

# School of Gauges

## Spy Pro ESP Monitoring Accessories

AUG 9<sup>th</sup> , 2022

1. Temperature sensitive devices
2. Fitting Connector (Pd)
3. Installation Kit
4. Capillary / Discharge line
5. Discharge Sub
6. Surface Cable Kit
7. Surface Choke
8. Surface Acquisition Units

# Motor Temperature Sensor

## > Spy Pro

- All Spy Pro gauges are able to read motor temperature with:
  - Platinum 1K RTD
  - or
  - Type – J Thermocouple
- Temperature probes are connected inside the gauge assembly and the probe is placed close to the motor windings for maximum temperature transfer and fast response.

# Definition

## › Thermocouple

- A thermocouple is a sensor that measures temperature. It consists of two different types of metals, joined together at one end. When the junction of the two metals is heated or cooled, a voltage is created that can be correlated back to the temperature.

## › RTD

- RTDs - Resistance Temperature Detectors - are temperature sensors that contain a resistor that changes resistance value as its temperature changes. Most RTD elements consist of a length of fine coiled wire wrapped around a ceramic or glass core. The element is usually quite fragile, so it is placed inside a sheathed probe to protect it.

# RTD's vs Thermocouples

<b>1. Measuring Range</b>	<b>4. Drift</b>
<p>The main advantage of thermocouples is their range. Most RTD sensors are limited to temperatures of up to 400-500 °C, and in some cases higher, whereas certain thermocouples can be used to measure above the 1400 to 1800 °C range, which makes them suitable for a large range of applications.</p>	<p>The RTD sensors drift is small due to their design, which makes them produce stable readings for longer durations than thermocouples can. Unlike RTD sensors, a thermocouple has a relative high drift-over-time, which is typically caused by inhomogeneity of the conductor wires resulting from heat- and chemical exposure or mechanical damage, such as having been bent, tugged or squeezed during use. Due to this, frequent calibrations and adjustments are mandatory for thermocouples.</p>
<b>2. Accuracy</b>	<b>5. Single Point Measurements</b>
<p>RTD's provide the highest accuracy and may be the preferred solution when a temperature measurement accuracy is required to be around <math>\pm 0.05</math> to <math>\pm 0.1</math> °C. Thermocouples in comparison, have a lowered accuracy around <math>\pm 0.2</math> to <math>\pm 0.5</math> °C.</p>	<p>Due to the design of a thermocouple, it is possible to narrow the measuring point down to the exact spot where the two metals are welded together. This point can then be defined very accurately when operating thermocouples with "naked tips". For RTD sensors however, measurements are calculated by taking the average value along the entire surface of the PT (platinum) element itself. This is mainly a disadvantage for large elements like PT100, whereas smaller elements like the PT1000 rarely have this issue, as some leading suppliers can provide PT1000 elements as small as 1x1.5 mm</p>
<b>3. Sensitivity</b>	<b>6. Cost</b>
<p>Although a thermocouple sensor system usually has a faster response time due to the changing temperature at its point of contact, it generally takes longer to reach thermal equilibrium. This is largely due to the presence of the cold junction compensation, which does not respond to the change in temperature as quickly as the hot junction located at the tip of the sensor does. In comparison an RTD sensor is designed to be more durable and react faster to temperature changes (naked tip).</p>	<p>When it comes to cost, thermocouples are generally less expensive than RTD sensors, as most thermocouples cost between half to one third of an RTD. As mentioned however, thermocouples require regular adjustments and calibration, which in addition to the longer installation and setup times, adds to the long-term costs of the product.</p>

# RTD's vs Thermocouples

Parameter	RTD	Thermocouple
Typical Measuring Range	-240 to +650 °C	-270 to +2,320 °C
Long-term Stability	Excellent	Poor to Fair
Accuracy	Excellent	Good to Medium
Repeatability	Excellent	Poor to Fair
Response Time	Good	Medium to Excellent
Linearity	Good	Fair
Undesirable Self-Heating	Medium to Excellent	Excellent
Tip Sensitivity	Fair	Excellent

# Considerations

## › Motor RTD Installation Instructions for factory installed RTD

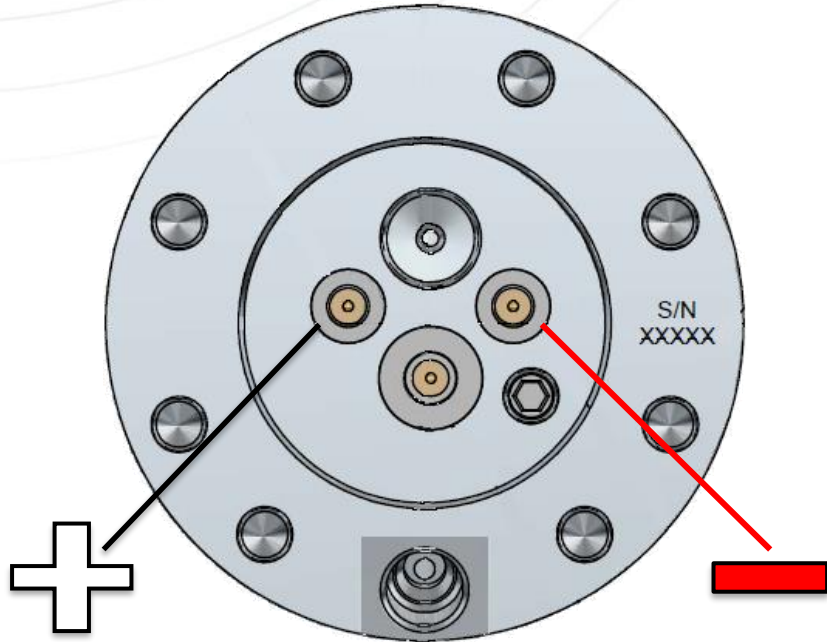
- Since the RTD is factory installed. Determine where to place the RTD probe in the base of the motor. The shielded RTD cable can be coiled inside the motor base. Remember to keep the wire away from the motor shaft to prevent damage to the RTD cable.

## › Motor Thermocouple Connection Instructions (Spy Pro Only – Field Installed)

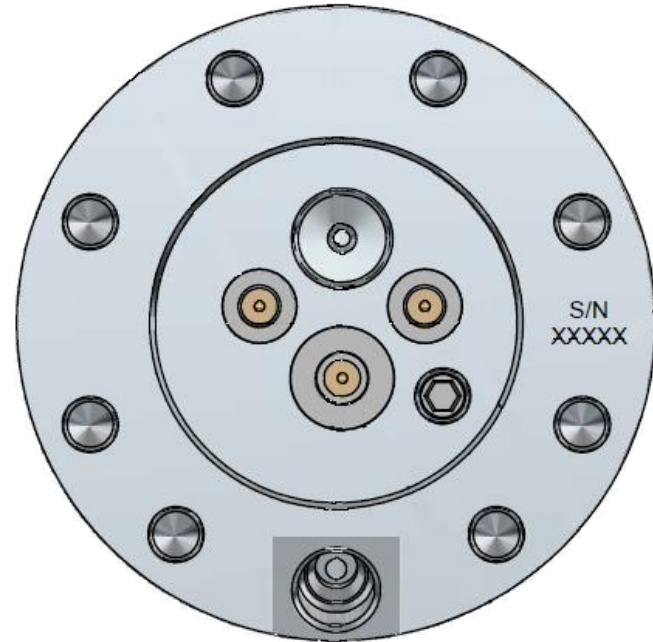
- The Spy Pro thermocouple optional Type – J thermocouple must be installed prior to the gauge being connected to the ESP motor. The gauge will come with a red and white wire attached to gauge and with a butt splice connection installed on the wires. The thermocouple sensor should be connected red to red and white to white.

# The correct feedthrough connections

Thermocouple Type J



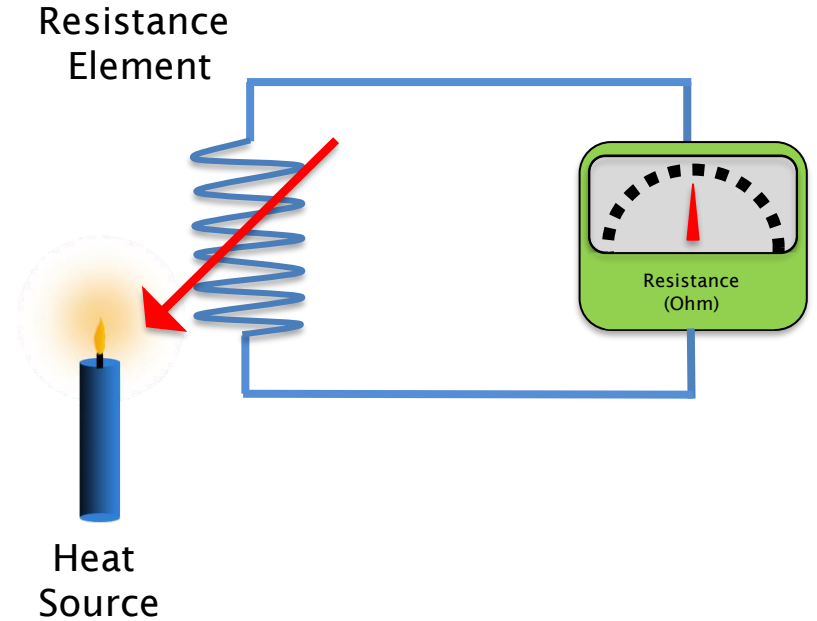
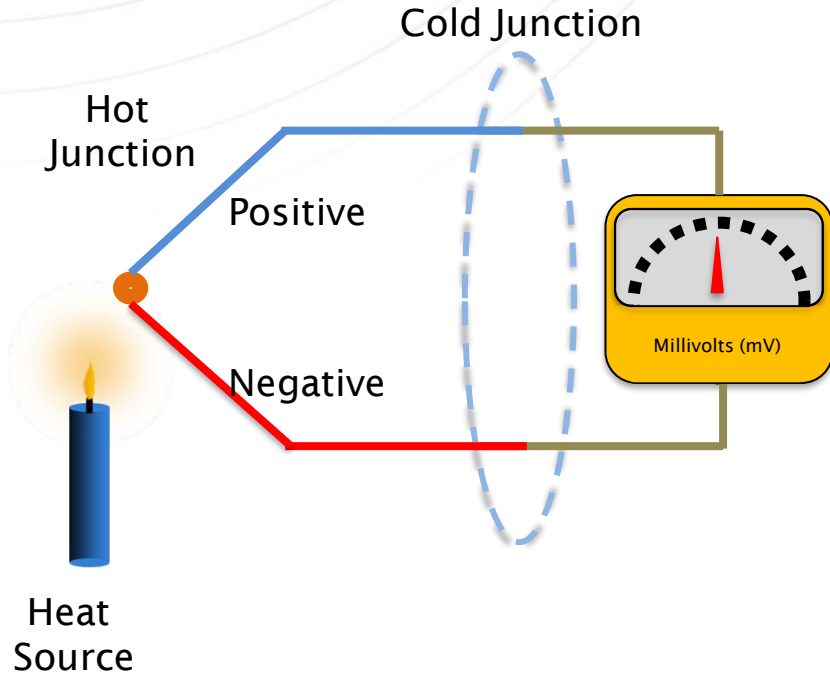
RTD



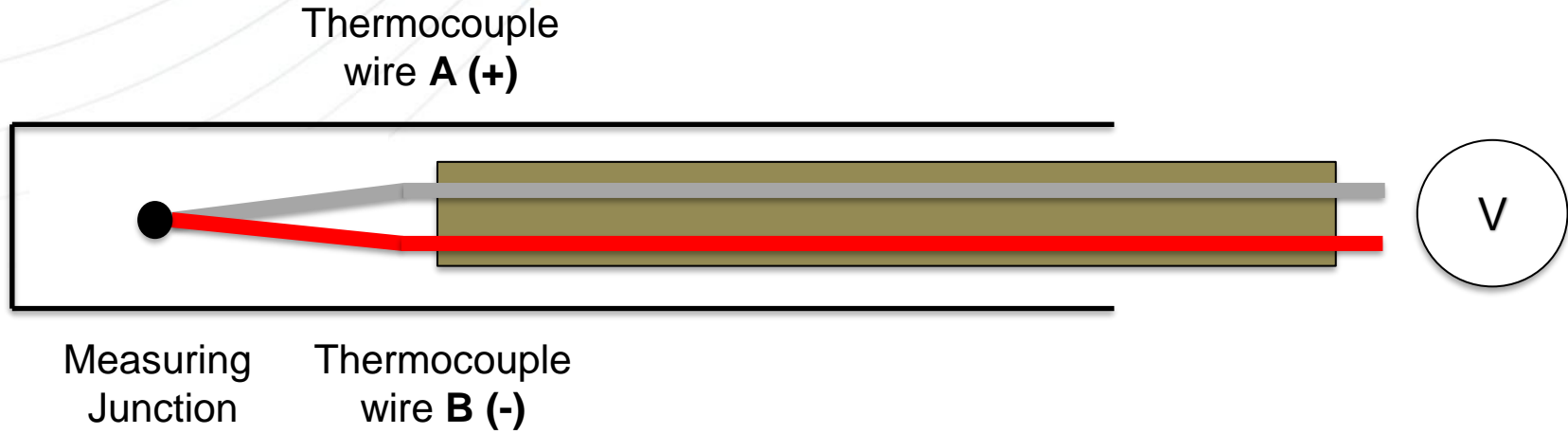
**NO POLARITY!!!**



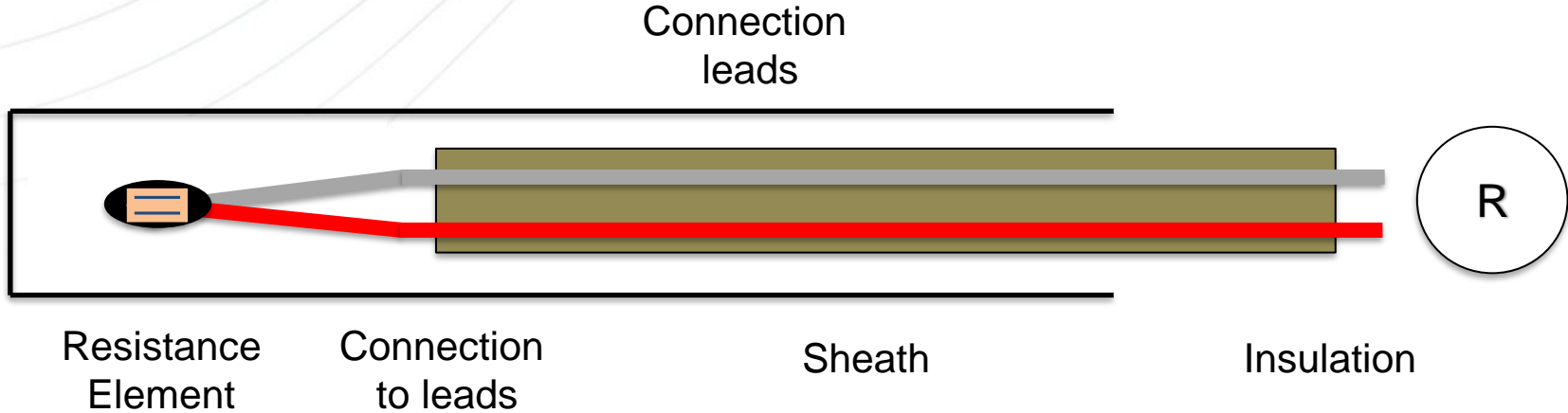
# How thermocouple/RTD work



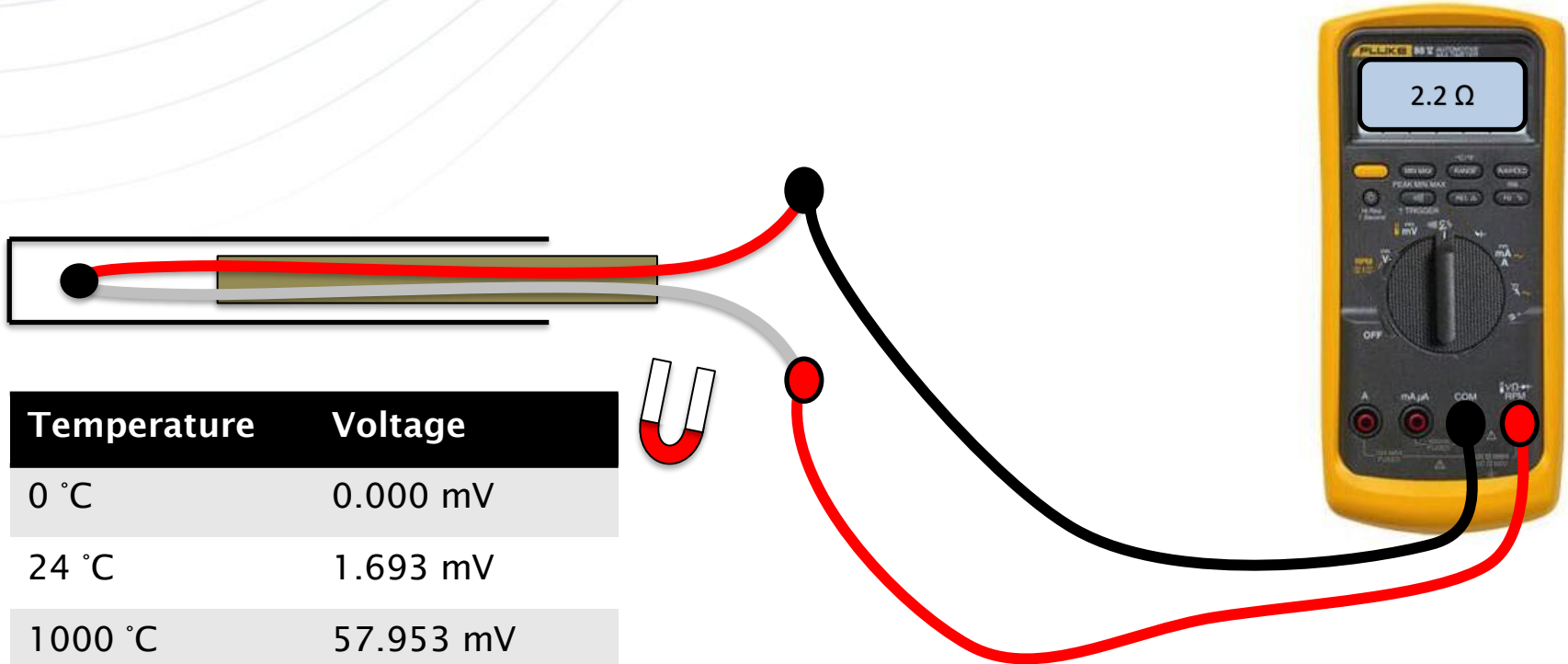
# Anatomy-Types of thermocouple



# Anatomy-Types of RTD



# How to test Thermocouple Type J



Temperature	Voltage
0 °C	0.000 mV
24 °C	1.693 mV
1000 °C	57.953 mV

Only positive is magnetic

# How to test RTD Type PT1000



Temperature	Resistance
0 °C	1000 ohms
1000 °C	138.4 ohms

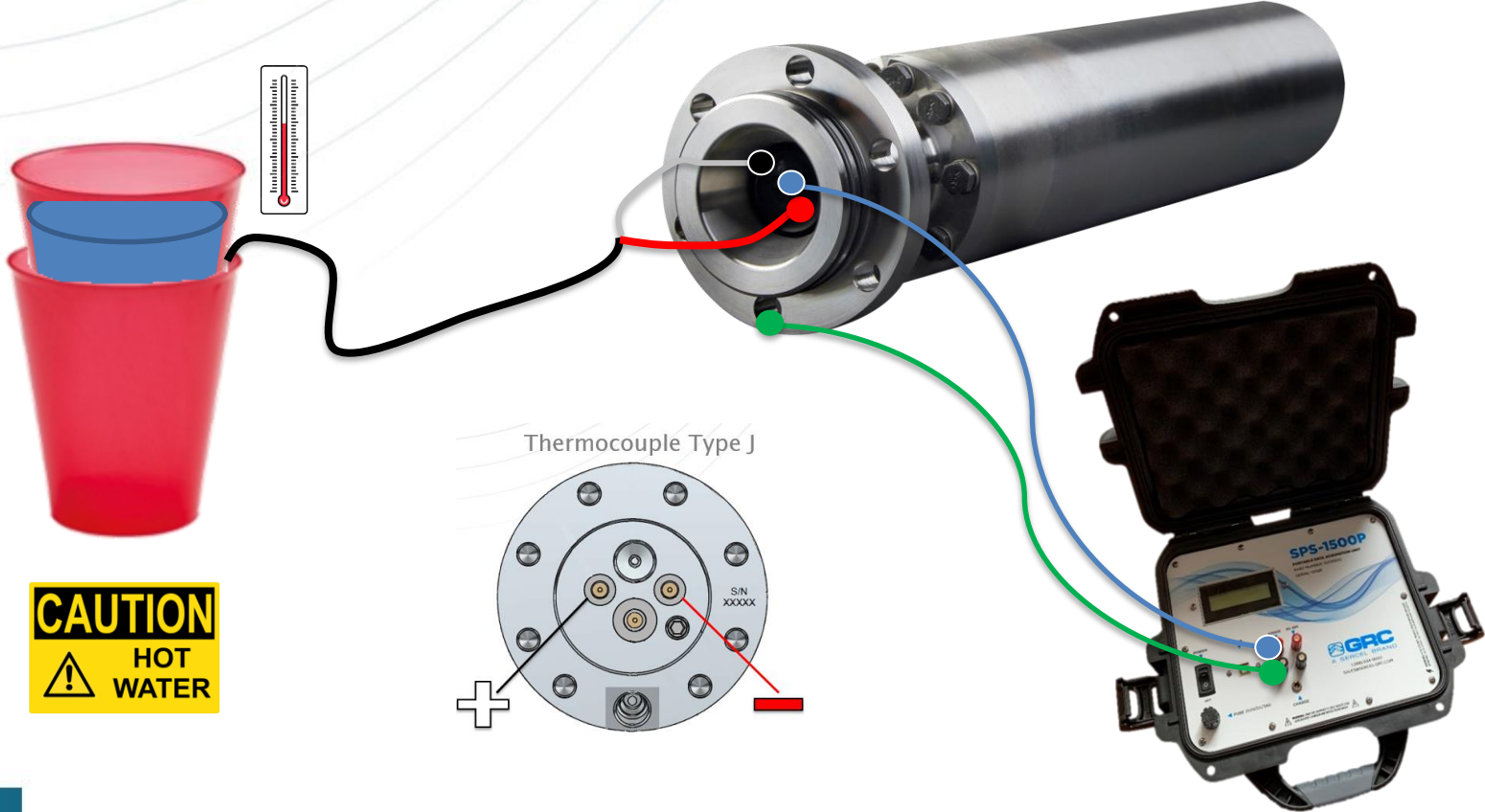


None of the wires are magnetic

# How to test thermocouple/RTD in workshop

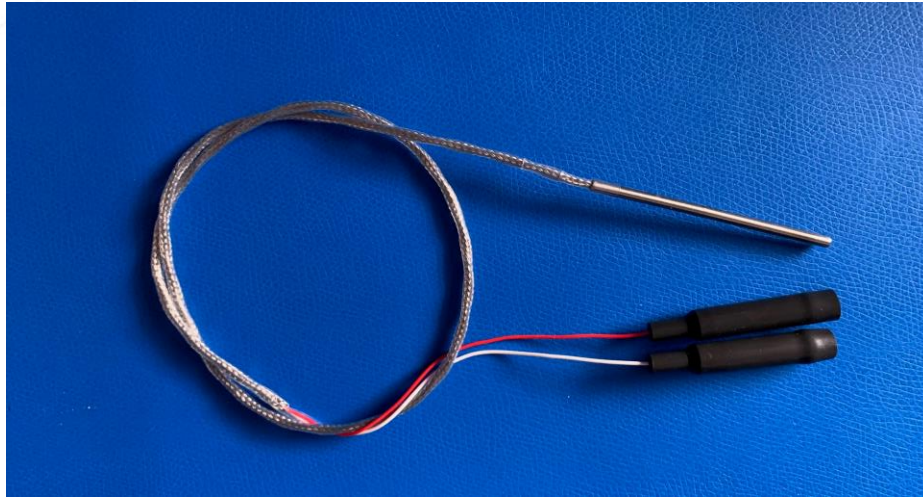


# How to test thermocouple/RTD in workshop



# Spare Parts

- › GRC PN: 10024824 ASSY, RTD AND WIRE HARNESS, PROBE (RESISTANCE THERMOMETER PROBE TYPE)

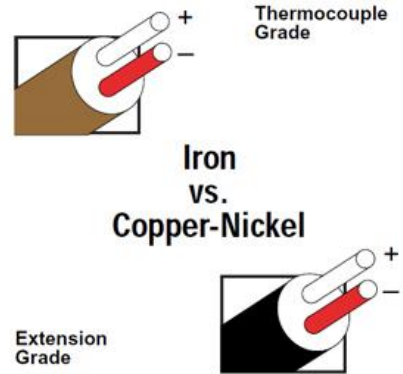


- › Confirm with GRC the P/N of sensor compatible with RTD



# Spare Parts

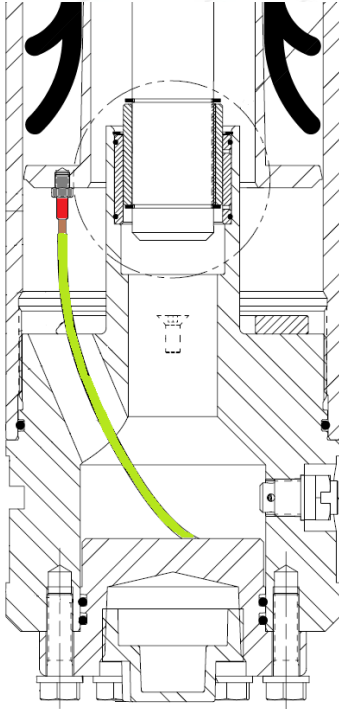
- › GRC PN: 10043768 THERMOCOUPLE J TYPE, 1 ½ INCH UNGROUNDED PROBE 1/8"(3MM) DIAMETER WITH 12 INCHES OF PFA INSULATED 24 AWG



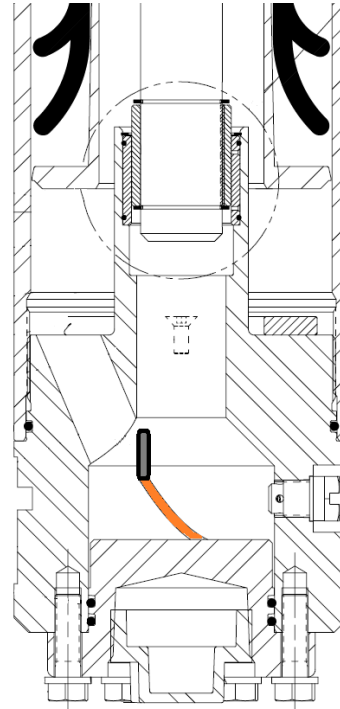
- › Confirm with GRC the P/N of sensor compatible with Thermocouple

# Connection diagram

MWT



MOT





ELECTRIC  
SUBMERSIBLE PUMP



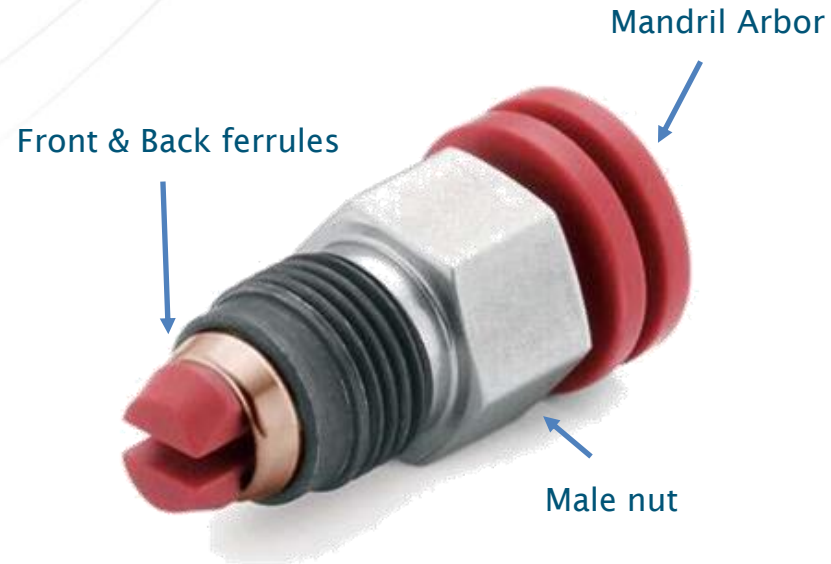
Tea Break..!



Coffee  
Break

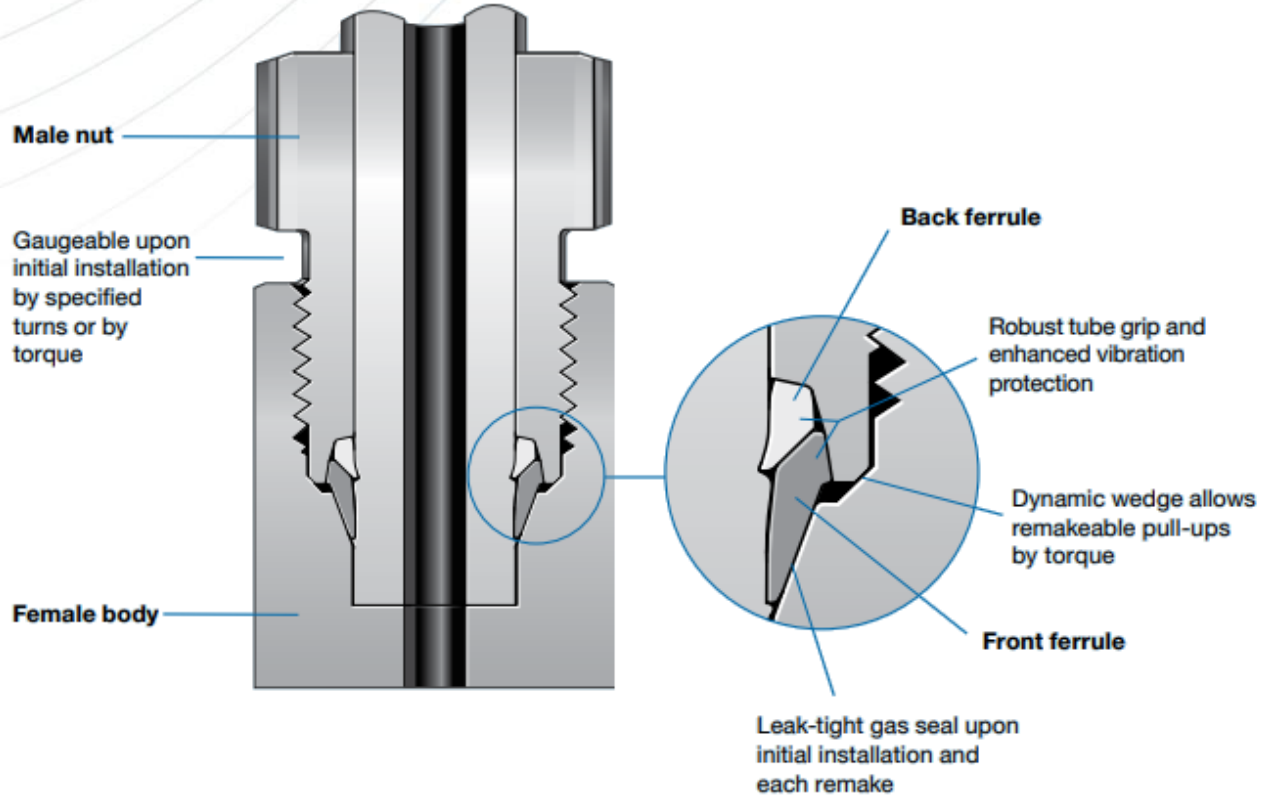
# Let's Take a Break

# Fitting Connector (Pd)



# Fitting Connector (Pd)

## Swagelok Medium-Pressure Tube Fittings—FK Series



# Fitting Connector (Pd)

- › Patented low-temperature case hardening processing of the ferrules, plus the specially designed ferrule geometry, promotes a patented hinging-colleting™ action
- › Easy installation, by specified turns or torque
- › Simple two-piece construction, body and cartridge
- › Leak-tight performance on a variety of tubing types and materials
- › Strain-hardened stainless-steel bodies offer lightweight, space-saving designs
- › Extensive Swagelok product test reports and third-party test reports

## Material of Construction

Component	Material/ASTM Specification
Body	316 SS/A276, A479
Front ferrule	316 SS/A276
Nut <sup>①</sup>	316 SS/A276, A479
Back ferrule	316 SS/A276

Wetted components listed in italics. ① Molybdenum disulfide-based lubricant.

# Installation Kit

**Product:** ASSY,BOOT/CONTACT/TEF.  
SLEEVE

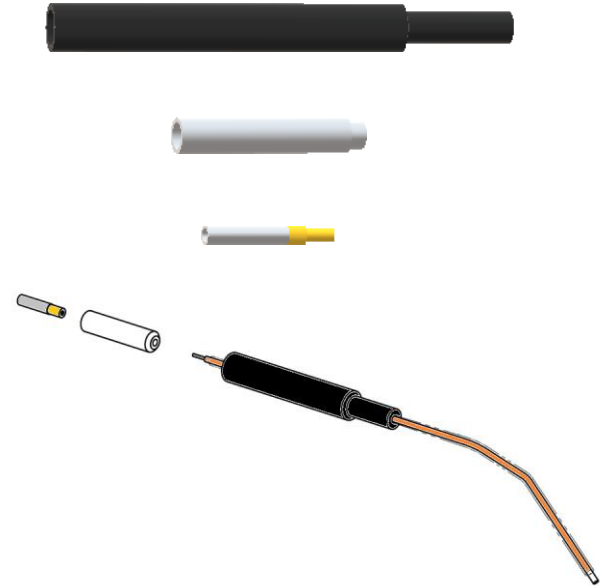
**Part Number:** 037-0054-04

**Presion rate:** 20,000 psi

**Temp rate:** 350° F

**Wire size:** 0.128 in (14 AWG)

**Material:** Fluoroelastomer (boot)  
Teflon (insulator)  
Stainless Steel (connector)



# Installation Kit

**Product:** ACCESSORY KIT, SPY PRO,  
FLANGE ADAPTERS, STANDARD

**Part Number:** 10038085

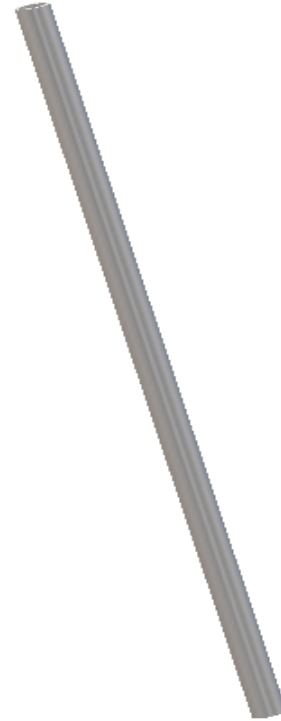
04 x	079-0233-06	VITON O-RING - 456 FLANGE
04 x	079-0142-02	VITON O-RING - 375 FLANGE
04 x	10037397	AFLAS O-RING - 456 FLANGE
04 x	10040281	AFLAS O-RING - 375 FLANGE
01 x	078-0016-00	PARKER SUPER O-LUBE
04 x	078-0016-00	TIE 1" BUNDLE
01 x	10038081	ASSY instructions





# Capillary/Discharge Line

<b>Product:</b>	<b>CAPILAR, 130 FT REEL 1/4" SS PRESS DISCHG</b>
<b>Part Number:</b>	<b>10026941</b>
<b>OD:</b>	0.250 in
<b>ID:</b>	0.152 in
<b>Wall thickness:</b>	0.049 in
<b>Length:</b>	130 ft.
<b>Work pressure:</b>	12,895 psi
<b>Material:</b>	316L Stainless Steel



# Discharge Sub

**Product:** DISCHARGE SUB, 3-1/2 410-13CR  
EUE PXB EC

**Part Number:** 10043683

**OD:** 5.075 in

**ID:** 3.000 in

**Overall length:** 12.94 in

**Upper connection:** 3-1/2 in EUE 9.3 lb/ft Box

**Lower connection:** 3-1/2 in EUE 9.3 lb/ft Pin

**Working pressure:** 5,000 psi

**Material:** 410-13CR PER NACE MR0175



# Discharge sub, Fitting

**Product:** MALE CON,1/4" TUBE X 1/4"NPT

**Part Number:** 089-0198-00

**Body Material:** 316 Stainless Steel

**Connection 1:** Size 1/4 in.

**Connection 1 Type:** Swagelok® Tube Fitting

**Body Type:** Male Connector

**Bulkhead:** No Bulkhead

**Connection 2:** Size 1/4 in.

**Connection 2 Type:** Male NPT



# Surface Cable Kit

**Product:** ESP SURFACE CABLE KIT, 3 METERS

**Part Number:** 10038090

032-0227-01 HIGH VOLT LEAD WIRE

Length: 30 ft

10038099 WIRE 18GA, 2COND, SHIELD

Length: 10 ft

10038100 WIRE 22GA, 2COND, SHIELD

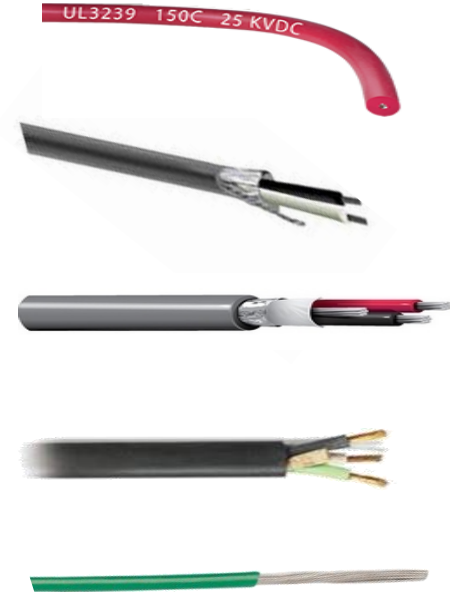
Length: 10 ft

10038101 WIRE 18GA, 3COND, AC POWER CORD

Length: 10 ft

032-0185-01 WIRE, 14AWG STRANDED GREEN

Length: 10 ft

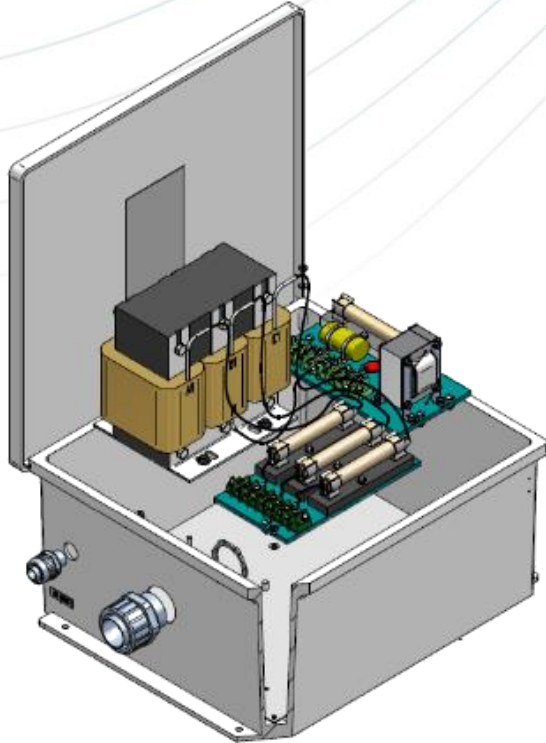


# Surface Choke

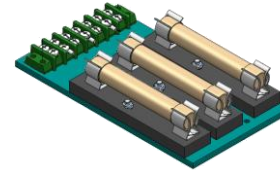
<b>Product:</b>	ASSY, ESP SURFACE CHOKE/SURGE
<b>Part Number:</b>	90B2175
<b>Height :</b>	20 in
<b>Width :</b>	17.65 in
<b>Depth :</b>	9.19 in
<b>Weight :</b>	60.0 lb
<b>Enclosure:</b>	NEMA 4X
<b>Mounting:</b>	Enclosure fits outside switch board / VSD
<b>Material enclosure:</b>	Fiberglass



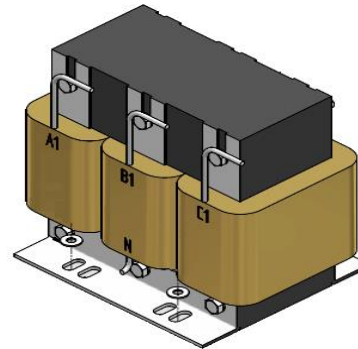
# Surface Choke



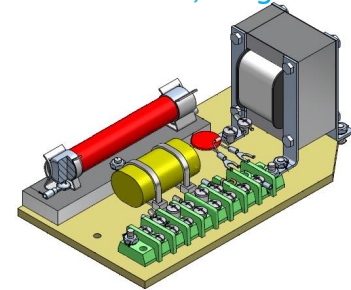
10049033  
ASSY, FUSE BLOCK, 3 PHASE



99B990S  
SURFACE CHOKE/INDUCTOR ASSY



90C2215  
Protector, Surge



# Surface Choke

**Product:** ASSY, FUSE BLOCK, 3 PHASE

**Part Number:** 10049033

**Fuse:** 3 x FUSE, HVC 5000V NO DELAY

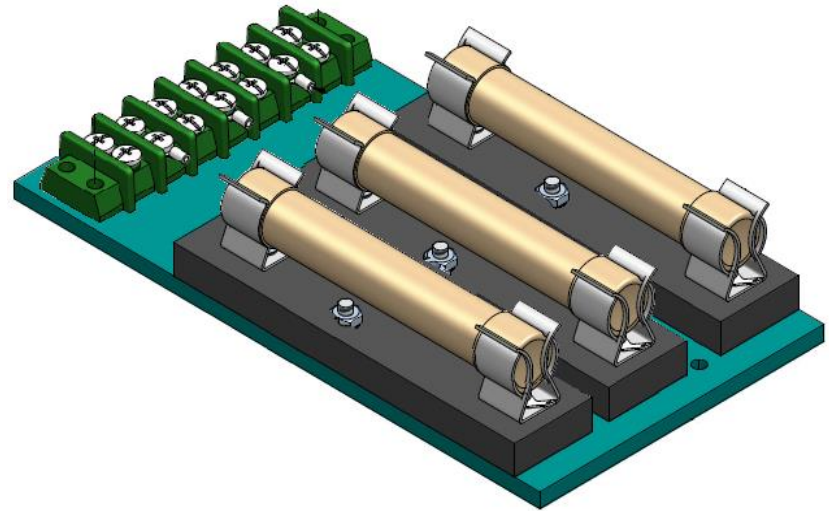
**Terminal:** Barrier Terminal Block

**Terminals:** 7 terminal positions

**Wire link:** White 14 Awg Stranded (2 In)

**Weight:** 0.920 Kg

**Dimensions:** 9.2 x 5.0 x 2.0 in (LxWxH)



# Surface Choke

**Product:** SURFACE CHOKE/INDUCTOR ASSY

**Part Number:** 99B990S

**Volts:** 2400V / PH

**Amps:** 0.0366 A

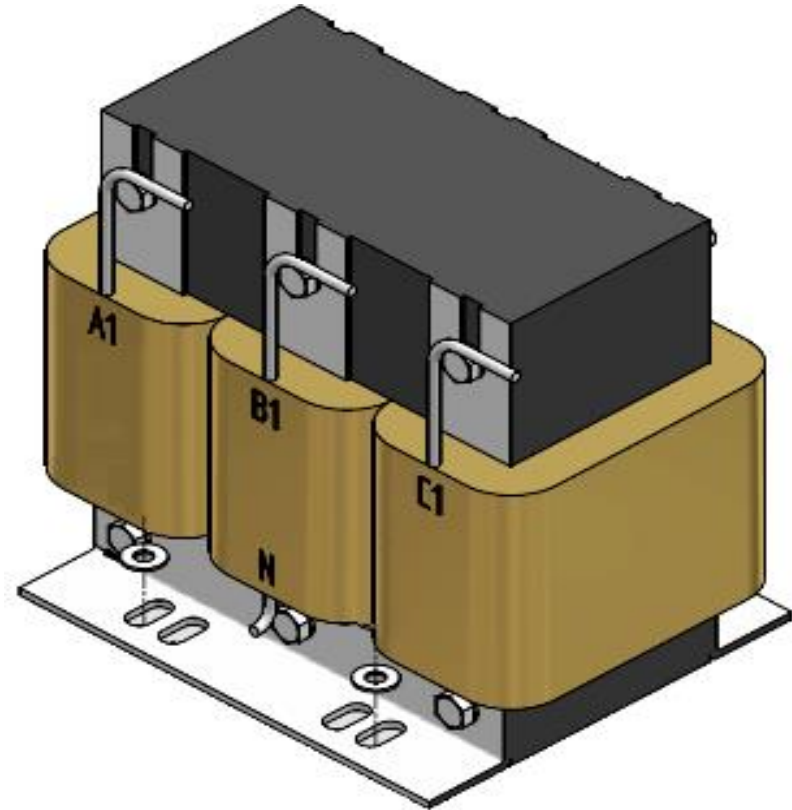
**Resistance:** 13.4 a 138.6 Ohm

**Inductance:** 150 - 200 H

**Weight:** 17.27 Kg

**Coils/unit:** 3

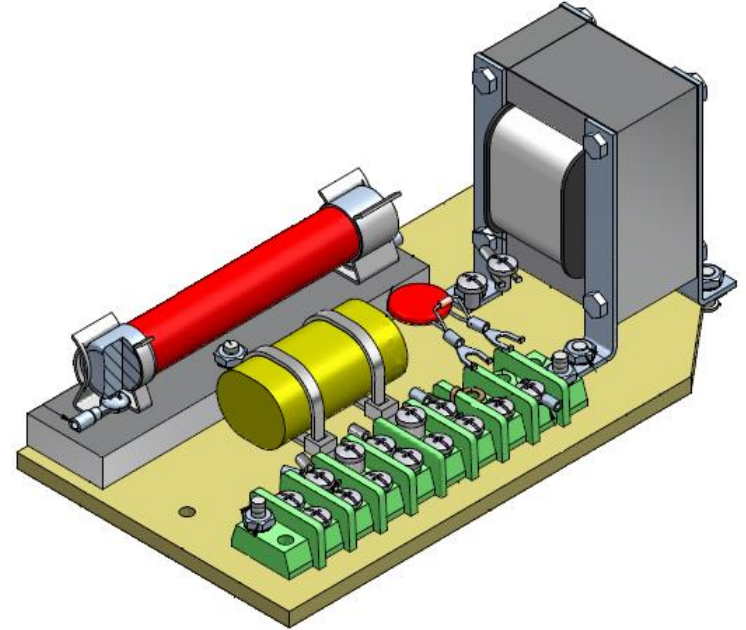
**Dimension:** 152 x 235 x 177 mm (LxWxH)



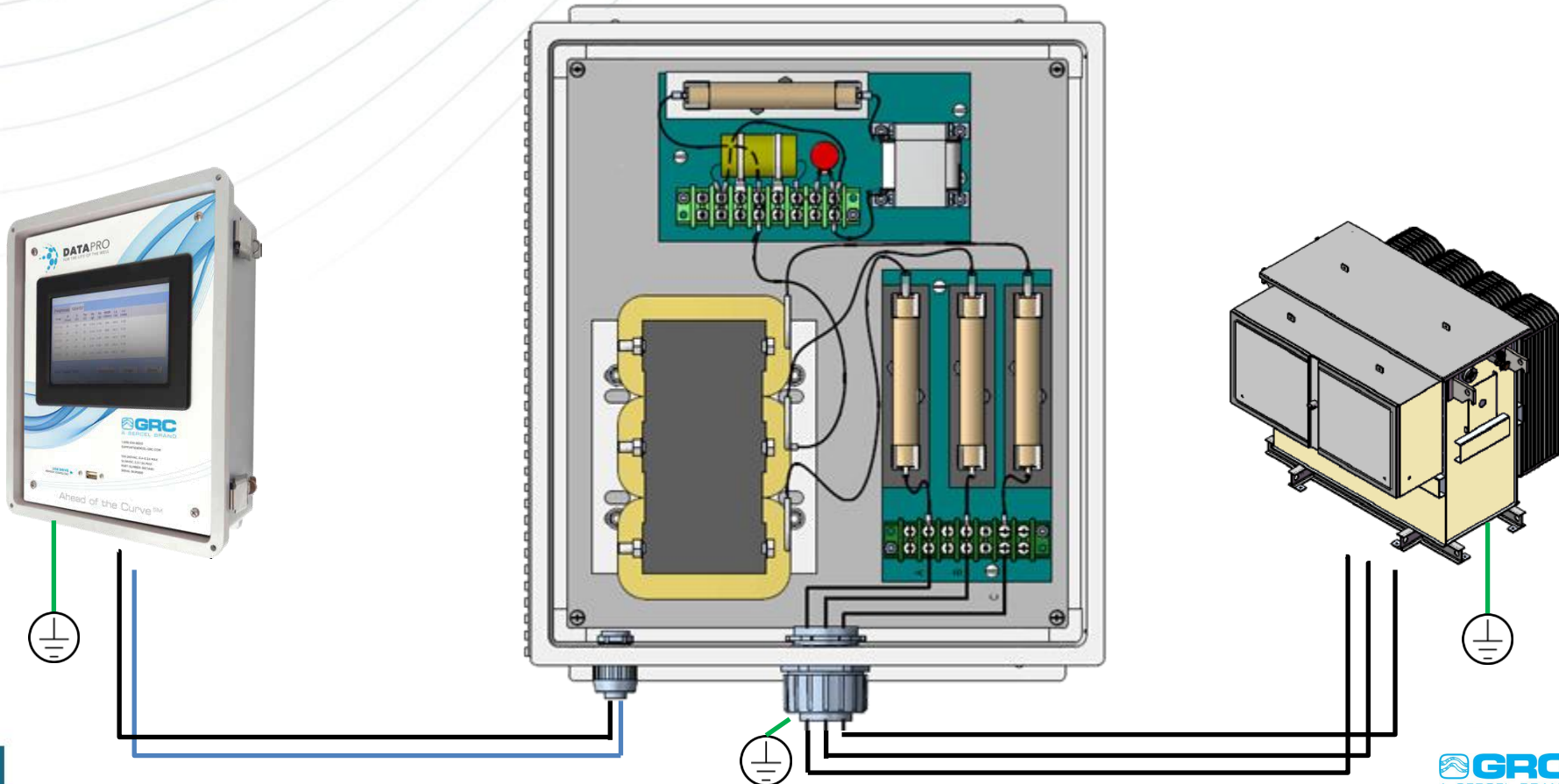


# Surface Choke

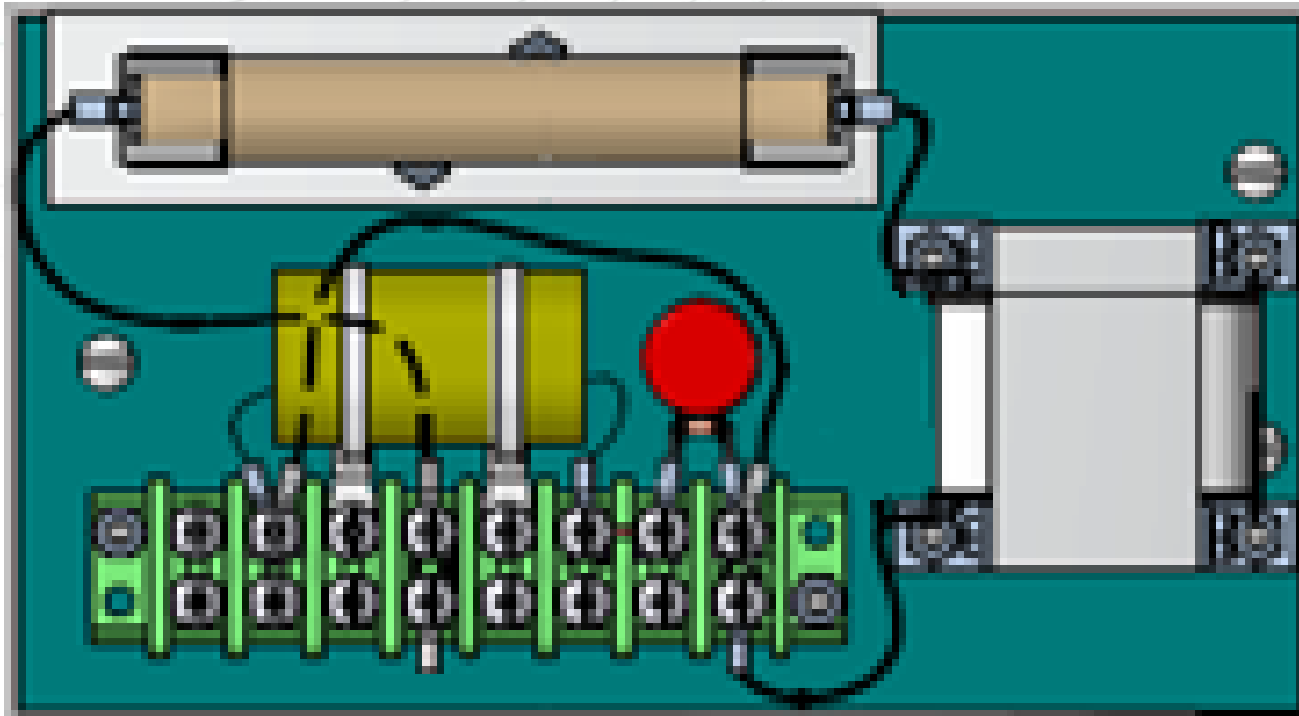
<b>Product:</b>	<b>PROTECTOR, SURGE</b>
<b>Part Number:</b>	<b>90C2215</b>
<b>Terminal block:</b>	2-row x 8 pole
<b>Fuse:</b>	1 x HVU 5000V
<b>Fuse Amp:</b>	½ Amp
<b>Capacitor :</b>	5uF 600V 5%
<b>Single coil :</b>	Induct. 25-40 H Res. 150-165 Ohm
<b>Mounting dimension:</b>	9.25 x 5.0 x 0.25 in (LxWxH)
<b>Mounting material:</b>	HDPE (High Density Polyethylene)



# Surface Choke, Connection Diagram



# Surface Choke, Connection Diagram



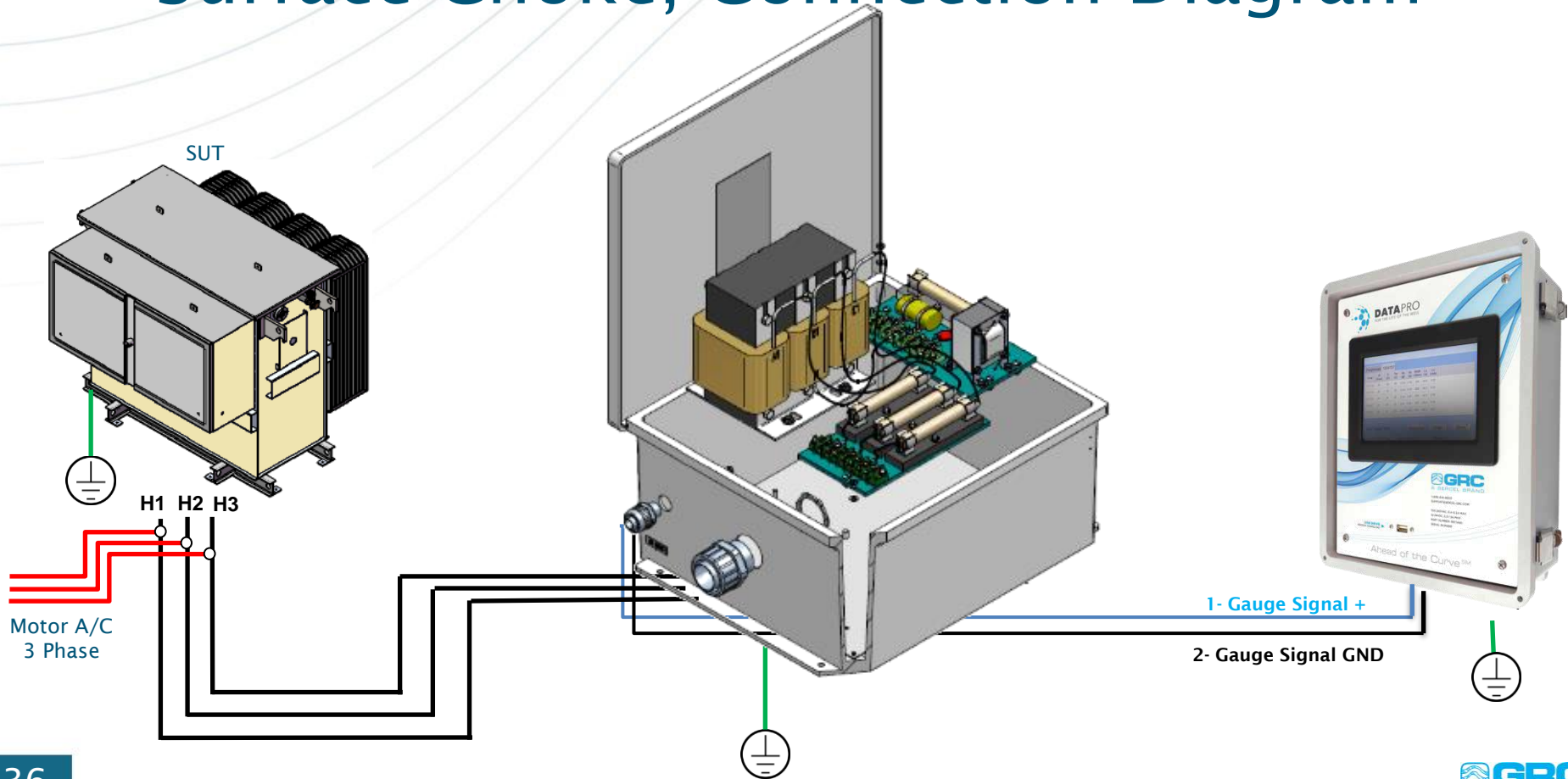
- ① N/C
- ② Gauge Signal +
- ③ N/C
- ④ Choke Neutral
- ⑤ N/C
- ⑥ Gauge Signal GND
- ⑦ Dedicated Well GND
- ⑧ N/C

- ①
- ②
- ③
- ④
- ⑤
- ⑥
- ⑦
- ⑧

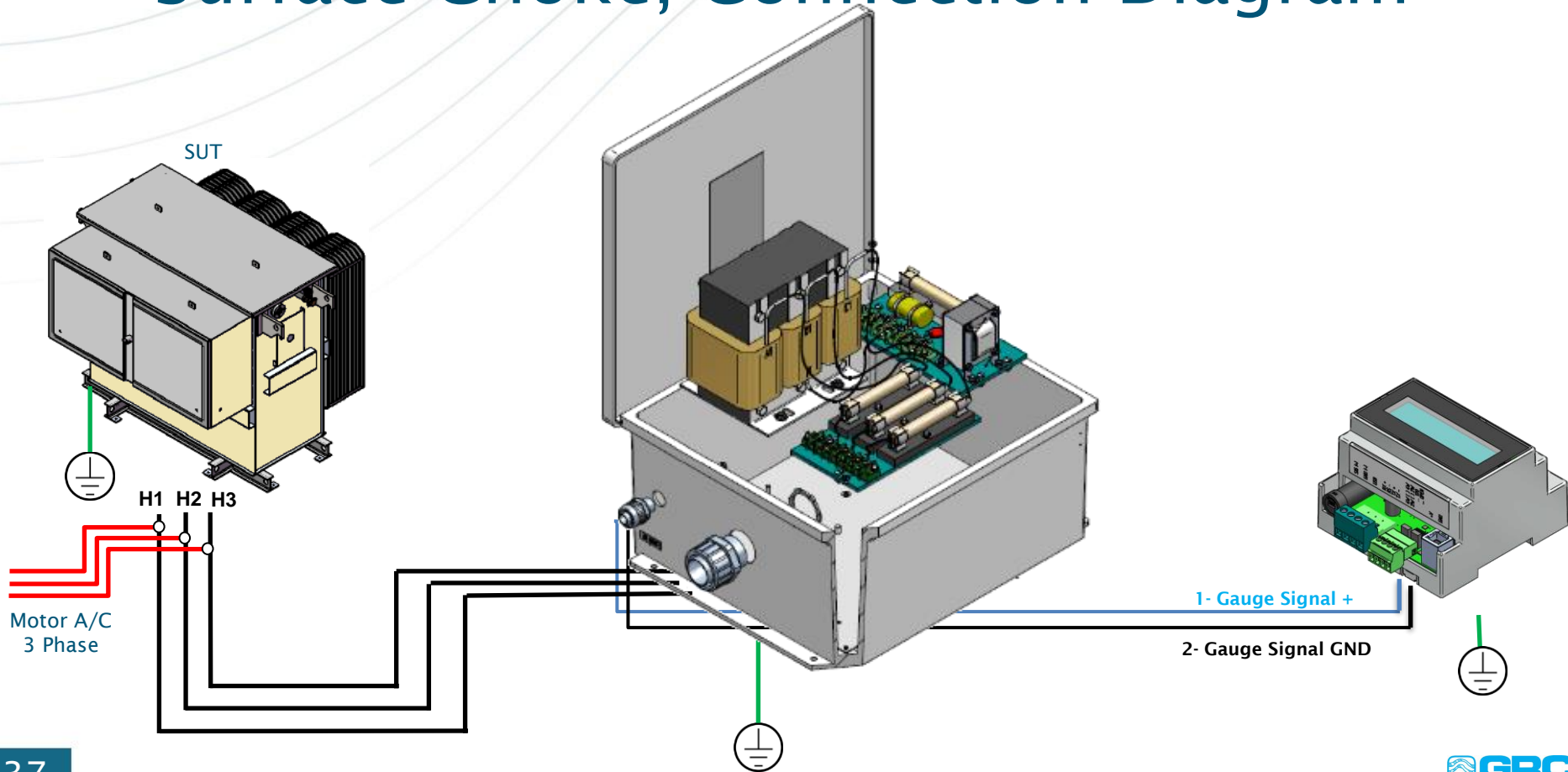
**GOOD GROUND EVERY TIME !!!**



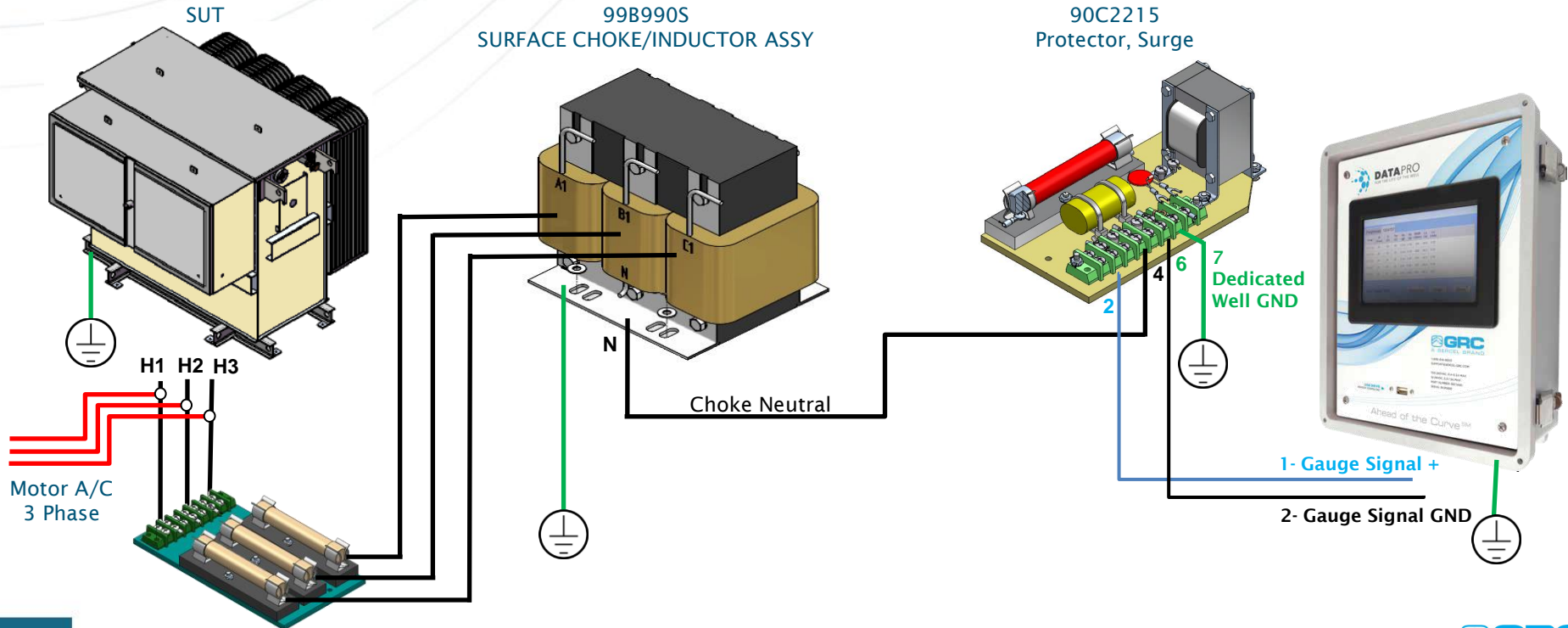
# Surface Choke, Connection Diagram



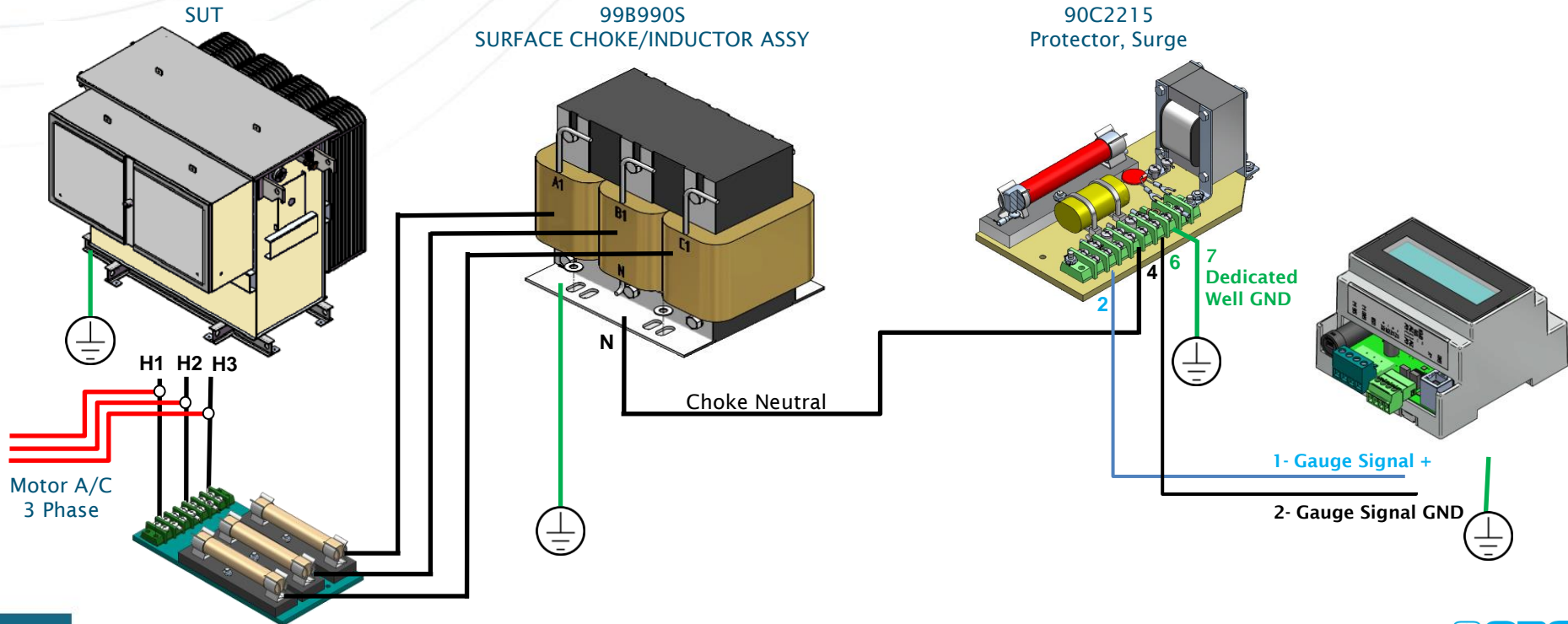
# Surface Choke, Connection Diagram



# Surface Choke, Connection Diagram



# Surface Choke, Connection Diagram





ELECTRIC  
SUBMERSIBLE PUMP



Tea Break..!



Coffee  
Break

# Let's Take a Break



# Surface Acquisition Units

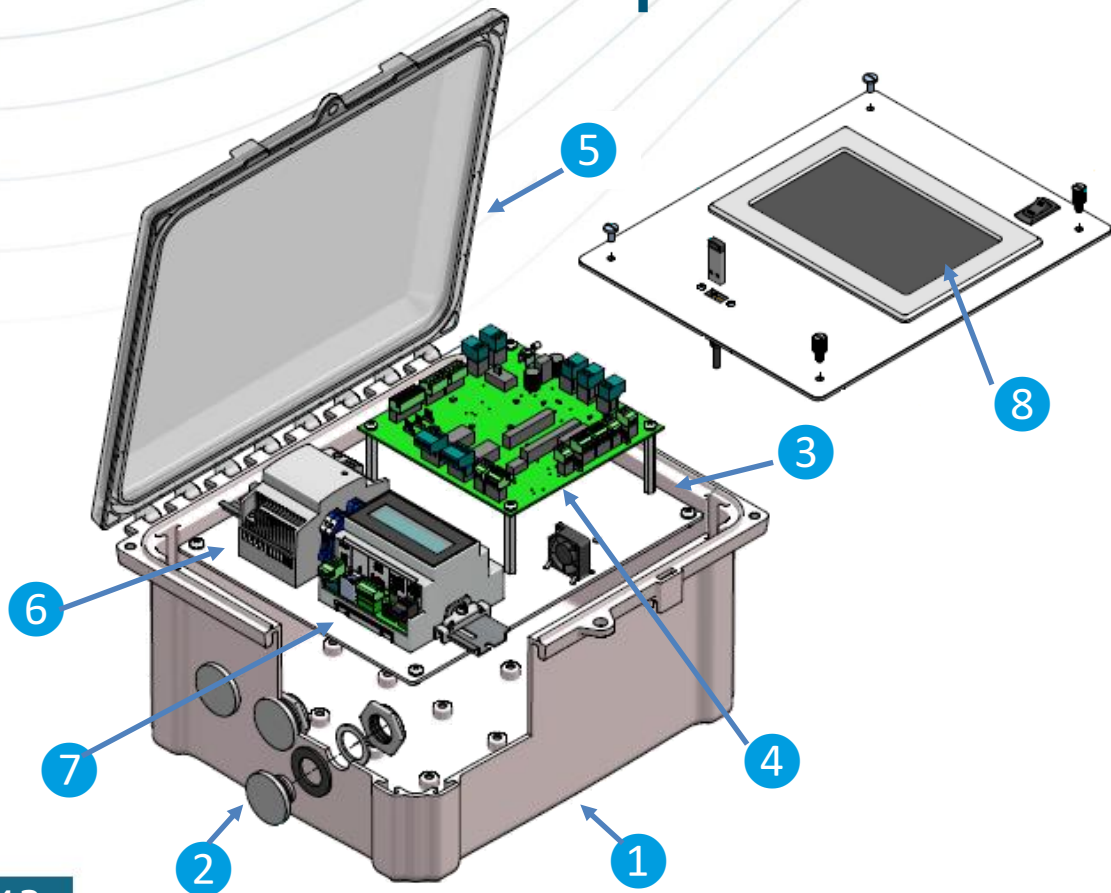


# Surface Acquisition Units, Data Pro

<b>Product:</b>	<b>SURFACE DAQ UNIT,DATA PRO,1 SPS</b>
<b>Part Number:</b>	<b>99C1440-3001000</b>
<b>Operating Temp Range:</b>	<b>-20°C to +60°C</b>
<b>DC Operating Voltage;</b>	<b>+12VDC (2.4A) to +24VDC (1.5A)</b>
<b>Capable of handling 3A of inrush current on startup</b>	
<b>AC Operating Voltage:</b>	<b>100VAC Min (400mA) to 240VAC Max (200mA)</b>
<b>Frequency:</b>	<b>50Hz - 60Hz</b>
<b>Display:</b>	<b>7-inch Color LCD, resolution 840 x 480</b>
<b>User Interface:</b>	<b>Touch-Screen LCD Enclosure Dimensions: 12" x 10" x 5"</b>
<b>Enclosure Rating:</b>	<b>NEMA-4X</b>

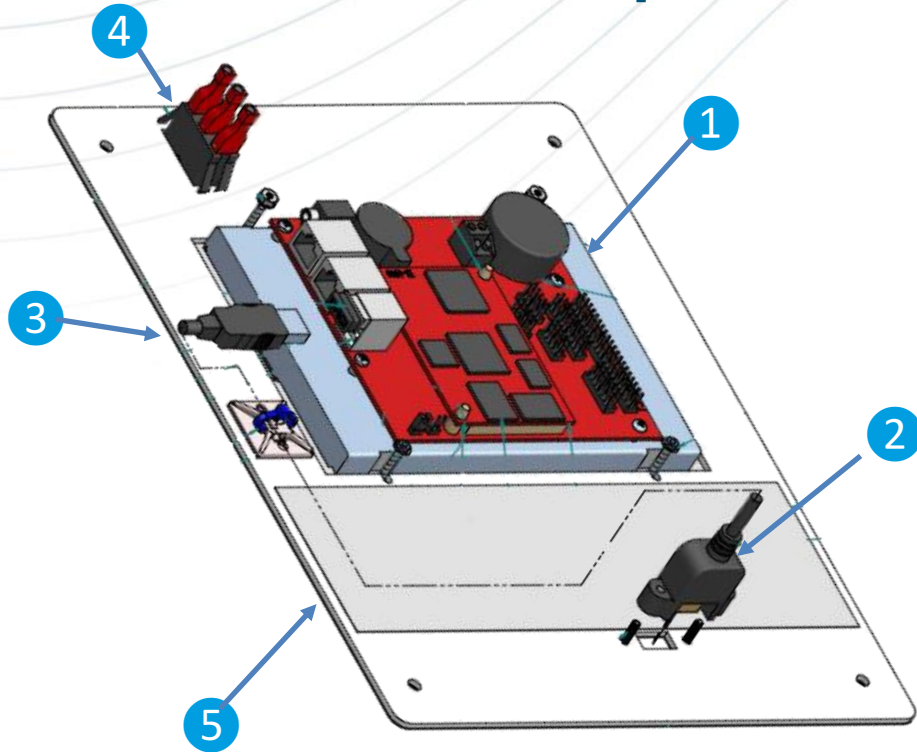


# Surface Acquisition Units, Data Pro



Item	Description / Descripción
1	ENCLOSURE (STD)
2	NON METALLIC ENCLOSURE HOLE PLUG
3	PANEL, INTERIOR MOUNT, DATA PRO
4	PCB ASSY, DATA PRO
5	LID CLEAR COVER
6	POWER SUPPLY, 12VDC 3.0A
7	SPS-1500 ASSEMBLY
8	CAPTIVE PANEL

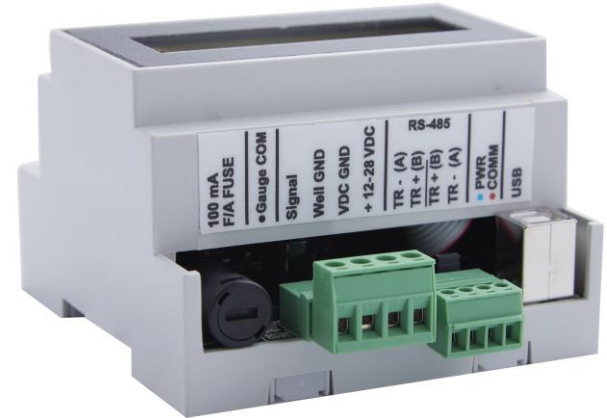
# Surface Acquisition Units, Data Pro



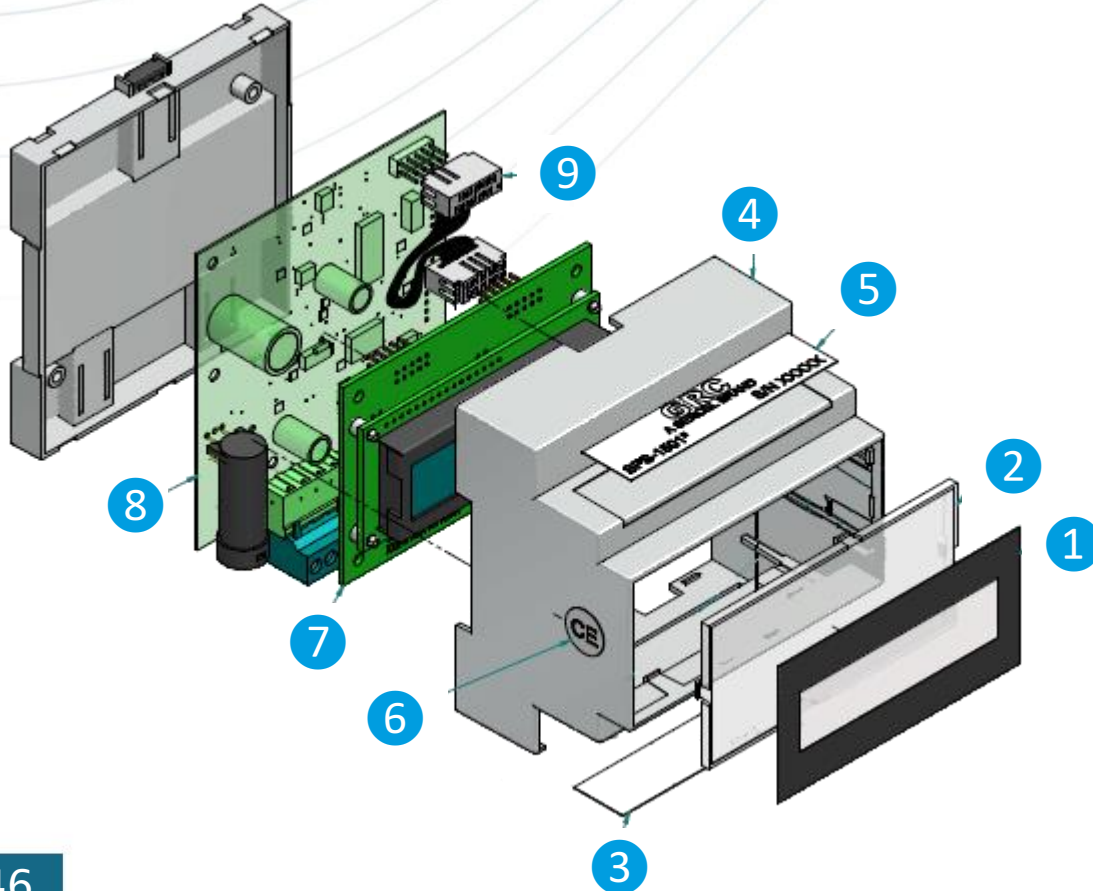
Item	Description / Descripción
1	7" VIDEO 1GHZ CPU MOUNTABLE PANEL
2	USB 2.0 EXTENSION CABLE
3	USB 2.0 EXTENSION CABLE
4	POWER SWITCH
5	DATA PRO FRONT PANEL

# Surface Acquisition Units, SPS-1500

<b>Product:</b>	SPS-1500
<b>Part Number:</b>	90B3125
<b>Display:</b>	16x2 Backlit LCD
<b>Dimension:</b>	3.68 x 4.07 x 2.30 in (LxWxH)
<b>Voltage Input:</b>	12 to 28 VDC, 0.5 Amp Max
<b>Polling Interface:</b>	RS-485/RS422 Isolated Modbus
<b>Gauge Power Out:</b>	40 to 80 VDC Out (~80mA Current Limited)
<b>Gauge Power Fuse:</b>	100mA, GRC P/N 043-0047-00
<b>Mounting Type:</b>	DIN rail
<b>Weight:</b>	0.500 lb.



# Surface Acquisition Units, SPS-1500



Item	Description / Descripción
1	LCD BEZEL COVER LABEL CUBIERTA DEL BISEL LCD
2	FRONT PANEL, FLAT TRANSPARENT PANEL FRONTAL TRANSPARENTE
3	SPS1500 PRODUCT WIRING LABEL ETIQUETA DE CABLEADO SPS-1500
4	ENCLOSURE ENCERRAMIENTO
5	SPS1501 PRODUCT IDENTIFICATION LABEL ETIQUETA DE IDENTIFICACIÓN
6	LABEL, CE IDENTIFICATION ETIQUETA DE IDENTIFICACION CE
7	PCB ASSY, SPS1500L LCD PCB DE PANTALLA
8	PCB ASSY, SPS1500L ESP PWR SPLY PCB SPS-1500 FUENTE DE PODER
9	CABLES 10P 6 SKT CABLE RIBBON

# Surface Acquisition Units, SPS-1500P

**Product:** SPS-1500P,RIH PORTABLE SAU

**Part Number:** 10036692

**Display:** 16x2 Backlit LCD

**Polling Interface:** RS-485/RS422 Isolated Modbus

**Operating Temperature:** -10°C~+40°C

**Storage Temperature:** -40°C ~+70°C

**Input Voltage AC:** 100 – 264VAC (50 – 60Hz)

**Display:** 16x2 Backlit LCD

**Dimension:** 12.53 x 10.13 x 6 in (LxWxH)

**Weight:** 6.00 lb.

**Enclosure Rating:** IP67

**Case Material:** NK-7 high impact polypropylene





ELECTRIC  
SUBMERSIBLE PUMP



Tea Break..!



Coffee  
Break

# Let's Take a Break