

Application Note #1190: Native Tag Drivers - Tips to Optimize Screen Performance

Introduction

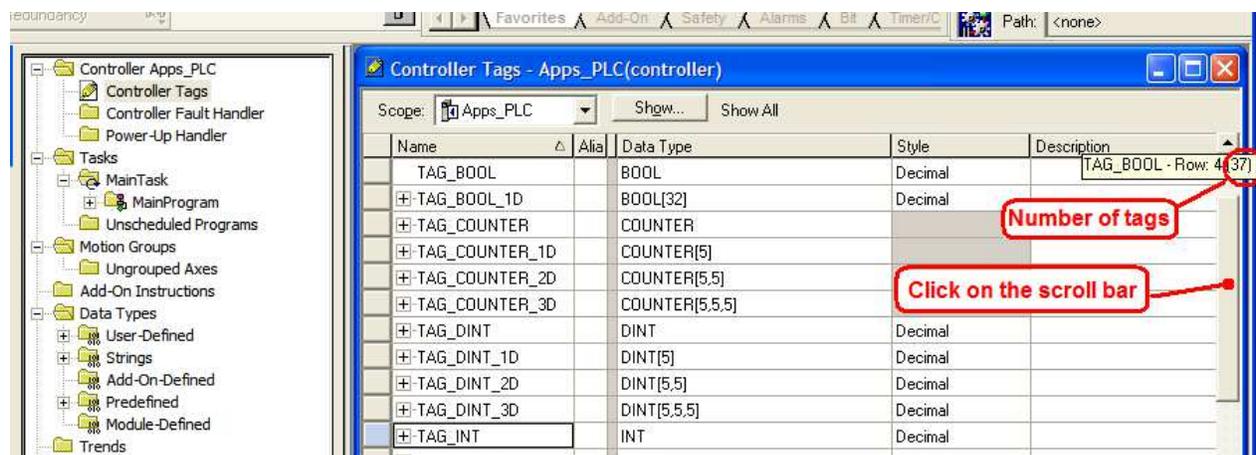
This document is intended for the users of GP-Pro EX Rockwell Native Tag Drivers. However much of this information also applies to other Device/PLC drivers. HMI performance optimization begins with the initial design of the PLC project. This is especially true when the PLC/device uses a native tag protocol. This application note begins with a section for the PLC programmer. It then continues with a section for the GP-Pro EX programmer, including screen design tips. Finally it concludes with a section on troubleshooting.

Rockwell Automation ControlLogix and CompactLogix projects use native tags and are often very large and complex. Many of the same techniques below also apply to any device/ PLC. Native tag protocols access un-located variables and that presents some special challenges. Tips to meet those challenges are included in the guide.

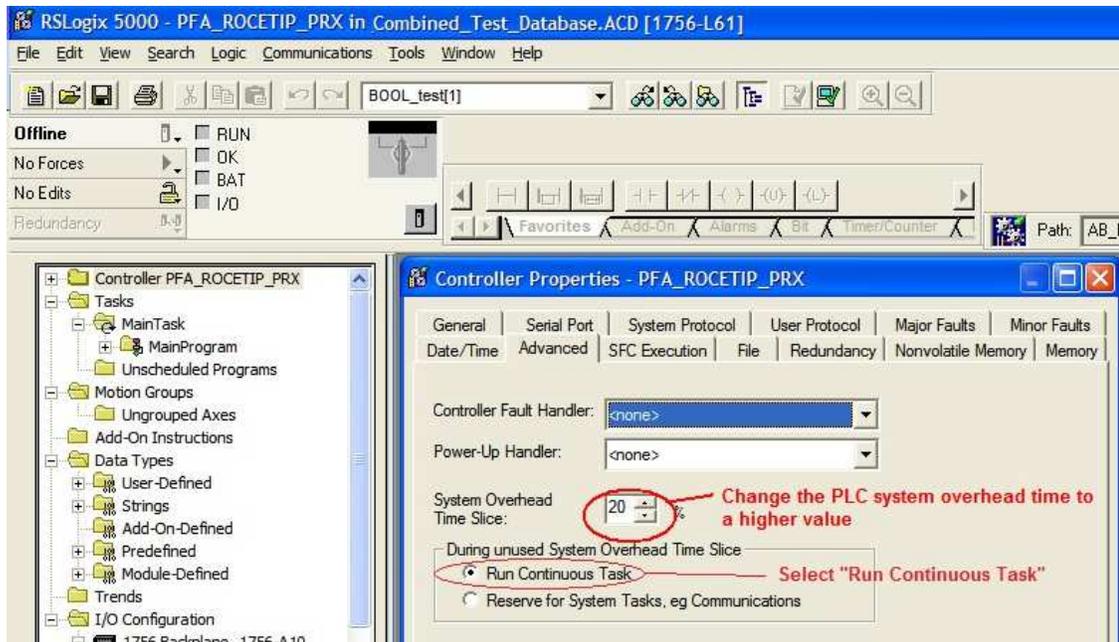
We recommend users of all native tag drivers upgrade to GP-Pro EX v2.70.100 or later and Device/PLC driver v1.19.20 or later. Very important changes were implemented in recent updates to the GP-Pro EX editor and native tag drivers including the Rockwell Ethernet driver. Download the latest driver at: <http://www.hmisource.com/otasuke/download/exdriver/plc/>

Developing the PLC Project:

1. **Create an INT array of 20 elements** for the HMI system area and watchdog timer. The array can be used by the PLC to monitor and control the HMI screens.
2. Try to keep the total number of tags in the PLC project below 4,000. The time to initial display of data on startup is slowed when the number of tags in the PLC project is greater than 4000 regardless of how few are actually included the GP-Pro EX Tag Data database. Click on the Tag window scroll bar in RSLogix to find the number of tags. If the combined number of controller scope tags and program scope tags exceeds 4000, reduce the number of tags by combining them into arrays and user defined structures.



3. **BOOL arrays should have a multiple of 32 elements.**
4. **Share PLC data with the HMI in arrays when possible.** A native tag array is accessed by the HMI as a contiguous block of data. Combining alarm variables into BOOL or DINT arrays improves the overall performance of the entire HMI project. Screens that have large numbers of variables perform better when the variables are combined in arrays. Best performance is achieved when the number of discontinuous device tags on a screen plus alarms is less than 40 items (current screen + alarms). An array of variables counts as single item. In the case of an array of structures each element counts as one item. Example: [PLC1]CartStatus.CartNo[2].Disabled) In the case where an array is a member of a Structure the entire array counts as a single item. Example: [PLC1]CartStatus.Disabled.CartNo[2]. *Note: Data types such as Timers and counters are structures.*
5. **Improve HMI performance by increasing the PLC “System Overhead Time Slice”.** To avoid performance issues when communicating with Control/Compact Logix processors do not exceed 70% CPU utilization on any communications module or over 4500 packets per second on any ENBT Ethernet module. To increase the System Overhead Time Slice In RS Logix 5000 go to the Controller Properties dialog box > Advanced tab. Be aware this change might also have an adverse performance impact on the control program being executed by the ControlLogix controller. (For more information refer to System overhead time slice in the Rockwell controlLogix5000 help files and obtain Rockwell Automation Support Center document 41212.)



6. **When possible use separate communication modules and networks for scheduled (such as I/O) and unscheduled communications (such as HMI) to improve performance.** i.e. separate Ethernet modules on the PLC for I/O and HMI communications. (Not possible for CompactLogix series PLCs.)

Developing the HMI Project:

1. **For CompactLogix** series, in GP-Pro EX under PLC/Device "Individual Device Settings" select "CompactLogix Direct Connection". If you have an older version of the device driver that does not offer this selection uncheck "Slot Number". **For ControlLogix** series PLCs enter the slot number of the CPU.
2. **Tags used in the HMI project must match tags in the PLC.** Save the PLC project as an .L5K file. Import the L5K file into GP-Pro EX to add the tags to the GP-Pro EX project. Avoid manually adding tags to the GP-Pro EX project when possible. Do not export the tags in CSV format from RSLogix or Logix Designer. Important structure information is not included in that export.

Note: Pro-face America functionally tested projects created in RS Logix 5000 and Logix Designer versions up to and including version 26. As of November 2015 no problems with the RSLogix or Logix Designer version have been reported to and confirmed by Pro-face technical support.

Caution on editing tags manually: Syntax and data structure errors caused by manually editing tags and structures do not appear until the tag is accessed during runtime. Tag syntax including caps and small letters as well as the data type must match the PLC project. If a data type structure is modified in the PLC such that it affects an element used in the HMI project the data type must also be modified in or re-imported into the HMI project.

3. **System Area Start Address must be assigned an INT variable.** Unless the "System Area Start Address" field is greyed out. Even if the "Enable System Data Area" is not selected. It is recommend an array of 20 INTs be created in the PLC and the first element of the array be assigned. .
4. Words LS0000 – LS0019 or Bit memory LS000000 – LS001915 mirror the System Area. Refer to appendix A1.4 of the Reference Manual for information before addressing LS memory. Consider using USR memory instead.
5. **Read Area Size should be 0.** It is not a communications parameter. It should be 0 unless the Read Area feature is used to exchange data with the PLC.
6. **An INT tag is required for the Watchdog Write Address** The Watchdog Timer Setting should be 0 unless the PLC project is using this feature to monitor the HMI. A DINT tag will work for the Watchdog Write Address. We suggest an unused element in the same INT array as the System Area Start Address.
7. Use the header and footer feature rather than window screens when practical. A window screen may not appear until PLC data is displayed on the main screen.
8. Eliminate any unused global or extended scripts.
9. **Avoid "Continuous Action" trigger for scripts.** This section should be used sparingly and the only for scripts that need to update every screen refresh. Trigger scripts only as often as needed, especially if they are writing to PLC tags. If a script needs to run multiple times per second consider using the internal HMI display scan counter register

LS2038 for a trigger. Triggering a script with “Bit On” LS203803 will cause the script to run more than once a second. The script can be triggered twice as often by selecting the next lower bit (i.e. changing the trigger from LS203803 to LS203802).

- Organize screen objects** so static objects are drawn while waiting for data needed to draw dynamic objects. This also reduces the need to refresh static objects during screen updates. To do this move unanimated static objects such as bit map graphics, text, lines, and boxes to the “base layer” or background. Refer to the Screen Data List. Typically Draw/Parts objects above (behind) the first animation on the list are on the “base layer”. See related APNT1175 for more information.

<https://www.hmisource.com/otasuke/files/appnotes/APNT1175.pdf>

Draw/Parts	Information	Animation
DD_0000	[PLC1]TAG_DINT	
SL_0000	[PLC1]TAG_DINT,[PLC1]TAG_DINT	
SL_0001	[PLC1]TAG_DINT,[PLC1]TAG_DINT	
GR_0000	[PLC1]TAG_DINT	
Filled Polygon	(231, 137, 321, 199)	
Rectangle	(327, 62, 439, 163)	
Circle/Oval	(362, 186, 440, 210),[PLC1]TAG_DINT,00,1	
Text	(201, 222, 456, 269)	
Rectangle	(231, 284, 316, 368),----	
Circle/Oval	(363, 275, 440, 325)	

Red annotations in the image: A bracket groups the first three rows as 'Back'. A bracket groups the next four rows as 'Base Layer'. A bracket groups the last three rows as 'Front Layer'. A red arrow points downwards from the 'Back' group to the 'Front Layer' group, labeled 'Drawing Order'.

- On screens with many dynamic objects choose screen parts rather than animation. Especially if the resulting screen appearance and functionality will be the same. For example, an indicator using Standard Parts object SW_SP221_OFF and SW_SP221_ON could be used to replace multi-state color/visibility animation of a rectangle or screen text.

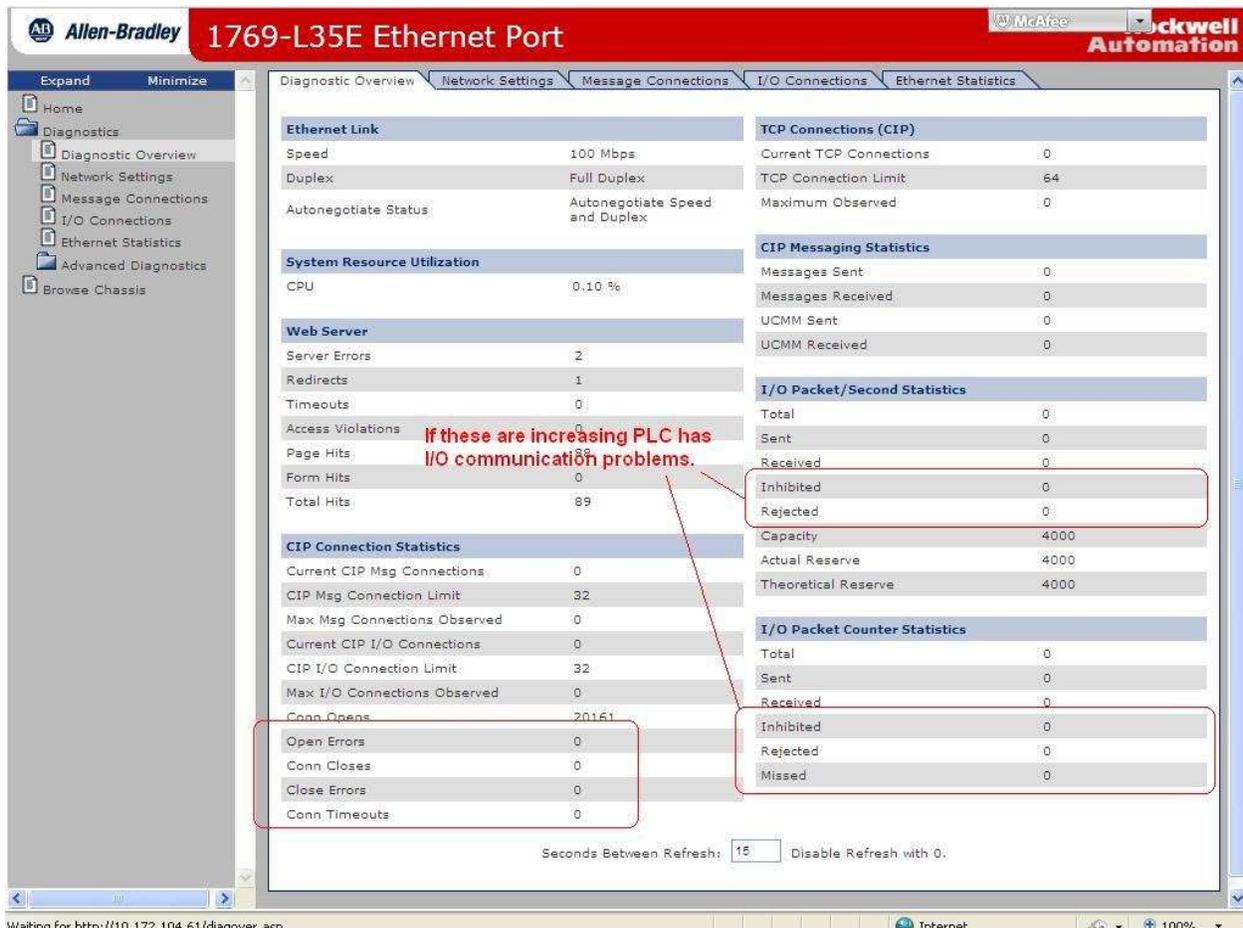
Use GP-Pro EX v2.70.100 or later. Important changes were implemented in recent updates to the GP-Pro EX editor and native tag drivers including the Rockwell Ethernet driver. Improvements increase the robustness of the tag database and L5K import of structures and I/O modules. Enhancements to handling the data type string in GP-Pro EX allow indirect addressing of string arrays.

Troubleshooting Control/CompactLogix Communications:

Review the Ethernet network topology. Are PLC I/O devices on the same Ethernet network and on the same PLC Ethernet connection? The PLC gives top priority to servicing the I/O. If network traffic is heavy or the network has issues communicating to I/O the HMI may get updated very, very, slowly and even exhibit communication errors. Follow Rockwell Automation’s recommendations for Ethernet I/O networks.

Go on-line with the PLC.

- In RSLogix 5000 check *Controller Properties*:
 - *Major Faults* – should be none
 - *Minor Faults* – should be none
 - *Advanced Tab*
- System Overhead Time Slice, default is 20%, try increasing it. Be aware this setting may affect PLC program execution times.
- Be sure “Run Continuous Task” is checked
- One way to reduce the PLC and Ethernet loading is to modify the RPI “Requested Packet Interval” for Ethernet I/O devices to reduce network and PLC processor loading. *For example: Try setting VF drives at greater than default 20msec.*
- Open internet Explorer and enter the PLC Ethernet IP address to view the embedded diagnostic web pages. The web pages differ between Ethernet adapters so your pages may differ but the concept is the same as follows. Look on the Ethernet Statistics page error counters: all media counters, In Error and Out Error Counters, and rejected packets. These numbers should be very low and not incrementing. Look on the Diagnostics Overview page. There should be no connection timeouts. Under I/O Packet Counter Statistics the missed counter should be zero.



In the GP-Pro EX project:

- Verify the system area is data type INT.
- Is the PLC a CompactLogix? If so in GP-Pro EX under PLC/Device "Individual Device Settings" be sure "Slot Number" is unchecked.
- If all screens are slow look for the following in the system area, alarms, global scripts, data logging, logic, and etc. If the slowness is on specific screens look for the following only on those screens and scripts:
 - Verify PLC and HMI tags match... syntax, data type/structures
 - Avoid selecting "Continuous" trigger in scripts that write to the PLC.
 - Verify HMI is accessing tags as the proper data type. Example: Accessing DINTs as 16 bit words. Avoid writing to DINTs as 16 bit words.

Network Diagnostics:

Often slow HMI updates are a symptom of a network issue also impacting PLC I/O performance. If error counts are incrementing when accessing the PLC Ethernet port diagnostic data consider using Wireshark or other Ethernet analyzing software to help locate problems.

HMI Performance Diagnostics:

- Create a data display and assign it to [PLC1]#H_DriverCycleTime. (replace PLC1 with the name of your PLC)
- Create in PLC logic a self-reset msec timer TON and place the ACC value on the screen to observe actual data refresh performance.

For more information on Pro-face and our full line of HMI, Operator Interface and Industrial PC products please visit our web site at www.profaceamerica.com.

For technical support email: support@profaceamerica.com or call: 800.289.9266.

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