



The “Turbo” Caribou Horizon Aerospace “Checkpoint” Engine Instrument System

Checkpoint instruments consist of the following:

- Discrete 2 Inch Round Instruments
- Digital Display Monitoring Panel (DDMP)

The Horizon 2-inch round Checkpoint instruments were developed to replace D’Arsonval meter movements, Stepper Motors and Synchro technology with new micro based instruments.

DISCRETE 2 INCH ROUND INSTRUMENTS:

- ALL TSO CERTIFIED
- DEPTH BEHIND PANEL 3.75 INCHES
- DO-160
- SOFTWARE DO-178
- OUTPUT WARNING SIGNALS
- ANNUCIATOR LIGHTS
- IDENTIFY FAILURE IN INSTRUMENT OR SENSOR
- IN-LINE POINTER (Virtually no Parallax)

DIGITAL DISPLAY MONITORING PANEL: (DDMP)

- TSO CERTIFIED
- SOFTWARE DO-178
- FULL FUNCTION FUEL COMPUTER (NMPG, Fuel at Destination, Fuel Endurance)
- POWER MONITOR
- TEMPERATURE MONITOR
- EXCEEDANCE RECORDING & DOWNLOADING
- DISPLAY VOLTS/AMPS (Eliminate discrete instrument)
- DISPLAY CABIN & OUTSIDE AIR TEMP (OAT)
- DISPLAY SIX (6) ENGINE INSTRUMENTS DIGITALLY (2.10 PERCENT ACCY)

This state-of-the-art Engine Instrument and Monitoring System was chosen to service the engine monitoring requirements of the Turbo Caribou design.

The 2-inch instruments operate and interface with the Digital Display Monitoring Panel (DDMP).

The Instruments incorporate a microprocessor based circuit that translates the input signals from external transducers and controls a brushless DC motor that positions the pointer.

The self positioning nature of the motor requires no positional feedback devices enabling the instrument to achieve required tolerances with only one (1) moving part, the pointer.

The instrument display incorporates an “In Line Pointer” that allows the scale/dial plate to be moved tight behind the cover glass, improving the viewing angle and minimizing parallax. The in-line pointer does not pass over the dial plate and at no time does the pointer obscure the numerals or graduations.

The instruments have a digital communications interface that allows it to communicate with the Digital Monitoring Panel to provide a full Engine Monitoring System that includes exceedance recordings and fuel management, which can be interfaced with the aircraft GPS system.

The DDMP can combine satellite navigation data with its knowledge of an airplane's fuel consumption to provide the pilot with predictions of fuel remaining at specified points in the future along the intended route of flight. These predictions are revised automatically and continually in response to changing flight circumstances, eliminating the need for manual recalculation or other form of pilot intervention.

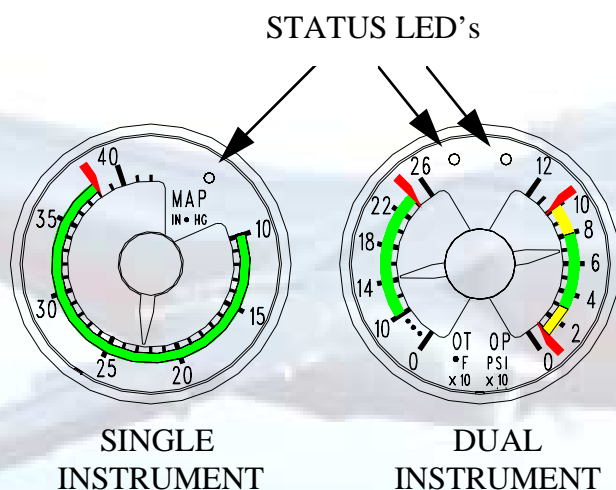


Analog Instruments

The system uses conventional 2" round engine instruments with either a single or dual pointer configuration. Instrument readings are displayed using a familiar rotating pointer against a fixed scale plate. An in-line pointer configuration is provided to minimize parallax and maximize viewing angle.

INSTRUMENT SELF TEST

Each instrument is microprocessor based and performs a power on self test, a continuous self test, and a continuous sensor validity test. A two color (green/red) status LED is provided for each instrument. Upon initial power up, each instrument performs a power on self test. During this test, and prior to assuming normal operation, the status LED glows red then green and the pointer is driven to the full scale position, followed by the off scale zero position. The alarm audible alert is energized for one second at the end of the power on test.



INSTRUMENT STATUS LED

The status LED provides an instant indication of the instrument status as follows:

- **No LED Indication:** Instrument is functioning normally. (If pointer is parked off scale low, no power to instrument)
- **Green LED glows constantly:** The instrument is being displayed in digital form on the DDMP.
- **Red LED glows constantly:** The parameter being measured is in an exceedance condition. (An Alarm Message is also displayed on the DDMP. See DDMP: Alarm Mode)
- **Red LED flashes quickly (4 times per second):** The input sensor has failed, or is providing erroneous information.
- **Red LED flashes slowly (2 times per second):** Self Test has identified a problem within the instrument. – Instrument Failure

Digital Display Monitoring Panel (DDMP)

The DDMP provides a digital readout of each parameter, continually monitors for range (exceedance) conditions, and utilizes the data provided for auxiliary functions including Fuel Management Calculations.

A central display unit, the Digital Display Monitoring Panel (DDMP) is capable of displaying data from each of the Engine Monitoring Instruments, as well as several other less critical aircraft parameters that will assist the pilot with various flight management functions. The DDMP continuously monitors each analog instrument via a digital communications link. Direct sensor inputs are provided for Outside Air Temperature, Cabin Air Temperature, Electrical System Inputs, and static pressure.

The DDMP represents new capability for small aircraft. It summarizes substantial amounts of information concerning aircraft status, allowing the pilot to absorb the relevant information more rapidly. It will provide a means of notifying the pilot of individual engine parameter exceedances and will provide automatic logging of these events. Finally, it will provide dedicated function calculation, such as the amount of fuel that will be remaining at the destination.

The DDMP user interface has been designed to be as intuitive as possible. It will allow the pilot to perform complex functions with a minimum of interruptions. For instance, no data will need to be entered into the unit during in-flight operations. Care has been taken to ensure this user interface will be as understandable as it is simple.

FUNCTIONALITY

The operation of the DDMP primarily depends on the use of the ▲ ▼ buttons (located on the left side of the front panel) and the **SEL** button (located on the right side of the front panel). (**See Figure 1.**)

The ▲, ▼ buttons allow the user to scroll through the instrument options.

The **SEL** button allows the user to move to the next instrument displayed on the panel.

➔ **NOTE:** These three buttons on the DDMP are the primary buttons for changing any of the displays and modes on the DDMP.

POWER UP MODE

Overview

- **Version Display** - Displays the current DDMP firmware version.
- **Date and Time** - Displays the current DDMP data and time.
- **Checker Board Test** - Tests both sides of the DDMP display with alternate bit patterns.
- **ROM and NVRAM Tests** - Verifies RAM and ROM checksums are correct.
- **Aux Port** - Tests the auxiliary communication ports.
- **CAT** - Tests the CAT connection (on the DDMP) for sensor reasonableness.
- **OAT** - Tests the OAT connection (on the DDMP) for sensor reasonableness.

INSTRUMENT MODE

Overview

Upon Power Up, the DDMP displays the date and time and goes through a sequence of Pass/Fail modes. These series of tests ensure that each instrument is able to communicate with the DDMP properly. If the DDMP cannot communicate with an instrument, a FAIL message will be displayed.

Each of the DDMP's two displays can be setup to display any three analog instrument values in digital form. (The DDMP can display up to as many as six instruments combined.)

Instrument mode displays the instrument parameters (data reads from the instruments), on the DDMP as follows:

Left side (Left Engine)	Right Side (Right Engine)
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TRQ	TRQ
Np	Np
ITT	ITT
Ng	Ng
FF	FF
OT	OT
OP	OP
LBS (fuel remaining)	

→ **NOTE:** Fuel remaining is calculated by subtracting FF from quantity of fuel entered into the DDMP.

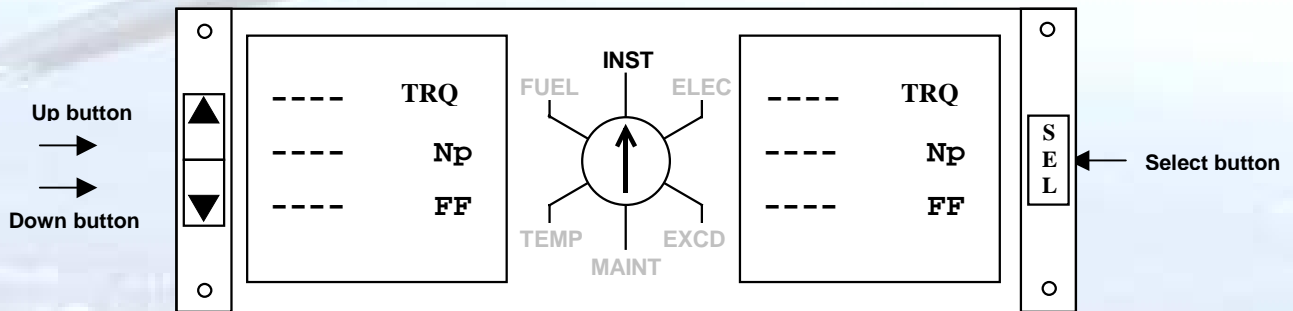


Figure 1: Instrument Mode