a. The operator shall be able to recall archived data from the disk to be displayed in graphic format along with Real-time data, OPC data, alarm counters and any data programmatically added to the chart.

b. The display of archived data shall be user-configurable. It shall be possible to configure objects in graphic displays that, when selected, fetch pre-defined historical trend data from disk and display it to the operator. The System must allow for users to edit a pen's attributes during runtime.

c. The display shall support unlimited variables to be displayed on the same time/value axis simultaneously. For each entry in the display list, the operator will be able to assign a given point name and marker to a particular line color selected from palettes of unlimited colors. The operator may also enter display engineering units ranges to cause scaling of the display. Support shall be provided for multiple, different y-axis engineering units to be displayed, as appropriate.

d. The trend object will allow for bi-directional trending and scrolling. A user can select right to left or left to right.

e. A movable, vertical line will act as a time cursor on the display. This cursor can be moved by dragging it with the mouse. The date, time, and values of the trends corresponding to that time will be displayed in the bottom portion of the screen.

f. The grid of the trend object shall be scrollable.

g. The trend may be shifted forward or backward in time ("panning") by clicking on left/right buttons. New data will be fetched from the historical file as appropriate. Two sets of buttons shall be provided that cause shifting by different amounts of time. The amount of time shifting caused by these buttons shall be user-configurable.

h. The ability to display historical (pre collected) data with current (real time) data on the same chart shall be supported.

i. A transparent option for the trend shall be selectable.

j. The user shall be able to "zoom" in on any section of the trend display by "cutting" that section with a mouse. The software will automatically re-scale both the y-axis and time axis and will fetch the appropriate data for the time period selected.

k. The trend object shall have a refresh rate selectable in .1 second increments from a minimum of.10 seconds to a maximum of 1800 seconds.

Q. DATA HISTORIAN

1. General Requirements

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    g. The Data Historian shall be built with 64-bit code. The Data Historian shall operate on both 32-bit (x86) systems and 64-bit (x64) systems. The Data Historian shall automatically detect and install 32-bit or 64-bit Data Historian based on the System architecture.

    h. The Data Historian shall serve SCADA information to the corporate business unit. The Data Historian shall replicate the SCADA real-time database along with the historical trending and archiving data.

2. Administration And Configuration

    a. Administrative functions (e.g., point configuration, archive maintenance, etc.) shall be configurable using native tools or via a 100% browser based interface (Internet Explorer) without the need for any 3rd party ActiveX controls on the client computer.

    b. A non web-based administration tool shall also be available so that a web site is not required for system configuration.

    c. The user shall be able to browse and add points from any of the data sources (e.g. OPC)

    d. All configuration changes shall be “on-line” without the need to stop and re-start the data historian

    e. System shall provide for the automatic creation of archive files and the ability to automatically overwrite the oldest archive for unattended operation

    f. The System shall provide a method for backing up all on-line/active archives on-line without the need to stop the archive system.

3. Security

    a. The historian shall support Active Directory service providing single-log on capability and a central repository for information.

    b. Role-based security shall restrict user access to different administration and system functions. At a minimum these shall include:

        1) Security administrators
        2) Point maintenance
        3) Archive file maintenance
        4) Data collector maintenance
        5) Data readers
        6) Audited writes
        7) Unaudited writes

    c. Point-based security shall be configurable on a point-by-point basis and shall include the following:

        1) Readers
        2) Writers
        3) Administrators

    d. Security system shall support both local and domain-based security

4. Audit Trail

    a. The Data Historian shall come with an automatic audit trail mechanism that stores all configuration changes, user connections, security violations and performance metrics.

    b. The audit trail shall not be modifiable – a user may insert custom messages, but once stored an audit message cannot be modified or deleted regardless of the user's security privileges.

5. Point And Data Collection

    a. The System shall provide a graphical interface to browse and add points from any supported data source. Added points shall automatically determine the data type, description, point name from the data source

    b. All configuration changes shall be performed on-line with no restart required.

    c. The System shall use IRIG-B time code from the local GPS clock for time stamping data whenever possible.

d. System shall support both polled and exception-based data collection.

e. System shall provide both a collection rate and a collection-offset configuration.

f. Collection rates shall be configurable using intuitive seconds, minutes, hours drop down select lists.

g. System shall support 1 millisecond time stamp resolution.

h. System shall support the following native data types:

1) Single integer (2bytes)
2) Double integer (4bytes)
3) Single Float (4 bytes)
4) Double Float (8 bytes)
5) Scaled floats (scaling a float across 2 bytes)
6) Fixed length string (of any length)
7) Variable length string (of any length)
8) Binary Large Objects (BLOBs of any size)

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l. System shall provide for recording time stamps from either a collector PC or from the OPC/PLC point.

m. SCADA HMI shall have an automatic store and forward mechanism to ensure that data is not lost when disconnected to the data historian.

1) The store and forward mechanism shall not require the user to pre-allocate a buffer file, or set a maximum buffer file size. Instead, the System shall provide for utilizing available disk space up to a user configurable limit.

2) The store and forward mechanism shall automatically detect when the historian is available and forward data from the buffer files while simultaneously collecting all incoming data.

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6. Calculation Engine

   a. Architecture and Data Collection

      1) The System shall provide a calculation engine for the automatic calculation and analysis of both incoming and archived data and then storing the results of the calculation in the data historian as a point value.

      2) The calculation engine shall be configurable so that it can be installed on a PC, or several PCs that are remote from the data historian.

      3) The calculation engine shall have a store and forward mechanism to ensure that calculated results are not lost if the connection to the data historian is down.

      4) The calculation engine shall have a recovery logic system so that any updates to trigger points (calculation inputs) cause the calculation to re-fire. The calculation points shall be configurable to execute both as polled or unsolicited/trigger-based points.

      5) Unsolicited points execute their calculation whenever an assigned trigger point receives a new value, time stamp or change in quality.

      6) Calculations shall support an unlimited number of trigger points.

   b. Calculation Functions - The System shall support the following calculation functions:

      1) Browse and select any historian point as an input to the calculation
      2) Current/last stored value of any point
      3) Previous values of a point
      4) Next value of a point
      5) Interpolated values of a point
      6) Current/previous/next time stamp
      7) Current/previous/next quality
      8) Historical time-weighted average
      9) Historical time-weighted minimum
      10) Historical maximum
      11) Historical time-weighted standard deviation
      12) Historical time-weighted total
      13) Historical count of samples
      14) Historical raw average
      15) Historical raw standard deviation
      16) Historical raw total
      17) Time of minimum sample
      18) Time of maximum sample
      19) Total time that a sample was good

c. The System shall support filtered calculations so that the above calculations are automatically filtered/limited based upon another point's value. E.g., Calculate the minimum amps (point 1) over the previous day, but exclude any samples in which for the same time period the line voltage (point 2) was 0. Or, return the average for point 1, while the batch id (point 2) = 'ABC'

7. Calculation Configurations

a. The System shall support filtered calculations so that the above calculations are automatically filtered /limited based upon another point's value.

b. Calculations shall support full visual basic scripting within the calculation.

c. Calculations shall be configurable using the same administration tools (web and non-web) including all visual basic scripting and functions.

d. The System shall have tools to assess the time that a calculation takes to execute, as well as a means of disabling calculations that exceed a configurable maximum execution time.

e. The calculation engine shall have a manual recalculation engine so that calculations can be applied to legacy data and values stored alongside the legacy data as if the calculation engine had been executing in real time when the legacy data was archived.

8. Client Tools

a. Microsoft Excel

1) The data historian shall come with a Microsoft Excel tool bar so that users can readily extract data and develop reports using Excel.

2) The Excel add-in shall provide for the ability to import or modify points

3) The Excel add-in shall provide for the ability to import stored data.

4) The Excel add-in shall provide for the ability to import and view comments for any stored data

5) The Excel add-in shall not require the user to know the SQL query language.

6) The Excel interface shall provide for automatic recalculation if any cell is changed – e.g., a point name, time periods, selected calculations and so forth.

b. OLE DB

1) The data historian shall come with an OLE DB interface so that data can be extracted and viewed by client applications such as SQL Server and Crystal Reports.

2) The OLE DB interface shall provide access to all server time-weighted calculations as described in the Microsoft Excel section above.

3) The OLE DB Provider shall have write access disabled. You cannot insert, update, or delete data in archives using the provider.

4) The OLE DB interface shall provide SET statements and other functions so that time-weighted calculations and reports can be easily extracted.

5) e.g. The user shall be able to get the hourly average of a point or several points, regardless of how frequently they were collected by entering a statement such as shown below:

6) SET Interval milliseconds = 1Hour, Start Time = Yesterday, End Time = Today, Calculation Mode = Average Select Timestamp, Value from Raw Data where Point name = Point1 or Point name = Point2 SET statements shall include functions as shown below:

7) SET statements shall include functions as shown below:

a. Today, Yesterday, Now, Beginning of month, etc.

b. Interval = hours, minutes, seconds (for evenly spaced reports)

8) The OLE DB interface shall provide access to all system configuration, audit messages, and data

9) The data historian shall come with an OPC HDA interface so that data can be extracted and viewed by OPC HDA client applications.

c. system

1) The data historian shall have native connectivity to that manufacturers system product.

2) The HMI interface shall provide the ability to select if charts shall reflect time changes due to daylight savings time.

9. Web Interface

    a. The data historian shall have a 100% web-based client interface to browse, chart and display data.

R. EVENT SCHEDULING

1. The System shall support an event scheduler with event-based events, and time-based events. Any valid scripts or the like can be included in the scheduler. The scheduler shall be able to run as a background “service” to allow scripts to run regardless if an operator is logged in, or if the graphic application running.

2. Event-Based Events