MODEL KRV CAPACITANCE LEVEL SENSOR

Features

- No adjustment required
- High sensitivity with dielectric constant as low as 1.1
- Ignores coatings and build up
- Detects solids, liquids, and interface of two immiscible liquids

General Description

The KRV series of capacitance sensors are designed for point level detection of liquids, solids, powder, or interface between two immiscible liquids.

Radio Frequency sensors are typically used to detect liquids, but have a difficult time with solid or powder materials. The KRV series overcome this limitation by having a parallel LC circuit on its oscillator and five switch selected sensitivity ranges. The KRV series easily detect solid and powder materials such as plastic powder/pellet, fly ash, carbon black, and similar substances.

The KRV series reliably detect the interface between two immiscible liquids, oil and water as an example. The KRV can be set to operate in water but not in oil. Additionally, the KRV will ignore heavy oily build up on its electrode.

Operational Description

When the electrode is in free air, the oscillation circuit synchronizes with the detection circuit. When the electrode is in the medium, the synchronization between the oscillation circuit and the detection circuit breaks with the capacitance of the medium being taken in. This difference is then converted into the relay output.

Sensitivity Settings for Applications

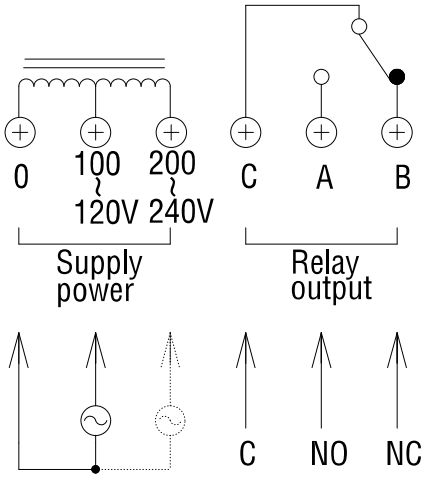
- "A" sensitivity: 0.5PF to 5PF, ∞ to 100kΩ
  For solids and liquids (ε s≤1.1) such as Aluminum powder, Calcium carbonate, Cement, Fly ash, Ink, Paint, Plastic resin, etc.
- "B1" sensitivity: 2PF to 5PF, 100kΩ to 50kΩ
  For solids and liquids (ε s≤2.2) such as Coffee powder, Feed, Flour, Oil, Starch, etc.
- "B2" sensitivity: 5PF to 10PF, 50kΩ to 30kΩ
  For solids and liquids (ε s≤3.0) such as Grain, Sand, Sugar, Water, etc.
- "C" sensitivity: 200PF to 1000PF, 2kΩ to 200Ω
  For liquids and slurry (ε s≤50) such as Dehydrated cake, Drainage, Night soil, Sewage, Slurry, etc.
- "D" sensitivity: 4000PF to 50000PF, 500Ω to 2Ω
  For liquids (ε s≤90) such as Chemical slurry, Quicklime (liquid), etc.

Note: Normally, NOHKEN will set the proper sensitivity range before shipment in accordance with your specified medium when ordering.

Technical Information of Fluoro Plastic

- PTFE: Teflon® 4F (Poly Tetra Fluoro Ethylene), operating temp. 200°C Max.
- FEP : Teflon® 4-6F (fluorinated Ethylene Polypropylene), operating temp. 200°C Max.
- ETFE: Tefzel® (Ethylene Tetra Floro Ethylene), operating temp. 150°C Max.
- ECTFE: Halar® (Ethylene Chloro Tri Fluoro Ethylene), operating temp. 150°C Max
- PVDF: Kynar® 2F (Poly VinyliDene Fluoride), operating temp. 120°C Max.

Wiring



Ordering Information

KRV	For universal application	
	2	Standard
	3	Heavy duty
	5	Flat probe
	6	Wire extension
	9	High sensitivity
	N	Plug mounting
	F	Flange mounting
	T	with heat radiation fin
	P	FEP tubing (for 2F only)
	PT	FEP tubing with heat radiation fin (for 2F only)
	A	Foam detection
	H	New Housing
	0	Flat-face flange
	1	Raised-face flange
	4	Plug mounting
	J	JIS flange
	A	ANSI flange
	D	DIN flange
	G	G plug
	R	R plug
	T	NPT plug
	S	304 stainless steel
	S6	316 stainless steel
	F	Insulator, PTFE for 2, 3, 9, and PE for 5, 6.
	C	Ceramic insulator for high temp.
	0	Viton shield
	1	Thermiculite shield
	2	Kalrez shield
	3	Perfluore shield
	▪▪▪▪	Specify the probe length
	3	24V DC
	4	100-120/200-240V AC
	0	G1/2
	3	with NPT 3/4" socket

KRV	2	N		H	4	R	S	F	0	250	4	0	= KRV-2NH-4RSF0-250-40

* The mounting size should be specified when you order.
* The length of electrode and insulator should be specified in mm if required.
* The medium must be informed for sensitivity setting when you order.
* The operating temp, and pressure should be informed for correct model selection.

MODEL KSV FOR CONDUCTIVE MEDIUM

Features

- Ignores heavy conductive build up
- Single probe/Mechanically strong

General Description

The KSV series of capacitance sensors are made specifically for point level detection of conductive medium. Applications include water, chemical solutions, acid based slurries, conductive granules, and sticky liquids.

Build up is one of the most common problems for capacitance sensors. Conventional Radio Frequency sensors solve this problem by using a guard probes (the second or third element to the electrode). But this complicated probe construction tends to make probes easily broken, particularly if twisted in agitated containers. Consequently, conventional RF sensors are installed vertically and limited to a fixed length, foamed in one piece.

The KSV series have overcome this limitation by using the series resonance circuit and a single electrode. This circuit corrects for conductive build up by measuring its resistance. The single electrode can be mounted in virtually any position and is available with a number of standard mountings.

Operational Description

The electrode of the KSV is a part of the oscillation circuit. When the electrode is in the free air, the oscillation is stopped. When it is in medium, the oscillation is restored by measuring capacitance of medium and the relay is energized.

Applications

- Liquids (except for oil): Water, Caustic soda, Hydrochloric acid, nitric acid, Sulfuric acid, etc.
- Sticky conductive medium: Drainage, Dehydrated cake, Night soil, Sewage, Sludge, Slurry, etc.

Ignores Heavy Conductive Buildup

The characteristics of the KSV circuit are defined by:

① $\omega b > \omega c$: Oscillation stops (The electrode is in the air.)

② $\omega b < \omega c$: Oscillation starts (The electrode is in the medium.)

③ $\omega b = 1/(C+\Delta C) \cdot R$

ωb: Frequency when the electrode is coated or covered by the medium.

ωc: Adjusted frequency when the electrode is in the air.

C : The stray capacitance of the electrode.

ΔC: The capacitance of the medium.

R : Resistance of the medium.

When a conductive resistance builds up forms on the electrode, ωb increases as R falls (③). This means $\omega b > \omega c$ so that oscillation cannot start (①).

When actual medium level is covering the electrode, ωb decreases by taking in ΔC(③). This means $\omega b < \omega c$ so that oscillation starts and the relay energizes.

In this way, by taking resistance of conductive build up and canceling capacitance of that, the KSV prevents false relay trips.

Value of capacitance and resistance of sensitivity are shown on Table 1.

Table 1

Sensitivity	Capacitance	Resistance
H	5 to 60PF	1.5kΩ or more
L	90 to 180PF	800Ω or more

Ordering Information

KSV	For universal application												
	2	Standard											
	3	Heavy duty											
	5	Flat probe											
	6	Wire extension											
	9	High sensitivity											
		N	Plug mounting										
		F	Flange mounting										
			T	with heat radiation fin									
			P	FEP tubing (for 2F only)									
			PT	FEP tubing with heat radiation fin (for 2F only)									
			A	Foam detection									
				H	New Housing								
					0	Flat-face flange							
					1	Raised-face flange							
					4	Plug mounting							
						J	JIS flange						
						A	ANSI flange						
						D	DIN flange						
						G	G plug						
						R	R plug						
						T	NPT plug						
							S	304 stainless steel					
							S6	316 stainless steel					
								F	Insulator, PTFE for 2, 3, 9, and PE for 5, 6.				
								C	Ceramic insulator for high temp.				
									0	Viton shield			
									1	Thermiculite shield			
									2	Kalrez shield			
									3	Perfluore shield			
										▪▪▪▪	Specify the probe length		
											0	100/200V AC	
											1	110/220V AC	
											2	120/240V AC	
											3	24V DC	
												0	G1/2
												3	with NPT 3/4" socket

KSV	2	N		H	4	R	S	F	0	250	4	0	= KSV-2NH-4RSF0-250-40

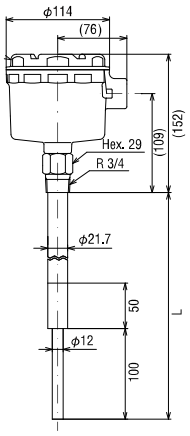
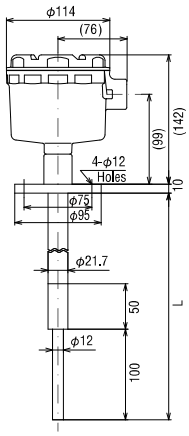
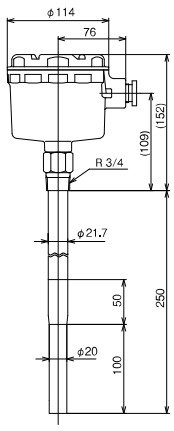
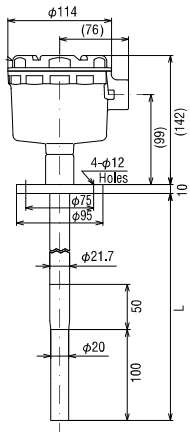
* The mounting size should be specified when you order.

* The length of electrode and insulator should be specified in mm if required.

* The medium must be informed for sensitivity setting when you order.

* The operating temp, and pressure should be informed for correct model selection.

Specifications

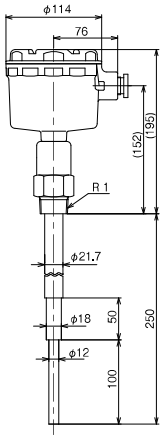
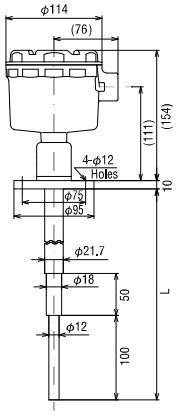
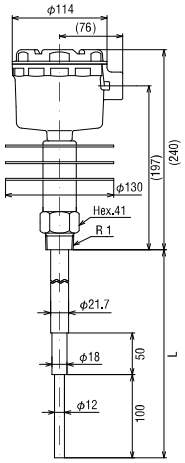
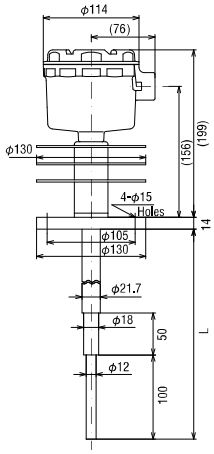
Model		1NH	1FH	2NH	2FH
Description		Standard			
Drawing					
Mounting		R3/4	JIS5K25A	R3/4	JIS5K25A
Supply Power	KRV	100 to 120V AC, 200 to 240V AC or 24V DC			
	KSV	100/200, 110/220, 120/240V AV or 24V DC			
Power Consumption	KRV	Approx. 2.5VA Max.			
	KSV	Approx. 2.2VA Max.			
Relay Output		1 SPDT, 250V 3A AC, 30V 3A DC (Resistive) C-A: Normally Open contact C-B: Normally Closed contact			
Detection Time Delay	KRV	Adjustable between 0.5 to 10 seconds			
	KSV	Not provided			
Operating Temperature	Housing	-10 to 55˚C			
	Electrode	-20 to 60˚C			
Maximum Pressure		1 MPa			
Maximum Humidity		85% RH			
Material	Housing	ADC12			
	Electrode	304SS*			
	Insulator	PTFE*			
	O-ring	FPM/FKM*			
Cable Entry		G1/2			
Protection		IP65			
Length of Electrode	Standard	250mm			
	Option	50 to 4000mm			

*Other materials are available.

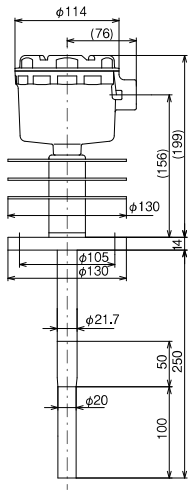
*Specification of products shall be changed by the application and operational condition.

Technical Note

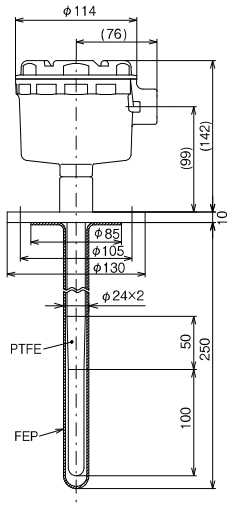
- The heat resistive type is optionally available up to 400˚C.
- Form detection and insulated tube types are optionally available.

3NH	3FH	4NH	4FH
Heavy duty		Heavy duty Heat proof	
			
R1	JIS5K25A	R1	JIS5K25A
100 to 120V AC, 200 to 240V AC or 24V DC			
100/200, 110/220, 120/240V AV or 24V DC			
Approx. 2.5VA Max.			
Approx. 2.2VA Max.			
1 SPDT, 250V 3A AC, 30V 3A DC (Resistive) C-A: Normally Open contact C-B: Normally Closed contact			
Adjustable between 0.5 to 10 seconds			
Not provided			
-10 to 55˚C		-10 to 55˚C	
-20 to 60˚C		-20 to 180˚C	
1 MPa			
85% RH			
ADC12			
304SS*			
PTFE*			
FPM/FKM*			
G1/2			
IP65			
250mm			
50 to 4000mm			

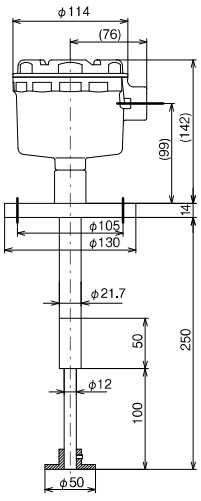
Code-T
Heat resistive



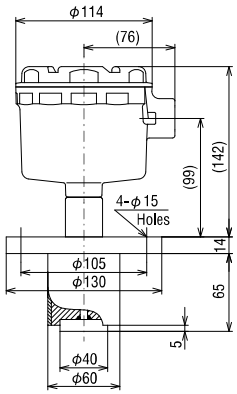
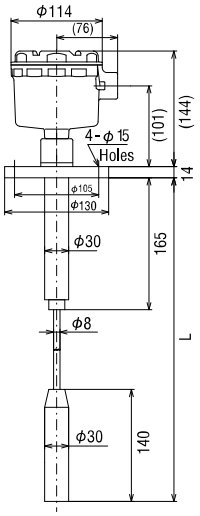
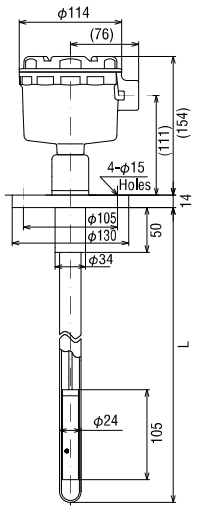
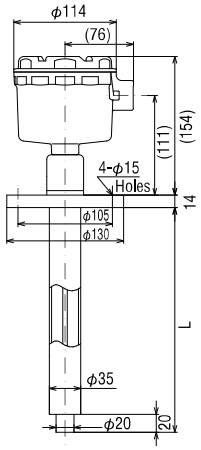
Code-P
Insulated electrode



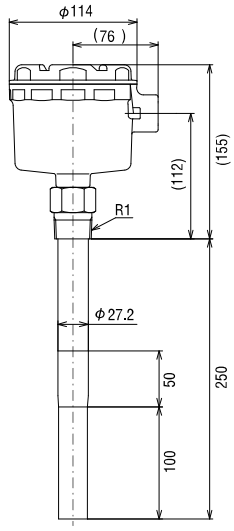
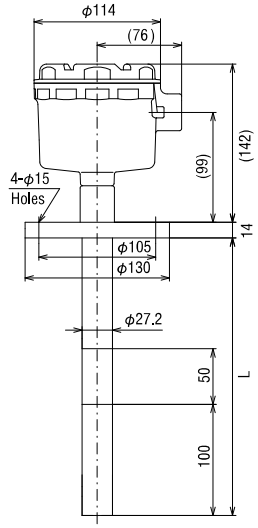
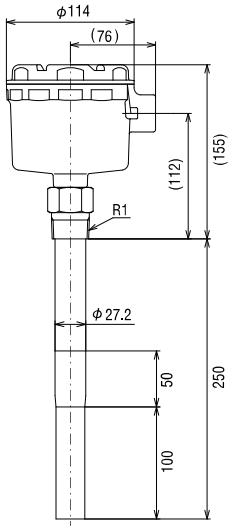
Code-A
Foam detection



Specifications

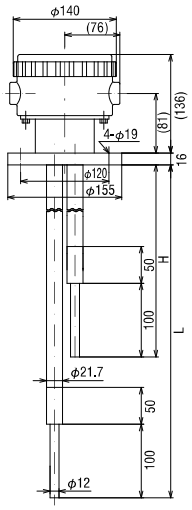
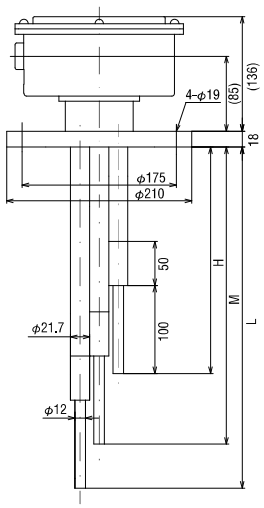
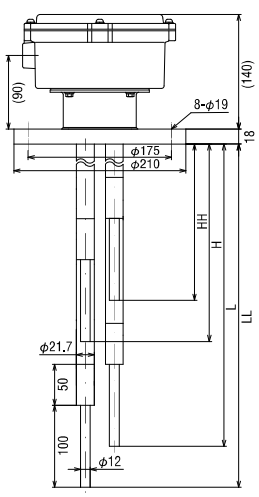
Model		5FH	6FH	7FH	8FH
Description		Flash probe	Wire extension	Pipe type	Stick proof type
Drawing					
Mounting		JIS5K50A	JIS5K50A	JIS5K50A	JIS5K50A
Supply Power	KRV	100 to 120V AC, 200 to 240V AC or 24V DC			
	KSV	100/200, 110/220, 120/240V AV or 24V DC			
Power Consumption	KRV	Approx. 2.5VA Max.			
	KSV	Approx. 2.2VA Max.			
Relay Output		1 SPDT, 250V 3A AC, 30V 3A DC (Resistive) C-A: Normally Open contact C-B: Normally Closed contact			
Detection Time Delay	KRV	Adjustable between 0.5 to 10 seconds			
	KSV	Not provided			
Operating Temperature	Housing	–10 to 55˚C			
	Electrode	–20 to 60˚C			
Maximum Pressure		1 MPa	500 kPa	100 kPa	1 MPa
Maximum Humidity		85% RH			
Material	Housing	ADC12			
	Electrode	304SS*		C3604BD	304SS*
	Insulator	PE*		FEP (Pipe)	FRP
	O-ring	FPM/FKM*			
Cable Entry		G1/2			
Protection		IP65			
Length of Electrode	Standard	65mm	1000mm	250mm	
	Option	5 to 500mm	500 to 10000mm	50 to 4000mm	

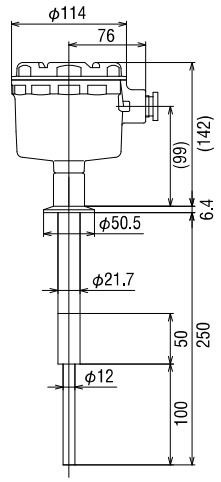
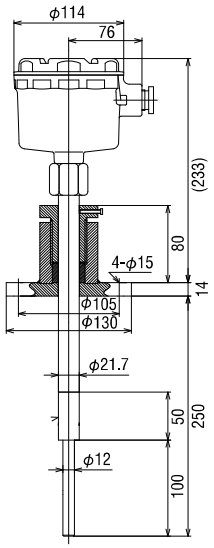
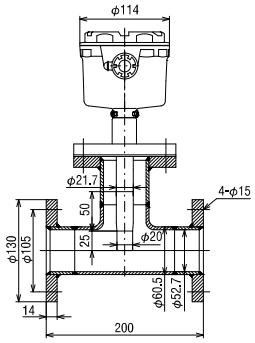
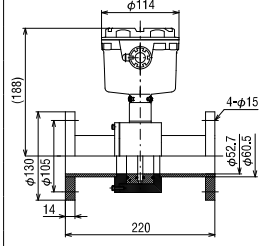
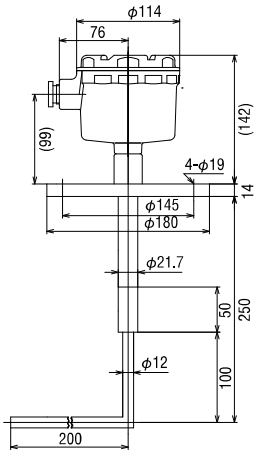
*Other materials are available.

9NH	9FH	25FH
Special type		High Sensitivity
		
R1	JIS5K50A	JIS5K50A
100 to 120V AC, 200 to 240V AC or 24V DC		
100/200, 110/220, 120/240V AV or 24V DC		
Approx. 2.5VA Max.		
Approx. 2.2VA Max.		
1 SPDT, 250V 3A AC, 30V 3A DC (Resistive) C-A: Normally Open contact C-B: Normally Closed contact		
Adjustable between 0.5 to 10 seconds		
Not provided		
–10 to 55˚C		
–20 to 60˚C		
1 MPa		
85% RH		
ADC12		
304SS*		
PTFE*		
FPM/FKM*		
G1/2		
IP65		
250mm		
50 to 4000mm		

Special type of sensor

Specifications

Description		2 points detection	3 points detection	4 points detection
Drawing				
Application		Multi points detection by one sensor		
Adaptive Model of PCB		KRV, KSV, KRS (The shape of housing is different for separation type.)		
Mounting		JIS5K50A	JIS5K80A	JIS5K100A
Material	Housing	ADC12		
	Electrode	304SS		
	Insulator	PE (Option: PTFE, Ceramic, etc.)		
Maximum Pressure		1 MPa		
Operation Temp. (Electrode)		-20 to 60˚C		
Power Supply		100V, 200V AC ±10% 50/60Hz (KRV: 100-120/200-240V AC ±10% 50/60Hz)		
Power Consumption		KRV: approx. 2.5VA, KSV: approx. 2.4VA	KRV: approx. 5.6VA, KSV: approx. 3.8VA	KRV: approx. 6.6VA, KSV: approx. 5.6VA
Relay Output		250V 3A AC, 30V 3A DC (Resistive)		
Insulation Resistance		100 Ω or more, 500V DC		
Withstand Voltage		1500V AC, 1 Minute		
Vibration Proof		10 to 55 Hz (Amplitude 1.5mm)		
Maximum Humidity		85% RH		

Sanitary Flange	Slide Flange	Pipe line A	Pipe Line B	Horizontal mounting
				
Foods & Beverage	Detection point changeable	Detect liquid inside of pipe		No space at the top of tank
KRV, KSV, KRS, KST, KRT, KRE65, KSD, KRD, KUV, KUD				
Sanitary 1.5S	JIS5K50A			JIS5K80A
ADC12				
304SS				
PE (Option: PTFE, Ceramic, etc.)				
1 MPa	–	1 MPa		
-20 to 60˚C				
100V, 200V AC ±10% 50/60Hz (KRV: 100-120/200-240V AC ±10% 50/60Hz)				
Approx. 4VA (KRV・KRE65: approx. 2.5VA, KSV・KUV: approx. 2.2VA)				
250V 3A AC, 30V 3A DC (Resistive)				
100 Ω or more, 500V DC				
1500V AC, 1 Minute				
10 to 55 Hz (Amplitude 1.5mm)				
85% RH				

MODEL KRE, KRD, KSD

INTRINSIC SAFETY CAPACITANCE LEVEL SENSOR

Features

- Usable in hazardous location
- Up to 200 meters separation distance
- Adjustable at remote safe location

Approvals

i3aG5 for KRE and KRD system
i3nG5 for KSD system

Technical Notes:

1. Since these systems are approved as the complete assembly, place your order for the sensor and the amplifier together.
2. Return these systems to NOHKEN for repair and/or replacement, when modification, disassembly, or replacement of parts is needed.

General Description

For application in hazardous area, the KRE, KRD, and KSD series are recommended. Model KRE and KRD system are approved as intrinsically safe of i3aG5 and Model KSD system is approved as intrinsically safe of i3nG5 by Technical Institute of Industrial Safety (TIIS), Japanese Ministry of Labor.

The remote amplifier of these systems can be mounted up to 200 meters away from sensor. All field adjustments are made at remote safe location. KRE6000 is outdoor use, and KRE6200, KRI and KSI is indoor use.

Recommended cable for KRE is RG62A/U which can not be shorten or extended at site. Therefore, separation distance has to be informed, when you order. The 3-core shielded cable of CVVS-3C is recommended for KRD and KSD. This cable can be shorten or extended at site. Therefore, it is convenience for you when you do not know the separation distance.

Ordering Information

1. Sensor

KRE65	Intrinsically safe for outdoor and indoor use
KRD	Intrinsically safe for indoor use
KSD	Intrinsically safe for indoor use
2	Standard
3	Heavy duty
5	Flat probe
6	Wire extension
9	High sensitivity
N	Plug mounting
F	Flange mounting
T	with heat radiation fin
P	FEP tubing (for 2F only)
PT	FEP tubing with heat radiation fin (for 2F only)
A	Foam detection
H	New Housing for KRD & KSD
0	Flat-face flange
1	Raised-face flange
4	Plug mounting
J	JIS flange
A	ANSI flange
D	DIN flange
G	G plug
R	R plug
T	NPT plug
S	304 stainless steel
S6	316 stainless steel
F	Insulator, PTFE for 2, 3, 9, and PE for 5, 6.
0	Viton shield
1	Kalrez shield
2	Perfluore shield
▪▪▪▪	Specify the probe length

KRE65	2	N			4	R	S	F	0	250	= KRE65-2N-4RSF0-250
KRD	2	N		H	4	R	S	F	0	250	= KRD-2NH-4RSF0-250

* The mounting size should be specified when you order.
* The length of electrode and insulator should be specified in mm if required.
* The separation distance and medium must be informed when you order for sensitivity setting.
* The operating temp, and pressure should be informed for correct model selection.

2. Amplifier

KRE6000	Connect with KRE65 for mounting at site
KRE6200	Connect with KRE65 for mounting indoor
KRI	Connect with KRD
KSI	Connect with KSD
1	100/200V AC
2	110/220V AC
3	120/240V AC for KRI and KSI

KRE6000	1	=KRE6000-1

Specifications

Sensor

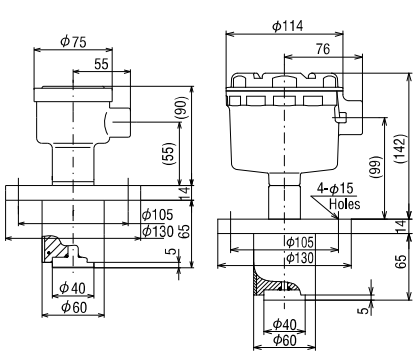
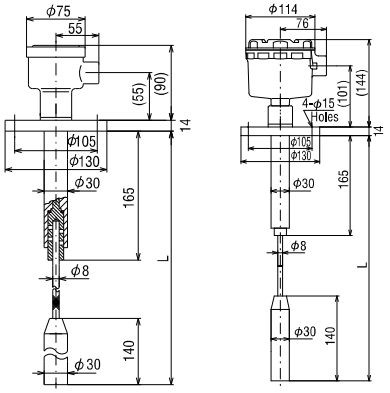
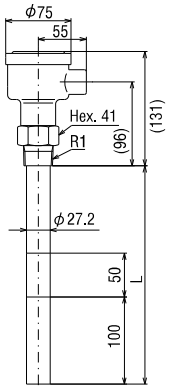
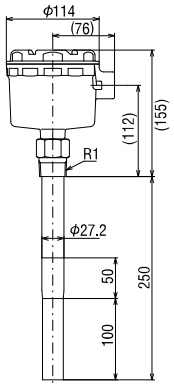
Model		2N	2F	3N	3F
Description		Standard		Heavy duty	
Drawing		KRE	KRD/KSD	KRE	KRD/KSD
Mounting		R3/4	JIS5K25A	R1	JIS5K25A
Operating Temperature	Housing	-10 to 40˚C (Recognized by TIIS for using in hazardous location)			
	Electrode	-20 to 60˚C (180˚C Max. for Heat proof type)			
Maximum Pressure		1 MPa		3 MPa	
Maximum Humidity		85% RH			
Material	Housing	ADC12			
	Electrode	304SS*			
	Insulator	PTFE*			
	O-ring	FPM/FKM			
Cable Entry		G1/2			
Protection		IP65			
Length of Electrode	Standard	250mm			
	Option	50 to 4000mm		100 to 1000mm	

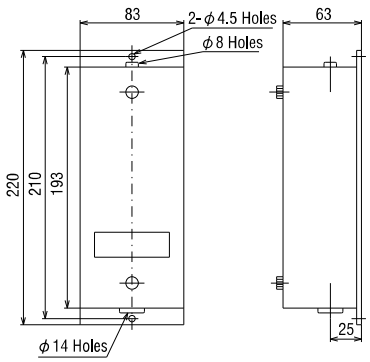
*Other materials are available.

*The specification of products shall be changed by the application and operational condition.

Amplifier

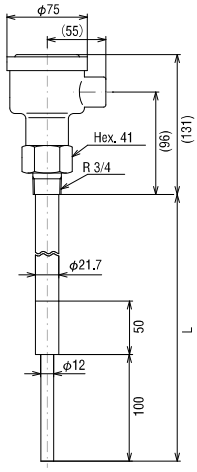
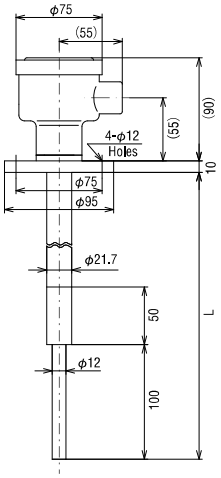
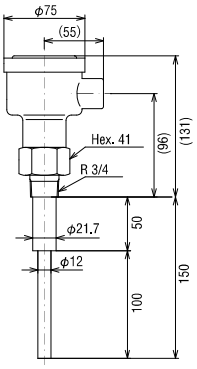
Model	KRE6000	KRE6200
Drawing		
Supply Power	100/200, 110/220V AC, 50/60Hz	
Power Consumption	Approx. 2.5VA Max.	
Relay Output	1 SPDT, 250V 2A AC/30V 2A DC (Resistive) C-A: Normally Open contact C-B: Normally Closed contact	
Operating Temperature	-10 to 40˚C	
Maximum Humidity	85% RH	
Sensitivity	0.5 to 4000pF	
Material	AC	Steel structure and Acryl
Cable Entries	3-G1/2	ϕ10 and ϕ16 holes
Protection	IP54	IP10
Recommended Cable	RG 62 A/U	

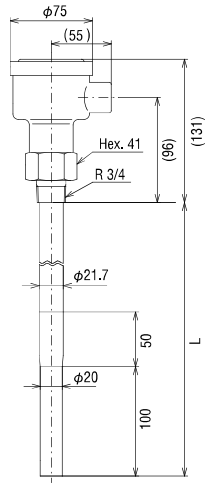
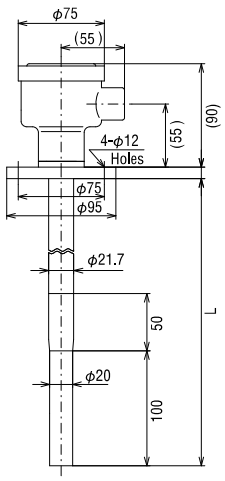
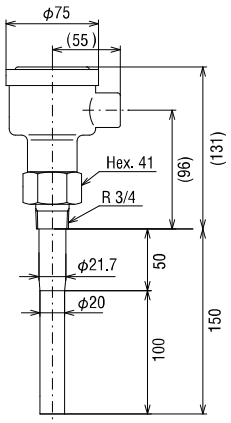
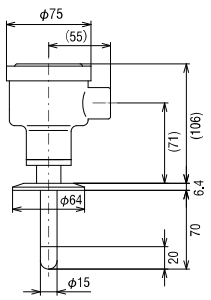
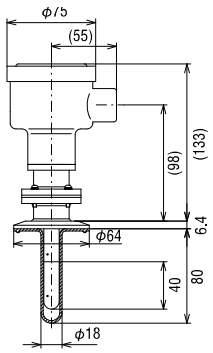
5F	6F	9N	9F
Flat probe	Wire extension	High sensitivity	
KRE KRD/KSD	KRE KRD/KSD	KRE	KRD/KSD
			
JIS5K50A	JIS5K50A	R1	JIS5K50A
−10 to 40˚C (Recognized by TIIS for using in hazardous location)			
−20 to 60˚C (180˚C Max. for Heat proof type)			
1 MPa	500 kPa	1 MPa	
85% RH			
ADC12			
304SS*			
PE*		PTFE*	
FPM/FKM			
G1/2			
IP65			
65mm	1000mm	250mm	
5 to 500mm	500 to 10000mm	50 to 4000mm	

KRI/KSI

100/200, 110/220, 120/240V AC 50/60Hz
Approx. 4VA Max.
1 SPDT, 250V 2A AC/30V 2A DC (Resistive) C-A: Normally Open contact C-B: Normally Closed contact
−10 to 40˚C
85% RH
More than 5pF or 90pF
Steel structure
ϕ8 and ϕ12 holes
IP10
3-core shielded cable

Compact Type of Sensor

Specifications

Model		1N	1F	1N
Description		Standard		Compact
Drawing				
Adaptive Model of PCB		KSC, KRC, (KRC-1N/1F for RoHS)		
Mounting		R3/4	JIS5K25A	R3/4
Material	Housing	ADC12		
	Electrode	304SS		
	Insulator	PE		
Operation Temperature	Housing	-20 to 50˚C		
	Electrode	60˚C Max.		
Maximum Pressure		1 MPa		
Maximum Humidity		85% RH		
Power Supply		24V DC (±10%)		
Power Consumption		0.8W Max. without load, (RoHS product: 0.9W Max. without load)		
Output		Voltage output: 1V DC or less, 22V DC or more / NPN Transistor output, 100mA Max		
Delay Timer		Adjustable between 0.5 to 10 seconds		
Protection		IP65		
Cable entry		G1/2		
Length of electrode		250mm		150mm

2N	2F	2N	9F	9FPT
Standard		Compact	Special Sanitary	Heat proof Sanitary
				
KSC, KRC, (KRC-1N/1F for RoHS)				
R3/4	JIS5K25A	R3/4	ISO 2"	
ADC12				
304SS				
PE				
-20 to 50˚C				
60˚C Max.				150˚C Max.
1 MPa				100 kPa
85% RH				
24V DC (±10%)				
0.8W Max. without load, (RoHS product: 0.9W Max. without load)				
Voltage output: 1V DC or less, 22V DC or more / NPN Transistor output, 100mA Max				
Adjustable between 0.5 to 10 seconds				
IP65				
G1/2				
250mm		150mm	70mm	80mm