INSTRUCTION MANUAL

CSIOPCServer User's Manual and Installation Guide

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CSIOPCServer

1. What is OPC and CSIOPCServer?

OPC is an acronym for "OLE (Object Linking and Embedding) for Process Control". It is a set of industry standards, based on Microsoft's OLE technology, designed to provide a common interface between automation and control hardware and software. The OPC specifications were developed by a group of organizations involved in the automation and control industries in conjunction with Microsoft Corporation. CSIOPCServer is a server application developed by Campbell Scientific to provide data from its dataloggers, via LoggerNet data acquisition and management software, in an OPC format to other applications. The CSIOPCServer supports OPC Data Access Specification 2.05a.

The purpose of this document is to describe how to use the CSIOPCServer to distribute information from a Campbell Scientific datalogger network to a third party OPC client. A brief overview is provided on the LoggerNet software and its role in facilitating this transfer of data. Refer to the LoggerNet User's Manual for additional information.

2. Hardware/Software Requirements and Installation

A resource disk is provided that includes installation files and documentation for the CSIOPCServer. CSIOPCServer was designed to run on a PC-based computer system. A Windows NT, 2000, or XP operating system is suggested, though the application will run on Windows 95, 98, or ME. In addition, Campbell Scientific's LoggerNet data acquisition and management software (version 1.1 or higher) must be installed and running on the computer that will act as the server for the datalogger network.

NOTE

LoggerNet and CSIOPCServer require TCP/IP services to be installed and running on the computer.

When the resource disk is inserted into the CD-ROM drive of your computer, the installation process should begin automatically. If it does not begin, access your CD-ROM drive and double-click the SETUP.EXE file. Follow the instructions on the screen to complete the installation.

2.1 Running the CSIOPCServer

The CSIOPCServer is registered as a Component Object Model (COM) server in the Windows operating system during installation. Therefore, it is not necessary to manually start the application. When an OPC client is started, the CSIOPCServer will be invoked automatically. However, if the server is not invoked, or if something occurs that requires the server to be shut down, it can be started by selecting Programs | Campbell Scientific OPC Server from the Windows start button. An icon, similar to that shown above, will appear in the computer's system tray when the CSIOPCServer is active.

NOTE Because the CSIOPCServer registration information is written to the Windows registry, if the executable is moved to another directory the registry must be edited to reflect this change. Refer to Section 6.1 for additional information.

2.2 Providing Data to Multiple Computers

The CSIOPCServer is designed to run on the same computer as the OPC client(s). Therefore, a copy of the CSIOPCServer must be running on each computer for which it will be providing data.

Each licensed copy of the CSIOPCServer allows the use of the software on one computer. If multiple computers will run the CSIOPCServer, multiple licenses must be purchased.

3. CSI's Hardware and Software in an OPC Application

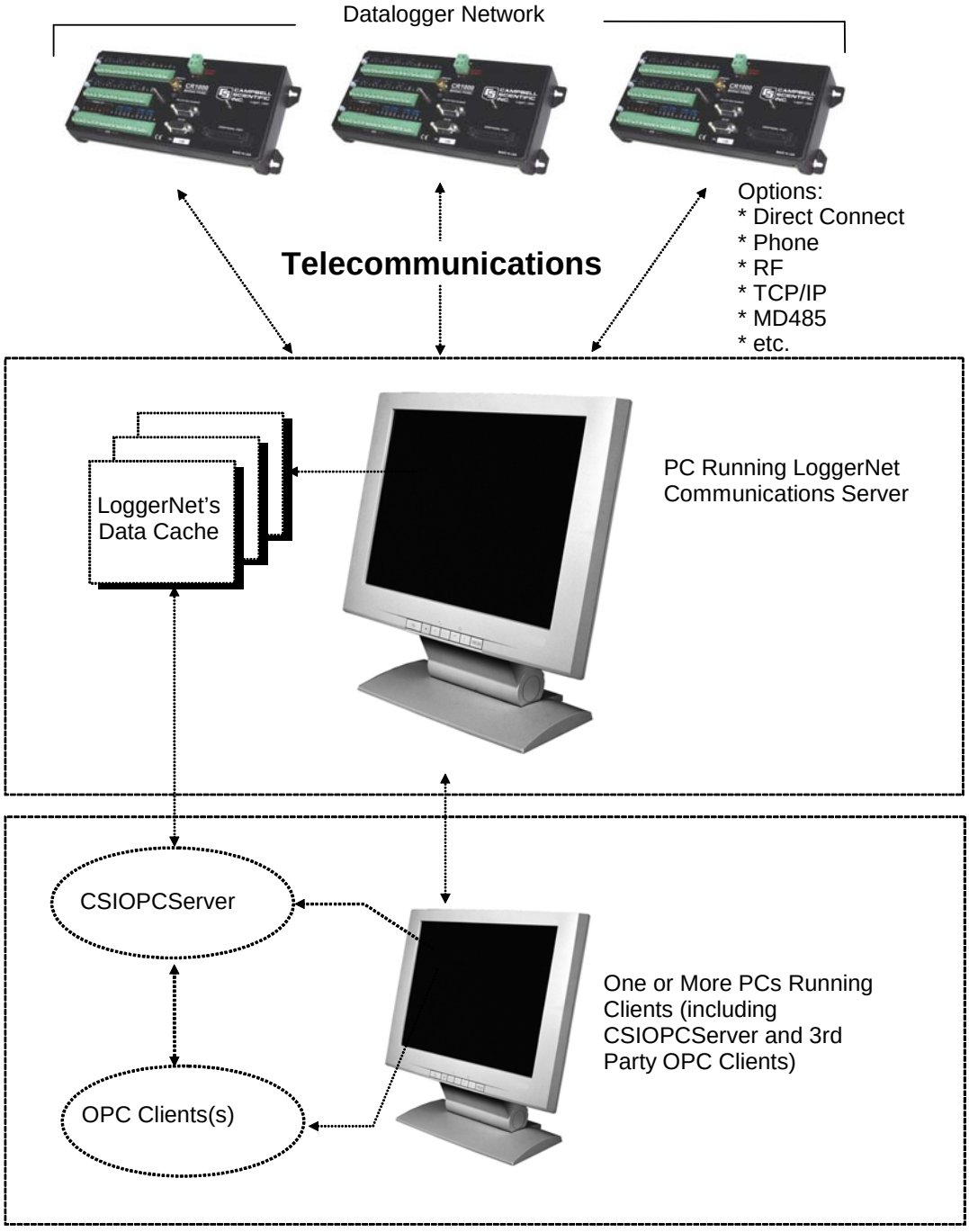
The CSIOPCServer is used to make data available from the LoggerNet communications server to other OPC-compatible applications. The CSIOPCServer requires LoggerNet version 1.1 or higher. To better understand the role of the CSIOPCServer in an OPC application, it is helpful to review how the LoggerNet software and its clients function in a data acquisition and management network.

The main component of the LoggerNet software is an application known as the LoggerNet communications server. All communication with the dataloggers occurs via the communications server. The communications server maintains a data cache (or binary database) of the data collected from the dataloggers and distributes the data simultaneously to multiple client applications for viewing, analysis, and archival.

The client applications provide tools for managing the datalogger network and retrieving data from the dataloggers. Clients can run on the same computer as the communications server, or, depending upon the version of LoggerNet you are running, they can connect to the communications server over a local area network or the Internet.

CSIOPCServer is a LoggerNet client. The function of the CSIOPCServer is to read the information from the data cache and make that data available to OPC-compatible clients. It must be run on each computer requiring the transfer of data from the LoggerNet communications server to an OPC client. In this sense, it is both a client and a server—it is a client to the LoggerNet communications server, and it is a server to an OPC client.

The diagram below depicts the flow of information between the datalogger network, LoggerNet communications server, LoggerNet client applications, and remote clients.



Note that data must be collected from a datalogger and stored in the LoggerNet data cache before that data will be available to OPC clients. Use LoggerNet's Setup screen client to define the data tables to be collected and the schedule on which the data should be stored in the data cache.

4. Identifying Data Values

4.1 Data Tags

A data tag is a text-based identifier for a specific data value that is being passed from the LoggerNet communications server to an OPC client via the CSIOPCServer. When a control in the OPC client is set up to display a data value from a datalogger, the OPC client uses the data tag to request the information from CSIOPCServer. Data tags used by CSIOPCServer are defined using a combination of the device name in the LoggerNet device map and data table and field names contained in the datalogger program. Data tags take the form of:

CSIOPCServer.device_name.table_name.field_name

where device_name is the name of the datalogger in LoggerNet's network map, table_name is the name of the table in the datalogger program, and field_name is the name of the variable, port, or flag for the data value being returned.

CRBasic dataloggers support variable arrays (dimensioned variables). CSI OPC Server supports only single-dimensioned variables, which take the format:

CSIOPCServer.device_name.table_name.field_name(array_element)

Where field_name is the name of the dimensioned array and array_element is the specific variable in the dimensioned array for the value being returned. As an example, the variable array created by “Public Temp(4)” in a CR1000 program for a datalogger named WeatherCR1000 would have the data tags:

CSIOPCServer.WeatherCR1000.Public.Temp(1)
CSIOPCServer.WeatherCR1000.Public.Temp(2)
CSIOPCServer.WeatherCR1000.Public.Temp(3)
CSIOPCServer.WeatherCR1000.Public.Temp(4)

Multi-dimensioned arrays are only supported if the elements of the arrays are given an alias. For example, you could use the following instructions in the CR1000 program:

```
Public Temp(2,3)
Alias Temp(1,1) = TC1
Alias Temp(2,1) = TC2
Alias Temp(1,2) = TC3
Alias Temp(2,2) = TC4
Alias Temp(1,3) = TC5
Alias Temp(2,3) = TC6
```

And CSI OPC Server would show tags as TC1, TC2, TC3, etc.

NOTE The format may vary somewhat from the examples given above, depending upon the client.

4.2 CSIOPCServer Browser

The CSIOPCServer allows OPC Universal Tag compliant browsing so that data tag names can be searched for from within an OPC application. The browser provides a list of all dataloggers in the network map and their associated data tables. The datalogger devices and their tables are presented in a directory-tree type structure, with variable names displayed under their respective tables. Multi-dimensional variables are presented with the name of the dimensioned variable as part of the directory-tree structure, with each variable in the array listed as a separate element.

NOTE The browser is a tool of convenience—it is not necessary to assign data tags using the browser. Data tag names can be typed in directly, in the format described above.

5. Data Reliability

5.1 OPC Technology and Campbell Scientific Dataloggers

OPC technology relies on consistent data from the OPC server. It expects that the structure of the data being passed from the server will not change. Therefore, it does not readily accommodate changes that occur if a new program is downloaded to a datalogger.

If changes are made to the datalogger program or the LoggerNet device map, it may be necessary to shut down and restart the OPC client before the client will recognize the data from the new device. Whether or not this is necessary will depend upon whether the OPC client stores device and table information or queries the server for the information at regular intervals.

The OPC Data Access Specification 2.05a supported by the CSIOPCServer is designed for real-time monitoring and control. It does not lend itself very well to historical trending. The data value passed to the OPC client is always the most recent value stored in the data cache. Because of this, if data is stored in a datalogger on a one-second interval, and that data is being collected using LoggerNet on a five-second interval, then the information passed to the OPC client will be missing some data points. If viewing historical trends is important, then the data should be exported to a file or one of the other LoggerNet clients should be used instead of CSIOPCServer.

5.2 Data Quality

CSIOPCServer will assign the data quality of "Bad" to any value that it determines is missing or stale. Situations that may return a "Bad" data quality include:

- The specified data tag does not exist in the datalogger table (because an error was typed when entering the data tag directly, a new program was downloaded to the datalogger, or the data tag was removed from the datalogger program).
- The table for a specified data tag does not exist or is not being collected by the LoggerNet communications server.
- The LoggerNet communication server has entered a Secondary Retry state with the datalogger because of communication failure with the device.
- The data value retrieved from the datalogger is out of range and is returned as NaN (not a number).

In instances where the data tag existed but has been removed from the program or from collection, once the situation is resolved collection of that value will resume automatically. If the Bad data quality is due to communication with the datalogger being in a secondary retry state, the display of good data values will resume when LoggerNet restores normal communication with the datalogger.

6. Technical Notes

6.1 Registering the CSIOPCServer

If the CSIOPCServer executable is moved to a different directory or if that directory is renamed, it will be necessary to re-register the server for it to run automatically when an OPC client is started. Open a command prompt screen and change to the directory in which the executable resides. Then type:

```
CSIOPCServer /RegServer
```

In some instances, you may wish to remove the CSIOPCServer application as a COM server from your computer. Open a command prompt and change to the directory in which the executable resides. Then type:

```
CSIOPCServer /UnregServer
```

6.2 DCOM

CSIOPCServer has not been tested for DCOM compatibility. Therefore, DCOM implementation is not supported by Campbell Scientific. We do not support running the CSIOPCServer on one DC to feed ODC clients on other PCs.

6.3 Server and Device Operational Statistics

The server controller and individual devices maintain statistics that help to describe their operation. These statistics are made available to the clients in a collection of tables associated with a virtual device. It is represented by _ _*statistics*_ _ in the communications server.

Each device in the network map is represented by two tables in the statistics device. The names of these tables are the result of appending the strings *"_hist"* and *"_std"* to the device name.

The network controller also maintains statistics regarding the operation of the communications server as a whole. These statistics are available in the *"_ _LgrNet_ _ _ _controller_ _"* table.

6.3.1 Device History Statistics

The name of a history table for a device is the result of appending the string *"_hist"* to the device name. This table consists of three columns and has a row size of 144. A new record for the table is generated every ten minutes. This allows the table to describe the operation of the datalogger over the last 24 hours. The counters for this table are set to zero at the beginning of each ten-minute interval. The columns for this table are as follows:

6.3.1.1 Attempts

Type: uint4

Description: Records the total number of communications attempts the device made during the ten-minute interval. This counter is incremented by one for every entry that appears in the communications status log and is associated with the device.

6.3.1.2 Failures

Type: uint4

Description: Records the total number of communications failures that the device experienced during the ten-minute interval. This counter is incremented by one for every "F" record that appears in the communication status log and is associated with the device.

6.3.1.3 Retries

Type: uint4

Description: Records the total number of retries that the device experienced during the ten-minute interval. This counter is incremented by one for every "W" record that appears in the communication status log and is associated with the device.

6.3.2 Device "Standard" Statistics

The name of the standard statistics table associated with a device is the result of appending the string, *"_std"* to the device name. This number of columns in this table is variable depending on the device type and the version of the LoggerNet server, although there are statistics that are common to all.

6.3.2.1 Communication Enabled

Type: boolean

Applies to: all device types

Description: Relates whether communication is enabled for this device.

6.3.2.2 Average Error %

Type: float

Applies to: all device types

Description: A running average of the number of “W” or “F” messages that are logged in the communication status log for the device versus the total number of messages logged.

6.3.2.3 Total Retries

Type: uint4

Applies to: all device types

Description: A running total of the number of communication retry events that have been logged since the device was started or the statistic was last reset.

6.3.2.4 Total Failures

Type: uint4

Applies to: all device types

Description: A running total of the number of communications failure events that have been logged since the device was started or the statistic was last reset.

6.3.2.5 Total Attempts

Type: uint4

Applies to: all device types

Description: A running total of the total number of communications attempts that have been made for the device since the device was started or the statistic was last reset.

6.3.2.6 Comm Status

Type: byte enumeration

Applies to: all device types

Description: Describes the current communication state of the device. The following values are defined:

1. normal (last communication succeeded)
2. marginal (last communication needs to be retried)
3. critical (last communication failed)
4. unknown (No communication attempt has failed since last reset or the device was started)

6.3.2.7 Last Clk Chk

Type: stamp

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X, CR10T, CR10X-TD, CR510T, CR23X-TD, CR9000, CR5000, CR10X-PB, CR510-PB, CR23X-PB, CR200 Series, CR800, CR1000, CR3000, RF95T

Description: Relates the server time when the clock was last checked.

6.3.2.8 Last Clk Set

Type: stamp

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X, CR10T, CR10X-TD, CR510T, CR23X-TD, CR9000, CR5000, CR10X-PB, CR510-PB, CR23X-PB, CR200 Series, CR800, CR1000, CR3000, RF95T

Description: Relates the server time when the clock was last set.

6.3.2.9 Last Clk Diff

Type: interval (int8)

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X, CR10T, CR10X-TD, CR510T, CR23X-TD, CR9000, CR5000, CR10X-PB, CR510-PB, CR23X-PB, CR200 Series, CR800, CR1000, CR3000, RF95T

Description: Relates the difference between the server clock and the datalogger clock at the last time the clock was checked or set.

6.3.2.10 Coll Enabled

Type: boolean

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X, CR10T, CR10X-TD, CR510T, CR23X-TD, CR9000, CR5000, CR10X-PB, CR510-PB, CR23X-PB, CR200 Series, CR800, CR1000, CR3000

Description: Set to true to indicate that scheduled collection is enabled for the datalogger.

6.3.2.11 Last Data Coll

Type: stamp

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X, CR10T, CR10X-TD, CR510T, CR23X-TD, CR9000, CR5000, CR10X-PB, CR510-PB, CR23X-PB, CR200 Series, CR800, CR1000, CR3000

Description: The server time when the last data collection took place for the datalogger. This statistic will be updated after a manual poll or scheduled data collection succeeds or partially succeeds (brings in some data from some areas but not all data from all selected areas).

6.3.2.12 Next Data Coll

Type: stamp

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X, CR10T, CR10X-TD, CR510T, CR23X-TD, CR9000, CR5000, CR10X-PB, CR510-PB, CR23X-PB, CR200 Series, CR800, CR1000, CR3000

Description: The server time when the next polling event will take place for the datalogger for the currently active schedule.

6.3.2.13 Last Coll Attempt

Type: stamp

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X, CR10T, CR10X-TD, CR510T, CR23X-TD, CR9000, CR5000, CR10X-PB, CR510-PB, CR23X-PB, CR205, CR210, CR215, CR1000

Description: Describes the last time data collection (manual poll or scheduled collection) was started for this device.

6.3.2.14 Coll State

Type: enumeration

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X, CR10T, CR10X-TD, CR510T, CR23X-TD, CR9000, CR5000, CR10X-PB, CR510-PB, CR23X-PB, CR200 Series, CR800, CR1000, CR3000

Description: The current state of scheduled collection for the datalogger. The following values are defined:

1. normal - The normal collection schedule is active.
2. primary - The primary retry schedule is active.
3. secondary - The secondary retry schedule is active.
4. schedule off - The collection schedule is disabled.

5. comm disabled - Communications for this device, one of its parents, or for the whole network is disabled.

6. invalid table defs - Collection for this station is disabled until the table definitions are refreshed.

7. network paused - Automated operations are paused for the network either because the scheduledOn setting is turned off or because the server application DLL (coralib3.dll and newer) has not yet been enabled for automation.

8. unreachable – The device cannot be reached through the network.

6.3.2.15 Vals Last Coll

Type: uint4

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X, CR10T, CR10X-TD, CR510T, CR23X-TD, CR9000, CR5000, CR10X-PB, CR510-PB, CR23X-PB, CR205, CR210, CR215, CR1000

Description: The number of scalar values that have been collected from the datalogger since the last poll began.

6.3.2.16 Vals to Coll

Type: uint4

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X, CR10T, CR10X-TD, CR510T, CR23XTD, CR9000, CR5000, CR10X-PB, CR510-PB, CR23X-PB, CR200 Series, CR800, CR1000, CR3000

Description: The number of scalar values that are/were expected in the current or last poll.

6.3.2.17 Values in Holes

Type: uint4

Applies to: CR10T, CR10X-TD, CR510T, CR23X-TD

Description: The number of values in holes that need to be collected from the datalogger.

6.3.2.18 Uncoll Holes

Type: uint4

Applies to: CR10T, CR10X-TD, CR510T, CR23X-TD

Description: The total number of values that have been in uncollectable holes since the device was started or the statistic was reset.

6.3.2.19 Line State

Type: enumeration

Applies to: All devices except BMP5 (PakBus) dataloggers

Description: The current line state for this device. The following values are defined:

1. not-applicable — In its current configuration, this device will not communicate directly with the server. This value will appear in association with BMP1 dataloggers connected to the server through an RF95T.
2. off-line — The server has no communication resources open for this device.
3. on-line — The server has communication resources open for this device.
4. transparent — This device has been dialed to reach a child device.
5. undialing — The child devices have gone off-line and this device is cleaning up the link so that it can go to an off-line state.
6. comm-disabled — Communications are disabled for either this device, its parent, or for the whole
7. network. unreachable — The device cannot be reached through the network.
8. pending — The device has requested the link from its parent but that request is still pending.
9. targeted — The device has requested the link from its parent and its parents (and grandparents) are being dialed to open the link.

6.3.2.20 Polling Active

Type: bool

Applies to: All datalogger devices

Description: Reflects whether there is presently a polling operation that is active for the device. A value of true will indicate that some sort of polling is taking place.

6.3.2.21 FS1 to Collect

Type: uint4

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X

Description: Reflects the total number of final storage values that need to be collected from final storage area one of a classic datalogger if collection is active for that area. If collection is not active for that area, this statistic reflects the last count that should have been collected.

6.3.2.22 FS1 Collected

Type: uint4

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X

Description: Reflects the total number of final storage values that have been collected from a classic dataloggers final storage area one.

6.3.2.23 FS2 to Collect

Type: uint4

Applies to: CR10, CR10X, CR510, CR23X

Description: Reflects the total number of final storage values that need to be collected from final storage area two of a classic datalogger if collection is active for that area. If collection is not active for that area, this statistic reflects the last count that should have been collected.

6.3.2.24 FS2 Collected

Type: uint4

Applies to: CR10, CR10X, CR510, CR23X

Description: Reflects the total number of final storage values that have been collected from a classic dataloggers final storage area two.

6.3.2.25 Logger Ver

Type: uint4

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X

Description: Relates the datalogger interface version as given in the datalogger's response to the "A" command.

6.3.2.26 Watchdog Err

Type: uint4

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X

Description: Relates the datalogger watch dog error count as given in the classic datalogger's response to the "A" command.

6.3.2.27 Prog Overrun

Type: uint4

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X

Description: Relates the number of datalogger program overruns that have occurred since the last reset as given in the classic datalogger's response to the "A" command.

6.3.2.28 Mem Code

Type: uint4

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X

Description: Relates the memory size code as given by the classic datalogger's response to the "A" command.

6.3.2.29 Coll Retries

Type: uint4

Applies to: 21X, CR7X, CR10, CR10X, CR500, CR510, CR23X, CR10T, CR10X-TD, CR510T, CR23X-TD, CR9000, CR5000, CR10X-PB, CR510-PB, CR23X-PB, CR205, CR210, CR215, CR1000

Description: Reports the number of collection retries that the datalogger device has had since the first collection error occurred. This statistic is reset to zero when the logger returns to a normal collection state.

6.3.2.30 Low Volt Stopped

Type: uint4

Applies to: CR10X, CR500, CR510, CR23X

Description: Reports the number of times that a classic datalogger has shut itself down because its supply voltage has been too low. This information is read from the "A" command results.

6.3.2.31 Low 5v

Type: uint4

Applies to: CR23X

Description: Reports the number of times that the CR23X +5 volt supply has been reported below five volts. This information is read from the "A" command results.

6.3.2.32 Lith Batt Volt

Type: float

Applies to: CR10X, CR500, CR510, CR23X

Description: Reports the lithium battery voltage on classic dataloggers. This value is extracted from the results of the "A" command.

6.3.2.33 Table Defs State

Type: enumeration

Applies to: CR10T, CR10X-TD, CR510T, CR23X-TD, CR9000, CR5000, CR10X-PB, CR510-PB, CR23XPB, CR200 Series, CR800, CR1000, CR300

Description: Relates the current state of cached table definitions for a table based (BMP1, BMP3, or BMP5) datalogger. The following values are defined:

1. none - No table definitions have been received from the datalogger.
2. current – The server's table definitions are believed to be current for the datalogger.
3. suspect – A collection attempt has returned an invalid table definitions code. The server needs to verify the table definitions for the logger.
4. getting – Indicates that the server is currently trying to get the table definitions from the datalogger
5. invalid – The table definitions are known to be invalid and need to be manually refreshed before collection can continue.

6.3.3 Server Statistics

The statistics relating to the host machine for the server or to the operation of the server as a whole can be found in a the table named *"__LgrNet____controller__"*. These statistics are updated every ten seconds. There is only one row defined for the table. The statistics available in this table are as follows:

6.3.3.1 Disc Space Avail

Type: int8

Description: Relates how many bytes are free on the volume where the server's working directory resides.

6.3.3.2 Avail Virt Mem

Type: uint4

Description: Relates the amount of virtual memory that is available to the server process.

6.3.3.3 Used Virt Mem

Type: uint4

Description: Relates the amount of virtual memory that is being used by the server process. This value is derived from the AvailVirtMem by subtracting the value of that statistic from the maximum size win32 memory space (2^{31}- 1).

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