1.0 Introduction

1.1 Who is RKI Instruments?

RKI Instruments, Inc. is an innovative gas detection company located in Union City, California. RKI began in 1994 with the belief that distributors and customers deserve a permanent reliable source for advanced gas detection instruments and sensors.

RKI is partnered with Riken Keiki Company, Ltd., the world leader in gas detection and sensor technologies. Celebrating over 65 years in the gas detection business, Riken has over 200,000 points of detection world wide in the semiconductor industry alone. RKI is the exclusive North American supplier of Riken products.

RKI is also known for unique product development. Through ingenuity and years of industry experience, we have developed our own line of gas detection instruments and accessories to complement the Riken product line. RKI developed products are designed around Riken's long lasting field proven sensors.

The EAGLE™ is the first and most popular product that RKI has developed. With over 300 configurations and the capability of simultaneously monitoring up to 6 gases, it is the most versatile portable instrument in the industry detecting the widest range of toxic gases. Following developmental breakthrough of the EAGLE, RKI also designed and introduced many additional instruments and controllers:

Beacon 110 - Single point wall mount controller

Beacon 200 - Two point wall mount controller

Beacon 800 - Eight channel wall mount controller

Pioneer 4W - Four channel wall mount controller

Pioneer 16R - 16 point rack mount controller

PS 2 - Single point stand alone system

S-Series transmitters: Basic 4-20mA transmitters for LEL/O2/H2S/CO and other gases

M2 – Diffusion sensor / stand alone transmitter with display and relays

For 12 straight years, RKI has continued to grow and has moved into a new 19,000 square foot facility in May, 2005. RKI's continued success is attributed to our seasoned professionals. Each RKI employee has an average of 11 years of gas detection experience and our company's top six executives combined industry experience totals more than 130 years.

This combination of quality products and knowledgeable, supportive people provides you with the ability and opportunity to confidently face almost any gas monitoring application. Our policy is to provide strong, quick support to our customers and outlets, and to stand fully behind our products.

Who is RKI Instruments? RKI is gas detection for life.

1.0 Introduction

1.2 Purpose of This Manual

The intended purpose of this manual is to provide a guide to assist users and specifiers of gas monitoring systems in the selection of the proper RKI gas monitoring system for their use. RKI supplies a wide variety of gas monitors, capable of solving a wide variety of different applications. This manual describes many of the systems and systems components available from RKI. This manual is not intended to be a complete guide or provide a solution to every possible gas detection situation. For assistance with the use of this manual, or for help with your particular situation or needs, please feel free to contact RKI Systems Applications Engineering.

1.3 History of Gas Detection

Attempts at gas detection started in coal mines, where the hazards of explosive atmospheres, Oxygen deficiency, and toxic gases were responsible for a high mortality rate among miners. Open flame lamps were used as the earliest warning method—they burned brightly in the presence of combustibles or dimly in a low-Oxygen environment—but too often they ignited explosive atmospheres.

Caged birds (the origin of the phrase “canary in a coal mine”) were also tried as a means of early warning. Some species of small birds would collapse in Oxygen-deficient or toxic conditions sooner than humans; the condition of the bird indicated the need to evacuate. This approach also had drawbacks; some birds were not as sensitive to these conditions as humans, again resulting in miner deaths.

In 1925 Dr. Jiro Tsuji of the Physical and Chemical Research Institute in Japan developed an interferometer; an “explosive meter” based on light-wave interference. This invention was the cornerstone achievement in modern gas detection, combining accuracy, safety, and reliability. Dr. Tsuji later founded Riken Keiki Co., Ltd, a world leader in all types of gas detection.

In the USA, the catalytic combustion gas sensor, and the first gas detection meter, (the J-W gas indicator) was developed in 1927 by Dr. Oliver W. Johnson. This research and instrument development was sponsored by Standard Oil. In 1926 there were several explosions of ships tanks, and it was recognized that some method of testing for this hazard was badly needed.

Since the early years, gas detection technology has advanced tremendously. Riken Keiki has always maintained their leadership in this industry by remaining on the forefront of sensor research and instrument development.

1.4 Reasons for Detecting Gas

Gas Detection is often necessary or desirable for a number of reasons. The use of a gas monitoring system, with appropriate action taken if dangerous levels of gases are detected, can help to prevent an explosion or can help to prevent worker injury or exposure to toxic gases. Action can be taken, and initiated automatically by the gas monitor, to help prevent the gas level from rising further. Such action could be the automatic shut-off of gas valves, turning on a ventilation fan, shutting down a process, or audible and visual alarms to alert and evacuate personnel. In some situations, the gas monitor is used for process control. RKI gas monitors are generally intended for worker and plant safety, and are not intended for process control use where high levels of gases or vapors may be present all the time. Some examples of common gas monitoring applications are as follows:

1.4.1 Flammable gas detection for worker and plant safety:

Flammable gases and vapors pose a threat of explosion, which can maim or kill personnel and cause property damage. Typically first alarm levels are set to 10% LEL (this is 10% of the amount of gas necessary to cause an explosion, and is the OSHA mandated first alarm level). If gas sources are automatically shut off, or ventilation fans turned on, it can prevent the gas level from reaching a potentially flammable level.

1.4.2 Oxygen detection for worker safety:

The Oxygen level in normal fresh air is approximately 21% Volume. Reduced Oxygen levels can cause dizziness in workers and potential passing out. If levels are too low it can cause serious brain damage or death. In some work or underground environments, low Oxygen conditions can be formed either by displacement of the Oxygen by another gas, or by consumption of the Oxygen in the area by a chemical or biological process. An Oxygen monitor can help to prevent injury or death by providing an early warning of reduced Oxygen concentration. Typically a low Oxygen alarm is triggered if the Oxygen level drops below 19.5% Volume (the OSHA mandated level), and personnel can be evacuated until the problem is properly investigated and resolved.

1.4.3 Toxic gas monitoring:

Toxic gases such as H2S or CO can be present in refinery or petrochemical applications, parking garages, and many other situations. Monitoring of these gases, and appropriate action taken if alarm levels are exceeded, can help to prevent injury or death. In Semiconductor plants, and many other plants and factories, often toxic gases are used in a process or can be generated by a process. Monitoring of these gases can help to alert personnel to potentially dangerous situations.

1.4.4 Duct or Tool Monitoring:

In Semiconductor plants, many highly toxic and flammable gases are used in the manufacturing processes. Gas cabinets, valve manifold boxes, and semiconductor fabrication tools, are generally heavily ventilated with ducts drawing air away from these devices. Gas monitoring of the exhaust ducts can provide an early indication of a leak prior to its entering the general work space where it could endanger worker health.

1.4.5 Many other applications:

Many plants, factories, tunnels, parking garages, underground vaults, storage facilities, and a wide variety of other situations, have the potential for having dangerous gases or vapors present. RKI offers a wide selection of equipment to enable us to solve almost any gas monitoring safety related application.

1.5 RKI / Riken Benefits

Riken Keiki Co. Ltd. is over 65 years old and has more experience with semiconductor gas monitoring than any other company. A large staff of engineers and scientists constantly develops new techniques of gas detection, and also improves existing techniques. They have developed gas monitoring technology that is unique to solve specific application problems for the semiconductor industry. Here are a few examples:

1.5.1 Hydrogen Detection

For Hydrogen detection in semiconductor applications, Riken has developed a unique hydrogen specific solid state sensor. It has a very sensitive range of 0-2000 ppm for hydrogen, and the sensor has a molecular sieve to make it very specific to just hydrogen. In other words, you will not get interferences or false alarms from any other gases such as IPA, which historically can cause a problem in semiconductor plants. Riken also offers an LEL H2 sensor that is lighly specific to hydrogen detection. We believe no other manufacturer offers specificity like this.

1.5.2 NF3 Detection

For Nitrogen Trifluoride detection we utilize a pyrolyzer heater to break down the NF3 to be detected as NO2. Our field proven pyrolyzer works extremely well and the replaceable heater element has a life of at least two years. We have thousands of these in operation worldwide, and we feel there is no other similar system on the market that approaches the reliability of our Pyrolyzer.

1.53 TEOS

We offer a unique TEOS monitor that has no interferences from IPA or other commonly troublsome interference gases. Our TEOS detector utilizes a pyrolyzer to convert the TEOS to SiO2, and then an ionization chamber to detect the SiO2 particulates. This provides a trouble-free (no interference) detector for TEOS.

1.5.4 Detection Capability and Ranges

Compare our detection capability and ranges to those of other manufacturers, and you will find that we offer the best selection of gases and ranges in the industry for semiconductor gas monitoring.

1.5.5 Long Life Sensors

Long life, stable sensors are our strongest point. Our sensors are all built and tested under rigid conditions. Excellent design and quality control assures that our sensors will easily last over two years, and it is not uncommon for them to last more than 3 or 4 years in some cases. As a result, your sensor replacement costs and total cost of ownership will be low with our equipment.

1.5.6 No Zero Drift

Zero drift can cause costly false alarms. Our systems, and our GD-K77D and M2 detector/transmitters, contain unique electronics and software that effectively eliminates zero drift. Our monitors can determine the difference between long or short term zero drift of the sensor, and an actual gas signal, and they eliminate any drift. This means that whether you use our systems complete, or use our transmitters to tie into a PLC system, you will not have false alarms caused by zero drift.

1.5.7 Long Calibration Frequency

The high stability of our sensors means that calibration is required only every 6 to 12 months. This again helps to keep maintenance costs as low as possible.

1.5.8 Speed of Response

Our systems provide extremely fast response. For most gases, T60 response time is less than 10 seconds. We recommend the use of sample draw detectors for most semiconductor applications. Since the sample is drawn in and forced directly onto the sensor, the response is very quick; generally faster than using a diffusion sensor. Especially for gases that are strongly absorptive, (such as O3, HF, HCl, and F2), diffusion sensors from other manufacturers generally have low sensitivity and slow response to such gases.

1.5.9 Accuracy

Our sample drawing heads provide higher field accuracy than most diffusion techniques can. When a diffusion sensor is calibrated, it must be either lowered into a container of gas sample, or a gas sample can be flowed onto it by placing a test cup over the sensor. The first of these methods is stagnant and depends on the gas molecules diffusing to the sensor. The second method actually forces the gas onto the sensor, which causes a different reading than using the first method. Also, if gas is flowed onto a sensor face, the velocity and angle of the flow are critical in determining the sensor signal output. So, when you install a diffusion sensor into a room, the signal from the sensor will depend on the placement of the sensor and the gas flow velocities across it's face. Likewise, for a sensor installed into a duct or other enclosed compartment, the speed and direction of the airflow can greatly affect the signal output from the sensor. Since our sample draw heads always present the gas to the sensor in the same way, both during calibration and actual use, there is no concern of the external airflows affecting the accuracy.

1.5.10 Maintenance

Our GD-K77D sensor/transmitter is designed so that maintenance is very quick. The sensor can be replaced in less than one minute without the use of any tools. The pump also can be replaced in less than one minute. Both the sensor and the pump are designed for long life so a minimum of servicing will be required.

1.5.11 Manufacturing Capability

Riken has enormous sensor manufacturing and test capability, making approx. 50,000 sensors per year of all types. Also, since the company has over 700 employees, we generally can get you what you need, when you need it.