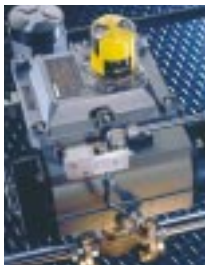




NETWORK SYSTEMS FOR VALVE AUTOMATION

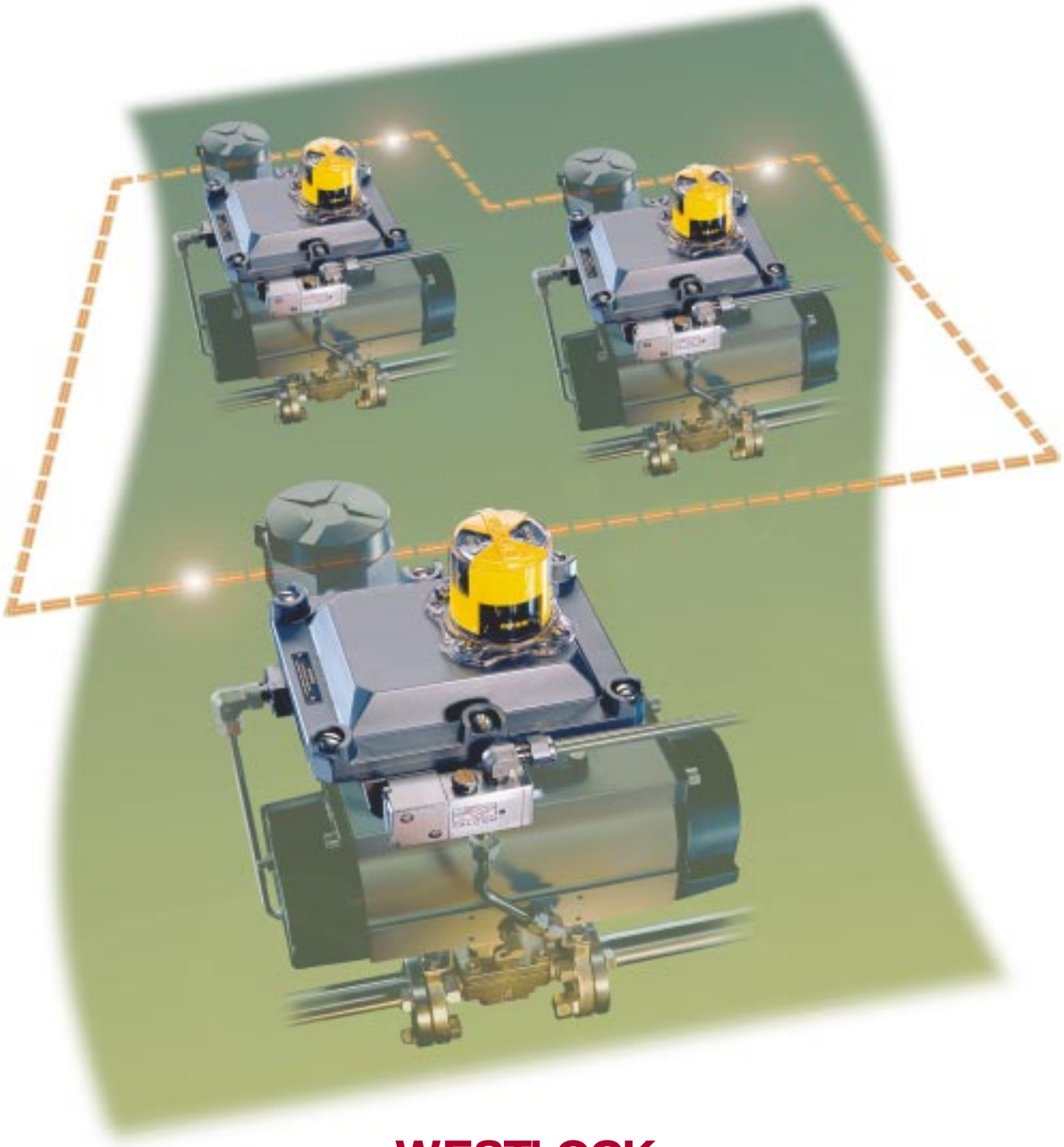
INTELLIS

Intellis Network Solutions

INTELLIS®

NETWORK SYSTEMS FOR VALVE AUTOMATION

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



WESTLOCK
Network Systems Group

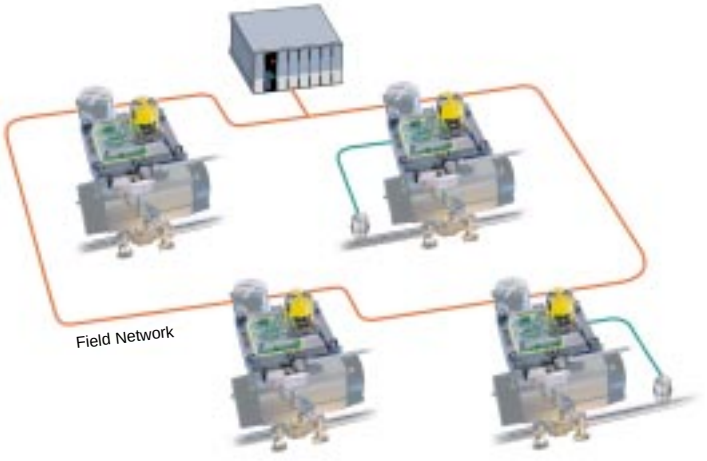
INTELLIS®

Network Systems for Valve Automation

Network Monitor (resin enclosure)

Intellis® 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.



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® 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** 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®** 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® Ver. 2.1** 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. 900 ft. with repeater
Maximum Network Monitors per System	100/network 10 networks/system	32/network 1/system	63/network 2 networks/system	62/network 1 network/system
Maximum I/O Points per System	800/network 8000/system	256/network plus optional 4/20 mA analog I/O 256/system	504/network plus optional 4/20 mA analog I/O 1008/system	434/network 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 & 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®** 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®** 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. 125/system using repeaters
Maximum I/O Points per System	48 discrete 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, 500, 1500, 12000 kbps
Redundancy	Yes	No
Valves Specific Diagnostics	Yes	Yes

Intellis® System Overview

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

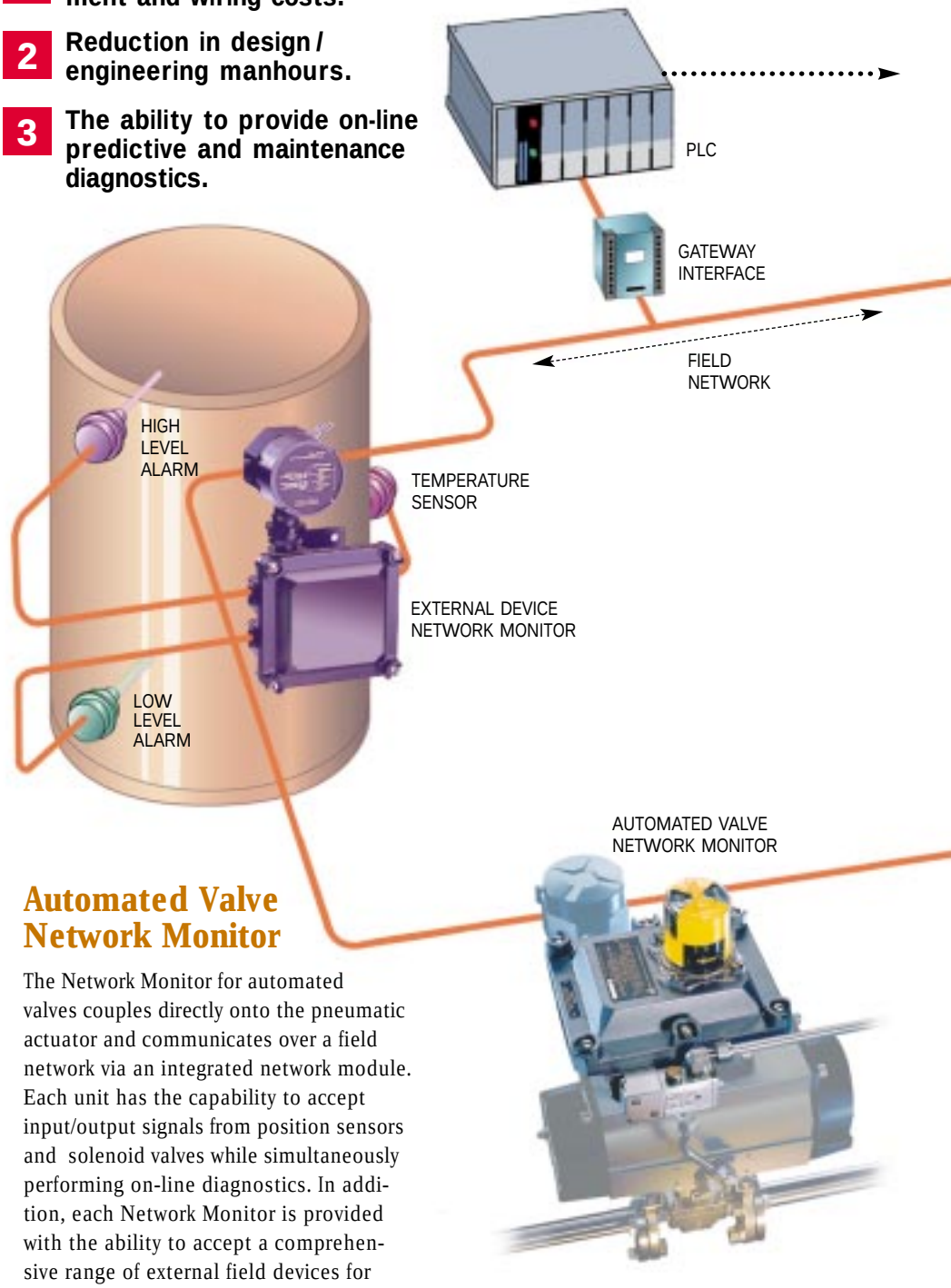
Field Network

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.

External Device Network Monitor

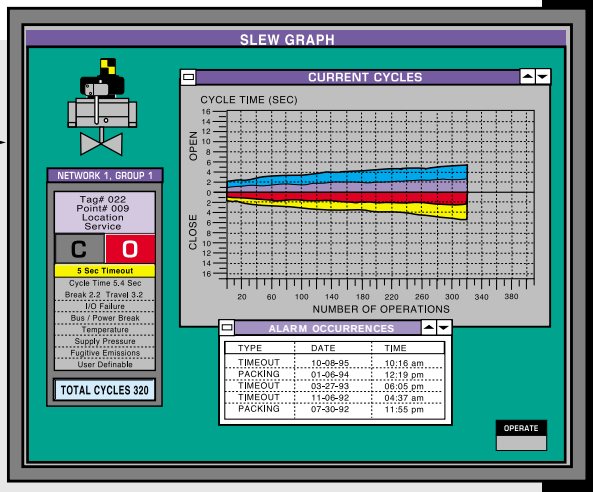
Network Monitors are available for control or monitoring of non-valve related devices (sensors, alarms, actuators, indicating lights, etc.) Integrated network modules, have as standard, protective diodes and optical isolation and are housed in a General Purpose, Division 2 Nonincendive or Explosionproof 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.

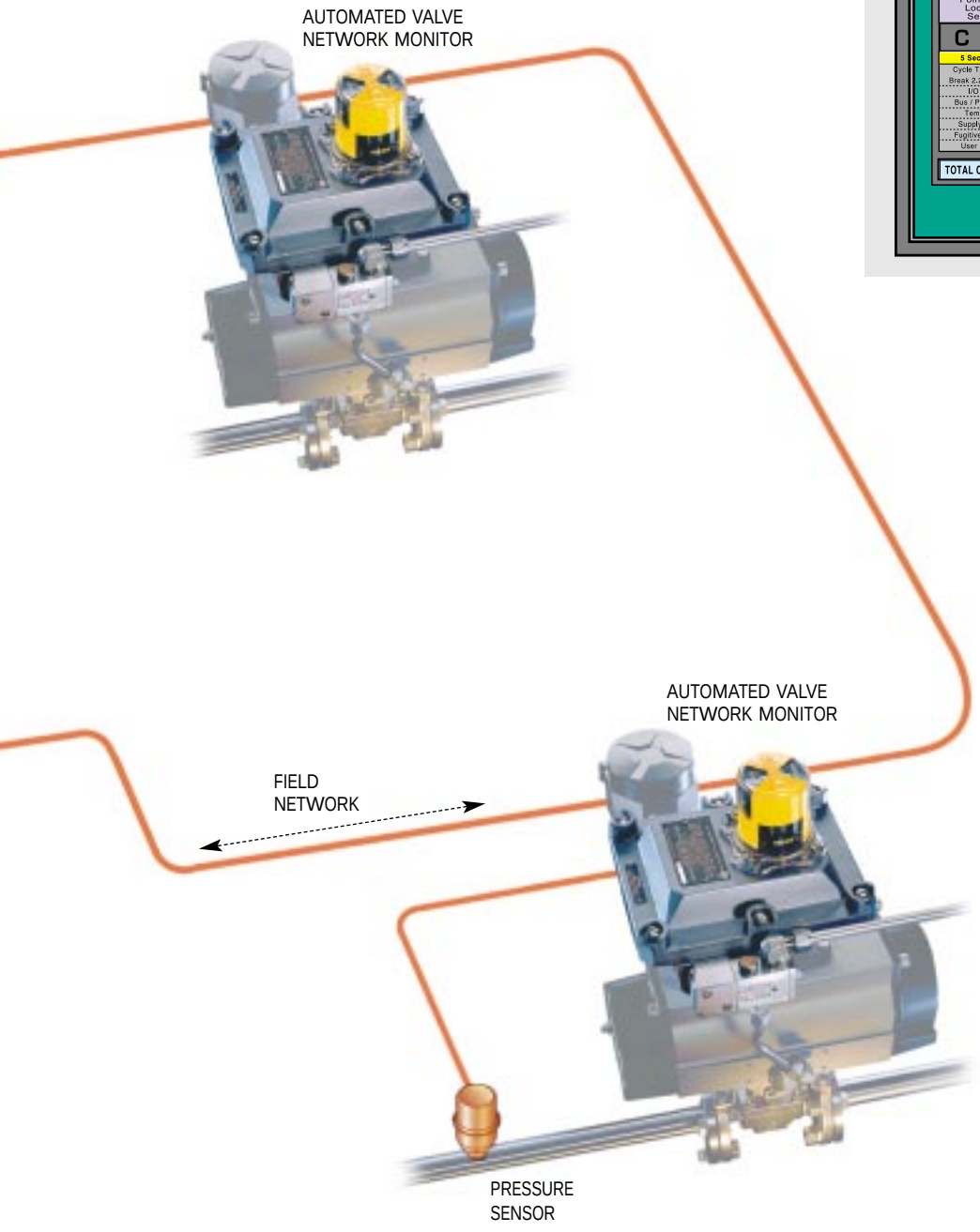
1. **A major reduction in equipment and wiring costs.**
2. **Reduction in design / engineering manhours.**
3. **The ability to provide on-line predictive and maintenance diagnostics.**



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.





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.

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

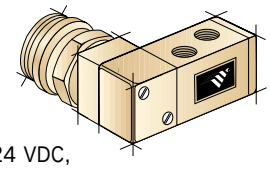
The integrity of every network is confirmed in the field through the utilization of a diagnostic and programming tool. The hand-held service unit will fully check all device functionality.

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

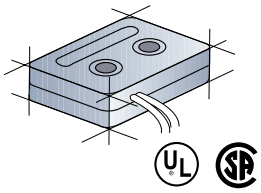
FALCON®
LOW POWER SOLENOID TECHNOLOGY



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 Nema 4, 4x, 7, 9 Class I, Groups C & D Class II, Groups E, F & G, Div. 1 & 2 Class I, Groups A & B, Div. 2	**Engineered Resin** Nema 4, 4x, Nonincendive Class I, Groups A, B, C & D Class II, Groups F & G 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 **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	.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
	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***	Aluminum **79ME**	Card A 2 Inputs 1 Output **A**	**STANDARD** (Black & Yellow) **BY**	**90° Rotation** B1	Use above listing for ordering solenoid	• Cables • Power Supplies • Gateways • Repeaters • Extenders • Configuration Tools • Software/Diagnostics
Foundation Fieldbus **73***	Aluminum w/ Junction Housing **79XE**	Card B 6 Inputs 2 Outputs** **B**	**ANSI YELLOW** (Inherently Hazardous) **AY**	**90° Rotation** B3		
ModBus Direct **74**	Engineered Resin **44R**		**ANSI GREEN** (Liquid-Low Hazard) **AG**	**90° Rotation** B5		**Application Support**
ModBus **75**	Engineered Resin w/ Junction Housing **44X**		**ANSI BLUE** (Gas-Low Hazard) **AB**	**180° Rotation** B7		• Engineering Design • Integration • Start-up Support • Training
DeviceNet **76**			**ANSI RED** (Fire Quenching) **AR**	**180° Rotation** B9		
AS-interface **77**						

* 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

WESTLOCK

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Saddle Brook, NJ 07663
201-794-7650
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Westlock Controls LTD.
22 Chapman Way
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Fax: 011-55-11-7291-0931

Web Site: www.westlockcontrols.com

The Economic Advantages of Field Networks*

Labor Costs

The utilization of an industrial communications field network will greatly contribute to the overall reduction of labor costs as compared to a conventional hardwired scheme where individual wires must be pulled through a protective conduit that is hundreds of feet long.

Hardwired 180 valve system $223,905
Networked 180 valve system $102,129

Engineering/Design Costs

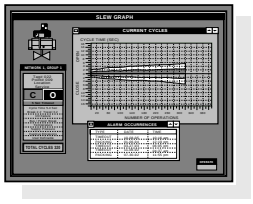
Automated valves and process sensors are simply connected to the network at the points along the path where they are located. A total engineering/design savings of over 5 hours per valve can be realized.

Hardwired 180 valve system $116,460
Networked 180 valve system $51,120

Material Costs

The amount of conduit, fittings, wire, and junction housings is greatly reduced. When compared with conventional systems, field networks eliminate a substantial amount of field wiring and the labor necessory to install it.

Hardwired 180 valve system $228,404
Networked 180 valve system $182,355



Maintenance Costs

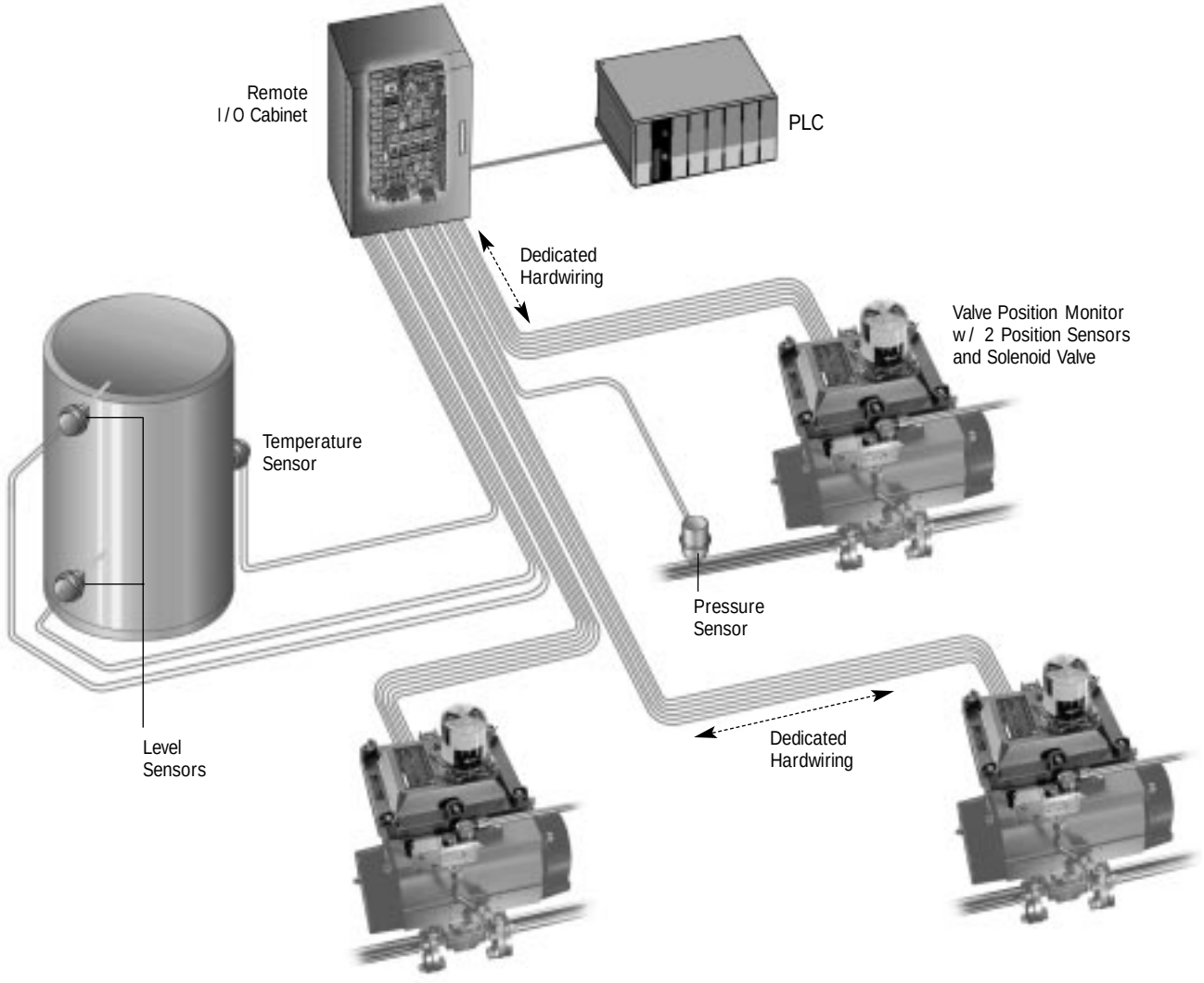
Field networks create the foundation for a plant wide valve management system that takes full responsibility for monitoring and diagnosing valve performance from start-up to predictive/preventive maintenance scheduling.

*A detailed cost analysis for each field network can be found on the following pages:

WESTLOCK
Network Systems Group

Typical Hardwired System

Conventional wiring systems generally require that individual control wires run from the I/O cabinet to the position sensors and solenoid of each automated valve. For systems consisting of a multitude of pneumatically actuated on-off valves, hundreds of wires must be run and properly connected — not only to each position sensor and solenoid valve, but also back to the proper point of connection at the I/O cabinet.

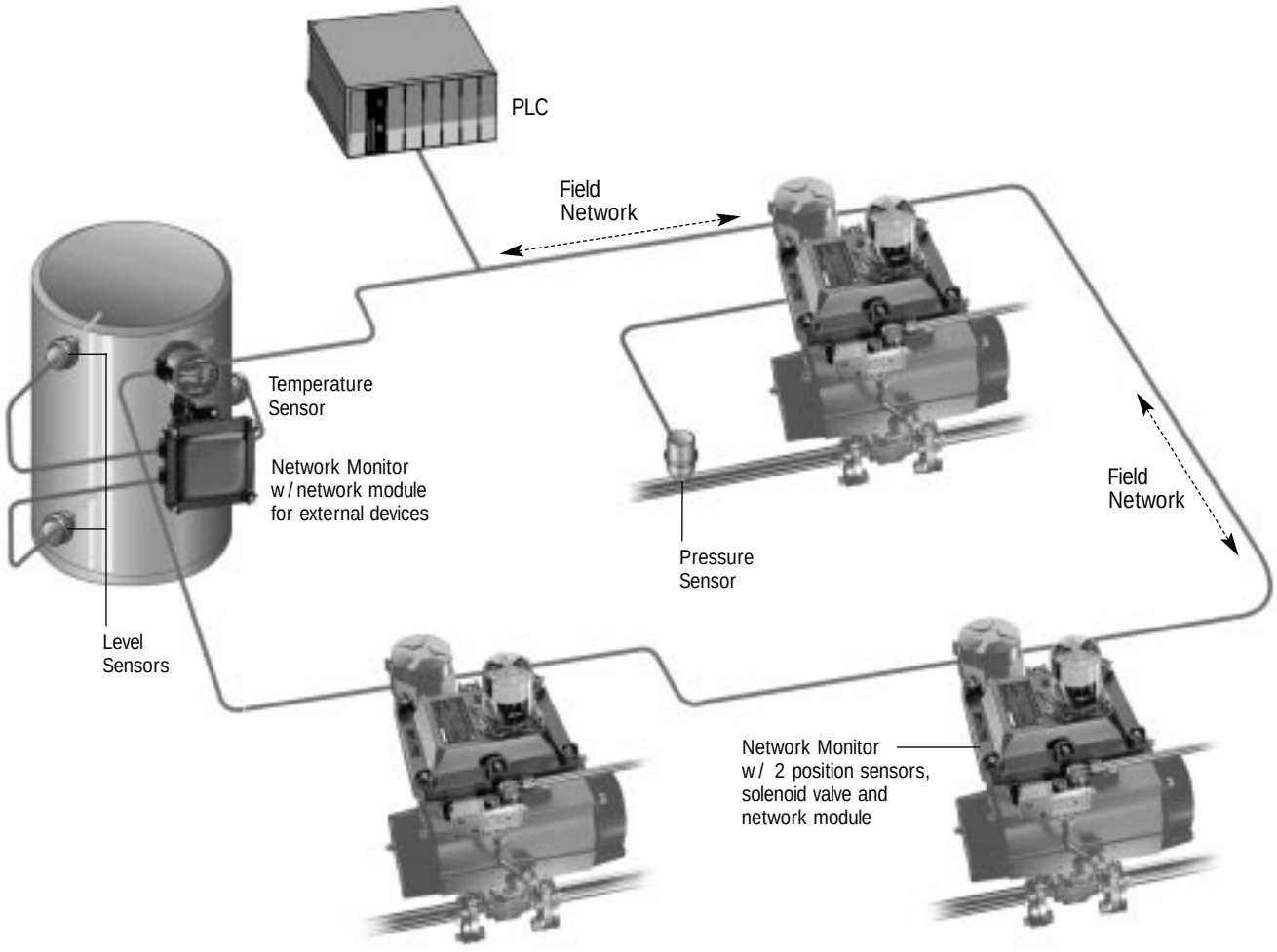


HARDWIRED SYSTEM COST (180 Valve System)	Labor & Material Cost	$452,309	$838 Per I/O Point
	Engineering/Design Cost	$116,460	$216 Per I/O Point
	TOTAL COST	**$568,769**	**$1,054 Per I/O Pt**

A detailed cost analysis for each field network can be found on the following pages: ModBus 4-7 • DeviceNet 8-11 • AS-interface 12-15

INTELLIS® Network System

By integrating a network module within the Westlock Network Monitor, pneumatically actuated on-off valves and external devices are simply connected to the field network at the points along the path where they are located. The need for remote I/O cabinets and thousands of feet of dedicated control wiring from each automated valve and external sensor is eliminated.



INTELLIS SYSTEM COST (180 Valve System)			
	Labor & Material Cost	$284,484	$526 Per I/O Point
	Engineering/Design Cost	$51,120	$94 Per I/O Point
	TOTAL COST	**$335,604**	**$620 Per I/O Pt**

A detailed cost analysis for each field network can be found on the following pages: ModBus 4-7 • DeviceNet 8-11 • AS-interface 12-15

Cost Analysis

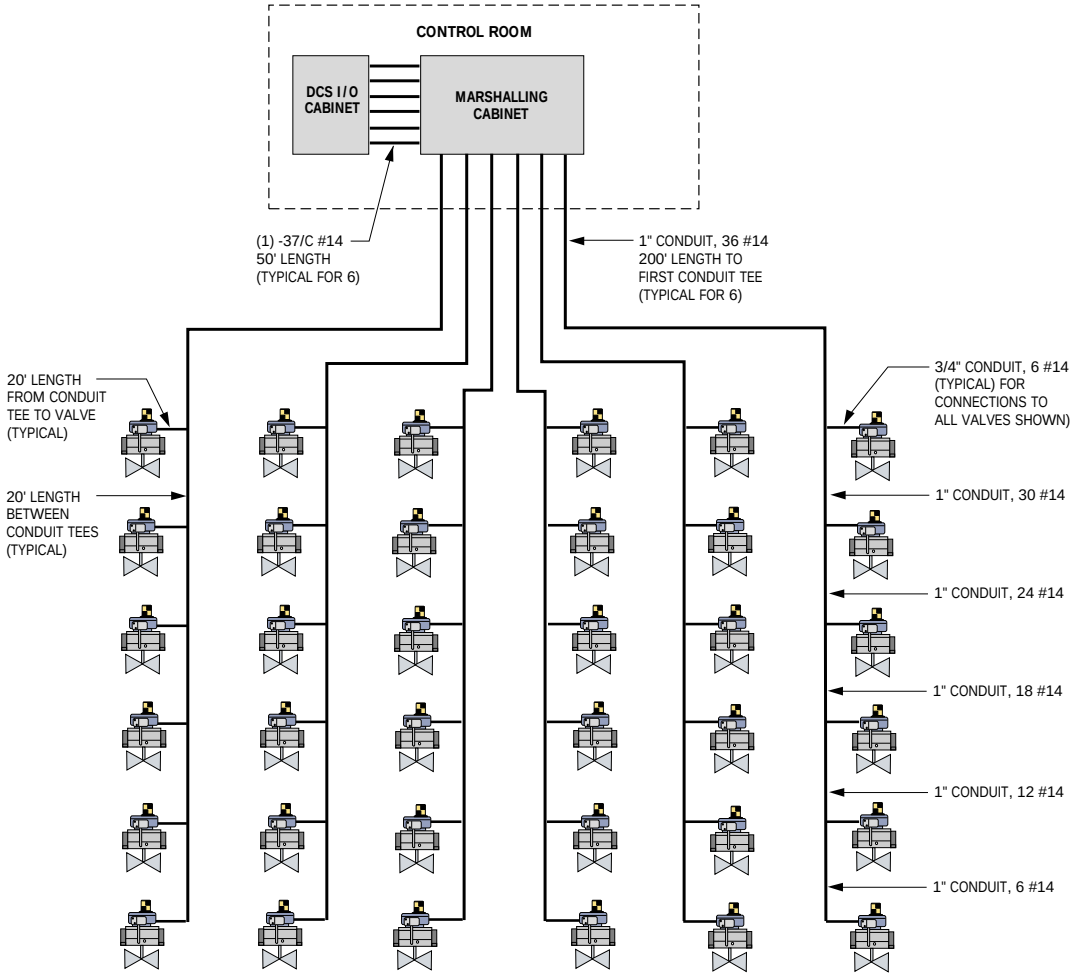
CONVENTIONAL SYSTEM

DCS with Central I/O

This sketch is typical for 5 field networks. (36 valves per network, 180 valves per system)

NOTES:

1. All valves shown are pneumatic actuated on/off type, with 3-way solenoid and open/close position sensors.
2. All conduit is above ground, ridgid galvanized steel.
3. All #14 wiring is type THHN insulation



CONVENTIONAL SYSTEM (DCS with Central I/O)

MATERIAL DESCRIPTION	TAKEOFF QUANTITY		INSTALLATION LABOR				MATERIAL		
	AMOUNT	UNIT	PER UNIT	TOTAL HOURS	MH RATE	LABOR COST	COST/ UNIT	MATERIAL COST	TOTAL L&M COST
3/4" Conduit	5400	feet	0.1	540.0	50	27,000	0.95	5,130	$32,130
1" Conduit	7200	feet	0.1	720.0	50	36,000	1.39	10,008	$46,008
Conduit Fittings & Supports	allowance	lot	–	960.0	50	48,000		14,600	$62,600
#14 Wire	300000	feet	0.006	1,800.0	50	90.000	0.06	18,000	$108,000
37/C #14 Multiconductor Cable	1800	feet	0.04	72.0	50	3,600	1.25	2,250	$5,850
#16 Twisted Pair, Shielded	0	feet	0.007	–	50	–	0.15	–	–
RS-232 Cabling	0	feet	0.008	–	50	–	0.75	–	–
Terminations	4320	each	0.08	345.6	50	17,280	0.05	216	$17,496
Valve Solenoid & Position Sensors	180	each	0	–	50	–	450	81,000	$81.000
Intellis Network Interf. Mgr. & PC	0	each	0	–	50	–	7500	–	–
Marshalling Cabinet	540	each	0.075	40.5	50	2,025	80	43,200	$45,225
Input/Output Hardware	540	per I/O point	0	–	50	–	100	54,000	$54.000
TOTALS				**4,478.1**		**$223,905**		**$228,404**	**$452,309**

Cost Analysis

INTELLIS® MODBUS SYSTEM

DCS with Network Monitors

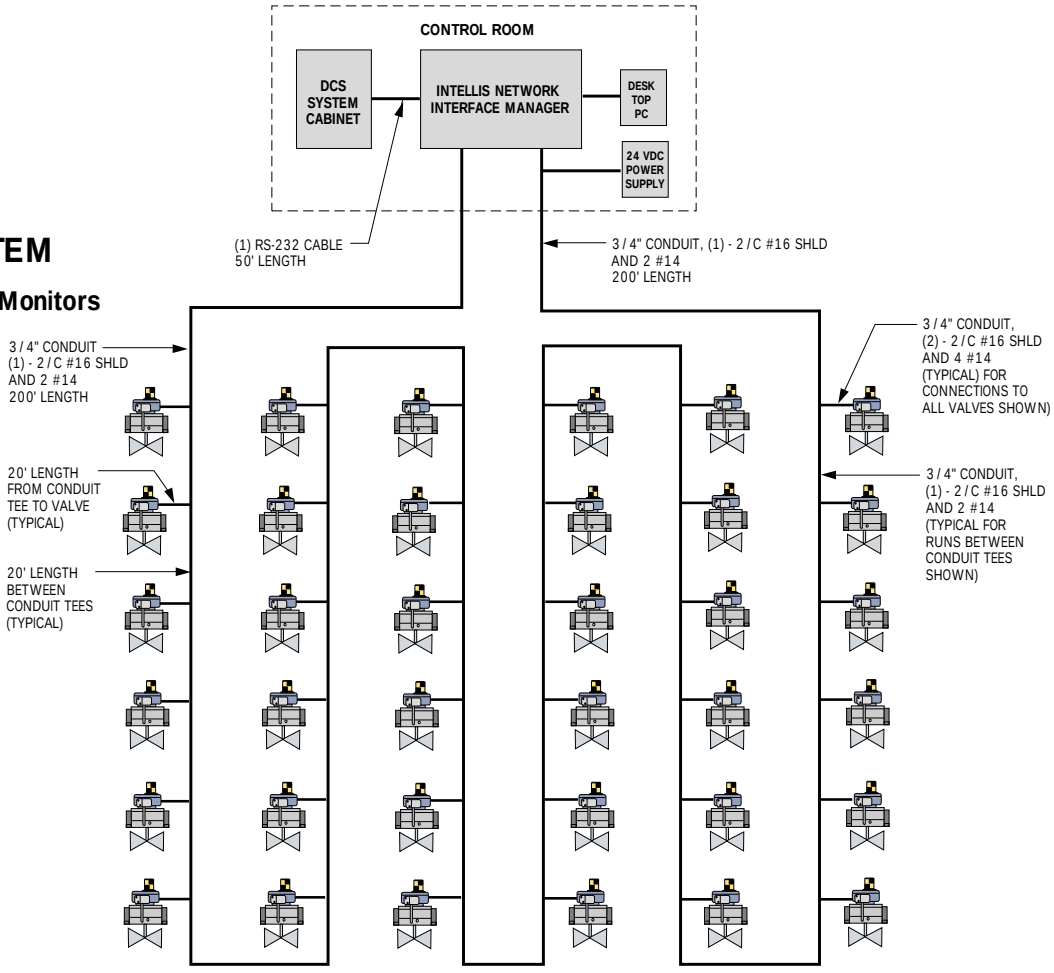
This sketch is typical for 5 field networks. (36 valves per network, 180 valves per system)

NOTES:

1. All valves shown are pneumatic actuated on/off type, with 3-way solenoid and open/close position sensors.

2. All conduit is above ground, ridgid galvanized steel.

3. All #14 wiring is type THHN insulation



INTELLIS SYSTEM (DCS with Network Monitors)

MATERIAL DESCRIPTION	TAKEOFF QUANTITY		INSTALLATION LABOR				MATERIAL		
	AMOUNT	UNIT	PER UNIT	TOTAL HOURS	MH RATE	LABOR COST	COST/ UNIT	MATERIAL COST	TOTAL L&M COST
3/4" Conduit	9200	feet	0.1	920.0	50	46,000	0.95	8,740	$54,740
1" Conduit	0	feet	0.1	–	50	–	1.39	–	–
Conduit Fittings & Supports	allowance	lot	–	736.0	50	36,800		8,770	$45,570
#14 Wire	25400	feet	0.006	152.4	50	7,620	0.06	1,524	$9,144
37/C #14 Multiconductor Cable	0	feet	0.04	–	50	–	1.25	–	–
#16 Twisted Pair, Shielded	12700	feet	0.007	88.9	50	4,445	0.15	1,905	$6,350
RS-232 Cabling	60	feet	0.008	0.5	50	24	0.75	45	$69
Terminations	1810	each	0.08	144.8	50	7,240	0.05	91	$7,331
Network Monitors	180	each	0	–	50	–	846	152,280	$152,280
Intellis Network Interf. Mgr. & PC	1	each	0	–	50	–	9000	9000	$9,000
Marshalling Cabinet	0	each	0.075	–	50	–	80	–	–
Input/Output Hardware	0	per I/O point	0	–	50	–	100	–	–
TOTALS				**2,042.6**		**$102,129**		**$182,355**	**$284,484**

Cost Analysis

ENGINEERING/ DESIGN COSTS

Conventional System vs INTELLIS® with Modbus

The following tabulations are on a per valve basis for engineering and design activities normally associated with ON/OFF valves on a process industry capital project.

A total engineering/design savings of over **5 hours per valve** can be realized. On a project with 180 ON/OFF valves and an engineering billing rate of $70/hr, savings would exceed **$65,340**. A schedule **savings of 936 man-hours** would also be achieved.

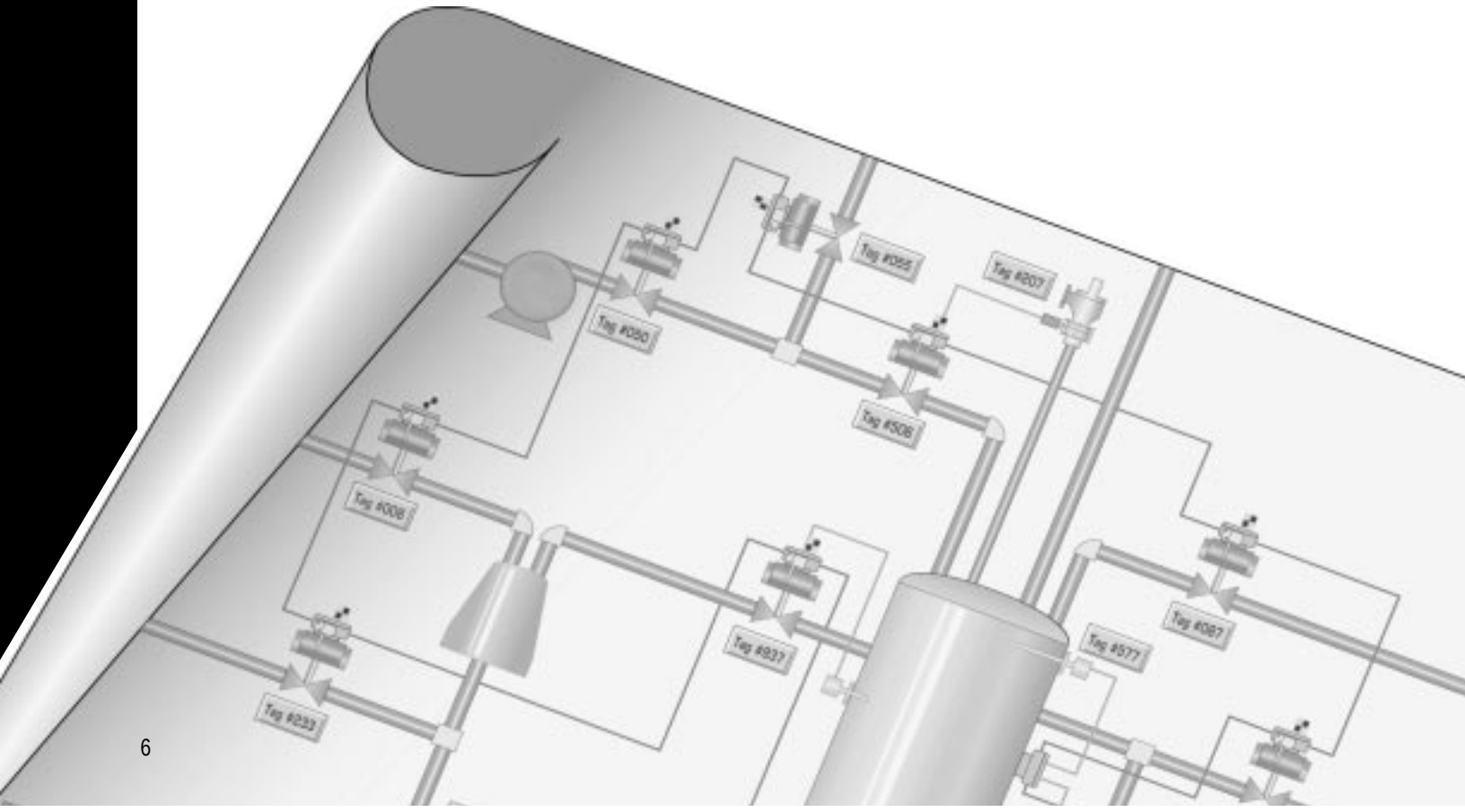
ENGINEERING/DESIGN ACTIVITY	CONVENTIONAL ON/OFF VALVE	INTELLIS Network Monitors
P & ID Development/Production	0.1 hrs	0.1 hrs
Instrument Index Development/Production	0.5 hrs	0.5 hrs
I/O Address Assignments	0.3 hrs	0.1 hrs
I/O List Development/Production	1.5 hrs	0.5 hrs
Instrument Loop Diagram Design/Documentation	4 hrs	2 hrs
Marshalling Panel Design/Documentation	0.3 hrs	0 hrs
Field Terminal Box Design/Documentation	0.3 hrs	0.1 hrs
Electrical Cabling and Termination Lists.	2.25 hrs	0.75 hrs
Total Hours	**9.25**	**4.05**
Cost per Valve $70/hr engineering billing rate	**$647.00**	**$284.00**

Savings per Valve = $363.00

Savings per I/O Point (3 I/O per valve) = $121.00

Total Engineering & Design Savings for 180 on/off valves = $65,340

Total Schedule Savings = 936 Manhours



Cost Analysis

COMPARATIVE COST ANALYSIS SUMMARY

Conventional I/O System vs Intellis® with ModBus

The following is an abreviated cost summary of the Distributed Control System wiring scheme example outlined on the previous pages. Each example utilized a total of 180 pneumatically actuated on/off valves with 3-way solenoid and open/close position sensors. The entire system called for a total of 540 I/O points (3 per valve).

CONVENTIONAL SYSTEM

Labor & Material Cost	$452,309	
Cost per I/O Point		$838
Engineering/Design Cost	$116,460	
Cost per I/O Point		$216
TOTAL COST	**$568,769**	**$1,054/I/O pt**

INTELLIS SYSTEM

Labor & Material Cost	$284,484	
Cost per I/O Point		$526
Engineering/Design Cost	$51,120	
Cost per I/O Point		$94
TOTAL COST	**$335,604**	**$620/I/O pt**

INTELLIS System Total Savings = $233,165

Savings per Valve = $1,302

Cost Analysis

CONVENTIONAL SYSTEM

DCS with Central I/O

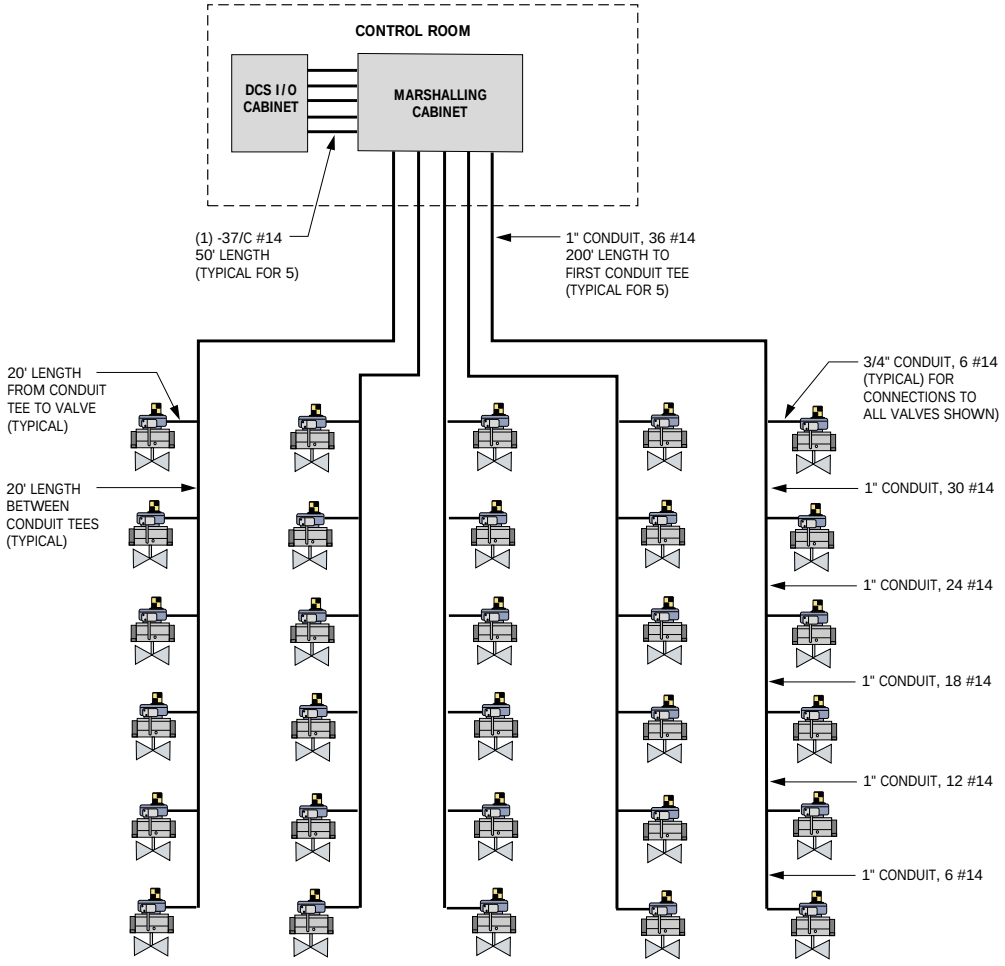
This sketch is typical for 4 field networks. (30 valves per network, 120 valves per system)

NOTES:

1. All valves shown are pneumatic actuated on/off type, with 3-way solenoid and open/close position sensors.

2. All conduit is above ground, ridgid galvanized steel.

3. All #14 wiring is type THHN insulation



CONVENTIONAL SYSTEM (DCS with Central I/O)

MATERIAL DESCRIPTION	TAKEOFF QUANTITY		INSTALLATION LABOR				MATERIAL		
	AMOUNT	UNIT	PER UNIT	TOTAL HOURS	MH RATE	LABOR COST	COST/ UNIT	MATERIAL COST	TOTAL L&M COST
3/4" Conduit	3600	feet	0.1	360.0	50	18,000	0.95	3,420	$21,420
1" Conduit	4800	feet	0.1	480.0	50	24,000	1.39	6,672	$30,672
Conduit Fittings & Supports	allowance	lot		672.0	50	33,600		14,600	$48,200
#14 Wire	194400	feet	0.006	1,166.4	50	58,320	0.06	11,664	$69,984
37/C #14 Multiconductor Cable	1000	feet	0.04	40.0	50	2,000	1.25	1,250	$3,250
RS-232 Cabling	0	feet	0.008	–	50	–	0.75		
Terminations	2920	each	0.08	233.6	50	11,680	0.05	146	$11,826
Valve Solenoid & Position Sensors	120	each	0	–	50	–	450	54,000	$54,000
PLC with DeviceNet Scanner	0	each	0	–	50	–	0	–	
Marshalling Cabinet	360	each	0.075	27.0	50	1,350	80	28,800	$30,150
Input/Output Hardware	360	per I/O point	0	–	50	–	100	36,000	$36,000
TOTALS				**2,979.0**		**$148,950**		**$156,552**	**$305,502**

Cost Analysis

INTELLIS DEVICENET SYSTEM

DCS with Network Monitors

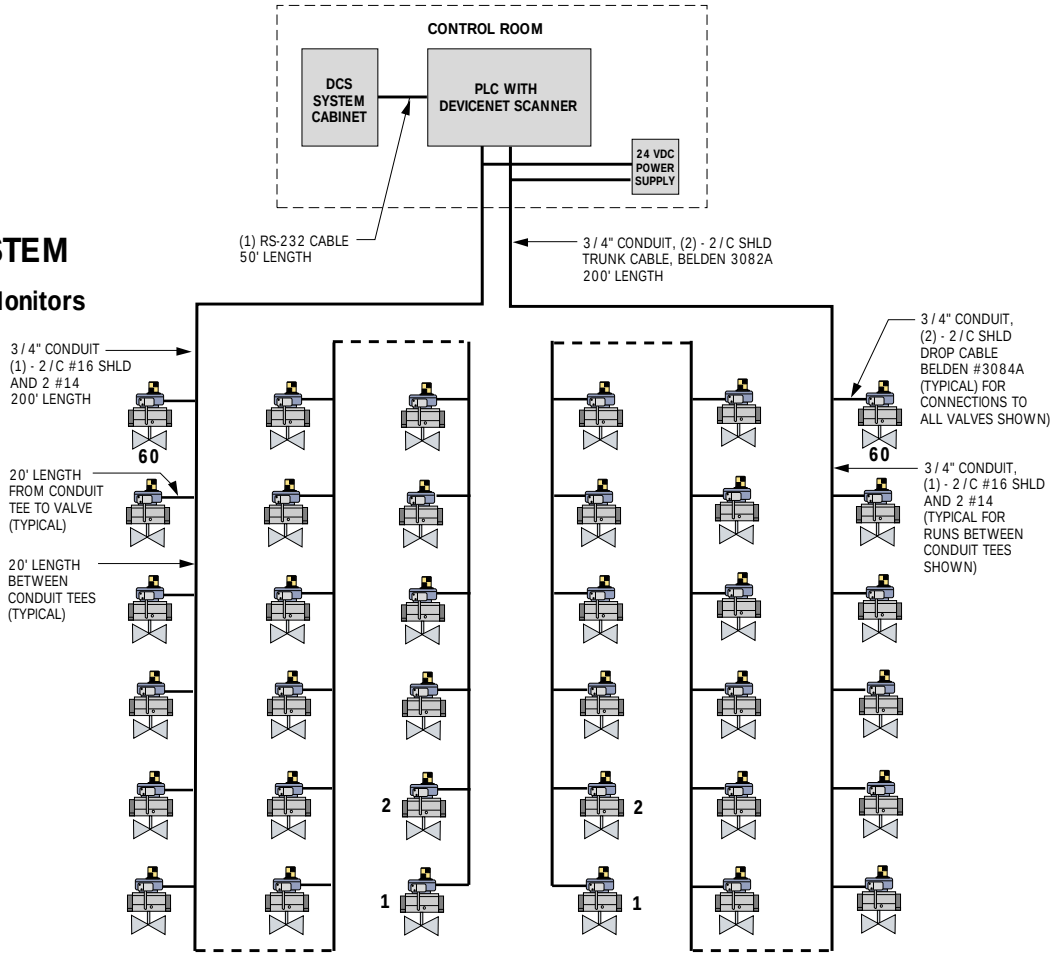
This sketch is typical for 2 field networks. (60 valves per network, 120 valves per system)

NOTES:

1. All valves shown are pneumatic actuated on/off type, with 3-way solenoid and open/close position sensors.

2. All conduit is above ground, ridgid galvanized steel.

3. All #14 wiring is type THHN insulation



INTELLIS SYSTEM (DCS with DeviceNet Network Monitors)

MATERIAL DESCRIPTION	TAKEOFF QUANTITY		INSTALLATION LABOR				MATERIAL		
	AMOUNT	UNIT	PER UNIT	TOTAL HOURS	MH RATE	LABOR COST	COST/ UNIT	MATERIAL COST	TOTAL L&M COST
3/4" Conduit	5160	feet	0.1	516.00	50	25,800	0.95	4,902	$30,702
1" Conduit	0	feet	0.1	–	50	–	1.39	–	–
Conduit Fittings & Supports	allowance	lot	–	412.8	50	20,640	–	8,770	$29,410
#14 Wire	0	feet	0.006	–	50	–	0.06	–	–
37/C #14 Multiconductor Cable	0	feet	0.04	–	50	–	1.25	–	–
DeviceNet Trunk Cable	2760	feet	0.007	19.3	50	966	1.2	3,312	$4,278
DeviceNet Drop Cable	2400	feet	0.007	16.8	50	840	0.7	1,680	$2,520
RS-232 Cabling	60	feet	0.008	0.5	50	24	0.75	45	$69
Terminations	1440	each	0.08	115.2	50	5,760	0.05	72	$5,832
Field Terminal Box	0	per t. block	0.08	–	50	–	0	–	–
Network Monitors	120	each	0	–	50	–	846	101,520	$101,520
PLC with DeviceNet Scanner	1	each	–	–		–	–	10,000	$10,000
Marshalling Cabinet	0	each	0.075	–	50	–	80	–	–
Input/Output Hardware	0	per I/O point	0	–	50	–	100	–	–
TOTALS				**1,080.6**		**$54,030**		**$130,301**	**$184,331**

Cost Analysis

ENGINEERING/ DESIGN COSTS

Conventional System vs INTELLIS® with DeviceNet

The following tabulations are on a per valve basis for engineering and design activities normally associated with ON/OFF valves on a process industry capital project.

A total engineering/design savings of over **5 hours per valve** can be realized. On a project with 120 ON/OFF valves and an engineering billing rate of $70/hr, savings would exceed **$43,560**. A schedule **savings of 624 man-hours** would also be achieved.

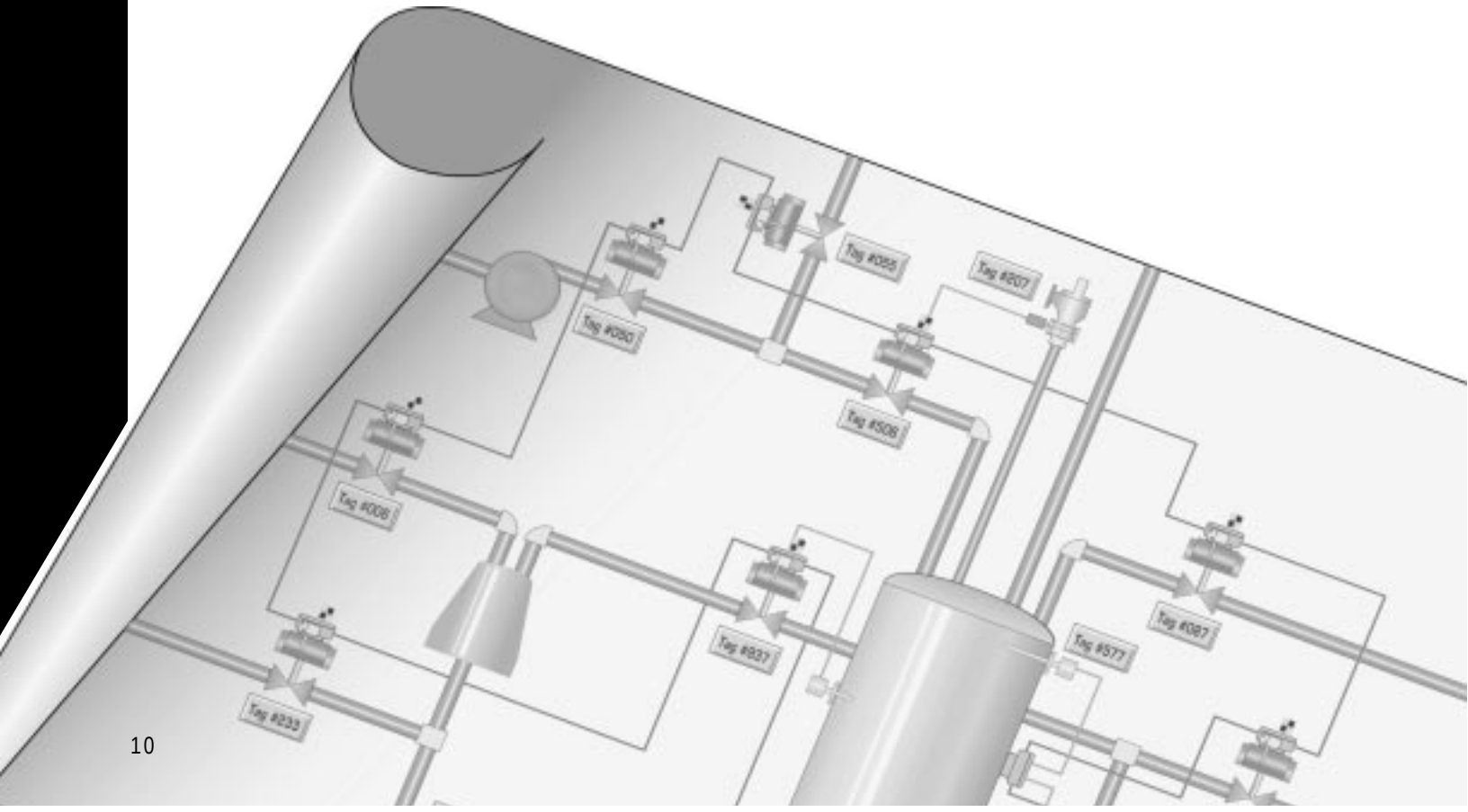
ENGINEERING/DESIGN ACTIVITY	CONVENTIONAL ON/OFF VALVE	INTELLIS Network Monitors
P & ID Development/Production	0.1 hrs	0.1 hrs
Instrument Index Development/Production	0.5 hrs	0.5 hrs
I/O Address Assignments	0.3 hrs	0.1 hrs
I/O List Development/Production	1.5 hrs	0.5 hrs
Instrument Loop Diagram Design/Documentation	4 hrs	2 hrs
Marshalling Panel Design/Documentation	0.3 hrs	0 hrs
Field Terminal Box Design/Documentation	0.3 hrs	0.1 hrs
Electrical Cabling and Termination Lists.	2.25 hrs	0.75 hrs
Total Hours	**9.25**	**4.05**
Cost per Valve $70/hr engineering billing rate	**$647.00**	**$284.00**

Savings per Valve = $363.00

Savings per I/O Point (3 I/O per valve) = $121.00

Total Engineering & Design Savings for 120 on/off valves = $43,560

Total Schedule Savings = 624 Manhours



Cost Analysis

COMPARATIVE COST ANALYSIS SUMMARY

Conventional I/O System vs INTELLIS® with DeviceNet

The following is an abreviated cost summary of the Distributed Control System wiring scheme example outlined on the previous pages. The example utilizes a total of 120 pneumatically actuated on/off valves with 3-way solenoid and open/close position sensors. The entire system calls for a total of 360 I/O points (3 per valve).

CONVENTIONAL SYSTEM

Labor & Material Cost	$305,502	
Cost per I/O Point		$848
Engineering/Design Cost	$77,640	
Cost per I/O Point		$216
TOTAL COST	**$383,142**	**$1,064/I/O pt**

INTELLIS SYSTEM

Labor & Material Cost	$184,331	
Cost per I/O Point		$512
Engineering/Design Cost	$34,080	
Cost per I/O Point		$94
TOTAL COST	**$218,411**	**$606/I/O pt**

INTELLIS System Total Savings = $164,731

Savings per Valve = $1,372

Cost Analysis

CONVENTIONAL SYSTEM

DCS with Central I/O

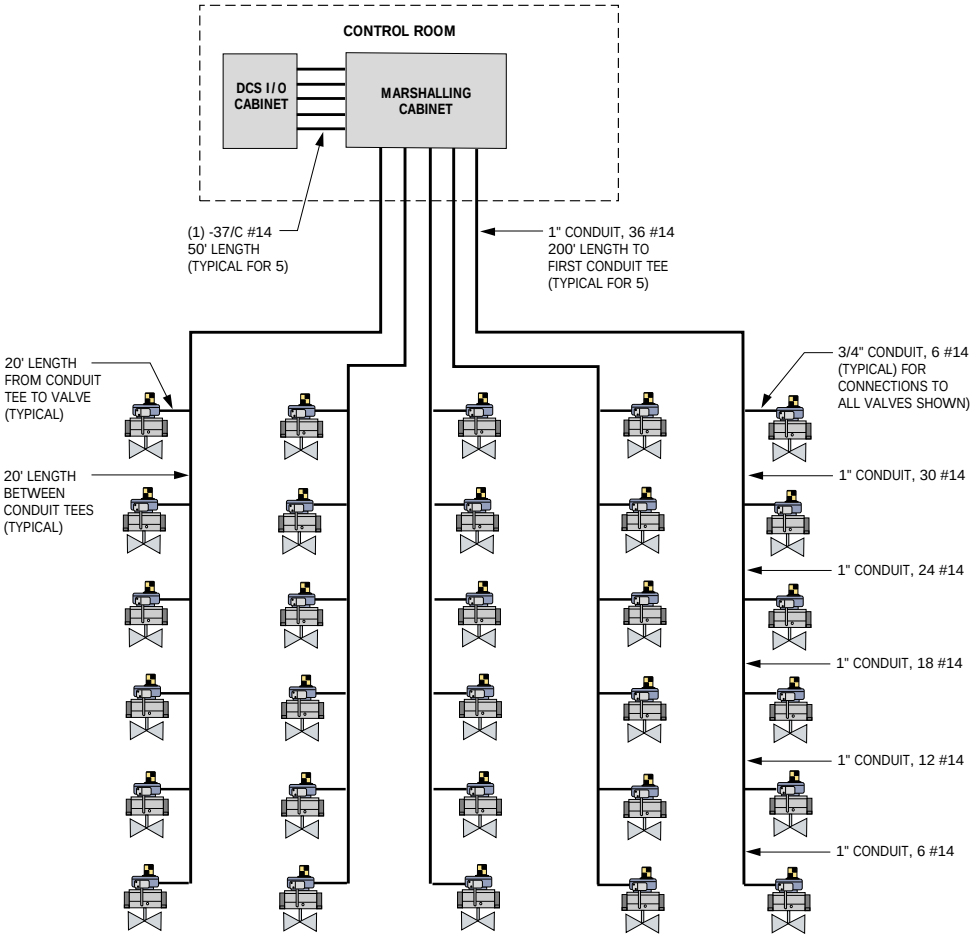
This sketch is typical for 4 field networks. (30 valves per network, 120 valves per system)

NOTES:

1. All valves shown are pneumatic actuated on/off type, with 3-way solenoid and open/close position sensors.

2. All conduit is above ground, ridgid galvanized steel.

3. All #14 wiring is type THHN insulation



CONVENTIONAL SYSTEM (DCS with Central I/O)

MATERIAL DESCRIPTION	TAKEOFF QUANTITY		INSTALLATION LABOR				MATERIAL		
	AMOUNT	UNIT	PER UNIT	TOTAL HOURS	MH RATE	LABOR COST	COST/ UNIT	MATERIAL COST	TOTAL L&M COST
3/4" Conduit	3600	feet	0.1	360.0	50	18,000	0.95	3,420	$21,420
1" Conduit	4800	feet	0.1	480.0	50	24,000	1.39	6,672	$30,672
Conduit Fittings & Supports	allowance	lot	–	672.0	50	33,600	–	14,600	$48,200
#14 Wire	194400	feet	0.006	1,166.4	50	58,320	0.06	11,664	$69,984
37/C #14 Multiconductor Cable	1000	feet	0.04	40.0	50	2,000	1.25	1,250	$3,250
RS-232 Cabling	0	feet	0.008	–	50	–	0.75	–	–
Terminations	2920	each	0.08	233.6	50	11,680	0.05	146	$11,826
Valve Solenoid & Position Sensors	120	each	0	–	50	–	450	54,000	$54,000
Profibus Gateway & Power Supply	0	each	0	–	50	–	0	–	–
Marshalling Cabinet	360	each	0.075	27.0	50	1,350	80	28,800	$30,150
Input/Output Hardware	360	per I/O point	0	–	50	–	100	36,000	$36,000
TOTALS				**2,979.0**		**$148,950**		**$156,552**	**$305,502**

Cost Analysis

INTELLIS AS-interface Ver. 2.1 SYSTEM

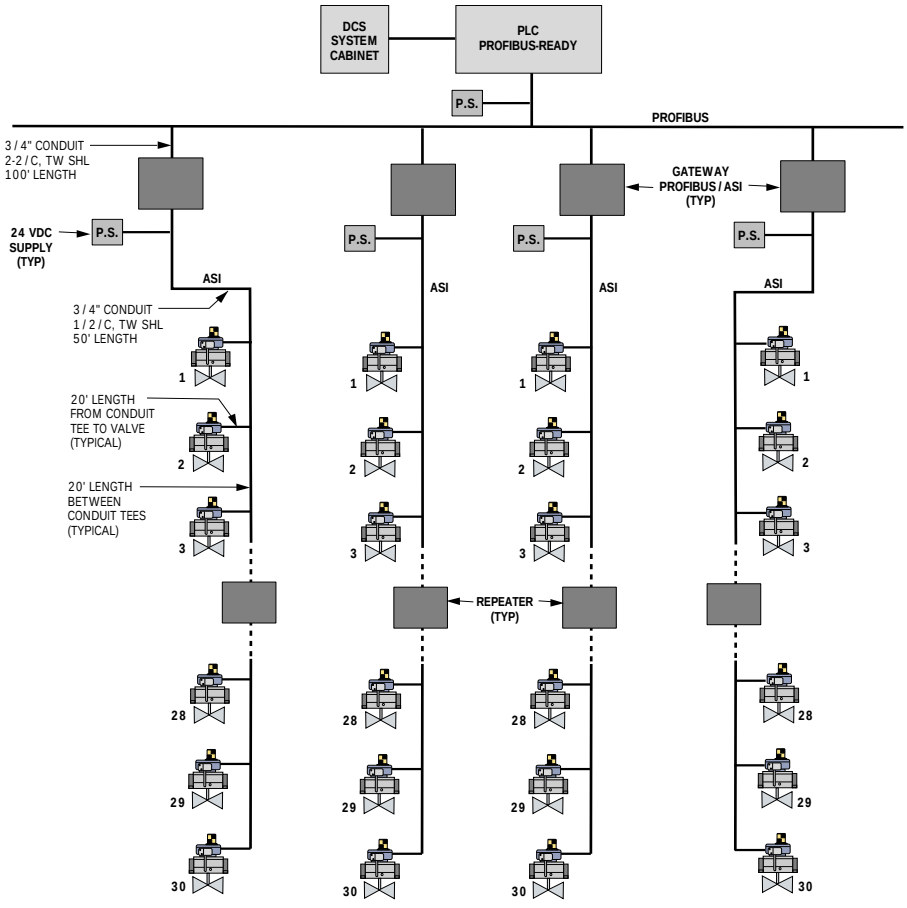
DCS with Network Monitors

This sketch is typical for 4 field networks. (30 valves per network, 120 valves per system)

NOTES:

1. All valves shown are pneumatic actuated on/off type, with 3-way solenoid and open/close position sensors.

2. All conduit is above ground, ridgid galvanized steel.



INTELLIS SYSTEM (DCS with AS-interface Network Monitors)

MATERIAL DESCRIPTION	TAKEOFF QUANTITY		INSTALLATION LABOR				MATERIAL		
	AMOUNT	UNIT	PER UNIT	TOTAL HOURS	MH RATE	LABOR COST	COST / UNIT	MATERIAL COST	TOTAL L&M COST
3/4" Conduit	5400	feet	0.1	540.0	50	27,000	0.95	5,130	$32,130
1" Conduit	0	feet	0.1	–	50	–	1.39	–	–
Conduit Fittings & Supports	allowance	lot		432.8	50	21,600		4,104	$25,704
#14 Wire	0	feet	0.006	–	50	–	0.06	–	–
37/C #14 Multiconductor Cable	0	feet	0.04	–	50	–	1.25	–	–
#16 Twisted Pair, Shielded	5400	feet	0.007	37.8	50	1,890	0.15	810	$2,700
Profibus Drop Cable	400	feet	0.007	2.8	50	140	0.7	280	$420
Profibus Trunk Cable	400	feet	0.007	2.8	50	140	1.2	480	$620
RS-232 Cabling	0	feet	0.008	–	50	–	0.75	–	–
Terminations	720	each	0.08	57.6	50	2,880	0.05	36	$2,916
Network Monitors	120	each	0	–	50	–	726	87.120	$87,120
Profibus Gateway & Power Supply	4	each	0	–		–	1,800	7,200	$7,200
Repeater	4	each					1,600	6,400	$6,400
Marshalling Cabinet	0	each	0.075	–	50	–	80	–	–
Input/Output Hardware	0	per I/O point	0	–	50	–	100	–	–
TOTALS				**1,073.0**		**$53,650**		**$111,560**	**$165,210**

Cost Analysis

ENGINEERING/ DESIGN COSTS

Conventional System vs INTELLIS with AS-interface

The following tabulations are on a per valve basis for engineering and design activities normally associated with ON/OFF valves on a process industry capital project.

A total engineering/design savings of over **5 hours per valve** can be realized. On a project with 120 ON/OFF valves and an engineering billing rate of $70/hr, savings would exceed **$43,560**. A schedule **savings of 624 man-hours** would also be achieved.

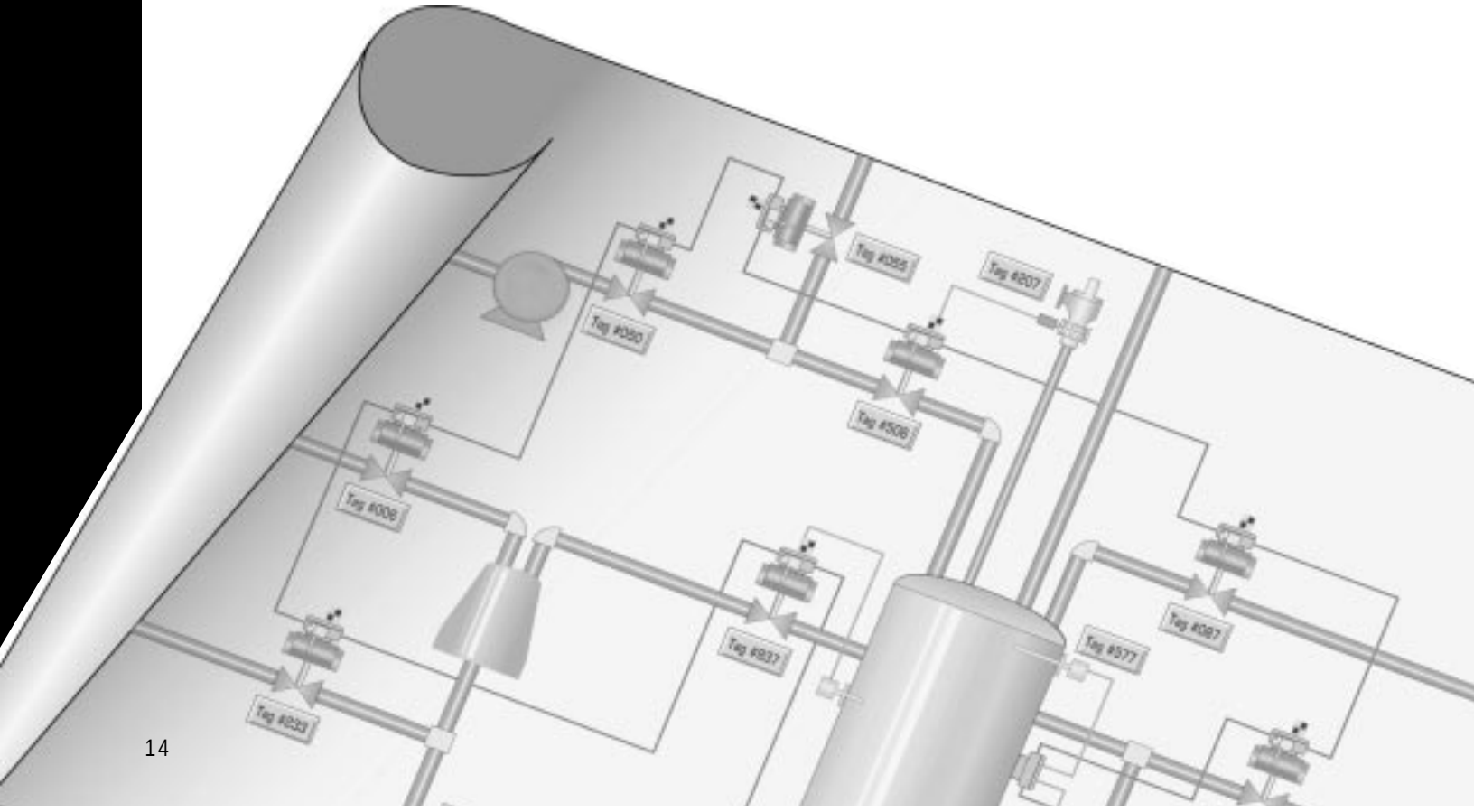
ENGINEERING/DESIGN ACTIVITY	CONVENTIONAL ON/OFF VALVE	INTELLIS™ Network Monitors
P & ID Development/Production	0.1 hrs	0.1 hrs
Instrument Index Development/Production	0.5 hrs	0.5 hrs
I/O Address Assignments	0.3 hrs	0.1 hrs
I/O List Development/Production	1.5 hrs	0.5 hrs
Instrument Loop Diagram Design/Documentation	4 hrs	2 hrs
Marshalling Panel Design/Documentation	0.3 hrs	0 hrs
Field Terminal Box Design/Documentation	0.3 hrs	0.1 hrs
Electrical Cabling and Termination Lists.	2.25 hrs	0.75 hrs
Total Hours	**9.25**	**4.05**
Cost per Valve $70/hr engineering billing rate	**$647.00**	**$284.00**

Savings per Valve = $363.00

Savings per I/O Point (3 I/O per valve) = $121.00

Total Engineering & Design Savings for 120 on/off valves = $43,560

Total Schedule Savings = 624 Manhours



Cost Analysis

COMPARATIVE COST ANALYSIS SUMMARY

Conventional I/O System vs INTELLIS® with AS-interface

The following is an abreviated cost summary of the Distributed Control System wiring scheme outlined in the previous pages. The example utilizes a total of 120 pneumatically actuated on/off valves with 3-way solenoid and open/close position sensors. The entire system calls for a total of 360 I/O points (3 per valve).

CONVENTIONAL SYSTEM

Labor & Material Cost	$305,502	
Cost per I/O Point		$848
Engineering/Design Cost	$77,640	
Cost per I/O Point		$216
TOTAL COST	**$383,142**	**$1,064/I/O pt**

INTELLIS SYSTEM

Labor & Material Cost	$165,210	
Cost per I/O Point		$459
Engineering/Design Cost	$34,080	
Cost per I/O Point		$94
TOTAL COST	**$199,290**	**$553/I/O pt**

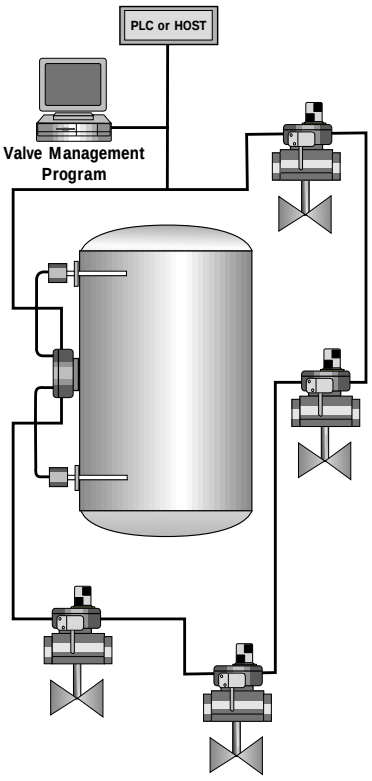
INTELLIS System Total Savings = $183,852

Savings per Valve = $1,532

Network Monitors with ModBus® Interface Capability

Intellis® 7500

ModBus® Network Systems



MODBUS®

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. A single ModBus Intellis system will accommodate up to 10 independent automated valve networks having a maximum of 100 valves per network. The ModBus protocol provides for 800 programmable discrete I/O points on each network or 8000 points per system. More complex systems may be developed, including redundancy of network communications and control.

Intellis® ModBus® Overview

Physical Media	Twisted pair for communications, two wires for power
Maximum Distance	3000 ft.
Maximum Network Monitors per System	100/network 10 networks/system
Maximum I/O Points per System	800/network 8000/system
Current Consumption Per Network Monitor	120 mA
Interface Capability	All PLC's & DCS w/Modbus Port.
Communications Method	Master/slave with cyclic polling
Error Checking	CRC check
Network Topology	Closed loop bus
Transmission Speed	9.6 kbps
Redundancy	Yes
Valve Specific Diagnostics	Yes

WESTLOCK
Network Systems Group

How The System Operates

Field Network

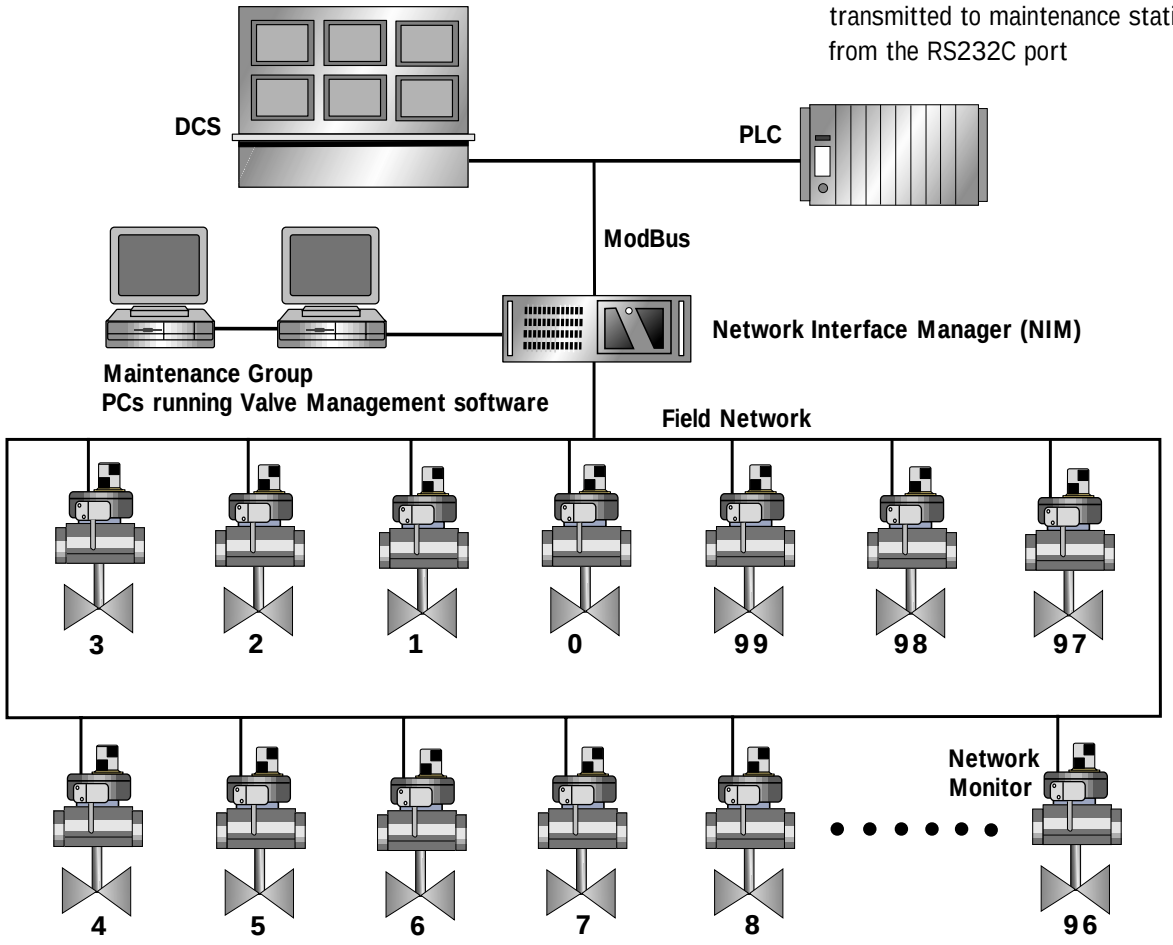
A field network consists of a group of Network Monitors interconnected with a common communications protocol. With the ModBus Intellis® System, I/O service and diagnostics are communicated over a local area field network.

Network Monitor

Each Network Monitor is assigned a number from 0 to 99 which is called its address number. This number identifies one Network Monitor from all the other Network Monitors in the system.

Network Interface Manager

Data is transfered serially in "select-check" form from the Network Monitor to the Network Interface Manager (NIM). One hundred valves are polled by the NIM in approximately one second. Interfacing to a host computer is implemented via a ModBus port in the NIM while on-line diagnostics are transmitted to maintenance stations from the RS232C port



Number of I/O points on a single network.

Because each network may connect up to 100 Network Monitors, the total number of programmable discrete I/O points would be 800 per network. If the two points utilized for temperature and supply pressure monitoring of each Network Monitor were not counted, this would leave a total of 600 I/O points per network.

Number of I/O points on a single system.

Since each Network Interface Manager can accommodate up to 10 independent field networks, a single ModBus system may serially connect up to 1000 Network Monitors or 8000 I/O points.

ModBus® Network Systems

NETWORK MONITORS

A ModBus® Network System is established by integrating an OnBoard I/O module directly within the Westlock Network Monitor. Each I/O card has the capability to accept input/output signals from automated valves, position sensors, solenoid valves, emissions monitors and external devices (level alarms, temperature and pressure sensors, flow switches, etc.)

Automated Valve Network Monitor

The Automated Valve Network Monitor couples directly to the pneumatic actuator. It houses three functional components; position sensors, low-power solenoid valve, and an OnBoard I/O module. The OnBoard I/O module is capable of accepting six input and two output devices.

ONBOARD I/O CARD

INPUT 1: Valve Position Sensor (open)
INPUT 2: Valve Position Sensor (closed)
INPUT 3: Temperature Monitor (internal electronics)
INPUT 4: External Device or Optional Pressure Monitor (supply air)
INPUT 5: External Device
INPUT 6: External Device
OUTPUT 1: Solenoid Valve (actuation control)
OUTPUT 2: Dual Coil Application or External Device

External Device Network Monitor

An External Device Network Monitor is available for control or monitoring of non-valve related devices (sensors, alarms, actuators, indicating lights, etc.).

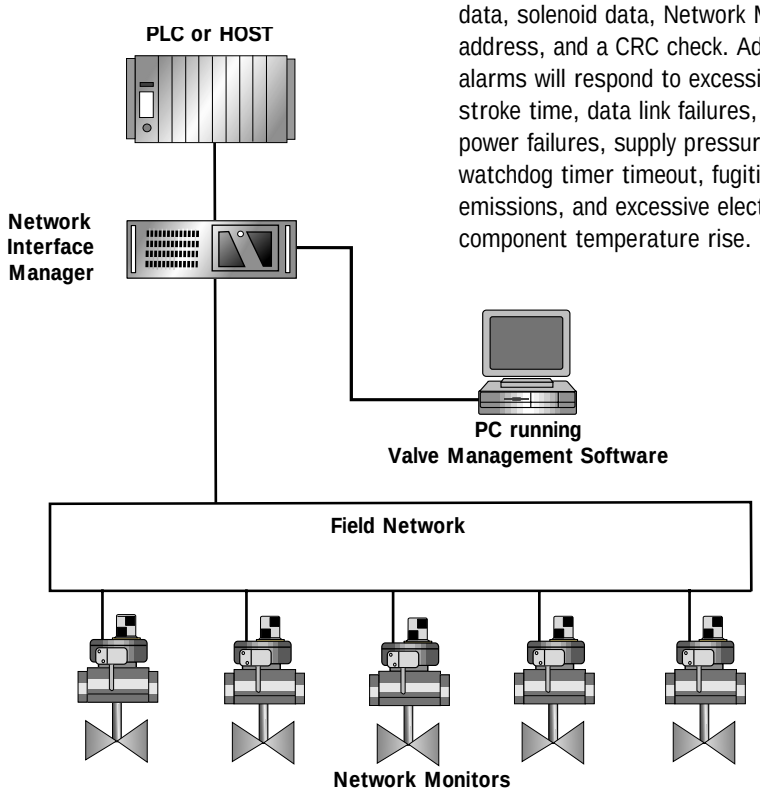
Depending upon the process layout, a wide range of options exist. Standard units are supplied with protective diodes and optical isolation features. External Device Network Monitors are available in **4 input / 2 output** or **6 input** configurations. Power requirements for each external device are considered within the design parameters of the overall system.

Communications Gateway

The Network Interface Manager (NIM), intended for control room installation, supervises the exchange of signal data on the Field Network and functions as the interface between the Network Monitors and the host. A microprocessor in the NIM regulates data exchange with each Network Monitor.

Interfacing to a PLC or DCS is implemented via a Modbus port in the NIM with diagnostic data being sent to a Maintenance Station via a separate RS232C port.

Each NIM can communicate with 10 independent field communication networks having up to 100 valves per Network or a total of 1000 automated valves. The NIM polls each Network Monitor in rotation confirming position data, solenoid data, Network Monitor address, and a CRC check. Additionally, alarms will respond to excessive valve stroke time, data link failures, local power failures, supply pressure drops, watchdog timer timeout, fugitive emissions, and excessive electronic component temperature rise.



Network Interface Manager Communications

The NIM is an industrial computer used to provide communication between the field communications network and a host controller such as a PLC, PC, or DCS. Communication between the host and the NIM is achieved through a communications link using the Modbus RTU protocol. The communications link is an RS-232C serial link that operates in the RTU mode at 9600 kbps.

The host controller (designated as Master) communicates to the NIM designated as Slave) by a Master-Slave technique, in which only one device (the Master) can initiate transactions referred to as 'queries'; these transaction typically consist of commands for reading or modifying registers, coils or discrete inputs. The NIM (Slave) responds by supplying the requested data to the Master, or by taking the action requested in the query.

Data transfer between the host and the communications network is through shared data tables. The host reads input values from an input data table in the NIM and writes all output values to an output data table in the NIM. The NIM polls the Network Monitor in the network and updates the input data table with the information returned; also, it reads the output data table and sends the open or close commands to the Network Monitors.

WESTLOCK

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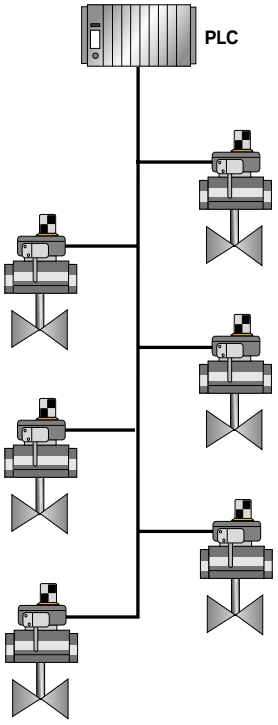
Intellis® 7600

DeviceNet® Network Systems

Network Monitors with DeviveNet® Capability



DeviceNet®

Allen-Bradley is the originator of the DeviceNet® protocol. DeviceNet is a completely open device network based upon proven Controller Area Network (CAN) technology. Network Monitors with DeviceNet capability connect automated valves and external devices directly to the control system, reducing the I/O interfaces and wiring associated with a typical hardwired solution. A single DeviceNet Intellis System will accommodate up to two independent automated valve networks having a maximum of 63 valves per network. The DeviceNet protocol provides for 504 programmable discrete I/O points on each network or 1,008 points per system.

Intellis® DeviceNet® Overview

Physical Media	Twisted pair for communications and power
Maximum Distance	1600 ft.
Maximum Network Monitors per System	63/network 2 networks/system
Maximum I/O Points per System	504/network 1008/system
Current Consumption Per Network Monitor	80 mA w/ solenoid energized
Interface Capability	Allen-Bradley, Omron, GE, Siemens
Communications Method	Master/slave multimaster, peer-to-peer
Error Checking	CRC check
Network Topology	Trunkline/dropline with branching
Transmission Speed	125 kbps, 250 kbps, 250 kbps
Redundancy	No
Valve Specific Diagnostics	Yes

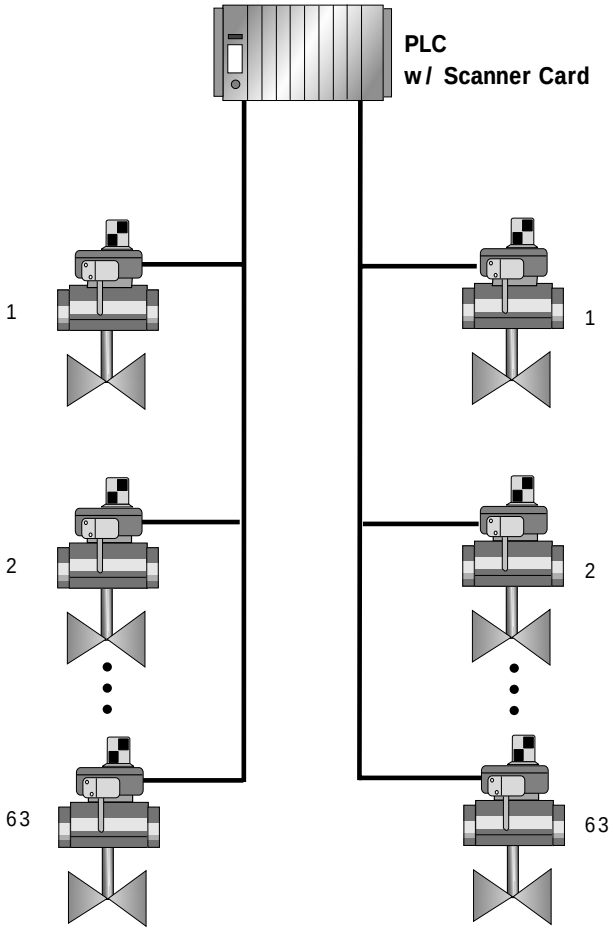
ROCKWELL AUTOMATION ENCOMPASS

WESTLOCK
Network Systems Group

How The System Operates

Field Network

A DeviceNet® field network consists of a group of Network Monitors interconnected with a common communications protocol (DeviceNet). The communication link is a master/slave data exchange between the DeviceNet Network Monitor and the scanner.



Network Monitor

Each Network Monitor has an integrated I/O module onboard that is assigned and addressed from 0 to 63. The address number identifies one Network Monitor from all the other Monitors in the system

Scanner Card

The Network Monitors interface with the PLC via a scanner card that resides in the PLC or DCS. Data gathered by the scanner from the DeviceNet field networks is communicated to PLC processors via discrete and/or block transfers over the chassis backplane.

Number of I/O points on a single network.

Because each network may connect up to 63 Network Monitors, the total number of programmable discrete I/O points comes to 504 (63 x 8).

Number of I/O points on a single system.

Since each scanner card for the Allen-Bradley PLC-5 series can accommodate two independent field networks, a single DeviceNet system will serially connect 126 Network Monitors or up to 1008 I/O points.

DeviceNet® Network Systems

NETWORK MONITORS

A DeviveNet Network System is established by integrating an OnBoard I/O module directly within the Westlock Network Monitor. Each I/O module has the capability to accept input/output signals from automated valves, position sensors, solenoid valves, emissions monitors and external devices (level alarms, temperature and pressure sensors, flow switches, etc.)

Automated Valve Network Monitor

The Automated Valve Network Monitor couples directly to the pneumatic actuator. It houses three functional components; position sensors, low-power solenoid valve, and an OnBoard I/O module. The OnBoard I/O module is capable of accepting six input and two output devices.

ONBOARD I/O CARD

INPUT 1:	Valve Position Sensor (open)
INPUT 2:	Valve Position Sensor (closed)
INPUT 3:	External Device or Optional Pressure Monitor (supply air)
INPUT 4:	External Device or Optional Fugitive Emissions Monitor
INPUT 5:	External Device
INPUT 6:	External Device
OUTPUT 1:	Solenoid Valve (actuation control)
OUTPUT 2:	Dual Coil Application or External Device

External Device Network Monitor

An External Device Network Monitor is available for control or monitoring of non-valve related devices (sensors, alarms, actuators, indicating lights, etc.).

Depending upon the process layout, a wide range of options exist. Standard units are supplied with protective diodes and optical isolation features. External Device Network Monitors are available in **4 input / 2 output** or **6 input** configurations. Power requirements for each external device are considered within the design parameters of the overall system.

Interface Scanner

DeviceNet Scanner for 1771 Chassis (1771-SDN)

The 1771-SDN DeviceNet scanner is a single-slot module that resides in the 1771 I/O chassis and provides connection to two DeviceNet networks.

Multiple scanners can reside in the same I/O chassis, limited only by the I/O chassis size and power supply capacity.

DeviceNet Features and Benefits

- Two independent DeviceNet channels: up to 63 Network Monitors each.
- Master-slave configuration: strobe and poll I/O messages.
- Two seven-segment status displays for network and module diagnostics.
- Diagnostic faulted device tables provide for PLC-5 logic monitoring.

Product Features and Benefits

- Single-slot module.
- Multiple scanners per I/O chassis: local, extended local, and remote chassis.
- Communicates with PLC controllers via discrete and block transfers over the 1771 backplane, or over remote I/O link.
- Module reset push-button.

Compatible Processors and Adapters

The 1771-SDN module is a bidirectional block-transfer module that also supports discrete I/O transfers with 1/2 slot addressing of 24 bits and 1 slot addressing of 8 bits.

Data from DeviceNet devices can be user-mapped into discrete input and block-transfer read areas or discrete output and block-transfer write areas.

DeviceNet Scanner for SLC Chassis (1747-SDN)

The 1747-SDN DeviceNet scanner is a single-slot module that resides in the SLC modular chassis and provides connection to the DeviceNet network.

Multiple scanners can reside in the same SLC chassis, limited only by the chassis size and power supply capacity.

DeviceNet Features and Benefits

- One channel per scanner: up to 63 Network Monitors.
- Master-slave configuration: strobe and poll I/O messages.
- Seven-segment status displays for network and module diagnostics.
- Diagnostic device failure tables provide for SLC logic monitoring.

Product Features and Benefits

- Single-slot module.
- Multiple scanners per SLC modular chassis.
- Communicates with SLC controllers via discrete and/or M1/M0 file transfers over the chassis backplane.
- Module reset push-button.

Compatible Processors and Adapters

You can use the 1747-SDN module in a local SLC chassis with an SLC 5/02, 5/03, or 5/04 controller in the leftmost slot.

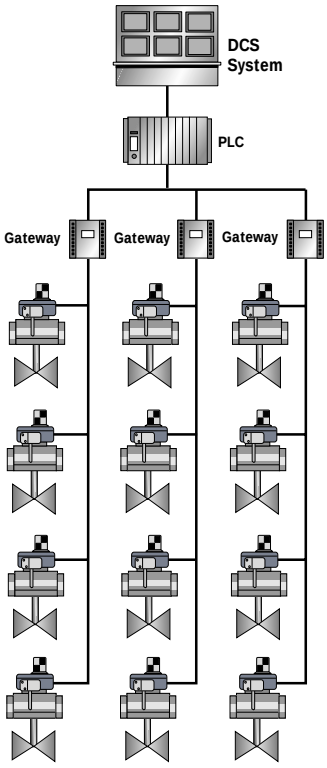
The 1747-SDN module is compatible with the 1746-A4, -A7, -A10, and -A13 SLC chassis.

Data from DeviceNet devices can be user-mapped into discrete input and M1 read file areas or M0 write file and discrete output areas.

Intellis® 7700

AS-interface® Ver 2.1 Network Systems

Network Monitors with AS-interface® Ver. 2.1 Capability



AS-interface® Ver 2.1

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, ModBus+, DeviceNet or Interbus-S PLC may be cost-effectively accessed by the integration of AS-Interface I/O module within the Westlock Network Monitor. A single AS-Interface Intellis system will support a network having a maximum of 62 automated valves with both power and communications transmitted over the same pair of wires. The AS-Interface Ver. 2.1 protocol provides for 434 programmable discrete I/O points on each network (248 inputs/186 outputs).

Intellis® AS-interface® Ver.2.1 Overview

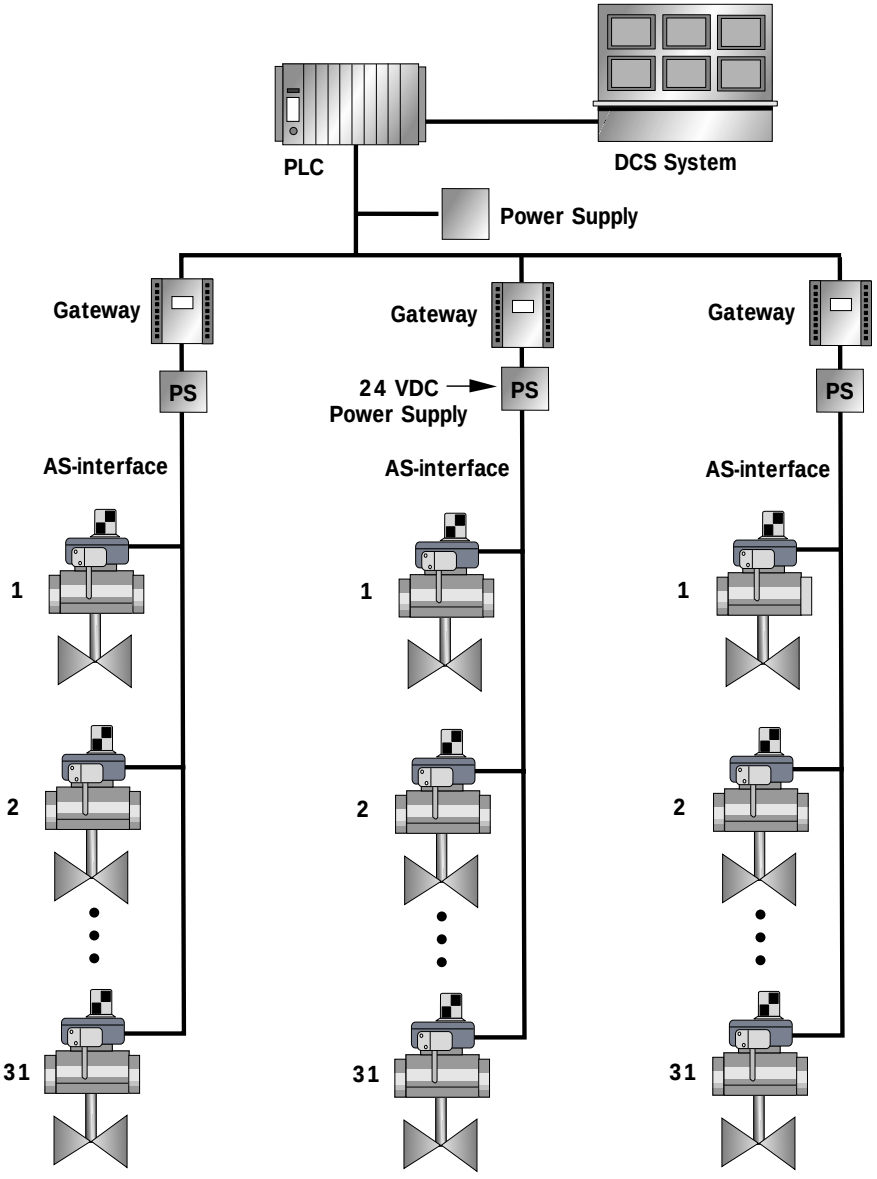
Physical Media	Two wire cable (communications and power)
Maximum Distance	300 ft. 900 ft. with repeater
Maximum Network Monitors per System	62/network 1 network/system
Maximum I/O Points per System	434/network 434/system
Current Consumption Per Network Monitor	40 mA w/ solenoid energized
Interface Capability	All PLC's & DCS w/Modbus, DeviceNet, ProfiBus Port.
Communications Method	Master/slave with cyclic polling
Error Checking	Control sum, parity
Network Topology	Bus, tree, star
Transmission Speed	167 kbps
Redundancy	No
Valves Specific Diagnostics	No

WESTLOCK
Network Systems Group

How The System Operates

Field Network

An AS-interface Ver. 2.1field network consists of a group of Network Monitors interconnected by a common communications protocol (AS-interface). The AS-interface is a master-slave (Gateway-Network Monitor) system and is capable of operating with a 30VDC supply on a two-wire unshielded and untwisted cable. Communication and power (8A) share the same two wires. The AS-interface system has a cycle time of less than 5mS. Maximum cable length/network (without repeaters) is 300 feet from the PLC or master controller.



Network Monitor

Each Network Monitor has an integrated I/O module onboard that is assigned and addressed from 1 to 31 subscript A or 1 - 31, sibscript B. The address number identifies one Network Monitor from all the other monitors in the system

Gateway Interface

The Network Monitors interface to higher level bus system such as a Profibus, DeviceNet, ModBus, Modbus+ and Interbus-S through the use of gateways. In some instances, direct connection is available to PLC's or PC's (Siemens Simatic 55 series, AG 90, 95 and 100, ET200V and RS232C, RS422 and RS485 serial interfaces).

Number of I/O points on a single system.

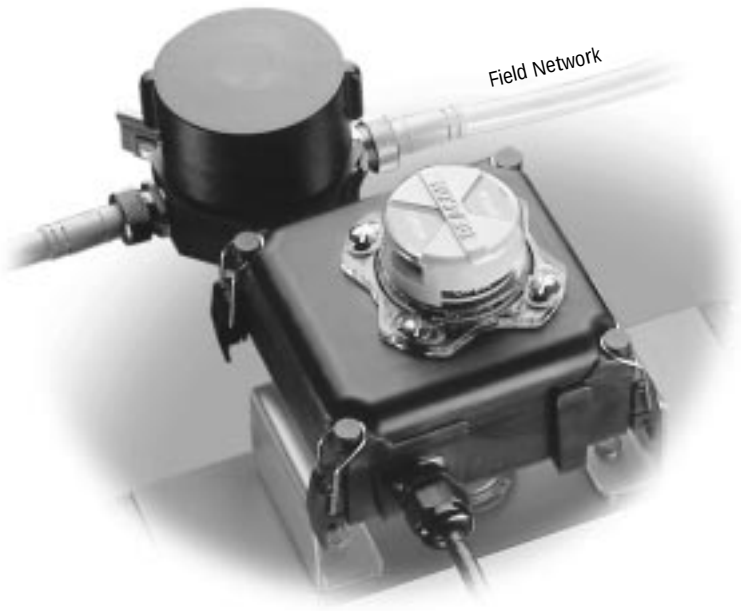
Because each network may connect up to 62 Network Monitors, the total number of programmable discrete I/O points comes to 434 (298 inputs/ 186 outputs).

AS-interface® Ver 2.1 Network Systems

NETWORK MONITORS

An AS-interface Network System is established by integrating an OnBoard I/O module directly within the Westlock Network Monitor. Each I/O module has the capability to accept input/output signals from automated valves, position sensors, solenoid valves, emissions monitors and external devices (level alarms, temperature and pressure sensors, flow switches, etc.)

Automated Valve Network Monitor



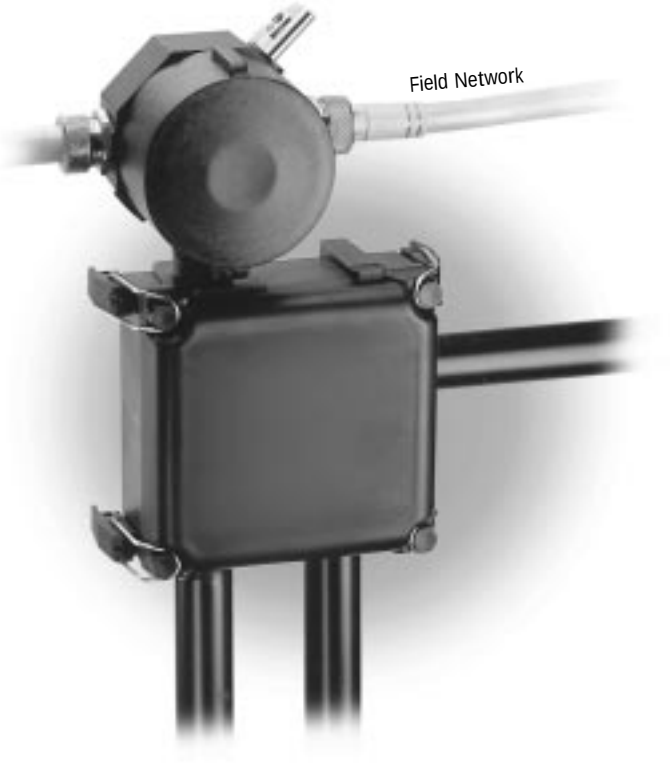
The Automated Valve Network Monitor couples directly to the pneumatic actuator. It houses three functional components; position sensors, low-power solenoid valve, and an OnBoard I/O card. The OnBoard I/O module is capable of accepting four input and four output devices.

ONBOARD I/O CARD

INPUT 1: Valve Position Sensor (open)
INPUT 2: Valve Position Sensor (closed)
INPUT 3: External Device or Optional Pressure Monitor (supply air)
INPUT 4: External Device or Optional Fugitive Emissions Monitor
OUTPUT 1: Solenoid Valve (actuation control)
OUTPUT 2: Dual Coil application or External Device
OUTPUT 3: External Device
OUTPUT 4: External Device*

*Ver. 2.0 AS-i slave

External Device Network Monitor



An External Device Network Monitor is available for control or monitoring of non-valve related devices (sensors, alarms, actuators, indicating lights, etc.).

Depending upon the process layout, a wide range of options exist. Standard units are supplied with protective diodes and optical isolation features. External Device Network Monitors are available in **4 input / 4 output*** configurations. Power requirements for each external device are considered within the design parameters of the overall system.

*Ver. 2.0 AS-i slave

Gateway

Gateway Interface

The AS-interface Gateway is responsible for management of the communications data on the field network and functions as the interface between the Network Monitors and the primary control system (PLC, DCS, PC). Along with specific PLC and PC interfaces, Gateways are standardly available for use with higher level networks such as Profibus, ModBus, DeviceNet and Interbus-S.

PROFIBUS®

The AS-interface/PROFIBUS gateways serve to connect the AS-interface network to the higher level PROFIBUS network. The gateways act as a complete master for the AS-interface and as a slave for PROFIBUS. All AS-interface functions can be called up via PROFIBUS.

The combined device has the essential advantage of making it possible to work in a PROFIBUS-FMS (9.6 KBaud to 500 KBaud) as well as in a PROFIBUS-DP network. (9.6 KBaud to 1500 KBaud).

ModBus®

The AS-interface/Modbus gateway serves to connect the AS-interface to a higher level Modbus network. The gateway acts as a complete master for the AS-interface and as a slave for the Modbus.

Commissioning, debugging and setting up of the AS-interface parameters can be accomplished with two push-buttons, the LED display and the LED's located on the gateway.

DeviceNet®

The AS-interface/DeviceNet gateway serves to connect the AS-interface to a DeviceNet network. The gateway acts as a complete master for the AS-interface and as a slave for the DeviceNet.

All AS-interface functions can be called up via DeviceNet. Commissioning, configuration and debugging on the AS-interface circuit can be accomplished with the two push-buttons, the LCD display and the LED's located on the gateway. It is also possible to configure the network with the DeviceNet Manager Software.

INTELLIS®

NETWORK SYSTEMS FOR DIAPHRAGM VALVES

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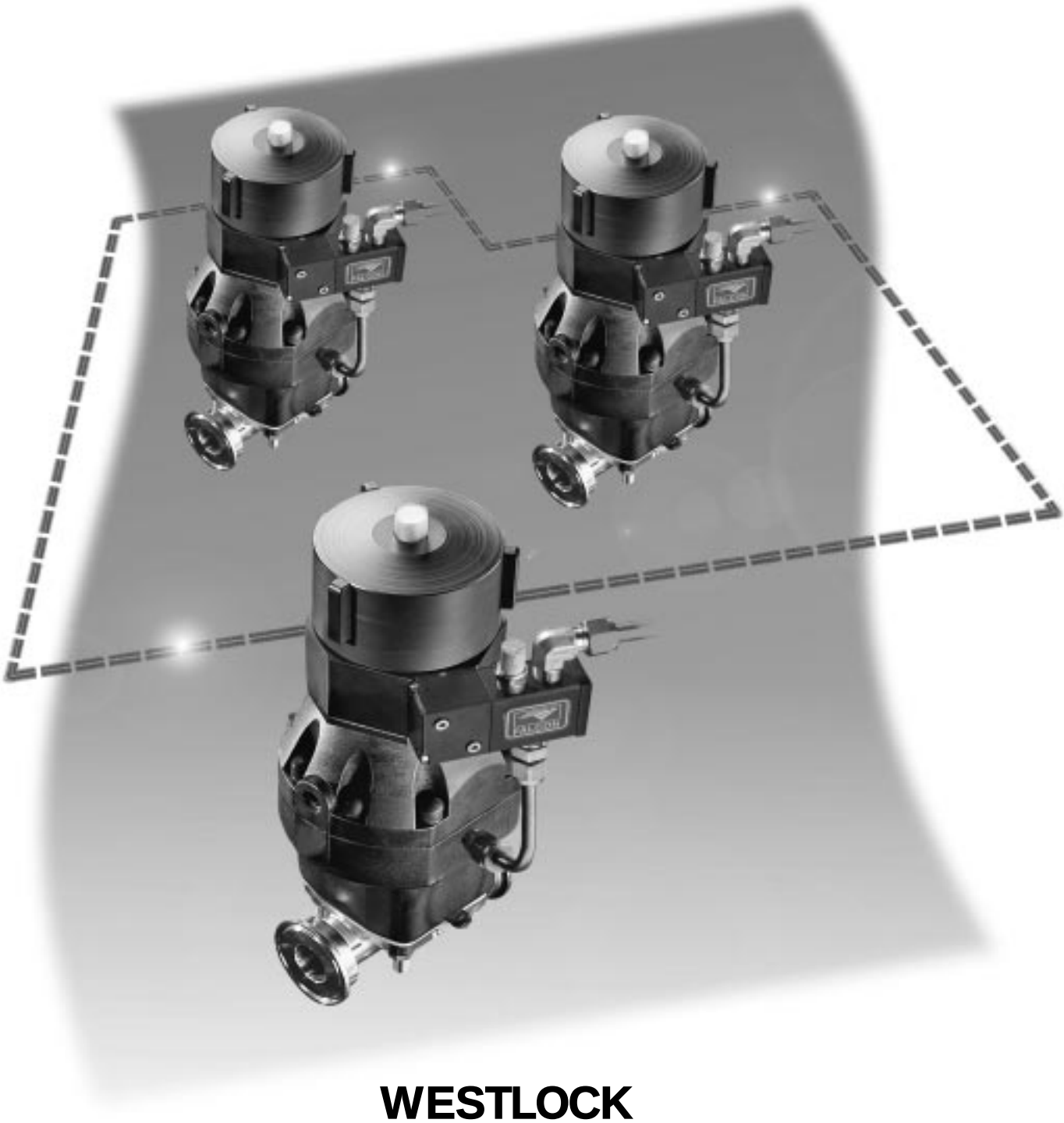
DeviceNet®
AS-interface® Ver. 2.1



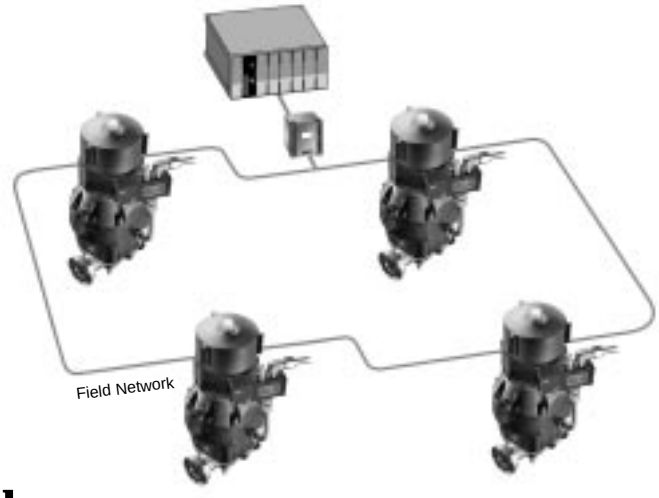
WESTLOCK
Network Systems Group

INTELLIS®

Network Systems for Diaphragm Valves

Intellis® 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 DeviceNet® 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.



The Network Monitor

The Network Monitor for diaphragm 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 a solenoid valve.

The Network Card

Depending upon the network standard selected DeviceNet® or AS-interface® a dedicated network card is integrated within the enclosure of each Network Monitor. The on-board network card is capable of communicating and controlling 2 inputs and one output.

NETWORK CARD A	
INPUT 1:	Valve Position Sensor (open)
INPUT 2:	Valve Position Sensor (closed)
OUTPUT 1:	Solenoid Valve (actuation control)

DeviceNet CONFORMANCE TESTED

ASI INTERFACE CONFORMANCE TESTED

ROCKWELL AUTOMATION ENCOMPASS PROGRAM PARTNER

Factory Mutual System Approved

Standard Network Protocols

The acceptability of standard network protocols such as DeviceNet® and AS-interface® has made it possible to effectively integrate process control components into a network. DeviceNet and AS-interface have emerged as de facto standards for interfacing discrete devices. They have proven themselves to be extremely reliable, simple to understand and consistantly 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	DeviceNet® 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® Ver 2.1 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 and power	Two wire cable (communications & power)
Maximum Distance	1600 ft.	300 ft. 900 ft. with repeater
Maximum Network Monitors per System	63/network 2 networks/system	62/network 1 network/system
Maximum I/O Points per System	189/network 378/system	186/network 186/system
Current Consumption Per Network Monitor	80 mA w/ solenoid energized	40 mA w/ solenoid energized
Interface Capability	Allen-Bradley, Omron, GE, Siemens	All PLC's & DCS w/ModBus, DeviceNet, ProfiBus Port
Communications Method	Master/slave	Master/slave with cyclic polling
Error Checking	CRC check	Control sum, parity
Network Topology	Trunkline/dropline with branching	Bus, tree, star
Transmission Speed	125 kbps, 250 kbps, 250 kbps	167 kbps
Redundancy	No	No
Valves Specific Diagnostics	Yes	No

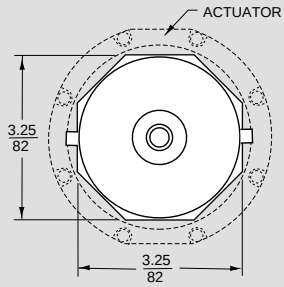
*For added I/O capability, please consult factory.

TECHNICAL SPECIFICATIONS & ORDERING GUIDE

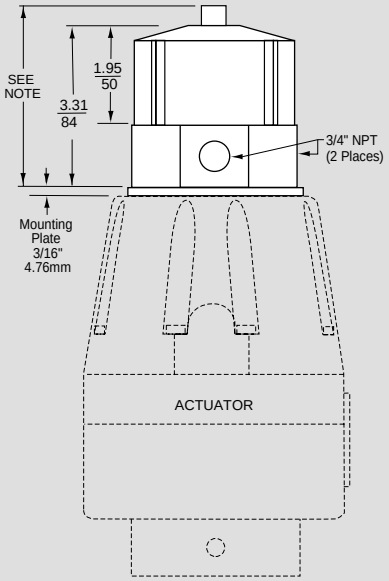
DIMENSIONAL DATA

Model 7699, 7799

Engineered Resin (Nylon)
Nema 4, 4x, Nonincendive
Class I, Groups A, B, C & D
Class II, Groups F & G, Division 2 only



TOP VIEW

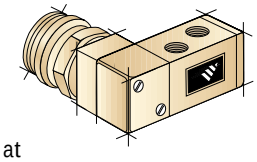


SIDE VIEW

ORDERING GUIDE

Network Protocol	Enclosure	Network Card	Solenoid	Gateway Interface
DeviceNet **76** AS-interface **77**	Engineered Resin **99RS** Engineered Resin w/ Junction Housing **99XS**	Card A 2 Inputs 1 Output **A**	Use above listing for ordering solenoid	DeviceNet Scanner for Allen-Bradley PLC5 **DS71** DeviceNet Scanner for Allen-Bradley SLC **DS47** AS-i/Profibus **1060** AS-i/DeviceNet **1078** AS-i/Modbus **1104** AS-i/Interbus-S **1079**

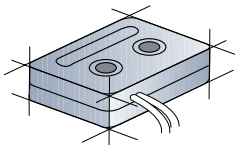
FALCON® LOW POWER SOLENOID TECHNOLOGY



SOLENOID VALVES

Falcon low power solenoid valves operate at 24 VDC, 20 mA, .5 watt. 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.

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**
	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**