SPC4™ MODEL 406A LOAD MONITORING SYSTEM

– Firmware Version 1.0 –

Revision 1.0

User Manual for Valley Forge 406A Unit

VALLEY FORGE & BOLT MANUFACTURING COMPANY

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INTRODUCTION TO VALLEY FORGE & BOLT LOAD INDICATING FASTENERS

Founded in 1974, by Ronald Clarke, Valley Forge & Bolt Mfg. Co. continues to maintain core values as a domestic manufacturer of the highest quality, state-of-the-art fasteners, and services in a timely and efficient manner. We began our legacy in controlled bolting supplying the mining industry with an improved design of forged liner bolts. Our capabilities expanded to forging and machining specialty fasteners and the innovation of our load indicating fasteners. Markets throughout the world, including, oil and gas, refining, chemical, power, heavy equipment, steel, and transportation have appreciated our efforts in continuous improvement.

Critical joints in any application require controlled bolting throughout their service life to maintain performance, enhance safety, simplify maintenance and inspections, and improve uptime. However, the term is more often applied to installation than to the service life of the bolted joint. Valley Forge & Bolt's family of load indicating fasteners makes it possible to monitor bolted joints after installation and to always know fastener tension, regardless of the service interval.

We are constantly developing new technology to optimize the integrity of the bolted joint. Our load indicating fasteners, Maxbolt™ and SPC4™, meet ASTM F-2482 standards to measure direct elongation or tension with an accuracy of +/-5% of minimum yield.

Maxbolt™ and SPC4™ fasteners directly measure fastener tension by built-in gages with the Maxbolt™ or by local or remote meters with the SPC4™ systems. Any tightening tool – hydraulic electric or a hand wrench may be used to install the fasteners to achieve even and optimal fastener load. These load indicating fasteners allow users to measure fastener load during installation, maintenance intervals or inspections and monitor load while fasteners are in service. Using the family of SPC4™ Meters, fastener load data is directly visible locally with analog and digital hand-held meters or transmitted through wired or wirelessly meters to a local or remote monitoring system. Tightening tool "shut-off" control is also available.

SPC4™ METERS

Each unit is shipped in a durable polymer carrying case, as shown, with a calibration gage.

SPC4™ 500A VF# SPC4-ASM-500A

SMALL, POCKET-SIZED MECHANICAL METER. This intrinsically safe unit consists of the handheld meter, calibration gage, calibration tool and meter lanyard. Easily snap this unit onto any SPC4™ fastener to quickly view the load that the fastener is experiencing. Meter dial indicates SPC4™ fastener load as a percentage of yield with the smallest visual increment ticks being 5% and largest labeled increments being 0%, 50%, and 100%. Meter calibration can be easily verified using the provided calibration gage. If need be, the reader can be easily adjusted with the provided calibration tool for offset drift that may occur over extended periods of use.

SPC4™ 406A VF# SPC4-ASM-406A

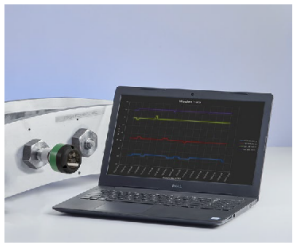
ELECTRONIC LOAD INDICATING METER. This unit consists of a handheld meter, (2) AA batteries, calibration gage and cleaning brush. This unit verifies the target load using a wired snap on probe to measure the load and digitally displays it on an LCD screen. The data is displayed as a percentage of minimum yield in 1% increments. The added Bluetooth 2.0 capability allows for remote clamp load monitoring to a smart device such as a cell phone or tablet This unit uses a power supply of (2) AA batteries. *(cell phone or tablet not included)*

SPC4™ 424A VF# SPC4-ASM-424A

ELECTRONIC LOAD INDICATING METER WITH INSTALLATION TOOL CONTROL. This unit consists of a handheld meter, power switching unit, extension cable, calibration gage and cleaning brush. This unit is specifically designed for large fastener installations and to control the torque wrench. The power switching control box is set to the desired load value in percent of the fastener's yield, the wired probe clips onto the fastener, and the power is cut to the torque wrench when the desired load is reached. Available in 110V or 220V.

SPC4™ 600A VF# SPC4-ASM-600A

ELECTRONIC LOAD INDICATING METER, DATA RECORDING SYSTEM. This unit consists of a handheld meter with AA batteries, calibration gage, cleaning brush, software CD, and a PC connection cable. This unit verifies the target load using a wired snap on probe to measure the load and digitally displays as a percentage of yield in increments of 1%. The digital display shows load as a percentage of yield in increments of 1%. The unit's digital display can be set to report the current flange or location, number of bolts, bolt location, date, time, and SPC4™ fastener load percentage. All data is recorded and may be downloaded to a PC using the software CD. This unit uses a power supply of six (6) AA batteries.



SPC4™ 702-02 VF# SPC4-ASM-702-02

WIRELESS LOAD INDICATING SYSTEM AND LOAD DATA LOGGING SYSTEM. The SPC4™ 702 series is a WiFi system that consists of SPC4™ 702-02 and SPC4™ 702-DL units to facilitate fastener load monitoring and data logging on both static and dynamic applications. The SPC4™ 702-02 unit is connected onto a SPC4™ fastener and remains in place to wirelessly transmit fastener load data, as a percentage of minimum yield, to the SPC4™ 702-DL unit that has a built-in network. The data is then recorded with the software provided. The SPC4™ 702 series operates at the radio frequency of 2.4 GHz. This system can also be configured with customer SCADA systems.

(laptop not included)

WARNING

FASTENER INSTALLATION CAN BE VERY DANGEROUS OR EVEN DEADLY! ALWAYS WEAR PROTECTIVE EQUIPMENT AND FOLLOW INSTRUCTIONS CAREFULLY WHILE OPERATING YOUR FASTENER TIGHTENING EQUIPMENT.

FOR SAFETY REASONS, NEVER PLACE ANY PART OF YOUR BODY, ESPECIALLY YOUR HEAD, DIRECTLY IN-LINE WITH THE FASTENER AND TIGHTENING EQUIPMENT.

ELECTRICITY MAY CAUSE SEVERE INJURY OR EVEN DEATH, SOMETIMES WITH RELATIVELY LOW VOLTAGES OR CURRENTS. THEREFORE, IT IS VITALLY IMPORTANT THAT ANY ELECTRONIC INSTRUMENTS, SUCH AS THIS SYSTEM, BE FULLY UNDERSTOOD BEFORE USE.

PLEASE DO NOT USE THIS SYSTEM, OR ANY OTHER PIECE OF ELECTRICAL OR ELECTRONIC TEST EQUIPMENT WITHOUT FIRST THOROUGHLY FAMILIARIZING YOURSELF WITH ITS CORRECT MODE OF OPERATION AND PROPER USE.

This device contains FCC ID: 2ADMF-HC06 RF module that complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

Table of Contents

1.0.0 Introduction

The SPC4™ Model 406A Load Monitoring System (SPC4™ System) is designed to measure SPC4™ fastener tension in real-time and display the load data as a percentage of minimum yield on the 406A's LCD or employ the Bluetooth 2.0 capability for remote clamp load monitoring from a smart device.. There are several uses for the 406A Load Monitoring System:

1. During fastener installation, the SPC4™ 406A will confirm that the fastener has reached desired proper clamp load.
2. During a flange installation, the SPC4™ 406A can be used to check how SPC4™ fasteners react as load is being distributed among the installed fasteners.
3. During maintenance inspections, the SPC4™ 406A can be used to verify load on each SPC4™ fastener to determine if it needs to be retightened.

The SPC4™ System contains precision electronic devices. Care must be taken in handling all its components. Abusive handling of these components or devices can render them inoperable and/or compromise the accuracy of the measured load readings.

All SPC4™ load indicating fasteners have been shipped with protective caps installed over the datum discs to protect and maintain surface cleanliness. These protective caps must remain on the datum disc, only to be removed during use of the SPC4™ 406A unit.

Valley Forge & Bolt Manufacturing Company assumes no responsibility for inaccurate loading or failure of SPC4™ load indicating fasteners as a result of damage to the measuring instrument caused by improper handling or improper maintenance of datum disc surfaces. With proper care and use, this system will provide years of reliable operation.

This manual includes critical information on the components, operation, and maintenance of the SPC4™ System. It is **imperative** to read this manual carefully and completely familiarize yourself with the operation of this system before use.

1.1.0 Inspection

When unpacking the SPC4™ System, carefully check each item for damage that may have occurred during shipment. If anything is damaged or missing contact:

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1.2.0 Included Items

1	SPC4™ Model 406A Load Monitoring System (406A unit)	**406A unit**
1	User's Manual (this manual)	**UM**
1	Calibration Gage (0% & 100%)	**CG**
1	Brass Bristle Brush	**BBB**
1	Carrying Case	**CC**
3	AA Batteries	**AA**
1	Helper Tool	**HT**

1.3.0 Descriptions of the SPC4™ Model 406A Load Monitoring System

1.3.1 406A Unit – Top View Descriptions

See Figure 1 - 406A Unit - Top View

1 ***"LINK" LED***

A red light emitting diode (LED) that represents the Bluetooth connection status of the 406A unit. The LED is off when the Bluetooth function is disabled. The LED blinks red when Bluetooth is enabled but not connected to another device. The LED will be continuously red when there is an active Bluetooth connection to another device.

2 **LIQUID CRYSTAL DISPLAY (LCD)**

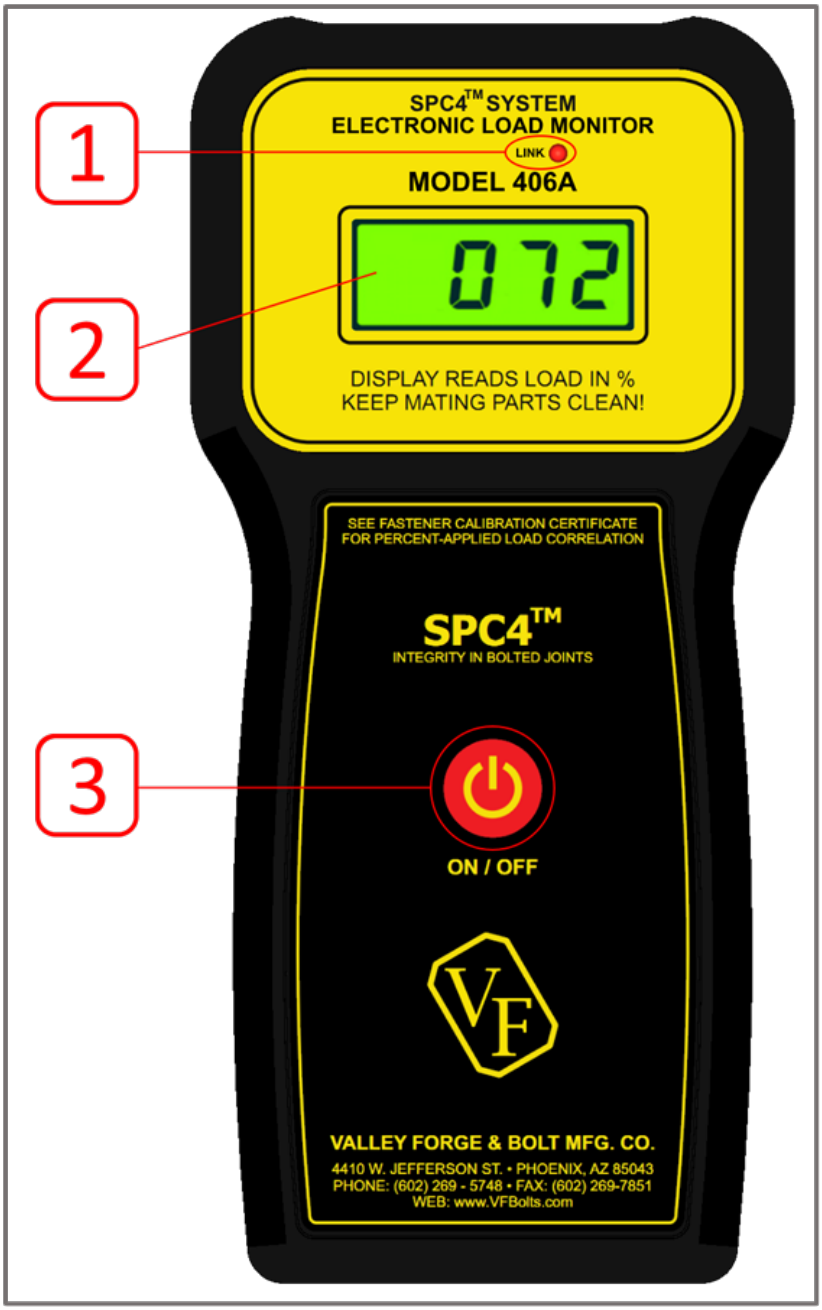
The LCD contains useful information regarding the status of the meter and displays the measured SPC4™ fastener load as a percentage of minimum yield. The LCD will show the words "BAT" in the bottom left corner of the LCD when the batteries of the 406A should be changed. A '~' like symbol will appear in the upper left corner of the LCD when the Bluetooth is enabled.

3 ***"ON/OFF" BUTTON***

A momentary press (a press followed by a release) will turn the 406A unit on or off (will toggle the power state of the 406A unit). Use the pad / underside of your finger (a soft surface) to press the "ON/OFF" button and **DO NOT** use a sharp object such as the tip of your fingernail or a tool.

1.3.2 406A Unit – Top View Image

Figure 1 - 406A Unit - Top View



1 - "*LINK*" **LED**

2 - **LIQUID CRYSTAL DISPLAY (LCD)**

3 - "*ON/OFF*" **BUTTON**

1.3.3 406A Unit – Rear View Descriptions

See Figure 2 - 406A - Rear View

4 BATTERY COMPARTMENT

The battery compartment of the 406A contains three AA batteries as well as the means to calibrate the unit and to enable/disable the Bluetooth.

5 ENCLOSURE SCREWS (x6)

These screws fasten the enclosure top to the enclosure bottom of the 406A unit. These screws should never be removed as there is zero user serviceable parts inside the enclosure.

6 *"OFFSET"* ADJUSTMENT

A dial used in calibrating the 406A unit. This dial is used to adjust the calibration offset value and should be used in conjunction with the 0% end of the calibration gage supplied with this unit.

7 *"GAIN"* ADJUSTMENT

A dial used in calibrating the 406A unit. This dial is used to adjust the calibration gain value and should be used in conjunction with the 100% end of the calibration gage supplied with this unit.

8 BLUETOOTH "ON/OFF" SWITCH

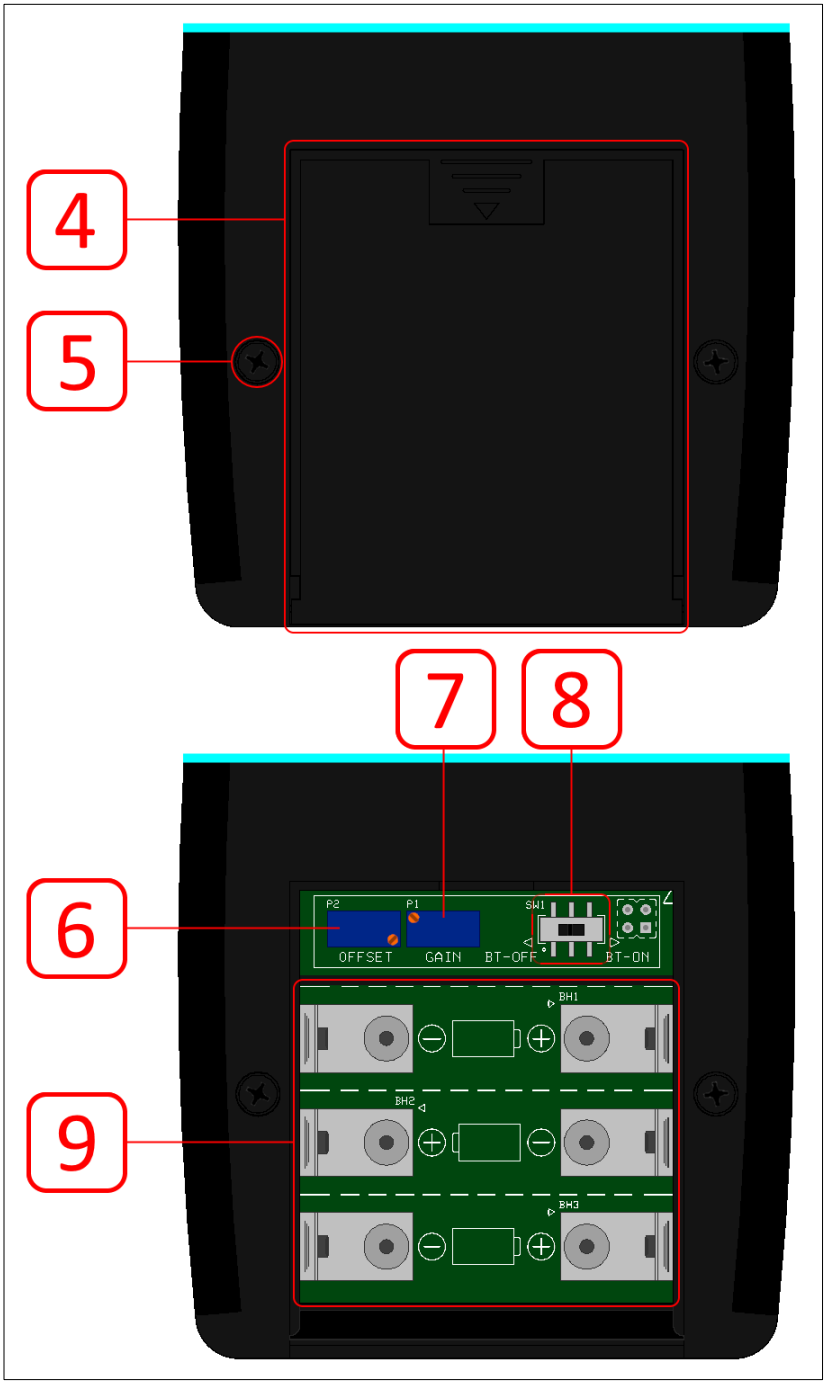
The Bluetooth "ON/OFF" switch enables or disables Bluetooth on the 406A unit. The Bluetooth is enabled when the switch is in the "BT-ON" position. The Bluetooth is disabled when the switch is in the "BT-OFF" position. To save battery life, disable the Bluetooth when not in use.

9 AA BATTERY CONTACTS

These battery contacts hold the three AA batteries (R6 size) that power the 406A unit. It should be noted that the battery contacts are designed to be tight to limit contact fatigue over the unit's years of service. Use the supplied Helper Tool to assist when installing and removing batteries.

1.3.4 406A Unit – Rear View Image

Figure 2 - 406A - Rear View



4 – **BATTERY COMPARTMENT**

5 – **ENCLOSURE SCREWS**

6 – **"*OFFSET*" ADJUSTMENT**

7 – **"*GAIN*" ADJUSTMENT**

8 – **BLUETOOTH "*ON/OFF*" SWITCH**

9 – **AA BATTERY CONTACTS**

1.3.5 Calibration Gage (CG)

Figure 3 - Calibration Gage (CG)

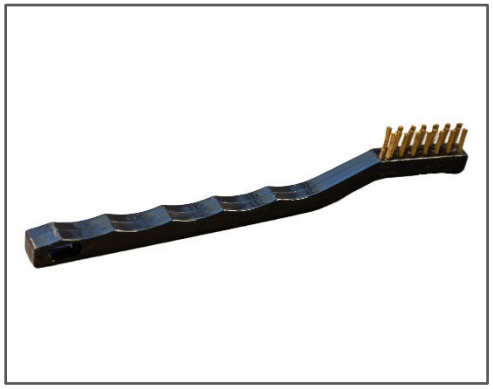
The calibration gage (see *Figure 3 - Calibration Gage (CG)*) is used to check the calibration of the 406A unit.

When the probe is attached to the end marked *"0%"*, the 406A unit will display a load value of "000" ±5% (between -5% "-005" and +5% "005").

When the probe is attached to the end marked *"100%"*, the 406A unit will display a load value of "100" ±5% (between 95% "095" and 105% "105").

1.3.6 Brass Bristle Brush (BBB)

Figure 4 - Brass Bristle Brush (BBB)



The brass bristle brush (see *Figure 4 - Brass Bristle Brush (BBB)*) is supplied with each unit in the event that a SPC4™ fastener datum-disk experiences corrosion, potentially seen in fastener's installed after several years. Use the BBB only on the SPC4™ fastener and **DO NOT** attempt to use it on any surface of the 406A unit.

1.3.7 Carrying Case (CC)

Figure 5 - Carrying Case (CC)

The carrying case (*see Figure 5 - Carrying Case (CC)*) protects the 406A unit and kit contents during transportation on and to the job, or when it is being stored for later use.

1.3.8 AA Batteries (AA)

Figure 6 – Battery (BAT)

The AA batteries (see *Figure 6 – Battery (BAT)*) are located inside of the 406A unit. They are D6 sized Alkaline batteries with a nominal voltage of 1.5V each.

See **2.2.0 406A Battery Replacement** on how to properly install or remove a 406A battery.

Battery life can be extended by using good practices such as turning off the Bluetooth when not in use.

We recommend using non-rechargeable AA Lithium batteries to further extend the battery life of the 406A.

1.3.9 Helper Tool (HT)

Figure 7 - Helper Tool (HT)

The supplied battery helper tool (see *Figure 7 - Helper Tool (HT)*) is to be used while installing or removing the 406A batteries.

This tool is very effective at assisting in the installation process of the batteries as it guides the and prevents damage to the batteries.

The HT should also be used in removing the batteries as a leverage tool to free the batteries from the contacts.

2.0.0 SPC4™ 406A Operation

Outlined in this section are instructions on how to properly measure the load of an SPC4™ fastener using the 406A unit along with the operation of the 406A unit including the optional Bluetooth connection, removing and replacing the batteries, and checking the calibration.

Calibration certificates are supplied for each 406A unit and SPC4™ fastener.

2.1.0 Measuring SPC4™ Fastener Load

[1] Determine if Bluetooth will be used or not before taking measurements. See **2.3.0 Using the 406A Bluetooth** if a Bluetooth connection will be used.

[2] Turn on the 406A unit by momentarily pressing the *"ON/OFF"* button.

The 406A will begin the boot up sequence by first testing all LCD segments, as seen in *Figure 8 - LCD Boot Up Sequence.*

Figure 8 - LCD Boot Up Sequence

After a second, the LCD will display the current firmware version of the 406A as shown in *Figure 9 - LCD Firmware Version*.

Figure 9 - LCD Firmware Version

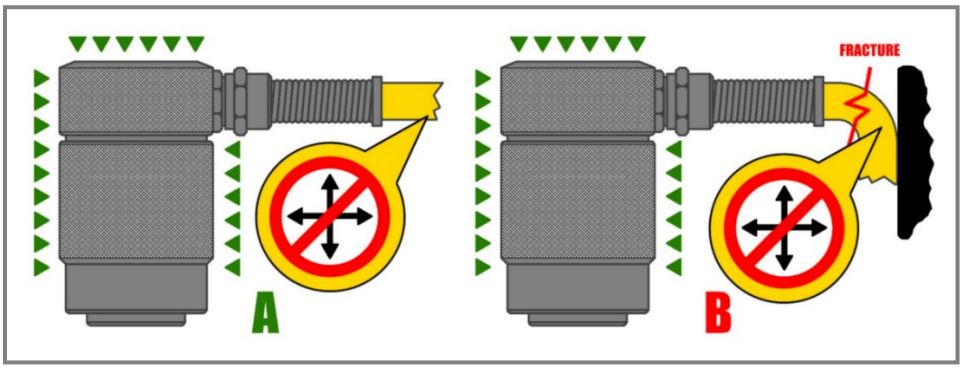
[3] After the boot up is complete, the 406A LCD will start displaying the measurement it is currently reading. When the 406A is not connected to datum disc the LCD will display "^---" as shown in *Figure 10 - LCD ^--- Measurement*.

Figure 10 - LCD ^--- Measurement

[4] At this point, it is recommended to check the calibration of the 406A unit before starting a new job (review and complete **2.4.0 System Calibration**).

NOTE: When handling the probe, grip it with your hand in the area of the green arrows as shown in *Figure 11 - Probe Handling - A.* It is essential to provide a path for the cable and the cable grip to move freely without crimping or bending. **DO NOT** pull or push the cable of the probe or the cable grip. **DO NOT** use the cable as a handle to carry the 406A unit and/or the probe. Repeated deformation of the cable as shown in *Figure 11 - Probe Handling-B* will cause fracture of the wires in the region marked on the drawing (the red sign marked "FRACTURE") and render the probe inoperable.

Figure 11 - Probe Handling



[5] Remove the protective cap from the fastener and verify that the datum disc and 406A probe sensor are clean of any liquid or debris. See **4.0.0 User Maintenance – Recommended Cleaning Procedures**.

[6] Remove the protective cap from the datum disc.

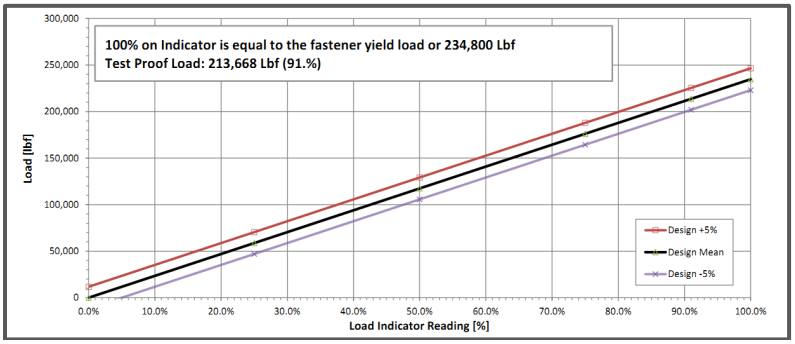
[7] Hold the 406A enclosure in one hand and use the other hand to grasp the attached probe assembly.

[8] Use uniform pressure to actuate the probe onto the fastener datum disc. The probe assembly will snap onto the fastener, at this point the probe is self-retaining.

[9] The LCD will now show the measured load (*See Figure 12 - LCD Load Reading Example*) of the fastener within ±5% as a percentage of the fastener's minimum yield load. Use the load certification sheet supplied with the SPC4™ fasteners to correlate this percentage to tension (*see Figure 13 - SPC4™ Calibration Cert.*). **NOTE:** Seen below is a 406A measured load of 72% which correlates to a load approximately 170,000 lbf.

Figure 12 - LCD Load Reading Example

Figure 13 - SPC4™ Calibration Cert.



[10] Remove the probe from the datum disc by pulling the probe sleeve away from the fastener.

CAUTION: DO NOT USE THE YELLOW CABLE TO PULL THE PROBE OFF THE DATUM DISC.

[11] Remember to reattach the protective cap over the datum disc! This ensures that the datum disc is protected from the environment and remains clean for future use.

2.2.0 406A Battery Replacement

[1] Relocate the 406A kit to a clean work bench. Remove the 406A from the kit and place it face down on a flat surface so that the back is exposed up.

[2] Remove the battery compartment cover to reveal the three AA batteries.

[3] Using one of the helper tools (HT), carefully remove each AA battery by leveraging the battery's positive end up. The clips hold onto the batteries tightly so some feel will be required.

[4] Dispose of the old batteries.

[5] Install fresh batteries into the 406A unit, following the positive and negative lead indications. The battery clips provide a tight fit so that the batteries are held in place during the use of the 406A unit. The use of the HT may be required to ease the batteries into position.

NOTE: Never mix batches of batteries, especially old and new batteries!

[6] Once the new batteries are installed, confirm that the 406A unit turns on.

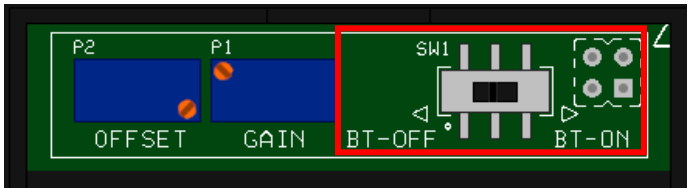
[7] Reattach the battery compartment cover.

2.3.0 Using the 406A Bluetooth

[1] Turn the 406A unit over so that the back is accessible. Remove the battery compartment cover.

[2] Locate the Bluetooth *"ON/OFF"* switch within the battery compartment as seen in *Figure 14 - ON/OFF Switch Location*.

Figure 14 - ON/OFF Switch Location



[3] Actuate the switch to the "BT-*ON*" position. The *"LINK"* LED will begin to blink and a new symbol '~' will appear on the LCD as seen in *Figure 15 - LCD Bluetooth ON*. The Bluetooth switch can be easily actuated using a HT.

Figure 15 - LCD Bluetooth ON

[4] Reattach the battery compartment cover.

[6] On a mobile device with Bluetooth capability such as a smart phone or tablet, enable Bluetooth.

[7] Begin searching for Bluetooth devices and find the device named "SPC4_M406A"

[8] Select the device and press pair. Enter the pairing code "4410". The mobile device and 406A unit are now paired. **NOTE:** There is **NO** change in the *"LINK"* LED at this time.

[9] On a mobile device open up a Bluetooth serial monitor of your choosing.

NOTE: A "Bluetooth serial monitor" app can be downloaded onto a smart device via the Appstore. Valley Forge does not endorse any particular app.

[10] With the Bluetooth serial monitor app open, establish a connection to the SPC4_M406A. Tweak the Bluetooth data settings to match the Bluetooth settings found in **3.1.0 Electrical Specifications**.

[11] Data can now be monitored remotely from a smart device.

2.4.0 System Calibration

[1] **Locate the Calibration Gage**. This gage is calibrated at VFB that enables a field check to verify that the 406A unit is properly calibrated by reading 0% "000" and 100% "100" (within ±5%).

[2] **Verify the 406A unit is reading 0% "000" (within ±5%).**

1. Turn on the 406A unit.
2. Attach the 406A unit to the supplied calibration gage at the end marked "0%".
3. Verify that LCD is reading "000" (within ±5%).

Figure 16 - LCD 0%

4. If the LCD is not reading "000" then an adjustment must be made by accessing the battery compartment.
5. First, remove the protective cover.
6. Adjust the "OFFSET" dial until the LCD reads "000".
7. Attach and remove the calibration gage several times to ensure the integrity of the "000" reading which verifies that the 0% measurement has been calibrated correctly.

[3] Verify the 406A unit is reading 100% "100" (within ±5%).

1. Attach the 406A unit to the supplied calibration gage at the end marked "100%".
2. Verify that LCD is reading "100" (within ±5%).

Figure 17: LCD 100%

3. If the LCD is not reading "100" then an adjustment must be made by accessing the battery compartment.
4. First, remove the protective cover.
5. Adjust the "GAIN" dial until the LCD reads "100".
6. Attach and remove the calibration gage several times to ensure the integrity of the "100" reading which verifies that the 100% measurement has been calibrated correctly.

[4] It may be necessary to perform the calibration check multiple times.

NOTE: Only adjust the *"OFFSET"* dial for 0% and the *"GAIN"* dial for 100%.

2.5.0 Low Battery Indication

If the battery supply voltage drops below approximately 3.1V while the 406A unit is on, the LCD will display low battery indication in the LCD as shown in *Figure 18 - Low Battery Indication*. The operation of the unit is not affected until the battery supply voltage reaches approximately 2.5V, but it is recommended to stop operation of the system and change the batteries at 3.1V. If the supply voltage drops to less than 1.8V, the unit will not turn back on.

Figure 18 - Low Battery Indication

3.0.0 SPC4™ Model 406A Load Monitoring System Specifications

3.1.0 Electrical Specifications

Input Voltage..... 4.5 VDC Nominal – 3 x AA (D6) Sized Batteries
Maximum Permissible Range ..... 2.5 VDC to 5.0 VDC
Low Battery Indication..... Under ≈ 3.1 VDC (or ≈ 1VDC/Cell)
Power Consumption (±5%)..... 2 µA (7.2µW) – Standby (OFF)
(At 20 °C / 68 °F)..... 20 mA (72mW) – Typical (ON – NO Bluetooth (BT))
..... 75 mA (270mW) – BT ON – Not Connected
..... 50 mA (180mW) – BT ON – Connected

Wireless Frequency ..... 2.4 GHz
Wireless Protocol..... Bluetooth Version 2.0 SPP (Serial Port Profile)
Wireless Data Format ..... Serial, 9600 baud, 8N1
Pairing Code 4410

Display Type..... 3-1/2 Digit Reflective LCD
..... (12.7 mm / 0.50 in. Digit Height)
Viewing Area (W x H) ..... 45.7 mm x 17.7 mm / 1.80 x 0.70 in.
Optimum Viewing Angle..... Six o' Clock

Measuring Method..... 16-Bit A-to-D Conversion and >87 dB 50/60 Hz Rejection
Precision..... Equal to or better than ±5% (±2% typical)

3.2.0 Environmental Specifications

Operating Conditions:
Temperature..... -10 to 60 °C / 14 to 140 °F
Humidity..... 80% Maximum (Non-condensing)

Storage Conditions:
Temperature..... -25 to 70 °C / -13 to 158 °F
Humidity..... 95% Maximum

Ingress Protections Class IP-54

Note: Any condensing humidity will have negative effects on the readings of the unit.

3.3.0 Physical Characteristics

Dimensions (L x W x H) ..... 260 x 100 x 33 mm / 10.24 x 3.94 x 1.30 in.
Weight ..... 762 g / 1.68 lbs.

4.0.0 User Maintenance – Recommended Cleaning Procedures

UNDER NO CIRCUMSTANCES SHOULD THE PROBE FACE OR THE DATUM DISC SURFACE BE ABRAIDED.

CAUTION:

1. **DO NOT** attempt to clean the probe sensor or the datum disc with abrasives or by scraping it with emery cloth or sandpaper.
2. **DO NOT** use abrasives, solvents, or aromatic hydrocarbons to clean the 406A unit as damage may occur to the plastic half of the enclosure. If cleaning is necessary, use only a mild solution of warm water and detergent.
3. Any attempts to clean the 406A unit should be made in the "OFF" power state while the enclosure lid is tightened on.
4. **DO NOT ATTEMPT TO CLEAN THE INSIDE OF THE ENCLOSURE!**

4.1.0 Cleaning the Probe Sensor

[1] Wipe the probe sensor face clean followed by a forced moisture-free air cleaning.

1. **ONLY** use a clean lint-free dry cotton cloth.
2. The forced air stream can be compressed air delivered through an air nozzle, or a can of compressed air commonly used in cleaning electronic components and computer equipment.

Figure 19 - Probe Sensor Cleanliness

Dirty or contaminated probe sensor face

Probe sensor face visually clean using a clean lint-free dry cotton cloth

[2] Visually inspect the surface has been cleaned from contaminants.

[3] Check the calibration as outlined in **2.4.0 System Calibration**.

4.2.0 Cleaning the Datum Disc on the SPC4™ Fastener

[1] Wipe the datum disc face clean (using the BBB as necessary) followed by a forced moisture-free air cleaning.

1. The forced air stream can be compressed air delivered through an air nozzle, or a can of compressed air commonly used in cleaning electronic components and computer equipment.

[2] Clean oil or grease from the datum disc surface

1. Soak the clean lint-free cloth with a solvent such as alcohol or acetone as required for thorough cleaning. The use of an aerosol can that contains automotive brake fluid has been proven successful in cleaning these contaminants. However, it must be a fast-drying formula and one that leaves no residue.

[3] Check Calibration

1. Using a calibrated meter, install meter on unloaded fastener to check 0 reading.
2. If meter is not reading 0 follow these steps, then refer to **5.0.0 Troubleshooting**.
    a) Ensure mating parts are clean – datum disc and probe
    b) Re-check the calibration as outlined in **2.4.0 System Calibration**.
    c) Ensure battery is not low; section **2.5.0 Low Battery Indication**.

IMPORTANT: To maintain the integrity of SPC4™ load indicating fasteners and minimize errors in measuring joint clamp load, it is imperative that the protective caps always remain installed to the datum discs of each fastener when the 406A unit is not installed.

4.3.0 Cleaning the Enclosure

[1] Ensure 406A unit is in the "OFF" state.

[2] Exterior cleaning **ONLY**! Wipe the outside of the enclosure surface clean with a mild solution of warm water and detergent.

CAUTION:

1. **TURN OFF** the 406A unit prior to cleaning the enclosure.
2. **ONLY CLEAN ENCLOSURE EXTERIOR**. The enclosure should remain closed when attempting to clean it.
3. **DO NOT** attempt to clean the outside of the enclosure with abrasives or by scraping it with emery cloth or sandpaper.
4. **DO NOT ATTEMPT** to clean the interior of the enclosure

5.0.0 Troubleshooting

The SPC4™ System is designed to be accurate, reliable, and easy to use. If a problem occurs during operation, follow the steps listed below to determine the source of the problem.

[1] Re-read the operating instructions. Pay attention to **"NOTES"** and **"CAUTIONS"**

[2] Check battery functionality

1. Open the battery compartment to visually inspect the battery connections.
2. Remember to close the battery compartment afterwards.

[3] Check the cleanliness of the probe sensor and SPC4™ fastener datum disc.

1. Inspect probe sensor and SPC4™ fastener datum disc for debris or dirt. Most of the erroneous load measurements are the result of a dirty probe and/or dirty datum disc.
2. Check both surfaces periodically for metal chips, liquids, dirt, and accumulated oxidation on the contact surfaces. Foreign matter accumulating between these surfaces will radically affect the load measurements.

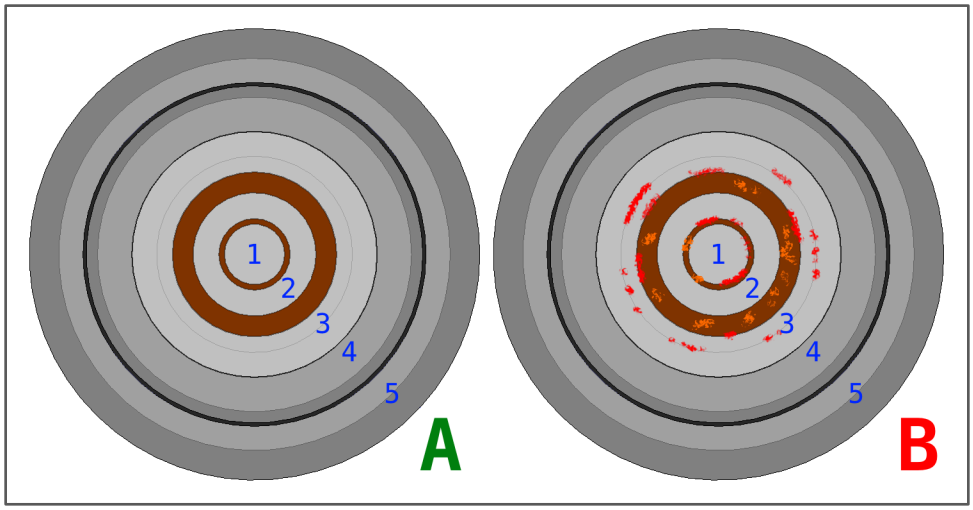
Figure 20 – Probe Sensor Cleanliness

Dirty or contaminated probe sensor face

Probe sensor face visually clean using a clean lint-free dry cotton cloth

3. A clean probe face is shown in *Figure 21 – 406A Probe & Sensor*, where (1) is the sensor pin, (2) the sensor shield, (3) the sensor inner body, (4) the probe exterior body, (5) the probe sleeve, and the brown material is an electrical insulator.

Figure 21 – 406A Probe & Sensor



4. The deposits shown on the sensor of *Figure 21 – 406A Probe & Sensor* represent dirt, small metallic chips, or other fine particles that may accumulate after repeated use. These deposits usually result in erratic and inconsistent load readings.
5. The metallic chips can become lodged into the insulator surfaces. In most of the cases, these will render the probe inoperable. In other cases, the chips may result in repeated erroneous readings with a zero offset. For example, when using the zero side of the CG a reading of 20% will be displayed instead of 0%, and 120% instead of one hundred when using the 100% side of the CG.

[4] Perform system calibration check, see **2.4.0 System Calibration**.

[5] Should the problem persist please contact us directly**.**

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