



SIGRAND

**SHDSL modem
Sigrand SG-16B**

**User's Guide
v. 2.5**

Novosibirsk
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How to use this Guide

To ease using this Guide the following notational conventions are provided here (icons as well as relevant fonts):

Icons

Icon	Meaning	Explanation
	Pay attention!	The text marked by this icon contains information making easy setup and maintenance of equipment
	Important information!	The text marked by this icon contains important information explaining details of operation of equipment or software. This allows to save your time and efforts while equipment setup.
	Do not make this!	Knowing this information allow you to avoid actions that can cause damage to hardware and/or personal injury.

Font usage

Designation	Explanation
Picture on the screen	This font shows contents of terminal screen while modem setup.
<u>Name of keyboard button</u>	This font shows computer keyboard buttons, e.g. "Enter" , which are used in the console management mode.
Select <i>Property</i> in the <i>File menu</i>	<i>Italic</i> notes the fragments of this Guide containing important information (together with the relevant icons). It also marks software buttons of menu in the text.
dsl stat	Bold font is used to designate modem management commands during a terminal session.



Before starting installation of the modem we recommend you to look for an updated version of this User's Guide as well as the firmware and the drivers available at our site www.sigrand.com

1. Modem description

The Sigrand SG-16B modem is a SHDSL-modem. It features an Ethernet-bridge and is designed to connect distributed local area networks as well as remote computers and other devices equipped with an Ethernet interface. The bridge can transmit VLAN IEEE 802.1Q tagged packets through the DSL interface and the Ethernet interfaces.

The SHDSL interface of the modem conforms to ITU-T G.991.2.bis standard and uses TCPAM (Trellis-Coded Pulse Amplitude Modulation) line coding.

Features of the TCPAM line coding:

The TCPAM line coding used by G.991.2 (G.SHDSL) compatible modems has a few modes. The modes differ in complexity of coding algorithm. The modes with larger number of modulation positions (TCPAM16, TCPAM32) are applicable for higher rates, the modes with less number of modulation positions (TCPAM4, TCPAM8) are applied for lower rates. Respectively, the more complicated the coding algorithm the worse the channel noise immunity and vice versa.

So take special attention to the TCPAM line coding algorithm selection while configuring the line rate. It may be necessary to change the line coding to achieve the best result.

Table 1 shows the line coding options and respective data rate ranges.

Table 1

Line coding	Data rate range (kbps)
TCPAM32	256 – 6016
TCPAM16	192 – 3840
TCPAM8	192 – 1216
TCPAM4	64 – 704



Manual line coding selection is available only in the console management mode – see chapter 3 of this Guide

Compatibility:

The Sigrand SG-16B modem line coding is compatible with all Sigrand SG-16 series and Granch SBNI16 series modems.



Limitations of compatibility:

Interoperability with the Granch SBNI16 modems is supported only within the compatible data rate range from 64 to 4608 kbps.

The modem features the following interfaces:

- one SHDSL interface (conforms to ITU-T G.991.2.bis standard) providing the data rate range from 192 to 5696 kbps and the optional extended range from 64 to 6016 kbps
- two Ethernet 10/100Mb (IEEE 802.3) interfaces with Auto-Negotiation and Auto MDI/MDI-X
- one EIA-232C (RS-232C) interface for modem management.

1.1 DSL interface specifications

Link type	point-to-point
Number of wires per line	2 (one pair)
Permitted cabling	any UTP
Line coding	TCPAM
Input/output impedance, Ω	135
Data rate range, kbps	64-6016
Data rate step, kbps	64
Transmission type	full duplex
Data transfer mode	synchronous, by packets
Packet type	HDLC
Checksum type	CRC32
Connector type	RJ-45
Galvanic decoupling transformer breakdown voltage, min, V	1500
Surge protector triggering voltage (differential), V	30

1.1.1 Maximum reach performance

Brief information about the maximum reach performance of the Sigrand SG-16B modem is shown on Table 2. The Bit Error Rate (BER) at the maximum reach is equal to or less than 10^{-7} . The specified reach is proved by testing at the Sigrand lab reference line. Full version of the rate table is available at our site www.sigrand.com. An actual reach may vary against the shown data due to variations of cable performance.

Table 2

Data rate (kbps)	Line coding	Rating	TPP50-0.4 cable (26 AWG)	TPP50-0.5 cable (24 AWG)
6016	TCPAM32	Length (km/ft)	1.8/3500	2.2/7200
		R (Ω)	476	420
4608	TCPAM32	Length (km/ft)	2.0/6500	2.6/8500
		R (Ω)	560	455
3072	TCPAM16	Length (km/ft)	3.0/9800	4.2/13700
		R (Ω)	840	736
2304	TCPAM16	Length (km/ft)	3.8/12400	5.4/17700
		R (Ω)	1064	945
1536	TCPAM16	Length (km/ft)	4.4/14400	6.4/20100
		R (Ω)	1232	1120
1024	TCPAM8	Length (km/ft)	5.0/16400	7.6/24900
		R (Ω)	1400	1330
512	TCPAM8	Length (km/ft)	5.8/19000	9.0/29500
		R (Ω)	1624	1575
256	TCPAM8	Length (km/ft)	6.6/21600	10.0/32800
		R (Ω)	1848	1750

128	TCPAM4	Length (km/ft)	7.4/24200	11.4/37400
		R (Ω)	2072	1995
64	TCPAM4	Length (km/ft)	7.4/24200	11.4/37400
		R (Ω)	2072	1995

1.1.2 File transfer performance

Performance of the SG-16B modem during file transferring by FTP protocol is shown on Table 3. The table contains average readings obtained on a line with error rate less than 10^{-7} .

Table 3

Line data rate (kbps)	File transfer performance (KBps)	Line data rate (kbps)	File transfer performance (KBps)
6016	700	1792	209
5696	662	1536	179
4608	536	1280	149
4096	478	1024	119
3584	418	768	89
3072	354	512	59
2560	304	256	29
2304	261	192	22
2048	234	128	15

1.2 Ethernet interface specifications

Interface type	10/100 Base-T
Number of ports	2
Data rate, Mbps	10/100
Duplex type	Half and full duplex
Compatibility	ANSI/IEEE Std 802.3
Auto MDI/MDI-X	available

1.3 Ethernet Bridge specifications

MAC-address table size	2048
Maximum packet size, bytes	1536
Packet buffer size, KBytes:	512 (340 packets)

1.4 RS-232C interface specifications

Baud rate	9600, 57600
Protocol parameters	8-N-1
Flow control	N/A
Connector type	RJ-45 (DB-9F with converter)

1.5 Power supply unit

Type	BPN-12-1V
Input voltage	220V/50Hz
Output voltage	12V
Maximum load current	1A
Polarity of central contact of connector	positive

1.6 Miscellaneous data

Overall modem dimensions:	
height, mm/in.	45/1.77
• width, mm/in.	225/8.86
• depth, mm/in.	165/6.5
Weight, g/lb	450/1
Weight with PSU, g/lb	1025/2.26
Power consumption, W	6

1.7 Shipment contents

Sigrand SG-16B modem	1 pc.
Power supply unit	1 pc.
Guide	1 pc.
Cable with converter RJ-45-DB-9	1 pc.
Package	1 pc.

1.8 Environmental specifications

The modem is designed to operate under office conditions as follows:

air temperature	10 .. 40 °C (50 .. 104 °F)
relative air humidity	up to 85 %
atmosphere pressure	84 .. 107 kPa (630 .. 802 mmHg)

1.9 Appearance, controls, indicators and connectors

The Sigrand SG-16B modem should be connected either to a computer equipped with an Ethernet or Fast Ethernet card or to an Ethernet-switch.



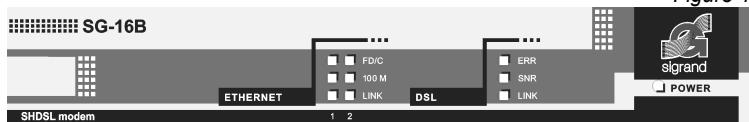
We recommend to connect the modem to an Ethernet switch, not a hub, since our equipment is optimized for interaction with Ethernet switches.

The modem is manageable by switches placed on the rear panel as well as by console management port (ch. 4.1). To manage the modem as well as to monitor its status you should have an ANSI-compatible terminal emulation software installed on your computer. Configure your terminal program according to ch. 1.3 of this Guide.

1.9.1 Front panel and indicators

The front panel indicators display the status of device operation.

Figure 1



Purpose of Sigrand SG-16B indicators

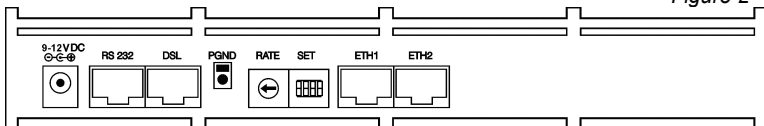
Table 3

Indicator	Status	Explanation	
POWER			
POWER	On	Modem is on	
	Off	Modem is off	
ETHERNET (channels 1 and 2)			
LINK	On	Valid Ethernet link detected	
	Off	Ethernet link not detected	
	Blink	Traffic exchange	
100M	LINK on	On	100Base-TX link detected
		Off	10Base-TX link detected
FD/C	LINK on	On	Full duplex
		Off	Half duplex
		Blink	Collision detected
DSL			
LINK	On	Active link to remote modem	
	Off	No link to remote modem	
SNR	LINK on	Blink	Bad Signal/noise ratio
		Off	Good Signal/noise ratio
	LINK off	Blink	Link activation in progress
		Off	No link
ERR	LINK on	Blink	A packet with error received
		Off	No error
	LINK off	On	Fatal error

1.9.2 Rear panel and connectors

Layout of connectors and switches on the rear panel of the Sigrand SG-16B modem

Figure 2

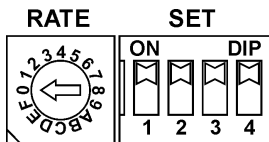


Purpose of connectors and switches of the Sigrand SG-16B modem

Table 4

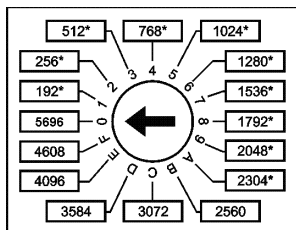
Power supply unit plug	9-12V DC
RS-232C console port for modem management	RS232
DSL line connector	DSL
Terminal to connect to protective ground	PGND
Dial to select fixed rate for DSL channel	RATE
DIP switches to set up modem operation mode	SET
Ethernet 10/100Base-T socket 1	ETH1
Ethernet 10/100Base-T socket 2	ETH2

Fig. 3



The “RATE” dial and the “SET” DIP switches (fig.3) specify operation mode of the DSL channel. The dial sets DSL channel data rate (fig.4).

Fig. 4



The “SET1” DIP switch selects “Master/Slave” mode, the “SET2” switch defines a method of the DSL channel rate negotiation and the “SET4” switch sets a mode of modem management. Purpose of the switches are shown on Table 5.

Table 5

Switch	Purpose	Position	Meaning
SET1	Operation mode	ON	Master modem (STU-C)
		OFF	Slave modem (STU-R)
SET2	Local or Preactivation rate select	ON	Rate is exchanged by Preactivation
		OFF	Rate is set locally on each modem
SET3	RS-232C console port baud rate	ON	57600 bps
		OFF	9600 bps
SET4	Modem management method	ON	by console port
		OFF	by DIP switches



Attention!

Reboot the modem to activate a new modem operation mode, changed by the DIP switches!

2. Modem setup directions

2.1 Connecting modem to a line



Make sure the line has no foreign devices varying its specifications such as fuses, inductors, load coils and other similar line conditioning devices. These devices may cause serious modem performance limitations or even completely prevent operation of an xDSL modem!



Make sure that the communication line in use has neither external voltage supply nor attached foreign telco devices! Ignoring this rule may cause permanent damage to both the modems and those foreign telco equipment!

2.1.1 Requirements to a communication line

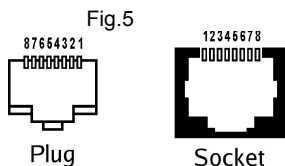
The line must comply with the following requirements for proper operation and performance:

- It must have neither leakage to ground nor to other wires (both connected and loosed). It should not have taps (branches).
- Both wires must belong to the same twisted pair if a multi-pair cable is used.
- Parallel connection of a few pairs (e. g., to reduce the line resistance) is not permitted.

Ignoring the aforementioned requirements may cause significant modem performance limitations or even completely prevent operation of an xDSL modem.

After you verify that the line comply with the aforementioned requirements -

- Fix the supplied RJ-45 plug on the cable in accordance with figure 5. The Sigrand SG-16B modem uses only one pair of pins, namely 4 and 5. Other pins are not assigned.
- Attach the cable to the DSL connector of the modem.



2.2 Choosing modem management method

There are two ways to manage the modem:

- by the DIP-switches placed on the rear panel of the modem (see fig.4);
- by a terminal program via the RS-232C console port.

Both modes have certain advantages over each other so a user is free to choose either setup mode according to actual requirements for modem operation.

Setup by switches is described here as the most simple method. Management by a terminal program is described in Chapter 3.

To use setup by switches, set the SET4 switch to OFF state. For quick reference use the sticker at the bottom side of the modem enclosure.

2.3 "Master"/"slave" mode

Two modems operating peer-to-peer must be configured by the SET1 DIP switch (fig. 3, table 4) such as one modem is set up as a "master" (SET1 is ON) and another one as a "slave" (SET1 is OFF). We recommend to use as a "master" the modem which is more accessible for management and maintenance.

2.4 Setting DSL rate

Fixed rate value is set by dial switch RATE (figures 2 and 4). One of 16 fixed data rates have to be selected by the dial.

2.4.1 Setting DSL rate for remote modem

This feature is available only for modems with firmware version 2.5 or higher.

The SET2 switch has the following meaning:

- if SET2 is OFF, the rate is set manually at both ends of the line. (In this case modem uses Annex A for compatibility with firmware version 2.4 and lower)
- if SET2 is ON, the DSL rate is set by the dial switch RATE of the “master” modem. (In this case Annex F is used.)

The SET2 switch must be set to the same position for both modems.



To operate properly peer-to-peer, the modems settings should match each other! Do not forget to configure the remote modem beforehand!

2.4.2 Rate selection guidelines

Before setting the data rate you should have known the performance of the line the modems are intended for. If the line performance is unavailable, apply the following technique to select the proper data rate:

- Measure resistance of the line. To do this, make short-circuit on either line side and attach an ohmmeter to another one. Then determine a maximum rate providing reliable communication by table 2.
- Switch carefully the dial to the required position with a screwdriver. Reboot both modems to activate the new settings. If the remote rate setting is used (SET2 is ON), change the “master” modem rate only. Link activation takes up to 2 or 3 minutes to succeed.
- If the link is not activated (the DSL LINK LED is not getting light) during the mentioned time, set a smaller value on the rate dial and do the next attempt to activate the link.

- If you can't get the link activated, consider to use console management mode (Chapter 3). In this mode you can try to succeed by varying the line coding (Chart 1) as well.

3. Modem management via console port

The modem is manageable by a terminal attached to the RS-232C console port or by a computer with any applicable terminal emulation software.

3.1 Terminal setup

Set the the SET4 DIP-switch to "ON" position to manage the modem through the console port. (see Table 5, Figure 2).

Set the baud rate of the modem console port by the SET3 switch. SET3 is OFF stands for 9600 baud, SET3 is ON stands for 57600 baud.

Attach the RS-232C port to a serial port of your computer by the supplied cable.

Configure the terminal emulation software installed on your computer (for example, HyperTerminal) as follows:

Data bits: 8
Parity: None
Stop bits: 1
Flow control: None

Baud rate (Bits per second) should be set to 9600 or 57600 in accordance with SET3 switch setting.

Power on or reboot the modem. If the terminal has been set up properly, the following message appears on the screen:

```
Sigrand SG-16B SHDSL modem V.2.5  
Interface module ETH1/ETH2  
Initialization complete  
:
```

3.2 General purpose commands

The modem is managed by a set of commands conventionally divided into two types: the “general purpose” commands such as **help**, **info**, **update**, **default**, **reboot**, and the interface management commands such as **dsl** and **eth1/eth2**.

Capabilities of the console management mode allow to configure the DSL interface as well as to control the Ethernet interfaces. It is also possible to watch status of the interfaces, etc. The summary of the general management capabilities can be invoked by the **help** command:

```
: help
**** Available commands: ****
HELP - display this text
HELP [ETH|DSL|PORT|E1|FXS|FXO] - detailed interface help
INFO - view information about hardware and firmware
STAT [RESET] - show all statistics (or clear it)
ETHx - view or change ETHx settings, x=1,2 (see HELP ETH)
DSL - view or change DSL settings (see HELP DSL)
PORT - view or change PORT settings (see HELP PORT)
E1 - view or change E1 settings (see HELP E1)
FXSx - view or change FXS settings, x=1,2 (see HELP FXS)
FXOx - view or change FXO settings, x=1,2 (see HELP FXO)
UPDATE - update sg16 firmware
DEFAULT - set factory defaults
REBOOT - reboot the modem
:
```



*The SG-16 modems are multi-functional devices with various types and combinations of system interfaces such as E1, V.35, FXO/FXS. Therefore the **help** command displays commands for each interface available in this firmware.*

The **info** command displays information about the firmware version, the modem uptime, and current status of the modem interfaces.

```
: info
Sigrand SG-16B SHDSL modem V.2.5
Setup mode: Terminal
SHDSL firmware: V.5.3E
FPGA configuration: V.2.20
Interface module ETH1/ETH2
Uptime: 0 days 01:08:55
ETH1: Rate=100 Mbit/s Duplex=FULL Auto-Neg FlowCont - OFFLINE
ETH2: Rate=100 Mbit/s Duplex=FULL Auto-Neg FlowCont - OFFLINE
DSL: CFG=PREACT Rate=192 Code=TCPAM16 MASTER Annex=F - OFFLINE
:
```

The **stat** command displays current status and statistics of the modem interfaces:

```
: stat
ETH1: Rate=100 Mbit/s Duplex=FULL Auto-Neg FlowCont - OFFLINE
TX=0 RX=0 ERR=0 COL=0
ETH2: Rate=100 Mbit/s Duplex=FULL Auto-Neg FlowCont - OFFLINE
TX=0 RX=0 ERR=0 COL=0
DSL: CFG=LOCAL Rate=5696 Code=TCPAM32 MASTER Annex=A - OFFLINE
TX=0 RX=0 ERR=1 LOSW=0 CRC6=0 RETRAIN=0 of 1
Total online time: 0 days 00:00:00
Total offline time: 0 days 00:00:28
Connect duration: 0 days 00:00:00
:
```

The **default** command resets all modem settings to factory default values.

```
: default
Load factory default and reboot? (y/n) Y
Default settings loaded
Rebooting...
```

entering cancel **N** or any other character except **Y** breaks the command execution and causes the prompt to enter a next command.

The **reboot** command performs reset of the modem.

```
: reboot
Rebooting...

Sigrand SG-16B SHDSL modem V.2.5
Interface module ETH1/ETH2
Initialization complete
:
```

The **update** command is used to update the modem firmware. Detailed procedure of firmware reprogramming is discussed in chapter 4 of this Guide.



*Not recognized commands causes appearance of the message **Unknown command**, illegal command options causes appearance of the message **Unknown keyword**.*

3.3 DSL interface management

We advise to invoke the **help dsl** command in advance to get informed about the DSL management features available through the console management mode:

```
: help dsl
DSL - show current DSL settings
DSL CFG [LOCAL|PREAMT] - configuration mode: Local or G.hs
Preamtivation
DSL RATE [rrrr|AUTO] | CODE cccc | MASTER | SLAVE - set mode for
DSLx
DSL ANNEX [A|B|F|G] - set Annex type
DSL STAT [RESET] - show statistics for DSL (or clear it)
DSL RETRAIN - force DSL to retrain
:
```

The **DSL** command allows to view statistics, to enter or to change settings of the DSL interface.

The command invoked with no option displays current settings of the interface

```
: dsl
DSL: CFG=PREACT Rate=192 Code=TCPAM16 MASTER Annex=F - OFFLINE
:
```

3.3.1 “Master”/“slave” mode selection

Configure one peer modem as “master”, do another one as “slave” for proper operation.

This is performed by the **dsl** command with the **master** or **slave** options:

```
: dsl master
DSL: CFG=LOCAL Rate=512 Code=TCPAM8 MASTER Annex=A - OFFLINE
: dsl slave
DSL: CFG=LOCAL Rate=512 Code=TCPAM8 SLAVE Annex=A - OFFLINE
:
```

3.3.2 Setting DSL rate

Modems with firmware version 2.5 or higher have the ability to set DSL rate from a “master” modem. The ability to set the rate manually at the both ends of the line is supported as well.

3.3.2.1 Setting DSL rate from “master” modem

In order to control the rate by accessing the “master” modem only, configure both modems beforehand for Preactivation (**dsl cfg preact**) and Annex F (**dsl annex f**):

```
: dsl cfg preact annex f
DSL: CFG=PREACT Rate=2304 Code=TCPAM16 MASTER Annex=F - OFFLINE
:
```

The rate setup is performed by the **RATE rrrr** option ("**rrrr**" stands for rate in kbps). The rate is within 192 to 5696 kbps range with 64 kbps step:

```
: dsl rate 192
DSL: CFG=PREACT Rate=192 Code=TCPAM16 MASTER Annex=F - OFFLINE
: dsl rate 5696
DSL: CFG=PREACT Rate=5696 Code=TCPAM32 MASTER Annex=F - OFFLINE
:
```

To set a new value of the rate, enter the command at the "master" modem only. The "slave" modem obtains the rate via G.hs Preactivation (ITU-T G.994.1) protocol.

3.3.2.2 Setting DSL rate manually both sides

If the lower rates (64 to 128 kbps) or the higher rates (5696-6016) are required, set the local control mode (**dsl cfg local**) for both modems. The Annex type can be set A or F, if both modems have firmware version 2.5 or higher. If one of the modems have firmware version 2.4 or lower (including Granch SBNI16 modems), only Annex A should be used for compatibility (**dsl annex a**).

```
: dsl cfg local annex a
DSL: CFG=LOCAL Rate=5696 Code=TCPAM32 MASTER Annex=A - OFFLINE
:
```

Manual rate setup is performed by the **RATE rrrr** option ("**rrrr**" stands for rate in kbps). The rate is within 64 to 6016 kbps range with 64 kbps step. The rate should be set the same for both sides:

```

: dsl rate 6016
DSL: CFG=LOCAL Rate=6016 Code=TCPAM32 MASTER Annex=A - OFFLINE
: dsl rate 64
DSL: CFG=LOCAL Rate=64 Code=TCPAM4 MASTER Annex=A - OFFLINE
:

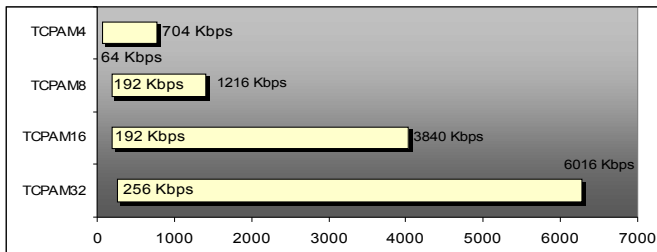
```

The line coding mode is also changed accordingly upon the rate change. See how rates match line coding on Chart 1.

3.3.3 Line coding selection

As mentioned above, different TCPAM line coding modes are used to transmit data with different rates.

Chart 1



The `code cccc` option of the `dsl` command provides a way to select a line coding mode of 4 available (TCPAM32, TCPAM16, TCPAM8 and TCPAM4). It allows to select a proper mode in according to ratings of the line.

```

: dsl code tcpam8
DSL: CFG=LOCAL Rate=512 Code=TCPAM8 MASTER Annex=A - OFFLINE
:

```




As follows from Chart 1, many data rates allow to use multiple line coding modes. Rule: apply a coding mode with less positions (TCPAM8, TCPAM4) on a line exposed to high level of noise; apply a coding mode with more positions (TCPAM32, TCPAM16) if bandwidth is limited.

In the local configuration mode (CFG=LOCAL) all four variations of the line coding are applicable. In the Preactivation mode (CFG=PREACT), only two codings can be used: TCPAM16 in the 192 to 3840 kbps range and TCPAM32 in the 768 to 5696 kbps range.

If the data rate is not within the permitted range for an entered line coding mode, the following message appears: **invalid line code for this rate.**

3.3.4 Link statistics

Use the **dsl** command with the **stat** option to view link statistics:

```
: dsl stat
DSL: CFG=LOCAL Rate=512 Code=TCPAM8 SLAVE Annex=A - ONLINE
TX=1341 RX=1231 ERR=1 LOSW=12 CRC6=11 RETRAIN=2 of 5
Loop Loss: 0.0 dB Noise Margin: +22.0 dB
Total online time: 0 days 00:42:19
Total offline time: 0 days 00:18:02
Connect duration: 0 days 00:15:53
:
```

Legend:

ONLINE – the DSL link is activated;

OFFLINE – the DSL link is not activated;

TX – the number of transmitted packets;

RX – the number of received packets;

ERR – the number of received packets with errors;

LOSW – the number of frame synchronization loss events;

CRC6 – the number of CRC6 checksum errors;

RETRAIN – the number of successful attempts to establish the link with regard to the total number of attempts;

Loop Loss – loop loss (attenuation level), dB;

Noise Margin – loop noise margin, dB;

Total online time – total time elapsed when link is on;

Total offline time – total time elapsed when link is off;

Connect duration – duration of the last successful session;

Use the **dsl** command with the **stat reset** option to clear the statistics counters:

```
: dsl stat reset
DSL: CFG=LOCAL Rate=512 Code=TCPAM8 SLAVE Annex=A - ONLINE
TX=0 RX=0 ERR=0 LOSW=0 CRC6=0 RETRAIN=0 of 0
Loop Loss: 0.0 dB Noise Margin: +22.0 dB
Total online time: 0 days 00:00:00
Total offline time: 0 days 00:00:00
Connect duration: 0 days 00:00:00
:
```

3.3.5 How to force a retrain

Retraining of the DSL interface is performed by the **dsl** command with the **retrain** option:

```
: dsl retrain
DSL: CFG=LOCAL Rate=512 Code=TCPAM8 SLAVE Annex=A - OFFLINE
:
```

3.4 Ethernet interfaces management

The Sigrand SG-16B modem features two Ethernet 10Base-T/100Base-T ports with Auto MDI/MDI-X.

The following commands allow to manage the ports:

```
: help eth
ETHx - show current ETHx settings, ETHx=1,2
ETHx RATE [10|100]|FULL|HALF|[/]AUTO|[/]FLOW - set mode for
ETHx
ETHx STAT [RESET] - show statistics for ETHx (or clear it)
:
```

The **eth** command allows to view statistics, to enter or to change Ethernet interface settings.

The command requires to specify interface index – **eth1** stands for the Ethernet1 interface and **eth2** the Ethernet2 interface. The command entered with no arguments allows to view current settings of the interfaces:

```
: eth1
ETH1: Rate=10 Mbit/s Duplex=HALF Auto-Neg FlowCont - ONLINE
:
```

3.4.1 Rate and duplex type

The modern Ethernet interfaces have Auto-Negotiation and flow control settings enabled by default.

Transmission rate and duplex type are detected automatically in Auto-Negotiation mode. The priority of operation mode detection descends from 100Base-TX Full Duplex (the highest priority), 100Base-TX Half Duplex, 10Base-T Full Duplex down to 10Base-TX Half Duplex (the lowest priority).

To disable the Auto-Negotiation mode use the **eth1** or the **eth2** commands with the **/auto** option:

```
: eth1
ETH1: Rate=100 Mbit/s Duplex=FULL Auto-Neg FlowCont - ONLINE
: eth1 /auto
ETH1: Rate=100 Mbit/s Duplex=FULL FlowCont - ONLINE
:
```

If Auto-Negotiation mode is off, use either the **eth1** or the **eth2** commands respectively with the **rate 10** or the **rate 100** options to set the Ethernet interface rate manually:

```
: eth1 rate 100
ETH1: Rate=100 Mbit/s Duplex=FULL FlowCont - ONLINE
: eth1 rate 10
ETH1: Rate=10 Mbit/s Duplex=FULL FlowCont - ONLINE
:
```

Also the **full** or the **half** options of the commands allows to switch between full and half duplex, use the options on the relevant interface:

```
: eth1 half
ETH1: Rate=10 Mbit/s Duplex=HALF FlowCont - ONLINE
: eth1 full
ETH1: Rate=10 Mbit/s Duplex=FULL FlowCont - ONLINE
:
```

Use the **eth1** or the **eth2** command with the **auto** option to enable Auto-Negotiation mode:

```
: eth1
ETH1: Rate=10 Mbit/s Duplex=FULL FlowCont - ONLINE
: eth1 auto
ETH1: Rate=100 Mbit/s Duplex=FULL Auto-Neg FlowCont - ONLINE
:
```

3.4.2 Flow control

Besides setting of the rate and the transmission mode, the modem features flow control in compliance with the IEEE 802.3x specifications. It improves operation, protects packet buffer against overflowing and prevents data loss. This technique may also improve total network throughput and help to achieve optimal performance.

Use the **eth1** or the **eth2** commands with the **flow** option to enable flow control feature:

```
: eth1 flow
ETH1: Rate=100 Mbit/s Duplex=FULL Auto-Neg FlowCont - ONLINE
:
```

Use the **eth1** or the **eth2** commands with the **/flow** option to disable the feature:

```
: eth1 /flow
ETH1: Rate=100 Mbit/s Duplex=FULL Auto-Neg - ONLINE
:
```

4. Updating built-in modem firmware

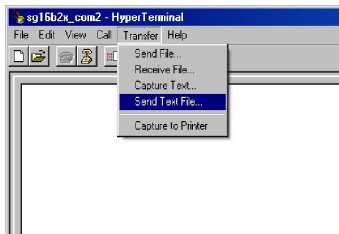
Use the **update** command to update the built-in firmware of the Sigrand SG-16B modem in the following order:

```
: update  
Load new image? (y/n) Y
```

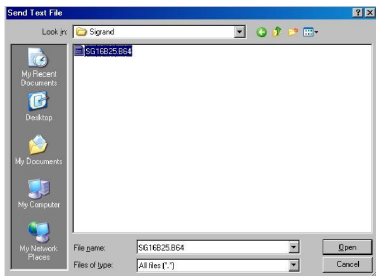
Upon entering procedure acknowledgement **Y** the memory buffer is clearing and the prompt to download the image file appears here:

```
Clearing buffer memory... OK  
Loading image...
```

Then select the “*Send Text File*” option in the *Send* menu of the terminal program (here we suppose you are using HyperTerminal from standard Microsoft Windows shipment),



then specify location of the image file planned to load to the modem. Image files look like *.b64. Since the firmware can contain a few image files, the update procedure has to be performed for each file. Order of file updating may be arbitrary.



```
Clearing buffer memory... OK
Loading image... OK
Checking image... OK, Type=SG16HOST V.2.5
Program new image? (y/n) Y
```

Enter acknowledgement **Y** to complete the write procedure:

```
Checking BootLoader... OK
Self-Programming... OK
Rebooting...
```

press **N** or **Esc** as a response to any prompt to cancel the update procedure:

```
: update
Load new image? (y/n) N
Update canceled!
:
```



Reboot the modem when the firmware has been updated!

Warranty and scope of liability

The Manufacturer warrants its Modem to be free from defects in materials and workmanship. This warranty applies only if the Purchaser has been used and maintained the Modem in accordance with the operating and maintenance directions given in this Guide. This warranty does not apply if the Modem has been subject to misuse, negligence, accident, fire or other casualty.

This warranty is valid for a period of 5 (five) years from either the purchase date as marked on the Warranty Coupon or the stated manufacturing date if the purchase date has not been marked. Subject to conditions and limitations set forth above and below, the Manufacturer will, at its option, either repair or replace the Modem that prove defective of improper workmanship or materials. The Manufacturer shall in no event be liable for any consequential, indirect or damages or expenses, lost revenues, lost profits, or any other incidental or consequential damages arising from the purchase, use or inability to use the modem, even if the Manufacturer has been advised of the possibility of such damages.



Warranty limitations:

Warranty is void for modems operating on wires having aerial sections.

MANUFACTURER ADDRESS

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Novosibirsk,

Russia

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www.sigrand.com

WARRANTY COUPON

For Sigrand SG-16B modem

Serial number _____

MFG date ____/____/200____
 day month year

Quality checker _____/_____/

Stamp

Seller	
Address	
Phone	
Sale date	
Stamp	
Signature	

Purchaser	
Address	
Phone	
Purchase date	
Stamp	
Signature	

General specifications of TPP cable

Table I.1 Frequency response for twisted-pair cabling with copper conductor and PE-insulation (for reference only)

f, kHz	Primary ratings			Secondary ratings	
	R~, Ω/km	L, H/km*10 ⁻⁴	G,S/km*10 ⁻⁴	Z , Ω	α, dB/km
Conductor diameter 0.4 mm (26 AWG)					
20	278	5.51	1.13	225.2	6.81
50	280	5.51	4.24	152.6	9.12
100	283	5.50	11.3	125.7	10.3
250	316	5.46	42.2	113.7	12.2
500	394	5.35	120	110.5	15.6
700	455	5.26	188	109.1	18.2
1000	535	5.15	305	107.7	21.7
Conductor diameter 0.5 mm (24 AWG)					
20	181	5.50	1.13	185.1	5.15
50	182	5.50	4.24	133.3	6.48
100	189	5.49	11.3	118.0	7.17
250	234	5.40	42.2	111.6	9.21
500	310	5.23	120	108.8	12.4
700	361	5.26	188	107.4	14.6
1000	424	5.04	305	106.3	17.2

Table I.2 Cable loop resistance to conductor diameter ratio:

Conductor diameter (mm)	Loop resistance (Ω/km)
0.32	432
0.4	278
0.5	180
0.64	110

Configuring SG-16PCI to interact with SG-16B

Proper operation of a SG-16PCI modem requires to set up the following settings:

- Line Rate
- Line Code
- Operation mode (Master/Slave)
- HDLC Frame Options

Be guided by the relevant instructions when configuring the SG-16PCI modem for different operating systems.

1. Line Rate

Use 64 step to change the rate when interact with a SG-16B modem. Remember that changing the rate may also require to change the line coding type (see Chart 1).

Set up the same rate on both the SG-16PCI and the SG-16B modems. Current driver release does not support automatic rate selection (Line Probe) for the DSL channel.

2. Line Code

To make interact the SG-16 SHDSL modems select line coding according to the rate, Table 2 and Chart 1.

Set up the same line coding for both the SG-16PCI modem and the SG-16B modem.

3. Operation mode (Master/Slave)



Set up one modem as “Master” (or “STU-C”) and another one as “Slave” (or “STU-R”).

4. HDLC Frame Options

Interaction between the SG-16PCI and the SG-16B SHDSL modems requires to set up “CRC32/CRC16” to value “CRC32” and “Fill Byte Value” to value “All bits are 1” on the SG-16PCI card.