

SECTION I

INTRODUCTION AND DESCRIPTION

1-1. INTRODUCTION.

1-2. This publication contains operations and maintenance instructions, for the Pressure-Temperature, Test Set, TTU-205C/E (see figure 1-1), Part Number 18910010000, manufactured by Kollsman Instrument Company, Merrimack, N.H. 03054. This manual is provided to familiarize maintenance personnel with the operation of the Pressure-Temperature Test Set and to provide maintenance instructions.

1-3. PURPOSE OF EQUIPMENT.

1-4. The Pressure-Temperature Test Set, Type TTU-205C/E hereinafter referred to as the Test Set, is used to provide regulated pitot and static pressure for evaluating performance characteristics of aircraft pneumatic instruments, air data systems, and other auxiliary equipment. The Test Set is also used to conduct dynamic tests, quantitative calibration tests, and pneumatic-system leak tests. Total Temperature probe is also simulated by the Test Set.

1-5. DESCRIPTION.

1-6. The Test Set is a single, compact assembly comprising a control panel and components assembly, and a combination carrying case with a removable cover. All of the controls, indicators, switches, electrical and pneumatic connectors are mounted on the front panel of the Test Set. All of the components are mounted on the underside of the control panel, which makes the subassemblies and components easily accessible when the panel is removed from its carrying case. The Test Set simulated airspeed and altitude information is read out directly on the display on the front panel.

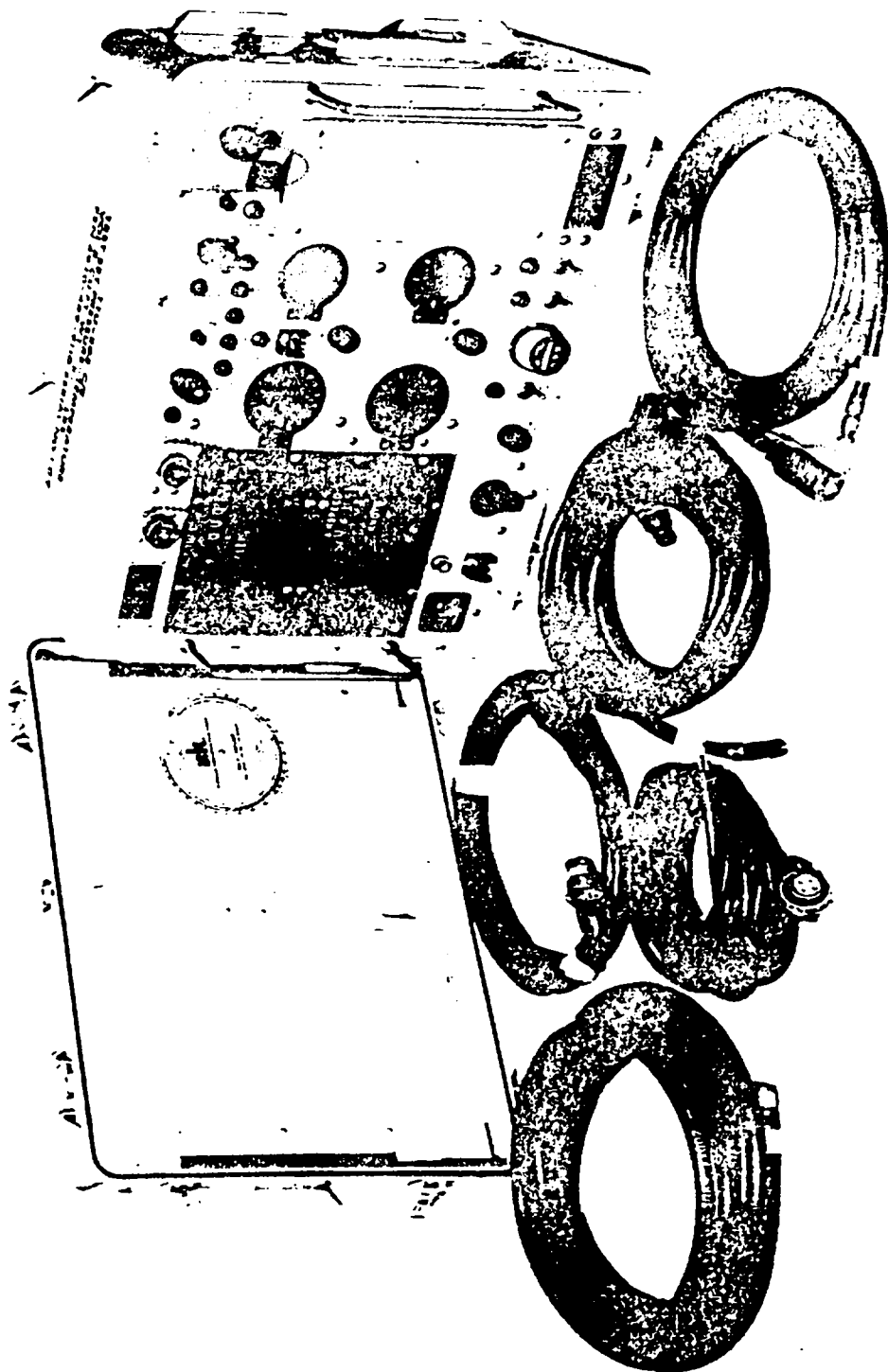
1-7. TESTING CAPABILITIES.

1-8. The Test Set has the following capabilities:

a. Performs overall system checks on the following equipment, either installed in or removed from the aircraft:

- Pneumatic Systems
- Air Data Systems
- Flight Instruments
- Pneumatic Ancillary Equipment

b. Provides simulated total temperature for the USAF MA-1 Probe (MIL-P-25726), which has a platinum resistance sensing element whose resistance is 50.0 ohms at 0°C.



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Figure 1-1. Pressure-Temperature Test Set TTU-205C/E

c. Connects directly into aircraft's pneumatic system to measure and control the static pressure (P_s) and pitot pressure (P_t) that is required by the pneumatic instruments of the aircraft.

d. Accepts electrical power from an external source.

e. Incorporates safety features that prevent damage to Test Set and the Unit under test.

1-9. LEADING PARTICULARS.

1-10. Pertinent information relative to the Test Set is presented in table 1-1.

Table 1-1. Leading Particulars

Power Requirements:	
A.C. Input	115 volts, 400 Hz., Single phase
Power Consumption	350 VA (approx.)
Weight	97 pounds
Dimensions:	
Length	24.87 inches
Width	18.85 inches
Height	14.00 inches
Volume	3.0 Cubic feet
Range:	
Altitude	-1500 to +80,000 feet (approx.) 31.5 to 0.82 " Hg A)
Airspeed	50 to 1000 knots (approx. 0.12 to 73.55" Hg diff.)
Static Load Range	5 to 250 cubic inches
Pitot Load Range	5 to 100 cubic inches
Slew Rate:	
Altitude	0 to 35,000 feet/minute
Airspeed	0 to 700 knots/minute
Static Test Fixture Vacuum	More than 4 psi below ambient
Temperature Simulation	30.0 to 129.9 ohms (approx.) -99 to +430°C)
Pressure Modulation:	
Frequency	0.05, 0.25 and, 0.50 Hz
Amplitude	Variable

1-11. SUPASSEMBLY DESCRIPTION.

1-12. The Test Set is comprised of the following subassemblies. Total Temperature Simulator assembly, altitude module, airspeed module, pump assembly, pneumatic assembly, electronics assembly, case and cover assembly (see figure 1-2).

1-13. TOTAL TEMPERATURE SIMULATOR ASSEMBLY. The Total Temperature Simulator (see figure 1-2) is a sealed unit containing precision resistors that are selected by a three digit thumbwheel type switch. The values range from 30.0 to 129.9 ohms (temperature range -99°C to $+430^{\circ}\text{C}$) in 0.1 ohm steps. The output of this assembly is made available at a front panel connector.

1-14. ALTITUDE MODULE ASSEMBLY. Mounted on the front panel, the Altitude Module (see figure 1-2) monitors and displays the altitude output of the system by means of the altitude sensors and servo. The altitude sensor is an absolute pressure measuring instrument consisting of a set of aneroid diaphragms which expand with a decrease in pressure and through a mechanical gear train rotates the rotors of two synchrotels. Synchrotels are Kollsman developed synchros with extremely low friction. One synchrotel is rotated at 1 turn per 10,000 feet of altitude and the second unit is geared down at a ratio of 19.06:1 to totalize the revolutions of the first synchrotel. The electrical output of this sensor is linear with altitude. The electrical output operates a servo loop within the assembly to provide a counter display of the altitude. Additional outputs are provided to (1) operate the pneumatic servo valve, (2) provide an input to the Mach Limit Loop and (3) provide two inputs to the Safety Logic to protect the Test Set and the unit under test.

1-15. AIRSPEED MODULE ASSEMBLY. The Airspeed Module (figure 1-2) mounted on the front panel monitors the airspeed (differential pressure) at the output of the Test Set by means of the sensor and servo. The sensor contains a differential (airspeed) diaphragm which expands with the application of pitot pressure and through a mechanical gear train rotates the rotor of a synchrotel. The electrical output of the synchrotel is proportional to airspeed. The outputs of the airspeed module are a counter type display of airspeed in knots and the electrical signals which are required to operate the pneumatic servo valve and safety logic circuitry.

1-16. PUMP ASSEMBLY. The pressure/vacuum pump (figure 1-2) consists of two piston-type pumps in a common housing. An electric motor drives both the pressure and vacuum sides of the pump simultaneously. An adjustable pressure control valve is installed in the top cover to provide adjustment of the output pressure. Valves installed at the top and bottom of the cylinders bases are so arranged to provide a pressure output from one side of the pump and a vacuum output from the other. It supplies pressure and vacuum references to both the altitude and airspeed servo valves and supplies vacuum to the Test Set's vacuum port.

1-17. PNEUMATIC ASSEMBLY. The pneumatic assembly (see figure 1-2) consists of the water separator/filter, bleed valves, solenoid valves, differential pressure switches, check valves, air filters and pressure ports. Pressure measuring

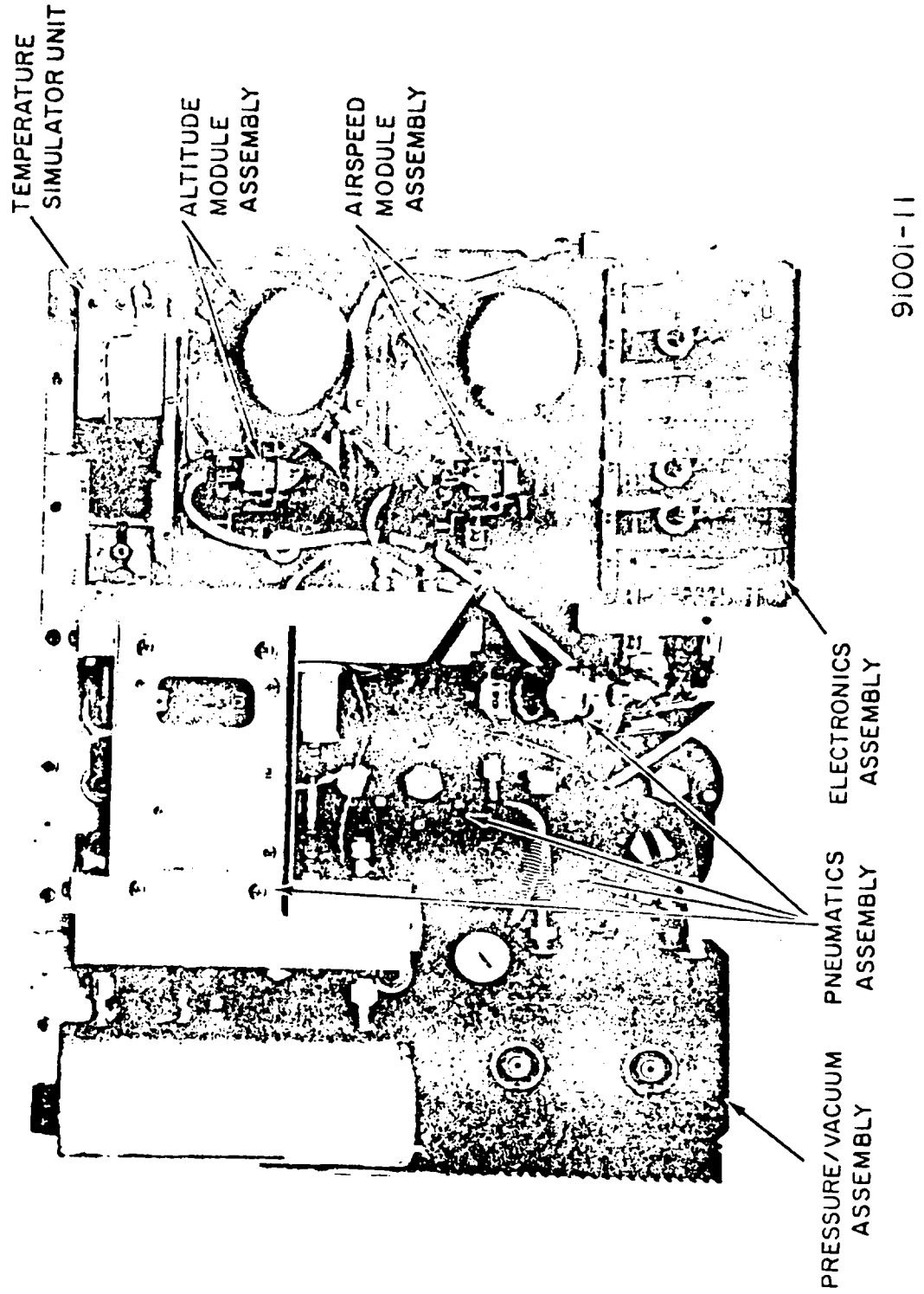


Figure 1-2. Pressure-Temperature Test Set TTU-205C/E Main Assemblies

are available for monitoring and testing purposes. The unregulated power supply is mounted on this assembly for easy accessibility and maintenance.

1-18. **ELECTRONICS ASSEMBLY.** The electronics assembly (see figure 1-2) consists of seven (7) printed circuit cards containing the components for the power and control of the various system functions.

1-19. **CASE AND COVER ASSEMBLY.** The Case and Cover Assembly (see figures 1-3 and 1-4) protects and houses the Test Set and provides storage space for the cable and hose assemblies. Operating instructions, including tables of altitude-vs-static pressure, airspeed-vs-differential pressure, and total temperature-vs-resistance, plus the system pneumatic schematic and overall electrical schematic, are located on the inside of the cover. A Mach computer is also located on the inside of the Test Set's cover.

1-20. FUNCTIONAL DESCRIPTION.

1-21. The TTU-205C/E is a portable pressure generating system, providing three pressure outputs:

- a. Fixed Vacuum Output which is used to hold static test fixtures to aircraft static ports.
- b. Static Pressure (P_s) output is controlled by the Test Set to a value set by the operator. The range of pressures obtainable are equivalent to altitudes from -1500 feet to 80,000 feet.
- c. Total Pressure (P_T) output is controlled by the Test Set to a value set by the operator. The impact pressure (a function of calibrated airspeed) is the difference between the Pitot pressure and the Static pressure. The range of the impact pressure is equivalent to that corresponding to calibrated airspeeds of from 50 to 1000 knots.

Figure 1-5 is a simplified functional block diagram of the TTU-205C/E and figure 1-6 is a schematic of the pneumatic portion of the Test Set.

1-22. **PRESSURE/VACUUM PUMP.** The pressure-vacuum pump is driven by a single phase 400 Hz motor, and it generates both a vacuum source and a pressure source for use by the pressure controlling servo loops.

1-23. **SERVO LOOP COMMANDS.** Paragraphs 1-24 through 1-27 describe the functions of the Servo Loop Commands.

- a. Static Pressure Servo Loop Commands are controlled by the altitude coarse and fine controls, located on the control panel. The coarse control is calibrated in thousands of feet, while the fine control is uncalibrated. This control has an adjustment range of approximately 1600 feet over a five turn, angular range. The static pressure servo loop operates by sensing the output pressure of the Test Set, comparing the altitude equivalent to this output pressure with the altitude commanded by the control panel setting and then changing the output pressure until the output is equal to the commanded altitude.