



ETHERNET INTELLIGENT PRESSURE SCANNER

9116 NetScanner System

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, ruggedized package. Each field-replaceable pressure sensor incorporates a temperature sensor and EEPROM for storage of calibration data along with 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.

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.

Features

- $\pm 0.05\%$ FS System Accuracy
- EU Throughput Rates of 500 Hz
- IP 66 Rated Enclosure

Applications

- Turbomachinery Test Stands
- Mobile Pressure Carts
- Wind Tunnel Wall Pressure Measurements

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Specifications

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

PARAMETER	9116	UNITS	COMMENTS
PNEUMATICS			
	±10		
	±20	In WC	
Pressure Range	±1	+50	+375
	±2.5	+60	+500
	±5	+100	+650
	±10	+125	+750
	±15	+150	+850
	+30	+200	+1100
	+35	+250	
	+45	+300	
Number of Pressure Inputs	16		available in any combination of ranges
Pneumatic Fittings	1/16", 1/8", 1/4", 4mm 5/16" -24 SAE .063" bulge tube		Compression fittings O-ring boss QDC tubing plate
Media	Dry		non-corrosive gas
Proof Pressure ¹	3.0X	FS min	range <15 psi
	2.0X		range 15-100 psi
	1.5X		range >100 psi
Burst Pressure	5.0X	FS min	range <15 psi
	3.0X		range 15-100 psi
	2.0X		range >100 psi
Max Line Pressure ²	100	psi	range ≤5 psi
	600		range >5 psi
Manifold Control Pressure	100	psi	min
	125		max
Purge Pressure ³	> max input pressure	psi	min
	1100		max
STATIC PERFORMANCE			
Measurement Resolution	±0.003	% FS	
Static Accuracy ⁴ After Rezero	±0.05	% FS	range > 2.5 psi
	±0.15	% FS	range ≤ 2.5 psi
Total Thermal Error ⁵	±0.001	% FS/°C	range > 2.5 psi
	±0.0015	% FS/°C	range ≤ 2.5 psi
Line Pressure Effect	±0.0003	% FS/psi	range ≥100 psi
	±0.0008	% FS/psi	range >5 psi to <100 psi
	±0.001	% FS/psi	range ≤ 5 psi
Measurement Rate	500	meas/ch/ sec	engineering units
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

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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	0 to 60	°C
Optional	-30 to 60	°C

Operating Temp Range

Standard	-20 to 70	°C	up to 95% non-condensing humidity
Optional	-30 to 80	°C	

Storage Temp

Size	9.50 x 3.50 x 3.54	inches	L x W x H
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Weight	6.5	lb
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Splashproof Rating	IP 66
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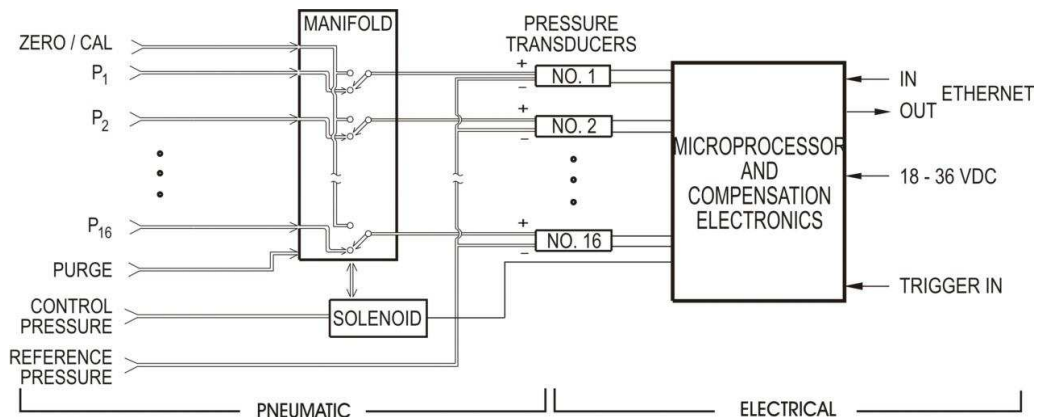
Acoustic Noise Rating	160 dB
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Notes:

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

Theory of Operation

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, non-linearity and temperature effects. The integral pneumatic manifold permits on-line rezero and even span calibration capability under microprocessor control.

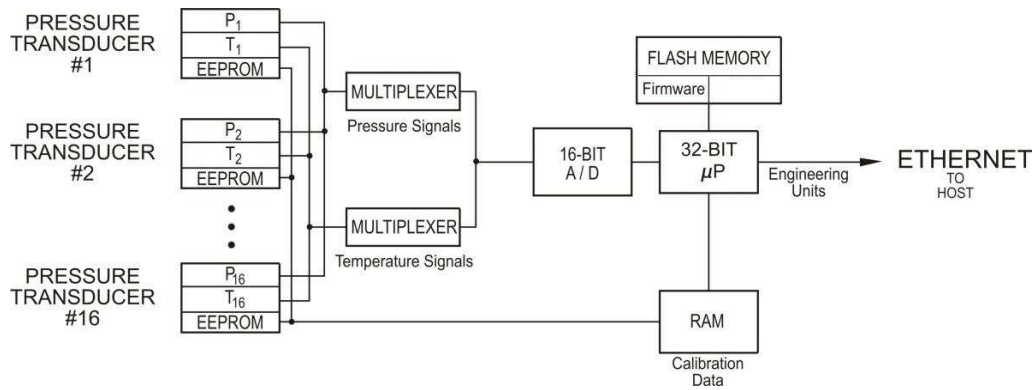


Pneumatic Intelligent Pressure Scanner Functional Diagram

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. LEAK CHARGE position is not available for pressures above 850 PSI.

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 100-125 psig 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 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.

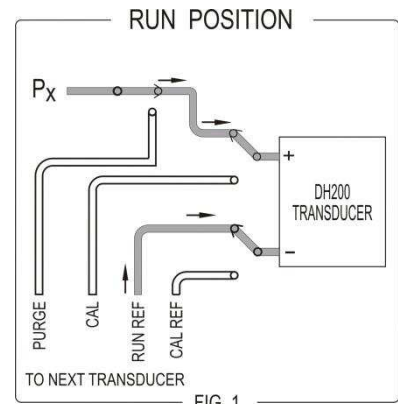


FIG. 1

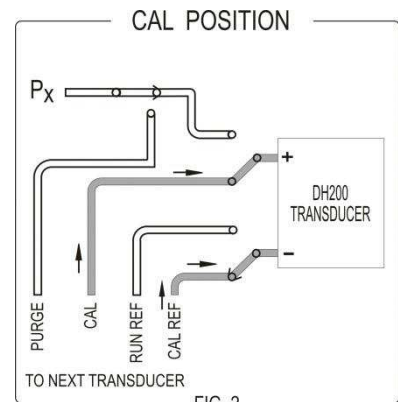


FIG. 2

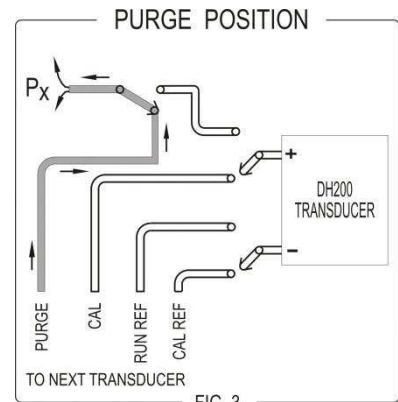


FIG. 3

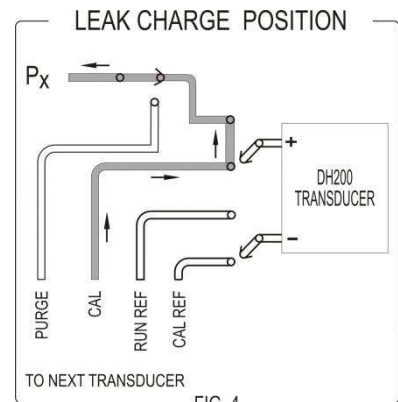


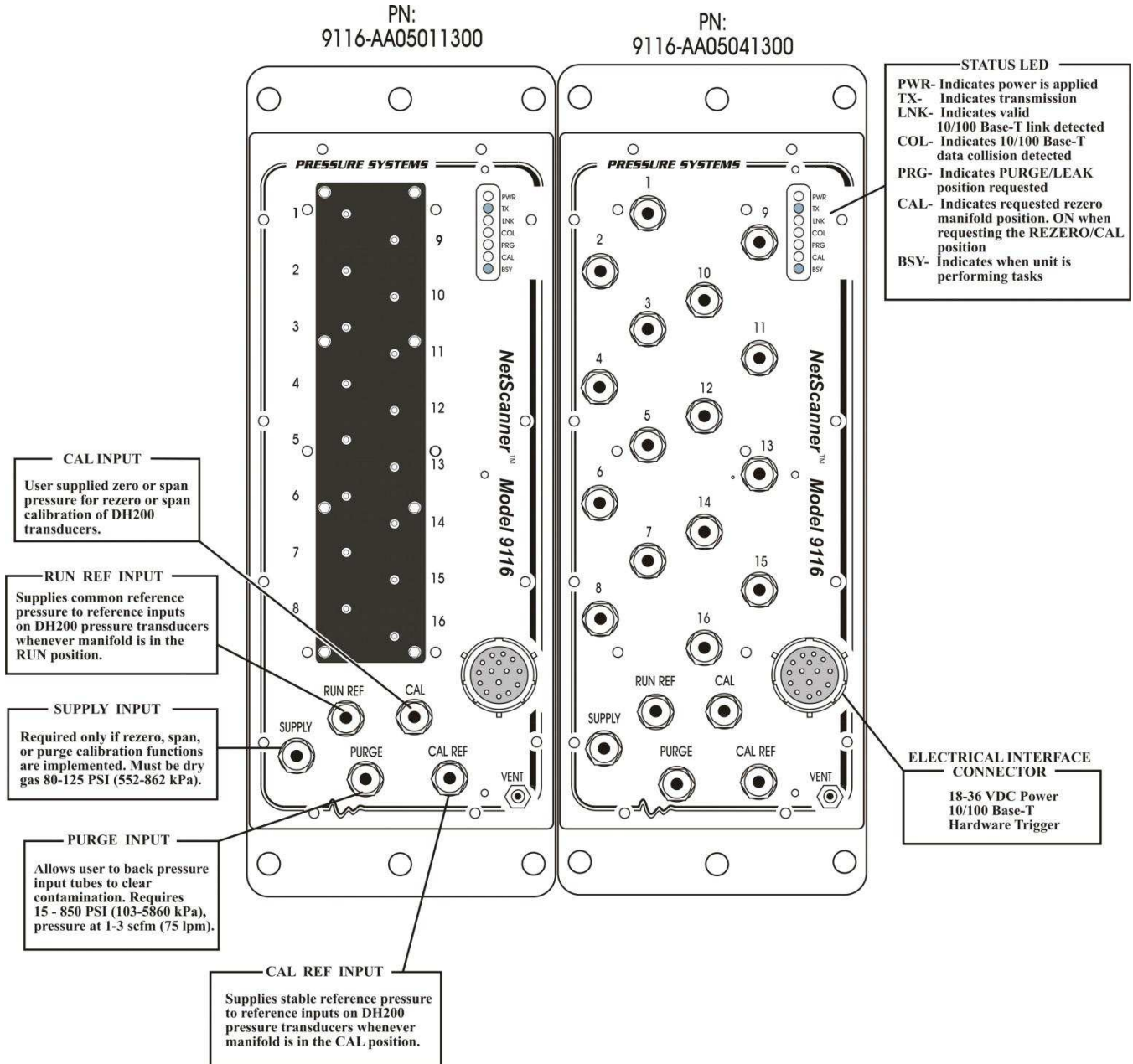
FIG. 4

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Front Panel Layout

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

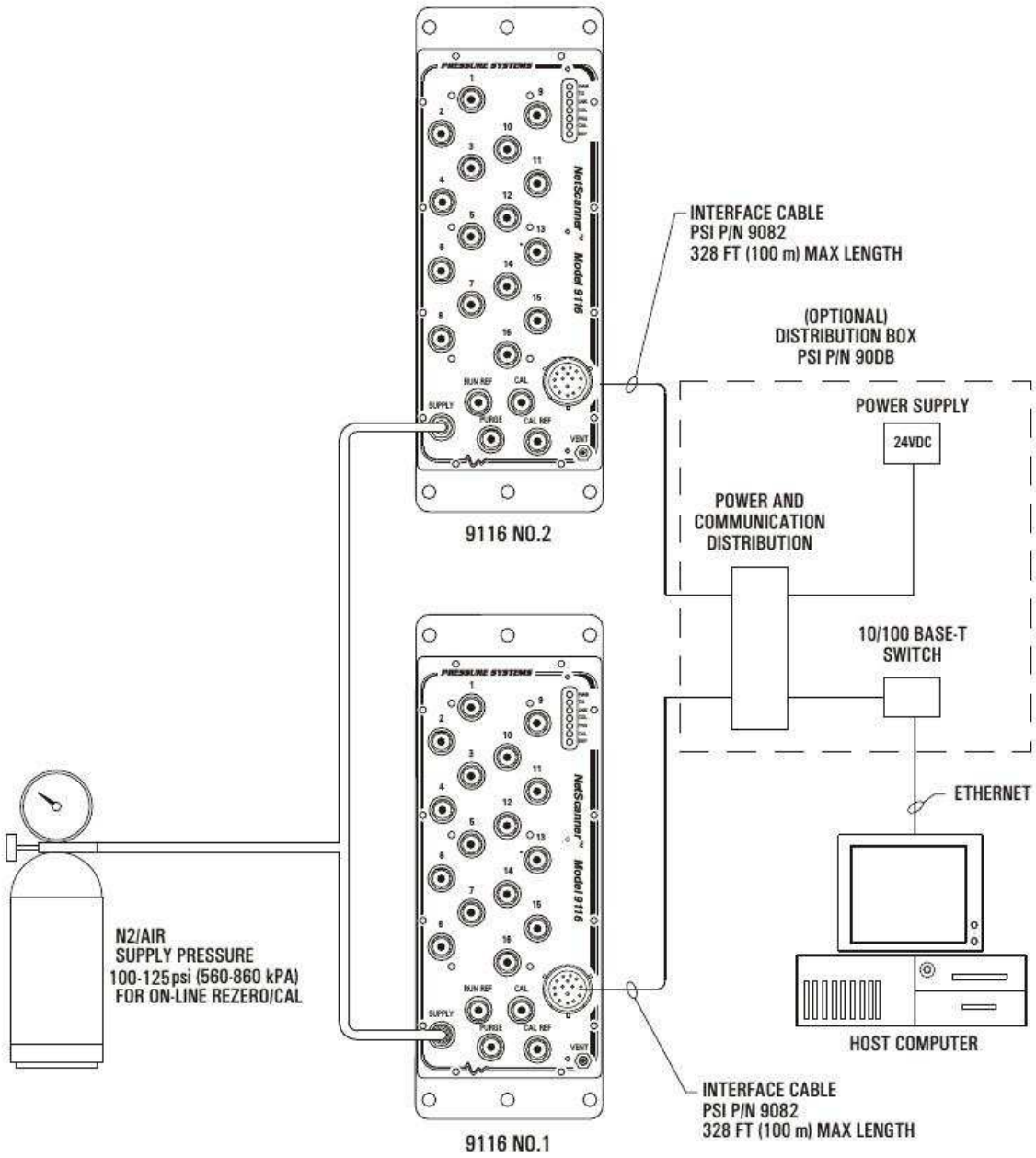


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Networking Example

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.

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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	08,	30 psid	23,	125 psid	31,	375 psid
02,	20" WC	09,	45 psid	24,	50 psid	32,	750 psid
03,	1 psid	10,	100 psid	25,	650 psid	34,	75 psid
04,	2.5 psid	11,	250 psid	26,	200 psid	39,	850 psid
05,	5 psid	12,	500 psid	27,	35 psid	75,	1100 psig
06,	10 psid	19,	600 psid	29,	60 psid	99,	Multirange
07,	15 psid	20,	300 psid	30,	150 psid		

BB = Manifold Options

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

FF = Calibrated Temperature

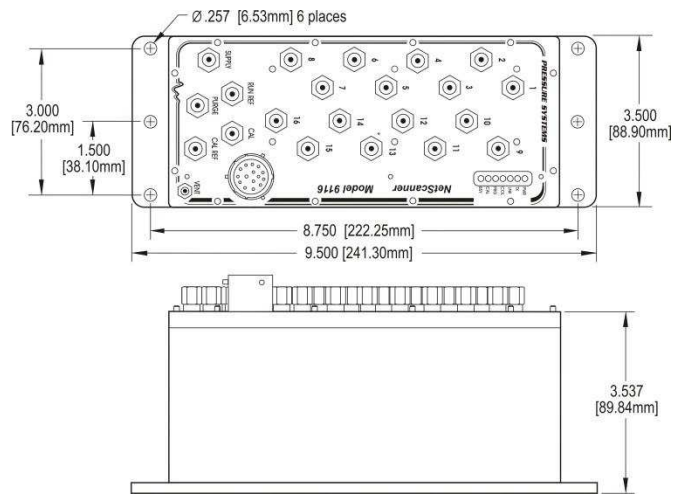
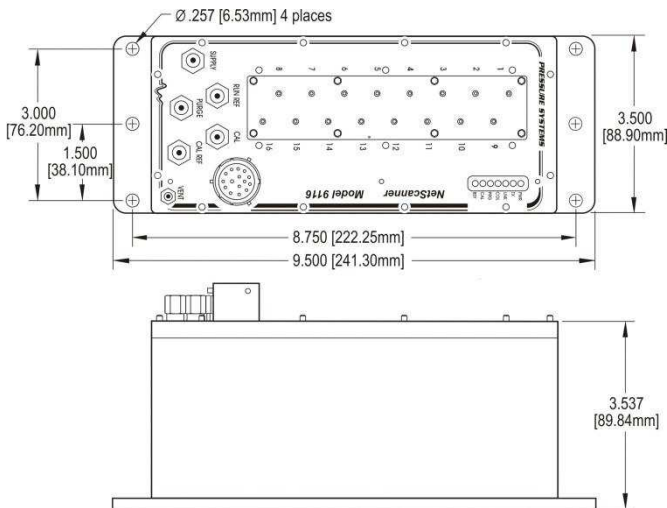
00, 0 to 60°C
06, -30 to 60°C

CC = Measurement Pressure Fittings

07, 5/16" - 24 SAE o-ring boss
01, 0.063" Bulged Tubulation, QDC
02, 1/8" Swagelok Style Compression
03, 1/4" Compression
04, 1/8" Compression
05, 1/16" Compression
10, 5/16 SAE to M10 Adapter
11, 4mm Compression

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



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