**Application Note #1237:** **Using the System Data Area with Native Tag PLCs**

## Introduction

This document explains how to use the GP-Pro EX System Data Area when using a native tag PLC/device driver. For illustration purposes we refer to the GP-Pro EX Rockwell Automation EtherNet/IP driver Native Tag and a Control Logix PLC in this application note. The System Data covered is the "System Area", "Read Area" and Watchdog Timer.

## GP-Pro EX System Data Area Overview

The GP-Pro EX System Data consists of the following:

- **System Area**

    The System Area contains information about the current state of the HMI, including the Current Screen number and a register that allows the PLC to change the HMI screen. The System Area is located in [#INTERNAL] registers LS0000 through LS0019. This address range is always reserved and accessible within the HMI project. All information and functions in the System Area can be shared with the PLC by enabling the System Area Data and selecting a "System Area Start Address". If enabled, the HMI and PLC will continuously exchange the selected information between the HMI System Area LS registers and the selected registers in the PLC.

- **Read Area**

    The Read Area is an array of up to 256 registers immediately following the GP-Pro EX System Area. Purpose of the read area is to continuously exchange information between HMI and PLC. The benefit of using the read area is that the HMI project can access PLC information within its internal registers (LS20 – LS275), and use this data for screen objects to minimize individual data requests directly to the PLC in those objects.

- **Watchdog Timer**

    The Watchdog timer provides the PLC with a heartbeat from the HMI. A single PLC register is used where the HMI writes 00FFh at the selected interval. The PLC should overwrite this value and periodically check if the 00FFh value is still being written.

## Reference

For detailed information on the topics covered in this application note:

- In GP-Pro EX use the Help > Reference Manual menu
- Open the Table of Contents page and refer to the following chapters:
    System Area & Read Area: Appendix A2
    Watchdog Timer: Chapter 5.14 Settings Guide / System Settings

## The Native Tag Driver and the System Area

Since a Native Tag driver is used to communicate to a tag based controller there is no automatic sequential array of registers available as with most traditional controllers. The solution is to create an array in the PLC/device for this purpose.

To use the System Area create an Integer array with 20 elements in the Tag list in the PLC programming software.

Fig 1. PLC Programming software Controller Scope Tag list (Edit mode)

| Name | △ | Alias For | Base Tag | Data Type | Style |
|------|---|-----------|----------|-----------|-------|
| ▶ | ⊞ AGP_SystemArea | | | INT[20] | Decimal |
| ✎ | | | | | |

Scope: PFA_TM  Show...  Show All

If you wish to use both the System Area and the Read Area create an Integer array of (20 + Read Area size) elements in the Tag list in the PLC programming software.

Fig 2. GP-Pro EX: System Settings \ Display Unit \ System Area Tab

Display | Operation | Mode | Logic | System Area | Extended Settings | Remote Viewer

**Display**

System Area Device        PLC1

**System Data Area**

System Area Start Address        [PLC1]AGP_DataArea[00]

Read Area Size        10        [PLC1]AGP_DataArea[20]

☑ Enable System Data Area

System Data Area Items        Number of Words in use: 20

☑ Current Screen: (1 Word)        [PLC1]AGP_DataArea[00]

☑ Error Status: (1 Word)        [PLC1]AGP_DataArea[01]

☑ Clock Data (Current): (4 Word)        [PLC1]AGP_DataArea[02]

☑ Status: (1 Word)        [PLC1]AGP_DataArea[06]

☑ Reserved (Write): (1 Word)        [PLC1]AGP_DataArea[07]

☑ Change-To Screen: (1 Word)        [PLC1]AGP_DataArea[08]

☑ Screen Display ON/OFF: (1 Word)        [PLC1]AGP_DataArea[09]

☑ Clock Data (Preset Value): (4 Word)        [PLC1]AGP_DataArea[10]

☑ Control: (1 Word)        [PLC1]AGP_DataArea[14]

☑ Reserved (Read): (1 Word)        [PLC1]AGP_DataArea[15]

☑ Window Control: (1 Word)        [PLC1]AGP_DataArea[16]

☑ Window Screen: (1 Word)        [PLC1]AGP_DataArea[17]

☑ Window Display Position: (2 Words)        [PLC1]AGP_DataArea[18]

In the example above an Integer array with 30 elements is required to fit both the System Area data (as illustrated above) starting at element 0 and the Read Area starting at element 20. The Read Area size 10 means elements 20 – 29 on the PLC will contain the same information as LS0020 – LS0029 on the HMI since all functions in the system area are selected.

Fig 3. Rockwell Automation PLC Programming software Controller Scope Tag list (Edit mode)



Figure 3 shows the Controller Tag needed for the example in Figure 2.

## The Native Tag Driver and the Watchdog Timer

The Watchdog timer on the HMI works with the Native Tag driver as it does with any other PLC. Please note however that even if this function is not used (0 second interval) a valid Tag name with the Integer data type must be assigned in the GP-Pro EX software in System Settings, Display Unit on the System Area tab.

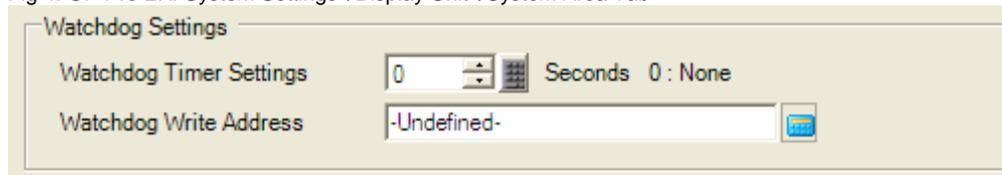Fig 4. GP-Pro EX: System Settings \ Display Unit \ System Area Tab



Figure 4 above shows a new project in which the Watchdog Write Address was not selected, if this is the case a warning may be displayed in the Error Check window in the screen editor. Double click the warning to go directly to the System Area Tab.

Fig 5. GP-Pro EX: Project \ Utility \ Error Check

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Date: April 2016 | Revision: none

## Read Area Example

The following Numeric Display example illustrates the difference between using the Read Area or direct PLC addressing in the HMI project Figure 6 shows a PLC Tag called "AGP_DataArea" which is an integer array of at least 30 elements, The System Area will use the first 20 elements, the Read Area starts at element 20.

Fig 6. GP-Pro EX: System Settings \ Display Unit \ System Area Tab
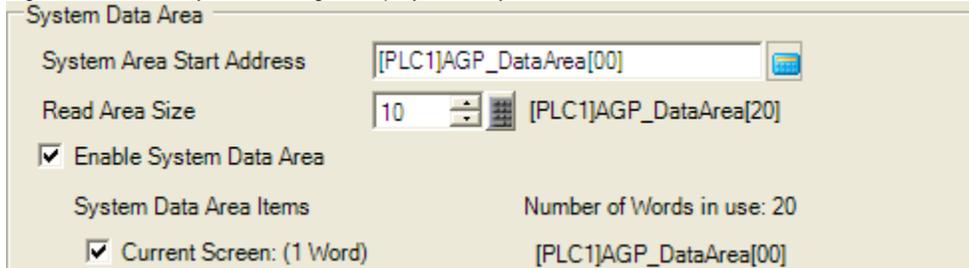


Figures 7 & 8 both have the same result: the same exact register in the PLC gets read and written to. In figure 7 the direct PLC address is used, in this case the HMI will request this data from the PLC on each communication cycle when this specific screen is active.

Fig 7. GP-Pro EX: Numeric (Input) Display set to PLC Address
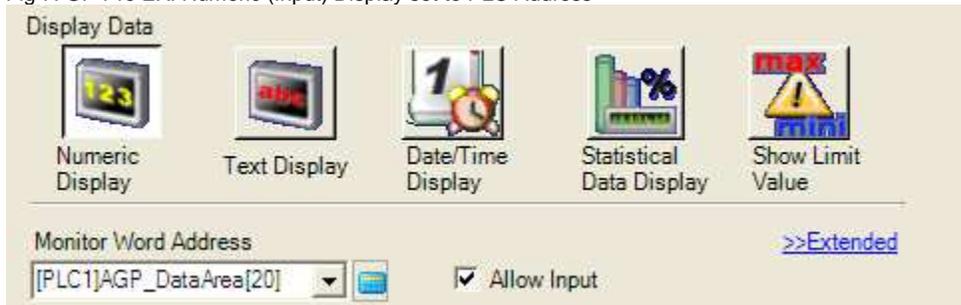


In figure 8 the Read Area equivalent of AGP_DataArea[20] is used [#INTERNAL]LS0020, in this case when the screen with this (input) display is active no additional PLC communication is required. The data is read from and written to the HMI internal register, while the Read Area function ensures the data is continuously shared between HMI and PLC.

Fig 8. GP-Pro EX: Numeric (Input) Display set to AGP Internal Address
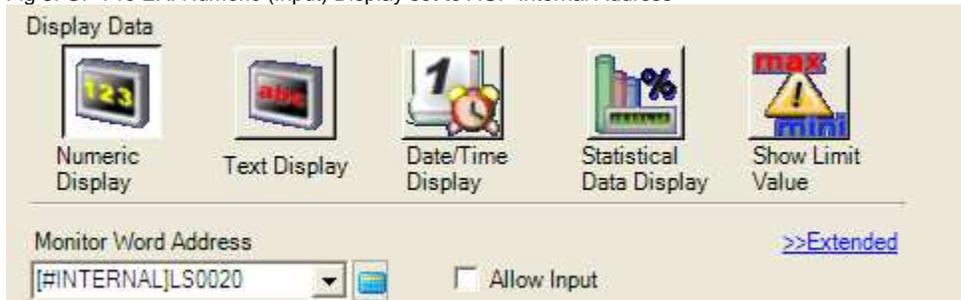
## Using HMI Current screen or Go To screen functions in PLC Logic

One of the primary uses of the GP-Pro EX System Area is to allow the PLC to take decisions based on the currently displayed screen on the HMI or change the HMI screen based on PLC logic. For this purpose the GP-Pro EX internal addresses LS0000 and LS0008 are available.

Fig 9. GP-Pro EX: PLC Mapping with all functions selected

| System Data Area | |
|---|---|
| System Area Start Address | [PLC1]AGP_DataArea[00] |
| Read Area Size | 10 [PLC1]AGP_DataArea[20] |
| ☑ Enable System Data Area | |
| System Data Area Items | Number of Words in use: 20 |
| ☑ Current Screen: (1 Word) | [PLC1]AGP_DataArea[00] |
| ☑ Error Status: (1 Word) | [PLC1]AGP_DataArea[01] |
| ☑ Clock Data (Current): (4 Word) | [PLC1]AGP_DataArea[02] |
| ☑ Status: (1 Word) | [PLC1]AGP_DataArea[06] |
| ☑ Reserved (Write): (1 Word) | [PLC1]AGP_DataArea[07] |
| ☑ Change-To Screen: (1 Word) | [PLC1]AGP_DataArea[08] |
| ☑ Screen Display ON/OFF: (1 Word) | [PLC1]AGP_DataArea[09] |
| ☑ Clock Data (Preset Value): (4 Word) | [PLC1]AGP_DataArea[10] |
| ☑ Control: (1 Word) | [PLC1]AGP_DataArea[14] |
| ☑ Reserved (Read): (1 Word) | [PLC1]AGP_DataArea[15] |
| ☑ Window Control: (1 Word) | [PLC1]AGP_DataArea[16] |
| ☑ Window Screen: (1 Word) | [PLC1]AGP_DataArea[17] |
| ☑ Window Display Position: (2 Words) | [PLC1]AGP_DataArea[18] |

Fig 10. GP-Pro EX: PLC Mapping with some functions selected

| System Data Area | |
|---|---|
| System Area Start Address | [PLC1]AGP_DataArea[00] |
| Read Area Size | 10 [PLC1]AGP_DataArea[03] |
| ☑ Enable System Data Area | |
| System Data Area Items | Number of Words in use: 3 |
| ☑ Current Screen: (1 Word) | [PLC1]AGP_DataArea[00] |
| ☐ Error Status: (1 Word) | |
| ☐ Clock Data (Current): (4 Word) | |
| ☑ Status: (1 Word) | [PLC1]AGP_DataArea[01] |
| ☐ Reserved (Write): (1 Word) | |
| ☑ Change-To Screen: (1 Word) | [PLC1]AGP_DataArea[02] |
| ☐ Screen Display ON/OFF: (1 Word) | |
| ☐ Clock Data (Preset Value): (4 Word) | |
| ☐ Control: (1 Word) | |
| ☐ Reserved (Read): (1 Word) | |
| ☐ Window Control: (1 Word) | |
| ☐ Window Screen: (1 Word) | |
| ☐ Window Display Position: (2 Words) | |

*Note: If not all System Area functions are selected (see figures 9 & 10) the PLC destination for the selected functions is assigned accordingly. When using some of the System Area functions Pro-face recommends enabling (mapping) all System Area functions, in this case when future changes are needed the PLC mapping table will not change. Note that deselecting any of the system area functions only disables the mapping to the PLC, the functions are still available with the HMI itself in LS memory.*

When interacting with the HMI screens in the PLC logic the following registers via the system area:
[#INTERNAL]LS0000 = Current Screen, Read Only
[#INTERNAL]LS0008 = Change Screen, Read / Write

To change screens from both the display unit and the device/PLC, from [System Settings] click [Display Unit], and in the [Display] tab select the [Reflect in Device/PLC] check box. If you do not enable [Reflect in Device/PLC], design your system so that after a screen change, you clear (reset to 0) the value in the device/PLC's [Change-To Screen] tag. Without clearing the tag value, screen changes may not run properly, or screen changes may occur unexpectedly.

*Notes on configuring capability to change screens from a PLC/device:*

- *From the [Project] menu's [System Settings], select [Display Unit]. In the [Display Settings] tab, if you select the [Reflect in Device/PLC] check box and set [Standby Mode] to [Screen Change], you cannot use the [Previous Screen] operation in a change screen switch to return to the screen defined in the [Change-To Screen in Standby Mode] field. Instead, you will return to the screen that was open prior to the previous screen. If this screen does not exist, the screen will not change.*

- *If you use a ladder program to clear (reset to 0) the value in the device/PLC's [Change-To Screen] address, do not use the [Reflect in Device/PLC] setting.*

- *To run a forced screen change from the device/PLC, in the device/PLC's [Change-To Screen], turn ON bit 15 (forced screen change bit), and in bits 0 to 14 specify the change screen number. In other words, add 8000(h) to the change screen number. While Bit 15 is ON, you use touch operations to change screens. However, you can also use the system variable #H_ChangeScreenNo to change screens.*

- *When a screen number that does not exist is set, a screen change will not function.*

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