



# Victoreen®

**Digital Preamplifier, Model 943-227-15, for use with  
Model 943-27 Current Mode Beta Detector**

## Operator Manual

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# Section 1

## General Information

### 1.1 General Description

The Victoreen® Model 943-227-15 Digital Preamplifier, is designed to operate with the Model 943-27, Current Mode Beta Scintillation detector and the Model 942A-200C Series Digital Ratemeter (UDR) or the Model 960 Series Digital Process Control system. When connected to the beta sensitive scintillation detector, it comprises a monitoring system which operates in the range of  $10^{-3}$  to  $10^5$  uCi/cc (or  $1E^0$  to  $1E^8$  Pico amperes). The UDR provides display, control, and annunciator functions for the monitoring system. The preamplifier contains a microprocessor controlled, auto-zeroing, integrating electrometer, a programmable gain amplifier, an analog-to-digital converter and an asynchronous serial communications interface. Communications with the UDR is accomplished via the optically isolated Victoreen Serial Communication Loop driver/receiver circuitry.

Interconnection of the detector and preamplifier is accomplished utilizing two, six (6) foot coaxial cables. One cable supplies the high voltage for the detector (negative polarity). The other cable is used for the detector output signal. Interconnection between the preamplifier and the UDR or 960 system is accomplished via a six-conductor cable and a high voltage coaxial cable.

The detector operates at a potential of approximately (-) 500 VDC, and produces a nominal DC output current of  $1 \times 10^{-12}$  amperes to  $1 \times 10^{-4}$  amperes. Depending on sampling geometry and detector set up, this corresponds to a range of  $1 \times 10^{-3}$  to  $1 \times 10^{+5}$  uCi/cc.

The preamplifier is a self-contained electronics unit that processes the DC input signal from the detector, digitizes the signal, and transmits the digitized value to the readout via a modified RS232C compatible serial data communication port. It contains two printed circuit boards (mounted on the rear of the enclosure cover, a terminal block for terminating the field cable from its associated controller and two connectors for terminating the detector Signal and HV coaxial cables. The larger of the two printed circuit boards is the 977-210-10M Serial Interface board. This board controls the communications with the controller. The smaller board is the 977-200-15M Electrometer. It contains the microprocessor and associated circuitry for converting the detector output current into a digital value.

For additional information on the detector or readout device, refer to the instruction manual for the Model 943-27-31 detector, the Model 942A-200C UDR, or the applicable Model 960 System manual.

### 1.2 Application

The Model 943-227-15 Digital Preamplifier is used with the Victoreen 942A-200C or Model 960 microprocessor based radiation monitors. The Model 942A-200C or 960 system provides the +15 VDC preamplifier electronics power, (-) 500 VDC detector power and the RS232C serial communications support. The digital preamplifier is available in two serial port configurations. For applications less than 50 feet, the Model 943-227-15, configured for RS232C communications, is used. For applications requiring signal transmission distances of up to 1 mile, the Model 943-227-15VL, configured for Victoreen Loop communications is used. Table 1-1 is a list of available configurations and compatible 9XX series equipment. Please contact Fluke Biomedical Radiation Management Services for additional information.

Table 1-1. 943-227-15 Variations and Compatible Equipment

<b>Preamplifier Variations</b>	<b>Application</b>	<b>Detector</b>	<b>Readout</b>
943-227-15 Digital Preamplifier	Transmission Distances Less than 50 feet	943-27-31 Beta Detector, Current Mode Operation	942A-200C Digital Ratemeter or Model 960 Digital Process Control System
943-227-15VL Digital Preamplifier	Transmission Distances up to 1 mile	943-27-31 Beta Detector, Current Mode Operation	942A-200C Digital Ratemeter or Model 960 Digital Process Control System
943-227-15VL-M1 Digital Preamplifier	Transmission Distances up to 1 mile; 2.0 inch conduit field cable interface	943-27-31 Beta Detector, Current Mode Operation	942A-200C Digital Ratemeter or Model 960 Digital Process Control System

### 1.3 Specifications

General specifications for the Model 943-227-15 Digital Preamplifier are listed below. The 943-227-15 series products are designed for nuclear applications, and any repairs to it by personnel not qualified to ANSI 45.2.6 1978, Skill Level II may void the nuclear rating.

If a problem develops, the preamplifier may either be returned to the factory for service, or repaired by a qualified technician.

Table 1-2. General Specifications for the 943-227-15 Digital Preamplifier

<b>Feature:</b>	<b>Specification:</b>
<b>Preamplifier Power</b>	+ 15 v @ 20 mA
<b>Preamplifier Input</b>	DC current, 1E-12 to 1E-3 amperes from 943-27 Current Mode Beta Scintillation detector
<b>Preamplifier Output</b>	943-227-15, RS232C; 943-227-15VL, Modified RS232C serial data for transmission distances up to 5,280 feet.
<b>Electronic Accuracy</b>	± 10% of the input current
<b>Response Time</b>	Decade / Time: 1 / 80 sec 2 / 32 sec 3 / 16 sec 4 / 4 sec 5 / 2 sec 6 / 0.9 sec 7 / 0.2 sec 8 / 0.2 sec
<b>Dimensions (H x W x D)</b>	943-227-15 or 943-227-15VL: 8.0 in. x10.0 in. x 4.0 in. (20.3 cm x 25.4 cm x 10.2 cm)  943-227-15-M1 or 943-227-15VL-M1: 8.0 in. x10.0 in. x 6.0 in. (20.3 cm x 25.4 cm x 15.2 cm)
<b>Weight</b>	Approximately 8 lbs. (3.6 kg)
<b>Housing</b>	Gasketed, NEMA 4, Steel enclosure with hinged cover
<b>Operating Temperature</b>	32 °F to 122 °F 0 °C to + 50 °C
<b>Relative Humidity</b>	0 to 99 % non-condensing
<b>Compatible Detectors</b>	Victoreen 943-27 Current Mode Beta scintillation detector only
<b>Detector Interface</b>	Detector cables enter thru "Seal Grip" fittings; Mating SHV receptacle provided for HV; Mating BNC receptacle provided for Signal
<b>Cable Requirements</b>	Victoreen Loop Communications: 6 conductors, 18 AWG (2, TwPr, 2 Single conductor) with overall shield. For max transmission distance, 16 AWG is recommended; RS232C communications: 8 Conductors, 18 AWG (4 TwPr) with overall shield.
<b>Modification Information</b>	For the Model 943-227-15VL-M1, refer to Modification description provided in Appendix E

Table 1-3. Preamplifier Serial Interface Board 977-210-10M Switch Settings

Switch	Normal Op.	Switch Function
SW1	Open	Microprocessor Reset switch, momentary contact
SW2	N/A	Not supplied
SW3-1	ON	OFF Selects 300 baud • <b>1/ON Selects 4800 baud (normal setting)</b>
SW3-2	OFF	OFF • (No function is implemented in the 977-210-10M)
SW3-3	OFF	OFF Selects Rate Mode (normal) • (Selects Maintenance Mode for factory PGA and Auto Zero set-up only)
SW3-4	OFF	OFF • (No function is implemented in the 977-210-10M)

**NOTE**

**SW3 is a 4-position DIP switch on the 977-210-10M serial interface board.**

Table 1-4. Jumper Positions for Preamplifier Serial Interface Board 977-210-10M

Jumper	Normal Setting	Function	Alternate Setting	Function
JMP1	A to B	Enables Victoreen Loop (normal)	B to C	Enables RS232C
JMP2	N/A	Deleted, Not Used	N/A	Deleted, Not Used

Table 1-5. Jumper Positions for Preamplifier Electrometer Board 977-200-15M

Jumper	Normal Setting	Function	Cal. Position	Function
JMP1	A to B	Normal Operation	B to C	PGA Offset Adjust *

\* Programmable Gain Amplifier requires a special test PROM and is a factory adjustment



Table 1-6. Field Electrical Connections, 943-227-15 and 943-227-15VL

943-227-15		943-27-15VL		
TB1-	Description	Connects To 977-210-10M	Description	Connects To 977-210-10M
1	XMIT	J4-1	+ VL, 15 VDC	J3-1
2	DTR	J4-2	+ TX	J3-2
3	GND	J4-3	- TX	J3-3
4	REC	J4-4	- VL	J3-4
5	Not Used	Not Used	+ RX	J3-5
6	Not Used	Not Used	- RX	J3-6
7	+ 15 VDC	J3-7	Not Used	Not Used
8	Ground	J3-8	Ground	J3-8
9	- 15 VDC	J3-4	Not Used	Not Used
10	Not Used	Not Used	Not Used	J3-11
<b>Detector Connections</b>			<b>Detector Connections</b>	
HV	Detector MHV	From Field coaxial cable	Detector MHV	From Field coaxial cable
SIG	Detector BNC	Factory Terminated, To 977-200- 15M, R41	Detector BNC	Factory Terminated, To 977-200- 15M, R41

Table 1-7. 977-210-10M LEDs

LED #	Indicates
LED1	+15 VDC is being supplied to the circuit board from the UDR when ON
LED2	Communications – Receive; ON (bright): both + 15 and -15 volt loops present ON (dim): Only one loop supply present OFF: no loop voltage from either supply

Table 1-8. 977-210-10M Test points

Test Point	Function
TP2	RS232 Transmit

## 1.4 Auxiliary Equipment

<u>Model</u>	<u>Description</u>
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None

## 1.5 Recommended Spare Parts

Table 1-9. Recommended Spare Parts List for the Model 943-227-15 Digital Preamplifier

Part Number	Description	Used On
977-200-15M	Electrometer Circuit Board	-
977-210-10M	Serial Interface Circuit Board	-
92-7072	Fuse, F1, F2, 1Amp, Communication Fuse	977-210-10M
450-1-0531	Dryer, Air (5 Grams)	977-200-15

## 1.6 Receiving Inspection

Upon receipt of the unit:

1. Inspect the carton(s) and contents for damage. If damage is evident, file a claim with the carrier and notify the Fluke Biomedical Radiation Management Services Customer Service Department.

Fluke Biomedical  
Radiation Management Service  
6045 Cochran Road  
Cleveland, Ohio 44139  
Phone: 440.248.9300  
Fax: 440.542.3682

2. Remove the contents from the packing material.
3. Verify that all items listed on the packing list have been received and are in good condition.

### NOTE

If any of the listed items are missing or damaged, notify the Fluke Biomedical Radiation Management Service Customer Service Department.

## 1.7 Storage

Storage of Fluke Biomedical instruments must comply with Level B storage requirements as outlined in ANSI N45.2.2 (1972) Section 6.1.2(.2). The storage area shall comply with ANSI N45.2.2 (1972) Section 6.2 Storage Area, Paragraphs 6.2.1 through 6.2.5. Housekeeping shall conform to ANSI N45.2.3 (1972).

Level B components shall be stored within a fire resistant, tear resistant, weather tight enclosure, in a well-ventilated building or equivalent.

Storage of Fluke Biomedical instruments must comply with the following:

1. Inspection and examination of items in storage must be in accordance with ANSI N45.2.2 (1972) Section 6.4.1.
2. Requirements for proper storage must be documented and written procedures or instructions must be established.
3. In the event of fire, post-fire evaluation must be in accordance with ANSI N45.2.2 (1972), Section 6.4.3.
4. Removal of items from storage must be in accordance with ANSI N45.2.2 (1972), Sections 6.5 and 6.6.

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## Section 2 Theory of Operation

### 2.1 Functional Description

The Model 943-227-15 Digital Preamplifier is an eight-decade, linear reading radiation. The preamplifier is sensitive to moisture and is mounted in a NEMA 4 sealed enclosure. The preamplifier box contains a desiccant package to remove moisture from the interior of the preamplifier. The desiccant has a color indicator to show when it should be replaced when the color changes to blue.

The detector electrometer converts the current from the detector to a voltage which is measured by the analog to digital converter of the preamplifier. Under program control, this measurement is made every 50 milliseconds on the first five decades and every 100 milliseconds on the upper three decades.

The electrometer is auto-ranging and auto-zeroing. An internal coarse zero control (factory adjusted) is provided. The microprocessor in the preamplifier performs data collection, integration and multiplication by a stored calibration factor, range changing and communication with the Model 942A-200C Digital Ratemeter or Model 960 Digital Process Radiation monitoring system.

### 2.2 Main Circuit Boards

The wide range ion chamber detector block diagram is shown in figure 2-1. Detector electronics are contained within two circuit board assemblies located in the preamplifier enclosure: the 977-210-10 High Voltage/Communications Interface circuit board assembly and the 977-200-15 Electrometer circuit board assembly. Schematic diagrams are located in Appendix B.

The 977-200-15M Electrometer circuit board contains the microprocessor, the EPROM, the integrating electrometer, the programmable gain amplifier, the analog to digital (A/D) converter, and the auto zero DAC circuit.

The 977-210-10M Communications Interface circuit board contains the dc voltage regulator, the BDC/DC converter, the asynchronous communication interface adapter (ACIA), the Victoreen communication loop driver/receiver, the RS232 communications driver/receiver, and the communication loop fuses.

### 2.3 977-200-15M Electrometer

Refer to the electrometer schematic 977-200-18M located in Appendix B. Z7 is a Texas Instruments TMS 70C00 microprocessor, which is utilized to control detector operation. Z8 latches port C of the microprocessor to form the lower order bits of memory address. Z10 is a 27C64 EPROM containing the operational firmware for the detector. Z18 is an optional RAM socket which is not utilized for this model detector. Z9 is a decoder for the upper order address bits. Z11 is a latch used to store control bits to select the gain of the programmable gain amplifier formed by the combination of Z5, Z4, and RN2. Available gains are 1 through 128 in binary increments 1, 2, 4, . . . 128. Z3 is an eight-bit analog to digital converter used to digitize the output of the programmable gain amplifier. Analog switch Z17 pin 11 selects either the integrating electrometer or the high voltage sense line as the input to the programmable gain amplifier is not active in this application. Refer to Table 2-1 for preamplifier register addresses and Table 2-2 for electrometer control bit assignments.

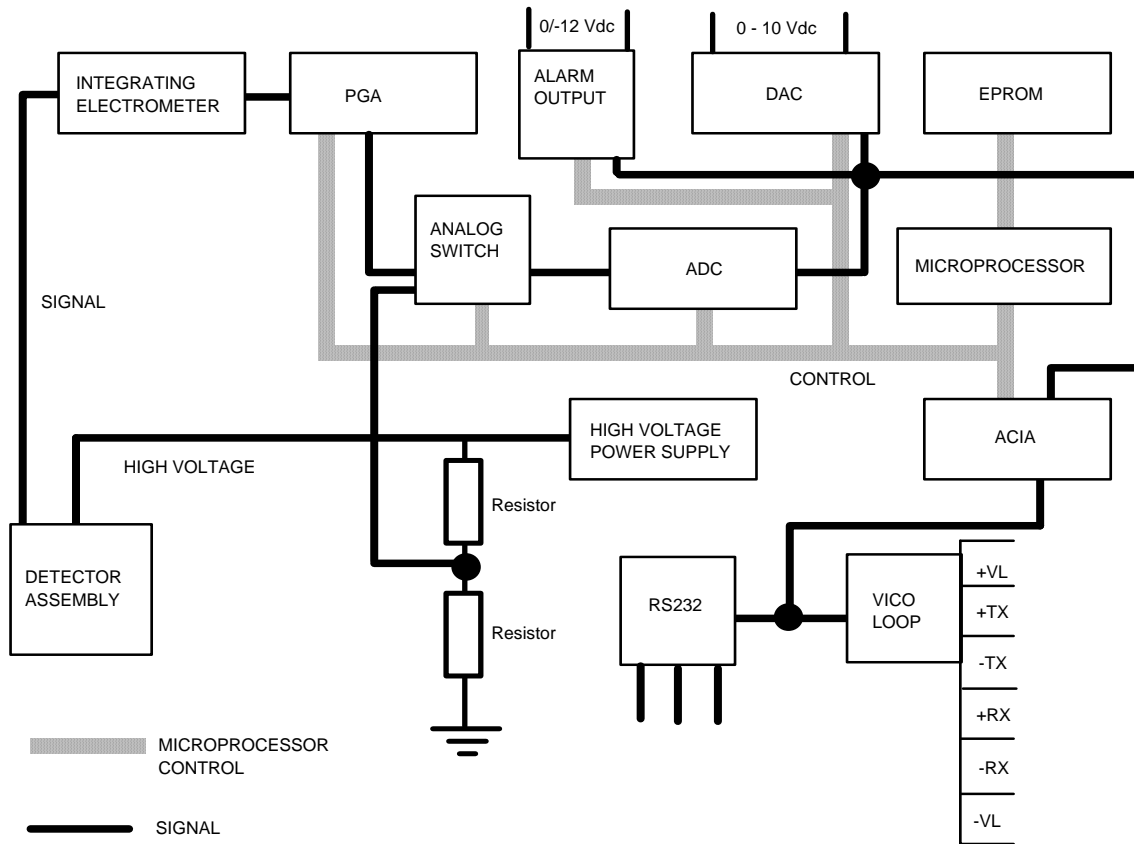


Figure 2-1. Typical Detector Electronics Block Diagram

Table 2-1. Preamplifier Register Addresses

Function	Hex Address
Electrometer Control	2000
ADC Convert CMD	4000
ADC Read Data	6000
ACIA T/R Data	A000
ACIA Status Register	A001
ACIA Command Register	A002
ACIA Control Register	A003
Input SW3	A008
RAM (not used)	C000-DFFF
EPROM	E000-FFFF

Table 2-2. Electrometer Control Bit Assignments

Bit Position								Description
7	6	5	4	3	2	1	0	
X	X	X	X	X	0	0	0	Gain = 1
X	X	X	X	X	0	0	1	Gain = 2
X	X	X	X	X	0	1	0	Gain = 4
X	X	X	X	X	0	1	1	Gain = 8
X	X	X	X	X	1	0	0	Gain = 16
X	X	X	X	X	1	0	1	Gain = 32
X	X	X	X	X	1	1	0	Gain = 64
X	X	X	X	X	1	1	1	Gain = 128
X	X	X	X	0	X	X	X	Unshort capacitor
X	X	X	X	1	X	X	X	Short capacitor
X	X	X	0	X	X	X	X	Digitize electrometer
X	X	X	1	X	X	X	X	Digitize high voltage

X = Bit position does not matter (1 or 0)

The integrating electrometer is formed by the combination of current source Z6, dual MOSFET Q4, operational amplifier Z12, transistor Q3, and analog switch Z17, pin 15.

Counter Z15 and ladder network RN3 form the auto-zero portion of the integrating electrometer. Refer to section 4 for auto-zero adjustment instructions (note this is a factory only adjustment).

Dual MOSFET Q4 acts as a low leakage input buffer to the electrometer. C17 is an integrating capacitor, while Z17, pin 15 and Q3 are the shorting elements of the integrator.

There is a hysteresis built into the range changing function of the electrometer. The range change-up occurs at the decade points whereas the range change-down occurs at 80% of the decade points. This hysteresis results in the display of only two significant digits when in the upper 20% of a decade. Whether or not this occurs depends on which direction the radiation level is trending. An increasing trend will result in three significant digits while a decreasing trend will result in two significant digits.

The response times for a change in reading within the same decade are listed in Table 2-1. If a change of 100 to 1000 times the current reading occurs, the instrument will range change within a single 50-millisecond clock cycle.

Table 2-3. Response Time

DECADE	RANGE	RESPONSE TIME
1	0.1 to 1.0 mR/h	80 sec.
2	1.0 to 10 mR/h	32 sec.
3	10 to 100 mR/h	16 sec.
4	100 to 1000 mR/h	4 sec.
5	1.0 to 10 R/h	2 sec.
6	10 to 100 R/h	0.9 sec.
7	100 to 1000 R/h	0.2 sec.
8	1.0 k to 10 kR/h	0.2 sec.

The following Test are provided on the 977-200-15M board:

*Table 2-4. 977-200-15M Test Points*

<b>Test Point</b>	<b>Function</b>
TP1	Electrometer Output
TP2	Analog +5 VDC supply
TP3	- 5 VDC supply
TP4	Digital +5 VDC supply (From 977-210-10M)
TP5	High Voltage Sense (Not Used)
TP6	+ 12 VDC supply (From 977-210-10M)
TP7	DC Ground
TP8	Programmable Gain Amplifier Output
TP9	Microprocessor Clock Signal
TP10	Chip Enable - EPROM

## 2.4 977-210-10M Interface Board

Refer to the Communications Interface, P/N 977-210-13M, schematic diagram in Appendix B. U12 is an asynchronous communications interface adapter (ACIA) which communicates with the UDR or 960 system. U1 is an analog switch used to select either the Victoreen loop or the RS232 driver/receiver for external communications. Optical isolation U10 isolates data transmitted on the Victoreen loop while the circuitry comprised of Q6, Q7, Q14, and Q18 are the actual loop drivers. Optical isolator U8 isolates the receive data from the Victoreen loop.

U2 and U3 are, respectively, the receiver and driver circuits for the RS232 port. U14 decodes address block A000 to provide chip enables to the ACIA switch input register U6.

Regulated power for the electronics (+/- 12 VDC) is derived from three terminal regulators VR3 and VR4. The  $\pm 5$  Vdc logic power is derived from the three terminal regulators VR1 and VR2.

Power for the detector is normally provided by the electronic high voltage power supply in the associated Model 942A-200C UDR or Model 960 System.

The following LEDs are provided to indicate operation of certain functions of the 977-210-10M board:

*Table 2-5. 977-210-10M LEDs*

<b>LED #</b>	<b>Indicates</b>
LED1	+15 VDC is being supplied to the circuit board from the UDR when ON
LED2	Communications – Receive; ON (bright): both + 15 and -15 volt loops present ON (dim): Only one loop supply present OFF: no loop voltage from either supply

The following Test are provided on the 977-210-10M board:

*Table 2-6. 977-210-10M Test points*

<b>Test Point</b>	<b>Function</b>
TP2	RS232 Transmit



### Victoreen Communications Loop – 943-227-15VL

Communication between the detector preamplifier and the UDR or 960 controller may be performed via Victoreen loop, a serial asynchronous communications interface. The communication utilizes Victoreen protocol and is intended for use in electrically hostile environments where high noise immunity is required. Noise immunity is achieved using differential line driving, and electrically isolating the end of each transmit/receive pair with opto-isolators. Using a  $\pm 15$  Vdc communications power supply, each 0 to 1 transition is equivalent to a 30-volt swing in loop voltage. Refer to the Model 942-200-80-1 Communications Board instruction manual for further information.

Jumper JP1 controls the communication communications method employed. JP1, A-B selects Victoreen loop communications.

### RS232C Communications – 943-227-15

Communication between the detector preamplifier and the UDR or 960 controller may be performed via RS232C serial asynchronous communications interface. Jumper JP1 controls the communication communications method employed.

JP1, B-C selects RS232C communications.

## 2.5 Preamplifier Switch & Jumper Settings

Switch and jumper settings for the preamplifier are summarized in Table 2-7, 2-8, and 2-9.

*Table 2-7. Preamplifier Serial Interface Board 977-210-10M Switch Settings*

Switch	Normal Op.	Switch Function
SW1	Open	Microprocessor Reset switch, momentary contact
SW2	N/A	Not supplied
SW3-1	ON	OFF Selects 300 baud • <b>1/ON Selects 4800 baud (normal setting)</b>
SW3-2	OFF	OFF • (No function is implemented in the 977-210-10M)
SW3-3	OFF	OFF Selects Rate Mode (normal) • (Selects Maintenance Mode for factory PGA and Auto Zero set-up only)
SW3-4	OFF	OFF • (No function is implemented in the 977-210-10M)

#### NOTE

**SW3 is a 4-position DIP switch on the 977-210-10M serial interface board.**

*Table 2-8. Jumper Positions for Preamplifier Serial Interface Board 977-210-10M*

<b>Jumper</b>	<b>Normal Setting</b>	<b>Function</b>	<b>Alternate Setting</b>	<b>Function</b>
JMP1	A to B	<b>Enables Victoreen Loop (normal)</b>	B to C	Enables RS232C
JMP2	N/A	Deleted, Not Used	N/A	Deleted, Not Used

*Table 2-9. Jumper Positions for Preamplifier Electrometer Board 977-200-15M*

<b>Jumper</b>	<b>Normal Setting</b>	<b>Function</b>	<b>Cal. Position</b>	<b>Function</b>
JMP1	A to B	Normal Operation	B to C	PGA Offset Adjust *

\* Programmable Gain Amplifier requires a special test PROM and is a factory adjustment

## Section 3 Operation

### 3.1 Installation

Installation consists of mounting the equipment, making the required electrical connections, and entering the desired set points.

#### CAUTION

**Remove all power prior to installing the Preamplifier.**

#### Preamplifier Mounting

The preamplifier is a self-contained unit that is designed for mounting on a wall, or structurally sound surface, within 6 feet of the detector. The preamplifier must be located in an area that is accessible for future maintenance.

#### CAUTION

**Remove all power prior to connecting field wiring.**

#### Electrical Interface

Electrical connections at the preamplifier include connecting the detector high voltage and signal coaxial cables and the field cable from the associated controller.

The detector high voltage and signal cables enter the preamplifier through "Seal Grip" type penetrations on the enclosure body. The "Seal Grips" contain a rubber gland that is intended to grip the coaxial cables to prevent moisture entry into the enclosure. The "Seal Grips" are an integral part of the detector cables. The "Seal Grip" enclosure nut is removed from the fitting. The insulating washer stay with the fitting. The detector signal and high voltage cables, with connectors and "Seal Grip" fitting nuts are then inserted into the holes preamplifier enclosure. The "Seal Grip" end fittings are then re-installed securely against the wall of the enclosure.

The detector Signal (BNC) and High Voltage (SHV) cables are then terminated on the bulkhead connectors located on the enclosure inner panel.

On the 943-227-15 or 943-227-15VL, the field cable is terminated on a "MS" type connector. A mating "MS" style connector supplied with the detector. It is not necessary to open the preamplifier enclosure to complete the interconnection to the associated controller.

On the 943-227-15VL-M1, a 2.0-inch conduit hub is provided to interface with the field conduit system and cable. The field conduit is connected to the preamplifier conduit hub and the field cable is routed through the conduit and into the preamplifier enclosure. The field signal cable is then terminated on the terminal block in the enclosure. Refer to the applicable wiring diagram or Table 3-1. The high voltage coax cable is then terminated on the mating SHV connector. Refer to Appendix D for further information.

A desiccant bag is provided in the enclosure to absorb moisture. The desiccant bags should be checked for moisture absorption prior to placing into service. Each bag contains a color indicator stripe that turns red when it should be replaced.

**NOTE**

The electrometer circuitry in the preamplifier is highly sensitive to moisture and physical damage. Use extreme care when the preamplifier case is opened as the high impedance electrometer circuitry is easily damaged. Do not leave the preamplifier enclosure in the open position for any extended period of time.

The preamplifier terminations are listed below.

*Table 3-1. 943-227-15 Preamplifier Electrical Connections*

	943-227-15		943-27-15VL	
TB1-	Description	Connects To 977-210-10M	Description	Connects To 977-210-10M
1	XMIT	J4-1	+ VL, 15 VDC	J3-1
2	DTR	J4-2	+ TX	J3-2
3	GND	J4-3	- TX	J3-3
4	REC	J4-4	- VL	J3-4
5	Not Used	Not Used	+ RX	J3-5
6	Not Used	Not Used	- RX	J3-6
7	+ 15 VDC	J3-7	Not Used	Not Used
8	Ground	J3-8	Ground	J3-8
9	- 15 VDC	J3-4	Not Used	Not Used
10	Not Used	Not Used	Not Used	J3-11
	<b>Detector Connections</b>		<b>Detector Connections</b>	
HV	Detector MHV	From Field coaxial cable	Detector MHV	From Field coaxial cable
SIG	Detector BNC	Factory Terminated, To 977-200- 15M, R41	Detector BNC	Factory Terminated, To 977-200- 15M, R41

## 3.2 Set-up

To place the system in operation, the following steps should be performed:

**NOTE**

**Ensure you have read and fully understand Section 1, 2 and 3 prior to continuing.**

1. Verify that jumpers and DIP switches and jumpers on the preamplifier, are set for the operational features desired. Refer to Section 1, Table 1-4.
2. Refer to the applicable controller manual prior to powering up the controller.



## 3.3 Operation

Operation of the 943-227-15 Digital Preamplifier is automatic and is controlled by the Model 942A-200C Digital Ratemeter or Model 960 Digital Process Radiation monitoring system. Once the power to the controlling device is turned on, the preamplifier begins operation. No operator interaction is required.

Refer to the instruction manual for the applicable controller, detector and the Model 942-200-80 Communications Option Board for further information.

### Normal Operation

If the measured radiation field is within the range of the detector during power-up, the uCi/cc value will be displayed on the controller. The digital display will update once per second.

### Alarms

The radiation alarms are initiated by the applicable controller. Refer to the applicable controller manual.

### Fail Alarm

There are two equipment failure conditions that can produce a FAIL output or an error display on the associated controller. The fail condition is true whenever any equipment failure is detected and false when no equipment failures are detected.

The following are the fail alarms provided by the 943-227-15 Preamplifier:

1. POWER Failure
2. Loop Test Failure

To return the channel to normal operation after a FAIL alarm, the condition, which caused the alarm, must be located and corrected.

### Power Failure

If the power to the controller is lost, the bar graph, alarm indicators, and the display are blanked (turned off). The HIGH, WARN, and FAIL relay coils will de-energize. If power to the preamplifier only is lost, or if there is a break in the power cable, operation of the microprocessor will stop. The display on the controller will then cease to update. If power to the controller is not lost, a break in the interconnecting wiring or the internal communication power fuses on the 977-210-10M Interface board should be checked. Loss of power to the preamplifier will also result in a loop communication failure.

### Loop Failure

If the UDR or 960 controller does not receive a valid message from the preamplifier in ten seconds, a loop failure is detected and an E0009 code will normally be displayed. Note the error code displayed is defined by the controlling device, and not by the preamplifier.

The loop failure can originate from bad seating of the serial communications board in the UDR or 960CD, bad connections in the preamplifier, bad connections at the P2 connector of the UDR, a baud rate mismatch between the setting on the serial board and that in the preamplifier, an invalid address setting on the serial board, or blown communication loop fuses.

The baud rate of the preamplifier may be set to either 300 or 4800 baud. SW3-1 on the 977-interface board must be in the ON position to select a baud rate of 4800 baud, the normal setting.

For UDR systems, the address of the 942-200-80 Communications board in the UDR must be set 4040 and the baud rate must be set to 4800 baud. If the wiring of the Communications option board to the P2 connector is suspected, a loop test can be performed as described in "Loop Test Mode". The instruction manual for the Communications option board (P/N 942-200-80-1) contains information on how to set up the serial board in the UDR.

### Firmware Version

This system requires a PROM for operation. For the part number and the latest revision of the PROM, see the Factory Test Data Sheet. This Manual has been prepared for use with the P/N 227LNK, Rev. 2, PROM.

## 3.4 Configuration Functions

The preamplifier configuration jumpers and required settings for this application are listed below:

*Table 3-2. Preamplifier Serial Interface Board 977-210-10M Switch Settings*

Switch	Normal Op.	Switch Function
SW1	Open	Microprocessor Reset switch, momentary contact
SW2	N/A	Not supplied
<b>SW3-1</b>	<b>ON</b>	OFF Selects 300 baud • <b>1/ON Selects 4800 baud (normal setting)</b>
SW3-2	<b>OFF</b>	OFF • (No function is implemented in the 977-210-10M)
SW3-3	<b>OFF</b>	OFF Selects Rate Mode (normal) • (Selects Maintenance Mode for factory PGA and Auto Zero set-up only)
SW3-4	<b>OFF</b>	OFF • (No function is implemented in the 977-210-10M)

### NOTE

**SW3 is a 4-position DIP switch on the 977-210-10M serial interface board.**

*Table 3-3. Jumper Positions for Preamplifier Serial Interface Board 977-210-10M*

Jumper	Normal Setting	Function	Alternate Setting	Function
JMP1	<b>A to B</b>	<b>Enables Victoreen Loop (normal)</b>	B to C	Enables RS232C
JMP2	N/A	Deleted, Not Used	N/A	Deleted, Not Used

*Table 3-4. Jumper Positions for Preamplifier Electrometer Board 977-200-15M*

Jumper	Normal Setting	Function	Cal. Position	Function
JMP1	<b>A to B</b>	Normal Operation	B to C	PGA Offset Adjust *

\* Programmable Gain Amplifier requires a special test PROM and is a factory adjustment

### **3.5 Set Point Error Codes**

Failure of the 943-227-17 preamplifier may result in the following error codes being displayed on the controlling device:

Code E0009 is normally used to identify a Loop communication failure. The error code may be due to a baud rate mismatch between the preamplifier and the UDR or 960 system communication board, a failure on either the preamplifier or UDR communication board. To clear the error code, the source of the error must be corrected.

### **3.6 Software Calculations**

The 943-227-17 continuously converts the current output of the detector to a digital value, controls the gain of the internal amplifier, performs periodic self checks, communicates with the UDR or Model 960 controller and provides a radiation value to the UDR of Model 960. An asynchronous, serial communication interface, processed through optically isolated drivers/receivers is utilized. The digital value is transmitted to the associated UDR or 960 System controller for further processing. Refer to the associated controller manual for further information. .



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## **Section 4**

# **Maintenance, Calibration and Troubleshooting**

### **4.1 Maintenance**

The 943-227-15 Digital Preamplifier is designed to operate for extended periods of time with no scheduled maintenance required. Operation may be verified by periodically actuating the check source (provided with the detector and sampling assembly) and observing the response of the unit. If the response varies by more than 50% of the normal value, further troubleshooting may be required. If a problem develops, troubleshoot the unit per Section 4.3 and the drawings in Appendix B.

Whenever the preamplifier enclosure is opened, the condition of the internal desiccant package should be checked. The desiccant bag is provided in the enclosure to absorb moisture. The desiccant bags should be checked for moisture absorption prior to placing into service, or whenever the electronics enclosure cover is opened. Each bag contains a color indicator stripe that turns red when it should be replaced.

### **4.2 Electronic Calibration**

#### **Electronic Adjustments**

There are no user adjustments available on the 943-227-15 Digital Preamplifier. The Programmable Gain Amplifier and Auto Zero are factory adjustments, requiring the use of a factory test PROM and test fixture. We strongly recommend the unit be returned to the factory for repair or adjustment.

Table 4-2 lists the electronic adjustments for the 943-227-15 digital preamplifier. The procedures for making these adjustments are contained in the factory Calibration Procedure listed below. Note that special test firmware is required to perform the electrical adjustments.

*Table 4-1. Electronic Adjustments*

Potentiometer	Adjustment (943-227-15)	Tolerance
R11	Programmable Gain Amplifier Offset Adjustment	± 2 mV
R12	Auto Zero Set-Up Adjustment	± 10 mV

#### **NOTE**

**Refer to the drawings in Appendix B to locate adjustment and/or test points, if required.**

The follow factory calibration and test procedures are listed for reference only.

<u>Document</u>	<u>Description</u>
TP943-227-15VL	Test Procedure, Victoreen Loop Communications
TP943-227-15	Test Procedure, RS232 communications
TP977-200-15M	Electrometer PCB Test Procedure

## 4.3 Troubleshooting

### WARNING

**Extreme care must be used when troubleshooting a system that has power applied. All standard troubleshooting precautions apply.**

### WARNING

**Once a problem has been located, remove all power before continuing with the repair.**

### CAUTION

**Personnel performing the troubleshooting/repair must be qualified to ANSI 45.2.6, 1978, Skill Level II.**

**Personnel performing the following procedure must be familiar with the operation of the monitoring system and the location of each piece of equipment used in the system.**

If a problem develops, verify that the voltages at connection point inputs and outputs are present and that all wiring is secure. Refer to Appendix B and C for drawings and parts lists. If a PROM requires replacement, specify the board revision level when ordering the part.

### Troubleshooting / Adjustments

Troubleshooting includes a verification of the LED operation status, the DC voltage levels and the loop communication loop fuses (Victoreen Loop Communications only).

Specialized test equipment and firmware are required to adjust the auto-zero and PGA subsystems in the electrometer. If the test equipment and firmware is not available, the unit should be returned to Fluke Biomedical RMS for re-alignment.

## Appendix A Connector Designations

### A.1 CONNECTOR DESIGNATIONS, 943-227-15 and 943-227-15VL

Table A-1. Field Electrical Connections, 943-227-15 and 943-227-15VL

	943-227-15		943-27-15VL	
TB1-	Description	Connects To 977-210-10M	Description	Connects To 977-210-10M
1	XMIT	J4-1	+ VL, 15 VDC	J3-1
2	DTR	J4-2	+ TX	J3-2
3	GND	J4-3	- TX	J3-3
4	REC	J4-4	- VL	J3-4
5	Not Used	Not Used	+ RX	J3-5
6	Not Used	Not Used	- RX	J3-6
7	+ 15 VDC	J3-7	Not Used	Not Used
8	Ground	J3-8	Ground	J3-8
9	- 15 VDC	J3-4	Not Used	Not Used
10	Not Used	Not Used	Not Used	J3-11
	<b>Detector Connections</b>		<b>Detector Connections</b>	
HV	Detector MHV	From Field coaxial cable	Detector MHV	From Field coaxial cable
SIG	Detector BNC	Factory Terminated, To 977-200- 15M, R41	Detector BNC	Factory Terminated, To 977-200- 15M, R41

## A.2 SWITCH AND JUMPER POSITIONS, 943-227-15 and 943-227-15VL

Table A-2. Preamplifier Serial Interface Board 977-210-10M Switch Settings

Switch	Normal Op.	Switch Function
SW1	Open	Microprocessor Reset switch, momentary contact
SW2	N/A	Not supplied
SW3-1	ON	OFF Selects 300 baud • <b>1/ON Selects 4800 baud (normal setting)</b>
SW3-2	OFF	OFF • (No function is implemented in the 977-210-10M)
SW3-3	OFF	OFF Selects Rate Mode (normal) • (Selects Maintenance Mode for factory PGA and Auto Zero set-up only)
SW3-4	OFF	OFF • (No function is implemented in the 977-210-10M)

### NOTE

**SW3 is a 4-position DIP switch on the 977-210-10M serial interface board.**

Table A-3. Jumper Positions for Preamplifier Serial Interface Board 977-210-10M

Jumper	Normal Setting	Function	Alternate Setting	Function
JMP1	A to B	<b>Enables Victoreen Loop (normal)</b>	B to C	Enables RS232C
JMP2	N/A	Deleted, Not Used	N/A	Deleted, Not Used

Table A-4. Jumper Positions for Preamplifier Electrometer Board 977-200-15M

Jumper	Normal Setting	Function	Cal. Position	Function
JMP1	A to B	Normal Operation	B to C	PGA Offset Adjust *

\* Programmable Gain Amplifier requires a special test PROM and is a factory adjustment

## Appendix B Applicable Drawings

### B.1 Applicable Drawings 943-227-15 and 943-227-15VL

<u>Drawing No.</u>	<u>Description</u>
943-227-15	Preamplifier Assembly, RS232
943-227-15VL	Preamplifier Assembly, Victoreen Loop
943-227-15VL-M1	Preamplifier Assembly, Victoreen Loop, w/Conduit Hubs
977-210-10M	Preamplifier HV/Interface Printed Circuit Board Assembly
977-210-13M	Preamplifier Printed Circuit Board Schematic
977-200-15M	Preamplifier Electrometer Board Assembly
977-200-18M	Preamplifier Schematic

### B.2 Related Manuals (Not Supplied with this document)

SXXXXXX-1	Applicable 960 Series system Manual
942A-200C-M1	Digital Ratemeter
943-27-31-1	Current Mode Beta Detector

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## Appendix C Bill of Materials

### C.1 Bill of Materials- 943-227-15 and 943-227-15VL

Part Number	Description
943-227-15	Preamplifier Assembly, RS232
943-227-15VL	Preamplifier Assembly, Victoreen Loop
943-227-15VL-M1	Preamplifier Assembly, Victoreen Loop, w/Conduit Hubs
977-210-10M	Preamplifier HV/Interface Printed Circuit Board Assembly
977-200-15M	Preamplifier Electrometer Board Assembly



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# **Appendix D**

## **Cable Termination Instructions**

### **D.1 Cable Termination Instructions**

The procedures and instructions provided in Appendix D are provided for reference in terminating the field cables to the Digital Preamplifier. A mating SHV connector is provided with the preamplifier. Ring lug terminals are to be provided by the user. The instructions provided below are based on the use of P/N 50-100 multi-conductor cable. For other customer-supplied cables, the same basic procedures, modified for the specific cable used, may be utilized.

#### **Detector Cable Termination:**

The detector high voltage and signal cables enter the preamplifier through “Seal Grip” type penetrations on the enclosure body. The “Seal Grips” contain a rubber gland that is intended to grip the coaxial cables to prevent moisture entry into the enclosure. The “Seal Grips” are an integral part of the detector cables. The “Seal Grip” enclosure nut is removed from the fitting. The insulating washer stays with the fitting. The detector signal and high voltage cables, with connectors and “Seal Grip” fitting nuts are then inserted into the holes preamplifier enclosure. The “Seal Grip: end fittings are then re-installed securely against the wall of the enclosure.

#### **Detector Field Cable Preparation, “MS” Connector:**

Prior to stripping the outer cable jacket, a 4-inch length of 0.75 I.D. shrinkable tubing (provided by the user) should be slid over the 0.675 in cable jacket. The shrink tubing will be used to seal and protect the end of the cable after the termination process is completed. To prepare the cable for termination, a minimum of 7 inches of the cable outer jacket must be stripped off the cable. This will allow for the stripping of approximately one inch from the various conductors, and provide 6 inches of actual service loop cable. In addition, for EMI/RFI protection, the drain wire must be terminated to an earth ground within the enclosure. The length of the drain wire will be based on the distance between the cable entry and the ground location. The length of cable jacket to be stripped will then be based on the distance to the drain wire grounding point.

Once the cable outer jacket is stripped to the proper length, the aluminum tape shield and Mylar binder may be removed, taking care not to damage the No. 20 AWG drain wire. The drain wire may then be separated from the remaining conductors, for routing and termination at the grounding point.

Next, the HV coaxial cable may be separated from the bundle, followed by the single conductors wires that are required for the specific application, and the polyester filler cord. Refer to the project specific detector loop drawing, or the generic detector loop drawing provided in Appendix B for actual conductors to be used.

The polyester filler cord may now be removed. Cut the cord as close to the outer jacket as possible.

The single conductors may now be stripped and soldered to the appropriate connector pin.

### **Detector Field Cable Preparation, 943-227-15VL-M1, Conduit Hub:**

Prior to terminating the cable, the field conduit must be run to the junction box, and the field cable pulled into the junction box.

To prepare the cable for termination, a minimum of 7 inches of the cable outer jacket must be stripped off the cable. This will allow for the stripping of approximately one inch from the various conductors, and provide 6 inches of actual service loop cable. In addition, for EMI/RFI protection, the drain wire must be terminated to an earth ground within the enclosure. The length of the drain wire will be based on the distance between the UDR rear panel and the ground location. The length of cable jacket to be stripped will then be based on the distance to the drain wire grounding point.

Once the cable outer jacket is stripped to the proper length, the aluminum tape shield and Mylar binder may be removed, taking care not to damage the No. 20 AWG drain wire. The drain wire may then be separated from the remaining conductors, for routing and termination at the grounding point.

Next, the HV coaxial cable may be separated from the bundle, followed by the single conductor wires that are required for the specific application, and the polyester filler cord. Refer to the project specific detector loop drawing, or the generic detector loop drawing provided in Appendix B for actual conductors to be used. The ring lug connectors may now be applied to the single conductor cables, and installed in accordance with the project electrical loop diagram.

Trim each conductor as required to reach its assigned terminal point. Allow a minimum of 1 in. spare conductor for future re-termination. Because of the unique requirements of each installation, terminal lugs for the detector single conductor terminations are not included, and are supplied by the user. Ring terminal, Crimp type lugs, Burndy YAE type, sized for the 18 AWG wire, or equivalent, are recommended.

The terminal block is designed to accept a maximum 14 AWG conductor, and is provided with 6-32 mounting screws. Strip the conductor as required by the lug manufacturer, install the lug, and terminate the conductor to the appropriate terminal. The screw terminals may now be torqued to 12 in-lbs.

The mating HV connector, P/N 30-92-1 (Kings 1705-14), may now be terminated per the applicable Kings data sheet attached.

The polyester filler cord may now be removed. Cut the cord as close to the outer jacket as possible

## HV CONNECTOR NOTES (HV)

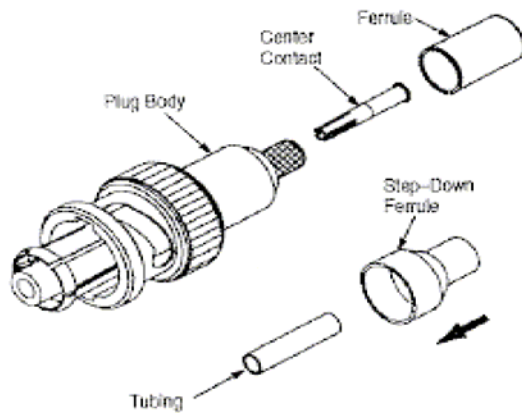
The mating HV connector, P/N 30-92-1 (Kings 1705-14), may now be terminated per the applicable Kings data sheet attached

<b>LOCATION</b>	<b>P/N</b>	<b>DOCUMENT</b>	<b>DESCRIPTION</b>
SHV SHV	92-9105-A (1705-1)	CP-400, Kings Cabling Procedure, Trim Code 441, 442	High Voltage Connector, SHV, male crimp contact pin (Use Tool KTH-100 with KTH-2062)
SHV	Alternate Connector 92-9105-A (51426-5)	AMP Instruction Sheet 408-2187	High Voltage Connector, SHV, male crimp contact pin (Use Tool 69710-1 with 220028-2 Die or Integral Die Tool 220022-2)
SHV	32-92-1 (1705-14)	CP-1001, Kings Cabling Procedure, CP-1000,	High Voltage Connector, SHV, Female solder contact pin



Standard High Voltage (SHV)  
COAXICON® Plug Connectors 51426-[]  
(Dual Crimp Type)

Instruction Sheet  
**408-2187**  
(was IS 2187)  
01 OCT 98 Rev A



**NOTE:** Some connectors are supplied with a step-down ferrule. When assembling the step-down ferrule over the cable braid, make sure the large diameter end faces the plug body.

Figure 1

1. INTRODUCTION

This instruction sheet covers the assembly of AMP® SHV COAXICON Plug (Dual Crimp Type) Connectors 51426-[] designed to provide shielded disconnects for high-voltage applications. The plug connectors accept a wide range of coaxial cables and can be crimped using AMP Double Action Hand Tool 220022-1 (408-6872), PRO-CRIMPER® II Hand Tool Frame 354940-1 (408-9630) fitted with appropriate die assembly, Hand Crimping Tool 69710-1 (408-2095), or 626 Pneumatic Tooling Assemblies 189721-[] or 189722-[] fitted with appropriate tool holder or adapter, crimping head, or die set (409-5862).

For a cross-reference of connector-to-cable and applicable tools and die assemblies, refer to AMP Catalog 82074. For detailed information on the tooling, refer to the applicable instructions (408- or 409-series).

**NOTE** Dimensions on this instruction sheet are in millimeters [with inches in brackets]. Figures are not drawn to scale.

Reasons for reissue are provided in Section 4, REVISION SUMMARY.

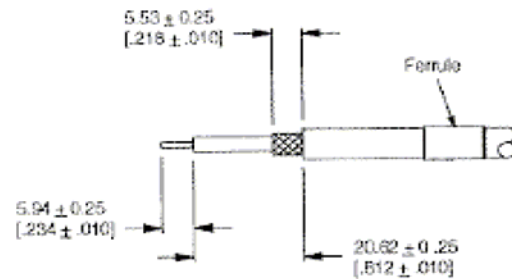
2. DESCRIPTION (Figure 1)

The plug connectors consist of a plug body with a bayonet locking coupling, a center contact, and a ferrule. Some connectors are supplied with a step-down ferrule and a tubing. The tubing is slipped over the cable dielectric before the center contact is crimped. In this use, the tubing compensates for small diameter cable dielectrics.

3. ASSEMBLY PROCEDURE

**NOTE** If using a step-down ferrule, slide it onto the cable with the small opening first.

- Slide ferrule onto unstripped cable; then strip cable using the recommended strip-length dimension in Figure 2. DO NOT nick or cut cable braid. Center conductor must be straight and free of burrs.



**NOTE:** Not to Scale

Figure 2

**NOTE** For connectors supplied with tubing, slip tubing over the cable dielectric before applying center contact.

- Insert center conductor into contact until the shoulder of the contact is against the inner dielectric of the cable. Refer to Figure 3.
- Crimp center contact using the recommended crimping tool. Refer to the instruction sheet packaged with the tool for detailed crimping instructions. See Figure 3.
- Flare cable braid so that it fits over and around the support sleeve of the plug assembly.

# CABLING PROCEDURE



CP-400

**1.** Cut cable end square, slide K-GRIP sleeve over jacket and make cuts 1 and 2 in jacket.

**2.** Remove jacket to dimension "A," flare or burge back braid and trim with scissors at edge of jacket.

**3.** Remove jacket to dimension "B."

**4.** Trim dimension "C." Exposed center conductor length will be equal to dimension "D" of trim code.

**5.** Solder or crimp contact to center conductor.

**5A.** For 10 & 20 KV connectors, when Cable Seal Gasket is supplied, place over center conductor and against cable dielectric. Solder contact to center conductor with gasket under compression.

**6.** Push K-GRIP Jr. over dielectric and under braid until dielectric bottoms in connector. When the "B" dimension in the trim code is 0, the K-GRIP Jr. is pushed under both braid and jacket. Teflon jackets may be slit axially 1/4" in two places to facilitate entry of the K-GRIP. When center contact is undercut captive type, insert cable assembly until insulator detent locks into contact.

**7.** Slide K-GRIP sleeve against shoulder on body and form hex by crimping.

CODE	TRIM CODE CHART			
	A	B	C	D
401	23/64	7/32	.468	7/64
402	11/32	7/32	.375	3/16
403	7/16	7/32	.493	5/32
405	49/64	7/32	.871	7/64
406	9/32	0	.089	3/16
407	11/16	0	.496	3/16
408	45/64	7/32	.809	7/64
409	19/64	3/16	.405	7/64
410	31/32	7/32	.562	5/8
413	21/32	7/32	.717	5/32
414	28/64	7/32	.556	7/64
415	15/32	3/16	.533	5/32
417	41/64	7/32	.743	7/64
418	46/64	7/32	.809	7/64
419	7/8	7/32	.894	7/64
421	15/64	0	.150	5/64
424	11/32	7/32	.450	7/64
426	17/64	7/32	.406	5/64
430	1/2	0	.211	1/4
431	9/16	0	.366	3/16
432	17/64	7/32	.390	3/32
433	5/16	7/32	.378	5/32
435	25/64	7/32	.524	5/64
438	35/64	7/32	.512	1/4
439	7/32	7/32	.345	3/32
440	11/32	7/32	.480	5/64
441	23/32	7/32	.772	5/32
447	1-1/64	7/32	.953	9/32
451	1-5/64	7/32	1.018	9/32
452	1-3/32	7/32	.890	5/8
457	45/64	7/32	.764	5/32
458	5/8	7/32	.871	11/64
459	35/64	7/32	.638	3/16
462	5/16	7/32	.437	3/32
464	15/32	7/32	.493	3/16
465	1/4	11/32	.432	5/32
468	25/64	7/32	.591	3/32
469	1/2	7/32	.580	9/64
470	13/32	7/32	.462	5/32
474	15/16	3/16	.880	15/64
475	1-3/4	3/16	1.827	5/16
477	19/64	9/32	.469	7/64
480	.281	.406	.500	.187
484	1-13/64	7/32	.948	15/64
487	27/64	7/32	.550	3/32
488	45/64	7/32	.316	33/64
489	11/32	11/32	.500	3/16
498	1/4	9/32	.380	.140
498	23/64	7/32	.316	17/64
5401	5/16	9/32	.432	5/32
5402	3/8	5/16	.500	3/16
5403	5/8	5/16	.750	3/16
5406	13/32	5/32	.500	3/16
5407	5/16	1/4	.437	1/8
5416	3/4	0	.680	3/16
5417	19/32	1/4	.703	9/64
5425	5/16	0	.187	1/8
5457	5/16	5/16	15/32	5/32

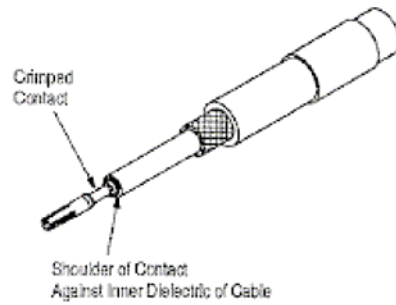


Figure 3

5. Insert crimped contact into plug body until it snaps into place. Make sure that the cable braid is positioned over the connector support sleeve. Pull back gently on the cable to ensure that the contact is held in place by the internal locking feature. See Figure 4.

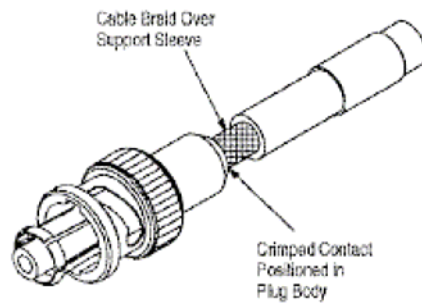


Figure 4

6. Slide ferrule forward over cable braid until it is positioned against the shoulder of the plug body. Crimp the ferrule using recommended crimping tool. Refer to the instruction sheet packaged with the tool for specific crimping instructions. See Figure 5.

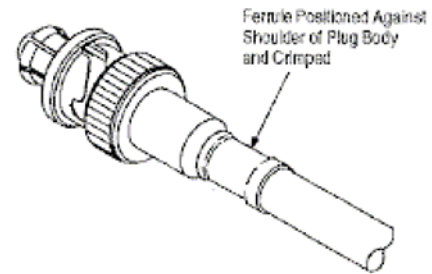


Figure 5

#### 4. REVISION SUMMARY

Since the previous release of this sheet, the following changes were made:

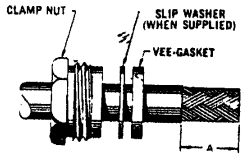
Per EC 0990-1112-98

- Added tubing and step-down ferrule in Figure 1
- Added notes regarding tubing and step-down ferrule to Sections 2 and 3
- Updated crimping tools in Section 1


F4  
PN 30-92-1

**KINGS**  
CABLING PROCEDURE CP-1000


CP-1001  
Pg 2 of 2  
**MASTER**



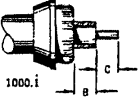
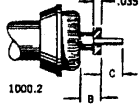
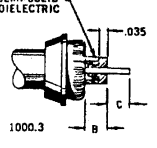

**1.** Cut cable end square, place clamp-nut, slip washer (when supplied), and gasket over jacket. Remove jacket to dimension "A."



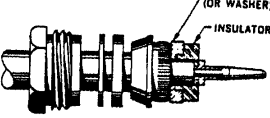
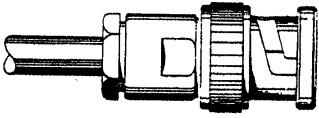
**2.** Comb out braid and taper forward. Place braid clamp over braid against jacket cut.



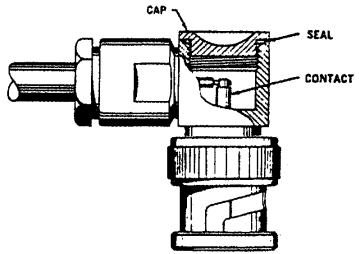
**3.** Fold braid back over braid clamp and trim as shown above. Remove dielectric to dimension "B." Cut center conductor to dimension "C."  
When cable positioning insulators are used adjust trim code dimensions as shown below, and assemble as indicated.

**4.** Solder or crimp contact to center conductor. For access type angle connectors, omit this step and proceed to step 5. For captive contacts, assemble contact capturing parts on cable before attaching contact as shown below.

**5.** Thread assembly into connector, and lock securely. Vee gasket must be split by braid clamp.



**6.** For access type angle connectors, solder center conductor in contact groove. Close access opening.

TRIM CODE CHART			
CODE	A	B	C
1001	11/16	.440	7/64

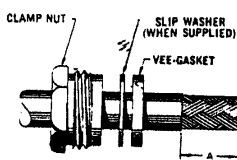


*PH*  
*P/N 30-92-1*  
**KINGS**  
CABLING PROCEDURE CP-1000


CP-1001

MASTER


*Pg 2 of 2*



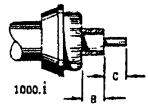
**1.** Cut cable end square, place clamp-nut, slip washer (when supplied), and gasket over jacket. Remove jacket to dimension "A."



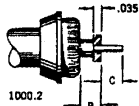
**2.** Comb out braid and taper forward. Place braid clamp over braid against jacket cut.



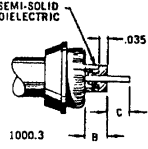
**3.** Fold braid back over braid clamp and trim as shown above. Remove dielectric to dimension "B." Cut center conductor to dimension "C."  
When cable positioning insulators are used adjust trim code dimensions as shown below, and assemble as indicated.




1000.1



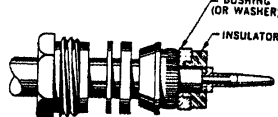
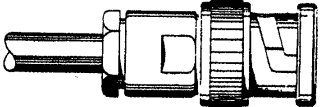
1000.2



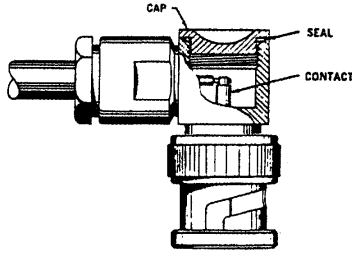
1000.3



**4.** Solder or crimp contact to center conductor.  
For access type angle connectors, omit this step and proceed to step 5.  
For captive contacts, assemble contact capturing parts on cable before attaching contact as shown below.

**5.** Thread assembly into connector, and lock securely. Vee gasket must be split by braid clamp.



**6.** For access type angle connectors, solder center conductor in contact groove. Close access opening.

TRIM CODE CHART			
CODE	A	B	C
1001	11/16	.440	7/64

## **Appendix E**

# **Modification Sheets, Engineering Instructions**

### **E.1 Modification Sheets, Engineering Instructions**

<b>P/N</b>	<b>Description</b>
943-227-15VL-M1	Modification consists of replacing the standard 8in H x 10in W x 4in D Enclosure with a 8in H x 10in W x 6in D Enclosure and replacing the field cable "Seal Grip" type entry fitting with a 2.0 in diameter sealed conduit fitting.

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