DM991 SERIES V

DATACOM

DM991C
DM991CE
DM991S
DM991SE

PRODUCT MANUAL

204.4092.08 rev. 08 Date: 8/12/2008

WARRANTY

This product is guaranteed to be free against manufacturing and raw material defects, during the period specified in the sales receipt.

The warranty includes only the repair and replacement of components or defective parts, free of charge. The warranty does not cover damages caused by any one of the following conditions: improper use, energy failures, natural phenomena (lightning, for example), failure in equipments connected to this product, improper grounding or repairs done by DATACOM unauthorized personnel.

This warranty does not cover repairs done at the customer's site. All equipments must be sent to DATACOM to be repaired.

Quality Management System

certified by DQS according to ISO9001

Register number (287097 QM)

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CONVENTIONS

In order to improve the agreement, the following conventions are made throughout this manual:

hyperlink - Indicates an internet site or an e-mail address.

Command or Button - Always that some reference to a command, a button or a software menu is made, this indication will be in italic.

```
#  Commands and messages from terminal screens are presented in not-
   formatted text, preceded from #.
```

Notes give an explanation about some topic in the foregoing paragraph.

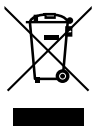
This symbol means that this text is very important and, if the orientations were not correct followed, it may cause damage or hazard.

This symbols means that, case the procedure was not correctly followed, may exist electrical shock risk.

Represents laser radiation. It is necessary to avoid eye and skin exposure.

Indicates that an equipment or a part is ESDS (Electrostatic Discharge Sensitive). It should not be handled without grounding wrist strap or equivalent.

Non-ionizing radiation emission.



I*WEEE Directive Symbol* (Applicable in the European Union and other European countries with separate collection systems).This symbol on the product or its packaging indicates that this product must not be disposed of with other waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your consumer waste equipment for recycling, please contact your local city recycling office or the dealer from whom you originally purchased the product

INDEX

FIGURE INDEX

TABLE INDEX

1. GENERAL RECOMMENDATION

Before the installation, read the entire manual attentively.

Always observe the instructions of security during the installation, operation or maintenance of this product. Installation, adjustment or maintenance must be carried through only by qualified, trained and authorized people.

The installation of any electric equipment must be in accordance with the current law in the place where this equipment will be installed. This includes adequate devices of protection, sizing and protection to the capacities of the equipment.

The power supply, where the supply cable is connected, must be positioned near the equipment and be on an easily accessible location, because the equipment is turned on and off through it.

Before connecting any cable to the equipment, make sure that the grounding system is functional.

To prevent risks of electric shock, before opening the DM991C/CE equipments, disconnect the power supply.

Follow attentively every guidance included in this manual. In case of doubts, please contact the authorized technical support.

The described equipment in this manual is sensible to the static electricity. Before handling any described equipment in this manual, verify if using devices of protection against static electricity, and if these are functioning correctly.

2. INTRODUCTION

The modem family DM991 series V has several G.SHDSL modem models, with E1 (G.703 and G.704), Digital (V.35 and V.36/V.11) and Ethernet (10/100BaseT) interfaces.

They come in eight models:

- DM991C 2W – Desktop. Can be adapted in a sub rack, using the accessory: desktop sub-rack adaptor. Its G.shdsl interface works on 2 wires.
- DM991C 4W – Desktop. Can be adapted in a sub rack, using the accessory: desktop sub-rack adaptor. Its G.shdsl interface may operate with 2 or 4 wires.
- DM991CE 2W – The same as the DM991C model, however it has the option to work as Bridge as well. Its G.shdsl interface works on 2 wires.
- DM991CE 4W – The same as the DM991C model, however it has the option to work as Bridge as well. Its G.shdsl interface may operate with 2 or 4 wires.
- DM991S 2W – Telebrás standard card. Can be used in cabinets or sub racks standard for 20 modems. Its G.shdsl interface works on 2 wires.
- DM991S 4W – Telebrás standard card. Can be used in cabinets or sub racks standard for 20 modems. Its G.shdsl interface may operate with 2 on 4 wires.
- DM991SE 2W - The same as the DM991S model, however it has the option to work as Bridge as well. Its G.shdsl interface works on 2 wires.
- DM991SE 4W - The same as the DM991S model, however it has the option to work as Bridge as well. Its G.shdsl interface may operate with 2 or 4 wires.

The letter "C", represents that the equipment is a table equipment, while the letter "S" represents that it is a card to be used in a Telebrás standard cabinet or shelf. The letter "E" present indicates Bridge mode operation.

In this manual the name DM991 will always be used to represent the entire modem family and whenever an explanation is restricted to certain models, such model will be clearly identified.

2.1. DM991S/SE 2W/4W

2.1.1. Front Panel

Figure 1 represents the front panel of the DM991S 2W modem, the Figure 2 presents the front panel of the DM991SE 2W modem, Figure 3 presents the front panel of the DM991S 4W modem and the Figure 4 presents the front panel of the DM991SE 4W modem.

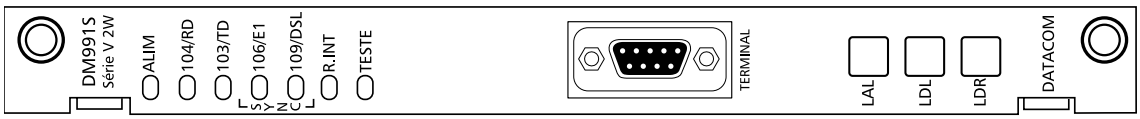


Figure 1. Front Panel - DM991S 2W

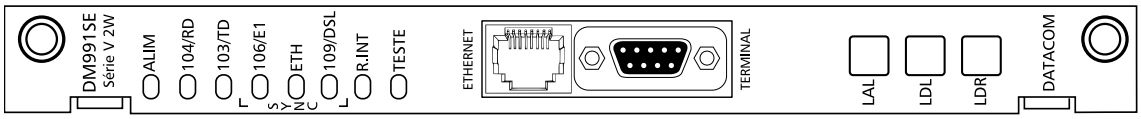


Figure 2. Front Panel - DM991SE 2W

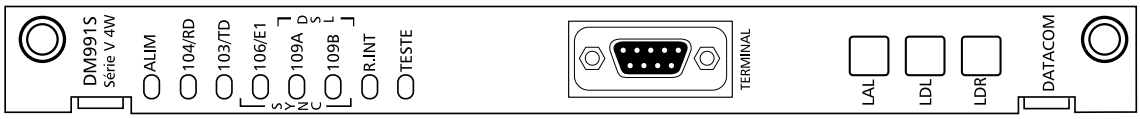


Figure 3. Front Panel - DM991S 4W

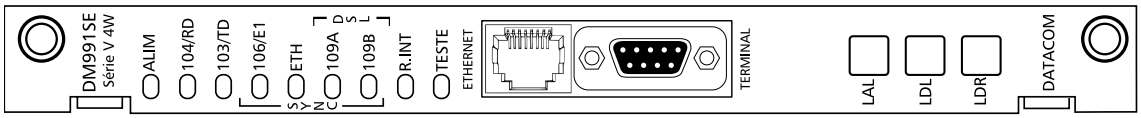


Figure 4. Front Panel - DM991SE 4W

- Signaling LEDs –The meaning of each LED can be found on Table 22.
- DB9 - The DB9 connector in the front panel is used to configure the equipment via terminal (communication serial port). The connector pinout is found on Table 1.

Signal	DB9	Origin
Transmission RS-232	2	DM991S/SE
Reception RS-232	3	ETD
Ground signal	5	-

Table 1. DM991S/SE - DB9 Connector Pinout

- RJ45 - The RJ45 connector is used for the Ethernet interface. Its pinout description is found on Table 2.

Function	Signal	RJ45	Origin
Received data: - wire	OUT -	1	DM991SE
Received data: + wire	OUT+	2	DM991SE
Transmited data: + wire	IN+	3	LAN
Transmited data: - wire	IN -	6	LAN

Table 2. DM991SE - RJ45 Connector Pinout

- Keys - The keys function is the testing execution:
  - LAL (Local Analogue Loopback)
  - LDL (Local Digital Loopback)
  - LDR (Local Digital Remote)

2.1.2. Back Panel

Figure 5 represents the back panel of the DM991S/SE modems (Telebrás standard sub-rack):

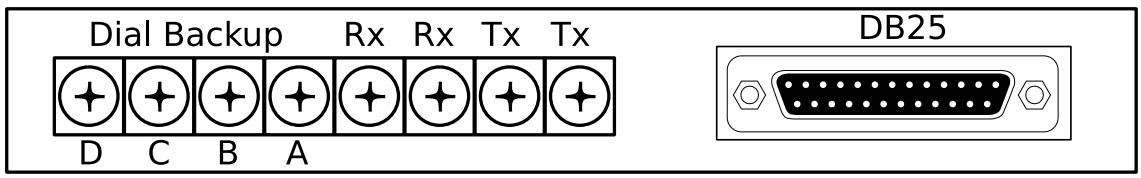


Figure 5. DM991S/SE Back Panel

- For the DB25 connector pinout, see table 11 in the chapter on the V.35 interface.

- Both TX pind are used for port A in the DSL interface. Both RX pins are used for port B in the DSL interface (for model 4W only). More details are provided in the Table 5.
- Dial Backup pins are used for the E1 interface. Pins A and B are for interface input (IN) and pins C and D are for interface output (OUT). More details are provided in the Table 12.

2.2. DM991C/CE 2W/4W

2.2.1. Front Panel

The Figure 6 represents the DM991C 2W modem panel, Figure 7 represents the DM991CE 2W modem panel, Figure 8 presents the DM991C 4W modem and the Figure 9 presents the DM991CE 4W modem

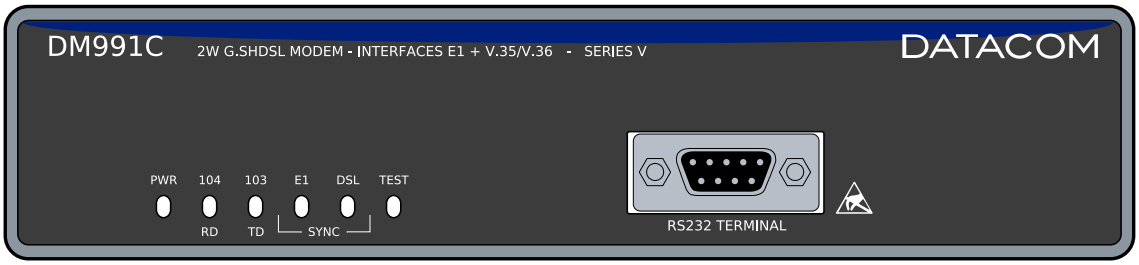


Figure 6. DM991C 2W Front Panel

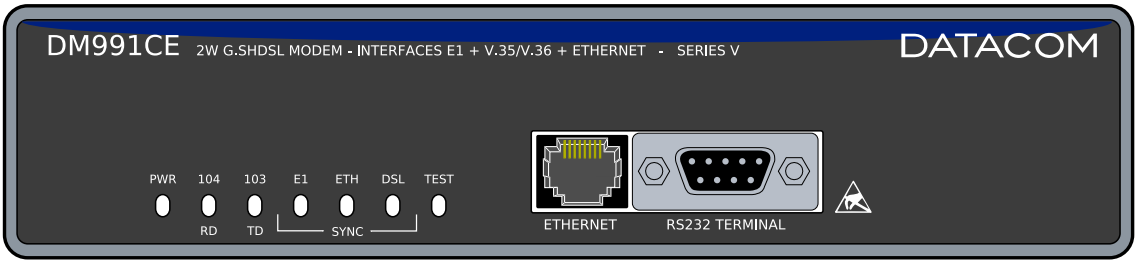


Figure 7. DM991CE 2W Front Panel

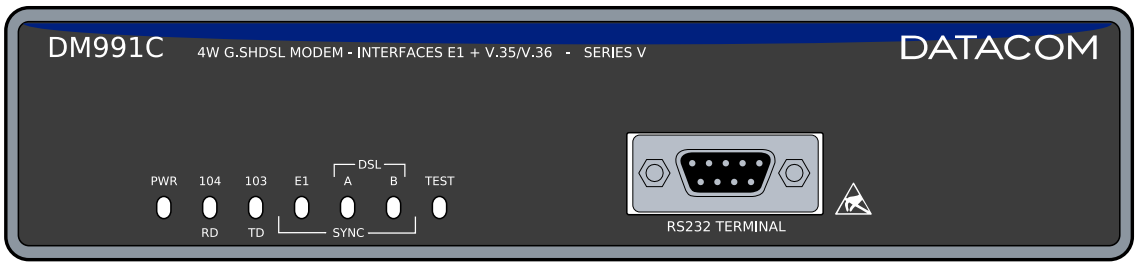


Figure 8. DM991C 4W Front Panel

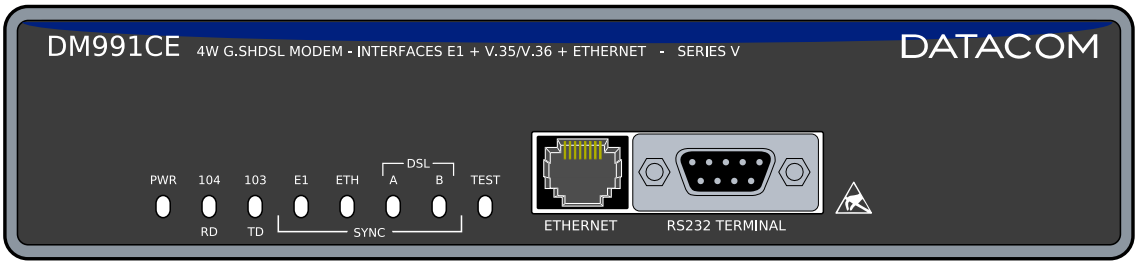


Figure 9. DM991CE 4W Front Panel

- Signaling LEDs –The meaning of each LED can be found on Table 23.
- DB9 - The DB9 connector in the front panel is used to configure the equipment via terminal (communication serial port). The connector pinout is found on Table 3.

Signal	DB9	Origin
Transmission RS-232	2	DM991C/CE
Reception RS-232	3	ETD
Ground signal	5	-

Table 3. DM991C/CE - DB9 Connector Pinout

- RJ45 - The RJ45 connector is used as Ethernet interface. Its pinout description is found on Table 4.

Function	Signal	RJ45	Origin
Received data: + wire	OUT+	1	DM991CE
Received data: - wire	OUT-	2	DM991CE
Transmited data: + wire	IN+	3	LAN
Transmited data: - wire	IN-	6	LAN

Table 4. DM991CE - RJ45 Connector Pinout

2.2.2. Back Panel

Figure 10 represents the back panel of the DM991C/CE modens:

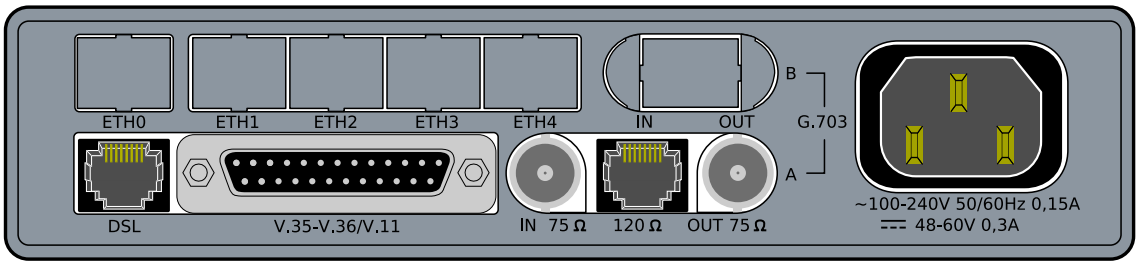


Figure 10. DM991C/CE Back Panel

- 75ohms Connectors – connection for G.703 interface for coaxial cable with 75ohms impedance, available in BNC connectors;
- 120ohms Connector- connection for G.703 interface for twisted pair with 120ohms impedance, available in RJ-48 connector;
- Digital Connector- digital interface connection, according to recommendation V.35 or V.36/V.11.They are available in DB25 with ISO2110 Amd.1 pinning. Optionally, the equipment can be assembled with a Telebrás pinning selection. Adapter cables for V.35 (ISO2593) or V.36/V.11 (ISO4902) may be separately provided. For the DB25 connector pinout, see chapter 4;
- G.shdsl Connector – Connection to the G.shdsl interface, available through the RJ45 connector, using pins 4 and 5;
- Power connector – Connection to the power source. Can be connected directly to an AC network as well as a DC network, as long as the tensions specified on Table 255 are respected.

3. G.SHDSL INTERFACE

The DM991S/SE modem G.shdsl interface presents connection through the screw connector block, as seen in Table 5. The DM991C/CE modem G.shdsl interface presents connection through an RJ45 with pinout as shown in Table 6.

Signal	screw connector block	Port
TIP	TX -1	A
RING	TX -2	
TIP	RX -1	B*
RING	RX -2	

Table 5. DM991S/SE - G.shdsl Interface Pinout

* Only 4W modem

Signal	Pin (RJ45)	Port
TIP	4	A
RING	5	
TIP	3	B*
RING	6	

Table 6. DM991C/CE - G.shdsl Interface Pinout

* Only 4W modem.

The G.shdsl (G.991.2) standard specifies symmetrical connection to 2 wires for subscriber's lines.

The handshake negotiations are done according to the ITU-T G.994.1 recommendation.

It can be configured as LTU (central) or NTU (user), always working as a cluster to other interfaces in the equipment.

It can be configured to operate in quasi-synchronous, synchronous or automatic selection modes.

It can be configured to operate as per Annex A, B or with automatic selection, defined on recommendation G.991.2.

It supports operation with rates up to 2,304 kbit/s per line, according to annexes A and B in standard G.991.2.

It can carry from 1 to 36 64-kbit/s timeslots, with line channel alignment.

The interface range alternates according to the transmission rate, between 7,100m (for 192kbit/s on a noise-free 0.4-mm line) and 4,100m (for 2,304kbit/s on a noise-free 0.4-mm line).

When configured as NTU, the interface accepts any rate, annex and frame type that the LTU indicates during the handshake. The number of channels of the aggregate should always be the same or larger to the sum of tributaries channels.

Only for DM991C/CE: The interface has primary protection - (sparklers) capable of supporting electrical discharges according to the ITU-T K.21 recommendation.

The cabinets destined to the DM991S/SE models usually have primary protection devices, so these models do not come with additional sparklers.

3.1. Interface Characteristics

ITU-T Recommendation G.991.2 describes a transmission method for data transport in telecommunication access networks over twisted pairs in the full-duplex mode, with echo canceling.

The interface operate in lines of type 135ohms balanced.

The line coding is 16-level TC-PAM type (16-TCPAM).

The table below shows the line encoding and power transmitted to each annex.

Annex	Number of channels [n x 64kbit/s]	Modulation	Power [dBm]
A	3 a 36	16-TCPAM	13,5
B	3 a 31	16-TCPAM	13,5
	32 a 36	16-TCPAM	14,5

Table 7. Modulation and power on the line

Connection is done by the basic phases: Handshake, Training, and Data Mode.

3.2. Handshake (Pre-activation)

The pre-activation phase follows ITU-T Recommendation G.994.1, which describes the handshake procedures for xDSL transceivers.

While on this phase, the two equipments exchange information and they negotiate the parameters that will be used for the connection.

The ends implement a 12 kHz DPSK modem for the NTU and 20 kHz one for the LTU to perform the handshake. The Recommendation predefined messages are exchanged and the equipments agree to a common mode of operation.

In this phase, many parameters are set: the final transmission rate, Annex to be used (A or B), type of information to transport (TPS-TC - Transmission Protocol-Specific Transmission Convergence), type of transmission frame (plesiochronous or synchronous), and some others.

If the interfaces do not converge to a common configuration, the two equipments abort the transmission and they do not pass to the next stage: they will retry after some moments.

For the DM991 the user equipment (NTU) will always accept the configuration sent to it by the office equipment (LTU), easing installation.

During handshake, the DSL interface LED stays mostly off, briefly blinking once a second.

3.3. Training (Activation)

In this phase the two modems test the transmission line using the rate that was agreed during handshake to determine which coefficients they shall employ for the receive and transmit digital filters.

During training, the equipments use the normal line coding (TC-PAM) and they no longer use DPSK encoding.

At first, both modems test the line. Then the precoder coefficients are exchanged and used during data transmission.

Two things can occur at the end of this stage: the modems do pass the training phase, they determine the adequate coefficients for the line, and then they enter the data mode or, the modems cannot determine the coefficients, for some reason (maybe the line is too long, or there is too much noise, or during training some very strong perturbation renders the convergence not viable, etc.) and they abort transmission.

In the activation stage, the DSL interface LED blinks once a second (on and off times are equal).

3.4. Data Mode

This is the final stage, where the modem transmits data normally. It will use the final G.shdsl frame, sending information as negotiated during handshake and using the coefficients that were calculated after the transmission line was evaluated during the training period.

Whenever the interface is in sync, the DSL status LED will remain on.

3.4.1. G.shdsl Frame Structure

The G.shdsl frame has four data blocks (*payload blocks*) that are separated by the header bits. The header repeats itself each 6ms, regardless of the configured rate.

The header has an essential function for data transmission, for it ensures alignment, it transports management information through EOC (*Embedded Operations Channel*) and it also has a data error identification mechanism (CRC6).

The frame G.shdsl also allows to transmit CAS information (Channel Associated Signilling) from link E1.

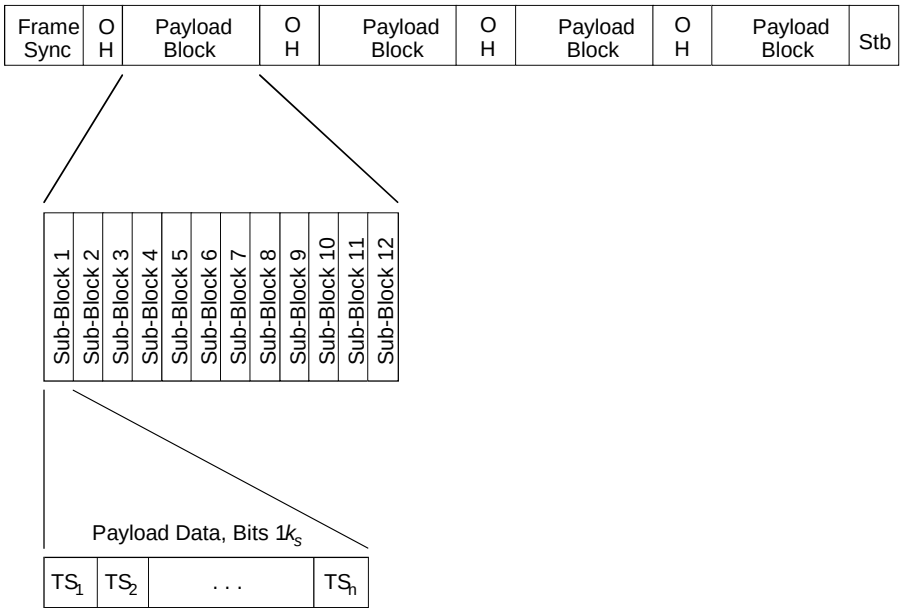


Figure 11. G.shdsl frame order diagram with CAS signaling

The sub block size varies according to the number of channels. Each sub block has Nx8 bits, where N is the number of channels that was negotiated during handshake.

Figure 12. G.shdsl frame order diagram with CAS signaling

The frame structure that is sent and received by the G.shdsl modem consists in the E1 timeslots, in the V.35 channel at Nx64k, in the Ethernet channel at Nx64kbit/s, in empty timeslots (idle) for filling the installed modem rate and in a CAS timeslot, in this order.

Bit	Name	Description
1-14	sw1-sw14	Frame Sync Word
15	fbit1/losd	Fixed Indicator bit #1 (Loss of Signal)
16	fbit2/sega	Fixed Indicator bit #2 (Segment Anomaly)
17 -> k+16	b1	Payload block #1
K + 17	eoc01	EOC bit #1
K + 18	eoc02	EOC bit #2
K + 19	eoc03	EOC bit #3
K + 20	eoc04	EOC bit #4
K + 21	crc1	Cyclic Redundancy Check #1
K + 22	crc2	Cyclic Redundancy Check #2
K + 23	fbit3/ps	Fixed Indicator bit #3 (Power Status)
K + 24	sbid1	Stuff bit ID #1
K + 25	eoc05	EOC bit #5
K + 26	eoc06	EOC bit #6
k + 27 -> 2k + 26	b2	Payload block #2
2k + 27	eoc07	EOC bit #7
2k + 28	eoc08	EOC bit #8
2k + 29	eoc09	EOC bit #9
2k + 30	eoc10	EOC bit #10
2k + 31	crc3	Cyclic Redundancy Check #3
2k + 32	crc4	Cyclic Redundancy Check #4
2k + 33	fbit4/segd	Fixed Indicator bit #4 (Segment Defect)
2k + 34	eoc11	EOC bit #11
2k + 35	eoc12	EOC bit #12
2k + 36	sbid2	Stuff bit ID #2
2k + 37 -> 3k + 36	b3	Payload block #3
3k + 37	eoc13	EOC bit #13
3k + 38	eoc14	EOC bit #14
3k + 39	eoc15	EOC bit #15
3k + 40	eoc16	EOC bit #16
3k + 41	crc5	Cyclic Redundancy Check #5
3k + 42	crc6	Cyclic Redundancy Check #6
3k + 43	eoc17	EOC bit #17
3k + 44	eoc18	EOC bit #18
3k + 45	eoc19	EOC bit #19
3k + 46	eoc20	EOC bit #20
3k + 47 -> 4k + 46	b4	Payload block #4
4k + 47	stb1	Stuff bit #1
4k + 48	stb2	Stuff bit #2
4k + 49	stb3	Stuff bit #3

Table 8. G.shdsl Frame Structure

During the data mode, link failures can occur. Such failures are monitored and reported to the user as follows:

3.4.2. CRC Anomaly

A CRC anomaly shall be declared when the received CRC6 information is different from the CRC6 generated on the received data. The CRC6 bits are part of the previous G.shdsl frame. A discrepancy between the received CRC6 value and the evaluated CRC6 on the interface indicates that an error occurred in some bit (or bits) of the frame, but it does not indicate how many, or which bits were in error.

The interface status LED will blink once every second, remaining ON the most of the time while a CRC error is showing up.

3.4.3. Loop Attenuation Defect

A loop attenuation defect occurs when the line displays an attenuation that exceeds the programmed threshold. The standard limit for the DM991 G.shdsl interface is 35 dB.

3.4.4. SNR Margin Defect

An SNR margin defect occurs when the signal-to-noise ratio falls below the specified margin, i.e., when the signal quality is too poor. The standard signal-to-noise ratio for the DM991 G.shdsl interface is 6 dB.

3.4.5. LOSW Defect

An LOSW (Loss of Sync Word Defect) defect shall be declared when at least three consecutive received frames contain one or more errors in the framing bits. The term framing bits shall refer to that portion of Frame Sync Word, Stuff Bits and Stuff Bit Ids – see Table 8 -, which are used for G.shdsl frame synchronization. An LOSW defect shall be cleared when at least two consecutive received frames contain no errors in the framing bits. For the DM991, the error indication is activated for one second after the reception of the two error-free consecutive frames.

When the interface is indicating LOSWD, the DSL interface status LED blinks four times per second (4 Hz).

3.4.6. LOSW Failure

An LOSW failure (*Loss of Sync Word Failure*) shall be declared after 2.5 ± 0.5 seconds of contiguous LOSW defect. The LOSWF shall be cleared when the LOSW defect is absent for 20 seconds or less (i.e. clear within 20 s). The minimum hold time for indication of LOSW failure shall be 2 seconds.

When the interface is indicating LOSWF, the DSL interface status LED blinks eight times per second (i.e. at 4 Hz).

3.5. G.shdsl Interface Configurations

The operation modes are all configured by software.

The explanation of the configuration parameters of the G.shdsl interface is presented below.

3.5.1. Terminal Type

Indicates if the interface operates as LTU (central office) or as NTU (subscriber).

When the modem is configured as LTU, it will determine every connection parameters during handshake, as the Annex to be used, the number of channels, the clock type (synchronous or plesiochronous), etc. It is not possible to recover the system clock from the interface clock when it is set up in such a way.

When the modem is set up as NTU, it is mandatory that the settings of the annex and of the clock type (Frame Mode) be automatic, for it accepts any settings determined by the LTU.

It is not possible to interconnect two equipments which are set up for the same type of terminal, for the handshake happens between LTU and NTU only.

3.5.2. Frame Mode

This option determines the interface operating mode as synchronous or plesiochronous.

In plesiochronous mode, the transmission and receive clocks are independent of the line clock, which is generated by the LTU. The line clock shall be accurate to within ± 32 ppm of the nominal frequency, as defined by G.991.2. Periodically, four stuff bits are automatically inserted to adequate the data clock to the line clock. This procedure is essential for equipment synchronization.

When set up in synchronous mode, the line clock becomes the same as the data clock. The precision of such clock gets to be, thus, the same as the precision of the clock that is selected as the equipment synchronization clock. Recommendation G.991.2 states that the clock precision shall be within ± 32 ppm, regardless of the clock scheme selected, so it is up to the user to set up a clock with such precision so as to operate within the Recommendation bounds (or the user can use a less precise clock, operating out of the Recommendation). In this way, the stb1 and stb2 stuff bits are always present, while stb3 and stb4 are not transmitted.

In the automatic selection mode, the LTU will use the NTU-selected mode. If the NTU accepts any mode (automatic configuration), the synchronous mode will be used.

3.5.3. Annex

The annexes determine slight variations on the Recommendation to better suit the equipment to the employed line.

One of three annex options can be chosen: A, B or automatic selection.

Annex A describes those specifications that are unique to lines operating under conditions such as those typically encountered within the North American network.

Annex B describes those specifications that are unique to lines operating under conditions such as those typically encountered within European networks.

For the automatic selection mode, the LTU will employ the NTU-selected annex. If the NTU accepts any type of annex, Annex B will be used.

3.6. Performance

The interface performance is directly related to the transmission line characteristics.

The gauge and the length of the line wire, the noise and the susceptibility to micro-interruptions to which the line is subjected will determine the maximum transmission rate.

The range also diminishes if the line sports a great number of splices and stubs. The length of the stubs also alters the line characteristics. This can increase the signal reflections and the line noise.

For a noise-free line using a 0.4-mm gage wire, with no seams or bifurcations, the range will be of 4,100 m for 2,304kbit/s, and with a modem set to 192kbit/s, the range can reach 7,100 m.

These tests were conducted with an artificial transmission line emulating the behavior of an actual line. The table 9 includes the expected ranges for some rates on a noise-free artificial line.

Data Rate [kbit/s]	0.4mm Wire [km]
192	7,1
256	6,7
384	6,1
512	5,9
768	5,5
1024	5,1
1536	4,3
2048	4,2
2304	4,1

Table 9. G.shdsl Interface Reach

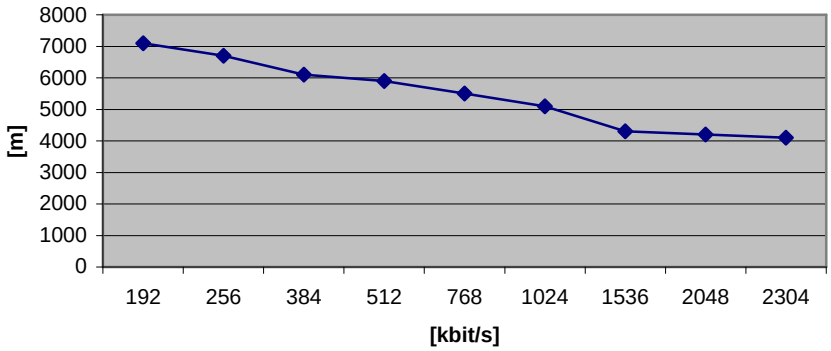


Figure 13. G.shdsl Interface Reach (m X kbit/s)

3.7. Four wire operation (4W)

The 4W modems presents two G.shdsl ports, these modems can operate in two ways.

3.7.1. Operating on two wires

When this modem is operating on 2 wires the data will be transmitted simultaneously on lines A and B, adopting (1+1) protection system.

The protection is semi-automatic, that is, after commuting to the backup link, data passes through this link until it has problems.

The switching time between both lines is approximately 1 second.

3.7.2. Operating on four wires:

When operating on 4 wires, this modem uses ports A and B as a single interface, being able to transmit on a longer reach and more bandwidth.

The number of timeslots used in the 4 wires operation is always pair (Nx128kbit/s), that is, if the configuration is set for an odd number, automatically one more timeslot will be used.

3.8. Electrical Protection

When the analogue lines of the G.shdsl interface pass through paths that can suffer from electric or atmospheric discharges, it is recommended that the user adds primary protection devices to the lines.

The G.shdsl interface of models DM991C and DM991CE already has sparkler devices, among others, as primary protection.

It is not appropriate to employ varistors as G.shdsl lines protection devices, as their high capacitance value can lower the interface performance significantly. The same care should be taken when using inductive protection.

4. V.35-V36/V.11 DIGITAL INTERFACE

The DB25 connector follows the ISO2110 Amd. 1 recommended pinout, for the V.35 interface as well as for the V.36/V.11.

In the DM991S/SE modems, that pinout can be altered to the Telebrás standard through the straps. Interface V.35

In the case of DM991S/SE modems, that pinning can be changed to the Telebrás standard through straps.

In the case of DM991C/CE modems, you have the option of asking for equipment with a pinning selections between ISO2110 Amd.1 and Telebrás standard through straps.

Data and clock signals are the differential balanced type, according to ITU-T's V.11 recommendation. Signals CT107, CT108, CT109, CT140, CT141 and CT142 follow the characteristics of recommendation V.28 (compatible with recommendation V.10). Control signals CT105 and CT106 can be configured by straps to follow the characteristics of recommendation V.28 (for V.35) or V.11 (for V.36/V.11).

The ETD can provide synchronism for data receiving through CT128.

The digital interface can be set up in rates from Nx64kbit/s to 2,304kbit/s on 2-wire modems (2W), and up to 4,608kbit/s on 4-wire modems (4W).

CT	Function	Signal	DB25	M34	DB25†	Signal source
			ISO 2110 Amd. 1	ISO 2593	Telebrás pinout	
101	Protection ground	P. Gnd	1	A	1	
102	Signal ground	S. Gnd	7	B	13	
103	Transmitted data	TDa	2	P	2	DTE
		TDb	14	S	15	
104	Received data	RDa	3	R	4	DM991
		RDb	16	T	17	
105	Request to send	RTS	4	C	5	DM991
106	Ready to send	CTS	5	D	7	DM991
107	Modem ready	DSR	6	E	9	DM991
108	Terminal ready	DTR	20	H	14	DTE
109‡	G.SHDSL interface synch	DCD	8	F	10	DM991
113	DTE transmission clock	XTCa	24	U	11	DTE
		XTCb	11	W	24	
114	Transmission clock	TCa	15	Y	3	DM991
		TCb	12	a/AA	16	
115	Reception clock	RCa	17	V	6	DM991
		RCb	8	X	19	
128	External reception clock	ERCa	22 *		23	DTE
		ERCb	23 *		8	
140	Digital Remote Loopback Request	RDL	21	N	12	DTE
141	Local Analogue Loopback request	LAL	18	L	21	DTE
142	Test indicator	TST	25	n/NN	25	DM991

Table 10. V.35 Interface Pinout

† For DM991S/SE only (or optionally for DM991C/CE).

‡ On DM991C V.35-V.36/V.11 interfaces, the CT109 signal presents the aggregate state (G.shdsl), remaining off while it is in error condition (except when there is CRC error).

* For ISO2110 Amd. 1, the ERCa (22) and ERCb (23) pins do not correspond to the CT128.

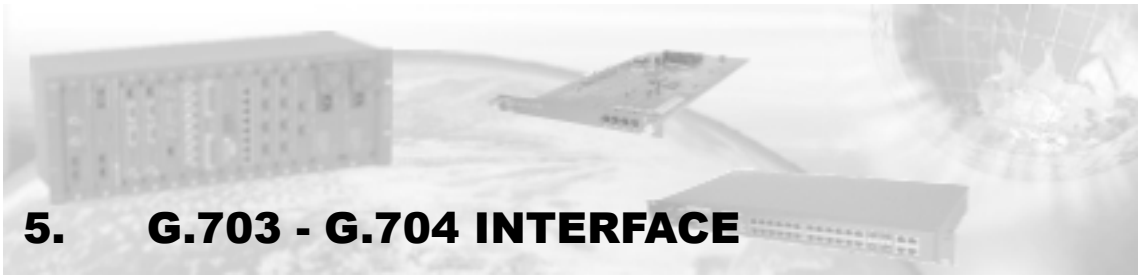
CT	Function	Signal	DB25	DB37	DB25†	Signal source
			ISO 2110 Amd. 1	ISO 4902	Telebrás pinout	
101	Protection ground	P. Gnd	1	1	1	
102	Signal ground	S. Gnd	7	19	13	
103	Transmitted data	TDa	2	4	2	DTE
		TDb	14	22	15	
104	Received data	RDa	3	6	4	DM991
		RDb	16	24	17	
105	Request to send	RTSa	4	7	5	DTE
		RTSb	19	25	18	
106	Ready to send	CTSa	5	9	7	DM991
		CTSb	13	27	20	
107	Modem ready	DSR	6	11	9	DM991
108	Terminal ready	DTR	20	12	14	DTE
109‡	G.SHDSL interface synch	DCDa	8	13	10	DM991
		DCDb	10	31	22	
113	DTE transmission clock	XTCa	24	17	11	DTE
		XTCb	11	35	24	
114	Transmission clock	TCa	15	5	3	DM991
		TCb	12	23	16	
115	Reception clock	RCa	17	8	6	DM991
		RCb	9	26	19	
128	External reception clock	ERCa	22 *		21	DTE
		ERCb	23 *		25	
140	Digital Remote Loopback Request	RDL	21	14	23	DTE
141	Local Analogue Loopback request	LAL	18	10	8	DTE
142	Test indicator	TST	25	18	12	DM991

Table 11. V.35 Interface Pinout

† For DM991S/SE only (or optionally for DM991C/CE).

‡ On DM991C V.35-V.36/V.11 interfaces, the CT109 signal presents the aggregate state (G.shdsl), remaining off while it is in error condition (except when there is CRC error).

* For ISO2110 Amd. 1, the ERCa (22) and ERCb (23) pins do not correspond to the CT128.



5. G.703 - G.704 INTERFACE

The interface allows usage of coaxial cable (75ohms) or for twisted pairs (120ohms). The cables are attached through transformers, so there is no polarity for the twisted pair.

5.1. DM991S/SE

There are straps which allow connecting the external net of the coaxial cable to the ground cable. This works either for the input channel (RX-IN) as for the output channel (TX-OUT).

When using twisted pair (120ohms), make sure the straps are not in the ground position.

The output wire that goes through pin 18B of the EDGE 2x30 connector is connected to the central pin of the E10 strap, and is the TX-OUT cable, that can be connected to the ground cable through this strap. In this case, it must be identified for each cabinet model which was the TX-OUT screw to be grounded by the strap, so it can be connected to the coaxial cable net. On the sub-racks, usually, the inferior TX-OUT screw is grounded.

The input wire that goes through pin 21B of the EDGE 2x30 connector is connected to the central pin through strap E11, and is the RX-IN cable, that can be connected to the ground wire through this strap. The same identification procedure of which screw has been grounded must take effect in this case. In the sub-rack, usually, the inferior TX-OUT screw is grounded.

Modem signal G.703 is available on Dial Backup terminals in the terminal strip.

Function	Signal	screw connector block	Signal source
Received data	OUT core	BkpC	DM991
Received data	OUT shield	BkpD	DM991
Transmitted data	IN core	BkpA	E1 Network
Transmitted data	IN shield	BkpB	E1 Network

Table 12. DM991S/SE - Pinout in the G.703 Screw connector block.

Function	Signal	DB25	Signal source
Received data	OUT core	4	DM991
Received data	OUT shield	17	DM991
Transmitted data	IN core	2	E1 Network
Transmitted data	IN shield	15	E1 Network

Table 13. DM991S/SE - G.703 Telebrás (DB25) Standard Pinout

When installing the DM991S/SE, remove the protection varistors from the cabinet or sub rack. These varistors deform the G.703 signal pulses, which can cause wrong bits, working intermittently, or even completely stopping the circuit activation. In case the cabinet or shelf was made by DATACOM or has gas-filled valve arrester instead of varistors, no changes are required.

Function	Signal	DB25	Signal Source
Received data	OUT core	21	DM991
Received data	OUT shield	14	DM991
Transmitted data	IN core	18	E1 Network
Transmitted data	IN shield	25	E1 Network

Table 14. DM991S/SE - G.703 Proprietary Pinout (DB25)

5.2. DM991C/CE

There are straps that allow you to connect the external coaxial cable network to the ground. On models DM991C/CE with PCI rev. 04 or higher, this applies both to the input channel (RX-IN) and to the output channel (TX-OUT). On models DM991C/CE with PCI rev. 03 or lower, this applies only to the input channel (RX-IN); in this case, the external output coaxial cable network (TX-OUT) is always connected to the ground.

Be careful as not to let those straps be in the grounded position when a 120-ohm twisted pair is used on the RJ48.

The G.703 signal output is available on the BNC OUT connector or between the pins 4 and 5 of the RJ48.

The G.703 signal input is available on the BNC IN connector or between the pins 1 and 2 of the RJ48

Function	Signal	RJ45	Signal Source
Received data	OUT	4	DM991
Received data	OUT	5	DM991
Transmitted data	IN	1	E1 Network
Transmitted data	IN	2	E1 Network

Table 15. DM991C/CE - G.703 RJ48 Pinout

6. ETHERNET INTERFACE

The DM991SE and DM991CE Ethernet interfaces allow interconnecting two LANs thru G.shdsl aggregated. It can be configured to Nx64kbit/s speed, to the aggregate configured limit. This tributary can be used joined with other modem tributaries.

Accepts packets of up to 1552 bytes, supporting VLAN.

6.1. Ethernet physical level

The DM991CE and DM991SE converters Ethernet interface is 10/100BaseT, according to the IEEE 802.3 specification.

The connection to the Ethernet interface is done through an RJ45 connector, seen in the front panel. The connector pinout is such that allows the use of straight cables to connect the equipment to Ethernet hubs.

6.2. Remote Bridge

The bridge's basic function is to segment a local network, avoiding all the Ethernet traffic to be transmitted by the local equipment to the remote equipment, wasting band.

To do so, the bridge can automatically learn the MAC addresses of the stations connected to the local network. In that way, it can filter the network traffic and transmit to the WAN side only the packets corresponding to the MAC addresses that do not pertain to the local network, besides broadcast and multicast packets.

The bridge operates on the MAC level of the Ethernet interface. In this way the tributary is completely transparent for upper layers protocols, such as TCP/IP, UDP, etc.

The bridge local address table can store up to 1.000 MAC addresses. If a station remains inactive for more than five minutes, its address will be removed from the table.

The process of filtering the packets to be transmitted imposes no limitation to the data flow. The delay introduced by the Bridge processing is of only 1 Ethernet frame.

The bridge has a buffer to Ethernet -> G.shdsl that may store up 322 packages Ethernet with 1552 bytes, but smaller packages may be stored in greater quantity.

In order G.shdsl -> Ethernet has a buffer of 64 packets of 1552 bytes Ethernet. Similarly, using smaller packages permites store more ones. Using this direction there is no filtering, because it has already been done by the bridge from remote equipment.

6.3. Ethernet Interface Configurations

The following interface configurations are possible:

- WAN Speed - It allows for the selection from 1 to 36 64-kbit/s time slots on 2-wire modems (2W), and from 1 to 72 time slots on 4-wire modems (4W);
- Self-negotiation - allows negotiation with the equipment connected by the Ethernet interface on the operating mode, interface velocity, and flow control use;
- Duplex - it is possible to choose between the Full-Duplex (both sides transmit simultaneously) and Half-Duplex modes (one side transmits at a time);

- Link Speed – it is possible operation velocity on the interface at 100Mbits/s or 10Mbits/s;
- Flow control - allows enabling flow control on the interface. Should it be operating on Full Duplex mode, pause frames will be used. Should it be on Half Duplex mode, back pressure mode will be used;
- On pause frames - when there is LAN clogging, the equipment will send pause frames to the link partner, so that it will wait for a determined time until sending the next data package;
- On back pressure - when there is LAN clogging, the equipment generates net collisions to limit traffic.

7. STRAPS

The DM991S/SE modems present substantial differences in relation to the DM991C/CE modems as to the configurations done through strapping, in such a way that the sub chapter 7.1 verses on the DM991S/SE modems strapping and sub-chapter 7.2 verse on the DM991C/CE modems strapping.

7.1. DM991S/SE

7.1.1. G.703 Interface Cable Selection (E4)

Position 120: Selects the use of twisted pair, meaning it operates on the G.703 interface with 120ohms impedance.

Position 75: Selects the use of coaxial cable, meaning it operates on the G.703 interface with 75ohms impedance – factory standard.

7.1.2. Output Coaxial Cable Grounding (E10)

Allows the coaxial cable shield to be grounded.

Position 0-1: Connects the output coaxial cable shield to the signal ground (depends on the pinout, configured according to: Table 12, Table 13 or Table 14).

Position 0-2: Isolated – factory standard.

Make sure the strap is not on grounding position when twisted pair is used(120ohms).

7.1.3. Input Coaxial Cable Grounding (E11)

Allows the coaxial cable shield to be grounded.

Position GND: Connects the input coaxial cable shield to the signal ground (depends on the pinout, configured according to: Table 12, Table 13 or Table 14).

Position ISOL: Isolated – factory standard.

Make sure the strap is not on grounding position when twisted pair is used(120ohms).

7.1.4. G.703 Interface Pinout (E12 to E15, E27 to E30 and E44 to E47)

Dial Backup – In this option, the equipment presents the G.703 interface in the Dial Backup pins in the screw connector block. The digital interface goes out the DB25 normally, according to the pinout configured through its straps – factory default.

E12 to E15: position 0-2.

E27 to E30: position 0-2.

E44 to E47: position 0-2.

(G.703) Telebrás Standard – In this option the equipment presents the G.703 interface in the TX and RX pins of the DB25, according to the Telebrás practice 225-540-780. The digital interface will not be used once it occupies some of its most important pins.

E12 to E15: position 0-1.

E27 to E30: position 0-1.

E44 to E47: position 0-2.

V.35 and G.703 in DB25 (G+V) – In this option, the equipment presents the G.703 interface in DB25 pins that are not crucial for most applications that use the digital interface. The digital interface should be configured for the ISO2110 Amd.1 standard, and signals CT106, CT108 and CT140 will not be used.

E12 to E15: position 0-1.

E27 to E30: position 0-2.

E44 to E47: position 0-1.

7.1.5. Digital Interface Selection (E16, E18 and E20)

Define if the electrical characteristics of the digital interface will be according to the V.35 or V.36/V.11 recommendation.

Position 0-1: Select V.36/V.11.

Position 0-2: Select V.35 – factory standard.

7.1.6. DB25 Connector Pinout (E31 to E41 and E48 to E59)

Allow to select the pinout standard for the DB25 connector of the V.35-V.36/V.11 digital interface.

Position 0-1: Telebrás standard pinout.

Position 0-2: ISO2110 Amd.1 standard pinout - factory standard.

7.2. DM991C/CE

7.2.1. G.703 Interface Cable Selection (E2, E3 and E25)

Position 120: selects the use of twisted pair, meaning it operates in the G.703 interface with 120ohms impedance.

Position 75: selects the use of coaxial cable, meaning it operates in the G.703 interface with 75ohms impedance- factory standard.

7.2.2. Input Coaxial Cable Grounding (E4)

This straps corresponds to the input line (IN) of interface E1.

GND Position: connects the external coaxial cable network to the signal ground.

ISOL Position: insulated - factory default.

Be careful as not to let those straps be in the grounded position when a twisted pair (120ohms) is used.

7.2.3. Output Coaxial Cable Grounding (E5)

This straps corresponds to the output line (OUT) of interface E1.

GND Position: connects the external coaxial cable network to the signal ground.

ISOL Position: insulated - factory default.

Be careful as not to let those straps be in the grounded position when a twisted pair (120ohms) is used.

This strap is available only on equipment with PCI rev. 04 or higher.

7.2.4. Digital Interface Selection (E10, E12 and E13)

Define if the electrical characteristics of the digital interface will be according to the V.35 or V.36/V.11 recommendation.

Position V.35: V.35 interface- factory standard.

Position V.11: V.36/V.11 interface.

7.2.5. Pinning on connector DB25 (E500 to E522) – Optional

As an option, DM991C/CE equipment can come from the factory with straps E500 to E522. These straps allow you to select the pinning standard for connector DB25 in digital interface V.35-V.36/V.11.

Position 0-1: Telebrás standard pinning.

Position 0-2: ISO2110 Amd.1 standard pinning – factory default.

8. DIP-SWITCHES

Only the DM991S/SE modems have DIP-switches, however, these equipments, as well as the DM991C/CE modems can also be configured via terminal.

8.1. Speed Selection (DIPs A1 to A5)

DIPs A1 to A5 select the transmission rate in the line and in the enabled tributary interface. If the modem is configured as NTU (DIP B5 on OFF), DIPs A1 to A5 will determine only the rate of the tributary interface, the line rate being defined by the LTU configuration.

When the keys are all OFF, the modem operates at 2048kbit/s (32 channels). If the E1 interface is enabled (DIP B4 on OFF), the data will be transmitted and received without frame synch search. The configurations set in the B1 to B3 DIP-switches will be ignored.

When one or more of the keys is ON, the interface will operate with the number of channels set by the keys sequence. The number of channels will be the same as the binary number written by the keys (A1=MSB), which is easier seen on Table 16.

Rates over 2048kbits/s, only will be configured by terminal or management.

A1	A2	A3	A4	A5	Number of channels	Speed
OFF	OFF	OFF	OFF	OFF	32	2048 kbit/s
OFF	OFF	OFF	OFF	ON	1	64 kbit/s
OFF	OFF	OFF	ON	OFF	2	128 kbit/s
OFF*	OFF*	OFF*	ON*	ON*	3	192 kbit/s
OFF	OFF	ON	OFF	OFF	4	256 kbit/s
OFF	OFF	ON	OFF	ON	5	320 kbit/s
OFF	OFF	ON	ON	OFF	6	384 kbit/s
OFF	OFF	ON	ON	ON	7	448 kbit/s
OFF	ON	OFF	OFF	OFF	8	512 kbit/s
OFF	ON	OFF	OFF	ON	9	576 kbit/s
OFF	ON	OFF	ON	OFF	10	640 kbit/s
OFF	ON	OFF	ON	ON	11	704 kbit/s
OFF	ON	ON	OFF	OFF	12	768 kbit/s
OFF	ON	ON	OFF	ON	13	832 kbit/s
OFF	ON	ON	ON	OFF	14	896 kbit/s
OFF	ON	ON	ON	ON	15	960 kbit/s
ON	OFF	OFF	OFF	OFF	16	1024 kbit/s
ON	OFF	OFF	OFF	ON	17	1088 kbit/s
ON	OFF	OFF	ON	OFF	18	1152 kbit/s
ON	OFF	OFF	ON	ON	19	1216 kbit/s
ON	OFF	ON	OFF	OFF	20	1280 kbit/s
ON	OFF	ON	OFF	ON	21	1344 kbit/s
ON	OFF	ON	ON	OFF	22	1408 kbit/s
ON	OFF	ON	ON	ON	23	1472 kbit/s
ON	ON	OFF	OFF	OFF	24	1536 kbit/s
ON	ON	OFF	OFF	ON	25	1600 kbit/s
ON	ON	OFF	ON	OFF	26	1664 kbit/s
ON	ON	OFF	ON	ON	27	1728 kbit/s
ON	ON	ON	OFF	OFF	28	1792 kbit/s
ON	ON	ON	OFF	ON	29	1856 kbit/s
ON	ON	ON	ON	OFF	30	1920 kbit/s
ON	ON	ON	ON	ON	31	1984 kbit/s

Table 16. Digital Interface Speed Configuration

* These are the DIP-switches factory default configurations.

8.2. Clock Selection (DIPs A6 and A7)

Defines the clock used by the modem.

A7	A6	Clock
ON	OFF	Internal
OFF	OFF	Regenerated
OFF	ON	External
ON	ON	External, with CT104 synched to CT113

Table 17. Internal Clock Selection of Equipment

The internal clock is obtained from the crystal oscillator from itself, with ±25ppm precision.

The regenerate clock is obtained through the line G.shdsl signal, having the same precision of the equipment providing the signal. When operating with regenerated clock, the modem automatically switches to internal clock in case of flaw in the G.shdsl signal in its input. When configured as LTU, the modem can not be configured with regenerated clock.

The external clock is provided by the DTE through the CT113 in the digital interface or recovered through the G.703 signal, depending on which interface is enabled. The DTE should provide it with ±50ppm precision for connection in plesiochronous mode and ±32ppm for connection in synchronous (to operate according to the G.991.2 rule). When operating with external clock, the modem automatically switches to internal clock in case of flaw in the external clock source, but errors can occur in the transmission sequence during the commuting.

The external clock with CT104 synched according to CT113 (External RX in Table 19) operates as external clock, being that in this mode the data (CT104) of the V.35 or V.36/V.11 interface are also transmitted to the DTE synched by the external clock CT113. The commuting to internal clock is automatic during the period in which there is clock loss in the CT113, but this can cause errors in the transmission sequence during the commuting. If the G.703 interface is enabled, the operation is the same as external clock.

8.3. LDR Enabling (DIP A8)

When ON, allows the LDR request to be accepted.

When OFF, rejects the LDR request.

In the converter mode the LDR test will be on V.35 interface

8.4. Cross-Connect CAS (DIP B1)

When ON, enables the E1 interface CAS transmission to the line.

When OFF, CAS synch is not generated or verified.

This DIP has no function when DIP B4 or DIP B7 is set to ON.

8.5. Timeslot 16 Enabling (DIP B2)

When ON, enables the data transmission through timeslot 16 of the E1 interface.

When OFF, disables the data transmission through timeslot 16 of the E1 interface.

This DIP has no function when DIP B4 or DIP B7 is set to ON.

8.6. CRC4 Enabling (DIP B3)

When ON, enables the generation and verification of CRC4 synch on the E1 interface.

When OFF, disables the generation and verification of CRC4 synch on the E1 interface.

This DIP has no function when DIP B4 or DIP B7 is set to ON.

8.7. E1/Digital interface selection (DIP B4)

When ON, enables the digital interface and disables the E1 interface.

When OFF, enables the E1 interface and disables the digital interface.

To use both interfaces simultaneously it is necessary to set the configurations through the remote management or the terminal. For that, DIP B6 must be set to ON or configured for the converter mode (DIP B7).

This DIP has no function when DIP B7 is set to ON.

8.8. Terminal type (DIP B5)

When ON, configures the modem as STU-C or LTU.

When OFF, configures the modem as STU-R or NTU.

When the modem is configured as NTU, DIPs A1-A5 determines the transmission rate of the interface selected by B4.

When the modem is configured in LTU, the frame mode is plesiochronous and the annex is automatic (in relation to the DIP-switches configuration). If other frame mode or annex is wished, it is necessary to do the configuration through the terminal.

This DIP has no function when DIP B7 is set to ON, that is, converter mode enabled.

8.9. Configuration (DIP B6)

When ON, enables the configuration functions and modem loopback tests by the manager or the terminal.

When OFF, the equipment configuration is given by the configuration of the other DIP-switches.

When this DIP-switch is ON, the configuration will be determined by the management system. In case no configuration has ever been done by the manager the DIP-Switches configuration will be used until the management system programs a different configuration. To store the configuration done by the manager in a non volatile (E2PROM), the request must be done via manager or terminal. This way, the equipment can recover the configuration even after being shut off.

When OFF, it is possible to monitor the modem through the manager, but the configuration is inhibited. The modem is then configured by the straps and DIP-switches.

8.10. Converter Mode / Ethernet interface enabling (DIP B7)

The DIP B7 presents different functions for modems DM991S and DM991SE:

8.10.1. DM991S

When ON, enables Converter Mode (Item 8.4).

8.10.2. DM991SE

When OFF, disables the Ethernet interface. In this case the active interface is selected through DIP B4.

When ON, enables the Ethernet interface. In this case, DIP B4 will be ignored and the only tributary enabled will be the Ethernet. To enable the other tributaries simultaneously it is necessary to set the configurations through the remote management or the terminal. For that, DIP B6 must be set to ON.

8.11. Four wire operation

Only for 4W modems.

When ON, the G.shdsl interface works over 4 wires.

When OFF, the G.shdsl interface works over 2 wires.

8.12. DIPs Summary

DIP	Function	OPERATION	POSITION
A1 to A5	Speed selection	Table	See table⊥
A6/A7	Transmissio clock	Internal	OFF / ON
		External	ON / OFF *
		Regenerated	OFF / OFF
		External RX	ON / ON
A8	LDR request	Accepts	ON
		Does not accept	OFF*
B1<<	Cross-Connect CAS	Enabled	ON
		Disabled	OFF*
B1<<	Timeslot 16	Enabled	ON
		Disabled	OFF*
B3<<	CRC4	Enabled	ON
		DIsabled	OFF*
B4†	Interface	V.35	ON*
		G.703	OFF
B5	Terminal type	LTU	ON*
		NTU	OFF
B6	Configuration	Management	ON
		Dip-Switches	OFF*
B7◊	Ethernet◊	Enabled	ON*
		disabled	OFF
	Converter Mode#	Enabled	ON
		disabled	OFF*
B8▼	4W Operation	Enabled	ON*
		disabled	OFF

Table 18. DM991S/SE – DIPs Summary

⊥ See Table 16.

* Factory standard position

† This DIP loses purpose when DIP B7 is se to ON.

◊ Only for DM991SE model.

Only for DM991S model

▼ Only for modems that works on four wires (4W).

<<These DIPs have no function when DIP B4 is ON and DIP B7 is OFF.

The DM991SE modems leave factory configured to internal transmission clock (A6=OFF/A7=ON)

9. OPERATION DESCRIPTION

The equipment works completely autonomous, meaning once it has been configured it does not need external intervention; as well as if it is initialized it goes automatically into operation according with the configuration saved on the (E2PROM) memory, without needing any special initializing procedure. The interfaces statuses are indicated by (LEDs) and automatically go back into normal operation when any malfunctioning status is corrected.

9.1. Equipment Management

There are the following different ways to manage the DM991 family modems:

- Through a VT100 terminal (using PC emulator);

The terminal has management priority over other methods. This way, the management opening via germinal will disconnect other active managements at that instant..

- Through the DMG20 management card, that acts as an SNMP proxy agent, communicating with the DM991S/SE through the RS485 interface with the Telebrás protocol for modem management in sub-racks. Can be integrated to the DATACOM equipments management system using the DmView software;

Only DM991S/SE modems can be directly managed through the DMG20 management card.

- Through the remote management, that can be integrated to the DATACOM equipments management system using the DmView software. This configuration can be used when the DM991 is the remote to a DM705 equipment (as shown on Figure 14).

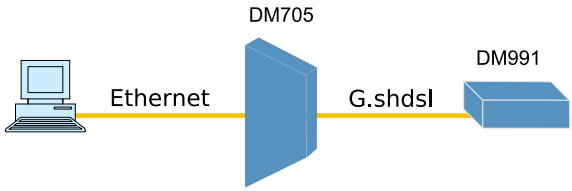


Figure 14. DM991 Managed as DM705 remote

9.2. Equipment Clocks

9.2.1. Transmission Clock

The modem transmission clock can be configured through the terminal or the management and there are the following clock options:

- Internal - is obtained from the modem's crystal oscillator, with 25 ppm precision.
- Regenerated from the G.shdsl interface - has the same precision as the equipment providing the signal. When configured as LTU, the modem can not be configured with regenerated clock.

- Regenerated from the E1 interface - Is provided by the DTE through the G.703 signal of the E1 interface.
- Regenerated from the digital interface - Is provided by the DTE through the CT113 signal. The digital interface must have the clock configured as external (CT113) or CT104 sinc. CT113.

Whichever the configuration, the clock used for the transmission should have at least ±50ppm precision for connection in plesiochronous mode and ±32ppm for connection in synchronous (to operate according to the G.991.2 rule). The modem automatically switches to internal clock in case of flaw in the configured clock, but errors can occur in the transmission sequence during the commuting.

9.2.2. Plesiochronous Mode

When in plesiochronous mode, the transmission and reception clocks are independent from the line clock which is generated by the LTU. That is why the clocks used can be from different sources.

Figure 15 shows how the clocks in the connection of two DM991 works, one operating with internal clock and other operating with the DSL interface regenerated clock.

The LTU equipment sends the data in the DSL interface using the internal clock. In the NTU side, the clock received from the DSL interface is taken to the E1 and digital interfaces (continuous arrows). Also, according to the selection of regenerated clock a loop is done in the clock, so that it is used in the data transmission by the DSL interface (traced arrow).

Back in the LTU side, the equipment uses the clock received from the DSL interface for the E1 and digital interfaces.

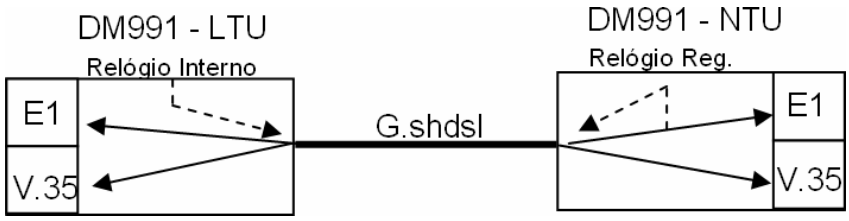


Figure 15. Internal and Regenerated Clocks in Plesiochronous Mode

Figure 16 shows how the clocks in the connection of two DM991 works, one operating with the external clock coming from the E1 interface and other operating with the DSL interface regenerated clock.

The LTU equipment receives the clock form the E1 interface and uses it to send data in the DSL interface (traced arrow). In the NTU side, the clock received from the DSL interface is used for data transmission in the E1 and digital interfaces (continuous arrows). Also, a loop in the clock is done, so that it is used in the data transmission by the DSL interface (traced arrow).

In the LTU equipment, the clock received from the DSL interface is used in the E1 and digital interfaces (continuous arrows).

The clocks work in this same way when the external clock comes from the digital interface, (from a router, for example) instead of coming from the E1 interface.

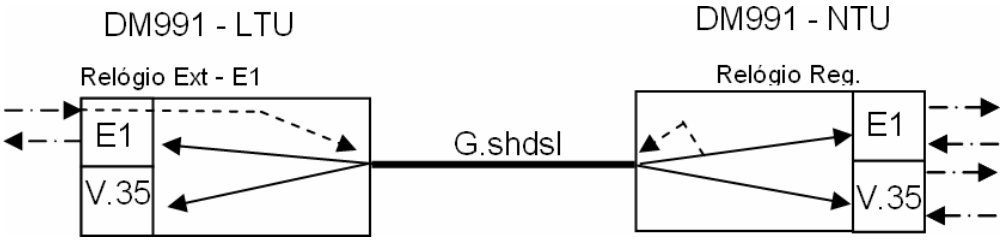


Figure 16. E1 External Clock and Regenerated in Plesiochronous Mode

Figure 17 shows two DM991 operating with external clocks coming from the V.35 (CT113). Both digital interfaces are connected to routers that have their clocks configured as internal.

The scheme is very similar to the ones already showed. The external clock coming form the V.35 in the LTU equipment is passed to the DSL interface, which in its turn is passed to the E1 and digital interfaces of the NTU equipment. The same happens the other way around (clock coming from the V.35 in the NTU passes trough the DSL interface and goes to the E1 and digital interfaces in the LTU).

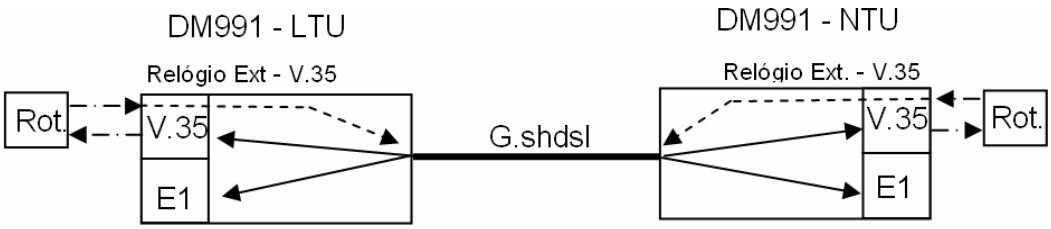


Figure 17. Digital interface External Clocks in Plesiochronous Mode

9.2.3. Synchronous Mode

This mode functions in a similar way as described in the plesiochronous mode, however some details should be observed:

a. In this mode, the TX and RX should be the same. The user must decide on operating with internal clock in the LTU and regenerated in the NTU or on making sure that the external clocks are synchronized.

b. It is not possible to do an external clock loop in the LTU in this mode.

c. When using a regenerated clock, the external equipment should provide the clock with a minimum accuracy of ±32ppm for proper modem operation.

9.3. Digital Interface Clocks

9.3.1. Clock Source

In this mode the digital interface uses as transmission clock (CT114) the one provided by equipment clock source.

Figure 18 shows how the V.35 works with Clock Source. The traced arrow indicates that the CT115 is generated from the DSL interface regenerated clock of the DM991. The CT114 is generated from the system clock, which in this case, can be internal, regenerated from the line or regenerated from the E1 interface (it can not be regenerated from the digital interface, in which case the use of the CT113 would be necessary).

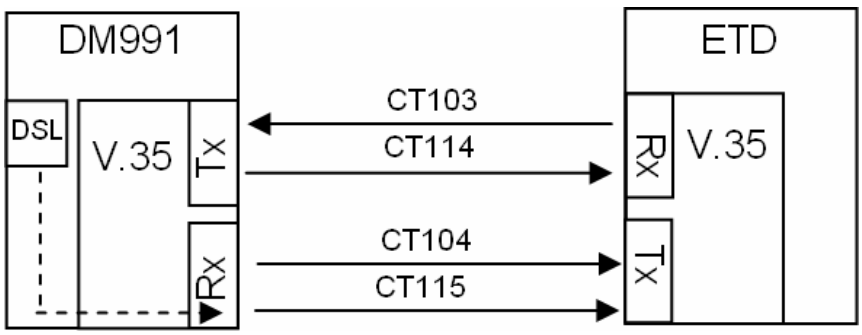


Figure 18. Digital Interface Operation with Clock Source

9.3.2. External (CT113)

In this mode the V.35 uses the CT113 (transmission clock of the equipment connected to the DM991) to generate the o CT114 (transmission clock of the DM991).

Figure 19 shows how a digital interface configured as external works when a DM991, with regenerated clock from the DSL, is connected to an ECD equipment. The traced arrow indicates that the CT115 derives from the DSL interface regenerated clock. The doted arrow indicates that the equipment uses as transmission clock (CT114) the clock provided by the ECD through the CT113.

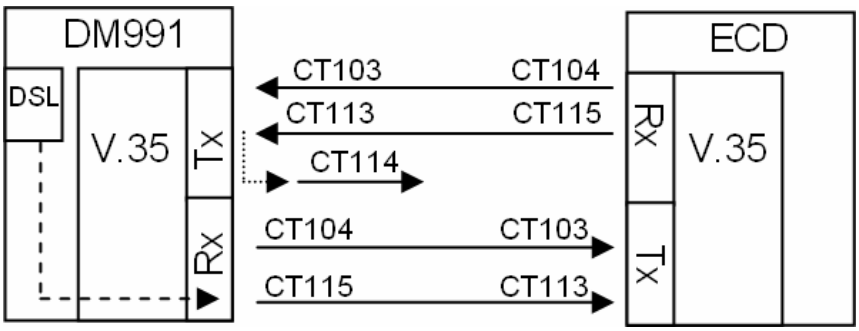


Figure 19. Digital Interface Operating with External

9.3.3. CT104 sinc. CT113

In this mode the digital interface works in the same way as in the External mode, but with the CT104 being generated from the CT113. This mode is recommended to connect a DM991 equipment to a NewBridge® equipment that operates as ECD. In this case, the system clock is usually the V.35 external clock.

Figure 20 shows how a V.35 configured as CT104 sinc. CT113 works when a DM991 is connected to an ECD equipment. The scheme is the same as the one shown in the External mode, except that the CT113 received by the DM991 is also used to control the CT104 (as the doted arrow shows). The CT115 does not alter itself in this way.

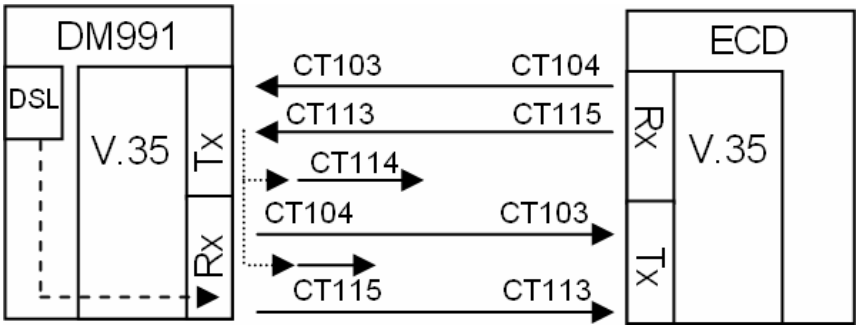


Figure 20. Digital Interface Operation with CT104 sinc. CT113

9.3.4. CT113 Unlooped to CT114

In this mode the digital interface works as in the External mode, however the CT113 is not passed to the CT114. It is recommended when connecting the DM991 to some routers.

Figure 21 shows how a V.35 configured as CT113 Unlooped to CT114 works when a DM991 is connected to the ECD equipment. The scheme is the same as the one shown in the External mode, except the CT113 is not passed to the CT114. Therefore the CT114 derives from the system clock. In this case the modem can not be configured as the digital interface external clock, but it will use the CT113 to sample the CT103.

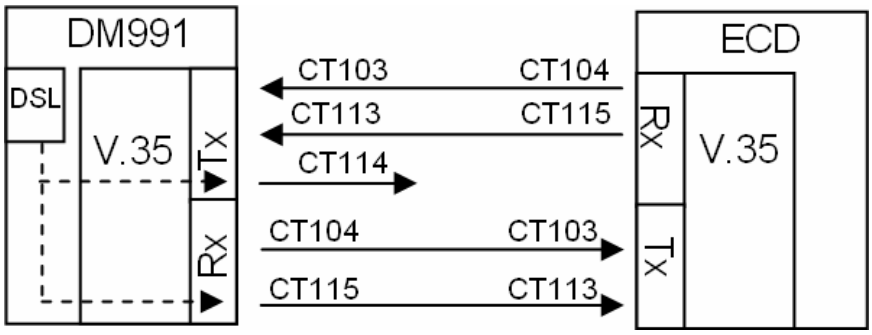


Figure 21. Digital Interface with CT113 Unlooped to CT114

9.3.5. CT128 Enabled

External reception clock provided by the DTE. When enabled, substitutes the CT115, which stops being used (although it still exists). When the equipment connected to the DM991 does not generate the CT128, this option should be disabled. In this case the CT115 will be used as reception clock.

9.3.6. Invert Tx Clock

When enabled, this option inverts the equipment's transmission clock signal phase (CT114). Used to compensate problems generated by delays in some routers.

9.4. Converter Mode

Equipment DM991S and DM991C can also operate as interface converters, converting G.703 signals (bit rate of 2048kbit/s), with frame structure according to G.704, to V.35 or V.36/V.11 interface signals. In this mode, the G.shdsl interface is disabled.

The digital interface and E1 tributary continue operating of same way.

The converter mode can be enabled by DIP B7 (on DM991S) or disabling the G.shdsl interface by terminal/ management.

This feature is included as of the following FW versions:

- DM991C 4W: 0229-06 – 09/28/06 - 15:43
- DM991C 2W: 0225-01 – 10/02/06 - 16:23
- DM991S 2W and 4W: all versions have this feature.

10. TERMINAL MANAGEMENT

The DM991 family modems can be configured through a VT100 terminal (or an emulator of a PC Terminal such as the Windows® HyperTerminal®) connected to the Terminal port in the front panel.

The Terminal should be configured for 9600bit/s without flow control, 1 stop bit and without parity bit. When configured with Windows2000®, it is recommended not to use the HyperTerminal®, for it presents some problems working on this platform. For that, it is recommended to use the TeraTerm®, which is freeware and can be acquired at the following web address:

http://www.vector.co.jp/authors/VA002416/teraterm.html

As soon as the connection is established, the terminal might ask for an access password, which is factory configured as “admin” (this password will only be requested if the user configures the equipment to do so). This password can be changed or even disabled as will bee seen next.

The terminal has a 10 minute timeout, in a way that if nothing is typed in that time, it returns to the password identification screen. Bellow are described the configuration and management menus.

```
#    ------------------------------------------------------------------------
#                                   D A T A C O M
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#
#        1 - Choose equipment to configure
#        2 - Equipment information
#        3 - Terminal access password configuration
#        4 - Change terminal language
#
#        E - Exit
#        R - Exit and reset
#
#
#
#
#
#            Option: [ ]
#
#
#    ------------------------------------------------------------------------
#                            www.datacom.ind.br
#    ------------------------------------------------------------------------
```

The options on this screen are:

- 1 - Choose equipment: accesses the configuration menu for the interfaces, making it possible to chose between configuring the equipment local or remotely.
- 2 - Equipment configuration: informs the factory default parameters and detailed information on the equipment.
- 3 - Password configurations: allows the terminal access password to be configured, altered or disabled.
- 4 - Change terminal language: allows changing the terminal language to English or Portuguese.
- E - Exit: The “Exit” option is used to finalize the terminal access, returning to the access password screen, so new configurations can only be done providing the right password is informed once more, when the password request option is enabled.

- R - Exit and reset: The “Exit and reset” option finalizes the terminal access and restarts the equipment.

In the DM991S/SE equipments it is necessary to use the option "E" and wait 10 minutes so the Telebrás management goes back on.

10.1. Equipment Information

```
#    ------------------------------------------------------------------------
#                                  D A T A C O M
#               DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                              Equipment Information
#
#        Product code                       :[ 3011                     ]
#        Firmware version                   :[ 50                       ]
#        Software boot version              :[ 1                        ]
#        Hardware version                   :[ 1                        ]
#        Serial number                      :[ 278742                   ]
#        Release date (mm/dd/yy hh:mm)      :[ 01/04/06 - 05:52 pm      ]
#        E2PROM version                     :[ 1                        ]
#        Number of after factory resets     :[ 56                       ]
#        Factory code                       :[ 7                        ]
#
#
#
#
#
#
#    ------------------------------------------------------------------------
#                                    <ESC> Back
#    ------------------------------------------------------------------------
```

When this option is chosen, the following parameters will be presented:

- Product code;
- Firmware version;
- Software boot version;
- Hardware version;
- Serial number;
- Release date;
- E2PROM version;
- Number of after factory resets - updated at each system reset;
- Factory code;

10.2. Password Configuration

```
#    ------------------------------------------------------------------------
#                                    D A T A C O M
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                               Password Configuration
#
#        1 - Enable or disable terminal access password on initialization
#        2 - Change terminal access password
#
#
#
#
#
#
#
#
#
#
#
#             Option: [ ]
#
#
#    ------------------------------------------------------------------------
#                                     <ESC> Back
#    ------------------------------------------------------------------------
```

- 1 – Password enabling - this menu allows to disable the password request on the access terminal menu. When disabled the terminal warns that the password will be lost and will return to the factory default (“admin”) in case the option is re enabled.
- 2 – Password alteration - is used to alter the password, which should have from 5 to 15 characters. The user must type in the old password and then twice the new password.

Should this password be forgotten, it will be necessary contact technical support to solve this problem. Have at hand the serial number and the software version. To obtain these numbers, simply type “L” (lowercase) and ENTER on the password screen.

10.3. Language Configuration

```
#    ------------------------------------------------------------------------
#                                    D A T A C O M
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                              Change Terminal Language
#
#        Language                              :[ English    - Ingles      ]
#
#
#
#
#
#
#
#
#
#
#
#
#
#
#
#    ------------------------------------------------------------------------
#                           <ESC> Exit   <ENTER> Save and Exit
#    ------------------------------------------------------------------------
```

In this menu it is possible to choose the terminal language. The available options are English and Portuguese.

Press TAB to alter between options.

10.4. Choosing Equipment to be Configured

```
#    ------------------------------------------------------------------------
#                                    D A T A C O M
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                                  Choose Equipment
#
#        *1 - DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#
#
#
#
#
#
#
#
#
#
#
#
#
#            Option: [ ]
#
#
#    ------------------------------------------------------------------------
#                             <ESC> Back   <ENTER> Refresh
#    ------------------------------------------------------------------------
```

In this menu the user chooses if he wishes to configure the local or the remote equipment, as long as it is enabled for remote configuration. A list of manageable equipments will be shown, in such way that the ones capable of management at that time will be signaled by a * along side its number on the menu.

If an equipment is listed, however without the *, it means there already is a manager acting in the equipment at that time.

Through the number presented on the list, the equipment to be configured is chosen. The first equipment on the list is always the local.

For each manageable equipment, there is a Main Menu distributed in the following way:

```
#    ------------------------------------------------------------------------
#                                    D A T A C O M                      [ 1 ]
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                                     Main Menu
#
#        1 - Configuration menu
#        2 - Tests menu
#        3 - Status menu
#        4 - Performance menu
#        F - Firmware download to local equipment
#
#
#
#
#
#
#
#            Option: [ ]
#
#
#    ------------------------------------------------------------------------
#                                     <ESC> Back
#    ------------------------------------------------------------------------
```

- 1 - Configuration menu: allows the general equipment or interfaces characteristics to be configured.
- 2 - Test menu: Allows the activation of the available tests.
- 3 - Status menu: Allows the equipment or interface general status visualization.
- 4 -Performance Menu: Allows the G.shdsl interface performance parameters visualization.

- F - Firmware download for both local and remote equipment: allows the firmware download to be done, for future upgrades. The download can be for either the local as for the remote modem.

10.5. Configuration Menu

In this configuration menu the user has access to all information of the equipment.

All configurations made in the sub-menus of this equipment are saved in a user memory, which will need to be activated in order for the equipment to be configured in the desired manner. The configuration in use on the equipment will be stored in a memory called Equipment Memory. The user's configurations however, will be in a memory called User Memory.

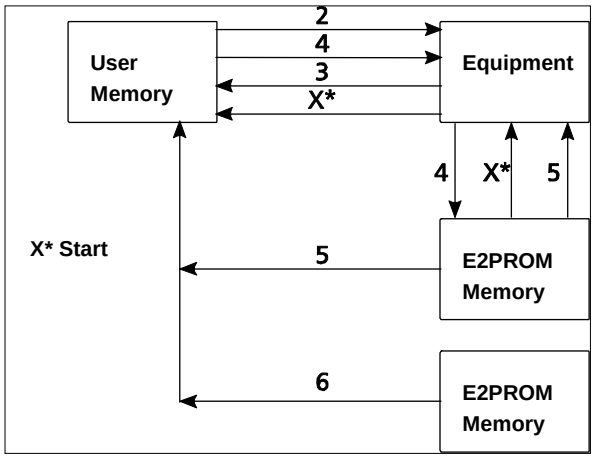


Figure 22. Configuration memories diagram

Figure 22 presents all actions that can be taken with the equipment memories.

- Equipment memory: configuration in use in the equipment, coming from the configuration stored on the E2PROM memory after initialization (X*) or of the configuration of the user (User memory), after the activation command (2). The equipment memory is passed on to the E2PROM memory when "save configurations on E2PROM" (4) is selected and is passed on to the user memory with the command "Refresh configurations" (3)
- User memory: contains the configurations the user locally programmed via terminal or remotely via SNMP. It is where the information of what has been configured on the terminal screens is stored. The user memory is passed on to the equipment memory when it is selected "apply changes" (2), then if the configurations are valid, they will become active. The command "charge E2PROM configurations" (5) will charge into the user memory the configuration stored on the E2PROM memory. It can also be used to load into this memory the standard factory configuration by using the command "load standard factory configuration" (6). The standard configuration is factory programmed and cannot be altered.
- E2PROM Memory: it's a non volatile memory from where the equipment reads the configurations on the moment of initialization (X*). This memory is copied into the User Memory through the command "Load E2PROM configurations" (5) and is altered through the command "Save configurations to E2PROM" (4), which activates the configuration of the user, and sends the Equipment Memory to E2PROM.

```
#    ------------------------------------------------------------------------
#                                  D A T A C O M                          [ 1 ]
#                         DM991CE - G.SHDSL Modem With Ethernet Bridge
#    ------------------------------------------------------------------------
#                                Configuration Menu
#
#     G - General configuration
#     D - G.SHDSL interface
#     V - V.35 interface
#     E - E1 interface
#     B - BRIDGE interface
#
#     1 - Test user configuration
#     2 - Update changes (User->Equipment)
#     3 - Reload equipment configuration (Equipment->User)
#     4 - Save equipment configuration to E2PROM (Equipment->E2PROM)
#     5 - Load E2PROM to user memory and equipment (E2PROM->User and Equipment)
#     6 - Load factory values to user memory(Factory->User)
#     7 - View Activation LOG
#     User memory status :[ Factory configuration                    ]
#     Option: [ ]
#    ------------------------------------------------------------------------
#                              <ESC> Back   <ENTER> Refresh
#    ------------------------------------------------------------------------
```

- G - General configurations: allows the equipment clock and other general characteristics configuration.
- D - G.SHDSL interface: G.shdsl interface specific parameters configuration menu.
- V - Interface V.35: digital interface specific parameters configuration menu.
- E - E1 interface: E1 interface specific parameters configuration menu.
- B - BRIDGE interface: Ethernet interface specific parameters configuration menu (only for DM991SE and DM991CE models).
- 1 - Test user configuration: this option tests if the configurations set by the user are valid and if its application is possible, without actually activating them in the equipment. When the configuration is completely valid “Compatible temporary configuration” will show on the configuration field. If any adjustments are necessary in the user configuration “partially active configuration” will show and if it is not possible to activate the configurations “Invalid temporary configuration” will show.
- 2 - Apply changes: this option makes the equipment try to apply the user configurations. If the configurations are applied completely, them the status indication will show” Active configuration”. If however, it applies it with the automatic change of any incoherent configuration, “ Partially active configuration” will show and if it is not possible to apply the user’s configurations “Invalid configuration” will show.
- 3 - Update configurations: this option writes over the user’s configuration with the equipment configuration. Used when it is wished to obtain the configuration that was on the equipment (discarding the changes done by the user that were not loaded).
- 4 - Save configurations on E2PROM: this option makes the equipment save the active configuration into the E2PROM, so the next time the equipment is initiated it will return to the same configuration.
- 5 - Load E2PROM configurations: this option reads the configuration stored on the E2PROM, overwriting the user configuration. To make this configuration active the “apply changes” options must be executed.
- 6 - Load factory configuration: This option loads the user memory with the factory default configuration. To make this configuration active, the “Apply changes” option must be executed.

- 7 - Visualize activation LOG: This option presents a LOG containing the errors when partially invalid or invalid configurations try to be activated.

10.5.1. Equipment General Configurations Menu

On this menu, pressing TAB will change the value of the object to be configured.

Press ENTER to exit this menu and save the changes in the user memory, and ESC to exit and cancel the changes.

This menu can be accessed by pressing “G” on the configuration menu and is destined to the equipment global clock configuration and to the enabling or not of destructive configurations to the management link.

- Clock Source: configures the transmission clock of the equipment. The options are: internal and regenerated (of the DSL, E1 or digital interface).
- Enable destructive configuration: enables or disables the destructive configurations for the remote management. It is necessary to enable this object in case the user wants to disable the remote management through the EOC on the G.shdsl interface or to disable the G.shdsl interface (enable converter mode).

```
#   ------------------------------------------------------------------------
#                                D A T A C O M                          [ 1 ]
#               DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ---------------------------------------------------------------------
#                             General Configuration
#
#        Clock source                      :[ Regenerated from G.SHDSL ]
#        Enable destructive configuration  :[ No                       ]
#
#
#
#
#
#
#
#
#
#
#
#
#
#
#    ---------------------------------------------------------------------
#           <P>revious  <ESC> Exit <ENTER> Save and Exit <TAB> Change <N>ext
#    ---------------------------------------------------------------------
```

The clock can be regenerated from any one of the interfaces or be internally generated by the equipment. However, all the interfaces, aggregate and tributaries should be in synch or referenced to the same synch source.

10.5.2. G.shdsl Interface Configuration Menu

```
#   ------------------------------------------------------------------------
#                                D A T A C O M                          [ 1 ]
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ----------------------------------------------------------------------
#                              G.SHDSL Configuration
#
#        Enable Operation                  :[ Yes                      ]
#        Enable tests                      :[ Yes                      ]
#        Enable RDL reception              :[ Yes                      ]
#        Number of channels                :[ 32                       ]
#        Remote management                 :[ Use EOC bits             ]
#        Unit type                         :[ NTU                      ]
#        Annex                             :[ Automatic                ]
#        Frame mode                        :[ Automatic                ]
#        Line Operation                    :[ 2 Wires                  ]
#
#
#
#
#
#
#    ----------------------------------------------------------------------
#           <P>revious  <ESC> Exit <ENTER> Save and Exit <TAB> Change <N>ext
#    ----------------------------------------------------------------------
```

- Enable Operation: enables or disables the interface, when disabled the modem to take on Converter Mode.

This option is available only for models DM991S and DM991C. In order to disable the G.shdsl interface, you have to enable the destructive settings in the general equipment settings menu.

- Enable tests: enables the test activation on this interface through the test menu or through the management.
- Enable RDL reception: informs if the interface should recognize and accept the LDR request, through the remote modem and go into loop.
- Number of channels: It can range from 1 to 36 2-wire channels and 1 to 72 4-wire channels.
- Remote management: Allows to configure the G.shdsl interface management channel or to disable it.
- Operation mode: determines if the modem operates as LTU (central) or as NTU (user).
- Annex : Can be configured as annex A, B or automatic selection.
- Frame mode: selects synchronous, plesiochronous or automatic mode.
- Line Operation: Enables operation in the line, on 2 wires or 4 wires.

Only for 4W models.

10.5.3. Digital Interface Configuration Menu

```
#    ------------------------------------------------------------------------
#                                  D A T A C O M                          [ 1 ]
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                                V.35 Configuration
#
#        Enable operation                  :[ No                        ]
#        Enable tests                      :[ Yes                       ]
#        Number of channels                :[ 01                        ]
#        CT105 (RTS)                       :[ Forced ON                 ]
#        CT108 (DTR)                       :[ Forced ON                 ]
#        Clock                             :[ Device 2M clock source    ]
#        CT128 (ERC)                       :[ Disable                   ]
#        CT140 (RDL)                       :[ Forced OFF                ]
#        CT141 (LAL)                       :[ Forced OFF                ]
#        Invert TX clock                   :[ No                        ]
#        CT103/CT104 Monit                 :[ Yes                       ]
#        CT103 filtering (open loop)       :[ No                        ]
#
#
#
#    ------------------------------------------------------------------------
#           <P>revious  <ESC> Exit <ENTER> Save and Exit <TAB> Change <N>ext
#    ------------------------------------------------------------------------
```

- Enable operation: enables or disables the interface.
- Enable tests: enables the test activation on this interface by the test menu or the management.
- Number of channels: sets the number of time slots in the interface. It can range from 1 to 36 2-wire DSL channels and 1 to 72 4-wire DSL channels.
- CT105 (RTS): indicates if the CT105 controlled signal, generated by the DTE, signaling transmission request should be considered or ignored (forced ON).
- CT108 (DTR): Indicates if the CT108 control signal, generated by the DTE, signaling that the terminal is ready, should be considered or ignored (forced ON).
- Clock: Defines which clock will be used to sample the CT103:
    - General synch source: the interface will use as clock the equipment clock source (regenerated from an interface or internal);
    - External (CT113): the interface will use the CT113 signal to sample the CT103;
    - CT104 sync CT113: the interface will use the CT113 signal to sample the CT103 and to generate the CT104;
    - CT113 unlooped CT114: the CT113 clock is not passed on to the CT114, which will be the system clock. The CT113 signal is sampled according to the CT113. Recommended when connecting the DM991 to some routers models;

For more information contact DATACOM's technical support.

- CT128 (ERC): selects if the data sent in the CT104 should be synched with the CT128 signal of the interface. If the previous parameter, clock, is selected for CT104 sinc. CT113, this object can not enabled;
- Invert TX clock: inverts the sampling clock border selected to sample the CT103.
- CT103/CT104 Monit: enables the monitoring of type of information transmitted or received in digital interface.

Available in FW version 110.

- CT103 filtering: enables the filtering of type of information received in digital interface. It has effect only on status information, not on the data received in digital interface.

Available in FW version 110.

10.5.4. E1 Interface Configuration Menu

```
#    ------------------------------------------------------------------------
#                                  D A T A C O M                          [ 1 ]
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                                 E1 Configuration
#
#        Enable operation                  :[ Yes                      ]
#        Enable tests                      :[ Yes                      ]
#        Idle byte                         :[ 255                      ]
#        Number of channels                :[ 03                       ]
#        Initial timeslot                  :[ 01                       ]
#        Channel signaling                 :[ Disable                  ]
#        Check CRC4                        :[ No                       ]
#        Timeslot 16 with user data        :[ No                       ]
#        Line impedance                    :[ 75  Ohms                 ]
#        Unused channels                   :[ Idle                     ]
#
#
#
#
#
#    ------------------------------------------------------------------------
#           <P>revious  <ESC> Exit <ENTER> Save and Exit <TAB> Change <N>ext
#    ------------------------------------------------------------------------
```

- Enable operation: enables or disables the interface.
- Enable tests: enables the test activation in the interface by the test menu or management.
- Idle byte: is the decimal value of the byte to be transmitted in the unused timeslots in case they are configured as IDLE.
- Number of channels: configures the number of interface timeslots.
- Initial timeslot: configures the number of the initial data channel. In case CAS is disabled the initial channel must be 01.
- Channel signaling: indicates which signaling type will be used in timeslot 16:
    - Disabled: no signaling is transmitted. Only in this configuration can the timeslot 16 be enabled for data;
    - CAS emulation: the equipment simulates CAS signaling, finding CAS multiframe synch, but without transmitting effective information on channel signaling;
    - Cross Connect CAS: the CAS signaling is received by the E1 and transmitted to the G.shdsl interface.
- Check CRC4: enables CRC4 use.
- Timeslot 16 with user data: enables user data transmission on timeslot 16.
- Line impedance: configures the interface for coaxial cable (75ohms) or twisted pair (120ohms).

To configure the impedance it is necessary to adjust the position of straps E2, E3 and E25 (for DM991C/CE modems) or E4 strap (fro DM991S/SE modems).

- Unused channels: selects what to send on the unused timeslots.

- Drop insert: insert: this configuration makes the received unused timeslots to be retransmitted, enabling the drop insert of several equipments in the same E1 link;
- Idle: this configuration retransmits the user configured value in the “Idle byte” parameter, in each unused timeslot.

10.5.5. Bridge Interface Configuration Menu (only for DM991CE and DM991SE)

```
#    ------------------------------------------------------------------------
#                                D A T A C O M                          [ 1 ]
#                        DM991CE - G.SHDSL Modem With Ethernet Bridge
#    ------------------------------------------------------------------------
#                                Bridge Configuration
#
#        Enable operation                  :[ Yes                      ]
#        WAN Data Rate                     :[ 03                       ]
#        Duplex                            :[ Full-Duplex              ]
#        Link Speed                        :[ 100 Mbit/s               ]
#        Enable Auto Negotiation           :[ Yes                      ]
#        Enable Back Pressure              :[ Yes                      ]
#        Enable Pause Frames               :[ Yes                      ]
#
#
#
#
#
#
#
#
#    ------------------------------------------------------------------------
#           <P>revious  <ESC> Exit <ENTER> Save and Exit <TAB> Change <N>ext
#    ------------------------------------------------------------------------
```

- Enable operation: enables or disables the interface.
- Wan data rate - number of timeslots used on the interface (Nx64kbit/s, up to the aggregate limit).
- Duplex: chooses between the operational modes:
  - Half- Duplex: uses a single band direction at a time;
  - Full- Duplex: uses both band directions simultaneously.
- Link speed: chooses Ethernet port speed, in the LAN direction, between 100Mbit/s or 10Mbit/s.
- Enable auto negotiation: enables or disables the interface parameters auto negotiation.
- Enable back pressure: allows enabling the interface flow control, when using half duplex mode.
- Enable pause frames: allows enabling the interface flow control, when in full-duplex mode.

10.6. Test Menu

On the tests menu the access to the test commands is individual for each interface.

In all test menus, whatever the interface, there is an indication of the status of the tests on the interface.

```
#    ------------------------------------------------------------------------
#                                   D A T A C O M                          [ 1 ]
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                                    Tests Menu
#
#        D - G.SHDSL interface
#        V - V.35 interface
#        E - E1 interface
#
#
#
#
#
#
#
#
#
#            Option: [ ]
#
#
#    ------------------------------------------------------------------------
#                                     <ESC> Back
#    ------------------------------------------------------------------------
```

For all interfaces:

- Test status: indicates if there is any test being run and which;
  - No test active: no test running;
  - Unavailable: the interface is disabled;
  - Running LDL: LDL test being run;
  - Running LDR-TXLDR: LDR test being run by the local equipment;
  - Running LDR-RXLDR: LDR test being run by remote equipment;
  - Running LAL: LAL test being run.

For the BERT tests:

- BERT status: indicates the test status.
- BERT test time (seconds): shows for how long the test has been running.
- BERT error time (seconds): shows for how long the test has been in error.
- Status of test: indicates the test running.
  - Running BERT: only BERT is being run;
  - Running TXLDR & BERT: LDR test being run by the local equipment plus BERT test, both running.

To run the LDR test along with the BERT test, the LDR must be activated first, and then the BERT test.

10.6.1. G.shdsl Interface Test Menu

```
#    ------------------------------------------------------------------------
#                                  D A T A C O M                          [ 1 ]
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                                  G.SHDSL Tests
#
#        1 - Stop  testing
#        2 - Start LDL test
#        3 - Start LAL test
#        4 - Start RDL test
#        5 - Start BERT test
#        6 - Insert BERT error
#        7 - Reset BERT counters
#
#
#
#
#        Current test status               :[ Not running              ]
#
#        Option: [ ]
#
#    ------------------------------------------------------------------------
#                <P>revious    <ESC> Exit     <ENTER> Refresh    <N>ext
#    ------------------------------------------------------------------------
```

- 1 - Stop testing: disables the current test.
- 2 - LDL: starts LDL tes.
- 3 - LAL: activates LAL test, (can only be run in the local equipment).
- 4 - LDR: starts LDR test.
- 5 - Initiate BERT sequence: activates BERT test.
- 6 - Insert BERT error: generates bit error in the BERT sequence being transmitted.
- 7- Reset BERT counters: resets counters of total time and test error time.

10.6.2. Digital Interface Test Menu

```
#    ------------------------------------------------------------------------
#                                  D A T A C O M                          [ 1 ]
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                                    V.35 Tests
#
#        1 - Stop  testing
#        2 - Start LDL test
#
#
#
#
#
#
#
#
#
#
#        Current test status               :[ Unavailable              ]
#
#        Option: [ ]
#
#    ------------------------------------------------------------------------
#                <P>revious    <ESC> Exit     <ENTER> Refresh    <N>ext
#    ------------------------------------------------------------------------
```

- 1 - Stop testing: disables the current test.
- 2 - LDL: activates LDL test.

10.6.3. E1 Interface Test Menu

```
#    ------------------------------------------------------------------------
#                                  D A T A C O M                          [ 1 ]
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                                    E1 Tests
#
#        1 - Stop  testing
#        2 - Start LDL test
#        3 - Start LAL test
#
#
#
#
#
#
#
#
#        Current test status               :[ Not running              ]
#
#        Option: [ ]
#
#    ------------------------------------------------------------------------
#               <P>revious    <ESC> Exit     <ENTER> Refresh    <N>ext
#    ------------------------------------------------------------------------
```

- 1 - Stop testing: disables the current test.
- 2 - LDL: activates LDL test.
- 3 - LAL: activates LAL test.

10.7. Status Menu

On this menu are available the information on the equipment status and each interfaces as a whole.

```
#    ------------------------------------------------------------------------
#                                  D A T A C O M                          [ 1 ]
#                        DM991CE - G.SHDSL Modem With Ethernet Bridge
#    ------------------------------------------------------------------------
#                                   Status Menu
#
#        G - Equipment status
#        D - G.SHDSL interface
#        V - V.35 interface
#        E - E1 interface
#        B - BRIDGE interface
#
#
#
#
#
#
#
#            Option: [ ]
#
#
#    ------------------------------------------------------------------------
#                                    <ESC> Back
#    ------------------------------------------------------------------------
```

- G - Shows general operation equipment status.
- D - Shows G.shdsl interface status
- V - Shows digital interface status.
- E - Shows E1 interface status.
- B - Shows Bridge interface status (only for DM991CE and DM991SE).

Pressinging *ENTER*, the information will be updated.

10.7.1. Equipment Status Menu

```
#    ------------------------------------------------------------------------
#                                D A T A C O M                          [ 1 ]
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                                Equipment Status
#
#        Current test                        :[ No active tests          ]
#        Device 2048 clock source            :[ Internal (regen. failed) ]
#        Up time                             :[ 0 days 1h:54m:51s        ]
#        Number of after factory resets      :[ 16                       ]
#
#
#
#
#
#
#
#
#
#
#
#
#    ------------------------------------------------------------------------
#                <P>revious    <ESC> Exit     <ENTER> Refresh    <N>ext
#    ------------------------------------------------------------------------
```

- Current test: indicates if any interface is in test.
- Device 2048 clock source - general synch source: indicates the configured transmission clock status.
- Up time: time the equipment has been running since the last reset.
- Number of after factory resets: number of equipment resets since the equipment left the factory.

10.7.2. G.shdsl Interface Status Menu

```
#    ------------------------------------------------------------------------
#                                D A T A C O M                          [ 1 ]
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                                G.SHDSL Status
#
#        Operation                           :[ Active                   ]
#        Current test                        :[ Not running              ]
#        BERT test result                    :[ Not running              ]
#        Link                                :[ No carrier               ]
#        Loop attenuation                    :[ Not trained              ]
#        SNR margin                          :[ Not trained              ]
#        Data rate                           :[ Not trained              ]
#        Frame mode                          :[ Not trained              ]
#
#
#
#
#
#
#
#
#    ------------------------------------------------------------------------
#                <P>revious    <ESC> Exit     <ENTER> Refresh    <N>ext
#    ------------------------------------------------------------------------
```

- Operation: indicates if the interface is active.
- Current test: indicates if there is any test active on the interface.
- BERT test result: indicates BERT test results.
- Link: shows the G.shdsl link status. The following status are possible:
    - Synch OK;
    - No carrier;

- Handshake;
- Non-aligned TDM (only for model 4W operating with 4 wire
- Training;
- LOSW Defect;
- LOSW Flaw;
- No CRC synch;
- No CAS synch.

- Loop attenuation: shows the status of the Loop Attenuation Defect.
- SNR margin: shows the status of the Signal-Noise Relation Defect.
- Data rate: indicates the interface transmission rate (number of channels) negotiated during the handshake.
- Frame mode: Shows the interface operation mode (synchronous or plesiochronous) negotiated during the handshake.
- Annex: Shows the Annex (A or B) negotiated during the handshake.

Available in FW version 110.

- Modulation: Shows the modulation (16-TCPAM) negotiated during the handshake.

Available in FW version 110.

10.7.3. Digital Interface Status Menu

```
#    ------------------------------------------------------------------------
#                                D A T A C O M                          [ 1 ]
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                                V.35 Status
#
#       Operation                      :[ Active                 ]
#       Current test                   :[ Not running            ]
#       CT105 (RTS)                    :[ Forced ON              ]
#       CT108 (DTR)                    :[ Forced ON              ]
#       CT109 (DCD)                    :[ ON                     ]
#       CT113 (XTC)                    :[ Ignored                ]
#       CT128 (ERC)                    :[ Forced OFF             ]
#       CT103 (TD)                     :[ All 1s                 ]
#       CT104 (RD)                     :[ All 1s                 ]
#
#
#
#
#
#
#
#
#    ------------------------------------------------------------------------
#              <P>revious    <ESC> Exit     <ENTER> Refresh    <N>ext
#    ------------------------------------------------------------------------
```

- Operation: indicates if the interface is active.
- Current test: indicates if there is any test active on the interface.
- CT105 (RTS): indicates if the CT105 signal is active or not. If configured to be ignored "*Forced ON*" will show.

- CT108 (DTR): indicates if the CT108 signal is active or not. If configured to be ignored "*Forced ON*" will show.
- CT109 (DCD): if active indicates that the aggregate is operating properly and the data received is valid (CT104).
- CT113 (XTC): in case the CT113 is enabled, indicates it is operating on the configured frequency. "Ignored" means disabled, "On" means operating properly and "Off" means not operating properly.
- CT128 (ERC): in case the CT128 is enabled, indicates it is operating on the configured frequency. "Ignored" means disabled," On" means operating properly and "Off" means not operating properly.
- CT103 (TD): Report the type of information transmitted for digital interface.
- CT104 (RD): Report the type of information received for digital interface

10.7.4. E1 Interface Status Menu

```
#    ------------------------------------------------------------------------
#                                 D A T A C O M                          [ 1 ]
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                                   E1 Status
#
#        Operation                       :[ Active                  ]
#        Current test                    :[ Not running             ]
#        Link                            :[ No carrier              ]
#
#
#
#
#
#
#
#
#
#
#
#
#
#    ------------------------------------------------------------------------
#               <P>revious    <ESC> Exit     <ENTER> Refresh    <N>ext
#    ------------------------------------------------------------------------
```

- Operation: indicates if the interface is active.
- Current test: indicates if there is any test active in the interface.
- Link: shows the E1 link status indicating if there is carrier present, frame, CAS, CRC4 synch, remote alarm or if it is totally in synch.

10.7.5. Bridge Interface Status Menu

```
#    ------------------------------------------------------------------------
#                                D A T A C O M                          [ 1 ]
#                       DM991CE - G.SHDSL Modem With Ethernet Bridge
#    ------------------------------------------------------------------------
#                                Bridge Status
#
#        Operation                       :[ Active                  ]
#        Link                            :[ No Link                 ]
#        Auto Negotiation                :[ Unavailable             ]
#
#
#
#
#
#
#
#
#
#
#
#
#    ------------------------------------------------------------------------
#              <P>revious    <ESC> Exit     <ENTER> Refresh    <N>ext
#    ------------------------------------------------------------------------
```

- Operation: indicates if the interface is active.
- Link: indicates if there is synch on the interface.
- Auto negotiation: indicates if the equipment connected using full-duplex mode or half-duplex mode.

10.8. Performance Menu

On this menu the following G.shdsl interface performance information are available.

Pressing *ENTER*, the information will be updated. The key "*R*" restarts the performance counters.

```
#    ------------------------------------------------------------------------
#                                D A T A C O M                          [ 1 ]
#                 DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                               G.SHDSL Performance
#
#        Code violations (CV)              :[ 0                       ]
#        Errored seconds (ES)              :[ 0                       ]
#        Severely errored seconds (SES)    :[ 0                       ]
#        LOSW seconds (LOSWS)              :[ 0                       ]
#        Unavailable seconds (UAS)         :[ 0                       ]
#        Loop attenuation (dB)             :[ Not trained             ]
#        Signal quality (dB)               :[ Not trained             ]
#        Time since last counters reset (s):[ 7741                    ]
#
#
#
#
#
#
#
#
#    ------------------------------------------------------------------------
#                  <ESC> Back    <ENTER> Refresh    <R>eset Counters
#    ------------------------------------------------------------------------
```

- Code Violation (CV): CRC errors counter on the G.shdsl interface occurred during a accumulated period.
- Errored Seconds (ES): counter of 1 second intervals during which one or more anomalies on the CRC and/or one or more LOSW defects are verified.
- Severely Errored Seconds (SES): counter of 1 second intervals during which at least 50 anomalies on the CRC or one or more LOSW defects happen.

- LOSW Seconds (LOSWS): counter of 1 second intervals during which one or more LOSW defects happen.
- Unavailable Seconds (UAS): counter of 1 second intervals during which the G.shdsl line is unavailable. The line is considered unavailable after 10 continuous seconds of SES. Once unavailable, the line will become available after 10 continuous seconds without SES.
- Loop attenuation (dB): indicates the loop attenuation in dB.
- Signal quality(dB): indicates, in dB, an estimative of the signal-noise relation margin to obtain an error rate of 10^{-7}.
- Time since last counters reset (s): time, in seconds, since the last above described performance counters reset.

10.9. Terminal Firmware Download

```
#    ------------------------------------------------------------------------
#                                  D A T A C O M                          [ 1 ]
#                DM991C - G.SHDSL Modem - E1 and V.35 Interfaces
#    ------------------------------------------------------------------------
#                                Firmware Download
#
#
#
#
#
#
#                  Follow instructions below to send firmware file or
#
#                press any key and wait a few seconds to abort download.
#
#
#
#
#
#
#
#    ------------------------------------------------------------------------
#    Action: Start Download.
#    ------------------------------------------------------------------------
```

On the terminal, on the main screen of the equipment, press “F” to gain access to the firmware download screen.

The detailed procedure for firmware updating is detailed on chapter 14.

This feature is included as of the following FW versions:

- DM991S 4W: 0241-03 – 06/19/06 - 18:27
- DM991C 4W: 0229-03 – 06/19/06 - 18:44
- In other models, all versions have this feature.

To download firmware versions that do not have this feature, contact DATACOM's technical support.

11. REMOTE MANAGEMENT

The DM991 modems can be remotely managed, or they can remotely manage other equipments.

Using the local terminal with the management link of the G.shdsl aggregate, the equipment can manage a DM991S/SE or a DM991C/CE remote or it can be managed by a remote equipment (a DM991S/SE, a DM991CE or a DM705). DM991S/SE models can also be managed through the DATACOM management card for Telebrás sub racks, DMG20.

Through the management it is possible to configure, monitor and run test loops through the management commands. With the management active through the DMG20 it is also possible to visualize the traps equipment change status alerts) sent by the DM991S/SE.

It's not possible to manage remotely the DM991S or DM991C in converter mode.

User interfacing depends on how management is carried out. If it is through local terminals, options will show up in text menus If managing via local terminal, the options will appear in text menus. Using the DATACOM integrated management, with the DmView software application, it is possible to manage the whole system with an interface full of graphic resources and fairly intuitive, as well as allowing administrative chores to be done, such as resources provision, configurations backup and alarms management.

The priority of remote management is given to the equipment that first connects to it. However, while the equipment terminal is being used, it is not possible to remotely manage the equipment.

Management from the G.shdsl link is done by the EOC channel (Embedded Operations Channel), which does not occupy the data band (also called out-of-band management), having a rate of 3,33kbit/s. The exchanged packets follow the format set by the G.991.2 rule and they flow by the EOC proprietary messages range.

To use the EOC channel remote management, the “Remote Management” option (in the DSL interface configurations) must be in the position EOC bits.

To disable the EOC, first the “enable destructive configuration” (in General Configurations, in the terminal) must be enabled. In doing so, the via EOC link will be lost, however the configuration that caused the link to crash will be understood and activated by the remote equipment (in case it is valid). Finally, the remote manager will no longer have access to the remote equipment. To re-enable the remote management the terminal local intervention is necessary.

The configuration set by the management system can be stored in a non-volatile memory (E2PROM) for recovery even after a power failure. The equipment will only write the configuration when the management (local or remote) asks it to do so.

The equipment will not activate and will not store an invalid or incoherent configuration. In case the user tries to activate an invalid configuration, the equipment will try to correct it and, if not possible, the configuration will not be activated.

12. TESTS

The tests in the DSL interface can be executed via management, through the keys in the frontal panel (LAL, LDL and LDR, only for DM991S/SE models), or through the CT140 (LDR) and CT141 (LAL) signals, coming from the digital interface. Remember that signals CT140 and CT141 should be set up as controlled in the digital interface, so that testing can be enabled.

LDR reception can be enabled by the management as well as by DIP A8 (only for DM991S/SE models).

The tests in the E1 and digital interface can only be run by the management.

To initiate a test in an interface, first it is necessary to disable any test that interface may be running (which means it is only possible to run one test at a time in each interface). The only exception is the LDR test combined with the BERT test. In that case, you have to enable RDL first and then the BERT test.

12.1. G.shdsl Interface Tests

12.1.1. Local Digital Loopback Test- LDL

This test helps the external and internal data link status verification. Two loopbacks are done. The internal loopback makes the data coming from the tributaries to return to them. The external loopback makes the external data coming from the G.shdsl to be retransmitted by this interface. Figure 23 shows the test conditions.

Figure 23. DM991 - Local Digital Loopback on G.shdsl Interface

12.1.2. Local Analogue Loopback Test - LAL

The local analogue loopback tests serves to test the analogue part of the interface circuits. The data transmitted by the DSL interface also return to the tributaries and the data externally received by the aggregate is discarded. Figure 24 shows the test conditions.

Figure 24. DM991 - Local Analogue Loopback Test on G.shdsl Interface

12.1.3. BERT Test

The used BERT test standard is the 511 (2^9 - 1). The BERT is generated from the G.shdsl interface and it is sent outside the equipment (line), therefore being able to be used to test its own data link, to which is connected. The BERT is generated in the number of data channels in which the interface connects and rewrites the user's data.

When the equipment is in BERT it will send mark (all bits equal 1) to the tributaries. Figure 25 shows the pattern generation in this interface.

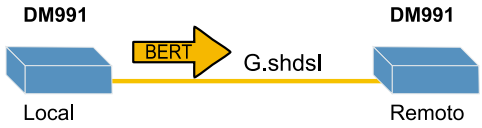


Figure 25. DM991 - BERT Test on G.shdsl Interface

The BERT of DM991 modems is generated with exact rate of line (minimum 192Kbit/s), except the timeslot used for CAS, in which is sent mark (all bits equal 1). It is different of interfaces DM705 - DSL1/DSL2/DSL8 where BERT is sent in accordance with the number of channels configured for the interface (minimum 64kbit/s).

12.1.4. RDL Test

This test facilitates the verification of the link status and of the two data directions. The interface sends a loopback request to the remote equipment. The remote detects the RDL request and sends a loop closing confirmation signal. When the equipment that sent the request detects the answer, it goes into testing. The remote device has the same behavior when in LDL test. In the terminal status menu, the remote side shows the RX-LDR indication while the local side shows the TX-LDR indication. Figure 26 shows the pattern generation in this interface.

It is also possible to simultaneously execute the BERT, eliminating the need for an external test-set and locally testing the metallic link. To carry this test it is necessary to first activate the RDL and then the BERT.

The equipment will remain on testing conditions until the key (in the case of DM991S/SE modems) or the CT141 are deactivated.

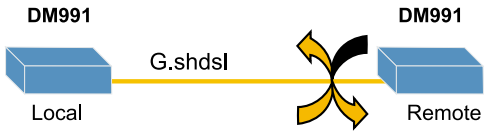


Figure 26. DM991 - RDL Test on G.shdsl interface

12.2. E1 Interface Tests

12.2.1. LDL Test

This test helps the verification of the internal and external data link status. Two loopbacks are done. The internal loopback makes the data coming from the G.shdsl interface to be retransmitted. The external loopback makes the external data coming from the E1 tributary to return to it. Figure 27 shows the test conditions

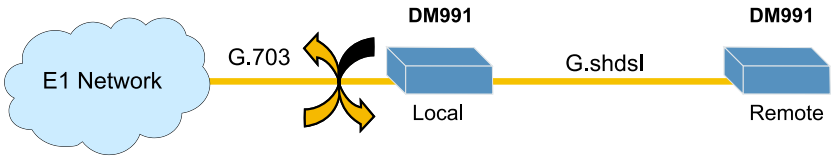


Figure 27. DM991 - LDL Test on E1 Interface

12.2.2. LAL Test

The LAL tests the analogue part of the interface circuits. The data transmitted through the E1 interface returns to the modem interface and the data coming from the E1 is discarded.

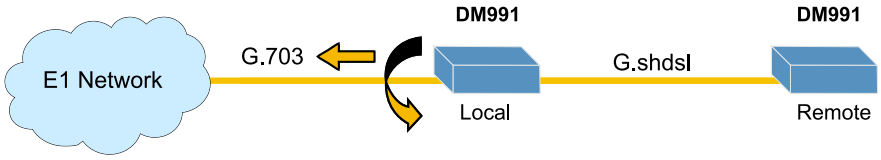


Figure 28. DM991 - LAL Test on E1 Interface

12.3. Digital Interface Tests

12.3.1. LDL Test

This test helps the verification of the internal and external data link status. Two loopbacks are done. The internal loopback makes the data coming from the G.shdsl interface to be retransmitted. The external loopback makes the external data coming from the digital interface to return to it. During LDL testing the data in the digital interface remains in sync with the clocks configured for regular operation. Figure 29 shows the test conditions.

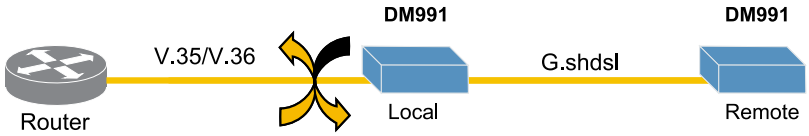


Figure 29. DM991 – LDL on Digital interface

When the modem is configured by DIPs (DIP B6 = OFF), it is not possible to remotely run tests through the terminal.

13. CONVERTER MODE TESTS

The Converter Mode is only available on equipments DM991S and DM991C.

Tests can be activated by the terminal/management, by CT141, or even by keys (only in DM991S). Remember that signal CT141 must be set up as controlled in the digital interface, so that testing can be enabled.

13.1. Local Analogue Loopback - LAL

Pressing the LAL (DM991S) key, activating this test through the Telebrás management or when CT141 turns ON, (if controlled) the equipment goes into local analogue loopback test.

In this test, the transmission data are returned to the reception. The loopback is done inside the G.703 interface, passing through the complete converter analogue circuit, as seen Figure 30.

The test signal can be given by DTE or by the converser.

If the equipment is working with a regenerated clock, activating the test, the clock will automatically be altered to an internal clock. The led test and the led 109 will light up. When using the digital interface, signals CT142 and CT109 are set to ON. On the TX-OUT line the signal is transmitted normally, meaning the same signal returning to the digital interface.

The converter will remain in the test conditions until the key or CT141 is deactivated, or until the test is stopped by Telebrás management.

Figure 30. LAL test Converter Mode

13.2. Local Digital Loopback Test - LDL

Pressing the LDL (DM991S) key or activating this test by management forces the equipment to run the local digital loopback test.

When the digital interface is being used the DTE transmission data (CT103) are redirected to the DTE reception (CT104). The loopback is done inside the V.35 - V.36/V.11 converter interface. Simultaneously the signal recovered in the G.703 interface line IN is again retransmitted to line OUT, that is, the loopback is also done between the G.703 interface receive and transmit drivers. The test led, the 109 led, the CT142 and the CT109 are set as ON. In this way this test verifies the connection and the interface with the local DTE, as well as the connection with the remote side.

The converser will remain in the test conditions until the key is deactivated, or until the test is stopped by the management. If the test is activated by the key and disabled by the management the key will remain pressed but the equipment will leave test mode. This can be detected by the TEST LED on the front panel. In case the configuration is altered after that, the equipment will go into test again, once it will recognize once more the key

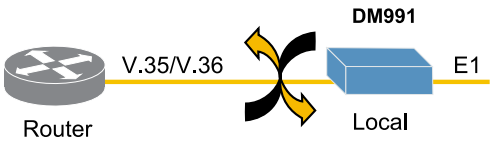


Figure 31. LDL Test Converter Mode

14. FIRMWARE DOWNLOAD

Equipments go through constant upgrades, in which new facilitators are installed. To use them, it is necessary that the equipment firmware is modified. This is done by downloading a new firmware.

To download, the user must have available in his/hers computer the file with the new firmware (which can be obtained on the DATACOM web site:

www.datacom.ind.br

The file has an ".im" extension.

After obtaining file, the user can download it into the equipment through the terminal, sending the file in a binary form.

Normally, the Windows® HyperTerminal does not send files in a binary form, but in text form. Therefore it is recommended not to use the Windows® terminal to download software. DATACOM recommends the use of the TeraTerm, which is a freeware software and can be found in the following address:

www.vector.co.jp/authors/VA002416/teraterm.html

To update the firmware, log on to the terminal and choose the equipment to which the firmware will be sent. On the main menu screen press "F". At the bottom of the screen, a message will show up, indicating the download status. To start sending, the user must wait until a message appears indicating that the download can be started. When this message appears, click on "File – Send File...". Now select the firmware, marking the "binary" option on the lower left corner of the screen. After that, click on "Open" and wait for the download to finish. (Around 5 minutes at 9600bits/s)

The download happens with normal modem operation. When the transference is concluded, the equipment will check the integrity of the received file. Should it be a valid file, the equipment will automatically update your firmware, and only then will it restart, interrupting the connection for about a minute and a half.

This feature is included as of the following FW versions:

- DM991S 4W: 0241-03 - 19/06/06 - 18:27
- DM991C 4W: 0229-03 - 19/06/06 - 18:44
- In other models, all versions have this feature.

To download firmware versions that do not have this feature, contact DATACOM's technical support.

15. INSTALLATION AND OPERATION

Always observe the instructions of security during the installation, operation or maintenance of this product. Installation, adjustment or maintenance must be carried through only by qualified, trained and authorized people.

Before connecting any cable to the equipment, make sure that the grounding system is functional.

To prevent risks of electric shock, before opening the DM991C/CE equipments, disconnect the power supply.

The described equipment in this manual is sensible to the static electricity. Before handling any described equipment in this manual, verify if using devices of protection against static electricity, and if these are functioning correctly.

15.1. Installation

15.1.1. DM991S/SE

The installation of the DM991S/SE modem simply consist of inserting the modem card in a Telebrás standard sub-rack slot in which its operation is desired (the options of the E1 interface pinout in the screw connector block are shown in Table 13 ,Table 14 and Table14).

Make sure the card is running smoothly in the tracks. It should fit easily. If this does not occur, do not force it. Take the card out again and verify what is blocking it.

15.1.2. DM991C/CE

The power input of the equipment can be either AC (93 to 250V, 50-60Hz) or DC (36 to 72V), its selection being automatic. The connector is available in the back panel. To turn on the equipment just connect the power cable.

For instructions about the installation of power supply see chapter 19.3 - Power Input.

15.2. Operation

The configuration is done initially through the serial port, available in the RS-232 connector in the front panel. The PC connection is done through a cable with DB9 male connector on the equipment side and DB9 or DB25 female connector on the PC side. The pinout is given on Table 1 for the DM991S/SE and on Table 2 fro the DM991C/CE.

There must be no voltage difference between the DM991 DB9 pin 5 (signal ground) and the PC DB9 pin 5 (or DB25 pin 7). This can cause damage the DM991 and PC serial interfaces. To be sure to avoid this, use an AC voltmeter to measure the voltage between these pins. If there is voltage difference, check if the modem and the PC are properly grounded. It is not necessary to turn the equipment off to plug in the serial cable, if the above conditions are met.

- Digital interface pins (V.35 - V.36/V11) available for connection through the DB25 female connector;
- The IN and OUT signals of the E1 interface are available for connection through the BNC (coaxial cable 75ohms) or through the RJ48 connector (twisted pair, 120ohms), in the back panel (for DM991C/CE). The pinout can be seen on Table 15.
- The G.703 interface of the modem is available in the pins reserved for Dial Backup in the screw connector block or in the DB25, this configuration being done through straps (for DM991S/SE).
- The connection to the G.shdsl interface is available in the RJ45 connector identified with the stamp “SHDSL” in the back panel (for DM991C/CE).
- The connection for the G.shdsl interface is available in the TX pins of the screw connector block (for DM991S/SE).
- The connection for the Ethernet interface is available in the RJ45 connector identified with the stamp “ETHERNET” in the front panel (for DM991SE and DM991CE).

15.3. Accessory

15.3.1. Adapter Cable DB25 X DB25 2BNC

The modems card DM991S/DM991SE, offer a proprietor pinout for use of digital interface and E1 tributary, where these two interfaces may be available in DB25 connector of the sub rack.

For this application the DATACOM offers the adapter cable DB25 x DB25 2BNC.

This cable presents 1 DB25 male connector to be connected to DB25 of sub rack in one of sides, 2 BNC connectors to connection of E1 interface and 1 DB25 female connector to connection of digital interface (V.35/V.36) with ISO2110 Amd.1 standard pinout.

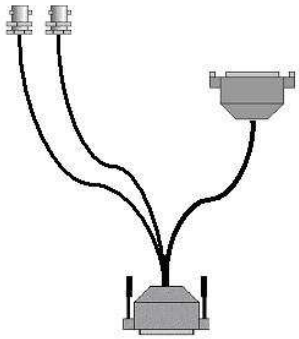


Figure 32. Adapter Cable DB25 x DB25 2BNC

16. G.703 - G.704

Here are described the structures defined by the G.704 recommendation. Note that a G.703 signal at 2048kbits/s with an according frame structure with the G.704 is also called E1 signal.

16.1. G.704 Frame structure

The interface operates at a nominal speed of 2048kbit/s, with bits grouped in frames. Each frame is made of 256bits, arranged in 32 timeslots, each of 8 bits. The frame repetition rate is 8000 times per second, resulting in a 64kbit/s rate for each timeslot. The number of user available timeslots for the user is at most 31, because timeslot 0 is used for frame synchronism. In telephony applications employing channel associated signaling (CAS), only 30 timeslots are available, for timeslot 16 transports CAS signaling.

The frame structure can be seen on Figure 33.

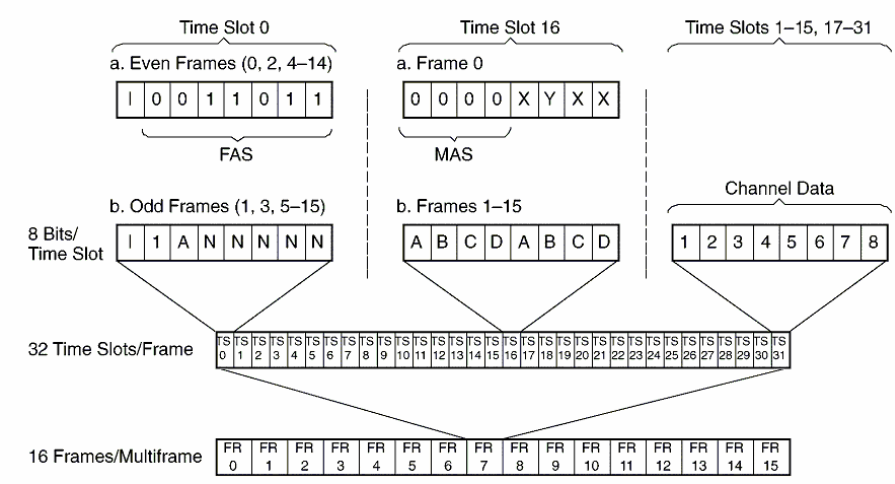


Figure 33. ITU-T G.707 E1 frame structure recommendation

Frames are organized in larger structures, called multiframe. Every E1 signal is organized in two frames multiframes. The first frame carries the FAS signal and the second frame contains no frame alignment signal (NFAS).

Alterned frames	Bit number							
	1	2	3	4	5	6	7	8
Frame containing the Frame Alignment Signal	Si	0	0	1	1	0	1	1
	Note 1	Frame alignment signal						
Frame wthout FAS	Si	1	A	S_{a4}	S_{a5}	S_{a6}	S_{a7}	S_{a8}
	Note 1	Note 2	Note 3	Note 4				
Notes:								
1) Si – bit reserved for international use. Usually set to 1 except when CRC4 is used as will be seen. 2) Bit always set on 1. 3)Remote alarm indication. If operation normal, set on 0, in alarm set on 1. In case the converter receptor loses frame synch this bit is transmitted in 1. 4) For specific uses: Bits usually set on 1.								

Table 19. Multiframe structure

Besides this basic multiframe, which is always present, there may be other types of multiframe that are completely independent among them, and superimposed over the basic multiframe:

16.1.1. CRC4 Multiframe

Made up by 16 frames and uses Si bit of timeslot 0 of the frames to perform the Cyclic Redundancy Check-4 procedure, making it possible to evaluate transmission quality. This multiframe always starts at a frame that has FAS. The multiframe structure is identified by a six-bit structure known as the CRC4 multiframe alignment signal, found on odd frames. On the last two odd frames, sub multiframe error signals are transmitted. Bit E of frame 13 (E13) corresponds to the error occurred on sub-multiframe I and E15 correspond to the error occurred on sub-frame II. On the even frames, which have FAS present, the four CRC bits calculated from the previous sub-frame are transmitted. Table 20, shows the CRC4 multiframe structure.

SMF	Frame #	Bits 1 to 8 of timeslot 0 of each interface							
		1	2	3	4	5	6	7	8
I	0	C1/Si	0	0	1	1	0	1	1
	1	0/Si	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
	2	C2/Si	0	0	1	1	0	1	1
	3	0/Si	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
	4	C3/Si	0	0	1	1	0	1	1
	5	1/Si	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
	6	C4/Si	0	0	1	1	0	1	1
	7	0/Si	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
II	8	C1/Si	0	0	1	1	0	1	1
	9	1/Si	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
	10	C2/Si	0	0	1	1	0	1	1
	11	1/Si	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
	12	C3/Si	0	0	1	1	0	1	1
	13	E/Si	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
	14	C4/Si	0	0	1	1	0	1	1
	15	E/Si	1	A	Sa4	Sa5	Sa6	Sa7	Sa8

SMF indicates the sub-multiframe. This calculations are used for the CRC4 calculation.

The Si bit is the international bit

The A bit is used to indicate a remote alarm (active in 1).

Sa4 to Sa8 are bits recommended by the ITU-T for point to point specific aplications.

Sa4 to Sa8 mut remain on 1 when not being used and traverssing an international barrier.

The E bit is used to indicate CRC4 error. The normal bi status is 1. When a CRC4 error is detected, the bit corresponding to the sub-multiframe in which the error was detected is set to 0.

C1 to C4 are used to transmit CRC4 code.

Timeslot 0, which contains the 0011011 sequence is define as the word FAS and timeslot 0 which does not have FAS is the NFAS.

Table 20. CRC4 multiframe structure

16.1.2. CAS Multiframe (Channel Associated Signaling)

Usually used over lines that transmit voice channels. Its multiframe alignment is performed by timeslot 16, with no relation to a possible CRC4 multiframe. Table 21 shows the CAS multiframes structures.

CAS and CRC4 structures are fully independent and can be individually disabled by the user.

In the case of signaling by a common channel, timeslot 16 is used. The signal aligning method in this channel is part of the signaling protocol in use.

Frame #	bits 1 to 8 of timeslot 16 of each frame							
	1	2	3	4	5	6	7	8
0	0	0	0	0	X0	Y	X1	X2
1	A1	B1	C1	D1	A16	B16	C16	D16
2	A2	B2	C2	D2	A17	B17	C17	D17
3	A3	B3	C3	D3	A18	B18	C18	D18
4	A4	B4	C4	D4	A19	B19	C19	D19
5	A5	B5	C5	D5	A20	B20	C20	D20
6	A6	B6	C6	D6	A21	B21	C21	D21
7	A7	B7	C7	D7	A22	B22	C22	D22
8	A8	B8	C8	D8	A23	B23	C23	D23
9	A9	B9	C9	D9	A24	B24	C24	D24
10	A10	B10	C10	D10	A25	B25	C25	D25
11	A11	B11	C11	D11	A26	B26	C26	D26
12	A12	B12	C12	D12	A27	B27	C27	D27
13	A13	B13	C13	D13	A28	B28	C28	D28
14	A14	B14	C14	D14	A29	B29	C29	D29
15	A15	B15	C15	D15	A30	B30	C30	D30

Ai-Di are the channel signaling bits. Channel numbers refer to phone channels. Timeslots 1 to 15 and 17 to 31 correspond to the phone channels 1 to 30.

X0-X2 are the x bits of the G.704 regulation, usually set to 1.

Y is the Yellow Alarm remote multiframe. When in 1 indicates that the alarm is activated.

The MAS is defined as the timeslot 16 that has the 0000xyxx sequence and can be in the frames that have FAS as well as in the ones that do not.

Table 21. CAS Multiframe Structure

16.2. Electrical Characteristics

The E1 line signal follows the HDB3 (High Density Bipolar 3) coding from ITU G.703 recommendation, which is an improvement in the AMI (Alternate Mark Inversion) coding.

In the AMI code, mark is transmitted as alternate positive and negative pulses, while spaces are transmitted as zero level voltage. AMI cannot transmit a long zero sequence because as there are no signal variations on the line, the receiver will lose signal timing.

For the HDB3 format, mark is coded as for the AMI code, but four consecutive zeros (spaces) are replaced by a 000V or B00V sequence. The choice of one or other is done in such way that the number of B pulses between V consecutive pulses is odd, meaning successive V pulses have alternate polarity in order that no DC component is introduced in the signal. The Figure 34 shows an application example of HDB3 coding in a bit sequence.

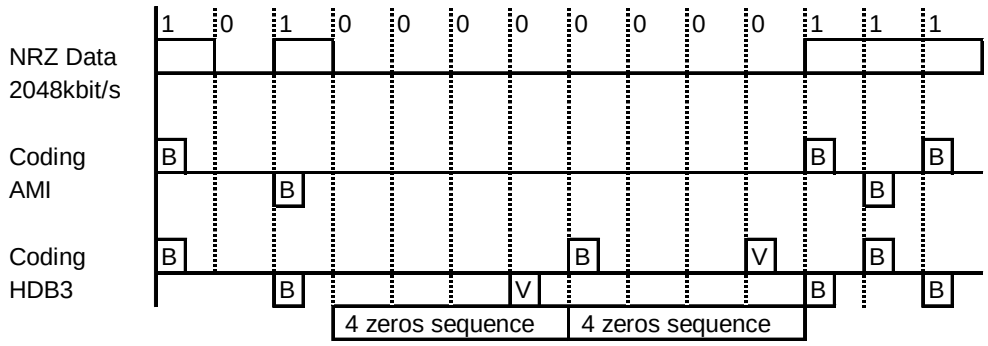


Figure 34. HDB3 coding in the G.703 2048kbit/s Interface

16.2.1. G.703 Interface Electrical Characteristics for Coaxial Cable

Speed: 2048kbit/s ± 50ppm

Pulse format: rectangular

Number of pairs in each transmission direction: 1 coaxial pair

Nominal impedance: 75ohms resistive

Pulse peak tensions: 2.37V ± 0.237V

Space peak tensions: 0V ± 0.237V

Pulse nominal duration: 244 nanoseconds

Rate between the positive and negative pulse amplitudes in the median point of a pulse width: from 0.95 to 1.05

Rate between the positive and negative pulse widths in nominal half amplitude: from 0.95 to 1.05

16.2.2. G.703 Interface Electricial Characteristics for Twisted Pair

Rate: 2048kbit/s +/- 50ppm

Pulse format: rectangular

Number of pairs for each transmission direction: 1 symmetric pair

Nominal impedance: 120ohms resistive

Pulse peak tension: 3 V +/- 0.3 V

Space peak tensions: 0 V +/- 0.3 V

Pulse nominal duration: 244 nanoseconds

Rate between the positive and negative pulse amplitudes in the median point of a pulse width: from 0.95 to 1.05

Rate between the positive and negative pulse widths in nominal half amplitude: from 0.95 to 1.05

17. PANEL LEDS

17.1. DM991S/SE Modems Front Panel LEDs

Led	Status	Behaviour
ALIM	Equipment on	Turned on
104₪	Recived data	Turned on
	Receiving all 1 or all 0	Turned off
103₪	Transmited data	Turned on
	Transmiting all 1 or all 0	Turned off
106 E1†	No carrier	Turned off
	AIS reception	Blinks twice a second (most of the time turned off)
	No frame synch	Blinks once a second (most of the time turned off)
	Remote Alarm Indication	Blinks once a second (most of the time on)
	No CAS synch *	Blinks once a second (most of the time on)
	No CRC4 synch *	Blinks twice a second (most of the time on)
	Frame, CAS and CRC4 synch	Turned on
106/E1◊	Ready to transmit	Follows CT106
ETH ⊥	Link Ethernet	Turned on
	Activity on the Interface	Blinks
109(Ø) DSL	No carrier	Turned off
	Handshake	Blinks once a second (most of the time turned off)
	Training	On time equal to off time, blinking once every second (1Hz)
	TDM not aligned *	On time equal to off time, blinking once every second (1Hz)
	LOSWD or LOSWF	On time equal to off time, blinking four times every second (4Hz)
	CRC error or no CAS synch	Blinks once a second (most of the time on)
	In synch	Turned on
R. INT	Configured for internal clock	Turned on
	Configured for regenerated clock which is ok	Turned off
TEST	No test active	Turned off
	Any test active	Turned on
	BERT error detected in the G.shdsl interface	On time equal to off time, blinking four times every second (4Hz)

Table 22. LEDs Meaning - DM991S/SE

* When enabled, otherwise ignored.

₪ When interface V.35 is disabled, these LEDs will represent data from interface E1 or data from the Ethernet interface (only in DM991SE, if interface E1 is disabled).

† With the E1 interface enabled.

◊ With the E1 disabled.

⊥ Only for DM991SE.

Ø In the 4W model this LED is replaced for 109A (line A) and 109B (line B) LEDs. The operation of LEDs remains the same.

<< Only on model 4W, when configured for 4 wires.

The DM991S/SE modems show also the following keys:

- LAL: Activates LAL test.
- LDL: Activates LDL test, for the G.703 side as well as for the V.35 or V.36/V.11 side.
- LDR: Generate LDR request.

The DM991C/CE modems show the same operations, however they are enabled by software.

17.2. DM991C/CE Modems Front Panel LEDs

Led	Status	Behaviour
ALIM	Equipment on	Turned on
104₪	Recived data	Turned on
	Receiving all 1 or all 0	Turned off
103₪	Transmited data	Turned on
	Transmiting all 1 or all 0	Turned off
E1	No carrier	Turned off
	AIS reception	Blinks twice a second (most of the time turned off)
	No frame synch	Blinks once a second (most of the time turned off)
	Remote Alarm Indication	Blinks once a second (most of the time on)
	No CAS synch *	Blinks once a second (most of the time on)
	No CRC4 synch *	Blinks twice a second (most of the time on)
	Frame, CAS and CRC4 synch	Turned on
ETH ⊥	Link Ethernet	Turned on
	Activity on the Interface	Blinks
DSL(Ø)	No carrier	Turned off
	Handshake	Blinks once a second (most of the time turned off)
	Training	On time equal to off time, blinking once every second (1Hz)
	TDM not aligned *	On time equal to off time, blinking once every second (1Hz)
	LOSWD or LOSWF	On time equal to off time, blinking four times every second (4Hz)
	CRC error or no CAS synch	Blinks once a second (most of the time on)
	In synch	Turned on
TEST	No test active	Turned off
	Any test active	Turned on
	BERT error detected in the G.shdsl interface	On time equal to off time, blinking four times every second (4Hz)

Table 23. LEDs meaning - DM991C/CE

* When enabled, otherwise ignored.

₪ When interface V.35 is disabled, these LEDs will represent data from interface E1 or data from the Ethernet interface (only in DM991SE, if interface E1 is disabled).

⊥ Only for DM991CE.

Ø In the 4W model this LED is replaced for 109A (line A) and 109B (line B) LEDs. The operation of LEDs remains the same.

<< Only on model 4W, when configured for 4 wires

18. STRAPS AND DIP SWITCHES MAP

18.1. DM991S/SE

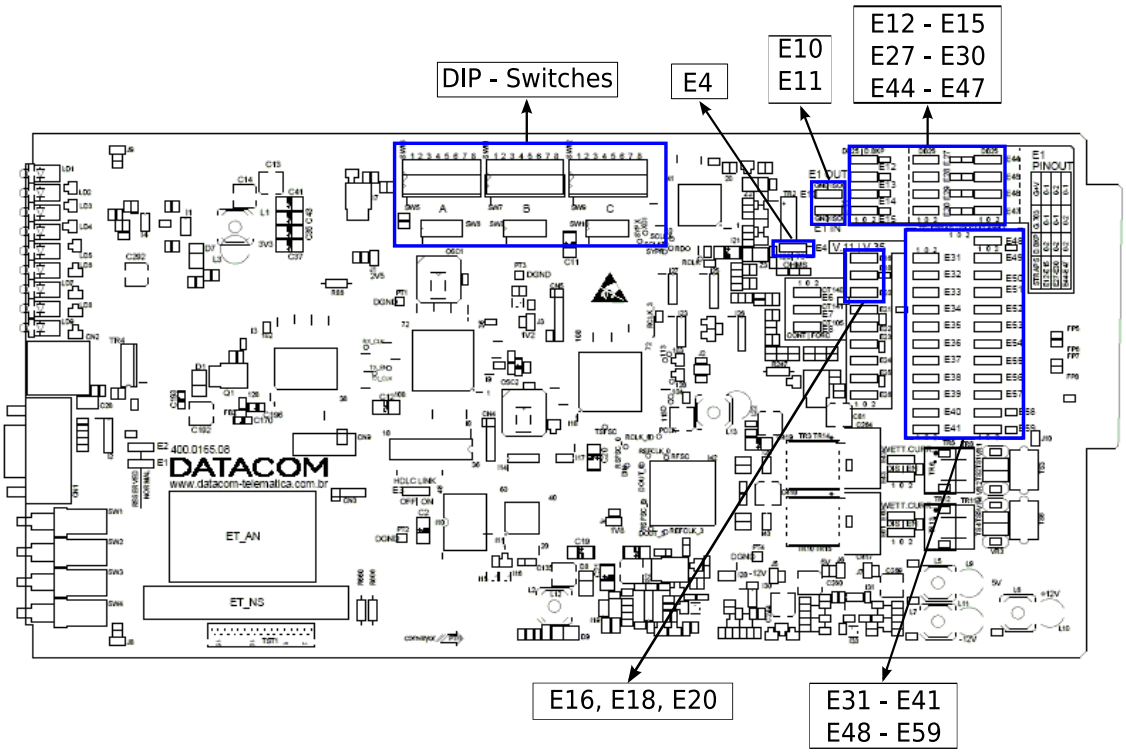


Figure 35. DM991S/SE - Straps and DIPs map

18.2. DM991C/CE

DM991C/CE models have different strap positions, depending on the PCI revision used.

18.2.1. PCI rev. 03 or lesser

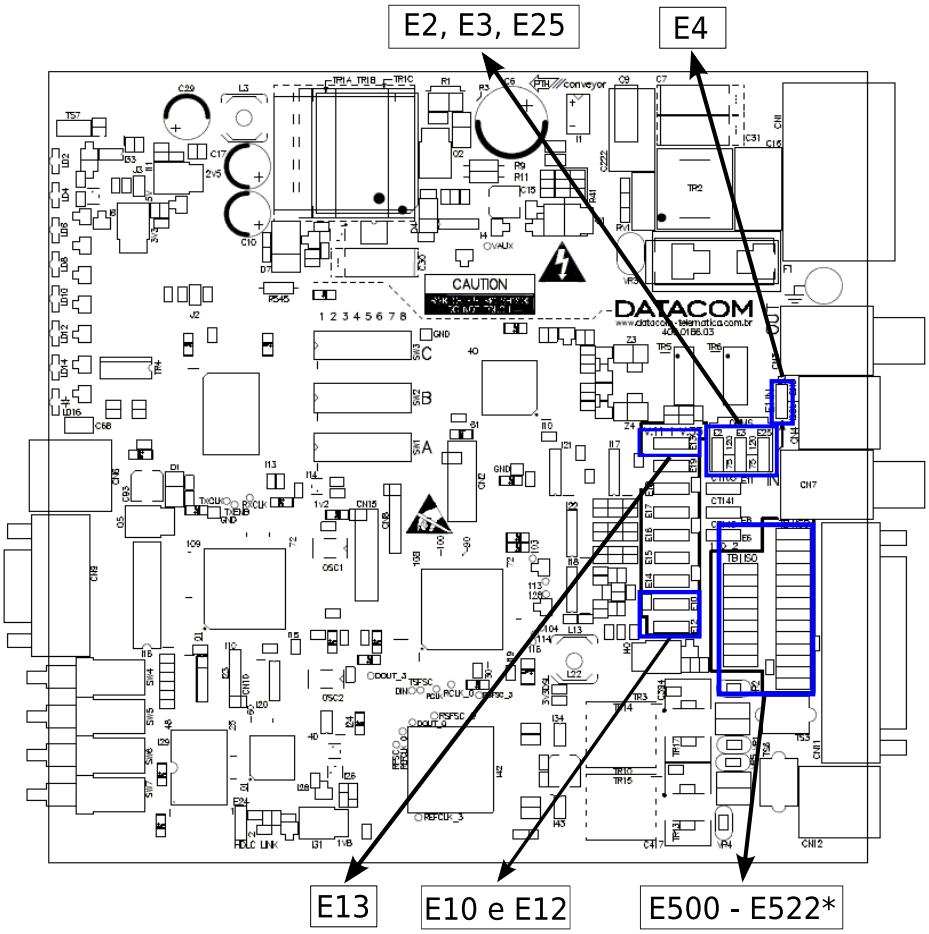


Figure 36. DM991C/CE – Map of Straps (PCI rev. 03 ou inferior)

* Optionally available on demand.

18.2.2. PCI rev. 04 or higher

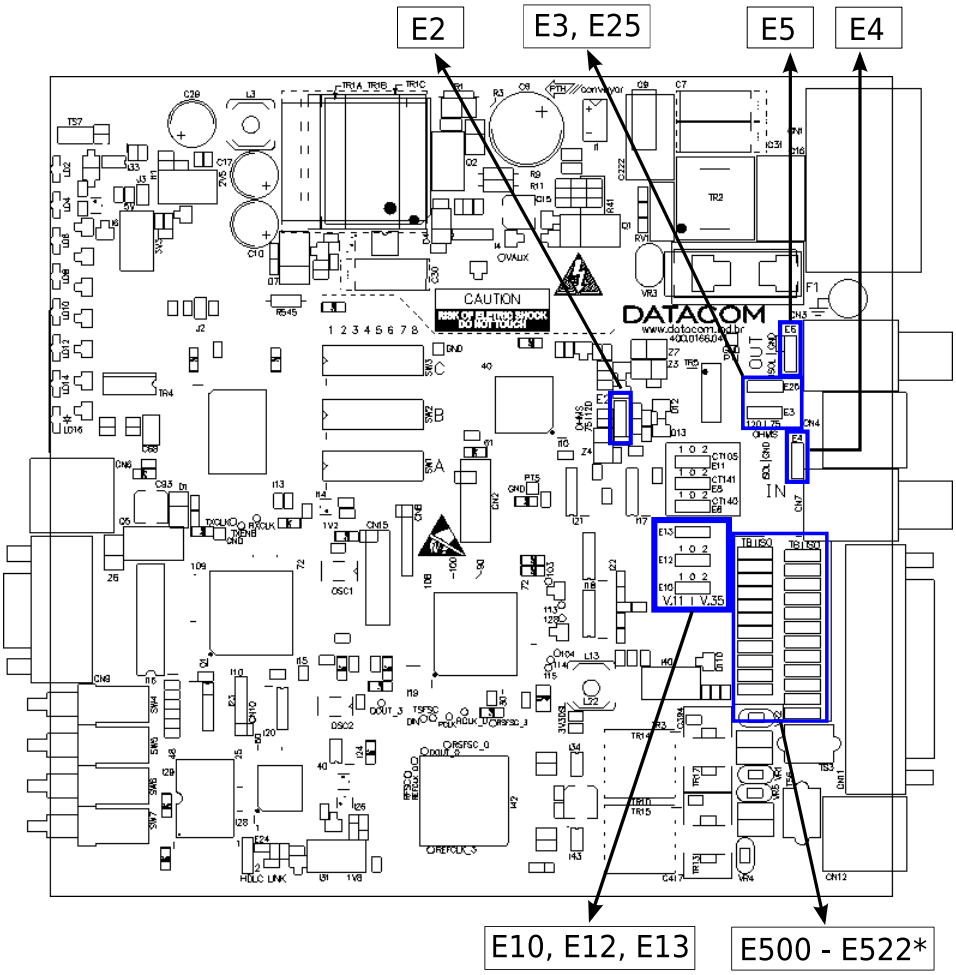


Figure 37. DM991C/CE – Map of Straps (PCI rev. 03 ou superior)

* Optionally available on demand.

19. TECHNICAL SPECIFICATIONS

19.1. Environmental Conditions

Operating temperature: 0 to 60 ℃.

Relative humidity: up to 95% non-condensing.

19.2. Power

19.2.1. DM991S/SE

Maximum modem power consumption is 5,5W.

19.2.2. DM991C/CE

Maximum modem power consumption is 8W.

19.3. Power Input

The installation of any electric equipment must be in accordance with the current law in the place where this equipment will be installed. This includes adequate devices of protection, sizing and protection to the capacities of the equipment.

Always observe the instructions of security during the installation, operation or maintenance of this product. Installation, adjustment or maintenance must be carried through only by qualified, trained and authorized people.

Before connecting any cable to the equipment, make sure that the grounding system is functional.

The described equipment in this manual is sensible to the static electricity. Before handling any described equipment in this manual, verify if using devices of protection against static electricity, and if these are functioning correctly.

19.3.1. DM991S/SE

Is provided by the cabinet or the sub-rack, with the following maximum consumption:

Power input(V)	Maximum consumption (mA)
+5	700
+12	200
-12	150

Table 24. Current Maximum Consumption - DM991S/SE

19.3.2. DM991C/CE

Power is supplied to the equipment through a power tri polar cable terminated with a three-prong plug. The power cord can be plugged onto any AC outlet, within the specified limits (Table 25), the selection is automatically done. If DC power is used, the AC plug should be cut and plugged in a way that the central pin correspond to the protection ground and then the plugging should be done according to Figure 38. The converter chassis is grounded by the protection ground.

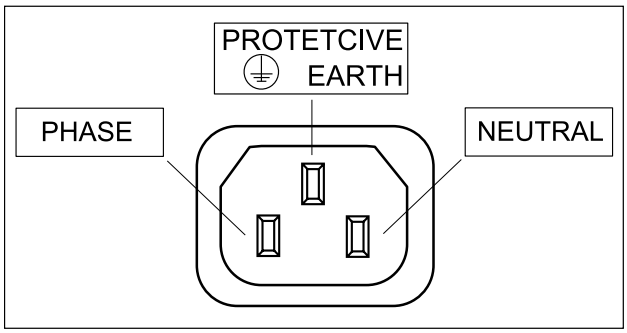


Figure 38. Power Cable Pinout - DM991C/CE

	Minimum power (V)	Maximum power (V)
AC 50~60 Hz	93	250
DC	36	72

Table 25. Power Input Range - DM991C/CE

The power supply, where the supply cable is connected, must be positioned near the equipment and be on an easily accessible location, because the equipment is turned on and off through it.

In case of using DC voltage, you must be careful so that the equipment protection earth cable (green cable with yellow line related to the central socket pin) matches the system protection earth cable. This cable must be connected before any other connection.

The equipment supports an 1A fuse, type T (delay), 250 V. If necessary, replace it only for another one of the same type and value.

To prevent risks of electric shock, before opening the DM991C/CE equipments, disconnect the power supply.

19.4. Dimensions

19.4.1. DM991S/SE

The equipment is presented in a Telebrás standard card for standardized sub-rackets, measuring 177mm x 16,6mm x 316,5mm (width x height x depth). The dimensions are according with figures 1 and 2 of the 225-540-780 regulation.

19.4.2. DM991C/CE

The equipment is presented in a desktop with 195mm width, 200mm depth and 44mm height (without the rubber feet, 46mm with the rubber feet).

19.5. Weight

19.5.1. DM991S/SE

The equipment weighs around 0,265kgf.

19.5.2. DM991C/CE

The equipment weighs around 0,700kgf.

20. APPLICABLE STANDARDS

- ITU-T
  - G.703, G.704, G.706, G.736, G.823, G.991.2, G.994.1, K.21,
  - V.35, V.36, V.11, V.24 and V.28.
- Telebrás
  - 225-100-706 in the part relating to the G.703 interface, clocks and alarms.
  - SDT 225-540-784 e SDT 225-540-530 in the items contained in the technical requirements and procedures applicable to Anatel category I telecom product's certification.
  - 225-540-780: mechanics and consumption (only DM991S/SE).
  - 225-540-781: General Structure Specifications of Management Network for Standard Modems (only DM991S/SE).
- CISPR
  - Publication 22.
- Anatel
  - Annex to Resolution No. 238, dated November 9th, 2000.
  - Annex to Resolution No. 442, dated July 21st, 2006.
- IEC
  - IEC61000-4-2, IEC61000-4-3, IEC61000-4-4, IEC61000-4-5, IEC61000-4-6, IEC61000-4-11, IEC60950-2, IEC60950-3, IEC60950-5, IEC60950-6.
- IEEE
  - IEEE 802.3 (Ethernet), IEEE 802.1, 802.1Q Tag-based VLANs, 802.1Q VLAN priority Tag and Port Based VLAN

21. ANNEX I – SAFETY WARNINGS

Before the installation, read the entire manual attentively.

The power supply, where the supply cable is connected, must be positioned near the equipment and be on an easily accessible location, because the equipment is turned on and off through it.

Follow attentively every guidance included in this manual. In case of doubts, please contact the authorized technical support.

Before connecting any cable to the equipment, make sure that the grounding system is functional.

There must be no voltage difference between the DM991 DB9 pin 5 (signal ground) and the PC DB9 pin 5 (or DB25 pin 7). This can cause damage the DM991 and PC serial interfaces. To be sure to avoid this, use an AC voltmeter to measure the voltage between these pins. If there is voltage difference, check if the modem and the PC are properly grounded. It is not necessary to turn the equipment off to plug in the serial cable, if the above conditions are met.

In case of using DC voltage, you must be careful so that the equipment protection earth cable (green cable with yellow line related to the central socket pin) matches the system protection earth cable. This cable must be connected before any other connection.

The equipment supports an 1A fuse, type T (delay), 250 V. If necessary, replace it only for another one of the same type and value.

Always observe the instructions of security during the installation, operation or maintenance of this product. Installation, adjustment or maintenance must be carried through only by qualified, trained and authorized people.

To prevent risks of electric shock, before opening the DM991C/CE equipments, disconnect the power supply.

The described equipment in this manual is sensible to the static electricity. Before handling any described equipment in this manual, verify if using devices of protection against static electricity, and if these are functioning correctly.

22. ANLAGE 2 - SICHERHEITSHINWEISE

Ganzes Handbuch vor der Installation aufmerksam durchlesen.

Die Energiequelle, an die das Einspeisekabel angeschlossen wird, muss sich in der Nähe der Anlage befinden und leicht zugänglich sein, da die Anlage durch sie ein- und ausgeschaltet wird.

Aufmerksam alle in diesem Handbuch enthaltenen Hinweise befolgen. Im Zweifelsfall einen zugelassenen technischen Service kontaktieren.

Bevor irgendein Kabel an die Anlage angeschlossen wird, sich vergewissern, dass das Erdungssystem korrekt funktioniert.

Es muss darauf geachtet werden, das keine Potentialdifferenz zwischen den DB9-Stift 5 des DM991 (Signalerde) und den DB9-Stift 5 (oder den DB25-Stift 7) des PCs entsteht, da dies die seriellen DM991- und PC-Schnittstellen beschädigen könnte. Um sich zu vergewissern, dass dies nicht vorkommt, muss die Spannung zwischen diesen beiden Stiften mit einem AC-Voltmeter gemessen werden. Sollte eine Potentialdifferenz festgestellt werden, Erdung der Anlagen überprüfen. Wenn die obigen Bedingungen eingehalten werden, braucht die Anlage zum Anschluss des seriellen Kabels nicht ausgeschaltet zu werden.

Wenn Gleichstrom verwendet wird, darauf achten, dass die Schutzerdung der Anlage (grüne Leitung mit gelbem Streifen, der sich auf den Steckdosenmittelstift bezieht) der Systemschutzerdung entspricht. Diese Leitung muss vor allen anderen Verbindungen angeschlossen werden.

Die Anlage arbeitet mit Sicherungen 1A, Typ T (Verzögerung), 250 V. Sie dürfen nur durch Sicherungen vom gleichem Typ und mit gleichem Wert ersetzt werden.

Immer die Sicherheitshinweise während der Installation, dem Betrieb oder der Wartung dieser Anlage beachten. Installation, Einstellung und Wartung dürfen nur von geschultem, qualifiziertem und zugelassenem Personal durchgeführt werden.

Um das Risiko von elektrischen Schlägen zu vermeiden, vor dem Öffnen DM991C/CE, trennen die Energiequelle.

Die in diesem Handbuch beschriebenen Anlagen sind empfindlich gegen statische Elektrizität. Bevor irgendeine in diesem Handbuch beschriebene Vorrichtung berührt wird, sich vergewissern, dass Schutzvorrichtungen gegen statische Elektrizität getragen werden und dass sie korrekt funktionieren.

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