



Model 611
Mass Airflow Machine Test Stand

Dimensions: 33" H x 24" W x 36" D
838mm H x 610mm W x 559mm D

GAS TURBINE AND JET ENGINE COMPONENT TESTING

Mass Airflow Capacity

PRODUCT REQUIREMENTS

Multiple manufacturers in the Aerospace industry required Airflow Test Stands to calculate Mass Airflow and test equations. Flow test sequences, called "circuits," can automatically flow air with multiple test steps and various airflow equations (such as specialized reduced airflow measurements). CCDI was first in the industry to offer such test equations, and has continued to do so for over 40 years.

EFFICIENT TESTING SOLUTION

The Model 611 is a system designed to test the mass airflow capacity of one or two turbine engine components. The portable automatic test stand is one of the few machines to measure multiple components simultaneously, thus improving the efficiency of part testing.

FEATURES

- Mass Flow Measurement Accurate to +/- .50%
- Mass Flow Measurement Repeatable to +/- 0.25%
- Ideal for Production Cells and Special Applications
- Configurations Available: 611, 611XH

SYSTEM SPECIFICATIONS

NIST Traceable Air flow Measurement, can also be used for EFA (inches H₂O option)
15 to 30 Seconds per Part Test, Fast response
Manual Flow Valve Operation (Automatic Pressurization optional)
Flow Range Determined by Nozzle Size
Interchangeable Flow Nozzles (choice of 11)
Single/Dual Sonic Flow Nozzles (1 or 2)
Low Pressure Option: 0-2 PSIG (0-14 kPa), 0-50"H₂O or High Pressure Testing: 0-50 PSIG (0-345 kPa)
English and SI Units
IBM Pentium Computer
MS Windows Based Part Test Software

QC Report, Label and Data Acquisition File

Operator Training, Testing, Certification

Two-Year Warranty on Parts and Labor

Can also flow small Effective Flow Areas measurements (using Low Press. Option)

High Range Model Available for 0.353-0.707" (0.9-1.8 cm) dia. Sonic Nozzles

Flow Capabilities

0.000119 to 0.102682 Pounds per Second (0.000054 to 0.046575 kg/s), varies with nozzles purchased

0.000189 to 0.163089 Flow Parameter

Airflow Flow Test Stand Flow Ranges (see nozzle sizes)

NOZZLE	Min Flow	Max Flow	Min	Max	Min	Max	Min	Max
DIA.IN.	lbs/sec	lbs/sec	FP	FP	EFA	EFA	EFA	EFA
					@5"H2O	@5"H2O	@10"H2O	@10"H2O
0.015	0.00014	0.00041	0.000222	0.000643	0.0018	0.0052	0.0013	0.0037
0.021	0.0003	0.0008	0.000437	0.001260	0.0035	0.0102	0.0025	0.0072
0.025	0.0004	0.0011	0.000619	0.001785	0.0050	0.0145	0.0036	0.0102
0.031	0.0006	0.0017	0.000951	0.002745	0.0077	0.0223	0.0055	0.0157
.021+.031	0.0009	0.0025	0.001388	0.004004	0.0113	0.0325	0.0080	0.0230
.025+.031	0.0010	0.0029	0.001571	0.004530	0.0127	0.0367	0.0090	0.0260
0.044	0.0012	0.0035	0.001917	0.005530	0.0155	0.0448	0.0110	0.0317
.021+.044	0.0015	0.0043	0.002354	0.006790	0.0191	0.0551	0.0135	0.0389
.025+.044	0.0016	0.0046	0.002537	0.007316	0.0206	0.0593	0.0146	0.0420
.031+.044	0.0018	0.0052	0.002868	0.008275	0.0233	0.0671	0.0165	0.0475
0.062	0.0024	0.0069	0.003807	0.010980	0.0309	0.0890	0.0218	0.0630
.062+.031	0.0030	0.0086	0.004759	0.013726	0.0386	0.1113	0.0273	0.0787
.062+.044	0.0036	0.0104	0.005724	0.016510	0.0464	0.1339	0.0328	0.0947
0.088	0.005	0.014	0.007668	0.022120	0.0622	0.1794	0.0440	0.1269
.088+.044	0.0060	0.0174	0.009585	0.027651	0.0777	0.2242	0.0550	0.1586
.088+.062	0.0072	0.0208	0.011475	0.033102	0.0931	0.2684	0.0658	0.1899
0.125	0.010	0.028	0.015473	0.044633	0.1255	0.3619	0.0888	0.2560
.125+.062	0.013	0.037	0.020232	0.058359	0.1641	0.4732	0.1161	0.3348
.125+.088	0.015	0.042	0.023141	0.066754	0.1876	0.5413	0.1327	0.3829
0.177	0.02	0.06	0.031024	0.089491	0.2516	0.7257	0.1780	0.5133
.177+.088	0.026	0.074	0.040609	0.117143	0.3293	0.9499	0.2329	0.6720
.177+.125	0.029	0.084	0.046497	0.134125	0.3770	1.0876	0.2667	0.7694
0.250	0.04	0.11	0.061891	0.178532	0.5019	1.4477	0.3550	1.0241
.250+.125	0.052	0.149	0.082123	0.236891	0.6659	1.9209	0.4711	1.3589
.250+.177	0.059	0.169	0.092915	0.268023	0.7534	2.1733	0.5330	1.5374

Notes:

FP = Flow Parameter lbs/sec * Sqrt(Temperature) / Room Pressure

EFA = Square Inch Area Measurement - Requires Inches of water gauge option

FACILITY REQUIREMENTS

Electrical Power and Air	100-250 VAC Single Phase, 50-60 Hz, 5A Service Pressurized air at 100 psig, dry to 0° F Dew Point		
Pressure Range	0.5 to 50 PSIG – Standard 0-50 Inches Water Gauge – Optional		
Temperature Ranges	T1 Upstream Temperature 46-120°F (8- 49 °C) T3 Part Downstream Temperature 46-120°F (8- 49 °C)		
Transducer Pressure Ranges	P1 Upstream Pressure	0-100 PSIG (0-690 kPa)	0.10% FS
	P2 Downstream Pressure	0-100 PSIG (0-690 kPa)	0.25% FS
	P3 Part Pressure	0-50 PSIG (0-345 kPa)	0.10% FS
	P4 Probe Pressure	0-30 PSIG (0-207 kPa)	0.10% FS
	PB Barometric Pressure	26-32"HgA	0.10% FS
	T1 Upstream Temp	46-120°F (8- 49 °C)	+/- 1DegF
	T3 Downstream Temp	46-120°F (8- 49 °C)	+/- 1 DegF

SOFTWARE

CCDI Airflow Test Stands have basic operation screens and a calibration screen.

Test Screen - Users operate the machine from this screen.

Setup Screen - Contains the machine configuration and calibration data.

Diagnostic Screen - Displays state of valves and nozzles used.

CCDI Mass Airflow Test Screen
Select Edit Setup Diagnostics Quit Help About Print Screen Version 6.55G

Part ID: <NEW> Find Cust: Op/Date: DRB/15Mar07
Circuit: <NEW> Assy: Order:
Stage: Serial: Track #:
Apply Recall Old Test

Circuit	S1	S2	R1	R2	R3	S
<NEW>	0.00	0.00	0.000	0.000	0.000	0.000
<NEW>	0.00	0.00	0.000	0.000	0.000	0.000

P1: 0.00 P3: 0.00
P4: 0.00 PB: 0.00
T1: 0.0 T3: 0.0

Equation: 0 R1max: 0.000000
Scale: 0=Norm R1min: 0.000000
1=Water Gauge R2max: 0.000000
Std Baro: 0.00 R2min: 0.000000
Std Temp: 0.00 R3max: 0.000000
Set 1: 0.00000 R3min: 0.000000
Set 2: 0.00000 R-typical: 0.000000
Apply Detail -F3

Filename: testrec.dat Apply
☒ PID ☐ Rst
 -1.0 -0.1 -0.01 -.001 +.001 +0.01 +0.1 +1.0 Tm DC DC 0.000

Message: Clear

XXX	ID BOX	TST BOX	TST (A)	TST (B)	ACCEPT	PRINT	TST (C)	TST (D)	TST (E)	SAVE	RSLT BX
F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12

Status: Check T3 - Low Readings

Test Screen

Menu Bar - Allows navigation to other screens, selection of part test programs, finding information.

Identification Box - In the upper left corner box, fill in details associated with the airflow test that gets recorded and printed. This information is also kept with files that can be transmitted to a network.

Test/Log Box - CCDI machines can have up to 64 test sequences (or increased as needed) for a single part. The first box (short) is the real time results box that shows the test data in operation. The second box (long) is the log of the test results. Some software versions have three result boxes for parts that use "Exit Flow" measurements. The log provides a summary of test data.

Gauge Displays - Gauge measurement readings. They are automatically converted to units that match the parts being measured.

Test Parameters Box - Right corner box allows the test parameters and limits to be entered. More information can be entered by selecting "Detail," which will prompt the detail box.

Filename - This allows selection of a filename for the test data. The filename can be stored in the part "profile" - A file recipe in the hard drive for the next time you test.

PID Control Box - Displays activity of the pressurization controller and allows user to adjust values.

Message and Status Boxes - Messages from the system and operator instructions can be posted here.

Function Key Menu - Our test screen can be operated by mouse or function key.

Flow Test Details & Special Commands	
Accept Band: <input type="text" value="0.00"/> %	<input type="checkbox"/> Enable PID Multiplier:
<input type="checkbox"/> Auto Timer: <input type="text" value="0"/> Seconds	Proportional: <input type="text" value="0.000"/>
<input type="checkbox"/> Auto Step (at finish) to Next Circuit	Integral Gain: <input type="text" value="0.000"/>
<input type="checkbox"/> Keep air flowing for next flow test	Deriv. Gain: <input type="text" value="0.000"/>
<input type="checkbox"/> Startup Pressure Delay: <input type="text" value="0"/> Seconds	Sample Rate: <input type="text" value="0.000"/>
<input type="checkbox"/> Manual Nozzles: Noz #'s: <input type="text" value="00"/>	Reset Time: <input type="text" value="0.000"/>
<input type="checkbox"/> Require Serial Number	PID Adjust: <input type="text" value="0.000"/>
Force Flow Port: * <input type="text"/>	Valve Enable: <input type="text" value="00"/>
	Starting Voltage: <input type="text" value="0.000"/>
	<input type="checkbox"/> Always Record Voltage
User Instructions: <input type="text"/>	
Test Data in [8.3] Filename: <input type="text" value="testrec.dat"/>	<input type="button" value="Print"/>
Profile Name: test.tst	<input type="button" value="Close/Apply"/>
Master Part Limits	
R1 Max: <input type="text" value="0.0000000"/>	R2 Max: <input type="text" value="0.0000000"/>
R3 Max: <input type="text" value="0.0000000"/>	
R1 Min: <input type="text" value="0.0000000"/>	R2 Min: <input type="text" value="0.0000000"/>
R3 Min: <input type="text" value="0.0000000"/>	
<input type="checkbox"/> Perform Master Checking <input type="checkbox"/> Disable testing on fail	
Circuit No: 01	

Detail Box

From this screen, you can adjust percent error allowed on setpoints and the "Auto Timer" to shut off the air for a certain period of time. This will end the test after the pressure is consistent for the selected time interval.

Auto-step allows the next flow sequence to proceed automatically. The Startup Delay makes time at the beginning of the test to stabilize.

Manual Nozzle allows the user to select the nozzles. The system defaults to setpoint and flow limit information. The Master Parts Limits section is to be completed by the user as well.

The PID Control (Pressurization) can be finely tuned for the most demanding production lines.

Note: Fixtures/Tooling varies in volume. These parameters are adjustable to achieve the best response

Flow Testing Features

- CCDI Airflow machines were the first machines on the market with automatic sequencing.
- If you test a part in various manufacturing stages, the old data can be recalled at a later time to fill-in the blanks.
- Automatic or Manual, Single or Dual Nozzle Selection Available
- Two-stage cancel button can temporarily stop a test and restart; a second cancel can discard the results to start over.
- Beginning of a test can be paused for a specified number of seconds.
- Test results record all gauges and K values making analysis simple for auditing.
- In a Flow Restriction Test, the PID control can be turned off in order to monitor for flow restriction cause by external tooling.
- The program has leak tests that check for internal and external leaks at various stages
 - Our leak testing sequences can be automated
 - Volume based leak tests allow for fixed volume entry in testing parameters.
- The Diagnostic screen is great tool for technicians and makes understanding of the equipment easy for maintenance

Setup Screen - CCDI Mass Airflow

Utilities Save Setup Return to Test Screen Print Screen Change Password

Sonic Nozzle K Form		System Configuration		Machine SN: 644-01-1234		Sensor/Transducer Calib.	
Nozzle 1 Dia:	0.021	Max. Shop Press:	85.00	Leak Test Delay:	08	P1 Sensor Read	
PSIA	K	Accept Band %:	0.30	Nozzle Count:	09	PSIG	% F.S.
41.009	0.000187164	Xducer Input/Range:	10+100	System Series:	622	0.00	0.000 C
42.990	0.000187296	Acquisition Device:	5141	Display COM:	1	10.00	27.500 C
44.974	0.000187572	PID Reset Time:	10	Acquis. COM:	2	20.00	35.410 C
50.000	0.000187926	Dual Nozzle Selection:	<input checked="" type="checkbox"/>	High Speed 232:	<input type="checkbox"/>	30.00	43.340 C
55.004	0.000188645	Disable PID Control:	<input type="checkbox"/>	Master Checking:	<input type="checkbox"/>	40.00	51.280 C
60.005	0.000188912	Invert Digital Outputs:	<input type="checkbox"/>	PID 2level Disable:	<input type="checkbox"/>	50.00	59.200 C
64.980	0.000189519	Audit Flow Test:	<input type="checkbox"/>	P3 Low Option:	<input type="checkbox"/>	60.00	67.120 C
74.991	0.000190227	Blank Serial on Save:	<input type="checkbox"/>	Don't forget to Save:	<input type="checkbox"/>	70.00	75.070 C
84.993	0.000190812	Separate DATA Folder:	<input checked="" type="checkbox"/>	Already Mastered:	<input type="checkbox"/>	85.00	86.940 C
89.998	0.000191529	Record Starting Voltage:	<input type="checkbox"/>	Part Recall Reset:	<input type="button" value="Apply"/>	100.00	98.810 C
Date:	12-Sep-06	Printout Title:				Date:	11-Dec-06
Calib. By:		Printout 2nd:	CCDI Mass Airflow Stand - SN: 644-34-1920			Cal. By:	cls
Sonic Ratio:	1.50	Pressurization PID Control				S/N:	1095159
S/N:	644-27-021	PID Control for:				Prev Next Apply	
Prev Next Apply		P3 - Nozzle 1					
		Prop. Gain:	0.250			Setup Errors / Notes / Warnings	
		Int. Gain:	0.100				
		Der. Gain:	0.010				
		Samp. Rate:	0.500				
		Next Apply					

Setup Screen: Contains nozzle calibration, transducer calibration, system configuration data, and built-in pressurization tuning information.

Diagnostic Screen - CCDI Mass Airflow

Utilities Emerg. Vent Reset I/O Return To Test Screen Print Screen

Digital Output

- ☐ System Air Off - 1
- ☐ #6 Nozzle Flow - 4
- ☐ #5 Nozzle Flow - 5
- ☐ #4 Nozzle Flow - 6
- ☐ #3 Nozzle Flow - 7
- ☐ #2 Nozzle Flow - 8
- ☐ #1 Nozzle Flow - 9
- ☐ Engage P3 Low - 18
- ☐ Vent Transducers - 19

622/620 Digital Output Control

- ☐ Rt. Lower Flow Port A - 11
- ☐ Lt. Lower Flow Port C - 12
- ☐ Rt. Upper Flow Port B - 13
- ☐ Lt. Upper Flow Port D - 14

- ☐ Reserved - 2
- ☐ Reserved - 3
- ☐ Reserved - 10
- ☐ Reserved - 15
- ☐ Reserved - 16
- ☐ Reserved - 17
- ☐ Reserved - 20
- ☐ Reserved - 21
- ☐ Reserved - 22
- ☐ Reserved - 23
- ☐ Reserved - 24

Foot Pedal:

Analog In - Scaled Units

Upstream Pressure P1:	<input type="text" value="0.000"/>	Absolute Pressure PB:	<input type="text" value="0.000"/>
Downstream Pressure P2:	<input type="text" value="0.000"/>	Flow Sensor % F1:	<input type="text" value="0.0000"/>
Part Pressure P3:	<input type="text" value="0.000"/>	Upstream Temp. T1:	<input type="text" value="0.000"/>
Probe/Exit Pressure P4:	<input type="text" value="0.000"/>	Part Temperature T3:	<input type="text" value="0.000"/>

E/P Control (Electric / Pressure)

Up/down Voltage Step Size: 1.0

Enter Value: 0-10.000 VDC

Analog I/O Communications

Out: In:

Data Buffers:

Diagnostic Screen

From the Diagnostic Screen, you can operate the valves, take pressure measurements, check data-communications, and control output pressure. Very useful for troubleshooting.