Dynamax

IRT INFRARED TEMPERATURE SYSTEMS

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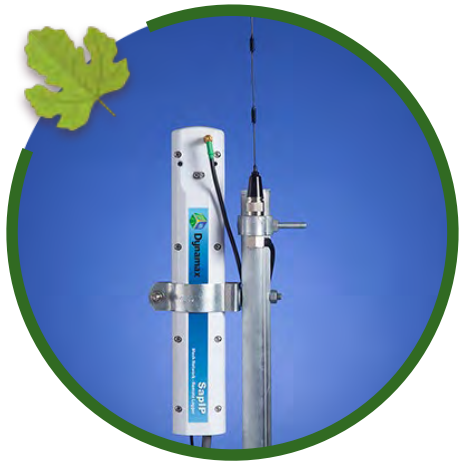
Crop and Water Stress Management Service and Equipment



Sap Flow and Sap Velocity Systems

- FLOW32, FLGS-TDP, SapIP Wireless Sap Flow Systems
- Patented EXO-Skin sensors
- Dynagage Heat Balance Sap Flow Sensors
- HPFM & HCFM Hydraulic Conductance Meters
- DEX Dendrometers

Systems Integrator

- Custom Weather Stations
- Environmental Science Applications
- Hydrology and Water Balance Systems

Agrisensors.NET Cloud-Based Data Manager

Complete IRT Systems

SALH-IRT Stress Accumulator Logger System

Stand alone data logging system
Monitors up to (25) wireless IRT sensors

IRT Coordinator System

Use a PC with IRT Watcher software
Monitors up to (27) wireless IRT sensors
Add to Center Pivot Irrigation Systems

SapIP IRT System

Add multiple IRT analog sensors to existing SapIP wireless networks
Monitor plant water use, soil moisture, ET weather, and IRT leaf temp., all in one wireless network

IRT Analog or SDI12 Sensors

Add to almost any data logger

RHT Weather Node

RH & Temp. to compute CWSI and vapor pressure deficit

IRT-SALH Stress Accumulator Logging System

- ✓ Monitors up to (25) IRT sensors, (3) routers
- ✓ Stress accumulator software (SAL)
- ✓ ZigBee link radio frequency transceiver, high power and waterproof 2.5 GHz antenna (500 m LOS)
- ✓ SD card slot for data storage (1 million records)
- ✓ Wi-Fi for data collection/observation, 50-100 ft. range
- ✓ Browser data access with authentication
- ✓ Mapping for IRT locations, field irrigation picture
- ✓ CWSI, iDANS, and temperature transmission to mobile device – Wi-Fi interface page

Full Features: Dynamax IRT System

Leaf temperature relating to plant stress
Compare to CWSI or other Stress Models

Used in irrigation scheduling

Excellent for drip/center pivot or other irrigation systems

Developed with USDA-ARS

Wireless, SDI-12, or Analog IR Temperature of ±0.5° C
±0.5º C accuracy over wide range of ambient (0-50º C)

20 degree Narrow Field of View
Very narrow field of view
95% sensitivity for a 3:1 (distance:width)
6 ft. distance gives a 2 ft. window

Rechargeable batteries (solar- 2 W separate)

Up to 27 units per network on an IRT Coordinator

1 min to 60 min output timing

RF Zigbee output in API format, low-cost coordinators

50 – 500 m range based on antenna gain

SapIP-RHT Relative Humidity and Temp Sensor

RH & Temperature Node (SPIP-RHT)

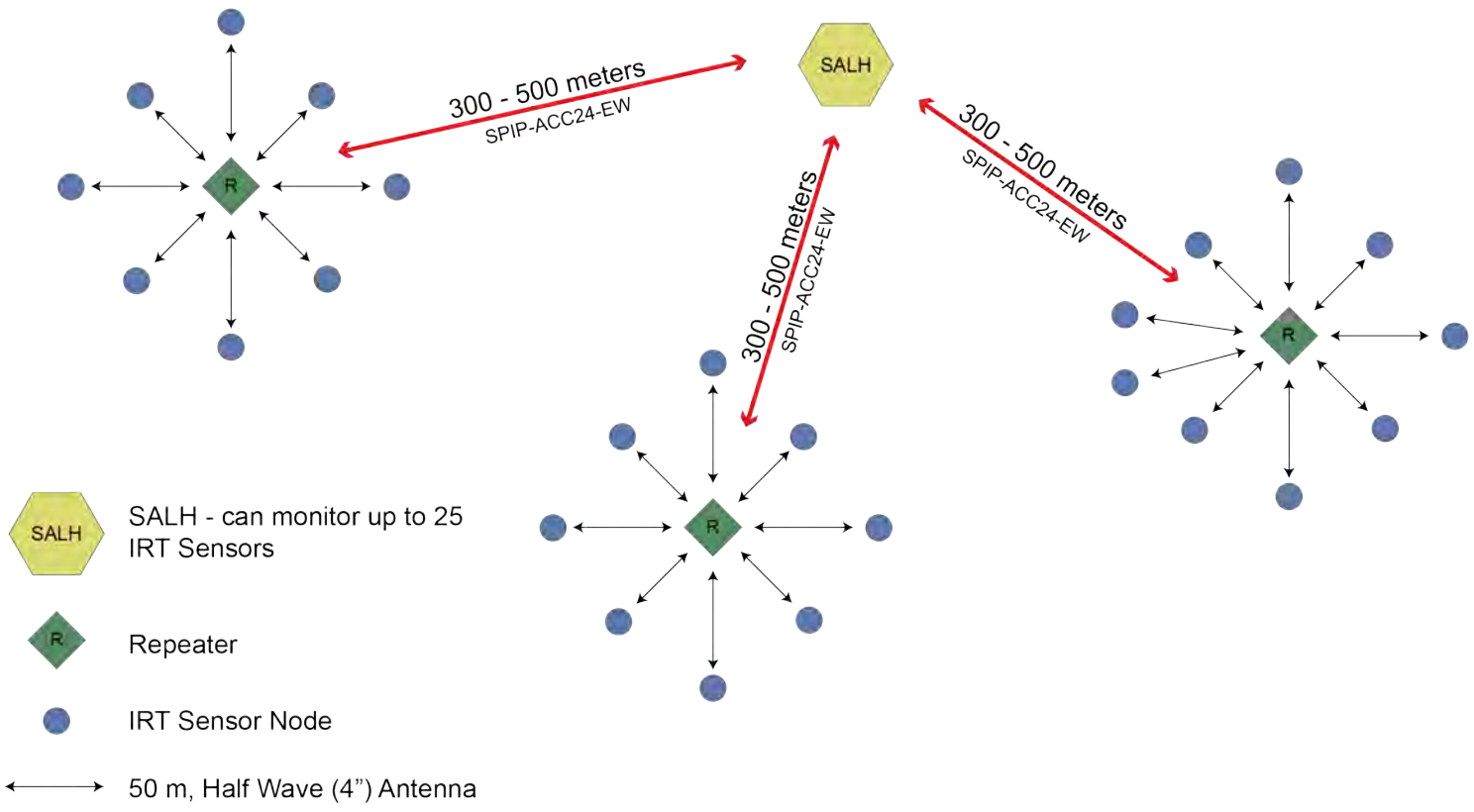
High Precision Sensors
- 0.1° C temperature accuracy for ambient
- Replaceable rotronic RHT sensor

For Calculation of Crop Water Stress Index (CWSI) or Vapor Pressure Deficit (VPD)
- High Stress = Temperature is above ambient or non-stressed plants

Wireless Connection to SALH Logger or Coordinator

SPIP-RHT Includes Battery and Charger

SALH System Configuration



SapIP nodes can be “daisy-chained” several levels deep, allowing distances of 2-3 miles to be monitored.

SapIP systems are versatile to meet application requirements.

CWSI Plant Stress Data Analysis

CWSI = 0.4 to 0.6, “0” is no stress

0.5 = 50% reduction in water use

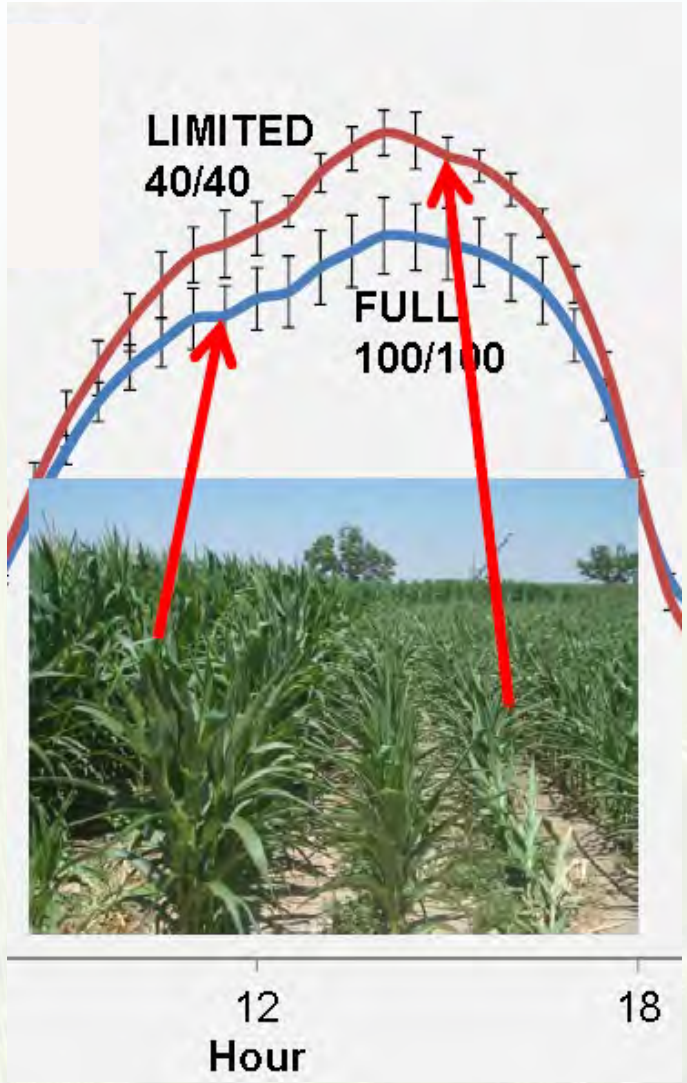
$$\mathrm{CWSI} = \frac{(\mathrm{d}T_{\mathrm{m}} - \mathrm{d}T_{\mathrm{LL}})}{(\mathrm{d}T_{\mathrm{UL}} - \mathrm{d}T_{\mathrm{LL}})}$$

dT $_{UL}$- Upper limit

dT $_{LL}$ – Lower limit

$$\mathrm{d}T_{\mathrm{LL}} = m \times \mathrm{VPD} + b$$

$$\mathrm{d}T_{\mathrm{UL}} = m \times \mathrm{VPG} + b$$



CWSI Plant Stress Data Analysis

Example:
T_{UL}=15C
T_{LL}=5C

$$CWSI = \frac{(dT_m - dT_{LL})}{(dT_{UL} - dT_{LL})}$$

dT_m = Max ($T - T_{air}$)

Plant leaf temperature vs:

Total water stress CWSI

CWSI = 1 - Ea/Ep = Actual Transp./Transp. Potential

Growers decide how much CWSI can be tolerated before irrigation (0.4 to 0.6)

Water is conserved if irrigation schedule is reduced & stress factor is neutral

Air = 30° C

40° C

$$CWSI = \frac{(40\text{-}30)C - (5\ C)}{(15\ C) - (5\ C)} = 0.50$$

Significant Stress depending on plant

Air = 30° C

35° C

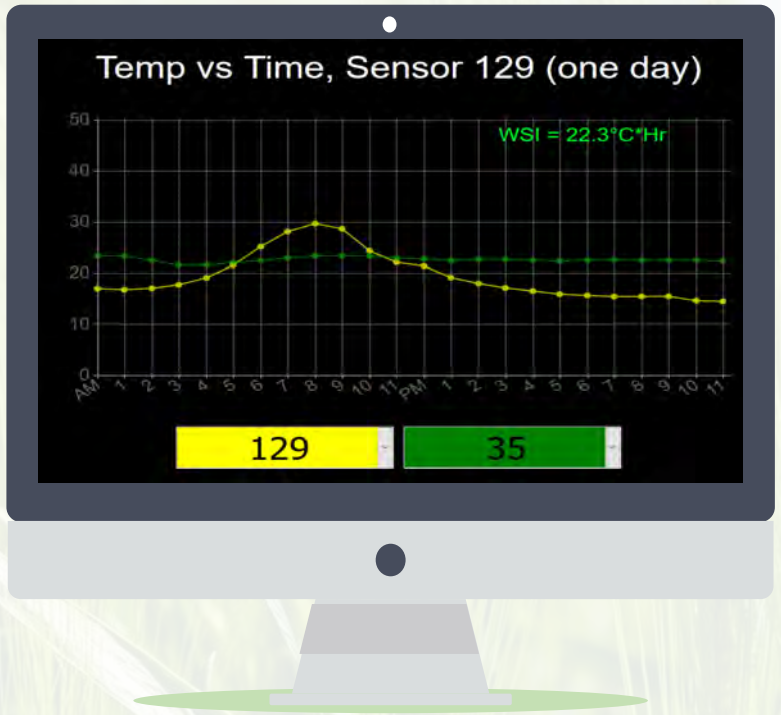
CWSI = 0.0
No Stress (T_{LL}=5 C)

CWSI Plant Stress Data Analysis

Plant leaf temperature vs:

DANS = Degrees Above Non-Stressed plants

Stress Factor = higher temperature above well watered plant (Degree-Hours)



Air = 30° C

40° C

Above well-watered:
DANS = 5.0° C

Air = 30° C

35° C

iDANS = Integrated Degrees Above Non-Stressed plants
(Shown Above as WSI= 22.3° C)

SapIP Coordinator Module

Coordinator connected to PC via USB or irrigation controller

Smart controllers have program changes based on temperature
CWSI algorithm is used

IRT Watcher Software

Allows for collection of files to PC

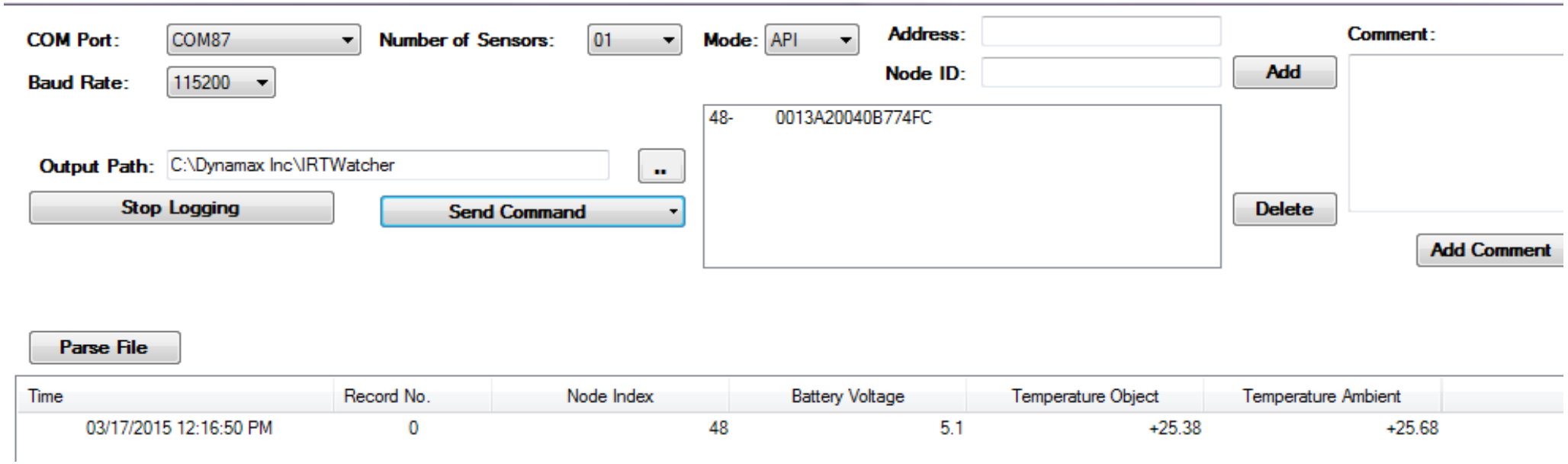
300-500 meters of “Line of Sight” with Outdoor Antenna

IRT-ACC24-EW

Use Routers to Add Distance

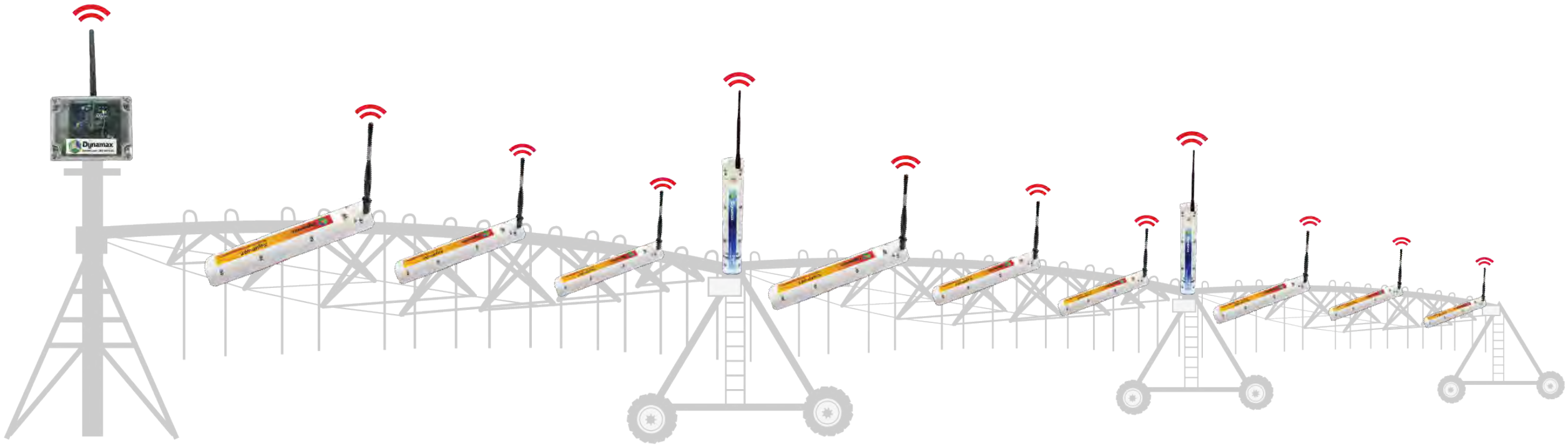
Additional 300-500 meters
Up to (27) IRT with (3) routers

IRT-SALH Stress Accumulator Logging System

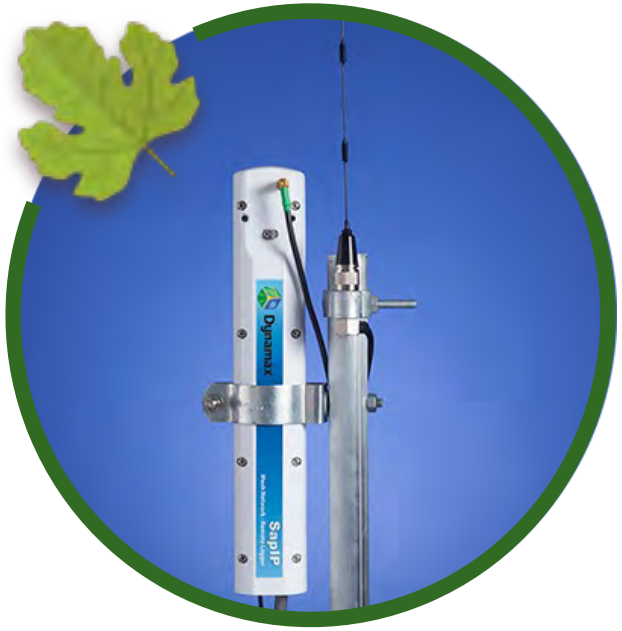


- ✓ Install on PC or Industrial Control PC with Windows Operating System
- ✓ Set up communications from USB to Coordinator
- ✓ Retrieve records for each IRT Node
- ✓ Save all data into .csv files, attached with date and time
- ✓ Use setup and network commands. Ex. “Sample” and “Network Reset” commands

Add IRT Coordinator to Moveable Irrigation Arm



Add IRT to SapIP System



SapIP Nodes
Sap Flow or TDP

Micro-Climate Kit
Weather and ET

Soil Moisture Node
*Add 4 or 6 SM150 Sensors

SPIP-IRT-AD
*Add up to
(6) IRT Leaf Temp to (1)
SapIP Node

Full Features: SapIP System

Nodes

- 30,000 Records
- 8 Analog In
- 2 Digital In
- Heater power
- Excitation

Gateway

- GSM or LAN Versions
- Power 120 or 220 Volt
- UPS Battery Backup
- Solar/Battery Option

Complete System

Wiring, grounding, antenna, surge protector, mounting hardware provided

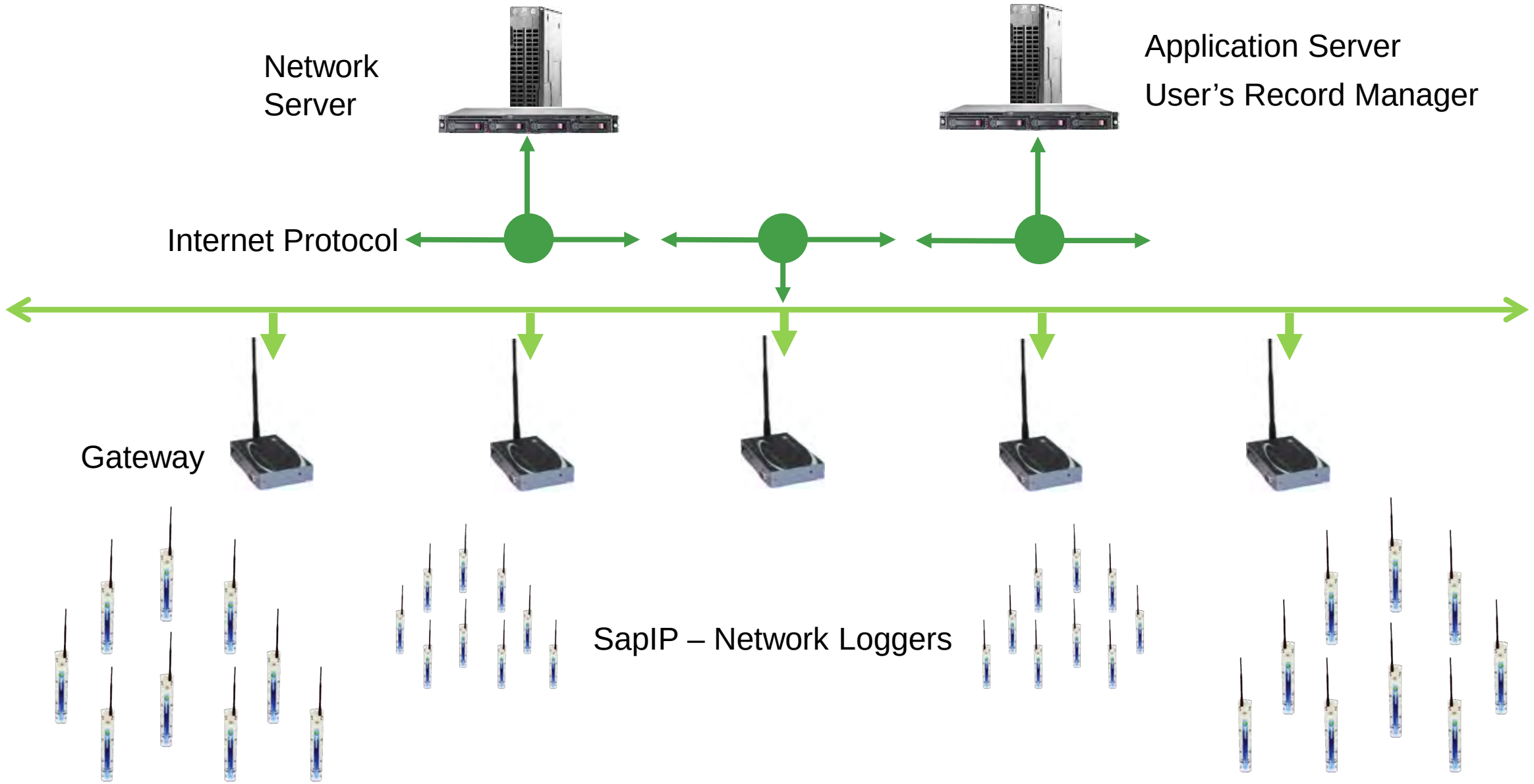
Antenna

- 2.4 GHz High Gain - 500 m Range
- 900 MHz High Gain – 1000 m Range

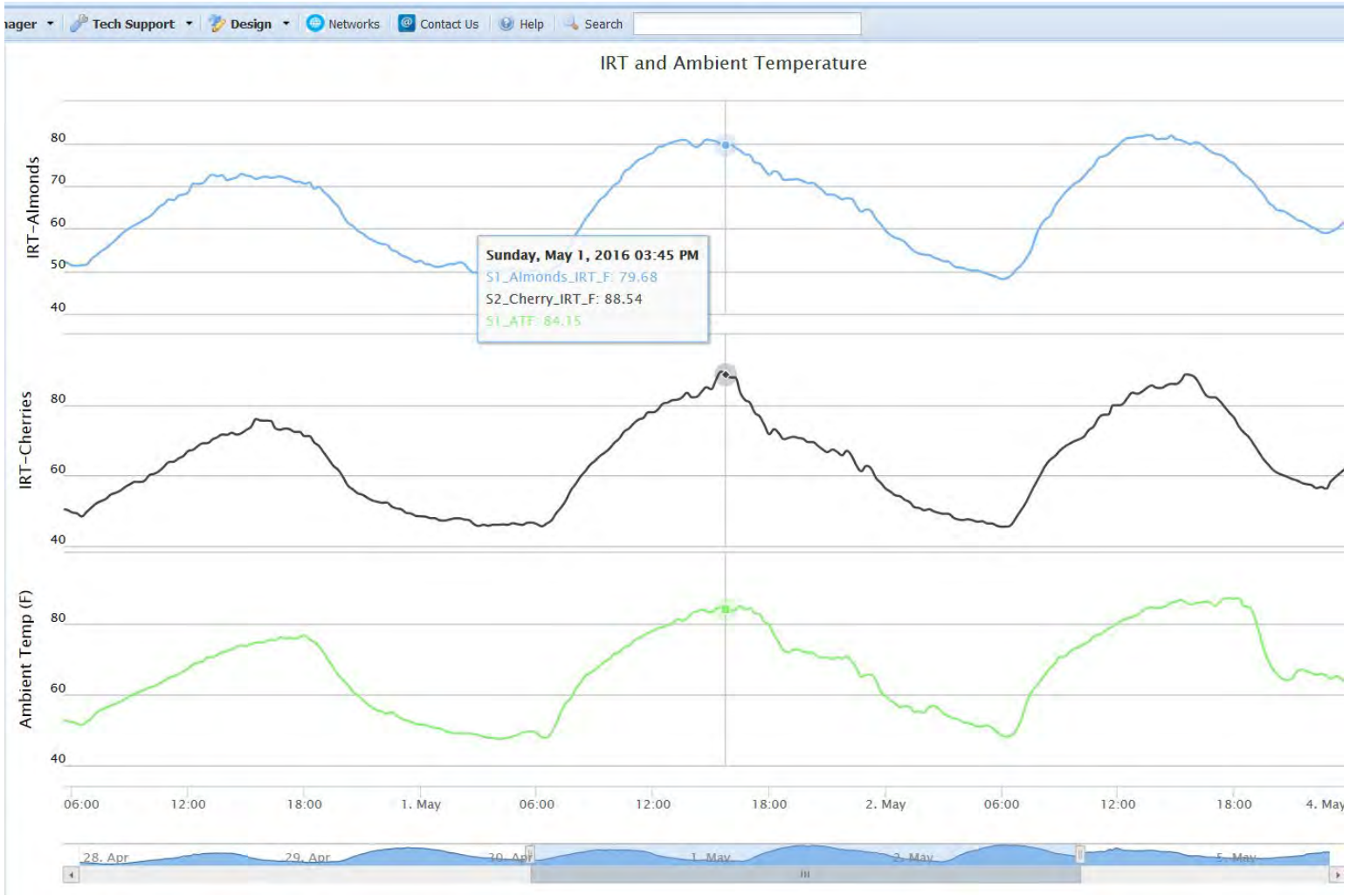
SapIP REP Router

- 500 m hops to SapIP Nodes

Agrisensors.NET Remote Logging Network



Agrisensors.NET Site Data



Not Well-Watered

Leaf Temperature for Cherries (Black) is 4 degrees above Ambient (Green)

Well-Watered

Leaf Temperature for Almonds (Blue) is below Ambient (Green)

IRT Sensor Models

1) Wireless IRT – Zigbee (SPIP-IRT)

Output = Serial #, Battery Volts,
T-Target, T-Body

Must obtain a Coordinator in Zigbee and a Router for every +9 nodes

2) Analog IRT Sensors (SPIP-IRT-AD)

Temp in Analog – For conventional signal loggers, two wire signal.
(-40° to 60° C = 0 to 1 V)

3) SDI-12 IRT – transmit (SPIP-IRT-SDI)

Output=Serial #, Battery Volts, T-Target, T-Body


Dynamax
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FOR YOUR
INTEREST
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