

Proposal to Fukuda Test Environment Solution

- Fukuda proposes using standard test circuits that adapt to client measurement conditions for the air leak tester in order to operate under optimal conditions.

FUKUDATESTENVIRONMENT SOLUTION

| Work Property | Work Condition | Seal Device | Measurement Method | Equipment Condition | Operation Process | Temperature Setting | Equipment Setting | Plant Environment |
|---|--|--|--|---|--|---|---|---|
| Material, Structure, Temperature, Resisting Pressure, Pressure Property, Dispersion | Moisture, Oil, Germs, Corrosion, Dirt, Environmental Pollution | Seal Material, Seal Structure, Stability, Reproducibility, Performance | Pressure, Flow, Direct Pressure, Differential Pressure, Hydrogen, Helium, Sealed Product | Piping Material, Manual, Automatic, Original Pressure Control, Lock | Preceding Process, Subsequent Process, Transporting Device | Work Temperature, Air Temperature, Sounding Temperature | Air Control, Management Equipment, Vibration, Noise, Exhaust Disposal | Air Conditioning, Lighting, Misting, Soot, Dust |

Proposal to Fukuda Test Environment Solution

The air leak test has been widely used in a variety of production lines as an economically efficient and automatic seal test method. However, increased quality and shorter production time are now under serious consideration as a result of changing needs by the customer, direct environmental issues, escalating costs and competition.

This state of affairs is common in the seal test process field, and it is implausible to expect an improvement in test specifications or decrease in tact time using the conventional system. One possible solution involves preparing 2 seal testers; however, this approach will not show any real benefit to the customer. As a result, FUKUDA proposed to accommodate for this by creating a more favorable set of environmental and measurement conditions for the air leak tester.

The air leak test is a simple test method performed by pressurizing (or evacuating) the inside of test objects with air before sealing the container. It then detects the pressure variation inside the test object to confirm if a leak is present. However, as the pressure changes due to temperature and volume variation, this testing method is not always 100% accurate. Moreover, if test specifications become unstable, precise measurement cannot be guaranteed if conditions are not sufficient to suppress any variations. In addition, only experienced Engineers can identify factors that can cause pressure to vary (not including leaks) within the measurement environment.

FUKUDA has manufactured standard test circuits that can be applied to various measurement conditions, and the customer can use them in alliance with FUKUDA's technologies that have been refined for over 50 years.

Contents

| | Page |
|---|----------|
| ■ Selection of the Measurement System | 2 |
| ● Selection by the work volume and test pressure | |
| ● Selection according to the work characteristics and the environment condition | |
| ■ System Examples | 3 |
| ■ Seal Test Circuit | |
| ● Common Seal Test Circuit | 4 ~ 5 |
| ● Automobile Fuel Tank Seal Test (Low pressure and large volume test) | SET-001 |
| ● Engine Assembly Seal Test (Complex test) | SET-002 |
| ● Injector Seal Test (Small volume test) | SET-003 |
| ● Lamp Cover Seal Test (Small pressure test) | SET-004 |
| ● Hydraulic Control Product Seal Test (High pressure test) | SET-005 |
| ● Resin Intake Manifold (Negative pressure test) | SET-006 |
| ● Waterproof Portable Telephone Seal Test (Hermetic sealed product test) | SET-501 |
| ● Hermetic Type Lamp Cover Seal Test (Simplified hermetic product test) | SET-007 |
| ● Rubber Hose Seal Test (Work/work comparison test) | SET-008 |
| ● Oil Filter Seal Test (Leak side measurement test) | SET-009 |
| ■ Options | |
| ● Air Leak Tester | LPU-300 |
| ● Filter for Tester | KF-101 |
| | KF-201 |
| | KF-202 |
| | KF-203 |
| | KF-901 |
| | KF-902 |
| | KF-903 |
| ● Air Pressure Stabilization Tank | KT-201 |
| ● Primary Regulator | KR-101 |
| | KR-201 |
| | KR-901 |
| | KR-902 |
| ● Test Pressure Regulator | R5 |
| | P-200 |
| | APU |
| | KRZ-0205 |
| | KRZ-0906 |
| | KR-202 |
| | KR-204 |
| | KR-903 |
| | KR-904 |
| | KRZ-0905 |
| ● Test Pressure Switching Valve | KV-201 |
| | KV-202 |
| | KV-101 |
| ● Charge Bypass | KV-201 |
| ● Work Pressure Confirmation | CBU-600 |
| | KM-901 |
| | KM-904 |
| ● Confirmation Gauge | FFM-100 |
| | CAL |
| | KM-903 |
| ● Work Switch Unit | ESV |
| ● Exhaust Bypass | EBU-600 |
| | FE-20 |
| ● Piping Material | KP-901 |
| | KJ-901 |
| ● Leak Tester Switch Unit | D4-001 |
| ● Check Tool | CL-100 |
| | DG-72 |
| ● Stability Standard Container | M-100 |
| ● Transformer | D1-901 |
| ■ Point of View Sheet | 40 ~ 41 |

Selection of the Measurement System

To construct a seal test system that fits the test object product to be seal tested (hereafter referred to as the 'work'), it is necessary to examine the work characteristics in order to select the measurement system and item (consisting in the system) fitting the condition.

■ Selection by Work Volume and Test Pressure

Select the basic items according to the test pressure and the work volume. The pressure and flow rate ranges (capability of pressurization and exhaust) of the selected items are determined according to the following condition: The first process in the leak test is to fill (exhaust) the test pressure inside the work. It is recommended to use large flow rates to pressurize large volumes of work, and also necessary to select pneumatic equipment suitable to the work volume. Also, the pressurization process must be considered to factor in the pressure inside the work to accomplish stable measurement.

Points to be Considered:

- Pipe diameter ensuring the pressurization and evacuation flow rate is suitable for the work volume.
- Test pressure regulator suitable for the work volume, and the evacuation capability of the primary regulator.
- Assurance of the repeatability of the pressurization characteristics.
 - Sensitivity and precision of the test pressure regulator.
- Air source stability to support the instantaneous flow rate during pressurization.
- Pipe diameter of the air pressure source with or without the accumulator tank.

■ Selection According to Work Characteristics and Environment Conditions

It is necessary to select a proper measurement system and items according to individual work characteristics and measurement environment.

The air leak test method is used to test for leaks by measuring the pressure variation inside the sealed work. If pressure variation occurs for reasons other than a leak, correct testing cannot be accomplished. Also, if any factors vary inside the work pressure due to environmental conditions, or changes within the work itself, it becomes necessary to select countermeasures against those factors.

Depending on the condition, it may be necessary to determine the system by observing effects showing from or put to the work.

Points to be Considered:

- **Will the temperature vary?**
In the preceding process (cleaning with warm water)/In the measurement (air conditioner etc.)/ In system (electromagnetic valve etc.)
- **Will the volume vary?**
Work expansion by heating (soft material)/Seal sink down/O-ring displacement
- **Work structure.**
Inside work is complex, and the path is narrow/Existing check valve/Existing porous material (filter etc.).
- **With or without residual material of the preceding process.**
Use the same cleaning agent as in the preceding process
- **Effect to the work.**
Pressure should not exceed a certain value and should not be exposed to humidity.

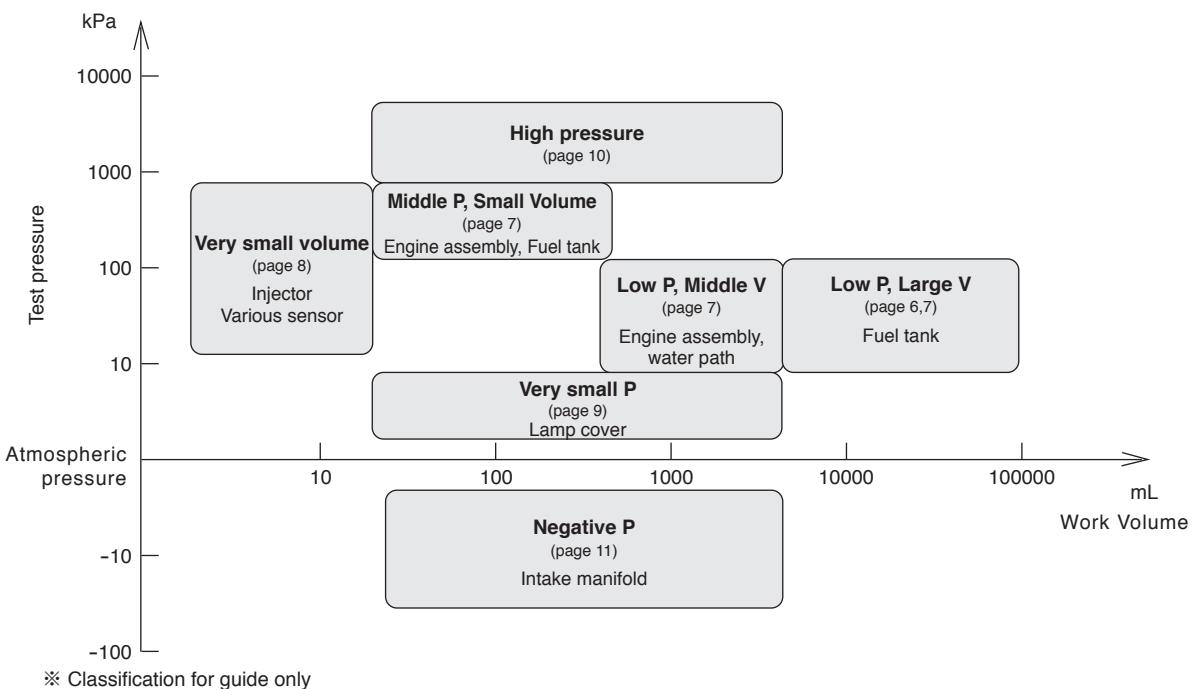
■ System examples

System and Item Selection Examples

| Work Name | Basic Requirement | Additional Requirement | Page | Similar Work |
|----------------------------------|---|---|------|---|
| Automobile fuel tank | Test pressure low and work volume very large | Work is soft. Measurement pipe is long | 6 | Pail can, resin intake manifold, gas meter etc. |
| Engine assembly | Complex test where test pressure and volume differ between works. | Inner path is complex. | 7 | Engine bear etc. |
| Injector | Work inner volume is very small. | Small leak specification | 8 | Sensor parts, pressure regulator etc. |
| Lamp cover | Test with small pressure | Work is soft | 9 | Gas meter, gas cooking appliance |
| Hydraulic Control System Product | Test with high pressure | | 10 | Radiator, heater, compressor, common rail etc. |
| Resin intake manifold | Test with negative pressure | Work is soft | 11 | Canister, fuel tank, resin made sanitary part etc. |
| Water proof portable telephone | No pressurization port of work | | 12 | Sensor, water proof watch, bath room products, camera on board etc. |
| Tail lamp cover | No pressurization port of work | Work inner volume is relatively large. | 13 | Water closet float, seal type sensor etc. |
| Rubber hose | Work is very soft | | 14 | Evaporator, delivery pipe, warm water pipe etc |
| Oil filter | Large amounts of porous materials inside work. | | 15 | Valve, canister, hollow filament filter etc. |

Example Systems Portfolio

(The system is configured according to the work characteristics as main factors for water proof portable telephones, tail lamp covers, rubber hoses, and oil filters)



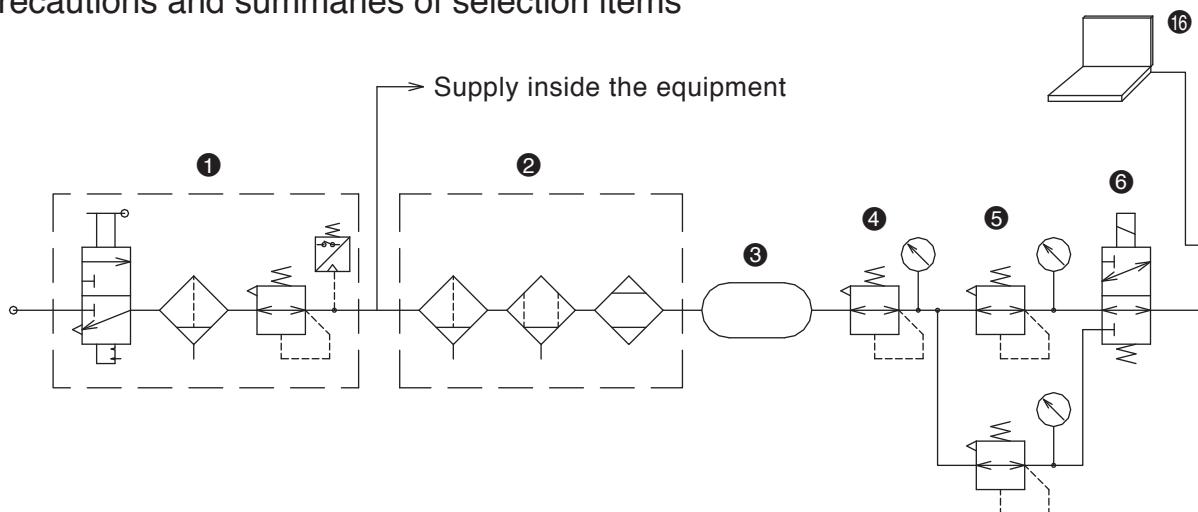
Selection item according to measurement conditions other than shown above

| Measurement Condition | Item | Measurement System | Page |
|---|---------------------|----------------------|------|
| The residual cleaning agent or work oil may remain inside work. | Exhaust bypass | Common chapter No.11 | 35 |
| Plurality of measurement point and measure by switching exists. | Work switching unit | Common chapter No.10 | 34 |

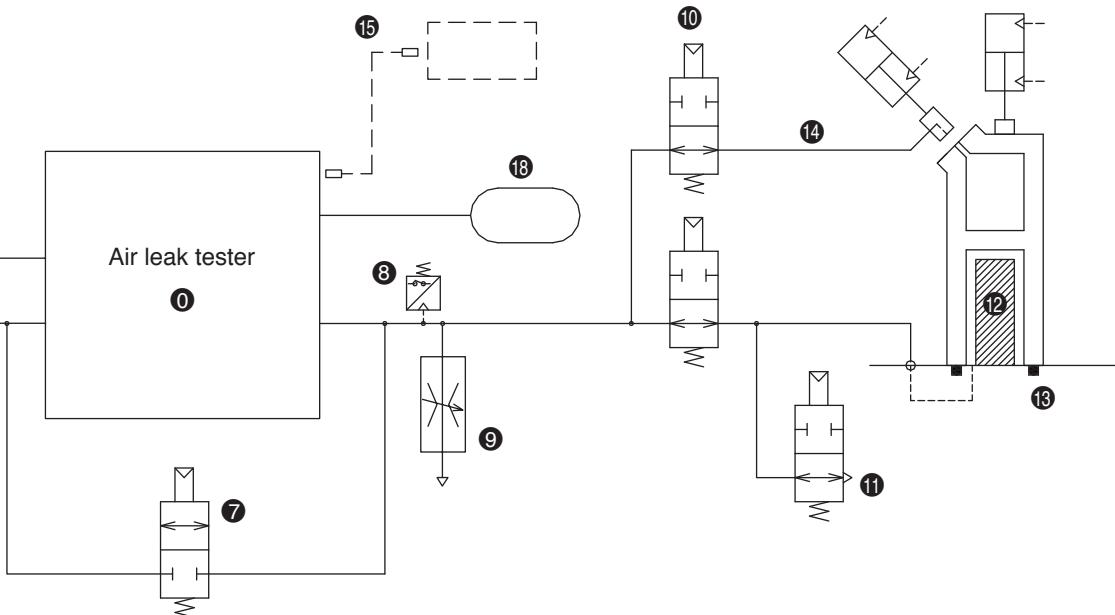
When the measurement cannot be correctly performed, the necessary countermeasure is shown at the end of this document. Also, refer to the countermeasure at the time of system construction for advanced preparation.

Common Seal Test circuit

● Common precautions and summaries of selection items



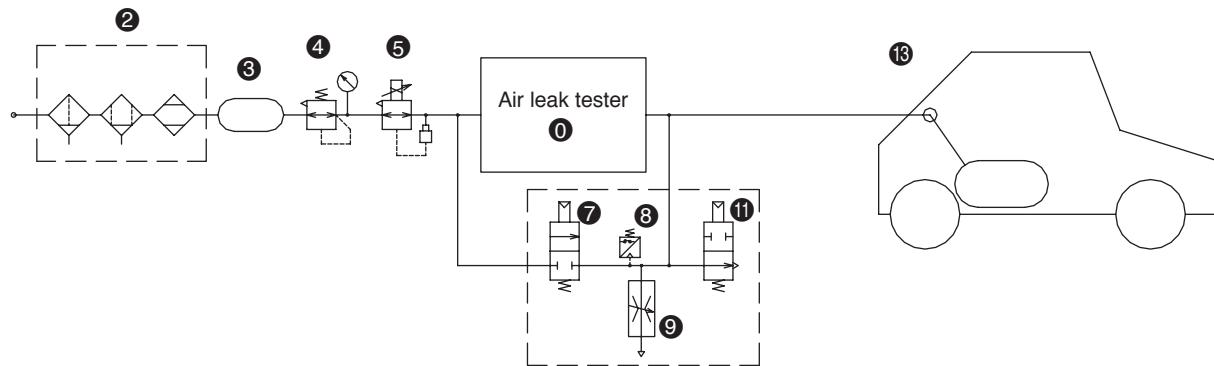
| No. | Item | Purpose | Comment |
|-----|--|--|---|
| 0 | Leak tester | Main body | — |
| 1 | Air source to equipment supply filter | Filter regulator of the air source to supply the equipment | — |
| 2 | Tester Filter | Filter to supply correct air to tester | Recommend JIS B 8392-1:2000 Compressed air quality class 1.3.1 |
| 3 | Air P stability tank | Accumulator to stabilize test air to improve measurement precision | Large work volume is effective in general, but is also effective for small work depending on the air source situation. |
| 4 | Primary regulator | Primary regulator to stabilize test air pressure | Set to test pressure + 100kPa as the guide line. It is necessary to for the evacuation flow rate to exceed the test pressure regulator. |
| 5 | Test P regulator | Precision regulator supplying test pressure | Repeatability should be excellent against the exhaust flow rate variation by the work pressurization |
| 6 | Test P switch valve | Switching valve to switch a plurality of test pressures | — |
| 7 | Charge bypass | Supply test pressure in a short time to large work volumes | Large diameter valve that can flow with large flow rate. Structure to prevent the effect on the measurement as it enters into the measurement circuit at the OUT side. |
| 8 | Work P confirmation | Monitor the inner work pressure | Structure to prevent the effect on the measurement as it enters the measurement circuit. It is indispensable against the inner pressure loss at the large leak measurement using very small pressure. |
| 9 | Confirmation gauge | Confirm system operates by generating a false leak | Can be used at periodical maintenance and work start check, as well as at set up time. |
| 10 | Switch measurement point | Switching unit to measure a plurality of works (measuring point) | Structure to prevent the effect on the measurement as it enters the measurement circuit. |
| 11 | Exhaust bypass | Prevent foreign material from entering the work | Periodical maintenance is required because foreign materials from the work focus on this valve. Structure to prevent effect on the measurement as it enters into the measurement circuit. |
| 12 | Core | Decrease work inner volume to increase detection sensitivity | — |
| 13 | Seal | Seal the work | — |
| 14 | Piping material | Piping material of the leak test measurement circuit | Joint structure which is difficult to create leaks. Pipe that is difficult to change shape through pressurization. Heat insulation effect to prevent wind effects (depending on wall thickness and protective material) |
| 15 | Model conversion | Convert to new tester | May require some change in the equipment side depending on the model difference. |
| 16 | Analysis tool | Tool to analyze measurement status and problem | — |
| 17 | Check tool | Tool to check the tester | — |
| 18 | Stability standard container | — | — |



| Product Name | Selection category (guide line) | Model | Page | No. | |
|---|--|---|----------------|-----|--|
| — | — | — | — | 0 | |
| Drain catcher Main line filter Source pressure regulator | General part that can be obtained at air pressure equipment manufacturer | — | — | 1 | |
| Air filter Mist separator Dryer | Select process flow rate according to work volume | KF-101 KF-201, 202, 203 KF-901, 902 | 16 ~ 19 | 2 | |
| Air tank | Work volume ~ 2L | KT-201 | 20 | 3 | |
| | Work volume 2 ~ 10L | | | | |
| | Work volume 10L ~ | | | | |
| Primary regulator | Select evacuation flow rate according to work volume | KR-101 KR-201 KR-901, 902 | 20 ~ 22 | 4 | |
| Precision regulator | Select evacuation flow rate according to work volume | R5, P-200, APU-X005 KRZ-0205, 0905 KR-202, 204, 903, 904 | 22 ~ 27 | 5 | |
| Test pressure switching valve | Select valve according to test pressure Select diameter according to work volume | KV-201, 202 | 28 | 6 | |
| Charge bypass unit | Select valve according to test pressure Select diameter according to work volume | CBU-600 | 30 | 7 | |
| Digital pressure gauge | Select according to test pressure | KM-901, 904 | 30 ~ 31 | 8 | |
| Flow standard | Leak 0.2 ~ 20 mL/min | FFM-100 | 32 | 9 | |
| Float type flow rate meter | Leak 20 ~ 200 mL/min | KM-903 | 33 | | |
| Calibrator ※Some testers include | Work volume ~ 0.1L | CAL | 32 | | |
| | Work volume ~ 1.0L | | | | |
| | Work volume ~ 5.0L | | | | |
| Work switching unit | — | ESV | 34 | 10 | |
| Exhaust bypass unit | FL-600, 601 system | EBU-600 | 35 | 11 | |
| External exhaust bypass unit | FL-3700, 294, 296 system | FE-20 | 35 | | |
| Molded core, worked core | — | — | — | 12 | |
| O-ring, Seal material | — | — | — | 13 | |
| Coupler | Prepare according to necessary conditions | — | — | | |
| Piping material Joint | Select material according to test pressure Select diameter according to work volume | KP-901 KJ-901 | 36 | 14 | |
| Conversion cable | FL-600 for FL-3700 equipment | Contact us | — | 15 | |
| | FL-600 for FL-294 equipment | | | | |
| | Others | | | | |
| Application software | FL-600, 601 (distribute sample software) | — | — | 16 | |
| | FL-3700 (distribute sample software) | — | — | | |
| Super penguin | For calibration of test pressure difference pressure | CL-100 | 37 | 17 | |
| Precision very small pressure difference gauge | For calibration of difference pressure | DG-72-X002 | 38 | | |
| Stability tank | — | M-100 | 39 | 18 | |

The large diameter pipe, large accumulator tank, and large flow rate regulator are required for the low pressure and large volume test. Also, the APU must be prepared to ensure turbo functionality and repeatability of the pressurization characteristics when considering the following factors:

- Piping length extends beyond the work
- Work expands through pressurization



Set Type No.
SET-001

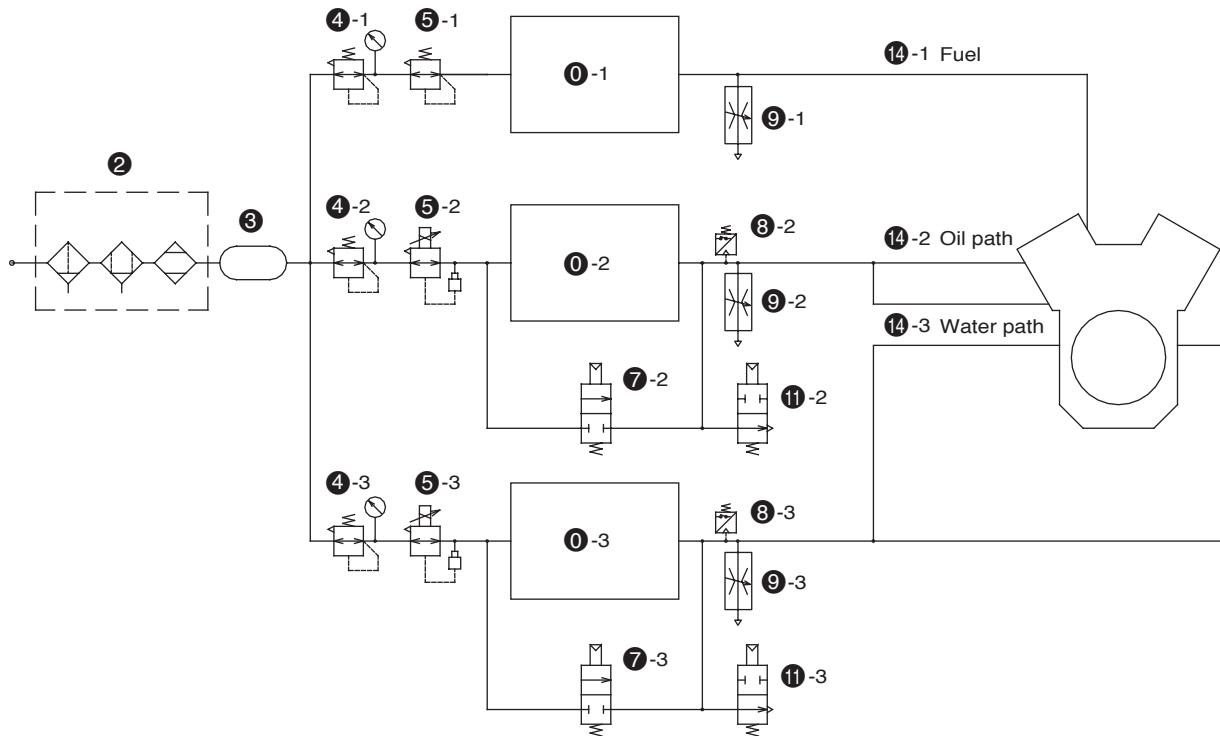
| No. | Item | Product Name | Remarks | Model | Page |
|-----|-----------------------------|-------------------------------------|--|----------------|------|
| 0 | Tester | Master less air leak tester | — | FL-600L-2 | — |
| 2 | Tester Filter | Filter | Air filter, mist separator, dryer | KF-101 | 16 |
| 3 | Air pressure stability tank | Air tank | 38 L | KT-201 | 20 |
| 4 | Primary regulator | Large flow rate regulator | — | KR-101 | 20 |
| 5 | Test pressure regulator | Large flow rate precision regulator | — | APU-130WP-X005 | 24 |
| 7 | Charge bypass | Charge bypass unit | — | CBU-600-X001 | — |
| 8 | Work pressure confirmation | Digital pressure gauge | Pressure is abnormal at more than 25 kPa | | |
| 9 | Confirmation gauge | Area type flow meter | 300 mL/min F.S. | | |
| 11 | Exhaust bypass | Exhaust bypass unit | — | Contact us | — |
| 13 | Seal tool | Air picker | — | | |
| | | Screw type seal tool | — | Contact us | — |

This system can also be adapted for the following seal tests:

- Lamp oil tank for heater seal test
- Pail can system
- Resin intake manifold
- Reserve tank
- Wet area product (bath)
- Gas meter

※ Model GR-001 assembly dedicated leak tester is provided.

The test pressure and inner volume differ according to the measurement part in the engine assembly seal test. In this condition, select the peripheral equipment adapted for each condition. It may become difficult to achieve performance even if the peripheral is prepared exclusively for the inner volume, because the work inner path is complicated and a plurality of room is connected by a narrow path.



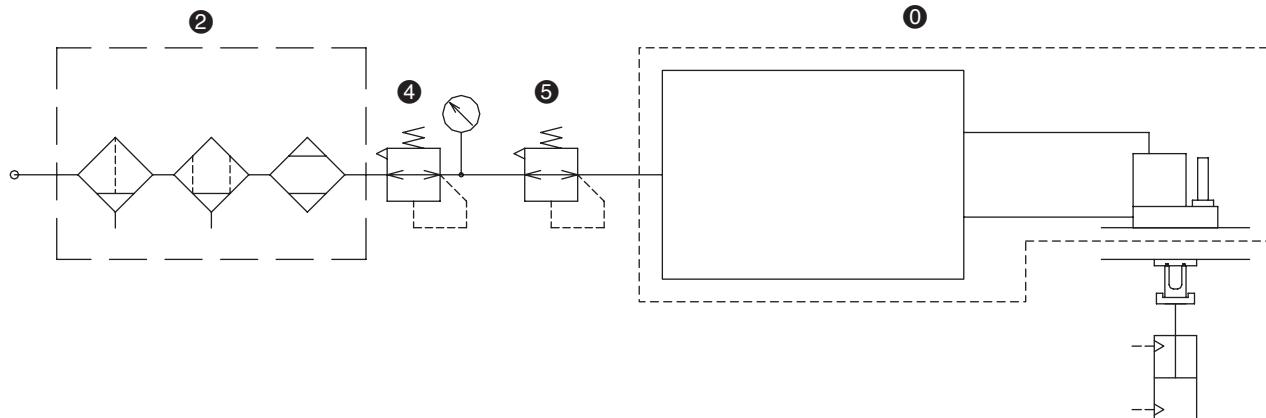
Set Type No.
SET-002

| No. | Item | Product Name | Remarks | Model | Page |
|------|-----------------------------|---------------------------------------|--|----------------|---------|
| 0-1 | Teste | Master less air leak tester | Test P* 400kPa | FL-600M-2 | — |
| 0-2 | | | Test P* 30kPa | FL-600L-2 | — |
| 0-3 | | | Test P* 80kPa | | — |
| 2 | Test Filter | Filter | Air filter + Mist separator + Polymer membrane dryer | KF-101 | 16 |
| 3 | Air pressure stability tank | Air tank | 38L | KT-201 | 20 |
| 4-1 | Primary regulator | Regulator | — | KR-201 | 21 |
| 4-2 | | Large flow regulator | — | — | — |
| 4-3 | | Dial air regulator | — | KR-101 | 20 |
| 5-1 | Test pressure regulator | Precision regulator | — | KR-202 | 26 |
| 5-2 | | Precision electro pneumatic regulator | — | APU-120WP-X005 | 24 |
| 5-3 | | Precision electro pneumatic regulator | — | APU-90W-X005 | 24 |
| 7-2 | Charge bypass | Charge, evacuation bypass unit | Includes evacuation bypass function of 11-2 and 11-3 | CBU-600 | 30 |
| 7-3 | | | | | |
| 8-2 | Work pressure confirmation | Digital pressure gauge | Monitors over pressure | KM-901 | 30 ~ 31 |
| 8-3 | | | | | |
| 9-1 | Confirmation gauge | Flow standard | — | FFM-100 | 32 |
| 9-2 | | | | | |
| 9-3 | | | | | |
| 14-1 | Piping material | Nylon tube for high pressure | Interlocking piping with sleeve | KP-901, KJ-901 | 36 |
| 14-2 | | Nylon tube | General tube with more than $\phi 12$ | — | — |
| 14-3 | | — | — | — | — |

*Ideal test pressure.

※ For oil path, Model GR-001 assembly dedicated leak tester is provided.

The peripheral equipment load becomes small for test work of very small volume. However, if the configuration is the same as for other test work volumes, the ratio of the work volume/piping volume approaches one (or less than one), and therefore, it becomes impossible to determine which is the measurement target. As a result, the measurement is performed without piping by attaching the measurement unit to the tool (FUKUDA patent). By using this method, the highly sensitive and highly stable leak test becomes possible.



Set Type No.

SET-003

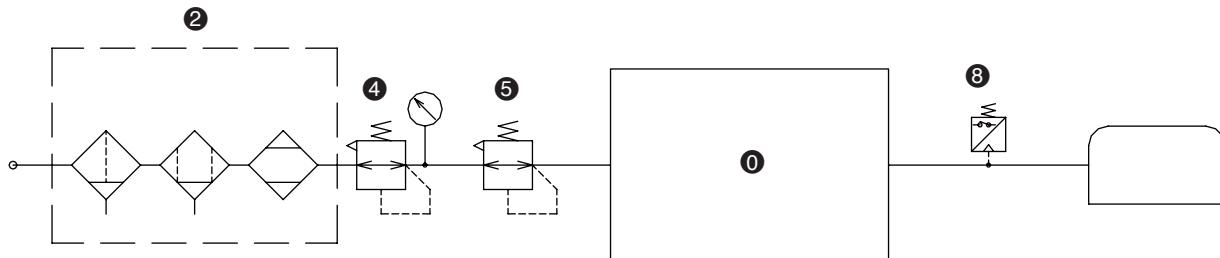
| No. | Item | Product Name | Remarks | Model | Page |
|-----|-------------------------|---------------------------|-----------------------------------|----------------------|------|
| 0 | Tester | Separate type leak tester | High function type | FL-601+LPU-300-X004 | 16 |
| | | | General type | FL-2710+LPU-300-X020 | 16 |
| | | | Simple type | FL-294+LPU-300-X020 | 16 |
| 2 | Tester filter | Filter | Air filter, mist separator, dryer | KF-101 | 16 |
| 4 | Primary regulator | General purpose regulator | — | KR-201 | 21 |
| 5 | Test pressure regulator | Precision regulator | — | KR-202 | 26 |

This system can also be used for the following seal tests:

- Various sensor part seal test
- Pressure regulator
- Sensor device
- Meter system
- Very small work

It is not easy for pneumatic equipment to control ultra low pressure. Generally, work that requires ultra low test pressure consists of very soft materials, and therefore, precision at ultra low pressures, and repeatability of pressurization characteristics are required for the regulator.

Also, due to low test pressure, if there is a large leak, the test pressure cannot be kept until the detection process, and the possibility of making a miss judgment occurs. As a result, it is essential to ensure a work inner pressure monitor is provided.



Set Type No.

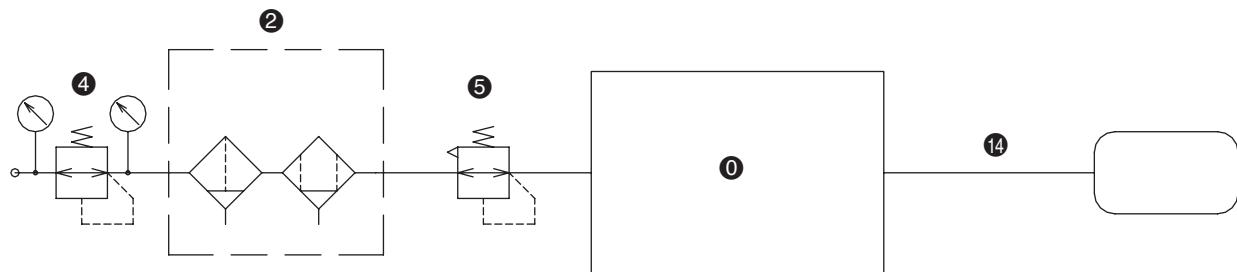
SET-004

| No. | Item | Product Name | Remarks | Model | Page |
|-----|----------------------------|------------------------------------|-----------------------------------|----------|------|
| 0 | Tester | Master less air leak tester | High function type | FL-600UL | — |
| 2 | Tester filter | Filter | Air filter, mist separator, dryer | KF-101 | 16 |
| 4 | Primary regulator | General purpose regulator | — | KR-201 | 21 |
| 5 | Test pressure regulator | Precision small pressure regulator | 5 ~ 20kPa | P-200 | 23 |
| | | Ultra low pressure regulator | 5 ~ 10kPa | R5 | 22 |
| 8 | Work pressure confirmation | Digital pressure gauge | Air loss monitor for large leak | KM-904 | 31 |

This system can also be applied to the following seal test.

- Gas meter
- Gas cooking unit
- Product with wet resin area

In high pressure ranges, the type of the air pressure equipment is limited thereby making it difficult to locate equipment with high-quality performance. In this condition, it is essential to think about the basics and consider all variables from a total point of view. Moreover, it is necessary to select equipment that does not generate heat, come equipped with pipes that do not expand with pressure, and layout that does not increase redundant volume.



Set Type No.

SET-005

| No. | Item | Product Name | Remarks | Model | Page |
|-----|-------------------------|---|--------------|-------------|------|
| 0 | Tester | Leak tester for each volume | 0.8 ~ 1.5MPa | FL-3710H1-1 | — |
| | | | 1.0 ~ 3.5MPa | FL-3710H2-1 | — |
| | | Fitting leak tester | 0.5 ~ 2.0MPa | FL-601H1-2 | — |
| 2 | Tester filter | Air filter | ~ 2.0MPa | KF-901 | 18 |
| | | Mist separator | ~ 4.0MPa | KF-903 | 19 |
| | | | ~ 2.0MPa | KF-902 | 19 |
| 4 | Primary regulator | Regulator for cylinder | ~ 4.0MPa | KR-902 | 22 |
| 5 | Test pressure regulator | Regulator ※ included in tester of FL-3700 series | ~ 3.4MPa | KR-904 | 27 |
| 14 | Piping material | Copper pipe | — | — | — |
| | | Stainless pipe | — | — | — |

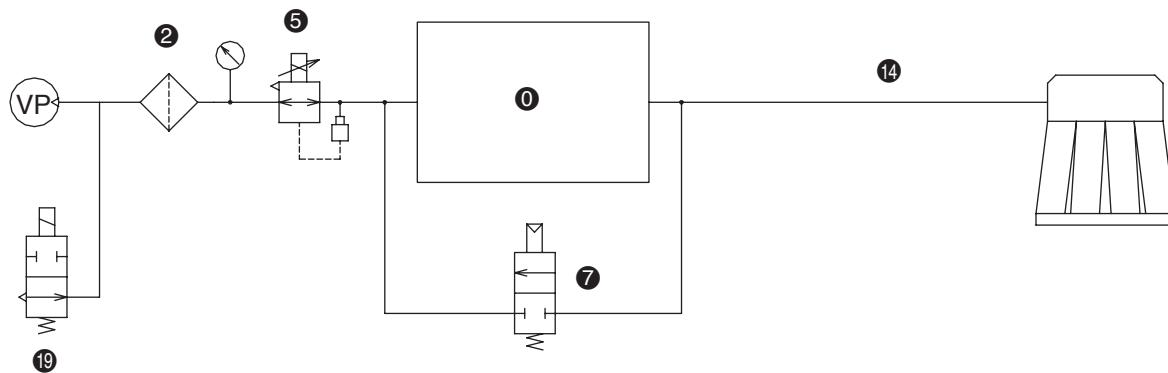
※ The above selected equipment may not satisfy High Pressure Gas Safety Laws.

The system can also be applied to the following seal tests:

- Radiator (0.8 - 3.0MPa)
- Heater
- Compressor
- Common rail
- Diesel injector
- Pressure regulator
- Other diesel system products
- Break system products
- Hydraulic system products

Evacuation flow becomes very small in vacuum measurements. Also, the effect on measurement performance gets affected if the capability of the evacuation equipment, which takes advantage of the regulator, as well as the assurance of the piping diameter are not considered. In the vacuum measurement, there are several cases where the air source accumulator tank cannot improve, and therefore, selecting this equipment becomes important in the planning stage.

The resin intake manifold varies the volume using the vacuum, and flow rare assurance and repeatability with the APU and bypass shall be considered.



Set Type No.

SET-006

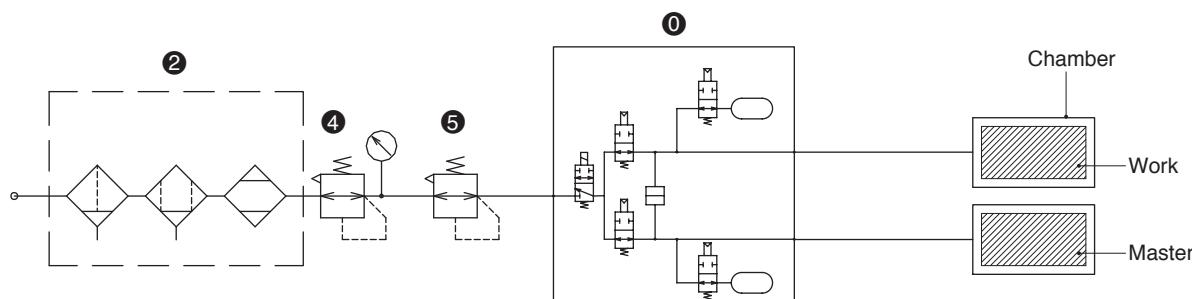
| No. | Item | Product Name | Remarks | Model | Page |
|-----|-------------------------|---------------------------------------|---------|----------------|---------|
| 0 | Tester | Master less air leak tester | — | FL-600V-2 | — |
| 2 | Filter | Suction filter | — | KF-203 | 18 |
| 5 | Test pressure regulator | Precision electro pneumatic regulator | — | APU-120WV-X005 | 24 |
| 7 | Exhaust bypass | Exhaust bypass unit | — | EBU-600V | 35 |
| 14 | Piping material | Nylon tube | — | KP-901, KJ-901 | 36 |
| 19 | Vent valve | Two port connection valve | — | KV-101 | 28 ~ 29 |

The system can also be applied to the following seal tests:

- Canister
- Product with wet resin area
- Fuel tank

If the work does not have a port to pressure, the work is put inside a capsule and the capsule is pressurized outside the work. As a result, the leak is detected by measuring the drop in pressure due to gas entering inside the work (hermetic product seal test). However if there is a large leak, the inside work also gets pressurized when the capsule is pressurized, and therefore, the correct test cannot be performed because there is no leak at the detection process. To avoid miss judgment of a large leak work, a special circuit (provided a class of the tester) is attached.

For the general large leak detection method (after pressurization), the pressure is split with the tank that is integrated in the tester. The pressure difference is measured between the work side and master side, and as a result, the large leak is confirmed.



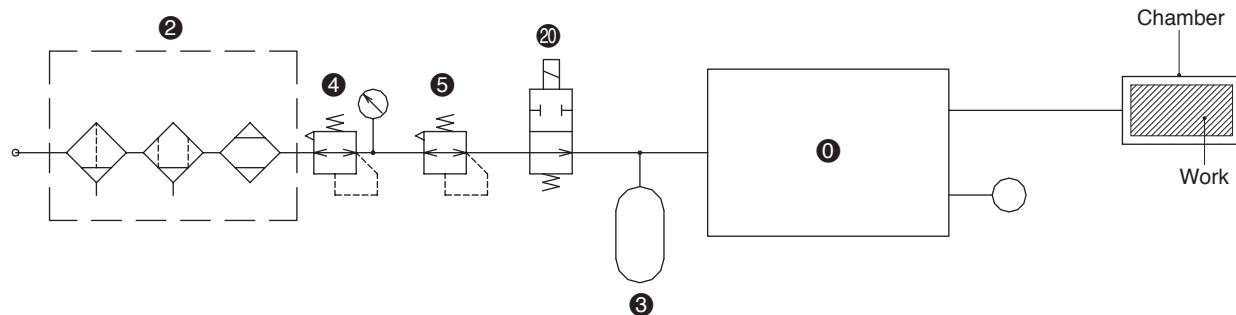
Set Type No.
SET-501

| No. | Item | Product Name | Remarks | Model | Page |
|-----|-------------------------|-------------------------------|---|---------------|------|
| 0 | Tester | Hermetic type air leak tester | Transient submerge test level | MS-531+FL-512 | — |
| 2 | Tester filter | Filter | Air filter + Mist separator + Polymer membrane type dryer | KF-101 | 16 |
| 4 | Primary regulator | Regulator | — | KR-201 | 21 |
| 5 | Test pressure regulator | Precision regulator | — | KR-202 | 26 |

The system can also be applied to the following seal tests:

- Water proof watch seal test
- Hermetic sensor seal test
- Bath area products
- On board camera

For cases of work with relatively large inner volumes where the work inner volume is almost the same as the residual volume, and equal to the capsule volume minus the work outside volume, the simple system can be constructed. The capsule with the work inside gets pressurized using compressed air stored (in advance) in the tank, and the test pressure is measured to detect a large leak. It is possible to use only one capsule to reduce equipment costs.



Set Type No.
SET-007

| No. | Item | Product Name | Remarks | Model | Page |
|-----|-------------------------|--|-----------------------------------|---|---------|
| 0 | Tester | Tank pressurization type air leak tester | Drip-proof level | FL294L-X022 | — |
| 2 | Tester filter | Filter | Air filter, mist separator, dryer | KF-101 | 16 |
| 3 | Air pressure tank | — | — | Design according to the measurement condition | — |
| 4 | Primary regulator | General regulator | — | KR-201 | 21 |
| 5 | Test pressure regulator | Precision regulator | — | KR-202 | 26 |
| 20 | Cutoff valve | Two port connection valve | — | KV-101 | 28 ~ 29 |

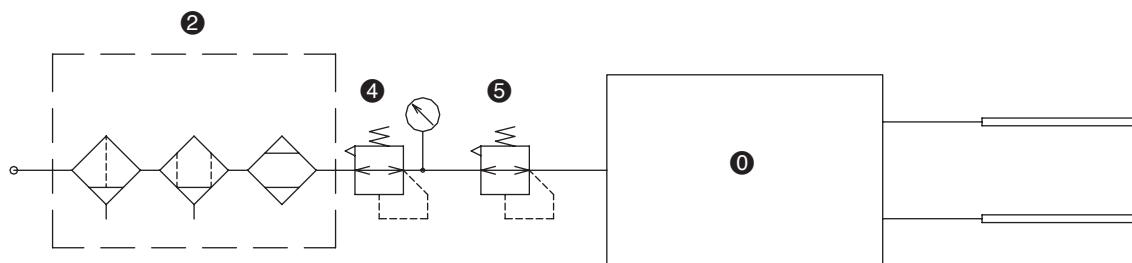
The system can also be applied to the following seal tests:

- Float for the water closet seal test
- Hermetic sensor

The soft rubber hose expands with pressurization and the inner pressure varies during the detection process, and therefore, it cannot be tested correctly using the conventional method. The turbo pressurization is effective against the inner volume change by expansion, however, it cannot be applied to work with large expansion coefficients such as rubber. In this condition, the work to work comparison method can be applied.

When two NG works are compared, there is a possible risk of overlooking the NG work. In order to prevent this from happening, a special tester is used which has a function to detect simultaneous leaks by comparing two separate works within the reference container.

The piping for both equipments should be set equivalent as much as possible to cancel work noise when using this measurement method.



Set Type No.

SET-008

| No. | Item | Product Name | Remarks | Model | Page |
|-----|-------------------------|--|---|----------------|------|
| 0 | Tester | Work to work comparison type leak tester | With simultaneous leak detection function | FL-601M-2-X001 | — |
| 2 | Tester filter | filter | Air filter + Mist separator + Polymer membrane type dryer | KF-101 | 16 |
| 4 | Primary regulator | Regulator | — | KR-201 | 21 |
| 5 | Test pressure regulator | Precision regulator | — | KR-202 | 26 |

The system can also be applied to the following seal tests:

- Delivery pipe seal test

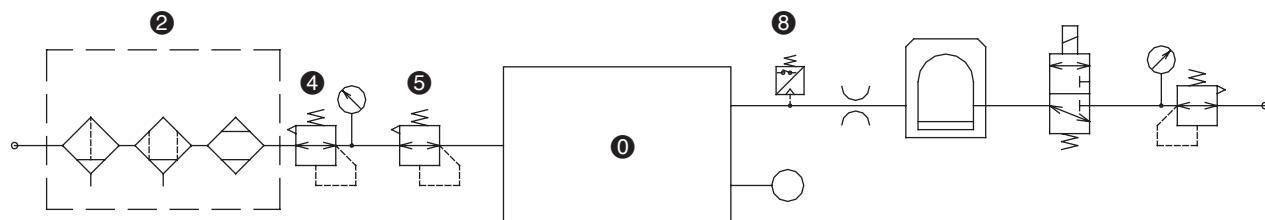
This system is applied to the delivery pipe seal test not because of the work expansion, but is used to cancel the wind effect on equipment as the delivery pipe test is sensitive to humidity and environmental temperature change. This is effective to prepare the cover to protect the tester from wind, or to avoid direct hand contact with the work to eliminate any thermal effects.

- Warm water pipe
- Fuel pump
- Fuel tank

When there is a porous filter element inside the work such as an oil filter, the air slowly enters the porous element (virtual leak) during the detection process, even after compression of the pressurization. This causes a drop in pressure which ultimately leads to a miss judgment.

If the virtual leak is very small, it can be converged in a short period using turbo pressurization. However, this process cannot cover work where this phenomenon covers the entire work such as a filter element. In this condition, a chamber surrounding the work is prepared, and the test is performed by measuring the chamber inner pressure increase by the leak. However, if the chamber is not sealed correctly, the chamber inner pressure does not increase even if there is a leak, and as a result, small pressure is applied for the measurement. If the work has a leak, the inner pressure increases and a work leak is detected. Conversely, if the chamber has a leak, the inner pressure decreases and a chamber seal abnormality is detected.

The circuit restrictor prevents the application of high pressure to the tester side by utilizing the phenomenon where the tester measurement circuit opens to the atmosphere when the tester is in pause status.



Set Type No.

SET-009

| No. | Item | Product Name | Remarks | Model | Page |
|-----|--|------------------------------|--|-------------|---------|
| 0 | Tester | - | Compact type | FL-296UL-1 | — |
| | | | General type | FL-3700UL-1 | — |
| | | | High function type | FL-601UL-2 | — |
| 2 | Tester filter | Filter | Air filter, mist separator, dryer | KF-101 | 16 |
| 4 | Primary regulator | General regulator | — | KR-201 | 21 |
| 5 | Regulator to check chamber abnormality | Ultra low pressure regulator | — | R5 | 22 |
| 8 | Chamber inner pressure confirmation | Digital pressure gauge | Monitor the large leak by chamber seal abnormality | KM-901 | 30 ~ 31 |

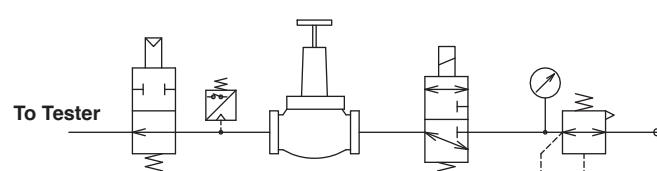
The system can also be applied to the following seal tests:

- Valve leak seal test

For cases of the valve leak test, the test pressure is applied to the input side, and the tester is connected to the port of the output side, and therefore, the chamber need not be prepared. The pressure may be very high in the case of the valve. In this condition, it is necessary to arrange the valve between the tester and the work as shown in the figure to the right, and confirm large leak generation using the pressure switch before performing the leak test.

- Canister

- Core filter





■ Specifications

| Item | LPU-300 |
|---------------------------------|---|
| Operation temperature | 5~40°C |
| Operation humidity | 45~85%RH |
| Storage temperature | -20~70°C |
| Supply air quality | Compressed air quality 1.3.1 (JIS B 8392-1) recommended |
| Pressure measurement range | ±1000Pa, ±1999Pa |
| Pressure precision | ±5% of F.S. (including hysteresis) |
| Pilot pressure | 0.3~0.5MPa |
| Measurement system inner volume | 0.7mL |
| Calibrator | 0~0.01mL |
| Power source | DC±15V 0.2A |

■ Model

LPU-300 ① - ②

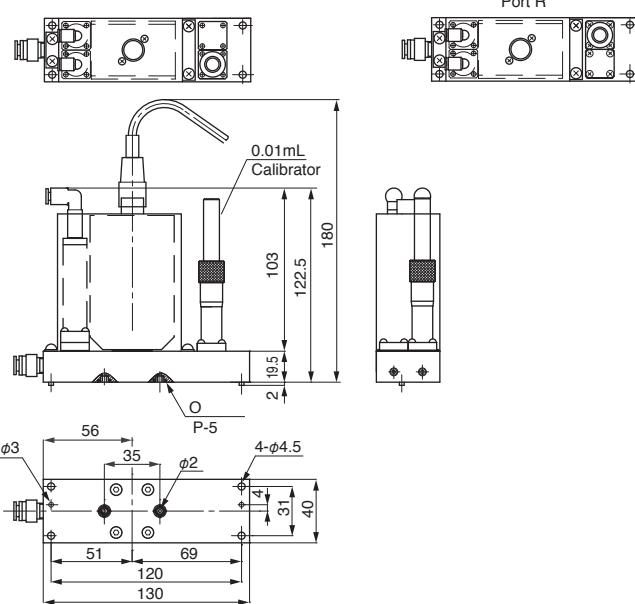
① Pressure range

| Sign | Pressure range |
|------|----------------|
| V | -10 ~ -90kPa |
| H | 10 ~ 1000kPa |

② Port

| Sign | Contents |
|---------|------------------------------------|
| No sign | Standard |
| R | Work, master port inverse position |

■ External dimensions (mm)



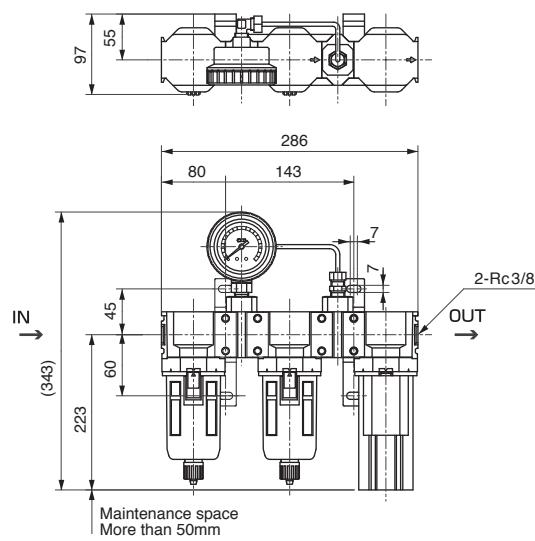
■ Specifications

| Item | KF-101 |
|----------------------------------|----------------------|
| Used fluid | Compressed air |
| Input air pressure | 0.4~1.0MPa |
| Guaranteed pressure | 1.5MPa |
| Input air temperature | 5~50°C |
| Environment temperature | 5~50°C |
| Output air atmospheric dew point | -20°C |
| Input air flow rate | 250L/min |
| Output air flow rate | 200L/min |
| Purge flow rate | 50L/min |
| Input air pressure dew point | 25°C |
| Input air pressure | 0.7MPa |
| Input air temperature | 25°C |
| Environment temperature | 25°C |
| Air filter | Rated filtration 5μm |

■ Model

KF-101

■ External dimensions (mm)





■ Model

KF-201-①②

① Dimension

| Sign | Power of air compressor |
|------|-------------------------|
| 1 | 0.75kW |
| 2 | 1.5kW |

② Option

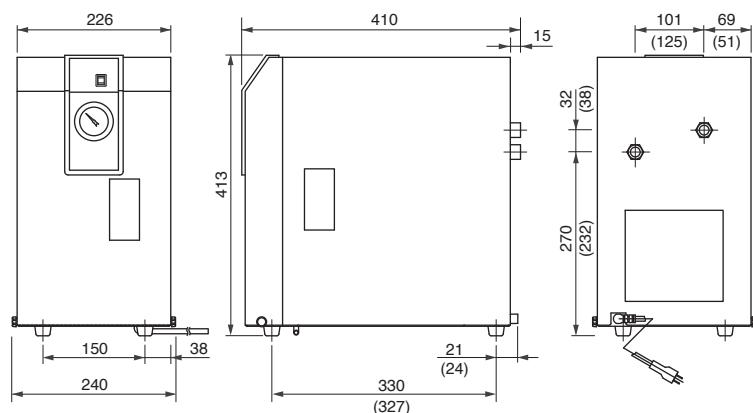
| Sign | Contents |
|---------|---------------------------------|
| No sign | No |
| A | For cooling compressed air |
| C | Copper pipe preserved |
| S | Power terminal block connection |

■ Specifications

| Item | Compressor size ① | | |
|--|---------------------------------|---------|-------|
| | 1:0.75kW | 2:1.5kW | |
| Processed air quantity m ³ /min | Standard condition(ANR) 50Hz | 0.10 | 0.20 |
| | 60Hz | 0.12 | 0.235 |
| Air compressor in suction status | 50Hz | 0.10 | 0.21 |
| | 60Hz | 0.12 | 0.24 |
| Input air pressure | 0.7MPa | | |
| Input air temperature | 35°C | | |
| Ambient temperature | 32°C | | |
| Output air pressure dew point | 10°C | | |
| Used fluid | Compressed air | | |
| Input air temperature | 5~50°C | | |
| Input air pressure | 0.15~1.0MPa | | |
| Ambient temperature/ Humidity (less than 85%RH) | 2~40°C | | |
| Power source voltage | AC100V | | |
| Power consumption (W) 50Hz/60Hz | 180/ 202 | | |
| Operating current (A) 50Hz/60Hz | 2.4/ 2.5 | | |

■ External dimensions (mm)

The figure inside () is the dimension of KF-201-2.



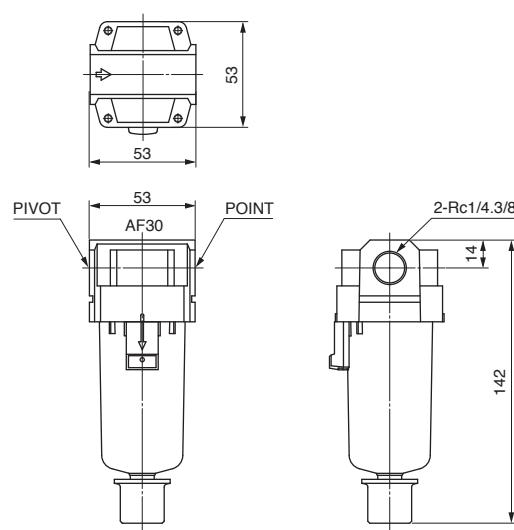
■ Specifications

| Item | KF-202 |
|---|-----------------------------------|
| Guaranteed pressure endurance | 3.0MPa |
| Maximum operating pressure | 2.0MPa |
| Ambient temperature and used fluid temperature | -5~60°C (without condensation) |
| Rated filtration | 5 μm |
| Connection diameter | Rc1/4 |

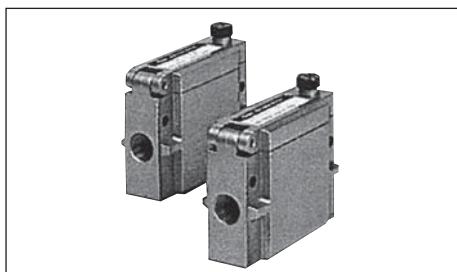
■ Model

KF-202

■ External dimensions (mm)



Air Suction Filter



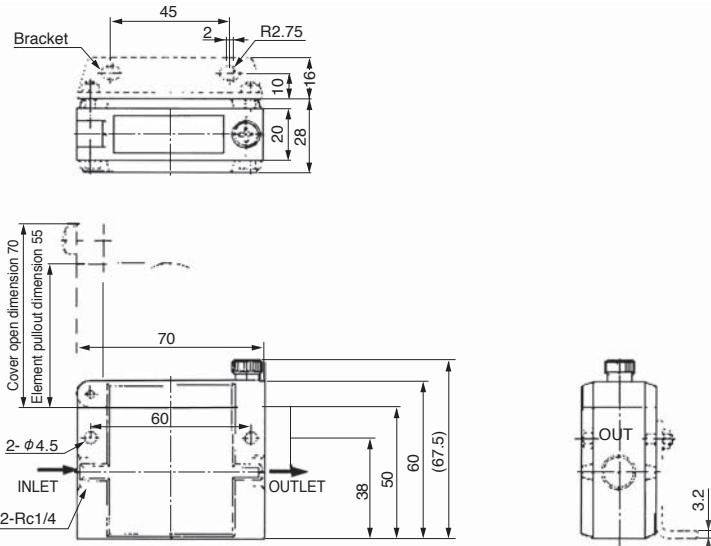
■ Model

KF-203

■ Specifications

| Item | KF-203 |
|--|---------------|
| Used fluid | Air, Nitrogen |
| Used pressure | -100~0kPa |
| Pressure endurance | 0.5MPa |
| Operation temperature range | 5~60°C |
| Rated filtration | 30μm |
| Pressure difference and endurance of element | 0.15MPa |
| Recommended flow rate | 200L/min |
| Pipe connection diameter | Rc1/4 |

■ External dimensions (mm)



Air Filter



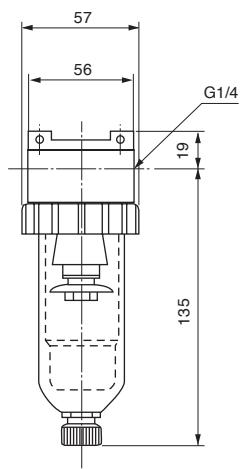
■ Specifications

| Item | KF-901 |
|------------------------|------------|
| Nominal flow rate | 1050NL/min |
| Maximum usage pressure | 2.5MPa |
| Operating temperature | 0~90°C |
| Filter element | 40μm |

■ Model

KF-901

■ External dimensions (mm)





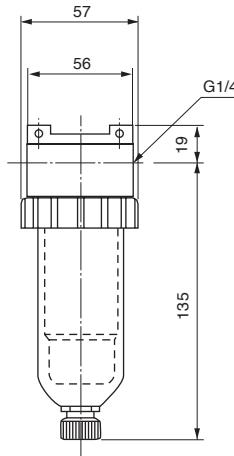
■ Model

KF-902

■ Specifications

| Item | KF-902 |
|----------------------------|--------------------|
| Nominal flow rate | 560NL/min |
| Maximum operation pressure | 2.5MPa |
| Operation temperature | 0~90°C |
| Filter element | 0.01 μm |

■ External dimensions (mm)



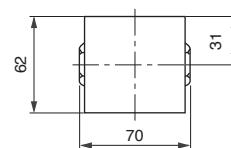
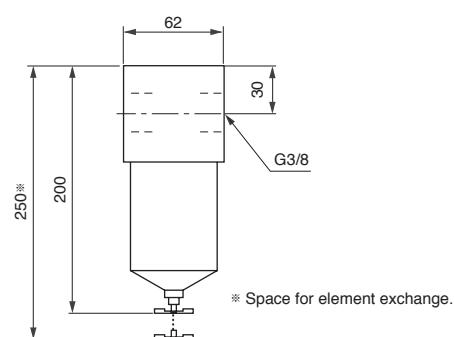
■ Model

KF-903

■ Specifications

| Item | KF-903 |
|----------------------------|------------------|
| Nominal flow rate | 2600NL/min |
| Maximum operation pressure | 4MPa |
| Operation temperature | 0~90°C |
| Filter element | 40 μm |

■ External dimensions (mm)





■ Specifications

| Item | KT-201-20L | KT-201-38L |
|---|-----------------------------|------------|
| Maximum operation Pressure | 1.0MPa | |
| Ambient temperature and operation fluid temperature | 0~75°C | |
| Steel material tensile strength | 400N/mm ² | |
| Material | SS400 | |
| Connection diameter | IN Rc3/4 OUT Rc1/2 | Rc3/4 |
| Weight | 14kg | 21kg |

■ Model

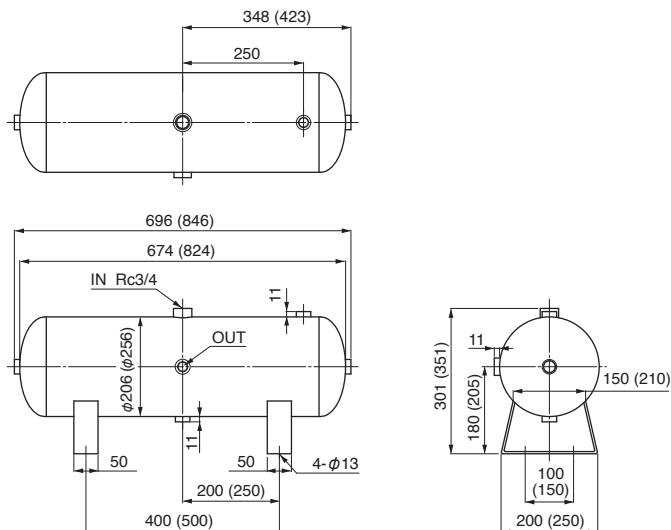
KT-201-1

① Tank capacity

| Sign | Capacity |
|------|----------|
| 20L | 20 L |
| 38L | 38 L |

■ External dimensions (mm)

The figure in () shows the dimension of KT-201-38L.



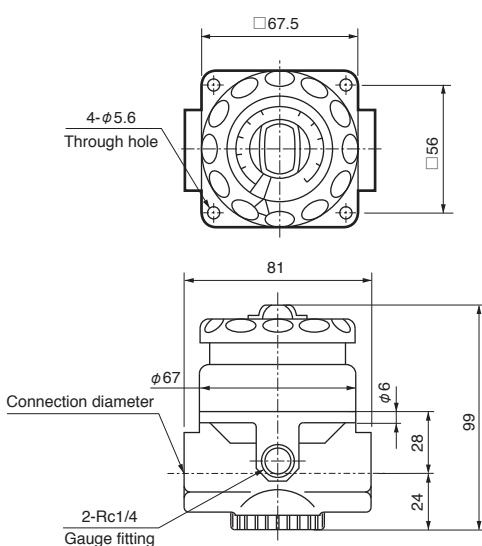
■ Model

KR-101

■ Specifications

| Item | KR-101 |
|---------------------------------|----------------------|
| Operation fluid | Compressed air |
| Maximum operation pressure | 2.06MPa |
| Assured pressure endurance | 3.09MPa |
| Fluid temperature (environment) | 5~65°C |
| Set pressure range | 0.05~0.27MPa |
| Relief | With relief function |
| Connection diameter | Rc 3/8 |
| Weight | 1kg |

■ External dimensions (mm)



Regulator

General Purpose Regulator



■ Model

KR-201-①②

① Fitting option

| Sign | Contents |
|------|--------------|
| N | No |
| B | with bracket |

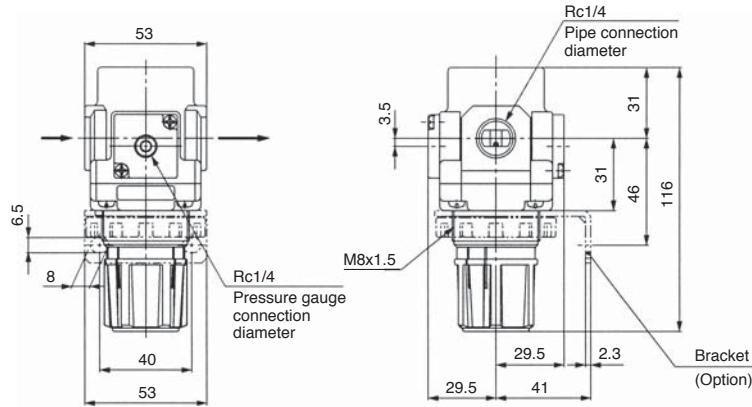
② Pressure gauge

| Sign | Contents |
|------|---------------------------|
| N | No |
| G | Round type pressure gauge |

■ Specifications

| Item | KR-201 |
|---|--|
| Pipe connection diameter | Rc1/4 |
| Pressure gauge connection diameter | Rc1/4 |
| Operation fluid | Air |
| Ambient temperature and operation fluid temperature | -5~60°C (without condensation) |
| Assured pressure endurance | 1.5MPa |
| Maximum operation pressure | 1.0MPa |
| Set pressure range | 0.05~0.85MPa |
| Relief pressure | Set pressure +0.05MPa (At relief flow rate 0.1L/min ANR) |
| Structure | Relief type |
| Weight | 0.29kg |

■ External dimensions (mm)



Regulator

Regulator for Cylinder



■ Model

KR-901-①②

① Pressure gauge at low pressure side

| Sign | Pressure (MPa) |
|------|----------------|
| 03 | 0.3 |
| 06 | 0.6 |
| 10 | 1 |
| 16 | 1.6 |

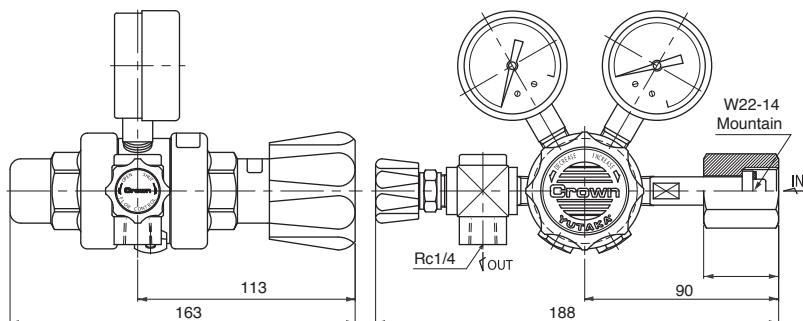
② Input shape

| Sign | Shape |
|------|-----------|
| R | Right nut |
| L | Left nut |

■ Specifications

| Item | KR-901 |
|-----------------------------------|---------------------------|
| Regulator main body | SUS316 |
| Regulator cover | ZDC |
| Valve seat | SUS316 |
| Valve sheet | PCTFE (Daifron) or Teflon |
| Diaphragm | PTFE (Teflon) + SUS316 |
| Relief valve seat | FKM (fluorocarbon rubber) |
| Output shape | Rc1/4 |
| High pressure side pressure gauge | 25MPa |
| Flow rate range | 25L/min |

■ External dimensions (mm)





■ Specifications

| Item | KR-902 |
|-----------------------|----------------------|
| Operation gas | N ₂ , Air |
| Weight | 3kg |
| Standard flow rate | 180m ³ /h |
| Maximum flow rate | 220m ³ /h |
| Exit connect diameter | Rc 1/4 |

■ Model

KR-902- 1 2 3

① Entrance connection

| Sign | Entrance connection | Remarks |
|------|-------------------------------------|--|
| A | Rc1/4 | Primary regulator not selectable |
| B | W22-14 Mountain (Right) Box nut (P) | Test pressure regulator not selectable |
| C | W22-14 Mountain (Left) Box nut (P) | Test pressure regulator not selectable |

② Primary side pressure gauge

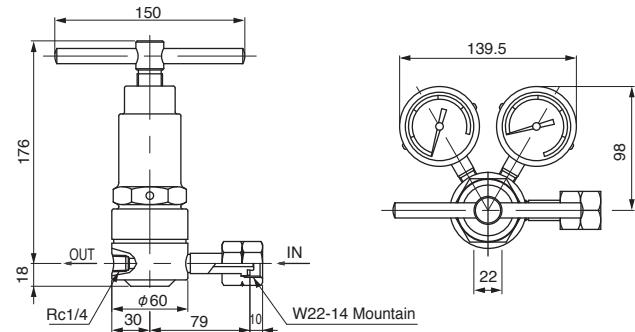
| Sign | Pressure range | Value in () is maximum used pressure | Remarks |
|------|----------------|---------------------------------------|--|
| 10 | 10(6) MPa | | Test pressure regulator not selectable |
| 15 | 15(10) MPa | | |
| 25 | 25(15) MPa | | Test pressure regulator not selectable |

③Secondary side pressure gauge

| Sign | Pressure range | Value in () is maximum used pressure | Remarks |
|------|----------------|---------------------------------------|--|
| 10 | 10(6) MPa | | |
| 15 | 15(10) MPa | | Test pressure regulator not selectable |
| 25 | 25(15) MPa | | Test pressure regulator not selectable |

※ For primary side pressure gauge, please choose higher pressure range than secondary pressure gauge.

■ External dimensions (mm)



Ultra Low Pressure Regulator



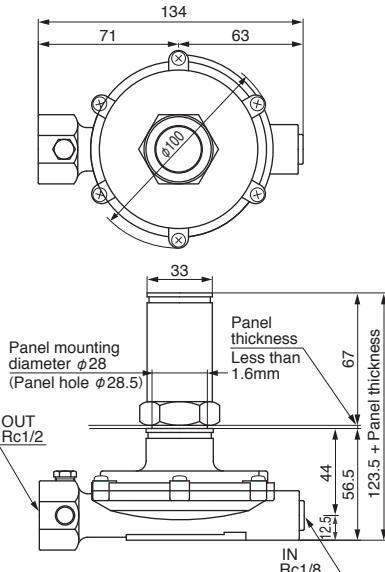
■ Specifications

| Item | R5 |
|---|-----------------------------------|
| Operation fluid | Air |
| Maximum supply pressure | 500kPa |
| Minimum supply pressure | Set pressure +100kPa |
| Set pressure range | 0.5~10kPa |
| Ambient temperature and air temperature | -5~50°C (Without condensation) |
| Weight | 0.7kg |

■ Model

R5

■ External dimensions (mm)





■ Model

P-200-1

① Pressure range

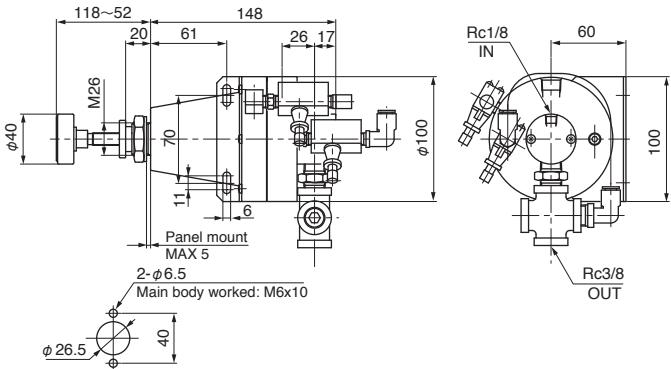
| Sign | Output pressure | Supply Pressure |
|------|-----------------|-------------------------------------|
| 1 | 0.1~1.0kPa | |
| 2 | 1.0~10.0kPa | 20~400kPa |
| 3 | 10.0~50.0kPa | (set pressure + more than 10 kPa) |
| 4 | 10.0~80.0kPa | |
| 5 | -0.1~1.0kPa | |
| 6 | -1.0~10.0kPa | -30~100kPa |
| 7 | -10.0~50.0kPa | (set pressure + less than -1.5 kPa) |
| 8 | -10.0~80.0kPa | |

■ Specifications

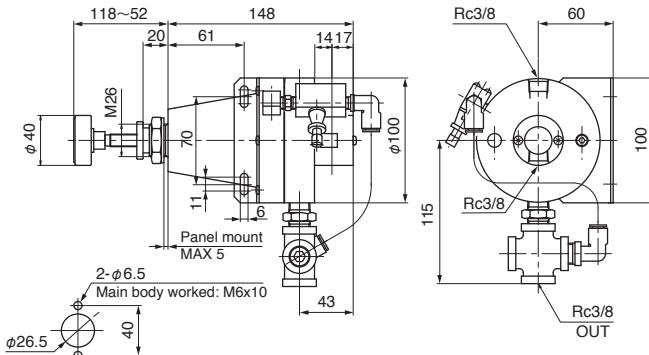
| Item | Pressure range | | |
|---|--------------------|--------------------|-------------------|
| | 1, 5 | 2, 6 | 3, 4, 7, 8 |
| Ambient temperature | 5~60°C | | |
| Regulated Flow Rate | 0.5L/min | 15L/min | 30L/min |
| Pressure change when changing from zero flow rate to the regulated flow rate | Less than 0.1 kPa | Less than 0.5 kPa | Less than 1 kPa |
| Set pressure change when returning from the regulated flow rate to zero flow rate | Less than 0.05 kPa | Less than 0.25 kPa | Less than 0.5 kPa |

■ External dimensions (mm)

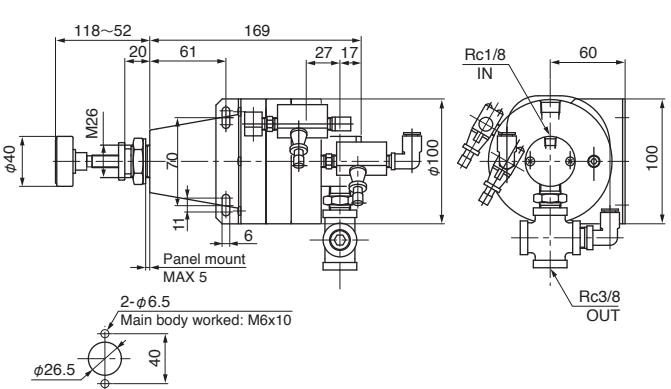
▼ In case of less than positive pressure 10kPa



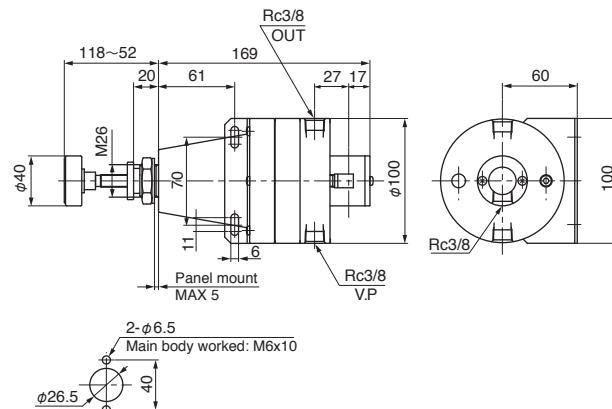
▼ In case of less than negative pressure 10kPa

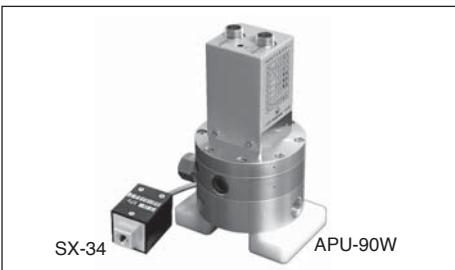


▼ In case of less than positive pressure 80kPa



▼ In case of less than negative pressure 80kPa





■ Specifications

| Item | APU |
|-------------------|----------------|
| Repeatability | ±0.15% of F.S. |
| Power source | DC ± 15V |
| Power consumption | 0.2A |
| Operation air | Clean air |

■ Model

APU - **①** **②** - (**③**) - **④** - **⑤** - **⑥**

① Shape

| Sign | Remarks |
|------|---------|
| 70W | φ70 mm |
| 90W | φ90 mm |
| 120W | φ120 mm |
| 130W | φ130 mm |

④ APU dedicated to leak tester

| Sign | Remarks |
|------|---------|
| X005 | |

⑤ Sensor model, precision

| Sign | Remarks |
|------|---|
| C | SX-100D: ±0.15% of F.S. (LF Range 0.3% of F.S.) |
| E | SX-34: ±1.0% of F.S. +990 unable to achieve (LF Range 2.0% of F.S.) |

⑥ APU dedicated cable

| Sign | Remarks |
|------|-------------------|
| 1.5 | Cable length 1.5m |
| 3 | Cable length 3.0m |

② Pressure control range

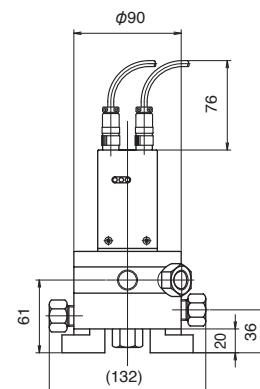
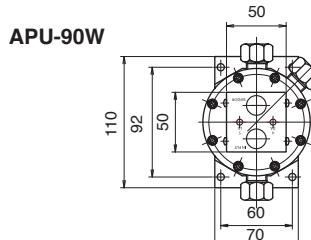
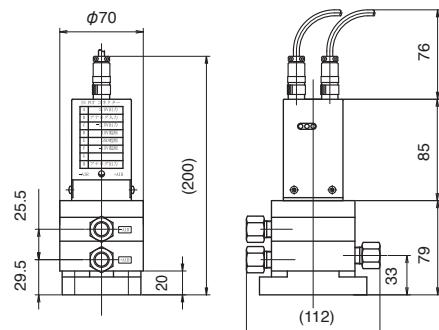
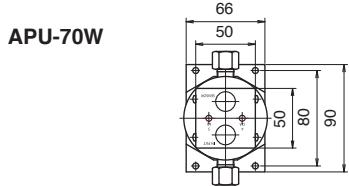
| Sign | Remarks |
|------|---------------------------|
| P | Positive pressure control |
| V | Negative pressure control |

Air leak tester is automatically controlled when the cable is connected.

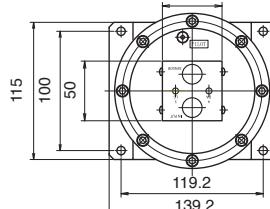
③ Pressure range

| Sign | FL-600, FL-601 | | | | FM-1061 | | FL-610, FL-611 | | | |
|------|----------------|-----|------|------|---------|------|----------------|--------|--------|--------|
| | 70W | 90W | 120W | 130W | 90W | 120W | 70W | 90W | 120W | 130W |
| -100 | V | V | V | V | | | V | VB | VB | VB |
| +50 | | | | | | | UL | | | |
| +20 | | UL | UL | UL | | | | | LC | LC |
| +100 | L | L | L | L | L | | LD, LE | LD, LE | LD, LE | LD, LE |
| +300 | | | | | | | LF | LF | LF | |
| +500 | | | | | M | | | | | |
| +700 | M | M | M | | | | MC | MC | MC | |
| +990 | H | H | | | | | HC | HC | | |

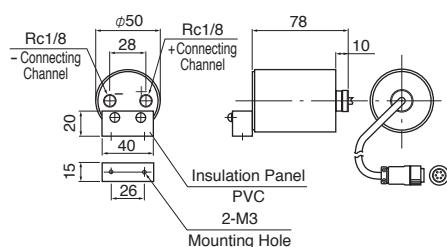
■ External dimensions (mm)



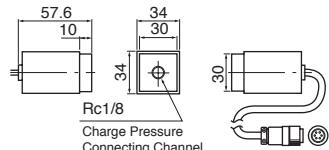
APU-130W



Pressure Sensor
SX-100D



Pressure Sensor
SX-34



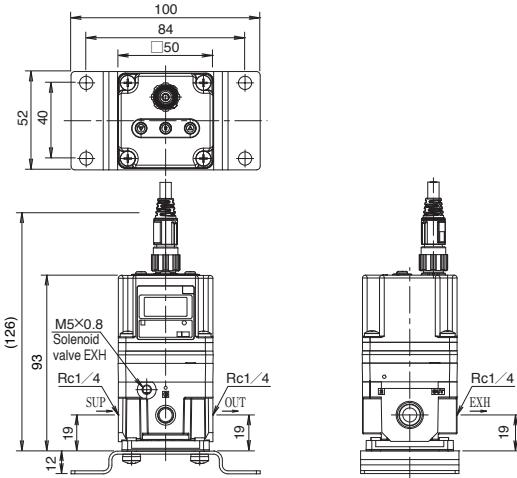


■ Specifications

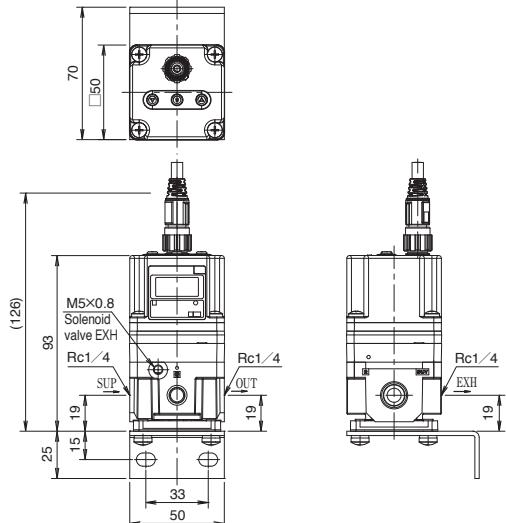
| Item | KRZ |
|---|--|
| Power source voltage | DC12~15V |
| Power consumption | Less than 0.18A |
| Input signal | DC 0~10V |
| Input impedance | About 6.5 kΩ |
| Output Signal | DC1~5V (Output impedance: About 1 kΩ) Output accuracy: less than ±6%(F.S.) |
| Linearity | Less than ±1% (F.S.) |
| Hysteresis | Less than 0.5% (F.S.) |
| Repeatability | Less than ±0.5% (F.S.) |
| Sensitivity | Less than 0.2% (F.S.) |
| Temperature characteristics | Less than ±0.12%(F.S./°C) |
| Output pressure display | Accuracy: ±2%F.S. ±1 digit Minimum unit: kPa: 1 |
| Ambient temperature and operation fluid temperature | 0~50°C (without condensation) |
| Protective structure | IP65 |
| Weight | Approx. 350g (without option) |

■ External dimensions (mm)

Flat bracket, Straight type connector



L shaped bracket, Straight type connector



■ Model

KRZ-0205 1 2 3 4

① Pressure range

| Sign | Pressure range | Set pressure range | Air leak tester correspond range | | | | | ALT F.S. | |
|------|----------------|--------------------|----------------------------------|--------|--------|--------|----------|----------|----------|
| | | | FL-600 | FL-601 | FL-610 | FL-611 | FLZ-0210 | | |
| 1 | -80 kPa | 1.3~ -80 kPa *1 | | | | VB*3 | VB*3 | | -90 kPa |
| 2 | 100 kPa | 5~100 kPa | L | L | LD | LD | LD | | 99.9 kPa |
| 3 | 300 kPa | 5~300 kPa *4 | | | LE | LE | | | 100 kPa |
| 4 | 700 kPa | 5~700 kPa *5 | M | M | MC | MC | | | 300 kPa |
| 5 | 900 kPa | 5~900 kPa *2 | H | H | HC | HC | HJ | | 700 kPa |
| | | | | | | | | | 990 kPa |

Caution 1: Cannot be used within the range under -80kPa.

Caution 2: Cannot be used within the range over 900kPa.

Caution 3: It is necessary to change the set value of the air leak tester (APU F.S. and APU polarities) for use in the VB range.

Caution 4: The maximum setting of the electro-pneumatic regulator has been changed from F.S. 500kPa to F.S. 300kPa.

Caution 5: The maximum setting of the electro-pneumatic regulator has been changed from F.S. 900kPa to F.S. 700kPa.

② Bracket

| Sign | Content |
|------|--|
| N | No brackets |
| F | 2x FR unit mounting brackets (FR unit connection fittings) |
| B | Flat bracket (For installation onto flat panels) |
| C | L shaped bracket (For installation onto vertical panels) |

Caution: The flat bracket or the L bracket cannot be used when using the FR unit mounting bracket to connect to the FR unit.

③ Air leak tester connection cable connector

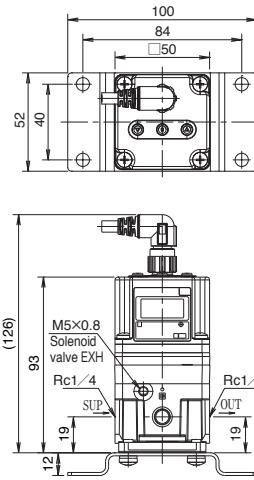
| Sign | Content | |
|------|--|-------|
| 1 | Straight type connector cable length | 0.6 m |
| 2 | | 1.5 m |
| 3 | | 3.0 m |
| 4 | | 5.0 m |
| 5 | Right angle type (L shape) connector cable length | 0.6 m |
| 6 | | 1.5 m |
| 7 | | 3.0 m |
| 8 | | 5.0 m |

④ CE Marking

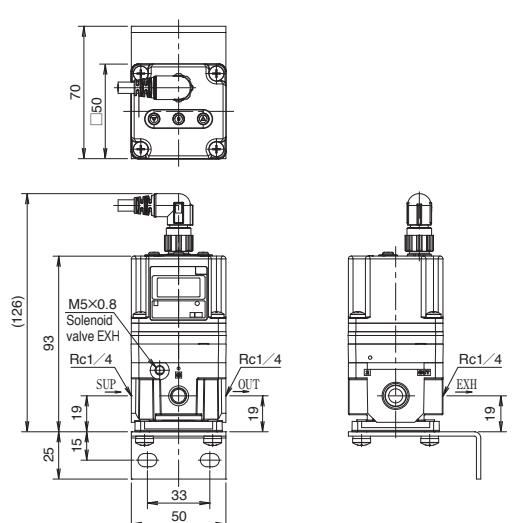
| Sign | Content |
|------|--------------------------|
| N | Not supported (standard) |
| Q | Supported |

Caution: The shape of the connector is the connector on the electro-pneumatic regulator side.

Flat bracket, Right angle type connector



L shaped bracket, Right angle type connector



Test Pressure Regulator

High pressure electro pneumatic regulator

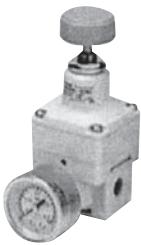


Specifications

| Item | KRZ-0906 |
|-----------------------------|---|
| Set pressure range | 5MPa (0~50bar) |
| Power source voltage | DC24V |
| Maximum current value | 1200mA |
| Output signal | DC0~10V (Sensitivity >50mV Impedance 100kΩ) |
| Linearity | Less than 0.5 % of the maximum control pressure |
| Hysteresis | Less than 1 % of the maximum control pressure |
| Repeatability | Less than 0.5 % of the maximum control pressure |
| Ambient temperature | 0~40°C (without condensation) |
| Operation fluid temperature | 0~60°C (without condensation) |
| Protective structure | IP65 |
| Weight | Approx. 950g (no option) |

Test Pressure Regulator

Precision Regulator

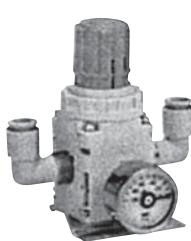


Specifications

| Item | KR-202 |
|---------------------------------------|--------------------------------|
| Maximum supply pressure | 1.0MPa |
| Minimum supply pressure | Set pressure + 0.05MPa |
| Sensitivity | Less than 0.2% of F.S. |
| Repeatability | Less than 0.5% of F.S. |
| Connection diameter | Rc1/4 |
| Connection diameter of pressure gauge | Rc1/8 (2 points) |
| Ambient temperature | -5~60°C (without condensation) |
| Weight | 0.3kg |

Test Pressure Regulator

Vacuum Regulator



Specifications

| Item | KR-204 |
|--|-------------------------------|
| Operation fluid | Air |
| Set pressure range ^(Caution: 1) | -100~-1.3kPa |
| Atmospheric air intake consumption ^(Caution: 2) | Less than 0.6L/min (ANR) |
| Handle resolution | Less than 0.13kPa |
| Ambient temperature | 5~60°C (without condensation) |
| VAC. side tubing external dimensions | φ8 |
| SET. side tubing external dimensions | φ8 |
| Weight (Standard piping specifications) | 250g (without accessories) |

Caution 1: Changes are possible due to pressure supplied from the vacuum pump.

Caution 2: Air is supplied from the atmosphere at all times.

Model

KRZ-0906-①②

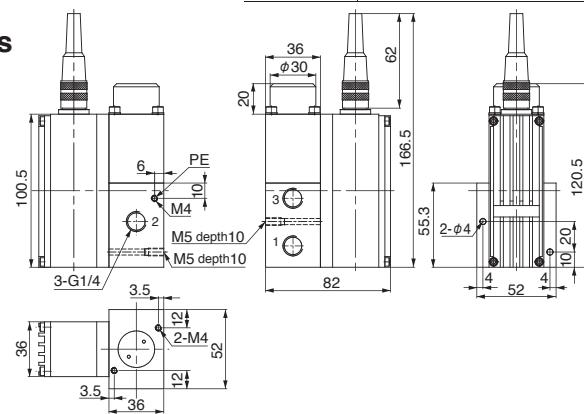
① Pressure range

| Sign | Set pressure range |
|------|--------------------|
| 1 | 5MPa (0~50bar) |

② Cable state

| Sign | Content |
|------|---|
| 1 | The cable supplied with this product is not modified |
| 2 | Cable is not modified for FL-6 XX Refer to the A127185-D-001 cable wiring manual |

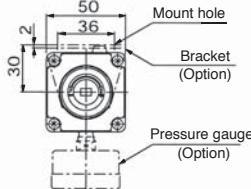
External dimensions (mm)



Model

KR-202-①②

External dimensions (mm)

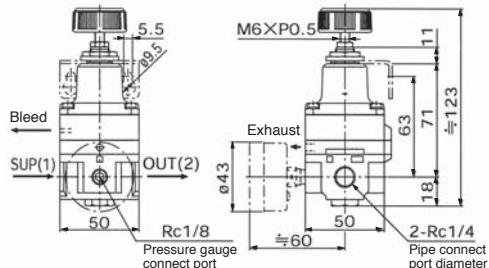


① Setting pressure range

| Sign | Setting Pressure range |
|------|------------------------|
| 0 | 0.005~0.2 MPa |
| 1 | 0.01 ~0.4 MPa |
| 2 | 0.01 ~0.8 MPa |

② Accessories

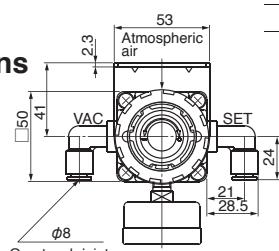
| Sign | Contents |
|------|---------------------|
| N | No |
| B | With bracket |
| G | With pressure gauge |



Model

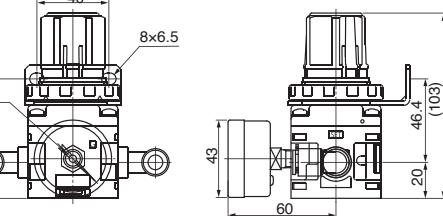
KR-204-①

External dimensions (mm)



① Accessories

| Sign | Contents |
|------|---------------------|
| N | No |
| B | With bracket |
| G | With pressure gauge |



Test Pressure Regulator

High Pressure Regulator



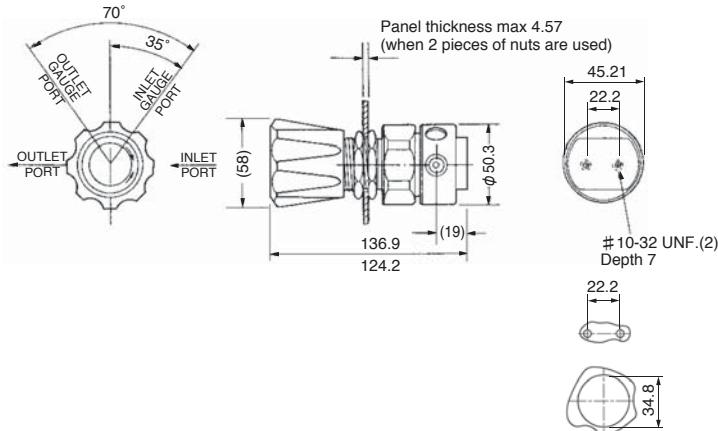
■ Specifications

| Item | KR-903 |
|----------------------------------|---|
| Maximum input pressure | 24.1MPa |
| Regulation pressure range | 0.01~3.44MPa |
| CV value | 0.06 (High pressure type) |
| Leak rate | $2 \times 10^{-9} \text{ Pa} \cdot \text{m}^3/\text{sec}$ |
| Input pressure endurance | 27.0MPa |
| Output pressure endurance | 150% of regulated pressure |
| Designed destruction pressure | 400% of regulated pressure |
| Operating temperature | -40~74°C |
| Main body material | Brass |
| Main body weight | Approx. 0.9kg |
| Inlet/Outlet connection diameter | NPT 1/4 |

■ Model

KR-903

■ External dimensions (mm)



Test Pressure Regulator

High Pressure Regulator



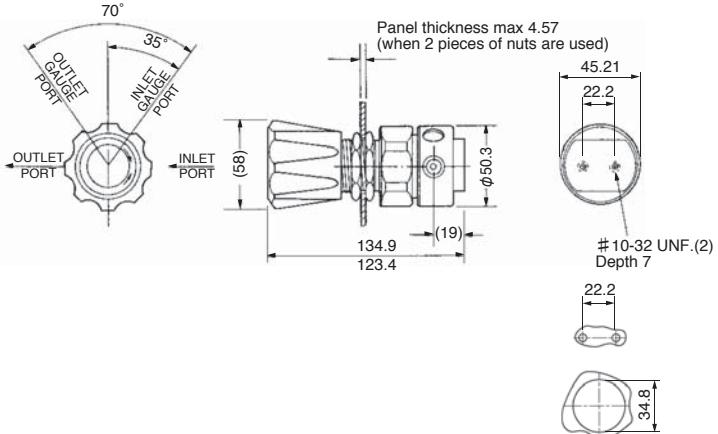
■ Specifications

| Item | KR-904 |
|---------------------------|----------------------------|
| Maximum input pressure | 24.13MPa |
| Output pressure endurance | 0.03~3.45MPa |
| Design pressure endurance | 150% of maximum pressure |
| Operating temperature | -26~93°C |
| CV value | 0.06 |
| Body material | Brass |
| Structure | Includes exhaust mechanism |
| Inlet/Outlet gauge port | NPT 1/4 |
| Body weight | 0.91kg (no gauge) |

■ Model

KR-904

■ External dimensions (mm)



Test Pressure Regulator

High Pressure Regulator



■ Specifications

| Item | KRZ-0905-1 |
|---------------------------|---------------------------------|
| Set pressure range | Max. 5.5MPa |
| Regulation pressure range | 0~5.5MPa (0~800PSI) |
| CV value | 0.06 |
| Operating temperature | -40~74°C (without condensation) |
| Weight | Approx. 2.2kg |

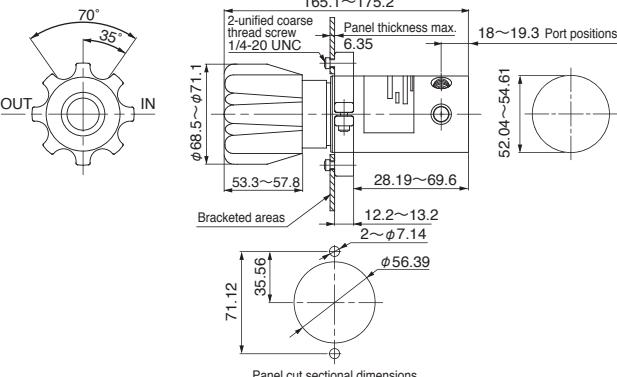
■ Model

KRZ-0905-1

● Pressure range

| Sign | Set pressure range |
|------|--------------------|
| 1 | Max. 5.5MPa |

■ External dimensions (mm)



Test Pressure Switching Valve

Three Port Connection Valve



Specifications

| Item | KV-201 |
|---|---|
| Switching method | Direct acting double position single solenoid |
| Operation fluid | Air |
| Operation pressure range | 0~0.9MPa |
| Ambient temperature and operation fluid temperature | -10~50°C (without condensation) |
| Response time | Less than 30ms (at 0.5MPa) |
| Maximum operating frequency | 10Hz |
| Manual operation | Non lock push type |
| Body type | Direct piping type |
| Lead wire removal method | Grommet, Lead wire length 300mm |
| Connection diameter | Rc1/4 |
| Surge voltage countermeasure | With protection circuit |

Test Pressure Switching Valve

Three Port Connection Valve



Specifications

| Item | KV-202 |
|---|---|
| Switching method | Direct acting double type, position single solenoid |
| Operation fluid | Air |
| Operation pressure range | 0~1.0MPa |
| Ambient temperature and operation fluid temperature | -10~50°C (without condensation) |
| Response time | Less than 30ms (at 0.5MPa) |
| Maximum operating frequency | 5Hz |
| Rated voltage | AC100V 50/60Hz |
| Lead wire take out method | Grommet, lead wire length 300mm |
| Connection diameter | Rc3/8 |
| Surge voltage countermeasure | With protection circuit |

Model

KV-201- 1 2

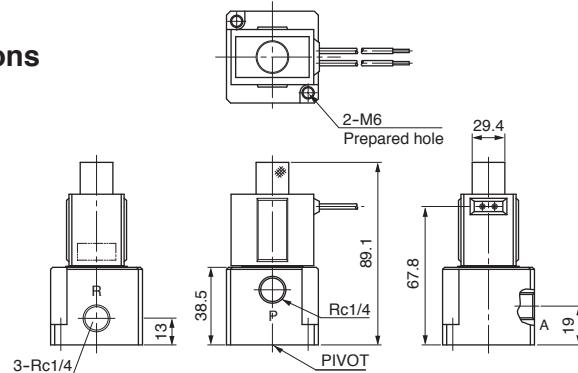
① Valve

| Sign | Content |
|------|----------------------|
| N | Standard |
| V | Vacuum specification |

② Rated voltage

| Sign | Rated voltage |
|------|---------------|
| 1 | AC100V |
| 2 | AC110V |
| 3 | DC24V |

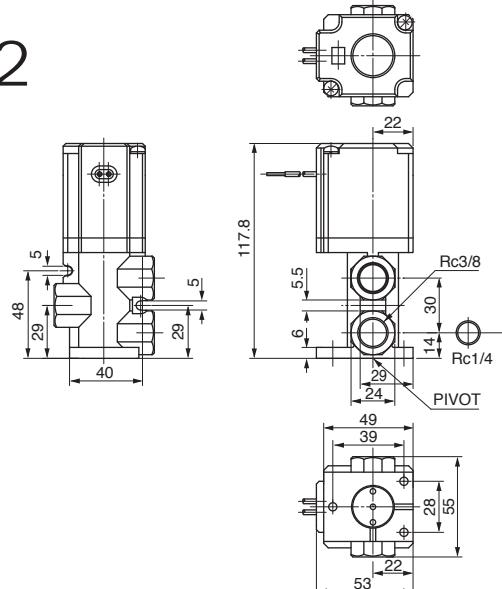
External dimensions (mm)



Model

KV-202

External dimensions (mm)



Test Pressure Switching Valve

Two Port Connection Valve



Specifications

| Item | KV-101 |
|--|--|
| Operation fluid | Air, Water, lamp oil, oil (less than 50mm ³ /sec) |
| Pressure endurance (with water pressure) | 25MPa |
| Fluid temperature | -10~60°C (Without condensation) |
| Ambient temperature | -20~60°C |
| Body seal material | Nitrile rubber |

Model

KV-101- 1 - 2 3 - 4

① Model shape

| Sign | Function |
|------|---------------------------|
| 31 | NC (normally closed) type |
| 41 | NC (normally closed) type |
| 42 | NC (normally closed) type |

② Connection diameter

| Sign | Specifications | ①-31 | ①-41 | ①-42 |
|------|----------------|------|------|------|
| A | Rc1/8 | ○ | — | — |
| B | Rc1/4 | ○ | ○ | ○ |
| C | Rc3/8 | — | ○ | ○ |

③ Orifice

| Sign | Specifications | ①-31 | ①-41 | ①-42 |
|------|----------------|------|------|------|
| 1 | φ 1.5 | ○ | ○ | ○ |
| 2 | φ 2 | ○ | ○ | ○ |
| 3 | φ 3 | ○ | ○ | ○ |
| 4 | φ 3.5 | ○ | ○ | ○ |
| 5 | φ 4 | ○ | ○ | ○ |
| 6 | φ 5 | ○ | ○ | ○ |
| 7 | φ 7 | — | ○ | ○ |

④ Power source voltage

| Sign | Specifications |
|------|----------------|
| 100 | AC100V |
| 200 | AC200V |
| 024 | DC24V |

※ Refer to model specifications on the next page.

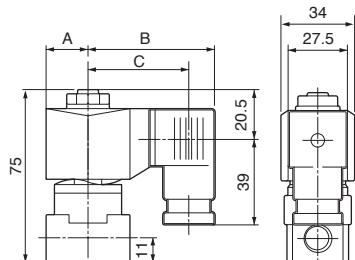
■ KV-101 Specifications by Model

| | Shape | Connection | Orifice | Maximum operable Pressure (MPa) | | | | | | Maximum usage pressure (MPa) | |
|--------|-------|------------|---------|---------------------------------|------|-------------------------------|------|------|------|------------------------------------|--|
| | | | | Air | | Water, hot water, lamp oil | | Oil | | | |
| | | | | AC | DC | AC | DC | AC | DC | | |
| KV-101 | 31 | A, B | 1 | φ1.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 1.0 | |
| | | | 2 | φ2 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.0 | |
| | | | 3 | φ3 | 1.0 | 0.5 | 0.7 | 0.5 | 0.5 | 0.7 | |
| | | | 4 | φ3.5 | 0.6 | 0.4 | 0.5 | 0.4 | 0.4 | 0.5 | |
| | | | 5 | φ4 | 0.4 | 0.25 | 0.3 | 0.25 | 0.25 | 0.3 | |
| | | | 6 | φ5 | 0.2 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | |
| | 41 | B, C | 1 | φ1.5 | 5.0 | 4.0 | 4.5 | 4.0 | 4.0 | 1.0 | |
| | | | 2 | φ2 | 3.0 | 2.5 | 2.7 | 2.5 | 2.5 | 1.0 | |
| | | | 3 | φ3 | 1.5 | 0.9 | 1.3 | 0.9 | 0.9 | 1.0 | |
| | | | 4 | φ3.5 | 1.2 | 0.6 | 0.9 | 0.6 | 0.6 | 0.9 | |
| | | | 5 | φ4 | 1.0 | 0.5 | 0.7 | 0.5 | 0.5 | 0.7 | |
| | | | 6 | φ5 | 0.6 | 0.25 | 0.4 | 0.25 | 0.25 | 0.4 | |
| | | | 7 | φ7 | 0.25 | 0.1 | 0.2 | 0.1 | 0.15 | 0.2 | |
| | 42 | B, C | 1 | φ1.5 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 1.0 | |
| | | | 2 | φ2 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | |
| | | | 3 | φ3 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | |
| | | | 4 | φ3.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | |
| | | | 5 | φ4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | |
| | | | 6 | φ5 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | |
| | | | 7 | φ7 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | |

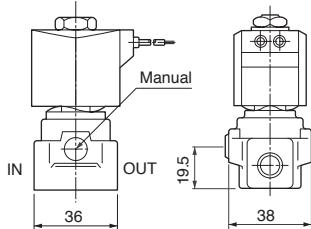
■ External dimensions (mm)

KV-101-31

▼ With DIN terminal box

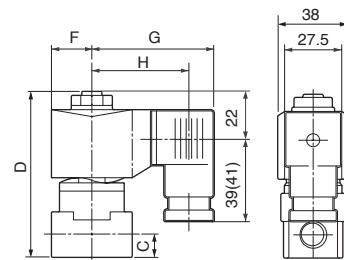


▼ Manual (lock type)

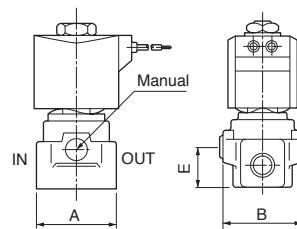


KV-101-41

▼ With DIN terminal box

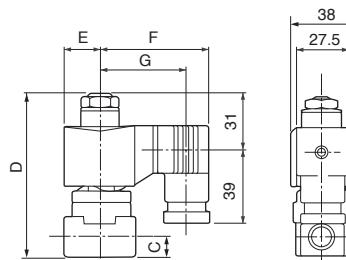


▼ Manual (lock type)

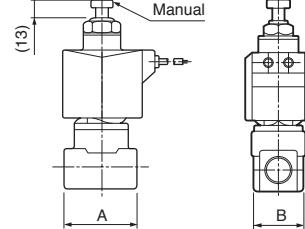


KV-101-42

▼ With DIN terminal box



▼ Manual (lock type)



| Type No. | A | B | C | D | E |
|-----------------|----|----|----|------|------|
| KV-101-41-B1~B6 | 36 | 38 | 11 | 80.5 | 19.5 |
| KV-101-41-B7 | 40 | 40 | 12 | 83.5 | 22.5 |
| KV-101-41-C1~C7 | 40 | 28 | 12 | 94 | 97 |

| Voltage | F | G | H |
|---------|------|------|----|
| AC | 23.5 | 65.5 | 54 |
| DC | 23.5 | 66 | 54 |

| Type No. | A | B | C | D |
|-----------------|----|----|----|----|
| KV-101-41-B1~B6 | 36 | 28 | 11 | 94 |
| KV-101-41-B7 | 40 | 28 | 12 | 97 |
| KV-101-41-C1~C7 | 40 | 72 | 60 | 97 |

| Voltage | E | F | G |
|---------|------|------|----|
| AC | 23.5 | 65.5 | 54 |
| DC | 28 | 72 | 60 |

| Voltage | A | B | C |
|---------|----|------|------|
| AC | 20 | 62 | 50.5 |
| DC | 21 | 63.5 | 52 |

Charge Bypass

Charge Bypass Unit



Specifications

| Item | CBU-600 |
|-----------------------------|-------------------------------------|
| Pilot valve drive pressure | 300~700kPa |
| Pilot valve rated voltage | DC24V |
| Operation temperature range | 0~40°C |
| Operation humidity range | 35~85%RH% (without condensation) |

Model

①-600 ②-③-④

① Model

| Sign | Function |
|------|--------------------|
| CBU | Charge bypass unit |

② Range

| Sign | Operation pressure range |
|------|--------------------------|
| C | 10~700 kPa |

③ Bypass unit control cable

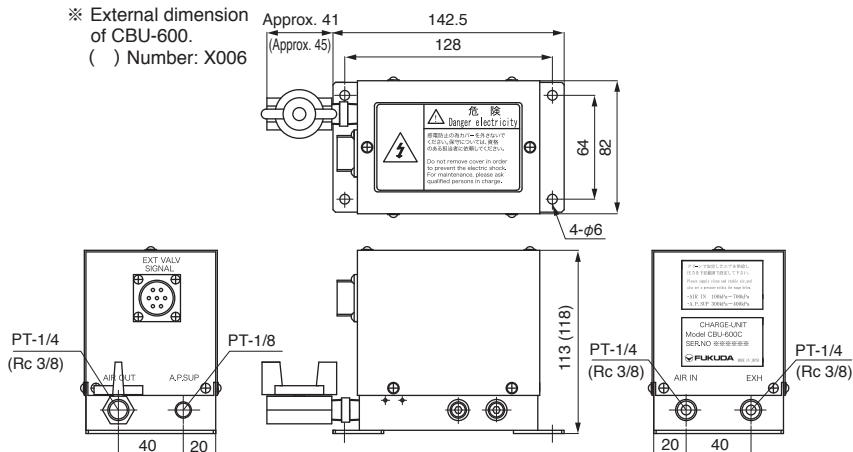
| Sign | Content | Remarks |
|------|---------|--------------------|
| 1.5 | 1.5m | Standard accessory |
| 3 | 3m | Option |

④ Exhalation flow rate

| Sign | Content |
|---------|-----------------|
| No sign | Standard |
| X006 | Large flow rate |

External dimensions (mm)

※ External dimension of CBU-600.
() Number: X006



Work Pressure Confirmation

Digital Pressure Gauge



Specifications

| Item | KM-901 |
|--|---|
| Pressure range (maximum display digit) | ±100kPa: -0.1~2MPa 0~500kPa: 0~50MPa |
| Operation fluid | Air, water, oil (Gas or fluid that will not corrode the liquid contact part) |
| Material of liquid contact part | SUS630(17-4PH)、SUS304 |
| Acceptable maximum pressure | 2 times the operation pressure range (1.5 times for 35MPa and 50MPa) |
| Display precision | ±(1.0% F.S. + 1 digit) |
| Temperature characteristics | ±0.1% F.S./ °C (For zero point and span) |
| Display method | 3½ digit, LED display (Character height 10mm) |
| Display period | 0.2sec |
| Power source/ Current consumption | 12~24V DC±10% Less than 30mA DC |
| Cable length | 2m |
| Operation temperature range | -10~50°C |
| Operation humidity range | 35~85% RH (without condensation) |
| Weight | Approximately 100g (including cable) |

Model

KM-901-①-②③④

① Mount

| Sign | Mount |
|------|------------------|
| 1 | Vertical mount |
| 3 | Horizontal mount |

② Connection screw

| Sign | Joint standard | Operation maximum pressure range |
|------|--------------------------------|----------------------------------|
| 2 | G1/4B | 50 MPa |
| 6 | R1/8 (M5 Female type included) | 1 MPa |
| 7 | R1/4 | 50 MPa |

③ Pressure range

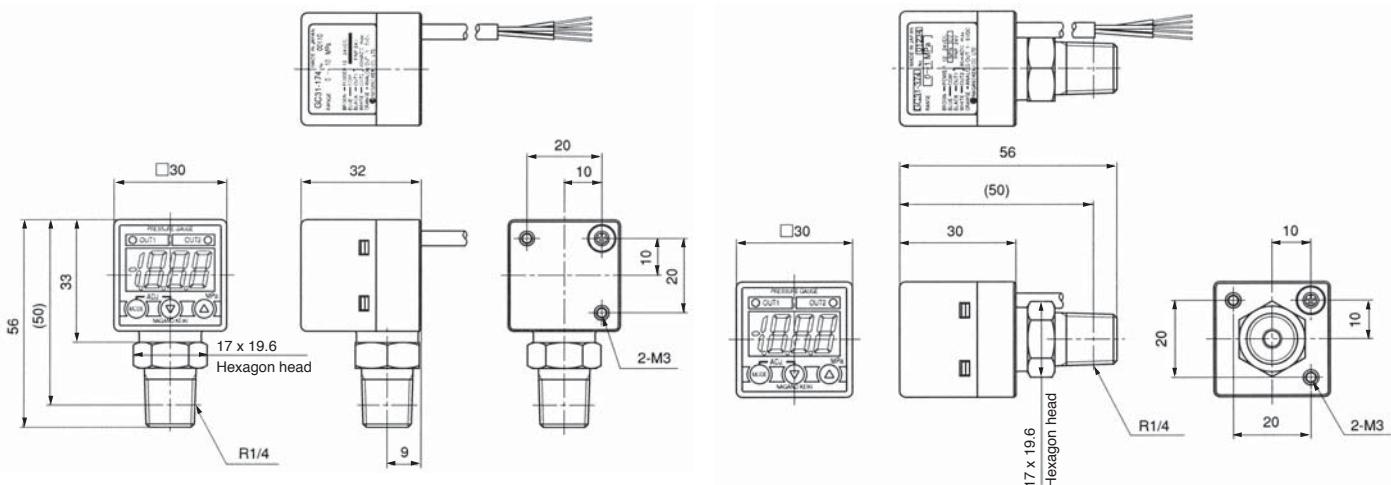
| Sign | Pressure range |
|------|----------------|
| A | -100~100 kPa |
| B | -100~500 kPa |
| C | -0.1~ 1 MPa |
| D | -0.1~ 2 MPa |
| G | 0~500 kPa |
| H | 0~ 1 MPa |
| J | 0~ 2 MPa |
| K | 0~ 3.5 MPa |
| L | 0~ 5 MPa |
| M | 0~ 10 MPa |
| N | 0~ 20 MPa |
| P | 0~ 35 MPa |
| Q | 0~ 50 MPa |

④ Comparator output

| Sign | Specifications |
|------|---|
| 1 | PNP open corrector ×2 output (80mA max.) |
| 3 | NPN open corrector ×2 output (30VDC, 80mA max.) |

※ Refer to external dimensions on the next page.

■ KM-901 External dimensions (mm)



■ Specifications

Sensor part

| Item | Specifications |
|---------------------------------|--|
| Measuring fluid | Dry gas |
| Connecting type | R1/4 |
| Material at gas connecting part | Elementos: Alumina 96% Connector: SUS316 Packing: Fluorosilicone |
| Voltage | 5V±0.25VDC |
| Accuracy | ±0.5%F.S. (at 23±3°C includes linearity and hysteresis) |

Display part

| Item | Specifications |
|----------------------|----------------------|
| Sampling speed | Max. 25 times/sec |
| Max. display | ±9999 (Full 4-digit) |
| Output | Photocoupler output |
| Power source voltage | DC24V±20% |

■ Model

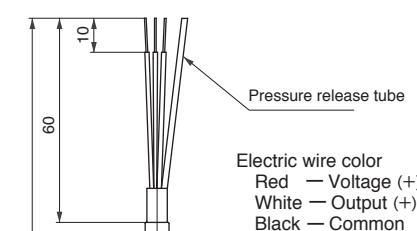
KM-904-1

① Tolerable pressure range

| Sign | Pressure range | Tolerable pressure range |
|------|----------------|--------------------------|
| 1 | 0~10 kPa | -10~50 kPa |
| 2 | 0~20 kPa | -20~100 kPa |
| 3 | 0~50 kPa | -50~250 kPa |
| 4 | 0~0.1 MPa | -0.1~0.5 MPa |
| 5 | 0~0.2 MPa | |
| 6 | -0.1~0.2 MPa | |
| 7 | 0~0.3 MPa | |
| 8 | -0.1~0.3 MPa | |
| 9 | 0~0.5 MPa | -0.1~1 MPa |

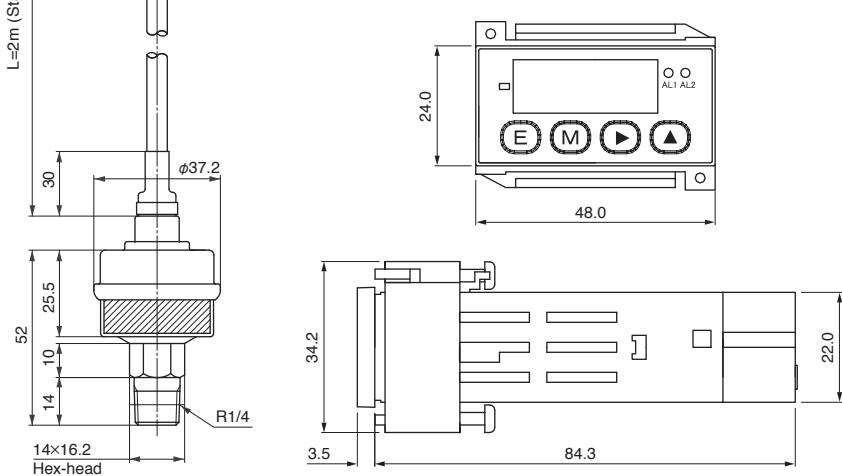
■ External dimensions (mm)

● Sensor part



Electric wire color
Red — Voltage (+)
White — Output (+)
Black — Common

● Display part



Confirmation gauge

Flow standard



■ Specifications

| Item | FFM-100 |
|-----------------------|---|
| Operation medium | Clean air (Corresponds to compressed air quality 1.3.1) |
| Operation temperature | 23 ±3°C |
| Repeatability | ±5% of measured flow rate (with ambient temperature 23 °C) ±0.05mL/min in case measured flow rate less than 1mL/min |
| Accessories | Coupling 2pcs Seal plug 1pc Instruction manual, certification, test results |

■ Model

FFM-100-①-②

① Pressure indication

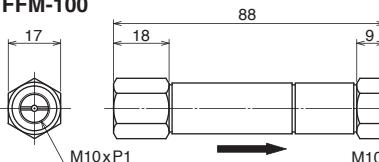
| Content | Pressure range |
|-------------------|----------------|
| Positive pressure | 10~50 kPa |
| | 50~100 kPa |
| | 100~800 kPa |
| Negative pressure | -10~80 kPa |
| | -10~80 kPa |

② Flow indication

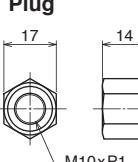
| Content | Pressure range |
|-------------------|----------------|
| Positive pressure | 0.1~50 mL/min |
| | 0.1~100 mL/min |
| | 0.1~200 mL/min |
| Negative pressure | 0.1~50 mL/min |
| | 0.1~50 mL/min |

■ External dimensions (mm)

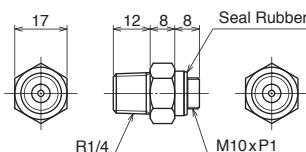
FFM-100



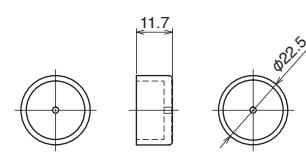
Plug



Coupling



Resin cap



Confirmation Gauge

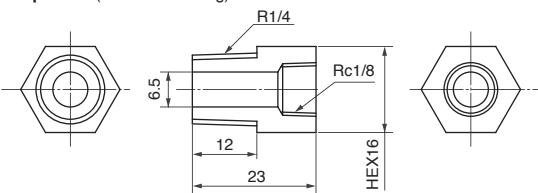
Calibrator



■ Specifications

| Item | Type | | |
|---------------------------------------|--|---------|---------|
| | CAL-0.1 | CAL-1.0 | CAL-5.0 |
| Stroke | 5 | 10 | 5 |
| Rotation number | 5 | 10 | 5 |
| Volume change per rotation mL | 0.02 | 0.1 | 1.0 |
| Volume change per minimum division mL | 0.0004 | 0.002 | 0.02 |
| Precision | 5% F.S. | | |
| Connection | R1/8 | | |
| Leak | 0.02 mL/min at 300 kPa | | |
| Operation pressure | Under atmospheric pressure | | |
| Operation temperature/ humidity | 0~40°C, 45~85%RH (without condensation) | | |

※ Option A (Conversion fitting)



■ Model

CAL-①-②

① Volume change indication

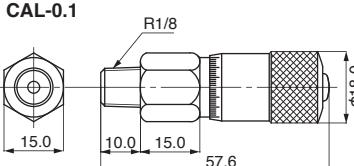
| Sign | Content |
|------|-------------|
| 0.1 | 0.1 mL F.S. |
| 1.0 | 1.0 mL F.S. |
| 5.0 | 5.0 mL F.S. |

② Option

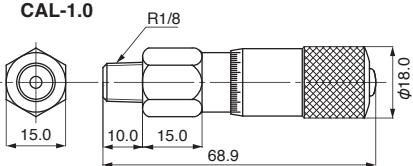
| Sign | Content |
|---------|------------------------------------|
| No sign | No |
| A * | R1/4 Conversion fitting attachment |
| B * | M10 Conversion fitting attachment |

■ External dimensions (mm)

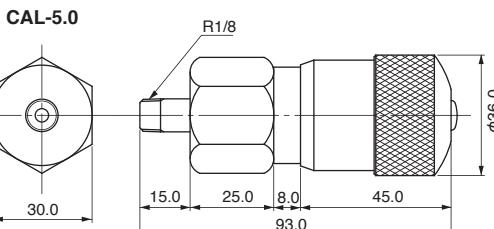
CAL-0.1



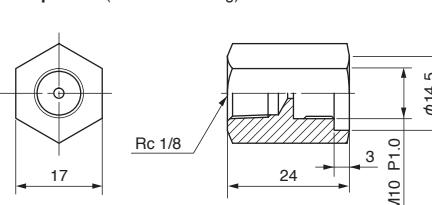
CAL-1.0



CAL-5.0



※ Option B (Conversion fitting)





■ Specifications

| Item | KM-903 |
|--------------------|-----------------------------|
| Precision | F.S. 2% (Measurement point) |
| Pressure endurance | Less than 100mL/min: 1.0MPa |
| | Less than 5L/min: 0.7MPa |
| | Less than 10L/min: 0.5MPa |
| Effective division | 10 : 1 |

■ Model

KM-903-**(1)****(2)**(**(3)**)**(4)**-**(5)**-**(6)**

① Total length

| Sign | Total length |
|------|--------------|
| 12 | 126 mm |
| 15 | 156 mm |
| 20 | 206 mm |
| 25 | 256 mm |

② Material

| Sign | Material |
|------|----------|
| SS | SUS 316 |
| B | Brass |

③ Flow rate

| Flow rate Total length | Total length | | | | | | | | |
|---------------------------|--------------|-----------|-----------|-----------|-----------|------------|------------|------------|------------|
| | 5 mL/min | 10 mL/min | 20 mL/min | 30 mL/min | 50 mL/min | 100 mL/min | 150 mL/min | 200 mL/min | 300 mL/min |
| 12 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 15 | - | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 20 | - | - | - | - | ○ | ○ | ○ | ○ | ○ |
| 25 | - | - | - | - | - | ○ | ○ | ○ | ○ |

④ Total length

| Flow rate Total length | Total length | | | | | | | | |
|---------------------------|--------------|---------|---------|---------|---------|----------|----------|----------|----------|
| | 500 mL/min | 1 L/min | 2 L/min | 3 L/min | 5 L/min | 10 L/min | 15 L/min | 20 L/min | 30 L/min |
| 12 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 15 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 20 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 25 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

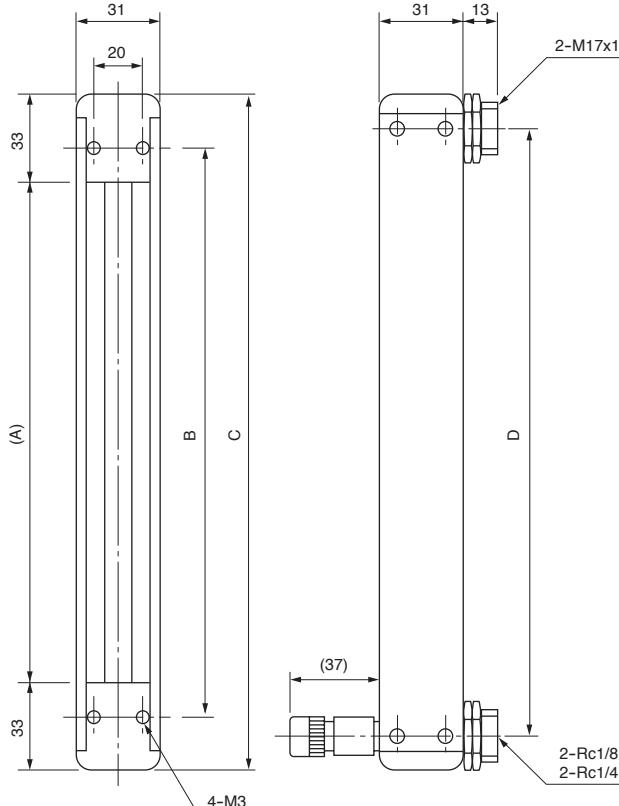
⑤ Needle position

| Sign | Position |
|------|-------------------|
| U | Upper part needle |
| D | Lower part needle |

⑥ Supply pressure

⑦ Output pressure

■ External dimensions (mm)



Dimensions of each part

| Part | 12 | 15 | 20 | 25 |
|------|-----|-----|-----|-----|
| A | 60 | 90 | 140 | 190 |
| B | 86 | 116 | 166 | 216 |
| C | 126 | 156 | 206 | 256 |
| D | 100 | 130 | 180 | 230 |



■ Model

ESV **①** - **②** - **③** - **④**

① Used tester

| Sign | Content |
|------|-----------------------|
| 100 | FL-600, FL-601 series |
| 110 | Series by each volume |

※ Please discuss your requirements with nearest sales office as testers are designed for specific operations.

② With/without exhaust valve

| Sign | Content |
|------|---------------|
| 0 | Without valve |
| 1 | With valve |

※ Please discuss your requirements with nearest sales office as testers are designed for specific operations.

③ Exhaust valve indication

| Sign | Content | Remarks |
|------|----------------------------------|---|
| 1 | Interlock with switching valve A | When 1 switching unit is used by 1 tester |
| 2 | Interlock with switching valve B | When 2 switching units are used by 1 tester |
| 3 | Single operation indication | Air pilot valve: all normal closed type. |
| 4 | Exhaust bypass specification | When used as external evacuation valve |

④ Cable indication

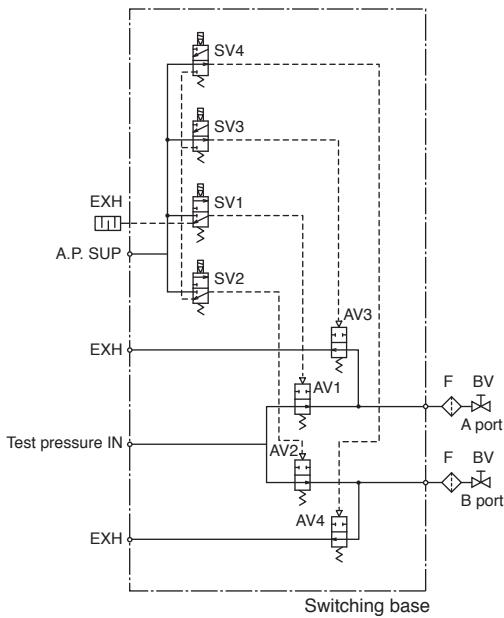
| Sign | Cable | Remarks |
|------|------------------------------------|---|
| 0 | No cable | |
| 1 | 1.5m | |
| 2 | 5m | |
| 3 | 1.5m × 2 | When interlocked switching valve A and B are used |
| 4 | 5m × 2 | When interlocked switching valve A and B are used |
| 5 | 1.5m + with CBU cable | |
| 6 | 1.5m + with EBU cable | |
| 7 | Specified single cable | |
| 8 | Exhaust bypass specification cable | |

■ Specifications

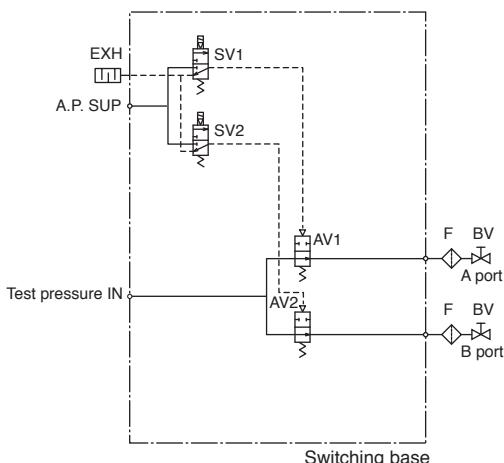
| Item | ESV |
|---------------------------------|---|
| Port number | 2 ports |
| Operation pressure range | -90~700kPa |
| Leak standard | 0.08mL/min (Test pressure 700kPa, One measurement circuit open, and one closed) |
| Air pilot supply pressure | 300~400kPa |
| Inner volume measurement system | 12.5mL |
| Operation fluid | Clean air and non corrosive fluid against C3604, A2017, and NBR |
| Operation temperature/humidity | 0~40°C, 45~85%RH (without condensation) |

■ Exhaust valve circuit diagram

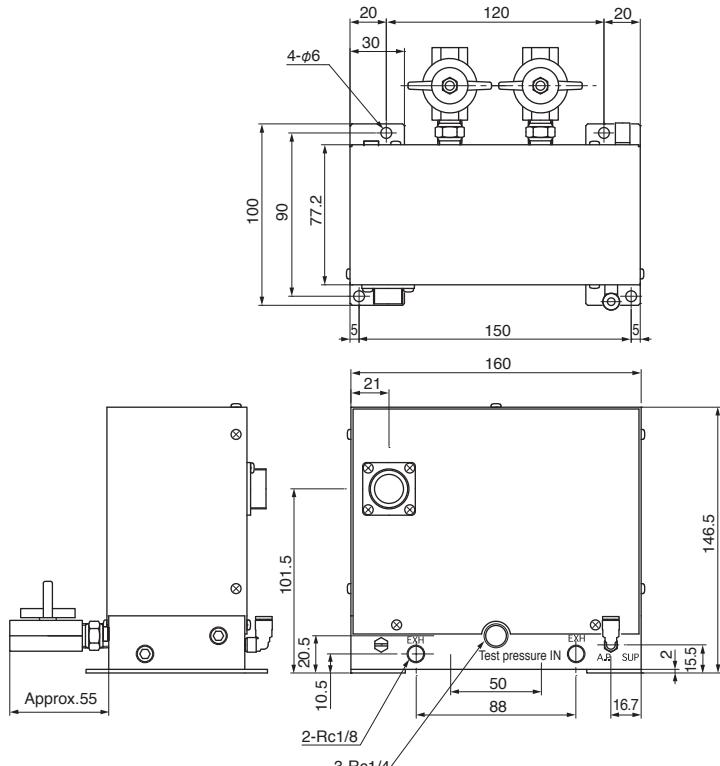
● With exhaust valve



● Without exhaust valve



■ External dimensions (mm)



Exhaust Bypass

Exhaust Bypass Unit



■ Specifications

| Item | EBU-600 |
|------------------------------|------------------------------------|
| Pilot valve driving pressure | 300~700kPa |
| Pilot valve rated voltage | DC24V |
| Operation temperature range | 0~40°C |
| Operation humidity range | 35~85%RH (without condensation) |

■ Model

① - 600 ② - ③

① Model

| Sign | Function |
|------|---------------------|
| EBU | Exhaust bypass unit |

② Range

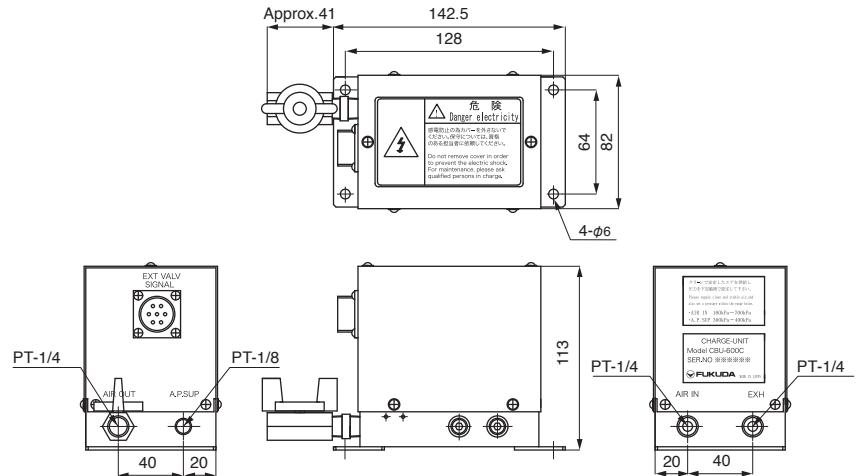
| Sign | Operation pressure range |
|------|--------------------------|
| C | 10~700 kPa |
| V | -5~-90 kPa |

※ The leak tester gets modified for V specifications.

③ Bypass unit control cable

| Sign | Content | Remarks |
|------|---------|--------------------|
| 1.5 | 1.5m | Standard accessory |
| 3 | 3m | Option |

■ External dimensions (mm)



Exhaust Bypass

External Exhaust Bypass Unit



■ Specifications

| Item | FE-20 |
|-----------------------------|---------------------------------|
| Cylinder driving pressure | 400~700kPa |
| Power source voltage | AC100V±10% 50/60Hz |
| Operation temperature range | 0~40°C |
| Operation humidity range | 35~85%RH (without condensation) |

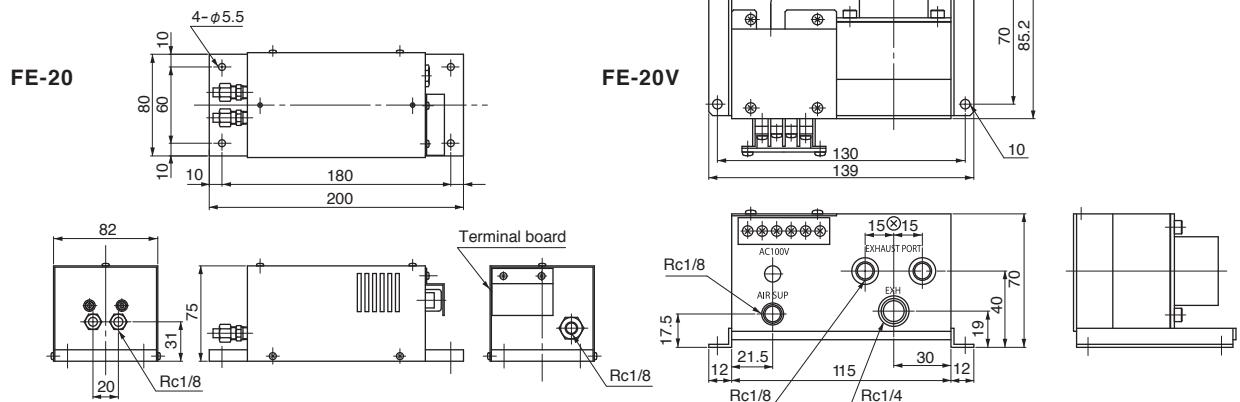
■ Model

FE-20 ①

① Model

| Sign | Pressure range | Function |
|------|----------------|----------|
| No | 1~990 kPa | AC100V |
| C | 1~800 kPa | AC100V |
| V | -5~-90 kPa | AC100V |
| X003 | 1~1.5MPa | AC100V |
| X005 | 1~1.5MPa | DC24V |

■ External dimensions (mm)





■ Model

KP-901-**(1)**-**(2)**-**(3)**-**(4)**

① Model

| Sign | External diameter (mm) | Internal diameter (mm) |
|------|------------------------|------------------------|
| 1/8 | 3.18 | 1.6 |
| 3/16 | 4.76 | 2.42 |
| 1/4 | 6.35 | 3.21 |
| 5/16 | 7.94 | 4.02 |
| 3/8 | 9.53 | 4.81 |
| 1/2 | 12.7 | 6.4 |

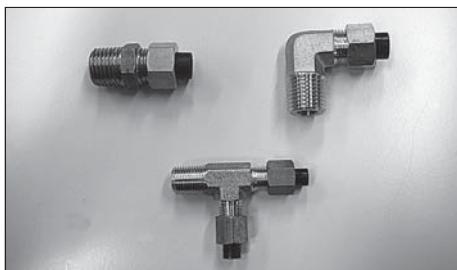
② Tube color

| Sign | Color |
|------|-------|
| B | Black |
| W | Opal |

③ Length

| Sign | Length |
|------|--------|
| 20 | 20 m |

④ Quantity



■ Model

KJ-901-**(1)** **(2)** -**(3)**

① Shape

| Sign | Content |
|------|-----------|
| C | Connector |
| E | 90° elbow |
| S | Service T |

③ Number

| Sign | Number |
|------|-----------|
| 10 | 10 pieces |

② Size

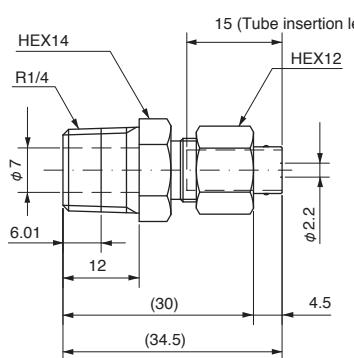
| Sign | Applied tube external diameter | T screw size | Connector | 90° elbow | Service T | Tube insertion length |
|------|--------------------------------|--------------|-----------|-----------|-----------|-----------------------|
| 01 | 1/8 | R1/8 | ○ | ○ | ○ | 21 mm |
| 02 | 3/16 | R1/8 | ○ | ○ | ○ | 15 mm |
| 03 | 3/16 | R1/4 | ○ | — | — | 15 mm |
| 04 | 1/4 | R1/8 | ○ | ○ | ○ | 15 mm |
| 05 | 1/4 | R1/4 | ○ | ○ | ○ | 15 mm |
| 06 | 5/16 | R1/8 | ○ | ○ | ○ | 16 mm |
| 07 | 5/16 | R1/4 | ○ | ○ | ○ | 16 mm |
| 08 | 3/8 | R1/8 | ○ | — | — | 18 mm |
| 09 | 3/8 | R1/4 | ○ | ○ | ○ | 18 mm |
| 10 | 3/8 | R3/8 | ○ | ○ | ○ | 18 mm |
| 11 | 1/2 | R1/4 | ○ | ○ | — | 19 mm |
| 12 | 1/2 | R3/8 | ○ | ○ | ○ | 19 mm |
| 13 | 1/2 | R1/2 | ○ | ○ | — | 19 mm |

■ Specifications

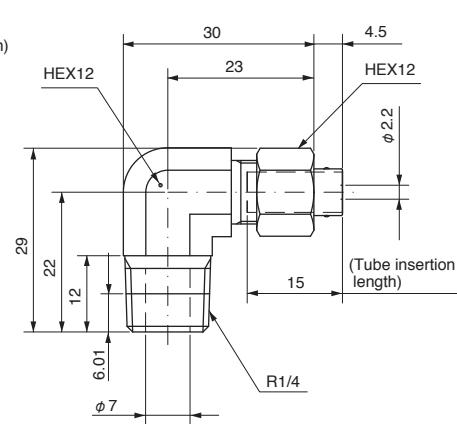
| Item | KJ-901 |
|-----------------------------|---|
| Operation fluid | Air, water, general hydraulic oil, chemicals |
| Maximum operation pressure | Depending on maximum operation pressure of operation tube |
| Operation temperature range | Air, general hydraulic oil : -40~+80°C Water : 0~+70°C |
| Negative performance | 0.1 Torr (-759.9 mmHG) |
| Material | Brass |

■ External dimensions (mm)

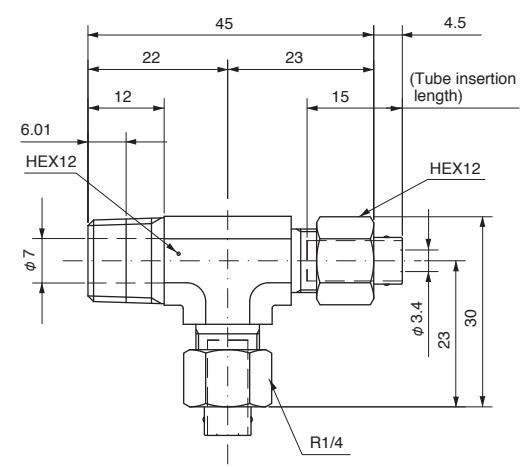
● Connector



● 90° elbow



● Service T





■ Model

D4-001-①

① Conversion signal

| Sign | Remarks |
|------|---|
| 01 | FL-3700 → FL-600 selection (ERR, INT / EXT signal logic change) |
| 02 | FL-296 → FL-600 selection (ERR, PSW signal logic change) |
| 03 | FL-3700 → FL-600 selection (No signal logic change) |
| 04 | FL-296 → FL-600 selection (No signal logic change) |

■ Specifications

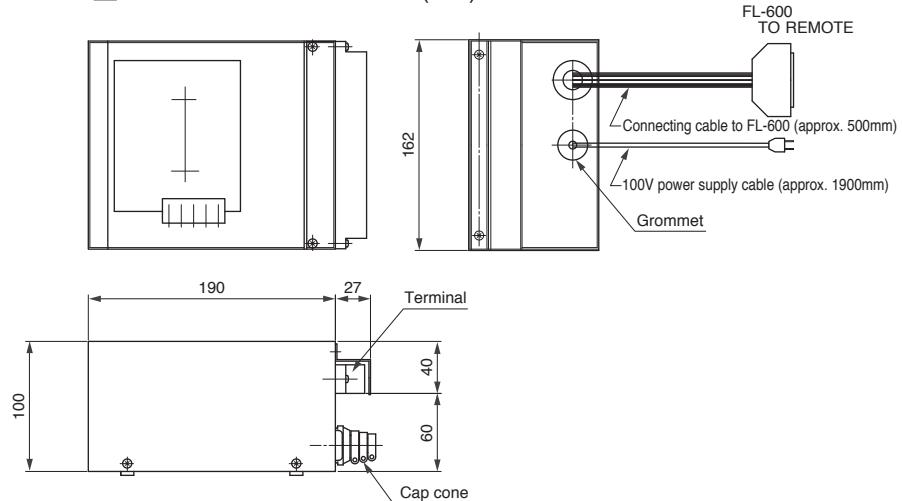
This conversion BOX with terminals allows FL-3700 series equipments connected to terminals are used for FL-600 series.

● Note:

Please refer to the FL-600 series operation manual for connecting method to sequencer, working voltage range, contact point volume, and other specifications.

※ FL-600 series corresponds to models FL-600, FL-601, and FL-610.

■ External dimensions (mm)



Check Tool

Pressure Standard Container



■ Specifications

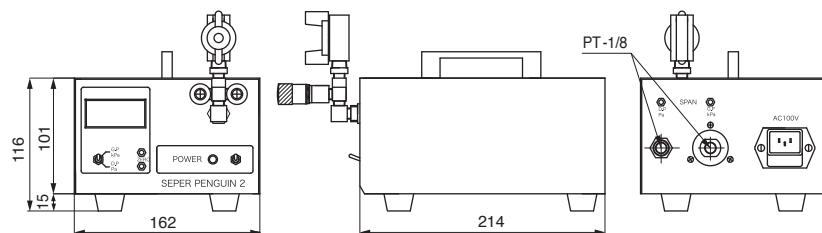
| Item | CL-100 |
|-----------------------|--|
| Ambient conditions | Temperature: 0~40°C No temperature change during measurement. |
| | Humidity: 40~80%RH (without condensation) |
| Power source voltage | Standard specification: AC90~110V Special specification: AC200~240V |
| Insulating resistance | More than 50MΩ at DC500V |
| Dimension | 160(W)×100(H)×210(D) mm |
| Weight | Approximately 3.3kg |
| Operation sensor | Pressure difference sensor: ±0.5% F.S. Direct pressure sensor: ±0.3% F.S. |
| | Pressure difference: -2000~2000Pa Direct pressure : 0~1000kPa (gauge pressure) |

※ Note specifications may differ from standard specifications.

■ Model

CL-100

■ External dimensions (mm)





■ Specifications

| Item | DG-72 | |
|------------------------------------|---|--|
| Measurement medium | SX-34 | Air, Nitrogen, Non corrosive gas |
| | SX-100D | |
| | PI-100C | Gas and liquid that will not corrode SUS630, SUS316, NBR |
| | PA-860 | |
| | PA-830 | |
| Sensor linearity | L : $\pm 1\%$ of F.S. | |
| | H : $\pm 0.3\%$ of F.S. | |
| Thermal zero span | L, H : $\pm 0.05\%$ / $^{\circ}\text{C}$ of F.S. | |
| Excess pressure | 2 times of range F.S. | |
| Destruction pressure | 3 times of range F.S. | |
| Pressure input port | Rc 1/8 | |
| Power source voltage | AC90~132V | |
| Current consumption | 200mA | |
| Voltage endurance | AC1500V 1 minute (AC line to case) | |
| Insulating resistance | More than 50M Ω at DC500V (AC line to case) | |
| Operation temperature and humidity | 0~40 $^{\circ}\text{C}$, 35~85%RH (without condensation) | |

■ Model

DG-72-**①** **②** **③** **④** -X002

① Sensor Precision (Precision for sensors that can not be prepared depending on the pressure range)

| Sign | Precision | Mounted Sensor | |
|------|------------------|----------------|----------------------|
| | | SX-34 | Air pressure |
| L | $\pm 1\%$ F.S. | PA-860 | Oil and air pressure |
| | | SX-100D | Air pressure |
| H | $\pm 0.3\%$ F.S. | PI-100C | Oil and air pressure |
| | | PA-830 | Oil and air pressure |
| | | PA-860-006 | Oil and air pressure |

② Pressure range configuration

| Sign | Measurement Pressure range | Precision L | | Precision H | |
|---------------|----------------------------|----------------------------------|--------|-----------------------|------------|
| | | Preparation | Sensor | Preparation | Sensor |
| -100 kPa | 0~100 kPaG | <input type="radio"/> | SX-34 | <input type="radio"/> | PA-830 |
| ± 1000 Pa | -1000~1000 PaG | <input checked="" type="radio"/> | - | <input type="radio"/> | SX-100D |
| 2 kPa | 0~2.00 kPaG | <input checked="" type="radio"/> | - | <input type="radio"/> | SX-100D |
| 50 kPa | 0~50 kPaG | | | | |
| 100 kPa | 0~100 kPaG | <input type="radio"/> | SX-34 | <input type="radio"/> | PA-830 |
| 200 kPa | 0~200 kPaG | | | | |
| 500 kPa | 0~500 kPaG | | | | |
| 1 MPa | 0~1.00 MPaG | <input checked="" type="radio"/> | - | | |
| 2 MPa | 0~2.00 MPaG | <input checked="" type="radio"/> | - | <input type="radio"/> | PI-100C |
| 5 MPa | 0~5.00 MPaG | | | | |
| 10 MPa | 0~10.00 MPaG | <input type="radio"/> | PA-860 | <input type="radio"/> | PA-860-006 |
| 20 MPa | 0~20.00 MPaG | | | | |

* X in the column is not manufactured.

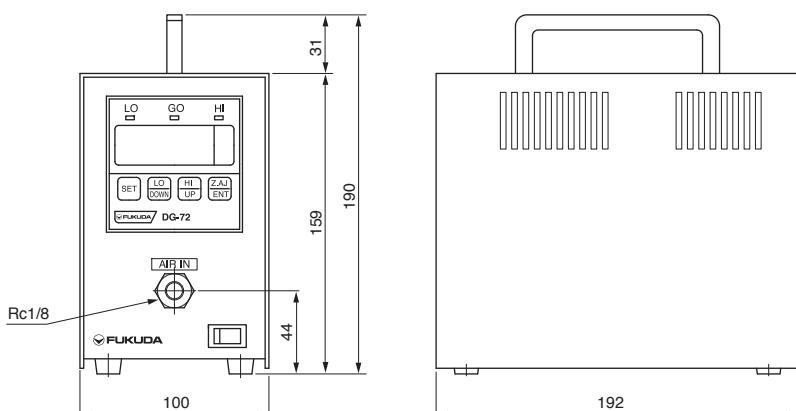
③ Input/Output specification

| Sign | Content | Remarks |
|------|------------------------|--------------------|
| No | No input/output signal | |
| R | Relay output | |
| T | Transistor output | NPN open collector |

④ Calibrator

| Sign | Content | Remarks |
|------|------------------|---------|
| No | No calibrator | |
| A | 1.0mL Calibrator | |
| B | 0.1mL Calibrator | |

■ External dimensions (mm)



Stability Tank



■ Specification

| Item | M-100 |
|--------------------|--------|
| Allowable pressure | 990kPa |

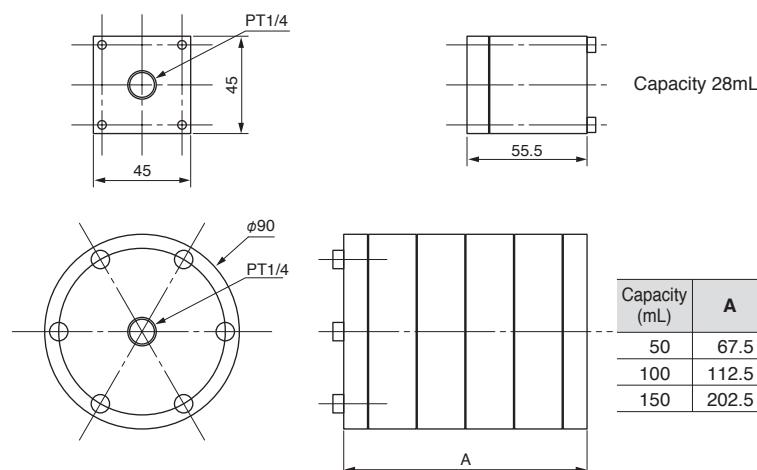
■ Model

M-100-①

① Tank capacity

| Sign | Content |
|-------|---------|
| 028ML | 28mL |
| 050ML | 50mL |
| 100ML | 100mL |
| 150ML | 150mL |

■ External dimensions (mm)



Transformer



■ Specification

| Item | Capacity: 300VA | Capacity: 500VA |
|-------------------|-----------------------------|-----------------|
| Phase numbers | Single phase double-winding | |
| Frequency | 50Hz/60Hz | |
| Primary voltage | 200/220/240V | |
| Secondary voltage | 100/110/115V | |
| Secondary current | 3A | |
| Weight | Approx. 5.8kg | Approx. 9kg |

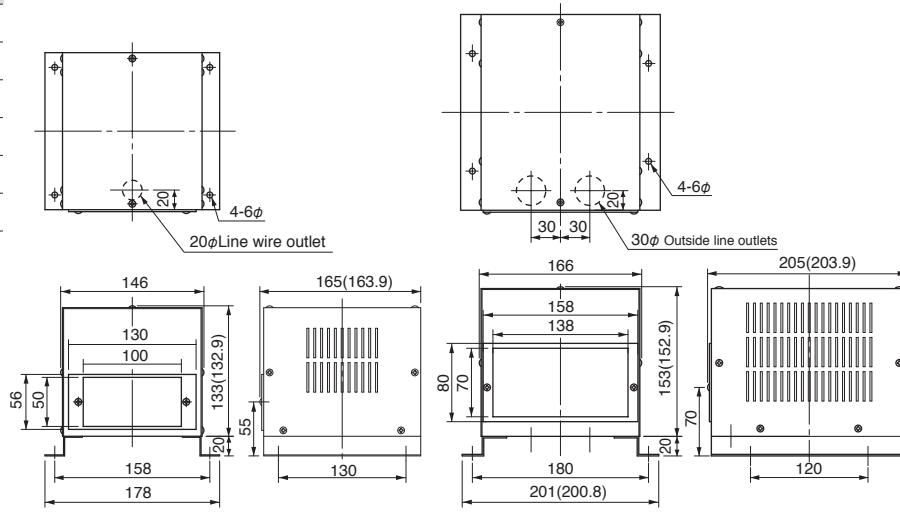
■ Model

D1-901-①

① Capacity

| Sign | Capacity |
|------|----------|
| 300 | 300VA |
| 500 | 500VA |

■ External dimensions (mm)



D1-901-300

D1-901-500

Observation sheet

※ Tester failure or apparent abnormality of equipment are not included.

| Segment | Phenomenon | Observation | Cause |
|-----------------|---|--|--|
| 1. Work | Measurement unstable (Result varies randomly) | <ul style="list-style-type: none"> Ratio between inner volume and leak criteria is large. Leak criteria (mL/sec): work volume (mL)=1:10000 | Work is large Leak criteria is small |
| 2. Work | Measurement unstable | <ul style="list-style-type: none"> Work expands with pressurization. Resin or rubber. Detected pressure difference is large even with increased pressure time. Detected pressure difference becomes small when pressure time increases (10 times) with good work. Becomes stable with repeated measurement. | Shape variation is large |
| 3. Work | Measurement unstable | <ul style="list-style-type: none"> Pressure difference wave form shifts suddenly O-ring present for side sealed in work. | Work inner seal moves |
| 4. Work | Measurement unstable | <ul style="list-style-type: none"> Work includes porous material (filter etc) Continuous measurement by atmospheric pressure after measurement shows large minus swing. | Inner leak present |
| 5. Work | Measurement unstable | <ul style="list-style-type: none"> Work is sensitive to temperature. Pressure difference wave form with long detection time snakes. | Effect of external temperature |
| 6. Work | Measurement sensitivity low (Real leak and tester display do not coincide) | <ul style="list-style-type: none"> Work shape variation large. | Work shrinks |
| 7. Work | Measurement sensitivity low (Real leak and tester display do not coincide) | <ul style="list-style-type: none"> Work inner structure is complex. Work (measurement circuit) includes check valve. | Filling pressure does not circulate well |
| 8. Work | Measurement sensitivity is low (NG good is judged to be good) | <ul style="list-style-type: none"> Work is wet. Work includes liquid such as oil. | Leak hole is closed by liquid |
| 9. Work | Measurement sensitivity is high | <ul style="list-style-type: none"> Several B.NG. Pressure difference swings out at small leak. | Criteria is large compared to inner volume |
| 10. Setting | Measurement unstable | <ul style="list-style-type: none"> Pressure difference swing at balance is large with good work. Pressure drop of the work inner pressure graph is large after pressurization finish with good work. (more than -5% drop) | Pressurization insufficient |
| 11. Setting | Measurement value of good work does not become zero | <ul style="list-style-type: none"> Mastering pressure difference wave form is not stable after M.DET completion. (Easy to observe the wave form by making M.DET time long). | Mastering time insufficient |
| 12. Equipment | Measurement unstable | <ul style="list-style-type: none"> Work is large (more than 5L) Distance between work and tester piping is long. Pressurizing port diameter is small compared to work size. | Pressuring flow insufficient |
| 13. Equipment | Measurement unstable | <ul style="list-style-type: none"> Work is large (more than 5L) Test pressure increase is slow at pressurization | Pressuring flow insufficient |
| 14. Equipment | Measurement unstable | <ul style="list-style-type: none"> Work is large (more than 5L) Supply pressure drops momentary at pressurization. | Supply flow insufficient |
| 15. Equipment | Measurement unstable | <ul style="list-style-type: none"> No pre-regulator in front of the pressure regulator. | Effect of supply pressure variation |
| 16. Equipment | Tester is frequently destroyed | <ul style="list-style-type: none"> Tool submerged and performs bubble test after NG decision. Cleaning water of precedent process remains | Foreign material (water) is sucked |
| 17. Equipment | Tester is frequently destroyed | <ul style="list-style-type: none"> Water or oil remains in filter of equipment or tester. Water comes out when air gun is operated. | Foreign material entered |
| 18. Equipment | Measurement unstable | <ul style="list-style-type: none"> Pressure difference varies when clamp tool is pushed by hand during detection. (Be careful as this operation is dangerous. Make sure to assure safety by manual confirmation or extension of detection time) Seal face is wide (Especially Betaseal) Seal material is soft | Seal is unstable |
| 19. Equipment | Measurement unstable | <ul style="list-style-type: none"> A plurality of measurement points is switched by electromagnetic valve. | Effect of temperature |
| 20. Equipment | Measurement unstable | <ul style="list-style-type: none"> A plurality of measurement points is switched by spool type valve (such as 3 way valve). | Inner leak Seal moves |
| 21. Equipment | Measurement unstable | <ul style="list-style-type: none"> Piping material is soft | Shape variation is large |
| 22. Equipment | Measurement unstable (at special timing) | <ul style="list-style-type: none"> Multi axis measurement is performed. Multi room measurement is performed. Occurs at NG (evacuation) timing of neighbor axis. | Interference |
| 23. Equipment | Measurement unstable (at special time range) | <ul style="list-style-type: none"> Many miss judgments in the morning, or after long breaks or pauses. Average value of good work varies gradually. There is the master. | Initial swing (master) |
| 24. Equipment | Measurement unstable (at special time range) | <ul style="list-style-type: none"> Many miss judgments in the morning, or after long breaks or pauses. Average value of good work varies gradually. Master less. | Initial swing (tool variation) |
| 25. Equipment | Measurement unstable (at special time range) | <ul style="list-style-type: none"> Impossible to measure in the morning during winter. It becomes possible at noontime. Work in winter morning is too cold | Condensation |
| 26. Equipment | Measurement value of good work does not become zero | <ul style="list-style-type: none"> Detection pressure difference occurs even with long pressure and balance time (5 - 10 times of normal value). (Pressure difference becomes long in proportion to time) | Leak |
| 27. Equipment | Large leak work is judged to be good | <ul style="list-style-type: none"> Measurement at very small pressure (less than 10kPa) | Test pressure loss |
| 28. Environment | Measurement is unstable | <ul style="list-style-type: none"> Average value of good part measurement result shifts gradually. Stable from 12:00 to 16:00. | Effect of ambient temperature |
| 29. Environment | Measurement unstable | <ul style="list-style-type: none"> Leak test equipment near entrance. There is a window near tester and tester receives direct sunshine. Air conditioner directly affects testers | Effect of ambient temperature |
| 30. Environment | Measurement unstable | <ul style="list-style-type: none"> Work is warm External process that changes the temperature of work such as welding or hot water cleaning. | Effect of work temperature |
| 31. Environment | Measurement unstable | <ul style="list-style-type: none"> Storage place of test waiting work and test place is different. Test waiting work is place near the floor. | Effect of work temperature |
| 32. Environment | Measurement unstable (at special timing) | <ul style="list-style-type: none"> Detecting pipe vibrates. Vibration during detection (other operation is done in parallel). Work moves during detection. | Vibration |
| 33. Environment | Measurement unstable | <ul style="list-style-type: none"> Pressure difference value varies up and down during detection. Varies if measurement opened in atmospheric pressure. | Electrical noise |

| Counter measure | Item | Example | Remarks |
|---|--|-----------------------------|--|
| ○ Decrease core volume | | | |
| ※ Study other test methods | H2 leak, He leak | | |
| ※ Study all variable such as conditions, tools, environment | LPU-300 | Injector Sensor parts | |
| ○ Use turbo pressurization | Turbo model such as FL-3700 | | |
| ○ Increase pressurization repeatability by precision regulator | APU series | Resin intake manifold | |
| △ Increase pressurization time | | | |
| ※ Study and propose work/work comparison method for the work with more variation. | FL-601M-2-X001 | Rubber hose | |
| ○ Perform turbo pressurization | Turbo model such as FL-3700 | Injector Engine assembly | |
| △ Increase pressurization time | | | |
| ○ Measure leak side | | Oil filter | |
| △ Perform turbo pressurization | | | |
| △ Increase pressurization time | | | |
| ○ Propose work/ work comparison method (Study complete symmetry) | FL-601M-2-X001 | Delivery pipe Evaporator | |
| ○ Protect work with cover | | | |
| ○ Adopt measured volume by flow standard | FFM-100 | Gasoline tank | Equivalent inner volume becomes larger than the real inner volume because of the work shape change. |
| ○ Pressurize work from a plurality position (other side) | | | |
| △ Increase pressurization time | | | |
| ○ Dry work and measure | | Mission assembly | |
| ※ Study other method | FL-273 | | Measure direct pressure |
| ○ Change tester measurement range | FL-283 | | Measure pressure difference of 10kPa |
| △ Decrease detection time | | | |
| △ Increase measurement inner volume | MH master chamber | | Measurement time may rise if increased volume is not stable. |
| ○ Increase pressurization time | | | |
| ○ Set appropriate M.DET time | | | |
| ○ Pressurize work from a plurality position | | Engine bear | |
| ○ Perform turbo pressurization | Turbo model such as FL-3700 | | |
| ○ Make pipe diameter large | | | |
| △ Increase pressurization time | | | |
| ○ Prepare pressurization bypass | CBU-600 | Gasoline tank | |
| ○ Perform APU pressurization | APU-90W, 130W series | | |
| ○ Increase the pressure reduce valve. Pre-regulator may need more flow rate. | | | |
| ○ Attach surge tank at tester air source. | VBAT38 | Gasoline tank | |
| ○ Provide pre-regulator and set test pressure + 100kPa. | AR series | | |
| ○ Provide evacuation bypass. | FE-20, EBU-600 | | |
| ○ Provide filter at pressure air source. Open drain at daily check and change filter element periodically. | AF + AFD | | |
| △ Replace to high performance filter(Lemans made) | | | |
| ○ Provide O-ring type and make metal touch. | | | |
| ○ Surround seal material to stop shape change | | | |
| △ Attach stopper to seal cylinder | | | |
| △ Study hardness of seal material | | | |
| △ Review seal force (including clamp force) | | | |
| ※ Review totally work and tool (from design) | | | |
| ○ Use air operation type switching valve | ESV | | |
| ○ Use poppet type valve | ESV | | |
| ○ Use high pressure pipe. Use N2 pipe even for low pressure. Shape change effect occurs at 500kPa even with N2 pipe. Study metal pipe when the pressure is high and effect is large. | N2 pipe | | One touch joint is not allowed (Use only products correctly selected from conditions such as low pressure, large volume, large leak criteria etc.) |
| ○ Synchronize measurement and evacuation timing. | | | |
| ○ Strengthen tool base or make it independent | | | |
| ○ Provide pressure reduce valve for each pressure air source of clamp cylinder and make them independent. | | | |
| ○ Introduce master less | FL-600 | Engine bear | |
| △ Use highly stable container. | MH master chamber | | |
| △ Repeat idle measurement to warm up. | | | |
| ○ Review tool stability(seal structure) | | | |
| △ Repeat idle measurement to warm up. | | | |
| ○ Provide dryer Make guide line of dew point of -20°C under pressure. | | | One touch joint is not allowed. Use only products correctly selected from conditions such as low pressure, large volume, and large leak criteria etc.) |
| ○ Stop leak of equipment and tool. | | | |
| ○ Provide pressure gauge to monitor the work pressure. | | Lamp cover | |
| ○ Perform ambient (drift) compensation. | FL-600, FL-3700 with drift compensation series | Engine bear | |
| ○ Study installation place. | | | |
| ○ Provide cover on equipment and protect work during measurement. | | | |
| ○ Attach cover on pipe to protect. | | | |
| ○ Study process order. | | | |
| ○ Measure after cooling. | | | |
| ○ Store test waiting work near tester and at the same height. | | | |
| ○ Remove vibration cause(Remove transportation vibration, study operation timing) | | | |
| ○ Fix pipe to stop vibration | | | |
| ○ Change earth wiring. | | | More effective to attach the filter if cause of noise is detected. |
| △ Provide noise filter | | | |

フクダは計測器の販売と共に、お客様に安全かつ正確に測定していただくため、測定環境の保全・改善をご提案致します。

In addition to sales of measurement devices, We therefore propose maintenance and improvement of measurement environment together with each measurement device to measure safely and accurately for Customers.

株式会社 **フクダ**
<http://www.fukuda-jp.com>

本社・工場 〒176-0021 東京都練馬区貫井3-16-5
 TEL.(03)3577-1111 FAX.(03)3577-1002



| | | | | |
|-------|-----------|-----------------------|----------------------|---------------------|
| 東北営業所 | 〒989-0217 | 宮城県白石市大平森合字清水田39-1 | TEL. (0224) 24-2672 | FAX. (0224) 24-2673 |
| 東京営業所 | 〒176-0021 | 東京都練馬区貫井3-16-5 | TEL. (050) 3540-3396 | FAX. (03) 3970-7218 |
| 厚木営業所 | 〒243-0815 | 神奈川県厚木市妻田西1-15-12 | TEL. (046) 222-3166 | FAX. (046) 222-0144 |
| 静岡営業所 | 〒421-0404 | 静岡県牧之原市静谷2543-1 | TEL. (0548) 27-3111 | FAX. (0548) 27-2228 |
| 中部営業所 | 〒448-0003 | 愛知県刈谷市一ツ木町2-9-2 | TEL. (0566) 21-2266 | FAX. (0566) 21-2181 |
| 近畿営業所 | 〒591-8008 | 大阪府堺市北区東浅香山町4-6圭祐館103 | TEL. (072) 259-0016 | FAX. (072) 259-0033 |
| 広島営業所 | 〒735-0006 | 広島県安芸郡府中町本町2-9-33-101 | TEL. (082) 286-0472 | FAX. (082) 286-0597 |
| 九州営業所 | 〒862-0941 | 熊本県熊本市中央区出水1-3-26 | TEL. (050) 3614-7762 | FAX. (096) 372-4220 |
| 海外営業部 | 〒176-0021 | 東京都練馬区貫井3-16-5 | TEL. (050) 3540-3406 | FAX. (03) 3970-7218 |

東北工場・東北分工場・静岡工場・新座事業所

FUKUDA CO., LTD. Head Office: 3-16-5, Nukui, Nerima-ku, Tokyo, 176-0021 Japan
<http://www.fukuda-jp.com> TEL. (81) 50-3540-3406 FAX. (81) 3-3970-7218

| | |
|---------------|--|
| ※ China : | NAGANO FUKUDA (TIANJIN) INSTRUMENTS CO.,LTD. (TIANJIN HEADQUARTERS) http://www.fukuda-tj.com.cn No.7 Factory, Fenghua Industrial Park, No.80, 9th Street TEDA Tianjin, China TEL. (86) 22-5981-0966 FAX. (86) 22-5981-0963 |
| ※ Korea : | KI SUNG TECHNOLOGY CO.,LTD. http://www.kisungtech.com 585-40, Gajwa-dong, Seo-gu, Incheon, Korea TEL. (82) 32-584-8464 FAX. (82) 32-584-8465 |
| ※ Taiwan : | LI AN INDUSTRY MEASUREMENT CORP. http://www.lian.com.tw 6F., No.49, Jyunsian Rd., Cidu Dist., Keelung, City 20653, Taiwan, R.O.C. TEL. (886) 2-2456-6663 FAX. (886) 2-2455-2129 |
| ※ India : | SYSCON INSTRUMENTS PRIVATE LTD. http://www.sysconinstruments.com Plot No.66, Electronics City, Hosur Road, Bangalore-560 100, India TEL. (91) 80-2852-0772 FAX. (91) 80-2852-0775 |
| ※ Thailand : | FUKUDA (THAILAND) CO.,LTD. http://www.fukudathailand.com 149/27-28 Pronphiwat Building 3B FL., Soi Anglopaza, Surawong Rd., Suriyawong, Bangrak, Bangkok 10500, Thailand TEL. (66) 2-634-1392 FAX. (66) 2-634-1395 |
| ※ USA : | FUKUDA USA INC. http://www.fukuda-us.com 2721 Pioneer Drive, Bowling Green, KY 42101, USA Toll Free Line.1-888-859-9898 TEL. (1) 270-745-7300 FAX. (1) 270-745-9959 |
| ※ Germany : | ADZ NAGANO GmbH http://www.adz.de Bergener Ring 43 D-01458 Ottendorf-Okrilla Germany TEL. (49) 35205-59-6930 FAX. (49) 35205-59-6959 |
| ※ Indonesia : | PT. FUKUDA TECHNOLOGY http://fukuda-id.com Komplek Cikarang Square Blok B-22 Cikarang-Bekasi 17550, Indonesia TEL. (62) 21-2909-4511 FAX. (62) 21-2909-4522 |
| ※ Vietnam : | PHUONG THANH PRODUCING-TRADING- IMPORT EXPORT CORP. http://www.lian-vn.com/vietnam 60 Duong 53, KDC Tan Quy Dong, P.Tan Phong, Q7, TPHCM, HCM City, Vietnam TEL. (84) 8-3771-0873 FAX. (84) 8-3771-0990 |
| ※ Mexico : | ERAT S.A. de C.V Av. Felipe Carrillo Puerto 299-A, Zona Industrial Benito Juarez, Queretaro, Qro. C.P. 76120, Mexico TEL.52 (442) 217-5382 / 52 (442) 217-0776 FAX.ext 108 |

※印の拠点は、当社 ISO 适用範囲外です。 ※Signifies ISO applications not met by Fukuda.

代理店 Contact

仕様は改良のため通知なく変更される場合があります。
 Specifications may change without notice for product improvement.