OPERATION AND MAINTENANCE MANUAL FOR STEP ATTENUATORS

Figure 1. *Models 4612K and 4622K Step Attenuators*

1. INTRODUCTION

This manual describes the Model 4412K/22K, 4512K/22K, and 4612K/22K Precision Step Attenuators (Figure 1). It provides specifications and a list of precautions the user should observe when using them.

2. DESCRIPTION

ANRITSU step attenuators provide attenuation from -–70 dB or 0–110 dB in 10 dB steps. The 70 dB step attenuators (4412K, 4512K, 4612K) have three switched attenuation sections, the 110 dB models (4422K, 4522K, 4622K) have four sections. Each section contains a precision attenuator module that is electromechanically switched in or out to provide the required attenuation. All models use in-line, female K Connectors®.

3. ATTENUATOR-SECTION SWITCHING

The step attenuators have a built-in dc switching circuit. Each attenuator section is controlled by its own driver circuit, which requires an externally applied signal of 24V, 125 mA. A typical external TTL driver for one section is shown in Figure 3. Table 1 shows the DIP connector pinout.

4. SPECIFICATIONS

Table 2 provides step attenuator performance specifications.

5. PRECAUTIONS

ANRITSU 44XX, 45XX, and 46XX series step attenuators are high-quality, precision laboratory components and should receive the same care and respect afforded other such components. Complying with the following precautionary notes will guarantee longer component life and less equipment downtime due to connector failure. Also, such compliance will ensure that RF component failures are not due to misuse or abuse—two failure modes not covered under the ANRITSU warranty.

a. Beware of Destructive Pin Depth on Mating Connectors. Measure the pin depth of the connector that mates with the RF component, *before* mating. Use an ANRITSU Pin Depth Gauge, Part No. 01-162, (Figure 2) or equivalent. When an RF component connector is mated with a con-

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NOTE: ANRITSU Company was formerly known as WILTRON Company.

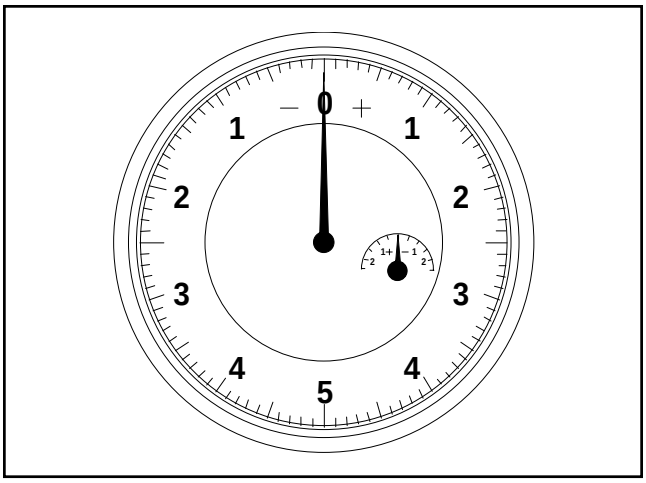


Figure 2. *Pin Depth Gauge*

nector having a destructive pin depth, damage will likely occur to the RF component connector. (A destructive pin depth has a center pin that is too long in respect to the connector's reference plane.)

The center pin on an RF component connector has a precision tolerance measured in mils (1/1000 inch), whereas connectors on test devices that mate with RF components may not be precision types. Their pins may not have the proper depth. *They must be measured before mating to ensure suitability.* When gauging pin depth, if the test device connector measures out of tolerance in the "+" region, the center pin is too long. Mating under this condition will likely damage the RF component connector. On the other hand, if the test device connector measures out of tolerance in the "–" region, the center pin is too short. While this will not cause any damage, it will result in a poor connection and a consequent degradation in performance.

The pin depth for all step attenuator models ranges from 0.000 to –0.003.

b. Avoid Over Torquing Connectors. Over torquing connectors is destructive; it may damage the mating surface of the outer conductor. This can change the pin depth and may damage the center pin. Proper torque for ANRITSU K Connectors is 5 inch-pounds. *Never* use pliers to tighten connectors.

c. Avoid Mechanical Shock. RF components are designed to withstand years of normal bench handling. However, do not drop or otherwise treat them roughly. They are laboratory-quality devices and, like other such devices, require careful handling.

d. Keep Step Attenuator Connectors Clean. The precise geometry that makes the RF component's high performance possible can be easily disturbed by dirt and other contamination adhering to connector interfaces. When not in use, keep the connectors covered.

6. MAINTENANCE

ANRITSU recommends that no maintenance other than connector cleaning be attempted by the customer. The step attenuator should be returned to ANRITSU for repair and/or service when needed.

The traditional method of cleaning connectors with a cotton swab and alcohol can break the male connector pin on the precision connectors. The reason: the cotton swab has a larger diameter than the connector (that is, the area between the coupling nut wall and the center pin.)

We still recommend using a cotton swab; however, you need to trim the swab before cleaning the outer conductor mating service.

Some precautions to follow when using the step attenuators:

Use a 5 inch-pound torque wrench when connecting to other devices. No other tools are recommended.

Do not disturb the connector center pin. Improper use (see above) of a cotton swab or other such probe to clean the inner connector may cause the center conductor to hinge on its bead and weaken or shear the internal connection.

Table 1. *Pin Assignments for DIP Connector*

Pin	Wire Color	Connections	
		Models 4412K, 4512K, 4612K	**Models 4422K, 4522K, 4622K**
1	—	—	—
2	White	10 dB Section Attenuator	10 dB Section Attenuator
3	Violet	40 dB Section Thru Line	40 dB Section 1 Thru Line
4	Green	—	40 dB Section 2 Thru Line
5	Orange	20 dB Section Attenuator	20 dB Section Attenuator
6	Brown	+24 Vdc	+24 Vdc
7	—	—	—
8	—	—	—
9	Red	40 dB Section Attenuator	40 dB Section 1 Attenuator
10	Yellow	—	40 dB Section 1 Attenuator
11	Blue	20 dB Section Thru Line	20 dB Section Thru Line
12	Grey		—
13	Black	10 dB Section Thru Line	10 dB Section Thru Line
14	—	—	—

Note: *Since the DIP connector pin assignments are identical to those used by other manufacturers, the ANRITSU attenuators can be substituted in existing system designs.*

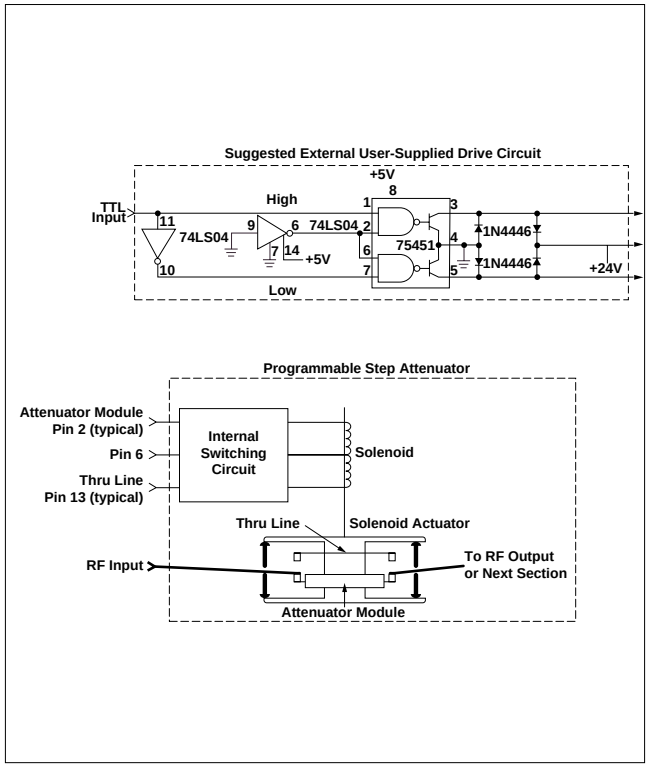


Figure 1. *Simplified schematic of one attenuator section shows an external TTL circuit that can be used to drive the attenuator internal dc switching circuits and solenoids.*

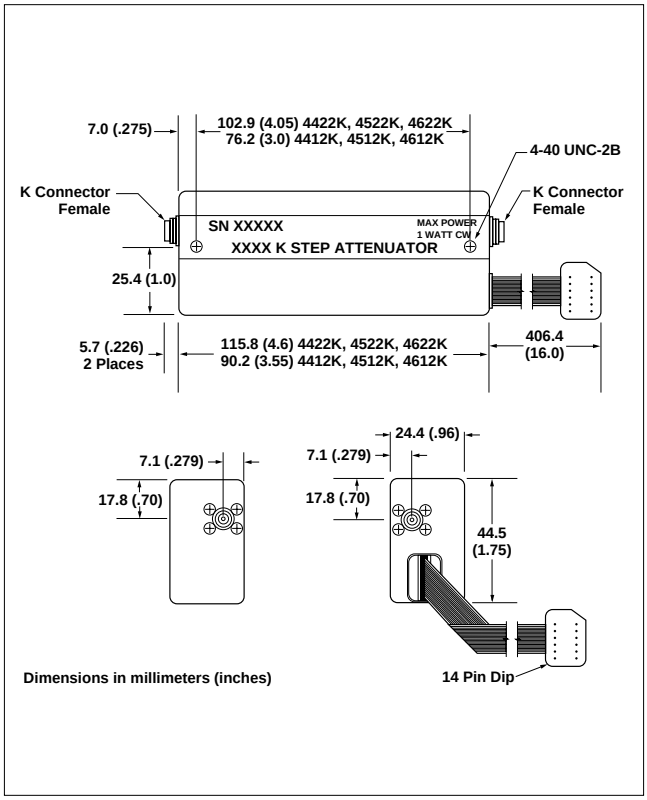


Figure 1. *Outline Drawing of 44XXK, 45XXK, and 46XXK Step Attenuators*

Table 2. *Performance Specifications*

PERFORMANCE

Frequency and Attenuation Ranges:

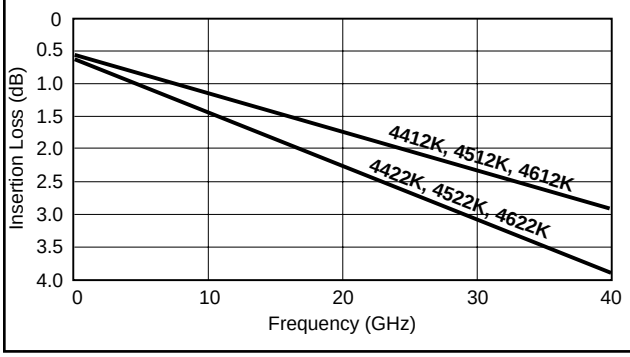
Model	Frequency Range	Attenuation Range In 10 dB Steps
4412K 4422K	DC to 20 GHz	0 to 70 dB 0 to 110 dB
4512K 4522K	DC to 26.5 GHz	0 to 70 dB 0 to 110 dB
4612K 4622K	DC to 40 GHz	0 to 70 dB 0 to 110 dB

Attenuator Accuracy (± dB)

Frequency (GHz)	Attenuation							
	10	20	30	40	50	60	70	80–110
DC–8	0.3	0.5	0.6	0.7	0.8	1.0	1.1	1.4
>8–12	0.4	0.5	0.7	0.9	1.0	1.3	1.5	2.0
>12–20	0.5	0.6	0.8	1.1	1.2	1.4	1.7	2.2
>20–26.5	0.7	0.8	1.0	1.5	1.6	1.9	2.3	2.8
>26.5–40	0.9	1.0	1.2	1.7	1.9	2.3	2.6	3.2

Switching Speed (maximum): 20 ms
Operating Voltage: 20 to 30V
Switching Control Current: 125 mA @ 24V nominal per section (three sections in 4412K, 4512K, 4612K; four in 4422K, 4522K, 4622K)
Solenoid Coil Impedance: 190 ohms
Solenoid Coil Inductance: 65 mH
RF Input Power (maximum): 1W average, 100W peak for 10 µs
RF Power Sensitivity: 0.001 dB/W
Temperature Coefficient: <0.001 dB/dB/°C
Life (minimum operations per second): 5 mil.
Repeatability (typical after 1 million operations): ±0.03 dB to 18 GHz,±0.05 dB to 26.5 GHz, ±0.08 dB to 40 GHz, ±20 dB to 60 GHz

Insertion Loss (maximum):



Impedance Match:

Frequency	Return Loss (dB)	SWR
DC–8	19	1.25
>8–12	14	1.5
>12–20	13	1.6
>20–26.5	11	1.8
>26.5–40	9	2.1

MECHANICAL

Weight:
4412K, 4512K, 4612K: 170g (6.0 oz)
4422K, 4522K, 4622K: 213g (7.5 oz)
Mounting Position: Any
RF Connectors: K Connectors, female, in-line
Programming Connector: 14 pin DIP
Programming Cable Length: 406 mm (16 in.)

ENVIRONMENTAL

Temperature:
Operating: 0°C to +70°C
Non-operating: –55°C to +85°C.
Altitude:
Operating: 4,600 m (15,000 ft) 17.3 Hg
Non-operating: 15 km (50,000 ft)
Shock:
Operating: 10g, 6 ms, on 6 sides, 3 blows
Non-operating: 500g, 1.8 ms, in 6 directions
Humidity: 0 to 95% relative humidity
EMC: Mil-Std-461, Method RE02, VDE 0871, CISPR#2.

OPTIONS

Option C Calibration Data (4412K, 4512K, 4612K only): Data is taken every 100 MHz from dc to 900 MHz and every 500 MHz from 1 GHz to 40 GHz.