

Modem application with PCD2.T813 and PCD2.T850

Revision 005

The document is regularly updated with new experiences and recommendation and is available over Internet. To be up to date, users must regularly get the newest version.

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Note 1:

The PCD2.T850 module is not a real modem but an ISDN terminal adapter. However, in this document, the term of 'Modem' applies to both analogue and ISDN devices.

Note 2:

This document is subject to modifications subsequent to new experiences and should therefore be regularly updated to the agents and end users.

1 History

01.02.2001 Revision 001

Initial version

14.03.2001 Revision 004

First version for general distribution.

28.05.2001 Revision 005

Init string for T813 modem changed (From &F to &F1) due to FW change in the modem.

Explanation about various initialization strings extended.

2 Introduction

Experiences have shown that the commissioning of a Modem application is a very tricky task. The use of the Modem library make the task of creating the PCD program easier, but in the other hand, the application becomes always complex and versatile.

The unlimited possibilities of combinations between PCD's, peripherals, modems, telephone networks, protocols and user applications make simply impossible to apply cooking receipts. One cannot expect that everything will work in a correct and stable manner in any circumstances. The final solution is therefore a result of analyzing and experiencing of the normal and abnormal situations. In numerous cases, the perfect solution doesn't exist and compromise must be accepted.

This document reports, experiences and useful information for modems applications with the PCD2.T8xx modems. It should be a resource of knowledge for end users as well as for technical supports. It does not only gives clear statements and instruction but also points out some critical situations that can only be solved by the end user it self.

Further documents are also important reference for the understanding of the working principle of a modem application in a PCD.

- Modem manuals
- S-Bus manual
- Manual and Help of the Modem library
- Help of the Configurators (Online and Offline)
- Workshop documents

3 Basic notions

This chapter is not a workshop document for Modem user. It just point out some important aspect that should be considered as basic notion as to get chance to understand how a modem application works and why it may not work. Before to come to more technical aspect, consider the two basic precepts when applying modem technology.

3.1 *Precept 1*

A modem application cannot be standardized once for all and be applied to the entire life of an installation and also to subsequent projects. Various external facts and events will cause problem to the modem application and will require to adapt some parameters, the initialization strings, the installation and even the application program.

Example :

- Change of the telephone installation in the building
- Modem type not anymore available for the new applications or for replacement
- Incompatible change of the partner station (Supervisor, Service center)
- Bug fixing in PCD firmware, modem firmware and libraries

3.2 *Precept 2*

Even with all possible prevention, a well debugged application program and the best initialization string, nobody can ensure to establish a modem connection with a given partner at a given time. Nevertheless, this must not be a reason for neglecting the minimum effort to be provided during putting a modem application in operation.

3.3 *S-Bus configuration*

The clear understanding of the S-Bus and especially S-Bus PGU configuration is necessary. Even if S-Bus PGU is not used, this feature may interfere with modem control and may avoid the application to work.

When combination of S-Bus PGU with the Modem Library is involved (almost all cases) the so called 'Modem+' feature is involved as to allow the sharing of the modem between the firmware and the Modem Driver.

3.4 *S-Bus modes*

Due to historical reason, the PCD systems supports 3 different S-Bus modes. It is important to know the possibilities and restrictions of each of this 3 modes.

3.5 Modem reset and initialization

A important condition of good working of a modem is the correct initialization of the Modem. The effects produced by the various possible reset and/or initialization of a modem must be clearly studied. Further explanations are given in the following chapter.

3.6 Modem hardware reset

Some modem situations and bad initialization may cause the modem to be in an undefined state or to be simply deadlocked. To solve such situations it is strongly recommended to use the Power down hang up of the Modem Library. Read the Help file of the modem library for more details.

3.7 Control lines and handshakes

As for digital and analogue signals, the cabling is the source of many trouble with Modem. The correct cabling is an important condition for a good functioning. If applicable, the differences between a full and a reduced handshake must be clear. When using intermediate cabling, like for serial analyzer, ensure that all control lines are going through.

4 Modem initialization.

Bad initialization strings is the source of numerous problems encountered with Modem application. Before to look for the correct initialization string it is important to understand the basic principle of initializing a modem.

Before to send a command to a modem, it is necessary to ensure that the modem is ready to receive and to execute the command. The therefore, the task of controlling the modem is to know at each time in which state the modem is. The firmware and the modem library ensure the correct sequencing of the initialization. The content of each string however is under the responsibility of the user.

Power up of the PCD

When the PCD is powered up, it cannot know in which state the modem is. Therefore, it will start by initializing the modem.

Power up of the Modem

The PCD can only detect a power down and a power up of the modem if the control lines are correctly connected between Modem and PCD:

At power up, the modem will initialize itself using a configuration which can be manually modified in the modem. See modem manual. At power up of the Modem, the PCD, will re-initialize the modem and this will overwrite the default modem initial state.

Which initialization strings are used ?

It is important to know that, two initialization mechanisms exist (the firmware and the modem driver) and two sets of the initialization string are defined. The initialization strings of the firmware are defined by the online configurator, the configuration file editor (PG4) or the hardware settings (PG5). The initialization strings for the modem driver of the Modem Library are defined in the file MODMBASE.DAT.

The rules are:

- If the serial line is configured as S-Bus PGU, the initialization is done by the PCD firmware.
- If the serial line is NOT configured in S-Bus PGU, the initialization is done by the modem driver of the Modem Library.
- If the DTMF+PGU standby mode is used, the modem driver re-initialize the modem in voice mode after the firmware initialization.
- Before each outgoing call, the modem is initialized by the modem driver. In this case, the alternate initialization string can be used.
- After each outgoing call, the modem is re-initialized depending on the PGU configuration (see above)

Initialization sequence.

The initialization sequence executed by the PCD is slightly different for the FW and for the Modem Library.

Initialization sequence of the FW

- Put the modem in command mode (+++)
- Send the Reset string
- Send the initialization string

Initialization sequence of the Modem Library

(except for the DTMF mode)

- Put the modem in command mode (+++)
- Send the Reset string
- Send the initialization string
- If it is an ISDN adapter, send the MSN

Initialization sequence of the Modem Library for the DTMF mode

- Put the modem in command mode (+++)
- Send the Reset string
- Send the initialization string
- Set the modem in voice mode

Important initialization and test commands

String valid for PCD2.T813 and PCD2.T850.

Name	Command	Comment
Reset	ATZ<CR> ATZ1<CR>	This command reset the modem as if it where switched of and on again. It loads the profile 0 or 1. This is the typical reset command compatible to almost all modems. Don't forget that the profiles can be manually change in the modem memory. Therefore, we are not 100% sure in which state the modem is.
Factory settings	AT&F<CR> AT&F1<CR>	This loads the factory settings 0 or 1 in the modem. These settings cannot be changed and so we are sure about the modem state. However, note that some parameters are not affected by this command.
Write profile into EEPROM.	AT&W0<CR> AT&W1<CR>	This command allow to save the current settings in the EEPROM memory of the modem. This command should only be used in special cases. In a normal case, the initialization string should start with &F and this will overwrites the former loaded profile.
Define profile.	AT&Y0<CR> AT&Y1<CR>	These command defines which profile is loaded at power up of the modem. This command should only be used in special cases.
Display settings	AT&V<CR>	This is not a initialization command but a useful command to display the current settings with a terminal program.
Reset profile 0	AT&FW0<CR>	This command will activate the factory settings and save it in the profile 0.
Modem information	ATIn n= 0 to 6	This is not a initialization command but a useful command to display modem information (like firmware version) with a terminal program.

Other remarks

It is not a good idea to put all commands in the initialization string. The length of a command line is limited by the modem. Therefore, only changes from factory settings should be included.

It is important to put the factory settings command at the beginning of the string, so the other commands are not overwritten by the factory settings.

5 Initialization strings

5.1 Generalities

For the PC modem, handled by PG4, the initialization strings are introduced in the modem list.

For the PC modem, handled by PG5, no initialization strings must be defined, the modem is handled by the CAPI port of Windows. Some S-Bus specific parameters like timeout must still be adjusted manually.

In PG4, for the PCD modem controlled by the FW, the initialization strings are introduced with the Online Configurator or with the Configuration File Editor when defining S-Bus PGU with Modem.

In PG5, for the PCD modem controlled by the FW, the initialization strings are introduced with the Online Configurator or in the Hardware settings when defining S-Bus PGU with Modem.

Note that (for PG4 and PG5) the initialization strings are also stored in a file on the PC itself. The configuration file (PG4) or the Hardware settings (PG5) will only keep a reference to the defined modem. Therefore, modifications must be manually updated when a project is moved to another PC. The best way to display the effective initialization string stored in the PCD is to use the Debugger and the command 'Display S-Bus'.

In the PG4 and PG5 the control characters are inserted in the strings with a backslash (\).

For the modem library, the initialization strings are located in the MODMBASE.DAT file. The control characters are introduced with the arrow brackets (<...>). Note also that some strings are defined as text ("text string"), have a variable length can be defined on several lines. Other are ASCII constants ('CNST') and cannot have more than 4 characters.

Special characters :

PGx	Modem Library	Description
\r	<CR>	To sends a Carriage Return. Attention ! Different in PGx and in the Modem Library.
\l	<LF>	To sends a Line Feed. Attention ! Different in PGx and in the Modem Library.
\\		In PGx, to send a single backslash.
	<> and <<	In the Modem Library, to send a '>' and a '<' character.

The following information are valid for the S-Bus Data mode only. To prevent the PG4/PG5 to use the Break or the Parity mode over modem, the corresponding options must be unchecked in the Modem definition.

5.2 PCD2.T813

Factory settings

After factory settings 1 is activated (AT&F1), the following parameters are set and can be displayed by the command AT&V:

```
B0 E1 L1 M1 N1 Q0 T V1 W0 X3 Y0 &C1 &D2 &G0 &J0 &K3 &Q5 &R1 &S0 &T5 &X0 &Y0
S0=000 ... S25=005 ...
```

Important settings for use with PCD are shown in bolt. *Settings changed by the initialization string or by an option in the mode driver are in italic.*

Command	Description
B0	CCITT modulation
E1	Echo ON
L1	Speaker to low level. Not applicable to the PCD2.T813
M1	Speaker activation. Not applicable to the PCD2.T813
Q0	Quiet control. With Q0 response are sent to PC/PCD. With Q1 no response is sent. For the Modem library, ring, busy and no carrier will not be displayed with Q1. It is important to set Q1 for modems connected with reduced handshake.
<i>T</i>	<i>Tone dialing. This settings can be changed with the corresponding option in the Modem Driver. Today, almost all PSTN supports tone dialing. Be careful with old PSTN.</i>
V1	Response in text form. Should not be changed without particular reason.
W0	Connect response form. With W0 only the baudrate is returned with the connect message.
X3	Response codes. X3 will also reports NO DIALTON and BUSY. This command can be changed by using the corresponding option in the Modem Driver. Same remarks as for the Q command.
Y0	No special Break handling. As security, disable also Break mode in the PGx modem definition.
&C1	DCD indicates 'Data Carrier Detected'. DCD is used to detect incoming calls and successful connection for outgoing calls.
&D2	The modem hangs up when DTR drops down. An incoming call is accepted only with DTR High.
&G0	No guard ton
&K3	RTS-CTS flow control between PC/PCD and Modem enabled. <i>This setting is changed to &K0 in the initialization string.</i>
&R1	RTS signal is ignored. CTS is handled if flow control is used.
&S0	DSR always on. The DSR signal is ON as long as the modem is connected to the PCD and powered ON. This allows to detect modem presence.
&Y0	Reset and power up activate profile 0. It is important to keep a standard profile 0 as to prevent a problem when the initialization string is sent. The initialization string will overwrite this profile

	with the &F command.
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<i>S0=000</i>	The modem is not in auto-answer mode by default.
<i>S25=005</i>	A DTR OFF signal is ignored for 0.05 sec. This will be changed by the command <i>S25=100</i> .

Note that further parameters and S-Register are relevant but not listed with the AT&V command. The following commands are also listed but not specified in the manual :

N1 &J0 &Q5 &T5 &X0.

Caution : The important parameter &Sx has been changed in the version 008 in the Modem FW. Former versions had the settings &S0 in the factory settings 0 and worked fine on PCD. Since version 008 this parameter is set to &S1 in the factory settings 0 but is still set to &S0 in factory settings 1. Therefore, &F has been changed to &F1 (factory 1) in the Modem Library SP 1.0.410.

Recommended initialization strings for PCD2.T813

Recommended commands for FW strings :

Reset :	ATZ\r
Initialization :	AT&F1%C0&K0\N0S25=100S0=2\r

Recommended strings for the Modem Library :

Reset :	"ATZ<CR>"
Initialization :	"AT&F1%C0&K0\N0S25=100<CR>"

Explanation :

Command	Description
AT	Command prefix.
Z	Resets the modem and load the profile 0. The profile 0 can be modified manually. However, it will be overwritten by the factory settings with the &F command.
&F1	Load factory settings 1. This settings is fixed in the modem. See above.
%C0	No data compression allowed. Data compression can cause problem with S-Bus protocol.
&K0	No flow control between PC/PCD and Modem. Flow control XON-XOFF as well as RTS-CTS are disabled. XON-XOFF characters may occur in S-Bus telegrams and can stop data transmission to the remote modem.
\N0	Disable error correction. Error can cause problem with S-Bus protocol as well as with some SMS Service Center. It is recommended to force error correction to be disabled. Don't forget to insert a second back slash in the FW string (\\N).
S25=100	Set DTR OFF delay to 1 sec. It means that a DTR OFF signal of up to 1 sec is ignored by the Modem. After 1 sec, the Modem hangs up the line. The Modem Library sets DTR OFF for 2 sec to hang up the line. Therefore this value must be lower than 200.
S0=2	Load register 0 with value 2. This will put the modem in auto-answer mode. The modem will answer all incoming call after 2 ring signal. In the modem library, this command is given by a separate string because the modem is not always initialized in auto-answer mode. The value 1 is also accepted but the modem will not answer before the 2 nd ring.

Further optional commands

These optional commands can be inserted to solve some problems and in some special cases. See note 1.

Command	Description
E0	Echo OFF. The FW as well as the Modem library does not need the echo from the modem. However, for manual test with a terminal program and for analyze, it is useful to have the echo from the modem as confirmation.
X4	With X4, a clear response is also returned for a blacklisted numbers. This can be set directly in the Modem Driver.
&D0	The modem will ignore DTR. If the DTR is not connected, the modem may not work. This command can be used in place of S25=xxx for modem connected to a line with reduced handshake (Line 0, 2 or 3). See note 2.

Note 1

For Pager and SMS calls, the optional initialization string 1 to 5 can be used.

Note 2

If two modems, or more, are used, it may be necessary to have a different initialization string for modems with reduced handshakes. In this case, copy the T813 strings to a user modem for the second modem and make the necessary modifications.

5.3 PCD2.T850

Factory settings

After factory settings 0 (&F), the following parameters are set and can be displayed by the command AT&V:

```
B10 E1 Q0 V1 W0 X4 &C1 &D2 &K3 &R1 &S0 %B0 #R0
S0:001 ...
```

Important settings for use with PCD are shown in bolt. *Settings changed by the initialization string or by an option in the mode driver are in italic.*

Command	Description
B10	Protocol X.75.
E1	Echo ON
Q0	Quiet control. With Q0 response are sent to PC/PCD. With Q1 no response is sent. For the Modem library, ring, busy and no carrier will not be displayed with Q1. It is important to set Q1 for modems connected with reduced handshake.
V1	Response in text form. Should not be changed without particular reason.
W0	Connect response form. With W0 Results are presented with extended result codes but no ISDN address.
X4	Response codes. X4 will also reports all messages like NO DIALTON and BUSY and with the line speed. This command can be changed by using the corresponding option in the Modem Driver. Same remarks as for the Q command.
&C1	DCD ON indicates ISDN connection is established and synchronized. DCD is used to detect incoming calls and successful connection for outgoing calls.
&D2	The modem hangs up when DTR drops down. An incoming call is accepted only with DTR High.
&K3	RTS-CTS flow control between PC/PCD and ISDM Module enabled. This setting is changed to &K0 in the initialization string.
&R1	CTS is always ON.
&S0	DSR always on. The DSR signal is ON as long as the modem is connected to the PCD and powered ON. This allow to detect modem presence.
%B0	Automatic baudrate detection enabled (autobauding).
#R0	

<i>S0=001</i>	The modem is in auto-answer mode by default. Furthermore, it will respond all calls unless an MSN number has been loaded.
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Note that further parameters and S-Register are relevant but not listed with the AT&V command.

Recommended initialization strings for PCD2.T850

Recommended commands for FW strings :

Reset :	ATZ\r
Initialization :	AT&FB10&K0\r

Recommended strings for the Modem Library :

Reset :	"ATZ<CR>"
Initialization :	"AT&FB10&K0S0=0<CR>"

Explanation :

Command	Description
AT	Command prefix.
Z	Resets the modem and load the profile 0. The profile 0 can be modified manually. However, it will be overwritten by the factory settings with the &F command.
&F	Load factory settings. This settings is fixed in the modem. See above. It will not reset the ISDN protocol and the MSN.
B10	X.75 protocol. The protocol is not reset to default by the &F command. Therefore, it is recommended to insert the B10 command in FW and library string in case it has been changed by a SMS call for instance.
&K0	No flow control between PC/PCD and ISDN Module. Flow control XON-XOFF as well as RTS-CTS are disabled. XON-XOFF characters may occur in S-Bus telegrams and can stop data transmission to the remote modem.
S0=0	Load register 0 with value 0. This will disable the auto-answer mode. For the FW string, the default value S0=1 is not changed. In the modem library, the ISDN module is put in auto-answer mode by a separate string because the modem is not always initialized in auto-answer mode.

Further optional commands

These optional commands can be inserted to solve some problems and in some special cases. See note 1.

Command	Description
B0	V110 asynchronous protocol.
B10	X.75-NL protocol (default).
B13	V120 protocol.
E0	Echo OFF. The FW as well as the Modem library does not need the echo from the modem. However, for manual test with a terminal program and for analyze, it is useful to have the echo from the modem as confirmation.
&D0	The modem will ignore DTR. If the DTR is not connected, the modem may not work. This command must be used for module connected to a line with reduced handshake (Line 0, 2 or 3). See note 2.

Note 1

For Pager and SMS calls, the optional initialization string 1 to 5 can be used.

Note 2

If two ISDN modules, or more, are used, it may be necessary to have a different initialization string for modules with reduced handshakes. In this case, copy the T850 strings to a user modem for the second module and make the necessary modifications.

Dial signal for ISDN Module

In the Modem Driver, there is an option to define the dial signal : Pulse or Tone. On an ISDN line, the dialing is done by sending a data telegram (no pulse nor tone). Usually, ISDN adapters accept ATDT (tone) as well as ATDP (pulse) as dial command. However, for better understanding, an ISDN option as been introduced and should be used with ISDN adapters. A simple ATD is then issued.

Load MSN in the ISDN Module.

By default, the ISDN Module will answer all incoming calls on the line. This is only acceptable if exactly one module is connected on the line. If several ISDN Module (or also phone devices) are connected on the same line, it is necessary to load the MSN on each device to be able to select the responding device for each call. In each device, the MSN is considered as valid if the defined digits match the last digits of the called numbers. Therefore, only the 2 last digits are usually required.

With the Modem library, use the corresponding Fbox to load the MSN in the ISDN Module.

If the ISDN Module is not initialized by the library (it's always the case when S-Bus PGU with Modem is configured), the MSN must be loaded in the Module manually (for instance with Hyperterminal) using the following commands. The MSN is automatically stored in non volatile memory. It will remain valid, even after power down, reset and AT&F command. It is cleared however with the AT&F1 command.

Command	Description
AT#Z=nn	Load the number nn in the Module.
AT#Z=*	The Module will accept all incoming calls (default).
AT#Z	Show the currently loaded MSN.

6 Open points

Command	Description
\G0	Disable Modem to Modem flow control XON-XOFF. Is it also necessary to disable XON-XOFF between modems ? What is the effect of this command?

What is the solution for a safe 'Modem watchdog' ? It should allows to get communication with the firmware (S-Bus PGU mode with Modem) even if the user program is lost and the modem is hanged up.

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