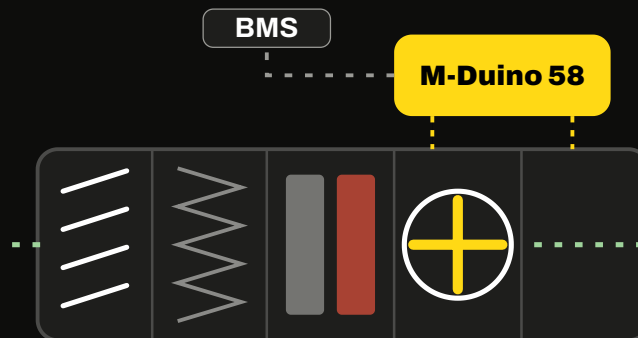


SECTOR: HVAC OEM

One controller design. Every unit in the series.

An M-Duino 58 runs the fans, coils and dampers, and talks Modbus to the BMS.

[Read the interactive case study online ›](#)


Schematic illustration

58

I/O on one M-Duino 58: 36 inputs and 22 outputs

16

analog inputs for temperatures, pressures, CO2 and humidity

8

analog outputs for fan drives, coil valves and dampers

1

controller design for the whole series, set by parameters

THE CHALLENGE

Many models, many options, one controller to support.

An OEM of air handling units sells a range of sizes, with or without heating coil, with an economizer or without, with one fan or two. Each unit goes to a different building, with a different building management system. The control engineer wants one controller and one program for the whole range, open enough to change, and with a clear map of data for the integrator of the building.

01

Hold the supply air

Keep the supply air temperature at its set point by sequencing heating, free cooling with outdoor air and mechanical cooling.

02

Move the right air

Hold the duct static pressure with the supply fan drive, and see when the filter needs a change.

03

Respect the safeties

Freeze and smoke protections stop the unit by wire. The controller must read them and bring the unit to a safe state.

04

Speak to the building

Give the BMS a fixed map: states, measures, alarms and the commands it is allowed to send.



One program for the range

Size, coils, fans and options are parameters set at the end of the line, not a different program for each unit.

HOW IT WORKS

Three jobs of the unit controller: temperature, air, safety.

Job 1 · Temperature

Heating, free cooling, cooling: one sequence for the supply air.

The PLC compares the supply air temperature with its set point and runs one sequence: first the heating valve, then the outdoor air damper for free cooling, then the cooling valve. The outdoor air temperature decides if free cooling is worth it.

- Supply air set point, PI loop
- Heating, economizer and cooling in sequence
- Minimum outdoor air always kept

Job 2 · Air

The fan holds the duct pressure. The filter tells when it is dirty.

The supply fan drive follows the duct static pressure: when the zone boxes close, the pressure rises and the fan slows down. The PLC also reads the pressure across the filter, and checks that each fan really runs after a start command. Close the boxes, clog the filter and make the fan fail.

- Duct static pressure, PI loop on the drive
- Filter alarm on differential pressure
- Fan proof: status must follow the command

Job 3 · Safety and BMS

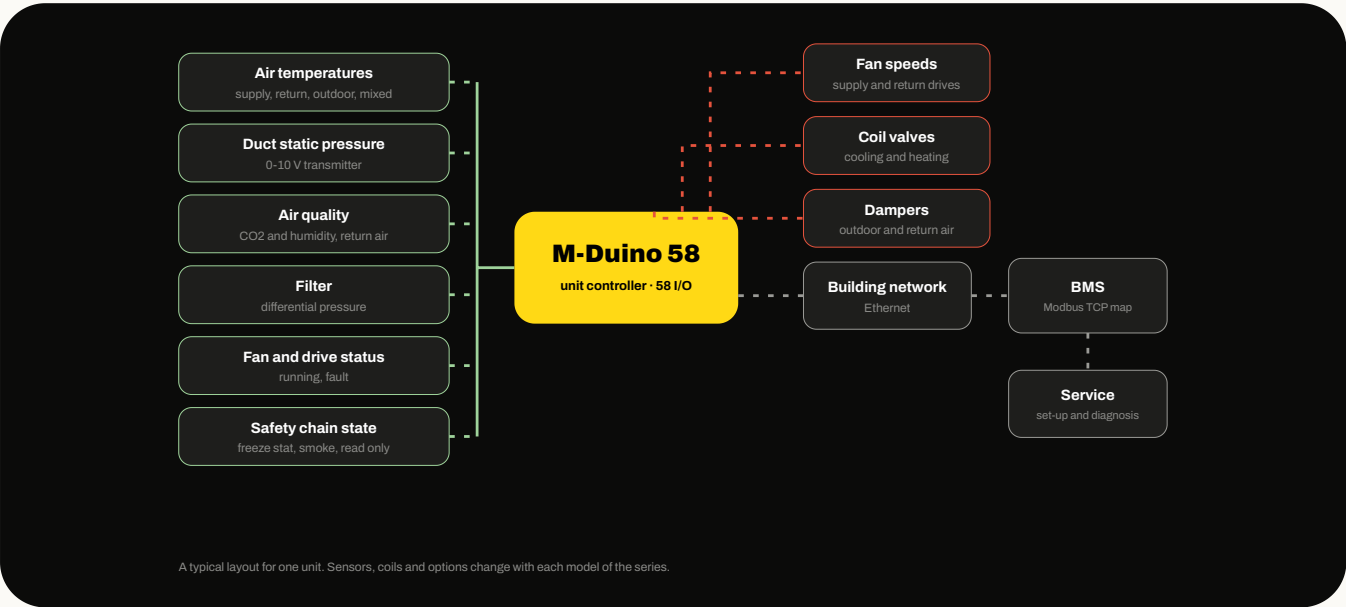
The safety chain stops the unit. The PLC makes it safe and tells the BMS.

Freeze and smoke protections are wired to stop the fans without waiting for the program. The PLC reads their state, closes the outdoor air damper, opens the heating valve on a freeze trip and sends the alarm. The BMS sees all of it in the Modbus TCP map, and can set occupied or unoccupied mode.

- Hardwired safety chain, read by the PLC
- Safe positions for dampers and valves
- Occupied and unoccupied mode from the BMS

How does a PLC control an air handling unit built in series?

An M-DUINO ETHERNET PLC ARDUINO 58 sits in the control panel of the unit. It reads the air temperatures, the duct static pressure, the air quality, the filter, the state of the fans and drives, and the state of the safety chain. It drives the fan speeds, the coil valves and the dampers, and gives the building management system a fixed Modbus TCP map over Ethernet.



Inputs to the PLC Outputs Building network

Signals

Signal	Between	Type	Purpose
Supply, return, outdoor, mixed air temperature	Transmitters → M-Duino 58	Analog 0-10 V	Supply air loop, economizer, freeze watch
Duct static pressure	Transmitter → PLC	Analog 0-10 V	Fan speed loop
CO2 and humidity	Return air sensors → PLC	Analog 0-10 V	Outdoor air and comfort
Filter pressure drop	Transmitter or switch → PLC	Analog or digital	Maintenance alarm
Fan running, drive fault	Drives → PLC	Digital in, or Modbus RTU (typical)	Fan proof and faults
Freeze stat, smoke detector	Safety chain → PLC	Digital in, read only	Safe positions and alarms
Fan speed	PLC → supply and return drives	Analog 0-10 V, or Modbus RTU	Hold duct pressure
Coil valves	PLC → cooling and heating valves	Analog 0-10 V	Supply air temperature
Dampers	PLC → outdoor and return air actuators	Analog 0-10 V	Minimum air and free cooling
Fan start, stages, alarm relay	PLC → panel	Digital out	Commands and signalling
States, measures, commands	PLC ↔ BMS	Modbus TCP over Ethernet	Building integration

One M-Duino 58 in the control panel of each unit.



M-DUINO ETHERNET PLC ARDUINO 58

An industrial PLC based on Arduino, with 58 I/O and Ethernet, for DIN rail. It is the unit controller: control loops, sequences, safe positions and the Modbus TCP map for the BMS.

Role	Unit controller: supply air, fans, dampers, coils, safeties and BMS map
Microcontroller	Arduino Mega 2560 (ATmega2560, 16 MHz)
Inputs	36: 16 analog/digital (0-10 V, 10-bit) and 20 digital optoisolated, 5 to 24 Vdc, 6 with interrupt
Outputs	22: 8 analog/digital/PWM (0-10 V, 8-bit) and 14 digital optoisolated, 5 to 24 Vdc
Communications	USB 2.0 Type-B, Ethernet (W5500, 10/100), RS-485, RS-232, TTL, I2C, SPI
Power and mounting	12 to 24 Vdc, DIN rail TS35, IP20, 0 to 60 °C; real-time clock and microSD slot

Temperature probes such as NTC or Pt1000 need transmitters to 0-10 V, or a temperature input module. The digital outputs are transistor outputs at 24 Vdc: use interface relays for contactors and compressor stages.

[See the M-Duino 58 ›](#)

All the unit in one PLC

With 36 inputs and 22 outputs, 16 of them analog in and 8 analog out, one M-Duino 58 covers the sensors and actuators of a typical unit.

Parameters, not versions

Size, coils, fans and options live in parameters set at the end of the line, so one program serves the range.

Safeties stay hardwired

Freeze and smoke protections stop the fans by wire. The PLC adds the safe positions and the alarms, it does not replace the chain.

SIMILAR PROJECT?

Tell us about your units. An engineer will answer.

Tell us the range of units, the sensors and actuators per model, the options and what the buildings expect from the BMS link. We will tell you which controller, which I/O and which data map fit.

READ IT ONLINE

industrialshields.com/case-study-hvac-oem-air-handling-unit-controller-m-duino

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