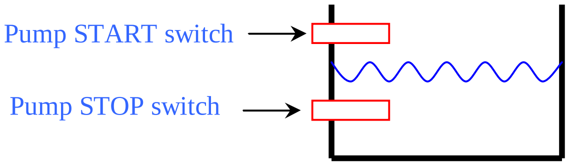
PUMP CONTROL TECHNIQUES ….
OLD PRACTICE VERSUS BEST PRACTICE

In many commercial and domestic situations there exists the need for managing the level of liquid in a tank or sump. When the level in the tank rises to an appropriate level a pump must be activated. When a lower level is reached the pump must stop.

The most basic way of controlling this process is with two simple level switches and a couple of latching relays. There is a 'High' switch and a 'Low' switch, whereby the 'High' switch Starts the pump and the 'Low' switch Stops the pump.

THE COMMON METHOD:



Fundamentally this method is all that is required to control a pump installation, but it is a dangerous solution as *any* failure in the system becomes a *catastrophic* failure.

SCENARIO 1:
The START switch fails to operate. (defective switch, blocked switch or damaged wiring) As a consequence the pump will remain dormant, and the tank will overflow, causing inconvenience and damage to property.

SCENARIO 2:
The PUMP fails. (defective pump, defective pump relay, jammed impeller, pump overload tripped, or a combination of the above) In this event the tank is also doomed to overflow.

The serviceman must enter the flooded area and manually drain the tank before the problem may be addressed. At this point the serviceman would have no way of knowing what had caused the problem and delays occur while a diagnosis is made and replacement parts are obtained and fitted. A worse outcome can be that the problem cannot be found as the cause is intermittent. The tank may be doomed to flood again tomorrow…

SCENARIO 3:
The STOP switch fails. The outcome is simple, the pump will drain the tank until it is empty, whereupon it will try to pump air indefinitely and burn out.
Unfortunately, every time a STOP switch fails, a new pump may have to be installed.

Whenever this simple approach to pump control is used, it is only a matter of time before one of the scenario's described above will occur. It may be only a week or more than a year, but a failure becomes inevitable. Where many such installations are present, the probability of failure is multiplied. Two important aspects are missing from this simple installation, **Redundancy** and **Supervision.**

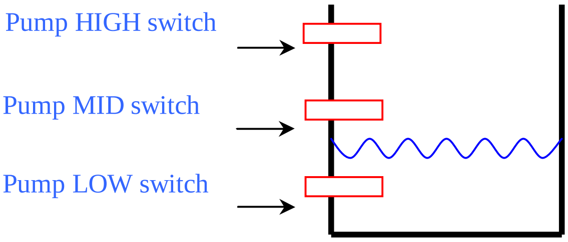
A second level of monitoring needs to be present to manage the pump operation. If things *do* go wrong, then human intervention must be instigated before permanent damage to equipment and property occurs.

A BETTER METHOD…

Much greater reliability can be obtained with a three-switch tank and the addition of some system intelligence.

The three switches within the tank are designated **LOW**, **MID** and **HIGH**. All normal pump activity is carried out by the **MID** switch.

The **LOW** and **HIGH** switches provide the necessary **redundancy** and **supervision** to the installation.



Whenever the **MID** switch gets wet, the pump is activated. The **MID** switch will soon become dry again. At that point a timer is started. As the pump rate and tank size are known, the timer has been set to stop the pump shortly before the level reaches the **LOW** probe.
It is important to note that the timer is operated after the switch goes *dry* because the total pumping time is automatically extended where a larger volume of liquid has been dumped into the tank.

Whenever the **HIGH** switch get wet, the pump will be forced **ON** (in the event that the **MID** switch has failed) and an audible/visual alarm should be activated.

Whenever the **LOW** switch becomes dry. The pump will be forced **OFF** (in the event that the **MID** switch has failed) and an audible/visual alarm should be activated.

- Whether the alarm is a flashing lamp at the site or an extended alarm to a remote monitoring station depends on the nature of the installation.
- Where the installation is in a domestic situation, an ‘Audible alarm’ on site should have a MUTE switch to silence the alarm for a fixed period.
- It is preferable that the Low and High alarms should flash/sound at uniquely different rates so that the nature of the problem can be reported and identified quickly.
- If the problem resolves itself, the alarm should automatically halt. Ideally the event should be recorded electronically so that fault trends may be observed when maintenance eventually takes place.
- Level switch measurement should have a built-in settling time of several seconds, so that a wet/dry condition is a true condition and not just a brief splash or surge.

FLOAT SWITCHES *versus* CONDUCTIVITY PROBES

The sensors used to detect liquid levels may be mechanical ‘float’ switches or metal probes that detect liquids through electrical conductivity. Both methods are valid and both need a reasonable degree of protection against the build up of sediments.

Where levels are critical, the conductivity probes will have a notable advantage over most float switches as there is no mechanical ‘lag’ between ON and OFF states. A disadvantage is that the system it connects to must be expecting the small changes in resistance detected by the probes to measure the conditions correctly.

SUMMARY

Historically, this level of supervision has been difficult to implement with installations intended to be ‘cheap’ and ‘simple’.

The high cost of field maintenance and the low cost of microprocessor based control have altered this marketplace. Fees incurred with a single pump failure could easily exceed the differences in installation costs between a simple control system and a more intelligent one.

This document has been produced so that decisions to be made on pump installations are based upon the best available information. Many control systems presently marketed fail to highlight these shortcomings. Systems that don’t work properly are the most expensive systems of all.