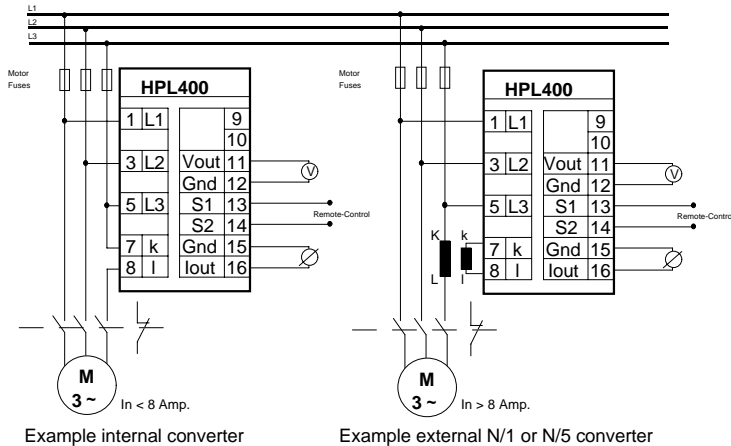


## Examples.

The drawing below shows the HPL400 connected to an AC-motor. In these examples the HPL400 is mounted directly at the motor-switch after the fuses. This enables the use of phaseasymmetrisupervision (motor-fuse blown). If the motor is controlled by a

frequency converter then the HPL400 must be mounted before the converter and the Dip. SW1 set to the "On" position ( $\cos\phi = 1$ ). If the motor current exceeds 8 Amp. then 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.**



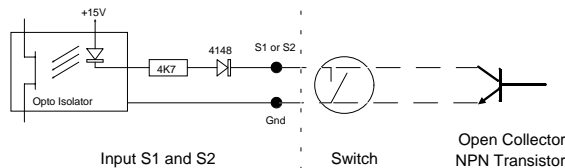
## Remote-Control

If the Dip. switch SW4 is set to the "On" position then the HPL400 is programmed for remote-control. The table to the right shows how Iout/Vout is controlled from the two digital inputs S1 and S2. In this case the HPL400 Iout/Vout is no longer programmable from the keyboard. After changing S1, S2 the PLC must

wait 50 ms before reading a new measurement variable.

S1	S2	Iout/Vout
Off	Off	kW [%]
On	Off	I [A]
Off	On	U [V]
On	On	Cosphi

Iout/Vout Remote-Control using S1, S2



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.

# WENtechnology

Raleigh, NC, USA

(919) 954-1004 [www.wentec.com](http://www.wentec.com)

# Unipower

Version 3.1  
HPL400 3 x 460 Volt

Technical Information

English Edition

## Technical Specification

### Mechanical

#### Housing

Makrolon 8020 (30% GV), UL94V-1 (house).  
Makrolon 2800, UL94V-2 (connector + front).

#### Mounting

Snap-on construction for 35mm mounting rail or wall mounting.

#### Protection Class

IP40 (house).  
IP20 (connector).

#### Temperature Range:

-15 - +50 °C.

#### Weight:

Approximately 500g.

#### Dimensions

D 75 x W 56 x H 110 mm.

### Electrical

#### Voltage Supply

400 - 500 Volt AC.  
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 voltage = measurement voltage, 3 VA.

#### Analog Output

4-20 mA, 0-400 ohm.  
0-10V Min. load 1 Kohm.  
Both outputs are electrically isolated from the measurement system.

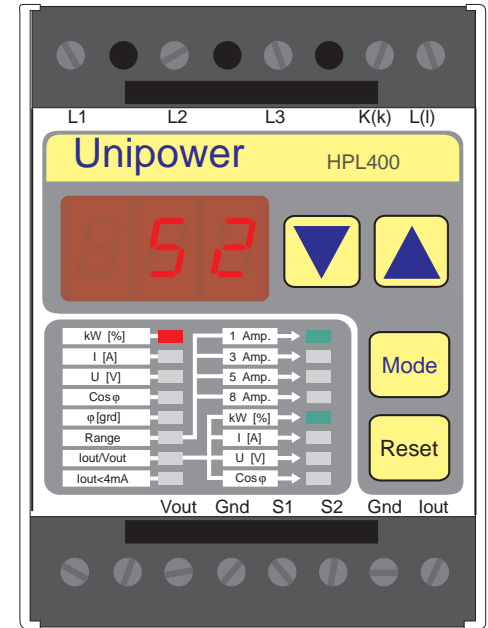
Terminal tight. torque: 7lbs/in, 0.79Nm  
Use 60/75 copper (CU) wire only

#### CE mark to:

EN50081-1, EN50082-2, EN61010-1

#### UL certified:

UL 508 - Industrial Control Equipment



## THE CONCEPT

The Unipower HPL400 is a member of a family of **"Intelligent Power-Control Units"** which is based upon the latest advance in the Microcontroller Technology. The unit measures true power-consumption and displays the consumption as a percentage of the selected power-range. The consumption (kW) is calculated from the following formula:

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

The HPL400 is a dedicated measurement transducer for PLC-interface etc. Beside the measurement of kW the unit also measure AC-voltage (U, Volt), AC-current (I, Amp.), angle φ and cosφ. The unit has a remote control option that enables the PLC to read both kW, U, I and cosφ. The unit register max./ min. values for all variables and the values are displayed by the activation of a single key. The HPL400 has a built in current converter that works up to 8 Amp.

## Programming & Display.

Mode	Function	Variable			Display	Default
[kW]%	kW display		Min. kW [%]	Max. kW [%]	kW [%]	
I [A]	AC-current display		Min. I [A]	Max. I [A]	I [A]	
U [V]	AC-voltage display		Min. U [V]	Max. U [V]	U [V]	
Cosφ	Cosφ display		Min. Cosφ	Max. Cosφ	Cosφ	
φ [deg]	φ display		Min. φ [deg]	Max. φ [deg]	φ [grd]	
Range	Define current-range	1, 3, 5, 8 Amp.	8 --> 1	1 --> 8	"Cur"	5 Amp.
Iout/Vout	Define analog output	kW [%], I [A], U [V], Cosφ	Decrease	Increase	"Iou"	kW [%]

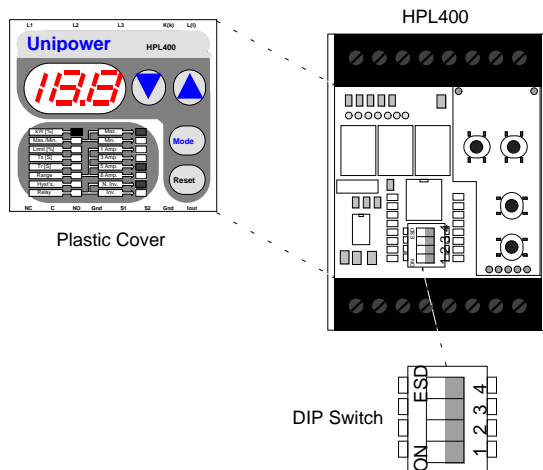
The HPL400 is programmed by the use of only three keys located at the front panel. The mode key is used to switch the display from showing kW [%] to display one of six variables (all variables and their ranges are listed in the function table above). The red mode LED is used to show which variable that is currently selected. Only "Range" and "Iout/Vout" are programmable by the use of the arrow-keys when chosen. For the remaining variables (measurement values) the arrow-keys are used to show the min. or max. peak so far reached. The max./min. peaks are reset after power-on or from the activation of the reset-key. Note that the keys are repeated if held down continuously. Variables are stored in EEPROM. When no key has been activated for about 5 seconds the display returns to the kW [%] position (Normal Operation).

LED Usage		Phase Error	Display	DIP Switch Usage	
Iout < 4mA	Iout < 4mA LED lit	Phaseorder L1 L3 L2	PH 1 (flashing)	SW 1	Measure before freq. cv. ON
Used to indicate cablebreak or no connection.		Voltage deviation > 8%	PH 2 (flashing)	SW 2	Phaseordersuperv. ON
		Phasedeviation > 5 degree	PH 3 (flashing)	SW 3	Phaseasymmetrisuperv. ON
				SW 4	Remote-Control S1S2 ON

The phaseorder supervision generates an alarm if the three phases L1, L2 and L3 have been reversed. The phaseasymmetrisupervision is a combination of voltage deviation- and phasedeviation-supervision. 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.

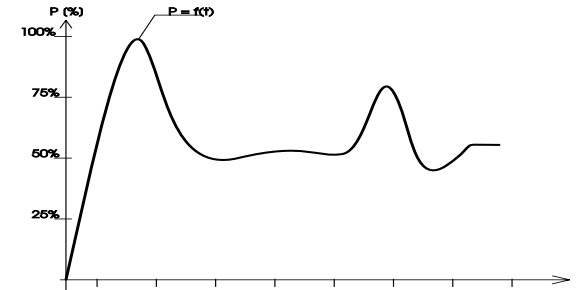
### Dip. Switch Access.

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



### Function.

The drawing below shows a possible AC-motor power consumption curve immediately after that



power has been applied to the motor. Unlike other members of the HPL400-family the HPL400 integrates no control or regulation functions. Only current range and the output function (Iout/Vout)

are programmable. Control or supervision functions are realized in the PLC-unit. A phaseorder or a phasesymmetrierror forces the Iout signal (4-20 mA) to 0 mA. The HPL400 measures the

mains voltage as an average of the three phasevoltages,  $V = (UL1 + UL2 + UL3) / 3$ . The current and the angle  $\phi$  are measured in one phase only, L3.

### Measurement Ranges & Precision.

Power Consumption: $P = \sqrt{3} \times 460 \times \cos\phi$ (3%)			
Range	Display=100%	Range	Display=100%
1 Amp.	0.80 kW	25 Amp.	19.92 kW
3 Amp.	2.39 kW	50 Amp.	39.84 kW
5 Amp.	3.98 kW	100 Amp.	79.67 kW
8 Amp.	6.37 kW	200 Amp.	159.35 kW
Internal converter, display = 0-150% Analog Output 20mA & 10V at 100%		External converter, display = 0-150% Analog Output 20mA & 10V at 100%	

When an external N/1 or N/5 current converter is used, then the power range is calculated from the formula:  $P = \sqrt{3} \times 0.460 \times N = 100 \% \text{ (kW)}$ .

With a N/1 converter the 1 Amp. current range must be selected. With a N/5 converter the 5 Amp. current range must be selected.

AC-current, I [A] (2%)		Angle $\phi$ & $\cos\phi$ (1%)			AC-voltage, U [V] (2%)	
Range at 100%	Display = 0-125%	Measure	Display	Analog Output	Measure*	Display
1 Amp.	0-1.25 Amp.	angle = 0°	0	-	400 V~	400
3 Amp.	0-3.75 Amp.	angle = 90°	90	-	500 V~	500
5 Amp.	0-6.25 Amp.	$\cos\phi$ at 0°	1.00	20 mA & 10V	* $V_m = (UL1 + UL2 + UL3) / 3$ Analog Output 20mA & 10V at 500V~	
8 Amp.	0-10.0 Amp.	$\cos\phi$ at 90°	0.00	4 mA & 0V		
Analog Output 20mA & 10V at 100%		angle $\phi$ range is 0-90° inductive				

The measurement ranges and precisions shown above are valid for sine-shaped voltages. The current is integrated for each voltage half-period. The integration ensures that the power is measured correct, even at very large form-factors, as for instance is seen when the unit is mounted before a frequency converter. The power calculation are accurate for symmetrical 3-Phase loads only. With 1-Phase loads the power measurement must be divided by 3.