HEATEFLEX®
by White Knight

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https://wkfluidhandling.com

PVDF/PFA Heaters Owner's Manual


HC


LH1


VHH

Table of Contents

Version 1.0.4 | 21 Mar 2025
Subject to change without notice

Materials Warranty

Heateflex® warranties the equipment offered to be free from defects in material and workmanship, under normal handling and proper usage, for a period of one year from the date of shipment. All products purchased from manufacturers by Heateflex® will carry that manufacturer's warranty period. This expressed warranty is in lieu of, and excludes all other representations made by advertisements or by agents. There are no implied warranties for the equipment.

Heateflex® agrees to correct any defect in workmanship or material which may develop under normal handling and proper usage during a period of one year from the date of shipment or, by its option, to repair or replace the defective equipment F.O.B. Arcadia, California, USA. Purchaser's remedies shall be limited exclusively to the right of repair or replacement.

Heateflex® shall not be liable for any expenses incurred by the purchaser or any other person by reason of the use, misuse, sale, or fabrication of the equipment regardless of whether the equipment conforms to the specifications.

Items returned for warranty repair must be prepaid and insured for shipment. Warranty claims are processed on the condition that prompt notification of a defect is given within the warranty period. Heateflex® shall have the sole right to determine whether, in fact, a warranty situation exists.

Declaration of Conformity to CE

We, Heateflex®, declare under our sole responsibility that our semiconductor fabrication equipment (models listed below), as delivered, are in conformity with the following European Directives:

Application of Council Directive:	2014/35/EU Low Voltage Directive
	2006/42/EC Machinery Directive
	2014/30/EU Electromagnetic Compatibility (EMC) Directive
Standards to which Conformity is Declared:	IEC 60335-1 ed5.0 Household and similar electrical appliances - Safety - Part 1: General requirements
	IEC 60335-2-35 ed5.0 Household and similar electrical appliances - Safety - Part 2-35: Particular requirements for instantaneous water heaters
	Directive 2014/35/EU Low Voltage Directive, Annex 1
	Directive 2006/42/EC Machinery Directive, Annex 1
	Directive 2014/30/EU Electromagnetic Compatibility (EMC) Directive, Essential Requirements
	EN61000-6-2 Electromagnetic Compatibility (EMC) - Part 6-2: Generic Standards - Immunity for Industrial Environments
Type of Equipment:	Heater
Manufacturer's Trade Name:	Heateflex® In-Line Heater
Manufacturer's Model or Type Designation:	All Series In-Line Heaters
Year CE Mark was affixed:	2019
Any modification or alteration of the above product(s) unwarranted by Heateflex® will nullify this declaration.	
CE	VP of Engineering

1. Product Information

1.1 Introduction

White Knight Heateflex® In-Line heaters provide ultra-high purity heating to meet the many heating applications, from Deionized Water (DIW) to Hydrofluoric Acid (HF) or Potassium Hydroxide (KOH), all while maintaining performance and quality. The heaters are available in PVDF or Teflon housings to provide flexibility and to ensure compatibility. White Knight Heateflex' s patented technology, provides a low-watt density design, efficient heating, rapid response, and excellent temperature control, with high power output in a compact housing.

White Knight also provides in-line heating using heat exchangers, the White Knight Vesper Series. These are available as exchangers only (no heating element) and as an all-in-one Heater and Exchanger. These are perfect for temperature trimming, heating near ambient, or processes with an exothermic reaction. The Vesper exchangers provide a high surface area in a compact housing, while also providing efficient heat transfer. The Heater/Heat Exchanger combo heater provides one housing solution, limiting the overall footprint compared to using one exchanger housing and one heater housing.

Model	Type	Wetted Surfaces	Power Output**	Max Temperature	Max Flow
DI Water / Less Aggressive Acids*					
LH1	Heater	PVDF	1-12 kW	100°C	56 LPM
LH7	Heater	PVDF	3-30 kW	100°C	121 LPM
VHB6	Heater & Exchanger	Process: PVDF	5000 W	100°C	Process: 49 LPM
		Shell: PVDF			Shell: 26 LPM
Aggressive Acids*					
HC	Heater	PFA	2-12 kW	160°C	56 LPM
CHF	Heater	PFA	6,000 W	120°C	38 LPM
VEB4	Exchanger	PFA	n/a	100°C	Process: 49 LPM
					Shell: 26 LPM
VHH1	Heater & Exchanger	Process: PFA	3 kW	100°C	Process: 49 LPM
		Shell: PVDF			Shell: 26 LPM
VCH1	Heater & Exchanger	Process: PFA	3 kW	100°C	Process: 49 LPM
		Shell: PVDF			Shell: 26 LPM

Model	Replacement Model
Legacy Models (Limited Availability)	
LHM	HC
LHN	HC
LHX	HC
VEH2	VEB4

Model	Replacement Model
Legacy Models (Discontinued)	
LHY	Contact us for recommendation. 435.783.6040 support@wkfluid.com
LHK	
LHR	
VEB1	
VEH6	
VHH6	

1.2 Model Number

AAAA - B - CC - DD - EEE - FFFF

Model | Modules | Wattage | Voltage | Liquid Level Sensor | Option(s)/Packages

1. Model	Code
LH1 Heater	LH1
LH7 Heater	LH7
HC Heater	HC
CHF Heater	CHF
VEB4 Exchanger Only	VEB4
VHB6 Heater/ Heat Exchanger	VHB6
VHH1 Heater/ Heat Exchanger	VHH1
VCH1 Heater/ Heat Exchanger	VCH1

2. Number of Modules *Blank for HC Models	
1 Module	1

3. Wattage	Code
1.0 kW	01
2.0 kW	02
3.0 kW	03
4.0 kW	04
5.0 kW	05
6.0 kW	06
9.0 kW	09
12.0 kW	12
15.0 kW	15
18.0 kW	18
20.0 kW	20
30.0 kW	30

4. Voltage	Code
120 VAC, 1-PH	B
208 VAC, 1-PH	C
220 VAC, 1-PH	D
230 VAC, 1-PH	E
240 VAC, 1-PH	F
380 VAC, 1-PH	H
415 VAC, 1-PH	I
440 VAC, 1-PH	J
480 VAC, 1-PH	L
208 VAC, 3-PH	N
220 VAC, 3-PH	O
230 VAC, 3-PH	P
240 VAC, 3-PH	Q
380 VAC, 3-PH	R
415 VAC, 3-PH	S
440 VAC, 3-PH	T
480 VAC, 3-PH	V
400 VAC, 3-PH	W
200 VAC, 1-PH	X
200 VAC, 3-PH	Y
400 VAC, 1-PH	XX
No Voltage Required	ZZ

5. Liquid Level Sensor
**Refer to Order Instructions for each model*

6. Option(s) /Packages
**Refer to Order Instructions for each model*

2. Receiving Inspection Procedure

This shipment was carefully inspected, checked, and properly packaged at our company, and delivered to the carrier in good condition. We fully expect your merchandise to arrive in your hands in good condition.

ALL PRODUCTS ARE SHIPPED F.O.B. FACTORY; THEREFORE, WHEN IT IS DELIVERED TO THE CARRIER, IT BECOMES YOUR PROPERTY. THUS, IT IS IMPORTANT THAT YOU TAKE NOTE OF ANY DAMAGE, WHETHER OBVIOUS OR HIDDEN, AND REPORT SAME TO THE TRANSPORTATION COMPANY WITHIN FIVE (5) DAYS OF RECEIPT OF THE SHIPMENT AT YOUR PREMISE TO AVOID FORFEITING CLAIMS FOR DAMAGE.

2.1 What To Do If Your Shipment Is Damaged:

Leave the items, packing material, and carton "as is". Notify your carrier's local office and ask for immediate inspection of the carton and its content.

After inspection has been made by the carrier, and you have received acknowledgment in writing as to the damage, please contact our Customer Service Department at (626) 599-8566 for return authorization. If writing for return authorization, please indicate your purchase order number.

We will repair or replace the merchandise depending on the extent of the damage.

It is your responsibility to follow the above instructions, or the carrier will not honor any claims for damage. If there are any shortages or questions regarding this shipment, please notify us within ten (10) days.

3. Safety Precautions

Every effort has been made to insure that this unit will run with a minimum of user input or maintenance. However, there are still precautions to be taken whenever operating, performing maintenance, or servicing this unit. This unit makes use of heating elements and electrical components, both of which pose inherent burn, fire, and electrical shock hazards. These hazards can result in injury to personnel, plant, and/or process. Please note the following to aid in the operation of your unit and to decrease risk of the above mentioned hazards.

3.1 Precautions

- Carefully and completely read this and all accompanying literature to verify that you understand the functionality and features of this system. Please become familiar with the integral safeties and controls within this system, and know their function.
- Always disconnect electrical power prior to installing, servicing or replacing electric heating elements and/or assemblies.
- Electrical termination enclosures should be selected to match the application's environment and be able to withstand worst-case failures, especially in hazardous locations.
- Avoid fire hazards. Electric heaters and their components can develop temperatures that produce an auto-ignition source. Avoid mounting heaters in atmospheres containing combustible gases, vapor or dust. Article 501 of the National Electrical Code (NEC) requires that the maximum sheath temperature when the heater is continually energized not exceed 80 percent of the surrounding atmosphere's auto-ignition temperature.
- Avoid exposing heaters to combustible materials. Keep heaters far away from combustible materials to prevent ignition.
- Be aware of labeling on the unit, such as a lightning-bolt warning symbol, which alerts you to a safety hazard, which could harm you or the unit.

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3.1 Precautions (Continued)

- Remove all metal from your person while servicing or operating the unit. This includes metal bracelets, rings, jewelry, metal-rimmed glasses, and wristwatches.
- Keep your clothing, hands, and feet dry at all times whenever working with electrical equipment.
- Pull the fuses, open the circuit breakers, or disconnect the circuits from their source of power to protect yourself, the test equipment and the equipment under test.
- Do not trouble shoot or service a circuit with the primary power applied.
- Ensure that no power is applied to a circuit when checking continuity or resistance.
- Use the correct tool (i.e. screwdriver, alignment tool, etc.) for the job.
- Do not use metal tools around the connectors when there is power to the unit, as they may cause arcing.
- Turn off power before connecting alligator clips to any circuit.
- Service should be performed by trained personnel only. Check every operation before they perform it.
- The operation of this unit creates large amounts of heated process fluid. This fluid is likely to be heated to temperatures above the threshold of safety for human contact. Please be advised of this and take the necessary precautions whenever connecting or disconnecting any plumbing from the system. If you are ever in doubt, turn the unit off, and wait an appropriate amount of time before performing any operations or service involving the plumbing.
- The process fluid within this system may also become pressurized from outside flow sources. It is the user's responsibility to verify that pressure within the system has been relieved externally; in order to prevent exposure to hazardous fluid such as heated de-ionized water, or heated acids.
- This unit has several safety interlocks integrated within the system. However, it is the user's responsibility to verify that incoming power has been disconnected from a remote source prior to opening or servicing the unit. This is advised to prevent user exposure to high voltage and current, and reduce the risk of electric shock.
- The function of this unit is to heat process fluid for use in ultra-pure operations. Therefore, during normal operation, the unit will become heated within the plumbing and the heater compartment. It is our recommendation that the unit is allowed a sufficient amount of time to cool before any maintenance or inspections are made to the unit in order to prevent user exposure to heated surfaces or air.
- The processes in which this unit is used involve heated fluids. Whenever heated fluids are involved, certain precautions must be taken in order to avoid user injury. This is especially important since it is highly likely that this unit will be used with aggressive fluids, such as de-ionized water and process acids, which can further harm or injure an individual. User exposure to these types of materials can result in

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burning, scalding, and in some cases deep tissue damage. To avoid injury, it is the user's responsibility to take the appropriate precautions as outlined above, and in all cases dealing with heated or aggressive materials. Use the appropriate safety equipment, such as, but not limited to, safety goggles, glasses, chemically resistant gloves, and garments.

- The heater is designed to heat acid and other potentially dangerous liquids. Extreme care should be taken to properly install the heater in a safe and appropriate manner that will protect personnel, such as double containment and/or a polypro enclosure with door interlocks that depressurizes the heater when the door is opened.
- The heater is not intended for use with flammable liquids. Use of this equipment with flammable liquids will greatly increase the fire risks of the system.

3.2 Environmental Safety Warnings

Label	Safety Warning
DANGER	High Voltage Electrical Equipment
WARNING	This Equipment Must Only Be Used Within The Range Of Environmental Conditions Listed Below. Operational Usage: INDOOR USE ONLY Max. Operating Pressure: (See Equipment Specifications Page) Max. Fluid Temperature: (See Equipment Specifications Page) Temperature Resolution: +/-1°C Max Operating Altitude: 6,600feet (2,000 meters) Ambient Temp. Range: 5°C ~ 40°C (Operating) -40°C ~ 60°C (Storage) Max. Relative Humidity: 80% up to 31°C 76.7% @ 32°C 73.3% @ 33°C 70.0% @ 34°C 66.7% @ 35°C 63.3% @ 36°C 60.0% @ 37°C 56.7% @ 38°C 53.3% @ 39°C 50.0% @ 40°C and below
WARNING	THIS EQUIPMENT MUST ONLY BE USED WITH SAFETY COMPONENTS (TEMPERATURE CONTROLLER, LEVEL CONTROLLER, HI-LIMIT CONTROLLER, ETC.) THAT IS APPROVED TO EIC/EN STANDARDS.
WARNING	ALL HEATERS SHOULD BE EQUIPPED WITH A THERMAL OVER-TEMPERATURE DEVICE AND THE IN-LINE HEATER SHOULD HAVE A LIQUID LEVEL CONTROL TO REDUCE THE POTENTIAL OF FIRE. IT IS THE CUSTOMER'S RESPONSIBILITY TO PURCHASE THERMAL AND LIQUID LEVEL CONTROL PROTECTION.

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4. Heater Operating Instructions

4.1 Heater Module Operation

For proper operation of your heater, we recommend that you read and understand the "SAFETY PRECAUTIONS" section of this manual. It will help you understand some hazards and potential risks or working with electrical components and heating systems.

1. Heater should be installed in a manner consistent with the supplied drawings.
2. Note the orientation of the heater and location of the input and output fittings.
3. This heater is designed under certain installation and mounting conditions, and attempting to operate it in a manner inconsistent with the documentation may result in serious injury to the user and damage to the facility.

Prior to filling the unit with fluid, ensure all plumbin connections and fittings are tight. Fittings can loosen during shipping. As the heater is heat cycled during start-up, recheck all fittings and tighten them to avoid any potential leaks. After the heat cycle and fitting check, the unit should perform for years without further fittings checks, but if your system produces vibrations (from pumps, etc.) you should check your fittings every three months.

Prior to being powered on, this equipment must be installed with customer supplied external over-current protective devices. (IMPORTANT: See Equipment Specifications page for Current Rating, Operating Voltage, and Type Rating.)

Please see the appropriate accompanying wiring diagram for details on how to wire your heater to the appropriate safeties and controls.

To maintain a safe operating condition, no power should be applied to the heater without a minimum flow of 1/2 GPM and 20-PSI minimum output pressure. Operating the heater outside these conditions can result in premature heater failure, heater short, or potentially hazardous heater burn out.

Failure to conform to this warning may result in severe damage. Heateflex assumes no risk for noncompliance. Heateflex does not guarantee any equipment that does not use the recommended safety equipment.

Verify Heater has the following safeties:

• Hi-Limit • Liquid Level • Thermal Cut-Off • Process Fluid Over Temperature

4.2 Vesper Exchanger Recommendations

For all exchanger units:

- Keep shell-side pressure lower than process-side pressure to prevent exchanger tubes from collapsing.
- Adjust the flow rate and input temperature of the shell-side fluid to control the temperature of the process-side.

For exchanger units with heaters:

- See recommendations for all exchangers (left).
- It is configured with the process-side flow path travel through the exchanger and then through the heater. This flow path allows the heater to adjust the temperature more accurately.
- Follow heater module operation section 4.1

Note: The process side is typically the tube side. Check exchanger drawings for details.

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4.3 Hi-Limit

Hi-limit safety consists of a thermocouple used to monitor the temperature at the heater and is connected to a hi-limit controller which signals when the heater exceeds the hi-limit set point to prevent the heating element from getting to an unsafe condition.

1. Connect the thermocouple bundled with the lead wire to the Hi-limit controller. This thermocouple now becomes the Hi-limit or over-temperature thermocouple.

    1.1. If the supplied heater does not have a Hi-limit or over-temperature thermocouple, we highly recommend that you purchase one on future units. The purpose of this safety is to protect the heater and your equipment from a boil-dry situation. This is a redundant safety backup in case the process over temperature and liquid level safeties fall.

2. Connect the thermocouple that is by itself on the output port of the heater to the process temperature controller. This thermocouple now becomes the process thermocouple.

    2.1. If the supplied heater does not have a process thermocouple, we highly recommend that you purchase one on future units. The purpose of this safety is to protect the heater and your equipment from an over-temperature situation.

3. Set the process temperature controller to desired operating temperature. (Example: Process set point = 60°C.)

4. Temporarily the Hi-limit controller set point at 150°C.

5. When the process temperature reaches about 80% of the process set point (Example: 48°C), reduce the Hi-limit temperature set point until the control relay trips the heater. (Note the Hi-Limit set point). At this point, add 5°C to 10°C to the Hi-limit temperature controllers. This is the Hi-limit safety set point for the heater.

    5.1. Example: Hi-limit control set point (110°C + 10°C = 120°C)

6. The process alarm set point should be set at 5°C above the process set point.

4.4 Liquid Level

Your heater should always be under liquid when operating. Operating heater in air or with a crystalline or precipitate solution that may coat the heater or sensors may result in damage to the heater and severely damage your equipment.

Non-compliance to Heater Operating Instructions will void warranty.
See safety connections and drawing for recommended wiring and installation.

4.5 Thermal Cut-Off

A mechanical one-shot sensor which opens when process fluid exceeds set temperature.

4.6 Process Fluid Over Temperature

The process over temperature set point should be set at 5°C above the process set point.

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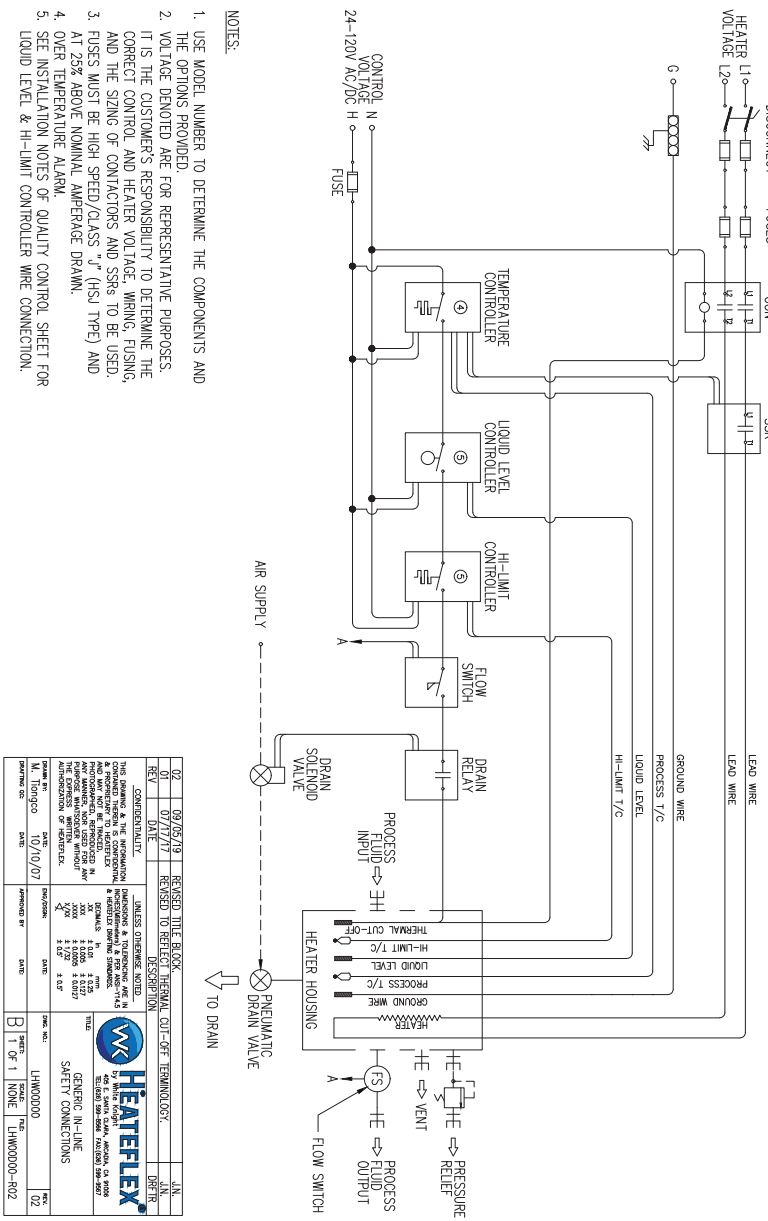
5. Drawings

5.1 Recommended Wiring Schematic



NOTES:

1. USE MODEL NUMBER TO DETERMINE THE COMPONENTS AND THE OPTIONS PROVIDED.
2. VOLTAGE DENOTED ARE FOR REPRESENTATIVE PURPOSES. IT IS THE CUSTOMER'S RESPONSIBILITY TO DETERMINE THE CORRECT CONTROL AND HEATER VOLTAGE, WIRING, FUSING, AND THE SIZING OF CONTACTORS AND SSRs TO BE USED.
3. FUSES MUST BE HIGH SPEED/CLASS "J" (HSJ TYPE) AND AT 25% ABOVE NOMINAL AMPERAGE DRAWN.
4. OVER TEMPERATURE ALARM.
5. SEE INSTALLATION NOTES OF QUALITY CONTROL SHEET FOR LIQUID LEVEL & HI-LIMIT CONTROLLER WIRE CONNECTION.

REV	DATE	DESCRIPTION	BY
02	09/05/19	REVISED TITLE BLOCK	J.N.
01	07/17/17	REVISED TO REFLECT THERMAL CUT-OFF TERMINOLOGY.	J.N.
REV	DATE	DESCRIPTION	BY

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UNLESS OTHERWISE NOTED: DIMENSIONS ARE IN INCHES[millimeters] & TOLERANCES ARE: IN DECIMALS: .XX ± 0.03 .XXX ± 0.010 .XXXX ± 0.0050 FRACTIONS ± 1/32" IN MILLIMETERS: XX ± 0.8 XXX ± 0.25 XXXX ± 0.127 ANGLES ± 0.5°

WK HEATEFLEX by White Knight
SELKIRK NEW YORK • ANCHORAGE ALASKA

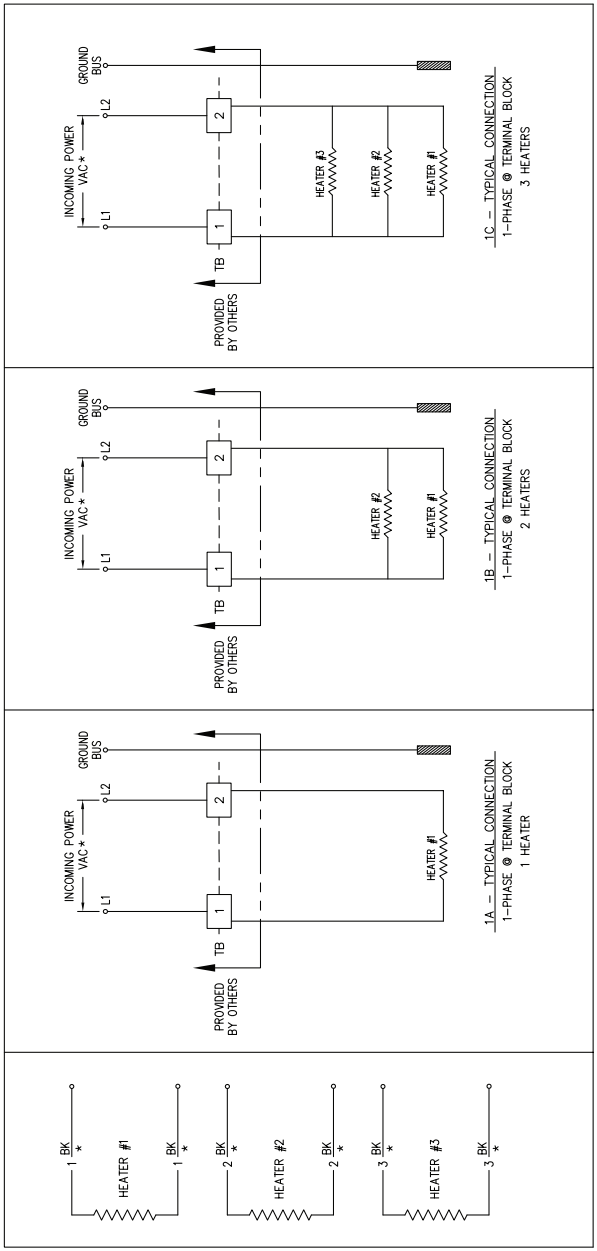
TITLE: GENERIC IN-LINE SAFETY CONNECTIONS

DRWG. NO.: LHW00000 REV. 02

DRAWN BY: M. Tiongco DATE: 10/10/07
DRAFTING OC: DATE:
ENG/DSGN: DATE:
APPROVED BY: DATE:

SIZE: B SHEET: 1 OF 1 SCALE: NONE FILE: LHW00000-R02

5.2 Typical Single Phase Wiring



NOTES:
1. ⏚ - SEE ENGINEERING SPECIFICATIONS SHEET FOR LEAD WIRE GAUGE & VOLTAGE DETAILS.
2. IT IS THE CUSTOMERS RESPONSIBILITY TO DETERMINE THE CORRECT CONTROL & HEATER VOLTAGE, WIRING, FUSING & THE SIZING OF ALL CONTACTORS USED FOR THIS UNIT.

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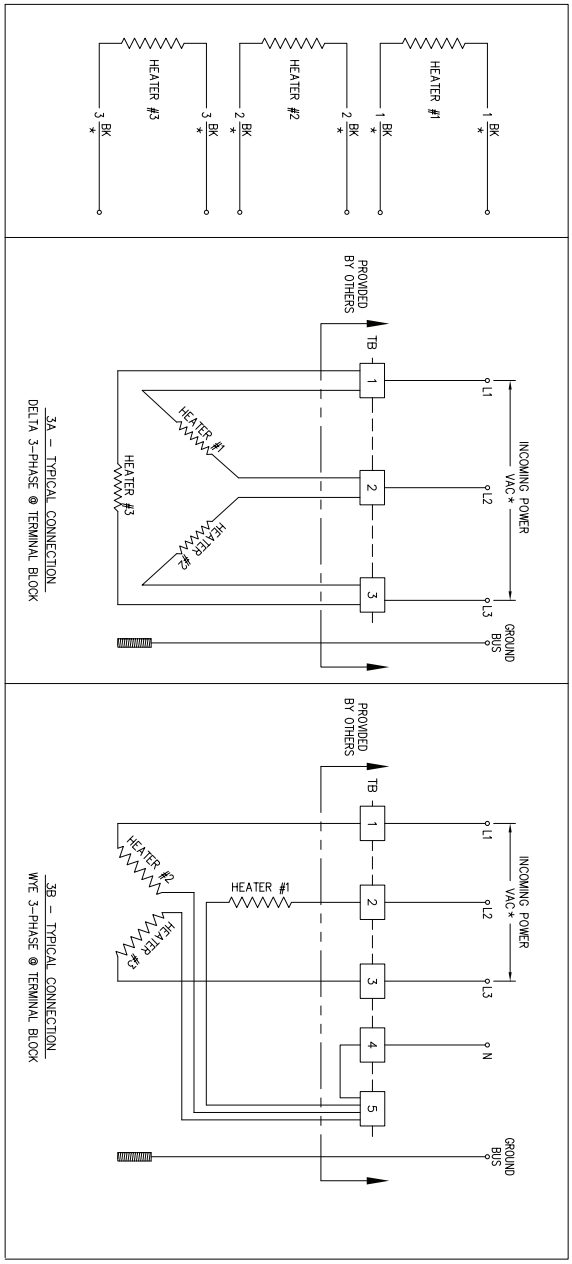
DECIMALS:	in	mm
XX	± 0.05	± 0.127
XXX	± 0.005	± 0.0127
XXXX	± 0.0005	± 0.0127
∠	± 0.5°	± 0.5°

DRAWN BY: LN
CHECKED BY: LN
APPROVED BY:
DATE:
ENG/DSGN:
DATE:
DWG. NO.: LHPH
SHEET: 1 OF 1
SCALE: NONE
FILE: LHPH-R01
REV: 01
TITLE: TYPICAL CONNECTION FOR 1–PH HEATER LEADS

HEATEFLEX®
by White Knight
Fluid Handling, Inc.
TEL: (540) 639-3466 FAX: (540) 639-9929

5.3 Typical Three Phase Wiring



NOTES:

1. * SEE ENGINEERING SPECIFICATIONS SHEET FOR LEAD WIRE GAUGE & VOLTAGE DETAILS.
2. IT IS THE CUSTOMERS RESPONSIBILITY TO DETERMINE THE CORRECT CONTROL & HEATER VOLTAGE, WIRING, FUSING & THE SIZING OF ALL CONTACTORS USED FOR THIS UNIT.

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01	09/05/19	REVISED TITLE BLOCK	J.N.

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INTERPRET DRAWING & PRINT PER ASME Y14.5
& HEATEFLEX DRAWING STANDARDS.

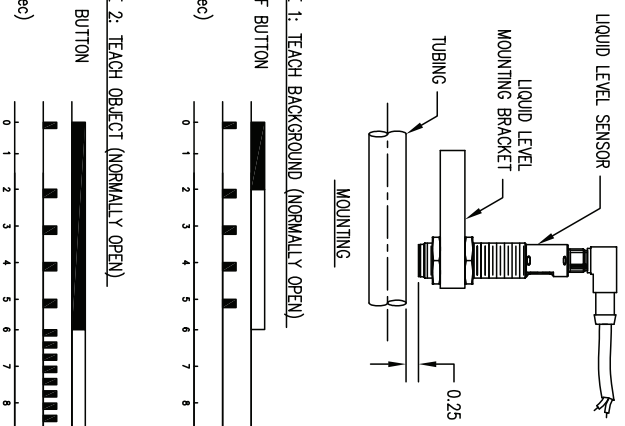
DRAWN BY: M.Tiongco DATE: 10/15/07
DRAWING NO:
APPROVED BY: DATE:

HEATEFLEX®
451 E. SMITH CLARK, ARIZONA, CA 85606
TEL (928) 564-4000 FAX (928) 564-4007

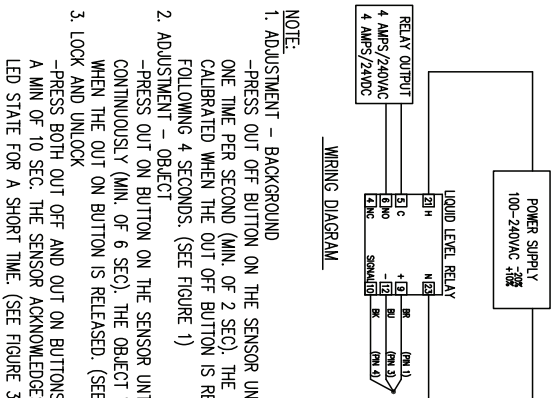
TITLE:
TYPICAL CONNECTION FOR 3-PH HEATER LEADS

DWG. NO.: INLINE 3-PHASE
REV.: 01
SHEET: 1 OF 1
SCALE: 1 : 1
FILE: LHJPH-R01

5.4 LHX457 Liquid Level Sensors 307774 & 307767A



MOUNTING



WIRING DIAGRAM

NOTE:

1. ADJUSTMENT – BACKGROUND
   –PRESS OUT OFF BUTTON ON THE SENSOR UNTIL LED IS FLASHING ONE TIME PER SECOND (MIN. OF 2 SEC). THE BACKGROUND WILL BE CALIBRATED WHEN THE OUT OFF BUTTON IS RELEASED DURING THE FOLLOWING 4 SECONDS. (SEE FIGURE 1)
2. ADJUSTMENT – OBJECT
   –PRESS OUT ON BUTTON ON THE SENSOR UNTIL LED ARE FLASHING CONTINUOUSLY (MIN. OF 6 SEC). THE OBJECT WILL BE CALIBRATED WHEN THE OUT ON BUTTON IS RELEASED. (SEE FIGURE 2)
3. LOCK AND UNLOCK
   –PRESS BOTH OUT OFF AND OUT ON BUTTONS SIMULTANEOUSLY FOR A MIN OF 10 SEC. THE SENSOR ACKNOWLEDGES BY CHANGING THE LED STATE FOR A SHORT TIME. (SEE FIGURE 3)

FIGURE 1: TEACH BACKGROUND (NORMALLY OPEN)

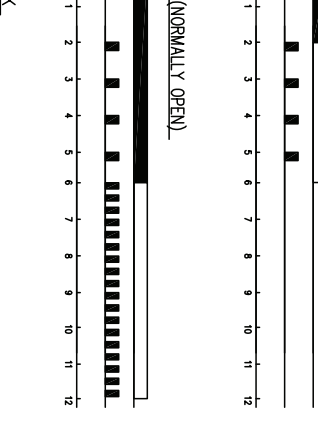


FIGURE 2: TEACH OBJECT (NORMALLY OPEN)

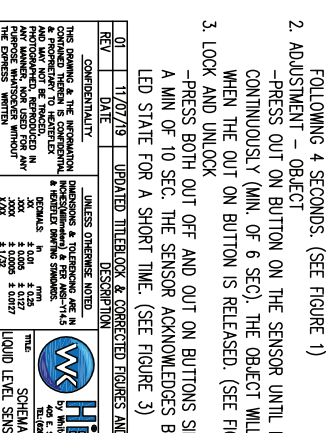
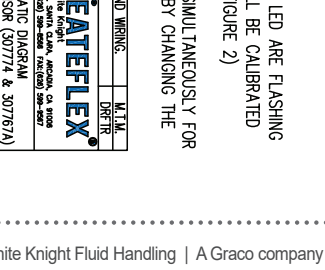


FIGURE 3: LOCK & UNLOCK



REV	DATE	DESCRIPTION	DRFTR
01	11/07/19	UPDATED TITLEBLOCK & CORRECTED FIGURES AND WIRING.	M.T.M.

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UNLESS OTHERWISE NOTED: DIMENSIONS & TOLERANCING ARE IN INCHES[Millimeters] & PER ANSI-Y14.5 STANDARDS. FRACTIONALS: ± IN: ± 0.25; .XX: ± 0.01; .XXX: ± 0.005; ANGULAR: ± 1/2°; .XXXX: ± 0.0050; ± 0.5'; .XXXXX: ± 0.00127; ± 0.5"

DWN/DSGNR: DATE:

APPROVED BY: DATE:

DRAWN BY: R. Mendoza DATE: 04/03/19

DRAFTING QC: DATE:

HEATEFLEX by White Knight
405 E. Smith Ranch Rd., San Marcos, CA 92069
TEL: (760) 744-0125 FAX: (760) 597-1457

TITLE: SCHEMATIC DIAGRAM LIQUID LEVEL SENSOR (307774 & 307767A) IN-LINE HEATER SERIES

DWG. NO.: LHX457 REV.: 01

SIZE: B SHEET: 1 OF 1 SCALE: NONE FILE: LHX457-R01

See Section 6 for additional information.

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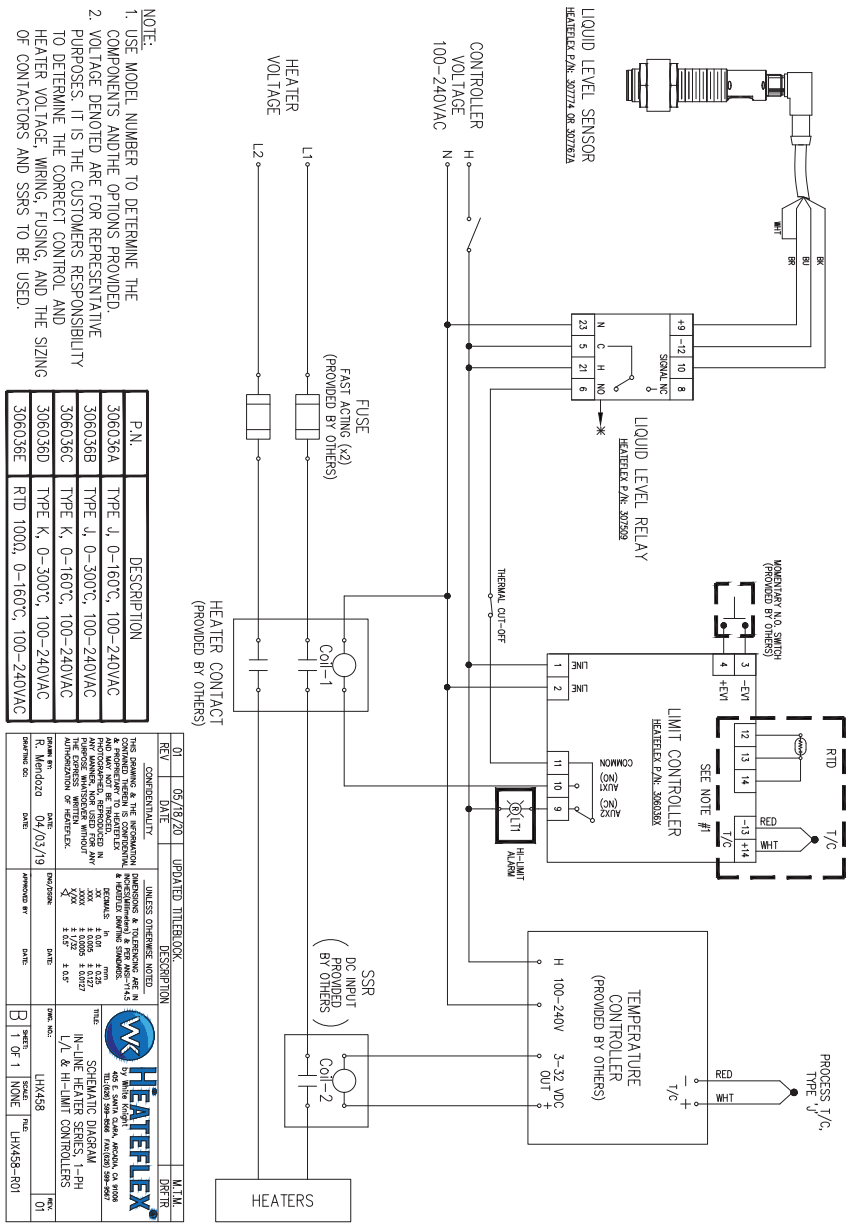
5.5 LHX458 Liquid Level Sensor 307774/307767A IFM Efector



NOTE:
1. USE MODEL NUMBER TO DETERMINE THE COMPONENTS ANDTHE OPTIONS PROVIDED.
2. VOLTAGE DENOTED ARE FOR REPRESENTATIVE PURPOSES. IT IS THE CUSTOMERS RESPONSIBILITY TO DETERMINE THE CORRECT CONTROL AND HEATER VOLTAGE, WIRING, FUSING, AND THE SIZING OF CONTACTORS AND SSRS TO BE USED.

P.N.	DESCRIPTION
306036A	TYPE J, 0-160°C, 100-240VAC
306036B	TYPE J, 0-300°C, 100-240VAC
306036C	TYPE K, 0-160°C, 100-240VAC
306036D	TYPE K, 0-300°C, 100-240VAC
306036E	RTD 100Ω, 0-160°C, 100-240VAC

REV	DATE	DESCRIPTION	M.T.M. DR'R
01	05/18/20	UPDATED TITLEBLOCK.	

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UNLESS OTHERWISE NOTED: DIMENSIONS & TOLERANCING ARE IN ACCORDANCE WITH ASME Y14.5 & HEATEFLEX DRAFTING STANDARDS.

DECIMALS:	in	mm
XX	± 0.01	± 0.25
XXX	± 0.005	± 0.127
XXXX	± 0.0005	± 0.0127
∠	± 0.5°	± 0.5°

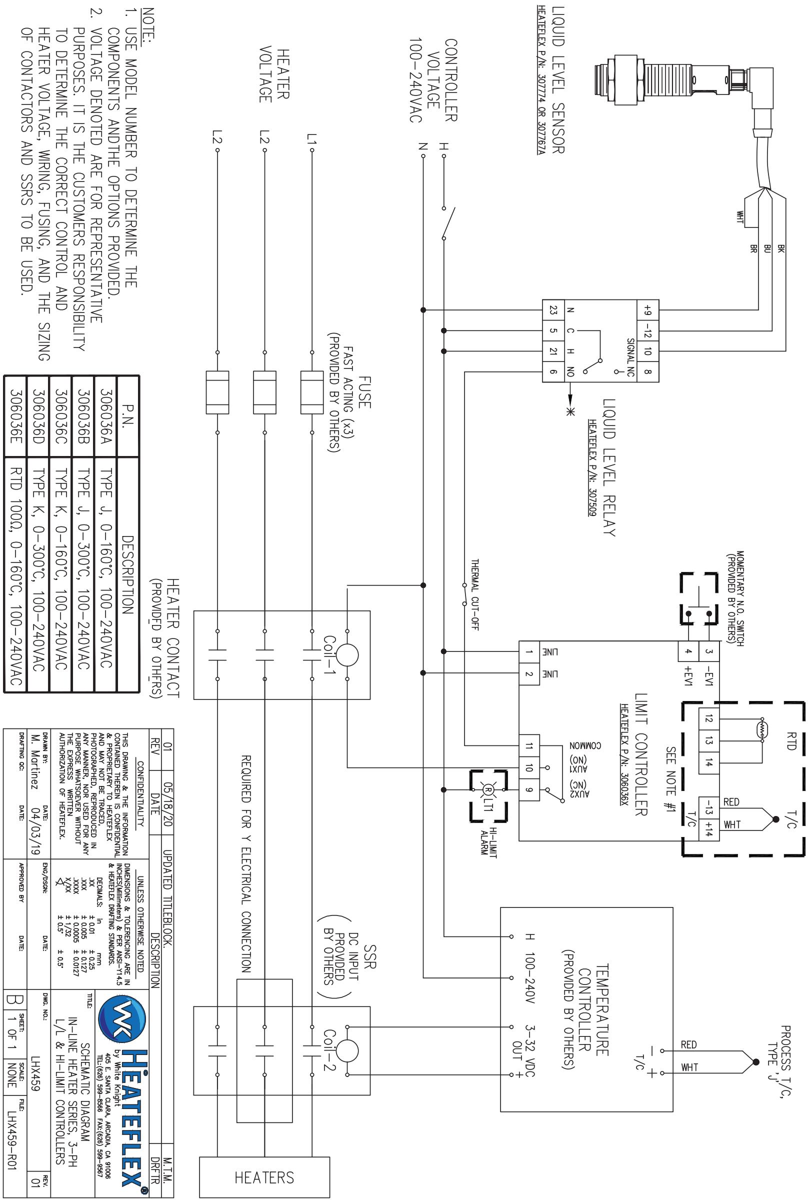
DRAWN BY: R. Mendoza — DATE: 04/03/19
DRAFTING CO: — DATE:
ENG/DSGN: — DATE:
APPROVED BY: — DATE:

HEATEFLEX
451 E. SANTA CLARA, ARCADIA, CA 91006
TEL:(626) 599-7566 FAX:(626) 599-7567

TITLE: SCHEMATIC DIAGRAM IN-LINE HEATER SERIES, 1-PH L/L & HI-LIMIT CONTROLLERS
DWG. NO.: LHX458
REV.: 01
SIZE: B
SHEET: 1 OF 1
SCALE: NONE
FILE: LHX458-R01

See Section 6 for additional information.

5.6 LHX459 Liquid Level Sensor 307774/ 307767A & High Limit Controller 306036X in Three Phase- IFM Efector & Omron


LIQUID LEVEL SENSOR
HEATEFLEX P/N: 307774 OR 307767A
CONTROLLER VOLTAGE 100–240VAC
HEATER VOLTAGE
L1
L2
L2
H
N
WHT
BR
BU
BK
LIQUID LEVEL RELAY
HEATEFLEX P/N: 307509
FUSE FAST ACTING (x3) (PROVIDED BY OTHERS)
THERMAL CUT-OFF
MOMENTARY N.O. SWITCH (PROVIDED BY OTHERS)
LIMIT CONTROLLER
HEATEFLEX P/N: 306036X
SEE NOTE #1
RTD
T/C
RED
WHT
HI-LIMIT ALARM
HEATER CONTACT (PROVIDED BY OTHERS)
Coil–1
Coil–2
REQUIRED FOR Y ELECTRICAL CONNECTION
SSR DC INPUT (PROVIDED BY OTHERS)
TEMPERATURE CONTROLLER (PROVIDED BY OTHERS)
H 100–240V
3–32 VDC OUT
PROCESS T/C, TYPE 'J'
HEATERS
NOTE:
1. USE MODEL NUMBER TO DETERMINE THE COMPONENTS ANDTHE OPTIONS PROVIDED.
2. VOLTAGE DENOTED ARE FOR REPRESENTATIVE PURPOSES. IT IS THE CUSTOMERS RESPONSIBILITY TO DETERMINE THE CORRECT CONTROL AND HEATER VOLTAGE, WIRING, FUSING, AND THE SIZING OF CONTACTORS AND SSRS TO BE USED.
TITLE: SCHEMATIC DIAGRAM IN-LINE HEATER SERIES, 3-PH L/L & HI-LIMIT CONTROLLERS
DWG. NO.: LHX459
REV. 01
DRAWN BY: M. Martinez 04/03/19
01 05/18/20 UPDATED TITLEBLOCK M.T.M.
FILE: LHX459-R01

P.N.	DESCRIPTION
306036A	TYPE J, 0–160°C, 100–240VAC
306036B	TYPE J, 0–300°C, 100–240VAC
306036C	TYPE K, 0–160°C, 100–240VAC
306036D	TYPE K, 0–300°C, 100–240VAC
306036E	RTD 100Ω, 0–160°C, 100–240VAC

See Section 6 for additional information.

6. High-Limit Controller

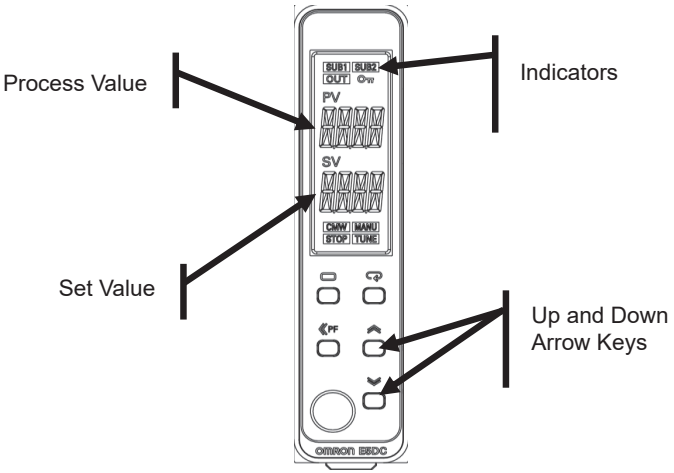
PN: (306035_/ 306036_)

6.1 Operating Instructions

The FM limit controller is to be used with a High Limit temperature sensor to detect the temperature at the heater element. This temperature reading is shown as the Process Value (PV) and is monitored to assure that the heater element does not exceed the specifed High Limit temperature Set Value which would occur in heater burnout condition. This High Limit temperature Set Value (SV) is set on the High Limit temperature controller to the desired temperature value. The factory setting for the High Limit temperature Set Value (SV) is 0°C (unless otherwise stated).

- To change the SV, press the Up and Down keys to change the value of the digit. The new SV will be taken immediately by the controller. (See Figure 1 for location)
- The limit controller is equipped with two relays. One relay (AUX1) to control the heater and the other relay to control an external indicating light. See Relay Position section for detail.
- See Part Number Legend Chart for temperature range, input sensor type, and voltage.
- The High Limit Alarm correlates to the limit controller's Indicator SUB1/SUB2 (see Figure 1 for location).
- The limit controller is password protected. Only Set Value can be changed.
- This Limit Controller is FM approved. Conforms to FM (Factory Mutual) Standards (FM3545/3810).

Figure 1 –Limit Temperature Controller Layout



6.2 Relay Positions

Power off state

- When the limit controller is not powered, the relay to control the heater (AUX1) is open and the relay to control the indicating light (AUX2) is closed.

Powered on with no alarm condition

- When the limit controller is powered and high limit temperature is below SV, the relay to control the heater (AUX1) is closed, the relay to control the external indicating light (AUX2) is open, and the limit controller indicator (SUB1/SUB2) is off.

Powered on with alarm condition

- When the limit controller is powered and high limit temperature is above SV, the relay to control the heater (AUX1) is open, the relay to control the external indicating light (AUX2) is closed, and the limit controller indicator (SUB1/SUB2) is on.

Powered on with no alarm condition and reset has not been initiated

- When the limit controller is powered and high limit temperature is below SV but reset has not been initiated, the relay to control the heater (AUX1) is open, the relay to control the external indicating light (AUX2) is closed, and the limit controller indicator (SUB1/SUB2) is on.

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6.3 Specifications Ratings

Power supply voltage

- 306036X: 100 to 240 VAC, 50/60 Hz.
- 306035X: 24 VAC, 50/60 Hz; 24 VDC.

Operating voltage range

- 85% to 110% of rated supply voltage. Power consumption
- 4.9 VA max. at 100 to 240 VAC, and 2.8 VA max. at 24 VDC or 1.5 W max. at 24 VDC.

Auxiliary/ Limit Output

- Number of outputs: 2
- Output specifications (AUX1 & AUX2): SPST-NO relay outputs: 250 VAC, 2 A (resistive load), Electrical life: 100,000 operations, Minimum applicable load: 10 mA at 5 V (reference value).

Event input (EV1)

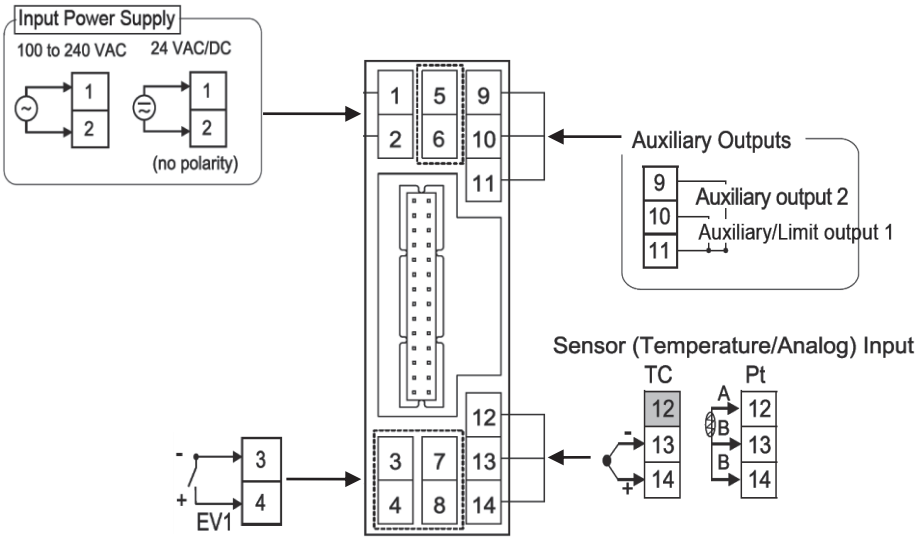
External contact input specifications

- Contact input ON: 1 kΩ max., OFF: 100 kΩ min.

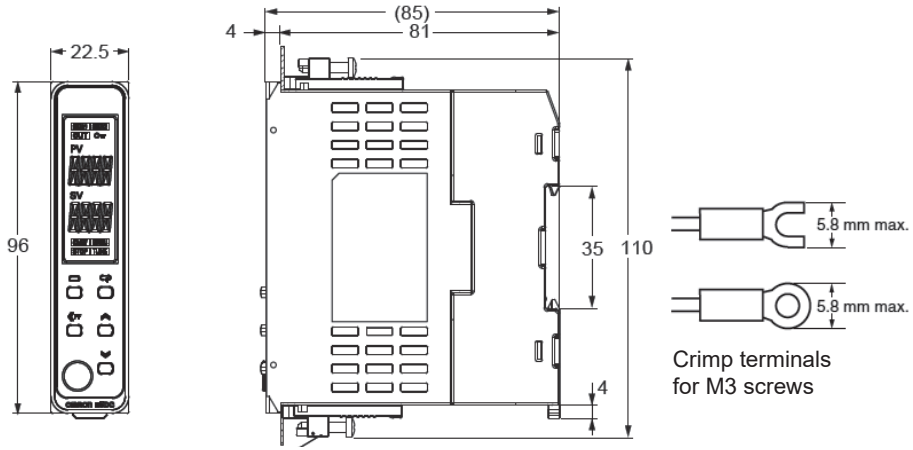
PART NUMBER LEGEND CHART

PART NUMBER	INPUT SENSOR	TEMPERATURE RANGE	POWER SUPPLY VOLTAGE
306035A	TYPE J	0-160°C	24 VAC/DC
306035B	TYPE J	0-300°C	24 VAC/DC
306036A	TYPE J	0-160°C	100-240 VAC
306036B	TYPE J	0-300°C	100-240 VAC
306035C	TYPE K	0-160°C	24 VAC/DC
306035D	TYPE K	0-300°C	24 VAC/DC
306036C	TYPE K	0-160°C	100-240 VAC
306036D	TYPE K	0-300°C	100-240 VAC
306035E	RTD 100Ω	0-160°C	24 VAC/DC
306036E	RTD 100Ω	0-160°C	100-240 VAC

6.4 External Connections



6.5 Dimensions

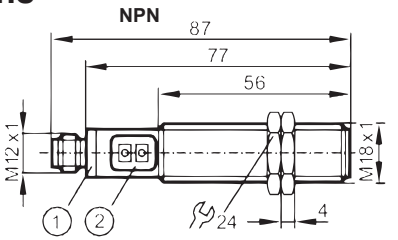


7. Efector Capacitive Liquid Level Sensors Operating Instructions

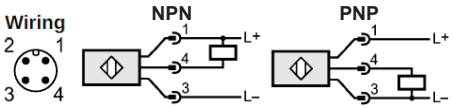
KG5065
KG-3120NFAKGP2T/US
8000165/00 09/2013
Capacitive sensor Plastic thread M18 x 1 Cable

7.1 Efector Product Information

Increased immunity to conducted radio frequency interference. Sensing range 8mm [nf] adjustable 2.5...8 mm non-flush mountable.



1. LED ring
2. Programming buttons



Electrical Data	
Operating voltage [V]	10...36 DC
Current consumption [mA]	250
Protection class	II
Reverse polarity protection	yes
Outputs	
Electrical design: PNP/NPN; (Automatic load detection PNP/NPN; Automatic load detection PNP/NPN:; when using a resistive load < 20 kΩ)	
Output function	normally open / closed; (selectable)
Max. voltage drop switching output DC [V]	2.5
Permanent current rating of switching output DC [mA]	200
Switching frequency DC [Hz]	10
Short-circuit proof	yes
Overload protection	yes
Monitoring range	
Sensing range [mm]	12
Accuracy / deviations	
Hysteresis [% of Sr]	1...15
Switch-point drift [% of Sr]	-20...20
Interfaces	
Communication interface	IO-Link
Transmission type	COM1 (4,8 kBaud)
IO-Link revision	1.1
SDCI standard	IEC 61131-9 CDV
IO-Link device ID	387d / 000183h
Profiles	Smart Sensor
SIO mode	yes
Min process cycle time [ms]	101
Remarks	
Pack quantity	1 pcs.

Operating conditions	
Ambient temperature [°C]	-25...80
Note on ambient temperature	temp. of sensing face: -25...110 °C
Protection	IP 65; IP 67
Tests / approvals	
EMC	EN 61000-4-2 ESD 8 kV AD EN 61000-4-3 HF radiated 10 V/m EN 61000-4-4 Burst 2 kV EN 61000-4-6 HF conducted 3 V EN 55011 class B
Vibration resistance	EN 60068-2-6 Fc (10...55 Hz) / 1 mm amplitude, vibration duration 5 min., 30 min. per axis with resonance or 55 Hz
Shock resistance	EN 60068-2-27 Ea 30 g 6 shocks / 11 ms half-sine (x, y, z)
MTTF [years]	566
Mechanical data	
Weight [g]	58.6
Housing	Threaded type
Mounting	non-flush mountable
Dimensions	M18 x 1 / L = 87
Thread designation	M18 x 1
Material	housing: PBT; plug: PC; Pushbuttons: TPE-U
Displays / operating elements	
Display	Switching status 1 x LED, yellow
Teach function	yes
Electronic lock	yes
Accessories	
Accessories (supplied)	lock nuts: 2
Electrical connection - plug	
Connector: 1 x M12	1 pcs.

8. Efector Capacitive Proximity Switch KI5082 Operating Instructions

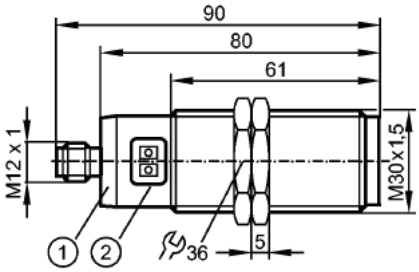
ifm electronic

80005166/00 09/2003

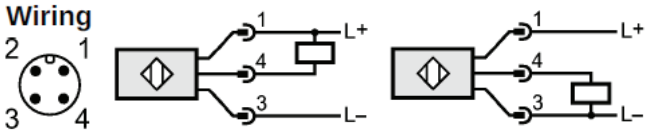
8.1

KI-3200NFAKGP2T/US
Capacitive sensor
Plastic thread M30 x 1.5
Connector
Teach function
Electronic lock
Automatic detection PNP/NPN *)

Sensing range 20 mm [nf]
5...40 mm adjustable via programming buttons
non-flush mountable



1. LED ring
2. Programming buttons



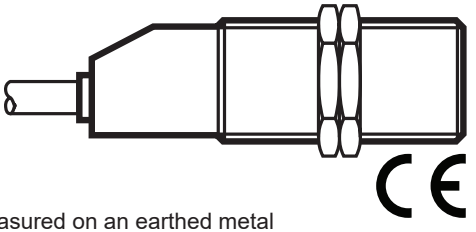
Application	**For dry bulk material and liquids. Optimized for media with a dielectric constant < 20 (e.g. oils, plastic granulates).**
Electrical design	**DC PNP/NPN**
Output	**normally open / closed programmable**

Operating voltage [V]	10...36 DC
Current rating [mA]	200
Short-circuit protection	pulsed
Reverse polarity protection	yes
Overload protection	yes
Voltage drop [V]	< 2.5
Current consumption [mA]	< 20
Automatic load detection PNP/NPN	when using a resistive load < 20 kΩ
Real sensing range [mm]	20 ± 10 %
Switch-point drift [% of Sr]	-20...20
Hysteresis [% of Sr]	1...15
Switching frequency [Hz]	10
Correction factors	water = 1 / glass approx. 0.3 / ceramics approx. 0.2 / PVC approx. 0.1

Target medium temp. [°C]	110
Ambient temperature [°C]	-25...80 *)
Protection	IP 65 / IP 67, II
EMC	IEC 60947-5-2: 1997 + A1: 1999 + A2: 2003
Housing material	housing: PBT; connector: PC; buttons: TPE-U
Function display switching status LED	yellow (LED ring and connector light translucently)
Connection	M12 connector
Weight [kg]	0.115
Remarks	*) temperature of the sensing face -25...110 °C *) load resistance < 20 kΩ
Accessories (included)	2 lock nuts

8.1 Function & Features

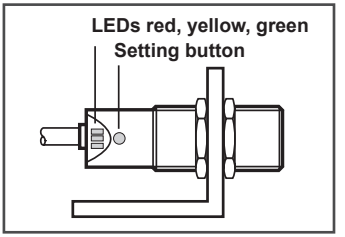
This proximity switch detects metals, almost all plastics, glass, ceramics,wood, paper, oils, greases, water and all hydrous materials without contact and indicates their presence by providing a switched signal.



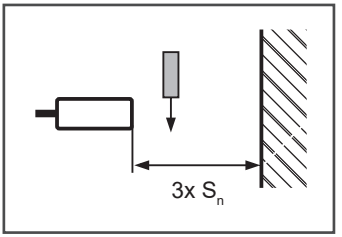
- Nominal sensing range (Sn) 8 mm (measured on an earthed metal plate and water; a shorter sensing range for other materials).
- Automatic adjustment to the medium to be detected.

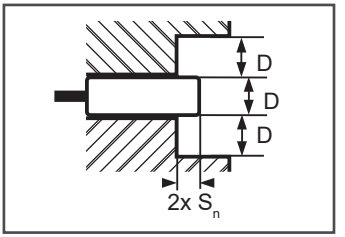
8.2 Installation

Mount the unit by means of amounting device. Secure it by means of the nuts provided so that it cannot work loose. Non-flush installation.

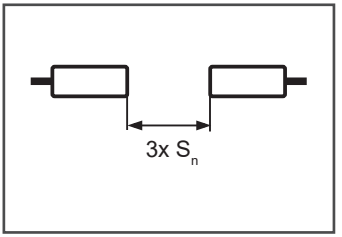


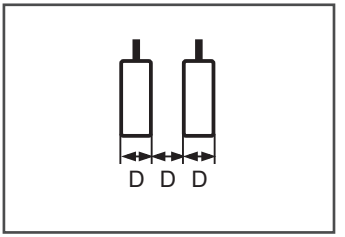
Open space around the sensing face:





Minimum distance when several switches of the same type are mounted:





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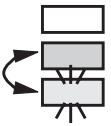
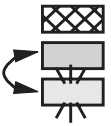
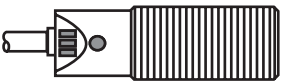
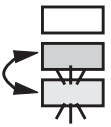
8.3 Electrical Connection

Disconnect power before connecting the proximity switch. Connection strictly to the indications on the type label. Core colors: BN = brown, BU = blue, BK = black.

8.4 Adjustment

The unit detects the "damped" state (= medium present) and the "undamped" state (= no medium present) and sets the optimum switch point.

1	 Press for 5s.		Yellow and green LEDs flash alternately (= unit is in the programming mode).
2	 Place the medium into the detection area of the sensor and press the button briefly.		The yellow and green LED's go out for a short time, then quickly flash alternately; the red LED is on.
3	 Remove the medium and increase the distance between the medium and the unit until the red LED goes out.		The yellow and green LED's continue to flash alternately. The red LED goes out.

If the red LED does not go out, the interval between the "damped" and the "undamped" signals is too short. Press the setting button twice. The unit passes into the operating mode with the switch point being unchanged.

4	 Press briefly.		The yellow and green LED's go out for a short time, then the green LED is on (= unit is in the operating mode).

Steps 2 and 3 can also be taken in reverse order: first align the unit without the medium being present and then place the medium into the detection area until the red LED goes out.

If the setting of the switch point is not possible (the signals for damped/undamped follow too close), the red LED flashes after step 4 (= adjustment error). Press the setting button once. The unit then passes into the operating mode with the switching point being unchanged.

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8.5 Locking / Unlocking

The unit can be electronically locked to prevent unwanted adjustment of the set parameters:

 Press for 10s.	→	The yellow and green LEDs flash alternately; after 10s the LEDs go out, the unit is locked.
 Press for 10s.	→	After 10s the LEDs go out, locking is annulled.

8.6 Operation

Check the safe functioning of the switch. The operation of the proximity switch is maintenance-free. For perfect functioning make sure that:

- the sensing face and the open space are kept free of deposits and foreign bodies, particularly for installation with the sensing face facing upwards.

LED display:

LED green lights	Unit is ready for operation.
LED yellow lights	Output is switched.
LED red lights	Uncertain working range.
LED red flashes	Internal malfunction, adjustment error.
LED's yellow + red	Simultaneous flashing: output is short-circuited.

9. Efector Switching Amplifier Operating Instructions

ifm electronic

DN0210, DN0220

80011079/00 01/2015

9.1 Preliminary Note

This document applies to switching amplifiers DN0210 and DN0220. Devices differ in the following points: number of input/output channels → see type label.

This document is intended for specialists. These specialists are people who are qualified by their training and their experience to see risks and to avoid possible hazards that may be caused during operation, installation or maintenance of the device.

Read this document before use to familiarise yourself with operating conditions, installation and operation. Keep this document during the entire duration of use of the device.

⚠ WARNING	**Adhere to warning notes and safety instructions (See Safety instructions).**

9.1.1 Symbols Used

- ► Instructions
- > Reaction, result
- […] Designation of keys, buttons or indications
- → Cross-reference

Important note: Non-compliance can result in malfunction or interference.

Information: Supplementary note.

9.1.2 Warning Signs Used

⚠ WARNING	**Warning of serious personal injury. Death or serious irreversible injuries may result.**
⚠ WARNING	**Warning of personal injury. Slight reversible injuries may result.**
Note	**Warning of damage to property.**

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9.2 Safety Instructions

9.2.1 General

Follow the operating instructions. Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or incorrect handling can affect the safety of operators and machinery.

The installation and connection must comply with the applicable national and international standards. Responsibility lies with the person installing the device.

The system installer is responsible for the safety of the system into which the device is integrated.

9.2.2 Target group

The device must only be installed, connected and put into operation by a qualified electrician.

9.2.3 Electrical connection

Disconnect the unit externally before handling it. Also disconnect any independently supplied relay load circuits.

The wiring of all signals in connection with the SELV circuit of the device must also comply with the SELV criteria (safety extra-low voltage, safe electrical isolation from other electric circuits).

If the externally supplied or internally generated SELV voltage is externally grounded, the responsibility lies with the user in accordance with the applicable national installation regulations. All statements in these operating instructions refer to the unit the SELV voltage of which is not grounded.

It is not allowed to supply external voltage to the terminals for the pulse pick-up supply. The consumption of current which exceeds the value given in the technical data is not allowed.

An external main switch must be installed for the unit which can switch off the unit and all related circuits. This main switch must be clearly assigned to the unit.

9.2.4 Handling

Be careful when handling the unit once power is applied. This is only allowed by qualified personnel due to the protection rating IP 20.

9.2.5 Installation location

For the correct operation the device must be mounted in a housing which can only be opened using a tool or in a locked control cabinet (both protection rating IP 54 or higher) as an enclosure in accordance with EN 61010.

9.2.6 Housing temperature

As described in the technical specifications below the device can be operated in a wide ambient temperature range. Because of the additional internal heating the operating elements and the housing walls can have high perceptible temperatures when touched in hot environments.

9.2.7 Tampering with the device

In case of malfunction of the unit or queries please contact the manufacturer. Any tampering with the device can seriously affect the safety of operators and machinery. This is not permitted and leads to the exclusion of any liability and warranty claims.

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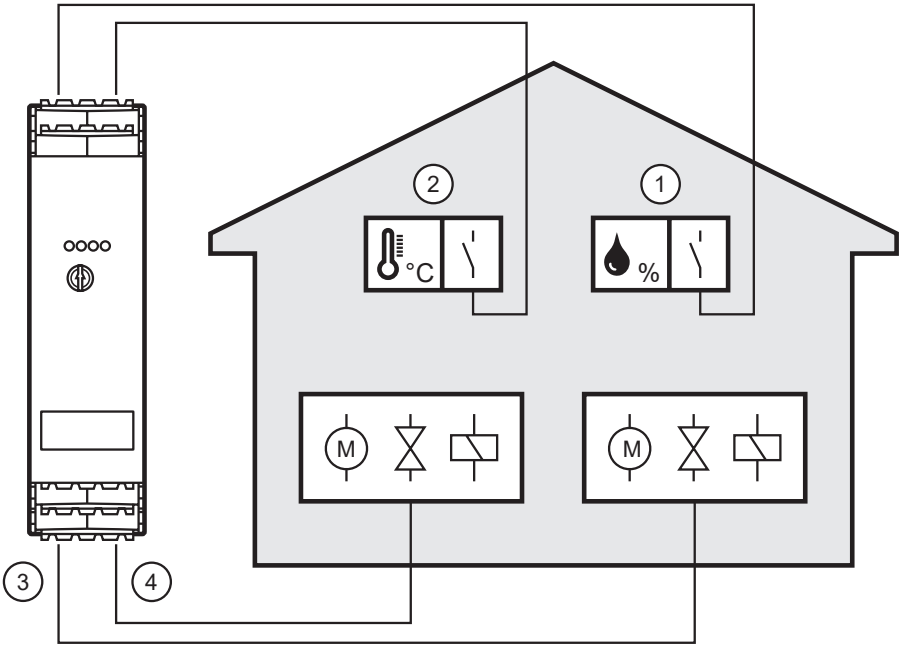
9.3 Functions & Features

Switching amplifier is used for power supply and signal evaluation of PNP/NPN switching sensors or mechanical contacts. Relay outputs 1 and 2 are switched without delay by the input signals 1 and 2 (number of input/output channels depends on device variant).

Each input channel is equipped with an independent overload/short circuit protection mechanism. When an overload or a short circuit has been removed, each input channel automatically returns to normal operation.



Example: DN0220 (2-channel)

1: Humidity sensor with switching output for input signal 1

2: Temperature sensor with switching output for input signal 2

3: Relay output 1 for switching electric motors, valves, etc.

4: Relay output 2 for switching electric motors, valves, etc.

WARNING **The device is not approved for safety-related tasks in the field of operator protection.**

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9.4 Operating & Display Elements

Switching amplifier is used for power supply and signal evaluation of PNP/NPN switching sensors or mechanical contacts. Relay outputs 1 and 2 are switched without delay by the input signals 1 and 2 (number of input/output channels depends on device variant).

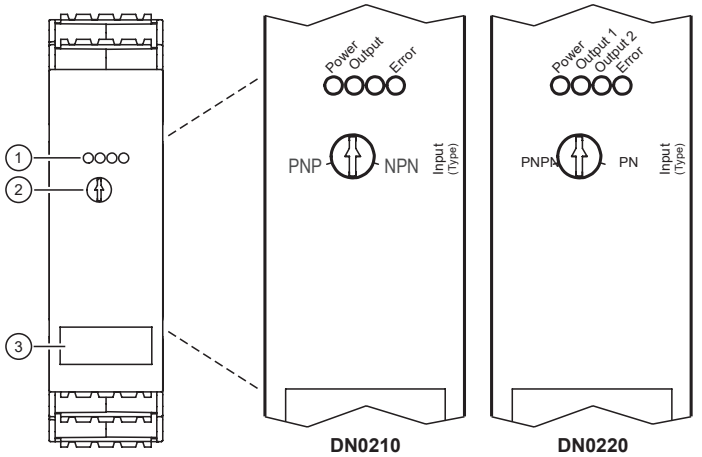
Each input channel is equipped with an independent overload/short circuit protection mechanism. When an overload or a short circuit has been removed, each input channel automatically returns to normal operation.

DN0210 (1-channel)
DN0220 (2-channel)

1: LEDs

2: Potentiometer

3: Panel for labelling



9.4.1 LEDs

LED	Color	Status	Description
Power	Green	On	Voltage supply OK
Output 1	Yellow	On	Relay 1 energized
Output 2	Yellow	On	Relay 2 energized
Error	Red	Flashing	Sensor supply overload or short circuit

Error signals and diagnosis (→ 10 Troubleshooting)

9.4.2 Potentiometer

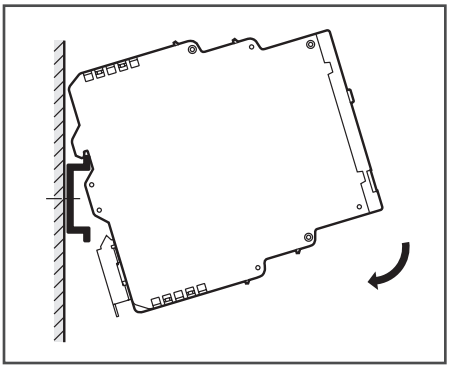
Potentiometer	Setting	
Input (type)	PNP (positive switching) NPN (negative switching)	(→ 6.4.1)

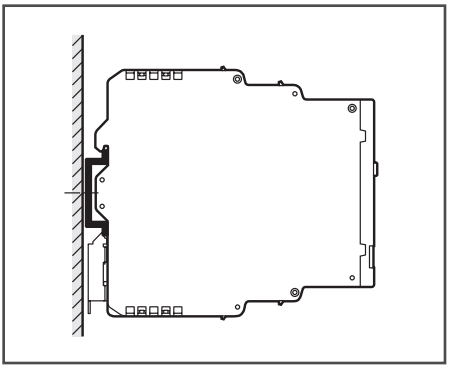
Setting applies to both inputs.

9.5 Installation

9.5.1 Installation of the device

► Install the device on a 35 mm DIN rail.

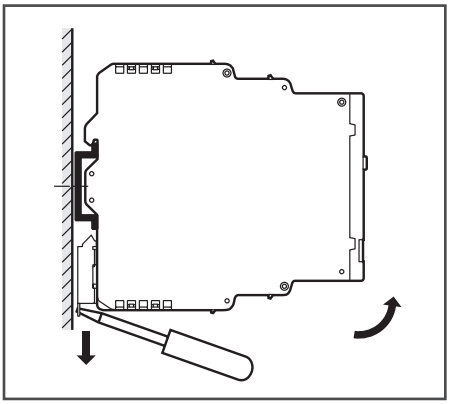




► Leave enough space between the unit and the top and bottom of the control cabinet to enable air circulation and to avoid excessive heating.

► Take into account the internal heating of all units when mounting several units side by side. The environmental conditions must be observed for every unit.

9.5.2 Remove the device



9.5.3 Mounting of the sensors

► Follow the manufacturer's installation instructions.

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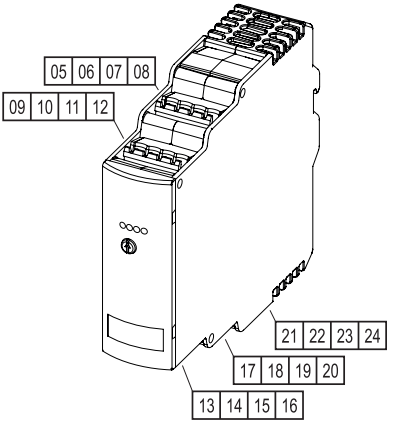
9.6 Electrical Connection

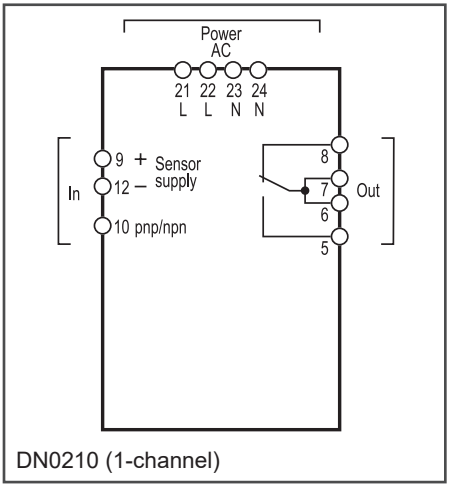
9.6.1 Connection accessories

The unit is supplied including the connectors.

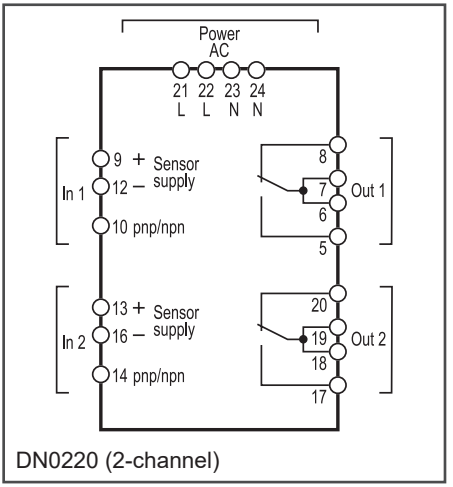
More information about accessories at:
www.ifm.com → Data sheet search →
Article number → Accessories



9.6.2 Terminal connection



DN0210 (1-channel)



DN0220 (2-channel)

WARNING

Only the supplied or technically identical connectors may be used on the terminals blocks for the AC supply and the relay outputs (→ 9 Technical data). To ensure protection rating IP 20 for the housing and the terminals, fully tighten the screws of the unused connector contacts.

WARNING

Do not use unconnected terminals which are not shown in the drawing such as terminal 11 as support point terminal.

9.6.3 Voltage supply (power)

- ► Voltage supply see type label.
- ► Connect the device to terminals 21/22 (L) and 23/24 (N).
- ► Lay all supply and signal cables separately. Use a screened cable if required in the application.

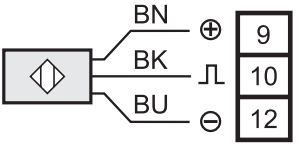
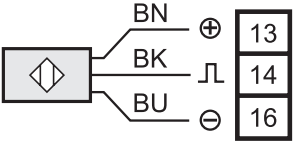
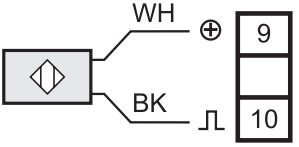
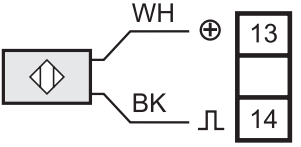
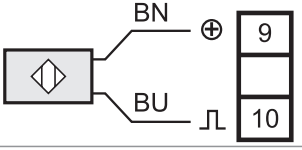
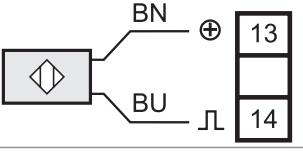
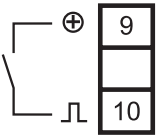
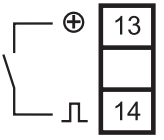
AC Supply

⚠ WARNING

The AC supply cable must be protected according to the cross-section used (max. 10 A).

The low voltage provided for the sensor supply meets the SELV criteria according to EN 61010, overvoltage category II, soiling degree 2.

9.6.4 Inputs – Connection of the sensors

Sensor type	Input 1	Input 2	Setting
3-Wire DC PNP			PNP
3-Wire DC NPN			NPN
2-wire DC quadronorm			PNP
2-Wire AC/DC			PNP
Mechanical switch			PNP

BN = Brown BU = Blue
BK = Black WH = White

The connection of mechanical switch contacts is not recommended since they tend to bounce and produce faulty pulses.

9.6.5 Outputs – Relay outputs

► To prevent excessive wear and to comply with the EMC standards, interference suppression of the contacts is required for switching inductive loads.

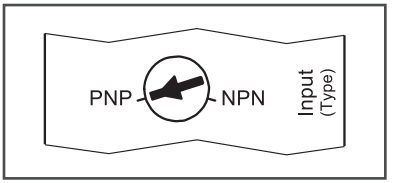
WARNING **To switch an AC voltage via the relay outputs, the AC supply must use the same supply cable (phase) as the voltage supply of the unit.**

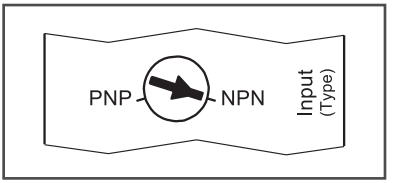
If the relay outputs are used to switch very small currents (e.g. PLC input), considerable contact resistance can arise.

9.7 Efector Settings

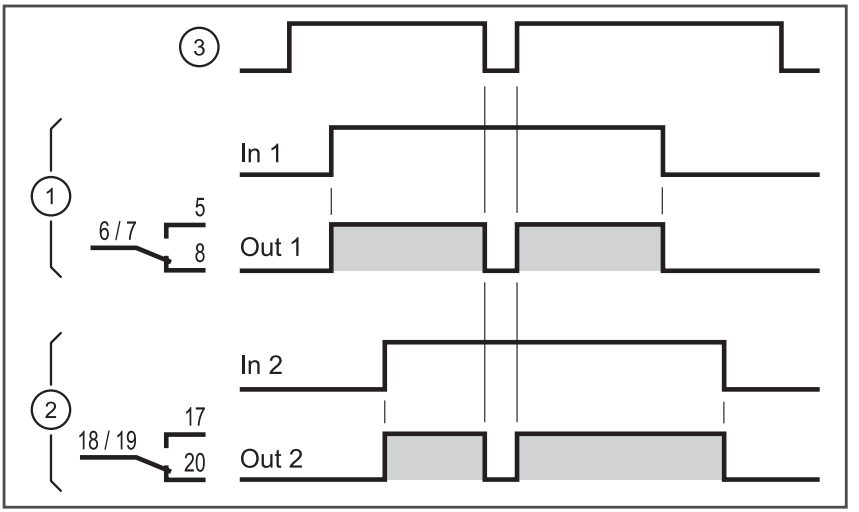
► Set the continuously adjustable potentiometer using a suitable screwdriver.

► Input type setting see table (→ 6.4.1 Connection of the sensors).





9.7.1 Switching Diagram



1: Channel 1
2: Channel 2
3: Voltage supply of the unit

= relay energized, i.e. switched

9.8 Efector Dimensions

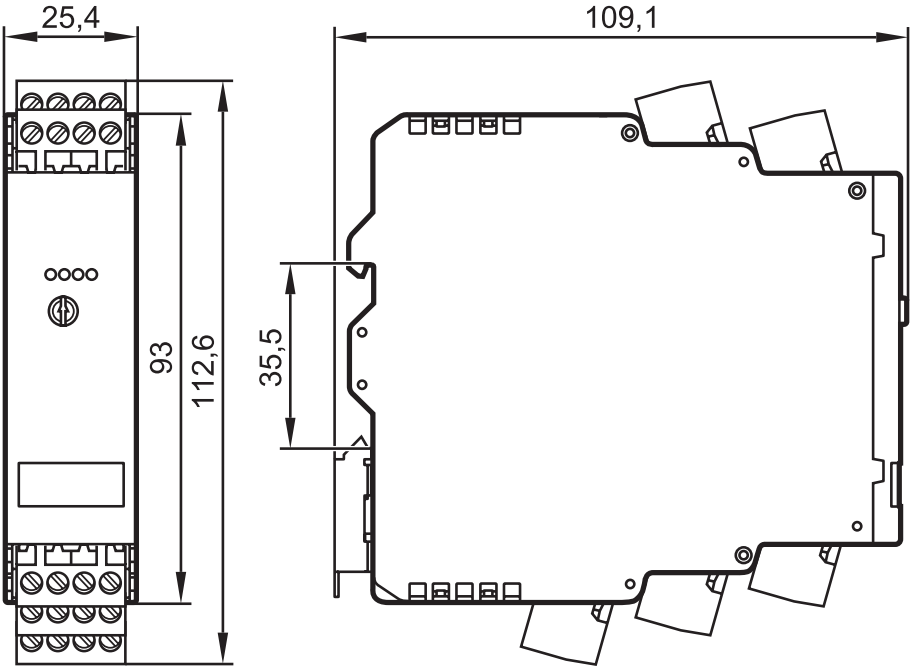


Figure shows DN0220 (2-channel) with connectors

9.9 Efector Technical Data

Order no.		DN0210	DN0210
Number of channels		1	2
Nominal voltage AC	[V]	110...240	
Nominal frequency	[Hz]	50...60	
Voltage tolerance	[%]	-20/+10	
Power consumption	[W]	≤ 11	
Auxiliary energy for sensors	[V]	24 DC SELV	
Voltage tolerance	[%]	±10	
Current per channel	[mA]	≤ 300	≤ 150
Sensor type (pulse input)		PNP/NPN (type 2 to IEC 61131-2)	
Input frequency	[Hz]	≤ 10 (duty cycle 50 %)	
Relay contact rating	[A]	4 Resistive load (240 V AC or 24 V DC) Electrically isolated Reinforced insulation to EN 61010 Overvoltage category II, Degree of soiling 2 to 240 V AC nominal voltage	
Protection housing / terminals		IP 20 / IP 20	
Ambient temperature	[°C]	-20…60	
Storage temperature	[°C]	-25…70	
Max. perm. relative humidity	[%]	80 (31 °C) Linearly decreasing to 50 (40 °C) Non condensing	
Maximum operating altitude	[m]	3000 above sea level	
Connection			
Device		4-pole terminal blocks with 5.0 mm pitch	
Connector		4 poles with screw connection (supplied with the unit)	
Type		Phoenix Contact MSTBT 2,5/4-ST BK 0.2…2.5 mm² (AWG 30…12)	

Data sheets are available at:
www.ifm.com → Data sheet search→ Article number

9.9.1 Approvals / Standards

EC declarations of conformity, approvals etc. can be downloaded at:
www.ifm.com → Data sheet search → Article number → More information

9.10 Efector Troubleshooting

LED				Error	Troubleshooting
Power	Output 1	Output 2	Error		
●	--	--	✳	Short circuit or overload at one or both sensor supply terminals.	Remove short circuit or overload.

Legend:

○ off

● on

✳ flashing

-- any

9.11 Efector Maintenance, Repair, Disposal

9.11.1 Maintenance

The unit is maintenance-free.

9.11.2 Cleaning the housing surface

► Disconnect the device.

► Clean the device from dirt using a soft, chemically untreated and dry cloth.

Micro-fibre cloths without chemical additives are recommended.

9.11.3 Repair

► The device must only be repaired by the manufacturer. Observe the safety instructions.

9.11.4 Disposal

► Dispose of the device in accordance with the national environmental regulations.

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Part No. LH2000-1905

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