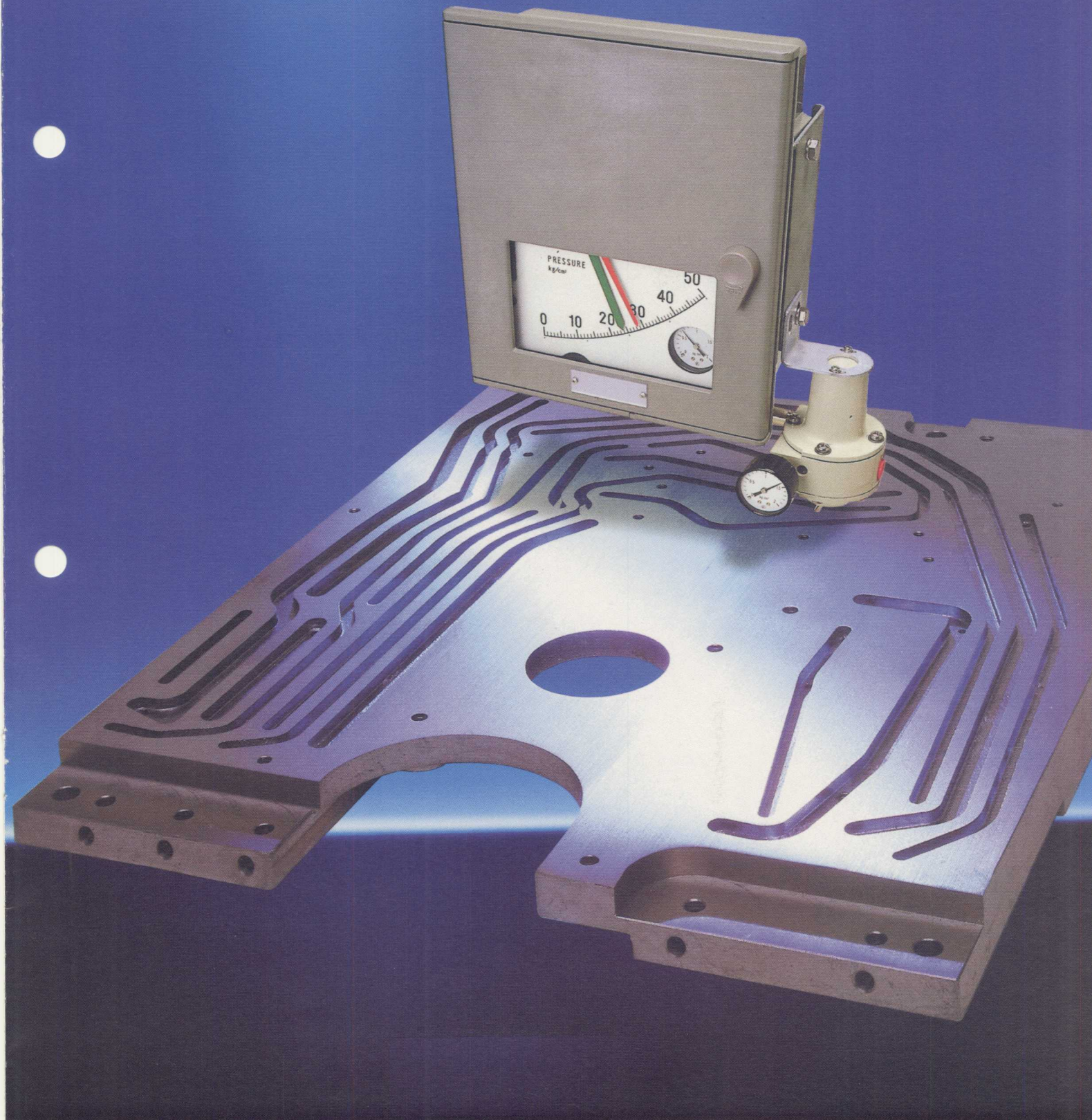
YAMATAKE

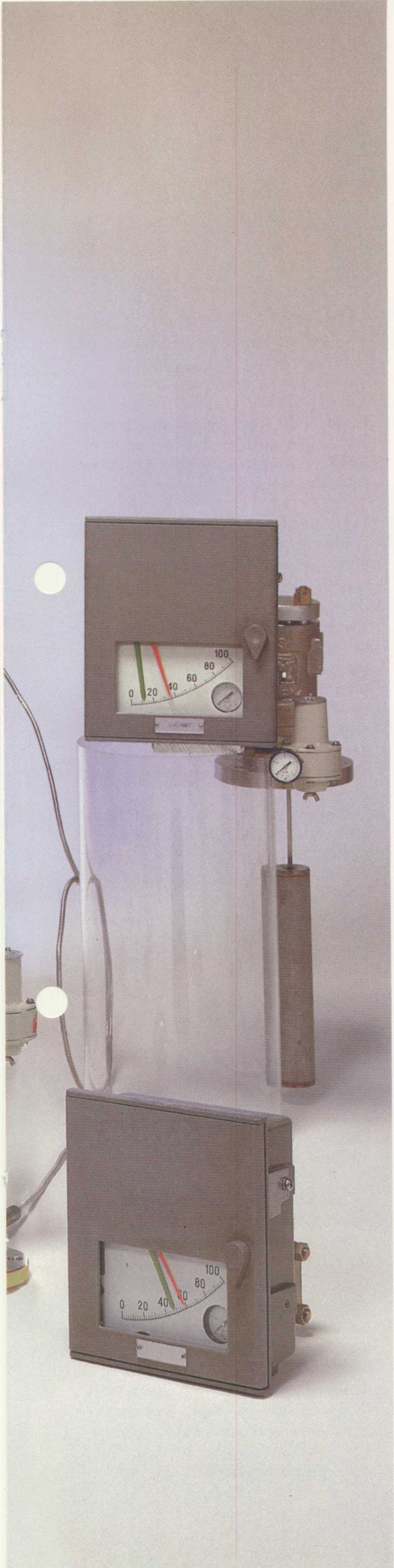
FIELD MOUNTED CONTROLLERS

K.F series



KFseries

The Flexibility to Cover All These Process Variables



The KF Series of Field Mounted Indicating Controllers provides both application flexibility and instrumentation savings by employing a common type of indicating control section in each instrument. All process variables, such as temperature, pressure, level and flow, can be measured and controlled by the same type of instrument. The difference is only in the detector. Thus, the KF Series provides model simplicity and uniformity, and requires very little in the way of maintenance.

The KF Series comprises not only Indicating Transmitters but also Indicating Transmitting Controllers.

Temperature

Gas-filled sensors are used for measurement of high temperatures and liquid-filled sensors for low temperatures. Both types are incorporated with a compensator for ambient temperature changes. A bellows, which generates a larger torque in response to liquid or gas-filled pressure changes reflecting process temperature changes, is used in the pressure receiver section, thereby improving resistance against vibration.

Liquid Level

Detectors for measurements of top surface levels, boundary surface levels, and specific gravities are available. Displacement-type level meters come in a torque tube model which is applicable to liquids of both low and high temperatures, and in a damping model which is incorporated with a variable damping mechanism. Specific requirements such as measurement of large liquid span or level control of viscous liquid can be dealt with by Model KFD.

Pressure

Pressure detectors are available in fixed range and variable range types. Fixed-range detectors come in a bellows or spiral model, while variable-range detectors are available in bourdon tube, bellows, remote sealed, and diaphragm models.

The largest problem with instruments which employ a spiral element--that they are highly susceptible to vibration--has been solved by employing a balancing weight, picking up the deflection angle from the center of the element and preventing any ways from the center of detection.

Flow

Measurement can cover a wide total flow range by using the differential pressure sensing element of the PREX 3000 Series Differential Pressure Transmitter.

Features

• Numerous Functions and Flexible Expandability of Control Operations

With just a screwdriver, the user can easily and securely alter, add or delete functions and replace a transmitter unit, an external SP setting mechanism (pneumatic pressure setting), a manual loader (with an auto/manual switch), a batch switch and an external reset mechanism. Therefore, the user can obtain numerous functional combinations that meet particular requirements.

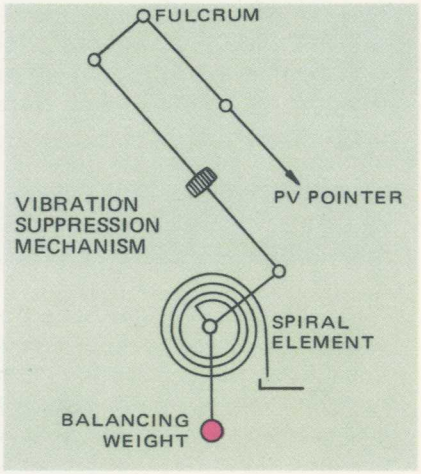
• High Reliability

The KF Series uses pneumatic circuit boards in place of the plastic tubing which had been a major source of troubled. High functional reliability is achieved by the adoption of twin bellows to ensure extended stability and by the use of a balancing weight to improve vibration resistance. Rugged metal case provides protection against environmental conditions. Basic design considerations are high reliability and easy operation.

• Stabling Operations

<Pressure Measurement>

All spiral elements are provided with a balancing weight to suppress vibration of the PV pointer, the measuring deflection angle is detected from the center axis, and away of the center axis is suppressed.

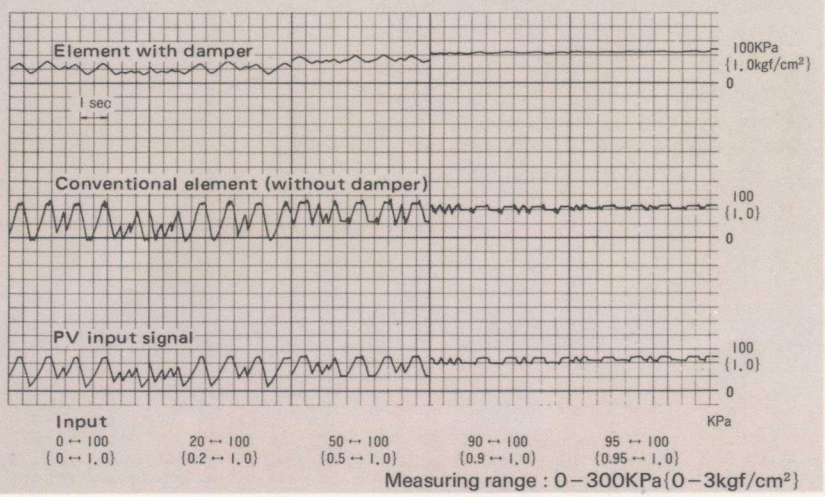


<Temperature Measurement>

A spiral element has hitherto been used for the pressure receiving element which converts into mechanical displacement the fluid-filled volume change or pressure change in response to a temperature change. The KF Series employs a bellows element which provided a sufficiently large torque so as not to be affected by vibration. As is the case for the spiral element for pressure measurement, a balancing weight is incorporated to suppress vibration of the PV pointer.

Example of Response to Pulsating Pressure Signal

The below chart shows the response characteristics of a conventional element and those of the element with a damper to the same input pressure signal. The chart reveals that the damper-equipped element responds sufficiently rapidly to the lower frequency components of the input signal while it suppresses the higher frequency components which adversely affect the instrument's operation or ever cause damage in extreme cases.



Measuring range : 0–300KPa{0–3kgf/cm²}

• Foolproof Structure

Only phillips head "+" screws are used for fixing and only plain "–" screws for adjusting instruments. This distinction helps prevent troubles that could occur from the use of improper screws. Mistakes in mounting are structurally prevented, ensuring correct unit replacement.

• Damping for Pulsating Pressure Measurement

There are many cases in which process pressures pulsate and measurement cannot be readily made. Typical are those encountered when measuring delivery pressures of reciprocating pumps. To smooth out the pulsating pressure signal and make a successful measurement, a restrictor and a capacity chamber have been used. This method, however, has always been threatened by clogging of the restrictor.

Yamatake has developed spiral elements which are incorporated with a damper for measurement of pulsating pressure signals. The reliability of these spiral elements has been proven through actual applications in the field. They have no restrictors and are safe from clogging.

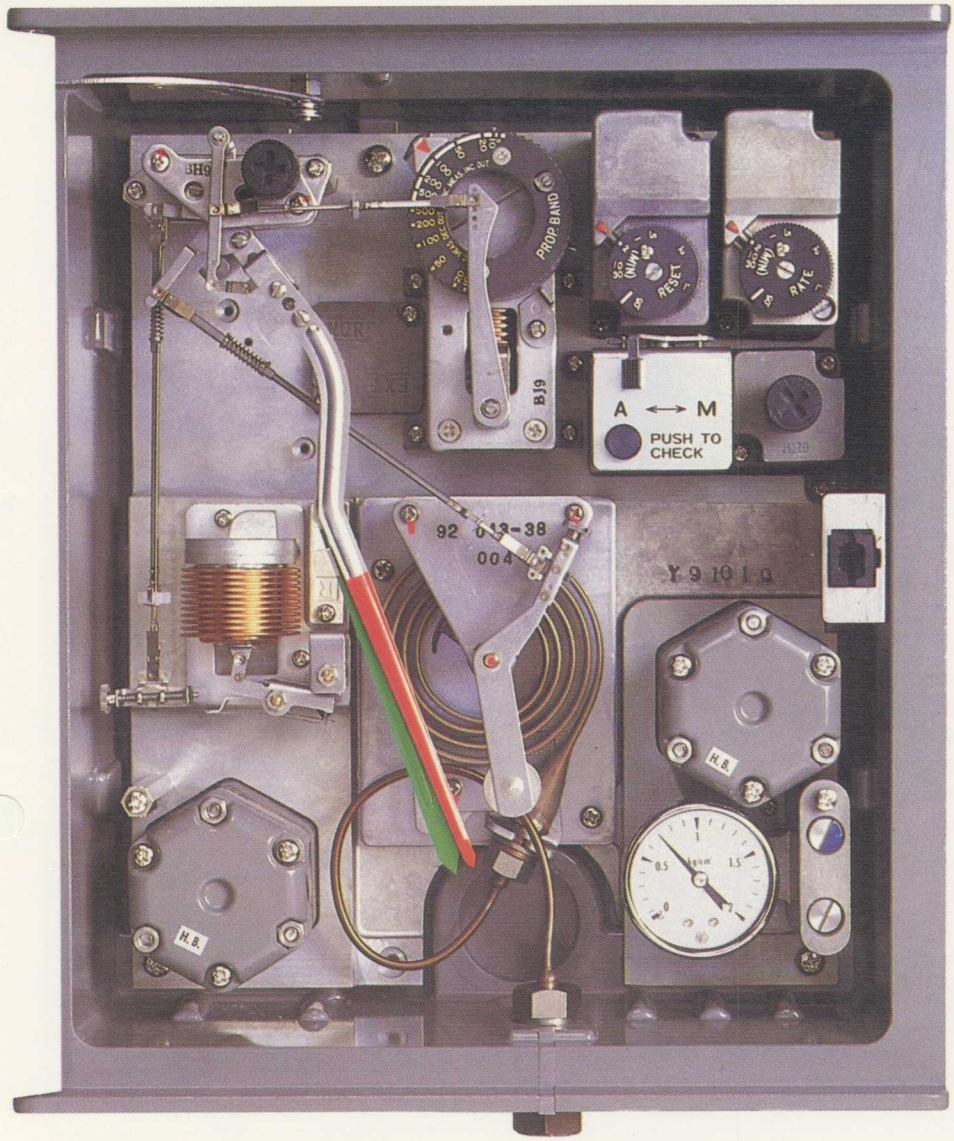
• Coexistence of All Functions

Through the efficient use of space inside the case, the KF Series has realized the coexistence of many functions in one instrument.
Yamatake believes that this ensures the versatility of the series, meeting the user's every need now and in the future.

• Cost Savings with Standardized Components

The measuring elements of the KF Series instruments are interchangeable with those of the large variety of other Yamatake pneumatic transmitters. Within the series, all components except measuring elements are interchangeable. With these standardized components, instrument functions can be freely modified or expanded, and application flexibility and instrumentation savings have been greatly enhanced.

Configuration



• Pneumatic Circuit Board

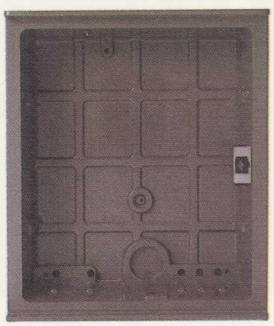
This is structurally rugged to provide protection from the environment and trouble-free operation and maintenance, due to the simple configuration of these functional units.

Free from spider web tubing, it promises environmental protection against various harsh conditions expected in the field.

• Case

The KF Series cases are diecast aluminum alloy with inflammable heat-processed fiberglass-reinforced polyester.

This provides extra protection against various environmental conditions that meet JIS F8001 Type 3 Splashproof, NAMA 3 or IP 54 Dust and Waterproof.



Case

• Controller Unit

Among the numerous control modes are P, PI, PID, PD, batch, on-off, differential gap, manual reset and external reset.

■ P (Proportional band) Action Unit

Proportional band setting ranges from 5% to 500%, and the unit can deal with process control of any time constant.

■ I (Integral), D (Derivative) Action Unit

Both integral time and derivative time can be set freely within the range of 0.05 ~ 30 minutes. The user can choose an optimum PID setting for any of process.

■ Batch Switch

A batch switch is used to control a batch process or any other process that starts with a large deviation. It helps prevent reset wind-up and assures optimum control with less overshoot because the signal for a predicted external load can be fed from an external reset signal connection port.

■ On-Off Action Unit

An on-off controller is available by removing reset and feedback bellows from an ordinary PI controller. It is used for liquid level control characterized by a large time constant and comparatively small dead time.

■ Differential Gap Action Unit

By use of reset bellows, this unit applies positive feedback. The gap width can be set freely in the range of 1% to 100%.

This unit should be used when on-off switching is repeated so often that undesirable effects may occur to final control elements.

• Remote Setpoint Unit and PV Signal Transmitting Unit

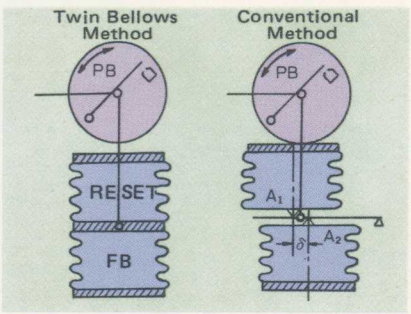
The remote setpoint unit is employed to set SP by use of external penumatic pressure. The KF Series permits the coexistence of the remote setpoint unit and the PV signal transmitting unit, which converts a measured variable into a pneumatic pressure 20~100KPa{0.2 – 1.0kgf/cm²}

• Manual Controller Unit

It is easy to mount a manual controller unit with an auto/manual transfer switch. For bumpless auto/manual switching, match manual output to automatic output by pushing the check button to adjust manual output.

• Twin Bellows

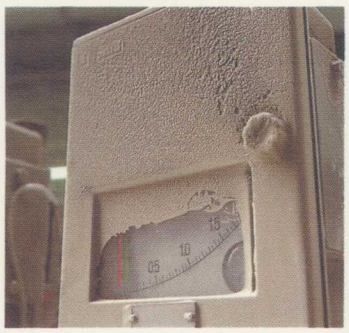
The conventional method requires matching or reset bellows and feedback bellows and incorporates deviation δ to eliminate the difference between their effective areas($A_1 - A_2$) and/or characteristics. The twin bellows employed for the KF controller is fabricated from a single piece of material and offers marvelous stability for an extended period, because it was born with a natural match.



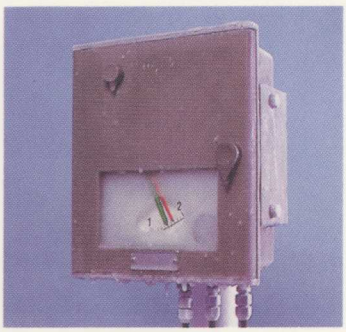
Specifications

Performance	Indicating Accuracy	± 1% FS
	Repeatability	0.3% FS or better
	Dead Zone	0.2% FS or better
Indication	Deflection Angle	44 degrees
	Scale Length	150 mm
	Pointers	PV (red) and SP (green)
	Output Indicating Meter	Scale range : 0~200KPa{0~2kgf/cm²}indicating accuracy : ±3% FS
Control Setting	Local Setting	Internal setting (with knob) or external setting
	Remote Setting	With pneumatic pressure 20~100KPa{0.2~1.0kgf/cm²}
	Setting Range	0 ~ 100% FS
Controller	Control Actions	P + Manual reset, PI, PID, PD + Manual reset, PI + Batch, On-Off, Differential gap, P + External reset, and PD + External reset
	Proportional Band (P)	5 ~ 500% (direct or reverse action)
	Integral Time (I)	0.05 ~ 30 minutes
	Derivative Time (D)	0.05 ~ 30 minutes
	Differential Gap Width	1 ~ 100% FS, adjustable
	Batch Setting Pressure	60~110KPa{0.6~1.1kgf/cm²}, adjustable
	External Reset Pressure	20~100KPa{0.2~1.0kgf/cm²}
General Specifications	Manual Reset	0 ~ 100% FS, adjustable (by pneumatic pressure setting)
	Output	20~100KPa{0.2~1.0kgf/cm²}, or 0~140KPa{0 or 1.4kgf/cm²}(for on-off control or differential gap control)
	Minimum Load	ID 4 mm x 3 m + 20 cm³
	Air Supply Pressure	140±14KPa{1.4±0.14kgf/cm²},
	Air Consumption (when balanced at 50% output)	Indicating transmitter: 4 Nℓ/min. Indicating controller: 4 Nℓ/min. Indicating controller + Pneumatic Transmitter: 8 Nℓ/min. Indication only: 0 Manual controller: +3 Nℓ/min. (The above figures are for the fixed-range type instruments.)
	Air Supply Capacity	Pneumatic transmission: 40 Nℓ/min. Manual control: 30 Nℓ/min. Output: 40 Nℓ/min.
	Air Connections	Rc1/4 or 1/4NPT, internal thread
	Ambient Temperature	–30 to +80°C
	Ambient Humidity	10 to 90% RH
	Enclosure	Applicable standards for case: Splashproof and dustproof structure: JIS F8001 Class 3 Splashproof, NEMA 3, IEC IP54 Vibration resistance: Lloyd Regulation or equivalent Materials Case: Aluminium diecast Door: Glass-fiber-reinforced polyester resin Case Finish: Baked acryl paint (Corrosion-resistant paint and silver paint optional)
	Mounting	KFT (Temperature), KFP (Pressure, Fixed range): Wall mount, 2-in. pipe mount, or panel flush mount KFK (Pressure, Variable Range): 2-in. pipe mount or panel flush mount KFD (Differential pressure): 2-in. pipe mount, panel flush mount, or direct mount on process KFL (Liquid level): Direct mount on process

▲ Splashproof



▲ Dustproof

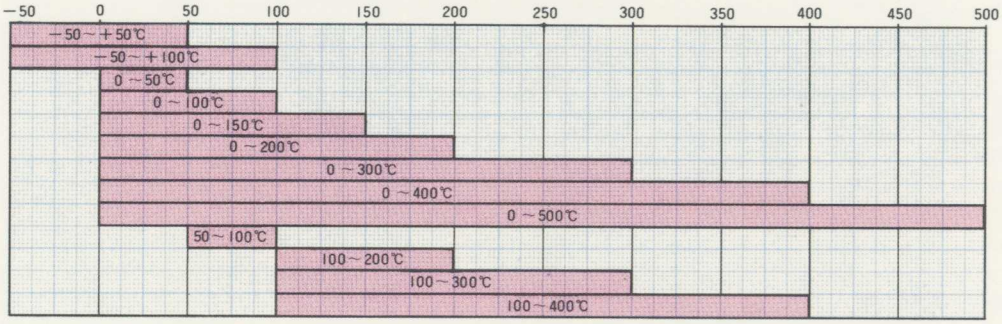


▲ Sub-zero temperature resistance

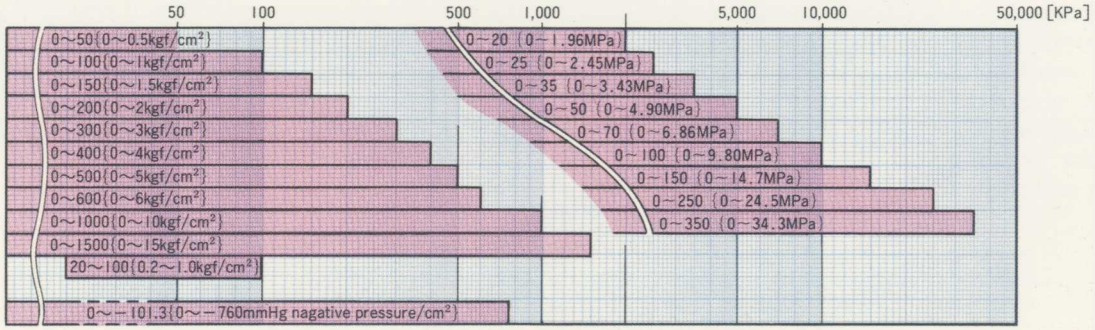
Wide Range

Table of Measuring Ranges

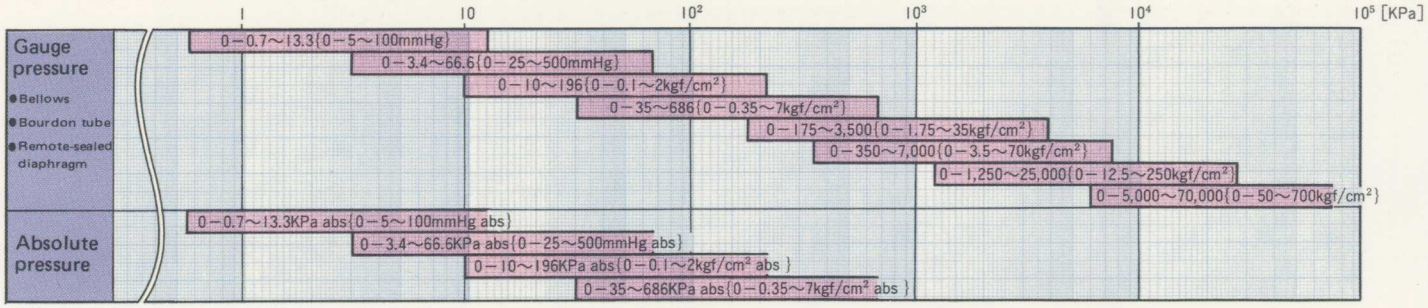
● Model KFT Temperature Indicating Controllers



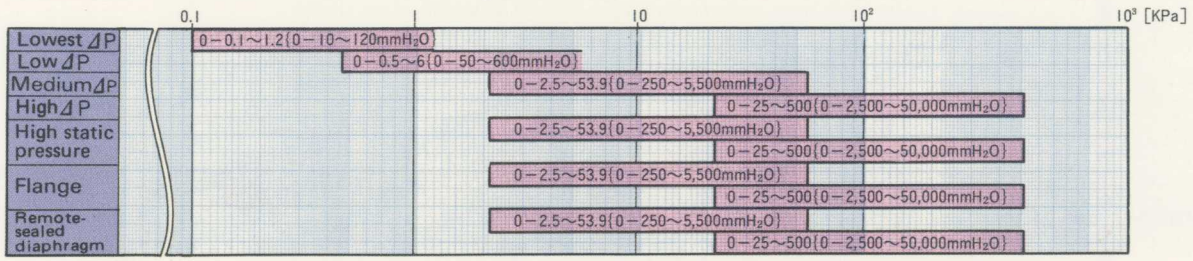
● Model KFP (Fixed Range) Pressure Indicating Controllers



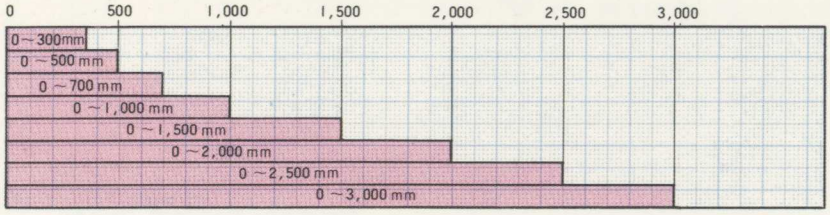
● Model KFK (Variable Range) Pressure Indicating Controllers



● Model KFD Differential Pressure Indicating Controllers



● Model KFL Liquid Level Indicating Controllers



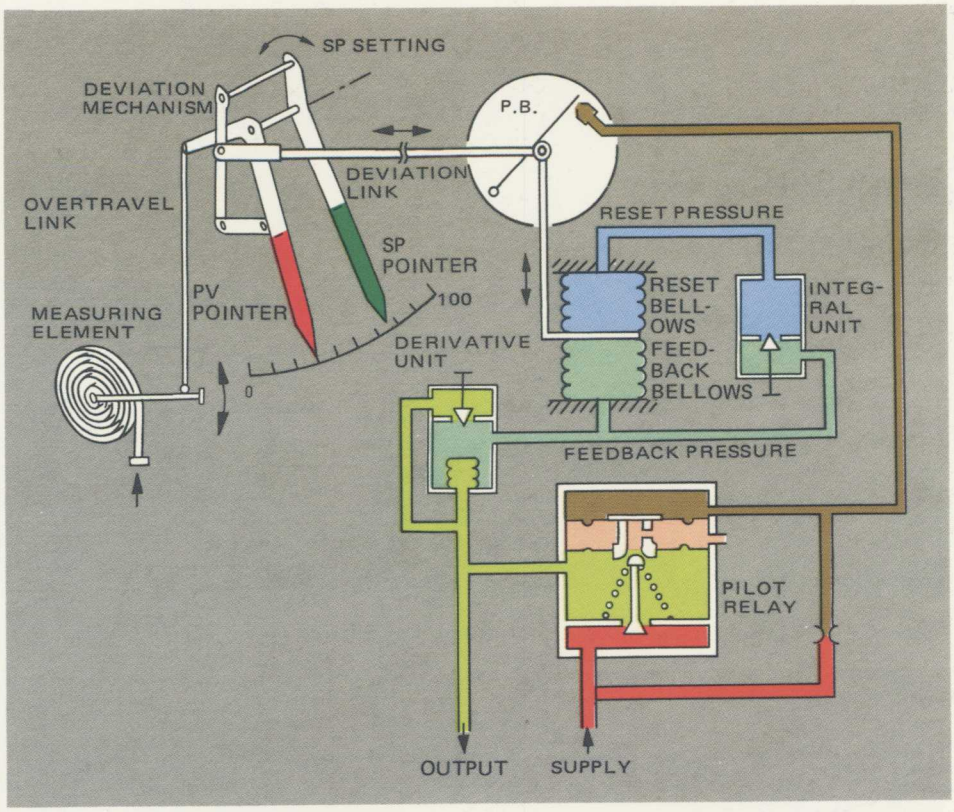
Principles of Operation

How does the KF Series operate? The figure briefly illustrates the principle of operation of the PID controller.

The displacement of PV value is detected by the measuring element and transmitted to the deviation mechanism through an overtravel protected link. Then it is compared with the SP value and a deviation signal is generated.

The displacement, proportional to the deviation, is transmitted to the controller from the deviation link. It moves the flapper, changes the back pressure in the nozzle and controls the pilot relay output. Part of the output passes through the differential unit, gives feedback pressure and produces reset pressure in the integral unit to balance the controller.

In the case of the P action controller, the pressure on the reset bellows is fixed. Reset pressure is set either manually (manual reset) or externally with pneumatic pressure signals (external reset). For differential gap or on-off action, the user simply has to replace the P action unit with a unit of the desired action.



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Saving through Automation

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