

MPS4232

MINIATURE PRESSURE SCANNER

HARDWARE AND SOFTWARE MANUAL

SOFTWARE VERSION 1.00



Scanivalve



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PREFACE

WARNINGS, CAUTIONS, AND NOTES



WARNING

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.



CAUTION

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.

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Scanivalve Corporation, Liberty Lake, Washington, hereafter referred to as Seller, warrants to the Buyer and the first end user that its products will be free from defects in workmanship and material for a period of twelve (12) months from date of delivery. Written notice of any claimed defect must be received by Seller within thirty (30) days after such defect is first discovered. The claimed defective product must be returned by prepaid transportation to Seller within ninety (90) days after the defect is first discovered. Seller's obligations under this Warranty are limited to repairing or replacing, at its option, any product or component part thereof that is proven to be other than as herein warranted.

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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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LabVIEW® is a registered trademark of National Instruments.

All other brand and product names are trademarks or registered trademarks of their respective companies.

PACKAGING FOR SHIPMENT

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 least 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: SPECIFICATIONS

GENERAL SPECIFICATIONS

Size (WxHxD) (includes tubes)	0.5" x 1.62" x 4.13" [12.7mm x 41.15mm x 104.78mm]
Weight	0.19lbs [86.2g]
Inputs (Px)	0.042" [1.067mm] OD (standard) 0.031" [.787mm] OD (optional)
Inputs (REF)	0.063" [1.600mm] OD
Standard Full Scale Ranges*	±4 inH ₂ O, ±8 inH ₂ O, ±1psid, ±5psid, ±15psid, 50psid [995.4Pa, 1990.7Pa, 6.89kPa, 34.5kPa, 103.4kPa, 344.7kPa]

* Modules calibrated at +15PSI F.S. or higher are only calibrated to -15PSI.

Accuracy**	
4 inH ₂ O	±0.20% FS
8 inH ₂ O	±0.15% FS
1psid	±0.06% FS
5psid	±0.06% FS
15psid	±0.06% FS
50psid	±0.06% FS

** Including linearity, hysteresis, and repeatability.

Overpressure (No damage)	
4 inH ₂ O	2psi
8 inH ₂ O	2psi
1psid	10psi
5psid	40psi
15psid	75psi
50psid	200psi

Maximum Reference Pressure	50psig (344.7kPa) or overpressure range, whichever is less
----------------------------	--

Data Output Rate*** - Hz (samples/channel/second)	
Binary	1000Hz
ASCII	100Hz

*** maximum data rate depends on network

A/D Resolution	24bit
Ethernet Connection	100baseT MDIX auto-crossing
Communications	
Ethernet IEEE802.3	
TCP/IP	HTTP, Telnet, FTP
UDP	
Precision Time Protocol	IEEE1588-2008v2
Power Requirements	5-36Vdc, 3.5W
External Trigger	5-15Vdc, 6.5mA
Mating Connectors	
Ethernet	TE Connectivity PLG 8P8C Mini2
Power	TE Connectivity PLG 8P8C Mini1

ENVIRONMENT SPECIFICATIONS

Temperature	
Operation	0 to 70°C
Storage	0 to 80°C
Compensated	0 to 70°C
Humidity	
Operation	5 to 95% RH, Non-Condensing
Storage	5 to 95% RH, Non-Condensing
Shock & Vibration	MIL-STD-810G, Category 24
Media	Gasses compatible with Silicon, Silicone, Aluminum and Buna-N
Maximum Environmental Pressure	100psia (690kPa absolute)
Minimum Environmental Pressure	0.50psia (3.45kPa absolute)
Standards:	CE & RoHS v3

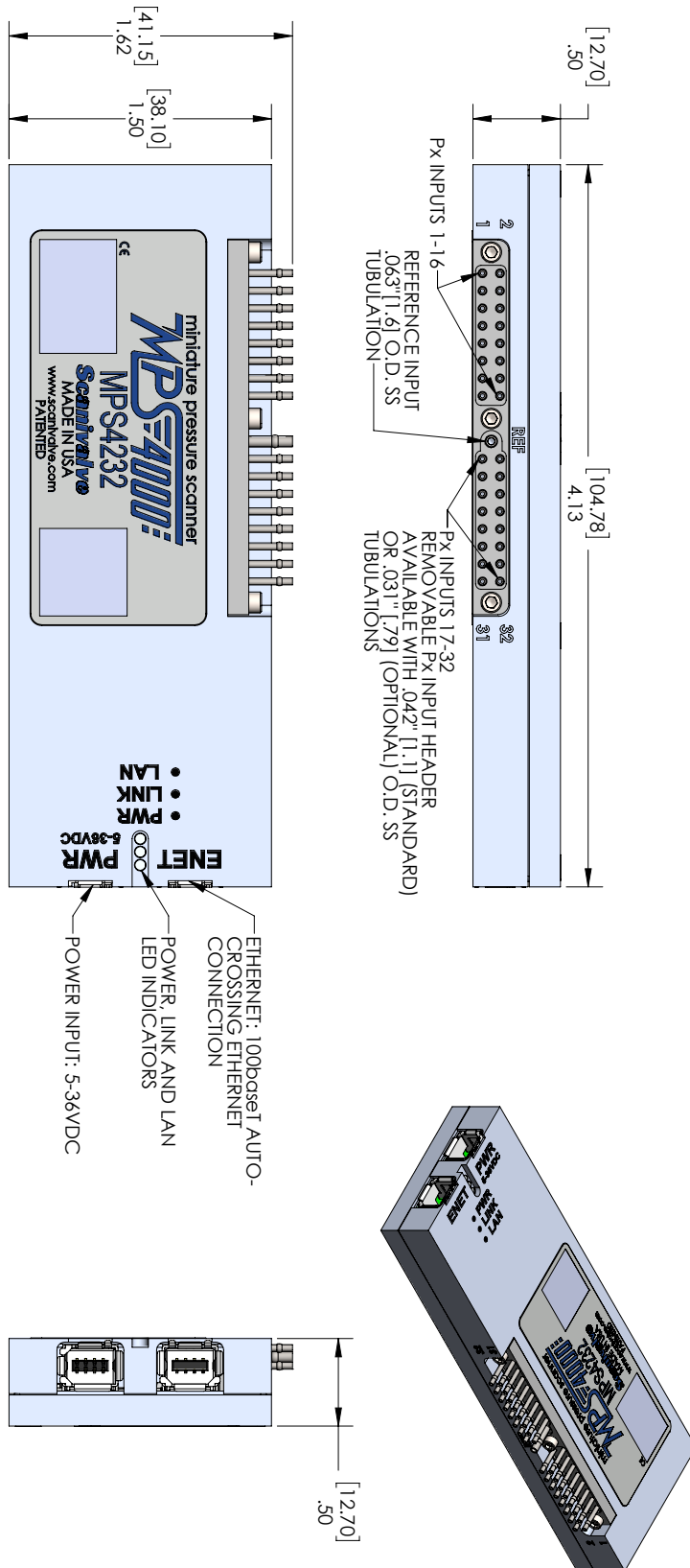


FIGURE 1-1: MPS4232 DIMENSIONAL DRAWING

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SECTION 2: INTRODUCTION

OVERVIEW

The MPS4232 is a 32 channel, intelligent, miniature pressure scanner. Each MPS4232 series scanner incorporates 32 individual piezoresistive pressure sensors. In addition to the pressure sensors, the MPS4232 integrates all of the electronics for the analog-to-digital (A/D) conversion process and a dual-core processor operating system supporting the engineering unit conversion process and all communications overhead. The integral DC/DC converters allow for a single 5-36Vdc power input. Communications and data output is via Ethernet, and RS-232 communications are included for backup and troubleshooting. All 32 pressure sensors share a common reference cavity in the center of the module.

The MPS4200 series is the first product designed by Scanivalve to leverage the proprietary “Dynamic CALZ” function. The function effectively nulls the zero offset of the entire analog-to-digital conversion process with every single scan. This feature produces extremely stable sensor outputs and virtually eliminates all zero drift in the system. With negligible zero drift over time or temperature, the traditional pneumatic zero correction that was frequently required is now greatly reduced.

MODULE CONFIGURATIONS

The MPS4232 is the 32 channel pressure scanner variant in the MPS4000 series of pressure scanners. All variants in the series use the same sensor package. However, the electronics are different for each, and the overall form factor is slightly different for each model. Because the interface, form factor, and function is different for each variant they will be covered in separate documents. There are several options that, for the most part, apply to all variants.

PRESSURE RANGE

Each MPS module can be ordered in the following pressure ranges:

4 inH ₂ O	5psi
8 inH ₂ O	15psi
1psi	50psi

VALVE ACTUATION

Unlike the MPS4200 64 channel scanners, the MPS4232 does not offer an integrated valve to change the pneumatic state of the module. The MPS4232 is always in “Measurement Mode”, meaning the Px ports are routed directly to each discrete sensor, and the REF port connects to an

internal cavity where the negative side of all 32 sensors are exposed. Any CALZ’s performed must be performed in a “wind-off” condition -- meaning no pressure is being applied to the input ports (Px and REF) and all tubes are exposed to ambient conditions.

For calibrations and validations, a removable calibration header can be used to manifold all 32 inputs to a single Calibration port. This removable header can be purchased separate from Scanivalve.

PRESSURE SENSORS

The 32 pressure sensors in the MPS4200 series are mounted in groups of four to custom designed ceramic bases. Eight (8) ceramic bases, or “sticks,” are RTV’d to a printed circuit board to create a 32 channel set. This architecture allows for a single four-channel sensor “stick” to be replaced at the factory if needed. It also provides double isolation from any mechanical stresses that may be present in the assembly.

Each PCB includes four (4) RTD’s. The RTD’s are used to measure the temperature across the entire sensor board, and are accurately compensated for the temperature of each sensor. The RTD’s are calibrated during the full calibration procedure of the MPS4232.

All sensors are installed onto a single printed circuit board, which also houses the modules A/Ds, processor, and external connections. The single sensor circuit board is mounted so that the negative side of all sensors are exposed to an open volume that is used as a common reference pressure for all 32 channels.

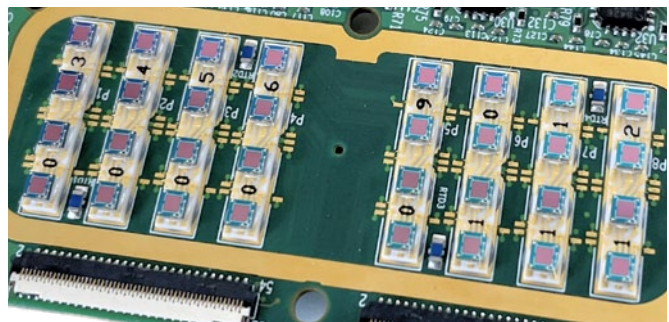


FIGURE 2-1: PRESSURE SENSOR OVERVIEW

ELECTRONICS

The MPS4232 has one (1) unique printed circuit board that houses all sensors, electronics, and connections. This board

contains:

- All of the interface electrical connectors including the Ethernet and Power connectors (which also supplies RS-232 and external triggering leads)
- DC-DC power supply
- Processor and memory chips
- All Analog-to-Digital converters (one per sensor)
- 32 pressure sensors (4 per ceramic stick)

PNEUMATIC INPUTS

For added convenience and flexibility, the pneumatic inputs on the MPS4000 series use removable headers. There is one input pneumatic connector on the MPS4232 that house the 32 individual channel inputs for measurement pressure (Px ports) and a single REF or reference port. The pneumatic connector is held on with three captive screws.

The removable input header allows for different input headers to be installed or removed at any time. This allows for different pneumatic inputs, allowing for plumbing to be removed from the module and swapped with another module or plumbing harness, blanking caps for protection, or a calibration input header for calibrations and validations. Please see Scanivalve's Module Accessory Catalog for a complete list of all pneumatic input options.



FIGURE 2-2: PNEUMATIC INPUT HEADERS

POWER & ETHERNET CONNECTIONS

The MPS4232 has its power and Ethernet connections located on one end. The power connection also serves as an external trigger input and allows for a serial connection. LEDs are positioned in a recessed cavity between the two connectors to indicate power, link and activity. Both the power and the Ethernet connector are TE Connectivity "Mini I/O" series but are polarized differently to prevent improper connections. The connectors are latching to prevent vibration from loosening the connections.



FIGURE 2-3: POWER & ETHERNET CONNECTIONS

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SECTION 3: OPERATION

UNPACK & INVENTORY

When you first unpack the MPS4232 module, begin by inspecting and inventorying the contents of the package. If any visible damage is immediately noticed or if any contents are missing, contact Scanivalve before proceeding. As a minimum, MPS4232 modules are shipped with the following contents:

1. MPS4232 Module
2. Protective Case
3. 155625 - Power Cable with Flying Leads
4. 156110 - Ethernet RJ45 Adaptor Cable
5. MPS4232 Resource Disk - USB (contains full calibration report, firmware files, and backup coefficients)
6. Certificate of Calibration

MOUNTING

The MPS can be mounted in any orientation. The light-weight nature of the MPS4232 allows it to be fixed to a surface using velcro or similar. *Note: 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.*

ENVIRONMENTAL CONSIDERATIONS

The MPS4232 series scanner is designed to withstand normal industrial, flight test, educational, wind tunnel or similar applications. The module is not water proof 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.

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 1: Specifications" on page 7. 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

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

WARM-UP

Due to the design of the MPS4232, the accuracy is only minimally impacted by the device warming up after initially being powered. The module can take up to 3 hours to fully warm up (in a 25°C ambient environment). It is recommended that the module be allowed to warm up for a 15-30 minutes before collecting data, but this is not mandatory. If time allows, the warm-up period should be extended to 60 minutes for most applications.

COMMUNICATIONS

The MPS module is designed primarily for Ethernet communications. This provides a means to configure the MPS module as well as scan and collect data from the module.

A serial RS-232 connection is also supported. The serial connection is designed to provide emergency communications with the module in cases where an Ethernet connection cannot be established. If the internal memory in the MPS is corrupted in any way, the serial connection allows the user to format the memory and restore the operating files.

SERIAL COMMUNICATIONS

Every MPS4232 module has an RS-232 serial output. It is available through the Power/Serial/Trigger connector on the module. This connector on the module is a TE Connectivity PLG 8P8C Mini1. This is a latching connector to prevent the connector from becoming unseated when subjected to vibrations. The wiring diagram for the power/serial/trigger connector can be found in Section 4: Hardware.

Settings for establishing a serial connection to the MPS4232 module are as follows:

Bits per second: 9600 BAUD
 Data bits: 8
 Parity: none
 Stop bits: 1
 Flow control: none

A serial and Ethernet connection can be established simultaneously. All commands listed in Section 5 are accepted via serial communications.

The serial connection is designed to be used to configure the module, provide emergency communications for

troubleshooting and find/change the MPS's IP address if it is unknown. For information on changing the communication parameters, including the module's Ethernet IP address, see "Changing the IP Address" procedure.

The Power/Serial/Trigger Communications port also serves as the input for the power and external scan trigger connections. For more information on externally triggering scans, see "Scanning With An External Trigger."

Several power/serial/trigger cables are available for purchase. Please see the Module Accessory Catalog for all cabling options.

ETHERNET COMMUNICATIONS

The MPS4232 has one Ethernet 100Base-T with MDIX auto-crossing connection. This is the primary means of communications with the MPS. This connector on the module is a TE Connectivity PLG 8P8C Mini2. This is a latching connector to prevent the connector from becoming unseated when subjected to vibrations.

Shielded Category 5e cable or better is recommended for all Ethernet connections. The wiring diagram for the Ethernet connector can be found in Section 4: Hardware.

Several Ethernet cables are available for purchase. Please see the Module Accessory Catalog for all cabling options.

SETTING UP AN ETHERNET CONNECTION

Before an Ethernet connection can be established, the IP address must be configured. This can be done manually with a "static" IP address. If a "static" IP address is desired, the IP address of the MPS must be set manually. The IP address assigned to the MPS must be compatible with the network/host computer.

USING A STATIC IPV4 ADDRESS

If a static IP address is desired, the IP address must be manually configured. The IP address that is configured in the MPS must be compatible with the network the MPS is being connected to. If simply connecting the MPS directly to a host computer, the IP address of the MPS and the host computer must be compatible, which may require manual configuration of the MPS and/or computer.

The range of compatible IP addresses is defined by the subnet mask. The standard default subnet mask is 255.255.0.0. This default subnet mask requires that the IP address of the module and host computer must share the first two octets, or sets of numbers. The third and fourth octets of the IP address are variable with this subnet, although it is typically recommended that the third

octet also be shared between the host computer and the module. The subnet mask digits of "255" define that the two IP addresses must have matching digits in those positions, and the subnet mask digit of "0" allows the two IP addresses to have unique values for those octets and still be compatible. No two devices on a single network can share the same IP address. Below are some examples of compatible and non-compatible IP addresses:

Example of matching the first three octets

Subnet mask: 255.255.255.0

Host computer: 191.30.95.90

MPS module: 191.30.95.100

Example of matching the first two octets

Subnet mask: 255.255.0.0

Host computer: 191.30.1.1

MPS module: 191.30.95.125

Example of NON-COMPATIBLE IP addresses

Subnet mask: 255.255.255.0

Host computer: 191.30.1.1

MPS module: 191.30.95.5

When configuring the network, the IP address of the MPS module can be modified to match the network, or the IP address of the host computer can be modified to be compatible with the MPS module.

The IP address of a Windows 7, 8, or 10 host computer can be changed under:

Control Panel -> Network and Sharing Center -> Local Area Connection/Ethernet -> Properties -> Internet Protocol Version 4 (TCP/IPv4) -> Properties

Changing the IP address of the host computer may require administrative rights.

The IP address of the computer can quickly be found using Windows Command Prompt and the command "ipconfig."

MPS4200 modules are shipped with a pre-configured IP address that uses the following format:

191.30.95.xxx

The first two octets used are unique to all Scanivalve products (191.30). The third octet is the device family code (95 for MPS4232). The fourth octet is the last three digits of the MPS's serial number. "xxx" is only a placeholder in the example as all modules will have different serial numbers.

Based on the examples above, the host computer can be configured to communicate with the shipped IP address of an MPS.

In situations where the IP address of the host computer

cannot be altered, the MPS's address must be changed to establish an Ethernet connection. The MPS's IP address is set with the **IPADD** variable in the IP Group of variables (**LIST IP**). This can be changed through an existing Ethernet connection or via serial connection.

If an existing Ethernet connection can be established (by changing the host computer's IP address, using an alternate computer, or by some other means), it is the preferred method for changing the IP address of the MPS. If Ethernet communication is not possible, a serial connection must be established with the MPS following the guidelines in the "Serial Communications" section.

If the IPADD variable is changed either through an Ethernet connection or a serial connection, the new address will not be effective until a **SAVE IP** command has been issued and the power is cycled. For more information on changing the IPADD variable, see the "Changing the IP address" procedure.

CLIENT/HOST OPTIONS

Once the module has been connected and the IP address has been configured, communications can be established with the MPS module. Communications can be made through several software packages including:

- PC _ Web Server
- PC - TCP/IP
- PC - UDP
- PC - ScanTel (Scanivalve PN: 155406-01)
- PC - LabVIEW
- PC - HyperTerminal (alt. PuTTY)

PC - WEB SERVER

The MPS4232 is integrated with an integral Web Server with an easy-to-use graphical interface. The Web Server can be accessed using a web browser; including Google Chrome and Microsoft Edge. All functionality available in the MPS can be accessed using the Web Server including additional features such as a terminal window for simple command-line communication and the ability to update the MPS's firmware and coefficient tables. This is the recommended means of communications for most users.

An internet connection is not required when accessing the MPS's Web Server. Not all web browsers are supported. Please see the section dedicated to the Web Server for more information.

PC - TCP/IP

The user may write their own TCP/IP interface using the software specification portion of this manual. This interface should allow the user to:

- Issue commands to any or all MPS modules on the network.
- Display returned information or scan data from the MPS module(s).
- Write returned information or scan data to the client/host in TCP/IP format.

PC - UDP

The MPS provides a dual-output function in which data can be output simultaneously out via a FTP connection and a UDP broadcast data stream. This allows for great flexibility in the configuration of the data collection. It allows users to configure a system such that data can be monitored "real-time" via the UDP stream and collected reliably via the FTP data transfer.

PC - SCANTEL

ScanTel is a free communications utility designed by Scanivalve to communicate with Scanivalve products including MPS modules. It is a text based, command line program that allows users to connect to a single MPS module, modify the configuration variables, and collect data using both TCP and UDP protocol. ScanTel is often the go-to choice for troubleshooting any Scanivalve module. ScanTel can be downloaded from www.scanivalve.com.

PC - LABVIEW

MPSLink and MPS4232Link are free LabVIEW® based programs specifically developed for the MPS4200 series. This program allows users to change variables, scan and collect data to the screen or to a CSV file with an easy to use graphical interface. While the standalone program can be installed and used easily, all VIs used to create the program are included. These VIs can be used as examples for users looking to create a custom LabVIEW® program to operate the MPS4200, or for integrating the MPS4200 into a preexisting LabVIEW® environment.

PC - HYPERTERMINAL

HyperTerminal is a Windows program included as part of Windows 2000, XP, and Vista Operating Systems. It is a text based, command line program. This program permits a users to connect to a single MPS module, modify the configuration variables, format the internal memory, or can be used for troubleshooting. HyperTerminal provides a means for both Serial RS-232 and Ethernet connections.

Alternate terminal emulators, such as PuTTY, can be downloaded for free from various sources online if HyperTerminal is not available.

SCANNING

Once the MPS module has been installed, powered on and allowed to thermally stabilize, data can be collected. There are several configuration variables that control how the MPS module samples pressure and how the data is output.

SCAN RATE

The scan rate is controlled by the variable: **RATE**. Rate is expressed in Hertz (Hz), which can be described as samples per channel per second, or more simply, frames per second. Because the MPS has one analog-to-digital converter per transducer, all pressure samples per channel will be taken synchronously.

Example: If rate is set to 10Hz, the MPS will sample a pressure value from each channel every 0.1 seconds. This data is packaged into a 'frame of data' and output to the configured destination.

Note: Max scan rates can be limited based on data destination, format, and configurations. See Appendix C, Table 1 for all scan rate limitations.

SCAN DURATION

The length of the scan, or number of frames output per scan, is controlled by the variable: **FPS**. A frame of data typically consists of a frame number, time stamp, and one averaged pressure and temperature sample for each sensor in the MPS.

Example: If frames per second is set to 100, and the scan rate is set to 10Hz, the MPS will output 100 frames of data at 10Hz. This scan will last 10 seconds and only 100 frames of data will be output. The scan will end when 100 frames are output.

Example: If frames per second is set to 0, and rate is set to 5Hz, the MPS will output data at 5Hz indefinitely. The scan must be stopped manually by the user.

SCAN DATA FORMAT

The data output for ASCII and Binary data collection is controlled by the variable: **FORMAT**. Format is split into three sections; Telnet, FTP/UDP, and Binary Server.

Example: If format is set to C (CSV), the MPS will output the scan data in a Comma Separated Variable ASCII format.

SCAN DATA UNITS

The pressure and temperature unit values output in each frame of data are controlled by the variable: **UNITS**. The MPS supports a number of pressure engineering units including PSI, Pascals, Bar, and more. Temperature is

limited to degrees Celsius.

Example: If units is set to PSI, the pressure values for each channel will be output in PSI engineering units, and the temperature for each channel will be in degrees Celsius.

Example: If units is set to RAW, the pressure values for each pressure and temperature channel will be output in raw A/D counts (used for troubleshooting).

STARTING A SCAN

Once the MPS has been configured for scanning, the MPS will start sampling and outputting data after the **SCAN** command is issued to the MPS module. The MPS will then enter 'scan' mode and will output data at the configured rate until the frames per scan (FPS) term is met or until the user has manually stopped the scan. Once the scan has been completed or terminated, the MPS will return to 'ready' mode and will be ready for the next command. The scenario above is an example of a free-run, internal rate scan (**TRIG 0**). Data will be output from the MPS module over the Ethernet connection and can be collected in the ASCII format.

There are several ways that the MPS can scan and collect data. These options include:

- Internal rate, software scan triggered
- Internal rate, hardware scan triggered
- External rate, hardware frame triggering
- External rate, software frame triggering
- Internal rate, scan-on-startup
- Internal rate, PTP time triggered

There are several ways that the MPS can output scan data. These options include:

- ASCII data via TCP or FTP
- Binary data via TCP, UDP, or FTP

These options make the MPS an extremely versatile and configurable unit. All different scanning and data output methods will be described in this manual. For more information on the commands used in this section, please refer to Section 5: Software.

SCANNING WITH AN EXTERNAL TRIGGER

The MPS4200 can be configured to scan with an external hardware or software trigger. This provides a simple means of synchronizing the data collection between multiple MPS units or legacy Scanivalve products when a IEEE-1588 PTP infrastructure is not in place. It also provides a means of synchronizing MPS scanners with other, third-party equipment that may not be IEEE-1588 PTP compatible.

The external hardware trigger voltage is input through pins 4 & 5 of the power connector. The MPS accepts a trigger voltage that is between +5 and +15Vdc at 6.5mA. A wiring diagram for the power/serial/trigger cable can be found in Section 4: Hardware.

MPS4200 has several options for external triggering which is controlled by the variable: **TRIG**. The external trigger can be used in one of three ways:

1. Hardware Frame Trigger
2. Software Frame Trigger
3. Hardware Scan Trigger

Options 1 & 2: the “Frame Trigger” options allow an external trigger to release a single frame of data per pulse sensed by the MPS. This means for each trigger pulse (or software command) the MPS will return a single frame of data. The rate of which the data is output is based on this external pulse rate.

For optimal external frame triggering, the internal rate of the MPS should be set $\geq 25\%$ higher than the external trigger rate. If a hardware trigger is being used, it must adhere to the MPS’s trigger voltage requirement. A duty cycle of 50% is recommended, and the “low” voltage must be as close to 0Vdc as possible.

The software frame trigger is a command sent to the MPS that will release a one frame of data per command received. The trigger can be one of two commands; either a **TRIG** command or a <tab> character (9 Hex or Control I). This works similar to external hardware triggering.

If time stamps are important when external frame triggering, it is recommended that the MPS’s internal rate be set to at least 2 times that of the external rate (or the max scan rate of the module). This will provide the best resolution for the frame time stamps.

SETTING UP AN EXTERNAL FRAME TRIGGER

To configure the MPS4200 to scan with an external frame trigger (hardware or software):

1. Set the variable **TRIG** to 1
2. Set the **RATE** variable to a rate at least 25% or faster than the intended external trigger rate
3. Set the MPS into “scan” mode by sending the command: **SCAN**
4. Supply a trigger; either hardware trigger pulse or a software trigger. For each trigger pulse, the MPS will output a single frame of data to the configured destination

Option 3: the “Hardware Scan Trigger” option allows for a **SCAN** to be initiated using an external voltage. When

the MPS senses that the trigger input level is “high” ($5Vdc \leq \text{voltage} \leq 15Vdc$), the MPS will enter scan mode where it will scan and continuously collect data based on its set internal rate. The MPS will continue to scan at this rate until any of the following conditions are met:

- The trigger input level is switched to “low” ($< 5Vdc$)
- The FPS variable is met (frames output = FPS)
- The scan is manually stopped by the user (software command or powering off the unit)

SETTING UP AN EXTERNAL SCAN TRIGGER

To configure the MPS4200 to scan with an external scan trigger:

1. Set the variable **TRIG** to 2
2. Set the **RATE** variable to the desired data collection rate
3. Supply a “high” voltage ($5Vdc < \text{voltage} < 15Vdc$). The MPS will collect and output data at the defined rate until the trigger input voltage is lowered below the 5Vdc trigger threshold level.

SCAN-ON-STARTUP OPTION

When **TRIG** is set to 3, the scan-on-startup feature is enabled. This commands the MPS to start scanning after the power up sequence has completed. The data output and destination for this feature must be set as FTP or UDP.

In the event that the FTP server is not ready to handle a connection from the MPS4200, the MPS will attempt to connect until it succeeds, a **STOP** command is received from the serial connection, or a **STOP** is received from the Ethernet connection. Once scanning is started, data output continues until a **STOP** is received, as described above.

Simply removing power from the MPS will stop the sending of data. Normally this will cause the FTP server to begin a time out period waiting for data. After the time out period, the FTP server should close the connection, flush any unsaved data to disk and close the file. The time out period of the FTP server is usually configurable. FTP servers may vary in their operation so check your FTP server manual for settings.

For UDP output, the MPS will output data to the UDP configured destination until a **STOP** command is received from the serial or Ethernet connection, the FPS variable has been met, or the MPS is powered down.

SCAN DATA OUTPUT METHODS

ASCII TCP SCAN DATA TRANSFER

The default method of ASCII data collection and transfer is configured using the default Telnet server (port 23) using a

TCP client. Programs like ScanTel, HyperTerminal, or PuTTY can be used to display and collect the ASCII data to the screen or to a file. If binary data output is not enabled, and the **SCAN** command is sent to the Telnet port, the MPS will typically return data to the host from where the command was sent.

ASCII data can be formatted using the **FORMAT** variable under **LIST S**. The three formats available are:

- Unformatted, column based (scrolling)
- Formatted, VT100 terminal style (updating)
- Comma Separated Variable, CSV (scrolling)

Data output follows the specified ASCII packet structure listed in Section 5: Software.

BINARY TCP SCAN DATA TRANSFER

The MPS4200 provides a binary TCP server designed to support any computer based TCP client, such as LabVIEW. The structure of the binary packet sent from the binary server is expressed in Section 5: Software.

The Binary TCP server expects a connection to arrive on port 503. Data will only stream to a single connection. If a second connection is opened on the port, data will send on the new connection.

Because all configuration settings may be handled via the Telnet server (port 23), the binary server supports starting and stopping a scan with commands sent to port 503. Sending the binary representation of the integer "1" will start a scan, and sending the binary representation of the integer "0" will stop the scan. The scanning will also stop if the FPS variable has been met, the MPS scan buffer overflows, or when the binary client disconnects from the MPS. The scan still adheres to the variables configured in the MPS; **RATE**, **FPS**, and **TRIG**.

Scans can also be initiated use the **SCAN** command via telnet, or an external scan trigger (**TRIG == 2**). When these options are used, the connection to port 503 must be opened prior to the **SCAN** command or external scan trigger. If this connection is not made, the MPS will not send scan data to this destination. The scanning will also stop if the FPS variable has been met, the MPS scan buffer overflows, or when the binary client disconnects from the MPS. The scan still adheres to the variables configured in the MPS; **RATE**, **FPS**, and **TRIG**.

FTP SCAN DATA TRANSFER

The MPS4200 can transfer scan data using FTP protocol to an applicable FTP server. The user may set up any suitable server or NAS capable of running as a FTP server.

When **ENFTP** is set to one, and a scan is started, the software will attempt to connect and open a file on the FTP server as configured by the FTP variables. The time and date that is indicated by the **GETTIME** command is used in the construction of the file name.

The file that is saved on the server is assembled as follows:

```
<path on server><base data filename><date>_<time>.<type>
```

Where <type> is:

- ".DAT" for binary
- ".TXT" for ASCII Text
- ".CSV" for ASCII CSV file.

The file is closed when the scan stops. If the file cannot be opened on the server when the scan starts, the scan is stopped before any data is output and the MPS will report an error.

FTP protocol can be used simultaneously with UDP output. This allows users to configure a system such that data can be monitored "real-time" via the UDP stream and collected reliably via the FTP data transfer. For more information on FTP variables, please see Section 5: Software.

UDP SCAN DATA TRANSFER

The MPS4200 can transfer scan data using UDP protocol to an applicable UDP client. The user may set up any suitable UDP client for this operation. Data output follows the specified packet structure listed in Section 5: Software.

UDP output supports a multicast address following the standard UDP multicast address group, using a UDP address of 224.0.0.0 through 239.255.255.255 and any valid port.

UDP protocol can be used simultaneously with FTP output. This allows users to configure a system such that data can be monitored "real-time" via the UDP stream and collected reliably via the FTP data transfer. For more information on UDP variables, please see Section 5: Software.

BINARY DATA BUFFERING

All binary data output, including the Binary server, can buffer up to 32768 frames of data (using the standard 32 channel binary packet) before the buffer overflows and stops scanning. This allows the host software to gather data from the MPS at a slower rate than the MPS is scanning. However, multiple frames must be read, at once, with each read.

To calculate the maximum time that the client can wait before reading data from the binary server use the following:

Max Delay = (1/MPS Rate) * (Max Frames in Buffer) / 2)
 Max Delay = (1/MPS Rate) * 32768 / 2)
 Max Delay = 16384 / MPS Rate

Note: The buffer size in the MPS4232 is 32768 frames. However, to handle delays in the network connection only half should be used as a target delay. Thus 16384 frames are the maximum frames to hold in the buffer.

ZERO OFFSET CALIBRATIONS (CALZ)

The MPS's software incorporates a zero offset correction feature (Quick Zero or **CALZ**). This feature provides a simple and quick means to correct for the minor zero drift problems inherent to piezoresistive sensors.

Because the MPS4232 does not have a calibration valve, the **CALZ** must be performed in a "wind-off" state (no pressure applied to the module). At that point, with the sensor at its natural zero differential state, any offset can be read and recorded. This can then be factored into the engineering unit conversion and mathematically removed automatically within the MPS software. Quick Zero calibrations can be performed in under 10 seconds.

Due to the nature of the piezoresistive sensors used in the MPS modules, it is recommended that a quick zero calibration be performed at least daily. Performing a quick zero more often will not cause any problems and is highly encouraged. There are no issues using the quick zero calibration each time before data is collected. Keep in mind, if the temperature of the module changes more than 5°C, a fresh quick zero should be performed.

Zero offset corrections may become obsolete after several hours or after the module has changed temperatures.

IEEE1588V2 PRECISION TIME PROTOCOL

The MPS is compliant with IEEE1588v2 Precision Time Protocol (PTP). The MPS's PTP engine can be configured as follows:

- Disabled
- Enabled as a PTP slave device
- Enabled as a PTP master device

When configured as a PTP slave device, the MPS will listen for PTPv2 packets being multicast on the network. This allows for the MPS's internal time and date to be set and synchronized when a PTP Grandmaster is active on the same network. This synchronization will also adjust the internal scan rate of the module to pace with the PTP Grandmaster time.

When the MPS4200 is configured as a PTP master device, the MPS will multicast PTPv2 packets over the network, similar to a PTP Grandmaster. The MPS will use its internal time and date when multicasting these packets for synchronization. The MPS configured as a PTP master allows other PTP enabled Scanivalve devices to be synchronized using the internal time and date of the 'master' MPS device. This synchronization on 'slave' devices will adjust the internal scan rate of the 'slaves' to pace with the PTP Master.

Note: Only one PTP Grandmaster or PTP master can be present on a network at any given time.

When the MPS is enabled as a 'slave' PTP device, the MPS requires that announce packets are multicast on the network.

Whether PTP is enabled or disabled, the **GETTIME** command will retrieve the current internal time of the MPS. When the MPS's PTP engine is disabled or enabled as a PTP master, the MPS's time and date can be manually set using the **SETTIME** command.

Other PTP related commands, including PTP statistical information, debug output, and setting the UTC offset, can be referenced in the PTP Commands section under Section 5: Software.

PTP TRIGGERED SCAN

The IEEE1588 protocol allows MPS4200 units to start scanning at a preset time and date while keeping their data samples time synchronized. This allows a user to synchronize the scan start time across multiple units. A scan start time and date in the future can be configured in the MPS4200 using the Scan Start Date (**SSD**) and Scan Start Time (**SST**) variables. After a **SCAN** command is issued, the MPS will enter scan mode but will not output data. Once the **SST** and **SSD** time has been met (based on the internal time of the MPS/PTP Time), the time will trigger the MPS to start releasing frames of data at the set internal rate. If **SST** and **SSD** are set for a time in the past (based on the internal time of the MPS), a **SCAN** command will execute a scan and the MPS will release data immediately.

The following table describes a start scan time with two MPS4200 units when setting **SSD** and **SST** for a time in the future.

Two (2) MPS4200s configured with: SST = 12:00:00, SSD = 2021/2/10, RATE = 1Hz						
1588 Date (hh:mm:ss)	1588 Time (YYYY/MM/DD)	Event	MPS 1 Frame #	MPS 2 Frame #	MPS 1 PTP Time Stamp (seconds)	MPS 2 PTP Time Stamp (seconds)
11:59:55	2021/2/10	SCAN to MPS 1				
11:59:56	2021/2/10					
11:59:57	2021/2/10	SCAN to MPS 2				
11:59:58	2021/2/10					
11:59:59	2021/2/10					
12:00:00	2021/2/10					
12:00:01	2021/2/10		1	1	1612987201	1612987201
12:00:02	2021/2/10		2	2	1612987202	1612987202
12:00:03	2021/2/10		3	3	1612987203	1612987203

The following table describes a start scan time with two MPS4200 units when **SSD** and **SST** are a time in the past.

Two (2) MPS4200s configured with: SST = 12:00:00, SSD = 2021/2/10, RATE = 1Hz						
1588 Date (hh:mm:ss)	1588 Time (YYYY/MM/DD)	Event	MPS 1 Frame #	MPS 2 Frame #	MPS 1 PTP Time Stamp (seconds)	MPS 2 PTP Time Stamp (seconds)
12:59:55	2021/2/10	SCAN to MPS 1				
12:59:56	2021/2/10		1		1612990796	
12:59:57	2021/2/10	SCAN to MPS 2	2		1612990797	
12:59:58	2021/2/10		3	1	1612990798	1612990798
12:59:59	2021/2/10		4	2	1612990799	1612990799
1:00:00	2021/2/10		5	3	1612990800	1612990800

MULTIPLE UNIT OPERATIONS

When working with multiple scanners, the operation can be greatly simplified by using the integrated “multiple unit” architecture. When the desired units are configured into “clusters” of modules, a single connection can be established to any one of the modules in the cluster. Once this connection is established, any of the “Multiple Unit” commands can be sent to the master unit which will in turn pass of the command to the other modules in the cluster. This allows many units to be started scanning, stopped or calibrated all at the same time from a single command sent to a single MPS4200 unit.

The MPS4200 uses the network multicast feature to establish a MPS4200 device cluster. In all cases the user connects to one MPS. This device becomes the master device. This master then passes the relevant commands on to the other devices that are members of the device cluster. Each MPS has the ability to be a master or slave.

The membership of a MPS4200 into a cluster is established by setting the variable **MCAST** to the same multicast address. All MPS4200 devices with the same **MCAST** setting become members of the same MPS4200 cluster. Note that changing the **MCAST** variable requires a **SAVE** to be issued to the unit and the MPS to be rebooted before the change becomes effective. Multiple clusters may exist on the same network. Multicast addresses are limited to the range from 224.0.0.0 through 239.255.255.255.

Once the MPS units have been configured to be included in a cluster and a connection has been established with the “master” unit - issue the command:

MFIND

A list of MPS modules included in the cluster will be returned. Review the list to ensure it is inclusive of all units that are expected to be included in the cluster. Once this has been verified, a scan on all units can be initiated with the command:

MSCAN

If at any point the scan needs to be terminated, issue the command:

MSTOP

These “multiple unit” commands that allow control of the cluster of scanners.

Other multicast commands accepted include calibration and validation commands that can be used for multiple unit field calibrations or validations. For more information on field calibrations and validations, please see the “Field Calibration and Validation” procedure.

MULTIPLE UNIT SCAN COMMAND

Multiple MPS units are started scanning by connecting to one MPS and issuing a **MSCAN** command. This device becomes the master and reissues a multicast SCAN command. See the table below for the scan start packet format. All devices that are set up to listen to this multicast address will respond to the SCAN command. The slave devices must still fulfill the SSD and SST requirements for starting a scan.

TABLE 3-1: MSCAN PACKET FORMAT

FUNCTION	BYTES	DATA TYPE	DESCRIPTION
Packet Type	2	Integer	0202

MULTIPLE UNIT STOP COMMAND

Multiple MPS units are stopped scanning by connecting to one MPS and issuing a MSTOP command. This device becomes the master and reissues a multicast STOP command. See the table below for the stop packet format. All devices that are set up to listen to this multicast address will respond to the STOP command.

TABLE 3-2: MSTOP PACKET FORMAT

FUNCTION	BYTES	DATA TYPE	DESCRIPTION
Packet Type	2	Integer	0303

MULTIPLE UNIT FIND COMMAND

The user may connect to one MPS4200 and issue a MFIND command. This command will return a list of all devices that are part of the multicast cluster. The MFIND command uses the Discovery Packet described below.

TABLE 3-3: MFIND PACKET FORMAT

FUNCTION	BYTES	DATA TYPE	DESCRIPTION
Packet Type	2	Integer	0101

WEB SERVER

The MPS4200 is configured with a single user Web Server application which provides a simple method for communication, configurations, and operations from virtually any host computer. The Web Server requires no additional software be installed on the host computer and provides a simple graphical interface for the user to use the MPS.

The screenshot displays the Scanivalve web server interface. At the top left is the Scanivalve logo. To its right, a box shows 'Model: MPS4232', 'Serial No: 4', 'Version: 0.30.47', and 'Pressure Range: 2.50'. Below the logo, a status box indicates '2022/04/05 21:06:48' and 'STATUS: READY'. A navigation bar contains 'SCAN' and 'FILESYSTEM' tabs. The main area features a 'Bargraph' plot, a 'Scan Configuration' panel with input fields for 'Rate [Hz]' (set to 10) and 'Frames Per Scan' (set to 0), and a 'Monitor' table. The 'Monitor' table has four rows and four columns: Tx, Temperature [C], Px, and Pressure [RAW]. The 'Support Links' section provides links to the Scanivalve website, resources for the MPS4232, and contact information. A 'Terminal' button is at the bottom left.

FIGURE 3-5: WEB SERVER HOME SCREEN

The Web Server has been tested with several web browsers to verify functionality and compatibility. Those that were tested are:

- Google Chrome
- Microsoft Edge
- Mozilla Firefox

To connect to the MPS4200's Web Server, simply open one of the supported browsers, enter the MPS's IP address into the address bar and press enter.

Once connected, the Web Server's Home screen will be displayed as shown in figure 3-5.

Basic module information will be displayed in the top right corner of the window. This will include the model number, current firmware version, serial number, and the nominal pressure range.

WEB SERVER: MAIN DISPLAY**FIGURE 3-6: MAIN DISPLAY**

The top portion of the Web Server is the “Main Display.” This display will remain constant through all pages of the Web Server. This display provides information about the module, universal functions, and a status window that will display the current status, time and date in the MPS. The main display is updated once per second to reflect the most current status of the MPS.

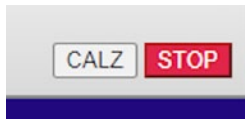


-- This area shows the MPS’s date and time, and current status.



-- This area shows information about the module, including:

- Model Number
- Firmware Version
- Serial Number
- Nominal Pressure Range



-- This area contain universal functions that can be run from any page.

STOP - This button can be used to stop any function in the MPS, including scans.

CALZ - This button will initiate a CALZ (zero offset correction).

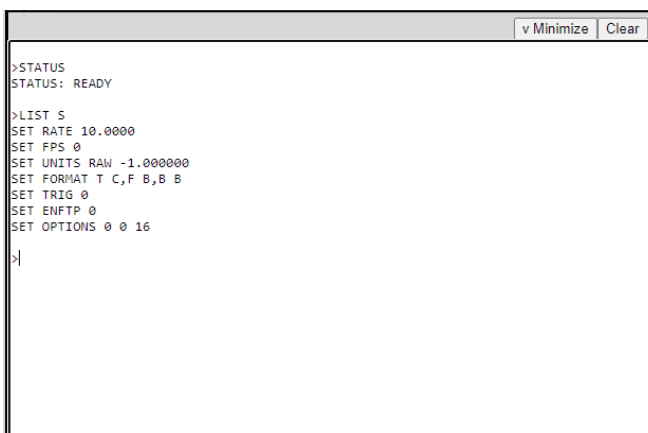
The main display also provides the links to the other pages available in the Web Server:

SCAN and **FILESYSTEM**.

Each of these pages will be discussed in the following sub-sections.

The bottom of each page will contain a “Terminal” pop-up option. This button will enable a terminal emulator window that is available on any page. This allows the user to send command-line based commands to the MPS module, similar to using ScanTel, HyperTerminal, or PuTTY. Most commands are accepted via the Terminal.

Once the window has been opened, the information in the terminal can be cleared with the “Clear” button. The “v Minimize” button will hide the terminal from the screen.



The terminal is available on all pages in the MPS web server. If the terminal is open, it will stay open when navigating between pages.

WEB SERVER: SCAN

The Scan page is used for configuring the scan data, displaying scan data to the screen, or collecting scan data to a file (ASCII or Binary).

SCAN | FILESYSTEM

Bargraph

Scan Configuration

Formatted For: Screen

Rate [Hz]:

Frames Per Scan:

Units: PSI

External Frame Trigger

Monitor

Frame: 237

Tx	Temperature [C]	Px	Pressure [PSI]
1	35.5900	3	-0.000030
2	38.2800	8	-0.000031
3	38.8000	16	-0.000020
4	37.5000	23	-0.000017

Support Links

[Scanivalve.com](#) - Scanivalve Corp. home page
[MPS4232 Resources](#) - information and resources for the MPS4232
 Miniature Ethernet Pressure Scanner
[Contact Scanivalve](#) - contact someone at Scanivalve

BARGRAPH -- This area of the Scan page can display pressure data for each channel in the MPS when scanning. Data will only be displayed if "Formatted For:" is set to "Screen."
 The X-Axis will auto-scale based on the highest pressure value from the channels, and will always display a "0.000". The max and min values will always scale 20% higher than the highest measured pressure value from any channel. The units are based on the "Units:" setting.
 The bar graph will only update at 2Hz, regardless of the set Rate in the MPS. Each of the blue bars represents one channel, starting with channel 1 at the top of the graph and channel 32 at the bottom.

Hovering the mouse over a bar will display the channel number and pressure value (based on the "Units:" setting).

Clicking on a bar (channel) will highlight this channel (light blue) and report that channel and pressure value in the right hand table in the Monitor Section.

SCAN CONFIGURATION -- This area of the Scan page allows for the scan configuration variable to be set when collecting data in the web server.

Formatted For: This selection will direct the collected data to a destination in the selected format.

Formatted For: Screen

Rate [Hz]:

Frames Per Scan:

Units: PSI

External Frame Trigger

-- Screen. This will display the scan data in the web server Bar Graph and Monitor table.

-- CSV. This will collect and format the data in ASCII CSV format. The file will be auto-downloaded.

-- TXT. This will collect and format the data in ASCII scrolling format. The file will be auto-downloaded.

-- DAT. This will collect and format the data in Binary format. The file will be auto-downloaded and must be converted in a separate software program (such as ScanTel).

Note: Screen and ASCII formats are limited to scan rates of 100Hz or less. Binary is limited to 1000Hz.

Rate [Hz]: This the scan rate, expressed in Hz.

Frames Per Scan: This is the setting for frames per scan (FPS variable). "0" cannot be used when scanning to a file.

Units: This sets the Engineering Units used for the pressure data.

External Frame Trigger: This will enable the use of an external frame trigger. See external triggering for more information.

WEB SERVER: SCAN (CONT.)

SCAN | FILESYSTEM

Bargraph

Scan Configuration

Formatted For: Screen

Rate [Hz]: 10

Frames Per Scan: 0

Units: PSI

External Frame Trigger

SCAN SAVE

Monitor

Frame: 237 Clear Channels

Tx	Temperature [C]	Px	Pressure [PSI]
1	35.5900	3	-0.000030
2	38.2800	8	-0.000031
3	38.8000	16	-0.000020
4	37.5000	23	-0.000017

Support Links

[Scanivalve.com](#) - Scanivalve Corp. home page
[MPS4232 Resources](#) - information and resources for the MPS4232
 Miniature Ethernet Pressure Scanner
[Contact Scanivalve](#) - contact someone at Scanivalve

SCAN BUTTON -- The SCAN button can be used to initiate data collection from the MPS. The scan will adhere to the configuration settings (Format, Rate, FPS, Units, External Triggering).
 When in SCAN mode, the status bar at the top will report STATUS: SCAN. All buttons (except STOP) and fields will be disabled until the scan has completed. Use the STOP button to interrupt any scan and return the MPS to ready mode.

SAVE BUTTON -- The SAVE button can be used to save the current scan configuration settings to the MPS memory.
 Note: when changing the Scan Configuration variables, it will not set the variables in **LIST S**. These setting are only applied to Web Server scans. The settings in **LIST S** will be maintained unless the SAVE button is used.

MONITOR -- This area provides scan information when the scan data is formatted for the screen. The following data will be displayed:
Frame: The current frame number for the displayed data.
Tx and Temperature [C]: The current temperature for each of the RTDs that reports the temperature of the module. All temperatures are reported in degrees Celsius.
Px & Pressure [UNITS]: Table to hold up to 4 channels of pressure data. This table will start blank until channels are selected in the bar graph. When a bar is selected, the bar will turn light blue and the channel number and pressure value will be displayed in the table. The units will be set by the Units setting.
 Only 4 channels can be selected at a time. In order to select different channels, the current selected channels must be cleared with the "Clear Channels" button.























SUPPORT LINKS-- This section provides links that will direct to different resources on the Scanivalve website. These pages can provide general information, MPS4000 resources (such as links to download manuals or data sheets), and a link to Scanivalve's contact form.

Note: These hyperlinks will only work successfully if an internal connection is available.

WEB SERVER: FILE BROWSER

The File Browser page is used to view files and scripts stored in the MPS, edit files or scripts, create and edit new scripts, upload files, and update the MPS's firmware.

SCAN | FILESYSTEM**Filesystem**

Filename	Size	Download	Delete
ip.cfg	87B		
scan.cfg	125B		
ftp.cfg	110B		
v0_31_22.mps	1044480B		
udp.cfg	39B		
Cal_4.cfg	11703B		
pga.cfg	439B		
id.cfg	60B		
oven.cfg	91B		
misc.cfg	50B		
ptp.cfg	91B		

Upload File
 v0_31_22.mps

This section displays all files that are currently in the MPS's memory. There is also a section where files can be uploaded.

FILENAME -- This column displays the names of the files.

SIZE -- This column displays the size of the file in bytes (B).

DOWNLOAD -- This column provides a link that will initiate a download of a file to the host computer.

DELETE -- This column provides a link that will delete a file.

Only .cfg, .txt, and .mps (MPS application) files will be displayed in this table. All cfg files contain MPS settings, including the IP address. Deleting these files may have adverse effects.

All files can be double clicked to activate a function:

CONFIG (.cfg or .txt) FILES -- When a file is double clicked, it will open the "Text Editor" in the adjacent console. The contents of this file will be displayed. This file can be edited and saved using the SAVE button in the console, or loaded into temporary memory using the LOAD button. Remember that editing or changing these files may have adverse effects.

APPLICATION (.mps) FILE -- When the ".mps" file is double clicked, a dialog box will appear. Double clicking will begin a firmware update. Press OK to continue, or CANCEL to cancel. Once firmware has been updated, this file may be deleted. This file does not have to be stored on the MPS for operation. *Note: Files that do NOT match .cfg, .txt, and .MPS are considered unsupported and the MPS will not upload these files. More than one .mps file in memory is prohibited.*

UPLOAD FILE -- This area allows for files to be uploaded to the MPS, including firmware files and configuration files.

File Viewer

```

Filename: scan.cfg
SET RATE 1000.0000
SET FPS 0
SET UNITS: RAW -1.000000
SET FORMAT T C, F 0, 0 B
SET TRIG 0
SET ENFTP 0
SET OPTFREQ 0 0 16
  
```

FILE VIEWER -- This window will allow you to view or edit coefficients (.txt) tables or configuration (.cfg) files.

FILENAME -- This field will display the filename of the script file. Filenames must include the file extension (.txt or .cfg). The filename cannot exceed 32 characters and cannot contain spaces.

SAVE -- This button is used to save the file being created or edited.

LOAD -- This button is used to load the current selected file into temporary memory (for applying new settings or new coefficients).

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SECTION 4: HARDWARE

PNEUMATIC CONNECTIONS

The MPS modules has several different pneumatic connections. All pneumatic inputs are located on the top of the module. There are two basic groups of pneumatic connections types on the module: pressure measurement connection and support connections. All pneumatic inputs are through one removable header for easy plumbing and system re-configuration. The measurement ports are located on the on the outer edge of the modules and are identified as 1-32 on one pneumatic header. These 32 input ports are directly connected to one of the individual pressure transducers within the module. On the same pneumatic header as the measurement input ports is the common reference port (REF). The REF port is used for connecting the reference manifold to a known, stable ambient pressure.

The 32 measurement input ports (or Px ports) are available with 0.042" or 0.031" OD tubes. The tube REF input will always be 0.063" OD.

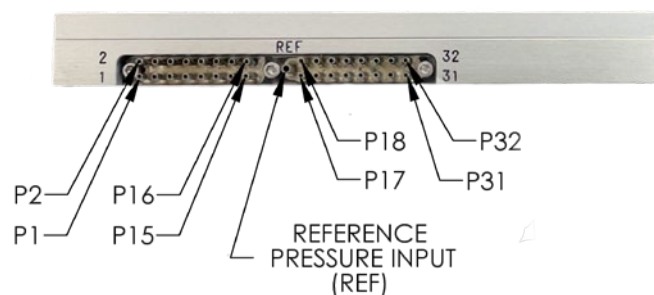


FIGURE 4-1: PNEUMATIC INPUTS

BASICS OF CONNECTING INPUT TUBES

All pneumatic connections are 0.063", 0.042" or 0.031" OD stainless steel bulged tubulations. These tubes are designed to have a tight-fitting plastic tube slid over the OD of the tube. For all low pressure connections (50psi and less) the plastic tubing can simply be slid over the tubulation and the connection is complete. When using Urethane or Vinyl tubing for high pressure applications, a helical spring clamp over the OD of the plastic tubing is recommended. The clamp is slid over the tubing and located around the apex of the bulged of the tubulation. This helps hold the plastic tubing in place and prevent leaks.

Installing the plastic tubing over the stainless steel tubing can be done much easier by using Scanivalve's special "Tubing push-on tool" P/N: TPOTL-XXX. This tool is offered

in a variety of sizes to work for tubing from 0.031" to 0.125" OD.

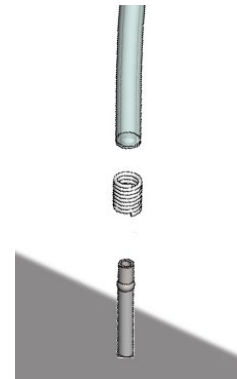


FIGURE 4-2: TUBULATION CONNECTION WITH HELICAL SPRING CLAMP

PRESSURE MEASUREMENT (Px) PORTS

Each MPS4232 scanner module has 32 pressure measurement ports, or "Px" ports. They are labeled as 1-32. Each of these ports are connected to a discrete pressure transducer. If any Px ports are not being used, it is recommended that they be covering to prevent dust or any debris from clogging the port.

REFERENCE (REF) PORT

The 'REF' port ties into a manifold that connects the back side (or negative side) or all transducers together. During most applications, the 'REF' port of low pressure modules (below 15 psi) should be routed to a known, stable static location. Typically this "reference" location will be a wind tunnel static port, a static barrel or in flight test applications the aircraft static system. This ensures that when a zero offset calibration (CALZ) is performed no unwanted offsets are introduced. During a calibration, positive pressures will be applied through the 'REF' port to perform the negative portion of the calibration.

For applications where an elevated reference pressure will be used, the maximum pressure applied to the REF input is 100psi, or sensor overpressure, whichever is less.

REMOVABLE PRESSURE INPUT HEADERS

All pneumatic inputs to the MPS are through a single removable input headers. The header is held in place with three #1-72 screws. A 1/16" Allen/hex wrench fits the screws.

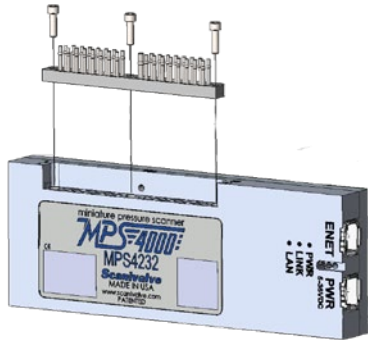


FIGURE 4-3: REMOVABLE INPUT HEADERS

The O-rings supported in the header cavity should be kept clean and watched to make sure they stay in place. Replacement or additional headers can be purchase separately as needed.

ELECTRICAL CONNECTORS

The MPS4232 has two electrical connectors located adjacent to each other on one end of the module. Both connectors are TE Connectivity “Mini I/O” series and are polarized to prevent improper connections. The connectors are latching to ensure a reliable connection. To disconnect the connectors, press down on the latch (shown in Figure 4-4 below) and pull up on the connector.



FIGURE 4-4: POWER/ETHERNET CONNECTOR LATCH

POWER/SERIAL/TRIGGER CONNECTION

The power/serial/trigger connector is located on the end of the module. The connector is an TE Connectivity PLG 8P8C Mini1. A flying leads cable is provided with each shipped MPS. The Pin-Out diagram for the power connector can be found in Figure 4-5.

Additional cables for the MPS modules can be ordered from Scanivalve in any length up to 100 feet (30 meters). Please see the Module Accessory Catalog for different cable options and part numbers.



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

The MPS4232 requires +5-36Vdc power and will consume no more than 3.5W.

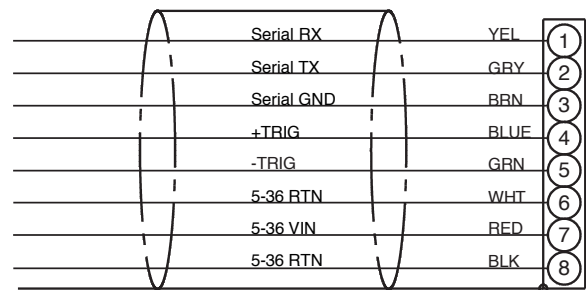
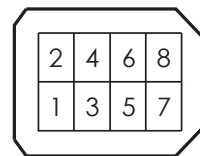


FIGURE 4-5: POWER/SERIAL/TRIGGER PIN-OUT

ETHERNET CONNECTOR

The primary means of communication with the MPS4232 module is the 100Base-T Ethernet port with MDIX auto-crossing. The connector is an TE Connectivity PLG 8P8C Mini1. A 3ft Ethernet extender cable (female RJ45) is provided with each shipped MPS. The Ethernet Pin-Out diagram is shown in Figure 4-6.

Additional cables for the MPS modules can be ordered from Scanivalve in any length up to 100 feet (30 meters). Please see the Module Accessory Catalog for different cable options and part numbers.

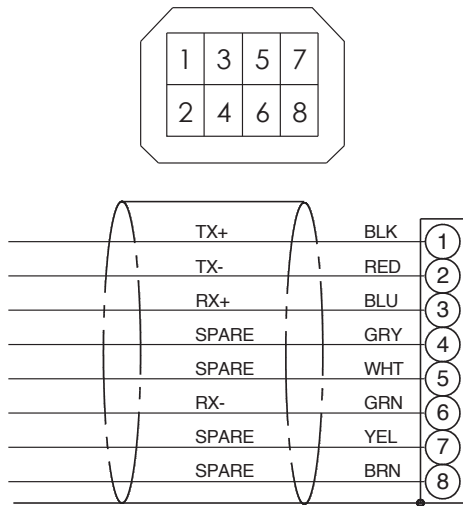


FIGURE 4-6: 100BASE-T ETHERNET PIN-OUT

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SECTION 5: SOFTWARE

OVERVIEW

The MPS4200 is a single user network server that supports connections from a Telnet Client and Web Browser Client. The operation of a MPS module is controlled by sending commands to selected modules by network addressing via the network. The MPS returns data or information over the network to the requesting client/host.

The MPS4200 also supports serial communication that can be used to set configuration variables, diagnostics and troubleshooting, or used when the MPS's IP address is not known.

The section on MPS Commands lists each command and explains its function.

MPS COMMANDS

The MPS software must run as embedded software on the MPS pressure scanner hardware. It performs the following general tasks:

1. Read and filter the raw A/D counts that represent pressure and temperature.
2. Convert the pressure A/D counts to user chosen pressure units.
3. Receive and execute commands from the Ethernet link.
4. Allow configurations to be saved through power down.
5. Output converted data, status, setup and calibration data over the Ethernet Link.
6. Set the MPS Physical Ethernet Address (MAC Address).
7. Data transfer protocol to be TCP, UDP, or FTP.
8. Support the user in troubleshooting the MPS hardware and system.

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 three options are:

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

When a MPS module is not in "READY" mode, most commands are disabled or not accepted. Examples of when the MPS module may not be in "READY" mode could be:

- During CALZ
- During SAVE
- While Scanning

The exceptions to this rule are the commands STOP, STATUS, and TRIG. These commands will have a note listed in the following sections if they are accepted when the MPS is not "READY."

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 communications variable is modified, such as IP, MAC, Gateway, or NAME, the configuration must be saved, and the MPS4200 software must be restarted in order for the changes to take effect.

MPS4200 BUFFER DESCRIPTION

The ring buffer on the MPS4200 sits between the scan task and the binary output task. It is 32768 elements in size with each element holding 160 bytes, making the total ring buffer 5,242,880 bytes. At 1000Hz, the MPS can buffer approximately 32.7 seconds of data (32768 / 1000). The binary output task has a lower priority than the scan task. This is necessary so that input scan data is not missed.

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.

MPS NETWORK CONFIGURATIONS

The MPS may be configured in three basic network arrangements:

ISOLATED NETWORK

The isolated MPS network provides the fastest possible data throughput because other network traffic has been eliminated. MPS commands are issued from the network client/host and data is directed to the network client/host in user-configured format. This configuration is ideal for high speed data transfer with data reduction that is handled by the network client/host.

INTEGRATED WITH SYSTEM NETWORK

The integrated MPS provides the most accessible data to all network clients. Any client/host on the network may control any or all of the MPS's. Depending on the data transfer protocol, network throughput may be reduced because of other network traffic. This configuration is ideal for systems that can tolerate slower data transfer rates but require easy access by multiple client/hosts to each MPS unit.

SUB-NETWORK WITH GATEWAY

The MPS sub-network allows high speed data transfer of the sub-network while allowing access by a larger network. The gateway is most effective as a multi-homed client/host that can store the MPS data for later access by client/hosts on the main system network.

MPS DATA OUTPUT 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.

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. Each line/command must be terminated with a <CR>, <CR-LF> or <LF-CR>

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.

*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.

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.

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.

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; <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 as there are only 4 RTDs.

FORMATTED ASCII

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

```

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 29>= <press> <channel 30>= <press> <channel 31>= <press> <channel 32>= <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> will be a raw A/D pressure count, <temperature> will be in °C.

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.

```

<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 *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.

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).

TABLE 5.1 - STANDARD 32 CHANNEL BINARY DATA PACKET

This is the standard binary packet for the MPS4232. This packet is a total of 196 bytes. This packet is used when SET SIM == 0 and FORMAT F or B is set to B.

FUNCTION	BYTES	DATA TYPE	DESCRIPTION
Packet Type	4	Integer	B Hex
Frame Number	4	U Integer	The current frame number if in the scan mode.
Frame Time (sec)	4	U Integer	Frame Time in seconds. This value will either be a time relative to 0 (when PTP is disabled), or an absolute PTP time.

FUNCTION	BYTES	DATA TYPE	DESCRIPTION
Frame Time (ns)	4	U Integer	Frame Time in nanoseconds. This value will either be a time relative to 0 (when PTP is disabled), or an absolute PTP time.
Temperatures	16	Float	Array of 4 temperature values as read from the 4 RTDs.
Pressures	128	Float or Integer	Array of 32 pressure values. The float or integer is selected based on the units (float = EU, integer = RAW).

TABLE 5.2 - PADDED 64 CHANNEL BINARY DATA PACKET

This binary packet is used when SET SIM == 64. When enabled, the packet size and structure will match a MPS4264, 64-channel binary packet, however will use padded data for channels not being used (pressure channels 33-64, temperatures 5-8). This allows the same packet structure to be used for MPS4200 32 and 64 channel modules in the same software. This packet is a total of 348 bytes.

FUNCTION	BYTES	DATA TYPE	DESCRIPTION
Packet Type	4	Integer	A Hex
Packet Size	4	Integer	Size in bytes of this packet (348)
Frame Number	4	Integer	The current frame number if in the scan mode.
Serial Number	4	Integer	Serial Number of the module (SET SN)
Frame Rate	4	Float	Scanning rate in Hz
Valve Status	4	Integer	0 - Px Only (32 is valveless)
Units index	4	Integer	Units conversion index (add table)
Units conversion factor	4	Float	Conversion factor from PSI to selected units
PTP Scan Start Time (sec)	4	Integer	Scan start time in seconds
PTP Scan Start Time (ns)	4	Integer	Scan start time 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). Channels 1 - 32 will be real data. Channels 33-64 will be padded with "0".
Frame Time	4	Integer	Time the frame occurred (seconds)
Frame Time	4	Integer	Time the frame occurred (nanoseconds)
External Trigger Time	4	Integer	Time the external trigger occurred (seconds)
External Trigger Time	4	Integer	Time the external trigger occurred (nanoseconds)

TABLE 5.3 - LABVIEW® BINARY PACKET (32 CHAN)

This is the standard LabVIEW® binary packet for the MPS4232. This packet is a total of 136 bytes sent as 34 array elements. This packet is used when FORMAT B is set to L and SIM is set to 0.

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 32	4	Float	33	Pressure values for channel 32

TABLE 5.4 - LABVIEW® BINARY PACKET (64 CHAN)

This is the LabVIEW® binary packet that simulates a MPS4264 packet. This packet is a total of 264 bytes sent as 66 array elements. This packet is used when FORMAT B is set to L and SIM is set to 64. *Note: This is implemented as a backward compatible MPS4264 LabVIEW® packet. Channel data 33-64 will be padded with 0 and do not represent believable data. This allows the same packet structure to be used for MPS4200 32 and 64 channel modules in the same software.*

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 64	4	Float	65	Padded data (0) for channel 64

FTP FILE NAMES AND FORMATS

When the MPS4232 is configured to output data via FTP, 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).

TABLE 5-8: FILE NAME EXTENSIONS

SETTING OF FORMAT VARIABLE	TYPE OF SCAN	FILE EXTENSION
SET FORMAT F A	ASCII	nnnn.txt
SET FORMAT F B	Binary	nnnn.dat
SET FORMAT F C	Comma Separated Variable	nnnn.csv

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.

EXAMPLE COMMAND TITLE

COMMAND	The name of the command
TYPE	<p>Lists the type of command. There are three types of commands in the MPS:</p> <p><u>Get</u> - 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></p> <p><u>Set</u> - 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.</p> <p><u>Function</u> - a Function command will cause the MPS to start a process or function and may not return any data.</p> <p>A command can be one or more types.</p> <p>Any command type labeled as "Disabled" are implemented as a placeholder to create backwards compatibility with MPS4264 software. These commands will be accepted, but will not change any functionality in the MPS4232.</p>
DESCRIPTION	Provides a description about the command and what it may be used for.
SYNTAX	<p>Lists the format of the command. The following conventions are used:</p> <p>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.</p> <p><parameter> - Words in < > indicate place holders for parameters that must be supplied.</p> <p>[<parameter>] - Parameters in [] indicate place holders for optional parameters that are not required.</p> <p><i>data</i> - Example data is shown in <i>italics</i>.</p> <p>data - Example commands are show in bold.</p> <p>, - Commas separate options, only one of the options may be used.</p>
RETURNS	<p>Lists the format of the information that the unit returns to the host.</p> <p>A PROMPT may be output when the MPS is ready to accept a command.</p>
DEFAULT	The default settings from the factory
EXAMPLE(S)	<p>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.</p> <p><i>data</i> - Example return data is shown in <i>italics</i>.</p> <p>data - Example commands are show in bold</p>
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.

GENERAL CONTROL COMMANDS**STATUS**

COMMAND	STATUS
TYPE	Get
DESCRIPTION	Displays the current mode of the MPS.
SYNTAX	STATUS
RETURNS	STATUS: <mode> Where <mode> is: READY = Ready mode SCAN = Currently scanning CALZ = Performing a zero calibration SAVE = Performing a save CAL = Performing a calibration VAL = Performing a 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 v1.00 >

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 <table border="0"> <tr> <td><i>filename</i></td> <td><i>size</i></td> </tr> <tr> <td><i>v100.mps</i></td> <td><i>942080</i></td> </tr> <tr> <td><i>scan.cfg</i></td> <td><i>122</i></td> </tr> <tr> <td><i>ip.cfg</i></td> <td><i>89</i></td> </tr> <tr> <td><i>Cal_1.cfg</i></td> <td><i>11336</i></td> </tr> </table> >	<i>filename</i>	<i>size</i>	<i>v100.mps</i>	<i>942080</i>	<i>scan.cfg</i>	<i>122</i>	<i>ip.cfg</i>	<i>89</i>	<i>Cal_1.cfg</i>	<i>11336</i>
<i>filename</i>	<i>size</i>										
<i>v100.mps</i>	<i>942080</i>										
<i>scan.cfg</i>	<i>122</i>										
<i>ip.cfg</i>	<i>89</i>										
<i>Cal_1.cfg</i>	<i>11336</i>										

DELETE FILE

COMMAND	DELFILE
TYPE	Function
DESCRIPTION	Deletes a selected file from flash memory.
SYNTAX	DELETE <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	DELETE FILE 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 <i>SET IPADD 192.168.0.240</i> <i>SET SUBNET 255.0.0.0</i> <i>SET MAC 0.96.93.95.0.1</i> <i>SET GW 0.0.0.0</i> >

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: <table border="1" data-bbox="462 1157 1190 1654"> <thead> <tr> <th><group></th> <th>Filename</th> <th>Contents</th> </tr> </thead> <tbody> <tr> <td>IP</td> <td>ip.cfg</td> <td>IP (bootloader) Variables</td> </tr> <tr> <td>ID</td> <td>id.cfg</td> <td>Identification Variables</td> </tr> <tr> <td>S</td> <td>scan.cfg</td> <td>Scan Variables</td> </tr> <tr> <td>PTP</td> <td>ptp.cfg</td> <td>PTP Variables</td> </tr> <tr> <td>FC</td> <td>Fc.cfg</td> <td>Field Cal Conversion Points</td> </tr> <tr> <td>C</td> <td>Cal_<sn>.cfg</td> <td>Full Calibration Coefficients</td> </tr> <tr> <td>M</td> <td>misc.cfg</td> <td>Miscellaneous Variables</td> </tr> <tr> <td>FTP</td> <td>ftp.cfg</td> <td>FTP Variables</td> </tr> <tr> <td>O</td> <td>oven.cfg</td> <td>Oven Control Variables</td> </tr> <tr> <td>PGA</td> <td>Cal_<sn>.cfg</td> <td>Programmable Gain Settings</td> </tr> <tr> <td>T</td> <td>Cal_<sn>.cfg</td> <td>Conversion Settings</td> </tr> </tbody> </table>	<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
<group>	Filename	Contents																																			
IP	ip.cfg	IP (bootloader) Variables																																			
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FC	Fc.cfg	Field Cal Conversion Points																																			
C	Cal_<sn>.cfg	Full Calibration Coefficients																																			
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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 <i>SET RATE 5.0000</i> <i>SET FPS 0</i> <i>SET UNITS PSI 1.000000</i> <i>SET FORMAT T F,F B,B B</i> <i>SET TRIG 0</i> <i>SET ENFTP 0</i> >
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 C, T, PGA, FC, and IP 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	<i>// To save all of the current settings (excluding C, T, PGA, IP, and FC)</i> SAVE >
EXAMPLE	<i>// To save only the "IP" settings to the file ip.cfg</i> SAVE IP >
NOTES	The "SAVE C" option saves all of the calibration related lists (LIST C, T, and PGA) and will print the SN in the Cal.cfg file generated. It can take up to 1 minute to complete this save.
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	<i>// Set the PTPEN variable to 1</i> 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. <u>WARNING: All data will be lost, including configuration files.</u> 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 <i>Type FDISKCONFIRM to confirm FDISK or STOP to escape FDISK Formatting...</i> >
NOTES	FDISK will not remove the installed firmware application.
NOTES	FSIDKCONFIRM will trigger a <i>Format Completed!</i> 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 and number.
SYNTAX	GET MODEL
RETURNS	The model name of the device
EXAMPLE	GET 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.
SYNTAX	SCAN
RETURNS	The scan data, followed by a prompt when the scan is completed.
EXAMPLE	SCAN :: <i>[Scan Data]</i> :: >
NOTES	Output is based on formatting. Please see MPS Data Output Definitions 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.
NOTES	If TRIG == 1, the MPS will enter SCAN mode but will not output data until a trigger is received. See the TRIG command for more information.

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.

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 <i>SET IPADD 10.0.1.222</i> <i>SET SUBNET 255.255.0.0</i> <i>SET MAC 0.96.93.90.0.100</i> <i>SET GW 0.0.0.0</i> >

SET IP ADDRESS OF THE MPS (IPADD)

COMMAND	IPADD
TYPE	Set/Get
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/Get
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/Get
DESCRIPTION	Sets the hardware's MAC address.

SYNTAX	SET MAC <xxx.xxx.xxx.xxx.xxx> Where <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/Get
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

SCAN VARIABLES**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 <i>SET RATE 5.0000</i> <i>SET FPS 0</i> <i>SET UNITS PSI 1.000000</i> <i>SET FORMAT T F,F B,B B</i> <i>SET TRIG 0</i> <i>SET ENFTP 0</i> <i>SET OPTIONS 0 0 16</i> >

SET RATE (RATE)

COMMAND	RATE
TYPE	Set/Get
DESCRIPTION	<p>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.</p> <p>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.</p> <p>When RATE is less than 500, the internal AD rate and number of averages can be calculated using the following equations:</p> $\text{AVG} = \text{ceil}(500 / \text{RATE})$ $\text{ADrate} = \text{RATE} \times \text{AVG}$ <p>where ceil(x) finds the next integer greater than x</p>
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 1000>

SET FRAMES PER SCAN (FPS)

COMMAND	FPS
TYPE	Set/Get

DESCRIPTION	<p>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.</p> <p>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.</p> <p>The FPS variable can be used to configure a scan for a certain time duration using the following equation:</p> $\text{FPS} = \text{RATE} \times \text{TIME}$ <p>where RATE is expressed in Hertz and TIME is expressed in seconds</p>
SYNTAX	<p>SET FPS <number of frames></p> <p>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.</p>
RETURNS	Prompt when ready to accept a new command
EXAMPLE	<p>SET FPS 100</p> <p>></p>
DEFAULT	0
RANGE	0 to 4294967295

SET SCAN UNITS (UNITS)

COMMAND	UNITS																												
TYPE	Set/Get																												
DESCRIPTION	Set the scan units (pressure engineering units)																												
SYNTAX	<p>SET UNITS <units> [<user cv>]</p> <p>Where <units> is one of the following:</p> <table style="width: 100%; border: none;"> <tr> <td>PSI</td> <td>ATM</td> <td>BAR</td> <td>CMHG</td> </tr> <tr> <td>CMH2O</td> <td>DECIBAR</td> <td>FTH2O</td> <td>GCM2</td> </tr> <tr> <td>INHG</td> <td>INH2O</td> <td>KNM2</td> <td>KGM2</td> </tr> <tr> <td>KGCM2</td> <td>KPA</td> <td>KIPIN2</td> <td>MPA</td> </tr> <tr> <td>MBAR</td> <td>MH2O</td> <td>MMHG</td> <td>NM2</td> </tr> <tr> <td>NCM2</td> <td>OZIN2</td> <td>OZFT2</td> <td>PA</td> </tr> <tr> <td>PSF</td> <td>TORR</td> <td>USER</td> <td>RAW</td> </tr> </table> <p>When <units> is set to USER, the user must enter a value for <user cv>.</p>	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
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																										
RETURNS	Prompt when ready to accept a new command																												
EXAMPLE	<p>// To configure the EU output to PSI</p> <p>UNITS PSI</p> <p>></p>																												
EXAMPLE	<p>// To configure a user conversion value</p> <p>UNITS USER 1.50</p> <p>></p>																												

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

SET SCANNING DATA FORMAT (FORMAT)

COMMAND	FORMAT
TYPE	Set/Get
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 = Binary format (.dat) See binary format definition below. L = LabVIEW binary format. See binary format for LabVIEW definition below.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	// Set the format for all data outputs 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/Get/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	<pre>// Disable external triggering SET TRIG 0 ></pre>
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.

SET ENABLE FTP (ENFTP)

COMMAND	ENFTP
TYPE	Set/Get
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	<pre>// Enable FTP data output SET ENFTP 1 ></pre>
DEFAULT	0
RANGE	0 or 1

SET OPTIONS (OPTIONS)

COMMAND	OPTIONS
TYPE	DISABLED (<i>Get/Set</i>)
DESCRIPTION	This variable is not used in the MPS4232 and is left for compatibility with MPS4264. Any values set in this variable will not affect the MPS4232.
SYNTAX	<i>SET OPTIONS <fast scan> <read mode> <statistical scan subset size></i>
RETURNS	<i>Prompt when ready to accept a new command</i>
EXAMPLE	<pre><i>SET OPTIONS 0 0 16</i> ></pre>
DEFAULT	<i>0 0 16</i>

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 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/Get
DESCRIPTION	Sets the nominal pressure ranges for the MPS
SYNTAX	SET NPR <npr1p> <npr1n> Where: <npr1p> is the maximum nominal pressure for channels 1 to 32. <npr1n> is the minimum nominal pressure for channels 1 to 32.
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/Get
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.

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/Get
DESCRIPTION	Sets debugging and simulation modes.
SYNTAX	SET SIM <code in hex> Where <code in hex>: Bit 2 when set shows PTP calculated start differentials Bit 5 changes the binary packet to a MPS4264 simulated packet (padded 64 channel packet)
RETURNS	Prompt when ready to accept a new command
EXAMPLE	// set the MPS4232 to output a simulated 64 channel binary packet SET SIM 64 >
DEFAULT	0
RANGE	0 to 65535

SET ECHO (ECHO)

COMMAND	ECHO
TYPE	Set/Get
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
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TYPE	DISABLED (<i>Set/Get</i>)
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/Get
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 1 for accuracy error percentages).
RETURNS	Prompt when ready to accept a new command
EXAMPLE	SET ETOL 0.1 >
DEFAULT	0
RANGE	0 - 100

FTP VARIABLES (LIST FTP)

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.

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 <i>SET USERFTP Scanivalve</i> <i>SET PASSFTP password</i> <i>SET PATHFTP /File</i> <i>SET IPFTP 10.0.1.222</i> <i>SET FILEFTP Scan</i> >

SET USER NAME (USERFTP)

COMMAND	USERFTP
TYPE	Set/Get
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/Get
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/Get
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/Get
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/Get
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

UDP VARIABLES

The UDP settings control the target and enable of scan data out the UDP port.

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/Get
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/Get
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. <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>

CALIBRATION AND VALIDATION COMMANDS**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	<p>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.</p> <p><i>*Coming in a future firmware update.</i></p>
RETURNS	Calibration data and a prompt when completed.
EXAMPLE	<p>CAL [:::data:::] ></p>
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	<p>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.</p> <p><i>*Coming in a future firmware update.</i></p>
RETURNS	Calibration information and a prompt when completed.
EXAMPLE	<p>MCAL [:::data:::] ></p>
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. <i>*Coming in a future firmware update.</i>
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.
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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. <i>*Coming in a future firmware update.</i>
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
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. This provides a Quick-Zero Offset Correction in the measurement state with no pressure applied.

CALIBRATION VARIABLES (LIST C)

The calibration settings control the calibration and validation of the MPS4200. See Section 6: Calibration and Validation Overview for more information on performing calibrations or validations.

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 <i>SET NUMPTS 0 9 0 9</i> <i>SET MIN 40.000000 -5.500000 5.000000 -5.000000</i> <i>SET MAX 60.000000 5.500000 55.000000 5.000000</i> <i>SET DELAY 5 5</i> <i>SET IPOVEN 0.0.0.0 0</i> <i>SET IPCAL 0.0.0.0 0 1</i> <i>SET CALAVG 16 16</i> <i>SET VALZO 0</i> <i>SET FCAL 3 -5.00 5.00</i> <i>SET FVAL 3 -5.00 5.00</i> >

SET NUMBER OF POINTS IN CONVERSION TABLE (NUMPTS)

COMMAND	NUMPTS
TYPE	Set/Get
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/Get
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/Get
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/Get
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/Get
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.
NOTES	When 0.0.0.0 0 0 is used, a simulated calibrator for debug is used.

SET THE CALIBRATION AND VALIDATION AVERAGE (CALAVG)

COMMAND	CALAVG
TYPE	Set/Get
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/Get
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/Get
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

OVEN VARIABLES (LIST O)

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 Section 6: Calibration and Validation Overview for more information.

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 0.0.0.0 0 SET STARTOVEN 0 SET STOPOVEN 0 SET TEMPOVEN 0 >

SET THE OVEN IP ADDRESS, PORT AND CALIBRATOR NUMBER (IPOVEN)

COMMAND	IPOVEN
TYPE	Set/Get
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	0.0.0.0 0
RANGE	These values are not range checked.

SET THE OVEN START COMMAND (STARTOVEN)

COMMAND	STARTOVEN
TYPE	Set/Get
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/Get
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/Get
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.

CONVERSION TABLE VARIABLES

The conversion table is responsible for converting raw pressure counts and temperature into accurate EU pressure.

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. <kn> - the least-squares coefficient value as used in the conversion equation. <a, b, c, dn> - 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 32 1.000000 1.000000 1.000000 1.000000 >
NOTES	These values should never be manipulated manually.

MULTICAST COMMANDS**MULTIPLE UNIT FIND**

COMMAND	MFIND
TYPE	Function
DESCRIPTION	Lists all of the MPS4232 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 <i>Found device SN9 IP Address 191.30.90.9</i> <i>Found device SN10 Address 191.30.90.10</i>

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 is stopped.
EXAMPLE	MSCAN >
NOTES	Output is based on formatting.

PRECISION TIME PROTOCOL VARIABLES (LIST PTP)

The precision time protocol settings control the PTP 1588 settings of the MPS4200. The PTP configuration is accessed by the command LIST PTP.

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 PTP ENABLE (PTPEN)

COMMAND	PTPEN
TYPE	Set/Get
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/Get
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.

SET SCAN START TIME (SST)

COMMAND	SST
TYPE	Set/Get
DESCRIPTION	Sets the time to start scanning as referenced to the PTP grandmaster. The MPS4200 will use the current PTP time as the scan start time under two conditions: 1) When the PTP system is disabled via the SET PTPEN 0 command. 2) When the current time has not been received from the PTP server since the MPS4200 was powered up. Under this condition the MPS4200 time will start at Jan 1 1970, 0:00:00.000 hours, or epoch 0 time. This most likely will happen when there is no PTP server on the network. If the MPS4200 was enabled and then disabled after receiving a time set from the PTP time server, the MPS4200 will keep time from the last clock setting from the PTP server. When these two cases are not met, the MPS4200 uses the start time set via the SET SST <time> and SET SSD <date> setting in the PTP group.
SYNTAX	SET SST <hh:mm:ss.ffff> Where: hh = Hours (24 hour format) mm = Minutes ss = Seconds ffff = fractions of a second.
RETURNS	Prompt when ready to accept a new command
EXAMPLE	SET SST 13:00:00.000 >
DEFAULT	0:0:0.0000
RANGE	Any valid time

SET SCAN START DATE (SSD)

COMMAND	SSD
TYPE	Set/Get
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/Get
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

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 <i>Current Time 2014/2/6 0:23:52.0 sec 3335 ns 439809720</i> >

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 in 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 14:20:00 <i>Entered 2016/6/22 14:20:0</i> <i>Time is 1466605200</i>

GET UTC OFFSET

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

RETURNS	<p>Current UTC Offset <value> <update> <valid></p> <p>Where:</p> <ul style="list-style-type: none">value = The current difference between TAI time and UTC time, in seconds, as supplied by the local grandmaster.update = UTC updated flagvalid = Set as 1 when UTC offset found is valid. <p>Followed by a prompt when ready for next command.</p>
EXAMPLE	<p>GETUTCO <i>Current UTC Offset 0 0 0</i> ></p>

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SECTION 6: MAINTENANCE

FIRMWARE INSTALLATION (WINDOWS 7, 8, 10)

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.

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.

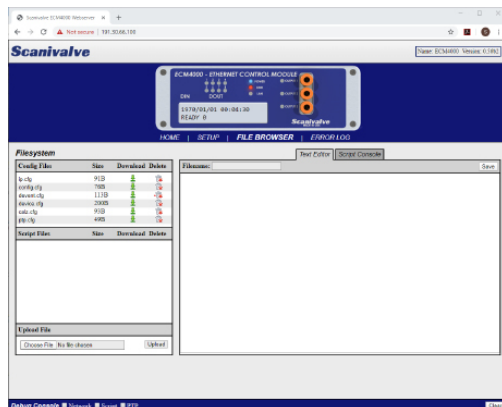


FIGURE 6-1: FILE BROWSER PAGE

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

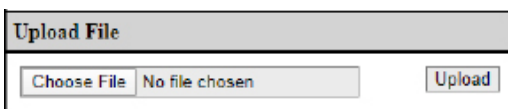


FIGURE 6-2: UPLOAD FILE

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."

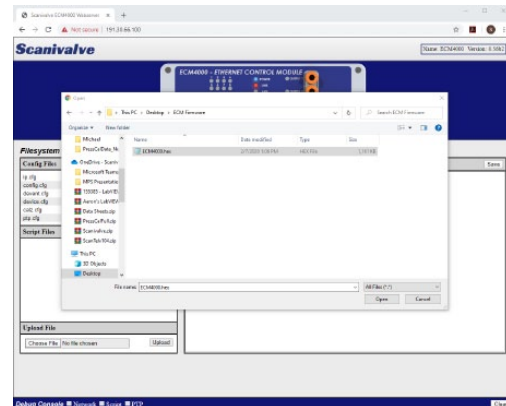


FIGURE 6-3: v1_00.MPS

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 upload process will overwrite the existing file.

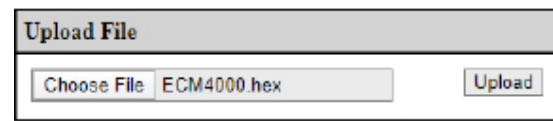


FIGURE 6-4: UPLOAD FILE

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

Config Files	Size	Download	Delete
ip.cfg	91B	↓	🗑️
config.cfg	76B	↓	🗑️
devicn.cfg	113B	↓	🗑️
devico.cfg	200B	↓	🗑️
calz.cfg	93B	↓	🗑️
ptp.cfg	49B	↓	🗑️
ECM4000.hex	1187960B	↓	🗑️
Script Files	Size	Download	Delete

FIGURE 6-5: CONFIG FILES

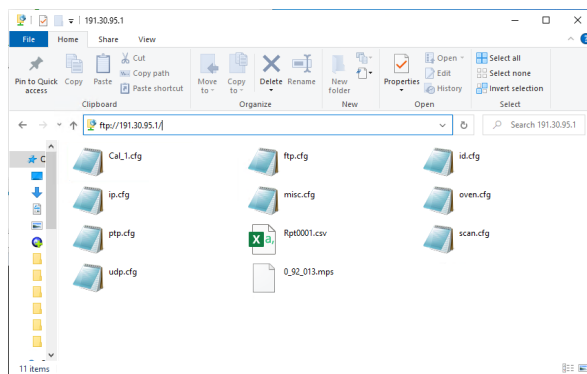
9. A dialog box will appear and ask for firmware update confirmation. Click "OK" to continue. A new dialog box will appear. The MPS will begin updating the firmware. When the update is complete, the dialog box will disappear and the browser will refresh and reload the MPS Home Page.

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.

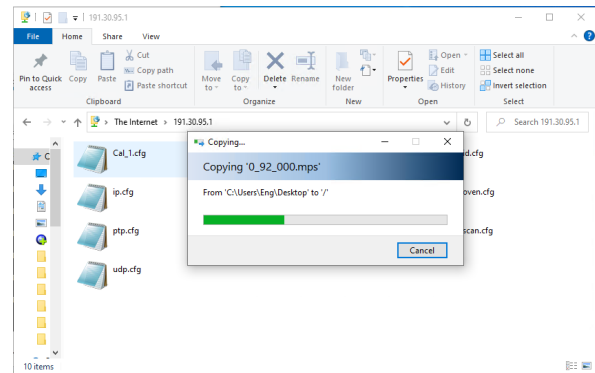
FIRMWARE INSTALLATION VIA FTP

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 MPS4232 firmware file is a binary file called “x_yy.mps” where x_yy is the firmware version.
6. Select the MPS4232 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 MPS4232. A progress window will provide progress information.

7. When the copy function is complete, the MPS4232 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.

**CALIBRATION COEFFICIENT INSTALLATION
(WINDOWS 7, 8, 10)**

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.

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.

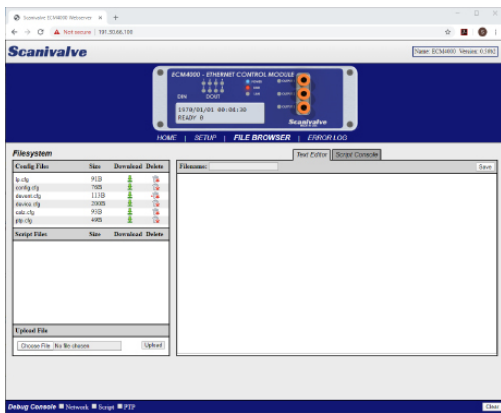


FIGURE 6-8: FILE BROWSER PAGE

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

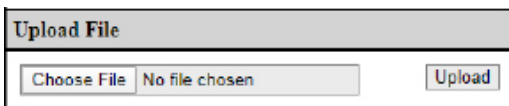


FIGURE 6-9: UPLOAD FILE

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."

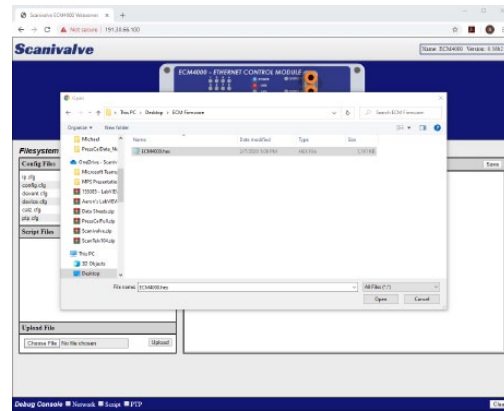


FIGURE 6-10: CAL_<SN>.CFG

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.

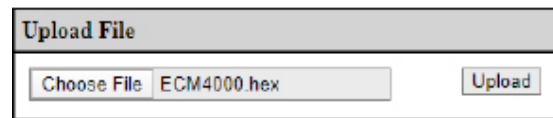


FIGURE 6-11: UPLOAD FILE

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

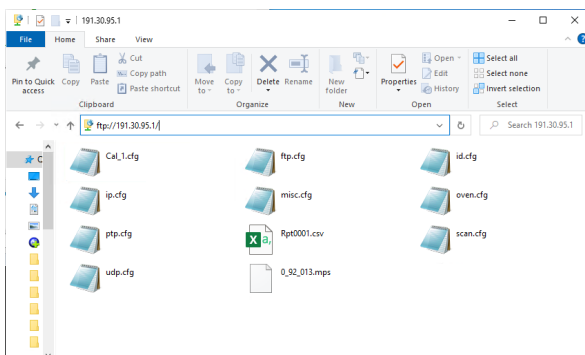
Config Files	Size	Download	Delete
ip.cfg	91B	↓	🗑️
config.cfg	76B	↓	🗑️
devont.cfg	113B	↓	🗑️
device.cfg	200B	↓	🗑️
calz.cfg	93B	↓	🗑️
ptp.cfg	49B	↓	🗑️
ECM4000.hex	1187960B	↓	🗑️
Script Files	Size	Download	Delete

FIGURE 6-12: 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

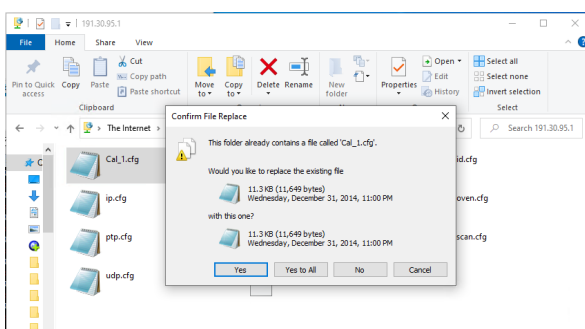
COEFFICIENT INSTALLATION VIA FTP

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 6-13: FLASH FILE CONTENTS**

5. Open Windows Explorer in another window and navigate to the directory where the calibration coefficients are stored. MPS4232 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 MPS4232 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 6-14: FLASH FILE CONTENTS**

The file will be copied to the MPS4232. 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 MPS4232 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

CHANGING THE IP ADDRESS

The following procedure will change the IP address of the MPS4200 using a terminal emulator (ScanTel, HyperTerminal, puTTY, etc). The webserver 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.

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 be 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:

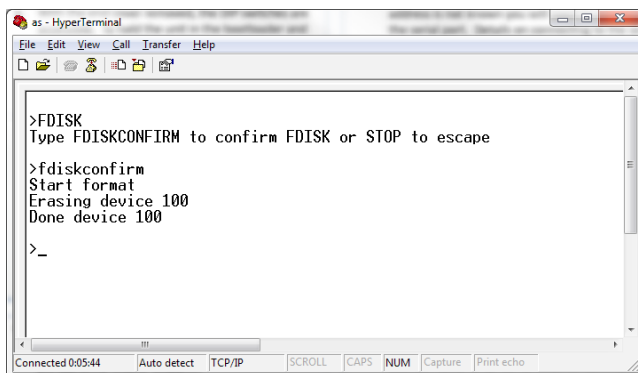
1. Power the MPS on.
If the IP address is known, you can attempt to connect to the unit via an Ethernet connection. If this is not successful, or if the IP address is not known, you must connect using the serial port. Details on connecting to the serial port can be found in the “Serial Communications”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

FDISKCONFIRM<ENTER>

The MPS will respond indicating completion:

```
Start format
Erasing device 100
Done device 100
>
```



```
>FDISK
Type FDISKCONFIRM to confirm FDISK or STOP to escape

>fdiskconfirm
Start format
Erasing device 100
Done device 100

>
```

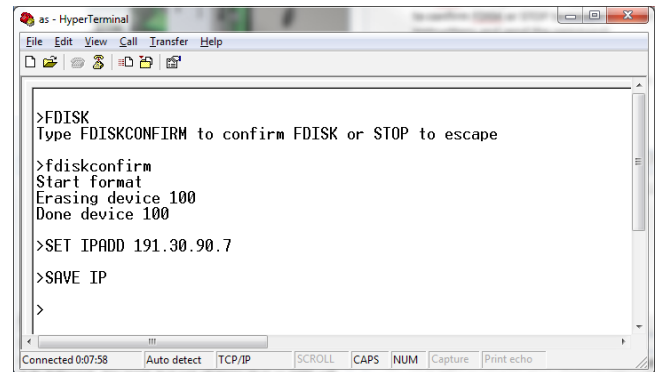
FIGURE 6-7: FDISK COMMAND

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>



```
>FDISK
Type FDISKCONFIRM to confirm FDISK or STOP to escape

>fdiskconfirm
Start format
Erasing device 100
Done device 100

>SET IPADD 191.30.90.7

>SAVE IP

>
```

FIGURE 6-8: 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.

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.

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.

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.

FIELD CALIBRATION & VALIDATION

*** Will be released in a future firmware update.**

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.

FIELD CALIBRATION & VALIDATION PROCEDURE

*** Will be released in a future firmware update.**

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.

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:

- Calibrator positive output to the CAL port.
- Calibrator negative output to the REF port.

Note: this requires a manifolded connection to all 32 inputs, or the calibration input header (PN 20080)

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.

4. Connect to a single MPS4200 using ScanTel (or similar program).

5. [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.

PERFORMING A SINGLE OR MULTI-FIELD CALIBRATION

A Field Calibration (single or multi-unit) will apply defined pressures from the calibrator in equal steps, at the current temperature of the module(s). This calibration create correction terms that are used across the full compensated range (0°-70°C). A validation is typically required after a calibration. The field calibration coefficients can be enabled or disabled at any time using the **FCENABLE** variable.

1. Follow the steps under Setup and Configuration.
2. [Optional] If a calibration 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, issue the command:
CAL F<ENTER>
To start an automated multi-unit field calibration, issue

the command:

MCAL F<ENTER>

The Field Calibration (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.

4. Once a Field Calibration is complete, the field coefficients are stored in **LIST FC**. The field calibration process will automatically enable the field coefficients in all modules (**SET FCENABLE 1**). To save these coefficients, the 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).

PERFORMING A SINGLE OR MULTI-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.

PERFORMING A SINGLE OR MULTI-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).

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.

TABLE 6-1: RECOMMENDED CAL/VAL SETTINGS

The following table shows Scanivalve’s recommended settings for MPS4232 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			

[INTENTIONALLY LEFT BLANK]

APPENDIX

APPENDIX A - ENGINEERING UNIT CONVERSION CONSTANTS

UNITS Setting	Engineering Unit	PSI to EU 1 PSI =	EU to PSI 1 EU =
ATM	Atmospheres	0.068046 A	14.6960 psi
BAR	Bars	0.068947 b	14.5039 psi
CMHG	Centimeter of Mercury	5.17149 cmHg	0.193368 psi
CMH2O	Centimeter of Water	70.308 cmH2O	0.014223 psi
DECIBAR	Decibar	0.68947 db	1.4504 psi
FTH2O	Foot of Water	2.3067 ftH2O	0.43352 psi
GCM2	Gram per square Centimeter	70.306 g/cm2	0.014224 psi
INHG	Inch of Mercury @ 0C	2.0360 inHg	0.491159 psi
INH2O	Inch of Water @ 4C	27.680 inH2O	0.036127 psi
KGCM2	Kilogram per square Centimeter	0.0703070 kg/cm2	14.2235 psi
KGM2	Kilogram per square Meter	703.069 kg/m2	0.0014223 psi
KIPIN2	kips per square inch(ksi)	0.001 kip/in2	1000.0 psi
KNM2	Kilonewton per square Meter	6.89476 kN/m2	0.145038 psi
KPA	Kilopascal	6.89476 kPa	0.145038 psi
MBAR	Millibar	68.947 mb	0.014504 psi
MH2O	Meter of Water	0.70309 mH2O	1.42229 psi
MMHG	Millimeter of Mercury	51.7149 mmHg	0.0193368 psi
MPA	Megapascal	0.00689476 Mpa	145.038 psi
NCM2	Newton per square Centimeter	0.689476 N/cm2	1.45038 psi
NM2	Newton per square Meter	6894.759766 N/m2	0.000145038 psi
OZFT2	Ounce per square Foot	2304.00 oz/ft2	0.000434028 psi
OZIN2	Ounce per square Inch	16.00 in/ft2	0.062500 psi
PA	Pascal	6894.759766 Pa	0.000145038 psi
PSF	Pound per square Foot	144.00 lb/ft2	0.00694444 psi
TORR	Torr	51.714901 T	0.0193368 psi

APPENDIX B - LABVIEW® CLIENT EXAMPLE

Below is an example LabVIEW® VI to show how to interface with the MPS4200 binary server. The frame structure to the left connects to the MPS4200 binary server with port 503 and prompts the user to enter a file name for the text file that will hold the scan data in CSV format. This example assumes that the SIM variable in the MPS4232 is set to 64 (0x40). If SIM is set to 0, the binary packet is 34 single elements per frame or 136 bytes.

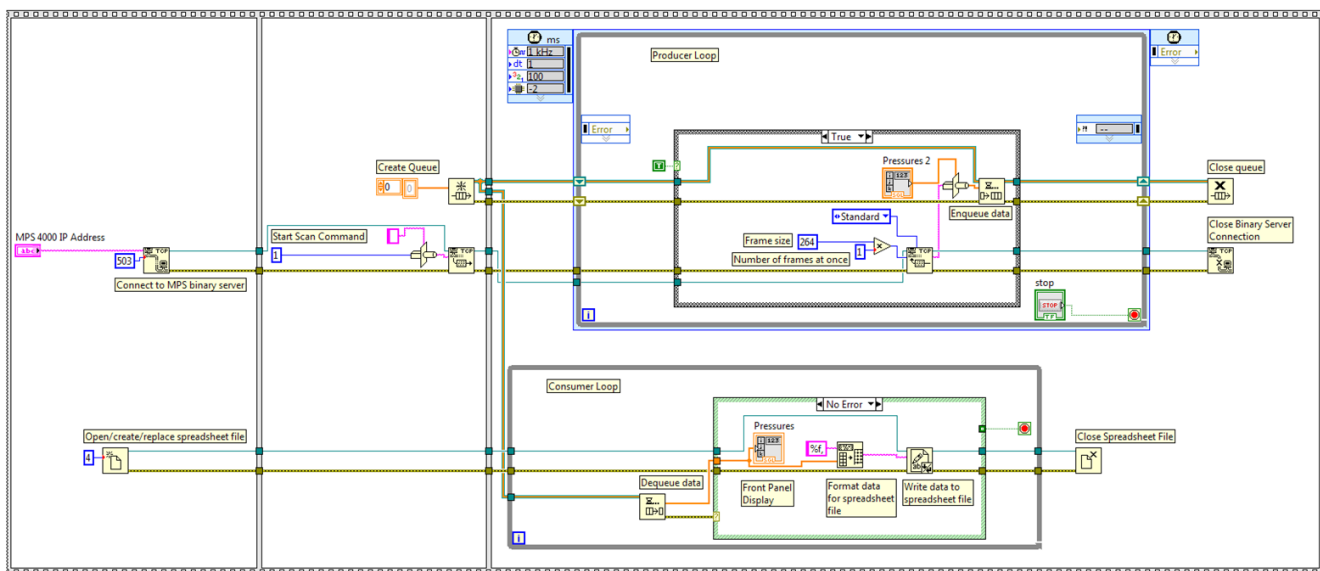
The next frame structure to the right creates a queue and starts the scan by writing a binary “1” to the binary server. A queue is used between the producer loop and the consumer loop to handle differences between sampling rates and writing rates. The next frame structure to the right supports the produce loop and the consumer loop.

The producer loop reads the data from the MPS4200 binary server. The MPS data is formatted such that the VI cast function can convert it directly to 66 single elements per frame or 264 bytes. This example runs the produce loop at 1ms, but this could be run at a slower period when the rate of the MPS is slower.

Multiple frames of data from the MPS may be read at once, however this will cause multiple frames of data in one array. For instance if 4 frames of data are desired with one read, the number of bytes to read is (4 X 264) or 1056 bytes. This allows the period of the producer loop to be reduced but the spreadsheet will then have 4 frames of data in one row. Additional LabVIEW functions, or spreadsheet post processing functions, are required to split out each data frame when multiple frames are read.

In tests with the produce loop set at a period of 1ms, and the read size set equal to 1 frame, data rates to 850 Hz are possible.

The consumer loop reads data from the queue, displays it to the front panel, converts the data to a string formatted for a CSV file, and writes the data to a CSV file. When an error is received from the queue, because the queue was closed from the producer loop, the consumer loop exits and closes the CSV file.



Scanivalve has created a standalone MPS4200 program titled MPSLink, that will interface with up to 8x MPS4200 modules, scan and collect data at the maximum rate, and will convert all data to a single .CSV file. This program is available for download on the Scanivalve website, under Software Downloads. Included in the download are all VI's that were used to create the program. These VI's can be useful examples when developing custom LabVIEW® software.

APPENDIX C - DATA MATRIX

Data Output Setup				Configurations							Notes
Data Destination	Data Format	Data Type	Sample Rate	UNITS	TRIG	ENUJP	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, 3	0	0	1	B, L	0	
			EXT	RAW	1	0	0	1	B, L	64	
			INT	RAW	0, 2, 3	0	0	1	B, L	0	
			EXT	RAW	1	0	0	1	B, L	64	
		EU Pressure	INT	PSI	0, 2, 3	0	0	1	B, L	0	
			EXT	PSI	1	0	0	1	B, L	64	
			INT	PSI	0, 2, 3	0	0	1	B, L	0	
			EXT	PSI	1	0	0	1	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	
			EXT	RAW	1	0	1	0	B	64	
		EU Pressure	INT	PSI	0, 2, 3	0	1	0	B	0	
			EXT	PSI	1	0	1	0	B	64	
UDP	ASCII	ADC Counts	INT	RAW	0, 2, 3	1	0	0	A, C	0	
			EXT	RAW	1	1	0	0	A, C	0	
		EU Pressure	INT	PSI	0, 2, 3	1	0	0	A, C	0	
			EXT	PSI	1	1	0	0	A, C	0	
	Binary	ADC Counts	INT	RAW	0, 2, 3	1	0	0	B	0	
			EXT	RAW	1	1	0	0	B	64	
		EU Pressure	INT	PSI	0, 2, 3	1	0	0	B	0	
			EXT	PSI	1	1	0	0	B	64	
Dual FTP/UDP	Binary Only	ADC Counts	INT	RAW	0, 2, 3	1	1	0	B	0	
			EXT	RAW	1	1	1	0	B	64	
			INT	RAW	0, 2, 3	1	1	0	B	0	
			EXT	RAW	1	1	1	0	B	64	
		EU Pressure	INT	PSI	0, 2, 3	1	1	0	B	0	
			EXT	PSI	1	1	1	0	B	64	
			INT	PSI	0, 2, 3	1	1	0	B	0	
			EXT	PSI	1	1	1	0	B	64	

APPENDIX D - SOFTWARE REVISION LOG

Version 1.00 - Initial Release

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**MPS4232 HARDWARE & SOFTWARE MANUAL
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