Kepware Products for Windows 95™ ,98™, 2000™,
NT™, And XP™

LinkMaster Client Connectivity Guide

KTSM-00022

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32 Bit KepserverEx Connectivity Guide

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Introduction to LinkMaster

The LinkMaster is a 32bit Windows application that provides a means of linking data between OPC servers. As a bonus, it can also act as an OPC to DDE converter for DDE client access. LinkMaster has the capabilities of both a "Server" and a "Client" application. As a client, the LinkMaster can access data from one or more OPC server(s). As a server, the LinkMaster is able to collect, organize and link data from other OPC servers and offer that data to an OPC/DDE client. In certain situations, there may be a need to transfer data from one server component to another or from one OPC client to another, but the two components were not designed to communicate directly. The LinkMaster solves this problem by acting as a universal go-between for OPC server/client components.

Across many software disciplines and business segments it is very common to hear the term "client/server application". In the industrial market, it usually refers to the sharing of manufacturing or production data between a variety of applications ranging from human machine interface (HMI) software and data historians, to large MES and ERP applications. Regardless of the business segment served, client/server applications have one thing in common, a standardized method of sharing data. In the industrial segment, many client/server technologies have been developed over the last ten years. Initially some of these technologies were proprietary. In many cases these proprietary client/server architectures were in wide use, but remained unavailable to third party applications. Early in the development of Windows, Microsoft provided a generic client server technology called DDE or Dynamic Data Exchange. DDE did provide a basic architecture that would allow many Windows applications from a wide range of vendors to share data, but there was one problem. DDE was not designed for the industrial market; it lacked much of the speed and robustness desired in an industrial setting. However, this did not stop DDE from becoming dominant client/server architecture, largely due to its availability in most Windows applications. In time, variations on Microsoft's DDE were developed by some of the leading vendors in the market. These variations addressed some of the speed and reliability issues of DDE, but many people in the industrial segment agreed that a better system for sharing data was needed.

Non OPC Connectivity

Kepware recognizes that a number of legacy applications still depend upon DDE for their underlying client server technology. To address these applications LinkMaster has been designed to provide the same access to device data via DDE, as can be achieved using OPC.

Supported Non OPC Methods

- CF_Text
- XL_Table
- AdvancedDDE
- NetDDE

Introduction to KepserverEx

KepserverEx is a 32 bit windows application that provides a means of bringing data and information from a wide range of industrial devices and systems into client applications on your windows PC. KepserverEx falls under the category of a "Server" application. It is very common to hear the term "client/server application" in use across many software disciplines and business segments. In the industrial market, it has usually come to mean the sharing of manufacturing or production data between a variety of applications ranging from human machine interface software and data historians, to large MES and ERP applications.

Regardless of the business segment served, client/server applications have one thing in common: a standardized method of sharing data. In the industrial segment, many client/server technologies have been developed over the last ten years. Initially, some of these technologies were proprietary. In many cases these proprietary client/server architectures were in wide use but remained unavailable to third party applications. Early in the development of windows, Microsoft provided a generic client/server technology called DDE or Dynamic Data Exchange. DDE did provide a basic architecture that would allow many windows applications from a wide range of vendors to share data, but there was one problem. DDE was not designed for the industrial market. It lacked much of the speed and robustness desired in an industrial setting. However, this did not stop DDE from becoming dominant client/server architecture, largely due to its availability in most windows applications. In time, variations on Microsoft's DDE were developed by some of the leading vendors in the market. These variations addressed some of the speed and reliability issues of DDE but many people in the industrial segment agreed that a better system needed to be developed.

With the advent of 32 bit Operating Systems, and the use of Ethernet to provide communications between devices, there was a need for quicker and cleaner data transfer between software applications. This is where OPC saw its birth into the industry.

OPC (OLE for Process and Control) servers provide a standardized method of allowing multiple industrial applications to share data in a quick and robust manner. The OPC server provided in this package has been designed to meet the demanding requirements found in the industrial environment.

This OPC server has been designed as a two-part program. The primary component provides all of the OPC and DDE connectivity as well as the user interface functions. The second part is comprised of plug-in communications drivers. This two-part design allows you to add multiple communications options to your SCADA application while utilizing a single OPC server product thus reducing your learning curve as your project grows.

OPC technology reflects the move from closed proprietary solutions to open architectures that provide more cost-effective solutions based on established standards.

Accessing KepserverEx

A Windows based client application must be used to view data from the KepserverEx application. In this section we will cover the basics of connecting a number of common OPC clients to KepserverEx. While we cannot possibly cover every client application that exists, we believe that after reviewing this document you should be able to deal with most client applications.

The intention of this section is to show connectivity to KepserverEx. It is assumed that you have already either configured your KepserverEx application by selecting the appropriate driver and settings or you have run the Simulator demo (Simdemo.opf) which is included with KepserverEx. For simplicity, the Simdemo project will be used for all examples contained in this section.

Before beginning any of the examples, start the KepserverEx application by selecting it from your Start Menu or from its desktop icon. Once the server is loaded, use the File|Open command to load the “Simdemo” project. The KepserverEx application is always active once you have opened an existing project or configured at least one channel and device in a new project. After you have selected a project, in this case the Simdemo project, KepserverEx will automatically load this project when an OPC client application invokes KepserverEx’s OPC server component.

Users have always had the ability to create what we refer to as “user defined tags” in their KepserverEx application. Prior to OPC, defined tags gave a DDE application designer the ability to create a label for device data. Assume register 1000 contained the value of parts made, without defined tags a DDE application would have directly accessed register 1000. Using defined tags a label can be created like “PartsMade”. Now the DDE application could access the data via this new label, removing the machine level knowledge from the client application and keeping it at the server level where it belongs. This label, while useful for DDE is a necessity for OPC clients. For

OPC clients, defined tags take on a greater role. Like the DDE example, defined tags allow you to create labels for your device data and keep the configuration of those tags in the server. OPC clients have a major advantage over DDE clients. OPC clients can browse the defined tags you create in your KepserverEx application, which allows you to simply point and click on a tag to add it to your OPC client project.

OPC Tag Browsing allows you to see a list of the defined tags you have created in your KepserverEx application, directly within your OPC client application.

For more information on defined tags see the "Designing a Project" section of the KepserverEx help file, which can be accessed from the Help/Contents menu selection of the KepserverEx application.

Non OPC Connectivity

While KeperverEx is first and foremost an OPC server, it was recognized that a number of applications still depend upon DDE or some other form of Connectivity for their underlying client server technology. To address these applications the server has been designed to provide the same access to device data via these as can be achieved using OPC. :

Supported Non OPC Methods

- CF_Text - Microsoft
- XL_Table - Microsoft
- NetDDE - Microsoft
- AdvancedDDE - RSView
- FastDDE/SuiteLink - WonderWare
- PDB - Ifix

Using KepserverEx Drivers

Part of the innovative design of Kepware's OPC/DDE Server Technology is the separation of the Hardware Protocol Driver from the Server Technology. This separation allows the user to use one or more drivers in the server at the same time. Each driver has its own help file that provides information on devices supported, communications parameters, cabling, addressing, and error messages.

The driver help file should contain all of the information you will need to connect your device to the PC so that the server can communicate with it. If you do not connect to the device, be sure to check the error messages and look up their meaning in the help file.

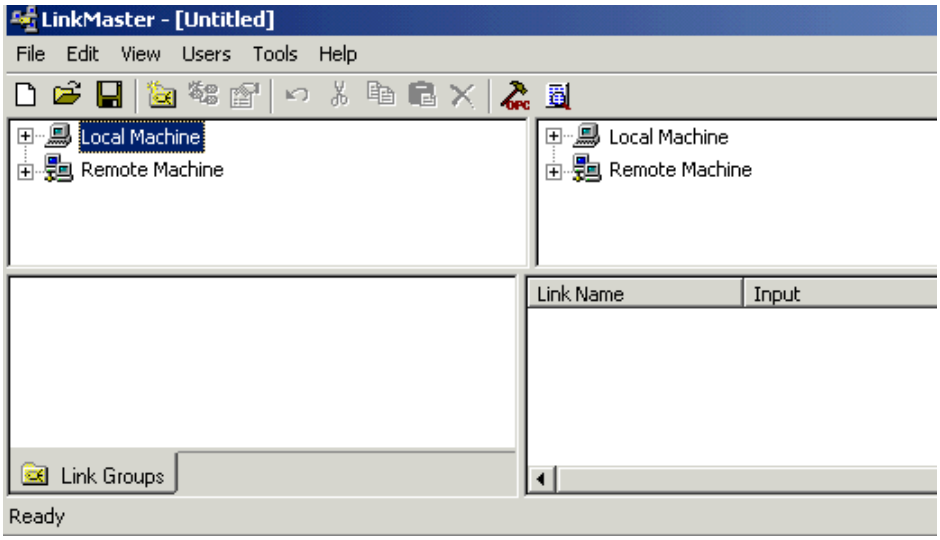
LinkMaster as an OPC Client

Connecting to a Server with LinkMaster

The following steps will show how to create a LinkMaster project to bridge between two devices in one OPC server. The same process can be used to bridge between different servers on the same PC or between servers on multiple PC's. All of the information in this guide can be found in the LinkMaster Help file.

Start LinkMaster

To start link master double click on its shortcut icon, either on the desk top of or in the Start|Programs|LinkMaster folder.

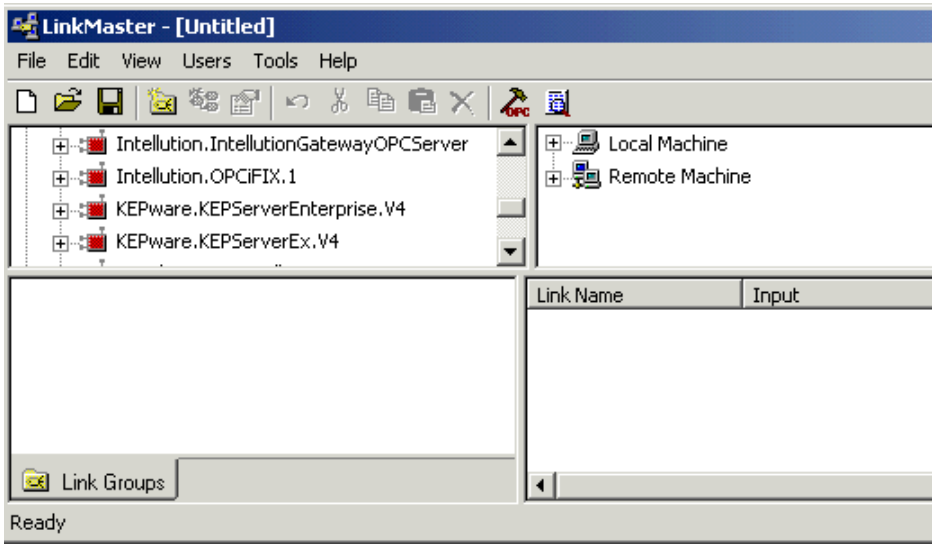


The fist time that LinkMaster starts you will get a new project. After that you will get the last project that was created and saved. To get a new project select File|New from the Main Menu or click the New File button.

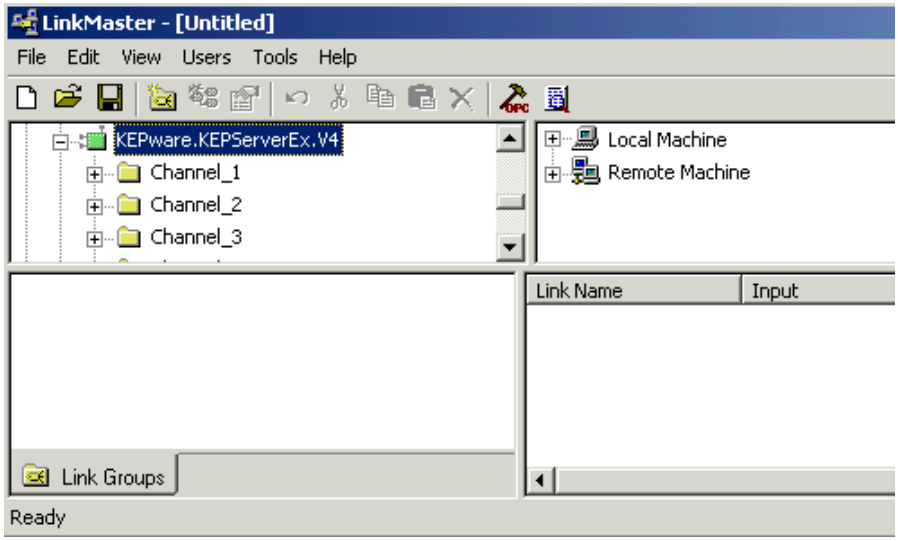
Browse and Connect to a Server

Next find the server or servers that contain the items to be placed in the links. This example browses the local PC but could as easily browse a remote PC for available servers. To browse for a server simply click on the expand icon or double click on the area you wish to browse.

LinkMaster uses OPCEnum for browsing and connecting to servers. If you cannot find a server but know that it is there it si possible that it is not properly registerd as an OPC 1.0 or 2.0 serverand you are using an older version of LinkMaster. Upgrading to the newest version of LinkMaster should correct this problem.



When you see the server you wish to connect to you can either expand the folder or double click it to connect to it. As soon as your are connected to the server, the folder ICON will change from red to green and in the case of Kepware's KepserverEx you will see the channels that are configured in the server project.

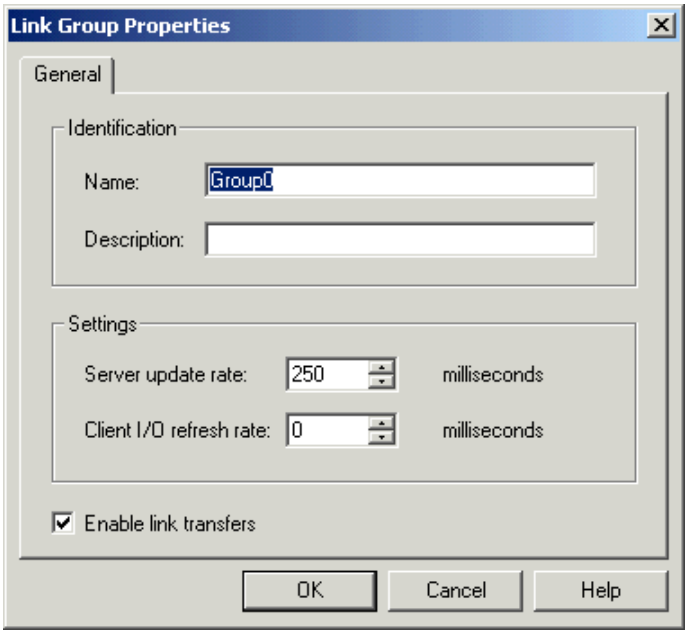


You can connect to multiple servers at one time with the LinkMaster and can use one or both of the browse panes to do so.

Create a Link Group

Once you have connected to at least one server you can start defining the data links. To do this you first have to create at least one Link Group. You can define as many link groups as needed within a single project.

To add a new link group you can use either the Edit|New Link Group in the Main Menu or from the Right Click menu, or lastly you can select the New Link Group  button. You can click OK and select the defaults for this group.



About the LinkGroup

Name - Enter the string that will represent the data available from this group. Each link group name must be unique in a LinkMaster application. The Link group name can be up to 31 characters long. While using long descriptive names is generally a good idea, keep in mind that some OPC client applications may have a limited display window when browsing the tag space of an OPC server such as LinkMaster. The Link group name entered here will be part of the OPC browser information.

Description - You can attach a comment to the Link group. A string of up to 64 characters can be entered for the description.

Server Update Rate - This sets the rate at which LinkMaster checks the server for changing values and updates the link's output item(s) if a change has occurred. For those familiar with OPC terminology, this value equates to the group update rate of the server and can dictate the rate that your OPC server will poll its connected devices. If the data you wish to transfer to your output, is changing slowly, you will want to define this setting at a slow rate. The default setting for the Server Update Rate is 250 milliseconds; the valid range is 10 to 3,600,000 milliseconds.

Client I/O Refresh - Specifies the rate at which link Input values are written to link Outputs. By default this option is set to zero (Off). Normally this setting does not need to be enabled because the Server Update Rate interval dictates refresh writes according to changing input values from the server. Unnecessary writing to the input cache with a possibly non-changing item can be expensive in terms of CPU resources, but in certain situations it may be important to "correct" the link's output if other sources have written to it. This parameter should only be used when continuous updates to your outputs are required.

Note: Writing from a high-speed input to a low speed output can overload the write queue of your target OPC server. A "Client I/O Refresh" setting that exceeds the ability of your OPC server to write data will, in many cases, cause your OPC server to consume more system memory than normally required. Continued operation in this state may consume all available system memory. Use the slowest acceptable rate if this parameter must be used. Also, you can adjust

the "Write Optimizations" done by LinkMaster to help reduce the number of writes sent to your OPC server.

Enable Link Transfers - This setting allows the user to turn On/Off link writes within that group. This setting can also be set via a client by accessing that group's system tag called "_Enabled".

Note: This will only effect the transfer of data between the input and output side of a link item. If you are using LinkMaster as a bridge between a server and a client the data will continue to be polled and passed on to the client application.

Group Icon - If a group is correctly added, you should see the group icon in the lower left hand window of LinkMaster. If the group icon turns gray, at any point during your project run, you probably have an item in the group that is in error (consult the event log). If the group color is red, then the link transfers for that group have been disabled.

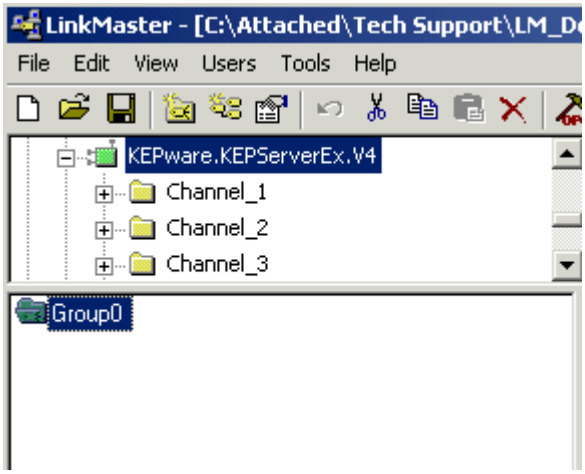
Feature Note: You can change any of these parameters at any time. Changes to a link group will take effect immediately. If you change the name of a link group, OPC clients that have already used that link group as part of an OPC item request will not be affected until they release the item and attempt to reacquire it. New link groups added to your project can immediately be viewed from an OPC client. To prevent operators from changing these parameters, implement the User Manager to restrict access rights to these and other LinkMaster features.

Create Link Items for the Link Group

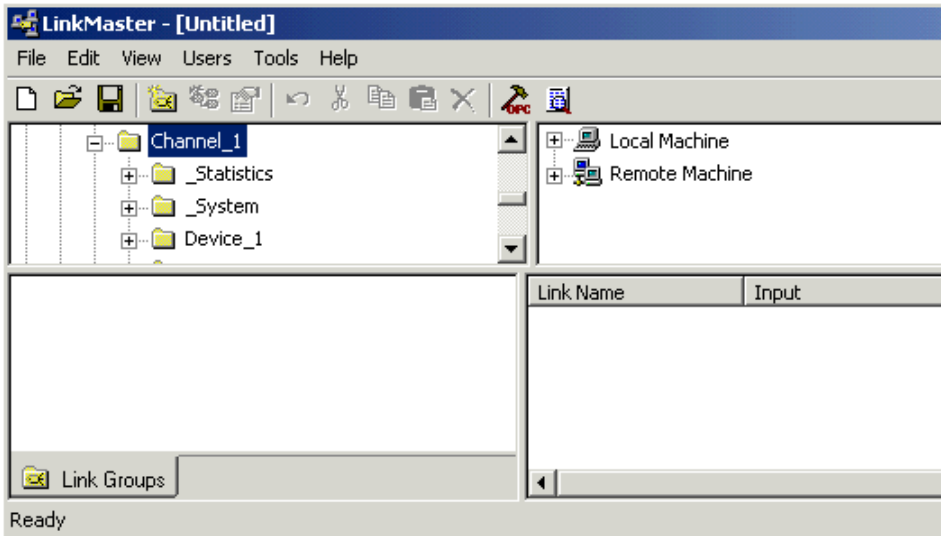
Once you have created a link group you will need to add link items to it. Remember that this example uses the KepserverEx for its connected client. Other servers may present the data differently to you when browsing it.

Adding Links with Drag and Drop

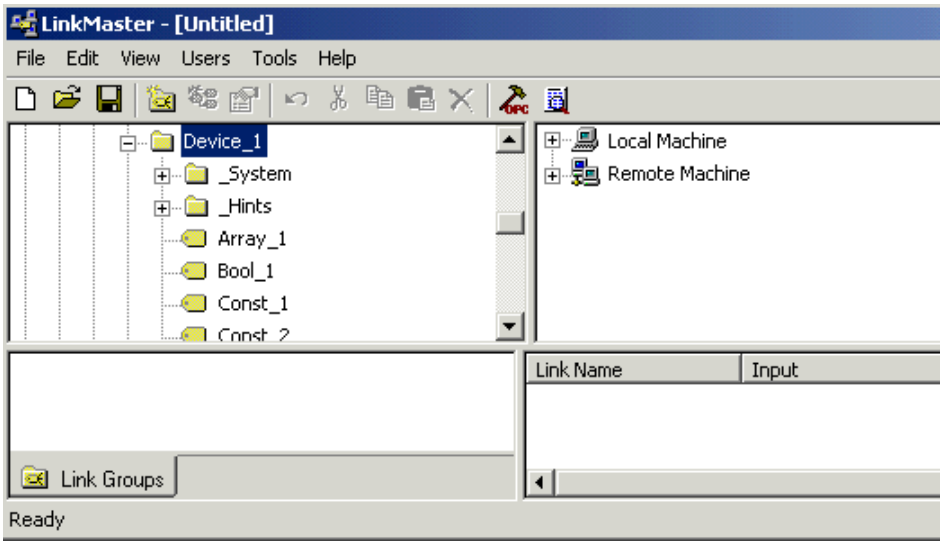
Select the group you plan to add the link items to.



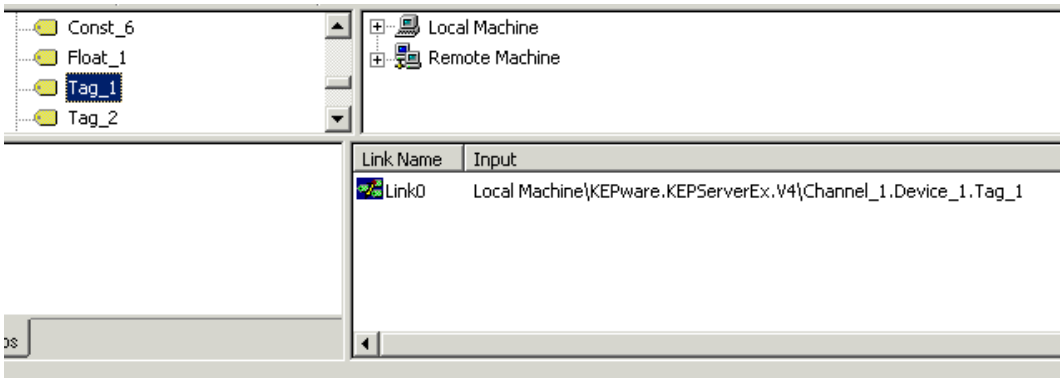
Expand the channels that you wish contains the device you want to get Items from.



Expand the Device that contains the item you want to use. You should see the tags under the device.

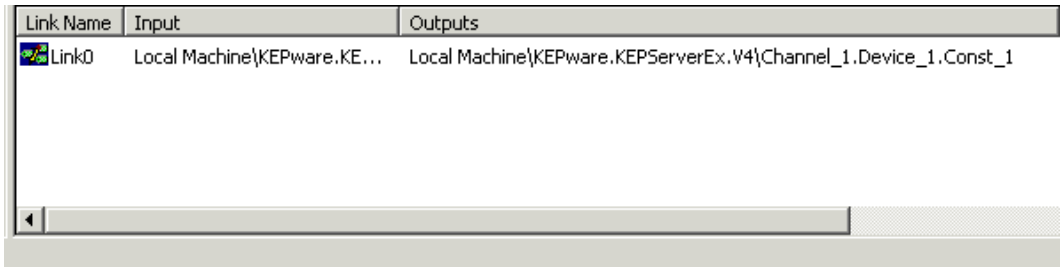


Now browse to the tag that you want. We selected Tag_1 and it will be the input to our link. Select the tag with the left mouse button and while holding it drag the mouse to the Link item section below Input and release the mouse button. LinkMaster will automatically create a new link with the item as the input. This value will be read from your target OPC server at the rate specified in your Link Group settings.



Next, if you are using link master to bridge two servers or devices you will need to browse to and select the item that the input value will be written to. This time you will drop the item on the output link that you just created. LinkMaster will immediately start polling the input and writing the changing value to the output item.

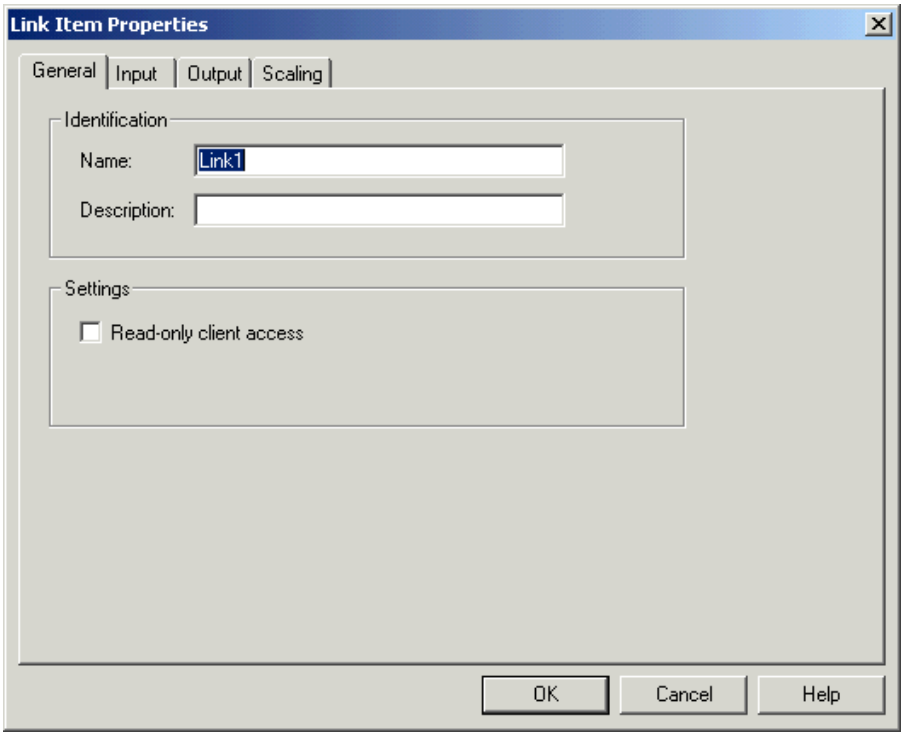
If you are using LinkMaster to Bridge from an OPC server to a DDE client or to throttle polling rates you do not have to create an output to the link..



Adding Links Manually

In addition to the Drag and Drop method you can manually add links to the link group. As in the Drag and Drop method you will have to select the link group you are adding to.

To add a new link you can use either Edit|New Link in the Main Menu or the Right Click menu, and lastly you can select the New Link button. The Link Item Properties will open to the General Tab. By default the new link item will be given the next sequential default link name. You can change the name if you wish.



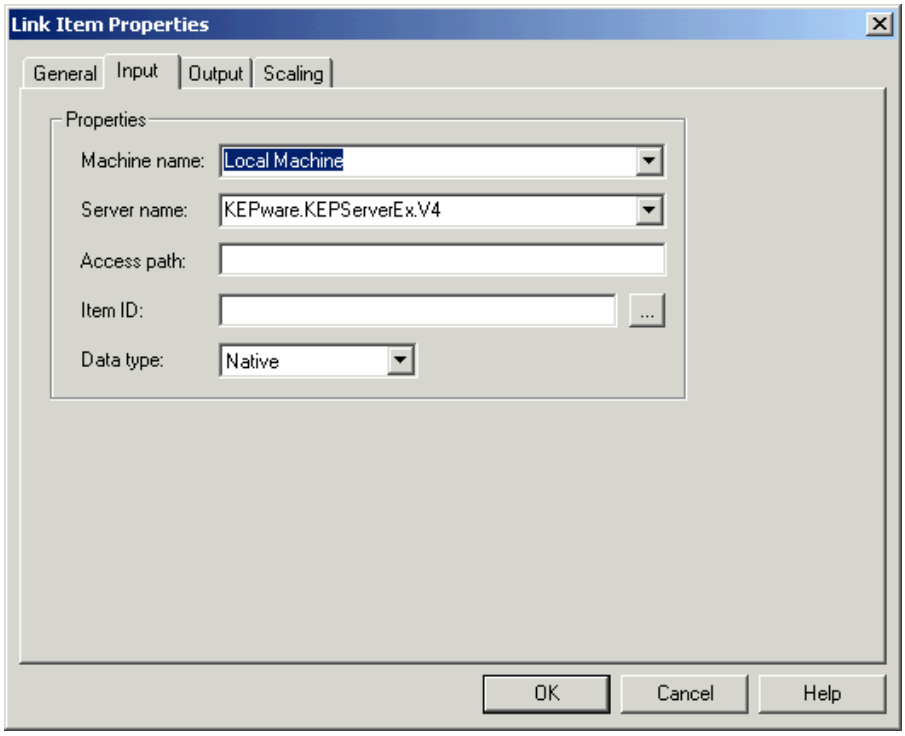
About the Link Item General Page

Name - This parameter allows you to enter the string that will represent the data available from this link tag. The name can be up to 31 characters in length and must be unique within any given link group.

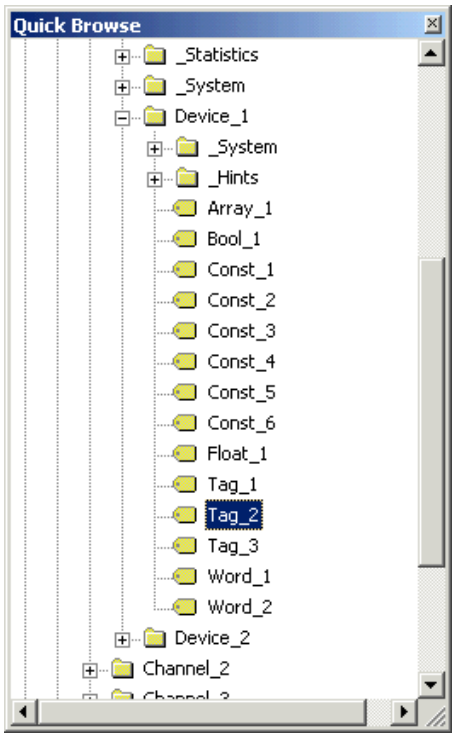
Description - This parameter allows you to attach a comment to this tag. A string of up to 64 characters can be entered for the description. If you are using an OPC client that supports Data Access 2.0 Tag Properties, the description parameter will be accessible from the Item Description property of the tag.

Read- only client access - This selection allows you to specify whether this link is "Read only" or "Read/Write". By selecting Read Only, you can prevent client applications from changing the data contained in this tag. Otherwise, leaving this setting unchecked will allow client applications to change this link tag's value as needed. The "Client access" selection also affects how this tag will appear in the browse space of an OPC client. Many OPC client applications allow you to filter tags based on their attributes. Changing the access method of this tag may change how and when the tag will appear in the browse space of your OPC client.

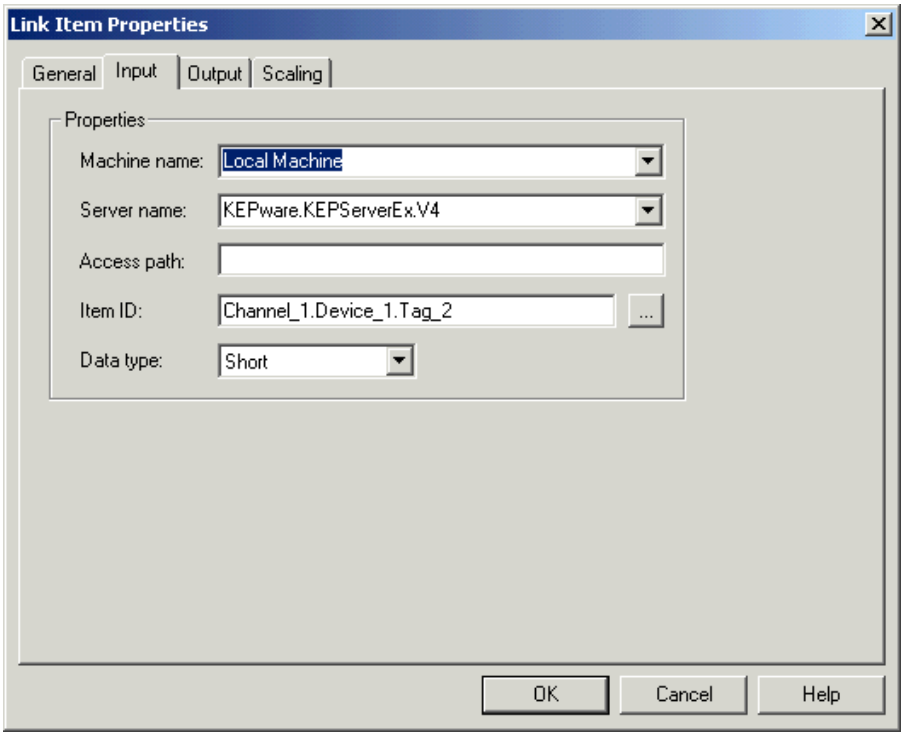
Next you will select the Input tab. The Link Item Input allows you to define the source of data that will be transferred to one or more output items. This value will be read from your target OPC server at the rate specified in your Link Group settings.



In the Input tab of the Link Item Properties window you will establish the Machine name by selecting the Machine/PC where the server you want is. Once the machine/PC selected you will select the server from the Server Name drop down list. You can type the Item ID of the tag you want as the input or you can use the Browse ... button to open the browse window and select the tag you want.



In the Browse window find the tag you want as an input and double click on it. As seen below the proper Item ID will we written to the Item ID field and the Data type will be changed to match that of the tag that was selected.



About the Link Item Input Page

Machine Name - You may choose either your local machine or a machine located on your Ethernet network (if any are available). If the server is located on the same machine as the LinkMaster, you can leave the setting as "Local Machine"

Server Name - Allows you to choose the OPC server from which you want to get source data from. In this case the Input data will be coming from KepserverEx.

Access Path - This is required by some OPC servers to complete an item definition. Refer to your OPC server's documentation to determine whether or not you need to specify an access path.

Item ID - The OPC server item used to reference the data. Refer to your OPC server's documentation to determine valid item names for the location in question. If the server supports tag browsing then you can select an item by using the browse feature.

Data Type - This is the requested data type that should be used when communicating between the OPC server and the OPC LinkMaster. This should be specified to agree with the size and type of the register or memory location that is being addressed. Supported data types are defined as follows:

Native	Default as determined by the OPC server
Boolean	Single bit
Char	Signed 8-bit value
Byte	Unsigned 8-bit value
Short	Signed 16-bit value
Word	Unsigned 16-bit value
Long	Signed 32-bit value
DWord	Unsigned 32-bit value

Real	Single precision floating point value. (32-bits)
Double	Double precision floating point value (64-bits)
String	Zero terminated character array

All of these are available as Array types except for Boolean and String.

At this point you can click on the Output tab to define the link output.

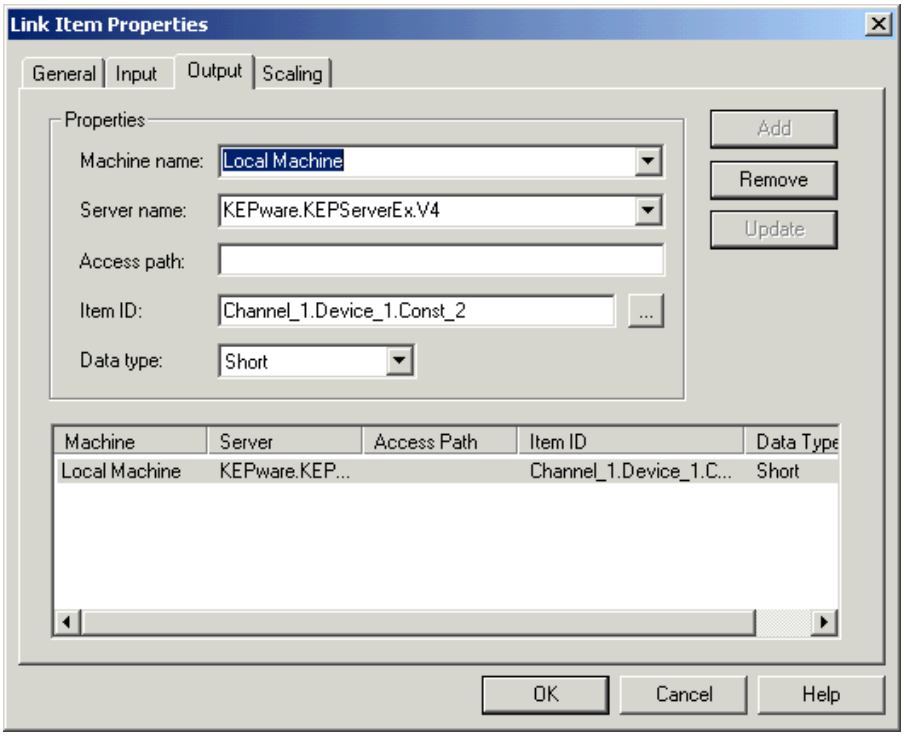
Link outputs allow you to define one or more OPC items that will be written to, when the Input item changes. The link's Output dialog allows you to, browse and select an available local or remote machine, choose an OPC server on the selected machine, and then select any of the desired tag items located on that server, as outputs.

You are allowed to add as many outputs as needed in the link item output section. Enter the item you want in the Item ID and click the Add button (or double-click).

You may also remove any output item at any time by highlighting the item in the output display and clicking the Remove button.

Any changes that are made to existing outputs can only be updated by pressing the Update button.

If you are using LinkMaster to Bridge from an OPC server to a DDE client or to throttle polling rates you do not have to create an output to the link..



About the Link Item Output Page

Machine Name - You may choose either your local machine or a machine located on your Ethernet network (if any are available). If the server is located on the same machine as the LinkMaster, you can leave the setting as "Local Machine"

Server Name - Allows you to choose the OPC server from which you want to get source data from. In this case the Input data will be coming from KepserverEx.

Access Path - This is required by some OPC servers to complete an item definition. Refer to your OPC server's documentation to determine whether or not you need to specify an access path.

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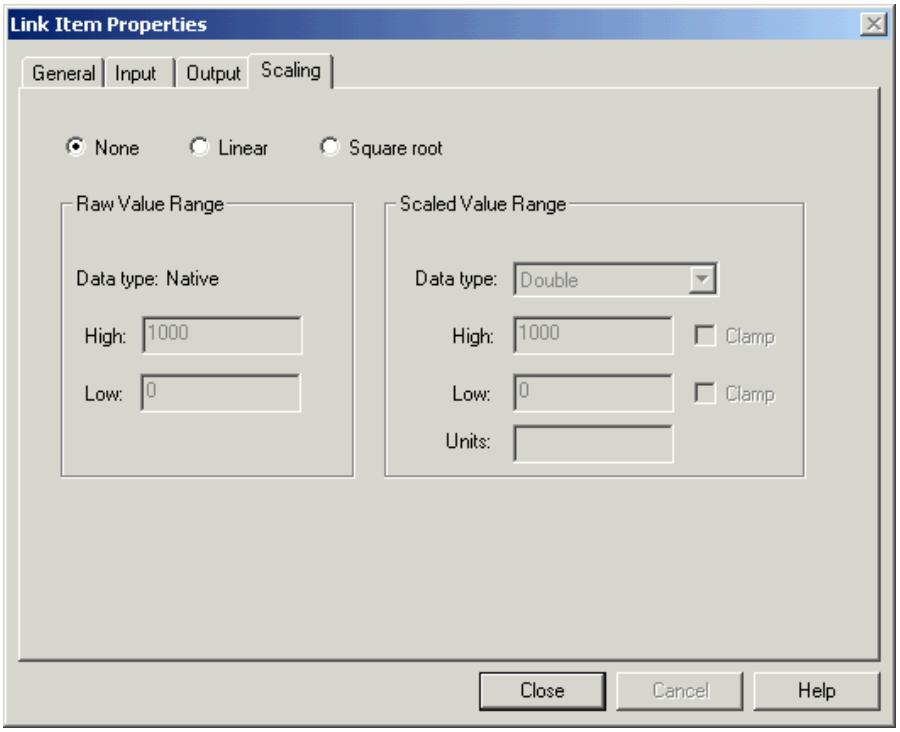
DWord	Unsigned 32-bit value
Real	Single precision floating point value. (32-bits)
Double	Double precision floating point value (64-bits)
String	Zero terminated character array

All of these are available as Array types except for Boolean and String.

LinkMaster supports Link Item scaling, which allows raw input data from your server to be scaled to a more appropriate range for your Link Output item or client application. There are two types of scaling: Linear and Square Root. If you need to scale your input data then you can select the Scaling tab at this time.



Selecting either Linear or Square Root scaling will enable scaling operations for the Link Item.

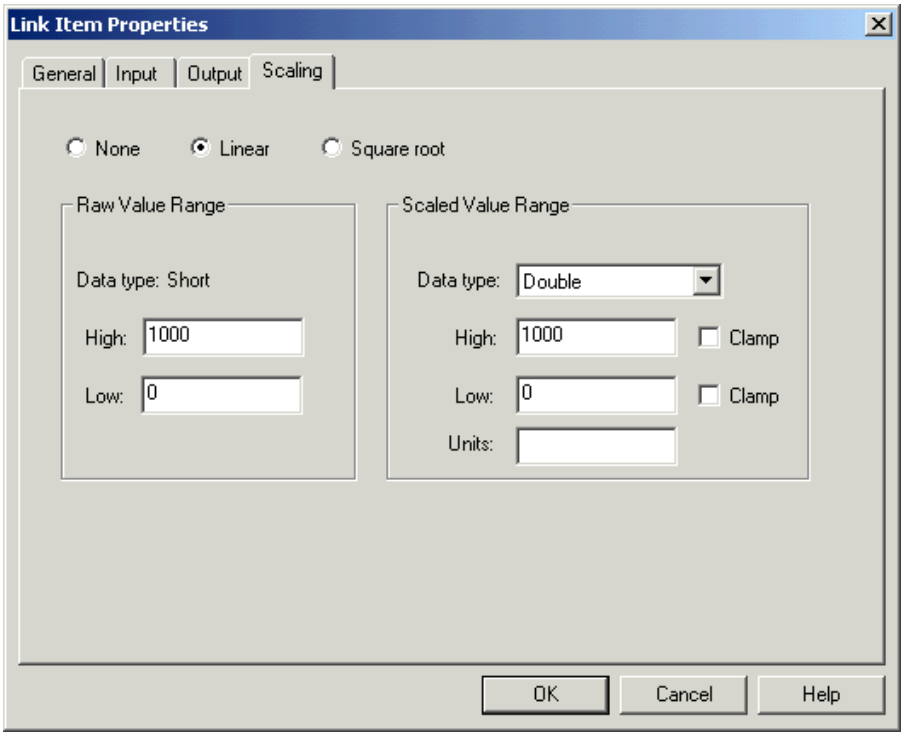
The raw data range allows you to specify the range of raw data from the server. The valid range is dependent upon the data type of the Link Item's raw value. If, for example, the raw value was set to Short, the valid range of the raw value would be -32768 to 32767. The raw high range must be greater than the raw low range.

Normally a scaled value is assumed to result in a floating-point value. LinkMaster does not make that assumption for you. The data type of the "Scaled Value" can be set to any valid OPC data type. This gives you the ability to scale from a raw data type, such as Short, to an engineering value with a data type of Long, if it is needed. The default scaled data type is "Double".

The scaled data range allows you to specify the range of the resulting scaled value. The valid range is dependent upon the data type of the scaled value. If, for example, the scaled data type is set to Long the valid range is -2147483648 to 2147483647. The scaled high range must be greater than the scaled low range.

In many cases the raw data from the device exceeds the range you have specified for the raw data. When this occurs the scaled value is also forced outside of the range you have established. To prevent this, the High and Low clamps can be used to constrain the scaled value to the range specified.

LinkMaster also allows a unit's string to be assigned to a scaled Link item. The unit's string can be up to 32 characters long.



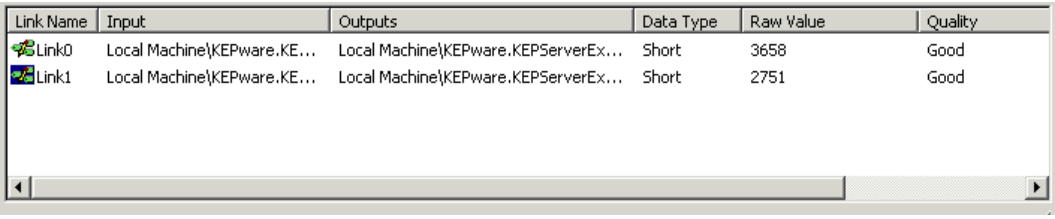
LinkMaster supports the OPC tag properties available in the 2.0 Data Access specifications. If the OPC client that you are using supports these properties, it can automatically configure the range of objects, like user input objects or displays, using the data entered here.

Note: You can change any of these parameters at any time. Changes made to LinkMaster properties such as scaling will take effect immediately; however

OPC clients that have already connected to this Link item tag will not be affected until they release and reacquire this tag.

Verifying the Link

Now that you have created one or more links you can verify that they are reading data as it changes by viewing the Raw value of the link which is displayed in the 5th column of the link item area.



Link Name	Input	Outputs	Data Type	Raw Value	Quality
Link0	Local Machine\KEPware.KE...	Local Machine\KEPware.KEPServerEx...	Short	3658	Good
Link1	Local Machine\KEPware.KE...	Local Machine\KEPware.KEPServerEx...	Short	2751	Good

Save and Close the Project

Once you have created a Link Master project you will want to save it. To save the project you can, select Help|Save from the main menu or click the Save button.

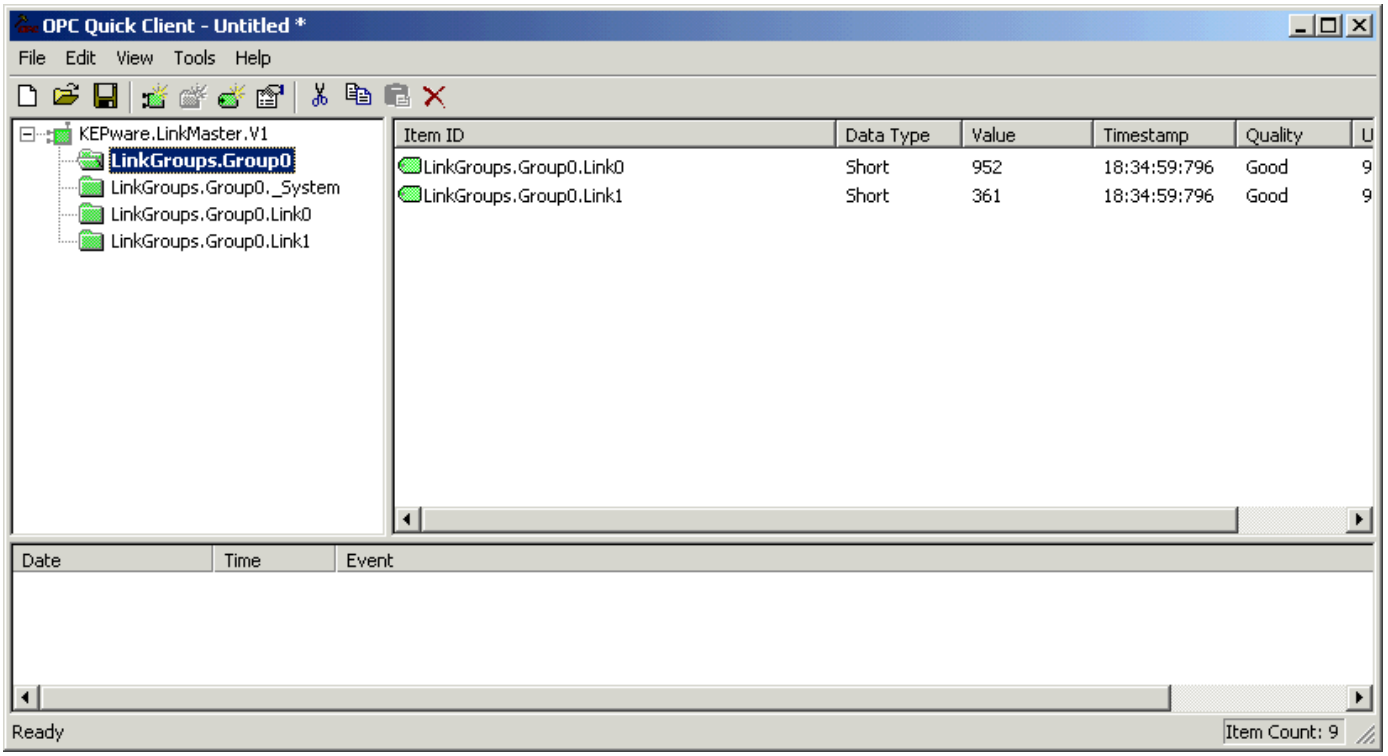
Once the project has been saved any time you open LinkMaster it will be loaded as long as it is the last project that was opened.

LinkMaster as an OPC/DDE Server

As we discussed at the beginning of this documents not only can LinkMaster be used to bridge data between one or more servers but it can also be a server itself to bridge data between OPC only servers and DDE only clients or to throttle client poll rates.

For a quick example of how LinkMaster can be a server go to the LinkMaster button bar and click the Launch OPC Client  button. This will cause the Kepware OPC Quick Client to start and automatically generate a project from the available Groups and items in LinkMaster.

You will notice right away that the client has several groups that are not visible in your LinkMaster project. These will contain system and link item specific items like group and link status tags and the group enable tag that was briefly discussed earlier. For details on these items see the LinkMaster help file.



Kepware's OPC QuickClient as an OPC Client

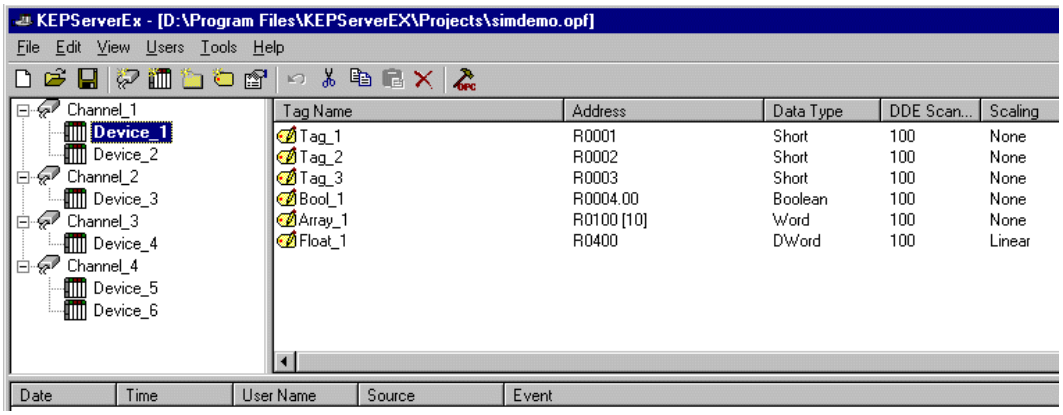
Connect to KepserverEx from Kepware's OPC Quick Client

Kepware's OPC Quick Client is an interface that can be used to connect to KepserverEx. For this example, the OPC Server Version used is V4.41.163 and the OPC client version used is version *4.20.66*. The following steps will show you how to create an OPC connection to the KepserverEx from the Test Client either by using the auto project launch form the server or by manually starting the client and creating a project. Both examples use the "SimDemo.opf" project provided with the server install.

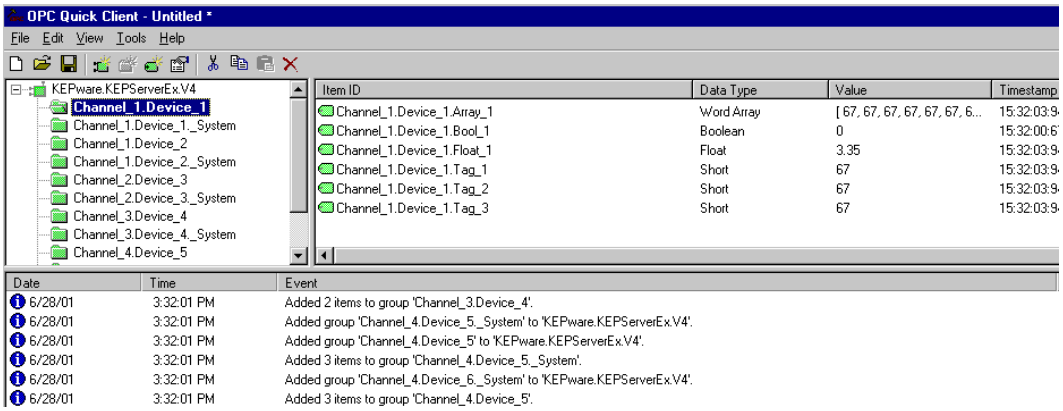
Auto Launch and Generate a Quick Client Project

In most cases when you are using the Quick Client you are testing to see of you can see all of the tags you have defined in the server. To aid in this process we provide the ability to launch the client from the server and automatically generate the client project.

1. In the Server, once you have added all of the tags you currently want, click on the Launch button  or select "Tools|Launch OPC Quick Client".

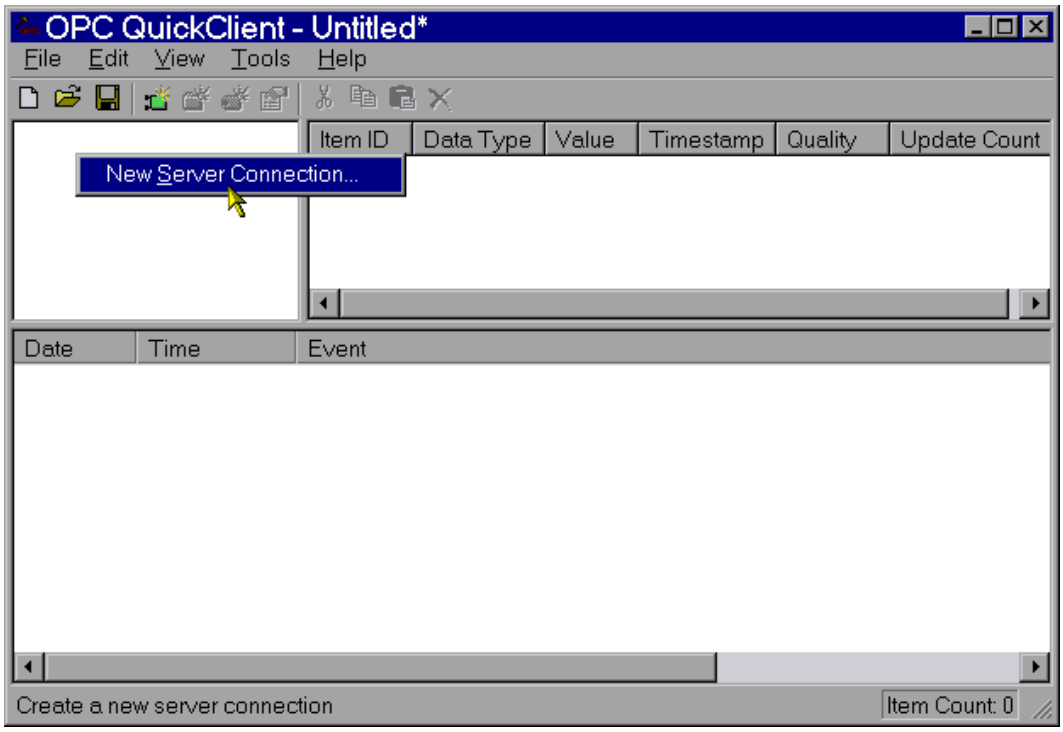


2. You will notice that the client project automatically opens to display the tags in the first Device group.



Manually Create a Quick Client Project

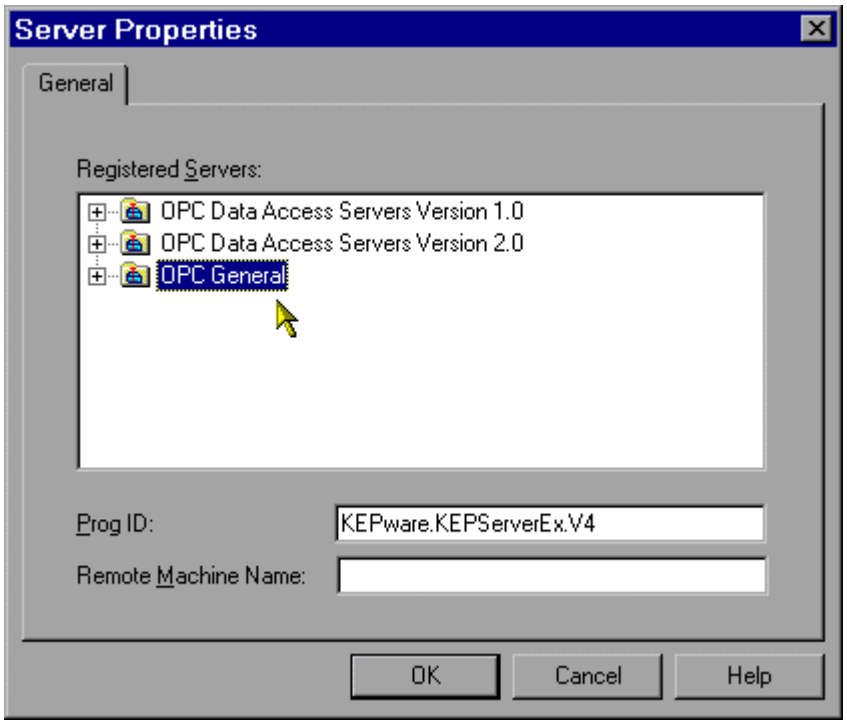
1. To start a new project, select New Server Connection… from the Edit menu or right click in the upper left display box and select New Server Connection…(shown below).



Browse for KepserverEx

For remote connections you have to be sure that you have DCOM properly configured. For information on how to configure DCOM see the two guides located either on the installation CD or at he Kepware web site.

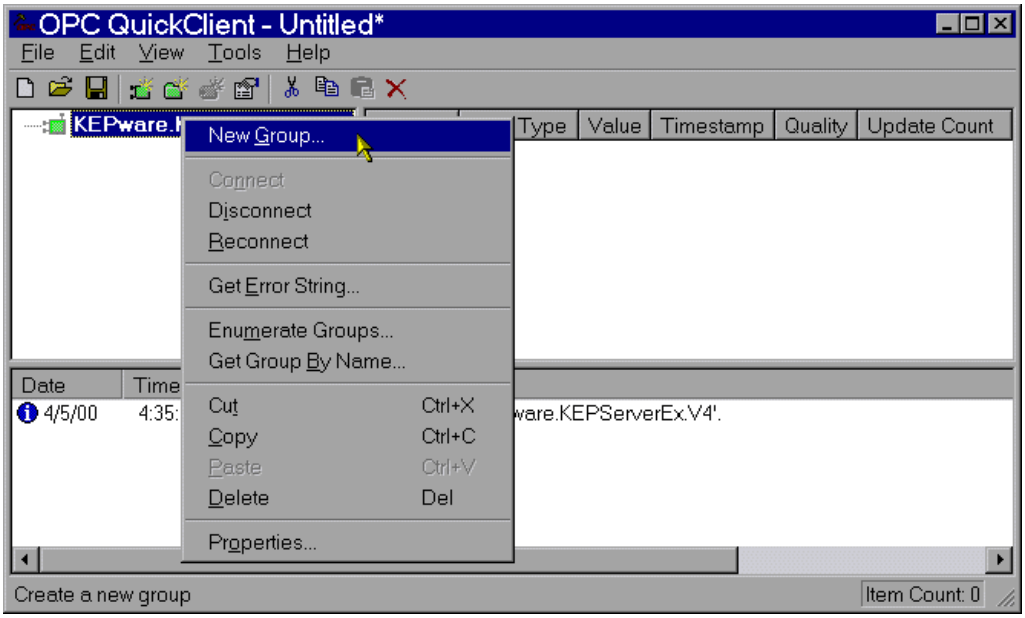
2. In the Server Properties window, click OK because the KepserverEx is set as the default server. If you were going to connect to the server running on another PC then you would enter the name of that PC in the Remote Machine Name field of the Server Properties window without any back slashes "\\".



Add a Tag/Item Group

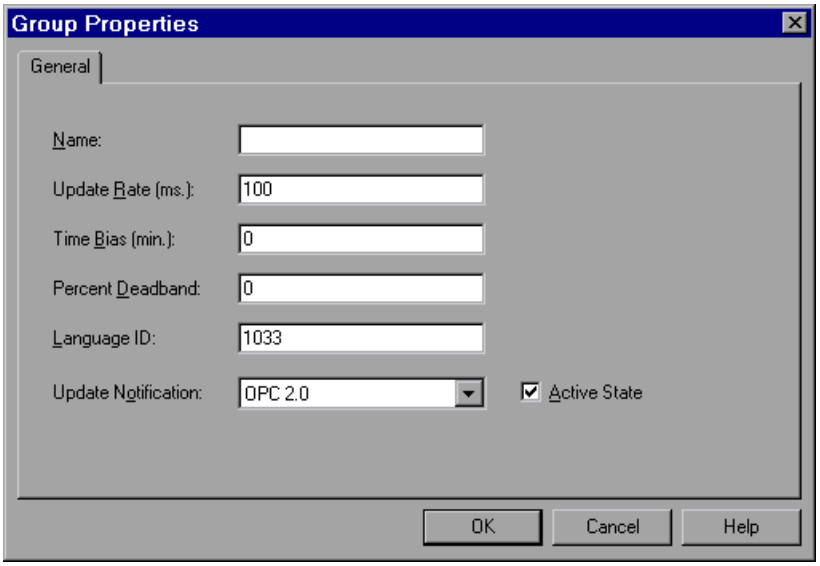
After choosing KepserverEx, there should be a visual representation of the client connection to the server provided in the upper left-hand display.

3. Right click on this connection and choose New Group or select New Group from the Edit menu.



Set Group Properties

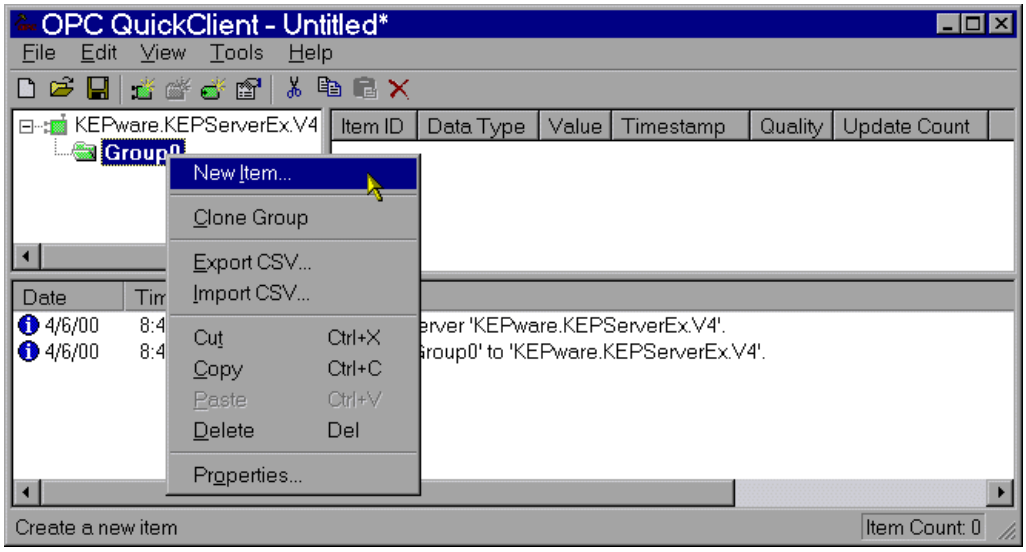
4. In the Group Properties window, enter a Name to identify the group. If no group name is entered, the server will generate a unique name for you. Also, make sure the Active State is enabled so the client will show active items for the group. Finally, click OK.



Add Tags/Items

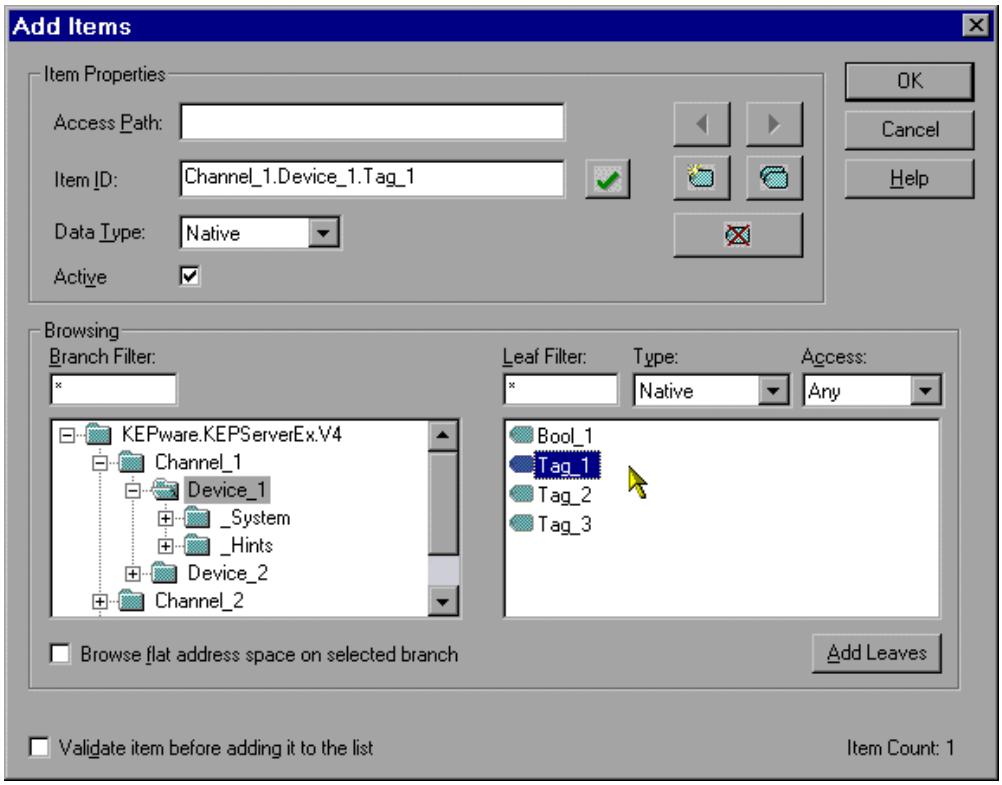
Now that a group has been created it is possible to add items.

5. Right click over the Group Name in the left display or select New Item from the Edit menu to open the Add Items window.



To learn more about using Kepware's OPC QuickClient with KepserverEx, see the KepserverEx help file "Designing a Project (Saving and Testing the Project)".

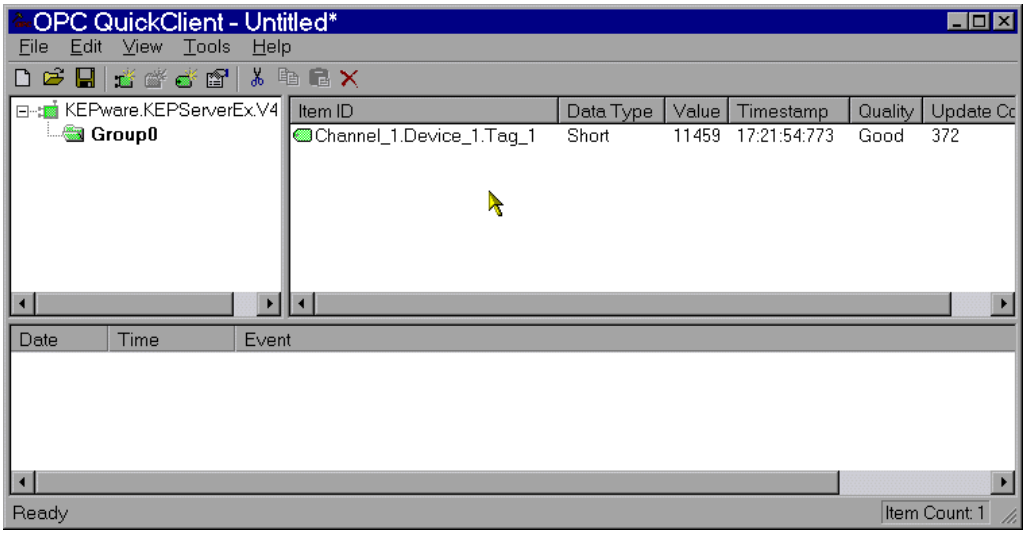
6. Using the tree view in the left display of the OPC Address Browser, select the Device or Group from which you wish to select Address items/tags. In the right hand pane, double click to add an item. In this example, Tag_1 in Device_1 on Channel_1 has been selected. Remember that these are items that have already been created in our Server Demo Project (Simdemo.opf). Also, you can view all possible address types and create a dynamic item by choosing " _Hints" under the device name in the tree menu.



7. Once you have selected all of the items to be displayed by the client, click OK

Check OPC Connection

8. Next we are going to verify that we are getting data from KepserverEx. You should see a Quality of "Good" in the Tag Monitor window for the tag and a Value that is ramping or incrementing very quickly.



9. You now have a good OPC connection to the Server from the OPC Quick Client.