Serial No. _____

PALMER

DIFFERENTIAL PRESSURE RECORDERS
USER MANUAL
Model 524

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PD1016 Rev D
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Thank you for purchasing a Palmer Differential Pressure Chart Recorder.
We appreciate your business.

All our Recorders are high quality, functionally sensitive instruments, proudly made in the USA, and shipped from our factory as a calibrated system.

IP55 COMPLIANT

CALIBRATION TRACEABLE TO NIST

ONE YEAR 1 WARRANTY
DP Unit

THREE YEAR 3 WARRANTY
Chart Recorder

MERCURY FREE OPTIONS

MNC Manufactured in North Carolina

ISO 9001:2015 CERTIFIED QUALITY MANAGEMENT SYSTEM

MADE IN THE USA

SAFETY

Prior to installation and use of this instrument, please read the entire manual and familiarize yourself and all operators with the safety precautions.

WARNING! This symbol identifies materials, processes or actions that can lead to personal injury or death.

CAUTION! Indicates materials, processes or actions that can lead to personal injury, damage to equipment or financial loss.

ATTENTION!

This is a calibrated precision instrument ready for installation.

Please read manual before attempting any adjustments!

INTRODUCTION

The Palmer model 524 Differential Pressure Recorder graphically records differential pressures up to 400 inches of water column at base pressures of up to 2500 PSI. An additional static pressure element up to 30,000 PSI/600 Bar and/or temperature element up to 600°F/300°C may be added.

Measurement of gas or liquid flow rates, liquid level, or other process variables may be determined from these measurements.

GENERAL INFORMATION

The Differential Pressure Unit (DPU) is a dual bellows assembly enclosed within high pressure housings. The bellows are liquid-filled and withstand over-range pressures equal to the working pressure of the housing without change to calibration. The torque tube transfers the motion of the bellows to the recording mechanism as rotary motion, and is hermetically sealed to eliminate leakage and does not require lubrication.

CAUTION! The DPU is extremely heavy. (~55lbs.) Caution should be used when unpacking, handling or mounting the unit.

Specifications and included accessories subject to change without notice.

INSTALLATION OF A DIFFERENTIAL PRESSURE RECORDER

General – Please inspect the shipment at time of unpacking for any damage that may have occurred during shipment. If the shipping container shows signs of damage, report it immediately to the carrier.

The interior of the case should be kept clean and free of dust. Dust may prevent the pens from marking clearly, and can interfere with the free movement of pivots and linkages.

Recorder Mounting – The Differential Pressure Recorder should always be mounted in a vertical, or upright position, see Figure A. The DPU is mounted to the back of the recorder case and includes an integral 2" pipestand mounting system which can be slipped over a well secured 2" vertical pipe.

Rotate the recorder to orient it to the desired position and secure it by tightening the three 3/8" screws provided.

Piping – The DPU is equipped with both a ¼" NPTF and ½" NPTF input fitting on the low and high pressure sides, see Figure A. The unused input must be plugged for proper operation. Use of a valve manifold in the connection of the DPU to the differential pressure source will facilitate in the operation and checking of the DPU.

WARNING! Be sure to use connection piping, tubing and fittings with pressure ratings exceeding the maximum pressure to be applied.

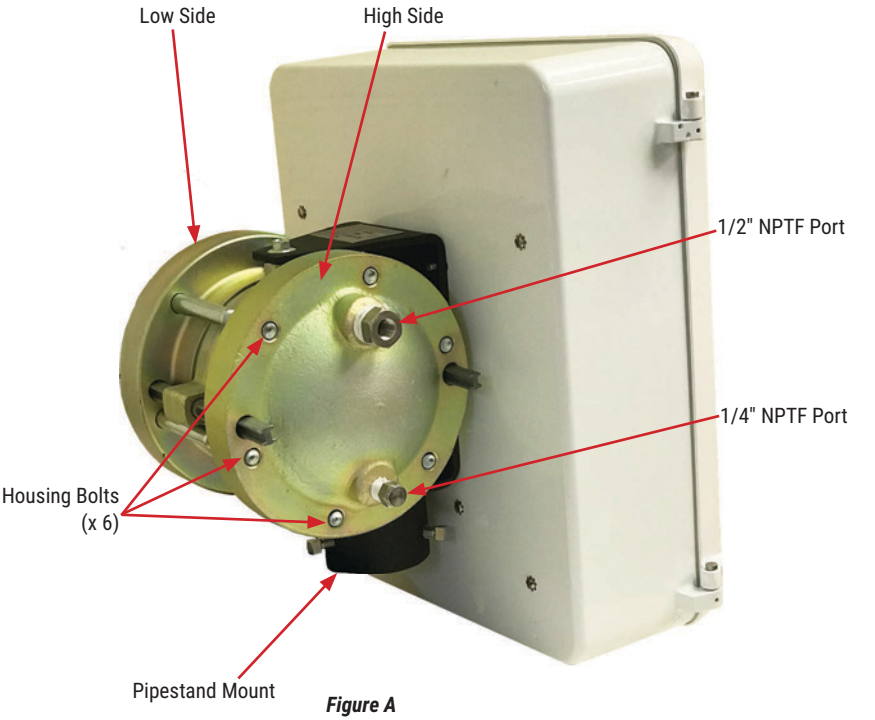


Figure A

CALIBRATION CHECK PROCEDURE

To verify the instruments factory calibration:

1. Verify the instrument is positioned vertically, level and secured.
2. Connect a known pressure source to the DPU's high pressure housing input, with the source providing zero pressure. Make sure to plug the unused input.
3. Vent the DPU's low-pressure side to atmosphere by removing one input plug from the low-pressure housing.
4. Remove the dust cover of the pulsation dampener valve and open the dampener by turning it fully counterclockwise until it stops turning. See Figures B and C on page 7.
5. Place a recording chart onto the chart plate and lock into position with the thimble.
6. Verify the pen is at 0% within the tolerance of the instrument.
7. Apply 100% of the rated differential pressure. Verify that the pen moves to the 100% pressure indication on the chart.
8. Apply 50% of the rated differential pressure. Verify that the pen moves to the 50% pressure indication on the chart.
9. If the pen does not accurately indicate the pressure being applied the instrument may need to be adjusted. For detailed instructions on making micro-adjustments, see pages 15-18.

Specifications and included accessories subject to change without notice.

STARTUP

CAUTION! Do not subject the DPU to unnecessary shock or over-range pressures during operation.

CAUTION! Make sure that both block valves are closed when performing a zero check. If only one block valve is closed, sealing fluid may be lost if seal pots are used. For gas measurement, a standing wave effect may occur that will offset the zero reading, thereby introducing error.

1. Always start with the block valves closed.
2. Perform a zero check on the instrument, per the following:

For Gas Service:

a. Verify the instrument is mounted level and is properly connected to the pressure source.

b. Tighten process connections to each DPU housing.

c. Check manifold and piping for leaks:

   i. Close shutoff valves, open the equalizer or bypass valve(s), and then slowly open one shutoff valve to pressurize the instrument.

   ii. When system is pressurized, close both valves opened in Step 1.

   iii. Any leakage will be indicated by pen movement, up or down the scale. If leakage is indicated, check all manifold and piping joints. Tighten as required.

   iv. Repeat steps i through iii until no pen movement occurs.

d. The pen should indicate zero. If it does not indicate zero, check for gas or liquid entrapment in the lines or in the DPU (depending upon orientation of piping and service). If no entrapment is found, set the pen to zero using the pen zero setting adjustment, see page 15.

e. Close equalizer valve and observe the pen:

   i. If zero, no further check is needed.

   ii. If upscale, a leak may exist on the low-pressure side. Check and tighten connections.

   iii. If downscale, a leak may exist on the low pressure side. Check and tighten connections.

   iv. If still slightly off, make a fine adjustment using the pen zero setting adjustment, see page 15.

For Liquid Service:

a. Fill the service lines with process fluid. Vent and bleed each side of the DPU before tightening the vent plugs.

b. Perform steps 2.a through 2.e in the Gas Service procedure above.

c. Open the shutoff valve. Leave the equalizer valve closed. The flow recorder is now operational.

3. Adjust the dampener valve as required.

OPERATION

WARNING! Be sure to use connection piping, tubing and fittings with pressure ratings exceeding the maximum pressure to be applied. Make sure all connections are tight. Failure to do so may result in injury or death.

To place the instrument into operation:
1. Install battery in chart drive, see page 9, or wind clock and set to the desired speed/time, see page 11.
2. Install chart onto chart plate, see pages 12-13.
3. Verify the pen cap has been removed; the pen has ink and is in contact with the chart.
4. Turn on pressure to the recorder.

In the event there is pulsation in the lines causing “noise” in the recording, the unit is equipped with a Pulse Dampener.

Perform the following:

Pulse Dampener: The built-in pulsation dampener controls the flow of fill-liquid between the high and low pressure bellows via an externally adjustable needle valve. In applications where pulsation is not a problem, the needle valve should be set to the full open position (counter-clockwise).

For adjustment, see Figures B, C:
1. Remove dust cover with a flat blade screwdriver and insert 1/8" hex key into needle valve.
2. Turn valve clockwise to closed position, approximately 3 turns.
3. Back out valve ½ turn counter-clockwise, or as required to reduce pulsations or shock pressures.

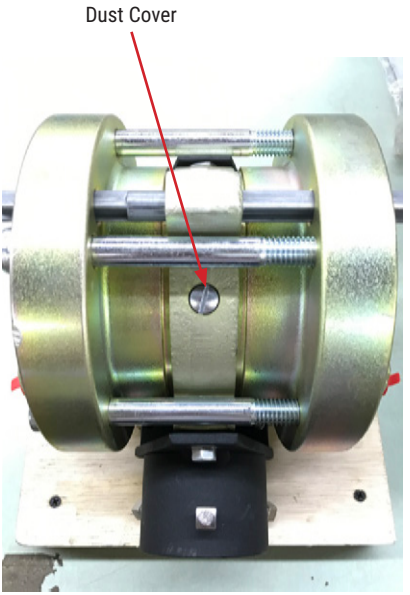


Figure B

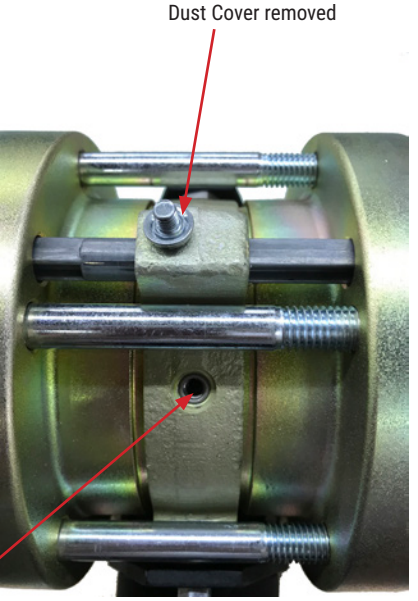


Figure C

Specifications and included accessories subject to change without notice.

HANDLING THE DPU

Warning: Before handling a DPU be sure to perform the following Pressure Check Procedure. Failure to perform this procedure can result in severe injury, death or substantial property damage due to the release of internal pressure.

PRESSURE CHECK PROCEDURE

This procedure should be performed prior to removing the DPU housing bolts if the DPU has been installed in gas applications with working pressure greater that 200 PSI.

1. Back off all housing bolts 4 turns, see page 5, Figure A, for location of housing bolts.
2. Check for internal pressure by attempting to move the housing in and out along the bolts. If the housing moves freely, no pressure is present and servicing or cleaning may continue.

Warning: If the housing does not move freely, the belows may be pressurized and is potentially hazardous if further disassembled. Tighten the bolts and return the unit to the factory or authorized service center. Tag the unit and specify, “Gas in Bellows”.

CLEANING / INSPECTION

Keep the unit clean to ensure proper performance and prevent injury or property damage.
For details on cleaning, contact Customer Service.

INSTALL OR REPLACE BATTERY IN BATTERY OPERATED DRIVES

Lift the pen arm to allow for clearance under the pens. Unscrew the thimble from the chart hub and remove the chart. Loosen the four screws holding the chart plate, Figure D, and gently push up on the plate. Lift the chart plate off the screws and pull the chart plate at the bottom to slide it out from under the pen arm.

Remove the battery cover as shown in Figure E, and replace battery and battery cover. Replace the chart plate, the chart, and the thimble. Gently lower the pens back into place.

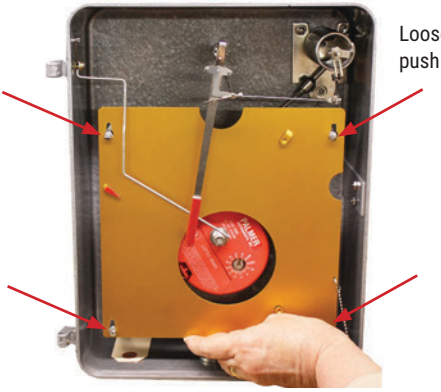


Figure D

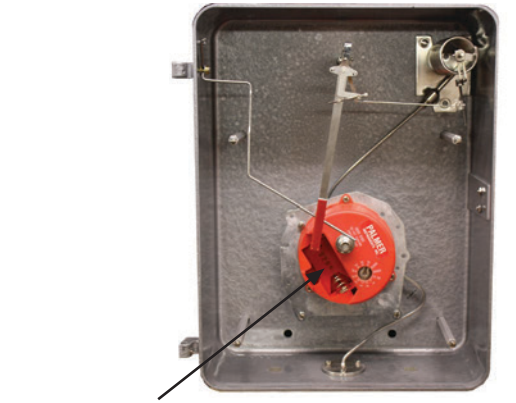


Figure E

Note: Images for illustration purposes only.
Discontinued pen arm lifter style shown above.

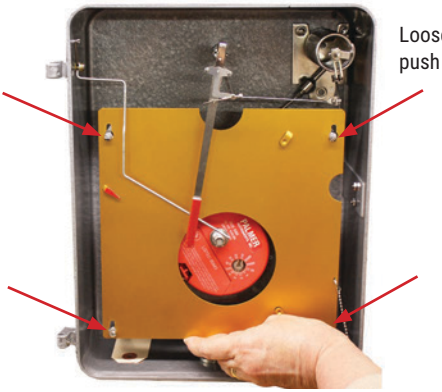
Specifications and included accessories subject to change without notice.

REPLACING A BATTERY OPERATED CHART DRIVE

Lift the pen arm to allow for clearance under the pens. Unscrew the thimble from the chart hub and remove the chart. Loosen the four screws holding the chart plate, Figure F, and gently push up on the plate. Lift the chart plate off the screws and pull the chart plate at the bottom to slide it out from under the pen arm

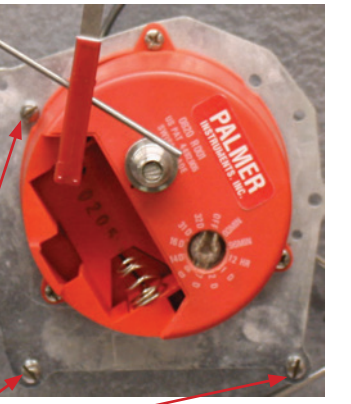
DO NOT REMOVE THE CHART DRIVE FROM THE MOUNTING PLATE!

Unscrew the 3 screws from the universal mounting plate under the chart drive, Figure G. Remove the entire universal mounting plate with the chart drive attached. Use a small adjustable wrench to loosen and remove the three posts, replace with the new posts provided. Replace the new chart drive (which comes attached to the universal mounting plate) in the same position by lining up the 3 holes in the mounting plate to the new posts behind it. Replace the 3 screws using the 6-40 screws provided, and tighten. Replace the chart plate, the chart, and the thimble. Lower the pens back in place, lining the top pen on the ARC Line on the chart. See page 14 for info on the ARC Line.



Loosen 4 screws and push up on chart plate

Figure F



Remove 3 Screws on universal mounting plate and lift plate with chart drive attached

Figure G

Note: Spring Wound Chart Drives are replaced in the same manner as the Battery Operated Chart Drives, except they have two mounting screws instead of 3. If replacing your Spring Wound Chart Drive or changing from one type of Chart Drive to another please contact Customer Service for the correct size mounting posts for your clock.

Note: Images for illustration purposes only.
Discontinued pen arm lifter style shown above.

Specifications and included accessories subject to change without notice.

CHART DRIVES

We offer two types of drives for DP Recorders: Multi-Speed Battery Operated (Standard) and Spring Wound.

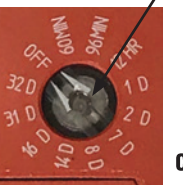
Quartz Multi-Speed Battery Operated Chart Drives (BOCD)

PC-11 Chart Drive: 11 speed motor, switch selectable: 60 min., 96 min., 12 hr., 24 hr., 48 hr., 7 day, 8 day, 14 day, 16 day, 31 day, or 32 day recording intervals.
With "OFF" option.

Note: PC-12 Chart Drive is no longer available. It is shown for reference information

PC-12 Chart Drive: 12 speed motor, switch selectable: 30 min., 60 min., 2 hr., 4 hr., 6 hr., 8 hr., 12 hr., 24 hr., 3 day, 4 day, or 7 day recording intervals.
No "OFF" option.

Rotation is set at factory to conform to your specifications. Verify that the drive is set properly. These battery operated drives feature a rugged rotation speed selector and are UL and CUL Listed: Class I, Groups C and D, Intrinsically Safe. Powered by a 1.5 volt "C" cell alkaline battery, it is recommended that the batteries be checked every three (3) months by a voltage meter.



This drive is good for operating temperatures of -40˚ to 160˚F (-40˚ to 71˚C). For longer battery life at temperatures below 10°F, use 3.6 Volt "C" size Lithium Thionyl Chloride battery, our part #DSA3060 (Tadiran, model TL-2200).

Inaccuracy and battery corrosion will develop if batteries are not replaced properly. See page 9 for directions for replacing a battery.

An "OFF" position saves battery life. When "ON", a pulsating red status light indicates that the unit is working, eliminating the need to double check the chart movement. This is particularly valuable in applications requiring slow rotational speeds. A body pilot pin is used to locate the BOCD on the mounting plate. Removing 3 screws permits exchange of chart drive. No recalibration is necessary. See page 10 for directions for changing a chart drive.

Specifications and included accessories subject to change without notice.

INSTALLING RECORDER CHARTS

To install a chart, unscrew the thimble and remove it from chart hub, see Figures H and I below.

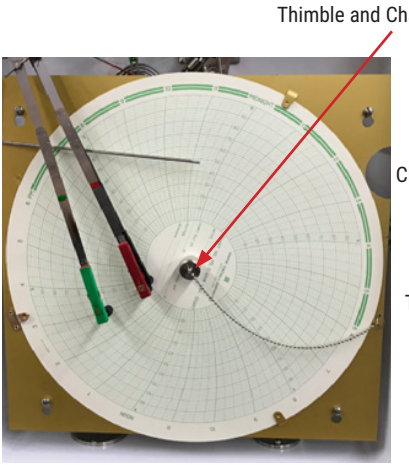


Figure H

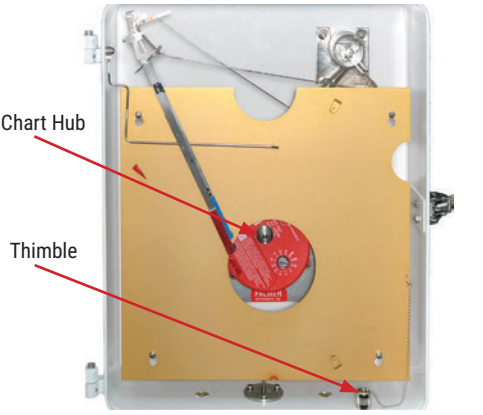


Figure I

Next, raise pen arm(s) using the pen arm lifter.

Straight Style Arm Lifter – place finger behind bend of pen arm lever as shown below in Figures J and K and gently lift.

Figure J - Straight Style Pen Arm

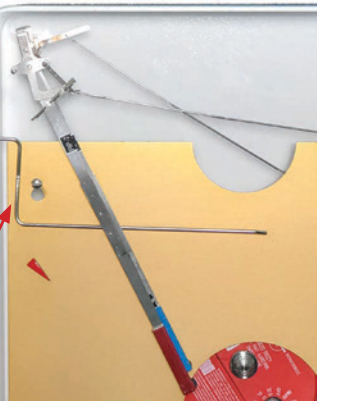


Figure K

Place chart on hub and slide under chart guide on top right side of chart plate. Rotate chart so that the correct time of day lines up with the red pointer on the left side of the chart plate. The DP pen should indicate the present time. Additional pens should be as close as possible to the present time and to one another. Replace the thimble on the chart hub and tighten as shown in Figure L.

Specifications and included accessories subject to change without notice.

INSTALLING RECORDER CHARTS, continued

Be sure to line up the top pen on the ARC Line. Additional pens should be as close as possible to the ARC line and to each other. The pen lifter may now be lowered in order to place pen pointer into contact with the chart.

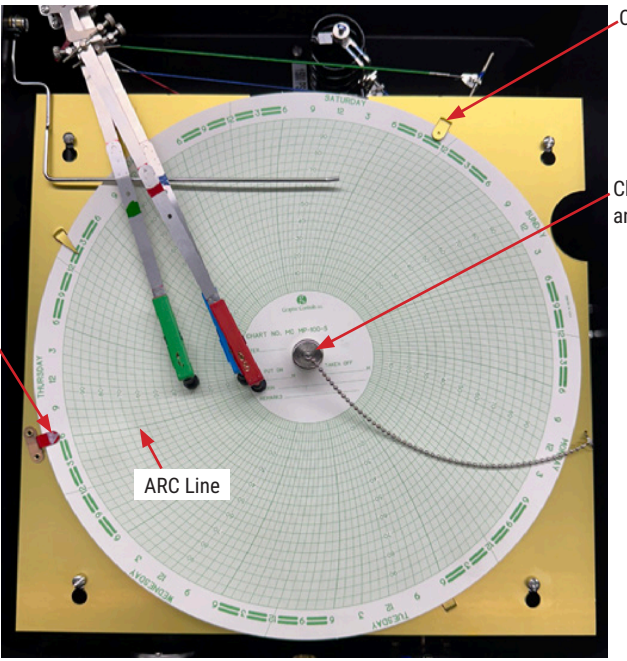


Figure L

REPLACING THE WINDOW

Aluminum Case Recorders have clips and screws that hold the window to the gasket on the Door. Replacing the window requires the purchase of the type of window you prefer, and a new gasket. Replacement window clip kits are available if needed.

To replace the window, lay the Recorder on its back and open the door. Prop up the back side of the recorder to allow the open door to be flat on the surface.

Loosen and remove the screws and the clips. Gently remove the window and the gasket by loosening the gasket with a flat tool. The new gasket is sticky on both sides. Remove the paper from one side of the new gasket, center it on the opening on the door, and gently press it to the case. Remove the paper from the other side of the gasket and center the window on the gasket and gently press. Replace the clips and the screws and tighten. **Do not over tighten the nuts or the screws. For more information go to the Instructions page in the Knowledge Center on our website.**

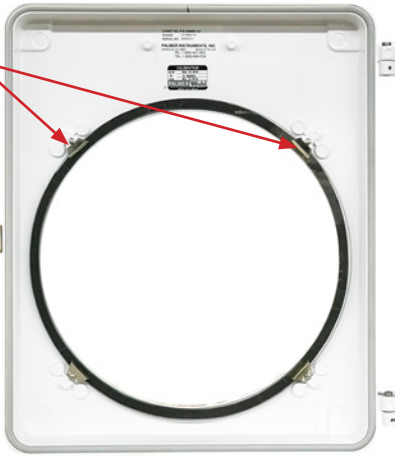


Figure M

Specifications and included accessories subject to change without notice.

REPLACING A DP RECORDER PEN

For all Differential Pressure Recorders the top (DP) pen will always track the ARC Line. For alignment purposes, these pens will be referred to as “DP pen” later in this manual. The DP Recorder uses clip-on style pens.

Pens should be checked periodically for cleanliness and sufficient ink. Replace as necessary. To change a Differential Pressure Recorder pen grasp the pen arm and gently unsnap the colored plastic tab that is clamped onto the pen arm.

Remove the pen and insert the new pen in place on the pen arm between the small pen arm clips. Snap the colored pen tab gently back onto the pen arm as in Figure N.

Remove the protective cap from the pen tip. Lay the pen arm back down and be certain it lines up with the ARC Line on the chart. The DP pen should always track the ARC Line and indicate the current time. See Figure O. For information on ordering DP Recorder Pens see page 19.

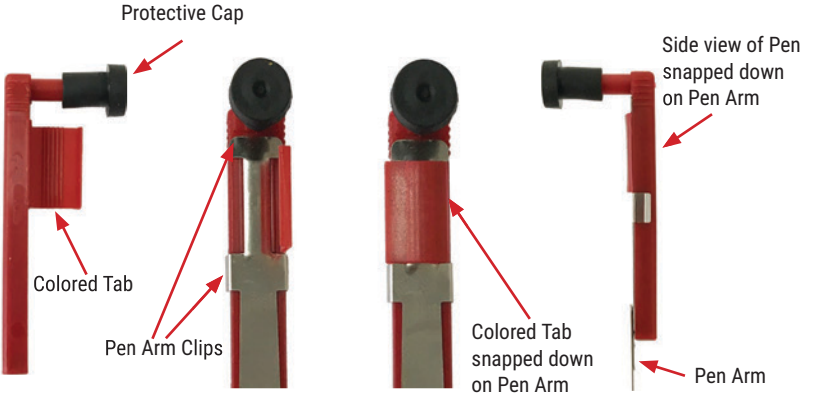


Figure N

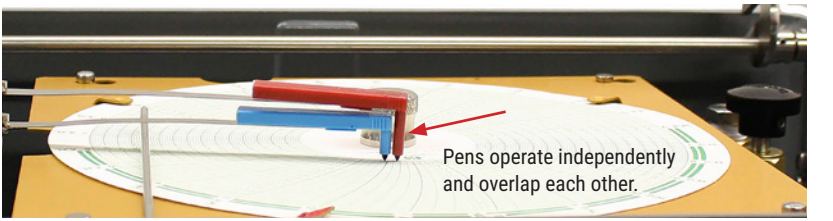


Figure O

ARC Line: The ARC Line is the distance between the pen pivot and the pen tip (9-7/16"). This is important when changing a pen in the field to be sure the Top Pen follows the arc line as shown on right. Pen can be adjusted as needed to follow the ARC Line .

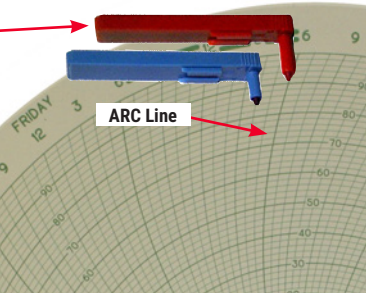


Figure O

Specifications and included accessories subject to change without notice.

STATIC PRESSURE AND DIFFERENTIAL PRESSURE SYSTEM CALIBRATION INSTRUCTIONS

The static pressure and DPU sensing devices and attached linkages and pen(s) have been correctly set prior to shipment, so recalibration should not be required. However, if calibration is needed, you may make micro-adjustments by performing the following steps:

Zero Setting Adjustment for Static Pressure and Differential Pressure System:

Check zero by disconnecting external pressure source. Pen should return to zero, indicating the recorder is properly calibrated. If not, adjust the pen arm position to the correct reading using the pen arm zero setting adjustment. See Figure P.

Pen **below** zero – Turn zero adjustment counterclockwise to move pen point up.
Pen **above** zero – Turn zero adjustment clockwise to move pen point down.

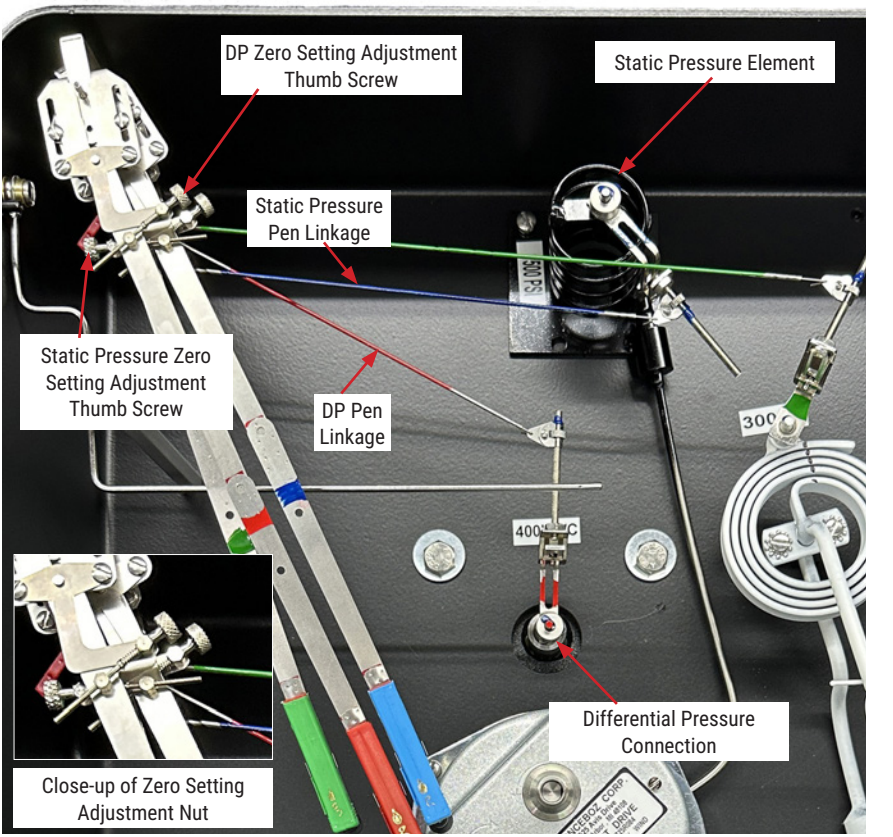


Figure P

The DP Pen is attached to the linkage which is painted Red to match the pen color. It is always the Top Pen. The Static Pressure Pen is painted Blue (or Black) to match the pen color. It is either the Second, Middle or Bottom Pen, depending on how many pens are in your system.

Specifications and included accessories subject to change without notice.

STATIC PRESSURE AND DIFFERENTIAL PRESSURE SYSTEM SPAN ADJUSTMENT

Span Adjustment for Static and Differential Pressure Systems:

Apply maximum pressure to element, using a dead weight tester or precision test gauge. If the reading on the chart agrees with the test equipment, the recorder is properly calibrated. If not, make a span adjustment by loosening the locking screw that holds the linkage adjustment tab on the span adjustment arm. See Figure Q. This will allow the adjustment tab to be moved up or down on the span adjustment arm, toward or away from the static or differential pressure element by turning the rotating span adjustment nut in the desired direction.

To **increase** span: Turn span adjustment nut to move linkage adjustment tab away from element.
To **decrease** span: Turn span adjustment nut to move linkage adjustment tab toward element.

Be sure to re-tighten the locking screw after this adjustment. Check at zero. Repeat zero and span adjustments as necessary until zero and full scales agree with test equipment. The readings should be within 1% of span of the calibration checkpoint pressures.

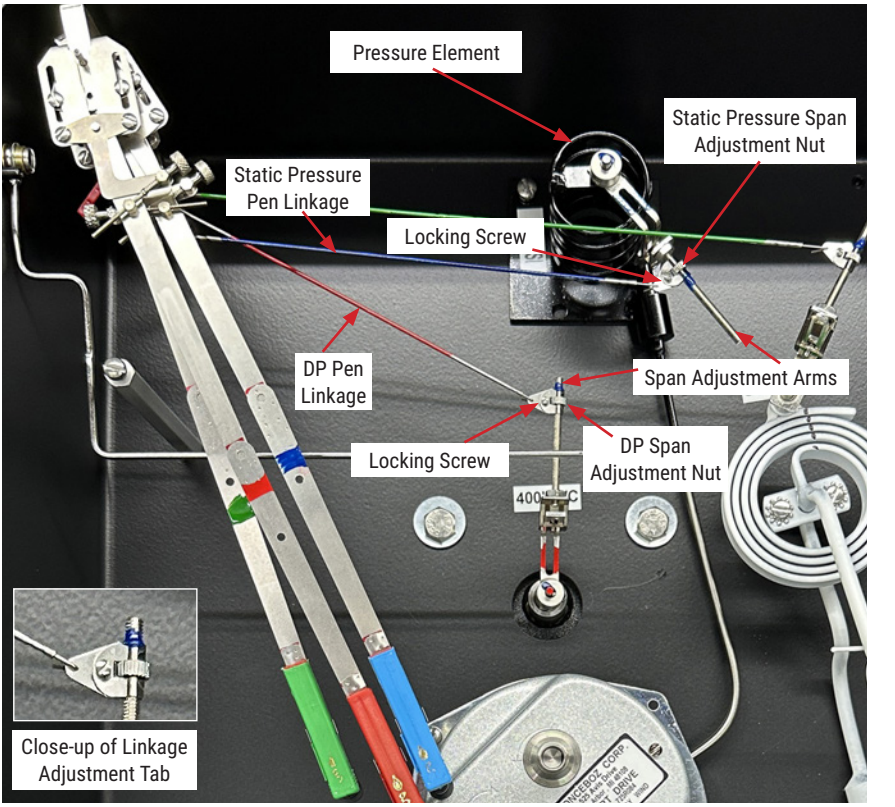


Figure Q

The DP Pen is attached to the linkage which is painted Red to match the pen color. It is always the Top Pen. The Static Pressure Pen is painted Blue (or Black) to match the pen color. It is either the Second, Middle or Bottom Pen, depending on how many pens are in your system.

Specifications and included accessories subject to change without notice.

TEMPERATURE SYSTEM CALIBRATION INSTRUCTIONS

The temperature sensing element and attached linkages and pen(s) have been correctly set prior to shipment, so recalibration should not be required. The complete temperature bulb must be exposed to the environment being monitored. If installing the sensing element in a thermowell, allow the recorder to reach operating temperature before tightening the threaded connection on swivel nut. Temperature recorders are case compensated for ambient temperatures.

To check calibration it is best to use precision thermometers, traceable to the National Institute of Standards and Technology (NIST), and two fixed temperature points such as 32°F and 212°F for example. Consult your chart for appropriate calibration points for the low and high temperature. Such calibration checks may be required by the user and can be done by making micro-adjustments following this simple procedure:

Zero Setting Adjustment for Temperature System:

Place the temperature bulb in a 32°F temperature bath in an insulated container packed tightly with shaved or crushed ice, preferably made from distilled water. Fill the container with distilled water to fill the air gaps in the ice. There should be no free floating ice. This will give a reading of 32°F or 0°C.

Wait until pen arm has completely stopped moving and compare the reading of the recorder with the temperature reading of the reference thermometer in the bath. If the reading on the chart agrees with the bath thermometer reading, the recorder is properly calibrated. If not, adjust the pen arm position to the correct reading using the pen arm zero setting adjustment. See Figure R.

Pen **below** 32°F reading – Turn zero setting adjustment clockwise to move the pen arm upscale.
Pen **above** 32°F reading – Turn zero setting adjustment counterclockwise to move pen arm down scale.

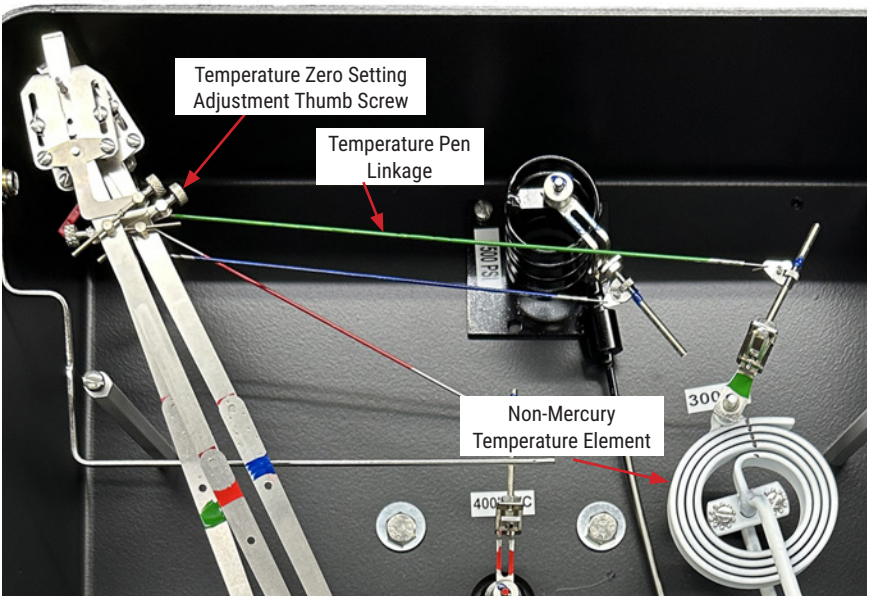


Figure R

The Temperature Pen is attached to the linkage which is painted Green to match the pen color. It is either the Second or Bottom Pen, depending on how many pens are in your system.

Specifications and included accessories subject to change without notice.

TEMPERATURE SYSTEM SPAN ADJUSTMENT

Span Adjustment for Temperature System:

Check span by placing temperature bulb in an agitated, mixed bath with a reference thermometer which indicates the lowest and the highest measurable points in the range of the recorder. (Note: Water boils at 212°F/100°C only at sea level. The boiling point drops about 2°F for each 1000 feet above sea level.)

If the reading on the chart agrees with the bath thermometer reading, the recorder is properly calibrated. If not, make a span adjustment by loosening the locking screw that holds the linkage adjustment tab on the span adjustment arm. See Figure S. This will allow the adjustment tab to be moved up or down on the span adjustment arm, toward or away from the temperature element by turning the rotating span adjustment nut in the desired direction.

To **increase** span: Turn span adjustment nut to move linkage adjustment tab away from element.

To **decrease** span: Turn span adjustment nut to move linkage adjustment tab toward element.

Be sure to re-tighten the locking screw after this adjustment. Check at 32°F. Repeat zero and span adjustments as necessary until low and high temperature readings agree with reference thermometer. The readings should be within 2% of span of the calibration checkpoint temperatures.

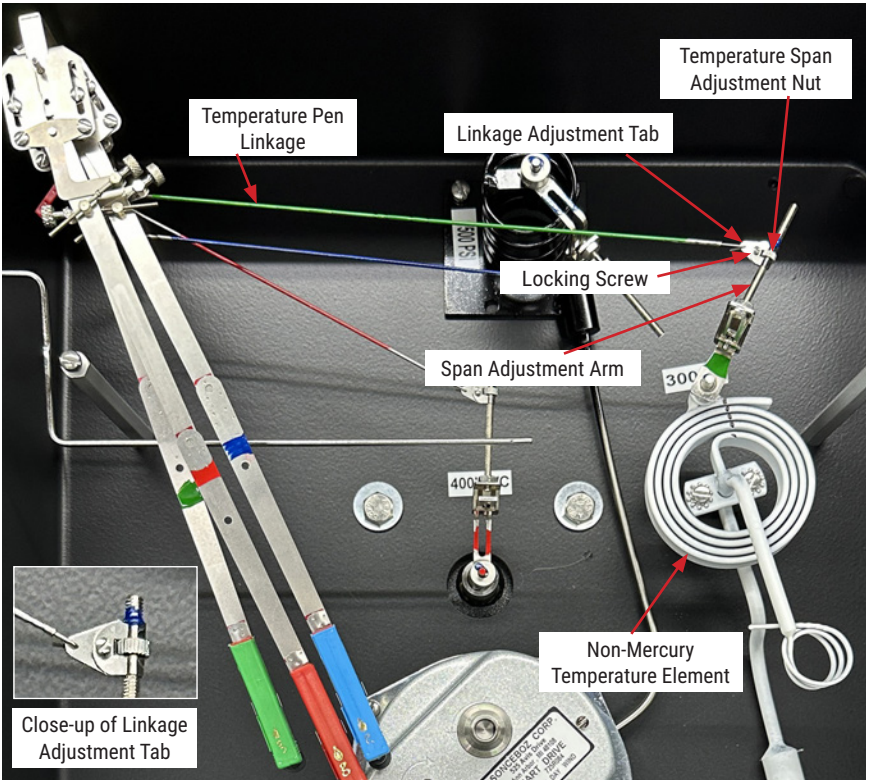


Figure S

The Temperature Pen is attached to the linkage which is painted Green to match the pen color. It is either the Second or Bottom Pen, depending on how many pens are in your system.

Specifications and included accessories subject to change without notice.

HOW TO ORDER DP RECORDER PENS

The Palmer Differential Pressure Recorder uses clip-on Scannable pens. These pens are designed specifically for the Gas Industry to produce consistently clean, scannable charts.
They offer:

- Broader line width to assure reliable scanner processing.
- Exclusive inks which virtually eliminate skips and estimations.
- All temperature inks for a solid, scannable trace in all types of climates.
- Pen arrays can be calibrated to a 15 minute time lag (.090") between Differential and Static pens on the Zero Line of a 24 hour chart.
- Scannable pens allow you to increase the number of charts that can be scanned to improve the accuracy of your billing operation.

The Pen Tips or Nibs, are different heights as shown below in Figure T. They are installed on separate Pen Arms which are also different heights and lengths. The Pen Arms move independently of each other, enabling the pens to operate while overlapping each other as shown in example in Figure O on page 14. Consult information below to order the correct pen for the desired position.

Order Part Number Series AR-3715 for DP Recorder Pens. Be sure to order the correct pen for the desired position.

AR-3715 -01-6 - Differential (Red Pen)
AR-3715 -58-6 - Pressure Scan (Black) or
AR-3715 -02-6 - Pressure Scan (Blue)
AR-3715 -03-6 - Temperature Scan (Green Pen)

For a 1 Pen DP Recorder:
Top Pen is Differential Pressure (Red)

For a 2 Pen DP / Temperature Recorder:
Top Pen is Differential Pressure (Red)
Bottom (or Second) Pen is Temperature Scan (Green)

For a 2 Pen DP / Pressure Recorder:
Top Pen is Differential Pressure (Red)
Middle (or Second) Pen is Pressure Scan (Black or Blue)

For a 3 Pen DP / Temperature / Pressure Recorder:
Top Pen is Differential Pressure (Red)
Middle Pen is Pressure Scan (Black or Blue)
Bottom Pen is Temperature Scan (Green)

Figure T

Specifications and included accessories subject to change without notice.

RETURN FOR CALIBRATION SERVICE OR REPAIR

If Service is needed for the DPU on this recorder, please return it to our factory.
Be sure to perform the Pressure Check Procedure as outlined on page 8 before shipping your unit.

To receive a NIST Traceable Certificate of Conformance or repair service on your product, go to palmerwahl.com and click on: Request an RMA (Return Material Authorization Number) and follow the instructions. You will receive your RMA number via email once your item is received at our facility.

If you prefer, call Customer Service at: 1-800-421-2853 for assistance with the RMA process. Material being returned to us should be packed well, preferably in the original shipping container.

Our quality management system is certified to conform to ISO 9001:2015. We maintain a calibration system in conformance with ANSI/NCSL Z-540 and MIL-STD-45662A.

All calibrations are performed against standard instruments, traceable to NIST. Records are stored for a minimum of three years. Standards used have a test ratio of four times greater than the unit being calibrated. We can perform certified, traceable calibrations in support of companies that require meeting FAA, FDA and USDA quality standards.

IP55 COMPLIANT

CALIBRATION TRACEABLE TO NIST

ONE YEAR 1 WARRANTY
DP Unit

THREE YEAR 3 WARRANTY
Chart Recorder

MERCURY FREE OPTIONS

MNC Manufactured in North Carolina

ISO 9001:2015 CERTIFIED QUALITY MANAGEMENT SYSTEM

MADE IN THE USA

Palmer Wahl
BEYOND THE SCALE

234 Old Weaverville Road
Asheville, NC 28804
Email: info@palmerwahl.com

Toll Free: 800-421-2853
Phone: 828-658-3131
Fax: 828-658-0728

Digital version of User Manual may differ from printed version.

Go to www.palmerwahl.com/service-support/user-manuals/ for most current information.

Specifications and included accessories subject to change without notice.