

Ethernet Intelligent Pressure Scanner

FEATURES

- User Accessible Memory for Test Configuration Management
- $\pm 0.05\%$ FS System Accuracy
- EU Throughput Rates of 500 Hz
- Auto-Negotiating 10/100 BaseT Ethernet with TCP & UDP Protocol
- Pressure Ranges up to 850 psid (5860 kPa)
- Built-in Rezero, Purge and Leak Check Features
- Triple Scan List Capability
- Rugged Splashproof Enclosure
- Hardware and Software Triggered Data Acquisition

APPLICATIONS

- Turbomachinery Test Stands
- Windtunnel Wall Pressure Measurements



The Model 9116 Pneumatic Intelligent Pressure Scanner is a completely self-contained high performance pressure acquisition module for multiple measurements of dry, non-corrosive gases. The scanner integrates 16 silicon piezoresistive pressure sensors of any pressure range with the latest microprocessor technology in a compact, rugged package. Each field-replaceable pressure sensor incorporates a temperature sensor and EEPROM for storage of calibration data as well as sensor identification information such as pressure range, factory calibration date, and user-managed last or next calibration date.

The microprocessor uses the data from the EEPROM to correct for sensor zero, span, linearity and thermal errors. It also performs digital temperature compensation of the sensors to reduce thermal errors by a factor of ten or more over conventional sensor compensation. The microprocessor also controls the actuation of an integral manifold to execute on-line zero or span calibration upon request. This capability virtually eliminates sensor zero drift error and provides guaranteed system accuracy of up to $\pm 0.05\%$ FS (Full Scale) after rezero.

This enhanced pressure scanner provides User Accessible Memory (UAM) to facilitate Test Configuration Management (TCM) through functionality derived from the IEEE-1451 standard for smart transducers. This enables test parameters to be entered and stored within the scanner for access by the host controller during test setup and operation.

The 9116 can sample using up to three concurrent scan lists at continuous rates up to 500 measurements per channel per second in engineering units. Pressure data in engineering units is output through an auto-negotiating 10 or 100 Mbit Ethernet interface supporting both TCP and UDP protocols. The scanner is supplied with comprehensive Visual Basic-based software called NUSS for PC compatible computers. Firmware upgrades are made available at no charge via our website and can be downloaded to the scanner over the Ethernet interface using NUSS.

The Model 9116 Intelligent Pressure Scanner is one component of the NetScanner™ System. Multiple NetScanner components measuring a wide variety of parameters and sharing the same command set can be networked to form a distributed intelligent data acquisition system.

Specifications subject to change without notice.

After 1 hour warmup @ 25°C with atmospheric reference pressure unless otherwise stated / FS = Full Scale

Parameter	9116	Units	Comments
PNEUMATICS			
Pressure Range ¹	10 (2.5)		
	1 (7)	45 (310)	psi (kPa) ranges ≥ 100 psi (689 kPa) are unidirectional only
	2.5 (17)	100 (689)	
	5 (34)	250 (1724)	
	10 (69)	500 (3447)	
	15 (103)	750 (5171)	
30 (207)	850 (5860)		
Number of Pressure Inputs	16		available in any combination of ranges
Pneumatic Fittings	1/16", 1/8", 1/4" 5/16" -24 SAE .063", .040" bulge tube		compression fittings o-ring boss QDC tubing plate
Media	Dry, non-corrosive gas		
Proof Pressure ²	3.0X 2.0X 1.5X		FS min range <15 psi (103 kPa) range 15-100 psi (103-689 kPa) range >100 psi (689 kPa)
Burst Pressure	5.0X 3.0X 2.0X		FS min range <15 psi (103 kPa) range 15-100 psi (103-689 kPa) range >100 psi (689 kPa)
Max Line Pressure ³	100 (689) 600 (4137)		psi (kPa) psi (kPa) range ≤ 5 psi (34 kPa) range >5 psi (34 kPa)
Manifold Control Pressure	80 (552) 125 (862)		psi (kPa) psi (kPa) min max
Purge Pressure ⁴	> max input pressure 850 (5860)		psi (kPa) psi (kPa) min max
STATIC PERFORMANCE			
Measurement Resolution	±0.003		% FS
Static Accuracy ⁵ After Rezero	±0.05		% FS
	±0.15		% FS
Total Thermal Error ⁶	±0.001		% FS/°C
	±0.0015		% FS/°C
Line Pressure Effect	±0.0003		% FS/psi range ≥ 100 psi (689 kPa)
	±0.0008		% FS/psi range >5 psi (34 kPa) to <100 psi (689 kPa)
	±0.001		% FS/psi range ≤ 5 psi (34 kPa)
Measurement Rate	500		meas/ch/ sec engineering units

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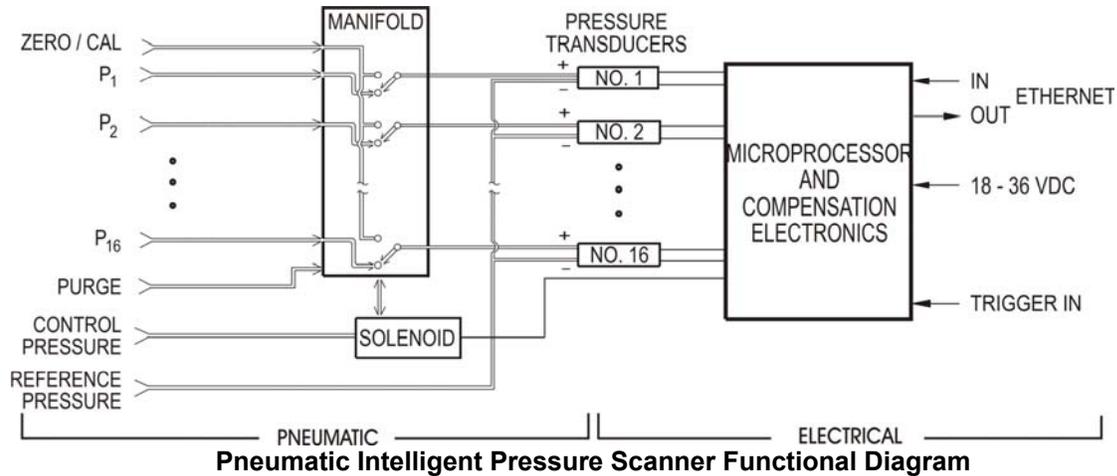
After 1 hour warmup @ 25°C with atmospheric reference pressure unless otherwise stated / FS = Full Scale

Parameter	9116	Units	Comments
ELECTRICAL			
Input Voltage	18 - 36	VDC	unregulated
Input Current	225	mA	maximum @ 24VDC
Hardware Trigger Threshold	2.5	VDC	TTL compatible differential input, ±5 VDC common mode voltage
COMMUNICATION			
Communication	10/100 Base-T		auto negotiating, half duplex/full duplex
Protocol	TCP and UDP	% FS	static or dynamic IP assignment
ENVIRONMENTAL/PHYSICAL			
Calibrated Temp Range Standard Optional	0 to 60 -30 to 60	°C °C	
Operating Temp Range Standard Optional	-20 to 70 -30 to 80	°C °C	up to 95% non-condensing humidity
Storage Temp	-30 to 80	°C	
Size	9.50 x 3.50 x 3.54 (24.1 x 8.9 x 8.9)	inches (cm)	L x W x H
Weight	6.5 (2.95)	lb (kg)	
Splashproof Rating	NEMA 13		
Acoustic Noise Rating	160dB		

Notes:

- 1 Standard ranges listed, consult factory for special ranges
- 2 Maximum applied pressure without reducing sensor performance
- 3 For anticipated Line (Reference) Pressures . . .
 - above 100 psi (689 kPa) on FS Pressure Ranges of ≤ 5 psi (34 kPa) or
 - above 600 psi (4137 kPa) on FS Pressure Ranges of > 5 psi (34 kPa)
 - calibration manifold should not be shifted at line pressure
 - rate of line pressure change should be no more than 10 psi/sec
- 4 Purge pressure must be greater than maximum input pressure.
- 5 Static accuracy includes the combined errors due to non-linearity, hysteresis and non-repeatability.
- 6 Includes thermal effects of zero & span relative to 25°C.
- 7 Consult factory for special temperature range calibrations.

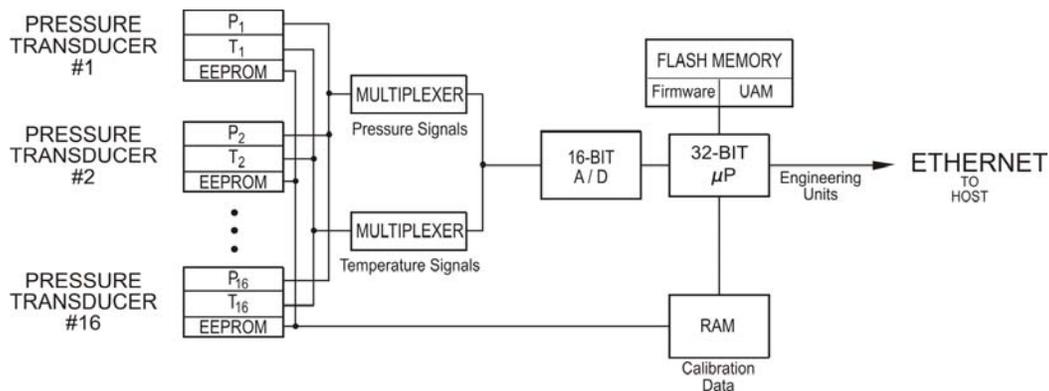
The 9116 combines integral pressure transducers with a miniature data acquisition system to provide a multichannel pressure scanner. The integration of the microprocessor with the pressure transducers provides several benefits in addition to the compact nature of the Intelligent Pressure Scanner. This pre-engineered approach to pressure acquisition offers guaranteed system accuracy, unlike individual pressure transducers where stated accuracy is met only if the many user-considerations are addressed, especially with respect to temperature effects and zero drift. The Model 9116 Ethernet Intelligent Pressure Scanners output pressure data in engineering units, digitally compensated for zero, span, nonlinearity and temperature effects. The integral pneumatic manifold permits on-line rezero and even span calibration capability under microprocessor control.



Digital Sensor Temperature Compensation

Silicon piezoresistive pressure sensors are low cost, miniature pressure sensing elements ideal for packaging individually for each pressure port. However, like most sensors, they are affected by temperature. Since these effects are repeatable, sensor calibration over temperature and pressure can be used to characterize and correct these errors.

Each silicon pressure sensor is packaged along with a nonvolatile memory device (EEPROM) and a temperature sensor in its own miniature field-replaceable housing. The transducers are factory-calibrated over the specified pressure and temperature spans. The resultant calibration data, along with the pressure range and serial number of the sensor, are stored in the integral EEPROM. The microprocessor utilizes this information to compensate transducer outputs for offset, sensitivity, nonlinearity, and thermal effects before transferring pressure data to the host computer. Should a transducer be replaced, the microprocessor will automatically recognize the new transducer upon power up and extract the calibration information from the EEPROM.



Pneumatic Design

Model 9116 Intelligent Pressure Scanners incorporate a unique manifold enabling on-line pneumatic rezero and span calibrations to maximize transducer accuracy. The manifold can be specified with either a common pressure reference or an individual pressure reference (true differential) per channel. Both configurations feature built-in purge and leak check capability of the pneumatic input lines as standard. The manifold utilizes a proprietary "O" ring seal providing years of leak free operation. If required, "O" rings can be replaced in the field using common tools.

Figures 1-4 illustrate the pneumatic function of the manifold for a single channel. Figures 1-3 depict the three manifold positions (RUN, CAL and PURGE). Figure 4 illustrates the LEAK CHARGE position for charging the input lines to execute a leak check.

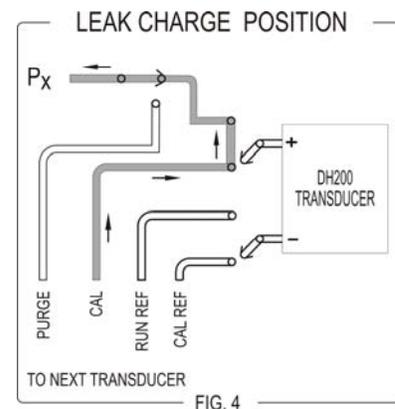
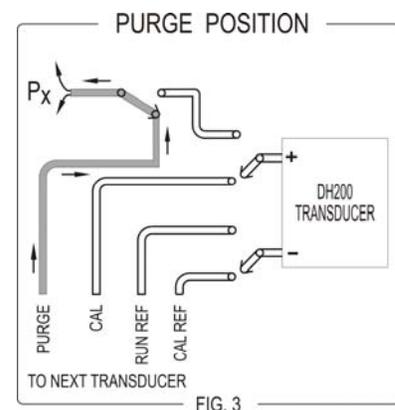
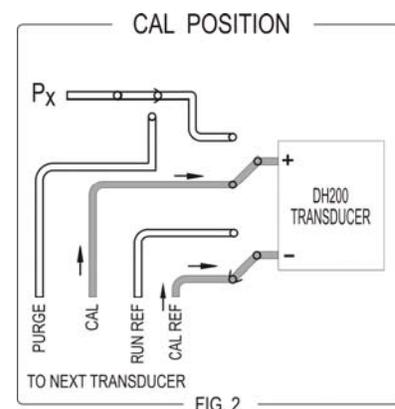
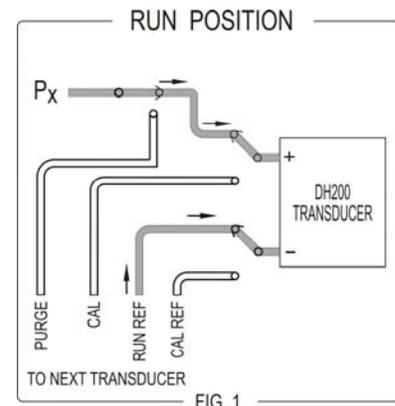
To initiate these operations, the user simply issues the appropriate command via the host computer. Operating under control of the onboard microprocessor, integral solenoids are energized to apply control pressure to one of four pistons within the manifold. One piston forces the manifold longitudinally into the CAL position; another returns it to the RUN position. The remaining two pistons force the manifold laterally into either the PURGE or the LEAK CHARGE positions. Pressure of 80-125 psig (560 to 860 kPa) must be present at the Supply Input port on the 9116 when the command is issued.

Rezero or span calibration functions place the manifold in the CAL position. Once there, data is acquired to update zero and/or span terms and the manifold is then returned to the RUN position. Span calibrations require the appropriate full scale pressure to be present at the Calibration port.

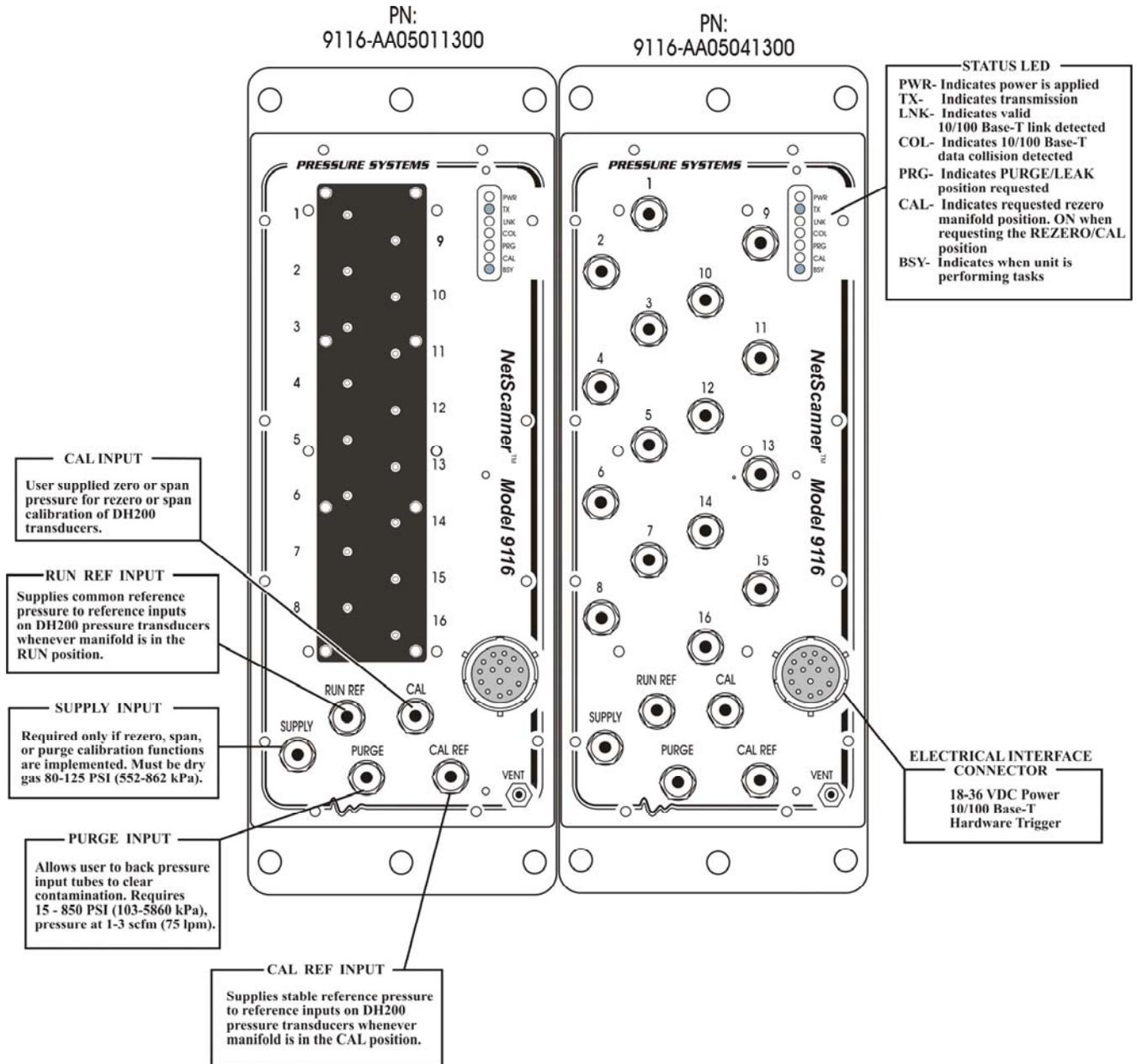
The purge function requires pressure in excess of the highest anticipated input pressure to be present at the Purge Input port. Issuing the Purge command places the manifold into the PURGE position allowing Purge pressure to exit the scanner through the input lines. Purging can require 1-3 scfm (75 lpm) of flow depending on applied purge pressure.

NOTE: On-line rezero or purge is not required to operate the scanner but insures maximum accuracy.

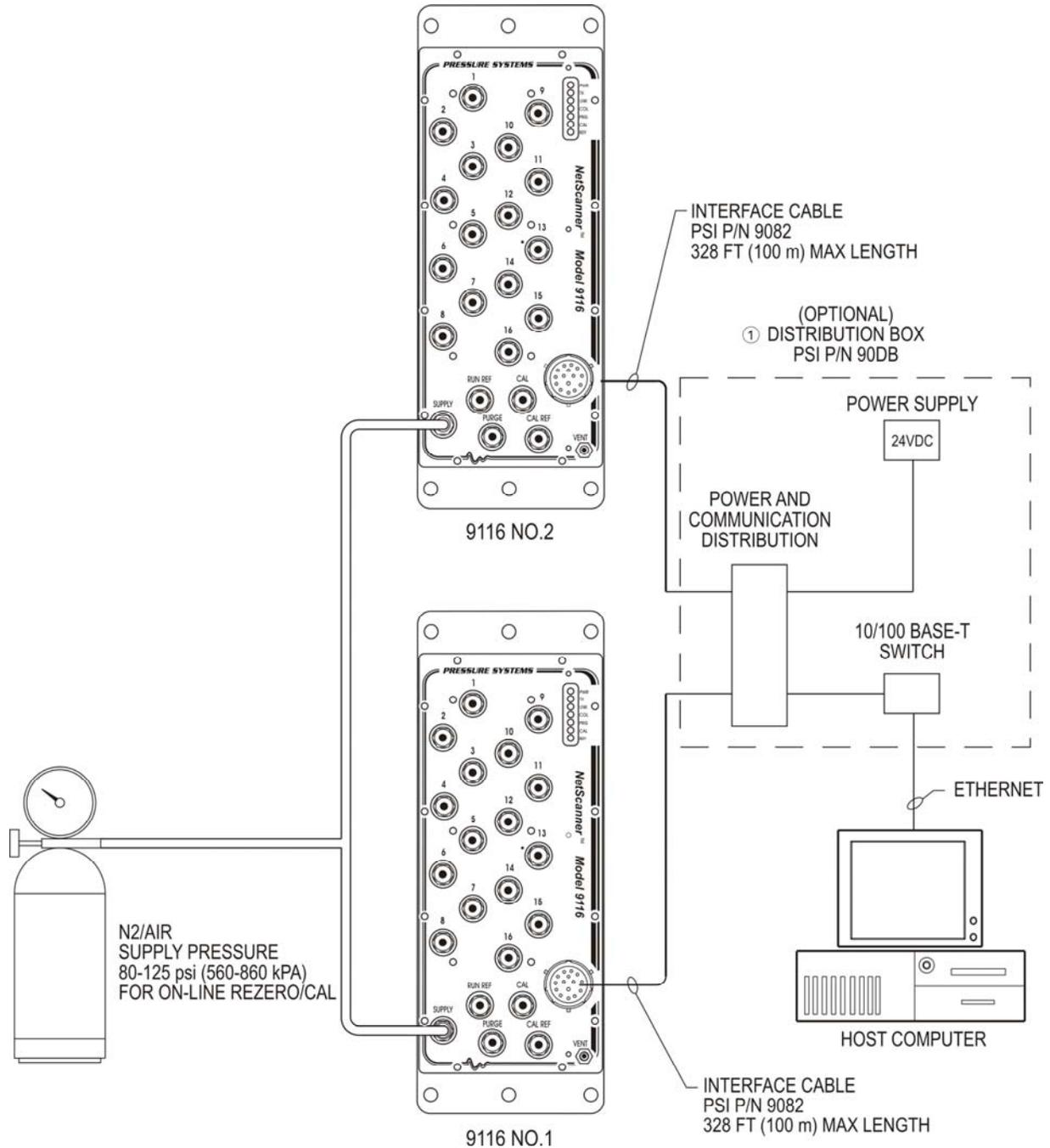
The leak check function requires the desired test pressure to be applied to the appropriate Calibration port and the input lines to be dead-ended at their source. Issuing the Leak command forces the manifold into the LEAK CHARGE position to charge the input lines using pressure from the Calibration port. Once charged, the manifold is commanded to the RUN position where periodic readings from the transducers can be obtained to analyze pressure decay in each input line.



The 9116 front panels contain all pneumatic and electrical connections required to operate the device.



Multiple NetScanner or compatible third party devices may be networked together. The illustration shown on this page shows the required cables and accessories necessary to integrate two Ethernet Intelligent Pressure Scanners to a desk top computer.



① PSI offers pre-engineered solutions for power and communication distribution depending on configuration.

Ordering Information:

PN: **9116-AABBCC13FF**

9116 Ethernet Intelligent Pressure Scanner, 16 Channels

AA = Pressure Range (Consult Factory for multiple pressure range configurations and other ranges not listed)

01, 10" WC (2.5 kPa)	09, 45 psid (310 kPa)	99, Multirange
02, 20" WC (5.0 kPa)	10, 100 psid (689 kPa)	
03, 1 psid (7 kPa)	11, 250 psid (1724 kPa)	
04, 2.5 psid (17 kPa)	12, 500 psid (3447 kPa)	
05, 5 psid (34 kPa)	19, 600 psid (4137 kPa)	
06, 10 psid (69 kPa)	32, 750 psid (5171 kPa)	
07, 15 psid (103 kPa)	39, 850 psid (5860 kPa)	
08, 30 psid (207 kPa)		

BB = Manifold Options

- 05, Common Differential, Purge, Leak Check
- 06, True Differential, Purge, Leak Check

CC = Measurement Pressure Fittings

- 00, 5/16" - 24 SAE o-ring boss
- 01, 0.063" Bulged Tubulation, QDC
- 03, 1/4" Compression
- 04, 1/8" Compression
- 05, 1/16" Compression
- 06, 0.040" Bulged Tubulation, QDC

FF = Calibrated Temperature

- 00, 0 to 60°C
- 06, -30 to 60°C

Example: 9116-0105041300

9116 Ethernet Intelligent Pressure Scanner, 16 channels, 10"WC, Common Differential with Purge and Leak Check, 1/8" Compression Fitting, Ethernet, 0-60°C

