Using the IGC100 with MICRO-ION® Gauges

The IGC100 controller is compatible with Series 355 MICRO-ION® gauges manufactured exclusively by Granville-Phillips, Helix Technology Corp (Longmont, CO, USA, www.granville.com).

This short application note discusses the wiring details, parts and gauge setup parameters required to connect and operate a MICRO-ION® gauge (G-P Catalog 355001) with an IGC100 controller.

The data included here is based on information available directly from Granville-Phillips[1], as well as SRS's own experience with MICRO-ION® gauges. For further information, please contact Stanford Research Systems.

In This Application Note

Wiring Requirements

IMPORTANT
The ION GAUGE connector (female), located on the back of the IGC100, is **NOT** pin-compatible with the connector (male) found in all MICRO-ION® Gauge cables manufactured by Granville-Phillips. A cable adapter, **SRS# O100CA1**, is required to complete the connection.

1. Purchase the MICRO-ION® gauge (G-P Catalog 355001) and signal cable (G-P Catalog 358008, 358009 or 358010) directly from Granville-Phillips[2].

2. Purchase a MICRO-ION® cable adapter, SRS# O100CA1, directly from Stanford Research Systems.

3. Mount the MICRO-ION® gauge on your vacuum system following its manufacturer's recommendations.

4. Connect the O100CA1 cable adapter to the ION GAUGE connector[3] on the back plane of the IGC100 controller.

5. Connect the O100CA1 cable adapter to the MICRO-ION® signal cable.

6. Connect the collector cable BNC connector of the signal cable to the proper collector port (1 for IG1, and 2 for IG2) on the back of the IGC100.

7. Connect the gauge end of the MICRO-ION® signal cable to the gauge head.

8. Adjust the gauge setup parameters according to the directions of the next section.

Gauge Setup Parameters

The IGC100 Gauge Setup parameters must be properly adjusted to obtain accurate pressure readings with MICRO-ION® gauges.

The adjustments required for pressure measurement accuracy are

1. IG Calibration Source
2. N_2 Sensitivity Factor
3. Emission Current
4. Degas Power
5. Degas Time
6. Overpressure Threshold
7. Gauge Protection

The following settings are strictly based on manufacturer's recommendations[4] :

IG Calibration Source	N2 Sense Factor(1/Torr)
N2 Sense Factor	20/Torr (nominal)
Degas Power	3 Watts (max)
Degas Time	2 minutes (max)
Gauge Protection	Micro-Ion

Adjust the emission current and overpressure threshold settings taking into account the vacuum system pressure range:

Pressure Range	Emission Current	Overpressure Threshold	Default Setup File
1E-9 to 2E-4 Torr (1)	4 mA	2E-4 Torr	N.A.
1E-7 to 8E-4 Torr	1 mA	8E-4 Torr	N.A.
1E-6 to 5E-2 Torr	.02 mA	5E-2	MICRO

(1) X-ray limit is specified at $3x10^{-10}$ Torr.

Degas

Recommendation

Granville-Phillips recommends the use of both filaments during degas. The "Both" filament selection setting cleans up the tube more satisfactorily allowing for a lower ultimate pressure reading.

Warning

Do not touch the MICRO-ION® Gauge during degas operation. Burns can occur.

The IGC100 controller will not allow a degas process to start if the pressure at the gauge head is above $2x10^{-5}$ Torr. A rough pressure indication is displayed during the degas

process. Degas power is carefully regulated during the entire process to minimize pressure bursts. Degas is completely shutdown if a pressure burst exceeding $5x10^{-5}$ Torr is detected at any time during the process.

The following recommendations should be observed while degassing MICRO-ION® gauges:

P > 10^{-5} Torr

If the pressure in the chamber (as measured at the MICRO-ION® gauge head) is above 10^{-5} Torr, perform a gauge and vacuum system bakeout instead of attempting an electron-bombardment degassing procedure. Degassing above 10^{-5} Torr is of little value and may (1) damage the filament and (2) cause pressure bursts that can cause an electrical discharge which can couple high voltage to the vacuum system hardware.

$5x10^{-7}$Torr < P < 10^{-5} Torr

Do not use the controller's Degas function while in this pressure range. Instead, outgas the MICRO-ION® gauge by operating the gauge in its normal operating mode with 4 mA of emission current for 2 minutes. Repeat this procedure as required until the desired base pressure is achieved. Degassing the gauge in this manner avoids the high electrode voltages used during a standard EB Degas. Due to its reduced size, the MICRO-ION gauge is very susceptible to high voltage electrical discharges during pressure bursts.

The normal operation of MICRO-ION® gauges with emission currents >4 mA is discouraged by its manufacturer[5].

P < $5x10^{-7}$Torr

Degas the MICRO-ION® gauge using the controller's built-in Degas function with a maximum of 3 W Degas Power and 2 minutes Degas Time settings. Do not exceed the recommended settings, since that may damage your gauge.

Bakeout

It is recommended to bake the gauge (and entire vacuum system if possible) in order to achieve an ultra-clean state. Recommended bakeout temperatures between 150ºC and 200ºC are usually adequate.

IMPORTANT

The gauge must not be baked above 200ºC. Remove the MICRO-ION® gauge cable from the gauge head when baking over 150ºC.

Gauge Protection

MICRO-ION® gauges are very compact, but still manage to include a dual filament assembly in their electrode structure. The dual ThO_2/Ir filament wires used for electron emission are very thin and require significantly less electrical power during operation (2V/2A normal, 2.3V/3A max) than standard ionization gauge filaments. As a result, the risk of overpowering is always present when MICRO-ION® gauges are connected to an ion gauge controller designed to operate standard ionization gauges.[6] Electrical overpowering will, in most cases, cause permanent damage to the filament wire.

The IGC100 controller includes a Gauge Protection function in its design which allows the user to limit the amount of power that can be safely delivered to a filament during operation. This Gauge Protection feature is gauge specific and intended to reduce the chances of filament burnouts when using gauges with delicate filaments, such as MICRO-ION® gauges.

To activate this protection for MICRO-ION® gauges, set the Gauge Protection (in the Advanced Gauge Setup menu) to Micro-Ion before operating a MICRO-ION® gauge. The MICRO-ION® protection is also set when the MICRO-ION® Default Setup is loaded.

IMPORTANT
Set the Gauge Protection to Micro-Ion when operating MICRO-ION® gauges with the IGC100 controller.

Accuracy

No independent studies on the accuracy and long-term stability specifications of MICRO-ION® gauges have been reported to date. Stanford Research Systems has used MICRO-ION® gauges in several applications, but no systematic study of their accuracy, gauge-to-gauge reproducibility and long-term performance has been conducted. MICRO-ION® users should contact Granville-Phillips directly for gauge accuracy information. Long term studies and systematic comparisons against standard Bayard-Alpert designs will be required to confirm the overall utility of these new gauges.

References

[1] Technical Notes #013606 and 355004, and Series 358 Vacuum Gauge Controller Instruction Manual (G-P Catalog#358013), Granville-Phillips, Helix Technology Corporation, Longmont, CO, USA, 1998, U.S. patent 6,198,105.

[2] Contact Granville-Phillips at: www.granville.com.

[3] Connect the cable adapter to the IG1 or IG2 port of the Dual Ion Gauge Connector Box, when connecting to an IGC100 with an O100IG option.

[4] Stanford Research Systems is not responsible for changes in design or specifications of third-party products that might render them incompatible with these recommendations and/or the IGC100 controller.

[5] Private communication from Granville-Phillips, Helix Technology Corporation, Longmont, CO, USA.

[6] For example, the gauge manufacturer (Helix Corporation, Longmont, CO) offers a cable adapter module (G-P part# 355002) to connect MICRO-ION® gauges to its standard ionization gauge controllers that limits the filament current to 3A.