

# AIRNEXUS

## HYDRONIC EXPANSION

ANX-EXP-HYDRO8

### Technical Reference Document

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# 1. Product Overview

The AirNexus Hydronic Expansion module (ANX-EXP-HYDRO8) is a purpose-built 8-channel I/O expansion for the AirNexus Core controller. Designed for both residential and commercial hydronic heating and cooling installations, it provides independent control of up to 8 zones — managing pumps, mixing valves, zone actuators, and monitoring analog sensors — all through a single compact DIN-rail mounted module.

The module communicates with the AirNexus Core via the ANX Bus (RS485), enabling plug-and-play expansion of the Core's I/O capacity. Multiple Hydronic Expansion modules can be daisy-chained from a single AirNexus Core to support larger installations.

## Requires AirNexus Core

The Hydronic Expansion module is not a standalone controller. It must be connected to an AirNexus Core via the ANX Bus (RS485) to operate. All logic, scheduling, and cloud connectivity is handled by the AirNexus Core.

## 1.1 Key Features

<p><b>8 Independent Outputs</b></p> <p>Relay outputs for pump run commands, mixing valve drive (open/close), zone actuators, and enable signals. Volt-free contacts rated 10A AC/DC.</p>	<p><b>8 Universal Inputs</b></p> <p>Configurable analog and digital inputs for temperature sensors (NTC), current transformer feedback (0–5V / 0–10V), and voltage-free status contacts.</p>	<p><b>RS485 / ANX Bus</b></p> <p>Communicates with AirNexus Core via RS485 Modbus RTU protocol. Daisy-chain multiple modules for expanded I/O capacity.</p>
<p><b>DIN-Rail Mounting</b></p> <p>Compact 110 × 90 × 50 mm enclosure designed for installation inside standard electrical DIN-rail panels.</p>	<p><b>Zone Scheduling</b></p> <p>Per-zone heating and cooling schedules configured via the AirNexus App and executed by the AirNexus Core.</p>	<p><b>Remote Management</b></p> <p>Full monitoring and control via the AirNexus App (iOS, Android, Windows) and all supported home automation drivers.</p>

## 2. Specifications

Electrical	
Supply Voltage	24VDC · 0.5A · ±5%
Power Consumption	Max 12W at full relay load
Outputs (DO)	
Number of Outputs	8 relay outputs (configurable as DO-1 to DO-8 per I/O schedule)
Relay Type	Volt-free contact · No internal voltage on output terminals
DC Relay Rating	10A DC max · 30V DC max
AC Relay Rating	10A AC rated current · 250V AC maximum
Output Typical Use	Pump run commands · Mixing valve open/close · Zone actuator drive · Enable signals
Inputs (AI/UI)	
Number of Inputs	8 universal inputs (configurable as UI-1 to UI-8 per I/O schedule)
Input Type	10 channels voltage-free contact input · Configurable as analog input
Analog Signal	0–5V and 0–10V compatible (current transformer CT feedback, NTC sensors)
Typical Input Use	NTC temperature sensors · CT current feedback · Voltage-free status contacts
Communications	
Interface	RS485 · Modbus RTU · ANX Bus daisy-chain
Standard	IEEE 802.3
Bus Role	Modbus slave · Controlled by AirNexus Core (Modbus master)
Termination	120Ω resistor at far-end module on RS485 bus
Mechanical & Environmental	
Dimensions	110 × 90 × 50 mm
Weight	165g
Enclosure Material	ABS plastic
Mounting	DIN-rail · Surface mount adaptor available
Operating Temp	–40°C to +85°C
Indicators	RX LED (red) · TX LED (green) · RS485 communication activity

## 3. Installation

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The AirNexus Hydronic Expansion module is designed for installation inside a standard electrical DIN-rail enclosure or control panel. All field wiring (pump relays, valve actuators, sensors, and bus cables) terminates on the screw terminal blocks on the module's perimeter.

### Qualified Installer Only

Installation must be performed by a suitably qualified electrical contractor. All wiring must comply with applicable local electrical codes and standards. Isolate all supplies before making any wiring connections.

### 3.1 Pre-Installation Checklist

- AirNexus Core is installed and powered in the same control panel or within RS485 cable reach
- 24VDC regulated supply available — module requires 24VDC 0.5A minimum
- RS485/ANX Bus cable run planned from AirNexus Core to this module
- Shielded twisted pair RS485 cable on hand (Belden 9841 or equivalent)
- Field device wiring (pump cables, valve actuator cables, sensor cables) accessible at panel
- I/O schedule (points list) prepared identifying which field device connects to which terminal
- Slave address determined for this module (unique address on the ANX Bus)

## 3.2 Installation Steps

### Installation Procedure — ANX-EXP-HYDRO8

- 1 Mount the module on DIN rail**

Clip the Hydronic Expansion module onto the DIN rail inside the control panel. Position it adjacent to the AirNexus Core if possible to minimise ANX Bus cable length. Ensure adequate clearance around the module for cable routing and terminal access.
- 2 Connect 24VDC power supply**

Wire 24VDC regulated power to the power input terminals on the module. Observe polarity — +V to positive, GND to negative. Verify supply voltage before powering on. The module requires 24VDC at 0.5A minimum.
- 3 Connect ANX Bus (RS485) to AirNexus Core**

Use shielded twisted pair cable to connect the RS485 A(+) and B(-) terminals on the module to the ANX Bus daisy-chain from the AirNexus Core. Bond the cable shield to earth at the Core end only — float the shield at the module end. If this is the last module in the chain, fit a 120Ω termination resistor across A(+) and B(-).
- 4 Wire digital outputs (DO-1 to DO-8)**

Connect field device control wires (pump relay coils, valve actuator inputs, element contactors, etc.) to the relay output terminals per your I/O schedule. Outputs are volt-free contacts — ensure the field device provides its own supply voltage through the contact. Verify load current does not exceed 10A per relay.
- 5 Wire universal inputs (UI-1 to UI-8)**

Connect sensor and feedback signal wires to the input terminals per your I/O schedule. NTC temperature sensors connect directly to the AI terminals. Current transformer (CT) signal cables (0–5V output) connect to the configured UI terminals. Voltage-free contacts (e.g. pump run confirm) connect to DI-configured terminals.
- 6 Label all field wiring**

Label every wire at both ends before closing the panel. Cable labels should identify the point reference (e.g. DO-3 PMP1-RUN, UI-7 PMP1-FB) as per the I/O schedule. This is essential for commissioning and future maintenance.
- 7 Power on and verify RS485 comms**

Power on the module. Observe the RX and TX LEDs — both should flash to indicate active RS485 communication with the AirNexus Core. If LEDs are not flashing, check cable polarity (A/B), termination, and slave address configuration.
- 8 Configure module in AirNexus App**

Open the AirNexus App on the site. Navigate to Device Management and confirm the Hydronic Expansion module appears as a connected device. Assign point labels and verify all I/O points match the I/O schedule. Perform point-by-point functional testing before closing the panel.

#### RS485 Daisy-Chain Topology

Wire the ANX Bus as a strict daisy-chain — Core → Module 1 → Module 2 → ... → Last Module → [120Ω]. Do not use star or T-junction wiring as this causes signal reflections and Modbus communication errors. The 120Ω termination resistor is fitted only at the last module in the chain.

## 4. Usage & Configuration

### 4.1 Typical Application — Hydronic System with AirNexus Core

The Hydronic Expansion module is the field I/O interface between the AirNexus Core's logic and the physical hydronic plant. The Core executes all control logic — including weather compensation curves, PID setpoint control, pump sequencing, and frost protection — and commands the Expansion module's relay outputs accordingly. Sensor and feedback data from the module's inputs is read by the Core and used in control decisions.

#### Typical I/O Assignments (Example — see project I/O schedule for actual assignments)

DO-1 / DO-2	Heat pump enable outputs — HP-HEAT and HP-COOL relay outputs wired to heat pump enable terminals
DO-3 / DO-4	Pump run commands — PMP1-RUN and PMP2-RUN relay outputs to pump contactor/relay coils
DO-5 / DO-6	Pump run commands or mixing valve drive — PMP3-RUN, PMP4-RUN, MV-OPEN, MV-CLOSE
DO-7 / DO-8	Mixing valve drive or zone actuator outputs — MV1-OPEN, MV1-CLOSE, ACT1, ACT2
UI-1 / UI-2	Temperature sensors — hot water tank NTC, buffer tank NTC (0–5V or resistance)
UI-3 to UI-6	Strap temperature sensors — mixing valve supply/return, zone supply/return (NTC)
UI-7 / UI-8	Current transformer (CT) feedback — pump run verification (0–5V CT output)

#### I/O Schedule

For every installation a project-specific I/O schedule (points list) must be prepared assigning each field device to a specific module terminal. The I/O schedule is the definitive reference for wiring and commissioning. Refer to the AirNexus project documentation for the site-specific schedule.

## 4.2 Relay Output Wiring Considerations

The relay outputs on the Hydronic Expansion module are volt-free contacts. They do not supply or switch any internal voltage — the field device must provide its own operating voltage through the contact.

- Pump run commands: wire relay contact in series with the pump contactor/starter coil supply
- Mixing valve drive: wire MV-OPEN and MV-CLOSE relay contacts to the actuator 24VAC/VDC terminals — ensure the two drive outputs are never energised simultaneously (interlock enforced in AirNexus logic)
- Zone actuators: wire relay contact to actuator supply terminal — confirm actuator voltage (24VAC or 24VDC) before wiring
- Heat pump enable: wire relay contact to the heat pump's hardwired enable terminal — verify terminal function with heat pump documentation
- Maximum relay load: 10A AC at 250V AC · 10A DC at 30V DC — do not exceed rated load

### Mixing Valve Interlock

Mixing valve drive-open (MV-OPEN) and drive-close (MV-CLOSE) outputs must never be energised simultaneously as this will damage the valve actuator. The AirNexus Core enforces this interlock in software. Do not bypass or override this interlock in the field.

## 4.3 Analog Input Wiring Considerations

Universal inputs can be configured for analog (AI) or digital (DI) operation. The most common analog input types used with the Hydronic Expansion module are:

Universal Input Types	
<b>NTC Temperature Sensor</b>	Two-wire NTC thermistor — strap or immersion type. No polarity. Apply thermal paste and insulate strap sensors. Calibrate against reference thermometer at commissioning (target $\pm 1^{\circ}\text{C}$ ).
<b>CT Feedback (0–5V)</b>	Current transformer signal cable — shielded, single pair. Shield bonded at module end only. Verify CT output range matches module input specification. Confirms pump or element is drawing current.
<b>CT Feedback (0–10V)</b>	As above — confirm module input configuration supports 0–10V range before connecting.
<b>Voltage-Free Contact</b>	Pump run confirm, valve end-switch, or other volt-free status contacts. Connect across DI-configured terminals. No external voltage required.

## 4.4 Zone Scheduling & Remote Control

All scheduling and remote control for zones managed by the Hydronic Expansion module is configured in the AirNexus App. The App communicates with the AirNexus Core, which translates schedule and setpoint commands into relay output actions on the Expansion module.

- Per-zone heating and cooling schedules — configured in the AirNexus App
- Setpoint and mode changes take effect within one polling cycle
- Historical temperature and system data logged continuously to AirNexus Cloud
- Full remote control via AirNexus App (iOS, Android, Windows) from anywhere
- Automation driver integration (Control4, Crestron, etc.) via AirNexus Core IP Driver

## 5. Commissioning

Commissioning the Hydronic Expansion module involves verifying every I/O point against the project I/O schedule before the system is handed over. The following sequence is recommended.

Commissioning Sequence — ANX-EXP-HYDRO8	
<b>1</b>	<b>Verify RS485 communication</b> Confirm the module appears in the AirNexus App as an online device. Check RX/TX LEDs are flashing. If the module is offline, check cable polarity, termination resistor placement, and that the slave address is unique on the bus.
<b>2</b>	<b>Point-by-point output test</b> For each DO (DO-1 to DO-8): energise the relay from the AirNexus App diagnostic screen and confirm the correct field device activates. Check at the device (pump starts, valve moves, actuator energises) — do not rely on relay click alone.
<b>3</b>	<b>Verify sensor readings</b> For each UI configured as NTC: confirm the temperature reading in the App matches a calibrated reference thermometer placed at the same location. Target $\pm 1^{\circ}\text{C}$ . For CT inputs: confirm reading is above zero when the associated pump is running and near zero when stopped.
<b>4</b>	<b>Test mixing valve interlock</b> Verify that the AirNexus logic does not allow MV-OPEN and MV-CLOSE to energise simultaneously. Attempt to force both outputs simultaneously via the diagnostic screen and confirm the interlock prevents concurrent operation.
<b>5</b>	<b>Functional sequence test</b> Run the system through at least one full heating cycle. Confirm pump starts, valve modulation, zone actuator operation, and sensor readings all behave as expected. Review the zone history graph in the AirNexus App after the test to verify data logging.
<b>6</b>	<b>Sign off I/O schedule</b> Mark each point on the project I/O schedule as tested and confirmed. Obtain written sign-off from the M&E contractor and electrical contractor before handover. File the signed I/O schedule with the project documentation.

## 6. Support & Further Information

<b>Website</b>	airnexus.io — product documentation, firmware, support portal
<b>Technical Support</b>	Available via the AirNexus support portal at airnexus.io
<b>Custom Engineering</b>	Contact via airnexus.io for bespoke integration and engineering projects
<b>App Downloads</b>	iOS App Store · Google Play · Windows at airnexus.io
<b>Related Documents</b>	AirNexus Core Technical Reference · Project I/O Schedule · Commissioning Checklist

### Document Information

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