

INFINITY

WEB-TO-WIRELESS REMOTE
MONITOR AND CONTROL SYSTEM

MONITOR & CONTROL FARM EQUIPMENT FROM THE M2M WEB SITE

Receive Voice or E-Mail messages within seconds

The Infinity is a full featured system based on the M2M Lodestar, a web-to-wireless remote monitoring and control system.

The Infinity includes a wireless modem that provides two-way communications to the automated M2M Network Operations Center and the www.m2mcomm.com web site. A choice of cellular or satellite based communications provides coverage anywhere in the world.

- CDMA/1X Cellular
- GSM/GPRS Cellular
- Iridium Satellite

There are many useful applications for the Infinity Farm Management System. This document describes four of them:

1. Lodestar Irrigation Load Control System
2. Cable Theft Security System
3. Farm Monitoring System
4. Cold Storage Facility Load Control System



1. THE LODESTAR IRRIGATION LOAD CONTROL SYSTEM

Load control for the purpose of electric Demand Side Management (DSM) involves the remote monitoring and control of high voltage pumps & irrigation systems. The objective of DSM is to reduce peak demands for electricity, usually on hot summer days. Irrigation systems are significantly different than other types of equipment that are controlled for DSM purposes:

- The equipment is located in remote and widespread outdoor environments
- Large Kilowatt (kW) loads provide significant opportunities for Demand Side Management
- High voltage equipment is involved, often 480 VAC
- High value crops require reliable operation and farmer friendly policies to encourage participation

The Lodestar Advantage

The Lodestar web-based control system design was developed to address the specific DSM requirements of irrigation pumps. The Lodestar includes all desired characteristics for the "Ideal Product":



- Centralized Control and Access – A secure Network Operations Center and web site
 - Two-Way Wireless Communications – Cellular communications provide widespread coverage in rural areas. Satellite based modems are used for sites outside of cellular coverage.
 - All control commands and actions are acknowledged
 - Remote Monitoring – Status reports upon request, on status change, or on a time schedule
 - Control on Demand – of any selected unit or group of units
 - Time Scheduled Controls – one time and repetitive control actions
 - Customer Notification of Load Shed Events – via Email and voice based phone calls
- A full history log and comprehensive reporting for each load shed event

The Lodestar is a high voltage load control product with 1 high voltage input, 2 analog inputs, and 1 high voltage control output. It can be powered from 120, 240, or 480 VAC.

While there are many variations in the internal wiring of irrigation control panels, the primary Lodestar objectives are always the same:

- Switch the pump OFF for a specific amount of time
- Measure and report the on /off status of the pump

2. CABLE THEFT SECURITY SYSTEM

The heavy copper conductors that provide power to a large irrigation pump have unfortunately become an attractive target for thieves. The remote location of most pumps also makes it difficult for the equipment owner to monitor the site.

The same Lodestar system that controls and monitors a pump can also be used as an effective cable theft alarm.

3. FARM MONITORING SYSTEMS

By adding preconfigured sensors and wiring, the Infinity system can provide additional significant benefits. These options can be added individually or as a group, as needed:

- Water pressure measurement
- Water flow rate measurement
- Electric current measurement
- Soil moisture at multiple depths and locations using wireless communication
- Temperature and humidity
- Any other sensor with a 4-20mA, SDI-12, or other compatible output

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Monitoring and reporting this valuable information gives the grower or agronomist the information needed to accurately manage the farm.

The information can be especially useful when an irrigator is offered an opportunity to participate in a Demand Side Management event. By reviewing the current soil moisture at key locations around the farm, the grower can quickly determine if pumps can be safely turned off for a few hours.

Water pressure, flow rates, and electrical current are useful for monitoring the complete irrigation system efficiency and operation, and for detecting problems or a need for maintenance. For example, monitoring the pressure before and after a sand filter can identify when a back flush is needed.

Data Logging

The standard Lodestar reports the currently measured values. The Infinity's Data Logger function adds the ability to also collect, save, and display historical data.

At one minute intervals, the system reads and saves the on/off state of all equipment, plus the measured value of each sensor value.

The one-minute readings are also averaged inside the Lodestar and saved as 15, 30, and 60 minute averages.

The Lodestar stores up to four days of one minute data samples, as well as the 15, 30, and 60 minute averages. The user can:

- Request data reports from a specific starting date and time.
- Schedule a periodic report request from the web site in intervals of 1, 15, 30, or 60 minutes.
- Request reports for only the specific sensors that are being used.

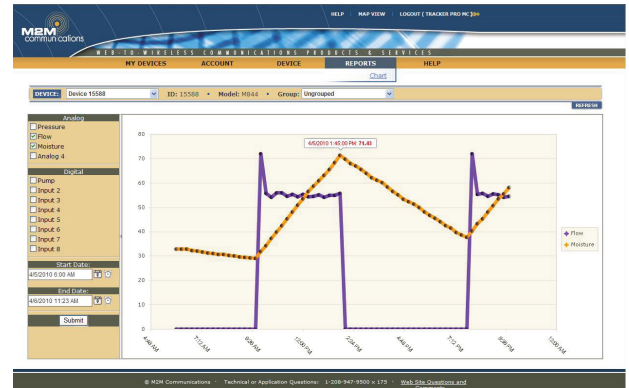
Time Scheduled Reports

In addition to polling the Infinity from the web site, the user may schedule automatic periodic reports from the unit by configuring the system to report the desired information at specific intervals.

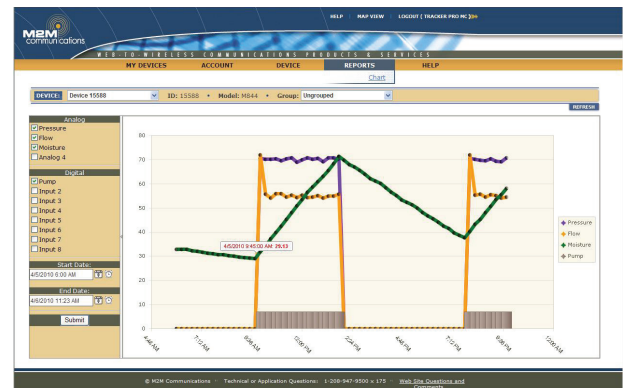
At The Secure M2M Web Site

Reported data is stored permanently (or until deleted) at the M2M web site. The data can be displayed in tables or graphically by the desired date range and can be labeled appropriately.

In the following example, the flow rate is overlaid upon a simple soil moisture reading:



In the following example, water pressure and the pump on/off status is added to the flow and moisture graphs. Any monitored sensors can be displayed over a selected time period:



4. COLD STORAGE FACILITY LOAD CONTROL SYSTEM – with hi/low temperature alarm

Cold storage facilities are excellent candidates for Demand Side Management projects. In this application, either the Lodestar or the M2M model M844 can be used as the primary controller. The product choice will usually be determined by the control and monitoring voltages of the refrigeration compressors, and the desired number of sensors and compressors to be controlled.

The Lodestar can be used if there is only one compressor to control. It also has wireless expansion capabilities.

The M844 can directly control up to four compressors and can monitor up to four sensors. However, it does not have high voltage or wireless expansion capabilities.

Typically one temperature sensor is installed outdoors and the other one inside the refrigerated room. The temperatures can be monitored and reported, both as the current value and as a data logged history chart.

If any monitored temperature drops below or rises above user configurable setpoints, an alarm can be sent to the M2M web site. The alarm report can then be relayed to multiple people using voice based telephone calls, Email or text messages.