A part of the new PINNACLE family

Sprite/Solaras Smart I/O

New!

Smart Distributed & Peer-to-Peer I/O – Wireless, cellular, serial, and Ethernet/Internet

- Multi-way peer-to-peer "I/O Mirroring". Replicate analog/discrete levels over miles
- Low-cost standalone monitoring and control as well as SCADA & DCS I/O
- Integrated Alarm Dialer and Remote Access by text message over cellular
- Integrated Pump/Setpoint Control with alternation and pump protection features
- Allen-Bradley (DF1) & Modicon (Modbus) support. "Plays well" with 3rd parties!
- High-speed Ethernet port is standard – not an extra cost option
- User configurable web page HMI built-in. No separate software needed.
- Secure AES encrypted communications over Ethernet, serial, radio and cellular.
- Built-in non-volatile totalizers, runtime meters, and rate computation
- Optional internal spread spectrum or cellular radio and RS-232/RS-485 port
- Store & Forward Repeater operation to extend internal & external radio range
- Low-power and smart power management for battery backed applications
- Built-in solar controller/battery charger/battery backup (Solaras)
- 3-year warranty on parts and labor

Solaras
(shown w/serial & wireless options)

Sprite
(shown wireless option)

Smart I/O – Sprite and Solaras are smart distributed and peer-to-peer I/O modules for monitoring and remote control:

- Add I/O to a PLC or RTU, or expand a SCADA or DCS system.
- I/O mirroring via radio, cellular, serial & Ethernet saves thousands of dollars in reduced wiring.
- Low cost cellular alarm dialing
- Use as a low-cost smart pump controller with built-in wireless I/O.
- Eliminate costly PLCs, HMIs and programming where smart I/O with a built-in web HMI will do.

Supported by most PLCs & HMIs Sprite and Solaras support Modbus (TCP/IP or RTU) or DF1 protocols.

Peer-to-peer I/O Mirroring - Multiple Smart I/O modules can link up "back-to-back" to exchange sensor and control signals over secure two-way wireless, cellular, or fiber optic links, leased lines, Ethernet, or the Internet. Smart I/O saves thousands of dollars in wiring and conduit costs.

Integrated Pump/Setpoint Control
Built-in duplex pump control (with alternation) and simple setpoint control; supporting up to 255 locations linked wirelessly or over Ethernet, eliminates costly controllers and hybrid solutions.

Cellular Alarming & Remote Access
Sprite and Solaras Smart I/O modules can text message alarms to multiple cell phones with user specified repeats until acknowledged. Also, use cell phones to securely access registers and acknowledge alarms remotely.

Web Page Configuration – Sprite and Solaras Smart I/O modules come ready to run, but can be customized with a standard web browser (like Windows Internet Explorer or Firefox). No special software is required on your PC.

Customizable User HMI – Sprite and Solaras include a user HMI that saves hundreds of dollars dedicated PC-based software. Set up by fill in the blanks configuration; no programming!

Remote Support – Sprite and Solaras Smart I/O can be reconfigured and customized, and I/O forced, over a secure Ethernet or wireless link, eliminating costly field trips and improving customer support.

Low Power & Solar Optimized – Sprite and Solaras Smart I/O modules are DC powered and optimized for solar and battery-backed systems with multiple power-saver modes and send-on-exception operation. Solaras even has a built-in regulator and battery charger for UPS battery backup or solar power – just add a battery.

Wireless Store & Forward – Any Sprite or Solaras Smart I/O module can also serve as a repeater to extend the effective range of a wireless network.

Smart I/O Functions – Sprite and Solaras I/O have built-in functions to eliminate programming, simplify installation & reduce system cost:

Discrete Inputs
- configurable filtering & debounce
- non-volatile high-speed totalizers
- non-volatile runtimes
- rate using period or interval

Discrete Outputs
- duty cycle (PWM) pulse function
- synchronized flash function
- rapid cycling hold-off

Analog Inputs
- configurable filtering/averaging
- configurable totalization
- generates switched 24V loop power

Communications Bridging
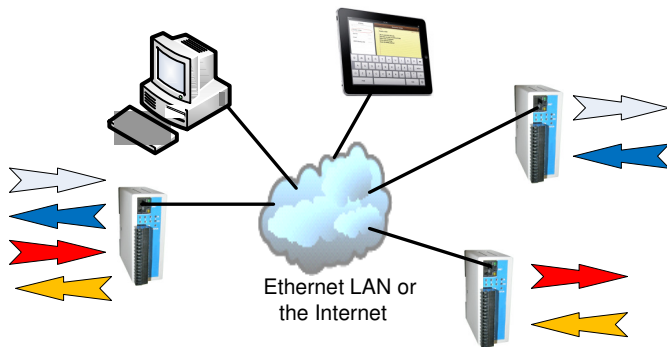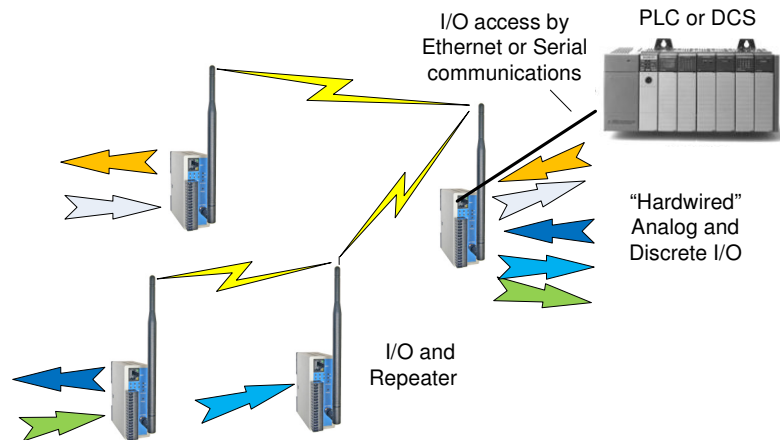- Ethernet to Serial/radio (virtual ports)

Analog readings, totalizers, runtimes and rates are internally scalable to engineering units so users see actual levels, flows and temperatures.

Rugged Reliability – Sprite and Solaras Smart I/O is100% tested ranging from -40 C to 80 C, and backed by an industry leading 3-year factory parts and labor warranty.

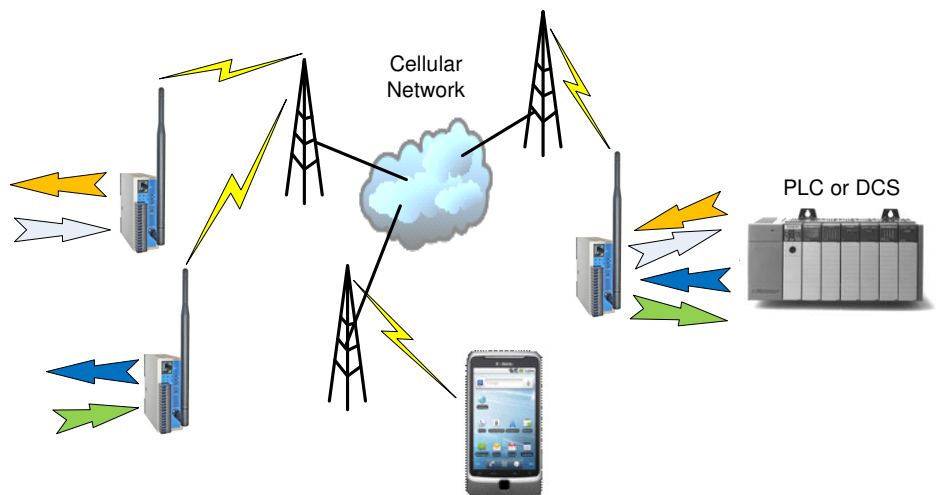## "Mirroring" I/O over Ethernet, the Internet, twisted pair, cellular or wireless links

Two or more Sprite or Solaras Smart I/O modules can exchange Analog and Discrete I/O as standalone devices. Analog and Discrete Inputs are "repeated" or mirrored as Outputs in both directions (2-way). In addition to I/O levels, all tag names, units, etc. as well as associated totalizer, rate and runtime measurements are available to PLCs and DCS systems, and to be displayed in the built-in web HMI.

Sprite and Solaras modules can automatically replicate analog and discrete inputs from one end of a communications link to outputs at the other end, in both directions. Multiple modules may "feed" a single module at the other end. Replicated I/O can be hardwired to traditional control equipment, or accessed by either Ethernet or Serial communications for devices with communications capability.

I/O access by Ethernet or Serial communications

PLC or DCS

"Hardwired" Analog and Discrete I/O

I/O and Repeater

Sprite and Solaras modules can also use high-speed copper or fiber Ethernet links or the Internet to mirror I/O. Besides I/O mirroring, other networked devices such as PCs, smart phones and IPads can access levels, flows, status, cycle totals and rates in meaningful scaled engineering units via the built-in web pages or by applications that perform PLC style register access. The modules are network savvy, know how to operate through routers, and can utilize Dynamic Name Servers and DHCP so that installation is a snap and valuable static I/P addresses are not required. The modules can be remotely configured and managed over these links by AES encrypted (secure) communications.

Ethernet LAN or the Internet

Sprite and Solaras modules can also utilize cellular networks as a practical and economical alternative to private radio and Internet networks. ICLs built-in report-on-exception technology intelligently minimizes the number of message transactions (calls) and text messaging cell phone numbers eliminates the hassles of setting and managing IP addresses. Using secure text messaging for data connections, annunciating alarms via conventional text messaging, and using password protected text messaging for remote access and management, cell phones can reliably either supplement or eliminate computers while costing less than $10 per month, per site in most cases. With Solaras and Sprite, simple control and alarming monitoring can be done over a cellular network without programming, and even traditional devices that are not "cellular aware" can take advantage of the wide area coverage of low-cost cellular technology for distributed I/O.
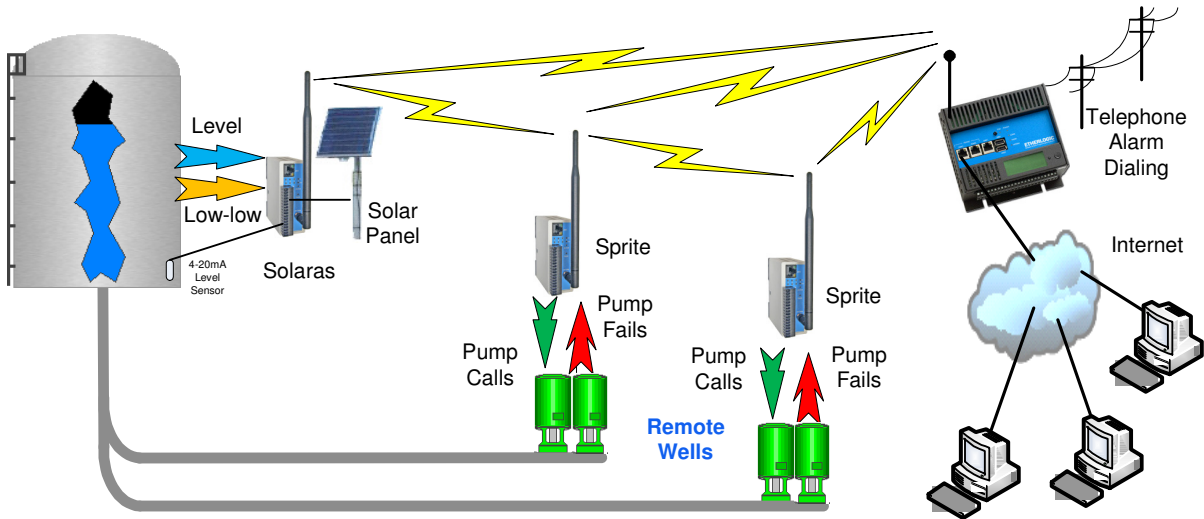
Cellular Network

PLC or DCS

Duplex Pump and Setpoint Control – Making more reliable water systems

Sprite and Solaras I/O modules have built-in single or duplex pump control capability, with alternation. Each module can safeguard against rapid cycling and simultaneous starting, as well as protecting the pumps against fault conditions (seal fails, over temperature, low well level, etc.). By using peer-to-peer wireless communications in combination with Solaras and Sprite modules, more reliable water systems can be built.

For example, in the system pictured below, a solar powered Solaras (with cycled loop-power 20mA level sensor to reduce power) communicates **directly** with a pair of well sites using Sprite modules. Without any other control equipment, the system can maintain the tank level while using Lead-Lag pump alternation at multiple (and redundant) sites. An ICL Pinnacle series controller in the system could also be used for control as shown, but is not required to make the water system function (one less critical radio link!). In this system, the Pinnacle controller is the user interface and data logger, recording levels, flows and cycles to its internal flash disk for historical trending, serving web pages to users via the internet (no extra cost HMI software required!) with real-time status and historical trend displays, and voice alarm dialing if something goes wrong. Lower cost, higher reliability, and no dedicated PC computers and expensive HMI software!
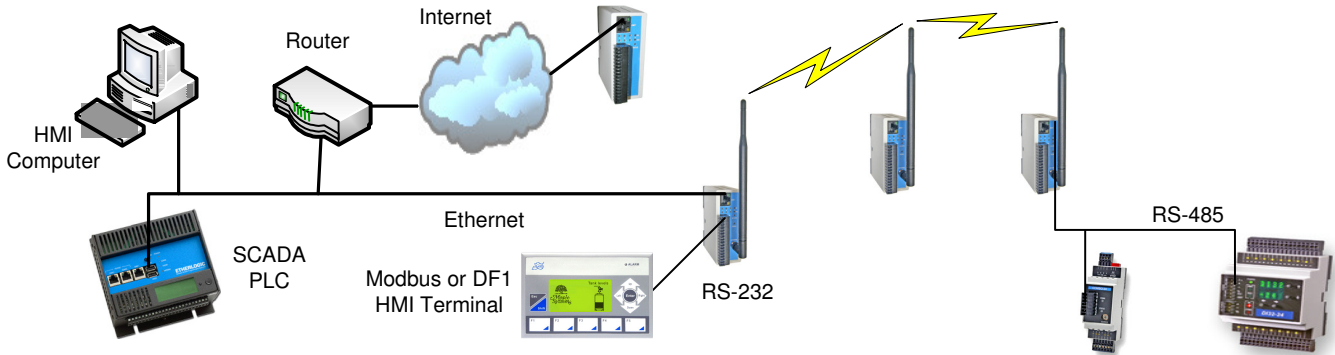
Note the same thing could be done using cellular technology, even eliminating the telephone alarm dialing by having the Solaras and Sprite modules automatically text message alarms to a list of cell phones (as shown on the previous page).

Sprite/Solaras Communications Bridging and Repeating/Routing

Sprite and Solaras I/O modules have independent Ethernet, Serial and internal radio communications ports. In addition to providing analog and discrete I/O access and some local control functions and alarming, these modules can help save money in linking together system components utilizing various types of communications mediums. These linking functions include "bridging" between networks, and repeating/routing over wireless networks. For example, a Solaras or Sprite module can take a Modbus TCP message from an HMI computer on it's Ethernet port and automatically convert it to a Modbus RTU message and resend it over a serial or radio link, and then converting and relaying the response. Even proprietary messages can be bridged, creating a virtual serial connections for the PC over the Ethernet LAN.

In the mixed media example below, an HMI computer and a PLC are talking to a Sprite I/O module over an Ethernet link. The Sprite I/O module is also acting as a communications bridge to a wireless network, passing messages to a 2nd wireless module that is acting as a repeater (in addition to I/O), to a 3rd module which has some RS-485 I/O devices connected to it. The HMI computer and the PLC have access to all of the devices in the system; with the Sprite or Solaras I/O modules not only handling sensor and control I/O, but managing communications bridging and repeating as well.

	Sprite	**Solaras**

Analog Inputs

	Sprite	Solaras
	2 + Input Power	**2 +** Input Power/Battery Voltage
Type/Resolution	-- 20mA, 12-bit --	
Measurement Averaging	Individually configurable by input; 1, 2, 4, 8, 16, 32 samples, "boxcar" technique	
Input Functions (each Input)	Accumulator (integrate/totalize input with 1 to 255 sec sampling interval)	

Analog Outputs

	Sprite	Solaras
	2	**0**
Type/Resolution	20mA, 12-bit (5v, 10V and other voltages optional)	

Discrete Inputs

	Sprite	Solaras
	4	**8** *
Type	Contact Closure or DC up to 30Vdc	
Input Conditioning	Programmable Filtering/Delay (0 to 65,535mS)	
Runtime	32-bit non-volatile timer per input, configurable to read in seconds, tenths of minutes and tenths of hours	
Totalizers	32-bit non-volatile high-speed counter per input, (5KHz Max.)	
Rate Measurement	Dual mode (Sample Period or 1/frequency), 1 to 255 second sample period, 0 to 65,535mS (1/F measurement technique)	

Discrete Outputs

	Sprite	Solaras
	4	**8** *
Type	Relay contact (3A max.)	Protected FET (1A max.)
Output Functions (each output)	Flash (sync'ed with other outputs), Pulse (one-shot) 1 to 65,535mS, PWM -1 to 65,535mS On/Off times	

Note: Solaras has 8 DIOs, usable in any combination as discrete inputs or outputs

Ethernet 10/100 BaseT
Protocol support — Modbus TCP (Slave), Modbus UDP (Slave), HTTP, ARP, SDX (ICL), Serial Port Forwarding to serial port or internal radio
Security — 128-bit AES encryption on data transfer. Separate passwords on user and configuration web pages and cellular access.

Serial Port (optional) RS-232 and RS-485
Data rate — 2400 baud to 115K baud
Protocols & Security — Modbus RTU Slave (Modicon), DF1 (Allen-Bradley), SDX (ICL), Store & Forward (Modbus & SDX). SDX uses 128-bit AES encryption

Internal Radio (optional) Choice of 2 radios; Digi (Xtend), Freewave (MR2)
Radio type — 902MHz to 928MHz Spread Spectrum, frequency hopping, (plus MESH networking with Digi Xtend radio)
Freewave — Sensitivity: -108dBm (BER 10^{-6}), 32-bit CRC, point to multipoint, network diagnostics, FGR-115 compatible
Digi/Maxstream — Sensitivity: -110dBm @9600 baud, -100dBm @115K baud, point to multipoint & peer to peer, DigiMesh
Modes of Operation: — Point to multipoint (Xtend or Freewave), peer to peer and mesh (Xtend only)
Output power — 1Watt maximum (user settable down to 100mW)
Data rate — 115K or 9600 baud, over the air
Antenna Connection: — Reverse polarity SMA (Xtend only), or MMCX (Xtend or Freewave)
Protocol support — Modbus RTU Slave (Modicon), DF1 (Allen-Bradley), SDX (ICL), Store & Forward (Modbus & SDX)
Security — 256-bit AES encryption on all over-the-air messaging, plus128-bit AES encryption on SDX messages

Cellular (optional) GSM/GPRS (AT&T or T-Mobile) or CDMA (Verizon or Sprint)
Protocol & Security — Secure Text Messaging (128-bit AES encryption) for data exchange, protected text messaging for remote cell phone access

Watchdog Timers Communications (individually configurable by port). Resets outputs to individually user defined states.
CPU – Ensures "sanity" of internal processor operation, automatic restart

Terminal Blocks Removable, 3.5mm (0.138"), 12 to 22AWG, 15A/contact maximum

Mounting 35mm. DIN rail or panel mount

Dimensions 1.4"W x 3.7"H x 3.8"D (includes terminal block and elevation off panel on DIN rail)

Environment - 40ºF(- 40ºC) to 158ºF (70 ºC), 5%RH to 95% RH, non-condensing

Power

	Sprite	Solaras
	10 to 30Vdc	12v Solar Panel (32V max.)
Ethernet/Radio/DOs/AOs OFF	0.36W	0.36W (excluding battery charging)
Ethernet ON	.+1.2W	+1.2W
DOs ON	+0.15W/DO	+0.01W/DO
AOs ON	+0.5W/AO	-------
Ethernet ON/ALL DOs-AOs ON/ Radio transmitting	4.2W max	3W max (excluding battery charging)

Recommended Battery (Solaras only) ------- 7AH to12AH sealed lead-acid (use 12AH w/external radio)

Warranty -- 3 years, factory parts and labor --

Represented by: