

17th NATIONAL CONFERENCE ON BUILDING COMMISSIONING



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Data Challenges and the Universal Translator Software

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AIA Quality Assurance



Learning Objectives

1. Identify common data management and processing issues for EBCx projects
2. Familiarize attendees with UT software applications
3. Show real-world data examples and discuss system diagnostics
4. Share notes on improving quality of graphic presentations

Where to get a copy of the UT software?

The screenshot shows the UT Online website interface. At the top, there is a navigation bar with links for Home, News, FAQ, Links, Contact Us, Search, Forum, UT Help, and Reference. The main content area is divided into three columns. The left column contains a 'Main Menu' with links to Home, News, FAQ, Links, Contact Us, Search, Forum, UT Help, and Reference. The middle column features an article titled 'What is the UT' with a sub-heading 'What is the Universal Translator (UT)?'. The article text describes the Universal Translator (UT) as software for data management and analysis, highlighting features like time correction, data filtering, and graphing. It also mentions that routines have been developed for equipment run-time, zone temperature variation, air-side economizers, and lighting controls. A 'Read more...' link is provided. Below the article is another section titled 'How do I get a copy of the UT?' with the text 'Registered users can download the latest version of the Universal Translator.' and another 'Read more...' link. The right column contains a poll titled 'Have you used UT to solve problems?' with four radio button options: 'Never', 'A few times', 'Several times', and 'I use it every day!'. There are 'Vote' and 'Results' buttons. At the bottom left, there is a 'UT Login' form with fields for 'Username' and 'Password', a 'Remember me' checkbox, and a 'Login' button. Below the login form is a link for 'Forgotten your password??' and a link for 'No account yet? Create one'. A red circle highlights the 'No account yet? Create one' link, with an arrow pointing to the text 'Register at www.utoonline.org'.

Home

Sunday, 12 November 2006

UT Online

The website for users of the Universal Translator application

Home News FAQ Links Contact Us Search Forum UT Help Reference

Main Menu

- Home
- News
- FAQ
- Links
- Contact Us
- Search
- Forum
- UT Help
- Reference

What is the UT

What is the Universal Translator (UT)?

The Universal Translator (UT) is software designed for the management and analysis of data from loggers and trends from building management systems. The UT is ideal for large data sets from multiple sources. The software includes time correction features including the ability to synchronize data sets with different recording rates. The UT has data filtering mechanisms and a flexible graphing tool. UT analysis routines have been developed for equipment run-time, zone temperature variation, air-side economizers, and lighting controls. A routine that calculates statistics for each data set is available, and the UT has the ability to export data into other spreadsheet or analysis tools if necessary.

Last Updated (Tuesday, 05 September 2006)
Read more...

How do I get a copy of the UT?

Registered users can download the latest version of the Universal Translator.

Last Updated (Tuesday, 05 September 2006)
Read more...
[Back]

UT Login

Username

Password

Remember me

Login

Forgotten your password??

No account yet? Create one

Polls

Have you used UT to solve problems?

Never

A few times

Several times

I use it every day!

Vote **Results**

Register at www.utoonline.org

What are some of your data
management/processing/analysis
issues?

Participant Input

Data Management Issues

Various file formats

- delimited
- fixed width
- header and data titles

Different recording methods

- instantaneous
- average
- status

Merging/appending records

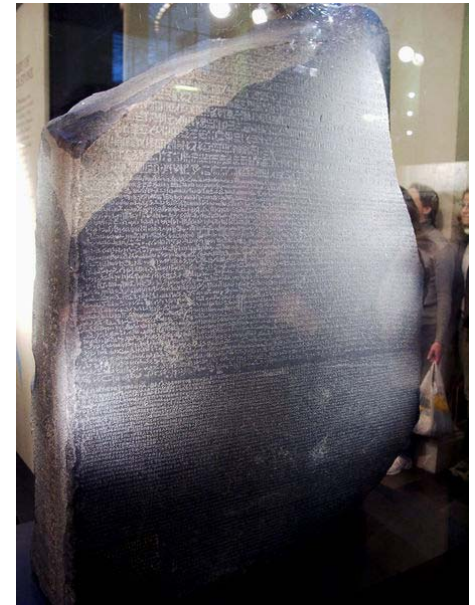
Non-synchronous recording rates

Different clock signals (time offset)

Data slope and offset corrections (calculated data)

Data filters (if/then conditions)

Must track all changes to data



Rosetta Stone

Background on Development of UT

Grew from experience with PEC Tool Lending Library

- Projects require multiple data sources and formats
- Managing dozens of records and large files an issue

Our experiences similar to engineers doing this work

Development of a tool to manage data unlikely to come from logger or EMS software developers

Tool could also integrate other capabilities

- Data validation
- Data analysis and reports
- Calculations, corrections and filters

Public funding means tool is free!!!

TLL homepage: www.pge.com/pec/tll



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PEC Tool Lending Library (TLL)

Tool The Tool Lending Library (TLL) is a Public Goods funded program that loans tools free-of-charge to people working on short term energy efficiency projects in California. We also provide measurement advice and application notes for some of the tools in the TLL.

Request to Borrow Tools

Our staff will match the right tool for your project measurement needs. Please submit a tool request form to tell us about your project.



Tool Lending Library Contents

The TLL contains dozens of measurement tools from a broad range of manufacturers. The list of tools is for reference only. Our staff will help you match the right tool with your needs.



Building Performance / Commissioning Classes

Come to our classes to learn to use tools, to learn about software and auditing techniques. Most of our programs are free of charge and qualify for continuing education credits.



App Notes & Measurement Protocols

The Tool Lending Library Application Notes describe measurement techniques and step-by-step instructions for specific tools. The notes serve as a primer for first-time users and as a

Related Resources

- [> Commissioning Library](#)
- [> ASTM](#)
- [> NIST](#)
- [> ASHRAE](#)
- [> Sensors Magazine](#)
- [> HPAC Engineering](#)
- [> Home Energy Magazine](#)
- [> PEC Energy Links](#)

Education & Training

- [+ Safe Kids](#)
- [+ About Energy](#)
- [+ Energenius](#)
- [+ Energy Training Center - Stockton](#)

Pacific Energy Center

- Classes
- Architecture
- Lighting
- HVAC
- Tool Lending Library
 - Request a Tool
 - TLL Catalog
 - Measurement Classes
 - Application Notes
 - E-mail the TLL Staff
- Resource Center
- Event Planning
- Reach Us (PEC)
- Online Tour

+ School Resource Program

UT Data Sources

Trends from Energy Management Systems

Data from loggers

Meteorological data

Billing data

Other data on building use

- Occupancy
- Production statistics
- Sales
- Inventory



Re-sampling

Combining data sets with different time stamps is common

User selects new synchronized interval

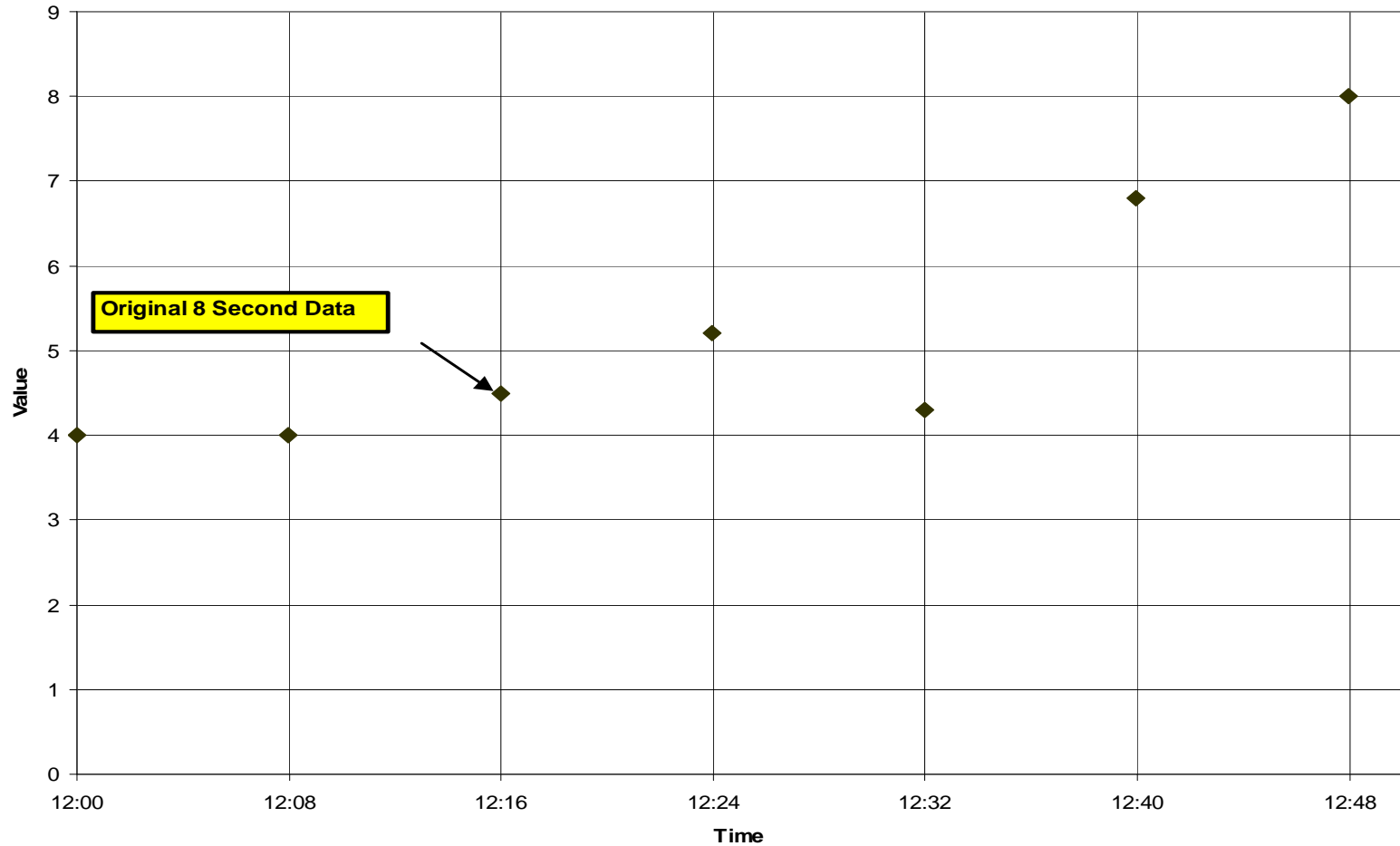
UT generates new records based on time-weighted averages

Processing time dependent on new interval

Not beneficial to select new interval faster than most frequent interval of original data

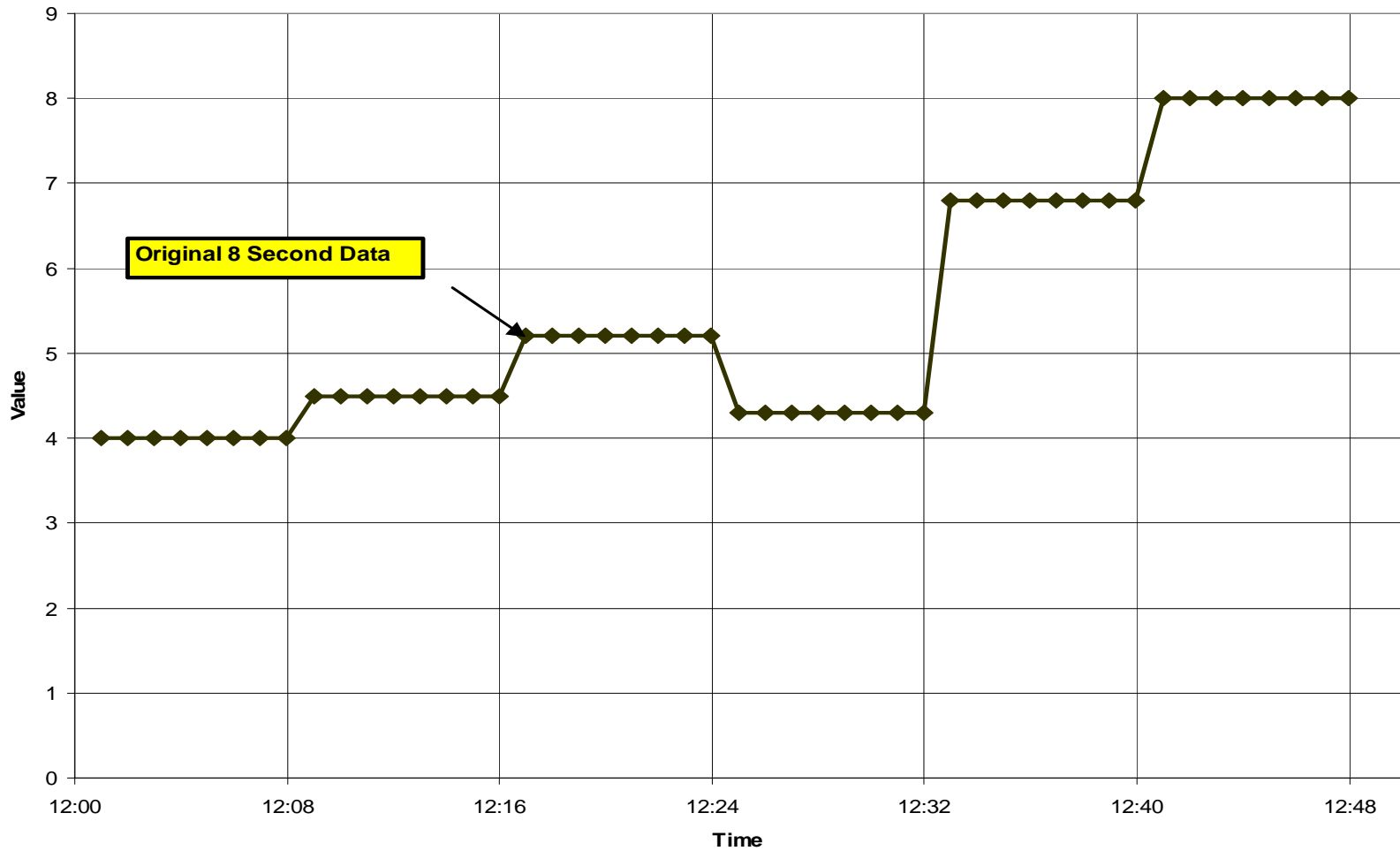
Data Re-sampling: Original Data

Original 8 Second Average Data



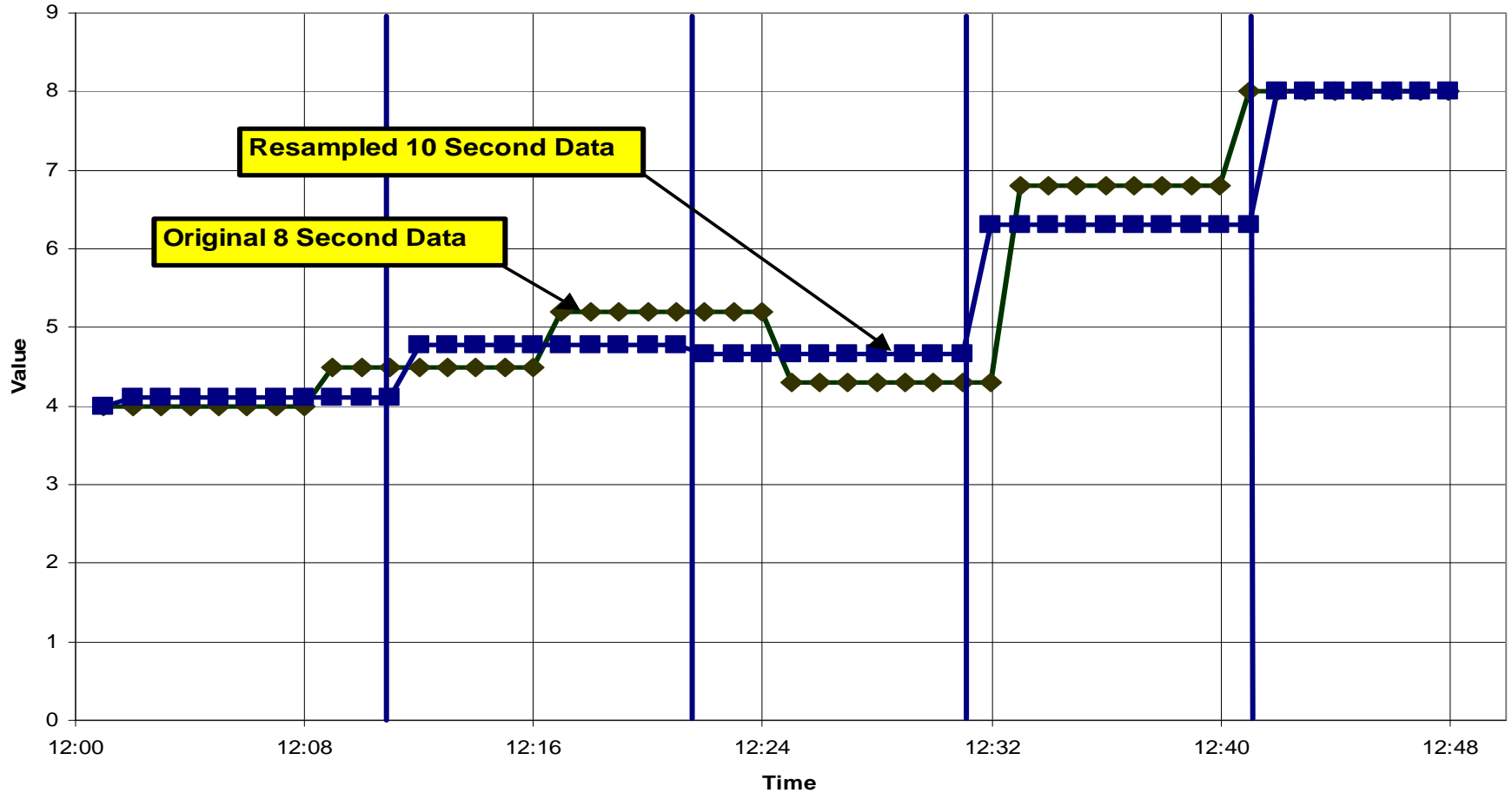
Converted to 1 second interval

Original 8 Second Average Data

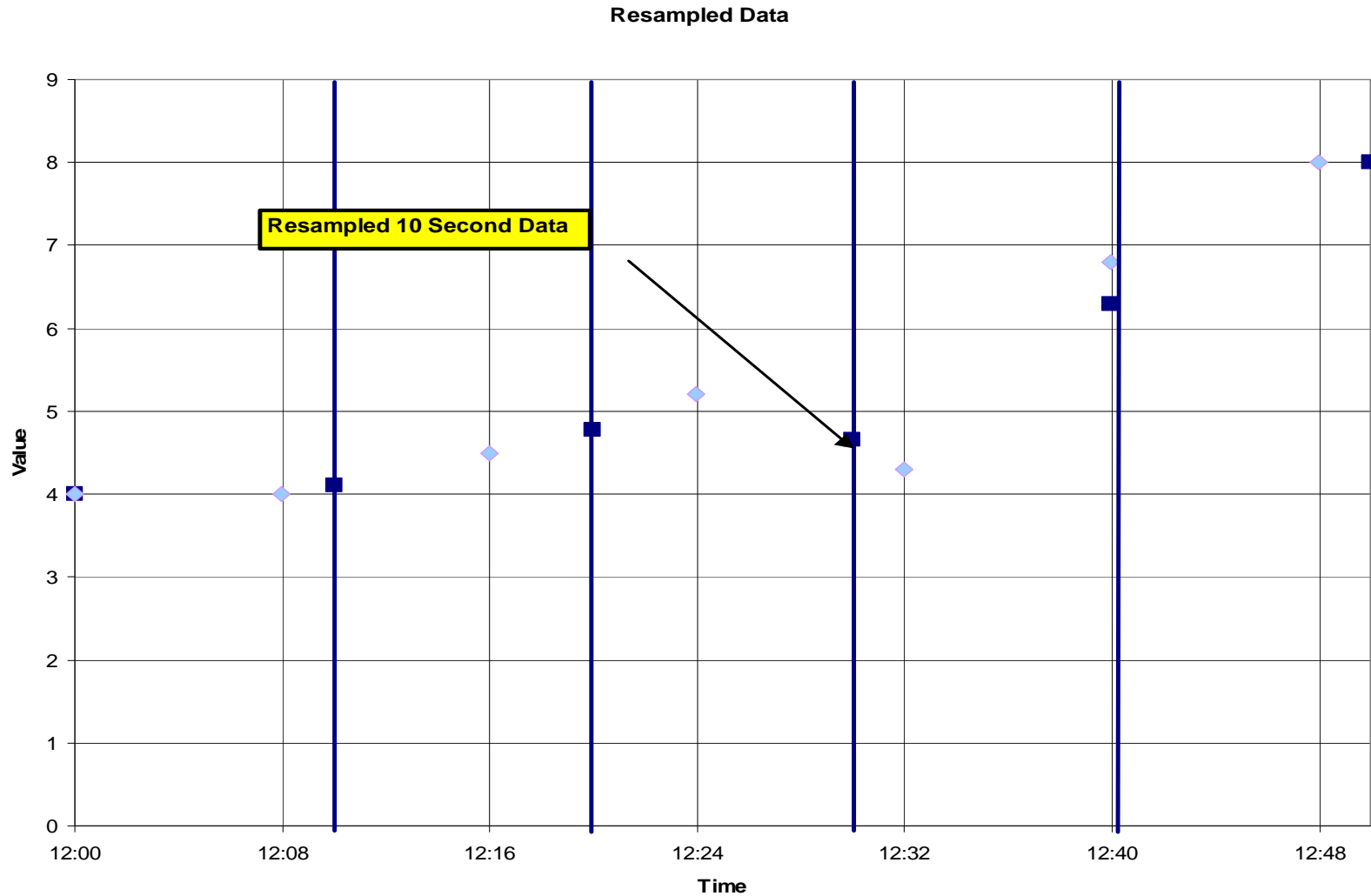


Re-sampling to 10 second data

Original and Resampled Data

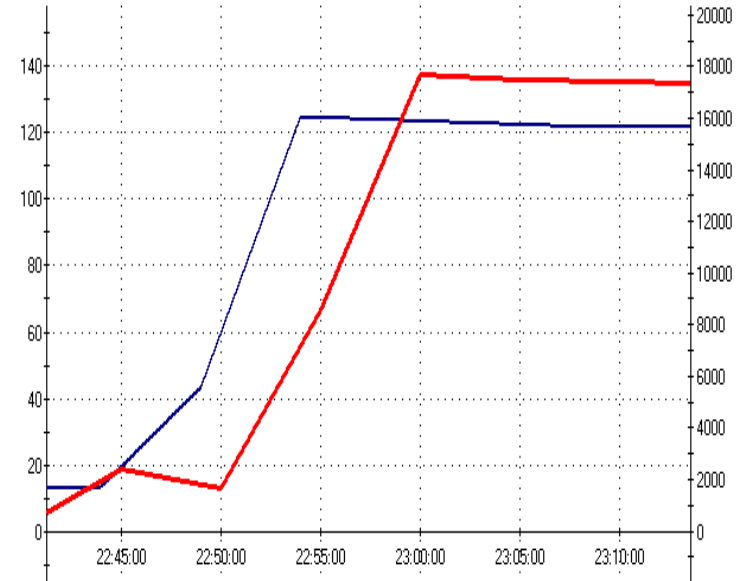
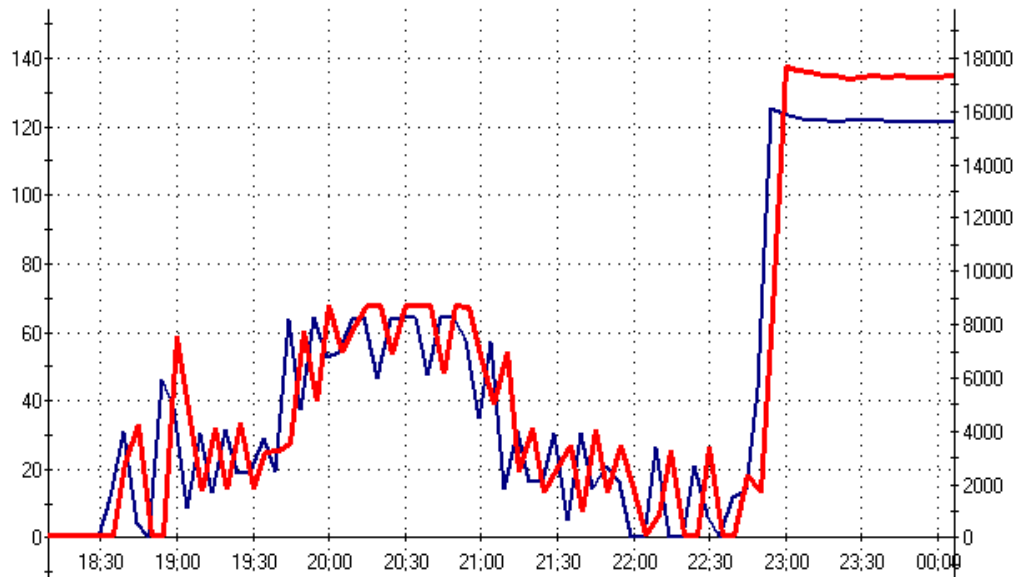


The new 10 second interval data



Time Offset: Different Data Clocks

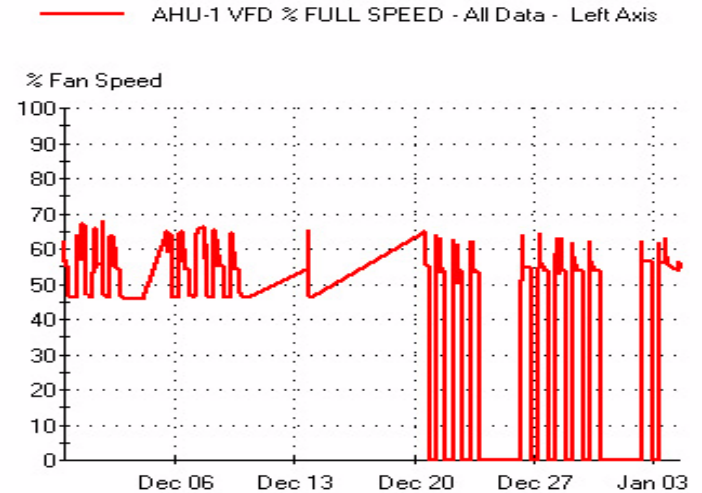
Data is off by six minutes
Can correct by adding six minutes to time of earlier data



Data Validation

Issues

- Data drop out
- Data shift
- Sensor accuracy/
logger resolution
- Relative accuracy of similar data
- Sensor/equipment failure
- Other data anomalies



Should be able to review data frequently and with ease

UT: Simple Navigation

The screenshot shows the software interface for 'Universal Translator (tm) - PEC economizer .co2'. The interface is divided into several panes:

- Menu Bar:** Located at the top, containing 'File', 'View', 'Project', 'Tools', 'Analysis', and 'Help'. It is highlighted with a red box and an arrow pointing to the text 'Menu Bar'.
- Short cuts:** A toolbar below the menu bar containing various icons for file operations and analysis. It is also highlighted with a red box and an arrow pointing to the text 'Short cuts'.
- Project Channels:** A list of channels on the left side, including 'fan status', 'mixed1', 'mixed2', 'mixed3', 'OSA1', 'OSA2', 'outsideco2', 'outsidetemp@co2', 'return air co2', 'return@unit', 'returninside', 'returntemp@co2', 'supplyair1', and 'supplyair2'. An arrow points from this pane to the text 'File management windows'.
- Datalogger Files:** A list of files on the bottom left, showing file paths such as 'C:\Program Files\PEC\Universal Translator\Data\economizer\062606\Mixed 3.txt'. An arrow points from this pane to the text '(these can be minimized)'. Below this text is the label 'Work area'.
- Tests:** A tree view on the right side showing a hierarchy under 'economizer' with a sub-folder 'TESTCHANNELS' containing the same channel names as the 'Project Channels' pane. An arrow points from this pane to the text 'File management windows'.
- Filters:** A pane at the bottom right showing a filter for 'fan on'.

Red arrows originate from the highlighted menu bar and toolbar, pointing to the 'Menu Bar' and 'Short cuts' labels. Other red arrows point from the 'Project Channels' and 'Datalogger Files' panes to the 'File management windows' label. A red arrow also points from the 'Datalogger Files' pane to the '(these can be minimized)' text.

Example Data Sets

What is the data source?

What is the recording interval?

When does the data begin?

What is being measured?

* Start	Start	Van
* Date	Time	Avg
5/11/2006	10:22:00	106.8
5/11/2006	10:37:00	119.9
5/11/2006	10:52:00	120.4
5/11/2006	11:07:00	120.5
5/11/2006	11:22:00	120.4

Data set 1

Data set 2	AHU-1 CHW VALVE POS
	Present Value
5/11/2006 0:01	0
5/11/2006 0:02	0
5/11/2006 0:03	0
5/11/2006 0:04	0
5/11/2006 0:05	0

5/4/2006	10:58:52 AM	Was OFF	0
5/4/2006	11:26:50 AM	Turned ON	1
5/4/2006	9:00:30 PM	Turned OFF	0
5/5/2006	7:00:08 AM	Turned ON	1
5/5/2006	9:00:18 PM	Turned OFF	0

Data set 3

Example Data #1

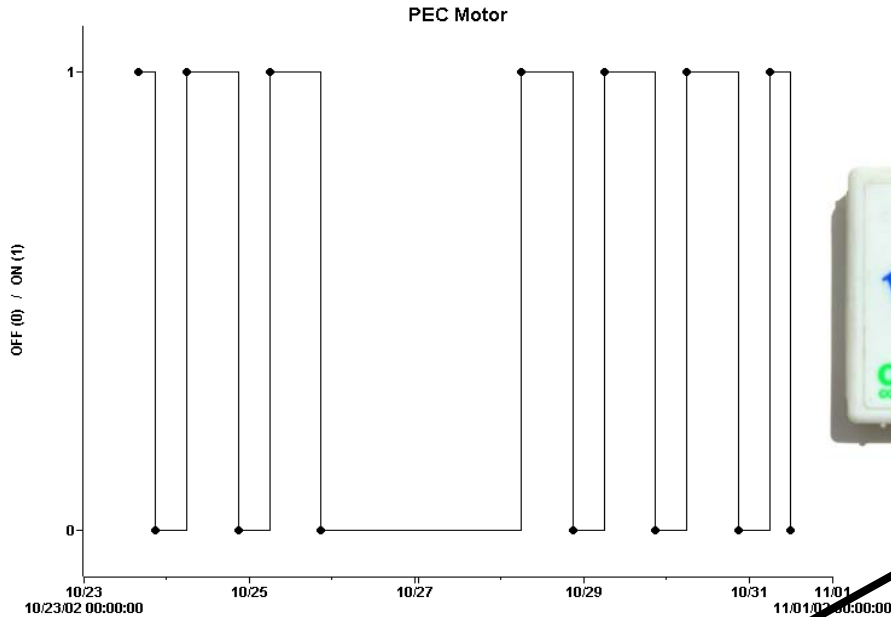
* Start * Date	Start Time	Van Avg	Vbn Avg	Vcn Avg	Ia Avg	Ib Avg	Ic Avg	In Avg	Wa Avg	Wb Avg	Wc Avg	Wt Avg	VAa Avg	VAb Avg	VAc Avg	VAt Avg	PFa Avg
5/11/2006	10:22:00	106.8	107.6	107.6	12.54	14.96	12.696	0	742.3	952	763.3	2457.4	1339.2	1608	1368.8	4316.8	0.55
5/11/2006	10:37:00	119.9	120.9	120.9	12.368	15.448	12.888	0	810.4	1113.6	860.8	2785.6	1484	1869.6	1558.4	4912.8	0.55
5/11/2006	10:52:00	120.4	121.5	121.2	13.536	16.488	13.816	0	909.8	1208	944	3062.4	1630.4	2004.8	1675.2	5311.2	0.56
5/11/2006	11:07:00	120.5	121.6	121.3	17.664	20.312	16.768	0	1234.4	1533.6	1199.2	3968	2130.4	2470.4	2034.4	6630.4	0.58
5/11/2006	11:22:00	120.4	121.5	121.3	15.48	17.992	15.12	0	1068.8	1482	1060.8	3462.4	1864.8	2186.4	1834.4	5886.4	0.57
5/11/2006	11:57:00	120.1	121.1	121.1	14.256	16.056	12.712	0	962.4	1172.8	866.4	3002.4	1715.2	1956.8	1540.8	5214.4	0.56
5/11/2006	12:07:00	120.3	121.6	121.1	13.936	16.464	12.824	0	924.8	1207.2	864	2996.8	1672.8	2003.2	1553.6	5231.2	0.55
5/11/2006	12:22:00	120.3	121.8	121.5	13.2	16.44	13.304	0	871.2	1204.8	895.2	2971.2	1588.8	2004	1617.6	5211.2	0.55
5/11/2006	12:37:00	120.3	121.8	121.7	13.176	15.368	12.392	0	876	1115.2	837.6	2829.6	1585.6	1872.8	1508.8	4968.8	0.55
5/11/2006	12:52:00	120.3	121.8	121.7	13.176	15.368	12.392	0	876	1115.2	837.6	2829.6	1585.6	1872.8	1508.8	4968.8	0.55
5/11/2006	13:07:00	120	121.6	121.1	13.936	16.464	12.824	0	924.8	1207.2	864	2996.8	1672.8	2003.2	1553.6	5231.2	0.55
5/11/2006	13:22:00	120.2	121.8	121.5	13.2	16.44	13.304	0	871.2	1204.8	895.2	2971.2	1588.8	2004	1617.6	5211.2	0.55
5/11/2006	13:37:00	120.3	121.8	121.7	13.176	15.368	12.392	0	876	1115.2	837.6	2829.6	1585.6	1872.8	1508.8	4968.8	0.55
5/11/2006	13:52:00	120.4	121.8	121.5	13.336	14.896	11.664	0	888	1069.6	784.7	2					0.55
5/11/2006	14:07:00	120.3	121.9	121.4	13.584	14.824	11.264	0	904	1063.2	756.7	2					0.55
5/11/2006	14:22:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	14:37:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	14:52:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	15:07:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	15:22:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	15:37:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	15:52:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	16:07:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	16:22:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	16:37:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	16:52:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	17:07:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	17:22:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	17:37:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	17:52:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	18:07:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	18:22:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	18:37:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	18:52:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	19:07:00	120.4	122.1	121.5	13.296	14.84	11.528	0	882.4	1071.2	775.5	2					0.55
5/11/2006	19:22:00	120.8	122.2	122	12.016	15.168	10.872	0	763.4	1135.2	713.5	2					0.53

Ib Avg	Ic Avg	In Avg	Wa Avg	Wb Avg	Wc Avg	Wt Avg
-----------	-----------	-----------	-----------	-----------	-----------	-----------

* Start * Date	Start Time	Van Avg
5/11/2006	10:22:00	106.8
5/11/2006	10:37:00	119.9
5/11/2006	10:52:00	120.4
5/11/2006	11:07:00	120.5
5/11/2006	11:22:00	120.4



Example Data #3



5/4/2006	10:58:52 AM	Was OFF	0
5/4/2006	11:26:50 AM	Turned ON	1
5/4/2006	9:00:30 PM	Turned OFF	0
5/5/2006	7:00:08 AM	Turned ON	1
5/5/2006	9:00:18 PM	Turned OFF	0
5/6/2006	8:05:46 AM	Turned ON	1
5/6/2006	5:00:17 PM	Turned OFF	0
5/8/2006	5:00:03 AM	Turned ON	1
5/8/2006	8:41:08 PM	Turned OFF	0
5/9/2006	7:00:12 AM	Turned ON	1
5/9/2006	9:00:08 PM	Turned OFF	0
5/10/2006	6:59:58 AM	Turned ON	1
5/10/2006	9:00:26 PM	Turned OFF	0
5/11/2006	6:59:53 AM	Turned ON	1
5/11/2006	9:00:04 PM	Turned OFF	0
5/12/2006	7:00:00 AM	Turned ON	1
5/12/2006	9:00:00 PM	Turned OFF	0
5/15/2006	5:05:07 AM	Turned ON	1
5/15/2006	8:59:58 PM	Turned OFF	0
5/16/2006	7:01:18 AM	Turned ON	1
5/16/2006	8:59:58 PM	Turned OFF	0
5/17/2006	6:59:50 AM	Turned ON	1
5/17/2006	8:59:48 PM	Turned OFF	0
5/18/2006	6:59:42 AM	Turned ON	1
5/18/2006	8:59:52 PM	Turned OFF	0
5/19/2006	6:59:38 AM	Turned ON	1
5/19/2006	8:51:47 PM	Turned OFF	0

5/4/2006	10:58:52 AM	Was OFF	0
5/4/2006	11:26:50 AM	Turned ON	1
5/4/2006	9:00:30 PM	Turned OFF	0
5/5/2006	7:00:08 AM	Turned ON	1
5/5/2006	9:00:18 PM	Turned OFF	0

Data set #3

Universal Translator Software Demonstration

Importing data, graphing,
time shifts, re-sampling,
filters & diagnostics.

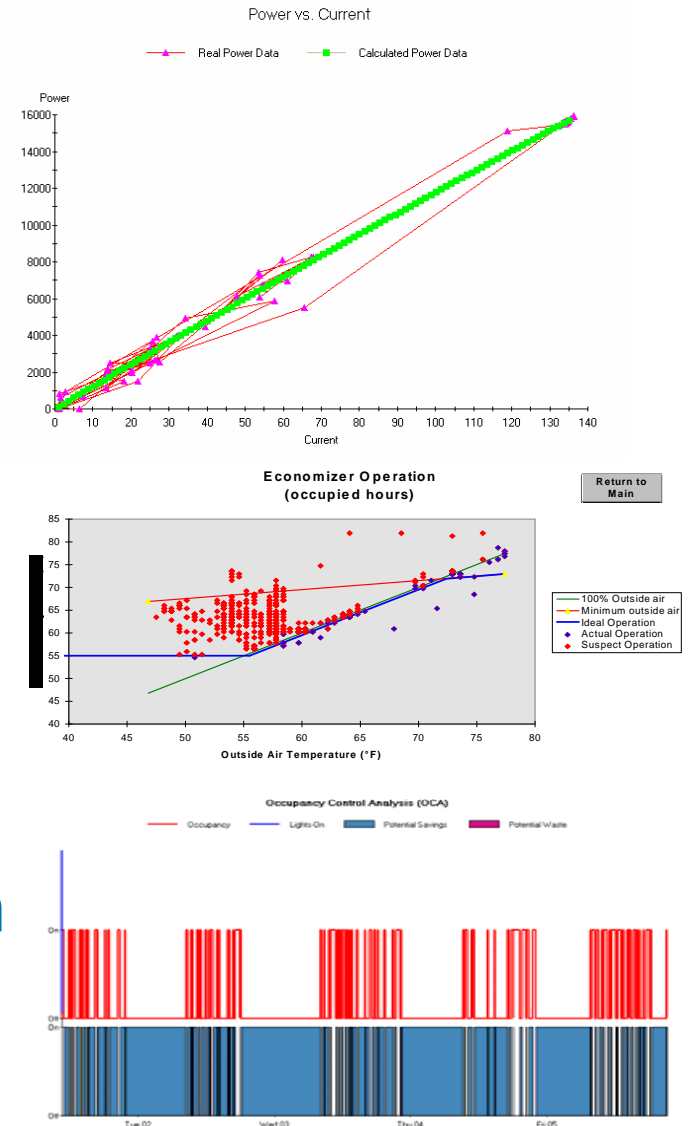
Universal Translator Software Demonstration

Other diagnostics

Data Analysis Routines

Economizer operation
Run time of equipment
Lighting controls
Plug load controllers
Psychrometrics
Zone set-point analysis
Regression analysis
Managing complex trend data

PIER funding will support addition
of many new diagnostics

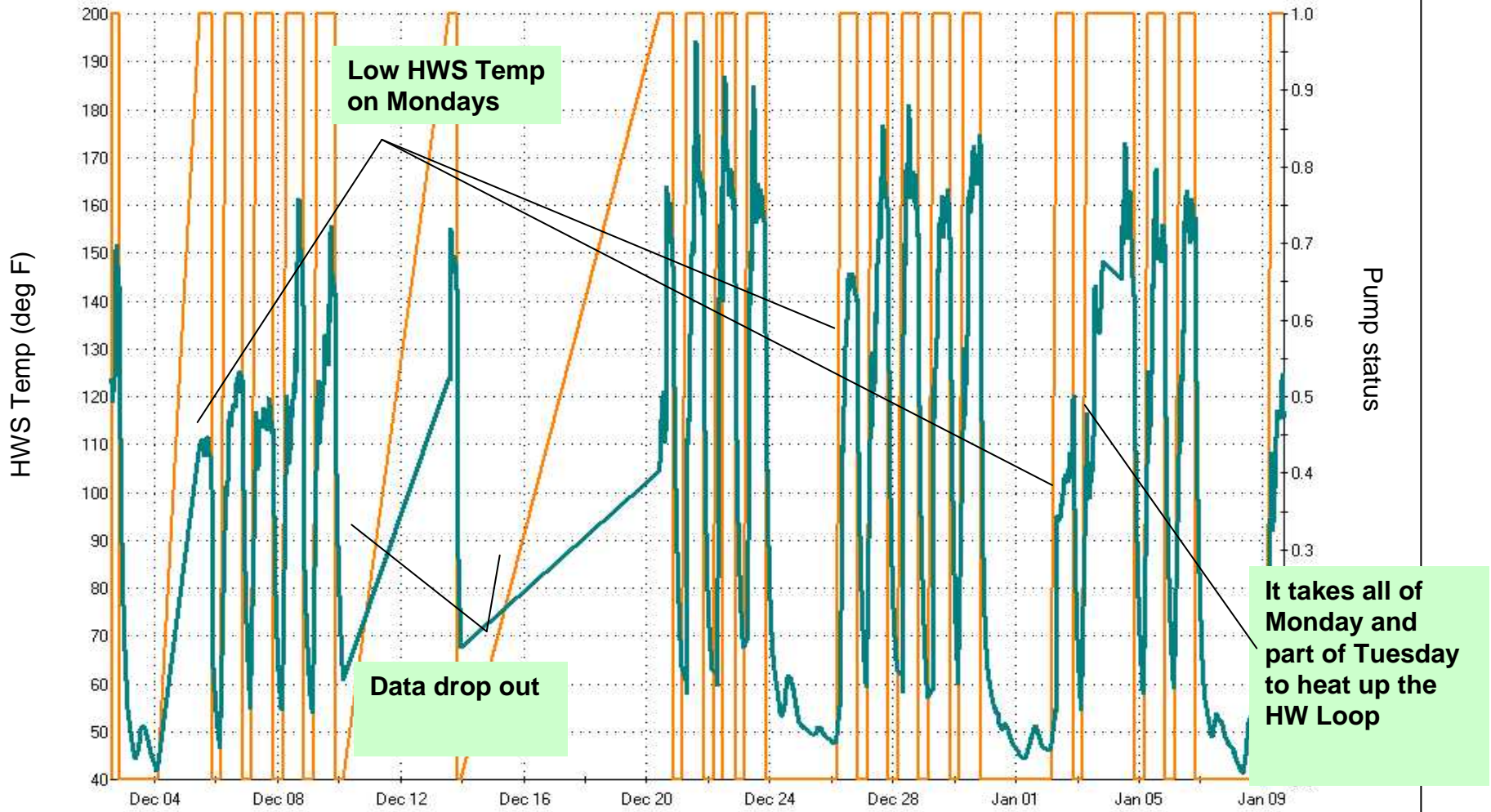


Universal Translator Software Demonstration

Quality of graphic
presentations

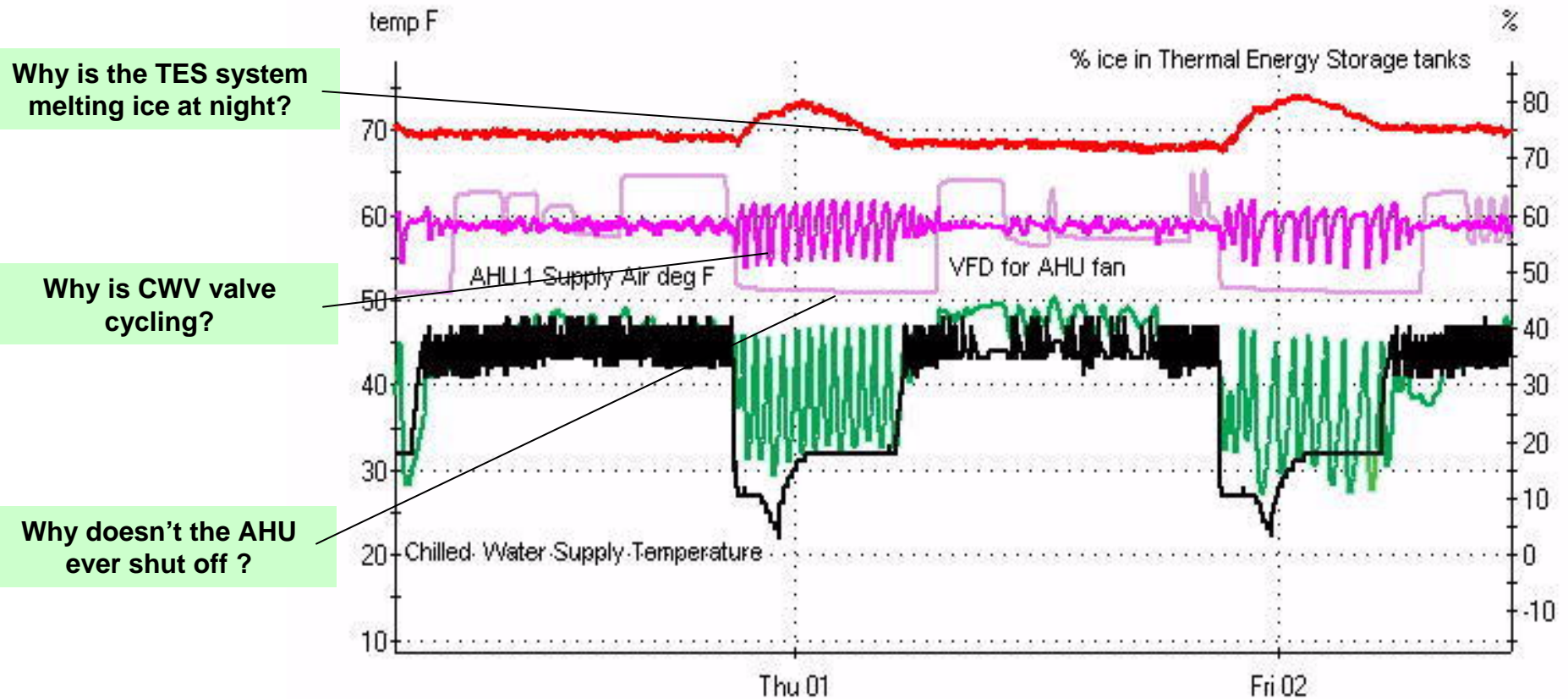
Data Representation Example I

HWST & Pump status with time



Data Representation Example 2

- AHU-1 SUP AIR TEMP - All Data - Left Axis
- Chilled Water Supply Temp - All Data - Left Axis
- ICE TANK LEVEL 1 - All Data - Right Axis
- AHU-1 CHW VALVE POS - All Data - Right Axis
- AHU-1 VFD % FULL SPEED - All Data - Right Axis



Ed Tufte's Principles of Graphical Excellence

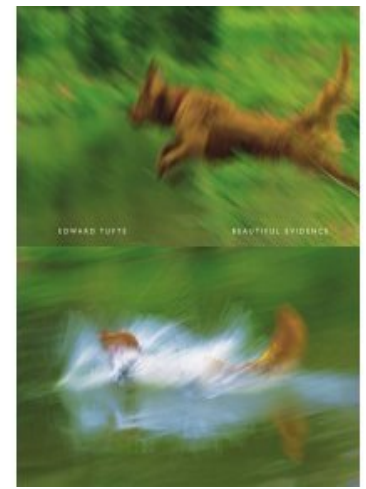
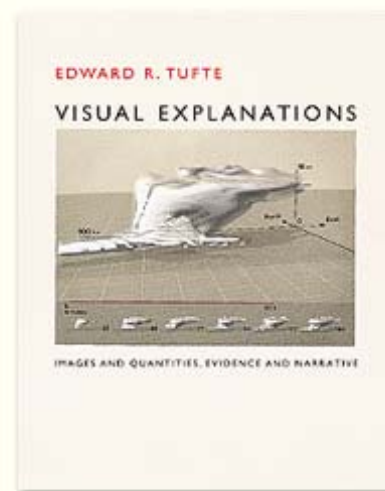
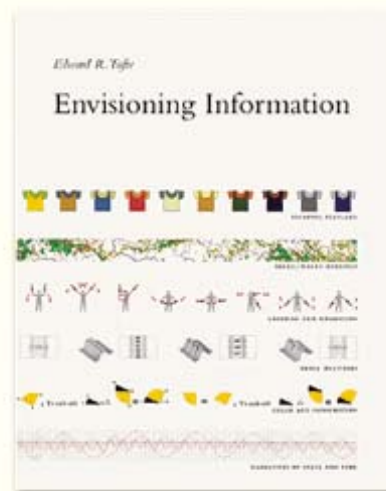
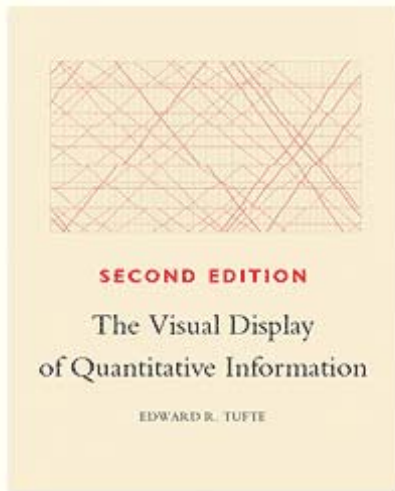
Graphical Excellence is the well-designed presentation of interesting data... a matter of *substance*, *statistics* and *design*.

Graphical Excellence consists of complex ideas communicated with clarity, precision and efficiency.

Graphical Excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space.

Graphical Excellence is nearly always multivariate.

Graphical Excellence requires telling the truth about data.



Where to get a copy of the UT software?

The screenshot shows the UT Online website interface. At the top, there is a navigation bar with links for Home, News, FAQ, Links, Contact Us, Search, Forum, UT Help, and Reference. The main content area is divided into three columns. The left column contains a 'Main Menu' with links to Home, News, FAQ, Links, Contact Us, Search, Forum, UT Help, and Reference. The middle column features an article titled 'What is the UT' with a sub-heading 'What is the Universal Translator (UT)?'. The article text describes the Universal Translator (UT) as software for managing and analyzing data from loggers and trends from building management systems. It includes time correction features, data filtering mechanisms, and a flexible graphing tool. The article is dated 'Last Updated (Tuesday, 05 September 2006)' and has a 'Read more...' link. Below the article is another section titled 'How do I get a copy of the UT?' with a sub-heading 'Registered users can download the latest version of the Universal Translator.' This section is also dated 'Last Updated (Tuesday, 05 September 2006)' and has a 'Read more...' link and a '[Back]' link. The right column contains a poll titled 'Polls' with the question 'Have you used UT to solve problems?'. The poll options are 'Never', 'A few times', 'Several times', and 'I use it every day!'. There are 'Vote' and 'Results' buttons. At the bottom left, there is a 'UT Login' form with fields for 'Username' and 'Password', a 'Remember me' checkbox, and a 'Login' button. Below the login form is a link for 'Forgotten your password??' and a link for 'No account yet? Create one'. A red circle highlights the 'No account yet? Create one' link, with an arrow pointing to the text 'Register at www.utoonline.org'.

Home

Sunday, 12 November 2006

UT Online

The website for users of the Universal Translator application

Home News FAQ Links Contact Us Search Forum UT Help Reference

Main Menu

- Home
- News
- FAQ
- Links
- Contact Us
- Search
- Forum
- UT Help
- Reference

What is the UT

What is the Universal Translator (UT)?

The Universal Translator (UT) is software designed for the management and analysis of data from loggers and trends from building management systems. The UT is ideal for large data sets from multiple sources. The software includes time correction features including the ability to synchronize data sets with different recording rates. The UT has data filtering mechanisms and a flexible graphing tool. UT analysis routines have been developed for equipment run-time, zone temperature variation, air-side economizers, and lighting controls. A routine that calculates statistics for each data set is available, and the UT has the ability to export data into other spreadsheet or analysis tools if necessary.

Last Updated (Tuesday, 05 September 2006)

[Read more...](#)

How do I get a copy of the UT?

Registered users can download the latest version of the Universal Translator.

Last Updated (Tuesday, 05 September 2006)

[Read more...](#)

[Back]

Polls

Have you used UT to solve problems?

- Never
- A few times
- Several times
- I use it every day!

[Vote](#) [Results](#)

UT Login

Username

Password

Remember me

[Login](#)

[Forgotten your password??](#)

[No account yet? Create one](#)

Register at www.utoonline.org

UTonline.org website also includes...

- Frequently asked questions
- Reference information
- Online tutorial and web-videos
- Users' forum
- News
- Help
- Links

Data Loggers Supported by UT



The *Universal Translator* can import data from various data loggers. Here's a [preliminary](#) list of vendors and devices. More info will be added in the near future.

Acme Data Loggers, Inc.	http://www.acmedl.com
Acme 1000	Temperature,DDI Support
Acme 2000	Temperature
ACR Systems, Inc.	http://www.acrsystems.com
Brand Electronics	http://www.brandelectronics.com
Dickson	http://www.dicksonweb.com
Hobo (Onset)	http://www.onsetcomp.com
Licor	http://www.licor.com
Pace Scientific	http://www.pace-sci.com/
Panamterics	...
Summit Technology	http://www.summittechnology.com
PS&T	...
Wattstopper	http://www.wattstopper.com

Last Updated (Thursday, 01 September 2005)

AIA Quality Assurance



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