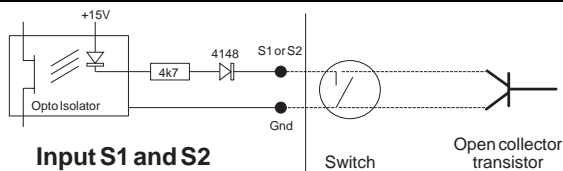
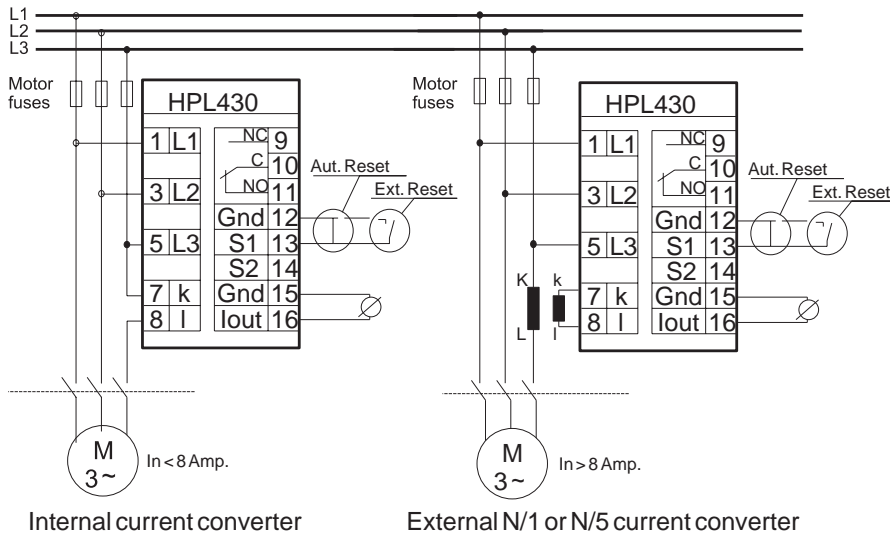


## Examples.

The examples below show the HPL430 used as a Max. load protection unit. When the Max. kW limit or the dP/dt limit is crossed an alarm is generated and the relay changes state. The drawing does not show how the alarm relay is used in the actual protection scheme (application specific). The alarm must be reset, either using the reset key located on the front panel or from the external reset input, S1. In these examples the HPL430 is mounted directly at the motor-switch after the fuses. If the input S1 and Gnd are shorted (Auto-Reset), the Max. kW alarm activates the hysteresis function implement-

ing a simple two-point regulation. This is for instance used in a grinding mill where the HPL430 measures the power consumption of the mill, but the relay output controls the feeder mechanism (belt, screw etc). **Note! When using autoreset the dP/dt-supervision is disabled.** The input S2 is used to disable the generation of alarms caused by the Max. kW or the dP/dt limit detector. The blocking of alarms is often necessary if the motor speed is changed either from a frequency converter or via a mechanical gear. If the motor current exceeds 8 Amp., an external current converter must be mounted as shown in the second example below.

**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 your distributor.

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# Unipower

HPL430  
Version 4.0

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, 0-400 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).

#### Temperature Range: -15 - +50 °C.

#### Weight: Approximately 500g.

#### Dimensions

D 110 x W 56 x H 75 mm.

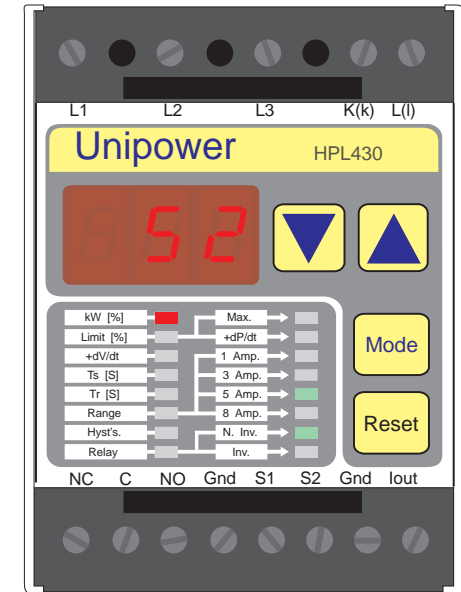
**Terminal tight. torque: 7lbs/in, 0.79Nm**  
**Use 60/75 copper (CU) wire only**

#### CE mark to:

EN50081-1, EN50082-2, EN61010-1

#### UL certified:

UL 508 - Industrial Control Equipment



## THE CONCEPT

The Unipower HPL430 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 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 HPL430 integrates a Max. kW and a special dP/dt limit detector. The unit has been developed specifically for the supervision of machinery that experiences variable power consumption because of shifting load or large temperature deviations. As well as the support functions Ts, Tr, hysteresis etc. the HPL430 has a built in current converter that works up to 8 Amp.

## Programming & Display.

Mode	Function	Parameter	▼	+	▲	Display	Default
[kW] %	kW display		Min. Peak	dP/dt Peak	Max. Peak	kW [%]	
Limit [%]	Max. kW limit	5-100%	Decrease	Increase	Limit [%]	80%	
Limit [%]	+dP/dt limit	1-50%	Decrease	Increase	Limit [%]	10%	
dV/dt	+dV/dt limit	1-25%	Decrease	Increase	dV/dt	5%	
Ts[S]	Start delay	0.1-25.0 Sec.	Decrease	Increase	Ts [Sek]	2.0 Sec.	
Tr[S]	Alarm reaction delay	0.0-25.0 Sec.	Decrease	Increase	Tr [Sek]	0.1 Sec.	
Range	Current range	1, 3, 5, 8 Amp.	8 --> 1	1 --> 8	"Cur"	5 Amp.	
Hyst's	Hysteresis	1-50%	Decrease	Increase	Hyst's [%]	10%	
Relay	Relay Polarity	N. Inv./Invert.	N. Inv.<-->Inv	N. Inv.<-->Inv	"Pol"	N. Inverted	

The HPL430 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 eight programmable parameters. All parameters and their programming ranges are listed in the function table above. The red mode LED in combination with the Max. and the +dP/dt LED 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. Parameters are stored in EEPROM. Note that the function of the keys are repeated if held down continuously. 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.

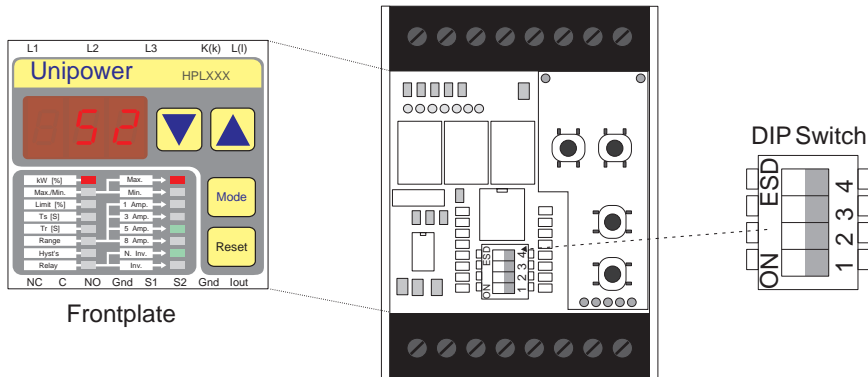
LED Usage		Phase Error		Display		DIP Switch Usage	
Max. Alarm	Max. LED flashing	Phase order L1 L3 L2	PH 1 (flashing)	SW 1	Unit protected	ON	
+dP/dt Alarm	+dP/dt LED flashing			SW 2	Phase order sup.	ON	
+dV/dt Excp.	+dV/dt LED lit			SW 3	Not used	OFF	
Start Delay	Ts LED lit			SW 4	Not used	OFF	
Alarm Delay	Tr LED lit						
Relay Closed	Relay LED lit						

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 the crossing of a 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 4-20mA signal Iout is set to 0 mA (possible remote alarm signaling).

## 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.

### HPL UNIT

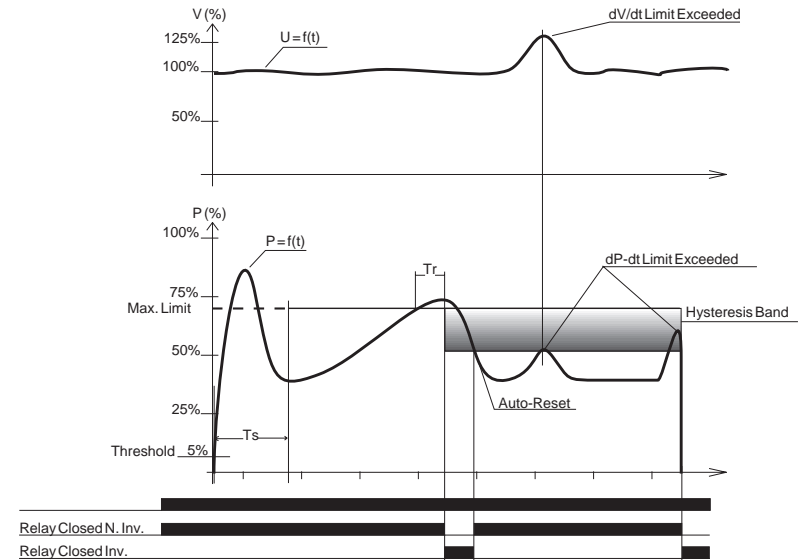


## Function.

The drawing below shows a typical AC-motor power consumption curve 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 after the power consumption reaches 5%. When Ts has expired, the limits (Max. kW [%], +dP/dt and +dV/dt), hysteresis, Tr etc. become active. If the power consumption drops below 5%, the supervision is switched off again. The HPL430 integrates, among others, an absolute Max. kW limit detector. The drawing shows how the reaction timer (Tr) becomes active

tegrates a special limit detector, a dP/dt (immediate power increase) detector, which has been developed in order to solve very complex cases of supervision. A couple of situations are described here.

- 1.) A machine is driven by an AC-motor with a large gear, which has a high exchange ratio. The gear typically has a large idle power consumption when the motor is cold, but the power consumption decreases with rising temperature. Such cases are not easy to load protect using only an absolute Max. kW limit, but the dP/dt supervision included in this unit can be used to great advantage, mainly because the dP/dt increases usually are caused by mechanical reasons (blocking from goods etc.).
- 2.) The supervision of a conveyer belt or chain of receptacles are also critical cases of load protec-



after the Max. limit has been 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 HPL430. The figure also shows how a possible Max. hysteresis band would be placed relative to the Max. limit. Hysteresis is activated when a Max. kW alarm is generated and the external reset is active (Auto-Reset mode). **Note! The +dP/dt limit is ignored when hysteresis is active.** Besides the absolute Max. kW limit the HPL430 in-

tion because the load is highly variable. In order to avoid false alarms by sudden mains voltage increases a dV/dt detector has been integrated into the HPL430. A voltage increase typically results in a square idle power consumption increase and might cause false alarms. If the dV/dt limit is exceeded simultaneously with a dP/dt infringement, the dP/dt is ignored. The dV/dt limit must be programmed so that the dV/dt LED is not lit by normal operation, 5-8% is a typical figure perhaps 10% when the mains are unstable. The dP/dt limit typically varies from 5-15% but the value is application specific.