Contents

SECTION 1
INTRODUCTION

The Model 921A Displacement - Force (DF) Test Station operation is similar to the highly acclaimed Models 951A and 961A Test Stations. The high accuracy and many of the features of the 951A and 961A have been incorporated in the 921A. Testing on the 921A is performed using remote test fixtures similar to the 961A. The remote operation permits testing a wide variety of components/devices and also allows the 921A to operate as part of a fully automated test line. Keyboards, springs, switches and other components requiring measurement of displacement, force, or resistance (one channel optional) can be tested manually, individually or with automatic feed. The 921A is also ideally suited for engineering investigation and new product development. Table 1-1 lists the specifications of the 921A.

When interfaced with a personal computer (PC), the resulting test data can be viewed, analyzed, and printed. The 921A stores test criteria for one test configuration. To assure simplicity of operation and efficient, effective, error-free use by anyone, the test station displays operator prompts and provides a minimum of operator controls: a MODE switch and a TEST switch.

Three operating modes are featured: 1) Local - a pass/fail indication is provided during standalone operation, test results are not stored; 2) PC - a PC interfaces with the test station and is used to configure device test criteria and view stored test results; and 3) Engineering - test data is logged for every 0.0001 inch of travel and is available for viewing at the PC.

The 921A features a precision lead-screw drive mechanism used to trip the device under test which serves to guarantee repeatability of results.

Prior to testing, the operator must perform a calibration cycle (refer to section 4.1). Testing cannot be initiated until a calibration cycle has been performed.

TABLE 1-1
MODEL 921A DISPLACEMENT - FORCE TEST STATION
SPECIFICATIONS

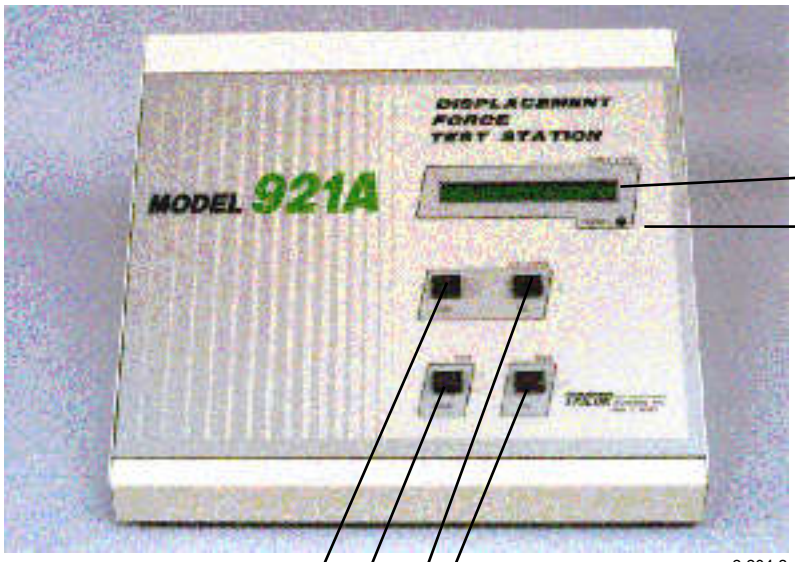
Power Requirements	115/220 V ac, 50/60 Hz, 230 VA
Test Cycle Time	6 to 10 seconds typ
Resistance Test Current	10 mA standard*
Resistance Measurement Channels	One (Optional)
Displacement*	
Range:	6.25 to 62.51 mm (0.246 to 2.461 inches) *standard^*
Resolution:	0.00254 mm (0.0001 inch) *programmable*
Abs Accuracy†:	±0.00762 mm (±0.0003 inch) max ±0.00254 mm (±0.0001 inch) typ ±0.00762 mm (±0.0003 inch) max ±0.00254 mm (±0.0001 inch) typ
Force*	
Range:	0 to 3.6 kg (0 to 8 lb) *standard^*
Resolution:	1 g (0.035 oz)
Abs Accuracy:	±0.25% of fsc max, ±0.2% of fsc typ
Repeatability:	±0.1% of fsc max, ±0.05% of fsc typ
Resistance* (Optional)	
Range:	0 to 4 Ω *standard^*
Resolution:	1 mΩ
Abs Accuracy:	±0.25% of fsc max, ±0.1% of fsc typ
Repeatability:	±0.1% of fsc max, ±0.05% of fsc typ

* Other ranges available.
† Related to free position.

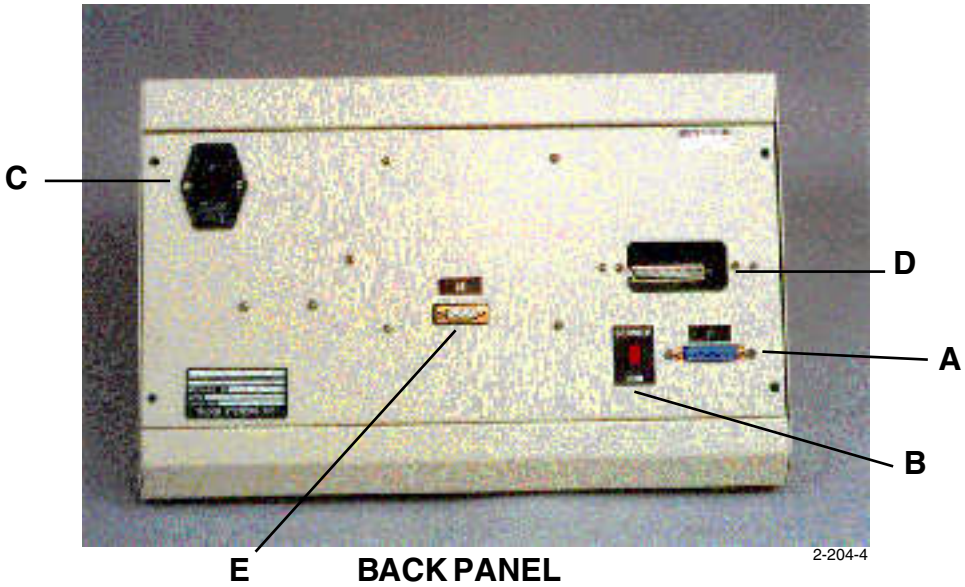
The test sequence is initiated by pressing the TEST switch or externally by the PC. During the test sequence, sensor data is logged in 921A memory. Test data is then analyzed, parameters are calculated, and the results are compared with the configuration criteria to determine a pass or fail status. The PASS or FAIL indicator then illuminates. Upon completion of the test sequence, the 921A is ready to test the next device.

The 921A stores test criteria for one device configuration and up to 32 test results (PC operating mode) in non-volatile memory so that once loaded the station will retain the test criteria even upon power-down. Device configurations are identified by device part numbers. The operator's display indicates which device is currently being tested by displaying the part number of the device in the left-hand corner of the display.

For a complete description of operating modes, configuration parameters, test results, test algorithms and the details for creating configurations and viewing results, refer to the DFR Operations Software Manual.



FRONT PANEL



BACK PANEL

Figure 1.1 921A Controls and Indicators

TABLE 1-2
CONTROLS AND INDICATORS
(Refer to Figure 1.1)

A - Back Panel Connector J1 – the serial communication channel connector used to connect the 921A to a PC using the supplied serial cable (Figure 1.4 or 1.5).

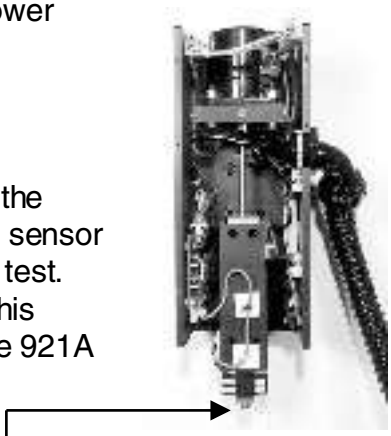
B - SERVICE/RUN Select Switch – active only when power is first applied to the 921A. This switch is placed in the RUN position for normal operation. When the switch is placed in the SERVICE position, the 921A is in the Service Mode where internal instrumentation circuits can be adjusted and various system functions checked.

C - Power Switch / Back Panel Input Power Module – consists of the following:

Slideout Panel

1) Input power voltage selection - permits selecting 110-120 V ac or 220-240 V ac operation by positioning the slideout voltage selector as indicated in section 2.1.
2) The slideout voltage selector panel contains two fuses. Remove the slideout panel to access the fuses.
3) Contains the male connector for the power cord.
4) Contains the power On/Off switch.

D - Precision Drive Mechanism — includes the motor, lead screw, and precision guide and sensor used to apply the force to the device under test. The connector on the corrugated cable of this assembly is connected to the rear (D) of the 921A electronics unit.



Precision Drive Mechanism (Cover Removed)

Force Sensor

TABLE 1-2
CONTROLS AND INDICATORS (Cont.)

E - Back Panel Resistance Connector J2 (optional) – the electrical resistance connector used with the resistance cable PN 921-112 to connect 921A to generic or user nests.

F - TEST STATUS PASS Indicator — illuminates green after a test cycle in which the device being tested passes all of the specified parameters (within tolerance).

G - TEST Switch / READY Indicator — has two functions:

1) The READY indicator illuminates when the 921A is ready for another device test sequence. The indicator extinguishes when a test sequence is initiated or if the 921A is not ready to accept a device for test.
2) The TEST switch is a pushbutton switch which, when illuminated, is pressed to initiate a test sequence. This switch is also used to initiate a calibration cycle when the 921A is in Calibration Mode.

NOTE: *The READY indicator does* ***not*** *indicate when to press the TEST switch. Its function is only to indicate that the 921A is ready for another test cycle.*

H - TEST STATUS FAIL Indicator — illuminates red after a test sequence in which a device fails one or more of the specified test parameters (out of tolerance).

I - MODE Switch / CAL Indicator — has two functions:

1) The MODE switch is used to initiate a calibration cycle.
2) The CAL indicator illuminates green when the 921A is in the Calibration Mode.

TABLE 1-6
CONTROLS AND INDICATORS (Cont.)

J - POWER Indicator — illuminates green when the 921A is turned on with power applied.

K - SYSTEM STATUS Operator's Display — contains two 40-character lines which supply information about 921A operation, such as the part number and version of the device configuration being tested. This display also prompts the operator concerning necessary actions, such as "Install Device and Press Ready," etc.

2-204-5

Figure 1.2 Resistance Cable 15-Pin M/F Sub D (Optional)
PN 921-112

2-204-8

Figure 1.3 Precision Drive Mechanism Showing Corrugated Cable and 37-Pin Connector

2-204-7

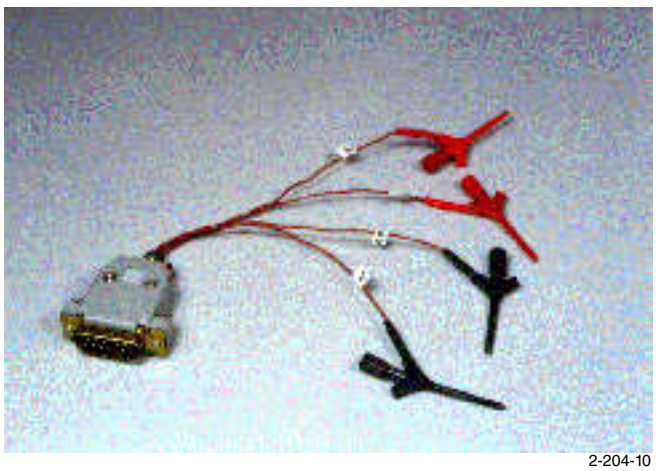
Figure 1.4 25-Pin M/F Sub D Serial Cable
PN 905-390-101

2-204-6

Figure 1.5 25 Pin M/ 9-Pin Female Serial Cable
PN 905-390-102

2-204-9

Figure 1.6 Two-Clip Generic Nest Assy
PN 921-140-101



2-204-10

Figure 1.7 Four-Clip Generic Nest Assy
PN 921-140-102

SECTION 2
SETUP AND INTERCONNECTION

2.1 HARDWARE

The power entry module (C-Figure 1.1) must be set for the user's facility power. The 921A is normally supplied configured for 110-120 V ac, 60 Hz. To reconfigure the 921A for 220-240 V ac, 50-60 Hz rotate the slideout voltage selector and position it accordingly. Plug the power cord into the 921A power entry module and into a properly grounded outlet.

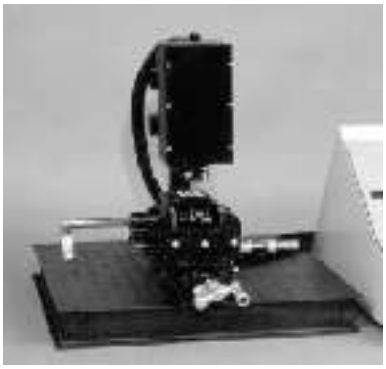
110-120V **220-240V**

2.2 PC CONNECTION

The 921A must be connected to a PC to upload configuration data to the station or download test data to the PC. Connect a PC with an open communication channel to the 921A using the serial communication cable supplied with the unit (see Figure 1.4 or 1.5) between the PC Serial COM port connector and 921A connector J1 (A-Figure 1.1). Tighten the connector securing screws to ensure a secure connection. If the cable supplied with the 921A is not long enough, a generic 1:1 25-pin D-type extension cable can be used with the cable supplied.

2.3 SOFTWARE

Refer to DFR Operations Software Manual.



Typical Test Fixture Setup

WARNING

Set up unit for facility power (115 or 220 Vac) prior to connecting to facility power (see paragraph 2.1).

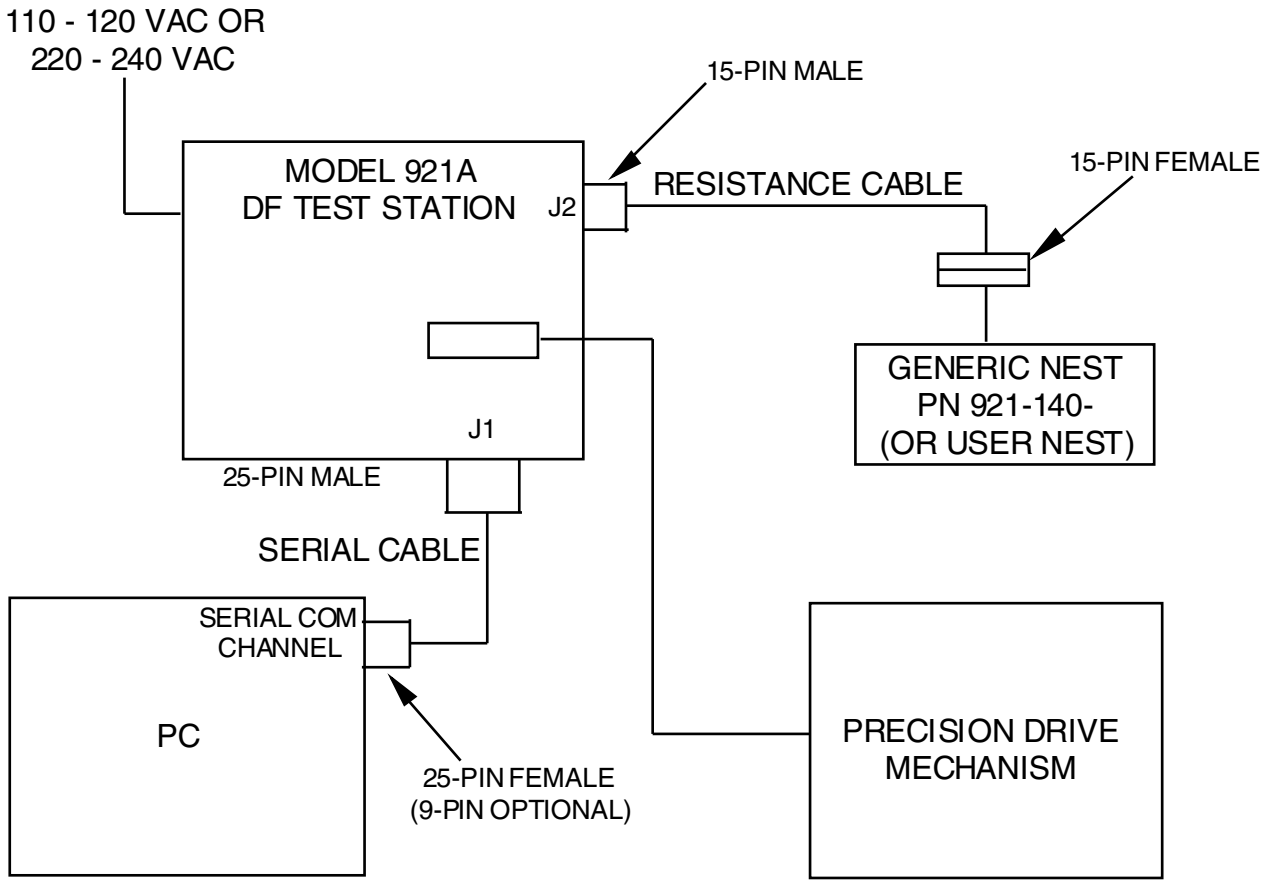


Figure 2.1 921A DF Test Station Interconnect

2.4 PRECISION DRIVE MECHANISM SETUP/CONNECTION

A suitable test fixture or vice should be used to hold the device for test. The drive mechanism force sensor must be centered over the device button, dome, etc., to which force is to be applied. The sensor must not be in contact with the device for test (allow at least a 1/16-inch gap). If the optional platform was purchased, the height of the force sensor above the device for test can be easily adjusted by loosening the knobs and raising and lowering the Precision Drive Mechanism to the desired position, and tightening the knobs.

WARNING

Support the Precision Drive Mechanism when loosening the knobs or the mechanism will slip on the post, possibly damaging the force transducer and/or the device under test.

The Precision Drive Mechanism cable connector connects to the rear of the 921A electronic unit using the two screws provided. Refer to Figure 2.2. Carefully remove the two screws, at the sides of the opening in the rear panel. Carefully mate the cable connector with the connector recessed in the rear panel opening. Secure with the two screws removed above.

Figure 2.2a

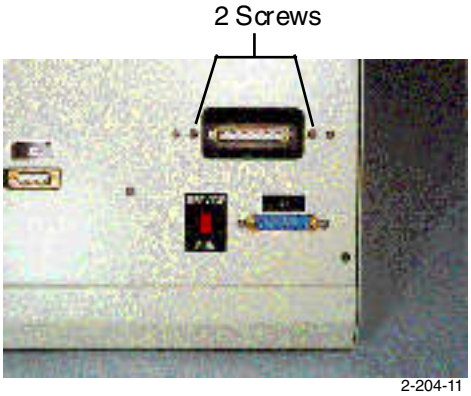


Figure 2.2b

2.5 ELECTRICAL RESISTANCE CONNECTION (OPTIONAL)

The 5-foot 15-pin Subminiature "D" Male/Female connector cable supplied with the resistance option is used to connect either the supplied generic nest assembly or the user's nest to the 921A (refer to Figure 1.2).

2.6 GENERIC NEST ASSEMBLY CONNECTION (OPTIONAL)

Two types of Generic Nest Assemblies are available: a two-clip version and a four-clip version. The type must be specified when ordering.

PN 921-140-101 Two-Clip Version

Resistance channel source and sense plus (red clip) are connected together and channel source and sense minus (black clip) are connected together. This nest does not allow 4-wire resistance measurement.

PN 921-140-102 Four-Clip Version

Resistance channel source (I+) and sense (S+) plus are separated and supplied with red clips. Resistance channel source (I-) and sense (S-) minus are separated and supplied with black clips. This nest allows performing 4-wire (Kelvin) resistance measurements with the 4 Ω resistance options.

2.7 USER NESTS

Table 2-1 shows the wiring of the 15-pin connector J2 on the rear of the unit. This information is provided for users who wish to wire their own nests.

2.8 FORCE TRANSDUCER TIPS

2.8.1 Interchangeable Force Transducer Tips (2.0 kg, 3.6 kg and 50 lb Transducers)

Table 2-1
J2 Connector Wiring

PIN	SIGNAL
1	INSTALL
2	CH1 SENSE +
3	CH1 SENSE -
4	
5	
6	
7	
8	CH1 SRC+
9	CHASSIS GROUND
10	
11	
12	
13	
14	SIGNAL GND
15	CH1 SRC -

Notes:
1. Pin 9, chassis ground is provided for shield termination. If user-designed nests have wire lengths in excess of 8 inches, those wires should be shielded. If the user nest is to be used in an electrically noisy environment, the wiring should be metal enclosed with the metal enclosure chassis grounded.
2. Pin 1, INSTALL signal provides a device installed interlock for testing. The test cycle will not initiate unless the Install signal is grounded (connected to Pin 14). The user-designed nest can incorporate a switch which is actuated when a device is installed in the nest, thereby grounding the Install signal. The user's nest design can defeat the interlock by jumpering Pin 1 to Pin 14 if the interlock function is not required.
3. Pin 3, CH1 SENSE - applies only to the 4 Ω resistance options.

WARNING

Care must be taken whenever handling the force transducer. These transducers are easily damaged. The 2.0 kg, 3.6 kg and 50 lb transducers are supplied with protective stops for overload under compression. However, tension or rotational forces applied in excess of 150% of full-scale rating will permanently damage the transducer.

The 2.0 kg, 3.6 kg and 50 lb force transducers are supplied with two tips (small and large, refer to Figure 2.3). To change tips on the force transducer, use the allen wrench provided and carefully loosen the set screw holding the tip (refer to Figure 2.4).

2-204-13

Figure 2.3 Typical Tips

Install the desired tip until it seats (bottoms out) in the transducer opening, and carefully tighten the set screw with the allen wrench.

2-204-14

Figure 2.4 3.6 kg / 2.0 kg / 50 lb Tip Setscrew Location

CAUTION

If users design their own tips, the mass and length must be kept at a minimum (comparable to the large tip supplied) or performance may be impaired.

2.8.2 75 g, 360 g and 750 g Transducer Tips

WARNING

Care must be taken whenever handling the force transducer. These transducers are easily damaged. Compression, tension or rotational forces applied in excess of 150% of full scale rating will permanently damage the transducer.

The 75 g, 360 g and 750 g transducers are supplied with a 4-40 setscrew as the transducer tip. This setscrew should not be removed. If the user requires a different size tip, the user tip should be designed to thread onto the 4-40 setscrew.

CAUTION

If users design their own tips, the mass and length must be kept at a minimum, since performance of the system may be impaired by the additional mass/length.

2.9 CHANGING FORCE TRANSDUCER ASSEMBLIES

The 921A allows changing force transducer assemblies (i.e., 3.6 kg, 2.0 kg, 400 g, 75 g, etc.). However each force transducer assembly must be specifically calibrated on the 921A unit on which it is used. Transducer assemblies calibrated on the same unit can be interchanged without recalibration. Refer to section 5.1 for transducer calibration information.

WARNING

DO NOT TOUCH THE TRANSDUCER TIP DURING HANDLING OR INSTALLATION/REMOVAL OR PERMANENT DAMAGE MAY RESULT.

Use proper ESD Handling procedures during installation/removal and handling/packaging (antistatic) the force transducer assembly. Failure to comply may result in damage to the equipment.

The transducer assembly consists of the force transducer, the force transducer circuit card assembly (CCA) and the CCA/transducer interconnect cable.

To remove the transducer assembly from the precision drive mechanism, remove the cover from this assembly as described in Appendix B, step 1. Remove the five (5) screws holding the left side plate to the back plate of the precision drive mechanism (Figure 2.5). Loosen the two (2) screws securing the harness connector to the force transducer CCA, then disconnect this connector (Figure 2.6). Remove the four (4) screws securing the force transducer CCA to the side plate (Figure 2.6). Carefully cut the tie wraps securing the force transducer assembly interconnect cable to the platform tie downs (Figure 2.7). Support the force transducer and remove the two (2) mounting screws (Figure 2.8). Carefully remove the transducer assembly. Bubble wrap and protect the force transducer/tip. Place the transducer assembly in an antistatic bag for ESD protection.

Install the new transducer on the precision drive mechanism in the reverse order of removal above. Be sure to secure the transducer interconnect cable to the tie downs, with tie wraps, as shown in Figure 2.7. The critical tie down area is the first tie down nearest the transducer. The cable must be secured to this tie down using two (2) tie wraps, 90° to each other, and tightened securely. The cable should not be able to be slide through this tie down if pulled with moderate force. The cable from the transducer to this tie down also cannot drag or come in contact with any surface during platform movement, or the system will not operate properly.

The remaining two tie down areas are not critical for performance. The cable should be tied down to these as shown in Figure 2.9 to provide the service loop for operation. Be sure sufficient slack in the cable is provided so that the precision drive mechanism limit switch (the furthest extended outward position) is actuated with some slack remaining. When the platform is in the home position (furthest retracted inward position) there must also be some slack remaining in the cable.

Figure 2.5

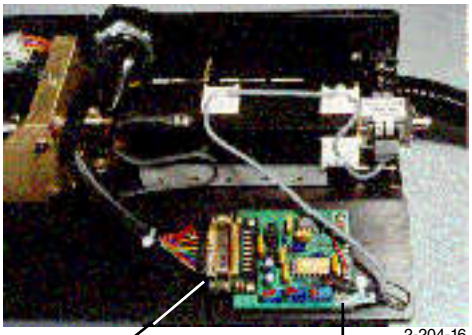


Figure 2.6

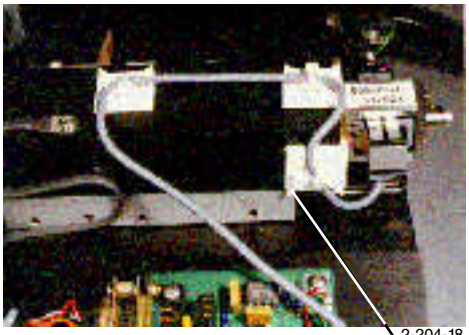


Figure 2.7

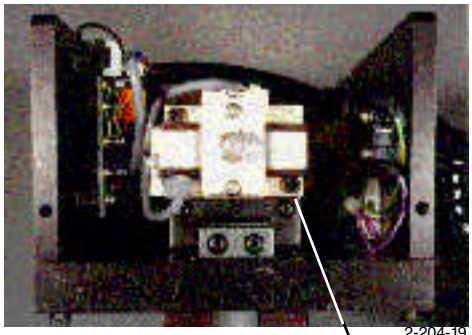


Figure 2.8

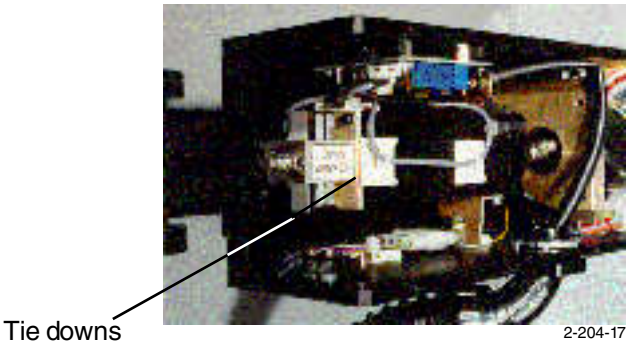


Figure 2.9

SECTION 3
CONFIGURATION

WARNING

Set up unit for facility power (115 or 220 Vac) prior to connecting to facility power.

After the 921A has been set up as described in section 2, it is ready for power.

3.1 TURN-ON

The power ON-OFF switch is located on the back panel as part of the power module (C-Figure 1.1). Place this switch in the ON position. The green POWER indicator should illuminate and all other indicators should remain off. If the POWER indicator does not illuminate, see section 6 Troubleshooting.

3.2 SELF-TEST

Upon application of power, the 921A performs a series of self-tests to verify that it is functioning properly. If any of the self-tests fail, see section 6 Troubleshooting. The message **PERFORMING SYSTEM SELF TEST TESTING CHECKSUM** will appear on the operator's display.

Areas tested during self-test include: CHECKSUM, CPU RAM, RAM 1, RAM 2, and RAM 3. The name of each of these areas is displayed as it is tested. During the self-test routine, either a message is briefly displayed stating that an area has passed, or the self-test routine stops and a message is displayed stating what area has failed. If a failure occurs, the 921A will not allow further operation. The reason for failure must be corrected before continuing (See Appendix A).

After a successful self-test, the CAL indicator will illuminate indicating that the station has automatically entered the Calibration mode. When the 921A is turned on, it has no reference for measurement and must perform a calibration cycle as discussed in paragraph 4.1 to establish measurement references.

If the display indicates a mismatch, the system setup and device are not compatible with the stored configuration. (See Appendix A)

SECTION 4
OPERATION

After the 921A has been configured, it is ready for operation. Turn on the 921A and allow it to perform its self-test routine and enter the Calibration Mode.

The operator's display contains two lines of information. The first line provides data about the device test configuration, i.e., the device part number, the version of the device configuration, and the work order (if applicable). This information is dependent upon the device test parameters stored in memory for the configuration. The second line of the display provides instructions for the operator.

Note: A valid configuration must be previously installed using the PC DFR Operations Software. If not, refer to the DFR Operations Software Manual and create/install a configuration in the 921A prior to proceeding.

4.1 CALIBRATION MODE

The Calibration Mode is used to obtain measurement references and is automatically entered upon the successful completion of a self-test routine. It can also be entered by pressing the MODE switch on the front panel whenever the operator's display indicates READY. The 921A will also enter the Calibration Mode if the Configuration is changed and the new device configuration requires a different calibration. Whenever the 921A is in Calibration Mode, only the CAL indicator is illuminated.

Press the Mode (CAL) switch to enter the Calibration Mode.

If the configuration parameters include a Reference Block Size (Ref Blk Size) value other than zero (refer to the DFR Operations Software Manual for details) the display will prompt for installation of the Distance Reference Gauge at this point; then to press test. (See restrictions, Appendix A).

If the Ref Blk Size value is zero or not applicable in the configuration, then the message **Ensure Pedestal Setup for CAL** is displayed. Press TEST when ready.

If the configuration uses resistance, then the Generic Nest Assembly (or equivalent) must be connected to the DF for calibration. If the four-clip version, PN 921-140-102 is used, the Red clips (I+ and S+) must be connected together and the black clips (I - and S -) must be connected together for the purpose of calibration. The red and black clips cannot be shorting together or to a metal surface. Failure to properly setup the Generic Nest (or equivalent) will result in a calibration failure message when calibration is attempted. The calibration process corrects out all system offsets and hardware deviations so that the device to be tested is the only unknown.

Install the block or tighten the vice clamp together. Position the sensor approximately 1/2-inch above the block or vice clamp and press READY.

The message **CALIBRATION IN PROCESS** will be displayed.

The sensor will move in to the block or vice clamp and back out twice. This process provides the exact positioning, force, and resistance data required to accurately test a device.

When the calibration cycle is complete, the READY indicator will illuminate, the CAL indicator will extinguish, and the message **INSTALL DEVICE, THEN PRESS READY** will be displayed. This message indicates that the calibration cycle is complete. All references have been obtained, and the 921A is ready to test the selected device.

The calibration cycle can be run whenever desired by pressing the MODE switch. This is useful if the operator suspects the original calibration has changed. For example, if the sensor has been moved by more than 1 inch, the original calibration will be invalid and a new calibration cycle will be necessary to reestablish calibration.

After the MODE switch has been pressed, the message **INSTALL DISTANCE REFERENCE GAUGE (or ENSURE PEDESTAL SETUP for CAL), PRESS READY WHEN INSTALLED. PRESS CAL TO ABORT** will be displayed.

This message indicates that a calibration cycle has been initiated. If an operator accidentally pressed the MODE switch, he/she now has the option to abort the calibration cycle by pressing the CAL switch. The 921A will retain the former calibration values and be prepared to test another device.

Whenever a different Configuration is installed, the display may instruct the operator to recalibrate. The 921A will automatically prompt the operator if a calibration is required due to a configuration change.

SECTION 5
SERVICE & ADJUSTMENTS

5.1 SERVICE MODE

WARNING

The Service Mode operates the moving platform at some service mode steps. Never operate the unit without the platform properly setup with the drive mechanism height adjusted to provide a suitable stop for the platform force transducer.

The Service Mode provides a means to periodically test and adjust the 921A internal measurement circuits. Adjustments should be performed on a regular basis as determined by the user's requirements. The Service Mode adjustments/calibration should be performed at least on an annual basis.

The SERVICE/RUN switch is located on the back panel (B-Figure 1.1). Turn off the 921A and place the switch in the SERVICE position. Install a Calibration Force Gauge under pressure transducer before turning on the 921A. Ensure that the serial communication cable is disconnected from the 921A. Turn on the 921A. It will perform its self-test routine and enter the Service Mode automatically. The message **FORCE CALIBRATION MODE, PRESS READY TO CONTINUE** will be displayed.

The Service Mode requires pressing the TEST/READY switch on the front panel to increment or step through the various service mode display screens. The TEST/READY switch must be depressed and held for at least 1 second prior to release to ensure the unit will recognize that the switch is pressed.

5.1.1 Force Calibration

This step allows adjusting the force offset and gain electronics on the force transducer assembly. Appendix B provides the detailed instructions for adjustment/calibration of the force transducer assembly.

If the operator wants to proceed to a different service mode step, be sure the platform is properly setup (see warning above) then press TEST/READY, as required.

5.1.2 Resistance Offset (Resistance Option Only)

This step allows adjusting the resistance offset electronics and verifying the internal resistance gain calibration value, as well as, verifying the resistance readings.

Appendix C provides the detailed instructions for adjustment/verification of the resistance electronics.

If the operator wants to proceed to a different service mode step, press TEST/READY, as required.

5.1.3 Lamp Test

This step allows verifying that the PASS, FAIL, READY, and CAL indicators are operational. Pressing the CAL switch will alternately turn all these indicators on and off.

If the operator wants to proceed to the next service mode step, press TEST/READY, as required.

5.1.4 Resistance CCA Code/Switch Installed (Resistance Option Only)

This step displays the Resistance CCA code (RCCA) value and the switch installed status. The RCCA code indentifies the specific optional Resistance CCA type installed in the unit. If the Generic Nest Assembly is connected to the unit, the SW Install Status should indicate TRUE; if it is disconnected, it should indicate FALSE.

If the operator wants to proceed to the next service mode step, press TEST/READY, as required.

5.1.5 Pressure Code

This step displays the Pressure (Force) Transducer Code value. The Pressure Code identifies the specific transducer type installed on the unit.

If the operator wants to proceed to the next service mode step, press TEST/ READY, as required.

5.1.6 Displacement Verification

This step allows verifying the system displacement accuracy.

Appendix D provides the detailed instructions for verification of the system displacement.

If the operator wants to proceed to the next service mode step, be sure the platform is properly setup (see warning above), then press TEST/READY, as required. In this case the next step is again Force Calibration (para. 5.1.1). The sequence can be repeated as often as desired.

SECTION 6
TROUBLESHOOTING

User troubleshooting of the 921A is limited to replacing fuses. Before returning the unit to TRICOR for service, check the following:

1) Verify that the power outlet has power. Plug in and turn on the 921A.

2) Does the POWER indicator illuminate?

   Yes - Go to step 3.

   No - Remove power plug from outlet.

   Remove slideout panel from power entry module (C-Figure 1.1). Check the two 2-A fuses. Replace defective fuse(s). Reapply power. If fuse(s) blow, return unit to TRICOR for service. Otherwise allow 921A to perform its self-test routine.

3) Does the operator's display indicate Self-Test?

   Yes - Go to step 4.

   No - Return unit to TRICOR for service.

4) Does Self-Test pass?

   Yes - Go to step 5.

   No - Return unit to TRICOR for service.

5) Does Calibration mode cycle complete?

   No - Remove plug from power outlet.

   Note:
   If the unit is under warranty, contact TRICOR prior to proceeding.

Remove the back panel (Refer to Appendix C Warnings and Step 1) prior to removing panel. Check the 4-A fuse (see Figure 5.1) on the power supply CCA (located on the right side of the base beneath the operator's display) .

Replace defective fuse, if any, with proper type. Reapply power. If fuse blows or unit still does not operate properly, return it to TRICOR for service.

Figure 5.1 4A Fuse Location on Power Supply CCA

APPENDIX A
RESTRICTIONS AND WARNING / PROBLEM / FAILURE MESSAGE DESCRIPTIONS

Max Force Restriction

Max Force parameter will establish the end of inward travel (bottomout). Max Force should be set to a reasonable value for the device under test. If the Max Force is set to small, the inward test range may not reach the desired bottomout point of the device under test. If the Max Force is set to large excessive force may be applied to the device under test.

Test Range Travel Restriction

The system can store a maximum of 2,500 data (log) points inward and 2,500 data (log) points outward. With the .0001" lead screw this is approximately .25" of travel in and out when operating in the 1 step/log mode. Note that this travel is the test range travel (free position to bottomout) and not total platform travel. If the test travel range exceeds the 2,500 data (log) points (more than approx. .25") then invalid results will occur. The configuration must be changed to increase the steps/log (i.e. 2 steps/log provides ~ .5" test travel with the standard .0001" lead screw). The user must configure the parameters properly for the device under test to ensure the test travel does not exceed the logging capacity of the system, or the test results/data will be invalid.

Ref Blk Size Restriction

Two restrictions apply to the Distance Reference Gauge and Ref Blk Size. One is the combination of the platform travel and the Ref Blk size cannot exceed 6.5535 inches. The other is the location or reference point established during the calibration cycle using the Distance Reference Gauge and Ref Blk Size must occur further inward than device bottomout during device testing. In other words, the reference point must be further (more travel) away from the platform home position than the device bottomout point during testing. Failure to comply with these restrictions will cause invalid results.

WARNING / PROBLEM / FAILURE MESSAGE DESCRIPTION

Sheet 1 of 2

DISPLAY MESSAGE	DESCRIPTION
FORCE SENSOR SELECTION MISMATCH	The current configuration requires a Force Transducer on the 921A with a different part number than the part number of the Force Transducer currently installed.
TEST BUFFER FULL - WAITING FOR PC	The 921A is operating in PC mode and the test buffer is full with 32 device test results stored. The PC must request and receive the stored results and clear the test result buffer before testing can resume.
WARNING - LOW BATTERY FOR MEMORY BACKUP	The 921A battery, used to retain configuration data in memory on power down, requires replacement.
THERE IS NO DEVICE INSTALLED TO TEST	The 921A does not detect a device present in the Test when the "TEST" switch is pressed to initiate a test cycle. Either a device is not properly installed, or the Test is improperly installed or defective.
A/D RESET, CALIBRATION FAILURE	The 921A Analog to Digital Converter has failed to reset and calibrate properly. This is a hardware failure. Power down unit several minutes, try again. If problem recurs, consult factory.
A/D CAL, CALIBRATION FAILURE	The 921A Analog to Digital converter has failed to calibrate properly. Power down unit several minutes, try again. If problem recurs, consult factory.
A/D CONVERSION (LOC) FAILURE	The 921A Analog to Digital Converter is not operating properly. Consult factory.
FORCE OFFSET CAL FAILURE (Press Test to Try Again)	The 921A Force Transducer offset exceeds acceptable limits for testing. Refer to 921A User's Manual for calibration requirements/procedures for Force Offset. If Force Offset cannot be adjusted to specification, consult factory.
WARNING - FORCE LIMIT EXCEEDED	The Force measured by the Force Transducer exceeds the acceptable limit. If Force Transducer is in contact with Test, press and hold "TEST" to back up platform from Test. If Force Transducer is not in contact with Test, check Force Gain/Offset calibration. If problem persists, consult factory.

WARNING / PROBLEM / FAILURE MESSAGE DESCRIPTION

DISPLAY MESSAGE	DESCRIPTION
SW IC TIO SLI CAL A LURE Power Down or Press Test to Retry CAL	Resistance channel offset calibration failure. Check Vest, using correct calibration block or Generic Vest, to ensure that Vest is properly installed. Be sure calibration block is properly seated and installing connector with Vest socket. Be sure configuration resistance channel allocation is correct for Vest design. Check resistance channel calibration and adjust if necessary. If problem persists, consult factory.
SW IC TIO GAIN CAL A LURE Power Down or Press Test to Retry CAL No Vest/Cable	Resistance channel gain calibration failure. Check Vest, using correct calibration block or Generic Vest, to ensure that Vest is properly installed. Be sure calibration block is properly seated and installing connector with Vest socket. Be sure configuration resistance channel allocation is correct for Vest design. Check resistance channel calibration and adjust if necessary. If problem persists, consult factory.
OVERLOAD LIMIT SWITCH SYSTEM FAILURE TEST MODE ABORTED - POWER DOWN	Force limit exceeded or limit switch connected during platform travel. Typical cause is Maximum Force parameter in configuration file (servo high travel limit or transducer). Reduce Maximum Force parameter value. Other causes are hardware failures. Consult factory.
WAITING FOR COMMUNICATION	RS-232 serial communication with PC interrupted. Possible cause is loose or disconnected cable between 9210 and PC or PC being turned off during communication. If necessary, power down 9210 and retry operating unit. If problem persists, consult factory.
SELF TEST FAILURE - POWER DOWN	If self test fails, note failure indication second line of 9210 display. Power down 9210 and retry operation. If problem persists, consult factory.
WORK OUT TEST CONFIGURATION STORED POWER DOWN TO RECEIVE SELECTION	The stored configuration does not contain a valid configuration. Refer to 9210 User's Manual and install a configuration.
9210 IN ENGINEERING CYCLE COMMAND FAILED Vest	If the 9210 is operating in Engineering Mode, the test cycle is normally initiated by the remote PC and this message is displayed if the 9210 Test switch is pressed. If the 9210 is operating in PC Mode, this message can be displayed if the test switch is pressed while a PC serial data transfer is in process. This occurs infrequently and
SYSTEM FAILURE - OVERLOAD EXCEEDED	Force limit exceeded. Check force calibration per 9210 User's Manual. If problem persists, consult factory.

APPENDIX B
Force Transducer CCA Calibration

Test Tool Required: Force Calibration Fixture PN 905-810

WARNING

Service is to be performed by qualified personnel only. Use only plastic adjustment tools. Failure to comply may result in damage to the equipment.

Step 1 Power down the unit. Remove the cover from the drive mechanism assembly (12 screws, Figure B.1). The force transducer CCA is located on the left side of the drive mechanism.

Step 2 Assemble the force calibration fixture PN 905-810 by attaching the force gauge with 2 screws (provided) to the "L" bracket (Figure B.2) Thread the force gauge tip (Figure B.3) onto the force gauge. Install the assembled "L" bracket with force gauge on the 921A baseplate (or equivalent) such that the force gauge tip is centered under the 921A drive mechanism assembly force transducer (refer to Figure B.4).

Step 3 Place the SERVICE/RUN switch on the unit rear panel in the SERVICE position.

The Service Mode is used to perform the calibration/adjustment. The Service Mode requires pressing the TEST/READY switch on the front panel to increment or step through the various service mode display screens. The TEST/READY switch must be depressed and held for at least 1 second prior to release to ensure the unit will recognize that the switch is pressed.

Step 4 Turn on the unit. After successful completion of the power-up self-test, the unit displays the FORCE CALIBRATION MODE message. Press the TEST/READY switch once. The message to Adjust Force Pot and the Offset value is displayed. The force transducer offset adjustment is performed using this display.

Step 5 There are two types of force transducer CCAs which are illustrated in Figures B.5a and B.5b. Examine your unit's force transducer CCA to determine which type is on the unit. Reference figure a or b accordingly to perform the adjustments of steps 6, 7, and 8.

Step 6 Adjust the force transducer CCA potentiometer labeled "offset" on Figure B.5 until the offset value displayed on the unit is as close to the nominal value listed below for your transducer type. The force offset adjustment must be within the range listed below for your transducer type for proper calibration.

Type	Nominal	Acceptable Range
3.6 kg	0.075 kg	0.025 to 0.200 kg
360 g	7.5 g	2.5 to 20.0 g
75 g	1.6 g	.5 to 4.2 g
2.0 kg	0.038 kg	0.012 to .100 kg
750 g	15 g	5 to 42 g
50 lb	1.04 lb	.35 lb to 2.80 lb
20 lb	0.38 lb	0.12 to 1.00 lb

Step 7 Turn on the force gauge. Select the units (kg or g) and zero the force gauge. Press the TEST/READY switch once. The unit drive mechanism will operate until the unit force transducer is in contact with the force gauge and reaches the calibration force level. The unit displays the adjust force pot(s) message for Force = Gauge value and displays

Force = "Measured Value"

Refer to Figure B.5 and adjust the GAIN 1 and/or the GAIN 2 potentiometer until the unit force "Measured Value" is equal to the force gauge value within the tolerance listed below for your transducer type.

Type	Adjustment Tolerance	Specification Tolerance
3.6 kg	± .003 kg	± .010 kg
360 g	± 0.4 g	± 2.0 g
75 g	± 0.1 g	± 0.5 g
2.0 kg	± .002 kg	± .005 kg
750 g	± 0.8 g	± 3.8 g
50 lb	± 0.04 lb	± 0.25 lb
20 lb	± 0.02 lb	± 0.10 lb

Step 8 Press the TEST/READY switch once. When the platform mechanism stops moving power down the unit. Repeat steps 4 through 8 until the step 6 offset is within acceptable range and the step 7 Measured Value is within adjustment tolerance without requiring further potentiometer adjustment, at steps 6 and 7. It typically takes performing steps 4 through 8 at least three times to achieve correct adjustment.

Step 9 Apply a small amount of Glytol to the potentiometer adjustment screw being sure some Glytol is applied between the screw and the body of the potentiometer. This completes the force transducer calibration.

Step 10 Install the cover on the head assembly with the screws removed in step 1. Remove the "L" bracket with force gauge from the baseplate. Remove the force gauge from the "L" bracket. Store force gauge and tip in original shipping case for protection.

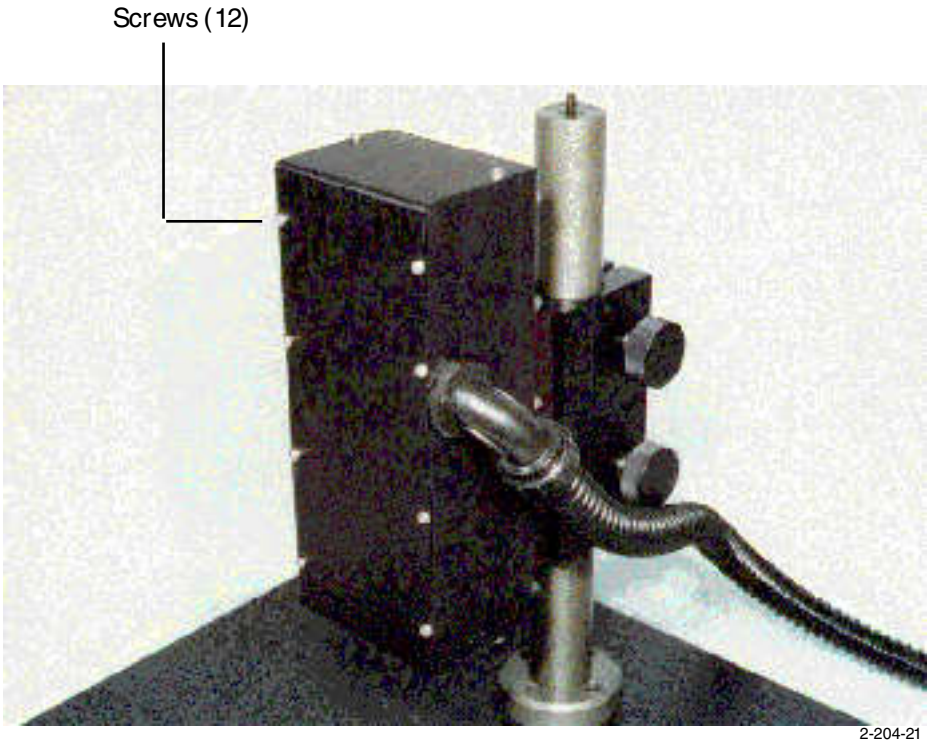


Figure B.1 Drive Mechanism Assembly Cover Removal

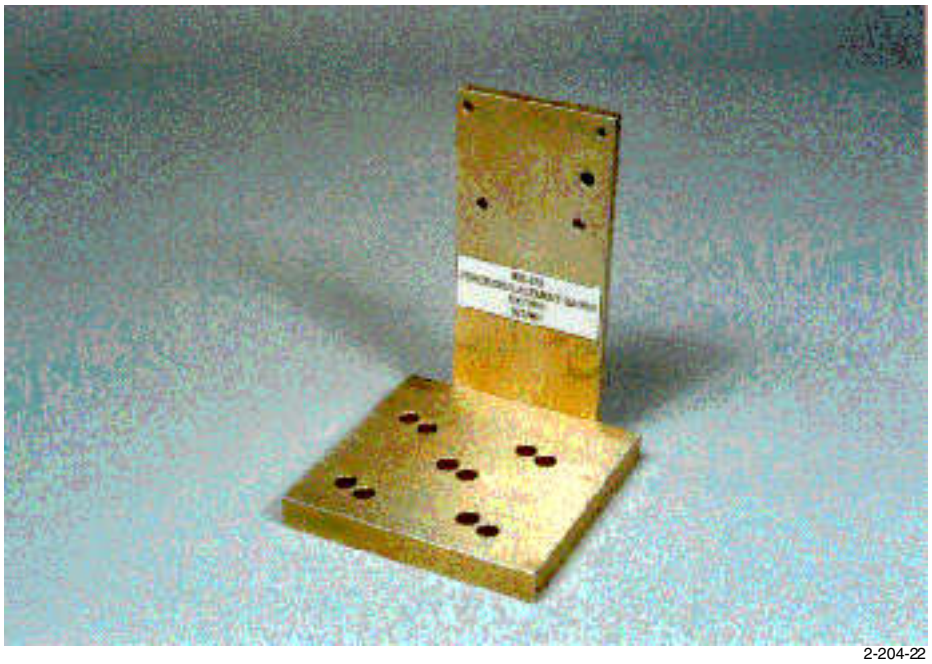


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Figure B.2 L Bracket/Gauge

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Figure B.3 Force Gauge with Tip

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Figure B.4 Center Gauge to Transducer Tip

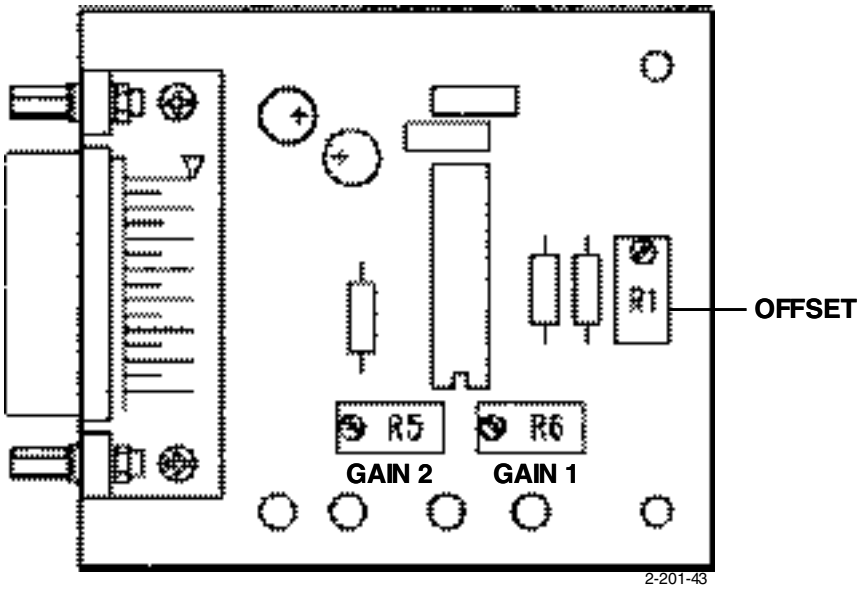

Figure B.5a Resistance Pot Locations
Force Transducer CCA Type 1

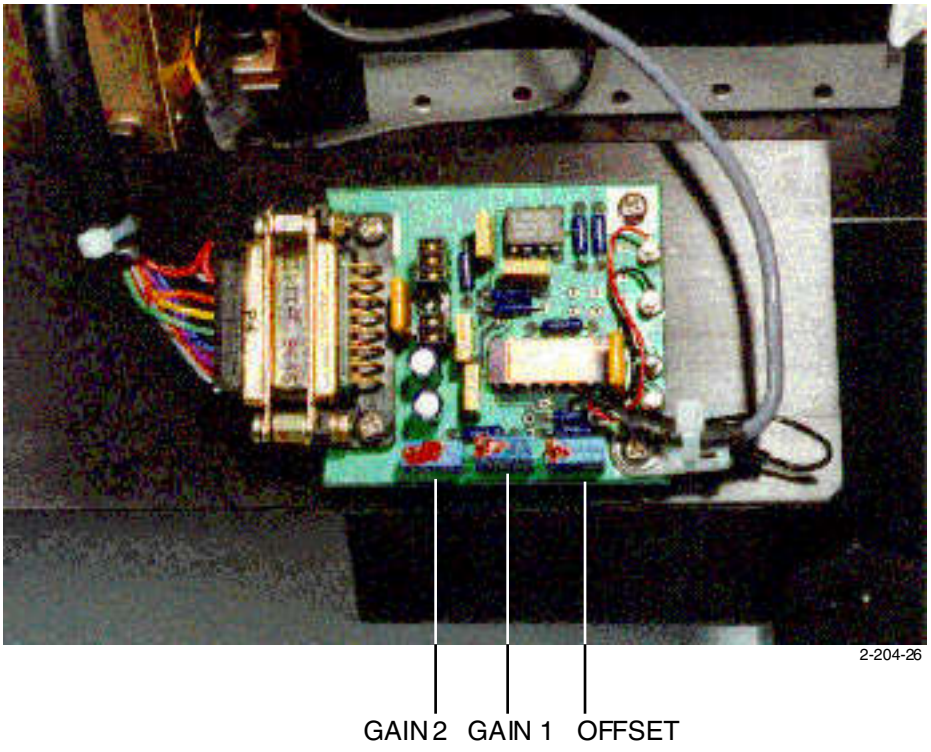

Figure B.5b Resistance Pot Locations
Force Transducer CCA Type 2

APPENDIX C
Resistance Adjustment/Verification
(Resistance Option Only)

Test Tool Required: Resistance Verification Fixture PN 921-811-XX (See Table C-1 for the complete part number of the fixture required based on the Resistance Option Type installed in the Model 921A)

Table C-1

Resistance Option Type	Resistance Fixture PN
4 Ω, 10mA	921-811-09
4 Ω, 25mA	921-811-09
16 kΩ, .25mA	921-811-01
1 kΩ, 1 mA	921-811-07
4 V, 4.99k Pullup	921-811-02

Each fixture consists of: The Resistance Test Box, a 37-pin to 15-pin adapter cable and the Offset/Gain Jumpering Connector.

Resistance Test Box

Offset/Gain Jumpering Connector

WARNING
DANGER

There is 115 V or 230 V ac voltages present within the unit. Service is to be performed by qualified personnel only. Use only plastic adjustment tools. Do not touch or come in physical contact with any wires, components or assemblies within the unit or severe injury or death can result.

WARNING

The Service Mode operates the moving platform at some service mode steps. Never operate the unit without the platform properly set up with the test fixture height adjusted to provide a suitable stop for the platform force transducer.

Step 1 Power down the unit. Disconnect the ac power cord from the primary power source. Remove the rear panel from the unit (four screws - figure C.1) and lay down on a flat surface.

Step 2 Adjust the height of the Drive Mechanism to provide a suitable stop for the platform force transducer.

Step 3 Connect the Drive Mechanism and Resistance Cable (PN 921-112) to the rear panel connectors per section 2 of the 921A User's Manual; however, do not connect P2 of the resistance cable to a nest. Connect the ac power cord to the unit and to the primary power source. Place the SERVICE/RUN switch on the unit rear panel in the SERVICE position. Turn on the unit.

The Service Mode is used to perform the calibration/adjustment. The Service Mode requires pressing the TEST/READY switch on the front panel to increment or step through the various service mode display screens. The TEST/READY switch must be depressed and held for at least 1 second prior to release to ensure the unit will recognize that the switch is pressed.

Step 4 After successful completion of the power-up self-test, the unit displays the Force Calibration Mode message. The Force Calibration will not be performed as part of this procedure. However, the unit must be sequenced through the service mode Force Calibration screens by pressing the TEST/READY switch on the front panel.

Press TEST/READY once- Force Offset Value displayed

Press TEST/READY again - Platform moves until Force Cal value is reached and stops.

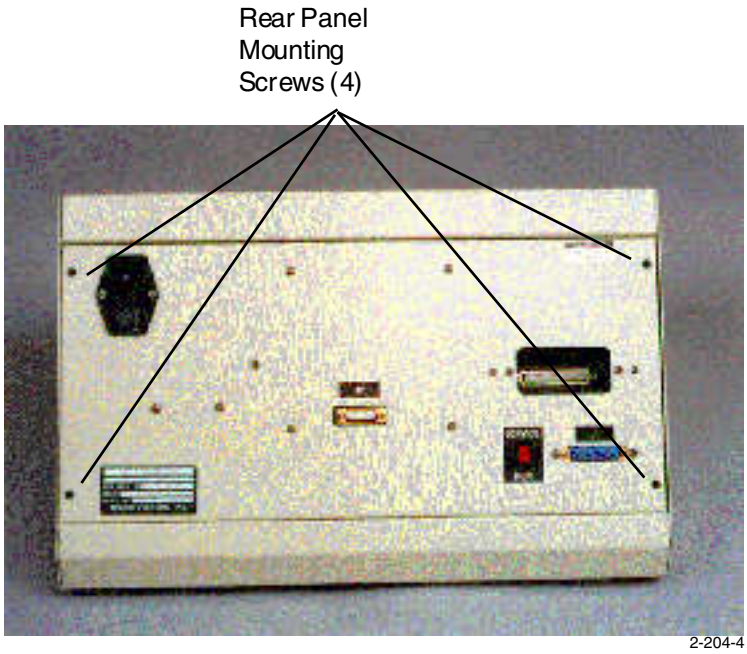

Figure C.1 921A Rear Panel

Press TEST/READY again - The platform returns to the home position. The resistance Offset Adjustment Mode message is displayed.

Install the Offset/Gain Jumpering Connector (part of PN 921-811-XX) on the Resistance Cable (PN 921-112) P2 Connector. **Do not remove the jumpering connector until instructed to do so by this procedure.**

Step 5 Press the TEST/READY switch once. The unit displays the offset values for the resistance current source channel. Figure C.2 identifies the location of the offset potentiometer (pot) and the corresponding pot designator which is displayed by the unit.

Step 6 The resistance offset value must be within the acceptable range listed below. If necessary, adjust the offset pot until the offset value displayed by the unit is within the acceptable range.

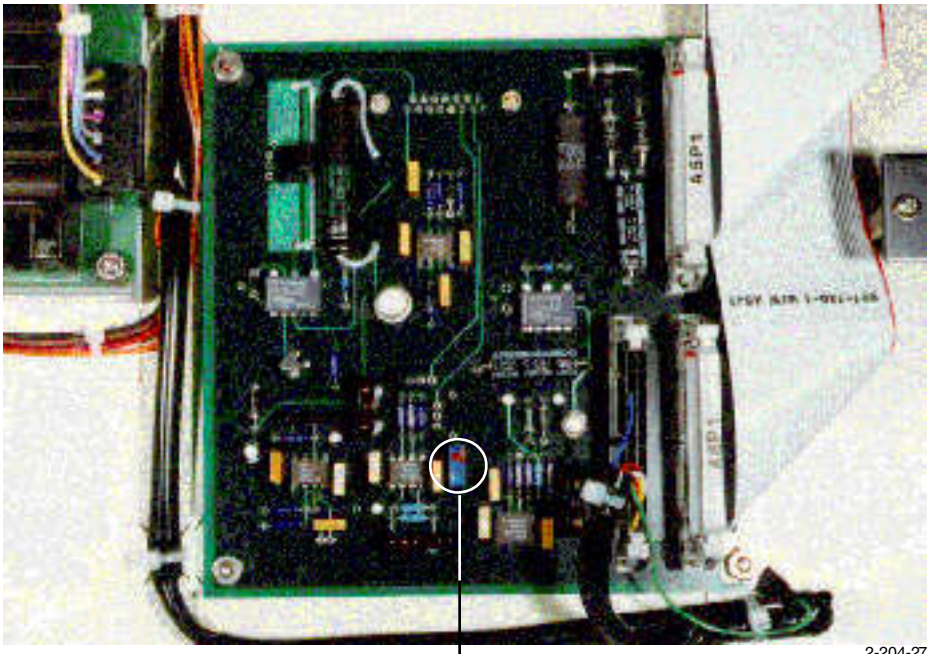

Figure C.2 Resistance CCA Offset Pot Location

Resistance Type	Acceptable Range
4 Ω, 10 mA Channel Offset	0.010 to 0.030
4 Ω, 25 mA Channel Offset	0.004 to 0.012
16 kΩ, .25 mA Channel Offset	0.001 to 0.030
1 kΩ, 1 mA Channel Offset	0.001 to 0.030
4 V, 4.99 k Pullup Channel Offset	0.001 to 0.030

Step 7 Press the TEST/READY switch once. The unit displays the GAIN Calibration Resistance Value message. Press the TEST/READY switch again. The unit displays the GAIN Calibration Value (GV). The Gain Values displayed should be in the range 3.800 ± .100. These are not adjustable values. Consult the factory if the GV value is not within this range.

Step 8 Press the TEST/READY switch once. The unit displays the Contact Resistance Value Mode message. Press the TEST/READY switch again. The unit displays the measured resistance for the resistance channel. The value displayed must be 4.095. This is the open circuit condition. Consult the factory if the channel is not equal to this value.

Step 9 Remove the Offset/Gain jumpering connector from the Resistance Cable P2 connector. Connect the Resistance Test Box (Part of PN 921-811-XX) connector to the Resistance Cable P2 Connector.

Tables C.2 through C.5 provide the switch settings and verification criteria for the different Resistance Option types. Use the appropriate table for the Resistance Option installed in the 921A.

Set the Resistance Test Box Resistance switch to each position listed in the appropriate table below and verify that the value displayed by the unit (CH1) equals the corresponding value listed in the table within the tolerance specified.

Table C.2 4 Ω, 10 mA or 25 mA Resistance Option using Resistance Fixture PN 921-811-09

Resistance Switch Position	Displayed Value (Ω)	Tolerance
1 (0 Ω)	0.000	±.010
2 (1 Ω)	1.000	±.010
3 (2 Ω)	2.000	±.010
4 (3 Ω)	3.000	±.010
5 (3.8 Ω)	3.800	±.010
6 (.025 Ω)	0.025	±.010
7 (.050 Ω)	0.050	±.010
8 (.075 Ω)	0.075	±.010

Table C.3 16 kΩ, .25 mA Resistance Option using Resistance Fixture PN 921-811-01

Resistance Switch Position	Displayed Value*	Tolerance
0 (0 kΩ)	0.000	± 0.010
1 (4 kΩ)	1.000	± 0.010
2 (8 kΩ)	2.000	± 0.010
3 (12 kΩ)	3.000	± 0.010
4 (16 kΩ)	4.000	± 0.010

* Resistance = Displayed Value x 4000 (Ω)

Table C.4 1 kΩ, 1 mA Resistance Option using Resistance Fixture PN 921-811-07

Resistance Switch Position	Displayed Value*	Tolerance
0 (0 Ω)	0.000	± 0.010
1 (250 Ω)	1.000	± 0.010
2 (500 Ω)	2.000	± 0.010
3 (750 Ω)	3.000	± 0.010
4 (1000 Ω)	4.000	± 0.010

* Resistance = Displayed Value x 250 (Ω)

Table C.5 4 V, 4.99k Pullup Resistance Option using Resistance Fixture PN 921-811-02

Resistance Switch Position	Displayed Value (Volts)	Tolerance
0 (0 V)	0.000	± 0.040
1 (1 V)	1.000	± 0.040
2 (2 V)	2.000	± 0.040
3 (3 V)	3.000	± 0.040
4 (4 V)	4.000	± 0.040

Consult the factory if any of the resistance values fail to meet the specified requirement. This completes the resistance calibration/verification.

Step 10 Power down the unit. Disconnect the ac power cord from the primary power source. Disconnect Test Tool PN 921-811-09 from the Resistance Cable P2 connector.

Step 11 If the potentiometer was adjusted, apply a small amount of Glytol to the potentiometer adjustment screw being sure some Glytol is applied between the screw and the body of the potentiometer.

Step 12 If no further internal adjustments are to be made, install the rear panel on the unit using the four screws removed in step 1.

APPENDIX D
Displacement Verification Procedure

Test Tool Required: Force/Displacement Gauge Fixture PN 905-378

Displacement Gauge: Mitutoyo PN 543-146 (or Equivalent)

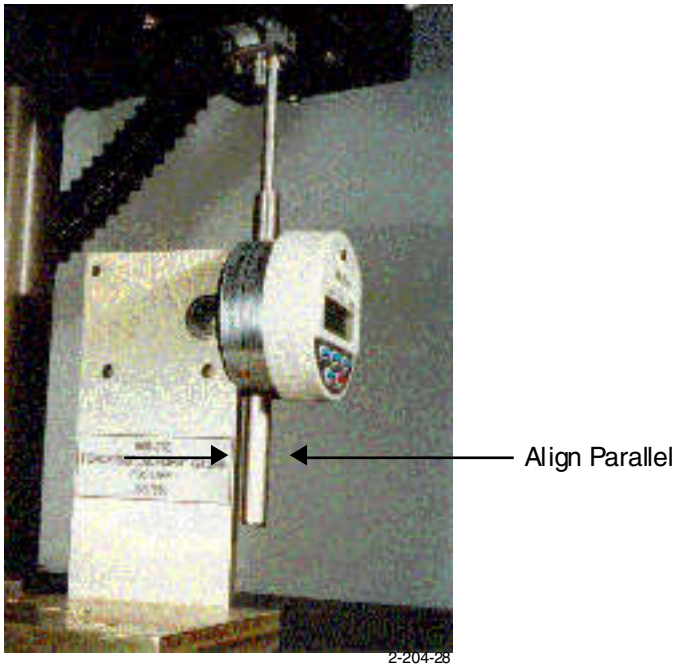

Figure D.1 Fixture with Gauge

WARNING

The Service Mode operates the moving platform at some service mode steps. Never operate the unit without the platform properly setup with the test fixture height adjusted to provide a suitable stop for the platform force transducer.

Step 1 Adjust the height of the Drive Mechanism to provide a suitable stop for the drive mechanism force transducer.

Step 2 Connect the Drive Mechanism to the rear panel connector per section 2 of the 921A User's Manual. Connect the ac power cord to the unit and to primary power source. Place the SERVICE/RUN switch on the unit rear panel in the SERVICE position. Turn on the unit.

The Service Mode is used to perform the calibration/adjustment. The Service Mode requires pressing the TEST/READY switch on the front panel to increment or step through the various service mode display screens. The TEST/READY switch must be depressed and held for at least 1 second prior to release to ensure the unit will recognize that the switch is pressed.

Step 3 After successful completion of the power-up self-test, the unit displays the Force Calibration Mode message. The Force Calibration will not be performed as part of this procedure. However, the unit must be sequenced through the Service Mode Force Calibration screens by pressing the TEST/READY switch on the front panel.

Press TEST/READY once - Force Offset Value displayed

Press TEST/READY again - Platform moves until Force Cal Value is reached and stops.

Press TEST/READY again - The platform returns to the home position.

If the unit is equipped with the Resistance Option, Resistance Offset Mode is displayed. If not, the Lamp Test Mode message is displayed. Press TEST/READY switch, as required, until the Displacement Verification Mode message is displayed, then proceed to step 4.

Step 4 Assemble the Displacement Gauge to Fixture PN 905-378, as shown in Figure D.1, using the bolt provided. Be certain the gauge is mounted with the plunger parallel to the side of the fixture (see Figure D.1). Install the assembled fixture with gauge on the 921A baseplate (optional) or equivalent, such that the displacement gauge plunger is slightly depressed

(approximately 1/16-inch) when contacting the Force Transducer Assembly (adjust the height of the drive mechanism, as necessary) as shown in Figure D.2.

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Figure D.2

Step 5 Prior to proceeding with the displacement test, the operator needs to become familiar with the test method. Table D.1 provides the approximate displacement locations to test. When the TEST/READY switch is pressed and released, the drive mechanism will begin incrementing (moving) into the displacement gauge. The 921A displacement value is presented on the unit display. The drive mechanism is incremented until the displacement reaches 0.2000 inch (standard .0001 inch lead screw) or until the TEST/READY switch is pressed and held in. The drive mechanism will remain stationary as long as the TEST/READY switch is held in (actuated). By monitoring the displacement value on the unit display and pressing/holding the TEST/READY switch, the operator can stop the platform at the approximate displacement points listed in Table D.1 and compare the unit displayed displacement to that of the fixture gauge.

Step 6 With the Displacement Verification Mode message displayed on the unit, turn on and zero the fixture gauge. Be sure the fixture gauge reads zero, or re-zero the gauge as necessary until the gauge reads zero before proceeding. Press, then release, then press and hold in the TEST/READY switch. This is the approximate zero reading. If the unit display still reads zero, then re-zero the fixture gauge (if necessary). If the unit reads other than zero, any difference should be noted and subsequent fixture gauge readings corrected for the initial zero difference. Release the TEST/READY switch, monitor the unit displacement until the next approximate displacement point, then press and hold the TEST/READY switch. Compare the fixture gauge to the unit displayed value. The unit value must be within ±0.0003 inch of the corrected gauge value for each displacement check for acceptance. Repeat until all displacement points listed in Table D-1, prior to the last displacement point, have been checked. The unit will automatically stop at the last displacement point (Do not press TEST/READY switch for this point). Check the unit displacement to the gauge at this point as well.

Step 7 Press TEST/READY switch again. The drive mechanism will retract and go to the home position. This completes the displacement verification.

Step 8 Power down unit. Remove fixture from baseplate. Remove and store gauge in original shipping case for protection.

Table D-1
Displacement Verification Table

Approximate Displacement	Unit Measurement	Mitutoyo Measurement
0.0000		
0.0125		
0.0250		
0.0500		
0.0750		
0.1000		
0.1250		
0.1500		
0.1750		
0.2000		