Product Manual

CLASSIC® Series

Thermal Flow, Level, Interface & Temperature Switches & Transmitters

KAYDEN®
Helping the World Switch®

KAYDEN®

Helping the World Switch®

NOTICE
Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using or maintaining this product. For equipment service or support needs, please contact your local representative.

⚠ CAUTION
The products described in this document are NOT designed for nuclear qualified applications.

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CLASSIC® 800 Specifications

Applications

- Flow, Level, Interface & Temperature

Process Connections

- 1/2", 3/4", 1", 1-1/4", 1-1/2" & 2" MNPT

- 3/4" FNPT & Flanged InLine

- Threaded (1" MNPT) & Flanged Retractable Packing Glands

Insertion 'U' Lengths

- **Imperial**
  1.2", 2", 3", 4", 6", 9", 12" & 18" standard

- **Metric**
  3, 5, 7.5, 10,15, 23, 30 & 45 cm standard

- **Custom Lengths**
  Available in 1/2" or 1 cm increments
  Min. 2.5" - Max. 120" (6.0 - 305 cm) model dependant

Wetted Materials

- 316/316L Stainless Steel - standard

- Titanium Gr. 2, Hastelloy C-276

- 316/316L Stainless Steel c/w Nickel Braze (830 & 832 InLine Models)

Enclosure Material

- Copper-free Aluminum
  (does not exceed 0.4% copper)

- Powder Coated Polyester TGIC
  (polyester triglycidyl isocyanurate)

- NEMA 4, 4X, 6P; IP65/67

- 1" FNPT Conduit Connection

- Buna O-Ring on Cover

Temperature Range – Continuous Service

- **Sensors**
  -55°C to +200°C (-58°F to +392°F)
  (Models 814 & 816: -55°C to +160°C [-58°F to +320°F])

- **Electronics**
  -55°C to +65°C (-67°F to +149°F)

Note: For temperatures above +65°C (+149°F) electronics must be remotely mounted. Refer to Electronics Location Considerations Page 10.

- **Storage**
  Product should be stored in a clean and dry environment between -30°C and +60° C (-34.5°F and 140° F)

Operating Pressure - Sensor

Threaded Style

- Maximum Working Pressure
  24 MPa (3500 psig) dependent on model and material of construction

Flanged Style

- Maximum Working Pressure
  per flange rating

Switch Point Range
(Insertion Style - 1/2" to 2"MNPT, Flanged)

- **Water-based Liquids**
  0.01 to 3.0 ft./sec. (0.003 to 0.9 meters/sec.)

- **Hydrocarbon-based Liquids**
  0.01 to 5.0 ft./sec. (0.003 to 1.5 meters/sec.)

- **Gases**
  0.25 to 254 sfps (0.076 to 77 smps)
  Standard conditions: 21°C (70°F) at 14.7 psi (1 atm)

Switch Point Range
(InLine Style)

- **Water-based Liquids**
  0.015 to 50 cc/sec.

- **Hydrocarbon-based Liquids**
  0.033 to 110 cc/sec.

- **Gases**
  0.6 to 20,000 cc/sec.
  Standard conditions: 21°C (70°F) at 14.7 psi (1 atm)

Accuracy

- **Flow Service**
  ±1% set point velocity over operating range of ±28°C (±50°F)

- **Level Service**
  ±0.25 inches (±0.64 cm)

- **Repeatability**
  ±0.5% Thermal Signal

- **Hysteresis (Dead Band)**
  ±1% Thermal Signal

- **Temperature**
  ±1° C or ±2% of full-scale range, whichever is greater.

Response Time

- Approximately 0.5 to 30 seconds

Remote Electronics Option

- Maximum recommended cable length - 200 feet (60 m)
- Cable type - 24 AWG minimum - twisted pairs

Heater Power

- Field adjustable to optimize performance

Input Power

- Universal Power standard 12-24 VDC and 115-230 VAC, 50-60 Hz
- Consumption Maximum 6.0 Watts
- DC input has reverse polarity protection
- AC & DC inputs have TVS diodes to protect against transient voltages (390 VAC, 39 VDC)
- Internal 1A self-resettable non-user-replaceable fuse

Outputs

- 4-20 mA current loop (with reverse voltage protection)
- Two (2) independent SPDT fully sealed relay contacts rated @ 4 amps resistive 230 VAC or 30 VDC Max.; individually adjustable

Start-Up Bypass Timer

- Adjustable: 0 to 100 seconds

Communications

- Modbus RTU via RS-485

Additional Features (Configure Using Kayden RCM Software or Modbus)

- Display Panel Lock-Out
- Set Points Configuration[1]
- Relay Actuation Delay Timer
  - Independently configurable for both On and Off, increasing or decreasing
  - Adjustable from 0 - 5000 seconds
- Start-up Bypass Timer[1]
  - Adjustable from 0 - 100 seconds
- Relay Mode Configuration[1]
  - Energized above or below set point
- Relay Temperature Switch Configuration
- Heater Power setting[1]

- Lower and Upper Range Values (LRV & URV) settings[1]
- Analog (4-20 mA) output configuration[1]
- View and Print Graphing (Trend) function
- Configuring settings; write to device, save to file and print
- Fault Event Log

Diagnostics

- Primary watchdog circuit monitors microprocessor parameter for anomalies
- Secondary watchdog circuit monitors microprocessor health
- Heater monitored for out-of-range conditions
- Fault Mode de-energizes relay(s) and halts power to the heater

Agency Approvals

- **CSA**
  Class I, Div. 1, Groups B, C and D; Ex d IIB + H2; AEx d IIB+H2 (Class I, Zone 1, Group IIB + H2,) T3; Enclosure Type 4 / IP55
- **Single Seal Approval**
  Per ANSI/ISA 12.27.01-2003
- **CRN** - Canadian Registration Number
  - CLASSIC 810: 0F22124.2C
  - CLASSIC 812:
    - 1" & 1-1/2": 0F13787.2C
    - 2" to 10": 0F13773.2C

  Note: Visit kayden.com for CRN specifics.

CRN
Canadian
Registration
Number

Factory Certifications

- Factory tested to NEMA 4, 4X, 6P; IP65/67. Contact Technical Support for reports.

Weights and Dimensions

- 810 Threaded 2" U length - 7 lbs (3.18 kg)
- Carton Size - 15" x 5" x 6" (38 cm x 13 cm x 15 cm)
- Other models/sizes - consult Kayden

Warranty

- One (1) Year from shipment date from factory (see Terms & Conditions on kayden.com for details)

Note: [1] Also configurable from Display Panel

Overview of CLASSIC Setup

1. Warm-Up

At initial start-up or restart, please allow approximately 90 seconds for the heater element to warm-up and the switch to stabilize before making any adjustments.

2. Primary Settings

The following are the basic configurations for the CLASSIC 800 Series Electronics Modules:

1. Relay 1
2. Relay 2
3. Set Point 1
4. Set Point 2
5. Heater Power
6. LRV and URV (0% and 100%)

3. Secondary Settings

The following are the additional configurations:

1. 4-20 mA Fault Configuration
2. Start-up Bypass Timer
3. Node Address & Software Revision
4. 4-20 mA Configuration

Notes

Notes

Models in this Manual

CLASSIC 810 Threaded
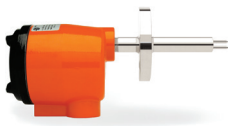
- Insertion Style - 1/2", 3/4", 1", 1-1/4", 1-1/2" & 2" MNPT

CLASSIC 812 Flanged

- Insertion Style - 1" ANSI 150 through 10" ANSI 900 Flanges

CLASSIC 814 Flanged Retractable Packing Gland

- Insertion Style - 1-1/2" through 10" ANSI 150 Flanges
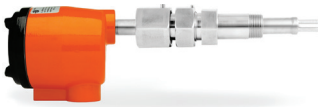
CLASSIC 816 Threaded Retractable Packing Gland

- Insertion Style - 1" MNPT

CLASSIC 830 Threaded

- InLine Style - 3/4" FNPT
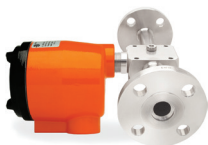
CLASSIC 832 Flanged

- InLine Style - 3/4" ANSI 150 through 10" ANSI 900 Flanges

CLASSIC® 800 Electronics

Display Panel & User Interface

The Kayden CLASSIC 800 Series Electronics Module is designed to be easy to install and adjust while displaying several control functions. The Kayden CLASSIC 800 Series Electronics Module features:

- Universal Power Input
- Continuous Self-test Diagnostics with Fault Indicator
- Easy setup; no jumpers or trim pots
- Incrementally adjustable heater power, range and relay set points.
- All CLASSIC 800 series switches/transmitters use the same 800 Series Electronics Module making it a universal spare part. The Electronics Module is easily installed in the field without returning the entire switch/transmitter to the factory.

- 4-20 mA Analog Output
- Start-up Bypass Timer

Figure 1 - CLASSIC 800 Display Panel

Display Panel Indicators

Relay 1	On steady when Relay 1 is energized
Relay 2	On steady when Relay 2 is energized
Fault	Indicates a self-test error or fault condition
Set Point 1	On steady when viewing Set Point 1
Set Point 2	On steady when viewing Set Point 2
Run Mode	Flashing when switch is operating
Bypass	Flashing when the Start-up Bypass Timer is active
Thermal Signal	Displays Thermal Signal

The Thermal Signal increases as

Flow	The flow rate increases
Level	The sensor is submerged
Interface	The sensor is submerged by the second liquid of greater thermal conductivity

Typical Applications

- Pump Protection - Dry Alarm
- Leak Detection
- Flow Monitoring & Verification
- Tank Overflow Protection
- Flare Gas Monitoring
- Monitoring Purge Air Flow
- Drain Line Flow
- Interface Control in Separation Vessels
- High Pressure Flows

- Lube Oil Systems
- Vent Monitoring
- Natural Gas to Boilers
- Emergency Eye Wash Stations
- Tanker Loading & Unloading
- Relief Valve & Rupture Disk Flow Monitoring
- Remote Indication of Flow via Analog Output & Digital Communications
- Liquids, Air & Gases

- Slurries
- Interface Detection
- Corrosive Liquids
- Hazardous & General-Purpose Areas
- Interface Control & Level Detection in Settling Vessels
- Chemical Injection/Additive Flow Monitoring

I. THE KAYDEN CLASSIC 800 - DIGITAL ELECTRONICS FEATURES

The CLASSIC 800 is versatile, rugged, cost effective and easy to use. All basic configurations can be performed using the Display Panel buttons, although additional configurations may require using Kayden RCM Software (or the Modbus interface).

The CLASSIC 800's Display Panel displays process condition (flow, level & interface) via the Thermal Signal Bar Graph as well as Relay state, Timer functions and operating conditions via individual LEDs.

The CLASSIC 800 may also be remotely controlled and/or monitored via RS-485 using Kayden RCM (Remote Control & Monitoring) Software with a suitable RS-485 communication adapter and cable.

Kayden's CLASSIC 800 series uses an advanced microprocessor to perform continuous **self-test diagnostics** on the Electronics Module and the sensor elements.

- Any open or shorted connection will result in an error indication that also opens all output contacts and disables the heater circuitry.

- A internal watchdog circuit in the microprocessor ensures the microprocessor program code is executing correctly, and an external watchdog circuit ensures the microprocessor itself is functioning correctly. Both circuits force the contacts open, turn the Fault LED ON, turn the heater off, and de-energize the relays in the event of a malfunction. This prevents the heater from running out-of-control, which could result in excessive probe temperatures or damage to the heater.

- The microprocessor also monitors the heater for out-of-range conditions. For example, in a level application when the sensor is "dry" for an extended period of time, the heater will cycle between its current setting and a lower power rating until such time as the sensor is again submerged.

Note: A configuration change could result in one or both relays energizing or de-energizing when normal operation is resumed.

The CLASSIC 800 includes a number of circuit protection features:

- Reverse polarity protection on the 12-24 VDC power input and 4-20 mA analog output.

- Transient-voltage suppression on 12-24 VDC and 115-230 VAC power inputs to protect against voltage spikes (TVS) diodes.

- Self-resettable non-user-replaceable fuse.

II. PRINCIPLE OF OPERATION

The Kayden CLASSIC sensor probe incorporates two RTDs and a heating element.

SENSOR (PROBE)

Active RTD   Reference RTD
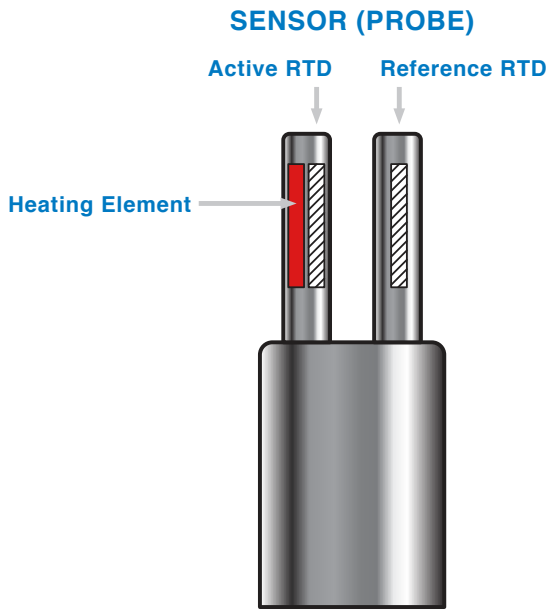
Heating Element

- The Reference RTD senses the temperature of the process.

- The Heating Element applies heat to the Active RTD. The CLASSIC 800 Series uses a constant heater power (configured by the operator).

- The electronics module calculates the thermal signal based on the temperature difference between the two RTDs.

- The difference in temperature between the two RTDs varies according to the heat dissipated by the media.

- A change in process (Flow, Level, or Interface) results in a change in Thermal Signal %.

The Thermal Signal depends primarily on:

1) The thermal conductivity of the process media.

2) The velocity of the process media past the sensor.

OUTPUTS

4-20 mA Thermal Signal

Relays (2)

Modbus RTU

ELECTRONICS MODULE
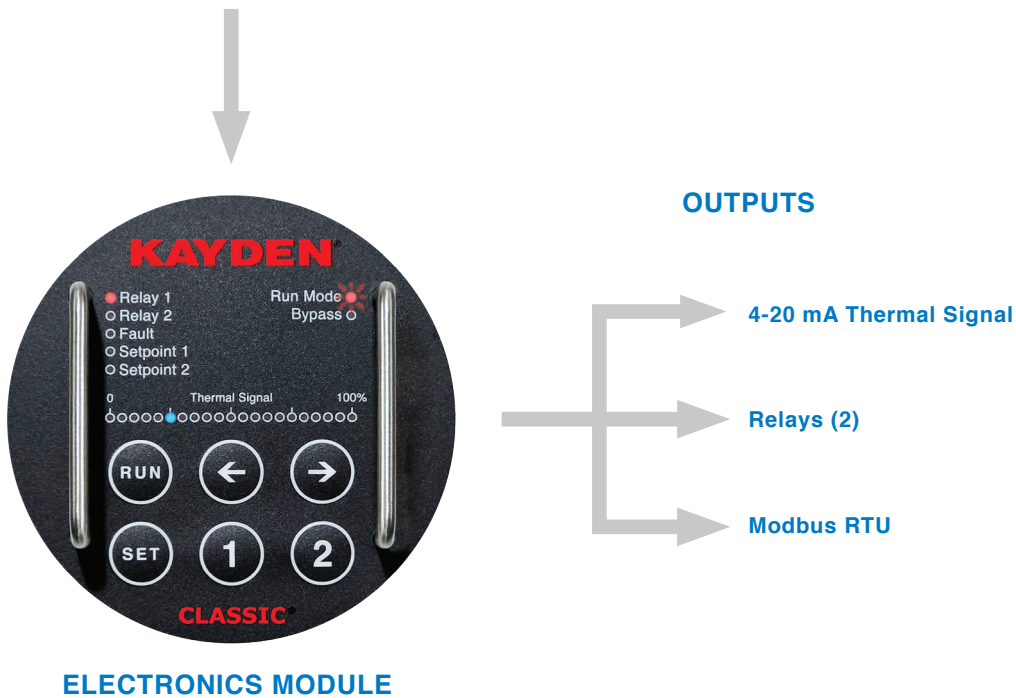
Figure 2 - CLASSIC 800 Probe & Outputs

III. THERMAL SIGNAL

Thermal Signal as it Applies to Flow, Level, and Interface

The CLASSIC 800 may be set up in the field for flow, level or interface with air, gases, liquids, or slurries. The CLASSIC 800 Local Thermal Signal Bar Graph display implies a range of flow detection from 0 to 100%.

If the LED bar graph indicates 0% then a minimum amount of heat is being carried away by the process.

If the LED bar graph indicates 100%, then a maximum amount of heat is being carried away by the process.

The Thermal Signal is continuously compared against the Relay Set Points and the relays are energized or de-energized appropriately.

Flow / No Flow

The **Thermal Signal increases as the FLOW increases.**

When the velocity of the process media is low or nonexistent, less thermal energy (heat) is dissipated from the heated sensor.

As the velocity increases, the amount of energy dissipated by the process media increases, thereby increasing the Thermal Signal.

The Thermal Signal is smallest (left-most LED illuminated) in a no-flow state and increases (LED moves to the right) as flow increases.

The relationship between Thermal Signal and velocity is **Non-Linear.**

The following figure is a typical flow curve showing Thermal Signal (heat loss) vs Velocity in glycol.
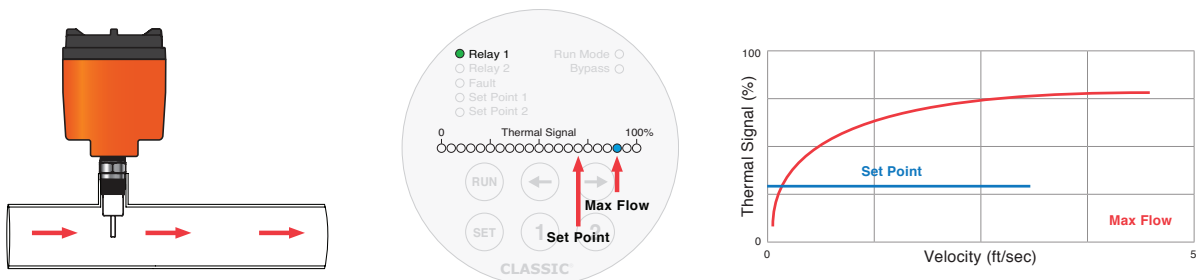
Figure 3 - Thermal Signal vs Velocity in Glycol

Level

The **Thermal Signal increases** when the sensor is **submerged in a fluid.**

Air and other gases have low thermal conductivity and do not dissipate heat as well as liquids.

Therefore the Thermal Signal is smallest in air or gas. The Thermal Signal increases as the sensor is submerged. The Thermal Signal is **lower** (left-most LED illuminated) in a **dry motionless state and increases once the sensor is submerged in fluid.** (see Figure 4).
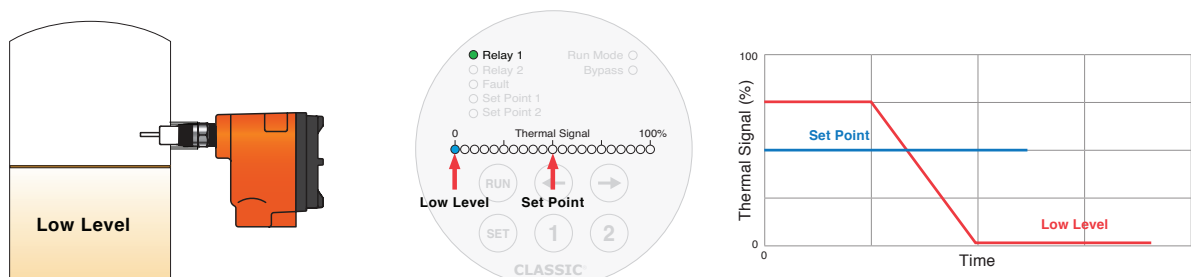
Figure 4 - Thermal Signal Dry vs Submerged

The Thermal Signal is **higher** (right-most LED illuminated) when the **sensor is submerged in a fluid** and decreases when the sensor is **exposed to air or gas in a motionless state** (see Figure 5).
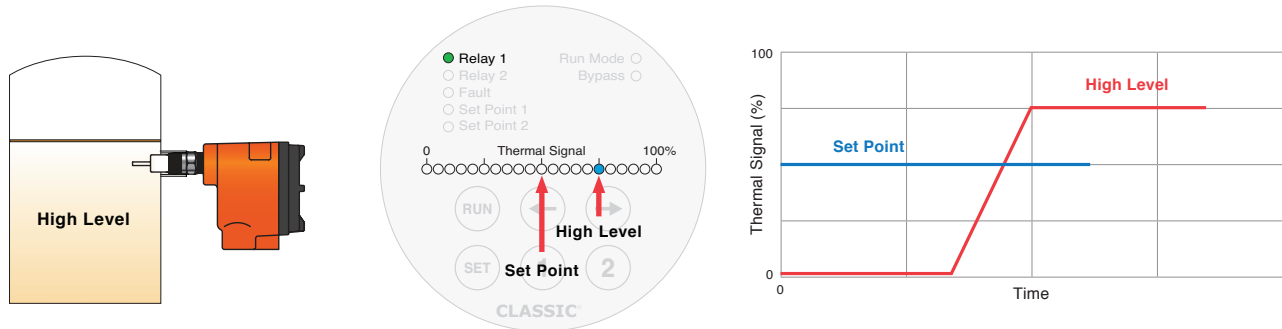
Figure 5 - Thermal Signal Submerged vs Dry

Interface

The Thermal Signal **changes** as the (interface) sensor is exposed to an **alternate fluid** which has a different rate of **thermal conductivity**.

The CLASSIC 800 can be set up to detect the difference between most liquids when:

- The **different rate of the thermo-conductivity** of the two fluids **is large enough** to detect.

- There is little or no velocity, and the process media is in a stable, motionless state.
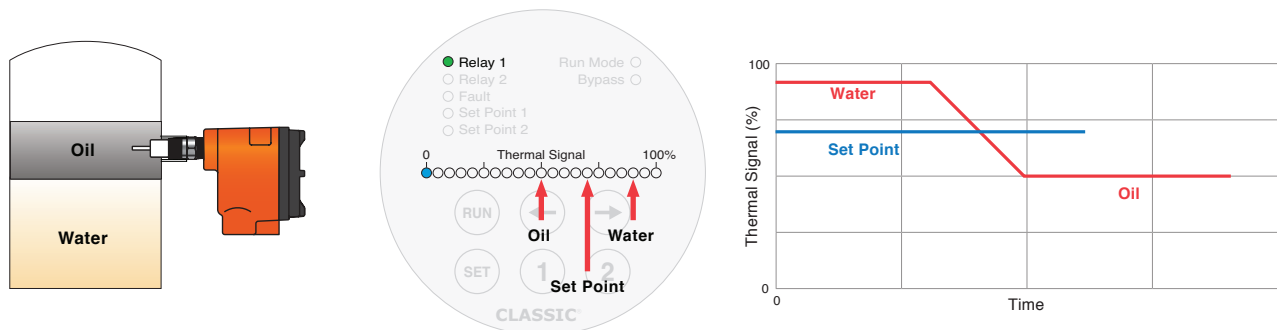
Figure 6 - Thermal Signal in Alternate Fluids

IV. 4-20 mA ANALOG OUTPUT

The **4-20 mA analog output signal** corresponds to the **Thermal Signal LED Bar Graph**.

- The 4-20 mA signal may be displayed either as forward-acting (ascending 4-20 mA) or reverse-acting (descending 20-4 mA).

- The 4-20 output can be configured to output either 3 mA (LOW) or 21 mA (HIGH) in a fault condition (NAMUR NE 43).

- When the CLASSIC is in **Set Mode**, the 4-20 mA Output is disabled and will default to LOW or HIGH.

Refer to the **Section 3, "View or Adjust the 4-20 mA Output Configuration (Forward or Reverse)"** or the **Classic 800 Series Quick Setup Guide**.

2   Installation Guidelines

I. GENERAL

Kayden electronics are designed to be universal for flow, level, interface and temperature applications and with most liquids, gases and slurries. Ensure:

- Correct setup of the electronics and,

- Proper physical installation of the sensor.

Location

- Consider the need for easy access in order to view the operation and make any required field adjustments.

- Provide at least 12 inches (30 cm) clearance if possible to allow access for setup and viewing after installation.

Shock and Vibration

- Install the switch/transmitter so as to minimize any effects due to vibration, shock and extreme temperatures.

Temperature

- The continuous operating temperature limits of the Electronics Module is -55°C to +65°C (-67°F to +149°F). Ambient temperatures in excess of +65°C (+149°F) require the electronics to be mounted remotely from the sensor. Consult kayden.com or the factory for more information.

- The continuous operating temperature limits of the sensors are -45°C to +200°C (-50°F to +392°F).

Turbulence / Interference

- Pumps, fans, valves, or pipe bends of 90° or more will cause turbulence or significant variance in the flow which will affect the repeatability of the switch. Care should be taken to minimize this possibility.

- For Pump Flow/No-Flow detection, the CLASSIC can be mounted on either the inlet or the discharge side of the pump (the best linear response will be on the inlet side). If the CLASSIC must be mounted on the discharge side, a straight run before the CLASSIC of at least 5 times the pipe bore diameter is recommended.

- Keep the sensor away from any devices that may cause physical damage such as: agitators, valves, injectors, etc.

    Note: Many times, especially when replacing a different type of instrument, the installation point is predetermined and is difficult to change. Kayden switches have specific design features that enable them to perform well even in difficult locations and applications. Please consult your local representative or Kayden for questions or installation / setup recommendations.

DISCHARGE: Turbulent Flow   INLET: Linear Flow
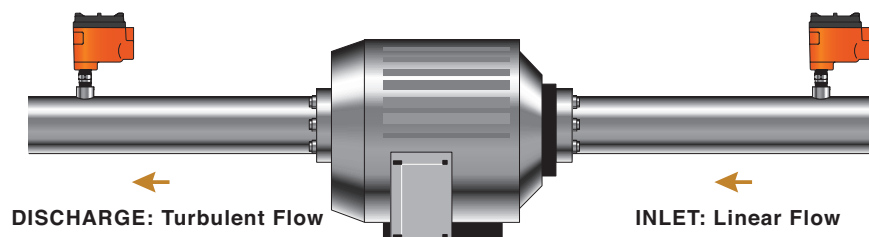
Figure 7 - Pump Flow Detection

Application Principles - Flow, Level, Interface & Temperature

✔ Consistent process composition

✔ Consistent process temperature

✔ Clean or dirty process

✔ Liquids

✔ Dry air & gas

✔ Slurries

✔ Emulsion

✔ Aerated Fluids

✖ Large temperature swings

✖ Wet or saturated air/gas

✖ Solids

✖ Sediment covering sensing tip
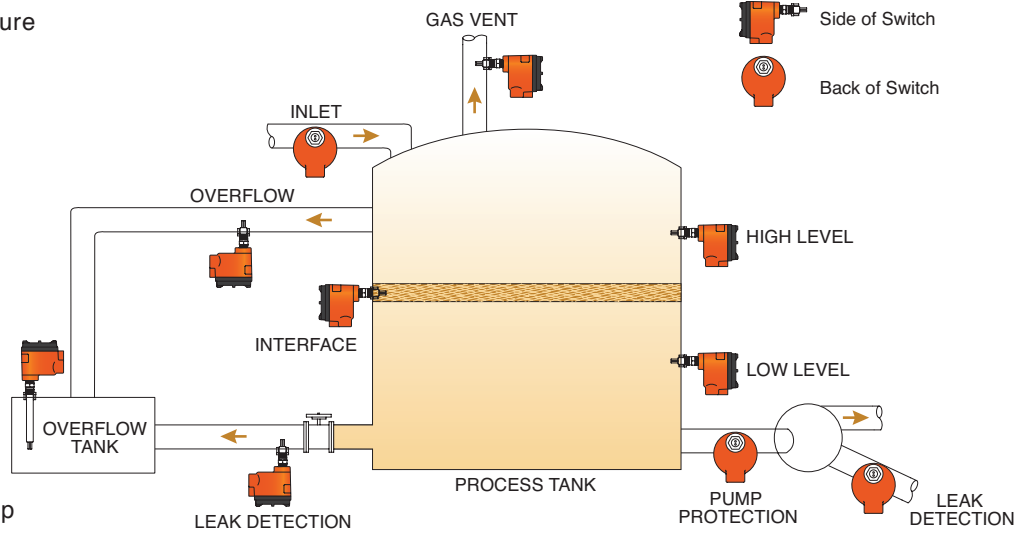
Application Considerations - Flow

Ideal Process Conditions

Liquids

- Consistent process composition & temperature

- Sufficient straight run flow profile (minimizes turbulence)

- Recommended minimum of 5 pipe diameters from any disturbance, preferably 15 pipe diameters.

Air & Gas

- Consistent process composition and temperature, ideally clean and dry but not necessarily so long as process is consistent.

- Sufficient straight run flow profile (minimizes turbulence)

- Recommended minimum of 5 pipe diameters from any disturbance, preferably 15 pipe diameters.

Slurries

- Consistent process composition & temperature

- Sufficient straight run flow profile (minimizes turbulence)

- Recommended minimum of 5 pipe diameters from any disturbance, preferably 15 pipe diameters.

Emulsion

- Consistent process composition & temperature

- Sufficient straight run flow profile (minimizes turbulence)

- Recommended minimum of 5 pipe diameters from any disturbance, preferably 15 pipe diameters.

Undesirable Process Conditions

Liquids

- Inconsistent process composition or temperature

- Insufficient straight run

- Turbulence

Air & Gas

- Inconsistent process composition or temperature

- Wet or saturated air/gas

Slurries

- Inconsistent process composition or temperature

- Insufficient straight run

- Turbulence

Emulsion

- Inconsistent process composition & temperature

- Insufficient straight run

- Turbulence

Solids

- Dry granulated processes are NOT good candidates for thermal switches

Application Considerations - Level

Ideal Process Conditions

Liquids

- Consistent process composition & temperature
- Non-turbulent applications

Slurries

- Consistent process composition & temperature

Emulsion

- Consistent process composition & temperature

Undesirable Process Conditions

Liquids

- Inconsistent process composition
- Turbulence
- Large temperature swings

Slurries

- Inconsistent process composition
- Turbulence
- Large temperature swings

Emulsion

- Inconsistent process composition
- Turbulence
- Large temperature swings

Solids

- Dry granulated processes are NOT good candidates for thermal switches

Application Considerations - Interface

Ideal Process Conditions

Liquids

- Liquid to Liquid
- Consistent process composition & temperature
- Non-turbulent applications
- Large differential in thermal conductivities

Air or Gas to Liquid

- Consistent process composition & temperature
- Non-turbulent applications
- Dry gas

Emulsion

- Consistent process composition & temperature
- Large differential in thermal conductivities

Undesirable Process Conditions

Liquid to Liquid

- Inconsistent process composition or temperature
- High aeration
- High turbulence
- Small differential in thermal conductivities

Air or Gas to Liquid

- Inconsistent process composition or temperature
- High turbulence

Emulsion

- Inconsistent process composition or temperature
- High aeration
- High turbulence
- Small differential in thermal conductivities

Solids

- Dry granulated processes are NOT good candidates for thermal switches

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Application Considerations - Temperature

Ideal Process Conditions

- Consistent Processes
- Process Temperature -55°C to +200°C

Undesirable Process Conditions

- Process Temperature < -55°C or > +200°C

Note: See Additional Setup Features on Page 41 to configure relays to respond to temperature.

II. ELECTRONICS LOCATION CONSIDERATIONS

A remote electronics enclosure is required when ambient temperatures near the sensor exceed 65°C (149°F) where the electronics will be mounted. The combination of several factors relative to temperature should be considered when mounting the switch/transmitter:

A. High temperatures of the process material, which may over time, become a convective heat source.

B. High ambient temperature, which may prevent the surrounding air from cooling or insulating the electronics.

C. Radiant heat, if the switch is installed in direct sun in a hot climate, or near a heat source.

D. Mechanical features of the installation such as pipe insulation, heat sinks, cooling fans, etc.

III. GUIDELINES FOR PIPE MOUNTING

The CLASSIC 800 is a flow, point level, interface and temperature sensing device. The sensor tip must be inserted in the proper location and to the proper depth in order to accurately react to your process conditions. The following information, including Figures 8 through 13, should be considered as text book examples for proper installation.

Notes: Most pipe connections for instrumentation are a variation of a butt-weld-type such as the Weldolet or Thredolet. The length of this connection must be added to the pipe diameter when determining the required insertion length for the sensor. The Kayden literature refers to this "insertion length" dimension as the "U" length, Figures 8 & 9.

Insertion Length
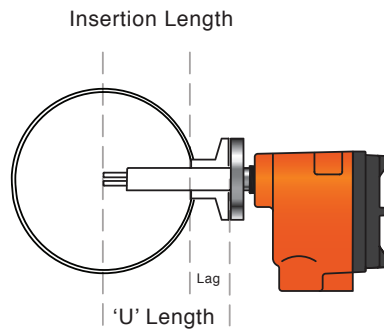
'U' Length

Figure 8 - Insertion 'U' Length (Flanged)

Insertion Length
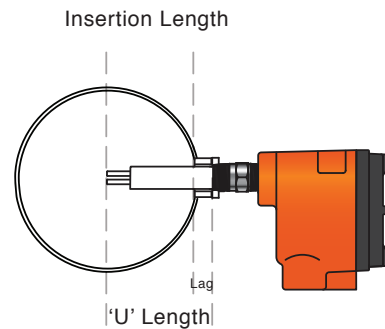
'U' Length

Figure 9 - Insertion 'U' Length

Horizontal Pipe - Side Mount - Ideal

As shown in Figure 10a, ensure the sensing tip is inserted to a point between 5% and 75% of the inside diameter of the pipe. Avoid locations where sediment may accumulate and isolate the sensing tip from the process.

Horizontal Pipe - Top Mount

Gas will always collect at the top of any pipe, ensure sensing tip is inserted to a point where it will be constantly and fully exposed to the desired process media.

Horizontal Pipe - Bottom Mount

Because sediment will collect at the bottom of any pipe, ensure sensing tip is inserted to a point where it will be constantly and fully exposed to the desired process media. Avoid locations where sediment may accumulate and eventually isolate the sensing tip from the process.

5% minimum

30% ideal
50% maximum
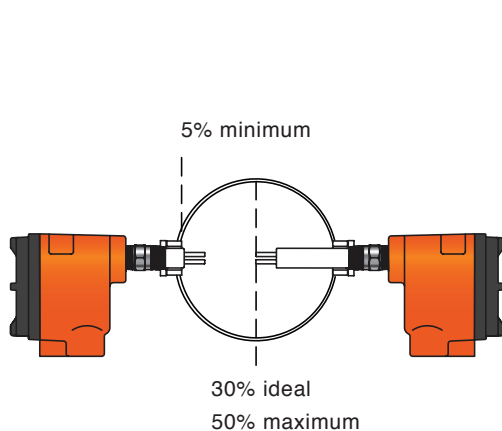
Figure 10a - Horizontal Pipe, Side Mounting

35% to 65% max
50%
35% to 45% max
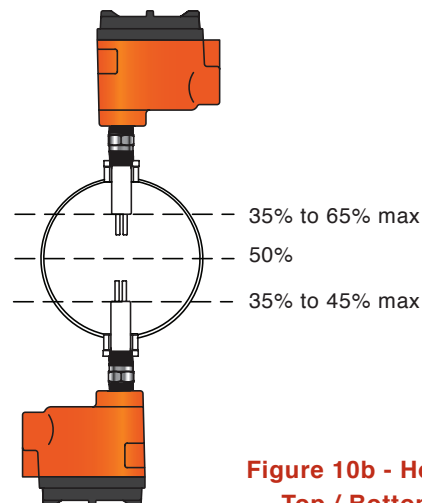
Figure 10b - Horizontal Pipe, Top / Bottom Mounting

Vertical Pipe

For vertical pipe mounting, Kayden strongly recommends installing the switch at a point of UPWARD process flow to ensure continued total immersion of the sensing tip.

If there is no other option except to install the flow switch in a vertical pipe with downward flow, the following information must be considered:

- A "waterfall effect" may occur in vertical pipe with low flow rates. The process may become substantially aerated and will therefore cause the switch to interpret the aeration as a lower flow rate (see Figure 11).

- The line should be full of the liquid/slurry at all times.

- The switch/transmitter must be far enough from an open outlet that air cavitation does not extend to the sensing tip and cause a false flow signal. A constriction at the outlet helps avoid this problem.

Vertical Pipe - Side Mount - Acceptable

- Ensure sensing tip is fully inside the pipe wall as a minimum and to the center of the pipe as a maximum.

- When installing the switch in vertical piping, Kayden strongly recommends installing the switch/transmitter at a point of UPWARD process flow to ensure continued total immersion of the sensing tip.

Vertical Pipe - Side Mount - Downward Flow

- Is only recommended for higher flow rates where the LINE IS KEPT FULL OF LIQUID OR SLURRY.

- For installation in a vertical gravity flow, the switch must be distant enough from an open outlet that air cavitation does not affect the sensing tip and cause a false flow signal. A constriction at the outlet helps avoid this problem.

- A waterfall effect will occur in vertical pipe with low flow rates. Also, the process is likely to become substantially aerated. The switch will interpret the aeration as a substantially lower flow rate and possibly cause a false low flow alarm.

Vertical Pipe - Side Mount - Top & Bottom Mount - Less Desirable

Positioning the sensor on a corner or elbow is not recommended as the process will be turbulent. The switch may interpret the turbulence as a constantly changing flow rate and fail to alarm as required.
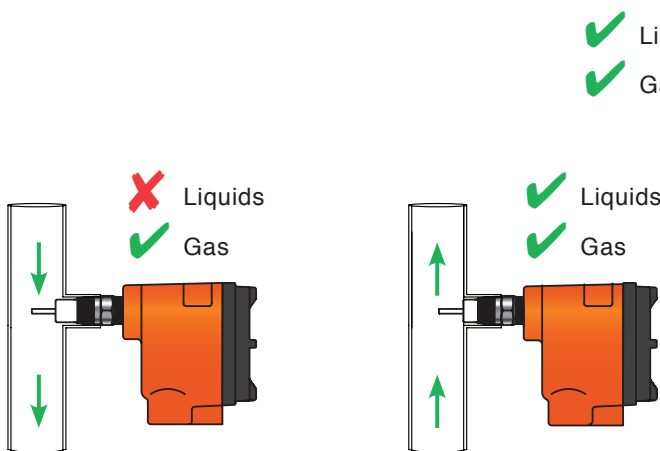
Figure 11 - Vertical Pipe, Flow Up & Down
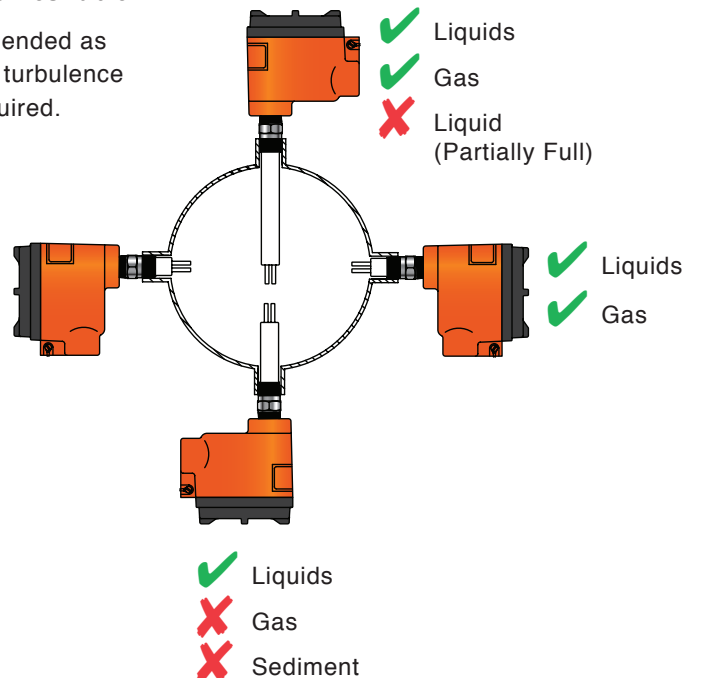
Figure 12 - Horizontal Pipe, Sensor Positioning

IV. INSTALLING THE SENSOR

Having followed the installation guidelines in Section 2, "Installation Guidelines", Subheadings I through III, you may now proceed with installation.

⚠ CAUTION

1. Use proper eye protection and any other safety equipment as required by your installation site.
2. Check electrical power to ensure that all power has been disconnected and 'locked out'.
3. Ensure the process tank and/or line pressures are 'zero'.
4. Ensure that steam, hot water, acids or any other potentially hazardous media will not be released.
5. Follow all safety precautions as specified for your installation site and/or local codes.

---

1.   Process Connections

*   **Threads**: Coat with a thin layer of thread tape or sealant/lubricant.
    Do not overtighten threads when installing.

*   **Flanges**: To ensure a correct seal on mating flanges, mount and tighten flanges according to ANSI standards.

2.   Sensor Orientation

*   To optimize the sensor's performance, ensure the sensor is positioned as outlined below.
    As shown in Figure 13, ensure the **arrows etched on the sensor flats** (<⟷>) are oriented parallel to the process flow. Blue arrows indicate the acceptable directions of the flow.
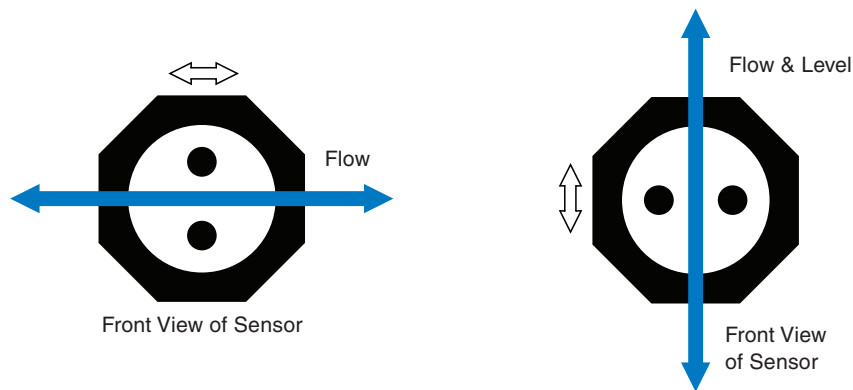
Figure 13 - Sensor Orientation for Horizontal Flow & Level

Notes: **1.** Liquids & Slurries: When mounted in a tee or section of pipe larger than the normal process pipe, position sensor at a sufficient insertion point so as to avoid contact with any air or gas bubbles that occur in the larger section of pipe.

2. Avoid locations where sediment may accumulate and eventually isolate the sensing tip from the process. Sediment covering the sensor tip may prevent the switch from being able to sense any changes in the process as the sediment will insulate the sensing tip.

V. ELECTRICAL

1. General

- Ensure all electrical installation is in accordance with all applicable local and national electrical code requirements. The CLASSIC 800 series standard configuration includes an explosion-proof enclosure. The CLASSIC 800 Series is approved by the Canadian Standards Association (CSA) and must be installed in accordance with applicable codes and standards..

- **Power Supply:** For applications using a DC power supply, ensure the power has less than 2% ripple.

- **Switch/Transmitter Enclosure:** The switch enclosure must be grounded in accordance with local and national electrical codes. The most effective grounding method is a direct internal connection to earth ground with minimal impedance. The (green) Internal Ground Connection screw is located inside the electrical enclosure and is identified by the universal ground symbol.

⚠ CAUTION
1. Mount the enclosure so that moisture/liquids will not enter the switch enclosure. If conduit connections are not sealed, moisture accumulation can damage the switch/transmitter.
2. Grounding the switch/enclosure via threaded conduit connection may not provide sufficient ground continuity.
3. Do not run the transient protection ground wire in the same conduit as the signal wiring as the ground wire may carry excessive current if a lightning strike occurs.

2. Wiring Connections to the Switch

- To make the electrical connections to the CLASSIC 800, it is necessary to remove the Electronics Module as follows:

    A. Remove the Cover

    - Turn the external stainless steel locking screw clockwise with a 5/32" (#10) Allen Key and turn the cover counter clockwise until it can be lifted off the enclosure.

    B. Remove the Electronics Module

    - To remove the Electronics Module, pull outward with an equal force on both stainless steel handles. Care should be taken to avoid damaging the sensor cable attached to the Electronics Module.

    - Practice ESD (electrostatic discharge) procedures when handling the Electronics Module. Electrostatic discharge may damage the electronics! Never place the Electronics Module on a surface or pass it to another person in a way that would allow an electrostatic discharge to pass through it.

    C. Removing the Sensor Connector from the Electronics Module

    - Refer to Figure 14.

    - The Electronics Module must be removed from the enclosure before any wiring can be connected to the Mounting Base Plate. Disconnect the sensor connector from the Electronics Module by disengaging the locking tab and pulling (with fingers) on the corners of the small black connector. **Do not pull directly on the wires**. The use of pliers may damage the connector.

Locking Tab

Push Down

Pull Connector (NOT Wires)
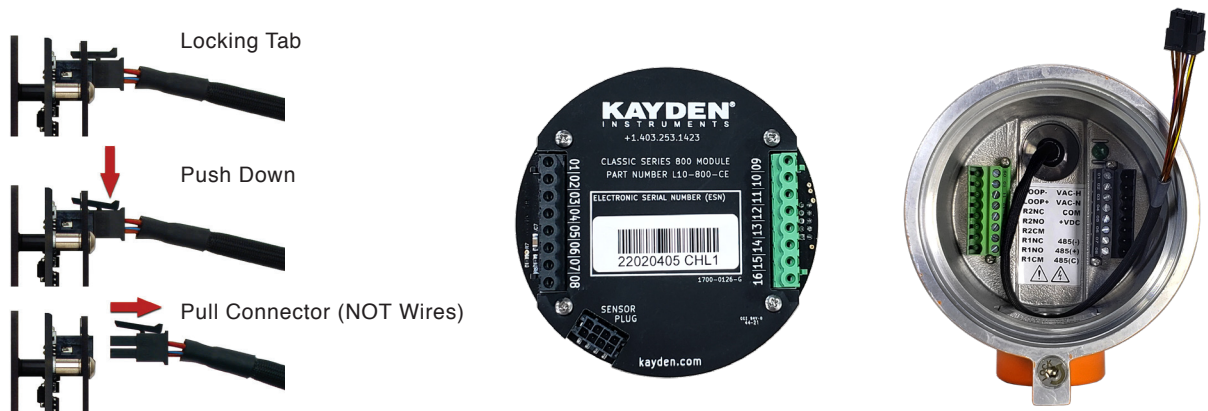
Figure 14 - Disconnecting Sensor Connector from the Electronics Module

- **Input Power Connections**

  The CLASSIC 800 will accept 12-24 VDC or 115-230 VAC input power via the universal power supply by wiring the Electronics Module according to input power available.

  - For AC power, connect the HOT line to VAC-H, the NEUTRAL to VAC-N and the GROUND wire to the green grounding screw in the enclosure, also indicated by the ground symbol.

  - For DC Power, connect the positive voltage to +VDC and the common or negative to COM. (see Figure 15 & 16)

- **Wiring the Relay Contacts**

  - The CLASSIC 800 features two (2) fully sealed independent relays, which may be wired for Normally Closed (NC) or Normally Open (NO) operation. Relay 1/Relay 2 are connected as shown in Figure 15.

- **Wiring the 4-20 mA Analog Output**

  - The CLASSIC 800 features a fully isolated 4-20 mA Analog Output, which can be wired in a 3-Wire or 4-Wire configuration as shown in Figures 19, 20, and 21.

- **Wiring RS-485 Interface**

  The RS-485 remote communications port is connected as follows:

  485 (C)   The common ground reference used on some 3-wire half-duplex systems. While no current should pass through this conductor, it should not be used as a shield. If using a shield it should only be connected to ground at one point, usually at the PLC or computer.

  485 (A-)   The A or negative data line.

  485 (B+)   The B or positive data line.

  485 (T)   This pin provides an AC coupled terminator of 120 ohms when shorted to 485 (A-). This feature eliminates the need to add an external terminator. It is AC coupled to reduce power consumption when the 485 bus is idle. For more details on AC vs. DC termination of RS-485 networks, contact Kayden Technical Support at kayden.com.

  Notes: For more information see Figures 15 & 16.

- **Replacing the Electronics Module in the Enclosure**

Repeat steps 2B and 2C in reverse order. The cable from the sensor to the Electronics Module should be gently positioned between the outside of the Mounting Base Plate with green & black connectors and the inside of the enclosure. If the excess length of the cable interferes with the mounting of the Electronics Module then gently rotate the Electronics Module one full turn to put a twist in the sensor cable.

- There is no surplus room in the enclosure for excessively long wires.

- Use a quality data communications cable for all non-power connections (RS-485). Ensure that the shield is sufficient to allow the cable to coexist with the power connections. Consult your local electrical code for requirements.

- All wires must be kept free and clear of the green & black mounting connectors on the Mounting Base Plate to prevent interference with the mounting of the Electronics Module.

- Treat the Electronics Module and sensor cable with care. While the CLASSIC 800 is a rugged unit, these assemblies can be damaged if mishandled.

VI. LOCAL ENCLOSURE WIRING DIAGRAMS

REVISIONS

ZONE	REV.	DESCRIPTION	DATE	APPROVED
All	0	INITIAL RELEASE	21SEPT01	PC
	1	ADDED DETAILS AND INCLUDED DC INFORMATION	15JAN07	TDH
	2	TITLEBLOCK	27MAY09	READ
All	3	ADD TERMINAL NUMBERS AND PAGE 2 TABLE	24APR22	DRS
All	4	CORRECT NEGATIVE & POSITIVE LEGENDS AND ADD NOTE 5	24JAN25	DRS

TERM	DESCRIPTION	FUNCTION
01	AC - HOT (L1)	AC INPUT (Note 1)
02	AC-NEUTRAL (L2)	115 VAC (230 VAC), 6W
03	DC NEGATIVE (-)	DC INPUT (Note 1)
04	DC POSITIVE (+)	12 - 24 VDC, 6W
05	AC COUPLED TERMINATOR	
06	NEGATIVE DATA (A)	RS-485 COMM
07	POSITIVE DATA (B)	(Note 4)
08	COMMON GROUND	

VAC-H 01
VAC-N 02
COM 03
+VDC 04
485(T) 05
485(-) 06
485(+) 07
485(C) 08

FUNCTION	DESCRIPTION	TERM
ANALOG OUT	4-20 mA (-)	09
(Note 2)	4-20 mA (+)	10
RELAY 2	NORMALLY CLOSED	11
SPDT	NORMALLY OPEN	12
(Note 3)	COMMON	13
RELAY 1	NORMALLY CLOSED	14
SPDT	NORMALLY OPEN	15
(Note 3)	COMMON	16

09 LOOP -
10 LOOP +
11 R2NC
12 R2NO
13 R2CM
14 R1NC
15 R1NO
16 R1CM

KAYDEN
INSTRUMENTS

TITLE:
WIRING/CONNECTION DIAGRAM
INTEGRAL ELECTRONICS
SERIES: CLASSIC 800

SIZE	DWG. NO.	REV
B	D15-3002-E	4

SCALE: NTS	WEIGHT:	SHEET 1 OF 1

	NAME	DATE
DRAWN	TDH	15JAN07
CHECKED	CHARUK	15JAN07
ENG. APPR.	KUYPERS	15JAN07

COMMENTS:

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES

TOLERANCES:
ANGULAR: 0.5°
ONE PLACE DECIMAL ±0.1
TWO PLACE DECIMAL ±0.02
THREE PLACE DECIMAL ±0.007

INTERPRET GEOMETRIC
TOLERANCING PER:

MATERIAL

FINISH

DO NOT SCALE DRAWING

NOTES:

1. CLASSIC can be powered by AC or DC
(if both AC and DC are connected, DC will take precedence if DC > 15V).

2. Analog Output is passive, loop requires excitation.

3. SPDT Fully Sealed Relay Contacts rated
4 Amps resistive at 230 VAC or 30 VDC Max.

4. RS-485 connection typically requires only Terminals 6, 7 and 8.
To use optional built-in terminator, also connect
Terminal 5 to Terminal 6. See manual for more information.

5. Interconnection wires must be 12 to 24 AWG

KAYDEN INSTRUMENTS   Calgary, Alberta, Canada   Phone: +1.403.253.1423   kayden.com

Figure 15 - CLASSIC 800 Electronics Module Terminal Wiring Diagram

VII. REMOTE ENCLOSURE WIRING DIAGRAMS & APPLICATIONS

A CLASSIC 800 Remote Enclosure should be used in three application circumstances:

1. **Process Temperature is Too Hot for the Local Electronics Enclosure**

    •   If the environment the sensor will be mounted in is too hot for the electronics module, or too hot for the safety of the operator, a remote electronics enclosure should be used.

2. **Enclosed or Difficult-to-Reach Locations**

    •   If the sensor is placed in a location that makes reading the electronics module difficult, use the remote electronics option for ease of operator viewing, typically at eye level.

3. **High Vibration**

    •   Mounting the electronics in a high-vibration location could damage the module.

Remote Electronics Enclosure   Local Sensor Enclosure
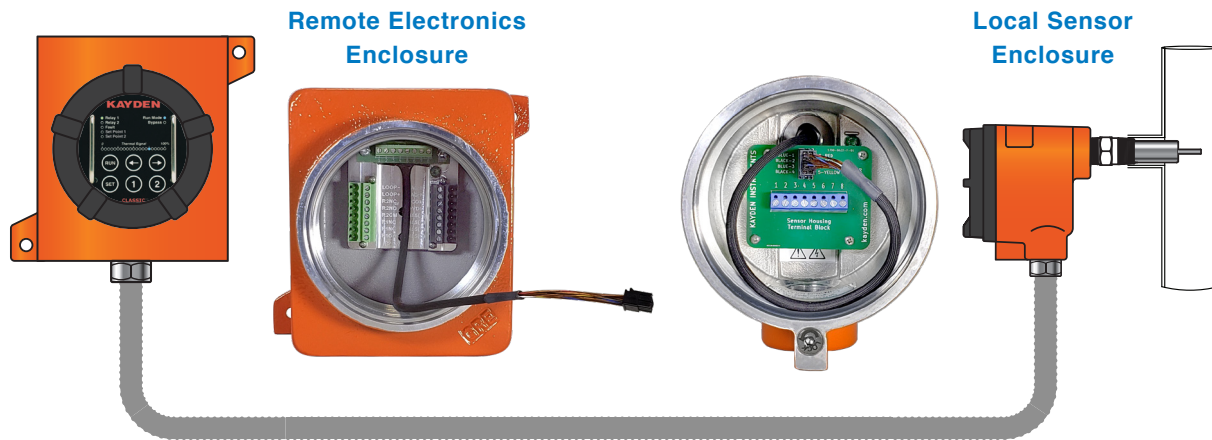
Figure 16 - CSA Remotely Mounted Electronics

Interconnecting Cables for Remote Electronics

Non-Armored Cable

Assembly includes heat shrink with crimp ferrules.
(Strain relief fittings are not included, however they are available as an option).

Construction

8 color coded conductors 20 AWG, shielded cable, PVC jacket.

Voltage Rating

30 volts RMS

Temperature Rating

-20°C to +80°C (-4°F to +176°F)

Part Number

A05-GP-xxxx (xxxx = length in feet)

Armored Cable

General Purpose (Non-hazardous) Cable & Connector Assembly

Assembly includes 2 general-purpose cable fittings.

Construction

8-strand concentric, Class B tinned copper, .020" PVC insulation, individual and overall foil shield, color & number coded, drain and Mylar separator, PVC inner jacket, aluminum interlock armor, PVC outer jacket.

Voltage Rating

300 volts

Temperature Rating

-40°C to +90°C (-40°F to +194°F); insulation rated @ 105°C (221°F)

Part Number

A06-GP-xxxx (xxxx = length in feet)

Flameproof Cable & Connector Assembly

Assembly includes 2 sealed explosion-proof cable fittings and sealing compound.

Construction: 8-strand concentric, Class B tinned copper, .020" PVC insulation, individual and overall foil shield, color & number coded, drain and Mylar separator, PVC inner jacket, aluminum interlock armor, PVC outer jacket.

Voltage Rating

300 volts

Temperature Rating

-40°C to +90°C (-40°F to +194°F); insulation rated @ 105°C (221°F)

Part Number

A06-XP-xxxx (xxxx = length in feet)

Connector Specifications

Connector Specification

Instrumentation cable comes with two (2) factory sealed hazardous location Thomas & Betts Star Teck XP cable fittings STX075-465. Assembly includes 2 sealed XP cable fittings, and sealing compound. Cable extra.

Connector Certifications

Type HLA. CSA Certified Class I, Divisions 1 and 2, Groups A, B, C and D; Class II, Divisions 1 and 2; Groups E, F and G; Class III, SL (integral seal) and Enclosure Type 4 and 4X. Complies with IEC requirements for Class 1, Zones 1 and 2, Groups IIC, IIB and IIA.

UL Listed for 1/2 through 3 inches when used with putty or liquid type compound: Class 1, Divisions 1 and 2, Groups A, B, C and D; Class II, Division 2, Groups F and G; Class III and Enclosure Type 4 and 4X.

UL Listed for 3-1/2 and 4 when used with putty or liquid type compound: Class 1, Divisions 1 and 2, Groups B, C and D; Class II, Division 2, Groups F and G; Class III and Enclosure Type 4 and 4X.

Cable Specifications

Wire Size: 4 Twisted Pair Shielded, 20 AWG

Construction: 7-strand concentric, Class B tinned copper, .020" PVC insulation, individual and over all foil shield, color & number coded, drain and Mylar separator, PVC inner jacket, aluminum interlock armour, PVC outer jacket.

Voltage Rating: 300 volts

Temperature Dry Rating: -40°C To +105°C

Cable Markings: Instrument/Control ACIC 4PR20 Shielded PVC 300V (-40°C) 105°C Dry 75°C Wet HLABCD Sun Res CSA FT4 LL7874 Canada ROHS 1575 MT

Notes:
1. This drawing is a reference document only.
2. Wire leads are labelled (1 - 8) for terminal strip connections.
3. See document D15-3001-E for wiring diagram.
4. All shield wires soldered together, ground at supply end only

A06-XP
REMOTE CABLE & CONNECTOR
DWG NO. D15-3001-E-CS REV 1
SIZE B SCALE NTS SHEET 1 OF 1

TELEMATIC CONTROLS INC; CALGARY, ALBERTA, CANADA PHONE: (403) 253-7939 WWW.TELEMATIC.COM

Figure 17 - A06-XP Remote Cable and Connector Specifications Drawing
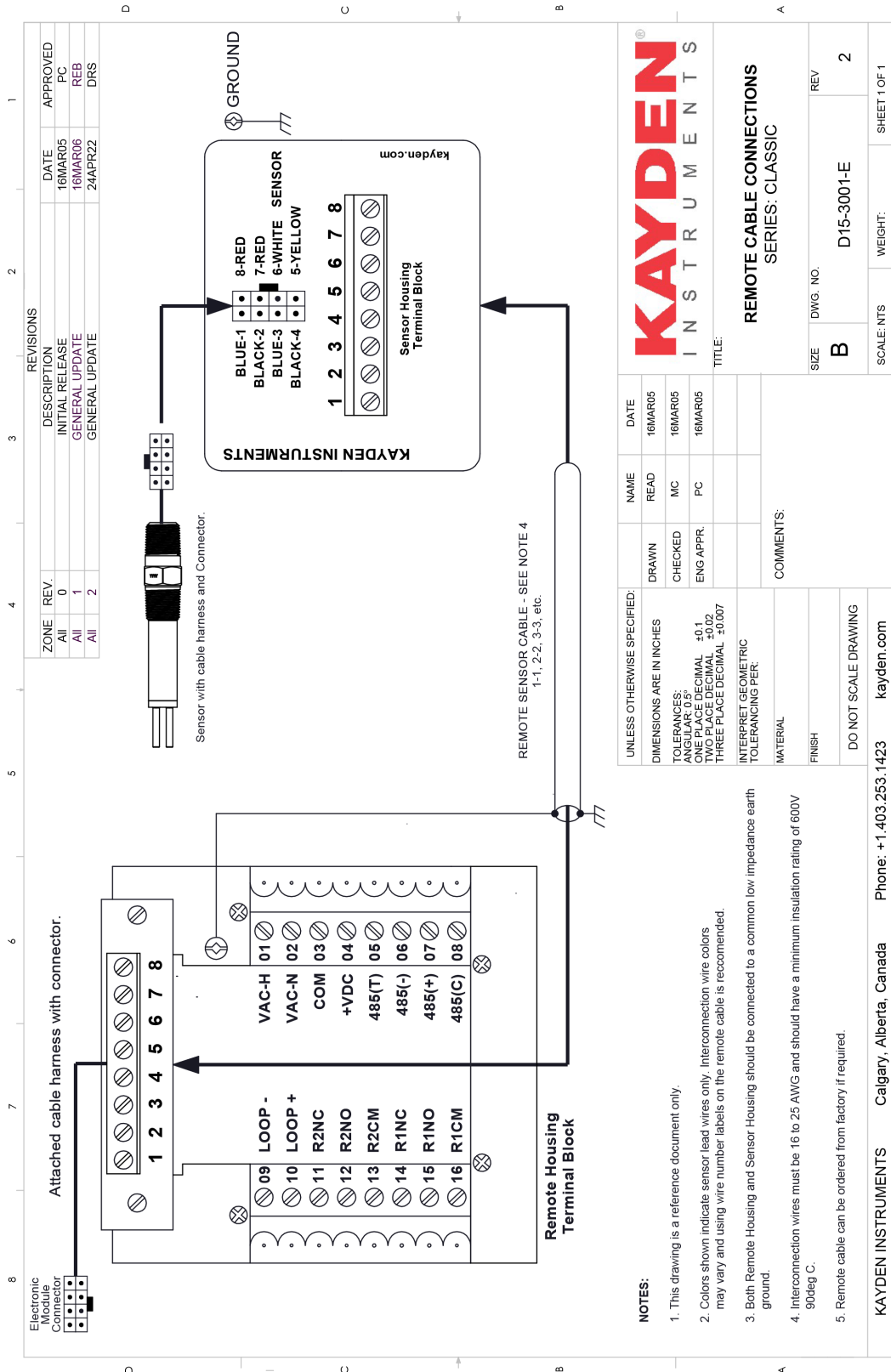
Figure 18 - CLASSIC 800 Wiring Diagram - Remote Electronics

Optional Wiring Methods for 4-20 mA Current Loop

CURRENT INPUT (4-20 mA)

4-20 mA LOOP POWER
(+12-24 VDC)

DC POWER SUPPLY

+12-24 VDC

-12-24 VDC

LOOP -   09
LOOP +   10
R2NC   11
R2NO   12
R2CM   13
R1NC   14
R1NO   15
R1CM   16

01   VAC-H
02   VAC-N
03   COM
04   +VDC
05   485(T)
06   485(-)
07   485(+)
08   485(C)

CLASSIC ENCLOSURE TERMINAL BLOCKS
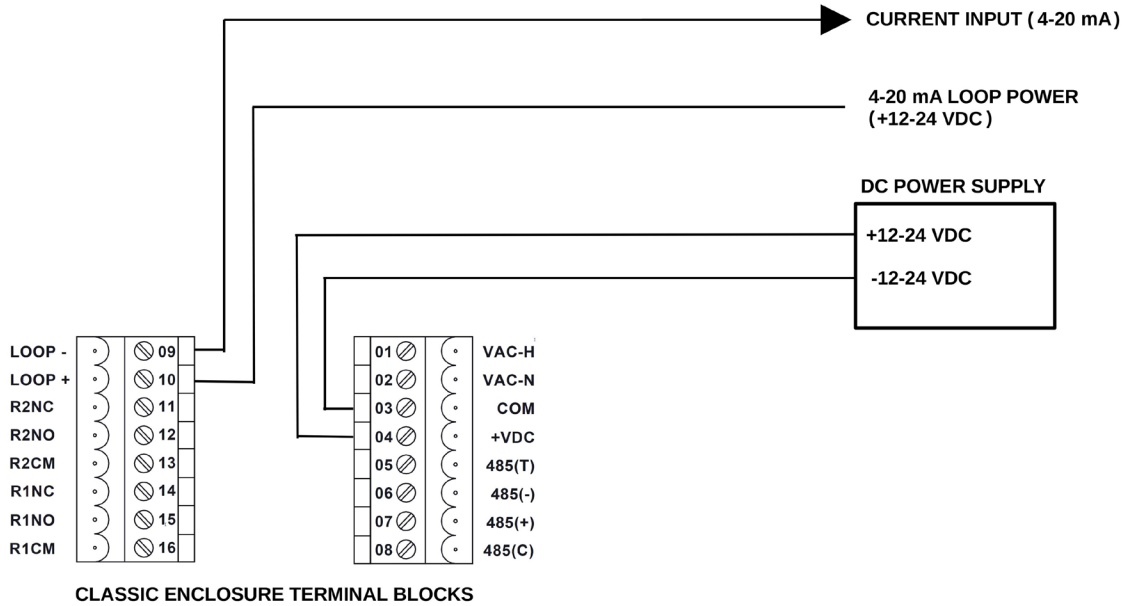
Figure 19 - DC Powered CLASSIC, 4-Wire External Loop Power - Current Sinking

+ CURRENT INPUT (4-20 mA)

- CURRENT INPUT (4-20 mA)

POWER SUPPLY AND INPUT
DEVICE MUST
SHARE COMMON REFERENCE

DC POWER SUPPLY

+12-24 VDC

-12-24 VDC

LOOP -   09
LOOP +   10
R2NC   11
R2NO   12
R2CM   13
R1NC   14
R1NO   15
R1CM   16

01   VAC-H
02   VAC-N
03   COM
04   +VDC
05   485(T)
06   485(-)
07   485(+)
08   485(C)

CLASSIC ENCLOSURE TERMINAL BLOCKS
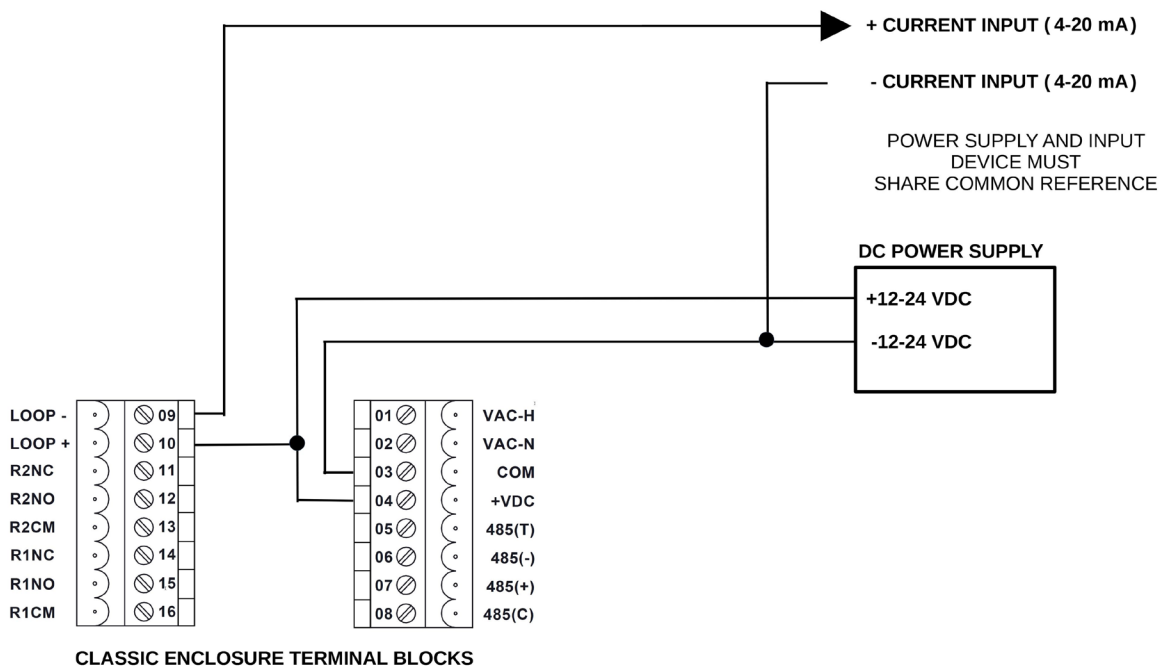
Figure 20 - DC Powered CLASSIC, 3-Wire Internal Loop Power - Current Sourcing

CURRENT INPUT (4-20 mA)

4-20 mA LOOP POWER
(+12-24 VDC)

AC POWER SUPPLY

115-230 VAC, NEUTRAL

115-230 VAC, HOT

LOOP -	09	01 VAC-H
LOOP +	10	02 VAC-N
R2NC	11	03 COM
R2NO	12	04 +VDC
R2CM	13	05 485(T)
R1NC	14	06 485(-)
R1NO	15	07 485(+)
R1CM	16	08 485(C)

CLASSIC ENCLOSURE TERMINAL BLOCKS

Figure 21 - AC Powered CLASSIC, 4-Wire External Loop Power - Current Sinking

VIII. TESTING THE INSTALLATION

1. Self-test Diagnostics

- The CLASSIC 800 continuously executes a self-test on its internal components and firmware. All diagnostics are controlled by the microprocessor and are independent of the operation of the switch and the process conditions.

- At initial power-on the CLASSIC 800 performs a complete self-test of all hardware and firmware. During this test all LEDs on the Thermal Signal display will flash for approximately 2 seconds.

- If a Fault is discovered during the self-test a Fault Code will be displayed and the relay will de-energize. (Fault Codes are explained in **Section 7 "Troubleshooting"**).

2. Power

- Turn on the power to the switch and **allow the sensor to heat up and stabilize (approximately 90 seconds)**.

- At the conclusion of the self-test, if there is no fault condition present, the Run Mode LED will begin flashing and a single LED (in the Thermal Signal Bar Graph) will appear on the display. As the heater element warms up, the switch will respond to the process conditions and this LED indicator will move to the left.

- Relay 1 and/or Relay 2 LEDs may illuminate depending upon the Thermal Signal, relay set point(s) and the programmed Relay condition (set to energize ABOVE or BELOW set point).

3. Manual Test

- Immerse the sensing tip in the actual process media by filling the pipe or vessel to the point at which the switch will actuate, or alternatively, into a container of the process media.

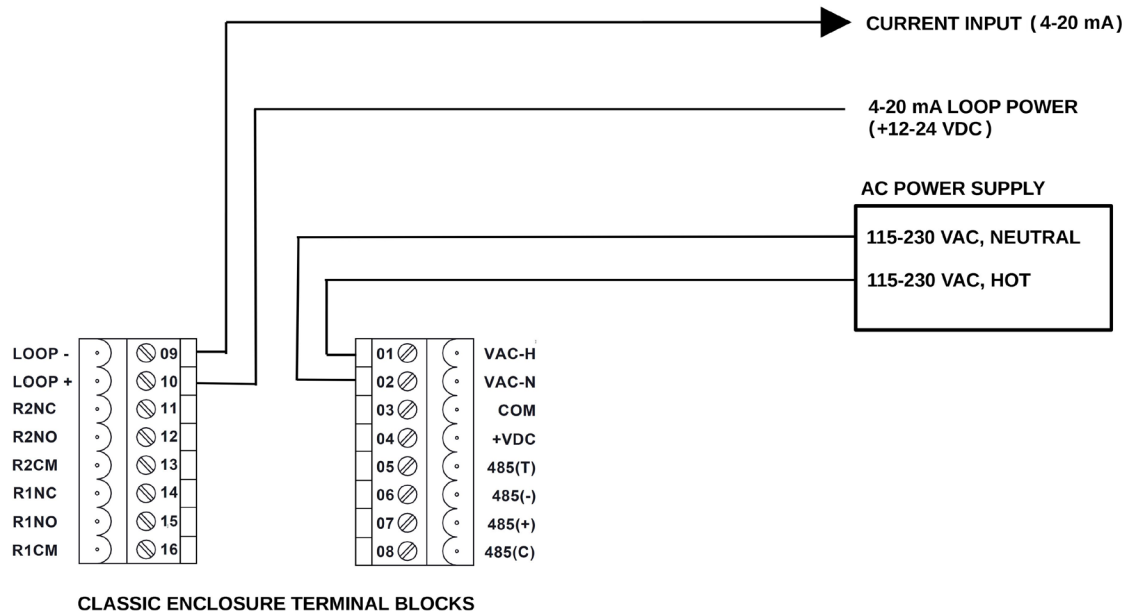- When the sensor is alternated between wet and dry conditions (in and out of the media), the illuminated Thermal Signal LEDs should move and the relay set point LED(s) should change state (ON/OFF). The degree and speed of the movement of the Thermal Signal LED depends completely on how well the current setup of the CLASSIC 800 corresponds to the process conditions of the test.*

   Note: *Because a complete setup may not have yet been performed allow at least 20 - 30 seconds for the sensor and relay to react when alternating between wet and dry conditions (in and out of the media).

- A complete explanation of setup procedures follows in **Section 4 "Setup & Operation"** and in the **Quick Setup Guide** for the CLASSIC 800.

3   Quick Setup Guide

Mechanical Installation

Observe the following safety guidelines before installing or removing your CLASSIC switch/transmitter:

- Use proper eye protection and any other safety equipment as required by your installation site.

- Check electrical power to ensure that all power has been disconnected and "locked out."

- Ensure the process tank or line pressures are "zero."

- Protect yourself against accidental release of steam, hot water, acids and other potentially hazardous media.

- Follow all safety precautions as specified for your installation site and local codes.

1. Before installing your CLASSIC, coat the sensor threads with facility-approved lubricant or sealant to prevent threads from binding.

2. Extra caution should be taken not to over-tighten the sensor threads while installing.

3. Install the CLASSIC, taking into account the orientation of the sensor as described below.

4. Keep in mind the need for easy access, safety of personnel and a suitable environment for the CLASSIC. In general, install the CLASSIC so as to minimize its exposure to vibration, shock, and extreme temperature fluctuations.

Sensor Orientation

The CLASSIC sensor is marked with the universal symbol ⟺ . This surface should be flat up and level in a horizontal flow application only. Refer to **Figures 1** and **2** for flow and level applications; this surface of the hex should be parallel to the direction of change in the process.

**Figure 1 -
Sensor Orientation for
Horizontal Flow**

Flow

Front View of Sensor

Horizontal Pipe: Side Mount

5% minimum

50% maximum

**Top/Bottom
Mount**

35% to 65% max
50%
35% to 45% max
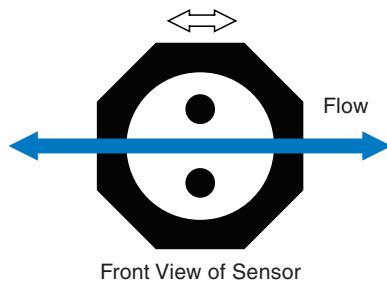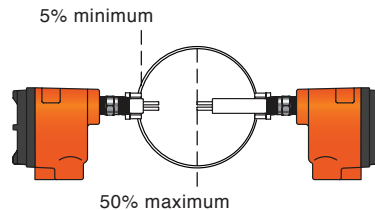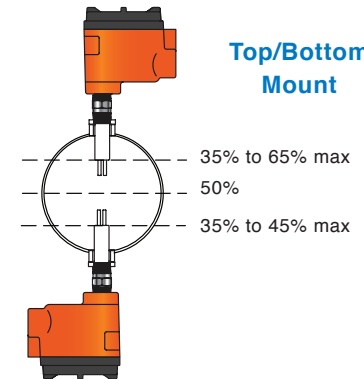
**Figure 2 -
Sensor Orientation for Vertical
Flow**

Flow & Level

Front View
of Sensor
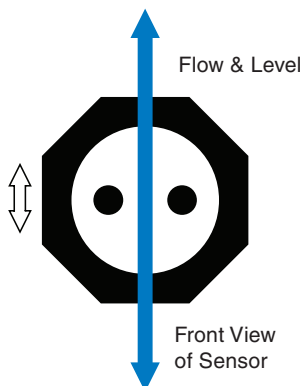
**Sensor Positioning,
Horizontal Pipe**

✔ Liquids
✔ Gas
✖ Liquid (Partially Full)

✔ Liquids
✔ Gas

✔ Liquids
✔ Gas

✔ Liquids
✖ Gas
✖ Sediment

KAYDEN | Quick Setup Guide
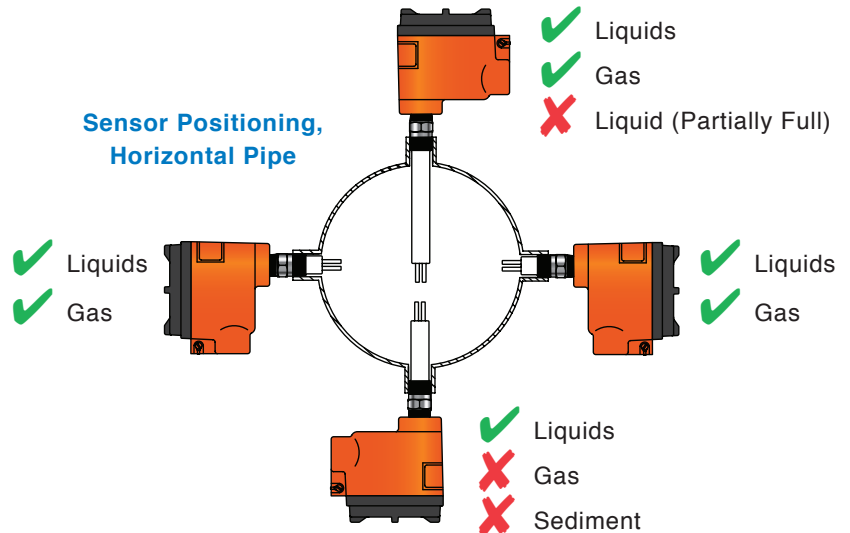
To configure or adjust the CLASSIC, perform these steps in the order indicated.
STEP 1 - Perform changes to Heater Power on Setting 7, then adjust Scaling on Settings 10 & 11
STEP 2 - Push RUN and verify the Thermal Signal is within the unscaled or new scaled view.
STEP 3 - Perform changes to Relay operation on settings 1 & 2
STEP 4 - Perform changes to Set Points on settings 4 & 5

● LED SOLID   ☀ LED FLASHING

SET — Press 1x
● **RELAY 1** — Select the coil operation to energize lower or higher than set point.
Factory Default: **LOWER**
← Energize Lower than Setpoint
→ Energize Higher than Setpoint

SET — Press 2x
● **RELAY 2** — Select the coil operation to energize lower or higher than set point.
Factory Default: **LOWER**
← Energize Lower than Setpoint
→ Energize Higher than Setpoint

SET — Press 3x
● **FAULT** — Select the fault action to be either Fail low at 3.0 mA or Fail high at 21 mA
Factory Default: **3.0 mA**
← 3.0 mA Output Fault
→ 21.0 mA Output Fault

SET — Press 4x
● **Set Point 1** — Select a Thermal Signal Set Point for Relay 1
Factory Default: **25%**
← Decrease Set Point
→ Increase Set Point

SET — Press 5x
● **Set Point 2** — Select a Thermal Signal Set Point for Relay 2
Factory Default: **75%**
← Decrease Set Point
→ Increase Set Point

SET — Press 6x
● **BYPASS** — Select an amount of time for the switch to return to RUN mode. Increments of 5 seconds.
Factory Default: **0 Seconds**
← Decrease Bypass Time
→ Increase Bypass Time

SET — Press 7x
☀ **RELAY 1** — Select a Heater Power setting. This directly affects the sensitivity to flow.
Factory Default: **75%**
← Decrease Heater Power
→ Increase Heater Power

SET — Press 8x
☀ **RELAY 2** — Select a Node Address for Modbus Comms. Software Rec is also identified on the left LEDs
Factory Default: **1**
← Decrease Node Address
→ Increase Node Address

SET — Press 9x
☀ **FAULT** — Select the action of the 4-20 mA Output to either Reverse or Forward acting.
Factory Default: **Forward**
← Forward Acting mA Output
→ Reverse Acting mA Output

SET — Press 10x
☀ **Set Point 1** — Select a zero percent thermal signal for the LRV scaled view.
Factory Default: **0%**
← Decrease LRV
→ Increase LRV

SET — Press 11x
☀ **Set Point 2** — Select a one hundred thermal signal for the URV Scaled View
Factory Default: **100%**
← Decrease URV
→ Increase URV

How to Enter, Scroll & Exit the Configuration Menu
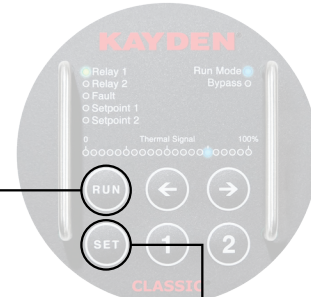
Press RUN to exit Setup and return to RUN MODE.
Note: If Bypass is turned on, the RUN MODE will not start until the selected time ends

Press SET to enter Configuration Mode. To access all 11 menu options, press SET repeatedly.

How to Perform Factory Reset
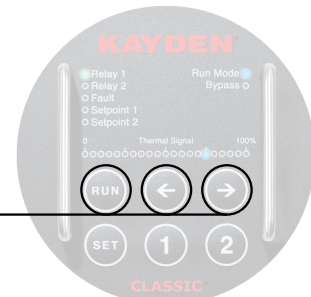
Press & Hold RUN + LEFT ARROW + RIGHT ARROW until all LEDs flash or run back and forth.

Previous configurations will be lost and the unit will return to factory defaults.

Relays will actuate and/or de-actuate during reset.

Consult Troubleshooting (Section 7) in Product Manual for full details.

Quick Check Buttons   *MUST BE IN RUN MODE

A - Press & Hold RUN to view Software Rev & Modbus Node Address
B - Press & Hold LEFT ARROW to view LRV and URV.
C - Press & Hold RIGHT ARROW to view Thermal Signal on Unscaled Bar Graph
D - Press & Hold 1 to view Set Point 1
E - Press & Hold 2 to view Set Point 2

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CLASSIC 800 Display Panel

Display Panel Indicators:

Relay 1	On steady when Relay 1 is energized
Relay 2	On steady when Relay 2 is energized
Fault	Indicates a self-test error or fault condition
Set Point 1	On steady when viewing Set Point 1
Set Point 2	On steady when viewing Set Point 2
Run Mode	Flashing when switch is operating
Bypass	Flashing when the Start-up Bypass Timer is active
Thermal Signal	Displays Thermal Signal

The Thermal Signal increases as:

Flow	The flow rate increases
Level	The sensor is submerged
Interface	The sensor is submerged by the second liquid of greater thermal conductivity
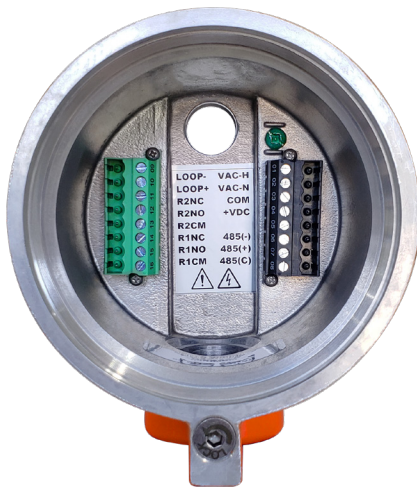
Mounting Base Plate / Terminal Assembly

RUN MODE - Run Mode LED is 'Flashing'	
RUN	Press and hold to view the **Software Revision** and **Node Address**
SET	Press and release to enter **Set Mode** (see table below)
Left Arrow	Press and hold to view the LRV and URV on Unscaled Bar Graph
Right Arrow	Press and hold to view Thermal Signal data on Unscaled Bar Graph
1	Press and hold to view **Set Point 1** on Bar Graph
2	Press and hold to view **Set Point 2** on Bar Graph

SET MODE - Run Mode LED is 'Off'	
RUN	Press and release to exit **Set Mode** and return to **Run Mode**
SET	Press and release to proceed to next step of **Set Mode**
Left Arrow	Adjust selection as per **Set Mode** function
Right Arrow	Adjust selection as per **Set Mode** function
1	No function in **Set Mode**
2	No function in **Set Mode**

Mounting Base Plate Wire Positions	
09 - **LOOP -**	01 - **VAC-H**
10 - **LOOP +**	02 - **VAC-N**
11 - **R2NC**	03 - **COM**
12 - **R2NO**	04 - **+VDC**
13 - **R2CM**	05 - **485-T**
14 - **R1NC**	06 - **485-A (-)**
15 - **R1NO**	07 - **485-B (+)**
16 - **R1CM**	08 - **485-C**

⚠ CAUTION

Installation, connection and maintenance must be carried out by expert technicians who have read these operating instructions. These operating instructions include all-important information required for the installation and operation of this product. They supplement the full Product Manual, and the relevant national regulations with respect to the equipment as well as with the maintenance activities.

POWER, AC/DC

Either AC or DC voltage can be used to power the CLASSIC:

- For AC power, connect the HOT line to VAC-H, the NEUTRAL to VAC-N and the GROUND wire to the green grounding screw, also indicated by the ground symbol.

- For DC Power, connect the positive voltage to +VDC and the common or negative to COM.

⚠ CAUTION

Never power on the circuits in a potentially explosive area without first installing the enclosure cover.

Always lock the cover in place. This may be required by your local safety or electrical code.

RELAY OUTPUTS

The CLASSIC features two independent set points each with its own mechanical relay for output. The connections for the contacts of these relays are:

R1COM	Common or pole contact for Relay 1
R1NC	Normally closed contact for Relay 1 when the coil is not energized
R1NO	Normally open contact for Relay 1 when the coil is not energized
R2COM	Common or pole contact for Relay 2
R2NC	Normally closed contact for Relay 2 when the coil is not energized
R2NO	Normally open contact for Relay 2 when the coil is not energized

NOTE: For fail-safe installations, the desirable relay state is usually energized and the circuit closed. Use the normally open contacts for fail-safe installations since they are closed when the relay is energized.

MAINTENANCE

Your Kayden instrument requires very little maintenance as there are no moving parts.

Without detailed knowledge of the environment parameters of the application surroundings and process data media, we cannot make specific recommendations for periodic inspection, cleaning, or testing procedures. we do however suggest general guidelines for

maintenance (see the CLASSIC Product Manual). Use operating experience to establish the frequency of each type of maintenance.

CALIBRATION

The CLASSIC does not require any calibration for use as a switch/transmitter. Once properly setup, the CLASSIC will be as stable and repeatable as the process in which it is installed. It may be necessary to check or repeat the setup procedure if the process changes dramatically over time.

HEATER POWER

The CLASSIC uses a constant power heater (2 Watt maximum), that can be set between 0 - 100% in 5% increments.

- Since the energy added by the heater is used in determining the Thermal Signal, altering the amount of heat changes the Thermal Signal.

- If the heater power is changed more than 5% (1 LED) this may require the 0% & 100% Thermal Signal to be similarly adjusted in order not to lose sensitivity and reaction time.

- The Factory Default Heater Power setting of 75% (1.5 watts) is suitable for most Flow applications with Hydro-carbons.

- RECOMMENDED HEATER POWER SETTINGS:

  - **30 - 60% heater power (7-13 LEDs)** - Air or Gas (Flow) (depending on velocity)

  - **60 - 75% heater power (13-16 LEDs)** - Oil or Hydrocarbon based liquids (Flow, Level & Interface)

  - **80 - 100% heater power (17-21 LEDs)** - Water or non-viscous liquids (Flow, Level & Interface)

The faster the flow rate (velocity) the more heat required. In level applications the amount of heat, in part, determines the reaction time.

The CLASSIC 800 Series has a "Smart Heater" function (see the **"Classic 800 Product Manual"**). If a heater operates constantly in a no flow or dry condition, a "Thermal Offset" can occur. This means the heater may affect the reading from the reference RTD. The microprocessor will automatically reduce the heater power setting to a lower power rating when the probe is "dry" or in a "no-flow" condition. When the process media touches the sensors, or flow begins again, the original heater power setting is restored.

KAYDEN®

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Setup & Operation

**Figure 1 - CLASSIC 800
Display Panel**

Display Panel Indicators:

Relay 1	On steady when Relay 1 is energized
Relay 2	On steady when Relay 2 is energized
Fault	Indicates a self-test error or fault condition
Set Point 1	On steady when viewing Set Point 1
Set Point 2	On steady when viewing Set Point 2
Run Mode	Flashing when switch is operating
Bypass	Flashing when the Start-up Bypass Timer is active
Thermal Signal	Displays Thermal Signal

The Thermal Signal increases as:

Flow	The flow rate increases
Level	The sensor is submerged
Interface	The sensor is submerged by the second liquid of greater thermal conductivity

Display Panel Button Functions - **RUN Mode and SET Mode.**

RUN MODE - Run Mode LED is 'Flashing'	
RUN	Press and hold to view the **Software Revision** and **Node Address**
SET	Press and release to enter **Set Mode** (see table below)
Left Arrow	Press and hold to view the LRV and URV on Unscaled Bar Graph
Right Arrow	Press and hold to view Thermal Signal data on Unscaled Bar Graph
1	Press and hold to view **Set Point 1** on Scaled Bar Graph
2	Press and hold to view **Set Point 2** on Scaled Bar Graph

SET MODE - Run Mode LED is 'Off'	
RUN	Press and release to exit **Set Mode** and return to **Run Mode**
SET	Press and release to proceed to next step of **Set Mode**
Left Arrow	Adjust selection as per **Set Mode** function
Right Arrow	Adjust selection as per **Set Mode** function
1	No function in **Set Mode**
2	No function in **Set Mode**

I. GENERAL INFORMATION

1. Warm-up

At initial start-up or restart allow approximately 90 seconds for the heater element to warm-up and the switch to stabilize before making any adjustments.

2. Diagnostics

As described in greater detail in **Section 7 "Troubleshooting"** an automatic diagnostic program runs continuously when power is connected. To prevent the possibility of intermittent failures the CLASSIC 800 will display a Fault condition in the event of improper electrical connection, loss of power and/or physical damage.

3. Universal Power

The CLASSIC 800 will accept either 12-24 VDC or 115-230 VAC but must be wired accordingly.

The CLASSIC 800 may not be loop powered. At a minimum the unit typically requires 4 wires: 2 for power and 2 for one relay (see Figure 12 - CLASSIC 800 Wiring Connection Diagram).

Power consumption for the CLASSIC 800 is rated at a maximum of 6 VA (watts). The maximum rating is based on the assumption that both relays are energized, the heater is at maximum power and several LEDs are illuminated. An application involving the relay energized and the heater at 80% power consumes typically 300 mA or 4 VA.

4. Electronics

The CLASSIC 800 Electronics Module is universal and may be installed for testing or operation in all CLASSIC 800 series switches/transmitters regardless of sensor configuration. Therefore, the Electronics Module may be considered a universal spare part and the most essential troubleshooting tool for all applications.

II. CONTROL SETTINGS and SETUP PROCEDURES

Quick Setup Guide

This section contains detailed information supplementing the **CLASSIC 800 "Quick Setup Guide"** (**Section 3**). For convenience, the procedures are listed in the same order as the Configuration Flow Chart in the Quick Setup Guide.

Quick Setup for Pump Flow / No Flow

For Kayden Flow / No Flow switch configuration: follow these steps:

1. Make sure switch is turned on with "Run" light flashing and wait a minute for probe to heat up and stabilize.

2. Turn pump "On then Off" to see the "No flow" and "Full flow" Thermal Signal values on the LED Bar Graph. Then adjust the LRV to the "No flow" value, and the URV to the "Full flow" value.

3. Now set the Set-point for the relay to approximately "the middle" of change "between No Flow to Full Flow change" indicated.

Note: For "Failsafe" operation. Relay should be energized during flow condition, with alarm wires connected to Normally Open & Common contacts.

Please contact Kayden Technical Support for any assistance for your application.

1. View or Adjust Relay 1 & 2 Energized Mode

The CLASSIC has two relays which can be independently configured to energize lower or higher than Set Point.

Both relays on the CLASSIC 800 have Normally Open and Normally Closed contacts. The terms 'Open' and 'Closed' refer to the de-energized state of the relays. Normally Open or Normally Closed operation for **Relay 1/Relay 2** is determined by wiring the contacts accordingly (see Figures 15 [pg. 17] & 18 [pg. 20]).

Relay 1 LED is ON to configure Relay 1

RELAY ENERGIZED LOWER THAN SET POINT

Set Relay Activation LOWER THAN SET POINT

RELAY ENERGIZED HIGHER THAN SET POINT

Set Relay Activation HIGHER THAN SET POINT

- **RUN** advances to Run Mode
- **SET** advances to next Setup step
- **Run Mode** LED is Off in Setup Mode

Figure 22 - Relay Energized Mode

To View or Adjust Relay 1 & 2 Energized Modes

1. Press **SET** until the **Relay 1** LED is ON solid to set the **Relay 1** Energized Mode, or until the **Relay 2** LED is ON solid for the **Relay 2** Energized Mode. The **Run Mode** LED will be OFF.

2. The **Thermal Bar Graph** will show the left 6 LEDs **(0% to 25%)** ON to indicate the energized mode is lower than set point, or the right 6 LEDs **(75% to 100%)** ON to indicate the energized mode is higher than set point.

3. To adjust the Mode, press and release the **Left** or **Right** Arrow keys.

4. When satisfied with your configuration, press and release **SET** to continue to the next programmable variable OR press and release **RUN** to return to **Run Mode.**

Failsafe Relay Configurations

The term "Fail-safe" refers to a method of wiring and programming control instrumentation commonly used in hazardous locations/applications.

- In a "Fail-safe" application the CLASSIC 800 switch/transmitter is wired and programmed so that the output relay is energized in normal process operating condition.

- Thus, in the event of a power failure, cable break, self-test failure, or other loss of electrical power, the contact is "opened", the relay is de-energized and an alarm will result.

A common "Fail-safe" setup for **NO FLOW CONDITION, PUMP PROTECTION:**

- Connect the relay contact wires to Normally Open (R1NO, R1CM)

- Program the relay(s) to energize above set point.

- Depending on application and setup of the switch/transmitter, the relay contact(s) will OPEN (de-energize) when:

    a. The Thermal Signal decreases due to a decrease or loss of flow/level.

    b. Power is lost to the switch/transmitter as described above.

2. View or Adjust 4-20 mA Fault Mode Configuration

The 4-20 mA output is used to monitor the analog data from the sensor, such as a self-test fault. The 4-20 mA output can be programmed for a value of 3.0 mA or 21 mA.

Note: Refer to **Section 7 "Troubleshooting"** for a description of fault conditions.

- **RUN** advances to Run Mode
- **SET** advances to next Setup step
- **Run Mode** LED is Off in Setup Mode
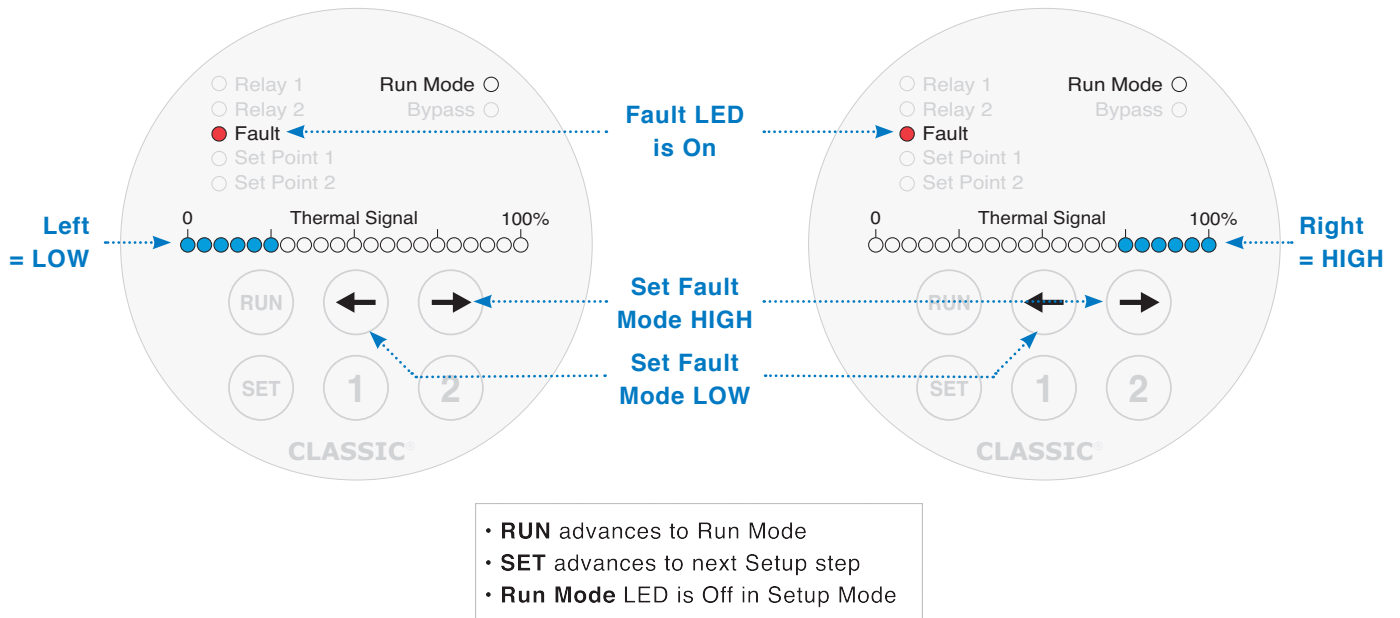
Figure 23 - 4-20 mA Fault Mode Configuration

To View or Adjust Fault Current

1. Press and release **SET** until the **Fault** LED is on solid; the **Run Mode** LED will be off.

2. The **Thermal Signal Bar** Graph shows the 4-20 Fault Mode.
   For **3.0 mA the 0-25% LED's are on solid;**
   for **21 mA the 75-100% LED's are on solid.**

3. To adjust the Mode, press and release the **Left** or **Right Arrow** keys.

4. When satisfied with your configuration, press and release **SET** to continue to the next programmable variable OR press and release **RUN** to return to **Run Mode.**

3. View or Adjust Set Points 1 & 2

Notes: 1. Viewing either **Set Point 1** or **2** from the Display Panel does not require entering the Manual Setup Mode. While still in **RUN Mode**, press and hold **1** or **2** to view the programmed **Set Point**.

2. In this context "Set Point" refers to the point(s) within the user defined range at which **Relay 1** and **Relay 2** energize/de-energize.

3. **Set Point 1** always corresponds to **Relay 1** and **Set Point 2** always corresponds to **Relay 2**.

4. Relay energize/de-energize can be delayed by configuring relay delay timers. Refer to Modbus Registers and Kayden RCM Software use in **Section 6**.
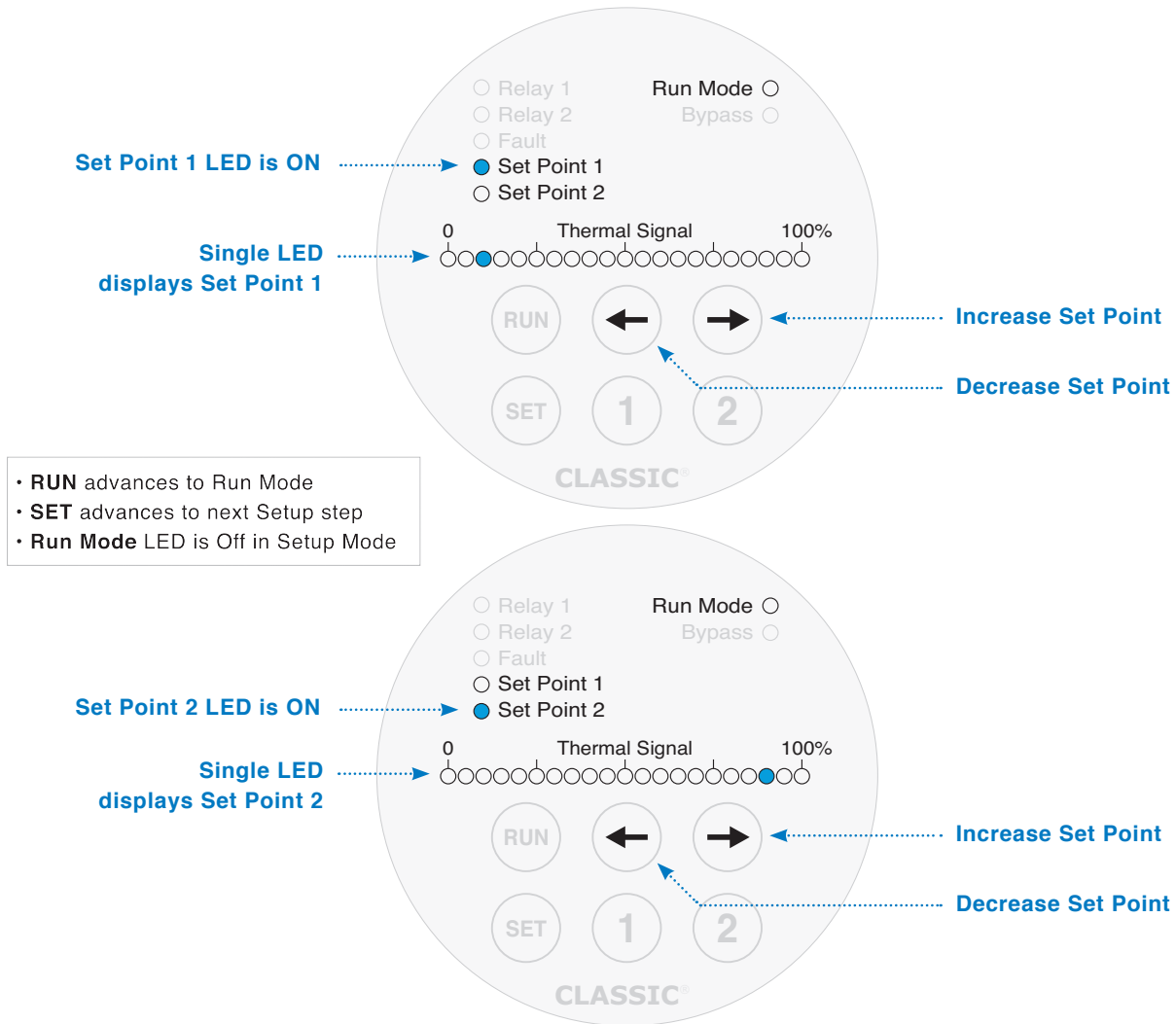
Figure 24 - Set Point 1 & 2 Configuration

To View or Adjust Set Points

1. Press and release **SET** until the **Set Point 1** or **Set Point 2** LED is on solid and the **Run Mode** LED is off.

2. One LED on the **Thermal Signal Bar Graph** will illuminate, corresponding to the present setting of the selected set point.

3. To adjust the selected **Set Point**, press and release the **Left** or **Right Arrow** keys.

4. When satisfied with your configuration, press and release **SET** to continue to the next programmable variable OR press and release **RUN** to return to **Run Mode**.

4. View or Adjust Start-up Bypass Timer

The Start-up Bypass Timer can be used to energize both relays when the CLASSIC is initially powered ON, or when the SET button is pressed followed by the RUN button. This provides a means to automatically restart a pump that has been turned OFF by the CLASSIC, without the need for additional hardware.

Notes: 1. The Start-up Bypass Timer is commonly used to automatically re-start a pump after the specified (programmed) time delay.

2. During the Bypass Delay, both relays are energized regardless of their Mode or the value of the **Thermal Signal**.

3. When the Start-up Bypass Timer is in use, neither Setup Mode nor the Thermal Signal Bar Graph are available until the programmed delay time expires.

The **Thermal Signal Bar Graph** displays the delay (each LED right of the zero LED in Bypass Mode equals 5 seconds; therefore the maximum time in Bypass is 100 seconds). Instead of measuring from 0 to 100 percent the **Thermal Signal Bar Graph** shows the delay from 0 to 100 seconds.

If the **Start-up Bypass Timer** is set to zero then no Bypass Delay will occur.
(The Factory Default setting is **zero seconds**.)

· **RUN** advances to Run Mode
· **SET** advances to next Setup step
· **Run Mode** LED is Off in Setup Mode
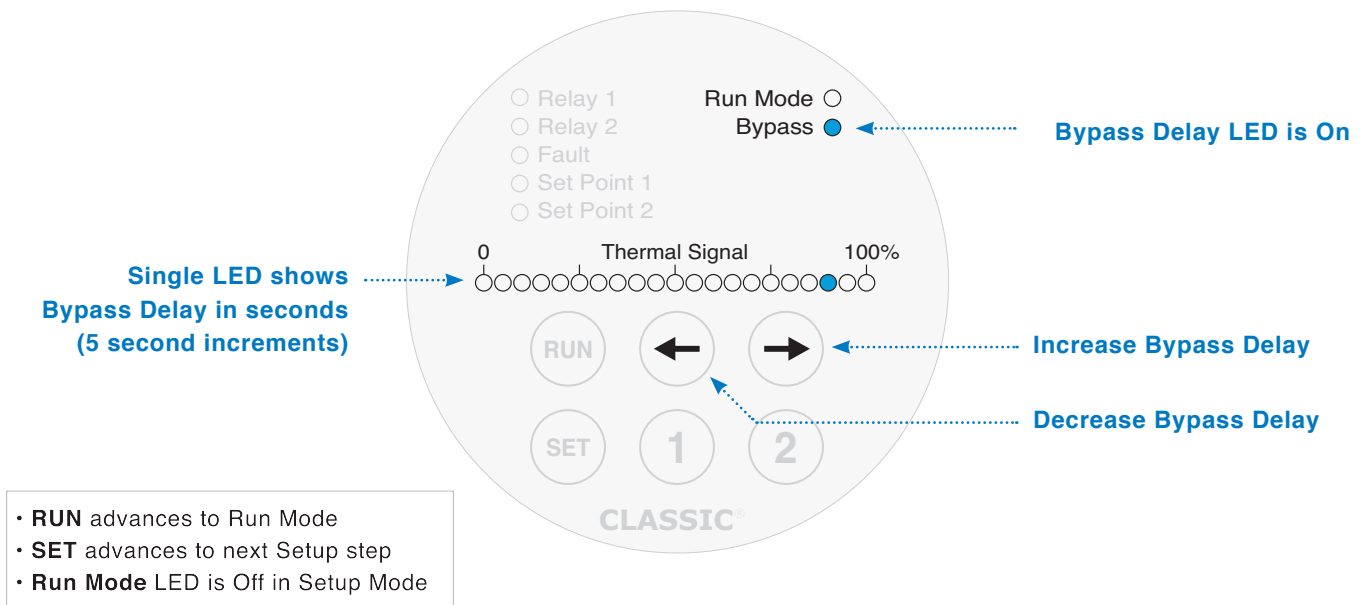
Figure 25 - Start-up Bypass Timer

To View or Adjust Bypass Timer Settings

1. Press and release **SET** until the **Bypass** LED is on solid and the **Run Mode** LED is off.

2. One LED on the **Thermal Signal Bar Graph** will illuminate corresponding to the present setting of the **Start-up Bypass Timer**.

3. To adjust the **Start-up Bypass Timer,** press and release the **Left** or **Right** Arrow keys.

4. When satisfied with your configuration, press and release **SET** to continue to the next programmable variable OR press and release **RUN** to return to **Run Mode**.

5. View or Adjust Heater Power

- The correct heater setting is determined primarily by the process media and secondarily by the velocity of the process. The heater setting is a key factor in determining the sensitivity and reaction time of the switch/transmitter.

- The CLASSIC 800's sensor heater produces 2 Watts at full power.

  - The "Smart Heater" function in the CLASSIC 800 Series continously monitors the Thermal Signal. If the Thermal Signal falls to zero, the heater power is automatically reduced from the user setting to prevent the creation of a "Thermal Offset". The heater power will be restored to the user setting when the Thermal Signal increases.

  - The Factory Default setting of 75% is optimal (70 - 80% depending on velocity) for Hydrocarbon-based liquids and suitable for many applications. The CLASSIC 800 allows the Heater Power to be set between 0% and 100% in 5% steps.

  - RECOMMENDED HEATER POWER SETTINGS:

    - **30 - 60% heater power** (**7-13 LEDs**) - Air or Gas (Flow) (depending on velocity)

    - **60 - 75% heater power** (**13-16 LEDs**) - Oil or Hydrocarbon based liquids (Flow, Level & Interface)

    - **80 - 100% heater power** (**17-21 LEDs**) - Water or non-viscous liquids (Flow, Level & Interface)

  The faster the flow rate (velocity) the more heat is required. In level applications the amount of heat, in part, determines the reaction time.

Note: The heater power is shown when using Kayden RCM software in the Graph view.
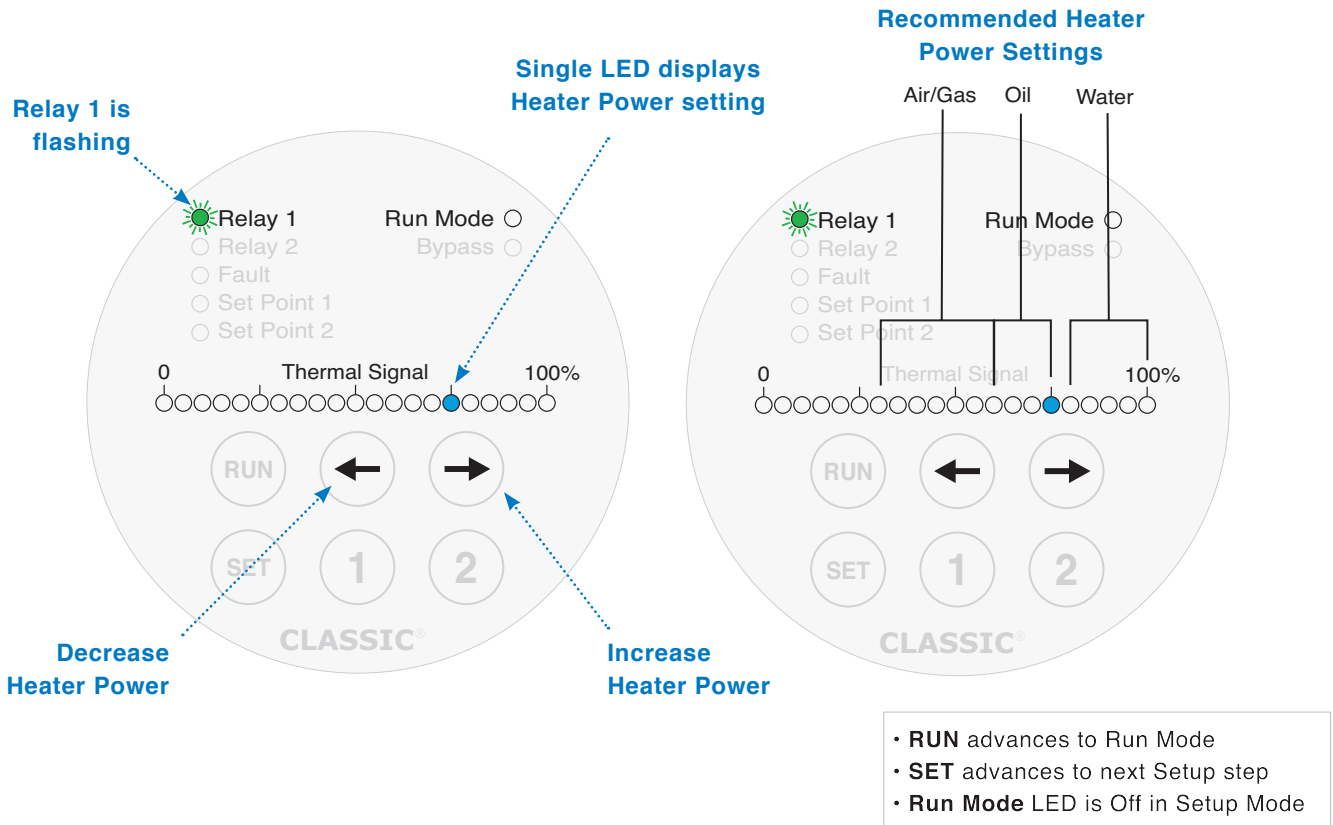
Figure 26 - Setting the Heater Power

6. View or Adjust Node Address & View the Software Revision

The Software Revision and Node Address are displayed on the **Thermal Signal Bar Graph** as two binary bytes. The Software Revision is not adjustable but can be useful should telephone support be required.

The Factory Default for the Node Address is 1 (one).

Adjusting the Node Address is only required if setting up a multi-point RS-485 network or adding the CLASSIC 800 to an existing RS-485 network.

The Software Revision and Node Address can also be viewed while in **Run Mode** by pressing and holding the **RUN** key.
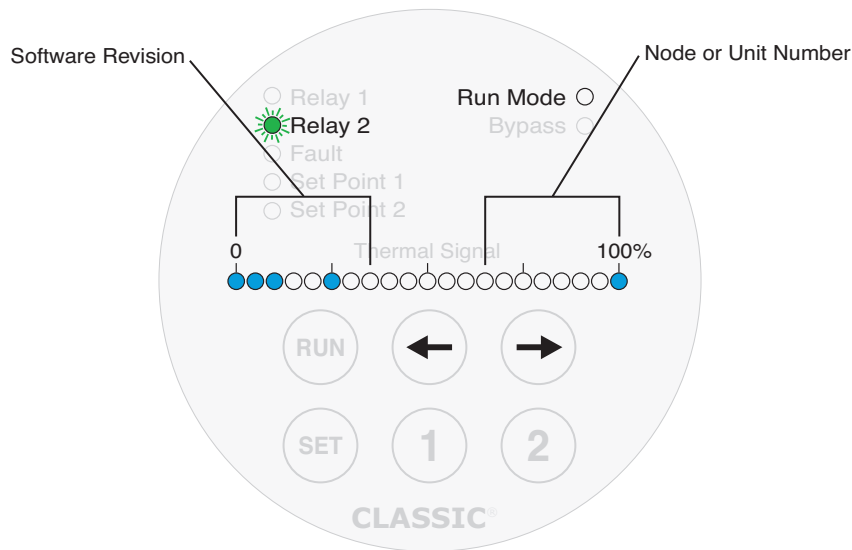
Figure 27 - Software Revision & Node (Unit) Number

To View or Adjust Node (Unit) Address

1.   Press and release **SET** until the **Relay 2** LED is **flashing** AND the **Run Mode** LED is off.

2.   The **Thermal Signal Bar Graph** now displays the value of the Software Revision and the setting of the Node Address.

3.   The Node Address is displayed in binary using the eight LED's on the righthand side of the Bar Graph. Refer to **3. Note Address** in **Section 5 Modbus** to interpret the Node Address.

4.   To adjust the Node Address, press and release the **Left** and **Right** Arrow keys.

5.   When satisfied with your configuration, press and release **SET** to continue to the next programmable variable or press and release **RUN** to return to **Run Mode**.

7. View or Adjust 4-20 mA Output Configuration (Forward or Reverse Acting)

The current output is an analog signal representing the Thermal Signal Bar Graph View. The action chosen only affects the 4-20 mA Analog Output, and does not affect the Thermal Signal Bar Graph.

FORWARD ACTING

Fault LED is flashing ············►

4 mA to 20 mA ············►

Push LEFT Arrow to Set for FORWARD Acting

REVERSE ACTING
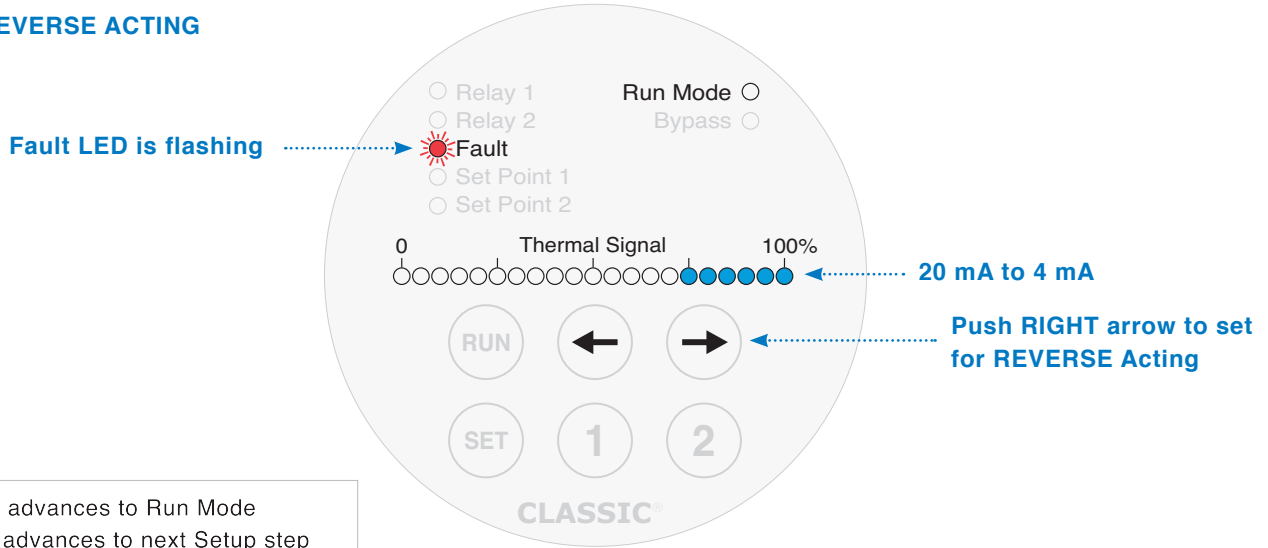
Fault LED is flashing ············►

20 mA to 4 mA

Push RIGHT arrow to set for REVERSE Acting

- **RUN** advances to Run Mode
- **SET** advances to next Setup step
- **Run Mode** LED is Off in Setup Mode

Figure 28 - 4-20 mA & 20-4 mA Output Mode

To View or Adjust 4-20 mA Output Current Mode

1. Press and release **SET** until the **Fault** LED is **flashing** AND the **Run Mode L**ED is off.

2. The **Thermal Signal Bar Graph** shows the 4-20 Output Mode.

    For 0% equal to 4 mA the 0-25% LED's are on solid.

    For 100% equal to 4 mA the 75-100% LED's are on solid.

3. To adjust the Mode, press and release the **Left** or **Right Arrow** keys.

4. When satisfied with your configuration, press and release **SET** to continue to the next programmable variable OR press and release **RUN** to return to **Run Mode**.

8. View Bar Graph Lower Range Value (0%) and Upper Range Value (100%)

The **Unscaled Bar Graph** is the maximum thermal signal range that the CLASSIC 800 can display.

For improved resolution, the Lower Range Value (LRV) and Upper Range Value (URV) can be adjusted in 5% incerments (the default value of LRV is 0% and URV is 100% as shown below in Figure 24).

LRV (Lower Range Value)

URV (Upper Range Value)

To view the current LRV & URV, press and hold LEFT button in RUN mode
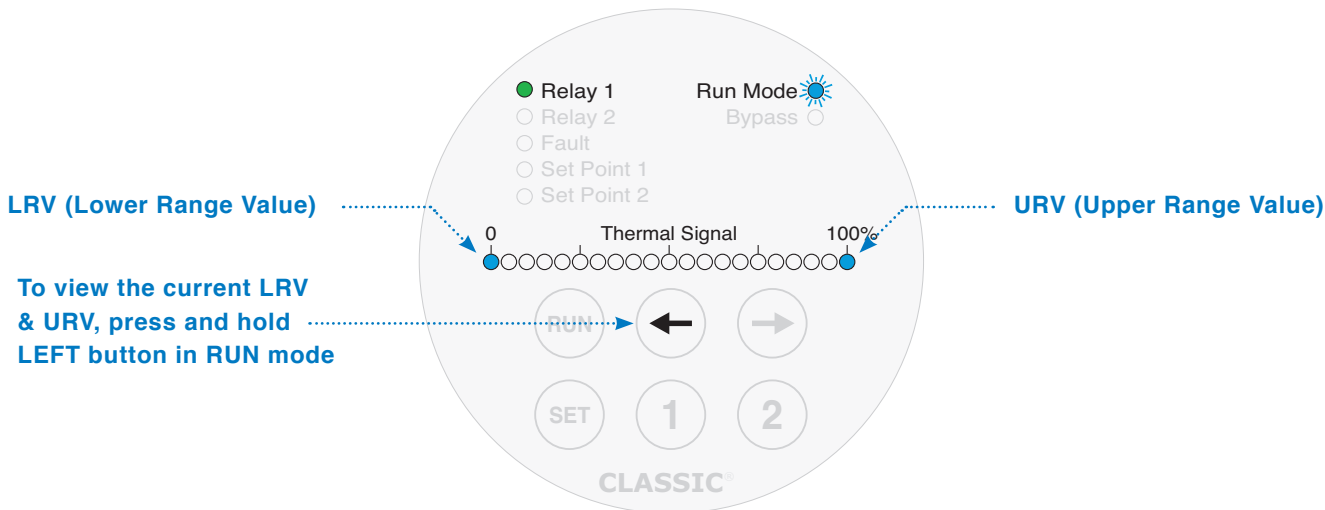
Figure 29 - Maximum Range of Lower Range Value (LRV) & Upper Range Value (URV)

Adjust the LRV and URV according to:

- Media type (oil, water or gas).
- Best resolution to configure the Relay Set Points

To illustrate the effect of changing the LRV and URV, see Figure 25.

- LRV has been moved from 0% to 50%
- URV has been moved from 100% to 75%

Air/Gas	0 - 50%
Oil	40 - 100%
Water	50 - 100%

Scaled LRV   **Scaled URV**

Improved resolution over the new range

Scaled Bar Graph View

Unscaled Bar Graph View

50% Unscaled is 0% Scaled

75% Unscaled is 100% Scaled
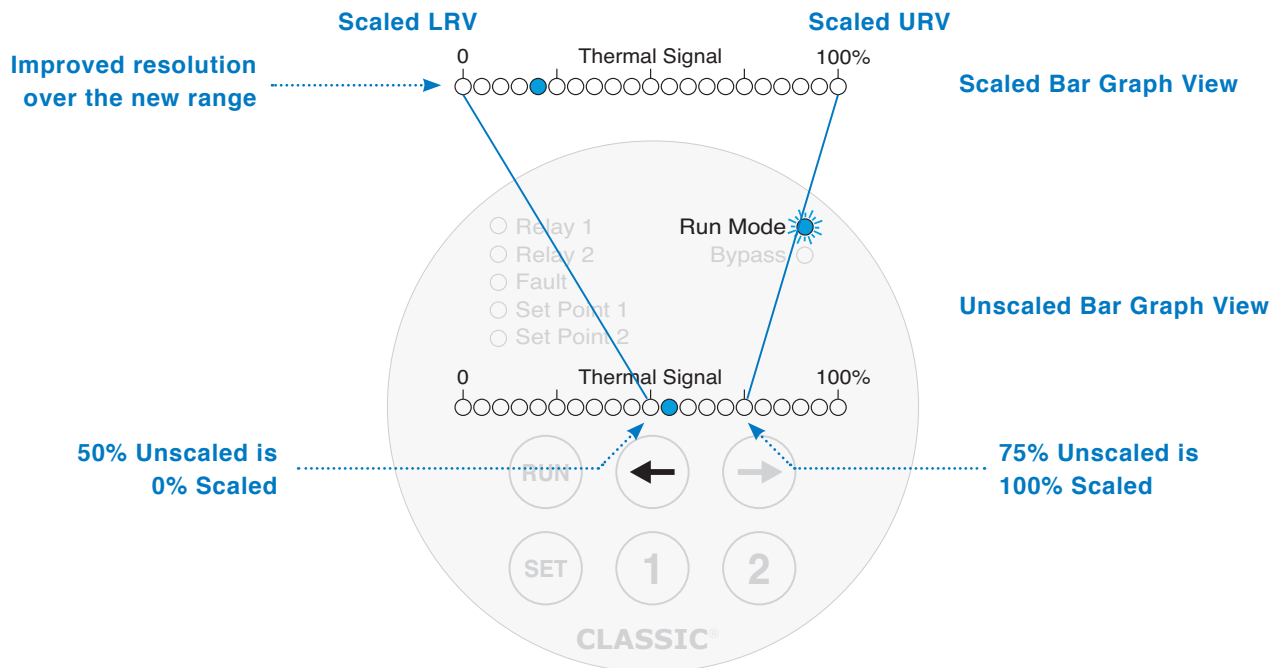
Figure 30 - Scaled Bar Graph View vs. Unscaled Bar Graph View

9. Adjust Bar Graph Lower Range Value (0%) and Upper Range Value (100%)

1. To set the LRV (0%), press and release **SET** until the **Set Point 1** status LED is **flashing**. To set the URV (100%), press and release **SET** until the **Set Point 2** status LED is **flashing**.

2. The **Thermal Signal Bar Graph** now shows the value of the LRV (or URV).

3. To adjust the LRV or URV, press and release the **Left** or **Right Arrow** keys.

4. When satisfied with your configuration, press and release **SET** to continue to the next Programmable Variable OR press and release **RUN** to return to **Run Mode**.

Set Point 1 is flashing to view or adjust the LRV

Single LED indicates LRV

Increase LRV

Decrease LRV

- **RUN** advances to Run Mode
- **SET** advances to next Setup step
- **Run Mode** LED is Off in Setup Mode
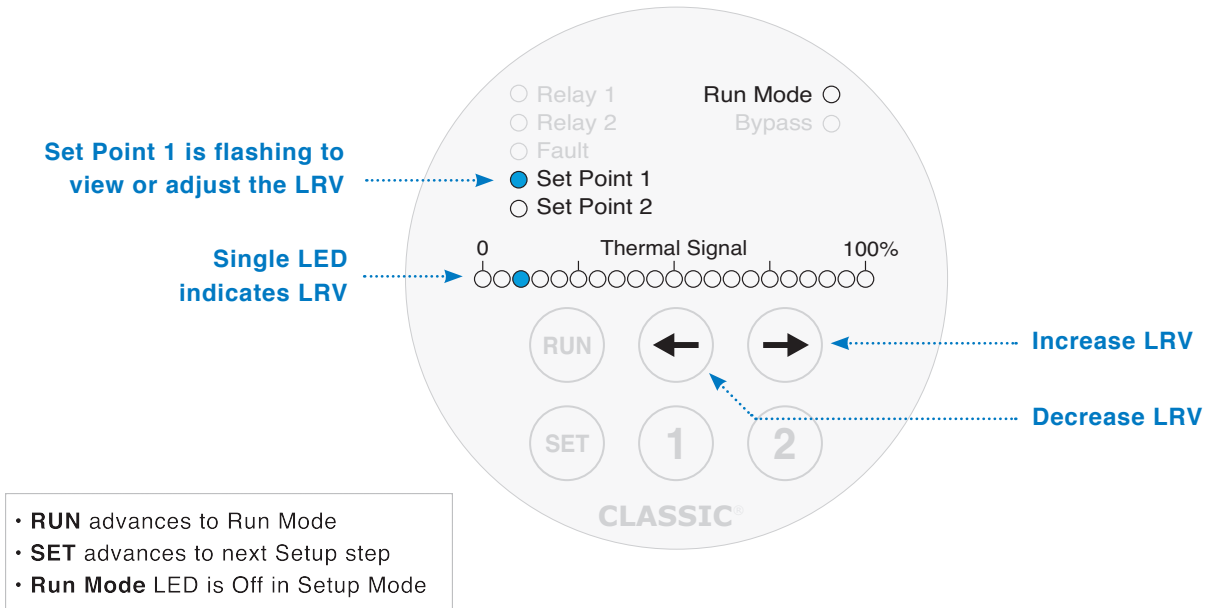
Figure 31 - Setting the Scaled Thermal Signal LRV

Set Point 2 is flashing to view or adjust the URV

Single LED indicates URV

Increase URV

Decrease URV

- **RUN** advances to Run Mode
- **SET** advances to next Setup step
- **Run Mode** LED is Off in Setup Mode

Figure 32 - Setting the Scaled Thermal Signal URV

Additional Setup Features Using Kayden RCM Software via Modbus RTU

Kayden RCM Software provides all the same features as the CLASSIC front panel UI, plus the additional features below:

- Configure relays to respond to temperature
- Configure Temperature Alarm Value (in Fahrenheit or Celsius)
- Configure Relay Delay Timers
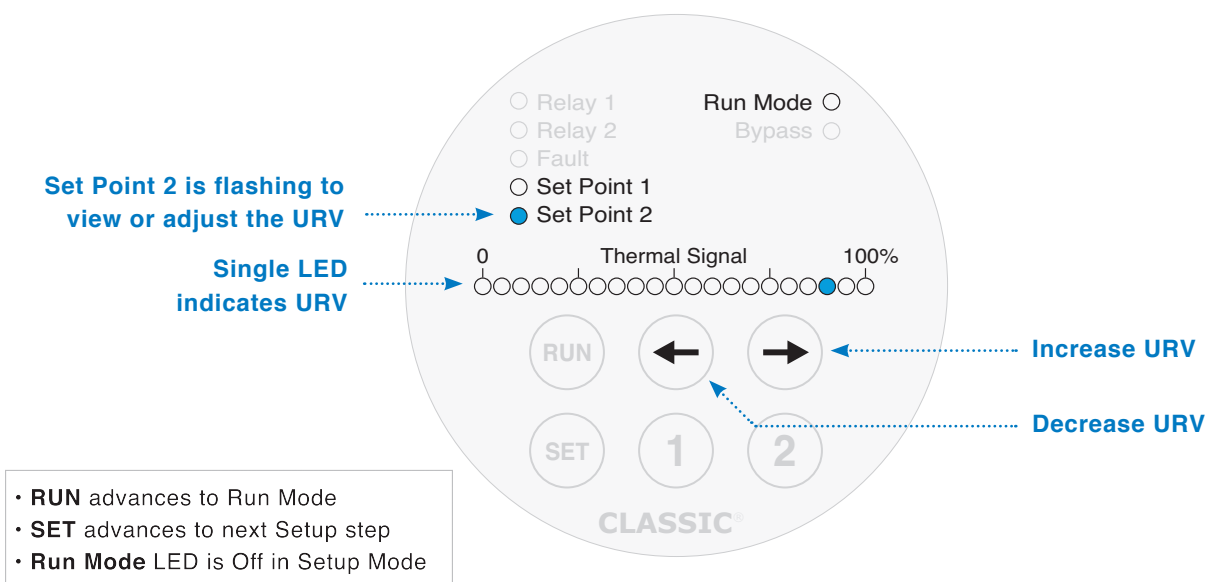- Configure the **Delay to Return Mode from Fault Mode** timer
- Save a Tag character string in the CLASSIC for identification
- Lock the front panel user interface to prevent accidental or undesired access

After launching RCM Software, access the Unit Configuration view
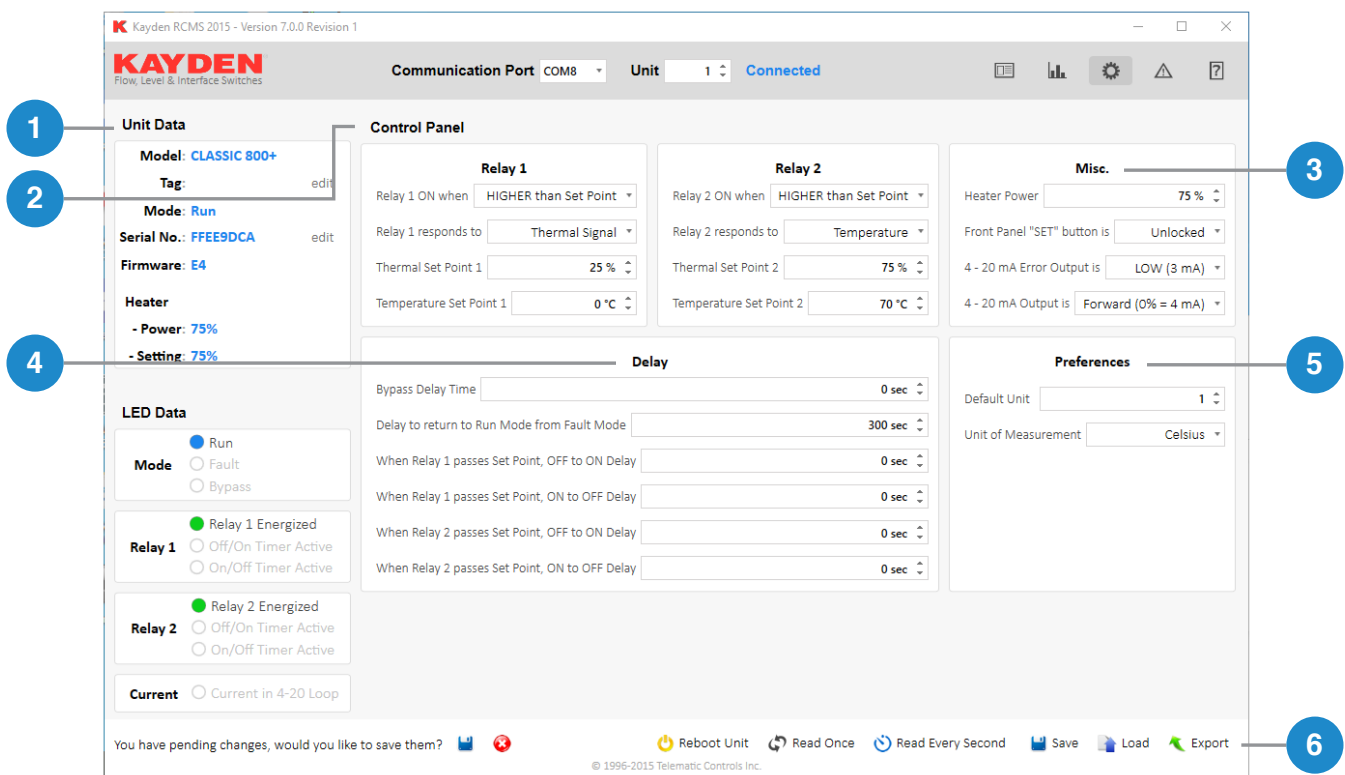
Configuration View

1. Displays CLASSIC unit information and LED status.

2. Configure Relay 1 and 2 Actuation Level, Thermal Signal or Temperature Control, and Setpoints**.**

3. Configure Heater Power, Lock Front Panel, Analog 4-20 mA Output Direction, and Analog 4-20 mA Error Condition.

4. Configure relay delay timers.

5. Select Unit of Measurement to display (also default Modbus ID for connecting after launch).

6. Control buttons to Reboot Unit, Read Once, Read Every Second, Save Configuration.

Notes: 1. To communicate with your Kayden CLASSIC 800, you will require an RS-485 adapter such as the Kayden SCA.

2. Additional copies or the latest revision of the RCM Software may be downloaded at our website, kayden.com, or call Kayden at +1 403 253 1423.

Kayden Setting & Configuration Log Sheet

Device Info		
Order, Model & Serial Number	
Process Media / Phase E.g. Water/Liquid, Propane/Gaseous	
Fluid Velocity m/s (ft/s)	
Operating Temperature °C (°F) Typical Process Temperature	
Install Date dd/mm/yyyy	

Configuration & Setting Information

		Mark an 'X' or state which LED(s) are illuminated between 0-100		
		✖		✖
Device Info	**Relay 1** LED NON-FLASHING	**First 6 LEDs** Energize lower than set point		**Last 6 LEDs** Energize higher than set point
	Relay 2 LED NON-FLASHING	**First 6 LEDs** Energize lower than set point		**First 6 LEDs** Energize lower than set point
	Fault LED NON-FLASHING	**First LED** Fail Low at 3.0 Ma		**Last LED** Fail Low at 21.0 Ma
	Set Point 1 LED NON-FLASHING	**Set Point 1 Setting** 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100		
	Set Point 2 LED NON-FLASHING	**Set Point 2 Setting** 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100		
	Bypass LED NON-FLASHING	**Bypass Time Amount. Each LED Represents 5 Seconds** 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100		
	Relay 1 FLASHING	**Heater Power Percentage** 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100		
	Relay 2 FLASHING	**Modbus Address Appears to the Right** (can be multiple LEDs) 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100		
	Fault FLASHING	**First 6 LEDs** Forward Acting		**First 6 LEDs** Reverse Acting
	Set Point 1 FLASHING	**State which LED is illuminated** 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100		
	Set Point 2 FLASHING	**State which LED is illuminated** 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100		

Record Fault Code

		Mark an 'X' or state which LED(s) are illuminated between 0-100						
Fault Code	**LEDs on 1st Toggle**		**State which LED(s) is illuminated** 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100					
	LEDs on 2nd Toggle		**State which LED(s) is illuminated** 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100					
	Front Display	**Relay 1**	**Relay 2**	**Fault**	**Set Point 1**	**Set Point 2**	**Run Mode**	**Bypass**
	X, O or Blank							

5   Modbus RTU Interface

1. Modbus History

Modbus is a serial communication protocol developed and published by Modicon in the late 1970's for use with its programmable logic controllers and has become the de facto standard for interconnected industrial electronic devices. Modbus is a client-server protocol; a Modbus client requests information from (or provides information to) a Modbus server. In a standard Modbus network, there is one client and up to 247 servers, each Modbus server has a unique Node Address.

The Modbus specification defines the general Modbus protocol and is available for free from The Modbus Organization (www.modbus.org). This chapter provides the specific implementation details of the Kayden CLASSIC.

2. Modbus Implementation

- Physical Layer: RS-485 half duplex, 9600 baud, 8 bits, no parity, 1 stop bit

- Data Link Layer: Modbus RTU

- Node Address: 1 to 239 (**Factory Default 1**)

3. Node Address

The CLASSIC displays the Node Address on the Bar Graph when the RUN button is depressed when in Run Mode, or when the SET button is pressed to access the View or Adjust the Node Address configuration menu (refer to Section 3.3 Configuration Flow Chart and Section 4.6 Setup & Operation – View or Adjust Node Address…).

The Node Address is displayed on the eight right-most LEDs of the Bar Graph as an 8-bit binary number.

<p align="center">Table 1 - Modbus Address Binary Table</p>

Modbus Node Address	Eight Right-Most Bar Graph LEDs 0 = Off, 1 = On
1	00000001
2	00000010
3	00000011
4	00000100
5	00000101
-	-
239	11101111

4. Function Codes

The CLASSIC supports the following Function Codes.

<p align="center">Table 2 - CLASSIC Modbus Function Codes</p>

Code	Name
01	Read Coil Status
03	Read Holding Registers
06	Preset Single Register
16	Preset Multiple Registers

5. Coils

A value of "0" indicates "inactive" (i.e. relay not energized, mode or timer not active, or 4-20 mA analog loop open). The coil values are also available in a single holding register; 40528 "BCoils".

Table 3 - Coils

Coil Number	Address (Hex)	Coil Function
1	0000	Relay 1
2	0001	Relay 2
3	0002	Run Mode
4	0003	Fault Mode
5	0004	Bypass Mode
6	0005	Loop Status
7	0006	-
8	0007	-
9	0008	Relay 1 Timer
10	0009	Relay 2 Timer
11	000A	Relay 1 Timer
12	000B	Relay 2 Timer
13	000C	-
14	000D	-
15	000E	-
16	000F	-

6. Holding Registers

Holding registers 40001 to 40048 are common status and configuration information.

All Holding Registers can be written to, but exercise care to avoid undesirable or incorrect behavior. Never write to Registers 40513 to 40535, except for Register 40517 which can be used to cause the CLASSIC to restart.

When writing to the CLASSIC to change its configuration, finish by writing '00F5h' to Register 40517 to cause a restart. This will ensure the new configuration takes effect.

Table 4 - Low Holding Registers (Configuration and Status)

Modbus Registers	Address (Hex)	Register Name	Description
40001	0000	PIDC	Product ID in high byte and Software revision in low byte
40002	0001	Node Address	Modbus server address. The upper byte must be 0.
40003-40004	0002-0003	ESN	Electronic Serial number formatted as a double word.
40005	0004	-	-
40006	0005	Bypass Delay	Number of 5 second delays from 0 to 20 (0 to 100 seconds)

Modbus Registers	Address (Hex)	Register Name	Description
40007	0006	4-20 Error Mode	Loop current while in error mode, 00FFh = 21mA, 0000h = 3mA
40008	0007	E-Lock	Front Panel Lock, 00E5h = Locked
40009	0008	NPWR	Number of Power Ons
40010	0009	NWDT	Number of Watch Dog Resets
40011	000A	NBOD	Number of Brown Out Detects
40012	000B	NERR	Number of Self Test Errors
40013	000C	NCOM	Number of Communication Errors
40014	000D	NOVR	Number of Overflow Errors
40015	000E	NFRM	Number of Framing Errors
40016	000F	NCRC	Number of CRC Errors
40017- 40024	0010-0017	CTAG	Custom ASCII Tag, 16 characters, 8 words
40025	0018	-	-
40026	0019	Error Mode Recovery Timer	Defaults value is 012Ch (300 seconds)
40027	001A	Relay Energized Mode	Upper byte for Relay 1, Lower byte for Relay 2 00 = On Lower than set point, FF = On Higher than set point
40028	001B	-	-
40029	001C	4-20 Forward Reverse Mode	0000 = 4 to 20mA 00FF = 20 to 4mA
40030	001D	Relay Flow/ Temperature Mode	Upper byte for Relay 1, Lower for Relay 2 00 = Flow, FF = Temperature
40031	001E	Temperature Setpoint 1	16 bit word, temperature in degrees Celsius 16 bit 'inverted signed' value e.g. 8001 = 1, 8000 = 0, 7FFF = -1
40032	001F	Temperature Setpoint 2	16 bit word, temperature in degrees Celsius 16 bit 'inverted signed' value e.g. 8001 = 1, 8000 = 0, 7FFF = -1
40033	0020	Thermal (Flow) Setpoint 1	Thermal Alarm Set Point 1 in 5% steps 0 thru 20 decimal = 0% thru 100%
40034	0021	Thermal (Flow) Setpoint 2	Thermal Alarm Set Point 2 in 5% steps 0 thru 20 decimal = 0% thru 100%
40035	0022	-	-
40036	0023	-	Reserved
40037	0024	Delay Timer R1 OFF to ON	Delay in seconds from 0 to FEFF (65279) Values of FF00 (65280) and up equal infinity
40038	0025	Delay Timer R2 OFF to ON	Delay in seconds from 0 to FEFF (65279) Values of FF00 (65280) and up equal infinity
40039	0026	Range	N/A
40040	0027	Heater Power	Default Heater Power 0 thru 20 decimal = 0% thru 100%

Modbus Registers	Address (Hex)	Register Name	Description
40041	0028	LED URV	Scaled Thermal Signal URV, 0 thru 20 decimal (5% increments)
40042	0029	LED LRV	Scaled Thermal Signal LRV, 0 thru 20 decimal (5% increments)
40043	002A	-	-
40044	002B	Delay Timer R1 ON to OFF	Delay in seconds from 0 to FEFF (65279) Values of FF00 (65280) and up equal infinity
40045	002C	Delay Timer R2 ON to OFF	Delay in seconds from 0 to FEFF (65279) Values of FF00 (65280) and up equal infinity
40046	002D	-	-
40047	002E	-	-
40048	002F	-	-

Table 5 - High Holding Registers (Run-Time Variables)

| Modbus Registers	Address (Hex)	Register Name	Description
40513	0200	AD0	Thermal Delta, 16 bit unsigned word, Inverse of Thermal Signal Thermal Delta of zero (0000h) = 100% Thermal Signal Thermal Delta of 60,000 (EA60h) = 0% Thermal Signal
40514	0201	-	-
40515	0202	-	-
40516	0203	Current Heater Power	Heater Power, indexed in 5% steps. 0 thru 20 decimal = 0% thru 100%
40517	0204	Mode Writing 00F5 will cause the CLASSIC to restart.	0000 - Reset 0001 - LED Self Test 0002 - Soft Reset 0003 - Startup heater and ADC 0004 - Bypass timer active 0005 - Run Mode 00F0 - Diagnostic mode 00F1 - Self Test mode 00F2 - Manual mode 00F5 - Reboot 00FE - Stop mode, (Heater Error) 00FF - Stop mode
40518	0205	Actual Temperature	Actual Process Temperature from Reference RTD in degrees Celsius, 16 bit signed word

Modbus Registers	Address (Hex)	Register Name	Description
40519	0206	-	Proprietary
40520	0207	-	Proprietary
40521	0208	-	Proprietary
40522	0209	-	Proprietary
40523	020A	-	Proprietary
40524	020B	-	Proprietary
40525	020C	-	Proprietary
40526	020D	-	Proprietary
40527	020E	-	Proprietary
40528	020F	BCoils	Output Coil status bits, as per 'Read Coil Status'
40533	0214	RTD1	Reference RTD
40534	0215	RTD2	Active RTD
40535	0216	Delta	Delta in ohms

6   Maintenance

I. GENERAL INFORMATION

With proper installation the CLASSIC 800 will require very little maintenance as there are no moving parts subject to wear. Following a few simple guidelines will ensure years of dependable service.
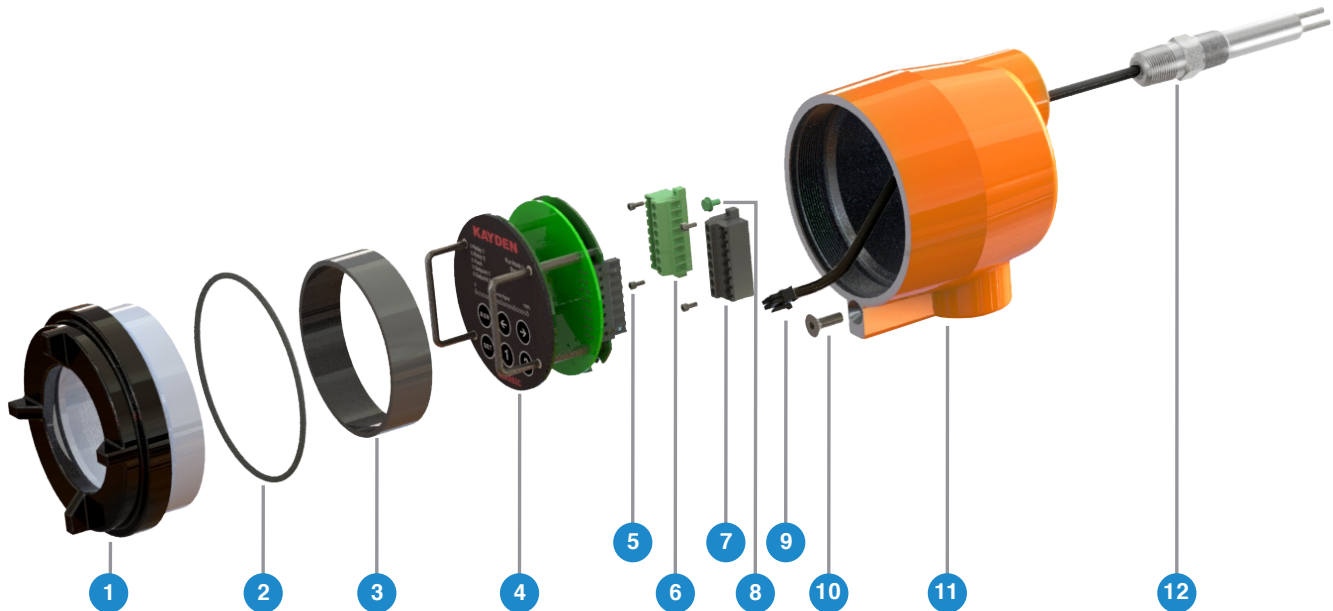
1. **Enclosure Cover (Lens Cover Shown)**	5. **Terminal Block Screws**	9. **Sensor Connector**
2. **Cover O-Ring**	6. **Left Terminal Block (Green)**	10. **Cover Locking Screw**
3. **Retaining Ring (Lens Cover Only)**	7. **Right Terminal Block (Black)**	11. **Enclosure**
4. **Electronics Module**	8. **Ground Screw**	12. **Sensor**

Figure 33 - Kayden CLASSIC Exploded View

1. Cover

In accordance with CSA and local codes, the cover must be properly installed at all times. The threads of the cover should be lightly coated with a lubricating compound to prevent seizing, freezing and corrosion. Spray lubricants are not recommended.

2. Process and Conduit Connections

- In accordance with CSA and local codes all power and communication wiring should be enclosed either in conduit or an approved jacketed cable. Ensure that the electrical connection made at the enclosure of the CLASSIC 800 meets all codes and requirements.

- As described in detail in Section 2 "Installation Guidelines", ensure that the sensor is installed with the proper orientation, to the proper depth, and coat threads with a thin layer of thread tape or sealant/lubricant.

- Most Fault conditions and reported "failures" are actually caused by loose, broken or improper electrical connections. Ensure that the connections for the sensor, input power and relay output are correct and secure.

3. **Sensing Elements**

   - The alloy (Stainless Steel, Titanium, Hastelloy, etc.) sensors require no periodic maintenance, but any deposits or scaling should be removed from the sensor tip as necessary. Use the appropriate cleaning device or material relative to your process (example: cloth, brush, wire brush, steel wool, sandpaper, water, detergent, compatible solvents to the sensor material, etc.).

   Notes: As described in detail in Section 2 "Installation Guidelines", proper physical installation of the sensor is critical to the operation of the switch/transmitter in terms of sensitivity and response time.

   Because sediment will collect at the bottom of any vessel, and entrained gases will always collect at the top of any vessel, ensure sensing tip is inserted to a point where it will be constantly and fully exposed to the desired process media. Avoid locations where sediment may accumulate and eventually isolate the sensing tip from the process.

4. **Electronics Module**

   - If it is necessary to remove the Electronics Module, appropriate ESD (electrostatic discharge) precautions must be observed, including handling the module after removal. Refer to Sub-section B "Remove the Electronics Module" on page 14.

   - Store Electronics Modules in a clean and dry environment between -30°C and +60°C (-34.5°F and 140°F).

5. **Adjustment & "Calibration"**

   The CLASSIC 800 is a digital flow, level, interface and temperature switch/transmitter and is built to require minimal maintenance and no calibration beyond proper installation and setup.

   - The Kayden Electronics Modules are completely digital and have no moving parts or mechanical trim pots that could be effected by vibration or high unit cycles.

   - The heater is a separate element from the sensors and is itself directly controlled by the microprocessor.

   Therefore, once properly setup, the CLASSIC 800 will be as stable and repeatable as the process in which it is installed. For instance, should the application change from Flow to Level or the media change from Hydrocarbon to Water-based, or the Flow Rate increases or decreases significantly, it may be necessary to check and/or change the setup parameters (Range, Heater Power, Set Point).

6. **Use Kayden RCM Software to Document Preventative Maintenance**

   One feature of the Kayden RCM Software* is the Configuration function which automatically stores all setup information and displays it on the Configuration screen within the software whenever the CLASSIC 800 is connected to a PC. This information may be named, stored and emailed as a file to preserve all operation setup parameters.

   During maintenance turnaround, RCM Software can be used to record and save the current configuration as a file.

   *The Kayden RCM Software is available upon request, at no charge on a USB Drive, when a new CLASSIC 800 is purchased. Additional copies may be downloaded at no charge from kayden.com. In addition to the software you will need a suitable RS-485 communication adapter and cable. These can be ordered online at kayden.com.
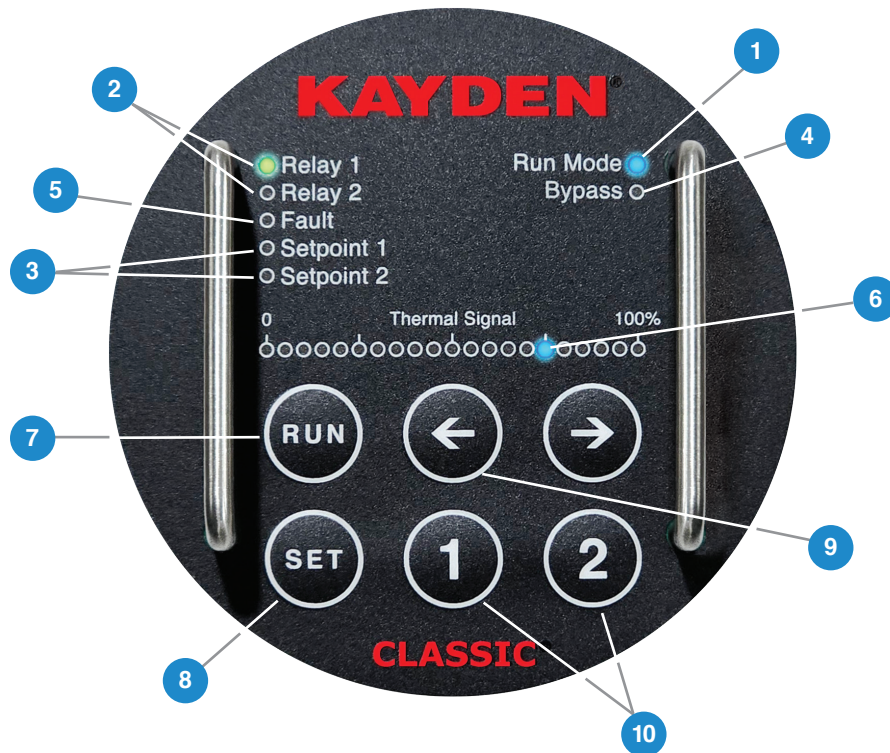
7 **Troubleshooting**

Figure 34 - Display Panel Indicators

1. **Run Mode**: Flashing LED indicates normal operation.

2. **Relay 1, Relay 2**: Solid LED indicates energized relay contact.

3. **Set Point 1, Set Point 2**: Solid when displaying the associated set point. (e.g. press and hold 1.) Blinking LED when a set point has been passed but relay response is delayed by an active timer

4. **Bypass**: Indicates that the Start-up Bypass Timer feature is currently enabled.

5. **Fault**: Indicates that the switch/transmitter is in Fault Mode when solid or Fault Recovery Mode when blinking. (See Fault Recovery Timer.)

6. **Thermal Signal Bar Graph**: Displays the Thermal Signal (rate of Thermal Dispersion by default) which represents the process condition (Flow, Level) as determined by the setup. Other values may be displayed depending on mode.

7. **RUN**: In RUN Mode pushing the RUN button changes the display from process condition to the Node Address and the Firmware revision. In Setup Mode pushing the RUN button returns the switch/transmitter to RUN Mode.

8. **SET**: Places the unit in Setup Mode unless locked by the Kayden RCM Software.

9. **Left Arrow**: In Setup Mode the Left Arrow reduces (moves the value to the left or towards 0). In RUN Mode pushing and holding the Left Arrow button will display the Unscaled Bar Graph View.

10. **1, 2**: Pushing and holding 1 or 2 will display Set Point 1 or Set Point 2 accordingly as programmed.

11. Pushing **RUN + LEFT ARROW + RIGHT ARROW** will reset the CLASSIC to factory settings. Refer to Configuration Flow Chart for Factory Default values.

1. LED Fault Indicator

The CLASSIC 800 is designed so that any error condition will be immediately detected and displayed as a FAULT condition on the Display Panel.

- The diagnostic circuit continuously monitors the operation of the heater, sensor elements, connecting pathways and all aspects of the Electronics Module.

- When in **FAULT MODE**:

  - **Both relays will de-energize and remain de-energized**

  - **The 4-20mA signal will output high or low**

  - **See LED Fault Code section, for a visual list of diagnostic faults displayed on bar graph**

- The FAULT remains on, until the problem is corrected. Once fault is corrected, the fault light will turn off, but only after a 300 second time delay to ensure fault does not return intermittently. Time delay is adjustable through the Kayden RCM software.

- The **4-20 mA** output can be programmed to revert to a value of either **3.0 mA** or **21 mA** to indicate FAULT mode. For more information see **Section 2 "Installation Guidelines, View or Adjust the 4-20 mA Fault Mode Configuration"**.

- All FAULT Codes are automatically recorded in the EVENT LOG. The EVENT LOG may be viewed in the Kayden RCM Software.

- If a sensor fault has been corrected (such as correcting faulty wiring), pressing SET and then RUN will cause the CLASSIC to resume Run mode immediately.

2. LED Fault Codes

In the event a FAULT occurs, the CLASSIC enters Fault Mode and the Fault LED on the Display Panel is turned on. In Fault Mode, the LED Bar Graph cycles every 7 seconds between showing the Fault Code, and showing the Software Version and Modbus Node Address.
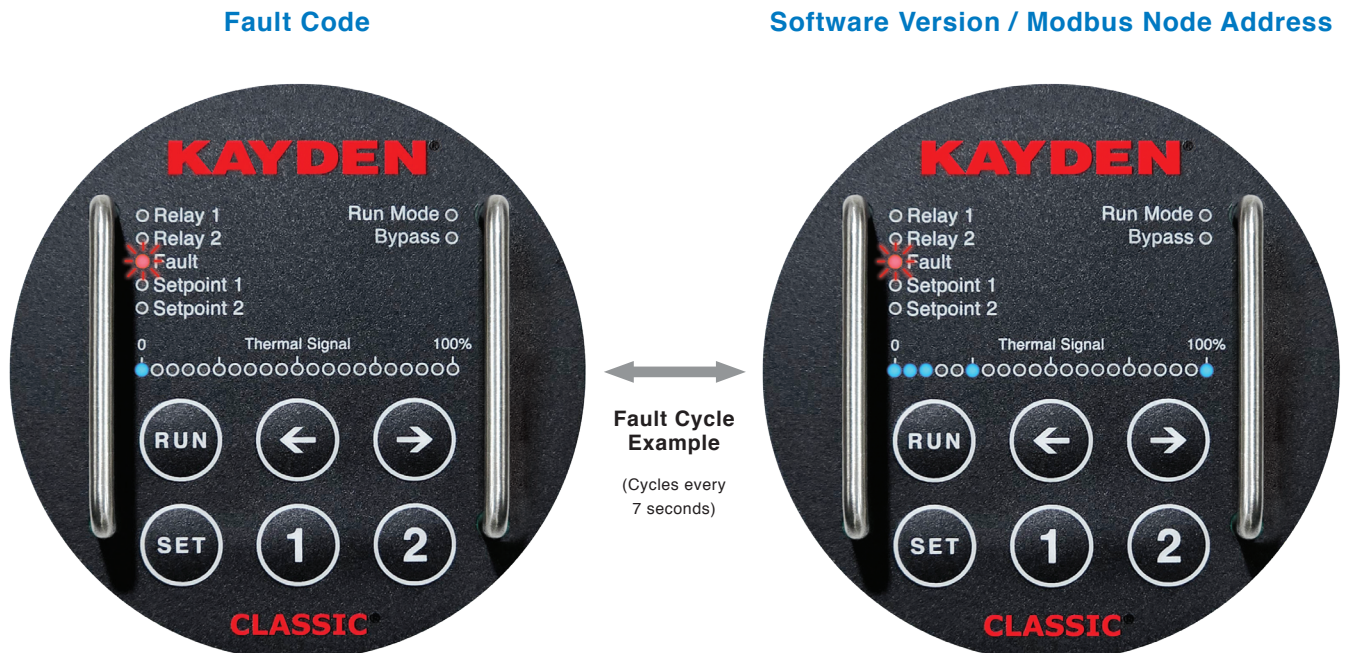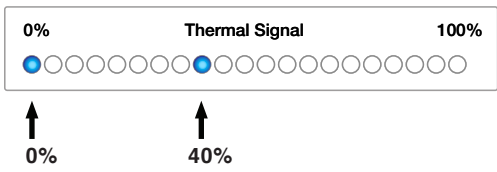
Fault Code

Software Version / Modbus Node Address

Fault Cycle Example

(Cycles every 7 seconds)

Figure 35 - Fault Cycle Display Example

Fault Code List

Description

Fault Code 1

| 0%	Thermal Signal	100%

↑ 0%   ↑ 40%

| RCMS Fault Code	+10.5 Volts too high
Description of Fault	Internal 10.5V supply voltage above specification.
Course of Action	Replace the Electronics Module

Fault Code 2

0%	Thermal Signal	100%

↑ 0%   ↑ 45%
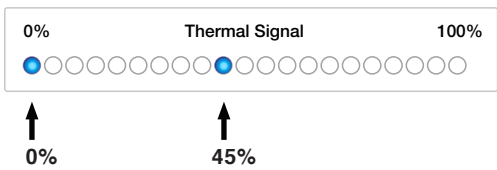
RCMS Fault Code	+10.5 Volts too low
Description of Fault	Internal 10.5V supply voltage below specification.
Course of Action	Confirm correct supply voltage. If correct, replace the Electronics Module.

Fault Code 3

0%	Thermal Signal	100%

↑ 0%   ↑ 50%
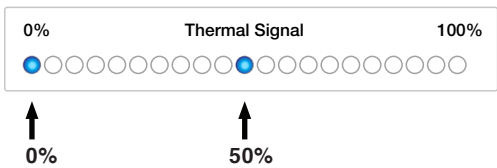
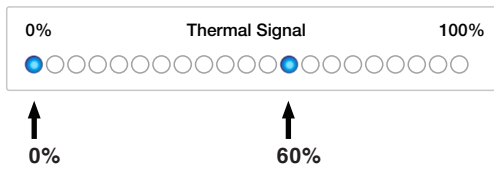| RCMS Fault Code	Heater is shorted
Description of Fault	Heater resistance below specification.
Course of Action	Confirm correct sensor heater resistance measurement at sensor plug to Electronics Module. If within spec, investigate sensor.

Fault Code 4

0%	Thermal Signal	100%

↑ 0%   ↑ 55%
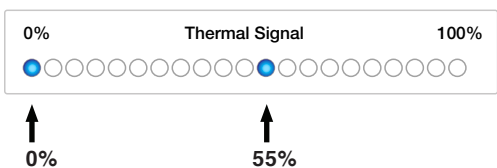
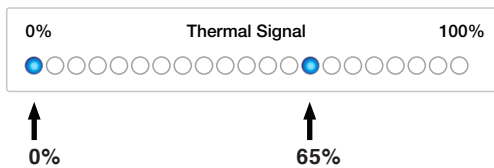| RCMS Fault Code	Heater is open
Description of Fault	Heater resistance above specification.
Course of Action	Confirm correct sensor heater resistance measurement at sensor plug to Electronics Module. If within spec, investigate sensor.

RCMS = Kayden RCM Software
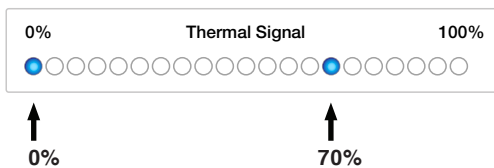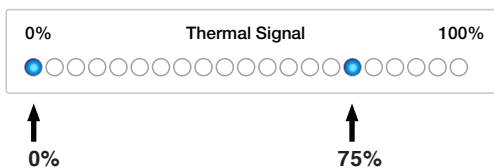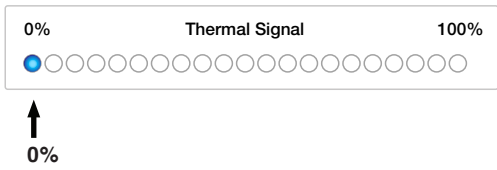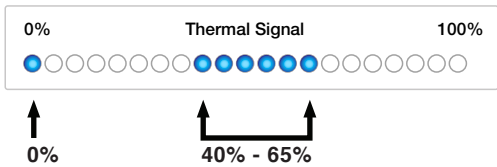
Fault Code List

Description

Fault Code 9

| 0% | Thermal Signal | 100% |

0%

RCMS Fault Code	No Fault Code in Kayden RCMS
Description of Fault	Logic Module Startup Failure
Course of Action	Perform FACTORY RESET. If operation not restored, replace the Electronics Module.

Fault Code 10

| 0% | Thermal Signal | 100% |

0%   40% - 65%

RCMS Fault Code	No Fault Code in Kayden RCMS
Description of Fault	Product Identification Code does not match installed firmware.
Course of Action	Perform FACTORY RESET. If operation not restored, replace the Electronics Module.

Fault Code 11

| 0% | Thermal Signal | 100% |

0%   40% - 65%   75%
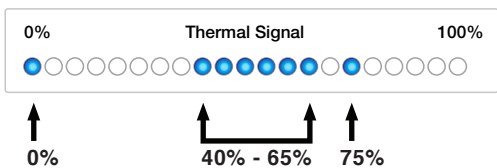
RCMS Fault Code	No Fault Code in Kayden RCMS
Description of Fault	Security Checksum Error, Eeprom memory fault.
Course of Action	Perform FACTORY RESET. If operation is not restored, replace Electronics Module.

Fault may occur as the result of power supply voltage below specified minimum (brown-out).

Fault Code 12

| 0% | Thermal Signal | 100% |

0% - 100%
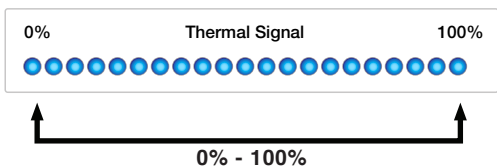
RCMS Fault Code	No Fault Code in Kayden RCMS
Description of Fault	Electronics Module Failure (special case with all bargraph LEDs illuminated).
Course of Action	Perform FACTORY RESET. If operation is not restored, replace Electronics Module.

Fault may occur as the result of power supply voltage below specified minimum (brown-out).

RCMS = Kayden RCM Software

Fault Code List

Description

Fault Code 13

0%	Thermal Signal	100%

0%   40% - 75%
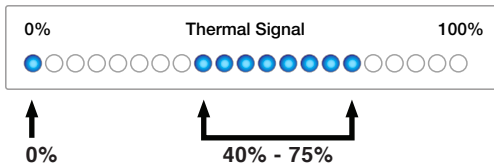
RCMS Fault Code	Self-Test Error
Description of Fault	Communication error between the module and the sensor.
Course of Action	Perform FACTORY RESET. If operation not restored replace Electronics Module.

Fault Code 14

0%	Thermal Signal	100%

40% - 75%
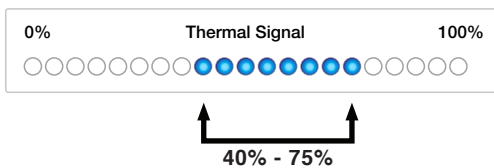
RCMS Fault Code	Probe Error
Description of Fault	The sensor is not connected properly or has a bad connection.
Course of Action	Confirm correct sensor resistance measurement at sensor plug connector to Electronics Module. If within spec, investigate sensor plug & wiring.

Fault Code 15

0%	Thermal Signal	100%

No LEDs On

RCMS Fault Code	No Fault code in Kayden RCMS
Description of Fault	Electronics Module malfunctioning to start.
Course of Action	If FAULT LED is not illuminated, confirm power is connected and in spec. If FAULT LED is illuminated, perform FACTORY RESET. If operation is not restored, replace Electronics Module.

Fault Code 16

0%	Thermal Signal	100%

100%
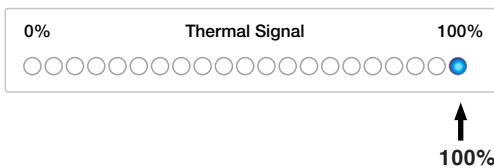
RCMS Fault Code	No Fault code in Kayden RCMS
Description of Fault	Electronics Module power failure.
Course of Action	Perform FACTORY RESET. If operation is not restored, replace Electronics Module. Fault may occur as the result of power supply voltage below specified minimum (brown-out).

**RCMS** = Kayden RCM Software
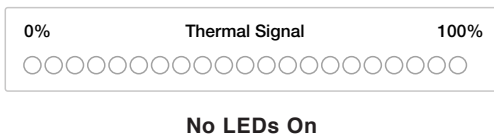
Fault Code List

Description

Fault Code 17

0%	Thermal Signal	100%

○●○○○○○○○○●○●○○○○○○○

↑ 0%　　　↑ 55% ↑ 65%
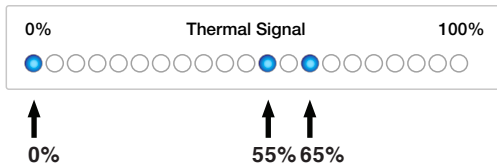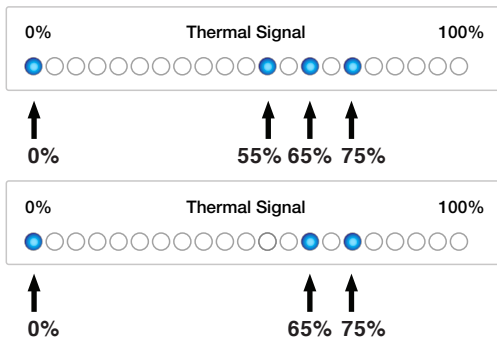
RCMS Fault Code	No Fault Code in RCMS
Description of Fault	Sensor Probe not detected.
Course of Action	Confirm correct sensor resistance measurement at sensor plug connector to Electronics Module. If within spec, investigate sensor plug & wiring.

Fault Code 18

0%	Thermal Signal	100%

●○○○○○○○○○●○●○●○○○○○

↑ 0%　　　↑ 55% ↑ 65% ↑ 75%

0%	Thermal Signal	100%

●○○○○○○○○○○●○●○○○○○○

↑ 0%　　　↑ 65% ↑ 75%

RCMS Fault Code	No Sensor Probe
Description of Fault	No Sensor probe connected.
Course of Action	Confirm correct sensor resistance measurement at sensor plug to Electronics Module. If within spec, investigate sensor plug & wiring.

RCMS = Kayden RCM Software

3. Fault Check List

A Fault is typically the result of:

- Faulty Electronics Module.

- Faulty sensor, or sensor connector.

- Faulty wiring of the CLASSIC terminal blocks.

- Faulty remote wiring (in the case of a remote electronics installation).

- Faulty external wiring.

If a Fault occurs:

- Check the power source and wiring terminations.

- Check for damaged or shorted wiring.

- Check the Electronics Module for correct insertion.

- Check the Sensor cable is correctly plugged into the Electronics Module.

- Check the Sensor has not been damaged.

- Check the Sensor resistances.

4. Restore Operation after a Fault

Options for clearing a Fault:

1. **Press "SET" button once, then press "RUN" button once.**

   - If the unit is in FAULT mode, but the fault has been addressed, to clear the remaining FAULT timer press SET followed by RUN. The unit will then be in RUN mode.

   - This should clear any short term faults, such as faulty wiring that is now corrected.

   - This does not affect the stored configuration settings.

2. **Power Cycle the Unit.**

   - Power cycling the CLASSIC Module will reboot the microprocessor and clear the FAULT timer as long as no persistent faults are present.

   - This does not affect the stored configuration settings.

   - This should clear a fault condition due to intermittent power or spikes which caused the microprocessor to start up incorrectly.

3. **Click the Re-boot button in RCM software.**

   - Clicking the reboot button in RCM Software is equivalent to performing a power cycle.

   - This does not affect the stored configuration settings.

4. **Perform a "Factory Reset".**

   - Performing a Factory Reset restores the configuration to the original factory settings.

   - May restore operation if the CLASSIC configuration memory has been corrupted e.g. due to intermittent or faulty power.

   - **Warning**: The current configuration will be lost.

   - It is recommended you contact Kayden Technical Support before performing a Factory Reset.

5. How to Perform a Factory Reset

Note: Record your current configuration before performing a Factory Reset. Use the Kayden Setting & Configuration Log Sheet (pg. 42), or Kayden RCMS (see Section 6 RCMS) to record your current configuration. If in Fault mode access current settings by pressing RUN, then SET.

To reset the CLASSIC to factory default settings follow these steps:

- A Factory Reset should not be performed without first consulting Kayden Technical Support.

- **Warning**: All previous configuration changes will be lost and the unit will be returned to it's factory defaults. Relays will actuate and/or de-actuate during reset.

- Factory Default Settings are shown in the Quick Setup Guide (pg. 26).

- Press **RUN + LEFT ARROW + RIGHT ARROW** simultaneously until all LEDs flash or run back and forth.

- A successful reset will be indicated by five consecutives flashes of all LEDs followed by a pause and two more flashes.

6. How to Check the Sensor

- An Ohmmeter can be used to check that the RTD's and Heater resistances are within proper tolerances, and for any shorts.

- See Molex sensor plug diagram and wire chart (Fig. 29) for correct resistance between wires, at 20°C. If the sensor is still in the process at a different temperature, consult an IEC 60751 1000 Ohm Platinum RTD temperature resistance chart for the correct resistance value.

- If the sensor resistances are not correct, consult Kayden Technical Support for guidance.

Pin	Wire Colour	Pin	Ω	Description
7	Red to Red	8	50	Heater
1	Blue to Blue	3	0	Reference RTD +/PWR
2	Black to Black	2	0	Active RTD +/PWR
1/3	Blue to Yellow	5	1100*	Reference RTD
2/4	Black to White	6	1100*	Active RTD
7/8	Red to any other lead	Any	Infinite	Heater short to RTD
1	Blue to Black	2/4	Infinite	Reference RTD +/PWR to Active

*Approximate RTD resistance at room temperature (20°C). Actual resistance varies from approx. 800Ω @ -45°C to 1700Ω @ 200°C
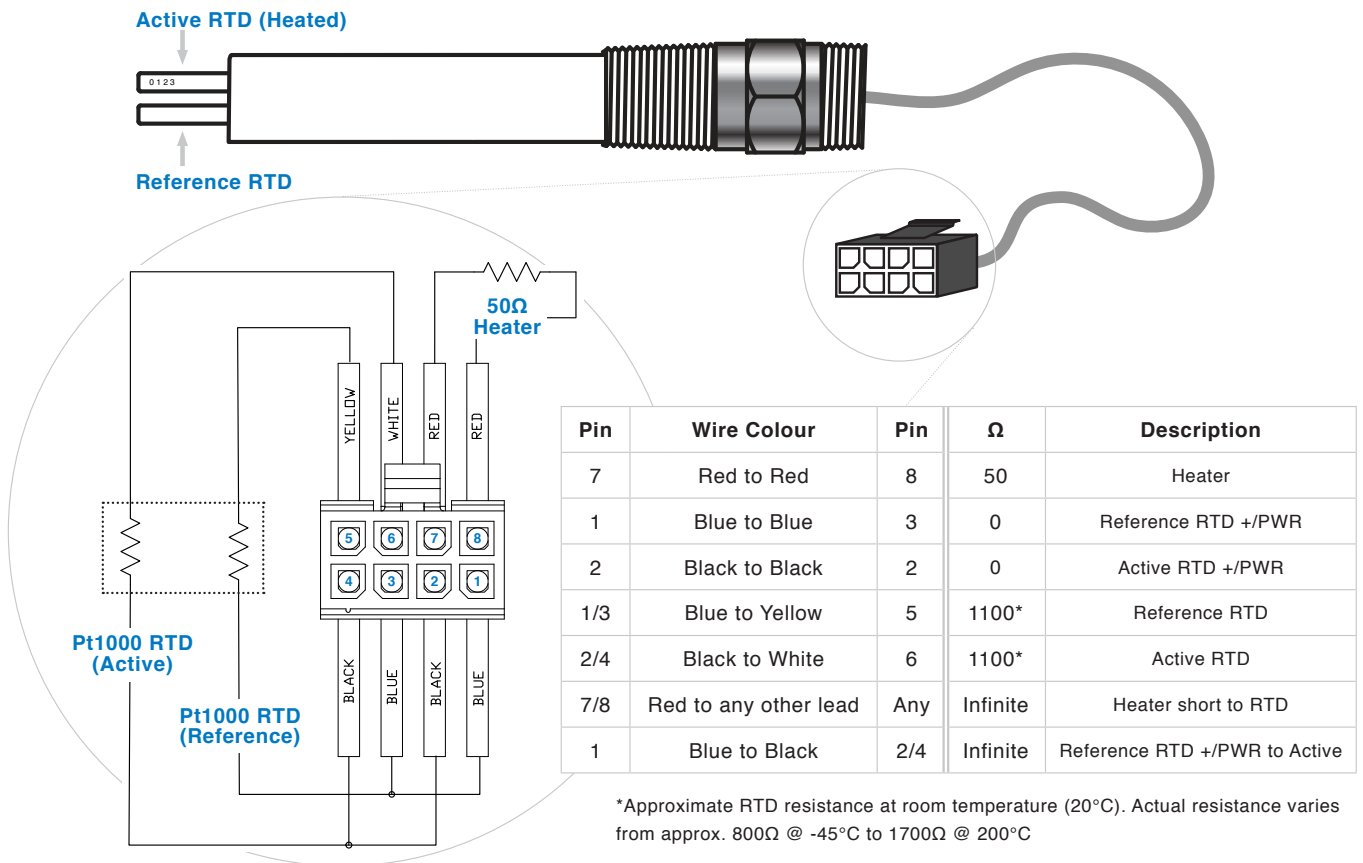
Figure 36 - Checking Sensor Resistances

7. Return of Material

To expedite the return process, call Kayden in Canada at +1 403 253-1423. You will be asked for product model and serial numbers, and be provided an RMA (Return Material Authorization) number.

8. Hazardous Materials

Kayden does not accept the return of Products that are contaminated with any hazardous material. It is solely the Customers responsibility to ensure any and all items returned to Kayden have been thoroughly and completely decontaminated.

9. Service, Technical Support & Contact Information

Kayden provides full in-house technical support 8 a.m. to 5 p.m. MST (Mountain Standard Time), Monday through Friday (except holidays).

Web	**kayden.com**
E-mail	**info@kayden.com**
Mail	Kayden Instruments
	3364-14th Avenue S.E.
	Calgary, Alberta, Canada T2Z 3V6
Your Local Distributor	To locate your local Distributor please visit kayden.com.

Glossary

Active RTD	The active RTD detects and outputs a signal to the Electronics Module which is proportionate to the process media temperature plus the heat added by the heater.
Analog Output	The CLASSIC provides a standard 4-20 mA current loop analog output. The output can be configured for Forward or Reverse operation (either rises as thermal signal increases or falls as thermal signal increases). The output value in the case of hardware failure (either Fault Mode, or offline during configuration) can be configured to 3 mA or 21 mA as per NAMUR NE 43.
Brownout	Supply power voltage has descended below the specified minimum requirement and recovered without being considered a power failure (or a power cycle). Correct operation is not guaranteed.
Bypass	Indicates the unit is in "Start-up Bypass Mode", which forces both relays to be energized for the duration of the Start-up Bypass Timer.
Current	Refers to the presence or absence of current flow in the 4-20 mA current loop analog output. RCMS provides a loop "Current" indicator showing if there is current flowing in the loop, or if the loop circuit is broken (also available for reading via a Modbus register, refer to the CLASSIC Modbus specification for details).
Cycle Power	The CLASSIC re-starts operation, the state (e.g. Fault State) is reset, the CLASSIC performs a self-test and enters RUN mode if no fault conditions are present.
Delay	The CLASSIC includes a number of delay timers to fine-tune operation and relay actuation. These options are configurable using RCMS or by accessing Modbus registers (refer to the CLASSIC Modbus specification for details). The Bypass Delay Timer sets an initial period to energize the relays before using the configured set points. Setting a bypass delay can be useful in applications such as a low flow alarm pump control when there is no process flow present when the CLASSIC starts up. Setting a Bypass Delay time allows the CLASSIC to start the pump and establish process flow before monitoring the process flow. OFF to ON and ON to OFF Delay Timers allow fine-tuning of relay actuation for situations where there is process surge.
Factory Re-Set	Restores default configuration (refer to Configuration Menu tree diagram for default configuration parameter values) and clears the Fault log. The CLASSIC re-starts operation as if power was cycled (see Cycle Power).
Fault	Indicates a self-test error (call Technical Support for further information).
Fault Log	The CLASSIC maintains a list of recent fault events. The fault events can be displayed using RCMS or by accessing Modbus registers (refer to the CLASSIC Modbus specification for details).
Firmware	The internal software of a CLASSIC and is associated with a version identifier.

Heater	The part of the sensing element that heats the active RTD.
Heater Power	The actual power used to heat the active RTD. The amount of power is configurable by the operator (see Heater Setting), also the heater power is automatically reduced by the SmartHeater algorithm when the thermal signal falls to 0%.
Heater Setting	The assigned power supplied to the heater in normal operations. The Kayden CLASSIC incorporates an "Intelligent Constant Power" or "SmartHeater" algorithm for heater control. The heater power is automatically adjusted by the CLASSIC firmware when the thermal signal is outside of the LED Range for faster response times.
Interface	The point where two different processes meet (as in oil & water).
LED	Light Emitting Diode
Local Enclosure	The enclosure attached to the sensing element. (Normally contains the Electronics Module).
Lock (Front Panel)	The CLASSIC Front Panel "SET" button can be locked to prevent accidentally taking the CLASSIC offline or mis-configuring. Locking and Unlocking can be performed using the Kayden RCM Software or by accessing the appropriate Modbus register (refer to the CLASSIC Modbus specification for details). Performing a Factory Reset will deactivate the lock via the front panel.
LRV	The LRV (Lower Range Value) is the lowest unscaled Thermal Signal that the (scaled) Bar Graph and 4-20 Analog Output will indicate.
Mode (of Operation)	A CLASSIC can be operating in one of four modes: **Run** - the normal operating condition, the Run Mode LED is blinking once per second. **Manual** - the CLASSIC is in manual configuration mode, activated by the SET button. The RUN LED is OFF, the CLASSIC is off-line and the relays are held in their current state. The status LED that is illuminated indicates the specific configuration state. **Fault** - the CLASSIC built-in-self-test has detected a fault. The Fault LED is illuminated (either blinking or on continuously), the Run Mode LED is off, the CLASSIC is offline and relays are deactivated. Refer to the error code displayed on the bar graph for troubleshooting. **Reset** - the CLASSIC is in the process of restarting (the Run Mode LED is off and the thermal bargraph LEDs rapidly sweep back and forth).
Model	The model name of a CLASSIC Series device (e.g. "CLASSIC 800+").
Mounting Base Plate	Connection for CLASSIC 800 series Electronics Module and Terminal Wiring Assembly.
Process Temperature	The Process Temperature is the temperature of the Reference RTD in the CLASSIC sensor. The CLASSIC can be configured to use temperature setpoints instead of thermal signal setpoints to control relay actuation (relays are individually configurable).
Push "Set" then "Run" buttons	Workaround to immediately enter RUN mode from FAULT mode without waiting for a return to Run Mode from Fault Mode once the delay timer has expired. If a fault condition exists, the CLASSIC will immediately re-enter FAULT mode.

Reference RTD	The Reference RTD detects and outputs a signal to the Electronics Module which is proportionate to the process media temperature.
Relay 1	Front panel LED indicating when the Relay 1 coil is energized.
Relay 2	Front panel LED indicating when the Relay 2 coil is energized.
Reboot	"Rebooting" is a computer term to mean restarting the computer. In RCMS, the Reboot button causes the CLASSIC to re-start operation as if power was cycled (see Cycle Power, and refer to Section 6 RCMS for RCMS operation).
Remote Enclosure	Enclosure for the Electronics Module. Used when the Electronics Module must be located away from the sensing element due to heat, vibration, lack of visibility, etc.
RCM, RCMS	Kayden Remote Control & Monitoring Software provides a graphical computer interface for the CLASSIC series.
RTD	Resistance Temperature Detector; a sensor whose resistance varies with temperature changes.
Run Mode	Indicates normal operation when flashing.
Serial Number	A unique factory assigned number to each CLASSIC.
Set Point 1	The Thermal Signal or Temperature value which determines the actuation of Relay 1. To view the value of Set Point 1, press and hold the "1" button while in Run mode, or press the SET button sufficient times to View or Adjust Set Point 1 (the Set Point 1 LED will be ON).
Set Point 2	The Thermal Signal or Temperature value which determines the actuation of Relay 2. To view the value of Set Point 2, press and hold the "2" button while in Run mode, or press the SET button sufficient times to View or Adjust Set Point 2 (the Set Point 2 LED will be ON).
Smart Heater	The "Smart Heater" reduces the heater power from from the user setting when the Thermal Signal falls to zero to prevent a "Thermal Offset". The original heater power is restored when the Thermal Signal increases.
Thermal Offset	Thermal offset is the difference in temperature between the Active RTD and the Reference RTD due to thermal convection.
Thermal Signal	The amount of thermal energy from the Active RTD dissipated by the process, calculated as the temperature difference between the Active and Reference RTDs and expressed as a percentage.
Thermal Signal - Unscaled	The maximum displayable thermal signal range with LRV = 0% and URV = 100%. Pressing the Right Arrow on the CLASSIC front panel will show the unscaled thermal signal when in RUN mode.

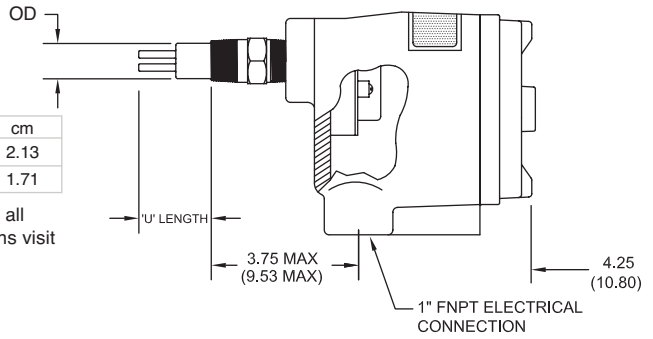| **Thermal Signal - Scaled**	The thermal signal scaled according to the user configured LRV and URV.
Unit Data	Refers to CLASSIC Model, Tag, Serial Number and Firmware version. Also the Unit Data group in Kayden RCMS.
URV	The URV (Upper Range Value) is the highest unscaled Thermal Signal that the (scaled) Bar Graph and 4-20 Analog Output will indicate.

Outline Dimensional Drawings

CLASSIC® 810 & 812
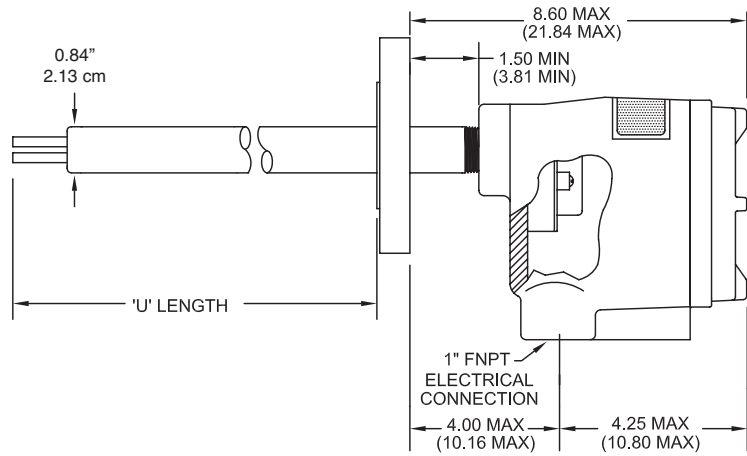
Inches (cm)

CLASSIC® 810 Threaded

1.27
(3.23)

1.13
(2.87)

4.26
(10.82)

4.75
(12.07)

OD
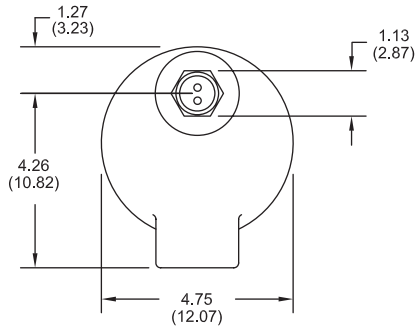
	Inches	cm
RAD to H	0.840	2.13
RAC	0.675	1.71

For dimensions on all
process connections visit
kayden.com

'U' LENGTH

3.75 MAX
(9.53 MAX)

1" FNPT ELECTRICAL
CONNECTION

4.25
(10.80)

CLASSIC® 812 Flanged

4.26
(10.82)

4.75
(12.07)

0.84"
2.13 cm

8.60 MAX
(21.84 MAX)

1.50 MIN
(3.81 MIN)

'U' LENGTH

1" FNPT
ELECTRICAL
CONNECTION

4.00 MAX
(10.16 MAX)

4.25 MAX
(10.80 MAX)
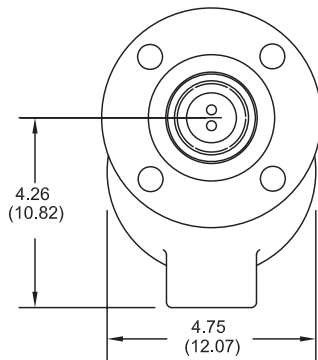
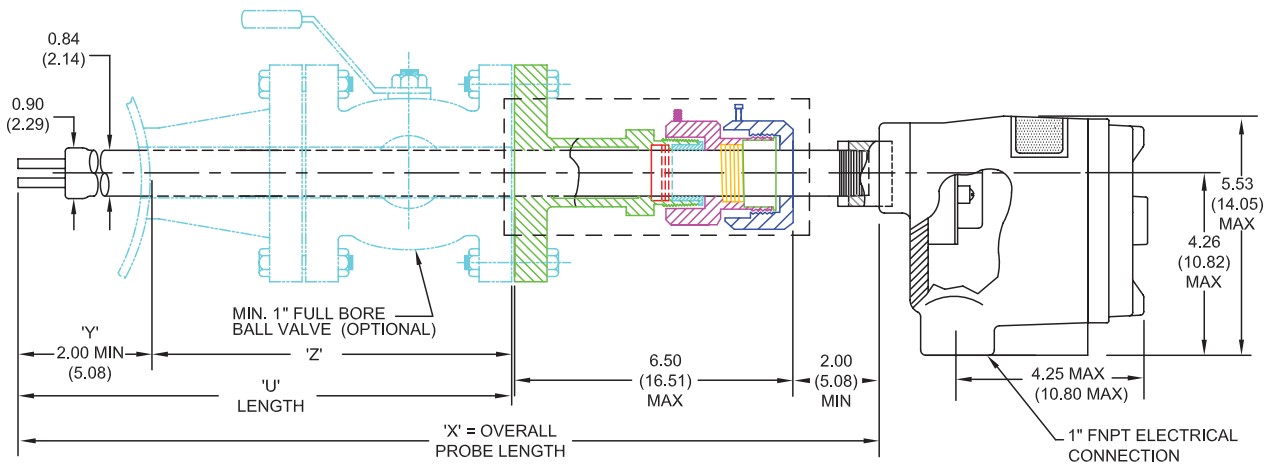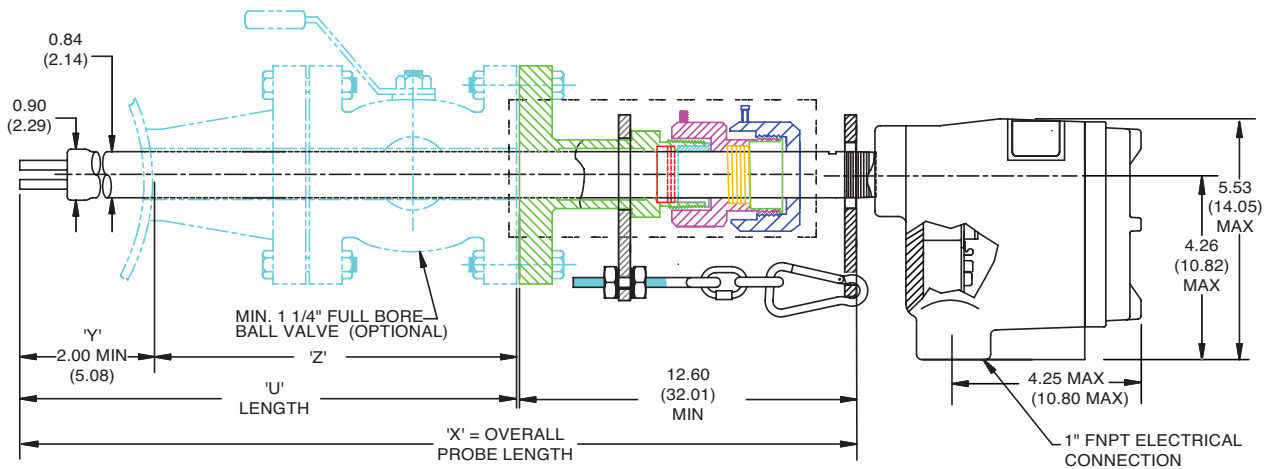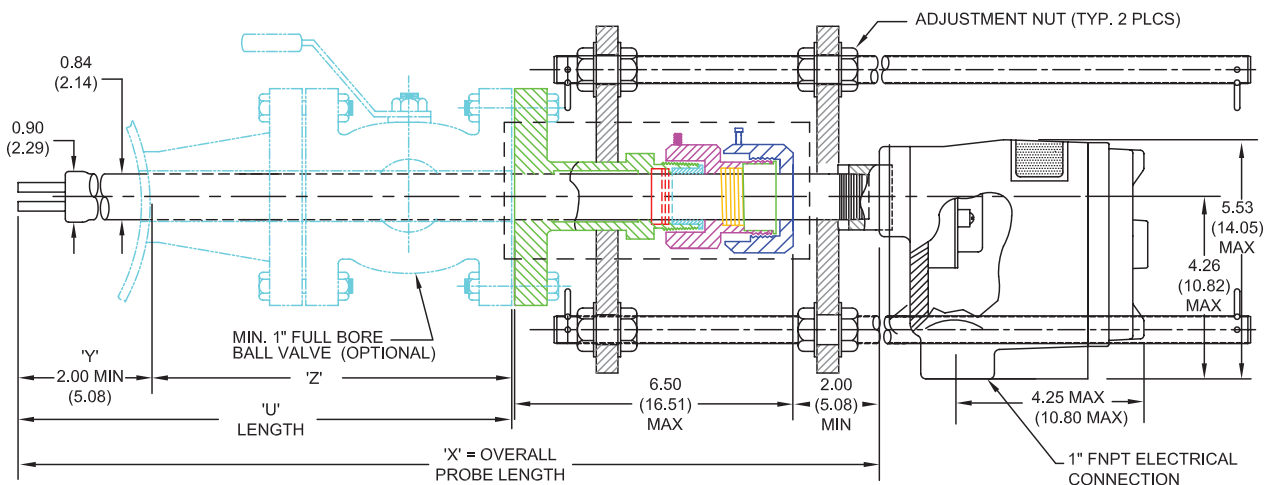## CLASSIC® 814

Inches (cm)

CLASSIC® 814 Retractable Packing Gland Flanged - to 50 psi

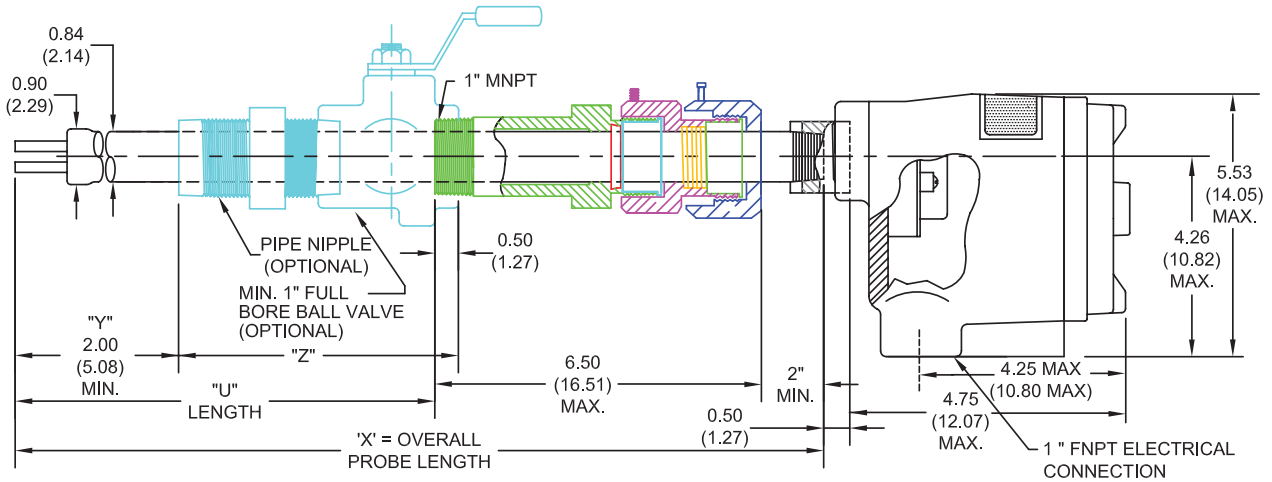### CLASSIC® 814 Retractable Packing Gland Flanged - 1" MNPT - c/w Retaining Chain - to 125 psi

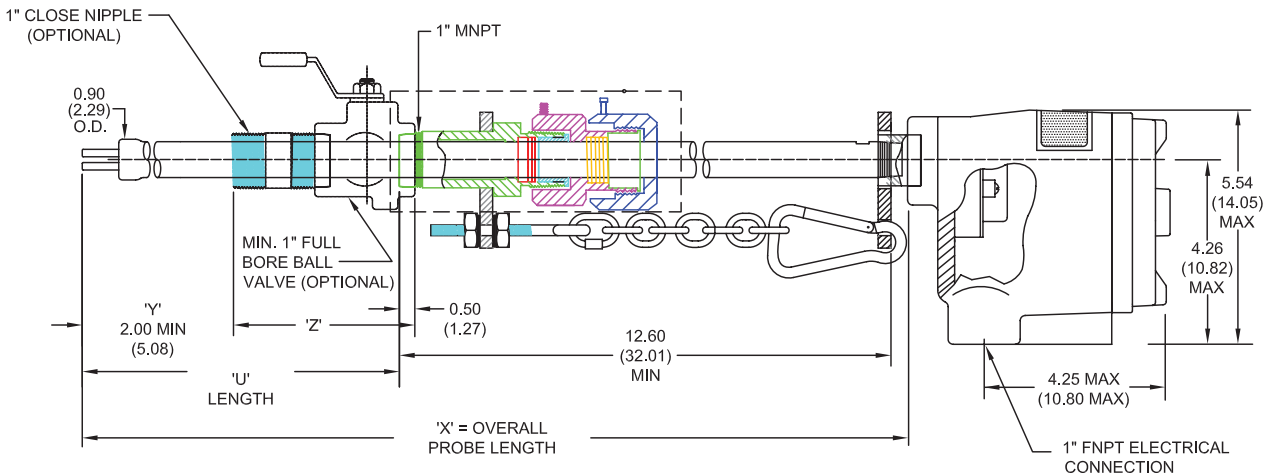### CLASSIC® 814 Retractable Packing Gland Flanged - to 275 psi
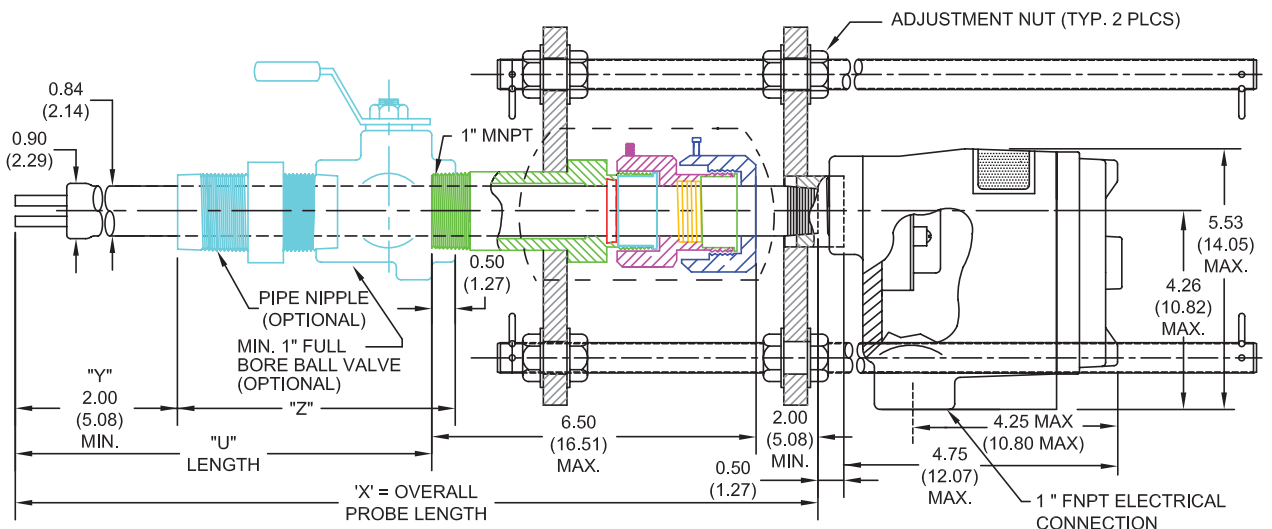
CLASSIC® 816

Inches (cm)

CLASSIC® 816 Retractable Packing Gland Threaded - 1" MNPT - to 50 psi

0.84 (2.14)
0.90 (2.29)
1" MNPT
PIPE NIPPLE (OPTIONAL)
MIN. 1" FULL BORE BALL VALVE (OPTIONAL)
0.50 (1.27)
"Y" 2.00 (5.08) MIN.
"Z"
"U" LENGTH
6.50 (16.51) MAX.
2" MIN.
0.50 (1.27)
'X' = OVERALL PROBE LENGTH
5.53 (14.05) MAX.
4.26 (10.82) MAX.
4.25 MAX (10.80 MAX)
4.75 (12.07) MAX.
1 " FNPT ELECTRICAL CONNECTION

CLASSIC® 816 Retractable Packing Gland Threaded - 1" MNPT - c/w Retaining Chain - to 125 psi

1" CLOSE NIPPLE (OPTIONAL)
1" MNPT
0.90 (2.29) O.D.
MIN. 1" FULL BORE BALL VALVE (OPTIONAL)
'Y' 2.00 MIN (5.08)
'Z'
'U' LENGTH
0.50 (1.27)
12.60 (32.01) MIN
'X' = OVERALL PROBE LENGTH
5.54 (14.05) MAX
4.26 (10.82) MAX
4.25 MAX (10.80 MAX)
1" FNPT ELECTRICAL CONNECTION

CLASSIC® 816 Retractable Packing Gland Threaded - 1" MNPT - to 500 psi

0.84 (2.14)
0.90 (2.29)
1" MNPT
ADJUSTMENT NUT (TYP. 2 PLCS)
PIPE NIPPLE (OPTIONAL)
MIN. 1" FULL BORE BALL VALVE (OPTIONAL)
"Y" 2.00 (5.08) MIN.
"Z"
"U" LENGTH
0.50 (1.27)
6.50 (16.51) MAX.
2.00 (5.08) MIN.
0.50 (1.27)
'X' = OVERALL PROBE LENGTH
5.53 (14.05) MAX.
4.26 (10.82) MAX.
4.25 MAX (10.80 MAX)
4.75 (12.07) MAX.
1 " FNPT ELECTRICAL CONNECTION

CLASSIC® 830

Inches (cm)

CLASSIC® 830 InLine Threaded - Horizontal

2.50
(63.5)

1.27
(3.23)

1.5
(38.1)

4.26
(10.82)

4.75
(12.07)

FLOW DIRECTION INDICATOR

FLAT UP AND
LEVEL ± 2°

3.00
(7.62)

5.50 MAX.
(13.97 MAX.)

1" FNPT ELECTRICAL
CONNECTION

4.25
(10.80)
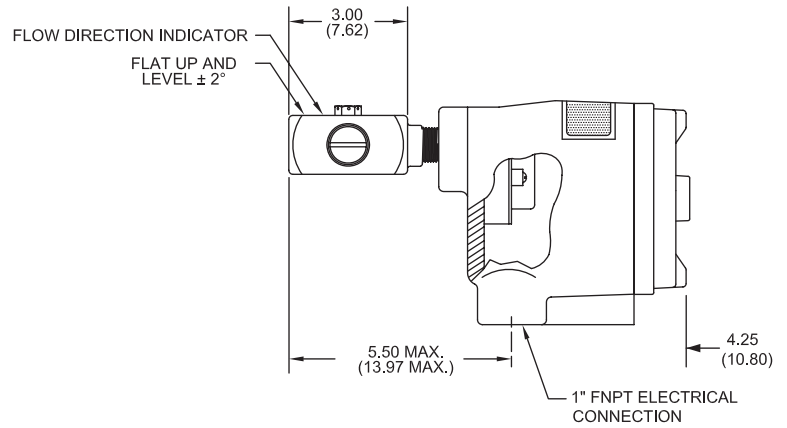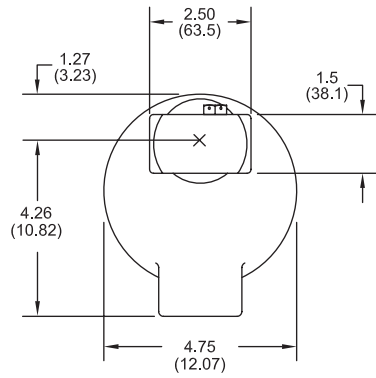
CLASSIC® 830 InLine Threaded - Vertical

1.50
(3.81)

1.27
(3.23)

FLAT UP AND
LEVEL ± 2°

2.50
(6.35)

4.26
(10.82)

FLOW DIRECTION
INDICATOR

4.75
(12.07)

3.00
(7.62)

5.50 MAX.
(13.97 MAX.)

1" FNPT ELECTRICAL
CONNECTION

4.25
(10.80)
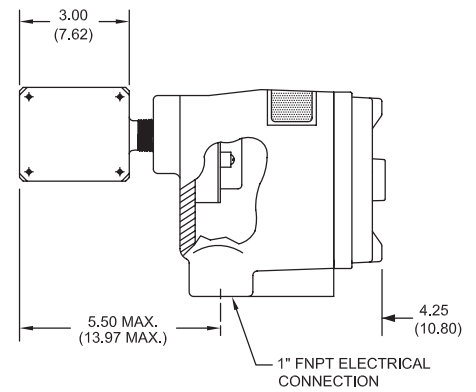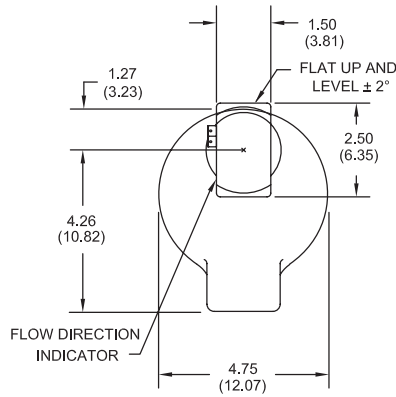
CLASSIC® 830 Detail - Mounting Holes

4 x 17/64 (0.265) Ø

2.94

0.5

2.50

2.00

0.47   2.00   0.47

1.25
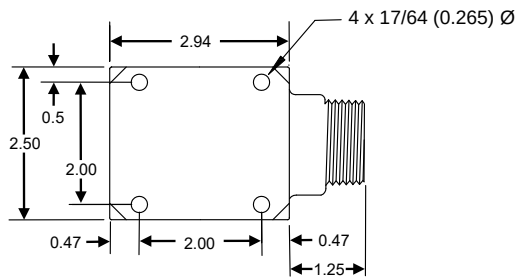
CLASSIC® 832

CLASSIC® 832 InLine Flanged - Horizontal

(as advised)

FLOW DIRECTION INDICATOR

"A"

1.27 (3.23)

4.26 (10.82)

4.75 (12.07)

4.25 (10.80)

1" FNPT ELECTRICAL CONNECTION
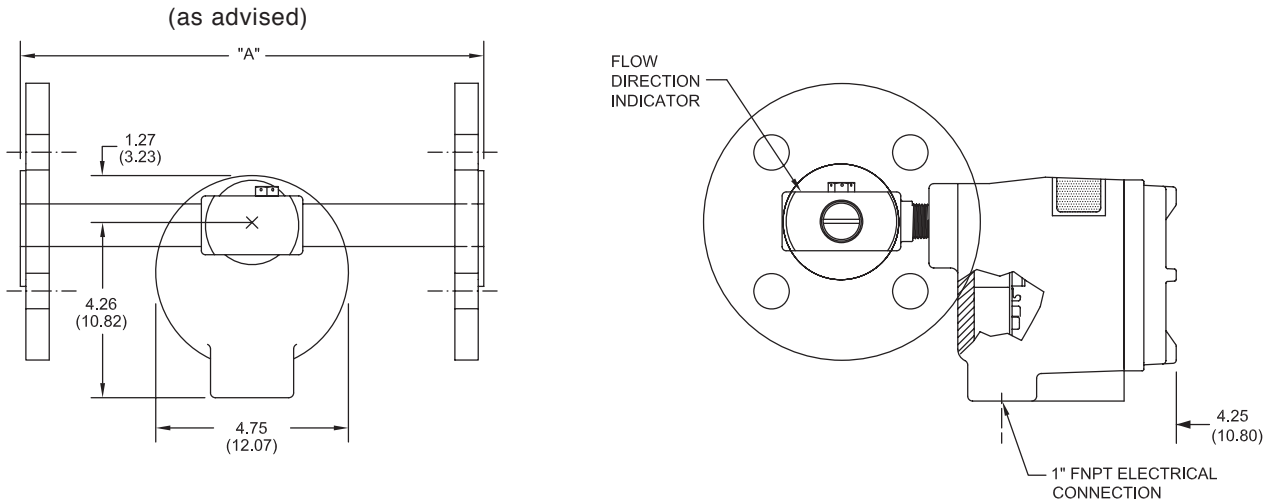
Inches (cm)

CLASSIC® 832 InLine Flanged - Vertical

1.50 (3.81)

1.27 (3.23)

2.50 (6.35)

"A"

4.26 (10.82)

FLOW DIRECTION INDICATOR

4.75 (12.07)

3.00 (7.62)

4.25 (10.80)

1" FNPT ELECTRICAL CONNECTION
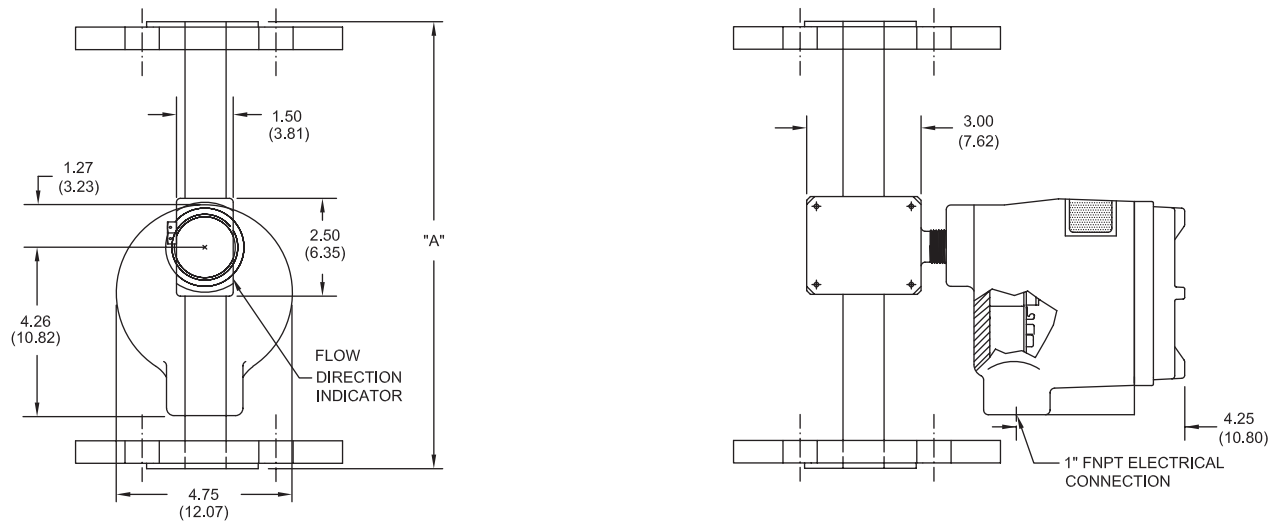
Remote Electronics Enclosure - Flameproof (CSA)

FIELD WIRING

SENSOR ENCLOSURE

BLUE—1   8—RED
BLACK—2 7—RED
BLUE—3   6—WHITE
BLACK—4 5—YELLOW

1 2 3 4 5 6 7 8

REMOTE ENCLOSURE

5.75
(14.61)

6.63
(16.84)

5.50
(13.97)

6.50
(16.51)

1" FNPT
ELECTRICAL
CONNECTION

5.70
(14.79)

1.44
(3.65)

1" FNPT
(2 PLACES)
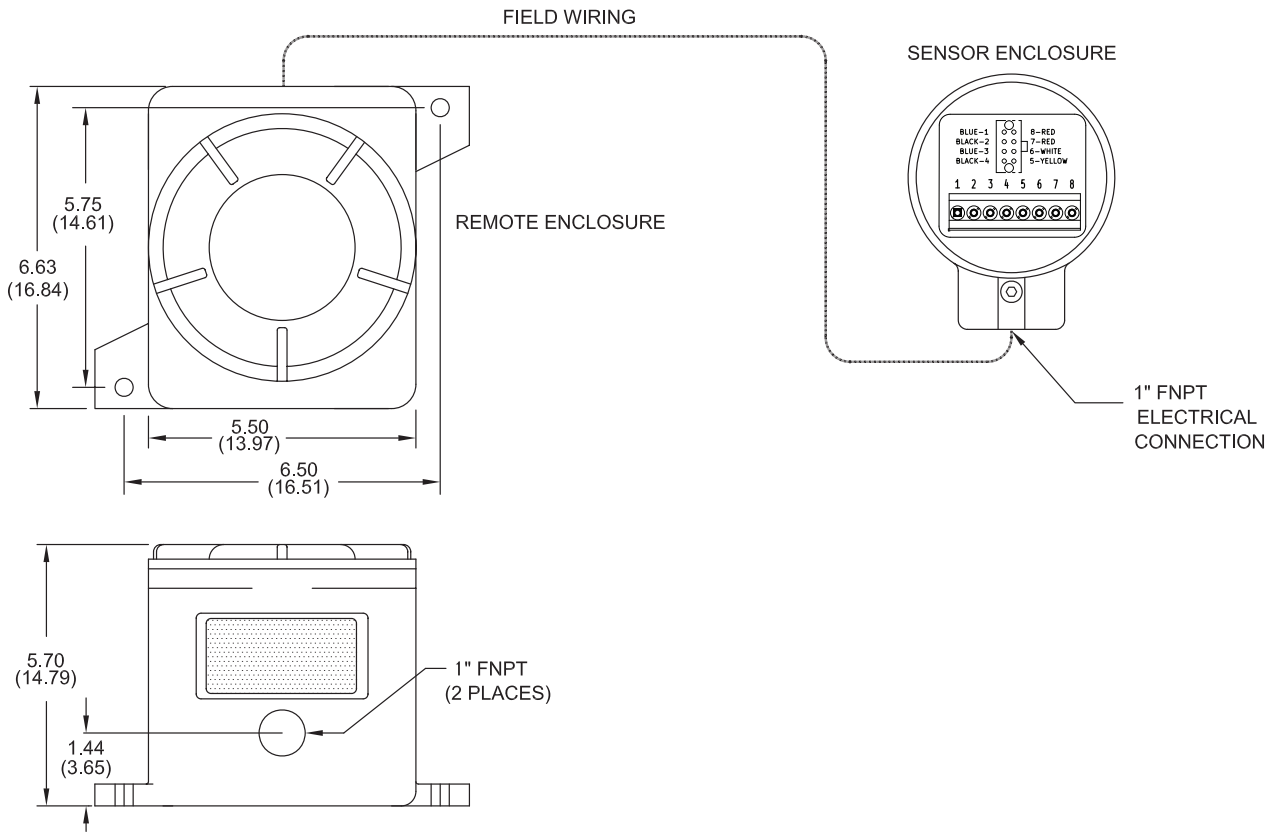
Note: Suitable for one (1) Electronics Module.

Note: For detailed drawings of all products visit kayden.com

B   Model Number Legends

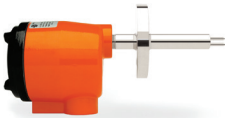To configure a Kayden CLASSIC please visit kayden.com or your Kayden catalog. We have provided the following legends for configuring products. We have also provided Product Configurators on kayden.com for added ease of use.

Model Number Legends are available for the following **CLASSIC 800** Flameproof Models

CLASSIC 810 Threaded

- Insertion Style - 1/2", 3/4", 1", 1-1/4", 1-1/2" & 2" MNPT

CLASSIC 812 Flanged

- Insertion Style - 1" ANSI 150 through 10" ANSI 900 Flanges

CLASSIC 814 Flanged Retractable Packing Gland

- Insertion Style - 1-1/2" through 10" ANSI 150 Flanges

CLASSIC 816 Threaded Retractable Packing Gland

- Insertion Style - 1" MNPT

CLASSIC 830 Threaded
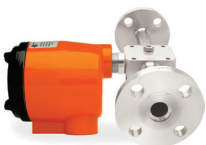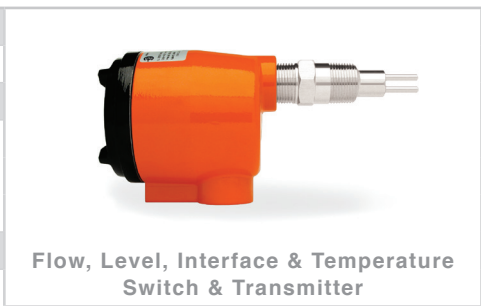
- InLine Style - 3/4" FNPT

CLASSIC 832 Flanged

- InLine Style - 3/4" ANSI 150 through 10" ANSI 900 Flanges

810	CODE	Sensor Type									
·	**R**	-55°C to +200°C (-58°F to +392°F) Continuous Service									
·		**CODE**	**Sensor Material**								
·		**A**	316/316L Stainless Steel								
·		**X**	Titanium Gr. 2								
·		**T**	Hastelloy C-276								
·		·	**CODE**	**Process Connection - MNPT**							
·			**C**	1/2"							
·			**D**	3/4"							
·			**E**	1"							
·			**F**	1-1/4"							
·			**G**	1-1/2"							
·			**H**	2"							
·			·	**CODE**	**Insertion 'U' Lengths**						
·				**0012**	1.2" (3.0 cm)						
·				**0020**	2" (5.0 cm)						
·				**0030**	3" (7.5 cm)						
·				**0040**	4" (10.1 cm)	Custom 'U' Lengths					
·				**0060**	6" (15.2 cm)	2.5" - 120" (6.0 cm - 305 cm)					
·				**0090**	9" (23 cm)	Available in 1/2" (1.0 cm) increments.					
·				**0120**	12" (30 cm)						
·				**0180**	18" (46 cm)						
·				**IXXXX**	Custom 'U' Lengths: Use 4 digits preceded by an 'I' (i.e. 3.5" 'U' = I0035) (Use 'M' for cm)						
·				·	**CODE**	**Input Power**					
·					**C**	12-24 VDC and 115-230 VAC, 50 to 60 Hz					
·					**Electronics**						
·					Microprocessor Controlled with User Interface.						
·					Two SPDT sealed relay contacts. Modbus via RS-485. 4-20 mA current loop.						
·						·	**CODE**	**Local Enclosure**			
·							**1**	Flameproof - Aluminum			
·							·	**CODE**	**Cover - For Local Enclosure**		
·								**B**	Blind Cover - Flameproof		
·								**G**	Glass Lens Cover - Flameproof		
·								·	**CODE**	**Remote Electronics Enclosure & Cover**	
·									**0A**	Not Required	
·									**1G**	Glass Lens Cover - Flameproof	
·									·	**CODE**	**Agency Approvals**
·										**1**	cCSAus (UL Standards)
·										**3**	cCSAus (UL Standards) & CRN
·										·	**CODE** **Language**
·											**E** English
810	**R**	**A**	**D**	**0020**	**C**		**1**	**G**	**0A**	**1**	**E**

Flow, Level, Interface & Temperature
Switch & Transmitter

Model Number Legend
DOC#: ML-810-006

ML-810-006-[004]

812	CODE	Sensor Type
·	R	-55°C to +200°C (-58°F to +392°F) Continuous Service

		CODE	Sensor Material
·	·	A	316/316L Stainless Steel
·	·	X	Titanium Gr. 2
·	·	T	Hastelloy C-276

		·	CODE	Process Connection - Flange Type
·	·	·	A	Raised Face
·	·	·	B	RTJ - Ring Type Joint

CODE	ANSI 1"	CODE	ANSI 1-1/2"	CODE	ANSI 2"	CODE	ANSI 3"	CODE	ANSI 4"	CODE	ANSI 5"	CODE	ANSI 6"	CODE	ANSI 8"	CODE	ANSI 10"
121	150	131	150	141	150	151	150	161	150	171	150	181	150	191	-	201	-
122	300	132	300	142	300	152	300	162	300	172	300	182	-	192	-	202	-
123	600	133	600	143	600	153	600	163	600	173	-	183	-	193	-	203	-
124	900	134	900	144	900	154	900	164	900	174	-	184	-	194	-	204	-

				CODE	Flange Material		
·	·	·	·	A	316/316L Stainless Steel	X	Titanium Gr. 2
·	·	·	·	T	Hastelloy C-276		

					CODE	Insertion 'U' Lengths 2.5" - 120" (6.4 cm - 305 cm) in 1/2" (1.0 cm) increments.
·	·	·	·	·	IXXXX	Custom 'U' Lengths: Use 4 digits preceded by an 'I' (i.e. 3.5" 'U' = I0035) ('M' = cm)

					·	CODE	Input Power
·	·	·	·	·	·	C	12-24 VDC and 115-230 VAC, 50 to 60 Hz

							Electronics
·	·	·	·	·	·	·	Microprocessor Controlled with User Interface.
·	·	·	·	·	·	·	Two SPDT fully sealed relay contacts. Modbus via RS-485. 4-20 mA current loop.

							CODE	Local Enclosure
·	·	·	·	·	·	·	1	Flameproof - Aluminum

								CODE	Cover - For Local Enclosure
·	·	·	·	·	·	·	·	B	Blind Cover - Flameproof
·	·	·	·	·	·	·	·	G	Glass Lens Cover - Flameproof

								·	CODE	Remote Electronics Enclosure & Cover
·	·	·	·	·	·	·	·	·	0A	Not Required
·	·	·	·	·	·	·	·	·	1G	Glass Lens Cover - Flameproof

									CODE	Agency Approvals
·	·	·	·	·	·	·	·	·	1	$_{c}$CSA$_{us}$ (UL Standards)
·	·	·	·	·	·	·	·	·	3	$_{c}$CSA$_{us}$ (UL Standards) & CRN

									·	CODE	Language
·	·	·	·	·	·	·	·	·	·	E	English

812	R	A	A	131	A	I0035	C		1	G	0A	1	E

Flow, Level, Interface & Temperature Switch & Transmitter

Model Number Legend
DOC#: ML-812-006

ML-812-006-[004]

Flow, Level, Interface & Temperature Switch & Transmitter

814	CODE	Sensor Type
·	**R**	-55°C to +160°C [-58°F to +320°F]) Continuous Service

		CODE	Sensor Material
·	·	**A**	316/316L Stainless Steel
·	·	**X**	Titanium Gr. 2
·	·	**T**	Hastelloy C-276

			CODE	Process Connection - Flange Type
·	·	·	**A**	Raised Face
·	·	·	**B**	RTJ - Ring Type Joint

CODE	ANSI	CODE	ANSI	CODE	ANSI	CODE	ANSI	CODE	ANSI	CODE	ANSI	CODE	ANSI	CODE	ANSI
	1-1/2"		2"		3"		4"		5"		6"		8"		10"
131	150	**141**	150	**151**	150	**161**	150	**171**	150	**181**	150	**191**	150	**201**	150

CODE	Flange Material		
A	316/316L Stainless Steel	**X**	Titanium Gr. 2
T	Hastelloy C-276		

CODE	Retraction Assembly
T	Low Pressure; 316/316L Stainless Steel (MWP 50 psi)
J	Low Pressure c/w Retaining Chain; 316/316L Stainless Steel (MWP 125 psi)
X	Medium Pressure; 316/316L Stainless Steel (MWP 275 psi)

CODE	Insertion 'U' Lengths 2.5" - 120" 6.4 cm - 305 cm in 1/2" 1.0 cm increments.
IXXXX	Custom 'U' Lengths: Use 4 digits preceded by an 'I' (i.e. 3.5" 'U' = I0035) ('M' = cm)

CODE	Input Power
C	12-24 VDC and 115-230 VAC, 50 to 60 Hz

Electronics
Microprocessor Controlled with User Interface. Two SPDT fully sealed relay contacts. Modbus via RS-485. 4-20 mA current loop.

CODE	Local Enclosure
1	Flameproof - Aluminum

CODE	Cover - For Local Enclosure / Sensor Enclosure
B	Blind Cover - Flameproof
G	Glass Lens Cover - Flameproof

CODE	Remote Electronics Enclosure & Cover
0A	Not Required
1G	Glass Lens Cover - Flameproof

CODE	Agency Approvals
1	cCSAus (UL Standards)

CODE	Language
E	English

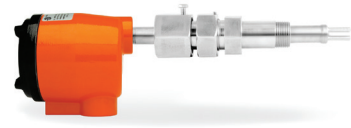| 814	R	A	A	131	A	T	I0035	C		1	G	0A	1	E	

Model Number Legend
DOC#: ML-814-006

ML-814-006-[004]

*Sensor only. The Packing Gland Assembly is available as standard in 316/316L Stainless Steel. For exotic alloys contact Kayden.

816	CODE	Sensor Type
·	R	-55°C to +160°C [-58°F to +320°F]) Continuous Service

		CODE	Sensor Material
·	·	A	316/316L Stainless Steel
·	·	X	Titanium Gr. 2
·	·	T	Hastelloy C-276

			CODE	Process Connection - MNPT
·	·	·	E	1"

Flow, Level, Interface & Temperature Switch & Transmitter

				CODE	Insertion 'U' Lengths
·	·	·	·	T	Low Pressure; 316/316L Stainless Steel (MWP 50 psi)
·	·	·	·	J	Low Pressure c/w Retaining Chain; 316/316L Stainless Steel (MWP 125 psi)
·	·	·	·	X	Medium Pressure; 316/316L Stainless Steel (MWP 500 psi)

					CODE	Insertion 'U' Lengths
·	·	·	·	·	IXXXX	Custom 'U' Lengths: Use 4 digits preceded by an 'I' (i.e. 3.5" 'U' = I0035) (Use 'M' for cm)

						CODE	Input Power
·	·	·	·	·	·	C	12-24 VDC and 115-230 VAC, 50 to 60 Hz

						·	Electronics
·	·	·	·	·	·	·	Microprocessor Controlled with User Interface.
·	·	·	·	·	·	·	Two SPDT fully sealed relay contacts. Modbus via RS-485. 4-20 mA current loop.

							·	CODE	Local Enclosure
·	·	·	·	·	·	·	·	1	Flameproof - Aluminum

								CODE	Cover - For Local Enclosure
·	·	·	·	·	·	·	·	B	Blind Cover - Flameproof
·	·	·	·	·	·	·	·	G	Glass Lens Cover - Flameproof

									CODE	Remote Electronics Enclosure & Cover
·	·	·	·	·	·	·	·	·	0A	Not Required
·	·	·	·	·	·	·	·	·	1G	Glass Lens Cover - Flameproof

										CODE	Agency Approvals
·	·	·	·	·	·	·	·	·	·	1	cCSAus (UL Standards)

											CODE	Language
·	·	·	·	·	·	·	·	·	·	·	E	English

| 816 | R | A | E | T | I0035 | C | | 1 | G | 0A | 1 | E | |

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Please refer to kayden.com for current specifications and configurations.

Model Number Legend
DOC#: ML-816-006

ML-816-006-[004]

*Sensor only. The Packing Gland Assembly is available as standard in 316/316L Stainless Steel. For exotic alloys contact Kayden.

830	CODE	Sensor Type													
·	**R**	-55°C to +200°C (-58°F to +392°F) Continuous Service													
·	·	**CODE**	**Sensor Material**												
·	·	**A3**	316/316L Stainless Steel c/w Nickel Braze												
·	·	·	**CODE**	**Process Connection - FNPT**											
·	·	·	**D**	3/4"											
·	·	·	·	**CODE**	**Sensor Assembly Body Length**										
·	·	·	·	**0035**	3.5" (8.8 cm)										
·	·	·	·	·	**CODE**	**Bleed Port**									
·	·	·	·	·	**A**	Standard									
·	·	·	·	·	·	**CODE**	**Sensor Mounting Orientation**								
·	·	·	·	·	·	**H**	Horizontal Pipe								
·	·	·	·	·	·	**V**	Vertical Pipe								
·	·	·	·	·	·	·	**CODE**	**Injection Tubes (3/4" MNPT x 1/4" FNPT)**							
·	·	·	·	·	·	·	**0**	Not Required							
·	·	·	·	·	·	·	**1**	Type 1; .180" Bore; 316/316L Stainless Steel							
·	·	·	·	·	·	·	**2**	Type 2; .086" Bore; 316/316L Stainless Steel							
·	·	·	·	·	·	·	·	**CODE**	**Mounting Bracket Kit**						
·	·	·	·	·	·	·	·	**A**	Not Required						
·	·	·	·	·	·	·	·	**B**	90° Angle Bracket with hardware for wall/stand mounting						
·	·	·	·	·	·	·	·	·	**CODE**	**Power**					
·	·	·	·	·	·	·	·	·	**C**	12-24 VDC and 115-230 VAC, 50 to 60 Hz					
·	·	·	·	·	·	·	·	·	·	**Electronics**					
·	·	·	·	·	·	·	·	·	·	Microprocessor Controlled with User Interface. Two SPDT fully sealed relay contacts. Modbus via RS-485. 4-20 mA current loop.					
·	·	·	·	·	·	·	·	·	·	·	**CODE**	**Local Enclosure**			
·	·	·	·	·	·	·	·	·	·	·	**1**	Flameproof - Aluminum			
·	·	·	·	·	·	·	·	·	·	·	·	**CODE**	**Cover - For Local Enclosure / Sensor Enclosure**		
·	·	·	·	·	·	·	·	·	·	·	·	**B**	Blind Cover - Flameproof		
·	·	·	·	·	·	·	·	·	·	·	·	**G**	Glass Lens Cover - Flameproof		
·	·	·	·	·	·	·	·	·	·	·	·	·	**CODE**	**Remote Electronics Enclosure & Cover**	
·	·	·	·	·	·	·	·	·	·	·	·	·	**0A**	Not Required	
·	·	·	·	·	·	·	·	·	·	·	·	·	**1G**	Glass Lens Cover - Flameproof	
·	·	·	·	·	·	·	·	·	·	·	·	·	·	**CODE**	**Agency Approvals**
·	·	·	·	·	·	·	·	·	·	·	·	·	·	**1**	cCSAus (UL Standards)
·	·	·	·	·	·	·	·	·	·	·	·	·	·	**CODE**	**Language**
·	·	·	·	·	·	·	·	·	·	·	·	·	·	**E**	English
830	**R**	**A3**	**D**	**0035**	**A**	**H**	**1**	**A**	**C**		**1**	**B**	**0A**	**1**	**E**

Flow, Level & Temperature
Switch & Transmitter

Model Number Legend
DOC#: ML-830-006

ML-830-006-[004]

832	CODE	Sensor Type
	R	-55°C to +200°C (-58°F to +392°F) Continuous Service

		CODE	Sensor Material
		A3	316/316L Stainless Steel c/w Nickel Braze

			CODE	Process Connection - Flange Type
			A	Raised Face
			B	RTJ - Ring Type Joint

CODE	ANSI 1"	CODE	ANSI 1-1/2"	CODE	ANSI 2"	CODE	ANSI 3"	CODE	ANSI 4"	CODE	ANSI 5"	CODE	ANSI 6"	CODE	ANSI 8"	CODE	ANSI 10"
121	150	131	150	141	150	151	150	161	150	171	150	181	150	191	150	201	150
122	300	132	300	142	300	152	300	162	300	172	300	182	300	192	300	202	300
123	600	133	600	143	600	153	600	163	600	173	600	183	600	193	600	203	600
124	900	134	900	144	900	154	900	164	900	174	900	184	900	194	900	204	900

CODE	Flange Material
A	316/316L Stainless Steel

CODE	Sensor Assembly Body Length Flange Face to Flange Face
IXXXX	Custom Body Lengths: Available in 1/2" (1.0 cm) increments. eg. 16.0" = 0160 ('M' = cm)
	7" - 72" (relative to flange size/rating)

CODE	Bleed Port
A	1/4" Threaded - Standard

CODE	Sensor Orientation
H	Horizontal
V	Vertical

CODE	Pipe Schedule
0	Schedule 40
1	Schedule 80 (Standard)

CODE	Input Power
C	12-24 VDC and 115-230 VAC, 50 to 60 Hz

Electronics
Microprocessor Controlled with User Interface. Two SPDT fully sealed relay contacts. Modbus via RS-485. 4-20 mA current loop.

CODE	Local Enclosure
1	Flameproof - Aluminum

CODE	Cover - For Local Enclosure / Sensor Enclosure
B	Blind Cover - Flameproof
G	Glass Lens Cover - Flameproof

CODE	Remote Electronics Enclosure & Cover
0A	Not Required
1G	Glass Lens Cover - Flameproof

CODE	Agency Approvals
1	cCSAus (UL Standards)

CODE	Language
E	English

832	R	A3	A	131	A	I0060	A	H	0	C		1	G	0A	1	E

Model Number Legend
DOC#: ML-832-006

ML-832-006-[004]

C   kayden.com Web Site

kayden.com is a comprehensive resource for most customer requirements.

The site offers a means to:

- **Configure Products**, Spare Parts and Accessories
- **Compare our products** to determine those best suited to your application
- View and download **Product Manuals**
- View and download **Outline Dimensional Drawings, Wiring Diagrams & Parts Lists**
- View and download **Quick Setup Guides**
- View and download **Product Specifications and Brochures**
- View our **Support Section for Troubleshooting Assistance**
- View our Corporate Policies (satisfaction guarantee, returns, repairs, etc.)
- Find your **Kayden Distributor**
- Download **Kayden RCM Software**
- View and download **Approval Certificates**

D

RCM Software Installation and Use

Kayden RCM (Remote Configuration and Management) Software, or simply RCMS, can be used to configure the Kayden CLASSIC, including features not accessible from the CLASSIC front panel such as delay timers and using temperature set points. RCMS can also save the configuration of a CLASSIC, which can be saved as a record or used to identically configure other CLASSICs.

RCMS is only available for computers running Microsoft Windows®

I. Install RCMS

1. Download

Download the RCMS installation ZIP file from the Kayden website.

kayden.com
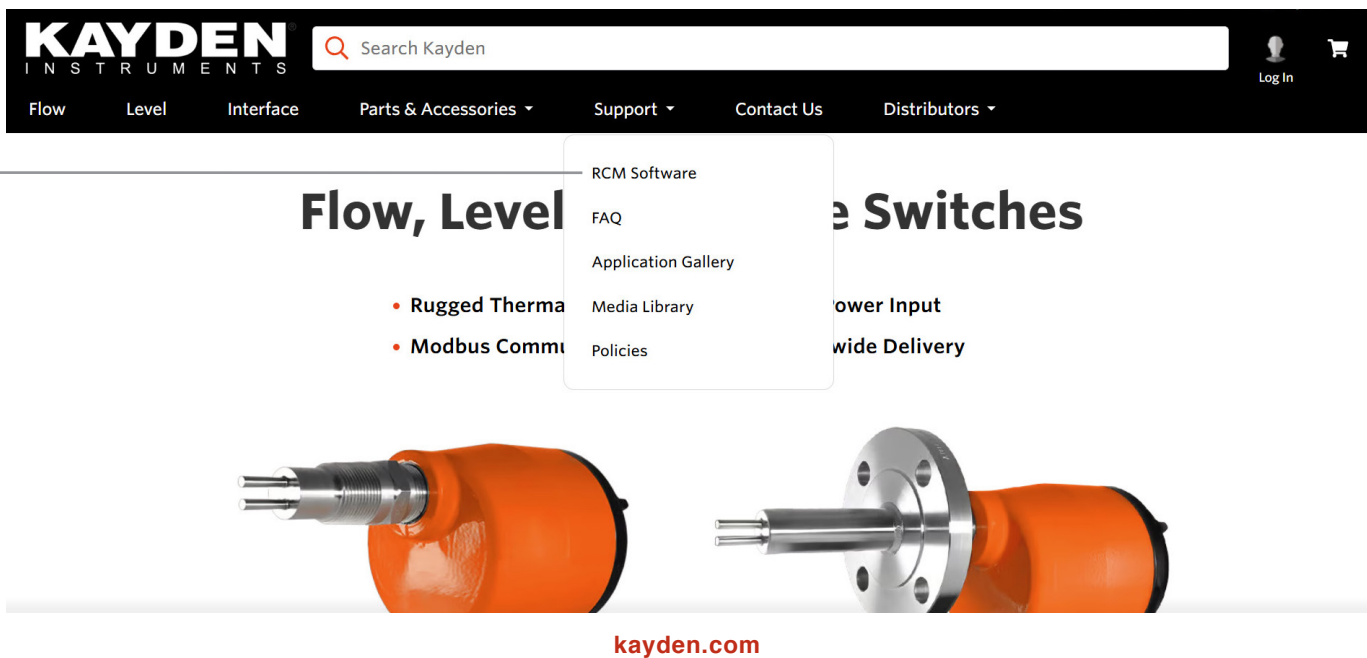
2. Open

Open the ZIP file using Windows Explorer and double-click setup.exe to install RCMS. You will need Administrator privileges to the computer or the Administrator password to continue.
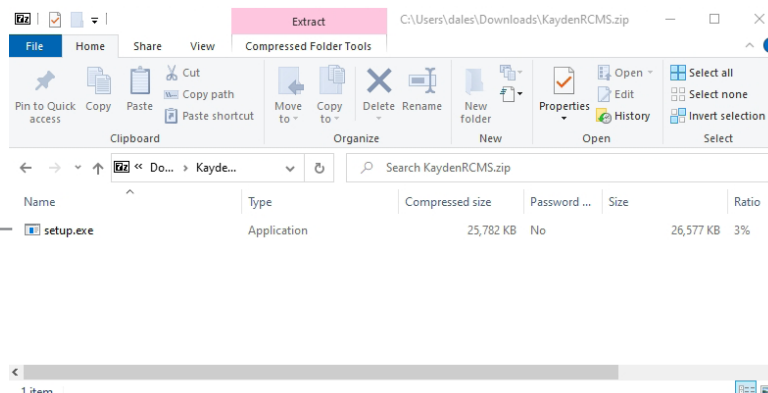
Once the installer is running, continue by clicking Next.

The installer will create a desktop icon for starting RCMS, as well as an entry in the Programs menu. You can delete the ZIP file after installation is complete.

II. Wire RS-485 Connection from Computer to CLASSIC

1. Connect to PC

Connect the computer with RCMS installed to a CLASSIC using a suitable RS-485 adapter (the CLASSIC communicates using single-duplex RS-485 at 9600 baud). Kayden offers both USB-to-RS-485 adapters as well as RS-232-to-RS-485 adapters.

III. RS-485 Communication Adapters and Cable

Communication Adapter

PC Port	Adapter	Cable
DB9	**Part Number: A15-321** Kayden SCA for computers with DB-9 RS-232.	**A05-CC-0004** 4 feet **A05-CC-0008** 8 feet **A05-CC-0010** 10 feet Contact factory for custom length.
USB	**Part Number: USB-RS485** Pigtail cable for direct connection with terminal block for optional use.	No cable required unless terminal block is used

2.   Start RCMS

Start RCMS. RCMS must be run as Administrator; hold the Shift key then right-click on the RCMS icon and select Run as Administrator from the pop-up context menu.

3.   Connect RCMS to the CLASSIC

After RCMS has started, you must specify the Unit number of the CLASSIC device (also called the Modbus Node Address) and the COM port used by the RS-485 Adapter.

RCMS will connect immediately if the previous settings used are still valid.
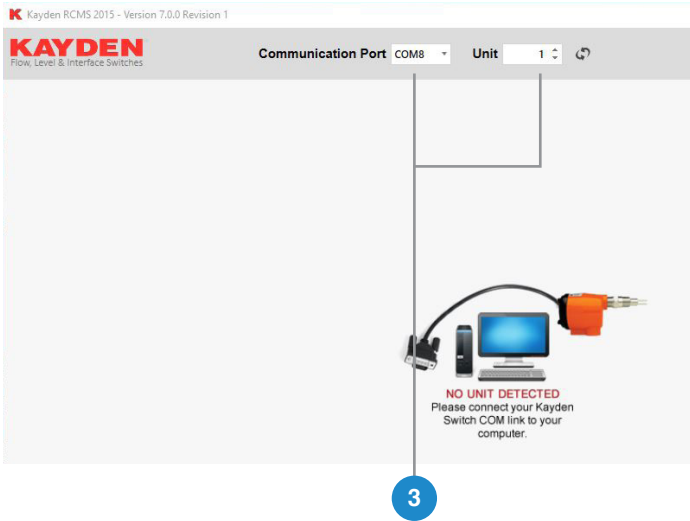
The default Unit number is Unit 1, which is the CLASSIC factory default Node Address.

The COM port the CLASSIC is connected to can be found through Windows Device Manager. In the following figure, Device Manager shows a single USB Serial Port which has been assigned COM8.
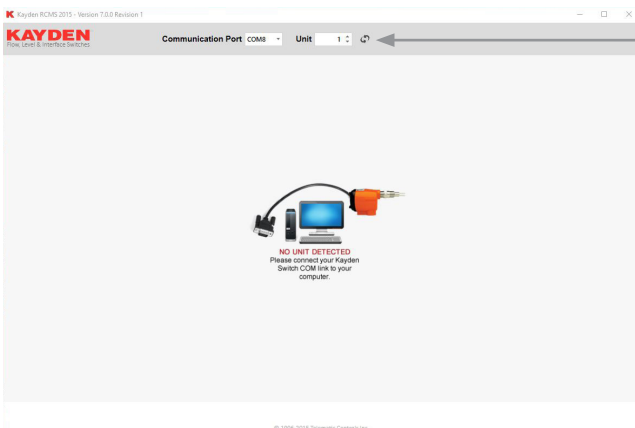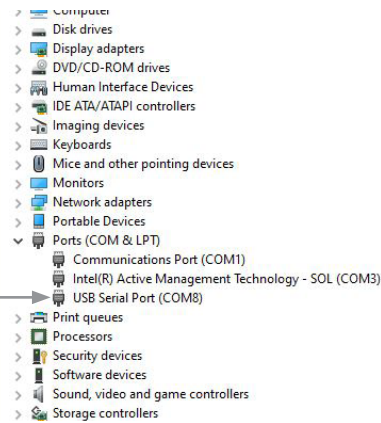
Click to Attempt Connection

After setting the Unit number and COM port, click the Refresh icon to connect to the CLASSIC.

If the connection is successful, RCMS will remember the COM port and Unit number and use them the next time it is run.
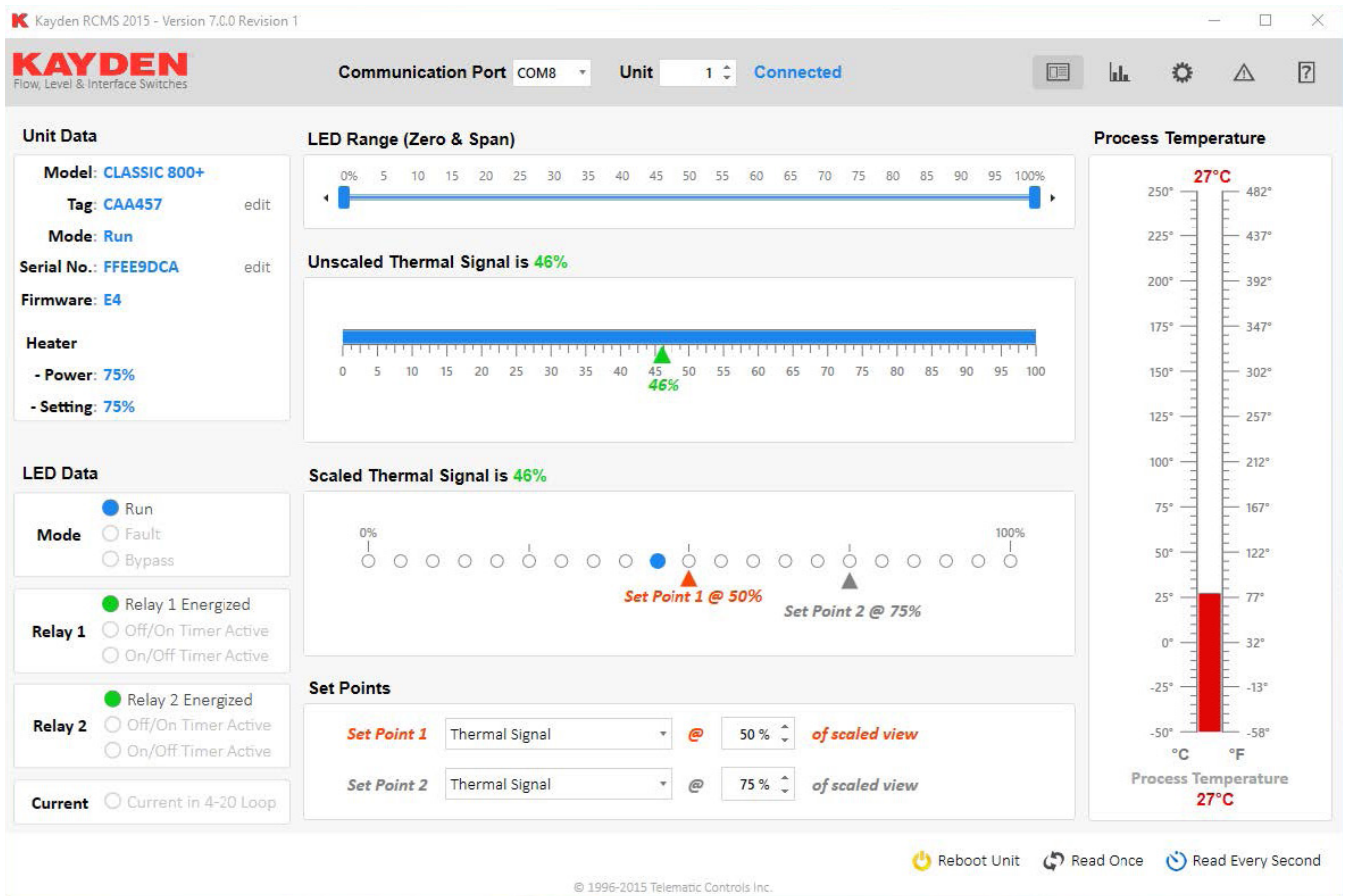
V. RCM Software Views

RCMS provides five views, selected using the icons in the upper right:
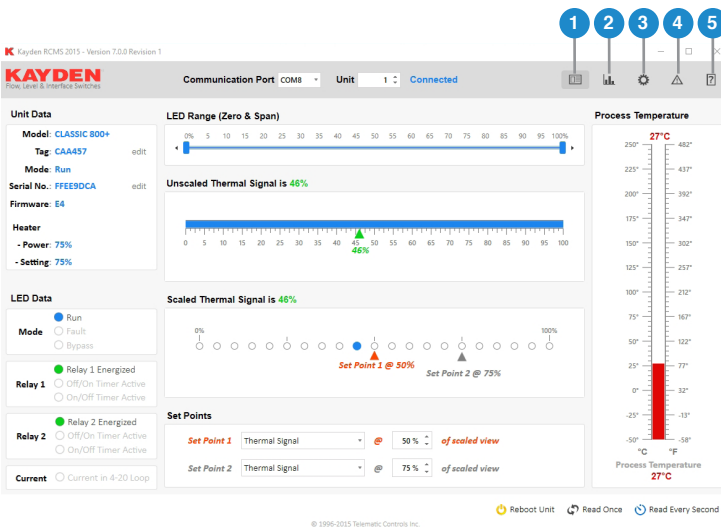
1 Control Panel – Shows operating status.

2 Graphs – Shows thermal signal or temperature trend line.

3 Unit Configuration – Configuration controls.

4 Fault Log – Lists operational and fault events, also error counters.

5 Help – CLASSIC Product Manual and Glossary.

V. Control Panel View

The Control Panel View displays device information, operating status, and allows some configuration. Click Read Once to update the dashboard, click Read Every Second to show changing status in real time.

The unit MUST stop reading to enter configuration mode (a STOP button appears if reading every second)
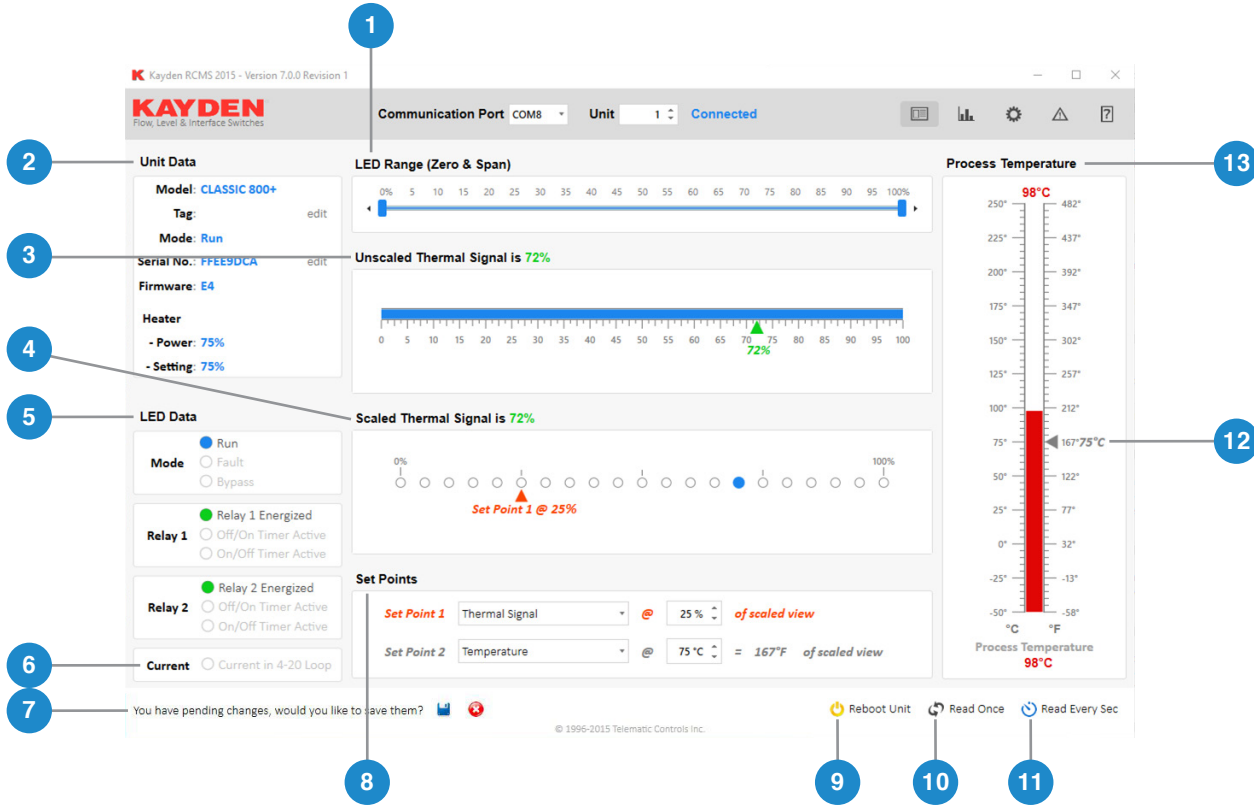
1. **LED Bar Graph Range** *(LRV & URV)*

   Adjust LRV and URV by dragging pointers.

2. **Unit Data**

   Lists Model, Tag (if configured), Serial Number, Firmware Version, Operating Mode, configured Heater Power and current Heater Power (if Smart Heater is operating, current power will be 20%).

3. **Unscaled Thermal Signal**

4. **Scaled Thermal Signal**

5. **LED Data**

   Replicates Front Panel LEDs. Shows operating mode, relay status, and analog 4-20 mA loop status.

6. **4-20 mA Current Loop Active** *(inactive if no loop current)*

7. **Save/Cancel**

   Click **"Save"** (Disk Icon) to save the configuration changes to the CLASSIC, or **"Cancel"** (X Icon) to revert to the current CLASSIC configuration.

8. **Relay Set Points**

   Displays whether responding to Thermal Signal or Temperature. The relays can be configured when the CLASSIC is not being read continuously.

9. **Click to Reboot CLASSIC** *(equivalent to cycling power, does not alter configuration)*

10. **Click to Refresh Control Panel** *(reads once)*

11. **Click to Continuously Update Control Panel** *(button changes to Stop Reading when clicked)*

12. **Temperature Set Point**

    Appears if a relay has been configured to respond to temperature. The temperature set point can be adjusted by dragging the arrow when the CLASSIC is not being read continuously.

13. **Process Temperature** *(reference RTD temperature)*

VI. Graphs View

The Graphs View will initially not show any data; to start graphing the Read Every Second button must be clicked.
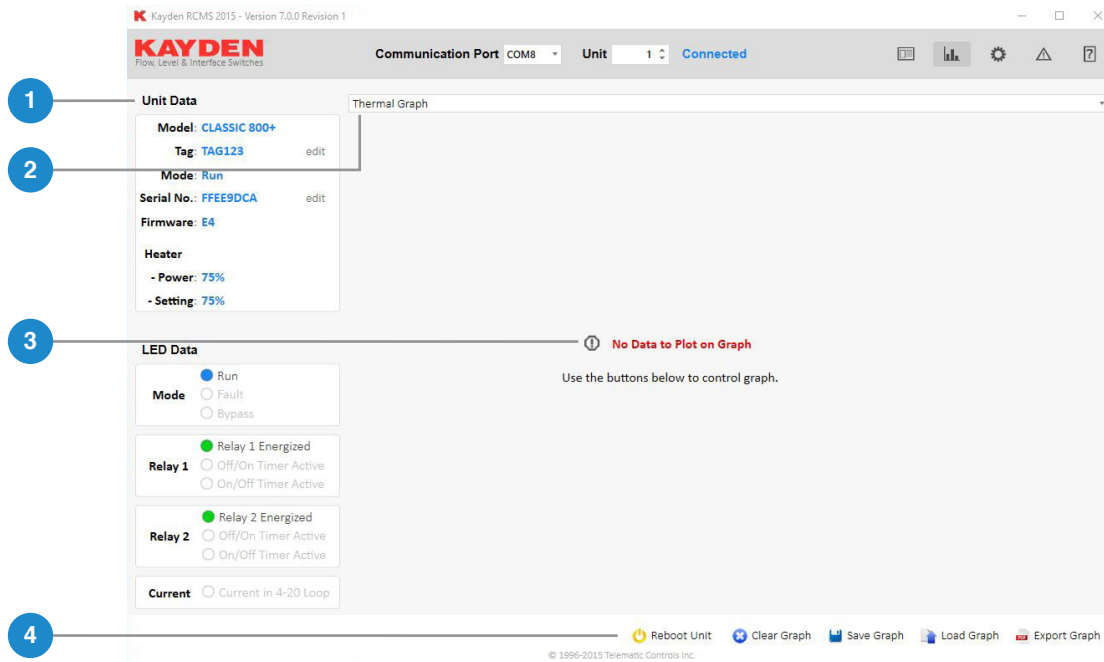
1. **Unit Data & LED Data**
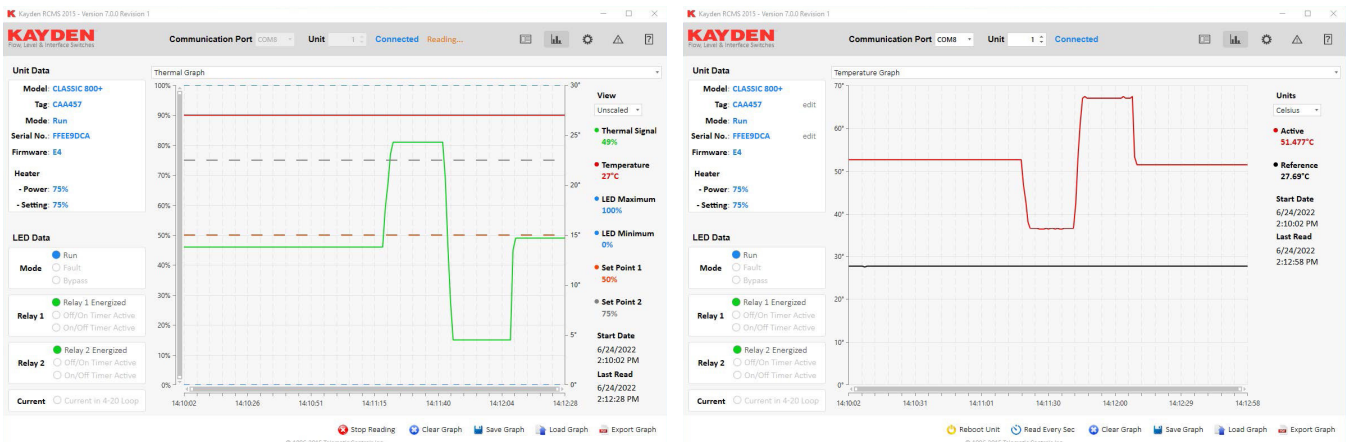
   Same as in the Control Panel View.

2. **Graph Selector**

   Selector to graph Thermal Signal or Temperature (plotting both the reference RTD and the active or heated RTD).

3. **Graph Region**

4. **Control Buttons**

   Control buttons to Reboot, Read Every Second, Clear Graph, Save Graph, (to a KGR file for viewing later in RCMS), Load Graph (an existing KGR format file), and Export Graph (to a PDF document). The Read Every Second button changes to a Stop Reading button after starting reading.

VII. Unit Configuration View

The Unit Configuration View is used to configure the CLASSIC operation. In addition to configurations available using the front panel.
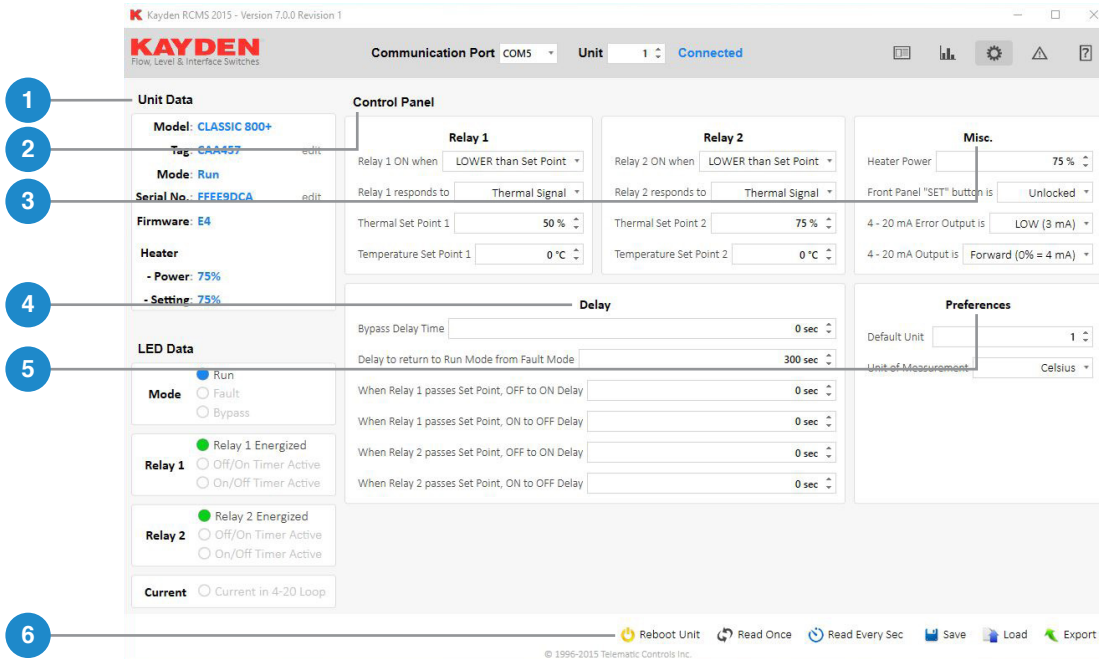
1. **Unit Data & LED Data**

   Same as in the Control Panel View.

2. **Control Panel**

   Relay 1 and 2 Actuation Level, Mode (Thermal Signal or Temperature Control), and Set Point configuration.

3. **Misc. Controls**

   Default Heater Power, Lock Front Panel, Analog 4-20 mA Output Direction, and Analog 4-20 mA Error Condition.

4. **Delay Timers**

5. **Preferences**

   Default unit and Unit of Measurement to show. These settings apply ONLY to RCMS and are NOT CLASSIC configurations.

6. **Control Buttons**

   Control buttons to Reboot Unit, Read Once, Read Every Second, Save (configuration to a KST file), Load (configuration from a KST file) and Export (save configuration to a text file).

RCMS can be used to save a custom CLASSIC configuration, as a record of the CLASSIC configuration, to revert changes in the future should it be necessary, or to configure multiple CLASSIC devices identically.

VIII. Save CLASSIC Configuration

1. Launch RCMS, connect to the CLASSIC, and access the Unit Configuration view in RCMS (click the gear icon in the upper right, or use shortcut Ctrl-J).

2. If the CLASSIC has not been configured yet, first edit the configuration and save the changes to the CLASSIC. For example, we will change the default Relay 1 Thermal Setpoint from 25% to 50%.

3. Save the CLASSIC configuration to a file by clicking the Save icon in RCMS. The default filename will be SerialNumber_TAG_Date_Time.kst, but this can be edited if desired (do not change the kst extension).

Change Thermal Set Point 1 to 50%

The Save icon will appear after Thermal Set Point 1 has been modified. Press the Save Icon to save the modified configuration to the CLASSIC.

RCMS can also generate a human readable text file listing the configuration parameters as well as the Serial Number and Tag (the Serial Number and Tag are identification, and are not included in the configuration).

Press to save configuration in a format that can be loaded and saved to a CLASSIC
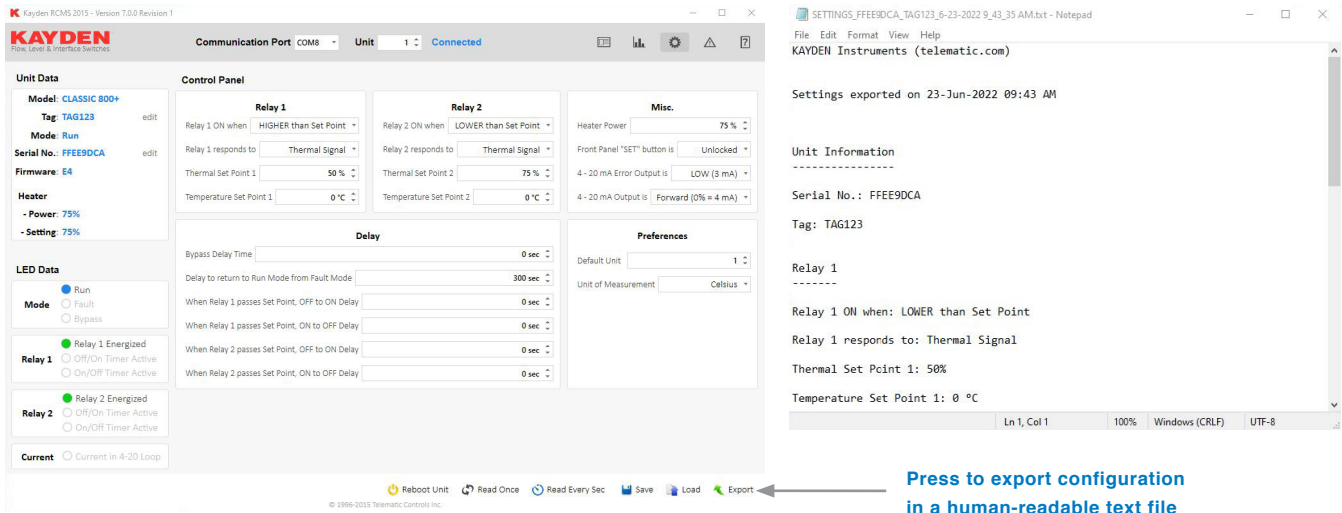
Press to export configuration
in a human-readable text file

IX. Load CLASSIC Configuration

1. If the CLASSIC is a new device and you configure the Tag on your CLASSIC devices, set the Tag first, before loading a configuration.
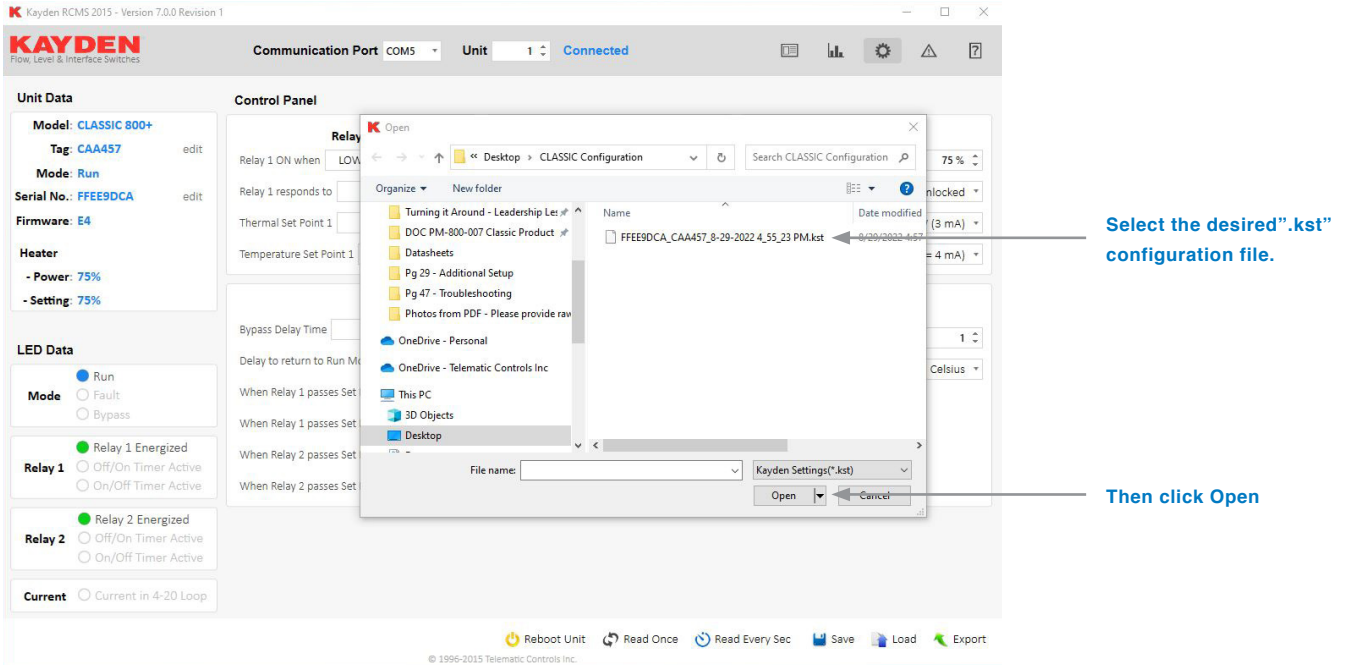

Click "edit" to edit the Tag

Enter the desired Tag text and click the Disk Icon to save to the CLASSIC
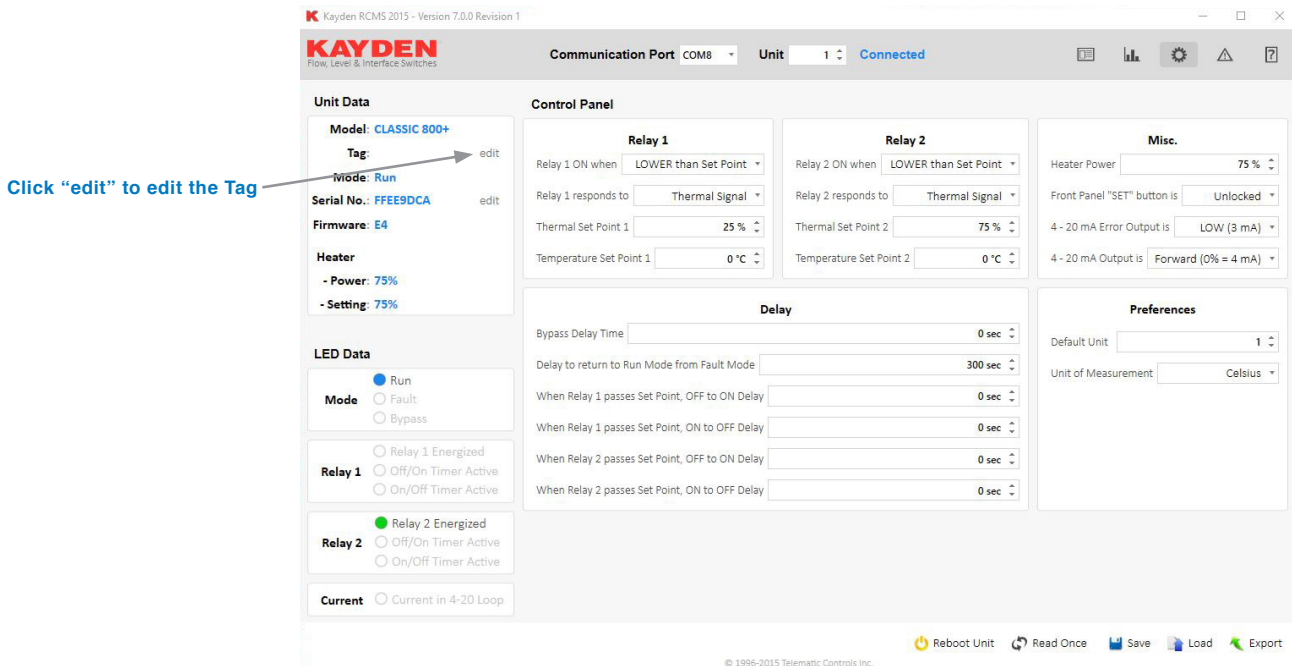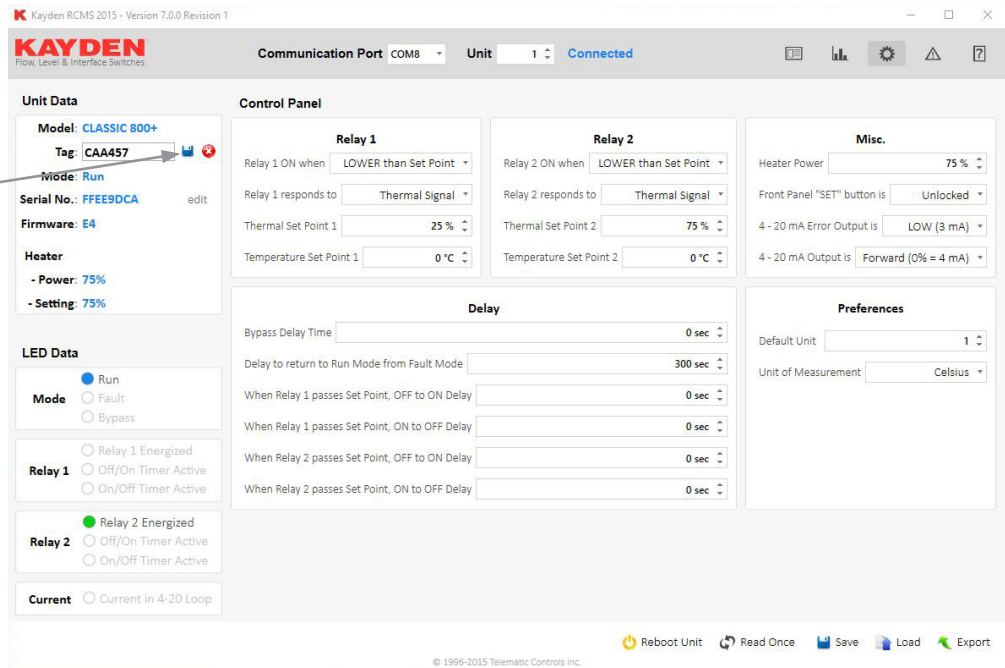
2.   Load the configuration into RCMS.
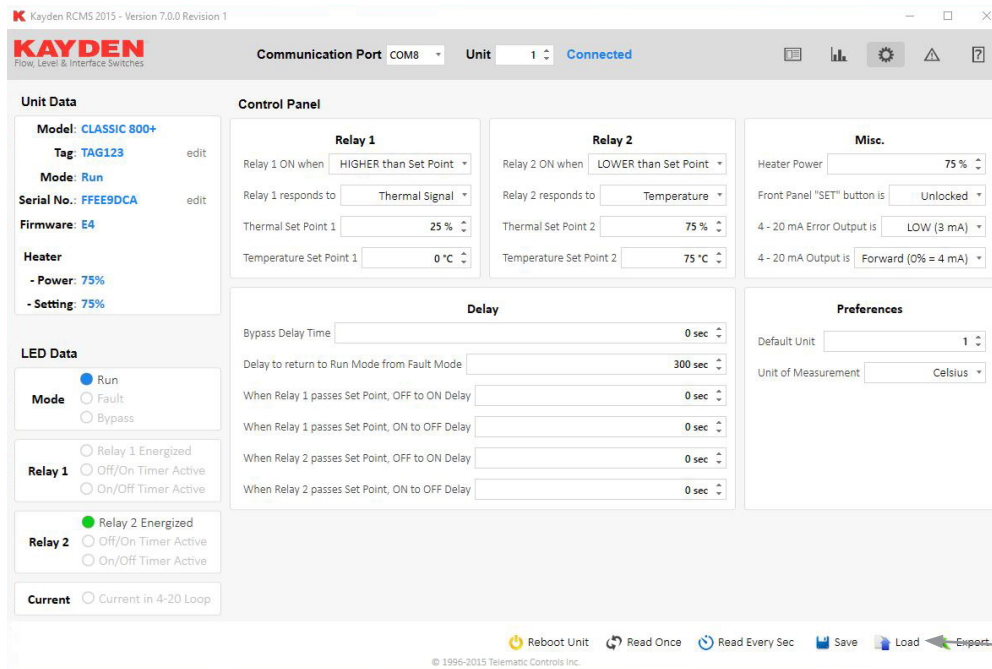
Click the Load Icon to select a configuration file to load

Select the desired".kst" configuration file.

Then click Open

3. Save the configuration to the CLASSIC. If the loaded configuration is different from the CLASSIC's current configuration, the change warning and disk icon will appear. Click the disk icon to save the configuration to the CLASSIC.

After saving, the CLASSIC restarts with the new configuration.

The warning and disc icon will appear if the loaded configuration is different from the current CLASSIC configuration
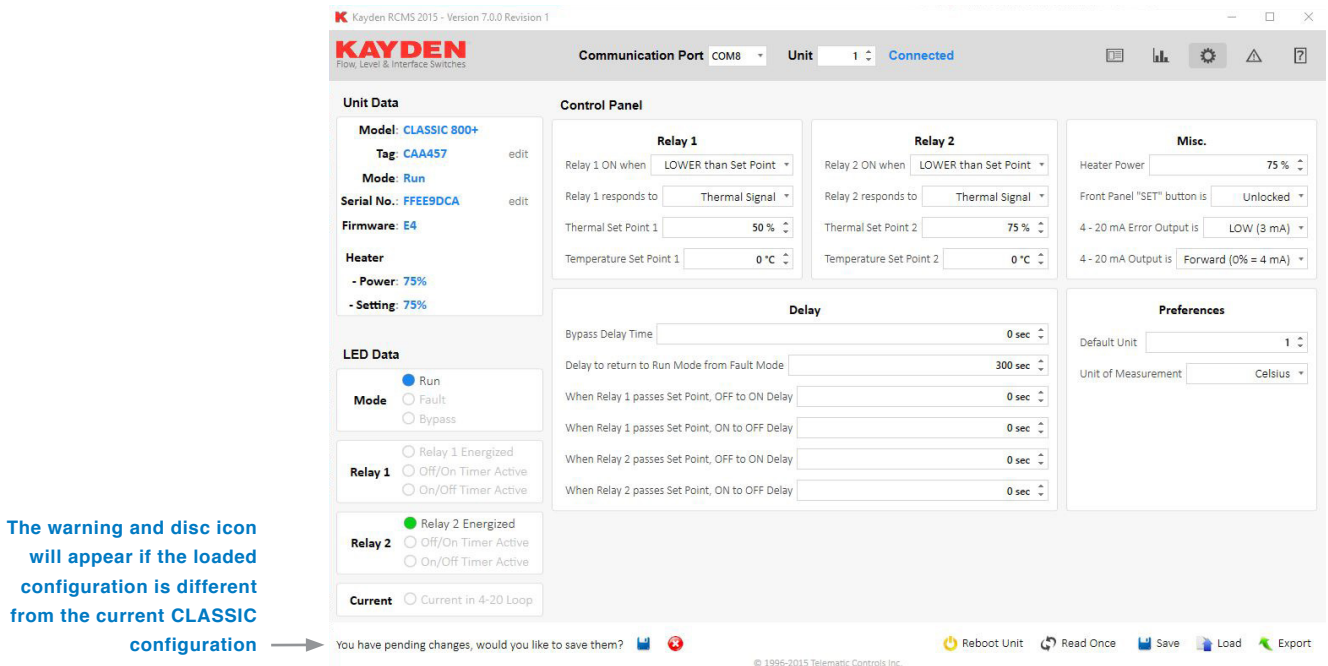
X. Fault Log View

The Fault Log View shows the stored Fault Log events, and value of the Error Counters.
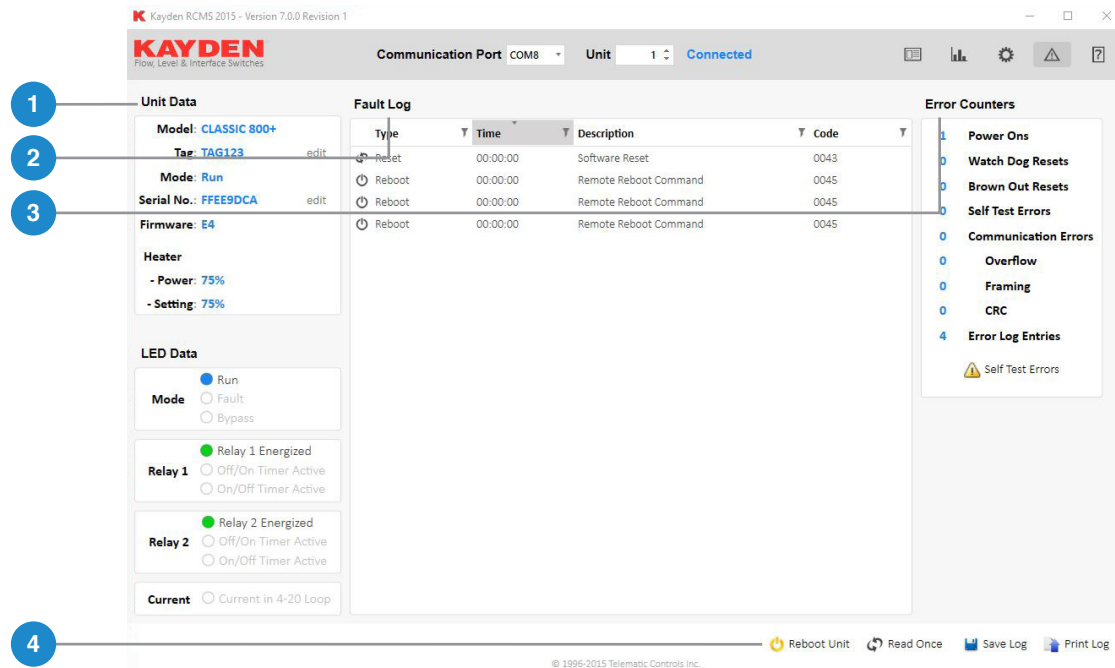
1.   Unit Data & LED Data

Same as in the Dashboard View.

2.   Fault Log

Fault Log Event List (not necessarily faults).

3.   Error Counters

a. **Power Ons**: Successful startup after applying or cycling power

b. **Watch Dog Resets**: Internal software failure and automatic restart

c. **Brown Out Resets**: Power source fell below the minimum acceptable voltage but recovered before complete failure (complete failure is a Power On)

d. **Self Test Errors**: Open or short-circuit in the sensor circuitry or wiring, or internal heater power supply failure

e. **Communication Errors**: Modbus communication failure due to incorrect message construction, incorrect baud rate, more than one device with the same ID on the Modbus, a faulty device on the Modbus, or electrical noise on the RS-485 interface

f. **Error Log Entries**: Total number of listed error log events to a maximum of 16. Older devices may show the total number of error events, although the maximum listed is 32.

4.   Control Buttons

Control buttons to Reboot Unit, Read Once, Save Log (to an Excel XLS file), and Print Log (to a system printer, which can include Microsoft Print to PDF).

XI. Help

The RCMS Help provides a list of RCMS features and a digital copy of the Kayden CLASSIC Product Manual.

Notes

Notes

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This document and other information from Kayden and its authorized distributors, provides product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current catalog located online at kayden.com.

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