

SPC4[®] 720R Remote Tension Monitor



– Firmware Version 1.0 –

Revision 06

User Manual for Valley Forge 720R Unit

VALLEY FORGE & BOLT MANUFACTURING COMPANY



4410 W. Jefferson St. • Phoenix, AZ 85043 • USA
Phone: (602) 269 - 5748 • Fax: (602) 269 - 7851
E-mail: sales@vfbolts.com • Web: www.vfbolts.com



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

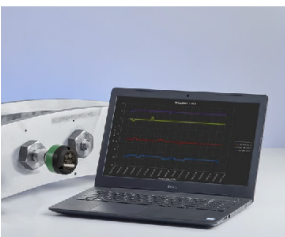
ELECTRONIC LOAD INDICATING METER WITH INSTALLATION TOOL CONTROL. This unit consists of a handheld meter, power switching unit, extension cable, calibration gage and cleaning brush. This unit is specifically designed for large fastener installations and to control the torque wrench. The power switching 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.

FCC ID: 2BN58-SPC4-720R-01T

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) L'appareil ne doit pas produire de brouillage;
- (2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IC: 34541-SPC4720R01T

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Changes or modifications not expressly approved by Valley Forge & Bolt could void the user's authority to operate the equipment.

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1.0.0 Introduction

The SPC4® 720R Remote Tension Monitor (RTM™) is designed to send fastener load data as a percentage of minimum yield, wirelessly over a RF network to a Valley Forge Gateway that will collect, manage, and graph received data. This SPC4® RTM™ System must be used with SPC4® load indicating fasteners and an on-site RTM™ Gateway dedicated to the SPC4® System.

The SPC4® System contains precision electronic devices. Care must be taken in handling the wireless units and 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 installation of the SPC4® 720R 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 can 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 ('X' amount per order) that may have occurred during shipment. If anything is damaged or missing contact:

VALLEY FORGE & BOLT MANUFACTURING COMPANY

4410 West Jefferson Street • Phoenix, AZ 85043 • USA

Phone: (602) 269 - 5748 • Fax: (602) 269 - 7851

E-mail: sales@vfbolts.com • Web: www.vfbolts.com

1.2.0 Included Items

X	SPC4® Model 720R Remote Tension Monitor (720R unit)	720R unit
1	User's Manual (this manual)	UM
1	Calibration Reference Gage (0% & 100%)	CG
X	Thread Adapter	TA
X	Set Screw x2	SS
X	Battery (*could be shipped separately or installed in the 720R unit)	BAT
X	Protective Cap	PC

1.3.0 Description of the SPC4® 720R Remote Tension Monitor

See *Figure 1 – 720R Unit - Top View* and *Figure 2 – 720R Unit - Side View*

1 720R ID

The Gateway & Node ID of the 720R can be found here. The Gateway ID determines the gateway that the 720R unit is assigned to and the Node ID determines the unique identifier for the 720R unit on that gateway. Above the ID is the wireless frequency of the 720R Unit.

2 "ON/OFF" BUTTON

A momentary press (a press followed by a release) will turn the 720R unit on or off (will toggle the power state of the 720R 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.

3 ENCLOSURE SCREWS (x3)

These screws fasten the enclosure lid to the enclosure bottom of the 720R unit, creating a watertight seal. These screws should only be removed by a qualified technician or operator. The only purpose for removing these screws is to replace the battery located in the enclosure bottom.

4 "CHECK" LED

A red LED that serves as a visual indicator when the fastener load is measuring outside the set parameters (adjustable via the gateway software) or the 720R has a low battery. Both LEDs blink consecutively for 5 seconds when the 720R unit is turned on.

5 "LINK" LED

A green LED that serves as a visual indicator when the fastener load is measuring within the set parameters (adjustable via the gateway software). Both LEDs blink simultaneously for several seconds when the 720R unit is turned on.

6 ENCLOSURE LID

The enclosure lid houses the main electronics such as the wireless radio. The top of the enclosure lid is where the 720R label can be found (see *Figure 1 – 720R Unit - Top View*).

7 ENCLOSURE BASE

The enclosure base supports the probe assembly as well as seal and protect the probe contents inside.

8 GASKET

The gasket creates a watertight seal and is located between the enclosure bottom and the probe assembly.

9 PROBE ASSEMBLY

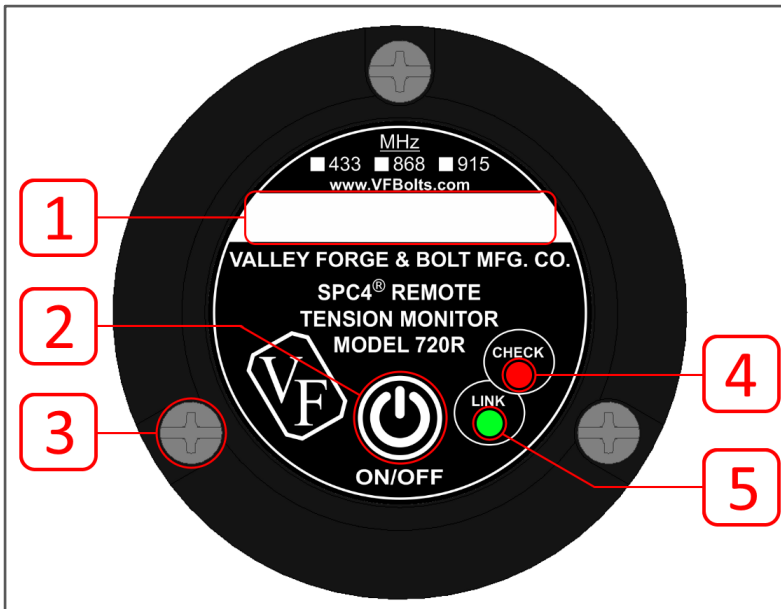
The probe assembly of the 720R unit can be attached to any SPC4® fastener which has a threaded area below the datum disk. The probe assembly has a threaded sleeve and houses the displacement transducer.

10 O-RING SEAL

The O-ring seal compresses around the datum disk when the 720R unit is installed, creating a watertight seal.

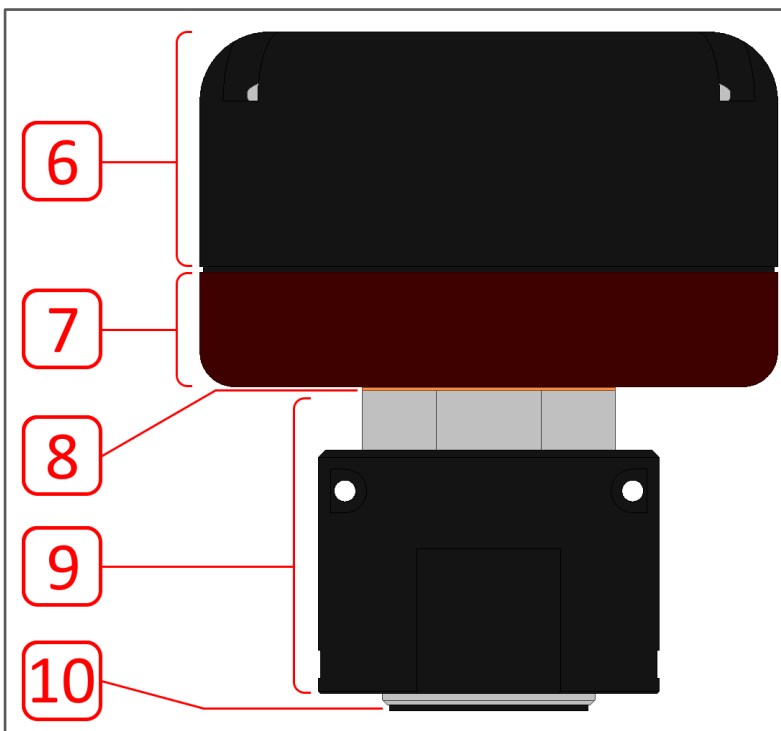
1.3.1 720R Unit

Figure 1 – 720R Unit - Top View



- 1** - 720R ID
- 2** - "ON/OFF" BUTTON
- 3** - ENCLOSURE SCREWS (x3)
- 4** - "CHECK" LED
- 5** - "LINK" LED

Figure 2 – 720R Unit - Side View



- 6** - ENCLOSURE LID
- 7** - ENCLOSURE BASE
- 8** - GASKET
- 9** - PROBE ASSEMBLY
- 10** - O-RING SEAL

1.3.2 Calibration Reference Gage (CG)

Figure 3 – Calibration Reference Gage (CG)



The supplied Calibration Reference Gage (see *Figure 3 – Calibration Reference Gage (CG)*) is used to check the calibration of the 720R unit.

When the probe is attached to the end marked "0%", the 720R unit will transmit a load value of "000" $\pm 5\%$ (between -5% "-005" and +5% "005").

When the probe is attached to the end marked "100%", the 720R unit will transmit a load value of "100" $\pm 5\%$ (between 95% "095" and 105% "105").

1.3.3 Thread Adapter (TA)

Figure 4 – Thread Adapter (TA)



The Thread Adapter (see *Figure 4 – Thread Adapter (TA)*) adapts SPC4® fastener protective cap threads to the 720R threads for installation.

One TA is supplied with each 720R unit. The TA threads can be sharp and should be handled carefully. The TA has opposing flats so that it can be tightened down with a wrench when installed.

See **2.1.0 Installation and Removal of the 720R Unit** for more details on proper TA installation.

1.3.4 Set Screw x2 (SS)

Figure 5 – Set Screw x2 (SS)



The Set Screws (see *Figure 5 – Set Screw x2 (SS)*) offer an additional layer of installation security while the 720R unit is installed on an SPC4® fastener. Two SS are supplied for each 720R unit.

The SS are Black Oxide 6-32 Thread, 1/8" Long with a soft brass tip. The SS has a 1/16" drive size.

The SS can be installed in the two opposing threaded holes found on the probe assembly black oxide sleeve.

See **2.1.1 Installation [7]** for more details on installation.

1.3.5 **Battery (BAT)**

Figure 6 – Battery (BAT)



The battery (see *Figure 6 – Battery (BAT)*) may or may not be shipped inside of the 720R unit due to shipping regulations or order details.

The battery is a CR123A 3V Lithium battery (non-rechargeable).

See **2.2.0 720R Battery Replacement** on how to properly install or uninstall a 720R battery.

Battery life is determined by the transmission rate of the 720R unit, environmental factors, and age.

2.0.0 **Operation and Measurement**

Outlined in this section are the installation and removal steps, battery replacement, and system calibration checks.

Each 720R unit comes preconfigured to a specific 720R Gateway and can then have specific operational parameters adjusted to suit the application's tension monitoring needs.

Calibration certificates are supplied for each SPC4® fastener providing correlation of the 720R unit percentage readings to joint clamp load (bolt tension) in lbf.

2.1.0 **Installation and Removal of the 720R Unit**

- [1] The use of 720R remote tension monitors will require that a Valley Forge 720R Gateway be installed near the installation location of the 720R units. The 720R Gateway is the central hub for the 720R system, which will retrieve, save, and graph incoming data from 720R units using the 720R Gateway Software.
- [2] **System Calibration Check** – It is recommended to check and record the calibration of every 720R unit (review and complete **2.3.0 System Calibration Check** for each 720R unit).
- [3] **Installation Placement Plan** – Each 720R unit must be assigned to the fastener to which it is being installed. Every 720R is assigned a fixed ID that is visible in the Gateway software. In addition to the ID, each 720R in the software can have a custom names and descriptions.
- [4] Prior to 720R unit installation, ensure that all SPC4® fasteners have been installed and tightened up to the target load value using a handheld SPC4® reader.

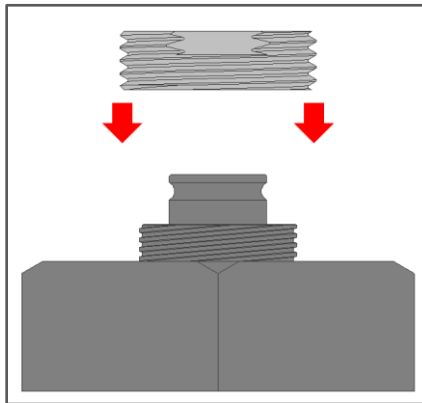
CAUTION: Before installation begins, verify that the bolted joint has zero electrical charge. The probe assembly of the 720R unit is **NOT** insulated and may result in personal injury or damage to the circuitry of the 720R unit.

2.1.1 **Installation**

- [1] Remove the protective cap from the fastener and verify that the datum disc and 720R probe sensor are clean of any liquid or debris. See **4.0.0 User Maintenance – Recommended Cleaning Procedures**.

- [2] Check the SPC4® fastener with a handheld SPC4® meter (mechanical or electrical; see *SPC4® Meters, pg. 2*) to verify correct load has been achieved prior to installing the 720R unit. Manually record the measured load value and fastener position for future cross referencing.
- [3] With a Thread Adapter (TA) in hand, orient the TA flats away from the fastener then thread the TA over and around the datum disc onto the threads below (See *Figure 7 – Thread Adapter Installation*). Use a 1" or adjustable wrench to tighten down the TA, securing it in place.

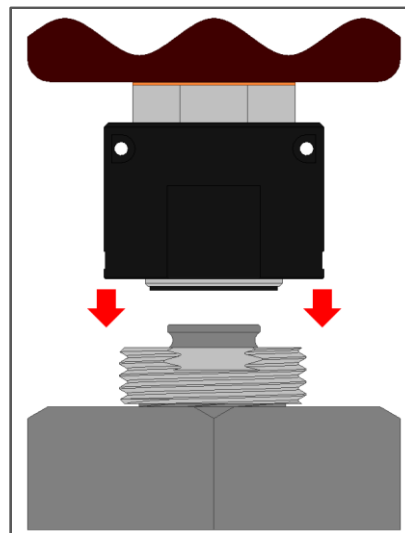
Figure 7 – Thread Adapter Installation



CAUTION: TAKE CARE when installing the TA to ensure that absolutely no damage is done to the datum disc surface. Any damage or contamination of the datum disc surface will lead to erroneous values from the 720R units.

- [4] After the TA has been installed, attach the 720R probe over the TA and onto the datum disc of the fastener (See *Figure 8 – 720R Unit Installation*). Begin by hand tightening the threaded sleeve down the TA and then use a 1-5/16" wrench to secure the 720R in place.

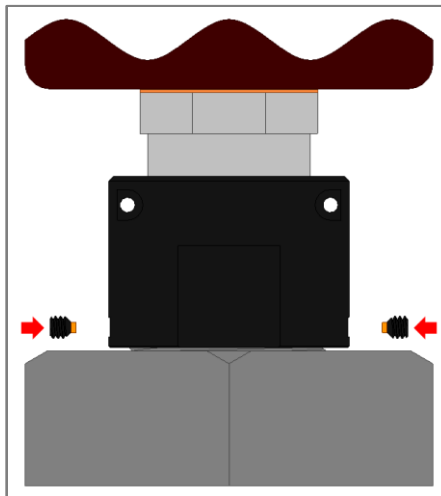
Figure 8 – 720R Unit Installation



CAUTION: ONLY utilize the threaded probe sleeve when installing the probe. Push down and thread the probe sleeve when attaching the probe assembly to the SPC4® fastener. **DO NOT** install by twisting the 720R enclosure.

- [5] Turn on the 720R unit. A momentary press (a press followed by a release) turns the unit "ON". Use the pad / underside of your finger (a soft surface) to press the "ON/OFF".
- [6] Check the first data transmission via your SPC4® 720R Gateway webpage. Verify the correct load percentage is being transmitted by referencing the recorded measurement from the handheld SPC4® meter taken in Step [2]. Use this first data transmission to verify correct operation. Refer to **4.1.0 Cleaning the Probe Sensor** if data transmission is not correct.
- [7] Install the Set Screws (SS) by placing them in the opposing threaded holes found in the threaded sleeve as shown in *Figure 9 – Set Screw Installation*. Tighten down the set screws using a 1/16" hex wrench to fully secure the 720R unit to the fastener.

Figure 9 – Set Screw Installation



- [8] Optional: Wire ties (customer supplied) should be installed using the through holes found in the threaded sleeve.
- [9] Once the SS is fully installed, verify that the 720R unit is powered in the "ON" state before leaving it attached to a fastener for an extended period.
- [10] Repeat the installation process for every 720R unit being used.

2.1.2 Removal

- [1] Begin the removal of the 720R unit by first removing any attached locking wire.
- [2] Remove the two Set Screws (SS).
- [3] Use a 1-5/16" wrench to remove the threaded probe from thread adapter on the SPC4® fastener.

- [4] Power off the 720R unit by depressing the "ON/OFF" button.

NOTE: Optional verification of the off state can be achieved by powering "ON" the unit and interrupting the boot up sequence by again pressing the "ON/OFF" button during the series of flashing LEDs. The LEDs should only flash one or two seconds on boot up to confirm "OFF" state. If they flash for five seconds, try again after a minimum of ten seconds.

NOTE: It is important that the 720R unit is turned off while it is being transported or stored for extended periods of time. Failure to do so will result in shortened battery life and potential collection of unwanted data.

- [5] Use a 1" wrench to remove TA from the fastener datum disk threads.
- [6] Install a protective cap over the SPC4® fastener datum disc. The protective cap should always remain in place when the 720R units are not installed.

2.2.0 720R Battery Replacement

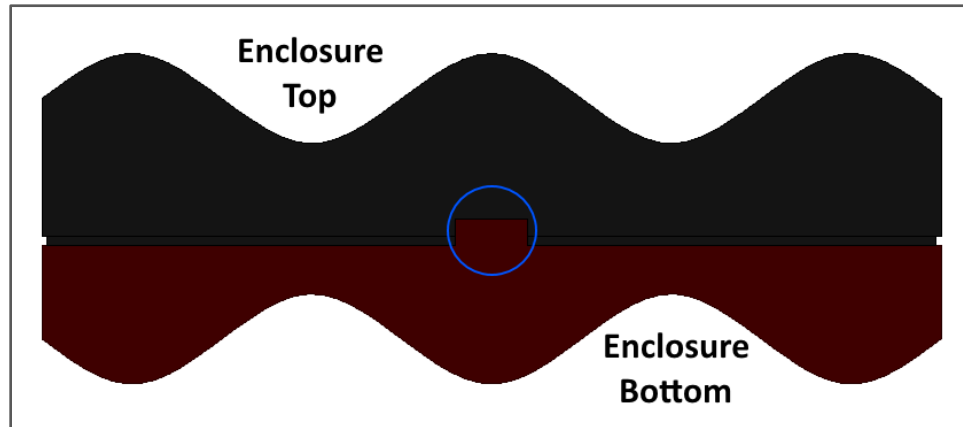
- [1] Remove the 720R unit from the fastener, install protective cap and bring the unit to a clean work bench.
- [2] Check that the 720R unit is off, or ensure the battery is completely dead. A dead battery will be indicated by no flashing LEDs and by the inability for the 720R unit to be turned on.
- [3] Remove the three enclosure screws and separate the enclosure lid carefully from the enclosure base (to avoid damaging any wires). **Do not remove or pull the wires.** Clean your hands and ground your body before proceeding.
- [4] The battery is located on the underside of the circuit board. Carefully remove the battery clip holding the battery in place by lifting the clip from one side.
- [5] Remove and dispose of the old battery.
- [6] Pay attention to the positive '+' and negative '-' ends of the new battery and battery holder. Insert the new battery in the correct orientation by matching the '+' together and the '-' together.
- [7] Reattach the battery clip.

[8] Reattach the enclosure lid of the 720R unit.

1. The enclosure lid is only reattached in a single orientation. See *Figure 10 – Enclosure Lid Orientation*.

CAUTION: Any attempt to reattach the enclosure lid to the enclosure bottom without matching the key and keyway will lead to damage and the unit may become nonfunctional.

Figure 10 – Enclosure Lid Orientation



2. **Ensure all wires are within the enclosure.**

CAUTION: Check that there are no wires visible outside of the 720R unit to avoid pinching the wires, which may lead to permanent damage leaving the unit nonfunctional.

3. To install the enclosure screws, first insert the enclosure screws into the top enclosure.
4. Tighten each enclosure screw in a circular, continuous sequence until the enclosure barely compresses the gasket.
5. Continue to tighten the screws in the same pattern using a torque screwdriver set to a value of 0.56 N • m (5.0 in. • lbs.) ($\pm 5\%$) to avoid overtightening.

[9] Re-check the calibration as outlined in **2.3.0 System Calibration Check** whenever the battery is replaced.

[10] It is recommended to replace all other 720R batteries of the same batch/order if they had the same or similar transmitting periods (do not “reuse” batteries).

[11] Other than the battery, the 720R unit contains no other user-serviceable or replaceable parts.

2.3.0 System Calibration Check

[1] **Locate the Calibration Reference Gage.** This gage is calibrated at VFB that enables a field check to verify that the 720R unit is reading 0% “000” and 100% “100” (within $\pm 5\%$). A wrench and set screws should **NOT** be used when checking calibration.

[2] **Verify the 720R unit is reading 0% “000” (within $\pm 5\%$).**

1. Attach the 720R unit to the supplied Reference Gage at the end marked “0%”.
2. Turn on the 720R unit, wait a few seconds for it to boot up and transmit data. An LED will blink once, indicating that it has transmitted the data.
3. Power off the 720R unit and verify it is off.

[3] Verify the 720R unit is reading 100% " 100" (within $\pm 5\%$).

1. Attach the 720R unit to the supplied Reference Gage at the end marked "100%".
2. Turn on the 720R unit, wait a few seconds for it to boot up and transmit data. An LED will blink once, indicating that it has transmitted the data.
3. Power off the 720R unit and verify it is off.

[4] Check that data has been transmitted. Verify the data was transmitted via the SPC4® 720R Gateway software. Review the 720R unit calibration values are reading " 000" and " 100" (within $\pm 5\%$).

NOTE: If the data does not read 0% " 000" or 100% " 100" (within $\pm 5\%$), see **5.0.0 Troubleshooting**.

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

3.0.0 SPC4® Model 720R Remote Tension Monitor Specifications

3.1.0 Electrical Specifications

Power Supply	1 CR123A battery (non-rechargeable)
Supply Voltage	3 V _{DC}
Nominal Range	1.5 V _{DC} to 3 V _{DC}
Power Consumption	4 μ A – Off 20 μ A – sleeping (typical) $\approx$ 15 mA Tx ($\approx$ 5.5 seconds)
Operating Time	Varies based on transmission rate & Power Levels
Measuring Method	24-Bit Analog to Digital Conversion
Precision	Equal to, or better than $\pm 5\%$ (within $\pm 2\%$ typical)

3.2.0 Wireless Specifications

915MHz Signal Radius.....Typically Less than 304.8 m / 1000 ft. (LoS)
.....MAX 20 dBm (100mW) Transmit Power
915MHz (902MHz – 928MHz) band consists of 84 usable frequency channels.
Wireless communication is proprietary and does NOT work with LoRa Systems.

868MHz Signal Radius.....Typically Less than 304.8 m / 1000 ft. (LoS)
.....MAX 20 dBm (100mW) Transmit Power
868MHz (865.1MHz – 869.5MHz) band consists of 15 usable frequency channels.
Wireless communication is proprietary and does NOT work with LoRa Systems.

433MHz Signal Radius.....Typically Less than 304.8 m / 1000 ft. (LoS)
.....MAX 20 dBm (100mW) Transmit Power
433MHz (433.05MHz – 434.79MHz) band consists of 6 usable frequency channels.
Wireless communication is proprietary and does NOT work with LoRa Systems.

3.3.0 Environmental Specifications

Operating Conditions:

Temperature..... -20 to 60 °C / -4 to 140 °F
Humidity..... 80% max (non-condensing)

Storage Conditions (no battery):

Temperature..... -40 to 85 °C / -40 to 185 °F
Humidity..... 95% max (non-condensing)

720R Ingress Protections Class..... IP-54 (dust protected & water protected)

(Installed) 720R Ingress Protections Class..... IP-64 (dustproof & water protected)

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

3.3.0 Physical Characteristics

Dimensions (W x L x H) 63.5 x 63.5 x 76.2 mm / 2.50 x 2.50 x 3.00 in.
Top of fastener install height..... 3.25 in.

Weight (without battery)..... 0.297 kg / 0.655 lbs.

Weight (with battery) 0.313 kg / 0.690 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 720R 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 720R 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 11 - 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 that the surface has been cleaned from contaminants.
- [3]** Check the calibration as outlined in **2.3.0 System Calibration Check**.

4.2.0 Cleaning the Datum Disc on the SPC4® Fastener

- [1]** Wipe the datum disc face clean 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 $0 \pm 5\%$ 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 **2.3.0 System Calibration Check**

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 720R unit is not installed.

4.3.0 Cleaning the Enclosure

- [1]** Ensure 720R 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 720R 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 enclosure to visually inspect the battery connection, connectors, and the interconnecting wires.
 2. Remember to close the enclosure 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 12 – Probe Sensor Cleanliness



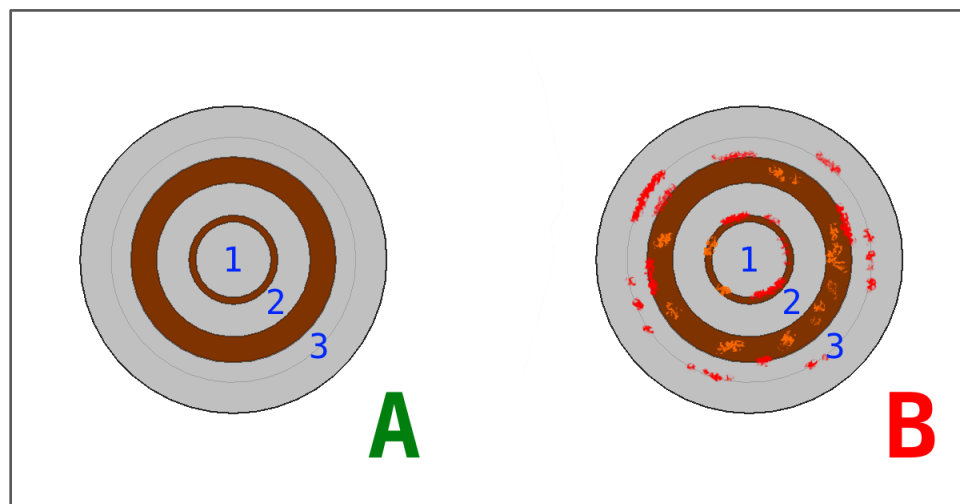
**Dirty or contaminated
probe sensor face**



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

3. A clean probe face is shown in *Figure 13 – 720R Sensor*, where (1) is the sensor pin, (2) the sensor shield, (3) the sensor inner body, and the brown material is an electrical insulator.

Figure 13 – 720R Sensor



4. The deposits shown on the sensor of *Figure 13 – 720R 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 **2.3.0 System Calibration Check**
- [5] Should the problem persist please contact us directly.

VALLEY FORGE & BOLT MANUFACTURING COMPANY

4410 West Jefferson Street • Phoenix, AZ 85043 • USA

Phone: (602) 269 - 5748 • Fax: (602) 269 - 7851

E-mail: sales@vfbolts.com • Web: www.vfbolts.com



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