Application Guide Electrical Measurement in Automation Industry

LEM

Made to measure…

When your job is to control motors, heaters, lamps and other electrically powered loads, you need accurate, real-time status feedback. Until recently, the traditional approach to this monitoring problem has been to use optical sensors, zero-speed switches and pressure switches. But these devices can be both expensive and unreliable.

Now LEM offers you better solutions. Our current, voltage and power sensors give you that critical feedback with all the speed, simplicity and dependability you want and need. Based on the premise that, “By measuring the power input to your load, you gain clear insight into actual equipment performance,” these solutions are:

- Faster…because you see load changes immediately. With this knowledge, you can prevent equipment failure and avert process disruption.

- Easier…because you simply snap a sensor over a wire. No need to bolt or weld complex brackets, valve manifolds or pipe taps.

- More reliable…because solid state sensors are tougher than electromechanical devices.

- Economical…because costs are reduced through quick, easy installation and long term dependability.

Please take a few minutes to look at the control, protection and monitoring applications in this guide. They describe just a few of the ways our customers have used LEM tranducers. Take it as an "idea generator" which will suggest a solution to come of your control problems.

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Crusher and Grinder Motors

You can optimize the performance of your size reduction equipment by automating the feed mechanism. Controlling the feed rate to grinders, crushers and shredders

- helps prevent jamming,
- improves the uniformity or structure of ground product, and
- enhances the efficiency of subsequent processing operations.

For a precise indication of the load on the crusher, simply install a current transducer on the motor lead (Fig.1). The output can be used for reliable closed-loop control between the crusher and the feeding mechanism. A drop in load will signal the conveyor or loader to increase the feed rate. A rise in load will initiate a decrease in the feed rate.
LEM current transducers are available in both self-powered and loop powered versions. The split-core design makes installation a snap.

Industrial Electrical Heaters

Electric heaters are used to supply heat to manufactured products, storage systems and re-circulating material. If a heater fails, the batch or process may have to be scrapped. A real time indication of heater status improves product quality and production efficiency. Applying a current switch (Fig.2) to the heater lead and integrating the signal with your DCS will allow you to

- monitor the heater's on/off status,
- alarm a failure, or
- automatically switch on a backup heater.

LEM current-operated switches offer you solid-state reliability at a low installed cost. The units are available in both solid-core and split-core configurations.

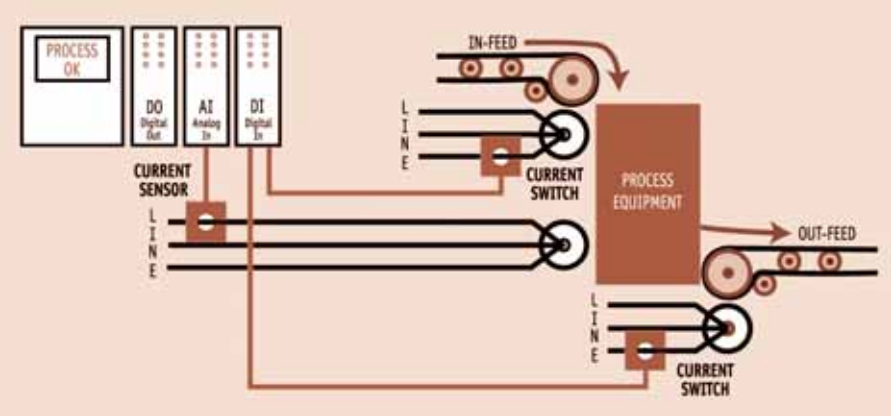


Fig 1.

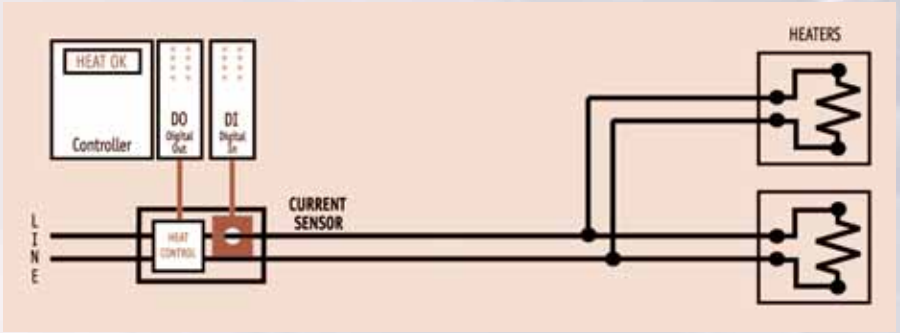


Fig 2.

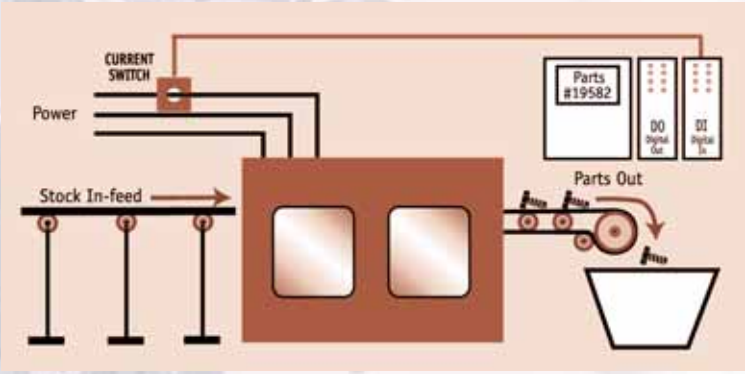


Fig 3.

Part Counting

Proximity sensors are frequently used to count milled, forged and stamped parts coming off an automated tool. Because these devices require precise alignment, dimensional variations or a change in part position can induce counting errors.

You can ensure more accurate counts by installing a current switch on the machine tool motor (Fig. 3). The switch will output a change-of-state signal every time the motor is loaded (the part is being machined) and unloaded (the machining process is completed). This method is more exact, and also eliminates the need for manual re-setting or tuning of a position-sensitive sensor.

For maximum resolution, LEM current-operated switches offer user-adjustable setpoints over three selectable ranges. The integrated LED provides also provides a visual indication of motor status.

Status Alarming

A common belief is that auxiliary contacts attached to a motor starter will indicate when a load comes on. However, auxiliary contacts only signal the position of a contactor, not the actual load status. If a downstream disconnect is opened for maintenance or the contact sticks, there can be serious consequences.

At a large fish farm, failed aerator pumps resulted in massive stock losses. Because the auxiliary contacts remained closed when a pump failed, the alarm was never activated, the back-up pumps were not switched on, and the fish suffocated. Now LEM current switches have been installed to alarm the operator and automatically switch on the back-up aerator pumps (Fig. 4).

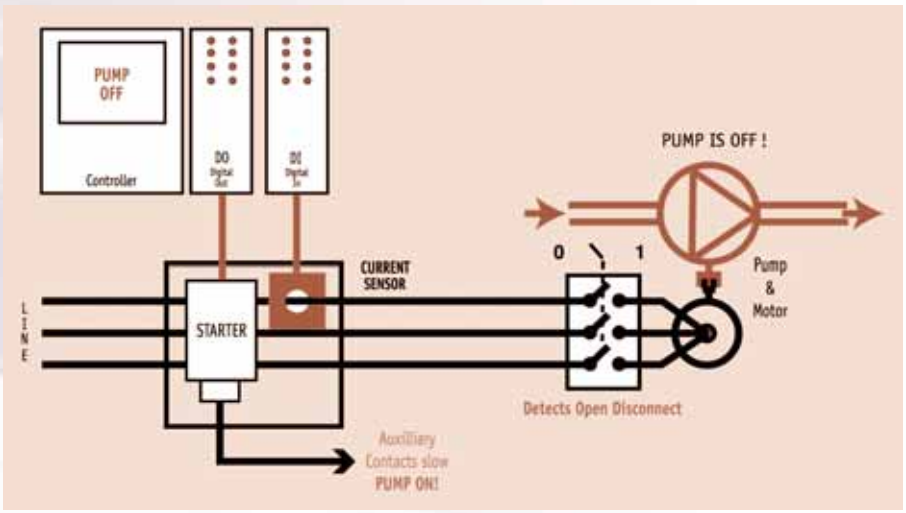


Fig 4.

Generator Startup

If power failure can stop your business in its tracks, you must have emergency generator power available. Switching to back-up power can be as simple as installing a current switch on the incoming utility line (Fig. 5) and integrating the signal with your generator control system. If prime power fails, your controller will automatically start up the standby generator.

LEM current-operated switches feature inherent electrical isolation, and provide a safe and reliable solution for this application. The compact units are totally powered by induction from the monitored line, and are UL and CE approved.

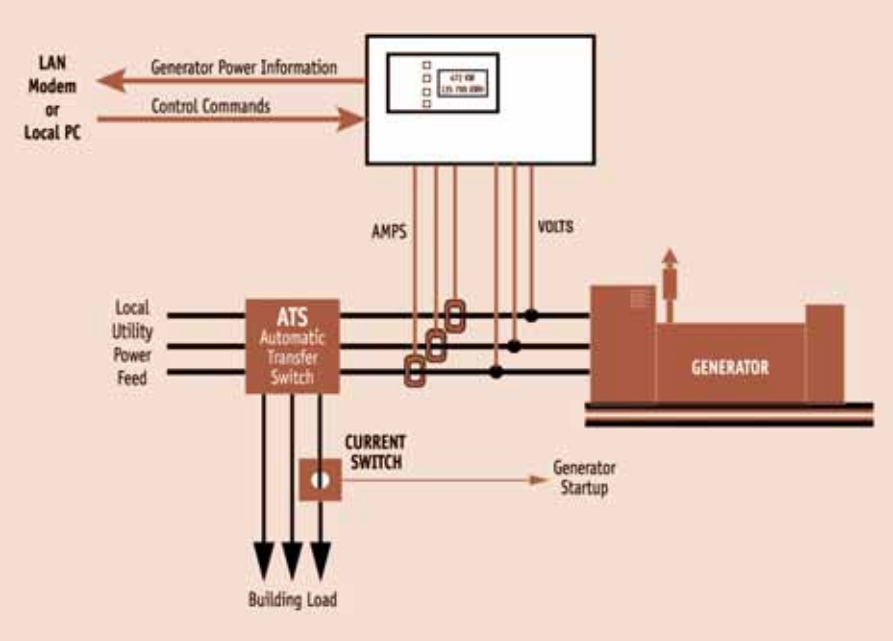


Fig 5.

Maintenance Operations

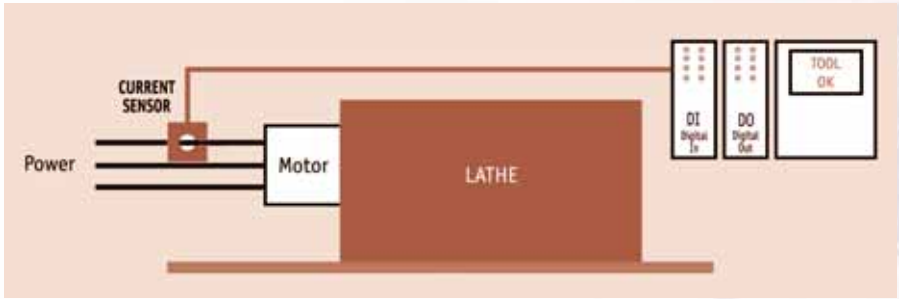


Fig 6.

Dull Tool Indication

Replacing or sharpening cutting tools before you need to is a waste of money. However, delaying this operation for too long can result in a quantity of rejected material. A good indicator of a tool's effectiveness is the motor's current draw.

By installing a current transducer (Fig .6) on the cutting tool, you can determine when the motor is drawing too much current. This is an indication that the tool is dull and should be sharpened or replaced. The single-piece design of LEM current transducers eliminates the need for panel wiring.

Pump Jam & Suction Loss Protection

Wastewater pumps can become jammed with organic matter and cause damage to both the motor and pump before thermal overloads are tripped. Alternately, a blockage in the pump suction line can cause the pump to run dry, overheat and break a seal. By installing a motor monitor on one leg of the motor leads you can monitor overloads (jammed pump) or underloads (loss of suction) (Fig. 7).

Used LEMs' current tranducers which give a real time motor's current feedback associated to a PLC makes a cheap an evolutive solution. Indeed, the PLC can be programmed like timers to compensate short duration abnormalities and motor startup in rush.

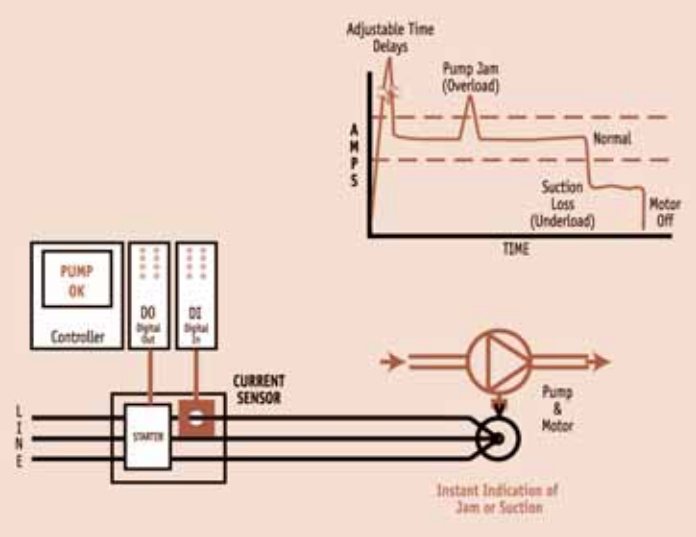


Fig 7.

Motor Start Counting

Large industrial electric motors need to be overhauled or rebuilt periodically. A predictive maintenance schedule, based on the number of motor starts, ensures proper operation and reduces the risk of motor failure.

By installing a current switch (Fig. 8) on the motor lead, and using the signal to run a counter, or feed into an automation system, you can obtain an accurate count of motor starts. This allows you to schedule motor maintenance and avoid costly emergency repairs. The top mounted terminals on LEM current switches simplify installation. And because they are selfpowered devices, there is no need for power supplies or power wiring.

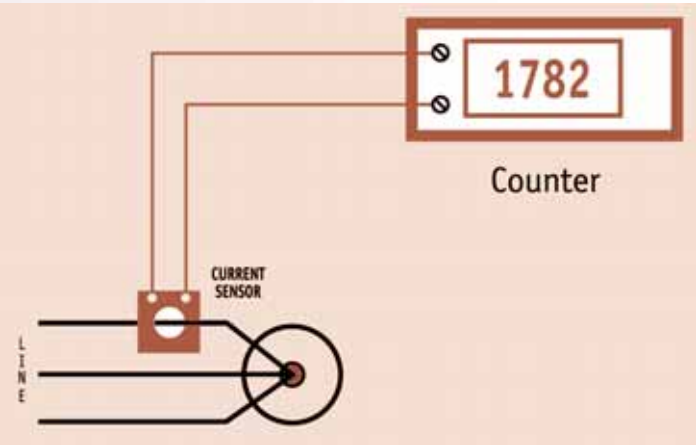


Fig 8.

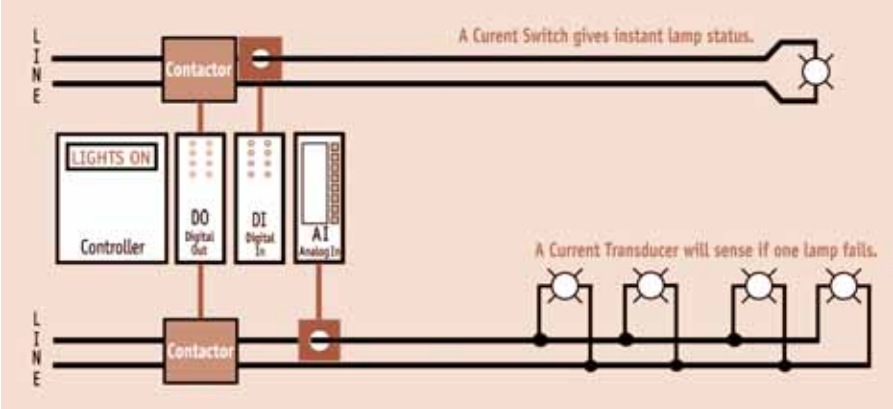


Fig 9.

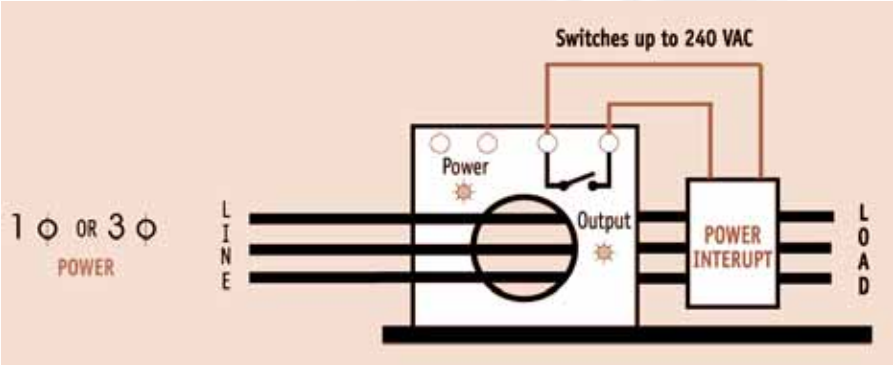


Fig 10.

Safety Light Monitoring

Safety lights on smokestacks, towers and airport runways are frequently monitored with a photocell. This method works fine if there is no contamination from other light sources. This method also requires a sensor at the lamp, which translates to long wiring runs and high installation costs.

A simpler and more cost-effective method is to monitor lamps directly from the lamp control panel. To monitor a single lamp, install a current switch on the lamp lead (Fig. 9). Alternately, you can install a current transducer at the control panel to read current change and detect failure of any lamp in the circuit.
Because LEM current sensors measure power rather than light, there is no risk of light contamination. This ensures a reliable reading of lamp status.

Ground Fault Protection

Undetected ground faults can expose personnel to lethal current. National and international standards now require that all electrical installations provide a means to protect equipment operators from ground faults.
An effective solution to this problem is to install a ground fault sensor on the power lead (Fig. 10). The device's output signal can then be integrated with your control system or power-interrupting device. This protects personnel working with electric loads, such as:

- Electric heat tape
- Immersion heaters
- Production tools and equipment

LEM ground fault sensors provide an isolated solid state contact and offer exceptional sensitivity - down to 5 mA leakage. The same sensor can be applied to a single-phase 50 amp circuit or a 10,000 amp three-phase circuit.

Safety Interlocks

Personnel protection is frequently accomplished by interlocking two or more motors. The objective is to start the second motor only when the first is running and driving its load.

By installing a current switch on the motors you can eliminate complex relay logic, proximity switches and control panel configuration (Fig. 11).

LEM current switches are frequently used as safety interlocks, in a variety of commercial and industrial facilities.

■ At a grain mill, an exhaust fan must be turned on before the silo is filled with flour. Flour dust is very flammable and a static electric spark can cause an explosion. Current switches are installed on all exhaust fans.

■ A milling operation uses current switches to ensure that the sawdust exhaust system is operating as soon as any of the saws, planers or other woodworking machines are turned on.

■ At a commercial laundry the exhaust booster fan must be turned on when the dryers are running. Current switches are used to interlock these operations.

■ An aggregate producer has ensured that both the infeed and outfeed conveyors are running before starting the crusher by installing current switches on the motors.

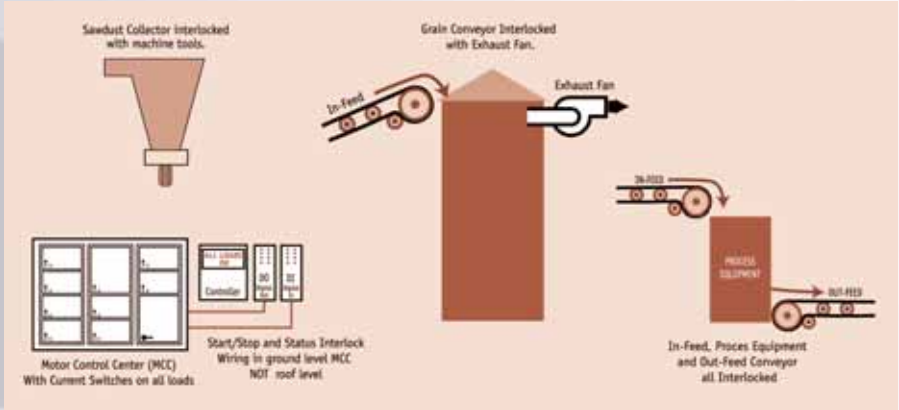
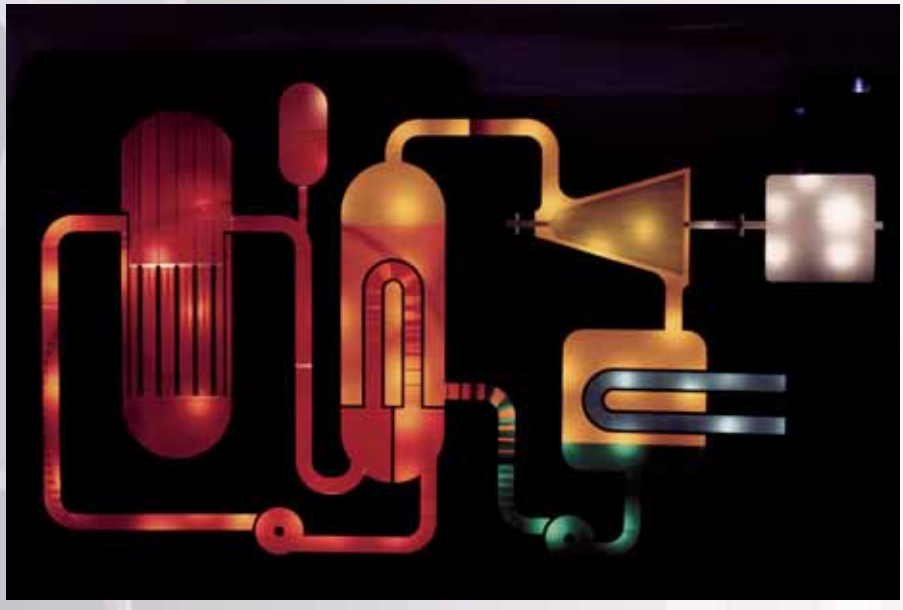


Fig 11.



DC Power Supply and Batteries

DC power is frequently used in many industrial applications including, petro-chemical, telecommunications metals and computers. In these applications batteries are frequently used to provide power back up to protect against power failure.

In TELECOM to keep the substation in good working order, manufacturers use devices (Energy Management System), (Fig.12) which watch the network power supply and auxiliary batteries and activate an alarm in case of problem.

By offering several options like split core busbar transducer, + 24 V DC to + 48 V DC power supply, or few mA for leackage current. LEMs' transducer range is well adapted for DC applications.

Cathodic Protection

Concrete structures build with steel reinforced, bridges, parking garages, pipelines, high voltage electricity pylon are damaged by corrosion with non negligible consequences.

Cathodic protection is the only proven standard procedure to reduce corrosion in the time. This method consist to decrease the potential of the reinrced steel of the structure below the potential of its environment. A low generated DC current flow between pipes and an anode which is buried in the earth. This current prevent against the electro-chemical process of corrosion (Fig.13).

Up to now the measurement of this DC current is done by a shunt which require to cut the cable to insert it and add a signal conditioning electroning to interface with the monitoring system.

LEMs' current transducer integrate already the signal conditionning and provide an isolation which protect the system against overvoltage due to the lightning.

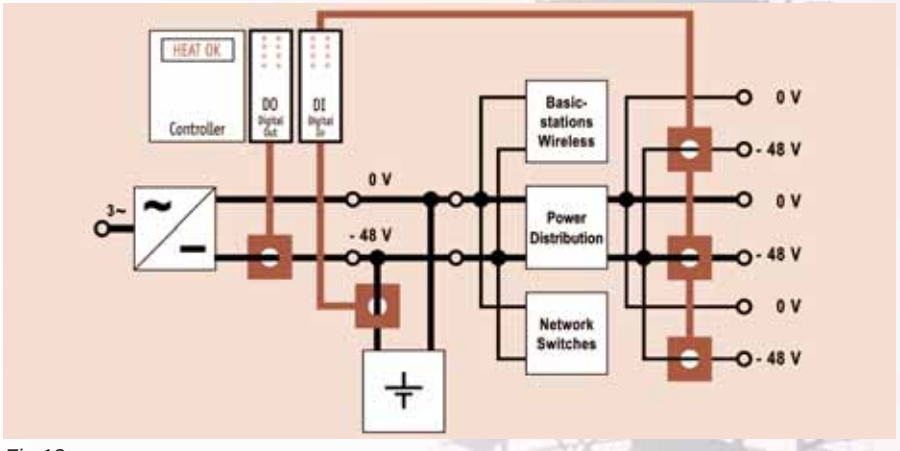


Fig 12.

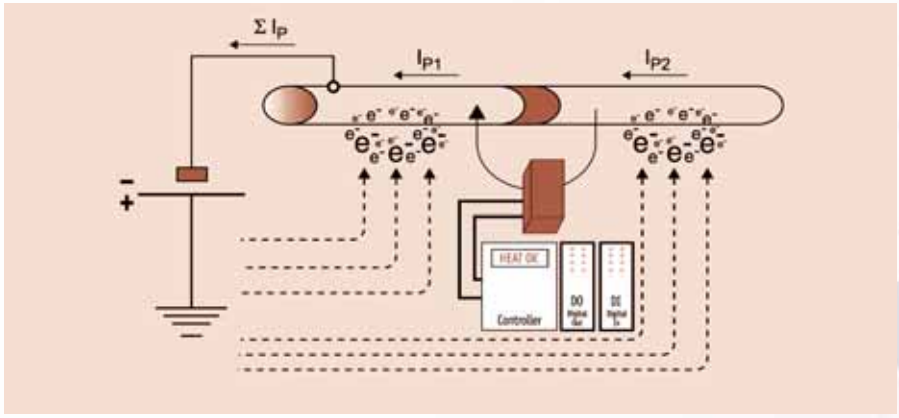


Fig 13.

Fan And Pump Monitoring

Good engineering practice dictates that every output must have a corresponding status input. On fans and pumps, a current switch can be snapped over one motor power leg and the output wired to your automation system (Fig.14).

LEM self-powered switch will close when the load comes on, and open when the load is off. By adjusting the setpoint, you can also determine whether or not the pump coupling or fan belt is intact. This reliable, solid-state solution eliminates the need for temperamental pressure switches, and reduces the cost of labor and conduit.

The universal solid-state output of LEM current switches is compatible with most automation systems.

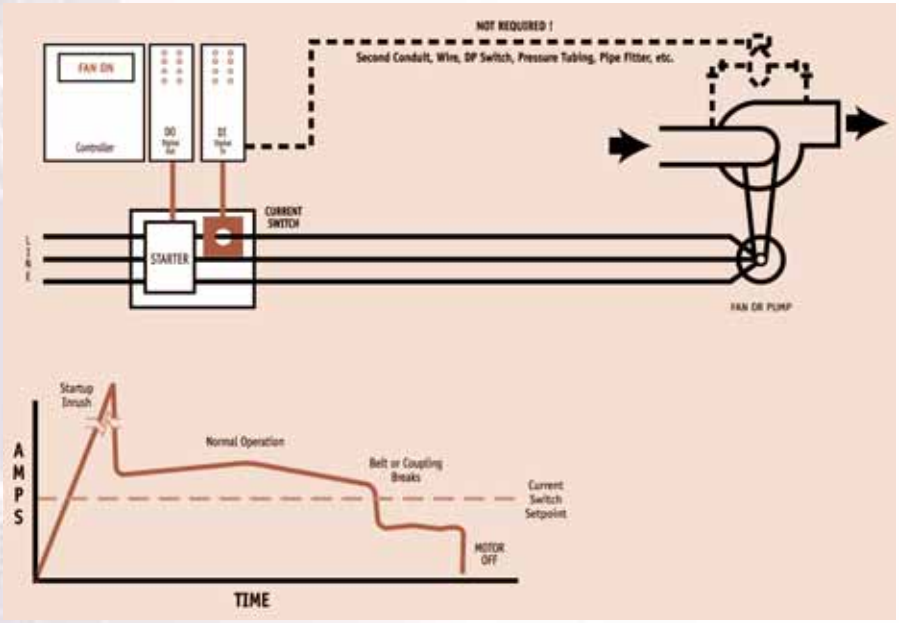


Fig 14.

Pump Backup

Critical loads require a backup pump that starts automatically in the case of a failure. Installing a current switch on the power lead of each pump gives you real-time on/off status. The solid state outputs can be wired into a PLC or tied into relay logic circuits to automate the back-up routines.
LEM current switches provide millisecond response and ensure fast, reliable response to pump failure.

Site Energy Monitoring

Liberalisation of the electricity market, and new environemental considerations, have opened up a new area of cost reduction for facilities managers and introduces the notion of energy management to establish the exact energy consumption.

By considering when possible the voltage and cost as a constant, a simple current measurement is enough to calculate an estimation of the energy consumption and follow the load profile.

Based on this analysis, engineers can find alternative solutions to replace equipments (e.g. motors, fans, lamps...) or to change people habit to increase energy efficiency and reduce waste.

The LEM's current and voltage transducer range can cover a wide diversity of needs for new and existing installations. Split core case is a key advantage for the second category.

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