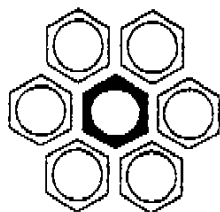


C-10 SERIES
PORTABLE INSTRUMENT CONSOLE

USERS MANUAL

**OPERATION, INSTALLATION,
SERVICE AND REPAIR
OF
MODELS C-10, C-10-1, AND C-10-2**



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SECTION I

DESCRIPTION AND OPERATION

1-1. INTRODUCTION

1-2. This manual contains general information, operating instructions, and parts data necessary for the operation, maintenance, and repair of the Model C-10, C-10-1, and C-10-2 Portable Instrument Consoles manufactured by GO-POWER SYSTEMS, Palo Alto, California.

1-3. GENERAL DESCRIPTION

1-4. The portable instrument consoles manufactured by GO-POWER SYSTEMS are designed to provide the user a remote operating location for the operation of various dynamometers also manufactured by GO-POWER SYSTEMS. The Model C-10 is designed to be used in conjunction with the GO-POWER automotive dynamometers, and the Model C-10-1 is designed to be used in conjunction with the GO-POWER DT1000 dynamometer and in-frame adapter systems. Before installing and operating the portable instrument consoles, the user should familiarize himself with installation and operation of the dynamometer and the various adapter systems by referring to the appropriate instruction manuals provided with those systems. The following paragraphs describe the portable instrument consoles and their operation.

1-5. **MODEL C-10 PORTABLE INSTRUMENT CONSOLE.** The Model C-10 Portable Instrument Console (Figure 1-1) is a self-contained unit consisting of an electronic tachometer, a hydraulic pressure gauge for measuring torque, and a load control actuator. The tachometer may be either a low speed or a high speed tachometer, depending on the user's requirements. The torque gauge is available in one of six different ranges chosen to best suit the requirements of most applications. Refer to Table 1-1 for available gauges and their specifications. The gauges are available with the faces incremented in pounds per foot or in kilograms per meter. The console is housed in a heavy gauge steel console with cast aluminum side panels and a removable bottom to allow access to the interior. The dimensions of the unit mounted on the pedestal are shown in Figure 1-2.

1-6. The unit is equipped with a series of four pushbuttons for controlling its operations. They are the power switch, two range switches, and a battery test switch. The power switch provides battery power to the tachometer, and the range switches are used for selecting the high or low range of the tachometer. The battery test switch is used to determine the strength of the battery. When the switch is depressed, a good battery will indicate full scale deflection on the tachometer. The off button should always be depressed during transit to protect the meter.

1-7. An optional pedestal, Model PED-1, is available with the console that will allow the console to be independently mounted in a remote location. Refer to Figure 1-2 for the pedestal dimensions.

1-8. An interconnect line for the torque meter, 20-feet (610-cm) long, with quick disconnect hydraulic fittings is included with the console. A tachometer cable 20-feet long is also included. Longer cables are available upon request.

1-9. **MODEL C-10-1 PORTABLE INSTRUMENT CONSOLE.** The Model C-10-1 Portable Instrument Console is identical to the Model C-10 except for the operating functions of the four pushbutton controls. Refer to Table 1-3 for the functions of the Model C-10-1 controls. The Model C-10-1 is also equipped with a dual range torque gauge. The outer scale (1500 ft-lbs) is used for the 1:127 mode of operation. Gauges other than the dual range are available as an option. Refer to Table 1-1 for torque gauge specifications.

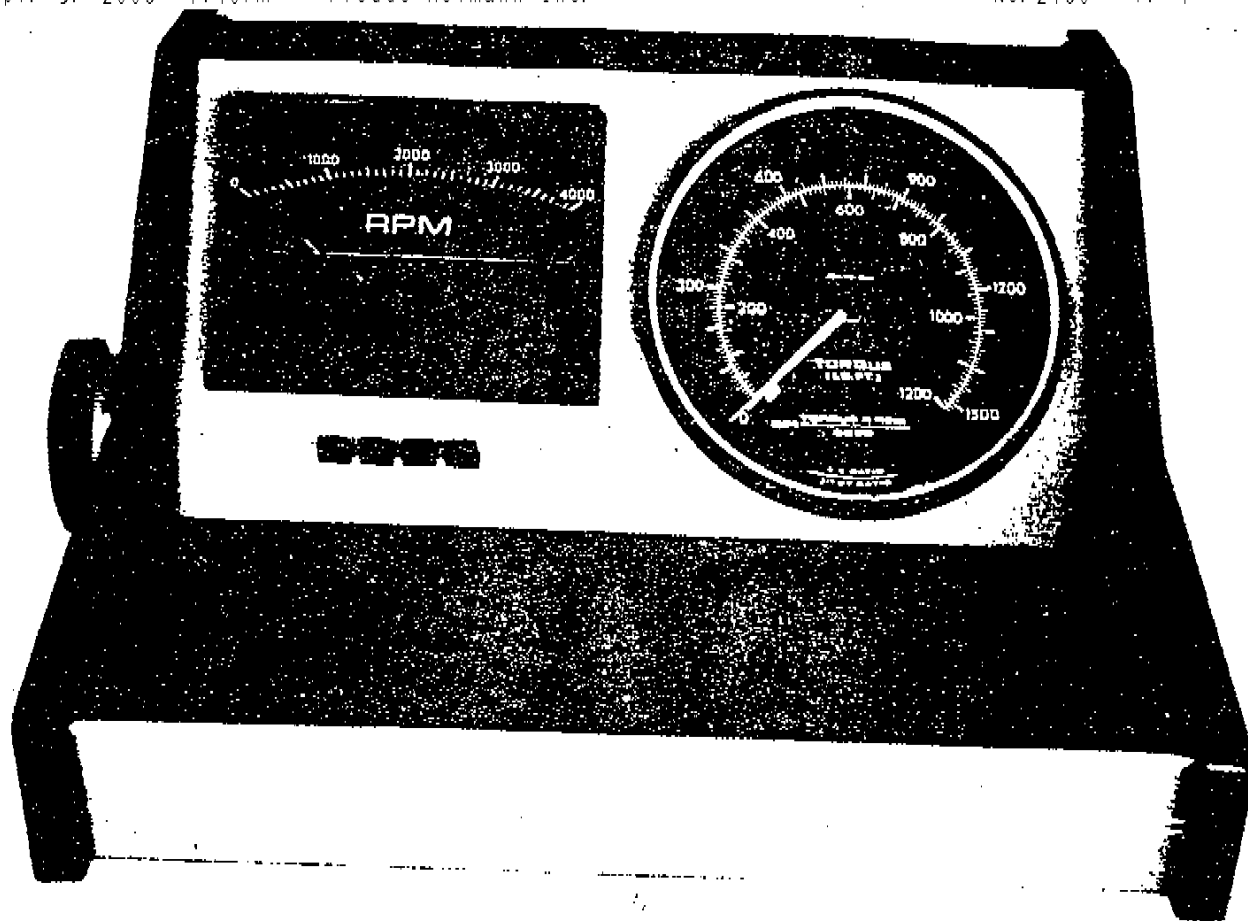


Figure 1-1. Portable Instrument Console, Model C-10

Table 1-1. Torque Gauge Specifications

RANGE		INCREMENTS		REPEATABILITY	
lb-ft	M-kg	lb-ft	M-kg	lb-ft	M-kg
Model C-10					
0-50	0-8	0.5	0.1	+0.05	+0.08
0-100	0-14	1.0	0.1	+0.1	+0.14
0-160	0-22	2.0	0.2	+0.2	+0.22
0-300	0-41	5.0	0.5	+0.3	+0.41
0-500	0-70	5.0	0.5	+0.5	+0.70
0-1000	0-140	10.0	1.0	+1.0	+1.40
Model C-10-1					
0-240	-	1.0	-	+0.2	-
0-640	-	2.0	-	+0.6	-
0-1200	165	-	-	+1.7	+1.2
0-1500	210	10.0	1.0	+2.0	+1.5

NOTE: Accuracy of gauges is 0.5% fs.

1-2

Model C-10-2

0-2000

10.0

+1.0

1-10 LEADING PARTICULARS

- 1-11. The leading particulars for the Model C-10 and the C-10-1 consoles are detailed in Table 1-2. Differences between models are so indicated.

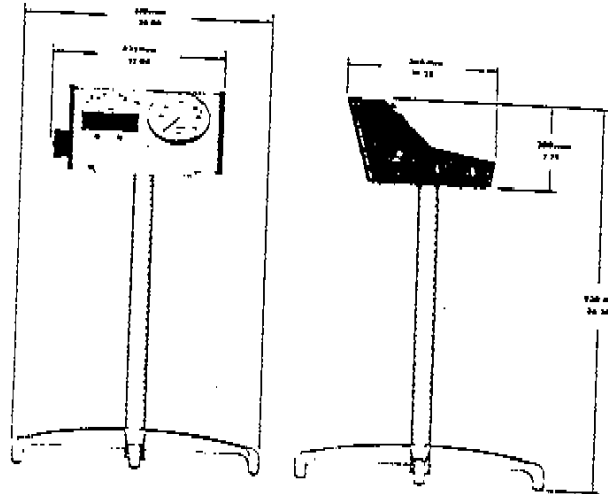


Figure 1-2. Portable Instrument Console Dimensions

Table 1-2. Leading Particulars

CHARACTERISTIC	SPECIFICATION
Power Requirement	9-volt Dry Cell Battery (internal)
Tachometers	
Low Speed (C-10-1)	0-4000 RPM*
High Speed (C-10)	Low Range 0-5000 RPM High Range 1-10,000 RPM
Accuracy	1% fs
Torque Gauge	(See Table 1-1)
System Accuracy	1.5% fs
System Repeatability	Better than 1% fs
Load Control	Hydraulic Actuator
Weight	20 pounds (9 kg) net

*Prior to August 1975, the Model C-10-1 was equipped with a dual range tachometer with a low range of 0-2500 RPM and a high range of 0-5000 RPM.

1-12. OPERATING INSTRUCTIONS

1-13. Operating instructions for the Portable Instrument Console include the location and function of the operating controls and indicators, and the set-up and step-by-step procedures necessary for the successful operation of the consoles.

1-14. CONTROLS AND INDICATORS. Operating controls and indicators are shown in Figure 1-3 and the names and functions are listed in Table 1-3.

1-15. OPERATION. To operate the Portable Instrument Console, set up the equipment as shown in Figure 1-4 and connect the lines as follows:

- a. Connect the torque meter and tachometer input lines to the rear of the console and to the dynamometer inputs.

Table 1-3. Controls and Indicators

ITEM	NAME	FUNCTION
C-10		
1	TEST	Pushbutton switch. Press to test battery strength.
2	OFF	Pushbutton switch. Press to turn unit off.
3	LOW	Pushbutton switch. Selects low range of tachometer.
C-10-1 (Prior to August 1975)		
1	OFF	Pushbutton switch. Press to turn unit off.
2	1:1 LOW	Pushbutton switch. Selects 1:1 operating mode and low range of tachometer
3	1:1 HIGH	Pushbutton switch. Selects 1:1 operating mode and high range of tachometer.
4	1:1.27	Pushbutton switch. Selects 1:1.27 operating mode.
7	BATTERY CHECK	Pushbutton switch. Press to test battery strength.
C-10-1 (After August 1975)		
1	TEST	Pushbutton switch. Press to test battery strength.
2	OFF	Pushbutton switch. Press to turn unit off.
3	1:1	Pushbutton switch. Selects 1:1 operating mode.
4	1:1.27	Pushbutton switch. Selects 1:1.27 operating mode.
All Units		
5	RPM	Tachometer. Indicates speed of engine in RPM.
6	TORQUE	Torque gauge. Indicates engine torque in pounds per foot or kilograms per meter.

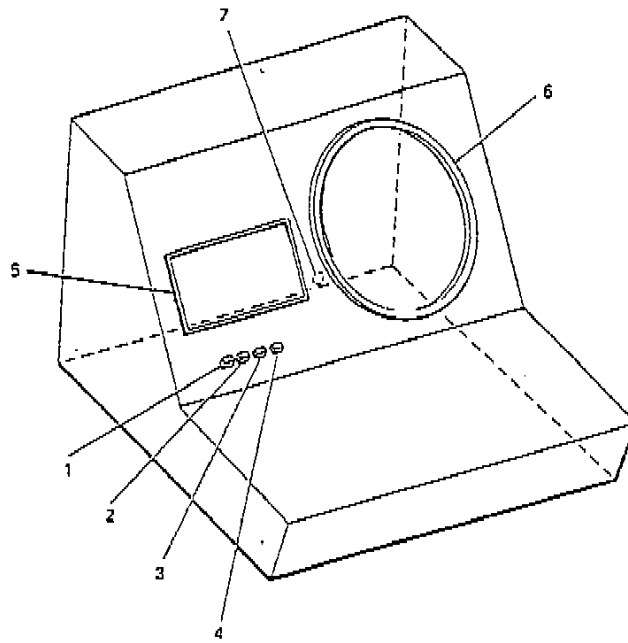


Figure 1-3. Portable Instrument Console, Controls and Indicators

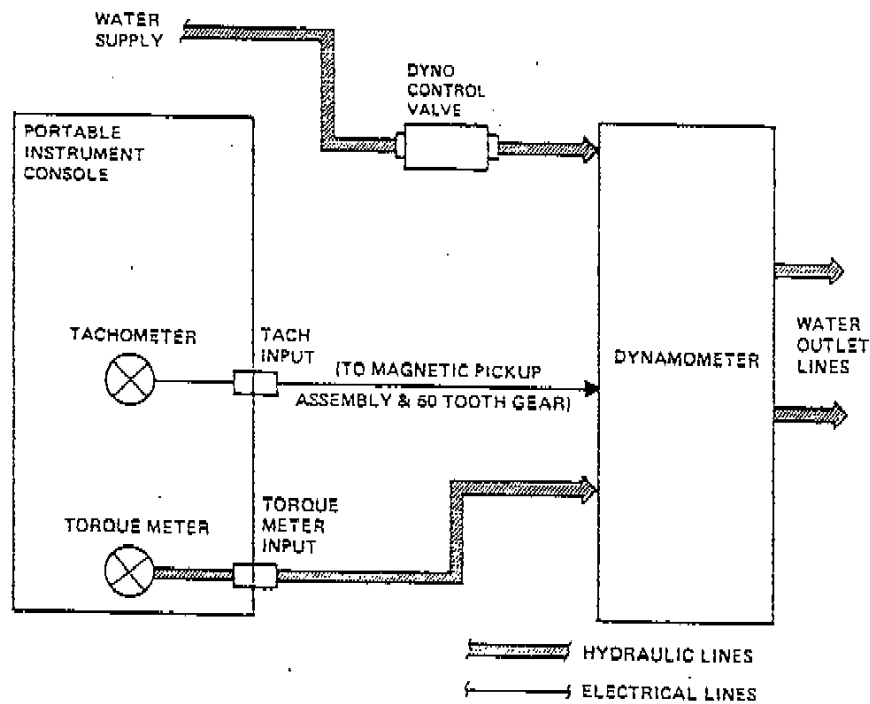


Figure 1-4. Portable Instrument Console Configuration Diagram

- b. Connect the water supply line to the control valve and then to the dynamometer.

CAUTION

The direction of water flow through the control valve must correspond to the arrow on the side of the valve.

- c. Press the mode control switch to select the appropriate mode of operation.
- d. Select the proper tachometer range by use of the range switch.
- e. Check battery operation by pressing the battery test switch. The tachometer should read full scale. If it does not, replace the battery.

Note

On units of the Model C-10-1 manufactured prior to August 1975, the battery test switch is located on the rear of the console. On these units, one of the operating mode switches must be depressed before the battery test switch will function.

- f. Insure that the dynamometer is properly connected to the engine under test and that all lines and cables are securely connected. Refer to the appropriate GO-POWER SYSTEMS operation and maintenance manual for dynamometer installation.

- g. Open the load control valve slightly to allow water to start flowing through the dynamometer.

Note

It is important to allow a small amount of water to flow in order to pre-lubricate the dynamometer seals.

- h. Start the engine.
 - i. Control the engine loading by observing the torque meter while rotating the load control valve knob.
- 1-16. SHUTDOWN. To shutdown operation, decrease engine loading, shut down engine, turn off water supply, turn off console power and disconnect all connecting lines.

SECTION II

MAINTENANCE

2-1. INTRODUCTION

2-2. This section contains the maintenance instructions for the Portable Instrument Console. These instructions include inspection and preventive maintenance, troubleshooting, repair, and alignment and adjustment procedures. The parenthetical following the noun name of a particular part or assembly refers to the index number assigned to that part or assembly on the appropriate illustration in Section 3.

2-3. INSPECTION AND PREVENTIVE MAINTENANCE

2-4. The inspection and preventive maintenance procedures are performed according to periods of operating time. These periods and the inspection and maintenance required are detailed in the following paragraphs.

2-5. DAILY MAINTENANCE. If the Portable Instrument Console is in continual use on a daily basis, the following procedures should be performed daily. If the console is not used on a daily basis, these procedures should be performed prior to operating the console.

- a. Inspect all hydraulic and electrical lines for proper connections, leaks or fraying.
- b. Inspect the console for leaks or corrosion.
- c. Check battery strength by use of the battery test switch on the console.

2-6. QUARTERLY MAINTENANCE. The following maintenance items must be performed every three months, or after every 500 hours of operation, whichever comes first.

- a. Remove bottom cover of the console and inspect for loose or broken wires, leaks or corrosion.

CAUTION

Do not add any fluid other than antifreeze without stopleak as damage to the unit will occur.

2-7. TROUBLESHOOTING

2-8. The Portable Instrument Console has been designed for trouble-free operation. Most troubles that will occur will be the result of improper handling or improper operation. If trouble symptoms occur, the operator should first shut down the console and visually inspect the system for proper line connections, leaks, kinked lines and sufficient water supply. If the trouble cannot be detected visually and corrected by routine operations, refer to Table 2-1 for more detailed troubleshooting information.

Note

Almost any trouble in the system will generate abnormally high readings on the tachometer. Abnormal performance at low speed may indicate that the dynamometer magnetic pickup is out of adjustment.

Table 2-1. Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
1. Tachometer not operating.	a. Dead battery.	Replace battery.
	b. Mag pickup is bad (should read 150-300 ohms on ohmmeter).	Repair or replace pickup ¹ .
	c. Tachometer cable is bad.	Repair or replace cable.
	d. PC card is bad.	Replace PC card.
	e. Meter is bad.	Replace meter.
2. Tachometer reading is inaccurate.	a. Battery is weak.	Replace battery.
	b. Magnetic pickup out of adjustment.	Readjust magnetic pickup ¹ .
	c. Tachometer cable or connector is bad.	Repair or replace as necessary.
	d. PC card is out of calibration.	Calibrate PC card or replace as necessary.
	e. Meter is bad.	Replace meter.
3. No reading on torque gauge.	a. No fluid in torque lines.	Fill lines with Dow-Corning 200 (260 centistokes).
	b. Torque lines not connected.	Connect torque lines.
	c. Bad torque gauge.	Replace gauge.
4. Leaky lines.	a. Loose or damaged connectors.	Tighten or replace connectors.
	b. Punctured or burned lines.	Replace lines.

NOTES: ¹ Refer to the dynamometer operation and maintenance manual for replacement or adjustment of the magnetic pickup.

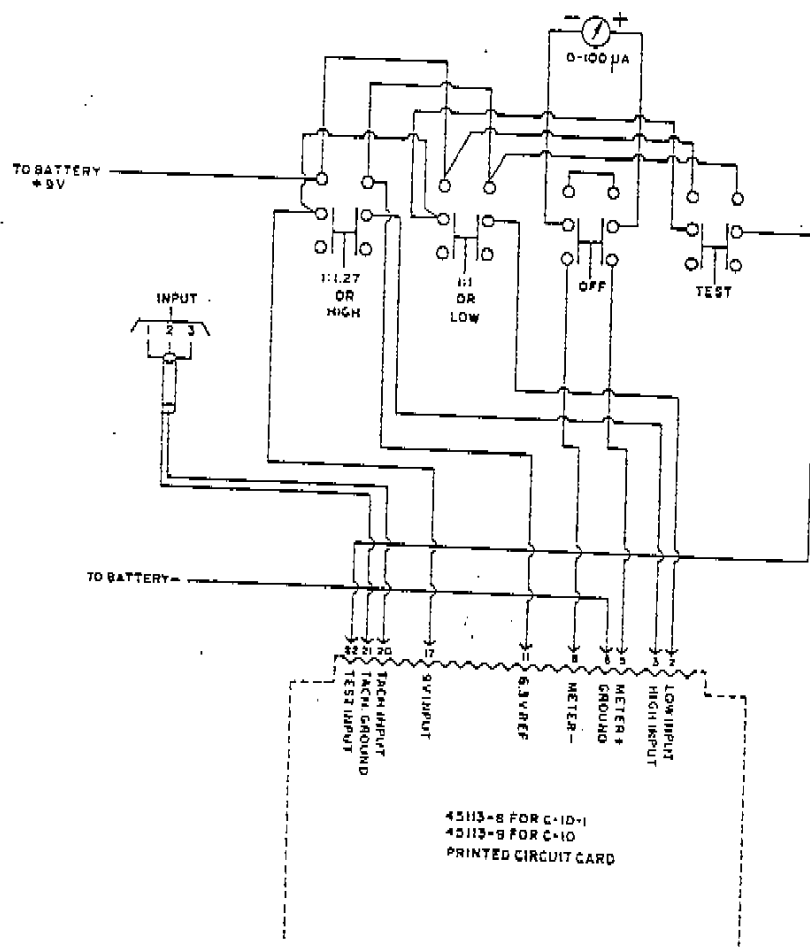


Figure 2-1. Portable Instrument Console, Typical Wiring Diagram

2-9. REPAIR

2-10. Repair of the Portable Instrument Console consists of removal and replacement procedures, alignment and adjustment instructions, and calibration instructions.

2-11. REMOVAL AND REPLACEMENT

2-12. Removal and replacement procedures provide the maintenance technicians with those procedures which are not obvious and are necessary for the maintenance and repair of the unit.

2-13. All removal and replacement procedures are obvious and may be accomplished by referring to the illustrated parts breakdown for the console, Figure 3-1.

2-14. DISASSEMBLY/ASSEMBLY OF THE TORQUE GAUGE

2-15. **DISASSEMBLY.** To disassemble the Torque Gauge for alignment or adjustment, proceed as follows:

a. Remove the Torque Gauge from the console by removing the two socket head cap screws (26) and the wing nut (36) from the back of the gauge.

b. Pry the snap ring out of its groove by means of a knife or screwdriver, and remove the glass and gasket.

c. Remove the three screws at the back of the gauge. This will allow the entire system, with dial and pointer attached, to be removed as a unit. The Torque Gauge can then be calibrated without removing the pointer or dial.

2-16. **ASSEMBLY.** After alignment and adjustment of the Torque Gauge has been completed, the gauge may be reassembled by simply reversing the order of the steps in the preceding paragraph.

CAUTION

Disassembly of the Torque Gauge should be attempted only if alignment or adjustment is indicated after testing with a suitable torque calibration arm provided with the dynamometer under test. If a suitable torque calibration arm is not available, return the Torque Gauge to the factory for repair.

2-17. ALIGNMENT AND ADJUSTMENT (See 2-26 before proceeding.)

2-18. Alignment and adjustment procedures for the Portable Instrument Console consist of procedures to align the printed circuit card and calibrate the Torque Gauge. There are four adjustments on the printed circuit card, they are: High, Low, 1:1.27, and Battery Test. Refer to the component location diagram, Figure 2-2, for the location of these adjustment.

2-19. To adjust the speed ranges of the Portable Instrument Console, a known electrical signal is required. This may be from a signal generator or from the magnetic pickup of the dynamometer when the rotating shaft has been calibrated by another tachometer.

2-20. If a signal generator is used, the signal level should be a 1-volt rms signal at a frequency of 1 Hz per desired rpm. For example, to calibrate the tachometer at 2,000 rpm, set the output of the signal generator to 2,000 Hz at 1.0 volt rms.

2-21. The Portable Instrument Console tachometer should be calibrated at approximately two-thirds scale. For example, a tachometer with a range of 5,000 rpm should be calibrated at the 3,300 point on the scale, 4,000 on the tachometer should be calibrated at 2,600, 2,500 should be calibrated at 1,650, etc. This practice should be followed unless a high degree of accuracy is desired at a specific rpm, then the tachometer should be calibrated at that specific point on the scale.

2-22. To adjust the 1:1.27 range of the Portable Instrument Console tachometer, it will be necessary to calculate the setting of the signal generator to simulate the required speed. To obtain the necessary signal generator setting, take the known speed and multiply that figure by 1.27. The result of this calculation is the setting of the signal generator necessary to obtain the required speed. For example, to calibrate the tachometer at 2,000 rpm on the 1:1.27 range, set the signal generator to 2,540 Hz ($2,000 \times 1.27 = 2,540$). Conversely, if the signal generator is set at 2,000 Hz, the tachometer reading should be 1,574.8 rpm ($2,000/1.27 = 1,574.8$).

2-23. HIGH ADJUSTMENT. To adjust the printed circuit card HIGH adjustment, proceed as follows:

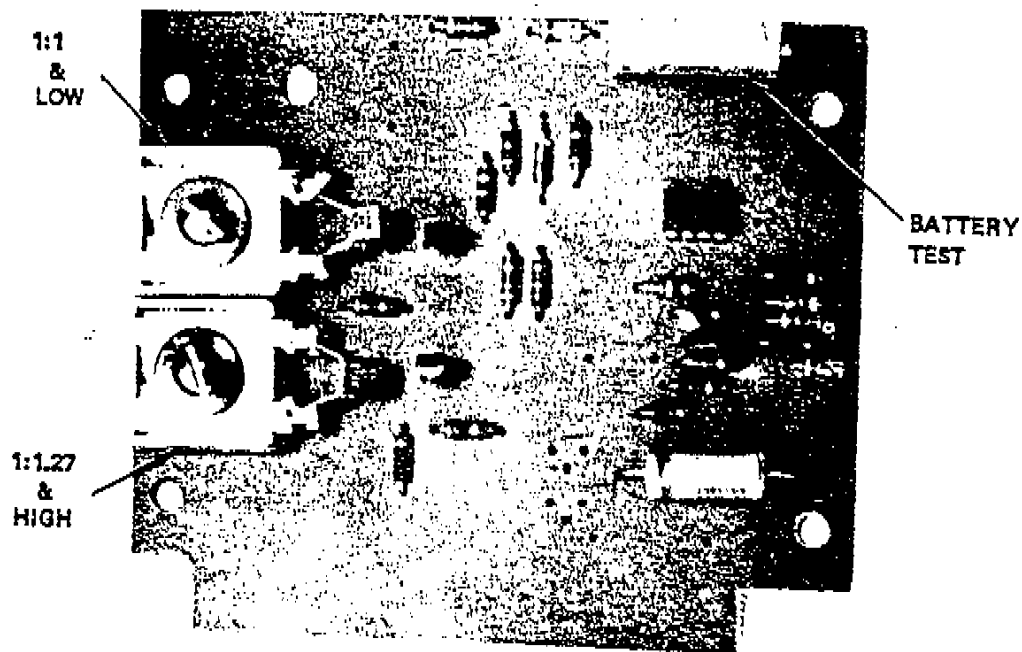
- a. Connect a calibrated source to the tachometer input on the unit, i.e., 3,000 Hz.
- b. Depress the HIGH switch on the console front panel.
- c. Adjust the HIGH capacitor on the printed circuit card until the tachometer reading is equivalent to the input source, in this case, 3,000 rpm.
- d. Disconnect the input source and secure the equipment.

2-24. LOW ADJUSTMENT. To adjust the printed circuit card LOW adjustment, proceed as follows:

- a. Connect a calibrated source to the tachometer input on the unit, i.e., 2,000 Hz.
- b. Depress the LOW switch on the console front panel.
- c. Adjust the LOW capacitor on the printed circuit card until the tachometer reading is equivalent to the input source, in this case, 2,000 rpm.
- d. Disconnect the input source and secure the equipment.

2-25. 1:1.27 ADJUSTMENT. To adjust the printed circuit card 1:1.27 adjustment, proceed as follows:

- a. Calibrate signal generator setting necessary to obtain desired tachometer reading per paragraph 2-22.
- b. Connect signal generator output to tachometer input on unit.
- c. Depress the 1:1.27 switch on the console front panel.



a. Model C-10 and Model C-10-1 after Aug 1975



b. Model C-10-1 prior to Aug 1975

Figure 2-2. Printed Circuit Card, CP3T, Component Location Diagram

d. Adjust the 1:1.27 capacitor on the printed circuit card until the tachometer reading indicates the calculated result.

e. Disconnect the signal generator and secure the equipment.

2-26. BATTERY TEST ADJUSTMENT. To adjust the printed circuit card BATTERY TEST adjustment, proceed as follows:

Note

This adjustment is to be made only if the meter is changed or if the printed circuit card internal voltage regulator is changed.

a. Remove the existing battery from the unit and insert a new, full strength, nine-volt battery.

b. Depress the TEST switch on the console front and, with the switch depressed, adjust the BATTERY TEST potentiometer and the printed circuit card until the tachometer indicator reads full scale.

Note

On units of the Model C-10-1 manufactured prior to August 1975, the battery test switch is located on the rear of the console. On these units, one of the operating mode switches must be depressed before the battery test switch will function.

c. Release the TEST switch and secure equipment.

2-27. TORQUE GAUGE CALIBRATION. To calibrate the Torque Gauge, proceed as follows:

CAUTION

Calibration of the Torque Gauge should only be attempted if an out-of-tolerance condition exists after testing of gauge with a suitable torque calibration arm provided with the dynamometer under test. Refer to the appropriate operation and maintenance manual for torque calibration procedures.

a. Remove the complete assembly from the case in accordance with the disassembly procedures stated in paragraph 2-15.

Note

The rear adjustment screw is for pointer setting; the cam slide adjustment is to correct for variance of pointer travel; and adjustment of the rotary movement is for positioning the cam in the roller. Refer to Figure 2-3 for adjustment locations.

- c. Apply a pressure to the gauge equal to 10% of the total scale. If the pointer does not indicate the same value as the input, reset it by the rear adjustment screw.

Note

If the pointer has been removed, press it on the staff to indicate at or near the 10% mark and reset it exactly by the rear adjustment screw.

- d. Increase the input pressure equal to full range. The pointer may indicate high or low, in which case, lengthen or shorten the distance of the slide nut (5) from the pivot (7). This is done by loosening the link screw (in slide nut 5) and sliding the link in or out.

- e. After proper adjustment has been completed, tighten link screw securely.

Note

After this adjustment has been made, it may be necessary to readjust the pointer at the 10% scale. If so, repeat steps c and d until proper indications are achieved.

- f. Apply a pressure equal to half scale on the gauge and note the pointer position. If the pointer is high at half scale, bend the tip (3) outward. If the pointer is low at half scale, bend the tip inward.

CAUTION

Ensure that the link does not bind at the tip screw.

- g. Gradually increase the input pressure and note the position of the pointer at all major graduations. If the indication is correct at all points, calibration is complete. If indications are not correct, repeat steps c through f. If, after attempting to calibrate the gauge the second time, correct indications cannot be obtained, return the entire assembly to the factory for repair.

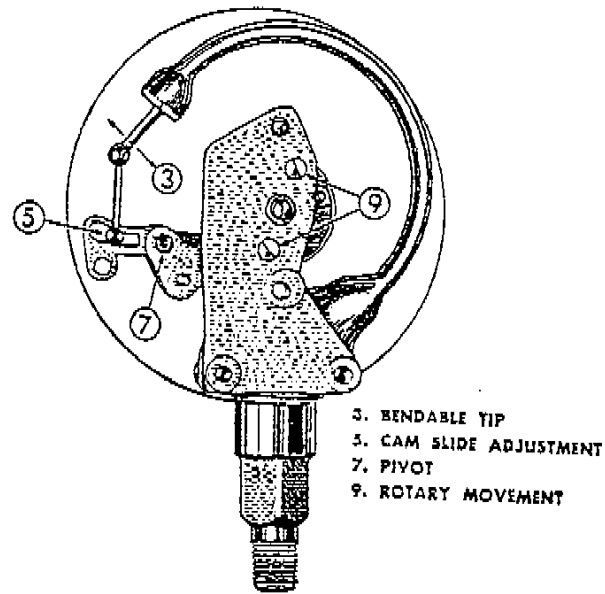


Figure 2-3. Torque Gauge Adjustment Location Diagram

SECTION III

ILLUSTRATED PARTS LIST

3-1. INTRODUCTION

3-2. The illustrated parts list illustrates and lists the part number, description, and quantity for each part necessary for the maintenance and repair of the GO-POWER Portable Instrument Consoles.

3-3. **FIGURE AND INDEX NUMBER.** The figure and index number column provides the figure numbers and index numbers that are used to key a part or assembly listed in the parts list to its appearance in the illustration.

3-4. **PART NUMBER.** The part number column provides the part number for the part in the listing. Parts manufactured or altered by GO-POWER are assigned part numbers originated by GO-POWER. Hardware having no identifying part number is indicated by the term COML (commercial) in the Part Number column. Procurement of these items shall be accomplished through the aid of the hardware description.

3-5. **DESCRIPTION.** The description column lists the noun name and the descriptive information for all assemblies, subassemblies and detail parts.

3-6. **QTY.** The Qty column lists the total number of each part as listed but does not necessarily reflect the total number used in the complete equipment.

3-7. **ILLUSTRATIONS.** Illustrations are keyed to the listings by means of index numbers. The index numbers on the illustrations and in the listing are used throughout the text as a means of identifying individual parts or assemblies.

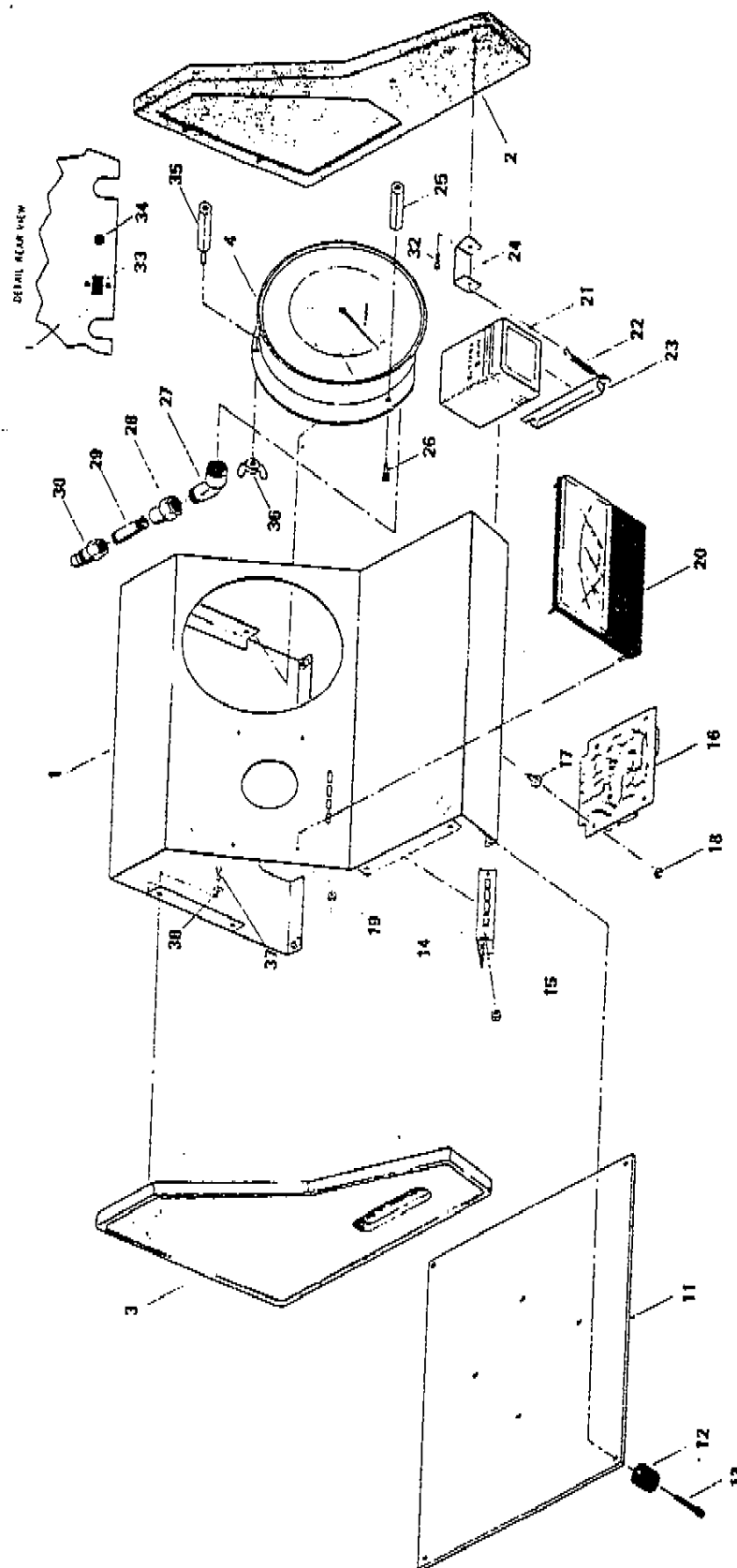


Figure 3-1. Portable Instrument Console

FIGURE & INDEX NO.	PART NO.	DESCRIPTION	QTY
3-1	-----	Portable Instrument Console	
-1	45058	Control Panel	1
45230-10 → -2	45059-1	Side Panel, Right Hand	1
-3	45060-01	Side Panel, Left Hand	1
-4	45230-X	Guage	1
-11	45061	Bottom Plate	1
-12	41004	Foot	1
-13	COML	Foot Mounting Screw, 10-32 x 1/2" SHCS	4
-14	45153	Switch	4
-15	COML	Nut, 6-32 KEP	1
-16	45113-X	Tachometer Control Card	2
-17	45166	Standoff	1
-18	COML	Nut, 6-32	4
-19	COML	Nut, Tachometer Mounting	4
-20	45251	Tachometer, C-10	4
	45253	Tachometer, C-10-1/C-10-2	1
-21	45111	Battery, 9 volt	1
-22	45122	Battery Clamp Spring	1
-23	45109	Battery Mounting Bracket	2
-24	45110	Battery Clip	1
-25	43143	Guage Standoff	2
-26	COML	Guage Mounting Screw, 10-32 x 1/2" SHCS	2
-27	45102	Elbow	2
-28	45103	Reducer	1
-29	45104	Extension-Nipple	1
-30	43192-1	Fitting, Q.D.	1
-32	COML	Socket Head Cap Screw, 10-32 x 1/2"	1
-33	44199	Connector, Tachometer Input, w/attaching hardware	2
-34	42021	Test Switch (on models prior to August 1975)	1
-35	43143-1	Guage Standoff	1
-36	COML	Wing Nut, 10-32	1
-37	COML	Screw, 10-32 x 1/2"	1
-38	COML	Lock Washer No. 10	6
	45115-00	Tach Cable Assembly (for consoles prior to 1985)	8
	45115-01	Tach Cable Assembly (1985 and after)	
	44128-00	Torque Line Assembly	

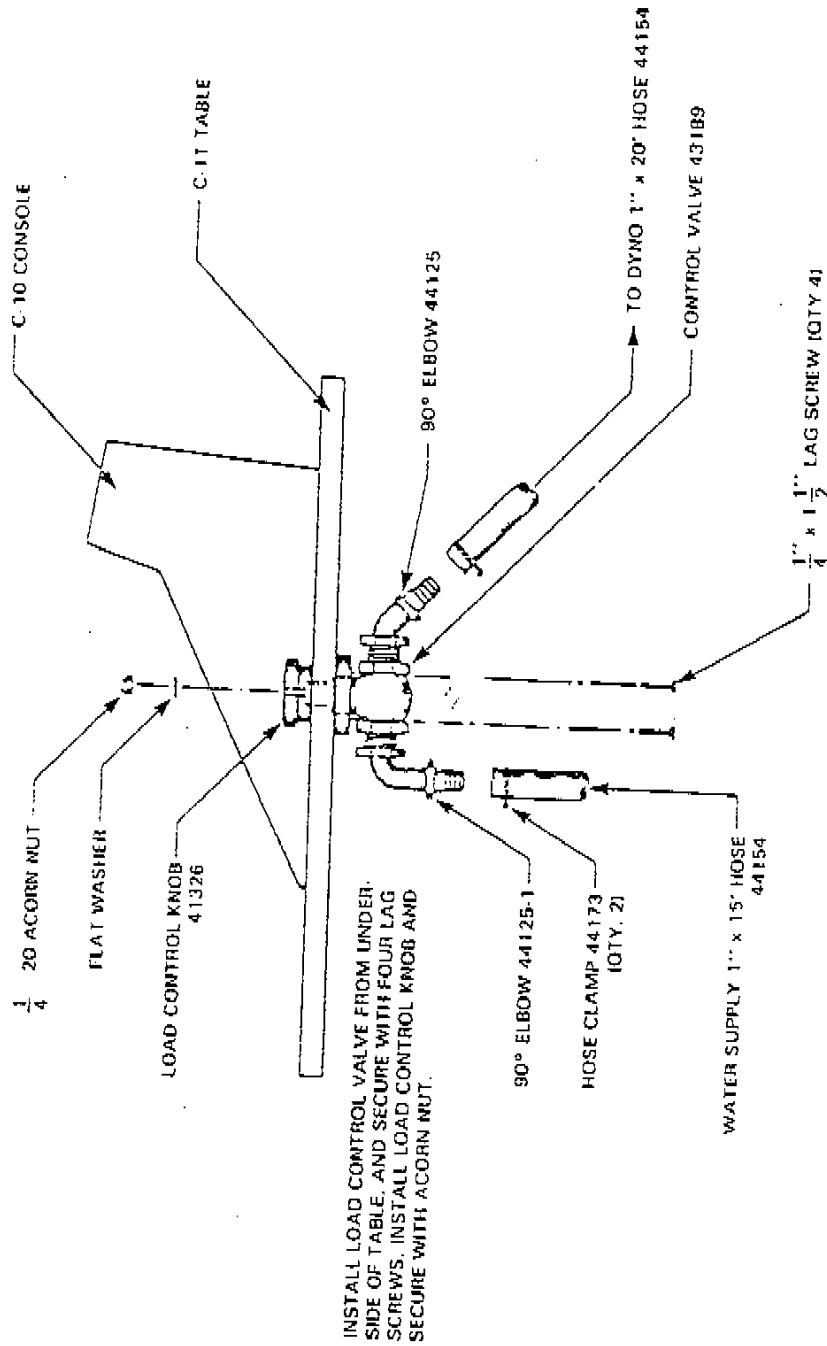


Figure 3-2. Typical Valve Installation, C-10, C-10-1

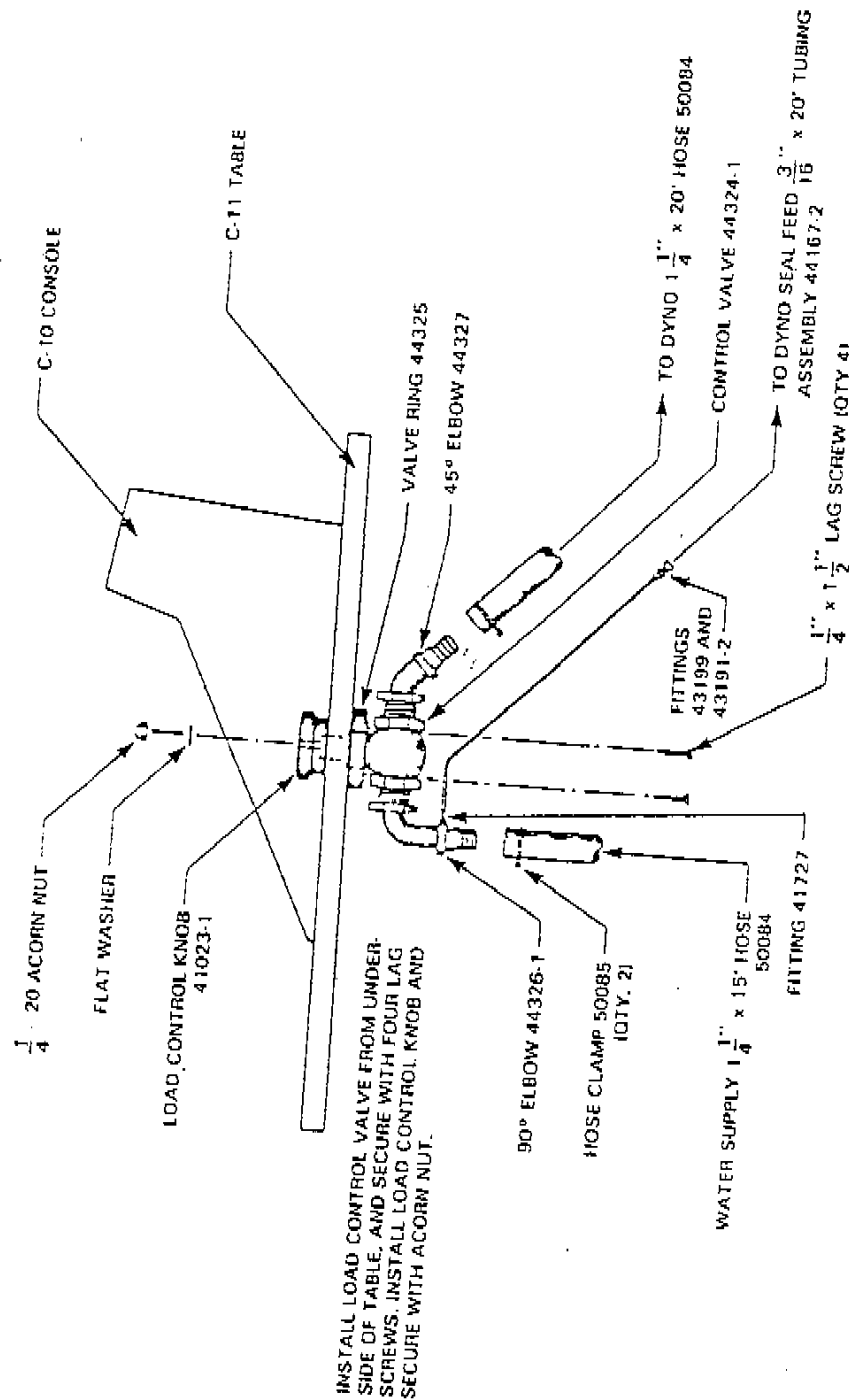


Figure 3-3. Typical Valve Installation, C-10-2