# SUPPORT NOTE

SN-103

# Reducing Potential for Guard Amplifier Oscillation

## The Problem

Some testing conditions lead to apparently inexplicable oscillations at the device under test. That is, the oscillation frequency is higher than the gain bandwidth product of the Reedholm instruments (10's of kHz), yet is much lower than the gain bandwidth product of transistors under test (typically >100MHz). To further complicate analysis, multiple matrix and instrument connections sometimes exacerbate oscillations, and sometimes eliminate them.

## One Possible Reason

High frequency, high power amplifiers used to provide active guarding are a possible power source for sustained oscillations. These amplifiers have 100% feedback, and their 5MHz gain bandwidth means they provide energy at high frequencies compared to the bandwidth of Reedholm instrument modules.

Inductance of wire-wound metering resistors within the VFIF and DMM instruments, especially the 500Ω resistor used for the 10mA ranges, form a resonant tank circuit with the guard to input capacitance that can result in sustained oscillation at a few MHz. This oscillation occurs despite use of 100Ω resistors between guard amplifiers and guard pathways. Fortunately, simply changing the guard current limiting resistors from 100 to 1000Ω reduces the Q of the tank circuit and thus eliminates this possible source of oscillation. Furthermore, the slightly slower rate at which the 1kΩ resistor permits driving the guard capacitance has no effect on system specifications.

This change eliminates oscillations involving the guard amplifiers, but few oscillations seen during testing are of this type. For instance, device dependent oscillations caused by local feedback on the probe card are not affected by this change and still require local compensation (ferrite beads, capacitors, resistors, etc.) or test conditions that preclude oscillation.

## Modules Affected

Prior to checkout or troubleshooting, resistors are replaced when any of the following modules are sent to Reedholm for upgrade or repair.

1) VFIF (P/N 11002)—Resistor R15
2) DMM-12 (P/N 11001)—Resistor R15
3) DMM-16 (P/N 11049)—Resistors R32 & 46
4) IFM (P/N 11060)—Resistor R15

## Required Capability, Tools, & Parts

The person responsible for removal and insertion of instrument modules must be trained in use of correct power-down and power-up methods for the system.

Whoever replaces the resistors must have proven skill in proper use of a soldering iron and in solder removal. Standard industrial carbon composition, or carbon film, resistors are used.

- Reedholm P/N 40125: 1kΩ, 1W, 5%
- TRW/IRC Resistor P/N GBT-1-1k-5
- Allen-Bradley Co. P/N GB1025
- U.S. Military P/N RCR32G102JS

## Suggested Replacement Sequence

Replacing the resistor(s) does not affect calibration, but the Main Diagnostic (DIAG) program should be run to verify functionality before any changes are made. If the system has a SelfCal Module (SCM), the SelfCal program should also be run to confirm that the instrument module(s) has acceptable gain and offset correction factors. If the only problem encountered is mis-calibration, the module should be calibrated after replacement of the resistor(s).

DIAG can be run immediately after replacing the resistor(s) in order to verify that no collateral damage occurred. Once the system has warmed up to a stable thermal state, SelfCal should be run to fully confirm system operation and establish correction tables.