



AJ-B-SD-0010030003-550001-AA

AIR LEAK TESTER

TECHNICAL MANUAL

FL-800 SERIES

Please particular reading the manual before using and safekeeping for warranty card

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TIANJIN BOYI PNEUMATICS CO., LTD.

- User's Notice Thank you for purchasing BOYI Air leak tester of differential pressure type FL-800 series.

This manual is designed to provide FL-800 users with basic function details, operation procedures and safety guidance. For best operation results and optimum efficiency, read this instruction manual thoroughly to understand the tester's many functions prior to operation.

- Declaration
 - The contents of this manual may be modified without notice due to function and performance improvements.
 - The testers actual external appearance may differ from the pictures indicated in this manual.
 - Please do the setup procedures and connect hardware after fully understand of this manual.
 - This manual has been written with care to provide the user with helpful and useful information. Please contact our company if there are any inaccuracies or questions of concern..
 - Reprinting or duplicating this manual partially or completely is prohibited.

Contents		
User's Notice		1 P
Contents		2 P
Safety precaution		4 P
Air leak tester of differential pressure type Outline	Characteristic	9 P
	Model	10 P
	Specification	13 P
Principle	About leak tester	14 P
	The importance of leak testing and allowable leakage rate	15 P
	Critical testing range	15 P
	Leak tester	15 P
	Leak testing principles	15 P
	The relationship between indications and leakage rates	15 P
Warm up	Item Checklist	16 P
	Main Part	16 P
	Accessory	16 P
	Option	16 P
	Additional equipment	17 P
	Leak tester layout	20 P
	Front view	20 P
	Back view	21 P
	Button	22 P
	Installation instructions	22 P
	Installation instructions of regulator	22 P
	Operation environment	23 P
	About the work(quizzee)/master(norm)	24 P
	Transporting instruction	24 P
	Machine size	25 P
	Installation guide	25 P
	Mounting tool assembly	25 P
	Basic piping	26 P
	Selctions of additional equipment	28 P
	Terminal wiring	29 P
	Attention	29 P
	APU Port	29 P
	Signal input	30 P
	Signal output	32 P
	Solenoid valve control	34 P
	Printer port	36 P
	Clamp cylinders control	36 P
	Charge bypass	37 P
	Exhaust bypass	37 P
	Remote signal timing	38 P
	Group NO. input code	39 P
	PLC Wiring example	40 P
	Power supply connection	42 P
	Power on/off	42 P

Basic operation	Operation in Summary	43 P
	Main setting interface	43 P
	Secondary setting interface	44 P
	Main setting interface preferences	45 P
	Secondary setting interface preferences	47 P
	Setting	48 P
	Group setting	48 P
	Control (switch) setting	48 P
	Test setting	49 P
	Exhaust bypass setting	50 P
Testing function	Action test	50 P
	Leak testing procedure	50 P
	Work volume testing procedure	52 P
Other function	Zero adjustment of testing pressure	55 P
	Bubble function	56 P
	Printer operation	57 P
	Account for printer operation	58 P
	Colck adjustment function	59 P
	Self test	60 P
	Result display	61 P
	USB operation	62 P
	RS232C/Ethernet output	63 P
Service	Service and inspection	73 P
	Daily inspections	73 P
	Periodic inspections	73 P
	Trouble shooting	73 P
Appendix	Common Q&A	77 P
	External dimensions diagram	78 P
	Pneumatic circuit diagram	79 P
	Free maintenance regulation	80 P
	Warranty	80 P

SAFETY PRECAUTION

Please read this “Safety Precaution” section before operating the equipment.

In this operation manual, symbol is used to indicate situations that may cause injury to operators or other person, or cause potential damage to property. Description of each symbol is indicated below.

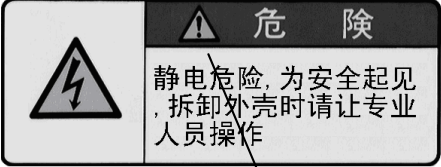
Symbol	Description
 Danger	Ignoring this warning and mishandling equipment may result in serious injury or death.
 Warning	Ignoring this warning and mishandling equipment may result in injury or death.
 Caution	Ignoring this marking and mishandling equipment may result injury or property damage.
 Danger	Static or Inductive voltage.

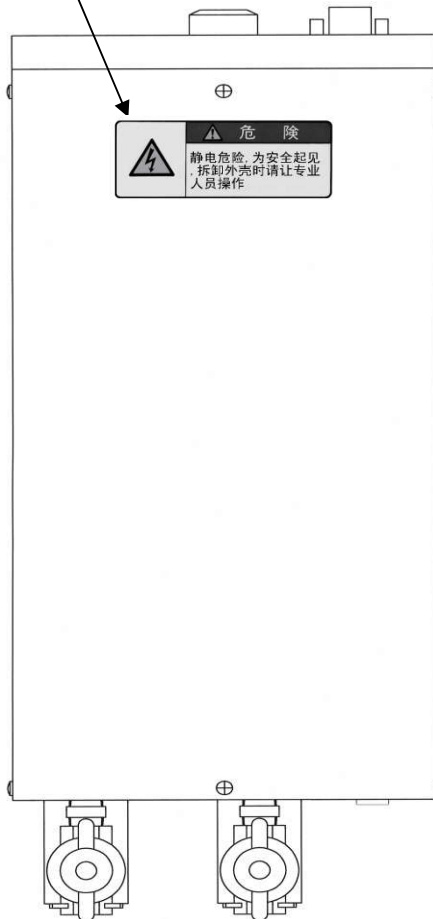
Terms	Description
Turn off the main switch	Implies not only turning off the power switch, but also turning off all power supply sources to the equipment from other fixtures.
Turn off the air supply	Implies not only turning off the air pressure supply into the equipment but also suspending the air pressure supply source and making sure that there is no pressure remaining in the equipment.

Symbol	Description
 Caution	Essential points for conducting correct testing and reminders to prevent problems from occurring. May also highlight instructions that are necessary to avoid malfunction and incorrect evaluation.
 Memo	References

● Control section

Notice on the body of tester

	 Danger • Do not remove tester casing. • Some parts positioned inside carries high voltage and may be driven unexpectedly, due to its mechanical sequences. Electrical shock or injuries may occur. Qualified professionals should carry out maintenance and service procedures.
---	---



- About the using method



Warning

Use proper voltage and designated pressure

Do not apply electrical voltage other than what is designated for the equipment. Neglecting this warning may cause possible conflagration, electric shock, or equipment malfunction.

Do not use with pressure other than what is designated for the equipment. It may cause explosion or damage the equipment.

Please supply of clean, dry, non-corrosive, nonflammable gas as pneumatic supply pressure.

Do not remove the casing

Do not remove the casing. There has high temperature, voltage, and pressure areas within the equipment and removing the casing may result in electric shock, burns or other injuries. Contact our service personnel in regards to periodical or routine maintenance.

Note air dehumidification to prevent water from entering inside the device.

Cylinder control

Use safety countermeasures when working with clamp cylinders. When controlling clamp cylinder actuation via signals from the Air leak tester of differential pressure type, provide an area sensor for protection from possible injuries. Cylinders may move unexpectedly due to gravity and the weight of the jigs when the main power and pneumatic supply are terminated. It is recommended to employ lock-up cylinders to avoid such problems.

Avoid eyewinker inbreak

Do not insert eyewinker such as metals and other inflammable materials into the tester through the vent hole or other openings. It will damage the tester, or cause possible fire and electrical shocks.

System design

The system includes a protection/security circuit in the design to assure that the system remains secured in an emergency situation such as tester malfunction or breakdown.

Grounding

Carry out executive FG installation for the power supply FG terminal. Potential electric shock may occur if grounding is not secured.

RS-232C

Please do not hot plugging the connector of RS-232C. It may damage the equipment.



Warning

Do not step on the tester

Do not play on the tester or use it as a step or footstool. The tester may fall down or break, and cause possible injuries.

Do not place anything on the tester. Items may fall and cause injuries.

Do not disconnect the compressed air supply unless necessary

Do not disconnect the compressed air supply connected to the fixture, air filter, and pressure regulator while they carry compressed air. An inadvertent disconnection will cause a large amount of compressed air to spurt out, and may cause possible injuries and eye impairment that could lead to blindness.



Warning

Do not operate under abnormality system conditions

Do not operate the tester unless under working conditions. Factors such as lack of workspace, incomplete piping or unsuitable conditions may cause the tester to spurt out a large amount of compressed air, and could cause injuries and/or eye impairment that could lead to blindness.

Do not open the ball valves on the rear panel while they are under pressure. It may cause compressed air or residual pressure to spurt out unexpectedly at the time of unclamping. It may also cause possible injury or eye impairment that could lead to blindness.

Long term shut down

Be sure to turn off the main power switch and cut off the air source for safety.

● Other



Warning

When damaged power cords, wiring and/or piping are found

When damaged power cords, wiring and/or piping are found, cut off the main power and compressed air source immediately, and replace the damaged parts. Continued use of damaged parts will cause fire, electric shock, and may rupture piping.

When inbreak water, oil or other eyewinker

If water, oil, or other eyewinker enters the tester, cut off the main power and compressed air source immediately. Contact your local BOYI distributor for technical advice. Continued operation of damaged testers can cause fire, or possible electric shock.

When fall or damaged

When a tester is dropped, inadvertently falls or breaks, cut off the main power and compressed air source immediately. Continued operation of damaged testers can cause fire or possible electric shock. For repair, contact your local BOYI distributor.

When working in abnormality system conditions

Continued use of damaged testers will cause irregular conditions such as smoke discharge, burning, other odd smells, or unusual sounds, and will lead to conflagration or electrical shock. Immediately cut off the main power and compressed air sources, and make sure that it is no longer smoking. (Make sure that it does not lead to a conflagration. If necessary, alarm the people near by about the possible danger). For maintenance and repair, contact your local BOYI distributor.



Warning

Periodic checking for your tester

The tester requires periodical checkups, maintenance service, and overhaul to maintain reliable test results and precision. Periodic cleanup to remove accumulated dust and lint inside of the tester will eliminate the possibility of conflagration or electrical leaks. Accumulated dust, lint and oil in the power plug outlet, tester connector, and terminal board can also cause conflagration and electrical leaks. Enforce periodic checkups and keep the tester as clean as possible.

Secure a proper operating environment

Use and keep this tester under an environment which has been specifically assigned according to specifications. This tester cannot be used where flammable, explosive, or vaporizing gas is present.

Be sure that the power supply is equal to specifications prior to initial power connection.

Using a welder close to this tester may cause damage and is not recommended. Do not press the touch panel or control keys on this tester with sharp objects.

Do not wipe the tester with paint thinner or other solvents for cleaning purposes.

Characteristics

- ◆ Liquid Crystal Display, friendly interface;
- ◆ Language: Chinese/English, easy to switch;
- ◆ Multifunctional standard calibration, improved testing accuracy;
- ◆ Testing process can be displayed by curve;
- ◆ Result unit can be displayed in Pa, mL/min, Pa/min, Pa.cm³/s;
- ◆ Testing pressure unit can be displayed in kPa, kg/cm², PSI, bar, MPa;
- ◆ Multifunctional RS232 port;
- ◆ USB port, can download the testing result by using a flash disk; (option)
- ◆ Embedded printer; (option)
- ◆ Complex terminals, support remote control and can connect PLC or other drives;
- ◆ Automatic testing the volume or calibrate the volume manually; (option)
- ◆ Can save latest 500 groups data;
- ◆ Multifunctional data analysis and statistic;
- ◆ Functions of charge bypass and exhaust bypass; (Need the related equipment)
- ◆ Adjust terminal output sequence manually;

■ Models

FL-800①-②③-④-⑤

① Pressure range

Mark	Working Range	Display Range
HV	Absolute pressure: 0.20kPa~50.00kPa	0.00~100.00kPa
V	-5~-90kPa	0.0~-99.9kPa
UL	0.5~20kPa	0.0~20.0kPa
L	10~200kPa	0~200kPa
M	50~700kPa	0~700kPa
H	100~990kPa	0~1000kPa
H1	0.2~2MPa	0~2.00MPa
H3	1~10MPa	0~10.0MPa
H4	2~20MPa	0~20.0MPa

② Leakage testing range

Mark	Working Range	Display Range
1	Tiny leakage	0~±2000Pa
2	Moderate leakage	0~±9999Pa
3	0.1~50kPa	0.00~50.00kPa
4	1~100kPa	0.0~100.0kPa
5	1~500kPa	0.0~500.0kPa
6	1~1000kPa	0~1000kPa

③ Volume Calibration

Mark	Description
1	Calibration (only UL、L、M、H)
2	Without Calibration

④ Option

Mark	Description	Max. supply pressure	Regulating pressure range
N	No have filter and regulator		
FR22	filter +regulator for mark UL	500kPa	0.5 ~ 10.0 kPa
PC295	Pressure regulator unit for mark UL	500kPa	0.5 ~ 20.0 kPa
FR13	filter +regulator for mark L	1.0 MPa	0.01 ~ 0.2 MPa
FR15	filter +regulator for mark M	1.0 MPa	0.01 ~ 0.8 MPa
FR16	filter +regulator for mark H	1.4 MPa	0.04 ~ 1.0 MPa
FR17	filter +regulator for mark H1	3.5 MPa	0.04 ~ 2.8 MPa
FR10	filter +regulator for mark V	-100 kPa	-1.3 ~ -100 kPa

⑤ Data inter face

Mark	Description
1	standard, interface of printer
3	interface of USB(data soroage,without communication)
4	interface of Ethernet (RJ45)

Note:

- 1、Type HV without filter and regulator
- 2、The model or special type MS: FL-800L-12-FR13-1-X01

Leakage testing range table

		HV	V	UL	L	M	H	H1	H3	H4
Mark	Working Range									
1	Tiny leakage	●	●	●	●	●	●	●		
2	Moderate leakage		●		●	●	●	●		
3	0.1~50kPa								●	●
4	1~100kPa								●	●
5	1~500kPa								●	●
6	1~1000kPa								●	●

Outer equipment

Mark	Name	Remark
C1	Calibrator	Calibrate 0.1mL
C3	Calibrator	Calibrate 1mL
C5	Calibrator	Calibrate 5mL
SP-40	Printer	Series printer
RS-C	Series Cable	9pin, RS232, 1.5m
FCU800-24	Charge bypass	Power DC 24V, 400kPa Lead pressure, only for L、M
FEU800-24	Exhaust bypass	
APU	Electro pneumatic transducer	For FL-800UL、L、M
FFM-100	Flow-master	Depending on testing pressure and the volume of the Work(quizzee)
RM-01	Collector signal converter	Control:start, reset, group
RM-03	Collector signal converter	Convert to relay signal
S800	Analysis software	
MP-01	Quick Connect Coupling	For FL-800L、M、H

Note: Outer equipment need buy by oneself

■ Models of Electro pneumatic transducer (APU)

When using APU to assistant FL-800 working, please select the suitable model as follow:

APU-①②-(③)-④-⑤-⑥

①Shape

Mark	Description
70W	φ70mm
90W	φ90mm
130W	φ130mm

②Control pressure range

Mark	Description
P	Positive pressure

③ Pressure range

Mark	Description
+20	For FL-800UL, for 90W、130W
+100	For FL-800L for 70W、90W、130W
+700	For FL-800M for 70W、90W

④ Leak tester use

Mark	Description
X005	Leak tester use, charge characteristic is different from standard.

⑤ Sensor

Mark	Description
C	SX-100D, accuracy: $\pm 0.15\%$ F.S.
E	SX-34, accuracy: $\pm 1.0\%$ F.S.

⑥ APU Control cable

Mark	Description
1.5	1.5m (standard)
3	3m

■ Specification

Test principle	Differential pressure comparison	
Differential sensor	$\pm 2\text{kPa} / 2\text{V}(\pm 10\text{kPa} / 2\text{V})$, Accuracy $\leq \pm 0.5\%$ F.S., Sensor coefficient $0.4 \times 10^{-5} \text{ml/Pa}$	
Gage pressure sensor	Relative pressure sensor	Accuracy $\leq \pm 1\%$ F.S.
	Absolute pressure sensor	Accuracy $\leq \pm 1\%$ F.S.
A.P.SUP	350kPa~450kPa	
Work(quizzee) volume	4.5mL	
Master(norm) volume	4.5mL	
Accuracy	The max allowable error $\leq \pm 5\%$ on the condition that 100ml standard workpiece and 1mL/min leakage rate have a test.	
Stability	$\leq \pm 2\%$	
Display	LCD (Blue LED background) Resolution 240×128 Viewable area W107mm×D57mm	
Group No. setting	0~31ch (Total 32ch)	
Remote I/O	Input terminals: 14 (PNP Type) Output terminals: 13 (NPN Type) Solenoid valve terminals: 8 (NPN Type)	
Critical current	Input: Less than 10mA for one terminal (driving), Less than DC 30V Output: Less than 200mA for one terminal, totality less 1A Outer Solenoid valve: Less than 0.5A for each one, totality less 1A	
Temperature range for operating & storage	Operating : 0 ~ 40 °C Storage: -5 ~ 45 °C	
Humidity range for operating & storage	<85%RH (not condensing)	
Power supply	AC 100~240V, 50/60Hz	
Power consumption	$\leq 50\text{W}$	
Anti interference	Pulse (1 μs 1500V) adds on AC220V power supply, 15ms distance, hold on 3min; Pulse (1 μs 1500V) adds on IO port, 15ms distance, hold on 3min;	
Insulation resistance	DC500V, >100M Ω .	
Current loss	AC100V / 50Hz within 1mA AC200V / 50Hz within 2mA	
Appearance dimension	W190×H292×D330	
Weight	9kg	

■ About Leak Tester

● The importance of leak testing and allowable leakage rate

A “leak” in a product may cause a variety of problems from industry to industry. For example, the existence of a leak in gasoline valves may cause fire or explosion, while a leak in a water valve may cause corrosion and be responsible for performance deterioration. From these examples, we can conclude that every product would under ideal circumstances not leak or have ‘ZERO’ leak.

Although ‘ZERO’ leak is highly desirable, it is nearly impossible, or rather, difficult to achieve, therefore it becomes necessary to determine the most reasonable leak rate (permissive leak rate) while foreseeing potential damages and effects that may originate from a leak problem. This permissive leak rate differs from product to product, industry to industry.

● Critical testing range

BOYI Air leak testers of differential pressure type are designed to use compressed air as its testing media in order to detect pressure alteration, caused by a leak in the work to automatically evaluate the existence of a leak. The differential pressure sensor that is used to detect leaks has sensitivity of less than 1Pa and accurately detects minute pressure changes.

$$\text{Minute leak detection sensitivity (mL/min)} = \frac{\text{Work volume (mL)} \times 10^{-4}}{\text{Time}}$$

● Leak tester

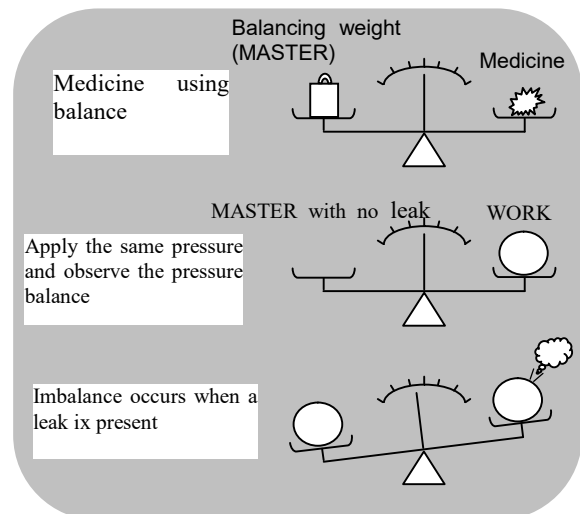
Some traditional methods of leak testing employed by manufacturers included the hydraulic submerging method, which involved immersing work parts into water to observe bubble formation and the soap water application method, which was conducted by applying soap water on the surface of the work part in order to observe bubble formation. Although these methods were commonly practiced, they most often received a great deal of interference from outside influences and determined greatly on the subjectivity and experience of the operators. These methods also required a long processing time and evaluation was terminated if bubbles were not found during the processing time. Moreover, these methods required after care, such as cleaning and drying and caused many manufactures unnecessary problems and headaches.

The Helium leak testing method is another method for leak testing some manufacturers have chosen to employ. This method is costly in that, not only is the initial investment of having to purchase the Helium leak tester expensive, but running costs and maintenance becomes necessary.

BOYI Air leak tester of differential pressure type use an originally developed highly sensitive differential pressure sensor, which allows testing minute leaks in a shorter period of time. By using air as it's testing media, not only can one expect high accuracy and sensitivity but also a reduction in running costs and the elimination of after processing. Leak testing conditions and requirements can be easily set according to the test products and setting definite conditions such as number value enables automated leak testing with constant objectivity. Operation of this equipment can also be controlled by external signals and thus supports full automation of the production process and reduction of labor costs.

● Leak Testing Principles

Please consider the balancing scale for measuring minute amounts of medicine. The balancing scale is a measuring instrument to precisely measure a weight of a certain value by comparing the weight of a balancing weight (or criterion) to the weighed object. BOYI Air leak tester of differential pressure type apply this same principle to its testing method, and charges the same amount of air pressure into the criterion part and the part to be tested, and observes the pressure change within the test part after a specific length of stabilizing time. If the test part has no leak, the charged pressure amount will not alter and the balance between the criterion and test parts will be maintained. However, if a leak is present, the pressure within the test part will decline as time lapses, causing pressure imbalance between the two.

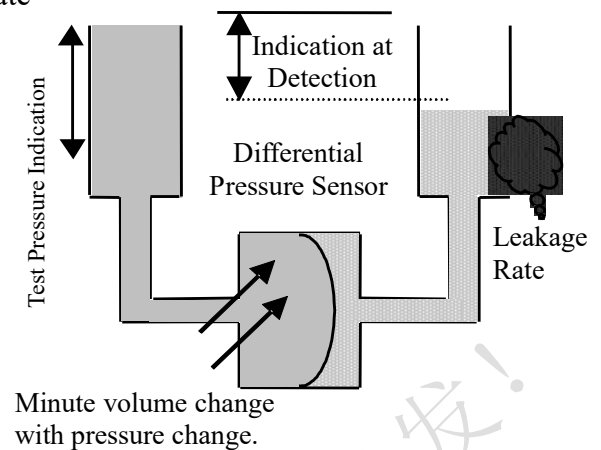


● The relationship between indication and leakage rate

In general, the indication on the leak tester at the detection process will not display the leak rate.

The indicated value is the pressure alteration rate (often called delta P), which is the rate of the resultant pressure decay equal to the leak rate.

This concept can be easily explained by portraying water leaking from buckets. Compare two buckets full of water, with one bucket leaking. Compare the level difference in the bucket which is not leaking (standard) to that of the bucket being evaluated. This is considered to be the same as the indicated rate on the leak tester. From this, one can calculate the leaked amount. Similarly, leak rate can be calculated from the pressure alteration rate.



There are some factors in equation, which have the below meaning.

Internal volume Big leak from a big internal volume container and small leak from small internal volume container maybe produce the same pressure change. Therefore it is necessary to know work's internal volume.

Pressure Air and water are different, air will contract when charged into a container and air will expand when exhausted to the open air.

Sensor coefficient there is a piece of diaphragm in a differential sensor which can change in shape. Pressure change can be detected by the diaphragm shape change. A minute volume change caused by the diaphragm shape change has a large influence to leak test accuracy.

【Reference information】 Compare of water pressure gage and BOYI Air leak tester of differential pressure type

Water pressure gage

$$k=2.51 \times 10^{-3} \text{ mL/Pa}$$

BOYI Air leak tester of differential pressure type

$$k=0.4 \times 10^{-5} \text{ mL/Pa}$$

Test pressure 0.5MPa

When MASTER and WORK are equal to 100mL, Air leak tester of differential pressure type accuracy is 28.4 times higher than water pressure gage.

Equation to calculate the relationship:

$$\Delta V_L = \frac{\Delta P}{T \cdot P_0} \left\{ V_w + k \left(1 + \frac{V_w}{V_s} \right) (P_0 + P_T) \right\}$$

Definitions of the symbols used in the equation are shown below:

ΔV_L : Leak rate (mL/s)

T : Detection time (s)

ΔP : Differential pressure rate generated in detection time T (Pa or mmH₂O)

P₀ : Atmospheric pressure (0.1013 MPa OR 1.033×10⁴mmH₂O)

V_w : Work internal volume (mL)

V_s : Master side internal volume (mL)

k : Sensor coefficient (40 mL /MPa OR 0.4×10⁻⁴ mL /mmH₂O)

P_T : Test pressure (gauge) (MPa OR kg / cm²G=×10⁴mmH₂O)

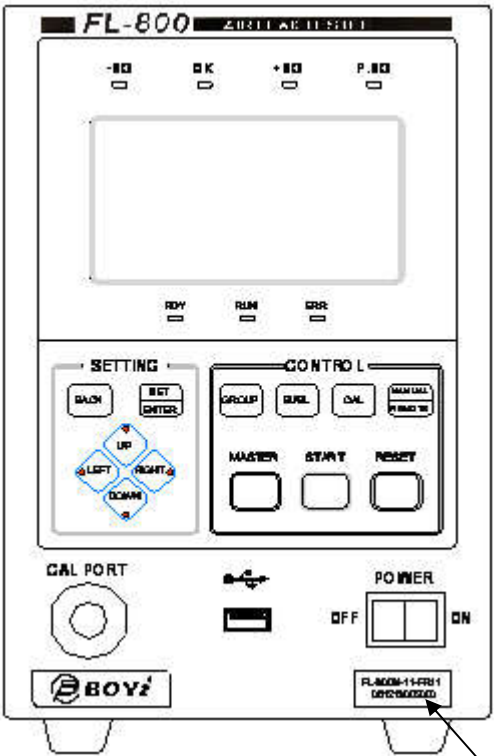
【Reference】 Pressure units and conversion chart

	1Pa	1MPa	1mmHg	1kg/cm ²	1mmH ₂ O
1Pa	1	1×10 ⁻⁶	7.500 62×10 ⁻³	1.019 72×10 ⁻⁵	1.019 72×10 ⁻¹
1MPa	1×10 ⁶	1	7.500 62×10 ³	1.019 72×10 ⁻¹	1.019 72×10 ⁵
1mmHg	1.333 22×10 ²	1.333 22×10 ⁻⁴	1	1.359 91×10 ⁻³	1.359 51×10 ¹
1kg/cm ²	9.806 65×10 ⁴	9.806 65×10 ⁻²	7.355 59×10 ²	1	1×10 ⁴
1mmH ₂ O	9.906 65	9.806 65×10 ⁻⁶	7.355 59×10 ⁻²	1×10 ⁻⁴	1

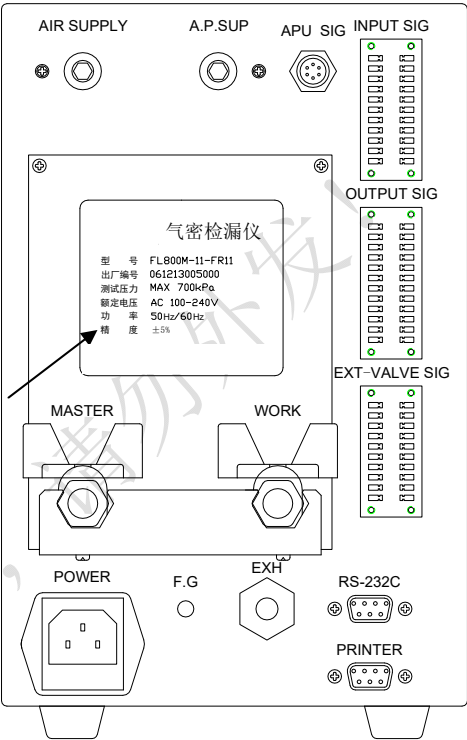
Item Checklist

Check that your package is complete. If you discover damaged or missing items, contact us or your retailer. Make sure you have the legal serial numbers.

- Air leak tester of differential pressure type x1



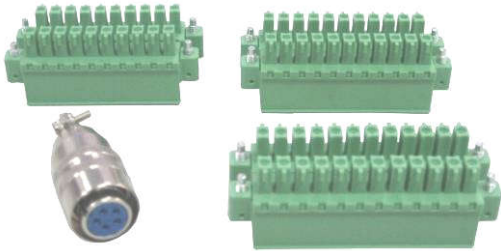
Model&Serial Number



Accessories



User's Manual x1
Test Result Book x1
Warranty Card x1



Input terminal connector	11P	1 pair
Output terminal connector	12P	1 pair
Solenoid valve connector	10P	1pair
Electro pneumatic transducer	5P	x1



Power Cable (250V, 2m) x1



Mounting Plates x2



Regulator for A.P.SUP x1

● option



FR13



FR15



FR16



FR10



FR17



FR22



PC295

● Outer equipment



0.1mL Calibrator



1.0mL Calibrator



5.0mL Calibrator



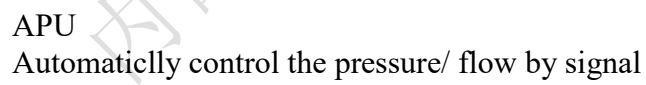
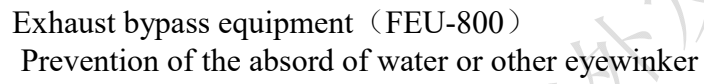
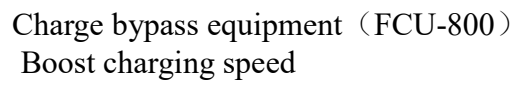
1.5m Series cable

For transmitting the signal to computer, i.e. testing result



Series printer

With power cable and data cable

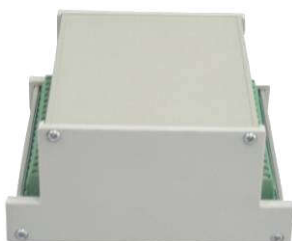




Flow master (leak orifice selection depending on the test pressure and work volume)



Remote controller (RM-01)
For controlling actions of start, stop calibration and group signals.



Collector signal converter, convert to relay signal
(RM-03)



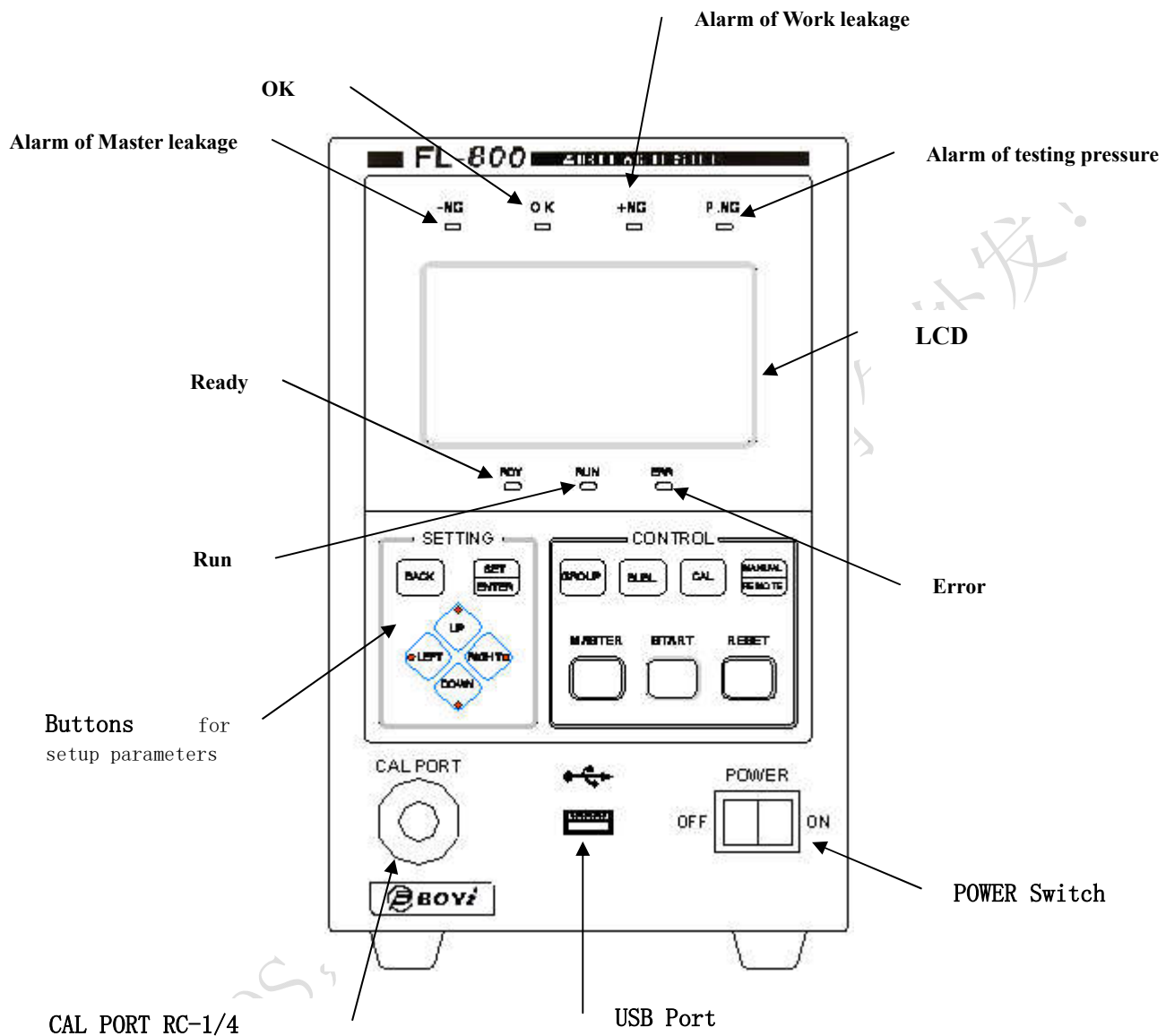
FL-800 Software of data analysis



KFH08N-02 x2

■ Leak tester layout

● 【Front panel】



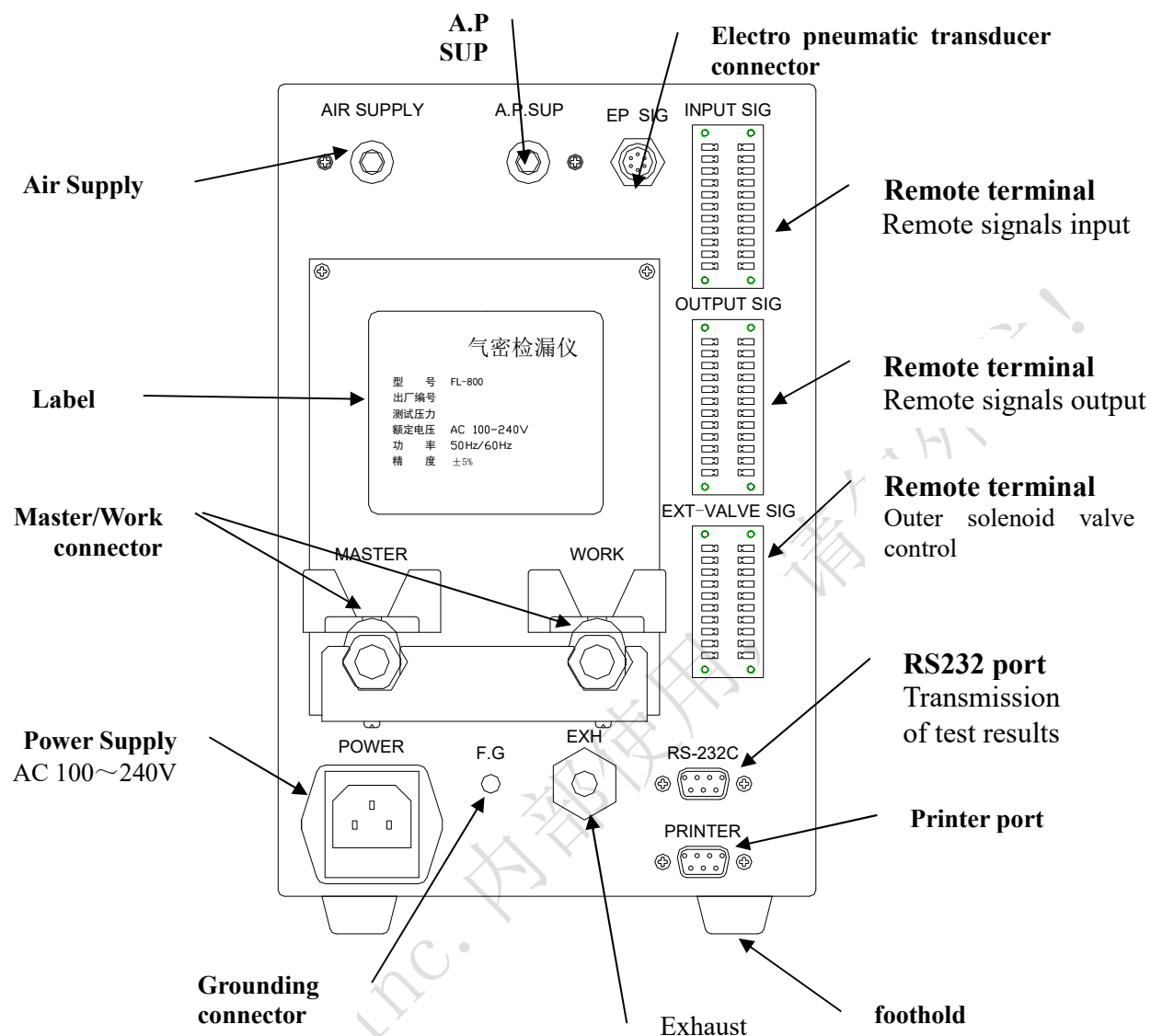
○Pipe requirement

Name	Connector	Description
CAL Port	RC-1/4	Connect a flow-master or calibrator

○Port requirement

Name	Connector	Description
USB	Flash Disk (Formatted at FAT32, one partition)	For saving result

● 【Rear view】



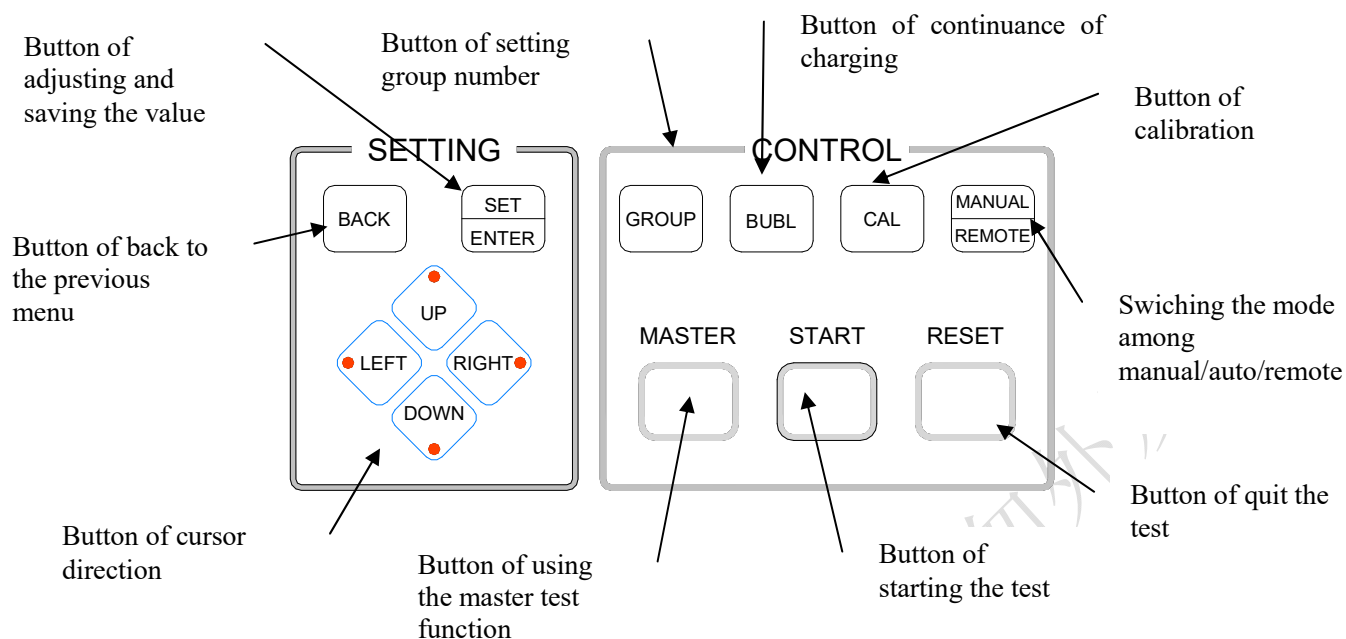
○Piping requirement

Pipe or connector	Connector size	Description
AIR SUPPLY	RC-1/4	Testing pressure air supply connector
A. P. SUP	RC-1/8	Driving pressure air supply connector
WORK	RC-1/4	WORK (quizzee) connector
MASTER	RC-1/4	MASTER (norm) connector
EXH	RC-1/4	Exhaust port

○Port

Name	Connector size	Description
EP SIG	XS12K5P	Electro pneumatic transducer connector
INPUT SIG	MCVR1.5/11-STF-3.81+MCVW1.5/11-STF-3.81	Remote signal receiver
OUTPUT SIG	MCVR1.5/12-STF-3.81+MCVW1.5/12-STF-3.81	Send testing status
EXT-VALVE SIG	MCVR1.5/10-STF-3.81+MCVW1.5/10-STF-3.81	Control outer solenoid valve
RS232C	RS-C 1.5m	Series signal transmit
PRINTER	Regular printer cable	
POWER	Regular cable	AC 100~240V

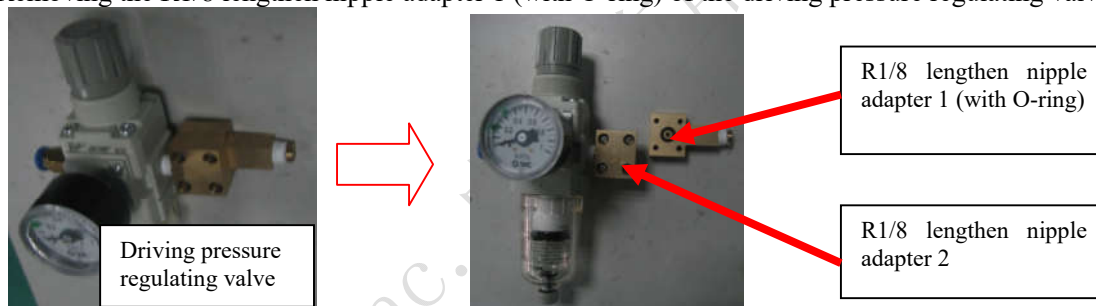
● 【Buttons】



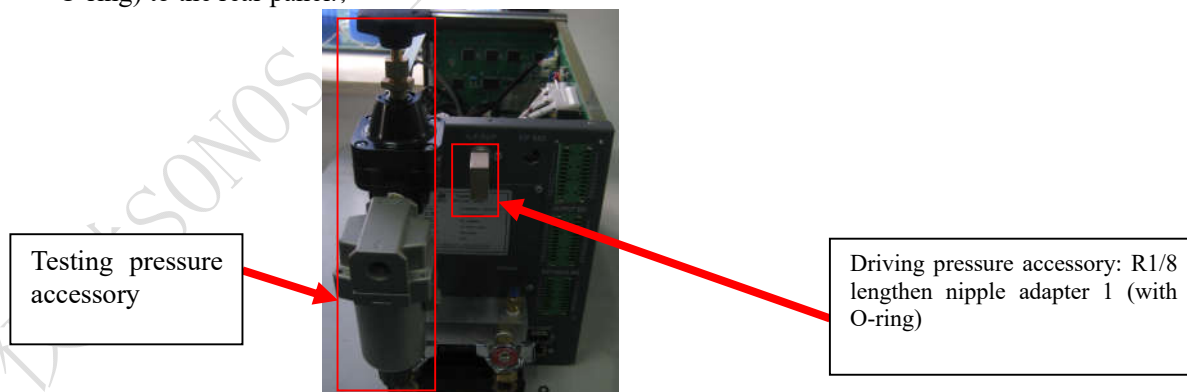
■ Installation instructions

● Installation instructions of regulator (L/M/H series):

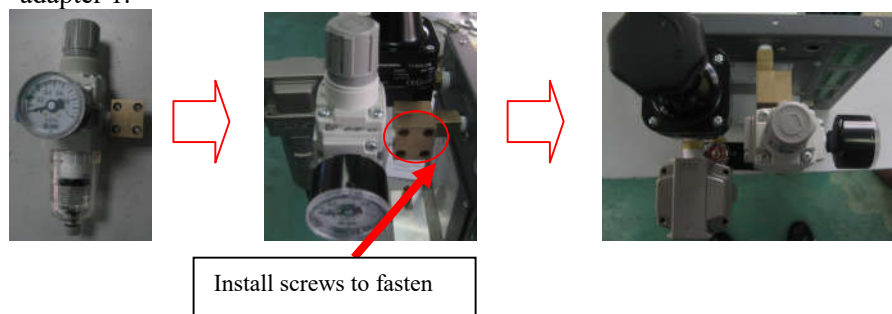
1. Removing the R1/8 lengthen nipple adapter 1 (with O-ring) of the driving pressure regulating valve:



2. Install the test pressure accessory to the rear panel, then Install the R1-8 lengthen nipple adapter 1 (with O-ring) to the rear panel.:



3. Connect the driving pressure regulating valve, R1/8 lengthen nipple adapter 2 and R1/8 lengthen nipple adapter 1.



Air leak tester of differential pressure type detect leaks by reading out precise pressure (air condition) alterations.

Thus, it requires different handling instructions from other standard precision equipment

 Warning	Tester must be in a stable position. Be sure to install the tester on a horizontal surface. Vibrations or earthquakes may cause the tester to fall and cause injury to operators.
	Do not place anything on top of the tester. Do not place anything on top of the tester. Falling objects may result in injury
 Caution	Do not install the tester in the following locations: - High moisture or dusty areas - Areas directly exposed to sunlight - Outdoor - The place without a ventilation
	Moving the Tester: - Be sure to shut off the power, unplug cords, cut off the pneumatic source and remove piping. - Be sure to carry the tester in a stable manner. (Do not carry the tester by the manifold handle.) May cause damage to the tester or to its casing and may result in injury.

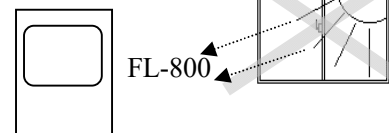
● Operation environment

- Do not install the tester near windows or other locations affected by direct sunlight.

Ambient Temperature: 5~40℃

Ambient Humidity: 45~80% RH with no condensation.

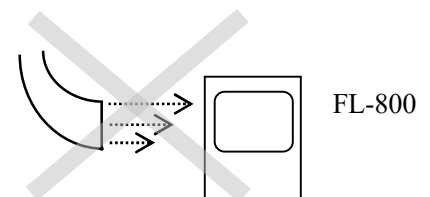
Install the tester where it will not receive any influences from temperature or humidity changes, such as at the center of the facility.



 Warning	For best results and accuracy, it is recommended that the operation temperature and environment humidity condition is $23 \pm 5^{\circ}\text{C}$, $55 \pm 10\% \text{RH}$. Transferring the tester rapidly from high to low temperature locations and/or humidity points may cause condensation. When such cases cannot be avoided, leave the tester in the environment for at least one hour in order for it to adjust to the surrounding temperature.
--	---

- Do not install the tester where it will receive direct influence from wind or blown air.

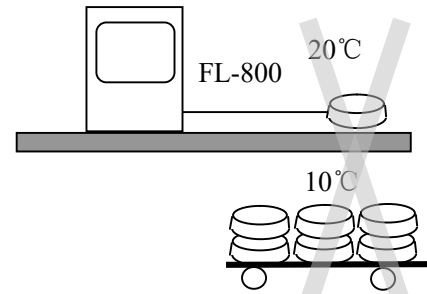
Install the tester in a location where it far from air condition, etc. If possible, please make a casing to protect it. Provide a cover for the tester and/or other fixtures if necessary.



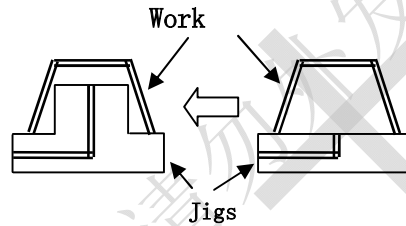
About the Work (quizzze)/Master (norm)

- Lessen the temperature difference between the work and master parts and the surrounding temperature.
If some work parts are left standing for a period of time, be sure to leave the parts close to the leak tester in order to assure that it is in a similar environment.

If pre-processing causes temperature changes (hot water cleansing, weltering, etc.), wait until the temperature of the test parts lower to room temperature. It is not possible to obtain accurate test results if temperature is not consistent.



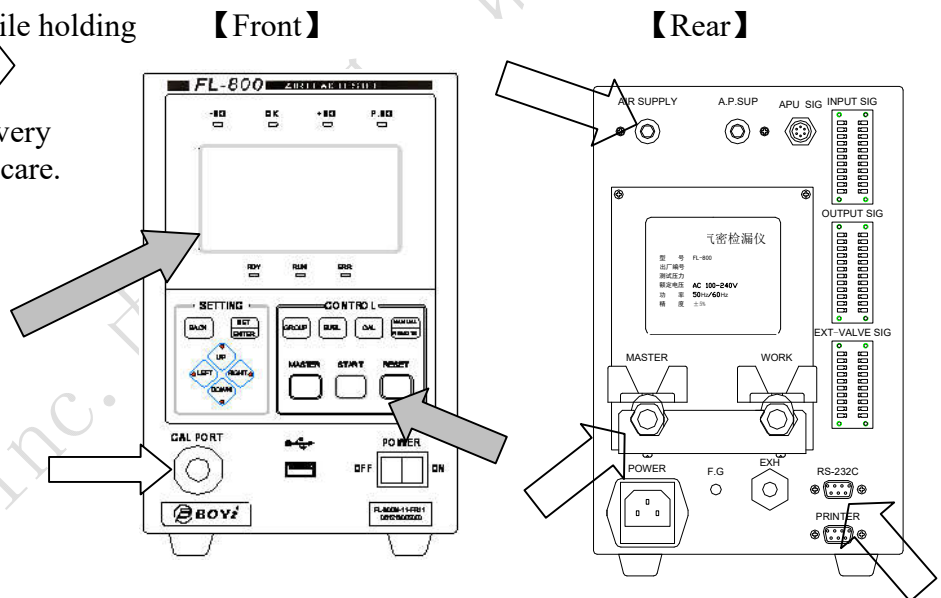
- Minimize the internal volume of the work parts. In order to increase testing sensitivity, minimize the internal volume of the work (including piping) by reducing the length of the pipe or by using a core.



● Transporting instructions

- Don't handle the tester while holding the parts indicated by →

→ indicating parts are very fragile, please handle with care.



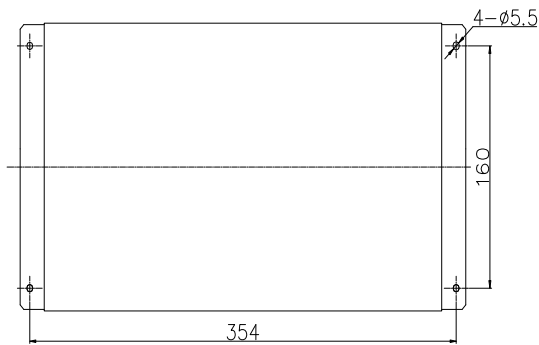
- The best way of movement

Please handle the bottom of the tester by your double hands.



- Machine Size

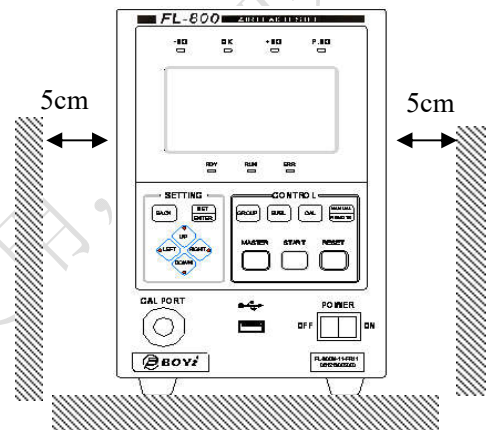
- Please use the provided mounting plates when installing this equipment.
 - Please refer to the external diagram for further details.



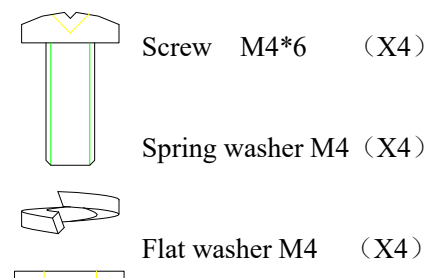
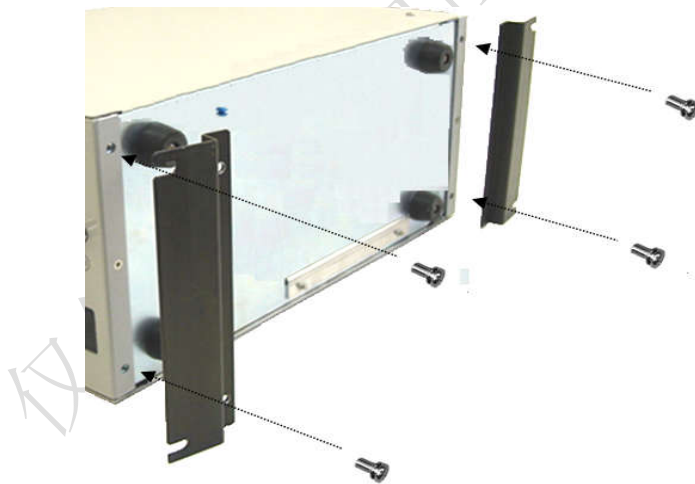
- Installation guide

Follow the remarks listed below for installation.

- There is a cooling fan located on the rear panel of the tester body. Reserve enough space between the tester and the wall of adjacent fixtures to maintain the air ventilation effect.
 - Leave a sufficient amount of space (as shown on the right) for connection cables.



- Mounting tool assembly



- Mount the metal fittings to the tap holes located on the bottom of the tester's main body. Secure it with the specified screws
 - Prior to any installation procedures, it is important that the power and air supply has been turned off to avoid the risk of accidents

■ Basic piping



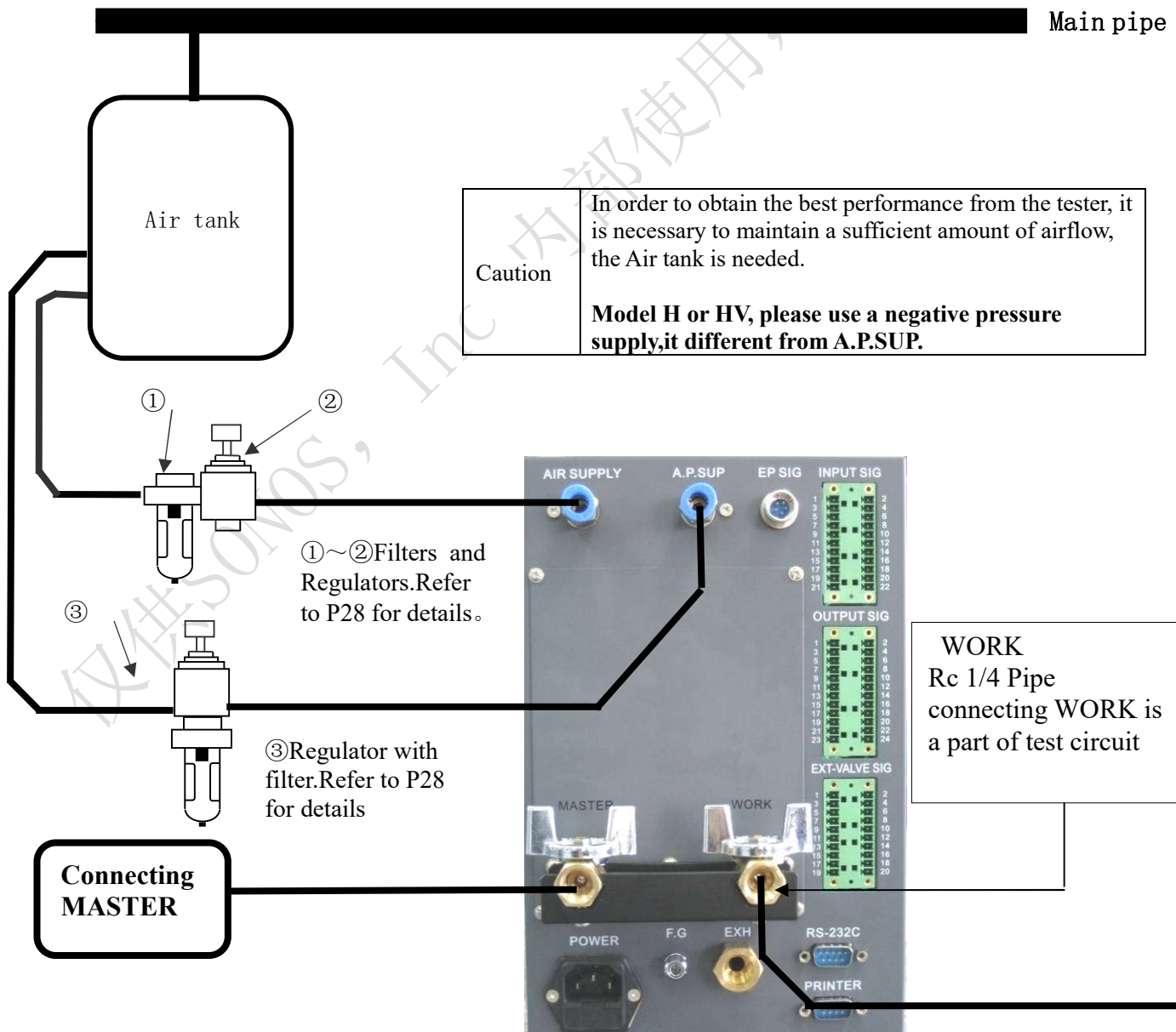
Warning

- Security assurance during piping procedures.
- Do not touch the terminal board or start piping procedures when power on.
 - Do not start piping procedures while connected to an air supply. Large amounts of compressed air may be emitted and cause injury. Secure a safe operation environment and start the procedures.



Caution

- Air supply
- Use clean, stable air supply as the air source. The primary reason for sensor malfunction is caused by water/oil intrusion. Please provide an air filter. An air dryer or air purification device is also recommended when necessary.
 - Air leak testers detect leaks by reading tiny differential pressure.. Thus, piping for air leak testers requires unique piping instructions. Follow the instructions below for high accuracy leak testing.



Caution

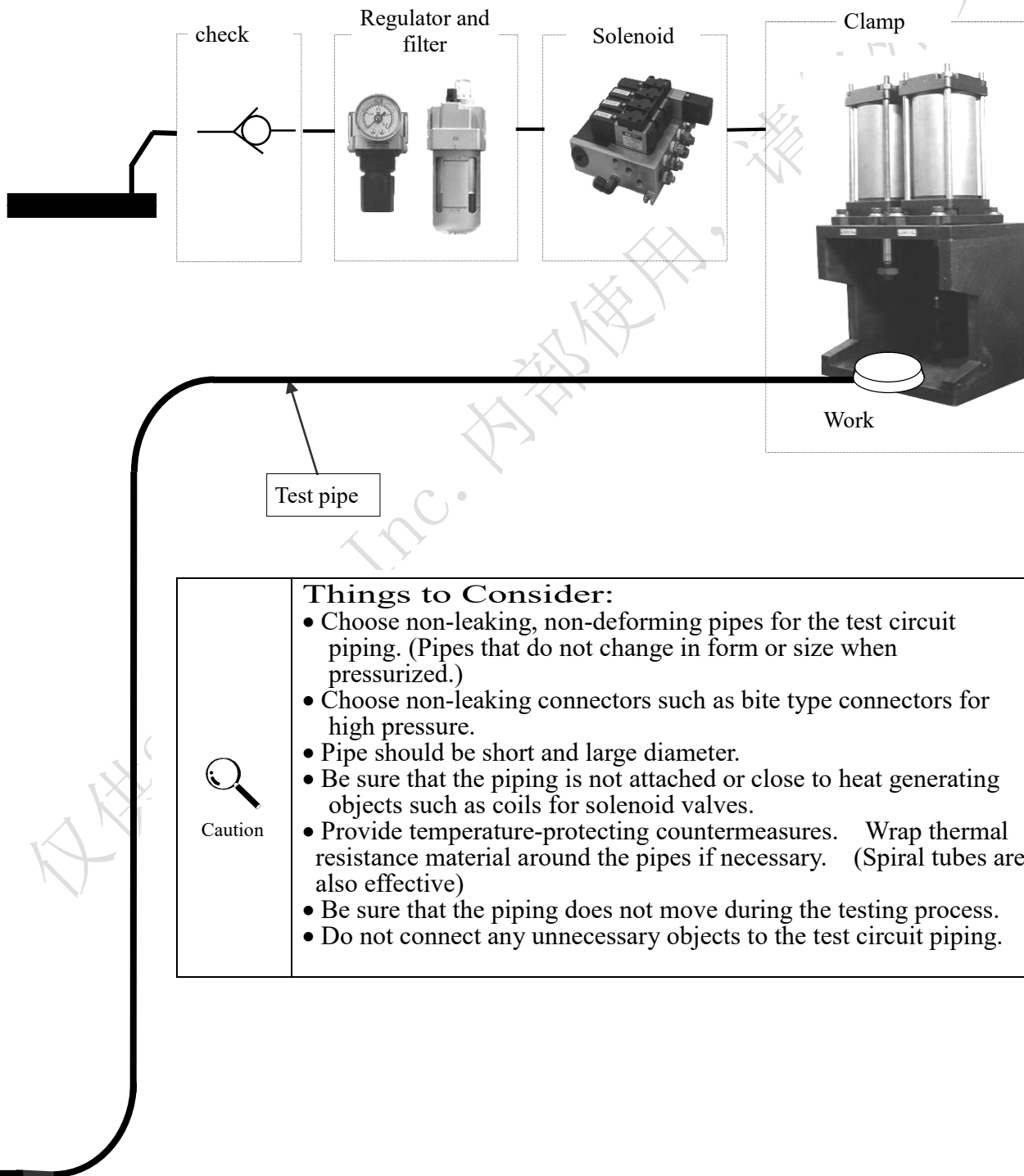


Clamp fixture

Inadequate clamping pressure will cause sealing materials to deform, destroy work parts or leaks. If there is over 20% of pressure tolerance against the set pressure, provide a compressor or increase the pressure supply. Arranging a surge tank between the passages may also be effective.

Provide a separate regulator for cylinder actuation pressure adjustment.

Pressure tolerance for the cylinder actuation may interfere with the pressure supply or shift the clamping force for multiple cylinders causing unsuitable testing.



Things to Consider:

- Choose non-leaking, non-deforming pipes for the test circuit piping. (Pipes that do not change in form or size when pressurized.)
- Choose non-leaking connectors such as bite type connectors for high pressure.
- Pipe should be short and large diameter.
- Be sure that the piping is not attached or close to heat generating objects such as coils for solenoid valves.
- Provide temperature-protecting countermeasures. Wrap thermal resistance material around the pipes if necessary. (Spiral tubes are also effective)
- Be sure that the piping does not move during the testing process.
- Do not connect any unnecessary objects to the test circuit piping.



Caution

■ Selection method of peripheral components

Refer to the below table on regulators and filters of FL-800

(Selection of regulator and filter mentioned in piping method at P26)

No.	Name	Optimal		Recommendation product	
				Range	Model
①	Filter	Filter aperture 0.3μ m 、 rated flow 450 L/min		V	ZFA200 series
				UL	AFD20 series
				L、 M	AFM-30 series
				H、 H1	AF-30 series
②	Regulator	Use high reactive and accuracy regulator.	Adjust to the required test pressure.	V	IRV2000 series
				UL	R5、 R70 series
				L	IR-2000 series
				M	IR-2020 series
				H	11-818 series
				H1	10292U series
③	Regulator with filter	Adjusting range0.35MPa~0.45MPa			AW20-01G series

 Memo	When testing works with small internal volumes, the pressure flow rate can be small as well. (The standard shown in the catalog is sufficient). However, most small size regulators are responsive to pressure changes and may be influenced by these changes. Please select regulators which are a little larger in size than noted.
 Caution	Please use air dryers or other cold and dry devices, etc., to filter water in the air supply. Oil and mist separator, Air Filter attached can't filter water. Too wet air supply may be harmful to the leak tester.

■ Remote terminal wiring

● Attentions of wiring

1. Cutting off power supply and air supply before wiring.
2. Considering each signal's use and capacity comprehensively then selecting diameter of cord.
3. Separating input signals wiring from output signals wiring to prevent electric interference.
4. Recommending Use of shielded cords to connect input signals.
5. F.G must be connecting to the ground.

 Caution:	1. Pay attention to output signal loads (rated load: DC 1A/24V)。
	2. Confirm that WORK is clamped then input start signal under clamp cylinders control.

● APU control terminal

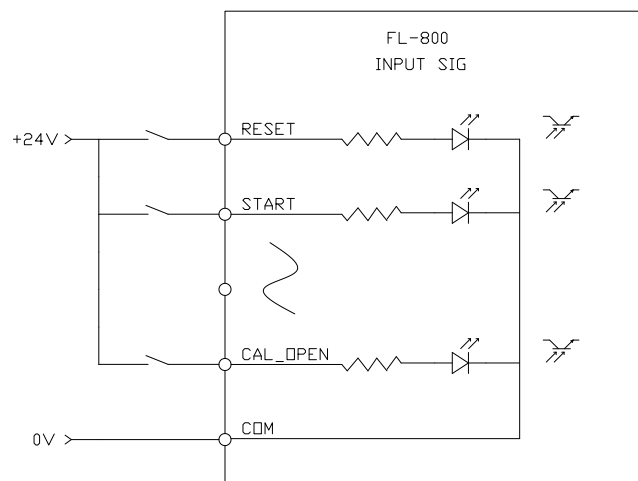
No.	Signal	Description
1	+15V	anode
2	VSS	Simulative ground
3	-15V	cathode
4	Vout	Signal output, 0 ~ 10V , Control peripheral components, Rated load 15mA
5	NC	void

- Input Signal

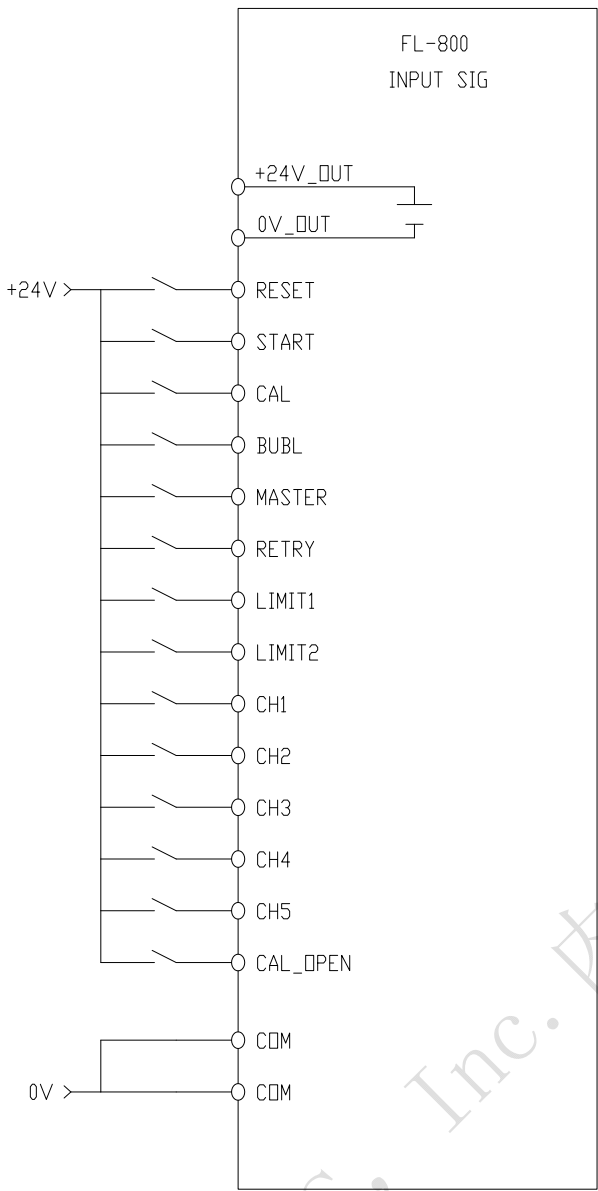
1. Terminal description

Type	Pin	Name	Description
Input	1	+24V_OUT	+24V (DC24V is supplied by FL-800)
	2	0V_OUT	OV (DC24V is supplied by FL-800)
	3	NC	Do not connect
	4	NC	Do not connect
	5	RESET	Reset, stop any operation
	6	START	Start test
	7	CAL	“constant flow mode”Calibration
	8	BUBL	Increase voltage,hold signal
	9	MASTER	Start master test
	10	RETRY	Retest, Same as START, previous result not save
	11	LIMIT1	Confirm unclamp
	12	LIMIT2	Confirm clamp
	13	CH1	Group No. input switch, 8421 code Format: 16 8 4 2 1 CH5 CH4 CH3 CH2 CH1
	14	CH2	
	15	CH3	
	16	CH4	
	17	CH5	
	18	CAL_OPEN	The standard leak can be linked to the CAL port for leak inspection when the port is open. It is applicable only when the machine has CAL function.
	19	NC	Do not connect
	20	NC	Do not connect
	21	COM	serial port
	22	COM	serial port

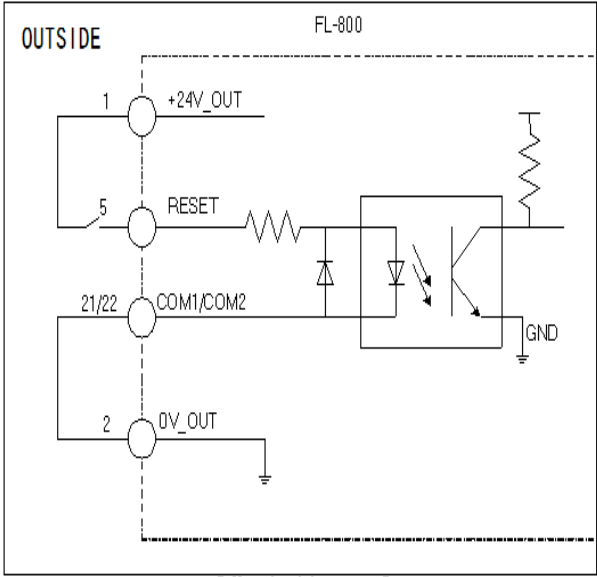
2. Internal structure



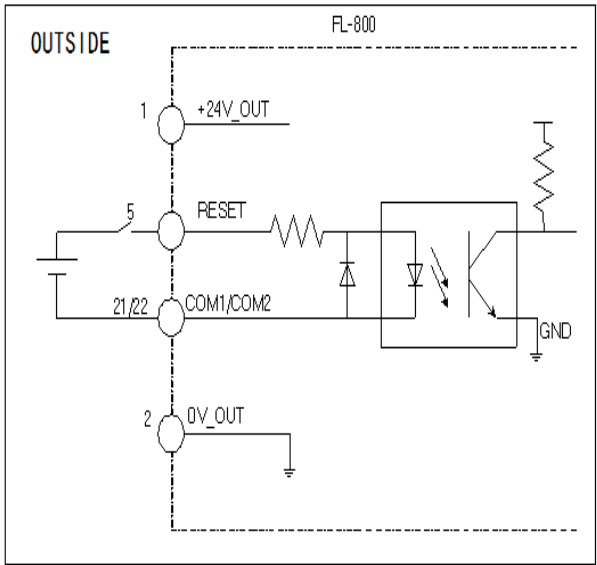
3. Connection method



Wiring diagram



【 Use inside power 】



【 Use outside power 】

Schematic diagram

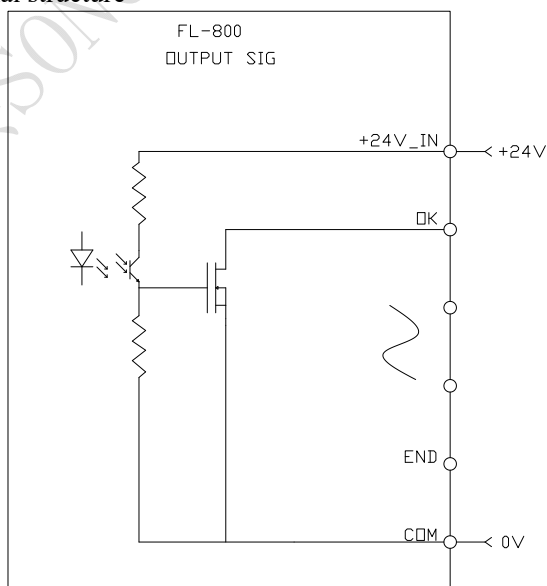
 Caution	1、 External power supply requirement: DC 24V $\pm$20%. 2、 Input terminal volume , $\leq$10mA 3、 It can use DV24V from FL-800 when there is no external power supply.
 Danger	1、 DV24 can not be used with external power supply in parallel. 2、 DV24 power supply volume from FL-800 $\leq$0.5A (Includes all back terminals)

● Output Signal

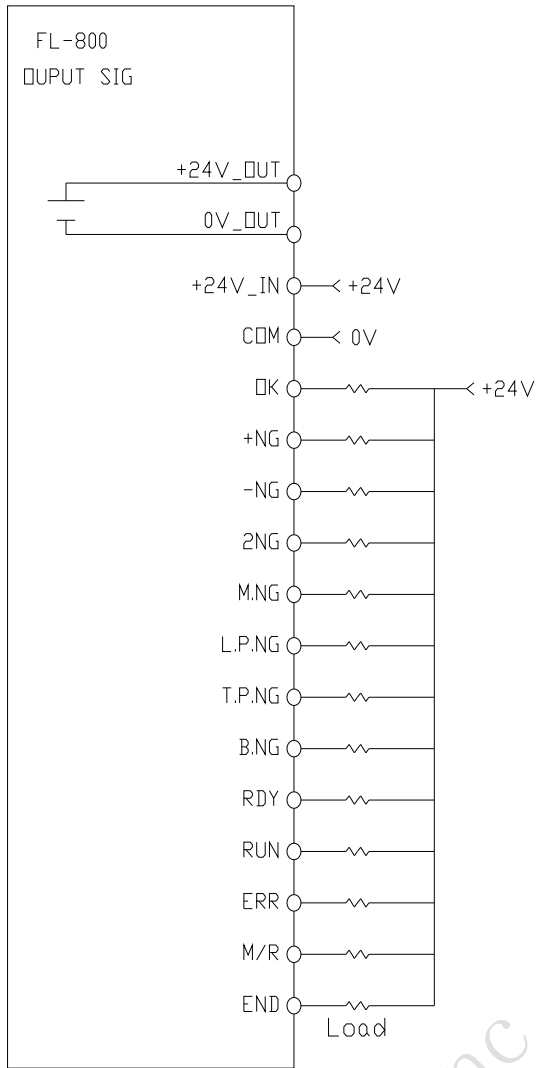
1. Output terminal

Type	Pin	Name	Description
Output	1	+24V_OUT	+24V (DC24V is supplied by FL-800)
	2	0V_OUT	0V (DC24V is supplied by FL-800)
	3	+24V_IN	+24V (External power supply) need connect
	4	COM	OV (External power supply) need connect
	5	OK	Tset result OK
	6	+NG	Tset result +NG
	7	-NG	Tset result -NG
	8	+2NG	Tset result +2NG
	9	M.NG	Mater Tset result M.NG
	10	L.P.NG	Charge1 pressure abnormity
	11	T.P.NG	Charge2 pressure abnormity
	12	B.NG	Balance2 mass leakage
	13	NC	Do not connect
	14	NC	Do not connect
	15	RDY	Ready signal
	16	RUN	Run signal
	17	ERR	Error
	18	M/R	Manual/Remote, Remote signal is valid
	19	END	End signal
	20	NC	Do not connect
	21	NC	Do not connect
	22	NC	Do not connect
	23	NC	Do not connect
	24	NC	Do not connect

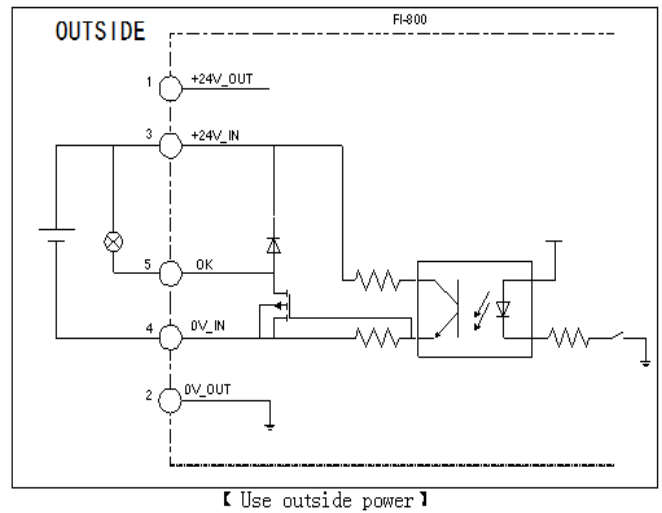
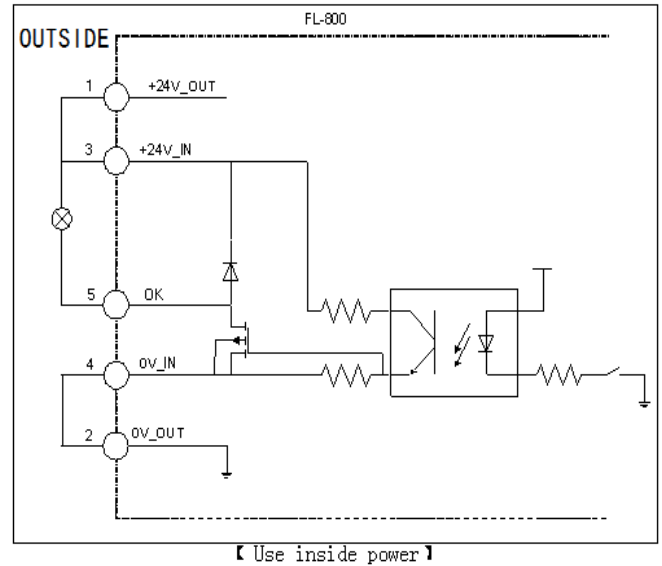
2. Internal structure



3. Connection method



Wiring diagram



Schematic diagram

**Caution**

- 1、 External power supply requirement: DC 24V $\pm 20\%$.
- 2、 Input terminal volume, each terminal $\leq 0.5A$, total $\leq 1A$
- 3、 It can use DV24V from FL-800 when there is no external power supply.

**Danger**

- 1、 DV24 can not be used with external power supply in parallel.
- 2、 DV24 power supply volume from FL-800 $\leq 0.5A$ (Includes all back terminals)

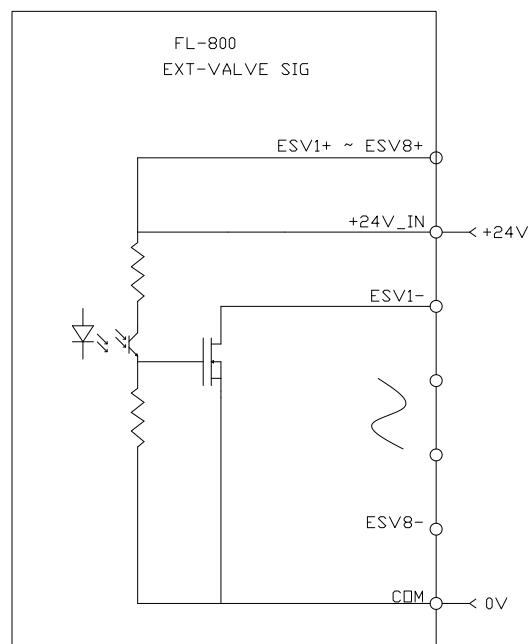
Warm Up—Terminal Wiring

● External-valve Signal

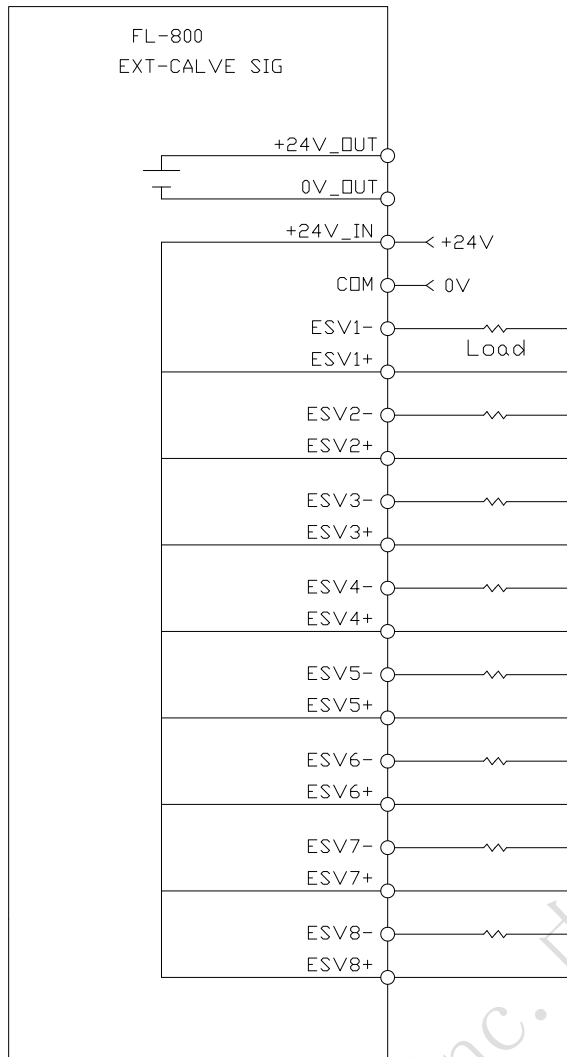
1. Terminal description

Type	Pin	Name	Description
Output	1	+24V_OUT	+24V (DC24V is supplied by FL-800)
	2	0V_OUT	0V (DC24V is supplied by FL-800)
	3	+24V_IN	+24V (External power supply) need connect
	4	COM	OV (External power supply) need connect
	5	ESV1-	ESV1 control terminal - (0V)
	6	ESV1+	ESV1 control terminal + (+24V)
	7	ESV2-	ESV2control terminal - (0V)
	8	ESV2+	ESV2control terminal + (+24V)
	9	ESV3-	ESV3control terminal - (0V)
	10	ESV3+	ESV3control terminal + (+24V)
	11	ESV4-	ESV4control terminal - (0V)
	12	ESV4+	ESV4control terminal + (+24V)
	13	ESV5-	ESV5control terminal - (0V)
	14	ESV5+	ESV5control terminal + (+24V)
	15	ESV6-	ESV6control terminal - (0V)
	16	ESV6+	ESV6control terminal + (+24V)
	17	ESV7-	ESV7control terminal - (0V)
	18	ESV7+	ESV7control terminal + (+24V)
	19	ESV8-	ESV8 control terminal - (0V)
	20	ESV8+	ESV8ontrol terminal + (+24V)

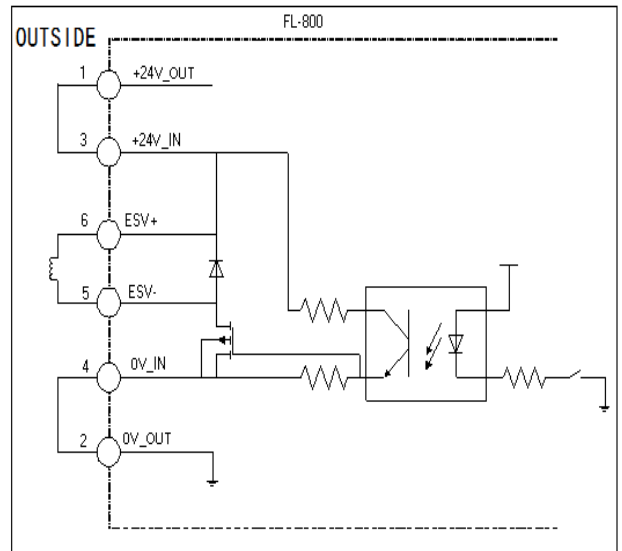
2. Internal structure



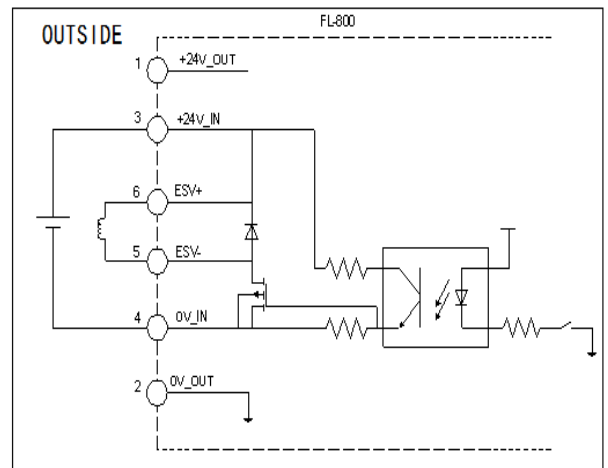
3. Connection method



Wiring diagram



【 Use inside power 】



【 Use outside power 】

Schematic diagram



Caution

- 1、 External power supply requirement: DC 24V $\pm$ 20%.
- 2、 Input terminal volume, each terminal $\leq$ 0.5A, total $\leq$ 1A
- 3、 It can use DV24V from FL-800 when there is no external power supply.



Danger

- 1、 DV24 can not be used with external power supply in parallel.
- 2、 DV24 power supply volume from FL-800 $\leq$ 0.5A (Includes all back terminals)

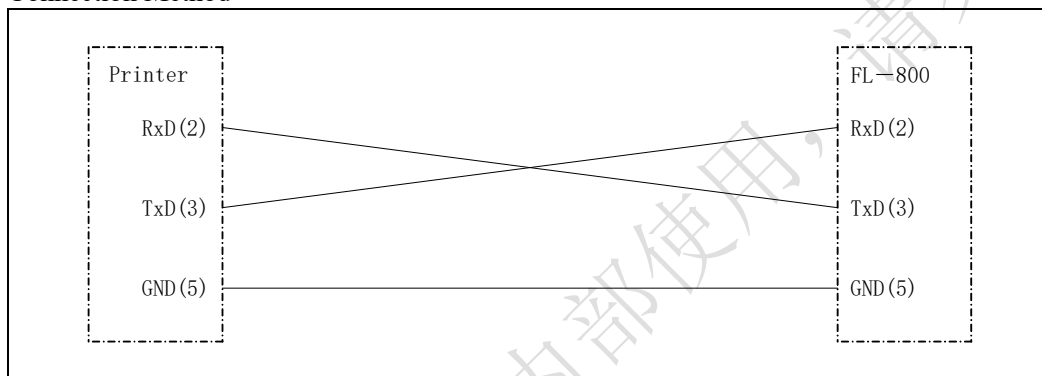
Warm Up—Terminal Wiring

- Printer port

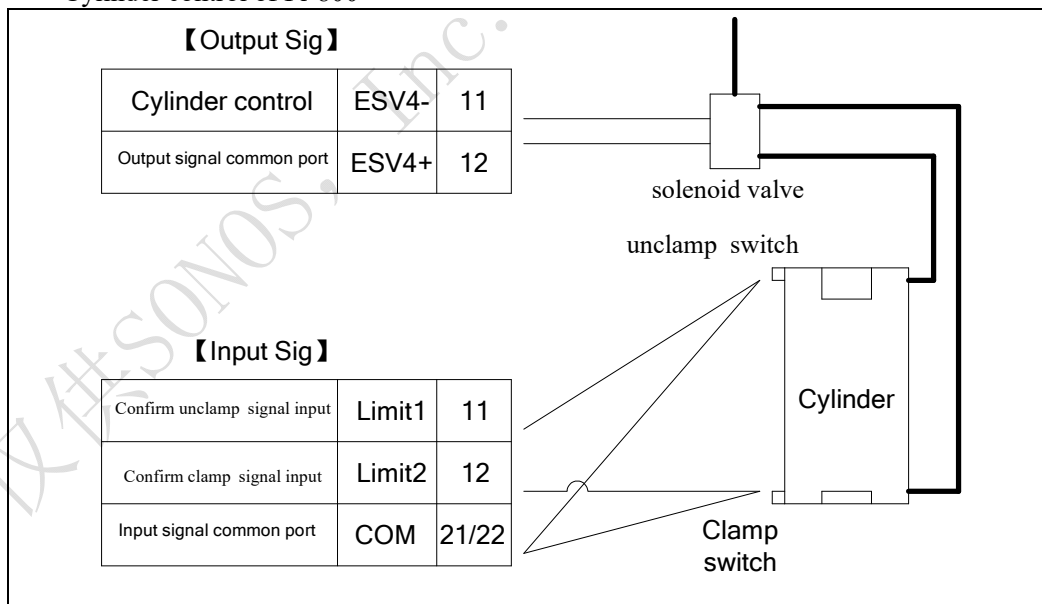
Printer port is a 9-pin serial port, please use the serial printer.

Type	Pin	Name	Description
	1		
Input	2	RxD	Signal receive
Output	3	TxD	Signal send
	4		
Ground	5	GND	Signal ground
	6		
	7		
	8		
	9		

Connection Method



- Cylinder control of FL-800



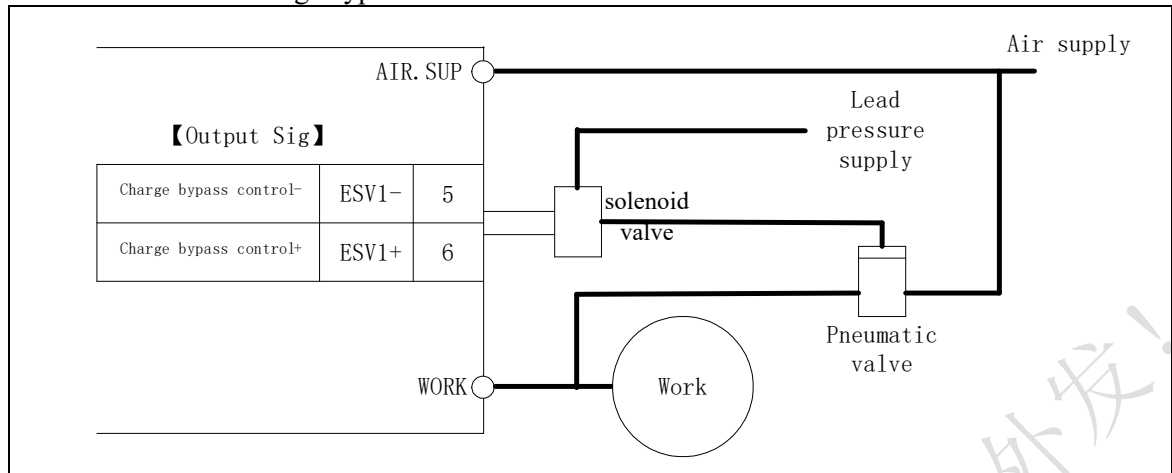
Please follow the instruction for selection of driving solenoid valve of cylinder:

Driving voltage DC 24V

Power consumption Equal or less than 0.5A

Caution: When using exhaust bypass function, please enter “Assistant setting” and set the “Exh mode” into “Bypass”.

● Connection of Charge bypass

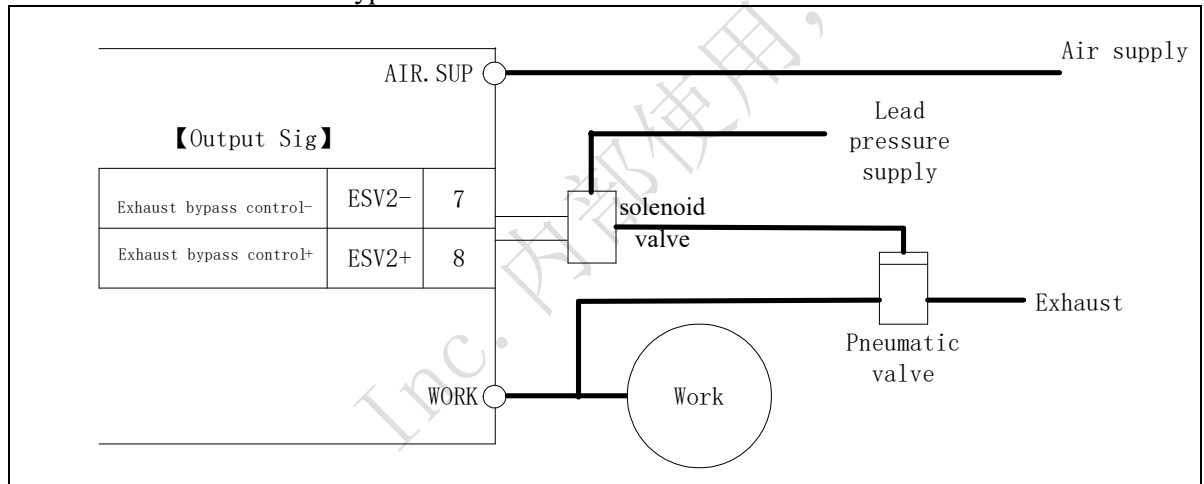


Please follow the instruction for selection of driving solenoid valve of cylinder:

Driving voltage DC 24V

Power consumption Equal or less than 0.5A

● Connection of Exhaust bypass



Please follow the instruction for selection of driving solenoid valve of cylinder:

Driving voltage DC 24V

Power consumption Equal or less than 0.5A

● Timing

		RDY Ready	DLY Delay	CHG1 Charge1	CHG2 Charge2	BAL1 Balance1	BAL2 Balance2	DET Detect	EXHD Exhaust Delay (*15)	EXH Exhaust	RDY Ready
INPUT	RESET	(*1)									
	START	(*2)									
	CAL	(*12)									
	CAL_OPE N	(*3)									
	BUBL	(*11)									
	Master	(*4)									
	Retry										
	Limit1	(*5)									
	Limit2	(*5)									
	CH1										
	CH2										
	CH3										
	CH4										
	CH5										
OUTPUT	OK									(*6)	
	+NG									(*6)	
	-NG									(*6)	
	+2NG									(*6)	
	M.NG									(*6)	
	L.P.NG									(*6)	
	T.P.NG									(*6)	
	B.NG									(*6)	
	ERR	(*7)									
	END										
	RDY										
Internal valve	AV1 Charge										
	AV5 Exhaust									(*14)	
	AV2 Balance										
	AV3 Balance										
	AV4 CAL	(*8)									
External solenoid valv	ESV1 Charge bypass	(*9)									
	ESV2 Exhaust bypass	(*10)									
	ESV3 External pressure switch										
	ESV4 Cylinder control										
	ESV5	(*13)									
	ESV6	(*13)									
	ESV7	(*13)									
	ESV8	(*13)									

The parts marked grey indicate that the input and output are available.

(*1) The Reset signal can be inputted at any stage, and the detection would be stopped once the signal is effective.

According to the practical application, the RESET signal can be connected to the nodes of normal close and normal open.

(*2) The group number of CH1~CH5 should be inputted before inputting the START、BUBL、Master、CAL signals.

(*3) The input of CAL_OPEN signal is valid during the whole stage of RDY, while it only starts instant sampling at the beginning of other stages.

(*4) The master function would not start when the MASTER mode is set to be 4.

(*5) It is generally a limit switch signal of the cylinder. Whether Limit1 is valid would be judged at the beginning of the DLY stage, while Limit2 be judged at the end of the stage. An ERR signal would be made even either of them is invalid.

(*6) The detection result would be displayed from the beginning of EXH stage, and only one of the signals would be displayed and hold until reset or next start.

(*7) The ERR signals would be made and displayed when errors happens, and they would be disappeared once errors are corrected.

(*8) The internal CAL port is valid during the volume measurement. It is open during the first measurement while closed during the second.

(*9) Normal close valve is used during the Charge Bypass stage.

(*10) Normal open valve is used during the Exhaustion Bypass stage.

(*11) Once the BUBL signal is effective, it is implied to charge under the test pressure

(*12) Once the BUBL signal is effective, the system would carryout Volume Calibration directly, and the set values of standard leak and test pressure are as same as previous set.

(*13) Outputs are configurable.

(*14) When the“Exh mode” was set into “Bypass”, the output is valid; when the“Exh mode” was set into “Local”, the output is invalid.

(*15) “Exhaust delay” sub-link of the exhaust link, the status bar displays the "exhaust", only the words in the countdown below show the specific sub-link status.

TestPressure will be shown at RDY and DLY processes; WorkPressure will be shown at CHG1,CHG2 and BAL1 proceses.

• Group number input code

	00	01	02	03	04	05	06	07	08	09	10	~	15	~	30	31
CH1		●		●		●		●		●		~	●	~		●
CH2			●	●			●	●			●	~	●	~	●	●
CH3					●	●	●	●				~	●	~	●	●
CH4									●	●	●	~	●	~	●	●
CH5												~		~	●	●

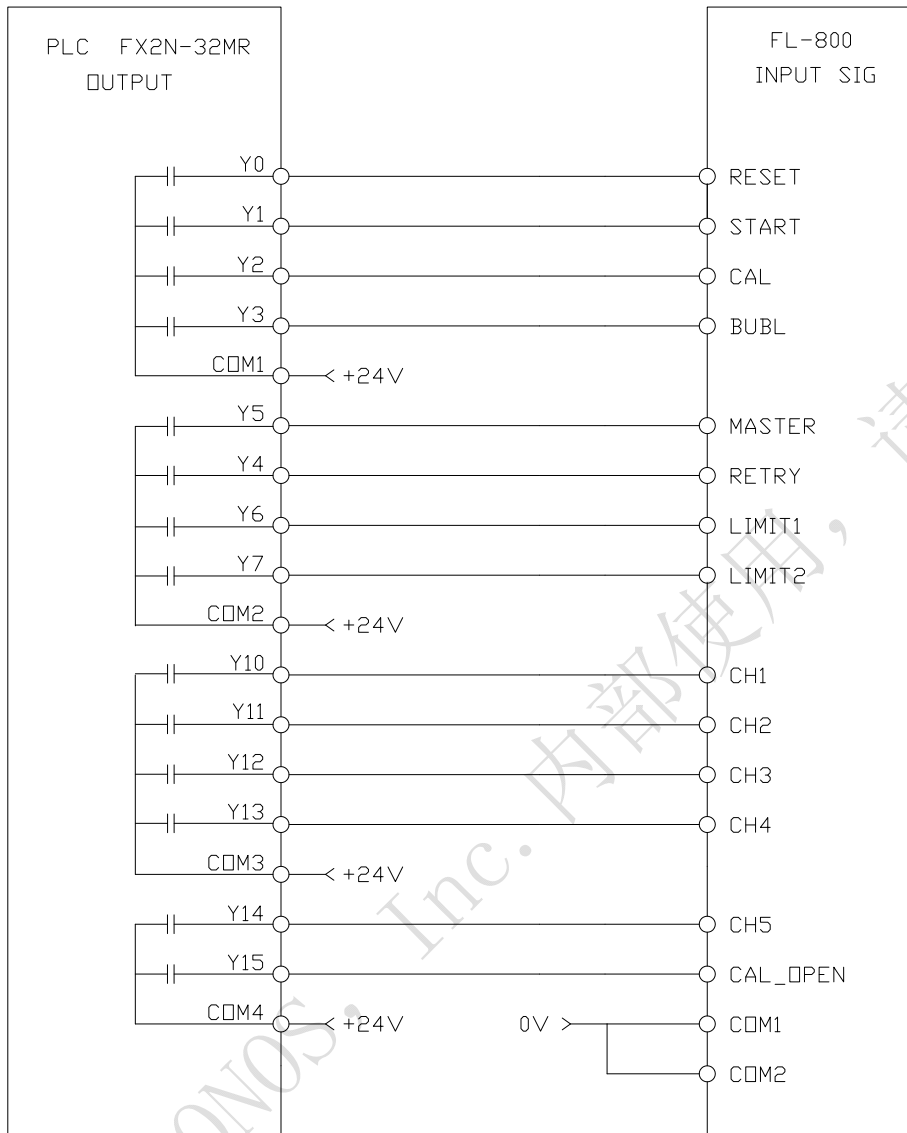
“●” is sign of valid

	Caution	Adjusting group number is performed only in the READY mode.
---	----------------	---

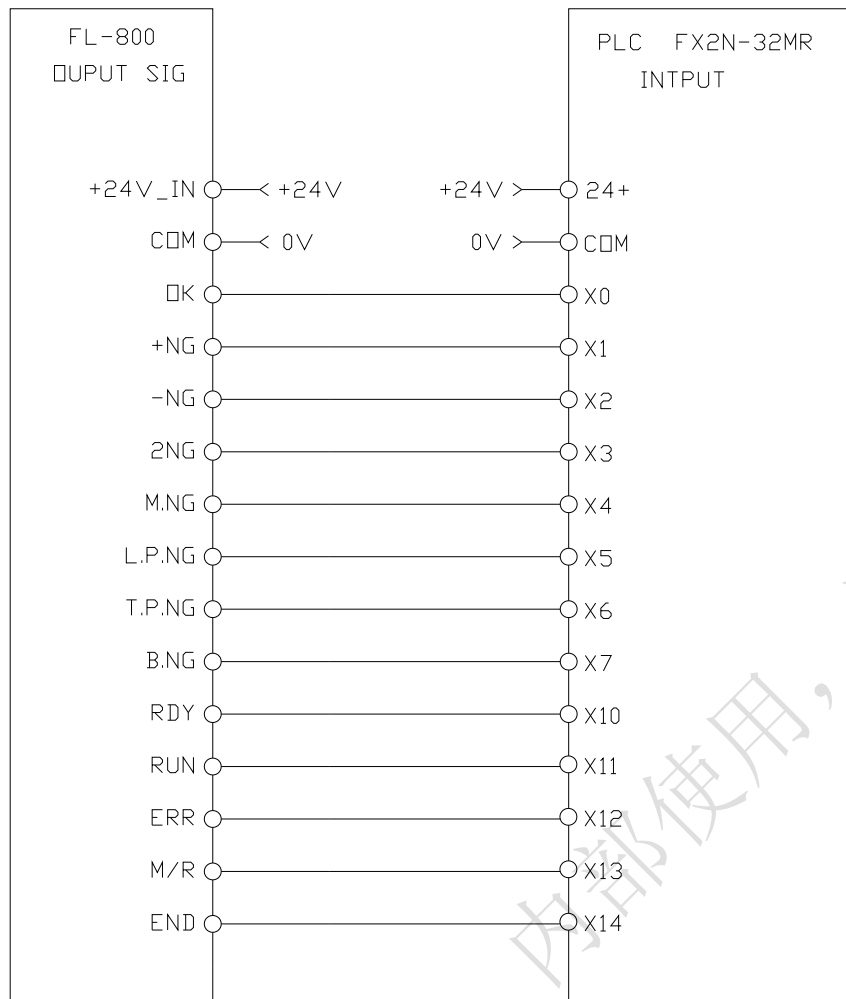
● PLC wiring example

This sample takes Mitsubishi FX2N - 32MR series PLC for instance, which is equipped with DC input and relay output. It includes wirings of input node and output node, and use external DC24V.

Input node wiring:

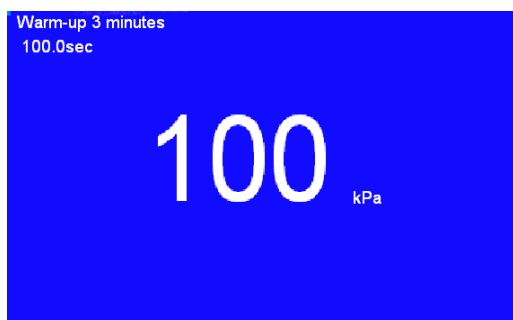
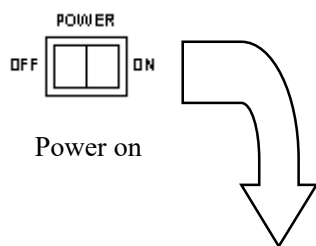


Output node wiring:

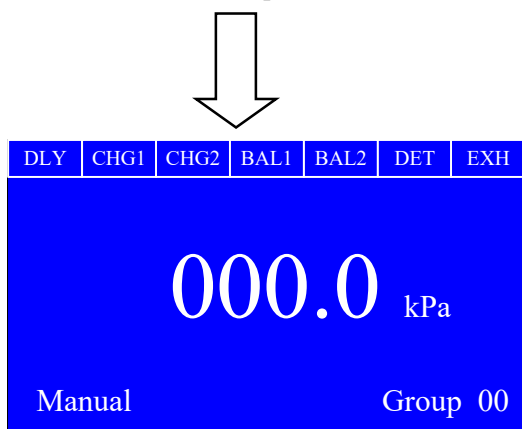


Warm Up—Power Supply Connection

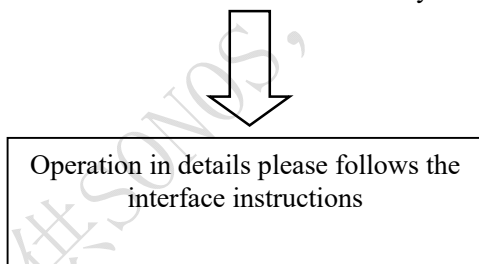
- Turn on the power switch



Warm up



Enter the initial interface for stand by (Ready)

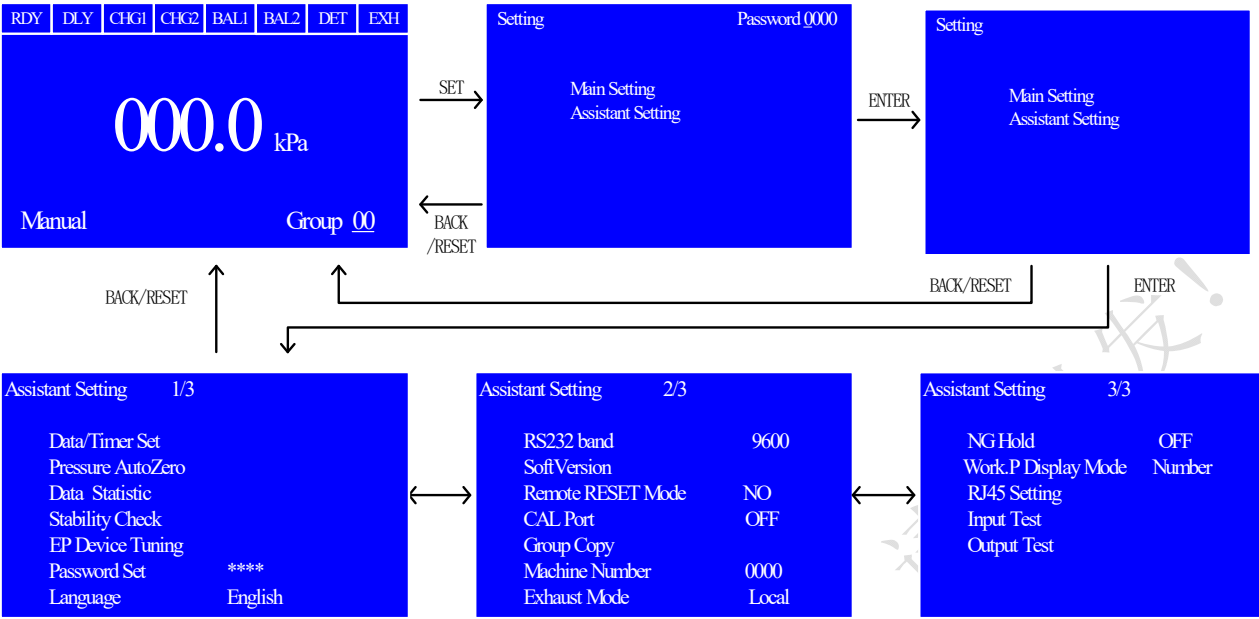


■ Operation in summary

- Main setting interface



● Assistant setting interface



● Initialization of user setting



Note: Please pay attention to the tips. Once initialization, all set values and test results will be lost and then be restored to default values

● Main setting interface parameter

Setting items		Setting Range	Description
Delay	Delay timer	000.0~999.9s 0000~9999s	The delay between start detect and pressure increase. The delay of external equipment reaction, such as cylinder.
Charge1	Charge1 timer	000.0~999.9s 0000~9999s	Time of charging by using the lead pressure. Lead pressur's charging time when using the Fast charge function. Fast charge function is not performed when setting value is 0. When using the fast charge functions, a external pressure switch (ESV3) is needed.
Charge2	Charge2 timer	000.1~999.9s 0001~9999s	Charge time of test pressure
Balance1	Balance1 timer	000.0~999.9s 0001~9999s	Time of balance 1. The period of stop charge and the comparison of master and work.
Balance2	Balance2 timer	000.1~999.9s 0001~9999s	Time of balance 1. The period of balance time of separating work and master.
Detect	Detect timer	000.1~999.9s 0001~9999s	Time of detection of leakage rate
Exhaust Delay	Waiting for the exhaust time	000.0~999.9s 0000~9999s	Waiting time before the exhaust.(after test)
Exhaust	Exhaust timer	000.1~999.9s 0001~9999s	Exhaust time, exhaust from the master and work
M.Detect	Master	010.0~0150.0s 0010~0150s	Time of master detect,using when there has the volume difference between master and work,which can not be ignored.
Timer Digit	Timer Digit	"000.0"、"0000"	Setup the Timer Digi, the longest:"999.9"、"9999"seconds.
+2NG	Secondary leakage standard	0000~9999	Determination standard of leakage testing result:Work If need setting, the value should big than "+NG".
+NG	Work leakage upper limit	0000~9999	Determination standard of leakage testing result:Work If need setting, the value should smaller than "+2NG".
-NG	Master leakage upper limit	0000~-9999	Determination standard of leakage testing result: Master Only can set the negative value
+M.NG	Master detect upper limit	0000~9999	Determination standard of master detecting result:Work
-M.NG	Master detect lower limit	0000~-9999	Determination standard of leakage testing result:Work
W.Volumn	Work volume	≥4.5mL	Work volume can be get by calibration automatically, or input manually (The volume contains the internal volume and the pipe volume)
M.Volumn	Master volume	≥4.5mL	Master volume need to input manually (The volume contains the internal volume and the pipe volume)
Leak Unit	Leak Unit	Pa Pa/min mL/min Pa.cm ³ /s	When select mL/min、Pa.cm ³ /s, the work volume and master volume must be set. Model HVcan only use "Pa"and"Pa/min"
Leak Digit	Leak Digit	"0000"、"000.0"、 "00.00"、"0.000"	When leak uint is Pa,the leak digit is only providing "0000"

Basic Operation—Operation in Summary

Lead.P	Lead pressure standard		Pressure value of charge 1 used
Lead.P up	Lead pressure upper limit		Finished charge 1, pressure upper limit determination
Lead.P down	Lead pressure lower limit		Finished charge 1, pressure lower limit determination
Test.P	Test pressure standard		Pressure value of charge 2 used
Test.P up	Test pressure upper limit		Finished charge 2, pressure upper limit determination
Test.P down	Test pressure lower limit		Finished charge 2, pressure lower limit determination
Pressure Unit	Test pressure unit	kPa kg/cm ² PSI bar MPa	
Master Mode	Standard sampling mode	0, 1, 2, 3, 4	Mode 0: Usually no master test Mode 1: Master data is defined as the differential pressure when performing the master test. Mode 2: Mode 0, without M.NG estimate. Mode 3: Mode 1, without M.NG estimate. Mode 4: Use the differential pressure value's regression to calculate slope and then convert to the leakage rate.
Print Mode	Printing mode	0, 1, 2, 3, 4	Mode 0: Without print Mode 1: Print No., Group No., Test value, Result, Date, Time Mode 2: Print No., Group No., Test value Mode 3: Print No., Group No., Test value, Result Mode 4: Print No., Group No., Test value
USB Disk Mode	USB Disk Mode	0, 1, 2	0=No flash disk 1=Save result data to flash disk after detection 2=Save all data(result, Machine number,code,DP) to flash disk after detection
RS232 Model	Serial communication mode	0, 1, 2, 3, 4, 5	Refer to page 68: Introductions of serial communication mode
Cylinder	Cylinder control mode	0, 1, 2	Mode 0: without cylinder control Mode 1: with limit switch on cylinder Mode 2: without limit switch on cylinder (Delay control)
SV5 Mode	SV5 mode		define ESV5~ESV8's valid stepDLY~EXH M-DET and DET share one step EXH and EXHD share one step
SV6 Mode	SV6 mode		
SV7 Mode	SV7 mode		
SV8 Mode	SV8 mode		
Midway Juge Mode	Midway Juge Mode	ON, OFF	ON: test over when test data overstep +2NG、+NG or -NG in DET.

● Assistant setting interface

Setting Items	Setting range	Description
Data/Time Set		Year, month, day, hour, minute, second
Pressure Auto zero		Use this function when the pressure has the excursion
Data Statistic		Test result record, analysis, view
Stability check		Self-test of local machine for sealing performance
EP Device Tuning		Use when you has the automatic pressure regulation equipment. Pead pressure and test pressure must be set before test
Password Set		Password for user setting
Language	Chinese/English	Language change
RS232 Baud	1200、2400、4800、 9600、19200	Bit rate of communicating with the computer
Soft Version		Display the version and date
Remote RESET Mode	NO、NC	The rear terminal RESET has two models including normal close and normal open, and it is set according to the practical application.
CAL Port	ON、OFF	CAL valve is normal open during the whole detection process when it is set to be ON; The standard leak can be linked to the CAL port for point inspection, instead of be linked to a triple valve connected to the work port. Note: It is applicable only when the machine has CAL function.
EP Device Type	APU、EP11、 RT.E/P、AP80	APU、EP11、RT.E/P are of voltage control and an additional power source of 0~10V is needed; AP80 is of RS485 model, therefore the module of converting RS232C to 458 is needed when linked to the RS-232C port in the rear panel of FL-800.
Group Copy	—	Copy the setup parameters directly of one group to another instead of re-inputting the same parameters.
Machine Number	0000—9999	Machine Number
Exh mode	Local、Bypass	Exh mode selection: When using tester exhaust function, please set the “Exh mode” into “Local”; When using exhaust bypass function, please set the “Exh mode” into “Bypass”.
NG Hold	ON、OFF	NG hold function is set to ON, if the test result is not OK, the cylinder clamp signal output (ESV4) to remain, until RESET.
Work.P Display Mode	Number、Graphics	Set the WorkPressure display mode
Net Setting		Set para of Net
Input Test		Check input signal
Output Test		Check output signal

Data Statistic

Setting Items	Setting range	Description
Quality Check	—	Count the number of the OK、+2NG、+NG、-NG、PNG、ERR in the detection records
Data Record	—	Browse the detection record with 8 records in one page
Data Analyze	—	Display the distribution of the data by chart
Clear Test Data	—	Empty the internal saved 500 records
Data Transfer to USB		Valid when the tester has the read and write module

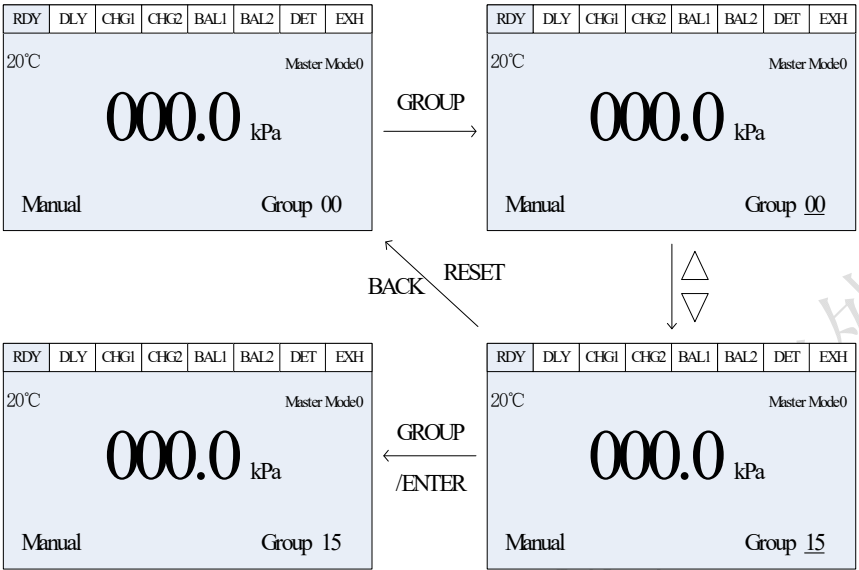
Net Setting

Setting Items	Setting range	Description
Confirm	—	Activation Parameters of Ethernet (RJ45) (After change parameters, must run this command to make parameters active)
Work Mode	UDP Server/UDP/ TCP Server/TCP Client	Set Work Mode
Local IP	255.255.255.255	Set Local IP
Local Port	0-65535	Set Local Port
Remote IP	255.255.255.255	Set Remote IP
Remote Port	0-65535	Set Remote Port
Subnet Mask	255.255.255.255	Set Subnet Mask
Gateway	255.255.255.255	Set Gateway

■ **Setting Method**

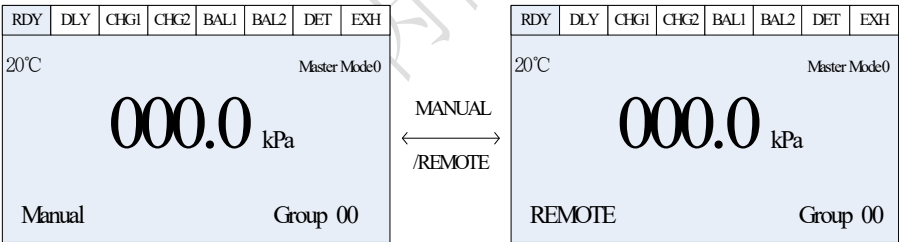
● **Group Number setting**

Press GROUP key to set the group number when the system in READY mode. After finish the setting, please press GROUP or ENTER to confirm or press BACK or RESET to cancel.



● **Setting of internal/external control**

Press MANUAL/REMOTE key when the system in any step of testing mode to switch internal/external control.



● Test setting

1. In testing interface, pressure SET to enter SETTING, input the password and then press ENTER to confirm.

Setting	Password 0000
Main Setting Assistant Setting	

2. Select “Main Setting”, press ENTER to enter “main setting interface”

Main Setting	1/5	Group 00
Delay	000.0 s	
Change1	000.0 s	
Change2	000.0 s	
Balance1	000.0 s	
Balance2	000.0 s	
Detect	000.0 s	
M.Detect	000.0 s	
Exhaust Delay	000.0 s	

3. Press   to select items, press   can turn the pages.
4. Press ENTER to modify the parameter. After finish the modification, press BACK to cancel or press RESET to quit to the testing interface.
5. 5 pages can be set:

Main Setting	1/5	Group 00
Delay	000.0 s	
Change1	000.0 s	
Change2	000.0 s	
Balance1	000.0 s	
Balance2	000.0 s	
Detect	000.0 s	
M.Detect	000.0 s	
Exhaust Delay	000.0 s	

Main Setting	2/5	Group 00
Exhaust	000.0 s	
Time Digit	000.0	
+2NG	20.00 mL/min	
+NG	10.00 mL/min	
- NG	-10.00 mL/min	
+M.NG	01.00 mL/min	
-M.NG	-01.00 mL/min	

Main Setting	3/5	Group 00
W.Volumn	? 7.2000E? 0 mL	
M.Volumn	? 7.2000E? 0 mL	
Leak Unit	mL/min	
Leak Digit	00.00	
Lead.P	200.0 kPa	
Lead.P Up	240.0 kPa	
Lead.P Down	260.0 kPa	
Test.P	100.0 kPa	

Main Setting	4/5	Group 00
Test.P Up	120.0 kPa	
Test.P Down	080.0 kPa	
Pressure Unit	kPa	
Master Mode	0	
USB Disk	ON	
Rs232 Mode	0	
Cylinder	0	
SV5 mode		

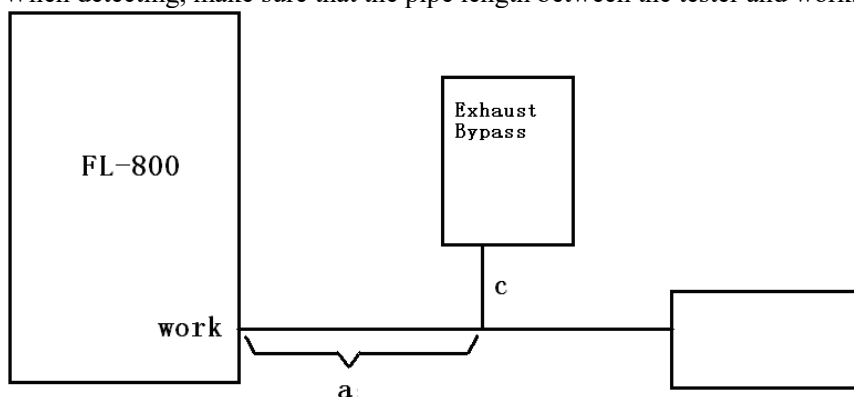
Main Setting	5/5	Group 00
SV6 mode		
SV7 mode		
SV8 mode		
Midway Judgment Mode	ON	

Exhaust Bypass Setting

- 1、 Enter Assistant setting interface, set the “Exhaust mode”into “Bypass”

Assistant setting	2/3
RS232 Baud	9600
Soft Version	
Remote Reset Mode	Normally Open
CAL Port	OFF
Group Copy	
Machine Number	0000
Exhaust Mode	Bypass

- 2、 Connect the control end of the exhaust bypass unit according to the wiring instructions (page 37)
- 3、 Prior to use please remove the muffler at the EXH port, and then block the leak EXH port with plug wire(wrapped with the seal tape)
- 4、 When detecting, make sure that the pipe length between the tester and works is as follows:



Length of Pipe a : When the internal diameter of the using pipe does not exceed 6mm, pipe a should be more than 0.5 meter
When the internal diameter of the using pipe exceeds 6mm, pipe a should be more than 1 meter

Detecting Action

- Leak detecting action

The description of the method of leak detecting operation.

Ready

- Check AIR SUPPLY and A.P.SUPconnected or not
- Check the Work ball valve open or not
- Check the Work is connected or not
- Check the parameter settings correct or not

- (1) Press START to begin the test when the air supply and the Work are will connected
- (2) Enter delay step

RDY	DLY	CHG1	CHG2	BAL1	BAL2	DET	EXH
20.0°C							
Master Mode0							
000.0 kPa							
Manual				Group 00			

RDY	DLY	CHG1	CHG2	BAL1	BAL2	DET	EXH
000.0s							
Master Mode0							
000.0 kPa							
Manual				Group 00			

- (3) Enter charge 1 step
- (4) Enter charge 2 step

RDY	DLY	CHG1	CHG2	BAL1	BAL2	DET	EXH
000.0s							
Master Mode0							
000.0 kPa							
Manual				Group 00			

RDY	DLY	CHG1	CHG2	BAL1	BAL2	DET	EXH
000.0s							
Master Mode0							
000.0 kPa							
Manual				Group 00			

- (5) Enter balance 1 step

RDY	DLY	CHG1	CHG2	BAL1	BAL2	DET	EXH
Timer: 999.9 s							
200.0 kPa							
Manual				Group 00			

- (6) Enter balance 2 step

RDY	DLY	CHG1	CHG2	BAL1	BAL2	DET	EXH
Timer: 999.9 s							
0000Pa							
0%							
Manual				Group 00			

- (7) Enter detecting step

RDY	DLY	CHG1	CHG2	BAL1	BAL2	DET	EXH
Timer: 999.9 s							
0000Pa							
0%							
Manual				Group 00			

- (8) Enter exhaust step

RDY	DLY	CHG1	CHG2	BAL1	BAL2	DET	EXH
Timer: 999.9 s							
1.000 ml/min							
Manual				Group 00			

- (9) After finish exhaust, stop at the exhaust interface, display the result, and stand by. Press RESET back to READY interface, press START to start the test.

- (10) Press RESET to quit the test in any step in testing procedure and then exhaust. The system will enter the READY interface. Press RESET when in the exhaust step, it will return READY interface directly.

- Volume detection

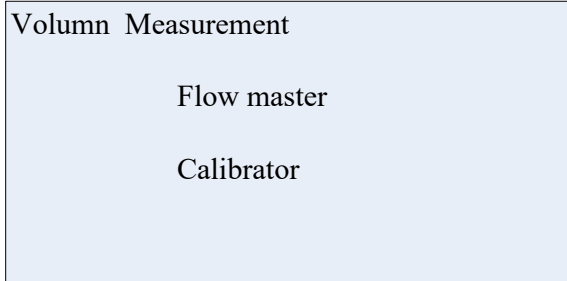
Volume detection has two method, one is flow-master calibration, the other is manual calibrator calibration.

- Flow-master calibration

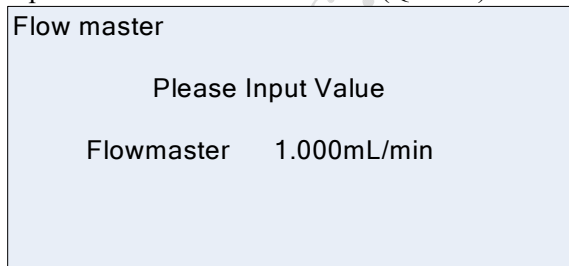
Ready

- Check AIR SUPPLY and A.P.SUPconnected or not
- Check the Work ball valve open or not
- Check the Work is connected or not
- Check the parameter settings correct or not

- (1) Connect BOYI Flow-master to the CAL port.
- (2) In “main setting”interface, we set master volume, if there is no connect,the volume is 7.2mL and please close the Work’s ball valve.
- (3) Press CAL, select “Flow master”,press START to confirm.



- (4) Select “Yes”, press ENTER to confirm.
- (5) Input“flow master standard value(Q value)” and then press ENTER



(6) Start Volume Test

From delay to exhaust, the system performs 2 test loops.(with/without the Flow-master) The testing result will be displayed on the screen in exhaust step. The result will be saved as the WORK volume of the main setting interface.

RDY	DLY	CHG1	CHG2	BAL1	BAL2	DET	EXH
Timer: 000.0 s							
0078 mL							
Manual				Group 00			

• Calibrator

Ready

- Turn off AIR SUPPLY and A.P.SUP
- Check the Work is connected or not
- Open the Work ball valve
- Open the Master ball valve, and should not connect master

- (1) Connect the BOYI calibrator to CAL port
- (2) Press CAL, select“calibrator”, press START to confirm.

Volumn Measurement
Flow master
Calibrator

- (3) Input the calibrate volume

Calibration
Please Input Calibrate Volumn
Volumn : 0.100mL

- (4) Adjust the BOYI calibrator to zero.
 (5) Press START to start test.

Calibration

dp	=+0000Pa
Average	= Pa
n	=

Calibrator Status

- (6) Wait until the pressure is jarless, press [→] to auto zero.

Calibration

dp	=+0000Pa
Average	= Pa
n	=

Calibrator Status

- (7) Adjust the BOYI calibrator, volume of adjust is according to input in (3).
 (8) Wait until the pressure is jarless, Press ENTER to calculate the result.

Calibration

dp	=+0000Pa
Average	= 137 Pa
n	= 05

Calculate Status

- (9) Press RESET, select YES,press ENTER to save WORK volume.



Caution

It is not for the Air leak tester of differential pressure type with the calibration function.

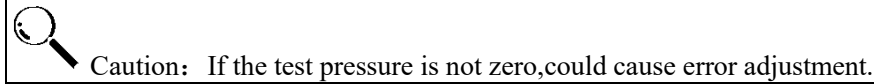
■ Zero adjust of test pressure

Sometimes drift occurs in internal analogue circuit because of ambient temperature etc. change. At this time, a traditional method is to adjust varistors by opening the leak tester's cover. Therefore the method is not only in trouble but also to influence analogue circuit.

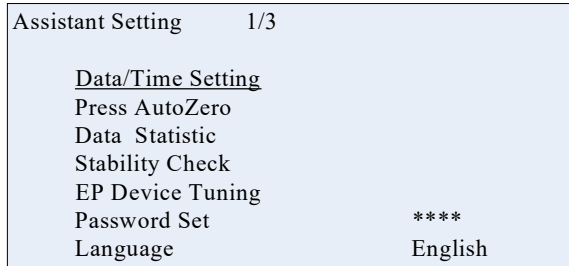
A man-machine conversation method is used in FL-800 leak testers to adjust zero, which is simple and accurate, furthermore this method doesn't influence test results.

Procedure :

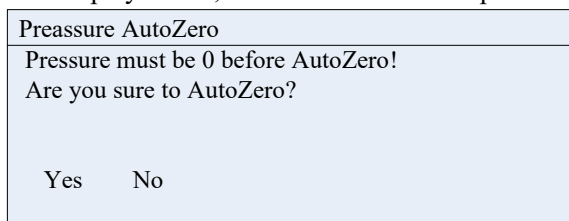
1. Confirm that test pressure is zero.



2. Enter "Assistant interface", select "Test pressure zero", press ENTER key.



3. Display "hint", select "YES" and then press ENTER to confirm.



4. Finish test pressure zero adjustment, system return to assistant setting interface.

■ Bubble function (BUBL)

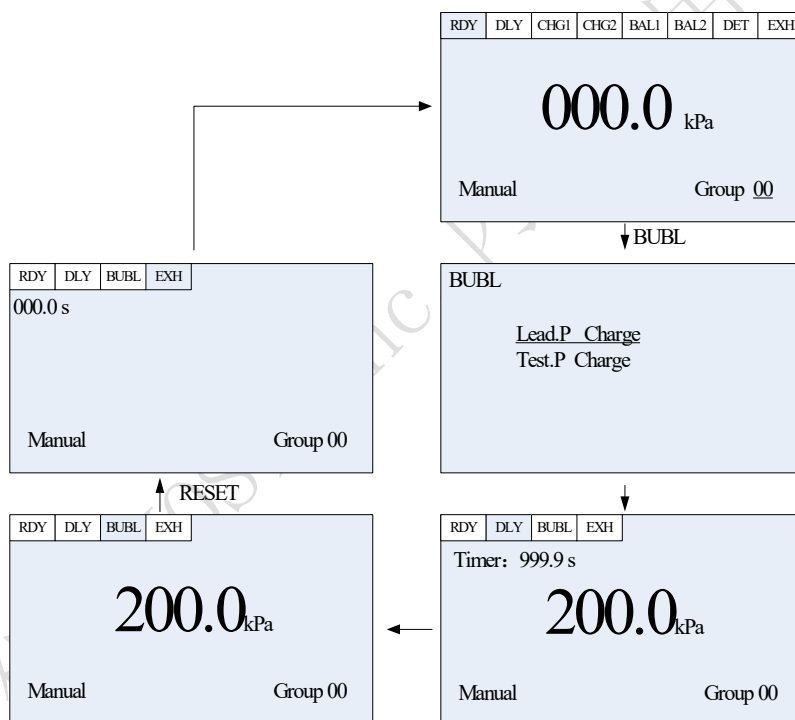
In order to find leak location, we usually charge air into a work then put it in water or smear soap water on it. Bubble function in FL-800 is used to charge air into a works, which guarantees to find leak location by the above methods.

1. Confirm work connected.

Warning: Maybe high pressure air spurts out to injure operators if work is connected loosely.

2. Press BUBL to charge air into a work.
3. Put the work in water.
4. Find leak location by bubble.
5. Take out work from water.
6. Press Reset to exhaust.

Operation:



When in Remote mode, please use Bubl and Reset Terminal to perform above operation.

■ Printer Operations

Operation method of the printer output result

Ready

1. Confirm light of printer green light.
2. Confirm paper in printer.
3. Confirm printer setting ON (refer to basic operation)

Printer prints out test result under the state of exhaust.

Please set “printer mode” in the main setting interface, if you want to ignore this function, please select mode 0.

Printer mode:

Mode 0: Without print

Mode 1: Print No., Group No., Test value, Result, Date, Time

Mode 2: Print No., Group No., Test value

Mode 3: Print No., Group No., Test value, Result

Mode 4: Print No., Group No., Test value

Printing format: (Model)

0001	00	0.000mL/min	OK	2007-12-31	23:59:59
↓	↓	↓	↓	↓	↓
No.	Group No.	Test value	Result	Date	Time

Print No. Capability: 0001~9999

When print No. is 9999, the next will return to 0001.

There is one space between the printing items.

■ Printer operation instruction

1) Printer installation

Insert a printer in the tester's front panel. Then put two tightening blocks in printer slots. Use a screw driver to tighten the screws in the tightening blocks. At this time the printer is tightly embedded in the tester's front panel. Pinch the upper two sides of the printer front lid out of the panel, the lid is opened.

2) Paper roll installation and paper input

Open the printer lid, pinch the two side elastic bars of printer's core drawing plate. Pull the drawing plate out for 2cm. The 2 ends of paper shaft is elastic, pinch the 2 ends of paper shaft to put it on the paper shaft bracket.

Turn on printer's power supply then the printer feeds 3 lines to enter ready status. At this time the LED is ON. Press the button once then the LED is OFF. Press the button for above 1 second, the printer begin to feed. Cut paper end to an triangle shape then put the paper into the inlet, the paper can be rolled into the inside. Wait the paper extending from the printer, press the button again stop it. The printer enters ready status automatically. Push back the the draw plate to the original position.

3) Self check

Turn off power supply, then press SEL key while turning on power supply. The printer begins to print self check list.

4) Running operation

Turning on power supply, then the printer begins to feed 3 lines. The LED is ON, which means the printer can accept data to print.

At the status of ready, press SEL (less than 1 s.) to enter the status of off line. Press SEL (less than 1 s.) again, the LED is ON to enter the status of ready. Under the status of off line, the printer's busy signal is busy and can not accept data.

No mater the LED is ON or OFF, press SEL (over 1 s.) to feed paper while the LED is off.

Press the key while printing, the current line is printed later to pause. The LED is off then the printer enters off line status. Press the key again (less than 1 s.) then printer enters on line status to continue to print. While pause, press the key for over 1 s. to feed the paper for exchange the paper.

5) Replace the color ribbon

After a period of printing time, the printed contents will fade. at this time it is needed to replace the ribbon. Open the printer's lid then pinch the two side elastic bars of printer's core drawing plate, Pull the drawing plate out to the extent of the ribbon box can be seen to replace the ribbon.

■ Clock Checking

1. Enter “Assistant setting interface”, press ENTER.

```
Assistant Setting      1/3

  Data/Time Setting
  Press AutoZero
  Data Statistic
  Stability Check
  EP Device Tuning
  Password Set         ****
  Language              English
```

2. Adjust time or date, press ENTER to update, and return to “assistant setting” interface. If you need to cancel please press RESET.

```
Data/Timer Set

      2006-05-28  14:25:12
```

■ Machine Self Test

1. Enter “assistant setting” interface, select “stability checking” and then press ENTER.

Assistant Setting	1/3
Data/Time Setting	
Press AutoZero	
Data Statistic	
<u>Stability Check</u>	
EP Device Tuning	
Password Set	****
Language	English

2. Display the hits, turn off the ball valve both of Work and Master, select “YES” and then press ENTER.

Stability check
The work and master port must be closed!
Are you sure to stability check?
Yes No

3. Start test, stop at the exhaust step, display the results.

■ View the test result

1. Enter “assistant setting” interface, select “Data Statistic”, press ENTER.

```

Assistant Setting      1/3

  Data/Time Setting
  Press AutoZero
  Data Statistic
  Stability Check
  EP Device Tuning
  Password Set        ****
  Language            English
  
```

2. Check quality record, select “quality check”,press ENTER.
3. To view the record, select”Data record”,press ENTER.
4. To view product test result curve, please select “Data analysis” and then press ENTER.
5. To clean up the record, please select “delete test result” and then press ENTER.
6. Transmit result to USB disk, select “transmit to USB disk” and then press ENTER.

```

Data Statistic

  Quality Check
  Data Record
  Data Analyze
  Clear Test Data
  
```

7. Need to input the group munber to check information of each group.

■ USB Operation

1. Enter “Assistant setting”-“Data Statistic” interface, select “transmit to USB disk” and press ENTER.
2. Select “YES” and then press ENTER to transmit

Data Transfer to USB	
Sure to save test record to USB disk?	
Yes	No

3. Finish download, return to the last menu

Data Transfer to USB	

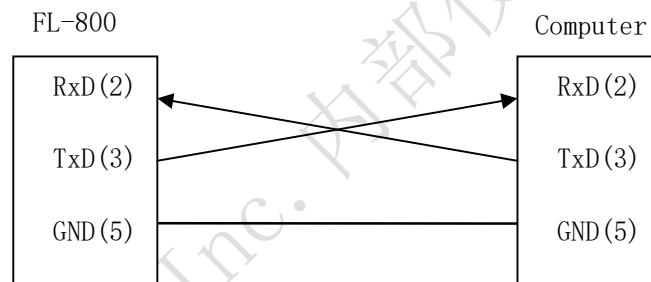
■ RS-232C/Ethernet Output

• RS-232C Output Parameter

Speed	1200、2400、4800、9600、19200 bps (optimal)
Start at	1 bit
Data bit	8 bit
Stop at	1 bit
Parity check	no
Error check	block check character
Communication	No physical layer protocol
Port	9 Pin RS232

• Pin

Type	Pin	Name	Description
	1		
Input	2	RxD	Signal receive
Output	3	TxD	Signal send
	4		
Ground	5	GND	Signal ground
	6		
	7		
	8		
	9		



- Ethernet Output Parameter : For details, see page 47.
- Please do not hot plugging the connector of RS-232C.
- Communication protocol (RS-232C & Ethernet protocol totally the same)
 ENQ = 05H ACK = 06H NAK = 15H STX = 02H ETX = 03H

When FL-800 receive ENQ will react (ACK, include Ready and Test steps). When command can not be performed or TEXT transition error, NAK react.

When write text to FL-800, ENQ is not react during the receiving process until receiving finish. If transmission interrupt for 5 seconds, the command will be canceled, NAK react.

1. Frame structure

Item	STX	TEXT transmission	ETX	BCC
Byte	1	N/A	1	1
Event	02H	ASCII Code	03H	00H~ffH

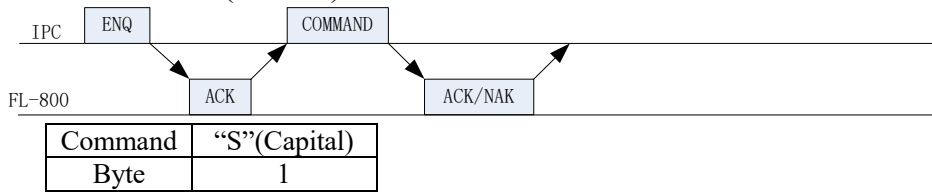
STX – Frame start

ETX – Frame end

BCC – Text block check character, contains STX and ETX.

Text transmission is ASCII code (20H~7EH), data out of range will be seen as invalid.

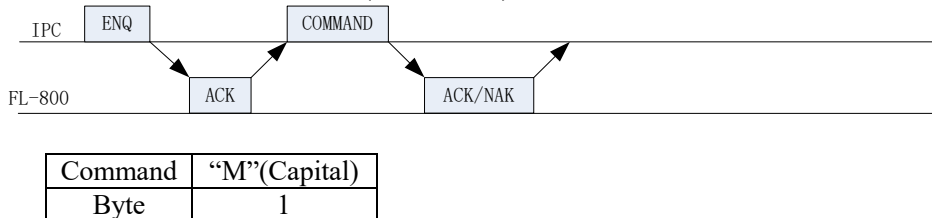
2. Serial to start (START)



The command is only valid (ACK react) in READY mode or finished exhaust, in other step will response NAK.

When “RS232 Model” setting is not “0”, the system will send result after testing finish.

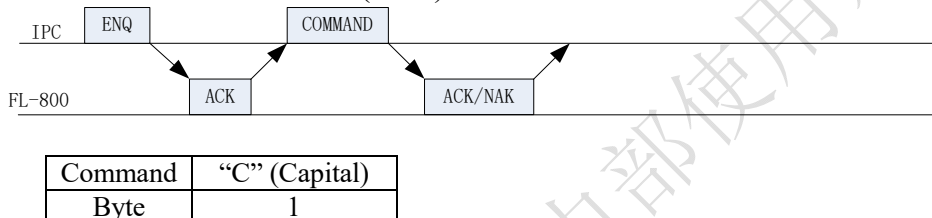
3. Serial to start master test(MASTER)



The command is only valid (ACK react) in READY mode or finished exhaust, in other step will response NAK.

When “RS232 Model” setting is not “0”, the system will send result after testing finish.

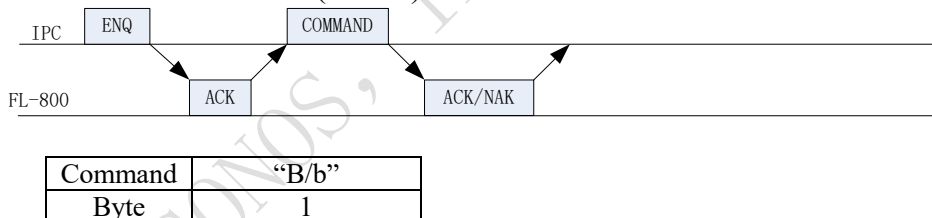
4. Serial to start calibration(CAL)



The command is only valid (ACK react) in READY mode or finished exhaust, in other step will response NAK.

“C” (Capital) to start “standard flow-master test”.

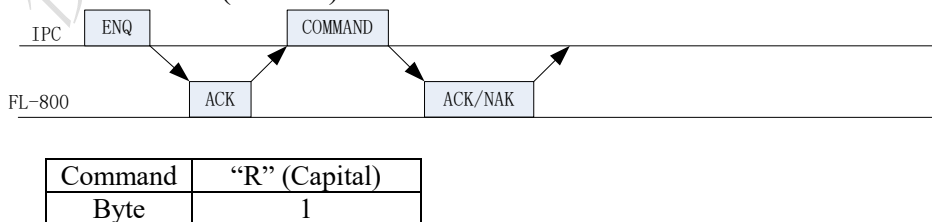
5. Serial to start BUBL (BUBL)



The command is only valid (ACK react) in READY mode or finished exhaust, in other step will response NAK.

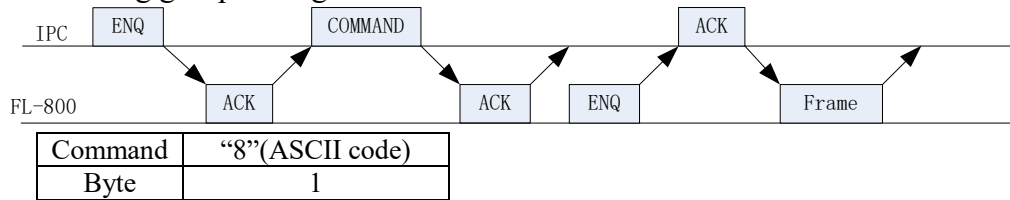
“b” for “Lead pressure” charging, “B” for “Tes pressure t” charging.

6. Serial to reset(RESET)



The command is only valid (ACK react) in NONE READY mode, in READY mode will response NAK.

7. Reading group setting



The command is only valid (ACK react) in READY mode or finished exhaust, in other step wills response NAK. It is only print current group settings.

Command is "1" in edition (1.13). Keep the command "1" in software after edition (1.14).

Data Frames are delivered as the format of Data Frame, and the format of transmitting content is as follow:

Item	Group No.	delay	Charge1	Chatge2	Balance1	Balance2	Detect	Exhaust	Master test
Byte	2	5							
Radix point	0	0/1							
Unit	-	s(second)							
Example	00/15	□0000/000.0							

Item	+2NG	+NG	-NG	+M.NG	-M.NG
Byte	6				
Radix point	0/1/2/3				
Unit	Depend on "Leak Unit"				
Example	□□0000/□-0000 □000.0/-000.0 □00.00/-00.00 □0.000/-0.000				

Note:-NG and -M.NG are zero or negative.

Item	Lead.P	Lead.P up	Lead.P down	Test.P	Test.P up	Test.P down
Byte	6					
Radix point	0/1					
Unit	kPa					
Example	□000.0/-000.0/□□0000/□00000					

Item	W.Volume	M.Volume	Leak Unit	Pressure Unit	Leak Digit
Byte	10		8	6	5
Radix point	4		-	-	-
Unit	mL		-	-	-
Example	±7.2000E±0		Pa□□□□□□ Pa/min□□ mL/min□□ Pa.cm3/s	kPa□□□ kg/cm2 PSI□□□ bar□□□	□0000 /000.0 /00.00 /0.000

Item	Timer Digit	Print Mode(USB Disk Mode)	RS232 Mode	Cylinder
Byte	5	1	1	1
Radix point	-	-	-	-
Unit	-	-	-	-
Example	□0000 /000.0	0/1/2/3/4 (0=OFF/1=ON)	0/1/2/3	0/1/2

Item	SV5 Mode	SV6 Mode	SV7 Mode	SV8 Mode	Master Mode
Byte	8				1
Radix point	-				-
Unit	-				-
Example	00000000/11111111(8segment, 0=close, 1=OPEN)				0/1/2/3/4

The following is added in edition(1.14):

Item	judge midway mode	DAC of Lead.P	DAC of Test.P
Byte	1	5	
Radix point	-	0	
Unit	-	-	
Example	(0=OFF/1=ON)	□0000~□4095	

“□” means “space”

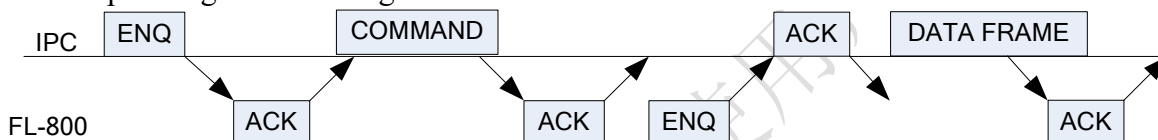
“/” means “or”

“-” means “none”

When the machine has the USB function, “Print Mode” should be instead of “USB Disk Mode”

Note: the data to FL-800 must be in range of setting.

8. Group setting value writing



Command	“9” (ASCII code)
Byte	1

The command is only valid (ACK react) in READY mode or finished exhaust, in other step will response NAK. Only write the current setting value.

Change the current group when the group inputed is not current group.

Data Frames are delivered as the format of Data Frame, and the format of transmitting content is same as "Reading group setting".

Command is “2” in edition (1.13). Keep the command “2” in software after edition (1.14).

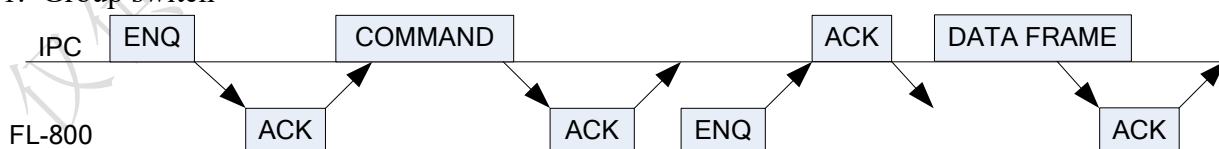
9. Reading assistant setting value

This command is not supply in edition 1.14 in manual, but keep the command is software for compatibility.

10. Writting assistant setting value

This command is not supply in edition 1.14 in manual, but keep the command is software for compatibility.

11. Group switch



Command	“0” (ASCII code)
Byte	1

The command is only valid (ACK react) in READY mode or finished exhaust, in other step will response NAK. Only write the current setting value.

This command is supply begin with edition 1.14.

Data Frames are delivered as the format of Data Frame, and the format of transmitting content is as follow:

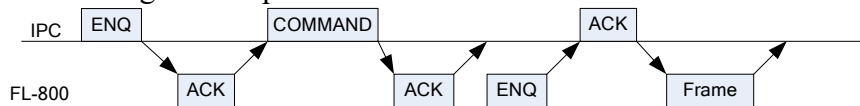
Text transmission	Current group
Byte	2
Radix point	0
Unit	-
Example	00/31

“□” means “space”

“/” means “or”

“-” means “none”

12. Reading current pressure value



Command	“5” (ASCIICode)
Byte	1

The command is only valid (ACK react) in READY mode or finished exhaust, in other step will response NAK.

Data Frames are delivered as the format of Data Frame, and the format of transmitting content is as follow:

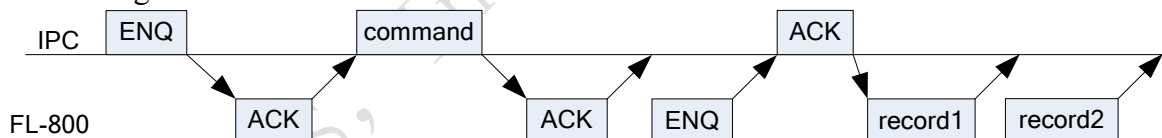
Text transmission	Pressure Mark	Current pressure
Byte	1	6
Radix point	-	0/1
Unit	-	kPa
Example	G	□000.0/-000.0/□□0000/□00000

“□” means “space”

“/” means “or”

“-” means “none”

13. Reading all records



Command	“6” (ASCIICode)
Byte	1

The command is only valid (ACK react) in READY mode or finished exhaust, in other step will response NAK. No test records will response NAK.

Formats of 500 records are same as the format of Data Frame.

A record is in one frame, and has its individual start, stop and parity bit.

And the format of transmitting content of record X is as follow:

Item	No.	Group No.	Date/ time
Byte	4	2	19
Radix point	0	0	-
Unit	-	-	-
Example	0001 /9999	00/15	2006-01-01 23:59:59

Item	delay	charge1	charge2	balance1	balance2	detect	exhaust
Byte	5						
Radix point	0/1						
Unit	s(second)						
Example	□0000/000.0						

Item	Testing data	Unit	determinant
Byte	6	8	4
Radix point	0/1/2/3	-	-
Unit	Depend on“Leak Unit”	-	-
Example	□□0000/□—0000 □000.0/—000.0 □00.00/—00.00 □0.000/—0.000	Pa□□□□□□ Pa/min□□ mL/min□□ Pa.cm3/s	OK□□/+2NG +NG□/-NG□ PNG□/ERR□

“□” means “space”

“/” means “or”

“-” means “none”

14. Introductions of serial communication model:

Notice, Number +H expresses hexadecimal byte output (such as 2fH). It is ASCII if it is without H as ending.

Mode 0 is no output.

When “RS232 Model” set as “0”, no data will be sent out in test progress and no data will be sent out after test finish as well.

Mode 1, The test record reading

When “RS232 Model” set as “1”, test result will be sent out after test finish.

Test result is sent out according to frame data structure. Format is as same as “reading all test record”

Mode 2 The test record reading (600 format)

When “RS232 Model” set as “2”, test result will be sent out after test finish.

Format of “test result” is different from “Frame data structure”, details as below

Content	Group . NO.	Comma	Judgment				Comma	SData	Comma	Test result	Blank
Number of bytes	2	1	4				1	5	1	6	1
Comma	0	-	-				-	-	-	Main setting-> setting decision of leakage rate sensitivity	-
Unit	-	-	-				-	-	-	-	-
Example	01 15	,	OK□□ +2NG LPNG TPNG	+NG□ -NG□ +BNG -BNG	+MNG -MNG +SNG -SNG	+LNG -LNG PNG□ ERR□	,	SData	,	+123.4 -12.34 +1.234 -1234.	□

Content	Test result unit	comma	Test pressure	Blank	Test pressure unit	comma	ETX	BCC	Enter
Number of bytes	6	1	5	1	4	1	1	1	1
Decimal point	-	-	Absolute value <100kpa, it has 1 decimal place. Absolute value ≥100kpa, it has no decimal places	-	-	-	-	-	-
Unit	-	-	-	-	-	-	-	-	-
Example	Pa□□□□ Pa/min mL/min Pa.cm3/s	,	+99.9 -100.		kPa□	,	03H	1fH	0dH

Mode 3. The test record reading (601 format)

When RS232 Model set as “3”, it send out test result after test finish.

Format of “test result” is different from “Frame data structure”, details as below,

Content	Group . NO.	Comma	Judgment				Comma	SData	Comma	Test result
Number of bytes	2	1	4				1	5	1	6
Decimal point	0	-	-				-	-	-	Main setting-> setting decision of leakage rate sensitivity
Unit	-	-	-				-	-	-	-
Example	01 15	,	OK□□ +2NG LPNG TPNG	+NG□ -NG□ +BNG -BNG	+MNG -MNG +SNG -SNG	+LNG -LNG PNG□ ERR□	,	SData	,	+123.4 -12.34 +1.234 -1234.

Content	Blank	Test result unit	Comma	Test pressure	Blank	Test pressure unit	Comma
Number of bytes	1	6	1	5	1	4	1
Decimal point	-	-	-	Absolute value <100kpa, it has 1 decimal place. Absolute value ≥100kpa, it has no decimal places	-	-	-
Unit	-	-	-	kPa	-	-	-
Example	□	Pa□□□□ Pa/min mL/min Pa.cm3/s	,	+99.9 -100.		kPa□	,

Content	Fill characters	ETX	BCC	Enter
Number of bytes	22	1	1	1
Decimal point	-	-	-	-
Unit	-	-	-	-
Example	+0.0000E+0, +0.0000E+0,	03H	1fH	0dH

Mode 4. Direct pressure curve and the test record reading

When “RS232 Model” set as “4”, Air leak tester will send out next series data.

- Related step data will be sent out when each step starts except warm-up step. Format as below,

Item	STX	Step mark	Step code	ETX	BCC
Number of bytes	1	1	2	1	1
Content	02H	P	01~12	03H	00H~FFH

“Step code” meaning

01:RDY (Ready) 02:DLY (Delay) 03:CHG1 (Charge 1) 04:CHG2 (Charge2)
05:BAL1 (Balance 1) 06:BAL2 (Balance 2) 07:DET (Detect) 8:EXH (Exhaust)
09:BUBL (bubble) 10:MASTER (base test) 11:CAL1 2:CAL2

- Test pressure will be sent out over and over again from DLY step to BAL1 step and BUBL step, format as below,

Item	STX	Step mark	Pressure			ETX	BCC
Number of bytes	1	1	6			1	1
Content	02H	G	refer to example			03H	00H~FFH
Decimal point	-	-	Absolute value<100kpa,it has 2 decimal places Absolute valve<1000kpa,it has 1 decimal place Absolute value ≥100kpa, it has no decimal places			-	-
Unit	-	-	kPa			-	-
Example	-	-	□□1234 □987.3	□99.24 -□1001	-987.6 -99.98	-	-

Other Function— RS232C/Ethernet output

- | Item | STX | Step mark | Temperature | | ETX | BCC |
|-----------------|-----|-----------|------------------|--------|-----|---------|
| Number of bytes | 1 | 1 | 6 | | 1 | 1 |
| Content | 02H | T | refer to example | | 03H | 00H~FFH |
| Decimal point | - | - | 1 | | - | - |
| Unit | - | - | °C | | - | - |
| Example | - | - | □023.4 | -003.5 | - | - |

- | Item | STX | Step mark | Differential pressure | | | ETX | BCC |
|-----------------|-----|-----------|--|------------------|------------------|-----|---------|
| Number of bytes | 1 | 1 | 6 | | | 1 | 1 |
| Content | 02H | D | refer to example | | | 03H | 00H~FFH |
| Decimal point | - | - | When leakage until is Pa and sensitivity of leakage rate is 000.0, display 1 decimal place; otherwise no display | | | - | - |
| Unit | - | - | Pa | | | - | - |
| Example | - | - | □1213.
□112.3 | □□0001
-□1234 | -012.1
-1202. | - | - |

- Mode 5, serial output model with bar code.

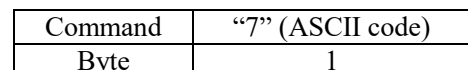
- Related step data will be sent out when test step start. Format as below,

- | Item | STX | Step mark | Step code | ETX | BCC |
|-----------------|-----|-----------|-----------|-----|---------|
| Number of bytes | 1 | 1 | 2 | 1 | 1 |
| Content | 02H | P | 07 | 03H | 00H~FFH |

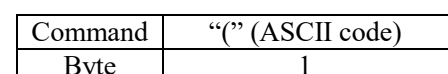
- | Item | STX | Step mark | Differential pressure | | | ETX | BCC |
|-----------------|-----|-----------|--|------------------|------------------|-----|---------|
| Number of bytes | 1 | 1 | 6 | | | 1 | 1 |
| Content | 02H | D | refer to example | | | 03H | 00H~FFH |
| Decimal point | - | - | When leakage until is Pa and sensitivity of leakage rate is 000.0, display 1 decimal place; otherwise no display | | | - | - |
| Unit | - | - | Pa | | | - | - |
| Example | - | - | □1213.
□112.3 | □□0001
-□1234 | -012.1
-1202. | - | - |

- [illegible]

15. Clean up all testing results



16. Write the setting of group extension



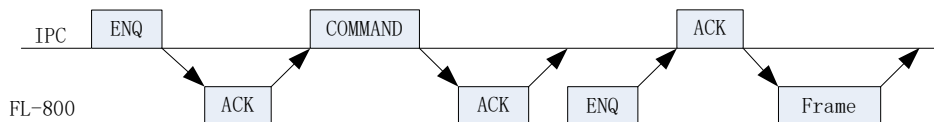
Item	Group	Waiting for exhaust timer	Preserving
Byte	2	5	20
Radix point	0	0/1	-
Unit	-	s(second)	-
Example	00/31	□0000/000.0	-

“□” means “space”

“/” means “or”

“-” means “none”

17. Write bar code



Command	“)” (ASCII code)
Bety	1

The command is only valid (ACK react), in order step will response NAK.

“data frames” send “frame date struture”, which “send text” format:

[illegible]

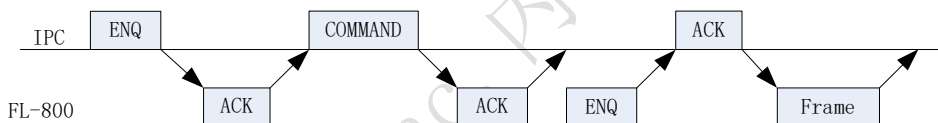
“□”means“space”

“/” means “or”

“-” means “none”

Caution: This command from the 1.27 version, not stored in the EEPROM,the power-down the all clear

18. Read out the current set of extensions to set the value



Command	“(?”(ASCII code)
Byte	1

The command is only valid (ACK react), in order step will response NAK.

Only output the current group settings.

“Data frames” send “frame date structure”, which “send text” format:

Item	Waiting for exhaust time	Preserving
Byte	5	20
Radix point	0/1	-
Unit	s(second)	-
Example	□0000/000.0	-

“□” means “space”

“/” means “or”

“-”means“none”

Caution: This command from the 1.27 version

When the Serial mode of FL-800 is set into 4 or 5, the data is sent automatically from serial of FL-800(without orders of host computer):

19. Display the current stage (sent at the beginning of each stage)

“Data frame” is sent according to “frame data structure”, and the format of “sending text” is as follows:

Sending text	Stage Mark	Stage
Bytes	1	2
Decimal point	-	-
Unit	-	-
Example	“P”	□0/11

“□”is sign of “Space”

“/” is sign of “Or ”

“-”means “none”

Meanings of the number in “Stage”:

0	Warm-up stage	7	Detect stage
1	Ready stage	8	Exhaust stage
2	Delay stage	9	BUBL stage
3	Charge1 stage	10	Master stage
4	Charge2 stage	11	CAL1 stage
5	Balance1 stage	12	CAL2 stage
6	Balance2 stage		

Caution: Serial port mode is set to “5”, only to send Detect aspects of the current link logo

20. **Send differential pressure** (in the balance2,Master,detection,CAL session,sent every 0.1seconds)

“Data frames”send“frame data structure”,which“send text”format:

Send text	Differential pressure sign	Differential pressure
Byte	1	6
Radix point	-	-
Unit	-	-
Example	“D”	□+0000/+000.0

“□”means“space”

“/”means“or”

“-”means“none”

Send date without units (actual units of“Pa”)

Caution: Detect link the serial port mode is set to “5”only last 60 seconds to send the current differential pressure curve (if Detect time less than 60 seconds.then the whole to send Detect link differential curve)。

When the Serial mode of FL-800 is set into 4 or 5, the data is sent automatically from serial of FL-800(without orders of host computer):

21. Send direct pressure curve (delay,CHG1,CHG2,balance,BUBL link sent every 0.1 seconds)
Same to the format with “the current pressure value read out”
22. Sent the temperature curve (CHG1,CHG2,balance1,once every 0.1seconds to send)

“Data frames”send“frame data structure”,which“send text”format:

Send text	Temperature sign	Temperature
Byte	1	6
Radix point	-	1
Unit	-	-
Example	“T”	+000.0

“□”means“space”

“/”means“or”

“-”means“none”

Send date without units (the actual unit“°C”)

■ Maintenance and inspection

- Daily and periodical maintenance is required to ensure proper Air leak tester of differential pressure type performance. Be sure to carry out the procedures.
- It is also recommended to monitor the reject evaluation production rate and the progress of the leak-testing rate along with maintenance procedures.
- Daily inspections (To be conducted daily or once a week.)
 - Are the necessary manual valves open?
 - Are each of the timer, $\pm$ NG evaluation rate, and test pressure setting values adequate?
 - Is the filter drain clean?
 - Does the tester evaluate sample OK and reject parts correctly?
 - Time set correct?
- Periodic inspections (To be conducted once every 6 months to 1 year)
 - Is the leak test fixture (system and jig) stable? (Are the sealing jigs leaking or showing signs of disintegrating?)
 - Is each signal/indicator working properly?
 - Is the Air leak tester of differential pressure type's unit function correct?
 - Confirm if filter element replacement is necessary.
 - Is the Air leak tester of differential pressure type's sensitivity accurate?

■ Error code and troubleshooting

Error Code	Description	Solution
109	In Master test, the charge time or detect time is not long enough.	Prolong charge and detect time. Or increase the Master volume(there has prodigious difference between Master and Work)
110_0	BAL Process T.PNG	Work Pressure < Test.P Down
110_1		Work Pressure > Test.P UP
110_2		Work Pressure $\leq$ 90% Test.P Standard
110_3		Work Pressure >110% Test.P Standard
110_4		Work Pressure < 50% Test.P
110_5		Work Pressure >150% Test.P
111	During the CAL volume check stage, the rated leakage of the standard leak is too low to generate enough differential pressure, and then the right volume cannot be detected.	check whether the standard leak is blocked by sundries; change to one standard leak with more leakage rate
112	Ethernet error	Contact FUKUDA agents

Error Code	Description	Solution
000	ROM Error	Contact FUKUDA agents
001	Enactment Error	Initialize ALT or Key in again
002	Initialization Error	Contact FUKUDA agents
003	A/D Chip error	Contact FUKUDA agents
004	D/A Chip error	Contact FUKUDA agents
005	Timer error	Contact FUKUDA agents
006	Differential pressure sensor over range	Check whether there has mass leakage or ball valve working condition
007	Gauge pressure sensor over range	Lower the air supply pressure
008	Temperature sensor over range	Contact FUKUDA agents
009	Rs232 error	Check the data cable connection
010	USB error	Check flash disk connection
011	Printer error	Check the data cable connection
012	Electro pneumatic transducer error (APU/EP11)	Check the data cable connection Check the tube connection Check the setting value valid or not
013	Use automatic zero adjusting when with a testing pressure	Turn off the air supply
100	+BNG alarm when testing the volume (CAL port close)	Make sure the Work is out of mass leakage
101	-BNG alarm when testing the volume (CAL port close)	Contact FUKUDA agents
102	+BNG alarm when testing the volume (CAL port open)	Make sure there is no leakage between Flow-master and CAL port
103	-BNG alarm when testing the volume (CAL port open)	Contact FUKUDA agents
104_0	CH2 Process T.PNG	Pressure<Test.P DOWN 1、 Check whther the value of air supply is too small. 2、 Check the leakage conditions between pipelines, fittings and work piece. 3、 Check whether the value of Test.P DOWN is too large.
104_1		Pressure > Test.P UP 1、 Check whether the value of air supply is too large. 2、 Check whether the value of Test.P UP is too small.
104_2		Pressure <90% Test.P Standard 1、 Check whether the value of air supply is too large. 2、 Check the leakage conditions between pipelines, fittings and work piece. 3、 Check whether the value of Test.P Standard is suitable. 4、 When above conditions are normal, set the value of Test.P DOWN(non-zero value) according to the actual requirement.
104_3		Pressure >110% Test.P Standard 1、 Check whether the value of air supply is too large. 2、 Check whether the value of Test.P Standard is suitable. 3、 When above conditions are normal, set the value of Test.P UP(non-zero value) according to the actual requirement.
105_0	L.PNG	Pressure <Lead.P Down 1、 Check whether the value of air supply is too small. 2、 Check the leakage conditions between pipelines, fittings and work piece. 3、 Check whether the value of Lead.P DOWN is too large.
105_1		Pressure > Lead.P UP 1、 Check whether the value of air supply is too large. 2、 Check whether the value of Lead.P UP is too small.
105_2		Pressure <90% Lead.P Standard 1、 Check whether the value of air supply is too small. 2、 Check the leakage conditions between pipelines, fittings and work piece. 3、 Check whether the value of Lead.P Standard is suitable. 4、 When above conditions are normal, set the value of Lead.P DOWN(non-zero value) according to the actual requirement.
105_3		Pressure >110% Lead.P Standard 1、 Check whether the value of air supply is too large. 2、 Check whether the value of Lead.P Standard is suitable. 3、 When above conditions are normal, set the value of Test.P UP(non-zero value) according to the actual requirement.
106	Volume test value less than 4.5mL	Check whether the test pressure is fit for the rated pressure of the standard leak; Check whether the input data of the leakage is the same as the rated leakage of the standard leak; Check whether there existing leakage in CAL connection
107	Loose Limit1 error	Check Loose Limit1
108	Clamp Limit2 error	Check Clamp Limit2

* If problem remains, please contact BOYI agents.

The factors of the judgment in every process.

Process	Link time decision point	Decision condition	Error Code	Decision result	Back Sig REMOTE
DLY	Start	Limit1 (cylinder loose) invalid;	ERR 107	ERR	ERR
	In process	The pressure of air supply beyond the range;	ERR 007	TPNG	T.P.NG
	End	Limit2 (cylinder intensify) invalid;	ERR 108		
CHG1	In process	The pressure of air supply beyond the range;	ERR 007	ERR	ERR
		Temperature beyond the range;	ERR 008		
	End	The pressure of air supply < lower limit of pilot pressure (lower limit of pilot pressure is not zero);	ERR 105	LPNG	L.P.NG
		The pressure of air supply > upper limit of pilot pressure (upper limit of pilot pressure is not zero);	ERR 105		
		The pressure of air supply < 90 % of the standard pilot pressure (upper limit and lower limit of pilot pressure set to zero and standard pilot pressure is not zero);	ERR 105		
		The pressure of air supply > 110 % of the standard pilot pressure (upper limit and lower limit of pilot pressure set to zero and standard pilot pressure is not zero);	ERR 105		
CHG2	In process	The pressure of air supply beyond the range;	ERR 007	ERR	ERR
		Temperature beyond the range;	ERR 008		
	End Before closing the charging valve	The differential pressure beyond the range;		+BNG -BNG	B.NG
	End	The pressure of air supply < lower limit of test pressure (lower limit of test pressure is not zero);	ERR 104	TPNG	T.P.NG
		The pressure of air supply > upper limit of test pressure (upper limit of test pressure is not zero);	ERR 104		
		The pressure of air supply < 90 % of the standard test pressure (upper limit and lower limit of test pressure set to zero and standard test pressure is not zero);	ERR 104		
		The pressure of air supply > 110 % of the standard test pressure (upper limit and lower limit of test pressure set to zero and standard test pressure is not zero);	ERR 104		
BAL1	In process	The pressure of the test object beyond the range;	ERR 007	ERR	ERR
		Temperature beyond the range;	ERR 008		
	End	The pressure of the test object < lower limit of test pressure (lower limit of test pressure is not zero);	ERR 110	TPNG	T.P.NG
		The pressure of the test object > upper limit of test pressure (upper limit of test pressure is not zero);	ERR 110		
		The pressure of the test object < 90 % of the standard test pressure (upper limit and lower limit of test pressure set to zero and standard test pressure is not zero);	ERR 110		
		The pressure of the test object > 110 % of the standard test pressure (upper limit and lower limit of test pressure set to zero and standard test pressure is not zero);	ERR 110		
		The pressure of the test object < 50 % of the pressure of air supply (The test pressure is standard and both upper limit and lower limit are zero);	ERR 110		
		The pressure of the test object > 150 % of the pressure of air supply (The test pressure is standard and both upper limit and lower limit are zero);	ERR 110		

Process	Link time decision point	Decision condition	Error Code	Decision result	Back Sig REMOTE
BAL2	In process	The differential pressure beyond the range;		+BNG -BNG	B.NG
		For UL type, leakage unit is not Pa, and it is $200\text{Pa} < \text{The pressure of air supply} < \text{The differential pressure is full range} > \text{The pressure of air supply 的 } 10\%$;			
DET	In process	The differential pressure beyond the test range of AD;		+BNG -BNG	B.NG
		For UL type, leakage unit is not Pa, and it is $200\text{Pa} < \text{The pressure of air supply} < \text{The differential pressure is full range} > \text{The pressure of air supply 的 } 20\%$;	Have the result directly		
	End	Differential pressure or leakage rate $> +2\text{NG}$ (The second leakage standard)		+2NG	+2NG
		Differential pressure or leakage rate $> +\text{NG}$ (upper limit of test leakage)		+NG	+NG
		$-\text{NG} \leq \text{Differential pressure or leakage rate} \leq +\text{NG}$		OK	OK
		Differential pressure or leakage rate $< -\text{NG}$ (lower limit of standard substance)		-NG	-NG
M.DET	In process	The differential pressure beyond the test range of AD;		+BNG -BNG	+BNG -BNG
	End	The differential curve is not linear;	ERR 109	Only hint	
		Differential pressure or leakage rate $> +\text{NG}$ (upper limit of test leakage)		+MNG	M.NG
		$-\text{NG} \leq \text{Differential pressure or leakage rate} \leq +\text{NG}$		OK	OK
		Differential pressure or leakage rate $< -\text{NG}$ (lower limit of standard substance)		-MNG	M.NG
CAL	In process	The differential pressure beyond the test range of AD;	ERR 006	ERR	ERR
	End	When open the leak, The differential curve is not linear;	ERR 109	ERR	ERR
		When open the leak, there is no differential pressure;	ERR 111	ERR	ERR
		Volume result $< 4.5\text{mL}$;	ERR 106	ERR	ERR
EXH					

■ FL-800 common Q&A

Q1: What should be paid attention to when FL-800 work internal volume calculation?

A1:

- ① Master volume setting must be correct and steady ambient temperature should be kept when volume testing.
- ② Make sure there is no leakage between Flow-master and CAL port.
- ③ Each state timer should set reasonable. In general each state timer should be set longer if work internal volume is bigger.

Refer to the below table:

Volume	CHG (s)	BAL (s)
10mL~200mL	30	5
200mL~500mL	60	5
500mL~1L	120	10
1L~5L	200	10
5L~10L	300	15

- ④ Flow master should be selected reasonable. Flow master of Bigger rated flow should be selected if work internal volume is bigger.

Refer to the below table:

Volume	Flow-master
10mL~200mL	0.5mL/min
200mL~1L	2 mL/min
1L~5L	5 mL/min
5L~10L	10 mL/min

- ⑤ It is recommended that test pressure should not be over 100kPa, which can reduce the influence of compressed air temperature.

Q2: Can FL-800 leak tester be used just after automatic work internal volume calculation?

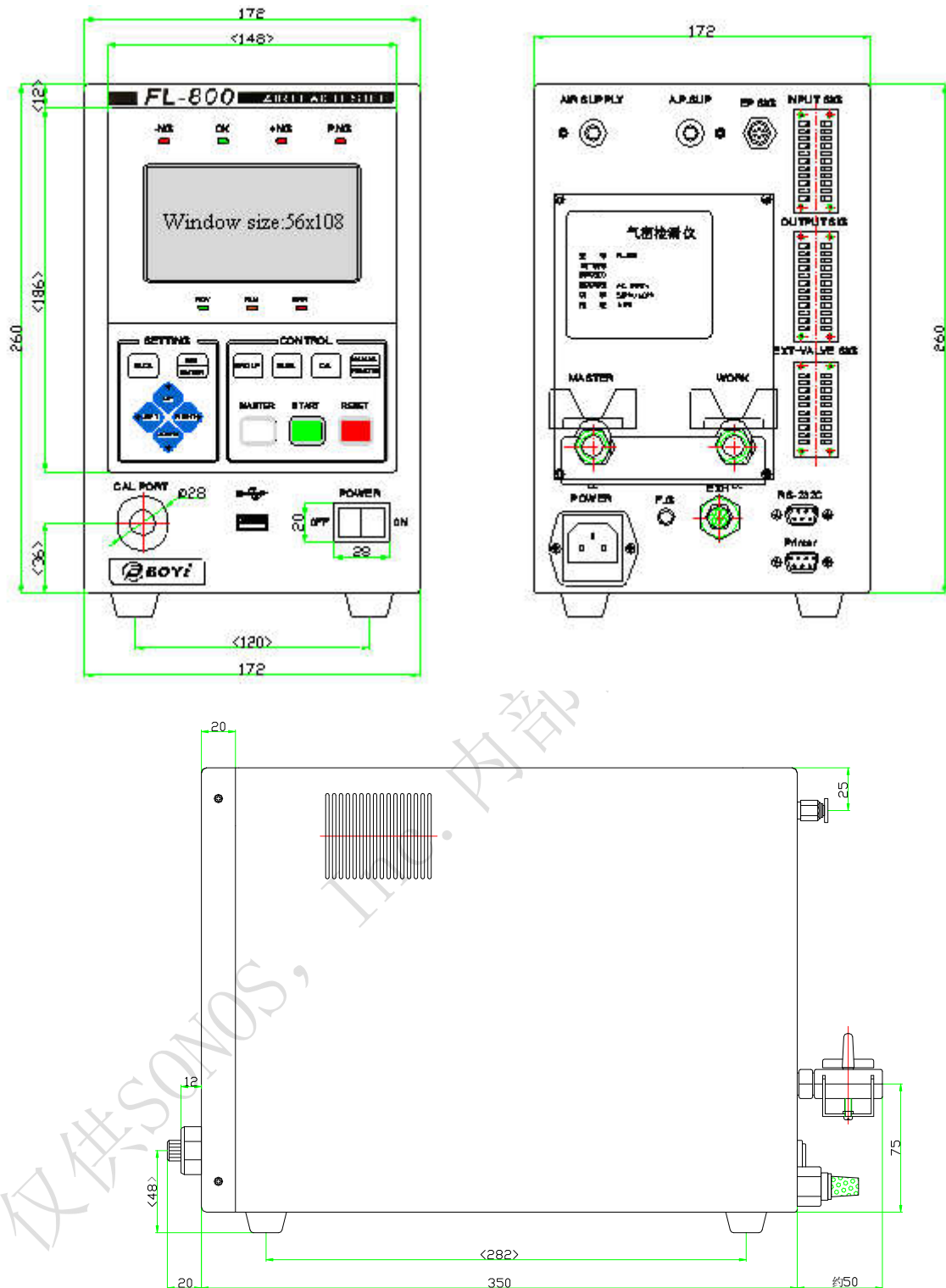
A2: Theoretically FL-800 leak tester can be used just after automatic work internal volume calculation. But internal solenoid valves generate heats during work internal volume calculation, and the heats don't disappear at once, which could influence the internal pneumatic circuit. Therefore if leak tester's unit stability and leak test are carried out just after automatic work internal volume calculation, the results maybe wrong. It is recommended that leak tester be used 30 minutes later after automatic work internal volume calculation.

Q3: Attention list before FL-800 use.

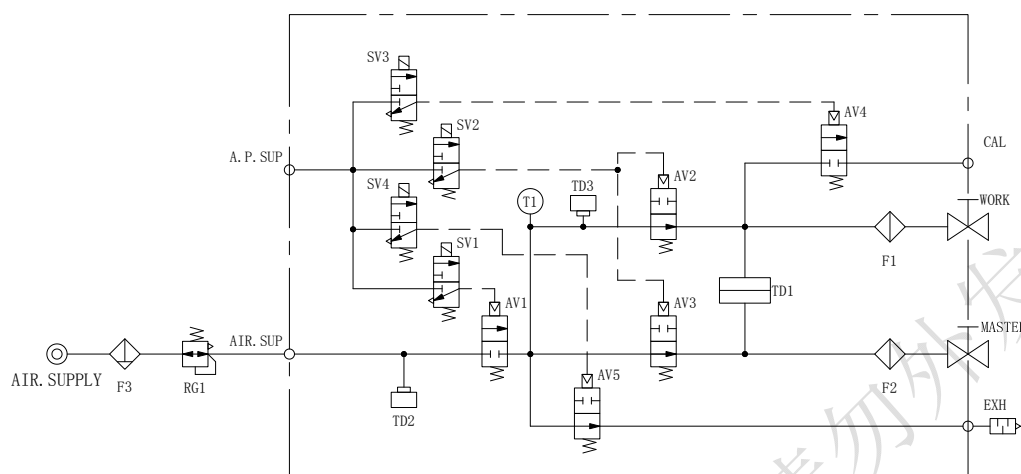
A3:

- ① Power supply: Please confirm power voltage according with the required voltage and frame ground.
- ② Remote terminal: Please confirm remote terminal wiring and current capacity.
- ③ Ball valve: Please close the ball valve not connected.
- ④ Whether the Work volume and Master volume setting value is same as the trim size.

■ External dimensions diagram



■ Pneumatic circuit diagram



Free maintenance regulation

1. Please use our product according to operation manual, we will provide free maintenance service within warranty period.

Please carry leak testers and warranty cards to the seller or our agents, you may also call to our company .

Tel: (86)4008139900 (86)22-25293830

2. Please inform sellers or our agents if your address changes.
3. Even in the said warranty period , the following cases are excluded from the warranty ,and labor and the cost of components are charged to the customer .
 - (1) Failure and /or damage caused by wrong operation, repair and/or modification by persons not authorized by BOYI.
 - (2) Instruments moved form their original installation place ,failure and/or damage during transportation after purchase.
 - (3) Failure and/or damage by fire ,earthquake, flood, lightning ,and other natural disaster, abnormal power line voltage, power line (voltage and frequency out of specification)
 - (4) Circumstance beyond the range of the regulation.
 - (5) There are no model, serial No, warranty record or rewritten in this manual.
 - (6) There is no company's seal in this manual.
4. This manual is valid only purchased from our company in Japan or overseas agents.
5. If you lose this manual, we can not reissue it.

Warranty Card

Product	
Model	
Serial No.	
Warranty	within one year after leave factory
Purchase date	

The guarantee sheet ensures free maintenance on the basis of date and conditions declared in the manual. Please contact with the company where you purchased it or the nearest sales office if beyond warranty period.

Checked chop



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