LoRa / LoRaWAN

LoRa (Long Range) is a low-power, long-range wireless communication technology designed for sparse, distributed sensor networks. LoRaWAN defines the network protocol layer used for device addressing, routing, and gateway communication.

Purpose in AOFS

- Long-distance soil moisture sensors
- Remote water tank level monitoring
- Environmental stations (wind, rainfall, temperature)
- Large farm perimeter or distributed zone monitoring
- Sparse deployments where mesh density is impractical

Layer Mapping

- Sensor → Field Controller (via local LoRa gateway)
- Optional Field → Farm Controller aggregation
- Not used for direct safety-critical actuation without local validation

Strengths

- Very long communication range (several kilometers depending on terrain)
- Extremely low power consumption
- Suitable for battery-powered or solar-powered remote sensors
- Reduced infrastructure requirements compared to dense mesh networks
- Well-suited for large or geographically dispersed farms

Limitations

- Low bandwidth (not suitable for high-frequency data transmission)
- Higher latency compared to short-range mesh protocols
- Typically requires a gateway device for network aggregation
- Not suitable for high-speed real-time control loops

AOFS Compliance Notes

- LoRa devices must communicate through a locally controlled gateway
- Field Controller must validate all received data before acting
- LoRa communication loss must not compromise irrigation safety
- Actuation commands must always be executed by the Field Controller, not directly by remote nodes

- All LoRa-originating data and events must be timestamped and logged
- LoRa connectivity is optional and must not be required for core operation