

Operation Manual

Installation Manual
Operation Manual
Maintenance Manual
Specifications & References

AIR LEAK TESTER LS-R700



Installation Manual

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INSTALLATION MANUAL

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1 Introduction

Thank you for purchasing the Air Leak Tester LS-R700 Series.

LS-R700 is a differential pressure decay air leak tester designed for industrial use.



This manual provides installation, operating and maintenance instructions for LS-R700 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]

Symbol	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]

⚠ 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) Ground the product before plugging it into a power source. 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) Do not use voltages other than those for which the product is rated. It could result in fires or electrical shock hazards.
- 4) If the product has been dropped or damaged, switch it off and disconnect the power plug from the outlet. Neglecting it could result in fires or electrical shock hazards.
- 5) 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.
- 6) Should foreign matter such as water or oil get inside the product, switch off the power immediately and unplug it from the outlet. 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.
- 7) This product is not customer-serviceable. Customer servicing could result in fires or electrical shock hazards.
- 8) Replace a fuse after turning off the power of the main unit and disconnecting the power plug from the outlet. Use a fuse equivalent to the current one for replacement. Using a different fuse could result in fires or electrical shock hazards.
- 9) 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 cable and remove the pressure source from the instrument. Not doing so 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 cable, which could result in fires or electrical shock hazards, observe these precautions:
 - Do not damage, modify or apply undue force to the power cable.
 - Before servicing the product, disconnect the power plug from the outlet.
 - Do not handle the power plug with wet hands.
 - When disconnecting the power plug, do not pull on the power cable.
- 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 install or remove the tubing with the product connected to an air pressure source. 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 feature equipped with the product will be compromised.

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, however, 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) The user is encouraged to consult your local Cosmo representative directly for any questions regarding the use of this product.



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INSTALLATION AND SETUP

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1 Unpacking

When you receive the LS-R700, 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-R700 with Quick mounting bracket: M4 screws (4)
Tube for pneumatic connection
Tube for connecting the tested part and reference master to LS-R700

For external device connection:

Control I/O cable
DCV24 Power source

For storing leak test data and/or test parameters:

USB memory
Computer
RS-232C serial communication cable

2 Part Identifications


2.1 Front Panel





A Color LCD:

B Pass lamp:
Lights when the test result is "Pass".

C Fail lamp:
Lights when the test result is "Fail".

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

E  (Maintenance port):
Do not remove the plug when

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

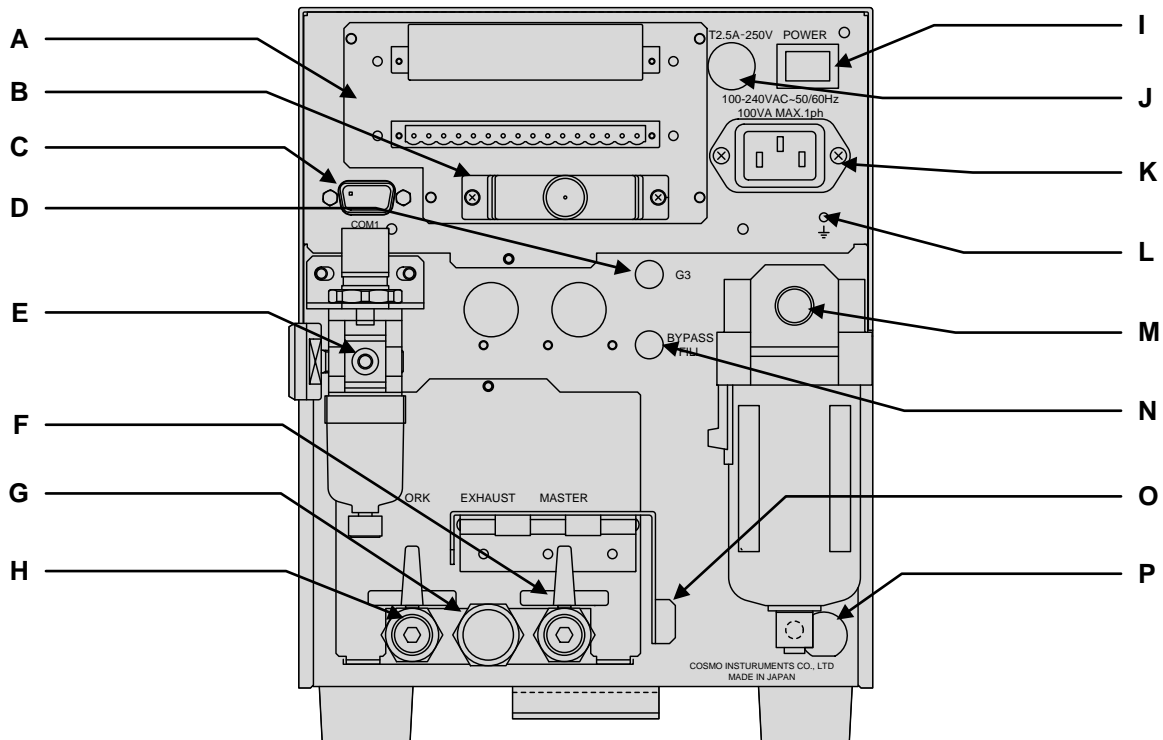
G Operation keys

H  key:
Used to stop a measurement in manual mode.

I  key:
Used to start a measurement in manual mode.

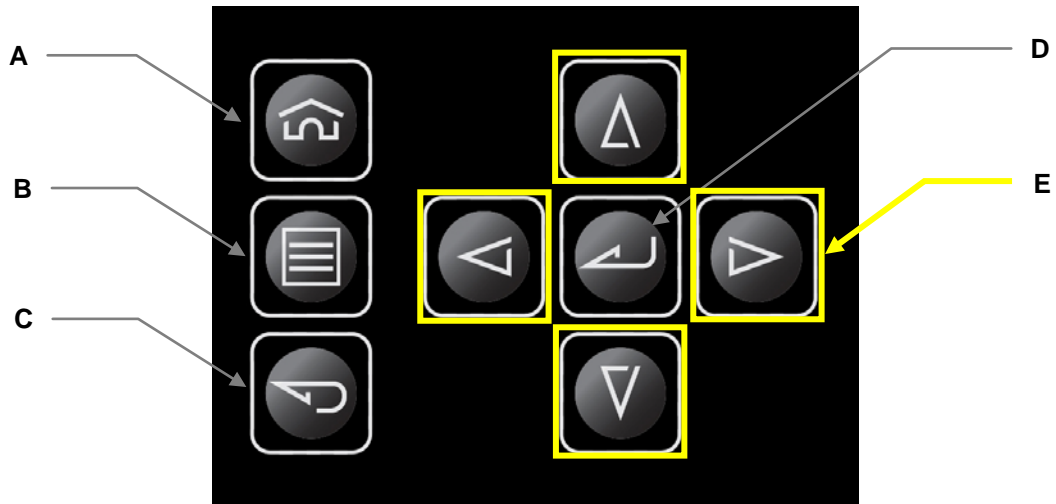
J Quick Mounting Bracket:
Using this bracket, LS-R700 can be installed and removed easily with two M4 screws.






2.2 Rear Panel



- A CONTROL I/O (Phoenix contact):**
External device is connected to control LS-R700 externally.
Upper: Input **A** Lower: Output **B**
- B CONTROL I/O (Special specification):**
D-sub connector
- C COM 1:**
Serial communication port.
Data is output in the designated format.
(RS-232C 9-pin male)
- D G3:**
Pilot pressure port for External Exhaust valve
(Push-to-connect fitting 4mm)
- E PILOT PRESSURE:**
Pilot pressure port
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 WORK:**
WORK-side stop valve
A port to connect a tested part (Work).
Leave the valve opened except for maintenance.
- I POWER:** Power switch
- J FUSE:** Fuse (T2.5A 250V)
- K 100 - 240 VAC~:** Power inlet
- L FG:** Grounding
- M TEST PRESSURE:**
Test pressure port
(Push-to-connect fitting 4mm)
- N BYPASS FILL (Option):**
Pilot pressure port for fill valve for Bypass circuit unit
- O Stop Valve Monitoring Switch with a valve cover (Option):**
When the valve(s) is open, the cover won't close and the switch is not pressed.
This is to prevent leak testing with the stop valves closed.
- P EP REGULATOR (Option):**
Electro-Pneumatic regulator connector

2.3 Operation Keys



- A  **Home key:** Used to open a measurement screen programmed to be the Home screen.
- B  **Menu key:** Used to open the main menu
- C  **Back key:** Used to back to the previous screen.
- D  **Enter key:** Used to complete the selection or numeric entry.
- E  **Cursor keys:** Used to move the cursor within a page or program numbers.

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 temperature 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-R700 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

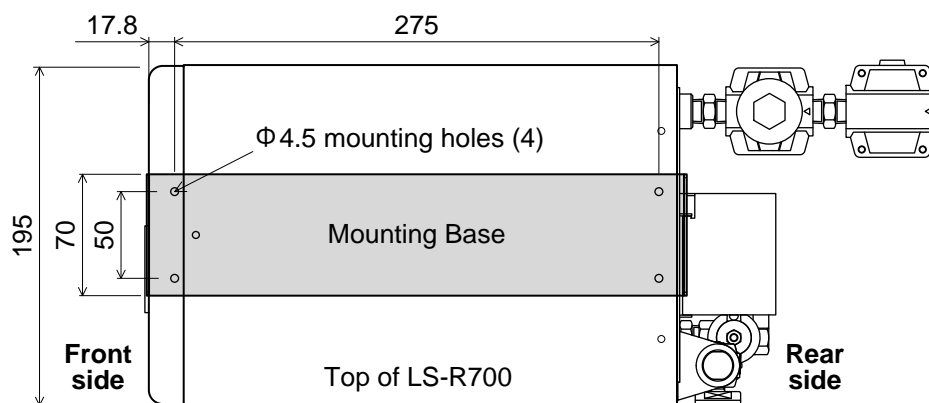
Mount the product securely on a structure with enough load capacity. Do not install the product on the insecure foundation or in places with vibration to avoid overturns and injuries.

LS-R700 comes with a mounting bracket that can be install/remove from the base with two screws.

Mounting Base

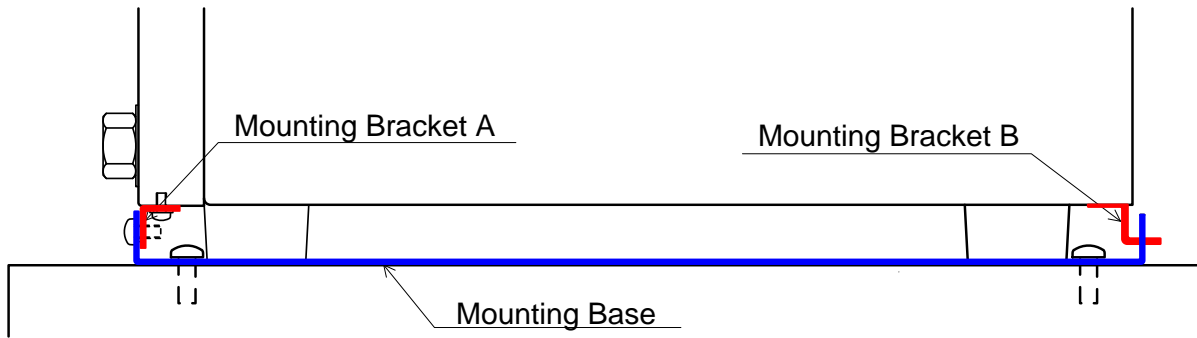
This base is loosely attached to the bottom of LS-R700. Remove it from the tester and mount it on the leak test stand where LS-R700 is to be mounted with four M4 screws. The mounting surface has to be flat and smooth.

Mount the mounting base on the test bench as shown below. M4 screws are not enclosed with LS-R700.

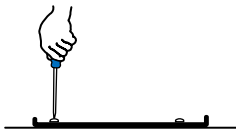


How to Mount

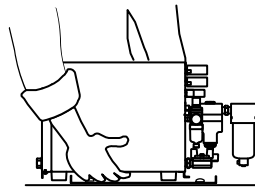
Two mounting brackets are attached to the bottom of the LS-R700, A in front and B in back.



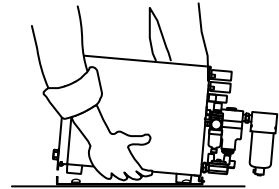
Mount as the following procedure:



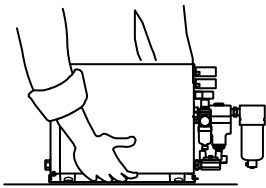
Mount the "Mounting Base" on a leak test stand.



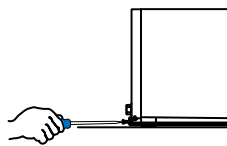
Place the LS-R700 with the Brackets **A** and **B** attached a little toward the front of where the LS-R700 is to be mounted.



Insert the bracket B to the rear latch of the mounting base while lifting the front of the LS-R700.



Lower the LS-R700 where the Bracket A gets behind the front latch of the mounting base and align the screw holes.



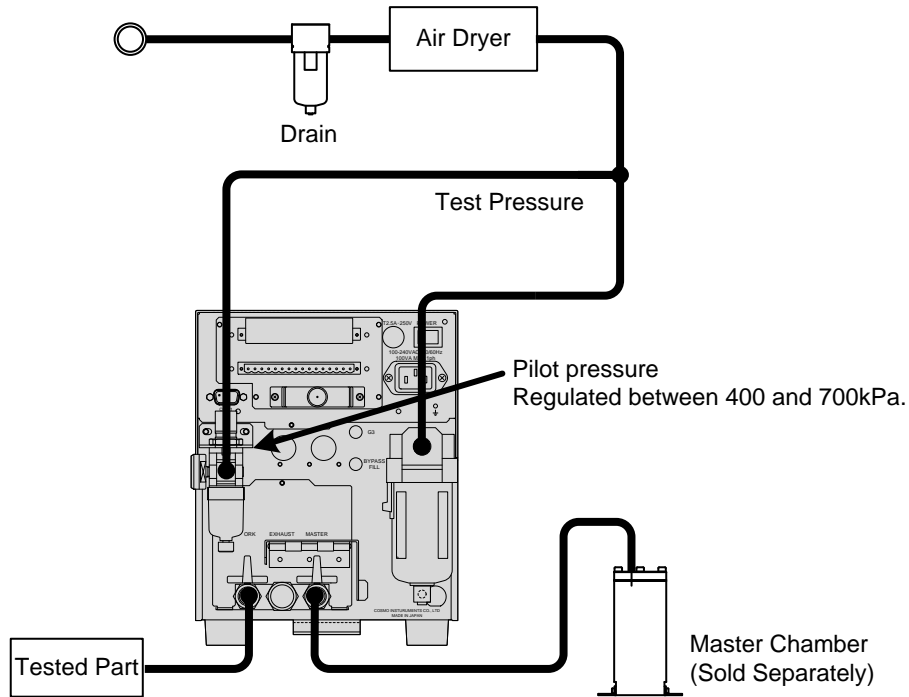
Mount the LS-R700 with two M4 screws.

3.3 Pneumatic Hookups

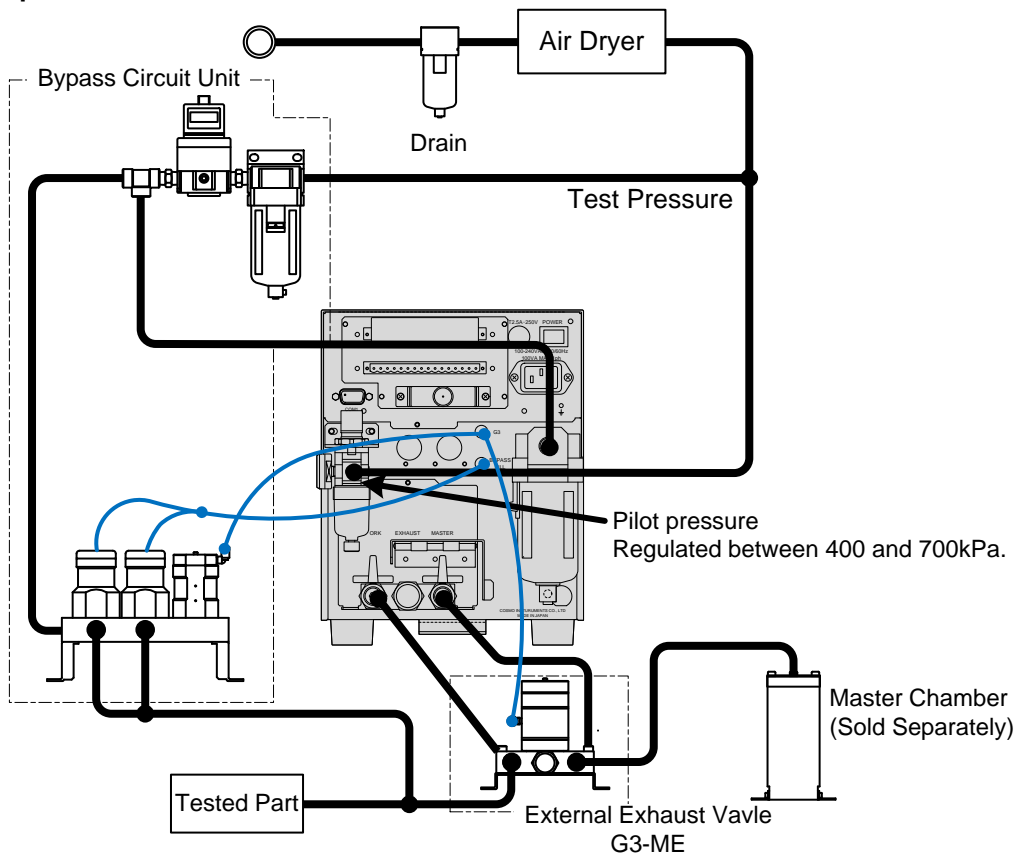


CAUTION
Be sure to shut off the pressure source before connection/disconnection.

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 LS-R700 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 LS-R700.

Test Pressure Connection

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

Pressure Range		Pressure Source	
Micro Low (L02)	Up to 20kPa	Connect a pressure source as the follows: <ul style="list-style-type: none"> • Sufficiently higher than the test pressure and stable • Has enough flow capacity • Should be regulated to at least 100kPa higher than the test pressure 	L02: Up to 200 kPa
Low (L)	Up to 100kPa		L: Up to 500 kPa
Low (LR)	Up to 95kPa		LR: Up to 200 kPa
Medium (M/MR)	Up to 800kPa		M: Up to 1 MPa MR: Up to 1 MPa
High (H20)	Up to 2.0MPa	Connect a pressure source regulated to the air filter.	
Vacuum (V)	Down to -100kPa	Connect a vacuum pump	NOTE Be sure that water or oil won't enter LS-R700 from vacuum pump.
Vacuum (VR)	Down to -75kPa		

Pilot Pressure Connection

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

Port: PILOT PRESSURE Port Diameter: 6mm quick disconnect fitting

3.4 Tubing for Tested part (Work) and Master

Select tubes considering the follows:

Cosmo recommends rigid nylon tubes that does 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 AC 100 - 240 V ±10%.

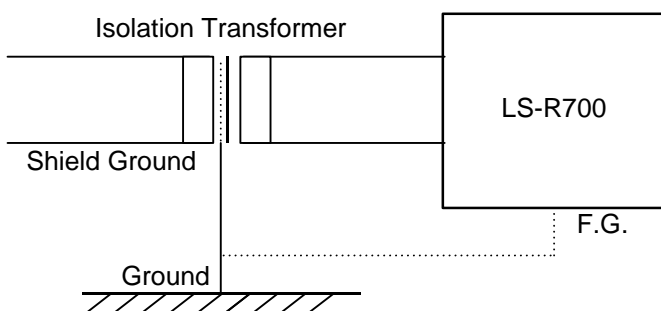
Make sure ground connection is made.

Use the enclosed power cord for the cases the power source is 125 VAC or lower.



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.

3.6 Control I/O Connector

The control I/O port interfaces the LS-R700 to an external devices such as PLC.

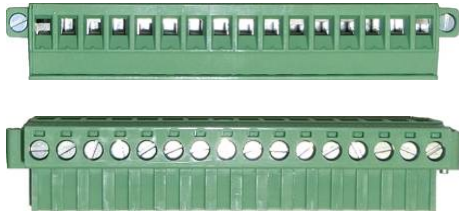
⚠ CAUTION

Electric Shock

Be sure to turn off the main power before wiring.

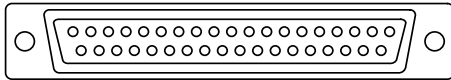
- A twisted pair cable preferably with shield should be used and should be separated from the power line.
- The length should be as short as possible without slack.
- Twisting the common line with the signal lines will help reduce noise.

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.

Press  to select a language > Press  to complete selection >  > **Enter** > 

LS-R700 will reboot in the selected language.



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

Press  or  on the Home screen to open the Main Menu Screen.

3 INTERFACE

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- 2 RS-232C Serial Interface Port.....32**
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 - 2.3 Formats of RS-232C Output.....33
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- 3 USB Port40**

1 Control I/O Port

The control I/O port interfaces LS-R700 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.

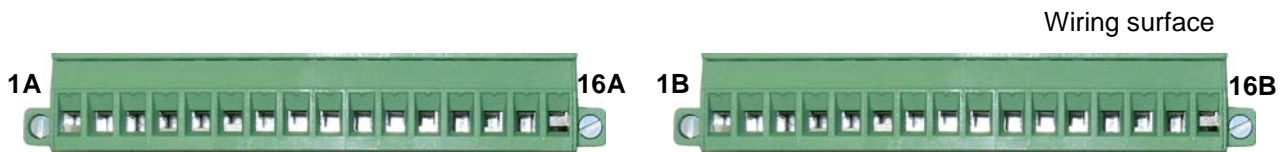
1.1 Standard Control I/O Port: Phoenix Contact

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



(NO: Normally Open / NC: Normally Close)

Input			Output		
Pin#	Function	Type	Pin#	Function	Type
1A	START	NO	1B	STAGE #0	NO
2A	STOP	NO/NC	2B	STAGE #1	NO
3A	CHG HOLD	NO	3B	ERROR	NO
4A	MASTERING/ DRIFT CLEAR *1	NO	4B	Reserved	
5A	K(Ve) CHECK	NO	5B	PASS	NO
6A	Calibration Valve Open/Close	NO	6B	UL FAIL	NO
7A	Reserved		7B	MASTERING REQUEST	NO
8A	Reserved		8B	Reserved	
9A	CH# 4 *2	NO	9B	BUSY	NO
10A	CH# 3 *2	NO	10B	END	NO
11A	CH# 2 *2	NO	11B	TIME EXTENSION *3	NO
+12A	CH# 1 *2	NO	12B	LL2 FAIL	NO
13A	CH# 0 *2	NO	13B	LL FAIL	NO
14A	Reserved		14B	UL2 FAIL	NO
15A	Reserved		15B	Common Return for all outputs	
16A	External DC Power input		16B	Reserved	

- *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 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".

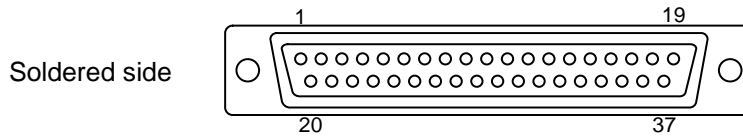
1.2 Control I/O Port D-SUB Connector (Special Spec.)

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	Pin#	Function	Type
1	Reserved		20	CH# 4 *2	Input NO
2	START	Input NO	21	CH# 3 *2	Input NO
3	STOP	Input NO/NC	22	CH# 2 *2	Input NO
4	CHARGE HOLD	Input NO	23	CH# 1 *2	Input NO
5	MASTERING/DRIFT CLEAR *1	Input NO	24	CH# 0 *2	Input NO
6	K(Ve) CHECK	Input NO	25	Reserved	
7	Calibration Valve Open/Close	Input NO	26	Reserved	
8	Reserved		27	Reserved	
9	Reserved		28	Reserved	
10	External DC Power input		29	Reserved	
11	Reserved		30	Reserved	
12	MASTERING REQUEST	Output NO	31	LL2 FAIL	Output NO
13	UL FAIL	Output NO	32	LL FAIL	Output NO
14	PASS	Output NO	33	UL2 FAIL	Output NO
15	Reserved	Output NO	34	TIME EXTENSION *3	Output NO
16	ERROR	Output NO	35	END	Output NO
17	STAGE #1	Output NO	36	BUSY	Output NO
18	STAGE #0	Output NO	37	Reserved	
19	Common Return for all outputs				

*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 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".

Power Source

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

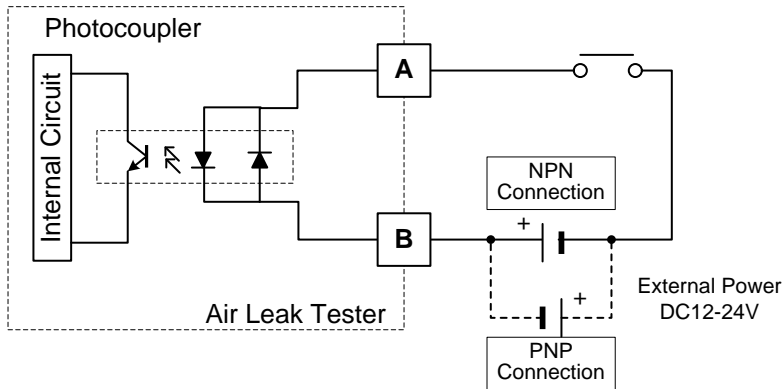
Rated input voltage: 12 - 24 VDC \pm 10%, 0.2 A MAX.

1.3 Input Specifications

Photocoupler diode input
 Input impedance: 3 KΩ
 Input current: 10 mA typ. (24 VDC)

Wiring

Input Circuit



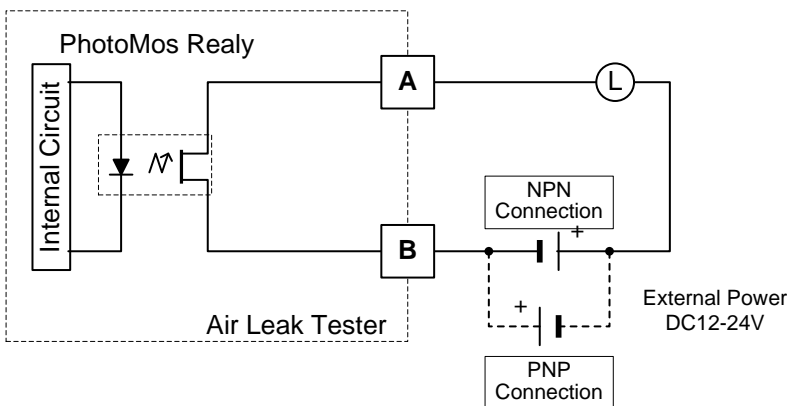
	Standard	D-SUB (Special spec.)
Pin# A	1A - 6A 9A - 13A	2 - 7 20 - 24
Pin# B	16A	10

1.4 Output Specifications

Open Collector Output
 Maximum switching capacity: 100 mA/24 V, 200
 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

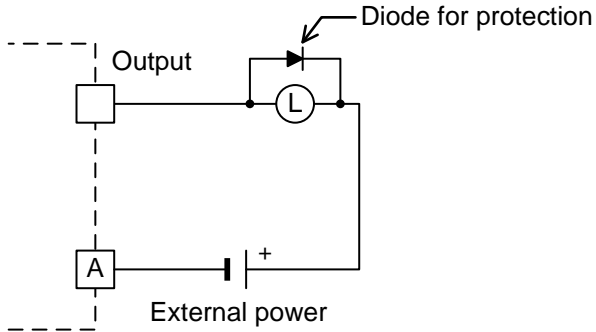


	Standard	D-SUB (Special spec.)
Pin# A	1B - 3B 5B - 7B 9B - 14B	12 - 14 16 - 18 31 - 36
Pin# B	15B	19

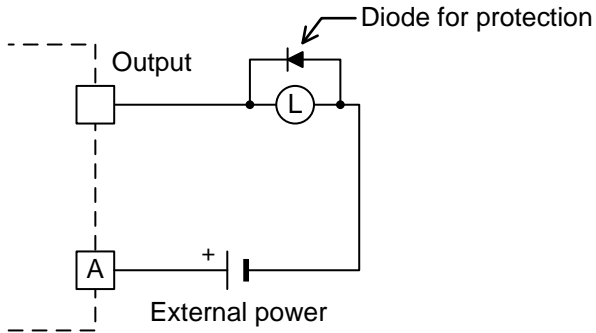
Protection of Output Load

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

NPN Connection



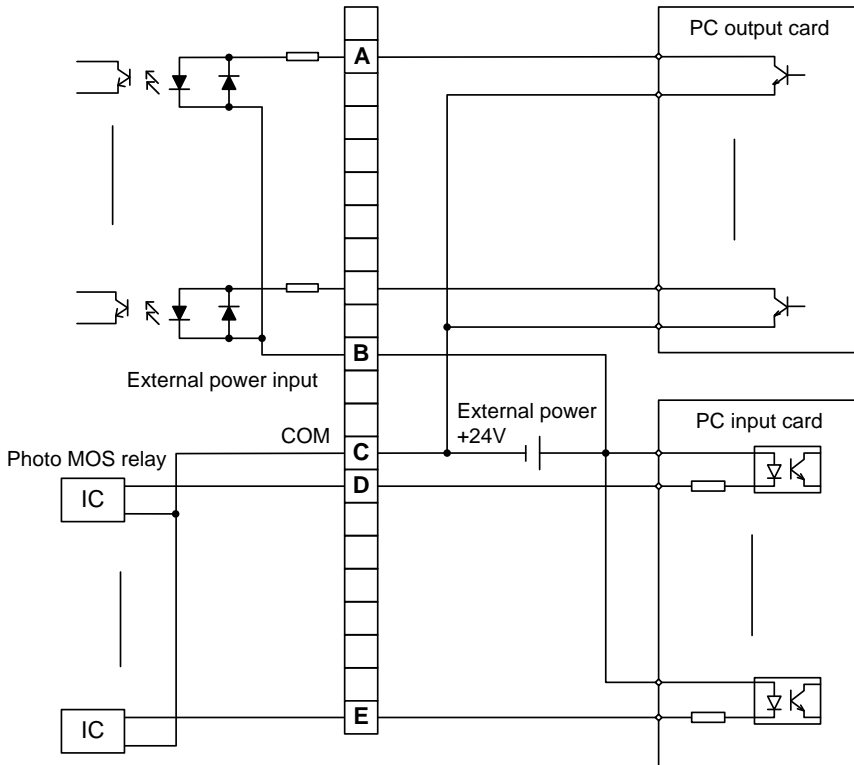
PNP Connection



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

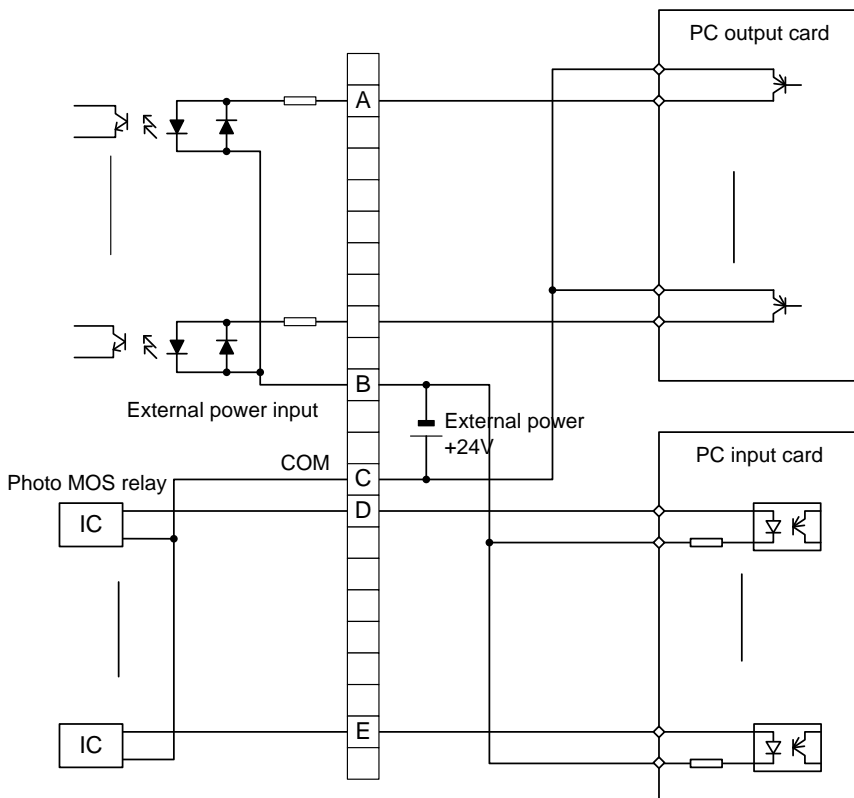
1.5 Typical PLC Connection

NPN-type input/output circuit configuration of LS-R700



	Standard	D-SUB (Special spec.)
Pin# A	1A	2
Pin# B	16A	10
Pin# C	15B	19
Pin# D	12B	31
Pin# E	9B	36

PNP-type input/output circuit configuration of LS-R700



	Standard	D-SUB (Special spec.)
Pin# A	1A	2
Pin# B	16A	10
Pin# C	15B	19
Pin# D	12B	31
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.

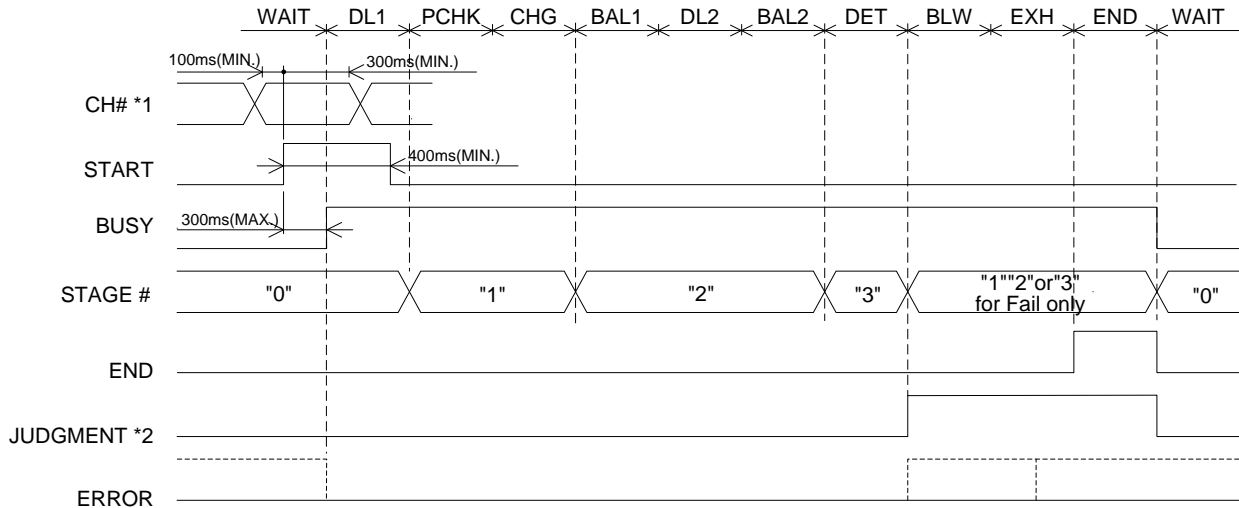
Stage	Stage #1	Stage #0	Stage #
WAIT, DL1	OFF	OFF	"0"
PCHK - CHG	OFF	ON	"1"
BAL1, DL2, BAL2	ON	OFF	"2"
DET	ON	ON	"3"
BLW - END	Hold	Hold	See NOTE

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.

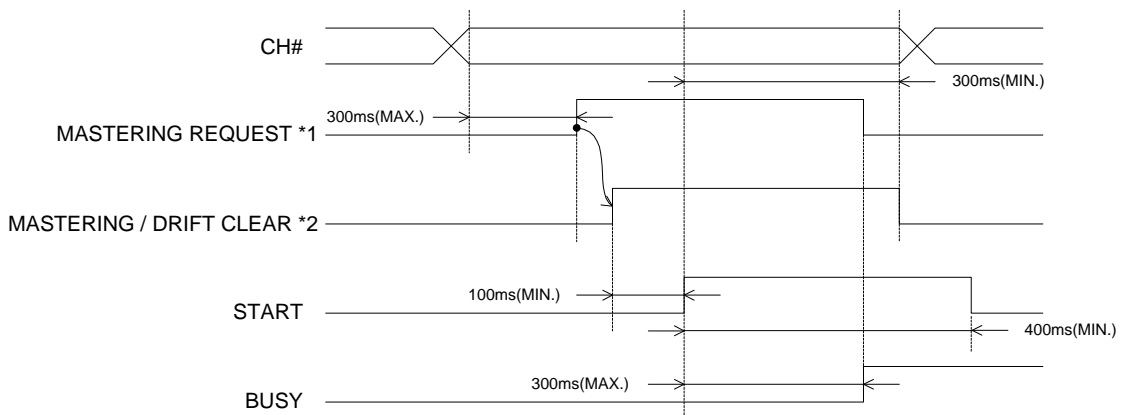
1.8 Signal Timing Charts

Leak Test Timing Chart



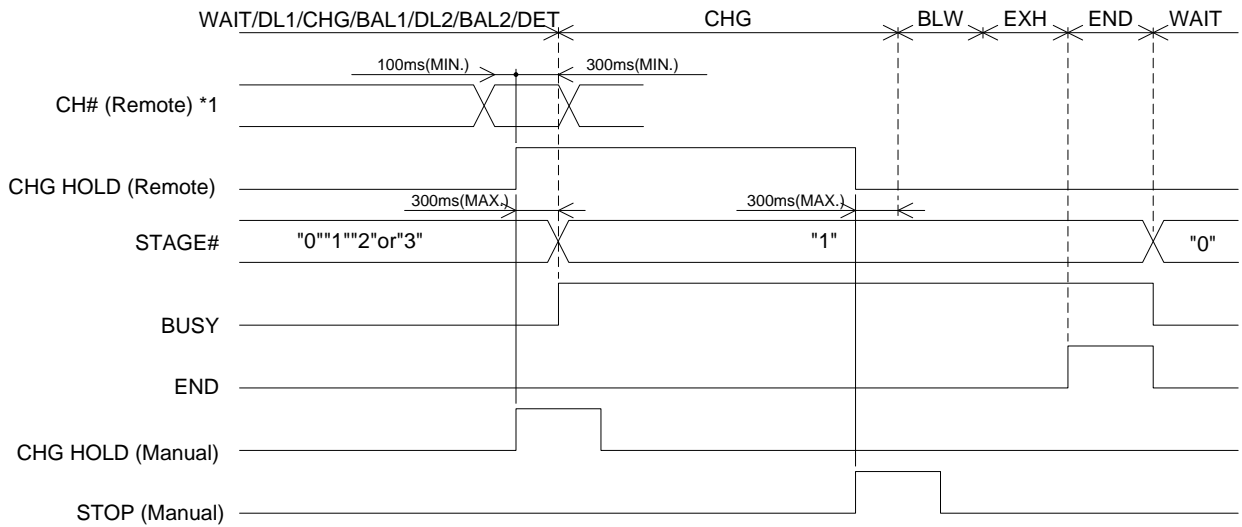
- *1 CH # includes CH #, K(Ve) CHECK, MASTERING / DRIFT CLR, and Calibration Valve Open/Close signals.
- *2 JUDGMENT includes PASS, UL FAIL, LL FAIL, UL2 FAIL AND LL2 FAIL signals.

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 after power is turned on.

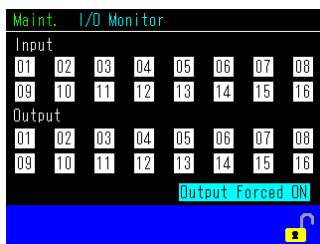
Refer to "4 BASIC OPERATIONS" for the details.

Go to:

- > Main Menu > Press to move the cursor to > > Settings Unlock >
- > Enter a passcode > Press to move the cursor to **Unlock** > > with
- > Press to move the cursor to > > "Switching to Manual Mode OK to continue?" > **Yes** >

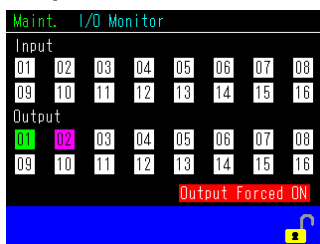
Then press to move the cursor to **Maint.** > Press to move the cursor to **I/O Monitor** >

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) Press to select the pin(s) to be checked
 > > Signal(s) will be transmitted.
- 3) Press to selecting the pins again
 > > Signals are reset.
- 4) Clearing Force output signals.
Go to: Output Forced ON >
 > "Clearing Forced Output Signal OK to continue?" > **Yes** >

Blue	Where the cursor is at
Pink	Currently transmitted while the cursor is there
Green	Currently transmitted

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-R700 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.

For setting the communication parameters, go to:

System > System Settings > RS-232C

2.1 RS-232C Interface

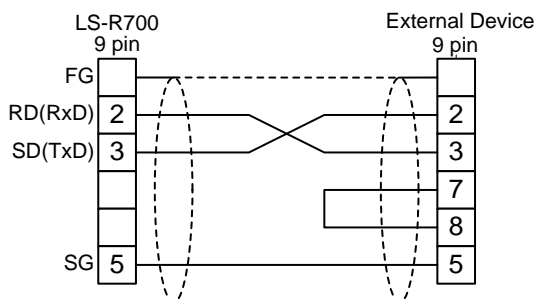
Data transmission	Half duplex
Baud rate	9600, 19200, 38400
Start bit	1 bit
Data length	8 bit
Parity	Non-parity
Stop bit	1 bit

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)



2.3 Formats of RS-232C Output

Data output is available from the RS-232C port on the rear panel.

The LS-R700 supports nine(9) output formats.

For selecting a format, go to:

System > System Settings > RS-232C > 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) or comma (2CH).
- 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_±LLLL: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	One 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 ~ 9, A ~ 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	One 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-R700

Code	Error Description
8000	Error: 1 PS Offset Error
4000	Error: 11 ~ 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	One ASCII code (1-digit hexadecimal)	--	1	D	1: LL FAIL 2: Pass 4: UL FAIL 9: LL2 FAIL C: UL2 FAIL D: Error
Leak (BAL)	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_S
 SS.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_±EE
 E.EEE_±FFF.FFF_e_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	One 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	1-digit decimal	--	0	1	
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	
No item	t	2-digit decimal	--	00	00	Fixed to 00
NR Iterations	u	2-digit decimal	--	01	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-R700

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 ~ 16 Air Operated Valve Error
18	Error: 51 Lo Battery SRAM Error

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


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

Leak Unit	00: Pa, 01: kPa, 02: mmH ₂ O, 03: inH ₂ O, 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

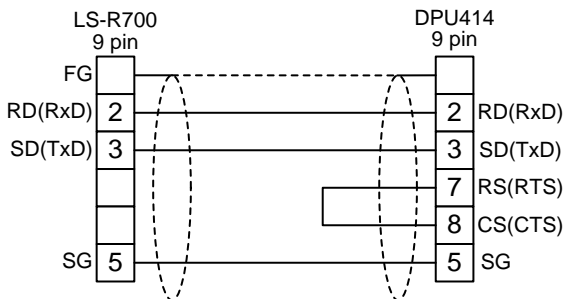
		DEC notation	HEX notation	Lower two digits		Remarks
				HEX notation	BIN notation	
Calculation of data strings	Sum	718	2CE	CE	11001110	Sum of every ASCII code
	Complement	-719	D31	31	110001	Complement of the sum
	Two's complement	-718	D32	32	110010	Adds 1 to the complement value
Checksum		32				

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
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.

Cosmo performed the performance check of USB with the following USB memories both made by SWISSBIT:

- SFU21024E1BP2TO-I-MS-111-STD 1GB
- FU22048E1BP2TO-I-MS-111-STD 2GB

What data can be stored or copied to USB Memory from LS-R700

- 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)

What data in USB Memory can be write on LS-R700

- Parameter Backup data
- System Backup data



Attention

Parameter Backup data backed up in the Setting menu cannot be restored to other LS-R700 even though the model is exactly the same.

Never restore the backup data to other LS-R700 because the span values of the sensors will be overwritten, which result in inaccurate measurement results.

NOTE

Please do not connect an USB memory infected with a virus to LS-R700. Cosmo will not be responsible for malfunction of LS-R700 due to virus infection via USB Memories.

OPERATION MANUAL


4 BASIC TOUCH SCREEN OPERATIONS

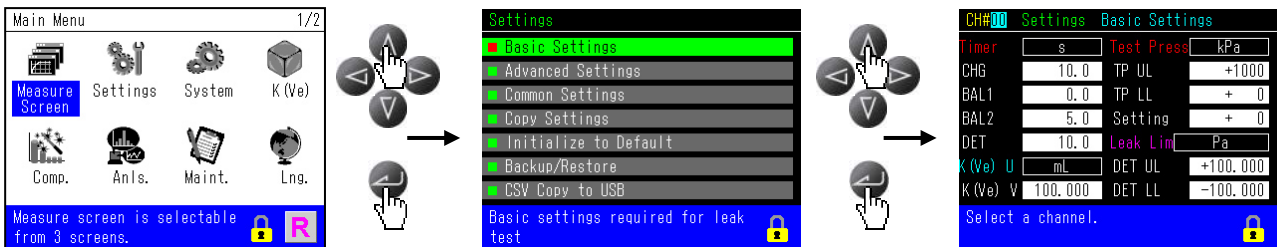
- 1 Turn On Power42
- 2 Go to Sub Menus and Items42
- 3 Go Back to the Previous Page42
- 4 Switch Pages42
- 5 Settings Lock / Unlock.....43
 - 5.1 Lock / Unlock Settings43
 - 5.2 Set a Passcode44
- 6 Switch the Operation mode between Remote and Manual44
- 7 Go to Home Screen44
- 8 Go to Main Menu.....45
- 9 Settings Operations45
 - 9.1 Change channels.....45
 - 9.2 Select an Option From Multiple Selections.....45
 - 9.3 Enter a value45

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

2 Go to Sub Menus and Items

All sub menus are accessible from the Main Menu, which consists of 2 pages.
 Select an item and pressing  goes to the next page.

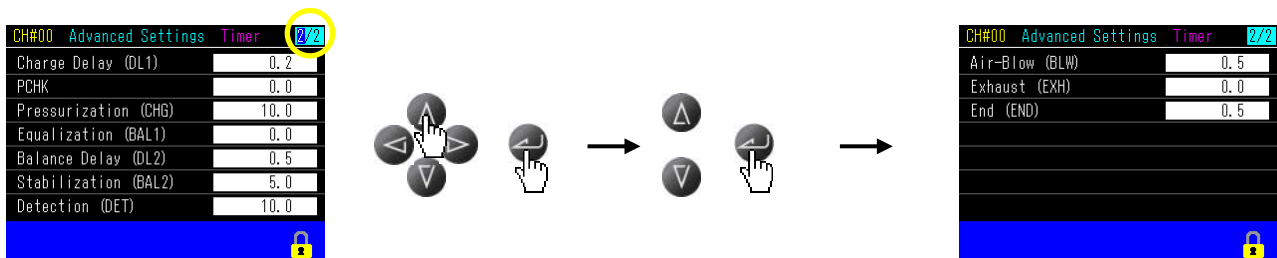


3 Go Back to the Previous Page

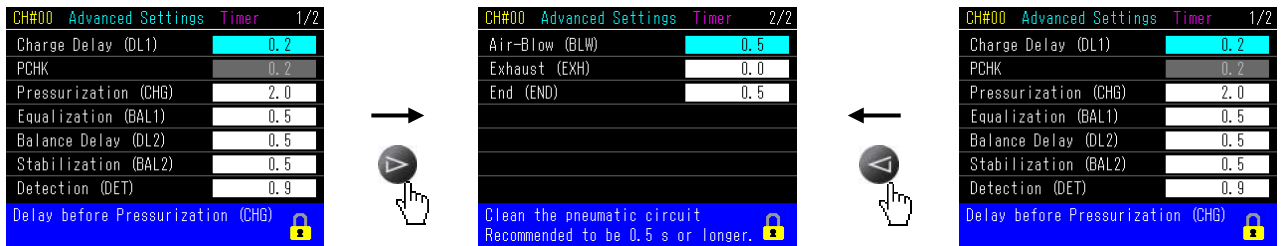


4 Switch Pages

Move to the page number with cursor keys and press , the change the page number with up/down cursor key to change the page number and press .



Pages can be switched also with right/left cursor key.

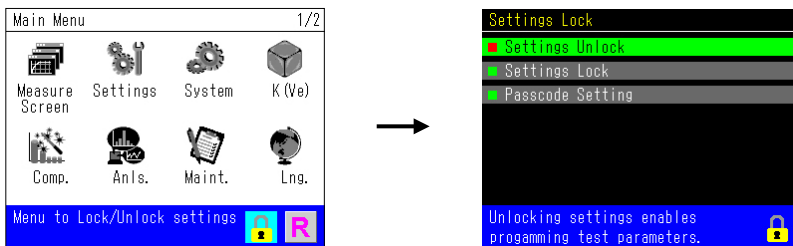


5 Settings Lock / Unlock

Unlocking the settings enables settings change. (Settings cannot be changed when it's locked)

Move the cursor to the pad lock icon on the Main menu and press

Lock menu includes Settings Unlock, Settings Lock and Passcode.



5.1 Lock / Unlock Settings

To unlocking settings



Go to:

- > Select Settings Unlock > Press to enable programming.
 - > Select a number with / .
 - > Press to move the cursor to the second digit > Press / to select a number.
 - > Press to move the cursor to the third digit > Press / to select a number.
 - > Press to move the cursor to the fourth digit > Press / to select a number.
 - > Press > Press to move the cursor to Unlock. > Press to complete.
- (Default is 0000)

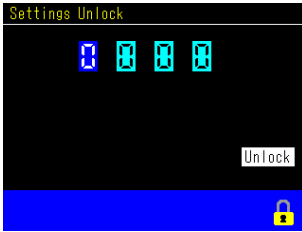
To locking settings



Go to:

- > Select Settings Lock > "Locking settings OK to continue?"
- >

5.2 Set a Passcode



NOTE
Do not forget the password

A passcode of your choice (4-digit number) can be set. Default is 0000.

Unlock the settings in the Lock Menu first, then

After Unlocking settings, go to:

Select Passcode Setting > Press to enable programming.

> Press / to select a number.

> Press to move the cursor to the second digit

> Press / to select a number.

> Press to move to the third digit > Press / to select a number.

> Press to move to the fourth digit > Press / to select a number.

> Press > Press to move to Enter. > Press to complete.

4

6 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, press **R** or **M** icon located on the lower right corner of the Main Menu and press after unlocking settings.

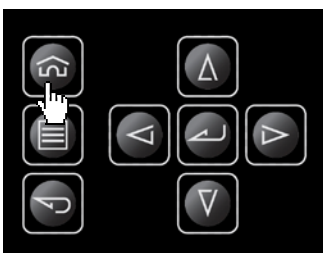
Switch from Remote to Manual

R → **M** Main Menu > **R** > "Switch to Manual Continue?" > Yes >
> **R** turns to **M**.

Switch from Manual to Remote

M → **R** Main Menu > **M** > "Switch to Remote Continue?" > Yes >
> **M** turns to **R**.

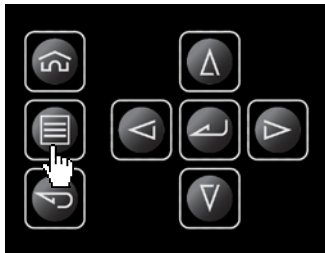
7 Go to Home Screen



Press to go to Home Screen.

Default setting is Standard measurement screen

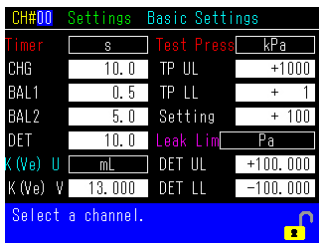
8 Go to Main Menu



Press to go to the Main Menu.

9 Settings Operations

9.1 Change channels

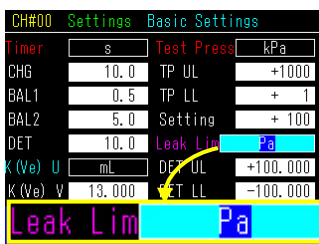


Press to move the cursor to CH# and press .

Press / to select a channel with and press .

CH#00 to CH#31

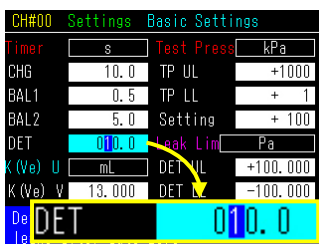
9.2 Select an Option From Multiple Selections



Press to move the cursor to an Item and press .

Press / to select an option and press .

9.3 Enter a value



Press to move the cursor to an Item and press .

Press / to move the cursor between digits, press / to enter numbers and press to complete the entry.



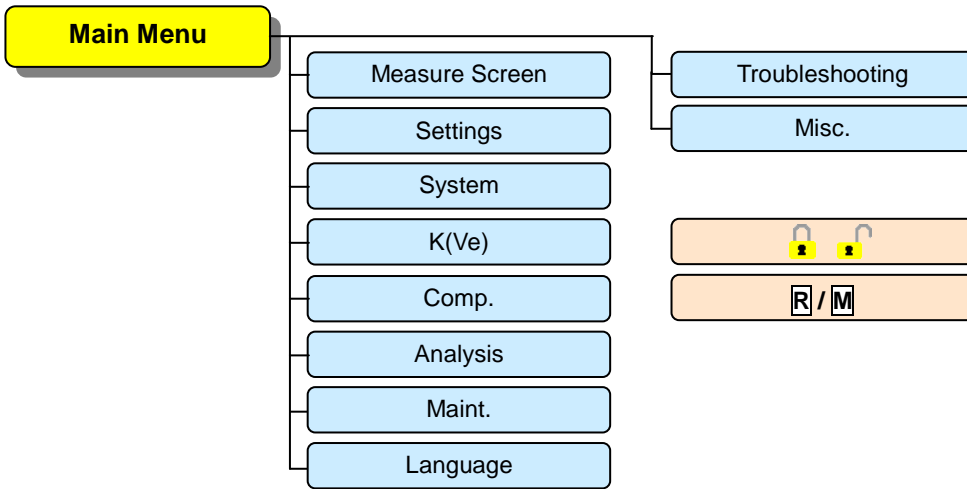
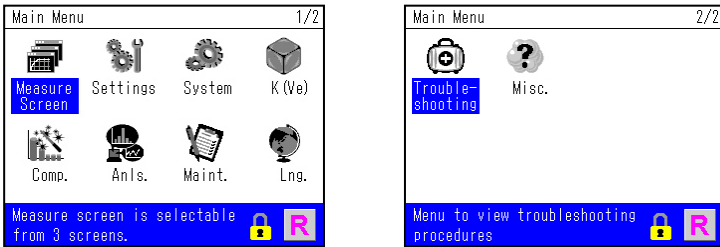
5

SCREEN LIST

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3 Settings Menu	51	7 Analysis Menu	62
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3.3 Common Settings.....	54	8 Maint. (Maintenance) Menu	62
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5 K(Ve) Menu	58	10.2 Large Leak List	65
5.1 K(Ve) Settings	58	10.3 Frequent (+) Fails	65
5.2 K(Ve) Automatic Setup	59	10.4 Frequent (-) Fails	65
5.3 K(Ve) Check	59	11 Misc. (Miscellaneous) Menu	65
		11.1 System Version.....	65

1 Main Menu

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

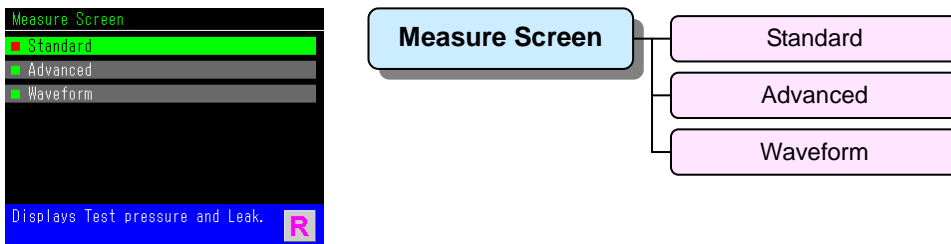


5

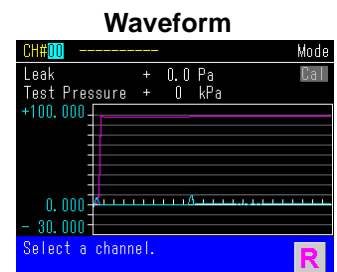
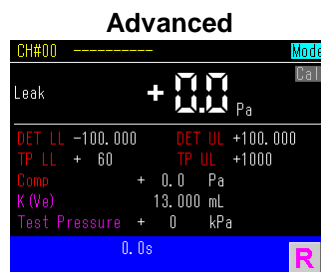
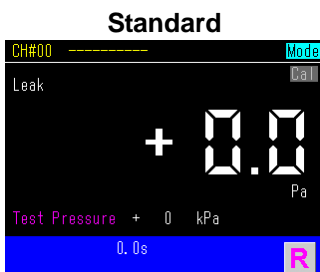
2 Measurement Screen Menu



There are 3 measurement screens, Standard, Advanced and Waveform, which can be switched while a test is in progress.



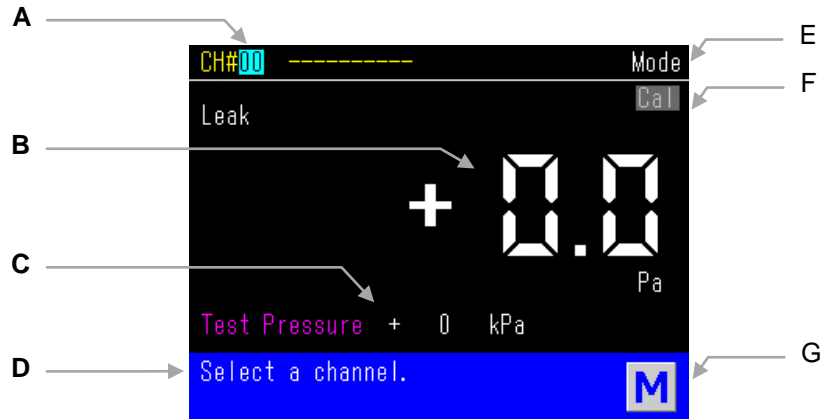
2.1 Measurement Screens (Remote)



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.

Standard screen is a simple display with the test pressure, leak and Pass/Fail judgment.



- 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 Guidance Bar:**
Stage, Stage timer, Test result and Error number are displayed.

- E Mode:**
Menu to change the measurement mode, Open/Close the Calibration valve and set Auto-Repeat of measurement.
- F CAL:**
Shown in green when the Calibration port (⊗) on the front panel is open, and in gray when closed.
- G Remote/Manual:**
Shows the current operation mode. **R** for Remote and **M** for Manual

Mode Description

Mode	
Meas Mode	Leak Test
Cal valve	Close
Auto-Repeat	Disable
Select from Leak Test, Charge Hold and Mastering. M	

Meas (Measurement) Mode

Measurement is selectable from the following three:

Leak Test: Air Leak Test

Mastering: Mastering value sampling

Charge Hold: Keeps pressurizing until **■** is pressed.

In Manual Mode, the electropneumatic pressure of E/P Regulator can be adjusted. Adjust with **▲** **▼** keys and complete with **⏪**.

Cal (Calibration) Valve

Open/Close the Calibration valve on the front panel

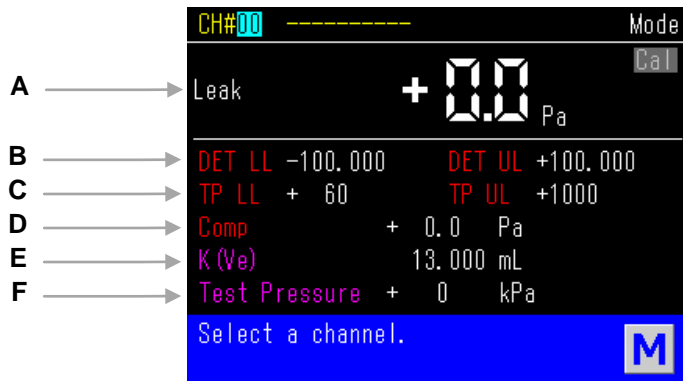
Used to check the accuracy of NG judgment (only for J model)

Auto-Repeat

A selected measurement: Leak Test or Mastering are repeated

Press **▶** to start the measurement and press **■** to stop.

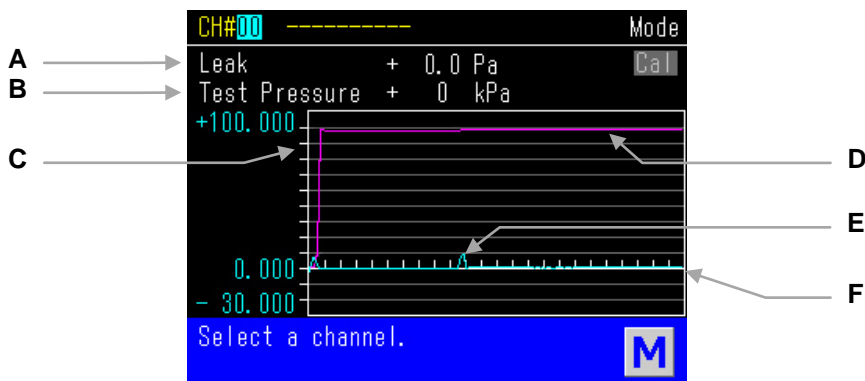
2.3 Measurement Screen Description: Advanced (Manual)



- A Leak:** Leak in a selected unit
- B TP LL / TP UL:** Upper and lower limits for test pressure
- C DET LL / DET UL:** Upper and lower limits for leak in Detection stage.
- D Comp:** Current compensation value
- E K(Ve):** The current K(Ve) value
- F Test Pressure:** Test pressure in a selected unit

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 pink line indicates Leak.

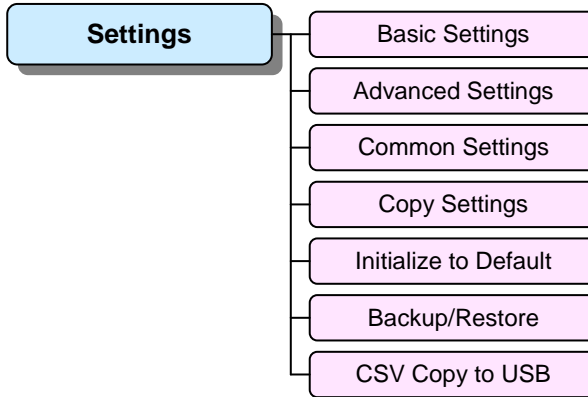
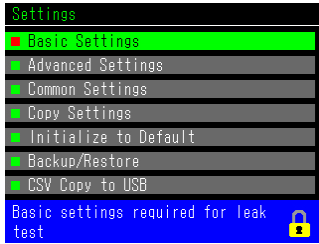


- A Leak:** Leak in a selected unit
- B Test Pressure:** Test pressure in a selected unit
- C Y axis:** DET UL is the full-scale of the Y axis. Although the scale for the test pressure is not displayed, the full-scale of the test pressure is its upper limit as well.
- D Test Pressure Graph:** The graph of the Test Pressure (Pink)
- E Leak Graph:** The graph of the Leak (Blue)
- F X axis:** Test time

3 Settings Menu



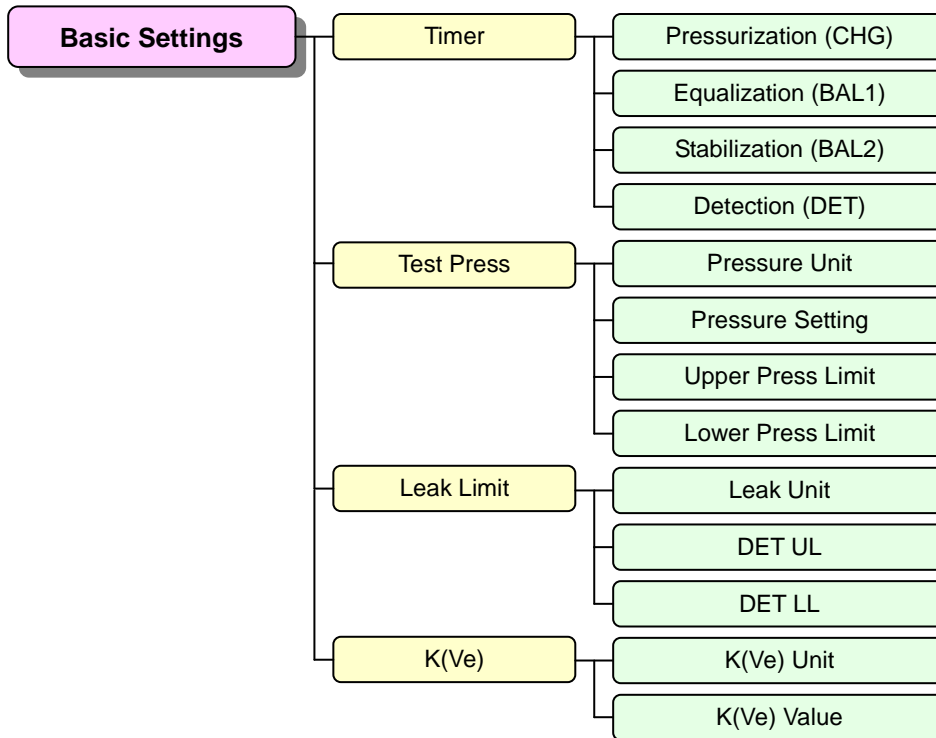
Menu to set the leak test parameters.



3.1 Basic Settings

Minimum settings for leak test.

Setting these items enables a simple leak test.

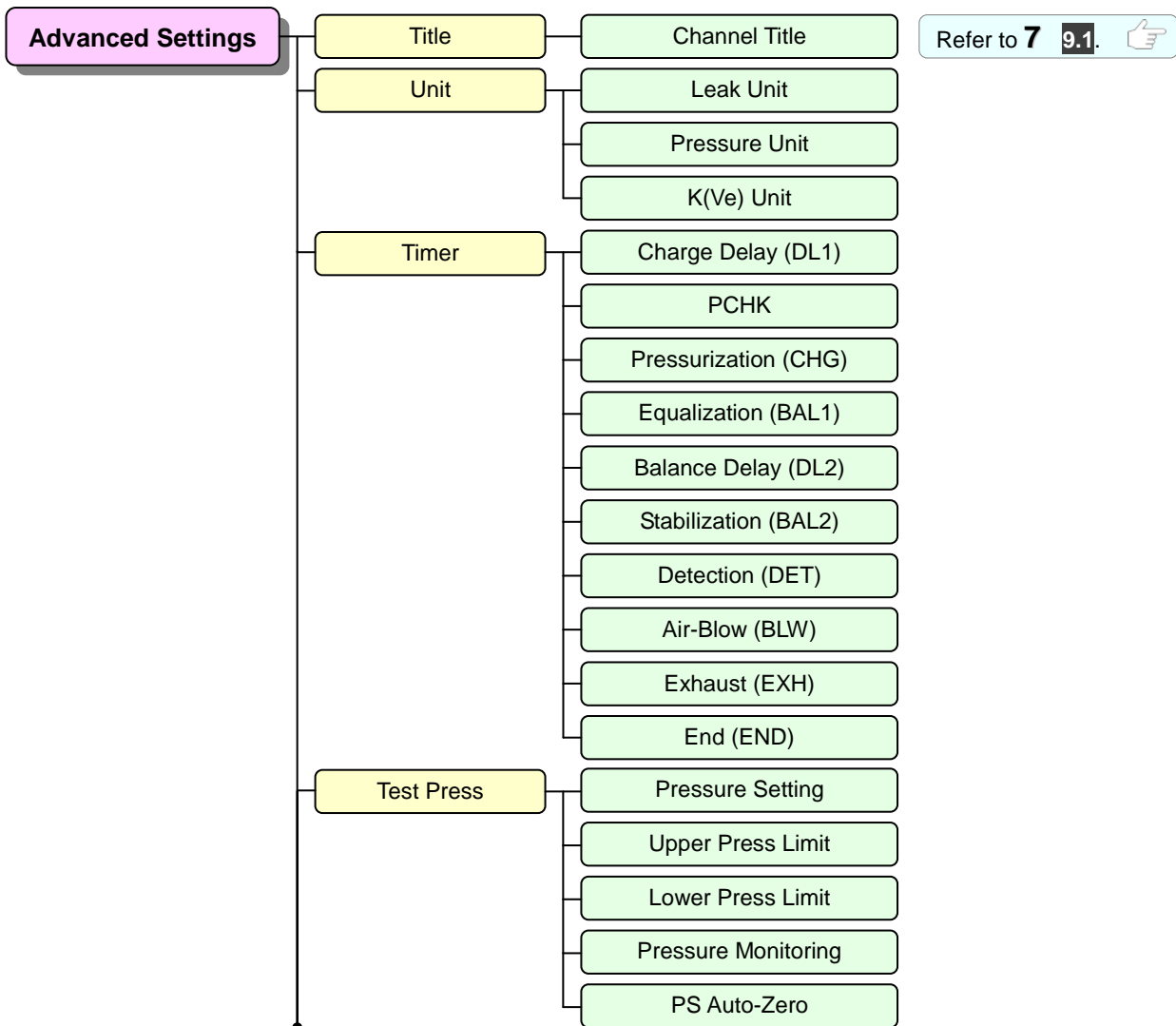


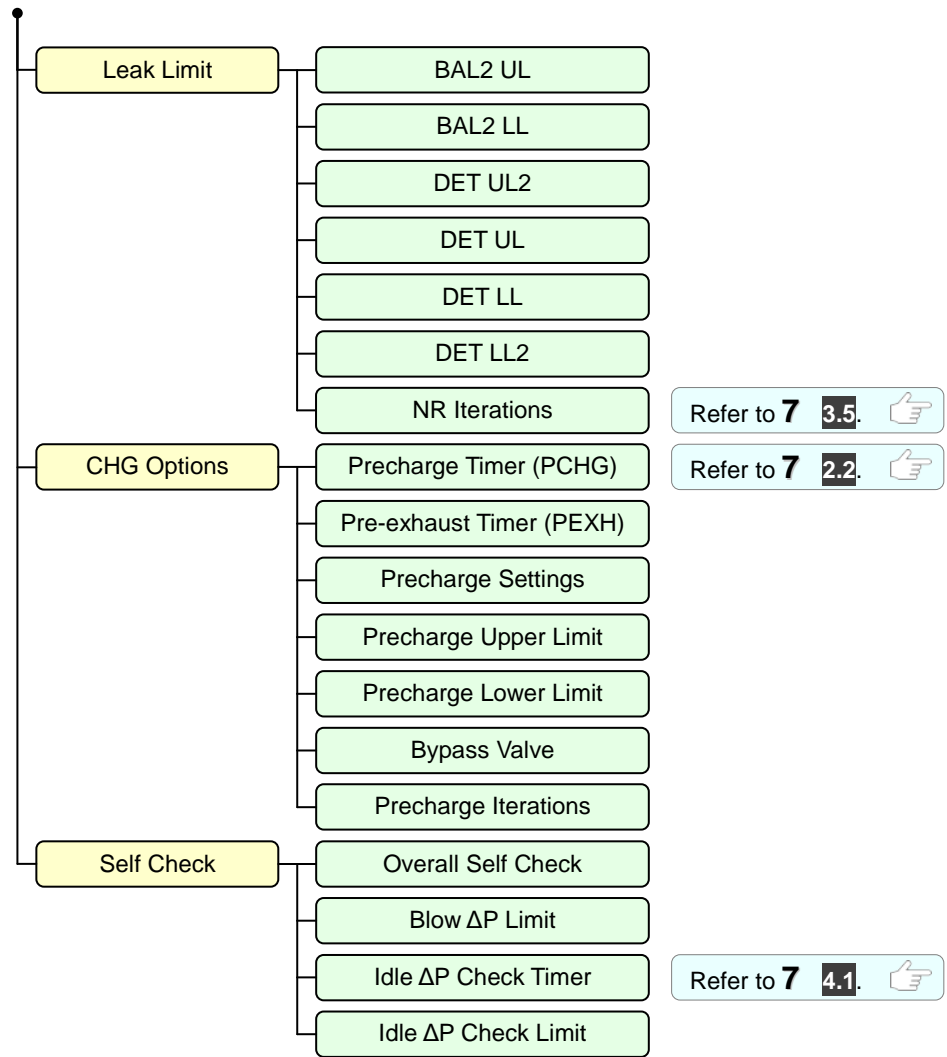
Timer	Pressurization (CHG)	0 to 999.9 [s]
	Equalization (BAL1)	
	Stabilization (BAL2)	
	Detection (DET)	
Test Pressure	Pressure Unit	kPa, MPa (PSI, kg/cm ² , bar, mbar, mmHg, cmHg, inHg) *1
	Pressure Setting	Pressure applied to tested part (WORK) and reference part (MASTER)
	Upper Press Limit	Varies 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 ₂ O, inH ₂ O, 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	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 ₂ O, inH ₂ O, 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 (in3, ft3) *1
Timer	Charge Delay (DL1)	0 to 999.9 [s]
	PCHK	Fixed to 0.2 [s] for the pneumatic circuits those have the stage and 0.0 (s) for those 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)	0.2 to 999.9 [s]	
End (END)		
Test Press	Pressure Setting	Pressure applied to tested part (WORK) and reference part (MASTER)
	Upper Press Limit	Monitors the test pressure.
	Lower Press Limit	Criteria for detecting Large leak.
	Pressure Monitoring	Enable/Disable Pressure Monitoring with upper/Lower test pressure limits.
	PS Auto-Zero	Disable/Enable

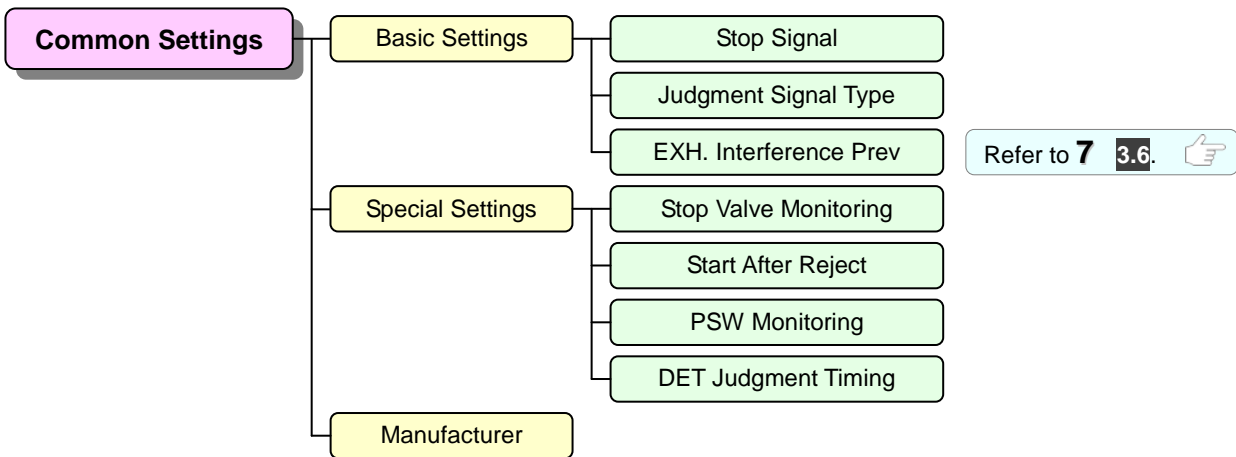
*1 The units in () are not available for SI unit restriction models.

Leak Limit	BAL2 UL	Upper leak limit for BAL2 stage
	BAL2 LL	Lower leak limit for 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.
CHG Options	Precharge Timer (PCHG)	0.0 to 999.9 [s] For testing a large volume part with a low test pressure.
	Pre-exhaust Timer (PEXH)	0.0 to 999.9 [s] Varies depending on the test specifications.
	Precharge Settings	Available only for E/P regulator models.
	Precharge Upper Limit	
	Precharge Lower Limit	
	Bypass Valve	Disable/Enable Bypass Circuit Unit is sold separately.
	Precharge Iterations	1 to 20
Self Check	Overall Self Check	Disable/Enable
	Blow ΔP Limit	Check the pneumatic circuit of LS-R700
	Idle ΔP Check Timer	Check the fill valve during idle state.
	Idle ΔP Check Limit	

5

3.3 Common Settings

Common settings for all the channels



Basic Settings	Stop Signal	Normally Open, Normally Closed	
	Judgment Signal Type	Pulse, Hold	
	EXH. Interference Prev	Disable/Enable	
Special Settings	Stop Valve Monitoring	Enable, Disable	Enable if the option W is selected.
	Start After Reject	Start only, Stop then Start	Normally "Start only"
	PSW Monitoring	Enable, Disable	Available only for H20 and L02 models
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

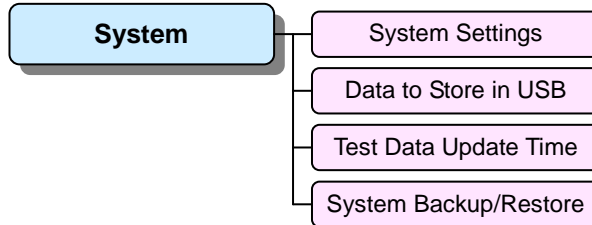
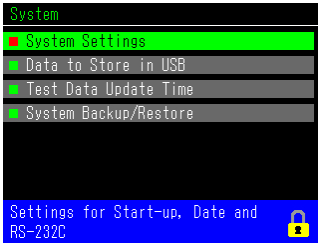
All the current test parameters are copy to USB Memory in the cvs format.

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

4 System Menu



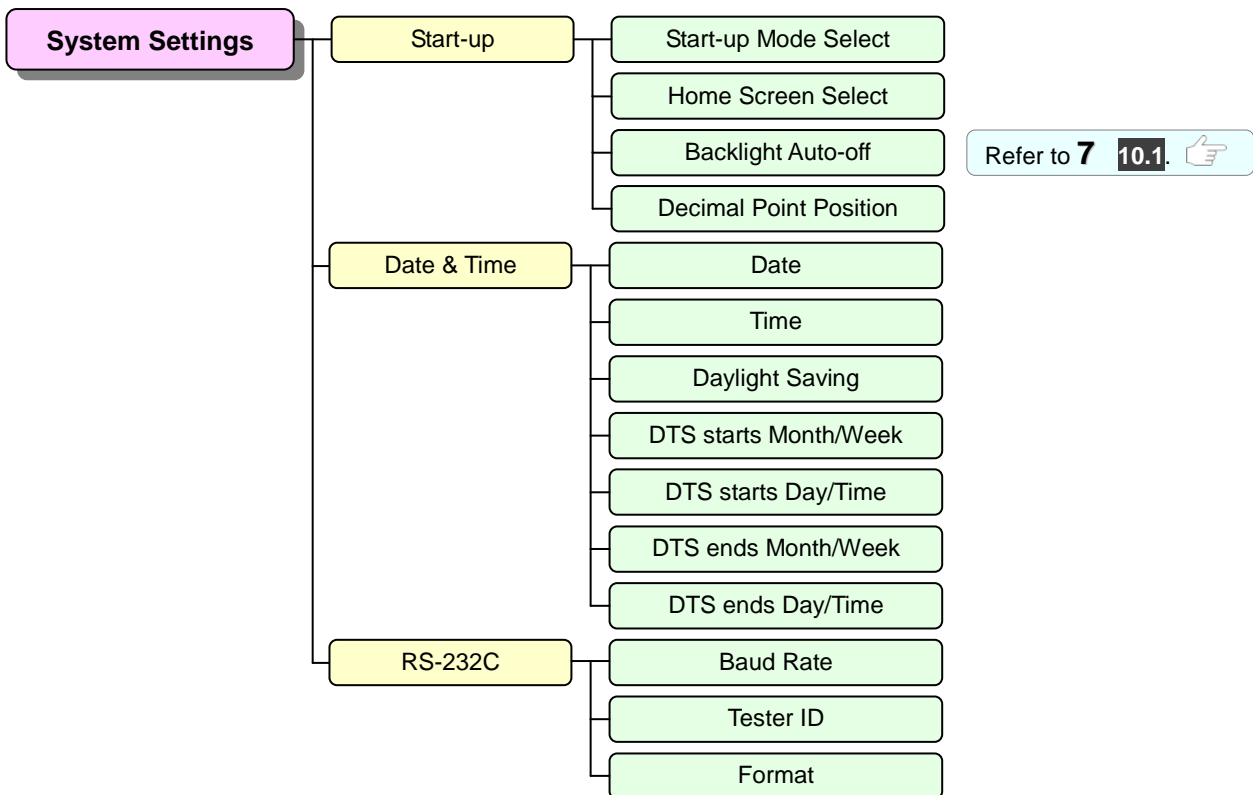
Menu to program the start-up settings, calendar feature and data output and to perform System Backup/Restore.



4.1 System Settings

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

5



Start-up	Start-up Mode Select	Remote / Manual
	Home Screen Select	Selectable: Standard, Advanced, Waveform
	Backlight Auto-off	LCD backlight goes off if no operation key is touched for the programmed period. Disable, 1, 5, 10, 30, 60, 120, 240 [mins]
	Decimal Point Position	Select the position of decimal point in the leak rate to be displayed from 0, 0.0, 0.00, and 0.000. When the leak rate is in units of differential pressure, this setting is disabled.
Date & Time	Date	Select year, month and date YYYY-MM-DD
	Time	Select hour, minute and second HH:MM:SS
	Daylight Saving	Disable/Enable DST feature
	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
	Tester ID	Used when more than 1 tester are used.
	Format	Selectable: T Format, ID Format, I Format, DT Format K Format, L Format, M Format, P Format, D Format

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.

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.)

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

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 System Backup/Restore

The entire system can be backed up and/or restored. (USB memory)

The current system settings can be restored easily from backup.

Backup

Restore

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

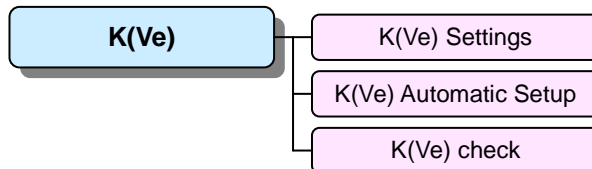
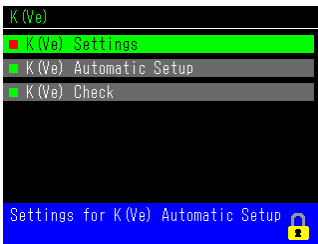
5 K(Ve) Menu



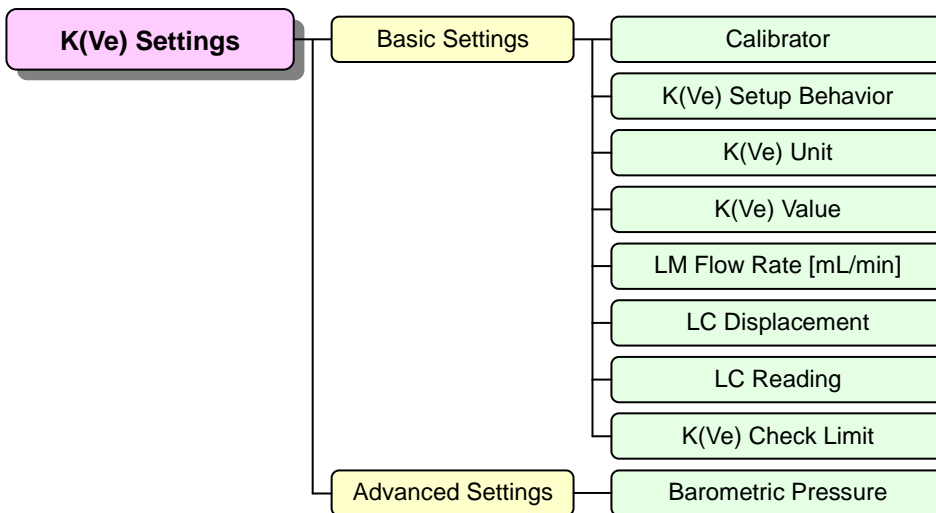
LS-R700 computes leakage based on the measurement of the pressure difference between the non-leaking master and the tested part.

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 Settings	Calibrator	Leak Master, LC4, LC2, LC1, 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.
	LC Displacement (ΔV)	Enter the LC displacement used for K(Ve) Automatic Setup.
	LC Reading	Enter LC reading (turns) used for K(Ve) Automatic Setup.
	K(Ve) Check Limit	Set K(Ve) Check Limit in percentage (%).
Advanced Settings	Barometric Pressure	Fixed to 101325 [Pa]

*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.

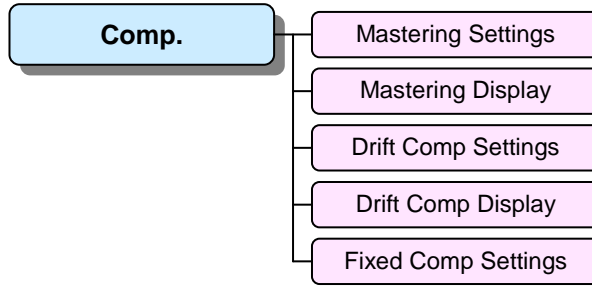
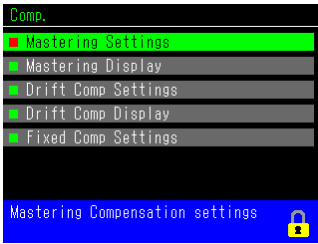
Program K(Ve) Check Limit in percentage (%) before performing K(Ve) Check.

LS-R700 compares K(Ve) measured with a known good part to the K(Ve) stored in memory.

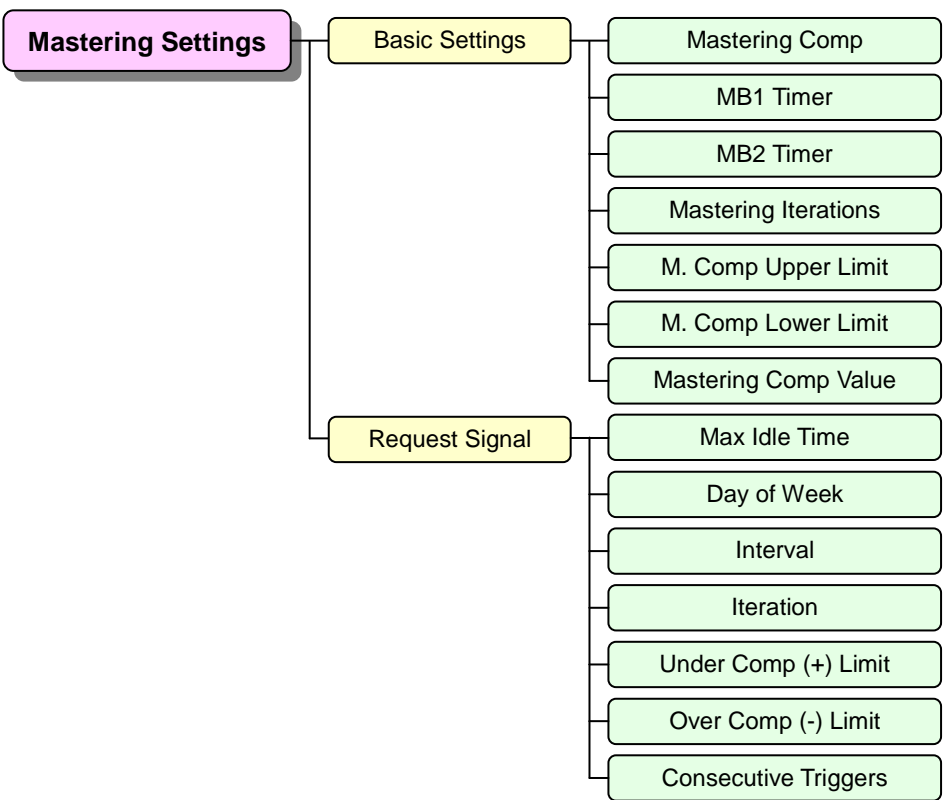
An error is displayed if the difference exceeds the tolerance. This can be used for daily sensitivity checks.

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.

5

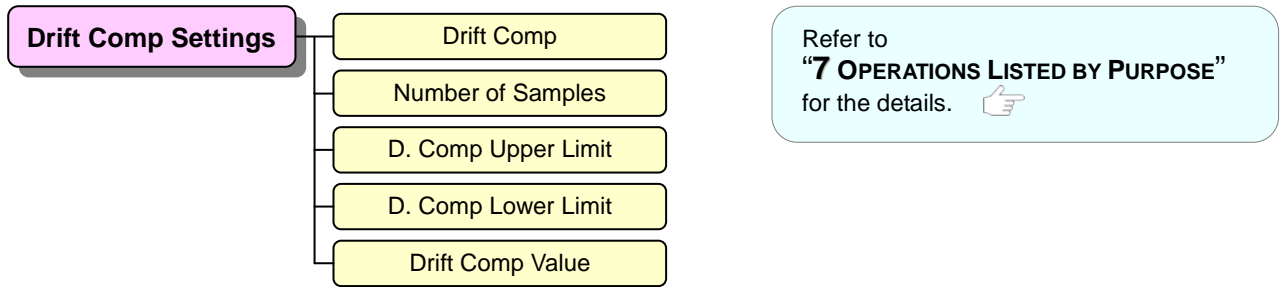
Basic Settings	Mastering Comp	Disable/Enable Mastering Compensation feature
	MB1 Timer	BAL1 timer for Mastering: 0 to 999.9 [s] Recommended timer: 1.0 [s]
	MB2 Timer	BAL2 timer for Mastering: 0 to 999.9 [s] Recommended timer: 2.0 [s]
	Mastering Iterations	1 to 20 Normally 5 times
	M. Comp Upper Limit	0 to ±9999.9 (programmed unit) Mastering Upper/Lower limits.
	M. Comp Lower Limit	Normally 120 to 150% of DET UL/LL
	Mastering Comp Value	Mastering Comp value can be entered automatically or automatically
Request Signal	Max Idle time	Idle time in production line. Exceeding the time transmits Mastering Request Signal. Setting this to 0 disable the feature.
	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	
	Under Comp (+) Limit	Upper leak limit for transmitting Mastering Request Signal.
	Over Comp (-) Limit	Lower leak limit for transmitting Mastering Request Signal.
	Consecutive Triggers	Number of triggers for transmitting Mastering Request Signal.

6.2 Mastering Display

Displays up to 20 DET data.

The display can be toggled between the table (List) and bar graph(Graph).

6.3 Drift Comp Settings



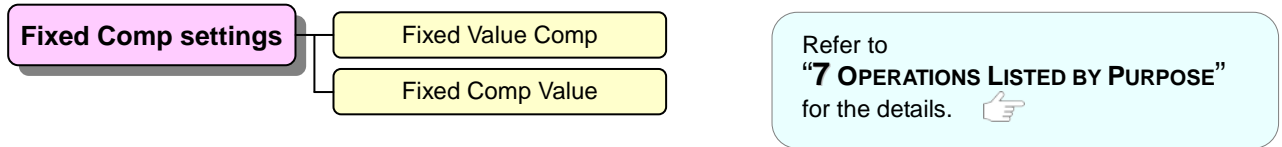
Drift Comp	Disable/Enable Drift compensation feature
Number of Samples	0 to 20
D. Comp Upper Limit	0 to 9999.9 Set Upper/Lower limits of compensation value.
D. Comp Lower Limit	
Drift Comp Value	Drift Comp Value can be entered automatically or manually.

6.4 Drift Comp Display

Displays up to 20 sampled data.

The display can be toggled between the table (List) and bar graph(Graph).

6.5 Fixed Comp Settings

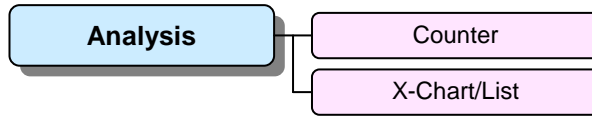
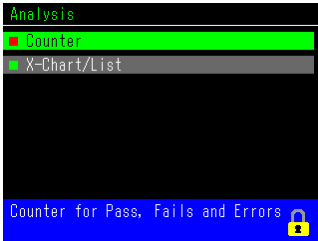


Fixed Value Comp	Disable/Enable Fixed value compensation feature.
Fixed Comp Value	Compensation value is manually entered.

7 Analysis Menu



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



7.1 Counter

Counter is displayed by a channel.

Select **Reset** and press in to reset the counter in the displayed channel.

7.2 X-Chart/List

Measured data is displayed in a graph.

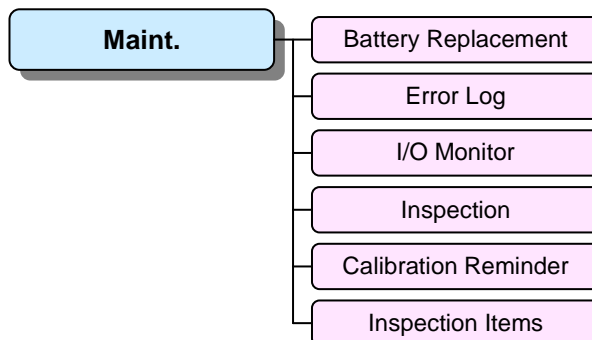
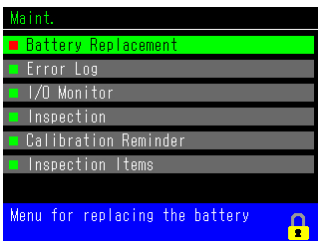
Refer to **"7 OPERATIONS LISTED BY PURPOSE"** for the details.

8 Maint. (Maintenance) Menu



Go to this menu for LS-R700 maintenance such as Battery Replacement and Inspection as well as viewing error log and I/O Monitor.

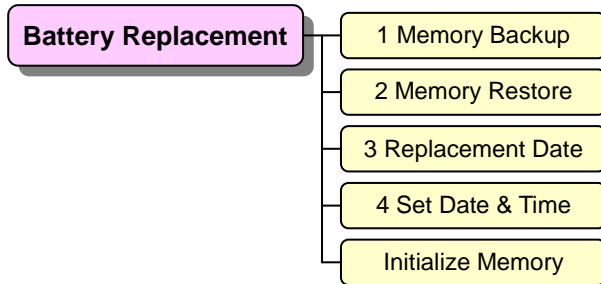
The person use the menu must be the person who is in charge of Maintenance of LS-R700.



5

8.1 Battery Replacement

Menu for replacing battery. Follow the number for the battery replacement.



Refer to “**8 MAINTENANCE**” for the details. 

8.2 Error Log

Displays Error Log.

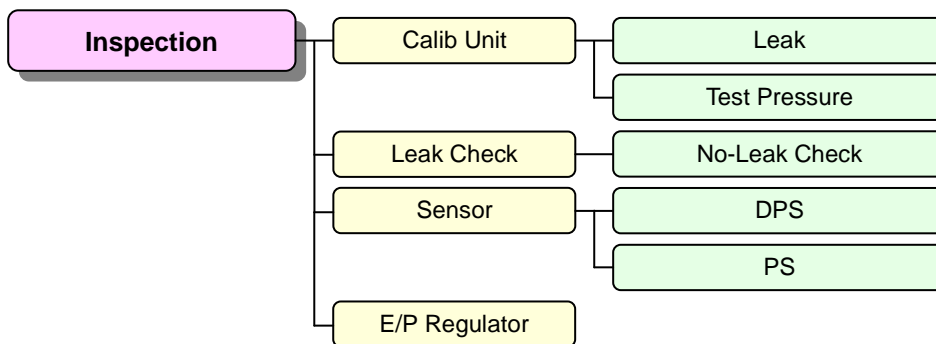
5

8.3 I/O Monitor

I/O signals can be monitored on this screen.

Refer to “**3 INTERFACE**” for the details. 

8.4 Inspection



Calib Unit	Leak	Pa, kPa (mmH ₂ O, inH ₂ O, inH ₂ O, 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-R700 itself.
Sensor	DPS	Adjust DPS offset and check the span
	PS	Adjust PS offset and check the span
E/P Regulator		Adjust E/P regulator

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

8.5 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.

8.6 Inspection Items

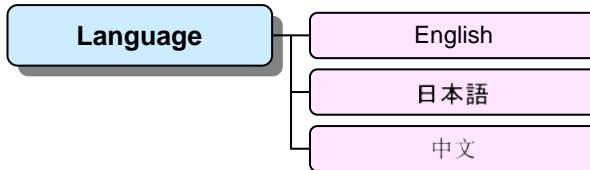
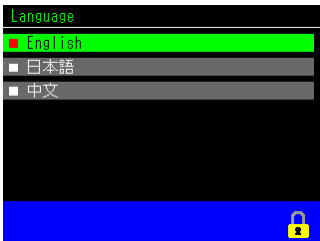
Displays Daily, Monthly and Annual inspection points.

5

9 Language Menu



Menu to select a language. 3 languages, English, Japanese and Chinese are available.



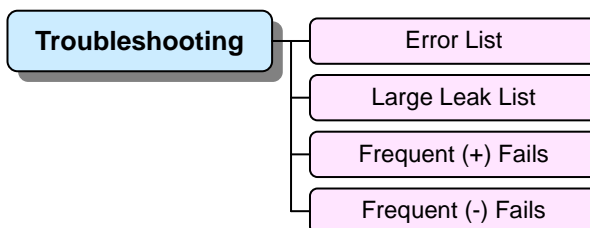
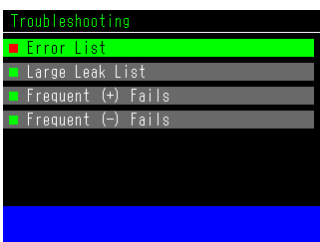
Refer to "7 OPERATIONS LISTED BY PURPOSE" for the details.

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.

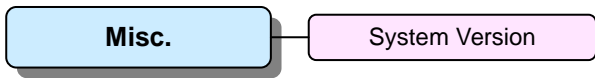
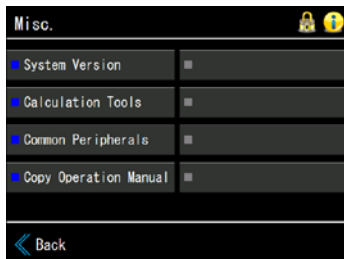
Refer to “**9 TROUBLESHOOTING**” for the details. 

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.



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1 Initial Setups

This section provides the required Initial setups before using LS-R700




Attention


Settings unlock is required to change settings and toggling to Manual (M) mode 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 (R) or Manual (M)

Go to:  > Main Menu > 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 pressed.

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


1.3 Set Date

Set the current date.

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

1.4 Set Time

Set the current time.

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

2 Perform a Simple Air Leak Test



Attention

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

2.1 Test Parameter Entry

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

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

2.2 Timer

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

CH#00	Settings	Basic Settings
Timer	s	Test Press kPa
CHG	10.0	TP UL +1000
BAL1	0.5	TP LL + 1
BAL2	5.0	Setting + 100
DET	10.0	Leak Lim Pa
K (Ve) U	mL	DET UL +100.000
K (Ve) V	13.000	DET LL -100.000

Pressurization timer: Pressurize the part to test pressure.

- 1) Enter 40 [s] for Pressurization (CHG)
- 2) Enter 30 [s] for Equalization (BAL1)
- 3) Enter 5 [s] for Stabilization (BAL2)
- 4) Enter 1 to 10 [s] for Detection (DET)

Under condition where the Pressurization and Stabilization times are sufficiently long.

2.3 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. Besides, if a large leak occurs in the system, LS-R700 can detect it before tester proceeds to Stabilization (BAL2) and Detection (DET) stages.

CH#00	Settings	Basic Settings
Timer	s	Test Press kPa
CHG	10.0	TP UL +1000
BAL1	0.5	TP LL + 1
BAL2	5.0	Setting + 100
DET	10.0	Leak Lim Pa
K (Ve) U	mL	DET UL +100.000
K (Ve) V	13.000	DET LL -100.000


Select a Test Pressure Unit.

- 1) Select a pressure unit.
- 2) 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.
- 3) Enter Upper Pressure Limit
- 4) Enter Lower Pressure Limit
For the models other than Type C and Vacuum, program a value larger than 0.

2.4 Leak Limit

Set the parameters according to your test specifications.

CH#00 Settings Basic Settings			
Timer	s	Test Press	KPa
CHG	10.0	TP UL	+1000
BAL1	0.5	TP LL	+ 1
BAL2	5.0	Setting	+ 100
DET	10.0	Leak Lim	Pa
K(Ve) U	mL	DET UL	+100.000
K(Ve) V	13.000	DET LL	-100.000


Select a Leak Unit. 

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

2.5 K(Ve)

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

CH#00 Settings Basic Settings			
Timer	s	Test Press	KPa
CHG	10.0	TP UL	+1000
BAL1	0.5	TP LL	+ 1
BAL2	5.0	Setting	+ 100
DET	10.0	Leak Lim	Pa
K(Ve) U	mL	DET UL	+100.000
K(Ve) V	13.000	DET LL	-100.000

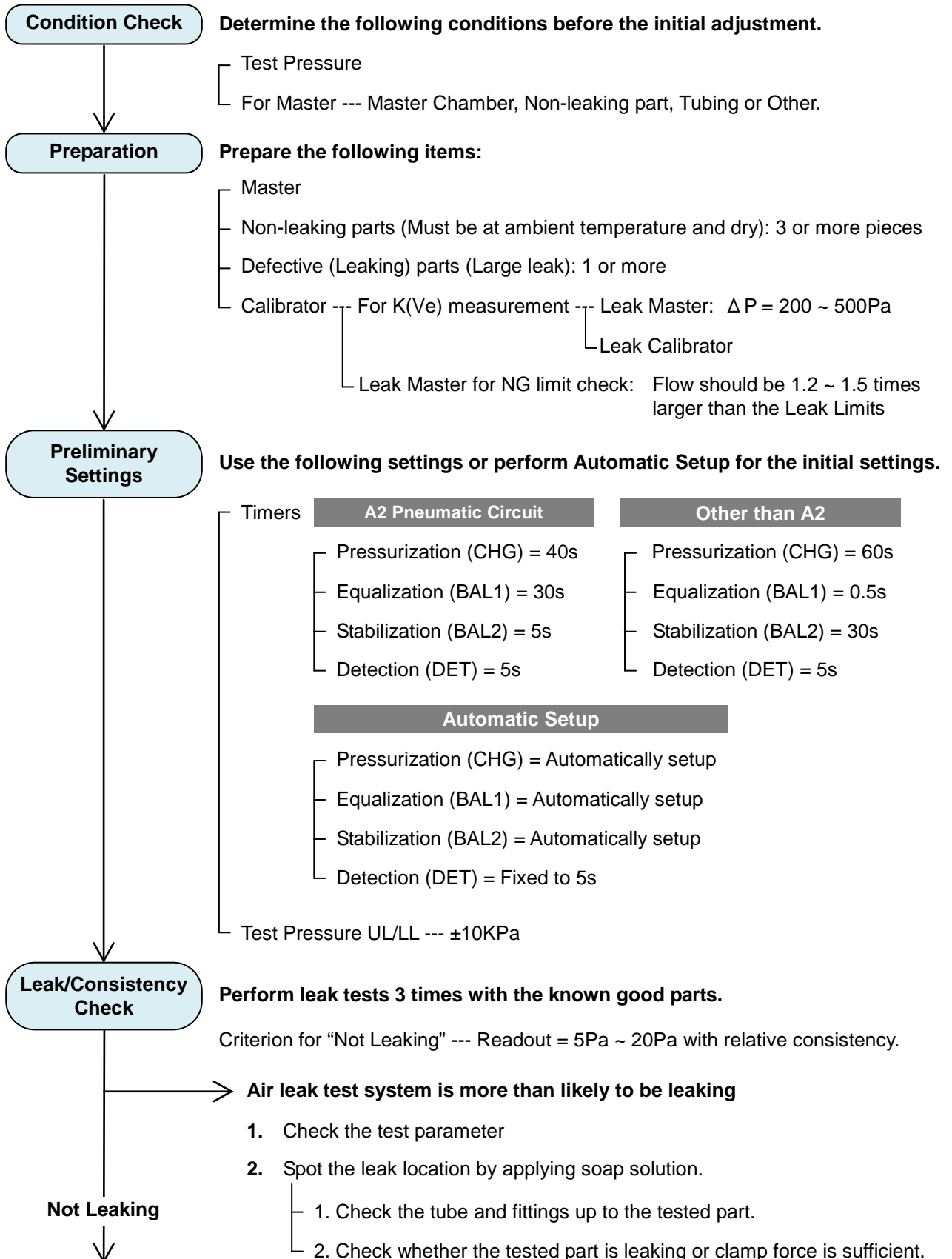
K(Ve) = Leak Coefficient
Select a unit for Leak coefficient. 

- 1) Select a K(Ve) unit.
- 2) Enter K(Ve) value.

3 Flow for Initial Adjustment

LS-R700 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.



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 Initial Test Parameter 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.

4.1 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. 

5 Notation of Air Leak Tests stages and Limits



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

Stage	Symbol
Idle state	WAIT
Charge Delay	DL1
PCHK	PCHK
Precharge	PCHG
Pressurization	CHG
Equalization	BAL1
Balance Delay	DL2
Stabilization	BAL2
Detection	DET
Air-Blow	BLW
Exhaust	EXH
Pre-exhaust	PEXH
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)

6

6 Air Leak Test Result List

Display	Criteria	
OK	$DET\ LL < Leak < DET\ UL$	
DET UL2	$DET\ UL2 \leq Leak$	
DET UL	$DET\ UL \leq Leak < DET\ UL2$	
DET LL	$DET\ LL2 < Leak \leq DET\ LL$	
DET LL2	$Leak \leq DET\ LL2$	
BAL2 UL	$BAL2\ UL \leq Leak$	
BAL2 LL	$Leak \leq BAL2\ LL$	
CHG Large Leak WORK side	Differential pressure exceeds $\pm 300Pa$ in CHG.	Refer to "4 Large Leak List" in "9 TROUBLESHOOTING" for the details. 
DL2 Large Leak WORK side	Differential pressure exceeds $\pm 50\%$ 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

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Attention

Settings unlock is required to change settings and toggling to Manual (M) mode 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-R700 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.

1.1 K(Ve) Automatic Setup

A tool called Leak Master is used for K(Ve) Automatic Setup.

- 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.
 ☰ > Main Menu > Measure Screen > Mode > Meas Mode > Charge Hold
- 4) 🔍 > Press ▶ to start and check the test pressure.
- 5) ☰ > Main Menu > K(Ve) > K(Ve) Automatic Setup > Basic settings > K(Ve) Setup Behavior > Select 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 LC or QLC. Mastering is effective for reducing the BAL2 timer and DET timer.

CH#00	K (Ve)	Basic	1/2
Calibrator	Leak Master		
K (Ve) Setup Behavior	3-phase		
K (Ve) Unit	mL		
K (Ve) Value	13.000		
LM Flow Rate [mL/min]	0.000		
ALC Displacement	0.000 mL		
ALC Reading	0.00 turns		
Select a behavior for K (Ve) Automatic Setup.			

3-phase: LS-R700 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.

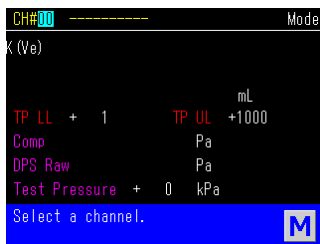
1-phase: LS-R700 will cycle through one sequence and calculate the system volume K(Ve).

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 Leak Master (Type J)

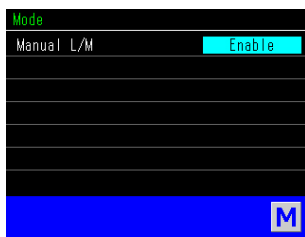


- 1) Remove the plug from the \times Calibration port and connect a Leak Master.
- 2) Check whether Calibrator is set to Leak Master.
 $\left[\text{Menu} \right] > \text{Main Menu} > \text{K(Ve)} > \text{K(Ve) Settings} > \text{Basic Settings} > \text{Calibrator}$
- 3) Enter the Flow Rate of the connected Leak Master in mL/min.
- 4) Start K(Ve) Automatic Setup
 $\left[\text{Left Arrow} \right] > \left[\text{Right Arrow} \right] > \text{K(Ve)} > \text{K(Ve) Automatic Setup} > \left[\text{Play} \right]$
 After 3 phases of tests, LS-R700 will show the K(Ve) value.
- 5) Change the Leak Unit to a Flow rate unit.
 $\left[\text{Menu} \right] > \text{Main Menu} > \text{Settings} > \text{Advanced Settings} > \text{Unit} > \text{Leak Unit}$
- 6) Remove the Leak Master from the \times 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".
 $\left[\text{Menu} \right] > \text{Main Menu} > \text{K(Ve)} > \text{K(Ve) Settings} > \text{Basic Settings} > \text{Calibrator}$
- 2) Enter the Flow Rate of the connected Leak Master in mL/min.
- 3) Select Manual Leak Master
 $\left[\text{Left Arrow} \right] \left[\text{Right Arrow} \right] > \text{K(Ve)} > \text{K(Ve) Automatic Setup} > \text{Mode}$
- 4) Start K(Ve) Automatic Setup
 $\left[\text{Left Arrow} \right] > \text{K(Ve) Automatic Setup} > \left[\text{Play} \right]$

3-phase

- 1) Press $\left[\text{Play} \right]$ to start K(Ve) Automatic Setup
- 2) After 2 phases of tests, LS-R700 will be idle state.
 Remove the plug from \times Calibration port and connect a Leak Master.
- 3) Press $\left[\text{Play} \right]$ to resume measurement.
 After measurement is completed LS-R700 will show the K(Ve) value.
- 4) Change the Leak Unit to a Flow rate unit. $\left[\text{Menu} \right] > \text{Settings} > \text{Advanced Settings} > \text{Unit} > \text{Leak Unit}$
- 5) Remove the Leak Master from the \times Calibration port and put the plug back on firmly.

1-phase

- 1) Remove the plug from the \times Calibration port and connect a Leak Master.
- 2) Press $\left[\text{Play} \right]$ to start K(Ve) Automatic Setup
 After measurement is completed LS-R700 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. $\left[\text{Menu} \right] > \text{Settings} > \text{Advanced Settings} > \text{Unit} > \text{Leak Unit}$
- 5) Remove the Leak Master from the \times Calibration port and put the plug back on firmly.

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

Manually enter the calculated K(Ve)

☰ > Main Menu > K(Ve) > K(Ve) Settings > Basic Settings > K(Ve) Value

2 Reducing Cycle Time

What to do

- Use Mastering Compensation
- Use Bypass Circuit Unit (Option)

2.1 Setting 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.



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.

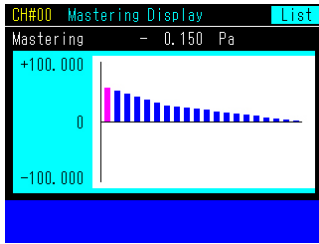
Mastering Compensation




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

Mastering Compensation feature is Disabled for the default.

- 1) Connect a Reference Master to the 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
☰ > Main Menu >Comp. > Mastering Settings > Basic Settings
- 4) Enable Mastering Compensation Feature
Mastering Comp > Enable
- 5) Set MB1 (Mastering Equalization) timer to 1.0 [s] and MB2 (Mastering Stabilization) timer to 2.0 [s] and Mastering Iterations to 5.
- 6) Press 🏠 to go to the Home screen.

CH#00 Mastering Settings Basic	
Mastering Comp	Disable
MB1 Timer	2.0
MB2 Timer	3.0
Mastering Iterations	5
M. Comp Upper Limit	+250.000
M. Comp Lower Limit	-250.000
Mastering Comp Value	+ 0.000
Enable/Disable Mastering Compensation feature	



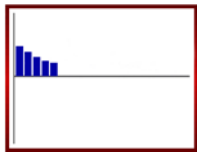
- 7) Mode > Meas Mode > Mastering
- 8) Start Mastering Value Sampling
 > 
- 9) Check the Mastering graph
 > Main Menu > Comp > Mastering Display > Graph
- 10) An ideal Mastering graph shows DET data gradually decreases and becomes constant close to 0.

How to verify Mastering Data



Data stops decreasing and eventually becomes constant.

Ideal

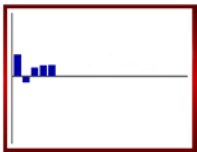
Data continues to decline.
 Increase the number of iterations.

Try again



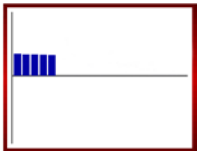

Data is stable and constant.
 CHG and BAL1 timers can be reduced.

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) When the Mastering data is not close to ideal, check the seals, part and fittings for possible leaks. If no leak was found, increase the Mastering Iterations.

 > Comp > Mastering Settings > Basic Settings > Mastering Iterations

- 13) Execute Mastering Value Sampling again.



 > Home screen > 

- 14) If increasing Mastering Iteration does not stabilize the data, extend CHG, MB1 and MB2 timers


 > Main Menu > Settings > Basic Settings > Timer > Pressurization (CHG)

 > Main Menu > Comp > Mastering Settings > Basic Settings > MB1 Timer / MB2 Timer

- 15) Execute Mastering Value Sampling again.

 > Home screen > 

- 16) Record the first DET data

 > Main Menu > Comp > Mastering Display

- 17) Enter Compensation Limits

 > Comp > Mastering Settings > Basic Settings

Upper Limit: Enter value approx. 1.2 to 1.5 of the recorded DET data

Lower Limit: Enter 0

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 Works themselves may vary. After such occasions, executing a Mastering Value Sampling is recommended.
- **Production Part Changeover**
For production lines that produce multiple Works, each Work 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**
When settings such as stage timers are changed, the execution of a Mastering Value Sampling is required.
- **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 Works 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.


Mastering Value Sampling can be executed externally through I/O port as well.

Refer to “3 INTERFACE” for the details. 


Set the Condition to transmit Mastering Request signal.

CH#00 Mastering Settings Request Sig	
Max Idle Time	10 min
Day of Week	Monday
Interval	5 min
Iteration	5
Under Comp (+) Limit	+ 25.000
Over Comp (-) Limit	- 25.000
Consecutive Triggers	5
The signal will be transmitted when exceeding this time. 	

Set necessary conditions.

 > Main Menu > Comp > Mastering Settings > Request Signal

2.2 Bypass Charge (Option)

CH#00 Advanced Settings CHG Options	
Precharge Timer (PCHG)	0.0
Pre-exhaust Timer (PEXH)	0.0
Precharge Settings	+ 0
Precharge Upper Limit	+1000
Precharge Lower Limit	+ 1
Bypass Valve	Disable
Precharge Iteration	1
Used when test pressure is low and part volume is large 	

Program the followings:

 > Main Menu > Settings > Advanced Settings > CHG Options

- Precharge Timer (PCHG)
- Precharge Setting
- Precharge Upper Limit / Precharge Lower Limit
- Bypass Valve > Toggle to Enable.

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 Setting Mastering Compensation


Refer to [2.1 Setting Mastering Compensation](#) for the details. 

3.2 Setting 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.

CH#00 Drift Comp Settings	
Drift Comp	Disable
Number of Samples	0
D. Comp Upper Limit	+ 25.000
D. Comp Lower Limit	- 25.000
Drift Comp Value	+ 0.000
Enable/Disable Drift Compensation feature 	

NOTE

The figures in this section are general recommendation.

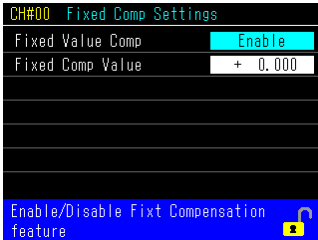
Drift Compensation feature is Disable as default.

- 1)  > Main Menu >Comp > Drift Comp Feature
- 2) Select a Channel.
- 3) Enable Drift Comp.
- 4) Enter 5 to Number of Samples.
- 5) Enter 50~80% to Comp Upper Limit.
- 6) Enter 0.0 to Comp Lower Limit.

3.3 Setting 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 disable as default.

- 1) > Main Menu > Comp > Fixed Comp. Settings
- 2) Enable Fixed Value Comp.
- 3) Enter a comp value to Fixed Comp Value

3.4 Use Mastering Comp with Drift Compensation

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}

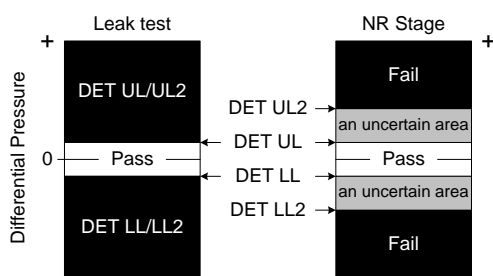
2nd test Displayed value = 2nd raw data – {(1st raw data + Mastering value) / 2}

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 Setting 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-R700 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.

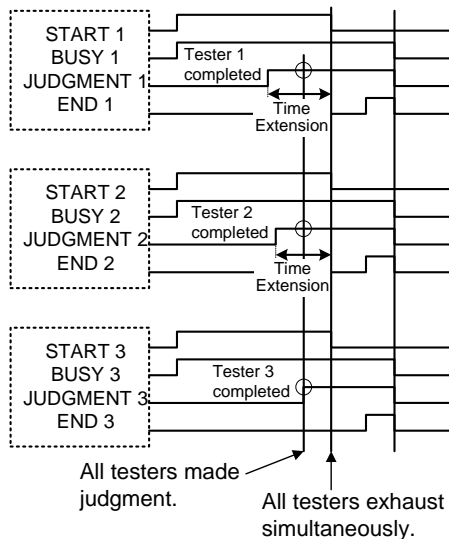
In the NR process, DET stage is repeated for the previously set number of times and make a judgment, however, leak test ends instantaneously if GO judgment is made before repeating the set number. The number of iteration of DET stage can be set up to 20. Setting the iteration number to 1 disables the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

CH#00	Advanced Settings	Leak Limit
BAL2 UL		+900.000
BAL2 LL		-900.000
DET UL2		+200.000
DET UL		+100.000
DET LL		-100.000
DET LL2		-200.000
NR Iterations		1
Noise Reduction iteration		

- 1) Enter 2 or larger number to NR Iterations
 ☰ > Main Menu > Settings > Advanced Settings > Leak Limit > NR Iterations
- 2) Enter DET (UL2)
- 3) Enter DET (LL2)

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.

3.6 Setting Exhaust Interference Prevention



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 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.

Common Settings Basic	
Stop Signal	Normally Open
Judgment Signal Type	Pulse
EXH. Interference Prev	Enable
Select Enable/Disable of Exhaust Interference Prevention.	

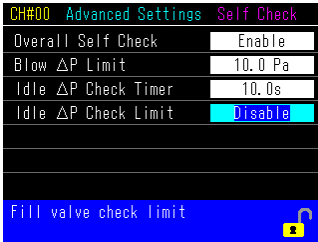
- Enable EXH. Interference Prev
 ☰ > Main Menu > Settings > Common Settings > Basic Settings > EXH. Interference Prev > Select Enable

4 Enhance Test Reliability

What to do

- Set Idle ΔP Check

4.1 Setting Idle ΔP Check (Self Check)



LS-R700 checks if fill valve is closed during idle state.

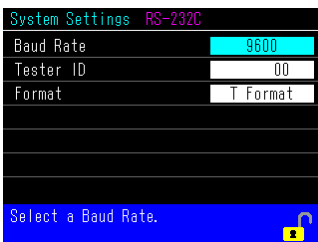
- ☰ > Main Menu > Settings > Advanced Settings > Self Check
- > Idle ΔP Check Timer
- > Idle ΔP Check Limit

5 Managing Data on Computer

What to do

- Program RS-232C Communication settings
- Select Data to store in USB Memory
- Backup the current programmed test parameters

5.1 Program RS-232C Settings

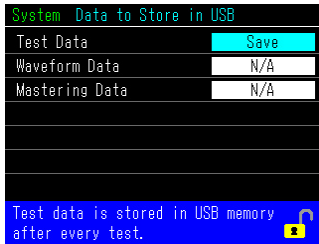


Test results along with various data can be transmitted through RS-232C port in a format of your choice.

- ☰ > Main Menu > System > System Settings > RS-232C

Refer to “3 INTERFACE” for the details.

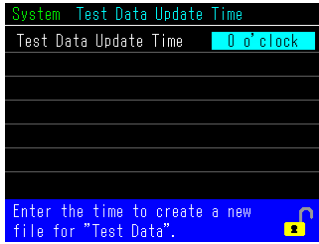
5.2 Collecting Data in USB Memory



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

Select Data to store in USB memory.

> Main Menu > System > Data to Store in USB



When Test Data is selected above, a new file is created once a day at the programmed time. Usually timer is set any time between the last shift and the first shift.

Set the time to create a new file for Test Data

> System > Test Data Update Time

NOTE

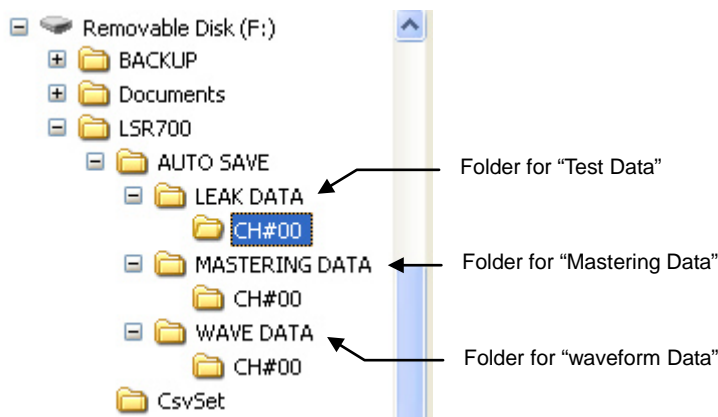
Please leave the USB Memory on the USB port all the time for the data collection.

Viewing The Stored Data in USB

Pull out the USB memory from LS-R700 and connect it to your computer.

All the data is in CSV format

Data is automatically named by the date and time and stored in each folder sorted by channels.



Test Data

Name of file: YYYYMMDD_HH_CH#XX.csv

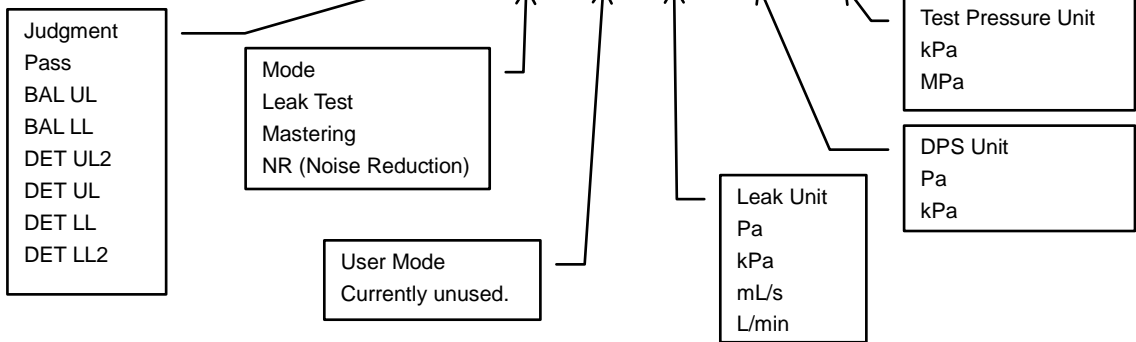
Year Month Date_Hour_Channel#.csv

ig: 20130723_00_CH#00.csv (_ represents a space)

Pass: Removable Disc\LS-R700\AUTO SAVE\LEAK DATA\YYYYMMDD_HH_CH#XX.csv

Example:

FILE NAM	LSR700\AUTO SAVE\LEAK DATA\CH#00\20130723 00 CH#00.csv													
CH#	BAL Leak	DET Leak	Comp Val	Mastering	DPS Raw	Test Press	Judgment	Mode	User Mode	Leak Unit	DPSRawU	TPress Un	DET UL	DET LL
0	0	0	0.7	0.7	0.8	0.8	OK	Leak Test	---	Pa	Pa	kPa	100	-100
0	0.2	1.8	0	0	1.8	1.8	OK	Mastering	---	Pa	Pa	kPa	100	-100
0	-2.3	1638.4	0	0	1638.4	1638.4	BAL2 L W	Mastering	---	Pa	Pa	kPa	100	-100
0	999.9	1598.1	0	0	1598.1	1598.1	BAL2 L W	Leak Test	---	Pa	Pa	kPa	100	-100



Waveform Data

Name of file: YYYYMMDD_HH_CH#XX.csv

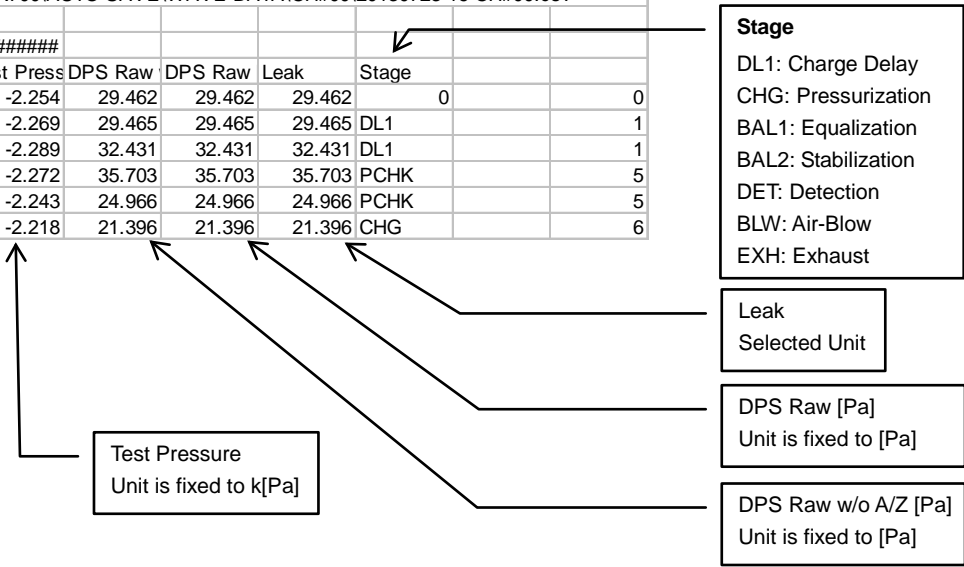
Year Month Date_Hour_Channel#.csv

ig: 20130723_16_CH#00.csv (_ represents a space)

Pass: Removable Disc\LS-R700\AUTO SAVE\WAVE DATA\YYYYMMDD_HH_CH#XX.csv

Example:

FILE NAM	LSR700\AUTO SAVE\WAVE DATA\CH#00\20130723 16 CH#00.csv						
DATE	#####						
Sample#	Test Press	DPS Raw	DPS Raw	Leak	Stage		
1	-2.254	29.462	29.462	29.462	0		0
2	-2.269	29.465	29.465	29.465	DL1		1
3	-2.289	32.431	32.431	32.431	DL1		1
4	-2.272	35.703	35.703	35.703	PCHK		5
5	-2.243	24.966	24.966	24.966	PCHK		5
6	-2.218	21.396	21.396	21.396	CHG		6



Mastering Data


Name of file: YYYYMMCH#XX.csv
 Year Month Channel#.csv
ig: 201307CH#00.csv

Pass: Removable Disc\LS-R700\AUTO SAVE\MASTERING DATA\ YYYYMMCH#XX.csv

Example

FILE NAM	LSR700\AUTO SAVE\MASTERTING DATA\CH#00\201307CH#00.csv												
DATE	#####												
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
	-0.5	1.3	1.1	0.9	0.6	1.8							
DATE	#####												
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
	0	-3.5											

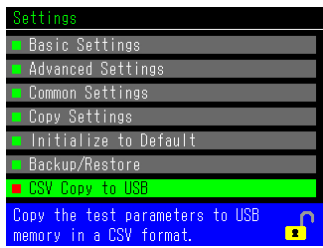
Update Time for Each Data File

- **Test Data:** A new file is created once a day at preset hour
 > Main Menu >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-R700 to USB

Refer to **7.1 Use X-Chart** . 

5.3 Copy Test Parameters to UBS Memory



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

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

 > Main Menu > 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-R700

The file can be viewed in a computer.

The screenshot shows a Windows Explorer window with the address bar set to 'F:\LSR700\CsvSet'. The file list shows '201308271705.csv' (13 KB, Microsoft Excel Com...). An arrow points from this file to a Microsoft Excel spreadsheet titled '201308271705.csv'. The spreadsheet contains the following data:

FILE NAME	LSR700\CsvFileAllSettings\201308271705.csv										
Version:	1.0.0.0	Release:	8/1/2013								
Advanced Settings	CH#0	CH#1	CH#2	CH#3	CH#4	CH#5	CH#6	CH#7	CH#8	CH#9	CH#10
Channel Name	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Unit	Leak	Pa	Pa	Pa	Pa	Pa	Pa	Pa	Pa	Pa	Pa
	Test Press	kPa	kPa	kPa	kPa	kPa	kPa	kPa	kPa	kPa	kPa
	K(Ve) Val	mL	mL	mL	mL	mL	mL	mL	mL	mL	mL
	Temperature										
Timer	Charge De	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	PCHK	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Charge (Ch	5	10	10	10	10	10	10	10	5	10
	Equalizati	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Balance D	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Balance (E	2	5	5	5	5	5	5	5	2	5
	Detection i	3	10	10	10	10	10	10	10	3	10
	Air-Blow (E	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Exhaust (E	0	0	0	0	0	0	0	0	0	0
	End (END)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Test Press	EP Regula	EP/1	EP/1	EP/1	EP/1	EP/1	EP/1	EP/1	EP/1	EP/1	EP/1
	Setting	0	0	0	0	0	0	0	0	0	0
	High Limit	90	0	0	0	0	0	0	0	90	0

A callout box highlights the channel headers (CH#0 to CH#10) with the text: "All the test parameters are listed by channels."

The Folder and Files

The backup data is stored in a folder "CsvSet" that is automatically created in LSR-700 folder.

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

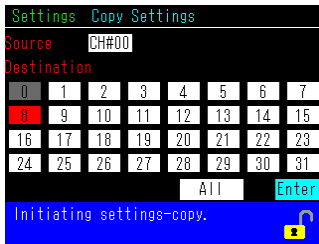
Pass: Removable Disc\LSR700\CsvSet\YYYYMMDDHHMM.csv

6 Programming Parameters for the Similar Tested Parts

What to do

- Copy Settings
- Initialize to Default

6.1 Copy Settings



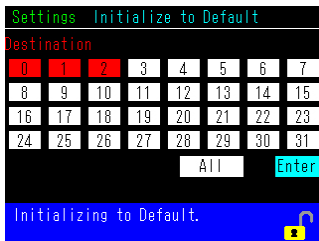
Test parameters of a channel can be copied to other channels.

- 1) > Main Menu > Settings > Copy Settings
- 2) Select a source channel
- 3) Select destination channels
More than one channels can be selected.
- 4) **Enter** > "Initiating Settings-Copy OK to continue?" > **Yes**

Blue	Where the cursor is at
Pink	Currently transmitted while the cursor is there
Green	Currently transmitted

NOTE
The counter of destination channel will be reset.

6.2 Initialize to Default



Default parameters can be copied to other channels.

- 1) > Main Menu > Settings > Initialize to Default
- 2) Select destination channel(s)
More than one channels can be selected.
- 3) **Enter** > "Initializing to Default OK to continue?" > **Yes**

Blue	Where the cursor is at
Pink	Currently transmitted while the cursor is there
Green	Currently transmitted

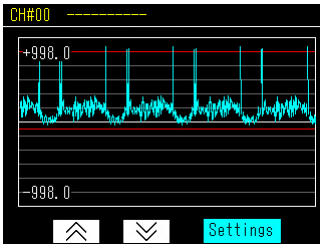
NOTE
The Mastering Value, Compensation Value and Counter of destination channel will be reset.

7 Analyze Measured Data

What to do

- Use X-Chart to view daily trends and simple statistic of the test data

7.1 Use X-Chart

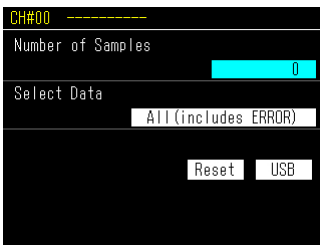


LS-R700 stores up to 1000 test logs in all 32 channels.

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).

This is useful for viewing daily trends and simple statistics of the test results without using a computer.

The scale of Y-axis changes with and .



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

Number of Samples

Programmed number of the data is extracted for statistics.

Setting it to 0 uses all the data in the current channel

Select Data

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

Reset: Resets all the test data in all the channels.

USB: Saves the data set to Number of Samples and Select Data in a USB memory in the CSV format.

Saves in LSR700\MANUAL SAVE\LEAK DATA\CH#

20140519171415.csv

The file name consists of the date, hours, minutes and seconds when the data are saved in the USB memory.

FILE LSR700\MANUAL SAVE\LEAK DATA\CH#00\20140519171415.csv

CH#	DET Le	Test Pr	Judgm	Mode	User M	Leak U	T Press	Date&T
0	3.8	71	OK	Leak T	---	Pa	kPa	201405

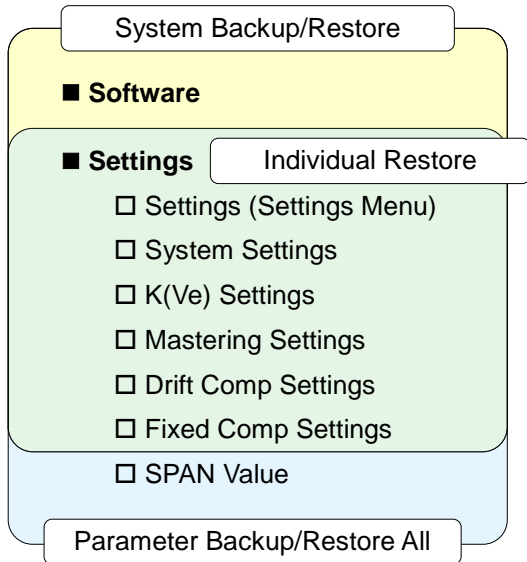
NOTE

Compensation Value is not included in the logs to be copied to USB memory.

8 Backup and Restore

What to do

- Restoring test parameters after changing them temporarily: Parameter Backup/Restore
- Preparing for replacing LS-R700 for some trouble: System Backup and Restore



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.

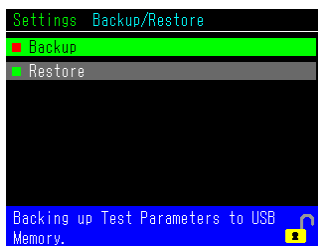
NOTE

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

8.1 Restoring 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.

Backup



- 1) Connect a USB memory to the USB port on the front panel.
- 2) Execute Parameter Backup
 (Menu Icon) > Main Menu > 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-R700 and cannot be viewed in computers.

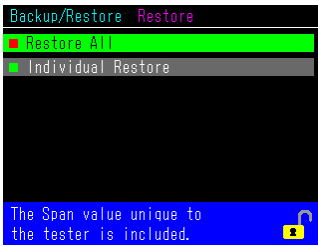


Attention

The backup data cannot be restored to any other LS-R700. SPAN values for the pressure sensor (PS) and the differential pressure sensor (DPS) will be overwritten and the test results will be inaccurate.

NEVER restore the backup data to other LS-R700.

Restore All



- 1) Connect a USB memory to the USB port on the front panel.
- 2) Execute Parameter Restore
 (Menu Icon) > Main Menu > Settings > Backup/Restore > Restore > Restore All
 "Initiating Test Parameter Restore OK to continue?" > **Yes**

NOTE

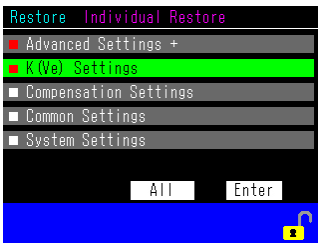
Mastering Value, Compensation Value and Counter are reset after Parameter Restore.



Attention

NEVER use this feature to copy the test parameters to other testers.
 The backup data can be restored only to itself.

Individual Restore

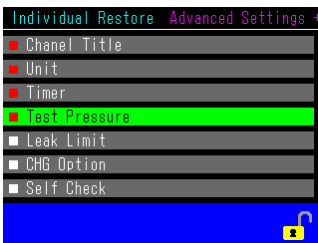


In Individual Restore, test parameters set to the LS-R700 can be copied to other LS-R700 testers. Items selected among the backup from the source tester can be restored individually to the destination tester. However, this feature requires full understanding that there are items that affect each other such as timers, leak limits and K(Ve) value.

- 1) Connect a USB memory to the USB port on the front panel.
- 2) (Menu Icon) > Main Menu > Settings > Backup/Restore > Restore > Individual Restore > Select parameters to be restored > **Enter**
 "Initiating Test Parameter Restore OK to continue?" > **Yes**

NOTE

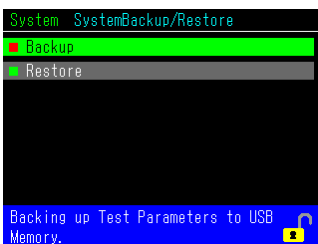
Further individual items can be selected for **Advanced Settings +**.



8.2 Preparing for Replacing LS-R700

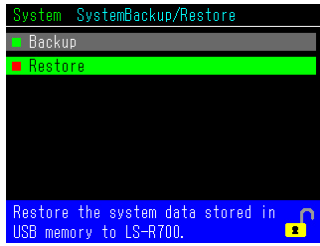
Perform System backup to prepare for restoring the test system in case of trouble in the future. The current system settings can be restored easily to another testser from backup.

Backup



- 1) Insert a USB memory into the USB port on the front panel.
- 2) Execute the System Backup.
 (Menu Icon) > Main Menu > System > System Backup/Restore > Backup > "Initiating System Backup OK to continue?" > **Yes**

Restore



- 1) Connect a USB memory to the USB port on the front panel.
- 2) Execute the System Restore.
 ☰ > Main Menu > System > System Backup/Restore > Restore > "Initiating System Restore OK to continue?" > **Yes**



Model Information

A2MRGK4.UX2

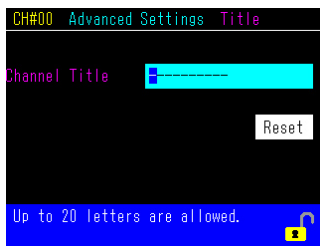


Attention

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-R700 to ensure that they are identical.

9 Other Settings

9.1 Name Channels



Each channel can be named.

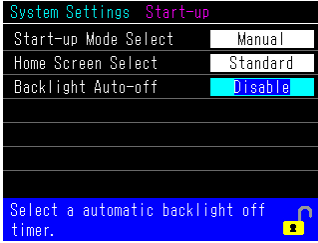
- ☰ > Main Menu > Settings > Advanced Settings > Channel Name > Channel Title

Use Up/Down keys to enter letters and numbers and Right/Left keys to move the cursor.

Reset resets the whole title.

10 Other Features

10.1 Backlight Auto-off

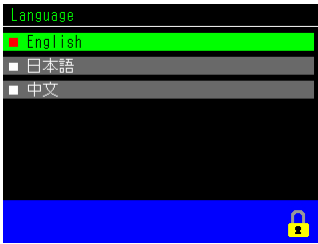


The backlight of LS-R700 goes off automatically when any operation key is not touched for programmed period of time.

☰ > Main Menu > System > System Settings > Start-up > Backlight Auto-off > Select the duration

(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 and Chinese

☰ > Main Menu > Language > Select a language > "Changing language. OK to continue?" > **Yes** > "Changing language. Do not shut off the power."

Language will be changed to the selected one.

7

11 For Maintaining 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.

This can be used for daily sensitivity checks of Type J models.

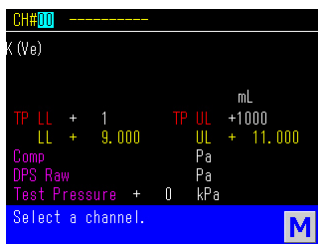
K(Ve) Check behavior will be same as the K(Ve) Automatic Setup.



K(Ve) Check Limit

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

 > Main Menu > K(Ve) > K(Ve) Settings > Basic > K(Ve) Check Limit

Manual Operation



- 1)  > Main Menu > K(Ve) > K(Ve) Check
- 2) Press  to start K(Ve) Check.

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.

12 Updating Software

LS-R700 can be updated by users.

Please follow the procedure comes with the update file.



MAINTENANCE MANUAL

8 MAINTENANCE

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 - 5.3 How to Troubleshoot ERROR 51 105
 - 5.4 If ERROR 51 Occurs Right After Replacing Battery 105
- 6 Initializing Memory105**

Periodic Inspection and Calibration helps maintain the accuracy of LS-R700 and prevent malfunction
Performing the following inspection is highly recommended.



Attention

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

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.
 > Main Menu > Maint. > Inspection > Leak Check > No-Leak Test
- 4) Check the test PS offset.
 > Main Menu > Maint. > Inspection > Sensor > PS

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

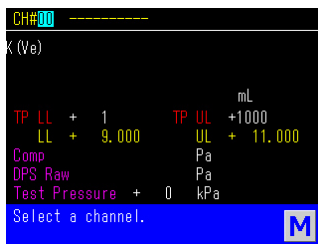
Compares K(Ve) measured with a reference master tested part to the K(Ve) stored in memory. This can be used for daily sensitivity checks of Type J models. K(Ve) Check behavior will be same as the K(Ve) Automatic Setup.



K(Ve) Check Limit

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

 > Main Menu > K(Ve) > K(Ve) Settings > Basic > K(Ve) Check Limit

Manual Operation



- 1)  > Main Menu > K(Ve) > K(Ve) Check
- 2) Press  to start K(Ve) Check.

Remote Operation

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

Results for K(Ve) Check

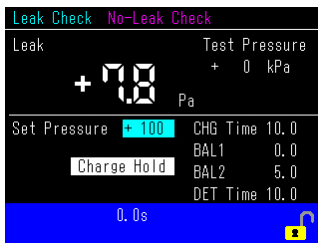
Lower than LL	Within the Limits	Larger than UL
DET LL	Pass	DET UL

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.

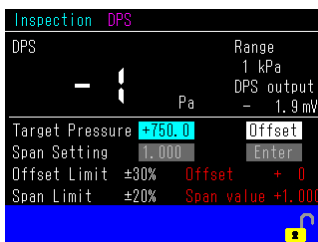
4.2 No-Leak Check



No-Leak Check is a leak check of LS-R700 itself.

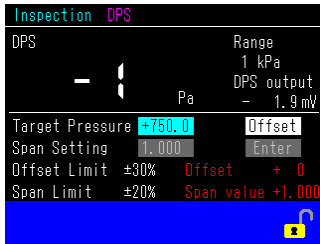
- 1) Close the both WORK- and MASTER-side stop valves on the rear panel.
- 2) > Main Menu > Maint. > Inspection > Leak Check > No-Leak Check
- 3) Check whether the displayed test pressure is appropriate.
Go to: Charge Hold
- 4) Press to cancel the Charge Hold.
- 5) If the test pressure is inappropriate, adjust it.
Go to: Set Pressure
- 6) Press to start a No-Leak Check.
- 7) Timers are fixed to the follows:
CHG=10.0s BAL1=0.5s BAL2=5.0s DET=10.0s
LS-R700 is not leaking if the result is within ± 10 Pa.
If not, contact Cosmo for repair.
- 8) Press to stop
- 9) Open the both WORK and MASTER side stop valves.

4.3 DPS Offset Adjustment



- 1) > Main Menu > Maint. > Inspection > Sensor > DPS
- 2) Check whether the sensor is open to the atmosphere.
- 3) Select **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

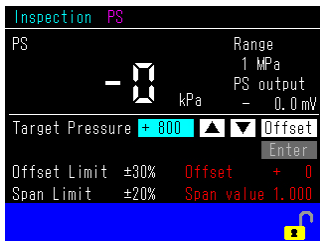


CAUTION

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.

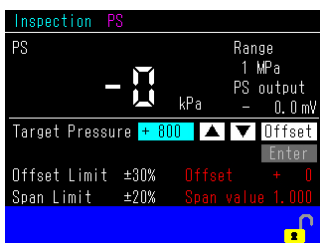
- 1) Remove the plugs from ☒ (Calibration port) and ☒ (Maintenance port).
- 2) Disconnect the air pressure source from Test pressure port and make sure that the air is completely exhausted from the pneumatic circuit of the tester. Leave the pilot pressure source as it is.
- 3) Connect the pressure generation source of calibration equipment to the ☒ Maintenance port.
- 4) Unlock settings and toggle to Manual mode.
- 5) ☰ > Main Menu > Maint. > Inspection > Sensor > DPS
- 6) Perform DPS offset adjustment.
- 7) Close the stop valves on both WORK- and MASTER-sides.
- 8) Press ▶ and pressurize LS-R700 with the calibration equipment.
- 9) DPS readout will be displayed on the screen of LS-R700.
- 10) Compare the readouts displayed on LS-R700 and displayed on the calibration equipment.

4.5 PS Offset Adjustment



- 1) ☰ > Main Menu > Maint. > Inspection > Sensor > PS
- 2) Check whether the sensor is open to the atmosphere.
- 3) Select **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) ☰ > Main Menu > Maint. > Inspection > Sensor > PS
- 5) Perform PS offset adjustment.
- 6) Close the stop valves on both WORK and MASTER sides.
- 7) Press ▶ and pressurize LS-R700 with the calibration equipment.
- 8) PS readout will be displayed on the screen of LS-R700.
- 9) Compare the readouts displayed on LS-R700 and displayed on the calibration equipment.

5 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 pressing  closes the pop up window, please replace the battery as soon as possible.

LS-R700 Internal Memory (SRAM)


LS-R700 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

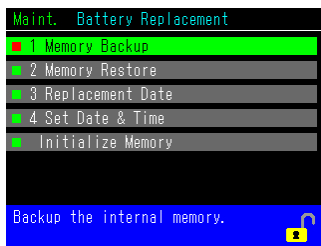
Product	Model	Life
Lithium battery	CR2032 (UL certified)	Three (3) years


 **CAUTION**
 Mounting a battery other than specified may cause an explosion.

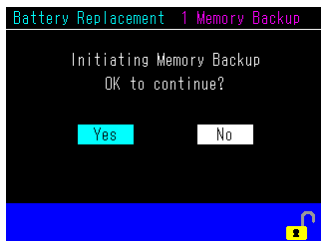
5.1 Battery Replacement Procedure

Please follow the instruction below.

1 Memory Backup



 > Main Menu > Maint. > Battery Replacement > 1 Memory Backup
 > "Initiating Memory Backup OK to continue?" > **Yes**



Replace the Battery

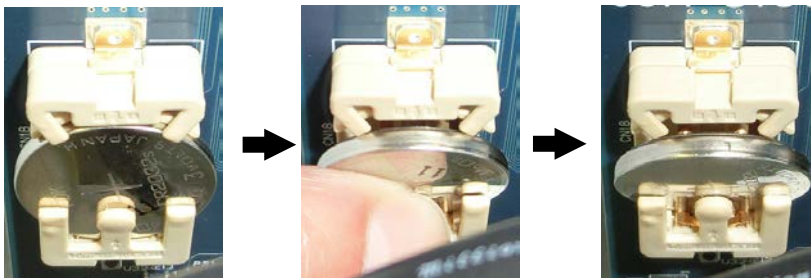
- 1) Turn off the power and unplug the power cord from the power connector of LS-R700.
- 2) Unscrew the two screws on the top of LS-R700 (Rear side and Front side) to remove the top cover.
- 3) The battery is mounted on the back side of the upper left corner of the front panel.

CAUTION
 Make sure not to touch unnecessary parts when removing the top cover. Touching unnecessary parts may cause lowering the performance of LS-R700

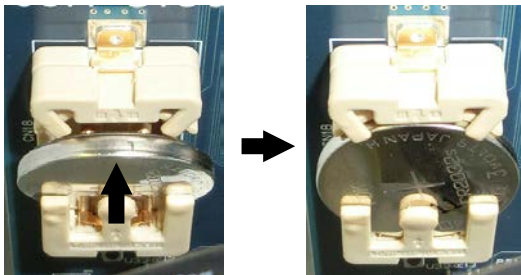


CAUTION
Electric Shock
 Make sure to turn off the power and unplug the power cord from LS-R700 before removing the top cover (⚠) to prevent electric shock or damage to the tester.

- 4) Push the center of the battery to pull it out.



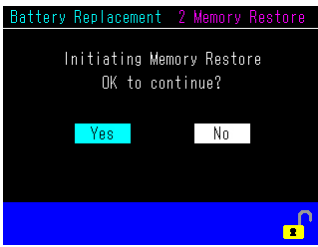
- 5) Mount a new battery in the correct direction (+ comes to the front) in the opposite procedure.
- 6) Push the top part of the battery as shown in the photo below to mount it.



- 7) Put back the top cover and I/O connector.

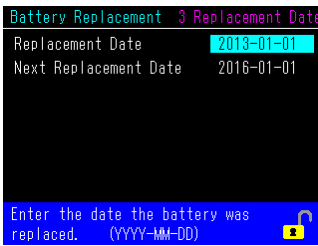
NOTE
 Dispose the old battery according to the instruction of the battery.

2 Memory Restore



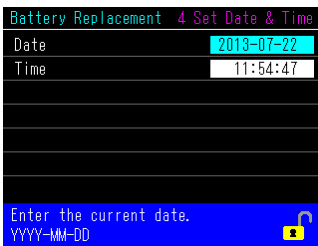
☰ > Main Menu > Maint. > Battery Replacement > 2 Memory Restore
 > "Initiating Memory Restore OK to continue?" > **Yes**

3 Replacement Date



☰ > Main Menu > Maint. > Battery Replacement > 3 Replacement Date
 Enter the date the battery was replaced
 Setting the date will update the next battery replacement date.

4 Set Date & Time



☰ > Main Menu > Maint. > Battery Replacement > 4 Set Date & Time
 > Date
 > Time
 Set the current date and time.

5.2 About ERROR 51: Lo Battery SRAM

All measurements are disabled if the error occurs. Please replace the battery immediately.
 The following data in LS-R700 will be wrong.

- Date and Time
- Compensation V (Man)
- Mastering Value (Man)
- Counter
- Test Result Log
- Error Log

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

5.3 How to Troubleshoot ERROR 51

- 1) Replace the battery
Refer to the previous page for the procedure.
- 2) Initialize Memory
☰ > Main Menu > Maint. > Battery Replacement > Initializing Memory
Refer to the next section for the details.
- 3) Enter the date the battery was replaced and memory was restored.
☰ > Main Menu > Maint. > Battery Replacement > 3 Replaced Date
- 4) Set the current date and time
☰ > Main Menu > Maint. > Battery Replacement > 4 Set Date & Time > Date/ Time

5.4 If ERROR 51 Occurs Right After Replacing Battery

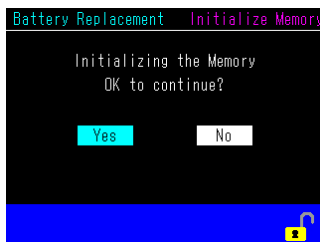
If the error occurred right after replacing battery, some internal electrical part may be malfunctioned. Contact Cosmo for repair after executing System Backup.

☰ > Main Menu > System > Backup/Restore > Backup

6 Initializing Memory

Items cleared by Memory Clear

- Date and Time
- Compensation V (Man)
- Mastering Value (Man)
- Counter
- Test Result Log
- Error Log



Unlock settings and toggle the operation mode to Manual.

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



9 TROUBLESHOOTING

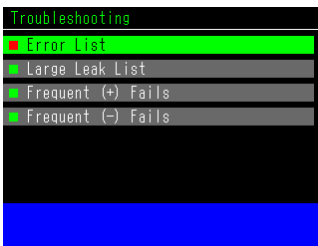
- 1 When an Error Occurred..... 108**
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- 5 Frequent (+) Fails 124**
- 6 Frequent (-) Fails 126**

1 When an Error Occurred

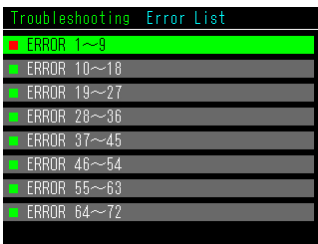
The error code is displayed when an error occurs.
Check the description of the error in Error List

2 Error List

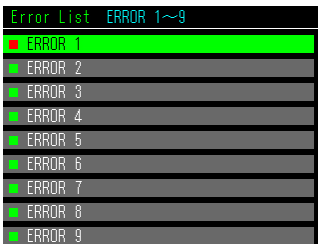
Menu to view descriptions, probable causes and treatments and all the errors.



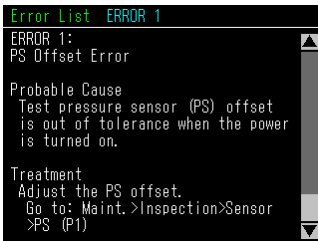
> Main Menu > Troubleshooting > Error List



The errors are divided every 9 codes.



Move the cursor to the Error code of your choice and press .
The probable cause and its treatment will be displayed.



3 Error Messages and Treatments

3.1 ERROR 1 PS Offset Error

Timing: During power-on check procedure
Criteria: Pressure sensor (PS) offset exceeds $\pm 2\%$ 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 $\pm 2\%$ 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 $\pm 2\%$ of the sensor range
Malfunction of the test pressure sensor (PS)	Contact Cosmo for repair if the offset exceeds $\pm 2\%$ 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 are applicable but when it occurred in CHG stage, the stages in shadowed 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
Zero "0" was set to the Lower Limit.	Set other numerical value than "0" to the Lower Limit.
Upper and Lower limits for Test pressure or Precharge are too low.	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. (Test pressure too low)	Extend CHG timer. Go to: Settings > Advanced Settings > Timer > Charge (CHG)
Precharge time is insufficient. (Precharge pressure too low)	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-R700 to supply an stable air. Setting up a dedicated pressure source for the LS-R700 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 are applicable but when it occurred in CHG stage, the stages in shadowed 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-R700 to supply an stable air. Setting up a dedicated pressure source for the LS-R700 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-R700 to supply an stable air. Setting up a dedicated pressure source for the LS-R700 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)

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

Probable Cause	Treatment
Pilot pressure fluctuates or the pressure setting is inappropriate.	Adjust the pilot pressure between 400kPa and 700 kPa. Avoid using air tools branching off the pressure source of the LS-R700 to supply an stable air. Setting up a dedicated pressure source for the LS-R700 is recommended.
Pressure source is disconnected.	Check the pressure source and the regulator setting.
Test pressure is too low for high pressure models, H20.	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 are applicable but when it occurred in CHG stage, the stages in shadowed 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 fluctuates or the pressure setting is inappropriate.	Adjust the pilot pressure between 400kPa and 700 kPa. Avoid using air tools branching off the pressure source of the LS-R700 to supply an stable air. Setting up a dedicated pressure source for the LS-R700 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 fluctuates or the pressure setting is inappropriate.	Adjust the pilot pressure between 400kPa and 700 kPa. Avoid using air tools branching off the pressure source of the LS-R700 to supply an stable air. Setting up a dedicated pressure source for the LS-R700 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 > <u>Special</u> > PSW Monitoring > Disable

Output Signal Timing Chart

▼ At the end of

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-R700 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 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	

3.12 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							

3.13 ERROR 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.
High and Low 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														

3.14 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 > <u>Basic</u> 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														

3.15 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 > <u>Unit</u> > 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														

3.16 ERROR 51 ~ ERROR 61 System Errors

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



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

System Errors


Error Code	Error Message	Description
ERROR 51	Lo Battery SRAM Error	<p>Probable Cause 1 The battery has discharged completely.</p> <p>Treatment 1 If this error occurs, none of the measurements is enabled. Replace the battery instantly following the procedures in the manual (8 Maintenance).</p> <p>Probable Cause 2 If the same error occurs after replacing the battery, some electrical parts may be malfunctioned.</p> <p>Treatment 2 Contact Cosmo for repair after executing a System Backup</p>
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.


System Backup

- Switch the operation mode to Manual(M)
- Press  on a measurement screen to cancel the error message.
Rebooting LS-R700 also cancels the error.
- Insert a USB memory into the USB port on the front panel.
- Execute the System Backup.
 -  > Main Menu > System > System Backup/Restore > Backup > "Initiating System Backup OK to continue?" > **Yes**

Output Signal Timing Chart

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	

System Restore Procedure


- Insert a USB memory into the USB port on the front panel.
- Execute the System Restore.
 -  > Main Menu > System > System Backup/Restore > Restore > "Initiating System Restore OK to continue?" > **Yes**
 - "Backup file is not found Restore failed." is displayed if USB memory is not inserted or the Backup file is not in the USB memory.

NOTE
Mastering Value, Compensation Value and Counter are reset after entire System Restore.

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:**
 >Main Menu > 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-R700 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.	

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: <ul style="list-style-type: none"> • 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.	

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-R700 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-R700 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.	

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-R700 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: <ul style="list-style-type: none"> • 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.	

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.	

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

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1 Primary Specifications

Differential Pressure Sensor (Standard)	Resolution: 0.1 Pa Display Range: ±999 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, Pa·m ³ /s, E-3 Pa·m ³ /s, Pa/s, Pa/min, *Pa/s, *Pa/min (mmH ₂ O, inH ₂ O, mmHg, in ³ /min, in ³ /d, ft ³ /h)
Leak Display	4 digits Sampling Rate: 10 times/s	
Leak Limit Range (Standard)	±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 from 400 to 700 kPa	
Tube Diameter	Rc(PT) 1/4: Test pressure, WORK and MASTER ports 6mm quick disconnect fitting: Pilot pressure	
CPU	SH-2A 144MHz DRAM 8MB	
LCD/TP	3.5 inch color LCD 320 x 240 dot (QVGA)	
Ambient Temperature	Operation Temperature: 5 to 45°C Storage Temperature: -20 to 60°C	
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 (D-sub 9 pins)	I/F fixed length	Test parameters are transmitted as well as test results.
	ID/F fixed length	
	T/F fixed length	Only test results are transmitted
	Others	Special formats
USB Port	Test Data	Judgment, Leak, Test pressure, Channel#, Timers, etc
	Copying test parameters	csv file
	Test Parameter Backup/Restore, System Backup/Restore, Firmware upgrade	
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 2 Pollution degree 2 Altitude 2000m or lower	Protection class I Place to use: indoor

*1 Reading Accuracy is only for the initial factory setting.
Reading accuracy after calibration will be ± 5% of :rdg ±1Pa.
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-R700-**A****B****C**

A: Pneumatic Circuit

Intelligent 1 Pneumatic Circuit	A1	Large flow circuit with great sensor protection features
Intelligent 2 Pneumatic Circuit	A2	Equipped 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 the leak specifications are quite small.
Secondary Pressure Circuit	C	For external pressure (secondary pressure) test

B: Test Pressure and Regulator Range

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)
EP Regulator Model *1	Vacuum	V	Test pressure range: -5 to -100 kPa (PS -100 kPa)
	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 EP = Electropneumatic

C: Options

Calibrator	J	Come with CAL driving valve for Leak Master	The valve open/close automatically during K(Ve) calibration and K(Ve) check. Not available for H20 and H49 models Leak Master is sold separately.
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 *2	D4	Sensor range: ± 10 kPa Display range: ± 10 kPa Resolution: 1 Pa	
Stop Valve Monitoring	W	Checks whether the stop valve on the WORK port is opened.	

*2 DPS = Differential pressure sensor



11

REFERENCE

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1 Leak Testing Overview

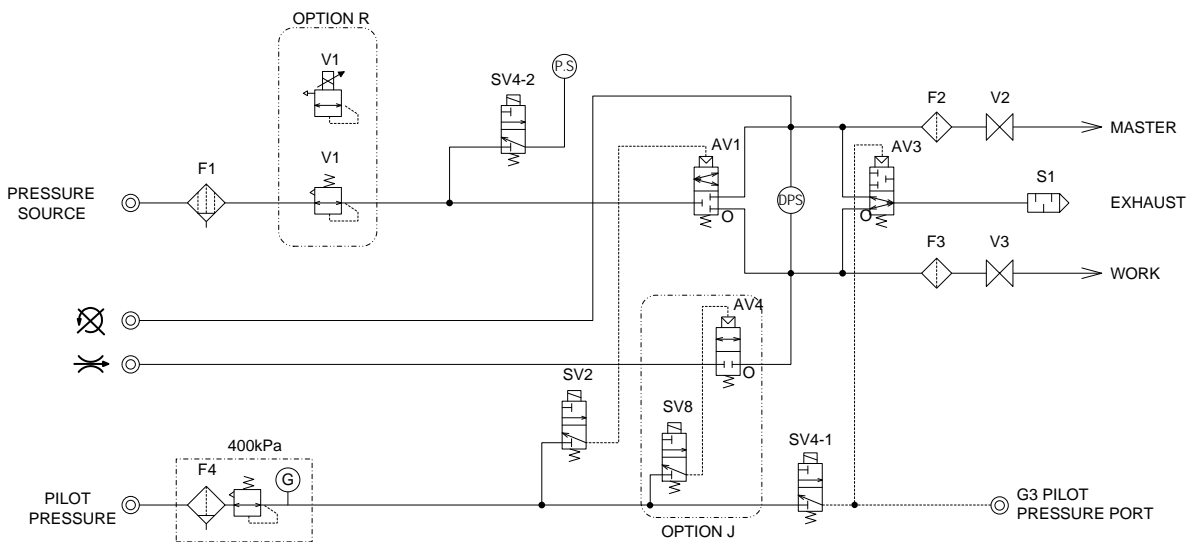
After a non-leaking reference part (MASTER) and a tested part (WORK) are pressurized simultaneously, isolating the MASTER and WORK from the pressure source, and the differential pressure sensor (DPS) measure the pressure drop resulting by leaks.

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 (DL2)	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 (A1 Medium pressure)



Timing Chart

Solenoid Valve	DL1	CHG	DL2	BAL2	DET	BLW	END
SV4-2							
SV2							
SV4-1							

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:

$$Q = K \cdot \Delta P / \Delta T$$

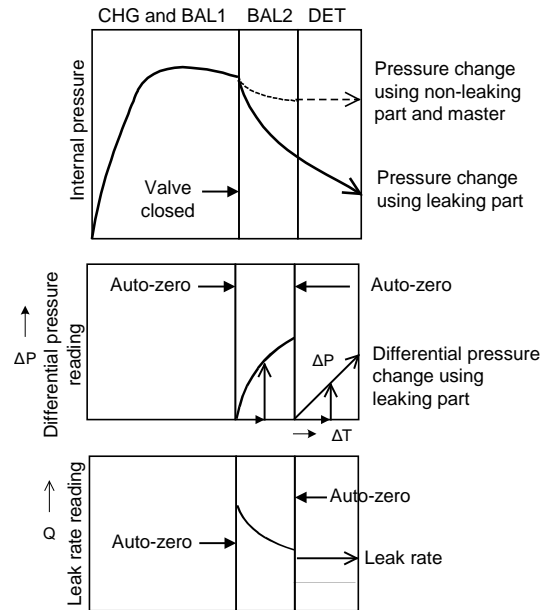
Where:

Q: Leak rate (mL/min)

K: 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:

$$PV = \text{constant (where P is absolute pressure)}$$

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

$$\text{Leak}(\Delta V_L) = V_e \times \Delta P / P_{atm}$$

Where:

ΔV_L : Leak [mL]

V_e : Equivalent internal volume [mL]

ΔP : Pressure drop due to a leak [Pa]

P_{atm} : Atmospheric pressure [Pa]

NOTE

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

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

Where:

- Ve: Equivalent internal volume [mL]
- Vw: Internal volume of the tested part 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 tested part 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 tested part remains unchanged ($Kw = 0$) during detection even though charged with pressure, **Equation A** can be simplified to **Equation B**:

$$Ks(1 + Vw/Vm) + Kw = 2Ks = 0.01 \text{ [mL/kPa]}$$

$$Ve = Vw + Vt + 0.01 \times (101.3 + P) \text{ ----- B}$$

- 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 tested part remains unchanged ($Kw = 0$) during detection even though charged with pressure, **Equation A** can be simplified to **Equation C**:

$$Ve = Vw + Vt + 0.005 \times (1 + Vw/109) \times (101.3 + P) \text{ ----- C}$$

NOTE
 When the volume of the Master is smaller than that of the tested part, Ve becomes larger, which causes lowering the DPS

Calculation of Leak Rate

The relationship between differential pressure and leak rate per unit time is given by the following equation:

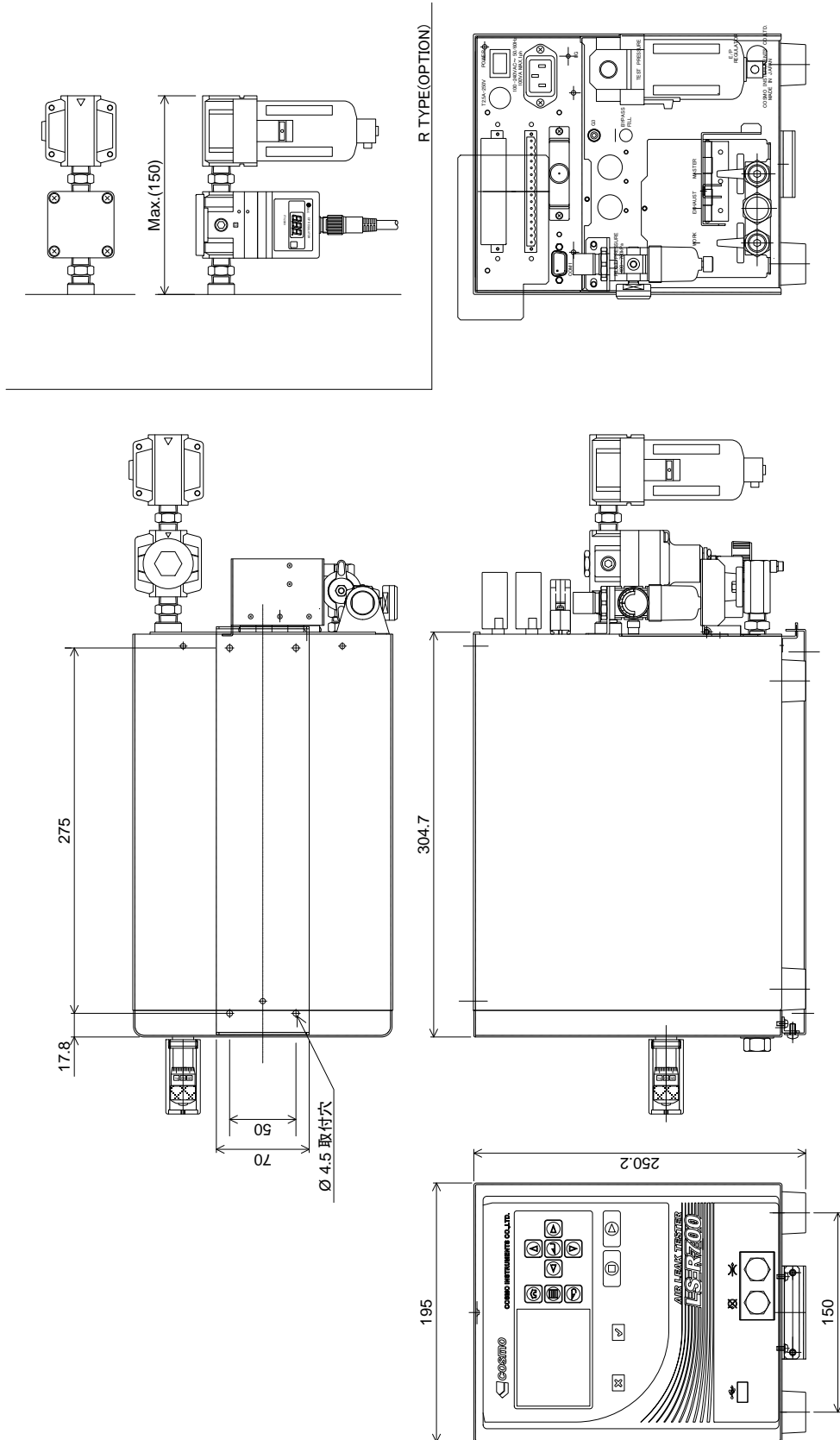
$$Q = Ve \times \frac{\Delta P}{1.013 \times 10^5} \times \frac{60}{T}$$

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-R700 uses the above equation to calculate the leak rate. Note that the tester uses standard atmospheric pressure for this calculation.

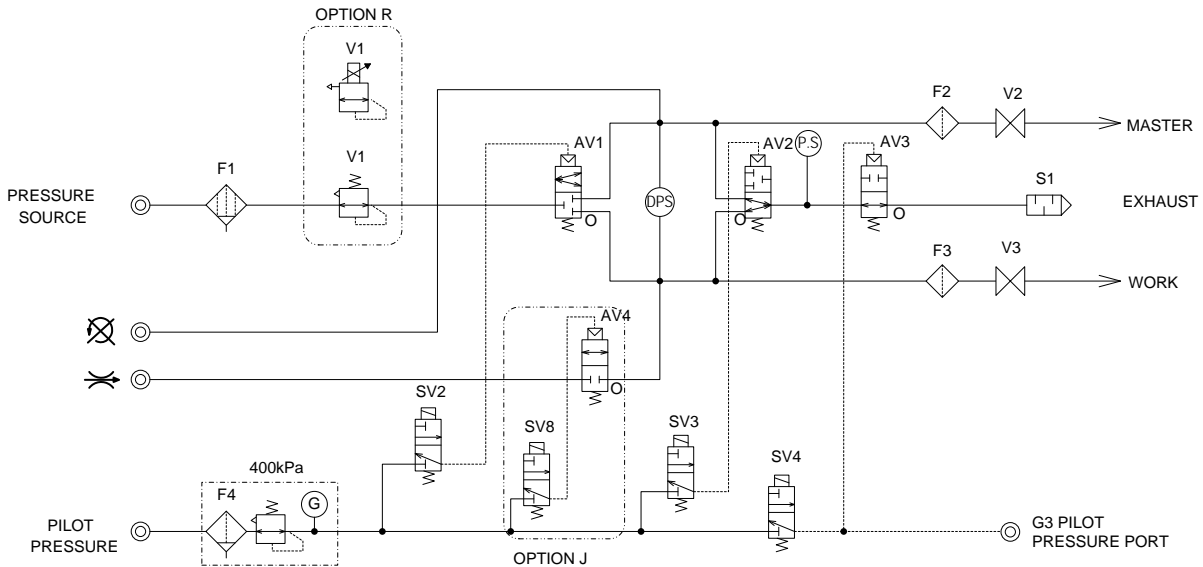
2 External Appearance



3 Pneumatic Circuit

NOTE
The actual circuit may not be same as the drawing.

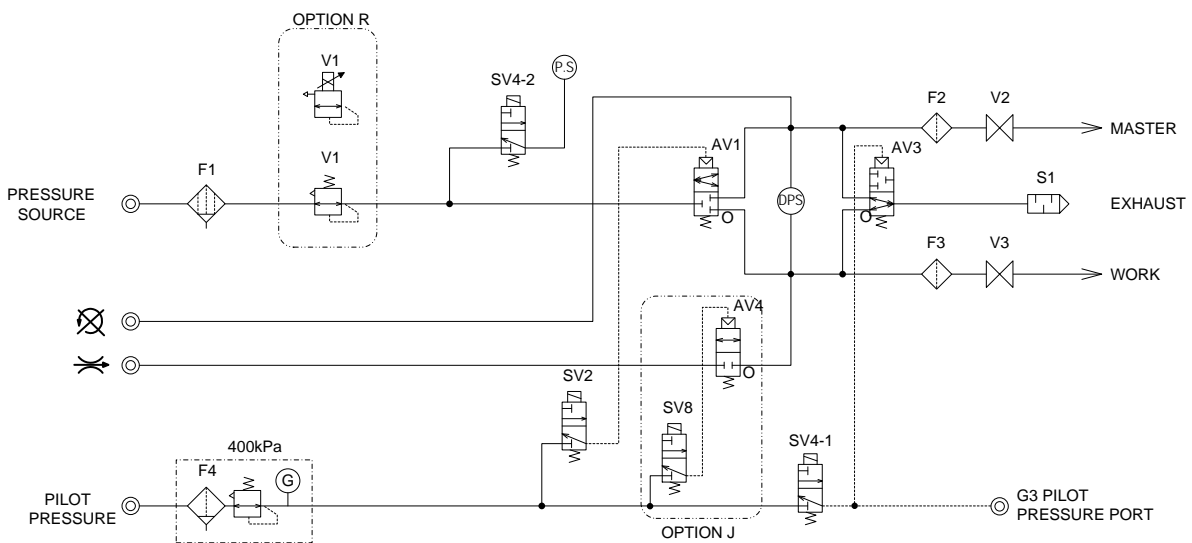
A2: (M: Medium Pressure / L: Low Pressure)



	DL1	PCHK	PCHG	PEXH	CHG	BAL1	DL2	BAL2	DET	BLOW	EXH	END
SV2												
SV3												
SV4												
SV7												
*SV8												

*SV8 is for K(Ve) Automatic Setup and K(Ve) Check.

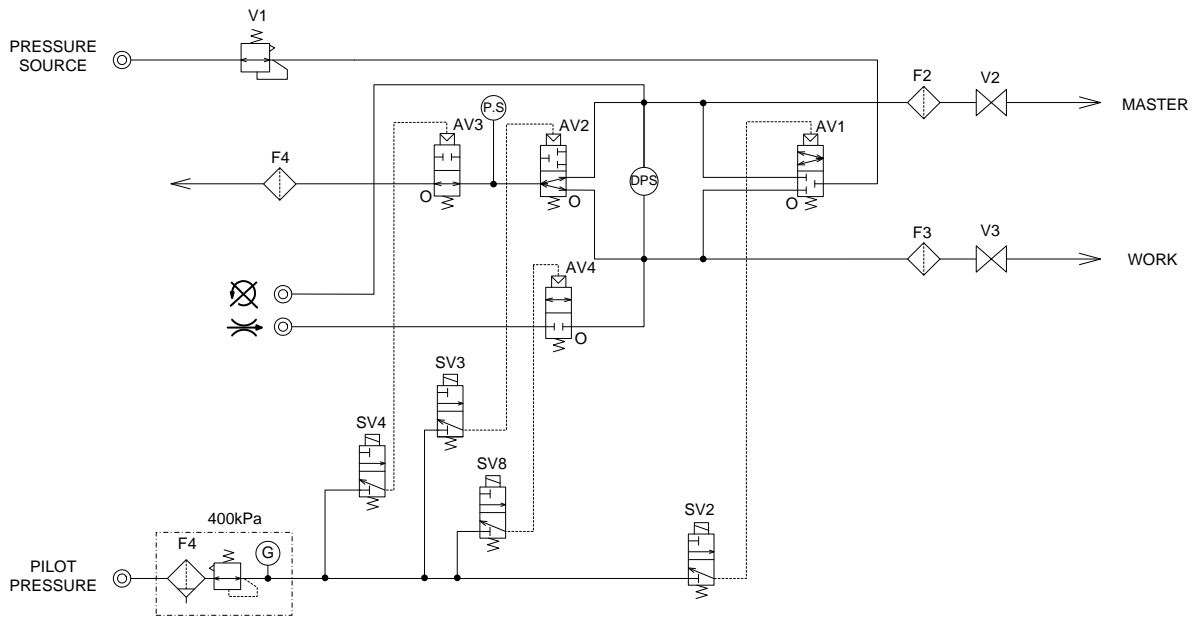
A1: (M: Medium Pressure / L: Low Pressure)



	DL1	PCHK	PEXE	CHG	DL2	BAL2	DET	BLOW	EXH	END
SV2										
SV3										
SV4										
SV5										
SV7										
*SV8										

*SV8 is for K(Ve) Automatic Setup and K(Ve) Check.

A2: (V: Vacuum Pressure)



	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/cm ² →	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	←1ln 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	ln 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 = $\times 10^{-3} = \times 0.001$ 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 marking is affixed to the CE conformed model of LS-R700.

Scope of CE marking conformity is the body of LS-R700.

For the power cord supplied with the LS-R700 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.

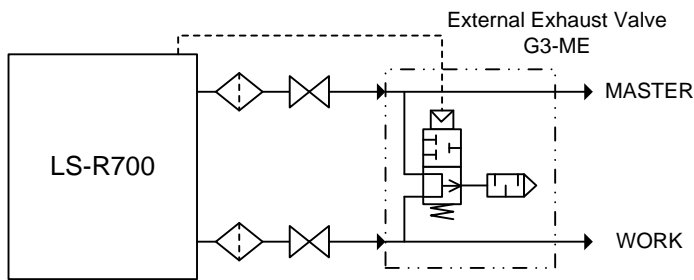
9 Common Peripherals

Refer to “2 INSTALLATION” for the details. 

9.1 External Exhaust Valve (Separately Sold)

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.




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.

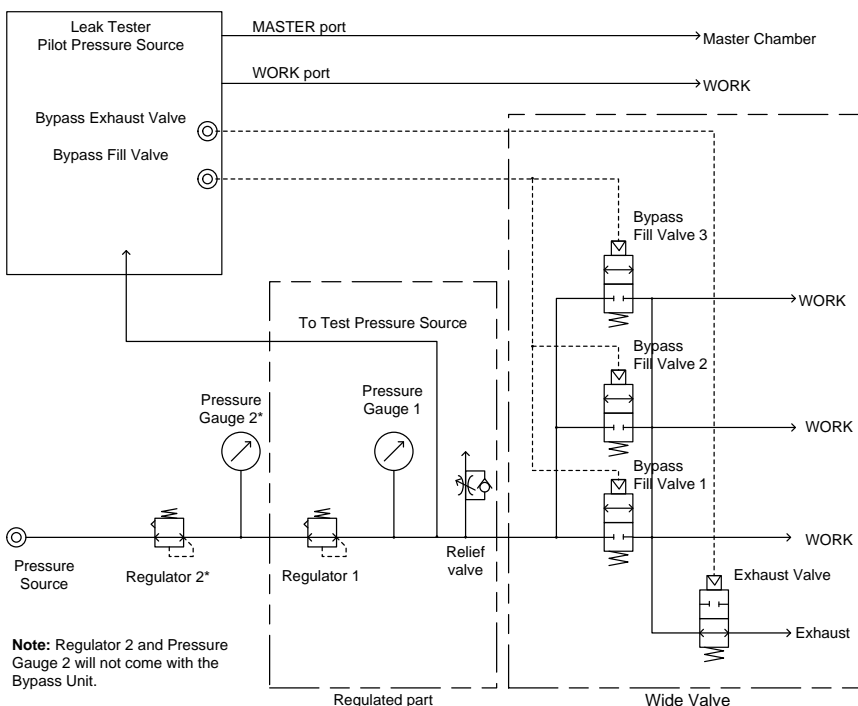
Models with the option B are equipped with a pilot pressure port for the Bypass Circuit Unit.

Air leak tester controls the Bypass Circuit Unit.

Enable the Bypass solenoid valve to use it.

Go to:  > Main Menu > Settings > Advanced Settings > CHG Options > Bypass Valve

Pneumatic Circuit Example (BU-100A-3L)



Note: Regulator 2 and Pressure Gauge 2 will not come with the Bypass Unit.



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■ Please note that addresses and numbers mentioned above may change.



* The specifications are subject to change without notice.

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