



Model 88
EFA Scientific Comparator Test Stand

Dimensions : 68" H x 50" W x 75" D
1727mm H x 1270mm W x 1905mm D

GAS TURBINE AND JET ENGINE COMPONENTS

Effective Flow Area Measurement

PRODUCT REQUIREMENTS

Accurately analyzing airflow through jet engine and gas turbine components has been critical in the success of the aerospace industry. CCDI has satisfied manufacturers for over 40 years by offering quality airflow test equipment and part testing to GE, Garrett, Pratt and Whitney, Solar Turbine, and others.

SOLUTION: TIME PROVEN DESIGN

The Model 88 takes measurements of Barometric Pressure, Air Temperature, and Humidity to reliably measure Effective Flow Area (EFA). Continuous improvement has been made on the technology for over 15 years as the design was refined to optimize performance, making the Model 88 an accurate and stable EFA instrument ideal for area airflow measurements of vane rings and segments.

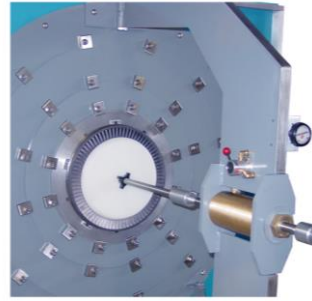
FEATURES

- Repeatability: +/- 0.1% *
- Step-by-Step Operator Software option
- Various configurations such as 88S-20, 88D-30, 88D-40 and others
- Uses Orifice Plates, ASME Nozzles, ASME Arrays
- Choice of NIST Traceable or dimensionally calibrated Orifices
- Current Available in English and French, other languages are possible
- Uses modern Microsoft .NET framework

* Conditions: Orifice plate at conditions of 70 Deg +/- 2 Deg F, 5" WC, less than 15 Sq. In. typical, depends on Model configuration. Call for additional repeatability details.



ASME Calibration Nozzles



Front View of Clamp

SYSTEM SPECIFICATIONS

- NIST Traceable EFA
- All air density parameters are measured
 - Room and Plenum Temperatures
 - Barometric and Plenum Pressures
 - Dew Point (Humidity)
- 30 or 40 AC Blower Motor – Various Blower/Compressor Range Configurations
- No reference blower needed
- Closed Loop AC Flux Vector Motor Controller with 1.0 to 4,999.9 RPM, no brushes to wear out.
- Software Controlled Clutch and Shut off Mechanism for choosing single or dual blower operation
- Large blower can be disengaged by clutch (software controlled for small part measurement)
- Less Than One Minute per EFA Measurement
- Takes Pressure or Vacuum (Optional) Measurements and Displays in Square Inches, Sq. Centimeters or Square Millimeters
- NIST Traceable Calibration Orifice Plates and ASME Subsonic Area Masters
- Customer Correlation Table for Each Part
- Four QC Reports and Data Acquisition File
- Automatic Data Acquisition, can be transferred over network
- Multiple Manufacturers Test Specs and Formulas
- GE, Garrett, P&W, and Solar Turbine Part Testing
- Free Operator Training, Testing and Certification
- One-Year Warranty on Parts and Labor
- Pressure from 0.5 to 20 H₂O, not limited to 0.5, 1 and 5" like other units
- Higher accuracy transducers, such as 0.01%FS optional
- All Controls to PC are via COM ports

Flow Capabilities

0.5 to 30 sq. in. Measurements (3.23 to 193.55 cm²) at 5" H₂O (Water Column) , 1.012 pressure ratio
 40 in² available with 40HP Motor Option

Pressure Range: 0 to 20" H₂O (Water Column), 1 to 1.049 pressure ratio, 0-20" H₂O Vacuum optional

FACILITY REQUIREMENTS

Electrical Power	380 - 460 VAC 3-phase 30 to 100 Amps, depending on power requirements for testing
Inlet Air Connection Pressure Range	30 to 100 PSIG (207 to 690 kPa) Pressurized Air Supply (filtered, compressed air at ambient temperature)
Temperature Range	50 - 100°F (10 - 38°C)

SOFTWARE

The Model 88 EFA Test Stand has new software called “EFAOne”. We simplified the user interface greatly. Here are some of the screens:

Test Screen – This is the overview of the testing and handles the workflow.

Flow Test Screen – This is where the flow test is carried out

Calibration Screen – The orifice plates and ASME nozzles are calibrated and managed here.

Correlation Screen – The correlation references are measured here and managed here.

Setup Screen - Carries the machine's configuration and calibration data.

Test Parameter Details - Measurement stability indicators regarding temperature and pressure as well as PID parameters and other testing details are selected on this screen.

EFA Testing

Part Test Profile Name : Part ID
TEST.TST : TEST

Batch or Job Info

Calibration/Correlation Tables

Cal Table: 55-25CM
Slope: 0.003249
Offset: -0.652191

Cor Table: 25CM
Slope: 6.451500
Offset: -0.000500

Ref. Pressure In. WC: 5.000

Atmospheric Pressure In. HgA: 0.000

Reference Blower RPM: 0.0

Main Blower RPM: 0.0

Plenum Press In. WC: 0.0000

Reference Blower Deg F: 0.00

Main Blower Deg F: 0.00

Test Results

Line	Serial	Customer	Cust. EFA	Cust EFA P-P%	Meas. EFA	EFA P-P%	Std Day RPM

Production Averages

F1 Cancel/Erase

Airflow Parameter Details

Zeroing Completed, Ready for next operation

Test Screen

Test Screen Features:

1. Part tests are stored in profiles that reference orifice plates and correlation parts which are shared by other parts.
2. Each step-by-step process is handled by the workflow buttons on the left. As each process is completed the next step is highlighted.
3. Results are tabulated on the Test Screen as a batch showing mastering and measurements.
4. Flow test conducted on “Flow Test” Screen, shows averaging, pass/fail status, stores lots of information with every test.

Flow Test Screen:

Flow and Verify Master Part

Part ID:
 Customer:
 Order:
 Serial:
 Job:
 Engine:
 Auxiliary:

Measurements
 Plenum Press In. WC: **0.0000**
 Flow Sq. In.: **0.00000**
 Area Measurement: **0.0000**

Test Status:
☐ Test In Progress Indicator
☐ Press. in Range
☐ Pressure Stable
☐ Temp. Stable
☐ RPM Stable
☐ Ready, counting
 Oil Pressure Ready
 Test Type:
 Test Seq #: 0000

No.	Area	Flow	Status
W01			
R01			

*Wxx - Warmup test, Rxx = Production Run
 Statistics (Warm-ups not included)
 Min: Max:
 Avg: P-P%: [Graph](#)

F1 Cancel **F4 Start** ☒ Close when finished flowing
F12 Exit Filename: Comments:

PID
☒ PID-Auto VDC: [Reset](#)

[Show PID Graph](#)

This screen pops up when conducting a flow test. The “Test Status” shows LED-like indicators as each condition reaches proper “steady state” to take final measurement.

Airflow Parameters

Certain screens are limited to users with certain password levels. We have reorganized these parameters sections to make them less overwhelming yet still give you the control that you need.

Airflow Parameter Details

Part Name: Revision: Profile Comment:
 OEM: Last Edited:
 File Name: [Save/Exit](#)

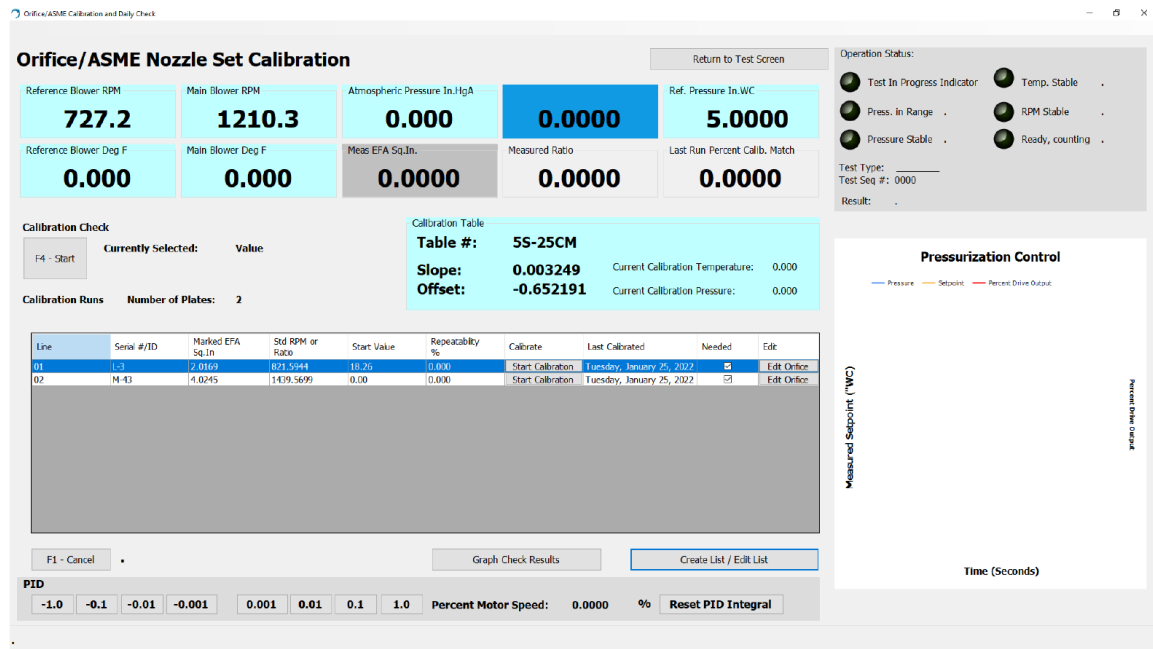
Settings | Input Requirements | Data Acquisition | PID Settings | Tables | Master Part Requirements | Finish Actions

Setpoint: Direction: Number Of Test Runs: [Typical Settings](#)
 Minimum Flow: Start Value: Number of Warm-up Runs:
 Maximum Flow:
 Num/Blowers: Pressure Decimal Places:
 Template Name: Flow Decimal Place:s
 Fixture ID: Final Area Decimal Places:
 Data Filename: Pressure Units:
☐ Condense Multi-line flow results into a single Average Flow log entry Area Units:

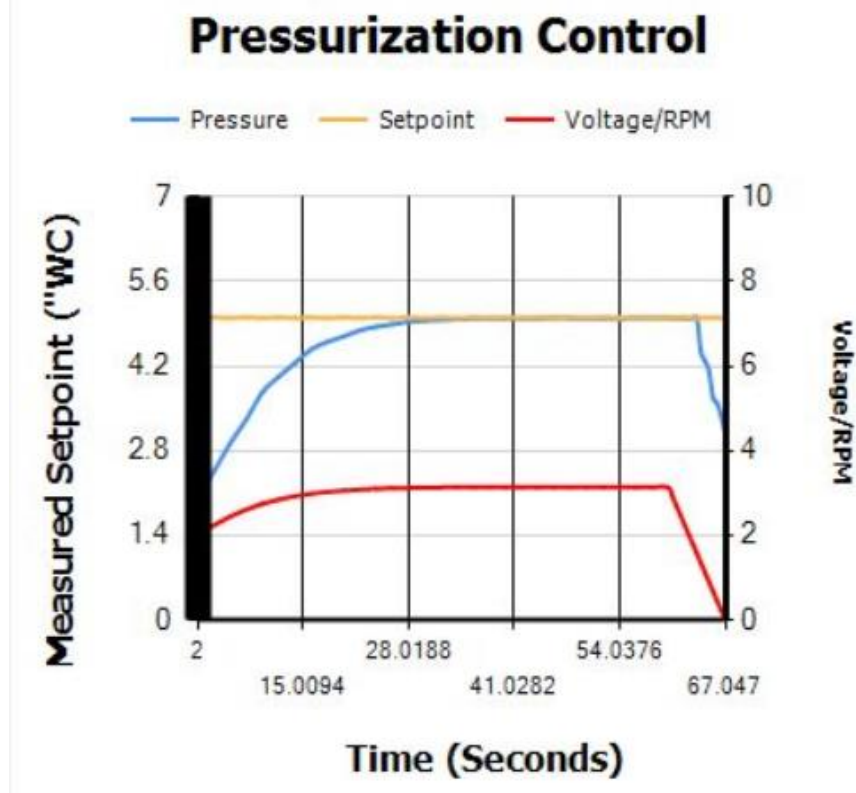
Orifice plate calibration.

Flow ranges no longer need to have three orifice plates to define a range. The new EFAONE software does EFA vs Standardized RPM. We call this “Standard Day RPM” because it stores and compares the RPM to values that are correct to a standardized

Atmospheric Pressure, Temperature and Humidity. Therefore, it can deal with changes much better than a reference blower can.



During a test you can monitor the motor and PID controls:



We have a report generator that allow selections of part tests and browsing of data.

The screenshot shows the EFA Print software interface. It includes a menu bar (Selection Criteria, Review/Print Old Reports, Configure, About, Exit) and a window title bar (EFA Print, MACHSER). The main area is divided into three sections for selection:

- Choose from this first:** Selected File: CALIB.DAT. A list shows CALIB.DAT selected.
- Choose this second:** Part ID: EFATEST. A list shows CALIB3, SWA-PT5, CALIB2, and EFATEST selected.
- Choose this last:** Date: Order: Blank - 10May18. A list shows various test dates and times, with "Blank - 10May18" selected.

Report Formatting options are on the right: Lt & Rt Margins: 25, Top/Bottom Margins: 25, Font Size: 10, Lines per page: 60.

Below these is a section "Then pick what you want to print by ticking the select checkbox:" followed by a table with columns: Select, Test No., S/N, Avg EFA, Cust EFA, Date, Time, Order, Record ID No., and Comment.

Select	Test No.	S/N	Avg EFA	Cust EFA	Date	Time	Order	Record ID No.	Comment
<input checked="" type="checkbox"/>	1	BLANK	1.69656	1.69656	10May18	11:02:37	Blank	50865485	
<input type="checkbox"/>	1	BLANK	1.70056	1.70056	10May18	11:05:17	Blank	50865490	
<input type="checkbox"/>	1	SWTU-11.61	14.4517	14.4517	10May18	11:23:07	Blank	50865526	
<input type="checkbox"/>	1	SWTU-11.61	14.43774	14.43774	10May18	11:25:59	Blank	50865531	
<input type="checkbox"/>	1	SWTU-11.61	14.43668	14.43668	10May18	11:27:22	Blank	50865534	
<input type="checkbox"/>	1	7M072-15.94	14.94633	14.94633	10May18	11:35:12	Blank	50865550	
<input type="checkbox"/>	1	7M072-15.94	14.94379	14.94379	10May18	11:36:44	Blank	50865553	
<input type="checkbox"/>	1	7M072-15.94	14.94116	14.94116	10May18	11:38:18	Blank	50865556	
<input type="checkbox"/>	1	SWA-11.75	14.4498	14.4498	10May18	11:46:03	Blank	50865572	

Below the table are buttons: Select Matching S/N's, Select All S/N's, Graph Flows, Deselect All. To the right are Setpt. Decimal Precision: 3, Result Decimal Precision: 3, Print Landscape, Print SignatureLine, and Save Reports (checked).

At the bottom left, "Selected Item(s) Statistics from Serial Number List" shows: Number of Records: xx, Minimum EFA: xx, Maximum EFA: xx, Average EFA: xx, Peak-to-Peak Percent: xx, Minimum Cust Area: xx, Maximum Cust Area: xx, Average Cust Area: xx, Peak-to-Peak Percent: xx.

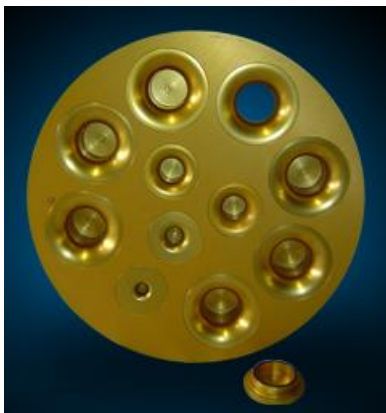
At the bottom right are buttons: Print Report Style A, Print Report Style B, Print Report Style C, Cal/Cor Report Style D, Print Report Style E, and a large red Exit button.

Calibration Masters

CCDI offers the unique “ASME Nozzle Array” which is used transfer NIST traceable EFA standard to orifice plates. The standard has a five-year calibration and dial up flows in 0.5, 1, 2 and 5 Sq. In. Increments up to 30 or 40 Square Inches depending whether the 9-position or 11-position array is used. The flows to each opened nozzle is additive to make a total flow.

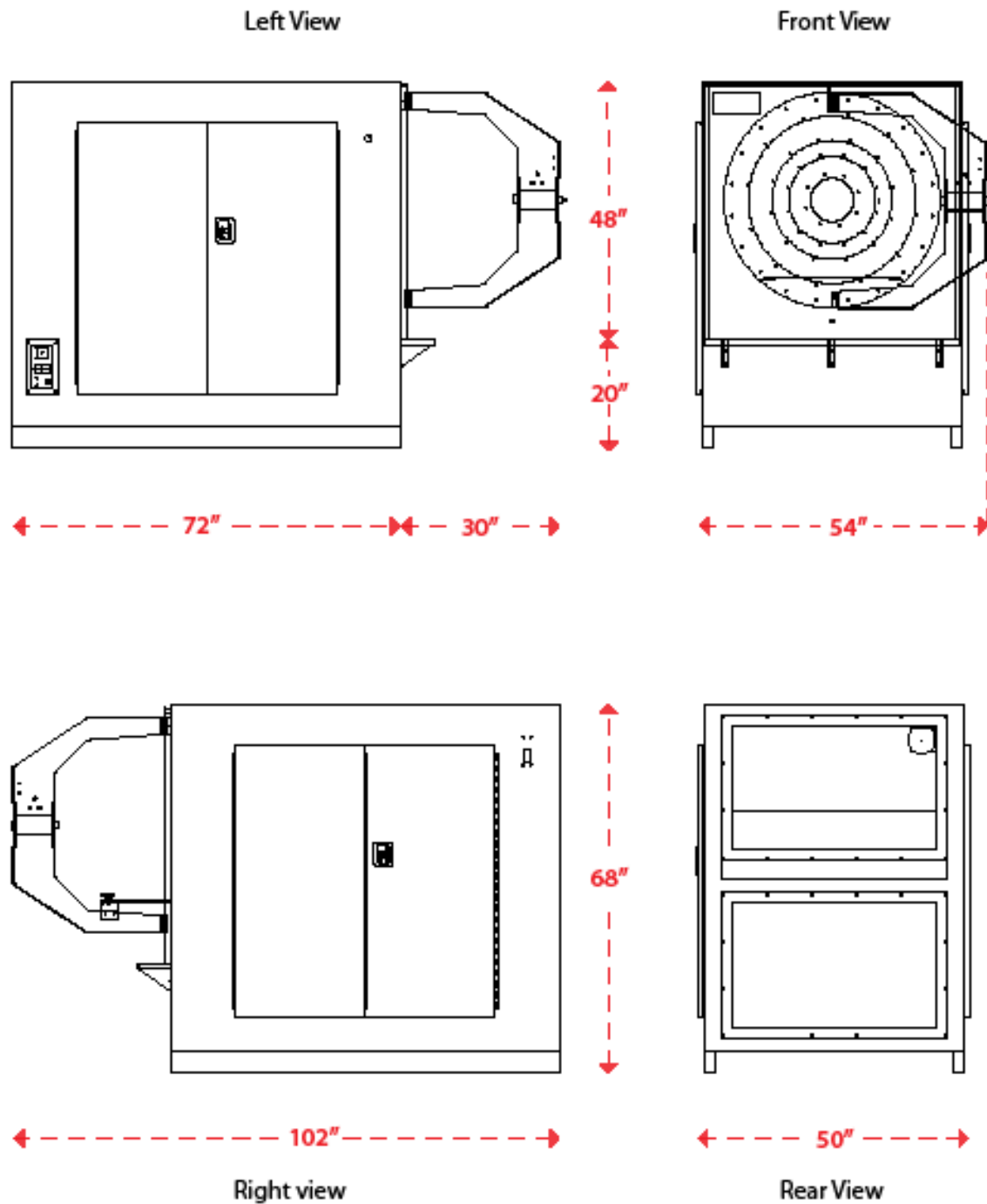
Corporations can use this array as their master standard and use it to control orifice plate calibrations at all their various satellite branches for more uniformity.

We can calibrate these at various pressures as well using our Sonic Nozzle transfer standards.



Photos





Space Requirement		
	Ideal	Minimum(longer Stabilization Time)
Front(ft.)	40	20
Rear(ft.)	15	10
Sides(ft.)	8 on either side	5 on either side
Top(ft.)	3	3