8000 to PACSystems

User Guide

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Section 1 - Introduction

The MOST 8000 Process IO System[1] consists of MOST EBIM controllers and their associated IO Modules. Together they provide a completely modular distributed I/O solution for both general purpose and rugged area applications. Unlike most process control equipment, the 8000 Process IO System is built to be mounted in the entire spectrum of plant environments, where extreme temperatures, corrosion, shock and vibrations are present. With the option of Intrinsically Safe I/O, they can be installed in environments where explosive gases are present.

The GE Fanuc PACSystems delivers the first Programmable Automation Control – one control engine and one development environment for multiple hardware platforms. PACSystems offers enhanced processing and communications speed and programming capacity over existing PLC technologies for high-speed processing, data acquisition and memory-intensive tasks like recipe storage and data logging.

Combining the ruggedness of the 8000 Process IO System and the versatility of the PACSystems provides an unbeatable combination.

Both systems have built-in features for transferring data to and from other devices. The 8000_to_PACSystems application understands the data transfer capabilities of both systems and allows the user to easily configure one or more MOST 8000 Process IO Systems as remote IO for a PACSystem. Data transfer is bi-directional and takes place on an Ethernet link using TCP.

The PACSystems appears as a remote Modbus device to the 8000 Process IO System. Following configuration using the 8000_to_PACSystems application, a table is built in the MOST Workbench that defines the data to be moved to and from the PACSystems. When this table is downloaded to the 8000 controller, data transfer begins immediately.

The following sections describe the steps necessary to configure an MOST 8000 Process IO System as remote IO for a PACSystem.

[1] Throughout the document when a reference is made to the 8000 system, the user can take this to mean the entire MOST 8000 Process IO System consisting of a simplex or duplex controller and up to 64 IO modules. Note that all 8000 controllers, Ebims, Hybrid, Logic, and SafetyNet, are supported.

Section 2 – Installing the 8000_to_PACSystems application

The 8000_to_PACSystems application consists of a single executable named *8000_to_PACSystems.exe*. This executable must be placed on a PC on which the MOST Workbench is already installed. You may place it anywhere, but for ease of use, it is recommended that this executable is stored in the *ExternalApps* folder under the Utilities folder that was created when the MOST Workbench was installed. In most cases, the full patch to this folder will be:

C:\Program Files\GE Fanuc\MOST\Control Center\Utilities\ExternalApps

If *8000_to_PACSystems.exe* is placed in the ExternalApps folder, then it may be conveniently launched from the MOST Workbench by selecting the following menu item:

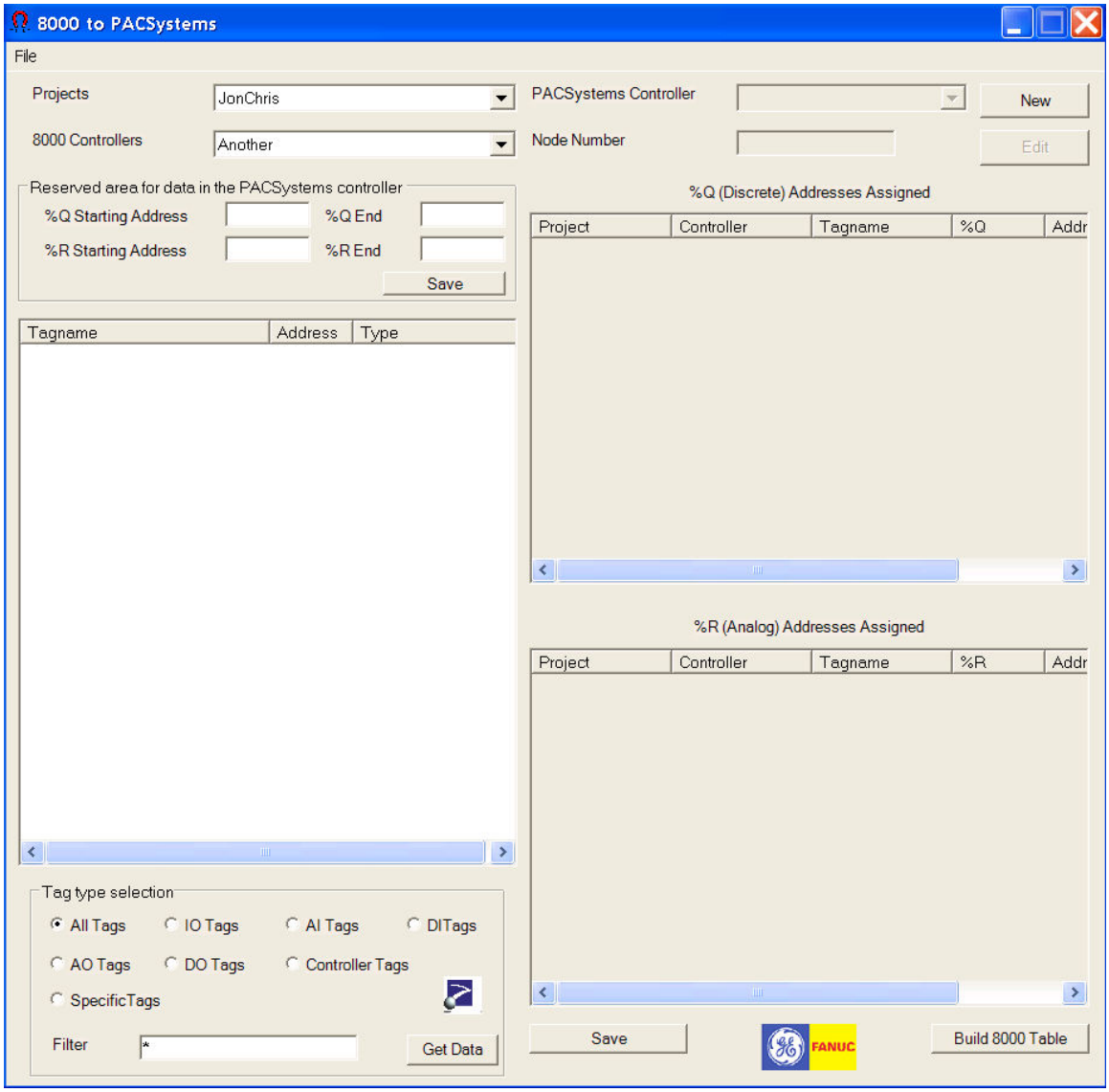
Tools->Administrative Tools->Launch 8000_to_PACSystems

If the *8000_to_PACSystems.exe* is placed somewhere else, then just double-click that application to launch it.

Section 2 – Defining the PACSystems

When the *8000_to_PACSystems* application is first launched, the application checks for the existence of an installed MOST Workbench and attempts to connect to the MOST database. If it is not successful, it returns a message box to the user describing the reason.[2]

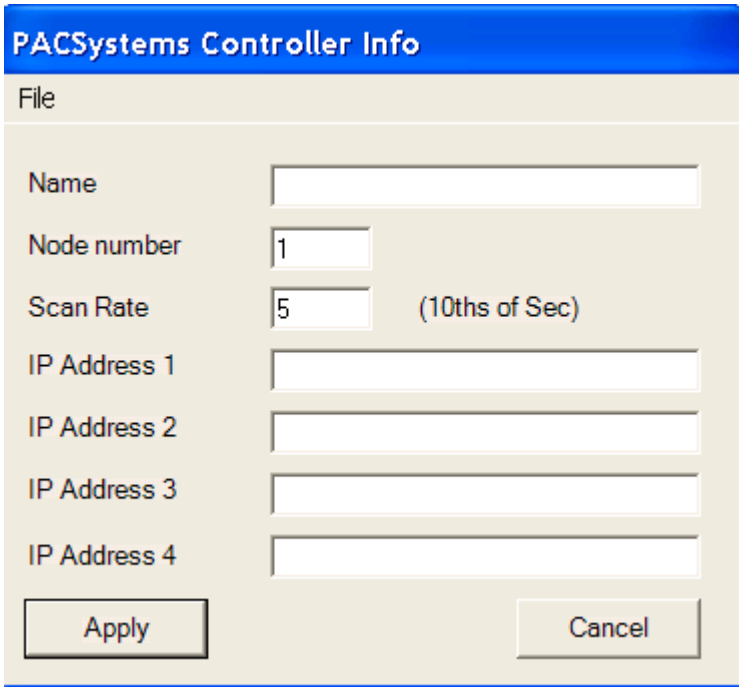
After the 8000_to_PACSystems application successfully connects to the database, it retrieves a list of all active projects and all of the controllers within each project. It then displays the following screen:



[2] As the *8000_to_PACSystems* application executes, it logs informational messages and errors to the Windows Event file. You may view these messages by launching the Windows Event Viewer. The messages appear in the OCPCC section with a source name of 800_toPACSystems topics.

Click the ***New*** button in the upper right corner of the screen to build a new PACSystems controller.

The following dialog box is displayed:

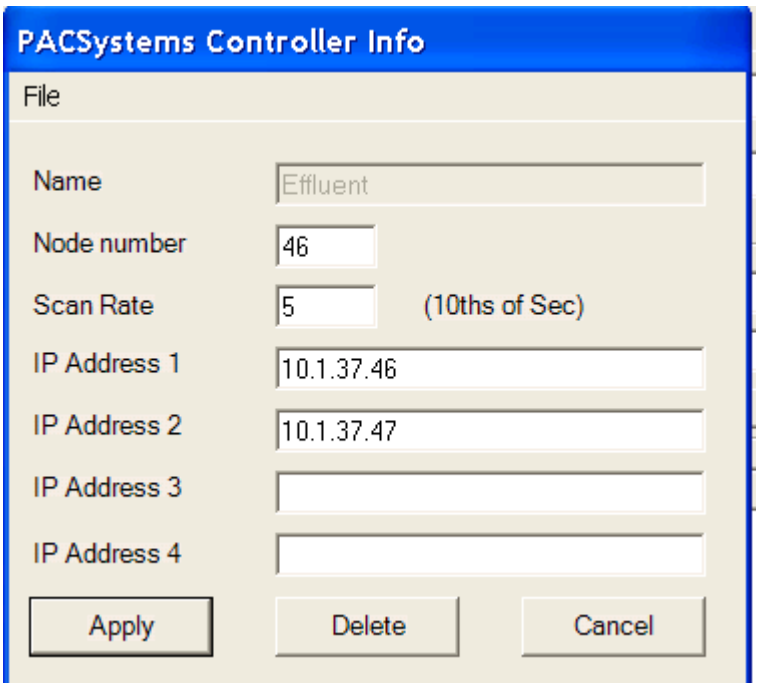


On this screen, enter the following:

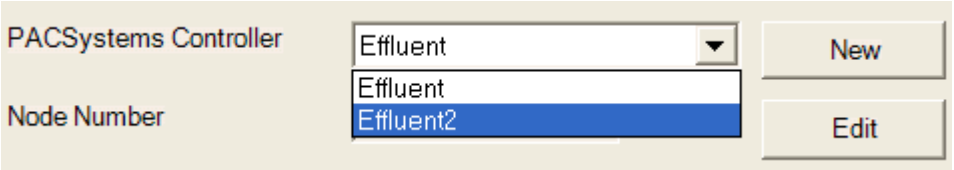
- **Name:** Name of the PACSystems controller.
- **Node number:** Modbus node number of the PACSystems controller. Valid entries are 1 to 255. Note that communications are performed using TCP, so this number is used by the 8000 controller only when constructing the messages to be sent to each device.
- **Scan Rate:** Rate at which 8000 controller attempts to send and receive data from the PACSystems controller. This value is entered in 10ths of seconds.
- **IP Address 1:** First IP address used for communication. The number must be entered in the form xxx.xxx.xxx.xxx where xxx is between 1 and 255.
- **IP Addresses 2-4:** Enter these IP addresses only if the PACSystems has redundant Ethernet cards and you want the 8000 controller to communicate directly with the redundant nodes. If additional IP Addresses are used, the Node number is automatically incremented to reflect the additional IP Address. For example, IP Address 2 will change the Node number by +1, IP Address 3 will change the Node number by +2, and IP Address 4 will change the Node number by +3.

Click ***Apply*** to apply the changes. The application will check the validity of the response and report any errors via message boxes. Click ***Cancel*** to exit without applying the changes.

The following is a an example of the PACSystems Controller Info dialog box with information entered:



Note that once a PACSystems controller is created, it is selected from the PACSystems controller pull down list box on the main dialog.

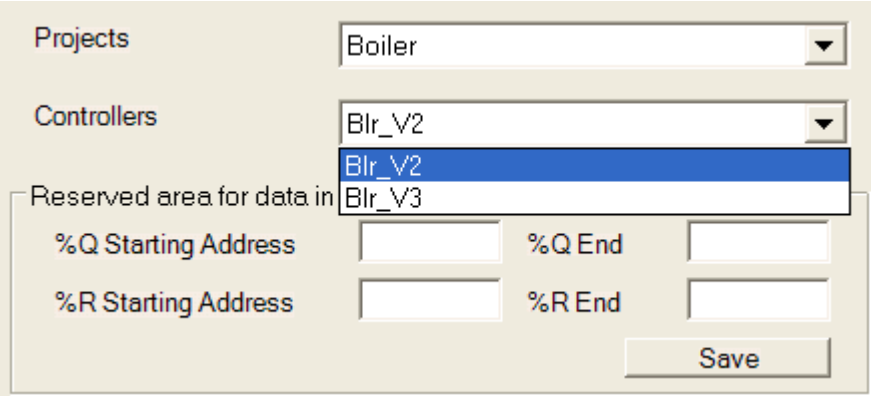


If more than one PACSystems controller is created, it is added to this pull down in alphabetical order. Selecting the name from the pull down and clicking the ***Edit*** button allows the user to edit the information about a PACSystems controller. The information on the PACSystems Controller Info form is filled in with the current data.

Section 3 – Reserving a data area in the PACSystems

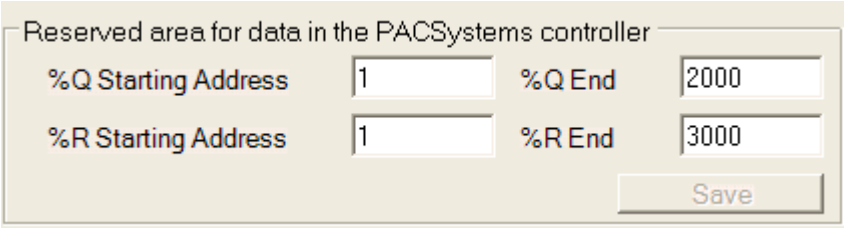
A PACSystems may receive data from several 8000 controllers. Therefore it is necessary to reserve blocks of registers for each 8000 controller.

First, select the desired project and 8000 controller from the pull down lists:



Next, reserve the area within the PACSystems controller for this 8000 controller by filling in the ***%Q Starting Address, %Q End, %R Starting Address, and %R End*** fields. Each entry must be between 1 and 32000 and the end addresses of each respective area must be greater than the start address. Click the ***Save*** button to apply the changes. The addresses are checked against existing reserved addresses within the selected PACSystems controller. If any overlap is found, a message box is returned to the user.

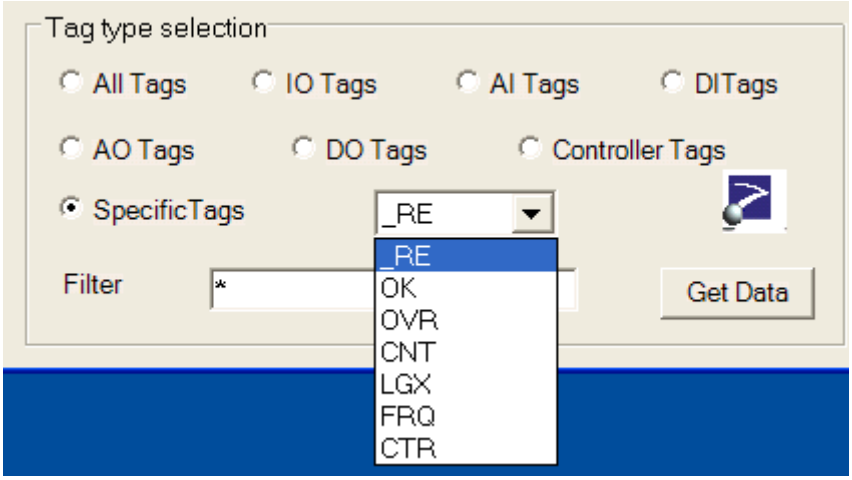
The following is an example of reserved areas within a PACSystems controller:



Section 4 – Selecting the 8000 controller tags to map

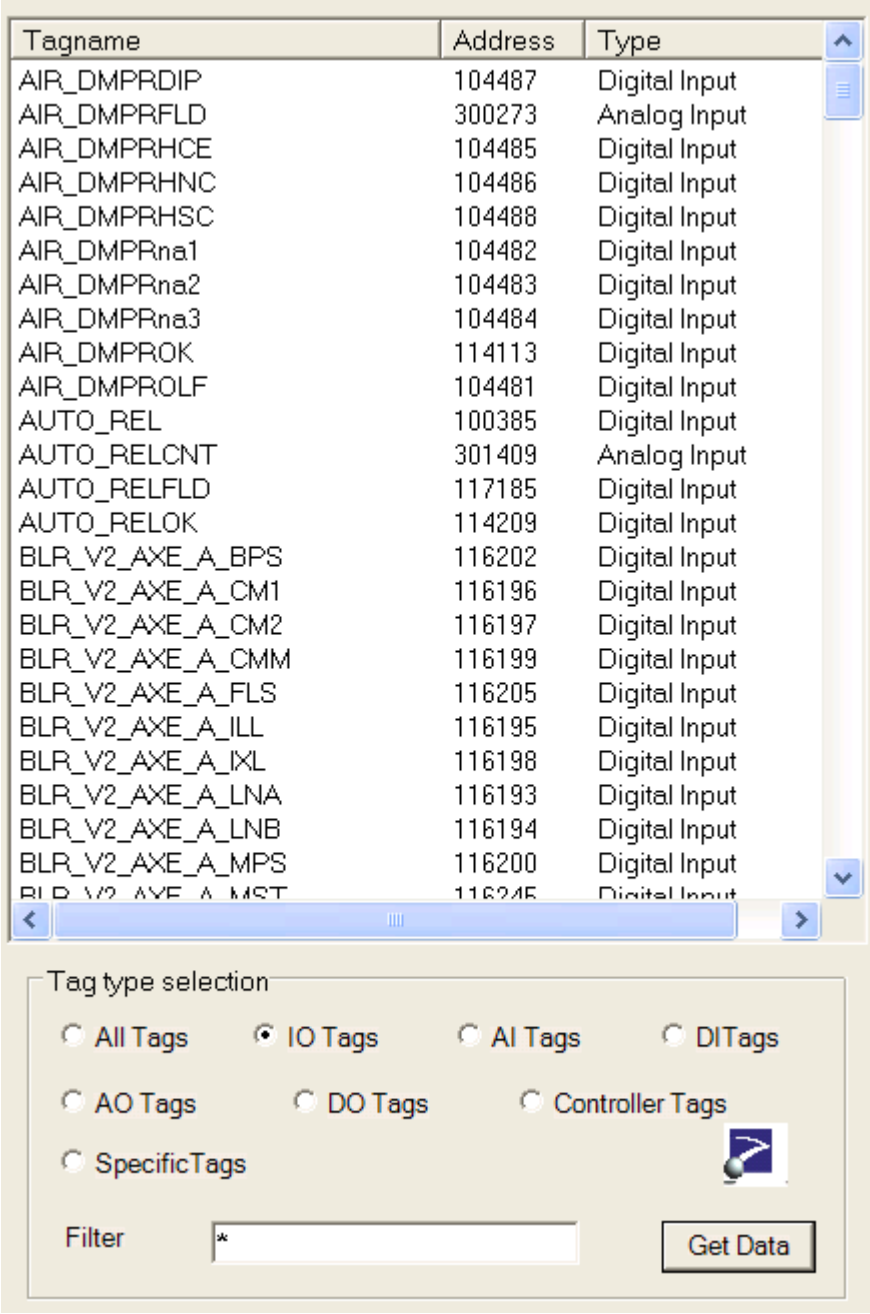
Next, the actual data points to be mapped are selected. To retrieve a list of tags, click the radio button that most closely identifies the data you wish to map:

- **All Tags:** All tags currently defined in the 8000 controller
- **IO Tags:** Tags assigned to IO Modules including compiler-generated tags (i.e. HH, FLD, etc.)
- **AI Tags:** Only IO tags in the 3x register space
- **DI Tags:** Only IO tags in the 1x register space
- **AO Tags:** Only IO tags in the 4x register space
- **DO Tags:** Only IO tags in the 0x register space
- **Controller Tags:** Compiler-generated tags unique to the controller (i.e. _CLK)
- **Specific Tags:** Selecting this option displays another pull list that allows retrieval of special tag types:



Additional filtering can be applied by entering the filter value into the ***Filter*** text box. The asterisk character (*) is a wildcard.

The desired tag type has been selected; click the ***Get Data*** button to retrieve all tags that match the criteria. The tag names, Modbus register address and tag type are returned and displayed in the list view box. The picture below shows a list of IO tags:



Tagname	Address	Type
AIR_DMPRDIP	104487	Digital Input
AIR_DMPRFLD	300273	Analog Input
AIR_DMPRHCE	104485	Digital Input
AIR_DMPRHNC	104486	Digital Input
AIR_DMPRHSC	104488	Digital Input
AIR_DMPRna1	104482	Digital Input
AIR_DMPRna2	104483	Digital Input
AIR_DMPRna3	104484	Digital Input
AIR_DMPROK	114113	Digital Input
AIR_DMPROLF	104481	Digital Input
AUTO_REL	100385	Digital Input
AUTO_RELCNT	301409	Analog Input
AUTO_RELFLD	117185	Digital Input
AUTO_RELOK	114209	Digital Input
BLR_V2_AXE_A_BPS	116202	Digital Input
BLR_V2_AXE_A_CM1	116196	Digital Input
BLR_V2_AXE_A_CM2	116197	Digital Input
BLR_V2_AXE_A_CMM	116199	Digital Input
BLR_V2_AXE_A_FLS	116205	Digital Input
BLR_V2_AXE_A_ILL	116195	Digital Input
BLR_V2_AXE_A_IXL	116198	Digital Input
BLR_V2_AXE_A_LNA	116193	Digital Input
BLR_V2_AXE_A_LNB	116194	Digital Input
BLR_V2_AXE_A_MPS	116200	Digital Input

Section 5 – Assigning the 8000 tags to the PACSystems registers

To assign the 8000 tags to the PACSystems registers, select a range of tags in the 8000 tags window and 'drag' them onto the proper ***%Q (Discrete) Registers Assigned*** or the **%R (Analog) Registers Assigned** list view. When dragging and dropping the tags, the following apply:

- Tags in the 8000 tags list may be sorted by clicking the desired column.
- Multiple tags may be selected by clicking the first tag and then holding the *Shift* key down to select a range of tags, or holding the *Ctrl* key down to select individual tags.
- A multiple selection is only valid if all of the 8000 registers selected fall within the same Modbus register space. That is, they must all be 0x, 1x, 3x, or 4x. Attempting to drag tags from multiple spaces results in a warning message.
- When a proper 'drag' operation begins, the appropriate destination list view (***%Q (Discrete) Registers Assigned*** or the **%R (Analog) Registers Assigned**) is highlighted.
- 'Dropping' the tags on the list view results in the following:
    - Tags are assigned at the first free space as defined by the reserved area for this controller.
    - Tags being read by the PACSystems controller count up from the beginning of the reserved area.
    - Tags being written by the PACSystems controller count down from the end of the reserved area.
    - Floating-point tags use two registers.
    - If sufficient register space is not available to map the tags, a warning message is returned.
    - If unused space is found, the new tags 'fill in the gaps'.[3]
- If tags are to be removed, select them from the appropriate assignment area and press the *Del* key. Tags that are not deleted are not moved.

The following picture illustrates several 8000 tags assigned to register spaces in a PACSystems controller:

[3] Assigning the PACSystems addresses in sequentially increasing or decreasing order allows the 8000 firmware can efficiently pack the data into as few Modbus packets as possible.

%Q (Discrete) Addresses Assigned

Project	Controller	Tagname	%Q	Address
Boiler	Blr_V2	ECON_GAS_INOK	00004	114241
Boiler	Blr_V2	ECON_GAS_OU...	00005	114242
Boiler	Blr_V2	ECON_H20_INOK	00006	114243
Boiler	Blr_V2	ECON_H20_OUT...	00007	114244
Boiler	Blr_V2	HI_DRUM_LVLOK	00001	114212
Boiler	Blr_V2	OIL_BLK_OPENOK	00002	114213
Boiler	Blr_V2	PLANT_MSTR_I...	00008	114245
Boiler	Blr_V2	PT3456OK	00009	114246
Boiler	Blr_V2	PURGEOK	00003	114214
Boiler	Blr_V2	TURB_LPO	02997	000323
Boiler	Blr_V2	TURB_RPO	02998	000322
Boiler	Blr_V2	VALVE1_OPN	02999	000321
Boiler	Blr_V2	AIC_O2CSW	02996	013193

%R (Analog) Addresses Assigned

Project	Controller	Tagname	%R	Address
Boiler	Blr_V2	ECON_GAS_IN	00504	300337
Boiler	Blr_V2	ECON_GAS_INFLD	00505	320957
Boiler	Blr_V2	ECON_GAS_OUT	00506	300338
Boiler	Blr_V2	ECON_GAS_OUTF...	00507	320958
Boiler	Blr_V2	ECON_H20_IN	00508	300339
Boiler	Blr_V2	ECON_H20_INFLD	00509	320959
Boiler	Blr_V2	ECON_H20_OUT	00510	300340
Boiler	Blr_V2	ECON_H20_OUTFLD	00511	320960

Save FANUC Build 8000 Table

When the desired tags have been mapped, click the ***Save*** button to save the data to the database.

Section 6 – Building the Remote Modbus Mapping table

After the desired tags have been assigned to a PACSystems controller, a table must be created in the MOST workbench that defines the communication techniques that the 8000 controller will use to move the data to and from the PACSystems controller. Simply clicking the **Build 8000 Table** button does this. Note that the **Build 8000 Table** button is enabled after the data has been saved.

When the **Build 8000 Table** button is clicked, the following actions occur:

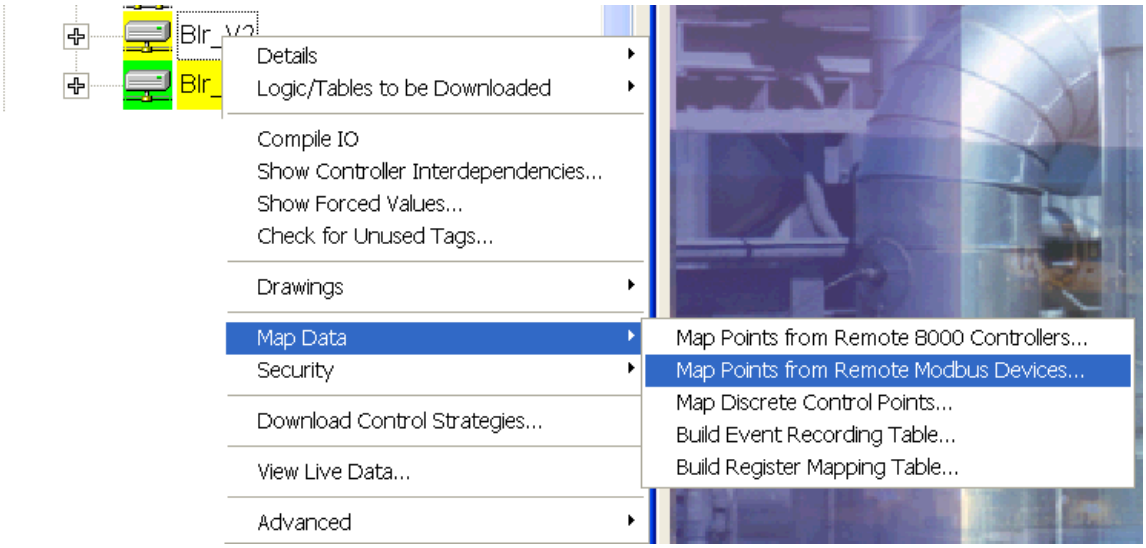
- For each IP address assigned a new Remote Modbus device is created. The Remote Modbus device follows the naming convention of *AutoPAC_<PACSName>_n* where *<PACSName>* is the name of the PACSystems controller and n is 1 to 4 for each IP address assigned. This occurs for each controller that has data mapped to this PACSystems controller. If a device already existed with this name, it and all of its associated mapping are deleted.
- For each device, the tag name, 8000 Register address, PACSystems address, and Modbus Function code are stored in the workbench database.[4]
- For each device, the default parameters are chosen for the following:
  - Controller Port – LAN using TCP
  - Scan Rate – as entered when PACSystems controller was defined.
  - Remote Socket Port No – 502
  - Command delay – 0
  - Response Timeout – 255 milliseconds
  - Active – Y for IP Address #1, N or all other IP Addresses
- A comma-separated Variable Input file is created in the MOST Temp folder with a naming convention of *<PACSName>_VariableInput.txt* where *<PACSName>* is the name of the PACSystems controller. This file may be used to import the 8000 tag names into a PACSystems if desired.

[4] Because the PACSystems register addresses were assigned in sequentially increasing or decreasing order the 8000 firmware can efficiently pack the data into as few Modbus packets as possible.

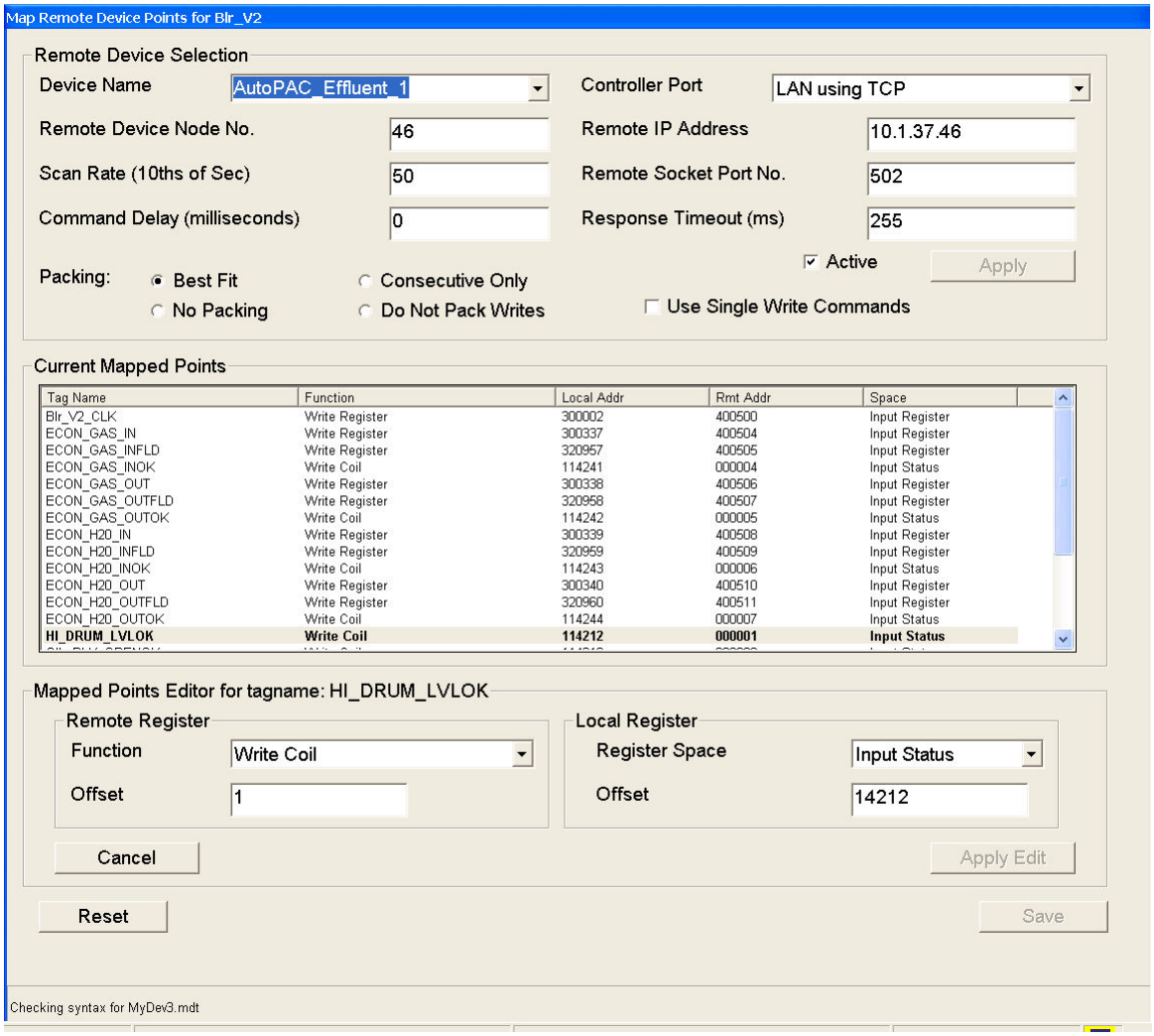
Section 7 – Starting the data transfer

The final step is to download the Remote Modbus table for each 8000 controller. This download starts the data transfer.

It is recommended that you review the Modbus table entries by selecting the Remote Modbus Mapping form in the MOST Workbench. This form is activated by right clicking on a controller and selecting the *Map Data -> Map Points from Remote Modbus Devices*.



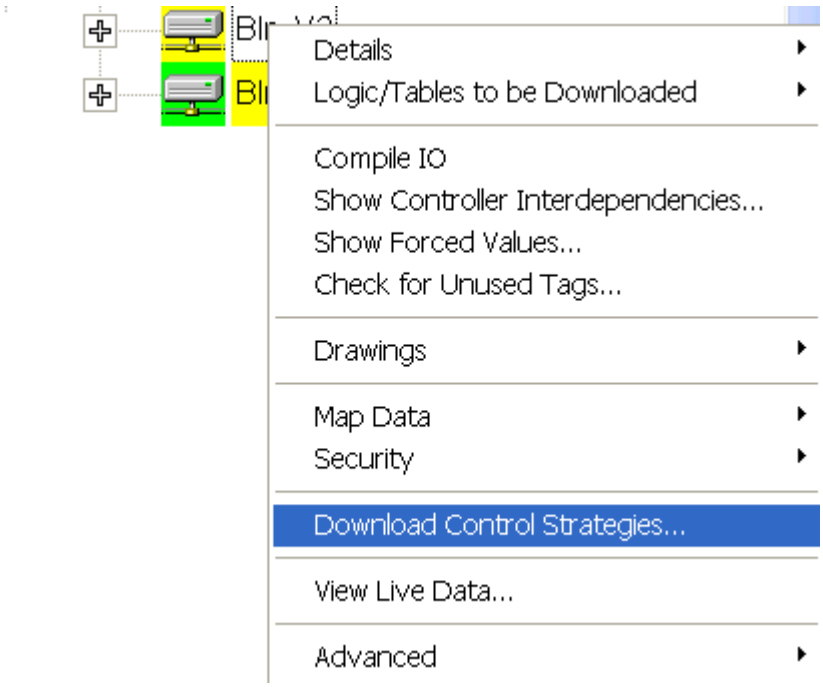
This launches the Remote Modbus form:



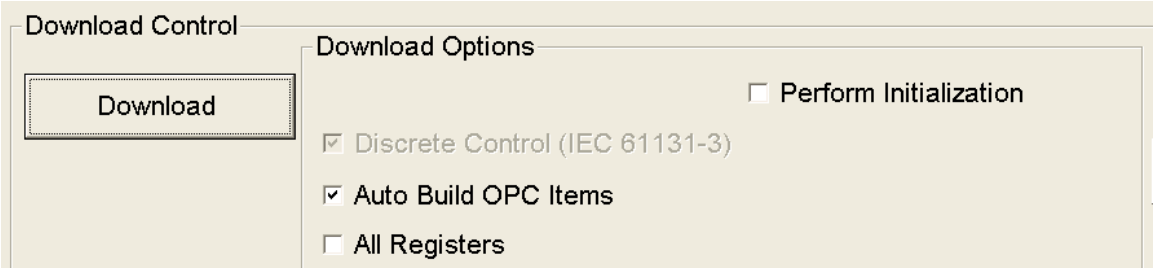
Use this form to verify and modify any of the parameters used for communications. For example, you may wish to change the scan rate.

- It is not recommended that any of the Packing parameters be changed.
- Use caution when modifying the Current Mapped Points as these values are chosen to match the criteria established when the points were configured in the 8000_to_PACSystems application.
- By default, the first device, that is the device with IP Address #1, is set Active. Any additional devices are set to inactive. If you wish to enable these devices, set them Active prior to the download.

Finally, use the download form to download this table to the 8000 controller(s). Note that download must be performed for each 8000 controller that is 'attached' to a PACSystems controller. Select the download form by right clicking on a controller and selecting the *Download Control Strategies* item from the popup menu:



When downloading, it is not necessary to download the strategies if they have not changed.[5]



When the download has completed successfully, the 8000 automatically begins transferring data to and from the PACSystems controller.

To monitor and verify the data transfer, return to the Remote Modbus form, move the mouse pointer to the Current Mapped Points window and click *Ctrl-L*.

[5] In the case of an EBIM, strategies are not present.