

# Display & Programming.

| Mode      | LED       | Function          | Parameter      | ▼         | ▲         | Display       | Default |
|-----------|-----------|-------------------|----------------|-----------|-----------|---------------|---------|
| %         | Red       | Measurement in %  |                | Min. Peak | Max. Peak | %, kW, HP**   |         |
| kW / HP   | Red       | Measurement in kW |                | P2        | P1Max     | kW            |         |
| kW/HP     | Green     | Measurement in HP |                | P2        | P1Max     | HP            |         |
| Ts        | Red       | Start timer       | 0.0 - 999 sec. | Decrease  | Increase  | Ts[Sec]       | 2.0     |
| Tr        | Red       | Response timers   | 0.0 - 999 sec. | Decrease  | Increase  | Tr[Sec]       | 0.1     |
| Parameter | Red       | Parameter access  | P00 - P15      | Decrease  | Increase  | Parameter no. |         |
| Limit 1   | Red/Green | Setpoint limit 1  | 6 - 99 %**     | Decrease  | Increase  | Setpoint [%]  | 80**    |
| Limit 2   | Red/Green | Setpoint limit 2  | 6 - 99 %**     | Decrease  | Increase  | Setpoint [%]  | 20**    |
| Range I/U | Red       | Current range     | 0.5 - 600/5A   | Decrease  | Increase  | Current [A]   | 10      |
| Range I/U | Green     | Voltage range     | 100 - 575 Vac  | Decrease  | Increase  | Voltage [V]   | 460*    |
| Relay 1   | Red       | Relay polarity 1  | n.inv/inv      | Decrease  | Increase  | n.in/in       | n.in    |
| Relay 2   | Red       | Relay polarity 2  | n.inv/inv      | Decrease  | Increase  | n.in/in       | n.in    |

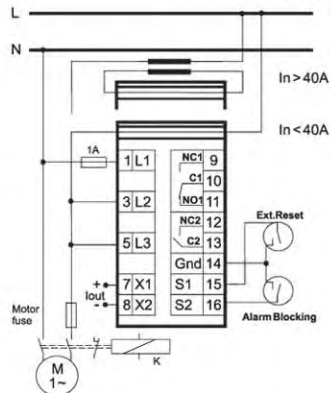
\* Depends on order specifications  
 \*\* Value depends on display mode (P02)

The **LM 580** is programmed by the use of only three keys located on the front panel. The "MODE" key is used to select one of the programmable parameters. All directly accessible parameters as well as their adjustable range are listed in the table above. Parameters are stored in EEPROM. If no key is activated for approx. 30 seconds, the display defaults to showing the measurement. The function of the keys is repeated if held down continuously. **Note:** If P15 is enabled P01 must be unlocked before changing parameters.

Access to the parameter list is found under the field „Parameter“. The display shows P00, which using the arrow-up key must be changed to the desired number (see table to the right). Upon pressing the „Mode“ key the value of the selected parameter is shown. It may now be changed using the arrow keys. To store the new value press the „Mode“ key and the unit returns to the parameter list. Pressing the „Reset“ key instead of the „Mode“ key discards the new value and keeps the old value and the unit returns to showing the measured value.

**Note:** When displaying setpoints a max-limit is displayed with a red LED and a min-limit with a green LED. This only applies to setpoints and not alarms, which are always displayed with a flashing red LED.

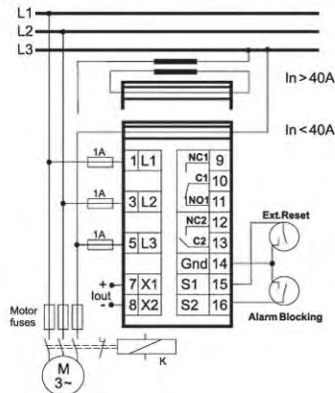
**Note: Current must be measured in the L3 phase (Terminal 5).  
 Direction is not important**



Single phase - connect phase to both L2 & L3  
 Connection to a single phased load

| Nr. | Parameter            | Range             |
|-----|----------------------|-------------------|
| P01 | Keylock              | Off, On*          |
| P02 | Display mode         | %, kW, HP         |
| P03 | Type limit 1         | Off, Lo, Hi       |
| P04 | Type limit 2         | Off, Lo, Hi       |
| P05 | Auto Shut Down       | Off, On           |
| P06 | Hysteresis limit 1   | Off, 1 - 50%**    |
| P07 | Hysteresis limit 2   | Off, 1 - 50%**    |
| P08 | Maximum shaft power  | 40 - 100% of P*** |
| P09 | Motor efficiency     | 50 - 100%         |
| P10 | lout = P1 or P2      | P1, P2            |
| P11 | Pmin (lout = 0(4)mA) | 0 - 50%           |
| P12 | Pmax (lout = 20mA)   | 50 - 100%         |
| P13 | Type of lout         | 0-20mA, 4-20mA    |
| P14 | lout mode            | n.inv, inv.       |
| P15 | Auto lock            | Off, On           |
| P16 | Damping filter       | Off, On           |
| P17 | S2 Select            | nor, SPC          |
| P18 | Factory settings     | Par, rSt-dEF      |

Underlined values are factory settings  
 \* If P15 is enabled default is On  
 \*\* Value is set in %, kW or HP (depending on display mode) in the range equivalent to 1-50% of the Maximum Shaft power (P08)  
 \*\*\* Value is set in kW or HP (depending on display mode) in the range equivalent to 40 - 100% of the measuring range (P)



Connection to a three phased load

# LINEMAN

**LM580**  
 Version 1.0

## Technical information

English edition

### Technical Specifications

#### Mechanical spec.

##### Housing

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

##### Mounting

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

##### Protection class

IP40 (house).  
 IP20 (connector).

##### Operating Temperature range:

-15 - +50 °C surrounding air.

##### Weight: Approx. 250g.

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

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

#### Electrical spec.

##### Supply / measuring voltage

1x100 - 1x400Vac, 10 ranges.  
 3x100 - 3x575Vac, 17 ranges

Ranges selectable via face plate

##### Current range

Internal: 0.5, 1, 2.5, 5, 10, 20, 30 & 40A  
 External: With N/5A converter (50-600A)

Ranges selectable via face plate

##### Accuracy: Class 2.

##### Consumption: 2 VA

##### Frequency range: 45 - 65 Hz

##### Relay spec.: 250 VAC/5 Amp.

##### Analogue output

0(4)-20mA, max load 400Ω  
 galvanically isolated from the measuring system.

##### CE-mark to:

EN61326-1, EN61010-1

##### UL certified:

UL508, File E194022

### Generally

**Lineman LM580** is equipped with a specially developed power supply for use from 100V - 575V - both single phased and three phased. Mains voltages in the whole world is hereby covered with one unit. **LM 580** also measures currents up to 40A without the use of an external current converter.

As all **Lineman LM**-modules the **LM 580** naturally integrates the functions necessary to establish an efficient and compact supervision or control; Start timer, reaction timer, setpoints etc.

For setup simplicity the **LM 580** includes peak detectors on the power measurement.

In addition to % all setpoints may be entered in kW or HP.





**Generally**

The measurement is based on a fast four quadrant multiplication of current and voltage making the **LM 580** capable of measuring the exact power consumption also on frequency inverters.

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

**Voltage range:**

The **LM 580** is equipped with a newly developed power supply unit making the unit applicable for voltages from 100V to 575V - single phased as well as three phased. Simply set up the connected voltage via the front.

**Measuring range:**

The unit contains a current converter up to 40A. Internally the range may be selected from 0.5A to 40A in 8 steps. If a larger range is required an external N/5A CT must be used. As for the voltage - just select the CT via the front and the **LM 580** computes the kw range as  $P = \sqrt{3} \times U \times I$ . The readout as well as the setpoints are limited to this range. Ex:

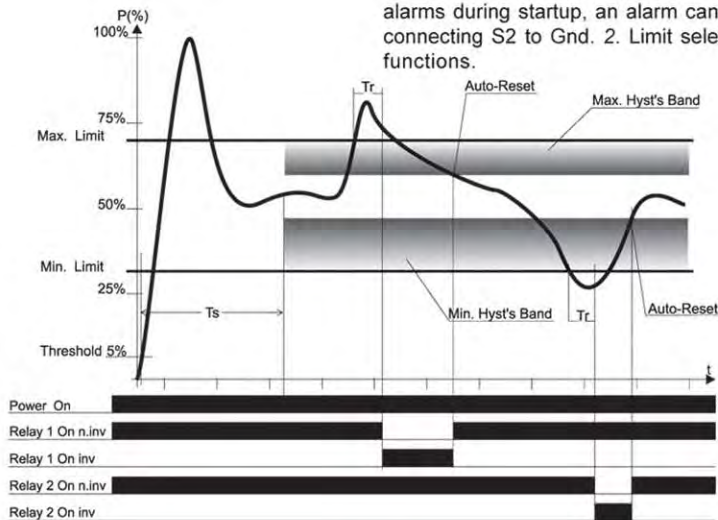
1A and 400V gives a range of  $P = 0,69kW = 100\%$

**Functions**

The figure below shows a typical consumption curve for an AC-motor (e.g. pump) immediately after power has been applied to the motor. Below the curve a bar shows the state of the relays.

**Ts: Start timer**

The programmable start timer (Ts) is used to avoid alarms at motor start. When the power consumption exceeds 5%, Ts is activated. After expiration of Ts limits, hysteresis, Tr etc will become active. If the power consumption drops below 5%, the supervision is disabled again.



**Setpoints:**

The **LM 580** includes two independent limits user selectable as max- or min-limits (P03 & P04).

Determining the setpoints may be done in two ways:

**1. Theoretically:**

$Md = P2 \times 60 / 2\pi n$ , where

Md: Torque where an alarm is required.

P2: Corresponding shaft power. n = rev./min.

$P1 = P2 + Po$  (Po from efficiency curve)

Setpoint may be set in kW/HP equal to the value of P1, or in [%]= 100 x P1/P, where P is range of the unit.

**2. Peak detectors:**

Run the motor at normal load and read the peak values by activating the arrow keys in the kW[%]-mode (The displayed value will follow the display mode). Place the Max. limit suitable above and the Min. limit suitable below. The Peak detectors may be reset by activating the relevant arrow key and at the same time pressing the Reset key. They are also reset by the power rising through the 5% threshold - therefore after a power down or motor restart.

**Tr: Reaction timer**

In the figure below it is shown, how the reaction timers (Tr) are activated upon exceeding the setpoints. Tr is used to avoid alarms, unless the setpoint has been exceeded for a certain period of time. If Tr is set to 0, the reaction time equals the time constant in the measuring circuit of approx. 40ms.

**Reset of alarms:**

Alarms may be reset with the „Reset“ key on the front plate or via the input S1, - see figure 2. It is only possible to reset an alarm if the alarm condition is no longer present.

**Inhibit of alarms (Input S2):**

Input S2 has two functions: 1. Just as Ts blocks for alarms during startup, an alarm can be inhibited by connecting S2 to Gnd. 2. Limit select - see special functions.

**Display Mode:**

All setpoints and power values may be set in true kW or HP as well as percentage of the selected range. The parameter P02 will control the displayed values.

**Auto Shut Down:**

If the motor is stopped deliberately a min limit will give an alarm unless Auto Shut Down is activated (P05).

**Hysteresis:**

From the figure to the left it is evident how possible Maximum- and Minimum- hysteresis bands are placed relative to the limits; The hysteresis band always lies above a Min. limit and below a Max. limit. Hysteresis is activated, when an alarm is generated and hysteresis is enabled in the **LM 580** setup (P06 & P07).

**Analogue output**

The **LM 580** features a current output configurable as either 0-20mA or 4-20mA (P13). If the output is in a control loop it can be inverted (P14). Using the shaft power settings (P08 & P09), the analogue output may reflect the shaft power P2 (P10).

**Zoom:**

The analogue output may be scaled to represent a limited range of the power consumption (P11 & P12). This only affects the analogue output - and not the readout or the setpoints.

**Filter:**

When dealing with fluctuating power signals a built-in damping filter (P16) may be used to advantage. It has a time constant of approx. 250ms.

**Relays:**

The unit is equipped with two relays; Relay 1 is a change-over switch which always is related to limit 1. Relay 2 is a close / break - switch, which always is related to limit 2. The polarity of the relays may be inverted independently of each other.

**Readout:**

The **LM 580** displays - like all other **LM** units - percentage of the power range. In addition to this also kW or HP may be displayed - as well as the power range. If the shaft power settings are used **LM 580** displays computed shaft power - either as a percentage of the rated shaft power or as true kW or HP.

**Factory settings:**

The unit may always return to the factory settings (P18), if a „fresh start“ parameters set up is desirable.

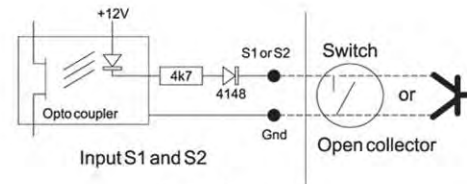


Figure 2

**Special functions**

**1. Limit select by input S2**

In some applications it can be useful to have two selectable limits. Examples: Supervising two speed motors used in cranes, Dalandermotors etc.

To change the function of S2 from normal [nor] (Alarm inhibit) to special [SPC] (Limit select) select (P17) and [SPC]. This causes both limits to become max.-limits (Hi) with setpoints of 80% for limit 1 and 60% for limit 2. Settings may of course be changed if desired.

Now the unit works as follows:

With S2 open Limit 2 is used and with S2 closed Limit 1 is used. To avoid false alarms a new Ts is activated each time the S2 input changes state from open to closed or from closed to open.

In this mode (Limit select) it is also possible to select separate current range for each limit. Both current ranges may be set independently of the selected limit.

**2. Shaft power P2:**

**LM 580** can compute shaft output power P2 as input power (P1) minus motor losses (P0) (heat, friction, copper losses, windage etc.)

Therefore;  $P2 = P1 - P0$

If you wish to use this feature, during the setup procedure you have to enter two parameters P08 (max shaft power P2max [kW]) and P09 (efficiency  $\eta$  at full load [%]).

**Note!** Please do not confuse efficiency  $\eta$  with Cos $\phi$ . In some motors they may be similar but in others there are big differences.

P2max is the kW rating on the motor plate or in the manufacturers' data, which may also state Motor efficiency  $\eta$ . If not then you will have to calculate it. To do this first calculate P1max using the formula;

$P1Max = \sqrt{3} \times U \times I(max) \times \cos\phi$ .

Example:

460V Motor rated 4.0kW, 6.8A, Cos $\phi$  0.81

So;  $P1Max = \sqrt{3} \times 460V \times 6.8A \times 0.81 = 4.388kW$

**Motor efficiency  $\eta = P2max/P1max$ .**

From the example above we know the motor is rated at 4.0kW (P2max) and that P1max = 4.388kW. Therefore 4.0/4.388 = 91.1%, say 91%, and this is parameter P09.

This is the motor efficiency AT FULL LOAD. However Motor losses decrease as the motor load decreases, therefore  $\eta$  changes. To calculate accurate and meaningful Shaft Output Power from Idle to full load power it is necessary to regulate  $\eta$  according to the actual motor load in real time. **LM 580** does this by using data modelled from typical motors across their entire power range.

**Note!** If these settings are used all setpoints are related to the shaft power (P2) and not to the input power (P).