# Maestro**Flex**™

## Automated Regulators

*Real time data means more time at the face.*

Maestro Digital Mine

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Maestro Digital Mine

# The Ventilation Challenge

Mine ventilation systems are designed around the planned life-of-mine (LOM) requirements considering all the worst-case-scenarios with respect to airflow demand which is mostly future based. As a result, many ventilation systems are over-sized early in the mine's life cycle and as such represents opportunities to reduce the mine's energy footprint as well as greenhouse gas (GHG) emissions and corporate decarbonization initiatives.

Conversely, mature underground mines are becoming increasingly ventilation constrained due to the increased depth of the ore body, heat due to auto compression, strata energy transfer as well as the increased total system resistance with longer passageways.

Underground ventilation systems require electricity to operate the fans and cooling systems. Many independent studies have shown that in mechanized metal mines, 50% of mine operating costs are electricity and of that 50-70% of the electrical cost is ventilation.

## Why mine engineers choose Maestro**Flex**™ Automated Regulators

1. Adjusting ventilation remotely, level by level, by controlling airflow quantity and quality assures worker health and safety as well as regulatory compliance.
2. Scheduling regulators to fully open before the blast cycle improves blast clearance times and allow miners to return to the face quicker and safer.
3. Reducing energy costs and GHG emissions by providing adequate ventilation to the operational areas of the mine versus ventilating all levels equally.
4. Delaying major capital-intensive projects like additional air raises, booster fans and larger primary fans by reducing the amount of ventilation in areas that are non-operational.

## Maestro**Flex**™ Automated Regulators are used for all forms of ventilation controls

- Manual based control systems
- Time-of-Day control systems
- Event-Based control system
- Real-Time (VoD) control systems

# MaestroFlex™

# The Advantage

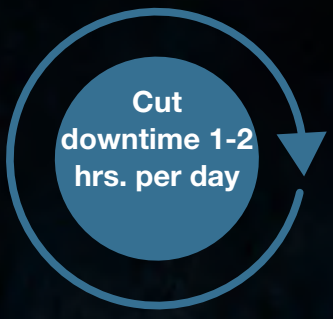
Digital automated regulators control airflow, clearing gases in active production areas (at the face). Maintenance free regulators reduce blast clearance time and greenhouse gases; increase energy savings; reduce integration time and drive down CAPEX costs by 50% as compared to traditional analog systems.

MaestroFlex™ Automated Regulators are designed to meet the harsh underground mining drill and blast cycles for decades of service. ModuDrive™ digital IIoT actuators provides real-time diagnostics that allows troubleshooting from surface through Duetto Analytics software.

The MaestroFlex™ regulator is used to automatically adjust the airflow on operating levels. Often installed either at the fresh air raise or return air raise and in many applications at both. The automated regulators replace drop board manual regulators that cannot be adjusted from surface, thus enabling operators from surface the ability to control ventilation as required either manually or using VoD software.

MaestroFlex™ Automated Regulators drive out significant CAPEX by eliminating expensive PLCs, transformers, engineering services and panel fabricators. MaestroFlex™ regulators provide a simple connection to any network switch and allow complete control, monitoring and real-time diagnostics over Modbus TCP/IP or EtherNet/IP™ communication protocols.

Automated regulators optimize worker safety and energy savings during the normal mining cycle and provide increased operational time at the face by quickly clearing the blast gases.




Mines report 25-50% energy reduction and cut downtime by 1-2 hrs per day by deploying ventilation controls.


MaestroFlex™ Automated Regulators have been used in critical 24/7 underground mining applications since 2007.

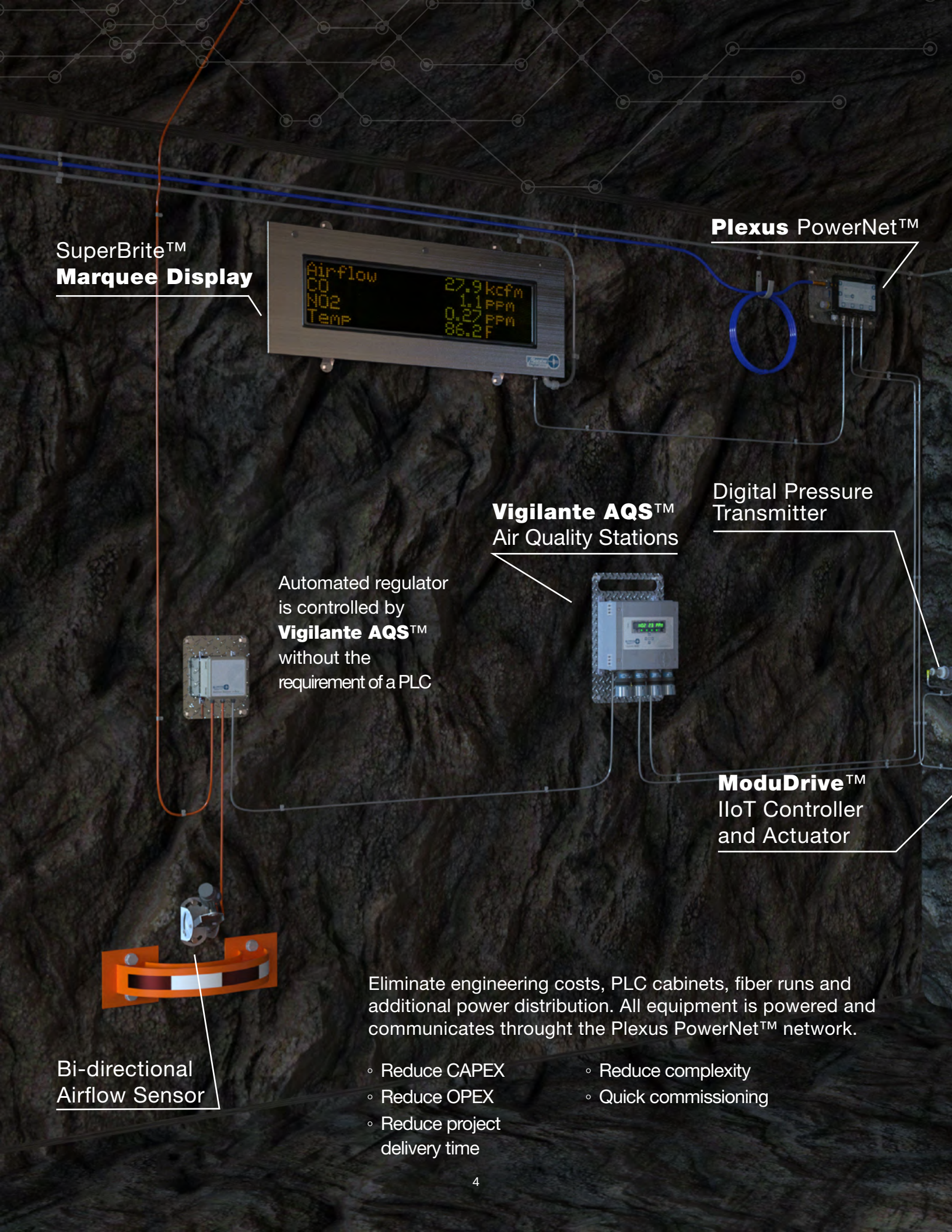
*"Vale has several louvers installed at Creighton Mine that have been in service for many years. Some have been in use for 8-10 years with zero issues. Over the last 3-4 years, the MaestroFlex™ Automated Regulators installed are heavy duty and trouble free. Construction is robust, (a 9' x 9' louver weighs ~ 6000 pounds), actuators are solid, everything is sealed and all steel is galvanized. Once installed, we rarely if ever service a louver. All in all, well-made louvers are good products for underground use from my experience. They are my go to choice for regulators.*

*The service and desire by Maestro to succeed in making the customer happy is second to none. The team is top notch. When problems or issues arise, whether it is with a louver or the airflow monitoring systems, solutions are quickly discovered and forwarded to site for implementation. Having bought louvers from a couple of suppliers, the ones currently being purchased from Maestro are very cost competitive."*

- *Brian Keen, Ventilation Specialist, Vale - Creighton Mine*

# Why Choose MaestroFlex™

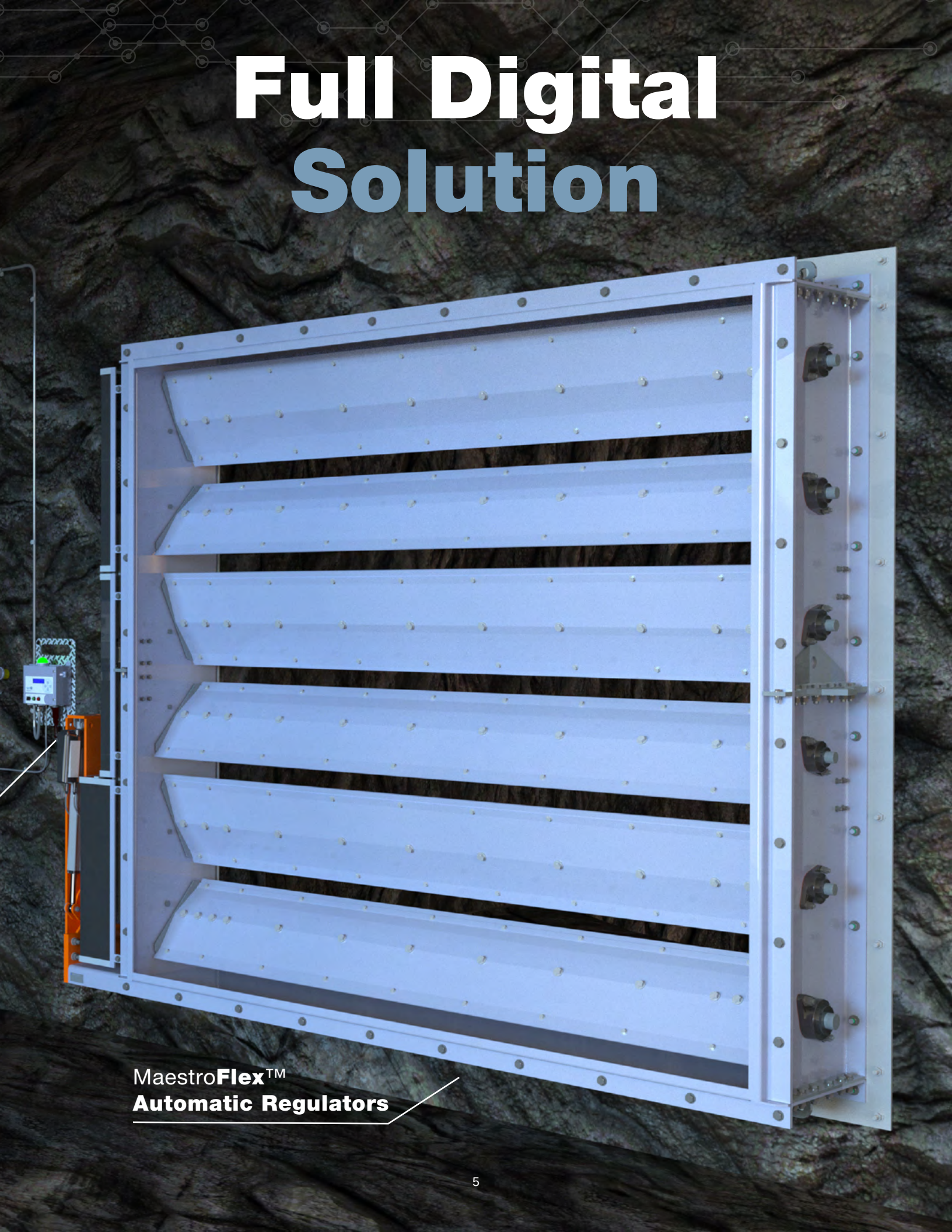
| | |
|---|---|
| ***Experience*** | MaestroFlex™ designed regulators have been used in over 500 applications globally in underground mines. |
| ***Avoid Risk*** | Regulators like control valves need to be properly sized otherwise the product might to either too small or large to provide suitable control. Although many fabrication shops might attempt to copy a design, they are not able to provide proper sizing that can put your project and people at risk. |
| ***Automation*** | Automated regulators require complex control systems or PLCs to work as a system. MaestroFlex™ has embedded edge based control functions built into ModuDrive™ IIoT actuators providing real-time based control and diagnostic functions that other regulators can not imitate. |
| ***CAPEX Reduction*** | MaestroFlex™ regulators eliminate the requirement of expensive and complex PLC's, panels and transformers to reduce high voltage to lower voltage levels. |
| ***Delivery*** | MaestroFlex™ regulators reduce long delivery times by standardization of drawings, designs and on-the shelf ModuDrive™ IIoT actuators. |
| ***Support*** | Maestro Digital Mine can help with typical bulkhead designs, cutting down the total project execution time and cost. |




Eliminate engineering costs, PLC cabinets, fiber runs and additional power distribution. All equipment is powered and communicates throught the Plexus PowerNet™ network.

- Reduce CAPEX
- Reduce OPEX
- Reduce project delivery time
- Reduce complexity
- Quick commissioning

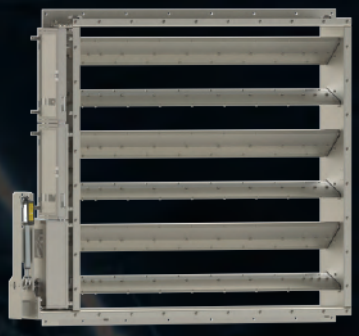
# Full Digital Solution



MaestroFlex™
**Automatic Regulators**

# Automated Regulator Designs

## Fixed horizontal split panel design

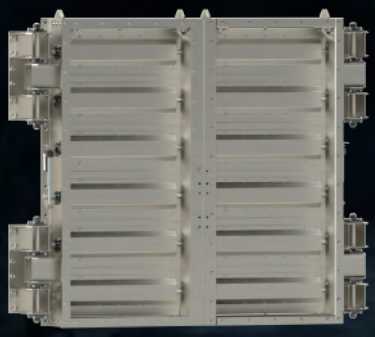


The split design consists of single linkage and IIoT actuator allowing the regulator to be transported through the shaft for installation.

## Fixed dual vertical split panel design

The dual panel design consists two panels, two separate linkages and two IIoT actuators for maximum redundancy.

## Barn-yard door design (Closed)



Dual hinged door design with dual IIoT actuators and controllers. The ideal design for the bottom level of the ore body on the air raise.

## Barn-yard door design (Opened)

Enables easy LHD access to muck out any sloughed ground fall material plugging the raise.

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Improve re-entry times, cycle time and productivity

Reduce primary fan stalling and expensive repairs

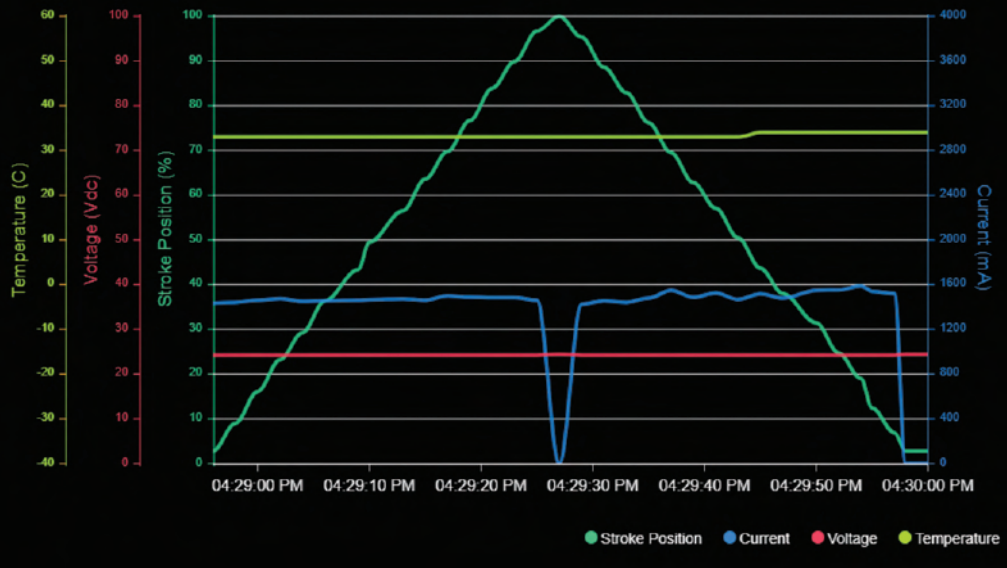
# Maximize safety
# Optimize Savings

ModuDrive™ digital IIoT actuators provides real-time diagnostics that allows troubleshooting from surface through Duetto Analytics software.

Installation signatures can be captured comparing the operation of a new MaestroFlex™ regulator overtime thereby providing early detection of potential failure points.

Smart IIoT actuators provide service counters for starts/stops/total run time, over/under voltage, power failures and min/max internal temperatures providing maximum up-time and worker safety.

Full feedback data on the stroke position, current draw and internal temperature provides early warning of bearing or blade damage to enable predictive maintenance.




## Maestro's Brand Promise -*We leave no one stranded*

Maestro Digital Mine applies its 20+ years of mining experience and globally recognized expertise in developing and enabling mine ventilation IIoT devices for underground mines and supplying regulators to the top global mining companies (Rio Tinto, Vale, Glencore, Newmont, etc.). The commitment to excellence is one of our core values and is evident in our technologies with our first regulators still in operations after 20 years of use in operating underground mines.

# Technical Specifications

| | *Basic general service* | *Longest life service* |
|---|---|---|
| ***Flanged frame*** | Painted (SSPC-SP10 surface preparation & Amerlock 2GF primer and top coat)<br>Low carbon steel (ASTM-A36) | Hot dipped galvanized low carbon steel (ASTM-A36) |
| ***Blades*** | Painted low carbon steel | Hot dipped galvanized low carbon steel |
| ***Blade operational*** | Opposing blade design for modulating service | Opposing blade design for modulating service |
| ***Seating*** | Metal to metal blade seating | Metal to metal blade seating |
| ***Shafts*** | Painted low carbon steel | 304 stainless steel |
| ***Linkages*** | Painted low carbon steel | 304 stainless steel |
| ***Bearings*** | Outboard permanently Lubricated ball bearings | Outboard permanently Lubricated ball bearings |
| ***Maximum operating differential pressure*** | 10” W.C. | 20” W.C. |
| ***Actuator*** | Single or dual IIoT actuators<br>100-220 VAC, 1 Phase, 3 AMP<br>Built-in controller for each actuator<br>Built-in feedback and diagnostic functions<br>Modbus TCP/IP | Single or dual IIoT actuators<br>100-220 VAC, 1 Phase, 3 AMP<br>Built-in controller for each actuator<br>Built-in feedback and diagnostic functions<br>Modbus TCP/IP |
| ***Pinch point protections options*** | OSHA linkage guard<br>Protection screen on front flange | OSHA linkage guard<br>Protection screen on front flange |
| ***Bulk head differential pressure transmitter*** | -40 to +40” W.C. range | -40 to +40” W.C. range |
| ***Airflow sensors*** | Single or dual ultrasonic airflow sensors | Single or dual ultrasonic airflow sensors |
| ***Blast gas sensors*** | 21 different sensor types | 21 different sensor types |
| ***Temperature and Humidity sensor*** | Dry bulb, wet bulb, worker heat stress and humidity | Dry bulb, wet bulb, worker heat stress and humidity |
| ***Bulkhead drainage*** | Slimes and water drainage duck bill valve | Slimes and water drainage duck bill valve |

# The Maestro Ecosystem

**Vigilante AQS**™
Air Quality Stations

DustMon **PM**™

**Plexus** PowerNet™


SuperBrite™
**Marquee Display**

For more information on the Maestro ecosystem visit maestrodigitalmine.com


# We make the **complex simple**

www.maestrodigitalmine.com
sales@maestrodigitalmine.com
Sudbury, Ontario, Canada
+1 705 805 6918

MDM1007-0624EN