TWEAKING THE MARGINS: HOW CONTROLS SET YOU UP FOR A BETTER YIELD AND A LEANER OPERATING BUDGET

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**INTRODUCTIONS**

**Moderator:**
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- Controls: Enabling critical functions in the facility
- Data Collection: Collecting data relevant to critical functions in the facility
- Automation: Performance of critical functions in the facility
MOST COMMONLY CONTROLLED

- Lighting
- HVAC
- CO2
- Alarms
- Irrigation
In general, controls will remove the “human” element from cultivation operations, minimizing the impact of mistakes and ensuring what’s supposed to happen, happens; when and how it’s supposed to happen.
● Used in a number of industrial applications and large scale buildings
  ○ Airports
  ○ Hospitals
  ○ Manufacturing

● Not widely used in cultivation operations
  ○ Controls largely limited to on/off (entry level)
Dashboards are not controls

- Satisfied/not satisfied - send signal to “turn on” or “turn off”
- Displays room parameters
- Generally acceptable for lighting, irrigation, CO2
- Common dashboards unacceptable for high quality HVAC systems
  - Do not actually control modulating functions
  - Do not display or provide all relevant information
  - Not capable of performing full controls sequence of operations
OPERATING EXPENSE BENEFITS

FOR LIGHTING
● Saving money with basic systems
  ○ Stage lighting on/off to reduce peak demand
● Saving even more money with more sophisticated systems
  ○ Stage lighting based on optimal PPFD for plant growth stage (based on timing or lighting sensor)
● Saving even more money with more sophisticated systems
  ○ LED lighting can be adjusted incrementally
    ■ Provides a consistent PPFD

Note: Not generally advised for HID lighting
OPERATING EXPENSE BENEFITS FOR HVAC
● Saving money with basic systems
  ○ Ensuring that set points are appropriate for the photoperiod (removing human element)
  ○ Staging equipment
  ○ Knowing when something is out of whack
● Saving even more money with more sophisticated systems
  ○ More sophisticated HVAC systems
  ○ Modulate all functions (cruise control vs. stop and go traffic)
  ○ Extreme precision
● Saving even more money with more sophisticated systems
  ○ Utilize multiple sensors to ensure homogeneity
● Saving even more money with more sophisticated systems
  ○ Operating status and energy use of each piece of equipment
■ Maintenance (use less energy and/or avoid early failure)
■ Operating adjustments to reduce energy use
■ Perfect sequence of operations
OPERATING EXPENSE BENEFITS

FOR CO₂

ALARMS

IRRIGATION/FERTIGATION
BENEFITS FOR OPEX - CO2

- Maximize yield, minimize expenses
- Homogenize CO2 levels throughout grow
- Level out swings in PPM
BENEFITS FOR OPEX - ALARMS

● Saving money with basic systems
  ○ Understanding when something is wrong in the cultivation space

● Saving even more money with more sophisticated systems
  ○ Understanding when something is wrong with a piece of equipment, before it impacts the cultivation space
  ○ Maintain ahead of failure, improve longevity
BENEFITS FOR OPEX - ALARMS

- Saving even more money with more sophisticated systems
  - Understanding when something is wrong with a piece of equipment, before it impacts the cultivation space
BENEFITS FOR OPEX - IRRIGATION/FERTIGATION

● Saving money with basic systems
  ○ Reducing manpower associated with irrigation

● Saving even more money with more sophisticated systems
  ○ Reducing runoff
  ○ Reducing nutrient use
MANUALLY OR THROUGH ANALYTICS COMPANIES
● How to use analytics
  ○ Revenue and yields
  ○ Performance and yields of varying PPFD to maximize production
  ○ Understanding correlations between seemingly unrelated events
● More ways to use analytics
  ○ Reviewing anomalies when harvests are particularly good/bad to identify a pattern
  ○ Reviewing energy performance related to cultivation operations
  ○ Perfecting processes to boost yields
Central Plant

Single Room

- **Average Temperature**
  - Central Plant: 79.2°F
  - Zone 1: 79.9°F
  - Zone 2: 78.4°F

- **Average Humidity**
  - Central Plant: 57.3%
  - Zone 1: 59.1 %RH
  - Zone 2: 58.1 %RH

- **Average CO₂**
  - Central Plant: 1175 ppm
  - Zone 1: 1183 ppm
  - Zone 2: 1108 ppm

- **Average VPD**
  - Central Plant: 1.5 ΔkPa
  - Zone 1: 1.5 ΔkPa
  - Zone 2: 1.5 ΔkPa
QUESTIONS?

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