ēKo
PRO Series

ēKo Pro Series System

FOR ENVIRONMENTAL MONITORING

The MEMSIC ēKo Pro Series Starter Kit is a wireless agricultural and environmental sensing system for crop monitoring, microclimate studies and environmental research. ēKo introduces both a new generation of sensor integration and wireless technology. The system provides ease in setup, use and maintenance within every aspect of the solution. There are no maintenance, cellular or satellite fees with this system. Your live data is viewed from any web browser anywhere in the world.

Please visit our website http://www.xbow.com/eko for an in-depth comparison of the ēKo Pro Series to other products being offered.

The ēKo Pro Starter Kit consists of [eK2100]:

- 3 x ēKo Sensor Nodes – eN2100

- 6 x Soil Moisture Sensors – eS1101

- 1 x Ambient Temperature / Humidity Sensor – eS1201

- 1 x ēKo Base Radio – eB2110

- 1 x ēKo Gateway with built-in ēKoView web application – eG2100

Key Benefits Include:

- Gain real-time insight into growing conditions

- Monitor variability among microclimates

- Optimize watering for deficit irrigation

- Track end-to-end water use

- Access new environments for monitoring with a wide variety of sensors

- Gain real-time environmental insight immediately with remote monitoring

- Get greater visibility into crop health and disease outbreak prediction

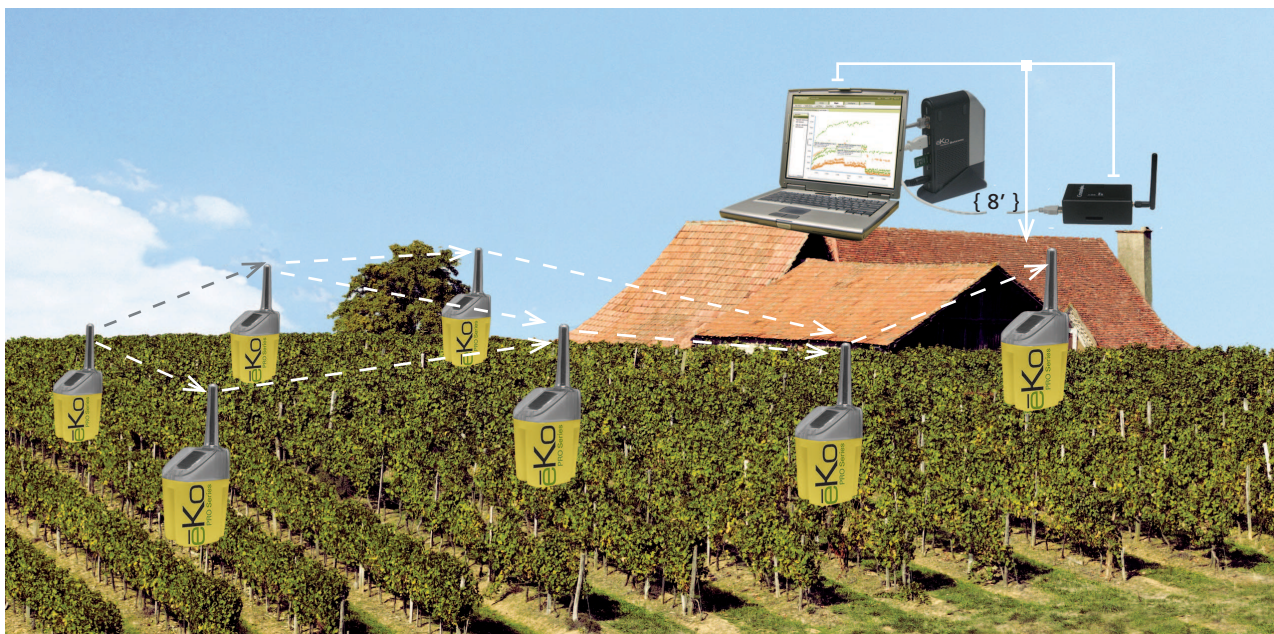## MEMSIC

Powerful Sensing Solutions for a Better Life

Wireless Mesh Technology

ēKo's wireless mesh network is based on MEMSIC's proprietary XMesh technology. This self-healing, self-configuring network allows nodes to extend their radio range by hopping messages [with 8 being the typical number of hops]. All ēKo Nodes can originate sensor data and also forward data from other ēKo Nodes. Each node runs MEMSIC's XMesh low-power mesh networking protocol. ēKo Nodes without sensors can be placed to act as repeaters if required.

Each ēKo Node monitors the radio traffic in its neighborhood and keeps track of possible alternate radio paths; if one path is blocked or degraded it will switch to an alternate path. The ēKo Gateway stores and forwards (optional) data from the sensor network that it receives from the ēKo Base Radio. The gateway comes pre-installed with the ēKoView web interface which allows users to remotely view sensor data over the internet using any standard web browser from any location throughout the world. Network messages such as data, health and neighbor status are displayed here. The gateway will connect to any standard Ethernet hub or router that is connected to the internet.

XMesh is a full featured multi-hop, ad-hoc, mesh networking protocol developed by MEMSIC for wireless sensor networks. A XMesh network consists of ēKo Nodes [eN2100] that wirelessly communicate to each other and are capable of hopping radio messages to an ēKo Base Radio [eB2110] where they are forwarded to an ēKo Gateway. The hopping effectively extends radio communication range and reduces the power required to transmit messages. MEMSIC recommends a maximum network size of 35 ēKo Nodes per gateway. To further expand your network please contact MEMSIC eko.sales@xbow.com.

By hopping data in this way, XMesh can provide two critical benefits, increased radio coverage and improved reliability. Two nodes do not need to be within direct radio range of each other to communicate. A message can be delivered to one or more nodes in between which will route the data. Likewise, if there is a bad radio link between two nodes, that obstacle can be overcome by rerouting around the area of bad service. Typically the nodes run in a low-power mode, spending most of their time in a sleep state, in order to achieve multi-year battery-life.

The ēKo Node – eN2100

The ēKo Node is a fully integrated, rugged outdoor sensor package that uses an energy-efficient radio and sensors for extended battery-life and performance. The ēKo Node integrates MEMSIC's IRIS family processor/radio board and antenna that are powered by rechargeable batteries and a solar cell. An ēKo Node is capable of an outdoor radio range of 500ft to 1500ft depending on deployment, remembering that the nodes themselves form a wireless mesh network and that to extend the range of coverage simply add additional ēKo Nodes to expand your coverage area. The nodes come pre-programmed and configured with MEMSIC's XMesh low-power networking protocol. This provides plug-and-play network scalability for wireless sensor networks.

Sensor Ports	
Number of Ports	**4**: Each port can support one ēKo compatible sensor.
Sensor Types	Each port supports either an ēKo compatible simple or smart sensor (MEMSIC ESB protocol).
Sensor Measurement Interval	One measurement every 15 minutes.
Connectors	Compatible with 6 pin, Switchcraft
Radio	
Frequency	2.405 to 2.480 GHz
Channels	16 channels available selectable via rotary switch
Type	DSSS, IEEE 802.15.4
Transmitter Power Output	+3dbm (typical)
Receive Sensitivity	-101dbm (typical)
Outdoor Range Per Single Radio Hop	Typical 500ft to 1500ft line-of-sight per hop. Range extended through mesh networking hops.
Outdoor Coverage (typical)	• **Flat with no overhead canopy:** One eN2100 per 15-25 acres • **Hilly but no overhead canopy:** One eN2100 per 5-7 acres • **Overhead canopy such as forest, orchards:** One eN2100 per 1-2 acres
Antenna	Dipole, internal
Certification	FC CE RoHS COMPLIANT
Visual Indicators	
LED	One tricolor LED to indicate sensor and network connectivity
Power	
Operating Current	0.4 mA average (no sensors) at 15 minute data sampling rate
Solar Panel	Self-contained 1.3"x 2.5" solar panel to recharge batteries

Batteries	**Standard:** 3 AA low-leakage NiMH rechargeable (via internal solar panel).
	 • Life Expectancy:
	   3 months with no solar recharging
	   > 5 years field life
	Optional: 3 D alkaline cells (no solar recharging)
	 • Life Expectancy: 3 yrs

Mechanical	
Water / Dust Resistance	IP66 (Protected from dust and high pressure water jets)
Operating Temperature	-40C to +60C
Operating Humidity	0 to 100 %RHI, Condensing
Storage Temperature	-45C to +70C
Mounting Bracket	Wall/pole attachable bracket for quick disconnect of eN2100.
Size	3.75" x 3.5" x 10.5" / 95 x 89 x 267mm
Weight	1.2 lbs/544g

ēKo Sensors

Each ēKo node can support up to four sensors. Sensors are simply plugged into the unit and when the ēKo Node is reset, it scans the sensor ports to auto-identify the sensors. ēKo Nodes are designed to accommodate almost any type of low-power sensor and allow for future support of many sensors. The ēKo Pro Series system can potentially support a wide range of external sensors from different manufacturers. Its plug-and-play Environmental Sensor Bus (ESB) architecture provides the versatility to interface both smart and custom sensors, with direct plug-in for any 2 or 3-wire sensors.

eS1101 – Soil Moisture and Soil Temperature

The eS1101 is a soil moisture sensor and soil temperature sensor. Up to four eS1101 sensors can be connected to one ēKo Node to measure soil moisture at different soil depths. By monitoring the sensor measurements between irrigations, it is possible to measure the rate at which the soil is drying out.

eS1101 – Soil Moisture and Soil Temperature	
Type	Simple ēKo sensor
Sensor Manufacturer / Model	• **Soil Moisture:** Irrometer/Watermark • **Soil Temperature:** Davis
Range	• **Water Potential:** 0 to 200 cbar • **Temperature:** -40C to +70C
Accuracy	+/- 5%
Cable Length	16ft / 4.8m
Connector	6 pin, Switchcraft
Size	• **Soil Moisture:** 3.25" x ¾" (diameter) • **Soil Temperature:** 1" x ¼" (diameter)
Weight	0.6 lbs including cable

eS1201 – Ambient Temperature and Humidity

The eS1201 is a temperature/humidity sensor that measures the ambient relative humidity and air temperature. These readings are also used to calculate dew point. The sensor enclosure protects the sensor from mechanical damage, and a membrane filter protects the sensor elements from dust, dirt, and water spray.

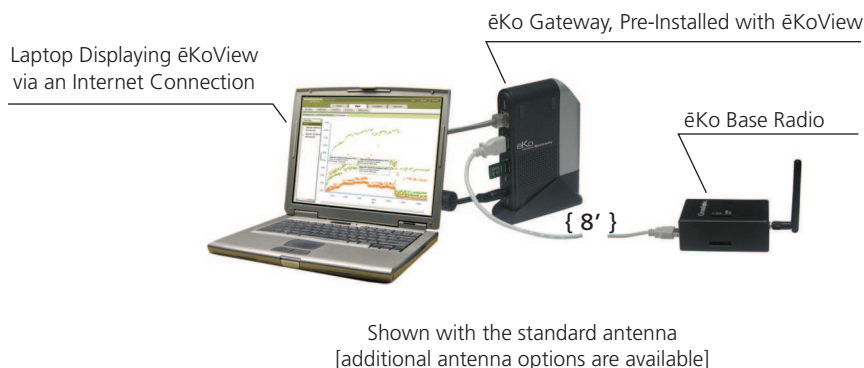| eS1201 – Ambient Temperature and Humidity	
Type	Simple ēKo sensor
Sensor Manufacturer / Model	MEMSIC – Using Sensirion SHT75
Range	• **Humidity:** 0 to 100%RHI • **Temperature:** -40 deg to 70 degC
Accuracy	• **Humidity:** +/-3% [10 to 90%RHI] • **Temperature:** +/-2C full range, +/-1C above -20C
Cable Length	20ft / 6m
Connector	6 pin, Switchcraft
Size	$3^5/_8$" x 1.4" (diameter)
Weight	0.5 lbs including cable
Weather Rating	IP65 Indoor / Outdoor

ēKo Base Radio – eB2110

The ēKo Base Radio, eB2110, is a fully integrated package that provides the connection between ēKo Sensor Nodes and the ēKo Gateway. The base radio integrates a MEMSIC IRIS family processor/radio board, antenna and USB interface board which is preprogrammed with MEMSIC's XMesh low-power networking protocol for communication with ēKo Nodes. The USB interface is used for data transfer between the base radio and the ēKoView application running inside the ēKo Gateway.

Radio	
Frequency	2.405 to 2.480 GHz
Channels	16 channels available
Type	DSSS, IEEE 802.15.4
Transmitter Power Output	+3dbm (typical)
Receive Sensitivity	-101dbm (typical)
Outdoor Range Per Hop	Typical 500ft to 1500ft line of sight per hop. Range extends through mesh networking hops.
Antenna	Removable dipole antenna. Optional outdoor and indoor antennas available.
Antenna Connector	Reverse SMA compatible with most wifi indoor and outdoor antennas
Certifications	FC CE RoHS COMPLIANT
Visual Indicator	
5 LED	Indicate power and radio communication
Cables	
USB	6ft USB cable between eB2110 and eB2100 gateway. (Accommodates up to 100ft USB extenders to remotely locate eB2110 from gateway)
Power	
Voltage	Supplied via USB cable from gateway.
Operating Current	30 mA average
Mechanical	
Enclosure	Indoor rated
Operating Temperature	6C to 40C ambient
Operating Humidity	10% to 80% non-condensing
Size	2.25" x 1.25" x 4"
Weight	0.25 lbs

Laptop Displaying ēKoView via an Internet Connection

ēKo Gateway, Pre-Installed with ēKoView

ēKo Base Radio

{ 8' }

Shown with the standard antenna
[additional antenna options are available]

ēKo Gateway – eG2100

The ēKo Gateway, eG2100, is an embedded Sensor Network gateway device. The ēKo Gateway runs the Debian Linux operating system. It comes preloaded with MEMSIC's Sensor Network management and data visualization software packages, ēKoView and XServe. These programs are automatically started when the gateway is turned on.

Gateway	
Operating System	Debian Linux OS
Flash Memory	
Type	USB plug – in
Memory Size	2 GB (gigabytes)
Connectors	
Ethernet	1 RJ45
USB	2 USB 2.0 host (USB 1.0/1.1 compatible)
Visual Indicators	
5 LEDs	Status indicators
Power	
Supply Voltage	5V
Power	4W
Mechanical	
Enclosure	Indoor rated
Operating Temperature	6C to 40C ambient
Operating Humidity	10% to 80% non-condensing
Size	5.2" x 0.83" x 3.6"
Weight	0.35 lbs
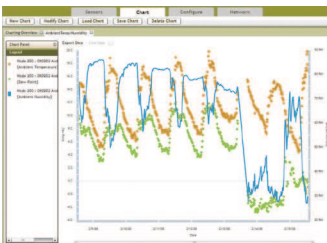
ēKoView – Web Interface

ēKoView offers a familiar and intuitive web browser based (i.e. Internet Explorer, Firefox etc) interface for sensor network data visualization. The ēKoView web application makes it easy for users to start monitoring and access their data from anywhere in the world via a laptop or smart phone. Through ēKoView's simplified intuitive interface, users can quickly setup and easily configure their views to display only the data that they are interested in. ēKoView comes pre-installed on the ēKo Gateway, a plug-and-play web server. Please go to www.xbow.com/eko/ekoview to view our online demo of this web application.

Key Features

- Create user-defined map view of sensor nodes across overall network

- Manage user-defined chart configurations

- Create trend charts of multiple sensors across customized time spans

- View details of individual sensor data

- Monitor performance of network and health of individual nodes

- Set alert levels and get notified via SMS or email

- Assign custom names to nodes and sensors