SAM™ Well Manager
Injection Well Controller

LUFKIN
AUTOMATION

Optimize and monitor the effectiveness of your water injections

The Lufkin Injection Well Controller (IWC) gathers and reports data from your injection well operations, helping you protect your reservoir and track the effectiveness of your water and CO_2 injection.

IWC enables you to monitor both the pressure and quantity of water or CO_2 injected into the reservoir, so you can avoid reservoir damage from excessive pressure while optimizing oil production.

The IWC also provides optional advanced features for:

- Monitoring pressure drop across the injection well filter to alert you to a clogged filter
- Reporting over/under pressures and injection volumes that may indicate equipment malfunctions

The power of SAM™

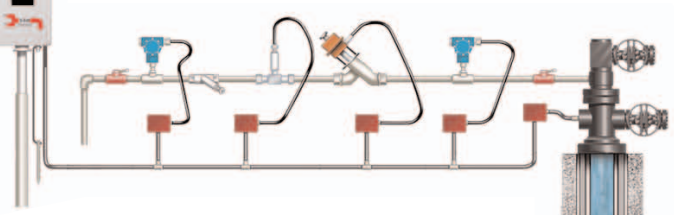
The IWC operates on the Lufkin SAM™ Well Manager platform, reducing the number of spare parts to keep on hand, simplifying training, and giving you a convenient single source for both rod pump and injection well automation.

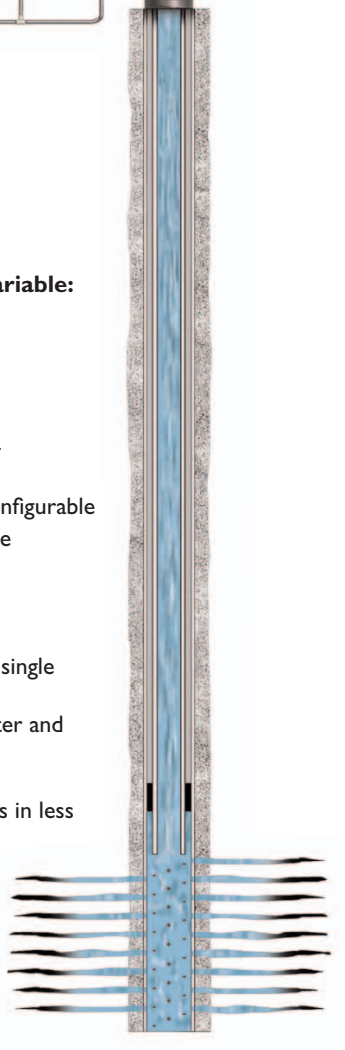
SAM is an advanced rod pump control system that can control from downhole card, surface card or motor speed.

SAM's powerful, patented technology uses a wave equation algorithm to calculate a downhole card on every stroke of the pumping unit. Its flash memory delivers quick upgrades without changing components. And an additional expansion bus allows the unit to grow with your requirements—making it fast and simple to add I/O or communication ports.

Protect your reservoir and productivity with IWC

- Protect your reservoir and productivity with IWC
- Avoid reservoir damage from excessive pressure
- Monitor injection speed to optimize production
- Easily track water/CO_2 supply
- Quickly identify clogged filters or equipment malfunctions





Primary Features

Multiple SAM configurations available

- 12VDC @ 0.41 amps nominal (standard)
- 120VAC (with optional power supply)
- Optional keypad/display (Use IPAQ/laptop as terminal interface)
- Optional RS-485 Modbus master. Special support for Control Microsystems 4102 multivariable transmitter and Rosemount 3095FB.
- Optional I/O multiplex board to select between CO_2 and H_2O meter runs at same wellhead.

Available SAM I/O (with included expansion board)

- 8 12-bit analog inputs (6 inputs dedicated to injection well controller)
  - 0-5VDC, 1-5DC, or 4-20mA.
  - 0.8-4VDC, 0.8-3.2VDC (with reduced resolution)
- 8 digital inputs/outputs
- All digitals are utilized for injection well controller (IWC) application
- 1 pulse input
  - Used for turbine meter input
- 2 communication ports
  - RS-232 up to 115.2K Baud with configurable parity and stop bits
  - External DB-9 connection for terminal emulation program.
  - Modbus RTU protocol (supports Lufkin "ELAM" extensions)

Measured process variables

- Upstream pressure
- Wellhead pressure
- Casing head pressure
- Differential pressure
- Temperature

Data sources for each process variable:

- *Analog input*
- *Smart transmitter input*
- *Constant*

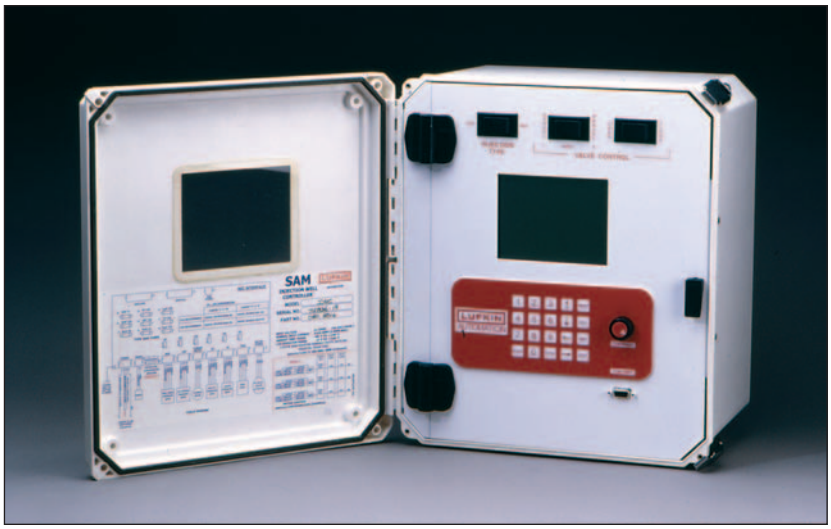
- Actuated valve I/O
  - 3-wire solid-state control output—NO RELAYS.
  - Motor control logic output user configurable
  - Motor can have independent voltage source—up to 28VDC

IWC control methodology

- Flow rate measurement
  - Measures CO_2 or H_2O—calculates single meter run
  - Supports turbine meter, wedge meter and orifice plate
  - NIST 14 density calculation (up to 17 components). Calculation —runs in less than one minute.
  - ANSI/API 2530 differential pressure calculation
  - Live process variables are sampled once per second
- Injection pressure and rate control

Control is based on pressure or rate priority and is user selectable. Pressure control has override option to keep rate within limits. Rate control has override option to keep pressure within limits.

- Dead band/high-low set points (2 set-point methods)
  - High and low dead-band set points
  - Single set point with (+/−) percentage dead-band
- Separate parameters for CO_2 and H_2O

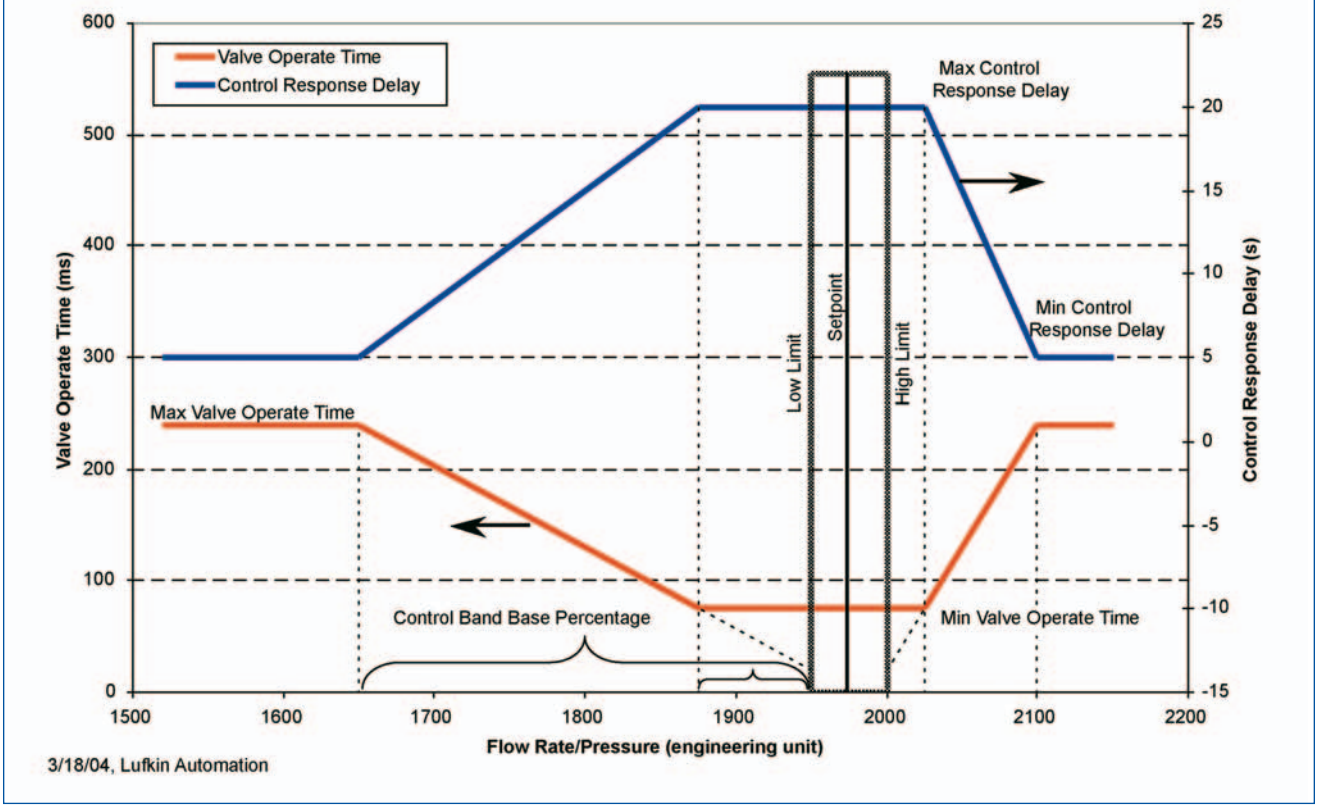


- Valve reaction—3 methods
  - Constant step—fixed on and off times
  - Proportional—(Not PID)
  - Continuous
- Pressure and rate alarms are configurable
  - Disabled
  - Control (close valve or freeze control)
  - Dynamic alarm
  - Latched alarm
  - Configurable priority (high, highhigh, low, lowlow)
- Valve limit detection
  - Timeout—user programmable time out
  - Continuous
- Manual valve actuation
  - Front panel control (2 motor valves with expansion card)
- Commissioning mode
  - Initiated on first power up. Allows user to program unit while flow calculation control is disabled. User may enter commission mode at any time.

Plotting and history

- Up to 3 traces can be plotted on screen; user can select what is shown
- 24-hour injection rate (1440 minute buffer)
- 60-day injection volume

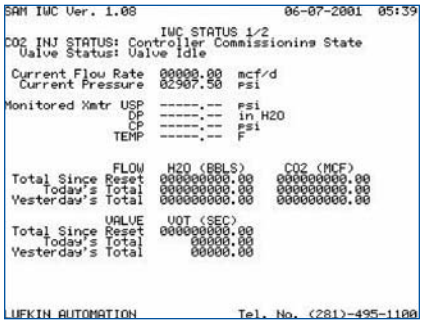
Injection Well Valve Control Method



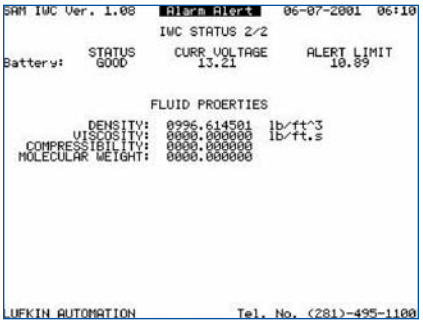
Proportion Control

Example screen shots

Status

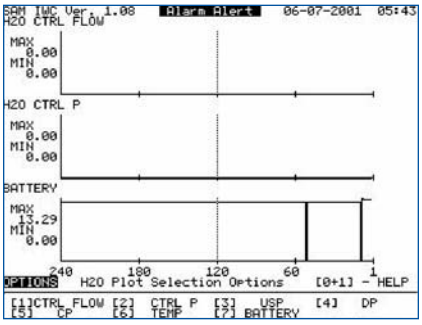


Status Screen



Status Screen

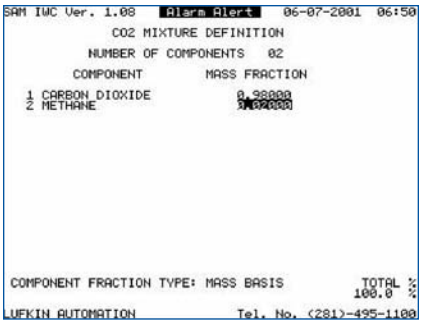
History



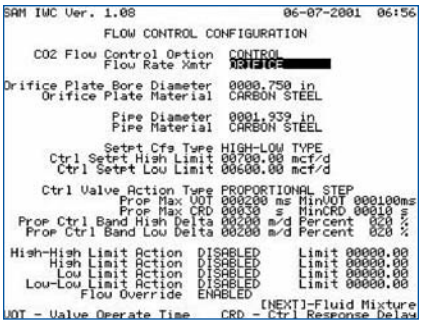
Three Plot History

Configuration

Pressure Control



CO_2 Mixtures for NIST14 Calculations



Orifice Plate and Control Configuration

For more information on how to protect your reservoir and better track your water/CO_2 injection system, contact:

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