



## ***New Total Solutions in Calibration: shorter, more technical content, new online version***

We have changed the *Total Solutions in Calibration* newsletter, making it shorter and easier to read. And at the same time, we have introduced a new online version with extended content. From now on, we will print one complete application note in each edition. Other new application notes will be referred to, so you can order them from us or view them on the [calibration.fluke.com](http://calibration.fluke.com) website. And, of course, there will still be other articles about Fluke products, services and news.

As you can see, the newsletter is now shorter. We have eliminated the training schedules and events, because these are always kept up-to-date and complete on the Fluke websites and in the online version of *Total Solutions in Calibration* newsletter.

By subscribing to this online newsletter, you get a number of benefits: To start with, you will be notified automatically by email when the next issue is published. Additional product information is readily available by referencing the product pages on our website, and you can order more product or application information online. The online newsletter is published in English, German, French and Spanish, with additional languages planned for the future. Additional articles matching your interests, and not included in the printed version, may also be published in the online *Total Solutions in Calibration*. And, of course, you always have online access to back-editions.

With these major changes in the content of the printed version, and the availability of the online edition, we would like to ask you which version you would prefer to receive.

To **continue to receive** the printed or online *Total Solutions in Calibration*, please visit <http://www.fluke.com/calibrators/newsletter>, click on "Subscribe" in the menu and select "New User Registration." Enter your email address and personal password, and complete the subscription form by entering your company information and selecting either the online version or printed version at the bottom of the form. This registration ensures that you will start to receive the online version or continue to receive your printed version.

If you do not have web access and would like to keep receiving printed copies, you can also complete the enclosed re-registration form and fax it to the fax number shown.

If you have any comments or questions about the new format, please let us know. We are interested in hearing more about what interests you. Additionally, if you have a story you would like to submit about how you use a Fluke calibrator or reference multimeter, please tell us. If your story is published you could win a new Fluke multimeter! Please send your comments, questions or stories to [barbara.richardson@fluke.com](mailto:barbara.richardson@fluke.com).

# New Fluke Priority Gold CarePlan helps keep your calibration instruments up and running

When your calibrator is out of your lab for calibration or repair, it isn't working for you. Fluke's new Priority Gold CarePlan can help. It's a comprehensive instrument calibration and repair support program that helps you reduce downtime and protect your investment in Fluke calibration hardware. You get all these extra privileges:

- Three-day in-house turnaround time for annual instrument calibration
- Automated annual notification of calibrations due
- Free repairs with five-day in-house turnaround time; or we'll lend you a free replacement calibrator
- Free product updates
- 10 % discount on product upgrades
- 20 % discounts on Fluke Metrology training classes
- First-in-queue priority telephone support

Gold CarePlan benefits are not available in all countries. Confirm availability with your local authorized representative.



**Details about the Priority Gold CarePlan are available in a free data sheet. To get your copy, just circle the appropriate number on the enclosed reply form.**

## Now through December 31, 2004... A special offer to get you started in dc/lf calibration

Get significant savings on this great basic combination of Fluke hardware, software, and training to help you get up and running quickly:

- **Fluke 5520A Multi-Product Calibrator with 600 MHz Oscilloscope Calibration option.** This workhorse instrument calibrates a wide range of today's electronic test equipment, including oscilloscopes to 600 MHz.
- **Fluke 8508A Reference Multimeter.** This 8.5 digit multimeter does the work of eight reference instruments and features reference standard accuracy and stability.
- **Fluke MET/CAL<sup>®</sup> procedures.** These warranted procedures operate under MET/CAL Plus Calibration Management Software to automate the operation of the 5520A and 8508A.
- **Fluke Calibration training.** A 50 % discount on any regularly scheduled Fluke calibration course.

Fluke offers you this combination of hardware, procedures and training at a great value — you save up to 20 % off the total price of the individual products if all purchased separately.



**For more information about this special offer, contact your local Fluke representative. For more detailed product information, just circle the appropriate numbers on the enclosed reply form.**

# total solutions

in calibration

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## Fluke 8508A application notes available

These application notes and technical papers about the 8508A Reference Multimeters are currently available:

- *Migrating from dc voltage dividers to modern reference multimeters*
- *Maximizing your reference multimeter, minimizing measurement uncertainties*

**To get your free copies of these application notes, just circle the appropriate number on the enclosed reply card.**

## Fluke achieves international standards accreditation for service center

Fluke Corporation recently announced accreditation of the service center at its Everett headquarters. The center was accredited to the stringent ISO/IEC 17025-1999 standard set by the American Association for Laboratory Accreditation (A2LA).

"The Everett Service Center has already obtained accreditation by the National Voluntary Laboratory Accreditation Program (NVLAP)," commented

Jorge Martins, manager of the service center's technical laboratory. "This new achievement gives customers additional confidence that the Everett Service Center can provide them with a full range of accredited services."

**If you have questions about where to obtain service for your Fluke or Hart Scientific products, contact your local Fluke representative. Information is also available on the Fluke web site, [www.fluke.com](http://www.fluke.com), and the Hart Scientific web site, [www.hartscientific.com](http://www.hartscientific.com).**

## Fluke and Hart Scientific customer training

Fluke Customer Training helps you get the most out of your test and measurement instruments and software. Current Fluke training schedules are maintained on the Fluke web at [www.fluke.com/2004caltraining](http://www.fluke.com/2004caltraining). Hart Scientific training information is available on the Hart website at [www.hartscientific.com/seminars](http://www.hartscientific.com/seminars).

**For more details about Fluke course descriptions, locations or schedules, circle the appropriate number on the enclosed reply form.**



## inside

### Calibration News

#### Page 1

*Fluke 8508A application notes available*

#### Page 1

*Fluke Corporation achieves international standards accreditation for service center*

#### Page 1

*Fluke and Hart Scientific customer training*

#### Page 2

*Fluke 396 Universal Waveform Generator*

### Application Note

#### Page 2

*Selecting a dry-well temperature calibrator that suits your needs*

**17** Issue 17  
Volume 5

# Selecting a dry-well temperature c

*Application note (complete within this newsletter)*

If you have industrial temperature sensors such as RTDs, thermocouples, thermistors, bi-metal thermometers or liquid-in-glass thermometers to calibrate, you need a reliable heat source to verify accuracy.

A dry-well calibrator is a great combination of accuracy, portability and price for industrial calibration applications. Typical dry-wells produce calibration accuracies  $\pm 0.5$  °C or better over a range of -45 °C up to 700 °C. In addition, for comparison of sensors in a dry-well's temperature block, hole-to-hole uniformity is typically  $\pm 0.05$  °C. These uncertainties are well matched to the typical uncertainties of industrial temperature sensors.

To select the appropriate dry-well for your industrial sensors, you should consider:

- Temperature range
- Accuracy, stability and uniformity
- Flexibility of well configuration
- Portability
- Sensor immersion
- Throughput

## Temperature range

The temperature limits of the dry-well must meet your minimum test requirements for the sensors being calibrated. The ideal calibration spans the entire usable range of the test sensor. However, extrapolating a non-critical temperature point may save time while not affecting the overall system uncertainty.

Even after a full-range calibration of your temperature sensor, it's a good idea to check its accuracy in the precise range it is most often used. If you calibrate an RTD between 0 °C and 100 °C but are only monitoring room temperature, you may want to set your dry-well to 25 °C and see how your calibrated sensor performs at its most important temperature.

## Accuracy and stability

The two most critical specs on a dry-well are accuracy and stability. Accuracy is how close the actual dry-well temperature is to the programmed set-point. Stability is the temperature fluctuation of the instrument around the desired

## Fluke 396 Universal Waveform Generator breaks new ground in universal waveform generator design

The 125 MS/s single-channel Fluke 396 Universal Waveform Generator combines arbitrary generator and synthesizer design with high resolution and a wide frequency range, offering versatile performance.

The 396 features 11 basic waveforms with adjustable parameters, all accessible from the front panel. Waveforms include sine, triangle, square, pulse, ramp, sinc, Gaussian, exponential up, exponential down, noise, and dc.

The 14-bit resolution provides 16,384 output levels,

allowing it to generate even audio and video waveforms with excellent fidelity and detail. The 125 MS/s sample rate provides excellent performance at high frequencies.

The new 396 includes a powerful, Windows-based program called ArbExplorer, which makes it fast and easy to generate waveforms. A virtual instrument control panel lets you control the 396 from your desktop, generating signals using standard functions and equations, or by drawing on the screen using the mouse.

Complex waveforms can be created easily, and waveform data can also be translated from formats such as ASCII and others.



**Detailed information about the new 396 Universal Waveform Generator is available on the Fluke web site. For a free data sheet, simply circle the appropriate number on the enclosed reply form.**



# calibrator that suits your needs

set-point over time. These two parameters add together to create the uncertainty of your calibration. If your dry-well does not meet your accuracy requirements and does not maintain a stable temperature, your probe could be reading a much different temperature than your display indicates.

A good rule of thumb is to make sure that your dry-well is at least twice as accurate as the sensors you are checking. Also, make sure to get a certificate from the manufacturer certifying that the accuracy is traceable to NIST. It shouldn't cost extra for the certificate.

Here's another tip. The dry-well should have at least the set-point resolution of the accuracy it claims or your target accuracy. For example, if you are calibrating an RTD to  $\pm 0.5$  °C at 100 °C and your instrument only displays temperature to  $\pm 1$  °C, you obviously can't claim better than 1 °C for your calibration.

## Uniformity

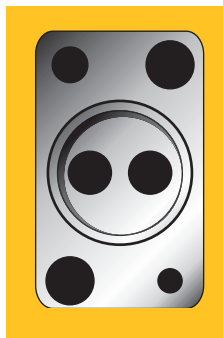
If you're using a reference thermometer, temperature uniformity throughout the block becomes critical. Gradients from the bottom of the block to the top of the block can be minimized by matching sensor depths (see "Sensor Immersion"). Well-to-well gradients are also inherent in the design and thermal characteristics of each dry-well and need to be factored into your total uncertainty calculation.

Some manufacturers confuse "accuracy" with well-to-well gradients, implying that their product is as "accurate" as its gradient. They fail to include stability and reference thermometer uncertainties, and they misrepresent their product's performance. Always consider how you are going to use your dry-well calibrator and then include the uncertainties that apply to your situation.

## Well flexibility

When purchasing a dry-well, make certain that the probes you need to test will fit in the unit's heated block. Most dry-wells use removable sleeves to size the main temperature well. This gives you the flexibility to calibrate

*A removable insert can be customized with two drilled holes for best accuracy.*



a wider variety of probes with one instrument. The best accuracy comes from the holes that are drilled directly into the block because the contact between the sensor and the heated block is better. Using a removable sleeve can add additional uncertainty by introducing an air gap in the block.

Make sure that as you compare sensors in the same block they are both in the same mass of metal. The manufacturer should be able to recommend the best way to compensate for the error in removable sleeves. For comparison calibrations in a dry-well, Hart Scientific recommends a specially designed sleeve with multiple holes in the same sleeve. This eliminates most of the introduced error.

## Portability



*Handheld block calibrators have made industrial calibration more portable.*

If you carry a lot of instruments to field sites, portability may be a concern. Size, weight and "carry-ability" are important factors to consider with many industrial applications. A dry-well should be designed for easy transport to the test site.

One of the most significant developments in dry-well technology was the emergence of the handheld dry-well. This brought dry-well technology to a new level of practicality. You can now pack a dry-block calibrator into your tool kit, whereas before you had to put it on a cart to move it around.

Some of these handheld units can be battery powered for greater portability. What we used to call portable is now bulky and heavy. Make sure that your unit adds to your calibration power, not to your back problems.

*continued on page 4*

## Selecting a dry-well . . .

*continued from page 3*

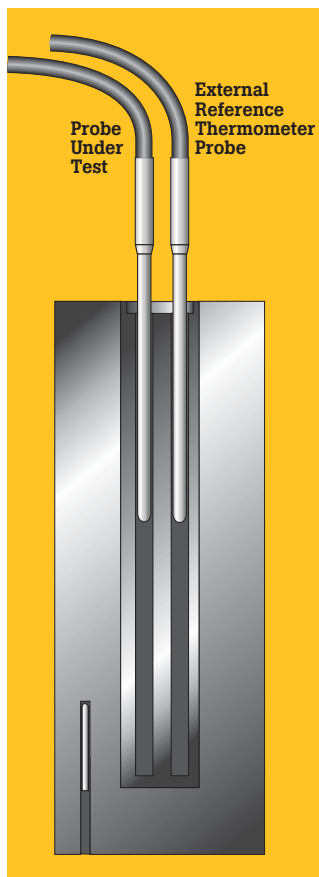
### Sensor immersion

Sensor immersion depth is a recurring topic when considering a dry-well for calibration of temperature probes. Immersion can be the single largest contributor to error in dry-well calibrations. In the ideal world, all of our sensor assemblies would be the same size and depth. Unfortunately, this is not the ideal world.

Immersing a 2-inch sensor assembly into a 6-inch well could yield an error up to 10°C. This is inherent in all dry-wells. In many cases, a bath is a better calibration medium, but not always practical. There are some techniques you can use to counter this error and bring a dry-well into a workable uncertainty level.

When calibrating a short-stem probe, always use a comparison technique. Do not compare the test reading to the dry-well display; it won't give you the best results. The dry-well is calibrated at the bottom of the well where the control probe is located. It's better to use a reference probe of similar size, diameter, and immersion depth into the block. The closer the sizes and depths match, the more accurate the comparison. Size impacts the amount of heat lost to ambient through the probe stem.

Immerse the similarly sized probes, the reference and test probe, at exactly the same depth into the block in holes that have a similar fit and distance from the heating source of the unit. What you are trying to achieve is identical heat properties inside the block, ensuring that both sensors are sensing the same temperatures in the same way. Any deviation will cause further error.



*Short-stem sensors should be calibrated by comparison at the same depth when using a block calibrator.*

### Throughput

If you are like the rest of the world, trying to calibrate as many sensors as possible in a limited time period, get a block calibrator that allows you to insert more than one probe at a time. If your unit only has one calibration well, have the manufacturer drill several holes into the removable sleeve.

An additional consideration for increased throughput is automation. Make sure that you select a manufacturer that has truly automating calibration software for controlling the calibration of your probes. This can save you an enormous amount of time. Also, make sure the unit you select includes a PC link, like an RS-232 interface, so if you need to automate in the future to stay competitive, you can.

Dry-wells have become the most practical tools in industrial temperature calibration. Units are built now that fit in your hand. Some are battery-powered and even accurate enough to be used as lab standards. Microprocessor-based controllers can store set-points and ramping cycles and even interface to your PC. Each unit is unique in its ability to satisfy the requirements of specific calibration applications.

Select the dry-well that best fits your application and you will have years of successful calibrating. If you have specific application concerns, call the manufacturer. They should be able to help you select the unit that best fits all the considerations mentioned in this article.



*Multiple hole blocks can increase throughput by calibrating several probes simultaneously.*

**Hart Scientific, a Fluke Company, makes some great dry-wells. To find out more, visit their web site at [www.hartscientific.com](http://www.hartscientific.com). Or circle the appropriate number on the enclosed reply form to get your free Hart Scientific catalog.**

## ***Now through December 31, 2004...*** **A special offer to expand your calibration capabilities**

Realize big savings and an immediate return on your investment when you add automated oscilloscope calibration capabilities to your laboratory:

- **Fluke 9500B Oscilloscope Calibrator.** This high-performance workstation disproves the notion that oscilloscope calibration must be time consuming and complicated.
- **Active Heads.** The 9500B provides full automation through its Active Heads. Five Active Heads are included as part of this special offer.
- **Fluke MET/CAL<sup>®</sup> procedures.** These warranted procedures operate under MET/CAL *Plus* Calibration Management Software to automate the operation of the 9500B.
- **Fluke Calibration training.** A 50 % discount on any regularly scheduled Fluke calibration course.

Fluke offers you this combination of hardware, procedures and training at a great value — you save up to 20 % off the total price of the individual products if all purchased separately.



***For more information about this special offer, contact your local Fluke representative. For more detailed product information, just circle the appropriate numbers on the enclosed reply form.***

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