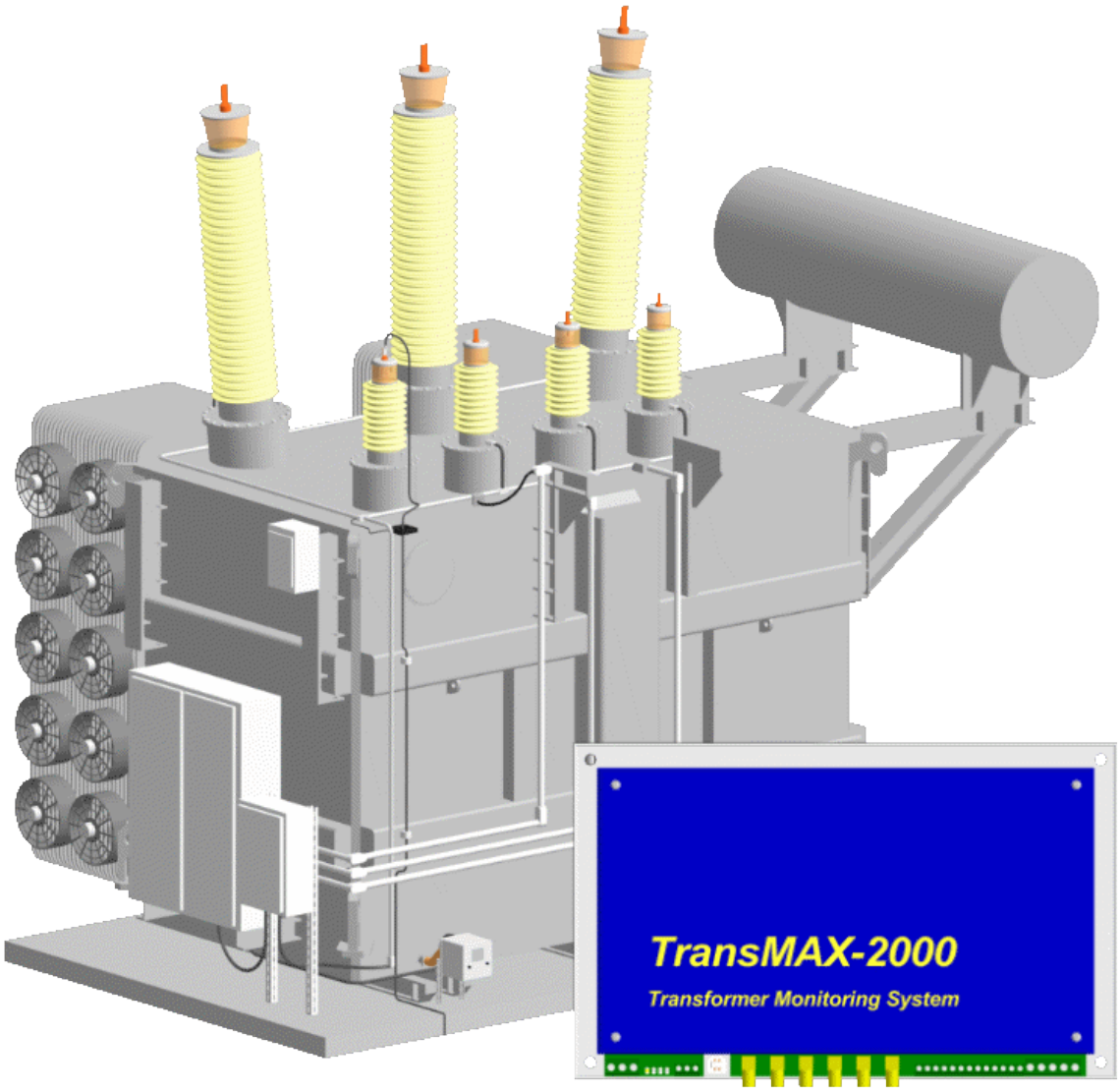


TransMAX-2000

User's Manual

Rev. 03-2023

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Introduction

The Transformer Monitoring System (transMax-2000) is designed to simultaneously monitor 2 of three-phase bushing groups, free-standing CTs using analysis of the bushing leakage current.

The device incorporates three different measurement modes on each tested component to provide accurate Power Factor and Capacitance values to evaluate the condition of the insulation. The measurement modes are:

Phase Comparison – compares the power factor of the tested component with another tested component energized with the same phase voltage.

The sum of three current tests – measures the imbalance current from the summation of A, B, and C phase currents from three tested components such as the three HV or LV bushings on the transformer.

Adjacent phase reference test – compares the power factor of the tested components with other phase components on the same equipment.

The bushing sensors/adapters are connected to the capacitor taps designed for all types of bushings to allow measurement of the leakage current up to 140 mA. The adapters are designed for bushings with grounded and undergrounded capacitor taps. The adapter is designed to prevent a voltage developing on the equipment should the sensor become disconnected from TransMax-2000.

Technical Specification:

Power supply	90 … 264 VAC, 47…63 Hz
Surge with stand	ANSI/IEEE C 37.90.1~1989
Ambient operating temperature	-40°C to 65°C
Storage temperature	-40°C to 85°C
Physical dimensions	19.0” X 21.0” X 8.0” Stainless Steel enclosure
Alarm relay output	2 relays with contacts rated 8A & 125 VAC
Number of channels	3 or 6
Leakage current input	0.1 … 140 mA RMS
PD frequency ranges: • high frequency (HF) • ultra-high frequency (UHF)	 0.5 … 20 MHz 0.3 … 1.5 GHz
Number of load current inputs	Up to 3
Number of temperature inputs	Up to 2
Ambient Temperature and Humidity	1 + 1
Number of humidity inputs	1
Communication	• Proprietary protocols (Serial / Ethernet) • Modbus RTU / Modbus TCP • DNP 3.0 Serial / DNP 3.0 Ethernet • etc.

Bushing sensors:

Rated Transformer Voltage	Any Voltage
Type of Capacitor Tap	Any manufacturer
Temperature Range	-55°C to +90°C, 95% Relative Humidity (non-condensing)
Installation Environment	Outdoor, no corrosive agents in the air
Maximum Permitted Power Frequency Current Through Bushing Insulation	140 ma, RMS
Maximum 60 Hz Voltage at the Tap at Monitoring	2.5 kV
Maximum Possible 60 Hz Voltage on the Tap at Opened or Mistakenly Cut Coax Cable	120 Volts

Output data:

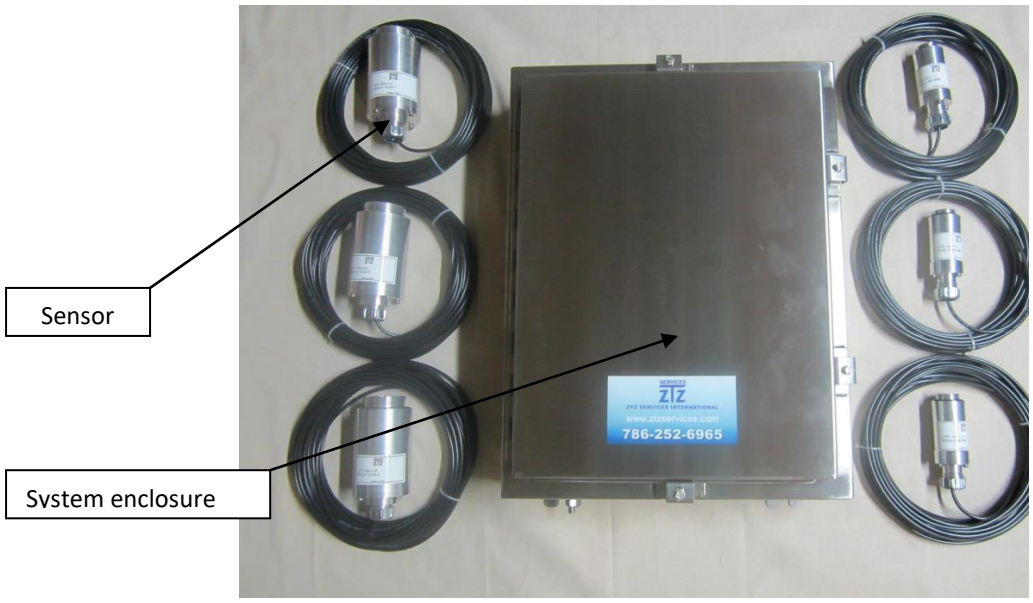
Measured data	Range	Resolution	
Power Factor	0 … 100%	0.01%	Power comparison mode
Current	0 … 140 mA	0.1mA	
Capacitance	100 … 5000pF	0.1 pF	Phase comparison mode
Imbalance Current phase angle	0 … 360 deg.	0.1 degree	
Partial discharge intensity	0 … 5000 mW	0.1 mW	
PD amplitude	0.02 … 100 nC ± 10 V	0.01 nC 0.01 V	
ADC		16 bits	
The sampling rate for 6 channel simultaneously sampling: • Leakage current monitor • Partial discharge monitor		 10 kHz 100 MHz	

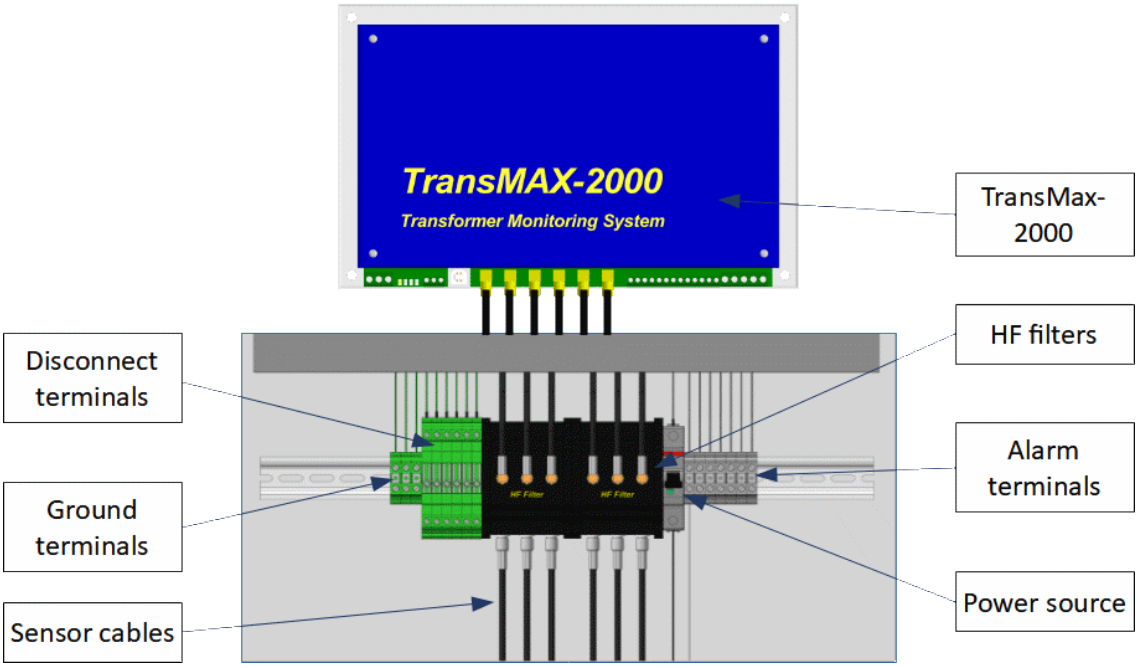
Product Description

The following section describes the connection layout to the TransMax-2000 enclosure and the parts included.

The TransMax-2000 system includes:

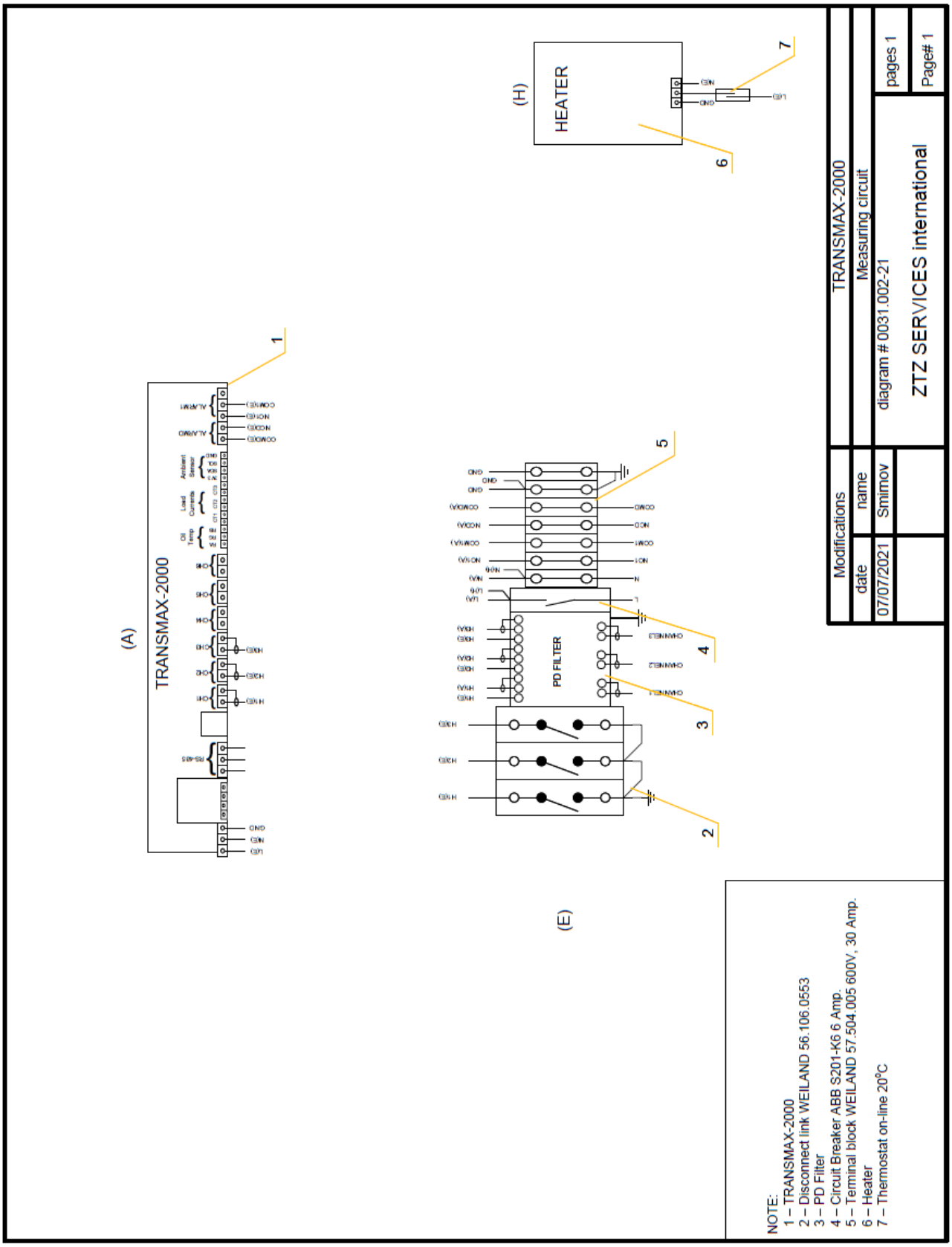
- TransMax-2000 enclosure;
- Bushing sensors;
- Ambient temp. and hum. Sensor
- Load current sensors (optional)
- Transformer temperature sensors (optional)
- Software;
- Communication cable;



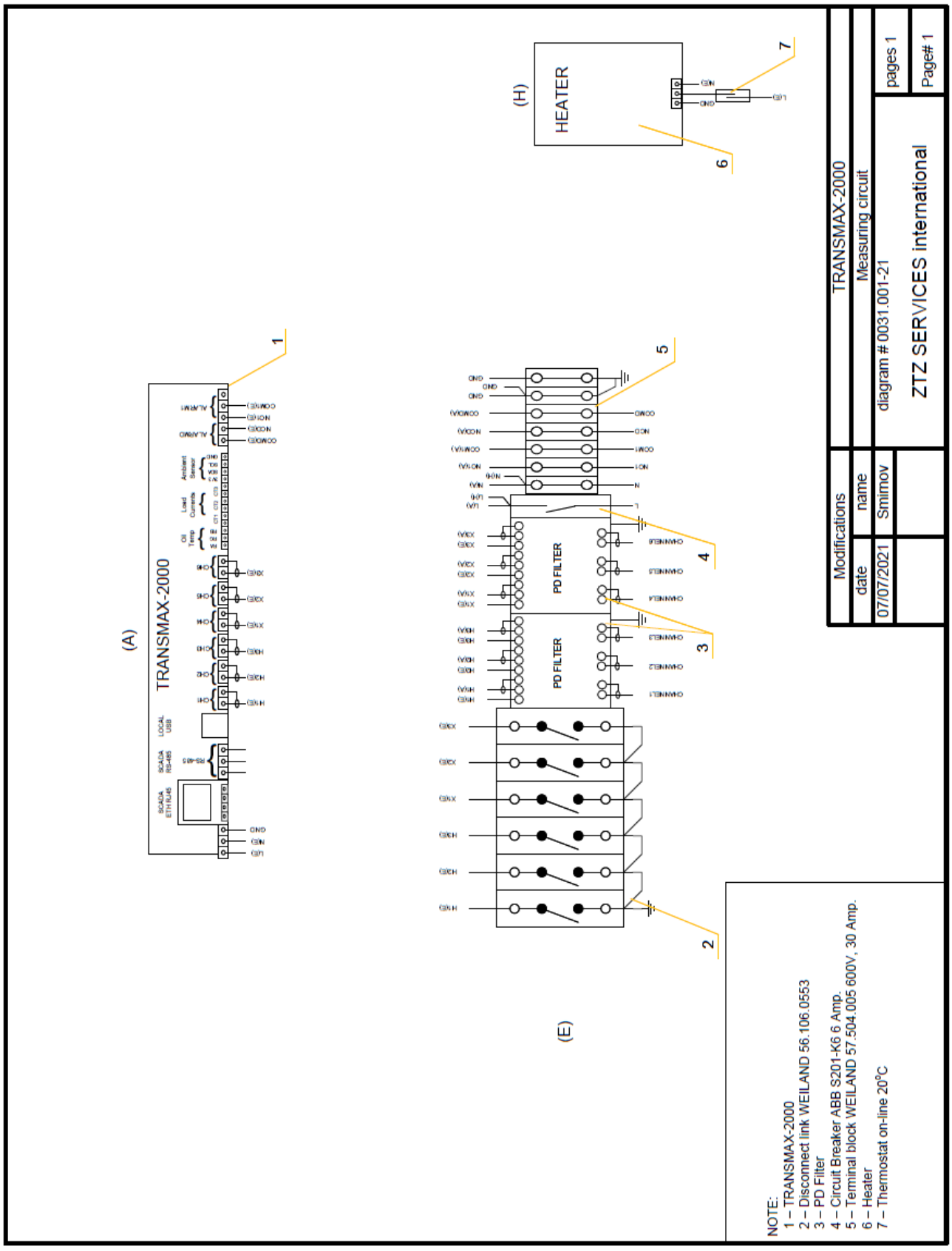

TransMAX-2000
Transformer Monitoring System
TransMax-2000
HF filters
Disconnect terminals
Alarm terminals
Ground terminals
Power source
Sensor cables

Connections layout

3-channel TransMax-2000 system

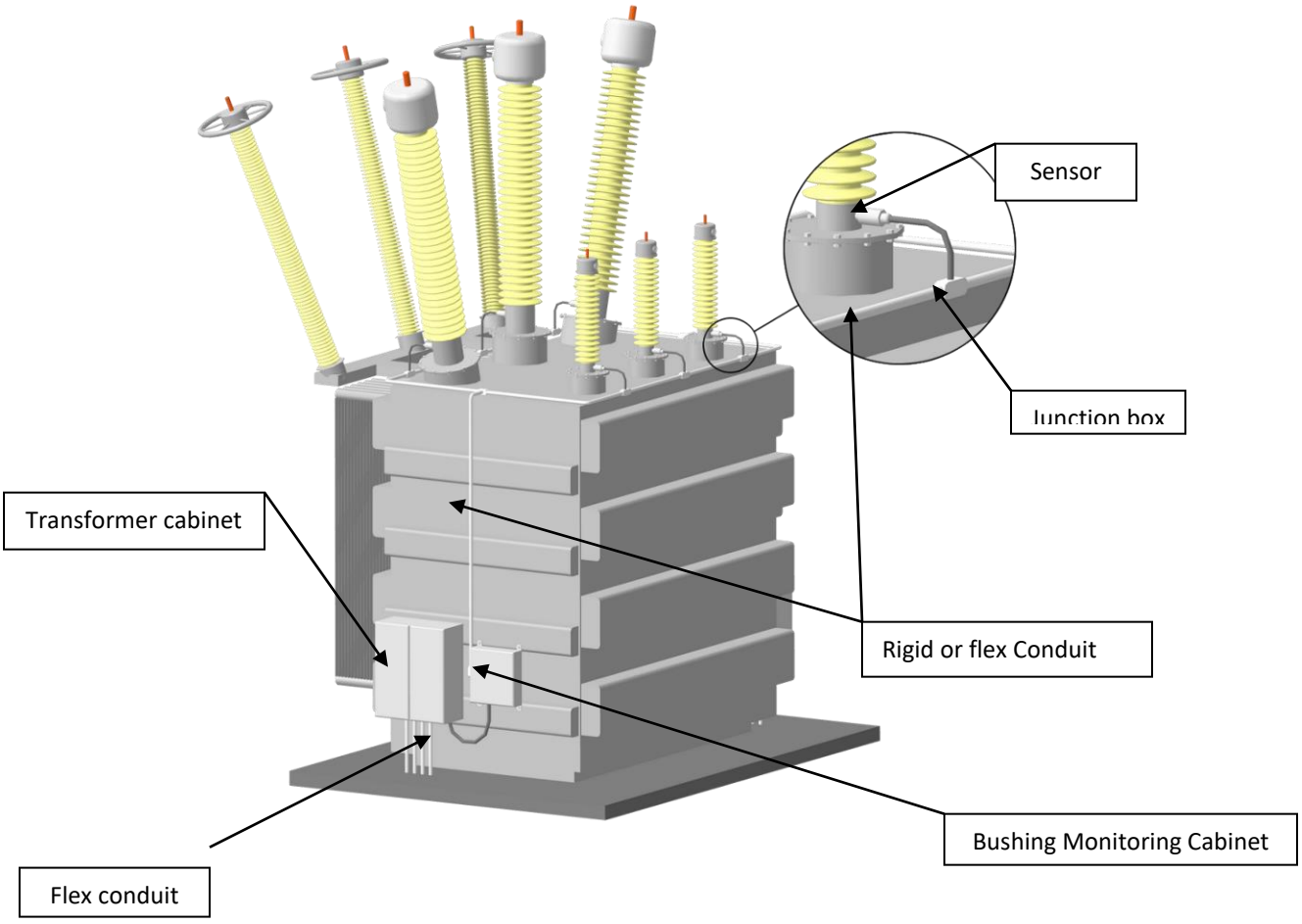


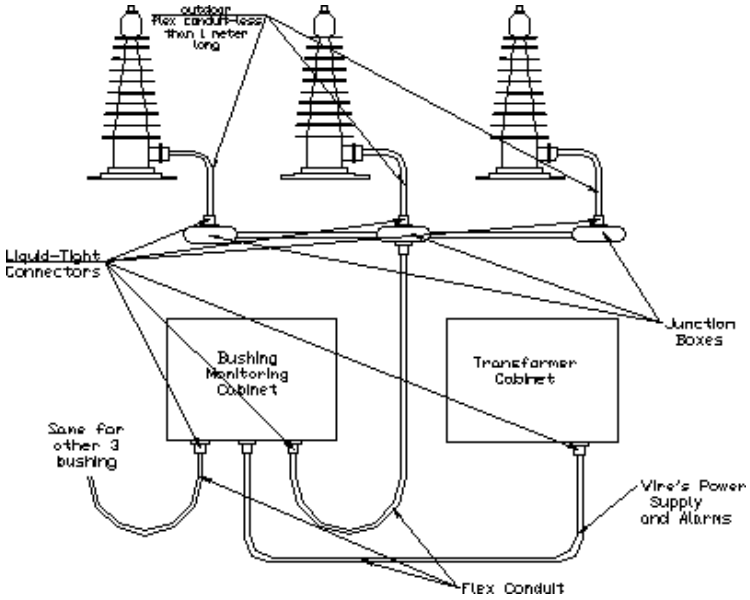
6-channel TransMax-2000 system



Installations and connections

This section gives information on the hookup of power, TRANSMAX-2000 enclosure dimensions, and installing TransMax-2000 enclosure and sensors to the bushings on the transformer.





Mounting the TransMax-2000 Enclosure

TransMax-2000 enclosures are intended for outside installation. For TransMax-2000 enclosure dimensions (inches) – see Figure 3.1.1.A and Figure 3.1.1.B

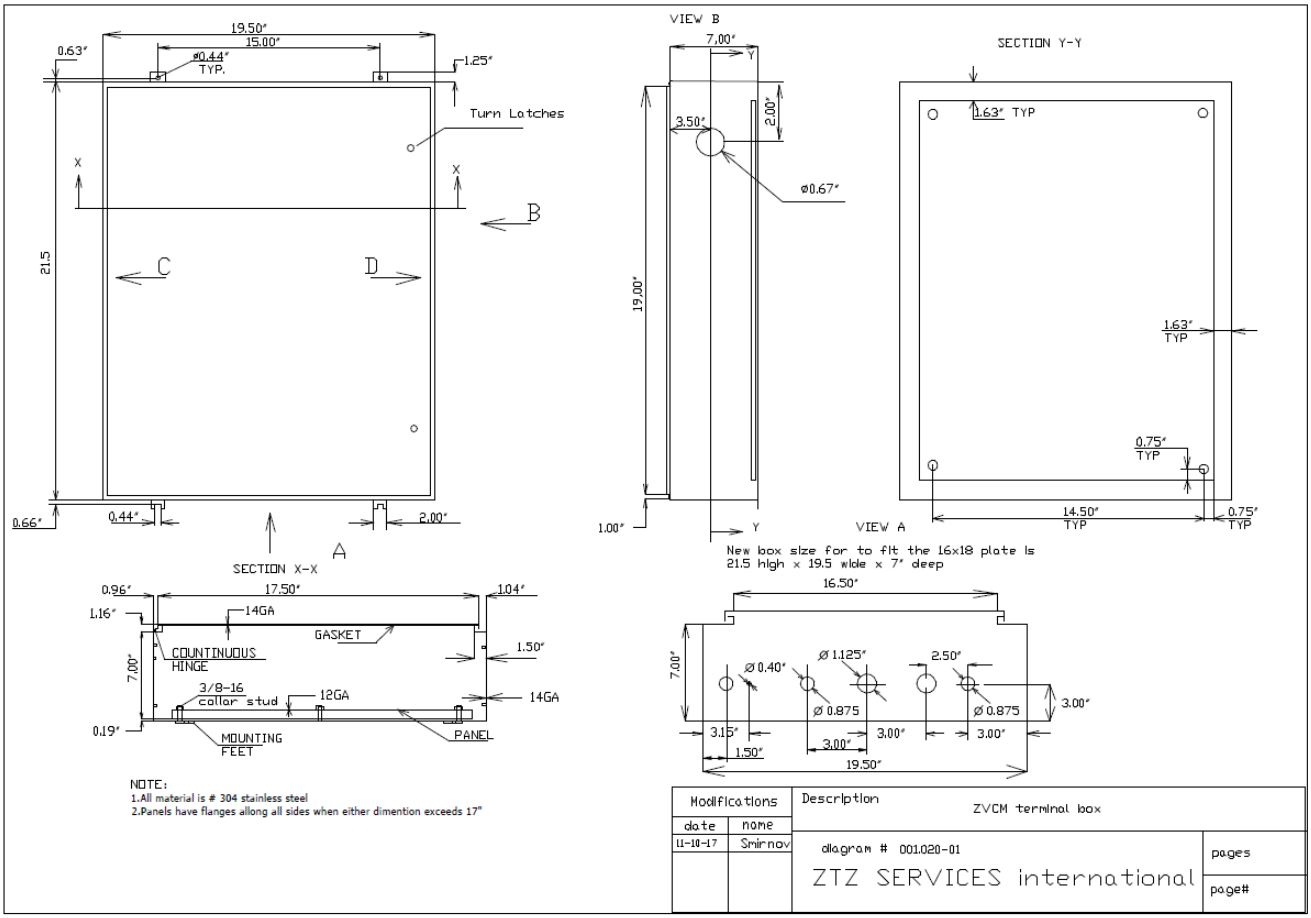


Figure 3.1.1. TransMax-2000 Enclosure for 3 and 6 channel

The TRANSMAX-2000 enclosure is installed on a stand-alone rack or attached to the wall of the transformer tank. If the TRANSMAX-2000 enclosure is mounted on the transformer tank, vibration buffers need to be installed (Figure 3.1.2.B).

For sample mounting of the TransMax-2000 enclosure – see Figure 3.1.2



Figure 3.1.2.A

TRANSMAX-2000 Enclosure installed on a

on a stand-alone rack

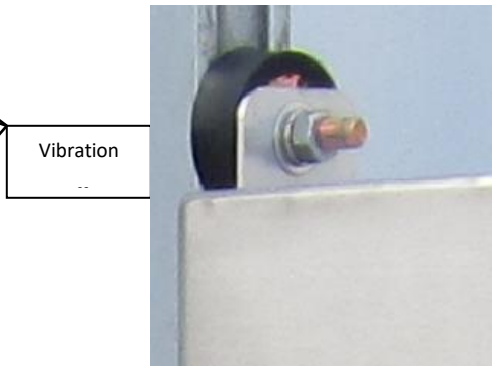
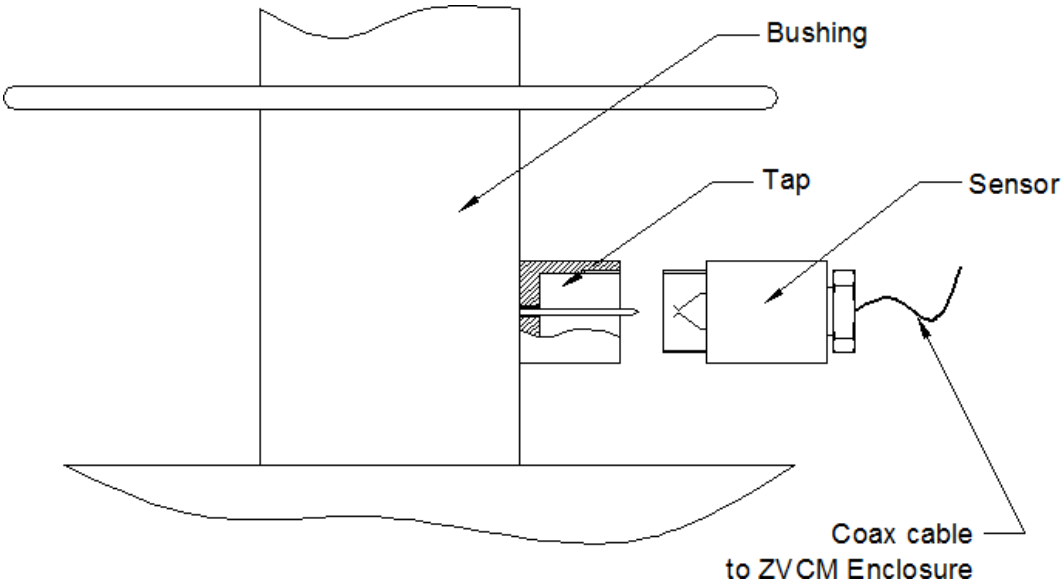


Figure 3.1.2.B

TRANSMAX-2000 Enclosure to the transformer tank

Mounting the bushing sensors

The bushing sensors are connected to the capacitor taps.



Preparation and installation of sensor:

General view of a sensor:



Check of a sensor before installation:

Using a multimeter, measure the resistance between the cable sheath and the body of the sensor and the central wire of the coax cable and the sheath. It should be approximately 1000 Ohms±15% for resistive type sensors and 1080 nF±15% for capacitive type sensors.





Unscrew the manufacturer grounding tap off the bushing body.




Clean inside the tap.

Coat the threads bushing sensor and tap with a light layer of petroleum jelly.

Install the sensor to the capacitor tap.



Check of a sensor after installation:

After installing the sensor to the bushing tap, measure the resistance between the central wire of the coax cable and the shield.



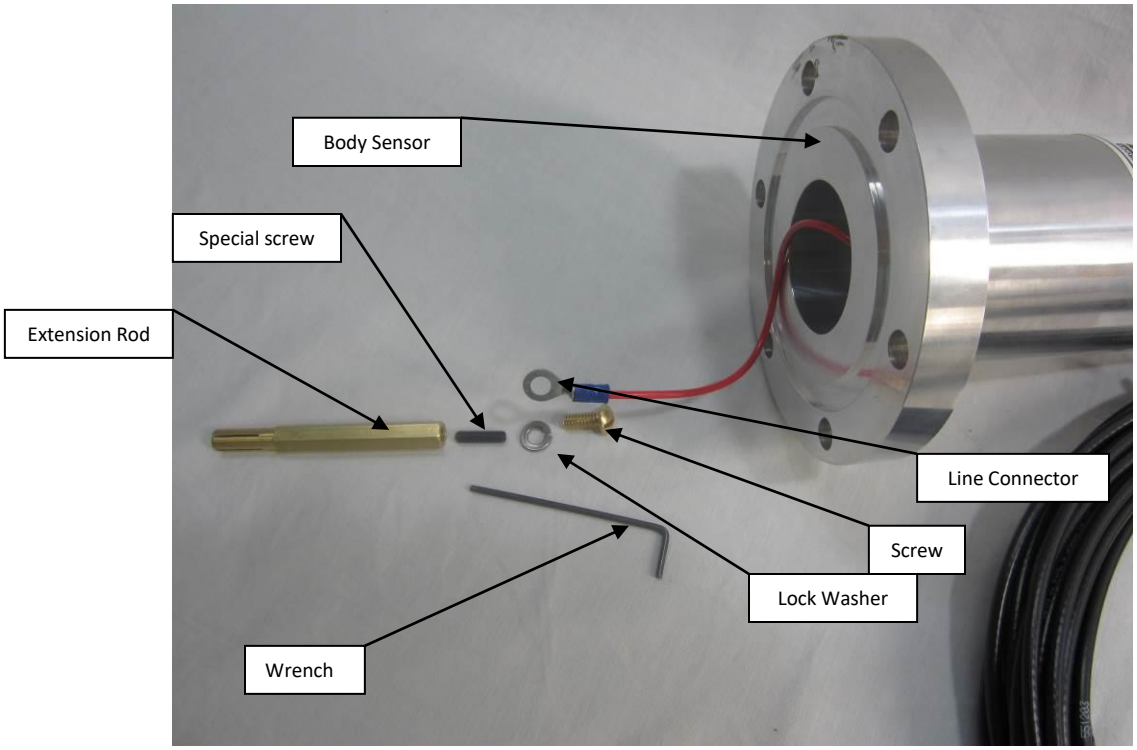
The sensor coax cable is pulled through a flex conduit or pipe.



The part of the cable entering the sensor must be protected by a flexible ½" conduit.

Preparation and installation of flange sensor:

General view of a sensor:



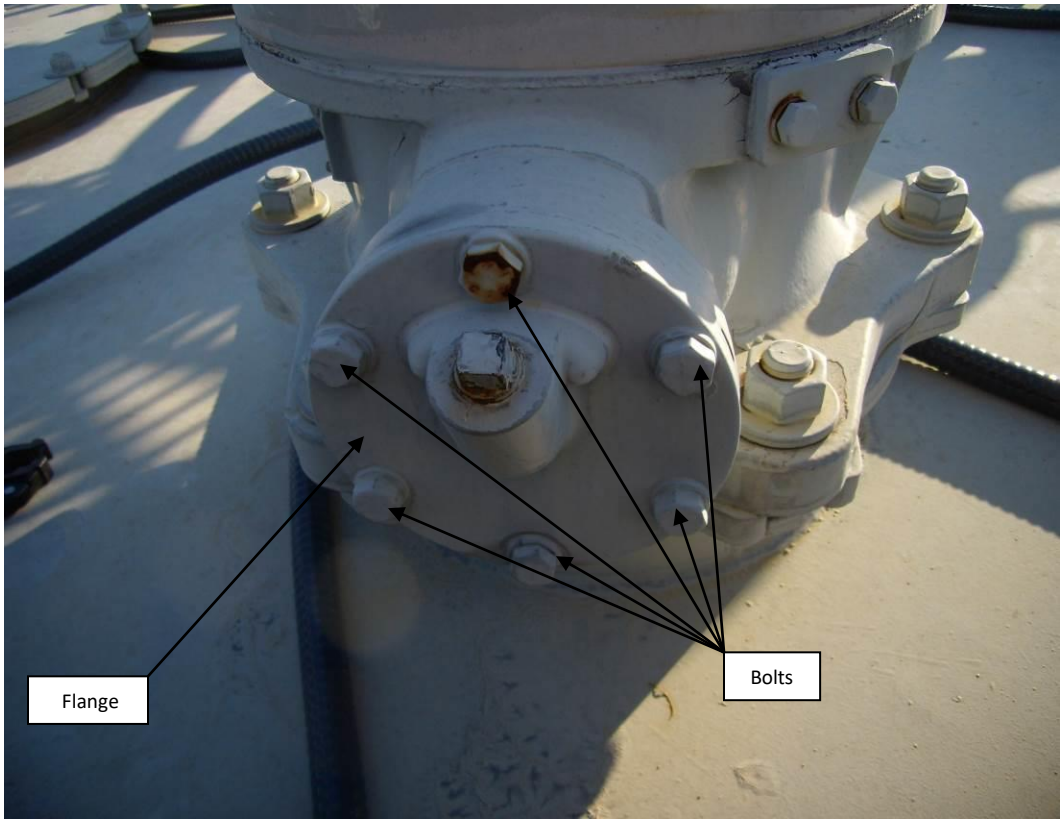
Check of a flange sensor:

Using a multimeter, measure the resistance between the cable sheath and the body of the flange sensor and the central wire of the coax cable and the sheath. Measure the resistance between the central wire of the coax cable and the sheath or body of the sensor. It should be approximately 1000 Ohms~15%.





Remove the manufacturer flange from the body.



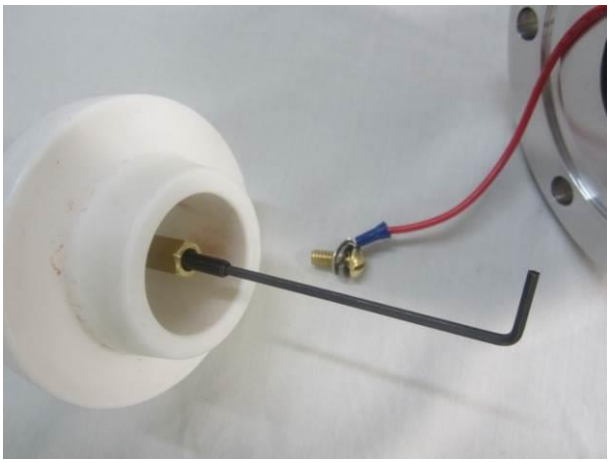
Clean inside the tap.

Insert the extension rod into the capacitor tap.

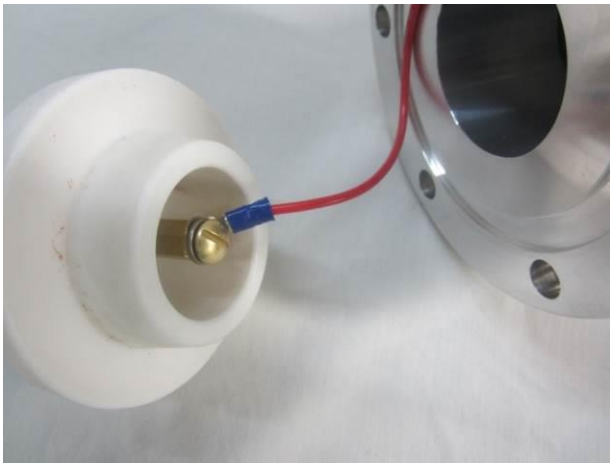




Insert a special screw into an extension rod and tighten it.



Install line with O-ring from sensor to the extension rod and bolt screw.



Install the flange sensor to the capacitor tap and tighten it.

After installing the flange sensor to the bushing tap, measure the resistance between the central wire of the coax cable and the sheath or body of the sensor.

The sensor's coax cable is pulled through flex conduit and/or rigid conduit.



The part of the cable entering the sensor must be protected by a flexible ½" conduit.

Bushing sensors connected to the TransMax-2000 enclosure.

Inside the TransMax-2000 cabinet, depending on the number of channels, 1 or 2 High-Frequency filters (HF-filter).

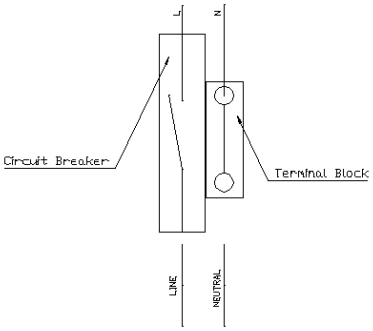
Sensors coax cable termination in the TransMax-2000 enclosure.

For sensor connection to the HF filters use a standard TNC connector for RG-58 cables. The cable preparation requirements are in Appendix 1.

After the TNC connector crimping check the resistance/capacitance (depending on sensor type) of the sensor again to be sure that the connector was terminated properly

Power hookup

The Bushing Monitoring System can be powered with AC voltage from 120~240 VAC ± 10%. Power is connected from the TRANSMAX-2000 enclosure. The line can be connected to the circuit breaker and neutral to the terminal block (see Figure 3.4.1).





Wiring the alarms

The Bushing Monitoring System monitors two sets of three bushings and has alarms for HV and LV bushings.

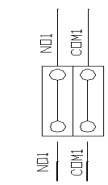




Figure 3.5.1 A

3 channels

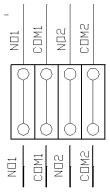
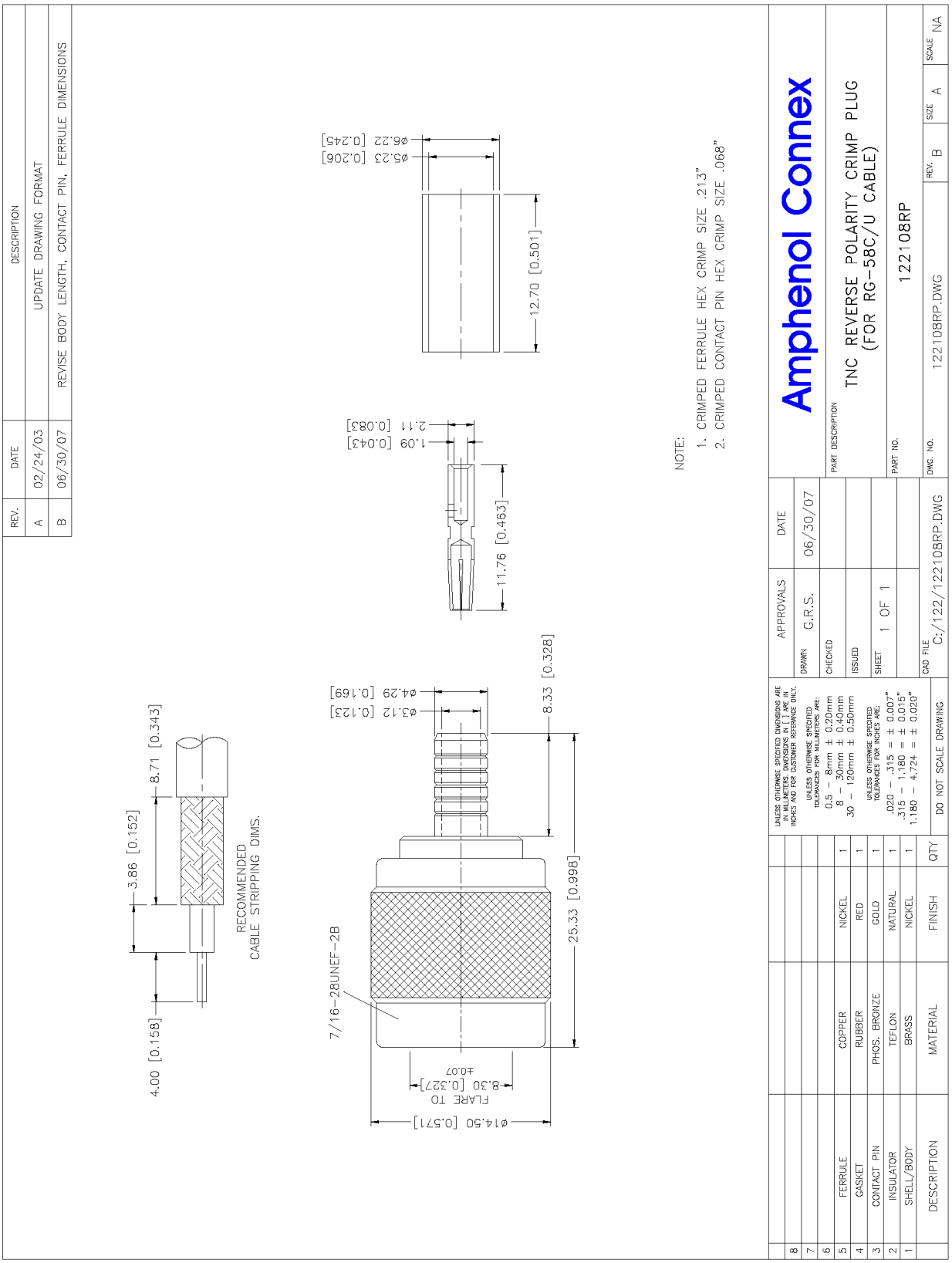




Figure 3.5.1 B

6 channels

Appendix 1


REV. | DATE | DESCRIPTION
A | 02/24/03 | UPDATE DRAWING FORMAT
B | 06/30/07 | REVISE BODY LENGTH, CONTACT PIN, FERRULE DIMENSIONS
NOTE:
1. CRIMPED FERRULE HEX CRIMP SIZE .213"
2. CRIMPED CONTACT PIN HEX CRIMP SIZE .068"
Ø6.22 [0.245]
Ø5.23 [0.206]
12.70 [0.501]
2.11 [0.083]
1.09 [0.043]
11.76 [0.463]
Ø4.29 [0.169]
Ø3.12 [0.123]
8.33 [0.328]
25.33 [0.998]
7/16-28UNEF-2B
Ø14.50 [0.571]
FLARE TO
8.30 [0.327] ±0.07
3.86 [0.152]
8.71 [0.343]
4.00 [0.158]
RECOMMENDED
CABLE STRIPPING DIMS.
Amphenol Connex
TNC REVERSE POLARITY CRIMP PLUG
(FOR RG-58C/U CABLE)
122108RP
APPROVALS | DATE
DRAWN G.R.S. 06/30/07
CHECKED
ISSUED
SHEET 1 OF 1
CAD FILE C:/122/122108RP.DWG
DWG. NO. 122108RP.DWG
REV. B
SIZE A
SCALE NA
DESCRIPTION | MATERIAL | FINISH | QTY
FERRULE | COPPER | NICKEL | 1
GASKET | RUBBER | RED | 1
CONTACT PIN | PHOS. BRONZE | GOLD | 1
INSULATOR | TEFLON | NATURAL | 1
SHELL/BODY | BRASS | NICKEL | 1
DO NOT SCALE DRAWING