Connecting UniOP to Simatic S7 MPI

The UniOP panel can be connected to the Siemens Simatic S7-300 and S7-400 families of PLCs. The communication is performed via the UniOP Aux Port using the MPI protocol.
This technical note describes the principal points to follow for a successful connection.

Important:	*You must use a panel equipped with a special communication interface module to connect the UniOP to a Simatic S7 PLC using the MPI protocol. The operator panel must have the part number with the suffix –0045 to support the special communication interface modules. There are two communication modules for the MPI communication: TCM01 or TCM07. MPI communication is performed through the Aux Port.*

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1 How to Connect to an S7 PLC Using the MPI Protocol

1.1 Using the Simatic S7 MPI protocol with the Designer

- Select the option “Project/Change Communication Driver” and choose the “Simatic S7 MPI” driver;
- Select the type of CPU that you intend to use with the option “Project/Controller Setup” (see Figure 1).

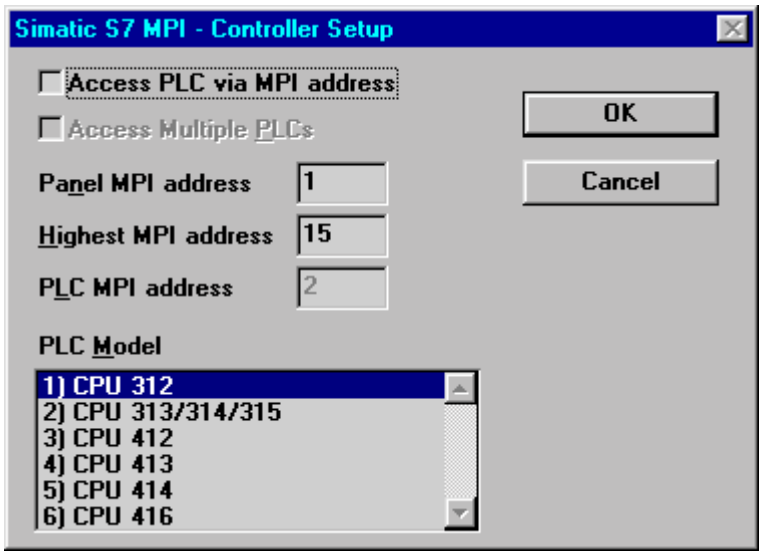

Figure 1. Controller Setup

Note: *It is important to select the actual CPU model that will be connected to the panel. Selecting the wrong type can result in communication problems, under certain particular conditions, and can result in the optimum communication not being achieved.*

1.2 Node Addressing on the MPI Bus

The S7 MPI protocol is a token passing protocol. Every node in the network must be assigned a unique MPI address. This also applies to UniOP. Every UniOP in the network must be assigned it's own unique MPI address. You do this by entering a number in the "Panel MPI address" edit box in the Controller Setup dialog box. You must also always specify the Highest MPI address that is present in the network. This is an important parameter that is global to the whole network.
When you configure your PLC with the PLC programming package you will also be required to specify this value. You should configure UniOP with the same value as the PLCs in the network. You specify this value by entering a number in the "Highest MPI address" edit box. You must enter either 15, 31, 63 or 126.

Note: *If the value that you enter for the Highest MPI address is smaller than the actual MPI address of the PLC then UniOP will not be able to communicate with the PLC. UniOP can only communicate with PLCs that have MPI addresses lower or equal to the Highest MPI address.*

UniOP is able to automatically determine the MPI addresses of the active PLCs in the network. This enables it, if there is a single PLC in the network, to automatically determine the MPI address of the PLC to which it is attached. This is a useful feature as it means that if you want to attach your UniOP to a single PLC then you do not need to remember it's MPI address. If you want to use this feature then do NOT select the option "Access PLC via MPI address". In this way UniOP will scan for all the active nodes in the network, it will then communicate with the node with the LOWEST MPI address. If you do select the option "Access PLC via MPI address" then UniOP will ALWAYS communicate with the node with the MPI address that you enter in the "PLC MPI address" edit box.

You can program the S7 PLC using the STEP7 programming software while UniOP is connected and communicating.

You can attach more than one UniOP to the network. There is no limitation as to the number of UniOPs that can be attached to the network from the UniOP side, however, different S7 MPI PLCs impose different restrictions as to the maximum number of nodes that they can communicate with. You should check what is the maximum number of nodes that your PLC can communicate with in the documentation for your particular PLC model type. Always remind to count also the STEP7 programming package as one node.

Note: *Always use the "Access PLC via MPI address" if you have more than one PLC or more than one UniOP in the network. The automatic MPI address detection mechanism in UniOP is enabled only if you have a single UniOP attached to a single PLC. Otherwise you must specify the PLC node with which you want to exchange data.*

1.3 Communication parameters for the S7 MPI

Communication parameters for the S7 MPI are fixed at:

Baud rate	187500
Parity	Even
Data bits	8
Stop bit	1

Designer does not allow you to modify these parameters.

1.4 RDA Setup

The Real Time Clock information in the Reserved Data Area (RDA) is coded in BCD and is arranged as shown in Table 1.

MBn	Day of the week
MBn+1	0
MBn+2	Month
MBn+3	Day
MBn+4	Hour
MBn+5	Year
MBn+6	Seconds
MBn+7	Minutes

Table 1. RTC information in the RDA

The page number displayed and the page number requested in the RDA are coded in binary.
The RDA can be freely positioned within the PLC memory.

For the parts of the RDA organized in bits (Keyboard Status, LED Control, Alarms, UniOP Status Word and PLC Command Word), the first bit in the RDA corresponds to the first bit in the PLC (i.e. the bit with the lowest address). For example, if the Keyboard Status area is positioned at the address MB0, then the key F1 will be mapped to M0.0, the key F8 will be mapped to M0.7 and so on as listed in the Table 2.

	.7	.6	.5	.4	.3	.2	.1	.0
MB0	F8	F7	F6	F5	F4	F3	F2	F1
MB1	F16	F15	F14	F13	F12	F11	F10	F9

Table 2. RDA bit information

Similarly, if the UniOP Status Word is positioned at the address MB12, then the status bit S0 will be mapped to M12.0, the bit S7 will be mapped to M12.7 while the bit S8 will be mapped to M13.0.

1.5 Multidrop Connection

UniOP supports a multidrop connection to more than one S7 MPI as shown in the Figure 2.
If you want to make use of this possibility you need to:

1. select the option “Project/Controller Setup” (see Figure 1);
2. make sure that the “Access PLC via MPI address” is selected;
3. click on the option “Access Multiple PLCs”;
4. specify the addresses of all the PLCs that you want to access.

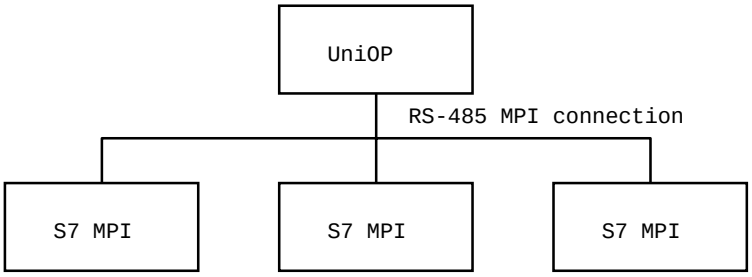

Figure 2. Multidrop Connection

2 Communication status 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:

00 **No errors**
Normal communication.

04 **Negative acknowledgement to request**
Occurs when the PLC does not accept the request from UniOP. This error should not occur, but if it does, it could be due to the PLC not having the resources to process the request.

05 **Time-out error to request**
Indicates that the communication line has been broken or the PLC has had a power fail.

06 **Ill formed response**
Means that the response data was received from the PLC but the amount of data received was not what was expected. This error occurs if UniOP tries to access data outside the valid range of the PLCs memory, for example, a non-existent data block.

07 **General communication error**
Should never happen; it indicates an error in the software.

08 **MPI chip error protect update**
Indicates an error in the low level handshaking with the internal MPI chip during the ProtectUpdate operation.

09 **MPI chip error send to lower level**
Indicates an error in the low level handshaking with the internal MPI chip during a low level chip access operation.

10 **Negative acknowledgement in response**
Occurs when the PLC accepts the request from UniOP but after processing the request returns a NAK.

15 **Time-out error on chip initialisation**
Indicates a time-out during the network initialisation phase. Probably indicates that the communication line has been broken or the PLC has had a power fail.

3 Technical Data and Connection Information

As introduced in the previous chapters, you must use a special communication module to enable MPI communication through the Aux Port of the operator panel.
There are two communication modules available: TCM01 and TCM07.
The difference between the two modules is the optical insulation which is available only in the TCM01.
The main technical specification on the UniOP interface using TCM01 and TCM07 modules is shown in Table 3.

	TCM01	**TCM07**
Baudrate	187.5Kps	187.5Kps
Optical Insulation	Yes	No

Table 3. Technical Specifications

The non-insulated TCM07 module can be used if a point-to-point connection between one operator panel and only one PLC is to be realised. The communication cable to be used for the point-to-point connection is CA128.

Note: *The Bus Connector 6ES7972-0BB20-0XA0 can be used for the PLC connector in order to provide the additional connection to the programming unit. The use of the special Profibus connectors 6ES7972-0BA20-0XA0 available from Siemens is highly recommended. Using such connectors will make wiring easier and will provide for the appropriate termination resistors to the network cable. Note that termination resistors are not shown in the diagram of the CA128 cable.*

In other cases where a more complicated network topology has been implemented, the optoisolated TCM01 modules are to be used.

4 Requirements and Compatibility

The Simatic S7 MPI protocol is included in the Designer DLL file UPLC55.DLL. The current release level is 3.04 for the communication driver and 5.01 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 TCM01 or TCM07 is required. The communication driver contained in UPLC55.DLL will not work with other communication modules.
The UniOP panel must have hardware type –0045 and firmware version number 4.10 or higher to support the TCM01 and TCM07 modules.

5 CPU specific information

5.1 Accessing I/O in the S7-400

In the S7-400 series, whenever the panel performs an MPI request to access an I/O module not configured, a communication error will be reported.
The situation is described in the example below.
Consider a system with an S7-400 CPU and Profibus DP distributed I/O based on 16DI modules.
The I/O mapping is defined as follows:

- Module 1: I0.0 (input bit 1), …, I1.7 (input bit 16);
- Module 2: I4.0 (input bit 1), …, I5.7 (input bit 16).

Note that there is a gap in the I/O map where there are no configured inputs (input bytes 2 and 3).
If a Designer project has two variables in the same page referring respectively to the first input byte I0.x and to the third input byte I4.x, the UniOP will try optimise the access reading a block of data (I0 to I4) and therefore will also try to read input bytes 2 and 3 which are not configured in the CPU.
In a situation like this the Designer will try to optimise the read access and generate a request to read all I/O points from module 1 and module 2 with a single MPI command.
As a consequence, an error code will be returned by the S7-400 CPU.
There are two possible work-arounds:

a) Change the I/O mapping to avoid the gaps.
b) Avoid putting non-contiguous I/O points in the same page.