

MICROPHONE AND BALANCED ARMATURE RECEIVER HANDLING AND ENVIRONMENTAL GUIDELINES



This guide contains general instructions and cautions for the handling and application environment for Knowles' microphones (excluding MEMS) and receivers in common usage. Specific applications frequently require additional advice and support. If you remain uncertain about handling and usage contact Knowles' Field Applications Engineering.

HANDLING

This section covers handling of the transducer during assembly into the finished product or application to ensure that the transducer is not destroyed before use and that latent faults are not introduced that will limit the life of the transducer in the field.

- Knowles' transducers are, by nature, sensitive to small forces. While they have been designed to be as robust as possible to shock and vibration forces, there are limits beyond which permanent damage will occur. In use, the transducer devices may need to be resiliently mounted to limit these forces. Prior to installation, care should be taken not to **drop** units – especially receivers.
- **Holding fixtures** should restrain the unit without any deformation as the cases are thin and active elements are close to the case walls. Do not exceed 15 Newton force. For the same reason, no probe should be inserted into the sound port.
- Excessive **mechanical force** from housing, gasket, test fixtures, tweezers, fingers, etc. can also deform/damage the transducer case or port tube.
- Injection pressure from **over-molding** will very likely deform the transducer housing causing damage. Assembly is generally preferable to over-molding.
- Improper **soldering** is the most frequent cause of transducer damage and can be very expensive if performed on many units before damage is detected. Knowles Application Note AN13 provides guidelines for soldering. For many products, soldering fixtures may be purchased through Knowles. Ask for details. Knowles SiSonic™ microphones are the only components designed to be exposed to solder reflow temperatures – reflow instructions for SiSonic appear on the model datasheets.
- **Lead attachment** can also cause damage, either due to improper soldering or because of mechanical stress. Litz wire, hook-up wire, or flex PCBs may be used to attach to the solder terminals of microphones or receivers. The conductors need to be sufficiently flexible not to damage the solder terminals due to bending torque or heat transfer. For hook-up wire, stranded and 28 AWG or thinner is recommended. Smaller terminals require thinner attach wire. Knowles can pre-attach wires or flex PCBs in manufacturing quantities on request.
- Most of Knowles' products incorporate materials which should not be subjected to temperatures in excess of 63°C (145°F). Above this temperature, irreversible damage may occur. Receivers that are driven at high output levels produce heat and this, added to the ambient temperature, must not exceed 63°C. With trained soldering personnel (and proper equipment), the brief exposure to higher **temperature** during assembly of leads to the soldering pads should not cause damage. Damage can occur due to high temperatures caused by the heat generated during exothermic reactions, such as the curing of potting compounds or the activation of heat shrink materials. The transducers are not damaged by temperatures as low as -40°C.
- Ingress of liquids or particles can damage transducers. Care must be taken so that fine dust particles do not enter and block the movement of the internal mechanism. (For example, magnetic particles could be drawn into the gaps of receivers.) Liquids, if present, could cause damage by restricting internal motion and putting undue strain on the moving elements. Liquid or gaseous solvents or corrosives may destroy metals or adhesives used in construction, or discharge the electret charge voltage in microphones. For this reason, scrupulous cleanliness should be maintained during parts storage and assembly, and solvents used sparingly and only in well-ventilated work areas. Acetone, Toluene, Chlorocarbons and some RTV sealants are examples of materials to be avoided. If you are not certain that materials in use are "transducer safe,"



controlled trials should be performed or Knowles should be consulted.

- Outgassing from **cyanoacrylate adhesives** will attack materials within microphones and receivers and cause damage. Microphone electret charge can be degraded. Given adequate ventilation (such as direct fan blowing) long enough to fully cure cyanoacrylate adhesives, it may be possible to use them without damage. Customer assumes responsibility for any damage.
- **Vented receivers** and most **directional microphones** include a direct path to the back volume of the transducer, and are therefore especially susceptible to damage due to ingress. Special care should be taken to prevent ingress into vents and back sound ports.
- High **electrostatic discharges (ESD)** can damage the sensitive FET inside Knowles electret (and piezoelectric) microphones. During lead attach to the transducer, and then to the user circuit, the usual precautions against electrostatic discharge should be taken. In particular the work place should be grounded as should the soldering iron and synthetic fabric should be avoided or treated with antistatic spray. Once connected to the user's circuit, the risk of damage is much lower.
- **Ultrasonic welding** of housing components will transmit energy that is likely to damage the transducer and is not recommended. It may be possible to develop an ultrasonic welding process that does not damage the transducer. The customer assumes responsibility for any such development or damage.
- Processes that cause water or other vapors to **condense** within the transducers will temporarily change the functionality of the transducer. Be sure to warm the device to dry it out before testing. Make sure that no condensed material can freeze while within the transducer.
- Nuclear or intense electromagnetic **radiation** (e.g. X-rays) can cause partial or total discharge of electrets with the consequent reduction or total loss of output of the microphones. Piezoelectric microphones are more resistant, but the field effect transistors can suffer degradation with exposure.
- Normal barometric **pressure changes** will not damage transducers, but rapid changes in pressure (explosive decompression or blasts from a compressed air nozzle) may bend or detach the drive mechanism in receivers or collapse the diaphragms in microphones. Take care to gently apply air

pressure when leak-testing assemblies.

- Caution: Users of Knowles' receivers in hearing instruments and in other products are advised that these receivers have the capacity to produce **very high levels of sound pressure**. To avoid possible hearing damage, special care should be exercised when performing listening tests using these receivers.

APPLICATION ENVIRONMENT

- Knowles' receivers are sensitive to **excessive shock**. Their delicate mechanisms are designed to give large acoustic outputs for small electrical inputs and must, therefore, respond to very small forces. The forces involved in dropping a receiver, even 30 cm onto a hard surface, may be as much as 100 times the operating forces. Therefore, the receiver must be cushioned against drop or the unit may become distorted or fail completely. Insert earphones typically include compliant tips and cabling that will cushion most drops, but designs frequently require a shock mount to prevent damage in usage. The moving parts within the receiver and the driven air cause the receiver case to vibrate and can create **feedback** to a live microphone in proximity. For this reason, a composite shock and vibration mount and/or acoustic echo canceler may be needed in some applications. Knowles may be able to provide advice or assistance in these circumstances.
- If the transducer is to be used in an environment where dust or moisture is likely to enter an unprotected receiver, suitable precautions must be taken to limit or prevent this from occurring.
- Where **solvent or corrosive vapors** are present, suitable barriers are needed to exclude these and still allow sound to pass. This is not easily achieved and may not be achievable for some materials, resulting in significant levels of corrosion. Atmospheric sulphur can cause sudden receiver failure due to corrosion and subsequent open circuit of the coil. One potential source of this contaminant that must be avoided is under-vulcanized natural or synthetic rubber used in connecting tubes or shock/vibration mounts.
- **ESD** is not normally a problem with microphones connected to the circuit in the application. It is not a problem with receivers.



- Operational **temperature** in the range -0°C to +63°C is acceptable. Storage temperature in the range -40°C to +63°C is acceptable. Temperatures outside of these ranges have been found to be permissible in many applications, though this should be confirmed by test for each specific application. Elevated temperature problems are related to creep, but short periods above 63°C may result in acceptably low degradation of performance.
- Relative to electret microphones, consult Knowles for reliability expectation in **humidity** for specific model series. The requirement for most microphone elements is that no units will be inoperative following the test and recovery cycle. There is little effect on receivers' performance from humidity in normal conditions. However, they could fail if corrosion also takes place when constantly in humid conditions. Condensation within units should be avoided at all times.
- Nuclear **radiation** and intense electromagnetic radiation can cause partial or total discharge of electret microphones and, consequently, reduction or total loss of output.
- Normal atmospheric **pressure changes** will not damage Knowles' transducers, since a pressure equalization mechanism is provided in each Knowles' transducer. It should be noted, however, that specifications are at normal atmospheric pressure, and the transducer's sensitivities and response curves will alter with barometric pressure, though these variations are significant only with large changes of pressure (e.g. during changes from sea level to high altitude).
- Proximity of a **permanent magnet** can affect or permanently degrade receiver performance. Exposure to over 200 Gauss may alter receiver performance. Exposure over 1000 Gauss may permanently alter or degrade receiver performance. The orientation of the permanent magnet with the receiver will influence the flux magnitude required to affect the receiver.
- Caution: Users of Knowles' receivers in hearing instruments and in other products are advised that these receivers have the capacity to produce **very high levels of sound pressure**. To avoid possible hearing damage, special care should be exercised in the application of these receivers.