



# TC-5916AP Pneumatic Shield Box

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User Manual

R20190930

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## Revision History

### Revision Record

Revision	Description	Date
v1.0	Initial Release	2019-09-23

## WARRANTY

TESCOM guarantees that this product will be free from defects in materials and workmanship for one year from the date of shipment. During the warranty period, TESCOm will, at its discretion, either repair or replace defective products.

For the warranty service, customer must notify TESCOm of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to TESCOm or to a service center designated by TESCOm. Customer shall pay for shipping charges as well as any other charges incurred outside of Korea. TESCOm shall pay shipping charge to return the product to the customer.

This warranty does not apply to [Expendables and Accessories](#) and any failure or damage caused by improper use or unauthorized service. In such cases, TESCOm may refuse to offer any service under the warranty.

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### LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulted from software (user interface) supplied by the customer or any third party, unauthorized modification or misuse, accident or abnormal condition of operation. Also, Tescom does NOT warrant certain parts which are considered expendable such as gaskets, gas springs, handle assemblies, accessories, antennas, I/O interfaces, modules and fixtures.

TESCOM's responsibility to repair or replace defective products is the sole and exclusive remedy provided to the customer for breach of this warranty. TESCOm will not be liable for any indirect, extraordinary, incidental, or consequential damages, despite any advance notice of the possibility of such damages.

## Safety Considerations

Review the following safety precautions to avoid personal injury, damage to this product, or damage to any product connected.

### **Do not disassemble any part unless listed replaceable in this manual**

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### **Do not operate in wet/damp conditions**

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To avoid injury or fire hazard, do not operate this product in wet or damp conditions.

### **Do not operate in explosive atmosphere**

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To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

### **Provide proper ventilation**

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To prevent product overheating, provide proper ventilation.

### **Do not operate with suspected failures**

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If there is any damage to this product, have it inspected by qualified service personnel

## Environmental Conditions

Refrain from using this equipment in a place subject to intense vibration, direct sunlight, or uneven ground. Also, use it where the temperature is between 0 °C to 50 °C and relative humidity is less than 85%.

# Safety Symbols and Terms





Various symbols are used in this manual and on the product itself to ensure correct usage, to prevent danger to the user and others, and to prevent property damage. The meanings of these symbols are described below. It is important that you read these descriptions thoroughly and fully understand its context.

## Safety Terms

**WARNING:** Identifies conditions or practices that could result in injury or loss of life.

**CAUTION:** Identifies conditions or practices that could result in damage to the product or other property.

**Symbols:** The following symbols may appear in this manual or on the product.

Symbol	Meaning
	<input checked="" type="checkbox"/> <b>Crush hazard</b> Moving part can cause serious injury. Must not operate Shield Box when unauthorized person is in proximity.
	Indicates a potentially hazardous situation which, if not avoided, could result in serious injury and/or equipment damage.
	Indicates a potentially hazardous situation which, if not avoided, may result in a minor or moderate injury and/or equipment damage. It may also be used to alert against unsafe practices.
	Indicates necessary information or useful information for operation and maintenance.



# PART 1. Getting Started

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# 1. Introduction and Specifications

## 1.1 Introduction

Shield Box is an equipment which shields RF signal by radiation or through I/O cables while testing wireless products.

Shield Box is highly effective in shielding while being small and sturdy. Therefore, it offers efficient and economical testing solution for mass production, service, and development.

### Key Features

- Reliable High-RF shielding up to 6 GHz
- Pneumatic control of door open-close and diverse fixture operation
- EMI filter on all data ports and power line
- Suitable for various tests to meet customers' needs
- Red/Green LED indicators visualizing the operation of ongoing test
- Remote operation by RS-232C

## 1.2 Specifications

### Mechanical Specification

RF Connectors without I/O interface panel		two(2) N(f) outside and SMA(f) inside
Input voltage		24 VDC
Power Consumption		Max 1.5 W
Remote Control		RS-232C, 3 wire, DB9(s)
Air Connector	Main connector	6 mm OD hose, one-touch push-on fitting
	Fixture control connector	4 mm OD hose, one-touch push-on fitting
	Input air pressure	5 to 10 bar

Dimension	Inside	328(W) x 298(D) x 206(H) mm
	Outside	420(W) x 430(D) x 260(H) mm, lid closed, 430(H) mm, lid open
Weight		approx. 13 kg
*Packing	Size	480(W) x 545(D) x 365(H) mm
	Weight	approx. 15 kg
*The size and/or weight of packing may vary by how the product is packed.		

## Typical RF Shielding

- The shielding effectiveness below is measured with blank panels; other I/O interface panels may result in different shielding effectiveness of the shield box.

Frequency	Shielding effectiveness (dB)
100 to 2000 MHz	> 70 dB
2000 to 3000 MHz	> 70 dB
3000 to 6000 MHz	> 60 dB

## 1.3 Initial Inspection

When TC-5916AP is delivered, inspect the package and its content as follows:

- ① Check for any damage that could have occurred during shipment.
- ② Verify that you have received the accessories supplied with the TC-5916AP and module, which are listed in [4.1 Exterior and Accessory Inspection](#)
- ③ In case of any abnormality, do not install or operate the product for your own safety. Please contact TESCOM immediately.

## 1.4 Optional Parts Check

Referring to [3. Optional Modules & Accessories](#), check optional panels and accessories whether they are in place as you ordered.

## 1.5 TESCOM Sales and Service Office

If you have difficulty with the product, call or write to our Technical Support specialists at:

**NOTICE**

TESCOM Company Limited # 927 Unitechvil, 142, Ilsan-ro, Ilsandong-gu, Goyang-si,  
Gyeonggi-do, Korea [ZIP 10442]

TEL.: 82-31-920-6600

FAX: 82-31-920-6607

Email: [support@tescom.org](mailto:support@tescom.org)

Website: <http://www.tescom.co.kr>

## **PART 2. Hardware Description**

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## 2. Hardware Overview

### 2.1 Component Identification

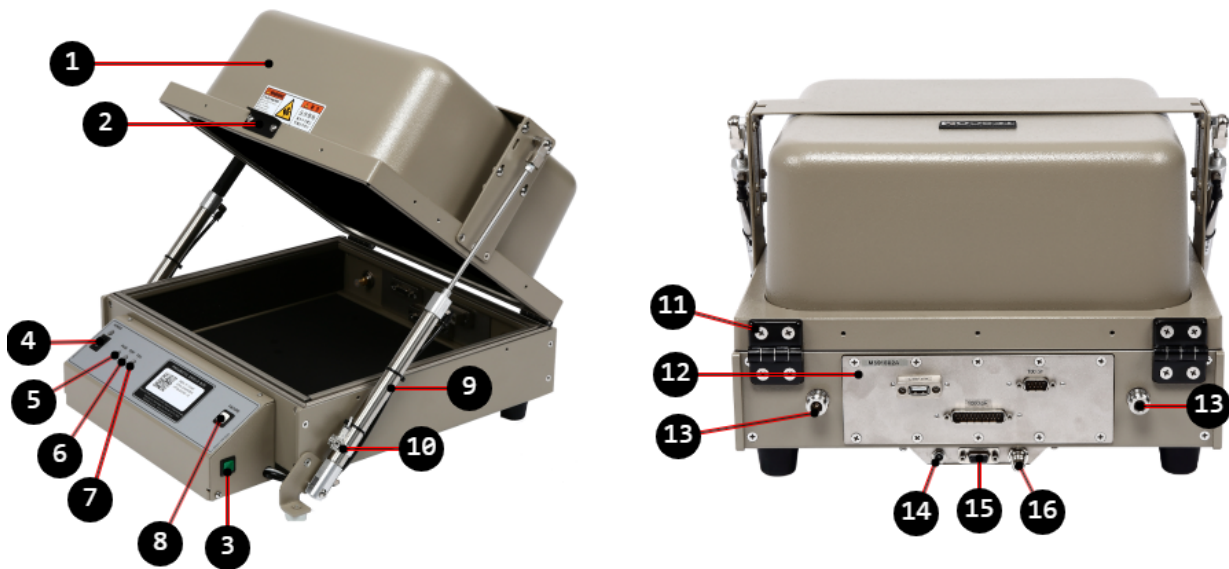


Figure 2-1 TC-5916AP Component Identification

Table 2-1 TC-5916AP Component Identification

No.	Name	No.	Name
①	Lid	⑨	Air Cylinder
②	Lid Handle	⑩	Lid Close Sensor
③	Lid Open/Close Button	⑪	Hinge
④	Power ON/OFF Switch	⑫	I/O Interface Panel
⑤	Green LED for PASS	⑬	N(f) outside and SMA(f) inside RF Connector
⑥	Orange LED for TEST	⑭	AC Input Connector
⑦	Red LED for FAIL	⑮	RS-232C Connector
⑧	Fixture Operation Button	⑯	Air Inlet

## 2.1.1 TC-5916AP Inside

### TC-5916AP Fixture Air Port

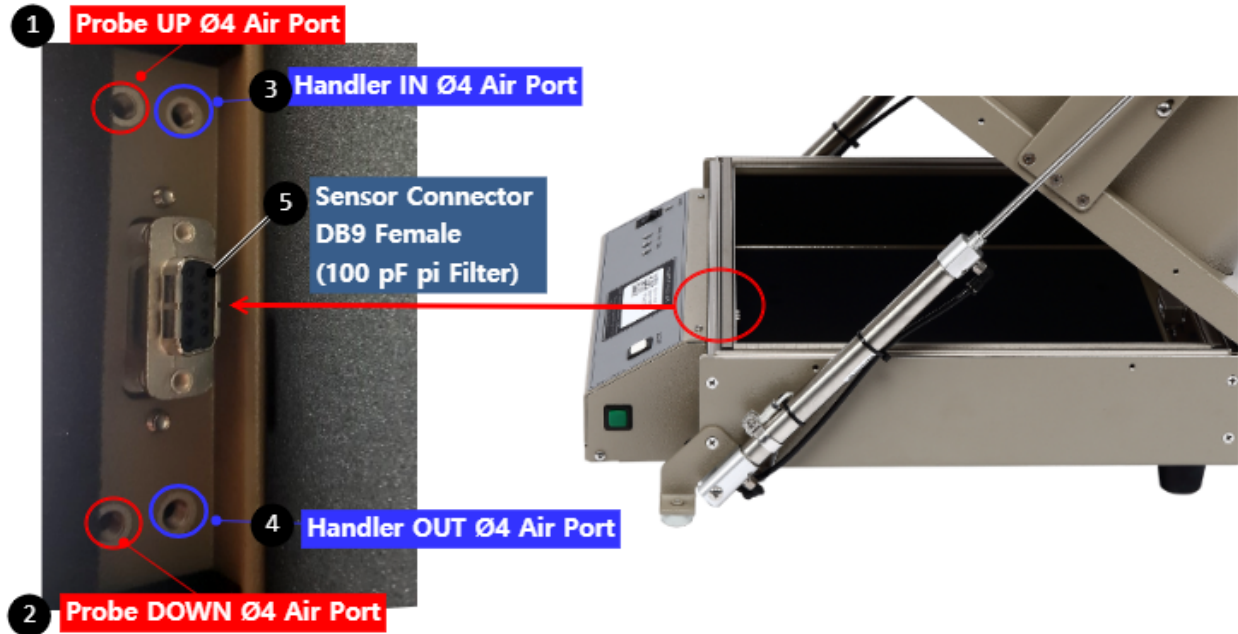
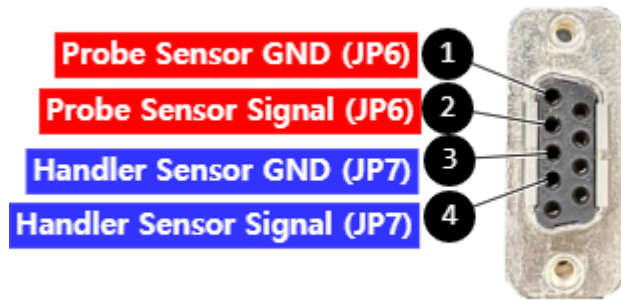


Figure 2-2 TC-5916AP Fixture Air Ports

Table 2-2 TC-5916AP Fixture Air Ports & Sensor Connector

No.	Name
①	Probe UP Air Port (Ø4) , Speed control function excluded
②	Probe DOWN Air Port (Ø4), Speed control function excluded
③	Handler IN Air Port (Ø4), Speed control function excluded
④	Handler OUT Air Port (Ø4), Speed control function excluded
⑤	Sensor Connector DB9 100 pF Filter, for connecting a sensor cable

Sensor Connector Pin Map



**TC-5916AP Inside D-SUB 9P (FEMALE)**

**Figure 2-3** TC-5916AP Inside D-SUB 9P (Female) Sensor Connector Specification

**Table 2-3** TC-5916AP Inside D-SUB 9P (Female) Connector Pin Map

Pin Number (Female)	Function
①	Probe Sensor GND
②	Probe Sensor Signal
③	Handler Sensor GND
④	Handler Sensor Signal



## 2.1.2 TC-5916AP Control Box

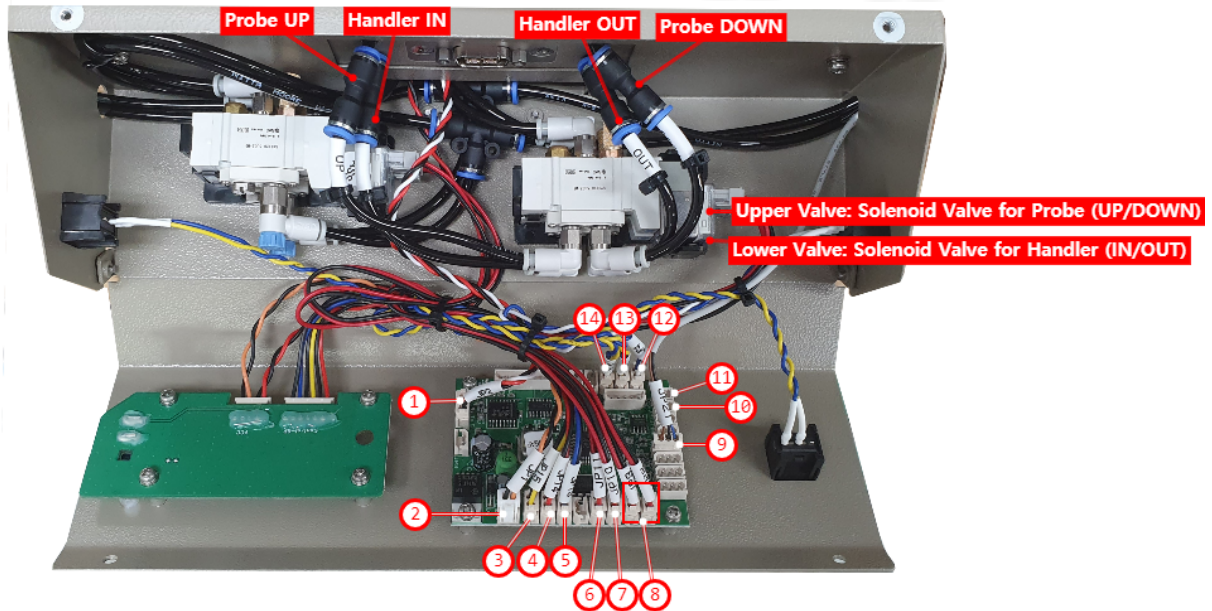
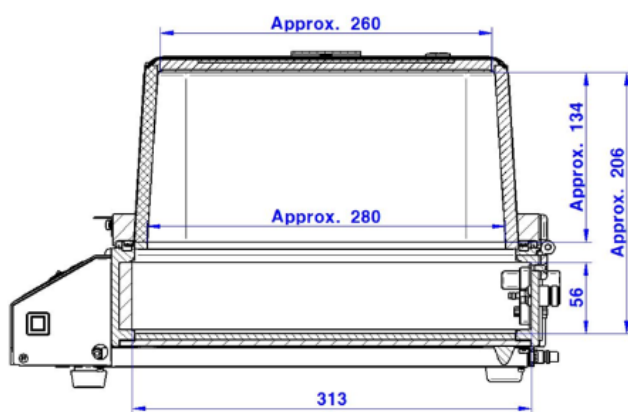
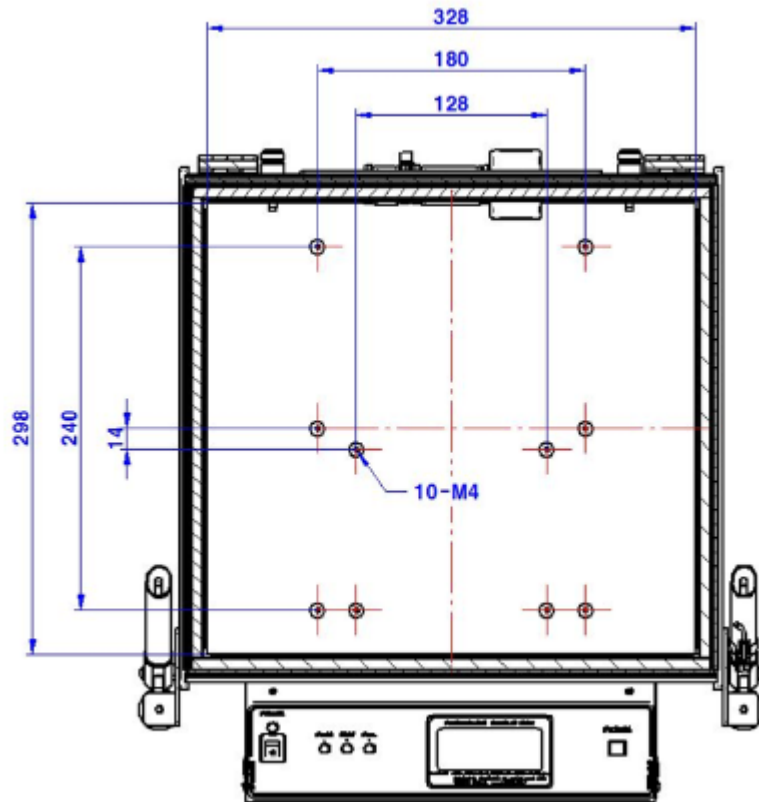


Figure 2-4 5916AP Control Box

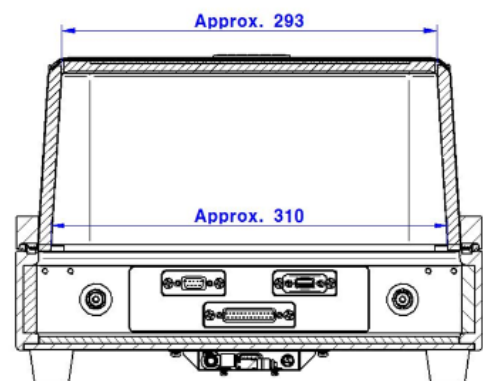
Table 2-4 TC-5916AP Control Board Connector

No.	Function	Connector	Description
①	RS-232C Communication	JP2	RS-232C Connector
②	Power Supply	JP1	+24V DC Input Connector
③	LED	JP15	FAIL LED Connector
④		JP14	PASS LED Connector
⑤		JP13	TEST LED Connector
⑥	Solenoid Valve	JP11	Solenoid Valve Connector for Handler
⑦		JP10	Solenoid Valve Connector for Probe
⑧		JP9	Solenoid Valve Connector for Lid
		JP8	Solenoid Valve Connector for Lid
⑨	Sensor	JP21	Lid Close Detection Sensor Connector
⑩		JP7	Handler Inward Detection Sensor Connector
⑪		JP6	Probe Downward Detection Sensor Connector
⑫	Operation Button	JP4	Right-Hand Side Lid Open Button Connector
⑬		JP5	Left-Hand Side Lid Open Button Connector
⑭		JP16	Fixture Operation Button Connector

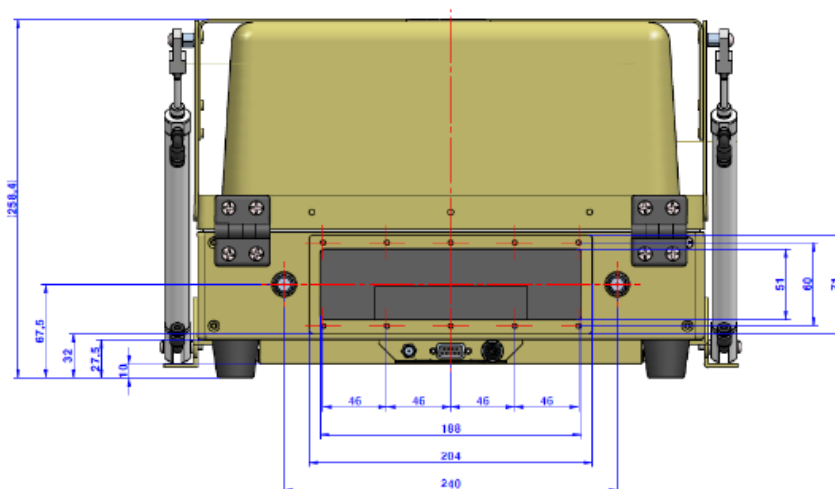
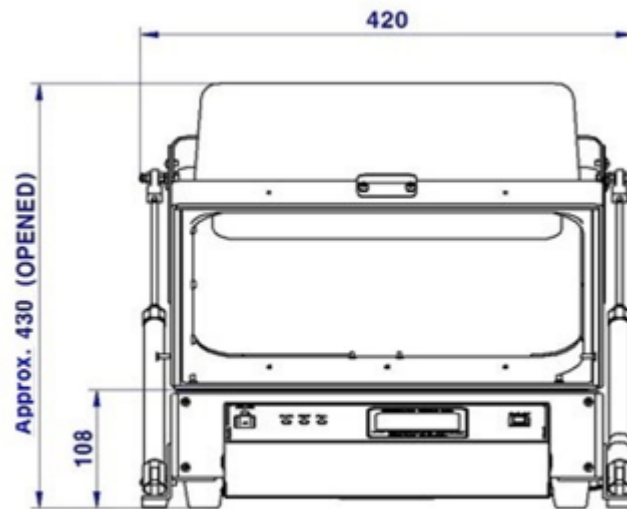
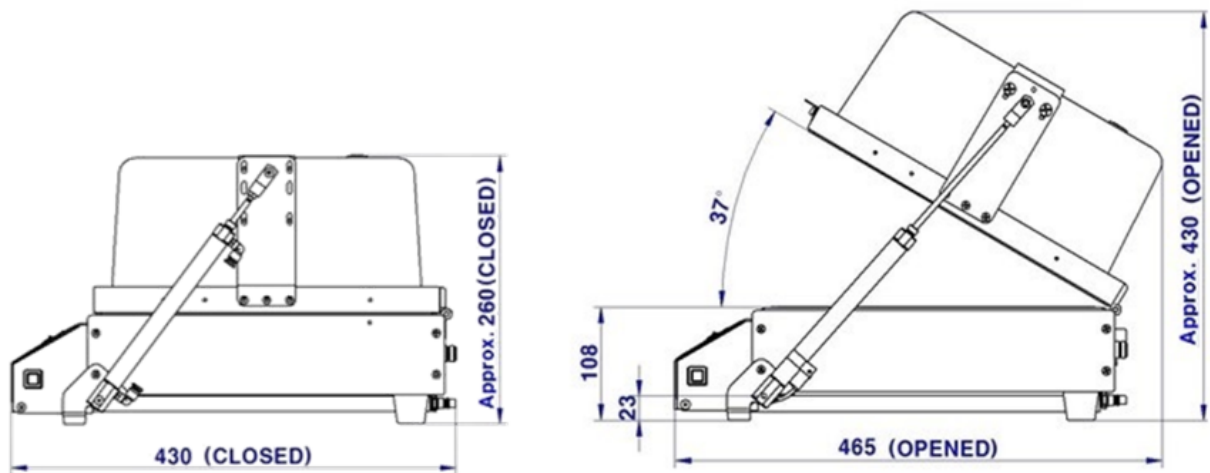
## 2.2 Dimension



Side Section View



Rear Section View



## 3. Optional Modules & Accessories

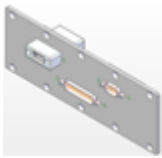
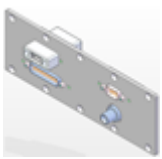
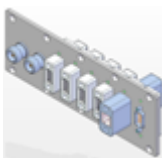
### 3.1 I/O Interface Panels

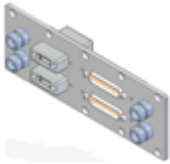

TC-5916AP has several types of panel options for connecting data interface, power, etc., and it can be customized to suit your needs.

#### 3.1.1 Pre-configured Panels

List of I/O interface panels already configured by us

**Table 3-1** Pre-configured Panels for TC-5916AP





I/O Interface Panel	Order Number	Configuration
 Data Interface Panel	M591602A	<ul style="list-style-type: none"> <li>• one(1) DB25(p) outside and DB25(s) inside, 1000 pF Pi filter</li> <li>• one(1) DB9(p) outside and DB9(s) inside, 100 pF Pi filter</li> <li>• one(1) USB 2.0 outside and inside</li> </ul>
 Data Interface Panel	M591605A	<ul style="list-style-type: none"> <li>• one(1) DB25(p) outside and DB25(s) inside, 100 pF Pi filter</li> <li>• one(1) DB9(p) outside and DB9(s) inside, 100 pF Pi filter</li> <li>• one(1) USB 2.0 outside and inside</li> <li>• one(1) DC Power Jack outside and inside</li> </ul>
 Data Interface Panel	M591632A	<ul style="list-style-type: none"> <li>• two(2) N (f) outside and SMA (f) inside</li> <li>• one(1) DB9(p) outside and DB9(s) inside, 1000 pF Pi filter</li> <li>• four(4) USB 2.0 outside and inside</li> <li>• one(1) RJ-45 outside and inside</li> </ul>

I/O Interface Panel	Order Number	Configuration
 Data Interface Panel	M5916135A	<ul style="list-style-type: none"> <li>• four(4) N (f) outside and SMA (f) inside</li> <li>• two(2) DB25(p) outside and DB25(s) inside, 100 pF Pi filter</li> <li>• two(2) USB 2.0 outside and inside</li> </ul>
 Data Interface Panel	M5916145C	<ul style="list-style-type: none"> <li>• five(5) SMA (f) outside and SMA (f) inside</li> <li>• one(1) DB9(p) outside and DB9(s) inside, 1000 pF Pi filter</li> <li>• two(2) USB 2.0 outside and inside</li> <li>• one(1) DC Power Jack outside and inside</li> </ul>

### 3.1.2 Custom Panels

By selecting and combining from the list below, you can set your own I/O interface panel besides [3.1.1 Pre-configured Panels](#).



**Table 3-2** Custom I/O Interface

I/O Interface	Order Number	Transmission Speed / Line Voltage	*Typical Shielding
 DB25, 1000pF pi Filter	3409-0009-1	3 Mbps / 100 VDC, 5 Amps max	>70 dB from 0.5 to 2 GHz >80 dB from 2 to 3 GHz >70 dB from 3 to 6 GHz
 DB25, 100pF pi Filter	3409-0014-1	10 Mbps / 100 VDC, 5 Amps max	>50 dB from 0.5 to 2 GHz >60 dB from 2 to 3 GHz >60 dB from 3 to 6 GHz
 DB9, 1000pF pi Filter	3409-0008-1	3 Mbps / 100 VDC, 5 Amps max	>70 dB from 0.5 to 2 GHz >80 dB from 2 to 3 GHz >70 dB from 3 to 6 GHz
 DB9, 100pF pi Filter	3409-0010-1	10 Mbps / 100 VDC, 5 Amps max	>50 dB from 0.5 to 2 GHz >60 dB from 2 to 3 GHz >60 dB from 3 to 6 GHz

I/O Interface	Oder Number	Transmission Speed / Line Voltage	*Typical Shielding
	3409-0018A-3	480 Mbps / 5 V, 500 mA / Max Current: 5A	>60 dB from 0.5 to 2 GHz >70 dB from 2 to 3 GHz >70 dB from 3 to 6 GHz
 USB 3.0 Filter(Active)	3409-0042A-2	5000 Mbps / 5 V, 600 mA / Max Current: 1.5 A	>80 dB from 0.5 to 2 GHz >80 dB from 2 to 3 GHz >75 dB from 3 to 6 GHz
 RJ-45 Filter	3409-0022A	1 Gbit/s Copper-Line Ethernet (1000 BASE-T)	>60 dB from 0.5 to 2 GHz >70 dB from 2 to 3 GHz >70 dB from 3 to 6 GHz
 DC Power Adaptor,	3406-0004A	50 VDC, 3 Amps max	>70 dB from 0.5 to 2 GHz >80 dB from 2 to 3 GHz >80 dB from 3 to 6 GHz
 DC Power Adaptor, Banana Jack Type	3406-0004A 3406-0006A	50 VDC, 10 Amps max	>70 dB from 0.5 to 2 GHz >80 dB from 2 to 3 GHz >80 dB from 3 to 6 GHz
 AC Power Adaptor	3103-0009A	250 VAC, 7 Amps max	>70 dB from 0.5 to 2 GHz >80 dB from 2 to 3 GHz >80 dB from 3 to 6 GHz

## NOTICE

1. Shielding effectiveness is an estimated value with each I/O interface applied.
2. The data above was measured by TESCOM, and they may be different depending on the measuring method and environment.
3. Each shielding effectiveness is measured without according cable. It is likely affected when a cable is connected. Also, it may vary depending on the type of cable.

I/O Interface	Order Number	Frequency Range / Impedance / V.S.W.R
 RF, N-SMA Connector	3408-0038	From DC to 6 GHz / 50 Ω / 1.15 max
 RF, SMA-SMA Connector	3408-0039	From DC to 8 GHz / 50 Ω / 1.15 max

## 3.2 Fixtures

TESCOM offers flexible fixtures that can change the position of the DUT. Depending on the shape of DUT, you can create your own fixture with fixture blocks in a few seconds. In addition, custom fixtures can be ordered and supplied to suit your needs.

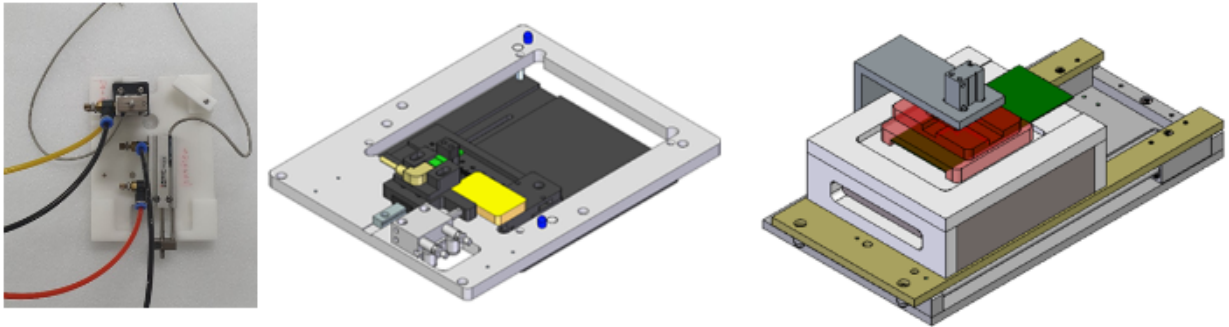
### 3.2.1 Standard Grid Fixtures

Table 3-3 TC-5916AP Standard Grid Fixture

Grid Fixture	Order Number	Configuration
	F59161A	<ul style="list-style-type: none"> <li>• Antenna Coupler Movable Fixture</li> <li>• Antenna Coupler(Optional): TC-93026A</li> <li>• 310(W) x 260(D) x 52(H) mm</li> </ul>
	F59165B	<ul style="list-style-type: none"> <li>• Antenna Coupler Fixed Fixture</li> <li>• Antenna Coupler(Optional): TC-93026A</li> <li>• 300(W) x 270(D) x 22(H) mm</li> </ul>

### 3.2.2 Custom Fixtures

TESCOM offers custom fixtures as well as standard fixtures to meet your demand. In addition to such fixtures, there are various Antenna Coupler options to set the best measuring system up for your specific device.



**Figure 3-1** Sample images of custom fixtures



## **PART 3. Putting into Operation**

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# 4. Setup and Operation

## 4.1 Exterior and Accessory Inspection

When TC-5916AP is delivered, inspect the package and check whether the following accessories are included:

### Exterior and Accessory Inspection

1. Upon receiving the TC-5530AP, check for any damages that could have occurred during shipment.
2. Verify that you have received the accessories supplied with the TC-5916AP and module, which are listed below.



Figure 4-1 TC-5916AP Accessories List

Table 4-1 TC-5916AP Accessories List

No.	Part Number	Name	Spec.	Quantity
		Operating Manual		1
		Test Report		1
①	4003-0025	Data Cable, DB9(p)-DB9(s) 2M	2 m	1
②	4010-0002	Power Cable, 220V	-	1
③	3001-0039	Switching Power Supply	2 m	1
④	4011-0001	SS-402, N(m) to N(m) 1m	1 m	1
⑤	9703-0074	Air Coupler (CPS15-6W)		1
⑥	C5915AP-0010	Cylinder Lock		1



In case of any abnormality, do not install or operate Shield Box for your own safety. Please contact TESCOM immediately.

## 4.2 Operating Environment

Avoid locations with severe vibration, chance of explosion, or direct sunlight. Set Shield Box in a place at 5 °C ~ 40 °C with humidity of less than 85%.

If Shield Box is not supposed to be used for a long time, securely pack it and store in a dry place at room temperature.

## 4.3 Connecting & Setting Up

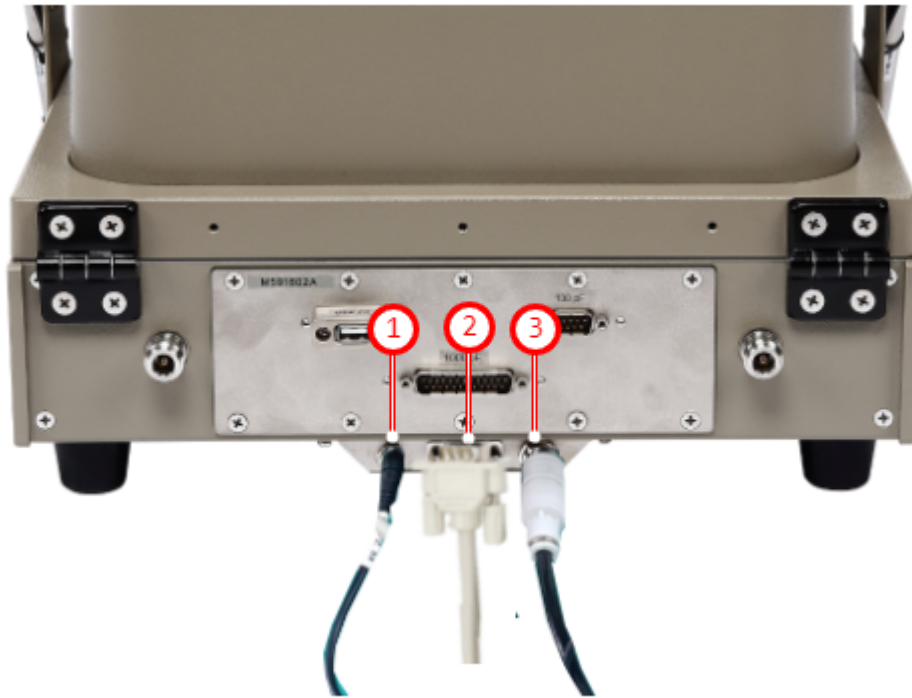


Figure 4-2 Cable Connection

No	Item	Description	Part Number	Quantity
①	DC 24V Power Cable	Supplies power to Shield Box	3001-0039	1EA
②	DATA, DB9(p)-DB9(s) 2m	Connects Shield Box to PC for control	4003-0025	1EA
③	Air Coupler	Main air inlet, 6 mm OD hose, 5 ~ 10 bar	9703-0074	1EA

### 4.3.1 Power Supply

#### 4.3.1.1 Connecting Power Supply Cable

In order to set TC-5916AP Shield Box in motion, connect the 24V DC Power Supply Adapter bundled with the product.



**CAUTION**

For your own safety, please use the 24V DC Power Supply Adapter provided by TESCOM.

### 4.3.1.2 Turning Shield Box On



- 1 Press the power switch on the TC-5916AP control box to the direction of "-" mark.
- 2 POWER LED Indicator will glow white when the power is on.

### 4.3.2 Compressed Air

**CAUTION**

Please make sure to turn off compressed air supply before connecting or disconnecting air hose.

#### 4.3.2.1 Compressed Air Requirement

- Input air pressure : 5 ~ 10 bar
- Main air connector : 6 mm OD hose, one-touch push-on fitting

**CAUTION**

It is highly recommended that the compressed air system must be used in conjunction as shown below. Insufficient air quality may cause deterioration of performance.

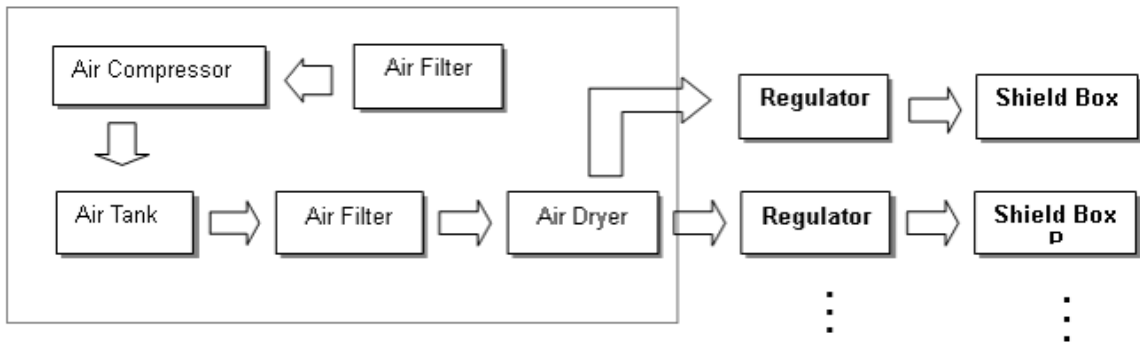


Figure 4-3 General Compressed Air System

### 4.3.2.2 Connecting Compressed Air Supply

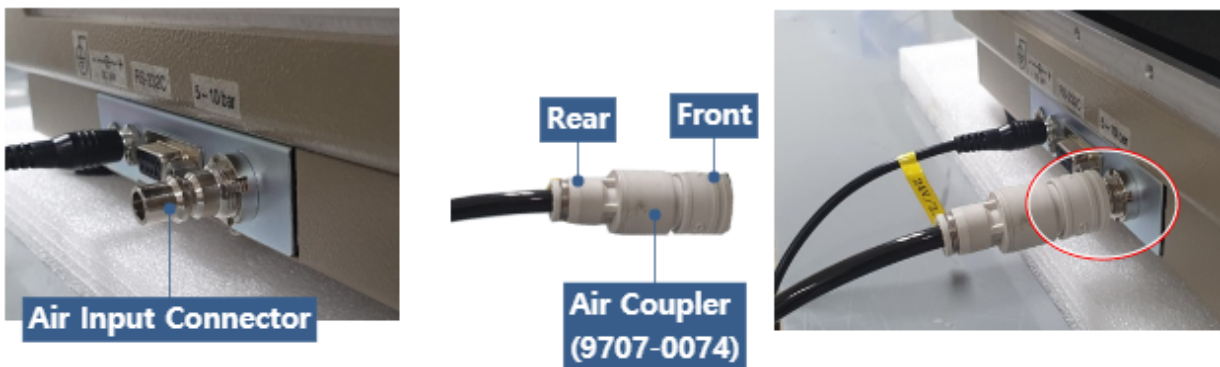


Figure 4-4 Connecting/Disconnecting Compressed Air Supply


- ① The compressed air inlet port is located at the TC-5916AP rear panel.
- ② Insert the 6 mm Air Hose to the rear point of Air Coupler.
- ③ Push the front side of Air Coupler on Air Input Connector until you hear a "click" sound.
- ④ Open the air valve and supply the compressed air.

**CAUTION**

The lid of Shield Box will pop open if you turn the power on while the compressed air is connected.

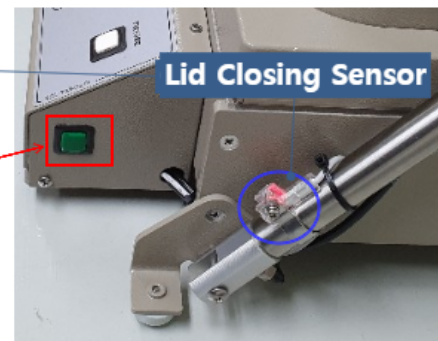
### 4.3.3 Lid Control

#### 4.3.3.1 Closing The Lid

- Press two OPEN/CLOSE buttons (  ) simultaneously on both sides of the control box.
- A red light will blink on the lid closing sensor.



[ Front View ]



[ Side View ]

**NOTICE**

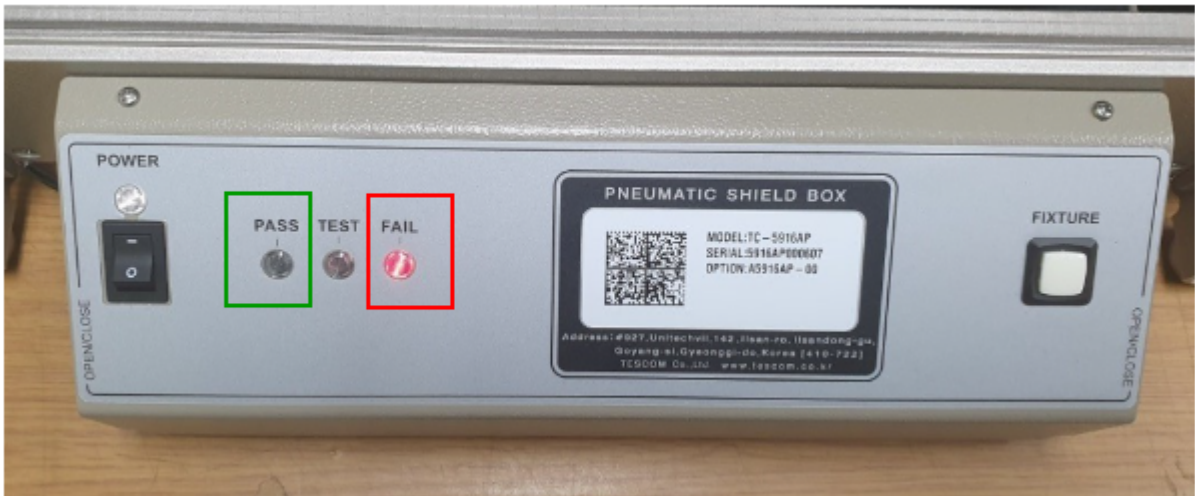
An orange light will glow at the TEST LED on the front control box when the lid is fully closed.

#### 4.3.3.2 Opening The Lid

- Press either one of the two OPEN/CLOSE buttons (  ) to open the lid.



### 4.3.3.3 PASS/FAIL LED Indicator



Green and red LED indicators will be on if the command "PASS" or "FAIL" is sent through RS-232C while the lid is closed.

This function can be useful to visualize the result when the Shield Box is controlled via RS-232C.

Note: The red LED will glow automatically if the lid close sensor does not detect the lid or a problem occurs during the fixture operation.

### 4.3.3.4 Counter Function

TC-5916AP counts the lid open/close cycle and saves it on the memory. The cumulative number of open/close frequency can be viewed on a PC by sending "COUNT?" query command through RS-232C. TC-5916AP will return the cumulative frequency data in an 8 digit number.



## 4.4 Shield Box Operation with Fixture

### NOTICE

The fixture operation mode of standard TC-5916AP is set as 'Handler Mode: Off', 'Probe Mode: Timer' at the time of release. (You can check it with the query command 'SOLENOID MODE?') You need to configure the fixture operation mode if you are to use it.

### 4.4.1 Fixture Operation Modes

The handler and the probe of fixture can operate in 3 modes each, and the operation is automatic according to the open or close of Shield Box.

The operation of fixture can be controlled with commands via RS-232C. Refer to the list of commands and each command in detail at [5.5.2.2 Handler & Probe Configuration Commands](#)

**Table 4-2** Handler and Probe Operation Modes

Operation Mode	Description
Sensor Mode	The operation of fixture is detected by sensors. This mode can prevent damage to either the product or DUT caused by malfunction.
Timer Mode	The operation runs by timer without using sensors. The waiting time is already set upon release and can not be changed.
Off Mode	The operation of fixture is off.

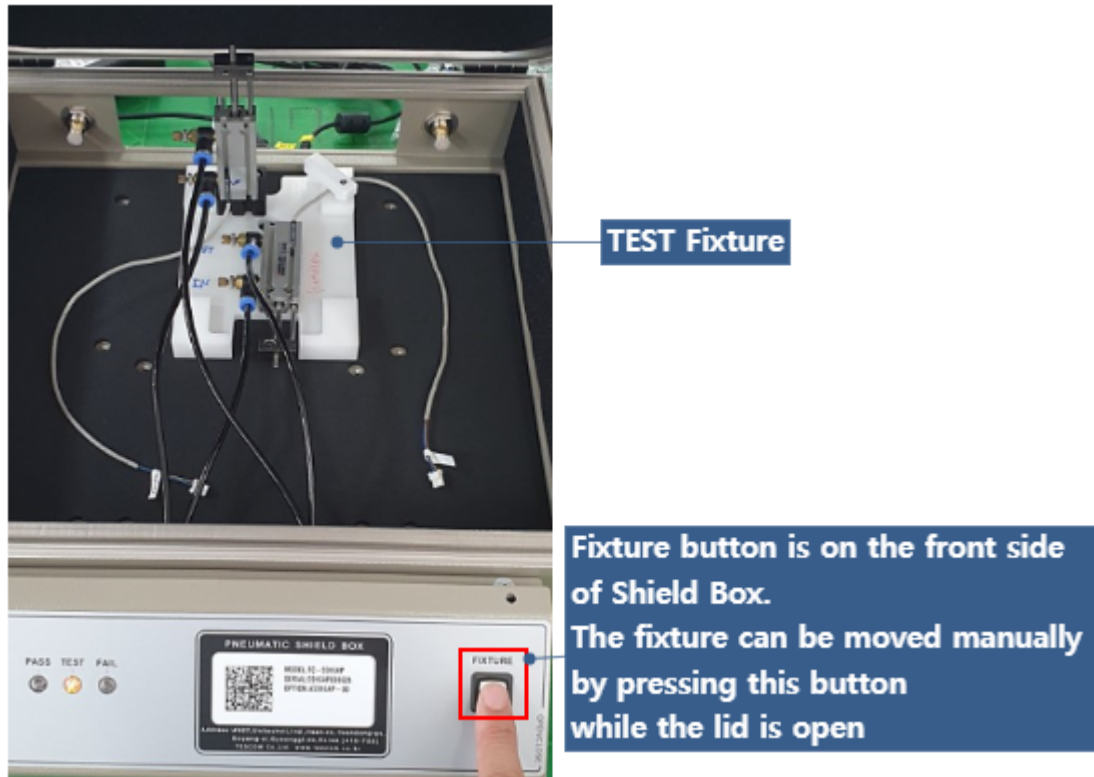
### CAUTION

It is NOT recommended operating fixture with the Timer Mode. Without sensors, the lid may close even when the fixture operation is incomplete, thus causing damage to the product or DUT.

### 4.4.2 Fixture Button ( ) Operation

The fixture can be moved step-by-step if you press the fixture button while the lid is open.

Each step can be run under sensor mode or timer mode, and every move can return to the previous step if there is any problem.



 **CAUTION**

- ① If the air supply is stopped while the lid is open, the lid will close whether the fixture is in position or not. There may be damage to the product or DUT.
- ② If a sensor detects that the operation is incomplete, everything returns to the previous position and the red LED will be turned on.

### 4.4.3 Fixture Connection

#### 4.4.3.1 Connecting air hose

**NOTICE**

The air hose for fixture is 4 mm outside diameter hose.

- 1 Open TC-5916AP Control Box.



Figure 4-5 Control Box Open

- 2 Locate the Air Hose for Handler and Probe.

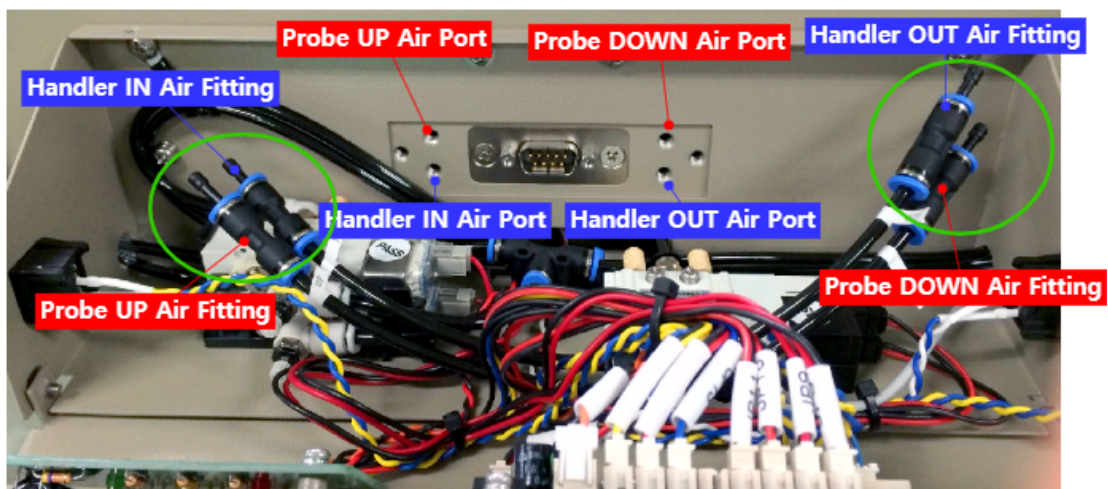


Figure 4-6 Air Ports for Fixture

- Remove the Fitting Plug, and connect 4 mm OD Air Hose to the Fitting.

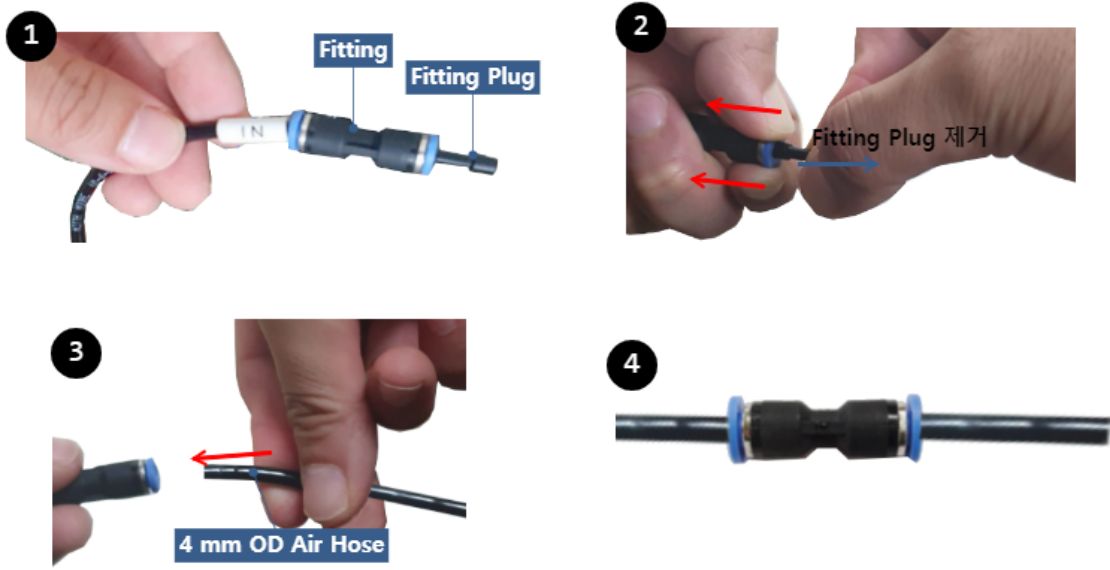
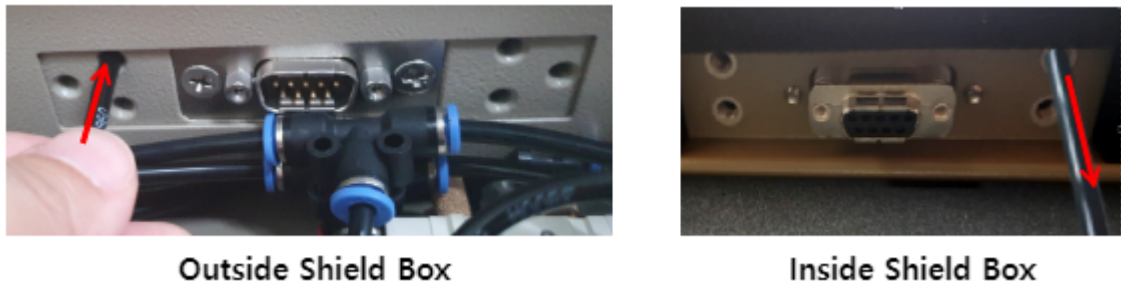


Figure 4-7 5916AP: Fitting Plug Removal

- Insert the hose to the Shield Box.



- With all Probe and Handler air hoses connected, it will look like below.

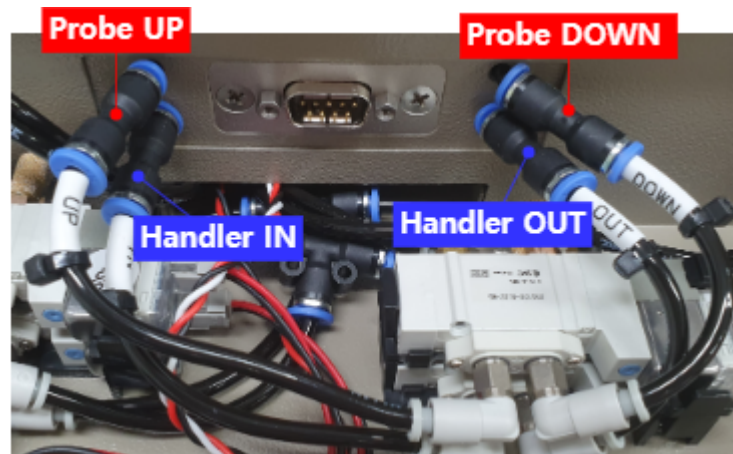


Figure 4-8 Air Hose Connection through Air Ports for Fixture

**NOTICE**

Figure 4-8 Air Hose Connection through Air Ports for Fixture is merely a recommendation, so the actual connection may be adjusted for your convenience.

### 4.4.3.2 Connecting Sensor Cables

If your fixture is set to sensor mode, the sensor connector of Shield Box must be connected to the control board.

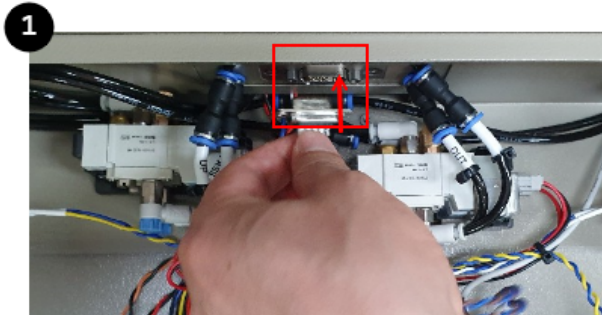
Connect to Sensor Connector inside Control Box



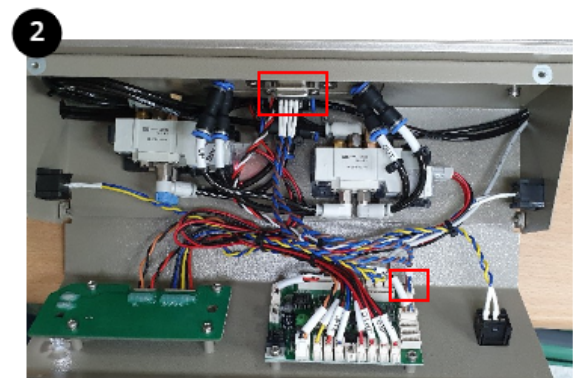
[4105-0315, Sensor Cable]

JP7: Plug into JP7 Connector on CPU Board

JP6: Plug into JP6 Connector on CPU Board



Inside TC-5916AP Control Box



JP6: Probe Downward Sensor

JP7: Handler Inward Sensor

Make sure the number of connector on CPU Board matches with the number of cable.



### 4.4.3.3 Installing Fixture

Handler and Probe Fixture shall be installed inside Shield Box as shown below.

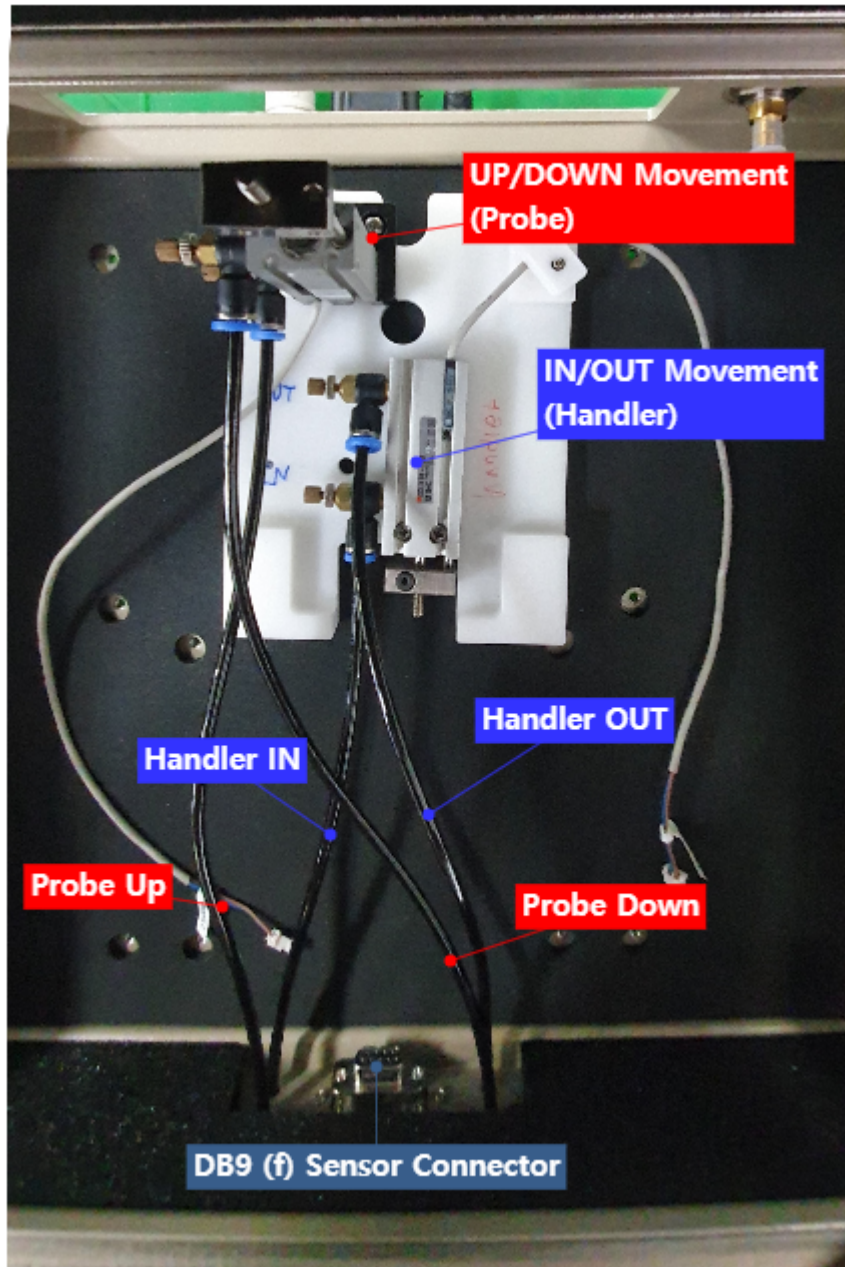


Figure 4-9 TC-5916AP Fixture Install Guide

## 4.5 Shield Box Operation without Fixture

In order to work Shield Box without fixture, the fixture mode must be set to 'Off Mode.'

**NOTICE**

Refer to [5.5.2.2 Handler & Probe Configuration Commands](#)

If the fixture mode is set to 'Sensor Mode,' sensors will detect nothing and thus the lid will stay open as if there is a problem..

Also, if it is set to 'Timer Mode,' the lid will take certain time to open and close, hence the operation is delayed.

# 5. Remote Operation Using RS-232C

TC-5916AP can be controlled remotely via RS-232C

## 5.1 RS-232C Cable Connection

Connect RS-232C Cable to RS-232C DB9 Connector on the rear side of Shield Box.

**CAUTION**

RS-232C Port on Shield Box is a DB9 Connector Female, so DB9 Data Cable (DB9(p) to DB9(s) Male to Female) should be used to connect Shield Box and PC.

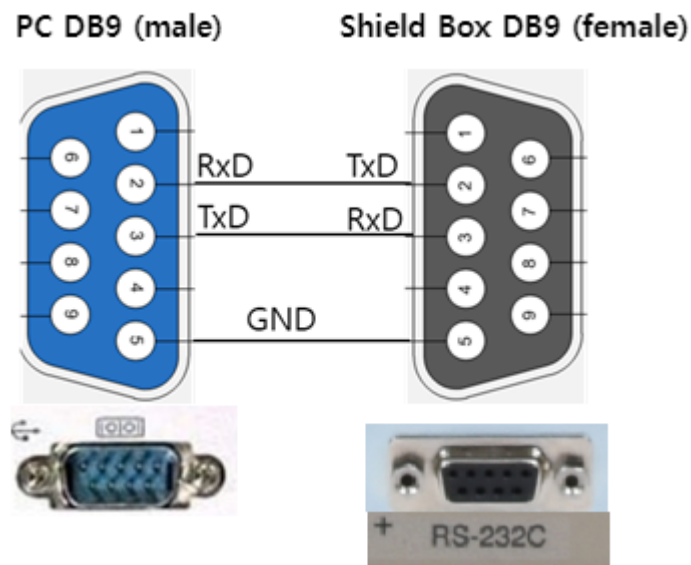


Figure 5-1 RS-232C Cable Pin Configuration



## 5.2 RS-232C Port Setting

UART port setting is required as follows in order to control the shield box via RS-232C.

Table 5-1 RS-232C Port Setting

Data rate	9600 bps
Data bits	8 bit
Parity	None
Stop bits	1 bit
Flow Control	None

## 5.3 Communication via RS-232C

### 5.3.1 Command and Response Message

- ① Every time a command is sent from PC to Shield Box, a CR(Carriage Return :  $\backslash r$  (0x0D)) is sent at the end of it. (Command+ $\backslash r$ (0x0D))
- ② When a command is sent, a response (Response Data+ $\backslash r$ (0x0D)) comes back after a moment.
- ③ If an invalid command is sent, an error (Error Data+ $\backslash r$ (0x0D)) comes back after a moment.
- ④ Commands are capitalization-free.

#### CAUTION

You must wait for a response whenever you send a command from PC to Shield Box. Otherwise, an error will occur.


## 5.4 PC Control with Terminal Application

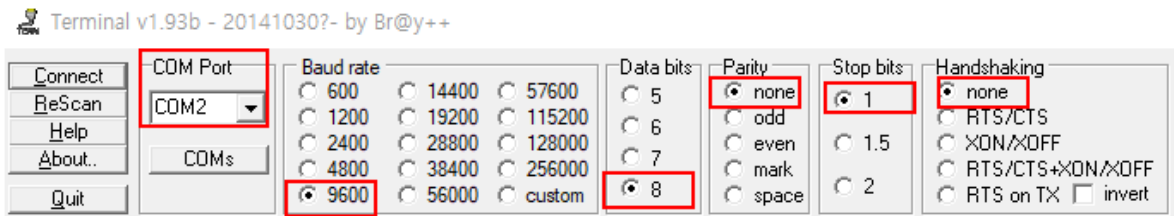
### NOTICE

Below you will see how you can control Shield Box using a communication software 'Terminal.'  
 The application is free to download from here:  
<https://sites.google.com/site/terminalbpp/>

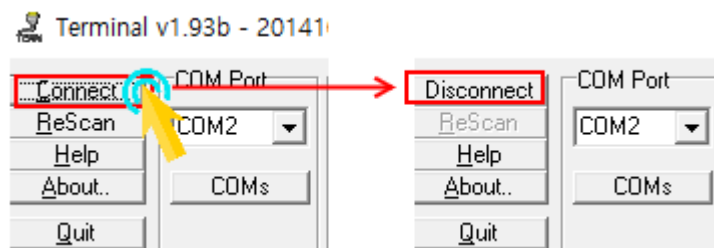
### NOTICE

Before beginning, set everything up in [4.3 Connecting & Setting Up](#) chapter.

- 1 Execute  Terminal .
- 2 Set COM Port, Baud Rate (9600 bps), Data Bit (8 bit), Parity Bit (None), Stop Bit (1 bit), Handshaking (none).

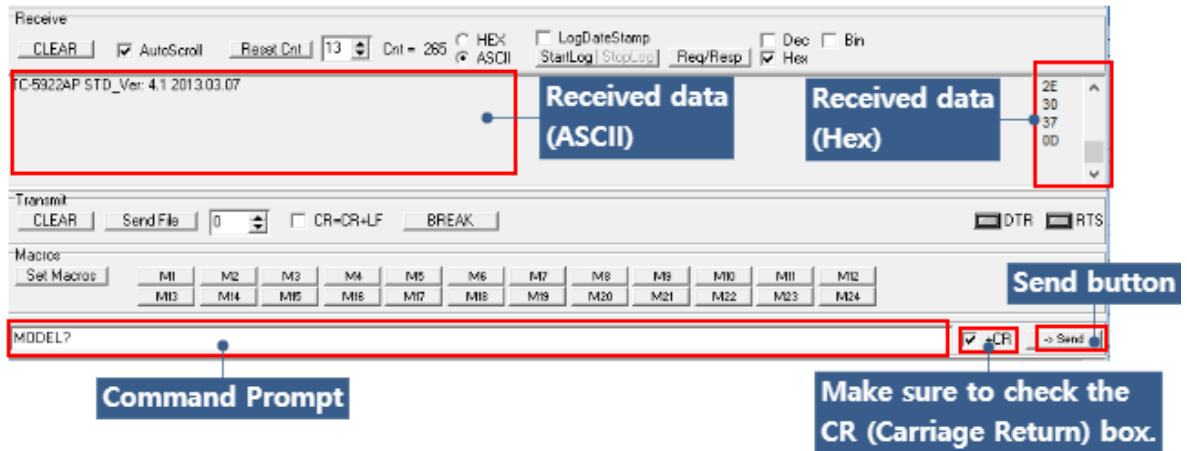


- 3 Press Connect.



4 Send a command and get a response.

1. Enter MODEL? on the command prompt and check +CR ( +CR - 2. A response (the model name and the firmware version) will appear on Receive window.
- 3. Check the Command List and try other commands.



## 5.5 RS-232C Commands

### 5.5.1 System Commands

MODEL?  
COUNT?

#### MODEL?

A query command to see the model name, firmware version, and date.

Type	Query
Input	MODEL?
Response	<Name>_<Version> <Date>
Example	MODEL? TC-5916AP_STD_Ver: 5.2 2019.04.09

#### COUNT?

A query command to check the number of lid(door) opened.

Type	Query
Input	COUNT?
Response	Numeric 8digit (예, 00000029)

### 5.5.2 Configuration Commands

5.5.2.1 Lid Button (OPEN/CLOSE) Configuration Commands  
5.5.2.2 Handler & Probe Configuration Commands

#### NOTICE

The lid will open whenever the lid button or fixture configuration mode is changed.

#### 5.5.2.1 Lid Button (OPEN/CLOSE) Configuration Commands

DUAL HAND?  
 DUAL HAND ON  
 DUAL HAND OFF

## DUAL HAND?

A query command to check the operating mode of the lid.

Type	Query
Input	DUAL HAND?
Response	{ DUAL HAND ON   DUAL HAND OFF } <ul style="list-style-type: none"> <li>• DUAL HAND ON : Both Lid OPEN/CLOSE Buttons should be pressed to close.</li> <li>• DUAL HAND OFF: Only one Lid OPEN/CLOSE Button is enough to close.</li> </ul>

## DUAL HAND ON

A command to set the Lid OPEN/CLOSE Button to Dual Hand Mode.

Two buttons on both sides of the control box must be pressed simultaneously to close the lid. Either one button works to open the lid.

Type	Command
Input	DUAL HAND ON
Response	OK

## DUAL HAND OFF

A command to turn the Dual Hand Mode off.

Only one button on the right hand side will work to open/close the lid.

Type	Command
Input	DUAL HAND OFF
Response	OK

### CAUTION

It is strongly recommended to use the Dual Hand Mode unless absolutely unnecessary. The other hand may be trapped if the mode is off.

## 5.5.2.2 Handler & Probe Configuration Commands

```
SOLENOID MODE?
HANDLER MODE SENSOR
HANDLER MODE TIMER
HANDLER MODE OFF
PROBE MODE SENSOR
PROBE MODE TIMER
PROBE MODE OFF
```

### SOLENOID MODE?

A query command to see the Handler & Probe operation modes.

<b>Type</b>	Query
<b>Input</b>	SOLENOID MODE?
<b>Response</b>	Handler:<mode>, Probe:<mode> <ul style="list-style-type: none"> <li>• &lt;mode&gt;: {OFF   TIMER   SENSOR }</li> </ul>
<b>Example</b>	// Below is how to change the Probe Mode from Off to Timer. SOLENOID MODE? Handler:OFF, Probe:OFF PROBE MODE TIMER OK

### CAUTION

It is NOT recommended operating fixture with the Timer Mode.  
 Without sensors, the lid may close even when the fixture operation is incomplete, thus causing damage to the product or DUT.

### HANDLER MODE SENSOR

A command to set the Handler in Sensor Mode.

<b>Type</b>	Command
<b>Input</b>	HANDLER MODE SENSOR
<b>Response</b>	OK

## HANDLER MODE TIMER

---

A command to set the Handler in Timer Mode.

Type	Command
Input	HANDLER MODE TIMER
Response	OK

---

## HANDLER MODE OFF

---

A command to set the Handler in Off Mode.

Type	Command
Input	HANDLER MODE OFF
Response	OK

---

## PROBE MODE SENSOR

---

A command to set the Probe in Sensor Mode.

Type	Command
Input	PROBE MODE SENSOR
Response	OK

---

## PROBE MODE TIMER

---

A command to set the Probe in Timer Mode.

Type	Command
Input	PROBE MODE TIMER
Response	OK

---

## PROBE MODE OFF

---

A command to set the Probe in Off Mode.

Type	Command
Input	PROBE MODE OFF
Response	OK

---

## 5.5.3 Lid Operation Commands

OPEN  
CLOSE  
LID?

### OPEN

A command to open the lid.

Type	Command
Input	OPEN
Response	OK <ul style="list-style-type: none"> <li>• OK : The lid opens (or is already open)</li> </ul>

#### NOTICE

If the lid does not open while the 'OPEN' command is sent and 'OK' response comes back, check the compressed air supply.

### CLOSE

A command to close the lid.

The Lid-Close Sensor on a cylinder will glow red if the lid is closed regularly.

Type	Command
Input	CLOSE
Response	{ READY   ERR20   ERR30   ERR60 } <ul style="list-style-type: none"> <li>• READY : Lid closed. Ready to test.</li> <li>• ERR20 : Only occurs when the Handler is in Sensor Mode. Inward Handler Sensor detection error. (The horizontal operation of the fixture is incomplete.)</li> <li>• ERR30 : Only occurs when the Probe is in Sensor Mode. Downward Probe Sensor detection error. (The vertical operation of the fixture is incomplete.)</li> <li>• ERR60 : Safety error. Multiple operation error.</li> </ul>



## LID?

A query command to check the current status of the lid.

Type	Query
Input	LID?
Response	{ OPEN   CLOSE } <ul style="list-style-type: none"> <li>• OPEN : Lid opened</li> <li>• CLOSE : Lid closed</li> </ul>

## 5.5.4 Handler Operation Commands

```
HANDLER?
INWARD
OUTWARD
```

## HANDLER?

A query command to check the current status of the Handler.

Type	Query
Input	HANDLER?
Response	{ INWARD   OUTWARD } <ul style="list-style-type: none"> <li>• INWARD: The Handler is at inward position.</li> <li>• OUTWARD: The Handler is at outward position.</li> </ul>

## INWARD

---

A command to put the Handler in.

When the lid is closed, only the INWARD command works. The OUTWARD command does not work and return the 'ERR40.'

Type	Command
Input	INWARD
Response	{ OK   ERR20   ERR40   ERR90 } <ul style="list-style-type: none"> <li>• OK: The Handler is at inward position.</li> <li>• ERR20: Only occurs when the Handler is in Sensor Mode. Inward Handler Sensor detection error. (The horizontal operation of fixture is incomplete.)</li> <li>• ERR40: Status Error, It occurs when an invalid command is sent. For example:             <ul style="list-style-type: none"> <li>◦ Handler OUTWARD or Probe UPWARD command is sent while the lid is closed.</li> <li>◦ Probe DOWNWARD or UPWARD command is sent while the Handler is at outward position.</li> <li>◦ Handler OUTWARD command is sent while the Probe is at downward position.</li> </ul> </li> </ul> *ERR90: The command is sent while the Handler is in Off Mode.

---

## OUTWARD

---

A command to drag the Handler out.

If the OUTWARD command is sent while the lid is closed or the Probe operation commands (DOWNWARD/UPWARD) are sent while the Handler is at outward position, it will only return 'ERR40.'

Type	Command
Input	OUTWARD
Response	{ OK   ERR40   ERR90 } <ul style="list-style-type: none"> <li>• OK: The Handler is at outward position.</li> <li>• ERR40: Status Error, It occurs when an invalid command is sent. For Example:             <ul style="list-style-type: none"> <li>◦ Handler OUTWARD or Probe UPWARD command is sent while the lid is closed.</li> <li>◦ Probe DOWNWARD or UPWARD command is sent while the Handler is at outward position.</li> <li>◦ Handler OUTWARD command is sent while the Probe is at downward position.</li> </ul> </li> <li>• ERR90: The command is sent while the Handler is in Off Mode.</li> </ul>

---

## 5.5.5 Probe Operation Commands

PROBE?  
UPWARD  
DOWNWARD

### PROBE?

A query command to check the current status of the Probe.

Type	Query
Input	PROBE?
Response	{ UPWARD   DOWNWARD } <ul style="list-style-type: none"> <li>• UPWARD: The Probe is at upward position.</li> <li>• DOWNWARD: The Probe is at downward position.</li> </ul>

### UPWARD

A command to lift the Probe up.

Type	Command
Input	UPWARD
Response	{ OK   ERR40   ERR90 } <ul style="list-style-type: none"> <li>• OK: The Probe is at upward position.</li> <li>• ERR40: Status Error, It occurs when an invalid command is sent. For example:                         <ul style="list-style-type: none"> <li>◦ Handler OUTWARD or Probe UPWARD command is sent while the lid is closed.</li> <li>◦ Probe DOWNWARD or UPWARD command is sent while the Handler is at outward position.</li> <li>◦ Handler OUTWARD command is sent while the Probe is at downward position.</li> </ul> </li> <li>• ERR90: The command is sent while the Probe is in Off Mode.</li> </ul>

## DOWNWARD

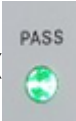
A command to lower the Probe down.

Type	Command
Input	DOWNWARD
Response	{ OK   ERR30   ERR40   ERR90 } <ul style="list-style-type: none"> <li>• OK: The Probe is at downward position.</li> <li>• ERR30: Only occurs when the Probe is in Sensor Mode. Downward Probe Sensor detection error. (The vertical operation of fixture is incomplete.)</li> <li>• ERR40: Status Error, It occurs when an invalid command is sent. For example:                             <ul style="list-style-type: none"> <li>◦ Handler OUTWARD or Probe UPWARD command is sent while the lid is closed.</li> <li>◦ Probe DOWNWARD or UPWARD command is sent while the Handler is at outward position.</li> <li>◦ Handler OUTWARD command is sent while the Probe is at downward position.</li> </ul> </li> <li>• ERR90: The command is sent while the Probe is in Off Mode.</li> </ul>

## 5.5.6 PASS/FAIL Commands (While The Lid is Closed)

### PASS

A command that decides PASS after a test.

If the PASS command is sent, the PASS LED on the control box glows green () and the lid opens automatically.

Type	Command
Input	PASS
Response	{ OK   ERR40 } <ul style="list-style-type: none"> <li>• OK : turns the green PASS LED on, and the lid opens.</li> <li>• ERR40: Status Error, The command is sent while the lid is open.</li> </ul>

### FAIL

The FAIL LED on the control box glows red () and the lid does **NOT** open.

Type	Command
Input	FAIL
Response	{ OK   ERR40 } <ul style="list-style-type: none"> <li>• OK : turns the red FAIL LED on.</li> <li>• ERR40: Status Error. The command is sent while the lid is open.</li> </ul>

## 5.5.7 Error Data List

**Table 5-2** The List of Error Data

Error Code	Description
ERR10	Syntax error. The command does not exist or is invalid.
ERR20	It only occurs when the Handler is in Sensor Mode. Inward Handler Sensor detection error. (The horizontal operation of fixture is incomplete.)
ERR30	It only occurs when the Probe is in Sensor Mode. Downward Probe Sensor detection error. (The vertical operation of fixture is incomplete.)
ERR40	Status Error, It occurs when an invalid command is sent. For example, a Handler OUTWARD or Probe UPWARD while the lid is closed. It is returned if the command is sent when the motion can not be done in conjunction with the current status.
ERR50	Lid Open Sensor error. It occurs only to certain products which should always detect whether the lid is open. The response comes when the sensor does not detect open lid.
ERR60	Safety error. It is returned when a problem in multiple motions occurs.
ERR90	It occurs when the command is sent while the Handler or the Probe is in Off Mode.

## 5.6 RS-232C Commands List

**Table 5-3** TC-5916AP RS-232C Commands List

RS-232C Command		Response	Description
System	MODEL?	Name+Version+Date	Verify model name and firmware of the product
	COUNT?	Numeric 8 digit(ex: 00000001)	Cumulative operation counter
Configuration (Lid Button Operation mode)	DUAL HAND?	DUAL HAND ON   DUAL HAND OFF	Check Lid OPEN/CLOSE Button Mode
	DUAL HAND ON	OK	Turn the Dual Hand Mode on.
	DUAL HAND OFF	OK	Turn the Dual Hand Mode off.
Configuration (Handler & Probe)	SOLENOID MODE?	Handler:xxx, Probe:xxx xxx: {OFF TIMER SENSOR}	Check Handler and Probe Mode
	HANDLER MODE SENSOR	OK	Set Handler Mode to Sensor Mode
	HANDLER MODE TIMER	OK	Set Handler Mode to Timer Mode
	HANDLER MODE OFF	OK	Set Handler Mode to Off Mode
	PROBE MODE SENSOR	OK	Set Probe Mode to Sensor Mode
	PROBE MODE TIMER	OK	Set Probe Mode to Timer Mode
	PROBE MODE OFF	OK	Set Probe Mode to Off Mode
Lid Operation Commands	LID?	OPEN   CLOSE	Check the current lid status
	OPEN	OK	Open the lid
	CLOSE	READY   ERR20   ERR30   ERR60	Close the lid
Handler Operation Commands	HANDLER?	INWARD   OUTWARD	Check the current Handler status
	INWARD	OK   ERR20   ERR40	Push the Handler in
	OUTWARD	OK   ERR40   ERR90	Drag the Handler out
Probe Operation Commands	PROBE?	UPWARD   DOWNWARD	Check the current Probe status
	UPWARD	OK   ERR40   ERR90	Lift the Probe up
	DOWNWARD	OK   ERR30   ERR40   ERR90	Lower the Probe down
PASS/FAIL (While The Lid is Closed)	PASS	OK   ERR40	Turn the green PASS LED on Open the lid
	FAIL	OK   ERR40	Turn the red FAIL LED on

# **PART 4. Maintenance**

---

## 6. Maintenance

### 6.1 Maintenance

TC-5916AP Pneumatic Shield Box is designed and built for long life and easy maintenance.

Optimal RF shielding is obtained by using gaskets between the body and the lid. It must be checked periodically for wear and tear which would compromise the performance. Pressure on the gasket by the lid results in a proper RF seal.

#### Check List for Maintenance

- Check for loose screws and tighten with proper tools, if necessary.
- Check for a loose connection. If a loose connector is found, tighten the connector with proper tools.
- Check for a damaged cable, especially near the connector-cable neck. Replace any damaged cables found.
- Visually inspect the RF seal (gasket) between the Shield Box body and lid for wear and tear.
- If there is excessive amount of dust or foreign substance on the aluminum surface (especially parts contact with gaskets), wipe it out with dry cloth.

**When cleaning gaskets,  
blow the dust with compressed air.  
If an excessive wear and tear is found,  
it should be replaced.**



Figure 6-1 TC-5916AP Gasket Placement



**CAUTION**

Do not clean this equipment with organic solvents such as benzene, toluene or acetone as they will damage the gasket parts.

## 6.2 Performance Test

TESCOM Shield Boxes are precision RF devices built very sturdily. Their electrical performance can, however, deteriorate with mechanical damages.

Worn out shielding gaskets, as well as metal corrosion or oxidation at the lid contact, can significantly reduce the effectiveness of the Shield Box. This section describes the test and calibration procedure for the Pneumatic Shield Box.

**CAUTION**

Performance test should be carried when performing the Pneumatic Shield Box maintenance and repair works.

### 6.2.1 Calibration Period

- Recommended calibration period : less than 6 months

**NOTICE**

The calibration period can vary depending on the number of operations and the equipment management method.

### 6.2.2 Required Equipment

- Spectrum Analyzer : < 6 GHz
- Signal Generator : < 6 GHz
- Dipole Antenna : TESCOM 900 MHz, 1.8 GHz, 2.4 GHz, 5.8 GHz

### 6.2.3 Performance Test Set Up

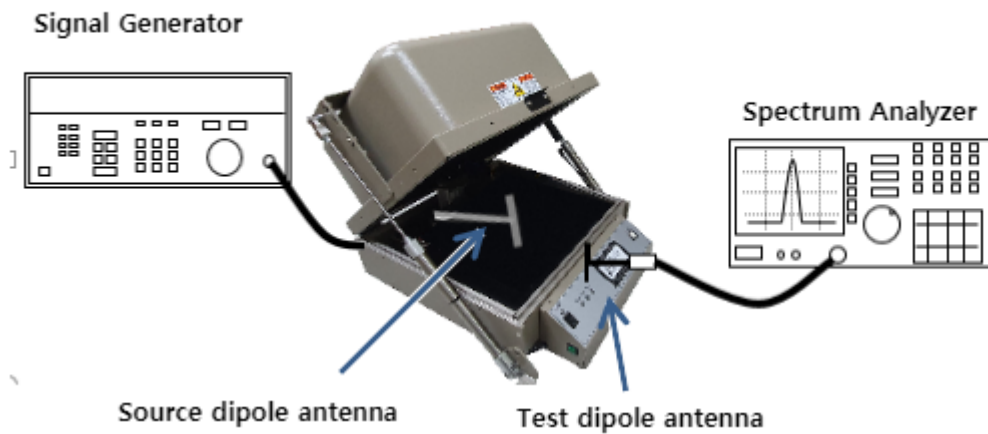


Figure 6-2 TC-5916AP Performance Test Set Up

### 6.2.4 Standard Specification

Frequency	Shielding effectiveness (dB)
100 to 2000 MHz	> 70 dB
2000 to 3000 MHz	> 70 dB
3000 to 6000 MHz	> 60 dB

**NOTICE**

The shielding effectiveness below is measured with blank panels; other I/O interface panels may result in different shielding effectiveness of the shield box. Please refer to [Table 3-1 Pre-configured Panels for TC-5916AP](#) and [Table 3-2 Custom I/O Interface](#).

## 6.2.5 Test Procedure

### NOTICE

Before measuring, check the shielding gasket around the lid. If there is a damaged part, replace the gasket and wipe the contact area, which is between the lid and the body except the gasket, with alcohol.

- 1 Turn the spectrum analyzer and signal generator on.
- 2 Using an RF cable, connect the RF Connector(N Type) on the rear side of TC-5916AP Shield Box to the RF output port(N Type) of signal generator.
- 3 Open the Shield Box lid and connect the 900 MHz Source Dipole Antenna to RF Port(SMA Type) inside the Shield Box. (Place the antenna at the center of the Shield Box.)
- 4 Set the output of signal generator to CW900 MHz, 10 dBm.
- 5 Connect the test antenna to the spectrum analyzer.



- 6 Set the spectrum analyzer as follows:
  - Center Frequency : 900 MHz
  - Span : 1 MHz
  - Amplitude: +10 dB
- 7 Circle the test antenna around the Shield Box lid, and check the maximum reception. (Make sure the lid is OPEN.)
  - Press Peak Search button on the spectrum analyzer to set the maximum value of measurement standard.

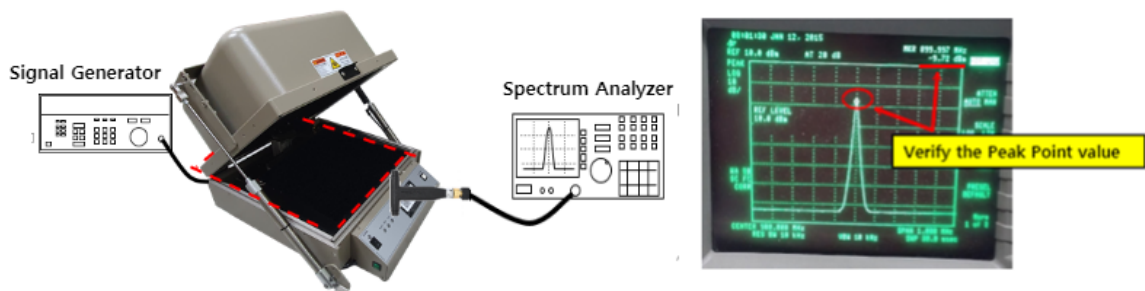


Figure 6-3 Measurement Standard Searching

- 8 Close the lid.
- 9 Set the input range of the spectrum analyzer as follows:
  - Center Frequency : 900 MHz
  - Span : 1 MHz
  - Amplitude: -30 dB
- 10 Circle the test antenna around the entire Shield Box, particularly around the lid and modules on the rear panel. Check the maximum leakage.



Figure 6-4 Maximum Leakage Test (Ex, value : -90 dBm)

**CAUTION**

Make sure the test antenna does not contact the surface of the Shield Box or the lid.

- 11 See if the difference between the measurement standard (a) and the maximum leakage (b) is within the specification (Shielding Effectiveness) of the product.

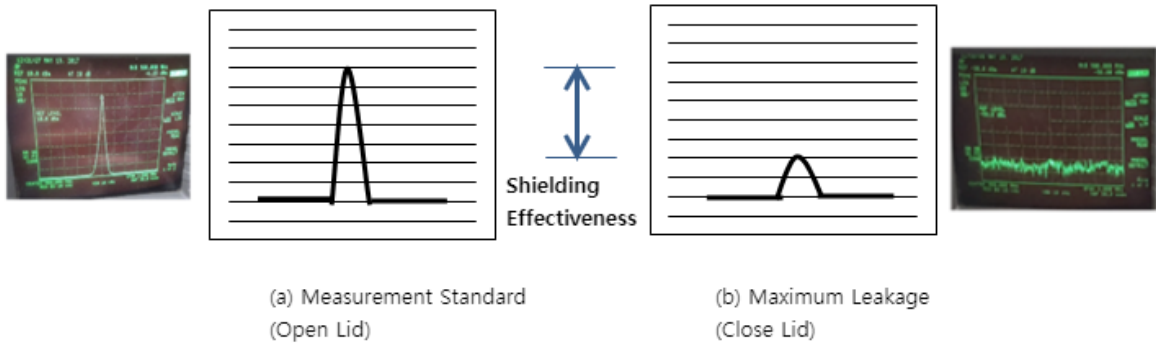


Figure 6-5 Spectrum Analyzer Display

- 12 Repeat the procedure with the frequency set to 1.8 GHz, 2.4 GHz, 5.8GHz.

# 7. Expendables and Accessories

Below is the list of expendables and accessories of TC-5916AP Shield Box. Please contact Tescom headquarters or your local distributor to order.

## 7.1 Expendables and Accessories

Below is the list of expendables and accessories. Please note that these items are NOT under warranty.

**Table 7-1** List of Expendables & Accessories

No.	View	Part designation	Order number	Qty	Remarks
①		Foam Gasket Set	R5916A-81	1 Set	4 kinds, 2 pcs each. 8 pcs total.
		SS-402, N(m) to N(m) 1m	4011-0001	1 ea	
		Data, DB9(p)-DB9(s) 2M	4003-0025	1 ea	See <a href="#">Figure 4-2 Cable Connection</a>



Figure 7-1 TC-5916AP Expendables Location

## 8. Check List for Common Problems

Below is the check list for common mistakes. Before calling for help, make sure the problem is NOT one of following issues nor a malfunction of any OTHER connected equipment.

### Power Supply Check

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- Verify that the power cord is connected to the product and the switch is on.
- Verify that the power supply is not short or out.
- Verify that the line voltage is within range of 100 ~ 240 VAC.

### Compressed Air Check

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- Check the connection of compressed air supply.
- Check the pressure. It should be within range of 5 ~ 10 bar.

### Data Cable Connection Check

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- If you are using PC to control the product, check the connection of RS-232C cable and the software settings.