GE Bushing Potential Device

Economical, Reliable operation of instruments and relays from oil-filled high-voltage bushings on power transformers and circuit breakers
The General Electric Type KA-108 Bushing Potential Device offers advanced design features and superior performance characteristics in a reliable, safe, economical voltage transforming device for the operation of instruments and relays from high-voltage circuits, 115 kV through 765 kV, 60 Hz (may also be applied at other High Voltages and at 50 Hz).

High Flexibility
The device is designed for use with most bushings having capacitance taps per IEEE C57.19.01 – 1991 Type A: Normally Grounded – see section titled: “Application Flexibility” for sketch of Capacitance Tap (or Potential Tap). The basic designs can be customized for use on circuits of 115 through 765 kV. (For other HV circuits contact the factory for special consideration.)

Greater Safety...

Maximum Protection
This potential device has several safety features:
(1) A ground switch for removing high-voltage from the device. The ground switch handle is interlocked with the control panel so that the panel cannot be opened to expose the high-voltage components until the switch has been moved to the “closed” position.
(2) A spark gap that protects the device circuit from abnormally high surge voltages.
(3) A flexible metal covered cable that connects the device to the bushing, so that no live circuits are exposed.

Advanced Design Features

Rating
There are two separate secondary windings in the device, each normally rated at 115 volts (for other output voltages contact the factory for special consideration). Both secondary windings are tapped at full output / sqrt (3) (i.e. 57.7% of full output). All secondary voltages are normally in phase with the line-to-ground voltage of the high-voltage system. The rating table below shows the NEMA SG 4-1990 Section 3.8 Class A watts output at 60 cycles for standard circuit voltage ratings.

Constant Burden Capacity
Under certain conditions greater volt-ampere burdens may be used, providing the watt component of the burden does not exceed the rated watt output of the device. In such a case the reactive component of the burden must be balanced out by the addition of capacitance, provided in the device as “power factor correction” capacitance. The burden may be distributed in any ratio between the two secondary windings to suit application requirements. The main secondary terminals (X1, X2, X3) should be used for the major burden, and the auxiliary secondary terminals (Y1, Y2, Y3) should be used, when required, for the smaller burdens. In three-phase applications, these windings are frequently connected in “broken delta” when zero sequence voltage is required for ground-fault detection and relaying.

TYPICAL POTENTIAL DEVICE RATINGS
(actual burden rates may vary depending on bushing make)

<table>
<thead>
<tr>
<th>Rated Circuit (kV)</th>
<th>Rated Line-to-Ground (kV)</th>
<th>Rated Watts Output (60 cycles)</th>
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</table>
Application Flexibility

The KA-108 bushing potential device is well suited to operate the usual types of relays, synchroscopes, volt-meters, indicating lamps, wattmeters (not for revenue) and similar instruments requiring a potential source of essentially constant ratio and phase relation with respect to the high-voltage circuit. The device's major field of application is in protection and control equipment for generating plants, substations, transmission lines, etc. It is not recommended for use where precise accuracy is required, and it is not intended that it should take the place of high-voltage metering equipment. The device is used in conjunction with a high-voltage capacitance bushing which contains a cylindrical metal plate, thus forming a capacitance voltage divider. Provision is made to connect the bushing potential device to this metal plate through an outlet located in the bushing mounting flange, and it is connected to the line through the capacitance of the bushing. Being connected between line and ground, the device operates on a single-phase basis. Where three-phase connections are needed, three devices are used, one connected to each bushing of the three-phase circuit. The secondary voltage and its phase angle are adjustable over a wide range of values, making it possible for the device to be used with most bushings having capacitance taps per IEE C57.19.01-1991 Type A (Normally Grounded).

1. Control Panel
2. Panel Securing Bolt
3. Circuit Diagram
4. Access Door
5. Control Panel Hinges
6. Bushing Tap Connection (entrance optional from left)
7. Auxiliary Capacitor (C3)
8. Transformer Tap Connector
9. Adjustment Transformer
10. Potential Device Transformer unit
11. Ground Switch
12. Adjustment Capacitors
13. Terminal Board
14. Heater
Please consult the factory for applications with foreign bushings. Our engineers will help you fit the device to your needs.

Superior Performance Characteristics

Performance characteristics are well within the Class A limits established by NEMA No. SG-4 - 1990. Potential devices contain both capacitance and inductance as essential elements in their resonant circuit network. Therefore, if burdens with comparatively large non-linear reactive components are used, the circuit characteristics may be affected. Burdens which include the use of closed iron magnetic circuits are to be avoided unless the iron-core magnetic material is operated at less than half the density required to reach the knee of its magnetization curve at normal voltage. The majority of relays, synchroscopes, and meters have linear impedance with the usual range of variation of voltage. When used with these normal types of burden, the device circuit is inherently stable throughout the operating range—up to two times normal voltage. The protective gap is set to function at voltages over two times normal to protect the circuit from higher overvoltages.

Rugged Construction

The bushing potential device consists of a high reactance transformer, a ground switch, a protective gap, and the required adjustment equipment. An auxiliary capacitor is also provided to augment the capacitance from the high-voltage bushing capacitance tap to ground. These elements are contained in a weatherproof steel housing provided with brackets for mounting the device on the side of a circuit breaker tank or a power transformer tank, either indoors or outdoors. The high-reactance transformer is located in back of the panel. A 38-watt space heater, at either 120 or 240 volts is provided to keep the compartment dry. This heater requires a separate power supply. The ground switch and protective gap assemblies are mounted to the top of the housing. When the ground switch is closed, all voltage is removed from the device. The protective gap is adjusted from inside the housing by means of a threaded stud and lock nuts. Factory setting is for approximately 15kv.

The adjustment devices, consisting of an adjustment transformer, a phase-angle adjustment capacitor, and a power-factor-correction-capacitor, are mounted on the back of the adjustment panel. The transformer and both capacitors contain taps to permit the necessary adjustments by means of switches and knobs on the front of the panel. The panel, located just inside the housing door, is hinged to permit easy access to the various devices.

Adjustments

The adjustment tap steps are sufficiently small to permit adjustment within ±1 percent ratio and ±1 degree phase angle. The best operating conditions and accuracy are obtained when the power factor of the burden is unity or slightly leading. Lagging burdens increase the voltage across the potential device primary windings and the high-voltage bushing capacitance tap, which may result in unnecessary protective-gap arc-overs. Since the usual burden consisting of relays and meters is somewhat lagging, the bushing potential device is provided with a tapped-power-factor correction capacitor which should be used when it is necessary to correct the net power factor of the burden to unity or slightly leading. It provides total capacitative volt-amperes equivalent to not less than 80 percent of the device watt rating, in steps not larger than 2-volt-amperes.

Dimensions and Weight

The KA-108 bushing potential device has an overall height of 25 inches, a projected floor space of 20 inches by 27 inches, and weights approximately 350 pounds. Unit identification and other pertinent operational information are contained on the standard nameplate.