INSIGHT

Insight Instrument Corporation
Box 122, Fort Erie, ON L2A 5M6
Tel. 905-871-0733 Fax. 905-871-5460

ROTORCRAFT FLIGHT MANUAL SUPPLEMENT

FOR

INSIGHT INSTRUMENT GRAPHIC ENGINE MONITORS
GEM 610C AND 1200C MODELS
Document No. GEM-RFM-S
Issue 1

APPROVAL NUMBER: STC SH13-45

This document serves as the TCCA-approved Rotorcraft Flight Manual Supplement when the rotocraft is equipped with Insight Instrument Graphic Engine Monitors GEM 610C or 1200C.
This document must be carried in the rotocraft at all times when the GEM 610C or 1200C instruments are installed in accordance with Supplemental Type Certificate SH13-45.
The information contained herein supplements or supersedes the basic Rotorcraft Flight Manual only in those areas listed herein. For limitations, procedures and performance information not contained in this document, consult the basic Rotorcraft Flight Manual.

TCCA APPROVED

CANADA
DEPARTMENT OF TRANSPORT
AIRCRAFT CERTIFICATION
BRANCH

NOV 18 2013

APPROVED

BY Madan Vij
CERTIFICATE NO. SH13-45
ISSUE NO. 1

Table of Contents

TC Approved
NOV 18 2013

TCCA APPROVED
Date: _____

Insight Instrument Corporation
Box 122, Fort Erie, ON L2A 5M6
Tel. 905-871-0733 Fax. 905-871-5460

LIST OF EFFECTIVE PAGES

Page	Issue	Comment
1	1	
2	1	
3	1	
4	1	
5	1	
6	1	
7	1	
8	1	
9	1	
10	1	
11	1	
12	1	
13	1	
14	1	
15	1	

TCCA APPROVED
Date: _____

Insight Instrument Corporation
Box 122, Fort Erie, ON L2A 5M6
Tel. 905-871-0733 Fax. 905-871-5460

RECORD OF REVISIONS

Issue	Date	Comment
1	15-07-13	First Issue

TC Approved
NOV 18 2013

TCCA APPROVED
Date: _____

Insight Instrument Corporation
Box 122, Fort Erie, ON L2A 5M6
Tel. 905-871-0733 Fax. 905-871-5460

SECTION I

GENERAL

The Insight Graphic Engine Monitors GEM 610C and 1200C are capable of displaying the rotorcraft's engine Exhaust Gas Temperature (EGT), Cylinder Head Temperature (CHT) and Turbine Inlet Temperature (TIT), Carburetor Temperature (CARB), Manifold Pressure (MAP), Tachometer (RPM), Oil Pressure (OIL), Fuel Flow (GPH), Bus Voltage (VDC) and Outside Air Temperature (OAT) on a Liquid Crystal Display (LCD).

The Insight Instrument GEM Models 610C and 1200C are primary engine instruments for display of the EGT, CHT and TIT parameters. Both can be configured as single-engine instruments, model 1200C also as a twin-engine instrument. They may also be used as additional, non-required indicators for those engine temperatures and additional engine parameters listed above.

The GEM instruments indicate temperatures that are displayed to one degree resolution in Fahrenheit or Celsius degrees. The temperature unit is displayed in the lower portion of the display. The LCD dims automatically with the intensity of ambient light.

The white, green and red coloured bargraph and digital values in the central and lower part of the display may be used as primary indicators for EGT, CHT, and TIT. The cyan coloured numbers at the top of display are additional parameters (fuel flow, RPM, OAT, etc.) , for reference only.

The EGT values are displayed as vertical white bar graphs, one per cylinder. Digital EGT values for each cylinder are indicated by white four-digit numbers below the bargraph. CHT are indicated by vertical bargraphs (one per cylinder) and 3-digit numerals below the bargraphs and below the EGT numbers. CHT is displayed as a green bargraph and green numerals while the CHT value is within normal CHT operating range, or by a red bargraph and number if the CHT value exceeds the maximum CHT limit. A horizontal red line indicates the maximum allowable CHT. The TIT (of a turbocharger-equipped engine) is displayed by a green vertical bargraph and numbers on the right-hand side of the display while the TIT value is within normal operating range, or by a red bargraph and numbers if the TIT value exceeds the maximum TIT limit. A red horizontal line displays the maximum allowable TIT.

The GEM instrument senses temperatures through thermocouple-type probes. The instrument is powered typically from the avionics bus and protected by a dedicated, trip-free, resettable 1A circuit breaker. GEM instruments automatically accommodate both 14 and 28 VDC electrical systems.

Descriptions of the different configurations of the GEM 610C are included on pages 6, 7, 8 and 9 of this Supplement.

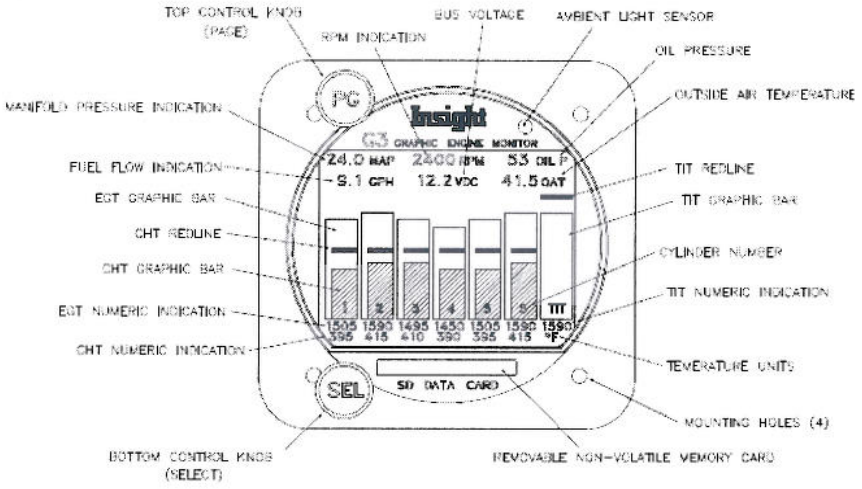
TCCA APPROVED
Date: _____

Insight Instrument Corporation
Box 122, Fort Erie, ON L2A 5M6
Tel. 905-871-0733 Fax. 905-871-5460

GEM 610C CONFIGURATIONS

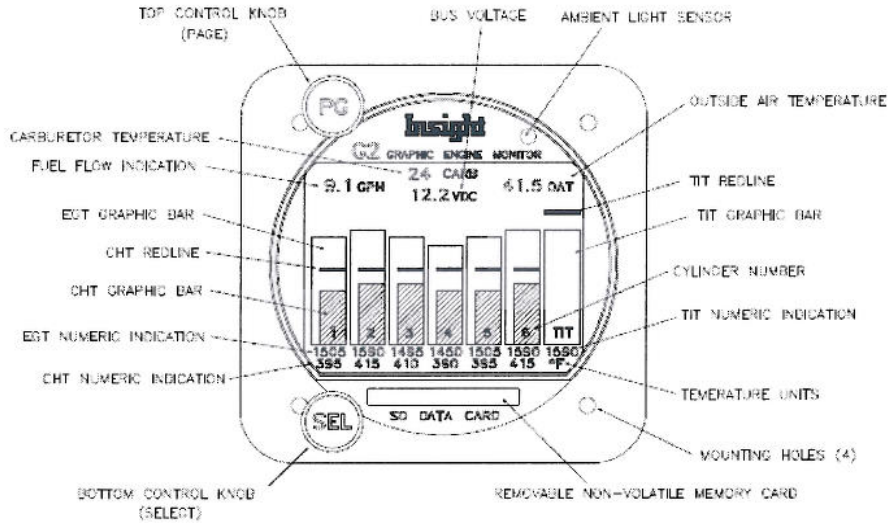
G3 CONFIGURATION

The GEM 610C G3 variant is shown below. The G3 instrument displays rotorcraft's engine Exhaust Gas Temperature (EGT), Cylinder Head Temperature (CHT) and Turbine Inlet Temperature (TIT), Carburetor Temperature (CARB), Manifold Pressure (MAP), Tachometer (RPM), Oil Pressure (OIL), Fuel Flow (GPH), Bus Voltage (VDC) and Outside Air Temperature (OAT) on a Liquid Crystal Display (LCD).



G2 CONFIGURATION

The GEM 610C G2 variant is shown below. The G2 instrument displays EGT, CHT, TIT, Carburetor Temperature, GPH, VDC and OAT on an LCD.



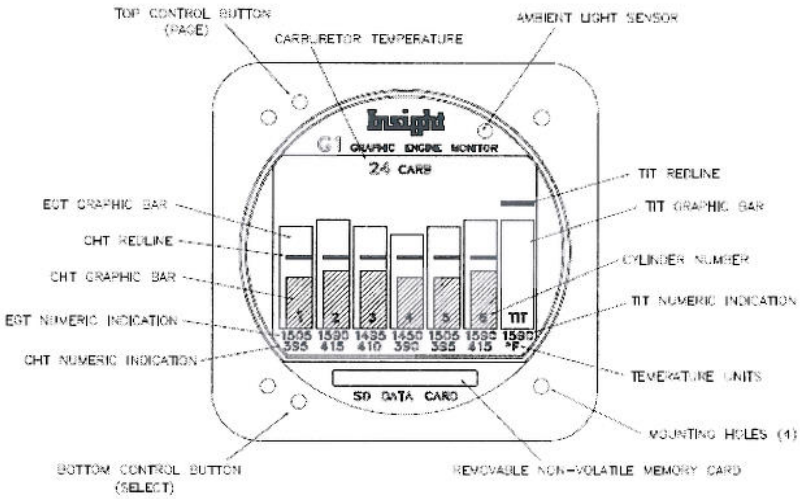
TCCA APPROVED
Date: _____

TC Approved
NOV 18 2013

Insight Instrument Corporation
Box 122, Fort Erie, ON L2A 5M6
Tel. 905-871-0733 Fax. 905-871-5460

G1 CONFIGURATION

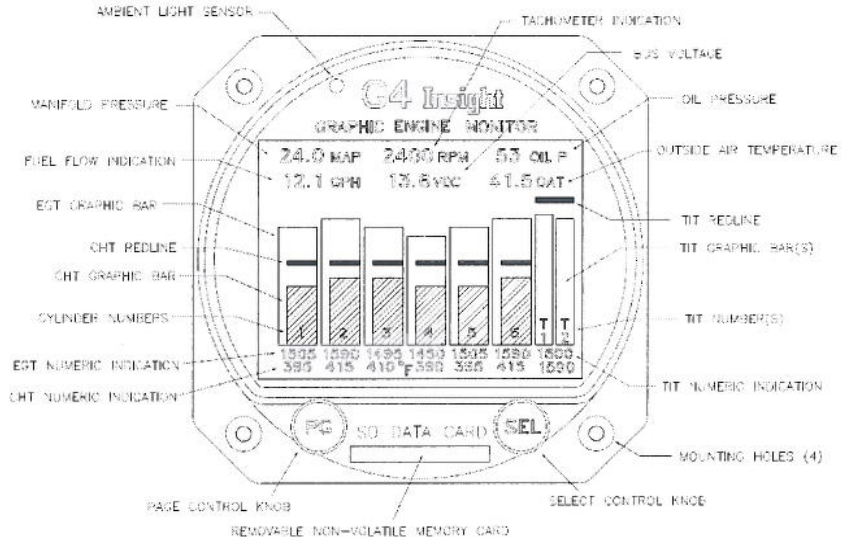
The GEM 610C G1 variant is shown below. The G1 instrument displays EGT, CHT, TIT and Carburetor Temperature (optional) on an LCD.



GEM 1200C CONFIGURATIONS

G4-001 SINGLE ENGINE CONFIGURATION

The GEM G4-001 variant is shown below. The GEM G4-001 instrument displays rotorcraft engine Exhaust Gas Temperature (EGT), Cylinder Head Temperature (CHT) and Turbine Inlet Temperature (TIT), Carburetor Temperature (CARB), Manifold Pressure (MAP), Tachometer (RPM), Oil Pressure (OIL), Fuel Flow (GPH), Bus Voltage (VDC) and Outside Air Temperature (OAT) on a Liquid Crystal Display (LCD).



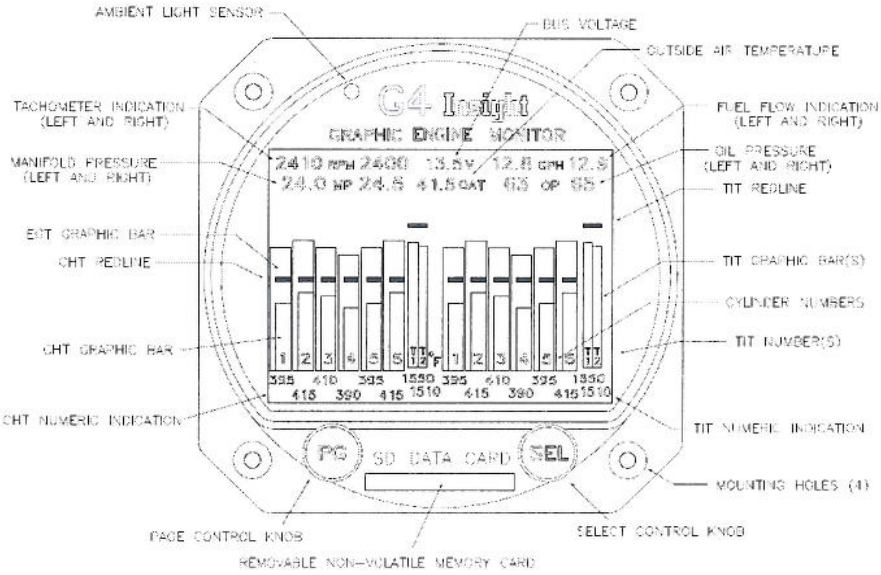
TCCA APPROVED
Date: _____

TC Approved
NOV 18 2013

Insight Instrument Corporation
Box 122, Fort Erie, ON L2A 5M6
Tel. 905-871-0733 Fax. 905-871-5460

G4-002 TWIN ENGINE CONFIGURATION

The GEM G4-002 variant is shown below. The GEM G4-002 instrument displays a twin-engine rotorcraft Exhaust Gas Temperature (EGT), Cylinder Head Temperature (CHT) and Turbine Inlet Temperature (TIT), Carburetor Temperature (CARB), Manifold Pressure (MAP), Tachometer (RPM), Oil Pressure (OIL), Fuel Flow (GPH), Bus Voltage (VDC) and Outside Air Temperature (OAT) on a Liquid Crystal Display (LCD). Each engine may be temporarily displayed similar to the G4-001 display by turning the page knob (PG) to the left or right accordingly for leaning or engine diagnostic purposes.



TCCA APPROVED
Date: _____

TC Approved
NOV 18 2013

Insight Instrument Corporation
Box 122, Fort Erie, ON L2A 5M6
Tel. 905-871-0733 Fax. 905-871-5460

SECTION II

LIMITATIONS

The Insight GEM 610C and 1200C instruments may replace any eligible rotorcraft Cylinder Head Temperature (CHT) indicator or Exhaust Gas Temperature (EGT) or Turbine Inlet Temperature (TIT) indicator. Both can be configured as single-engine instruments, model 1200C also as a twin-engine instrument.

The Manifold Pressure (MAP), Carburetor Temperature (CARB), Tachometer (RPM), Oil Pressure(OIL), Fuel Flow (GPH), Bus Voltage (VDC) and Outside Air Temperature (OAT) indications at the top of the display are supplementary information, for reference only.

TCCA APPROVED
Date: _____

SECTION III

EMERGENCY PROCEDURES

None.

Insight Instrument Corporation
Box 122, Fort Erie, ON L2A 5M6
Tel. 905-871-0733 Fax. 905-871-5460

SECTION IV
NORMAL PROCEDURES

Normal Operation

The GEM 610C and 1200C continuously measure and display EGT, CHT and TIT temperatures, Oil Pressure,Carburetor Temperature, Manifold Pressure, RPM, Fuel Flow, Bus Voltage and Outside Air Temperature.
Normal operating temperatures for CHT are displayed as green bargraphs and numerical values, yellow bargraphs and numbers when approaching maximum (redline), and red bargraphs and numbers when exceeding the redline .
The EGT operating temperatures are shown as white bargraphs and numerical values on the single engine display, and only with white bargraphs on the twin display.
The TIT (of a turbocharger-equipped engine) is displayed by a green vertical bargraph and numbers on the right-hand side of the display while the TIT value is within normal operating range, and by a red bargraph and numbers if the TIT exceeds the maximum TIT limit. A red horizontal line displays the maximum allowable TIT.

The G4-002 normally displays both engines simultaneously. For leaning purposes each engine may be viewed separately by turning the page knob (PG) left or right to display one engine at a time. At the conclusion of leaning the G4 display should be switched back (using PG) to the main twin engine page to monitor normal operation.

Cruise Leaning Procedure for Rich-of-Peak (ROP) Operation Using GEM

1. Establish cruise power setting and mixture according to the engine and airframe manufacturers' instructions.
2. Set the desired lean threshold by pushing the lower button and turning the knob. Push the lower button to exit. **(Not applicable to G1 configuration.)**
3. Lean mixture slowly until each cylinder reaches peak EGT and display the temperature difference in a box above each column. Reverse mixture control motion to enrich the mixture to obtain the fuel flow rate or EGT drop recommended by the engine and airframe manufacturer. The EGT drop is continuously displayed above the EGT column. **Reaching the desired EGT drop is annunciated by the temperature box changing from hollow to solid. (Not applicable to G1 configuration.)**
4. The user may retry the procedure by setting the mixture well on the rich side and then pushing the lower button for three (3) seconds to erase the temperature difference boxes. Then start from the beginning.

Cruise Leaning Procedure for Lean-of-Peak (LOP) Operation
(For rotorcraft approved for LOP mixture operation)

1. Establish cruise power setting and mixture according to the engine and airframe manufacturers' instructions.

TCCA APPROVED
Date: _____

2. Set the desired lean threshold by pushing the lower button and turning the knob. Push the lower button to exit. **(Not applicable to G1 configuration.)**
3. Lean mixture slowly until all cylinders display peak EGT difference boxes. Continue leaning until all the temperature difference boxes indicate the engine manufacturers' recommended LOP temperature drop. **This point is annunciated by the temperature box changing from hollow to solid. (Not applicable to G1 configuration.)**
4. The user may retry the procedure by setting the mixture well on the rich side and then pushing the lower button for three (3) seconds to erase the temperature difference boxes. Then start from the beginning.

CHT Limits

Aircraft engine manufacturers' specify a maximum cylinder head operating temperature and define it as the CHT redline. This temperature will be documented in the operating limitations section of the Pilot Operating Handbook/ RFM. This temperature is not recommended for continuous operation. It is instead the absolute maximum operating temperature that may be encountered under adverse conditions like steep climbs on a hot day. The pilot should avoid engine operation near the CHT redline for safe operations and long engine life.

Note: The CHT limit temperature is shown on the GEM instruments as a red line across the bargraphs. In the overheat conditions, the bargraph and numerical value representing the overheating cylinder will change from green to red.

Causes of High Temperatures

High CHT values may result from poor pilot technique during adverse conditions or a mechanical fault or abnormality of some kind. The cause might be inadequate cooling air, inadequate lubrication, improper combustion or increased cylinder heat generation from an engine component failure. Regardless of the cause the pilot should take steps to reduce the temperature to within safe limits. If the cause is determined to be from a fault or abnormality then a precautionary landing should be considered.

Reducing High Temperatures

The pilot may use any of the following procedures to reduce CHT:

1. Open cowl flaps (if equipped)
2. Reduce climb angle to increase cooling airflow (if climbing)
3. Increase airspeed to increase cooling airflow
4. Enrich mixture
5. Reduce power setting
6. Shutdown engine (multi-engine only)

TIT Limits

Engine manufacturers do not specify a maximum Exhaust Gas Temperature (EGT). All references to EGT are relative to peak temperature. However in a turbo-charged rotorcraft the EGT is measured collectively just prior to entering the turbo-charger and is called Turbine Inlet Temperature (TIT). The turbo has a definite temperature limit often near 1650 °F. The limit will be specified in the rotorcraft's POH/RFM. For long turbo life pilots often operate 100 °F below the specified limit.

The flow of exhaust gas through the turbo is controlled by a valve called a waste gate. The term waste gate is used because the valve opens to bypass or waste exhaust gas past the turbo. The waste gate may be fixed, manually controlled, linked to throttle motion or controlled automatically depending on the rotorcraft. If the waste gate is a manual style, a second throttle-like knob is used as the primary control of turbo performance and temperature. With the other waste gate systems the pilot controls turbo temperature primarily by mixture setting and to a lesser extent by power setting. Turbo rotorcraft are often leaned to control turbine inlet temperature only, rather than by reference to peak EGT. Failure of the waste gate control system or inability to control temperatures with normal limits may necessitate a precautionary landing.

Manual Brightness Adjustment

The instrument adjusts its brightness automatically, according to ambient lighting condition.

The GEM instruments may have minimum brightness adjusted. See Installation Instruction, Document No. 070906, latest revision. **(Not applicable to G1 configuration.)**

TCCA APPROVED
Date: _____

Insight Instrument Corporation
Box 122, Fort Erie, ON L2A 5M6
Tel. 905-871-0733 Fax. 905-871-5460

SECTION V

PERFORMANCE

No change to Rotorcraft Flight Manual

TCCA APPROVED
Date: _____

Insight Instrument Corporation
Box 122, Fort Erie, ON L2A 5M6
Tel. 905-871-0733 Fax. 905-871-5460

SECTION VI

WEIGHT AND BALANCE

See current weight and balance data.

Note: The GEM instument's weight is 0.22kg.

TCCA APPROVED
Date: _____

TC Approved
NOV 18 2013