Connecting UniOP to Simatic S5 Profibus

This Technical Note contains all the information required to connect the UniOP panels to a Profibus DP system with a Simatic S5 master and to take advantage from the advanced data access options supported by the UniOP Profibus DP driver.

Important: *this Technical Note applies only to the Profibus DP communication driver identified by the name 'Profibus DP S5' associated to the Designer file UPLC87.DLL. It is not compatible with the previous version referred to as 'SINEC L2 DP S5' and associated to the Designer file UPLC29.DLL. To run this version it is required a panel of hardware type –0045 and a communication module type TCM08.*

Contents

1. Introduction 2
2. Configuring UniOP as a Slave with COM Profibus 3
3. Using the UniOP Function Blocks in the Master PLC 8
4. Creating the UniOP COMM DB 9
4.1 Example 11
5. Configuring UniOP With Designer For Profibus DP 12
6. Summary 13
7. Troubleshooting 14
Appendix 1 - Communication Error Codes 15
Appendix 2 – Technical Data and Connection 16
Appendix 3 - Requirements and Compatibility 17
Appendix 4 - PLC specific information 18

1. Introduction

The UniOP panel can be connected to the Siemens Simatic S5 family of PLCs via the Profibus DP network. This technical note describes the principal points to follow for a successful connection.

A Profibus DP network can contain multiple nodes. A node in a Profibus DP network can be either a Master or a Slave. The Masters in the network have a group of Slaves assigned to them. A Master is able to exchange data with the Slaves that are under its control.

UniOP is always a Slave in a Profibus DP network and it is only able to exchange data with a single Master PLC. To enable UniOP to work, a set of special function blocks must be added to the PLC program in the Master PLC. These special function blocks are needed to process the requests from UniOP. These special function blocks use a Data Block, UniOP COMM DB, within the Master PLC to store configuration information. This approach has the advantage that it offers to the slave panel full access to the data in the PLC, as if the panel was directly connected through the programming port.

There are 4 main steps that you need to follow to make UniOP work with Profibus DP:

1) Program the Master PLC to have UniOP as a slave using the COM Profibus configuration software
2) Add the special function blocks for UniOP to the Master PLCs program
3) Create the UniOP COMM DB in the Master PLC and specify the configuration information in this DB
4) Configure UniOP with the Designer package

These steps are described in greater detail in the following sections

2. Configuring UniOP as a Slave with COM Profibus

The Master PLC must be configured to communicate with its Slaves. You can do this with the Siemens COM Profibus version 3.00 programming package. This package programs the Profibus DP port of the Master PLC so that it exchanges data with the specified Slaves. With this package you can select different types of Slaves such as MMI, Remote Inputs etc.

A Profibus DP Slave type file for UniOP is provided together with the panel. The filename is EX9649AX.GSD; this file contains the description of the UniOP panels as Profibus DP Slaves. The first thing you need to do is to copy this file to the GSD subdirectory of the COM Profibus installation directory and start the 'Scan GSD Files' in the COM Profibus sofware. This will enable COM Profibus to recognize UniOP as an MMI Slave type.

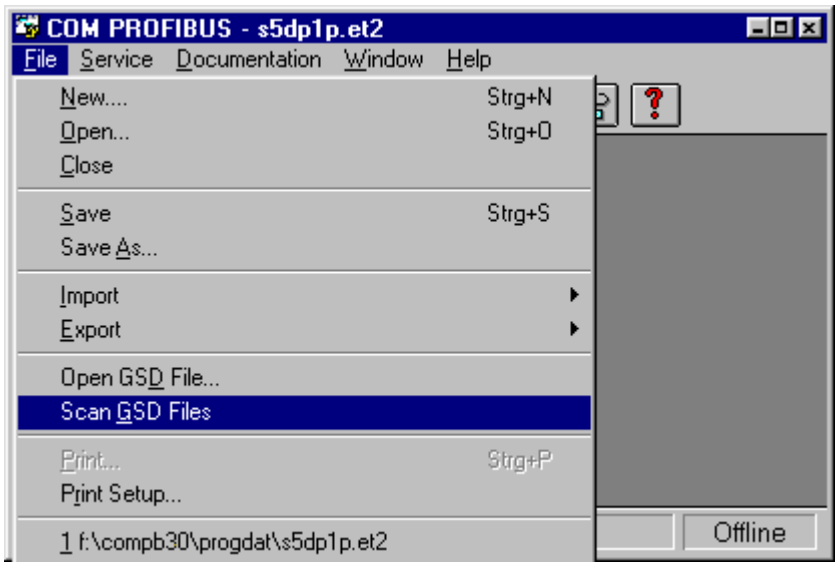

Figure 1 – Scanning for new GSD files

Before configuring UniOP as a Slave you must select the PLC type of the Master PLC and the addressing mode that you require.

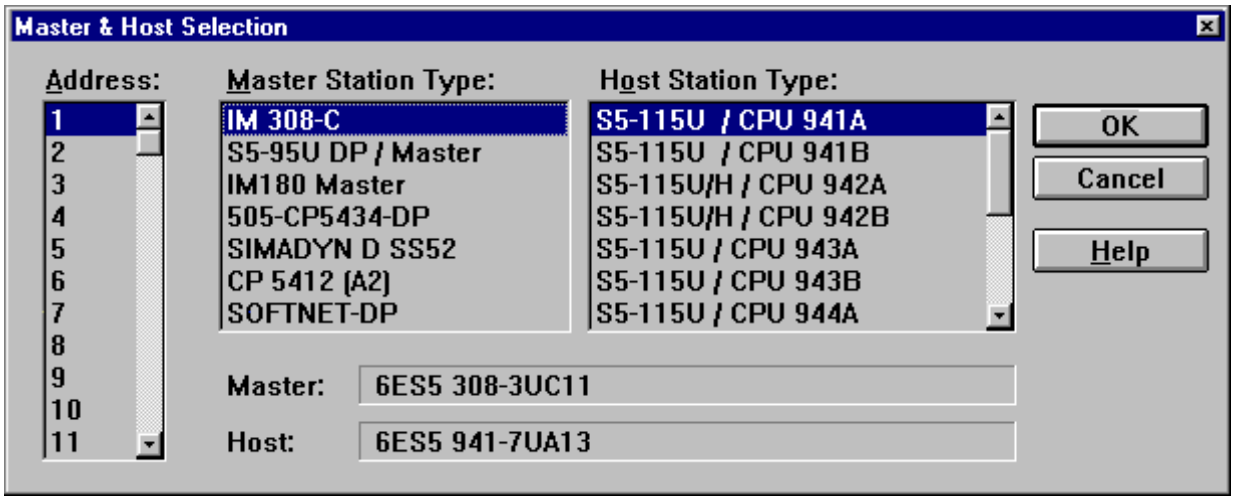

Figure 2 - Master & Host Selection Dialog Box

You select the addressing mode via the Master parameters dialog box as shown in Fig.3. There are a couple of points to bear in mind when selecting the addressing mode of the Master PLC.

1. UniOP supports the following addressing modes: Linear P, Linear Q , P Page and Q Page.
2. UniOP does NOT support the Multiprocessor addressing mode.
3. Not all addressing modes are supported by any Master system; please refer to the relevant Simatic documentation for more information.

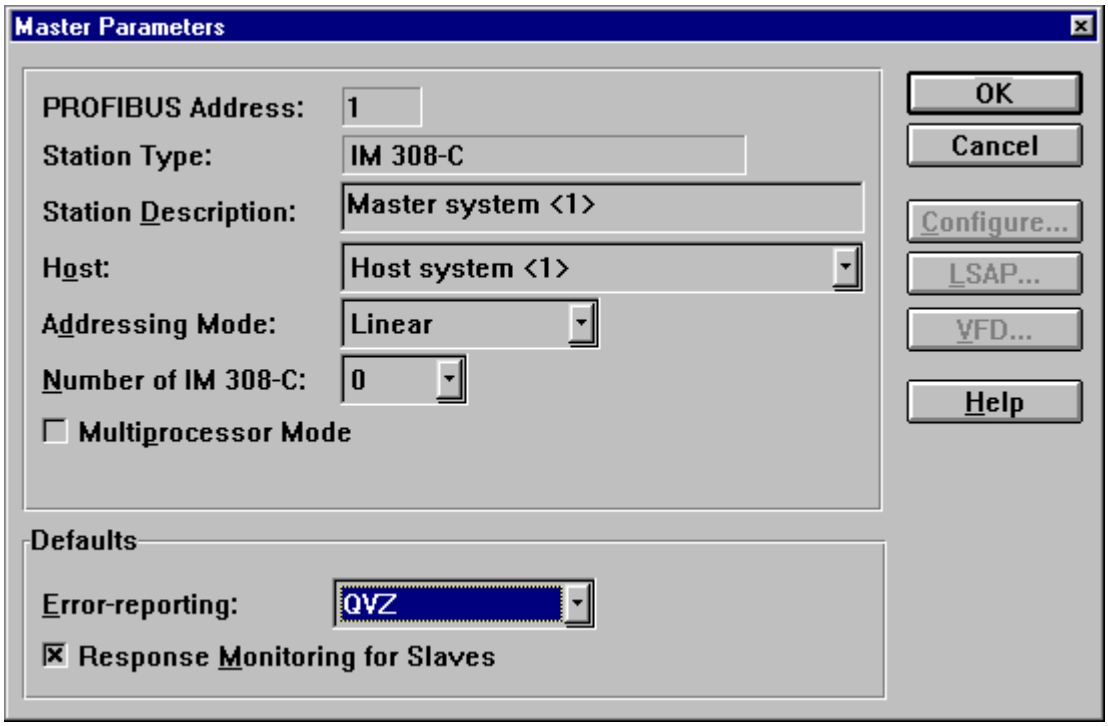

Figure 3 - Master Parameters Dialog Box

The network communcation speed must be specified. Note that UniOP supports communication speed from 9600 bauds to 12 Mb. UniOP performs automatic detection of the network speed.

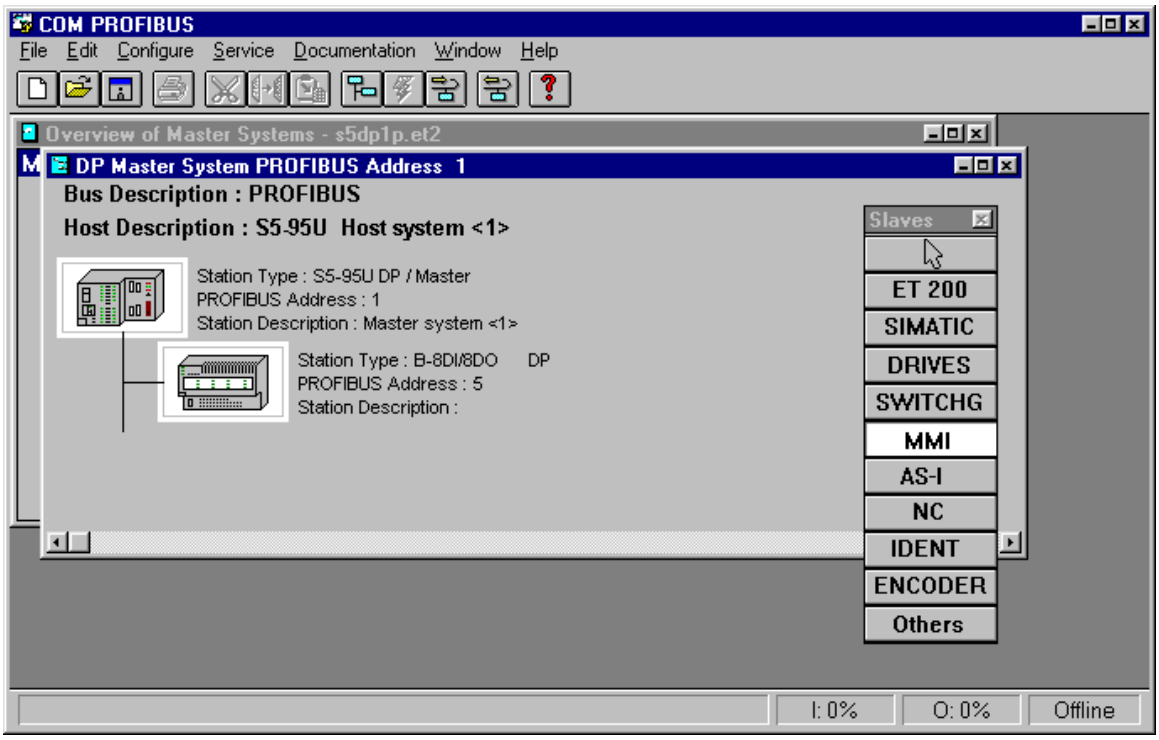

Figure 4 - COM Profibus Network Configuration Editor

Once you have selected the Master PLC type and addressing mode the COM Profibus screen will appear as shown in Figure 4. You can now add UniOP as a Slave of the Master PLC by clicking on the MMI button and selecting UniOP from the list of available MMI type files.

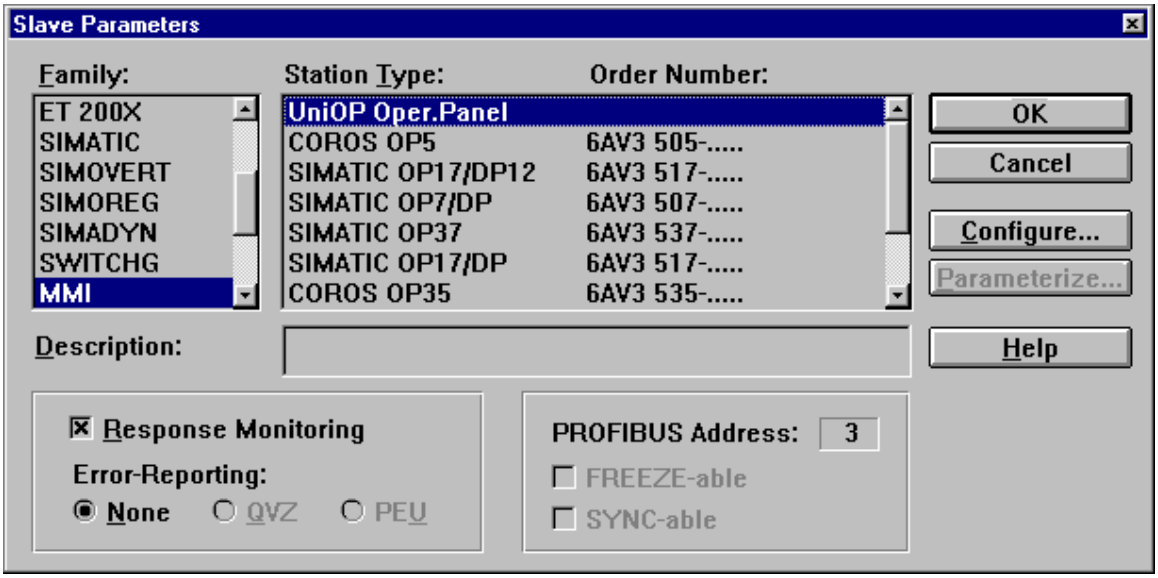

Figure 5 – Slave parameters Dialog Box

COM Profibus will then prompt you to enter the buffer size required by the slave unit. That can be done with the Preset Configuration dialog box shown in figure 6.
UniOP panel, when used as Profibus DP Slaves require an Input Buffer and an Output Buffer.

Note: *the current version supports only buffer sizes of 16 bytes and 32 bytes.Do not select buffer size 8 bytes.*

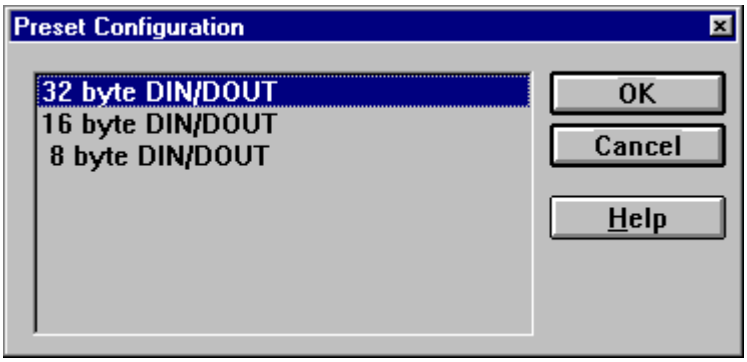

Figure 6 – Preset Configuration Dialog Box

Once you have done this you need to specify the Input and Output addresses that will be reserved for this UniOP panel in the Master PLCs memory and the error reporting for the Slave. You do this via the Configure UniOP dialog box as shown in Figure 7.

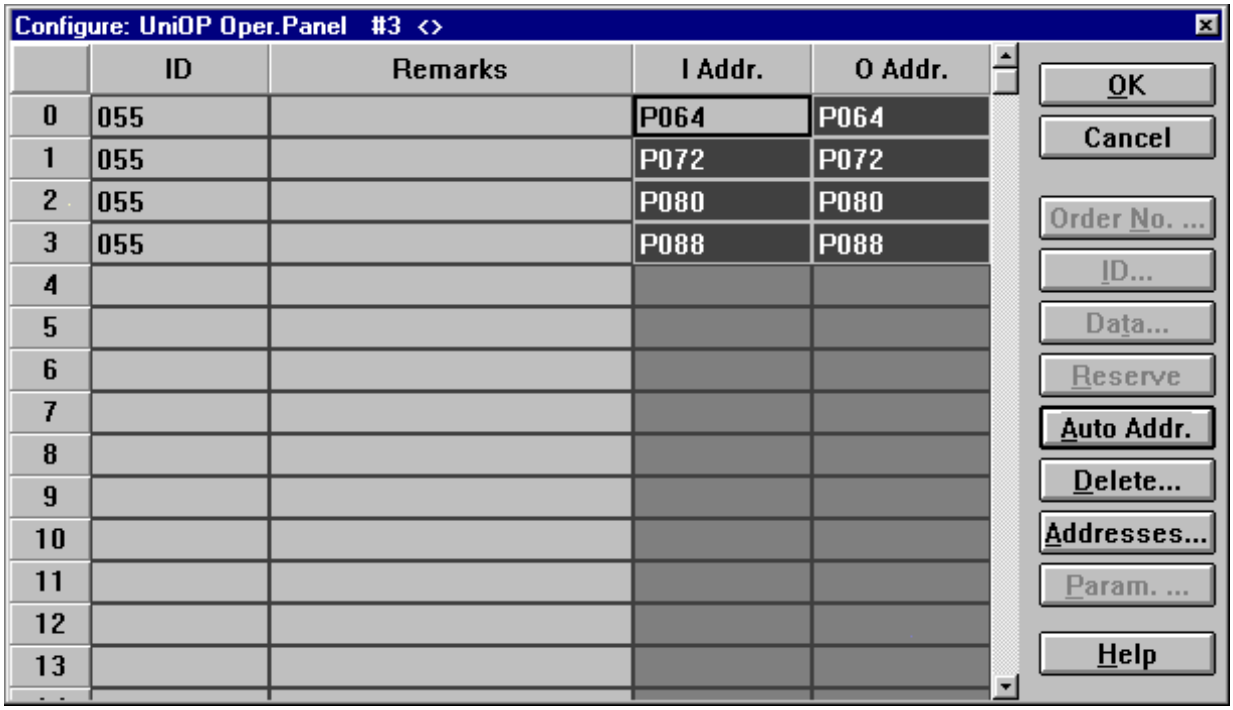

Figure 7 - Configure UniOP Dialog Box

There are a number of restrictions that you need to be aware of when specifying the Input and Output address information for UniOP:

1. You must define Input and Output addresses for all enabled Input and Output blocks. You can use the 'automatic addressing' mode for a quicker configuration. Figure 7 shows a configuration in which 32 byte buffer size has been selected.

2. The active sections of the Input area must be placed sequentially and must each be 8 bytes long. (If you use the 'automatic addressing' mode this is handled automatically.) As an example see Figure 7., here the Input address of the first block is set to P000, that of the second block is set to P008 (0+8), that of the third block to P016 (8+8) and that of the fourth block to P024 (16+8). A similair consideration applies to the Output area as can also be seen from Figure 7.

3. If you use the P Page or Q Page addressing modes then you must make sure that ALL the Input and Output blocks are placed in the same Page. Note that this means you CANNOT put the Input area and Output area in different Pages. You should be particularly carefull of this point as if you use the 'automatic addressing' mode COM Profibus wraps around to the next Page when the addresses on the current Page are exhausted.

Note: *see Appendix 4 – PLC Specific Information for more information on PLC specific addressing limitations.*

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4. You must DISABLE the error reporting for the UniOP. You do this by selecting 'Error-reporting NONE'and by disabling the Response monitoring check box. This is a very important point. UniOP will be unable to communicate if you do not disable Error Reporting for the panels. Note this does not mean that you have to disable error reporting for your other nodes in the Profibus DP network but just for the UniOP panels.Be carefull if you enable error reporting globally via the Host Parameters dialog box as this will turn on error reporting for ALL slaves, even for the UniOP panels for which you disabled error reporting locally. Therefore if you change the Global Error Reporting mode via the Host Parameters dialog Box you must make sure that you then DISABLE locally the Error Reporting mode for all UniOP panels.

3. Using the UniOP Function Blocks in the Master PLC

Three special function blocks must be added to the program for the Master PLC with which UniOP will communicate. These special function blocks are FB96, FB97 and FB98. These function blocks are provided together with the panel. The function blocks are slightly different for different PLC model types. You should make sure that you use the function blocks designed for your PLC model type. Different .S5D files are provided for the different model types. Each .S5D file contains FB96, FB97 and FB98. The following table lists the PLC model types supported by the different files:

File	PLC Model Type
US0950ST.S5D	S5-95
US1150ST.S5D	S5-115 CPU 941/942/943
US9450ST.S5D	S5-115 CPU 945
US9280ST.S5D	S5-135 CPU 928B

Apart from adding the special function blocks to the PLC program you also need to cyclically call FB97. You can do this by adding a call to FB97 to OB01 as illustrated below:

```
      :L     KF+11       11 = UniOP COMM DB number
      :SPA FB97
NAME  :UNIBATCH
```

The call to FB97 is quite straightforward, first the Data Block number used for the UniOP COMM DB is loaded into Accumulator 1 and then the function block is called. You must always specify the UniOP COMM DB in this way before calling FB97. The UniOP COMM DB is described in the next section. In the example above FB97 is called on every cycle of the PLC program and Data Block 11 is used for the UniOP COMM DB. It is important that FB97 is called cyclically, you should not call it only one time, as the function block only processes the requests from the UniOPs when it is called. The function blocks FB96 and FB98 should not be called directly, they are used internally by FB97.

The special function blocks use the merker area MB200 - MB255 as a temporary storage area during execution. These merkers will therefore be modified when the special function blocks are called. You can access this merker area with UniOP but you should be carefull that you do not try to write into this merker area with UniOP.

UniOP will not be able to communicate with the Master PLC if it is in STOP mode as the special function blocks will not be called.

Note that if you have multiple UniOPs connected to the Master PLC you do NOT need to call FB97 once for each UniOP. One call to the FB97 for every cycle of the PLC program is sufficient to process all the UniOPs attached to the Master PLC.

4. Creating the UniOP COMM DB

The UniOP COMM DB (UniOP Communication Data Block) is used to provide FB97 with information it needs about the Profibus DP addressing mode of the master, the number of UniOP panels to scan and the addresses for the Input and Output data of the panels in the Master PLCs memory. You must create a Data Block in the Master PLC that is at least 200 words long for the UniOP COMM DB. When you have created the data block you need to configure the data. The UniOP COMM DB has 2 distinct parts; the first part contains information about the configuration of the Profibus DP port of the PLC while the second part contains information about the various UniOP panels that are connected to this port. Basically this information is a duplication of the data that you enter in the Profibus Master with COM Profibus.

The Profibus DP Port part is placed in the first 4 words of the UniOP COMM DB and has the following format:

	DL	DR
DW0	Number Of Panels	Addressing Mode
DW1	IM 308-C Number	Buffer Size
DW2	0	0
DW3	Sequence Type	Reserved for Internal Use

Following on from the Profibus DP Port data comes the UniOP panel data. The number of UniOP panels connected to this port is specified by 'Number Of Panels'. Each UniOP panel is assigned 4 words in the UniOP COMM DB. The index 'n' runs from 0 upto Number Of Panels - 1. The format of the data for a single panel has the following format:

	DL	DR
DW(4 + n)	Input Address	Output Address
DW(5 + n)	Page Number	0
DW(6 + n)	0	0
DW(7 + n)	Error Code For Last Request	Job Number For Last Request

Number Of Panels specifies the total number of UniOP panels that you want to let communicate with the PLC. This can be between 0 and 60.

Addressing Mode specifies the addressing mode for the Profibus DP port that you selected in the COM Profibus package. The possible values are listed in the table below:

Addressing Mode Index	Addressing Mode
0	Linear P area
1	Linear Q area
2	P Page
3	Q Page

IM 308-C Number specifies the Number of the IM 308-C board that you entered in the COM Profibus package. It can be 0, 16, 32, 48, ..., 240 (in multiples of 16). Needs to be entered only if the Master is an IM308-C module.

Buffer Size specifies the size of the Profibus buffers used to communicate with the Master. Two buffer sizes are supported: 16 bytes and 32 bytes. Enter the the appropriate number in this location. Input and Output buffers always have the same size.

Sequence Type specifies how you want to handle the case of having Number Of Panels set to greater than 1. If you set this item to 0 then FB97 will process the requests from all the UniOP panels before returning. If you set this item to 1 then FB97 will process the request from only a single panel before returning, it will then process the request for the next panel on the subsequent call to FB97. This means that if Sequence Type is set to 0 the requests from the UniOP panels will be processed faster but the execution time of the PLC program will be longer. If the increased execution time of the PLC program causes problems for your application you can set Sequence Type to 1.

Reserved For Internal Use is actually used to keep track of which panel was processed last. This is used if Sequence Type is set to 1.

Input Address specifies the starting address in the Master PLCs memory where the Input data for this panel will be placed. This should be set to the same value that was configured with COM Profibus for this panel.

Output Address specifies the starting address in the Master PLCs memory where the Output data for this panel will be placed. This should be set to the same value that was configured with COM Profibus for this panel.

Page Number specifies the Page Number within the Master PLC where both the Input and Output data can be located. This should be set to the same value that was configured with COM Profibus for this panel.

Error Code For Last Request specifies the Error Code for the last communication request for this panel. You do not need to set this element. FB97 will actually write to this element to give you an indication of the error status of the communication. This field is therefore just for information. The error codes have the following meaning:

Error Code	Meaning
0	No Request Received
1	Request Processed OK
2	Request Rejected

Job Number For Last Request specifies the Job Number for the last communication request for this panel. Every time the UniOP makes a request it includes the Job Number in the request to the PLC. This Job Number is incremented for every new request. You do not need to set this element. This field is therefore just for information.

4.1 Example

As an example, imagine we have 3 UniOPs attached to a Master PLC that uses P Page addressing and 32 bytes buffer size. The Input address for the first panel is set to 1P000 and the Output address to 1P000. The Input address for the second panel is set to 1P032 and the Output address to 1P032. The Input address for the third panel is set to 2P000 and the Output address to 2P000. The UniOP COMM DB would take the following form:

	DL	DR
DW0	3 (Number Of Panels)	2 (Addressing Mode)
DW1	0 (IM 308-C Number)	32 (Buffer Size)
DW2	0	0
DW3	0 (Sequence Type)	0 (Reserved For Internal Use)
DW4	0 (Input Address)	0 (Output Address)
DW5	1 (Page Number)	0
DW6	0	0
DW7	0 (Error Code For Last Request)	0 (Job Number For Last Request)
DW8	32 (Input Address)	32 (Output Address)
DW9	1 (Page Number)	0
DW10	0	0
DW11	0 (Error Code For Last Request)	0 (Job Number For Last Request)
DW12	0 (Input Address)	0 (Output Address)
DW13	2 (Page Number)	0
DW14	0	0
DW15	0 (Error Code For Last Request)	0 (Job Number For Last Request)

5. Configuring UniOP With Designer For Profibus DP

1) To use the S5 Profibus DP protocol with the Designer, follow this procedure:
- Select the option 'Project/Change Communication Driver' and choose 'Profibus DP S5'

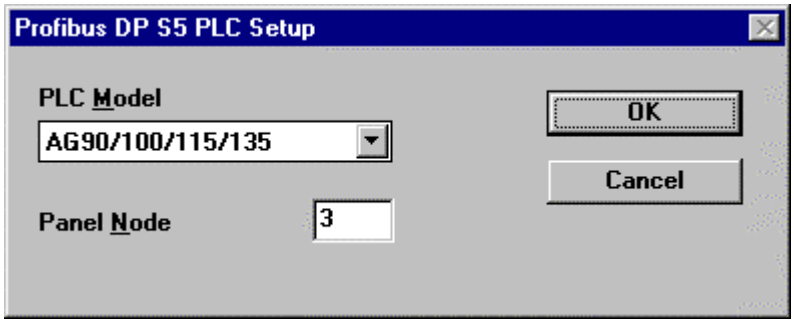

Figure 8 - Controller Setup

2) A UniOP panel in a Profibus DP network is always a Slave that exchanges data with a single Master PLC. Every UniOP in the Profibus DP network must be assigned it's own unique Node address. You do this by entering a number in the 'Panel Node' edit box in the Controller Setup dialog box.

3) Automatic recognition of the baud rate is supported. Communication speeds up to 12 Mb are supported. There is no need to enter the speed of the Profibus DP network

3) The Real Time Clock information in the Reserved Data Area (RDA) is coded in BCD

4) The page number displayed and the page number requested in the RDA are coded in binary.

5) The RDA can be freely positioned within the PLCs Data Block memory.

6) The cable to use for the direct connection between the Aux Port of the UniOP panel and the Profibus DP port of the PLC is CA128.

7) You can attach more than one UniOP to a single Master PLC.

6. Summary

To get your UniOP up and running as a Profibus DP slave here is a summary of what you need to do:-

1. Copy the EX9649AX.GSD file to the COM Profibus GSD subdirectory.
2. Configure your Master PLC specifying the UniOP panels as Slaves using the UNIOP MMI type.
3. Copy the special function blocks FB96, FB97 and FB98 to the Master PLCs program.
4. Cyclically call FB97 in OB1 of the Master PLC.
5. Configure the UNIOP COMM DB to match the addressing mode configured for the Master and the Input and Output address specified for the UniOP panels.
6. Create the project files for the UniOP panels. Make sure that the 'Panel Node' specified in the Designer Controller Setup dialog matches the node number used for the UniOP panel in the COM Profibus package.
7. Put the PLC into RUN mode.

7. Troubleshooting

UniOP doesn't communicate, COM LED blinks and the Communication Status shows COM ERR 05 or COM ERR 09:

1. PLC is in STOP or is not turned on?
2. Cable is not connected or is broken?
3. FB97 is not called cyclically from OB1?
4. UniOP has been programmed via the Designer Controller Setup dialog box to have a node number that is the same as another node in the network?
5. The UniOP COMM DB has not been configured properly. Either there is no panel specific block that matches the Input and Output address area for this panel or the UniOP COMM DB has been set to only scan a limited number of panels.

UniOP doesn't communicate, COM LED blinks and the Communication Status shows COM ERR 04

1. UniOP has been programmed by Designer to access a non-existent data block. Either the RDA or a data item?

PLC fails to go into RUN mode

1. The Master PLC has been configured with COM Profibus to have Response Monitoring enabled for the UniOP panels?
2. The UniOP COMM DB has not been configured properly. Either the addressing mode does not match the actual addressing mode of the Master PLC as configured with COM Profibus or the Input / Output addresses of the UniOP panels do not match the actual Input / Ouput addresses as configured with COM Profibus?
3. UniOP has been programmed via the Designer Controller Setup dialog box to have a node number that is the same as another node in the network?

Appendix 1 - Communication Error Codes

Current communication status is displayed in the System Menu of the UniOP. Beside the string describing current state of the communication, there is an additional error code representing the last (which may be not the current one) error encountered. The codes are following:

Code	Description	Notes
00	No error	There are no communication errors and there have been no errors since start-up.
04	Negative acknowledgement to request	The PLC does not accept the request from UniOP. This error occurs if a non-existent data block is accessed.
05	Time-out error to request	This error indicates that the communication line has been broken, the PLC has had a power fail or the PLC is in STOP. This happen also if the master has sent the parameters to UniOP without DP watchdog and the communication cable has been disconnected.
06	Ill formed response	Response data was received from the PLC but the amount of data received was not what was expected.
07	Internal failure	This should never happen. It indicates a hardware problem or software low level problem.
08	DP watchdog timeout	Indicates that the communication line has been broken or the PLC has had a power fail. This happens if the master has sent parameters to UniOP with DP watchdog and the communication cable has been disconnected.
09	Failed to enter data exchange	Indicates that the UniOP failed to enter the data exchange state. This happen turning on the UniOP with PLC powered off or with no cable connected. May also indicate that there are two or more slaves with the same node number.
10	Negative acknowledgement in response	This error occurs when the master PLC accepts the request from UniOP but after processing the request returns a NAK

Appendix 2 - Technical Data and Connection Information

The main technical information on the UniOP Profibus DP Slave interface using TCM08 is shown in the table below:

Baudrate	9.6 Kb to 12 Mb
Buffer size	16/32 bytes
Slave address	Software configurable
Optical insulation	Yes
Profibus Connector	Standard, 9 pin female sub-D type

UniOP has a standard Profibus connector. A simple point to point connection can be performed with the cable CA128.
In all other cases the usage of special connectors such as the Siemens 6ES7972-0BA20- 0XA0 and 6ES7972-0BB20- 0XA0 is recommended.

Appendix 3 - Requirements and Compatibility

This version of Profibus DP is included in the Designer DLL file UPLC87.DLL. The initial release level is 3.01 for the communication driver and 5.00 for the DLL (both version numbers can be seen in the Change Controller Driver dialog box of the Designer software).

A communication module of type TCM08 is required. This driver will not work with other communication modules such as the TCM01.
The UniOP panel must have hardware type –0045 and firmware version number 4.09 or higher to support the TCM08 modules.

The new GSD file EX9649AX.GSD is NOT compatible with older versions of the Profibus DP driver, such as that included in UPLC29 and referred to as 'SINEC L2 DP S5'.

Appendix 4 - PLC specific information

There are some configuration options which are specific for different PLC CPUs that can be used as the Profibus Master. This chapter will describe the different options for each of the DP master systems to which UniOP can be attached.

CPU	Notes
AG95U	Q area is not supported
AG115U CPU 942/943/944	Addresses P0-P127 are not supported Q area is not supported
AG115U CPU945	It is not possible to access the Timer and Counter areas. Timer and counter data formats are not available in the list of supported data types Addresses P0-P127 are not supported
AG135U CPU928B	There are no specific limitations