CASE STUDY · PHARMA / BIOTECH

From a Man With a Notebook to a Smart System That Never Sleeps

In a pharma lab in Bangalore, seven gas cylinders were being watched by one field engineer walking around with a pen and paper. No alerts. No screen. No alarm. Just a guy checking a dial. We changed that — completely.

CLIENT	PLATFORM	PROJECT	YEAR
Syngene Biotech	SmartNova BMS	Gas Cylinder Monitoring	2025

At a Glance

7	4	2	24/7	0
Gas Cylinders Monitored	Alarm Levels Per Cylinder	Panel Architecture	Live Monitoring No Gaps	Manual Readings Now

02 THE CHALLENGE

THE SENSOR CHALLENGE — What Nobody Talks About

Each pressure transmitter on the cylinder sends a 4–20 mA current signal — the raw signal travelling from the transmitter to the controller panel. Our controller sequence program is written using voltage values to calculate and display the pressure. Inside the controller, we convert the incoming 4–20 mA signal into 2–10 V. The controller reads that voltage, runs it through the sequence logic, and displays the correct pressure reading on the HMI screen.

Pain Point	What This Meant on the Ground
No live data	Pressure reading was only as fresh as the last time someone physically walked to the cylinder — could be many hours.
No alarm	If a cylinder went critical at night or on a holiday, nobody was there to catch it.
No history	Paper reports can be adjusted, lost, or misread. There was no trusted digital record.
No early warning	No way to say: this cylinder is getting low, act now before it becomes a crisis.
No single view	To know the status of all seven cylinders, you had to physically walk to all seven locations.

03 WHY THIS PROJECT STOOD OUT

This Was Not Just "Install a Sensor and Walk Away"

The Four-Alarm Ladder — Smart, Not Just Simple

Most basic systems use one alarm. We designed four setpoints per cylinder: 50 = Low-Low (danger) · 70 = Low (warning) · 90 = High (caution) · 110 = High-High (critical). This gives the team two warnings before a real problem, not zero.

Two Panels, One Smart System

Panel 1 held the main brain — controller, HMI, and communication module. Panel 2 held the 16UI/8UO IP I/O module connecting all sensors and alarms. Panel 1 = control room. Panel 2 = field crew.

We Tried Modbus RTU. It Failed. Here Is Why.

Modbus RTU picked up signal interference from surrounding equipment — values jumping, readings inconsistent. We switched to EtherNet/IP: like upgrading from a walkie-talkie to a direct phone line. Clean, fast, reliable.

A Screen That Shows You Everything

We installed a 10-inch HMI with full BMS graphics. All seven cylinders visible at once — live pressure, colour-coded alarm states (green / yellow / red), hooter status. One screen. Full picture. No walking required.

04 TECHNICAL ARCHITECTURE

How The System Works — Step by Step

Step	Stage	What Happens
STEP 01	**Signal From Cylinder**	Each pressure transmitter sends 4–20 mA. Current does not drop over long cables and resists electrical noise — the right choice for an industrial pharma environment.
STEP 02	**Signal Conversion at Panel**	The controller converts 4–20 mA to 2–10 V internally. This combines cable-stable current transmission with the voltage input the sequence program needs.
STEP 03	**Sequence Logic & Alarm Processing**	The controller reads the voltage and checks four setpoints per cylinder — 50, 70, 90, 110. Crossing any setpoint triggers the hooter immediately.
STEP 04	**EtherNet/IP Between Panels**	Panel 1 (controller + HMI) and Panel 2 (16UI/8UO IP I/O module) communicate via EtherNet/IP — replacing Modbus RTU which failed due to site interference.
STEP 05	**HMI Display**	A 10-inch touch-screen HMI shows all seven cylinders simultaneously — live pressure, alarm colour state, and hooter status — on one screen, all the time.

04b WHAT DATA IS MONITORED

Sensor / Point	Gas Types	Data Captured
Pressure Transmitters (×7)	O_2 (×4) and CO_2 (×3)	Live pressure in bar/PSI, 4–20 mA signal, alarm state per cylinder

Alarm Hooter	All cylinders	Activated at Low-Low (50) and High-High (110) setpoints
HMI Screen (10-inch)	All cylinders	Live visual display — pressure, alarm colour (green/yellow/red), hooter status
I/O Module — 16UI/8UO	All cylinders	16 digital inputs (pressure switches) · 8 digital outputs (hooter relay, indicators)

05 DEPLOYMENT TIMELINE

How We Built It — Step by Step

Phase	Milestone
Phase 1	Site survey, sensor selection, and panel design for 7-cylinder setup
Phase 2	Decision: 4–20 mA on all 7 transmitters, converted to 2–10 V at panel
Phase 3	Installation of 7 pressure transmitters on O_2 and CO_2 cylinders
Phase 4	Panel fabrication — Controller + HMI (Panel 1) and 16UI/8UO IP I/O (Panel 2)
Phase 5	Modbus RTU connection attempted — signal interference and data errors found
Phase 6	Switched to EtherNet/IP — clean, accurate data confirmed across both panels
Phase 7	Four-level setpoint logic programmed (50/70/90/110) for all 7 cylinders; hooter wired and tested
Phase 8	BMS graphics built on 10-inch HMI; full system commissioned and handed over

06 BUSINESS IMPACT

What Changed After We Were Done

Area	Before EnSmart	After EnSmart
Monitoring Hours	Only when engineer was on site	24 hours a day, 7 days a week
Alarm System	None	Four-level: Low-Low/Low/High/High-High per cylinder
Data Records	Paper notebook — adjustable, losable	Digital timestamped records, always trustworthy
Early Warning	No warning before crisis	Low alarm at 70 fires before dangerous level of 50
Signal Quality	Inconsistent; noise-prone voltage signals	4–20 mA → 2–10 V: stable, accurate, fault-detectable

Audit Ready	Manual reports with gaps	Full automated log — alarm history, pressure records
Engineer Time	Walking cylinders copying gauge readings by hand	Focused on real maintenance and inspections

07 FAQ

Frequently Asked Questions

Question	Answer
Why four alarm levels? Why not just one?	One alarm is too late. The four-level system gives two warnings on the low side and two on the high side. The team gets a Low alarm at 70 — well before the dangerous Low-Low at 50. One alarm gives you a shock. Four levels give you a plan.
Why use 4–20 mA and convert to 2–10 V? Why not 2–10 V directly?	Voltage drops over long cables; 4–20 mA current does not. Voltage picks up noise from nearby motors; 4–20 mA resists it. And if a cable breaks, 4–20 mA drops to 0 mA so you know immediately — 2–10 V cannot clearly separate a broken wire from a genuine low-pressure reading.
Why did Modbus RTU fail and what replaced it?	Modbus RTU uses serial cables that pick up interference in noisy industrial environments. Values jumped and could not be trusted. We switched to EtherNet/IP — standard Ethernet with built-in error checking — and the data came in perfectly from day one.
What does the 16UI/8UO IP module do?	It acts as a remote I/O unit close to the cylinders. It collects signals from 16 digital inputs (pressure switches, alarm contacts) and controls 8 digital outputs (hooter relay, indicator lights). All data travels over the network to Panel 1's controller as if everything were in one cabinet.
Can this system grow to handle more cylinders?	Yes. The 4–20 mA standard works with almost any pressure sensor. EtherNet/IP supports more I/O modules. Adding cylinders = adding transmitters + wiring to available input channels + programming setpoint logic. The core system does not change.
What does the operator see on the HMI screen?	A live visual of all seven cylinders simultaneously — current pressure reading, colour-coded alarm state (green = normal, yellow = warning, red = critical), and hooter status. One screen. Full picture. No walking required.

> *Before us — one man, seven cylinders, a pen. After us — one screen, seven cylinders, zero guessing. That is what we do at EnSmart.*

This Is What a Real BMS Upgrade Looks Like

A pharma lab had seven critical gas cylinders watched by one person with one pen. When that person went home, the cylinders were alone. We used 4–20 mA sensors, converted signals to 2–10 V at the panel, built two panels connected over EtherNet/IP, programmed four alarm levels per cylinder, and put everything on a 10-inch HMI so any operator sees the full picture in seconds. ensmart.ai · bmssales@ensmart.ai · SmartNova Platform