What are the core AO/DI/DL modules in LN-3000 architecture

The LN-3000 architecture is part of the **LN Series distributed control system** family built around **LONWORKS® industrial networking** from Johnson Controls. It uses modular AO (Analog Output), DI (Digital Input), and DL (Data or Digital Link) subsystems to extend distributed intelligence and interoperability across automation or HVAC networks.

Core Module Overview

The system's hardware architecture defines three key remote I/O module types that collectively form the AO, DI, and DL layers of control.

Module	Inputs	Outputs	Output Type	Key Function	Source
LN-IO301-1	8 universal inputs	8 digital outputs	Triac 1.0 A @ 24 VAC (PWM configurable)	Local control with mixed AO/DI handling; supports 12-bit D/A conversion	[1]
LN-IO401-1	12 universal inputs	12 digital outputs	Triac 1.0 A @ 24 VAC (PWM adjustable)	Expanded version for process loops or large HVAC zones	[1]
LN-IO520-1	16 universal inputs	0 outputs	N/A	Dedicated input module for data acquisition or control coordination	[1]

All three share consistent power, logic, and communication specifications, enabling interchangeable AO/DI functionality across the network.

AO (Analog Output) Module Functions

- **12-bit digital-to-analog conversion** ensures smooth control over actuators and analog valves.
- Outputs may be configured as PWM or digital triac channels with adjustable duty cycles from 2 s – 15 min.
- Supports **load shedding**, **flow calibration**, and **PID control loop adjustments** through software on the LN-Builder interface.
- Each channel features **status indicators** and **fuse protection** for 24 VAC power lines.[1]

DI (Digital Input) Module Functions

- Fully **software-configurable universal inputs** that support:
  - **Digital dry contacts** (for switch or sensor triggers).
  - **Analog 0–10 V DC** and **current 4–20 mA** sensors with parallel 249 Ω resistors.
  - **Resistive sensors** such as thermistors (Type 2, 3), **Pt100/Pt1000 RTDs**, or **potentiometers** for variable measurement.
- **16-bit A/D converter** provides fine-grain digital resolution for analog measurement inputs.[1]

DL (Data Link) and Communication Layer

- Built upon **LONWORKS® (LonTalk® protocol)** with **TP/FT-10 twisted-pair channels** running at 78 kbps.
- **Peer-to-peer communication** allows modules (I/O, supervisory, or controllers) to operate without a central intermediary.
- Network variables follow **LONMARK® standard SNVTs**, ensuring interoperability between controllers.
- Managed via **LNS plug-ins** such as **LN-Builder** or **LN-Configure**, which allow configuration of I/O parameters, PID sequences, calibration, and fault responses.
- DL firmware runs on a **Neuron 3150 10 MHz processor** with **64 KB nonvolatile flash** for program and storage memory.[1]

Physical and Environmental Design

- 24 VAC/DC ±15% power supply (6–15 VA typical).
- ABS UL94-5VA fire-retardant enclosure with CE, FCC, and UL916 compliance.
- Operating range: 0 – 50 °C, 0–90% RH non-condensing; designed for field or panel mounting.[1]

Architectural Summary

In the LN-3000 distributed control system:

- The **AO subsystem** manages analog actuation via configurable PWM/triac or voltage outputs.
- The **DI subsystem** aggregates universal sensor inputs (digital or analog) with real-time sampling and high resolution.
- The **DL subsystem** provides deterministic, peer-level communication over LONWORKS®, supporting decentralized decision logic and diagnostics.

Together these modules form a scalable, interoperable automation layer suitable for HVAC, process, and building management applications.[1]

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1. https://docs.johnsoncontrols.com/bas/api/khub/documents/PqKgF0_xN6VxPaf~70FAkw/content
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