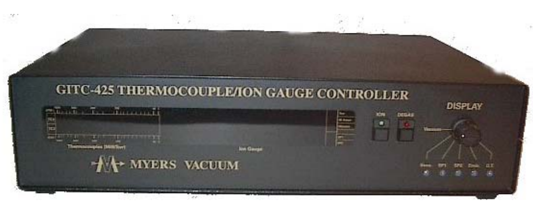
Instruction Manual For

Hot Cathode Ionization Gauge
Dual thermocouple
GITC-425



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Instruction Manual
GITC-425
Ionization Gauge Controller With dual Thermocouples Capability

DANGEROUS VOLTAGES are present during the operation of this ion gauge controller. Do not enter the controller cabinet. Do not touch any cable connections when power is being applied to the unit. Follow safe procedures to avoid electrical shock hazards.
Safety Pays. Determine what action you are going to take and study this instruction manual before beginning any action. If there is any concern about the best way to proceed, return the controller to Myers Vacuum for repairs or contact Myers Vacuum for repair procedures.

Explosive Gases

Do not use this equipment to measure the vacuum pressure of explosive, combustible, corrosive or unknown gases. Ionization gauge filaments operate at high temperatures.

Implosion and Explosion

Ion gauges in glass enclosures should not be treated roughly or be bumped. If the glass is damaged, it may implode causing glass to fly. If a positive pressure is developed inside the glass enclosure the glass may explode, again causing glass to fly. A shield may be installed around the glass enclosure to help prevent damage.
Install the ion gauge cable on the ion gauge pins before the gauge reaches vacuum pressures. This will prevent bending the gauge pins and possibly causing the glass to crack and the gauge to implode. The gauge cables should be securely fastened to prevent strains or stress on the gauge tube pins. Do not allow the gauge tube temperature to exceed 10̃□̣C. Sustained high temperatures can damage the tube, causing air leakage into the vacuum system.
Over pressurization of a gauge tube is as dangerous as implosion. Always remember that ion gauges are calibrated for Nitrogen gas. Other gas pressures should be carefully calculated to be sure that over pressurization and the possible explosion of the gauge tube does not occur.

Danger – High Voltage

+180 VAC is present in the gauge during operation. Do not touch the ion gauge tube, Ion Gauge Connector or tube connectors while the controller is in operation.

Grounding

For safe operation of vacuum equipment the vacuum chamber and all instrumentation, pumps, etc. MUST be grounded. **LETHAL VOLTAGES** may be established in the vacuum system if all chamber surfaces are not grounded. Check with an Ohmmeter to make sure all chamber surfaces are at ground potential, sometimes vacuum chamber gaskets will isolate parts. The ground screw on the back of the GITC-425 must be directly connected to the vacuum chamber.
Confirm that the shipped controller is the same as listed on the packing list and that it includes all the materials and options that were ordered. If materials are damaged, the carrier that delivered the carton or cartons must be notified in accordance with the Interstate Commerce Commission regulations - normally within 15 days. A damage claim must be filed with the carrier, do not call the manufacturer to file a claim, as all claims

must be made by the recipient through the delivering carrier. Myers Vacuum will be happy to help with shipping identification numbers, routing and/or shipment tracing. Any damaged materials including all shipping containers, boxes and packing materials should be kept for the carrier inspection.

Contact the manufacturer:
Myers Vacuum
RD# 2 Box 247A
Kittanning, PA 16201
Phone (724) 545 8331 or (800) 780-8331
Fax (724) 545-8332

If the shipment is not identical to the packing list or not what was ordered.

International Shipments

Inspect all materials received for shipping damage. Check to be certain your shipment includes all materials and controller options ordered. Any items damaged must be reported to the carrier making the delivery to the customs broker within 15 days of delivery. The Myers Vacuum GITC-425 Ionization Gauge Controller is guaranteed for one **year** against defects in parts, materials and workmanship. Any misuse or attempts to reprogram the controller during the warranty period will void the warranty. No other warranties are expressed or implied. If the unit malfunctions during the warranty period, return it to Myers Vacuum and it will be repaired at no charge. Please include a written statement of the problem with a contact name and phone number.

Power Requirements :
95 - 125 VAC (50/60 Hz), 185 Watts
200-250 VAC (50/60 Hz),185 Watts - OPTIONAL
Size: 3 ½" H (90 mm), 15" W (381 mm), 10.5" D (267 mm)
19" W (483mm), with Rack Mount

Weight: 14 Lbs. (6.4 Kg)

Temperature Range: 0 - 40^{0}C

Thermocouple Tubes: Type CVC/GTC-036
Range Atmosphere to 1.0×10^{-3} Torr

Ion Tube:
Type GIC-048-2
Range 9.9×10^{-4} to 1.0×10^{-10} Torr
Sensitivity Adjustable, 1/Torr to 64/Torr (Factory set to 13/Torr)
Emission Current Adjustable, 0.1 mA to 25.5 mA (Factory set to 4.1 mA)
Collector Potential 0 VDC
Grid Potential +180 VDC
Filament Potential +30 VDC
Degas I^2 R, 7V, 8A max; adjustable timer from 1 to 99 min.

Display:

Ion Gauge Main Display; scientific notation, 2 significant digits (Torr)
TC1 30 segment bar graph (Millitorr)
TC2 30 segment bar graph (Millitorr)
Sensitivity Main Display; 2 digits (/Torr)
SP1 Main Display; scientific notation, 2 significant digits (Torr)
SP2 Main Display; scientific notation, 2 significant digits (Torr)
Emission Current Main Display; 3 digits (Milliamps)
Degas Time Main Display; 2 digits (Minutes)
If Degas is on, then remaining time is also displayed

Accessories:

Recorder Output 0-10V; Logarithmic, 1 V/decade (on ion sensor)
Set-point Outputs SPDT relay output; 3 Amp @ 115 VAC.2

Thermocouple Installation

Situate the gauge tube in a clean, dry vacuum system with the open end pointing down so as to be self-draining should any vapors condense in it. Thread metal tubes into 1/8" female NPT threads. Connect the Thermocouple (TC) Cable to the TC tube base. The plastic base of the tube might break off if force is used and the plug is not properly lined up with the tube. Plug the other end of the cable into the TC1 Connector on the back of the GITC-425. (Or TC2 Connector if TC1 is already installed) Route the TC Cables so that they won't get tripped on or pulled.

Ionization Gauge Installation

WARNING - Connect the IG Cable to the glass tube before it is under vacuum. Accidental bending of the tube pins, while under vacuum, could cause the tube to crack and implode.

Use only a **GIC-048-2 Ion Gauge** tube with this controller. This controller has resistive degas and is not designed to be used with an other tube. Using this controller with a UHV tube, that requires E Beam degas, will damage the unit and **void the warrant**y. Mount the ionization gauge in a central location in the vacuum system. The ion gauge reading will read a higher vacuum if mounted near the vacuum pumps. The reading will be lower if mounted near a gas inlet or source of contamination. If your vacuum system has an electron beam source the tube should have a shield around it to keep any spurious charged particles out of it.
Connect the IG cable to the tube; don't force the cable head onto the tube. The pins on the tube can bend easily. Connect the collector plug onto the collector pin on the top of the tube. Plug the other end of the cable into the Ion Gauge Connector on the back of the GITC-425. Also connect the BNC Plug into the Ion Collector Connector next to the Ion Gauge Connector. Route the IG Cable so that it won't be tripped on or pulled.

Controller Installation

Place the controller in a secure place, or mount into an equipment rack with the Optional Rack Mount Kit. The unit comes from the factory, wired for either 115 or 230 VAC, check the back panel for input voltage type and connect the power cord to the appropriate voltage.

Grounding

Make sure the GITC-425 and the vacuum chamber are properly grounded to each other and to all vacuum instrumentation being used. See GROUNDING

Operation

READ THE SAFETY PAGE BEFORE PROCEEDING

Follow the instructions in the installation chapter and install the tubes and cables. If you are using a TC tube and an ion gauge tube and want the ion gauge to turn on automatically, set the AutoStart switch on the back of the controller to "ON". If you do not want the controller to automatically turn on the ion gauge tube, set the AutoStart switch to " OFF ".

Turn on the power switch on the back panel. Make sure the Mode (Display) Selector Switch is set to Vacuum. If the AutoStart is enabled and the pressure on the TC (station # 1) tube is Less than 1.0×10^{-3}, the controller will turn on the ion gauge tube and the ion indicator will light. After a few seconds, the controller will display the ion gauge pressure.

If you are not using a TC tube on station # 1 or the AutoStart is disabled, you will have to turn the ion gauge tube on. To do this, press the ION Switch on the front panel, the ion indicator will light. Wait a few seconds for the controller to display the pressure. To turn off the ion gauge, press the switch again.

Operation Modes

The GITC-425 has 7 different modes of operation; they are selected by turning the Mode Select Switch and are displayed on the main display.

Here is a list of the modes and what they do:

Vacuum: ** Display the Vacuum on the Ion Gauge
Sensitivity: Display & adjust sensitivity
Setpoint 1: SP1 Display & adjust setpoint 1
Setpoint 2: SP2 Display & adjust setpoint 2
Emission: Display & adjust emission
Degas Time D.T.: Display & adjust degas time
** Ion Gauge Tube must be on.

Sensitivity Adjustment

Turn the Mode Select Switch to the "Sens." position. The sensitivity value is displayed on the main display. To adjust the value, insert a small screwdriver in the "Sens." hole and turn the potentiometer. The range of adjustment is from 1 to 64/Torr. There are two factors in ion gauges that have a sensitivity value. The first is the sensitivity of the gauge tube and the second is the sensitivity of the gas in the vacuum system. These two values should be multiplied together to form the sensitivity value. (GIC-048-2 sensitivity is 13)

Sensitivity = Tube Sensitivity X Gas Sensitivity

Process Control Set Points

The GITC-425 has two-process control set points. They are activated by the vacuum pressure on the main display. Only the ion gauge effects the operation of the setpoints. To display or adjust the setpoints turn the Mode Select Switch to the SP1 or SP2 position depending on which setpoint you are adjusting. The setpoint value is displayed on the main display. To adjust the value, insert a small screwdriver in the setpoint hole and turn the potentiometer. The range of adjustment is from 9.9×10^{-1} to 1.0×10^{-10} torr. The output of the setpoints are two relays rated at 3A @ 115 Vac. They can be connected to external equipment via the Accessory Connector.

GITC-425 Accessory Connector

Pin #	Function
1	Recorder Output Positive DC
2	Recorder Output Ground
3	SP2 Comm.
4	SP2 N.C.
5	SP2 N.O.
7	Sp1 Comm.
8	SP1 N.C.
9	SP1 N.O.

Emission Adjustment

Turn the Mode Select Switch to the "Emis." position. The emission current value will be displayed on the main display. To adjust the value, insert a small screwdriver in the "Emis." hole and turn the potentiometer. The range of adjustment is from 0.1 to 25.5 milliamps (the GIC-048-2 emission is 4.1).
The emission may need adjustment to accommodate different tubes or filaments. Do not use the emission adjustment to correct for different sensitivity. The GITC-425 has its own sensitivity adjustment and that should be used to change sensitivity.

Degassing

The GITC-425 uses resistive heating for degassing the ion gauge tube. Before degassing, the ion gauge tube must be on and in a good vacuum (i.e. 9.9×10^{-4} or lower). The degas cycle is started by pressing the Degas Button, the degas indicator should come on to indicate degassing. Degas will only start if the controller is in the vacuum mode and the ion gauge is turned on. The GITC-425 will degas for the amount of time set on the timer. To see how much time is left on the degas timer, turn the Mode Select Switch to the "D.T." position. The number on the left of the main display is the remaining time. There are 3 ways to shut off the degas cycle, first the degas timer can run out and the controller will turn off the degas, second you can press the degas button again, or you can turn off the ion gauge tube and the degas will also shut off.

Degas Timer

Turn the Mode Select Switch to the "D.T." position. The degas time value is displayed on the main display. To adjust the value, insert a small screwdriver in the "D.T." hole and turn the potentiometer. The range of adjustment is from 1 to 99 minutes.

Automatic Pumpdown Tracking

The Myers Vacuum Ion Gauge Controller features automatic pump down tracking (AutoStart). If AutoStart it turned on (located on the rear of gauge), by switching the AutoStart switch to "On", it will monitor the thermocouple station # 1 output and automatically switch to the ion gauge when the vacuum system reaches the correct crossover pressure. The thermocouple reads the vacuum system from atmosphere (~1000 millitorr) to 1 millitorr. At 1 millitorr the controller automatically samples the ion gauge to see if it will turn on. If it will not, the controller shuts off the power to the ion gauge tube for 60 seconds. The controller is programmed to try and turn on the tube every 60 seconds thereafter, until the pressure reaches 9.9×10^{-4} torr. After this pressure is reached the controller continually tracks the system pressure during the high vacuum pump down; changing scales automatically as the vacuum lowers. The lowest pressure that can be read with the GITC-425 is 1.0×10^{-10} torr. Because the ion gauge filament could oxidize or burnout at vacuum levels in the 10^{-3} torr range the controller will not allow the ion gauge tube to be operated in these ranges. The system pressure must be 9.9×10^{-4} torr or lower before the Myers Vacuum controller will allow the filament to be kept on. If the user doesn't want the controller to turn on and off the ion gauge, then set the AutoStart switch to "Off".

Analog Recorder Output

The Recorder Output of the GITC-425 is a 0 to 10 VDC signal accessible through the accessory connector. Pin 1 is the positive DC signal and Pin 2 is ground. It is a representation of what vacuum is displayed on the main display (Ion Gauge).

The Output is a linear 1-volt per decade.

The formula for the recorder output is:

$$V^{out} = (-\textit{Vac. Exponent} \times 1.0\ \text{VDC}) + (1 - (\textit{Vac. Mantissa} / 10))$$

Examples:

3.5 x 10 -5 = 5.65 VDC
9.9 x 10 -8 = 8.01 VDC
5.0 x 10 -6 = 6.50 VDC.9

Operating Principles

All ionization gauges operate on the basis of ionizing a fraction of the gas molecules present in the gauge and the collecting the gas ions. The gas ions are positively charged and cause an electrical current flow to the ion collector circuit. The magnitude of this current indicates the amount of pressure. A higher pressure (density of gas molecules) will cause a larger rate of ionization, resulting in a greater rate of positive ionic charge on the collector. These positive charges form a current in the collector circuit, from which the pressure is calculated.

Simple hot filament ionization gauges are available in several forms; such as the triode geometry or the more popular inverted triode (Bayard-Alpert) geometry. A schematic view of a GIC-048-2 gauge is shown in its manual. These tubes usually have glass enclosures, however they are also available with no enclosure (nude gauge). As shown in its manual the ion collector is a slender wire down the center of a grid structure. The electron emitting filaments are outside the grid structure. Since the traditional triode gauge arrangement has the electron emitter inside the grid and the ion collector outside the grid, the Bayard-Alpert gauge is often referred to as an inverted triode gauge.

The schematic (inside of the GIC-048-2 instruction manual) shows two electron emitting filaments; however only one filament is used during the operation of the gauge. The second one is available for use when the first one burns out. The filaments are usually made of tungsten with yttrium coated filaments. The coated filaments have a longer life because they can withstand operation in higher partial pressures of oxygen and water vapor. In the normal operation of the gauge, power is applied to the filament. The filament heats and electrons are emitted. The emission current is usually a few milliamperes when the gauge is operated in the high vacuum pressure range. The emitted electrons are accelerated toward the positively biased grid. Usually this accelerating potential difference is 150 volts. The grid is a relatively open structure therefore most of the electrons pass through the grid, slow down, turn around and are accelerated back toward the grid again. The electrons pass through the grid and may oscillate back and forth through the grid structure many times before they hit the grid. This long mean free path for the electrons improves the probability that they will hit a gas molecule and ionize it even though the pressure may be in the ultra-high vacuum range. When such an ionizing collision takes place the positively charged gas ion is attracted to the most negative element in the gauge tube, the ion wire. Usually the ion collector wire is held at ground potential or zero volts. The ionized gas molecules are attracted to the ion collector and create a current in the collector circuit, which provides the pressure indication.

Pressure Calculation

In hot filament ion gauges, the ionizing electrons are emitted from the hot filament. The rate at which electrons are emitted is measured by the emission current (Ie) of the filament. The gas ions produced in the gauge are attracted to the ion collector and produce an ion current (Ic) in the ion collector circuit. In order to determine the pressure (P) measured by the ion collector current we need to know what relationship exists among the variables; P, Ie and Ic. There is a direct relationship between the ion current and the emission current. If the user increases the emission current more electrons are emitted from the filament. Therefore more gas molecules will be contacted and ionized and the ion current will be increased. The ion current is a direct function of the density of the gas molecules present. As the pressure increases, the density of gas molecules increases. Hence there will be more gas molecules hit by the emitting electrons, resulting in an increase of ion current. The ion current is also a function of the geometry of the elements in the tube and to some degree the electrical potentials of the various elements. If the emitted electrons have a very long mean free path from emitter to collector there is an increased probability of hitting a gas molecule, ionizing it and producing an increased ion current. We must remember that the probability of ionization is also a function of the gas species present in the gauge tube. The effect of geometry, electrical potentials and gas species are combined to form the gauge sensitivity (s).

The equation that relates all these quantities is:

P = Ic Ie X S

S = Tube Sensitivity x Gas Sensitivity.

Effects of Various Gases

(Relative Sensitivity)

Various gases in the gauge tube will different effects have on the indicated pressure. We have to make the distinction between the true pressure in the gauge tube and the pressure that is indicated by the controller. Almost all manufacturers calibrate their gauges so that the indicated pressure is nearly identical with the true pressure when the gas is a normal air mixture.

In any gauge tube that has a fixed volume and operates at a constant temperature, the true pressure is determined solely by the number of gas molecules present. However the indicated pressure in an ionization gauge is determined by the rate at which gas ions are collected. Typically this rate of collection is determined by the rate gas molecules are ionized. This ionization rate varies with gases, other than normal air or nitrogen, causing a discrepancy between the indicated pressure and the true pressure (when nitrogen or normal air is not being used). The relative sensitivity of a gas is the relationship between the ionization rate of the gas and nitrogen. When not using nitrogen, the indicated pressure of the ion gauge controller must be divided by the relative sensitivity number for that gas.

Gas	Sesitivity
Helium	0.178
Neon	0.316
Hydrogen	0.410
Oxygen	0.780
Water Vapor	0.90
Nitrogen	1.00
Carbon Monoxide	1.01
Carbon Dioxide	1.39
Argon	1.42
Krypton	1.94
Xenon	2.75

Degas

There is a possibility at some time during ion gauge operation that the pressure in the gauge tube will be higher than the pressure in the vacuum system because of gases and vapors desorbing from the surfaces of the gauge tube. Degassing is the process by which we attempt to speed up desorbtion or outgassing of the surfaces inside the gauge tube. Once these surfaces are outgassed or degassed, the pressure in the gauge tube is more likely to be equal to the pressure in the vacuum system.

Degassing is usually accomplished by applying an additional amount of electrical power to some of the elements in the tube, thus causing those elements to heat. Heated surfaces outgas more rapidly than cool surfaces. Heat flow, by radiation and conductance, causes all the gauge surfaces to heat, and thus to outgas.

The GITC-425 performs degas by using Resistive heating (I 2 R). An electrical current is passed through the grid structure. This causes these wires and all the gauge elements to get hot. In order to thoroughly outgas a hot filament gauge tube allow 5 to 45 minutes of operation in the degas mode. It may take a longer period of degas time or repeated degas cycles if the gauge is extremely contaminated.

X-ray Limit

The x-ray limit is one of the fundamental factors, which limit the minimum pressure that is measurable by the hot filament ionization gauge. In any gauge there is a hot, electron-emitting filament on the axis of a cylindrical electrode structure. Surrounding the filament is a positively biased electron collecting grid, and a negatively biased ion collector surface. Electrons emitted from the filament are accelerated to the grid. Some of the electrons hit gas molecules and ionize them. The positively charged ions are attached to the ion collector circuit. The arriving charged ions give rise to a current in the ion collector circuit. The ion current is supposed to be proportional to the pressure in the gauge tube.

When the emitted electrons hit the grid they impact with enough energy that soft (low energy) x-rays are generated. These x- rays are emitted from the grid structure in all directions, so that many of the x-rays hit the ion collector surface. When a x-ray hits the ion collector it simulates the emission of a negative electron from the ion collector. A negatively charged electron leaving the ion collector is electrically equivalent to a positively charged ion arriving at the collector. The electronics in the ion collector circuit cannot distinguish the difference. Therefore as long as the arriving ion current is much greater than the x-ray stimulated (leaving electron) current, the gauge can accurately indicate the pressure. But, if the pressure is so low that the ion current becomes comparable to or less than the x-ray stimulated electron current, the gauge electronics will only indicate a lowering pressure down
to that "stimulated pressure," analogous to the value of the x-ray stimulated electron current. At this point the gauge is said to be at its x-ray limit.

Electrometer

The electrometer collects and monitors the current in the collector circuit and thus indicates the vacuum level by the amount of current. The electrometer is a high precision integration amplifier that converts the current to a pulse width. The microprocessor computes the vacuum by timing the width of the pulse. The electrometer must be able to monitor a large current flow in the 10 -4 torr range and a very minute current flow in the 10 -9 torr range.

Operating Principles

The thermocouple sensing mechanism consists of a tube with an internal filament, which is heated by passing a current through it. A thermocouple filament is welded to the center of the heated filament. The thermocouple filament generates an output voltage as it is heated. The heat transfer between the filaments varies with the vacuum pressure, thus the output voltage varies. The thermocouple voltage is directly proportional to the increased temperature of the filament and thus generates an increase in voltage. A sensitive millivolt-meter, calibrated and marked to read directly in microns provides a reading of the thermocouple output. The reading in microns is displayed on a bar graph on the front panel of the controller.

Controller Interface

The GITC-425 Ion Gauge Controller has provisions for two thermocouple tubes. Thermocouple 1 is for use in monitoring the vacuum system pressure and is displayed on a bar graph located on the front panel of the controller. Thermocouple 2 is usually used to measure a secondary vacuum like in a foreline, roughing pump or insulation vacuum. TC2 is displayed on a bar graph of its own. The output of both thermocouple 1 and thermocouple 2 are amplified by a precision OP AMP circuit for an accurate reading. The signals are sent to the microprocessor via the A/D Converter. The microprocessor then converts the voltage to a vacuum pressure, using a lookup table located in the microprocessor.

Calibration of Thermocouple's

The GTC-036 thermocouple tubes are designed with very close drive current specs, for this reason if the tubes are switched or replaced, there is no need to recalibrate GITC-425 Controller.

If you wish to recalibrate the TC tubes the following procedure should be used:

Zero Adjust

Connect a GTC-036 tube that is at atmosphere, to the unit. Using the Adjustment potentiometers set the reference voltages to .10 VDC. The voltage reading for TC1 is between the side of R53 closest to the front and ground (chassis). For TC2, the voltage reading is between the side of R50 closest to the front and ground.

Gain Adjustment
Connect a TC tube that is in a known vacuum from 10^{-2} to 10^{-3} Torr, to the GITC-425. Turn the Gain potentiometer until the reading is the same as the vacuum

Potentiometer Names

Adjustment	**TC1**	**TC2**
Zero	R49	R46
Gain	R42	R39

The GITC-425 Ion Gauge Controller has a full functioning remote computer port. All aspects of the GITC-425 can be controlled via the RS-232 interface by sending simple commands to the controller. Any computer or terminal with a serial RS-232 port can be connected to the GITC-425. If the controller is connected when the power is turned on the software version name will be sent to the computer.

RS-232 Interface

The RS-232 interface uses a standard 9 pin serial port. The port specifications are listed in below. The Pin out of the controllers RS-232 port is listed below, you can get by with only the TX, RX & Ground wires connected. The DTR is connected internally to the DSR and the RTS to the CTS.

	Pin #	**Function**
Interface Type RS-232	1	NC
Interface Mode DTE	2	TX (Transmit Data)
Baud Rate 2400	3	RX (Receive Data)
Stop Bits 1	4	DTR
Data Bits 8	5	Ground
Parity Bits None	6	DSR
Flow Control None	7	RTS
Voltage of Logic 0 +12 VDC	8	CTS
Voltage of Logic 1 -12 VDC	9	NC

Software Commands

- All commands must terminate with a <CR>
- The controller will echo back the characters received (unless disabled).
- Standard ASCII is used
- "n, nn, nn.n" refer to a numerical value
- "m.m" refer to a mantissa value
- "ee" refer to an exponent

Command	Response	Example	Description
=RS	S=*nn* (1 to 64)	=RS S=10	Read Sensitivity
=RE	E=*nn.n* (1.0 to 25.5)	=RE E=10.0	Read Degas Time
=RT	T=nn (1 to 99)	=RT T=30	Read Degas Time
=R1	1=m.m-ee (9.9-01 to 1.0-10)	=R1 1=2.3-04	Read Setpoint 1
=R2	2=m.m-ee (9.9-01 to 1.0-10)	=R2 2=5.0-09	Read Setpoint 2
=RV	V=m.m-ee (2.0-00 to 1.0-10)	=RV V=5.0-07	Read Vacuum
=R*	*= b1b2b3b4	=R* *=1010	Read Status .b1= Ion on .b2=Degas On .b3=SP1 On .b4=SP2 On
=SS:nn (1 to 64)	S:OK	=SS:25 S:OK	Set Sensitivity
=SE:nn.n (1.0 to 25.5)	E:OK	=SE:4.0 e;OK	Set Emission Current
=ST:nn (1 to 99)	T:OK	=ST:20 T;OK	Set Degas Time
=S1:m.m-ee (9.9-01 to 1.0-10)	1:OK	=S1:1.0-4 1:OK	Set Setpoint 1
=S2:m.m-ee (9.9-01 to 1.0-10)	2:OK	=S1:1.0-4 1:OK	Set Setpoint 2
=SF1	F=:On	=SF1 F=On	Turn on Ion Gauge (You should check the status to see if the filament stays on or get shut off)
=SF0	F=Off	=SF0 F=Off	Turn Off ion Guage

=SD1	D=On	=SF0 F=OFF	Turn On Degas (you will get an error 3 if the ion gauge is not on)
=SD0	D=Off	=SD0 D=Off	Turn Off Degas
	Error 1	Sdkcjbn	Syntax Error
	Error 2	=ST:99 Error 2	Number Out of Range
	Error 3	=ST:99 Error 3	Operation Not Allowed
	Error 4		TX Buffer Overflowed
=R#	IFS400 V?.??.?? SN <serial number>	=R# IGS400 V.00.00	Read Serial number
=X	IGS400 V?.??.??	=X IGS400 V.00.00	Read GITC-425 (Displays Software Version)

Ion Gauge Shut Down Codes
When the GITC-425 turns off the ion gauge tube, the controller will display a CODE# on the main display. This will stay on the display for about 2 seconds. Here is the list of the code numbers and what they mean:

CODE1
The Ion Gauge shuts off because it can not get or hold the Emission Current.
Possible Problems: Pressure is to High
Ion Gauge Cable is disconnected
Filament Fuse is blown

CODE 2
The Ion Gauge shuts off because it can not establish Collector Current.
Possible Problems: Pressure is too Low
Ion Collector BNC is disconnected

CODE 3
The Ion Gauge shuts off because the vacuum higher than $9.9x10^{-4}$. This is the normal shut down mode when bringing the pressure up in the vacuum system.

CODE 4
There is a problem with the EPROM.
If this Code is displayed call Myers Vacuum for repair.

CODE 6
There is a problem with the RS-232 receiver routine.
Possible Problems: RS-232 Cable is loose or broken
Baud Rate or Communication Setting is wrong.

GITC-425 Ionization Gauge

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Troubleshooting Guide for the GITC-425

Symptom Possible Cause

Unit won't power up, no response to power switch.
- No power to unit
- Power cord not inserted tightly
- Power fuse is blown

3A Power fuse blows repeatedly.
- Wrong line voltage
- Wrong Power fuse rating
- Defective Power Supply

8A fuse blows repeatedly.
- Ion Gauge tube filament is shorted
- Ion Gauge cable is shorted

Tube and ION LED won't turn on
- Mode select switch is not in vacuum

AutoStart won't work
- AutoStart switch set to "Off"
- TC1 is calibrated wrong

Ion Gauge tube won't come on, or comes on briefly then shuts off with CodE1 displayed. (The Tube does NOT light up at all)
- Unplugged Ion Gauge Cable
- Burned out filament
- Blown 6A fuse
- Broken Ion Gauge Cable
- Defective Power Supply

Ion Gauge tube won't come on, or comes on briefly then shuts off with CodE1 displayed. (The Tube light's up briefly)
- System pressure is too high
- Badly contaminated Ion Gauge tube
- Defective Ion Gauge Cable
- Defective Ion Gauge tube

Ion Gauge tube won't come on, or comes on briefly then shuts off with CodE2 displayed.
- System pressure is too low
- Ion Collector BNC is unplugged
- Ion Collector wire is off of the tube
- Defective Ion Gauge Cable

Ion Gauge tube won't come on, or comes on briefly then shuts off with CodE3 displayed.
- System Pressure is too high

Degas won't come on
- Ion Gauge is not turned on
- Mode switch is not in vacuum

Thermocouple reading stays at ATM

- Blown thermocouple tube
- Bad cable or connection

Thermocouple reading is low or never reaches 1.0 x 10^{-3} Torr

- TC tube out of calibration

CodE4 is being displayed on the controller.

- Send Unit back for repair

CodE6 is being displayed on the controller.

- RS-232 Cable is loose or broken
- Wrong Communication Settings.