

CTI Profibus-DP Driver for Connecting 2500 Series™ CPUs to Siemens® COROS® HMI Units

This document describes the configuration and installation of the CTI Profibus-DP SFSUB Driver for communications with COROS® OP/TP devices using the SIMATIC® 505 L2DP and/or Windows® CE-based panels using SIMATIC 500/505-DP drivers. The CTI DP-Driver provides direct interface from the CTI 2500 Series™ CPUs to the HMI units connected on the integrated Profibus-DP network.

This document includes references to other software programs used for configuration of HMI devices, Profibus-DP networks, and PLC programming. These programs are used for installation and parameterization of the CTI Profibus-DP Driver within an existing PLC application program running on a CTI 2500 Series™ CPU. It is assumed the user is knowledgeable on the use of these programs, and this document is not intended to be a user guide or tutorial.

See the README_VXX text file file for a history of the enhancements and/or corrections made in updated releases.

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Good data processing procedures dictate that any program be thoroughly tested in each application before relying on it for monitoring and/or control of a critical process. The user must assume the entire risk of installing and using the software.

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1. Overview

This document describes the configuration and installation of the CTI Profibus-DP Driver for the following Siemens® COROS® HMI devices:

- 1) RMOS-based Operator Panels (TD17, OP5, OP7, OP15, OP17, OP25, OP27, OP35, OP37) and Touch Panels (TP27, TP37) using the SIMATIC® 505 L2DP V6.0 protocol..
- 2) Windows® CE-based Operator Panels (OP77B, OP170B, OP177B, OP270, OP277), Touch Panels (TP170B, TP177B, TP270, TP277), Multi-Panels (MP270, MP277, MP370, MP377), Mobile Panels (Mobile Panel 170, Mobile Panel 177, Mobile Panel 277) and SIMATIC®, SINUMERIC®, and SIMATION® Panel PCs using the SIMATIC® 500/505-DP V6.0 protocol.

The CTI DP-SFSUB Driver provides direct interface from the CTI 2500 Series™ CPUs or Siemens® Model 505-7202 Field Interface Module (FIM) to the HMI units connected on the Profibus-DP network and configured for use with the protocols listed above.

The CTI DP-SFSUB Driver replaces the functions performed by the Siemens® 505-DP external programs FAP.REC (via XSUB1, XSUB2, and XSUB3) and/or HMI.REC (via XSUB1, XSUB4, and XSUB5). The Profibus-DP interface and PLC operations are executed in a single SFSUB, and this program is called from the RLL using a single SFSUB box instruction. Therefore the entire driver interface consists of one RLL network and one SFSUB program.

The CTI driver supports all of the Profibus-DP communication buffer sizes that can be configured within ProTool/Pro® or WinCC® flexible. The SIMATIC® drivers allow the I/O buffer to begin at any valid address. However, it requires that the Profibus-DP input/output buffers be consecutive, and the output buffer must follow the input buffer.

Examples:

Profibus-DP Configuration for SIMATIC® 505 L2DP Protocol:

	<u>Input</u>	<u>Output</u>
32-Byte Buffers:	WX1-WX16	WY17-WY32
64-Byte Buffers:	WX1-WX32	WY33-WY64
120-Byte Buffers:	WX1-WX60	WY61-WY120

Profibus-DP Configuration for SIMATIC® 500/505-DP Protocol:

	<u>Input</u>	<u>Output</u>
Tiny: 32-Bytes In / 22-Bytes Out	WX1-WX16	WY17-WY27
Small: 42-Bytes In / 22-Bytes Out	WX1-WX21	WY22-WY32
Middle: 64-Bytes In / 32-Bytes Out	WX1-WX32	WY33-WY48
Big: 122-Bytes In / 64-Bytes Out:	WX1-WX61	WY62-WY93

In addition, this solution allows multiple HMI devices to be connected to the CTI 2500 Series™ PLC. A single SFSUB program supports multiple HMI units using either or both protocols, but a separate RLL network is required to call the SFSUB (with different parameter set) for each HMI unit.

A Profibus-DP network configuration (created using COM-PROFIBUS® or COMET200®) can be reused with the CTI DP-Driver without modification.

Chapter 2 describes the configuration steps required for HMI's connected to the CPU via Siemens® Field Interface Module (FIM).

Chapter 3 describes steps for use of COM-PROFIBUS® to create the Profibus-DP network configuration for COROS® HMI units, merging the COM-PROFIBUS® “binary file” into PLC program, and mapping the Profibus I/O using 505 WorkShop® or TISOFT.

Chapter 4 describes the same procedure for creation of network configuration for COROS® HMI units and Profibus I/O mapping using 505 WorkShop® embedded Profibus configurator.

Chapter 5 shows steps for merging the CTI DP-SFSUB Driver into PLC applications using 505 WorkShop®.

Chapter 6 describes the procedure for merging the CTI DP-SFSUB Driver into PLC applications using TISOFT V6/V7.

Chapter 7 includes details on the execution of the CTI DP-SFSUB Driver and provides tips on achieving optimum performance and fastest HMI response times. Please read this section for latest information regarding compatibility with CTI Series 2500™ CPU Firmware Versions.

2. Use with Siemens® Field Interface Module (FIM)

This chapter describes the special configuration steps required when Siemens® Model 505-7202 Field Interface Module (FIM) is used to provide the Profibus-DP interface to the Siemens® HMI Unit(s). This setup allows the CTI 2500 Series™ CPU to access the OP I/O buffers as though each HMI unit was a single I/O module located in a Remote Base.

2.1. FIM Configuration

This section does not provide all of the details regarding setup and operation of the FIM. Please refer to *SIMATIC® 505 Field Interface Module User Manual (Order Manual No. 505-8124-5)* for complete description of the Field Interface Module.

The Field Interface Module must be setup to run the Profibus-DP application. Additionally, all switches set to properly identify the Profibus Network Baud Rate, Remote I/O Base number, and the Slave Address Range Selection.

Use the *Siemens® 505-7202 Profibus-DP Configurator* utility to set the I/O buffer size for each the COROS® OP/TP unit to be connected to the FIM as shown in the following sections:

2.1.1. FIM Configuration for RMOS-based Operator Panels

This includes the following COROS® Operator Panels and Touch Panels:
TD17, OP5, OP7, OP15, OP17, OP25, OP27, OP35, OP37, TP27, and TP37

I/O Buffer Size = 32 bytes (16WX/16WY):

Edit Slave

Slave/Slot #1

Station Address: Slave disabled (Not polled)

IDENT Word (hex):

Slave Description:

I/O Configuration (hex): 37373737

User Parameter Data (hex):

WatchDog Time (mSecs):

Diagnostics Location: V: # Words (2 Bytes)

Slave Protocol

- PROFIBUS-DP NORM
- ET200 V3.0
- SPM V1.0

NOTE: # Words MUST include the first word, (length of the new diagnostics data) which is updated by the FIM

I/O Buffer Size = 64 bytes (32WX/32WY):

Edit Slave

Slave/Slot #1

Station Address: Slave disabled (Not polled)

IDENT Word (hex):

Slave Description:

I/O Configuration (hex): Edit

User Parameter Data (hex): Edit

WatchDog Time (mSecs):

Diagnostics Location: V: # Words (2 Bytes)

Slave Protocol

PROFIBUS-DP NORM

ET200 V3.0

SPM V1.0

NOTE: # Words MUST include the first word, (length of the new diagnostics data) which is updated by the FIM

Ok

Clear

Read Slave

Help

Cancel

The FIM does not support 120-byte (60WX/60WY) I/O buffers.

2.1.2. FIM Configuration for Windows®-based Operator Panels

This includes the following COROS® Operator Panels, Multi-Panels, and Panel PCs: TP170, OP170, OP270, MP270, MP370, PC670, and PC870

The FIM interface does not allow configuration of an odd number of WX/WY (word) Inputs/Outputs. Therefore, the “Middle” I/O Buffer Size (32WX/16WY) must be used for FIM applications. It is also required that the SIMATIC® 500/505-DP Driver **Block Length** parameter be set to “Class B Middle” as well as the I/O Configuration as shown below when using the FIM.

Edit Slave

Slave/Slot #1

Station Address: [] **Slave disabled (Not polled)**

IDENT Word (hex): []

Slave Description: []

I/O Configuration (hex): 3F3F1F1F **Edit**

User Parameter Data (hex): [] **Edit**

WatchDog Time (mSecs): []

Diagnostics Location: V: [] [] # Words (2 Bytes)

Slave Protocol

PROFIBUS-DP NORM

ET200 V3.0

SPM V1.0

NOTE: # Words MUST include the first word, (length of the new diagnostics data) which is updated by the FIM.

Ok

Clear

Read Slave

Help

Cancel

2.2. Remote I/O Configuration

The HMI units to be connected must contain ProTool® or WinCC® flexible configuration with Baud Rate selection and Profibus-DP slave addressing the range supported by the FIM interface. Check the FIM switches to ensure the proper Remote I/O Base Number, Profibus-DP Application, Baud Rate, and Slave Address Range are selected.

The ‘COMM’ LED is illuminated when the FIM is communicating with the PLC via the Remote I/O link. The HMI devices should be powered up and connected via Profibus cable to PORT 2 before proceeding.

The Profibus-DP I/O configuration used for the COROS® HMI units is initially read by the FIM as an invalid Remote-I/O configuration. This configuration must be altered to word values using the “Byte Matching” technique described in the *SIMATIC® 505 Field Interface Module User Manual*.

The following screen shows the I/O configuration for HMI unit before modification:

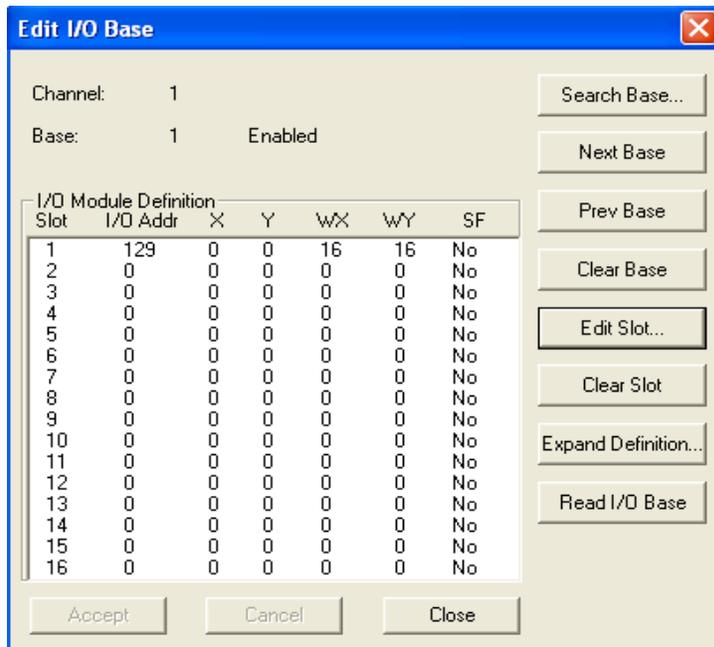
Slot	I/O Addr	X	Y	WX	WY	SF
1	1	32	32	32	32	No
2	0	0	0	0	0	No
3	0	0	0	0	0	No
4	0	0	0	0	0	No
5	0	0	0	0	0	No
6	0	0	0	0	0	No
7	0	0	0	0	0	No
8	0	0	0	0	0	No
9	0	0	0	0	0	No
10	0	0	0	0	0	No
11	0	0	0	0	0	No
12	0	0	0	0	0	No
13	0	0	0	0	0	No
14	0	0	0	0	0	No
15	0	0	0	0	0	No
16	0	0	0	0	0	No

Select [Edit Slot] and enter the I/O configuration matching the I/O Buffer Size set in the FIM as downloaded by the *Siemens® 505-7202 Profibus-DP Configurator* .

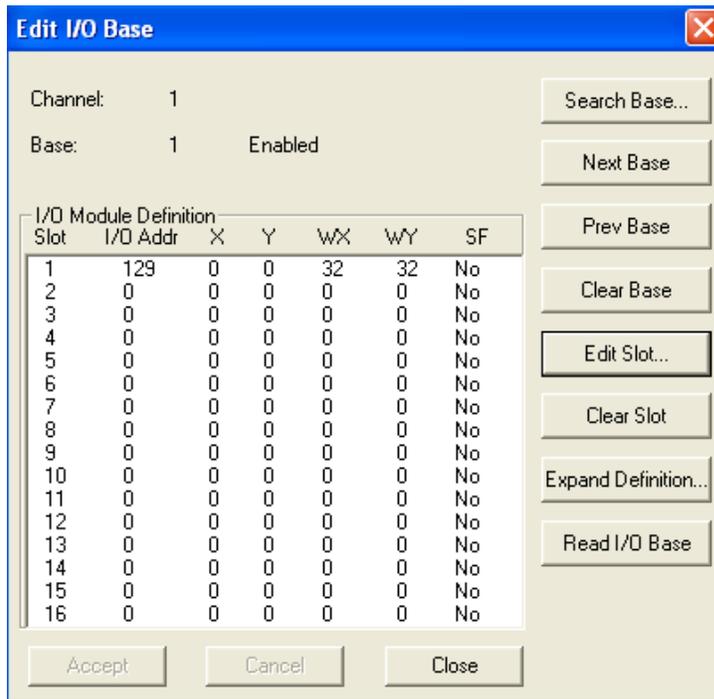
2.2.1. Remote I/O Config for RMOS-based Operator Panels

This includes the following COROS® Operator Panels and Touch Panels:
TD17, OP5, OP7, OP15, OP17, OP25, OP27, OP35, OP37, TP27, and TP37

The following screen shows the modified I/O configuration for 32-byte buffers (16WX/16WY):



The following screen shows the modified I/O configuration for 64-byte buffers (32WX/32WY):



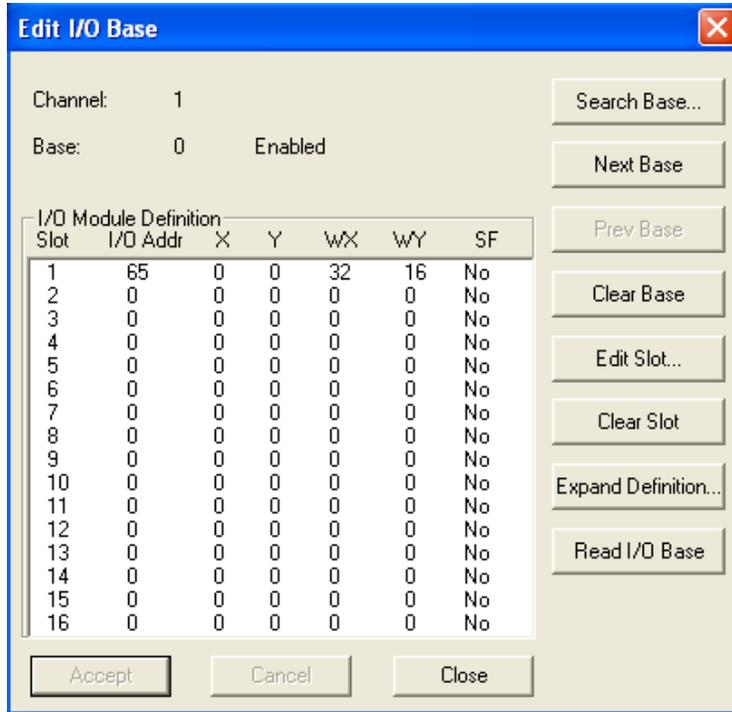
When the FIM Profibus-DP slave configuration matches the I/O Module Definition within the Remote I/O Base, the FIM 'CFG' LED illuminates.

See Chapter 5 for a description of the CTI DP-Driver installation for WorkShop® applications. Driver installations for TISOFT™ programs is described in Chapter 7.

2.2.2. Remote I/O Configuration for Windows®-based Operator Panels

This includes the following COROS® Operator Panels, Multi-Panels, and Panel PCs: TP170, OP170, OP270, MP270, MP370, PC670, and PC870

The following screen shows the modified I/O configuration for 'Middle' I/O Buffer Size.



When the FIM Profibus-DP slave configuration matches the I/O Module Definition within the Remote I/O Base, the FIM 'CFG' LED illuminates.

See Chapter 5 for a description of the CTI DP-Driver installation for WorkShop® applications. Driver installations for TISOFT™ programs is described in Chapter 7.

3. Profibus-DP Configuration using COM-PROFIBUS®

This chapter provides a description of the steps to create a new Profibus-DP network configuration using Siemens COM-PROFIBUS® utility and merging of the configuration into your PLC program.

The same functions can also be completed with the Profibus-DP configurator embedded into 505 WorkShop® V4.30 or later. See Chapter 4 for details if using that method.

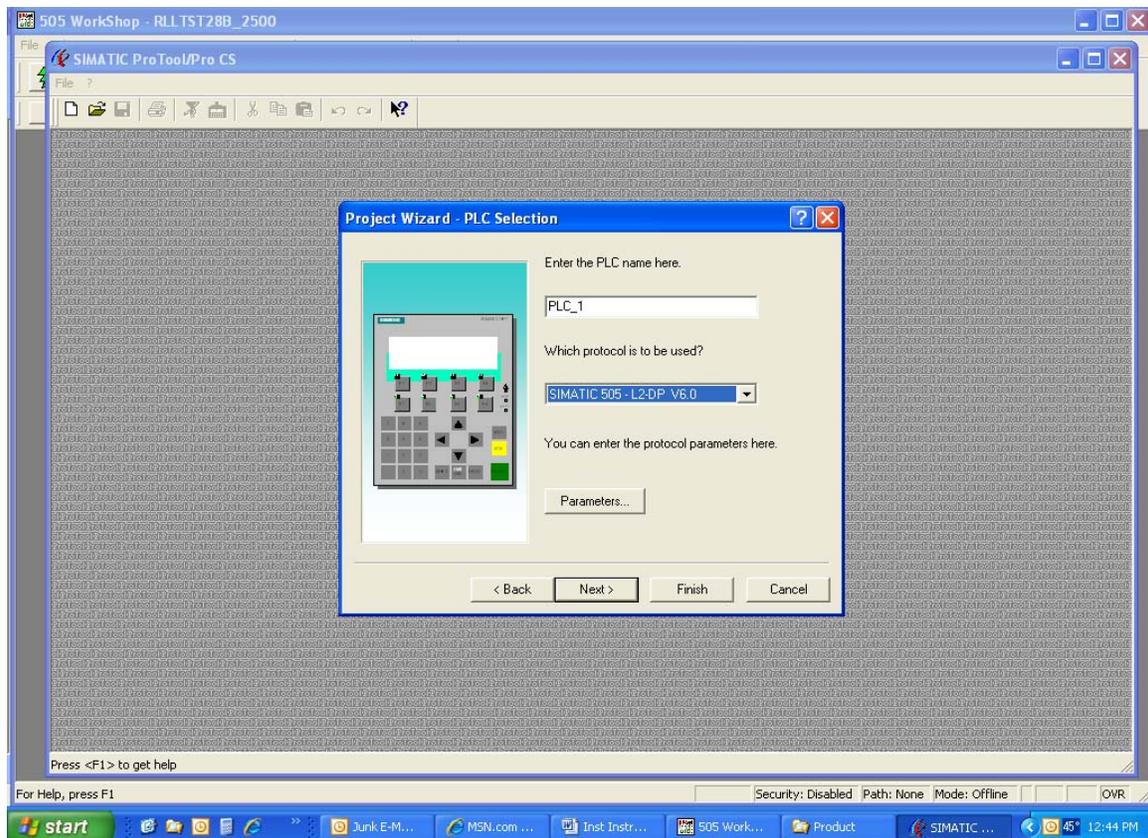
Chapters 3-4 can be skipped if you have previously used the external subroutine programs (XSUB2-3 or XSUB4-5) for Profibus-DP communications with the Siemens® HMI Unit(s). In that case, the existing Profibus-DP configuration can be used without modification.

Chapter 5 describes the CTI DP-SFSUB Driver installation using 505 WorkShop®. Installation using the TISOFT™ programming software is described in Chapter 6.

3.1. Profibus-DP Configuration using COM-PROFIBUS®

Perform the following steps for a new installation and/or configuration:

1. Select the appropriate protocol (SIMATIC® 505 L2DP or SIMATIC® 500/505-DP) within HMI configuration (using ProTool/Pro® or WinCC® flexible software) as shown below:



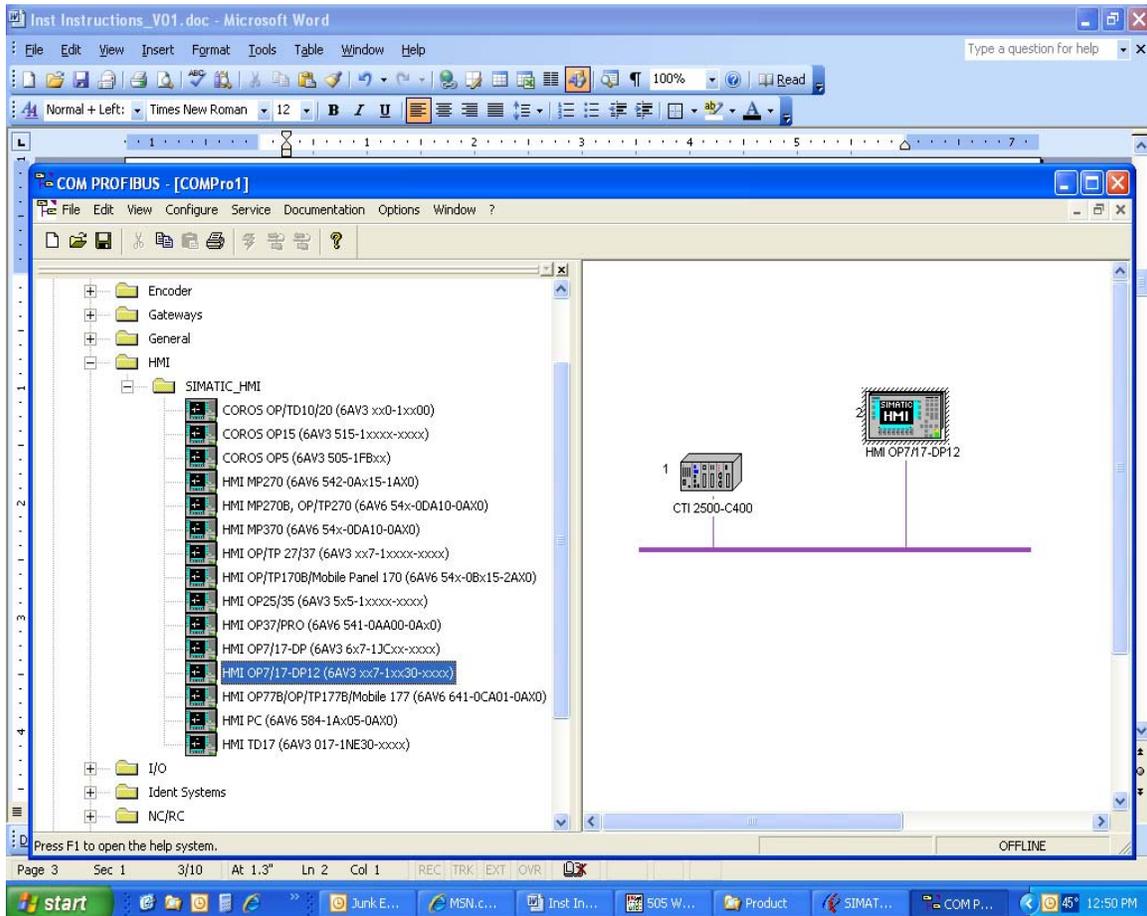
2. Ensure the Generic Station Description (GSD) file accessed by COM-PROFIBUS® utility contains configuration parameters for HMI-PLC communications.

There are two different types of GSD files provided with ProTool/Pro® and WinCC® flexible for operator panels. One type of GSD file includes Profinet I/O configuration

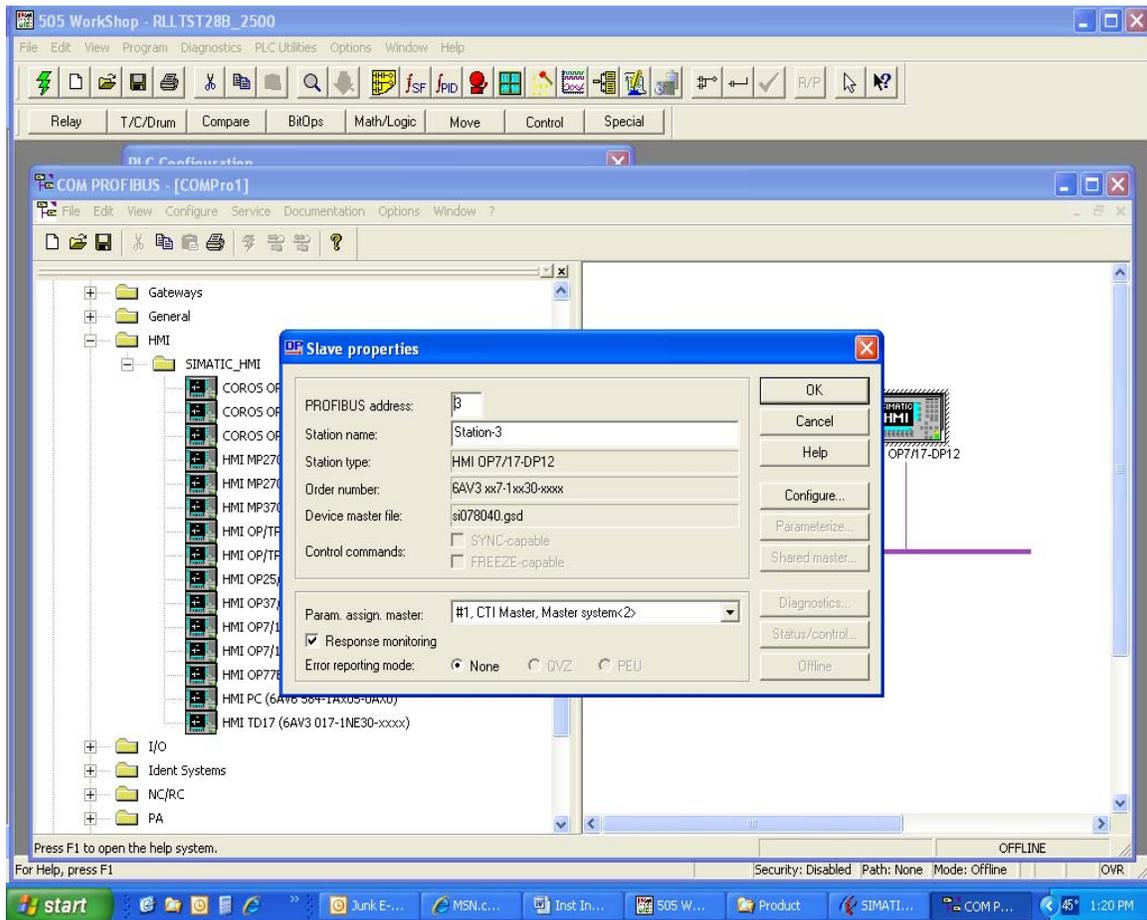
data (DP direct keys), and the second type sets I/O buffer sizes for HMI-PLC communications (S5 communications). Both GSD file types have identical filenames.

The GSD file type can be verified by viewing the contents using a text editor such as Windows® Notepad. The proper GSD file contains user-defined modules such as “32 Bytes” and “64 Bytes” (for RMOS-based panels) or “Class B tiny” and “Class B small” (for Windows-CE based panels).

3. Using COM-PROFIBUS® Profibus-DP configuration utility, select the slave device icon corresponding to the HMI unit type.



4. Set Profibus-DP Station Address for the HMI unit via [Slave Properties] screen.



5. Select [Slave Properties]/[Configure]/ [Module] to set the DP-I/O Buffer Size as shown below.

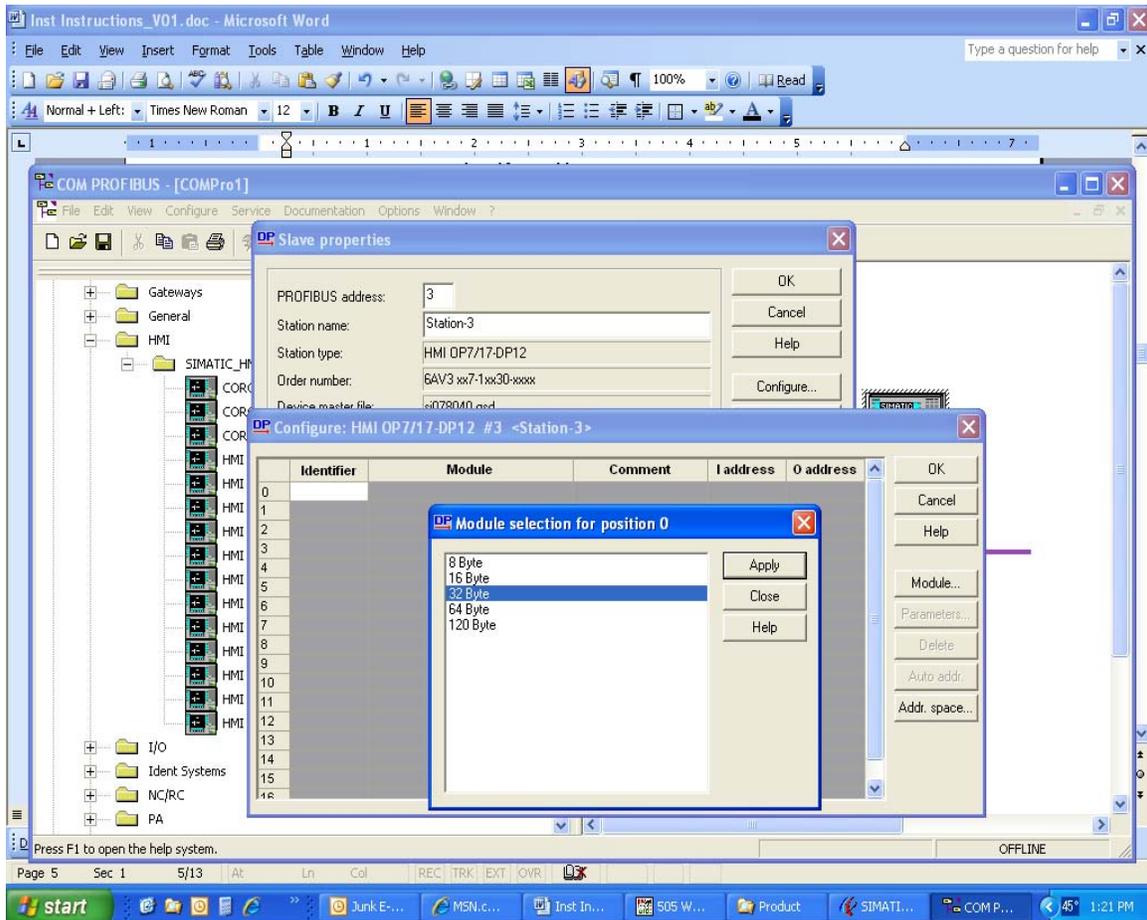
a. If using **SIMATIC® 505 L2DP** driver, select one of the following I/O buffer sizes:

32 Bytes = 16WX/16WY I/O Buffer

64 Bytes = 32WX/32WY I/O Buffer

120 Bytes = 60WX/60WY I/O Buffer

TIP: *If the majority of operator screens contain 5 or fewer variables, “32 Byte” buffer size provides optimum performance. This selection should work in most applications.*

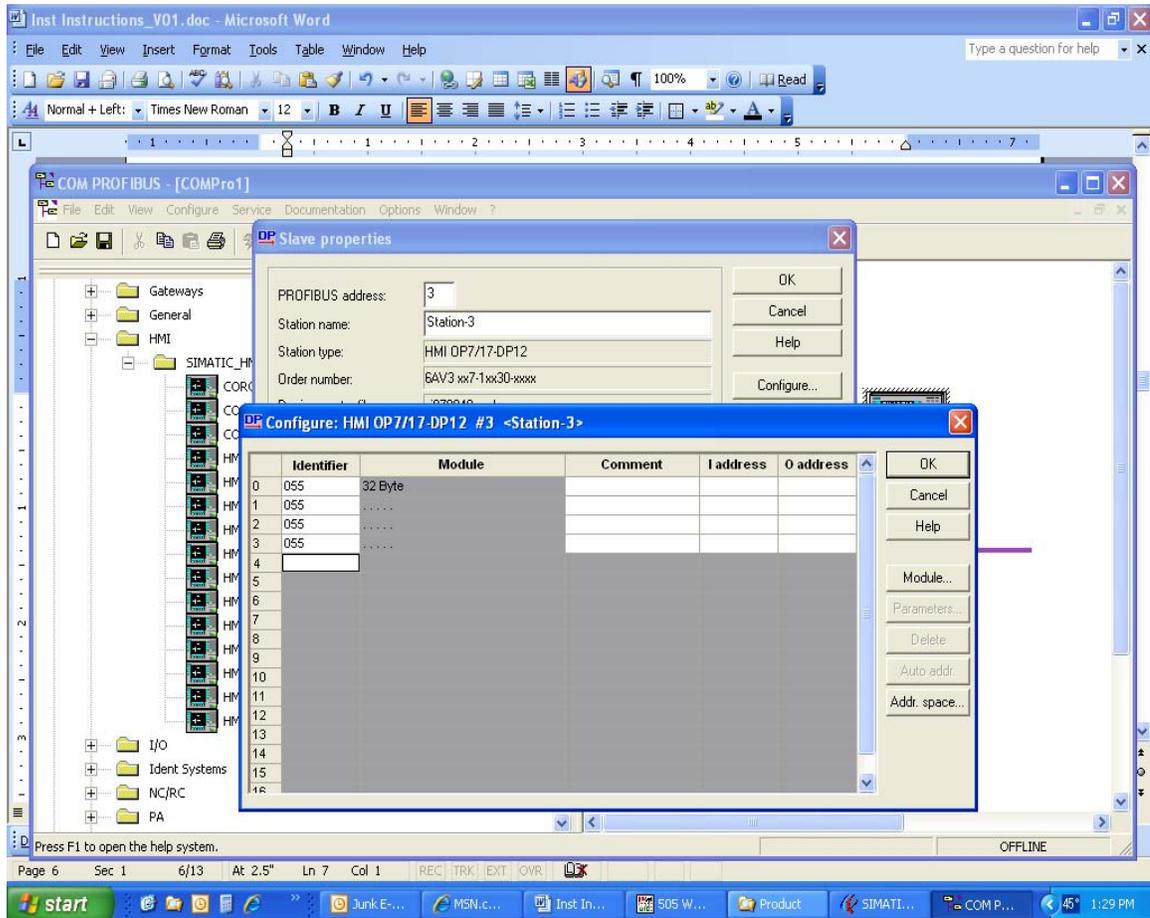


When the buffer size is selected, the 'Identifier' field is filled in as follows:

32 Bytes: 4 Rows of "055" (37H)
64 Bytes: 8 Rows of "055" (37H)
120 Bytes: 15 Rows of "055" (37H)

Each value of "055" (37 Hex) configures both Input and Output size of 8 Bytes. Therefore, the number of rows is a multiplier to set the actual I/O buffer size (i.e., four rows = 4 X 8 I/O Bytes = 32 Bytes Input and 32 Bytes Output).

The example below shows a buffer size of 32-Bytes.In/Out.

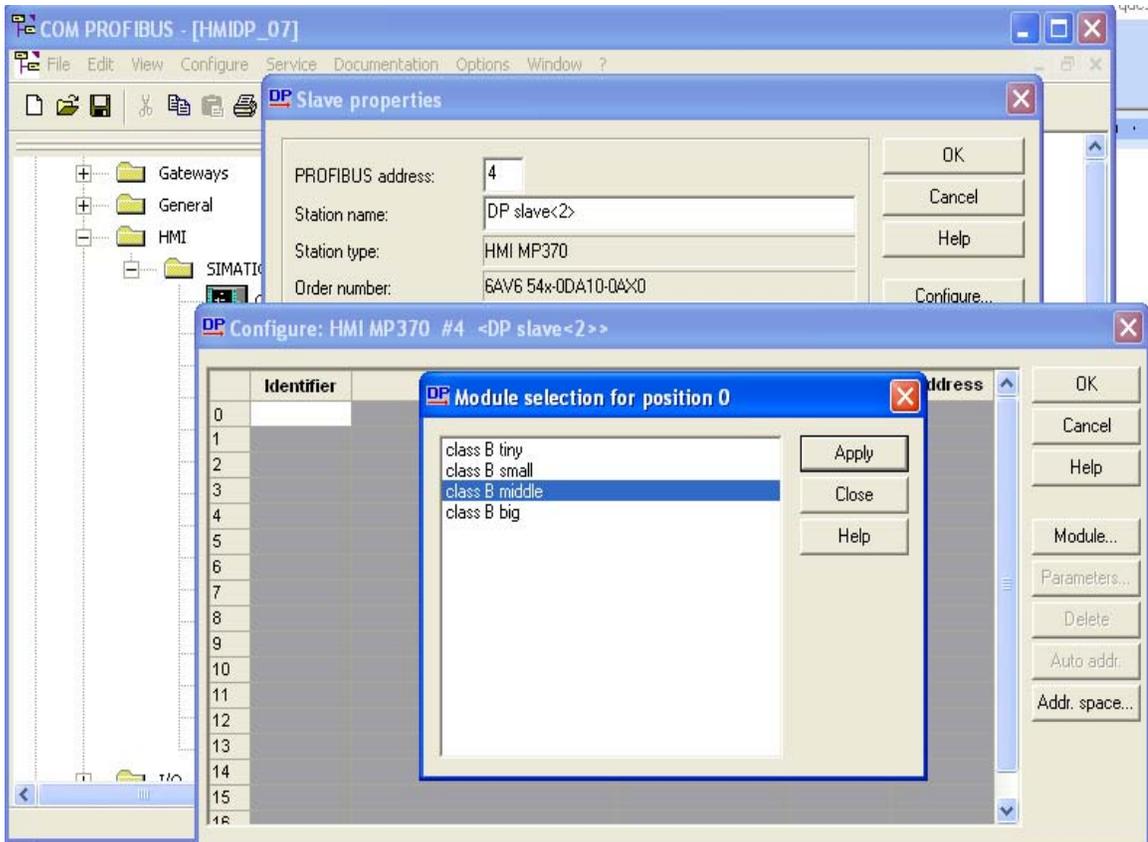


Press [OK] to save the configuration. Export Binary (2BF) File.

b. If using the **SIMATIC® 500/505-DP** driver, select one of the following I/O buffers:

- Tiny = 32-Bytes In / 22-Bytes Out (16WX/11WY)
- Small = 42-Bytes In / 22-Bytes Out (21WX/11WY)
- Middle = 64-Bytes In / 32-Bytes Out (32WX/16WY)
- Big = 122-Bytes In / 64-Bytes Out (61WX/32WY)

TIP: *The 'Small' or 'Middle' I/O buffer size provides the optimal interface for most applications. The 'Middle' I/O buffer size should be used when accessing a large group of words for 'Alarm Messaging' or 'Event Messaging'.*



When the buffer size is selected, the 'Identifier' field is filled with one of the following sets of values:

- Tiny: 63, 53, 25
- Small: 63, 53, 31, 32DI
- Middle: 63, 63, 31, 31
- Big: 63, 63, 63, 63, 31, 31, 31, 25

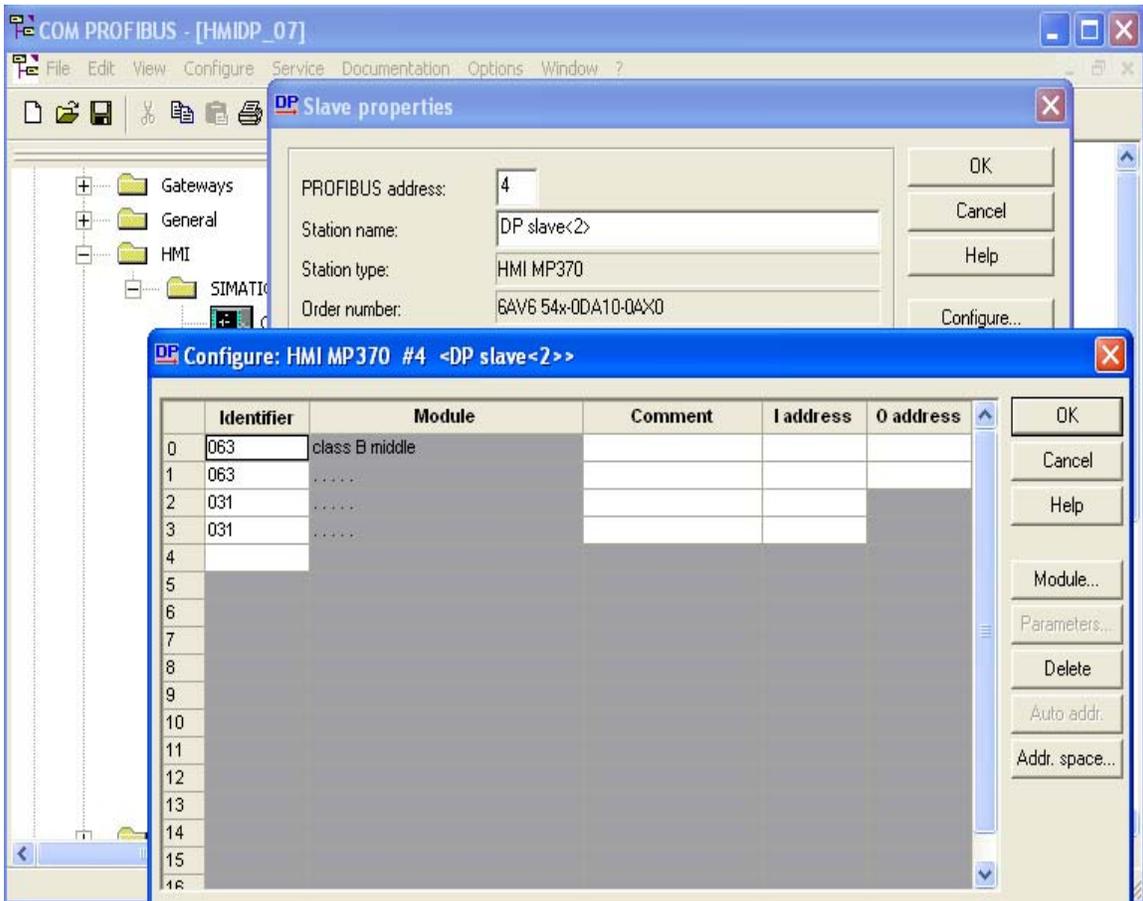
Each value configures a group of Inputs, Outputs, or both as shown below:

<u>Value</u>	<u>Hex</u>	<u>I/O Config</u>
63	3F	16 Bytes Input and Output
53	35	6 Bytes Input and Output
25	19	10 Bytes Input
31	1F	16 Bytes Input
32DI		4 Bytes Input

The combination of these I/O configurations then determined the actual I/O interface for the HMI device. For instance, the 'Middle' buufer size is calculated as follows:

$$\begin{aligned} \text{Inputs} &= 16 \text{ Bytes (63)} + 16 \text{ Bytes (63)} + 16 \text{ Bytes (31)} + 16 \text{ Bytes (31)} \\ &= 64 \text{ Bytes} = 32 \text{ Words} \\ \text{Outputs} &= 16 \text{ Bytes (63)} + 16 \text{ Bytes (63)} \\ &= 32 \text{ Bytes} = 16 \text{ Words} \end{aligned}$$

The example below shows the 'Middle' I/O buffer size (32WX/16WY):



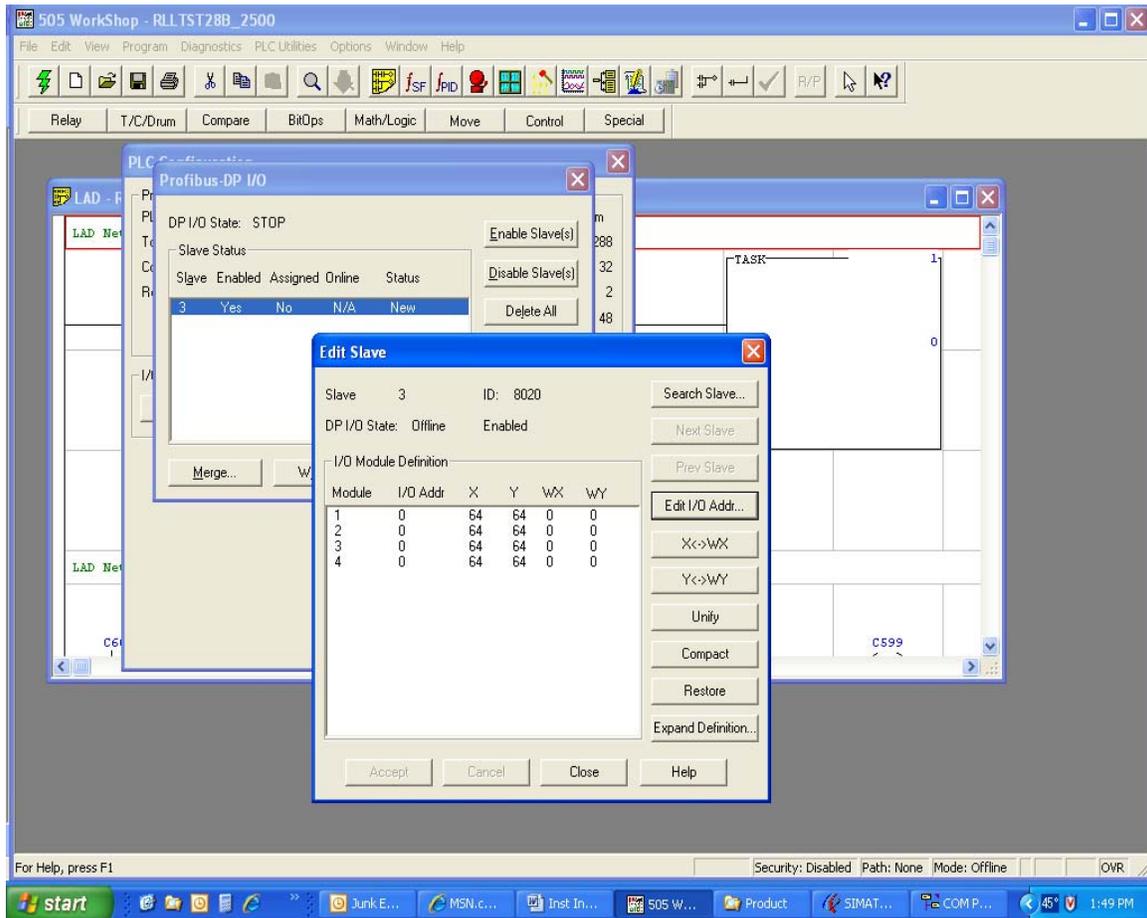
Press [OK] to save the configuration. Export Binary (2BF) File.

3.2. Merge COM-PROFIBUS® Config into 505 WorkShop® Programs

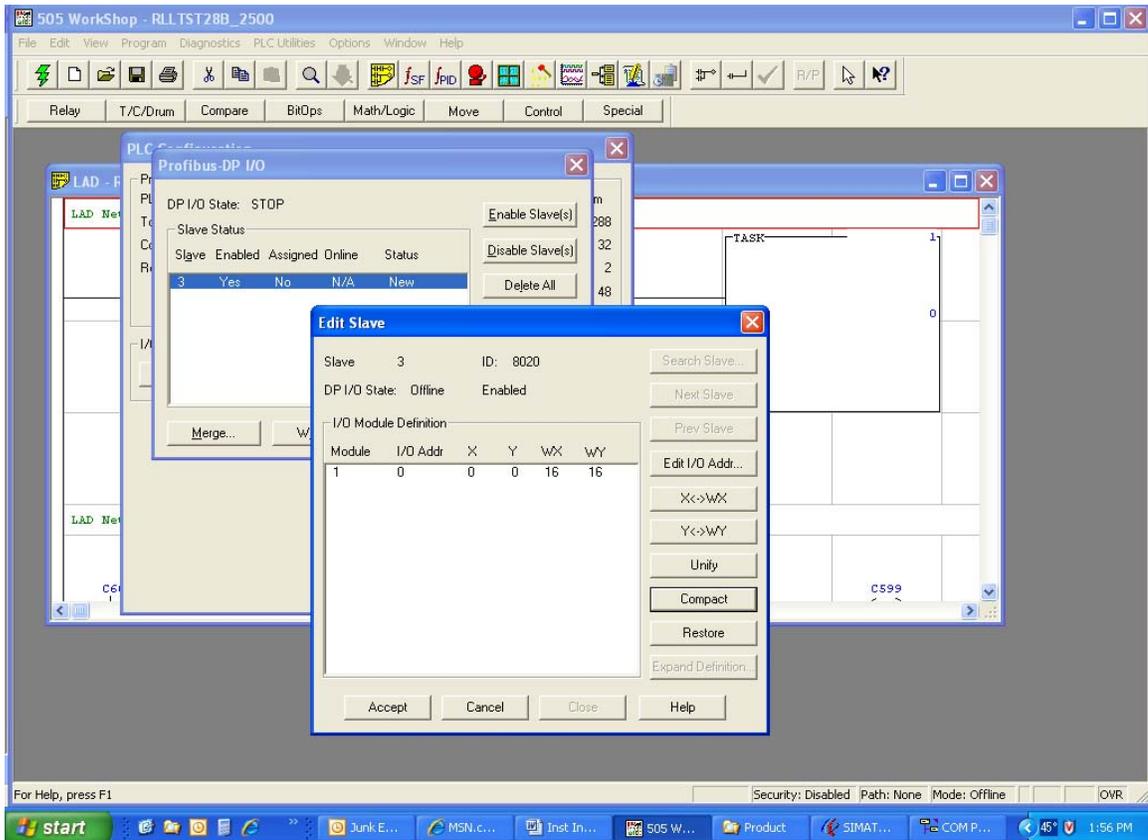
This section describes the steps required to merge the COM-PROFIBUS® configuration into PLC Application Program using 505 WorkShop®. If you are using TISOFT™, the steps are described in Section 3.3.

1. Open your PLC Application in WorkShop®.
Select [PLC Configuration] / [Profibus I/O] / [Merge].
2. Select the Profibus-DP Configuration Binary File saved in the previous section.
3. The Slave Address of the HMI Unit appears in the window.
Select the Slave Address corresponding to the HMI and press [Edit Slave].
4. The Profibus-DP configuration for the HMI is displayed as shown below. The default I/O configuration is presented as a “bit-based” (X/Y) interface. Alter the I/O configuration to its corresponding “Word-based” interface by pressing the [Compact] button.

The following screen shows 32-Byte “bit-based” I/O interface for the **SIMATIC® 500 L2DP** driver:



After the interface is compacted into its “Word-based” 16WX/16WY equivalent:

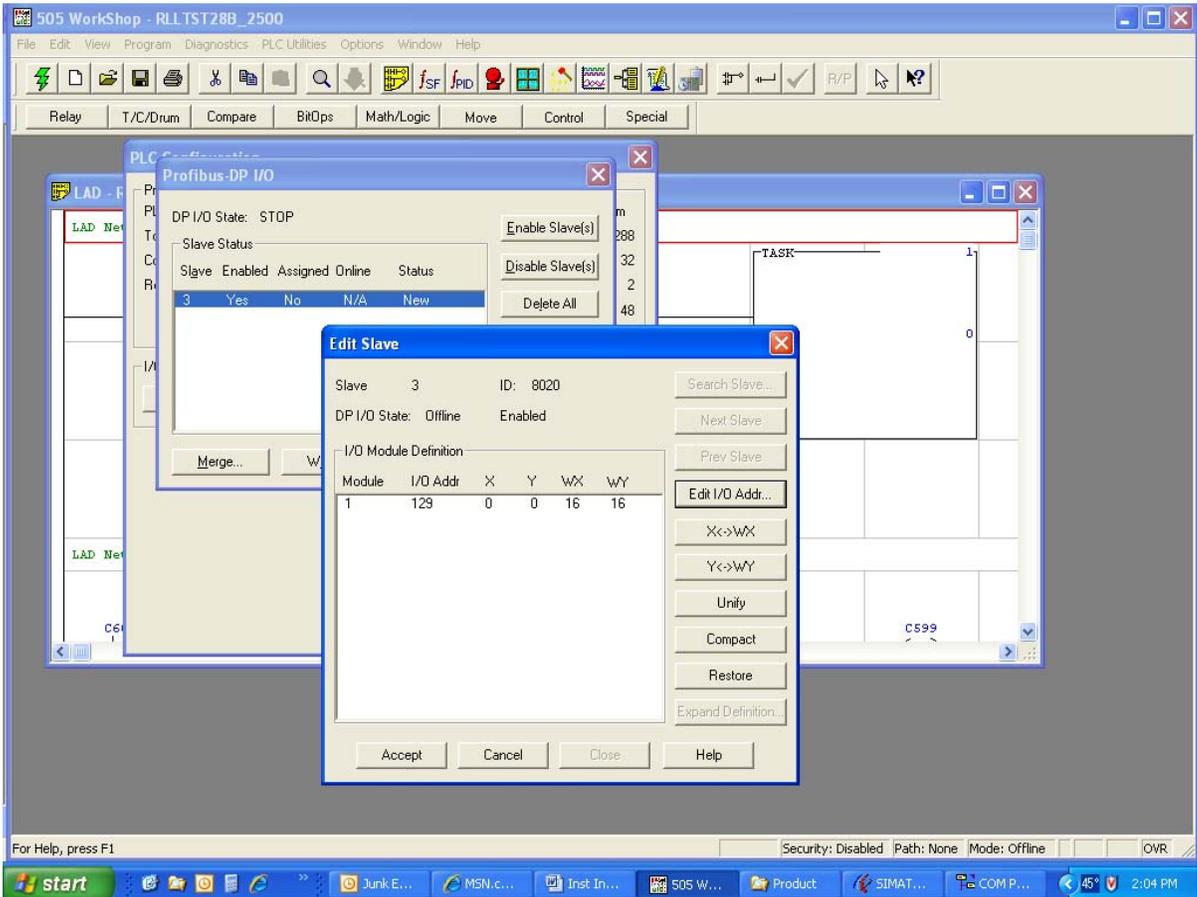


- Next select [Edit I/O Addr] to enter Start Address for the Profibus-DP I/O interface buffer. The HMI drivers require that the Input Buffer must be specified first, and the Output Buffer immediately follow it.

Therefore, the “I/O Address” entered in this Dialog Box must specify the Input Buffer Starting Address. Any valid WX/WY address can be entered. Press [Accept] in the ‘Edit Slave’ window to save the Profibus-DP configuration.

Example 1 below specifies an HMI interface with following specs:

Protocol = **SIMATIC® 505 L2DP**
 I/O Buffer Size = 32 Bytes
 Input Buffer Start Address = WX129
 Output Buffer Start Address = WY145



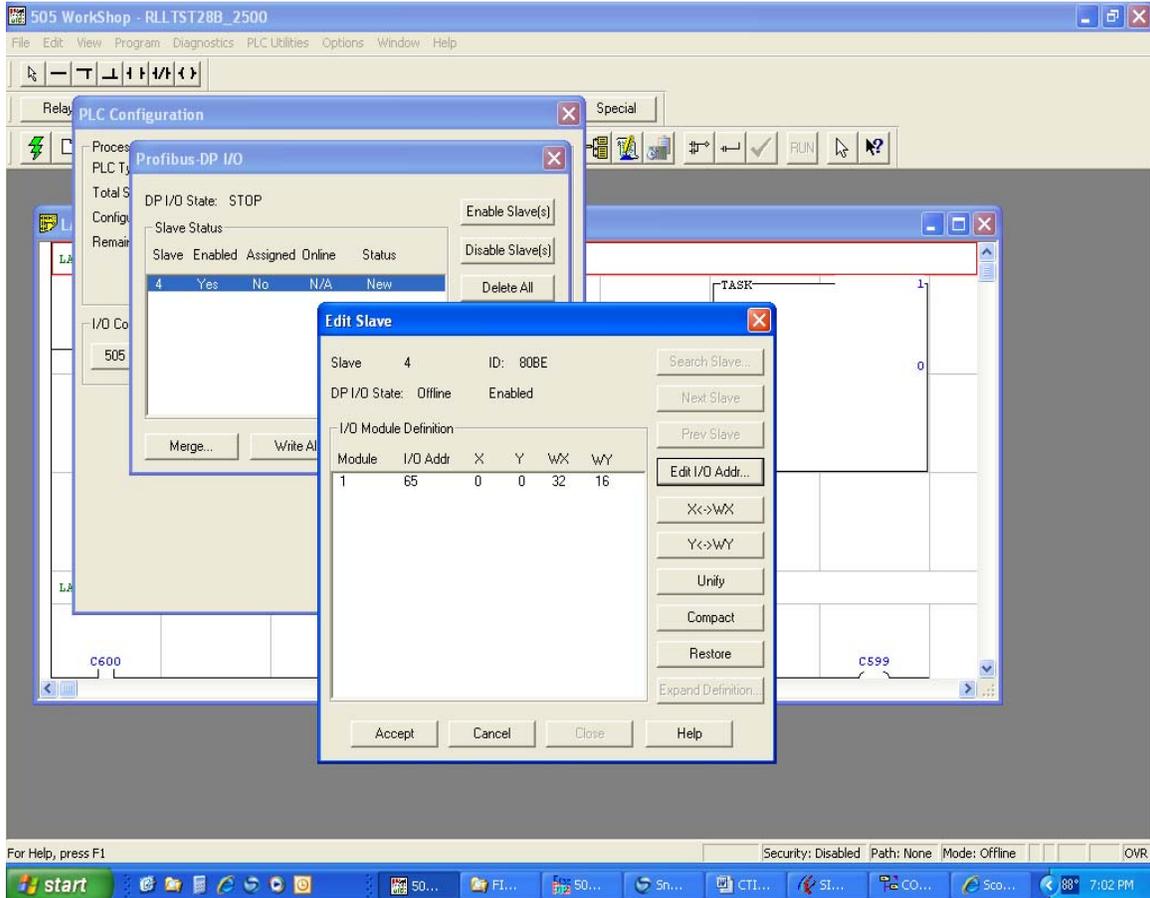
Example 2 below specifies an HMI interface with following specs:

Protocol = **SIMATIC® 500/505-DP**

I/O Buffer Size = 'Middle' (In: 64 Bytes/ Out: 32 Bytes)

Input Buffer Start Address = WX65

Output Buffer Start Address = WY97

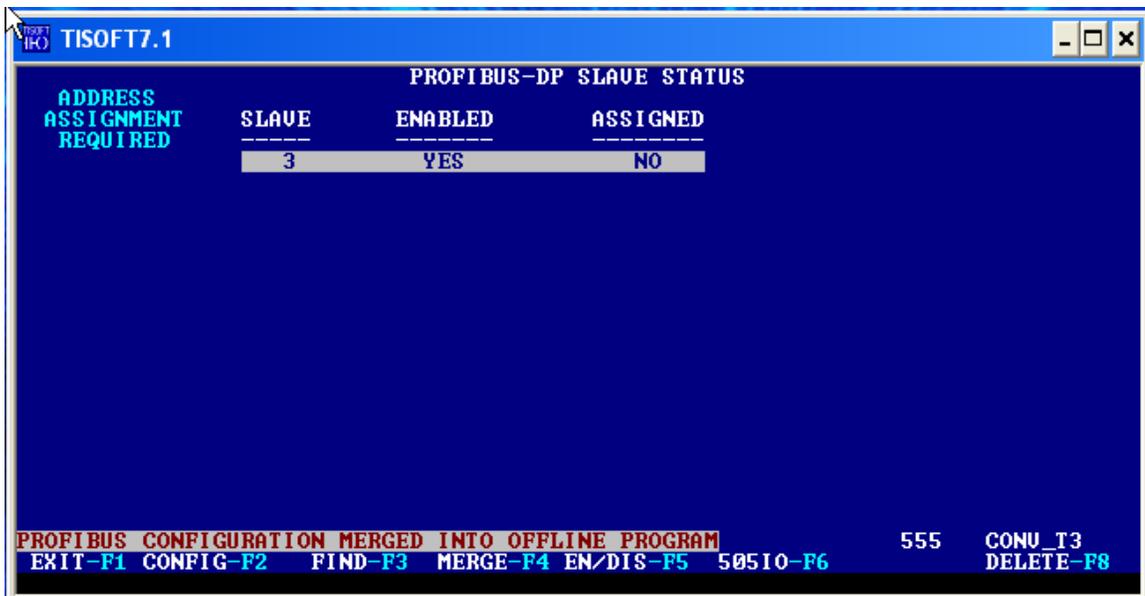


3.3. Merge COM-PROFIBUS® Config File into TISOFT Programs

This section describes the steps required to merge the COM-PROFIBUS® Profibus-DP configuration into PLC Application Programs using TISOFT Release 6.x or Release 7.x.

The following screens are shown using TISOFT Release 7.1. However, these steps are identical in TISOFT Release 6.x.

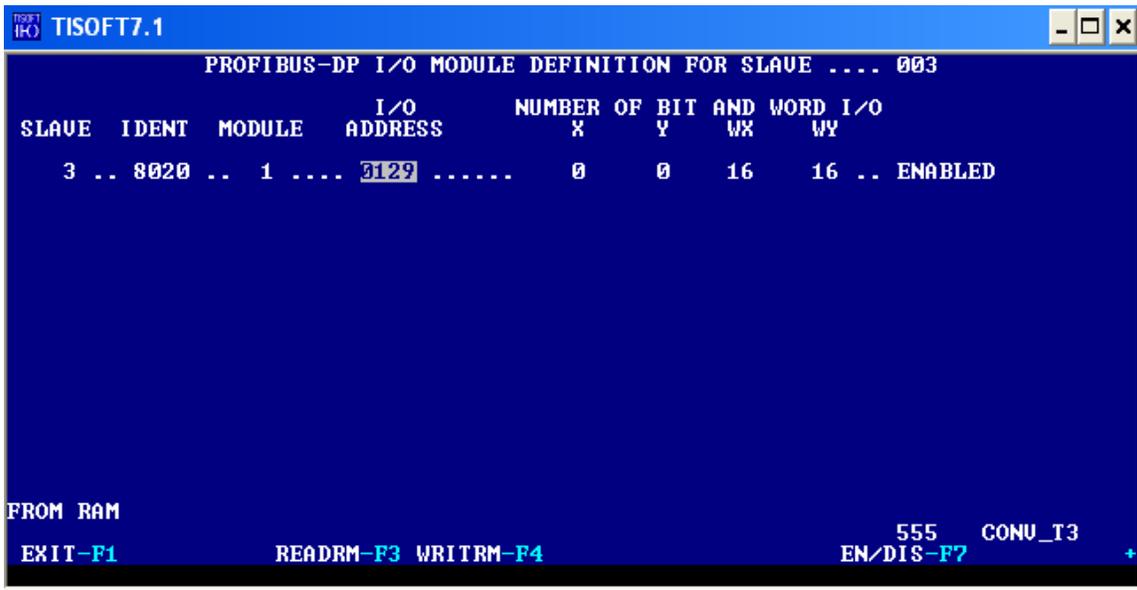
1. Open your PLC Application in “Offline” in TISOFT™.
Press <Space>/ [CONFIO-F3] / [PROF-DP – F6] / [MERGE-F4] / [YES-F2].
2. Select the Profibus-DP Configuration Binary File saved in Step 5. Change Directory and highlight file (if necessary); then press [SELECT-F8].
3. The Slave Address of the HMI Unit appears in the window. Highlight the Slave Address (using Cursor keys if necessary) corresponding to the HMI and press [CONFIG-F2].



5. Move cursor so that I/O Address for HMI Slave is highlighted. Enter the Start Address for the Profibus-DP I/O interface buffer. The HMI drivers require that the Input Buffer must be specified first and the Output Buffer immediately follow. Therefore, the “I/O Address” entered in this field must specify the Input Buffer Starting Address. Any valid WX/WY address can be entered. Press <Space> / [WRITRM-F4] to save the Profibus-DP configuration.

Example 1 below specifies an HMI interface with following specs:

Protocol = **SIMATIC® 505 L2DP**
 I/O Buffer Size = 32 Bytes
 Input Buffer Start Address = WX129
 Output Buffer Start Address = WY 145



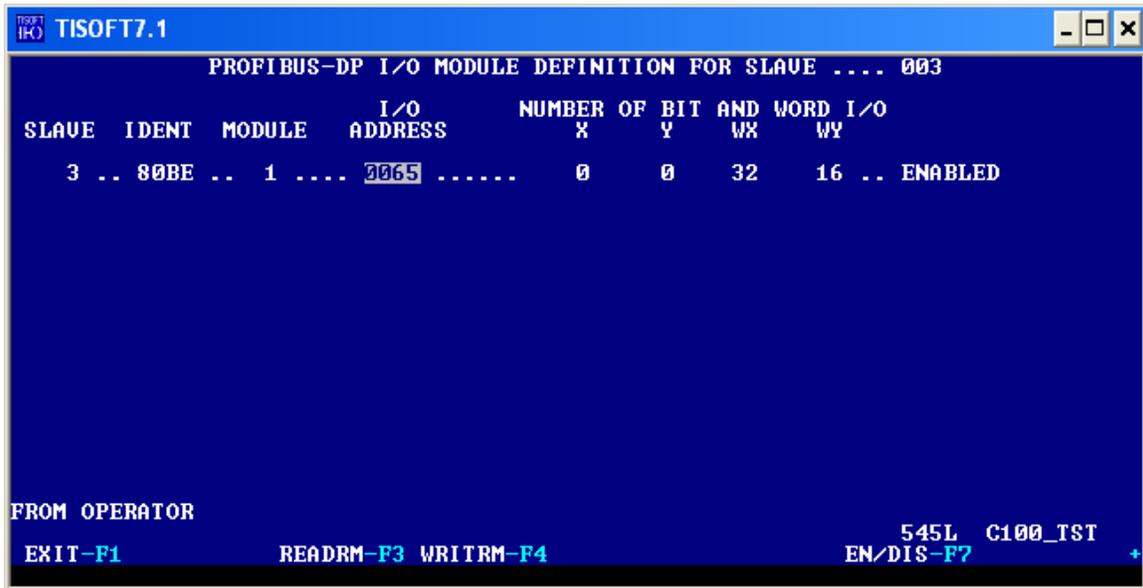
Example 2 below specifies an HMI interface with following specs:

Protocol = **SIMATIC® 500/505-DP**

I/O Buffer Size = 'Middle' (In: 64 Bytes/ Out: 32 Bytes)

Input Buffer Start Address = WX65

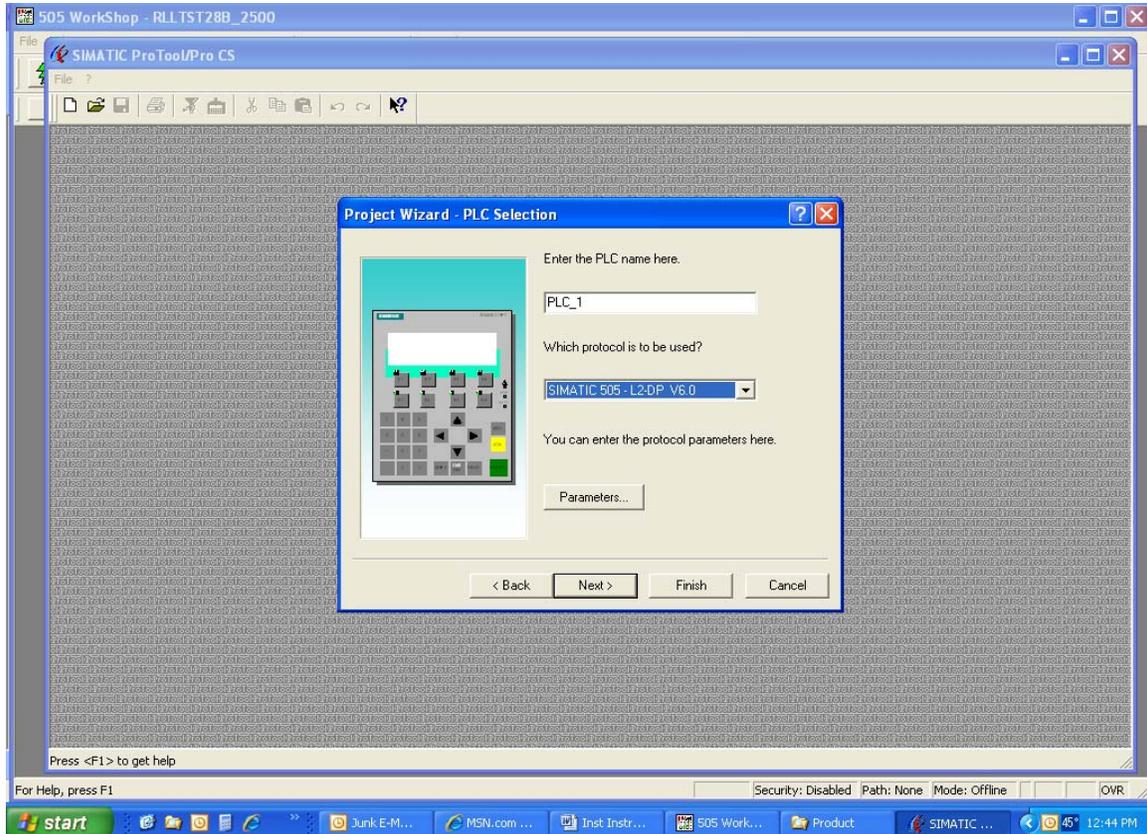
Output Buffer Start Address = WY97



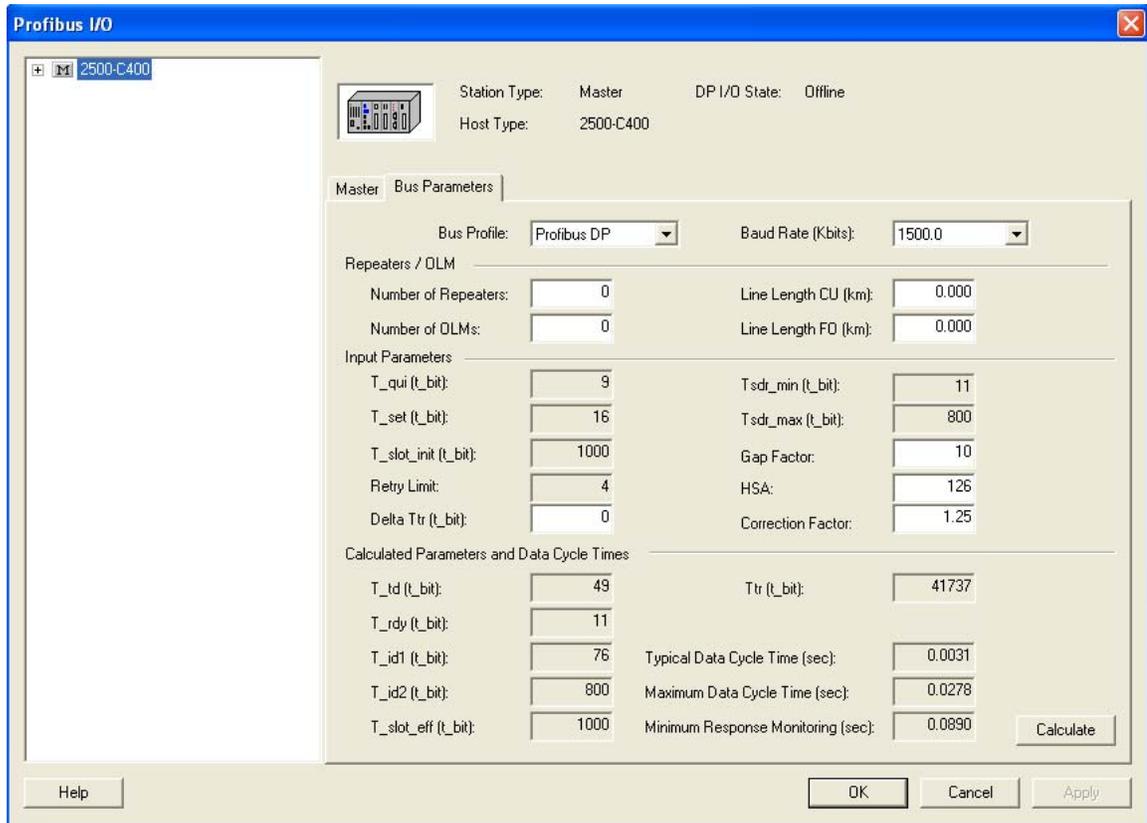
4. Profibus-DP Configuration using 505 WorkShop®

This chapter describes the steps for creating a Profibus-DP network configuration for HMI devices using the Profibus I/O Configurator embedded into 505 WorkShop V4.30 or later. This process is a combination of the network configuration, slave device parameterization, and I/O mapping operations.

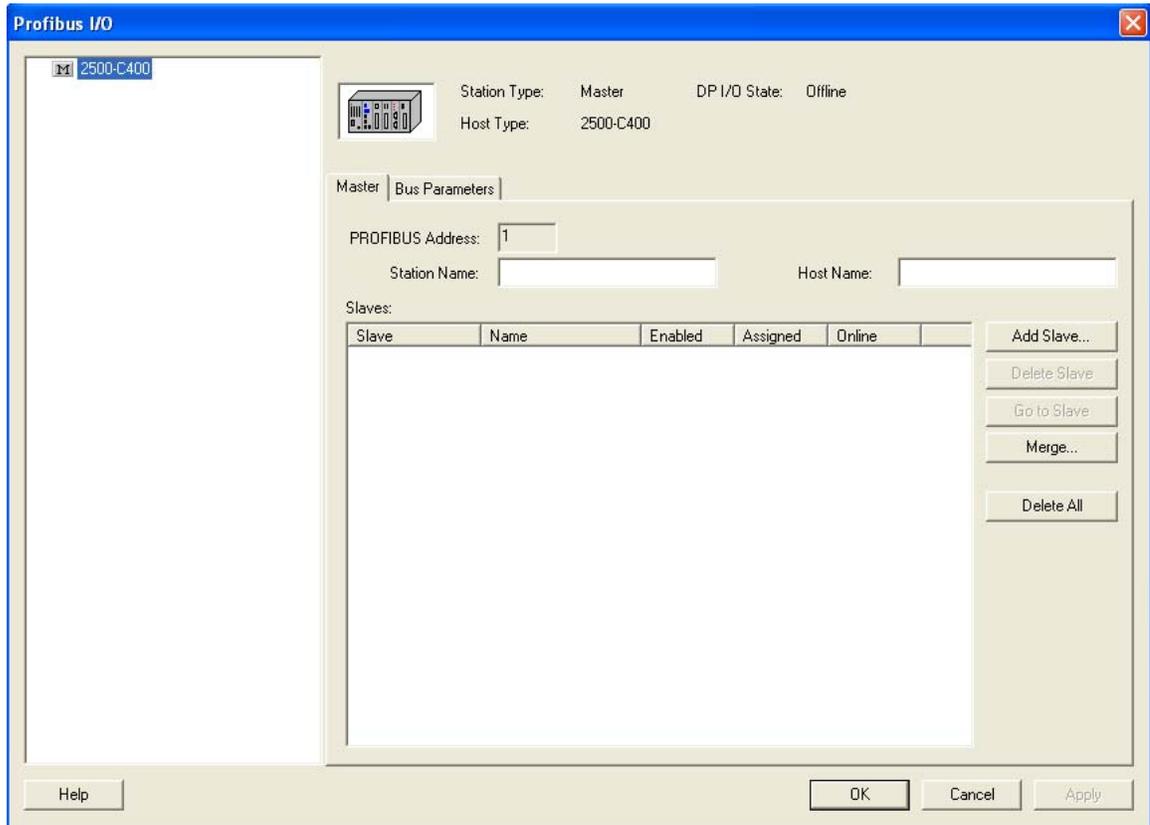
1. Select the appropriate protocol (**SIMATIC® 505 L2DP** or **SIMATIC® 500/505-DP**) within HMI configuration (using ProTool/Pro® or WinCC® flexible software) as shown below:



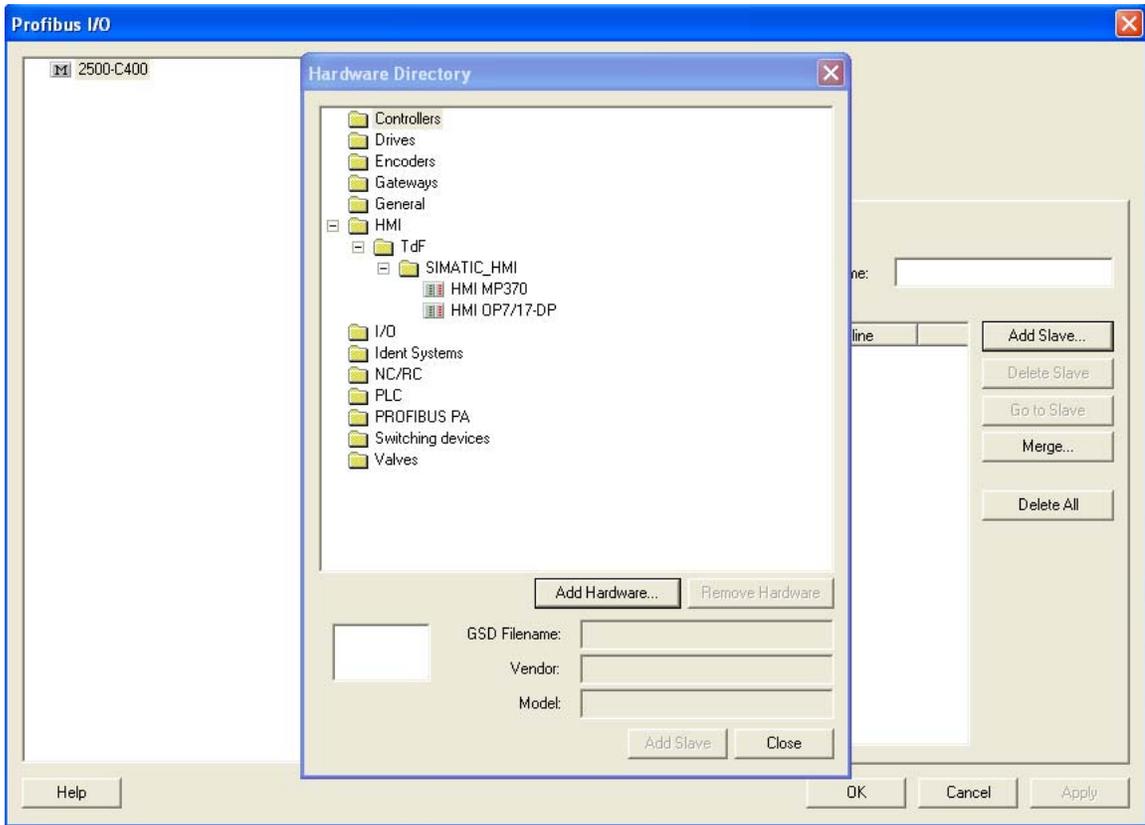
- Set Profibus-DP network parameters by selecting [Bus Parameters] tab and modifying data fields as required. Specifically note network “baud rate” and choose value no greater than 1.5M (1500 Kbits) when possible to improve the reliability of communications..



3. Open the Profibus-DP configurator in 505 WorkShop® by selecting [PLC Configuration] / [I/O Configuration - Profibus I/O]. The following screen appears:



4. Select [Add Slave] to add your HMI device to the Profibus-DP network. The Hardware Directory is then displayed to allow selection of the device to be added to the network. The following screen shows the HMI devices available for selection.



5. Each device must first be added to the 505 WorkShop® Hardware Directory before it can be added to the Profibus-DP network. If your device is not listed, it can be added by pressing [Add Hardware] and selecting the location of the corresponding GSD file.

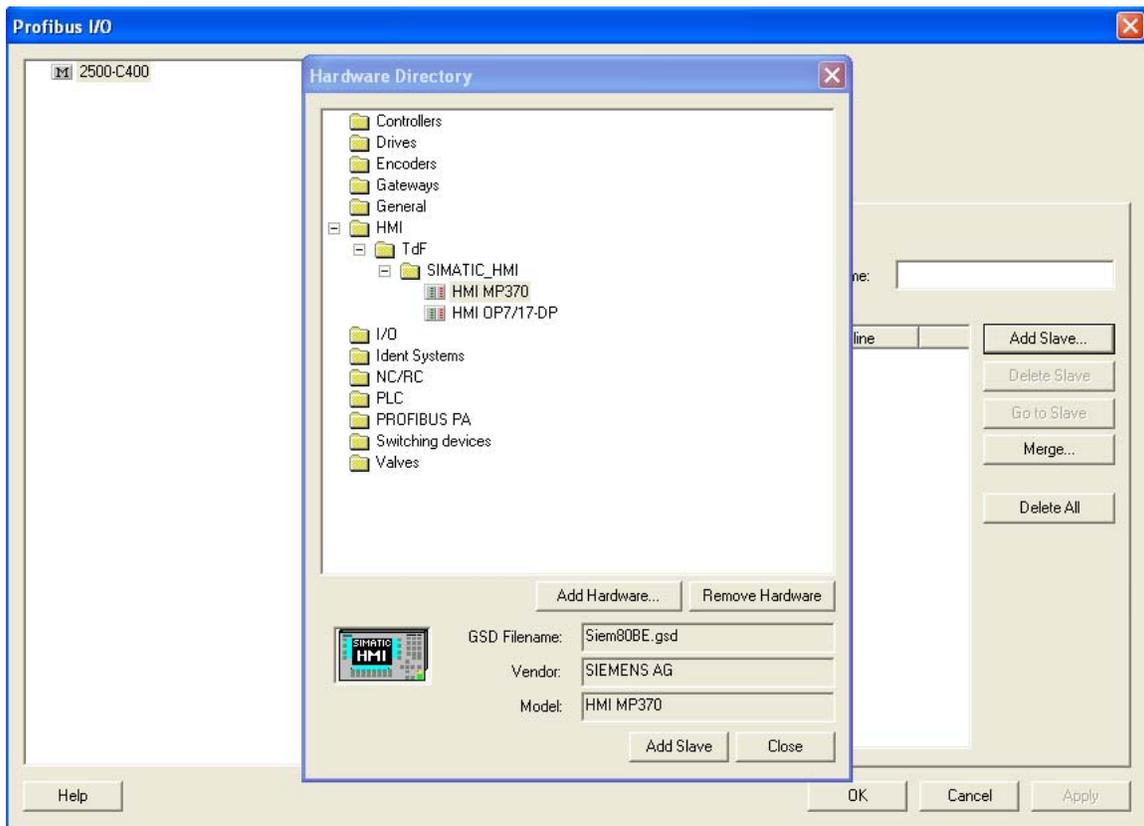
If the COM-PROFIBUS® utility has been used previously for creating Profibus-DP network configurations, the GSD files are located in the SIEMENS/CPBV51/GSD folder.

Ensure the Generic Station Description (GSD) files accessed by 505 WorkShop® utility contains configuration parameters for HMI-PLC communications.

There are two different types of GSD files provided with ProTool/Pro® and WinCC® flexible for operator panels. One type of GSD file includes Profinet I/O configuration data (DP direct keys), and the second type sets I/O buffer sizes for HMI-PLC communications (S5 communications). Both GSD file types have identical filenames.

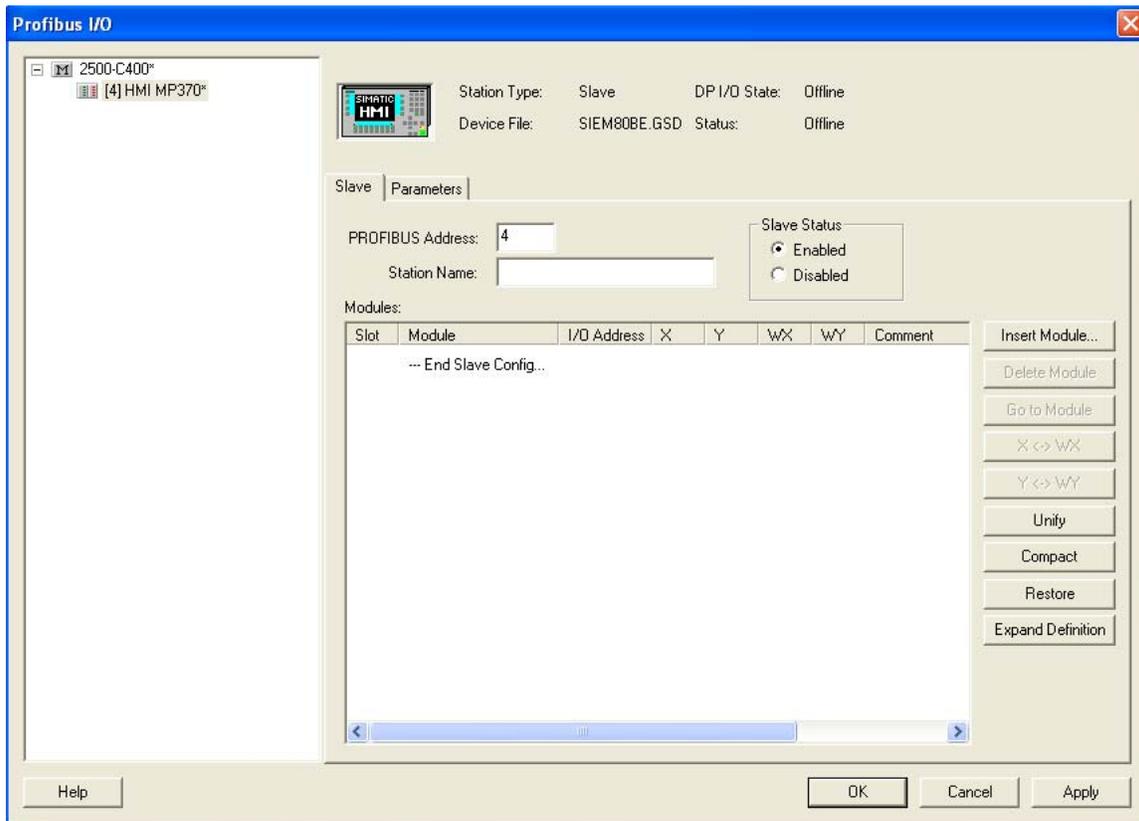
The GSD file type can be verified by viewing the contents using a text editor such as Windows® Notepad. The proper GSD file contains user-defined modules such as “32 Bytes” and “64 Bytes” (for RMOS-based panels) or “Class B tiny” and “Class B small” (for Windows-CE based panels).

- When desired HMI device appears in the Hardware List, select the device and details including icon bitmap are displayed as shown below.



Press [Add Slave] and [Close] to add the device to the Profibus-DP network and return to overview screen.

7. Press [Go to Slave] to modify device parameters. Set Profibus-DP Station Address for the HMI unit by modifying “PROFIBUS Address” field.

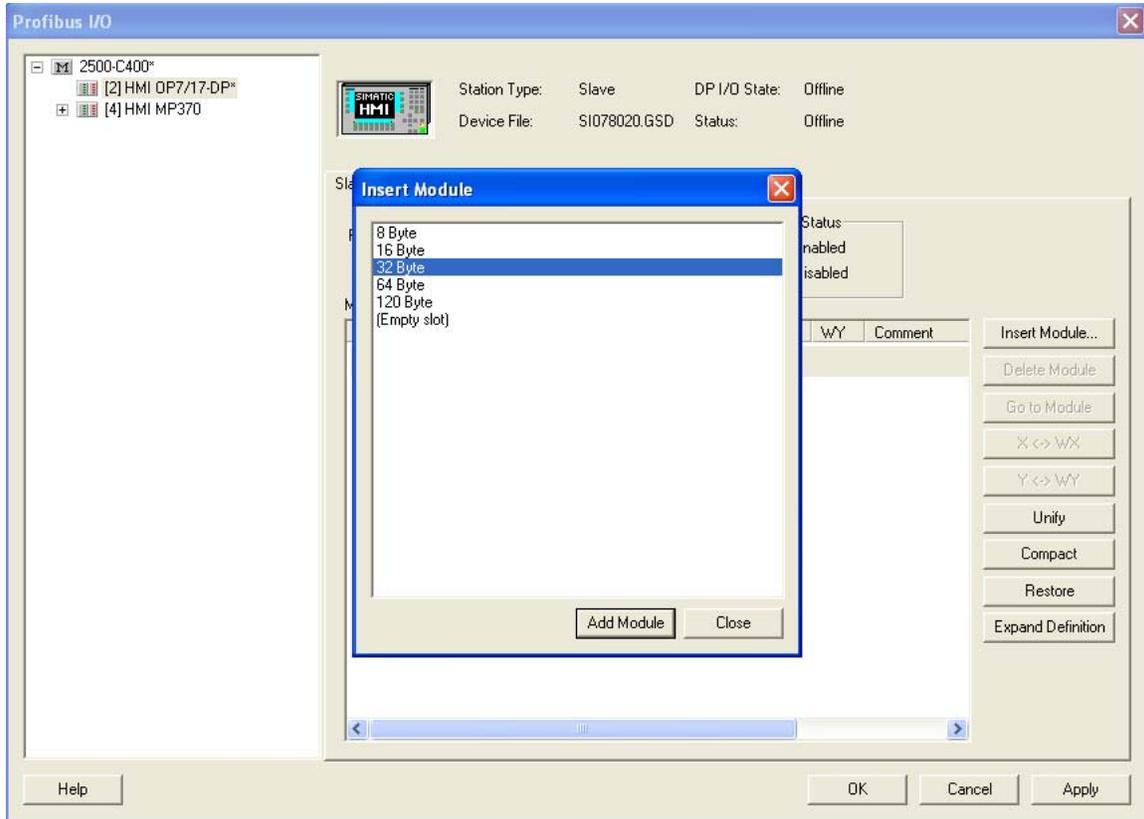


8. Press [Insert Module] to set the DP-I/O Buffer Size.

4.1. Mapping Profibus-DP I/O for SIMATIC® 505 L2DP driver

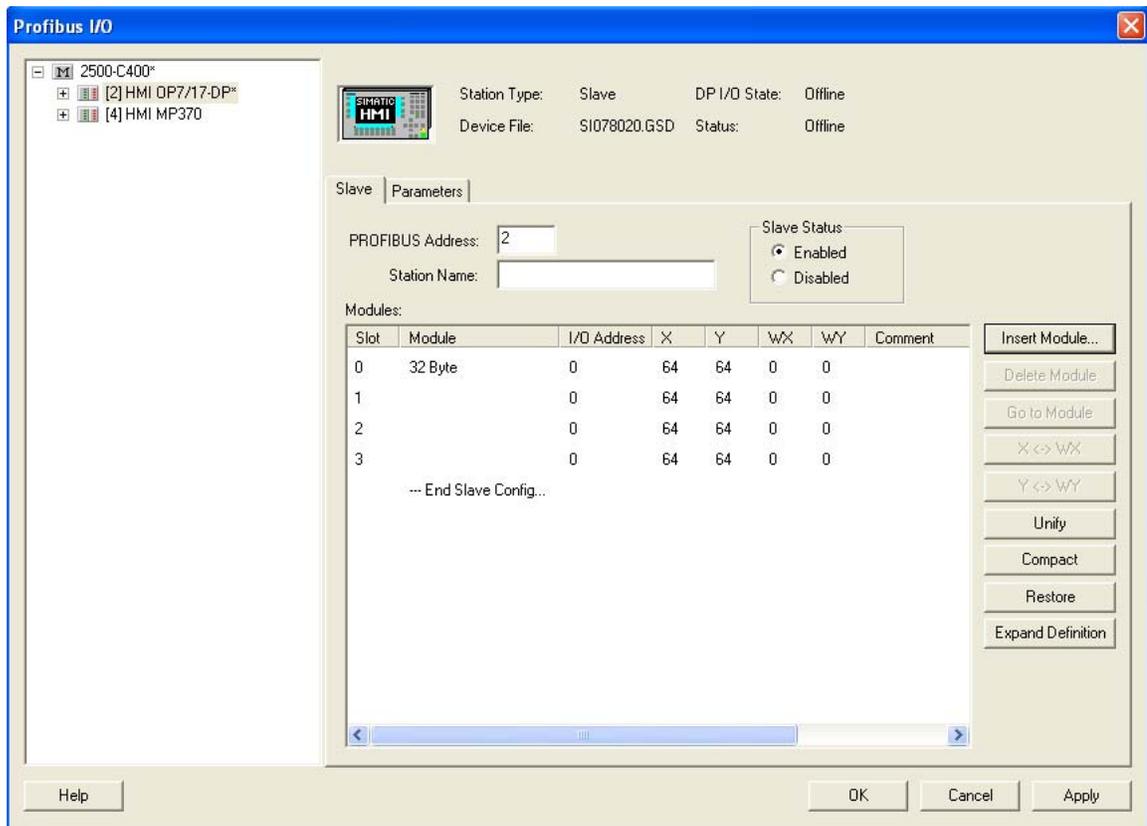
1. If using SIMATIC® 505 L2DP driver, select one of the following I/O buffer sizes:
 - 32 Bytes = 16WX/16WY I/O Buffer
 - 64 Bytes = 32WX/32WY I/O Buffer
 - 120 Bytes = 60WX/60WY I/O Buffer

TIP: *If the majority of operator screens contain 5 or fewer variables, “32 Byte” buffer size provides optimum performance. This selection should work in most applications.*



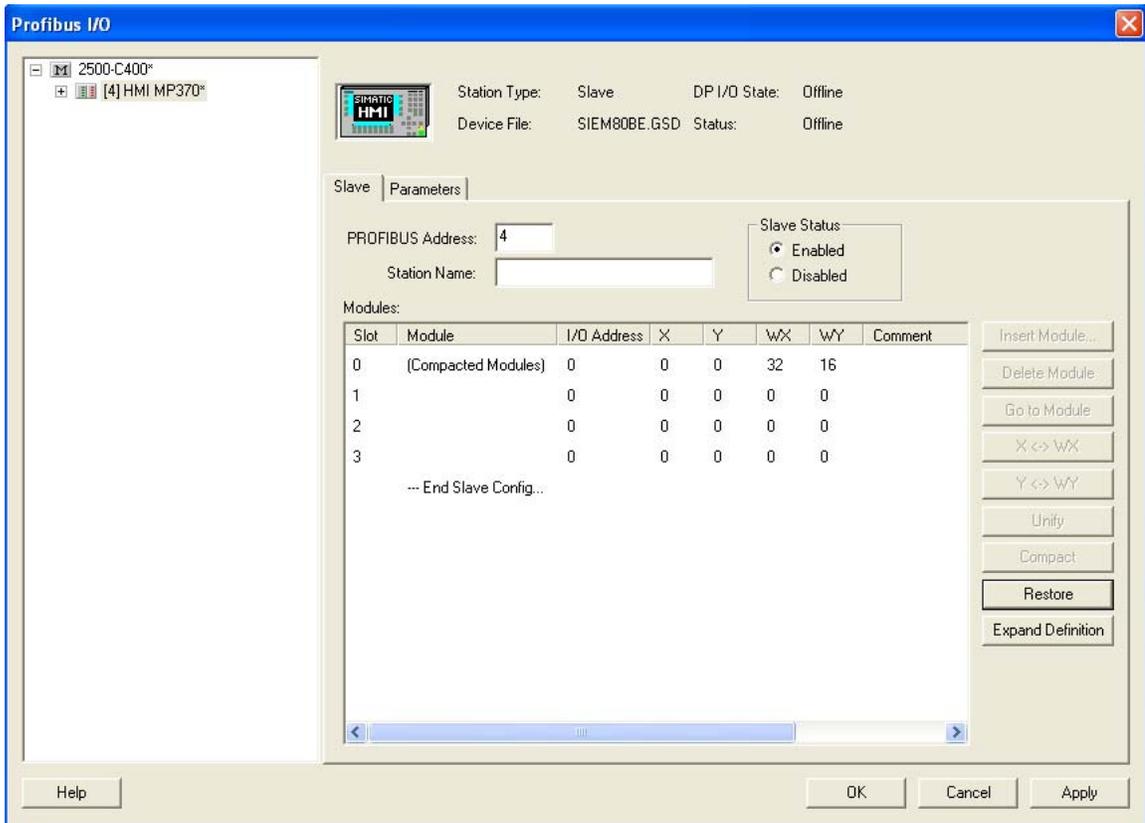
Press [Close] to return to device parameter screen.

- The selected Profibus-DP configuration for the HMI is presented as a “bit-based” (X/Y) interface. The following screen shows the “32 Byte” I/O interface for the **SIMATIC® 505 L2DP** driver:



Press [OK] to save the configuration. Export Binary (2BF) File.

- Alter the I/O configuration to its corresponding “Word-based” interface by pressing the [Compact] button. The result is shown below.



- Click on “I/O Address” field for Slot 0 and enter Start Address for the Profibus-DP I/O interface buffer. The HMI drivers require that the Input Buffer must be specified first, and the Output Buffer immediately follow it.

Therefore, the “I/O Address” entered in this Dialog Box must specify the Input Buffer Starting Address. Any valid WX/WY address can be entered. Press [Accept] in the ‘Edit Slave’ window to save the Profibus-DP configuration.

Press [Apply] to accept settings when entry is complete.

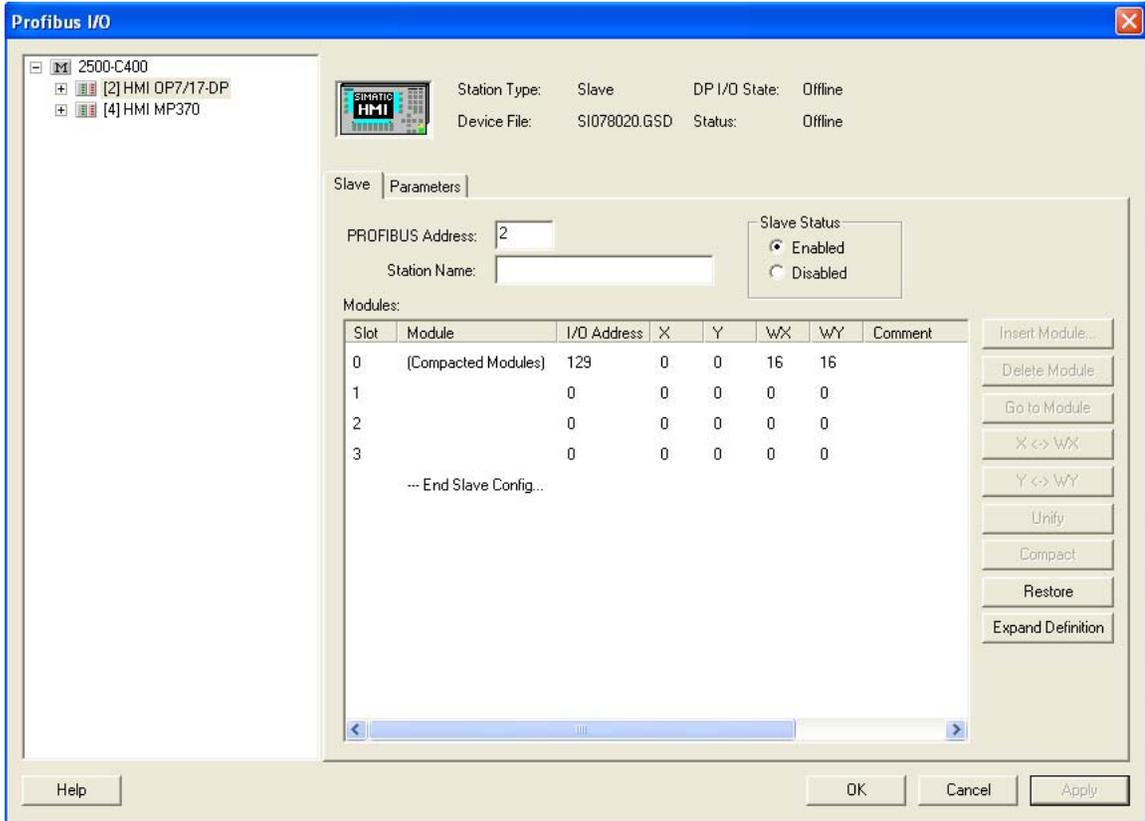
5. The example below specifies an HMI interface with following specs:

Protocol = SIMATIC® 505 L2DP

I/O Buffer Size = 32 Bytes

Input Buffer Start Address = WX129

Output Buffer Start Address = WY145

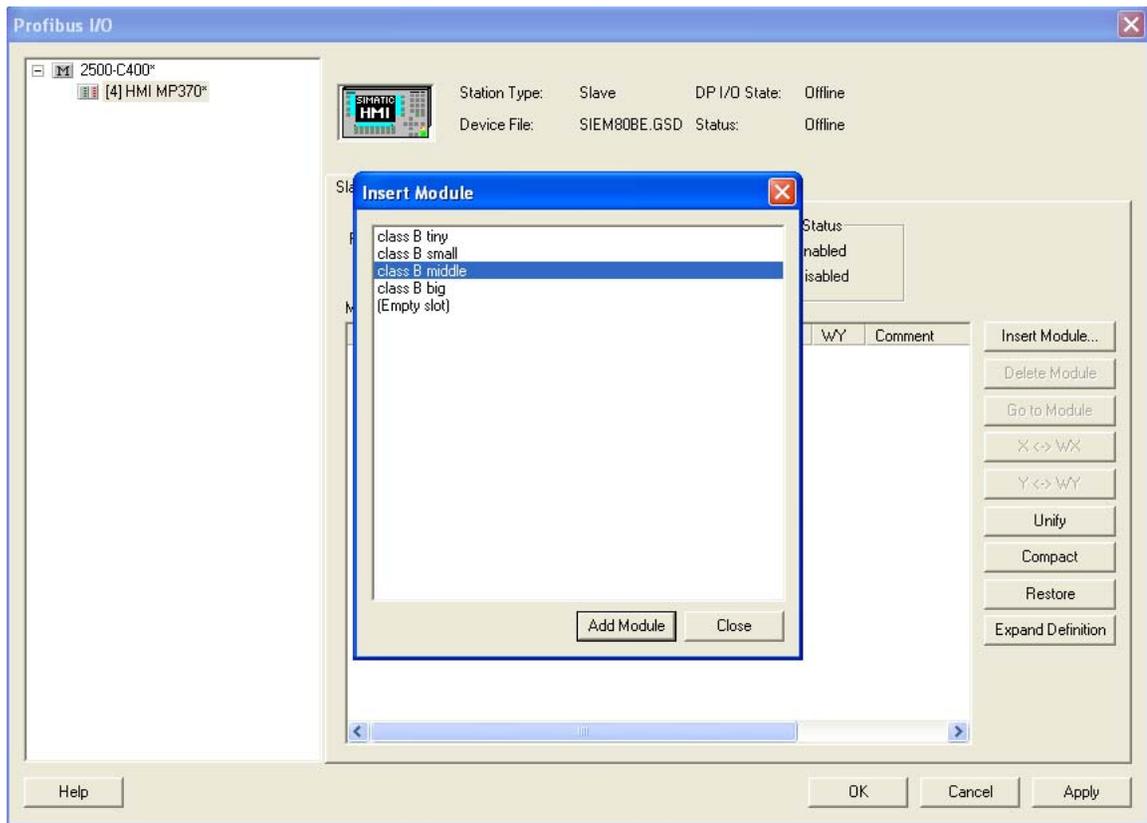


4.2. Mapping Profibus-DP I/O for SIMATIC® 500/505-DP Driver

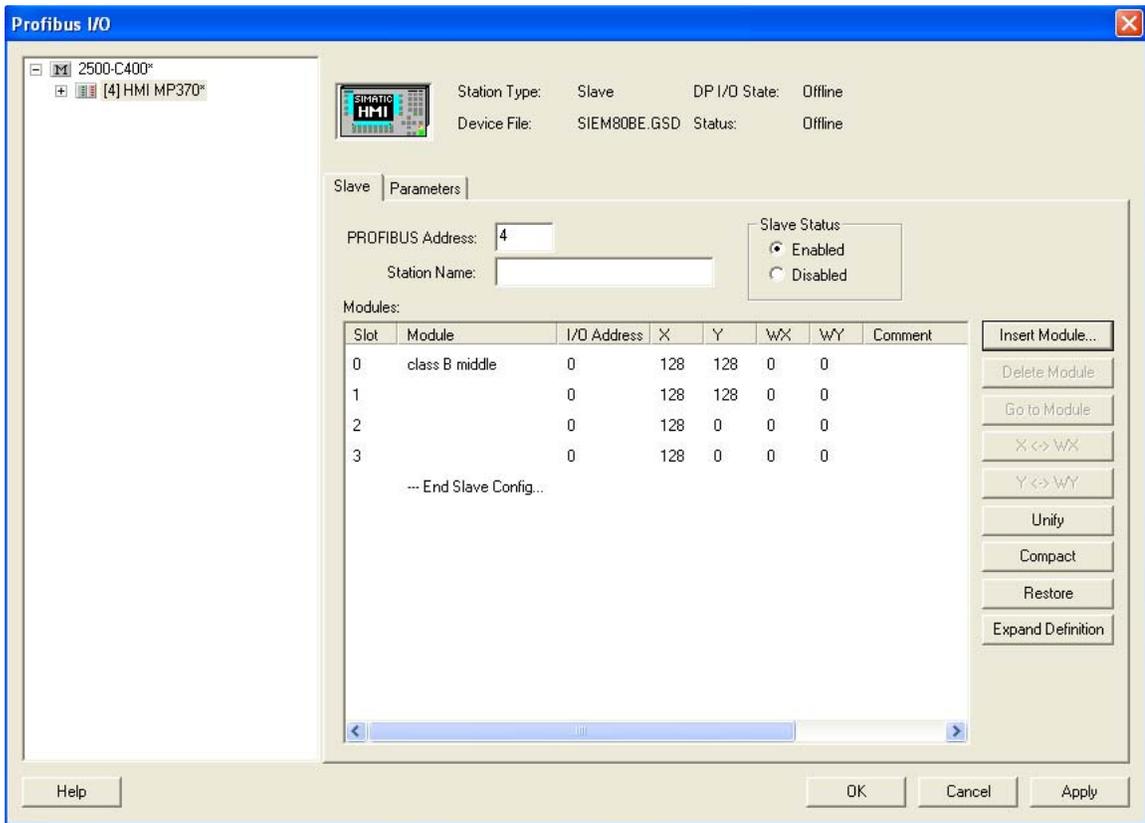
1. If using the SIMATIC® 500/505-DP driver, select one of the following I/O buffers:

Tiny = 32-Bytes In / 22-Bytes Out (16WX/11WY)
Small = 42-Bytes In / 22-Bytes Out (21WX/11WY)
Middle = 64-Bytes In / 32-Bytes Out (32WX/16WY)
Big = 122-Bytes In / 64-Bytes Out (61WX/32WY)

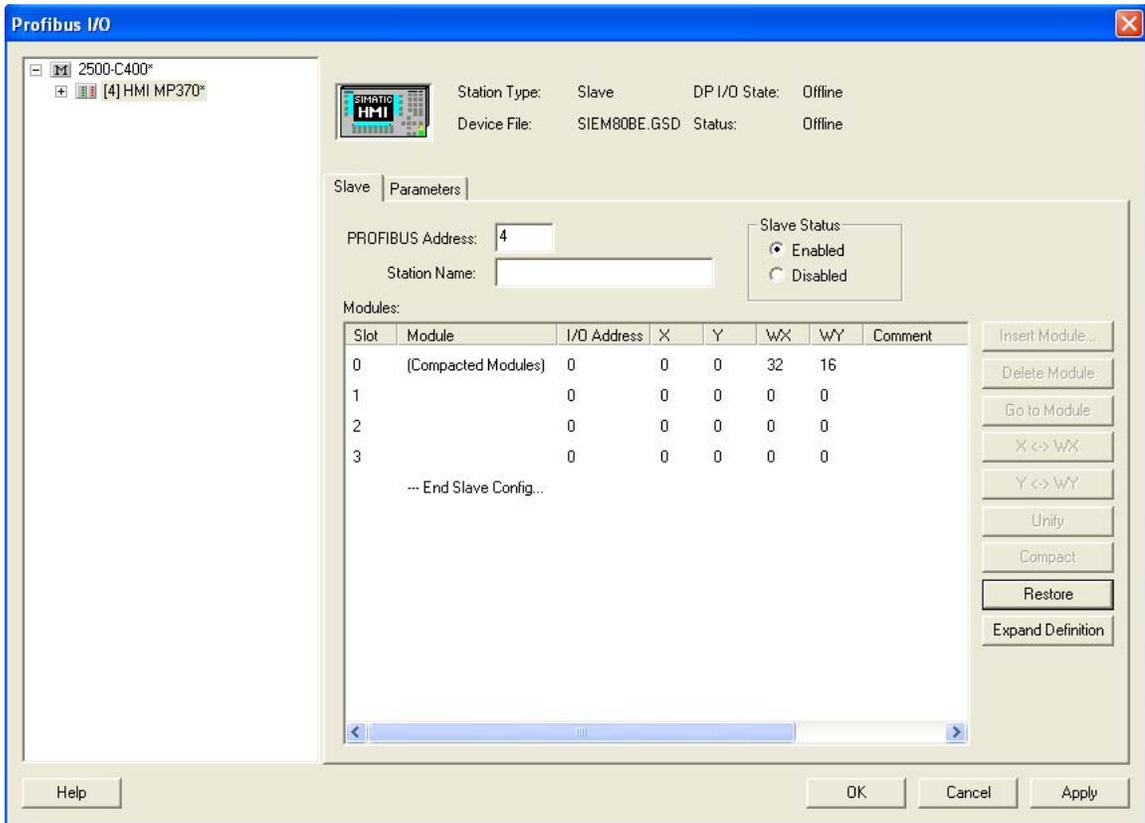
TIP: The 'Small' or 'Middle' I/O buffer size provides the optimal interface for most applications. The 'Middle' I/O buffer size should be used when accessing a large group of words for 'Alarm Messaging' or 'Event Messaging'.



- The selected Profibus-DP configuration for the HMI is presented as a “bit-based” (X/Y) interface. The following screen shows the “class B middle” I/O interface for the **SIMATIC® 500/505-DP** driver:



- Alter the I/O configuration to its corresponding “Word-based” interface by pressing the [Compact] button. The result is shown below.



- Click on “I/O Address” field for Slot 0 and enter Start Address for the Profibus-DP I/O interface buffer. The HMI drivers require that the Input Buffer must be specified first, and the Output Buffer immediately follow it.

Therefore, the “I/O Address” entered in this Dialog Box must specify the Input Buffer Starting Address. Any valid WX/WY address can be entered. Press [Accept] in the ‘Edit Slave’ window to save the Profibus-DP configuration.

Press [Apply] to accept settings when entry is complete.

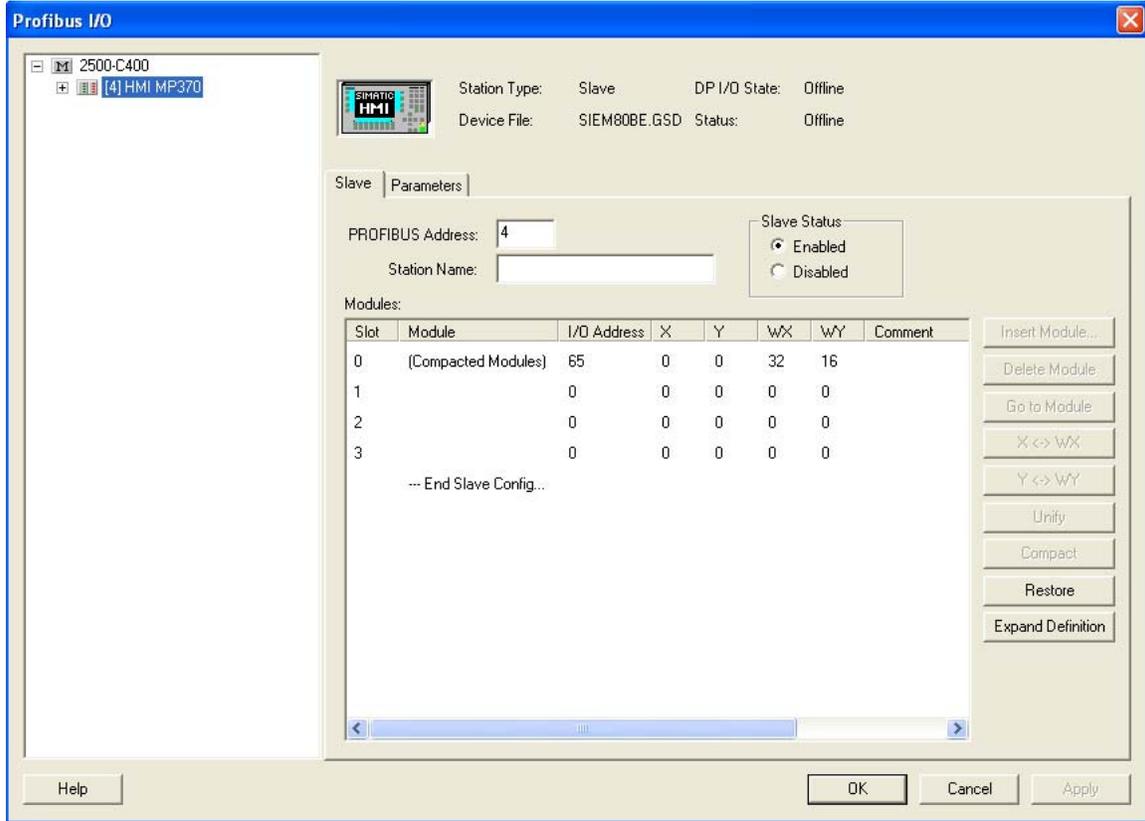
5. The example below specifies an HMI interface with following specs:

Protocol = **SIMATIC® 500/505-DP**

I/O Buffer Size = 'Middle' (In: 64 Bytes/ Out: 32 Bytes)

Input Buffer Start Address = WX65

Output Buffer Start Address = WY97

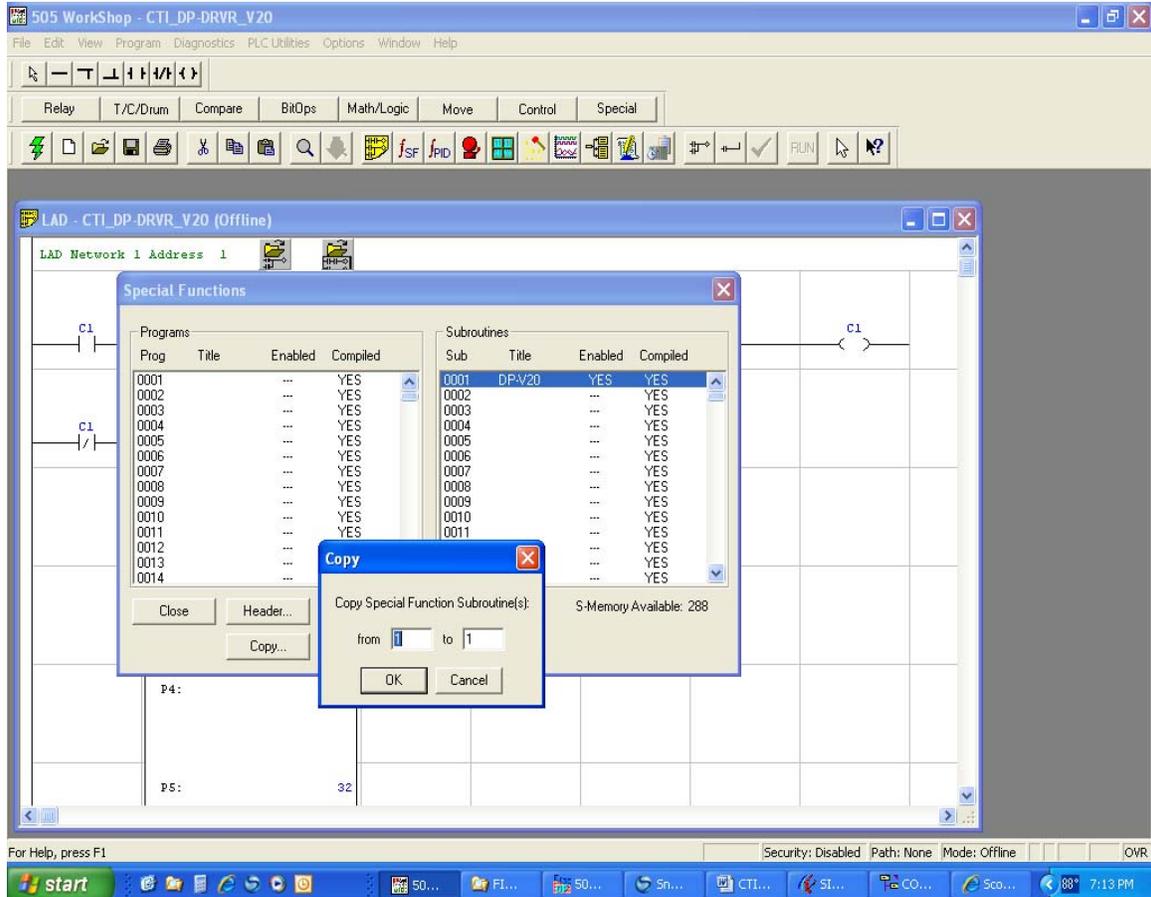


5. DP-SFSUB Driver Installation using 505 WorkShop®

The attached WorkShop® program contains the DP-SFSUB Driver and example RLL network.

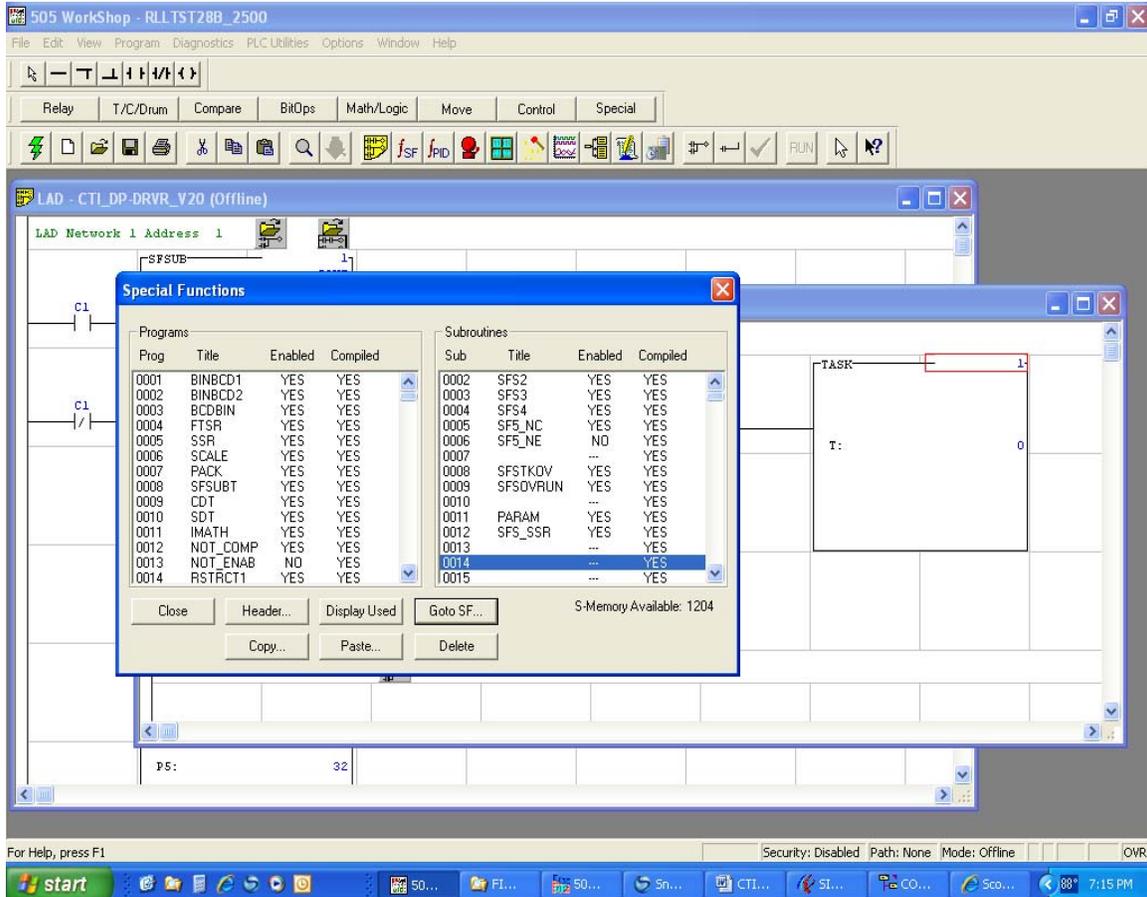
Install CTI DP-SFSUB Driver as described below:

1. Start WorkShop®. Open both CTI_DP-DRVR program and your PLC application program “Offline”.
2. Select the CTI program, view Special Functions (via **fSF**), and select SFSUB #1. Press [Copy] button as shown below. Then press [OK].

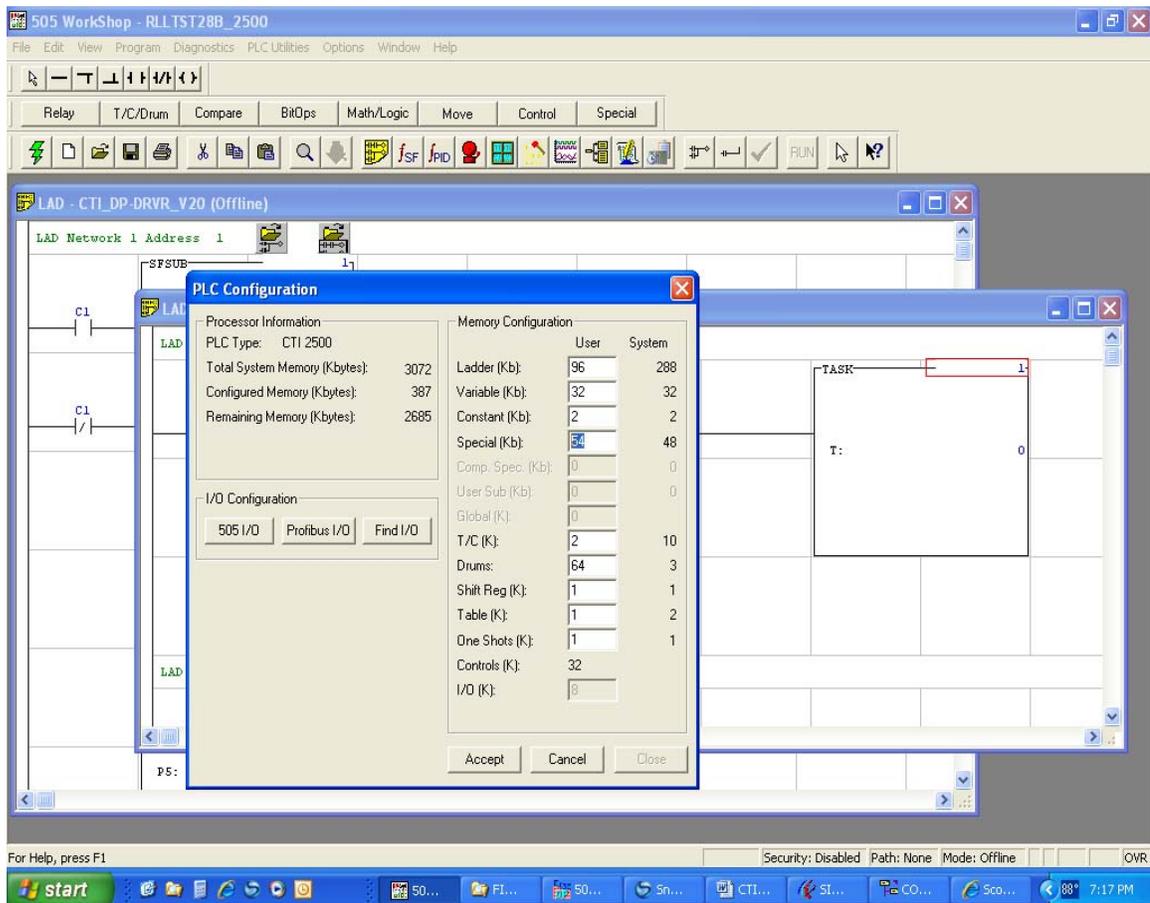


3. Select your PLC application program. View [Special Functions] (same as above) and check 'S-Memory Available' value.

If less than 6100 bytes are available (my example shows 1204), you must increase the S-Memory configuration so that a minimum of 6K bytes are available. If more than 6100 bytes are free, you can skip to Step 5.

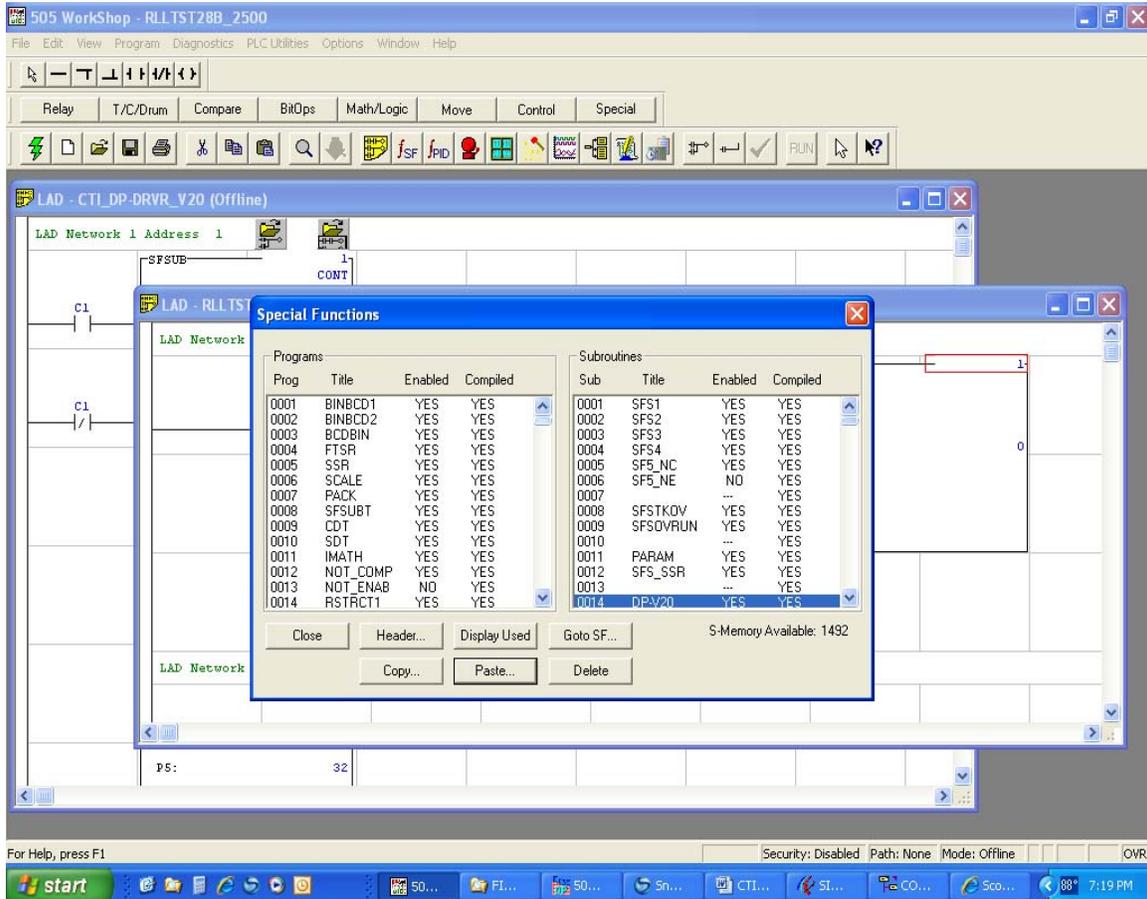


- Press [PLC Utilities] in the main menu. Then select [PLC Configuration] to view CPU Memory Configuration. Increase allocation of 'Special (KB)' memory by 6K bytes. Then press [Accept] to save new memory configuration.



In this example, the S-Memory allocation is increased from 48K to 54K bytes.

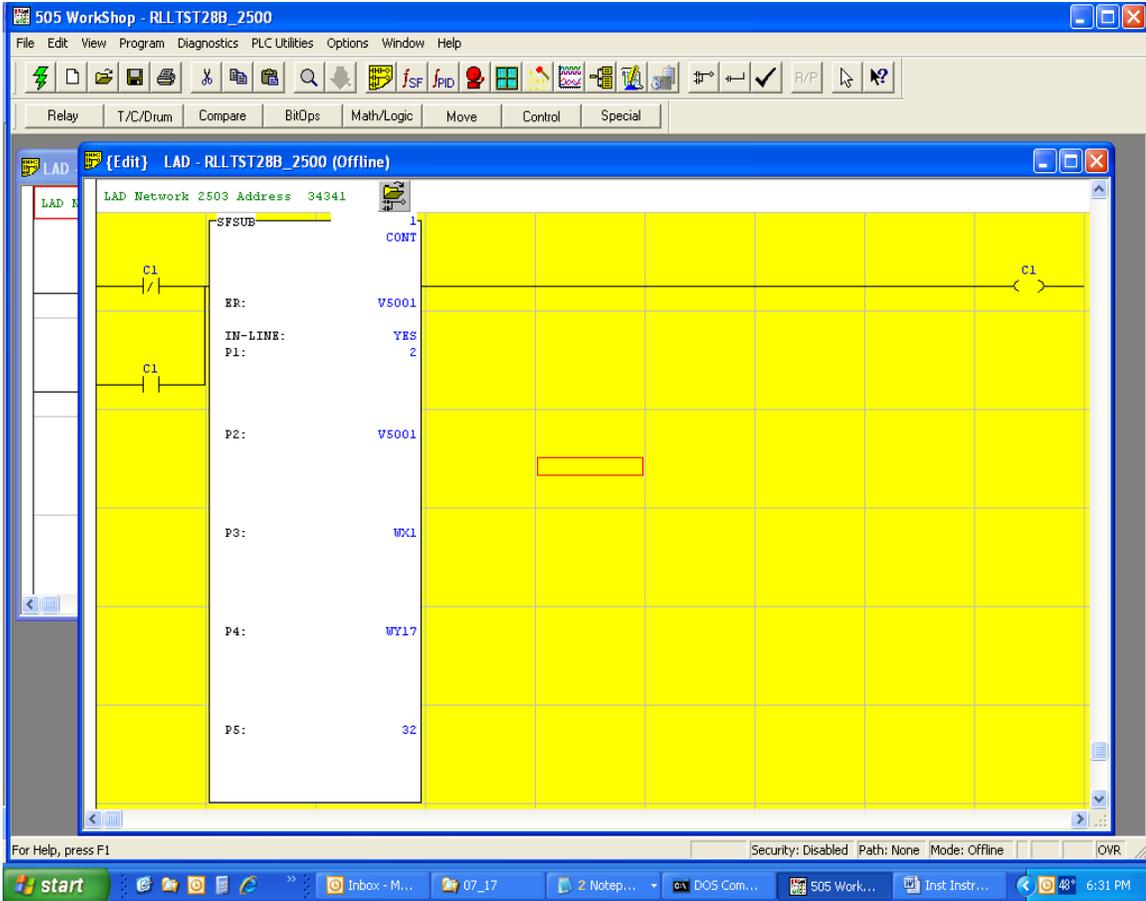
5. Once again, view ‘Special Functions’ and select any unused SFSUB number. In this example, SFSUB# 14 is selected. Press the [Paste] button to insert CTI DP-SFSUB into your program. The name “DP-V2x” will be displayed in the selected SFSUB slot as shown below.



6. If your application program currently includes RLL networks with XSUB instructions:
 - a. Find each instance of XSUB2 instruction and note the following parameters:
 - IO1 – PLC Workspace Area (308-word memory block)
 - IO12 – Start Address for HMI Profibus-DP Input (WX) Buffer
 - IO13 – Start Address for HMI Profibus-DP Output (WY) Buffer
 - b. Find each instance of XSUB4 instruction and note the following parameters:
 - IO1 – PLC Workspace Area (approx 288-word memory block)
 - IO2 – Start Address for HMI Profibus-DP Input (WX) Buffer

The XSUB boxes are not valid instructions in the CTI 2500 Series® PLC. These networks must be deleted before the PLC application program will compile.

- Copy the RLL network containing the SFSUB instruction box from CTI DP-DRVR program and paste it into your PLC application program as shown below. The position where the network is placed within your existing program does not affect the SFSUB execution or the HMI response times.



8. Modify the parameter values in the SFSUB instruction box for your specific application as noted below:

- SFSUB #:** Enter the SFSUB Program number as selected in Step 5. (In my example, Program # “14” is entered here).
- CONT:** This field selects “Continue on Error”.
This selection should always be set to “CONT”.
- IN-LINE:** This field designates the SFSUB for immediate execution within RLL scan when input is ON. This should always be set = “YES”.
- ER:** This field selects the 3-Word Special Function Error Code (SFEC). The SFEC must be set as the first 3 words of the PLC Workspace Area. Therefore, the starting address of the PLC Workspace Area must be entered here. See description of Parameter ‘P2’ below.
- P1:** This field designates the operation of the DP-SFSUB Driver.
For communications via SIMATIC® 505 L2DP protocol (emulation of XSUB2-3 operation), set values as follows:
PLC Profibus-DP Port = 2
FIM Interface = 12
For communications via SIMATIC® 500/505-DP protocol (emulation of XSUB4-5 operation), set values as follows:
PLC Profibus-DP Port = 4
FIM Interface = 14
- P2:** Starting location for PLC Workspace Area – a consecutive memory block dedicated to the CTI DP-V20 SFSUB for communication with a single HMI device. This memory area must not be overwritten by other sections of the PLC program. This address must be identical to the ‘ER’ (SFEC) field. This parameter corresponds to ‘IO1’ parameter in XSUB2/XSUB4 instructions
When using the SIMATIC® 505 L2DP protocol, the PLC Workspace occupies a contiguous 300-word memory area.
When using the SIMATIC® 500/505-DP protocol, the PLC Workspace occupies a contiguous 40-word memory area.
- P3:** Starting Address for Input (WX) Buffer.
This address must be identical to the ‘I/O Address’ entered for the HMI unit I/O Buffer interface -- Profibus-DP or Remote I/O address (if FIM used).
This parameter corresponds to ‘IO12’ parameter entered in XSUB2 instruction box or ‘IO2’ parameter in XSUB4 instruction box.

P4: Starting Address for Output (WY) Buffer. The HMI Output Buffer must immediately follow the Input Buffer (P3), and the Output Buffer Start Address depends on the buffer size selected.

When using the SIMATIC® 505 L2DP protocol, the Output Buffer Start Address is calculated as follows:

$$16WX/16WY: \quad P4 = P3 + 16$$

$$32WX/32WY: \quad P4 = P3 + 32$$

$$60WX/60WY: \quad P4 = P3 + 60$$

When using the SIMATIC® 500/505-DP protocol, the Output Buffer Start Address is calculated as follows:

$$\text{Tiny (16WX/11WY):} \quad P4 = P3 + 16$$

$$\text{Small (21WX/11WY):} \quad P4 = P3 + 21$$

$$\text{Middle (32WX/16WY):} \quad P4 = P3 + 32$$

$$\text{Big (61WX/21WY):} \quad P4 = P3 + 61$$

P5: I/O Communication Buffer Size (number of bytes).

This must correspond to the **Number of Bytes** configured for Profibus-DP Input Buffer for the corresponding HMI device. This value must equal the I/O configuration set in COM-PROFIBUS®: (or Slave I/O Configuration set in FIM Profibus-DP Configurator).

When using the SIMATIC® 505 L2DP protocol, this parameter must equal one of the following values:

$$16WX/16WY: \quad P5 = 32$$

$$32WX/32WY: \quad P5 = 64$$

$$60WX/60WY: \quad P5 = 120$$

When using the SIMATIC® 500/505-DP protocol, this parameter must equal one of the following values:

$$\text{Tiny (16WX/11WY):} \quad P5 = 32$$

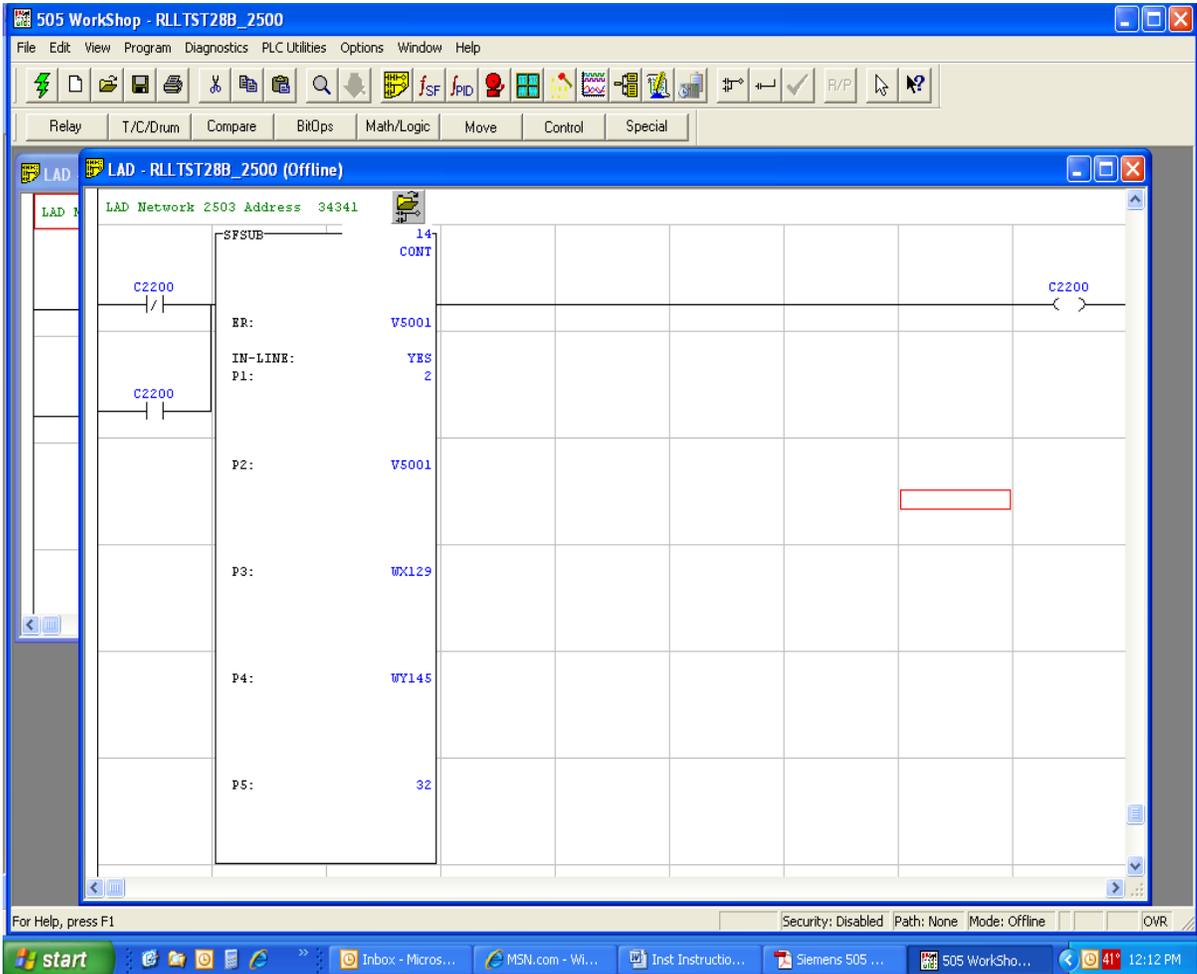
$$\text{Small (21WX/11WY):} \quad P5 = 42$$

$$\text{Middle (32WX/16WY):} \quad P5 = 64$$

$$\text{Big (61WX/21WY):} \quad P5 = 122$$

9. Edit the reference to the contacts and coil in the RLL network containing the SFSUB instruction to associate a Control Relay (C1-C32768) that is currently unused in your PLC application. Press [√] to accept changes to RLL network.

The following screen shows the edited RLL network using the example parameters:



The installation of the CTI DP-SFSUB Driver is complete.

6. DP-SFSUB Driver Installation using TISOFT

This chapter describes the steps to insert (or merge) the CTI DP-SFSUB Driver into an existing TISOFT™ program, along with minor RLL changes that are required to execute the SFSUB program.

The CTI DP-SFSUB Driver is provided in both TISOFT Release 6.x and TISOFT Release 7.x formats. The process of merging the CTI DP-SFSUB Driver into your application is identical for both versions. The RLL additions are slightly different and detailed in the corresponding section.

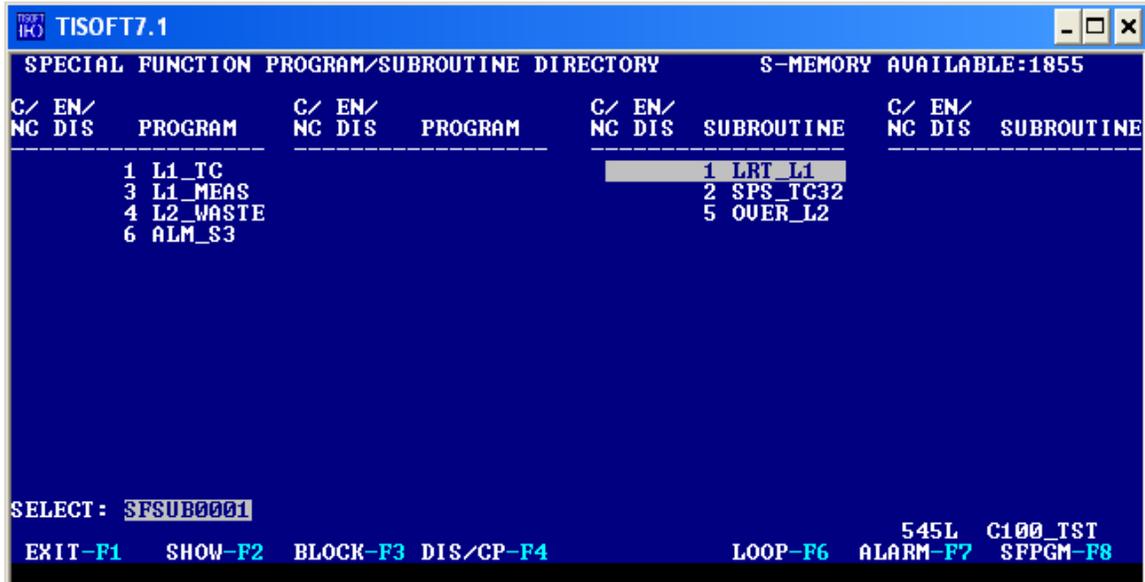
6.1. Merging CTI DP-SFSUB into an Existing Program

The following steps can be used to install the CTI DP-SFSUB Driver into an existing program.

1. Open your PLC Application in “Offline” in TISOFT™.
View ‘Special Functions’ by pressing <Space> / [SFPGM-F8].

Note the ‘S-Memory Available’ value displayed in the upper right corner..

If less than 6100 bytes are available (my example shows 1855), you must increase the S-Memory configuration so that a minimum of 6K bytes are available. If more than 6100 bytes are free, you can skip to Step 3.



- View 'CPU Memory Configuration' by pressing [EXIT-F1] / [CONFME-F2]. Increase allocation of 'Special (S)' memory by 4KBytes. Any 'User Sub (U)' memory previously configured should be discarded and value set to zero.

In the example below, 'Special (S)' memory is increased from 8K Bytes to 14K Bytes and 'User Sub (U)' memory is decreased from 10K to 0K Bytes.

Before:

PLC TYPE: 545L		MEMORY CONFIGURATION	
		USER MEMORY	SYSTEM MEMORY
LADDER <L>	.....	16 KBYTES	48 KBYTES
VARIABLE <U>	.....	4 KBYTES	4 KBYTES
CONSTANT <K>	.....	0 KBYTES	0 KBYTES
SPECIAL <S>	.....	8 KBYTES	8 KBYTES
USER SUB <U>	.....	10 KBYTES	10 KBYTES
TMR/CTR	.....	10	50 BYTES
DRUMS	.....	2	96 BYTES
SHIFT REG	.....	10	10 BYTES
TABLE MOVE	.....	10	20 BYTES
ONE SHOTS	.....	10	10 BYTES
CONTROL RELAYS	...	4 K	
I/O <X,Y,WX,WY>	..	1 K	
TOTAL SYSTEM MEMORY			96 KBYTES
CONFIGURED SYSTEM MEMORY			71 KBYTES
REMAINING SYSTEM MEMORY			25 KBYTES

FROM RAM

EXIT-F1 READRM-F2 WRITRM-F3 545-F4 545L-F5 575-F6 545L C100_TST 555-F7 REQAPP-F8 +

After:

PLC TYPE: 545L		MEMORY CONFIGURATION	
		USER MEMORY	SYSTEM MEMORY
LADDER <L>	.....	16 KBYTES	48 KBYTES
VARIABLE <U>	.....	4 KBYTES	4 KBYTES
CONSTANT <K>	.....	0 KBYTES	0 KBYTES
SPECIAL <S>	.....	14 KBYTES	14 KBYTES
USER SUB <U>	.....	0 KBYTES	0 KBYTES
TMR/CTR	.....	10	50 BYTES
DRUMS	.....	2	96 BYTES
SHIFT REG	.....	10	10 BYTES
TABLE MOVE	.....	10	20 BYTES
ONE SHOTS	.....	10	10 BYTES
CONTROL RELAYS	...	4 K	
I/O <X,Y,WX,WY>	..	1 K	
TOTAL SYSTEM MEMORY			96 KBYTES
CONFIGURED SYSTEM MEMORY			67 KBYTES
REMAINING SYSTEM MEMORY			29 KBYTES

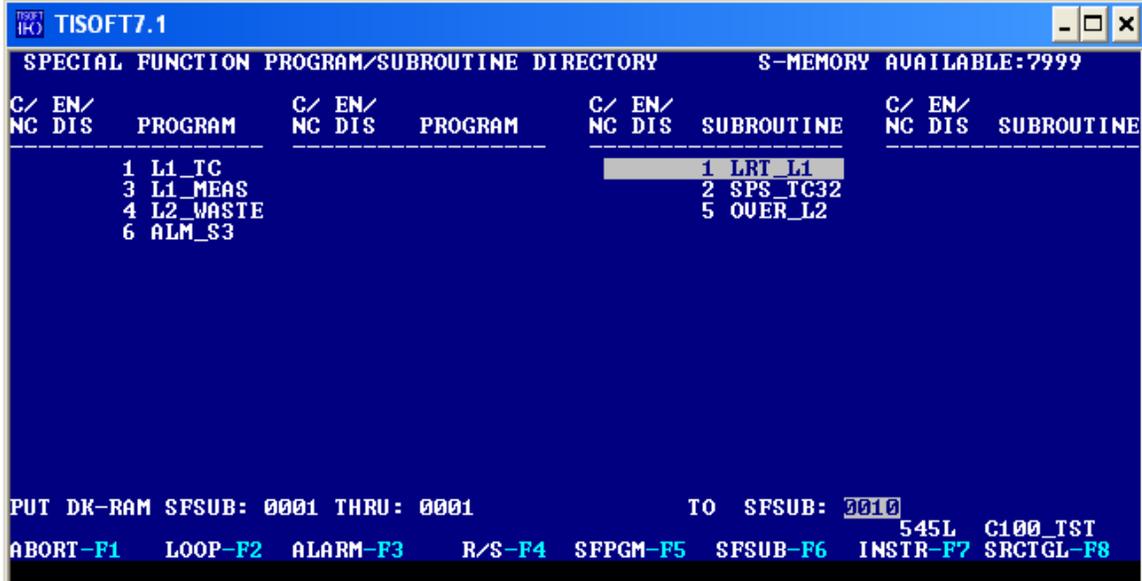
FROM RAM

EXIT-F1 READRM-F2 WRITRM-F3 545-F4 545L-F5 575-F6 545L C100_TST 555-F7 REQAPP-F8 +

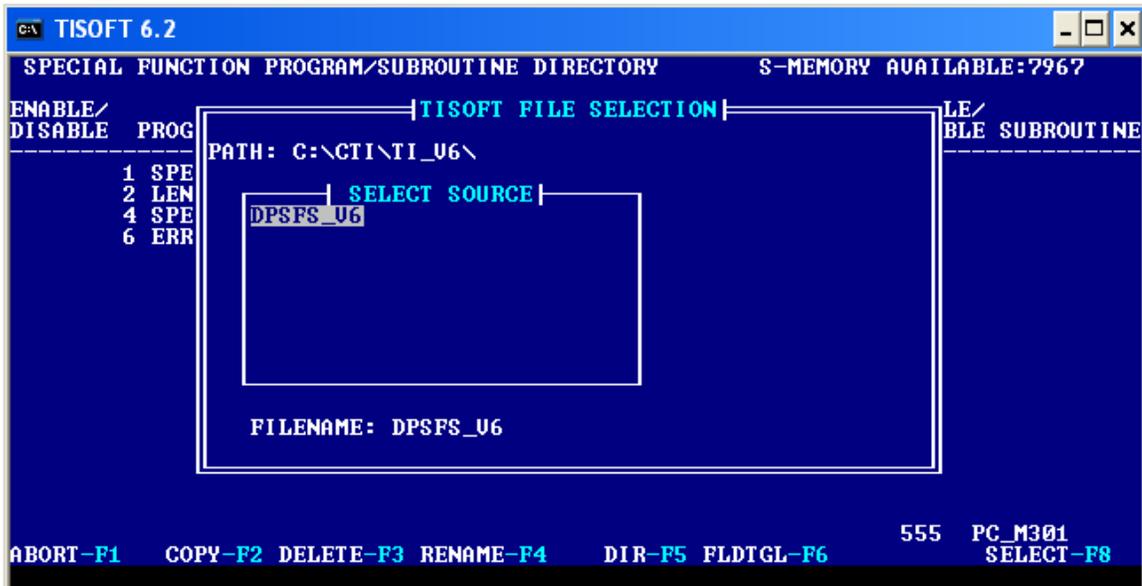
Press [WRITRM-F3] to save new memory configuration.

Return to 'Special Functions' screen by pressing [EXIT-F1] / [SFPGM-F8].

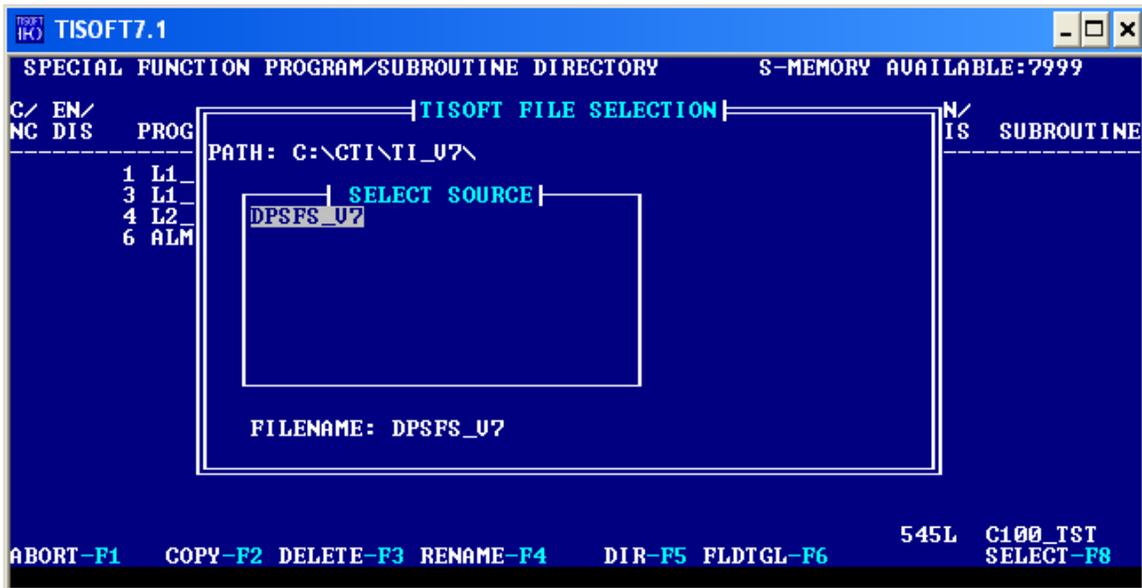
3. Merge CTI DP-SFSUB Driver into your PLC application as shown below:
 - a. Press [SFSUB-F8] to highlight SF Subroutines.
 - b. Press [BLOCK-F3] / [PUT-P5} to display prompt to merge an external SFSUB into another PLC program. The external SFSUB Program to be inserted is named SFSUB# 1 in the CTI DP_DRVR program. You must enter an unused program number (1-1023) in the 'TO SFSUB:' field where the CTI Driver will be installed. The example below inserts the CTI DP-SFSUB Driver into SFSUB# 10.



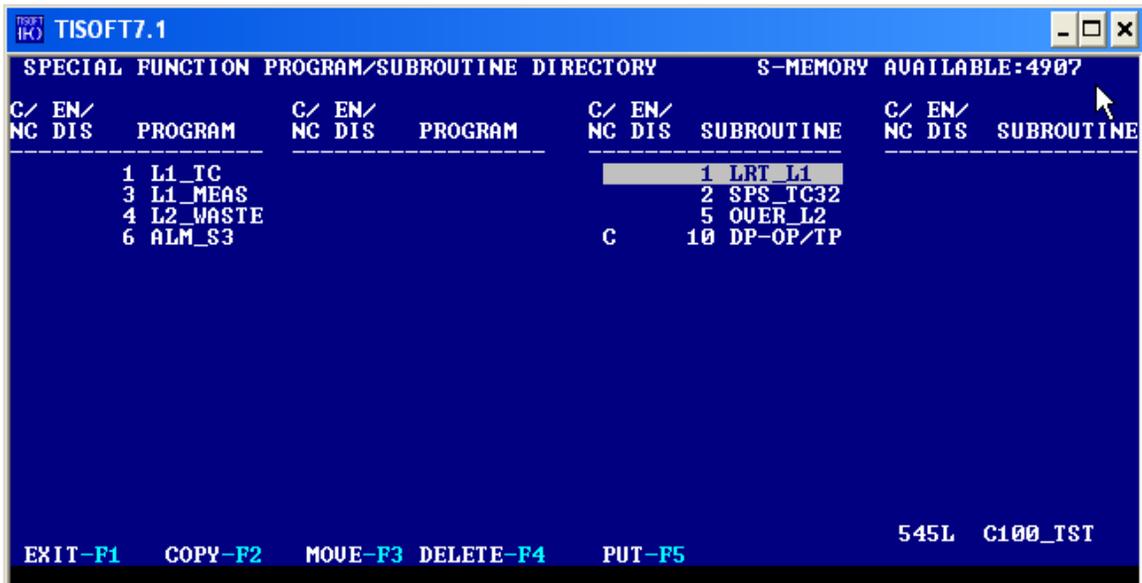
- c. Press [Enter] and use the 'TISOFT FILE SELECTION' screen to locate the CTI DP-SFSUB Driver that matches the TISOFT Release version being used. If you are using TISOFT Version 6, select program 'DPSFS_V6'.



If you are using TISOFT Version 7, select program 'DPSFS_V7'.



- d. For all versions, press [SELECT-F8] and the CTI DP-SFSUB Driver is merged into your PLC application program at the SFSUB# specified.



6.2. RLL Requirements for Executing CTI DP-SFSUB Driver

The fastest response time to the attached HMI devices is achieved when the CTI SFSUB is executed 'In-Line' during each PLC scan. This feature is available only in later SIMATIC® 555 CPU models that supported the PowerMath™ feature.

All CTI 2500 Series™ CPU's contain a hardware floating point unit (FPU) to emulate PowerMath™ functions. However, TISOFT™ does not recognize this feature in the Model 2500-C200 CPU since it emulates the SIMATIC® 545 controller. Therefore, only Models 2500-C300 and 2500-C400 can be programmed in TISOFT™ to execute all PowerMath™ functions.

TISOFT™ Release 6.3 or Release 7.x is the preferred PLC Programming tool to use for this installation. These versions support the PowerMath™ feature in SIMATIC® 555 (and Models 2500-C300 and 2500-C400) controllers.

Earlier versions of TISOFT™ Release 6 (prior to Rel. 6.3) can be used, but these versions do not support PowerMath™ feature (and 'In-Line' SFSUB execution) for any CPU model. Therefore, driver performance is impacted and HMI response time is slower.

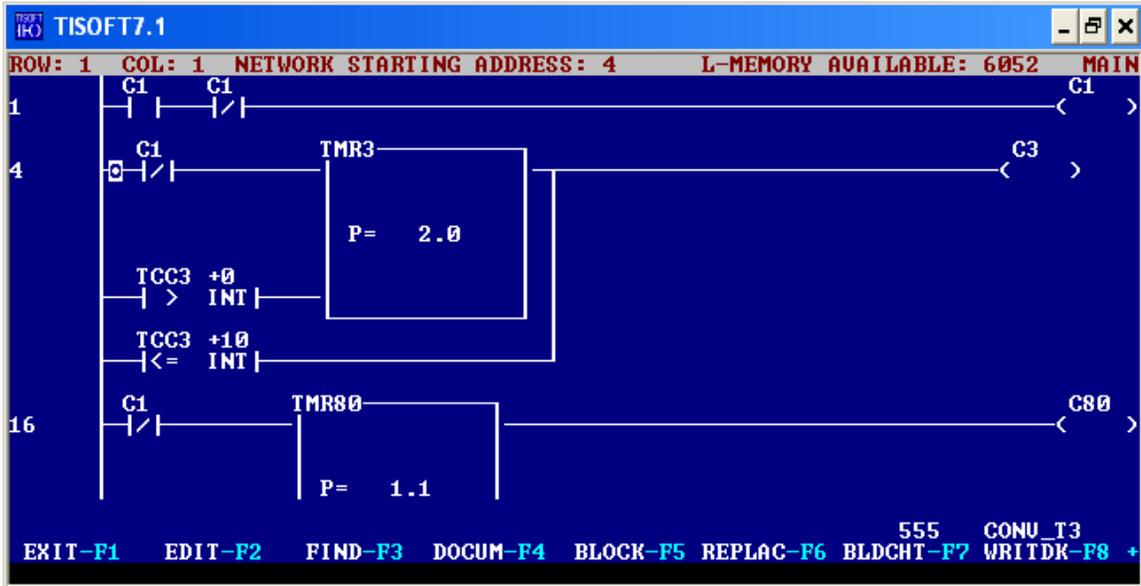
The CTI DP-SFSUB Driver is called from RLL via the SFSUB Box instruction. A network template is provided as part of the installation software. The appropriate network template (based on TISOFT Release version and 2500 Series model) can be imported into your PLC application as shown below:

1. Return to RLL Main Menu.
2. If your application program currently includes RLL networks with XSUB instructions:
 - a. Use [FIND-F3] to locate each instance of XSUB2 instruction and note the following parameters:
 - IO1 – PLC Workspace Area (308-word memory block)
 - IO12 – Start Address for HMI Profibus-DP Input (WX) Buffer
 - IO13 – Start Address for HMI Profibus-DP Output (WY) Buffer
 - b. Find each instance of XSUB4 instruction and note the following parameters:
 - IO1 – PLC Workspace Area (approx 288-word memory block)
 - IO2 – Start Address for HMI Profibus-DP Input (WX) Buffer

The XSUB boxes are not valid instructions in the CTI 2500 Series™ PLC. These networks must be deleted before the PLC application program will compile.

3. Determine the position in your RLL program where the new network(s) calling the CTI DP-SFSUB should be placed. It is entirely the user's decision and the position will not affect SFSUB execution or HMI response time. Place cursor at RLL position to insert new network.

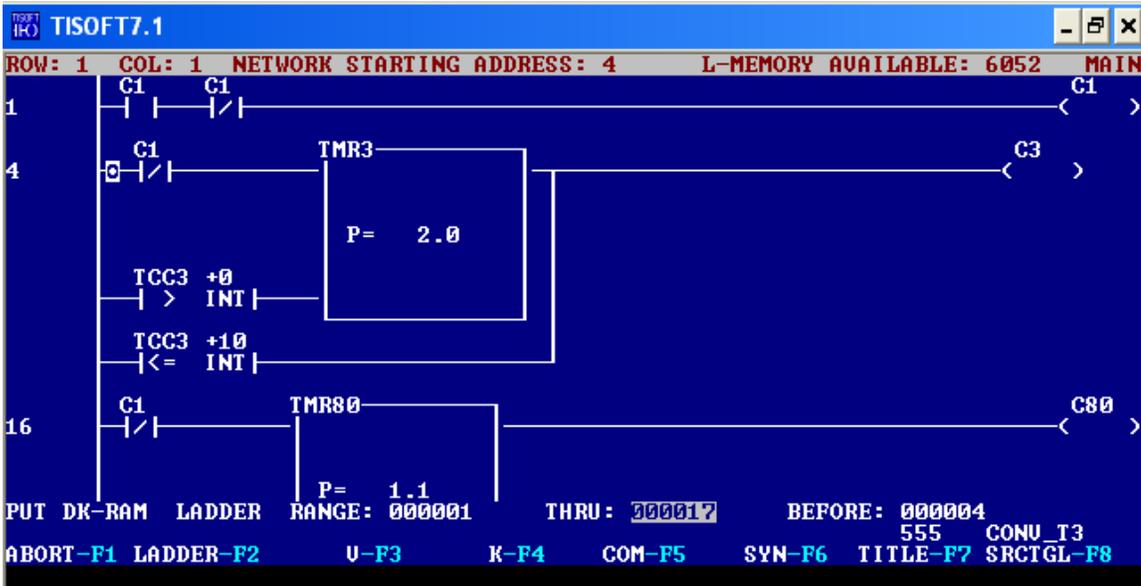
4. Press [BLOCK-F5] / [PUT-P5} to display prompt to merge RLL networks from an external TISOFT program.



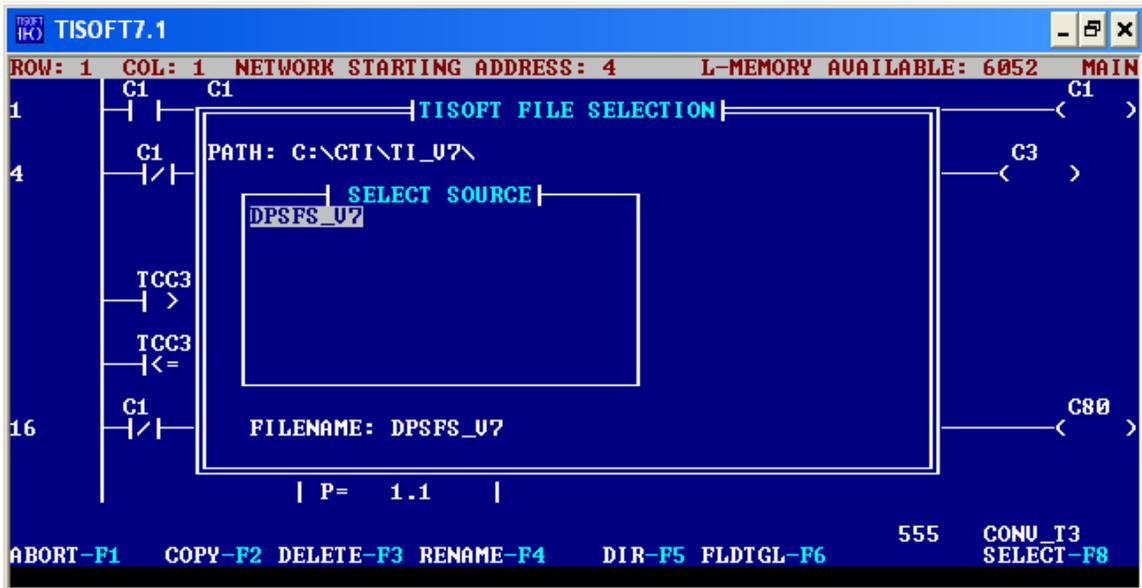
5. The LADDER Address Range depends on your version of TISOFT™ and 2500 Series™ CPU Model as described at the beginning of this section.

If using TISOFT™ Release 7.0 or 7.1 with CPU Model 2500-C300 or Model 2500-C400

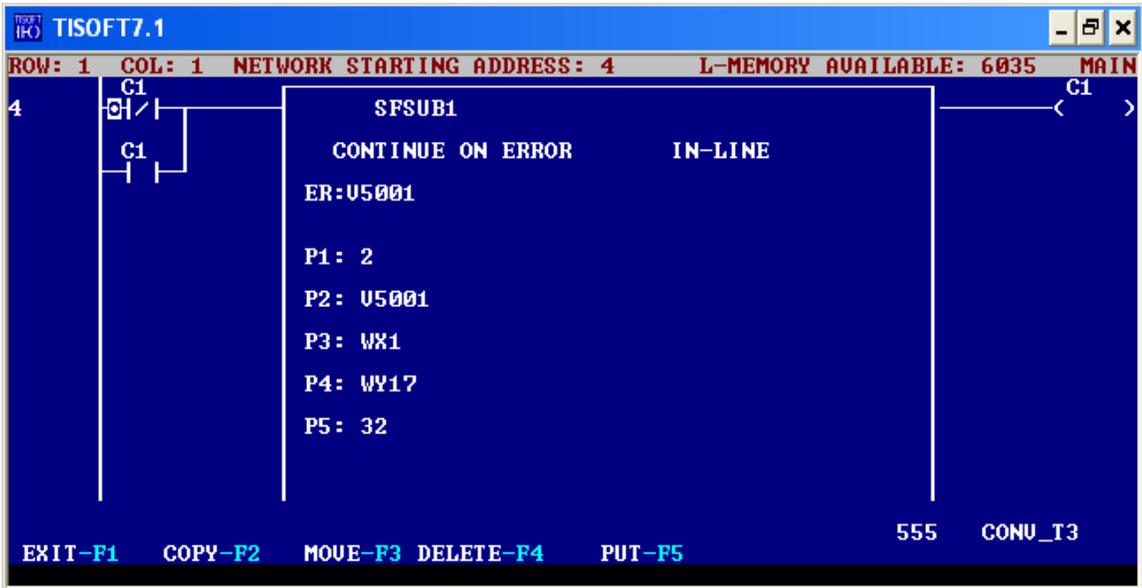
- a. Enter LADDER Address Range '000001' thru '00017' as shown below. The 'BEFORE' Address determines the RLL Network Address in your PLC application program.



- b. Press [Enter], and use the 'TISOFT™ FILE SELECTION' screen to locate the CTI Driver install program 'DPSFS_V7' (as shown below).

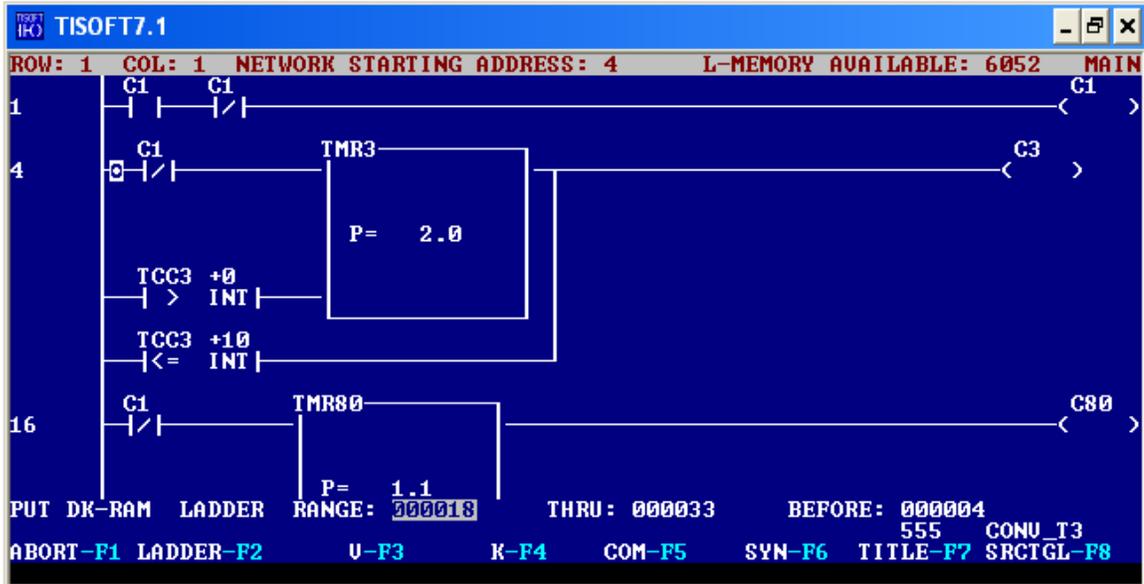


- c. Press [SELECT-F8] and the RLL Network containing the SFSUB Box instruction with 'In-Line' execution attribute is merged into your PLC application program. The customization of this network for your PLC program is described in Step 6..

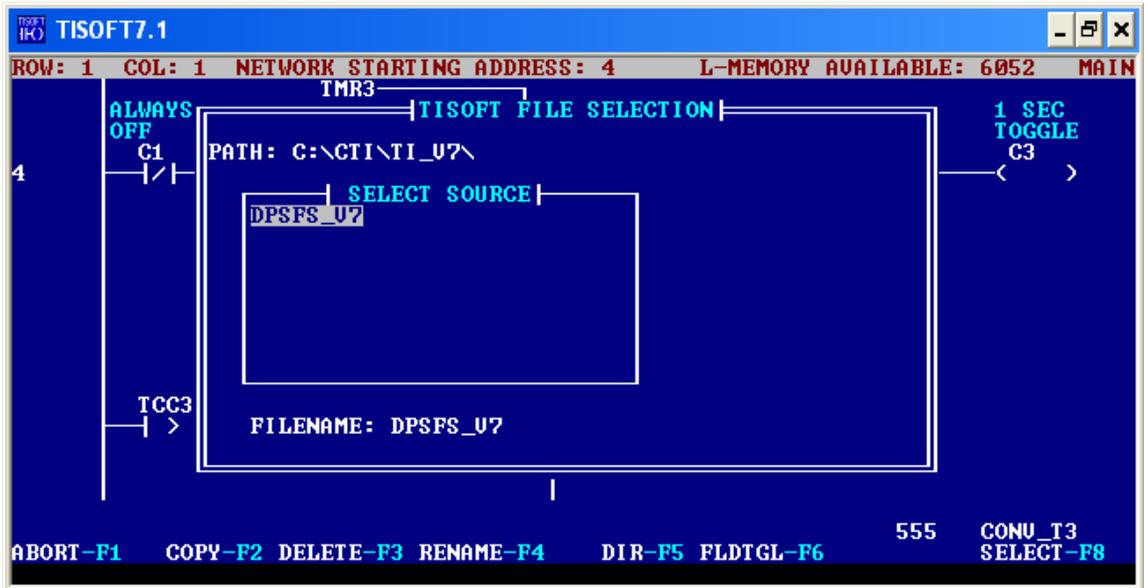


If using TISOFT™ Release 7.0 or 7.1 with CPU Model 2500-C200

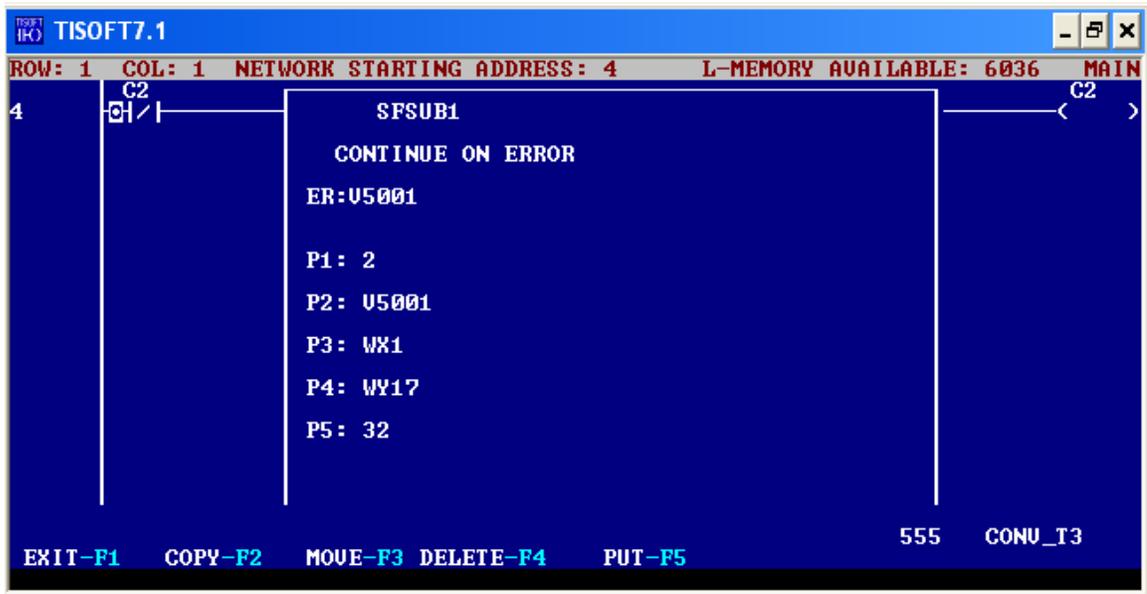
- a. Enter LADDER Address Range '000018' thru '00033' as shown below. The 'BEFORE' Address determines the RLL Network Address in your PLC application program.



- b. Press [Enter], and use the 'TISOFT™ FILE SELECTION' screen to locate the CTI Driver install program 'DPSFS_V7' (as shown below).



- c. Press [SELECT-F8] and the RLL Network containing the SFSUB Box instruction (without 'In-Line' execution attribute) is merged into your PLC application program. Skip to Step 6.



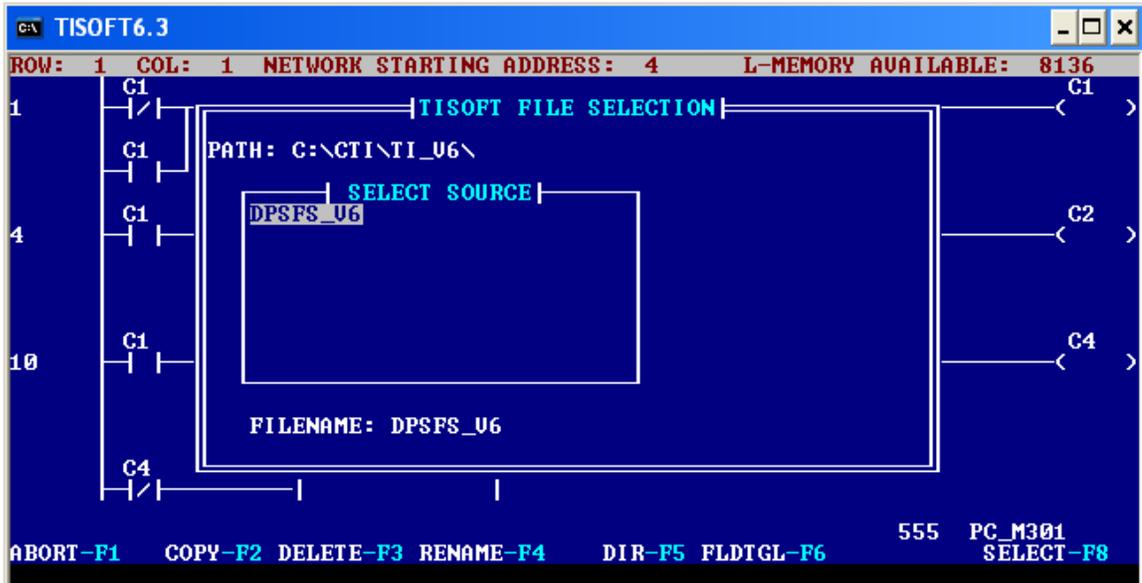
- d. See notes in Chapter 8 regarding setting 'SFUB Time Slice' to ensure optimum performance.

If using TISOFT™ Release 6.3 with CPU Model 2500-C300 or Model 2500-C400

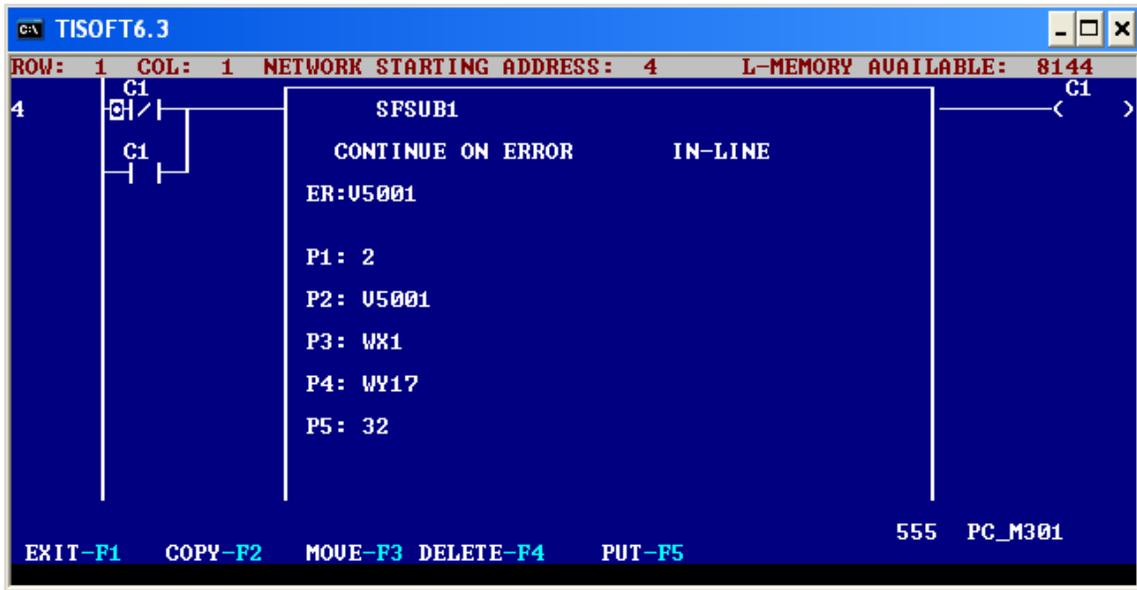
- a. Enter LADDER Address Range '000001' thru '00017' as shown below. The 'BEFORE' Address determines the RLL Network Address in your PLC application program.



- b. Press [Enter], and use the 'TISOFT™ FILE SELECTION' screen to locate the CTI Driver install program 'DPSFS_V6' (as shown below).

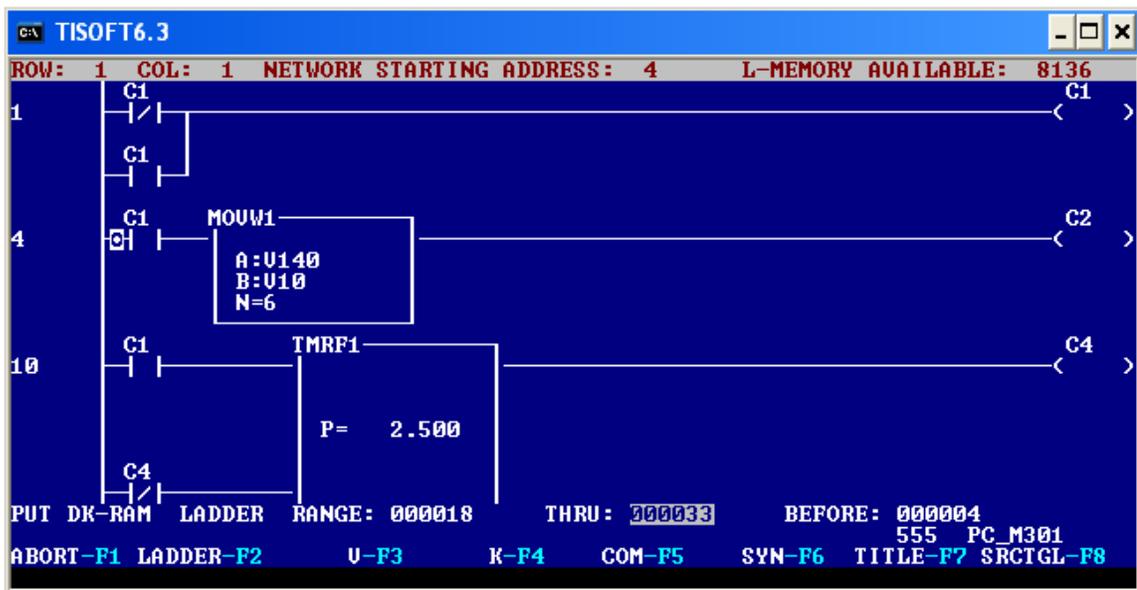


- c. Press [SELECT-F8] and the RLL Network containing the SFSUB Box instruction with 'In-Line' execution attribute is merged into your PLC application program. The customization of this network for your PLC program is described in Step 6..

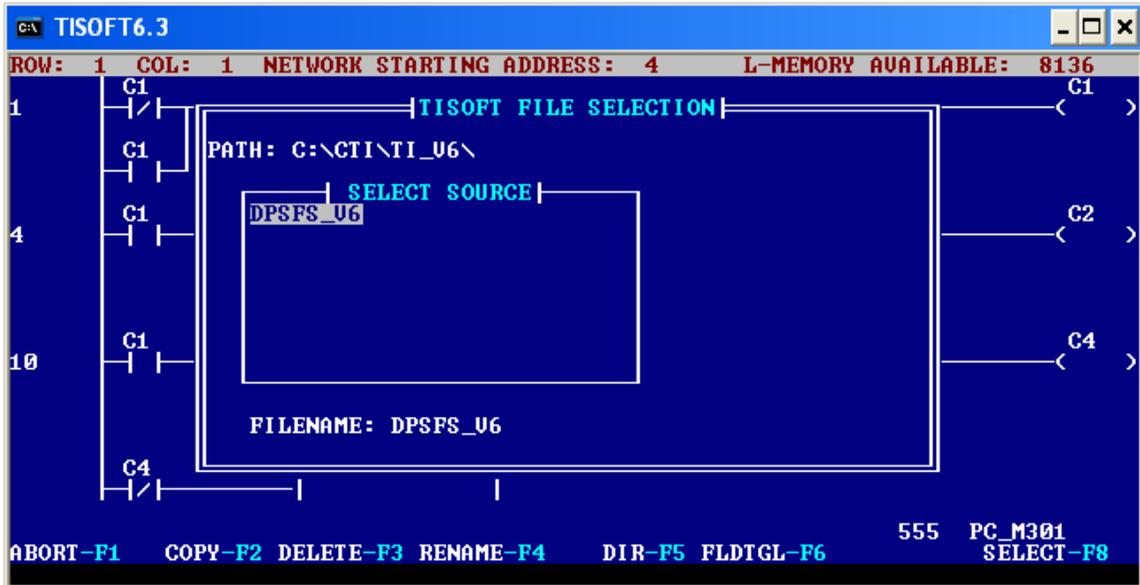


If using TISOFT™ Release 6.3 with CPU Model 2500-C200

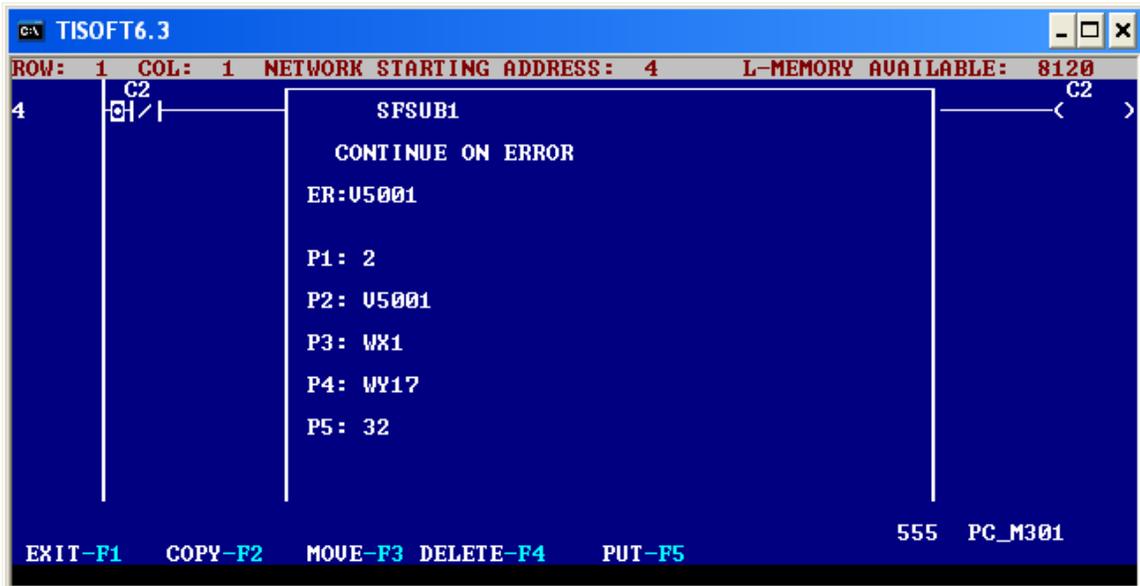
- a. Enter LADDER Address Range '000018' thru '00033' as shown below. The 'BEFORE' Address determines the RLL Network Address in your PLC application program.



- b. Press [Enter], and use the 'TISOFT™ FILE SELECTION' screen to locate the CTI Driver install program 'DPSFS_V6' (as shown below).



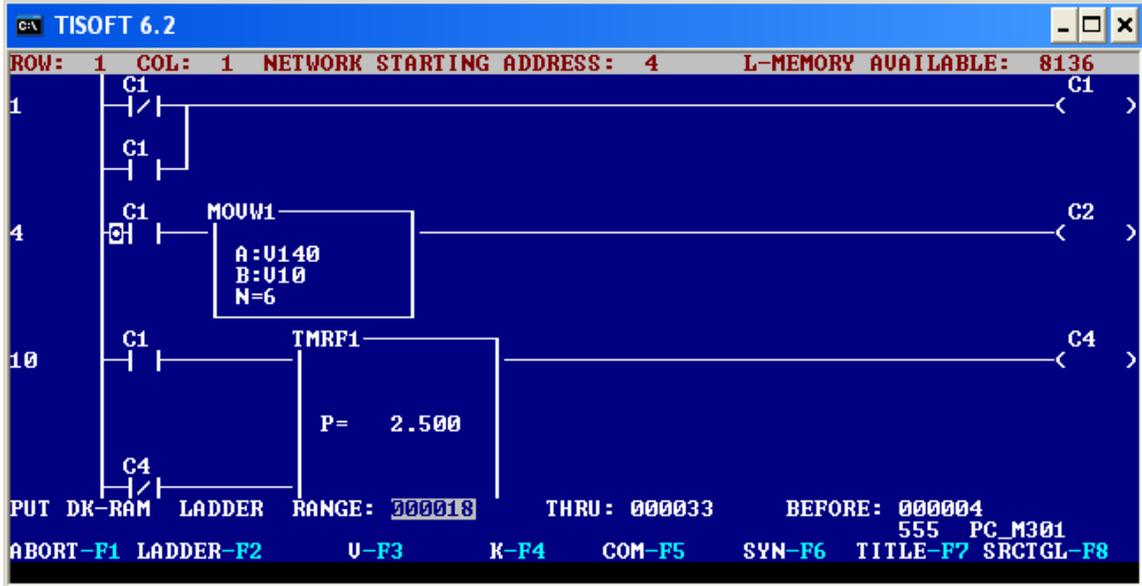
- c. Press [SELECT-F8] and the RLL Network containing the SFSUB Box instruction (without 'In-Line' execution attribute) is merged into your PLC application program. Skip to Step 6.



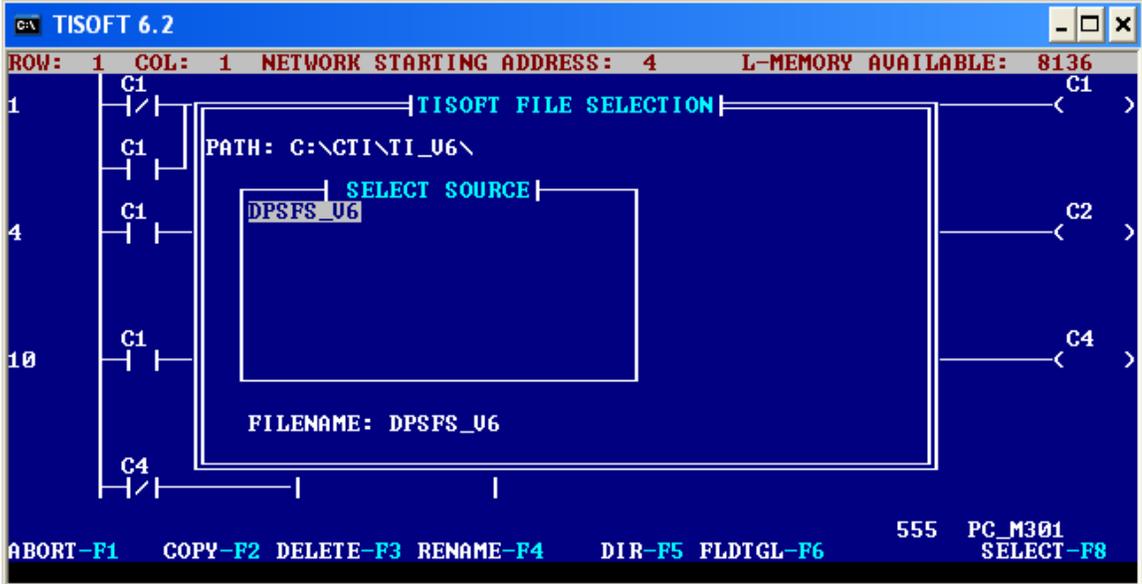
- d. See notes in Chapter 8 regarding setting 'SFSUB Time Slice' to ensure optimum performance.

If using TISOFT™ Release 6.2 (or earlier) with any 2500 Series CPU Model

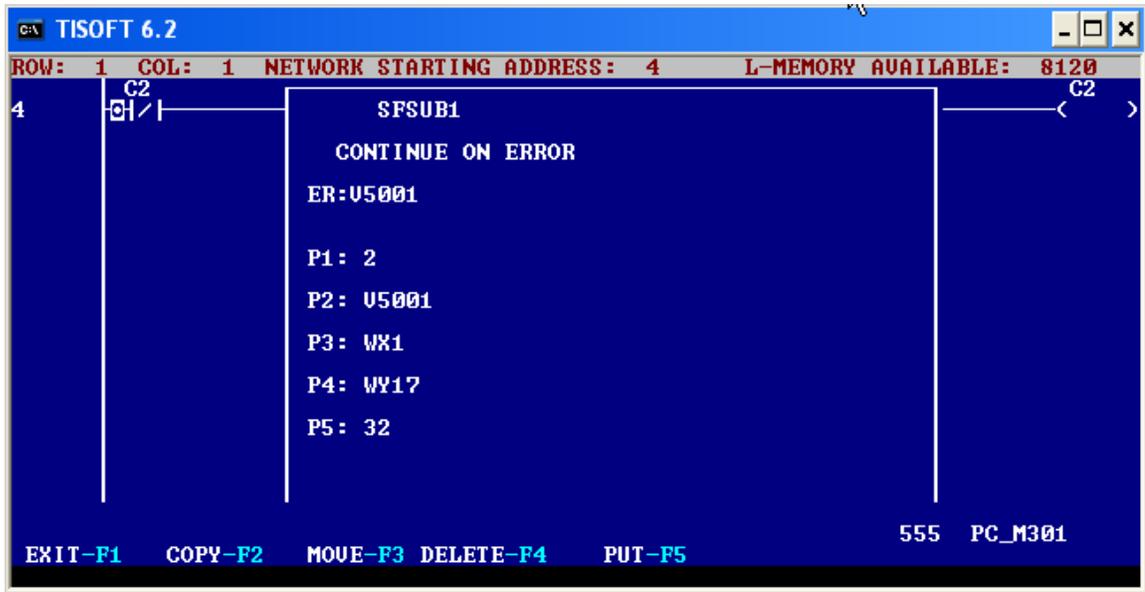
- a. Enter LADDER Address Range '000018' thru '00033' as shown below. The 'BEFORE' Address determines the RLL Network Address in your PLC application program.



- b. Press [Enter], and use the 'TISOFT™ FILE SELECTION' screen to locate the CTI Driver install program 'DPSFS_V6' (as shown below).



- c. Press [SELECT-F8] and the RLL Network containing the SFSUB Box instruction (without 'In-Line' execution attribute) is merged into your PLC application program. Skip to Step 6.



- d. See notes in Chapter 8 regarding setting 'SFSUB Time Slice' to ensure optimum performance.

6. Modify the parameter values in the SFSUB instruction box (via [BOX-F2]) for your specific application as noted below:

- SFSUB #:** Enter the SFSUB Program number as selected in Section 7.1
In my example, SFSUB# 10 was selected..
- CONT:** This field selects “Continue on Error”.
This selection should always be set to “CONT”.
- IN-LINE:** This field designates the SFSUB for immediate execution within RLL scan when input is ON. This attribute is displayed when using TISOFT Release 6.3 (or later) and CPU Model 2500-C300 or Model 2500-C400.
- ER:** This field selects the 3-Word Special Function Error Code (SFEC).
The SFEC must be set as the first 3 words of the PLC Workspace Area. Therefore, the starting address of the PLC Workspace Area must be entered here. See description of Parameter ‘P2’ below.
- P1:** This field designates the operation of the DP-SFSUB Driver.
For communications via SIMATIC® 505 L2DP protocol (emulation of XSUB2-3 operation), set values as follows:
PLC Profibus-DP Port = 2
FIM Interface = 12
For communications via SIMATIC® 500/505-DP protocol (emulation of XSUB4-5 operation), set values as follows:
PLC Profibus-DP Port = 4
FIM Interface = 14
- P2:** Starting location for PLC Workspace Area – a consecutive memory block dedicated to the CTI DP-V20 SFSUB for communication with a single HMI device. This memory area must not be overwritten by other sections of the PLC program. This address must be identical to the ‘ER’ (SFEC) field. This parameter corresponds to ‘IO1’ parameter in XSUB2/XSUB4 instructions
When using the SIMATIC® 505 L2DP protocol, the PLC Workspace occupies a contiguous 300-word memory area.
When using the SIMATIC® 500/505-DP protocol, the PLC Workspace occupies a contiguous 40-word memory area.
- P3:** Starting Address for Input (WX) Buffer.
This address must be identical to the ‘I/O Address’ entered for the HMI unit I/O Buffer interface -- Profibus-DP or Remote I/O address (if FIM used).
This parameter corresponds to ‘IO12’ parameter entered in XSUB2 instruction box or ‘IO2’ parameter in XSUB4 instruction box.

P4: Starting Address for Output (WY) Buffer. The HMI Output Buffer must immediately follow the Input Buffer (P3), and the Output Buffer Start Address depends on the buffer size selected.

When using the SIMATIC® 505 L2DP protocol, the Output Buffer Start Address is calculated as follows:

$$16WX/16WY: \quad P4 = P3 + 16$$

$$32WX/32WY: \quad P4 = P3 + 32$$

$$60WX/60WY: \quad P4 = P3 + 60$$

When using the SIMATIC® 500/505-DP protocol, the Output Buffer Start Address is calculated as follows:

$$\text{Tiny (16WX/11WY):} \quad P4 = P3 + 16$$

$$\text{Small (21WX/11WY):} \quad P4 = P3 + 21$$

$$\text{Middle (32WX/16WY):} \quad P4 = P3 + 32$$

$$\text{Big (61WX/21WY):} \quad P4 = P3 + 61$$

P5: I/O Communication Buffer Size (number of bytes).

This must correspond to the **Number of Bytes** configured for Profibus-DP Input Buffer for the corresponding HMI device. This value must equal the I/O configuration set in COM-PROFIBUS®: (or Slave I/O Configuration set in FIM Profibus-DP Configurator).

When using the SIMATIC® 505 L2DP protocol, this parameter must equal one of the following values:

$$16WX/16WY: \quad P5 = 32$$

$$32WX/32WY: \quad P5 = 64$$

$$60WX/60WY: \quad P5 = 120$$

When using the SIMATIC® 500/505-DP protocol, this parameter must equal one of the following values:

$$\text{Tiny (16WX/11WY):} \quad P5 = 32$$

$$\text{Small (21WX/11WY):} \quad P5 = 42$$

$$\text{Middle (32WX/16WY):} \quad P5 = 64$$

$$\text{Big (61WX/21WY):} \quad P5 = 122$$

7. Edit (via [EDIT-F2]) the reference address for the contacts and coil in the RLL network containing the CTI SFSUB instruction to associate a Control Relay (C1-C32768) that is currently unused in your PLC application. Then select [BOX-F6] to customize the SFSUB parameters. Press [ENTER-F8] to accept the changes to the RLL network.

Example of customized RLL network with 'In-Line' SFSUB execution::



Example of customized RLL network with queued SFSUB execution:



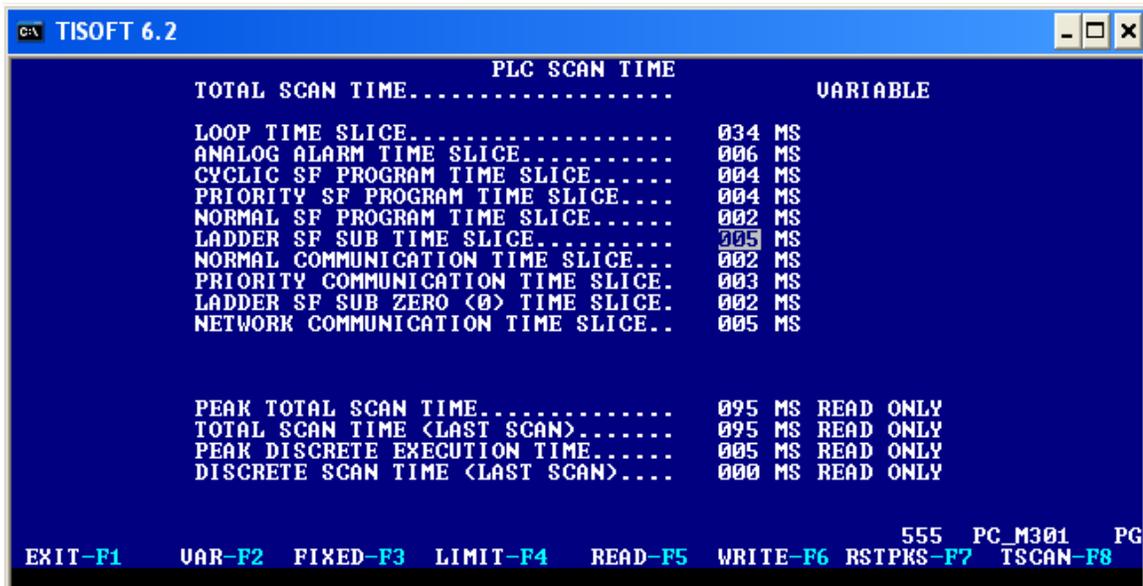
The installation of the CTI DP-SFSUB Driver is complete.

7. Execution of CTI DP-SFSUB Driver

This section provides details on the execution of the CTI DP-SFSUB Driver, and the differences between the CTI Driver and the Siemens® external XSUB programs.

1. To ensure proper operation for all configurations, the CTI 2500 Series™ CPU should contain Firmware V3.08 or later when executing the DP-SFSUB Driver.
2. The CTI DP-SFSUB Driver interface is contained in one (1) SFSUB program. The SF Subroutine is called by a SFSUB RLL instruction. One program supports multiple HMI units, but a separate SFSUB RLL instruction box containing unique parameter values must be entered for each HMI unit to be connected.
3. If 505 WorkShop® programming software is used, the CTI SFSUB can be executed 'In-Line' each PLC scan with all 2500 Series™ CPU Models. If TISOFT™ is used, this attribute can only be selected in Release 6.3 (or later) when used with CTI Model 2500-C300 or Model 2500-C400 CPUs.
4. Queued SFSUB execution is mandatory when TISOFT Release 6.2 (or earlier) is used as programming software, or CTI Model 2500-C200 CPU is used with any version of TISOFT™. This method is completely functional and provides satisfactory performance with PLC scan times up to approximately 50 msec.

When using this method, the 'Ladder SFSUB Time Slice' interval (shown highlighted below) should be set high enough to ensure the DP-SFSUB Driver runs during the scan in which it is triggered. We recommend setting a value equal to "5 MS" for each connected HMI device plus additional time as needed to run other SFSUB programs in your PLC application.



```

c:\ TISOFT 6.2
PLC SCAN TIME
TOTAL SCAN TIME.....
LOOP TIME SLICE..... 034 MS
ANALOG ALARM TIME SLICE..... 006 MS
CYCLIC SF PROGRAM TIME SLICE..... 004 MS
PRIORITY SF PROGRAM TIME SLICE.... 004 MS
NORMAL SF PROGRAM TIME SLICE..... 002 MS
LADDER SF SUB TIME SLICE..... 005 MS
NORMAL COMMUNICATION TIME SLICE... 002 MS
PRIORITY COMMUNICATION TIME SLICE. 003 MS
LADDER SF SUB ZERO <0> TIME SLICE. 002 MS
NETWORK COMMUNICATION TIME SLICE.. 005 MS

PEAK TOTAL SCAN TIME..... 095 MS READ ONLY
TOTAL SCAN TIME <LAST SCAN>..... 095 MS READ ONLY
PEAK DISCRETE EXECUTION TIME..... 005 MS READ ONLY
DISCRETE SCAN TIME <LAST SCAN>.... 000 MS READ ONLY

555 PC_M301 PG
EXIT-F1 VAR-F2 FIXED-F3 LIMIT-F4 READ-F5 WRITE-F6 RSTPKS-F7 TSCAN-F8
```

5. The DP-SFSUB Driver requires approximately 6K bytes of ‘Special (S) Memory’ for program storage. Additionally, all configurable memory types that are accessible by the DP-SFSUB (V, K, T/C) must have a memory configuration greater than zero.
6. The DP-SFSUB utilizes operational codes (Op Codes) that are valid only in controllers that support PowerMath™ feature. All CTI Series 2500 CPUs emulate PowerMath and support these Op Codes. All versions of TISOFT™ will upload/download the SFSUB program correctly. However, the SFSUB statements are not accurately displayed in programming software packages that do not support PowerMath™ (TISOFT™ Release 6.2 or earlier).
7. Each instance of the SFSUB instruction box requires a unique dedicated memory area for storage of configuration information and run-time data. The starting address of the memory block is specified by SFSUB Parameter ‘P2’. This memory area must **not** be written by any other part of the PLC application program. The size of the memory block is dependent on the HMI protocol driver that is selected.
 - a. A memory block of consecutive 300 words is required for each HMI device interfaced using the **SIMATIC® 505 L2DP** protocol driver,
 - b. A memory block of consecutive 40 words is required for each HMI device interfaced using the **SIMATIC® 500/5-2DP** protocol driver,
8. When the CPU transitions from ‘Program → Run’ or ‘Edit → Run’, the DP-SFSUB automatically re-initializes communications with the HMI unit. Any changes to Profibus-DP configuration or SFSUB parameters take effect on the transition to ‘Run’ mode. Communications with the HMI is also re-initialized whenever a communications failure occurs or the HMI unit goes “Offline”
9. The DP-SFSUB operates only when PLC is in ‘Run’ mode and Profibus-DP mode is set to ‘Operate’.
10. The DP-SFSUB Driver supports all data types, memory addresses, and data formats allowed by Siemens® 505-DP external programs (XSUB2-3 and/or XSUB4-5) as shown in the following tables. The one difference is noted below.
 - a. When the **SIMATIC® 505 L2DP** protocol is selected:

<u>Data Type</u>	<u>Mem Addr</u>	<u>Data Format</u>
Discrete Input/Output	X/Y	Bit
Control Relay	C	Bit
Variable Memory	V	Signed/Unsigned Integer, Signed/Unsigned Long Int, Real (Float), or ASCII
Word Input/Output	WX/WY	Signed/Unsigned Integer, Signed/Unsigned Long Int, Real (Float), or ASCII

<u>Data Type</u>	<u>Mem Addr</u>	<u>Data Format</u>
Constant Memory (Read Only)	K	Signed/Unsigned Integer, Signed/Unsigned Long Int, Real (Float), or ASCII

b. When the **SIMATIC® 500/505-DP** protocol is selected:

<u>Data Type</u>	<u>Mem Addr</u>	<u>Data Format</u>
Discrete Input/Output	X/Y	Bit
Control Relay	C	Bit
Variable Memory	V	Signed/Unsigned Integer, Signed/Unsigned Long Int, Real (Float), or ASCII
Word Input/Output	WX/WY	Signed/Unsigned Integer, Signed/Unsigned Long Int, Real (Float), or ASCII
Constant Memory (Read Only)	K	Signed/Unsigned Integer, Signed/Unsigned Long Int, Real (Float), or ASCII
Timer-Counter Preset	TCP	Signed/Unsigned Integer
** Timer-Counter Current (Read Only)	TCC	Signed/Unsigned Integer
PLC Status Words (Read Only)	STW	Signed/Unsigned Integer

** The CTI DP-SFSUB has “Read-Only” access to TCC memory. Therefore, it cannot write directly to TCC memory, and an Error Code is returned to HMI if attempted.

11. All configured memory addresses (for memory types specified above) are accessible by HMI. The CTI DP-SFSUB does not allow the user to configure the range of PLC memory addresses that can be accessed from the HMI (as set by XSUB2-XSUB4 initialization parameters). It is the responsibility of the user to limit user access via ProTool/Pro® or WinCC® flexible configuration.
12. If the HMI unit requests a Read/Write operation to an invalid (unconfigured) memory address, the operation is aborted and an Error Code to the HMI. device.

13. The performance of the HMI interface is dependent on PLC scan time and Profibus-DP network Data Cycle Time. Typically, the Profibus-DP network cycle time is much less than the PLC scan time – resulting in the PLC scan time being the most critical factor in the HMI update times.

The following items should be considered when installing and configuring the CTI DP-SFSUB Driver:

- a. The DP-SFSUB Driver executes each PLC scan when RLL ‘In-Line’ operation is selected. This feature provides maximum SFSUB performance and fastest HMI response time. .
- b. Both HMI protocols utilize a ‘handshake’ sequence between the HMI and PLC to perform Read/Write operations. The L2DP protocol requires a minimum of three (3) “states” to complete each Read or Write operation. The SIMATIC® 500/505-DP protocol is more efficient and can complete a Read/Write operation in two (2) “states”. One “state” operation is completed each time the DP-SFSUB is executed after appropriate data is received in the Profibus-DP Input Buffer.
- c. Typically, the execution time of the CTI DP-SFSUB is less than 3 milliseconds (ms) each PLC scan. Worst case execution time is 5 ms – meaning that a maximum of 5 ms is added to the PLC scan time for each RLL (SFSUB) instruction used to call the CTI DP-SFSUB.Driver.
- d. The Profibus-DP communications buffer size can also affect performance. Use the following guidelines for setting the DP-I/O buffer size:

When the **SIMATIC® 505 L2DP** protocol is selected:

- If the majority of operator screens configured for HMI unit contain 5 data variables or less, set DP-I/O buffer size to ‘32’ (16WX/16WY).
- If the majority of operator screens configured for HMI unit contain between 6–11 data variables, set DP-I/O buffer size to ‘64’ (32WX/32WY).
- If using the Siemens® 505-7202 Field Interface Module (FIM) to connect to the HMI unit, you must set I/O buffer size to ‘32’ or ‘64’.
- If 12 or more data variables are configured for a majority of the operator screens and you are using the integrated CPU Profibus-DP port, set DP-I/O buffer size to ‘120’ (60WX/60WY).

When the **SIMATIC® 500/505-DP** protocol is selected:

- We recommend setting the DP-Buffer Size to ‘Small’ model (21WX/11WY) or ‘Middle’ model (32WX/16WY) for all applications. If the HMI is configured for monitoring an *Area Pointer* memory block, the ‘Middle’ model should be selected.
- If FIM is used for Profibus-DP master, then the ‘Middle’ model (32WX/16WY) must be selected.

14. The polling times for *Area Pointers* and data variables are specified by ProTool/Pro® or WinCC® flexible configuration. Follow the recommendations included in the Help files to optimize update times. Specifically note the following:

- The SIMATIC® 505 L2DP HMI Driver limits *Tag* data variables to addresses in the range of 1-32767 (i.e., V1 thru V32767). This is not included in the Help file documentation. *Area Pointers* can use the entire address range for the memory type as specified in the PLC Configuration.
- The SIMATIC® 500/505-DP HMI Driver has no restrictions on memory addresses for *Tags* or *Area Pointers*.
- Performance is degraded when data variable polling times are too short. Set polling times in accordance to the rate that the process value changes. The recommended polling time is 1 second.
- If the PLC scan time is less than twice the data cycle time of the Profibus-DP network, increase the Profibus-DP baud rate to the highest possible value.