

BH112JD Jetcal[®] Analyzer/Trimmer

THE JETCAL[®] ANALYZER WITH A MEMORY

MICROPROCESSOR BASED AND PROGRAMMABLE FOR TESTING A VARIETY OF TURBINE ENGINES



The BH112JD Jetcal[®] Analyzer/Trimmer is a microprocessor-based data acquisition unit which incorporates a combination of capabilities not available in most portable engine test equipment.

The BH112JD Jetcal[®] Analyzer/Trimmer is designed to:

- (1) functionally check and troubleshoot the temperature measuring system used in aircraft turbine engines without running the engines,
- (2) accurately monitor, record and print out critical engine parameters during engine trim.

The BH112JD Jetcal[®] Analyzer/Trimmer consists of the instrument case and the accessory case. The instrument case includes the Portable Trim Module and Probe Control Section. The Portable Trim Module can be lifted out of the instrument case and carried into the aircraft for direct comparison with the cockpit indicators. This feature allows airborne tests in some helicopter applications where engine tests must be accomplished while airborne.

Input Parameter Flexibility

Basic engine test parameters - temperature, speed, and pressure - can all be scaled to the exact requirements of the engine being tested. Temperature can be displayed in °C or °F. Engine speed can be scaled in %RPM, direct RPM, or in frequency (Hz). Externally measured pressure can be displayed in "Hg, PSI, FT/LBS, %Torque, or Mbar. Internally measured pressure can be displayed in "Hg, PSI, or Mbar. A complete set of scale factors for up to ten different engine types can be easily entered into memory or changed by the operator. The tester's alpha-numeric display provides instructional prompts to the operator throughout the scaling procedure. The scaling information is retained permanently in memory unless changed by the operator. Once this procedure has been completed, the Engine Select Switch allows the operator to select the specific calibration and scale factors appropriate for the engine under test.

Speed/Frequency Measurement

The speed/frequency measurement system is designed to display engine speed when supplied with input signals from standard aircraft tachometer generators or from monopole pickups. The RPM Select Switch allows any one of three speed inputs to be selected.

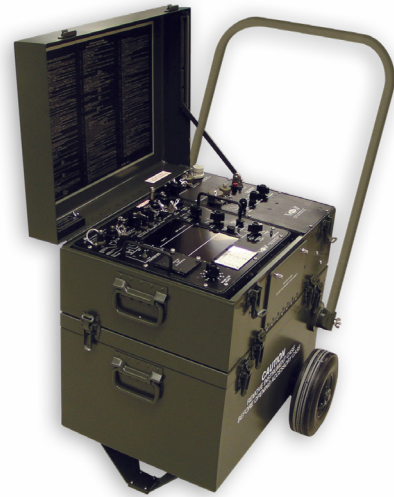
The speed/frequency circuits are designed to condition three different frequency inputs (30,000 Hz maximum). Each frequency channel can be scaled differently and can have different engineering units. Units which can be selected are: %RPM, RPM, and Hz.

The speed/frequency measurement system can also be used to measure fuel flow in PPH when the flow transducer has a frequency output.

DATA ACQUISITION

ACCURACY ON WHEELS:

Portable and self-contained, the Jetcal® Analyzer/Trimmer consists of a compartmented accessory case and an instrument case with removable trim module. Instructions for use of the Jetcal® Analyzer/Trimmer are contained within the case.



Temperature/Standard Day Calculation

The output of the engine's thermocouple harness is used to measure engine temperatures. Temperature can be displayed in units of °C or °F. The maximum range of this measurement is from 0 to 1350°C or 2462°F in one degree increments. Calibration of this parameter is Chromel®-Alumel® (ISA Type K) or the special calibration required by the some engines.

When used in conjunction with the Probe Control Section, the Trim Module measures heater probe temperatures as well as the thermocouple outage output.

An RTD type temperature probe is available as an accessory to accurately measure and display ambient temperature. Ambient temperature signals supplied by the RTD are displayed in °C or °F. The range of this measurement is -60°C to 100°C or -75°F to 212°F in 0.1 degree increments.

Should the engine test procedures require engine speed and temperature readings be corrected to standard day conditions, the input from the ambient temperature probe is used to automatically provide the standard day correction factor. Should a probe not be available, corrected temperature and speed readings can be calculated by the tester using an ambient temperature which is entered manually by the operator.

Pressure/EPR System

An internal pressure transducer is included in the test set which is capable of measuring ambient pressure.

External (optional) pressure transducers can be supplied to measure parameters such as engine torque, burner pressure or ambient pressure.

When calculating engine pressure ratio (EPR, defined by P_{t7}/P_{t2} or P_{ext}/P_{int}), the engine exhaust pressure is measured on the external transducer. The ambient pressure is either measured on an internal transducer or manually entered when an internal measurement is not available. In EPR position, the Jetcal® displays the ratio of the two inputs.

Data Printout

The BH112JD stores data for printout by an internal printer. The engine serial number (or other ID number), date and trim target can be entered in memory prior to testing so that printed data can be easily identified.

Built-In Test

The Trim Module contains a comprehensive built-in test feature. Should a fault be detected, the display will indicate to the operator the circuit which has failed.

Cockpit Temperature Indicator Test

The tester is capable of providing a simulated thermocouple output which can be used to check the calibration of high impedance (null balance) or low impedance (current drawing) temperature indicators.

Thermocouple Harness Tests

The accuracy of current drawing engine temperature indicators is dependent upon the resistance of the thermocouple harness. The BH112JD can be used to accurately measure the resistance of any harness (40 ohms maximum). The BH112JD can also measure insulation resistance accurately to 200,000 ohms.

Calibration

In order to improve system reliability, all potentiometer-type calibration adjustments are eliminated. All test set calibration is handled exclusively through software.

ENGINE TYPE 2		
ID:	110151498	#001
TRIM TGT:	TRQ1380FLB	
PEXT	1388	FT.LB.
TEMP	641	DEG.C
N1	91.1	PCNT.
N2	96.2	PCNT.
TAMB	20.7	DEG.C
PAMB	29.38	IN. HG.

ENGINE TYPE 1		
ID:	10319N36B	#025
TRIM TGT:	EPR 1.78	
PEXH	51.62	IN. HG.
PEXH/PAMB	1.754	
TEMP	556	DEG.C
N1	100.0	PCNT.
N2	92.9	PCNT.
TAMB	22.3	DEG.C
PAMB	29.43	IN. HG.
STANDARD DAY READINGS		
TEMP	535	DEG.C
N1	98.8	PCNT.
N2	91.7	PCNT.

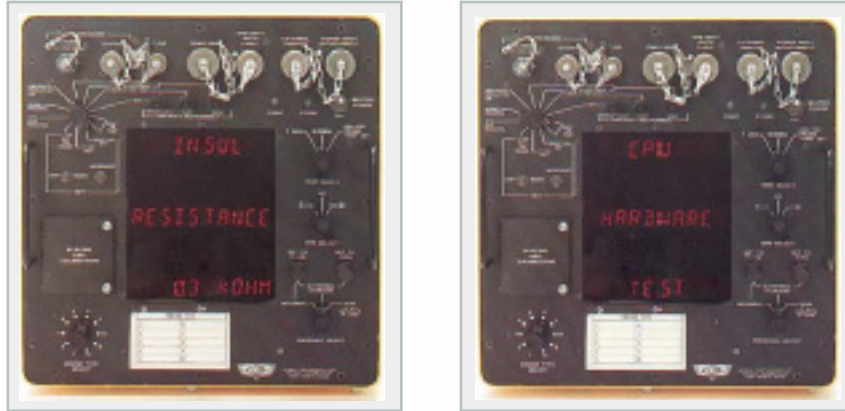
The Probe Control Section contains the power supply and controls required for the operation of the heater probes. This section of the Jetcal® Analyzer also includes the connector and switch required to perform spread tests.

In order to test the engine thermocouple harness, a heater probe is placed over each engine thermocouple. The BH112JD Jetcal® Analyzer controls the power applied to the probes in order to maintain them at a preselected test temperature. Since the probe is precisely fitted to the engine thermocouple, the probe and thermocouple are maintained at the same temperature. A thermocouple embedded in the probe accurately measures the probe temperature and provides feedback to the heating circuit in the test set. If the aircraft thermocouple temperature displayed on the Jetcal® Analyzer or cockpit indicator does not agree with the probe temperature, a malfunction

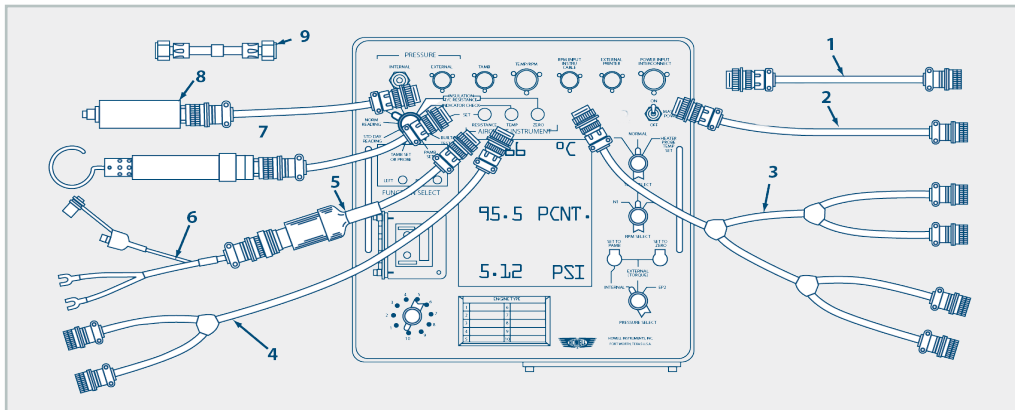
is indicated. The Jetcal® Analyzer can then be used as a trouble-shooting device to check cockpit temperature indicator calibration, thermocouple harness circuit and insulation resistance.

In addition to checking the engine thermocouple system, the Jetcal® Analyzer can be used to test continuous wire fire detection systems and thermal switches. By using a special air leak detector, maintenance personnel can locate air leaks at engine parting surfaces, bleed air ports, and anti-ice and air conditioning ducts .

Digital Display Feature of Trim Module



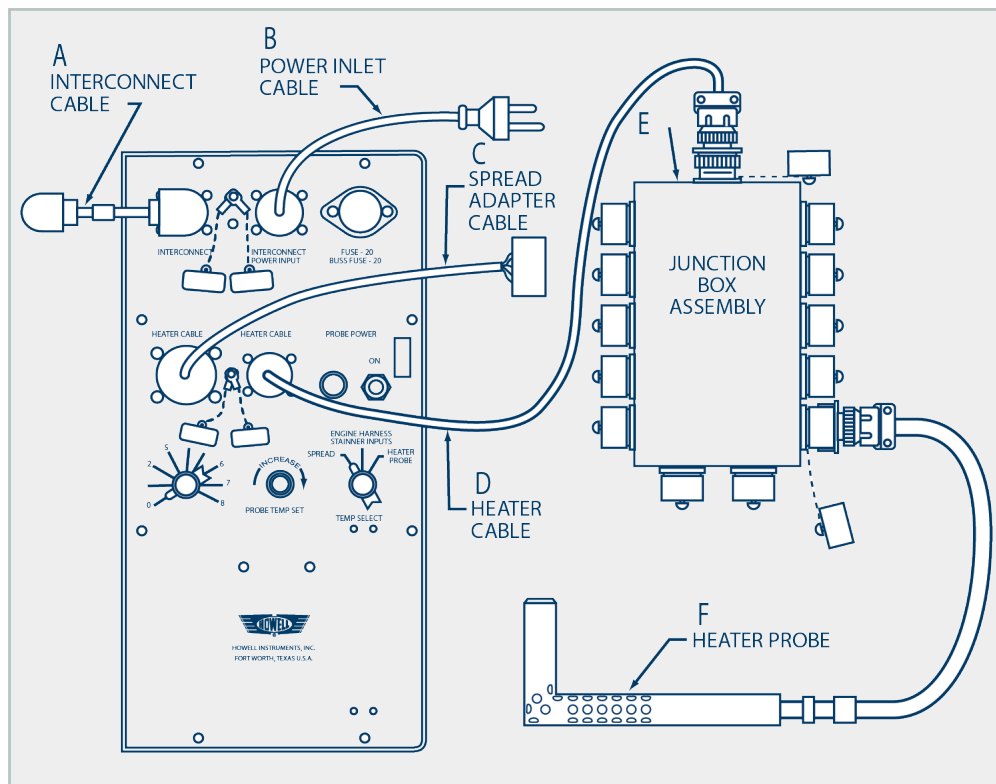
Typical BH112JD Connection Scheme



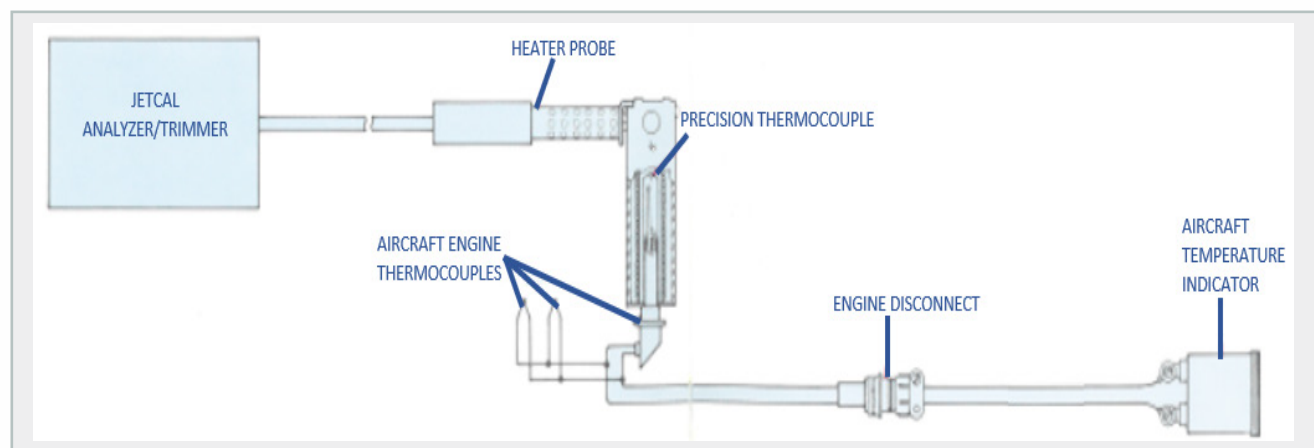
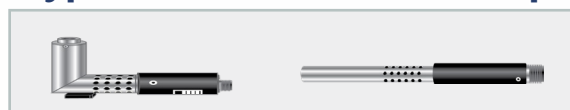
1. Power Input/Interconnect - Power cable connects here for independent operation of Trimmer Section. Interconnect cable is connected for use with Probe Control Section.
2. Cable to connect H337 to remote printer.
3. RPM/Frequency Cable - Connects in parallel to aircraft system at tachometer generator or cockpit RPM indicator.
4. RPM/Temp Signal Cable - Capable of one temp input and three RPM inputs. Design of this cable dependent upon application.
5. General Purpose Temp Cable - Allows operator to monitor engine temperature, check cockpit indicator, measure thermocouple harness loop and insulation resistance.
6. Temperature Adapter for specific application.
7. Ambient Temperature Probe Assembly.
8. External Pressure Transducer Assembly.
9. Pressure Hose for Internal Pressure Transducer.

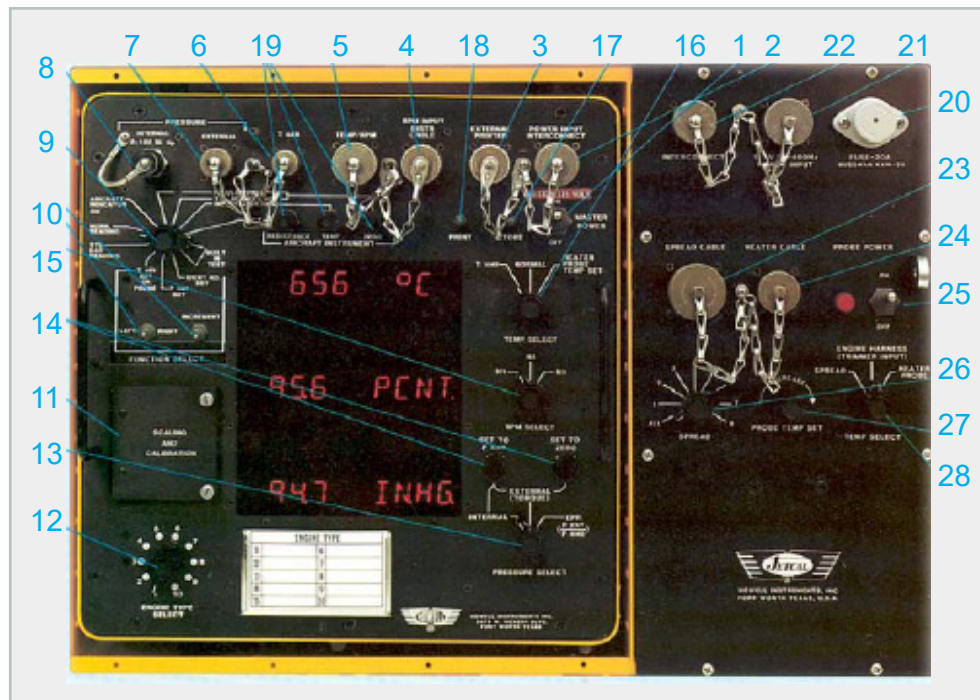
Typical Probe Control Module

- A. Interconnect - Provides connection to Trimmer Section.
- B. Power Input - Main power input.
- C. Spread Cable - Connection for Spread Cable.
- D. Heater Cable - Connection for power and temperature signal to Junction Box or Heater Probe.
- E. Junction Box - Heater Probe terminal connection.
- F. Heater Probe - (model no. and quantity determined by engine application)



Typical Heater Probe Set-Up





1. MASTER POWER SWITCH - Controls power to Jetcal Analyzer.
2. POWER INPUT CONNECTOR - For power input cable or interconnect to Probe Control Section.
3. EXTERNAL PRINTER CONNECTOR - Allows operator to connect to a remote printer for data retrieval.
4. RPM INPUT INSTRUMENT CABLE CONNECTOR - This is an auxiliary connector which contains provisions for three RPM (frequency) inputs. These inputs are connected in parallel with the three RPM inputs available in the TEMP/RPM connector. The use of this connector allows the operator to use many of its existing Jetcal Analyzer cables and adapters.
5. TEMP/RPM CONNECTOR - This connector is used for engine temperature and three speed inputs as well as providing connections for aircraft indicator checks and thermocouple harness insulation and resistance checks.
6. T AMB CONNECTOR - Connection for ambient temperature probe.
7. EXTERNAL PRESSURE CONNECTOR - Connector for cable to external pressure transducer.
8. INTERNAL PRESSURE CONNECTION - Hose connection for internal pressure transducer.
9. FUNCTION SELECT SWITCH - Controls operation of test set as follows:
 - (a) NORM. READING - Displays the real time engine parameters as selected by the TEMP, RPM and PRESSURE SELECT.
 - (b) AIRCRAFT INDICATOR ON - The BH112JD cannot be operated in parallel with current drawing type cockpit temperature indicators. In case this condition exists, the cockpit indicator is disconnected when the FUNCTION SELECT SWITCH is in any position except A/C IND ON. When AIRCRAFT INDICATOR ON is selected, the Trim Module is disconnected and the cockpit indicator is reconnected to the engine thermocouple harness.
 - (c) INSULATION - Causes test set to display Thermocouple harness insulation resistance.
 - (d) T/C RESISTANCE - Causes test set to display thermocouple harness loop resistance.
 - (e) INDICATOR CHECK - Causes test set to output and display the simulated thermocouple signal which is used to check the calibration of the cockpit temperature indicator.

- (f) SET- When current drawing-type cockpit temperature indicators are being tested in the INDICATOR CHECK mode, it is important that the correct thermocouple harness resistance is used. In the SET position, the operator enters the appropriate harness resistance such as 8 ohms or 22 ohms.
- (g) BUILT-IN TEST - When this mode is selected, the built-in test routine is initiated. The display provides the operator with a message of satisfactory performance if no fault is detected. If a fault is detected, the display will identify the defective circuit.
- (h) IDENT. NO. SET - This switch position allows the operator to set the date, identification number, and trim target into memory so that proper identification of data printout is provided. Also, it is used to set the trim target.
- (I) PAMB SET - Allows operator to manually display set in ambient pressure.
- (j) TAMB SET OR PROBE - This switch temperature indicators are being tested in the position allows the operator to read the temperature measured by the ambient temperature probe. If an ambient temperature probe is not connected to the test set, this position is used to manually enter the ambient temperature.
- (k) STD DAY READING - In this position, the temperature and speed displays are corrected to standard day conditions ($T/8$ and $N/8$ respectively).
- 10. LEFT/RIGHT-INCREMENT - These switches are used to set in ambient pressure, ambient temperature, I.D. number, date, and trim target. They are also used in some portions of the calibration and scaling procedure.
- 11. SCALING & CALIBRATION - Controls used to scale and calibrate the tester are located beneath panel.
- 12. ENGINE TYPE SELECT - This switch allows the operator to preset scale factors and calibration which are appropriate for the engine under test. The adjacent placard allows the operator to identify the engine type which is appropriate for each different switch position.
- 13. PRESSURE SELECT SWITCH - Allows the selection of the internal transducer, external transducer or EPA reading for display.
- 14. SET TO PAMB-SET TO ZERO - These switches provide a means of setting the internal transducer accurately to existing transducer to be set to ambient pressure or zero, whichever is appropriate.
- 15. RPM SELECT - Allows the selection of three speed/frequency inputs.
- 16. TEMP SELECT - Provides means for displaying engine temperature, ambient temperature, or the preset heater probe test temperature.
- 17. STORE - Depressing this switch stores current data in memory for later printout. Eighteen sets of data can be stored in the memory. If no printer is available, the stored data may be viewed on the display.
- 18. PRINT - Activation of this switch causes printer to operate.
- 19. AIRCRAFT INSTRUMENT
 - (a) RESISTANCE - This potentiometer is used to duplicate aircraft thermocouple harness resistance. This adjustment is required when testing current drawing aircraft temperature Instruments.
 - (b) TEMP - This potentiometer is used to vary the magnitude of the simulated thermocouple output.
 - (c) ZERO - This potentiometer is used to remove, "zero out," the effects of the cabling which connects the tester to the aircraft, allowing an accurate determination of aircraft harness resistance.
- 20. FUSE - Fuse for probe control circuit.
- 21. POWER INPUT CONNECTOR - Main power input connector.
- 22. INTERCONNECT - Connects Probe Control Section to Trim Module.
- 23. SPREAD CABLE CONNECTOR - Mates spread cable.
- 24. HEATER CABLE - Mates heater cable.
- 25. PROBE POWER SWITCH - Controls power to heater probes.
- 26. SPREAD SWITCH - Allows operator to select individual thermocouples in engine harness for display.
- 27. PROBE TEMP SET POTENTIOMETER - Allows the operator to preset the temperature at which the heater probes are to be controlled.
- 28. TEMP SELECT SWITCH - The switch allows the operator to select spread, temperature, engine harness temperature, or probe temperature for display.

Environmental

The BH112JD is a ruggedized unit capable of operating in the severe environmental conditions(- 40°C to + 70°C ambient temperature) encountered on the flight line.

Warranty

The BH112JD Engine Test Set is warranted for one year after delivery. The warranty does not cover units which have been damaged by improper handling or by application of improper power or signal inputs, or units on which the original identification plates have been removed or altered.

The manufacturer will repair or replace any unit returned to the factory during the one-year warranty period unless abnormal use is indicated, in which case the customer will be contacted and advised of the repair charge prior to the initiation of repair.

BH112JD-801/-901 Jetcal® Analyzer/Trimmer has additional parameters in the same hardware:

In particular:

1. One additional Pressure signal from a dedicated pressure transducer. Range depends on the transducer. This input can be used to measure an additional pressure, such as “P3”, Compressor Discharge Pressure (CDP), or Engine/ Transmission Pressure.
2. One additional RTD input which can be used to monitor T2 CIT or T3 Compressor Discharge Temperature (CDT).
3. Synchro input to measure angular positions such as “Guide Vane Angles”

Ordering Information

The BH112JD-801 and BH112JD-901 can be ordered as follows:

BH112JD-801 : 230Vac • 50 to 400Hz Power

BH112JD-901 : 115Vac • 50 to 400Hz Power

The trimmer section, when used separately, operates only from 115VAC 50-400Hz or 28VDC.

Special part numbers will be assigned to those units which require specific accessory kits, non-standard hardware or software features.

