VISION MICROSYSTEMS INC.

ADVANCED ELECTRONIC INSTRUMENTATION

VM 1000
Operator's Guide

(Excerpts from the VM 1000 Installation, Maintenance, and Operations Manual)

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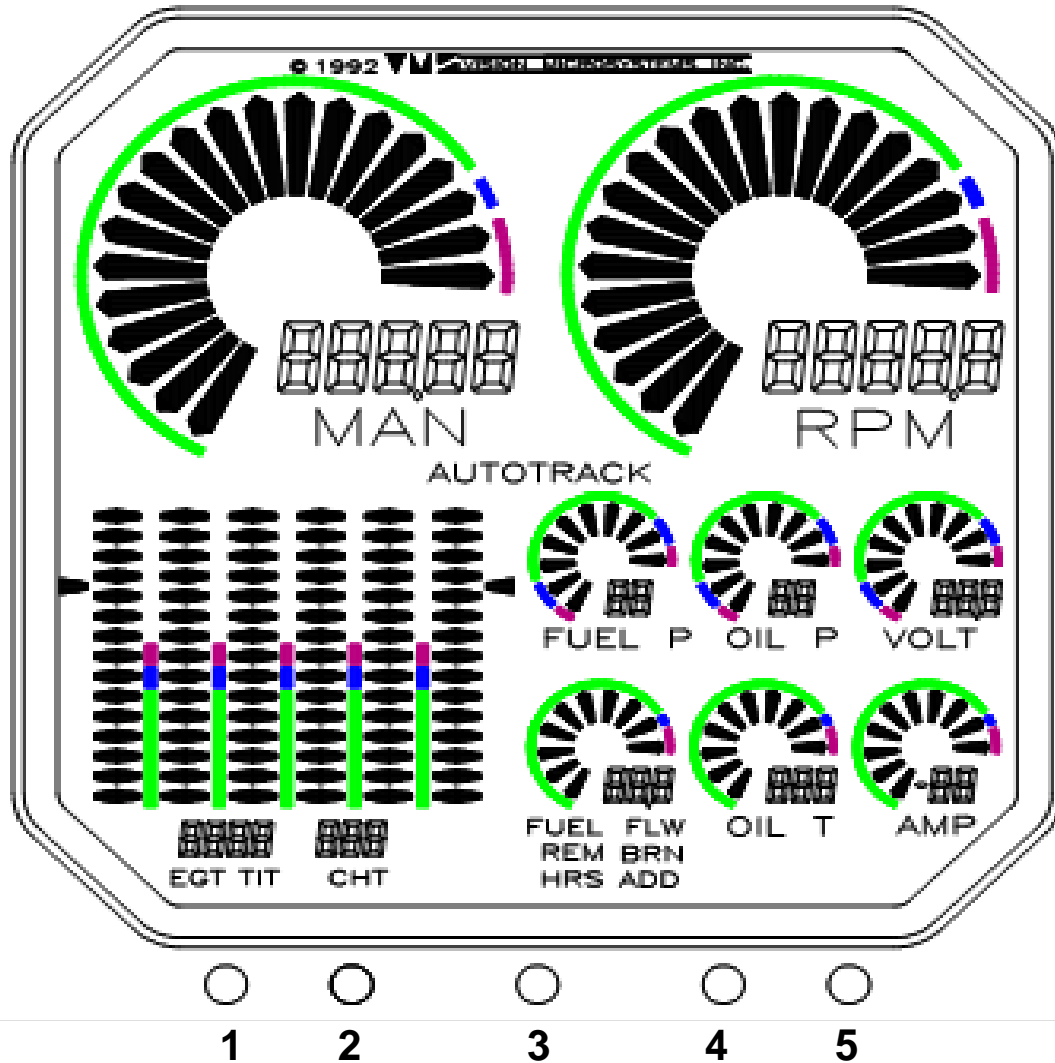 VISION MICROSYSTEMS INCORPORATED.

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1.1 TACHOMETER OPERATION

The tachometer system provides both a full sweep graphic analog display and four place digital display. When you start the engine you will see the analog graph rise in proportion to the engine speed. Full color range marks provide you with a quick reference to monitor normal, caution and red line engine RPM.

RPM:

The digital readout provides you with exact RPM information. The resolution (or incremental steps) of the digital display is 10 RPM. For example, the display might read '2400' and after you make a slight increase in power, it would read '2410'. This is a definite advantage over other digital tachs that read in less than 10 RPM steps. They change so frequently that it becomes very distracting and annoying to the pilot. We recommend using the digital display for RPM checks and letting the engine stabilize for a minimum of three seconds during the checks. The high accuracy of the tach will allow you to follow long-term performance trends of your engine and prop, such as static maximum rpm, carb heat effectiveness, and typical mag drops. These can be important indicators of engine and accessory condition.

Engine Operating Hours:

Another feature is the 'engine hours counter'. When the engine is off, the digital display reads the total accumulated engine hours to a maximum of '5999.9'. Engine hours are accumulated any time RPM is greater than 1500.

RPM Alert:

A warning alert activates whenever the engines redline is reached. The RPM display will flash until this condition is corrected.

1.2 MANIFOLD PRESSURE OPERATION

The manifold pressure system provides both a full sweep graphic analog display and three place digital display.

The full sweep graphic display resolution is 1" IN. HG. The full color range marks provide you with a quick reference to manifold pressure when making fast power changes.

The digital readout provides you with precise manifold pressure information. This allows very precise power settings to be achieved.

You can, for example, in stabilized conditions, watch for small changes in pressure that can indicate throttle creep or induction problems.

For new induction system designs, or modifications to existing designs, this repeatability is extremely valuable to judge the performance of the design or design changes.

Manifold Pressure Alert:

A warning alert activates whenever the engines redline is reached (typically only for turbocharged engines). The display will flash until this condition is corrected.

1.3 OIL SYSTEM OPERATION

Both oil pressure and oil temperature are displayed continuously in two separate full sweep graphic and digital areas.

Oil Pressure:

As oil pressure rises, the graph size increases proportionately. The full color range marks let you see at a glance how close to red line oil pressure you are.

The digital display reads out in 1 PSI increments to a maximum of 99. This is very useful for monitoring typical engine oil pressure trends. Because of the high accuracy and repeatability of this system, the oil pressure can be closely monitored for unusual trends. For example, if you are cruising in a stabilized condition, and the oil pressure starts to count down, and oil temp is counting up, this could help you to identify impending oil-loss or cooling problems.

Oil Pressure Alert:

A warning alert activates whenever the engines redline is reached. The display will flash until this condition is corrected.

Oil Temperature:

Oil temperature is displayed both graphically and digitally. As oil temperature rises, the graph size increases proportionately. This is consistent with the oil pressure display and makes it very easy to determine relationships between the two parameters.

The full color range marks let you see at a glance how close to red line oil temperature you are.

The digital display reads out in 1 degree Fahrenheit increments to a maximum of 300 degrees. This is very useful for monitoring typical engine oil cooling system performance.

For new engine installations, you can take advantage of the high accuracy and repeatability for analyzing the engine oil cooler system efficiency. If the cooling does not seem to be effective enough, you can make changes and repeat your tests with the confidence that the next test data will reflect the results of your changes.

Oil Temperature Alert:

Your oil temp system also provides you with built-in warning annunciators. If the oil temperature rises above redline, the system captures the event and the display is flashed until the problem is corrected. This is a real advantage in the busy cockpit.

1.4   FUEL COMPUTER SYSTEM OPERATION

Fuel Pressure:

Fuel Pressure is displayed both digitally and graphically. As fuel pressure rises, the graph rises proportionately. Full color operating range marks are provided that indicates the normal operating range of fuel pressure for your engine at a glance. The digital display allows you to see small variations and make notations of typical fuel pressure behavior.

Fuel Pressure Alert:
The system has a built-in warning system and will flash should fuel pressure move outside of the limits for your particular engine.

Fuel Flow:
Fuel Flow is displayed both digitally and graphically. As fuel flow increases, the graph increases proportionately. The digital display provides tenth gallon resolution.

There are four additional features that the fuel computer provides:
 'REM' - Fuel remaining onboard
 'BRN' - Fuel burned since last power-up
 'HRS' - Hours of fuel remaining
 'ADD' - Add fuel to computer memory.

An exclusive feature of our fuel flow computer is its ability to 'damp out' the wide variations in displayed fuel flow normally seen on other fuel flow digital readouts. Our system will smooth these short term flow variations to give you a steady flow indication with NO sacrifice in accuracy.

Fuel Remaining Alert:
Your fuel computer has a built-in 'Low Fuel Remaining' warning annunciator. When the computed fuel total is less than a factory programmed amount (10 gallons standard), the display will flash.

1.5   ADDING FUEL TO THE FUEL COMPUTER

***************************** WARNING ********************************
IMPROPER USE OF THIS FEATURE WILL GIVE YOU INCORRECT FUEL 'REM' AND 'HRS' INFORMATION. INSURE THAT YOU UNDERSTAND THE OPERATION OF THIS SYSTEM BEFORE USING IT INFLIGHT. AFTER INSTALLATION AND PERIODICALLY THEREAFTER, VERIFY THAT THE SYSTEMS ACCURACY IS ACCEPTABLE FOR YOUR INTENDED USE.
****

Your fuel computer has a unique feature that allows you to 'ADD' fuel according to how much has been pumped into the tank(s). You are not required to calculate the new total fuel level after adding fuel, as on many other fuel computers. This system does it for you. Follow the steps below to 'ADD' fuel to the computer, referring to '**Error! Reference source not found.**':

STEP 1. Press 'BUTTON 4' until the **'ADD'** indicator activates

STEP 1. Press 'BUTTON 3 to add tens and 'BUTTON 5' to add ones to match the fuel that was pumped into the tank(s).

NOTE: To 'top off' the tank(s) just press 'BUTTON 3' to run up a number more that your max capacity. The system will only add what is needed to 'fill' the computers electronic tank to its max capacity as set up in '**Error! Reference source not found.**'.

STEP 2. If you made a mistake just leave everything alone for more than 20 seconds and the computer will automatically cancel the **'ADD'** mode. If you are happy with the entered value, then press 'BUTTON 4' and the new fuel will be automatically added to the prior fuel **'REM'** total. Double check this new total by pressing 'BUTTON 4' until the **'REM'** fuel is shown.

NOTE: In the event you want to 'zero' the current fuel remaining value, press Button 4 until **'REM'** is displayed and continue holding it in. Simultaneously press Button 3 and the **'REM'** value will be cleared to zero.

1.6 FUEL COMPUTER NORMAL OPERATION MODES

Press 'BUTTON 4' to select the desired fuel computer operating mode. The mode is displayed below the permanent words '**FUEL FLW**' on the display:

'FUEL FLW': Fuel Flow is the default mode after powering up. This mode displays the fuel flow in the appropriate Units Per Hour both digitally and graphically. The digital section provides 0.1 unit resolution. The graphic section provides you with a quick reference of the current fuel flow.

'REM': This mode displays the current fuel total remaining in gallons. It is digitally displayed in 0.1 gallon increments. This mode is ONLY usable, if you have kept the computer's memory updated with fuel information corresponding to the actual aircraft usable fuel and have always had the computer operational when fuel is being burned. The graphic display is shut off as it has no relationship to this parameter.

'HRS': This mode displays the calculated hours of fuel remaining (sometimes referred to as endurance), as a function of the current flow rate and current fuel total in the computer's memory. It is digitally displayed in 0.1 hour increments. This mode is ONLY usable, if you have kept the computer's memory updated with fuel information corresponding to the actual aircraft usable fuel and have always had the computer operational when fuel is being burned. The graphic display is shut off as it has no relationship to this parameter.

'BRN': This mode displays the gallons of fuel burned in flight since system power up. It is digitally displayed in 0.1 gallon increments. The graphic display is shut off as it has no relationship to this parameter.

'ADD': This mode allows you to add fuel to the fuel computers 'electronic tank' after fuel has physically been added to the aircraft's tank(s). See section on 'ADDING FUEL TO THE COMPUTER'.

1.7 CYLINDER ANALYZER SYSTEM OPERATION

The engine analyzer system displays all cylinder information both graphically and digitally. Full color reference marks are provided for cylinder head green, yellow and redline temperatures.

'DIAMOND GRAPH' DISPLAY MODES:

'GRAPHIC MODE 1' (ABSOLUTE EGT): Press 'BUTTON 1' once (if in GRAPHIC MODE 1) to activate. All four graphs in the upper area come on and display absolute EGT temperature. This mode is most useful to spot plug / injector or valve problems. Each bar equals +50 deg. F with the base beginning at 1300 deg. F.

'GRAPHIC MODE 2' (RELATIVE EGT MODE) Press 'BUTTON 1' again (if in GRAPHIC MODE 2) to activate. All four graphs, plus two brackets, in the upper area come on and display RELATIVE EGT temperatures. This mode is most useful to watch short-term behavior of EGT to spot plug / injector or valve problems or when leaning to peak EGT. Each bar equals +20 deg. F with the bases normalized when the mode was activated.

DIGITAL DISPLAY MODES:

The digital displays shows individual temperatures for EGT and CHT. Periodically messages such as '**E1**   **C1**' appear to show which probes you are viewing digitally (ex.1: '**E1**   **C1**' means '**E**'GT **1** and '**C**'HT **1** are in view; ex. 2: '**P1**   **H4**' means '**P**'eak EGT **1** (hottest) and '**H**'ottest CHT 4 are in view).

The digital display defaults to the hottest CHT. For example, if CHT 1 is the hottest, the digital display will show H1 periodically. Pressing button 2   will cycle through each CHT and the hottest and allow you to select a different CHT by choosing C1, C2 etc. After the unit is turned on, the digital display defaults to show the hottest CHT. Temperature is displayed in Fahrenheit units.

Additionally, warning messages are shown if a cylinder has reached 'red line' temperature (ex: '**H2**' for hot cylinder 2), or is being 'shock cooled' (ex: '**C3**' for cold cylinder 3).

You can select a digital view by successively pressing 'BUTTON 2' :

Digital Mode #	Digital View	Cyl. Numbers	
1	Cyl. 1 EGT & CHT	'**E1**'	'**C1**'
2	Cyl. 2 EGT & CHT	'**E2**'	'**C2**'
3	Cyl. 3 EGT & CHT	'**E3**'	'**C3**'
4	Cyl. 4 EGT & CHT	'**E4**'	'**C4**'
5	Hottest EGT & CHT	'**P**n'	'**H**n'

After powering up the unit, the EGT digital display defaults to EGT 1   Periodically the digital display will identify which EGT you are seeing by showing and E followed by the EGT number, such as E1 for EGT 1. After you have successfully leaned the engine (as an example, lets assume it was EGT 2), the digital readout is locked to that EGT and E1 will change to P2 signifying that it **p**eaked on EGT 2. Tap button 2 to select a different EGT by choosing E1, E2, E3 etc. (Note: not available when in the peak mode). Temperature is displayed in Fahrenheit units.

LEANING YOUR ENGINE:

STEP 1: **STABILIZE;** the aircraft engine temps, throttle, rpm and insure mixture is on the rich (cooler) side temperature (approximately 100 Deg F cooler) of max EGT. To verify this, enrichen mixture to see that <u>ALL</u> EGT values decrease.

STEP 2: **LEAN;** the engine mixture smoothly to start the EGT bars climbing (about one bar per 2 seconds). Lean so as not to exceed max EGT. (See your engine manual for proper recommended operation). The digital readout should be showing either 'P1' or 'P2' indicating which EGT is hottest. Use this digital display to monitor and fine tune the EGT temperature according to your engine operating manual.

1.8 ELECTRICAL MONITORING SYSTEM OPERATION

VOLTAGE is displayed both graphically and digitally. Full color range marks provide a quick reference for fast analysis of voltage levels. As voltage rises, the graph size increases proportionately.

Additionally your system has a built-in warning system that flashes the graph when system voltage is out of nominal range (either too low or too high) .

AMPERAGE is displayed both graphically and digitally. Full color range marks provide a quick reference for fast analysis of amperage levels. As amperage rises, the graph size increases proportionately.
The digital readout displays amperage at 1 amp resolution. This is useful for troubleshooting.

The amp system functions as an 'alternator load meter' displaying current flow FROM the alternator TO the aircraft electrical system allowing you to see if a load (such as pitot heat) is really drawing current when turned on. You should see an increase on the amp display when you turn on a load, such as pitot heat for example. This tells you that the pitot heater is drawing power and is probably OK. By verifying that voltage remains the same, then it can be assumed that the alternator is supporting the additional load. A very handy feature for in-flight testing / verification of electrical loads and the alternator charging system.

Additionally your system has a built-in warning that flashes the graph and triggers the audio/visual annunciator system (if installed) when the alternator does not produce power for the electrical system. This occurs at low amperage levels of approximately less than 2 amps.

1.9 'AUTOTRACK' ™ SYSTEM OPERATION

The 'Autotrack' system is a breakthrough in modern engine monitoring technology. Designed to reduce the pilot's workload by assisting in the tedious and often overlooked

job of monitoring engine parameters for deviations from one minute to the next, 'Autotrack' adds a new level of safety to engine management.

 Subtle changes may occur in engine parameters that can precede major problems. These changes are often missed by even the most attentive of pilots. 'Autotrack' alerts you to these changes allowing you to analyze the situation and take appropriate action.

WHEN TO USE 'Autotrack':

- Climb - Activate during climb to alert you periodically as CHT increases and to a decrease in manifold pressure.

- Cruise - Activate during cruise to alert you if any parameter begins to drift from your selected starting point.

- Descent - Activate during descent to alert you to increasing manifold pressure and rising EGT due to a leaning mixture.

HOW TO USE 'Autotrack':

STEP 1. STABILIZE the aircraft. Set up your desired power and mixture condition. Allow the engine time to stabilize (i.e., engine temps and pressures, etc.).

STEP 2. Press 'BUTTON 3'. The 'Autotrack' indicator will activate in the display and the system will begin tracking the engine's performance from this point.

The 'Autotrack' system is now armed and watching for engine deviation from the point you picked. To cancel, simply press 'BUTTON 3' again to extinguish the 'Autotrack' indicator. Re-arm again at any time.

NOTE: Any important alert condition, (i.e., low fuel pressure, high CHT, etc.) automatically cancels 'Autotrack' mode.

'Autotrack' ALERT INDICATIONS:
If any engine parameter deviates beyond the initial set point, the system will flash the corresponding graphic display and the 'AUTOTRACK' indicator.

If the deviation is large enough, a graphic pointer (circular sweep displays only) will show where the parameter was before the deviation occurred. This gives you a chance to evaluate the magnitude of the deviation and take the appropriate action.

To shut off the alert condition, return the parameter to its previous value (example: adjusting manifold pressure due to a climb) or simply press 'BUTTON 3' to shut off the 'AUTOTRACK' system.

If optionally equipped, an audible and visual alert will activate in the EC100 caution advisory system.

1.10 FLIGHT DATA RECORDER SYSTEM OPERATION

The Flight Data Recorder System comes standard with your VM1000 and is designed to allow you to review / record the performance of the engine and systems during each flight. This is extremely valuable during initial flight testing and for subsequent trend analysis.

You may retrieve data using the Flight Data Recorder at any time during the flight or even after the aircraft has been shut down for a prolonged period of time.

Minimum and maximum values are automatically recorded during the flight and can be reviewed at any time before the next flight. Taxi data is automatically omitted, as this info is generally not important. Actual time of flight is also recorded.

HOW TO USE 'Flight Data Recorder':

STEP 1. Press 'BUTTON 5'. The first set of data are flight minimums encountered (i.e., lowest fuel pressure, lowest voltage, amperage, etc.). Also the RPM digital display now shows the actual flight hours and tenths.

STEP 2. Press 'BUTTON 5' again. The next set of data are flight maximums encountered (i.e., max CHT, max Oil Temp, max RPM, etc.).

STEP 3. Press 'BUTTON 5' again. The Flight Data Recorder is shut off. The recorder data will automatically shut off in approximately 20 seconds if no button is pressed.

1.11   INDICATOR CARE AND MAINTENANCE

The indicators require no scheduled care or maintenance. However, you probably will want to clean them occasionally. We recommend the use of diaper flannel. **NEVER use paper towels or tissues, as they can have a high abrasive content.**

To properly clean your indicator, remove surface dust and abrasives by blowing on the indicator face or brushing with a soft bristle brush. Next, 'fog' the indicator with your breath and gently rub the indicator. **NEVER use any solvents or cleaning fluids on the indicators.**