P.O. Box 185
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RTD TEMPERATURE SENSING SYSTEM

General Overview

The Prime Technology RTD Temperature System 9219-00-0002 is a three-channel temperature measuring system that utilizes two RTD Temperature Sensor inputs per channel. The system is being offered for application to the temperature measuring of ordnance stowage areas on the SSGN upgrade.

The Prime Technology RTD Temperature System 9219-00-0003 is a one-channel temperature measuring system that utilizes two RTD Temperature Sensor inputs. The system is also offered for application to temperature measuring of ordnance stowage areas on the SSGN upgrade.

The 9219-00-0003 RTD Temperature System (Reference Figure 1) consists of the following modules;

- One One channel chassis (part number 9211-04-2000),
- One RTD Smart Indicator Module (part number 921222BA12A0027),
- One RTD Interface Module (part number 9219-96-0001),
- One Power Supply Assembly (part number 9211-96-0001)
- Two RTD Sensors (part number 9220-04-0003).

The 9219-00-0002 RTD Temperature System (Reference Figure 2) consists of the following modules;

- One three channel chassis (part number 9211-04-4000),
- Three RTD Smart Indicator Modules (part number 921222BA12A0027),
- One RTD Interface Module (part number 9219-96-0001),
- One Power Supply Assembly (part number 9211-96-0001), and
- Six RTD Sensors (part number 9220-04-0003).

The architecture of this design is based on Prime Technology's Model 9219 Temperature Indicator System that is used on the Virginia Class Submarine as the Lockout Trunk Indicator System. The Model 9219 System has been designed and [is to be] qualified to Electric Boat's (EB) Specification 4195. The design modifications required to meet this new application include updating the chassis Assembly of the 9219 to provide for two RTD input sensors per channel and to accommodate the addition of the RTD Interface Modules.

The new design efforts required for this project are the following.

- The RTD Interface Module
- The 4 bay (3 channel) 9211 chassis assembly
- The New RTD Sensor

The Power Supply and RTD Smart Indicator Modules (Prime Technology Model 9212) will be used without change except the additional software features added for the Smart Indicator.

The RTD Temperature Sensor is the "normal" pressure RTD Temperature Sensor that is a modification of the High Pressure design, used by the Lockout Trunk application, to reduce costs through redesigning the housing for the reduced specification requirements. The new design sensor will also have a much faster thermal response time that will fit the RTD Temperature System requirement.

We will provide similarity claim documentation for the system, less the sensor, based on former qualification data. The similarity data is assumed to be acceptable in forming the basis of this proposal. We have included pricing for qualification, including the plan and report, for the new RTD Sensor. The qualification will consist of vibration, shock and a thermal response tests.

Figures 1 and 2 show a block diagram of the single channel and 3 channel systems respectively. The Power Supply and RTD Interface Module will be the same for both configurations. The RTD Interface Module will be electrically the same in both configurations but will have different front panel assemblies.

Chassis

The chassis is used to house all of the sub-assemblies. It also contains the motherboards that interface to the sub assemblies as well as a channel selector switch (this switch is used on the three-channel chassis only), an Ext Alarm Switch and the common alarm circuitry. The chassis also includes all of the electrical interface connectors required.

The Channel Selector switch is used to select a channel. The numbers on the Selector switch indicate the channel selection. The Ext Alarm switch is used to disable the external alarm. The Alarm Acknowledge, Test, up/down switches, the cloning connector and the test potentiometer are located on the Power Supply Assembly front panel. These controls are used to calibrate, test and clone (patent by Prime Technology) the Model 9212 Smart Indicator.

The power comes in on connector J1. The RTDs used in each ordnance space share a connector. The connector for channel one is J4, channel 2 is J5 and for channel 3 is J6. The common alarm interface connector is on J2 and the External Alarm interface is on J3.

Note: The one-channel system uses only J1 thru J4.

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Power Supply Module

The power supply module consists of an AC to DC power supply, illuminated fuse holder, AC power on indicator, Power on/off switch, set switch, alarm acknowledge switch, test potentiometer, test switch, up/down switch and cloning (Prime Technology patented Technology) port connector

The AC to DC power supply converts 115vac 60hz, switched, fused power into unregulated +24vdc that is used by the modules in the panel.

The test potentiometer, test switch, and channel select switch are used in conjunction to apply an internally generated test signal to a particular RTD Smart Indicator Module when the channel selector switch is in that channel's position and the test switch is in test mode.

The Alarm Acknowledge switch is used to reset the local alarm lamp when an alarm is on. When the switch is moved into the alarm acknowledge position, and an alarm exists, the alarm indicator on the power supply module turns off. The Set and UP/DN switches are used for setup of the alarm levels on the Smart Indicator modules as well as other selectable features. The cloning port is used to clone the curve characteristics from the Smart Indicator located in the channel one position to the Smart Indicator to be updated.

RTD Smart Indicator Modules

The RTD Smart Indicator Module, the Prime Technology Model 9212, is used to process RTD information, display the temperature of the selected RTD, check for alarm conditions, and generate the output controls for the common alarm. The RTD signal used by the RTD Smart Indicator Module comes from the RTD Interface Module.

The RTD signal to the RTD Interface Module is a lead length compensated signal. The signal that the RTD Interface Module selects to send to the RTD Smart Indicator Module is the highest temperature of the two RTDs connected to the RTD module. The Interface module makes the selection and applies that signal to the RTD Smart Indicator Module.

The change required to the Model 9212 Smart Indicator design include software updates to allow for serial data to and from the RTD Interface Module. The Smart Indicator from this application can be used in other applications of the Smart Indicator however the changes as defined by this paragraph preclude the use of the standard Smart Indicator in this application.

RTD Interface Module

Reference figure 3 for the functional block diagram of the RTD Interface Module. The RTD Interface Module receives all of the RTD signals. The signals are then lead-length compensated. After the signals are compensated, which removes the errors due to the voltage drop across the RTD cabling lead-length, the two RTDs for each ordnance space are tested to validate that they are within the required range. If they are within a valid range they are compared to each other and the RTD signal that has the highest temperature is digitally communicated to the respective RTD Smart Indicator Module via the RS422 serial port. This results in a very accurate system not affected by

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analog signal errors. The RTD Smart Indicator Modules will record a fault if a new serial message with its respective address is not received within one second.

If an RTD is found to be out of the acceptable range, its bicolor Status LED on the front of the RTD Interface Module, is illuminated red. If the RTD is within the acceptable range, its status LED is illuminated green.

The RTD Interface module records and stores the temperature data as follows. The highest and lowest Temperature registration from each ordnance stowage space is time stamp stored in memory. This data is saved for the last seven days of operation. .

The RTD Interface Module displays the current highest and lowest temperatures on a small LCD display. There is one display for each channel located on the front of the RTD Interface Module. If the temperature history needs to be viewed, the RTD Interface module is selected by using the Chassis channel selector switch. The up and down switches on the power supply are then used to scroll thru the recorded history. Approximately Ten seconds after the last activation of the up or down buttons, the display will revert back to the current temperature automatically.

The same RTD Interface Module will be used in the one channel panel and the three-channel panel. A display mask in the front display area will need to be changed depending on whether it is a single or three channel panel.

To signify that the RTD Interface Module's processor is functioning normally, a blinking character will be displayed in the lower right corner of the LCD display.

A one-milliamp current source, which is derived from the RTD Interface Module, is applied to each RTD.

The RTD Interface Module is housed in a casing that is similar to the Model 9212 Smart Indicator module. It interfaces to the chassis utilizing the same method as the Model 9212 Smart Indicator. It slides into a bay designated for this module and interfaces through a rear connector into a mating motherboard connector. Accommodation of the added electronic module is the reason a 3-channel system utilizes a 4 bay chassis and a single channel system uses a 2 bay chassis. Reference figure 6 for mechanical properties of the RTD Interface Module.

Input Power

The input voltage used for powering the RTD systems will be 115vac 60hz. The single channel system will have a maximum current requirement of 250 mA AC while the three-channel system will have a maximum current of 600 ma AC.

Common Alarm

Both the single-channel and three-channel systems will have a set of common alarm contacts that will be capable of switching 24 Volts DC at 150 mA. The common alarm includes a supervisor, 6.8K-ohm ¼ watt +/- 5%, resistor across its contacts. If any of the channels exceed its temperature set point, a common and local alarm will be initialized. The local alarm will cause a relay to close,

which can be used to drive a remote bell to annunciate, and illuminates a light on the front panel of the temperature panel. The audible alarm, if used, can be silenced with a switch on the front of the temperature panel's power supply assembly. When the alarm is silenced, the alarm indicator on the power supply module starts flashing.

The alarm set point range is settable over the entire temperature range. An illuminated LED on the bargraph of the RTD Smart Indicator Module indicates the alarm set point. When the bargraph is illuminated at the set point, the LED is turned off. This allows the set point to continue to be identifiable because all the LEDs above and below the set point are illuminated.

System Accuracy

The system, excluding the RTD sensor, has an accuracy of +/- 1 degrees Fahrenheit in the range of 20 to 180 degrees Fahrenheit full scale. Inclusive of the RTD sensor, the accuracy is +/- 3 degrees Fahrenheit full scale.

Response Time

The response time to a change in temperature includes Panel and RTD sensor.

9220-04-003 New Design, low-pressure sensor response time is less than 1 minute when measured per procedure detailed in MIL-STD-24388.

Physical Dimensions

The single-channel panel configuration is as shown in figure 4.

The three-channel panel configuration is as shown in figure 5.

Weight

The single-channel Panel's weight will not exceed **TBD** pounds and the three-channel panel will not exceed **TBD** pounds.

Degree of Enclosure

Both panel's degree of enclosure are Drip proof to 45 degrees.

Insulation Resistance

Power inputs and chassis ground are isolated by greater than 10 Meg-ohms @ 500vdc.

The input power, signal inputs, and alarm outputs shall be isolated by greater than 10 Meg-ohms @ 500vdc.

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EMI

The Panels are designed to meet MIL-STD-461D and Mil-STD-461C as defined in EB Specification 4195.

Shock

The Temperature Panels are designed to meet MIL-S-901 as defined in EB Specification 4195.

Vibration

The Temperature Panels are designed to meet MIL-STD-167-1 as defined in EB Specification 4195

Temperature

The Temperature Panels are designed to operate in an ambient temperature range between 32 and 122 degrees Fahrenheit. The Temperature panel's storage temperature range is minus 40 to 154 degrees Fahrenheit.

Humidity

The Temperature Panels shall meet the humidity conditions as described in EB-3991 paragraph 3.6.4.3. This is the requirement set in EB specification 4195.

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Figure 1

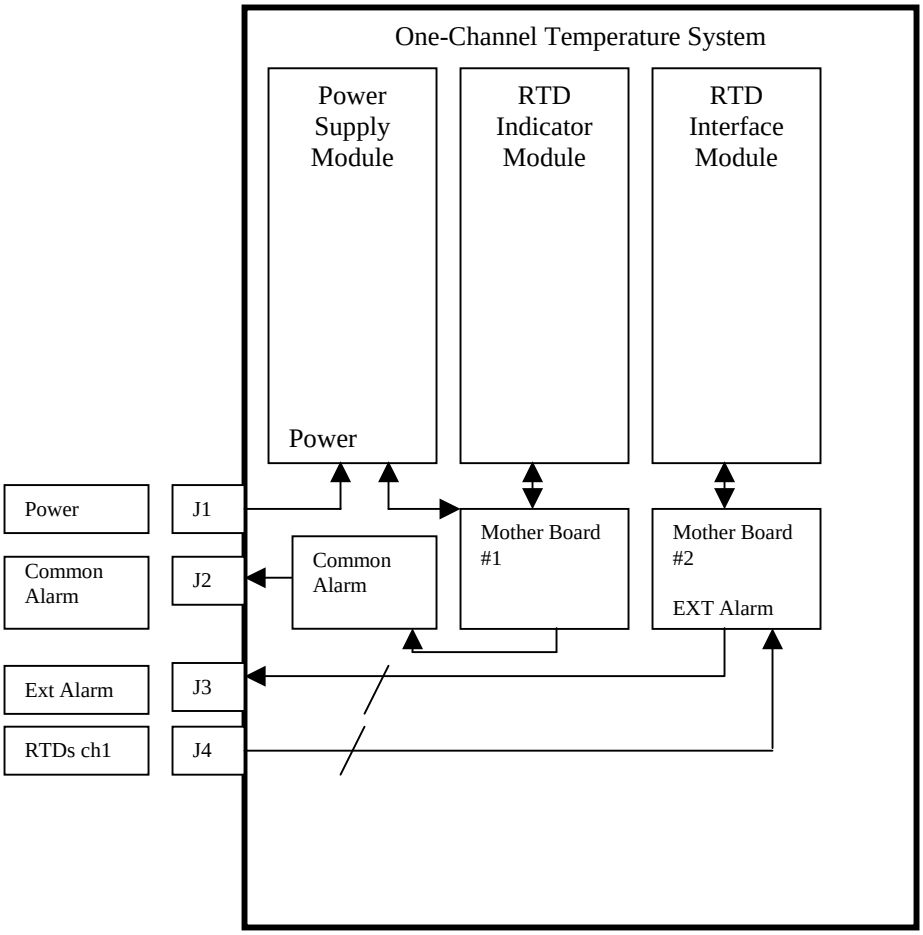

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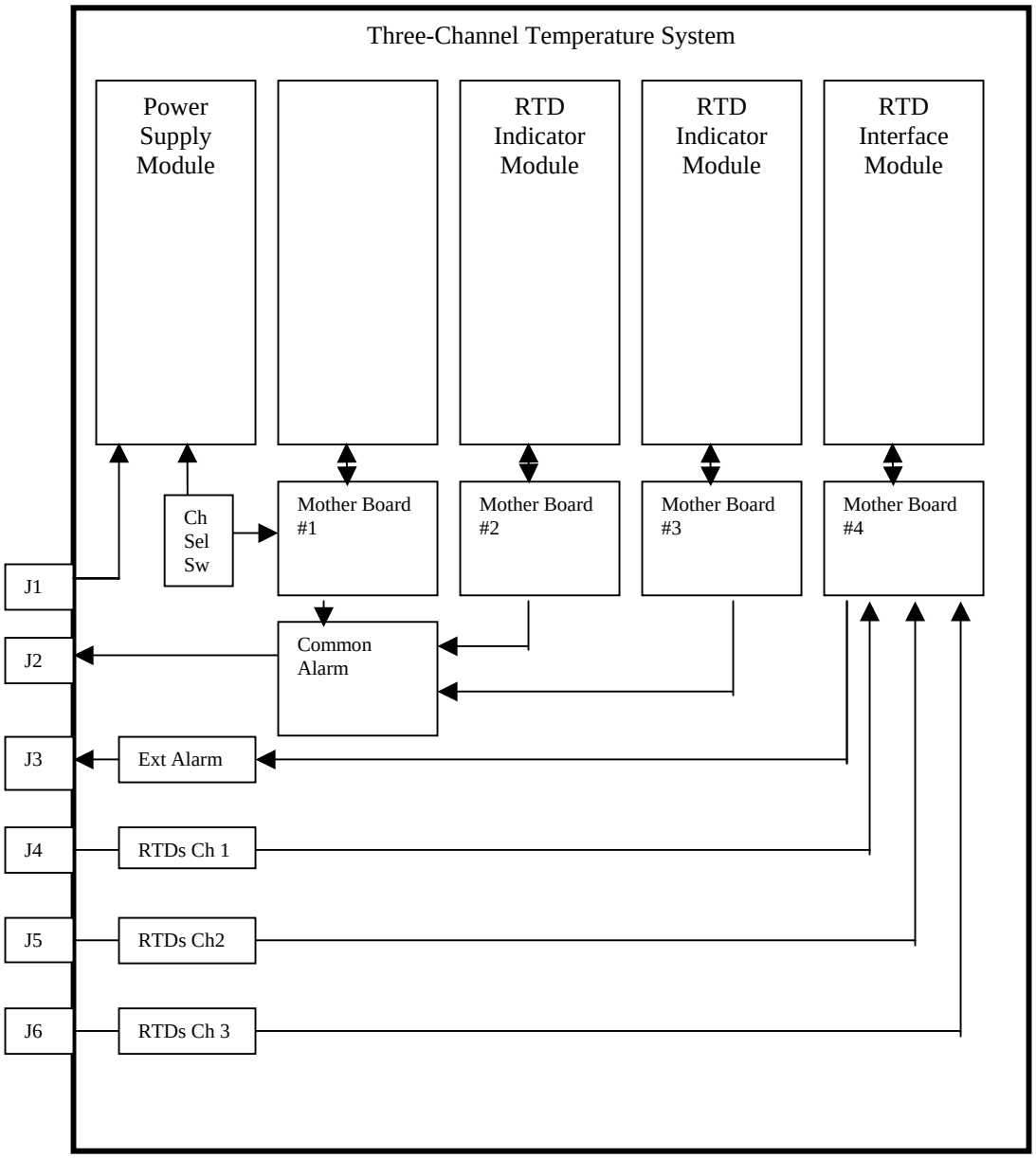
Figure 2



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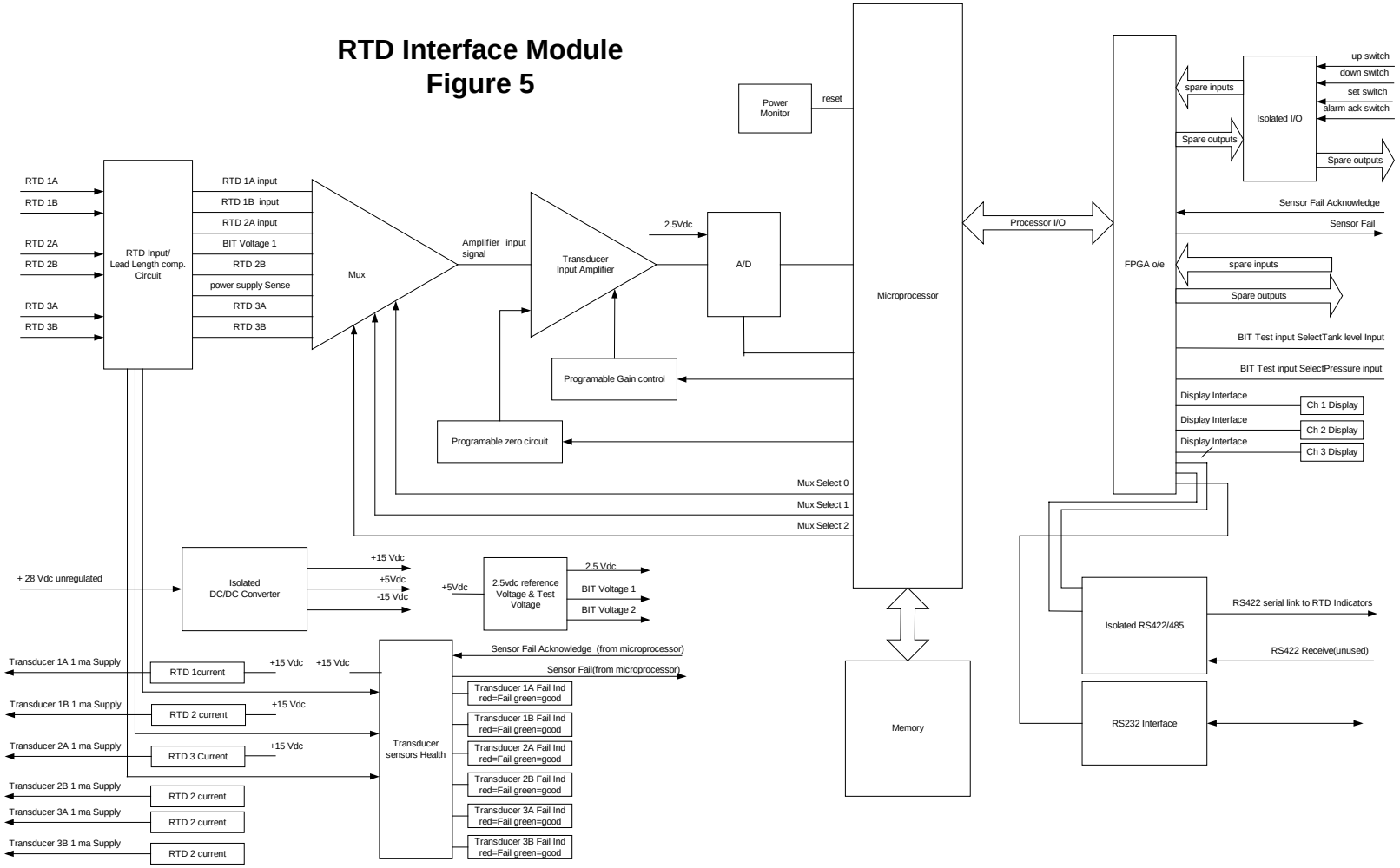
RTD Interface Module
Figure 5



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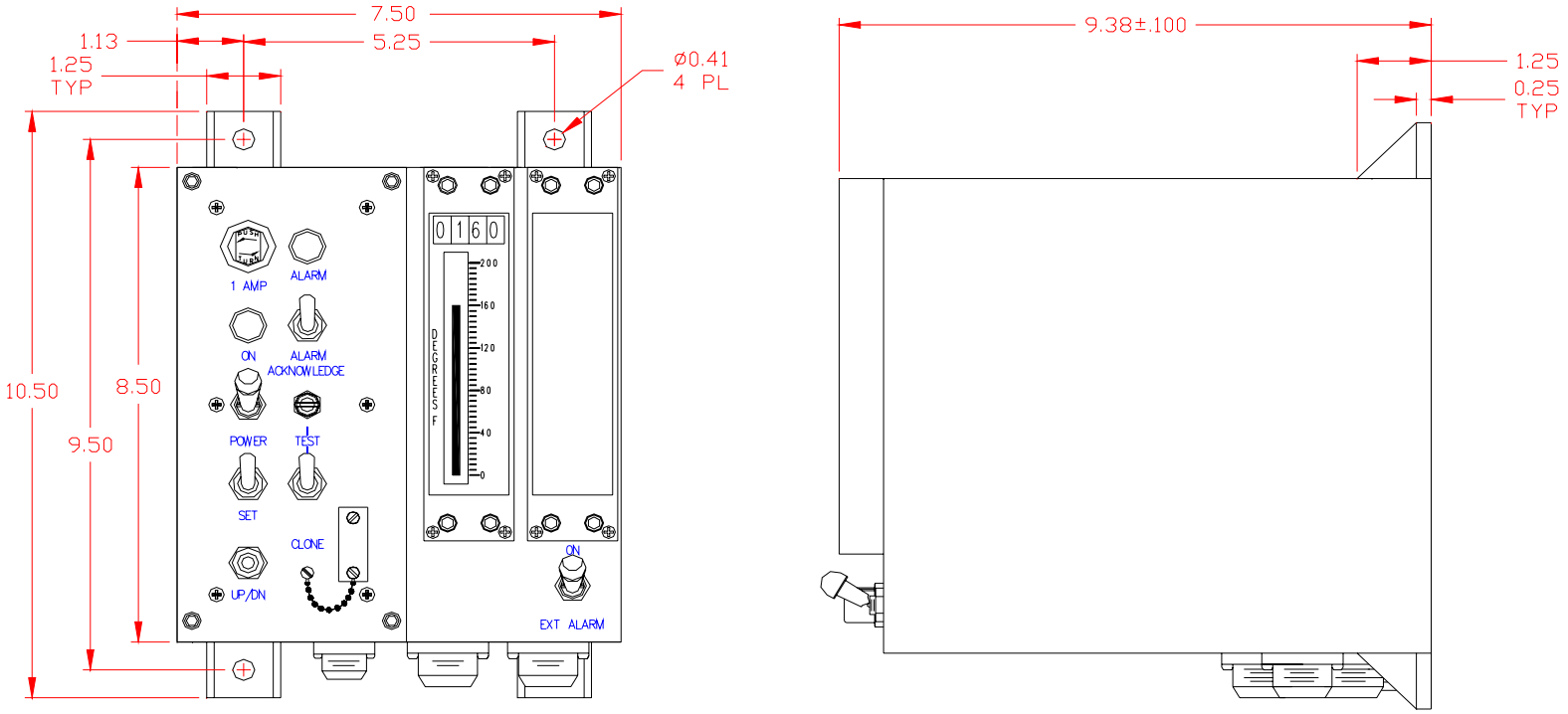

Figure 4: One channel Mechanical Outline.

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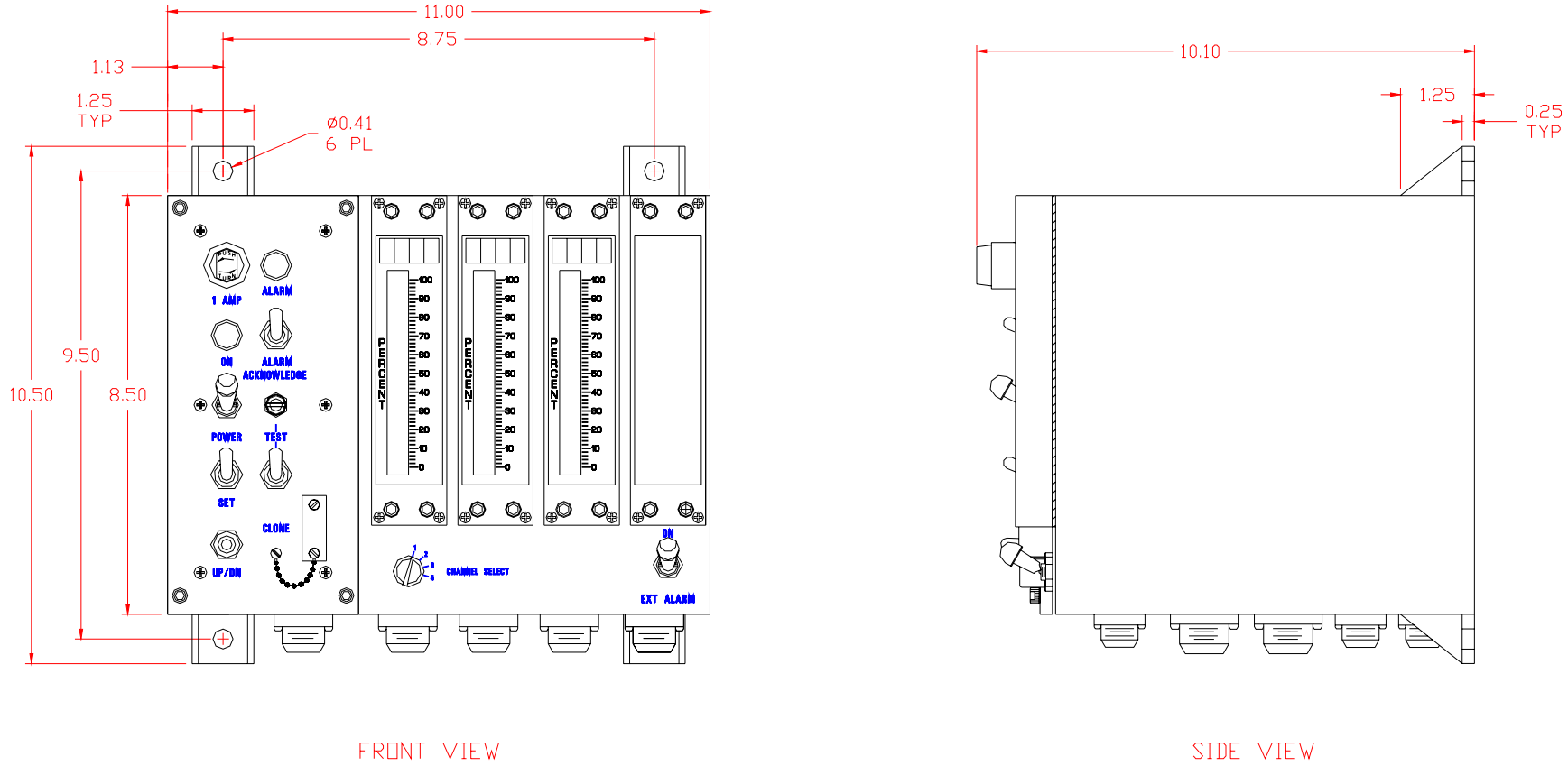

Figure 5: Three channel Mechanical Outline

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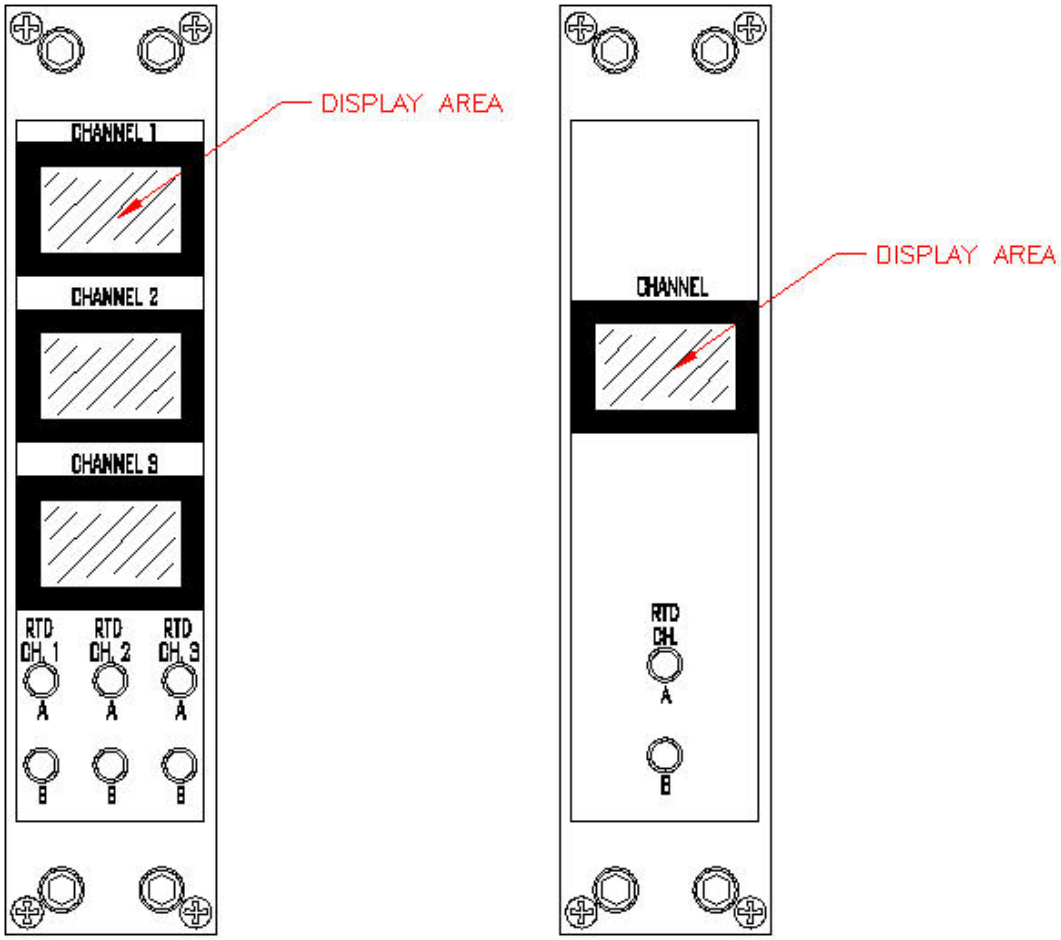

Figure 6: RTD Interface Module front view.