

Alternative energy systems

Application note



Solar and other types of renewable energy is here to stay. The disadvantage is of course that this technology is expensive and therefore a prime target for theft. These systems are also complex with several components needed to make a functioning system.



This application note explains how the GSM Commander range of products can be used not only to protect these systems from criminal activity but also to control and monitor the critical components against failure. These systems vary widely in terms of layout and detail. Some installations are small DC solar units, and in other cases, it can be many kilowatts of generation capacity with complex management systems. It is therefore difficult to come up with a one-size-fits-all solution. The GSM Commander is an ideal solution because it can be customized to solve even the trickiest problems.

Typical challenges to be solved

Theft of solar panels and turbines

These are always the most exposed pieces of hardware and a very obvious target. The requirement is for theft to be prevented by early warning or discouragement.

Theft of batteries, controllers, inverters

The requirement is obviously to prevent access to the site and to have early warning of unauthorised activity

Cable theft

Everywhere there is power, there are cables, and where there are cables, they tend to "disappear." We need to prevent it as far as possible, or detect unauthorised activity as early as possible.

Monitoring and control of battery systems and electronics

Batteries are incredibly expensive, and if something goes wrong in the management of the batteries, it can lead to battery failure (which can be expensive) or loss of power to the load. We need to monitor battery systems to verify they are charged to a sufficient level and also monitor their temperature. A solution should provide early warning to the user that something is wrong, before it goes wrong even more..

Theft of solar panels and turbines

Conventional early warning / physical access monitoring

This should always be the very first solution to consider when planning a monitoring installation. Early warning is of utmost importance, because it gives the responder more time. In the case of a solar system or turbine, it is a very obvious idea to install a barrier such as a fence or wall around the installation. We all know a fence on its own is pretty useless, but if you monitor that fence or wall, and you can detect unauthorised access soon, then you know of the event before something bad has happened yet. This gives you time to respond. Polygon Technologies have an “**Intelligent Vibration sensor**” (IVS) device that is hermetically sealed and 100% adjustable. Adjustability is of course of extreme importance in reducing false alarms, because no two installations are alike. Of course the GSM Commander is an indispensable piece of equipment here, because detecting a problem means nothing if you are unable to communicate it..



Real-world Example

Here is a fantastic example where this method is used with great effect. Tandelta Technologies in Namibia installed a system at this solar pump installation, where the solar panels have been stolen multiple times. He has a fence around the tower, and the barbed wire on the tower. There are also locking devices on the solar panels. When the criminal passes the fence, the GSM Commander is triggered by a vibration sensor or a door contact installed in the gate (the gate is conveniently left unlocked).



Then the criminal needs to climb up the tower and get past the barbed wire. The problem for the criminal is that this takes more time than it does for Mr Farmer to organize a welcoming committee and meet him at the site... These methods may not sound very elegant, but they are incredibly effective.

Theft of batteries, controllers, inverters

Conventional early warning / physical access monitoring

In this case the method of detection may be different, but the early warning principle remains. An important factor here is that a GSM Commander that is used to communicate early warnings can also be applied towards doing other things at the site, such as battery monitoring..

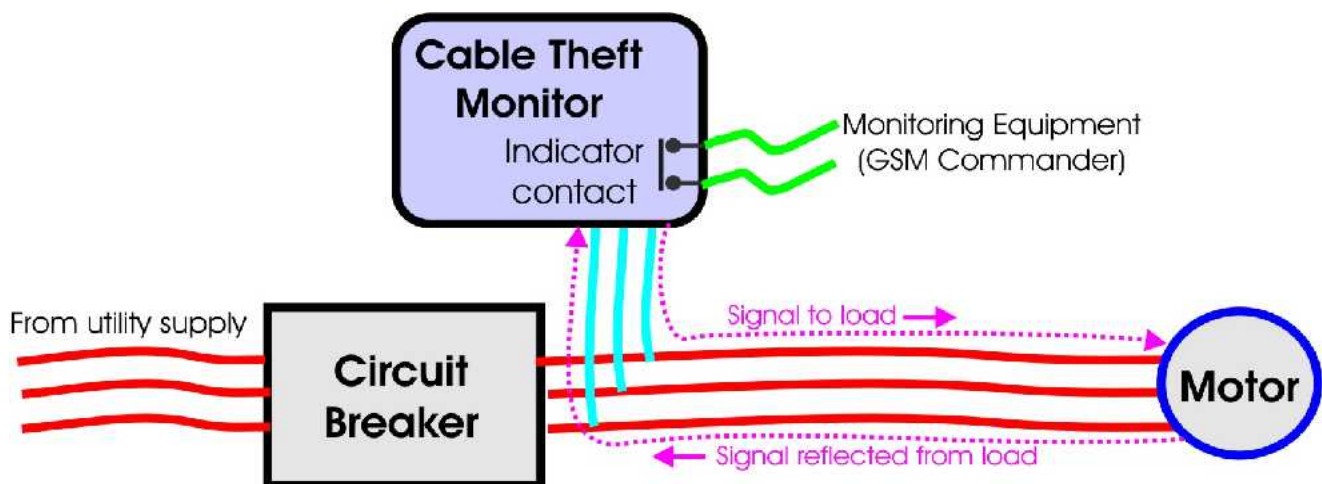
Cable theft

Loop detection

Loop monitoring lacks in the elegance department, but makes up for it in practicality. The principle involves using a spare piece of wire configured as a loop, running through the area at risk. Continuity of the loop is monitored, and a break in continuity then signals a probable incident. In this instance, the principle can be applied towards protecting solar panel cables and power cables, assuming that a spare wire(s) is available.

Dead cable monitoring

A good example would be cable runs that feed pumps or motors that may be off for extended periods. In some cases the pump will be submerged or otherwise inaccessible or possibly in an unsafe location. A good way to monitor these cables is to monitor the dead cable by verifying continuity. The Polygon Technologies **“Cable Theft Monitor” (CTM)** device injects a DC signal onto one of the conductors in the dead cable. The signal will travel down the line to the load, where a DC reflective device is installed. In the case of a motor or pump, the load itself provides this function. From the load, the signal travels back up the line towards the CTM device, where it is monitored. If the CTM does not pick up the returned signal, it is able to indicate that an incident is under way. This sounds simple enough, but the caveat comes in when the power comes back on. The signal injection device should also be able to survive power-on conditions for indefinite periods and automatically revert to signal injection monitoring as soon as the power is off. The Polygon Technologies CTM withstands up to 600V at its terminals for indefinite periods, allowing its use in 525V mining applications. Increased resolution can be achieved by installing multiple CTM devices along the cable run.



Monitoring and control of battery systems and electronics

Voltage / current / Charge Cycle monitoring

In an alternative energy system, there are many analog parameters that can tell a lot about how well an installation is functioning. An obvious first stop would be to measure and report the voltage of the batteries in the system. Furthermore, it is a good idea to monitor the voltage arriving from the solar panel / turbine. In some cases it can be handy to measure currents, such as load current and charging current. This information can be very powerful. If you are in a remote location, and you can see that battery has a low voltage, and you can see a healthy output voltage from the solar panel, and you know it is daytime, then you will expect a considerable charging current. Such a system can thus be configured to notify you if the charge controller has a problem – before the battery goes down. Likewise, if you know it is daytime and you measure a zero incoming voltage from the solar panel, then you know it is broken or stolen. Nothing prevents you from getting really clever and to actually install a simple sensor to measure the amount of sunlight that falls on the solar panel, so that the GSM Commander can know that there it is in fact a bright day outside, and use this to determine when to let you know of any problems. The **Analog Expansion** for the GSM Commander GC0641 provides an additional 8 analog inputs, with input types selectable between 0-30v or 4-20mA. This makes it possible to interface your GSM Commander to any monitoring device or any sensor.



Temperature Monitoring

If your GSM Commander know the temperatures of your batteries and electronic systems, you can be notified when things go wrong. An inverter that is running hot can be a sign of overload or of a faulty device. A battery that runs too hot can be a sign of overcharging, perhaps a faulty charge controller. The GSM Commander puts you in control with its two on-board Temperature inputs (using inexpensive probes). If two temperature inputs are not enough, you can easily add more by using the Analog expansion unit, which provides a further 8 inputs where temperature measurement systems can be connected.

Device control / timed functions

The GSM commander can be used to perform timing and control functions. This includes controlling pumps, switchgear, lighting, access and other things. Intelligent control and automatic reaction to events are an added bonus. A good example will be to monitor the battery voltage, and if it starts to run low, the GSM Commander can perhaps automatically switch off less important loads such as lighting, conserving battery power.

Integrated operation

The power of the GSM Commander becomes evident when we consider the above applications, and the fact that they can all be implemented on the same GSM commander device in a single installation! When considering an involved installation with multiple solar panels, turbines, batteries and a whole collection of other devices, an on-site GSM Commander can bring a lot of intelligence to the party, and not only keep you in control of what is happening, but also protect your installation against inevitable criminal attacks. The sky is the limit with the GSM Commander!