## Example.

The drawing below shows the HPL405A connected to an AC-motor. If the motor is controlled by a frequency inverter the HPL405A must be mounted **before** the converter. The HPL405A includes an internal current converter for currents up to 8 Amp. Larger currents require an external N/1 or N/5 current converter.
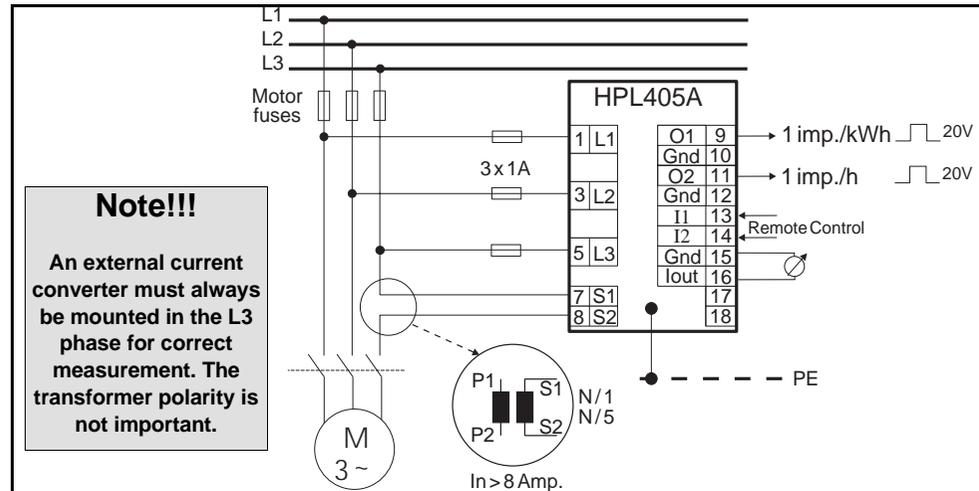
Note!!!

An external current converter must always be mounted in the L3 phase for correct measurement. The transformer polarity is not important.

Remote Control.

If the Dip. switch SW1 is set to the "On" position then the HPL405A is programmed for remote-control. The table to the right shows how Iout is controlled from the two digital inputs I1 and I2. In this case the HPL405A Iout is no longer programmable from the keyboard. After changing I1, I2 the PLC must wait 50 ms before reading a new measurement variable.

I1	I2	Iout
Off	Off	kW [%P1]
On	Off	I [A]
Off	On	U [V]
On	On	Power faktor

Iout remote-control by I1, I2
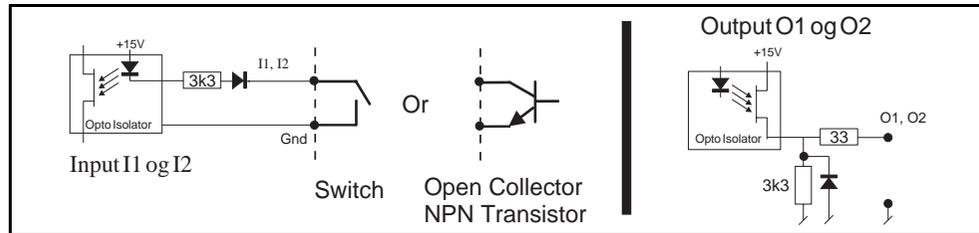
If you need further information about the HPL-family of *Intelligent Power-Control Units* and its ability to solve your problems, please do not hesitate to contact us.

WENtechnology

Raleigh, NC, USA

(919) 954-1004 *www.wentec.com*

Unipower HPL405A
Version 1.4 — 3 x 460 Volt

Technical Information   English Edition
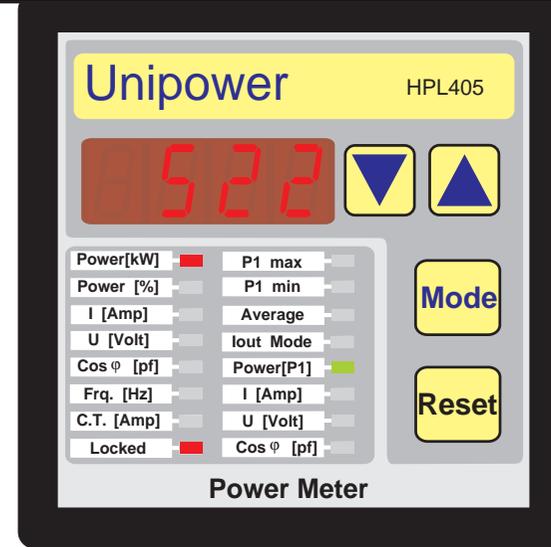
Technical Specification

Mechanical
   Housing: Noryl.
   Mounting: Panel mounting.
   Protection Class: IP54.
   Operating Temperature Range: -15 - +55 ℃.
   Weight: App. 400g.
   Dimensions: D 143 x W 72 x H 72 mm.

Electrical
   Power Supply: 410 - 510 VAC.
   Current Range
      Internal: max. 8 Amp.
      External: N/1 or N/5 converter.
   Power factor Range: 0-1.
   Frequency Range: 50/60 Hz.
   Consumption:
      Power supplied from measurement circuit, 3 VA.
   Analogue Output
      4 (0)-20 mA, 0 - 400 ohm.
      The output is electrically isolated from the measurement system and short circuit protected.

CE mark to:
   EN50081-2, EN50082-2, EN61010-1

T H E   C O N C E P T

The Unipower HPL405A is a member of a family of *Intelligent Power-Control Units*, which is based upon the latest advance in Microcontroller technology. The unit calculates and measures true power consumption from the formula:

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

The unit is a pure measurement transducer for PLC interface etc. Besides kW the unit also measures true RMS-Voltage (U, Volt), RMS-Current (I, Amp.) and power factor. The unit may be remote controlled from a PLC in a way which enables the PLC to read both kW, U, I and power factor on the same analogue input. The unit registers max./min. values of all variables and the values are displayed by the activation of a single key. The analogue output may be scaled both from top and bottom if necessary. The HPL405A either displays true kW or kW as a percentage of the selected measurement range.The HPL405A includes a internal current converter that works up to 8 Amp.

Programming & Display

Mode	Function	Variable	▼	▲	Display	Default
Power(kW)	kW display		Min. kW	Max. kW	kW	
Power(%)	kW (%P1) display		Min. kW (%P1)	Max. kW (%P1)	kW (%P1)	
I (Amp.)	AC-current display		Min. I [Amp]	Max. I [Amp]	I (Amp.)	
U (Volt)	AC-voltage display		Min. U [Volt]	Max. U [Volt]	U (Volt)	
Cosφ (pf)	Cosφ/P.F.display		Min. P.F.	Max. P.F.	Power factor	
Frq. (Hz)	Frequency display		Min. frequency	Max. frequency	Frequency	
C.T.Amp.	Converter size/type	Int./n-1/n-5 (see table)	Decrease	Increase	1 - 5000 Amp.**	int, 1 Amp.
Locked	Programming lock	On, Off			"On/Off"	"On"
P1 max	P1 max define	kW = 20 mA setpunkt	Decrease	Increase	20 mA setpoint	0.797 kW
P1 min	P1 min define	kW = 4(0) mA setpunkt	Decrease	Increase	4(0) mA setpoint	0 kW
Average	Averaging interval	0.1 - 5.0 Sec.	Decrease	Increase	0.1 - 5.0 sec.	0.5 sec.
Iout Mode	Analog output mode	kW(%)/I(A)/U(V)/P.F.			"Iout"	kW(%)

(**) The display changes between converter size and type

The HPL405A is operated by four keys located on the frontpanel. The "Mode"-key is used to change the display from showing kW to display/alter one of the other variables. All the variables and their programming ranges are shown in the table above. The led on the front shows which variable is chosen. Before a varible is changed the unit must get **'unlocked'**. This is done by activating the "mode"-key until the led **'Locked'** is lit. The display now shows **'On'** and when both "arrow"-keys are activated continuously for 5 seconds the display shows **'Off'** and the unit is programable. The led **'Locked'** flashes when the unit is unlocked again. The unit is locked again when the reset-key is activated or when 5 minuttes has elapsed. Variables are saved into EEPROM. For the measurement variables the arrow-keys are used to show **max./min. values**. If no key has been activated for 5 second the display returns to the position programmed into Iout. The max.min. values are preset to actual values during power-on or by the activation of the reset-key.Note! The keys' functions are repeated when continously activated.

Measurement Ranges.

Analogue output 4 - 20 mA:

Power(%P1)
   kW = P1min = 4 mA
   kW = P1max = 20 mA.

I (Amp)
   I = 0.0 Amp = 4 mA
   I = C.T. Amp = 20 mA.

U (Volt)
   U = 0.0 Volt = 4 mA
   U = Nominal Voltage + 10% = 20 mA
   ex. 460 Volt + 10% = 506 Volt

Power Factor
   P.F. = 0.0 = 4 mA
   P.F. = 1.0 = 20 mA.

P = √3 x 460 x I x cosφ (2%)			
C.T.[Amp]	P1max	Extern N/1, N/5 [Amp]	P1max
Intern, 1 Amp	0.797 kW	75 Amp.	59.8 kW
Intern, 2 Amp	1.59 kW	100 Amp.	79.7 kW
Intern, 3 Amp	2.39 kW	125 Amp.	99.6 kW
Intern, 4 Amp	3.19 kW	150 Amp.	120 kW
Intern, 5 Amp	3.98 kW	200 Amp.	159 kW
Intern, 6 Amp	4.78 kW	250 Amp.	199 kW
Intern, 7 Amp	5.58 kW	300 Amp.	239 kW
Intern, 8 Amp	6.37 kW	400 Amp.	319 kW
		500 Amp.	398 kW
		600 Amp.	478 kW
		700 Amp.	558 kW
		750 Amp.	598 kW
		800 Amp.	637 kW
		900 Amp.	717 kW
Extern N/1, N/5 [Amp]	P1max	1000 Amp.	797 kW
10 Amp.	7.97 kW	1200 Amp.	956 kW
15 Amp.	12.0 kW	1250 Amp.	996 kW
20 Amp.	15.9 kW	1500 Amp.	1200 kW
25 Amp.	19.9 kW	2000 Amp.	1590 kW
30 Amp.	23.9 kW	2500 Amp.	1990 kW
40 Amp.	31.9 kW	3000 Amp.	2390 kW
50 Amp.	39.8 kW	4000 Amp.	3190 kW
60 Amp.	47.8 kW	5000 Amp.**	3980 kW

Function.

The drawing below shows a possible power consumption curve of an AC-motor immediately after power has been applied to the motor. Opposite other members of the Unipower family, the HPL405A does not include dedicated control function (relays). Current range (C.T. Amp.), output function (Iout mode), P1max,

power band. The analogue output signal (Iout = 4-20 mA) is now proportional to the power consumption within the band. The drawing below shows the HPL405A programmed to use a 100/1 current converter, which corresponds to a maximum power consumption of 69.3 kW. **P1max** is then set to 40kW and **P1min** to 20 kW. Now the analogue output signal equals 20 mA at 40 kW and 4 mA at 20 kW.
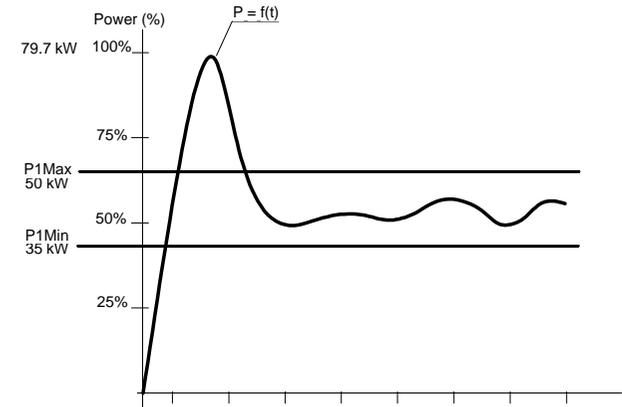
P1min and averaging interval is however programable from the front panel. Regulation and control functions must be realized in a PLC-unit etc. The HPL405A implements a pure digital measurement principle where current and voltage is sampled at the rate of 20 kHz. The HPL405A measures true RMS-values of both current and voltage. When current range has been selected from the front panel (**C.T. Amp**) the maximum power range is readable in the mode **P1max**. The mode **P1min** displays zero immediately after current range has been selected. It is now possible to scale **P1max** downwards and **P1min** upwards to create a narrow

The mode **Power(%)** on the front panel always shows 100%, when the power consumption is equal to or greater than **P1max** and zero when the consumption is equal to or less than **P1min**.
The **output O1** is a pulse output with1 pulse/kWh. The width of the pulse is changeable between 30ms and 1000ms. After having unlocked the unit (see page 2) Press both arrow-keys simultaneously until a number is flashing in the display. This number is the puls width in ms and may altered by activating the arrow-keys. When finished press the Reset key and the unit returns to showing kW.

Dip. switch usage.

The dip. switch is not immediate accessible to the user. In order to access the switch the four screws at the back of the unit must be removed. Then the unit must be pulled out of the housing and the dip. switch is located at the front panel pcb (printed circuit board) between the two rows of leds. Dip. switch no. 1 is used to enable/disable remote control (**Sw1 'On' = remote control, default = 'Off'**). Dip. switch no. 2 is reserved for future use and must be **'Off'**. Dip. switch no. 4 is reserved for calibration purpose and must be **'Off'**. To use the unit as a single phase unit, please contact your local dealer.