

## Application note AN530

### Task

Supervision of variable load applications with shock load supervision ( $dP/dt$ ).

### Description

Supervision of applications where normal operation is performed with variable load – making a fixed set point unusable.

The principle in shock load supervision is to monitor changes rather than the actual measurement - i.e. compare to previous measurements.

### Unipower

For this task the Unipower HPL530 is used.

### Setup

HPL530 has a limit with a specially developed shock load supervision algorithm as well as a normal max/min limit. Each limit has its own output relay; Limit 1 (max/min) controls Relay 1 and limit  $dP$  (shock load) controls Relay 2.

**Voltage Range** must be set to the nominal voltage for the motor.

**Current range** should be selected so that the rated motor current is covered.

**Start timer** ( $T_s$ ) must be set large enough to filter out the start up current for the motor. If set too small, an alarm will occur at start up. If set too large, damage to equipment might occur if an alarm condition is present at start up. So please set  $T_s$  just large enough for the motor to be at nominal speed when  $T_s$  expires.

**Response timer** ( $T_r$ ) must be set according to the need for intervention due to overload / underload. Typically values below 0.5 seconds are applicable for overload protection, but an exact value can not be given here.

**Note:** No response timer is available for the shock load limit – a detected alarm condition here will result in an immediate alarm on the relay 2 output.

**Limit 1 type (P01)** should be selected as the application requires. Possible choices are Max-limit, Min-limit or Off. If selected as Off the relay 1 will have no function.

**Limit  $dP$  type (P02)** may be set to monitor positive power changes only ( $+P$ ) or both positive and negative power changes ( $\pm P$ ). If a power drop occurs during a  $+P$  supervision no action is taken. During  $\pm P$  supervision a power drop is treated the same way as an increase.

**Limit 1 Setpoint (Max/Min)** could be set using the peak detectors; Leave the motor running at maximum acceptable load and read the max-peak. The setpoint should be assigned a value appropriately above. This procedure is applicable for a min limit also – with conditions changed to reflect the minimum acceptable load. Then read the min-peak and assign the setpoint a value appropriately below.

**Limit  $dP$  Setpoint** will need to be set so that no alarms occur during normal operation (i.e. the normal change in load). This is easiest done using the build-in  $dP/dt$  peak detector; Leave the motor running under normal conditions and read the  $dP$  peak by pressing both arrow keys simultaneously. Now set the  $dP$  setpoint appropriately above this value.  $dP$  setpoint is set in the “Limit  $dP$ ” display mode with the red LED lit and the display reading  $Pxx$ , where the value following “P” is the setpoint in %.

**Limit  $dU$  Setpoint** is a very important parameter in shock load supervision; It is used to avoid shock load alarms caused by a sudden drop or increase in supply voltage to the motor. For instance a 5% change in supply voltage

causes a 10% change in idle power consumption of the motor. So depending on the load of the motor this change could easily generate a shock load alarm.

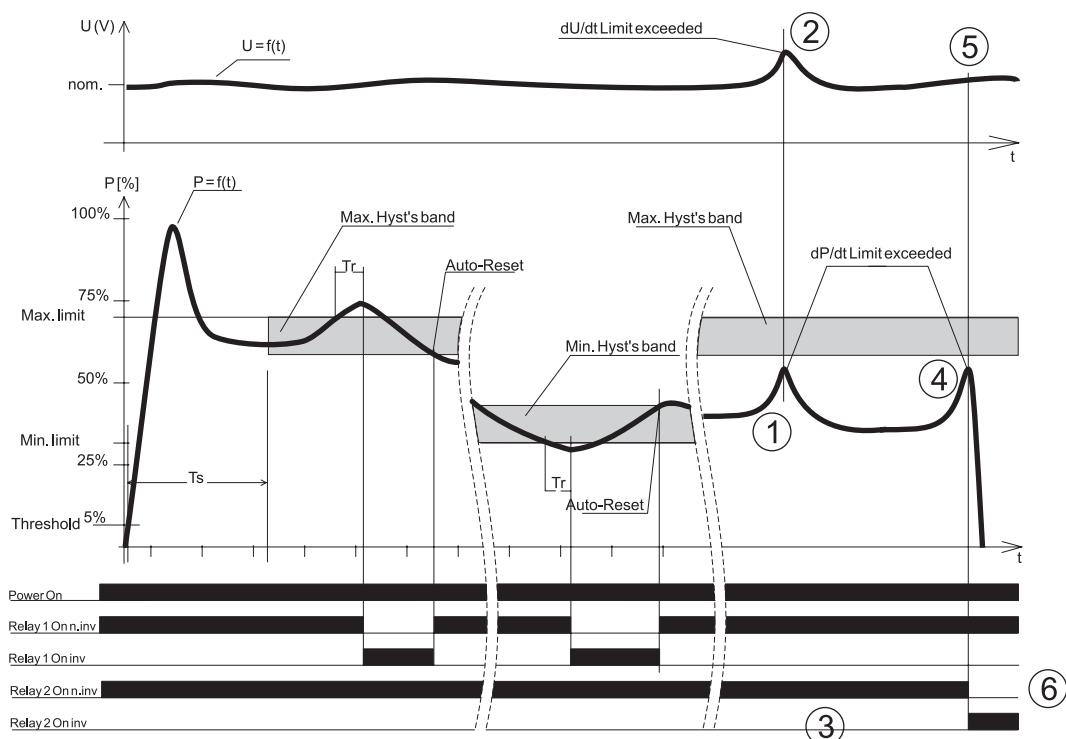
Selecting an appropriate value for the dU setpoint is done by leaving the motor running at normal operating conditions and lowering the dU set point value until the Limit dP LED is flashing green. This LED flashing green means that the voltage changes block for dP alarms. Now the value needs to be increased until the flashing stops so as not to block for alarms under normal voltage conditions.

dU setpoint is set in the “Limit dP” display mode with the green LED lit and the display reading Uxx. The value following the U is in volt.

## Mode of operation

The following figure shows the capabilities of the HPL530. The principle of shock load supervision is shown to the right in the figure.

At the bottom of the figure the state of the relays is shown above which the course of the power measurement can be seen. The voltage course is shown as a curve at the top of the figure.



At point (1) a shock load is detected. Before generating an alarm the voltage condition is checked. At point (2) a dU/dt is detected (In this example a rapid voltage increase) causing the unit to ignore the detected shock load. This is seen at point (3) where no alarm is generated – the relay remains unchanged.

At point (4) a similar shock load as (1) is detected. Again the voltage condition is checked (5) where no dU/dt is present and the HPL530 generates an alarm (6): The Relay 2 changes state.

The generated alarm may be reset by pressing the reset key or by activating the external input S1.

**Note:** If using external auto-reset (connecting S1 permanently to gnd) the shock load supervision is disabled. The input S1 may be used to deliberately block for shock load alarms by activating the input (connecting it to gnd) during a time when known shock loads occur.

## Connection

The schematic below shows how the HPL530 may be connected to solve the task. It is important that the input S1 (terminal 15) is not permanently connected to gnd (terminal 14), in which case the shock load supervision is permanently disabled.

In the example the two output relays are connected in series to produce only one signal for alarm for both limits. If it is required to be able to distinguish between an over/under load and a shock load, the relays must be connected to separate inputs in the controller circuit.

