Product Manual

CMP™ Series

Thermal Flow & Level Switches

KAYDEN INSTRUMENTS 16th ANNIVERSARY 1994 2010

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 Kayden representative.

⚠ CAUTION

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

Table of Contents

CMP™ 100 Specifications

Applications:

- Flow & Level (Liquids): Models 112 & 122
- Flow (Inert Gases): Models 115 & 125

Process Connections:

- 3/4" MNPT
- Sanitary 1" to 3.5" Tri-Clamp®

Insertion 'U' Lengths:

- **Imperial:**
  1.2", 2" & 4" (for 112 & 115 Models)
  2" & 4" (for 122 & 125 Models)
- **Metric:**
  3 cm, 5 cm & 10 cm (for 112 & 115 Models)
  5 cm & 10 cm (for 122 & 125 Models)

Wetted Material:

- 304/316L Stainless Steel

Temperature Range – Continuous Service:

- **Sensor:**
  -40°F to +167°F (-40°C to +65°C)
- **Electronics:**
  -40°F to +167°F (-40°C to +65°C)

Operating Pressure - Sensor:

Threaded Style:

- Maximum Working Pressure:
  24 MPa (3500 psig) at 70°F (21°C)
  Derated with temperature

Sanitary Tri-Clamp® Style:

- Maximum Working Pressure:
  1723 kPa (250 psig) at 70°F (21°C)

Switch Point Range-Flow:

- **Water-based Liquids:**
  0.01 to 3.0 feet/sec.
  (0.003 to 0.91 meter/sec.)
- **Inert Gases:**
  0.25 to 125 feet/sec.
  (0.076 to 38.1 meter/sec.)
  Standard conditions: 70°F (21°C) at 14.7 psi (1 atm)

Accuracy:

- **Flow Service:**
  ±5% set point velocity
  over operating range of ±50°F (±28°C)
- **Level Service:**
  ±0.50 inches (±1.3 cm)

Response Time:

- Approximately 0.5 to 30 seconds.

Input Power:

- 12-36 VDC
- Consumption: Maximum: 2.4 watts

Heater Power:

- Fixed

Outputs:

- Single SPDT sealed relay rated @ 0.5 amp
  resistive 36 volts AC/DC

Cable:

- Thermoplastic Polyurethane Jacket (Estane® 58887)

Cable Lengths:

- **Imperial:**
  10', 20', 30', 40' & 50'
- **Metric:**
  3.0 m, 6.0 m, 9.1 m, 12.1 m & 15.2 m

Note: Custom cable lengths available upon request.

Warranty:

- Three (3) Years from shipment date from factory
  (see Terms & Conditions on kayden.com for details)

Introduction

This Installation Manual will help you setup and install your new switch.

Kayden designed the Thermal Dispersion Product Group in order to simplify the use of flow, level, interface and temperature switches. The Kayden CMP switch is a general-purpose flow or point level switch. The CMP design allows for simple installation and setup. It is very rugged and not prone to damage under normal use.

The output configuration of the CMP is customer selected during installation. The power leads configure the relay output to be either energized (NC) above or below set point when the switch is dry.

- **The output is capable of 0.5 amp @ 36 volts maximum.**
- **The CMP is designed to work at temperatures up to 167°F (65°C) and pressures up to 3500 psig (24 MPa).**
- **The CMP will operate on any DC voltage from 12 to 36 VDC.**

I. THEORY OF OPERATION

The CMP's sensing element contains two platinum Resistance Temperature Detectors (RTDs) encased in welded steel thermowells. Thermal energy, in the form of heat, is added to one RTD while the other RTD senses the process temperature. The temperature differential between the two RTDs is related to the unique properties of the process.

The value being measured is the 'Thermal Signal'* or the rate of thermal dispersion. The formula that determines the 'Thermal Signal'* has only two variables:

1) The thermal conductivity of the process material and,

2) The rate of process material past the sensor probe.

When one of these variables is constant (e.g. velocity equals zero) in a given application, the value of the other variable (e.g. process material) can be monitored by the CMP.

* Thermal Signal: The amount of thermal energy dissipated by the process for a given range.

II. APPLICATIONS

Application Characteristics

– Most Favorable (Optimal) - Process Conditions that support the thermal dispersion operating principle: Consistent flow rates, consistent process materials (homogeneous process).

– Least Favorable (Poorest) - Process Conditions that may undermine the thermal dispersion operating principle: Swirling, intermittent flows, inconsistent flow rates, inconsistent process composition and large temperature swings.

Flow/No-Flow Detection

– The temperature difference between the two RTD's is greatest in a no-flow condition and decreases as flow increases which cools the heated RTD. Changes in flow velocity directly affect the rate of heat dissipation (thermal dispersion) and, in turn, the magnitude of the temperature difference between the RTDs. The set point is indicated by a change of state of the relay contact.

Liquid Level Interface

– In liquid level/interface applications, the temperature difference between the two RTD's is greatest when dry and decreases when the level element is submerged, cooling the heated RTD. As all processes exhibit different heat transfer characteristics, highly sensitive Kayden Liquid Level/Interface Controllers may be specifically calibrated to detect interfaces between fluids including liquids, inert gases, slurries and foam.

When the CMP is used as a level-sensing switch, the process velocity is assumed to be zero. In actual applications the velocity of the process will seldom equal absolute zero, therefore it is important to understand that process media movement will have an effect on the sensor and should be considered when setting up the switch.

Typical Applications

- Pump Protection – Dry Alarm
- Leak Detection
- Flow Monitoring & Verification
- Tank Overflow Protection
- Monitoring Purge Air Flow
- Drain Line Flow
- High Pressure Flows
- Vent Monitoring
- Emergency Eye Wash Stations
- Tanker Loading & Unloading
- Relief Valve & Rupture Disk Flow Monitoring
- Liquids, Air & Gases
- Slurries
- Corrosive Liquids
- General-Purpose Areas
- Level Detection in Settling Vessels
- Chemical Injection/Additive Flow Monitoring

Installation Guidelines

I. MOUNTING

Mounting - Level

Install the CMP through a ¾" MNPT fitting on the side of the tank at the required level monitoring point. The hex flats are marked with double-sided arrows. These should be aligned parallel to the liquid movement. In this orientation both the active and reference RTD's will contact the liquid or become dry at the same time. These sensors are very sensitive to fluid movement and they may interpret any cooling of the element as flow, possibly giving false responses.

Mounting - Flow

Install the CMP through a ¾" MNPT fitting on the pipe. The hex flats are marked with double-sided arrows. Final alignment should be with these arrows parallel to flow. This mounting point should be chosen such that any situations which will cause disturbances in the pipe (elbows, valves, etc.) will not adversely affect the flow pattern at the switch location. This will allow the switch to perform accurately and repeatably.

Note: The CMP is constructed of 316L or 316L/304 Stainless Steel and is designed to be completely immersed in any fluid that is not reactive or corrosive to Stainless Steel. However, the Display Panel (see Figure 1 below) is not completely sealed against liquid immersion or other moisture. If the CMP is installed in an area where this is likely it is recommended that a NEMA 4X enclosure is used. See figure 2 below:

Figure 1 - CMP Display Panel

Figure 2 - Optional CMP Enclosure

Application Considerations - Flow

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

Air & Gas:
- Consistent process composition & temperature
- Sufficient straight run flow profile (minimizes turbulence)
- Clean and dry

Slurries:
- Consistent process composition & temperature
- Sufficient straight run flow profile (minimizes turbulence)

Emulsion:
- Consistent process composition & temperature
- Sufficient straight run flow profile (minimizes turbulence)

Undesirable Process Conditions

Liquids:
- Inconsistent process composition or temperature
- Insufficient straight run
- Turbulence
- Aerated fluids

Air & Gas:
- Inconsistent process composition or temperature
- Wet or saturated air/gas

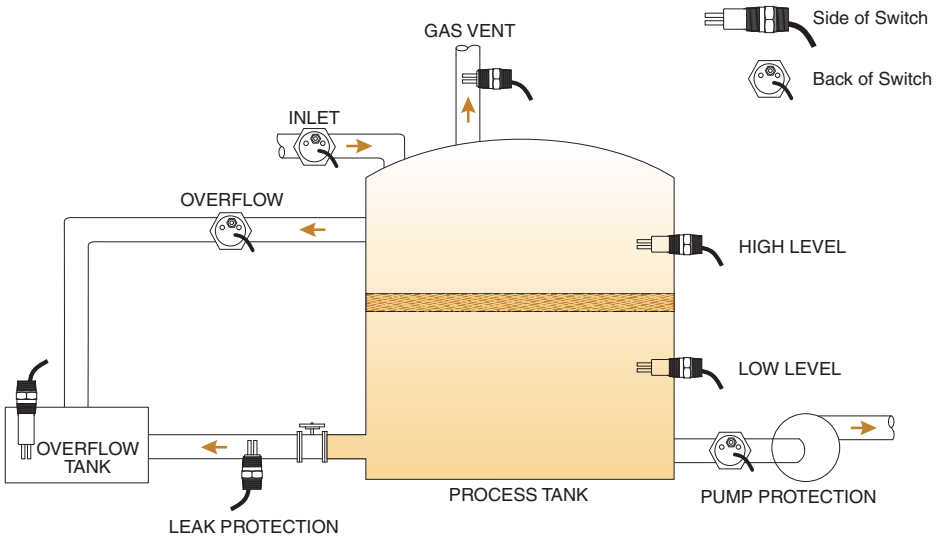
Slurries:
- Inconsistent process composition or temperature
- Insufficient straight run
- Turbulence
- Aerated fluids

Emulsion:
- Inconsistent process composition & temperature
- Insufficient straight run
- Turbulence
- Aerated fluids

Solids:
- Dry granulated processes are NOT good candidates for thermal switches

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 - Level

Level

Ideal Process Conditions

Liquids:
- Consistent process composition
- Non-turbulent

Slurries:
- Consistent process composition

Emulsion:
- Consistent process composition

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

Interface

Ideal Process Conditions

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

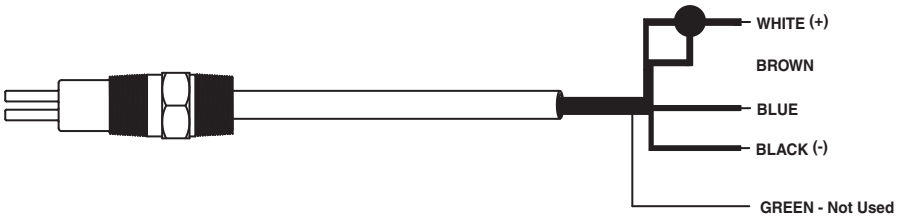
III. WIRING

Determine the cable length required to connect the CMP to your equipment. Allow enough slack to allow easy installation and removal. Strip the outside jacket by using a very sharp knife and cutting the jacket. This polyurethane jacket is very rugged and can be difficult to strip. Connect the power leads to a DC power source between 12 and 36 VDC. Before you hook these leads up, determine if you want the relay energized or de-energized. Connect the power leads according to your requirements, as shown below:

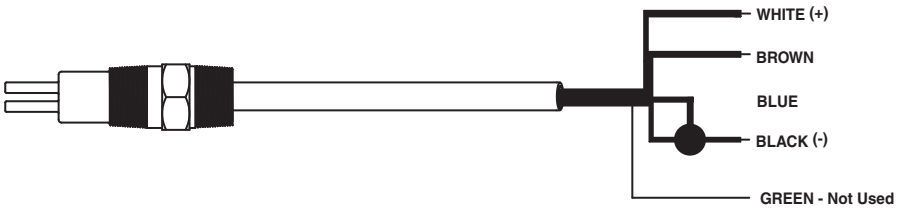
- **White (1) positive (+) and Black (2) negative (-): Relay energized above set point**
- **Black (2) positive (+) and White (1) negative (–): Relay energized below set point**

Connect the relay output leads to your control circuitry.

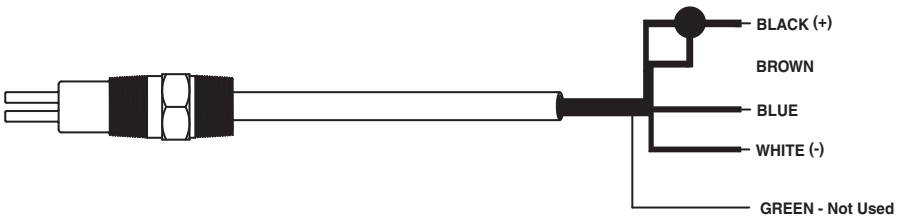
3 WIRE APPLICATION



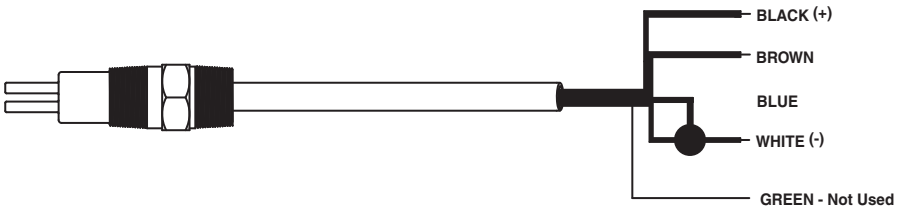
Relay energized above set point.
Relay pulls to positive supply.



Relay energized above set point.
Relay pulls to negitive supply.



Relay energized below set point.
Relay pulls to positive supply.

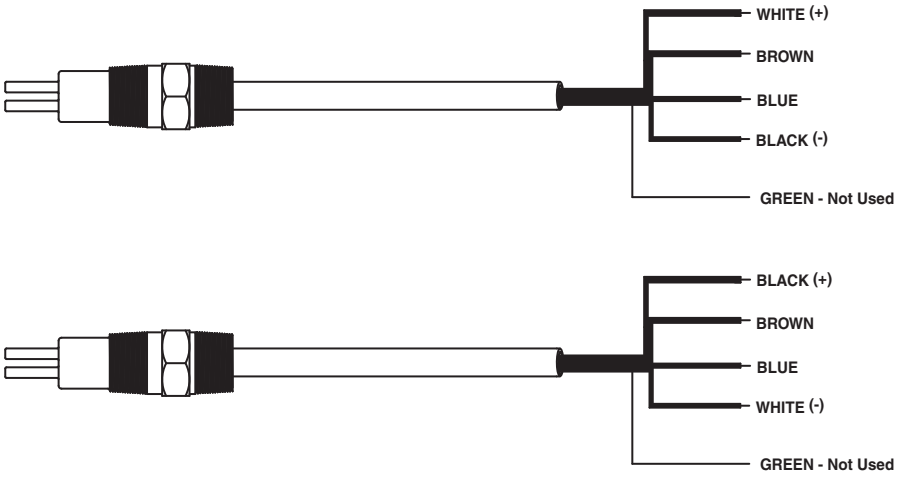


Relay energized below set point.
Relay pulls to negative supply.

Notes: **1.** The first generation CMP used different colors of wiring. Contact Kayden for more information.

2. Green wire is not used.

4 WIRE APPLICATION



Low Level / No Flow Alarm

Relay energized above set point.
Relay contacts isolated.

High Level Alarm

Relay energized below set point.
Relay contacts isolated.

Notes: **1.** The first generation CMP used different colors of wiring. Contact Kayden for more information.

2. Green wire is not used.

I. SETUP AS A "LEVEL" SWITCH: 4 WIRE CONFIGURATION

High Level Alarm

Failsafe Condition

- Probe Dry
- Relay (RLY) light on – coil energized
- Contacts Closed – closed loop
- Black wire connected to + positive of power supply
- White wire connected to – negative of power supply

1. Apply power and let unit warm up for 5 minutes.
2. Place switch into the process fluid and allow for it to stabilize for a minimum of 2 minutes (or a fluid with same or similar thermal properties).
3. Turn trim-pot fully counter-clockwise (15 turn trim-pot – should feel or hear clicking when you reach end of travel).
4. Relay (RLY) light should be off – Turn trim-pot clockwise till light comes on.
5. Additional turns clockwise will add time (or dead-band) from wet to dry condition.
6. Remove from fluid and count how many seconds until relay (RLY) light comes on. Put in and count. Ideally you want the amount of time to trip and re-set (wet to dry) to be equal.

Low Level Alarm

Failsafe Operating Condition

- Probe Wet
- Relay (RLY) light on - coil energized
- Contacts Closed – closed loop
- White wire connected to + positive of power supply
- Black wire connected to - negative of power supply

1. Apply power and let unit warm up for 5 minutes.
2. Place switch into the process fluid and allow for it to stabilize for a minimum of 2 minutes (or a fluid with same or similar thermal properties).
3. Turn trim-pot fully counter-clockwise (15 turn trim-pot – should feel or hear clicking when you reach end of travel).
4. Relay light should be off – Turn trim-pot clockwise till light comes on.
5. Additional turns clockwise will add time (or dead-band) from wet to dry condition.
6. Remove from fluid and count how many seconds until relay (RLY) light comes on. Put in and count. Ideally you want the amount of time to trip and re-set (wet to dry) to be equal.

II. SETUP AS A "FLOW" SWITCH: 4 WIRE CONFIGURATION

No Flow Alarm

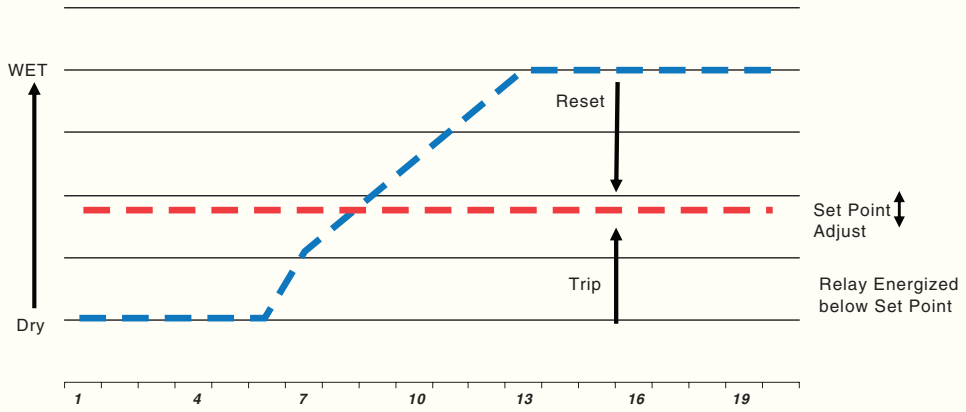
Failsafe Operating Condition

- Product in normal "Flow" condition
- Relay (RLY) light on - coil energized
- Contacts Closed – closed loop
- White wire connected to + positive of power supply
- Black wire connected to - negative of power supply

1. Apply power and let unit warm up for 5 minutes.
2. Place switch into the process fluid and allow for it to stabilize for a minimum of 2 minutes (or a fluid with same or similar thermal properties).
3. In no-flow condition - turn trim-pot fully counter-clockwise (15 turn trim-pot – should feel or hear clicking when you reach end of travel).
4. Relay light should be off – turn trim-pot clockwise until light comes on.
5. Any additional turns counter clockwise will add time (or dead-band) from no flow to flow (This time will vary with thermal conductivity of product)
6. Start flow and count how many seconds until relay (RLY) light comes on. Stop flow and count.
7. Ideally you want the amount of time to trip (flow to no flow) and re-set (no flow to flow) to be equal.

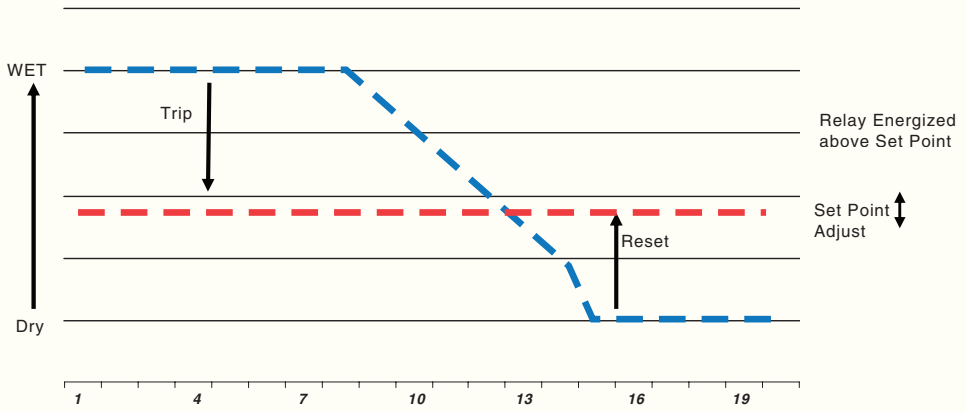
If the switch appears to be working the opposite of what you expect, reverse the power leads. The relay leads will now function in the opposite manner.

High Level Alarm Application



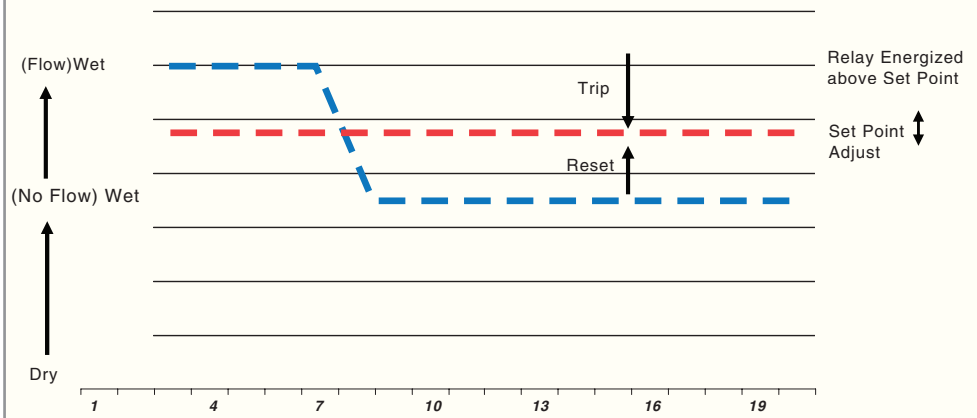
Time in seconds approximate
Varies with process medium

Low Level Alarm Application



Time in seconds approximate
Varies with process medium

Flow to No Flow Application



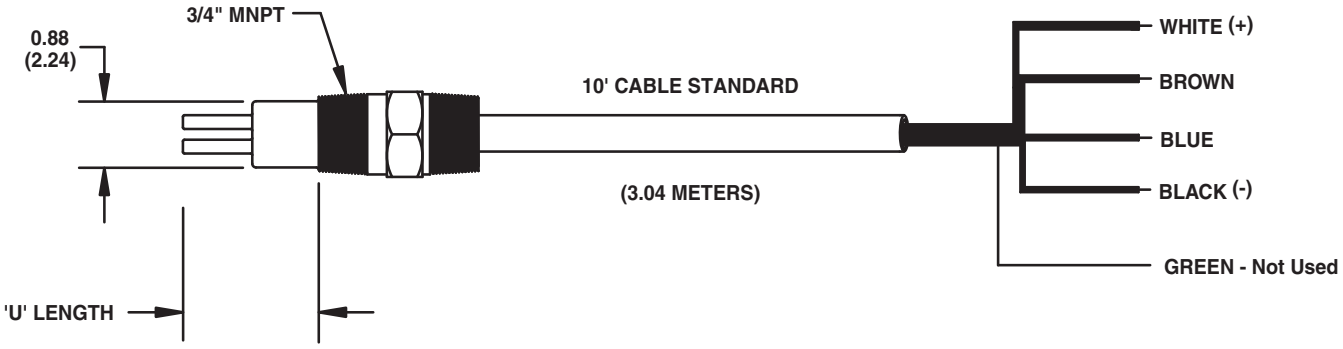
Time in seconds approximate
Varies with process medium

Glossary

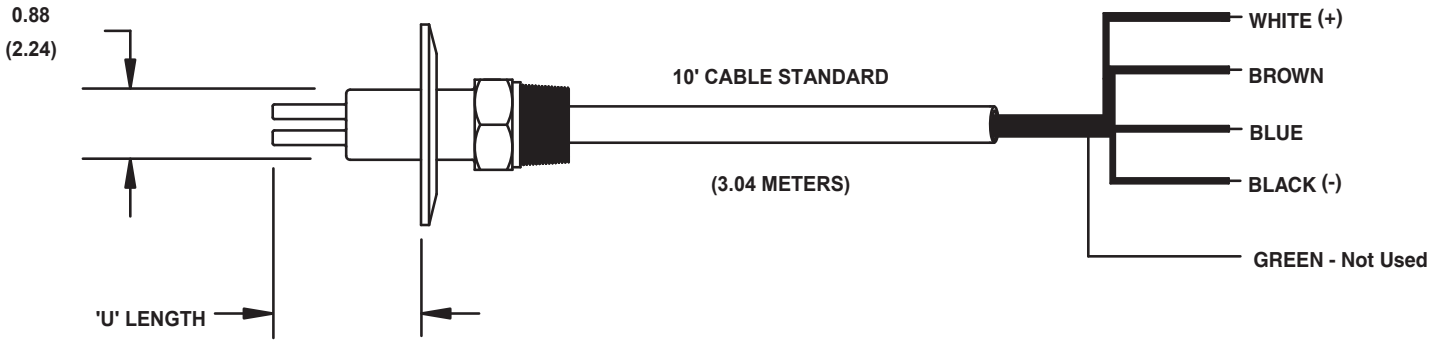
Active RTD	The active RTD detects and outputs a signal to the Electronics Module which is proportionate to the process media temperature plus heat added by the heater.
Bypass	Indicates the unit is in “Start-up Bypass Mode”, which forces both relays to be energized for the duration of the Start-up Bypass Timer.
Fault	Indicates a self-test error (call Technical Support for further information).
Heater	The part of the sensing element that heats the active RTD.
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).
Mounting Base Plate	Connection for CLASSIC 800 series Electronics Module and Terminal Wiring Assembly
Reference RTD	The Reference RTD detects and outputs a signal to the Electronics Module which is proportionate to the process media temperature.
Relay 1	Indicates Relay 1’s coil is energized.
Relay 2	Indicates Relay 2’s coil is energized.
Remote Enclosure	Enclosure for the Electronics Module. Used when the Electronics Module must be located away from the sensing element (extreme heat, vibration, convenience etc.).
RCM, RCMS	Kayden Remote Control & Monitoring Software provides a graphical computer interface for the CLASSIC and BASIC series.
RTD	Resistance Temperature Detector; a sensor whose resistance varies with temperature changes.
Run Mode	Indicates normal operation when flashing.
Set Point 1	Indicates when the Thermal Signal Bar Graph is displaying the value of Set Point 1.
Set Point 2	Indicates when the Thermal Signal Bar Graph is displaying the value of Set Point 2.
Thermal Offset	Thermal convection
Thermal Signal	The amount of thermal energy dissipated from the Active RTD by the process.

Outline Dimensional Drawings

CMP 112, 115, 122, & 125



CMP 112 & 115 Threaded



CMP 122 & 125 Sanitary Flanged

Model Number Legends

CMP Electronics

Microprocessor Based Electronics

The electronics are epoxy encapsulated within the sensor housing offering a **simple operating status display** and trim-pot.

CMP Display Panel

LED Indicator:

Green LED	Indicates the relay is energized
Blue LED	Indicates power on

Standard Features:

- Solid state electronics
- Relay can be set to energize above or below set point
- Set point adjustable with the trim-pot
- Available in Threaded and Sanitary Flanged configurations

Threaded Assembly

Sanitary Assembly

112	CODE	Sensor Operating Temperature Range
·	T	'T' Type Sensor

CODE	Material of Construction - Sensor
A	316L Stainless Steel

CODE	Process Connection - MNPT
D	3/4"

CODE	Insertion 'U' Lengths	
0012	1.2"	(3.0 cm)
0020	2"	(5.0 cm)
0040	4"	(10.1 cm)

CODE	Input Power
E	12-36 VDC

Electronics
Epoxy Encapsulated within Sensor Housing.
Single SPST sealed relay contact.

CODE	Agency Approvals
6	None - Non-hazardous only

CODE	Language
E	English

CODE	Cable Length	
0100	10'	(3.0 m)
0300	30'	(9.1 m)
0500	50'	(15.2 m)

112	T	A	D	0020	E		6	E	0100

Flow & Level Switch (Liquids)

Model Number Legend
Doc. #: ML-112-003-000

115	CODE	Sensor Operating Temperature Range
·	T	'T' Type Sensor

CODE	Material of Construction - Sensor
A	316L Stainless Steel

CODE	Process Connection - MNPT
D	3/4"

CODE	Insertion 'U' Lengths	
0012	1.2"	(3.0 cm)
0020	2"	(5.0 cm)
0040	4"	(10.1 cm)

CODE	Input Power
E	12-36 VDC

Electronics
Epoxy Encapsulated within Sensor Housing.
Single SPST sealed relay contact.

CODE	Agency Approvals
6	None - Non-hazardous only

CODE	Language
E	English

CODE	Cable Length	
0100	10'	(3.0 m)
0300	30'	(9.1 m)
0500	50'	(15.2 m)

115	T	A	D	0020	E		6	E	0100

Flow Switch (Inert Gases)

Model Number Legend
Doc. #: ML-115-003-000

122	CODE	Sensor Operating Temperature Range
·	T	'T' Type Sensor

CODE	Material of Construction - Sensor
A6	304/316L Stainless Steel - Sanitary - (3A Compliant)

CODE	Process Connection - Tri-Clamp®
E	1"
G	1.5"
H	2"
J	2.5"
K	3"
L	3.5"

CODE	Insertion 'U' Lengths
0020	2" (5.0 cm)
0040	4" (10.1 cm)

CODE	Input Power
E	12-36 VDC

Electronics
Epoxy Encapsulated within Sensor Housing.
Single SPST sealed relay contact.

CODE	Agency Approvals
6	None - Non-hazardous only

CODE	Language
E	English

CODE	Cable Length
0100	10' (3.0 m)
0300	30' (9.1 m)
0500	50' (15.2 m)

122	T	A6	G	0020	E		6	E	0100

Flow & Level Switch (Liquids)

Model Number Legend
Doc. #: ML-122-003-000

125	CODE	Sensor Operating Temperature Range
·	T	'T' Type Sensor

CODE	Material of Construction - Sensor
A6	304/316L Stainless Steel - Sanitary - (3A Compliant)

CODE	Process Connection - Tri-Clamp®
E	1"
G	1.5"
H	2"
J	2.5"
K	3"
L	3.5"

CODE	Insertion 'U' Lengths
0020	2" (5.0 cm)
0040	4" (10.1 cm)

CODE	Input Power
E	12-36 VDC

Electronics
Epoxy Encapsulated within Sensor Housing.
Single SPST sealed relay contact.

CODE	Agency Approvals
6	None - Non-hazardous only

CODE	Language
E	English

CODE	Cable Length
0100	10' (3.0 m)
0300	30' (9.1 m)
0500	50' (15.2 m)

125	T	A6	G	0020	E		6	E	0100

Flow Switch (Inert Gases)

Model Number Legend
Doc. #: ML-125-003-000

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 print **Product Manuals**
- View and print **Outline Dimensional Drawings, Wiring Diagrams & Parts Lists**
- View and print **Quick Setup Guides**
- View and print **Product Specifications and Brochures**
- View our **Support Section for Troubleshooting Assistance**
- View our Corporate Policies (satisfaction guarantee, returns, repairs, etc.)
- View a brief list of **Kayden Customers**
- Download **Kayden RCM Software**
- View and print **Approval Certificates**

Notes

Contact Us

Telephone	Fax	
1 (403) 253-1423	1 (403) 253-1460	North America
001 (403) 253-1423	001 (403) 253-1460	International

E-Mail sales@kayden.com

Web kayden.com

Hours Monday – Friday 8:00 a.m. – 5:00 p.m. MST

Mailing Address 3368 – 114th Avenue S.E., Calgary, Alberta, Canada T2Z 3V6

Contact a Local Distributor

Distributors

Visit kayden.com to find a local Distributor near you. Kayden Distributors provide local inventory, technical support and service.

Kayden 60-Day 100% Satisfaction Guarantee

Standard Products

Standard Products are eligible for the 60-Day 100% Satisfaction Guarantee. If you purchased new Standard Products from Kayden or an Authorized Kayden Distributor, you may return them to the place of purchase up to 60 days from the date of invoice for a refund or credit of the product purchase price provided the quantity of Products does not exceed twenty-five units (nominal restocking fee apply to only those quantities exceeding twenty-five units).

Custom Products

Custom Products are not eligible for this guarantee as they are manufactured specifically to the customers' individual and unique requirements. Ship returns prepaid. Please note the refund or credit will not include any charges for special documentation, special equipment, special service, special approvals, drawings, certificates, equipment tags, set points, flow curves, x-rays, dye penetration tests, opened software, shipping or insurance shown on your invoice. View the Return Policy in detail at kayden.com.

Kayden offers the following:

- 60 calendar days from the date of invoice.
- Up to twenty-five (25) Standard Products of any type or combination per order. Should the customer, for any reason, be unsatisfied with any or all of the Products, he/she may return any or all of them for a full refund.

Visit kayden.com to view the Kayden 60-Day 100% Satisfaction Guarantee in detail.

Warranty

Three (3) Years from shipment date from factory (see Terms & Conditions on kayden.com for details).

Ordering Information

5 Ways to Place an Order:

Your Local Distributor

Visit www.kayden.com to find a local Distributor near you.

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