



dataTaker workshop

Datalogging Basics

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What is Data Acquisition?

- Data acquisition is simply the gathering of information about a system or process
- It's simplest form could be to measure the length of a piece of string with a ruler

What is Data Logging?

- Data logging is when acquired data is stored or logged for later use or analysis
- It's simplest form could be to write that measured length down on a sheet of paper

The differences - data acquisition and data logging?

- Data loggers typically have slower sample rates
- Data loggers are stand-alone devices
- Data loggers may operate unattended for long periods of time (so must be reliable)
- Data loggers have some form of built-in memory

Function of a data logger

- Read sensors
 - Report real-time values
- Store data
- Process data
 - calculations
 - alarms
- Data transfer
 - automatically or manually

What sensors can they read?

- Commercially available sensors are many and varied.
- Any sensor with an electrical output can be read either directly or via a signal conditioner*

* A signal conditioner accepts non-standard electrical signals and converts them to something more readily accepted

Sensors

Commercially available sensors include:

- temperature, humidity
- pressure, force, mass, weight
- velocity, acceleration, vibration
- strain, stress, distortion, fatigue
- flow, level, pH, wind speed
- length, thickness, displacement
- state, pulse, counter
- and lots of others...

Sensor outputs

Sensors produce an electrical output that is proportional to the quantity of the parameter being sensed

- Electrical output from sensors can be
 - Voltage
 - Resistance
 - Current
 - Frequency
 - Binary states or pulses (counts)
 - Serial data - RS232, RS422, RS485, SDI-12
 - Parallel data - BCD, Gray Code, phased encoders

How much data can they store?

- Typically anywhere from 32KB to GBs
 - dataTaker have 128MB* = 10 million data points
- More is not always best
 - how do you manage 2GB of data?
- Fill and stop or overwrite old data

* expandable

Data processing

- Happens in the background while the data logger is performing it's other functions
- Calculations
 - Averaging
 - Scaling
 - Mathematical formulas (eg. wind direction)
- Alarms
 - Audible, visual, SMS
 - Initiate actions (eg. turn on a pump)

Data transfer

- May be Ethernet, USB or serial
- Cell phone, modem, satellite
- Manually
 - Laptop or PC
 - USB memory stick, SD card or other portable data device
- Automatically
 - FTP (File Transfer Protocol) over Internet or Intranet
 - Email
 - Proprietary software applications

Characteristics of a data logger – Analogue inputs

- Anything from one to several hundred
- Loggers typically only have one A-D converter which means only one sensor is read at a time
- Time must be allowed for sensor settling before taking a reading
- Switching may be relay or solid state

Characteristics of a data logger – Sample speed

- **Sample speed** is the number of readings per unit time of a single channel, or of a group of channels
- Expressed as samples/second (Hz)
- Varies from less than 1 Hz to MHz for specialised systems
- Variable within the same system

Characteristics of a data logger – Sample speed

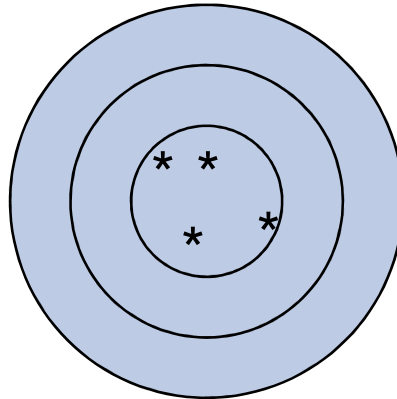
- Appropriate sampling speed is dependent on many factors
 - How quickly does the measurement change?
 - How long will the test last?
 - How much data storage capacity do you have?
 - How much data can your analysis software handle?
- Faster is not always better! Too much data can be difficult to manage

Characteristics of a data logger - % uncertainty

- Accuracy
 - Difference between the measured value and the true value
- Linearity
 - How well the measured data points fit a straight line
- Repeatability
 - The variance in readings of the same value.
- Resolution
 - The degree to which the system can determine that two readings are different

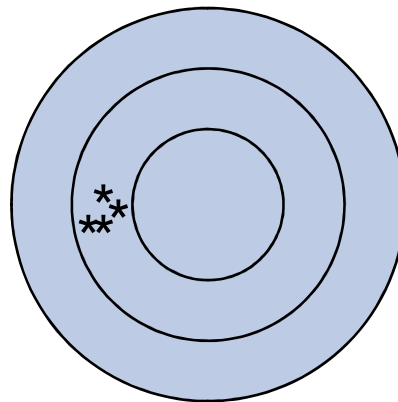
Characteristics of a data logger - Accuracy

- **Accuracy** is measuring the true value of a signal.
 - usually expressed as % full scale of measuring range
 - accuracy will often vary with operating conditions such as ambient temperature, signal type, environmental noise, etc.



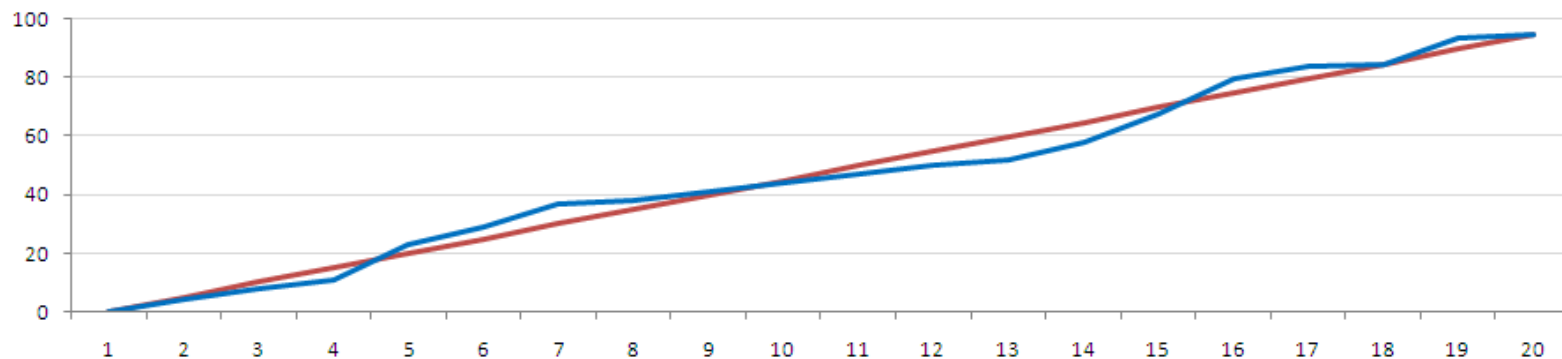
Characteristics of a data logger - Repeatability

- **Repeatability** is measuring the same value for the same signal.
 - usually expressed as % full scale of measuring range
 - repeatability will often vary with operating conditions such as ambient temperature, signal type, environmental noise, etc.



Characteristics of a data logger - Linearity

- **Linearity** is the degree to which the relationship between the true value and the measured value of the signal remain constant.
 - usually expressed as % full scale of measuring range
 - linearity will often vary with operating conditions such as ambient temperature, signal type, environmental noise, etc.



Characteristics of a data logger - Resolution

- **Resolution** is the smallest difference that the data logger can determine between two readings.
 - usually expressed as a binary proportion of the measuring range
 - for example a 16 bit ADC can measure a 15.26 microvolt change on a 1 Volt range
 - resolution is usually fixed, but may vary with sampling speed