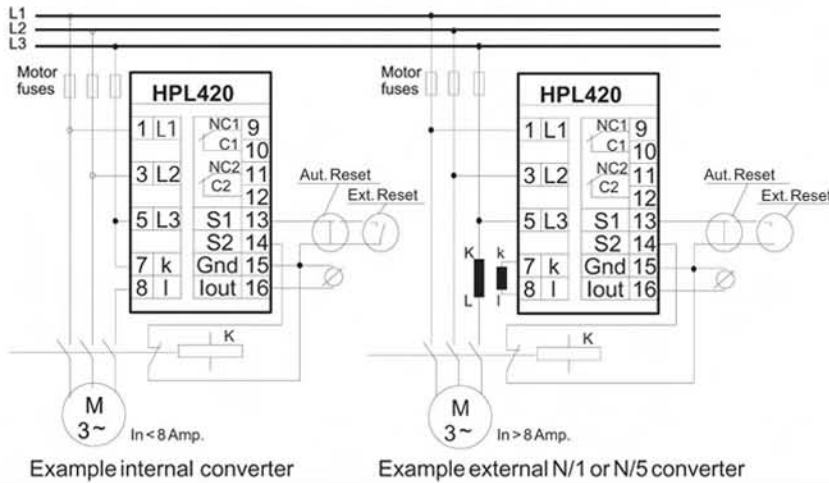
##### CE mark to:

EN50081-1, EN50082-2, EN61010-1

##### UL certified:

UL 508 - Industrial Control Equipment

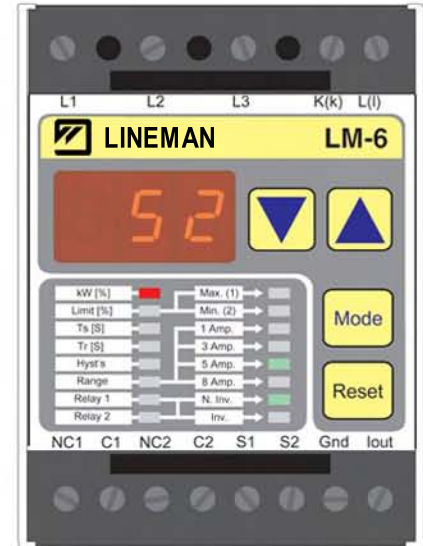
**Note!!! An external current converter must always be mounted in the L3-phase for correct measurements. The converter polarity is not important.**



If you need further information about the HPL-family of **Intelligent Power-Control Units** and its ability to solve your problems, please do not hesitate to contact us.



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### THE CONCEPT

The Unipower **LM-6** is a member of a family of **"Intelligent Power-Control Units"**. The unit measures true power-consumption and shows the consumption as a percentage of the selected power-range. The power-consumption (kW) is calculated from the following formula:

$$P = \sqrt{3} \times U \times I \times \text{Cos}\phi$$

The primary function of the unit lies in the supervision and control of machinery driven by 3-phased AC-motors. The **LM-6** integrates both a Max. and a Min. kW limit detector plus the support functions necessary to establish the efficient and compact supervision or regulation of various types of machinery such as pumps, ventilators and conveyor. As well as the support functions Ts, Tr, hysteresis etc. the **LM-6** has a built in current converter that works up to 8 Amp.

## Programming & Display.

Mode	Function	Parameter	▼	▲	Display	Default
[kW] %	Normal Mode		Min. Peak	Max. Peak	kW [%]	
Limit [%]	Max. Limit	5-100%	Decrease	Increase	Limit [%]	80%
Limit [%]	Min. Limit	5-100%	Decrease	Increase	Limit [%]	20%
Ts[S]	Start Delay	0.1-25.0 Sec.	Decrease	Increase	Ts [Sek]	2.0 Sec.
Tr[S]	Max. Alarm Reaction	0.0-25.0 Sec.*	Decrease	Increase	Tr [Sek]	0.1 Sec.
Tr[S]	Min. Alarm Reaction	0.0-25.0 Sec.*	Decrease	Increase	Tr [Sek]	0.1 Sec.
Hyst's	Max. Hysteresis	2-50%	Decrease	Increase	Hyst's [%]	10%
Hyst's	Min. Hysteresis	2-50%	Decrease	Increase	Hyst's [%]	10%
Range	Current Range	1, 3, 5, 8 Amp.	8 --> 1	1 --> 8	"Cur"	5 Amp.
Relay 1	Relay 1 Polarity	N. Inv./Invert.	N. Inv<-->Inv	N. Inv<-->Inv	"Pol"	N. Inverted
Relay 2	Relay 2 Polarity	N. Inv./Invert.	N. Inv<-->Inv	N. Inv<-->Inv	"Pol"	N. Inverted

\* 0.0 sec. equals an alarm delay of 10ms

The HPL420 is programmed by the use of only three keys located on the front panel. The mode key is used to switch the display from showing kW [%] to display one of ten programmable parameters. All the parameters and their programming ranges are listed in the function table above. The red mode LED in combination with the two red Max. and Min. LED's are used to show which parameter may be altered. When a parameter has been selected by the mode key, the value may be altered by the two arrow-keys. Note that the function of the keys is repeated if held down continuously. Parameters are stored in EEPROM. When no key has been activated for about 5 seconds the display returns to the kW [%] position (Normal Operation). When the Dip. Sw. 1 is 'On' the unit is protected against programming; but it is still possible to display current settings.

LED Usage	
Max. Alarm	Max. LED flashing
Min. Alarm	Min. LED flashing
Start Delay	Ts LED lit
Alarm Delay	Tr LED lit
Relay 1 Closed	Relay 1 LED lit
Relay 2 Closed	Relay 2 LED lit

Phase Error	Display
Phase order L1L3L2	PH 1 (flashing)

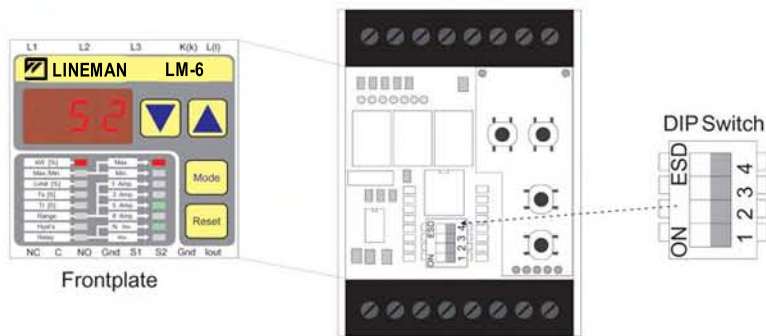
DIP Switch Usage		
SW 1	Unit protected	ON
SW 2	Phase order sup.	ON
SW 3	Not Used	
SW 4	Not Used	

The Phase order supervision generates an alarm if the three phases L1, L2 and L3 have been reversed. A phase error toggles the relay in exactly the same way as a Max. limit and the display shows which type of error has occurred. A phase error is automatically reset when it has been corrected. During a phase error the 4-20 mA signal out is set to 0 mA (possible remote alarm signalling).

### Dip. Switch Access.

1. Disconnect the Mains Power.
2. Remove the front plate. (Use a small screwdriver).
3. Change the switch settings and assemble the unit again.

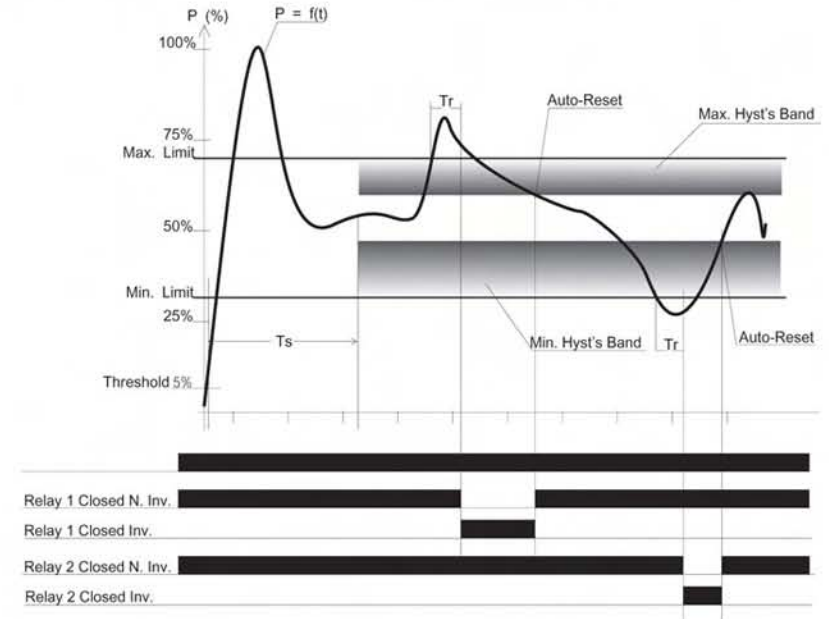
LM-6 UNIT



### Function.

The drawing below shows a typical AC-motor power consumption curve (ex. pump) immediately after power has been applied to the motor. The programmable start timer (Ts) is used to filter out from the protection/regulation cycle the large peak power consumption generated by the motor when starting. The Ts delay function is activated

exceeded. Tr is used to avoid alarms unless the power consumption has been greater than the limit for a certain time duration. The default reaction time is set to 100 ms from the factory, but it may be programmed as low as 10 ms from the keyboard. This very fast reaction time, which may be essential to a lot of applications, is possible only due to the extremely fast digital type of power measurement principle used in the



after the power consumption reaches 5%. When Ts expires, the limit, hysteresis, Tr etc. become active. If the power consumption drops below 5%, the supervising is switched off again. A spare break-switch from the Motor Switch must be connected to the S2 input, otherwise an alarm is generated each time the motor is switched off intentionally. The drawing also shows how the reaction timer (Tr) becomes active after the limit has been

HPL420. The figure also shows how a possible Maximum- and Minimum-hysteresis band would be placed relative to the corresponding limit. Hysteresis is activated when an alarm is generated and the external reset is active (Auto-Reset mode). A phase error (order or asymmetry) and a Max. or Min. alarm, without Auto-Reset, forces the Iout signal (4-20 mA) to 0 mA (possible remote alarm signalling).