# INTELLIS®

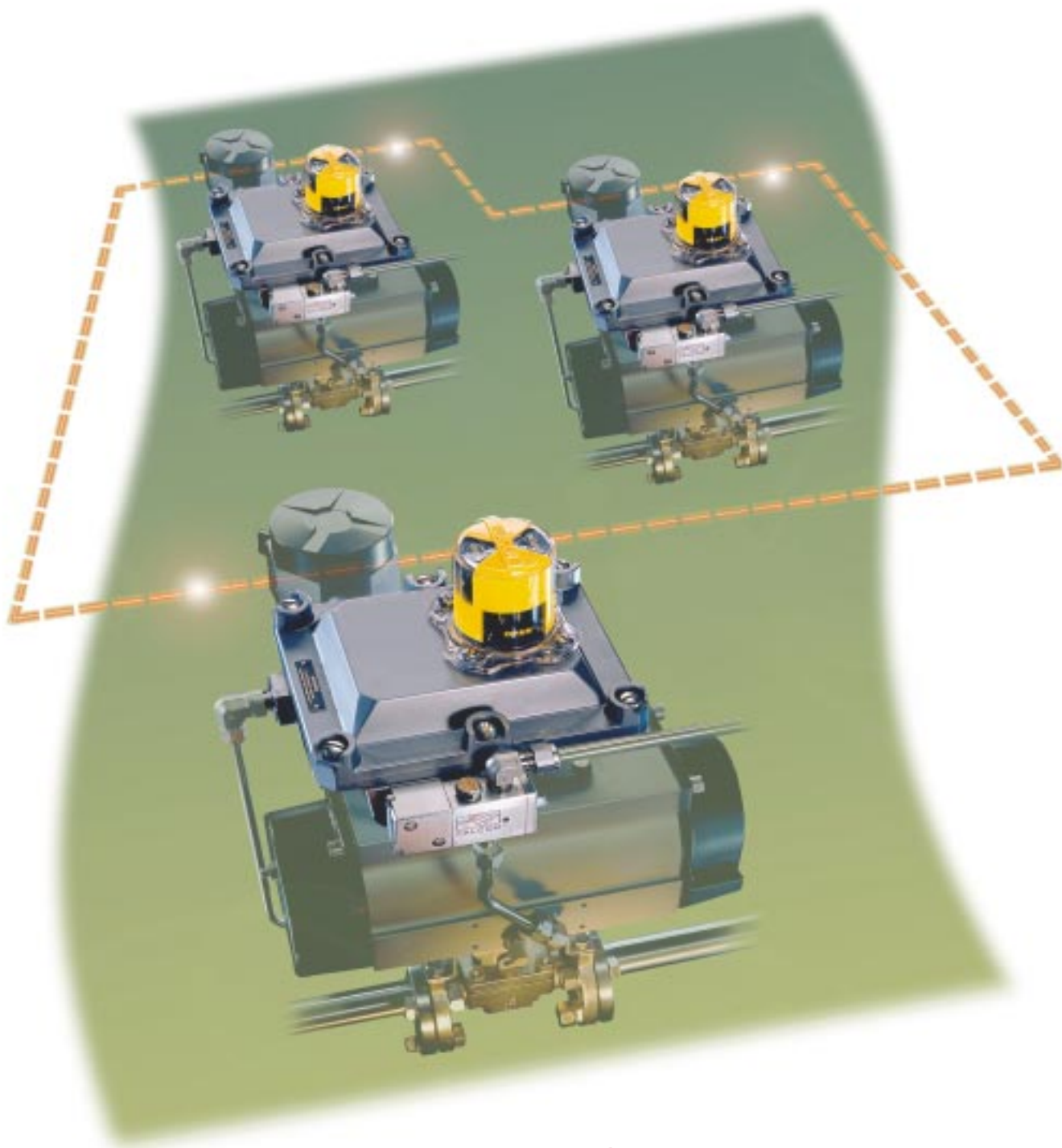## NETWORK SYSTEMS FOR VALVE AUTOMATION

•

ModBus®, DeviceNet®, AS-interface®
Profibus®, Foundation Fieldbus®



**WESTLOCK**
Network Systems Group

# INTELLIS®

## Network Systems for Valve Automation

ntellis® is a family of industrial control field Network Monitors which use embedded control systems to automate valves and link field I/O to the host PLC or DCS. Network Monitors are standard Westlock Control Monitors with the addition of a network I/O module. Each Network Monitor houses two hermetically sealed position sensors for valve position monitoring, a low power solenoid valve for actuation control, and a network interface module for communication via the ModBus®, DeviceNet®, Profibus, Foundation Fieldbus or AS-interface® protocol.

By switching from a conventional hardwired I/O system to an Intellis® network, immediate cost savings are realized through the elimination of hundreds of dedicated wires and their associated costs.

*Network Monitor (resin enclosure)*
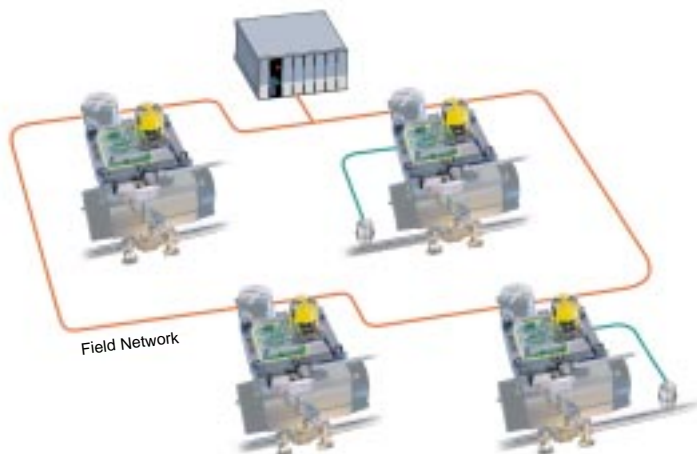
Field Network

## The Network Module

Depending upon the network standard selected (ModBus®, DeviceNet®, AS-interface®, Profibust®, Foundation Fieldbus®, a dedicated network module is integrated within the enclosure of each Network Monitor.  The on-board network module is  available in two configurations.  Network module (A) is capable of communicating and controlling 4 inputs and two outputs. Network madule (B) will communicate with and control up to six inputs and two outputs depending on the protocol.

| NETWORK CARD A | |
|---|---|
| **INPUT 1:** | Valve Position Sensor (open) |
| **INPUT 2:** | Valve Position Sensor (closed) |
| **INPUT 3:** | External Device |
| **INPUT 4:** | External Device |
| **OUTPUT 1:** | Solenoid Valve (actuation control) |
| **OUTPUT 2:** | Dual Coil or External |

| NETWORK CARD B[1] | |
|---|---|
| **INPUT 1:** | Valve Position Sensor (open) |
| **INPUT 2:** | Valve Position Sensor (closed) |
| **INPUT 3:** | External Device[2] |
| **INPUT 4:** | External Device[2] |
| **INPUT 5:** | External Device[2] |
| **INPUT 6:** | External Device[2] |
| **OUTPUT 1:** | Solenoid Valve (actuation control) |
| **OUTPUT 2:** | Dual Coil Application or External Device |

[1]AS-interface: 4 inputs/4 output
[2]Optically isolated

# Standard Network Protocols

The acceptability of standard network protocols such as ModBus®, DeviceNet® and AS-interface® has made it possible to effectively integrate process control components into a network. ModBus, DeviceNet, AS-interface, Profibus and Foundation Fieldbus have emerged as de facto standards for interfacing discrete devices. They have proven themselves to be extremely reliable, simple to understand and consistently cost effective. The integration of these five major network standards with various manufacturers of PLC's and DCS systems is readily accomplished through the implementation of off-the shelf gateway interfaces.

## Network Protocol Overview

| | **ModBus®**<br>The ModBus® protocol has been placed in the public domain, operates over a serial interface and is supported by almost every PLC, DCS, and operator interface (OI) company. | **ModBus Direct**<br>ModBus Direct devices can be connected to almost every PLC, DCS with a ModBus port without any interface. Any 4/20 mA devices can be put into the network using an analog I/O module attached to the ModBus direct port. | **DeviceNet®**<br>Allen-Bradley is the originator of the DeviceNet® protocol. DeviceNet is an open device network standard based upon proven Controller Area Network (CAN) technology. | **AS-interface®**<br>**Ver. 2.1**<br>The AS-Interface® protocol was developed by a consortium of major European companies. Designed specifically for use in low level automated systems, any Profibus, ModBus, DeviceNet or Interbus PLC may be accessed through a gateway interface. |
|---|---|---|---|---|
| **Physical Media** | Twisted pair for communications, two wires for power | Twisted pair for communications two wires for power | Twisted pair for communications and power | Two wire cable (communications & power) |
| **Maximum Distance** | 3000 ft. | 3000 ft. | 1600 ft. | 300 ft.<br>900 ft. with repeater |
| **Maximum Network Monitors per System** | 100/network<br>10 networks/system | 32/network<br>1/system | 63/network<br>2 networks/system | 62/network<br>1 network/system |
| **Maximum I/O Points per System** | 800/network<br>8000/system | 256/network plus optional 4/20 mA analog I/O<br>256/system | 504/network plus optional 4/20 mA analog I/O<br>1008/system | 434/network<br>434/system |
| **Current Consumption Per Network Monitor** | 60 mA + 20-25 mA/coil | 60 mA + 20-25 mA/coil | 80 mA + 20-25 mA/coil | 20 mA + 20-25 mA/coil |
| **Interface Capability** | All PLC's &<br>DCS w/ModBus Port | All PLC's & DCS w/ModBus, Port | Allen-Bradley, Omron, GE, Siemens | All PLC's & DCS w/ModBus, DeviceNet, ProfiBus Port |
| **Communications Method** | Master/slave with cyclic polling | Master/slave with cyclic polling | Master/slave multimaster, peer-to-peer | Master/slave with cyclic polling |
| **Error Checking** | CRC check | CDC check | CRC check | Control sum, parity |
| **Network Topology** | Closed loop bus | Daisy Chain/Zero drop | Trunkline/dropline with branching | Bus, tree, star |
| **Transmission Speed** | 9.6 kbps | 9.6kps, 19.2kps | 125 kbps, 250 kbps, 250 kbps | 167 kbps |
| **Redundancy** | Yes | No | No | No |
| **Valves Specific Diagnostics** | Yes | Yes | Yes | No |

# Standard Network Protocols cont.

The acceptability of standard network protocols such as ModBus®, DeviceNet® and AS-interface® has made it possible to effectively integrate process control components into a serial network. ModBus, DeviceNet, AS-interface, Profibus and Foundation Fieldbus have emerged as de facto standards for interfacing discrete devices. They have proven themselves to be extremely reliable, simple to understand and consistently cost effective. The integration of these three major network standards with various manufacturers of PLC's and DCS systems is readily accomplished through the implementation of off-the shelf gateway interfaces.

| Network Protocol Overview | **Foundation Fieldbus®**<br>The initial specification for Foundation Fieldbus, drafted in 1987, was a joint effort of the IEC and the ISA to create an international fieldbus standard. | **Profibus®**<br>Started as a joint Fieldbus project in 1987 between several companies (Siemens, Klockner-Moeller, Bosch and 10 other manufacturers). The Profibus User Organization (PNO) was founded in 1989 and has a membership of over 1000 companies. |
|---|---|---|
| **Physical Media** | Twisted pair for communications, and power. | Twisted pair for communications, two wires for power. |
| **Maximum Distance** | 1900m, including spurs | 1200m |
| **Maximum Network Monitors per System** | 6/segment if bus powered & IS 12/segment if bus powered & non-IS 32/segment if neither bus powered nor IS | 32/segment.<br>125/system using repeaters |
| **Maximum I/O Points per System** | 48 discrete<br>24 analog | 1134 / system |
| **Current Consumption Per Network Monitor** | 25mA max. | 120 mA |
| **Interface Capability** | All PLC's & DCS supporting the FF protocol | All PLC's & DCS supporting the Profibus protocol |
| **Communications Method** | Peer to peer | Peer to peer and cyclic Master/slave |
| **Error Checking** | Manchester encoding | CRC |
| **Network Topology** | Daisy Chain, trunk/drop (spurs), branching drop (spurs), point to point | Linear, stubs to be avoised (if unavoidable stubs must be≤0.3m), no branches. |
| **Transmission Speed** | 31.25 kbps | 9.6, 19.2, 93.75, 187.5,<br>500, 1500, 12000 kbps |
| **Redundancy** | Yes | No |
| **Valves Specific Diagnostics** | Yes | Yes |

# Intellis® System Overview

## ModBus® • DeviceNet® • AS-interface® • Profibus® • Foundation Fieldbus®
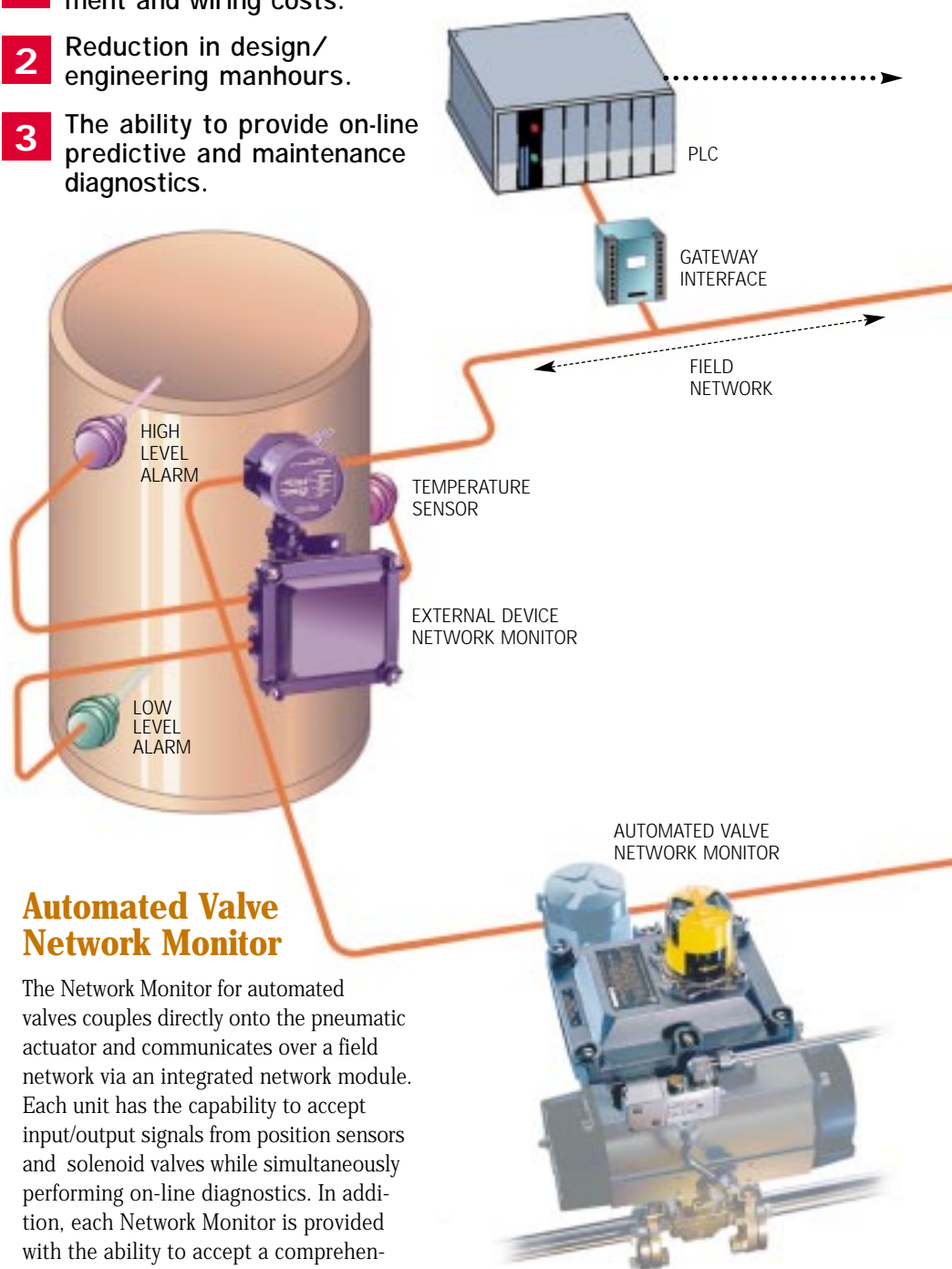
## Field Network

A field communications network is comprised of a specific number of Network Monitors interconnected by a common communications protocol. Network Monitors may be placed on the field network in any physical order. Each Monitor is assigned a unique address and accepts input/output signals from valve position sensors, solenoids, and external devices. Communications with a PLC, DCS or host computer is accomplished by a gateway interface or scanner card having specific compatibility with the primary control network.

**1**   A major reduction in equipment and wiring costs.

**2**   Reduction in design/engineering manhours.

**3**   The ability to provide on-line predictive and maintenance diagnostics.

PLC

GATEWAY INTERFACE

FIELD NETWORK

HIGH LEVEL ALARM

TEMPERATURE SENSOR

EXTERNAL DEVICE NETWORK MONITOR

LOW LEVEL ALARM

AUTOMATED VALVE NETWORK MONITOR

## External Device Network Monitor

Network Monitors are available for control or monitoring of non-valve related devices (sensors, alarms, actuators, indicating lights, etc.) Integrated network modules, have as standard, protective diodes and optical isolation and are housed in a General Purpose, Division 2 Nonincendive or Explosionproof enclosures with a 16 point terminal block for simplification of wiring. Depending on the protocol each stand-alone Network Monitor is capable of accepting six external devices.
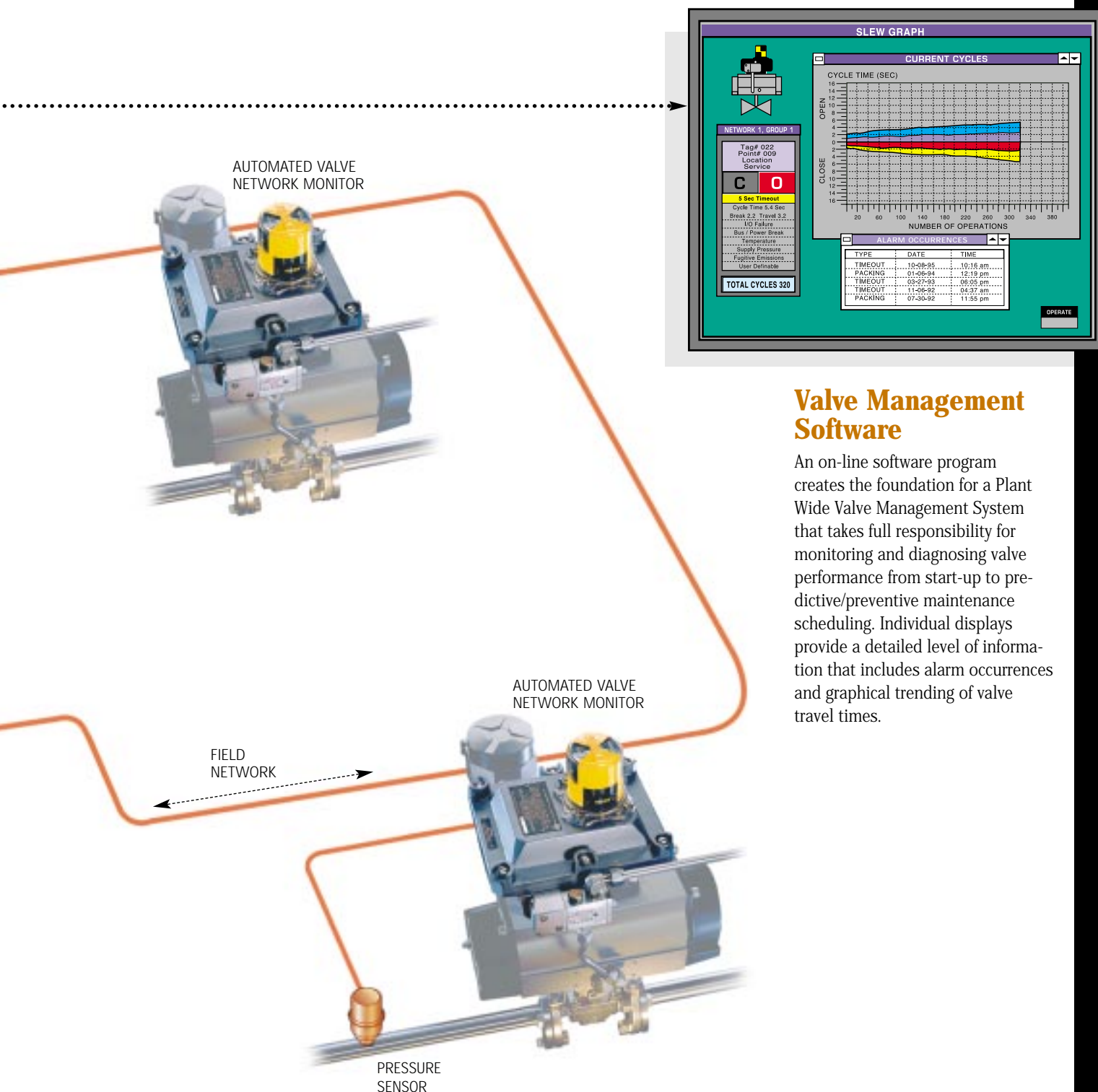
## Automated Valve Network Monitor

The Network Monitor for automated valves couples directly onto the pneumatic actuator and communicates over a field network via an integrated network module. Each unit has the capability to accept input/output signals from position sensors and solenoid valves while simultaneously performing on-line diagnostics. In addition, each Network Monitor is provided with the ability to accept a comprehensive range of external field devices for control or alarm purposes.

# Intellis® System Overview



**SLEW GRAPH**

**CURRENT CYCLES**

CYCLE TIME (SEC)

OPEN

CLOSE

NUMBER OF OPERATIONS

NETWORK 1, GROUP 1

Tag# 022
Point# 009
Location
Service

C    O

5 Sec Timeout

Cycle Time 5.4 Sec
Break 2.2 Travel 3.2
I/O Failure
Bus / Power Break
Temperature
Supply Pressure
Fugitive Emissions
User Definable

**TOTAL CYCLES 320**

**ALARM OCCURRENCES**

| TYPE | DATE | TIME |
|---|---|---|
| TIMEOUT | 10-08-95 | 10:16 am |
| PACKING | 01-06-94 | 12:19 pm |
| TIMEOUT | 03-27-93 | 06:05 pm |
| TIMEOUT | 11-06-92 | 04:37 am |
| PACKING | 07-30-92 | 11:55 pm |

OPERATE

AUTOMATED VALVE
NETWORK MONITOR

AUTOMATED VALVE
NETWORK MONITOR

FIELD
NETWORK

PRESSURE
SENSOR

## Valve Management Software

An on-line software program creates the foundation for a Plant Wide Valve Management System that takes full responsibility for monitoring and diagnosing valve performance from start-up to predictive/preventive maintenance scheduling. Individual displays provide a detailed level of information that includes alarm occurrences and graphical trending of valve travel times.

# System Support

## Conformance Testing

Prior to integration within the Westlock Network Monitor, each network card is subjected to a rigid functionality test and then undergoes a specified period of component "burn-in". After assurance of network card integrity, a communications network, identical to the network specified for a project, is replicated in-house and conformance tested before shipment to the field.

A fully operational communications network with protocol specific network cards and PLC or Host network interface gateways is assembled and then required to satisfactorily operate around-the-clock. A custom software program monitors commands and response, recording any deviations or failure within the system.

## Field Confirmation

The integrity of every network is confirmed in the field through the utilization of a diagnostic and programming tool. The hand-held service unit will fully check all device functionality.

## Personnel Training

Plant personnel, responsible for maintenance and on-going operations, receive in-depth training on field networks, interface devices, hardware components, configuration tools and predictive diagnostic software specifically related to each individual system.

## TECHNICAL SPECIFICATIONS & ORDERING GUIDE

**FALCON®**
LOW POWER SOLENOID TECHNOLOGY
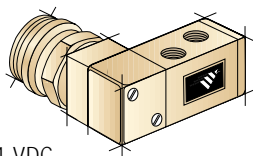
### SOLENOID VALVES

Falcon low power solenoid valves operate at 24 VDC, 20 mA, 0.5 watts. The low power feature (20 mA) allows for a major reduction in power supply requirements. When utilizing the AS-interface protocol, power and communications may be transmitted on the same two wire cable.

### VALVE POSITION SENSORS

Utilized for full open/close position detection and predictive diagnostic functions, each proximity sensor is hermetically sealed against the intrusion of explosive gases, moisture, and corrosion.
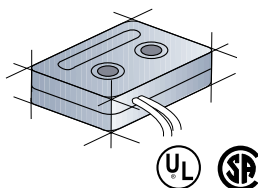
### AREA CLASSIFICATIONS

| Model 7579, 7679, 7779 | Model 7544, 7644, 7744 |
|---|---|
| **Aluminum** | **Engineered Resin** |
| Nema 4, 4x, 7, 9 | Nema 4, 4x, Nonincendive |
| Class I, Groups C & D | Class I, Groups A, B, C & D |
| Class II, Groups E, F & G, Div. 1 & 2 | Class II, Groups F & G |
| Class I, Groups A & B, Div. 2 | Division 2 only |

### ORDERING GUIDE  (FALCON® SOLENOID)

| COILS | CV | Body | 3-Way | 4-Way |
|---|---|---|---|---|
| **FSO** 24 VDC 0.5 watts  NEMA 4, 4x, Nonincendive Class I, Groups A, B, C, D Class II, Grps. F, G, Div. 2 | .3 Cv | Brass | 2100 | 2500 |
| | | Alum. | 3100 | 3500 |
| | | 303 S.S. | 4100 | 4500 |
| | | 316 S.S. | 5100 | 5500 |
| | | Delrin | 6100 | 6500 |
| | .5 Cv | Brass | 2200 | 2600 |
| | | Alum. | 3200 | 3600 |
| | | 303 SS | 4200 | 4600 |
| | | 316 S.S. | 5200 | 5600 |
| | | Delrin | 6200 | 6600 |
| **XSO** 24 VDC 0.5 watts  NEMA 4, 4x, 7, 9 Class I, Groups C, D Class II, Groups E, F, G Div. 1 & 2 | 1.2 Cv | Brass | 2300 | 2700 |
| | | Alum. | 3300 | 3700 |
| | | 303 S.S. | 4300 | 4700 |
| | | 316 S.S. | 5300 | 5700 |
| | | Delrin | 6300 | 6700 |
| | 3.5 Cv | Alum. | 3400 | 3800 |
| | | Delrin | 6400 | 6800 |

NOTE: For dual coil applications, please consult factory.
For Manual Override suffix part number with **MO**

### ORDERING GUIDE

| Network Protocol | Enclosure | Network Card | Beacon | 3-Way Beacon | Solenoid | Pefipheral Interface Devices |
|---|---|---|---|---|---|---|
| ProfiBus **72\*** Foundation Fieldbus **73\*** ModBus Direct **74** ModBus **75** DeviceNet **76** AS-interface **77** | Aluminum **79ME**  Aluminum w/ Junction Housing **79XE**  Engineered Resin **44R**  Engineered Resin w/ Junction Housing **44X** | Card A 2 Inputs 1 Output **A**  Card B 6 Inputs 2 Outputs\*\* **B** | STANDARD (Black & Yellow) **BY**  ANSI YELLOW (Inherently Hazardous) **AY**  ANSI GREEN (Liquid-Low Hazard) **AG**  ANSI BLUE (Gas-Low Hazard) **AB**  ANSI RED (Fire Quenching) **AR** | 90° Rotation **B1**  90° Rotation **B3**  90° Rotation **B5**  180° Rotation **B7**  180° Rotation **B9** | Use above listing for ordering solenoid | • Cables • Power Supplies • Gateways • Repeaters • Extenders • Configuration Tools • Software/Diagnostics  **Application Support**  • Engineering Design • Integration • Start-up Support • Training |

\* Consult Factory   \*AS-interface: 4 inputs/4 outputs  •  For Namur mounting configuration suffix enclosure designation with the letter "N", Example: 7644RNABY

**For Sanitary Diaphragm valves, see bulletin number 720**

## *The future of valve automation*