MPS4200

16, 32 and 64 Gen2 Channel
Miniature Pressure Scanners

Hardware, Software, and User Manual

Software Version: 4.01

Scanivalve

PREFACE

WARNINGS, CAUTIONS, AND NOTES

The WARNING! symbol indicates that danger of injury to persons and the environment and/or considerable damage (mortal danger, danger of injury) could occur if the respective safety precautions are not taken.

The CAUTION! symbol indicates danger to the system and material if the respective safety precautions are not taken.

The ESD note symbol indicates that proper precautions for handling Electrostatic Sensitive Devices need to be taken when performing the related operation. This includes the use of grounded work surfaces and personal wrist straps to prevent damage to sensitive electronic components.

WARRANTY

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Surface transportation charges covering any repaired or replacement product or component part shall be at Seller's expense; however, inspection, testing and return transportation charges covering any product or component part returned and redelivered, which proves not to be defective, shall be at the expense of Buyer or the end user, whomever has returned such product or component part.

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BY OPERATION OF LAW OR OTHERWISE, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND IN NO EVENT SHALL SELLER BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

In the event of a failure:

1) Notify Scanivalve Corporation, Customer Service Department. Include model number and serial number. On receipt of this information, service data or shipping instructions will be forwarded. This may be transacted by telephone or e-mail.

2) On receipt of shipping instructions, forward the product, transportation prepaid. Repairs will be made and the product returned.

3) All shipments should be made via "Best Way." The product should be shipped in the original packing container or wrapped in protective material and surrounded by a minimum of four (4) inches of a shock absorbing material.

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If the product must be shipped, whether being returned to Scanivalve or relocated to another location, it must be packaged properly to minimize the risk of damage. The recommended method of packing is to place the instrument in a container, surrounded on all sides with at lease four inches of shock attenuating material such as Styrofoam peanuts.

Important Notice

Please note that the product specifications and other information contained in this manual are subject to change without notice. Scanivalve Corporation makes an effort and strives to provide complete and current information for the proper use of the equipment. If there are any questions regarding this manual or the proper use of the equipment, contact Scanivalve Corporation.

Contact Information

If there are any questions or concerns regarding any Scanivalve product, please do not hesitate to contact us at the following:

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Scanivalve Corporation is an ISO 9001:2015 certified company.

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SECTION 1: INTRODUCTION

1.1 Overview

The MPS4200 Series is a family of intelligent, miniature pressure scanners designed for accurate and reliable differential pressure measurement in demanding applications such as flight test, wind tunnel testing, automotive development, and engine/turbine testing. Each scanner integrates high-precision electronics for high-accuracy data and advanced processing to deliver stable, time-aligned measurements for complex environments.

WARNING! This manual may be used for an MPS4264 Gen1, but not all specifications, commands, or features may not be available. Please refer to the MPS4264 Gen1 Manual.

1.1.1 Core Technology

Each MPS4200 module incorporates 24-bit analog-to-digital converters (ADCs) paired with a dual-core processor to enable high-resolution measurement, engineering-unit conversion, and communication management. This architecture supports synchronous scanning, where all channels sample simultaneously to produce time-coherent datasets. Output stability is enhanced by Dynamic CALZ, a proprietary per-scan zeroing routine that cancels A/D offset and minimizes zero drift over time and temperature. For thermal compensation, internal RTDs monitor module temperature, and pressure and temperature calibration tables are stored in memory and applied during conversion for accurate results across operating conditions.

1.1.2 Pneumatic Design

The MPS4200 Series uses a stable piezoresistive sensor package combined with a common differential architecture, where each sensor measures differential pressure and the negative (reference) side of all sensors shares a common reference cavity for consistent measurements. Pressure ranges are available from 4 inH_2O to 100 psi. To simplify installation and reduce downtime, all modules feature removable pneumatic input headers, allowing quick turnover between tests and enabling pre-plumbing for faster setup.

1.1.3 Channel Configurations

The primary configuration option available in the MPS4200 is around the channel count of the module.

MPS4216 - 16-Channel Module

- Compact module
- No integrated valving (always in measurement mode)
- Pressure ranges available up to 100 psi
- Data rates up to 3,500Hz

MPS4232 - 32-Channel Module

- Expanded channel count
- No integrated valving (always in measurement mode)
- Pressure ranges available up to 100 psi
- Data rates up to 2,500Hz

MPS4264 - 64-Channel Module (Gen2)

- High-density channel count
- Integrated valving that allows for different pneumatic modes: Measurement, Calibrate, Purge
- Three valve configurations available:
  Pneumatic driven: CPx or NPx
  Electrically driven: EPx
- Pressure ranges available up to 50 psi
- Data rates up to 1,250Hz
- Available with a Thermal Control Unit (TCU) for operating temperature range expansion and a ruggedized packaging

The MPS4200 Series combines advanced electronics, precise pneumatic design, and flexible configurations to deliver accurate, time-coherent differential pressure measurements for a wide range of applications. Configurations scale from compact 16-channel modules to high-density 64-channel systems with integrated valving and optional thermal control.

This manual includes detailed specifications, wiring and pneumatic connection diagrams, communication settings, and configuration-specific features for all MPS4200 modules. It covers data acquisition options, valve actuation for 64-channel units, and Thermal Control Unit integration. Calibration details, operating guidelines, and maintenance steps are provided to support accurate measurements and reliable performance in a range of test environments.

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SECTION 2: SPECIFICATIONS

2.1 GENERAL SPECIFICATIONS

	MPS4216	MPS4232	MPS4264 Gen2
Dimensions	See dimension drawings (figures 2.1 - 2.4)		
Weight	0.12lbs [52.6g]	0.19lbs [86.2g]	NPx: 0.488lbs [221g] CPx: 0.478lbs [217g] EPx: 0.804lbs [365g]
Channels	16	32	64
Pressure Ranges*	0.145PSI to 100PSI		0.145PSI to 50PSI
Accuracy	See pressure ranges table		
A/D Resolution	24-bit ADC		
Binary Data Output Rate†	3,500Hz	2,500Hz	1,250Hz
ASCII Data Output Rate†	200Hz	100Hz	50Hz
Power Connector	TE Connectivity PLG 8P8C Mini1		
Power Supply	5 to 36VDC		CPx & NPx: 9 to 36VDC EPx: 18 to 36VDC
Power Consumption	3.5W		CPx & NPx: 3.5W EPx: 5.5W
External Trigger	5 to 15 VDC, 6.5mA		
Ethernet Connector	TE Connectivity PLG 8P8C Mini2		
Ethernet Connection	100BaseT, MDIX Auto-crossing		
Communication Protocols	TCP/IP, UDP, FTP, HTTP, IEEE1588-2008v2 PTP		
Data Synchronization	IEEE1588-2008v2 PTP Timestamping External Hardware Triggering		
Valve Options / Control	No	No	Yes, See Valve Configuration 2.3
Channel (Px) Inputs	0.042" [1.067mm] OD Tubulations (standard) 0.031" [0.787mm] OD non-bulged tubulations (optional)		
Reference (REF) Inputs	0.063" [1.067mm] OD Tubulations		
Calibration (CAL) Inputs	N/A‡		0.063" [1.067mm] OD Tubulations
Purge (PRG) Inputs	N/A‡		0.063" [1.067mm] OD Tubulations
Control (CTL) Inputs	N/A		0.063" [1.067mm] OD Tubulations
Operating Temperature	0° to 70°C**		
Temperature Compensated Range	0° to 70°C		
Storage Temperature	0° to 80°C		
Humidity	5 to 95% RH, Non-condensing		
Environment Pressure	Minimum: 0.5PSIA (3.4kPa abs) Maximum: 100PSIA (690kPa abs)		
Media	Dry gases compatible with silicon, silicone, aluminum, Buna-N, gold, RTV		
Standards	CE, MIL-STD-810G Cat 24, RoHS v3		

** See pressure ranges table for all standard ranges available*
† Maximum data rate may vary based on network limitations
‡ Removable headers available to provide Calibration and Purging capabilities
*** Can be extended to -60°C and up to 125°C when installed in a TCU (MPS4264 Only)*

2.2 Pressure Range Specifications

Full-Scale Pressure Range[1]		Output Resolution[2]	Proof Pressure[3]	Burst Pressure[4]	Maximum Reference Pressure	Measurement Range[5]		Total System Accuracy[6]	Typical Measurement Error[7]
PSI	kPa	Pa			PSIG	-PSI to	+PSI	%FS	%FS
0.145	0.999	0.0005	1PSI	4PSI	50PSI	-0.145	0.145	±0.2	±0.12
0.289	1.993	0.0006				-0.289	0.289	±0.15	±0.07
1	6.894	0.0017	5PSI	10PSI		-1	1	±0.06	±0.03
5	34.47	0.0086	40PSI	75PSI		-5	5		±0.03
10	68.95	0.0172				-10	10		±0.02
15	103.4	0.0259				-15	15		
30	206.8	0.0517	75PSI	100PSI			30		
50	344.7	0.0862					50		
100[8]	689.5	0.1724	150PSI	150PSI			100		

1 Standard ranges available. Custom ranges may be available, but may have a reduced accuracy. Please consult Scanivalve for more information.
2 Output resolution absolute value based on typical 24-bit ADC output at calibrated range. Actual resolution will vary from sensor to sensor.
3 Proof Pressure is the maximum pressure that may be applied without changing the performance or characteristics of the pressure sensors.
4 Burst Pressure is the maximum pressure that may be applied without physically damaging the unit.
5 Modules cannot be used to measure pressure beyond 110% of the listed measurement range.
6 The worst-case error over a 6-month period, including linearity, hysteresis, repeatability, and temperature effects, with a quick-zero calibration.
7 A statistically derived error band based on historical calibration data representing the 95th percentile, or 2 x sigma, of observed performance after a quick-zero calibration. Includes contributions from sensor behavior, temperature variation, and system-level effects.
8 Not available in the MPS4264 64-channel scanners.

2.3 Valve Configuration Specifications *(MPS4264 Only)*

Valve Type	Description	Control	Best Use Case
NPx (Normally Px)	Defaults to measurement mode; requires control pressure only for calibration/purge	Pneumatic 90-120PSI	Simplified systems without constant control pressure, or used alongside Scanivalve DSA modules
CPx (Control Px)	Legacy-compatible; requires control pressure to switch modes (bi-directional operation)	Pneumatic 65-120PSI	Integration with legacy Scanivalve ZOC systems
EPx (Electric Px)	Software-controlled valve switching; no pneumatic control	Electric (motorized)	Remote, or applications where no supply pressure is available

2.4 MPS Thermal Control Unit (TCU) Specifications *(MPS4264 Only)*

	No Heater or Cooling	Heater Only	Heater and Cooling
Dimensions	See dimension drawings (figure 2.5 and 2.6)		
Weight[9]	CPx & NPx: 1.62lbs [0.73kg] EPx: 2.58lbs [1.17kg]	CPx & NPx: 1.77lbs [0.8kg] EPx: 2.73lbs [1.24kg]	CPx & NPx: 1.97lbs [0.89kg] EPx: 2.93lbs [1.33kg]
Power Connector	M12 Series, 17 Contact		
Power Supply	See General Specifications[11]	Heater Power: 20 to 30VDC	
Power Consumption	See General Specifications[11]	Heater Consumption: 45W	
Pneumatic Connector	70MPS Series (0.063” [1.067mm] OD Tubulations Standard, 0.042” OD Tubulations Optional)		
Operating Temperature	-5° to 60°C	-60° to 60°C	-60° to 125°C
Cooling Requirements	N/A		23°C air at 3.0CFM[10]
Cooling Input	N/A		1/4” OD Compression
Ingress Protection	IP-54		

9 Includes installed MPS4264 and mating pneumatic connector, without mounting straps (1x mounting strap adds approximately 0.25lbs)
10 Recommended for environments above 60°C. Required for 125°C operating temperature.
11 The MPSTCU contains an installed MPS4264 module. For all other specifications, please see General Specifications.

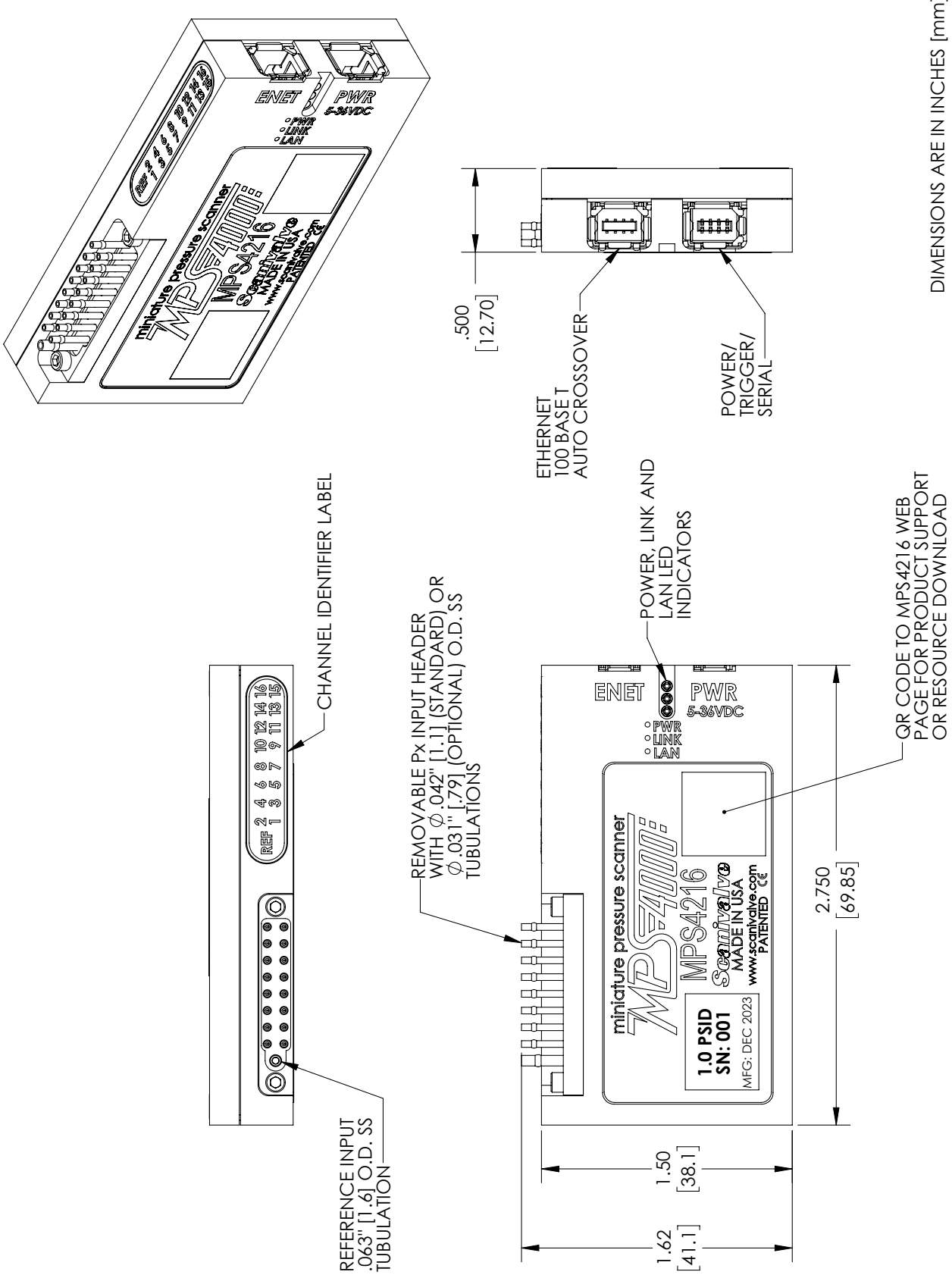


FIGURE 2.1: MPS4216 DIMENSIONAL DRAWING

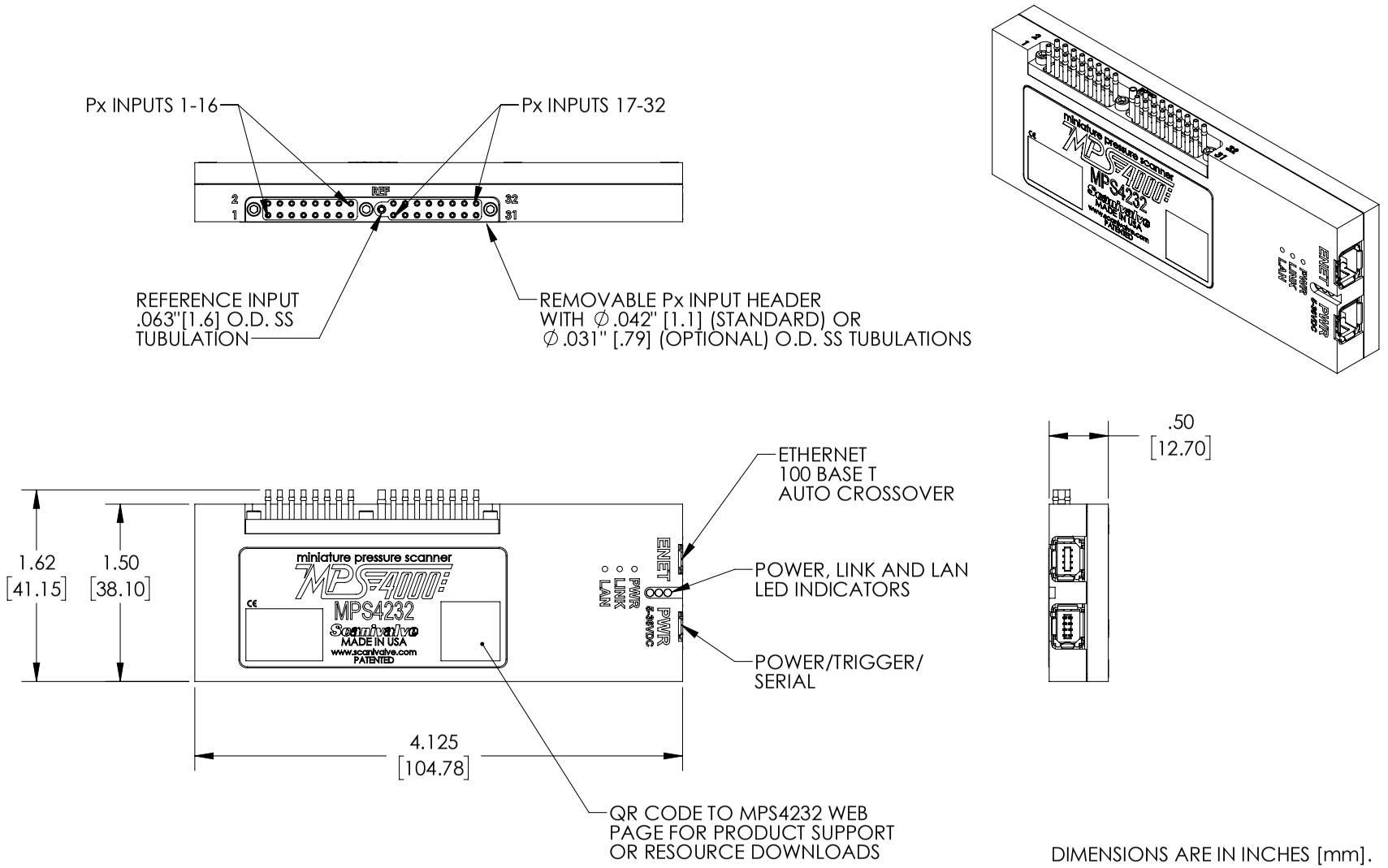


FIGURE 2.2: MPS4232 DIMENSIONAL DRAWING

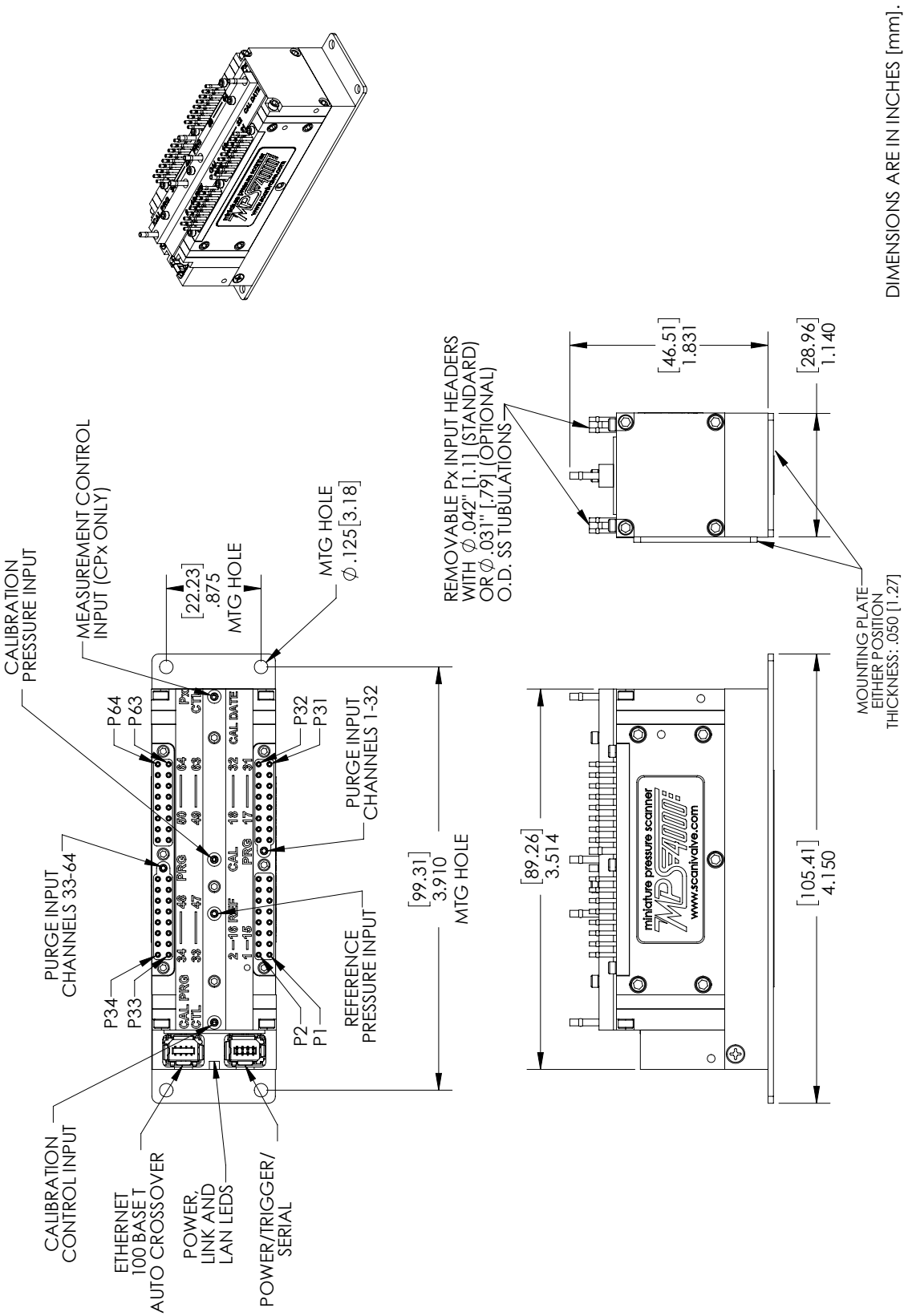
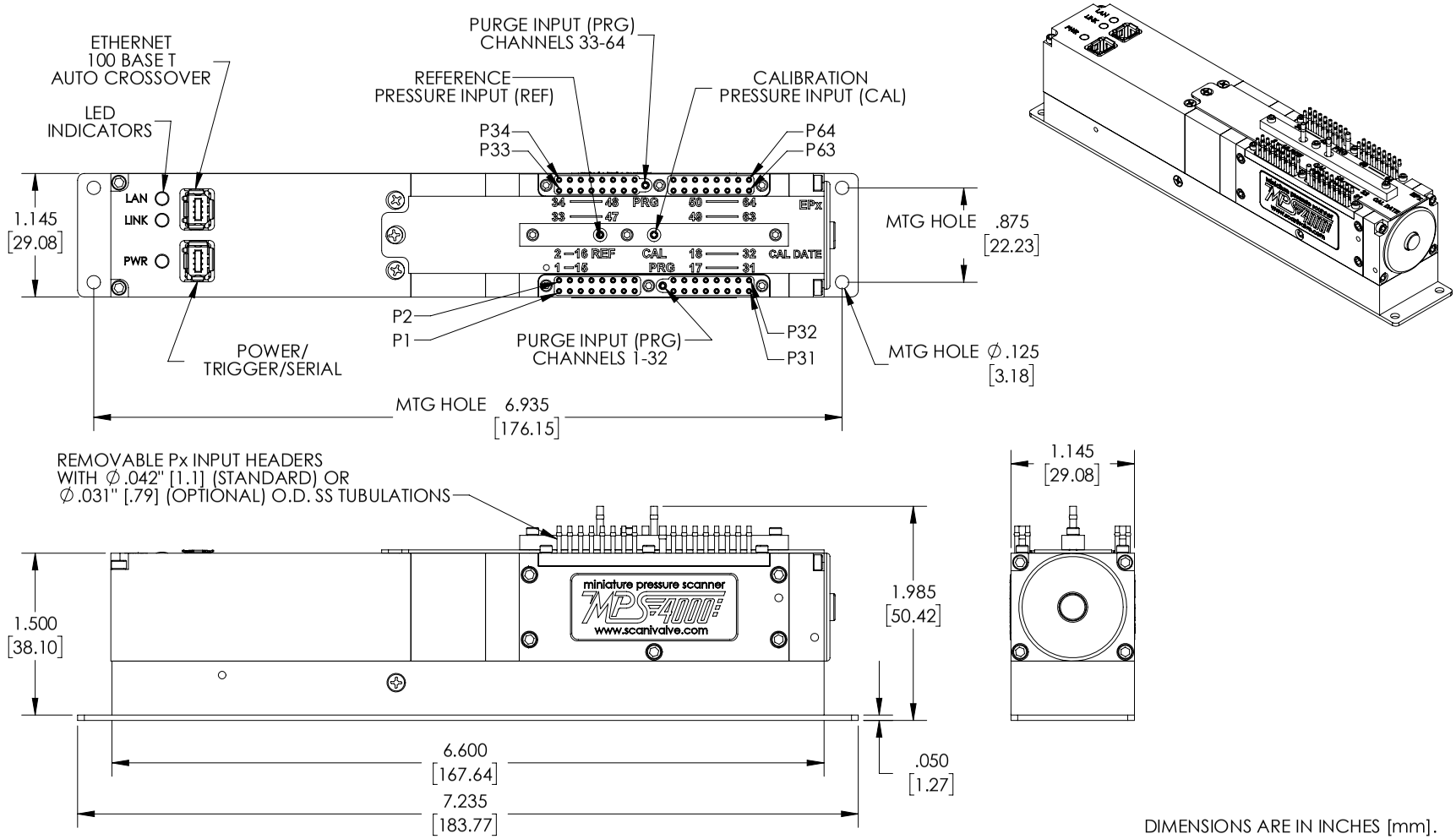


FIGURE 2.3: MPS4264 CPX AND NPX DIMENSIONAL DRAWING



DIMENSIONS ARE IN INCHES [mm].

FIGURE 2.4: MPS4264 EPX DIMENSIONAL DRAWING

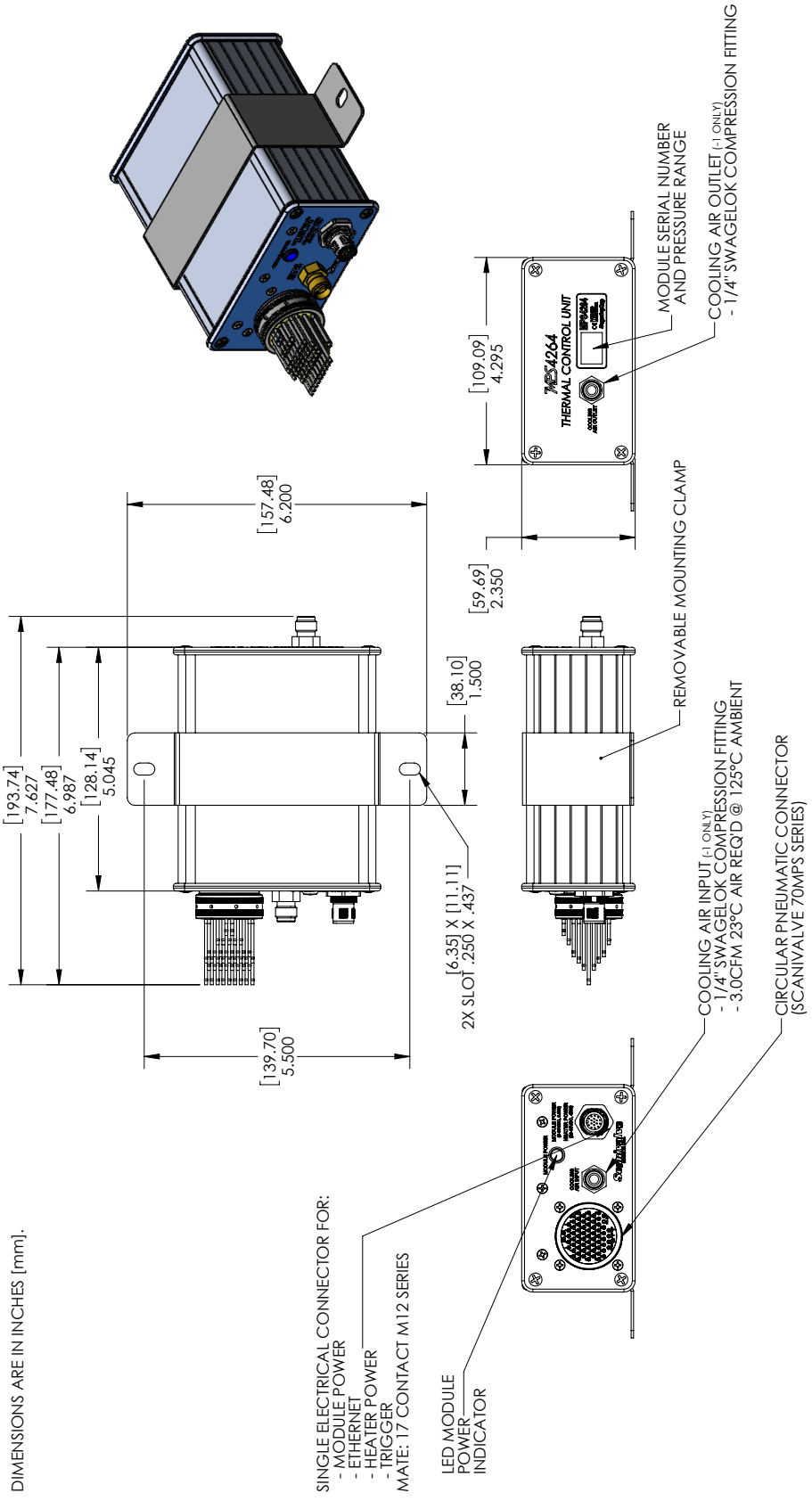


FIGURE 2.5: MPS4264TCU CPX AND NPX DIMENSIONAL DRAWING

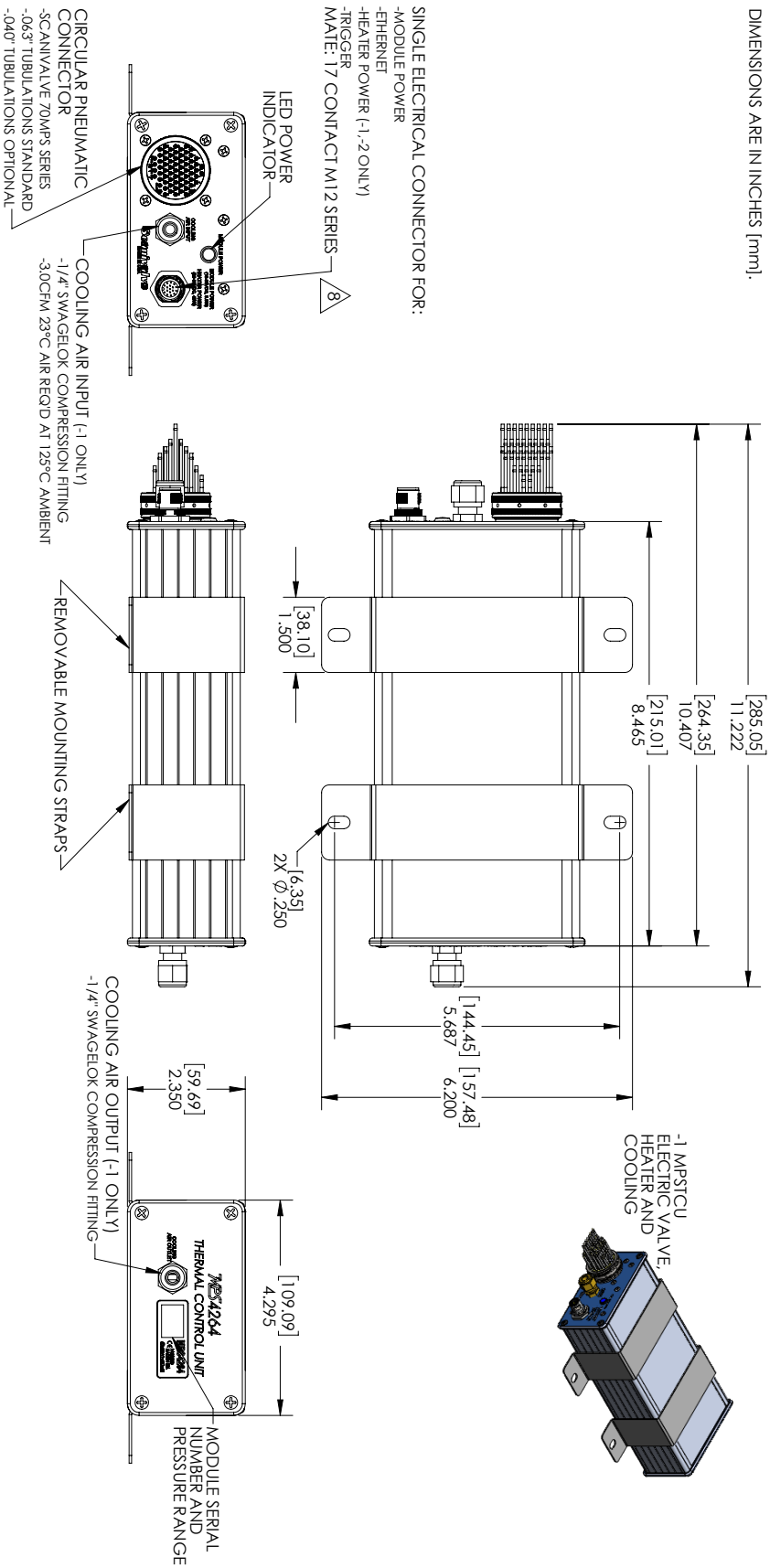


FIGURE 2.6: MPS4264TCU EPX DIMENSIONAL DRAWING

SECTION 3: SAFETY AND SETUP

3.1 SAFETY INFORMATION

WARNING! Failure to follow these instructions may result in injury or damage to the equipment.

- Read this manual and its contents completely before installing or operating the module.
- When required, handle the device in an ESD safe environment using ground work surfaces and wrist straps.
- Do not exceed the specified pressure or electrical ratings as discussed in Section 2.
- Ensure proper grounding before powering the device.
- Do not connect or disconnect power connector when power is active.
- Always depressurize all connected lines before installing or removing pressure connections.
- Operate within the environmental conditions specified in ”Section 2: Specifications”.
- Protect the module from splash, spray, or mist. The MPS4200 series is not waterproof.

3.2 UNPACKING AND INVENTORY

When you first unpack the shipment, begin by inspecting and inventorying the contents of the package. If any visible damage is noticed or contents are missing, contact Scanivalve before proceeding. Avoid dropping or exposing the unit to moisture during unpacking.

As a minimum, MPS4200 modules are shipped with the following contents:

1. MPS4200 Module
2. Protective Case
3. 155625 - Power Cable with Flying Leads
4. 156110 - Ethernet RJ45 Adaptor Cable
5. Spare 2-56 x 3/16” SS screws for Mounting Plate
6. Spare #1 Allen x 1/4” SS Hex screws for pneumatic headers
7. Spare 0.065” x 0.099” Buna-N orings for header screws *(to make captive)*

For MPSTCU units, the MPS module will be installed in the TCU enclosure. These configurations are shipped with the following contents:

1. MPS4264TCU
2. 70MPSM Pneumatic Connector (w/gascage)
3. 6535-01 70MPS spanner wrench
4. M12, 17 Contact, 1.5m flying leads cable
5. 21425-01 MPSTCU Mounting Strap
   (2x for EPx configurations)

Every module will also include:

1. Resource Disk (USB) - Contains full calibration report, firmware files, documentation, and backup coefficients
2. Certificate of Calibration (hard copy)

Note: Optional accessories, power supplies, or cabling may be provided depending on the initial order. Refer to order documentation or contact Scanivalve for details.

3.3 MOUNTING

All MPS configurations can be mounted in any orientation for general use.

For applications where the module may be subjected to centrifugal forces (e.g., wind turbine blades), it is ideal to mount the module so the sensor diaphragm is parallel with the direction of rotation. This orientation will ensure that the sensor will be minimally influenced by centrifugal force.

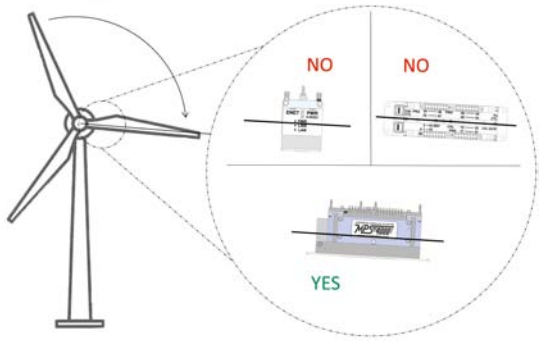


FIGURE 3.3.1: CENTRIFUGAL MOUNTING ORIENTATION - MPS4264

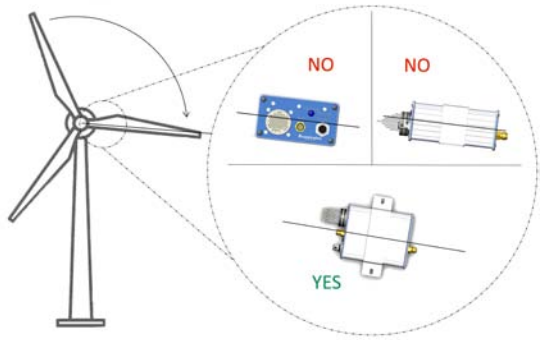


FIGURE 3.3.2: CENTRIFUGAL MOUNTING ORIENTATION - MPSTCU

3.3.1 MPS4216 AND MPS4232

The lightweight nature of the MPS4200 allow it to be fixed to a surface using velcro or similar methods.

CAUTION! The screws on the back side of the MPS should not be removed and used for mounting. These screws maintain the leak-tight aspect of the module.

3.3.2 MPS4264

A stainless steel mounting plate is included with the module, fixed to the bottom of the MPS when shipped. Using three #2-56 screws, the mounting plate can be mounted to the side of the module. Four 0.125" (3.1mm) holes are provided for mounting to a fixed surface or structure. See Figure 2.3 and Figure 2.4 for hole spacing, and Figures 3.3.2.1 and 3.3.2.2 as examples for attaching the mounting plate to the MPS module.

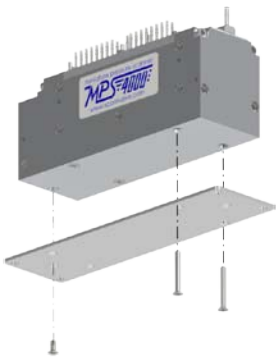


FIGURE 3.3.2.1: MPS4264 MOUNTING PLATE, BOTTOM

Note: The long screws on the bottom of the MPS should be reinstalled if the mounting plate is moved to the side. Short screws should not be used in place.

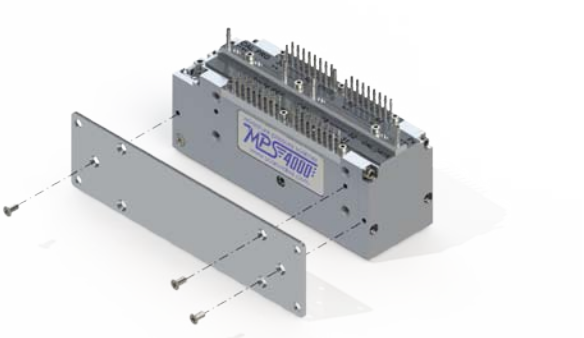


FIGURE 3.3.2.2: MPS4264 MOUNTING PLATE, SIDE

3.3.3 MPSTCU

The MPSTCU enclosure includes stainless steel mounting strap(s) for securing the unit to a fixed surface or structure. CPx and NPx variants will include one strap, where the EPx will include two. Ensure the straps are tightened securely to prevent movement during operation, especially in high vibration or dynamic environments. Avoid overtightening straps to prevent deformation. See Figure 2.5 and 2.6 for mounting strap holes.

3.4 ENVIRONMENTAL CONSIDERATIONS

The MPS4200 series scanner is designed to withstand normal industrial, educational, wind tunnel or similar applications. The module is not waterproof and it should be protected from any splash, spray, or mist. If any moisture gets spilled or splashed on the MPS module, wipe it dry immediately to prevent damage to the module. Modules installed in MPSTCU are IP54 rated, which guards against limited dust ingress and splashing water, but does not protect from submersion.

The MPS module should not be mounted in a location where it may be subjected to extreme temperature shifts or ambient temperatures outside limits defined in Section 2.

Keep in mind that the internal temperature of the module will run approximately 5°C - 10°C warmer than ambient temperature. This temperature increase is accounted for in the calibration tables. The temperature specification listed is in relation to the ambient temperature.

CAUTION! Mounting the MPS module inadequately or in an environment that does not conform to the recommendations can results in permanent damage to the module.

SECTION 4: HARDWARE

This section provide instructions for connecting electrical and pneumatic lines to the MPS series modules. Refer to Section 3 for safety and mounting precautions before proceeding.

4.1 Electrical Connectors

The MPS4200 has two electrical connectors located adjacent to each other on one end of the module. Both connectors are TE Connectivity Mini I/O series connectors. They are polarized to prevent improper mating and include latches to ensure a secure, reliable connection. To disconnect a connector, press down on the latch (shown in Figure 4.1) and pull upward to release it. Do not pull on the cable itself.

Figure 4.1: Power/Ethernet Connector Latch

The MPSTCU uses a single electrical connector that combines power, Ethernet, and triggering into one interface. This connector is an M12-series, 17-contact threaded connector designed for secure retention. A proper connection is required to maintain the unit's IP54 environmental rating.

CAUTION! Do not make or break the power connector with power applied! Doing so risks damage to the module.

4.1.1 MPS4200 Power/Serial/Trigger Connection

The PWR connector is located on the end of the module and provides inputs for DC power, serial communication, and external triggering. Power and external trigger signals (optional) may be connected using the supplied flying-leads cable. User-fabricated cables may also be made using a compatible mating connector and the pin-out information in Figure 4.1.1.

MPS4200 Power Connection			
	MPS4216	MPS4232	MPS4264 Gen2
Connector	TE Connectivity PLG 8P8C Mini1		
Power Supply	5 to 36VDC		CPx & NPx: 9-36VDC EPx: 18-36VDC
Power Consumption	3.5W		CPx & NPx: 3.5W EPx: 5.5W
External Trigger	5 to 15 VDC, 6.5mA		

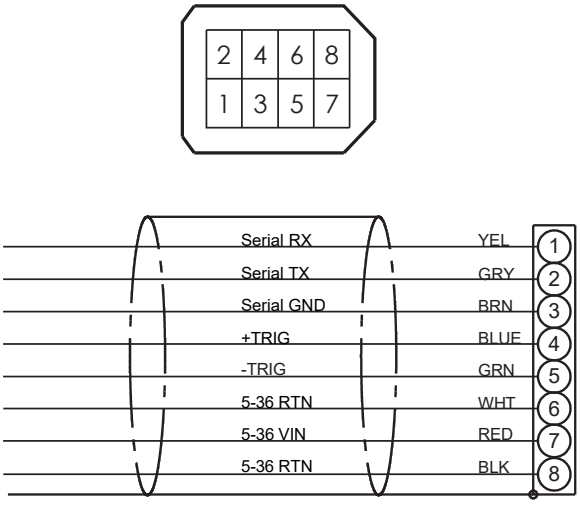


Figure 4.1.1: Power/Serial/Trigger Pin-Out

Scanivalve's PDM power supply series may be used to provide suitable DC power. Some PDM models also provide serial and trigger breakout connections. Additional MPS cables are available from Scanivalve in lengths up to 150 ft (45 m). Refer to the Module Accessory Catalog for available part numbers.

4.1.2 MPS4200 Ethernet Connector

The Ethernet (ENET) connector is also located on the end of the module and is the primary communication interface. A 3 ft Ethernet extender cable (Mini I/O to RJ45 female) is included with each MPS module to allow the use of standard Ethernet cables. Additional cables up to 150 ft (45 m) are available; consult the Module Accessory Catalog for details.

User-manufactured Ethernet cables may be made using the appropriate mating connector. The Ethernet pin-out diagram is shown in Figure 4.1.2.

MPS4200 Ethernet Connection			
	MPS4216	MPS4232	MPS4264 Gen2
Connector	TE Connectivity PLG 8P8C Mini2		
Ethernet Connection	100BaseT, MDIX Auto-crossing		

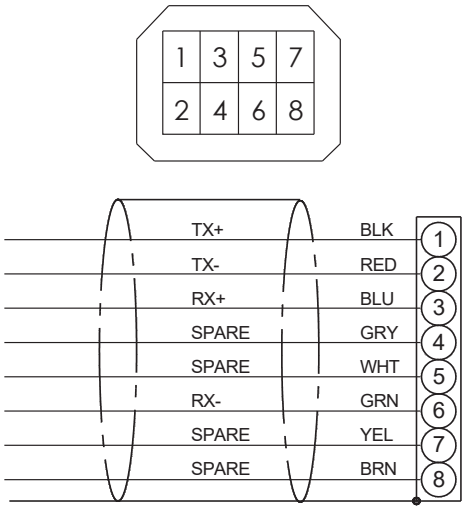


FIGURE 4.1.2: ETHERNET PIN-OUT

4.1.3 MPSTCU Power/Ethernet/Trigger Connection

The combined power, Ethernet, and trigger connector is located on the MPSTCU front panel. All signals are routed through a single M12-series, 17-contact connector. Connections can be made using the supplied flying-leads cable or through a user-fabricated cable using the pin-out in Figure 4.1.3.

Note: The supplied flying-leads cable is not flight-test rated. Flight-test-rated flying lead cables can be ordered from Scanivalve.

MPSTCU Power/Ethernet Connection		
	MPS Power	Heater Power
Connector	M12 Series, 17 Contact	
Power Supply	See MPS4200 Power Connection Table	20 to 30VDC
Power Consumption	See MPS4200 Power Connection Table	45W

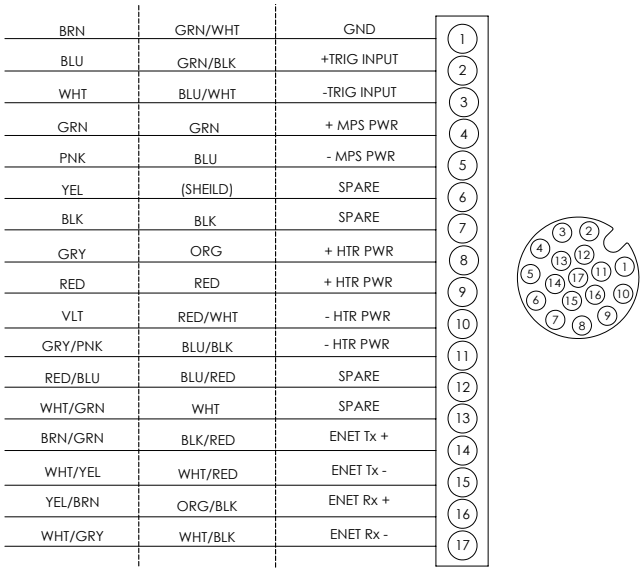


FIGURE 4.1.3: MPSTCU M12 PIN-OUT

Colors noted in figure 4.1.3 are:
Left Column: Standard accessory flying leads cable (Black)
Center Column: Flight test rated flying leads cable (Orange)
Right Column: Pin Assignment

If an MPSTCU is equipped with an internal heater, both heater power pins (±HTR PWR) must be used to support the maximum possible current draw. It is acceptable to bifurcate the DC power cable so that both heater pins are energized (e.g., DC+ to pins 8 & 9 and DC-/RTN to pins 10 & 11).

Note: the MPS module power (MPS PWR) is isolated and applies only to the internal MPS4200.

4.2 PNEUMATIC CONNECTIONS

This section describes how to connect the pneumatic lines for MPS Series modules, with emphasis on proper routing, cleanliness, and pressure control to ensure accurate measurements and reliable operation. Before connecting any pneumatic lines, review "Section 3: Safety and Setup" on page 16. Verify that all tubing, manifolds, and fittings are clean, rated for the intended pressure range, and compatible with the media in use. Contamination, leaks, or over-pressure can introduce significant measurement error, reduce stability, or permanently damage internal components.

4.2.1 Installation Practices and Safety

Proper pneumatic installation is essential for equipment protection, operator safety, and stable long-term measurements. All tubing, fittings, manifolds, and accessories must be rated for the maximum expected pressure, temperature, and media. Components should be clean and dry before installation, and when possible, purge lines with clean, dry gas to remove particulates or moisture before connection.

All pneumatic interfaces on MPS4200 and MPSTCU modules use stainless-steel bulged tubulations with outer diameters of 0.063", 0.042", or 0.031". These tubulations are designed for tight-fit plastic tubing installed directly over the tube OD. For low-pressure connections (50 psi and below), the tubing may be simply pushed over the tubulation to create a seal. For high-pressure applications, urethane or vinyl tubing should be secured with a helical spring clamp positioned at the apex of the tubulation bulge to prevent slippage and leaks.

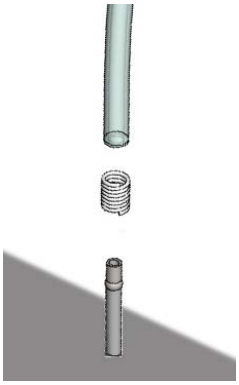


Figure 4.2.1: Tubulation connection with helical spring clamp

Compatible tubing, clamps, tools, and accessories are available in the Scanivalve Pneumatic Accessory Catalog.

4.2.2 Port Definition and Function

Each module includes several pneumatic ports depending on configuration. Understanding the purpose and limitations of each port is critical to proper installation and safe operation. Port locations are physically labeled on the module and shown in "Section 2: Specifications", dimensional drawings.

4.2.3 Pressure Measurement (Px) Ports

Each MPS4200 module includes multiple Px input ports, each connected to a discrete internal transducer. These ports are the primary pressure measurement inputs. Unused Px ports should be capped or covered to prevent dust, debris, or moisture from entering the internal manifold, which can contaminate the calibration valve or cause sensor drift.

MPS4200 Px ports are supplied as 0.042" OD tubulations, with optional input headers available in 0.031" OD. MPSTCU modules use 0.063" OD tubulations for Px ports, with optional 0.042" and 0.031" OD variants.

4.2.4 Reference (REF) Port

The REF port provides input to the internal cavity that connects the negative side of all transducers. For low-pressure applications (below 15 psi), the REF port should be routed to a stable static location such as a wind tunnel static port, static barrel, or aircraft static system. This ensures that reference pressure remains stable and prevents unwanted offsets during measurement.

Positive pressures may also be applied to the REF port to perform the negative portion of a calibration. When using elevated reference pressures, the REF port must not exceed 50 psig or the sensor over-pressure rating, whichever is lower. All MPS modules use a 0.063" OD tubulation for the REF port.

4.2.5 Calibration (CAL) Port

MPS4264 and MPSTCU Only

The CAL port allows a known calibration pressure to be applied and manifolded to the positive side of all transducers of the associated pressure range. During normal measurement operation, the CAL port is internally isolated. It becomes active only when the internal calibration valve is placed in Calibration Mode.

For low-pressure modules (below 15 psi), the CAL port should be routed to a stable static location whenever not in use. It is generally recommended that CAL and REF be routed to the same static reference to ensure accurate pneumatic zeroing (CALZ). All CAL ports use a 0.063" OD tubulation.

4.2.6 Purge (PRG) Ports

MPS4264 and MPSTCU Only

The PRG port supplies purge pressure used to clear Px lines of moisture or contaminants. Purge pressure must always be clean, dry instrument-grade air or nitrogen. The module must be placed in Calibration/Purge Mode for purge flow to reach the Px lines, which is accomplished by applying control pressure to the CAL-PRG CTL port.

Purge pressure may be as high as 75 psi. Purge requirements vary depending on system tubing volume, contamination levels, and test pressures. Recommended purge pressures are summarized below:

Module Pressure Range	Recommended Purge Pressure
4" H_2O to 10"H_2O	1 to 3 PSI
15"H_2O to 2 PSI	3 to 10 PSI
2.5 PSI to 15 PSI	15 to 50 PSI
20+ PSI	50 to 75 PSI

All PRG ports use a 0.063" OD tubulation.

4.2.7 Calibrate Mode Control (CAL PRG CTL) Port

MPS4264 and MPSTCU Only
This port will not be available with EPx configurations.

The CAL PRG CTL control pressure input is used to shift the internal calibration valves into Calibration/Purge mode. For more information on Valve states, see "5.11 Valve State Operation".

The maximum input pressure for the CAL-PRG CTL input is 120psi. The minimum pressure required for NPx modules is 90psi. Pressure must be applied continuously for the valve state to be maintained in CAL PRG mode.

The minimum pressure required for CPx modules is 60psi. Pressure must only be applied for a few seconds to transition the valve into the CAL PRG state. Pressure does not need to be applied continuously.

Clean, dry instrument grade air or nitrogen should be used. All MPS modules and configurations use 0.063" OD tubulations for this port.

4.2.8 Measurement Mode Control (Px CTL) Port

MPS4264 and MPSTCU Only
This port is not available with NPx or EPx configurations

The Px CTL control pressure input is used to shift the internal calibration valve into the Measurement mode. I For more information on Valve states, see "5.11 Valve State Operation".

The maximum input pressure for the Px CTL input is 120psi.

To actuate or cycle the valve 60-120psi is recommended. Pressure does not need to be continuously applied to hold the valve in measurement mode, only applied for a few seconds.

Clean, dry instrument grade air or nitrogen should be used. All MPS modules and configurations use 0.063" OD tubulations for this port.

4.2.9 Removable Pressure Input Headers

All MPS4200 and MPSTCU pneumatic connections are made through one or more removable input headers. MPS4200 headers are secured using #1-72 screws accessible with a 1/16" hex wrench. The O-rings within the header cavity should remain clean, properly seated, and undamaged; replacements and spare headers are available separately.

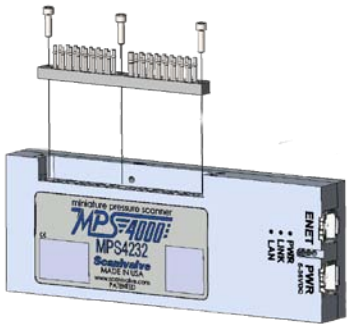


Figure 4.2.9.1: MPS4232 Removable Input Header

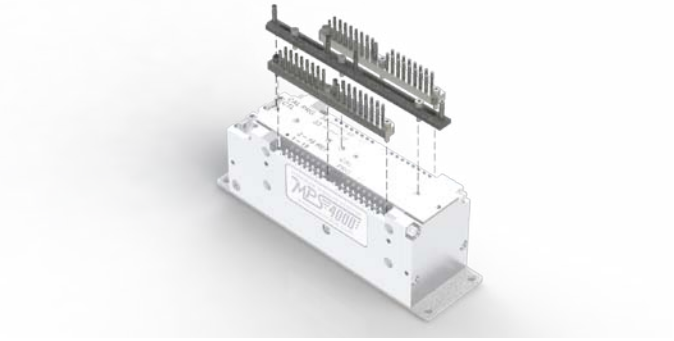


Figure 4.2.9.2: MPS4264 Removable Input Headers

The MPSTCU uses a single 70MPS series male connector. This threaded connector uses a brass gascage (brass "cage" with housed O-Rings) to isolate and seal all pneumatic ports. It may be hand-tightened and then snugged an additional 1/4 to 1/2 turn using the supplied spanner wrench to ensure proper sealing.

SECTION 5: OPERATION

This section explains how to connect to the MPS, configure scan behavior, trigger and synchronize acquisitions, choose data output methods, and perform calibration/purge workflows. Valve actuation (for Calibration/Purge modes) applies to MPS4264 modules (including MPSTCU).

5.1 Warm-Up

Because of the design of the MPS, measurement accuracy is only minimally impacted during initial warm-up after power-on. In a 25 °C ambient environment, the module may take up to 3 hours to reach full thermal equilibrium; however, the pressure readings remain very good throughout this period. As illustrated in Figure 5.1, a representative 5 psi module was powered on and three channels were monitored along with the internal module temperature. The only noticeable change in pressure occurs during approximately the first 15 minutes after power-up; beyond that, residual drift is small and continues to settle gradually toward equilibrium.

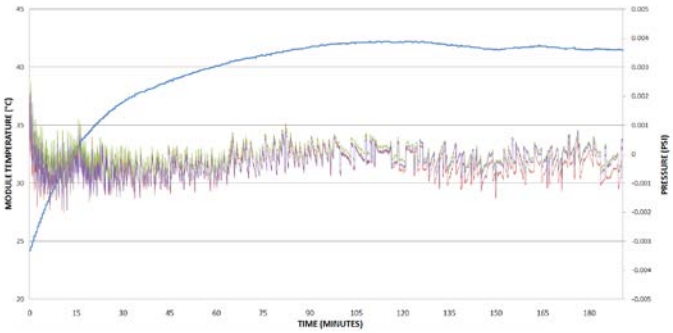


Figure 5.1: Temperature & Pressure Through Module Warm-up

It is recommended to allow 15–30 minutes of warm-up before collecting data; this is not mandatory, and data collection can begin sooner when required. When time allows, extending warm-up to 60 minutes is advisable for most applications to further reduce drift, especially for long acquisitions or low-range measurements. For tests that experience ambient temperature changes (e.g., > 5 °C), consider performing a Quick Zero (CALZ) after the temperature stabilizes to remove any small zero offsets - see "5.10.1 Zero Offset Calibration (CALZ)".

5.2 Communications

The MPS4200 communicates primarily over Ethernet, which supports all normal operation including configuration, scanning, data transfer, firmware updates, and access to the embedded Web Server. Ethernet should be used for all standard workflows.

A secondary RS-232 serial interface is available for maintenance and recovery tasks. Serial communication is not intended for pressure data collection and should only be used when Ethernet is unavailable or when the module requires configuration changes.

Connector pin-outs and mechanical details for both interfaces are provided in Section 4: Hardware.

5.2.1 Serial Communications

Every MPS4200 includes an RS-232 serial interface through the Power/Serial/Trigger connector. This interface is intended solely for:

- Viewing or modifying the module's IP address
- Low-level configuration
- Troubleshooting and diagnostics

Serial communication can not be used for scanning or data retrieval. Default serial settings are:

- 9600 baud
- 8 data bits
- No parity
- 1 stop bit
- No flow control

A serial and Ethernet session may be active simultaneously.

5.2.2 Ethernet Communications

Ethernet is the primary interface for the MPS4200 and supports all operational functions. The module includes a 100Base-T Ethernet port with MDIX auto-crossing, allowing the use of standard network cables.

For best performance, use shielded Category 5e or better cabling. The supplied Ethernet extender cable allows connection to a standard RJ45 patch cable.

The MPS uses static IPv4 addressing. Details on configuring the IP address and verifying communication are provided in Section 5.3 (Ethernet Setup). Once the host and module are on a compatible network, communication can be verified by:

- Pinging the module
- Opening the embedded Web Server
- Connecting via Telnet and issuing a basic query

The MPS4200 uses TCP as the primary interface for configuration, command execution, and scan control. All

configuration variables, system commands, and operational controls are accessed through a TCP session, either via Telnet or through the embedded Web Server interface. Data output may be sent through TCP, FTP, or UDP, depending on the selected configuration. Configuration and data display are also possible through HTTP using the embedded Web Server, although the Web Server does not expose a formal API.

5.3 Network Configuration

The MPS4200 uses static IPv4 addressing for all Ethernet communication. Before establishing a connection, the host computer and the MPS must be configured with compatible IP addresses. This section describes the MPS address format, how to determine compatibility, and the basic steps for updating the IP address if necessary.

5.3.1 Factory Default IP Address

Each MPS4200 is shipped with a unique static IPv4 address in the following format:

191.30.yy.xxx

Where:

- **191.30** is reserved for Scanivalve products
- **yy** = device family code
  - **90** = MPS4264 Gen1
  - **94** = MPS4264 Gen2
  - **95** = MPS4232
  - **96** = MPS4216
- **xxx** = last three digits of the module's serial number

Example:
A MPS4232 with serial number 147 would have a default IP address of 191.30.95.147.

5.3.2 Subnet Compatibility

To communicate with the MPS, the host computer must be configured on the same subnet. Compatibility is determined by the subnet mask. A subnet mask defines which parts of the IP address must match between devices.

Examples:

Subnet	Host IP	MPS IP	Compatible?
255.255.255.0	191.30.95.90	191.30.95.1	**Yes**
255.255.0.0	191.30.95.90	191.30.90.1	**Yes**
255.255.255.0	191.30.96.1	191.30.95.9	**No**

If the two devices do not share compatible IPs, you may either change the host computer's IP or change the MPS IP address. Either option is acceptable.

5.3.3 Changing the Host IP Computer's IP Address

The host PC's IP address can be changed using standard operating system network settings. This may require administrative rights. The current IP configuration can be viewed in Windows using Command Prompt and the command:

ipconfig

Computers may have multiple network interfaces, as well as multiple Ethernet interfaces. Ensure you review the correct one per your computer configuration.

The procedure for changing a host computer's IP address varies by operating system. Refer to your OS documentation or search online for instructions appropriate to your system.

5.3.4 Changing the MPS IP Address

If changing the host IP is not possible or practical, the MPS's IP address can be changed by modifying the **IPADD** variable in the IP variable group **LIST IP**.

Changing the IP value requires:

1. An existing Ethernet connection or a serial connection
2. Setting the IP address by following the command syntax and using a compatible IP for the network
3. Issuing the command: **SAVE IP**
4. Power cycling the module for changes to take effect

If Ethernet communication cannot be established due to an unknown IP address, a serial connection provides a reliable fallback for modifying or viewing the IP settings.

See "6.5 Changing the IP Address" for exact steps on changing the IP address.

5.3.5 Verifying Communication

Once the host and MPS addresses are compatible, communication can be verified using any of the following:

- Ping the MPS IP address (Windows Command Prompt)
- Open the embedded Web Server in a supported browser using the IP address (does not require internet access)
- Connect via Telnet and send a basic **STATUS** command (using ScanTel or similar client software)

Note: anti-virus and firewall programs can block traffic to unknown or new devices. If unable to communicate properly with the device, temporarily disable these and check again.

5.4 Software Operation

Once Ethernet communication has been established, the MPS4200 can be operated through several software interfaces. All configuration, command execution, and scan control are performed using TCP, either through the embedded Web Server, ScanTel, a Telnet client, or a custom TCP application. These interfaces allow users to configure variables, initiate scans, access diagnostics, and manage module behavior.

Note: Detailed command syntax, variable lists, and data/packet formats are documented in "Section 7: Software".

5.4.1 Choosing the Right Interface

The MPS4200 provides several software interfaces for configuration and data acquisition. The summary below outlines when to use each method.

- **Web Server**: Easiest interactive control with most functionality. Recommended for general use and configuration.
- **ScanTel**: Fastest non-Web option; ideal for quick operation, basic data collection, and troubleshooting.
- **TCP Client**: Full command and configuration access. Required for automation or programmatic control.
- **LabVIEW Environment**: Common DAQ environment with example VIs and tools available for easy integration.
- **Terminal Emulators**: Useful for simple configuration and diagnostics; best for serial access or troubleshooting.

5.4.2 Scanivalve Web Server (SWS)

The Scanivalve Web Server (SWS) provides full access to module configuration and operational controls through a browser-based interface (Google Chrome and Microsoft Edge are supported). Using SWS, users can view and modify configuration variables, monitor live pressures and temperatures, start and stop scans, issue commands via an integrated terminal window, upload firmware and coefficient files, and access system diagnostics.

Access: Navigate to http://<MPS-IP-address> (no internet connection is required).

Important: Some browsers may automatically redirect to HTTPS. The MPS4200 supports HTTP only. If redirected, update the URL to begin with http://.

Shared UI platform: SWS is a shared Scanivalve GUI platform used across multiple products. Interface elements may vary slightly by model (e.g., valve-related indicators/controls may be shown for MPS4264/MPSTCU units but not for MPS4216/4232).

For page-level UI details, screen elements, and workflows, refer to the Scanivalve Web Server (SWS) Guide, which is distributed with each product that supports SWS.

Note: The Web Server is intended for interactive use and does not expose a programmatic API. For automation, use a TCP client as described in "5.4.4 TCP/IP Clients".

5.4.3 ScanTel Utility

ScanTel (PN 155406-01) is a free Scanivalve Windows utility for direct communication with a single module. It is the fastest way to operate the MPS when not using the Web Server and not writing a custom client. ScanTel supports TCP and UDP and provides command-line configuration, real-time monitoring, data capture, and troubleshooting tools. It's ideal for validating connectivity, exploring variables/commands, or basic data collection.

ScanTel is commonly recommended when writing custom software as a validation tool. It is also commonly used as a tool to convert raw binary data from scanners to an ASCII readable format.

5.4.4 TCP/IP Clients

Any software capable of opening a TCP socket can control and operate the MPS4200, including custom applications, LabVIEW programs, Python and MATLAB scripts, and third-party DAQ systems. TCP is the primary protocol for configuration and function control, including scan execution.

For some programming languages, Telnet type libraries or toolboxes can expedite the process of communications with the MPS module, as Scanivalve devices are very basic Telnet servers.

Note: Command sets, variable groups (e.g., LIST categories), and response formats are specified in "Section 7: Software"l.

5.4.5 LabVIEW Tools

Scanivalve provides free LabVIEW utilities and example VIs designed specifically for the MPS series. These tools use TCP to control the module and allow the user to configure modules, scan and collect data, display data in real-time, convert binary data to ASCII format for display or storage, or can help integrate the MPS into an existing LabVIEW environment.

5.4.6 Terminal Emulator Applications

Terminal applications such as PuTTY, HyperTerminal, ScanTel (5.4.3) or the Web Server's (5.4.2) terminal window

can be used to send manual commands for configuration and diagnostics. This is useful for changing network parameters, formatting memory, or performing low-level checks. Terminal use is typically not intended for routine data acquisition.

PuTTY and Hyperterminal are the recommended programs for serial communication.

5.5 Measurement Operation

Measurement operation consists of setting the sampling parameters (e.g., rate, frames per scan, units), initiating a scan, and managing the module state until scanning is complete. All scan configuration and scan control is performed through TCP, either via the Web Server, ScanTel, or a custom TCP client.

Note: For details on ASCII/Binary packet formats, configurations commands, and programming examples, refer to "Section 7: Software".

5.5.1 Scan Rate (RATE)

The scan rate is controlled by the variable RATE, expressed in Hertz (Hz), where 1 Hz corresponds to one sample per channel per second. The MPS4200 samples all pressure channels synchronously, using one analog-to-digital converter per transducer. Each complete set of sampled pressure values—along with the associated frame number, timestamp, and other metadata—is referred to as a frame.

Example:
If RATE = 10, the MPS4200 collects one frame of data every 0.1 seconds (10 frames per second).

The maximum achievable scan rate depends on the selected data output method and configuration. Refer to Section 2: Specifications, Data Output Rate(s) for details.

Note: Scan Rate and Data Rate are used synonymously. The module samples internally at the RATE setting and outputs data frames at the same rate.

5.5.2 Frames Per Scan (FPS)

The total number of frames produced in a scan is controlled by FPS. FPS is commonly used as a way to scan for a set duration. Once the scan is started, the MPS outputs frames at the configured RATE until one of the following occurs:

- The number of frames reaches the FPS value
- The scan is manually stopped
- A trigger condition ends the scan *(when applicable)*
- The module is powered off

Setting FPS = 0 enables continuous scanning and is common for real-time monitoring or long-duration tests.

Example:
RATE = 10 Hz and FPS = 100: the scan duration lasts 10 seconds. 100 frames of data are output.

RATE = 5 Hz and FPS = 0: the MPS outputs data indefinitely until a STOP command is issued.

Note: using FPS 1 in most cases is not advised. If one frame of data is to be output when requested, see Software Frame Triggering, or TRIG 1.

5.5.3 Scan Data Units (UNITS)

The UNITS variable controls the engineering units for pressure and temperature in the output data. The MPS4200 supports a variety of pressure units, such as PSI, Pascal, Inches of Water, and Bar.

Temperature is always reported in degrees Celsius when an Engineering Unit is set.

Example:
UNITS = PA: Pressure data is output in Pascals and temperatures in °C.

Notes:

- All calibration tables convert from the raw ADC values to PSI. Any EU set that is not PSI is converted from PSI to the set EU value using conversion constants (see Appendix).
- Changing UNITS affects only the formatting of scan output.
- A user value can be used to convert PSI to any value. This is set with USERS <cvt factor>.
- The RAW ADC counts can be output using RAW or RAWC, but this is typically only used for troubleshooting and diagnostics.

5.5.4 Scan Data Format (FORMAT)

The FORMAT variable controls how scan data is presented, transmitted, or logged. FORMAT affects ASCII and binary representation but does not affect the actual numeric values or sampling behavior. Format can be set per the different outputs (Telnet, FTP/UDP, Binary Server), and options include:

- ASCII — human-readable output in CSV, Unformatted column, or VT100 terminal.
- Structured Binary — binary data as defined in the Software & Programming manual.

FORMAT does not determine where data is sent; it determines how the values are encoded. Destination behavior

(e.g., TCP, UDP, FTP) is described in Section 5.8.

5.5.5 Initiating a Scan (SCAN/STOP)

Once the measurement parameters have been configured, the scan is started by issuing a SCAN command over TCP. When SCAN is received, the MPS enters scan mode and begins sampling at the configured RATE. When the scan completes (FPS reached or a STOP command is issued), the MPS returns to ready mode and waits for the next instruction.

Typical behaviors are:

- If FPS > 0, scanning stops automatically once the frame count is reached.
- If FPS = 0, scanning continues until a STOP command is sent.

The data destination must be configured prior to a scan to ensure the data is sent to the correct destination. This could include ASCII via TCP for basic collection, or Binary data via UDP/FTP/TCP for high-speed scanning.

Note: Scan behavior may be influenced by triggering or synchronization methods. See "5.7 Triggering and Synchronization" for more information or alternate methods.

5.5.6 Typical Measurement Workflow

Typical (basic) measurement sequence consists of:

- Configure parameters: RATE, FPS, FORMAT, UNITS
- Verify the output destination (Section 5.8)
- Issue the SCAN command
- Receive or monitor data through the configured output channel
- Issue STOP when finished (FPS = 0) or wait for the scan to complete (FPS > 1).
- (Optional, but Recommended) Perform CALZ between tests (Section 5.x)

This workflow is the same regardless of whether the user operates the MPS via the Web Server, ScanTel, or a custom TCP client.

Alternative sampling, scanning, and synchronization methods can be found in the next section.

5.6 Module Operating States

The MPS operates in a finite set of internal states that define how it responds to commands, triggers, calibration, and data output operations. Understanding these states helps explain why certain actions succeed, are delayed, or are rejected, and is essential when coordinating scans, triggers, calibration, and multi-unit operation.

At any given time, an MPS module is in one primary operating state. Transitions between states occur due to user commands, trigger events, completion of operations, or error conditions. The current state can always be queried with the STATUS command.

Note: Operating states describe functional behavior. They are independent of data output method (TCP, UDP, FTP) and do not change scan rate or data format.

The following table shows an overview on the different states and transitions, which are discussed in the subsequent sections.

State	Purpose	Typical Entry	Typical Exit
READY	Idle or Configuration	Power-up; completion of other states	SCAN; CALZ; CAL/VAL; SAVE
SCAN	Data Acquisition	Scan command; trigger event	FPS met; STOP; Scan trigger event; Error
CALVAL	Calibration or Validation	CAL/VAL Command	STOP; Process completion; Error
CALZ	Zero-offset Calibration	CALZ Command	STOP; process completion
SAVE	Commit Configuration	SAVE command	Write complete
EVALVE	Valve transition state (EPx Only)	EPX, ECAL, EPRG commands	process completion

5.6.1 Power-Up and Initialization

When power is first applied, the module enters an Initialization state. During this time, the internal processor, network interface, sensor electronics, and stored configuration are initialized.

- Network services become available near the end of initialization
- No configurations or functions can occur in this state
- Information is always output via serial as the module boots
- The module transitions automatically to the Ready (Idle) state once initialization is complete.

5.6.2 READY STATE

READY is the default idle state of the module. The module enters READY on power-up after initialization, and returns to READY when scans or calibration activities are completed.

In the Ready state:

- Configuration variables may be viewed or modified
- Scans may be started (immediately or pending triggers)
- Calibration or validation operations may be initiated
- No scan data is being produced.

Most user interaction with the MPS occurs while the module is in the Ready state.

5.6.3 SCAN STATE

The SCAN state indicates that the module is actively performing a scan or is armed for a scan.

In the Scan state:

- All channels are sampled at the configured rate
- Data frames are produced and output via the data output method
- Data output my start immediately or wait for local conditions to be satisfied:
  - Frame trigger (Section 5.7.3)
  - Scan-On-Startup (Section 5.7.5)
  - Time trigger (Section 5.7.7)

The module will exit the scan state when:

- The configured number of frames (FPS) is met
- A stop command is received
- A trigger condition ends the scan
- An error occurs

Most commands are disabled in this state and will report an error if attempted.

5.6.4 CALVAL STATE

The CALVAL state indicates that the module is actively performing a calibration or validation sequence. Upon completion of the process, the module will return to ready.

You can review more about the process in “5.9 Multi-Unit Operation” or “6.8 Field Calibration & Validation Procedure”.

5.6.5 CALZ STATE

CALZ is a short-duration state used exclusively for Zero Offset Calibration. It is a quick operation intended to correct small zero shifts due to temperature changes or environmental effects.

During CALZ:

- The module performs a brief internal scan, averages the values, and stores the values in an array
- No data frames are produced or output

CALZ typically completes within 15 seconds and returns the module to READY automatically.

See ”5.10.1 Zero Offset Calibration (CALZ)” for recommended usage.

5.6.6 SAVE STATE

SAVE is a transient state used when the module writes configuration data, calibration coefficients, or system information to non-volatile memory.

While in save, configuration changes are committed to internal memory. These operations are typically short. Once completed, the module will automatically return to ready.

Note: A module should never be powered off while in save mode.

5.6.7 EVALVE STATE

EVALVE is a notification state used when an EPx module is changing the valve state. When any of the Electric valve commands are used, the MPS will enter this state until the valve transition has completed.

This state is only possible on EPx configured devices.

5.7 TRIGGERING AND SYNCHRONIZATION

The MPS4200 supports multiple triggering and timing options to control when scans begin and when individual frames are released. Triggering allows the module to synchronize data acquisition with external equipment, match test events, or coordinate operation across multiple MPS devices. Synchronization using IEEE-1588 Precision Time Protocol (PTPv2) provides a means to align timestamps and initiate scans at a defined future time.

All triggering modes described in this section apply to scanning behavior only; they do not affect calibration or purge workflows (see “5.10 Calibration and Purge Operations”), or valve actuation (see “5.11 Valve State Operation”).

5.7.1 TRIGGERING OVERVIEW

The MPS4200 can operate using internal or external timing sources to determine:

- When a scan begins or ends
- When an individual frame of data is released

- How device timestamps and internal pacing synchronize with other instruments

The variable TRIG selects the trigger mode. Variables such as RATE, FPS, and SSD/SST (for timed starts) also influence system timing.

Because the MPS internally samples at the RATE, even when using external trigger modes, the internal sampling and output rate must be chosen carefully to avoid dropped frames or timing conflicts.

5.7.2 Internal Triggering (TRIG 0)

In the default mode, all timing is controlled internally.

- The scan begins immediately when the SCAN command is issued.
- Frames are produced at the configured RATE
- Scanning stops once FPS has been met, or a STOP command is issued

Internal triggering is recommended when external synchronization is not required, for slower scanning speeds, or any general use / basic data collection is required.

Note: FPS 1 scans are highly discouraged. Issuing a SCAN command has execution overhead i.e., software entering scan mode and exiting scan mode. If one frame of data is required when commanded or triggered, see "5.7.3 Frame Triggering (TRIG 1)".

5.7.3 Frame Triggering (TRIG 1)

The Frame Trigger mode allows the MPS to release one frame per trigger event. Each hardware trigger pulse or software trigger command results in a single frame of data being output. This mode is useful for synchronizing multiple devices without a PTP infrastructure, coordinating data capture with third-party equipment, or any environment where data is needed on demand.

Frame Trigger Behavior

- The MPS samples internally at RATE (MPS must be in scan mode, executed via command)
- A frame of data is output only when a trigger is received
- Internal timestamps are assigned at the moment the data was sampled
- As long as the MPS is in SCAN mode, it will always be listening for triggers
- MPS will exit scan mode when FPS is met, or STOP command is issued

Setting the Internal Rate

To avoid missed triggers, the internal rate should be set to a value 25% or higher than the expected external trigger rate. For the best timestamp resolution, the internal rate should be 2x the external rate, or set to the maximum rate.

External Hardware Trigger Requirements

- Input Voltage: 4.5 to 15VDC, 6.5mA
- Input provided through Power/Serial/Trigger connector (see section 4)
- Square wave with ~50% duty cycle, with a low state as close to 0VDC as possible.
- Avoid any slow-rising edges or noisy signals
- Set the internal rate appropriately

Software Trigger Requirements

Alternative to an external voltage / hardware setup, frames can be triggered using a software command. Once in SCAN mode:

- Send the TRIG command
- Send the ASCII TAB character (0x09 or Control I)

5.7.4 External Scan Triggering (TRIG 2)

In hardware scan trigger mode, an external voltage input controls when an scan begins and ends. When the trigger input level is high (5–15 VDC, 6.5mA), the MPS enters scan mode and outputs frames at the configured RATE. Scanning stops when:

- The trigger voltage returns to low (<5 VDC)
- The FPS count is reached
- A STOP command is issued
- The module is powered off

External scan triggering is commonly used when the MPS must begin scanning in response to a system-level event, controlled in an environment where software to send the SCAN/STOP command may not be readily available, or to provide a mechanical switch to start/stop data collection.

When TRIG = 2, all functions of "5.7.2 Internal Triggering (TRIG 0)" are still true, meaning the SCAN/STOP commands are still available.

5.7.5 Scan-on-Startup (TRIG 3)

When TRIG = 3, the MPS automatically begins scanning after completing its power-up sequence. This mode is typically used for unattended or embedded installations.

Data output and destination must be configured for FTP or UDP, as these methods do not require an open control connection at scan start.

If the configured FTP server is unavailable at startup, the MPS repeatedly attempts to connect until the server responds, a STOP command is received, or power is removed.

Note: using this method in conjunction with PTPv2 may require additional time to data collection as PTP requires synchronization time (generally 5 or more minutes). Time-stamps may not be accurate during this time frame. If PTP is enabled but no PTP grandmaster is present, the MPS will stop scanning.

5.7.6 Precision Time Protocol (PTPv2) Synchronization

The MPS4200 is compliant with IEEE-1588v2 Precision Time Protocol and supports the following roles:

PTP Disabled (PTPEN 0)

- The module uses its internal clock
- All timing behavior is local to the device
- Timed scan starts (SST/SSD) still work but are based on internal time

PTP Slave (PTPEN 1)

- The MPS synchronizes its internal time to a network PTP Grandmaster (if available)
- Internal timing (RATE) adjusts to maintain phase alignment with PTP.
- Enables synchronized timestamps across multiple devices
- Scan start can be triggered based on a specific date and time.

PTP Master (PTPEN 2)

Modules can be configured as a PTP Master that will act like a PTP Grandmaster, but with limited functionality. The main difference is that a Scanivalve device enabled as a PTP master will not retrieve time from an accurate time source i.e., GPS. The PTP master device will use its internal clock to synchronize other devices.

- The MPS multicasts PTPv2 Sync/Announce packets
- PTP enabled slave devices synchronize to the MPS based on the master's local (naive) time
- Only one PTP Master should exist on the network (no priority / domain control)
- Scan start can be triggered based on a specific date and time.
- Good for simple or small systems where synchronization is required, but synchronization to real time is not necessary.

Time Retrieval and Manual Adjustment

- GETTIME retrieves the current internal time of a module (any PTP setting)
- SETTIME adjusts time when PTP is disabled or when the device acts as a PTP Master

Additional PTP statistics, UTC offset configuration, and diagnostic tools are listed in the"Section 7: Software".

5.7.7 Time Triggered Scan (SSD/SST)

The MPS can start a scan at a precise time in the future using Scan Start Date (SSD) and Scan Start Time (SST). This is ideally used in systems that are PTP synchronized and allows multiple modules to begin a scan at the same time.

Workflow:

1. Configure SSD and SST
2. Issue SCAN (the device will enter SCAN mode but does not output data)
3. Once the internal time reaches SSD+SST, frames begin to output at the configured rate

If SSD/SST are set to a time in the past, relative to the device time, the SCAN command will begin data output immediately.

Note: The PTP synchronized system can be to a true real-time (PTP Grandmaster) or a naive time (Scanivalve PTP master). Set SSD/SST appropriately based on the synchronized systems time.

5.8 Scan Data Output Methods

After a scan has been started, the MPS4200 will output data using TCP, FTP, or UDP, depending on user configuration. Data output may be formatted in ASCII or Binary format via TCP and FTP, or as Binary via UDP. All data output methods use the same packet structure; only the transport method differs.

TCP can deliver ASCII data via the Telnet interface or binary data through the Binary Server (port 503). The ASCII interface supports full two-way communication for configuration and control, while the Binary Server supports high-speed data output and limited start/stop control. FTP and UDP are output-only transports and do not accept configuration or control commands.

Packet structures, binary formats, buffer information, and parsing details are provided in the "Section 7: Software".

5.8.1 Overview of Output Behavior

The MPS4200 always samples internally at the configured RATE, producing one frame of data per sample cycle. Once a scan has begun, frames are delivered to the selected output method(s).

Output method selection does not affect measurement timing or sample rate; it determines only how and where frames are delivered.

The data output method used depends on applicational needs:

- **TCP ASCII** -- Human-readable, easy to verify; ideal for troubleshooting and low-rate monitoring
- **TCP Binary** -- High-throughput, structured, and reliable; best for automation of programmatic acquisition
- **UDP Binary** -- Low-latency; good for real-time displays or broadcasting
- **FTP Output** -- best for long-duration data, archival, or reliable unattended operation

5.8.2 TCP ASCII OUTPUT

The standard TCP/Telnet interface provides human-readable ASCII data output and also supports full two-way communication for scan control and configuration. ASCII formatting is controlled by the FORMAT variable and supports:

- Unformatted ASCII (A): basic columnar output
- VT100 formatted (F): screen-updating terminal display
- CSV (C): comma-separated ASCII suitable for logging or parsing

TCP ASCII output is useful for:

- Quick functional checks
- Low-rate or simple data collection
- Displaying data in terminal applications
- Debugging or inspecting variable changes in real time

It is the simplest and most transparent way to observe live data frames without parsing binary packets, and can also be used for simple operation and slower-rate data collection.

5.8.3 TCP BINARY OUTPUT

The TCP Binary Server interface provides structured binary data output at all available scan rates. Because it uses a consistent binary format, it is the preferred method for high-speed or automated data acquisition. This interface provides reliable, real-time delivery of binary frames and allows the user to achieve the maximum scan rates supported by the module.

Key characteristics:

- The Binary Server listens for incoming connections on TCP port 503
- Only one client connection can receive data at a time
- If a second client connects to port 503, the new connection becomes the active receiver
- Binary packet structure is consistent

Although all configuration and variable management must be performed through the Telnet (ASCII) server on port 23, the Binary Server supports basic scan control. Sending the binary representation of the integer 1 to port 503 will start a scan, and sending the integer 0 will stop a scan. These start/stop commands are optional and operate in addition to all scan methods available over the Telnet interface, including TRIG-based and Telnet-based scan control.

5.8.4 UDP DATA OUTPUT

UDP provides a lightweight, low-latency method of receiving binary scan data. It supports both unicast and multicast addressing and is useful for real-time visualization or distribution to multiple receiving systems. Important characteristics:

- Binary-only output
- Packet structure is identical to TCP Binary and FTP
- UDP is output-only; the MPS does not accept or respond to UDP commands
- Lower latency, but packet delivery is not guaranteed
- Supports multiple listeners via multicast
- Can be used with Scan-On-Startup (“5.7.5 Scan-on-Startup (TRIG 3)”)

5.8.4 FTP DATA OUTPUT

FTP provides a reliable method for logging long-duration or unattended tests. The MPS4200 writes data directly to a configured FTP server or NAS device in either ASCII or Binary format.

When FTP data output is configured:

1. The MPS attempts a connection to the FTP server when a scan is initiated
2. Attempts to create a new file using the naming format with current time/date (internal time of module)
3. Writes each frame to the file as its sampled
4. Closes the file when the scan stops

During the initial connection attempt, the connection is negotiated, often with user and password requirements, and creating the file. If any of these are to fail, the module will return to ready and report an error.

FTP uses the TCP transport layer, which guarantees packets and data in order. FTP is a good alternative to TCP as FTP servers are often simple to setup and maintain. It is ideal for long duration scans and data collection in environments where a connection to the MPS may not be available (when used in conjunction with Scan triggering or Scan-On-Startup).

5.9 MULTI-UNIT OPERATION

Multiple Unit Operation provides a simple mechanism for coordinating scan start, scan stop, and calibration/

validation actions across more than one MPS module. This feature allows a single module to notify other modules when a coordinated operation should begin or end, reducing operator workload in multi-scanner systems.

Multiple Unit Operation does not provide centralized configuration. All module configuration (network settings, scan parameters, trigger settings, output destinations, and calibration setup) must be performed individually on each module prior to using multiple unit commands.

5.9.2 Cluster Concept

A cluster is a group of MPS modules configured to listen for coordinated commands. When an operator connects to one module and issues a multiple unit command, that module acts as the command source and forwards the command to the other cluster members.

- Any MPS module may act as the command source
- There is no fixed master or slave designation
- Roles are determined by which module the user connects to for a given operation

5.9.3 Cluster Formation (Multicast)

Multiple Unit Operation uses Ethernet multicast addressing to identify cluster membership.

- All modules with the same multicast address are members of the same cluster
- Modules with different multicast addresses are not part of the same cluster
- Multiple independent clusters may exist on the same network
- Valid multicast addresses are in the range: 224.0.0.0 through 239.255.255.255
- The command MFIND can be used to verify or validate the cluster

5.9.4 Coordinated Scan Control

Once cluster membership is configured, a single start command can be used to initiate scanning on all cluster members (MSCAN). Similarly, a single stop command can be used to halt scanning on all members (MSTOP).
Important behavior notes:

- Each module still evaluates its local conditions
- Scan start may occur immediately or be delayed based on:
  - TRIG configuration
  - External trigger inputs
  - SSD/SST (timed start)
- A coordinated stop command terminates scanning immediately on all modules

Multiple Unit Operation ensures that all modules receive the same start/stop instruction, but each module controls when it actually transitions based on its configuration (see Section 5.7).

5.9.6 Coordinated Calibration or Validation

Where supported by the module configuration, a single calibration or validation command may be forwarded to all modules in a cluster (MCAL/MVAL/MCALVAL). This allows operators to initiate calibration or validation sequences on multiple units simultaneously.

This behavior is still governed by:

- Each module's calibration settings
- Each module's valve configuration
- Local pneumatic routing

Refer to "5.10 Calibration and Purge Operations" and "5.11 Valve State Operation" for details on applicable workflows.

5.9.5 Limitations and Best Practices

- Ensure all modules are fully configured individually before using multiple unit commands
- Confirm cluster membership before issuing commands (MFIND)
- Use consistent scan and trigger settings across all modules for synchronized behavior
- Multiple Unit Operation does not synchronize data output; each module outputs data independently

5.10 Calibration and Purge Operations

Calibration and purge operations help maintain measurement accuracy and pneumatic integrity, particularly in low-pressure applications or environments where tubing may accumulate moisture or contaminants. The type of calibration and purge capabilities available depends on the MPS model configuration.

- MPS4216 and MPS4232 do not include internal calibration valves and therefore must be calibrated in a "wind-off" condition using different input headers. Purging must be performed from the header and cannot be used through the module.
- MPS4264 include internal pneumatic valve systems that support automated calibration and purge workflows. Valve actuation is described in "5.11 Valve State Operation". This also applies to MPS4264 modules mounted in an MPSTCU.

Calibration and purge operations do not affect sampling rate or output behavior.

5.10.1 Zero Offset Calibration (CALZ)

Zero Offset Calibration, or CALZ, provides a quick means of correcting minor zero drift inherent to piezoresistive sensors. CALZ adjusts the internal zero reference used for

converting raw sensor values to engineering units. A CALZ operation typically completes in under 15 seconds and does not require external pressure sources unless specified by the application.

MPS4216 and MPS4232
Due to a lack of internal valving, these modules must be in a true zero-differential state (often referred to as "wind-off") when a CALZ is performed. All Px input should be unpressurized and open to the same static environment as the REF port.

MPS4264 (including MPSTCU)
CALZ may be performed in either Measurement mode or Calibration/Purge mode.

- Performing the CALZ in measurement mode must follow the same guidelines as the MPS4216/ MPS4232 for a "wind-off" condition.
- For on-condition CALZs, placing the module into Calibration mode prior to the CALZ is ideal. It is best practice to route the REF and CAL ports to the same stable, static reference (as the application allows) which will provide a true zero-differential pressure across the module , and block any pressure at the Px Inputs. Valve operation is provided in "5.11 Valve State Operation".

When to Perform a CALZ

- At a minimum, once daily stable temperature environment
- After any temperature change greater than ±5°C
- After initial system power-on/warm-up (see "5.1 Warm-Up")
- Between test runs (or scans) when maximum accuracy is required
- Whenever the REF or CAL pneumatic routing has changed

CALZ correct the zero point only. It does not alter span, linearity, or temperature compensation coefficients.

5.10.2 Field Calibration & Validation

Field Calibration and Validation provide practical ways to maintain measurement accuracy over time using known, traceable pressures at the module's current operating temperature. Unlike factory "Full" calibration, Field calibration does not require an environmental chamber and is optimized for on-site upkeep of accuracy with minimal disruption.

During a Field Calibration, the module measures a series of applied pressures and generates a set of Field coefficients, which act as a correction to the factory master calibration table. A Field Validation checks the module's performance by comparing measured pressures to the applied standard and calculating the error. Field coefficients may be enabled or disabled without altering the factory calibration.

Module Capabilities

- MPS4216 and MPS4232: No internal calibration valves. Calibration pressure must be applied directly to the all Px and REF inputs, or with the use of the MPS Calibration Header.
- MPS4264 (and TCU): Internal valve supports calibration mode, where one pressure can be applied to all sensors (CAL for positive, REF for negative). This also allows the MPS4264 to be field calibration in-situ.

Recommended Use
Scanivalve recommends that validations (including Field) are peformed every 6 months and calibrated as needed. Field calibrations can also be performed anytime the module is used in a new environment or prior to testing.

Field Calibrations do not replace the factory calibration, but supplement it. For complete recalibration over temperature, it is recommended to return the module to the nearest capable facility, or to the Scanivalve factory, for a full calibration.

Note: field calibrations and validation processes are embedded in the MPS4200 memory and does not require any special software or programs. Field calibration and validation procedures, command sequences, and automation details can be found in "Section 7: Software".

5.10.3 Purge Operation

Purging is used to remove moisture, condensation, or particulate contamination from the Px input lines in order to maintain pneumatic integrity and ensure stable pressure measurements. Purging is especially useful in humid environments, outdoor installations, or systems with long or complex tubing paths.

Purge capability depends on the module configuration:

- MPS4216 and MPS4232: These modules do not include internal valves for purging. Any purging of input lines must be performed externally by disconnecting the input header and using a purge adaptor.
- MPS4264 (and TCU): These modules support integrated purge using the PRG port (one per bank of 32 channels) when the device is placed into Calibration/ Purge mode. Valve actuation behavior is described in "5.11 Valve State Operation".

Typical Purge Sequences
The following steps can be used for typical purge operation in the MPS4264 and TCU:

1. Place the module into Calibration/Purge mode (see "5.11 Valve State Operation").
2. Apply purge pressure to the PRG ports.
3. Maintain purge flow long enough to flush moisture or contaminants from all Px input lines.
4. Vent the purge pressure.
5. Return the module to Measurement mode (see "5.11 Valve State Operation").
6. Allow the pneumatic system to stabilize ie., allow any pressures to disperse, before starting data collection.

The following steps could be used for a typical purge with the MPS4216 and MPS4232:

1. Disconnect the removable Px Input header and connect it to the appropriate purge adaptor.
2. Apply purge pressure to the PRG ports.
3. Maintain purge flow long enough to flush moisture or contaminants from all Px input lines.
4. Vent the purge pressure.
5. Disconnect the Px input header from the purge adaptor and reconnect to the MPS.

Note: this procedure can also be used with the MPS4264 and MPSTCU if a higher purge is required (purge pressure over 75PSI). See the Scanivalve Pneumatic Accessory catalog for MPS purge adaptors.

Purge Pressures

Recommended purge pressures for each pressure-range configuration are provided in Section 4, under the PRG Port description. These values are specific to the MPS4264 where purge pressure travels through the module. For manual purging with MPS4216/4232, purge pressures can be adjusted per the application.

Purging Best Practices

- Verify correct tubing routing and PRG connections prior to applying pressure.
- Confirm downstream venting is adequate to avoid back-pressure effects.
- After purging, allow the module and pneumatic system to stabilize before data collection, and perform a CALZ if possible.
- For systems with long tubing or significant volume, additional purge durations may be required (recommended over short, high pressure purges).

5.11 Valve State Operation

The MPS4264 includes an internal pneumatic valve system that allows for pressure to be rerouted for calibration and purge workflows. The valve system allows the module to switch between Measurement Mode and Calibration/Purge Mode, controlling the pneumatic pathways connected to the Px, CAL, and PRG ports.

Valve operation does not affect the module's sampling behavior, scan rate, or data output method. It only determines how pressures are routed internally.

Only modules configured with an internal valve mechanism (CPx, NPx, or EPx) support valve state changes. This includes MPS modules mounted in an MPSTCU package. The MPS4216 and MPS4232 do not include valve systems and always operate in Measurement Mode.

5.11.1 Valve Modes

The internal valve supports two functional pneumatic modes: Measurement Mode and Calibration/Purge mode.

Measurement Mode

Each pressure transducer is connected individually to its corresponding Px input. The CAL and PRG ports are internally isolated. This mode is used for all normal data acquisition.

Calibration/Purge Mode

The positive side of all transducers is manifolded internally and connected to the CAL port. All Px input lines are manifolded internally and connected to the PRG port. Used for applying calibration pressures (via CAL) or purging Px lines (via PRG).

The REF port is unaffected by any valve operation.

5.11.2 Actuation Types (CPx, NPx, EPx)

The MPS4264 supports three valve actuation types. The actuation type determines how the internal valve changes state, but not the pneumatic routing itself.

CPx — Pneumatic, Latching

Uses two pneumatic control inputs:

- CAL-PRG CTL: Places the module into Calibration/Purge Mode)
- Px CTL: Places the module to Measurement Mode

CPx modules require 60–120 psi clean, dry air or nitrogen for control pressure. The valve is 'latching': a short application of control pressure (typically 2–4 seconds) is sufficient in low-vibration environments. In high-vibration environments, continuous pressure may be required to maintain the valve state.

NPx — Pneumatic, Non-Latching

Uses a single pneumatic control input (CAL-PRG CTL) to enter and hold Calibration/Purge Mode.

NPx modules require continuous 90–120 psi pressure to remain in Calibration/Purge Mode. Removing control pressure returns the module to Measurement Mode.

EPx — Electrically Actuated
Valve actuation is performed electronically with no pneumatic control ports. Mode changes are performed through software or the Web Server interface. Intended for applications where pneumatic control pressure is not available or desired.

5.11.3 How Valve State Affects Pneumatic Routing

The valve determines which ports are active in the different mode.

In Measurement Mode:

- Px inputs are directly connected to the transducers (individually isolated)
- CAL is blocked
- PRG is blocked
- REF is open to the negative side of all transducers

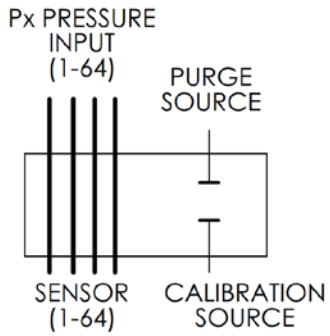


FIGURE 5.11.3.1: MEASUREMENT MODE

In Calibration/Purge Mode:

- CAL pressure is routed to the positive side of all transducers
- PRG pressure is routed to all Px lines (on PRG port per 32 channel banks)
- REF is open to the negative side of all transducers

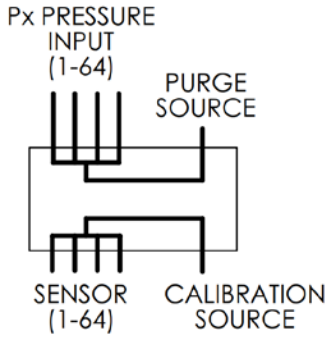


FIGURE 5.11.3.2: CALIBRATION MODE

5.11.4 Valve Related References

- Basic valve state information can be found in Section 2.
- Port definitions and tubulation sizes for Px, CAL, REF, PRG, CAL-PRG CTL, and Px CTL are provided in Section 4.2.
- Procedures and command syntax for changing valve states can be found in “Section 7: Software”.
- Calibration operations (CALZ, Field Calibration) can be found in “5.10 Calibration and Purge Operations”.
- Purge operation can be found in Section “5.10.3 Purge Operation”.

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SECTION 6: MAINTENANCE

6.1 QUICK TROUBLESHOOTING GUIDE

This section provides practical steps for diagnosing common issues with MPS series modules. Most problems fall into four categories: network communication, scan configuration, data output configuration, or pneumatic connections. This section is designed to help users quickly identify symptoms, understand likely causes, and apply corrective actions

Symptom	Most Likely Cause(s)	What to Check / Do
Cannot connect to module over Ethernet	No Power or Ethernet connection; IP Mismatch; Subnet Mismatch; Firewall/Antivirus	Verify power and Ethernet are connected (Power and Link lights are on). Verify host and MPS IP addresses are in the same subnet. Disable firewall/antivirus temporarily. Attempt to ping the module after any change to validate connection ability.
Web Server (SWS) doesn't load	Invalid Ethernet connection (see above); Browser forced HTTPS	Check Ethernet connection (above). Ensure URL starts with http://<ipaddr> Clear redirect in browser.
Telnet connection refused	Wrong IP or blocked port 23	Check Ethernet Connection. Verify correct IP address (use serial for extra validation) Ensure port 23 is not blocked (firewall/ antivirus).
Scan wont start / no data	Triggering is enabled; PTP is enabled but no valid Grand-master; Invalid or unexpected data destination settings	Check TRIG setting under LIST S. Check PTP is enabled, and a PTP Grandmaster is on the network (confirm with Wireshark). Check LIST S, FTP, and UDP and validated settings and destination selection.
No data on port 503	Binary client not established before scan; Second connection is active; Incorrect binary scan command	Connection must be made to port 503 prior to the SCAN command. May be a secondary connection and data is being sent there. If using binary server scan/stop, ensure it is a binary representation. Test with Telnet SCAN/STOP commands.
No data via UDP	Unresponsive receiver; Bad IGMP settings; Firewall/antivirus blocking unknown UDP data; Confirm scan started	Check that UDP receiver is present or has joined the multicast group (if destination is multicast). Check network switch for IGMP settings. Temporarily disable firmware/antivirus. Check LIST UDP settings are enabled and correct.
No data via FTP	Credential are incorrect; Path does not exist or lacks permissions; FTP server is unreachable; Firewall issues	Check all settings in LIST FTP are correct per the FTP server configuration. Use Wireshark to monitor port 21 to see connection information for clues. Temporarily disable any firewalls as they may block unknown FTP data.

External trigger not detected	Wrong voltage level or wiring; Incorrect TRIG setting	Ensure triggering voltage is 5-15VDC. Check wiring to trigger input. Ensure that enough power is provided (6.5mA minimum) -- in many cases, current availability is not high enough to drive multiple devices. Check TRIG setting.
Data looks noisy or offset	Bad or no CALZ; Major thermal change; Pneumatic leak; Noisy or bad reference environment; Bad power or cabling	Perform a CALZ to see if data is corrected. Allow time for thermal changes, then perform CALZ. Perform basic leak checks on channel(s) Check or treat REF location/plumbing. Change power supply, location, or cabling.
Data is 9999	Pressure is beyond measuring range (overpressure); Temperature is beyond measurement range; Missing or corrupted coefficients; Bad Field Cal coefficients; Hardware issue	Remove any pressure from scanner (including control pressure) and vent all ports to atmosphere. Remove module from too hot or cold environment and allow time. Check RAW values to rule out hard-ware issues (use 6.2 General Checkout Procedure). Replace coefficients with last known, good coefficients. Disable Field Cal (SET FCENABLE 0) and check.
Valve will not switch	Insufficient control pressure; Dried valve	Verify control pressure is within range. Use 120PSI temporarily evaluate valve movement. Attempt to cycle valve both directions with 120PSI to lubricate internal parts.
Scan is short / ends to quickly	FPS is set to low; Unexpected change in trigger; Binary buffer overflow (may come with error); Scanning too fast for configuration (may come with error)	Check FPS setting in LIST S. Validate that external trigger is connected correctly and voltage on/off is expected. Binary buffer overflow is occurring. Generally means network or destina-tion cannot handle amount or speed of data. Check network, receiving host, or receiving software. RATE is too high for data output format or destination. Check rate limitations (Section 2) and adjust accordingly.
Timestamp drift or inconsistency	PTP has poor sync; External frame trigger inconsistent; Internal rate is not greater than external trigger	Check PTP sync using PTPSTAT, GETTIME, GETUTCO, and check PTP Grandmaster and PTP network. Validate that external frame trigger device is 50% duty cycle, voltage is correct, and “low” voltage is close to 0. Ensure than RATE is set to 1.25x or greater than external rate

6.2 MPS General Checkout Procedure

The following is a checkout procedure for MPS4200 series modules. This procedure can be used as a verification that the module is fully functional before implementing it into a system, or as a diagnostic check if it is suspected that the module is not functioning correctly. Ensure that the module has been warmed up for at least 1 hour before beginning this procedure. This procedure will not verify the accuracy of the module. If the module fails this procedure in any way, please contact Scanivalve.

This procedure is best performed using the Web Server, or a TCP/IP connection using ScanTel. This is will help isolate potential software issues. This procedure is written for ScanTel but can be adapted for the Web Server.

Begin by establishing a connection, and configuring the module for the test by issuing the following commands:

SET RATE 2<ENTER>
SET FPS 1<ENTER>
SET ENFTP 0<ENTER>
SET ENUDP 0<ENTER>
SET PTPEN 0<ENTER>
FORMAT T F<ENTER>
SET SIM 0<ENTER>

1. Check raw pressure and temperature readings.
   Send the following commands:
   SET UNITS RAW<ENTER>
   CALZ 0<ENTER>
   SCAN<ENTER>

   The raw pressure readings in the second column should all be near or less than ±1,000,000 counts. Some ranges may have an offset, but generally you should not see more than 4,000,000 counts.
   The raw temperature readings (at room temp) should be greater than 0 and up to 4,000,000 counts.

   Repeat the scan command several times. Values should not be:
   - Exactly 0 after multiple scan attempts.
   - A value of ±8.3 million.
   - A non-changing value after multiple scan attempts.

2. Verify the CALZ function. Send the following commands:
   CALZ<ENTER>
   (wait 10-15 seconds for the CALZ to complete)
   SCAN<ENTER>

   The raw pressure readings should all be near 0 and between ±500 counts. Temperature will remain unchanged.

3. Verify the Engineering Unit Conversion
   Send the following commands:
   SET UNITS PSI<ENTER>
   SCAN<ENTER>

   The pressure readings should be very close to 0.0psi
   The temperature readings should be near the ambient room temperature in degrees C. Depending on how long it has been powered up, there may be as much as a +15°C difference due to self heating.

4. Verify the reference (REF) response. Send the following commands:
   STOP<ENTER>
   SET FPS 0<ENTER>
   SCAN<ENTER>

   All channels should still be near 0.0psi.

   With the unit scanning, apply between 75% and 100% of positive full scale pressure (or 15psi maximum, whichever is least) to the reference port(s) on the module.
   This should result in an even, negative reading across all channels.

5. Check for leaks in the reference plumbing. With the unit still scanning, apply and trap the pressure on the reference port(s).

   Monitor the pressures for 60 seconds. A pressure drop of up to 0.1% of full scale is acceptable.

   Vent the pressure off of the reference port(s) when complete.

6. Verify individual Px response. With the unit still scanning, apply between 75 and 100% of full scale pressure individually to all Px (measurement) inputs.

   This should result in a believable positive pressure on the channel with pressure applied. Test each channel.

7. [MPS4264 only] Verify the calibration input (CAL) response.
   For NPx variants, apply 90-120psi to the CAL-PRG CTL port.
   For CPx variants, apply 60-120psi to the CAL-PRG CTL port.
   For EPx variants, Issue the following command:
   ECAL<ENTER>

   With the unit still scanning, apply between 75 and 100%

of full scale pressure to the CAL port(s)
This should result in a believable positive pressure across all channels.

8. [MPS4264 only] Check for leaks in the calibration plumbing.
With the unit still scanning, apply and trap the pressure on the calibration port(s).

Monitor the pressures for 60 seconds. A pressure drop of up to 0.1% of full scale is acceptable.

Vent the pressure off of the calibration port(s).

For all modules, issue the command:
STOP<ENTER>
Or use the ESC key to stop the scan.

9. Check for drifting/unstable sensors. Send the following commands:
SET UNITS RAW<ENTER>
CALZ<ENTER>
(wait 10-15 seconds for the CALZ to complete)
SCAN<ENTER>

Monitor all 16 channels. All sensor readings should stay stable within ±2000 counts for 1 minute. These counts may be higher for lower pressure modules (<1psid).
Then issue the command:
STOP<ENTER>
Or use the ESC key to stop the scan.

10. Check for noisy output. Send the following commands:
SET RATE 50<ENTER>
SCAN<ENTER>

Monitor all 16 channels for 1 minute, watching for any unusual "spiking" data. All readings should stay within ±1000 counts from the original reading for the duration of the 1 minute test. These counts may be higher or may appear to be more "noisy" for lower pressure modules (<1psid) due to the sensitivity of the sensors.
Then issue the command:
STOP<ENTER>
Or use the ESC key to stop the scan

11. [OPTIONAL - MPS4264 Only] Check Purge operation.
Send the following commands:
RATE 2<ENTER>
SCAN<ENTER>

For all modules with a range less than 5PSI, apply a low purge pressure to the PRG ports and slowly increase the pressure. During the increase, monitor the scan data to ensure the pressure is not being sensed by the sensor. If the sensors are not registering the pressure, increase the purge pressure to the desired purge pressure (15PSI recommended).

For all modules with a range greater than 5PSI, apply 15PSI to the PRG port.

Verify that purge pressure is flowing out of all Px input ports.
Verify that there is no purge pressure flowing out of any other port.
Verify that the sensors are not responding to the purge pressure.

At the completion of the test, vent the purge supply pressure, **STOP** the scan, and return the module to Px Measurement mode.
For NPx variants, vent the control pressure applied to the CAL-PRG CTL port.
For CPx variants, apply 60-120psi to the PX CTL port.
For EPx variants, Issue the following command:
EPX<ENTER>

6.3 FIRMWARE INSTALLATION

The MPS's firmware can be upload and updated using the MPS Web Server or the FTP file server via Ethernet connection. Using the MPS Web Server is the preferred method. Please contact Scanivalve for the latest MPS firmware version.

6.3.1 FIRMWARE INSTALLATION VIA WEB SERVER

1. Connect the MPS to the host computer via Ethernet connection. Ensure the MPS is powered on.
2. Open the web browser of choice:
   Google Chrome
   Microsoft Edge
   Mozilla Firefox
   Note: Verify pop-ups are allowed in the browser.
3. Enter in the MPS's IP address into the address bar and press enter.
4. Navigate to the File Browser page on the MPS's Web Server.

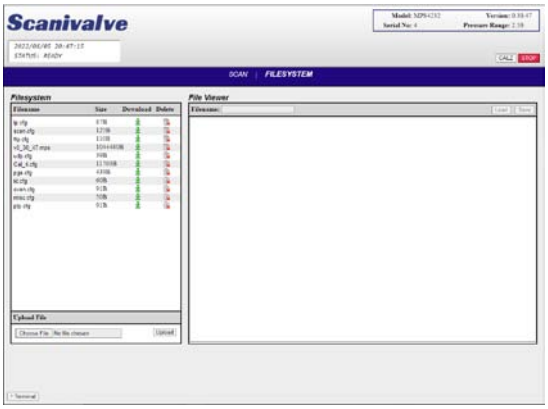

FIGURE 6-1: FILE BROWSER PAGE

5. In the "Upload File" section, click "Choose File."

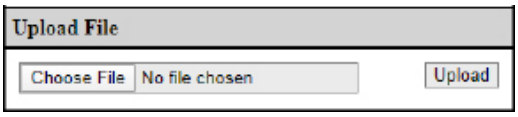

FIGURE 6-2: UPLOAD FILE

6. Navigate to the location where the MPS's firmware file is stored. The file will be called v<version>.mps. Select the file and click "Open."

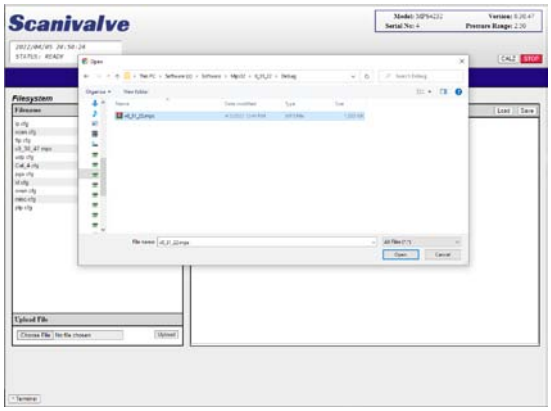

FIGURE 6-3: V1_00.MPS

7. The .mps file will now appear in the "Upload File" section. Click "Upload." A dialog box will appear with information.
   If there is an existing .mps firmware file on the MPS, the file must be deleted prior to upload.

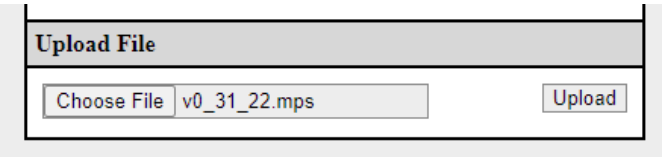

FIGURE 6-4: UPLOAD FILE

8. The .mps file will now appear in the "Filesystem" table. To initiate the update process, double click the .mps filename in the table.

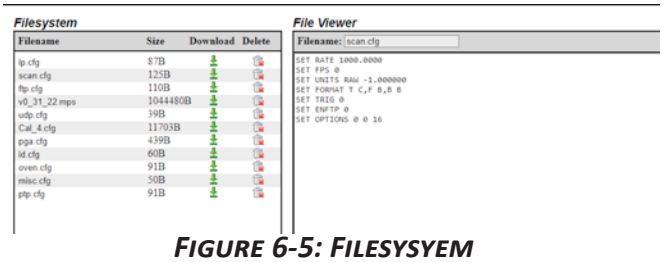

FIGURE 6-5: FILESYSYEM

9. A dialog box will appear and ask for firmware update confirmation. Click "OK" to continue.
   A new dialog box will appear. The MPS will begin updating the firmware. When the update is complete, the dialog box will disappear and the browser will refresh and reload the MPS Home Page.
   The "Version" in the top right corner of the MPS web page should reflect the latest version.
   Note: The .mps file can be deleted from the File System once the update is complete. It does not need to reside in the memory for operation.

6.3.2 Firmware Installation via FTP

1. Connect a host computer to the Ethernet port and ensure the MPS is powered on.

2. Open Windows FIle Explorer.

3. In the Address Bar, type:
   ftp://<IPAddress><Enter>
   Where: <IPAddress> is the IP Address of the MPS.

4. The host computer should connect to the FTP file server. If the connection is successful, the contents of the MPS flash storage will be displayed in a folder format.

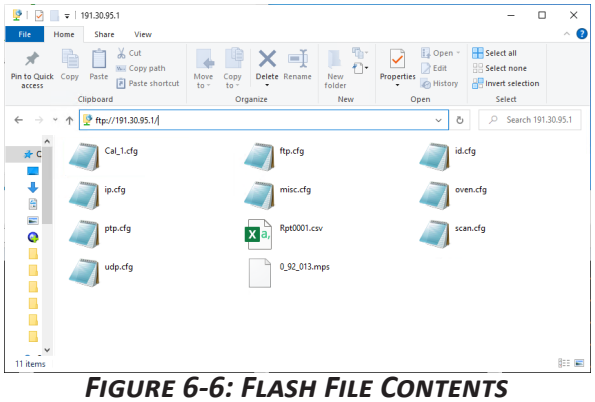

Figure 6-6: Flash File Contents

5. Open Windows Explorer in another window and navigate to the directory where the new firmware file is stored. The MPS4200 firmware file is a binary file called “x_yy.mps” where x_yy is the firmware version.

6. Select the MPS4200 window, right click in the current or old firmware file in the file server and click “Delete.”

   Note: the old firmware file must be deleted from the MPS’s file server before the new file is uploaded.

7. Highlight the new firmware file to be copied to the MPS, right click and click “Copy”, and then click in the MPS file server and click “Paste.”

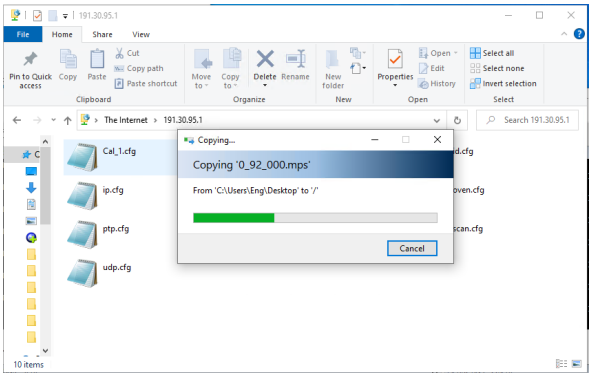

Figure 6-7: Copying Firmware File

The file will be copied to the MPS4200. A progress window will provide progress information.

7. When the copy function is complete, the MPS4200 window will show the new files. The time and date of the new file can be used to confirm that the new files were uploaded successfully.

8. The new firmware file must be loaded into RAM. Connect to the MPS via Telnet using ScanTel or similar, and execute the command:
   PGM<ENTER>
The MPS will load the file with messages and then reboot itself. This may take up to 30 seconds.

6.4 CALIBRATION COEFFICIENT INSTALLATION

The MPS's Calibration Coefficient file can be uploaded or updated using the MPS Web Server or FTP file server via Ethernet connection. Using the MPS Web Server is the preferred method.

Backup coefficient files are provided with every calibrated MPS module on a Scanivalve USB Thumb Drive. These files should be archived on a local computer for future use. In the event you cannot locate your backup file, please contact Scanivalve with the model and serial number of your module.

6.4.1 COEFFICIENT INSTALLATION VIA WEB SERVER

1. Connect the MPS to the host computer via Ethernet connection. Ensure the MPS is powered on.
2. Open the web browser of choice:
   Google Chrome
   Microsoft Edge
   Mozilla Firefox
   Note: Verify pop-ups are allowed in the browser.
3. Enter in the MPS's IP address into the address bar and press enter.
4. Navigate to the File Browser page on the MPS's Web Server.

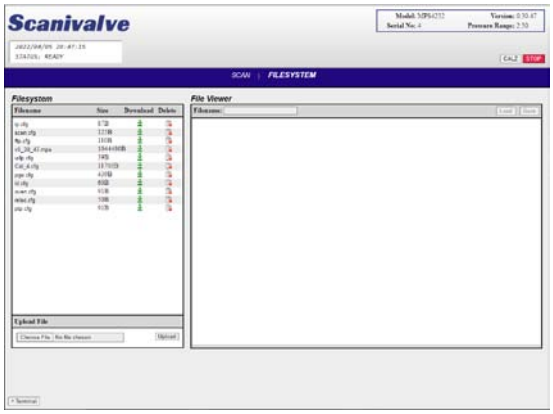

FIGURE 6-8: FILE BROWSER PAGE

5. In the "Upload File" section, click "Choose File."

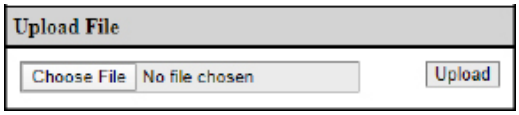

FIGURE 6-9: UPLOAD FILE

6. Navigate to the location where the MPS's coefficient file is stored. The file will be called "Cal_<sn>.cfg" where <sn> is the serial number of the module. Select the file and click "Open."
7. The Cal cfg file will now appear in the "Upload File" section. Click "Upload." A dialog box will appear with information.

   If there is an existing Cal cfg file on the MPS with the same name, the upload process will overwrite the existing file.

8. The Cal cfg file will now appear in the "Config Files" table.

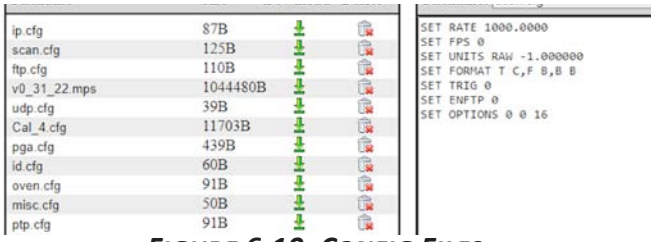

FIGURE 6-10: CONFIG FILES

9. The new file must be loaded into RAM by one of the following methods:
   - Double click on the new Cal.cfg file and click the LOAD button.
   - Power cycle the MPS
   - Execute a **REBOOT** command
   - Execute a **LOAD <cal filename>** command
   where <cal filename> is the name of the Cal file

6.4.2 COEFFICIENT INSTALLATION VIA FTP

1. Connect a host computer to the Ethernet port and ensure the MPS is powered on.

2. Open Windows FIle Explorer.

3. In the Address Bar, type:
   ftp://<IPAddress><Enter>
   Where: <IPAddress> is the IP Address of the MPS.

4. The host computer should connect to the FTP file server. If the connection is successful, the contents of the MPS flash storage will be displayed in a folder format.

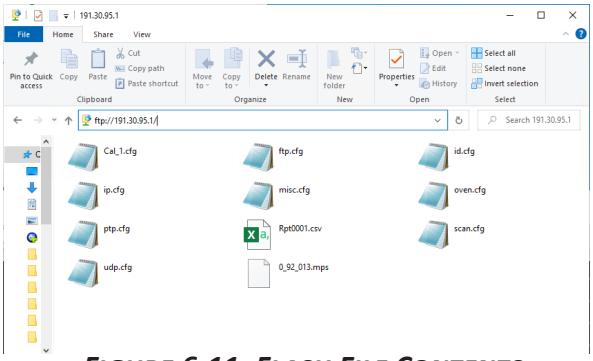

FIGURE 6-11: FLASH FILE CONTENTS

5. Open Windows Explorer in another window and navigate to the directory where the calibration coefficients are stored. MPS4200 calibration coefficients are a text file called “Cal_<sn>.cfg” where <sn> is the serial number of the module.
   Highlight the file to be copied to the MPS, right click and click “Copy.”

6. Select the MPS4200 window, right click in the file area and click “Paste.”

As long as the filename matches, the MPS will prompt if you would like to overwrite the file. Click yes to overwrite the old file.

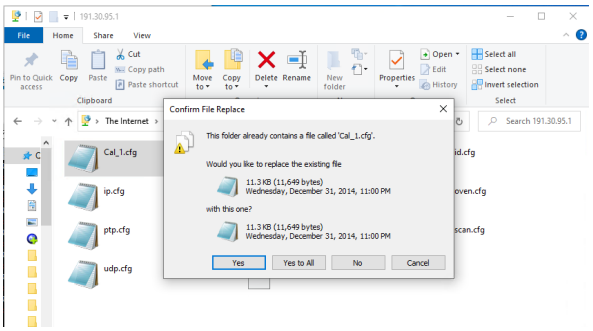

FIGURE 6-12: FLASH FILE CONTENTS

The file will be copied to the MPS4200. A progress window will provide progress information.

Alternately, the file can be “drag-and-dropped” and overwritten.

7. When the copy function is complete, the MPS4200 window will show the new files. The time and date of the new file can be used to confirm that the new files were uploaded successfully.

8. The new file must be loaded into RAM by one of the following methods:
   - Power cycle the MPS
   - Execute a **REBOOT** command
   - Execute a **LOAD <cal filename>** command
   where <cal filename> is the name of the Cal_ file

6.5 CHANGING THE IP ADDRESS

The following procedure will change the IP address of the MPS4200 using a terminal emulator (ScanTel, HyperTerminal, puTTY, etc). The Web Server terminal can be used as an alternative if an Ethernet connection is available.

1. Establish a connection to the MPS4200 using a serial or Ethernet connection and appropriate software. For initial connection information, please see Section 3: Operation.

2. Issue the command:
   LIST IP<ENTER>
   The IP address variable and value will be displayed.

3. Issue the command:
   SET IPADD xxx.xxx.xxx.xxx<ENTER>
   (*where* **xxx.xxx.xxx.xxx** *is the IP address desired)*

4. Issue the command:
   LIST IP<ENTER>
   Confirm that the IP address set is correct.

5. [Optional] If the Subnet or Gateway must be changed, please do so in the same steps as 2 - 4 using the **SUBNET** and **GW** variables.

5. Issue the command:
   SAVE IP<ENTER>
   Wait for the return prompt “>”.
   The IP address has now been saved. Issue the command: **REBOOT**<ENTER> or cycle the MPS power. The MPS will now boot with the new IP address.

6.6 FORMATTING THE FLASH DISK

Should the flash disk of the MPS need to be reformatted, it can be done fairly simply if the following procedure is carefully followed. For most, but not all times that an MPS will be reformatted, a serial connection needs to be available to communicate with the unit. If you are able to currently establish an Ethernet connection with the unit, reformatting may not the best option. However, if an Ethernet connection cannot be established with the unit it is probably the case that the MPS application file or memory system has been corrupted and needs to be reformatted.

Note: This procedure will delete all files and settings in the MPS. All setting will be returned to default. This procedure will not remove the operating system.

The procedure for reformatting the MPS is as follows:

1. Power the MPS on.
   If the IP address is known, you can attempt to connect to the unit via an Ethernet connection. If this is not successful, or if the IP address is not known, you must connect using the serial port. Details on connecting to the serial port can be found in the "Serial Communications" section.

2. Once a connection is established, issue the command:
   FDISK<ENTER>

   The MPS will respond with "Type FDISKCONFIRM to confirm FDISK or STOP to escape" Follow the instructions and send the command:
   FDISKCONFRM<ENTER>

   The MPS will respond indicating completion:
   Start format
   Erasing device 100
   Done device 100
   >

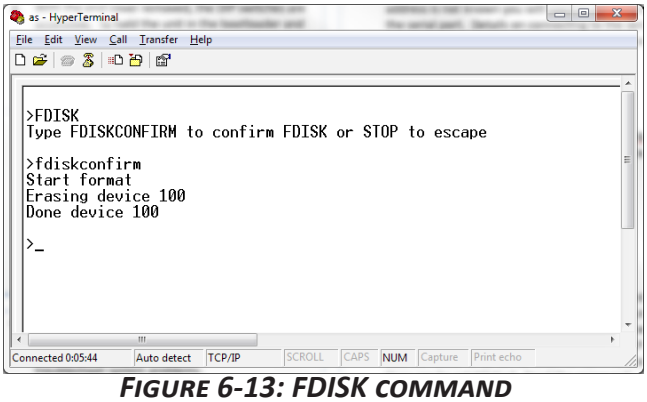

FIGURE 6-13: FDISK COMMAND

3. At this point the flash disk has been reformatted and all contents have been deleted. All configuration settings, including the MPS's IP address have been deleted. The IP address must be configured by issuing the command:
   SET IPADD XXX.XXX.XXX.XXX<ENTER>
   (where xxx.xxx.xxx.xxx is the desired IP address)

   Followed by the commands:
   SAVE IP<ENTER>

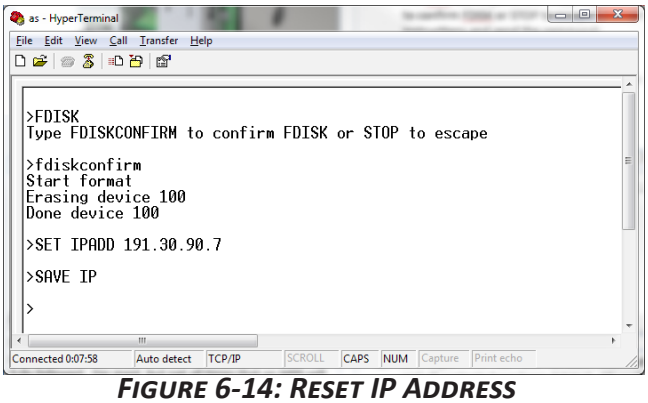

FIGURE 6-14: RESET IP ADDRESS

4. Power cycle the MPS module or issue the **REBOOT** command.

5. After the MPS has cycled power and rebooted, files can be reloaded to the MPS module using the File Browser page on the Web Server. The most important file to upload is the Calibration Coefficient Table. Follow the "Calibration Coefficient Installation" procedure to restore Engineering Unit scanning ability. All settings in LIST ID must also be restored.

   If any other files were archived, they can also be uploaded to the module at this time. Otherwise, all settings can be reset per the users configuration and saved.

6.7 Calibration & Validation Overview

The MPS4200 uses stable, temperature compensated piezoelectric pressures sensors. The use of these sensors in the new design, along with the ability to perform frequent, online zero-offset calibrations (**CALZ**), allow the MPS4200 to hold published accuracy for up to 6 months. Scanivalve recommends performing a validations on MPS4200s using a high-accuracy pressure standard on a 6 month interval, and calibrating when required. Reports generated by the validation process are stored in the MPS's memory.

Every MPS4200 module is calibrated from the factory over a series of 15 temperatures between 0° and 70°C. At each temperature, 25 pressures are applied. This calibration creates a matrix of discrete temperatures and pressures, called the master calibration coefficients. The MPS4200 converts these points into a polynomial, least-squares fit. After calibration coefficients are created, a multi-temperature validation is performed over 3 temperatures from 10° to 60°C, applying 15 different pressures at each temperature.

Automated calibrations and validations require a Scanivalve SPC4000 or SPC4050 calibrator. Manual calibrations and validations can be performed using a non-Scanivalve calibrator. Performing a manual calibration requires user input, and manual application of pressures instructed by MPS.

All Calibration and Validation processes are handled internally, requiring no additional software on the host computer. The MPS4200 allows for single or multi-unit calibration and validations. Mutli-unit calibration or validations are controlled using a single MPS4200 device. Once this is configured properly, a calibration, validation, or calibration-validation can be performed on multiple units, using a single module as the master controller.

There are two calibration/validation types that can be performed in the MPS: Full Calibration and Validation, and Field Calibration and Validation.

6.7.1 Full Calibration & validation

A full calibration deletes all stored calibration coefficients and applies known pressures over a series of temperatures (as described in the previous section), followed by a multi-temperature validation. This duplicates what is performed at the factory during the module's original manufacture and calibration. Full calibration and validation requires an Ethernet controllable environmental chamber capable of reaching the entire 0°C and 70°C range, and a suitable, high-accuracy pressure standard. It is recommended that for full calibrations, the module be returned to Scanivalve or a certified Scanivalve Representative.

An automated full calibration/validation routine typically takes 20 hours or more.

6.7.2 Field Calibration & validation

For versions 1.03 and higher

During a field calibration or validation, a series of pressures are applied to the module at a single temperature. The temperature of the module does not have to be controlled to a specific temperature, and does not require an environmental chamber. The MPS4200 calculates a second set of "field" coefficients at the current temperature of the MPS, which is then used as a correction term across the full coefficient table (0°-70°C). This technique is suitable for maintaining module's coefficients long-term in the field.

An automated field calibration/validation routine typically takes less than an hour.

6.8 Field Calibration & Validation Procedure

For versions 1.03 and higher

The following section is a guide for performing field calibrations and/or validations on one or more MPS4200 modules. If there are any questions or concerns, please contact Scanivalve TechSupport.

Modules with version 4.00 and higher can be used as master units to perform Field Calibration and Validations on all other configurations, including MPS4264 Gen1 modules.

6.8.1 Setup and Configuration

1. Connect power and Ethernet connections to each MPS module that will be calibrated or validated. Modules should be allowed one or more hours of warm-up time before a calibration or validation is performed.

2. Connect to each MPS module using ScanTel or similar, and set the following configurations:

SET MCAST <unique multicast address><ENTER>
SET IPCAL <IP address of the calibrator> <port of calibrator> <calibrator channel><ENTER>
SET VALZO 1<ENTER>
SET FCAL <number of calibration points> <min cal pressure> <max cal pressure><ENTER>
SET FVAL <number of validation points> <min val pressure> <max val pressure><ENTER>

- Recommended settings can be found in later in this section, under Table 6-1.
- If a manual calibrator is to be used, ignore the IPCAL

variable.
- Each device that will be calibrated or validated must be configured the same, unless there are different ranges.

3. [Optional] If MCAST is altered, a **SAVE**<ENTER> and power cycle if required. Issue the **SAVE**<ENTER> command and wait for the save to complete. Once the prompt (>) is returned, issue the command:
REBOOT<ENTER>

Disconnect and close all instances of ScanTel that are open and allow time for the modules to reboot.

4. Make all necessary pneumatic connections to the MPS, including:
- For MPS4264: Control Pressure to place module into Calibrate Mode
  - 60-120psi for CPx at CALCTL port.
  - 90-120psi for NPx at CALCTL port.
  - ECAL command for EPx.
- Calibrator positive output to the CAL port*.
- Calibrator negative output to the REF port**.

** For MPS4232/16, CAL requires a manifolded connection to all Px inputs, or using the calibration input header*

*** Applying a positive pressure to the REF port is used to calibrate the negative pressures.*

5. Connect to a single MPS4200 using ScanTel (or similar program) and verify that all settings are correct.

For MPS4264, issue the command:
VALVESTATE<ENTER>
Ensure that the module returns with **CAL** (Calibrate mode).

6. Leak checks, or trap and decay tests, and pressure response should be performed on both the CAL and REF port to ensure correct plumbing, and that there are no leaks present.

7. [Optional] For multiple module calibration/validations, issue the command:
MFIND<ENTER>

Ensure that all expected modules respond.
If they do not, please check that all module's **MCAST** variables match before continuing.

6.8.2 Performing a Single or Multi-Module Field Validation

A Field Validation (single or multi-unit) will apply pressures from the calibrator at the current temperature of the modules, compare the EU readings to the calibrator readings, and find the percent error of full scale. This will validate the current coefficient table in the MPS module. This can be performed with or without field calibration coefficients (**FCENABLE**).

1. Follow the steps under Setup and Configuration.

2. [Optional] If a validation log is required (for troubleshooting or requested by Scanivalve), start an ASCII capture file using ScanTel:
File > Start ASCII Capture
Name the file and save in a directory.

3. To start an automated single unit field validation, issue the command:
VAL F<ENTER>
To start an automated multi-unit field validation, issue the command:
MVAL F<ENTER>

The Field Validation (single or multi) will begin. The process will stream information to the screen. When completed, the MPS will return a completed message, followed by a Prompt (>). If there is an issue, check the log to find the error and correct any noted errors. If there is an issue, check the log to find the error and correct any noted errors.

4. Once the validation is completed, the report can be found on the MPS's system memory. Open "Windows Explorer" and in the address bar, type:
FTP://<IP address of the MPS> <ENTER>

Drag and drop (or copy and paste) the RptXXX.csv to the desktop for viewing. This must be repeated for every module that was validated.

6.8.3 Performing a Single or Multi-Module Field Calibration-Validation

A Field Calibration-Validation (single or multi-unit) will apply pressures from the calibrator at the current temperature of the modules, create and enable the field calibration coefficients, and then auto-perform a validation. This process allows for a single command to start a calibration and validation without additional user input.

1. Follow the steps under Setup and Configuration.

2. [Optional] If a calibration-validation log is required (for troubleshooting or requested by Scanivalve), start an ASCII capture file using ScanTel:
File > Start ASCII Capture
Name the file and save in a directory.

3. To start an automated single unit field calibration-validation, issue the command:
   CALVAL F<ENTER>
To start an automated multi-unit field calibration-validation, issue the command:
   MCALVAL F<ENTER>

The Field Calibration-Validation (single or multi) will begin. The process will stream information to the screen. When completed, the MPS will return a completed message, followed by a Prompt (>). If there is an issue, check the log to find the error and correct any noted errors.

The calibration process will automatically enable the field calibration coefficients (**SET FCENABLE 1**) before the validation. Once a Field Calibration-Validation is complete, the field coefficients are stored in **LIST FC**.

5. Once the validation is completed, the report can be found on the MPS's system memory. Open a window in "Windows Explorer" and in the address bar, type:
   FTP://<IP address of the MPS> <ENTER>

Drag and drop (or copy and paste) the RptXXX.csv to the desktop for viewing. This must be repeated for every module that was validated.

6. If the module passes validation; in ScanTel, issue the command:
   SAVE FC<ENTER>

Saving the FC terms must be repeated for every module that was calibrated (connect using ScanTel and issue the command).

6.8.4 Performing a Manual Field Calibration or Validation

If a manual calibrator is to be used (non-Scanivalve calibrator), repeat the steps as show in the procedures above, however replace the "**F**" variable of the CAL/VAL commands with "**FM**". The MPS will start the commanded sequence and will instruct the user to apply pressure manually, and input the pressure reading of the calibrator at each pressure point.

Follow the on screen prompts to complete the process. At any time, the STOP command or ESC key can be used to quit out of the process.

When prompted to enter pressure, enter actual pressure values as PSIG values up to 6 decimal places. This will include negative and positive pressures.

6.8.5 Recommended Cal/Val Settings Table

The following table shows Scanivalve's recommended settings for MPS4200 Field Calibration and Validations.

Typical Full Scale Range	Min Val Pressure	Max Val Pressure	Min Cal Pressure	Max Cal Pressure	Field Cal Number of Points	Field Val Number of Points	CALAVG
4" H2O	-0.145	0.145	-0.159	0.159	5 to 13	11 to 15	1 16 - or - 12 128
8" H2O	-0.289	0.289	-0.318	0.318			
1 psid	-1	1	-1.1	1.1			
5 psid	-5	5	-5.5	5.5			
15 psid	-15	15	-16.5	16.5			
50 psid	-15	50	-16.5	55			
100 psid	-15	100	-16.5	110			

SECTION 7: SOFTWARE

7.1 Overview

The MPS4200 exposes a single-user network interface for command/control and data access:

- TCP ASCII / Telnet (port 23): Full configuration and control; also supports ASCII data output. See “5.8.2 TCP ASCII output”.
- TCP Binary Server (port 503): High-rate binary data output with limited scan control. See “5.8.3 TCP Binary Output”.
- UDP (binary only): Output-only; unicast or multicast receive. See “5.8.4 UDP Data Output”.
- FTP (ASCII or binary files): Output-only, file-based logging. See “5.8.4 FTP Data Output”.
- SWS – Scanivalve Web Server (HTTP only): Browser UI for interactive operation. See “5.4.2 Scanivalve Web Server (SWS)”.
- Serial (RS-232): Maintenance/recovery (unknown IP, base config, diagnostics). See “5.2.1 Serial Communications”.

Control channel: All configuration and general scan control are performed via TCP ASCII (port 23) or SWS. The TCP Binary interface supports only start/stop control signals for convenience.

Operating states: Command acceptance is constrained by module state (READY, SCAN, CALVAL, CALZ, SAVE). See “5.6 Module Operating States”.

7.2 Network Topology

Choose topology based on throughput, reliability, and accessibility (see “5.3 Network Configuration”, “5.8 Scan Data Output Methods”):

- Isolated test network: best throughput/lowest jitter for high-rate TCP Binary/UDP.
- Integrated lab/enterprise network: easiest multi-user access; may require multicast enablement.
- Sub-network with gateway: high-rate capture locally; share data via a multi-homed host (common with FTP archiving).

7.3 MPS4200 Buffer Description

The buffer is the liaison between the scan task and the scan output task. The scan output task has a higher priority than the scan task. Under initial conditions, when the buffer is empty, the scan task places one frame of data in the buffer. It then signals the scan output task to read the buffer until it is empty. However, when multiple frames of data are in the buffer, the output task continues until the buffer is empty. Multiple frames of data will accumulate if the scan output task is blocked by the network while outputting data.

The total ring buffer allows for a total of 1024 frames. If the data receiver falls behind, the MPS will attempt to buffer frames until the receiver is ready again. If the buffer becomes full and the receiver will no longer receive data, the MPS will empty the buffer, Return to Ready mode, and report an error to the Telnet port.

7.4 MPS Data Definitions

When requested the MPS sends an application packet to the client. Each packet sent to the client starts with a Packet Type Word. This word defines the packet type. All packet data will be received as signed.

7.4.1 Host to MPS Command Packet

FUNCTION	BYTES	DATA TYPE	DESCRIPTION
ASCII command data. Refer to the command section of this manual for more information.	1 to 80	String	Unique to packet. Must be terminated. See information below.

TCP/IP does not guarantee that packet boundaries will be maintained between a host and a MPS module. Therefore, all

commands from a host must be terminated properly with one of four options. The MPS will detect and adjust to the termination option being used by a host.

The four options are:

- CR (ASCII 13)
- LF (ASCII 10)
- LF-CR (ASCII 10 - ASCII 13)
- CR-LF (ASCII 13 - ASCII 10)

The maximum string length for commands sent to the MPS4200 is 79 characters. Any command received that is longer than 79 characters will be discarded and an error will be generated.

When a MPS module is not in "READY" mode, most commands are disabled or not accepted. Non Ready modes can be found in Section "5.6 Module Operating States".

The exception to this rule include the commands STOP, STATUS, and TRIG. Any command that falls in this category will have a note listed in the following sections if they are accepted when the MPS is not "READY."

7.4.2 MPS to Host ASCII Packet

FUNCTION	BYTES	DATA TYPE	DESCRIPTION
ASCII data*. Refer to the Command Section of this manual for the proper Command return formats.	1 to 1492	String	Unique to packet and varies. See information below.

*This packet will be transmitted when the host issues one of the following commands (excluding a return prompt):

1. SCAN from Telnet connection
2. Any Get command type
3. STATUS
4. LIST <group> or TYPE <group>
5. FDISK
6. An Error message if an error is generated

All responses from the MPS will end with a termination configuration and prompt character (">"). For "multi-list" or "multi-line" responses, such as the response to a LIST command, each line will be terminated with a CR-LF (\r\n), except for the last line in the response, which will include the ">" character.

Single line response: If the MPS is ready, a **STATUS** command would respond as:

STATUS: READY<CR><LF>
>

Multi-line response: If the MPS is ready, a **LIST IP** command would respond as:

SET IPADD 191.30.95.1<CR><LF>
SET SUBNET 191.30.95.1<CR><LF>
SET GW 0.0.0.0<CR><LF>
SET MAC 0:60:5d:82:0:04<CR><LF>
>

The ">" signifies that the MPS module is ready to accept a new command. It is safest to always wait for prompt before sending the next command.

7.4.3 Scan Data Formats

Scan data from the MPS4200 can be formatted in six different ways: ASCII (A), Comma Separated Variable (CSV or C), formatted for VT100 terminals (F), Binary (B), and LabVIEW Binary (L). The format is selected by setting the **FORMAT**

configuration variable to A, C, F, B, or L respectively. It can also be selected by clicking on the appropriate link on the "Scan" page when using the Web Browser.

The **FORMAT** configuration variable sets the format for Telnet (T), FTP/UDP (F), and Binary Server (B) separately. See the description of **FORMAT** for detailed description.

7.4.4 File Names and Formats

When the MPS4200 is configured to output data via FTP or through the SWS (Web Server), it must create a file at the destination. The table below shows the common file names and formats for FTP scan data when the different formats are used (ASCII, Binary, CSV).

SWS: FORMATTED FOR	FORMAT VARIABLE	TYPE OF SCAN	FILE EXTENSION
.TXT	FORMAT F A	ASCII	nnnn.txt
.DAT	FORMAT F B	Binary	nnnn.dat
.CSV	FORMAT F C	Comma Separated Variable (ASCII)	nnnn.csv

7.5 ASCII Scan Data Examples

The MPS4200 can be configured to output ASCII scan data in several formats. The format is configured with the **FORMAT** variable. Once a scan has stopped, the output will be followed by the **PROMPT** configuration.
Note: Examples in this section may only show a limited amount of channels for simplicity and space.

7.5.1 Unformatted ASCII

When **FORMAT T** or F is set to A, data is displayed in a column type format and is scrolling at the set rate.

```
Frame # <number>
<channel 1> <pressure> <temperature>
<channel 2> <pressure> <temperature>
      ::        ::        ::        ::        ::
<channel n> <pressure>
```

If **UNITS** is set to an engineering unit value; <pressure> will be a value in EU, <temperature> will be in °C.
If **UNITS** is set to RAW; <press> and <temperature> will be a raw A/D pressure count.
If **UNITS** is set to RAWC; <pressure> will be a raw A/D pressure count, <temperature> will be in °C.
The <temperature> will only be shown on channels 1 through 4 for MPS4216 and MPS4232, and channels 1 through 8 on MPS4264.

7.5.2 Formatted ASCII

When **FORMAT T** is set to F, Data is displayed in a VT100 terminal style and will update at the set rate. Below is an example of the MPS4216.

```
Frame=<number>
<temp 1>= <temperature>  <temp 2>= <temperature>  <temp 3>= <temperature>  <temp 4>= <temperature>
<channel 1>=  <press>  <channel 2>=  <press>  <channel 3>=  <press>  <channel 4>=  <press>
<channel 5>=  <press>  <channel 6>=  <press>  <channel 7>=  <press>  <channel 8>=  <press>
<channel 9>=  <press>  <channel 10>=  <press>  <channel 11>=  <press>  <channel 12>=  <press>
<channel 13>=  <press>  <channel 14>=  <press>  <channel 15>=  <press>  <channel 16>=  <press>
```

If **UNITS** is set to an engineering unit value; <press> will be a value in EU, <temperature> will be in °C.

If **UNITS** is set to RAW; <press> and <temperature> will be a raw A/D pressure count.
If **UNITS** is set to RAWC; <press> will be a raw A/D pressure count, <temperature> will be in °C.

7.5.3 Comma Separated Variable ASCII

When **FORMAT T** or F is set to C, Data is output in comma separated variable (CSV) and is scrolling at the set rate. This data can be captured, saved, and opened as a .CSV file. A header row will be output before scan data is output. Below is an example using the MPS4232.

<frame number>,<temp 1>,<temp 2>,<temp 3>,<temp 4>,<frame time seconds>,<frame time nanoseconds>,<press 1>,<press 2>,<press 3>, <press 4>, <press 5>,<press 6>,<press 7>,<press 8>,<press 9>,<press 10>,<press 11>,<press 12>,<press 13>, <press 14>,<press 15>,<press 16>,<press 17>,<press 18>,<press 19>, <press 20>, <press 21>,<press 22>,<press 23>,<press 24>,<press 25>,<press 26>,<press 27>,<press 28>,<press 29>, <press 30>,<press 31>,<press 32>

If **UNITS** is set to an engineering unit value; <press *n*> will be a value in EU, <temp *n*> will be in °C.
If **UNITS** is set to RAW; <press> and <temperature> will be a raw A/D pressure count.
If **UNITS** is set to RAWC; <press *n*> will be a raw A/D pressure count, <temp *n*> will be in °C.
If **PTPEN** is set to 0, the Frame Time Seconds/Nanoseconds will be the frame time relative to 0 (scan start time).
If **PTPEN** is set to 1 or 2, the Frame Time Seconds/Nanoseconds will be an absolute PTP time.

7.6 Binary Scan Data Formats

The MPS4200 can be configured to output Binary scan data in several formats. The format is configured with the **FORMAT** variable, using F (FTP/UDP) or B (Binary Server). Scanivalve has incorporated several binary packets for diverse configurability. Most Binary packets, when collected to a file, can be converted to a readable ASCII format using ScanTel (excluding LabVIEW® binary packets).

Binary data formats follow network byte order (big endian). If the receiving process on the host is processing it from a Network Stream, it may be read in host byte order (little endian).

7.6.1 Standard Binary Data Packet

This is the standard binary packet for the MPS4200. This packet is used when SET SIM == 0 and FORMAT F or B is set to B. The total size of the packet depends on the overall channel count. MPS4216 is 96 bytes, MPS4232 is 160 bytes, MPS4264 is 304.

FUNCTION	BYTES	DATA TYPE	DESCRIPTION
Packet Type	4	Integer	0x5b for MPS4216 RAW data, 0x5d for MPS4216 EU data 0x63 for MPS4232 RAW data, 0x65 for MPS4232 EU data 0x69 for MPS4264 RAW data, 0x6d for MPS4264 EU data
Frame Number	4	U Integer	The frame number
Frame Time (sec)	4	U Integer	Frame Time in seconds. This value will either be time relative to 0 when PTP is disabled, or an absolute PTP time.
Frame Time (ns)	4	U Integer	Frame Time in nanoseconds. This value will either be time relative to 0 when PTP is disabled, or an absolute PTP time.
Temperatures	16 or 32	Float	Array of temperature values as read from the RTDs (4 bytes per RTD) MPS4216 and MPS4232 have 4 RTDs, MPS4264 have 8 RTDs.
Pressures	Varies	Float or Integer	Array of pressure values. The float or integer is identified by the Packet Type bytes (EU float, RAW int). Bytes is Number of Channel x 4 (64, 128, or 256)

7.6.2 LabVIEW® Binary Packet

This is the standard LabVIEW® binary packet for the MPS4200. It is only available using the Binary Server (port 503). This packet is used when FORMAT B is set to L, and SIM is set to 0. The total packet size and array elements depend on the number of channels. For the MPS4216, the packet total is 72 sent as 18 array elements. For the MPS4232, the packet total is 136 bytes sent as 34 array elements. Note: when SIM is set to 64, MPS4216 and 4232 module will pad unavailable channels).

FUNCTION	BYTES	DATA TYPE	ARRAY ELEMENT	DESCRIPTION
Frame Number	4	Float	0	The current frame number if in the scan mode.
MPS Average Temperature	4	Float	1	Average temperature (4 RTDs) of MPS.
Pressure Channel 1	4	Float	2	Pressure values for channel 1
Pressure Channel 2	4	Float	3	Pressure values for channel 2
::: :::	:::	::: :::	::: :::	::: ::: ::: :::
Pressure Channel 16	4	Float	17	Pressure values for channel 16 (End of packet for MPS4216)
::: :::	:::	::: :::	::: :::	::: ::: ::: :::
Pressure Channel 32	4	Float	33	Pressure values for channel 32 (End of Packet for MPS4232)
::: :::	:::	::: :::	::: :::	::: ::: ::: :::
Pressure Channel 64	4	Float	65	Pressure values for channel 64 (End of Packet for MPS4264)

7.6.3 Legacy Gen1 64 Channel Binary Packet

This binary packet is used when SET SIM == 64. When enabled, the packet size and structure will match a MPS4264 Gen1 64-channel binary packet, however will use padded data for channels not available (i.e., for a MPS4232, pressure channels 33-64, temperatures 5-8). This allows the same packet structure to be used for MPS4200 16, 32, and 64 Gen2 channel modules. This packet is a total of 348 bytes. When using SIM 64, Scan Rates are limited to 1000Hz.

FUNCTION	BYTES	DATA TYPE	DESCRIPTION
Packet Type	4	Integer	0x0A
Packet Size	4	Integer	Size of packet, in bytes (348)
Frame Number	4	Integer	The frame number
Serial Number	4	Integer	Serial Number of the module (SN)
Frame Rate	4	Float	Scanning rate in Hz
Valve Status	4	Integer	0 - Px, 1 - Cal
Units index	4	Integer	Units conversion index (See Appendix A - Binary Index)
Units conversion factor	4	Float	Conversion factor from PSI to selected units
Scan Start Time (sec)	4	Integer	Scan start time (SST) in seconds
Scan Start Time (ns)	4	Integer	Scan start time (SST) in nanoseconds
External Trigger Time	4	U Integer	External Trigger Time in us
Temperatures	32	Float	Array of 4 temperature values as read from the 4 RTDs. The remaining bytes will be padded with “0” (5 - 8).
Pressures	256	Float or Integer	Array of 64 pressure values. The float or integer is selected based on the units (float = EU, integer = RAW). All unavailable sensors will be padded with “0” (i.e., channels 17-64 in an MPS4216)
Frame Time (Sec)	4	Integer	Frame time in seconds, relative to 0 (SST)
Frame Time (ns)	4	Integer	Frame time in nanoseconds, relative to 0 (SST)
External Trigger Time	4	Integer	Time the external trigger occurred in seconds, relative to 0 (SST)
External Trigger Time	4	Integer	Time the external trigger occurred nanoseconds, relative to 0 (SST)

7.7 Command Format

All of the commands accepted by the MPS are explained with the following sections: command, type, syntax, parameters/ arguments, description, returns, examples, ranges, and default values and notes when applicable. The table below is an example of how commands will be explained and shown in this section of the manual.

7.7.1 Example Command Title

COMMAND	The name of the command
TYPE	Lists the type of command. There are three types of commands in the MPS: Get - a Get type command retrieves information. Any command that begins with "SET" can be retrieved if the "GET" command is used i.e., GET <command name> Set - a Set type command will set configurations. These commands typically require an argument or value. In order to change these variables, these commands must begin with the "SET" command. Function - a Function command will cause the MPS to start a process or function and may not return any data. A command can be one or more types. Any command type labeled as "Disabled" are implemented as a placeholder to create backwards compatibility with MPS4264 Gen1 software. These commands will be accepted, but will not change any functionality.
DESCRIPTION	Provides a description about the command and what it may be used for.
SYNTAX	Lists the format of the command. The following conventions are used: **BP** - Boldface letters indicate command keywords and operators. Within the discussion of syntax, bold type indicates that the text must be entered exactly as shown. <parameter> - Words in < > indicate place holders for parameters that must be supplied. [<parameter>] - Parameters in [ ] indicate place holders for optional parameters that are not required. *data* - Example data is shown in *italics*. **data** - Example commands are show in **bold**. , - Commas separate options, only one of the options may be used.
RETURNS	Lists the format of the information that the unit returns to the host. A PROMPT may be output when the MPS is ready to accept a command.
DEFAULT	The default settings from the factory
EXAMPLE(S)	Example commands that do not necessarily apply to all applications. When "//" is used, this indicates a comment to explain the commands that proceed it and are not used in the command sequence. *data* - Example return data is shown in *italics*. **data** - Example commands are show in **bold**
RANGE	Lists the range of available arguments for the command unless otherwise stated. If range is not provided, the argument(s) are not range checked.
NOTES	Additional comments relevant to the command or variables.

7.8 General Control Commands

Status

COMMAND	STATUS
TYPE	Get
DESCRIPTION	Displays the current mode of the MPS. Refer to “5.6 Module Operating States” for detailed information on the different states.
SYNTAX	**STATUS**
RETURNS	STATUS: <mode> Where <mode> is: READY = Ready mode SCAN = Currently scanning CALZ = Performing a zero calibration SAVE = Performing a save CALVAL = Performing a calibration/validation PGM = Programming firmware Followed by a prompt when ready to accept a new command.
EXAMPLE	**STATUS** *STATUS: READY* >
EXAMPLE	// If the MPS is scanning **STATUS** *STATUS: SCAN* >
NOTES	This command is accepted at all times.

MPS Firmware Version

COMMAND	VER
TYPE	Get
DESCRIPTION	Retrieves the current software version.
SYNTAX	**VER**
RETURNS	The main firmware version string, followed by the prompt when ready to accept a new command.
EXAMPLE	**VER** *MPS Scanivalve (c) 2021 Ver 2.00* >

MPS Core Versions

COMMAND	COREVER
TYPE	Get
DESCRIPTION	Retrieves the individual software versions for the ARM and DSP.
SYNTAX	**COREVER**
RETURNS	The version string for both ARM and DSP sides of the processor, followed by the prompt when ready to accept a new command.
EXAMPLE	**COREVER** *ARMv0.12.502 / DSPv0.12.337* >

Calibration Version

COMMAND	CALVER
TYPE	Get
DESCRIPTION	Retrieves the software version of the MPS used during the last saved calibration.
SYNTAX	**CALVER**
RETURNS	The version string followed by the prompt when ready to accept a new command.
EXAMPLE	**CALVER** *1.08* >

Flash Directory Contents

COMMAND	DIR
TYPE	Get
DESCRIPTION	Returns the files saved on the flash memory, including the total size (bytes).
SYNTAX	**DIR**
RETURNS	Prompt when ready to accept a new command.
EXAMPLE	**DIR** *filename size date time* *1.04.mps 942080 2015/01/01 02:18:31* *scan.cfg 122 2015/01/01 02:18:32* *ip.cfg 89 2015/01/01 12:08:31* *Cal_1.cfg 11336 2015/01/01 08:45:32* >

Delete File

COMMAND	DEL
TYPE	Function
DESCRIPTION	Deletes a selected file from flash memory.
SYNTAX	**DEL** <filename> Where <filename> is the name of the file on the flash, including the extension.
RETURNS	Prompt when ready to accept a new command.
EXAMPLE	**DEL scan.cfg** >

Load Configuration File

COMMAND	LOAD
TYPE	Function
DESCRIPTION	Commands the MPS to load settings stored in a file on the flash to RAM.
SYNTAX	**LOAD** <filename> Where <filename> is the name of the file, including the extension. The file must be a configuration file.
RETURNS	Prompt when ready to accept a new command.
EXAMPLE	**LOAD scan.cfg** >

File Contents

COMMAND	TYPE
TYPE	Get
DESCRIPTION	Commands the MPS to list all settings, or a specified group of settings, that are stored on the flash.
SYNTAX	**TYPE** <filename> Where <filename> is the name of the file, including the extension. The file must be a configuration file.
RETURNS	The file contents and a prompt when ready to accept a new command.
EXAMPLE	**TYPE ip.cfg** *SET IPADD 192.168.0.240* *SET SUBNET 255.0.0.0* *SET MAC 0.96.93.95.0.1* *SET GW 0.0.0.0* >

List

COMMAND	LIST
TYPE	Function
DESCRIPTION	Commands the MPS to list all settings, or a specified group of settings, that are stored in RAM.
SYNTAX	**LIST** <group> Where:

<group>	Filename	Contents
IP	ip.cfg	IP (bootloader) Variables
ID	id.cfg	Identification Variables
S	scan.cfg	Scan Variables
PTP	ptp.cfg	PTP Variables
FC	Fc.cfg	Field Cal Conversion Points
C	Cal_<sn>.cfg	Full Calibration Coefficients
M	misc.cfg	Miscellaneous Variables
FTP	ftp.cfg	FTP Variables
O	oven.cfg	Oven Control Variables
PGA	Cal_<sn>.cfg	Programmable Gain Settings
T	Cal_<sn>.cfg	Conversion Settings

RETURNS	<setting> <variable> ::: ::: ::: ::: <setting> <variable> Followed by a prompt when ready to accept a new command.

EXAMPLE	**LIST S** *SET RATE 5.0000* *SET FPS 0* *SET UNITS PSI 1.000000* *SET FORMAT T F,F B,B B* *SET TRIG 0* *SET ENFTP 0* >
NOTES	Detailed responses from each LIST can be found later in the software section.

SAVE

COMMAND	SAVE
TYPE	Function
DESCRIPTION	Saves all configurations to flash, or a selected group of configurations.
SYNTAX	**SAVE** [<group>] When no <group> is present, all configurations except FC are saved (these lists must be saved individually). When a configuration is present, only that group of variables is saved. See the **LIST** command for a full list of groups.
RETURNS	Prompt when saving is complete and ready to accept a new command.
EXAMPLE	// To save all of the current settings (excluding FC) **SAVE** >
EXAMPLE	// To save only the “IP” settings to the file ip.cfg **SAVE IP** >
WARNING	Do not power cycle a module while the module is in SAVE mode. This can cause undesirable effects. If a SAVE has been issued, wait for the MPS to return a prompt, or use the STATUS command and wait for STATUS: READY before power cycling the unit.

SET

COMMAND	SET
TYPE	Function
DESCRIPTION	Commands the MPS to set one of the many configuration variables. Configuration variables available are described in subsequent sections.
SYNTAX	**SET** <name> <value> Where: <name> - the name of the configuration variable to be set or modified. <value> - the value or argument for the <name> variable.
RETURNS	Prompt when ready to accept a new command.
EXAMPLE	// Set the PTPEN variable to 1 **SET PTPEN 1** >

STOP

COMMAND	STOP
TYPE	Function
DESCRIPTION	Cancels all commands or routines and returns the MPS to READY mode.
SYNTAX	**STOP** or <ESC>
RETURNS	Prompt when ready to accept a new command.
EXAMPLE	**STOP** >
NOTES	This command is accepted at all times.

REBOOT

COMMAND	REBOOT
TYPE	Function
DESCRIPTION	Reboots the MPS (soft reboot).
SYNTAX	**REBOOT**
RETURNS	Nothing.
EXAMPLE	**REBOOT**

FORMAT FLASH

COMMAND	FDISK
TYPE	Function
DESCRIPTION	Erases and formats the internal memory. WARNING: All data will be lost, including configuration files. Once the command is issued, the MPS will respond with a confirmation message to approve the FDISK command or to cancel.
SYNTAX	**FDISK**
RETURNS	Type FDISKCONFIRM to confirm FDISK or STOP to escape FDISK Formatting… Prompt when ready for next command.
EXAMPLE	**FDISK** *Type FDISKCONFIRM to confirm FDISK or STOP to escape FDISK Formatting…* >
NOTES	FDISK will not remove the installed firmware application, but will remove the file if in memory.
NOTES	FSIDKCONFIRM will trigger a *Format Completed!* message.

READ CURRENT TEMPERATURE

COMMAND	TREAD
TYPE	Get
DESCRIPTION	Returns the current internal RTD temperatures.
SYNTAX	**TREAD** [<channel>] Where channel is a temperature channel number from 1 to 8. When omitted all temperature channels are returned.
RETURNS	Temperature of the internal RTDs
EXAMPLE	**TREAD** 32.687500,32.375000,32.500000,32.437500 >

READ MODEL

COMMAND	MODEL
TYPE	Get
DESCRIPTION	Returns the set model name.
SYNTAX	**MODEL**
RETURNS	The model name of the device
EXAMPLE	**MODEL** MPS4232 >
NOTES	This variable is set at the factory and cannot be changed in the field.

SCAN

COMMAND	SCAN
TYPE	Function
DESCRIPTION	Commands the MPS to being sampling values from the internal sensors and outputs data to the designated target. The MPS will enter SCAN mode. Refer to “5.5 Measurement Operation” for help on scanning.
SYNTAX	**SCAN**
RETURNS	The scan data, followed by a prompt when the scan is completed.
EXAMPLE	**SCAN** *::: [Scan Data] :::* >
NOTES	Output is based on formatting. Please see “7.5 ASCII Scan Data Examples” or “7.6 Binary Scan Data Formats” for more information.
NOTES	If PTP is enabled, the MPS may used PTP time as a trigger to start scanning if configured to do so. Refer to “5.7.7 Time Triggered Scan (SSD/SST)”.
NOTES	If TRIG == 1, the MPS will enter SCAN mode but will not output data until a trigger is received. Refer to “5.7.3 Frame Triggering (TRIG 1)”.

7.9 IP Variables

The IP settings control the IP address and associated network identification settings of the MPS4200. The IP configuration is accessed by the command LIST IP. These settings can only be saved using the SAVE IP command and will not take effect until a SAVE and reboot.

List IP Settings (LIST IP)

TYPE	Get
DESCRIPTION	Returns all of the IP settings.
SYNTAX	LIST IP
RETURNS	All of the IP setting followed by the prompt.
EXAMPLE	**LIST IP** *SET IPADD 10.0.1.222* *SET SUBNET 255.255.0.0* *SET MAC 0.96.93.90.0.100* *SET GW 0.0.0.0* >

Set IP Address of the MPS (IPADD)

COMMAND	IPADD
TYPE	Set
DESCRIPTION	Sets or retrieves the IP address of the MPS.
SYNTAX	IPADD <ipadd> Where <ipadd> is any valid IP address in the form nnn.nnn.nnn.nnn
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET IPADD 10.0.1.222** >
DEFAULT	191.30.95.100
RANGE	Any valid IP address

Set Subnet of the MPS (SUBNET)

COMMAND	SUBNET
TYPE	Set
DESCRIPTION	Sets the subnet mask.
SYNTAX	SET SUBNET <mask> Where <mask> is in the form nnn.nnn.nnn.nnn
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET SUBNET 255.255.0.0** >
DEFAULT	255.255.255.0
RANGE	Any valid subnet mask

Set Physical Ethernet Address (MAC)

COMMAND	MAC
TYPE	Set

DESCRIPTION	Sets the hardware's MAC address.
SYNTAX	SET MAC <xxx.xxx.xxx.xxx.xxx.xxx> Where <xxx.xxx.xxx.xxx.xxx.xxx> is any valid MAC address in decimal format.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET MAC 0.96.93.90.0.123** >
DEFAULT	000.096.093.xxx.yyy.yyy Where xxx is the family code where yyy.yyy is the serial number of the module.
NOTES	This value is set by Scanivalve at the factory and should not be altered unless otherwise advised.

SET GATEWAY (GW)

COMMAND	GW
TYPE	Set
DESCRIPTION	This is the IP address of the network gateway used for network communication. If not present 0.0.0.0 must be used.
SYNTAX	SET GW <gw address> Where <gw address> is any valid IP address in the form nnn.nnn.nnn.nnn
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET GW 10.0.2.123** >
DEFAULT	0.0.0.0

7.10 Scan Variables

Refer to “5.5 Measurement Operation” for most details.

List Scan Settings (LIST S)

DESCRIPTION	Returns all of the scan settings
SYNTAX	LIST S
RETURNS	All of the scan setting followed by the prompt.
EXAMPLE	**LIST S** *SET RATE 5.0000* *SET FPS 0* *SET UNITS PSI 1.000000* *SET FORMAT T F,F B,B B* *SET TRIG 0* *SET ENFTP 0* *SET OPTIONS 0 0 16* >

Set Rate (RATE)

COMMAND	RATE
TYPE	Set/Get
DESCRIPTION	Sets the scan rate of the MPS, or retrieves the current setting. This value is expressed in Hertz (Hz) or samples per channel per second. The MPS uses internal averaging for rate settings less than 500 (Hz). This means that the MPS will take X amount of samples and average these values before outputting a single pressure value in the data packet. When RATE is greater than or equal to 500, AVG will always be 1 (no averaging). The internal AD Rate will be equal to the set RATE. When RATE is less than 500, the internal AD rate and number of averages can be calculated using the following equations: AVG = ceil (500 / RATE) ADrate = RATE × AVG where ceil(x) finds the next integer greater than x
SYNTAX	SET RATE <rate> Where <rate> is the number of samples per seconds for all channels in Hz (sample/channel/second)
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET RATE 50** >
DEFAULT	1
RANGE	<.25 to 3500>
NOTES	See Section 2 for max rate settings per configuration.

Set Frames Per Scan (FPS)

COMMAND	FPS
TYPE	Set/Get

DESCRIPTION	Sets the number of frames to output during a scan. Once this number of frames is met during a scan, the MPS will stop scanning and return to READY mode. A Frame contains a sampled pressure value per channel output (32 channels total) plus time stamp, frame number, temperatures, and other additional information defined by the data output configured in the MPS. The FPS variable can be used to configure a scan for a certain time duration using the following equation: FPS = RATE x TIME where RATE is expressed in Hertz and TIME is expressed in seconds
SYNTAX	**SET FPS** <number of frames> Where <number of frames> is the number of frames in a scan. When set to 0 the scan continues until the STOP command is issued.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET FPS 100** >
DEFAULT	0
RANGE	0 to 4294967295

SET SCAN UNITS (UNITS)

COMMAND	UNITS
TYPE	Set/Get
DESCRIPTION	Set the scan units (pressure engineering units)
SYNTAX	**SET UNITS** <units> [<user cv>] Where <units> is one of the following: PSI ATM BAR CMHG CMH2O DECIBAR FTH2O GCM2 INHG INH2O KNM2 KGM2 KGCM2 KPA KIPIN2 MPA MBAR MH2O MMHG NM2 NCM2 OZIN2 OZFT2 PA PSF TORR USER RAW RAW C When <units> is set to USER, the user must enter a value for <user cv>. See “Appendix A - Engineering Unit Conversion Constants” for full details.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	// To configure the EU output to PSI **UNITS PSI** >
EXAMPLE	// To configure a user conversion value **UNITS USER 1.50** >

EXAMPLE	// To retrieve the current setting **UNITS** *UNITS RAW* >
DEFAULT	PSI

SET SCANNING DATA FORMAT (FORMAT)

COMMAND	FORMAT
TYPE	Set
DESCRIPTION	Set the format of the scanned data for each of the destinations: Telnet, FTP and Binary Server. It also sets the data format for each of the different destinations.
SYNTAX	**SET FORMAT** <destination> <format code> [,<destination> <format code>,<destination> <format code>] Where: <destination> is: T =Telnet (only A, F and C format code apply) F = FTP/UDP (only A, B and C format codes apply) B = Binary server (only B and L format codes apply) <format code> is: A = ASCII F = Formatted ASCII C = CSV format B = Standard Binary format L = LabVIEW binary format
RETURNS	Prompt when ready to accept a new command
EXAMPLE	// Set the format for all data ouputs **SET FORMAT T F,F B,B B** >
EXAMPLE	// Set the format for the binary server output to the LabVIEW packet format **SET FORMAT B L** >
DEFAULT	T F, F B, B B
NOTES	The entire string does not need to be set if only changing one format. For example; if changing the FTP format to output CSV, you may use the command **SET FORMAT F C**

SET TRIGGER (TRIG)

COMMAND	TRIG
TYPE	Set/Function
DESCRIPTION	Sets the external triggering functionality in the MPS.

SYNTAX	**SET TRIG** <value> Where <value>: 0 = External triggering is disabled. The MPS will scan using an internal trigger. 1 = External frame trigger is enabled. The SCAN command must be used to place the MPS into SCAN mode. Once in scan mode, the MPS will wait for an external hardware trigger pulse to release a frame of data, a **TRIG** command, or a <TAB> character code (9 HEX or Control I). The MPS will return to READY mode when a STOP command is issued, or FPS has been met. 2 = External scan trigger is enabled. The MPS will accept an applicable external voltage to execute a SCAN and stop the scan. 3 = Autostart is enabled. The MPS will start to scan and send data on power up (after the module's firmware has loaded).
RETURNS	Prompt when ready to accept a new command
EXAMPLE	// Disable external triggering **SET TRIG 0** >
DEFAULT	0
RANGE	0, 1, 2 or 3
NOTES	Setting TRIG to 3 requires a SAVE command followed by a reboot in order for the change to take effect. If PTP is enabled, it will delay 30 seconds to allow time for PTP sync to take place.

SET ENABLE FTP (ENFTP)

COMMAND	ENFTP
TYPE	Set
DESCRIPTION	Enables or disables sending data to the users FTP server.
SYNTAX	**SET ENFTP** <value> Where <value>: 0 = Disabled 1 = Enabled
RETURNS	Prompt when ready to accept a new command.
EXAMPLE	// Enable FTP data output **SET ENFTP 1** >
DEFAULT	0
RANGE	0 or 1

SET OPTIONS (OPTIONS)

COMMAND	OPTIONS
TYPE	DISABLED *(Set)*
DESCRIPTION	This variable is not used in the MPS4200 and is left for compatibility with MPS4264. Any values set in this variable will not affect the MPS4200.
SYNTAX	*SET OPTIONS <fast scan> <read mode> <statistical scan subset size>*
RETURNS	*Prompt when ready to accept a new command*
EXAMPLE	*SET OPTIONS 0 0 16* >
DEFAULT	*0 0 0*

7.11 Identification Variables

The identification settings control the serial number and the nominal pressure range of the MPS4200.

List Identification Settings (LIST ID)

DESCRIPTION	Returns all of the identification settings.
SYNTAX	LIST ID
RETURNS	All settings followed by the prompt.
EXAMPLE	**LIST ID** *SET SN 222* *SET NPR 5.0000 -5.0000 5.0000 -5.0000* *SET MCAST 224.0.1.2* *SET MODEL MPS4216* >

Set Serial Number (SN)

COMMAND	SN
TYPE	Set/Get
DESCRIPTION	Sets the serial number of the MPS.
SYNTAX	**SET SN** <sn> Where: <sn> is the serial number ranging from 0 to 32767.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET SN 123** >
DEFAULT	100
RANGE	0 to 32767
NOTES	This value will get printed to the name of the Cal.cfg file when a SAVE C is issued. Format is: Cal_<sn>.cfg

Set Nominal Pressure Range (NPR)

COMMAND	NPR
TYPE	Set
DESCRIPTION	Sets the nominal pressure ranges for the MPS
SYNTAX	**SET NPR** <npr1p> <npr1n> Where: <npr1p> is the maximum nominal pressure for all channels <npr1n> is the minimum nominal pressure for all channels
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET NPR 15.0 -15.0** >
DEFAULT	15.0 -15.0

Set the Multiple Device Multicast Address (MCAST)

COMMAND	MCAST
TYPE	Set

DESCRIPTION	Sets the multicast IP address used for multiple unit calibration and validation. This address must be the same for all units to be calibrated as a group.
SYNTAX	**SET MCAST** <ipadd> Where: <ipadd> - Is the multicast address in the range of 224.0.0.0 to 239.255.255.255
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET MCAST 224.0.1.2** >
DEFAULT	224.1.1.11
NOTES	A save and power cycle is required for changes to take effect.

SET MODEL NUMBER (MODEL)

COMMAND	MODEL
TYPE	Set/Get
DESCRIPTION	Sets the serial number of the MPS.
SYNTAX	**SET MODEL** <model> Where: <model> is the model of the MPS: MPS4216, MPS4232, or MPS4264.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET MODEL MPS4232** >
DEFAULT	MPS4232
NOTES	This value is set at the factory and must not be changed.
NOTES	Using the command GET MODEL will response with the full line: SET MODEL <model>. This response differs from the generic **MODEL** command.

7.12 Miscellaneous Variables

This is a collection of settings that are used for miscellaneous settings.

List Miscellaneous Settings (LIST M)

DESCRIPTION	Returns all of the miscellaneous settings
SYNTAX	LIST M
RETURNS	All of the miscellaneous setting followed by the prompt.
EXAMPLE	**LIST M** *SET SIM 0* *SET ECHO 0* *SET XITE 2* *SET ETOL 0* >

Set Simulation (SIM)

COMMAND	SIM
TYPE	Set
DESCRIPTION	Sets debugging and simulation modes.
SYNTAX	**SET SIM** <code in hex> Where <code in hex>: Bit 2 set will show PTP calculated start differentials Bit 6 changes the binary packet to a MPS4264 simulated packet (padded 64 channel packet) The value can be set using a hex or decimal value.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	// set the MPS4200 to output a simulated 64 channel binary packet **SET SIM 64** >
DEFAULT	0
RANGE	0 to 65535

Set Echo (ECHO)

COMMAND	ECHO
TYPE	Set
DESCRIPTION	Sets echo for serial and Telnet communication.
SYNTAX	**SET ECHO** <value> Where <value> is 0 for disabled or 1 for enabled.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET ECHO 1** >
DEFAULT	0
RANGE	0 or 1

Set Excitation (XITE)

COMMAND	XITE

TYPE	DISABLED *(Set)*
DESCRIPTION	Sets excitation mode
SYNTAX	**SET XITE** <polarity> Where <polarity> is: 0 = Negative only 1 = Positive only 2 = Regular 3 = Reversed
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET XITE 2** >
DEFAULT	2
RANGE	0 - 3
WARNING	This variable should not be changed from the default setting unless instructed by Scanivalve.

Set Validation Error Tolerance (ETOL)

COMMAND	ETOL
TYPE	Set
DESCRIPTION	Changes the error tolerance value set in the validation report generated by the MPS.
SYNTAX	**SET ETOL** <error> Where <error> is the value for the Full-Scale error percentage value for pass/fail limits. When set to '0', the MPS will use the default error percentage based on the pressure range (see specifications in Section 2 of the User Manual or the MPS4200 Data Sheet for accuracy error percentages).
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET ETOL 0.1** >
DEFAULT	0
RANGE	0 - 100

7.13 FTP Variables

The FTP settings are used to control the MPS4200 FTP client connection to the FTP server, which is enabled by the ENFTP variable under LIST S. Refer to ”5.8.4 FTP Data Output”.

LIST FTP Settings (LIST FTP)

DESCRIPTION	Returns all of the FTP settings
SYNTAX	LIST FTP
RETURNS	All of the FTP setting followed by the prompt.
EXAMPLE	**LIST FTP** *SET USERFTP Scanivalve* *SET PASSFTP password* *SET PATHFTP /File* *SET IPFTP 10.0.1.222* *SET FILEFTP Scan* >

Set User Name (USERFTP)

COMMAND	USERFTP
TYPE	Set
DESCRIPTION	Sets the name of the user login on the FTP server or NAS
SYNTAX	**SET USERFTP** <user name>
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET USERFTP Scanivalve** >
DEFAULT	admin

Set FTP Password (PASSFTP)

COMMAND	PASSFTP
TYPE	Set
DESCRIPTION	Sets the name of the user password for login on the FTP server or NAS
SYNTAX	**SET PASSFTP** <password>
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET PASSFTP password** >
DEFAULT	password

Set FTP Path (PATHFTP)

COMMAND	PATHFTP
TYPE	Set
DESCRIPTION	Set the directory path of the scan data file on the user’s computer. The argument does not require the use of a drive letter e.g., C: or D:.
SYNTAX	**SET PATHFTP** <directory path> The <directory path> must start with a “/”.
RETURNS	Prompt when ready to accept a new command

EXAMPLE	**SET PATHFTP /disk1/share** >
DEFAULT	/disk1/share

SET FTP IP ADDRESS (IPFTP)

COMMAND	IPFTP
TYPE	Set
DESCRIPTION	Set the IP address of the users FTP server.
SYNTAX	**SET IPFTP** <IP Address>
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET IPFTP 10.0.1.222** >
DEFAULT	10.0.0.1

SET FTP FILE NAME (FILEFTP)

COMMAND	FILEFTP
TYPE	Set
DESCRIPTION	Set the base name for the scan data on the user's computer. The actual file name will have the time and date appended to the file. It will have a file extension based on the data format.
SYNTAX	**SET FILEFTP** scan
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET FILEFTP Scan_117_** >
DEFAULT	SCAN

7.14 UDP Variables

The UDP settings control the target and enable of scan data out the UDP port. Refer to “5.8.4 UDP Data Output”.

List UDP Settings (LIST UDP)

DESCRIPTION	Returns all of the UDP settings
SYNTAX	LIST UDP
RETURNS	All of the setting followed by the prompt.
EXAMPLE	**LIST UDP** *SET ENUDP 0* *SET IPUDP 224.0.1.2* >

Set UDP Enable (ENUDP)

COMMAND	ENUDP
TYPE	Set
DESCRIPTION	Configures UDP data output.
SYNTAX	**SET ENUDP** <0 or 1> Where: 0 = Disabled 1 = Enabled
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET ENUDP 1** >
DEFAULT	0
RANGE	0 or 1
NOTES	SET FORMAT F B must be set for the MPS to send Binary data via UDP.

Set the UDP Target Address and Port (IPUDP)

COMMAND	IPUDP
TYPE	Set
DESCRIPTION	Sets the UDP data output target address and port.
SYNTAX	**SET IPUDP** <udpadd> <port> Where: <udpadd> = Is the target IP address for the UDP scan data. Can be a unicast or multicast address. <port> = Is the target port.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET IPUDP 224.0.1.2 23** >
DEFAULT	0.0.0.0 0
RANGE	<Any valid IP address> <0-65535>

7.15 Calibration and Validation Commands

Refer to “6.7 Calibration & Validation Overview”.

Calibration

COMMAND	CAL
TYPE	Function
DESCRIPTION	Starts a full or field calibration, single unit or multiple unit, as defined by the variables in LIST C and/or LIST O.
SYNTAX	**CAL** [<F or FM>] Where: F = Initiates a single temperature field calibration, with no thermal chamber connection. MPS connection to a calibrator is required. *FM = Initiates a manual single unit, single temperature field calibration with no thermal chamber or calibrator connection. When the optional parameter is not present, the unit performs a full calibration.
RETURNS	Calibration data and a prompt when completed.
EXAMPLE	**CAL** *[:::data:::]* >
NOTES	A Scanivalve SPC4000 or SPC4050 is required for automated calibrations. An Ethernet controllable thermal chamber is required for full calibrations.

Multiple Unit Calibration

COMMAND	MCAL
TYPE	Function
DESCRIPTION	When the master receives the MCAL command, it starts the multiple device full or field calibration sequence, as defined by the variables in LIST C and/or LIST O.
SYNTAX	**MCAL** [<F or FM>] Where: F = Initiates a multiple unit, single temperature filed calibration with no oven connection. MPS connection to a calibrator required. *FM = Initiates a manual multiple unit single temperature calibration with no oven connection. Does not connect to a calibrator and pressure must be applied manually. When the optional parameter is not present, the unit performs a full multi-unit calibration.
RETURNS	Calibration information and a prompt when completed.
EXAMPLE	**MCAL** *[:::data:::]* >
NOTES	A Scanivalve SPC4000 or SPC4050 is required for automated calibrations. An Ethernet controllable thermal chamber is required for full calibrations.

Calibration & Validation

COMMAND	CALVAL
TYPE	Function
DESCRIPTION	Starts a full or field calibration and validation sequence (continuous), as defined by the variables in LIST C and/or LIST O. A validation report is generated and stored in the MPS’s file system.

SYNTAX	**CALVAL** [F] Where: F = Initiates a single unit field calibration, followed by a field validation with no oven connection. MPS connection to a calibrator required. When the optional parameter is not present, the unit performs a full calibration/validation.
RETURNS	Calibration and validation information and a prompt when completed.
EXAMPLE	**CALVAL** *[:::data:::]* >
NOTES	A Scanivalve SPC4000 or SPC4050 is required for automated calibrations/validations. An Ethernet controllable thermal chamber is required for full calibration/validations.

MULTIPLE UNIT CALIBRATION & VALIDATION

COMMAND	MCALVAL
TYPE	Function
DESCRIPTION	When the master receives the MCALVAL command, it starts the multiple device full or field calibration and validation sequence (continuous), as defined by the variables in LIST C and/or LIST O. A validation report is generated and stored in each MPS's file system.
SYNTAX	**MCALVAL** [F] F = Initiates a multiple unit single temperature calibration with no oven connection. MPS connection to a calibrator required. When the optional parameter is not present, the unit performs a full multi-unit calibration and validation.
RETURNS	Calibration and validation information and a prompt when completed.
EXAMPLE	**MCALVAL** *[:::data:::]* >
NOTES	A Scanivalve SPC4000 or SPC4050 is required for automated calibrations/validations. An Ethernet controllable thermal chamber is required for full calibrations/validations.

VALIDATION

COMMAND	VAL
TYPE	Function
DESCRIPTION	Starts a full or field validation, as defined by the variables in LIST C and/or LIST O. A validation report is generated and stored in the MPS's file system.
SYNTAX	**VAL** [<F or FM>] Where: F = Initiates a single temperature field validation, with no oven connection. MPS connection to a calibrator required. FM = Initiates a single temperature manual field validation with no oven or calibrator connection. When the optional parameter is not present, the unit performs a full validation.
RETURNS	Validation Data
EXAMPLE	**VAL** *[:::data:::]* >

NOTES	A Scanivalve SPC4000 or SPC4050 is required for automated validations. An Ethernet controllable thermal chamber is required for full validations.

MULTIPLE UNIT VALIDATION

COMMAND	MVAL
TYPE	Function
DESCRIPTION	When the master receives the MVAL command, it starts the multiple device full or field validation sequence, as defined by the variables in LIST C and/or LIST O. A validation report is generated and stored in each MPS's file system.
SYNTAX	**MVAL** [<F or FM>] Where: F = Initiates a single temperature field validation, with no oven connection. MPS connection to a calibrator required. FM = Initiates a single temperature manual field validation with no oven or calibrator connection. When the optional parameter is not present, the unit performs a full multi-unit validation.
RETURNS	Validation Data
EXAMPLE	**MVAL** *[:::data:::]* >
NOTES	A Scanivalve SPC4000 or SPC4050 is required for automated validations An Ethernet controllable thermal chamber is required for full validations.

QUICK-ZERO OFFSET CALIBRATION (CALZ)

COMMAND	CALZ
TYPE	Function/Set/Get
DESCRIPTION	Starts a zero calibration and places the MPS4200 into CALZ mode. This operation produces A/D count values for each pressure channel that is subtracted from the raw pressure counts before converting to the chosen pressure units.
SYNTAX	**CALZ** [0] If the option "0" is used, this will disable any previous CALZ correction factors. The scan data will then be non-corrected.
RETURNS	A prompt when ready for the next command.
EXAMPLE	**CALZ** >
NOTES	A CALZ does not require additional equipment, is performed internally, and the command can be issued at any time. Typically, a CALZ is issued when the module is in the CALIBRATE valve state. This allows the CAL and REF ports to be tied together externally to provide an equal, or zero differential, pressure to the positive and negative sides of the transducer. This provides an optimal Quick-Zero Offset Correction. CALZ's can be performed when the module is in MEASUREMENT (Px) mode. This is typically performed in a "wind-off" condition, known as a "wind-off CALZ", where no pressure is being applied to the REF or Px ports of the module. Refer to "5.10.1 Zero Offset Calibration (CALZ)" on page 31.

7.16 Calibration Variables

The calibration settings control the calibration and validation of the MPS4200. Refer to "6.7 Calibration & Validation Overview".

List Calibration Settings (LIST C)

DESCRIPTION	Returns all of the calibration settings
SYNTAX	LIST C
RETURNS	All of the calibration settings followed by the prompt.
EXAMPLE	**LIST C** *SET NUMPTS 11 9 15 9* *SET MIN 40.000000 -5.500000 5.000000 -5.000000* *SET MAX 60.000000 5.500000 55.000000 5.000000* *SET DELAY 120 0 0 300* *SET IPCAL 10.0.0.1 1025 1* *SET CALAVG 16 16* *SET VALZO 0* *SET FCAL 3 -5.00 5.00* *SET FVAL 3 -5.00 5.00* >

Set Number of Points in Conversion Table (NUMPTS)

COMMAND	NUMPTS
TYPE	Set
DESCRIPTION	Sets the number calibration and validation temperature and pressure points. This setting works with the MIN and MAX setting to the calibration and validation points.
SYNTAX	**SET NUMPTS** <tcal> <pcal> <tval> <pval> Where: <tcal> = Number of temperature points for a calibration. <pcal> = Number of pressure points for a calibration. <tval> = Number of temperature points for a validation. <pval> = Number of pressure points for a validation. These values are not range checked.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET NUMPTS 15 25 3 15** >
DEFAULT	5 9 5 9
RANGE	<0 to 15> <0 to 25> <0 to 15> <0 to 25>

Set Minimum Calibration and Validation Values (MIN)

COMMAND	MIN
TYPE	Set
DESCRIPTION	Sets the minimum calibration and validation temperature and pressure.
SYNTAX	**SET MIN** <tcal> <pcal> <tval> <pval> Where: <tcal> = Minimum temperature value for a calibration. <pcal> = Minimum pressure value for a calibration. <tval> = Minimum temperature value for a validation. <pval> = Minimum pressure value for a validation.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET MIN 0 -5.5 10 -5.0** >
DEFAULT	0 -15 0 -15
RANGE	These values are not range checked.

Set Maximum Calibration and Validation Values (MAX)

COMMAND	MAX
TYPE	Set
DESCRIPTION	Sets the maximum calibration and validation temperature and pressure.
SYNTAX	**SET MAX** <tcal> <pcal> <tval> <pval> Where: <tcal> = Maximum temperature value for a calibration. <pcal> = Maximum pressure value for a calibration. <tval> = Maximum temperature value for a validation. <pval> = Maximum pressure value for a validation.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET MAX 70 5.5 60 5.0** >
DEFAULT	70 15 70 15
RANGE	These values are not range checked.

Set Oven and Calibrator Delays (DELAY)

COMMAND	DELAY
TYPE	Set
DESCRIPTION	Sets the delay in minutes and seconds for the oven and calibrator, respectively.
SYNTAX	**SET DELAY** <iodelay> <odelay> <cdelay> <spcdelay> Where: <iodelay> = Initial oven delay in minutes. <odelay> = Oven delay in minutes. Setting this value to zero enables a stable query to the MPS (MPS must be +/-0.125°C for 10 minutes, 120 minute timeout). <cdelay> = Calibrator delay in seconds. Setting this value to zero uses the calibrator's STABLE command. <spcdelay> = Special Delay in seconds. This dwell is between the time between the positive applied points, and the negative applied points.

RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET DELAY 120 45 0 200** >
DEFAULT	120 0 0 300
RANGE	These values are not range checked.

SET THE CALIBRATOR IP ADDRESS, PORT AND CALIBRATOR NUMBER (IPCAL)

COMMAND	IPCAL
TYPE	Set
DESCRIPTION	Sets the IP address and port for the calibrator. This is only applicable when using a Scanivalve SPC4000 or SPC4050 calibrator.
SYNTAX	**SET IPCAL** <ipadd> <port> <calibrator number> Where: <ipadd> = Calibrator IP address. <port> = Calibrator port. <calibrator number> = Calibrator number.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET IPCAL 10.0.0.122 23 1** >
DEFAULT	10.0.0.61 23 1
RANGE	These values are not range checked.

SET THE CALIBRATION AND VALIDATION AVERAGE (CALAVG)

COMMAND	CALAVG
TYPE	Set
DESCRIPTION	Sets the number of samples taken from the MPS for a calibration and validation.
SYNTAX	**SET CALAVG** <calrate> <calavg> Where: <calrate> = Is the scan rate at which the samples are taken for the calibration/validation. <calavg> = Is the number of sample taken for the calibration/validation. Valid values range between 1 and 32000.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET CALAVG 12 128** >
DEFAULT	0.9 16
RANGE	<0 to 850> <1 to 32000>

SET ENABLE CALZ BEFORE VALIDATION (VALZO)

COMMAND	VALZO
TYPE	Set/Get
DESCRIPTION	When set (1) a CALZ is performed at the start of each temperature during a validation.
SYNTAX	**SET VALZO** <0 or 1>
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET VALZO 1** >

DEFAULT	0
RANGE	0 or 1

SET FIELD CALIBRATION POINTS (FCAL)

COMMAND	FCAL
TYPE	Set
DESCRIPTION	Sets the number of points and the min/max pressure for field calibration. Points will be evenly spaced between the minimum and maximum and will include a 0.00 point.
SYNTAX	**SET FCAL** <number of points> <minimum pressure> <maximum pressure>
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET FCAL 13 -5.00 5.00** >
DEFAULT	0
RANGE	These values are not range checked

SET FIELD VALIDATION POINTS (FVAL)

COMMAND	FVAL
TYPE	Set
DESCRIPTION	Sets the number of points and the min/max pressure for field validation. Points will be evenly spaced between the minimum and maximum and will include a 0.00 point.
SYNTAX	**SET FVAL** <number of points> <minimum pressure> <maximum pressure>
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET FVAL 15 -5.00 5.00** >
DEFAULT	0
RANGE	These values are not range checked

7.17 Oven Variables

The oven settings control the thermal chamber when performing a multi-temperature calibration or validation of the MPS4200. These settings are only required if performing a full calibration or validation. Refer to “6.7 Calibration & Validation Overview”.

List Oven Settings (LIST O)

DESCRIPTION	Returns all of the oven settings
SYNTAX	LIST C
RETURNS	All of the oven settings followed by the prompt.
EXAMPLE	**LIST O** *SET IPOVEN 10.0.0.1 0* *SET STARTOVEN 0* *SET STOPOVEN 0* *SET TEMPOVEN 0* >

Set the Oven IP Address, Port and Calibrator Number (IPOven)

COMMAND	IPOVEN
TYPE	Set
DESCRIPTION	Sets the IP address and port for the oven / thermal chamber.
SYNTAX	**SET IPOVEN** <ipadd> <port> Where: <ipadd> = Calibrator IP address <port> = Calibrator port If 0.0.0.0 0 is set, no oven is used.
RETURNS	Prompt when ready to accept a new command.
EXAMPLE	**SET IPOVEN 10.0.0.122 1025** >
DEFAULT	10.0.0.1 0

Set the Oven Start Command (STARTOVEN)

COMMAND	STARTOVEN
TYPE	Set
DESCRIPTION	Sets the command to send the oven / thermal chamber to start.
SYNTAX	**SET STARTOVEN** [<start oven command>] If no command is entered, a <CR> is sent to the oven.
RETURNS	Prompt when ready to accept a new command.
EXAMPLE	**SET STARTOVEN RUNM** **>**
DEFAULT	0
RANGE	These values are not range checked.

Set the Oven Stop Command (STOPOVEN)

COMMAND	STOPOVEN
TYPE	Set
DESCRIPTION	Sets the command to stop the oven / thermal chamber.
SYNTAX	**SET STOPOVEN** [<stop oven command>] If no command is entered, a CR is sent to the oven.
RETURNS	Prompt when ready to accept a new command.
EXAMPLE	**SET STOPOVEN STOP** >
DEFAULT	0
RANGE	These values are not range checked.

SET THE TEMPERATURE COMMAND (TEMPOVEN)

COMMAND	TEMPOVEN
TYPE	Set
DESCRIPTION	Sets the command to send the oven / thermal chamber to a temperature.
SYNTAX	**SET TEMPOVEN** [<set temperature command>] If no command is entered, a CR is sent to the oven.
RETURNS	Prompt when ready to accept a new command.
EXAMPLE	**SET TEMPOVEN SETP1,** >
DEFAULT	0
RANGE	These values are not range checked.

7.18 Conversion Table Variables

The conversion table is responsible for converting raw pressure counts and temperature into accurate EU pressure. Refer to "6.7 Calibration & Validation Overview".

List Least-Squared Coefficients (LIST T)

DESCRIPTION	Returns the least-squares and error correction coefficients.
SYNTAX	LIST T
RETURNS	The least-squares conversion and error correction coefficients for each pressure channel, in the format: SET K <channel> <k1> <k2> <k3> <k4> <k5> <k6> SET A <channel> <a1> <a2> <a3> <a4> SET B <channel> <b1> <b2> <b3> <b4> SET C <channel> <c1> <c2> <c3> <c4> SET D <channel> <d1> <d2> <d3> <d4> Where: <channel> - is the pressure channel 1 to 32. <k*n*> - the least-squares coefficient value as used in the conversion equation. <a, b, c, d*n*> - the error correction coefficient used in the background task to obtain the respective A, B, C, or D coefficient for the current temperature.
EXAMPLE	**LIST T** SET K 1 5.526097E-02 1.113042E-04 1.068045E-07 1.908862E-10 -1.825929E-07 5.010776E-16 ::: *<channels 2 through 31>* ::: SET K 32 1.824528E-02 1.728427E-05 1.125552E-07 1.937218E-10 8.462436E-08 6.297182E-16 SET A 1 5.418055E-29 -1.750566E-26 1.211565E-24 6.328985E-23 SET B 1 -1.037300E-22 -5.255588E-21 2.689422E-18 5.163233E-17 SET C 1 7.753362E-17 1.316558E-13 -9.490233E-12 6.842524E-11 SET D 1 4.354304E-10 2.671218E-08 -5.311249E-06 6.469795E-05 ::: *<channels 2 through 31>* ::: SET A 32 -1.042455E-28 -8.901835E-28 9.933755E-25 8.592377E-23 SET B 32 -5.249502E-22 4.515980E-20 7.136923E-19 -2.463333E-18 SET C 32 4.681487E-16 1.250421E-13 -1.269469E-11 8.363017E-11 SET D 32 -2.882084E-09 4.051924E-07 -1.732523E-05 1.873441E-04 >

Set Coefficients

COMMAND	Varies based on term
TYPE	Set
DESCRIPTION	Sets conversion coefficients.
SYNTAX	**SET** <coefficient term> <channel> <term1> <term2> <term3> <term4> [<term5> <term6>] Where: <coefficient term> - is K, A, B, C, or D. <channel> - is the channel form 1 to 32. <term1-6> - are the coefficient correction values based on the term.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET A 15 1.000000 1.000000 1.000000 1.000000** >
NOTES	These values should **never** be manipulated manually.

7.19 Field Calibration Variables

The field calibration variables are responsible for storing correction terms created after a field calibration. These settings can only be saved using a SAVE FC command. Refer to “6.7 Calibration & Validation Overview”.

List Field Calibration Settings (LIST FC)

DESCRIPTION	Returns the field calibration correction coefficients and the field calibration correction status.
SYNTAX	LIST FC
RETURNS	All field calibration correction coefficients, plus the field calibration correction status. SET FCENABLE <status> SET FC <channel> <fc1> <fc2> <fc3> Where: <status> - is the status of the field calibration corrections. <channel> - is the pressure channel 1 to max channel. <fc*n*> - the coefficient terms used in calculating the field calibration offset for correcting the EU pressure after conversion
EXAMPLE	**LIST T** SET FCENABLE 1 SET FC 1 -2.397058E-05 3.163599E-11 -6.514663E-18 SET FC 2 4.611204E-04 2.498326E-11 -1.436391E-17 ::: *<channels 3 through 30>* ::: SET FC 31 5.109234E-03 6.208174E-11 1.013237E-17 SET FC 32 1.061724E-03 3.800963E-11 -1.320103E-17 >

Set Field Calibration Correction Status

COMMAND	FCENABLE
TYPE	Set/Get
DESCRIPTION	Enables or disables the use of the stored field calibration correction coefficients.
SYNTAX	**SET FCENABLE** <status> Where <status> is: 0 = disabled (the standard coefficients are used). 1 = enabled (the field calibration correction terms are in use).
RETURNS	Prompt when ready to accept a new command.
EXAMPLE	**SET FCENABLE 1** >

Set Field Calibration Coefficients

COMMAND	FC
TYPE	Set
DESCRIPTION	Sets thee field calibration correction coefficients.
SYNTAX	**SET FC** <channel> <fc1> <fc2> <fc3> Where: <channel> - is the pressure channel 1 to max channel. <fc*n*> - the coefficient terms used in calculating the field calibration offset for correcting the EU pressure after conversion.
RETURNS	Prompt when ready to accept a new command.
NOTES	These values should **never** be manipulated manually.

7.20 Multicast Commands

Commands that can be used in multicast nodes. Refer to “5.9 Multi-Unit Operation”. Also refer to LIST ID for the MCAST variable.

Multiple Unit Find

COMMAND	MFIND
TYPE	Function
DESCRIPTION	Lists all of the MPS4200 devices in the multicast cluster of the master.
SYNTAX	MFIND
RETURNS	A list of MPS modules found in the multicast “cluster” followed by a prompt ready for the next command.
EXAMPLE	**MFIND** *Found device SN9 IP Address 191.30.90.9* *Found device SN10 IP Address 191.30.90.10* >

Multiple Unit Stop

COMMAND	MSTOP
TYPE	Function
DESCRIPTION	Sent to stop multiple units when working with multiple devices. When the master receives the MSTOP command it issues a STOP command to the multicast address set in the MCAST variable. Each MPS member of this multicast cluster will stop scanning.
SYNTAX	MSTOP
RETURNS	Prompt ready for the next command.
EXAMPLE	**MSTOP** >

Multiple Unit Scan

COMMAND	MSCAN
TYPE	Function
DESCRIPTION	When the master receives the MSCAN command it issues a SCAN command to the multicast address set in the MCAST variable. Each MPS member of this multicast cluster will start scanning provided the SSD and SST conditions are met.
SYNTAX	MSCAN
RETURNS	Scan Data. The prompt will appear after the scan has stopped.
EXAMPLE	**MSCAN** >
NOTES	Output is based on formatting.

7.21 Precision Time Protocol Variables

The precision time protocol settings control the PTP 1588 settings of the MPS4200. The PTP configuration is accessed by the command LIST PTP. Refer to “5.7.6 Precision Time Protocol (PTPv2) Synchronization” and “5.7.7 Time Triggered Scan (SSD/SST)”.

LIST Precision Time Protocol Settings (LIST PTP)

DESCRIPTION	Returns all of the PTP settings
SYNTAX	LIST PTP
RETURNS	All of the PTP setting followed by the prompt.
EXAMPLE	**LIST PTP** *SET PTPEN 1* *SET STAT 0* *SET SST 0:0:0.000000* *SET SSD 1971/1/1* *SET UTCOFFSET -7:00:00* *SET MAXOFM 0* >

SET PTP Enable (PTPEN)

COMMAND	PTPEN
TYPE	Set
DESCRIPTION	Enables the precision time protocol engine in the MPS4200. When PTPEN is set to 2, the MPS will serve as a PTP master.
SYNTAX	SET PTPEN <status> Where <status> is: 0 = off 1 = PTP Slave unit 2 = PTP Master unit
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET PTPEN 1** >
DEFAULT	0
RANGE	0 to 2
NOTES	In order to set a MPS to a PTP Master (PTPEN == 2), PTP must first be disabled (PTPEN == 0). PTPEN 2 cannot be set when PTPEN == 1.

SET PTP Statistical Output (STAT)

COMMAND	STAT
TYPE	Set
DESCRIPTION	Sets the destination of PTP statistical output
SYNTAX	**SET STAT** <level code> Where <level code> is: 0 = off 1 = serial 2 = network

RETURNS	Prompt when ready to accept a new command The statistical data is output in the following format: <ofm>, <msd>, <smd>, <mpd>, <obc> ofm = Offset From Master. Time that slave and master differ in units of microseconds msd = Master to Slave Delay. Filtered packet delivery time from master to slave smd = Slave to Master Delay. Filtered packet delivery time from slave to master mpd = Mean Path Delay. Filtered mean path delay time obc = Observed Correction. The observed correction of the internal clock in nanoseconds
EXAMPLE	**SET STAT 0** >
DEFAULT	0
RANGE	0 to 2
NOTES	Once set, the MPS will stream this data until SET STAT 0 is issued. A STOP command will not stop this stream of data.
NOTES	For a one time measure of the ofm value, see **PTPSTAT**.

SET SCAN START TIME (SST)

COMMAND	SST
TYPE	Set
DESCRIPTION	Sets the time to start scanning as referenced to the internal time of the MPS (typically syncronized to a PTP Grandmaster). The MPS4200 will use the current time as the scan start time under two conditions: 1) When the PTP system is disabled via the SET PTPEN 0 command. 2) When PTP is enabled and synchronized, and the SST/SSD variables are set to a date and time in the past. If these two cases are not met, the MPS4200 uses the start time and date set via the SET SST <time> and SET SSD <date> setting in the PTP group. After a SCAN command is executed, the MPS will wait until the time set in SST/SSD matches the internal time before releasing data.
SYNTAX	**SET SST** <hh:mm:ss> Where: hh = Hours (24 hour format) mm = Minutes ss = Seconds
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET SST 13:00:00** >
DEFAULT	0:0:0
RANGE	Any valid time

SET SCAN START DATE (SSD)

COMMAND	SSD
TYPE	Set
DESCRIPTION	Sets the date to start scanning as referenced to the grandmaster. See SST for more information.

SYNTAX	**SET SSD** <yyyy/mm/dd > Where: yyyy - Year mm - Month dd - Day
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET SSD 2016/08/10** >
DEFAULT	1971/1/1
RANGE	Any valid date

SET UTC OFFSET (UTCOFFSET)

COMMAND	UTCOFFSET
TYPE	Set
DESCRIPTION	Sets the offset to be added or subtracted from network time.
SYNTAX	**SET UTCOFFSET** <hh:mm:ss> Where: hh = Hours from -12 to 12 mm = Minutes from 0 to 59 ss = Seconds from 0 to 59
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET UTCOFFSET -9:0:0** >
DEFAULT	0:0:0
RANGE	Any valid time

SET MAX OFFSET FROM MASTER LIMIT (MAXOFM)

COMMAND	MAXOFM
TYPE	Set
DESCRIPTION	Sets the max offset from master possible before scan operations are shut down. This allows the MPS to stop or prevent scanning if the PTP synchronization is beyond a set limit. If the max offset is outside of the set value, scanning cannot be executed until the OFM value falls below the limit for at least 4 samples.
SYNTAX	**SET MAXOFM** <limit> Where <limit> is the max offset from master limit in microseconds. When set to 0, the function will be disabled.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**SET MAXOFM 10** >
DEFAULT	0
RANGE	0 to 10000

7.22 PTP (Precision Time Protocol) Commands

Get PTP Time

COMMAND	GETTIME
TYPE	Get
DESCRIPTION	Gets the current PTP time as used by the MPS. Time is adjusted by UTCOFFSET.
SYNTAX	**GETTIME**
RETURNS	Current Time yyyy/mm/dd hh:mm:ss sec nnnn ns Followed by a prompt when ready for next command.
EXAMPLE	**GETTIME** *Current Time 2014/2/6 0:23:52.0 sec 3335 ns 439809720* >

Set PTP Time

COMMAND	SETTIME
TYPE	Set
DESCRIPTION	Sets the current PTP time as used by the MPS. Time is adjusted by UTCOFFSET. When a grandmaster is active on the network, the time set by the SETTIME command is over written by the grand master time if the module is configured as a PTP Slave (PTPEN == 1).
SYNTAX	**SETTIME** <yyyy/mm/dd> <hh:mm:ss> Where: yyyy = Year mm = Month dd = Day hh = Hours (24 hour format) mm = Minutes ss = Seconds
RETURNS	Current Time yyyy/mm/dd hh:mm:ss sec nnnn ns Followed by a prompt when ready for next command.
EXAMPLE	**SETTIME 2016/6/22 14:20:0.00** *Entered 2016/6/22 14:20:0* *Time is 1466605200*

Get UTC Offset

COMMAND	GETUTCO
TYPE	Get
DESCRIPTION	Retrieves the current UTC offset.
SYNTAX	**GETUTCO**

RETURNS	Current UTC Offset <value> <update> <valid> Where: value = The current difference between TAI time and UTC time, in seconds, as supplied by the local grandmaster. update = UTC updated flag valid = Set as 1 when UTC offset found is valid. Followed by a prompt when ready for next command.
EXAMPLE	**GETUTCO** *Current UTC Offset 0 0 0* *>*

GET PTP STAT

COMMAND	PTPSTAT
TYPE	Get
DESCRIPTION	Retrieves the current difference between the DSA's time and the Grandmasters time.
SYNTAX	**PTPSTAT**
RETURNS	PTPSTAT,<second>,<nanoseconds> Where: second = offset from master, seconds nanoseconds = offset from master, nanoseconds. Followed by a prompt when ready for next command.
EXAMPLE	**PTPSTAT** *PTPSTAT,0,39* *>*

7.23 ELECTRIC VALVE COMMANDS

The following commands are specific to the EPx configurations of the MPS4264. These commands will not be acknowledged in any other MPS valve configuration, and will prompt and ERROR if attempted.

VALVE STATE - MEASUREMENT MODE (EPX)

DESCRIPTION	Changes the valve state to Px (Measurement) mode with the use of the internal motor.
SYNTAX	EPX
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**EPX** >
NOTES	The command will not be accepted if the valve is already in Px mode. The valve state can be queried during transition using the STATUS command.

VALVE STATE - CALIBRATE MODE (ECAL)

DESCRIPTION	Changes the valve state to CAL mode with the use of the internal motor.
SYNTAX	ECAL
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**ECAL** >
NOTES	The command will not be accepted if the valve is already in Cal or Purge mode. The valve state can be queried during transition using the STATUS command.

VALVE STATE - PURGE MODE (EPRG)

DESCRIPTION	Changes the valve state to PURGE mode with the use of the internal motor.
SYNTAX	EPRG
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**EPRG** >
NOTES	The command will not be accepted if the valve is already in Purge or Cal mode. The valve state can be queried during transition using the STATUS command.

ELECTRIC ZERO-OFFSET CALIBRATION (ECALZ)

DESCRIPTION	Performs a CALZ after the valve state has been moved to CAL mode.
SYNTAX	ECALZ
RETURNS	Prompt when ready to accept a new command
EXAMPLE	**ECALZ** >
NOTES	This command will start a sequence in the electric valve that will perform the following: Transition valve state to CAL mode Perform a CALZ Transition valve state to Px mode The command will not be accepted if the valve is in Cal or Purge mode. This command is only designed to be used while in Px mode. This command may take 1 minute to complete.

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APPENDIX

APPENDIX A - ENGINEERING UNIT CONVERSION CONSTANTS

UNITS Setting	Engineering Unit	Binary Index	PSI to EU 1 PSI =	EU to PSI 1 EU =
PSI	Pound per square Inch	0	1 psi	1 psi
ATM	Atmospheres	1	0.068046 A	14.6960 psi
BAR	Bars	2	0.068947 b	14.5039 psi
CMHG	Centimeter of Mercury	3	5.17149 cmHg	0.193368 psi
CMH2O	Centimeter of Water	4	70.308 cmH2O	0.014223 psi
DECIBAR	Decibar	5	0.68947 db	1.4504 psi
FTH2O	Foot of Water	6	2.3067 ftH2O	0.43352 psi
GCM2	Gram per square Centimeter	7	70.306 g/cm2	0.014224 psi
INHG	Inch of Mercury @ 0̊C	8	2.0360 inHg	0.491159 psi
INH2O	Inch of Water @ 4̊C	9	27.680 inH2O	0.036127 psi
KGCM2	Kilogram per square Centimeter	10	0.0703070 kg/cm2	14.2235 psi
KGM2	Kilogram per square Meter	11	703.069 kg/m2	0.0014223 psi
KIPIN2	kips per square inch(ksi)	12	0.001 kip/in2	1000.0 psi
KNM2	Kilonewton per square Meter	13	6.89476 kN/m2	0.145038 psi
KPA	Kilopascal	14	6.89476 kPa	0.145038 psi
MBAR	Millibar	15	68.947 mb	0.014504 psi
MH2O	Meter of Water	16	0.70309 mH2O	1.42229 psi
MMHG	Millimeter of Mercury	17	51.7149 mmHg	0.0193368 psi
MPA	Megapascal	18	0.00689476 Mpa	145.038 psi
NCM2	Newton per square Centimeter	19	0.689476 N/cm2	1.45038 psi
NM2	Newton per square Meter	20	6894.759766 N/m2	0.000145038 psi
OZFT2	Ounce per square Foot	21	2304.00 oz/ft2	0.000434028 psi
OZIN2	Ounce per square Inch	22	16.00 in/ft2	0.062500 psi
PA	Pascal	23	6894.759766 Pa	0.000145038 psi
PSF	Pound per square Foot	24	144.00 lb/ft2	0.00694444 psi
TORR	Torr	25	51.714901 T	0.0193368 psi
USER	User Defined	26		
RAW	RAW A/D Counts, Pressure and Temperature	27	n/a	n/a
RAWC	RAW Pressure A/D Counts, Temperature in DegC	n/a	n/a	n/a

APPENDIX B - DATA MATRIX

Data Output Setup				Configurations							Notes
Data Destination	Data Format	Data Type	Sample Rate	UNITS	TRIG	ENUDP	ENFTP	Binary Server Connected	FORMAT	SIM	
TCP Telnet	ASCII Only	ADC Counts	INT	RAW	0, 2, 3	0	0	0	A, F, C	0	
			EXT	RAW	1	0	0	0	A, F, C	0	
		EU Pressure	INT	PSI	0, 2, 3	0	0	0	A, F, C	0	
			EXT	PSI	1	0	0	0	A, F, C	0	
TCP Binary Server (port 503)	Binary Only	ADC Counts	INT	RAW	0, 2	0	0	1	B, L	0	
									B, L	64	
			EXT	RAW	1	0	0	1	B, L	0	
									B, L	64	
		EU Pressure	INT	PSI	0, 2	0	0	1	B, L	0	
									B, L	64	
			EXT	PSI	1	0	0	1	B, L	0	
									B, L	64	
FTP	ASCII	ADC Counts	INT	RAW	0, 2, 3	0	1	0	A, C	0	
			EXT	RAW	1	0	1	0	A, C	0	
		EU Pressure	INT	PSI	0, 2, 3	0	1	0	A, C	0	
			EXT	PSI	1	0	1	0	A, C	0	
	Binary	ADC Counts	INT	RAW	0, 2, 3	0	1	0	B	0	
										64	
			EXT	RAW	1	0	1	0	B	0	
										64	
		EU Pressure	INT	PSI	0, 2, 3	0	1	0	B	0	
										64	
			EXT	PSI	1	0	1	0	B	0	
										64	
UDP	Binary Only	ADC Counts	INT	RAW	0, 2, 3	1	0	0	B	0	
										64	
			EXT	RAW	1	1	0	0	B	0	
										64	
		EU Pressure	INT	PSI	0, 2, 3	1	0	0	B	0	
										64	
			EXT	PSI	1	1	0	0	B	0	
										64	
Web Server	ASCII or Binary	Any	INT or EXT	Any	0 or 1 only	X	X	X	ASCII, CSV, Binary	0	

APPENDIX C - SOFTWARE REVISION LOG

Version 1.00 - Initial Release. (April 2022)
Version 1.01 - Fixed a PTP time conversion rollover. Resolved a CALZ issue that would output debug messages after a Calibration or Validation. Minor bug fixes for reliability. (May 2022)
Version 1.02 - Not Released.
Version 1.03 - Enabled Field Calibration and Validations functions, including multi-unit, automatic or manual calibrator use. Added LIST FC and FCENABLE variables. (June 2022)
Version 1.04 - Minor calibration routine fixes. (February 2024)
Version 2.00 - Major Release. Support for MPS4216. Scan routine fixes and enhancements. Improved scan rate ability and reliability. Major PTP fixes and improvements for one and two-step grandmasters, PTP master ability, timing and sync fixes. Added MODEL variable. Minor CALZ routine fixes. Minor variable range checking and bug fixes. Oven based command fixes. Resolved intermittent timing issue when using Scan Trigger. (November 2024)
Version 4.00 - Major Release. Support for MPS4264 Gen2. Scan routine fixes and enhancements. Improved scan rate ability. Allows for modules to cal/val MPS4264 Gen1. (February 2026)
Version 4.01 - Support for Electric Valve (EPx) commands and states. PTP state flag bug fix. (February 2026)

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