

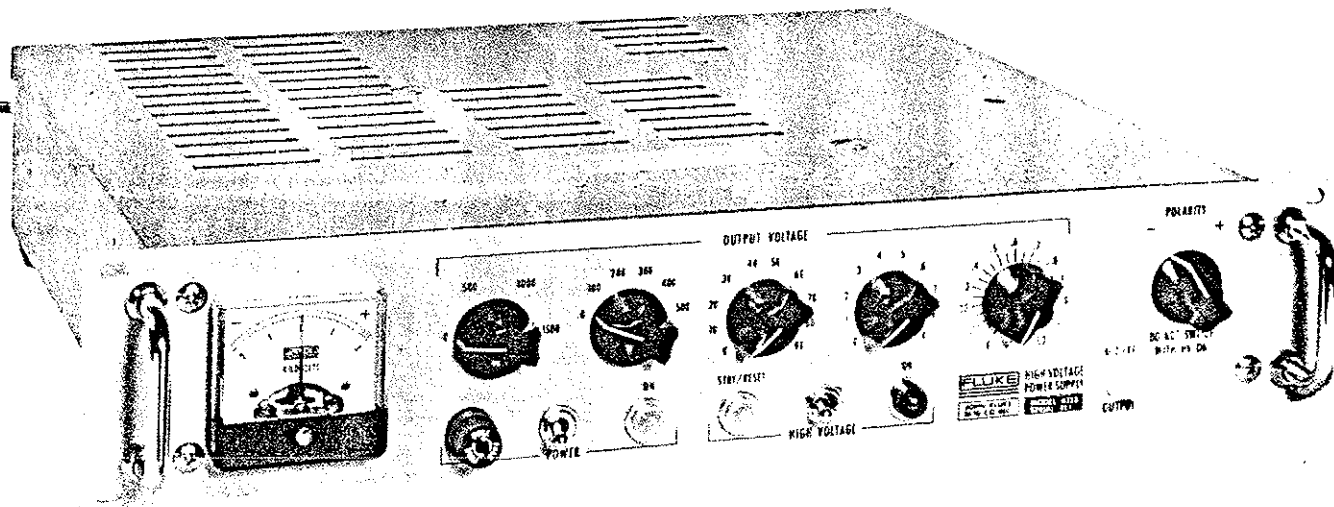
MI # 9646

412B DC Power Supply

Instruction Manual

P/N 294017
July 1965
Rev. 2 7/74





MODEL 412B HIGH VOLTAGE DC POWER SUPPLY

SECTION II

OPERATING INSTRUCTIONS

2-1. FUNCTION OF EXTERNAL CONTROLS, TERMINALS, AND INDICATORS

2-2. The location, reference designation, and functional description of external controls, terminals, and indicators on the Model 412B are given in Figure 2-1.

CONTROL, TERMINAL, or INDICATOR	LOCATION	REFERENCE DESIGNATION	FUNCTIONAL DESCRIPTION
POWER switch	Front panel	S1	Applies AC line power to the control circuit and to the primary of the transformer.
POWER ON indicator lamp	Front panel	DS1	Illuminates when power is applied to the control circuit and transformer.
HIGH VOLTAGE switch	Front panel	S2	Used to apply transformer power to the high-voltage rectifiers when the STBY/RESET lamp is illuminated.
STBY/RESET indicator lamp	Front panel	DS2	Indicates completion of the time-delay cycle, by illuminating 30 seconds after line power is applied to the 412B. The HIGH-VOLTAGE switch must be set to STBY/RESET for completion of the time-delay cycle.
HIGH VOLTAGE ON indicator lamp	Front panel	DS3	Illuminates when the high voltage is available at the OUTPUT connectors.
POLARITY switch	Front panel	S7	Selects an output either positive or negative with respect to chassis ground.
OUTPUT VOLTAGE dials	Front panel	S3, S4, S5, S6, and R119	The first four dials select the output voltage in three steps of 500 volts, five steps of 100 volts, nine steps of 10 volts, and nine steps of 1 volt, respectively. R119 provides a continuous output range of 0 to 1.2 volts.
Voltmeter	Front panel	M1	Indicates the approximate output voltage from -2.1 to +2.1 kv. Accuracy is $\pm 3\%$ of full scale.
Output connectors	Front and back panels	J1 and J2	UG931/U connectors provided for connecting the load to the instrument. One mating connector is supplied.

Figure 2-1. FUNCTION OF EXTERNAL CONTROLS, TERMINALS, AND INDICATORS

2-3. INPUT POWER

2-4. Two power transformers (T1) are available for this instrument, 100/115 vac or 115/230 vac. On the rear panel of each instrument a decal indicates the operating voltage of the transformer installed. This operating voltage can be changed by altering the wiring configuration of the transformer. To change the operating voltage of the 115/230 vac transformer, refer to the decal located on the power transformer. Refer to Figure 2-2 for changing the operating voltage of the 100/115 vac power transformer. To gain access to the power transformer, remove the instrument's top cover.

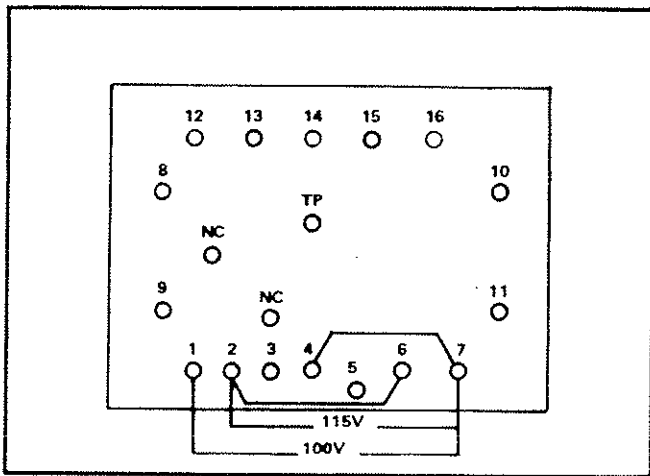


Figure 2-2. 100/115V TRANSFORMER CONFIGURATION

2-5. INITIAL OPERATION

2-6. The following procedure is recommended when operating the Model 412B for the first time after shipping or a long period of idleness. This procedure will minimize the possibility of damage resulting from a faulty component.

a. Connect the line plug to a 115 vac power source. If the instrument has been wired for 230 volt operation, connect to 230 vac.

WARNING

This instrument is equipped with a 3-wire line cord, one lead of which is connected to the metal chassis. Connection to a properly-wired outlet automatically connects the chassis of the instrument to earth ground. If an adapter is used to connect the line to a two-contact outlet, the green lead extending from the adapter should be connected to a suitable ground.

- b. Set the HIGH VOLTAGE switch to STBY/RESET.
- c. Set the POWER switch to ON. The ON lamp will illuminate. After approximately 30 seconds, the time-delay relay will close and the STBY/RESET lamp will illuminate.
- d. Set the second OUTPUT VOLTAGE dial to 500.
- e. After the STBY/RESET lamp illuminates, set the HIGH VOLTAGE switch to ON. Carefully observe if

the HIGH VOLTAGE ON lamp illuminates and if the panel meter indicates 500 (+63) volts.

CAUTION

If the output exceeds 563 volts, immediately set the HIGH VOLTAGE switch to STBY/RESET.

- f. If the output voltage is within tolerance, the power supply may be operated as in paragraph 2-7 or 2-8. If the output is not within tolerance, perform steps g. through i.
- g. Set the HIGH VOLTAGE switch to STBY/RESET.
- h. Locate and correct the source of trouble. Refer to paragraph 4-5.
- i. Repeat the initial operating procedure, steps b. through e.

2-7. OPERATING PROCEDURE

- a. Set the POWER switch to ON. The ON lamp will illuminate.
- b. Set the HIGH VOLTAGE switch to STBY/RESET. After approximately 30 seconds the time-delay relay will close and the STBY/RESET lamp will illuminate.
- c. Set the POLARITY switch to the desired polarity.
- d. Set the OUTPUT VOLTAGE dials to the desired output.

CAUTION

Rapidly decreasing the setting of the OUTPUT VOLTAGE dials with the high voltage on may damage the sampling string resistors. When dialing down the output voltage, pause approximately 1/2 second in each switch position.

- e. Connect the load circuit securely to the output connector. Check the external circuit for conflicts in grounding before applying power to the load.

WARNING

This power supply can produce lethal voltage. Always set the HIGH VOLTAGE switch to STBY/RESET and wait until the output voltage has decayed to zero before connecting or disconnecting the load.

- f. After the STBY/RESET lamp illuminates, set the HIGH VOLTAGE switch to ON. The STBY/RESET lamp will extinguish and the HIGH VOLTAGE ON lamp will illuminate. The panel meter will indicate the approximate output voltage.

NOTE

If the overcurrent trip level has been reduced from the factory setting of 32 ma, it may be necessary to set the HIGH VOLTAGE switch to ON with a reduced output voltage setting, to prevent actuating the overcurrent trip when the HIGH VOLTAGE switch is set to ON. In this case, step d, above, would follow step f. If the HIGH VOLTAGE switch is set to ON immediately after the STBY/RESET lamp illuminates, any overload will cause the output voltage to oscillate between ON and STBY/RESET. The oscillation can be stopped and/or pre-

vented by correcting the overload condition.

- g. To remove the high voltage from the output connector, set the HIGH VOLTAGE switch to STBY/RESET.

NOTE

When the HIGH VOLTAGE switch is in the STBY/RESET position, there may be a voltage of 2 to 3 volts present at the output connector, due to grid conduction of the passing tubes.

h. The output polarity of the 412B may be changed at any time when no load is connected to the instrument. When a load is connected, especially one that is highly reactive, the HIGH VOLTAGE switch should be set to STBY/RESET, or the output voltage should be reduced to 500 volts, before changing the output polarity. If the polarity is switched at high output voltages with reactive loads, the POLARITY switch may be damaged.

i. The 412B is protected from overload damage by an overcurrent protection circuit which removes power from the high voltage rectifiers at an output current of 32 ma, or at the value set during calibration of the instrument. When the overload trip is actuated, the HIGH VOLTAGE ON lamp will extinguish. The high voltage may be re-applied to the output connectors as follows:

(1) Set the HIGH VOLTAGE switch to STBY/RESET. After approximately 30 seconds the STBY/RESET lamp will illuminate.

(2) Set the HIGH VOLTAGE switch to ON. The STBY/RESET lamp will extinguish and the HIGH VOLTAGE ON lamp will illuminate. The output voltage will be available at the output connectors.

2-8. CALIBRATION OF METERS

2-9. The 412B may be used for direct calibration of dc instruments to an accuracy of 0.25% or 100 mv at 2100 cardinal points, 1 volt apart, from 0 to 2099 volts. The vernier dial provides an additional 1.2 volts of range for calibration between cardinal points. Proceed as follows:

- a. Set the POWER switch to ON. The ON lamp will illuminate.
- b. Set the HIGH VOLTAGE switch to STBY/RESET. This allows the time-delay relay to start its cycle. After approximately 30 seconds, the time-delay relay will close and the STBY/RESET lamp will illuminate.
- c. Set the POLARITY switch to the desired polarity.
- d. Connect the instrument being calibrated firmly to the power supply. Check the external circuit for conflicts in grounding before applying power to the load.
- e. After the STBY/RESET lamp illuminates, set the HIGH VOLTAGE switch to ON. The STBY/RESET lamp will extinguish and the HIGH VOLTAGE ON lamp will illuminate.
- f. Set the first four OUTPUT VOLTAGE dials to the desired cardinal point. Use the last dial if a calibration point between the one volt cardinal points is desired.

g. To remove the output voltage from the output connector, set the HIGH VOLTAGE switch to STBY/RESET.

2-10. When used with a Fluke differential voltmeter and voltage divider, the 412B is capable of calibrating dc instruments from 0 to 2100 volts with an accuracy of 0.01% to 0.06% with 5 millivolts resolution. For calibration of instruments from 0 to 500 volts, proceed as follows:

- a. Set the POWER switch to ON. The ON lamp will illuminate.
- b. Set the HIGH VOLTAGE switch to STBY/RESET. After approximately 30 seconds, the time-delay relay will close and the STBY/RESET lamp will illuminate.
- c. Set the POLARITY switch to the desired polarity.
- d. Connect the instrument being calibrated securely to the power supply. Check the external circuit for conflicts in grounding before applying power to the load.
- e. Connect a Fluke differential voltmeter to the instrument being calibrated.
- f. Set the differential voltmeter to measure the voltage desired at the calibration point.
- g. Set the HIGH VOLTAGE switch to ON. The STBY/RESET lamp will extinguish and the HIGH VOLTAGE ON lamp will illuminate.
- h. Null the differential voltmeter by adjusting the OUTPUT VOLTAGE dials. The accuracy of the voltage measured is from 0.01% to 0.05%, depending on the accuracy of the differential voltmeter used.
 1. Set the HIGH VOLTAGE switch to STBY/RESET.
 - j. Repeat steps f. through i. for as many calibration points as desired.

2-11. For calibration of instruments from 500 volts to 2100 volts, proceed as follows:

- a. Set the POWER switch to ON. The ON lamp will illuminate.
- b. Set the HIGH VOLTAGE switch to STBY/RESET. After approximately 30 seconds, the time-delay relay will close and the STBY/RESET lamp will illuminate.
- c. Set the POLARITY switch to the desired polarity.
- d. Connect the instrument being calibrated firmly to the power supply. Check the external circuit for conflicts in grounding before applying power to the load.
- e. Connect a Fluke Model 80E Voltage Divider to the instrument being calibrated, and connect a differential voltmeter to the 10 volt maximum output divider terminal.
- f. Set the differential voltmeter to measure the voltage at the desired calibration point, considering the voltage division ratio of the voltage divider.
- g. Set the HIGH VOLTAGE switch to ON. The STBY/RESET lamp will extinguish and the HIGH VOLTAGE ON lamp will illuminate.
- h. Null the differential voltmeter by adjusting the OUTPUT VOLTAGE dials. The accuracy of the voltage measured is from $\pm 0.02\%$ to $\pm 0.06\%$, according to the accuracy of the differential voltmeter and voltage divider used.
 - i. Set the HIGH VOLTAGE switch to STBY/RESET.
 - j. Repeat steps f. through i. for as many calibration points as desired.

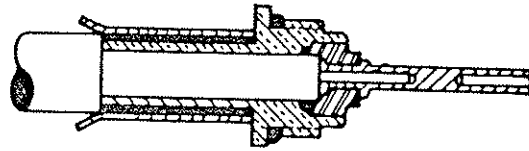
2-12. COAXIAL CABLE ASSEMBLY

2-13. Coaxial cables used to connect the instrument to a load are not provided by John Fluke Mfg. Co., Inc. Procurement of cables and the assembly of mating cable connectors must be carefully undertaken to insure safety of personnel.

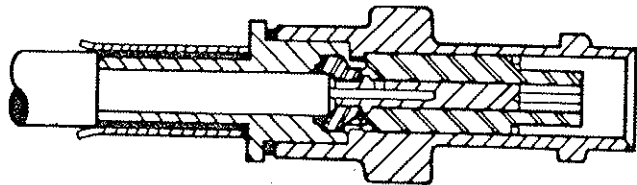
WARNING!

Extreme care should be exercised when utilizing high voltage conductors and connectors. Improper assembly of cable connectors or careless use of high voltage equipment may expose personnel to voltage of lethal magnitude.

d. Slide outer sleeves over braid until it is flush against back of nut. Crimp as close to nut as possible using proper crimping tool.



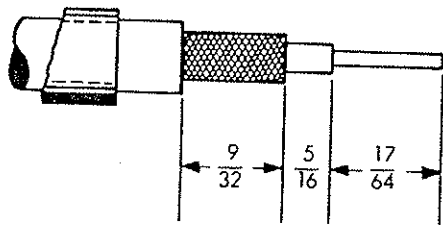
e. Insert finished cable assy. into body either jack or plug and tighten by rotating body. Do not rotate nut sub-assembly.



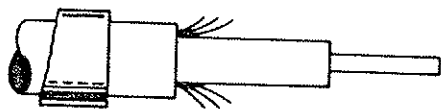
2-14. General instructions are provided herein for the assembly of two types of cable connectors issued as an accessory item with John Fluke instruments. Additional information on the assembly of these connectors, or on other types of connectors considered for use with the instrument, may be obtained from the cable or connector vending agency.

2-15. DAGE TYPE 486-1 CONNECTOR ASSEMBLY

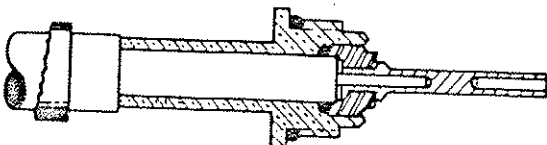
a. Cut cable off square on end. Slide outer sleeve over cable and slide back out of way. Trim cable to dim. shown being careful not to nick center conductor or braid. Tin dip center conductor. Remove all excess solder.



b. Rotate dielectric to slightly flare braid.



c. Push cable into nut sub-assembly until the center conductor is visible thru hole in contact. Soft solder center conductor thru hole in contact. Remove excess solder. Fold braid down over back end tube of nut. Trim excess braid if necessary.

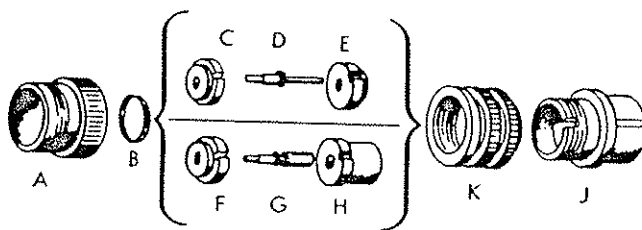


2-16. AMPHENOL MS 3106A CONNECTOR ASSEMBLY

a. Strip cable jacket, braid, and dielectric to dimensions shown. All cuts are to be sharp and square. Do not nick braid, dielectric, and center conductor. Tinning of center conductor is not necessary if contact is to be crimped. For solder method, tin center conductor avoiding excessive heat.



b. Disassemble connector by removing the back shell and retainer ring.

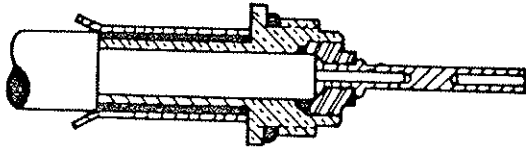


WITH PIN INSERT
(Male)

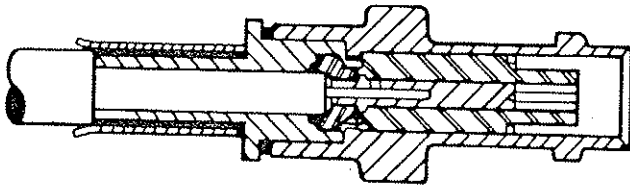
WITH SOCKET INSERT
(Female)

- | | | | |
|---|------------------|---|---------------------|
| A | Back Shell | A | Back Shell |
| B | Retainer Ring | B | Retainer Ring |
| C | Pin Rear Insert | F | Socket Rear Insert |
| D | Pin Contact | G | Socket Contact |
| E | Pin Front Insert | H | Socket Front Insert |
| J | Front Shell | J | Front Shell |
| K | Coupling Ring | K | Coupling Ring |

d. Slide outer sleeves over braid until it is flush against back of nut. Crimp as close to nut as possible using proper crimping tool.



e. Insert finished cable assy. into body either jack or plug and tighten by rotating body. Do not rotate nut sub-assembly.



connection from the cable shield to the cable clamp. The connecting copper approximately 5 inches long and size 14 or 16. A terminal lug should be used to connect the shield to the cable clamp. The wire should be carefully soldered, taking care not to damage the insulation of the shield. The ends of the shield should be clipped off to the center conductor or contact to the

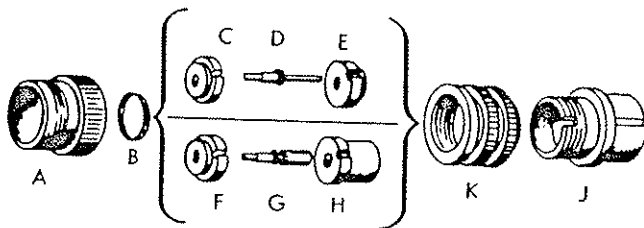
the cable connector by placing the contact insert, then coupling the back shell to the reverse of the disassembly procedure.

2-16. AMPHENOL MS 3106A CONNECTOR ASSEMBLY

a. Strip cable jacket, braid, and dielectric to dimensions shown. All cuts are to be sharp and square. Do not nick braid, dielectric, and center conductor. Tinning of center conductor is not necessary if contact is to be crimped. For solder method, tin center conductor avoiding excessive heat.



b. Disassemble connector by removing the back shell and retainer ring.



WITH PIN INSERT
(Male)

WITH SOCKET INSERT
(Female)

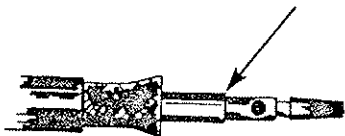
- A Back Shell
- B Retainer Ring
- C Pin Rear Insert
- D Pin Contact
- E Pin Front Insert
- J Front Shell
- K Coupling Ring

- A Back Shell
- B Retainer Ring
- F Socket Rear Insert
- G Socket Contact
- H Socket Front Insert
- J Front Shell
- K Coupling Ring

c. Insert cable thru clamp MS 3057A and rear components of connector. Place the cable center conductor into the socket contact.

d. Soft solder contact to cable center conductor. Do not get any solder on outside surfaces of contact. Avoid excessive heat to prevent swelling or dielectric.

Contact must butt against cable dielectric



e. Provide a connection from the cable shield to the securing bolt of the cable clamp. The connecting copper wire should be approximately 5 inches long and size 14 or larger in diameter. A terminal lug should be used to connect the wire to the clamp. The wire should be carefully soldered to the shield, taking care not to damage the insulation of the cable. Loose ends of the shield should be clipped off to prevent shorting the center conductor or contact to the shield.

f. Assemble the cable connector by placing the contact into the socket front insert, then coupling the back shell to the front shell in the reverse of the disassembly procedure.