Introduction

This application note describes how a communication is established between a local PC and a remote PROCESS-PLC over a phone line.

If you want to use the modem for the controller families NANO, DELTA and PASE-E, it is important that the serial interface supports the '8E1' data format (1 start bit, 8 data bits, even parity and 1 stop bit).

Important Notes

Due to the great variety of modem types available on the market, it is unfortunately not possible to specify a complete, universal initialization command because each manufacturer implements the modem's command set in a different way.

We tried, however, to generate a documentation of the configuration steps that is as complete as possible. For more detailed information about modem commands and their syntax, please refer to the manual of the respective modem.

Note on Safety

Danger

No safety-critical works such as commissioning of axes may be carried out using the modem connection.

Operating Behavior and EMC

Important

It is up to the user to select the most appropriate modem for the intended application, and above all to check electromagnetic compatibility (EMC). (Commercially available modem types usually do not meet the requirements for industrial use !)

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Electrical Connections

Overview

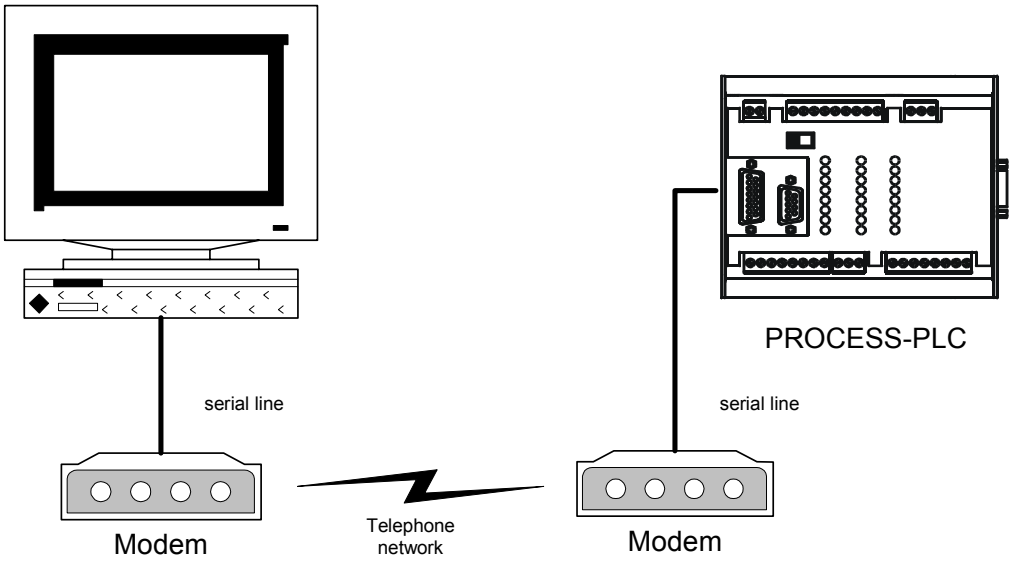

Figure 1

Connecting Cable for Modem and PROCESS-PLC

A special cable is necessary to connect the modem with the PROCESS-PLC, i.e. a “null modem cable” which must be manufactured by yourself.
Here, the transmitting and receiving wires are crossed. Both ends of the cable are equipped with a SUB-D male connector.

Wiring Diagram

Modem 9 pin		Modem 25 pin	Controller 9 pin	
3	TXD	2	2	RXD
2	RXD	3	3	TXD
5	GND	7	7	GND
7	RTS	4		
8	CTS	5		
6	DSR	6		
4	DTR	20		
1	DCD	8		

- Connection to DSR - DTR - DCD only necessary when using a WESTERMO modem.
- Make DSR - DTR wire connection only when a telephone connection cannot be established in another way (applies e.g. for Austria) .

Figure 2

Connecting Cable for Modem and PC

A commercially available modem cable as delivered with the modem can be used.

Wiring Diagram

PC 9 pin		PC 25 pin	Modem 9 pin		Modem 25 pin
3	TXD	2	3	TXD	2
2	RXD	3	2	RXD	3
5	GND	7	5	GND	7
7	RTS	4	7	RTS	4
8	CTS	5	8	CTS	5
6	DSR	6	6	DSR	6
4	DTR	20	4	DTR	20
1	DCD	8	1	DCD	8
9	RI	22	9	RI	22

Figure 3

Explanation of Terms

Abbreviation	Designation	Meaning
TxD	Transmit Data	Transmit data from the PC to the modem
RXD	Receive Data	Receive data from the modem to the PC
GND	Signal Ground	Signal ground
RTS	Request to Send	Command from the PC to the modem: Data will be transmitted on the serial interface.
CTS	Clear to Send	Message from the modem to the PC: Modem is ready to transmit data on the serial interface.
DSR	Data Set Ready	Message from the modem to the PC: Modem is ready
DTR	Data Terminal Ready	Message from the PC to the modem PC is ready. (If this signal is inactive, the modem ignores other signals on the serial interface)
DCD	Data Carrier Detect	Message from the modem to the PC: The connection has been established
RI	Ring Indicator	Message from the modem to the PC: Incoming call

Configuring the Modem

Protocol Types

There are two different protocols that need to be taken into account when configuring the modems.

pcom3 Protocol: MIKRO, PASE-E Controllers (old protocol)

In this protocol, the communication between PROCESS-PLC and SYMPAS has the data format '8N1' (1 start bit, 8 data bits, no parity, 1 stop bit).
This data format is supported by any modem. Thus, configuration is reduced to the following points:

a) Deactivating the data flow control and modem result codes of both modems.
b) Ignoring the state of the DTR line (Data Terminal Ready) of the modem on the PLC side.
c) Entering the number of rings (modem register S0) of both modems.

Point a) causes the modems to suppress messages to SYMPAS or the controller which they do not understand.
Points b) and c) ensure that the modems accept a call via the phone line.

pcom5 Protocol: NANO, DELTA, PASE-E Controllers (new protocol)

In this protocol, the '8E1' data format (1 start bit, 8 data bits, even parity, 1 stop bit) is used to exchange data between PROCESS-PLC and SYMPAS. This protocol offers additional transmission reliability due to the parity check.
This data format has an overlength (11 bits instead of 10 bits are transmitted per character compared to the ’8N1’ data format) and must be preset in the modem separately. Additionally, the following configurations are necessary:

a) Deactivating the data flow control and modem result codes of both modems.
b) Ignoring the state of the DTR line (Data Terminal Ready) of the modem on the PLC side.
c) Entering the number of rings (modem register S0) of both modems.

Point a) causes the modems to suppress messages to SYMPAS or the controller, which they do not understand.
Points b) and c) ensure that the modems accept a call over the phone line.

SYMPAS

SYMPAS provides a terminal mode that serves to input all modem commands. To activate this mode, select *Special / Terminal* from the menu.

Settings in SYMPAS necessary to configure a modem

If a brand-new modem is connected to SYMPAS, the controller type must be set to "MIKRO" to allow that the modem can understand the configuration commands. To activate the respective dialog window, select *Special / Settings...* from the menu or press the key combination *Ctrl-E* .

The modem responds to all commands with “OK” until the configuration command “Disable modem result codes” is issued.

Working with SYMPAS via Modem

The SYMPAS editor can be used to edit programs. The connection is slightly slower than when using a direct RS232 connection but all SYMPAS options are available.

When using slower modems (< 14440 bit/s), only quit the terminal mode when the DCD line is active or when the DCD-LED on the modem is lit (DCD = Data Carrier Detect). This signal indicates that a connection via phone line was established successfully and that a data carrier signal from the remote end is present. If the terminal mode is quit too early and setup mode is active, the telephone connection will be disconnected immediately. The reason is that the modem receives data from SYMPAS via the serial line while it is establishing the connection. During connection setup, any data received by the modem is a signal to disconnect the connection.

Terminating the Modem Connection

To terminate the telephone connection properly, it is necessary to change to terminal mode again.
Type the line '**+++ ATH**' and confirm by pressing the Enter key.

Another, though not recommended, possibility to terminate the connection is to simply switch off one of the two modems.

Note

If the telephone connection is terminated by the "ATH" command in terminal mode and the mode changes to the SYMPAS setup mode, the phenomena might occur that SYMPAS continues to indicate "NANO B V…running" or something similar. The display changes to "No Sync" only after some time (even after some minutes) or when the mode is changed manually (e.g. to the editor and back). Trying to set or read registers, flags, inputs or outputs does not change this behavior but, of course, provides undefined results.

Saving the modem configuration permanently

Save the correct modem configuration in the non-volatile memory of the modem to ensure that it is retained also the next time the modem is turned on. To do this, issue e.g. the command AT&W or AT*W0.

Exemplary Configurations for Various Modem Types

The following exemplary configurations do not represent device recommendations by Jetter AG.

ELSA MicroLink 56k i

The ELSA MicroLink 56k i was specifically designed for industrial use and provides higher immunity to interference with respect to EMC than commercial office modems.

pcom3 Protocol

The following configuration is necessary:

Modem Command	Explanation
AT&F	Load factory default settings
AT&D0	Ignore DTR status change (Note for Austria: This command is not possible, see Figure 2)
AT+IFC=0,0	No handshake on serial interface
ATS0=1	Accept call after 1 ring
ATX3	Ignore dial tone (for extensions)
ATQ1	Disable modem result codes
AT*W0	Save the current configuration in the non-volatile memory of the modem

pcom5 Protocol

This modem type supports a “Pseudo”11Bit mode, i.e. the ‘8E1’ data format is used on the serial interface to the PC/controller, and the ‘8N1’ data format is used on the interface on the telephone side. The data is exchanged across the telephone line independent of the serial interface. This allows to make use of all advantages the modem provides on the telephone line, such as transmission speed, handshake and error correction.
The 8E1 data format is only active during data transmission.

The entire configuration must be performed in the standard data format 8N1. Therefore, SYMPAS must be set to the controller type MIKRO (see section “SYMPAS”).
The following configuration is necessary:

Modem Command	Explanation
AT&F	Load factory default settings
AT&D0	Ignore DTR status change (Note for Austria: This command is not possible, see Figure 2)
AT+IFC=0,0	No handshake on serial interace
ATS53=1	8E1 data format on serial interface
ATS0=1	Accept call after 1 ring
ATX3	Ignore dial tone (for extensions)
ATQ1	Disable response from the modem
AT*W0	Save the current configuration in the non-volatile memory of the modem

Operation

The following commands cause the modem to attempt a call or terminate a telephone connection:

Modem Command	Explanation
ATDTxxx	Call no. xxx by using tone dialing
+++ATH	Hang up
AT%V	Display firmware version (should be at least 1.15)

Industrial Modem WESTERMO TD-32

The WESTERMO company produces modems for installation on DIN-rails. The advantage of this kind of modem is that configuration is mainly performed via DIP switches.
Please refer to the TD-32 manual for correct identification of the DIP switches.

Wiring

Refer to the section "Wiring Diagram" on page 3.

The following connections need to be made:

- SUB-D male connector between modem and PLC: TxD, RxD and GND
- Wire connection: RTS - CTS
- Wire connection: DSR - DTR - DCD

pcom3 Protocol

DIP-Switch Setting
Remove the cover from the TD-32 and set the sliders as follows:

SW3: Set DIP-sliders 1 and 3 to ON
SW4: Set DIP-sliders 2, 3 and 8 to ON Set all other DIP-sliders to OFF
SW5: Set DIP-slider 4 to ON

Software Configuration
The following configuration is necessary:

Modem Command	Explanation
AT&F	Load factory default settings
AT&K0	No handshake on serial interace
ATS0=1	Accept call after 1 ring
ATX3	Ignore dial tone (for extensions)
ATQ1	Disable modem result codes
AT*W0	Save the current configuration in the non-volatile memory of the modem
AT*W1	Save the current configuration in the non-volatile memory of the modem

pcom5 Protocol

DIP-Switch Setting
Remove the cover from the TD-32 and set the sliders as follows:

SW3: Set DIP-sliders 1 and 3 to ON
SW4: Set DIP-sliders 2, 3 and 7 to ON Set all other DIP-sliders to OFF
SW5: Set DIP-slider 4 to ON

Software Configuration
The following configuration is necessary:

Modem command	Explanation
AT&F	Load factory default settings
AT&K0	No handshake on serial interace
ATS0=1	Accept call after 1 ring
ATX3	Ignore dial tone (for extensions)
ATQ1	Disable modem result codes
AT*W0	Save the current configuration in the non-volatile memory of the modem
AT*W1	Save the current configuration in the non-volatile memory of the modem

Some Important Modem Commands

Important Note

For configuration commands, please always consult the manual delivered with your modem since different types of modems might work with different commands.

General Commands

(These commands apply to most modem types)

Dialing from the main line

ATDP<Tel.#> Pulse dialing method
ATDP<Tel.#> Tone dialing method

Dialing from an extension in a private telephone system (private branch exchange, PBX)

ATDP0W<Tel.#> Pulse dialing method
ATDT0W<Tel.#> Tone dialing method

Connection to the central office by dialing 0. (The modem waits for the dial tone of the central office before dialing the telephone number.)

ATX3DP<**0**+Tel.#> Pulse dialing method
ATX3DT<**0**+Tel.#> Tone dialing method

The modem does not wait for the dial tone of the central office but dials the telephone number at once. When dialing from an extension, a ‘0’ is prefixed to the telephone number.

Terminating a modem connection

ATH

Usually, the escape sequence ‘+++’ (without Enter key) must be entered before the command is issued to trigger the modem to change from data mode to command mode.

Resetting the modem

ATZ

The configuration is loaded from the non-volatile memory. Any modem configuration that has been modified in the meantime is overwritten.

Saving the modem configuration

AT&W First memory bank
AT*W0 First memory bank
AT*W1 Second memory bank

The current modem configuration is saved in the non-volatile memory. Therefore, this configuration is retained when the modem is switched off and is automatically recalled the next time the modem is switched on. For this purpose, most modems offer two independent memory banks to allow that two modem configurations can be saved.

Querying the value of a modem register

ATS<Reg.#>**?**

Displays the content of the specified modem register.

Write a value to a modem register

ATS<Reg.#>=<value>

Writes the value to the modem register.

Disable modem result codes

ATQ1

All messages sent by the modem to the PC are suppressed.

Enable modem result codes

ATQ0

Exemplary Program

The function in this programming example triggers the connected modem to dial a telephone number over the user-programmable serial interface, and then enables the serial interface for the communication with SYMPAS.

The exemplary program was developed and tested for a PROCESS-PLC NANO-B or NANO-C.
For other controller families, the register numbers must be adapted accordingly.

Program Listing

```
 0: DEF_FUNCTION [TelephoneDial, TD]
     Par: TelNumberPtr
     Var: help, Digit, ByteCounter
 1:       ;
 2:       ; This function dials a telephone number
 3:       ; over the user-programmable RS232 of the
 4:       ; Nano-B and returns to the
 5:       ; pcom-5 mode. The TelNo. must be
 6:       ; present in a text register and is
 7:       ; passed along as parameter.
 8:       ;
 9:       REGISTER_LOAD [10000 with 1]              ;PC-IO PRIM-protocol
10:       REGISTER_LOAD [10001 with 6]              ;Baud rate 9600
11:       REGISTER_LOAD [10002 with 2]              ;8 bits even, 1 stop
12:       DISPLAY_TEXT [#9, cp=0, "atdt"]
13:       REGISTER_LOAD [help with RR(TelNumberPtr)]
14:       REG help
15:       =
16:       REG help
17:       WAND
18:       b00000000000000011111111                  ;Extract and save
19:       REGISTER_LOAD [Digit with R(help)]        ;length of TelNo.
20:       REGISTER_LOAD [ByteCounter with 3]
21:   IF
22:       REG Digit                                 ;no TelNo. available?
23:       =
24:       0
25:     THEN
26:       REG TelephoneDial                         ;then error
27:       =
28:       -1
29:       RETURN
30:     ELSE
31: LABEL Loop
32:       REGISTER_LOAD [help with RR(TelNumberPtr)]
33:   IF
34:       REG ByteCounter                           ;extract lower digit
35:       =                                         ;in the register
36:       1
37:     THEN
38:       REG help
39:       =
40:       REG help
41:       WAND
42:       b00000000000000011111111
43:   IF
44:       REG ByteCounter                           ;extract digit in the middle
```

```
 45:       =                                        ;of the register
 46:       2
 47:     THEN
 48:       REG help
 49:       =
 50:       REG help
 51:       WAND
 52:       b00000000111111100000000
 53:       REG help                                 ;and shift to the right
 54:       =
 55:       REG help
 56:       /
 57:       256
 58:   IF
 59:       REG ByteCounter                          ;Exctract upper digit
 60:       =                                        ;in the register
 61:       3
 62:     THEN
 63:       REG help
 64:       =
 65:       REG help
 66:       WAND
 67:       b11111111000000000000000
 68:       REG help                                 ;and shift to the right
 69:       =
 70:       REG help
 71:       /
 72:       65536
 73:     THEN
 74:       REGISTER_LOAD [10003 with R(help)]       ;Output digit
 75:       REG ByteCounter                          ;next byte
 76:       =
 77:       REG ByteCounter
 78:       +
 79:       1
 80:       REG Digit                                ;and one digit less
 81:       =
 82:       REG Digit
 83:       -
 84:       1
 85:   IF
 86:       REG Digit                                ;no digit available anymore?
 87:       =
 88:       0
 89:     THEN
 90:       GOTO Exit                                ;then dialing completed
 91:     ELSE
 92:   IF
 93:       REG ByteCounter                          ;if ByteCounter too large
 94:       =
 95:       4
 96:     THEN
 97:       REG ByteCounter                          ;then adapt ByteCounter
 98:       =
 99:       1
100:       REG TelNumberPtr                         ;and fetch new
101:       =                                        ;text register
102:       REG TelNumberPtr
103:       +
```

```
104:       1
105:     THEN
106:       GOTO Loop
107: LABEL Exit
108:       REGISTER_LOAD [10003 with 13]             ;end dialing
109:   WHEN
110:       REGZERO 10004
111:     THEN
112:       REGISTER_LOAD [10000 with 0]              ;then PC-IO pcom-5
113:       REG TelephoneDial                         ;and end of function
114:       =
115:       0
116:       RETURN
117: END_DEF
118:       ;
119:       ;
120: TASK 0 ----------------------------------
121:   WHEN
122:       E 101
123:     THEN
124:       TelephoneDial [TelNumberPtr=telno]
125:       DELAY 50
126:       GOTO 0
      End of program
```

Symbol file

```
telno           100 = "92"
Loop            !
Exit            !
```