
Online
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CAMPBELL SCIENTIFIC
Australia, Pty Ltd
WHEN MEASUREMENTS MATTER

In This Issue......

Last 2007 Training Course

Sydney 26th - 28th November

Does one of your team require Campbell Scientific data logger training?

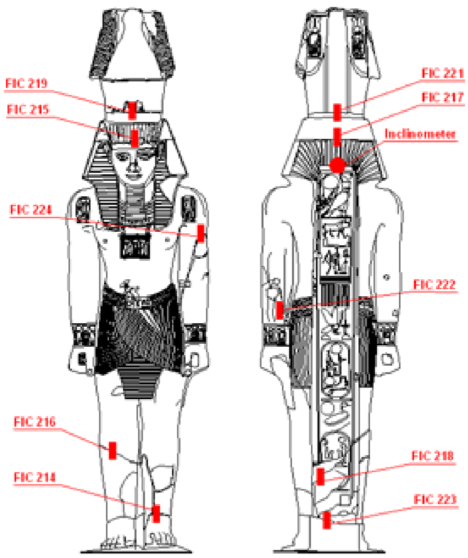
Our last CR1000 / CRBasic course will be held 26th - 28th November in Sydney. The course is aimed at beginners to intermeadiates & we encourage users to attend and learn how to use your equipment to its full potential. The course covers our CRBasic data loggers including our CR200, CR800, CR1000 & CR3000 models. For a full outline and pricing details please contact Bree on training@campbellsci.com.au

ADVANCED USERS

CSA will shortly be announcing an advanced 1 day course due to be held 29th November in Sydney. We will be sending more info next month so keep your eyes peeled!

Where in the World is Campbell Scientific?

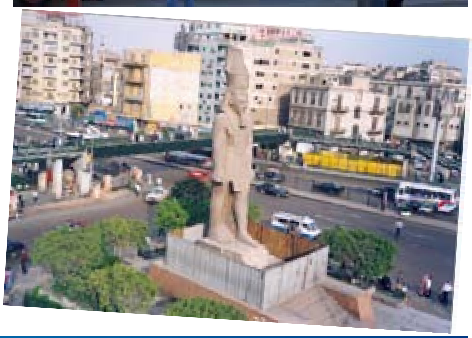
Telemac Use Campbell Logger in Ancient Egyptian Statue Move.



Recently Telemac have been involved in monitoring crack movement and inclination of the 11m high, 100 tonne statue of Ramses II during its relocation from the centre of Cairo to Giza last August. Traffic fumes and vibrations were causing concern for archaeologists and a decision was made to move the ancient statue to a safer home.

10 FIC fissurometers and one Geocline biaxial tiltmeter were installed as shown on the drawing and monitored with a Campbell Scientific CR1000 data acquisition system providing daily reports to the local authorities during packing of the statue.

The statue, transported standing inside an iron cage covered with rubber foam and hung on a steel pendulum-like bridge, was monitored throughout its 35 km,10 hour journey by a following car transmitting sensor readings in real time via a Bluetooth link.



The trip was deemed as a success. As yet the system has not detected any variations of the cracks and the Ramses II Statue can now breathe purer air in its new home outside the Grand Egyptian Museum overlooking the Giza Plateau.

Thanks to Mme Isabelle LAMARQUE (Directeur Général- Manager, Telemac), Campbell Scientific UK & Campbell Scientific France for the documentation & images.

Hydrosense Soil Moisture System
- Helping you water wisely

As we all know, water is becoming an increasingly precious resource for not only our households, but for a wide range of industries, particularly our agricultural sector.

With large parts of our country in drought it's important that irrigation needs are well monitored - ensuring plants get the water they need without overwatering.

CSA's Hydrosense soil moisture system can do exactly that - and in a small portable unit that can be used at multiple sites. No lugging multiple equipment, no complex systems - just a small haldheld display and lightweight sophisticated soil moisture probe.

The Hydrosense provides you with quick and reliable soil water content measurements in the field. Measurements are easily obtained by inserting the probe (12cm or 20 cm option) rods into the soil and pressing a single button on the display unit.

The display unit is a simple to operate device housed in a splash-proof enclosure that includes two membrane buttons used to operate the system. The sensor itself consists of two parts; the sensor head and the rods. The sensor head includes the circuitry that provides the electrical output of the moisture measurement while the 5 mm diameter stainless steel rods provide the physical interface between the electronics and the soil.

Users also have the option of two operating modes, allowing you to choose between standard lab calibrated measurements or your own custom settings.

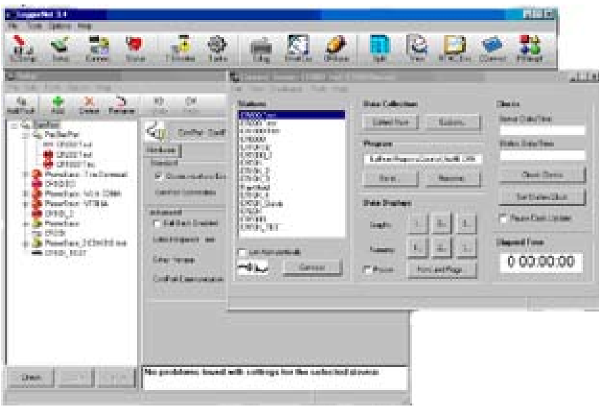
The lightweight packaging and ease of use makes the HydroSense a versatile tool for monitoring and managing soil water needs in a wide range of applications and conditions.

WANT TO KNOW MORE?
Contact our team on info@campbellsci.com.au

ARE YOU USING THE LATEST SOFTWARE WITH YOUR EQUIPMENT?

Check out the latest software upgrades, patches and operating systems on our downloads page
http://www.campbellsci.com.au/downloads

LoggerNet 3.4 Now Available



CSI has just released the latest version of LoggerNet v 3.4 While the latest version contains a number of new enhancements, the biggest change is that LoggerNet is now fully compatible with Windows Vista.

Due to new development tools being updated to allow compatibility with Windows Vista, Loggernet 3.4 does not support Windows NT.
Users of Loggernet 3.xx can download the lastest version of LoggerNet and the latest operating sysem by visiting our dowloads page
http://www.campbellsci.com.au/downloads

CRBasic Logger Flash Increase

CSI has recently announced that they will be increasing the flash memory size from 128k to 512k. This change will apply to the following logger models - CR800, CR850, CR1000 and CR3000.

The memory upgrade allows larger and more complex programs to be stored in the logger.

We expect to start shipping these units from mid August onwards. If you require any further info or would like to look into upgrading your current logger please contact our support team.

TECH TIP

Implementing Internet Protocols with Campbell Scientific Data Loggers – Part 2

In part 1 of our article (Online 17 - May 2007, to download the Part 1 go to ftp://ftp.campbellsci.com.au/online/online17/Online17.pdf), we discussed the settings required for the data logger to be able to interface with a cell phone modem and successfully establish a PPP link to the internet. In part 2 of this discussion, we will focus on the options for making use of the internet connectivity to be able to move data to and from the data logger.

The data logger has a PPP connection to the internet, what can we do with it?

Firstly, let's define some regularly used terms. The terms Client and Server are used often in TCP/IP networking. A Client is the software package that initiates a connection to a server. The Server is the software package that accepts connections from Clients and in most cases, can accept multiple connections at the same time. For example, when transferring a file from a logger to a server via FTP, the logger uses its FTP Client software to establish a connection and log in to the FTP Server. When this is done, the file can be transferred from one location to another.

Static IP Address Vs Dynamic IP Address

Whether the logger will be operating as a Client or a Server depends on the application, but one thing that is critical about this decision is whether the IP address of the logger's internet connection is static or dynamic. If the modem establishes a connection to the internet and a dynamic IP address is allocated for the connection (which is normally the case), connections to other machines on the internet must be initiated by the logger. This is due to the fact that other machines won't know the address of the logger. Furthermore, the dynamic IP addresses that are allocated are often part of a private network, existing behind a proxy server operated by the cell phone service provider. This means that traffic can not be routed to the logger (with a dynamic IP address) by devices outside this private network unless a connection has already been established (by the loggers).

If the modem establishes a connection to the internet and a static IP address is allocated, then connections can be established by the logger or the machine on the internet to which we wish to communicate. A connection with a static IP address has one major advantage. The advantage is that every time the PPP connection is established, the IP address allocated will always be the same and traffic can be routed directly to this address from anywhere on the network.

In most cases, getting access to static IP addresses involves spending some money with the cell phone service provider to configure a private network or IPWAN which includes the logger modems and the computer(s) that will be used to communicate with them.

Moving Data

In the majority of cases where a data logger and a PPP connection is used, there is a requirement to move data from the logger to a PC or server of some kind. From the Campbell Scientific point of view, moving data across the PPP link can be classified into two main categories.
These categories are:

- Using Loggernet software or
- Not using Loggernet software.

Using Loggernet Software

If Loggernet software is being used, the PC on which it is operating will have an internet connection and the ability to establish or receive TCP connections with devices on the internet. (This may require modification to PC and Network firewall settings).
If the logger has been allocated a static IP address, Loggernet can be configured to connect directly to the station as would be done over a serial cable or dial-up connection.
If the logger has been allocated a dynamic IP address, then the logger would need to be programmed to establish a TCP socket connection to the appropriate IP address and port number where Loggernet is operating. Once this connection has been made, the logger will perform a "Call-back" which will allow Loggernet to poll the data from the data logger.

Not using Loggernet Software

If Loggernet software isn't being used, then the options for communications involve many of the standard TCP/IP protocols. Data can be transferred to remote servers by using FTP, UDP or by logging in to a remote SMTP server and send or collect an email with an attachment. Alternatively, if some custom software that allows TCP connections is to be used on the PC side, the logger can be programmed to establish a TCP socket connection on a port number of any machine whose IP address is known. Once this connection has been established, the logger can communicate with this software. All of these options involve the logger establishing the connections as is required if the logger has had a dynamic IP address allocated. All of these options involve moving data from the logger to another location where it can be dealt with or processed by another software package.

If the modem has been allocated a static IP address, incoming connections to the logger can be established. This allows some extra services to be utilised.

These extra options include:

Web Server – a high level of flexibility in the HTML code that can be hosted in the logger. The logger can host custom designed pages that make use of images, links and graphics. These pages can be populated with real-time data from the loggers data tables and can present graphics using Java, XML and SVG languages to name a few. These pages are hosted for anyone who establishes a HTTP connection to the loggers IP address

FTP Server – allows connections to be made from FTP Clients to transfer files to or from the logger.

Other Useful Protocols supported by the logger's TCP/IP Stack

NTP (Network Time Protocol) – allows the logger clock to be set from a time server somewhere on the internet.
Telnet
Ping (ICMP)

Using the same modem for Internet and Dial Up Capabilities

The PPPOpen() and PPPClose() instructions allow the user to control under what conditions the PPP link to the internet is established and disconnected.

This enables the modem to be used in a standard "dial up" mode when the PPP link is not active. All of the features such as dial up connection to collect data, set the clock or send new programs as well as logger initiated communications such as sending SMS messages or checking for received SMS messages can all still be done while the PPP link is closed.

That pretty much wraps up the discussion! There are literally thousands of options in terms of how these services can be used and determining the best option fro any particular network requires some thought.

If you would like to discuss the possibilities of how a internet connected data logger can work in your network, please don't hesitate to contact our friendly sales and support team.

Lightning Protection and your System

On average, there are 100 lightning strikes occurring every second around world and the single biggest causes of serious damage seen by our repair department is when your equipment is in the path of one of these strikes.

There are basically two types of lightning strike that can cause damage - direct strikes and indirect strikes.
A direct strike is what typically comes to mind when you think of a tree being struck by lightning. This type of strike will generally cause significant damage to a station regardless of the protection applied. The huge discharge of electricity overloads the electronic circuits, and can also melt, burn and vaporise aluminium, glass and plastics. With metal towers and antennae, there is an acceptance that the likelihood of a direct strike is far greater with an increase in vertical height – so lower is better if possible.

The indirect strike is best imagined as a strike that occurs at some distance from the station. The lightning spreads over the surface of the earth causing an electrified grid which can damage any electronic components in the nearby vicinity. This effect results in large transient voltages being induced in cabling including power cables, communications lines or sensors. This surge then travels along those lines into the station and may damage internal wiring and attached equipment. Indirect strikes are much more commonplace and fortunately, far easier to provide increased protection against than direct strikes.

While protection kits may not protect from direct lightning stikes, they can protect your equipment from the more common indirect strikes.

In both cases, lightning generates massive electromagnetic fields inducing voltages far beyond what electronic equipment can safely handle. Campbell Scientific data loggers utilise spark-gap arrestors which are among the more effective means of lightning protection available, but they will not work if not deployed in conjunction with an adequate grounding system.

CSA's weather station lightning protection system is a passive grounding system and consists of an aluminium lightning rod, a grounding stake, heavy duty earthing cables, brass termination fittings and surge suppressors. The system provides an alternate (lower resistance) path for the surge to follow into the ground rather than travelling through the data logger and sensor circuitry. Any antenna wiring that enters the structure may be considered a possible entrance point for lightning, and should be addressed with proper protection using surge suppression equipment or appropriate grounding techniques.

No matter how good your lightning protector is, it still needs to be correctly installed and connected to a suitable ground. In some cases such as low-conductivity soils, multiple earth stakes may even be required for adequate grounding. CSA offers a comprehensive range of products to protect your system against lightning damage, including the POLYPHASER Coaxial protector, grounding rods and copper earth stakes.

WANT TO KNOW MORE?
Contact our team on
support@campbellsci.com.au

Fire Weather - Protecting our Forests & Parks

Summer is fast approaching and like last year the upcoming season will unfortunately bring more devastating bushfires. Over the past 30 years Australia has been affected by between 20 to 25 major bushfires, each of which has been estimated to cause in excess of $10 million damage. In addition to these large scale bushfires many small scale bushfire incidents occur across Australia causing damage to property, native wildlife and fauna, personal memorabilia and in some circumstances the loss of life.

We all have heard the warnings about preparing ourselves, our properties and homes such as cleaning gutters, checking hoses and clearing bushes and branches - but what about protecting parks & wildlife?

There are three elements to a bushfire: Oxygen, heat and fuel.

Fuel is the only one of these three that we have any control over and can be monitored or controlled by measuring the water content or by hazard reduction burning. Campbell Scientific Australia has a number of products to assist in bushfire management, ranging from hand held moisture meters to automated weather stations. These include the DMM600 which is a hand held duff moisture meter allowing measurement of volumetric water content of organic forest floor material, the CS505 and CS205/107 sensors which provide automated fuel moisture and temperature measurements, and the RAWS-F quick deployment complete weather station which provides real time collection and transmission of weather data.

Hazard reduction or prescribed burning has been practiced on a systematic and scientific basis in parts of Australia for more than 25 years, and has been shown to be operationally effective in reducing the impact of wildfires in a wide range of eucalypt forest types and in conifer plantations. The RAWS-F (Remote Automated Station for Fire Weather) is a quick deployment station designed for use with Hazard Reduction burning and can be setup in as little as 10 minutes – without tools. It consists of a 6ft tripod, meteorological sensors, and an aluminium environmental enclosure that houses and protects a CR1000M datalogger and 12V battery. The battery is recharged via a solar panel or an AC transformer.

The outside of the enclosure has colour-coded, keyed connectors for attaching wind speed and direction, air temperature and relative humidity, precipitation, solar radiation, and the optional fuel moisture/temperature sensors. Besides the connectors, a wiring panel is provided that allows the attachment of additional sensors that measure barometric pressure, stream flow or water depth.

Communication options include satellite transmitter, telephone, cellular phone, and radio. There is also an option that allows you to call a RAWS-F via a hand-held radio and receive a verbal report of real-time site conditions. The station's components fit inside two carrying cases for easily transporting the station to your site.

Instrumentation for Beginners

Glossary of Terminology

Just starting out with Campbell Scientific equipment?

There's a few basic things you'll need to understand first, so our glossary of terminology below will take you through various terms used when measuring and collecting data. Enjoy!

Let's start with first things first – what are analogue and digital measurements?

Measurement: the act or process of assigning numbers to phenomena according to a rule.

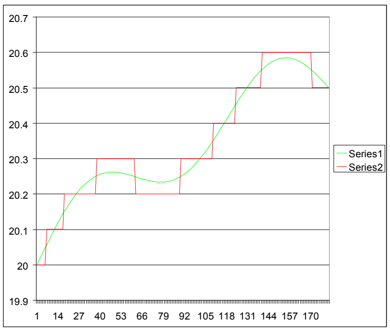
This means that when we "measure" a variable we compare its size to a standardised scale and determine the nearest value on that scale. Remember that in order for anyone else to use the measurement we must all agree to use the same scale. The process of comparing the output of a given instrument or sensor to a standard scale is known as calibration.

Analogue: A quantity of a continuously variable nature.

In simple terms this means that something is considered "analogue" if it varies "smoothly" over a given range, without jumping from one value to the next. Most often in instrumentation, the analogue value in which we are interested is electrical in nature and hopefully has a well understood relationship to the physical quantity that we wish to measure.

Digital: Storing information as a string of digits, usually using a binary system.

Sometimes in modern marketing you could be forgiven for associating the word "digital" with "good" or "high-tech", but as you can see the definition is much more sedate than this. The act of converting a value to a finite set of digits makes that value digital. Something that may not be immediately apparent from this though is that a digital value varies in "jumps". To illustrate this and to show the distinction between analogue and digital values, consider the temperature measurement example below:



In this case, our hypothetical digital sensor is able to represent values with 1 decimal place. As you can see, although it is able to represent the changes in temperature, the value changes in discrete steps, whereas the analogue sensor changes value smoothly.

Measurement Quality

Now that we have covered what analogue and digital measurements are, it would be useful to have a means of determining how good our measurements are.

Error : When it comes to measurement quality the most important concept to understand is that **all measurements have error.** There are no exceptions - only the scale varies. In everyday English we associate the word "error" with a mistake and that brings with it negative connotations of error being a bad thing - in fact error is simply a measure of how far we can trust a measurement.

For example if the weather forecast predicts a maximum temperature of 30 degrees, you wouldn't be surprised if the temperature reached 31 degrees, but on the other hand you would be very surprised if it reached 40 degrees. This concept of "trustworthiness" is reinforced by the strict mathematical term for error which is the "confidence interval".

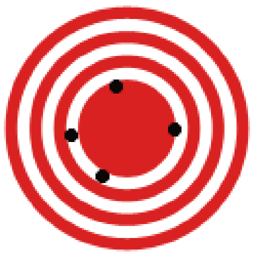
It is important to always maintain a realistic perspective when considering the errors in a measurement system. While it would seem that less error is always better, this can lead to over-designed systems. For example, it would be senseless to specify a temperature error of +/- 0.01 degrees for a domestic airconditioner controller. The variations in the room due to people, windows and air turbulence would create differences many times greater than this, so the accuracy would be wasted.

Error is very complicated to describe, but the three most important factors used to determine measurement error are accuracy, resolution and linearity. It is useful to note that these terms apply equally to sensors as well as the instruments that read them.

Accuracy

This is perhaps the most widely used, misused and abused term in instrumentation. Accuracy is the degree of conformity of a measured or calculated quantity to its actual (true) value. In other words, the accuracy of a measurement refers to how closely the output of the device compares with the actual physical value being measured.

Sometimes you will also see precision used interchangeably with accuracy. Precision is closely related to accuracy but is slightly different. Precision is a measure of how closely future measurements will be to each other given the same input. It is also referred to as repeatability. Imagine we are firing arrows at a target with the goal of hitting the centre of the bullseye. Below the two diagrams illustrate the difference between a high-accuracy, low precision and low accuracy, high precision results.



High accuracy, low precision

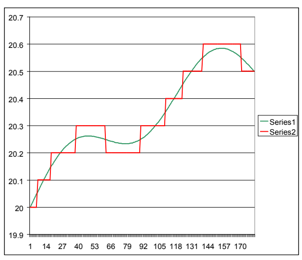
Low accuracy, high precision

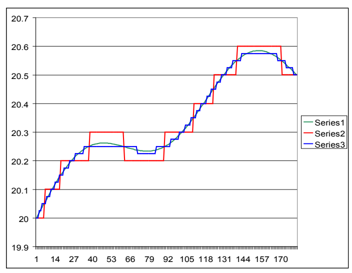
An ideal measurement would be highly accurate and also be very precise.

Resolution

Resolution is the smallest change in the input that causes a change at the output. In some cases this effect may be the result of mechanical friction or inertia, it may be the discrete nature of the measurement, as in the case of a tipping bucket raingauge which can only measure a "tip" when the bucket is full, it may be due to electrical self heating for some kinds of temperature sensors or it may be due to conversion of a measurement to digital. The humble watch is a good illustration of resolution - if your watch only has an hour and minute hand, you can't realistically detect the seconds as they pass by.

If we revisit our earlier example of analogue vs digital values, you will notice that the size of each "step" in the digital value is the resolution of the measurement.





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Who's Taking Your Call? Meet Our Sales & Support Team....

As some of you probably know there has been a lot of changes here at CSA over the past couple of years.

But one thing hasn't changed - our commitment to providing you with quality sales service & technical support

So who's taking your call these days? Meet our friendly and very talented sales and support team....

Belinda Beer- Technical Sales & Support

Some of you may remember Belinda from her reception and order days - but no more !

Belinda's sharp mind & in depth product knowledge has led to her becoming an extremely valued and intergral member of the sales and support team.

Corinne Malot - Technical Sales & Support

Corinne Malot (formerly Verite) has been with CSA for two years now, and continues to provide customers with a high level of sales service & technical support.

A marine biologist herself, Corinne specialises in marine & water quality applications.

Michelle Douglas - Technical Sales

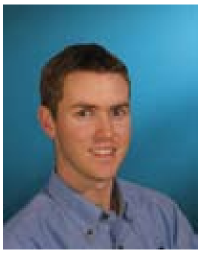
Michelle has recently returned to us from a brief stint down in Tassie and has jumped straight back into her previous role in sales, with her usual high level of enthusiaim.

Need product info, pricing or a quote? Michelle is your go-to girl!

Gavin Shaw - Technical Sales & Support

Gavin is our most recent addition to the team - and it's like he's been here for years!

Zimbabwean by birth, Gavin obtained his engineering degree through QUT in Brisbane before moving to Townsville. He has quickly picked up the ropes here at CSA and is set to become a programming wizard!



Jason Gunders- Technical Support & Repairs

Jason has been a long-time member of our support team and has now also taken on the role of MR. Fixit in our repairs department.

With years of experience supporting CS products and a keen interest in electronics Jason has taken on the role with great relish & expertise

CONTINUED FROM PAGE 5....

Instrumentation 101 - Gloassary of terms..

As you can see from these charts, as the step size reduces, the digital value matches the analogue value more and more closely.

Manufacturers will not often state the resolution for analogue sensors because it can be quite difficult to determine and sometimes falsely believing that resolution only applies to digital measurements. In contrast however, it is quite straightforward to determine the resolution of a digital measurement. It is generally half the size of the smallest digit.

For example, if we are using a digital multimeter to measure resistance and the display shows the value in units of ohms, then the (best case) resolution would be +/-0.5 ohm. Because digital measurements are very often made using an analog-to-digital converter (ADC) and because the result is generally a binary number resolution will often be specified in terms of "bits" (binary digits). You can use the number of bits to work out the size of the resolution steps as follows:

$$\text{Resolution} = \frac{\text{Range}_{max} - \text{Range}_{min}}{2^{no\_of\_bits}}$$

So for example if we use a 10 bit ADC to measure a +/-3V range, the resolution steps would be:

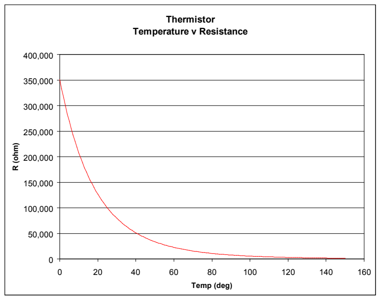
$$\text{Resolution} = \frac{3 - {}^{-}3}{2^{10}}$$

$$= \frac{6}{1024} = 5.86 \text{ mV}$$

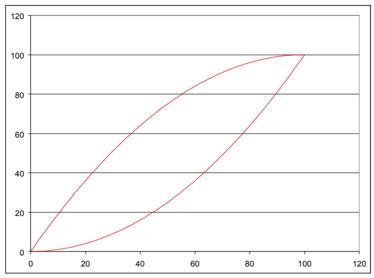
Linearity

In instrumentation the term linearity is something of a mis-nomer. Strictly speaking, linearity is a measure of closely the response of a system matches a straight line. However it would be more appropriate to call it non-linearity, because generally manufacturers actually use this term to refer to how much their sensors deviate from a straight line relationship.

There are many different kinds of non-linearity. Some sensors, like thermistors for instance, are inherently non-linear because of the fundamental nature of the sensing element (see side graph 1). As you can see, the relationship between resistance and temperature is far from a straight line. Thankfully, thermistors are fairly well understood and normally match the well known Steinhart-Hart equation. This equation can then be used to "linearise" the sensor, so that its curved response curve becomes approximately linear again. Beware though that whenever a linearisation relationship like this is used, it introduces a "linearisation error", which should not be forgotten.



Hysteresis is another form of non-linearity. It occurs when a system or sensor's response lags behind the stimulus that caused it. The result is a different output for the same stimulus depending on which direction the value was approached. (see side graph 2)



As you can see from this diagram, the measured value would be different for the same input if we approached that way from above or below. This type of non-linearity is common in load cells or any sensor that depends on a spring to take its measurement such as your bathroom scales.

Well that wraps up our Instrumentation 101 for this issue! If you have any questions or would like to discuss further feel free to contact us!.