

Rackmount Pressure Scanner

9916/98RK-1

Features

- ±0.05% FS System Accuracy
- EU throughput Rates of 100 Hz
- IEEE 1588-2008 PTPv2 & NTP Disciplined Clock
- Scheduled Start of Scanning
- IPv4 and IPv6 Compatible
- Removable Memory
- Hardware Compatible with 98RK and 98RK-1
- Highly Software Compatible with 9816



98RK-1 Rackmount Pressure Scanner

Applications

- Turbine Engine Research
- Turbomachinery Test Stands
- Large Channel Count Pressure Requirements



Description

TE Connectivity's Rackmount version of its highly successful NetScanner System features the latest generation Model 9916 Rackmount intelligent pressure scanner.

Model 9916 Scanners integrate 16 silicon piezoresistive sensors of any pressure range with a microprocessor. Each field-replaceable pressure sensor incorporates a temperature sensor and an integral EEPROM for storage of personalized calibration data as well as sensor information such as serial number, pressure range, factory calibration date. Integrating the EEPROM within the sensor enables simplified field replacement of sensors with automatic uploading of sensor data during power up.

The microprocessor uses the data from the EEPROM to correct for sensor offset, span, linearity and thermal errors. The microprocessor's digital temperature compensation algorithm reduces sensor 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 calibrations upon request. This capability virtually eliminates sensor offset drift error and provides system accuracy errors less than ±0.05% FS (Full Scale).

The Model 9916 can sample using up to three concurrent scan lists at continuous rates up to 100 measurements per channel per second in engineering units with timestamps.

Pressure data in engineering units is output through an auto-negotiating 10 or 100 Mbit Ethernet interface supporting both TCP and UDP protocols. The Model 9916 data output optionally includes data time stamps derived from either the 9916 internal real time clock, NTP clock or an IEEE 1588-2008 Precision Time Protocol (PTPv2) grand master clock. The scanner is supplied with comprehensive software called NUSS for PC compatible computers. Firmware upgrades are available at no charge and can be downloaded to the scanner over the 9916 Ethernet interface using NUSS.

The Model 9916 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.

The Model 9916 replaces the discontinued Model 9816 and features high hardware and software compatibility. The Model 9916 can be used with 98RK and 98RK-1s, and in mixed use with Model 9816s. Specific compatibility is dependent upon customer installation.

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Specifications				
Parameter	9916	98RK-1	Units	Comments
Pneumatics				
Pressure Ranges ¹	10 (2.5) 20 (5.0)	N/A	in WC (kPa)	
	1 (7) 2.5 (17) 5 (34) 10 (69) 15 (103) 30 (207) 45 (310) 100 (689) 250 (1724) 500 (3447) 750 (5171) 850 (5860)	N/A	psid (kPa)	ranges < 100 psi (689 kPa) are bidirectional ranges ≥ 100 psi (689 kPa) are unidirectional
Number of Measurement Inputs	16	N/A		
Pneumatic Fittings	0.063 bulged tubulation or SAE 5/16-24 o-ring boss (if front access specified)	SAE 7/16-24 o-ring boss		variety of compression adapter fittings available See page 6 for standard fittings
Media	Dry, non-corrosive gas			for liquid pressures refer to Model 9022 datasheet
Proof Pressure ²	3.0X 2.0X 1.5X	NA	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	N/A	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 (4134)	N/A	psi (kPa)	range ≤ 5 psi (34 kPa) range > 5 psi (34 kPa)
Manifold Control Pressure	80 (552) 125 (862)		psi (kPa)	min max
Purge Pressure ⁴	> max input pressure 850 (5860)		psi (kPa)	min max
Static Performance				
Measurement Resolution	±0.003	N/A	% FS	
Static Accuracy ⁵ After Rezero	±0.05 ±0.15	N/A	% FS	range > 2.5 psi (17 kPa) range ≤ 2.5 psi (17 kPa)
Total Thermal Error ⁶	±0.001 ±0.0015	N/A	% FS/°C % FS/°C	range > 2.5 psi (17 kPa) range ≤ 2.5 psi (17 kPa)
Line Pressure Effect	±0.0003 ±0.0008 ±0.001	N/A	% FS/psi % FS/psi % FS/psi	range ≥ 100 psi (689 kPa) range > 5 psi (34 kPa) to < 100 psi (689 kPa) range ≤ 5 psi (34 kPa)
Measurement Rate	100	N/A	ch/sec	engineering units
Communication				
Ethernet	10/100 Base T	Auto negotiating half/full duplex		
Protocol	TCP and UDP			static or dynamic IP assignment
Time Protocol	PTPv2 (IEEE 1588-2008) or NTP			External master clock or server required

Rackmount Pressure Scanner

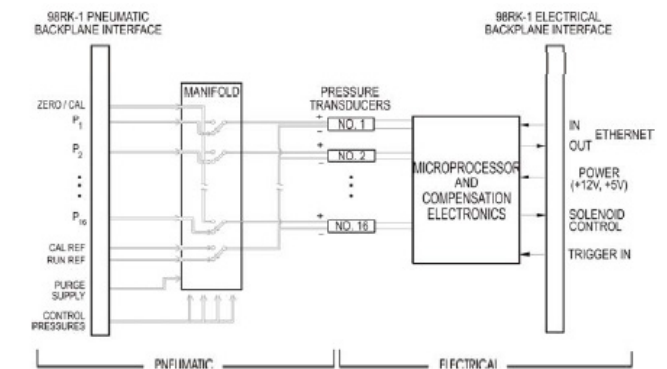
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Electrical				
Input Voltage	N/A	85 - 264	VAC	47 – 63 Hz
Operating Power	N/A	65 ⁷	watts	
Hardware Trigger	2.5		VDC	TTL compatible differential input, ± 5 VDC common mode voltage
Environmental/Physical				
Compensated Temp Range	0 to 60		°C	
Operating Temp Range	0 to 50		°C	Up to 95% non-condensing humidity
Storage Temp	-20 to 80		°C	
Size	2.06 x 7.00 x 15.25 (5.2 x 17.7 x 38.7)	17.00 X 8.75 X 19.00 (43.2 X 22.2 X 48.3)	inches (cm)	L x W x H
Weight	6.5 (3.0)	26.9 (12.2)	lb (kg)	

- 1) Consult Factory for intermediate pressure ranges and multirange configurations.
- 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) Maximum power consumption with full compliment of 9816 scanners and remotely connected NetScanner modules in highest power draw configurations.

Specification subject to change without notice.

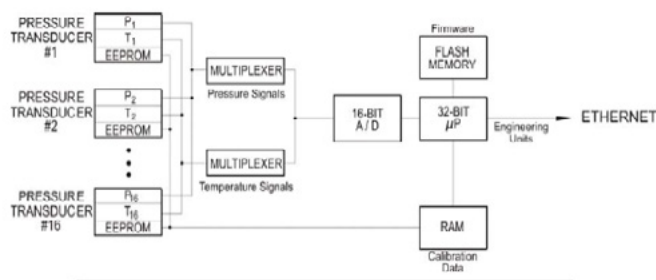
The Model 9916 Rackmount Intelligent Pressure Scanner combines the integral pressure transducers with a miniature data acquisition system to provide a multichannel pressure scanner. The integration of the microprocessor with the pressure transducers provides several benefits in addition to the self-contained nature of the Intelligent Pressure Scanner. This pre-engineered approach to pressure acquisition offers higher 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 9916 outputs 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.



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 recognize the new transducer upon power up and extract the calibration information from the EEPROM.



Digital Sensor Temperature Compensation Functional Diagram

INTERNAL CLOCKS AND TIME KEEPING

The 9916 contains an internal real time clock (RTC) for keeping system date and time. This clock is factory initialized to UTC-0 time. The 9916 also has the ability to continually synchronize its internal RTC to either an NTP server or IEEE 1588-2008 Precision Time Protocol (PTPv2) grandmaster clock if they are present and accessible on the 9916's network. As part of the 9916 data stream configuration, data samples may optionally include an absolute time stamp indicating when the data sample was acquired. It is also possible to configure 9916 data streams to start autonomously at a set absolute time. This is useful for initiating data streaming synchronously through a large 9916 configuration without the use of the hardware trigger signal.

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Pneumatic Design

The Model 9916 Rackmount Intelligent Pressure Scanner 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.

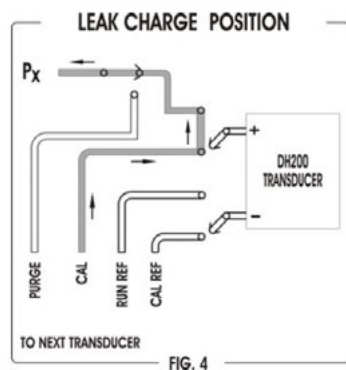
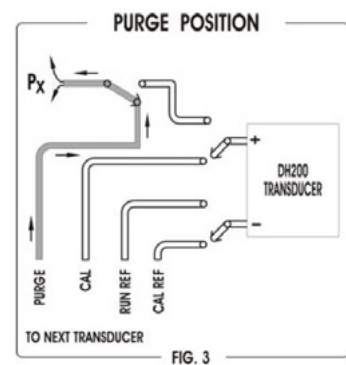
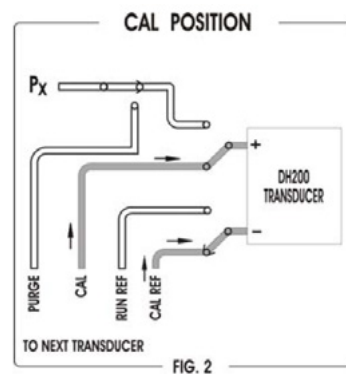
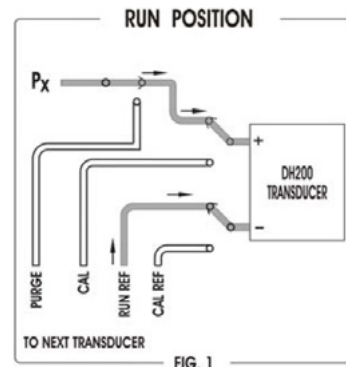
To initiate these operations, the user simply issues the appropriate command via the host computer. Operating under control of the onboard microprocessor, integral solenoids are energized to apply control pressure to two of four pistons within the manifold. One piston forces the manifold longitudinally 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 Control Pressure Supply Input port on the rear of the 98RK-1 rack 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 respective calibration input ports on the rear of the rack.

The purge function requires pressure in excess of the highest anticipated input pressure to be present at the Purge Input port on the rear of the rack. 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 ensures maximum accuracy.

The LEAK CHARGE function requires the desired test pressure to be applied to the appropriate calibration port on the rear of the rack and the input lines to be dead-ended at their source. Issuing the LEAK CHARGE command forces the manifold into the LEAK CHARGE position to charge the input lines using pressure from the respective calibration ports. Once charged, the manifold is commanded to the RUN position where periodic reading from the transducers can be obtained to analyze pressure decay in each input line.

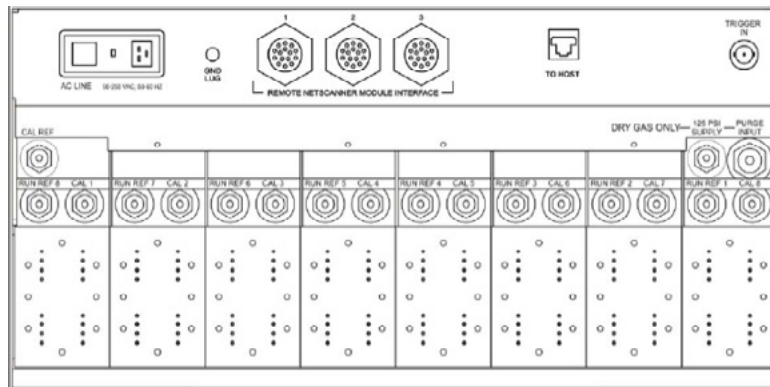


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Scanner Interface Rack

The enhanced Model 98RK-1 Scanner Interface Rack is a 19" rackmountable chassis housing up to eight 9816 scanners. Electrical connections and utility pressures to service the scanners are made via the rear of the chassis. These connections are automatically made to the 9816 scanners once they are inserted into the chassis and secured with the integral locking rod. The 98RK-1 also provides Ethernet connection, hardware trigger and power supply for up to three remote Intelligent Pressure Scanners. The 98RK-1 accepts a universal 85-264 volt 47-63 Hz power input. Measurement pressures can be input via the front of the scanners or the rear of the chassis. The scanners are keyed to receive span calibration pressures from one of eight calibration ports on the rear of chassis based on the range of their internal transducers. This eliminates the possibility of accidental overpressure while interchanging scanners within the chassis. These calibration ports also serve to provide leak check and accuracy verification pressures to the scanners. Pressure Systems manufactures a line of programmable pressure controllers to support these operations. Both the 98RK-1 and the 9816 scanners incorporate front panel LED's to indicate the status of Ethernet links, power supply, scanner manifold position and system health.



98RK-1 Scanner Interface Rack Rear Panel Layout

Standard pneumatic connections

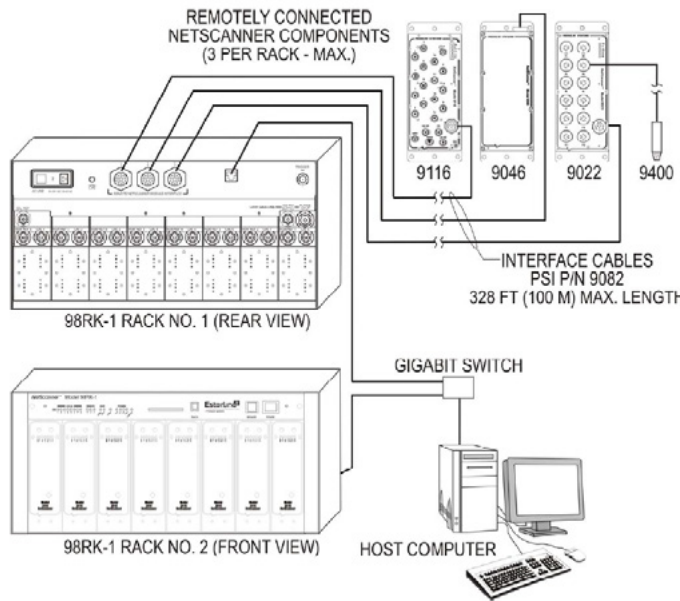
	9816	98RK-1
Measurement Inputs	1/8" compression fitting or 0.063" OD bulged tubulation (if front access specified)	0.063" OD bulged tubulation (if rear access specified)
125 psi SUPPLY, CAL REF, RUN REF and CAL inputs (except CAL7 & CAL8)	N/A	1/4" compression fitting
CAL7 & CAL8	N/A	1/8" compression fitting
PURGE input	N/A	3/8" compression fitting

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Networking Example

The NetScanner System allows for a combination of rackmount and stand-alone components to be networked. The illustration on this page shows a configuration for interfacing two 98RK-1 Scanner Interface Racks and three remote NetScanner components to a host computer. Contact PSI to discuss alternate network solutions.





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Ordering Information

PN: 9916-AABBCC0000 9916 Rackmount Intelligent Pressure Scanner

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

01	10"WC (2.5 kPa)	08	30 psid (207 kPa)
02	20"WC (5.0 kPa)	09	45 psid (310 kPa)
03	1 psid (7 kPa)	10	100 psid (689 kPa)
04	2.5 psid (17 kPa)	11	250 psid (1722 kPa)
05	5 psid (34 kPa)	12	500 psid (3445 kPa)
06	10 psid (69 kPa)	32	750 psid (5168 kPa)
07	15 psid (103 kPa)	39	850 psid (5860 kPa)
		99	Multirange

BB = Pneumatic Connection

01	0.063", Front Access QDC
02	Rear Access QDC
03	1/8" Compression Fitting, Front Access
05	4mm Compression Fitting, Front Access

CC = Manifold Options

06	Common Differential
07	True Differential, Front Access only

BB = 01 or 05

PN: 98RK-1 Scanner Interface Rack, Universal VAC Input

Example: 9916-0702060000	9916 Rackmount Intelligent Pressure Scanner, 15 psid, Rear Access, Common Differential
98RK-1	98RK-1 Scanner Interface Rack, Universal VAC Input