# Artificial Lift
## Production Automation

Monoflo®

One Company, Unlimited Solutions

NOV Monoflo is a leading name in the design, manufacture and supply of progressing cavity pumps, grinders, screens and packaged solutions worldwide. We have 8 international sites and a global distribution network, as well as over 70 years experience in providing a range of products for multiple application requirements of today's industries.

Our strong heritage and global success is recognised and supported by our parent company National Oilwell Varco (NOV), who are world leaders in the oil and gas industry.

The NOV Monoflo line of downhole progressing cavity pumps (PC Pumps) are designed for use in both oil and coal bed methane recovery applications where the economics of oil and gas production demand efficiency, reliability and low life cycle cost from the pumping equipment.

## Production Solutions

NOV Monoflo's line of Variable Frequency Drive Controllers (VFD), which contain our state of the art software, provide a new level of control at your pump. Constructed specifically for operation in the oilfield, these controllers combine motor and pump control in a single, compact package designed to improve energy efficiency and provide enhanced protection both new and existing pumping systems, while maximizing production. The controller offers easy to use controls for operation as well as surface and downhole information in a variety of formats for well analysis.

NOV Monoflo provides a complete line of artificial lifting technologies and oilfield equipment through over 30 service centre locations across Canada and more than 150 locations around the globe.

## Why Automate Artificial Lift Systems?

- An operator interface provides access to system parameters that are organised into logical groups for easy navigation.
- A fault log is used to capture time-stamped diagnostic information to aid in troubleshooting drive or pump problems.
- Customizable monitors and optimizers help safeguard against damage to vital parts of the pumping system while also maximizing production.
- The controllers incorporate unique design features that reduce electric utility costs and improve power quality.
- Rapid restart minimizes lost well production due to momentary power outages.
- Advanced pump-control strategies minimize the energy cost per barrel of fluid produced.
- The controllers are capable of providing near-unity power factor at all speeds and loads to avoid utility power factor penalties.
- An enhanced RTU protocol allows efficient transfer of both 16-bit and 32-bit data through local or remote networks.
- The controllers provide more than 100 user programmable settings for well specific operations.

### Sucker Rod Pump Controller

Provides superior control of conventional, air-balanced, beam balanced, phased-crank, Mark II, Reserve Mark, and Rotaflex artificial lifts. The drive integrates motor control, speed optimization, logic, pump fill control and rod load control into a single, compact solution that increases production, improves energy efficiency and enhances the reliability of both new and existing pumping systems.

### Progressing Cavity Pump Controller

Provides a number of features specifically designed for operation of progressing cavity pumps. The drive combines motor and pump control into a single, compact package that increases production, improves energy efficiency, and enhances the reliability of both new and existing pumping systems.

### Linear Rod Pump

This is a revelatory concept in sucker-rod artificial lift systems. Variable speed control, simple mechanics and industry leading control software packaged into a compact lightweight unobtrusive solution with significant cost and performance advantages over traditional approaches is what makes the LRP system so revolutionary.

## Applications

At any instant during the life of a well, and even within a pump cycle, there is a single constraint that limits production. Production can be maximized without compromising efficiency or reliability by forcing the system to operate at the particular constraint limiting production at each instant of time.

Determining the applicable limits and moving smoothly between them in real time is a key advantage of the NOV Monoflo system. Models of all the system elements are run in real time at the wellhead to detect appropriate limits and enforce associated control strategies. At different points in the pump cycle, the system may be limited by maximum motor speed, motor thermal capacity, power demands, gearbox maximum torque, rod maximum load, rod fall velocity or pump fill. Multiple constraint optimization is particularly beneficial in applications with variable inflow conditions such as those found in coal-bed methane, high gas/oil ration, and thermally stimulated wells.

Embedded mathematical models of drives, motor, pump unit, rod string, pump, flow line, tubing, casing, fluid and reservoir use component specifications and well completion information along with field setup parameters to monitor pumping system operation.

Identification routines automatically determine installation dependant system parameters, including those of the electric motor, pumping unit, rod string, and downhole pump. The models capture the thermal, mechanical, electrical and hydraulic behaviour of the pumping systems to control the pumping process with greater precision than ever before.

### Gas-Powered Artificial Lifting System

Combines a power source and advanced well automation control into a compact unit specifically designed for oil and gas production. The unique system provides a fully integrated solution for customers with pumping applications remote from electrical service or those that want to minimize gas flaring and eliminate electrical utility costs. The unit is easy to install and maintain.

### Electric Submersible Pump (ESP) Controller

Provides a number of features specifically designed for operation of electric submersible pumps. The drive combines motor and pump control into a single, compact package that increases production, improves energy efficiency and enhances the reliability of both new and existing pumping systems.

### Multipump Control

Regulates the pressure of a fluid delivery system using a single drive that orchestrates series of pumps. The programme seamlessly integrates motor-control, logic and process control functions into a single compact solution. With its sophisticated pump modelling technology, the controller leverages the computing power of its digital signal processor (DSP) to provide superior control, optimal efficiency and comprehensive protection for the pumping systems.

## Manufacturing and Design

NOV Monoflo's VFD controllers are engineered and manufactured specifically for oilfield pumping applications and to meet the challenges of varying conditions at the well. The controllers continuously monitor and rapidly adapt to changing downhole conditions, and each can be configured to operate various artificial lift technologies. Digital technology is used to deliver precise control of motor voltage, current, speed and torque. Advanced control features and automated setup increases productivity and extend the life of artificial lifting systems.

## Features & Benefits

NOV Monoflo's controllers include a user friendly, graphical operator interface. An LCD display provides easy to read text and graphics with a keypad with allows for easy menu navigation and data entry. Online set up instructions, prompts, warnings, bar graph displays, and logical data groupings result in fast startups, smooth operations and minimum downtime. Password protection is also used to prevent unauthorized access to controller parameters.

The controller provides a number of options for manual, remote and automatic control of pump speed. Speed commands can be selected from a number of sources including potentiometer adjustments, keypad presents, serial data communications, and internal optimization controllers. The motor can be operated up to twice base speed at constant power. This allows the overall gear ratio to be increased, thereby providing increased low-speed torque without loss of maximum pump speed.

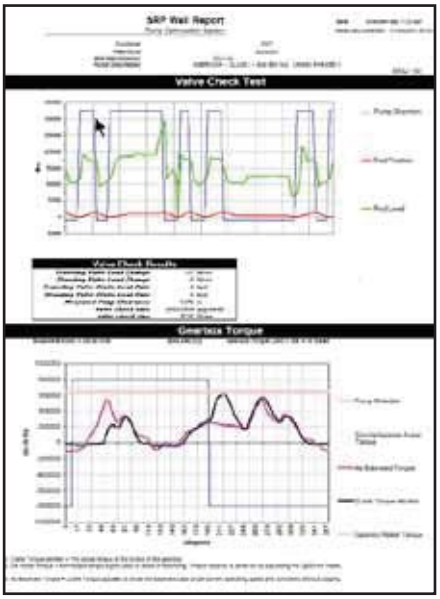
Various display options are available and allow the operator flexibility and choices in monitoring specific aspects of the pumping system.

## Controller Features & Benefits

| | SUCKER ROD AND LINEAR ROD PUMP CONTROLLERS | PC AND ELECTRIC SUBMERSIBLE PUMP CONTROLLERS |
|---|---|---|
| **Speed References** | • Analog potentiometers<br>• Keypad / display presets<br>• Serial communications<br>• Optimization controllers | • Analog potentiometers<br>• Keypad / display presets<br>• Serial communications<br>• Optimization controllers |
| **Speed Control** | • Single, dual or triple speed<br>• Rotaflex cornering speed<br>• Extended speed controls<br>• Speed profile control | • Local speed control<br>• Remote speed control<br>• Extended speed control<br>• Fluid level control<br>• Pump off control<br>• Gas flow optimizer |
| **Power Control** | • Maximum power limiter<br>• Regenerative power limiter<br>• Power demand economizer<br>• Power flow optimizer | • Power demand limiter<br>• Power flow optimizer<br>• Time of use optimizer<br>• Cyclic energy optimizer |
| **Protection** | • Motor current limiter<br>• Motor torque limiter<br>• Motor thermal limiter<br>• Gearbox torque limiter<br>• Gas interference limiter<br>• Birdle separation limiter<br>• Rod maximum load limiter<br>• Rod minimum load limiter<br>• Pump fill controller | • Motor current limiter<br>• Motor torque limiter<br>• Motor thermal limiter<br>• Rod string torque limiter<br>• Pump pressure limiter<br>• Low torque detector<br>• Low speed detector |
| **Torque Control** | • Starting torque manager<br>• Gearbox torque economizer | |
| **Pump Fill Control** | • Pump off control<br>• Pump fill optimizer<br>• Gas interference limiter | |

# Communication Media

NOV Monoflo realizes the importance of communication and the ability to access information from pumping systems remotely as well as to transfer this information to others worldwide. NOV Monoflo's controllers utilize various communications software. The following outlines the software and communictions capabilities of the VFS's:




## Uedit™ and Drivelink™ Software

Computer programmes that communicate with the controller and allow for a no-limit information session. Uedit monitors such values as pump fill, motor torque, motor amperage, pump jack, API and others. Drivelink gives operators the ability to view and graph any aspect of the well and the ability to data log information from the controller's program.

## Palm Pilot Software

Specific software designed for a palm system allows the operator to download graphs and data at the controller in a 'real time' environment. This also gives users the opportunity to archive all the well information from the controller and transfer it to a desktop computer.

## Well Report Generator

Spreadsheet that communicates with the controller and delivers a four page report using Excel, complete with torque and dynamometer charts.


## Wireless Communications

Radio, satellite and cell phone connections are available for gathering information and there are various online features that give customers instructions on functionality, a quick glance summary of all the wells currently being monitored by EMC and a search option where customers can select a well and view statistics in more detail. In addition a Well Card allows customers the ability to view updated information on the well and reports detailing every aspect of the well can be printed.

---


**Europe**

Mono Pumps Ltd, Martin Street,
Audenshaw, Manchester, M34 5JA,
England
T. +44 (0)161 339 9000
E. info@mono-pumps.com

D.M.I EST, 56 rue du Pont
88300 Rebeuville, France
T. +33 (0)3 29 94 26 88
E. dmi-est@dmi-est.fr

**Americas**

Monoflo Canada., 5702 63rd Ave
Alberta, Lloydminster
Canada, T9V0Y4
T. +1 (780) 8755504
F. +1 (780) 8758584
E. info.monoflo@nov.com

NOV Monoflo, 9606 Kirkton
Houston, Texas 77095, USA
T. +1 281 200 1200
E. inquire@monoflo.com

Monoflo S.A., Ing Huergo 2239
(1842) Monte Grande
Pcia. de Buenos Aires, Argentina
T. +54 11 4290 9940/50
E. info@monoflo.com.ar

**Australasia**

Mono Pumps (Australia) Pty Ltd
Mono House, 338-348
Lower Dandenong Road
Mordialloc, Victoria 3195, Australia
T. +1800 333 138
E. ozsales@mono-pumps.com

Mono Pumps (New Zealand) Ltd
PO Box 71-021, Fremlin Place, Avondale
Auckland 7, New Zealand
T. +64 (0)9 829 0333
E. info@mono-pumps.co.nz

**Asia**

Mono Pumps Ltd, No. 500 YaGang Road
Lujia Village, Malu, Jiading District
Shanghai 201801, P.R. China
T. +86 (0)21 5915 7168
E. monoshanghai@nov.com

**www.monoflo.com**




NOV Monoflo®

One Company, Unlimited Solutions