

A complete turboshaft engine genset illustrating the concepts of electrical power generation, thermodynamic cycles and mass and energy conservation.



Product Summary

- Gas-Turbine-Driven Genset
- Portable, Self-Contained and Ready to Operate
- National Instruments™ DAQ System with Expandable LabVIEW™ Displays
- Complete Thermodynamic Teaching Solution
- Open-Ended Design to Meet ABET Criterion 3a,b,c,d,e,k and 4 Objectives
- Nothing More to Add or Buy - Ready to Start Teaching upon Delivery
- Supplied with a Comprehensive Operator's Manual, Checklists and Safety Instructions
- Industry Leading Warranty with Unsurpassed End-User Support
- Designed and Manufactured in the USA

Description

A complete turboshaft engine genset instrumented for educational purposes. The compact jet engine gasifier core is representative of all major gas turbine types and entails an axial flow turbine stage, reverse flow annular combustor and radial flow compressor stage. This permits textbook direct analysis of the air equivalent Brayton Cycle. Students are able to apply fluids, thermodynamics, combustion and gas turbine theory to the operation of an actual engine.

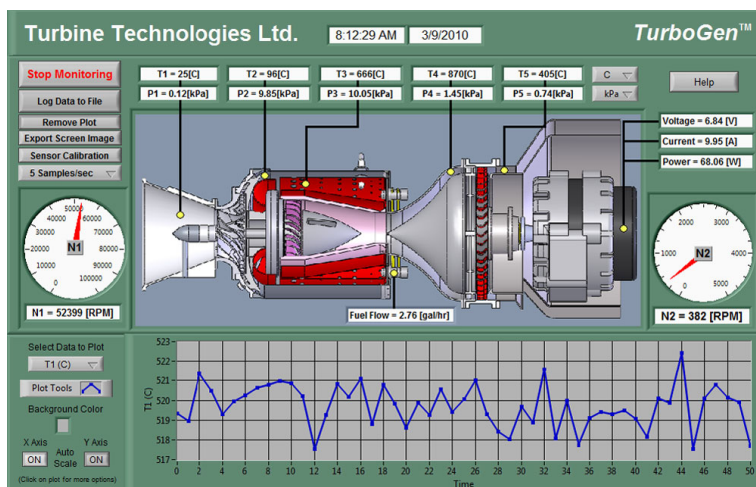
The electric power generation section features a thrust driven free power turbine directly coupled to a three phase liquid-cooled electric alternator. The generation circuit is base-loaded with an integrated fixed-value resistance module. An adjustable-rate excitation current controller allows wide-range alternator loading through the complete speed range of the generation system. The electrical power system can produce up to 14.4 volts, with a maximum rated power output of 2.1 kW. A jet thrust driven exhaust fan effectively expels heat and exhaust from the engine/generator compartment.

A fully automated engine start and health monitoring system is also included, which entails a Liquid Crystal Display status readout with a built-in cycle/hour meter.

Fifteen sensors report directly to an installed National Instruments™ DAQ platform, which entails customized LabVIEW™ displays (as depicted below). Data is configurable for output via numerous export options which include .txt and .csv file types.

The gas turbine generation system is purpose designed for this application. All components of the engine and bulk of the generation system are manufactured and assembled at TTL. This true OEM approach results in an affordable, ready to operate, supportable educational solution.

Data Acquisition & Gas Flow Path Screen Shot



Details

Dimensions	TurboGen™:	40 x 42 x 62 inches (102 x 107 x 158 cm)
	As Shipped:	48 x 54 x 70 inches (122 x 137 x 178 cm)
Weight	TurboGen™:	460 lbs (208kg) As Shipped: 614 lbs (276kg)
Instrumentation	Data Acquisition System with Configurable Data Output Windows XP Laptop Computer for On-Screen USB Data Display	
Sensors	<ul style="list-style-type: none"> • Compressor Inlet & Exit Temperature and Pressure • Turbine Inlet Temperature and Pressure • Turbine Exit / Power Turbine Inlet Temperature and Pressure • Power Turbine Exit Pressure and Temperature • Fuel Flow • Gasifier & Generator Rotational Speed (RPM) • Generator Current & Power 	
Generator Limits	Regulated Volts:	13.1 Volts
	Maximum Current:	194 Amps
	Maximum Power:	2541 Watts
	Maximum RPM:	5000
Gasifier Limits	Mass Flow:	1.1 lbs/s (0.5 kg/s)
	Turbine Inlet Temp:	1328°F (720°C)
	Engine Speed:	87,000 RPM
Operating Requirements	Approved Fuels:	Jet A,A-1,B;JP-8;Kerosene, Diesel, Fuel Oil #1 or #2
	Approved Oil:	MIL-PRF-23699F-STD
	Power:	120V single-phase 60Hz (220V 50Hz upon request)
	Air Pressure:	120 PSI (827 KPa)

Experimental Opportunities

- Energy relationships and the First Law of Thermodynamics.
- Cycle analysis and the Second Law of Thermodynamics.
- Control volume analysis.
- Entropy and enthalpy analysis.
- Isentropic analysis.
- Electric power generation analysis.
- Cycle and component efficiency studies.
- FEA & CFD analysis via available component CAD models.
- Airfoil velocity vector diagram construction.
- Experimental and data acquisition technique.

Purchase Specifications

- A complete micro turbine genset to consist of an engine/generator combination designed and manufactured specifically for engineering education.
- Engine must utilize an axial flow turbine stage, a reverse flow annular combustor, a free power turbine stage and a centrifugal compressor stage.
- System to include a USB connected laptop computer interfaced with National Instruments™ hardware and customized LabVIEW™ VI displays.
- System sensor package to entail 15 data reporting points to include compressor inlet temperature and pressure, compressor stage exit temperature and pressure, turbine inlet temperature and pressure, power turbine inlet temperature and pressure, power turbine exit temperature and pressure, fuel flow, engine core RPM, power turbine RPM, generator current and power.
- Engine to be of current manufacture and consisting of all new components.
- Traceable and verifiable material to be used throughout engine.
- All elements comprising the system to be contained in a rigid steel chassis mounted on rolling castors.
- Complete system not to require permanent facility modification or additions.
- Complete genset to be mounted behind transparent protective shields allowing clear view during operation.
- Fully automatic engine start and operational health monitoring system provided with LCD status readout and cumulative run-time cycle count.
- Representative engine components and technical data optionally available for teaching use and training aids.
- Manufacturer to guarantee spares availability and provide technical support services for core engine and power system.
- To be covered by a free two-year warranty.