

# EXPANDING LABORATORY PRODUCTIVITY AND CAPABILITIES



## **FIAS 100 and 400**

Flow Injection for Atomic Spectroscopy

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**PerkinElmer**<sup>®</sup>  
*For the Better*

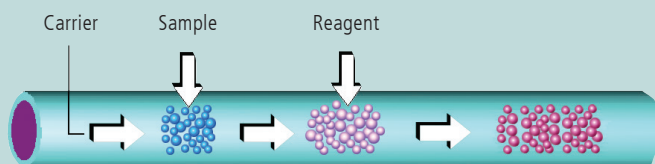
# Increase Productivity on PerkinElmer AA and ICP-OES Systems

Sample handling is an important aspect of any successful trace elemental analysis. On-line procedures for sample preparation and delivery are increasingly becoming methods of choice as the demands for productivity increase. Flow injection for atomic spectroscopy (FIAS) is a superb complement to PerkinElmer atomic absorption (AA) and inductively coupled plasma optical emission spectroscopy (ICP-OES) systems as a means of sample preparation and delivery. A fully integrated and automated system, the FIAS can dramatically increase laboratory productivity and capability.

Flow injection can be used in a variety of ways to enhance the productivity of your laboratory, including:

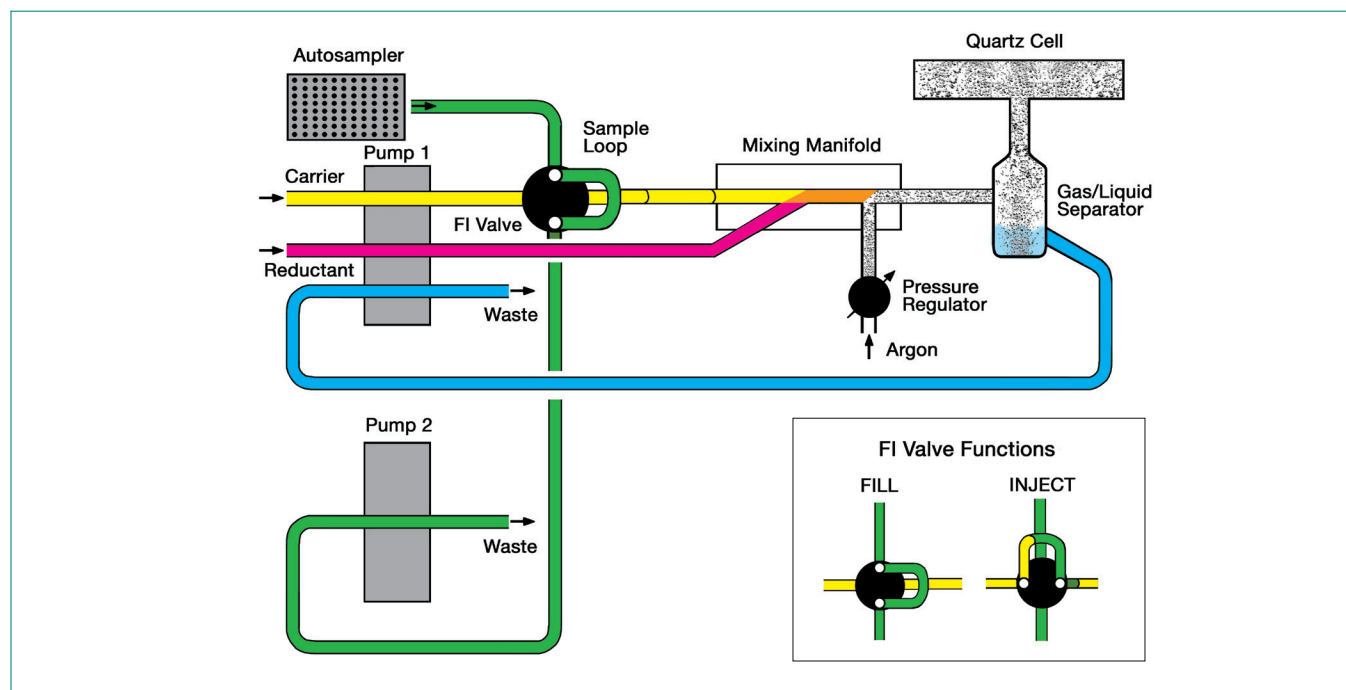
- Automated hydride generation for improved detection limits for hydride-forming elements
- On-line addition of sample additives and internal standards for reduced sample-preparation time
- Sample injection into a carrier stream to reduce washout times and improve stability for high-concentration samples

## What is Flow Injection?



Flow injection refers to the process of using a valve and pump assembly to inject small portions of sample into a stream of carrier solution. This schematic shows a sample slug being inserted into a moving carrier stream.

In the example below, a reagent is also inserted into the stream, which will be mixed with the sample to perform a type of sample pre-treatment (e.g., hydride generation).



Schematic diagram of FIAS 400 system for automated hydride generation.

# Fully Automatic Flow Injection for Improved Detection Limits

Flow injection (FI) fully automates mercury/hydride procedures, even for sequential multielement determinations.

## Hydride Generation

The FIAS 100 and FIAS 400 systems can perform up to 180 individual determinations per hour in the FI-MHS (Mercury Hydride System) operating mode. For fully automated analyses, an optional S10 autosampler can hold up to 270 samples and analyze them in any desired sequence. All that has to be done is to program the necessary parameters using Syngistix™ software for AA or ICP, depending on the technique. While in the automatic mode, the system monitors and controls the entire process.

The analytical performance of the FIAS systems is exceptional compared to flame AA analysis without hydride generation, as is shown by the detection limits in Table 1. Equally impressive is the performance of the FI-mercury/hydride technique for the analysis of samples with complex matrices. As the element to be determined is separated from the sample matrix, measurement takes place practically free of matrix interference and nonspecific absorption.

## Mercury

Although mercury determination can be combined with other elements in an ICP-OES analysis, it is typically measured in a dedicated analysis using mercury cold-vapor generation and AA detection. The FIAS system coupled with AA detection and the dedicated FIMS mercury system both provide detection limits compliant with regulatory methods.

Table 1. Detection Limits (µg/L) Using Flame and Hydride Generation AA.

Element	Hydride AA*	Flame AA
As	0.03	150
Bi	0.03	30
Sb	0.15	45
Se	0.03	100
Sn	0.10	150
Te	0.03	30

\*500 µL of solution

## Benefits of Flow Injection Mercury/Hydride Analysis

- Full automation yields high sample throughput
- Reduced reagent and carrier gas consumption for lower operating costs
- NaBH<sub>4</sub> or SnCl<sub>2</sub> methodologies for mercury
- Lower memory effects improve throughput
- Significantly lower interferences provide accurate results

# FIAS-Furnace for GFAA Hydride Analysis

## FIAS-Furnace Coupling

Combining the benefits of flow injection with the excellent sensitivity of graphite furnace provides additional performance and sample-handling capability.

Graphite furnace AA is one of the most sensitive techniques for trace metal determinations. However, with this technique, detection limits are constrained by the limited sample-volume capacity (typically 10 to 50  $\mu\text{L}$ ). This prevents the determination of ultratrace analyte concentrations in some samples. In such cases, time-consuming preconcentration procedures, or more expensive analytical techniques such as ICP-MS, are required.

With flow-injection or continuous-flow FIAS, hydride-forming elements or mercury can be concentrated in the graphite furnace using several milliliters of sample. Thus, detection limits are improved by up to two orders of magnitude (100 fold) or more (Table 2).

In addition, since the analyte elements are removed from the sample matrix, chemical and background absorption interferences are virtually eliminated, improving analytical accuracy.

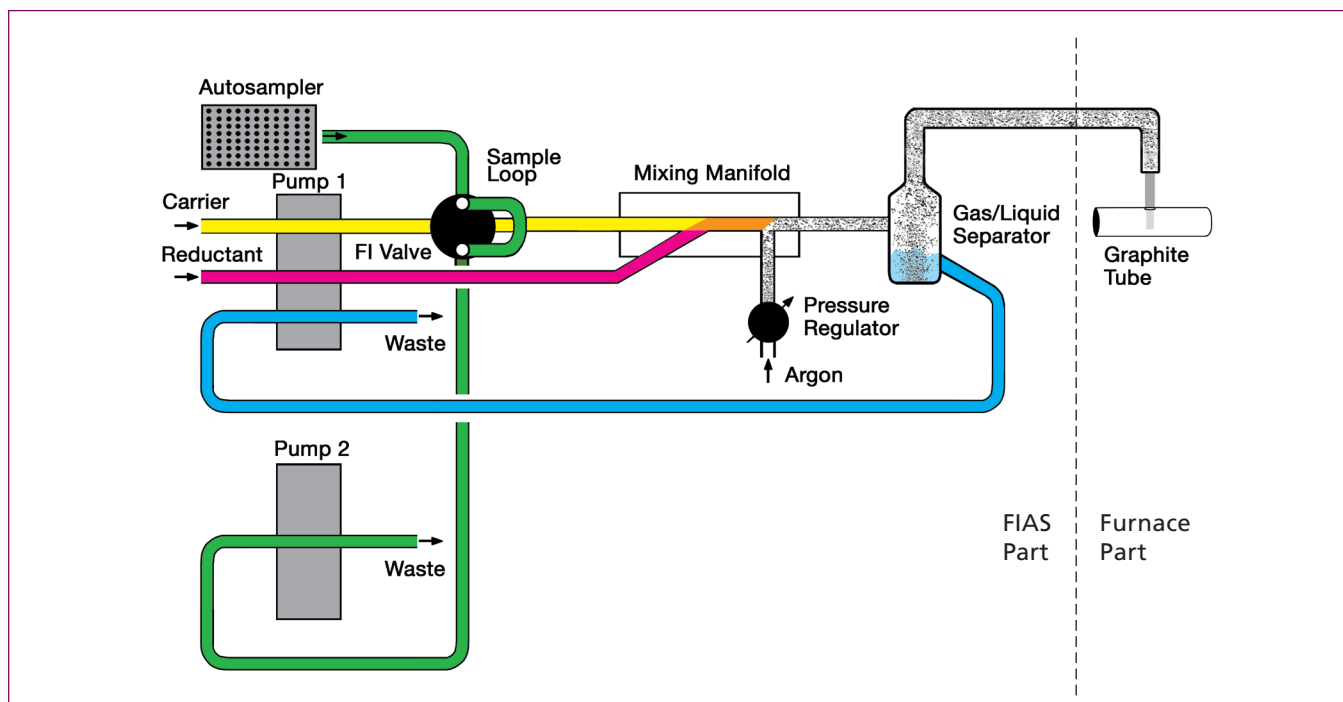
Table 2. Detection Limits for Aqueous Solutions Using Graphite Furnace and FIAS-Furnace Coupling.

Element	Detection Limit ( $\mu\text{g/L}$ ) Graphite Furnace*	FIAS-Furnace**
As	0.13	0.002
Bi	0.13	0.003
Ge	0.13	0.010
Sb	0.13	0.003
Se	0.13	0.001
Sn	0.25	0.006
Te	0.25	0.003

\*20  $\mu\text{L}$  sample volume \*\*5 mL sample volume

### Benefits of FIAS-Furnace Coupling for the Determination of Hydride-Forming Elements

- Detection limits improved by up to 100 fold
- Elimination of chemical and background interferences
- Fully automated operation improves productivity
- Eliminates time-consuming preconcentration techniques
- Cost-effective solution for ultratrace determinations



Schematic diagram of FIAS-furnace setup.

# Increase Your Lab Flexibility with FIAS for AA and ICP-OES

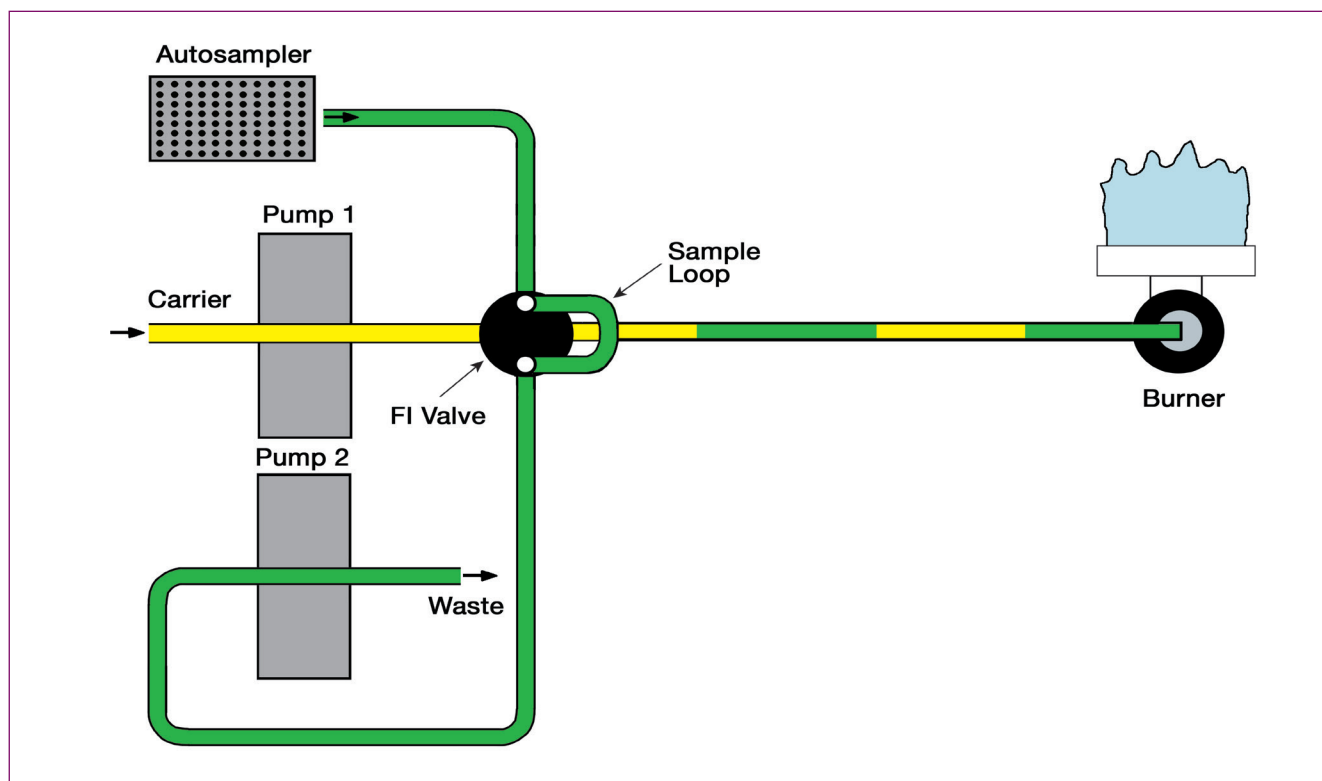
Flow injection represents one of the most flexible and efficient means of sample handling and delivery, offering several advantages for your AA or ICP-OES system. Plus, the system has been fully integrated with Syngistix for AA and ICP software.

Flow-injection analysis is ideally suited for samples containing high levels of dissolved solids. For example, saturated salt solutions or dissolved fusion mixtures can be directly analyzed for extended periods. Since the system is continuously rinsed with the carrier stream after each sample measurement, there is reduced danger of blocking the nebulizer or burner slot in AA. This maximizes instrument stability and reduces the time required to perform recalibration and maintenance. This type of sample delivery is also important when a high concentration of the analyte is present, reducing washout times.

Smaller samples (as small as 50  $\mu\text{L}$ ) can be used with flow injection, reducing the consumption of valuable or limited sample volumes. Low sample consumption is also beneficial for routine analysis. For example, with fully automated sequential multi-element analysis, more determinations can be performed with a given volume of sample.

## Benefits of FIAS with AA and ICP-OES

- Higher tolerance for complex sample matrices
- Faster washout of high-concentration analytes
- Lower sample consumption
- Closed system reduces contamination



FIAS 400 flow schematic.

## FIAS 100/400 Systems – Specifications

System Description	Automated flow injection system for use with Flame AA, cold-vapor and hydride-generation AA, graphite furnace AA and ICP-OES systems. The FIAS 100 system is provided with one peristaltic pump and the FIAS 400 system is provided with two peristaltic pumps.
System Control	Fully automated operation with computer-controlled spectrometer systems through control windows integrated into PerkinElmer instrument-control software.
Transport of Reagents	Stepper-motor driven peristaltic pump(s) with a maximum of eight channels each for tubing with 0.13 to 3.18 mm inner diameter. Pump speed is selectable from 20 to 120 rpm.
Sampling and Flow Switching	FI switching valve with five ports and exchangeable sample loops. All systems have exchangeable sample loops of various volumes.
Gas Supply	Carrier gas stream (argon) flow controlled from 40 to 250 mL/min by flow meter. Required inlet pressure: 320-400 kPa. Automatic switch-off after operating pauses of more than 10 min.
Absorption Cell	Quartz cell is required for mercury/hydride AA analysis.
Cell Heating	The cell can be heated using the air/acetylene flame or an optional electrically heated mantle (100 to 1000 °C).
Data Connection	Built-in RS-232C interface.
Power Requirements	115 VAC or 230 VAC $\pm$ 10%, 50/60 Hz $\pm$ 1%, 750 VA maximum.
Regulatory Compliance	Classified as a laboratory instrument. Complies with the applicable European Union directives and standards for safety, hazardous substances (RoHS) and electromagnetic compatibility for CE marking. The instrument has been developed and is produced in compliance with ISO 9001.
Weight	11.2 kg.
Dimensions (WxHxD)	42 cm x 18 cm x 41 cm (including sample tray).

### Expect More from the Leader in Atomic Spectroscopy

PerkinElmer has been at the forefront of atomic spectroscopy technology for over 50 years. No matter what your field, application or sample type, we have the tools and expertise to help you achieve accurate results quickly, efficiently, effortlessly.

With tens of thousands of installations worldwide, PerkinElmer systems are performing inorganic analyses every hour of every day. So turn to the most trusted name in the industry. And take advantage of a complete array of solutions engineered for unparalleled performance, accuracy and confidence.

For more information on our full suite of atomic spectroscopy products and services—including a wide array of mercury analyzers and sample preparation tools—please visit [www.perkinelmer.com/atomicspectroscopy](http://www.perkinelmer.com/atomicspectroscopy).

### Expand Your Expectations of a Lab Services Provider

Optimize your FIAS with our comprehensive suite of services from PerkinElmer OneSource. From instrument service and repair to analytics and optimized scientific workflows, OneSource provides all the tools you need to increase your lab efficiencies and get more out of your flow injection system. Far beyond the traditional model of a laboratory services company, OneSource becomes an integral part of your business, providing a high level of technical support and scientific expertise. Expect more from your laboratory services provider and discover our comprehensive set of tools to help empower your science and drive your business.

- Business intelligence solutions
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