Operation Manual

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AIR LEAK TESTER LS-R900

No.LS-R900-941B1-M

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INSTALLATION MANUAL

1 INTRODUCTION

1 Introduction

Thank you for purchasing the Air Leak Tester LS-R900 Series.
LS-R900 is a differential pressure decay air leak tester designed for industrial use.
This manual provides installation, operating and maintenance instructions for LS-R900 Series.
Read this operation manual carefully before using this product, and retain it for future reference.

2 Safety Precautions

This section provides how to use the product safely and avoid injuries to the operators or damages to your assets. Please handle the product according to these instructions and observe the following symbols that appear in this manual:

[Explanations of the signs]

Signs	Explanation
⚠ **WARNING**	Failure to take or avoid a specific action could result in death or serious physical harm to the user.
⚠ **CAUTION**	Failure to take or avoid a specific action could result in minor physical harm to the user, or in property damage.

[Explanations of the symbols]

Δ This symbol denotes a warning/caution to alert the users. A specific explanation of the potential danger and what must be done to avoid it follows. (Example: ⚠ Electrical shock hazard)

⚠ WARNING

1) Make sure the product is connected to ground. Neglecting it could result in electrical shock hazards. Do not ground the product to a gas pipe. It could result in fires or electrical shock hazards.
2) If the metal part of the power plug or surrounding area is dusty, clean it thoroughly with a dry cloth. Neglecting it could result in fires or electrical shock hazards.
3) Make sure there is enough clearance to connect and/or disconnect the power cord from the power inlet of the product.
4) Do not use voltages other than those for which the product is rated. It could result in fires or electrical shock hazards.
5) If the product has been dropped or damaged, switch it off and disconnect the power cord from the power inlet of the product. Neglecting it could result in fires or electrical shock hazards.
6) Do not apply air pressure in excess of the pressure rating of the product. Excessive pressure input could cause major component failure and/or injury.
7) Should foreign matter such as water or oil get inside the product, switch off the power immediately and disconnect it from the power inlet of the product. Neglecting it could result in fires or electrical shock hazards. Use extra caution when installing the product in an environment where water or oil exists nearby.
8) This product is not customer-serviceable. Customer servicing could result in fires or electrical shock hazards.
9) Replace a fuse after turning off the power of the main unit and disconnecting the power cord from the power inlet of the product. Use a fuse equivalent to the current one for replacement. Using a different fuse could result in fires or electrical shock hazards.
10) Discontinue using the product immediately under the following circumstances:
    - The product smokes.
    - The product emits abnormal noises.
    - The product has developed problems not covered in the Operation Manual.
    - The product cannot be operated as indicated in the Operation Manual.

    To avoid electrical shock hazards or physical harm, disconnect the power cord and remove the pressure source from the product. Neglecting it could result in fires or electrical shock hazards.

⚠ CAUTION

1) Do not use the product in places that are damp, that are exposed to direct sunlight or that are outside the temperature range of 5°C to 40°C. Using the product in such environments could result in malfunctions or failures.

2) To avoid damage to the power cord, which could result in fires or electrical shock hazards, observe these precautions:
   - Do not damage, modify or apply undue force to the power cord.
   - Before servicing the product, disconnect the power cord from the power inlet of the product.
   - Do not handle the power cord with wet hands.
   - When disconnecting the power cord, do not pull on the cord.

3) Mount the product securely on a structure with enough load capacity. Do not install the product on the insecure foundation or in places with vibration to avoid overturns and injuries.

4) Ensure the correct cable connection. Incorrectly connected cables could result in damage to the product and surrounding hardware.

5) Do not step on top of the product or place containers filled with liquids, oil or soapy water, or the like on it. Spills may result, causing physical harm, electrical shock hazard, rust or other damage.

6) Should the LCD become damaged, avoid skin contact with the liquid contained inside. It could cause inflammation. Wash with running water in case of skin contact.

7) Do not disassemble the product other than replacing the designated consumable parts. The product could malfunction, resulting in physical harm or electrical shock hazards.

8) Do not mount or remove the parts those are exposed to air pressure such as pipes while a pressure source is connected to the product. It could result in physical harm.
   Wear a safety goggle to protect your eyes.

9) When a leak test has been completed, unclamp the tested part only after all pressure has been released from the product. Residual pressure could result in physical harm.

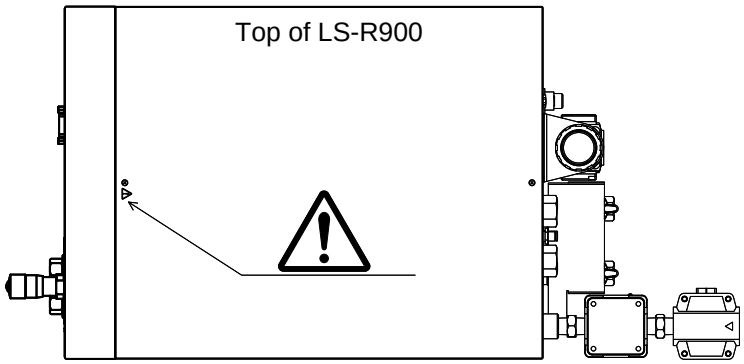
10) Hold its bottom to keep it from dropping when transferring the product. Do not lift the product by gripping its components on the rear panel such as the stop valves.

11) Put on steel-toe boots when transferring the product for shipping, installation, dismantling. Neglecting it could result in physical harm by dropping the product.

12) Wipe out the product lightly with a dry and soft cloth for maintenance. When the product is with heavy dirt, dilute the neutral detergent with water, soak the cloth in the detergent, squeeze the cloth, and wipe the dirt out. Do not use organic solvent.

13) Handle the product according to the instructions in this operation manual or the protection provided by the equipment may be impaired.

Cautionary note on the LS-R900 main unit



- Make sure to turn off the power and disconnect the power cord from LS-R900 before removing the top cover to prevent electric shock or damage to the tester due to short-circuit.

3 Notes

1) The information in this document is subject to change without notice to allow for performance or feature upgrades.
2) This document may not be reproduced in whole or in part without prior approval of the publisher.
3) We are not responsible for the items tested using the product or for any consequences resulting from the tests.
4) This product comes with the self-check feature to detect certain improper settings and/or operations, and any malfunctions of components to minimize incorrect pass/fail judgment. However, the scope of monitoring by self-checking is limited.
5) This product is a differential pressure decay air leak tester adopting the master comparison method. Please note that when using the product in an inappropriate environment, there are risks of incorrect fail judgments due to various effect such as leakage from the sealing fixture, part deformation, temperature changes in the part and/or fixture.
6) Users are encouraged to consult their local Cosmo representatives directly for any questions regarding the use of this product.

2 INSTALLATION AND SETUP

1 Unpacking

When you receive the LS-R900, unpack and check for the transport damage.

1.1 Accessories

Power cord	1
Control I/O connector: MSTB 2,5 / 16-STF-5,08 (Phoenix Contact)	2
Inspection record / Traceability related documents	1 each
Operation manual CD (Installation manual / Operation manual / Maintenance manual / Specifications & References)	1

1.2 Items to Be Prepared By the Customer

For installation:

For mounting LS-R900 with Quick mounting bracket: M4 screws (4)
Tube for pneumatic connection
Tube for connecting the tested part and reference master to LS-R900

For external device connection:

Control I/O cable
24VDC Power source

For storing leak test data and/or test parameters:

USB memory
Computer
RS-232C serial communication cable (commercially-available product)
USB serial conversion adapter (When the PC does not have an RS-232 communication port on it)

2 Part Identifications

2.1 Front Panel

A **LCD Touchscreen:**
All the settings are entered through the touch screen. Leak testing can be done manually as well.

B **RS-232C: (9-pin male)**
Serial communication, RS-232C (Front), port. Data is output in the designated format.

C **(USB port):**
Test Data, Waveform Data and Mastering Data are output in CSV format.
Software can be upgraded using this port.

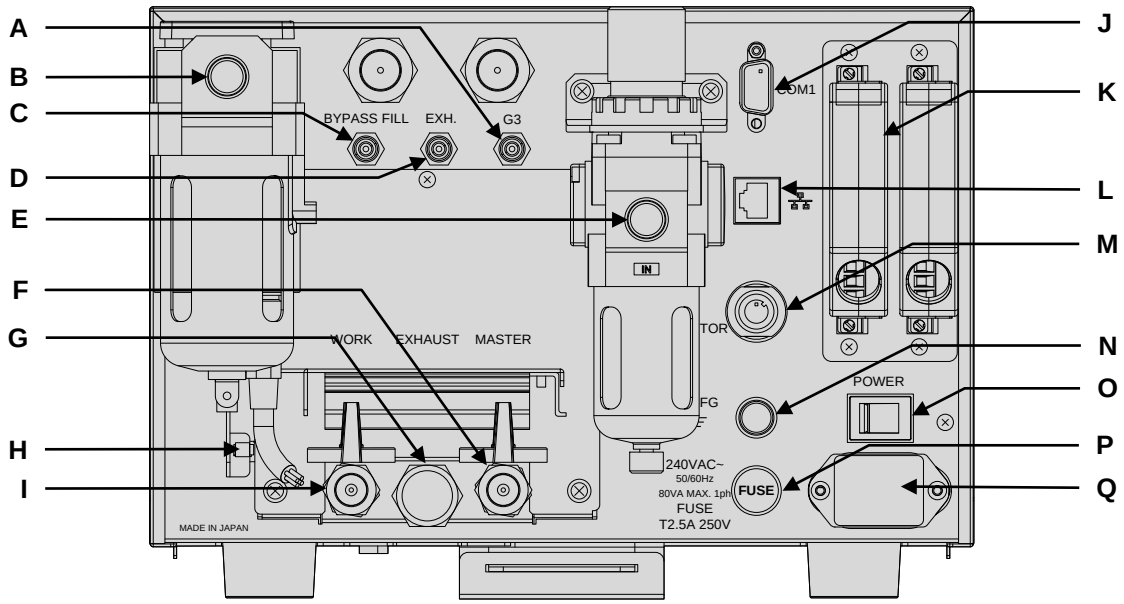
D **Auto-Leak Calibrator (ALC):**
ALC is equipped for the ALC models

E **(Maintenance port):**
Do not remove the plug in usual measurement.

F **(Calibration port):**
Connect a Leak Master to this port for daily maintenance.

G **Quick Mounting Bracket:**
Using this bracket, LS-R900 can be installed and removed easily with two M4 screws.

2.2 Rear Panel



A **G3:**
Pilot pressure port for External Exhaust valve (Push-to-connect fitting 4mm)

B **TEST PRESSURE:**
Test pressure inlet (Push-to-connect fitting 4mm)

C **BYPASS FILL:** (Option)
Pilot pressure port for fill valve for Bypass circuit unit (Push-to-connect fitting 4 mm)

D **EXH.:** (Option)
Pilot pressure port for exhaust valve for Bypass circuit unit (Push-to-connect fitting 4 mm)

E **PILOT PRESSURE:**
Pilot pressure inlet
Connect clean air regulated from 400 to 700 kPa

F **MASTER:**
MASTER-side stop valve.
A port to connect a reference (Master).
Leave the valve opened except for maintenance.

G **EXHAUST:**
Silencer for exhaust
Air is exhausted from this port after a leak test.

H **Stop Valve Monitoring Switch with a valve cover:** When the valve(s) is closed, the cover won't close and the switch is not pressed. This is to prevent leak testing with the stop valves closed.

I **WORK:**
WORK-side stop valve
A port to connect a tested part (Work).

J **COM 1:**
Serial communication, RS-232C (Rear), port.
Data is output in the designated format.
(9-pin male)

K **CONTROL I/O** (Phoenix contact)**:**
External device is connected to control LS-R900 externally.
Left side: Output **B** Right side: Input **A**

L **:** 10/100 BASE-T Connector

M **EP REGULATOR:** (Option)
Electro-Pneumatic regulator connector

N **FG :** Grounding

O **POWER:** Power switch

P **FUSE:** Fuse (T2.5A 250V)

Q **100 to 240 VAC~ :** Power inlet

NOTE

The symbol "**~**" for "100 to 240 VAC~" denotes alternating current.

3 Installation

3.1 Environment of Leak Tester and Leak Test Stand

Location of Leak Tester to Avoid Temperature Fluctuation

- Avoid direct sunlight.
- Avoid direct wind due to doors opening and closing.
- Avoid direct wind from heating and cooling vents.
- When above cannot be avoided, use a curtain. However, it's not good to cover the whole test stand area completely because of temperature fluctuations that could occur in the tested parts. Therefore, partial covering will give better result.

Effects of Plant Temperature on Leak Testing

- Do not put the leak test station right after heating, cooling welding or washing processes.
- If the temperatures of the floor and test bench are different, and the tested parts are taken from the floor, heat transfer will take place between the parts and the fixture. This will cause an error. The tested parts should be stored at the same level as the test bench in order to keep the temperature the same.

3.2 Installation of LS-R900 with Quick Mounting Brackets

⚠CAUTION

Hold its bottom to keep it from dropping when transferring the product. Do not lift the product by gripping its components on the rear panel such as the stop valves.

⚠CAUTION

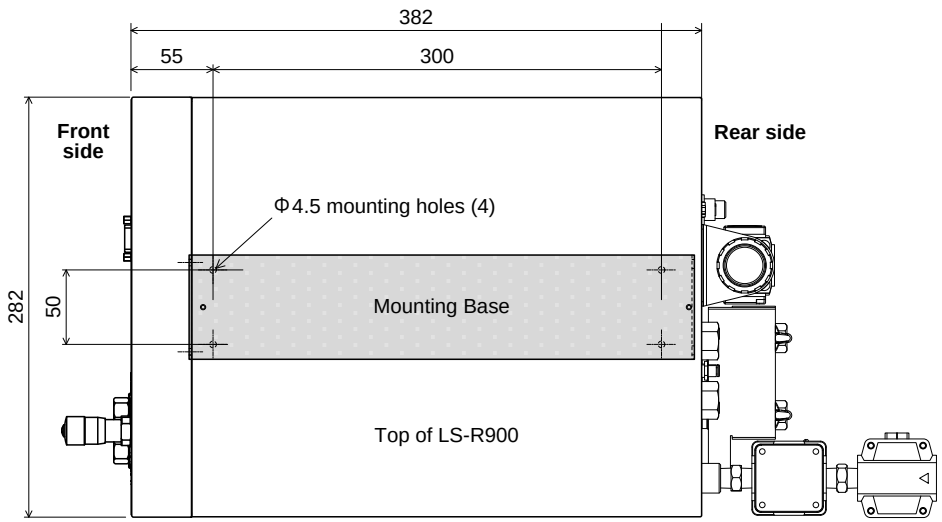
Mount the product securely on a structure with enough load capacity. Do not install the product on the insecure foundation or in places with vibration to avoid overturns and injuries.

LS-R900 comes with a mounting bracket that can be installed/removed from the base with two screws.

Mounting Base

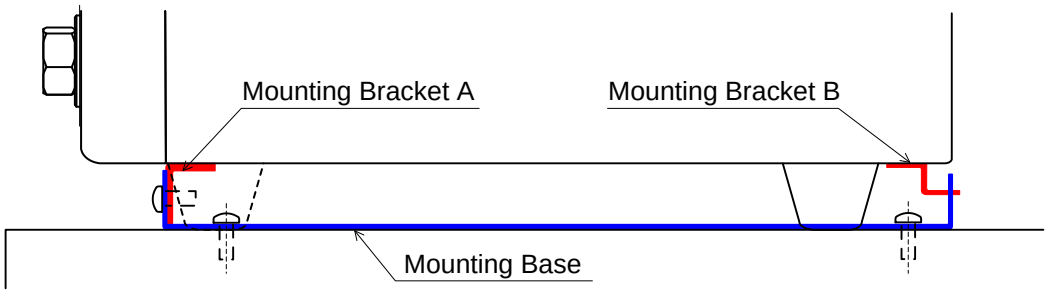
The mounting base is loosely attached to the bottom of LS-R900. Remove it from the tester and mount it with four M4 screws on the test bench where LS-R900 is to be mounted. The mounting surface has to be flat and smooth.

Mount the mounting base on the test bench as shown below. M4 screws are not enclosed with LS-R900.

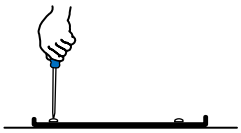


How to Mount

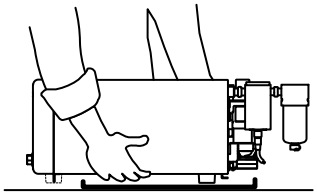
Two mounting brackets are attached to the bottom of the leak tester, A in front and B in back.



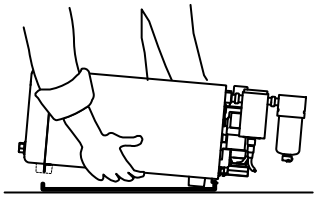
Mount as the following procedure:



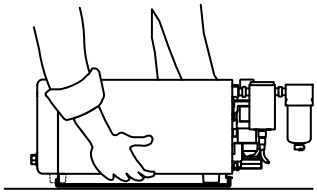
Mount the “Mounting Base” on a leak test stand.



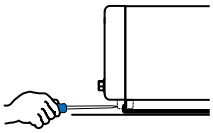
Place the LS-R900 with the Brackets **A** and **B** attached a little toward the front of where the leak tester is to be mounted.



Insert the bracket B to the rear latch of the mounting base while lifting the front of the LS-R900.



Lower the LS-R900 where the Bracket A gets behind the front latch of the mounting base and align the screw holes.



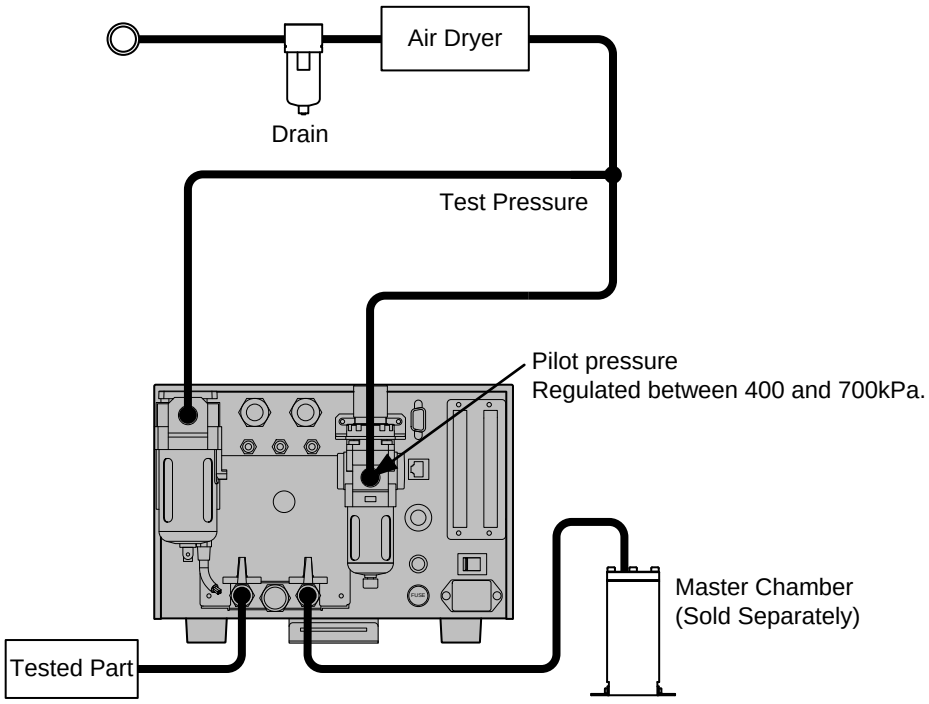
Mount the LS-R900 with two M4 screws.

3.3 Pneumatic Hookups

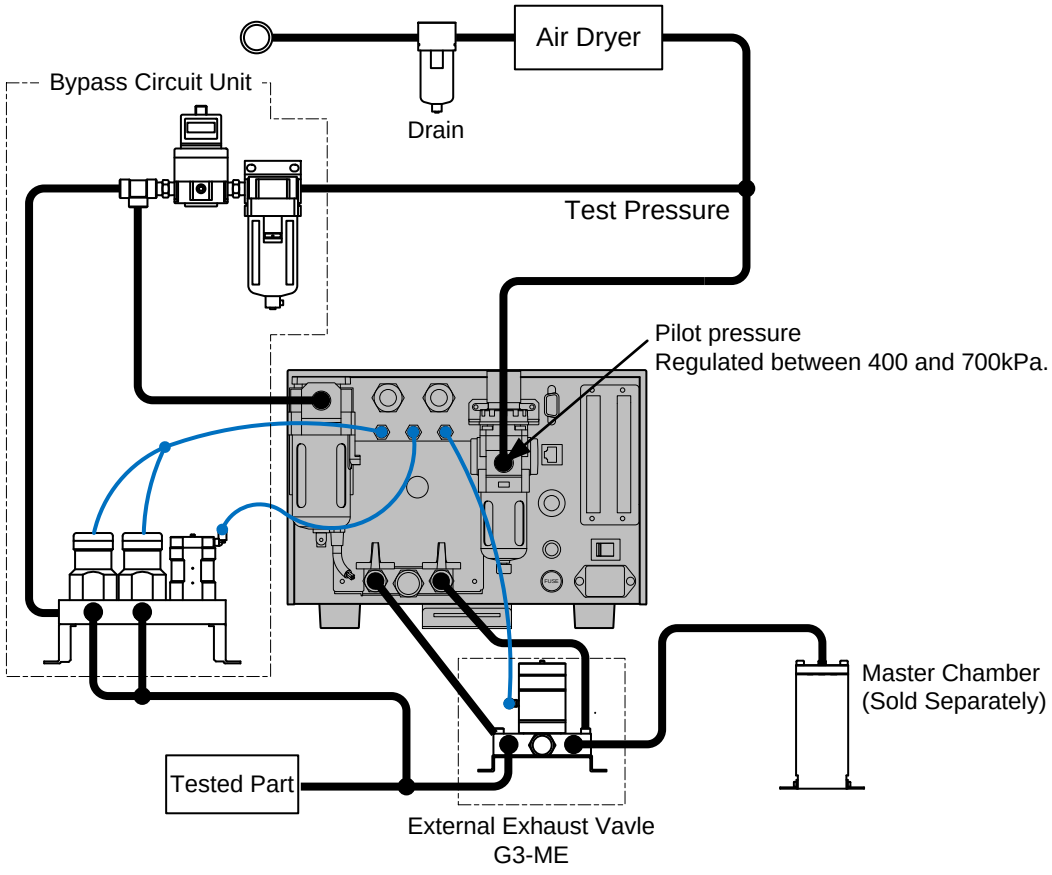
⚠CAUTION

Be sure to shut off the pressure source before connection/disconnection.

Standard Connection Example



Optional Equipment Connection



Pressure Connection Precautions

- The source pressure must be clean and dry. When there is water or oil inside of the plant compressor, an oil mist separator must be used. When there is a lot of water and oil in the compressor, use two or more separators.
- The lubricated air source should never be connected to the tester.
- Avoid direct wind from cooling vents. It may cause due condensation inside the tubes.
- When using an oil lubricated vacuum pump:
  A solenoid valve which opens to atmosphere should be used to prevent oil from entering the leak tester when the pump is turned off. The tester should also be installed at a higher level than the vacuum pump.

NOTE

Once the Differential Pressure Sensor (DPS) is contaminated, the offset becomes off causing frequent Fails.
Contact Cosmo for repair in those cases.

- The pressure of the air source must be sufficiently higher than the test pressure and stable.
- The air source must have enough flow capacity for the test as well.
- Source pressure should be regulated to at least 100kPa higher than the test pressure with an additional regulator inline before leak tester.

Test Pressure Connection

Port: TEST PRESSURE (“IN” on Oil mist separator) Port Size: Rc 1/4

<table>
<tr><th colspan="2">Pressure Range</th><th colspan="2">Pressure Source</th></tr>
<tr><td>Micro Low (L02)</td><td>Up to 20kPa</td><td rowspan="4">Connect a pressure source as the follows:
• Sufficiently higher than the test pressure and stable
• Has enough flow capacity
• Should be regulated to at least 100kPa higher than the test pressure</td><td>L02: Up to 200 kPa</td></tr>
<tr><td>Low (L)</td><td>Up to 100kPa</td><td>L: Up to 500 kPa</td></tr>
<tr><td>Low (LR)</td><td>Up to 95kPa</td><td>LR: Up to 200 kPa</td></tr>
<tr><td>Medium (M/MR)</td><td>Up to 800kPa</td><td>M: Up to 1 MPa
MR: Up to 1 MPa</td></tr>
<tr><td>High (H20)</td><td>Up to 2.0MPa</td><td colspan="2" rowspan="2">Connect a pressure source regulated to the air filter.</td></tr>
<tr><td>Extremely High (H49)</td><td>Up to 4.9MPa</td></tr>
<tr><td>Vacuum (V)</td><td>Down to -100kPa</td><td colspan="2" rowspan="2">Connect a vacuum pump
NOTE
Be sure that water or oil does not enter LS-R900 from vacuum pump.</td></tr>
<tr><td>Vacuum (VR)</td><td>Down to -75kPa</td></tr>
</table>

Pilot Pressure Connection

Pilot pressure is to activate air operate valves, which should be regulated between 400 and 700 kPa.

Port: PILOT PRESSURE Port Size: Rc 1/4

3.4 Tubing for Tested part (Work) and Master

Select tubes considering the follows:

Cosmo recommends rigid nylon tubes that do not expand by air pressure.

- The higher the test pressure is, the thicker the tubes should be, and the larger the part volume is, the larger the tube diameter should be.
- For small volume parts (approx. 1000mL or less), use compression type fittings but avoid using push-on type. However, for the tubing whose diameter is 12mm (1/2 in) or larger, push-on type fittings should be used because insert type fittings tends to be loosen over time.
- Make the tubes as short as possible. For the parts with small volume, use the tubes with small diameter.
- Tubes for WORK and MASTER sides should be same length and material if the Mastering compensation is not used.
- Vacuum type models require large diameter tubes. For case of high vacuum, use tubes with smooth internal surface.
- Mount the tubes so that they don't move during leak tests.

Recommended Tube (For test pressure of 800kPa or lower)

Manufacturer: Nitta Corporation
Inch size: N2-1 (for test pressure 200 kPa or lower), N2-2
Millimeter size: N2-4

Manufacturer: SMC Corporation
T Series

For the test pressure 800 kPa or higher:

Use steel tubes such as stainless steel.

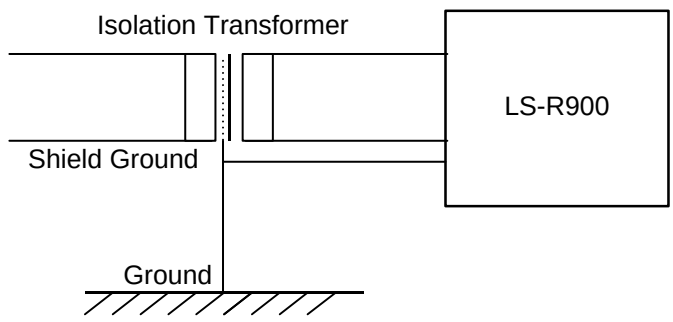
Select a steel tube based on its intensity.

3.5 Power Source

Connect to the power with the enclosed power cord. Required power source is 100 - 240 VAC±10%.
Make sure the product is connected to ground.
Use the enclosed power cord for the cases the power source is 125 VAC or lower.

⚠ CAUTION

Electric Shock
Applying power greater than specified could lead electric shock or fire.



NOTE

Please connect a power line that is free from the sources of noise.
Please use a noise suppressing isolation transformer if noise comes from the power line.
Grounding the F.G. pin may reduce noises as well.

3.6 Control I/O Connector

The control I/O port interfaces the leak tester to external devices such as PLC.

⚠CAUTION

Electric Shock

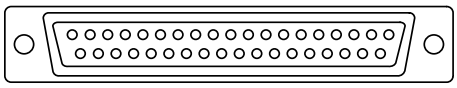
Be sure to turn off the main power before wiring.

- A twisted pair cable preferably with shield should be used and should be separated from the power line.
- The length should be as short as possible without slack.
- Twisting the common line with the signal lines will help reduce noise.

Phoenix Contact I/O Connector (Standard)

Strip off the insulation of the wire and insert it into the connector terminal and tighten the screw on the side.

D-SUB Connector (Special Spec.)



Connect wires to the terminal with soldering.

⚠CAUTION

Mishandling of the soldering iron could result in burns or fire. Be sure to follow its instruction.

Refer to "**3 INTERFACE**" for the details.

4 Turning on Power for the First Time

Turn on the power with the power switch on the rear panel.

Let the power on for 5 minutes or longer for a warm-up before starting leak tests.

The tester defaults to the initial Language select screen when the turning on the power for the first time.

Select a language and tap **Enter**. LS-R900 will shows the home screen (Standard Measurement Screen) in the selected language.

The programmed Home screen will be displayed (The default is Standard Measurement Screen)

NOTE

Tapping **Back** on the Home screen opens the Main Menu Screen.


MEMO

3 INTERFACE

1 Control I/O Port

The control I/O port interfaces LS-R900 to an external device with the capabilities to control and receive the test results remotely. This port allows the tester to be integrated into a completely automated line.

1.1 Standard Control I/O Port: Phoenix Contact

Connector Model

Leak Tester Side: DFK-MSTBVA 2,5/16-GF-5,08 (PHOENIX CONTACT)
Cable Side: MSTB 2,5/16-STF-5,08 (PHOENIX CONTACT)

Connector Pin Assignments

Input

Pin#	Function	Type
1A	START	NO
2A	STOP	NO/NC
3A	CHG HOLD	NO
4A	MASTERING/ DRIFT CLEAR ***1**	NO
5A	K(Ve) CHECK	NO
6A	Calibration Valve Open/Close	NO
7A	Reserved	
8A	Reserved	
9A	CH# 4 ***2**	NO
10A	CH# 3 ***2**	NO
11A	CH# 2 ***2**	NO
12A	CH# 1 ***2**	NO
13A	CH# 0 ***2**	NO
14A	Reserved	
15A	Reserved	
16A	External DC Power input	

Output

Pin#	Function	Type
1B	STAGE #0	NO
2B	STAGE #1	NO
3B	ERROR	NO
4B	Reserved	
5B	PASS	NO
6B	UL FAIL	NO
7B	MASTERING REQUEST	NO
8B	STBY ***3**	NO
9B	BUSY	NO
10B	END	NO
11B	TIME EXTENSION ***3**	NO
12B	LL2 FAIL	NO
13B	LL FAIL	NO
14B	UL2 FAIL	NO
15B	Common Return for all outputs	
16B	Reserved	

(NO: Normally Open /NC: Normally Close)

***1** When the Drift Compensation is enabled, receiving this signal resets the current Drift compensation value. When the Mastering Compensation is enabled, receiving this signal starts the Mastering value sampling process and resets the previous Mastering value.

***2** Input the necessary BCD codes.

Refer to **1.6 Channel Code** for the details.

***3** Only in Remote mode, this signal is transmitted when the tester is ready to start measurement after the power is turned on.

***4** This signal is transmitted when the test time is extended due to NR (Noise Reduction) or Mastering value sampling.
Use the signal to disable the cycle timer over alarm if necessary.

NOTE

Never short the pins marked "Reserved."

1.2 Control I/O Port D-SUB Connector (Special Spec.)

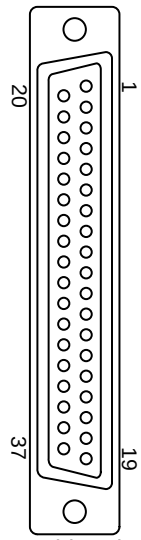
Connector Model

Leak Tester Side: XM3C-3722 (OMRON)
Cable Side: XM3D-3721 (OMRON)

Connector Pin Assignments

(NO: Normally Open / NC: Normally Close)

Pin#	Function	Type
20	CH# 4 ***1**	Input NO
21	CH# 3 ***1**	Input NO
22	CH# 2 ***1**	Input NO
23	CH# 1 ***1**	Input NO
24	CH# 0 ***1**	Input NO
25	Reserved	
26	Reserved	
27	Reserved	
28	Reserved	
29	Reserved	
30	Reserved	
31	UL2 FAIL	Output NO
32	LL FAIL	Output NO
33	LL2 FAIL	Output NO
34	TIME EXTENSION ***2**	Output NO
35	END	Output NO
36	BUSY	Output NO
37	Reserved	



Pin#	Function	Type
1	Reserved	
2	START	Input NO
3	STOP	Input NO/NC
4	CHARGE HOLD	Input NO
5	MASTERING/DRIFT CLEAR ***3**	Input NO
6	K(Ve) CHECK	Input NO
7	Calibration Valve Open/Close	Input NO
8	Reserved	
9	Reserved	
10	External DC Power input	
11	STBY ***4**	Output NO
12	MASTERING REQUEST	Output NO
13	UL FAIL	Output NO
14	PASS	Output NO
15	Reserved	
16	ERROR	Output NO
17	STAGE #1	Output NO
18	STAGE #0	Output NO
19	Common Return for all outputs	

***1** Input the necessary BCD codes. Refer to **1.6 Channel Code** for the details.

***2** This signal is transmitted when the test time is extended due to NR (Noise Reduction) or Mastering value sampling.

***3** When the Drift Compensation is enabled, receiving this signal resets the current Drift compensation value. When the Mastering Compensation is enabled, receiving this signal starts the Mastering value sampling process and resets the previous Mastering value.

***4** Only in Remote mode, this signal is transmitted when the tester is ready to start measurement after the power is turned on.

NOTE
Never short the pins marked “Reserved”.

Power Source

Operational power supply is required to use the Control I/O port.

Rated input voltage: 12 - 24 VDC ±10%, 0.2 A MAX.

1.3 Input Specifications

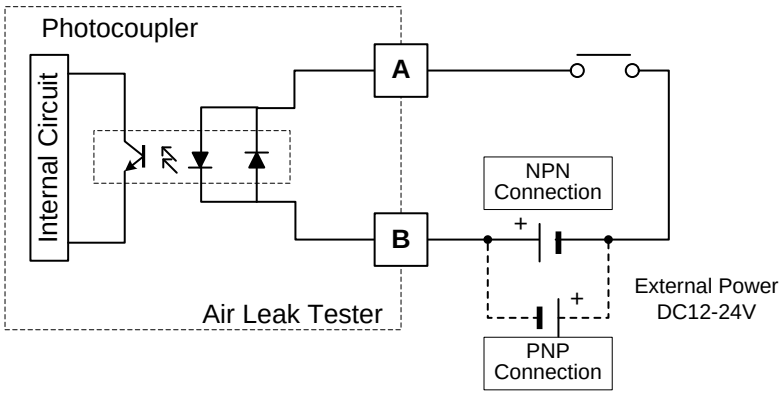
Photocoupler diode input

Input impedance: 3 KΩ

Input current: 10 mA typ. (24 VDC)

Wiring

Input Circuit



	Standard	D-SUB (Special spec.)
Pin# A	1A - 6A 9A - 13A	2 - 7 20 - 24
Pin# B	16A	10

1.4 Output Specifications

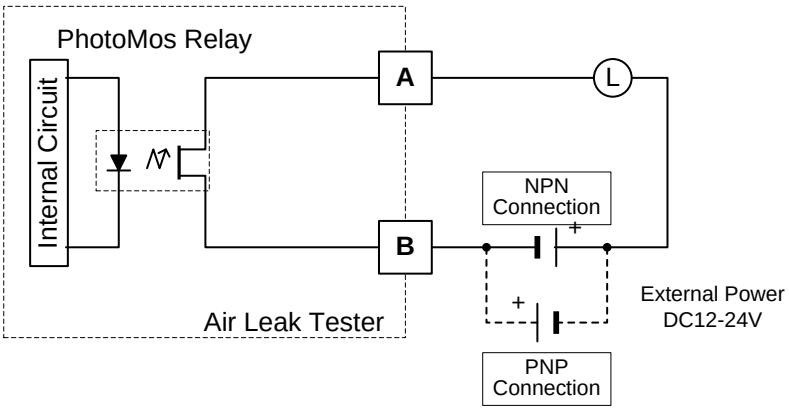
Open Collector Output

Maximum switching capacity: 100 mA/24 V,
For the Phoenix Contact connector, the total current of each group of the pins from 1B to 7B and pins from 9B to 14B should be 200 mA or less.
For the D-SUP connector, the total current of the pins from 12 to 18 or pins from 31 to 36 should be 200 mA or less.

Residual voltage while ON: 2 V max.

Wiring

Output Circuit

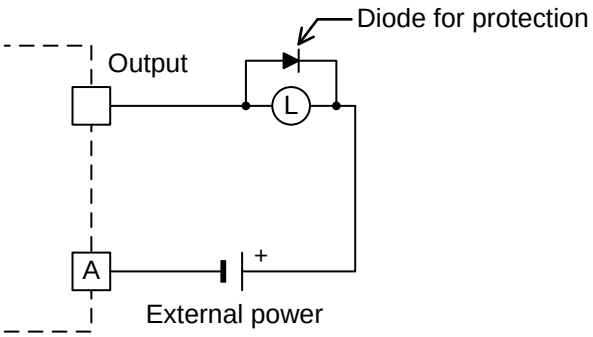


	Standard	D-SUB (Special spec.)
Pin# A	1B - 3B 5B - 7B 9B - 14B	12 - 14 16 - 18 31 - 36
Pin# B	15B	19

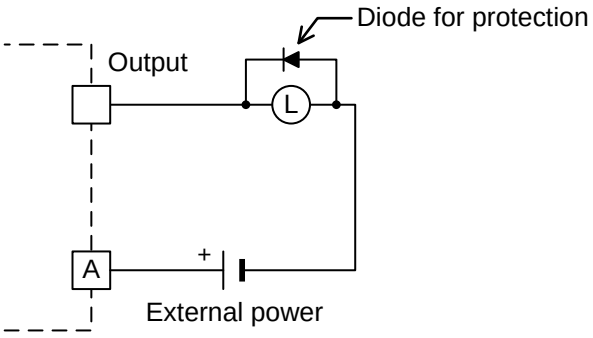
Protection of Output Load

When using the output induction load (such as relay, monitor etc.), please arrange the diode for protection.

NPN Connection



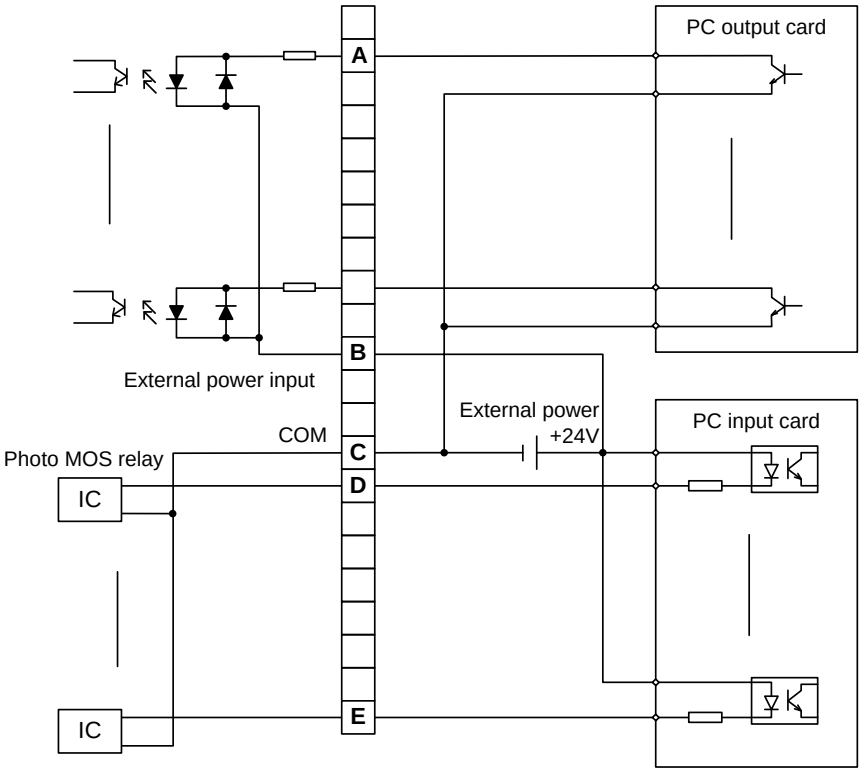
PNP Connection



	Standard	D-SUB (Special spec.)
Pin# A	15B	19

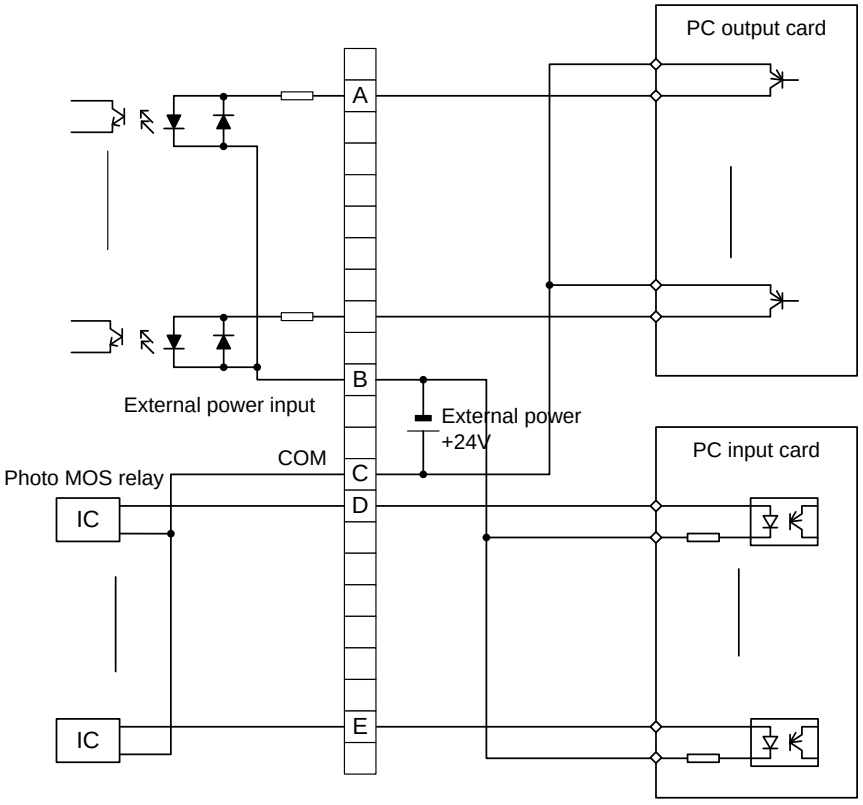
1.5 Typical PLC Connection

NPN-type input/output circuit configuration of LS-R900



	Standard	D-SUB (Special spec.)
Pin# A	1A	2
Pin# B	16A	10
Pin# C	15B	19
Pin# D	12B	33
Pin# E	9B	36

PNP-type input/output circuit configuration of LS-R900



	Standard	D-SUB (Special spec.)
Pin# A	1A	2
Pin# B	16A	10
Pin# C	15B	19
Pin# D	12B	33
Pin# E	9B	36

1.6 Channel Code

Pins 9A through 13A (For D-SUB, pins 20 through 24) are used for switching channel automatically by external device. Channel can be changed by entering BCD codes to those pins.

Pin 9A (For D-SUB, pin 20) is the most significant bit (MSB) and Pin 13A (For D-SUB, pin 24) is the least significant bit (LSB).

CH	CH# 4 Pin 9A (20) MSB	CH# 3 Pin 10A (21)	CH# 2 Pin 11A (22)	CH# 1 Pin 12A (23)	CH# 0 Pin 13A (24) LSB	
0	OFF	OFF	OFF	OFF	OFF	
1	OFF	OFF	OFF	OFF	**ON**	
2	OFF	OFF	OFF	**ON**	OFF	
-						
9	OFF	**ON**	OFF	OFF	**ON**	
10	OFF	**ON**	OFF	**ON**	OFF	
11	OFF	**ON**	OFF	**ON**	**ON**	
-						
14	OFF	**ON**	**ON**	**ON**	OFF	
15	OFF	**ON**	**ON**	**ON**	**ON**	
16	**ON**	OFF	OFF	OFF	OFF	
-						
29	**ON**	**ON**	**ON**	OFF	**ON**	
30	**ON**	**ON**	**ON**	**ON**	OFF	
31	**ON**	**ON**	**ON**	**ON**	**ON**	
	16	8	4	2	1	Weight of each bit

1.7 Stage Number Output

Leak test stages can be identified from combinations of Stage # 0 and Stage #1.

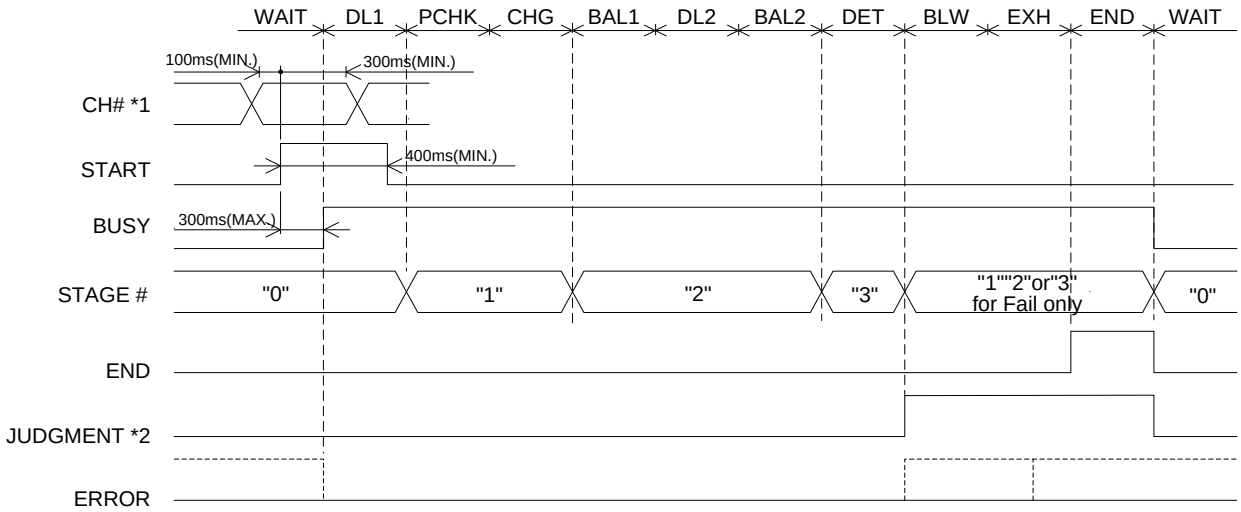
Stage	Stage #1	Stage #0	Stage #
WAIT, DL1	OFF	OFF	“0”
PCHK - CHG	OFF	ON	“1”
BAL1, DL2, BAL2	ON	OFF	“2”
DET	ON	ON	“3”
BLW - END	Hold	Hold	See **NOTE**

NOTE

The stage # in which a Fail judgment is made, or a Stop signal is received, is held from BLW through END stages (No output for a Pass judgment). For instance, if a Fail judgment is made during BAL2, the stage # in END stage is “2.” This makes sorting defected parts easier.

1.8 Signal Timing Charts

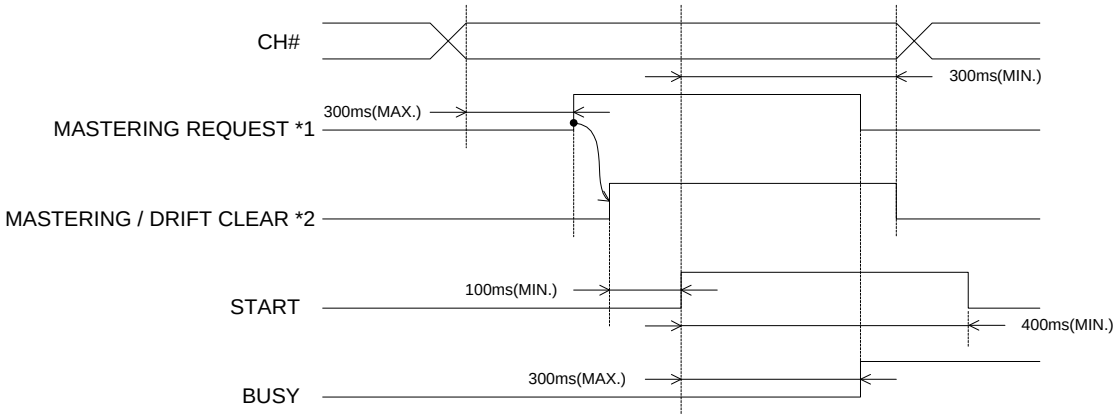
Leak Test Timing Chart



***1** CH # includes CH #, K(Ve) CHECK, MASTERING / DRIFT CLR, and Calibration Valve Open/Close signals.

***2** JUDGMENT includes PASS, UL FAIL, LL FAIL, UL2 FAIL AND LL2 FAIL signals.

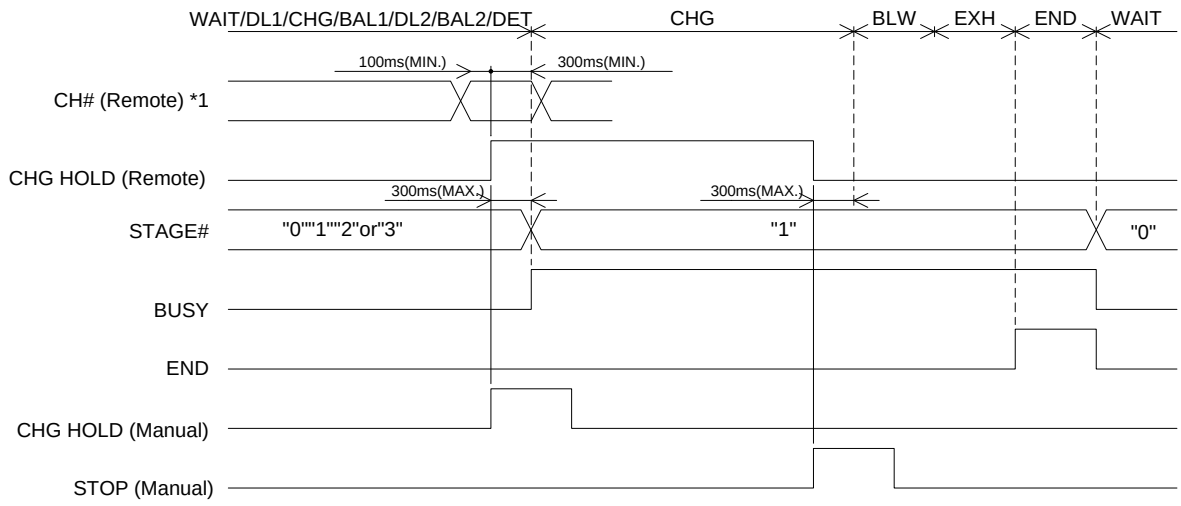
Mastering Timing Chart



***1** MASTERING REQUEST signal is an output signal.

***2** MASTERING/DRIFT CLEAR signal is an input signal.

Charge Hold Timing Chart



***1** CH # is acceptable in the WAIT stage, but not in any other stage.

1.9 Checking Wiring with I/O Monitor

This can be used to check if the wire connection to external devices is correct.

First, unlock settings and switch to Manual mode after power is turned on.

Refer to "**4 BASIC OPERATIONS**" for the details.

Go to:

Back > **Lock** > Settings Unlock > Enter a passcode and tap **Enter** > **Back**

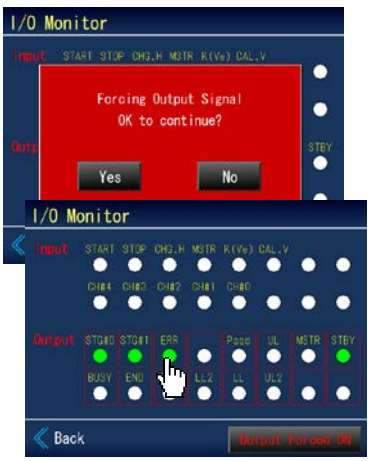
RM > "Switching to Manual Mode OK to continue?" > **Yes**

Then **Go to:** Maint. > I/O Monitor

Input

The pins lit green are receiving the signals.

Output



1) Forcing output signals.
   Go to: Output Forced ON
   > "Forcing Output Signal OK to continue?" > **Yes**
2) Tap the pin(s) to be checked and signal(s) is(are) transmitted.
3) Tapping the pins again resets the signals.
4) Clearing Force output signals.
   Go to: Output Forced ON
   > "Clearing Forced Output Signal OK to continue?" > **Yes**

2 RS-232C Serial Interface Port

This interface port is an asynchronous half duplex serial interface based on EIA-232. This interface provides communication with external devices such as computers (NULL-MODEM mode direct connections). Through this port, the LS-R900 transmits leak test data after every test execution.

The Leak Tester does not accept any commands from the host; it only transmits leak test data.

All the signals are transmitted at the beginning of the END stage.

For setting the communication parameters, go to:

System > System Settings > RS-232C(R) / RS-232C(F)

2.1 RS-232C Interface

Data transmission	Half duplex
Baud rate	9600, 19200, 38400, 57600 or 115200
Start bit	1 bit
Data length	7 or 8 bits
Parity	Non-parity, even number or odd number
Stop bit	1 or 2 bits

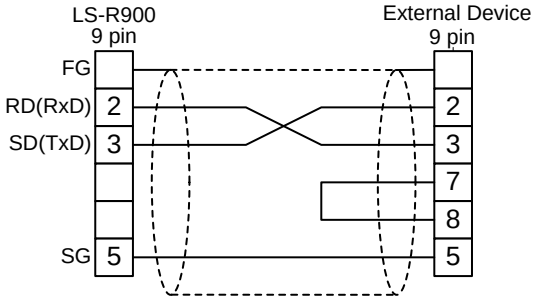
Connector pin assignments (DB-9P)

Pin #	Name	Function
2	RxD	Received Data
3	TxD	Transmitted Data
5	SG	Signal Ground

2.2 Interface Cable Wiring Example

Interface cable wiring diagram (COM1)

D-SUB 9-pin female Inch screw threads #4 to 40



2.3 Formats of RS-232C Output

Data output is available from the two RS-232C ports on the front and rear panel.

The LS-R900 supports nine (9) output formats.

For selecting a format, go to:

System > System Settings > RS-232C(R) / RS-232C(F) > Format

T Format	Fixed-length output of DET leak data only
ID Format	Fixed-length output: leak limits, DET leak and other data (Default format)
I Format	Fixed-length output: leak limits, DET leak and other data
DT Format	Fixed-length output: Date, Time and other data
K Format	Fixed-length output: Detection method, K(Ve), DET leak data and other data
L Format	Fixed-length output: BAL2 leak, DET leak and other data
M Format	Fixed-length output: DET leak, Stage timers and other data
P Format	Format for RS232C Printer RS-232C can be used.
D Format	Fixed-length output Test data is transmitted every 100ms

2.4 Data Format

- All output data is coded in ASCII numeric characters.
- A block of output data begins with ASCII code "#"(23H), and ends with a sequence of a carriage return (0DH).
- All output data are separated by spaces (20H).
- The checksum field is in hexadecimal notation and proceeded by the ASCII code ":" (3AH).
- A field with 3-digit integer data is preceded by two zeroes, and does not include a decimal point.
- ΔP and leak rate value may not match due to compensation.

NOTE
Differential pressure reading when an error occurs is +999.

NOTE
_ (underscore) represents space in the tables below.

T Format

#zz_00_J_±LLL.L:GG CR						
Data field		Data type	Unit	Min.	Max.	Note
Tester ID	z	2-digit decimal		00	99	
Result	J	ASCII code (1-digit hexadecimal)	--	1	D	1: LL FAIL 2: Pass 4: UL FAIL 9: LL2 FAIL C: UL2 FAIL D: Error
Leak	L	Floating point	Leak unit	±0.000	±00999	
Checksum	G	2-digit hexadecimal	--	00	FF	

ID Format (Default format)

#zz_00_J_±LLL.LLL_±AAA.AAA_±BBB.BBB_±DDD.DDD_±PPP.PPP_±EEE.EEE_±FFF.FFF_CC:GG CR						
Data field		Data type	Unit	Min.	Max.	Note
Tester ID	z	2-digit decimal		00	99	
Result	J	ASCII code (1-digit hexadecimal)	--	1	D	1: LL FAIL 2: Pass 4: UL FAIL 9: LL2 FAIL C: UL2 FAIL D: Error
Leak	L	Fixed point	Leak unit	± 000.000	± 999.000	
DET UL	A	Fixed point	Leak unit	± 000.000	± 999.999	
DET LL	B	Fixed point	Leak unit	± 000.000	± 999.999	
ΔP	D	Fixed point	Pa	± 000.000	± 999.000	
Test pressure	P	Fixed point	Test press unit	± 000.000	± 999.000	
TP UL	E	Fixed point	Test press unit	± 000.000	± 999.999	
TP LL	F	Fixed point	Test press unit	± 000.000	± 999.999	
CH#	C	2-digit decimal	--	00	32	
Checksum	G	2-digit hexadecimal	--	00	FF	

I Format

#zz_00_J_±LLL.LLL_±AAA.AAA_±BBB.BBB_±DDD.D_±PPP.PPP_±EEE.EEE_±FFF.FFF_C:GG CR						
Data field		Data type	Unit	Min.	Max.	Note
Tester ID	z	2-digit decimal		00	99	
Result	J	ASCII code (1-digit hexadecimal)	--	1	D	1: LL FAIL 2: Pass 4: UL FAIL 9: LL2 FAIL C: UL2 FAIL D: Error
Leak	L	Fixed point	Leak unit	± 000.000	± 999.000	
DET UL	A	Fixed point	Leak unit	± 000.000	± 999.999	
DET LL	B	Fixed point	Leak unit	± 000.000	± 999.999	
ΔP	D	Fixed point	daPa	± 0.000	± 00099	
Test pressure	P	Fixed point	Test press unit	± 000.000	± 999.000	
TP UL	E	Fixed point	Test press unit	± 000.000	± 999.999	
TP LL	F	Fixed point	Test press unit	± 000.000	± 999.999	
CH#	C	1 character	--	0	V	0 to 9, A to V
Checksum	G	2-digit hexadecimal	--	00	FF	

DT Format

ig: 0001, -9.50, -9.50, +.000, -0009.50, 96.1, END, 00, OK, 13-03-25, 00:00:00 CR		
Data field	Example	
Stage Timer	0001	Fixed to “0001”.
Leak	-9.50	Floating point
DPS Raw Output	-9.50	Floating point
Comp Value	+.000	Floating point
ΔP	-0009.50	Fixed point
Test Pressure	96.1	Floating point
END	END	Fixed to “END”
CH#	00	2-digit decimal
Result	OK	Refer to the table Result Symbols in **2.6 Printer**.
Date	13-03-25	YY-MM-DD
Time	00:00:00	HH:MM:SS

K Format

#zz,MM,J,±LLL.LLL,±AAA.AAA,±BBB.BBB,±SSS.SSS,±PPP.PPP,±EEE.EEE,±FFF.FFF,CC,±KKK.KKK,GGG.GGG,XX,RRRR,YYYY-MM-DD,HH:MM:SS,:GG CR						
Data field		Data type	Unit	Min.	Max.	Note
Tester ID	z	2-digit decimal		00	99	
Measurement Mode	M	2-digit decimal	--			00: Leak Test 01: Mastering 02: K(Ve) check 03: NR
Result	J	ASCII code (1-digit hexadecimal)	--	1	D	1: LL FAIL 2: Pass 4: UL FAIL 9: LL2 FAIL C: UL2 FAIL D: Error
Leak	L	Fixed point	Leak unit	± 000.000	± 999.000	
DET UL	A	Fixed point	Leak unit	± 000.000	± 999.999	
DET LL	B	Fixed point	Leak unit	± 000.000	± 999.999	
Comp Value	S	Fixed point	Leak unit	± 000.000	± 999.999	
Test pressure	P	Fixed point	Test press unit	± 000.000	± 999.000	
TP UL	E	Fixed point	Test press unit	± 000.000	± 999.999	
TP LL	F	Fixed point	Test press unit	± 000.000	± 999.999	
CH#	C	2-digit decimal	--	00	32	
K(Ve) Auto Setup	K	Fixed point	K(Ve) unit	± 000.000	± 999.999	
K(Ve) Value	G	Fixed point	K(Ve) unit	000.000	+ 999.999	
K(Ve) Check	X	2-digit decimal	%	00	30	00 to 30 every 1%
Error Code	R	4-digit hexadecimal	--	--	--	***1**
Date		YYYY-MM-DD	--	--	--	
Time		HH:MM:SS	--	--	--	
Checksum	G	2-digit hexadecimal	--	00	FF	

***1** Codes for errors and Corresponding Errors of LS-R900

Code	Error Description
4000	Error: 11 to 16 Air Operated Valve Error
0800	K(Ve) Check NG
0400	Error: 24 K(Ve) Value Out of Range
0200	Error: 2 PS Output Out of Range
0100	Large Leak
0080	Error: 3 Test Pressure Error
0020	Error: 1 PS Offset Error
0000	Pass

L Format

#ZZ_00_J_±LbLbLb.Lb_±LdLdLd.Ld : GG CR						
Data field		Data type	Unit	Min.	Max.	Note
Tester ID	z	2-digit decimal		00	99	
Result	J	ASCII code (1-digit hexadecimal)	--	1	D	1: LL FAIL 2: Pass 4: UL FAIL 9: LL2 FAIL C: UL2 FAIL D: Error
Leak (BAL2)	Lb	Floating point	Leak unit	± 0.000	± 00999	
Leak (DET)	Ld	Floating point	Leak unit	± 0.000	± 00999	
Checksum	G	2-digit hexadecimal	--	00	FF	

M Format

#zz_CC_RR_J_±LLL.LLL_±PPP.PPP_±DDD.DDD_±KKK.KKK_HHH.H_III.I_www.w_NNN.N_OOO.O_QQQ.Q_vvv.v_SSS.S_TTT.T_UUU.U_VVV.V_WWW.W_xxx.x_ll_pp_kk_±ccc.ccc_±ddd.ddd_±hhh.hhh_±aaa.aaa_±bbb.bbb_±iii.iii_±EEE.EEE_±FFF.FFF_ee_ff_gg_jj_±mmm.mmm_±nnn.nnn_±ooo.ooo_±qqq.qqq_±rrr.rrr_±sss.sss_tt_uu_±YYY.YYY_±ZZZ.ZZZ_YYMMDD_HHMMSS:GG CR

Data field		Data type	Unit	Min.	Max.	Note
Tester ID	z	2-digit decimal	--	00	99	
CH#	C	2-digit decimal	--	00	32	
Error code	R	2-digit decimal	--	01	18	***1**
Result	J	ASCII code (1-digit hexadecimal)	--	1	D	1: LL FAIL 2: Pass 4: UL FAIL 9: LL2 FAIL C: UL2 FAIL D: Error
Leak	L	Fixed point	Leak unit	-999.000	+999.000	
Test Pressure	P	Fixed point	Test press unit	-999.000	+999.000	
ΔP	D	Fixed point	Pa	-999.999	+999.999	
K(Ve)	K	Fixed point	K(Ve) unit	-999.999	+999.999	
DL1	H	Fixed point	Second	000.0	999.9	
CHG	I	Fixed point	Second	000.0	999.9	
BAL1	w	Fixed point	Second	000.0	999.9	
BAL2	N	Fixed point	Second	000.0	999.9	
DET	O	Fixed point	Second	000.0	999.9	
BLW	Q	Fixed point	Second	000.0	999.9	
END	v	Fixed point	Second	000.0	999.9	
EXH	S	Fixed point	Second	000.0	999.9	
MB1	T	Fixed point	Second	000.0	999.9	
MB2	U	Fixed point	Second	000.0	999.9	
PCHK	V	Fixed point	Second	000.0	000.2	***2**
PCHG	W	Fixed point	Second	000.0	999.9	
PEXH	x	Fixed point	Second	000.0	999.9	
Leak unit	l	2-digit decimal	--	00	16	***3**
Test Press Unit	p	2-digit decimal	--	00	08	***3**
K(Ve) Unit	k	2-digit decimal	--	00	03	***3**
BAL (UL)	c	Fixed point	Leak unit	-999.999	+999.999	
BAL (LL)	d	Fixed point	Leak unit	-999.999	+999.999	
DET (UL2)	h	Fixed point	Leak unit	-999.999	+999.999	
DET (UL)	a	Fixed point	Leak unit	-999.999	+999.999	
DET (LL)	b	Fixed point	Leak unit	-999.999	+999.999	
DET (LL2)	i	Fixed point	Leak unit	-999.999	+999.999	
TP UL	E	Fixed point	Test press unit	-999.999	+999.999	
TP LL	F	Fixed point	Test press unit	-999.999	+999.999	
Press Monitor	e	2-digit decimal	--	00	01	
Comp Type	f	2-digit decimal	--	00	02	***3**
Mastering Iterations	g	2-digit decimal	--	01	20	
Number of Samples	j	2-digit decimal	--	00	20	
Drift Comp.	m	Fixed point	Leak unit	- 999.999	+ 999.999	
Mastering Comp	n	Fixed point	Leak unit	- 999.999	+ 999.999	
D. Comp Upper Limit	o	Fixed point	Leak unit	- 999.999	+ 999.999	
D. Comp Lower Limit	q	Fixed point	Leak unit	- 999.999	+ 999.999	
M. Comp Upper Limit	r	Fixed point	Leak unit	- 999.999	+ 999.999	
M. Comp Lower Limit	s	Fixed point	Leak unit	- 999.999	+ 999.999	
Press Inlet	t	2-digit decimal	--	00	01	Fixed to 00
NR Iterations	u	2-digit decimal	--	00	20	
EP Precharge	Y	Fixed point	Test press unit	- 999.999	+ 999.999	

EP Pressurization	Z	Fixed point	Test press unit	- 999.999	+ 999.999	
Date		YYMMDD	--			
Time		HHMMSS	--			
Checksum	G	2-digit hexadecimal	--	00	FF	

***1** Codes for errors and Corresponding Errors of LS-R900

Code	Error Description
00	Not Error (Pass/Fail)
01	Error: 23 Mastering Error
02	Error: 52 SPI2_res
04	Error: 22 Stop Valves Closed
06	Error: 1 PS Offset Error
08	Error: 3 Test Pressure Error
10	Error: 2 PS Output Out of Range
15	Error: 11 to 16 Air Operated Valve Error
18	Error: 51 Lo Battery SRAM Error

***2** Fixed to 0.2 (s) for the pneumatic circuits that have the stage and 0.0[s] for those that don't have the stage.

***3** Leak Unit, Test Pressure Unit, K(Ve) Unit and Compensation Type

Code	Description
Leak Unit	**00:** Pa, **01**: kPa, **02:** mmH_2O, **03:** inH_2O, **04:** mmHg, **05:** mL/s, **06:** mL/min, **07:** in^3/min, **08:** in^3/d, **09:** L/min, **10:** Ft^3/h, **11:** Pam^3/s, **12:** E-3·m^3/s, **13:** Pa/s, **14:** Pa/min, **15:** *Pa/s, **16:** *Pa/min
Test Pressure Unit	**00:** kPa, **01:** MPa, **02:** PSI, **03:** kg/cm^2, **04:** bar, **05:** mbar, **06:** mmHg, **07:** cmHg, **08:** inHg.
K(Ve) Unit	**00:** mL, **01:** L, **02:** in^3, **03:** ft^3
Comp Type	**00:** No Compensation, **01:** Drift Compensation / Fixed Compensation, **02:** Mastering Compensation / Drift & Mastering Compensation

P Format

Refer to **2.6 Printer**.

D Format

ig: 0001, -9.50, -9.50, +.000, -9.50, 96.1, CHG, 00 CR		
Data field	Example	
Stage Timer	0001	4-digit decimal
Leak	-9.50	Floating point
DPS Raw Output	-9.50	Floating point
Comp Value	+.000	Floating point
ΔP	-9.50	Fixed point
Test Pressure	96.1	Floating point
Stage	CHG	Refer to "**6 SETUP**" for the details.
CH#	00	2-digit decimal

2.5 Checksum

Checksum is two's complement of the value that adds every ASCII code in the calculation range.

Calculation example: T format

Character number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Transmitted data		#	0	0		0	0		2		-	0	0	0	.	4	:	3	2	CR
ASCII Code	HEX	23	30	30	20	30	30	20	32	20	2D	30	30	30	2E	34	3A			D
	DEC	35	48	48	32	48	48	32	50	32	45	48	48	48	46	52	58			13

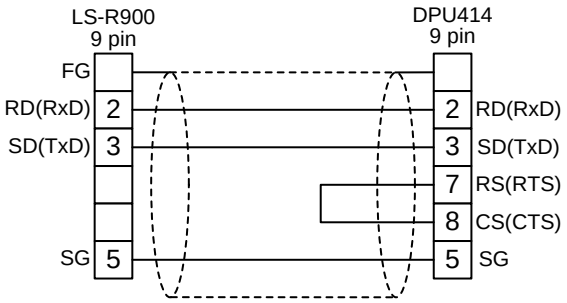
		DEC notation	HEX notation	Lower two digits		Remarks
				HEX notation	BIN notation	
Calculation of data strings	Sum	718	2CE	CE	11001110	Sum of every ASCII code
	Complement	-719	D31	31	110001	Complement of the sum
	Two's complement	-718	D32	32	110010	Adds 1 to the complement value
Checksum		32				

2.6 Printer

Use a printer that can print 80 characters or more in one line, and that can print character fonts. Also, use a cable whose length is 3 m or shorter.

Recommended Printer: DPU-414 series (Seiko)

Printer Cable Wiring



Change settings for the printer to the follows:
CR: Carriage Return
Baud Rate: 9600 (bps)

Data Dumping

Data is printed out after every leak test.

Print Out Fields

Field	Example	
DATE	12/12/01	Date the test was completed (YY-MM-DD)
TIME	11:14:21	Time the test was completed
CH#	00	Channel number I which the test was done
TOTAL#	116	Quantity of parts that have been tested
PRESSURE	97.8 kPa	Test pressure measured
dP [Pa]	5.59	The detected differential pressure drop
COMP[Pa]	5.77	Amount of compensation
LEAKAGE	0 mL/min	Calculated leak rate (after compensation)
RESULT	OK	Judgment of whether part is within the programmed leak limits (Pass). If there is an error detected during the leak test, an error symbol will be printed.

Result Symbols in Leak Test Data Print Out and D Format

Result Symbol	Description
OK	Pass
CHG NG , CHG -NG	CHG Large Leak
BAL1 +NG	Insufficient Test Pressure detected by PS (TP LL)
UL NG∗, LL NG∗	Exceeding UL or LL in BAL2
UL NG , LL NG	Exceeding UL or LL in DET
UL2 NG , LL2 NG	Exceeding UL2 or LL2 in DET
PS 0!	Error 1: PS Offset Error
PS OV !	Error 2: PS Output Out of Range
TP <> !	Error 3: Test Pressure Error
B1TP<>!	Error 4: BAL1 Test Pressure Error
DPS 0!	Error 10: DPS Offset Error
AV ?!1	Error 11: Air Operated Valve Error 1
AV ?!2	Error 12: Air Operated Valve Error 2
AV ?!4	Error 14: Air Operated Valve Error 4
AV ?!5	Error 15: Air Operated Valve Error 5
AV ?!6	Error 16: Air Operated Valve Error 6
BLKG ?!	Error 17: Blockage Check Error
DPS ?!	Error 21: DPS stopped oscillating
V CLS!	Error 22: Stop Valves Closed
MCMP<>!	Error 23: Mastering Error
SRAM !	Error 51: Lo Battery SRAM Error
SLV0!	Error 52: SPI2_res AD Communication Error
SLV1!	Error 53: SPI1-res I/O Communication Error
E2PRM !	Error 59: Flash data area bad track Error
SDCD ?!	Error 60: Flash program area WR Error Kernel
SRAMc !	Error 61: SRAM checksum Error

3 USB Port

Data speed is USB1.
Please use the USB memory formatted to FAT16 or FAT32 file system.

NOTE

Please do not connect an USB memory infected with a virus to LS-R900.
Cosmo will not be responsible for malfunction of LS-R900 due to virus infection via USB Memories.

What data can be stored or copied to USB Memory from LS-R900

- Parameters in one file (CSV copy to USB) in Settings Menu
- Live Test Data Recording (Test Data, Waveform Data, Mastering Data) in System Menu
- Test Data Copy in Analysis Menu
- Parameter Backup for Restore
- Entire System Backup for Restore (Except SPAN, Date of Restore and Compensation value)
- Operation Manual in Miscellaneous Menu

What data in USB Memory can be written on LS-R900

- Parameter Backup data
- System Backup data

Attention

When restoring (copying) the Parameter Backup data backed up in the Settings menu to other LS-R900, use “Individual Restore”.
Using "Restore All" overwrites some crucial information such as span values of the differential pressure sensor and pressure sensor, resulting incorrect measurement.

4 LAN Port

FTP server is planned to be equipped in the future.

OPERATION MANUAL

4 BASIC TOUCH SCREEN OPERATIONS

1 Turn On Power

Turn on the power with the power switch on the rear panel.

Home screen will be displayed on the LCD.
(Default is Standard measurement screen)

NOTE

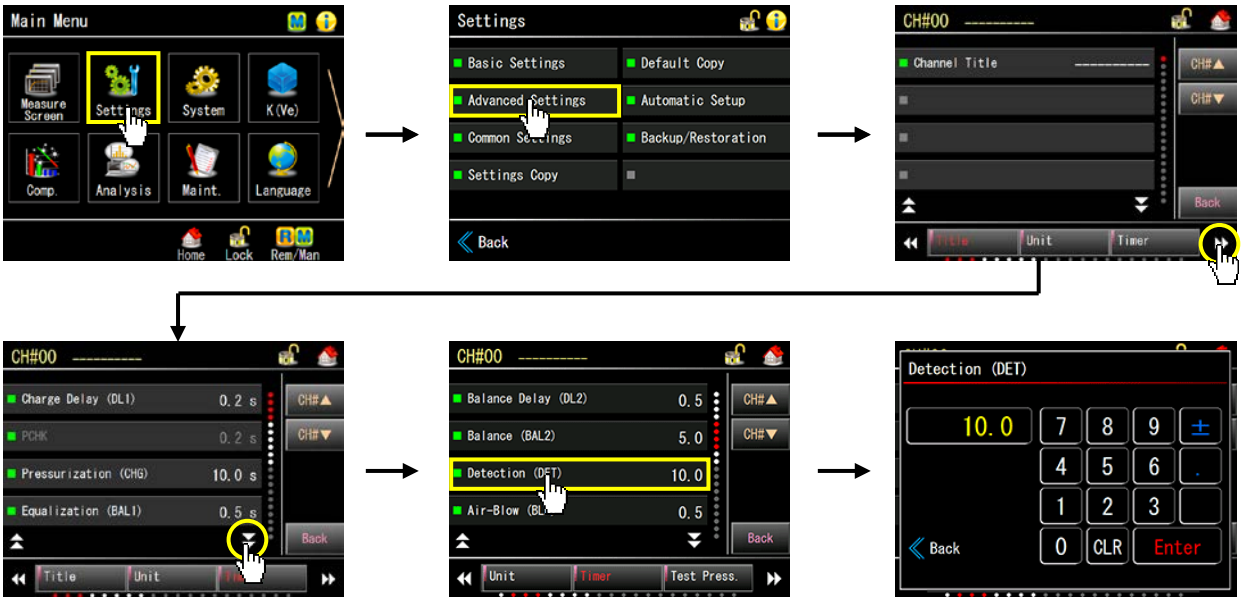
Tapping **Back** on the Home screen opens the Main Menu Screen.

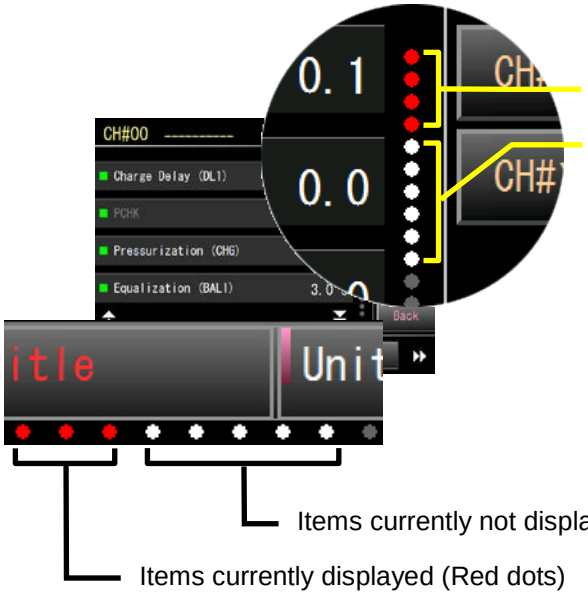
Let the power on for 5 minutes or longer for a warm-up before starting leak tests.

2 Go to Sub Menus, Pages and Items

All sub menus are accessible from the Main Menu, which consists of 2 pages.

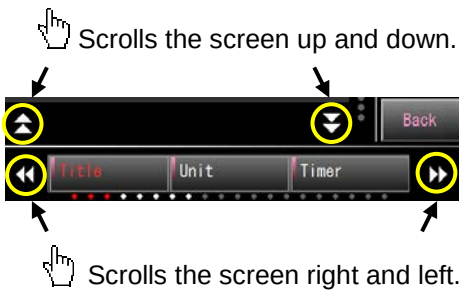
Tapping an icon or an item button goes to the next page.





Items currently displayed (Red dots)

Items currently not displayed (White dots)



Scrolls the screen up and down.

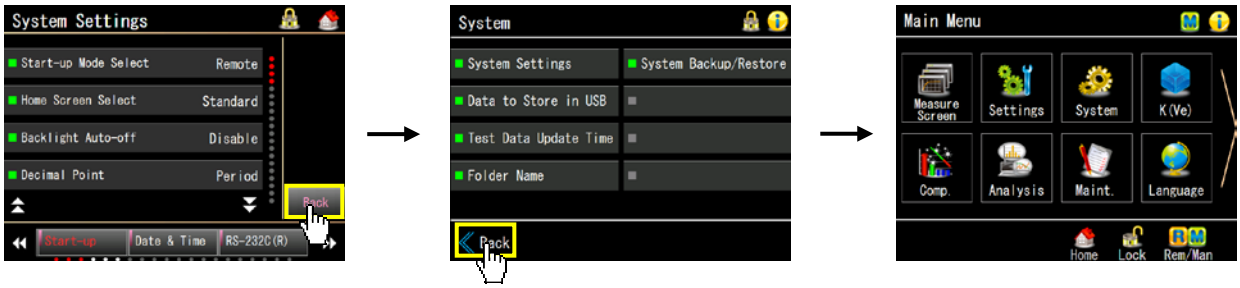
Items currently not displayed (White dots)

Items currently displayed (Red dots)

Scrolls the screen right and left.

3 Go Back to the Previous Page

Tap **Back**.

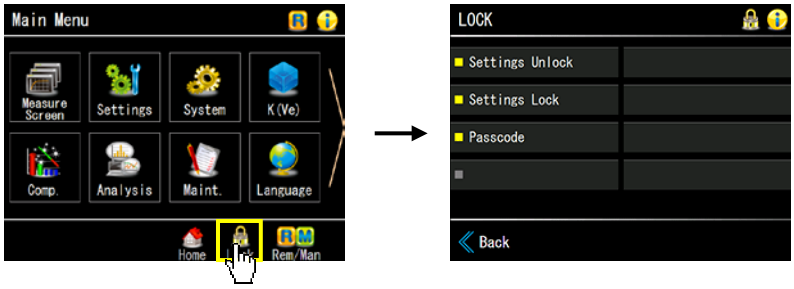


NOTE

Tapping **Back** on the Home screen that was displayed when the power is turned on opens the Main menu.

4 Settings Lock / Unlock

Unlocking the settings enables settings change. (Settings cannot be changed when it's locked)
Go to the Lock Menu by tapping the pad lock icon on the Main menu
Lock menu includes Settings Unlock, Settings Lock and Passcode.



4.1 Lock / Unlock Settings

To unlocking settings

Go to: Main Menu > **Lock** > Settings Unlock > Enter the passcode (Default: 0000)> **Enter**

To locking settings

Go to: Main Menu > **Lock** > Settings Lock > "Locking the settings OK to continue?" > **Yes**

4.2 Set a Passcode

A passcode of your choice (4-digit number) can be set. Default is 0000.
Unlock settings, then tap Passcode Setting to open the numeric key window.
Tap **CLR** to clear the current code, enter a passcode and tap **Enter**.

5 Switch the Operation mode between Remote and Manual

When the power is turned on, the operational mode will default to the currently set operation mode. (Default is Remote.)

To switch the operation mode, Tap R M located at the bottom of the Main Menu after unlocking settings.

Switch from Remote to Manual

R → M

Main Menu > **Rem/Man** > “Switch to Manual OK to continue?” > **Yes**

R on the upper right turns to **M**.

Switch from Manual to Remote

M → R

Main Menu > **Rem/Man** > “Switch to Remote OK to continue?” > **Yes**

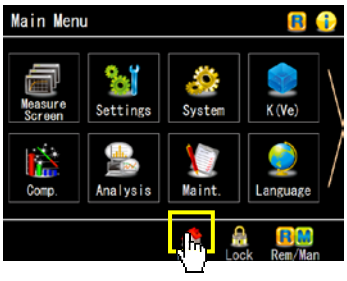
M on the upper right turns to **R**.

NOTE

Settings can be unlocked and Remote and Manual can be switched all at once by tapping R M on the Home screen while settings are locked.

6 Go to Home Screen

6.1 From Main Menu Screen



Tap on the lower bottom.

6.2 Directly From a Setting Screen (Shortcut)

This is a shortcut to open the Home screen without going through the Main menu.

Tap on the upper right corner.

This is convenient for searching the most appropriate test parameters by performing leak tests repeatedly.

7 Settings Operations

NOTE

Settings change is disable while the settings are locked.
Please unlock settings.
Go to: Lock > Settings Unlock

7.1 Change channels

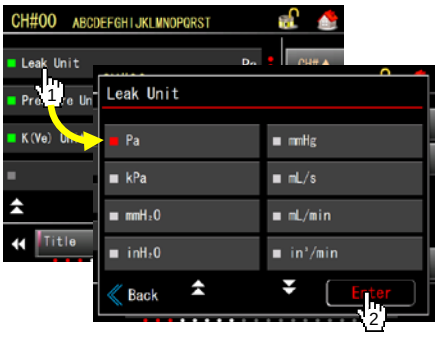
Channel number ascends by tapping **CH#▲** as CH#1 > CH#2 > CH#3

Channel number descends by tapping **CH#▼** as CH#31 > CH#30 > CH#29…

NOTE

The channel defaults to 00 when the power is turned on. However, in Manual mode, the channel defaults to the one displayed when the power was turned off the last time.

7.2 Select an Option From Multiple Selections



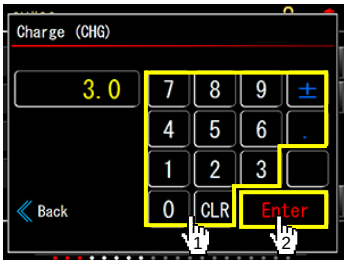
This is the settings for the items which are selected from multiple options.

Tap an item to set and a popup window for the options opens.

The option with a red square is currently selected.

1) Select an item and its square becomes yellow
2) Press **Enter** to complete the selection.

7.3 Enter a value with the numeric keypad

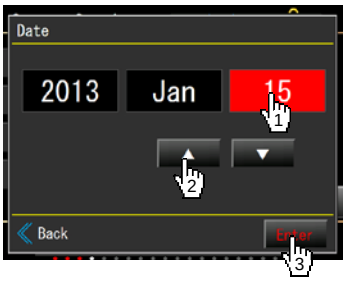


This is the settings for the items for which values are entered using the numeric keypad.

Tap an item to set and a popup window with a numeric keypad opens.

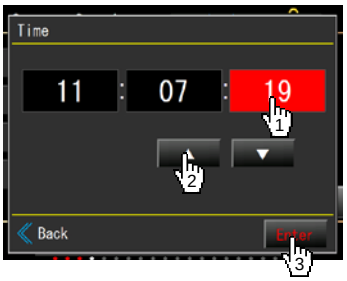
1) Tap **CLR** to clear the current value and enter a value.
2) Press **Enter** to complete.

7.4 Enter a date (Date, Replacement Date (Battery) and Next Inspection Date)



1) Select an item to change among year, month and date. The selected item is highlighted.
2) Tap ▲ ▼ to change the numbers.
3) **Enter** to complete.

7.5 Enter time (hour, minute and date)

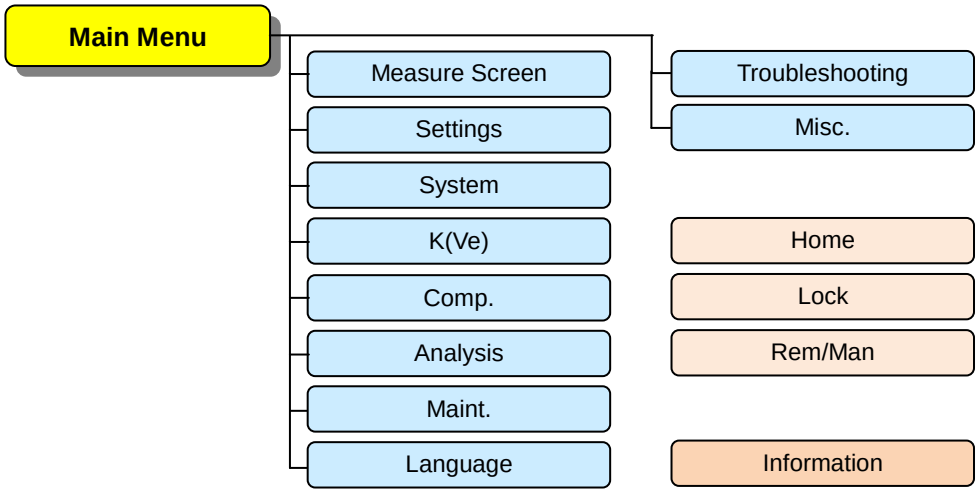


1) Select an item to change among hour, minute and second. The selected item is highlighted.
2) Tap ▲ ▼ to change the numbers.
3) **Enter** to complete.

5 SCREEN LIST

1 Main Menu

This is the main menu. All sub menus are accessible from this screen.



Home Tapping the icon returns to the Home screen.

To set the Home screen go to: System > System Settings > Start-up > Home Screen Select

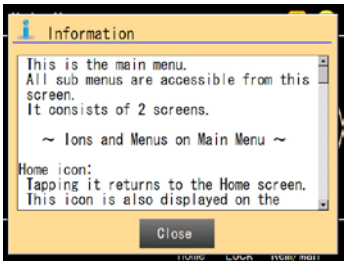
Lock

Menu to lock and unlock settings.

Passcode can be set.

Rem/Man Toggles Remote and Manual for measurements.

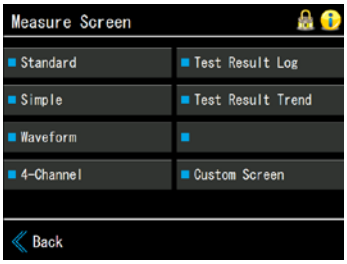
Information

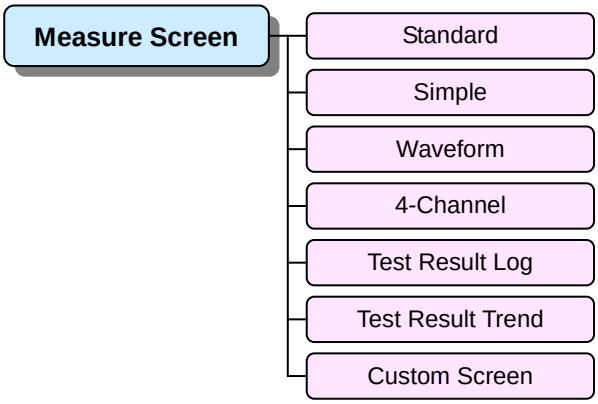


Tapping the icon opens information for each menu.

2 Measurement Screen Menu

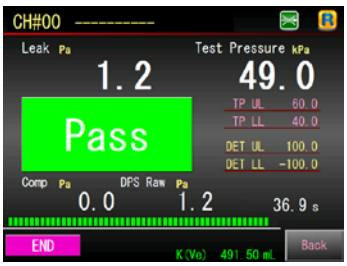
There are 6 measurement screens, Standard, Simple, Waveform, 4-Channel, Test Result Log List and Test Result Log Chart. The screens can be switched while a test is in progress.



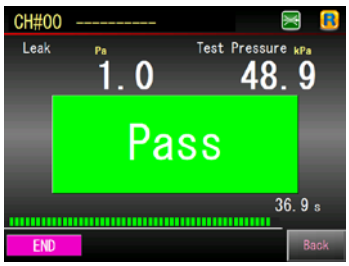


2.1 Measurement Screens (Remote)

Standard



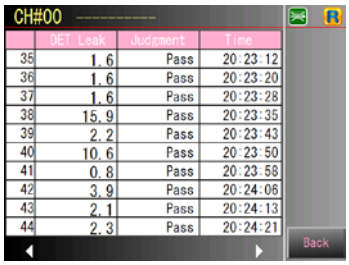
Simple



Waveform

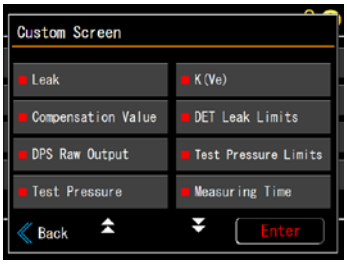
4-Channel

Test Result Log



Test Result Trend

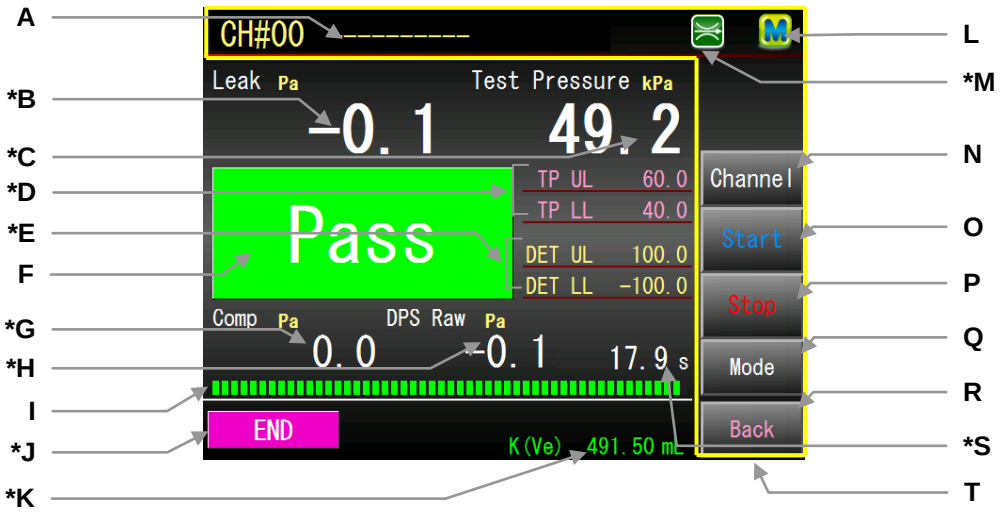
Custom Screen



2.2 Measurement Screen Description: Standard (Manual)

Usually manual mode measurement is performed for initial test parameter settings.
Unlock Settings and toggle the operation mode to Manual.
The items marked with * can be Display or Hidden in Custom Screen.

This is the only screen that displays all the items selectable in the Custom Screen.
The boxed off section is same for all the measurement screens.



A **CH#:** Channel number and title
Up to 20 letters are allowed for the channel title.

B **Leak:** Leak in a selected unit

C **Test Pressure:** Test pressure in a selected unit

D **TP UL / TP LL:**
Upper and lower limits for test pressure

E **DET UL / DET LL:**
Upper and lower limits for leak in Detection stage.

F **Pass/Fail Judgment:** Displayed after a test.

G **Comp:** Current compensation value

H **DPS Raw:** Raw output of the Differential Pressure Sensor

I **Time indicator:** Shows the progress of a test.

J **Stage:** The current stage

K **K(Ve):** The current K(Ve) value

L **Remote/Manual:**
R for Remote and M for Manual

M : Green when the Calibration port valve on the front panel (⋊) is closed and orange when it's opened.

N **Channel** : Channel selection

O **Start:** Starts measurement that was selected in the **Mode**.
Measurement ends after one cycle or is aborted with **Stop**.
For Charge hold, LS-R900 keeps pressurizing until **Stop** is tapped.

P **Stop:** Aborts a measurement or Charge hold.

Q **Mode:** Menu to select a measurement from Leak Test, Mastering Sampling, Charge Hold, Automatic Setup, Blockage Sampling and Burn-in.

R **Back:** When power is turned on tapping it goes to the Main Menu and other time, goes back to the previous screen.

S **Stage Timer:** Timer for each stage. Total timer is displayed in idle state.

T **Buttons:** Displayed only in the Manual Mode.

Channel Selection

The channel selection window will pops up by tapping **Channel**.

Channel number descend by tapping **CH#▼**.
Channel number ascend by tapping **CH#▲**.

Calibration Valve Description

This is used only when the calibrator model is J.

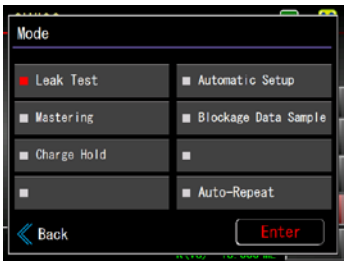
Green when the Calibration port valve on the front panel (⋊) is closed and **orange** when it's opened.

This is for checking the Fail Judgment performance by connecting a Leak Master for Fail judgment.

NOTE

Although the icon is displayed when the calibrator model is K (ALC is mounted), cannot be used in the same way.

Mode Description



A measurement to perform has to be selected from the following 6 before performing a measurement.

Leak Test: Air Leak Test

Mastering: Mastering value sampling

Charge Hold: Keeps pressurizing until **Stop** is tapped.
In Standard measurement screen in Manual mode, test pressure can be adjusted by tapping **Setting** while the charge hold is on.

Refer to 7 10.4.

Automatic Setup: Primary timers are automatically set for initial setups.

Blockage Date Sample: Samples the non-blocked data.

Auto-Repeat: Repeats the selected measurement: Leak Test, Mastering or Blockage Data Sample.
Select Auto-Repeat after selecting the type of measurement.

2.3 Measurement Screen Description: Simple (Manual)

Simple Pass/Fail display with the test pressure and leak.

2.4 Measurement Screen Description: Waveform (Manual)

Applied test pressure and measured Leak are displayed in graphs.

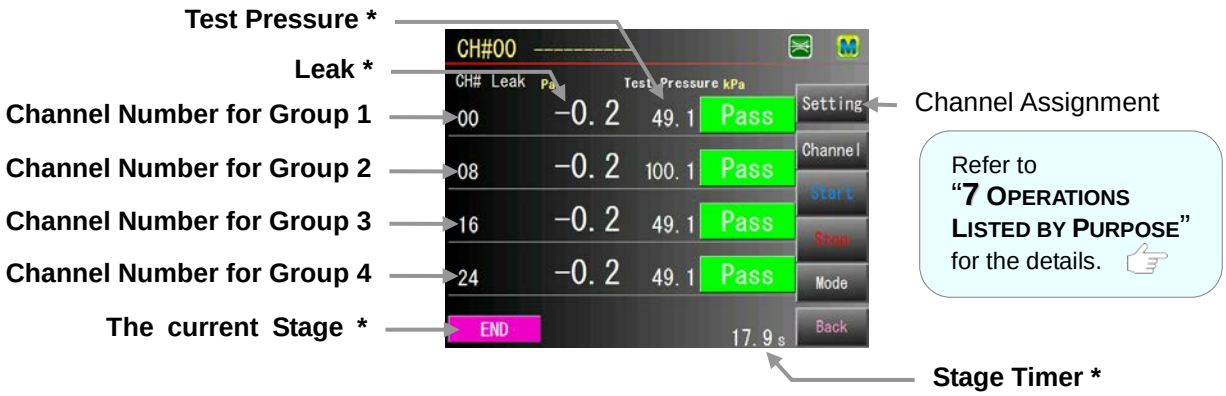
The blue line indicates Test Pressure and the green line indicates Leak.

2.5 Measurement Screen Description: 4-Channel (Manual)

Displays up to 4 channels per group of 8 out of 32 channels divided into 4 from 0 to 31 in order. Channels of your choice can be assigned to a group of your choice by tapping **Setting**.

This is useful for the cases where multiple cavities on one tested part are tested in a sequence.

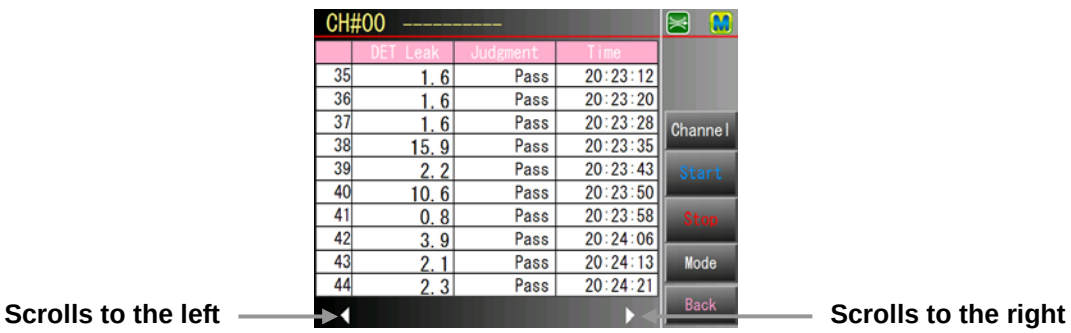
Entering Stop signal resets all the displayed test results.



2.6 Measurement Screen Description: Test Result Log (Manual)

List of the last 10 test logs that can be viewed during leak tests.

The list is updated after every test.



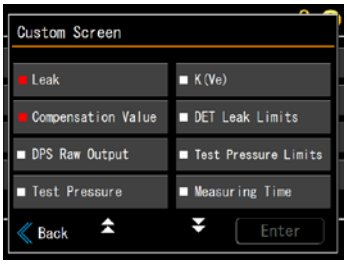
2.7 Measurement Screen Description: Test Result Trend (Manual)

Test trend of all the stored test logs of the channel of your choice are displayed in a graph. (Up to 5000 logs are stored in all 32 channels)

The graph is updated after every test.

Graphed item is selectable by tapping **Item Select**.

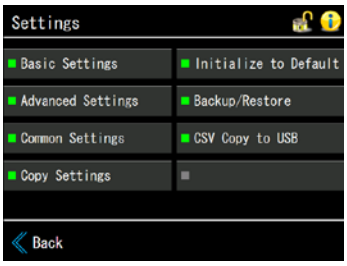
2.8 Custom Screen

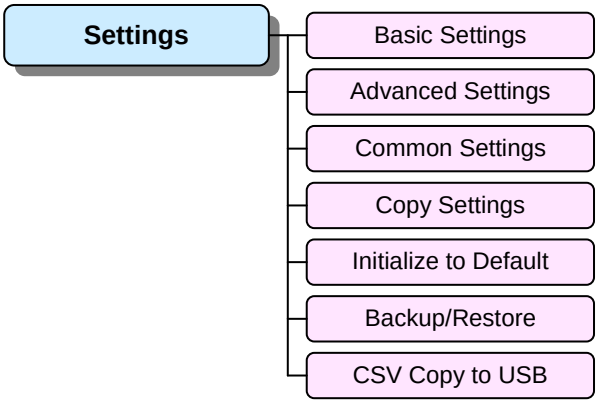


Refer to "**6 SETUP**" for the details.

3 Settings Menu

Menu to set the leak test parameters.

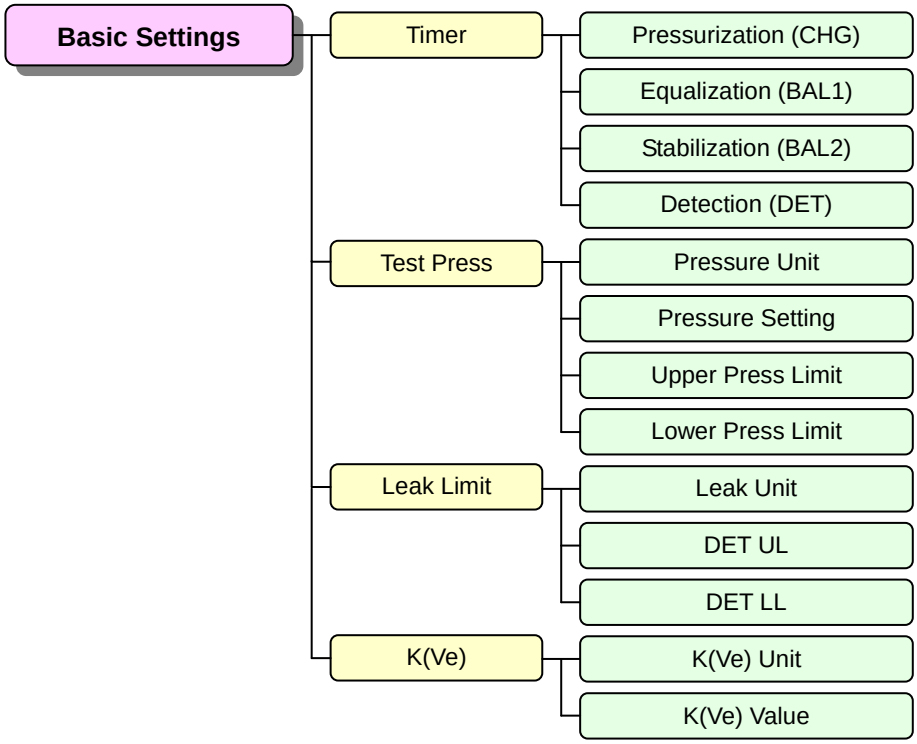




3.1 Basic Settings

Minimum settings for leak test.

Setting these items enables a simple leak test.

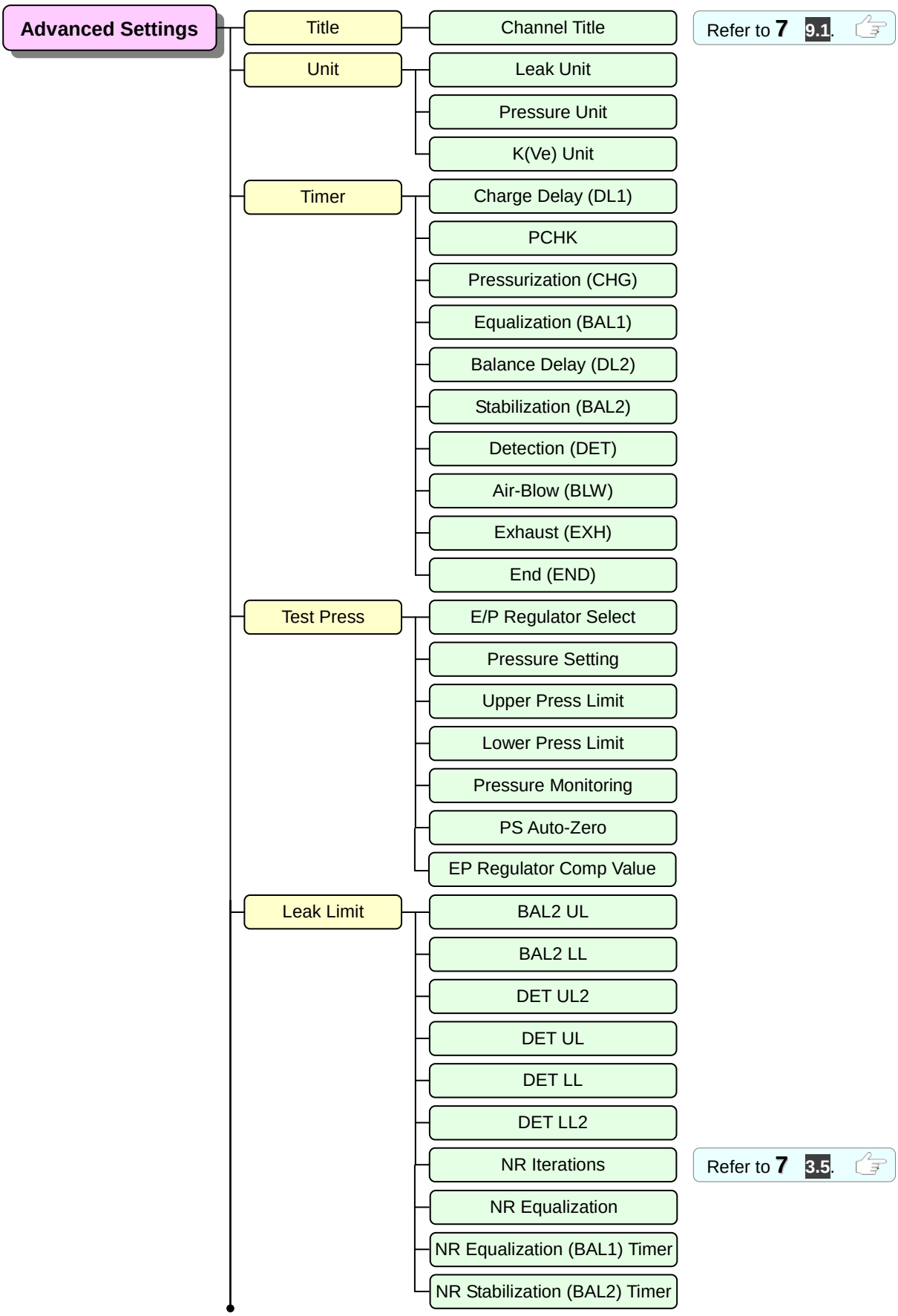


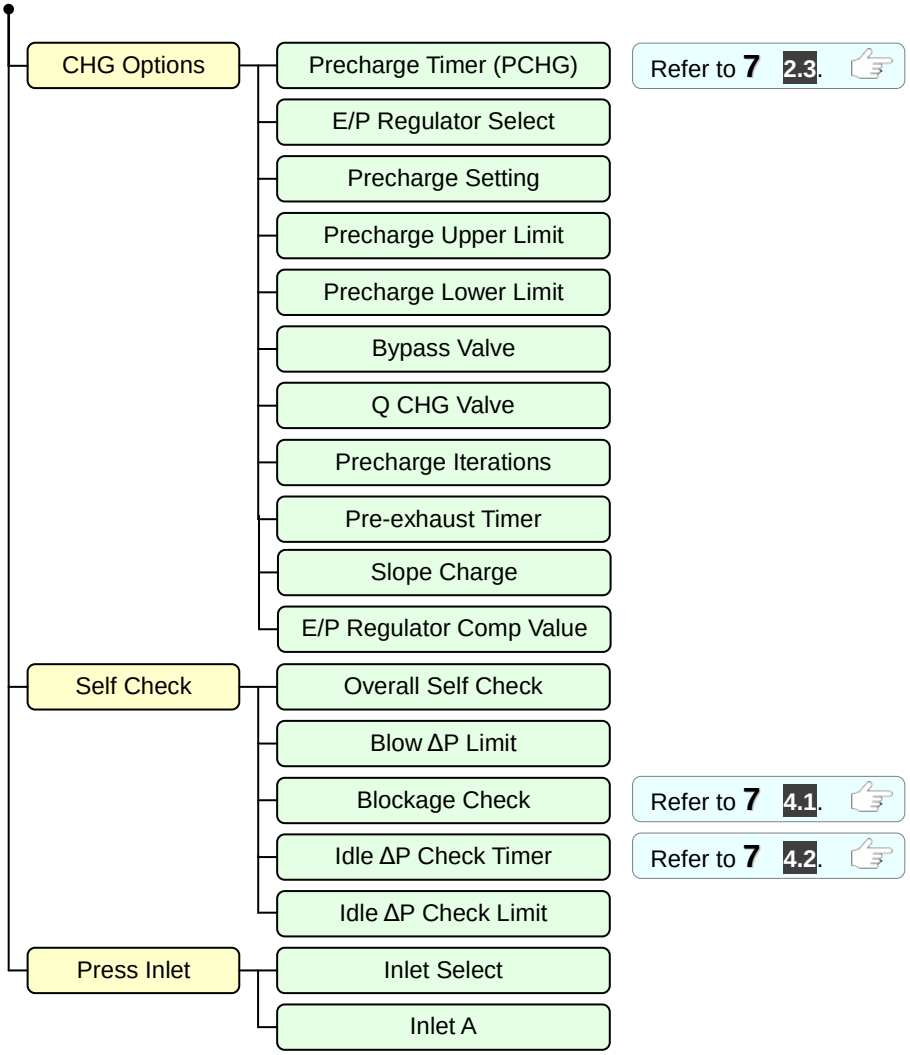
Timer	Pressurization (CHG)	0 to 999.9 [s]
	Equalization (BAL1)	
	Stabilization (BAL2)	
	Detection (DET)	
Test Pressure	Pressure Unit	kPa, MPa (PSI, kg/cm^2, bar, mbar, mmHg, cmHg, inHg) ***1**
	Pressure Setting	Pressure applied to tested part (WORK) and reference part (MASTER)
	Upper Press Limit	Varies depending on the test pressure range and unit.
	Lower Press Limit	
Leak Limit	Leak Unit	Pa, kPa, mL/s, mL/min, L/min, Pa·m^3/s, E-3 Pa·m^3/s, Pa/s, Pa/min, *Pa/s, *Pa/min (mmH_2O, inH_2O, mmHg, in^3/min, in^3/d, ft^3/h) ***1**
	DET UL	Small leak limit for WORK side during DET stage
	DET LL	Small leak limit for MASTER side during DET stage
K(Ve)	K(Ve) Unit	Unit for K(Ve) value
	K(Ve) Value	Please enter K(Ve) value if known.

***1** The units in ( ) are not available for SI unit restriction models.

3.2 Advanced Setting

All the leak test settings including the basic settings





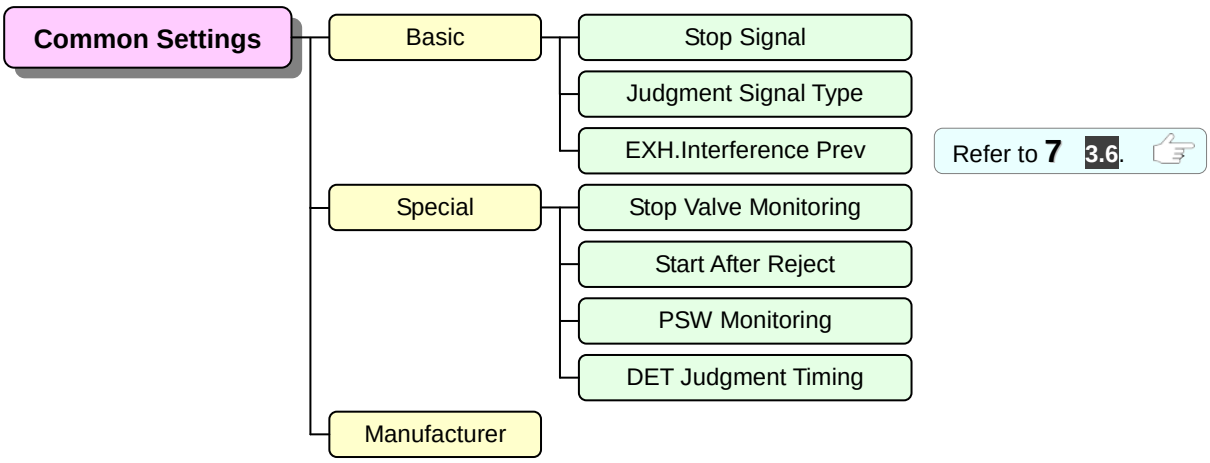
Title	Channel Title	Up to 20 letters are allowed.
Unit	Leak Unit	Pa, kPa, mL/s, mL/min, L/min, Pa·m^3/s, E-3 Pa·m^3/s, Pa/s, Pa/min, *Pa/s, *Pa/min (mmH_2O, inH_2O, mmHg, in^3/min, in^3/d, ft^3/h) ***1**
	Pressure Unit	kPa, MPa (PSI, kg/cm^2,, bar, mbar, mmHg, cmHg, inHg) ***1**
	K(Ve) Unit	mL, L (in^3, ft^3) *1
Timer	Charge Delay (DL1)	0 to 999.9 [s]
	PCHK	Fixed to 0.2 [s] for the pneumatic circuits that have the stage and 0.0 [s] for those that don't have the stage.
	Pressurization (CHG)	0 to 999.9 [s]
	Equalization (BAL1)	
	Balance Delay (DL2)	
	Stabilization (BAL2)	
	Detection (DET)	
	Air-Blow (BLW)	
	Exhaust (EXH)	
	End (END)	0.1 to 999.9 [s]
Test Press	E/P Regulator Select	EP/1
	Pressure Setting	Pressure applied to tested part (WORK) and reference part (MASTER)
	Upper Press Limit	Monitors the test pressure. Criteria for detecting Large leak from sealing fixture. Limits are allowed to be negative figures when [Secondary Rise] is selected for the (Inlet A).
	Lower Press Limit	
	Pressure Monitoring	Enable/Disable Pressure Monitoring with Upper/Lower test pressure limits.
	PS Auto-Zero	Disable/Enable
	E/P Regulator Comp Value	Used when there is a difference between the specified test pressure value and the displayed value.

***1** The units in ( ) are not available for SI unit restriction models.

Leak Limit	BAL2 UL	Upper leak limit for WORK side during BAL2 stage
	BAL2 LL	Lower leak limit for MASTER side during BAL2 stage
	DET UL2	Medium leak limit for WORK side during DET stage which should be greater than DET UL.
	DET UL	Small leak limit for WORK side during DET stage
	DET LL	Small leak limit for MASTER side during DET stage
	DET LL2	Medium leak limit for MASTER side during DET stage which should be smaller than DET LL.
	NR Iterations	Settable Range: 1 to 20 Setting it to 1 allows two-level limit setting. NR is enabled when the iterations are set to 2 or larger.
	NR Equalization	Disable/Enable When enabled, the NR Equalization (BAL1) Timer and NR Stabilization (BAL2) Timer can be set before Noise Reduction where normal detection is repeated.
	NR Equalization (BAL1) Timer	0.0 to 999.9 (s)
	NR Stabilization (BAL2) Timer	
CHG Options	Precharge Timer	0.0 to 999.9 [s] For testing a large volume part with a low test pressure.
	E/P Regulator Select	E/P1
	Precharge Setting	Available only for E/P regulator models.
	Precharge Upper Limit	
	Precharge Lower Limit	
	Bypass Valve	Disable/Enable Bypass Circuit Unit is sold separately.
	Q CHG Valve	Not available for this model
	Precharge Iterations	1 to 20
	Pre-exhaust Timer	0.0 to 999.9 [s] Varies depending on the test specifications.
	Slope Charge	Disable/Enable When enabled, pressure is gradually charged to the specified value of precharge pressure within the time of Precharge Timer.
	E/P Regulator Comp Value	The rate of precharge compensation by E/P Regulator.
Self Check	Overall Self Check	Disable/Enable
	Blow ΔP Limit	Check the pneumatic circuit of LS-R900
	Blockage Check	Check the blockage of external valves. 0 to 500 % Set to 0 to disable the feature.
	Idle ΔP Check Timer	Check the fill valve during idle state.
	Idle ΔP Check Limit	
Press Inlet	Inlet Select	Not available for this model
	Inlet A	Pressure / Vacuum / Secondary Rise

3.3 Common Settings

Common settings for all the channels



Basic	Stop Signal	Normally Open, Normally Closed	
	Judgment Signal Type	Pulse, Hold	
	EXH.Interference Prev	Disable/Enable	
Special	Stop Valve Monitoring	Enable, Disable	Do not change the settings
	Start After Reject	Start only, Stop then Start	Normally “Start only”
	PSW Monitoring	Enable, Disable	Available only for H49, H20 and L02 models
	DET Judgment Timing	End of DET, Abort at Limit	
Manufacturer		Settings cannot be changed.	

3.4 Copy Settings

Test parameters of a channel can be copied to other channels.

Refer to “7 OPERATIONS LISTED BY PURPOSE” for the details.

3.5 Initialize to Default

Default settings are copied to the channels of your choice.

Refer to “7 OPERATIONS LISTED BY PURPOSE” for the details.

3.6 Backup/Restore

The current test parameters can be restored easily from backup after changing them temporarily.

□ Backup

□ Restore
- Restore All
- Individual Restore

Refer to “7 OPERATIONS LISTED BY PURPOSE” for the details.

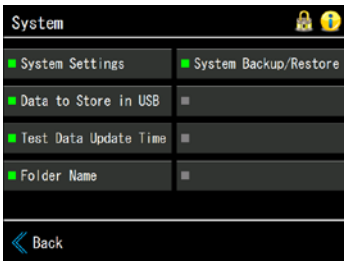
3.7 CSV Copy to USB

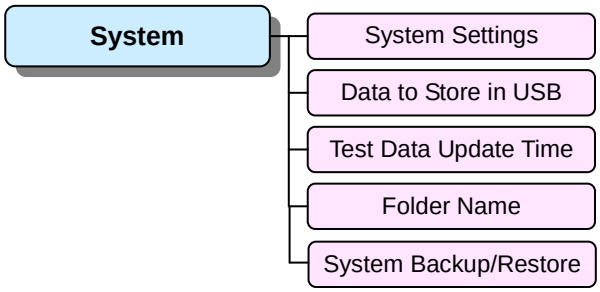
All the current test parameters are copied to USB Memory in the cvs format.

Refer to “7 OPERATIONS LISTED BY PURPOSE” for the details.

4 System Menu

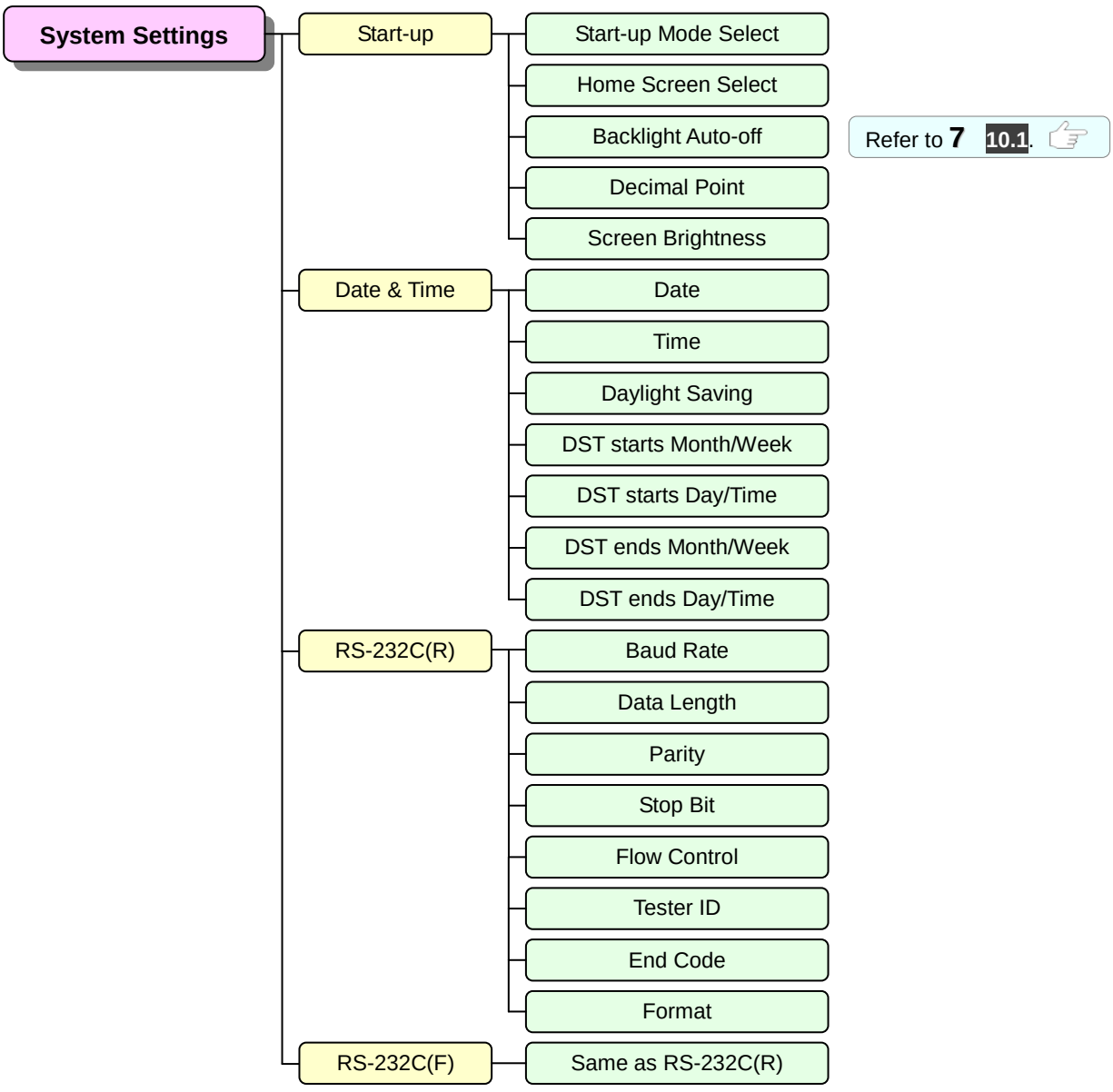
Menu to program the start-up settings, calendar feature and data output and to perform System Backup/Restore.





4.1 System Settings

Menu to set Start-up conditions, Date and Time and RS-232C



Refer to 7 10.1.

Start-up	Start-up Mode Select	Remote / Manual
	Home Screen Select	Selectable: Standard, Simple, Waveform, Customized, 4Channel, Test Result Log List, Test Result Log Chart
	Backlight Auto-off	Touch-screen backlight goes off if it is not touched for the programmed period. Disable, 1, 5, 10, 30, 60, 120, 240 [min]
	Decimal Point	Period or comma can be selected depending on the language.
	Screen Brightness	The brightness can be adjusted in the range from 1 to 100. 0: Dark 100: Bright
Date & Time	Date	yyyy/mm/dd
	Time	hh:mm:ss
	Daylight Saving	Disable/Enable
	DST starts Month/Week	Month: Mar, Apr / Sep, Oct, Nov Week: 1st, 2nd, 3rd, 4th, 5th
	DST starts Day/Time	Day: Sun, Sat Time: 0:00, 1:00, 2:00, 3:00
	DST ends Month/Week	Month: Feb, Mar, Apr / Sep, Oct, Nov Week: 1st, 2nd, 3rd, 4th, 5th
	DST ends Day/Time	Day: Sun, Sat Time: 0:00, 1:00, 2:00, 3:00, 4:00
RS-232C (R)	Baud Rate	9600, 19200, 38400, 57600, 115200
	Data Length	8, 7
	Parity	None, Even, Odd
	Stop Bit	1, 2
	Flow Control	None
	Tester ID	An ID will be assigned to each tester when more than one is used.
	End Code	<CR><LF>, <CR>, <LF>
	Format	Selectable: T Format, ID Format, I Format, DT Format K Format, L Format, M Format, P Format, D Format
RS-232C (F)	Same as RS-232C (R)	

4.2 Data to Store in USB

Menu to select data to be backed up to USB memory from [Test Data], [Waveform Data], and [Mastering Data]. (multiple selections allowed) File format is CSV.

Refer to "7 OPERATIONS LISTED BY PURPOSE" for the details.

□ Test Data (A new file is created once a day. Refer to the next section.)

□ Waveform Data (A new file is created once an hour.)

□ Mastering Data (A new file is created once a month.)

4.3 Test Data Update Time

Menu to set the time to create a new file in a USB memory for storing [Test Data].

A file is created at the programmed hour and data is update at the end of each test automatically.

4.4 Folder Name

The folder name can be set to the folder to be stored in the USB memory.

Refer to "7 OPERATIONS LISTED BY PURPOSE" for the details.

4.5 System Backup/Restore

The current system settings can be restored easily to another testser from backup for the purpose of replacing testers when some trouble happens.

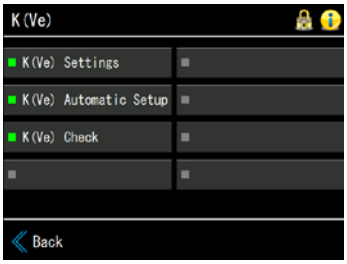
□ Backup

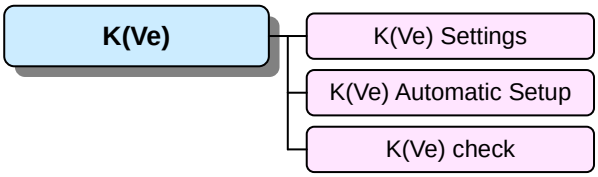
□ Restore

Refer to "7 OPERATIONS LISTED BY PURPOSE" for the details.

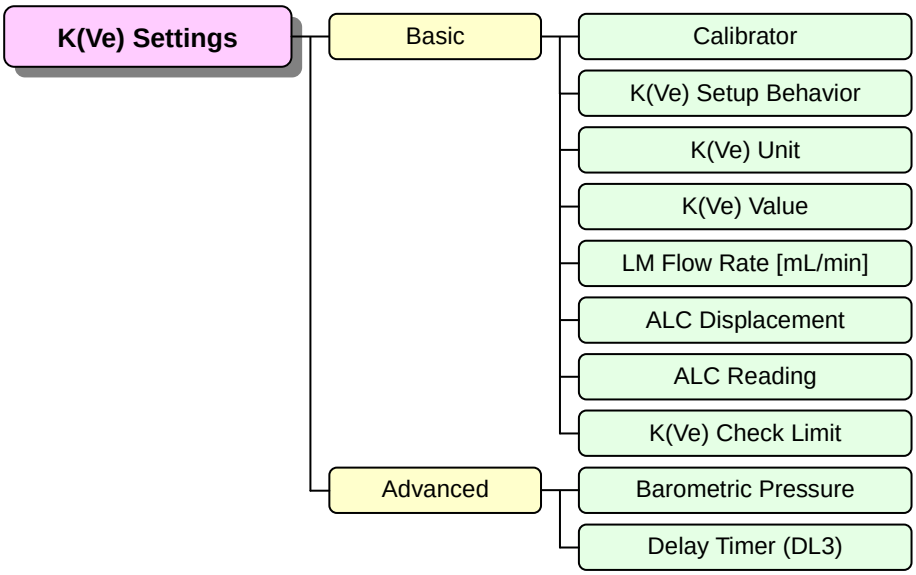
5 K(Ve) Menu

LS-R900 computes leakage based on the measurement of the pressure difference between the non-leaking master and the tested part. K(Ve) is "leak coefficient" which is used for converting measured differential pressure into a flow rate. This menu is to program the settings and carrying out the Automatic K(Ve) Setup.





5.1 K(Ve) Settings



Basic	Calibrator	ALC, LC1, LC2, LC4, Leak Master, QLC
	K(Ve) Setup Behavior	3-phase 1-phase, Mastering
	K(Ve) Unit	mL, L, (in^3, ft^3) *1
	K(Ve) Value	K(Ve) is entered automatically through K(Ve) Automatic Setup. K(Ve) can be manually entered as well
	LM Flow Rate [mL/min]	Enter Leak Master flow rate.
	ALC Displacement (ΔV)	Enter displacement of ALC/LC/QLC
	ALC Reading	Enter ALC reading
	K(Ve) Check Limit	Set K(Ve) Check Limit in percentage (%).
Advanced	Barometric Pressure	Fixed to 101325 [Pa]
	Delay Timer (DL3)	Enter time intervals to be provided between each phase when the 3-phase mode is selected in K(Ve) Setup Behavior.

***1** The units in ( ) are not available for SI unit restriction models.

5.2 K(Ve) Automatic Setup

Menu to perform K(Ve) Automatic Setup

Refer to "**7 OPERATIONS LISTED BY PURPOSE**" for the details.

5.3 K(Ve) Check

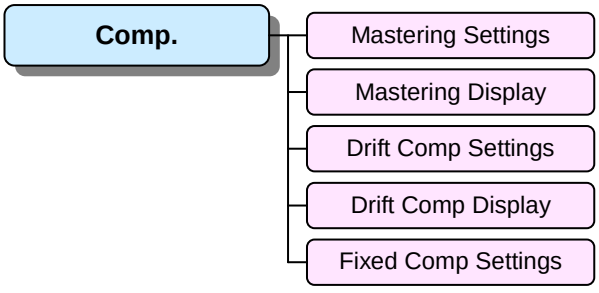
Menu to perform K(Ve) check manually.

LS-R900 compares K(Ve) measured with a known good part to the K(Ve) stored in memory.

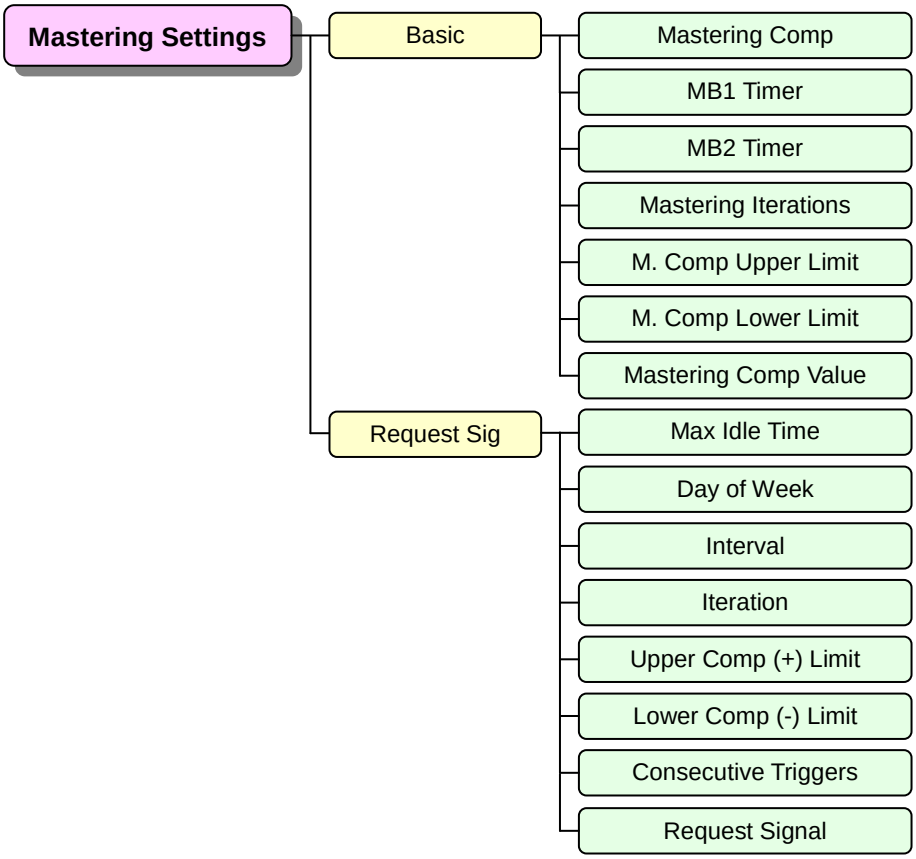
An error is displayed if the difference exceeds the tolerance. This can be used for daily sensitivity checks.

Refer to "**8 MAINTENANCE**" for the details.

6 Comp. (Compensation) Menu



6.1 Mastering Settings



Refer to "7 OPERATIONS LISTED BY PURPOSE" for the details.

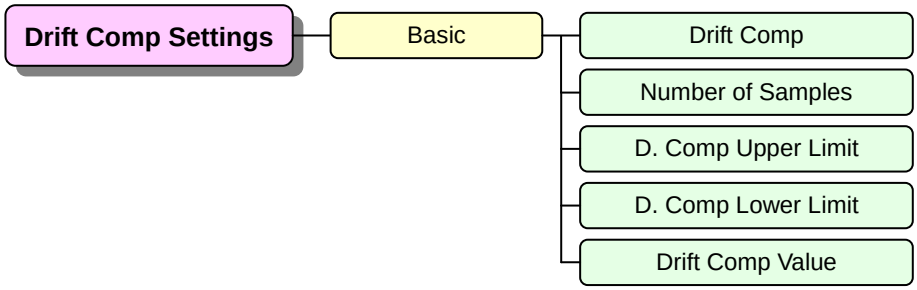
Basic	Mastering Comp	Disable/Enable Mastering Compensation feature
	MB1 Timer	BAL1 timer for Mastering: 0 to 999.9 [s] Recommended timer: 1.0 [s]
	MB2 Timer	BAL2 timer for Mastering: 0 to 999.9 [s] Recommended timer: 2.0 [s]
	Mastering Iterations	0 to 99 Normally 5 times
	M. Comp Upper Limit	0 to ±999.9 (programmed unit) Mastering Upper/Lower limits. Normally 120 to 150% of DET UL/LL
	M. Comp Lower Limit	
	Mastering Comp Value	Mastering Comp value can be entered automatically or automatically
Request Sig	Max Idle time	Idle time in production line. Exceeding the time transmits Mastering Request Signal.
	Day of Week	Repeatedly transmits Mastering Request Signal at the beginning of the programmed day of week for the programmed number of times with the programmed interval.
	Interval	
	Iterations	
	Upper Comp (+) Limit	Transmits Mastering Request Signal if Leak exceeds the limits consecutively for the programmed number of times.
	Lower Comp (-) Limit	
	Consecutive Triggers	
	Request Signal	Enable/Disable Set Enable or Disable of the Mastering Request Signal.

6.2 Mastering Display

Displays up to 20 DET data. The display can be toggled between the table and bar graph by tapping List/Graph.

Measurements can be performed on this screen in manual mode.

6.3 Drift Comp Settings



Refer to "7 OPERATIONS LISTED BY PURPOSE" for the details.

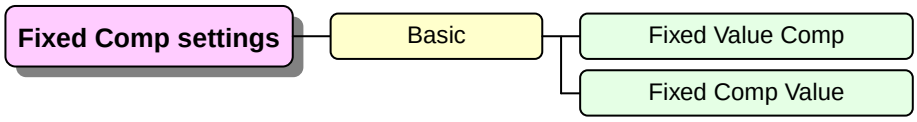
Basic	Drift Comp	Disable/Enable Drift compensation feature
	Number of Samples	0 to 20
	D. Comp Upper Limit	0 to 999.9 Set Upper/Lower limits of compensation value.
	D. Comp Lower Limit	
	Drift Comp Value	Drift Comp Value can be entered automatically or manually.

6.4 Drift Comp Display

Displays up to 20 sampled data. The display can be toggled between the table and bar graph by patting **List**/**Graph**.

Measurements can be performed on this screen in manual mode.

6.5 Fixed Comp Settings

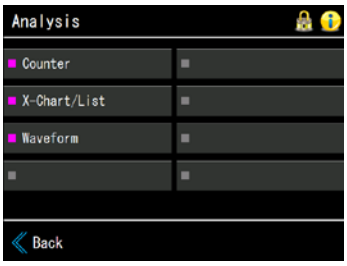


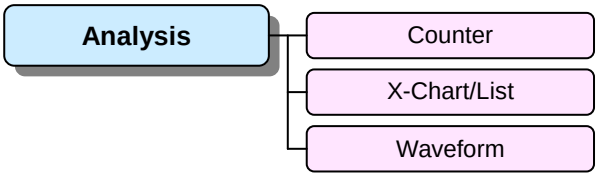
Refer to "7 OPERATIONS LISTED BY PURPOSE" for the details.

Basic	Fixed Value Comp	Disable/Enable Fixed value compensation feature.
	Fixed Comp Value	Compensation value is manually entered.

7 Analysis Menu

Menu to view the statistics of test results in figures and charts.





7.1 Counter

Counter is displayed by a channel.

Tapping **Reset** resets the counter of the displayed channel.

7.2 X-Chart/List

List/**Chart** toggles the display between List and Chart.

Refer to "7 OPERATIONS LISTED BY PURPOSE" for the details.

7.3 Waveform

The last test result is displayed in a waveform.

Waveform data is selectable from the followings:

- DPS Raw w/o A/Z: Not Auto-Zeroed
- Test Pressure
- Leak
- DPS Raw: After Auto-Zero

Changes scale of Y axis

Changes scale of X axis

Scrolls the chart right and left

How to read the chart

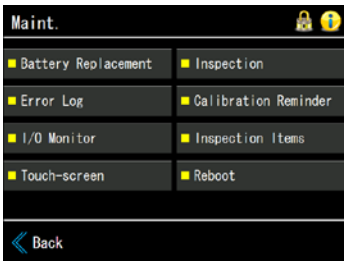
The beginning of each stage is shown with a colored vertical line as the follows:

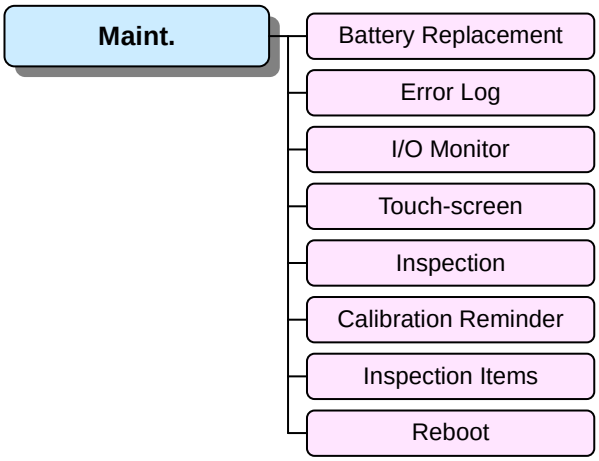
Yellow:	Equalization (BAL1)	**Blue:**	Air-Blow (BLW)
Pink:	Stabilization (BAL2)	**Cyan:**	Other stages.
Orange:	Detection (DET)	**Grey:**	Grid every 1 [s]

Refer to "7 OPERATIONS LISTED BY PURPOSE" for the details.

8 Maint. (Maintenance) Menu

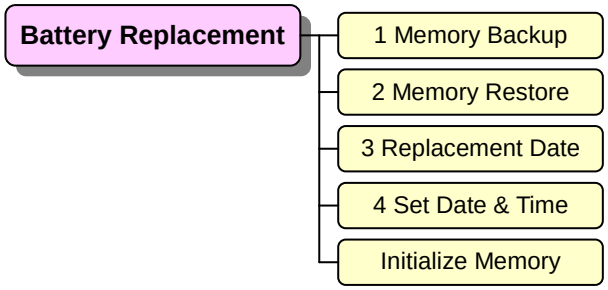
Go to this menu for LS-R900 maintenance such as Battery Replacement and Inspection as well as viewing error log and I/O Monitor





8.1 Battery Replacement

Menu for replacing battery.



Refer to "8 MAINTENANCE" for the details.

8.2 Error Log

Displays Error Log.

8.3 I/O Monitor

I/O signals can be monitored on this screen.

InPut

The pins received a signal light green

OutPut

The pins transmitted light green.

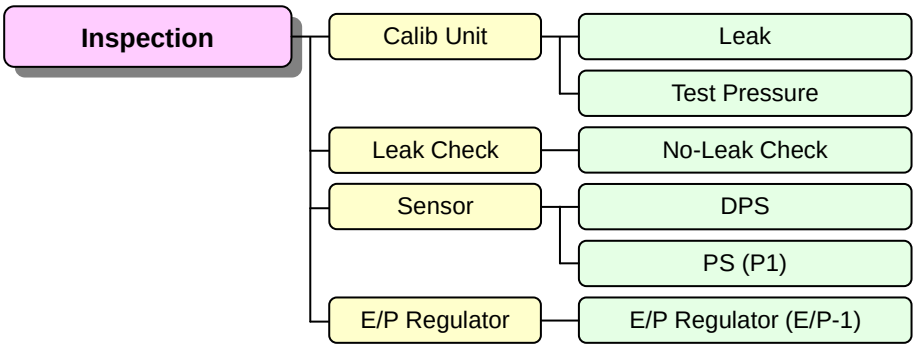
Refer to "3 INTERFACE" for the details.

8.4 Touch-screen

Touch-screen can be adjusted when it is off.

Refer to "8 MAINTENANCE" for the details.

8.5 Inspection



Calib Unit	Leak	Pa, kPa (mmH_2O, inH_2O, mmHg) *1
	Test Pressure	kPa, MPa (PSI, kg/cm^2, bar, mbar, mmHg, cmHg, inHg) *1
Leak Check	No Leak Check	Perform a No-Leak Check of LS-R900 itself.
Sensor	DPS	Adjust DPS offset and check the span
	PS (P1)	Adjust PS offset and check the span
E/P Regulator	E/P Regulator (E/P-1)	Adjust E/P regulator

***1** The units in ( ) are not available for SI unit restriction models.

8.6 Calibration Reminder

Menu to set the recalibration reminder by entering the date the inspection and calibration were performed and how many months the calibration is good for.

A message will pop up 1 month before the "Recalibration Target".

The Recalibration Target can be set up to 36 months from the date of inspection. Setting it to 0 months disables the reminder.

8.7 Inspection Items

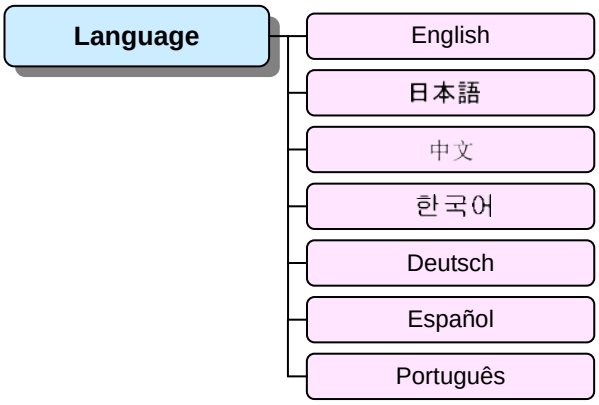
Displays Daily, Monthly and Annual inspection points.

8.8 Reboot

LS-R900 can be reboot.

9 Language Menu

Menu to select a language. Seven languages, English, Japanese, Chinese, Korean, Spanish, Germany, and Portuguese are available.

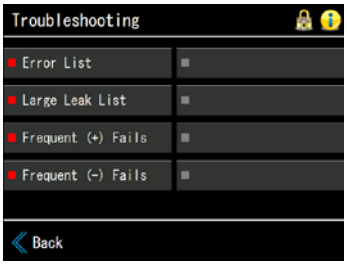


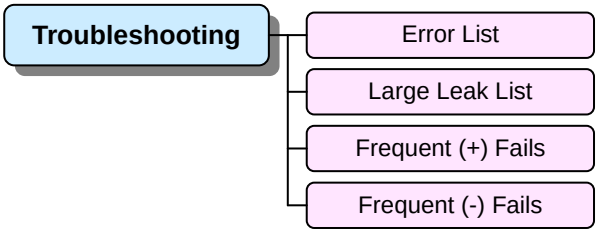
Refer to "7 OPERATIONS LISTED BY PURPOSE" for the details.

10 Troubleshooting Menu

Menu to view the troubleshooting

The maintenance job should be done by maintenance technicians.





10.1 Error List

Displays the probable causes and treatments for Errors.

Refer to "**9 TROUBLESHOOTING**" for the details.

10.2 Large Leak List

Displays the probable causes and treatments for Large Leaks.

Refer to "**9 TROUBLESHOOTING**" for the details.

10.3 Frequent (+) Fails

Displays the probable causes and treatments for frequent fails on the WORK-side.

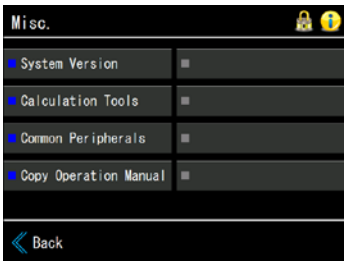
Refer to "9 TROUBLESHOOTING" for the details.

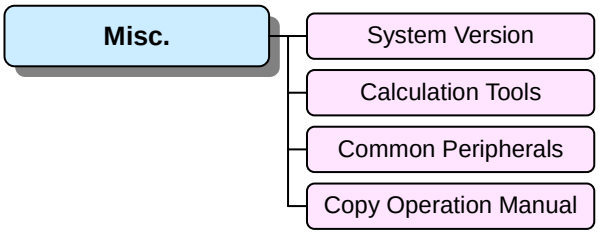
10.4 Frequent (-) Fails

Displays the probable causes and treatments for frequent fails on the MASTER-side.

Refer to "9 TROUBLESHOOTING" for the details.

11 Misc. (Miscellaneous) Menu





11.1 System Version

Menu to view or update System Version.
The software is updated in this menu.

11.2 Calculation Tools

Menu to calculate Q, Ve, ΔP and T3 by simply entering known variables.

Refer to "7 OPERATIONS LISTED BY PURPOSE" for the details.

11.3 Common Peripherals

Introducing Common Peripherals for Air Leak Tester.

11.4 Copy Operation Manual

Menu to copy the operation manual to USB memory.
A manual (PDF file) in a language of your choice will be copied to USB memory.

Refer to "7 OPERATIONS LISTED BY PURPOSE" for the details.

6 SETUP

1 Initial Setups

This section provides the required Initial setups before using LS-R900

Attention

A settings unlocking is required to change settings and toggling to Manual mode (M) to execute a measurement manually.

1.1 Operation Mode when the power turns on

Select a operation mode when the power is turned on from Remote (Rem) or Manual (Man)

Go to: System > System Settings > Start-up > Start-up Mode Select

1.2 Home Screen

Select the Home Screen which displays when power is turned on or when is tapped.

Go to: System > System Settings > Start-up > Home Screen Select

1.3 Set Date

Set the current date.

Go to: System > System Settings > Date & Time > Date

1.4 Set Time

Set the current time.

Go to: System > System Settings > Date & Time > Time

1.5 Customize Screen

Items to display for four measurement screens, Standard, Simple, Waveform and 4-Channel are selectable.
The selection in this screen reflects to all four screens.

All items are selected to be displayed as default.

Go to: Measure Screen > Custom Screen > Select items to display > **Enter**

1) Tap unnecessary items and the red mark turns white.
2) Tap **Enter** to complete the selection.

NOTE

The selected items are marked red.

2 Perform a Simple Air Leak Test

A simple Air Leak Test can be performed by programming the Basic Settings.

Go to: Settings > Basic Settings > Timer / Test Press / Leak Limit / K(Ve)

Attention

A settings unlocking is required to change settings and toggling to Manual mode (M) to execute a measurement manually.

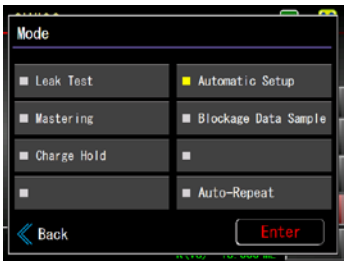
2.1 Timer

Manual Entry

Timer settings vary depending on test conditions.
Normally, setting long Pressurization (CHG) and Stabilization (BAL2) timers helps reduce drift and improves test accuracy.
The followings are the general guide

1) **Go to:** Settings > Basic Settings > Timer
2) Enter 40 [s] for Pressurization (CHG)
3) Enter 30 [s] for Equalization (BAL1)
4) Enter 5 [s] for Stabilization (BAL2)
5) Enter 1 to 10 [s] for Detection (DET)

Automatic Setup



This is an initial setup support feature for persons who have few or no experiences of setting up Air Leak Tester.

Refer to the latter section in this chapter, “**4** Automatic Setup”.

2.2 Test Pressure

Set the parameters according to your test specifications.
Pressure limits are for monitoring the applied pressure during the Pressurization stage to detect large leak.

1) Settings > Basic Settings > Test Press
2) Select a pressure unit.
3) Enter target test pressure in Pressure Setting
   Precision regulator: Adjust the pressure to the target.
   Electro-pneumatic regulator: The pressure will be regulated to the entered pressure.
4) Enter Upper Pressure Limit
5) Enter Lower Pressure Limit

2.3 Leak Limit

Set the parameters according to your test specifications.
Settings > Basic Settings > Leak Limit

1) Select a leak unit
2) Enter Detection (UL).
3) Enter Detection (LL).

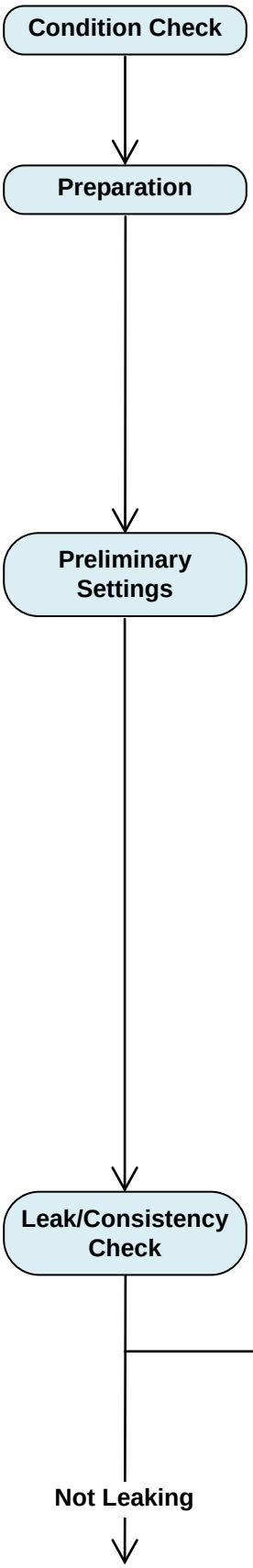
2.4 K(Ve)

Enter K(Ve) Unit and Value if they are determined.
Settings > Basic Settings > K(Ve)

1) K(Ve) Unit > Select a unit.
2) K(Ve) Value > Enter K(Ve) value if determined. > **Enter**

3 Flow for Initial Adjustment

LS-R900 computes leakage based on the measurement of the pressure difference between the non-leaking master and the tested part.
K(Ve) is "leak coefficient" which is used for converting measured differential pressure into a flow rate.



Condition Check

Determine the following conditions before the initial adjustment.

- Test Pressure
- For Master --- Master Chamber, Non-leaking part, Tubing or Other.

Preparation

Prepare the following items:

- Master
- Non-leaking parts (Must be at ambient temperature and dry): 3 or more pieces
- Defective (Leaking) parts (Large leak): 1 or more
- Calibrator --- For K(Ve) measurement --- ALC (QLC)
  - Leak Master: ΔP = 200 to 500Pa
  - Leak Master for NG limit check: Flow should be 1.2 to 1.5 times larger than the Leak Limits

Preliminary Settings

Use the following settings or perform Automatic Setup for the initial settings.

- Timers

A2 Pneumatic Circuit	Other than A2
Pressurization (CHG) = 40s	Pressurization (CHG) = 60s
Equalization (BAL1) = 30s	Equalization (BAL1) = 0.5s
Stabilization (BAL2) = 5s	Stabilization (BAL2) = 30s
Detection (DET) = 5s	Detection (DET) = 5s

Automatic Setup

- Pressurization (CHG) = Automatically setup
- Equalization (BAL1) = Automatically setup
- Stabilization (BAL2) = Automatically setup
- Detection (DET) = Fixed to 5s

- Test Pressure UL/LL --- ±10KPa

Leak/Consistency Check

Perform leak tests 3 times with the known good parts.

Criterion for “Not Leaking” --- Readout = 5Pa to 20Pa with relative consistency.

Air leak test system is more than likely to be leaking

1. Check the test parameter
2. Spot the leak location by applying soap solution.
   1. Check the tube and fittings up to the tested part.
   2. Check whether the tested part is leaking or clamp force is sufficient.

Not Leaking

Not Leaking

3. Check whether there are deformation factors.

- Yes --- Check ---- If the clamp force is appropriate.
  - If the machine is leveled.
  - Hardness of sealing material
  - If there is a stopper
  - If the tested part itself deforms.
- No --- Go to the next item to check.

4. Check the environmental factors.

- Effect of Ventilation --- From local (spot) cooling equipment
- Thermal Effect --- From sun light
  - From surrounding devices
  - Tested parts were wet. (Vaporization)

Fail Judgment Check

Perform leak tests 2 times with the known defective parts.

Criterion for "Correct NG (fail) Judgment" --- The readouts are obviously different from "Pass"

Correct Fail Judgment

K(Ve) Automatic Setup

Perform K(Ve) Automatic Setup with a non-leaking part to obtain the leak coefficient, K(Ve)

- Use the calibrator for K(Ve) Automatic Setup.
- Use the current timers

Refer to "**7 OPERATIONS LISTED BY PURPOSE**" for the details.

Verifying K(Ve)

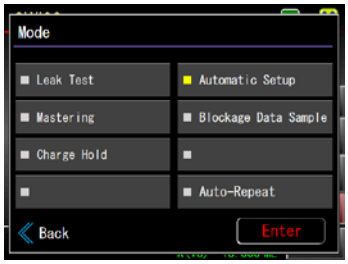
Check whether the measured leak coefficient is correct.

- Check the repeatability by performing K(Ve) Automatic Setup more than 1 time.
- Change the Leak unit to a flow unit.
- Connect the Leak Master for NG limit check to the CAL. PORT on the front panel and perform a leak test to verify the NG readout in a flow unit.
  - The displayed readout is close to the labeled flow of the Leak Master, it can be concluded that the obtained leak coefficient is correct.
- Perform a leak test after disconnect the Leak Master from the CAL. PORT and put back the plug.
  - Check displayed readout is obviously different from that of Fail.

The followings should be done after the initial adjustment is completed:

1) Determining the optimal cycle time
2) Verifying relative consistency in test results.
3) Entering all the required test parameters
4) System backup

4 Automatic Setup



Pressurization (CHG), Equalization (BAL1) and Stabilization (BAL2) timers are automatically setup by this feature.
Detection (DET) timer is fixed to 5 [s].

1) Set a known non-leaking part.

2) Set the test pressure.

3) **Go to:** Measure Screen > Select a measurement screen > **Mode** > Select Automatic Setup > **Enter**

4) Tap **Start** to start the Automatic Setup.
If the test result is Pass, CHG, BAL1 and BAL2 timers are automatically setup. DET timer is fixed to 5 [s].
Test pressure limit will be also automatically setup to ±10% of the set test pressure.

5) Change the mode to Leak Test.
Go to: **Mode** > Leak Test > **Enter**

5 System Backup

Please perform the system backup after all the test parameters are entered and setup is completed.

NOTE
The backup data is only for restore the test system and cannot be viewed in computers.

5.1 System Backup

Perform System backup to prepare for restoring the test system in case of trouble in the future.

System Restore

Refer to "**7 OPERATIONS LISTED BY PURPOSE**" for the details.

6 Notation of Air Leak Tests stages and Limits

Symbols are used for Leak test stages and Limits as follows:

Stage	Symbol
Idol state	WAIT
Charge Delay	DL1
Precharge	Pre CHG
Pressurization	CHG
Equalization	BAL1
Balance Delay	DL2
Stabilization	BAL2
Detection	DET
Air-Blow	BLW
Exhaust	EXH
Pre-exhaust	Pre EXH
End Delay	DL3
End	END
Equalization for Mastering	MB1
Stabilization for Mastering	MB2

Limit	Display
Stabilization Upper Limit	BAL2 UL
Stabilization Lower Limit	BAL2 LL
Detection Upper Limit 2	DET UL2
Detection Upper Limit	DET UL
Detection Lower Limit	DET LL
Detection Lower Limit 2	DET LL2

7 Air Leak Test Result List

Display	Criteria	
Pass	DET LL < **Leak** < DET UL	
DET UL2	DET UL2 ≤ **Leak**	
DET UL	DET UL ≤ **Leak** < DET UL2	
DET LL	DET LL2 < **Leak** ≤ DET LL	
DET LL2	**Leak** ≤ DET LL2	
BAL2 UL	BAL2 UL ≤ **Leak**	
BAL2 LL	**Leak** ≤ BAL2 LL	
CHG Large Leak WORK side	Differential pressure exceeds ±300Pa in CHG.	Refer to "**4 Large Leak List**" in "**9 TROUBLESHOOTING**" for the details.
DL2 Large Leak WORK side	Differential pressure exceeds ±50% of Accuracy Guaranteed Range in DL2	
BAL2 Large Leak WORK side	Differential pressure exceeds the maximum value of A/D conversion in BAL2 or DET.	
DET Large Leak WORK side		
Error XX	Refer to "**3 Error Messages and Treatments**" in "**9 TROUBLESHOOTING**" for the details.	

7 OPERATIONS LISTED BY PURPOSES

Attention

A settings unlocking is required to change settings and toggling to Manual mode (M) to execute a measurement manually.

1 Display Measured Differential Pressure in a Leak Rate Unit

What To Do

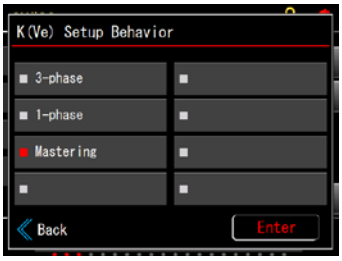
Obtain K(Ve) value through K(Ve) Automatic Setup or manually calculate and enter K(Ve) value.

LS-R900 computes leakage based on the measurement of the pressure difference between the non-leaking master and the tested part.

1.1 K(Ve) Automatic Setup

K(Ve) is "leak coefficient" which is used for converting measured differential pressure into a flow rate.

A tool called calibrator is used for K(Ve) Automatic Setup. There are two types of calibrator, Leak Master and Auto Leak Calibrator (ALC).



1) Connect a Reference Master to MASTER port. Master should be a Master Chamber or known non-leaking part.

2) Connect a known non-leaking part to the WORK port.

3) Check the test pressure by using CHG Hold.
Go to: K(Ve) > K(Ve) Automatic Setup > **CHG Hold**

4) K(Ve) > K(Ve) Automatic Setup > Basic > K(Ve) Setup Behavior > Select a behavior from 3-phase, 1-phase or Mastering.

NOTE

Mastering for the K(Ve) Setup Behavior can be selected only when the calibrator used for K(Ve) Automatic Setup is ALC, LC or QLC. Mastering is effective for reducing the BAL2 timer and DET timer.

3-phase	LS-R900 will cycle through a leak test three times. Phase 1 is a warm-up, in phase 2 Compensation value is measured, and in Phase 3, the leak calibrator introduces preset volume change/leak into the system creating a differential pressure which allows for the automatic setup of K(Ve). The compensation value measured in phase 2 is used in phase 3.
1-phase	LS-R900 will cycle through one sequence and calculate the system volume K(Ve). If Drift Comp Feature is enabled and a compensation value is stored in the Memory, the measured value is compensated by the value
Mastering	K(Ve) Setup is preceded by Mastering Sampling. The current settings are used for the Mastering Sampling. The sampled Mastering value is subtracted from the Measured value, which becomes K(Ve). Make sure that test data gets stabilized by Mastering.

Models with ALC (Type K)

1) Check whether Calibrator is set to ALC. **Go to:** K(Ve) > K(Ve) Settings > Basic > Calibrator

2) Enter ALC displacement ΔV.
Go to: Basic > ALC Displacement ΔV.
ALC Displacement is calculated with the following formula.

$$\Delta V = \frac{\Delta P \times V}{(101.3 + P) \times 10^3}$$

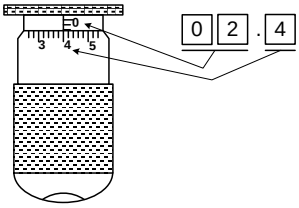
ΔV: ALC Displacement [mL]
V: Approximate volume of tested part [mL]
P: Test Pressure [kPa]
ΔP: Differential Pressure [Pa]

ΔP should be 50 to 80 % of the accuracy guaranteed range of DPS. For standard range, ΔP should be between 500 and 800Pa since the accuracy guaranteed range is 1000Pa.

3) Enter either ALC Displacement or ALC Reading
Entering either value changes the other value.
Adjust the ALC to the target revolutions. This diagram shows the ALC set at 2.4 revolutions.

Reading and Displacement of ALC

	Max Variation	Min reading	Variation when reading is 2.4
ALC-05	0.5 mL	0.001 mL	0.120 mL
ALC-1	1 mL	0.002 mL	0.240 mL
ALC-4	4 mL	0.008 mL	0.960 mL
ALC-10	10 mL	0.02 mL	2.40 mL



4) Start K(Ve) Automatic Setup **Go to:** **Back** > K(Ve) > K(Ve) Automatic Setup > **Start**
After 3 phases of tests, LS-R900 will show the K(Ve) value.

5) Change the Leak Unit to a Flow rate unit. **Go to:** Settings > Advanced Settings > Unit > Leak Unit

Models with Leak Master (Type J)

1) Remove the plug from the Calibration port and connect a Leak Master.

2) Check whether Calibrator is set to Leak Master.
Go to: K(Ve) > K(Ve) Settings > Basic > Calibrator

3) Enter the Flow Rate of the connected Leak Master in mL/min.
Go to: K(Ve) > K(Ve) Settings > Basic > LM Flow Rate [mL/min].

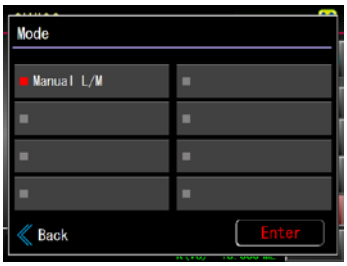
4) Start K(Ve) Automatic Setup
Go to: Back > K(Ve) > K(Ve) Automatic Setup > **Start**
After 3 phases of tests, LS-R900 will show the K(Ve) value.

5) Change the Leak Unit to a Flow rate unit.
Go to: Settings > Advanced Settings > Unit > Leak Unit

6) Remove the Leak Master from the Calibration port and put the plug back on firmly.

NOTE
Leak Master can be left on the calibration port. In that case, make sure dust will not accumulate inside.

Use Leak Master with Standard Models (with No Calibrator)



1) Check whether Calibrator is set to Leak Master.
   Go to: K(Ve) > K(Ve) Settings > Basic > Calibrator
2) Enter the Flow Rate of the connected Leak Master in mL/min.
   Go to: K(Ve) > K(Ve) Settings > Basic > LM Flow Rate [mL/min].
3) Select Manual Leak Master
   Go to: Back > K(Ve) > K(Ve) Automatic Setup > **Mode** > Manual L/M.
4) Start K(Ve) Automatic Setup
   Go to: Back > K(Ve) Automatic Setup > **Start**
   After measurement is completed LS-R900 will show the K(Ve) value.

NOTE
K(Ve) Automatic Setup with a Leak Master could be also performed on the Models with ALC.
In that case, make sure to adjust the ALC to 0 revolutions.

3-phase

1) Start K(Ve) Automatic Setup
   Go to: Back > K(Ve) Automatic Setup > **Start**
2) After 2 phases of tests, LS-R900 will be in idle state.
   Remove the plug from Calibration port and connect a Leak Master.
3) Resume measurement.
   Start > LS-R900 resumes K(Ve) Automatic Setup
   After measurement is completed LS-R900 will show the K(Ve) value.
4) Change the Leak Unit to a Flow rate unit. **Go to:** Settings > Advanced Settings > Unit > Leak Unit
5) Remove the Leak Master from the Calibration port and put the plug back on firmly.

1-phase

1) Remove the plug from the Calibration port and connect a Leak Master.
2) Start K(Ve) Automatic Setup
   Go to: K(Ve) > K(Ve) Automatic Setup > **Start**
   After measurement is completed, LS-R900 will show the K(Ve) value.
3) If Drift Comp Feature is enabled and a compensation value is stored in the Memory, the measured value is compensated by the value.
4) Change the Leak Unit to a Flow rate unit. **Go to:** Settings > Advanced Settings > Unit > Leak Unit
5) Remove the Leak Master from the Calibration port and put the plug back on firmly.

NOTE
Please contact Cosmo for using manual calibrator (LC) or Quick Leak Calibrator (QLC) for K(Ve) Automatic Setup

1.2 Manual Entry of K(Ve) Value (Leak Coefficient)

Manually enter the calculated K(Ve)

Go to: K(Ve) > K(Ve) Settings > Basic > K(Ve) Value

2 Reduce Cycle Time

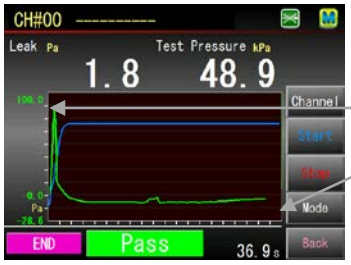
What to do

- Use Waveform in Measure Screen
- Use Mastering Compensation
- Use Bypass Circuit Unit (Option)
- Use Waveform in Analysis Menu

2.1 Use Measure Screen: Waveform

The measured Differential pressure and test pressure during leak test can be visualized in this measurement screen.

Stabilization can be verified to reduce cycle time.



Y-axis full scale	Test Pressure	Test pressure upper limit
	DPS	DET upper limit (UL)
X-axis full scale		Total timer

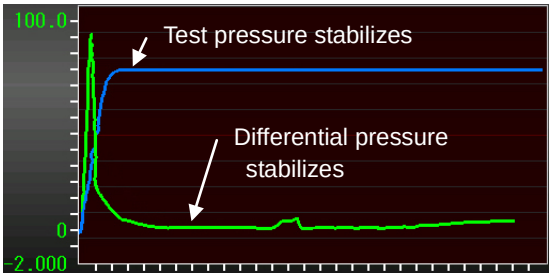
1) Set Home screen to Waveform for convenience of operation.
Go to: System > System Settings > Start-up > Home Screen Select > Waveform

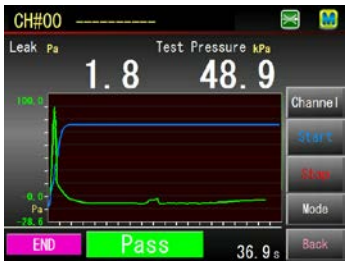
2) The total timer is the full scale of X-axis. Check the total cycle timer and calculate per how many seconds scales are marked.
Go to: Settings > Advanced Settings > Timer

3) Execute Leak test a few times

Go to: > **Mode** > Select Leak Test > **Start**

4) After measurement is completed, check the waveform to see if CHG timer can be reduced.
For instance, if current CHG timer is 30 s but DPS stabilized in 20 s, the CHG timer can be reduced to 20 s.





5) Go back to the Settings Menu and change the CHG timer.
Go to: Back > Timer > Pressurization (CHG)

6) Go back to the waveform screen and execute leak test several times to check the repeatability.

7) Repeat procedure 3) to 6) to search the ultimate cycle time.

NOTE

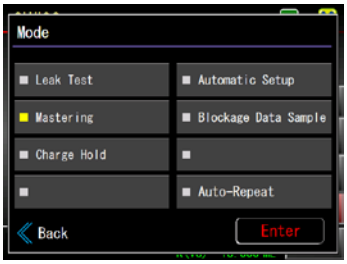
Similar but more analytic procedure can be performed in the waveform in Analysis Menu..

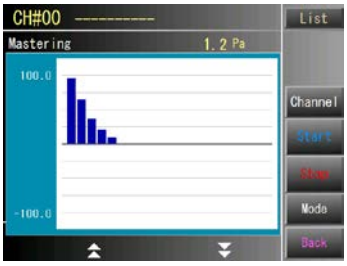
Refer to **7.2 Analysis Waveform**

2.2 Set Mastering Compensation

The measured pressure change in a leak test typically contains both the true leakage and drift errors due to adiabatic compression and changes in the ambient temperature. The pressure change due to leakage remains constant, while the drift portion decreases to zero. In other words, it reaches a completely stable state, over time. Therefore, when the detect stage is repeated a number of times, the measured pressure changes become more and more stable, and thus the true leak amount is finally measured.

Mastering compensation feature is Disabled as default.





1) Connect a Reference Master to MASTER port. Master should be a Master Chamber or known non-leaking part.
2) Connect a known non-leaking part to the WORK port.
3) Select a channel.
4) Set the necessary test parameters
   Go to: Comp > Mastering Settings > Basic
5) Enable Mastering Compensation Feature
   Go to: Mastering Comp > Enable
6) Set Mastering Equalization timer to 1.0 [s] and Mastering Stabilization timer to 2.0 [s] and Mastering Iterations to 5.
7) Go to the Home screen by tapping .
8) **Mode** > Select Mastering > **Enter**
9) **Start** > Mastering Value Sampling will be executed.
10) Check the Mastering graph
11) An ideal Mastering graph shows DET data gradually decreases and becomes constant close to 0.

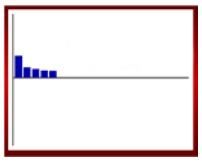
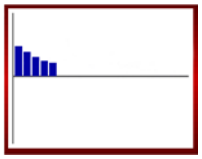
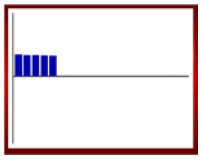
Attention

Mastering Process
After normal leak test, the MB1, MB2 and DET stage are repeated for the specified number of iterations.

Mastering Value Sampling
Mastering process to sample Mastering value.

Mastering Compensation
A compensation feature that measured data is compensated by Mastering Value obtained through the Mastering Value Sampling.

How to verify Mastering Data

	Data stops decreasing and eventually becomes constant.	Ideal ☆☆☆☆☆
	Data continues to decline. Increase the number of iterations.	Try again ☆
	Data is stable and constant. CHG and BAL1 timers can be reduced.	Decent ☆☆☆
	Data is drastically changing. Extend CHG and BAL2 timer settings.	Need to improve the condition
	Data does not decrease. There may be leak in the system.	Need to improve the condition

12) Check the seals, part and fittings for possible leaks when the Mastering data is not close to ideal. If there is no leak, increase the Mastering Iterations.

13) Execute Mastering Value Sampling
Go to: Mastering Display > **Start**

14) If increasing Mastering Iteration does not stabilize the data, extend CHG, MB1 and MB2 timers
Go to: Settings > Advanced Settings > Timer > Pressurization (CHG)
Go to: Mastering Settings > MB1 Timer / MB2 Timer

15) Execute Mastering Value Sampling again.
Go to: Mastering Display > **Start**

16) Verify the graph is close to ideal.
Toggle the display to List and record first DET Data
Go to: **List** > Record the first DET Data

17) Enter Compensation Limits
Go to: **Back** > Mastering Settings > Basic > Comp Upper Limit
> Enter value approx. 1.2 to 1.5 of the recorded value > **Enter**
Go to: **Back** > Mastering Settings > Basic > Comp Lower Limit > Enter 0 > **Enter**

When to execute a Mastering Value Sampling

A Mastering Value Sampling must be executed when the test parameters change, environmental conditions change, or the drift portion shifts significantly.

- Beginning of the first shift
At the beginning of the morning shift (when the machine is turned on) it is expected that environmental conditions will be significantly different from those at the time when the last Mastering was performed on the previous working day. Also the first two hours of the morning shift are typically when these conditions may change frequently, therefore, the Mastering Value Sampling may need to be initiated a few times during this period.

- After a long break
  During shift changes, breaks, or long waits for tested parts, etc., the ambient air temperature, fixtures, or conditions of the parts themselves may vary. After such occasions, executing a Mastering Value Sampling is recommended.
- Production Part Changeover
  For production lines that produce multiple parts, each part should be assigned to a specific leak tester channel (CH). Therefore, a Mastering Value Sampling is required on the new channel immediately after the model changeover.
- When the test parameters may have been altered
  A Mastering Value Sampling is required when some test parameters are changed
- When Fail occurs consecutively
  The seals in the fixture may be damaged in this case, assuming that a production line is unlikely to produce defective parts consecutively. Since the test result of a Mastering Value Sampling shows almost true leakage, it would help in determining if these Fail Judgments are from leaks or from fluctuations due to drift.

Performing Mastering Value Sampling

When using the Mastering Compensation in air leak testing, execute Mastering Value Sampling right before starting leak tests.

Mastering can be executed periodically or when the system falls in a preset condition using Mastering Request Signal.

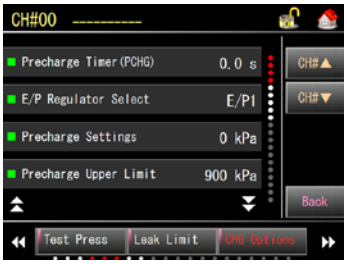
Refer to "3 INTERFACE" for the details.

Set the Condition to transmit Mastering Request signal.

Set each condition

Go to: Compensation > Mastering Settings > Request Sig.

2.3 Bypass Charge (Option)



Program the followings:

Go to: Settings > Advance Settings > CHG Options

Precharge Timer(PCHG)

Precharge Setting

Precharge Upper Limit / Precharge Lower Limit

Bypass Solenoid Valve > Enable

2.4 Analysis: Waveform

Refer to 7.2 Analysis Waveform for the details.

3 Enhance Test Result Reliability

What to do

- Use Mastering Compensation
- Use Drift Compensation
- Use Fixed Compensation
- Use Mastering and Drift Compensation together
- Use Noise Reduction
- Use Exhaust Interference Prevention feature

3.1 Set Mastering Compensation

Refer to **2.2 Setting Mastering Compensation** for the details.

3.2 Set Drift Compensation

Drift Compensation is a statistical compensation method. A running average of the latest Pass parts is used as a compensation value to keep track of moderate changes in the drift portion, such as those caused by gradual room temperature changes.

In this system, an average value of the previously sampled leak test data of Pass part is used as the average of the measurement error. This value is subtracted from the measured leakage of the current leak result. The number of values used in the calculation of this running average is Number of Samples.

When accurate data is not available or the test environment changes rather rapidly, the combined use of Mastering compensation is recommended. This generates the Mastering value that can be used as the initial compensation value for the Drift compensation.

NOTE
The figures in ( )* are general recommendation.

Drift Compensation feature is Disable as default.

1) **Go to:** Comp > Drift Comp Feature > Basic
2) Select a Channel.
3) Drift Comp Feature > Enable > **Enter**
4) **Go to:** Number of Samples > Enter (5) * > **Enter**
5) **Go to:** Comp Upper Limit > Enter (50 to 80%)* > **Enter**
6) **Go to:** Comp Lower Limit > Enter (0.0)* > **Enter**

3.3 Set Fixed Compensation

Fixed Compensation is used when environmental conditions are stable. It is recommended to use after verifying the environmental conditions are stable using Drift Compensation feature.

Enter a compensation value which is subtracted from the measured data.

The feature is Disabled as default.

1) **Go to:** Comp > Fixed Comp. Settings > Basic
2) Fixed Value Comp > Enable > **Enter**
3) Compensation Value > Enter a value > **Enter**

3.4 Use Mastering Comp with Drift Comp

When both Mastering Comp and Drift Comp feature are Enable (Number of samples must be set 2 or larger.), the Mastering value obtained by the Mastering value sampling is used as the initial compensation value for Drift compensation in a normal leak test. The compensation value for the second test is the mean value of the Mastering value and the raw data of the first test. If the number of the samples is set to 3, the running average of the latest 3 measured raw data is taken as a compensation value for the fourth test, so that the system learns to update the compensation value continuously.

1st test Displayed value = 1st raw data – {Mastering value}

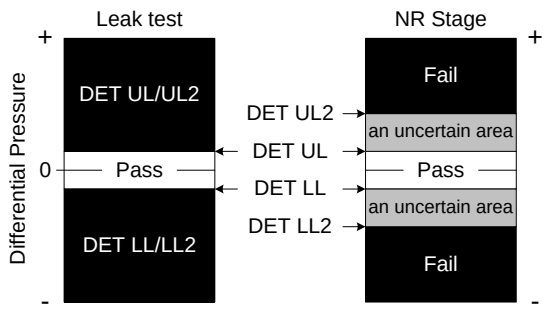
2nd test Displayed value = 2nd raw data – {(1st raw data + Mastering value) / 2}

3rd test Displayed value = 3rd raw data – {(2nd + 1st raw data + Mastering value) / 3}

⇩

5th test Displayed value = 5th raw data – {(4th + 3rd raw data + 2nd raw data) / 3}

3.5 Set Noise Reduction



Noise ratio over measurement increases when leak limits are lowered and/or test time is shortened, which may be a cause to increase false rejection of good parts.

In order to reduce the false rejection, Noise Reduction (NR) feature eliminates the noise by repeating the DET stage when the measured differential pressure falls in the previously set uncertain judgment region.

This feature is useful where there is a high percentage of noise presence caused by temperature or volume changes. It helps obtaining more critical judgment.

LS-R900 permits setting another sets of leak limits for DET stage, DET(UL2) and DET(LL2) which are called Noise Reduction (NR) limits, besides DET(UL) and DET(LL) limits. The ranges between those two sets of limits are considered as uncertain judgment regions. While NR feature is enabled, NR process automatically starts right after the normal leak test cycle when a measured leak data in DET stage falls in the uncertain judgment region.

In the NR process, DET stage is repeated for the previously set number of times and a judgment is made, however, leak test ends instantaneously if Pass judgment is made before repeating the set number. The number of iterations of DET stage can be set up to 20. Setting the iteration number to 1 disables the NR feature.

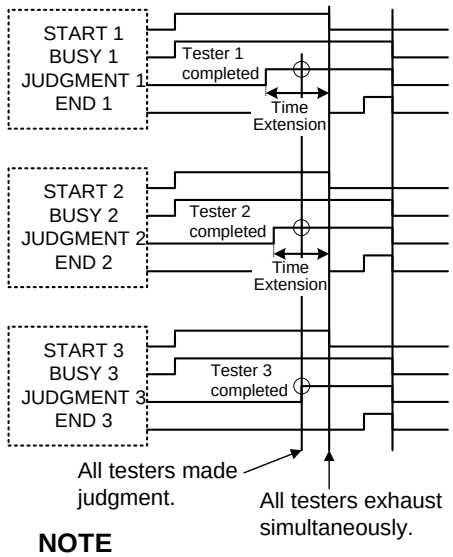
1) **Go to:** Settings > Advanced Settings > Leak Limit > NR Iterations > Enter 2 or larger number> **Enter**
2) Set DET (UL2) > **Enter**
3) Set DET (LL2) > **Enter**

NOTE

Setting the iteration number to 1 disables the NR feature. In this case, those NR limits, DET(UL2) and DET(LL2), can be simply used as additional limits. With these, defected parts can be sort out according to the degree of leakage.

When a Compensation feature is enabled, the compensation value is not deducted in and after the 2nd Noise Reduction. There may be cases where the Compensation feature and Noise Reduction cannot be used together. By enabling the NR Equalization and setting values to the NR Equalization Timer and NR Stabilization Timer, the compensation value is considered, making it possible to make effective use of Noise Reduction feature.

3.6 Set Exhaust Interference Prevention



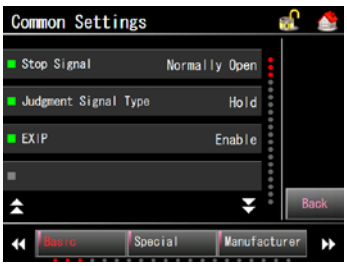
NOTE

The periods indicated as “Time Extension” are where the exhaust is delayed.

When using several leak testers to measure different cavities on the same part simultaneously, some interference may occur when one leak tester finishes its cycle while the other(s) are still in the leak test process. This is called “Exhaust Interference.” Exhaust interference can cause jumps in the leak tester readout during the exhaust of one of the other testers, both in normal leak test and Mastering Value Samplings.

In order to prevent this, all leak testers on the station must be synchronized with one another before exhausting air. With this software, the leak tester will keep holding the test pressure in the part even after it makes the judgment, as long as the START signal is turned on. As soon as the START signal turns off, the test pressure will be vented to the atmosphere.
In order to utilize this feature, the PLC must be programmed in such a way that it would hold the START signal until it receives the judgment signal of every tester in its control.

There are two types of Exhaust Interference Prevention. One is interference among the pneumatic circuits of its own system. The other is interference with other leak testers.



Go to: Settings > Common Settings > Basic > EXH. Interference Prev > Enable > **Enter**

4 Enhance Test Reliability

What to do

- Set Blockage Check
- Set Idle ΔP Check

4.1 Set Blockage Check

Check the blockage of eternal pneumatic (valves) circuit of LS-R900.

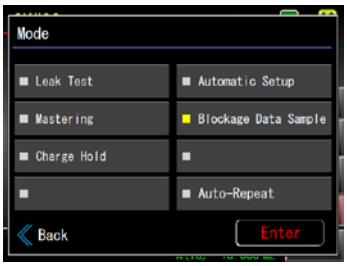
Measure and register the normal state and detect the blockage.

To set the tolerance

Go to: Settings > Advanced Settings > Self Check > Blockage Check > Set the tolerance in percentage. > **Enter**

Smaller the ratio is the harsher the criteria. Setting it to 0% disables the feature.

To register the normal state



Go to: Measure Screen > Select a measurement screen > **Mode** > Blockage sampling > **Enter**

Tap **Start** to start the Blockage sampling.
The normal state is registered if the result is **Pass**.

4.2 Set Idle ΔP Check (Self Check)

LS-R900 checks if fill valve is closed during idle state.

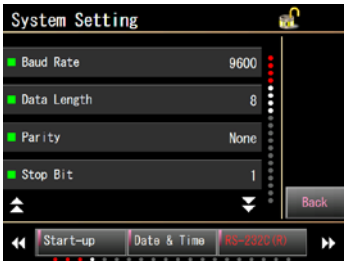
Go to: Settings > Advanced Settings > Self Check
> Idle ΔP Check Timer
> Idle ΔP Check Limit

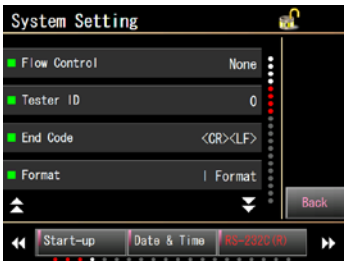
5 Manage Data on Computer

What to do

- Program Serial Communication settings.
- Select Data to store in USB Memory.
- Backup the current programmed test parameters.
- Name the folder where the data are stored.

5.1 Program RS-232C Settings





Test results along with various data can be transmitted through RS-232C port in a format of your choice.

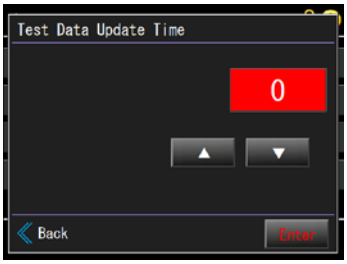
Go to: System > System Settings > RS-232C(R) / RS-232C(F)
Set each item and press Enter.

Refer to "**3 INTERFACE**" for the details.

5.2 Collect Data in USB Memory

Data to store in USB Memory can be selected from Test Data, Waveform Data and Mastering Data. More than one can be selected.

Go to: System > Data to Store in USB
> Select Data to store in USB Memory (More than one can be selected.)
> **Enter**



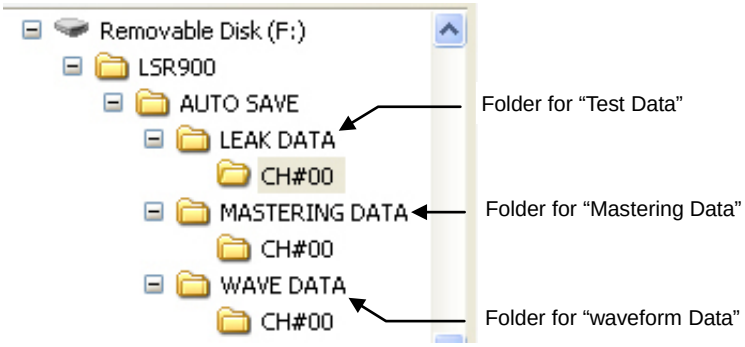
When Test Data is selected above, a new file is created once a day at the programmed time.
Set time to create a new file for Test Data by using ▲ and ▼.
Usually timer is set any time between the last shift and the first shift.

NOTE
Please leave the USB Memory on the USB port all the time for the data collection.

Viewing the Stored Data in USB

Pull out the USB memory from LS-R900 and connect it to your computer.

Data is stored in each data folder sorted by channels.



Test Data

Name of file: YYYYMMDD_HH_CH#XX.csv

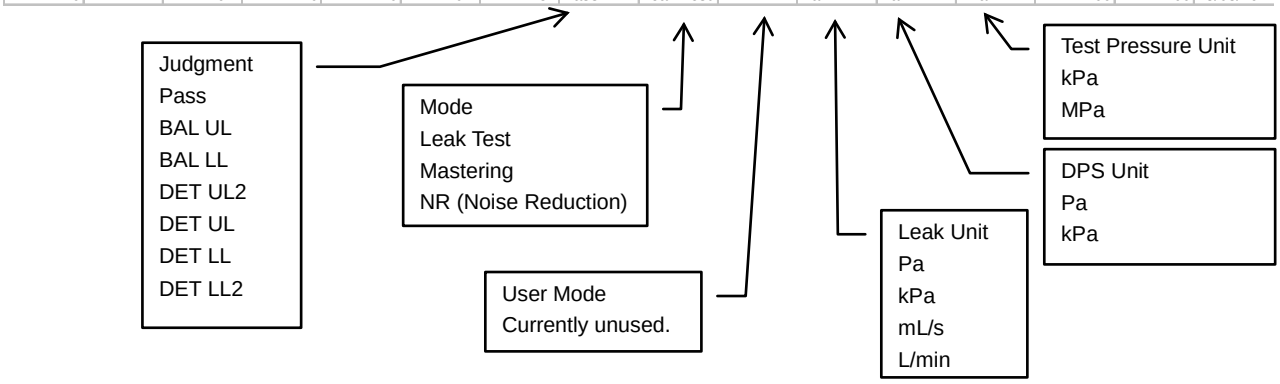
Year Month Date_Hour_Channel#.csv

ig: 20130319_00_CH#00.csv (_ represents a space)

Path: Removable Disc\LSR900\AUTO SAVE\LEAK DATA\ YYYYMMDD_HH_CH#XX.csv

Data Example

FILE NAM	LSR900/AUTO SAVE/LEAK DATA/CH#00/20130319 00 CH#00.csv														
CH#	BAL Leak	DET Leak	Comp Valu	Mastering	DPS Raw	Test Press	Judgment	Mode	User Mode	Leak Unit	DPSRawU	TPress Un	DET UL	DET LL	Date&Time
0	0	0	0	0	0	0	0	Leak Test	---	Pa	Pa	kPa	0	0	00/00/00 0
0	22.2	20.2	0	0	20.2	51	Pass	Leak Test	---	Pa	Pa	kPa	100	-100	13/03/19 1

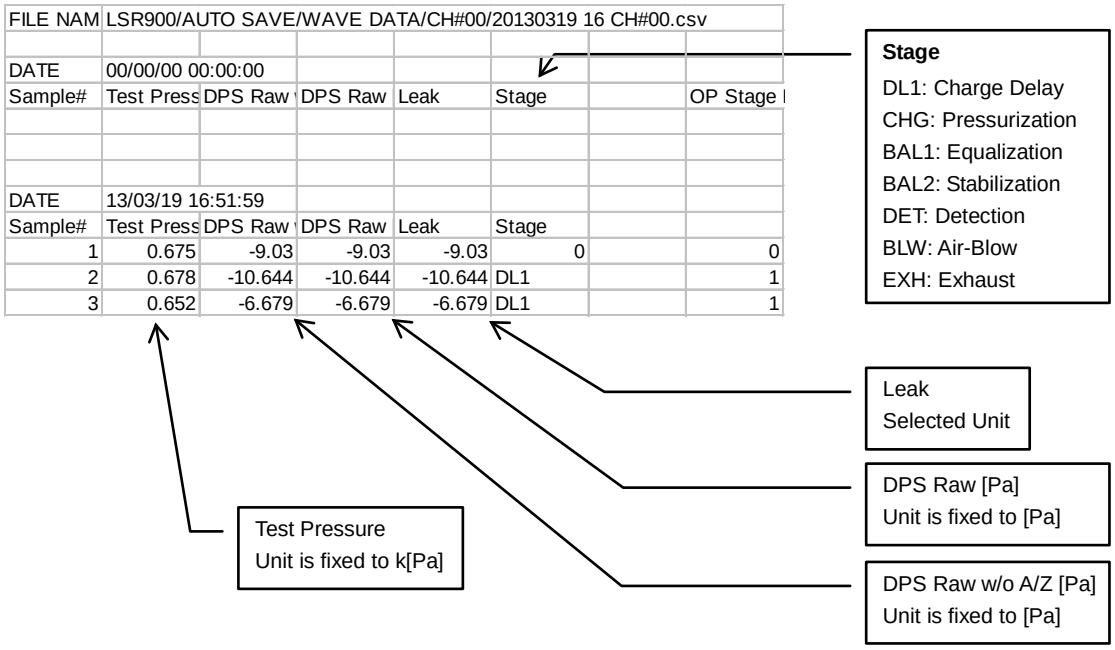


Waveform Data

Name of file: YYYYMMDD_HH_CH#XX.csv
Year Month Date_Hour_Channel#.csv
ig: 20130319_16_CH#00.csv (_ represents a space)
Path: Removable Disc\LSR900\AUTO SAVE\WAVE DATA\ YYYYMMDD_HH_CH#XX.csv

Data Example

FILE NAM	LSR900/AUTO SAVE/WAVE DATA/CH#00/20130319 16 CH#00.csv						
DATE	00/00/00 00:00:00						
Sample#	Test Press	DPS Raw	DPS Raw	Leak	Stage		OP Stage
DATE	13/03/19 16:51:59						
Sample#	Test Press	DPS Raw	DPS Raw	Leak	Stage		
1	0.675	-9.03	-9.03	-9.03	0		0
2	0.678	-10.644	-10.644	-10.644	DL1		1
3	0.652	-6.679	-6.679	-6.679	DL1		1



Mastering Data

Name of file: YYYYMMCH#XX.csv
Year Month Channel#.csv
ig: 201304CH#00.csv
Path: Removable Disc\LSR900/AUTO SAVE\MASTERING DATA\ YYYYMMCH#XX.csv

Data Example

FILE NAM	LSR900/AUTO SAVE/MASTERING DATA/CH#00/201304CH#00.csv												
DATE	13/04/02 11:23:59												
Mastering	DET 1	DET 2	DET 3	DET 4	DET 5	DET 6	DET 7	DET 8	DET 9	DET 10	DET 11	DET 12	DET 13
1	26.9	26.4	26.1	25.9	25.8								

Update Time for Each Data File

Test Data: A new file is created once a day at preset hour (System > Test Data Update Time)

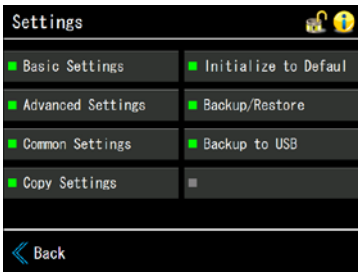
Waveform Data: A new file is created every 1 hour.

Mastering Data: A new file is created once a month

Copying the Test logs in the internal memory of LS-R900 to USB

Refer to **7.1 Use X-Chart** for the details.

5.3 Copy Test Parameters to UBS Memory



The current test parameters can be copied in one csv file to USB memory.

Insert a USB Memory into the USB port on the front panel.

Go to: Settings > CSV Copy to USB

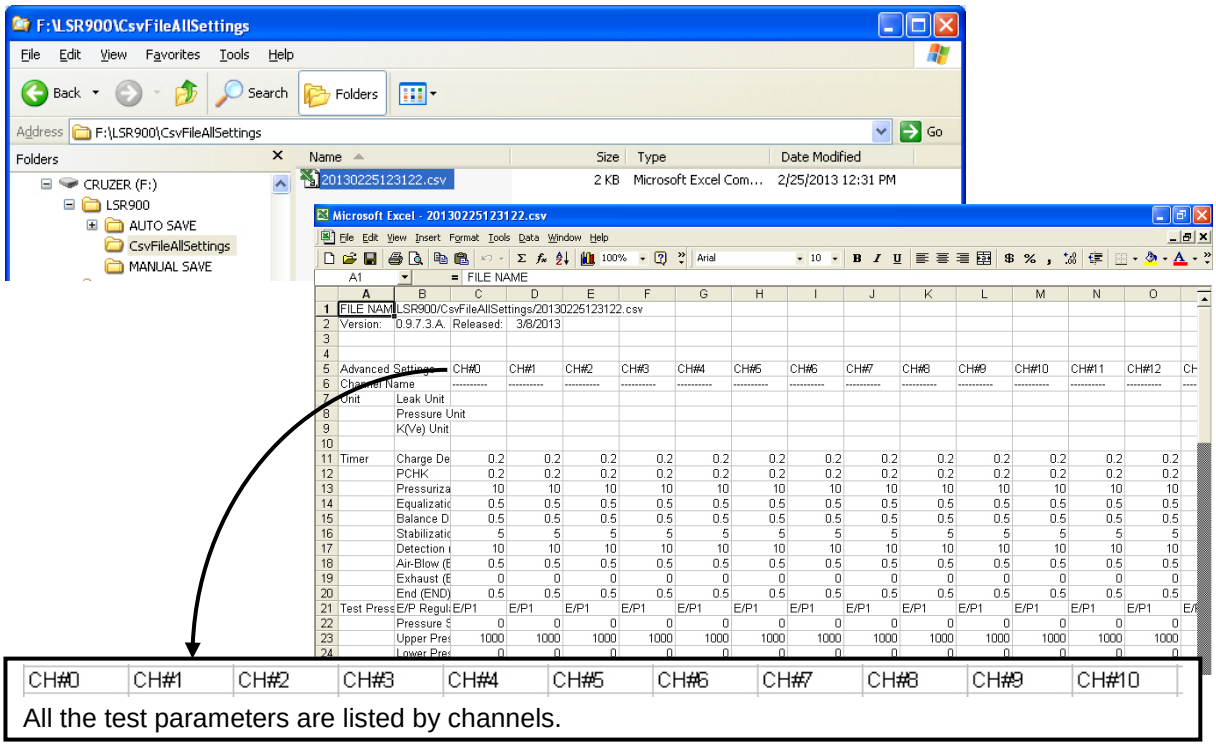
“Copying Test Parameters to USB Memory in csv OK to continue?”
> **Yes**

“Test Parameter copy in progress” appears on the screen.

“Test Parameter copy Completed” > **OK**

Unplug the USB Memory from LS-R900

The file can be viewed in a computer.



All the test parameters are listed by channels.

Folder and Files

The backup data is stored in a folder “CsvFileAllSettings” that is automatically created in LSR900 folder.

The file name is the date and time the file was created (YYYYMMDDHHMMSS.csv)

Path: Removable Disc\LSR900\CsvFileAllSettings\YYYYMMDDHHMMSS.csv

5.4 Name the Folder where Data ara Stored

System > Folder Name

The keyboard is displayed.

Press **CLR** and then input.

Up to 20 characters including alphabets, numbers and symbols can be set.

When the folder name is not changed, the folder is saved as LSR900.

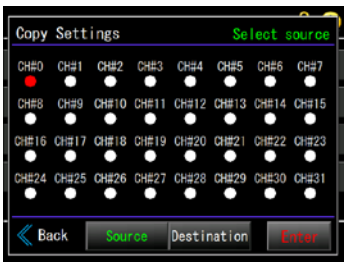
6 Program Parameters for the Similar Tested Parts

What to do

- Copy Settings
- Initialize to Default

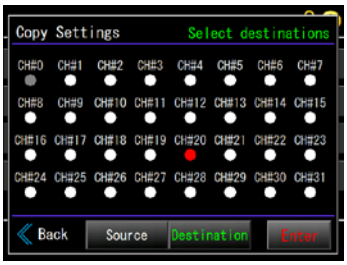
6.1 Copy Settings

Test parameters of a channel can be copied to other channels.



1) **Go to:** Settings > Copy Settings

2) Select a source channel

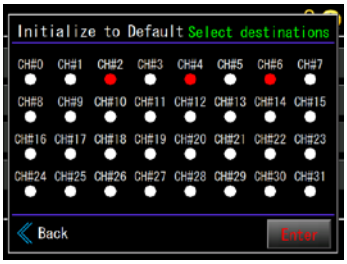


3) **Destination** > Select destination channel(s)
More than one channels can be selected.

4) **Enter** > “Initiating Settings-Copy OK to continue?” > **Yes**

6.2 Initialize to Default

Default parameters can be copied to other channels.



1) **Go to:** Settings > Initialize to Default

2) Select destination channel(s) > **Enter**
More than one channels can be selected.

3) “Initializing to Default OK to continue?” > **Yes**

7 Analyze Measured Data

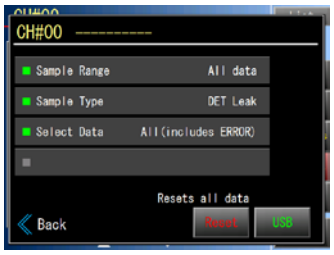
What to do

- Use X-Chart to view daily trends and simple statistic of the test data.
- Use Waveform to view the last leak test result in a wave form.

7.1 Use X-Chart

LS-R900 stores up to 5000 test logs in all 32 channels.
All the test logs in the channel of your choice are displayed in figures (oldest data at the top) or a chart (oldest data on the left).
Leak test logs after opening this menu will not be displayed unless **Update** is tapped.
This is useful for viewing daily trends and simple statistics of the test results without using a computer.

Statistics: Displays simple statistics of the extracted data.
(Xmax, Xmin, σ, Cpk/Cpu/Cpl, etc…)



Settings: Program the extract condition of the test result logs used in the statistics and X-chart.

Sample Range

Specify the range of sample data by setting the data numbers to Start and End. The data numbers are shown at the left side in the List.
Larger numbers indicate newer data. Check the numbers, and set to Start and End. The no. set to Start must be smaller than the no. set to End.
Setting example

Start 81 End 95: Specified range of data

Example of special settings (When 0 is set to Start and/or End, the range can be specifically set as below.)

Start 0 End 0: All data
Start 0 End 15: 15 data from the oldest data
Start 15 End 0: From data No.15 to the latest data
Start -15 End 0: 15 data back from the latest data

Sample Type

Select a sample Type from DET Leak or DPS Raw output

Select Data

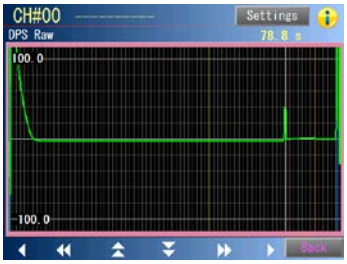
Select from All data (including errors), Pass only, Pass /UL/LL or Pass/UL2/UL/LL/LL2.

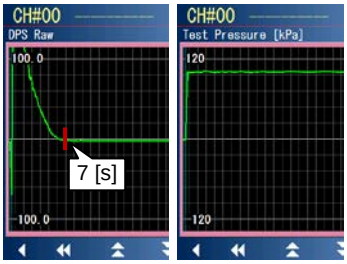
USB: Copies the extracted logs in the memory to USB memory.
Fields of the data are same as the TEST DATA in System Menu but the folder name is MANUAL SAVE instead of AUTO SAVE (LSR900\MANUAL SAVE\LEAK DATA/CH#)

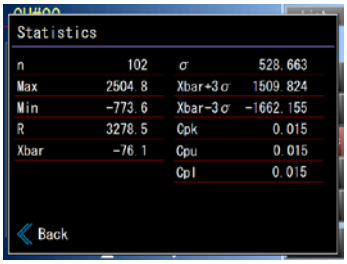
Reset: Resets all the test logs in memory.

Update: Updates the log display.
Leak test logs after opening this menu will not be displayed unless **Update** is tapped.

7.2 Analysis: Waveform







This menu is useful for determining the ultimate cycle time.

1) First, execute Automatic Setup to set provisional timers.
   Go to:
   Measure Screen > Standard > **Mode** > Automatic Setup > **Enter** > **Start**

2) Execute a leak test with the current test parameter to obtain a waveform data.
   Go to: Measure Screen > **Mode** > Leak Test > **Enter** > **Start**

3) Go to Waveform in Analysis menu **Go to:** Analysis > Waveform

4) Select DPS Raw for the Waveform data.
   Go to: **Settings** > Sample Type > DPS Raw > **Enter** > **Back**

5) Zoom in the display to check when the DPS raw output stabilizes by tapping . Grid is drawn every 1 second.

6) Switch the display to Test Pressure to check when it stabilizes.
   Go to: **Settings** > Sample Type > Test Pressure > **Enter** > **Back**

7) Between the DPS raw output and Test pressure, whichever takes longer to stabilize should be the standard.
   (Mostly it takes longer for DPS output to stabilize than test pressure.)

8) Determine and set the CHG timer by adding 3 seconds to the time the data stabilizes.
   Go to: **Back** > **Back** > Settings > Advanced Settings > Timer > Pressurization (CHG)
   In this example, it takes DPS raw output 7 seconds to stabilize. Then Pressurization timer should be 10 seconds (7 + 3 seconds)

9) Execute leak tests 5 times with 30 second intervals in between.

10) Check **R** (Range), **σ**(Standard Deviation) and **Cpk** to see the data is within your leak specifications
    Go to: Analysis > X-Chart > **Statistics**
    R: Range (Max-Min) **Rough standard:** within 20% of the leak spec.

NOTE

Similar but simpler procedure can be done in the Waveform in Measurement screen Menu.

Refer to **2.1 Use Measure Screen Waveform**

If the results are good

Verify the repeatability with the determined parameters.

If the results are not within the leak specifications

If the results are not within the specifications, extend CHG timer and repeat the process from 9) until the test results fall in the specification with repeatability.

If the cycle time has to be reduced more

Reduce CHG and BAL1 timers and repeat the process from 9) to see the results fall within the specification with repeatability with the reduced timers.

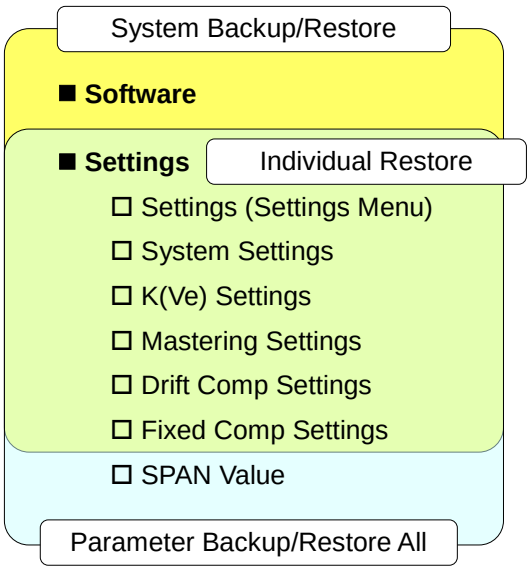
8 Backup and Restore

What to do

- Restoring test parameters after changing them temporarily: Parameter Backup/Restore
- Preparing for replacing LS-R900 for some trouble: System Backup and Restore
- Restoring when the folder name has been changed.

Attention

In LS-R900 of Ver. 1.0.0.7 and newer versions, a new feature was added, where the name of the folder to which data are stored can be changed when the data are saved in a USB memory.
When to restore backup data of Ver. 1.0.0.6 or older version to the LS-R900 of Ver. 1.0.0.7 or newer version, if the folder name in Ver. 1.0.0.7 or newer version has been changed, a method specifically designed for the restoring must be used.



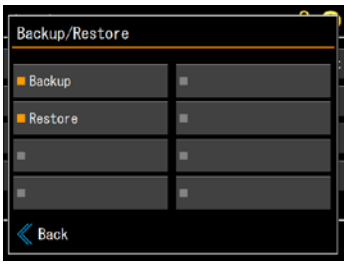
There are two different types of Backup/Restore, System in the System Menu and Test Parameters in the Settings Menu.

The chart shows which items are backed up for each backup.

NOTE

Items to restore can be selected individually by selecting **Individual Restore**.

8.1 Restore Test Parameters



Test parameters can be saved to USB memory for backup, which can be restored at a later date.

The current test parameters can be restored easily from backup after changing them temporarily.

Settings can be restored to other LS-R900's using Individual Restore.

Backup

1) Connect a USB memory to the USB port on the front panel.

2) **Go to:** Settings > Backup/Restore > Backup
"Initiating Test Parameter Backup OK to continue?" > **Yes**

NOTE

Backup data is only for restoring the test parameters to the LS-R900 and cannot be viewed in computers.

Restore All (When the folder name has not been changed)

1) Connect a USB memory to the USB port on the front panel.

2) **Go to:** Settings > Backup/Restore > Restore All
>"Initiating Test Parameter Restore OK to continue?" > **Yes**

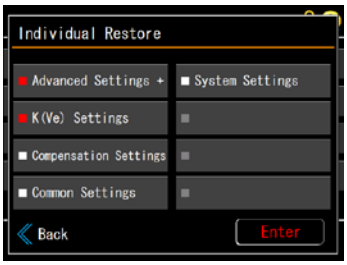
NOTE

Mastering Value, Compensation Value and Counter will be reset by Parameter Restore.

Attention

When restoring (copying) the test parameters saved in a USB memory to other LS-R900, use the "Individual Restore".
If "Restore All" is used, information such as span values of the Differential Pressure Sensor and Pressure Sensor are overwritten, resulting incorrect measurement.

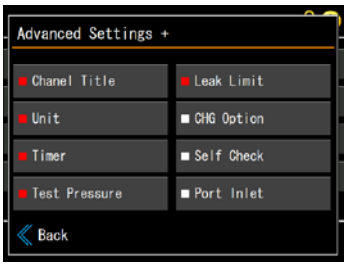
Individual Restore (When the folder name has not been changed)



This feature can be used to copy the settings from a LS-R900 to others. Items selected among the backup from the source tester can be restored individually to the destination tester.
However, this feature requires full understanding that there are items affecting each other such as timers, leak limits and K(Ve) value.

1) Connect a USB memory to the USB port on the front panel.

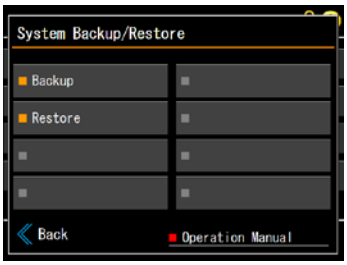
2) **Go to:** Settings > Backup/Restore > Individual Restore
> Select items to restore > **Enter**
>"Initiating Test Parameter Restore OK to continue?" > **Yes**



NOTE

Further individual items can be selected for **Advanced Settings +**.

8.2 Prepare for Replacing LS-R900



Model Information

A2MGK4.UX2

Perform System backup to prepare for restoring the test system in case of trouble in the future. The current system settings can be restored easily to another testser from backup.

System Backup

1) Connect a USB memory to the USB port on the front panel.

2) **Go to:** System > Backup/Restore > Backup
"Initiating System Backup OK to continue?" > **Yes**

NOTE
To back up the Operation Manual, select "Operation Manual".

System Restore (When the folder name has not been changed)

1) Connect a USB memory to the USB port on the front panel.

2) **Go to:** System > Backup/Restore > Restore
"Initiating System Restore OK to continue?" > **Yes**

Attention
Backup data can only be restored exactly the same models it was backed up from. Be sure to compare the model information on the front panel of the LS-R900 to ensure that they are identical.

8.3 Restoring when Folder Name has been Changed

In the LS-R900 of Ver. 1.0.0.7 and newer versions, a new feature was added, where the name of the folder to which data are stored can be changed when the data are saved in a USB memory. When the folder name has been changed in Parameter Backup and/or System Backup, restoring the data is restricted.

Relations between Backup and Restore depending on the software version

Versions of Source tester → Destination tester	Test Parameter / System	Folder Name	Restore
Ver.1.0.0.6 or older → Ver.1.0.0.7 or newer	Test Parameter	Unchanged	Can be restored
		Has been changed	When the folder name is changed back to "LSR900", the data can be restored.
	System	Unchanged	Can be restored
		Has been changed	When the folder name is changed back to "LSR900", the data can be restored.
Ver.1.0.0.7 or newer → Ver.1.0.0.6 or older	Test Parameter	Unchanged	Can be restored
		Has been changed	The destination tester needs be updated to Ver.1.0.0.7 or the backup file needs to be moved to the root directory of the USB memory and the folder name needs to be changed back to "LSR900".
	System	Unchanged	
		Has been changed	

Restoring the backup of LS-R900 of Ver.1.0.0.6 or older to LS-R900 of Ver.1.0.0.7 or newer

When the name of the folder storing the backup data of Ver.1.0.0.7 or newer has been changed, the folder name differs from the folder name of Ver.1.0.0.6. In this case, restoring of test parameters (Restore All, Individual Restore) and restoring of the system (System Restore) from Ver.1.0.0.6 to Ver.1.0.0.7 or newer cannot be performed.

For restoring, change the folder name of Ver.1.0.0.7 or newer back to “LSR900” and restore by the procedures explained above.

According to necessity, change the folder name again and then save the data for backup.

Refer to **5.4 Name the Folder where Data ara Stored** for the details.

Restoring the backup of LS-R900 of Ver.1.0.0.7 or newer to LS-R900 of Ver.1.0.0.6 or older

Use either of the following methods to restore the backup of Ver.1.0.0.7 or newer to an LS-R900 of Ver.1.0.0.6 or older.

- Update the software of Ver.1.0.0.6 or older to Ver.1.0.0.7 or newer before restoring.
- Move the backup file of Ver.1.0.0.7 or newer to the root directory of the USB memory and change the folder name back to “LSR900”.

Update the software of Ver.1.0.0.6 or older to Ver.1.0.0.7 or newer before restoring

1) Update the LS-R900 (destination tester) of Ver.1.0.0.6 or older to Ver.1.0.0.7 or newer according to the procedure for update.
2) Change the folder name of the destination tester to the folder name of the source tester from which the data were backed up.

Refer to **5.4 Name the Folder where Data ara Stored** for the details.

3) The backup data and the folder of the destination tester now have the same name, which makes restoring possible.
4) Restore by the procedures explained above.

Attention

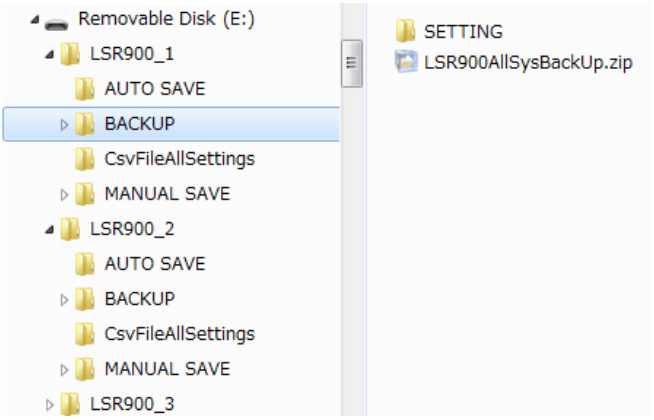
For updating, read Cosmo’s homepage.
Before updating, carefully read the procedure for update.

https://ssl.alpha-mail.ne.jp/cosmo-k.net/dl/e-soft/

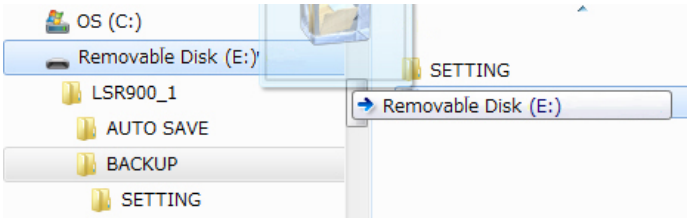
Move the backup file to the root directory of the USB memory and change the folder name back to "LSR900"

⚠CAUTION

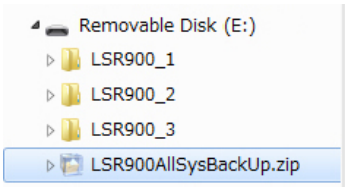
Moving the file to other folder involves possible mistakes such as damaging the file or dragging to an incorrect location. Carefully operate.
Cosmo will not bear any responsibility for any damage arising from this operation.



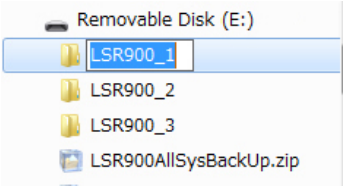
1) Display the root directory of the USB memory by Explorer or others on a PC.



2) Move the LSR900AllSysBackUp.zip file stored in the BACKUP folder of the source LS-R900 tester to the root directory of the USB memory.

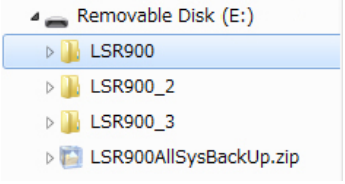


3) Check that the LSR900AllSysBackUp.zip file has moved to the root directory of the USB memory.



4) Change the name of the folder, from which the LSR900AllSysBackUp.zip was moved, to "LSR900".

5) Remove the USB memory from the PC.



6) The backup and the folder now have the same name "LSR900", making restoring possible.

7) Restore by the procedures explained above.

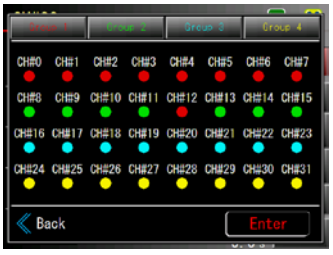
9 Other Settings

9.1 Name Channels

Each channel can be named.
Go to: Settings > Advanced Settings > Channel Title > Channel Title

Keyboard appears
Tap **CLR** first then type the title.
The channel title should be within 20 letters.

9.2 Assign Channels for Each Group for 4-Channel Measurement Screen

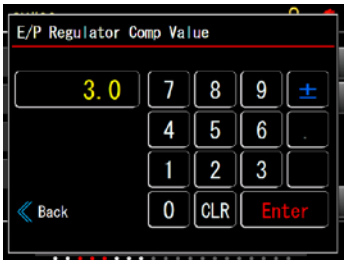


Settings appears on the right side of the screen when opening 4-Channel measurement screen in the Manual mode.

Channels of your choice can be assigned to a group of your choice by tapping the button.

Go to: Measure Screen > 4-Channel > **Setting**
> Tap a group to change the channel assignment
> Select channels of your choice > **Enter** > **Back**

9.3 Compensate E/P Regulator



The output value of the E/P Regulator can be compensated by setting the E/P Regulator Comp Value. Since compensation can be done for each channel, different test pressure settings can be made in detail for the channels.

Go to: Settings > Advanced Settings > Test Press > E/P Regulator Comp Value

The numerical keypad is displayed.

Input the compensation value > **Enter**

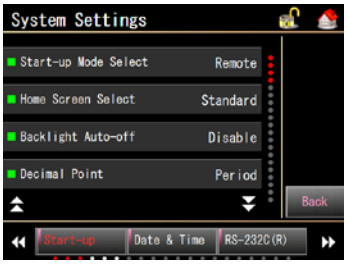
When the displayed test pressure is higher than the test pressure setting, input the value for the amount exceeding the test pressure setting. When the displayed test pressure is lower than the test pressure setting, input the value for the amount falling below the test pressure setting.

For example, when the test pressure setting is 100kPa and the displayed test pressure is 97kPa, set -3. When the test pressure setting is 100kPa and the displayed test pressure is 103kPa, set 3.
For adjustment when the last digit of the displayed test pressure fluctuates, set a numerical number after the decimal point.

Also for precharge, the E/P Regulator Comp Value can be set.

10 Other Features

10.1 Backlight Auto-off



The backlight of LS-R900 goes off automatically when the touch-screen is not touched for programmed period of time.

Unlock settings and toggle to Manual mode.

Go to: System > System Settings > Start-up > Backlight Auto-off > Select the duration > **Enter**

(Disable, 1 minute, 5 minutes, 10 minutes, 30 minutes, 60 minutes, 120 minutes, 240 minutes)

10.2 Select a Language

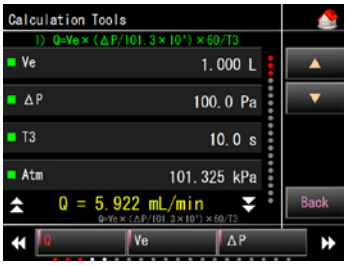
Select a display language from English, Japanese, Chinese, Korean, Spanish, German, and Portuguese.

Go to: Language > Select a language and tap **Enter**.

> "Reboot required when changing language OK to continue?" > **Yes**

LS-R900 will be rebooted and displayed in the selected language.

10.3 Calculation Tools



This is Menu to calculate Leak rate, Equivalent Internal Volume, Differential Pressure, Detection Time, and Atmospheric pressure.

Go to: Misc. > Calculation Tool

Q: Leak Rate [mL/min]
Ve: Equivalent Internal Volume [mL]
ΔP: Differential Pressure [Pa]
T3: Detection Time [s]
Atm: Atmospheric pressure (Fixed to 101.325kPa)

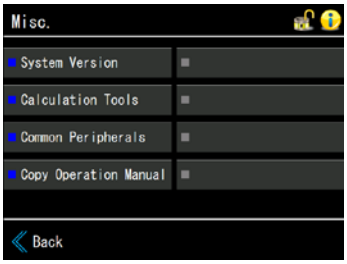
10.4 Fine Adjustment of Test Pressure

For EP regulator models, test pressure can be fine-tuned in the Standard measurement screen in the manual mode while Charge Hold is in progress.

Go to: Measure Screen > Standard > **Mode** > **Charge Hold** > **Enter** > **Start** > **Setting** > Adjust the test pressure with ▼ and ▲> **Enter**

Pressure Setting in the Settings Menu will be overwritten after **Enter**.

10.5 Copy Operation Manual to USB Memory



The Operation Manual can be copied to USB memory.

1) Insert a USB Memory into the USB port on the front panel.
2) **Go to:** Help > Copy Operation Manual > **Enter**
3) Select a language.
4) **Enter** > "Copying to USB OK to continue?" > **Yes**
5) Unplug the USB Memory from LS-R900

The operation manual is a PDF file.
The file can be viewed in a computer with Adobe Reader
The operation manual will be copied in a folder "OP MANUAL" that is automatically created in LS-R900 folder.

11 Maintain Reliable Test Results

11.1 Daily Inspection Points

Let the power on for 5 minutes or longer for a warm-up before starting inspections.

1) Check Filter/Mist Separator
   Drain any accumulated water and check the conditions of the element.
   Look for water/oil residues around the exhaust port.
2) Check the test pressure.
   Make sure that the regulator is adjusted to the correct pressure.
3) Pass/Fail Check
   Run a known good part on the machine to see the part passes. Then, apply a properly rated Leak Master and run another test to see the part fails.

NOTE

Water, oil, or other contaminants entering the Leak Tester through the air pressure source causes the largest majority of breakdowns in the Leak Tester.
If contaminants are found in the oil mist separator, it is strongly recommended to install an air dryer or additional in-line filters. Once the Leak Tester is contaminated, the pneumatic circuit will have to be overhauled for cleaning, and DPS replacement may be required.

11.2 K(Ve) Check

Compares K(Ve) measured with a reference master tested part to the K(Ve) stored in memory.

LS-R900 displays an error if the difference exceeds the tolerance. This can be used for daily sensitivity checks.

K(Ve) Check Limit

Setting a tolerance in percentage (±) to the K(Ve) currently stored in memory.

Go to: K(Ve) > K(Ve) Settings > Basic > K(Ve) Check Limit

Manual Operation

1) Go to K(Ve) Check screen **Go to:** K(Ve) > K(Ve) Check
2) K(Ve) Check starts by tapping **Start**.

Remote Operation

Transmit K(Ve) Check signal and Start Signals through control I/O port.

Results for K(Ve) Check

Lower than LL	Within the Limits	Larger than UL
DET LL	Pass	DET UL

When the Result was Fail (DET LL / DET UL)

Perform K(Ve) Check after checking the followings and executing Mastering if the result was **DET LL** or **DET UL**.

- Tested part
  Check whether the tested part used for K(Ve) Check was same reference master part used for K(Ve) Automatic Setup.
- Leak
  Check the sealing surface for contaminants.
- If test results are not relatively consistent.
  Normally extending Pressurization (CHG) timer or Equalization (BAL1) timer will help stabilize the pressure and consequently the test result will be consistent.

12 Updating Software

LS-R900 can be updated by users.

Check our web site for the update information.

Be sure to read the procedure before update.

URL **https://ssl.alpha-mail.ne.jp/cosmo-k.net/dl/e-soft/**


MEMO

MAINTENANCE MANUAL

8 MAINTENANCE

Periodic Inspection and Calibration helps maintain the accuracy of LS-R900 and prevent malfunction Performing the following inspection is highly recommended.

Attention

A settings unlocking is required to change settings and toggling to Manual mode is required to execute a measurement.

1 Daily Inspection Points

Let the power on for 5 minutes or longer for a warm-up before starting inspections.

1) Check Filter/Mist Separator

   Drain any accumulated water and check the conditions of the element.

   Look for water/oil residues around the exhaust port.

2) Check the test pressure.

   Make sure that the regulator is adjusted to the correct pressure.

3) Pass/Fail Check

   Run a known good part on the machine to see the part passes. Then, apply a properly rated Leak Master and run another test to see the part fails.

NOTE

Water, oil, or other contaminants entering the Leak Tester through the air pressure source causes the largest majority of breakdowns in the Leak Tester.
If contaminants are found in the oil mist separator, it is strongly recommended to install an air dryer or additional in-line filters. Once the Leak Tester is contaminated, the pneumatic circuit will have to be overhauled for cleaning, and DPS replacement may be required.

2 Monthly Inspection Points

1) Check the oil mist separators and the filter.
2) Check all the programmed test parameters and the test pressure.
3) Leak check of the leak tester

   Conduct a No-Leak check with the MASTER- and WORK-side stop valves closed.

   Go to: Maint. > Inspection > Leak Check > No-Leak Test
4) Check the test PS offset.

   Go to: Maint. > Inspection > Sensor > PS (P1) / (P2)

3 Annual Inspection Points

Contact your local Cosmo representative for scheduling Annual Calibration Service.

The following items will be inspected and calibrated.

1) Check the oil mist separator and the filter.
2) Leak check of the leak tester
3) Check the DPS offset.
4) Check the DPS span
5) Check the PS offset.
6) Check the PS span.

4 Features for Maintenance

4.1 K(Ve) Check

Compares K(Ve) measured with a reference master tested part to the K(Ve) stored in memory.

LS-R900 displays an error if the difference exceeds the tolerance. This can be used for daily sensitivity checks.

K(Ve) Check behavior should be the same behavior as the K(Ve) Automatic Setup for the current K(Ve) (3-Phase, 1-Phase).

K(Ve) Check Limit

Setting a tolerance in percentage (±) to the K(Ve) currently stored in memory.

Go to: K(Ve) > K(Ve) Settings > Basic > K(Ve) Check Limit

1) Go to K(Ve) Check screen **Go to:** K(Ve) > K(Ve) Check
2) K(Ve) Check starts by tapping **Start**.

Remote Operation

Transmit K(Ve) Check signal and Start Signals through control I/O port.

Results for K(Ve) Check

Lower than LL	Within the Limits	Larger than UL
DET LL	Pass	DET UL

When the Result was Fail

Perform K(Ve) Check after checking the followings and executing Mastering if the result was DET LL or DET UL.

- Tested part
  Check whether the tested part used for K(Ve) Check was same reference master part used for K(Ve) Automatic Setup.
- Leak
  Check the sealing surface for contaminants.
- If test results are not relatively consistent.
  Normally extending Pressurization (CHG) timer or Equalization (BAL1) timer will help stabilize the pressure and consequently the test result will be consistent.

4.2 No-Leak Check

No-Leak Check is a leak check of LS-R900 itself.

1) Close the both WORK- and MASTER-side stop valves on the rear panel.
2) **Go to:** Maint. > Inspection > Leak Check > No-Leak Check
3) Check whether the displayed test pressure is appropriate.
4) Tap **Start** to start a No-Leak Check.
5) Timers are fixed to the follows:
   CHG=10.0s BAL1=0.5s BAL2=5.0s DET=10.0s
   LS-R900 is not leaking if the result is within ±10 Pa.
   If not, contact Cosmo for repair.
6) Tap **Stop**.
7) Open both the WORK- and MASTER-side stop valves.

4.3 DPS Offset Adjustment

1) **Go to:** Maint. > Inspection > Sensor > DPS
2) Check whether the sensor is open to the atmosphere.
3) Tap **Offset**.
4) Check whether the reading is within the tolerance.
   Contact Cosmo for repair if the DPS reading exceeds the Offset Limit.

4.4 DPS Span Check

⚠CAUTION

Normally DPS Span calibration will be performed by Cosmo. Persons who have been specially trained by Cosmo can perform it as well, but in that case, Cosmo does not guarantee the calibrated value.

1) Remove the plugs from ⤖ (Calibration port) and ⊠ (Maintenance port).
2) Disconnect the air pressure source from Test pressure port and make sure that the air is completely exhausted from the pneumatic circuit of the tester. Leave the pilot pressure source as it is.
3) Connect the pressure generation source of calibration equipment to the ⊠ Maintenance port.
4) Unlock settings and toggle to Manual mode.
5) **Go to:** Maint. > Inspection > Sensor > DPS
6) Perform DPS offset adjustment.
7) Close the stop valves on both WORK- and MASTER-sides.
8) Tap **Start** and pressurize LS-R900 with the calibration equipment.
9) DPS readout will be displayed on the screen of LS-R900.
10) Compare the readouts displayed on LS-R900 and displayed on the calibration equipment.

4.5 PS Offset Adjustment

1) **Go to:** Maint. > Inspection > Sensor > PS (P1)
2) Check whether the sensor is open to the atmosphere.
3) Tap **Offset**.
4) Check whether the reading is within the tolerance.
5) Contact Cosmo for repair if the PS reading exceeds the Offset Limit.

4.6 PS Span Check

⚠CAUTION

Normally PS Span calibration will be performed by Cosmo. Persons who have been specially trained by Cosmo can perform it as well, but in that case, Cosmo does not guarantee the calibrated value.

1) Remove the plug from ⊠ (Maintenance port) and connect the calibration equipment that is appropriate for the model to the Maintenance port.
2) Leave the air pressure source connected to the Test pressure port but regulate the pressure to 0.
3) Unlock settings and toggle to Manual mode.
4) **Go to:** Maint. > Inspection > Sensor > PS(P1)
5) Perform PS offset adjustment.
6) Close the stop valves on both WORK- and MASTER-sides.
7) Tap **Start** and pressurize LS-R900 with the calibration equipment.
8) PS readout will be displayed on the screen of LS-R900.
9) Compare the readouts displayed on LS-R900 and displayed on the calibration equipment.

4.7 E/P Regulator Adjustment

The E/P Regulator can be adjusted only when, after the PS offset is adjusted and the PS span is checked, it is confirmed that both values are correct.

Zero-check of E/P Regulator unit

Open the pressure source to the atmosphere, and check that the indicator of E/P Regulator displays “000”.

Adjustment of E/P Regulator

1) Check that the plugs of (Calibration port) and (Maintenance port) are closed.
2) Close the WORK- and MASTER-side stop valves.
3) Maint. > Inspection > EP Regulator > E/P Regulator (E/P1)
4) Pressure Setting > Set 80% of the Range.
5) Tap **Start** and tap ▲ ▼ to adjust the PS output to the pressure setting.
6) Tap **Enter** and tap **Stop**.

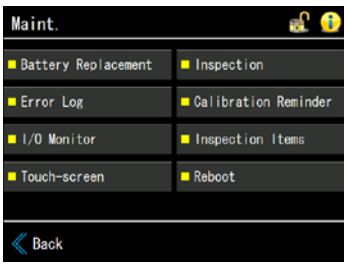
NOTE

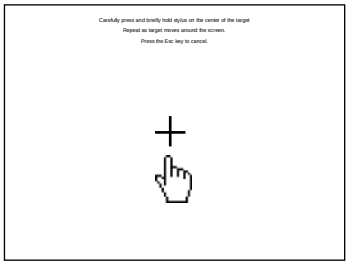
When the E/P Regulator Comp Value has been set, after span adjustment of E/P Regulator, make sure to check the compensation value of each channel.

Refer to “**7 OPERATIONS LISTED BY PURPOSE**” for the details.

5 Touch-Screen Adjustment

The touch-screen of LS-R900 may get off over the course. This can be adjusted easily.





Go to: Maint. > Touch-screen

> “Starting Touch-screen adjustment. OK to continue?” > **Yes**

1) “+” appears in the center of the screen along with the following instruction on the top:

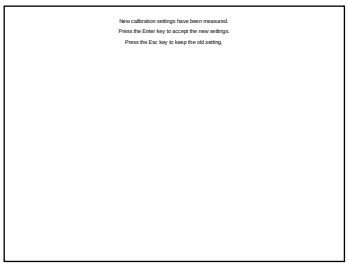
Carefully press and briefly hold stylus on the center of the target. Repeat as target moves around the screen. Press the Esc key to cancel.

Since There is no Esc key, turn off the power to cancel.

2) If the following message appears, the adjustment is complete.

New calibration settings have been measured. Press the Enter key to accept the new settings. Press the Esc key to keep the old setting.

Tap on the **message** instead of “Enter key” to accept the new settings.
In case you need to cancel the new setting, turn off the power.



3) If the message did not appear, the “New calibration” was not measured properly. Please start over.

6 Battery Replacement

Life of the battery for Memory backup is due in three (3) years.

A reminder to change the battery pops up every time the tester is powered on two weeks before the recommended replacement date until the battery is replaced.

Although tapping **OK** closes the pop up window, please replace the battery as soon as possible.

LS-R900 Internal Memory (SRAM)

LS-R900 buffers memory with a battery.
Memory includes calendar, Compensation V (Man), Mastering Value (Man), Counter, X-Chart/List, Error Log, which cannot be used once battery is discharged completely.

Battery

3v lithium battery

Product	Model	Life
Lithium battery	CR2032 (UL certified)	Three (3) years

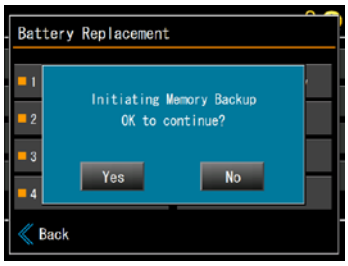
⚠ CAUTION

Mounting a battery other than specified may cause an explosion.

6.1 Battery Replacement Procedure

Please follow the instruction below.

1 Memory Backup



Maint. > Battery Replacement > 1 Memory Backup
> “Initiating Memory Backup OK to continue?” > **Yes**

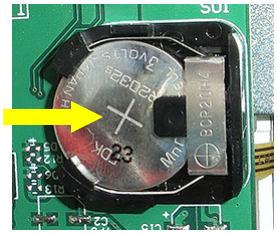
Replace the Battery

> **CAUTION**
> Make sure not to touch unnecessary parts when removing the top cover. Touching unnecessary parts may cause lowering the performance of LS-R900

> **CAUTION**
> **Electric Shock**
> Make sure to turn off the power and unplug the power cord from LS-R900 before removing the top cover (⚠) to prevent electric shock or damage to the tester.

1) Turn off the power and unplug the power cord from the power connector of LS-R900.
2) Remove the control I/O connector on the rear panel (standard connector) by unscrewing the two slot screws on both ends.
3) Unscrew the two screws on the top of LS-R900 (Rear side and Front side) to remove the top cover.
4) The battery is mounted on the back side of the upper left corner of the front panel.

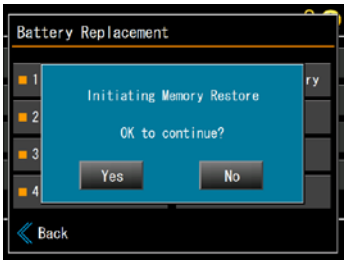
5) Push the battery as shown in the photo below while pressing it down to pull it out.
6)



> **NOTE**
> Dispose the old battery according to the instruction of the battery.

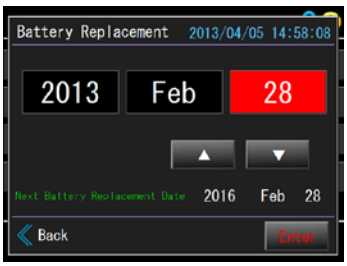
7) Mount a new battery in the opposite procedure.
8) Put back the top cover and I/O connector.

2 Memory Restore



Go to: Maint. > Battery Replacement > 2 Memory Restore > “Initiating Memory Restore OK to continue?” > **Yes**

3 Replacement Date

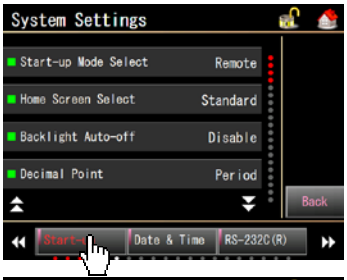


Go to: 3 Replacement Date

> Enter the date the battery was replaced > **Enter**

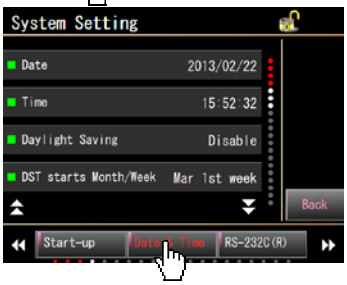
Setting the date will update the next battery replacement date.

4 Set Date & Time



Maint. > Battery Replacement > 4 Set Date & Time

The screen jump to System Menu



Set the current date and time.

> Date & Time > Date / Time

6.2 About ERROR 51: Lo Battery SRAM

All measurements are disabled if the error occurs. Please replace the battery immediately.

The following data in LS-R900 will be wrong.

- Date and Time
- Compensation V (Man)
- Mastering Value (Man)
- Counter
- X-Chart/List

NOTE

Please do not execute
Maint. > Battery Replacement
> Memory Backup after ERROR 51.

8

6.3 How to Troubleshoot ERROR 51

1) Replace the battery
   Refer to the previous page for the procedure.
2) Initialize Memory
   Maint. > Battery Replacement > Initializing Memory
   Refer to "**7 INITIALIZE MEMORY**" on the next page for procedure.
3) Enter the date the battery was replaced and memory was restored.
   Maint. > Battery Replacement > 3 Replaced Date
4) Set the current date and time
   Maint. > Battery Replacement > 4 Set Date & Time
   The screen jump to System Menu
   > Date & Time > Date / Time

6.4 If ERROR 51 Occurs Right After Replacing Battery

If the error occurred right after replacing battery, some internal electrical part may be malfunctioned.

Contact Cosmo for repair after executing System Backup.

Go to: System > Backup/Restore > Backup

7 Initialize Memory

Items cleared by Initialize Memory

- Compensation V (Man)
- Mastering Value (Man)
- Counter
- X-Chart/List
- Error Log

Unlock settings and toggle the operation mode to Manual.

Maint. > Battery Replacement > Initialize Memory
> " Initializing the Memory OK to continue?" > Yes

9 TROUBLESHOOTING

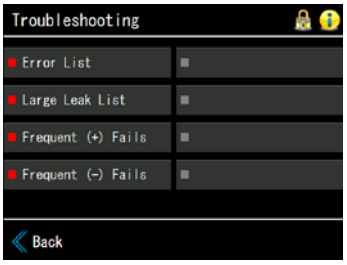
1 When an Error Occurred

The error code is displayed when an error occurs.

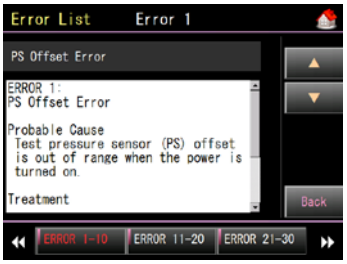
The error description, probable causes and the treatments are displayed by tapping the displayed code.

2 Error List

Menu to view descriptions, probable causes and treatments and all the errors.



Troubleshooting > Error List



The errors are divided every 10 codes.

Tapping ▲ ▼ goes forward or back within 10 errors.

3 Error Messages and Treatments

3.1 ERROR 1 PS Offset Error

Timing: During power-on check procedure
Criteria: Pressure sensor (PS) offset exceeds ±2% of its range.

Probable Cause	Treatment
Test pressure sensor (PS) offset is out of tolerance when the power is turned on.	Adjust the PS offset. **Go to:** Maint. > Inspection > Sensor > PS(P1) Contact Cosmo for repair if the offset exceeds ±2% of the sensor range.

Output Signal Timing Chart ▼ During power-on check procedure

PIN#		Function	TYPE	WAIT
Standard	D-SUB			
1B	18	STAGE #0	NO	
2B	17	STAGE #1	NO	
3B	16	ERROR	NO	
5B	14	PASS	NO	
6B	13	UL FAIL	NO	
9B	36	BUSY	NO	
10B	35	END	NO	
12B	33	LL2 FAIL	NO	
13B	32	LL FAIL	NO	
14B	31	UL2 FAIL	NO	

3.2 ERROR 2 PS Out of Range

Timing: At the end of Pressurization (CHG) or Precharge (PCHG) stage
Criteria: Test pressure exceeds the sensor range in CHG or PCHG stage.

Probable Cause	Treatment
Test pressure sensor (PS) was pressurized exceeding the sensor full-scale.	Adjust the test pressure. Pay extra attention for low pressure models.
Test pressure sensor (PS) offset is out of tolerance.	Adjust the PS offset. **Go to:** Maint. > Inspection > Sensor > PS (P1)
Cable disconnection or malfunction of the test pressure sensor (PS)	Adjust the PS offset. **Go to:** Maint. > Inspection > Sensor > PS(P1) Contact your local Cosmo representative if the offset exceeds ±2% of the sensor range
Malfunction of the test pressure sensor (PS)	Contact Cosmo for repair if the offset exceeds ±2% of the sensor range.

Output Signal Timing Chart ▼ ▼ At the end of PCHG or CHG

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BLW	EXH	END	WAIT
Standard	D-SUB												
1B	18	STAGE #0	NO										
2B	17	STAGE #1	NO										
3B	16	ERROR	NO										
5B	14	PASS	NO										
6B	13	UL FAIL	NO										
9B	36	BUSY	NO										
10B	35	END	NO										
12B	33	LL2 FAIL	NO										
13B	32	LL FAIL	NO										
14B	31	UL2 FAIL	NO										

NOTE

When the error occurred in PCHG, stages only in grey areas are applicable but when it occurred in CHG stage, the stages in shadowed areas are also applicable as well.

3.3 ERROR 3 Test Pressure Error

Timing: **Test pressure too low:** At the end of Pressurization (CHG)
Test pressure too high: Always monitored
Precharge pressure too low: At the end of Precharge (PCHG)
Precharge pressure too high: Always monitored

Criteria: Test pressure exceeds upper or lower limit in CHG or PCHG stage.

Probable Cause	Treatment
"0" is set to the lower limit	Set a numerical number other than "0" to the lower limit.
Upper and Lower limits for Test pressure or Precharge are too close or inappropriate.	Set larger limits. **For test pressure limits:** **Go to:** Settings > Advanced Settings > Test Press > Upper Press Limit / Lower Press Limit **For Precharge limits:** **Go to:** Settings > Advanced Settings > CHG Support > Precharge Upper Limit / Precharge Lower Limit
Pressurization time is insufficient. (When pressure is lowered.)	Extend CHG timer. **Go to**: Settings > Advanced Settings > Timer > Charge (CHG)
Precharge time is insufficient. (When Precharge pressure is lowered.)	Extend PCHG timer. **Go to:** Settings > Advanced Settings > CHG Options > Precharge timer
Fluctuation or a drop in the source pressure	Check the source pressure or the regulator setting. Avoid using air tools branching off the pressure source of the LS-R900 to supply a stable air. Setting up a dedicated pressure source for the LS-R900 is recommended.
Leaks from seals, part and fittings	Check the seals, part and fittings for possible leaks.
Malfunction of the test pressure sensor (PS)	Contact Cosmo for repair.

Output Signal Timing Chart

▼ ▼ At the end of PCHG or CHG

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BLW	EXH	END	WAIT
Standard	D-SUB												
1B	18	STAGE #0	NO										
2B	17	STAGE #1	NO										
3B	16	ERROR	NO										
5B	14	PASS	NO										
6B	13	UL FAIL	NO										
9B	36	BUSY	NO										
10B	35	END	NO										
12B	33	LL2 FAIL	NO										
13B	32	LL FAIL	NO										
14B	31	UL2 FAIL	NO										

NOTE

When the error occurred in PCHG, stages only in grey areas are applicable but when it occurred in CHG stage, the stages in shadowed areas are also applicable as well.

3.4 ERROR 4 BAL1 Lost Test Pressure

Timing: At the end of Equalization (BAL1)

Criteria: Programmed Test pressure lower limit

Probable Cause	Treatment
Leaks from seals, part and fittings	Check the seals, part and fittings for possible leaks.
Fluctuation or wrong setting of the pilot pressure	Adjust the pilot pressure between 400kPa and 700 kPa. Avoid using air tools branching off the pressure source of the LS-R900 to supply a stable air. Setting up a dedicated pressure source for the LS-R900 is recommended.
Malfunction of the solenoid valve, SV4, or air-operated valve, AV3.	Contact Cosmo for repair.

Output Signal Timing Chart ▼ At the end of BAL1

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BAL1	BLW	EXH	END	WAIT
Standard	D-SUB													
1B	18	STAGE #0	NO			■	■		■					
2B	17	STAGE #1	NO							■	■	■	■	
3B	16	ERROR	NO									■	■	■
5B	14	PASS	NO											
6B	13	UL FAIL	NO									■	■	
9B	36	BUSY	NO		■	■	■	■	■	■	■	■	■	
10B	35	END	NO										■	
12B	33	LL2 FAIL	NO									■	■	
13B	32	LL FAIL	NO									■	■	
14B	31	UL2 FAIL	NO									■	■	

3.5 ERROR 10 DPS Offset Error

Timing: During power-on check procedure

Criteria: Differential Pressure sensor (DPS) offset exceeds ±3% of its range.

Probable Cause	Treatment
Differential pressure sensor (DPS) offset is out of range when the power is turned on.	Adjust the DPS offset. **Go to:** Maint. > Inspection > Sensor > DPS Contact Cosmo for repair if the offset exceeds ±30%.

Output Signal Timing Chart ▼ During power-on check procedure

PIN#		Function	TYPE	WAIT
Standard	D-SUB			
1B	18	STAGE #0	NO	
2B	17	STAGE #1	NO	
3B	16	ERROR	NO	■
5B	14	PASS	NO	
6B	13	UL FAIL	NO	
9B	36	BUSY	NO	
10B	35	END	NO	
12B	33	LL2 FAIL	NO	
13B	32	LL FAIL	NO	
14B	31	UL2 FAIL	NO	

3.6 ERROR 11 Air Operated Valve Error 1

Timing: At the end of PCHK

Criteria: Test pressure sensor (PS) offset exceeds ±1% of the sensor range.

Probable Cause	Treatment
Pilot pressure is not stable or the regulator is not adjusted properly.	Adjust the pilot pressure between 400kPa and 700 kPa. Avoid using air tools branching off the pressure source of the LS-R900 to supply a stable air. Setting up a dedicated pressure source for the LS-R900 is recommended.
Test pressure sensor (PS) offset exceeds ±1% of the sensor range.	Adjust the PS offset or enable Auto-Zero feature to reset the pressure residue of the previous test. **PS Offset:** **Go to:** Maint. > Inspection > Sensor > PS(P1) **PS Auto-Zero:** **Go to:** Settings > Advanced Settings > Test Press > PS Auto-Zero
Charge Delay (DL1) timer is too short	Set the DL1 timer to 0.2 s or longer. **Go to:** Settings > Advanced Settings > Timer > Charge Delay (DL1)
Malfunction of the test pressure sensor (PS), solenoid valve or air-operated valve.	Contact Cosmo for repair.

Output Signal Timing Chart ▼ At the end of PCHK

PIN#		Function	TYPE	WAIT	DL1	PCHK	BLW	EXH	END	WAIT
Standard	D-SUB									
1B	18	STAGE #0	NO			■	■	■	■	
2B	17	STAGE #1	NO							
3B	16	ERROR	NO				■	■	■	■
5B	14	PASS	NO							
6B	13	UL FAIL	NO				■	■	■	
9B	36	BUSY	NO		■	■	■	■	■	
10B	35	END	NO						■	
12B	33	LL2 FAIL	NO				■	■	■	
13B	32	LL FAIL	NO				■	■	■	
14B	31	UL2 FAIL	NO				■	■	■	

3.7 ERROR 12 Air Operated Valve Error 2

Timing: At the end of Pressurization (CHG) or Precharge (PCHG) stage

Criteria: Auto-zero of PS is smaller than 1% of the sensor range at the end of CHG

Probable Cause	Treatment
Pilot pressure is not stable, or the regulator is not adjusted properly.	Adjust the pilot pressure between 400kPa and 700 kPa. Avoid using air tools branching off the pressure source of the LS-R900 to supply a stable air. Setting up a dedicated pressure source for the LS-R900 is recommended.
Pressure source is disconnected.	Check the pressure source and the regulator setting.
Test pressure is too low for high pressure models, H20 and H49.	Adjust the test pressure within the test pressure range.
Malfunction of the test pressure sensor (PS), solenoid valve or air-operated valve.	Contact Cosmo for repair.

Output Signal Timing Chart ▼ ▼ At the end of PCHG or CHG

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BLW	EXH	END	WAIT
Standard	D-SUB												
1B	18	STAGE #0	NO										
2B	17	STAGE #1	NO										
3B	16	ERROR	NO										
5B	14	PASS	NO										
6B	13	UL FAIL	NO										
9B	36	BUSY	NO										
10B	35	END	NO										
12B	33	LL2 FAIL	NO										
13B	32	LL FAIL	NO										
14B	31	UL2 FAIL	NO										

NOTE

When the error occurred in PCHG, stages only in grey areas are applicable but when it occurred in CHG stage, the stages in shadowed areas are also applicable as well.

3.8 ERROR 14 Air Operated Valve Error 4

Timing: At the end of Air-Blow (BLW)

Criteria: The difference pressure during Air-Blow did not reach the Blow ΔP Limit

Probable Cause	Treatment
Pilot pressure is not stable, or the regulator is not adjusted properly.	Adjust the pilot pressure between 400kPa and 700 kPa. Avoid using air tools branching off the pressure source of the LS-R900 to supply a stable air. Setting up a dedicated pressure source for the LS-R900 is recommended.
Air-Blow (BLW) timer is too short or Blow ΔP Limit is too high.	Extend the Air-Blow (BLW) timer or lower the Blow ΔP Limit. **Air-Blow (BLW) Timer:** **Go to:** Settings > Advanced Settings > Timer > Air-Blow (BLW) **Blow ΔP Limit:** **Go to:** Settings > Advanced Settings > Self Check > Blow ΔP Limit
Malfunction of the test pressure sensor (PS), solenoid valve or air-operated valve.	Contact Cosmo for repair.

Output Signal Timing Chart At the end of BLW ▼

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BAL2	DET	BLW	EXH	END	WAIT
Standard	D-SUB																
1B	18	STAGE #0	NO			■	■		■				■		■	■	
2B	17	STAGE #1	NO							■	■	■	■				
3B	16	ERROR	NO												■	■	■
5B	14	PASS	NO											■			
6B	13	UL FAIL	NO												■	■	
9B	36	BUSY	NO		■	■	■	■	■	■	■	■	■	■	■	■	
10B	35	END	NO													■	
12B	33	LL2 FAIL	NO												■	■	
13B	32	LL FAIL	NO												■	■	
14B	31	UL2 FAIL	NO												■	■	

3.9 ERROR 15 Air Operated Valve Error 5

Timing: At the end of Stabilization (BAL2) Only for High press and External Press.

Criteria: Pressure switch monitoring the pilot pressure for the Balance (BAL) valve is not activated.

Probable Cause	Treatment
Pilot pressure is not stable, or the regulator is not adjusted properly.	Adjust the pilot pressure between 400kPa and 700 kPa. Avoid using air tools branching off the pressure source of the LS-R900 to supply a stable air. Setting up a dedicated pressure source for the LS-R900 is recommended.
Malfunction of the pressure switch monitoring the pilot pressure for the Balance (BAL) valve.	Contact Cosmo for repair. As a provisional measure, the pressure switch monitoring can be disabled. **Go to:** Settings > Common Settings > Special > PSW Monitoring > Disable

Output Signal Timing Chart ▼ At the end of BAL2

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BAL2	BLW	EXH	END	WAIT
Standard	D-SUB															
1B	18	STAGE #0	NO			■	■		■							
2B	17	STAGE #1	NO							■	■	■	■	■	■	
3B	16	ERROR	NO										■	■	■	■
5B	14	PASS	NO													
6B	13	UL FAIL	NO										■	■	■	
9B	36	BUSY	NO			■	■	■	■	■	■	■	■	■	■	
10B	35	END	NO												■	
12B	33	LL2 FAIL	NO											■	■	
13B	32	LL FAIL	NO											■	■	
14B	31	UL2 FAIL	NO											■	■	

3.10 ERROR 16 Air Operated Valve Error 6

Timing: During idle state

Criteria: DPS offset exceeded the Idle ΔP Check limit within the programmed Idle ΔP Check Time

Probable Cause	Treatment
DPS offset exceeded its monitoring limit while the LS-R900 is in idle state.	Adjust DPS offset **Go to:** Maint. > Inspection > Sensor > DPS Contact Cosmo for repair if the DPS offset exceeds ±30% of its range.
Exhaust time is insufficient.	Extend Idle ΔP Check Timer or Exhaust timer. **Idle ΔP Check Timer:** **Go to:** Settings > Advanced Settings > Self Check > Idle ΔP Check Timer **Exhaust timer:** **Go to:** Settings > Advanced Settings > Timer > Exhaust(EXH)
Malfunction of the fill valve: SV1 or AV1	Contact Cosmo for repair.

Output Signal Timing Chart ▼ During idle state

PIN#		Function	TYPE	WAIT
Standard	D-SUB			
1B	18	STAGE #0	NO	
2B	17	STAGE #1	NO	
3B	16	ERROR	NO	
5B	14	PASS	NO	
6B	13	UL FAIL	NO	
9B	36	BUSY	NO	
10B	35	END	NO	
12B	33	LL2 FAIL	NO	
13B	32	LL FAIL	NO	
14B	31	UL2 FAIL	NO	

3.11 ERROR 17 Blockage Check Error

Timing: At the end of Pressurization (CHG)

Criteria: The Blockage data exceeded the programmed tolerance sampled Blockage Check data in the Memory.

Probable Cause	Treatment
Something is blocking the air way of the external pneumatic circuits (valves).	Check the external pneumatic circuit (valves)

Output Signal Timing Chart ▼ At the end of CHG

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BLW	EXH	END	WAIT
Standard	D-SUB												
1B	18	STAGE #0	NO										
2B	17	STAGE #1	NO										
3B	16	ERROR	NO										
5B	14	PASS	NO										
6B	13	UL FAIL	NO										
9B	36	BUSY	NO										
10B	35	END	NO										
12B	33	LL2 FAIL	NO										
13B	32	LL FAIL	NO										
14B	31	UL2 FAIL	NO										

3.12 ERROR 21 DPS Stopped Oscillating

Timing: Always monitored

Criteria: DPS stopped oscillating.

Probable Cause	Treatment
Malfunction of the DPS or power source or cable disconnection	Contact Cosmo for repair.

Output Signal Timing Chart ▼ During power-on check procedure

PIN#		Function	TYPE	WAIT
Standard	D-SUB			
1B	18	STAGE #0	NO	
2B	17	STAGE #1	NO	
3B	16	ERROR	NO	
5B	14	PASS	NO	
6B	13	UL FAIL	NO	
9B	36	BUSY	NO	
10B	35	END	NO	
12B	33	LL2 FAIL	NO	
13B	32	LL FAIL	NO	
14B	31	UL2 FAIL	NO	

3.13 ERROR 22 Stop Valves Closed

Timing: At the end of PCHK

Criteria: The stop valve monitoring switch is ON/OFF

Probable Cause	Treatment
Stop valves of WORK and MASTER ports are closed, which disturb the cover from closing. (The stop valve monitoring switch is not pressed.)	Open the stop valves.
If the error occurs even though the stop valves are opened, the stop valve monitoring switch may be malfunctioned.	Contact Cosmo for repair.

Output Signal Timing Chart ▼ At the end of PCHK

PIN#		Function	TYPE	WAIT	DL1	PCHK	BLW	EXH	END	WAIT
Standard	D-SUB									
1B	18	STAGE #0	NO							
2B	17	STAGE #1	NO							
3B	16	ERROR	NO							
5B	14	PASS	NO							
6B	13	UL FAIL	NO							
9B	36	BUSY	NO							
10B	35	END	NO							
12B	33	LL2 FAIL	NO							
13B	32	LL FAIL	NO							
14B	31	UL2 FAIL	NO							

3.14ERROR 23 Mastering Error

Timing: At the end of the last iteration of DET for Mastering value sampling

Criteria: Leak data at the end of the last DET iteration exceeded the Mastering Limit in the Mastering Sampling.

Probable Cause	Treatment
Pressurization and stabilization time is insufficient	Extend Charge(CHG) and Balance (BAL2) timers. **Go to:** Settings > Advanced Settings > Timer > Charge(CHG) / Balance(BAL2)
MB1(Mastering Equalization) timer, MB2(Mastering Stabilization) timer and/or Mastering Iterations are inappropriate.	Check the each setting. **Go to:** Comp. > Mastering Settings > Basic **Ref:** The recommended settings for MB1 and MB2 timers are 0.5 s. Make sure that the last DET data is not a negative figure.
Upper and Lower limits for Mastering are inappropriate.	Set larger limits. **Go to:** Comp. > Mastering Settings > Basic > High Limit / Lo Limit **Ref:** Typically the Mastering limits are set to be about 120 to 150% of the 1st DET in a Mastering value sampling. Default: ±250[Pa]

Output Signal Timing Chart Last iteration of DET for Mastering value sampling▼

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BAL2	DET	BLW	EXH	END	WAIT
Standard	D-SUB																
1B	18	STAGE #0	NO			■	■		■				■				
2B	17	STAGE #1	NO							■	■	■	■				
3B	16	ERROR	NO													■	■
5B	14	PASS	NO											■	■		
6B	13	UL FAIL	NO													■	
9B	36	BUSY	NO		■	■	■	■	■	■	■	■	■	■	■	■	
10B	35	END	NO													■	
12B	33	LL2 FAIL	NO													■	
13B	32	LL FAIL	NO													■	
14B	31	UL2 FAIL	NO													■	

3.15 ERROR 24 K(Ve) Value Out of Range

Timing: The last DET in K(Ve) Automatic Setup

Criteria: Calculated K(Ve) exceeded 100L.

Probable Cause	Treatment
The current K(Ve) settings does not match the calibrator used for K(Ve) Automatic Setup causing the measured value exceeding 100L.	Check the settings for the calibrator. **Go to:** K(Ve) > K(Ve)Settings > Basic The items are to be set varies depending on the calibrator used for K(Ve) Automatic Setup. **ALC:** ALC Displacement or ALC Reading **Leak Master:** LM Flow [mL/min]

Output Signal Timing Chart At the end of last DET in K(Ve) Automatic Setup▼

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BAL2	DET	BLW	EXH	END	WAIT
Standard	D-SUB																
1B	18	STAGE #0	NO			■	■		■				■				
2B	17	STAGE #1	NO							■	■	■	■				
3B	16	ERROR	NO											■	■	■	■
5B	14	PASS	NO														
6B	13	UL FAIL	NO											■	■	■	
9B	36	BUSY	NO		■	■	■	■	■	■	■	■	■	■	■	■	
10B	35	END	NO													■	
12B	33	LL2 FAIL	NO											■	■	■	
13B	32	LL FAIL	NO											■	■	■	
14B	31	UL2 FAIL	NO											■	■	■	

3.16 ERROR 25 Leak Limit Out of Range

Timing: The last DET in K(Ve) Automatic Setup

Criteria: K (Ve) Leak limits exceeded the DPS range after K(Ve) Automatic Setup

Probable Cause	Treatment
Leak limits exceeded the DPS range after executing the K(Ve) Automatic Setup.	Change the Leak unit to a pressure unit and perform K(Ve) Automatic Setup again. **Go to:** Settings > Advanced Settings> Unit > Leak

Output Signal Timing Chart At the end of last DET in K(Ve) Automatic Setup▼

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BAL2	DET	BLW	EXH	END	WAIT
Standard	D-SUB																
1B	18	STAGE #0	NO			■	■		■				■				
2B	17	STAGE #1	NO							■	■	■	■				
3B	16	ERROR	NO											■	■	■	■
5B	14	PASS	NO														
6B	13	UL FAIL	NO											■	■	■	
9B	36	BUSY	NO		■	■	■	■	■	■	■	■	■	■	■	■	
10B	35	END	NO													■	
12B	33	LL2 FAIL	NO											■	■	■	
13B	32	LL FAIL	NO											■	■	■	
14B	31	UL2 FAIL	NO											■	■	■	

3.17 ERROR 51 to ERROR 61 System Errors

Usually system errors (ERROR 51 to ERROR 61) are caused by malfunction of electrical components.

NOTE
ERROR 51 (Lo Battery SRAM Error) may occur because of the battery life.

System Errors

Error Code	Error Message	Description
ERROR 51	Lo Battery SRAM Error	**Probable Cause 1** The battery has discharged completely. **Treatment 1** If this error occurs, none of the measurements is enabled. Replace the battery instantly following the procedures in the manual (8 Maintenance). **Probable Cause 2** If the same error occurs after replacing the battery, some electrical parts may be malfunctioned. **Treatment 2** Contact Cosmo for repair after executing a System Back up following the instruction below:
ERROR 52	SPI2-res	AD Communication failure
ERROR 53	SPI1-res	I/O Communication failure
ERROR 59	Flash data area bad track Error	
ERROR 60	Flash program area WR Error Kernel	
ERROR 61	RAM checksum Error	

Contact Cosmo for repair after executing System Backup.

Refer to "**7 OPERATIONS LISTED BY PURPOSE**" for the details.

Output Signal Timing Chart ▼ At the start of measurement

PIN#		Function	TYPE	WAIT	DL1
Standard	D-SUB				
1B	18	STAGE #0	NO		
2B	17	STAGE #1	NO		
3B	16	ERROR	NO		
5B	14	PASS	NO		
6B	13	UL FAIL	NO		
9B	36	BUSY	NO		
10B	35	END	NO		
12B	33	LL2 FAIL	NO		
13B	32	LL FAIL	NO		
14B	31	UL2 FAIL	NO		

4 Large Leak List

Display	Probable Cause	Treatment
CHG Large Leak WORK side CHG Large Leak MASTER side	There is a large leak on the WORK/MASTER side system.	Check the seals, part and fittings for possible leaks.
DL2 Large Leak WORK side DL2 Large Leak MASTER side	There is a large leak on the WORK/MASTER side system.	Check the seals, part and fittings for possible leaks.
	Pressurization and stabilization time is insufficient.	Extend Precharge (PCHG), Pressurization (CHG) or Equalization (BAL1) timer. **Go to:** Settings > Advanced Settings > CHG Options > Precharge Timer(PCHG) Settings > Advanced Settings > Timer > Pressurization (CHG) Settings > Advanced Settings > Timer > Equalization (BAL1)
BAL2 Large Leak WORK side BAL2 Large Leak MASTER side	There is a large leak on the WORK/MASTER side system.	Check the seals, part and fittings for possible leaks.
	Pressurization and stabilization time is insufficient.	Extend Pressurization (CHG) or Equalization (BAL1) timer. **Go to:** Settings > Advanced Settings > Timer > Pressurization (CHG) Settings> Advanced Settings > Timer > Equalization (BAL1)
DET Large Leak WORK side DET Large Leak MASTER side	There is a large leak on the WORK/MASTER side system.	Check the seals, part and fittings for possible leaks.
	Pressurization and stabilization time is insufficient.	Extend Pressurization (CHG) or Stabilization (BAL2) timer. **Go to:** Settings > Advanced Settings > Timer > Pressurization (CHG) Settings> Advanced Settings > Timer > Stabilization (BAL2)

If the problem persists without identifiable causes, please conduct the No Leak Check.

1) Close both the WORK and MASTER stop valves on the rear panel of the tester.

2) **Go to:**
   Maint. > Inspection > Leak Check > No-Leak Check

Contact Cosmo for repair, if internal leak is found.

4.1 Output Signal Timing Charts for Large Leak Timing

CHG Large Leak WORK side ▼

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BLW	EXH	END	WAIT
Standard	D-SUB												
1B	18	STAGE #0	NO										
2B	17	STAGE #1	NO										
3B	16	ERROR	NO										
5B	14	PASS	NO										
6B	13	UL FAIL	NO										
9B	36	BUSY	NO										
10B	35	END	NO										
12B	33	LL2 FAIL	NO										
13B	32	LL FAIL	NO										
14B	31	UL2 FAIL	NO										

Large Leak MASTER side ▼

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BLW	EXH	END	WAIT
Standard	D-SUB												
1B	18	STAGE #0	NO										
2B	17	STAGE #1	NO										
3B	16	ERROR	NO										
5B	14	PASS	NO										
6B	13	UL FAIL	NO										
9B	36	BUSY	NO										
10B	35	END	NO										
12B	33	LL2 FAIL	NO										
13B	32	LL FAIL	NO										
14B	31	UL2 FAIL	NO										

DL2, BAL2 DET WORK/Master side

See the tables in the next page for the judgment timing.

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BAL2	DET	BLW	EXH	END	WAIT
Standard	D-SUB																
1B	18	STAGE #0	NO														
2B	17	STAGE #1	NO														
3B	16	ERROR	NO														
5B	14	PASS	NO														
6B	13	UL FAIL	NO	Varies depending on the stage that Large Leak was detected													
9B	36	BUSY	NO														
10B	35	END	NO														
12B	33	LL2 FAIL	NO	Varies depending on the stage that Large Leak was detected													
13B	32	LL FAIL	NO														
14B	31	UL2 FAIL	NO														

Output Signal Timing Charts

DL2 Large Leak WORK side

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BLW	EXH	END	WAIT
Standard	D-SUB											▼			
6B	13	UL FAIL	NO									■	■	■	
12B	33	LL2 FAIL	NO												
13B	32	LL FAIL	NO												
14B	31	UL2 FAIL	NO									■	■	■	

DL2 Large Leak MASTER side

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BLW	EXH	END	WAIT
Standard	D-SUB											▼			
6B	13	UL FAIL	NO												
12B	33	LL2 FAIL	NO									■	■	■	
13B	32	LL FAIL	NO									■	■	■	
14B	31	UL2 FAIL	NO												

BAL2 Large Leak WORK side

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BAL2	BLW	EXH	END	WAIT
Standard	D-SUB												▼			
6B	13	UL FAIL	NO										■	■	■	
12B	33	LL2 FAIL	NO													
13B	32	LL FAIL	NO													
14B	31	UL2 FAIL	NO										■	■	■	

BAL2 Large Leak MASTER side

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BAL2	BLW	EXH	END	WAIT
Standard	D-SUB												▼			
6B	13	UL FAIL	NO													
12B	33	LL2 FAIL	NO										■	■	■	
13B	32	LL FAIL	NO										■	■	■	
14B	31	UL2 FAIL	NO													

DET Large Leak WORK side

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BAL2	DET	BLW	EXH	END	WAIT
Standard	D-SUB													▼			
6B	13	UL FAIL	NO											■	■	■	
12B	33	LL2 FAIL	NO														
13B	32	LL FAIL	NO														
14B	31	UL2 FAIL	NO											■	■	■	

DET Large Leak MASTER side

PIN#		Function	TYPE	WAIT	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BAL2	DET	BLW	EXH	END	WAIT
Standard	D-SUB													▼			
6B	13	UL FAIL	NO														
12B	33	LL2 FAIL	NO											■	■	■	
13B	32	LL FAIL	NO											■	■	■	
14B	31	UL2 FAIL	NO														

5 Frequent (+) Fails

Follow the procedures below to identify the cause of the frequent fails and remedy the problem.

1 Perform a No-Leak Check with the stop valves on the rear panel closed.

If the LS-R900 is not leaking, the cause of the frequent fails is something else. Proceed to the next item to check. Contact Cosmo for repair if internal leak is found.

2 Check the fixture condition.

Probable Cause	Treatment
Leaks from tube fittings	Look for leaks in the fittings by performing a bubble test applying soap solution. Redo the tubing if needed.
Deformation of tube	Replace the tube with the harder one that does not deform with the air pressure.
Proceed to the next item to check if the problem persists without identifiable causes.	

3 Check the sealing condition.

Probable Cause	Treatment
Sealing material is missing.	Place the sealing material.
Sealing surface is contaminated.	Clean the sealing surface.
Sealing material is damaged or worn-out.	Replace it with a new one.
Sealing deforms when the fixture clamps.	Check the follows: • Whether the clearance between the sealing material and the groove is enough • Wear of the stopper • Whether the size and hardness of the sealing material are appropriate • If the thrust force of the cylinder has lowered
Proceed to the next item to check if the problem persists without identifiable causes.	

4 Check whether there were environmental changes.

Probable Cause	Treatment
Tested part is exposed to the direct wind from air conditioner or fan.	Move the source of the wind to where the wind directly hits the tested parts.
Some air tools are branched off the pressure source for the LS-R900 causing fluctuation in the pressure source.	Avoid using air tools branching off the pressure source for the tester to supply a stable air. Setting up a dedicated pressure source for the LS-R900 is recommended.
Air compressor capacity is insufficient.	Use the air compressor whose capacity is large enough.
The current compensation value may not be suitable for the current environmental condition.	Update the compensation value.
Proceed to the next item to check if the problem persists without identifiable causes.	

5 Check the condition of the tested parts.

Probable Cause	Treatment
Part temperature is higher or lower than the ambient temperature.	Let the part temperature be ambient by adding a cooling/warming buffer in the production line.
The tested parts are wet.	Improve the drying process or add one if there isn't any.
The tested parts get deformed by pressurization.	Add a stopper to prevent the deformation.
Leak due to the gas porosity or internal leak	Look for leaks in the fittings by performing a bubble test applying soap solution. Redo the tubing if needed. If no leak is confirmed, there may be internal leaks. If there is a leak, re-evaluate the production process.

6 Frequent (-) Fails

There are two types of the causes for the negative fails. One is caused by a pressure rise in WORK-side circuit and the other is caused by a pressure reduction in the MASTER side circuit.

Follow the procedures below to identify the cause of the frequent fails and remedy the problem.

1 Perform a No-Leak Check with the stop valves on the rear panel closed.

If the LS-R900 is not leaking, the cause of the frequent fails is something else. Proceed to the next item to check. Contact Cosmo for repair if internal leak is found.

2 By a pressure rise in WORK-side circuit

Probable Cause	Treatment
Sealing is not stable.	Check the follows: • Whether there is enough clearance between the sealing material and the groove. • Wear of the stopper • Whether the size and hardness of the sealing material are appropriate • Whether the thrust force of the cylinder is too high
A rise in temperature of the air inside the tested part due to the temperature rise of the cold tested part trying to match the ambient temperature.	Let the part temperature be ambient by adding a cooling/warming buffer in the production line. If the part is wet, add or improve the drying process.
Proceed to the next item to check if the problem persists without identifiable causes.	

3 By a pressure reduction in MASTER side circuit

Probable Cause	Treatment
There are leaks from the Master or the fittings on the MASTER side.	Check Master part and the fittings for possible leaks. Replace the Master part and fittings if leaks are found.
Deformation of MASTER side tube	Replace it with tube that is rigid enough not to deform.
Adiabatic compression effect of the Master	The size of the Master Chamber may be wrong, or the BAL2 timer may be too short. Replace the master to the one with good temperature stability. Extend BAL2 timer if possible.
Proceed to the next item to check if the problem persists without identifiable causes.	

4 By over compensation

Probable Cause	Treatment
The current compensation value may not be suitable for the current environmental condition.	Update the compensation value.

SPECIFICATIONS/REFERENCE

10 SPECIFICATIONS

1 Primary Specifications

Differential Pressure Sensor (Standard)	Resolution: 0.1 Pa Display Range: ±2500 Pa Accuracy Guaranteed Range: ±1000 Pa Sensor Range: ±2000 Pa Sensor Proof Pressure: 5 MPa Reading Accuracy: ±2.5% of rdg ±1Pa 50Pa or lower: ±2Pa ***1**		
Test Pressure Sensor	Reading Accuracy: ±1% of F.S. ±1 digit (Linearity, Hysteresis and Repeatability) Temperature Characteristics: ±0.1% of F.S. / °C		
Display Unit ***2**	Test Pressure	kPa, MPa (PSI, kg/cm^2, bar, mbar, mmHg, cmHg, inHg)	
	Leak ***3**	Pa, kPa, mL/s, mL/min, L/min (mmH_2O, inH_2O, mmHg, in^3/min, in^3/d, , ft^3/h)	
Leak Display		3 to 5 digits (Floating point) Sampling Rate: 10 times/s	
Leak Limit Range (Standard)		Up to ±999.9 Pa	
Number of Channels		32 channels (#0 to #31)	
Timers		Up to 999.9 s (Resolution: 0.1 s)	
Power Source		100 to 240 VAC ±10% at 50/60 Hz, 80 VA max Fuse: T2.5A 250V Dielectric strength voltage and resistance: 1400 VAC 10 sec, DC500 V 50 MΩ Internal Solenoid Power Source: 24VDC	
Test Pressure source		Clean air regulated to the test pressure. The source pressure must be sufficiently higher than the test pressure.	
Pilot Pressure		Clean air regulated in the range from 400 to 700 kPa	
Port Size		Rc(PT) 1/4 (Test pressure, Pilot pressure, WORK and MASTER ports)	
CPU		ARM9 400MHz, DRAM 128MB	
LCD/TP		5.7 inch color LCD 640 x 480 dot (VGA)	
Ambient Temperature		Operation Temperature: 5 to 45°C Storage Temperature: -20 to 60°C Consult with manufacturer for high temperature applications	
Humidity		80 %RH or less / no dew condensation	
Mass		Approx. 10 kg (Standard model)	
Control I/O Port		Input Signal: Start, Stop, etc. Output: Pass, UL Fail, LL Fail, etc.	
RS232C Serial Communication 2 ports (D-sub 9 pins)	I/F fixed length ID/F fixed length	Test parameters are transmitted as well as test results.	
	T/F fixed length	Only test results are transmitted	
	Others	Special formats	
USB Port	Test Data	Judgment, Leak, Compensation value, Test pressure, Channel#, Timers, etc.	
	Copying test parameters	csv file	
	Test Parameter Backup/Restore, System Backup/Restore, Firmware upgrade		
LAN Port	FTP server (Plan)		
Calibration / Maintenance Ports	M10 x 1.5 (O ring seal)		
EP Regulator	Repeatability: ±0.5% of F.S. or less Temperature Characteristics: ±0.16% of F.S./°C		
Standard Accessories	Power cord	For Japan: Rating: 125VAC/7A Length: 3m For overseas: Rating: 250VAC/10A Length: 2m (CE conformed)	
	Quick mounting brackets, Control I/O connector, Operation manual CD, Inspection record, Traceability documents		
Environmental Conditions (IEC 61010-1)	Over voltage category II Pollution degree 2 Altitude 2000m or lower	Protection class I Place to use: indoor	

***1** For the option D4: DPS 10kPa, the reading accuracy is ± 5% of rdg ±0.01kPa.

***2** The units in ( ) are not available for SI unit restriction models.

***3** Refer to "**11 REFERENCE**" for the details.

NOTE

Use a power cord that complies with the local standard and regulations.

2 Model Classifications

LS-R900-A B Option

A: Pneumatic Circuit

Intelligent 1 Pneumatic Circuit	A1	Large flow circuit with great sensor protection features
Intelligent 2 Pneumatic Circuit	A2	Equipped with an equalization valve and additional self-check features to A1 circuit
Micro Volume Circuit	AS01	For the parts whose volume is approx. 10 mL or smaller and the leak specifications are quite small.
Small Volume A1 Circuit	AS1	For the parts whose volume is approx. 100 mL or smaller and high detection performance is required.
Secondary Pressure Circuit	C	For external pressure (secondary pressure) test

B: Test Pressure Range and Regulator Specifications

Precision Regulator Model	Micro Low	L02	Test pressure range: 5 to 20 kPa (PS 20 kPa, Regulator: 200 kPa)
	Low	L	Test pressure range:10 to 100 kPa (PS 100 kPa, Regulator: 200 kPa)
	Medium	M	Test pressure range:50 to 800kPa (PS 1MPa, Regulator: 0.8 MPa)
	High	H20	Test pressure range:2.0 MPa or lower (PS 2 MPa, without regulator) ***1**
	Extremely High	H49	Test pressure range:4.9 MPa or lower (PS 5MPa, without regulator) ***1**
	Vacuum	V	Test pressure range: -5 to -100 kPa (PS -100 kPa)
EP Regulator Model ***2**	Low	LR	Test pressure range:10 to 95 kPa (PS 100 kPa, Regulator: 100 kPa)
	Medium	MR	Test pressure range:50 to 800 kPa (PS 1MPa, Regulator: 0.9 MPa)
	Vacuum	VR	Test pressure range: -5 to -75 kPa (PS -100 kPa, Regulator: -80 kPa)

***1** H20 and H49 do not conform to the UL Standards.

***2** EP = Electropneumatic

Options

Calibrator	J	Come with CAL driving valve for Leak Master	The valve opens/closes automatically during K(Ve) calibration and K(Ve) check. Not available for H20 and H49 models Leak Master is sold separately.	
	K05	Come with ALC ***3**	Max. Volume Change: 0.5mL	For Low, Medium and High press. with small volume part
	K1		Max. Volume Change: 1mL	For Low, Medium and High press with small to medium volume part
	K4		Max. Volume Change: 4mL	For Low, Medium and Vacuum press with medium to large volume part
	K10		Max. Volume Change: 10mL	For Low, Medium and Vacuum press with large volume part
Bypass Circuit Ready without Precision Regulator	B	Comes with a valve to control the separately sold Bypass Circuit Unit The Bypass Circuit Unit is equipped with a precision regulator.		
Nylon Filter Housing	RX02	Filter housing for the pilot pressure port is nylon.		
	RX03	Filter housings for the pilot pressure and test pressure ports are nylon.		
DPS 10kPa ***4**	D4	Sensor range: ±10 kPa Display range: ±10 kPa Resolution: 1 Pa		
Pressure/Vacuum Pressure Sensor	PV1	Equipped with a Pressure/Vacuum pressure sensor There are 2 sensor ranges: For Low press: ± 100 kPa For Medium press:-100 to 1000 kPa		

***3** ALC = Auto Leak Calibrator

***4** DPS = Differential pressure sensor


MEMO

11 REFERENCE

1 Leak Testing Overview

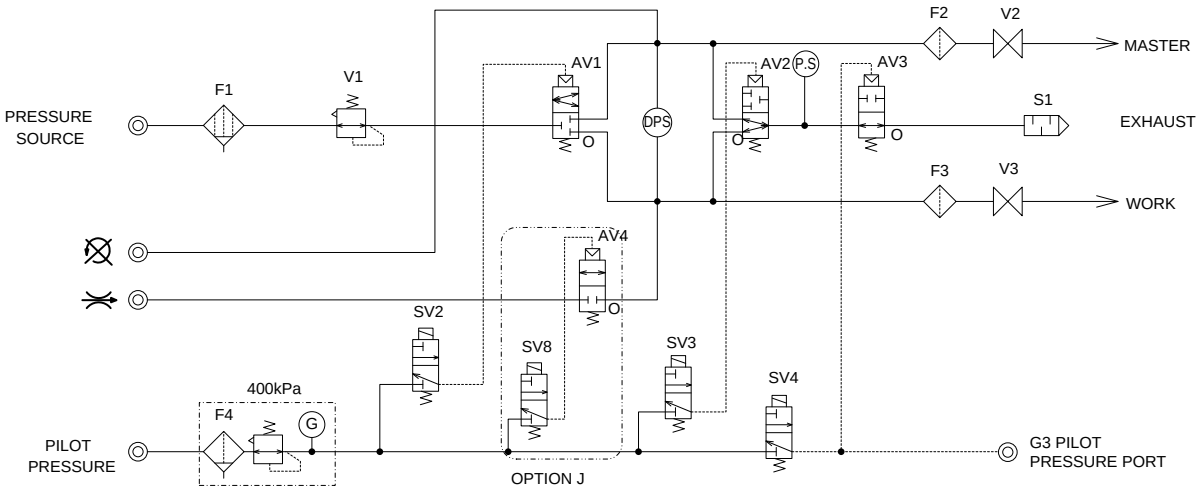
After a non-leaking reference part (MASTER) and a tested part (WORK) are pressurized simultaneously, isolating the MASTER and WORK from the pressure source, and the differential pressure sensor (DPS) measure the pressure drop resulting by leaks.

1.1 Stage Summary

Stages

Start	After clamping and sealing a WORK, initiates a start signal.
Charge (CHG)	Pressurizes or evacuates the WORK and the MASTER for testing.
Balance delay (BAL1)	Stops supply of test pressure. Waits for decrease in pressure changes caused by valve operation.
Balance (BAL2)	Isolates the WORK and the MASTER from each other to measure the pressure difference between them. Detects large leaks.
Detection (DET)	Detects small leaks. Drift compensation will be performed.
Air-blow, Exhaust and End (BLW, EXH, END)	Transmits judgment signal, and exhausts air from inside the WORK and MASTER from the exhaust port. Simultaneously, air-blow is performed to clean inside the tester.

Basic Type Pneumatic Circuit (A2 Medium pressure)



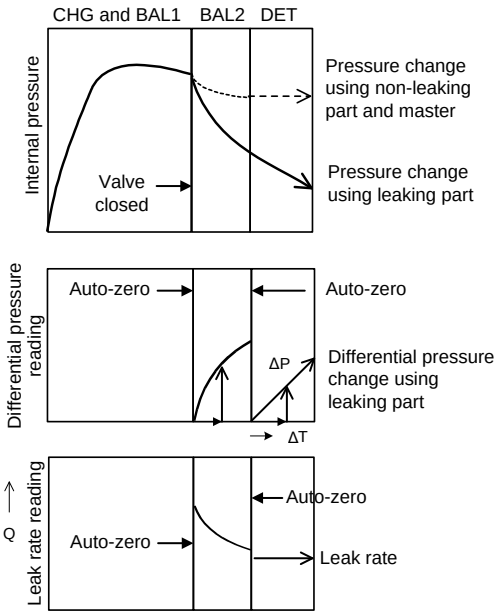
Timing Chart

Solenoid Valve	DL1		CHG	BAL1	BAL2	DET	BLW	END
SV2								
SV3								
SV4								

PCHK (Fixed to 0.2s)

1.2 Internal Pressure Changes of the WORK And MASTER

The figure on the right shows the pressure changes inside the WORK and the MASTER.



In the BAL2 and the DET stages, the differential pressure resulting from leaks rises at a constant rate with time. In the DET stage, the differential pressure sensor (DPS) output is zeroed through an automatic zero operation before a differential pressure reading is produced.

Leak rate is calculated using the following equation:

$Q = K(Ve) \cdot \Delta P / \Delta T$

Where:

Q: Leak rate (mL/min)
K(Ve): Leak coefficient (equivalent internal volume)
ΔP: Differential pressure
ΔT: Time

1.3 Leak Rate Conversion

Detected differential pressure can be converted into leak rate (mL/min) using a conversion equation derived from Boyle's Law. Using the unit's leak calibration facility makes calculations based on the conversion equation unnecessary.

Pressure and Volume Relationship

The relationship between pressure and volume is stated in Boyle's law, which establishes that, for an ideal gas, pressure multiplied by volume is constant at a constant temperature. Boyle's law can be represented by the following equation:

PV = constant (where P is absolute pressure)

The amount of leakage to atmosphere is calculated and expressed by the following equation derived from Boyle's law.

$$\text{Leak}(\Delta V_L) = Ve \times \Delta P / Patm$$

Where:

ΔV_L: Leak [mL]
Ve: Equivalent internal volume [mL]
ΔP: Pressure drop due to a leak [Pa]
Patm: Atmospheric pressure [Pa]

NOTE

The definition of internal equivalent volume, Ve, is the volume of air of the entire WORK-side pneumatic circuit at a particular test pressure. Ve is used as the leak coefficient K(Ve) in the leak rate calculation.

Equivalent Internal Volume

1) Equation for calculating equivalent internal volume
Equivalent internal volume can be calculated with the following equation:

$$Ve = Vw + Vt + \{Ks \times (1 + (Vw + Vt)/(Vm + Vt)) + Kw\} \times (101.3 + P) \quad \text{----- A}$$

Where:

Ve:	Equivalent internal volume [mL]
Vw:	Internal volume of the WORK and the tubing [mL]
Vm:	Internal volume of the MASTER and the tubing [mL]
Vt:	Tester internal volume [mL] (= 11 mL) (Standard pneumatic circuit)
Ks:	Change in internal volume of the sensor per unit pressure change [mL/kPa] (= 0.005 mL/kPa)
Kw:	Change in internal volume of the WORK per unit pressure change [mL/kPa]
P:	Test pressure [kPa]

Tester internal volume, Vt, of each pneumatic circuit (including CAL port)
Intelligent 1 pneumatic circuit, A1: 11 mL
Intelligent 2 pneumatic circuit, A2: 13 mL
A1 pneumatic circuit for small volume, AS1: 11mL
Small volume pneumatic circuit, A01, with stop valves: 6 mL
Secondary pressure detection method C: 7 mL

2) Equivalent internal volume when the internal volume of the MASTER is almost equal to that of the WORK (Tested part) (Vw = Vm)

(In other words, the MASTER-side circuit is same in volume as the WORK-side, and both are rigid enough that the test pressure does not physically change their dimensions.)
If the internal volume of the WORK remains unchanged (Kw = 0) during detection even though charged with pressure, **Equation A** can be simplified to **Equation B**:

$Ks(1 + Vw/Vm) + Kw = 2Ks = 0.01$ [mL/kPa]

$$Ve = Vw + Vt + 0.01 \times (101.3 + P) \quad \text{----- B}$$

3) Equivalent internal volume when a Master Chamber (**i.g.** MC-F02A, whose internal volume is 109 mL) is used as a MASTER

If the internal volume of the WORK remains unchanged (Kw = 0) during detection even though charged with pressure, **Equation A** can be simplified to **Equation C**:

$$Ve = Vw + Vt + 0.005 \times (1 + Vw/109) \times (101.3 + P) \quad \text{----- C}$$

NOTE
When the volume of the MASTER is smaller than that of the WORK, Ve becomes larger, which causes lowering the DPS sensitivity.

Calculation of Leak Rate

The relationship between differential pressure and leak rate per unit time is given by the following equation:

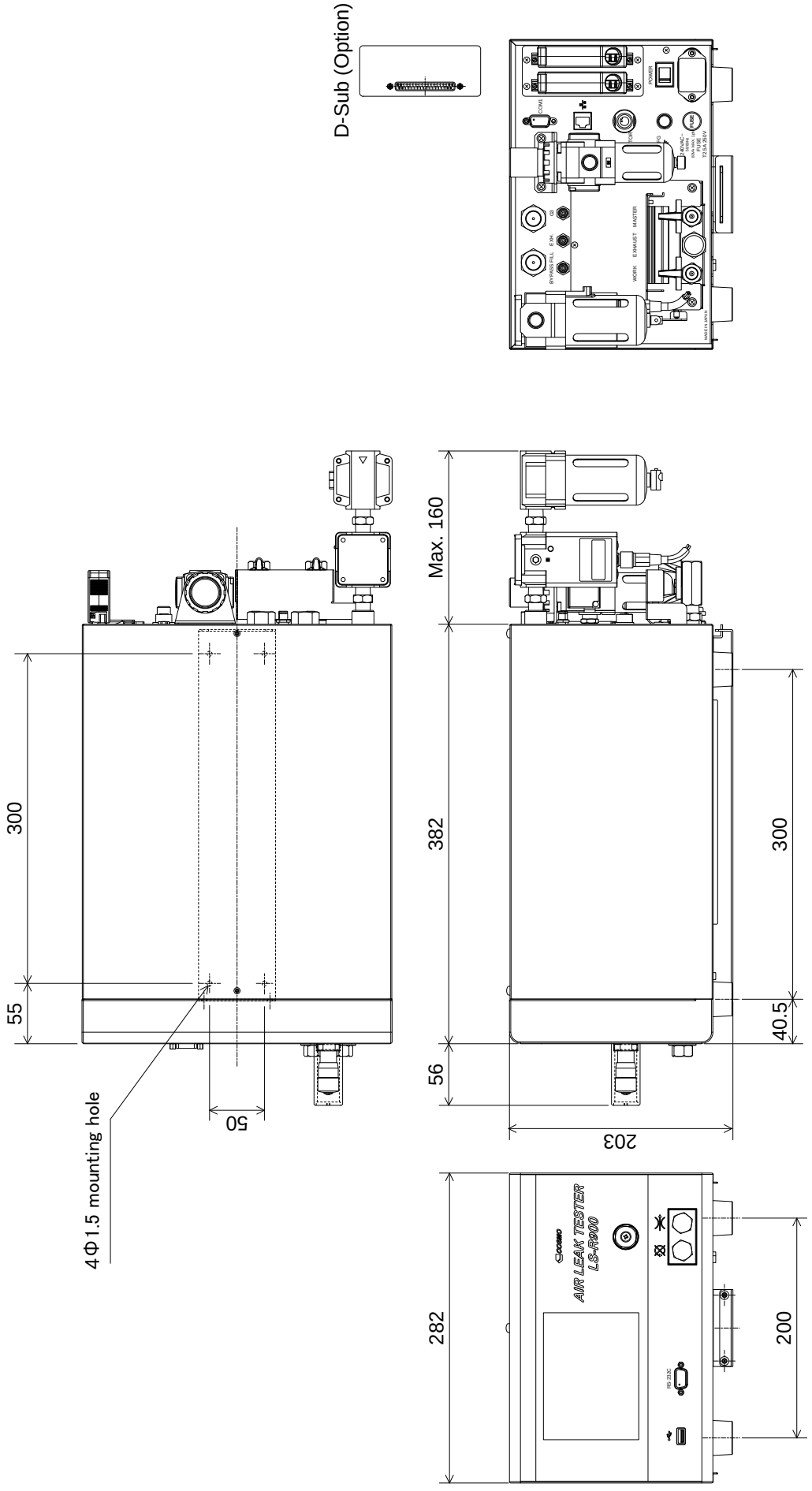
$$Q = Ve \times \frac{\Delta P}{1.013 \times 10^5} \times \frac{60}{T}$$

Where:

Q:	Volumetric leak rate [mL/min]
P:	Pressure drop due to leaks [Pa]
Ve:	Equivalent internal volume [mL]
T:	Detection time(s)

The LS-R900 uses the above equation to calculate the leak rate. Note that the tester uses standard atmospheric pressure for this calculation.

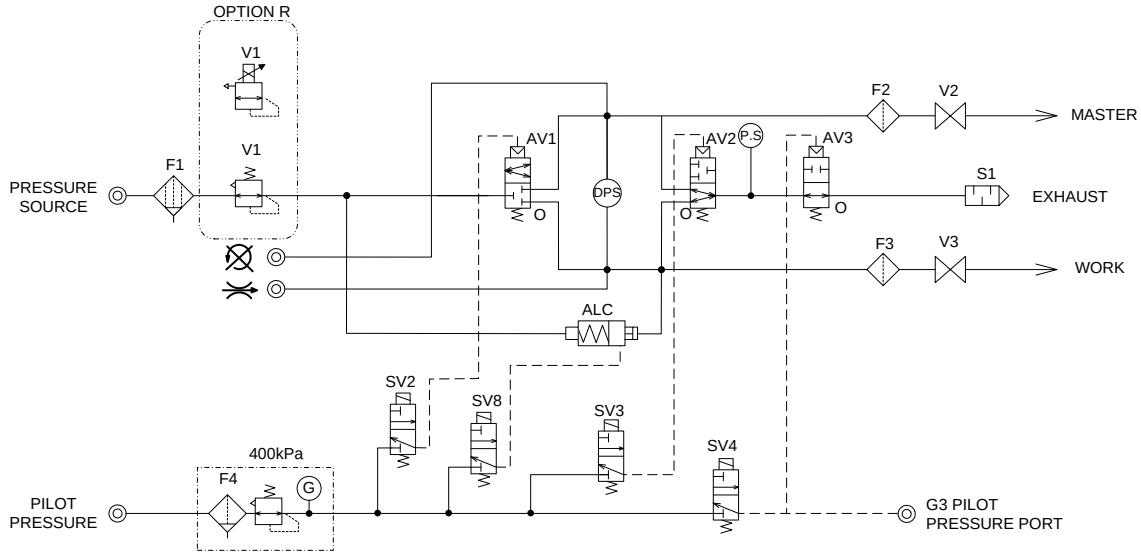
2 External Appearance



3 Pneumatic Circuit

NOTE
The actual circuit may not be same as the drawing.

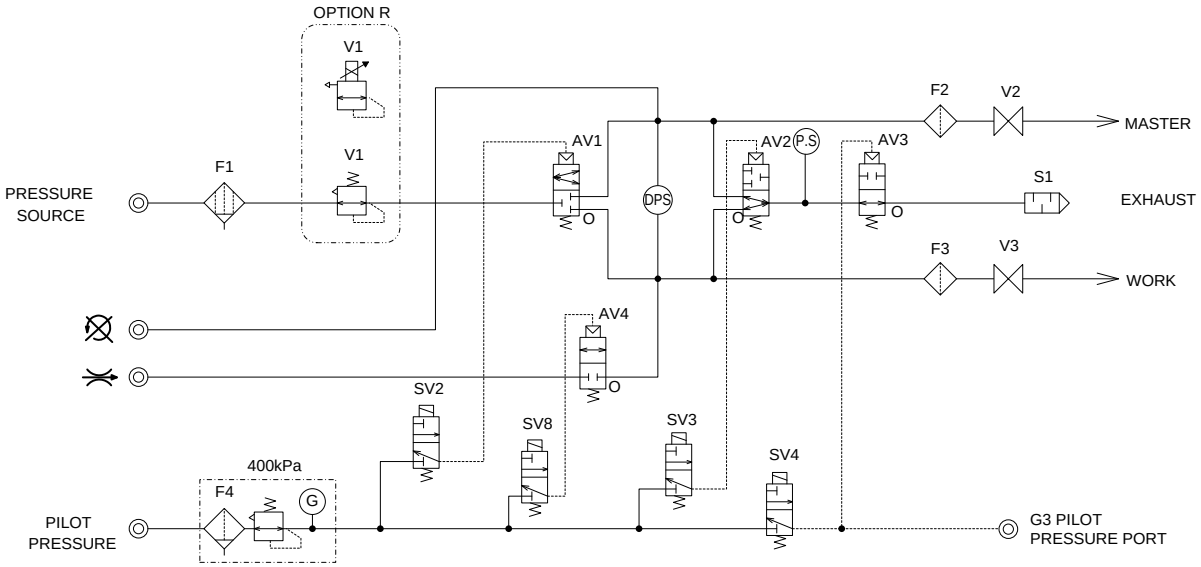
A2 Type K (Medium Pressure: M / Low Pressure: L)



	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BAL2	DET	BLOW	EXH	END
SV2		■	■		■					■		
SV3	■	■					■	■	■			
SV4		■	■		■	■	■	■	■			
*SV8									■			

*SV8 is for K(Ve) Automatic Setup and K(Ve) Check.

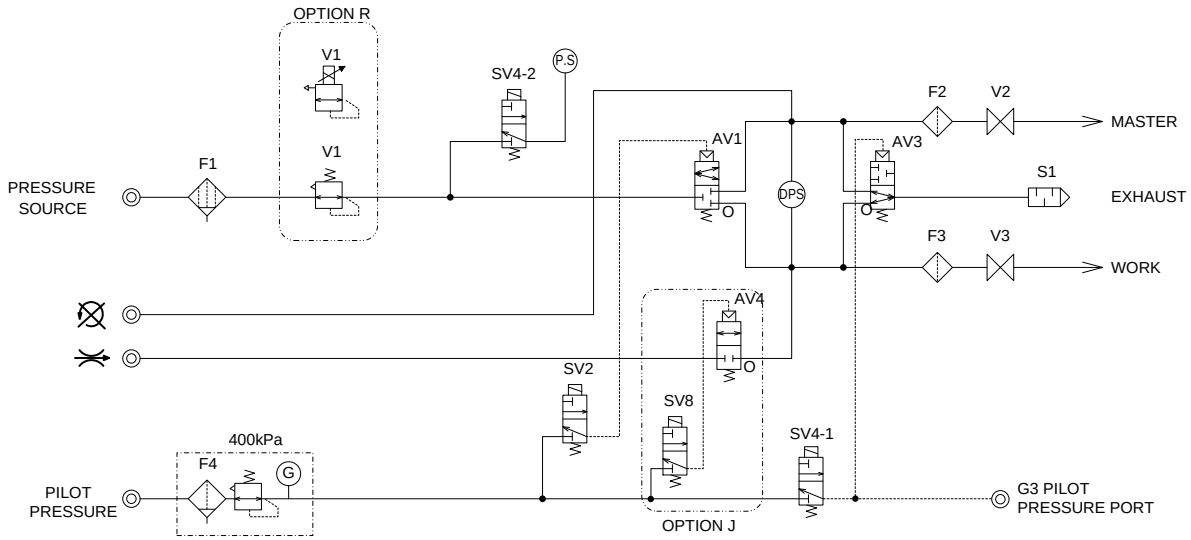
A2 Type J (Medium Pressure: M / Low Pressure: L)



	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BAL2	DET	BLOW	EXH	END
SV2		■	■		■					■		
SV3	■	■					■	■	■			
SV4		■	■		■	■	■	■	■			
SV5												
SV7												
*SV8	■	■	■	■	■	■	■	■	■	■	■	■

*SV8 is for K(Ve) Automatic Setup and K(Ve) Check.

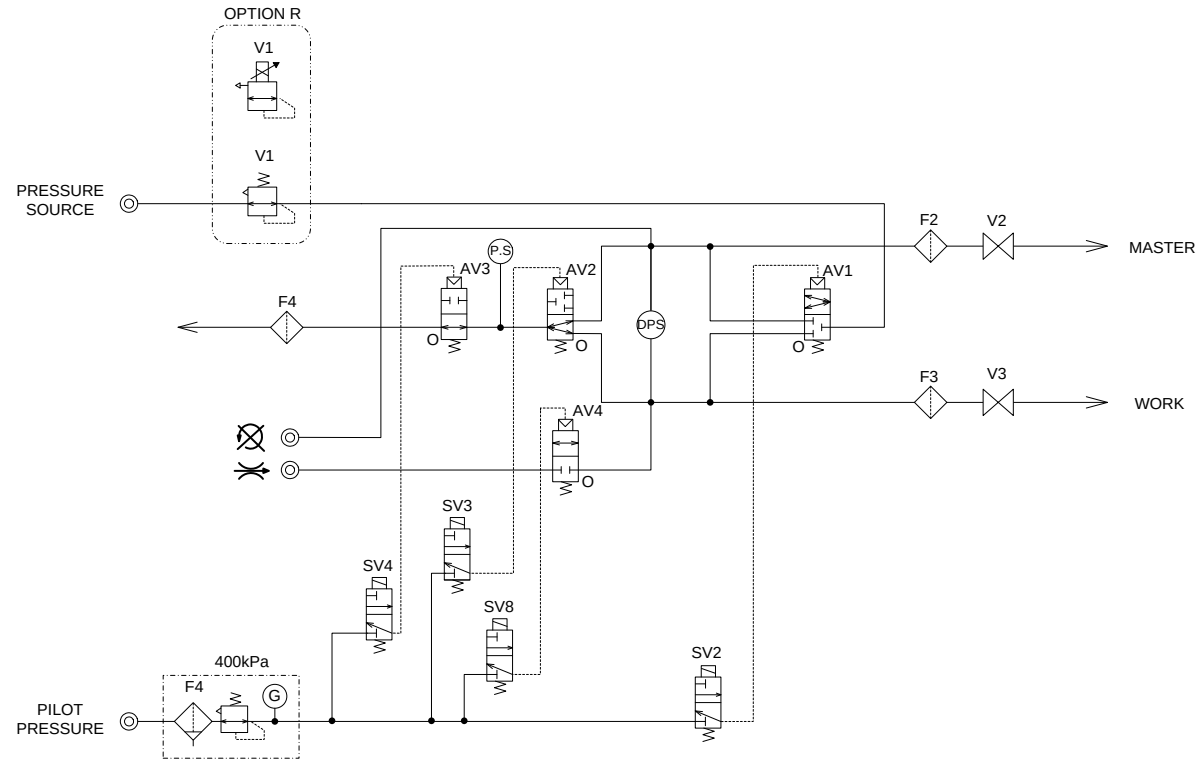
A1 Type J (Medium Pressure: M / Low Pressure: L)



	DL1	PCHG	PEXH	CHG	DL2	BAL2	DET	BLOW	EXH	END
SV2		■		■				■		
SV4		■		■	■	■	■			
SV7		■								
*SV8				■	■	■	■			

*SV8 is for K(Ve) Automatic Setup and K(Ve) Check.

A2 Type V (Vacuum Pressure: V)



	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BAL2	DET	BLOW	EXH	END
SV2		■	■		■					■		
SV3	■	■					■	■	■			
SV4		■	■		■	■	■	■	■			
*SV8	■	■	■	■	■	■	■	■	■	■	■	■

*SV8 is for K(Ve) Automatic Setup and K(Ve) Check.

4 Pressure Unit Conversion Table

1kg/cm2→	0.980665	14.2233	735.55914	28.959	393.7	10000	98.0665	0.0980665	980.665	0.96784
1.0197162	**←1bar→**	14.50373	750.06158	29.529962	401.46227	10197.162	100	0.1	1000	0.9869221
0.0703072	0.0689478	**←1psi→**	51.715083	2.0360254	27.679934	703.07172	6.8947783	0.0068948	68.947783	0.0680461
0.0013595	0.0013332	0.0193367	**←1mmHg→**	0.0393701	0.5352391	13.5951	0.1333224	0.0001333	1.3332239	0.0013158
0.0345316	0.0338639	0.491153	25.400018	**←1inHg→**	13.595083	345.31579	3.3863911	0.0033864	33.863911	0.033421
0.00254	0.0024909	0.0361273	1.8683239	0.073556	**←1 inH$_2$O→**	25.400051	0.2490894	0.0002491	2.4908941	0.0024583
0.0001	9.807E-05	0.0014223	0.0735559	0.0028959	0.03937	**←1mmH$_2$O→**	0.0098067	9.807E-06	0.0980665	9.678E-05
0.0101972	0.01	0.1450373	7.5006158	0.2952996	4.0146227	101.97162	**←1kPa→**	0.001	10	0.0098692
10.197162	10	145.0373	7500.6158	295.29962	4014.6227	101971.62	1000	**←1MPa→**	10000	9.8692214
0.0010197	0.001	0.0145037	0.7500616	0.02953	0.4014623	10.197162	0.1	0.0001	**←1hPa→**	0.0009869
1.0332286	1.0132512	14.695921	760.00076	29.921268	406.78211	10332.286	101.32512	0.1013251	1013.2512	**←1atm**
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
kg/cm^2	**bar**	**psi**	**mmHg, Torr**	**inHg**	**inH$_2$O**	**mmH$_2$O**	**kPa**	**MPa**	**hPa**	**atm**

5 Flow Unit Conversion Table

1mL/s	60	0.06	0.00019	101.3	0.1013
0.0167	**←1mL/min→**	0.001	0.01138	1.689	0.001689
16.667	1000	**←1L/min→**	11.37990	1689	1.001689
5272.45	87.874	87874.2	**←1In^3/d→**	52.035	0.052035
0.009869	0.5921	0.0005921	0.001922	**←1PaL/sec→**	0.001
9.869	592.1	0.5921	0.000001922	1000	**←1Pam^3/sec**
↓	↓	↓	↓	↓	↓
mL/s	**mL/min**	**L/min**	**In^3/d**	**PaL/sec**	**Pam^3/sec**

6 Leak Unit Description

Pa·m^3/s	SI Leak rate unit
E-3 Pa·m^3/s	E-3 = x 10^{-3} = x 0.001 **ig:** 0.001688 Pa·m^3/s = 1.688 E-3 Pa·m^3/s
Pa/s	Differential pressure (ΔP) per second. ΔP at the end of a stage is divided by the stage timer in second (Time average).
Pa/min	Differential pressure (ΔP) per second. ΔP at the end of a stage is divided by the stage timer in second and multiplied by 60 (Time average).
*Pa/s	Differential pressure (ΔP) of the last second in a stage. * is prefixed to distinguish from the Pa/s above. Be sure to disable all the compensation features when using this unit.
*Pa/min	Differential pressure (ΔP) of the last second in a stage multiplied by 60. * is prefixed to distinguish from the Pa/min above. Be sure to disable all the compensation features when using this unit.

7 CE Marking CE

CE marking is affixed to the CE conformed model of LS-R900.

Scope of CE marking conformity is the body of LS-R900.

For the power cord supplied with the LS-R900 is as the follows:

Power cord rated for 100 to 125 VAC is not conformed.

Power cord rated for 220 to 250 VAC is conformed.

Please use a power cord that complies with the local legislation.

NOTE

Display of the sensor readout may get fluctuated when it gets interfered by jamming. Removing the interference resolve the problem. (IEC-61000-4-3)

”EC Declaration of Conformity” to prove the product complies with the provisions of the European Directive is available upon request.

8 Information to Users (FCC Rules)

Changes or modifications not expressly approved by Cosmo could void the user’s authority to operate the equipment. (excluding particular specifications)

This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to part 15 of the FCC Rules. Those limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the operation manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the use will be required to correct the interference at his own experience.

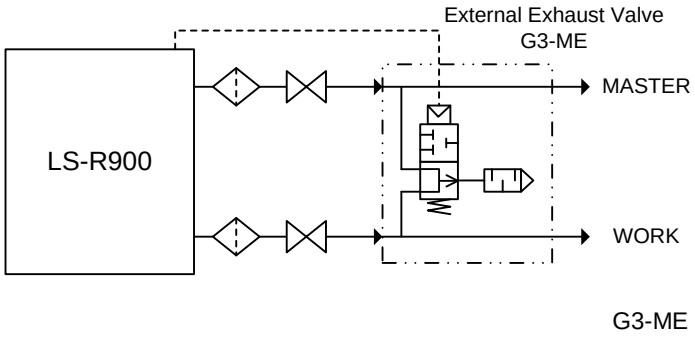
9 Common Peripherals

Refer to "**2 INSTALLATION**" for the details.

9.1 External Exhaust Valve

Water, oil, or other foreign matters inside the tested parts may get into the air leak tester when it exhausts air, which may damage the tester.

Installing an External Exhaust Valve between air leak tester and tested part prevent the contamination.



G3-ME

9.2 Bypass Circuit Unit

Test time can be reduced by using a Bypass Circuit Unit when testing tested parts with a large internal volume with low test pressure because it fills the parts with air in a short period of time.

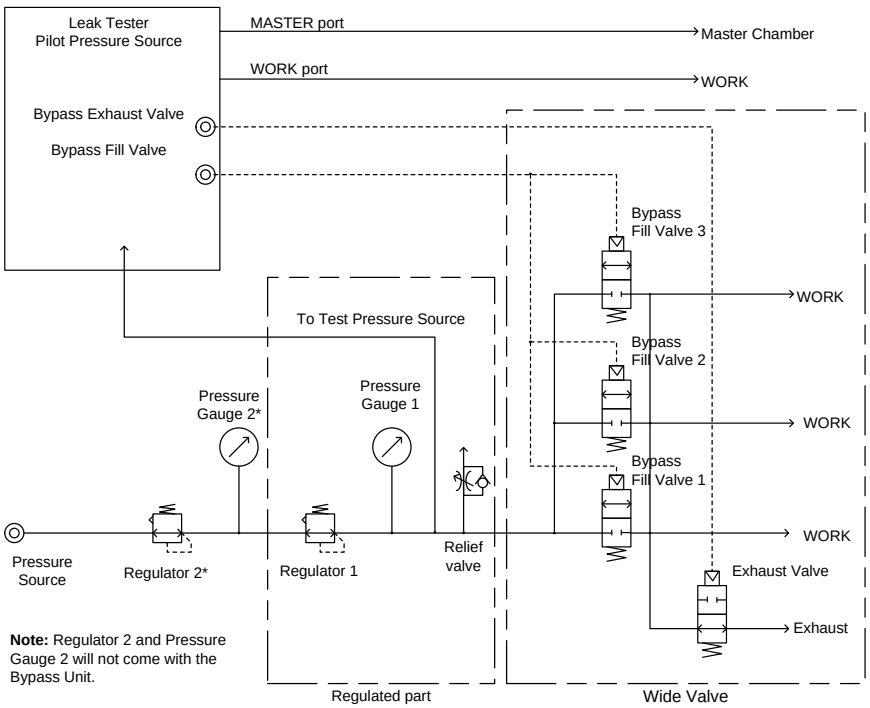
Models with the option B are equipped with a pilot pressure port for the Bypass Circuit Unit.

Air leak tester controls the Bypass Circuit Unit.

Enable the Bypass solenoid valve to use it.

Go to: Settings > Advanced Settings > CHG Options > Bypass Solenoid V

Pneumatic Circuit Example (BU-100A-3L)



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