NOKIA

DX 200

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Nokia BSC/TCSM S11 Product Documentation

Engineering for TCSM2

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Summary of changes

Summary of changes

Changes between document issues are cumulative. Therefore, the latest document issue contains all changes made to previous issues.

Changes between issues 7-1 and 7-0

Minor editorial changes.

Changes between issues 7-0 and 6-1

The following Exchange Terminals have been added:

- ET2E-T
- ET2E-TC
- ET2A-T

Section *Applicable NEBS3 compliance (optional)* has been added.

Changes between issues 6-0 and 6-1

Section *TCSM2 dimensioning* has been modified.

Changes between issues 5-0 and 6-0

Online modifications have been made.

1 Overview of Engineering for TCSM2

The *Engineering for TCSM2* describes some overall dimensioning rules that should be considered when the TCSM2E, TCSM2A or TCSM2A-C is purchased and plans for installation are being made. The subjects covered, however, do not include the installation planning instructions for the station power supply equipment or the PCM and alarm distribution frames.

- *TCSM2 in the GSM network*
- *Introduction to the structure of TCSM2*
- *Mechanical design of TCSM2*
- *TCSM2 rack description*
- *TCSM2 cartridge descriptions*
- *Power distribution in TCSM2*
- *Alarm system*
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2 TCSM2 in the GSM network

The second generation Nokia Transcoder performs transcoding functions in the Base Station Subsystem (BSS). The equipment also provides a submultiplexing scheme which is used between the transcoder and the BSC. These two functions together give a functional name to the equipment: Transcoder Submultiplexer Equipment (TCSM2). The variants TCSM2A and TCSM2A-C are used in markets with the 1.5 Mbit/s ANSI hierarchy. The variant TCSM2E is used in markets with the 2 Mbit/s ETSI hierarchy.

The following figure shows an overview of the GSM900/GSM1800/GSM1900 network and the position of TCSM2 in the network in relation to the other network elements.

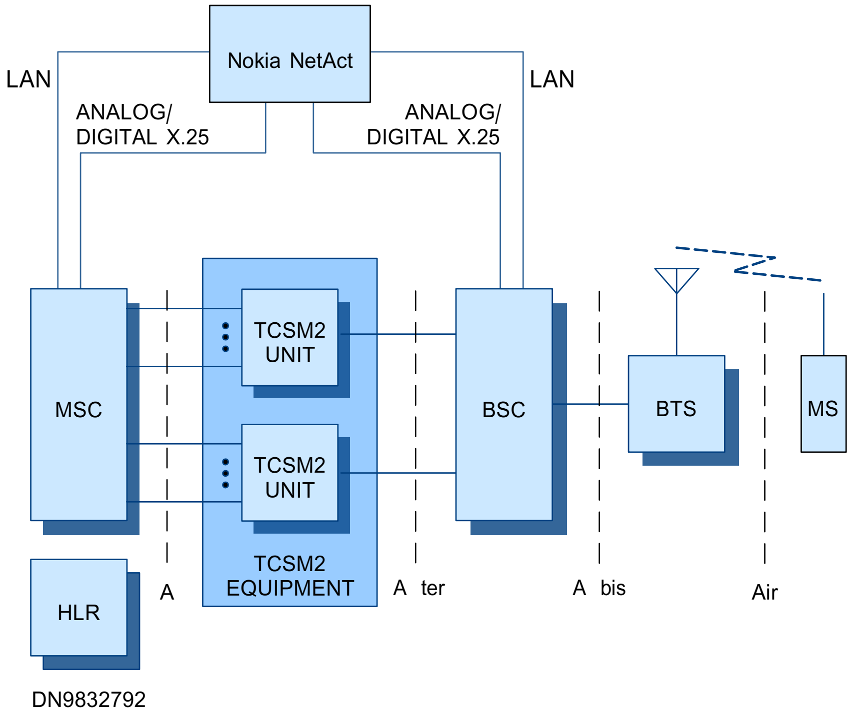

Figure 1. Overview of the GSM900/GSM1800/GSM1900 network

TCSM2 can be located either at the MSC or BSC site. When located at the MSC site, transmission capacity between the BSC and the MSC is saved because the signal is transmitted up to the MSC in transcoded form.

For a general introduction to *Engineering for TCSM2* , see *Overview of Engineering for TCSM2.*

3 Introduction to the structure of TCSM2

The DX 200 TCSM2 is based on a modular software (SW) and hardware (HW) structure, which allows for easy extendibility and flexible capacity dimensioning.

For a general introduction to *Engineering for TCSM2* , see *Overview of Engineering for TCSM2.*

3.1 TCSM2 block description

The TCSM2 unit consists of four main blocks:

- the Transcoder Controller plug-in unit (TRCO)
- a number of Transcoder plug-in units (TR16-S or TR12-T)
- the Exchange Terminal plug-in units (ET2A, ET2E, and/or ET2E-C/ET2E-S/ET2E-SC; ET2A-T, ET2E-T or ET2E-TC)
- the Power Supply plug-in unit (PSC1 or PSC1-S)

Note

For the sake of brevity, the term ET2E is often used in *Engineering for TCSM2* to refer to ET2E, ET2E-C, ET2E-S, ET2E-SC or ET2E-T, ET2E-TC; likewise, the term ET2A is often used to refer to ET2A or ET2A-T.

TRCO incorporates a microcomputer that controls and supervises the operation of TCSM2. PSC1 and/or PSC1-S supply the +5 V and -5 V operating voltages to TRCO and the TR16-S or TR12-T plug-in units.

The transcoding and rate adaptation functions are performed by the DSPs in the TR16-S or TR12-T plug-in units. TR12-T is provided with 12 DSPs and TR16-S with 16 DSPs.

TCSM2E and TCSM2A have a maximum of seven trunk interfaces towards the MSC and one towards the BSC. The TCSM2A-C has a maximum of six trunk interfaces towards the MSC and one towards the BSC. The functions related to the line interfaces are handled in the ET2 plug-in units. The block diagrams of TCSM2E, TCSM2A, and TCSM2A-C are presented in figures *TCSM2A block diagram,TCSM2A-C block diagram,* and *TCSM2E block diagram.*

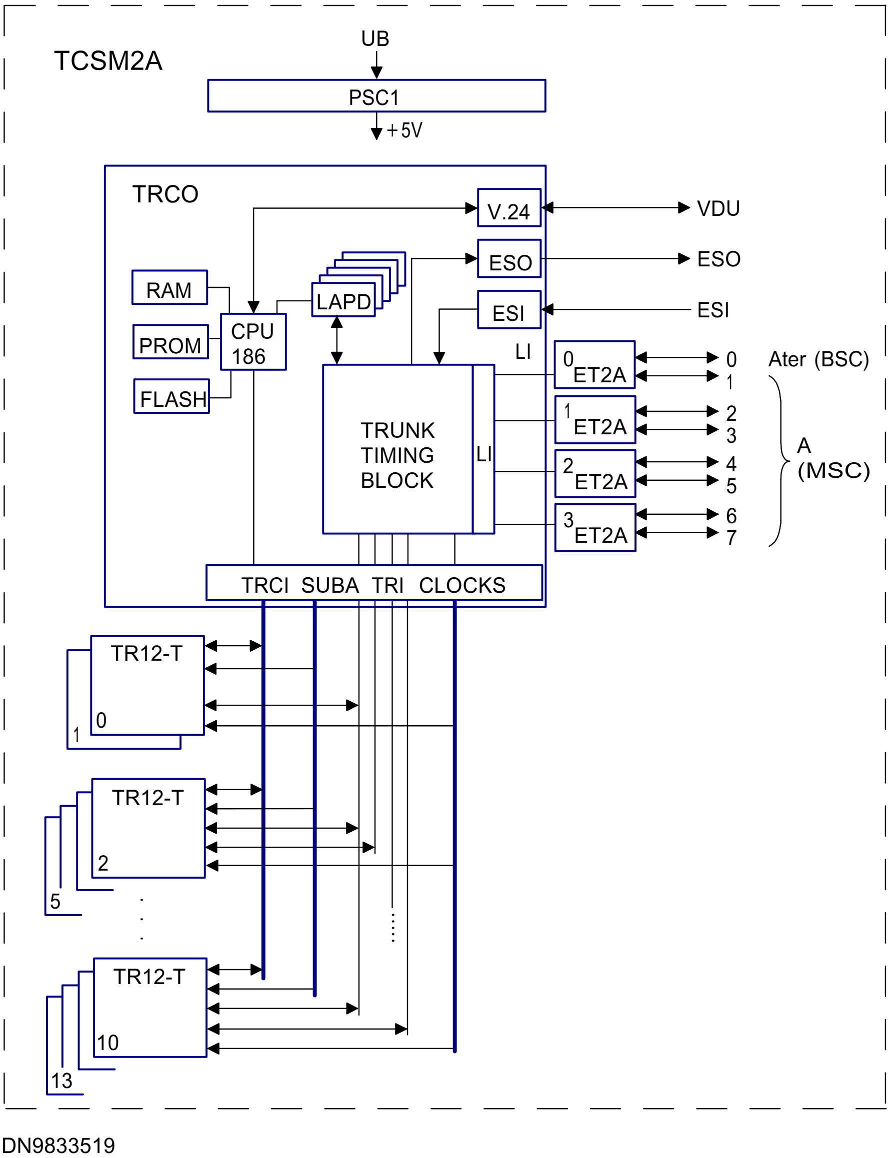

Figure 2. TCSM2A block diagram

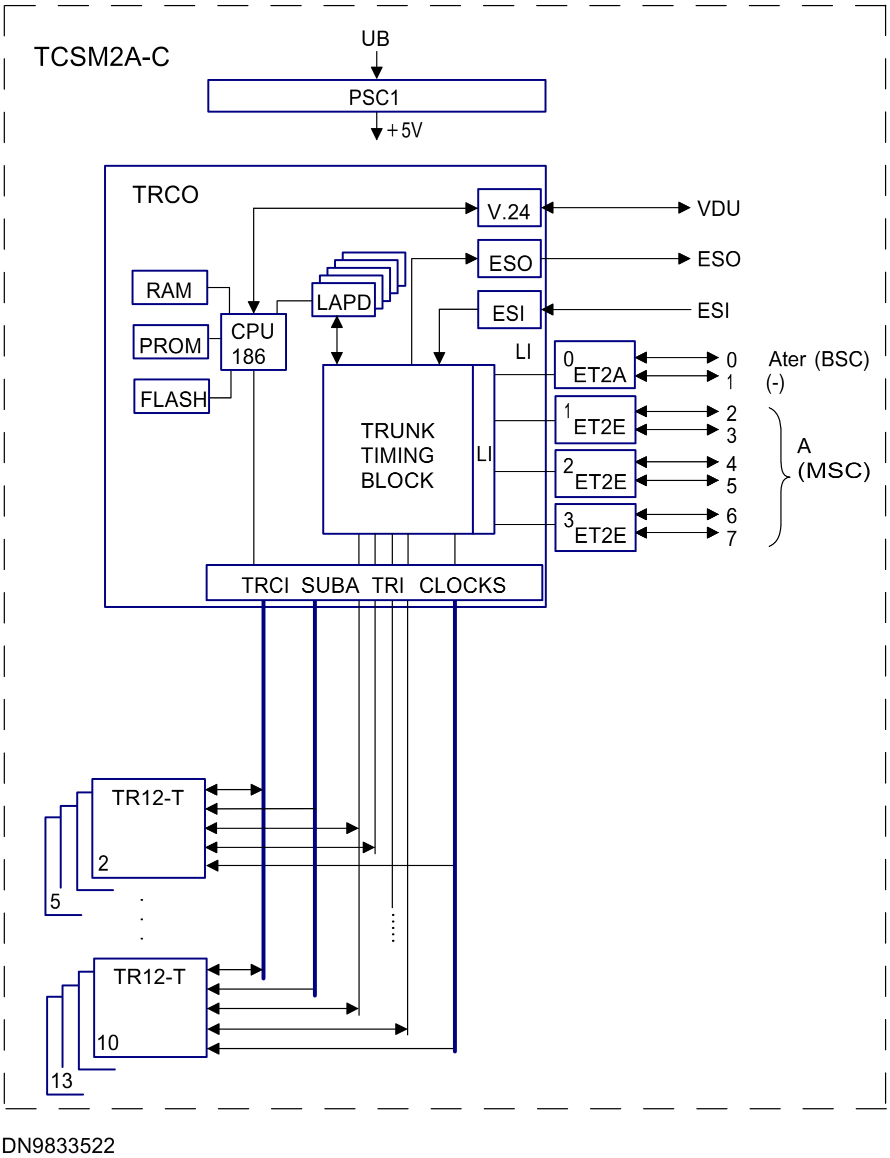

Figure 3. TCSM2A-C block diagram

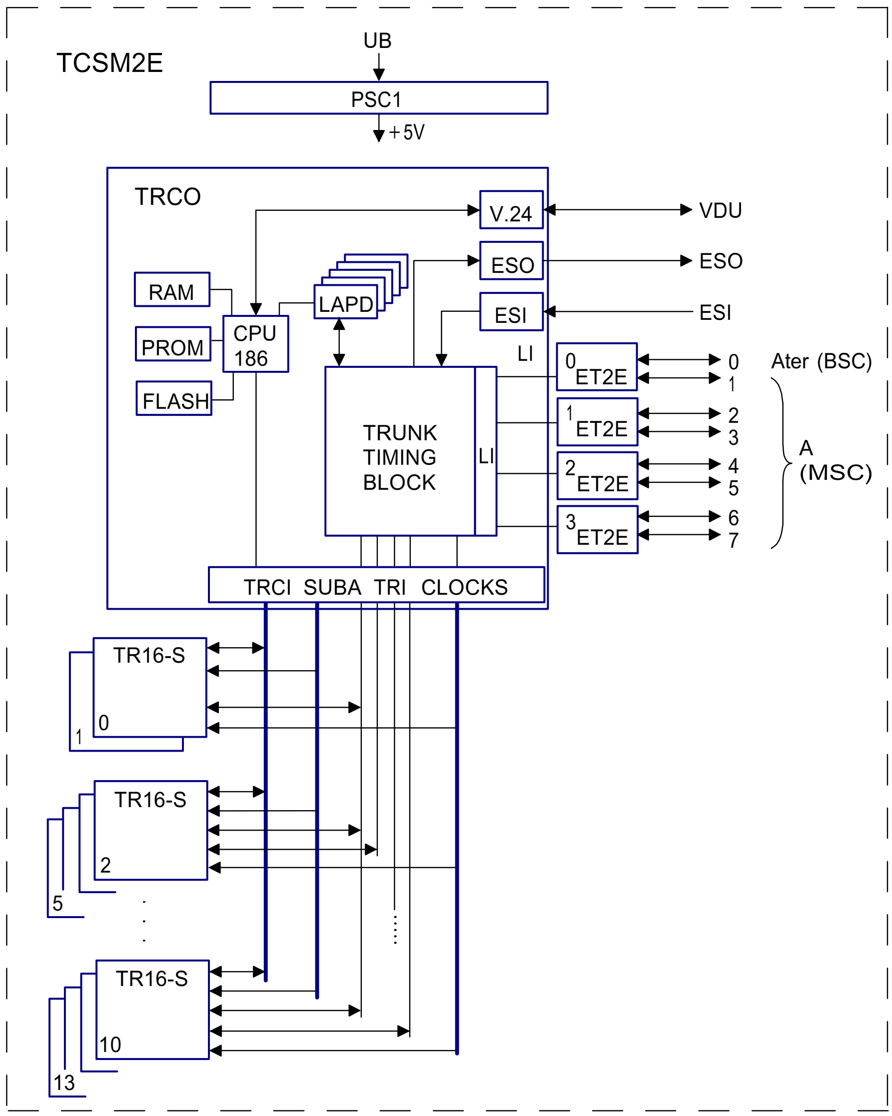

Figure 4. TCSM2E block diagram

See *Introduction to the structure of TCSM2*

3.2 TCSM2 dimensioning

The TC2E rack can house a maximum of eight TCSM2 units, some of which may not be equipped for traffic. Each unit can be programmed to handle different types of calls at different transmission rates.

The traffic alternatives offered by the TCSM2

TCSM2 supports a variety of traffic alternatives for processing and transmitting different types of calls. For speech calls, full-rate (FR), enhanced full-rate (EFR), half-rate (HR), and adaptive multirate (AMR) submultiplexing are provided. For data calls, full-rate and half-rate submultiplexing as well as High Speed Circuit Switched Data (HSCSD) transmission at the rates of maximum 2 × FR data (HS2) and maximum 4 × FR data (HS4) are available.

Listed in the table below are the traffic alternatives provided by TCSM2, along with the transmission rates, MSC side (Ater) time slot/ BSC side (A) time slot submultiplexing ratios, and the number of MSC side trunks per one BSC side trunk for each type of call.

Table 1. Channel types supported by TCSM2

Circuit type	Type of traffic	Transmission rate	Submultiplexing ratio (Ater TSs/A TSs)	MSC side trunks
A	FR/EFR speech, FR data	16 kbit/s	4:1	4
B	HR speech, HR data	8 kbit/s	8:1	7
C	FR/EFR/HR speech FR/HR data	16 or 8 kbit/s	4:1	4
D	FR/EFR/HR speech FR/HR data HS2 data	2 x 16 kbit/s	2:1	2
E	FR/EFR/HR speech FR/HR data HS4 data	4 x 16 kbit/s	1:1	1

Table 1. Channel types supported by TCSM2 (cont.)

Circuit type	Type of traffic	Transmission rate	Submultiplexing ratio (Ater TSs/A TSs)	MSC side trunks
F	AMR speech	16 kbit/s	4:1	4

The TCSM2 equipment and software allow also mixed allocations where different lines of the same TCSM2 unit are programmed to handle different types of calls. However, the number of different DSP softwares used simultaneously on a TCSM2 unit is limited to three. This limits the number of different types of configurations on the TCSM2 unit because circuit types C, D, and E are handled by one DSP software but types A, B, and F require their own DSP software.

Maximum capacity values for a one-rack configuration of TCSM2E:

- 1680 half-rate (HR) traffic channels (submultiplexed in 8 kbit/s units)
- 928 full-rate (FR) traffic channels (submultiplexed in 16 kbit/s units)
- 480 HSCSD traffic channels at the rate of maximum 2 × FR data; or
- 240 HSCSD traffic channels at the rate of maximum 4 × FR data

Maximum capacity values for a one-rack configuration of TCSM2A:

- 1328 half-rate (HR) traffic channels (submultiplexed in 8 kbit/s units)
- 752 full-rate (FR) traffic channels (submultiplexed in 16 kbit/s units)
- 376 HSCSD traffic channels at the rate of maximum 2 × FR data; or
- 184 HSCSD traffic channels at the rate of maximum 4 × FR data

Maximum capacity values for a one-rack configuration of TCSM2A-C:

- 1136 half-rate (HR) traffic channels (submultiplexed in 8 kbit/s units)
- 752 full-rate (FR) traffic channels (submultiplexed in 16 kbit/s units)
- 376 HSCSD traffic channels at the rate of maximum 2 × FR data; or
- 184 HSCSD traffic channels at the rate of maximum 4 × FR data

In practice, the time slot allocation selected may offer a lower maximum capacity than the above figures. This is because some time slots must be allocated for through-connected channels, for example, in the following situations:

- BSC - MSC common channel signalling reserves one or more time slots per BSC
- BSC - NMS X.25 channel reserves one or more time slots per BSC
- exceptional situations where some additional through-connected time slots are needed

Notes on the first generation DX 200 TCSM

The most important engineering-related issues to be considered when a first generation DX 200 TCSM installation is expanded with second generation equipment (TCSM2) are as follows:

- The PDE rack, which is used with TCSM for power feeding, is not used with TCSM2 at all.
- The supply voltage range is wider for TCSM; it allows lower voltages than TCSM2.
- Submultiplexing is always used with TCSM2, while TCSM can be used without submultiplexing.
- The TCE, PDE and BT1E racks (for the TCSM) are about 300 mm (11.8 in) higher and also narrower than the TC2E rack (for the TCSM2).

The difference in the dimensions of the TCE and TC2E racks has the following consequences:

- The doors of the TC2E rack require slightly more space for opening.
- TC2E allows lower rooms to be used for installation.

If racks for TCSM and TCSM2 are used in the same room, they should not be installed in a common row structure. The following options exist:

- Different height racks are installed in separate rack rows.
- Different height racks are installed in the same row, but in separate sections, with some space in between for installing the side plates.

See *Introduction to the structure of TCSM2*

4 Mechanical design of TCSM2

The basic mechanical structure of the DX 200 TCSM2 follows a standard hierarchy:

- racks
- cartridges and plug-in units
- internal cables

The dimensioning of the cartridges is based on IEC recommendations. The system is easy to install, maintain, and operate. Special attention has been paid to thermal factors and protection against interference.

For a general introduction to *Engineering for TCSM2* , see *Overview of Engineering for TCSM2.*

4.1 Racks

A rack is a standard frame into which the equipment of TCSM2 is mounted (see figure *The TC2E rack*). The frame consists of side plates, doors, and top and bottom plates. Adjustable legs can be fitted to the bottom. The plates are made of sheet steel. There are two types of racks used for housing the TCSM2 equipment:

- TC2E equipment rack
- R2A1 cable rack (optional)

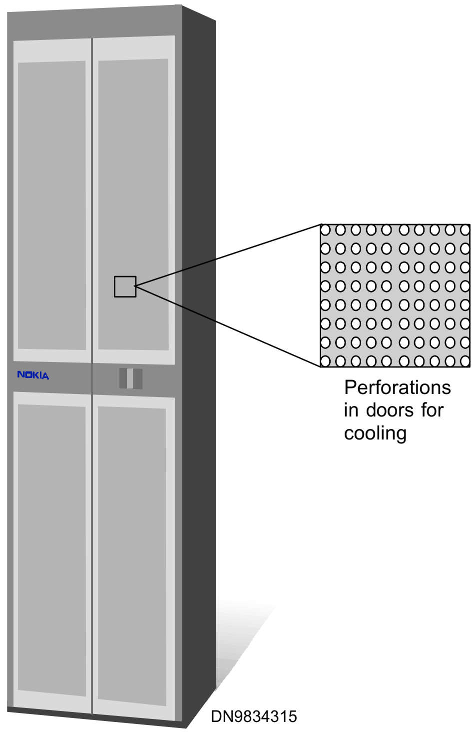

Figure 5. The TC2E rack

In addition to the items above, the optional CC19V vertical cable conduit can be used for routing the external cables.

Several racks can be joined together so that they form rack rows. When the rack doors are closed, each rack row constitutes an EMC-protected area. The racks can be equipped with inclined air flow guides for cooling the equipment. Perforations in the doors also aid cooling.

Rack dimensions

The dimensions of the racks are the following (H × W × D):

- TC2E equipment rack 1880 x 800 x 450 mm (6.17 ft × 23.6 in × 17.7 in)
- R2A1 cable rack 1880 x 200 x 450 mm (6.17 ft × 7.9 in × 17.7 in)
- CC19V cable conduit 1880 x 140 x 450 mm (6.46 ft × 5.51 in × 17.7 in)

Rack dimensions when installed

The depth of the racks is 450 mm (17.7 in) plus 50 mm (2 in) for the front and rear doors (25 mm + 25 mm, or 1 in + 1 in). The total depth of a rack with the doors installed is then 500 mm (19.7 in).

The length of the rack row increases by 80 mm (40 + 40 mm) or 3.2 in (1.6 in + 1.6 in) when the side panels are installed.

The racks stand on approximately 50-mm-high (2 in) adjustable mounts or rails. As there is a 90 mm (3.54 in) upper structure (for routing cables) on top of a rack row, its maximum total height is 2020 mm (6.63 ft). Above the rack row, a space of at least 500 mm (19.7 in) is required to ensure efficient ventilation.

For related information, see *Mechanical design of the TCSM2.*

4.2 Cartridges and plug-in units

Cartridges

The BSC2 racks are delivered from Nokia with all the cartridges already installed. They are made of stainless steel. For the dimensions of the cartridges, see *Cartridge Descriptions.*

Plug-in units

The printed circuit boards of the plug-in units used in TCSM2 are either double-sided or multi-layered. They are covered with a protective coating, which makes them easier to handle and protects the foils against scratches.

High quality SMB, RJ-45, D- and Euroconnectors are used as connectors. Both surface-mounted and hole-mounted components are used.

The dimensions of the plug-in units used in TCSM2 are:

- 100 mm × 220 mm; or 3.94 in × 8.66 in.
- 233.4 mm × 220 mm; or 9.19 in × 8.66 in.

For related information, see *Mechanical design of TCSM2.*

4.3 Internal cables

In their internal cabling, the DX 200 network elements use cables which are cut to length and equipped with connectors. The BSC2 racks are delivered from the factory with all the internal cables already installed.

The cables running between the transcoder rack(s) and the racks of an associated network element, if placed on the same site, can be run either:

- directly from one rack to another if TCSM2 is installed on the same site and in a common row with a DX 200 BSC2,
- through cable structures above the racks,
  - in case BSC2 site installation, a horizontal cable conduit (for example, DX 200 accessory CC132) can also be used between the rack rows)
- under the floor if the exchange room has a raised floor.

For related information, see *Mechanical design of the TCSM2.*

5 TCSM2 rack descriptions

The TC2E equipment rack, the R2A1 cabling rack, and the CC19V vertical cable conduit are used for housing the TCSM2 units. In some cases the R2A1 cabling rack and the CC19V vertical cable conduit are also used for routing the external cables.

The TCSM2 units serving the same BSC usually fit into one rack; in fact, a single rack can often house the TCSM2 units of more than one (typically small) BSS. As each TCSM2 unit is virtually independent of the others, it is also possible to route the traffic of one BSS through TCSM2 units in different racks.

If TCSM2 is located on the MSC site, the TCSM2 units allocated to different BSSs may be housed in the same TC2E rack. When the BSS channel capacity is extended, new TC1Cs can be placed into any TC2E rack (if it is not already fully equipped), regardless of its location in the BSS.

For related information, see *Overview of Engineering for TCSM2.*

5.1 Transcoder rack TC2E

A TC2E rack can contain a maximum of eight TCSM2 units. The same rack type is used irrespective of whether the transcoder is located at the MSC or the BSC site. The rack configuration comprises eight Transcoder Cartridges (TC1C) and four Transcoder Exchange Terminal Cartridges (ET1TC), which are installed in the racks at the factory, plus the internal cables, which are connected to the connectors at the rear side of the cartridges. The mechanical parts of the rack are made of stainless steel. The dimensions of the rack are:

- 1880 × 800 × 450 mm (6.17 ft × 31.5 in × 17.7 in)

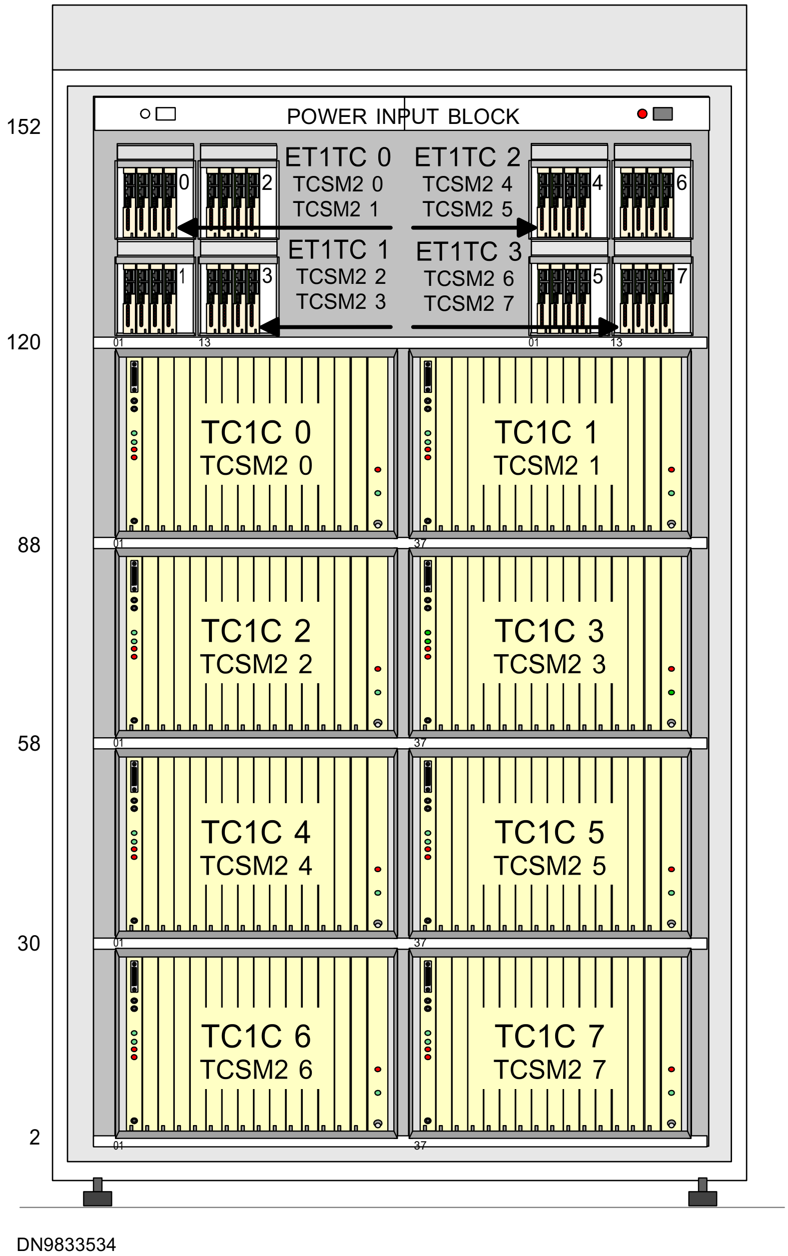

Figure 6. The TC2E rack layout

See *TCSM2 rack description.*

5.2 Items for raised floor installation (Cable Conduit CC19V, Cable Rack R2A1-S)

If there is an elevated floor in the equipment room, the incoming/outgoing cables can be placed under the floor and entered to the equipment racks through a vertical cable conduit (CC19V) and a cable rack (R2A1-S).

R2A1-S is used for all other types of cables except for the power supply cables. It can be placed at either end of the rack row or between two equipment racks. The power supply cables must be brought in through conduit CC19V, which is always placed at either end of the rack row.

The height and depth of the cable conduit and the cable rack are the same as those of the TC2E rack. The width measures for each item are:

- 140 mm / 5.5 in for the Cable Conduit assembly CC19V
- 200 mm / 7.9 in for the Cabling Rack assembly R2A1-S, complete with the Door Set DS192

For further information on the items above and their use, please refer to the *Installation Site Requirements for BSC and TCSM2.*

See also *TCSM2 rack description.*

5.3 Applicable NEBS3 compliance (optional)

TCSM2 can be upgraded to meet applicable NEBS level 3 compliance. This is achieved by fitting the rack with alternative doors and side plates including hinge bars as well as by installing fire protection plates and earth bonding-point bracket. The floor mounting in this case should be based on rails. Furthermore, there are dedicated cable conduit and cabling rack items for raised floor installations when TCSM2 is upgraded to meet applicable NEBS level 3 compliance.

Table 2. BSC and TCSM2 racks, cable racks, side plates, door sets, and cable conduits

Network element	Rack	Rack	Door set for rack	Side plate	Cable rack	Door set for cabling rack	Cable conduit	Note
BSCE, BSCi	BCBE	BCEE	DS222	SP22A-S, SP22A-T	R2A1-S	DS222	CC22V	
BSC2, BSC2i	BCBE	BCEE	DS196	SP19A-S	R2A1-S	DS192	CC19V	
BSC2, BSC2i	BCBE	BCEE	DS196E	SP19A-T	R2A1-T	DS192-S	CC19V-S	NEBS kit
TCSM2	TC2E	-	DS198	SP19A-S	R2A1-S	DS192	CC19V	
TCSM2	TC2E	-	DS198E	SP19A-T	R2A1-T	DS192-S	CC19V-S	NEBS kit
BSC3i	BSCC	-	-	-	-	-	SCC	

For related information, see *TCSM2 rack description* and *BSC and TCSM2 equipment room layout and space requirements.*

6 Cartridge descriptions

From the mechanical point of view, the cartridges used in TCSM2 consist of the cartridge mechanics and a mother board. They are installed into the rack(s) at the factory, but fitted with plug-in units only at the site. The mechanical parts of the cartridges are made of stainless steel. Regardless of the variant, the cartridges used in TCSM2 are always of the same two types, namely:

- Transcoder Cartridge (TC1C)
- Transcoder Exchange Terminal Cartridge (ET1TC)

For a general introduction to *Engineering for TCSM2* , see *Overview of Engineering for TCSM2.*

6.1 TC1C, Transcoder Cartridge

Purpose:	The TC1C cartridge houses the units performing the core functions of TCSM2, transcoding, and submultiplexing. In the transcoding process, voice-coded blocks of 260 bits are converted into 160 μ law (ANSI) or A law (ETSI) PCM samples of 8 bits and vice versa. In the submultiplexing process, the channel rate is adapted between the MSC and the BSC from 64 kbit/s to 8/16 kbit/s.	
Plug-in units:	TRCO	Transcoder Controller
	TR12-T	Transcoder Plug-in Unit (ANSI version)
	TR16-S	Transcoder Plug-in Unit (ETSI version)
	PSC1/PSC1-S	Power Supply for the Cartridge
Interfaces:	Physical interface: V.24/V.28	
	ESI/ESO synchronization (for test purposes)	

	Wired alarm input/output	
	FPGA programming	

The size of the TC1C cartridge is (height × width × depth):

- 262 mm × 360 mm × 300 mm or
- 10.3 in. × 14.2 in. × 11.8 in.

the size of the plug-in units is (height × depth):

- 233.4 mm × 220 mm or
- 9.19 in. × 8.66 in.

The basic configuration of the TC1C cartridge

The basic configuration of TC1C for *TCSM2E* is as follows (see the following figure):

- one Transcoder Controller (TRCO)
- a maximum of fourteen Transcoder plug-in units (TR16-Ss)
- one Power Supply for the Cartridge (PSC1/PSC1-S)

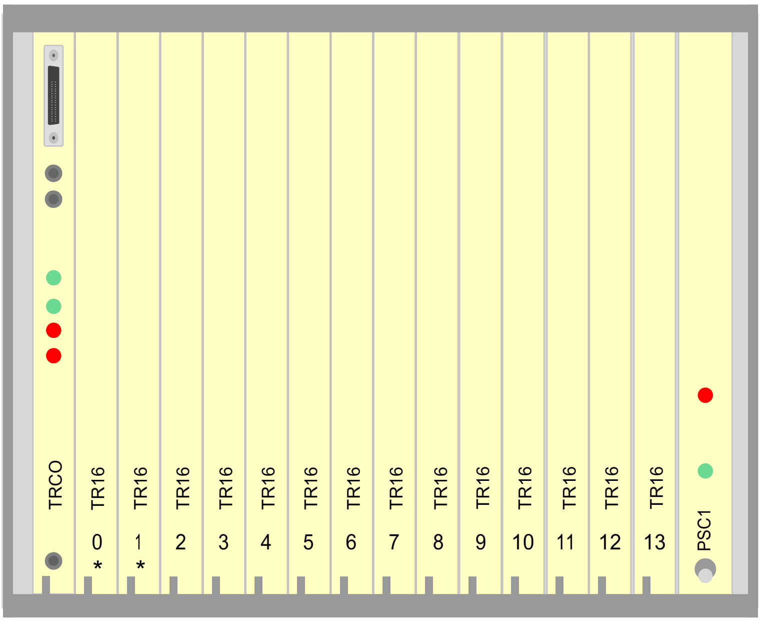

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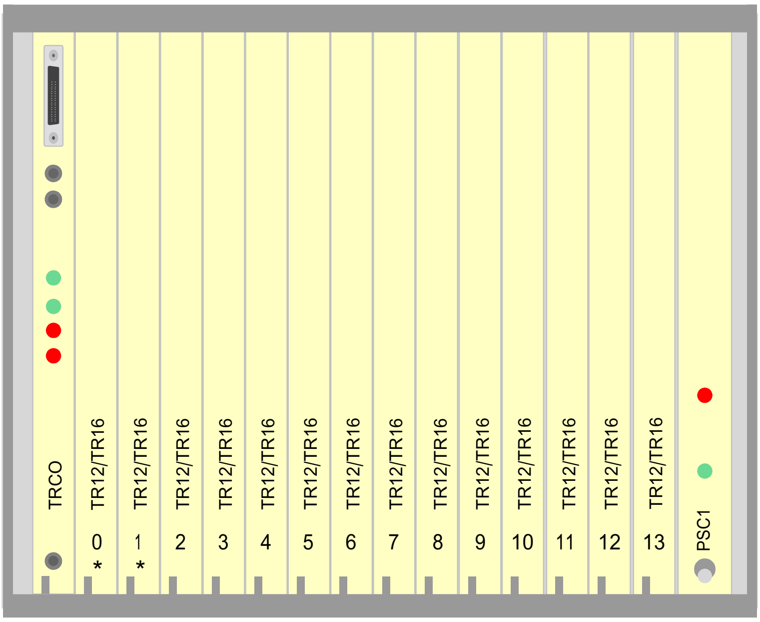
Figure 7. The TC1C cartridge for TCSM2E

The basic configuration of TC1C for *TCSM2A* and *TCSM2A-C* is as follows (see figure *The TC1C cartridge for TCSM2A*):

- one Transcoder Controller (TRCO)
- Transcoder plug-in units (TR12-Ts)
- one Power Supply for the Cartridge (PSC1/PSC1-S)

The maximum number of the Transcoder plug-in units is:

- fourteen in TCSM2A
- twelve in TCSM2A-C



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Positions marked with an asterisk (*) are left empty in the TCSM2A-C application.

Figure 8. The TC1C cartridge for TCSM2A

For alternative configurations, see *Configuring the TC1C and ET1TC cartridges for FR, EFR, AMR, HR, and HSCSD use.*

See also *Cartridge descriptions.*

6.2 ET1TC, Transcoder Exchange Terminal Cartridge

Purpose:	ET1TC contains the units for interfacing to the trunk.	
Plug-in units:	ET2A	Exchange Terminal plug-in unit
	ET2E	Exchange Terminal plug-in unit
	ET2E-C	Exchange Terminal plug-in unit

	ET2E-S	Exchange Terminal plug-in unit
	ET2E-SC	Exchange Terminal plug-in unit
	ET2A-T	Exchange Terminal plug-in unit
	ET2E-T	Exchange Terminal plug-in unit
	ET2E-TC	Exchange Terminal plug-in unit
Interfaces:	PCM	
	Synchronisation	

Note

For the sake of brevity, the term ET2E is often used in *Engineering for TCSM2* to refer to ET2E, ET2E-C, ET2E-S, ET2E-SC or ET2E-T, ET2E-TC; likewise, the term ET2A is often used to refer to ET2A or ET2A-T.

The ET1TC cartridge is of the following size (height × width × depth):

- 262 mm × 120 mm × 300 mm or
- 10.3 in. × 4.72 in. × 11.5 in.

The plug-in units in the cartridge are of the following size (height × depth):

- 100 mm × 220 mm or
- 3.94 in. × 8.66 in.

The basic configuration of the ET1TC cartridge

The configuration of the ET1TC cartridge for *TCSM2E* is as follows (see figure *The ET1TC cartridge for TCSM2E*):

- a maximum of eight ET2E plug-in units, capable of handling up to 16 trunks

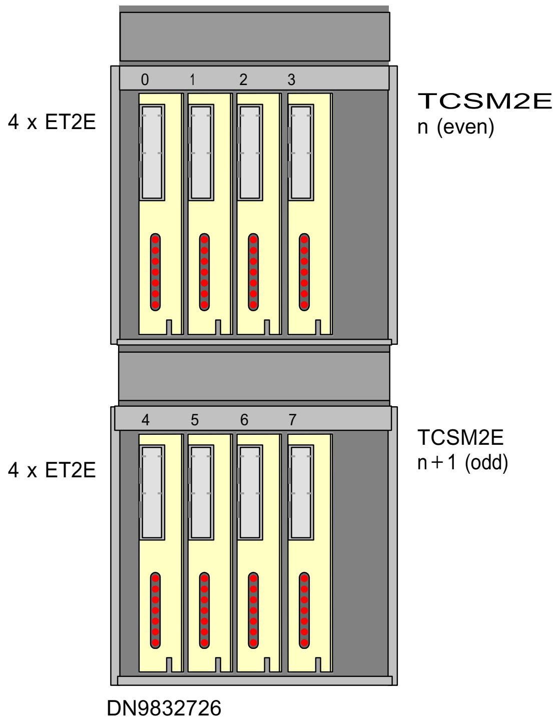


Figure 9. The ET1TC cartridge for TCSM2E

The basic configuration of the ET1TC cartridge for *TCSM2A* is as follows (see figure *The ET1TC cartridge for TCSM2A*):

- a maximum of eight ET2A plug-in units capable of handling up to 16 trunks

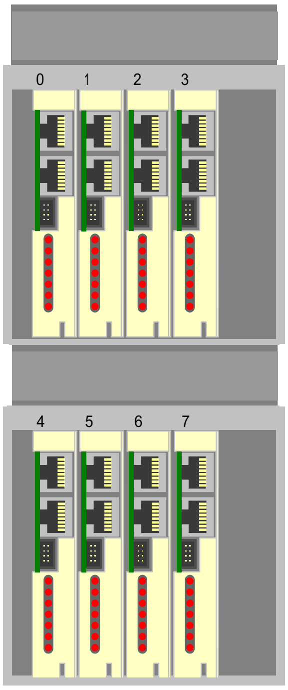


Figure 10. The ET1TC cartridge for TCSM2A

The basic configuration of ET1TC for *TCSM2A-C* is (see also figure *The ET1TC cartridge for TCSM2A-C*):

- a maximum of two ET2A plug-in units, capable of handling up to 4 trunks (inserted into slots 0 and 4)
- a maximum of six ET2E plug-in units, capable of handling up to 12 trunks (inserted into slots 1 to 3 and 5 to 7)

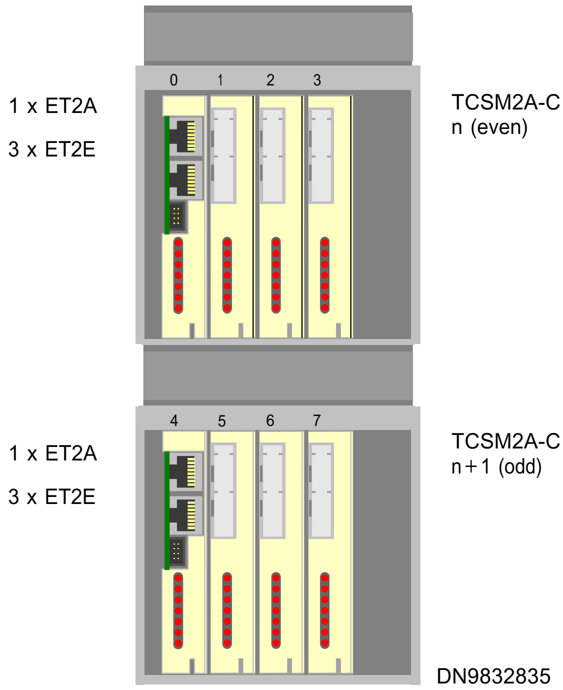


Figure 11. The ET1TC cartridge for TCSM2A-C

For alternative configurations, see *Configuring the TC1C and ET1TC cartridges for FR, EFR, AMR, HR, and HSCSD use.*

Configuring the TC1C and ET1TC cartridges for FR, EFR, AMR, HR, and HSCSD use

Listed in the tables below are the maximum numbers of the Exchange Terminal and Transcoder plug-in units required for processing full-rate, enhanced full-rate, half-rate, and HSCSD traffic. The configurations given in the tables represent the special cases when the whole TCSM2 unit is allocated to handle calls of the same type, with the maximum traffic channel capacity in use.

For mixed allocations and configurations where the capacity of TCSM2 is only partially utilised, the exact number of the necessary plug-in units must be determined separately, as it depends on the types of calls processed and the number of lines allocated to calls of each type, as well as on the number of active traffic channels.

Table 3. The maximum numbers of TR12-T or TR16-S plug-in units required for different types of traffic

Channel type	**Max. number of TR12-T or TR16-S plug-in units**		
	TCSM2A	**TCSM2A-C**	**TCSM2E**
FR/EFR/AMR	8	6	8
HR	14	12	14
HS2	4	4	4
HS4	2	2	2

Table 4. The maximum numbers of ET2A and ET2E plug-in units required for different types of traffic

Channel type	**Max. number of ET2A plug-in units**		**Max. number of ET2E plug-in units**	
	TCSM2A	**TCSM2A-C**	**TCSM2E**	
FR/EFR/AMR	3	1	2	3
HR	4	1	3	4
HS2	2	1	1	2
HS4	1	1	1	1

Note

TCSM2A-C uses ET2A and ET2E plug-in units simultaneously.

Mapping of the Exchange Terminal trunk interfaces

The tables below show the mapping of trunk interfaces of the Exchange Terminal plug-in units in the ET1TC cartridges.

Table 5. Mapping of the trunk interfaces to the ET2Es of TCSM2E

				ET2E number				
	0		**1**		**2**		**3**	
Trunk interface number	0 (Ater)	1	2	3	4	5	6	7
E1 interface number of ET2E	0	1	0	1	0	1	0	1
Equipped for 16 kbit/s TCH	x	x	x	x	x	-	-	-
Equipped for 8 kbit/s TCH	x	x	x	x	x	x	x	x
Equipped for HSCSD max. 2 × FR data	x	x	x	-	-	-	-	-
Equipped for HSCSD max. 4 × FR data	x	x	-	-	-	-	-	-

Table 6. Mapping of the trunk interfaces to the ET2As of TCSM2A

				ET2A number				
	0		**1**		**2**		**3**	
Trunk interface number	0 (Ater)	1	2	3	4	5	6	7
T1 interface number of ET2A	0	1	0	1	0	1	0	1
Equipped for 16 kbit/s TCH	x	x	x	x	x	-	-	-
Equipped for 8 kbit/s TCH	x	x	x	x	x	x	x	x
Equipped for HSCSD max. 2 × FR data	x	x	x	-	-	-	-	-

Table 6. Mapping of the trunk interfaces to the ET2As of TCSM2A (cont.)

				ET2A number				
	0		**1**		**2**		**3**	
Equipped for HSCSD max. 4 × FR data	x	x	-	-	-	-	-	-

Table 7. Mapping of the trunk interfaces to the ET2As and ET2Es of TCSM2A-C

	ET2x number (type in brackets)							
	0 (ET2A)		**1 (ET2E)**		**2 (ET2E)**		**3 (ET2E)**	
Trunk interface number	0 (Ater)	1	2	3	4	5	6	7
T1/E1 interface number of ET2x	0	-	0	1	0	1	0	1
Equipped for 16 kbit/s TCH	x	-	x	x	x	-	-	-
Equipped for 8 kbit/s TCH	x	-	x	x	x	x	x	x
Equipped for HSCSD max. 2 × FR data	x	-	x	x	-	-	-	-
Equipped for HSCSD max. 4 × FR data	x	-	x	-	-	-	-	-

See also *Cartridge descriptions.*

7 Power distribution in TCSM2

The following sections describe the power supply and power distribution of TCSM2 on the rack level. The subjects covered, however, do not include the station power supply dimensioning principles including the ground arrangements. For related information, see *Overview of Engineering for TCSM2.*

7.1 Power distribution to the TCSM2 rack equipment

All voltages needed by the TCSM2 equipment are generated by DC/DC converters, located either in the cartridges or plug-in units. They are operated on a nominal supply voltage of -48 V/-60 V and the voltage range is -40,5 to -72.

The TCSM2 racks are provided with two feeding input branches, each consisting of one PSA20 unit (circuit breakers, diodes, and filters) and one PSFP unit (fuses). The PSA 20 Power Supply Adapters have two separate inputs, which co-operate as follows:

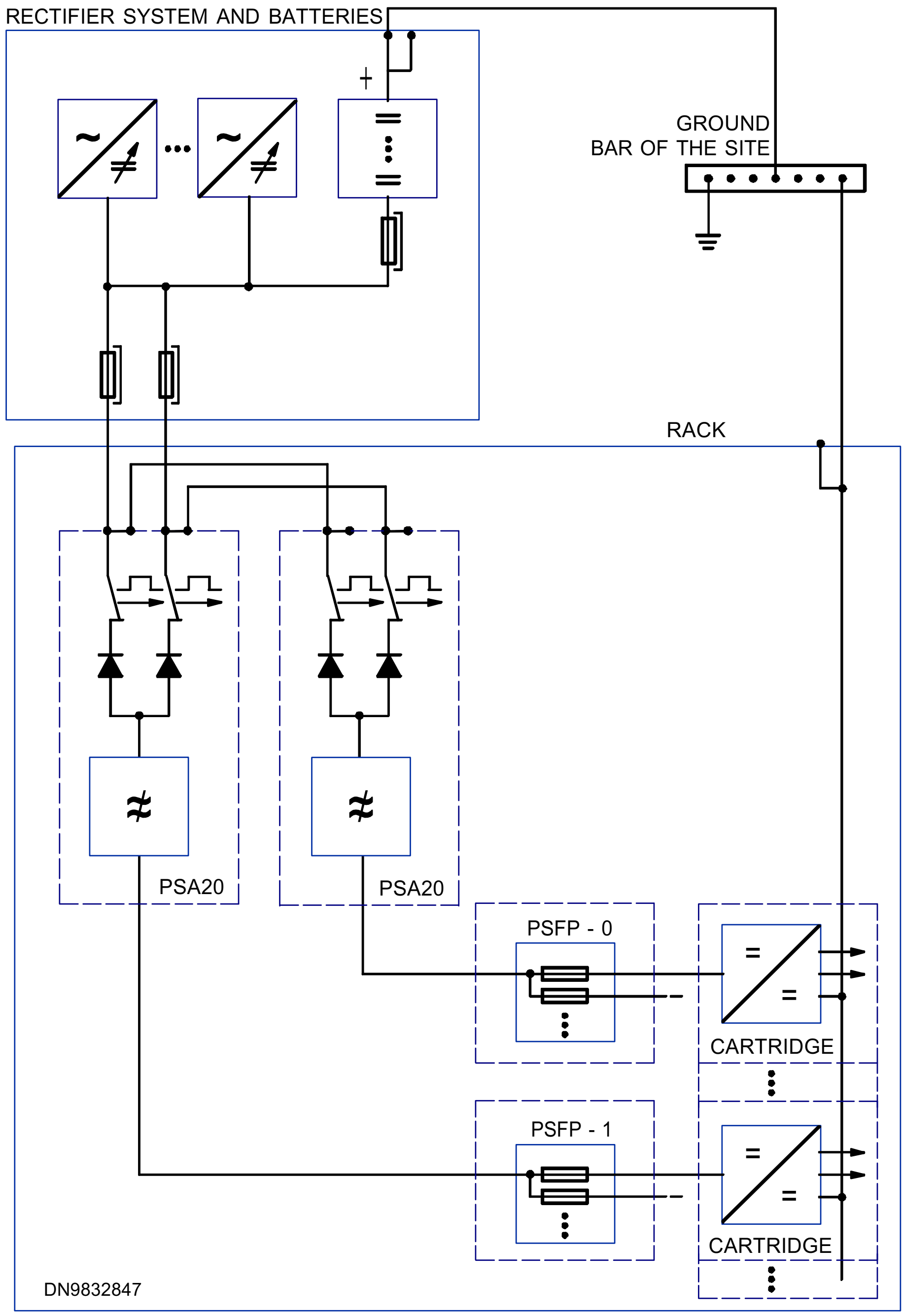
- The two inputs to the rack make a redundant pair. If either of the leads from the battery (cable or circuit breaker) fails, the other would continue to supply power to the whole rack.
- The two PSA20s are partly redundant with respect to each other. If the circuit breaker or diode in either of them fails, the other would continue to supply power to the whole rack.
- The two PSFPs are not redundant with respect to one another. If either of them fails, the operation of the corresponding functional units would be lost.

The circuit breakers of PSA20 have a 20 A rating and the fuses of PSFP have a 10 A rating.

There are two types of power supplies used in the TCSM2 cartridges. In type 1, the cartridge has a separate DC/DC converter unit which supplies all the plug-in units in the cartridge. In type 2, each plug-in unit in the cartridge has an internal DC/DC converter.

In TCSM2, the Transcoder Cartridges are of type 1 and the Transcoder Exchange Terminal Cartridges are of type 2.

The power supply principle of the TCSM2 racks is presented in figure *Power distribution diagram of TCSM2.*



For the sake of simplicity, only the negative lead is drawn from the battery to the cartridge.

Figure 12. Power distribution diagram of TCSM2

Note

On the rack, cartridge, and plug-in unit level, the positive and negative inputs to the DC/DC converters must not be connected to the station ground. The power cables are only connected to the station ground at a single point near the batteries.

TCSM2 on a BSC site

If a TCSM2 is installed on the BSC site, the supply cables can be daisy-chained through all the BSC2 and TC2E racks.

See *Power distribution in TCSM2.*

7.2 Power consumption of DX 200 TCSM2

The power consumption of the TCSM2 depends considerably on the number of active traffic channels, as well as the time slot allocations of the channels and the types of calls the equipment is programmed to process. The power consumption of a rack or rack row can be estimated using the following formula:

$P(\text{Watts}) = N_f \times 0.38 + N_e \times 0.38 + N_h \times 0.36 + N_{hd} \times 0.38 + A \times (N_f \times 0.02 + N_e \times 0.18 + N_h \times 0.17 + N_d \times 0.27)$,

where

N_f = number of (traditional ETSI) FR TCHs

N_e = number of EFR or AMR TCHs

N_h = number of HR TCHs

N_d = number of HSCSD (2 × 16 kbit/s or 4 × 16 kbit/s) channels

A = traffic (0 to 1 Erl/TCH)

Regarding FR, EFR, AMR and HR channels, the formula primarily applies to voice traffic. Data traffic results in consumption values which are considerably lower.

If HR is implemented with the DR principle, the formula cannot be directly applied. Instead of using the N_f , N_e , and N_h values as such, the traffic portions of FR, EFR, or AMR mode and HR mode must be estimated and based on these, the values of N_f , N_e , and N_d should be modified prior to making the calculation. The maximum consumption values for the cartridges are shown in the table below.

The maximum consumption values for fully equipped TC2E racks are shown in the tables below.

Table 8. Maximum consumption values for a normal TCSM2E application

Operation mode	**Consumption**
Full rate only	392 W
Enhanced full rate only (EFR/AMR)	592 W
Half rate only	940 W

Table 9. Maximum consumption values for a TCSM2A application

Operation mode	**Consumption**
Full rate only	312 W
Enhanced full rate only (EFR/AMR)	472 W
Half rate only	740 W

Table 10. Maximum consumption values for a normal TCSM2A-C application

Operation mode	**Consumption**
Full rate only	312 W
Enhanced full rate only (EFR/AMR)	472 W

Table 10. Maximum consumption values for a normal TCSM2A-C application (cont.)

Operation mode	Consumption
Half rate only	660 W

Table 11. Maximum consumption values for a TCSM2A-C application equipped with TR16-S plug-in units

Operation mode	Consumption
Full rate only	392 W
Enhanced full rate only (EFR/AMR)	592 W
Half rate only	860 W

The maximum power consumption values for the TCSM2 cartridges are shown in the tables below.

Table 12. Maximum consumption values for a TCSM2E application

Cartridge	Consumption
TC1C Full rate only	40 W
TC1C Half rate only	105 W
TC1C Enhanced full rate only (EFR/AMR)	65 W
ET1TC Full rate only	18 W
ET1TC Half rate only	25 W
ET1TC Enhanced full rate only (EFR/ AMR)	18 W

Table 13. Maximum consumption values for a TCSM2A application

Cartridge	Consumption
TC1C Full rate only	30 W
TC1C Half rate only	80 W
TC1C Enhanced full rate only (EFR/AMR)	50 W
ET1TC Full rate only	18 W
ET1TC Enhanced full rate only (EFR/ AMR)	18 W
ET1TC Half rate only	25 W

Table 14. Maximum consumption values for a TCSM2A-C application

Cartridge	Consumption
TC1C Full rate only	30 W
TC1C Half rate only	70 W
TC1C Enhanced full rate only (EFR/AMR)	50 W
ET1TC Full rate only	18 W
ET1TC Enhanced full rate only (EFR/ AMR)	18 W
ET1TC Half rate only	25 W

Table 15. Maximum consumption values for a TCSM2A-C application equipped with TR16-S plug-in units

Cartridge	Consumption
TC1C Full rate only	40 W
TC1C Half rate only	95 W
TC1C Enhanced full rate only (EFR/AMR)	65 W

Table 15. Maximum consumption values for a TCSM2A-C application equipped with TR16-S plug-in units (cont.)

Cartridge	Consumption
ET1TC Full rate only	18 W
ET1TC Enhanced full rate only (EFR/ AMR)	18 W
ET1TC Half rate only	25 W

See *Power distribution in TCSM2*.

8 Alarm system

The task of the alarm system is to collect and process the different fault and disturbance observations of the exchange and to find the cause of the observations: the fault. The alarm system first localises the functional unit in which the disturbance or fault has been generated after which the appropriate automatic recovery functions can be activated. The user is informed of failure conditions with alarm printouts and lamp panel controls. The alarm system stores all alarm events on a disk. Alarm history stored on the disk can later be examined by means of the user terminal.

With the help of the user interface, it is possible to cancel or block alarms, output alarm history, and change alarm-specific parameters as well as BSC lamp panel controls.

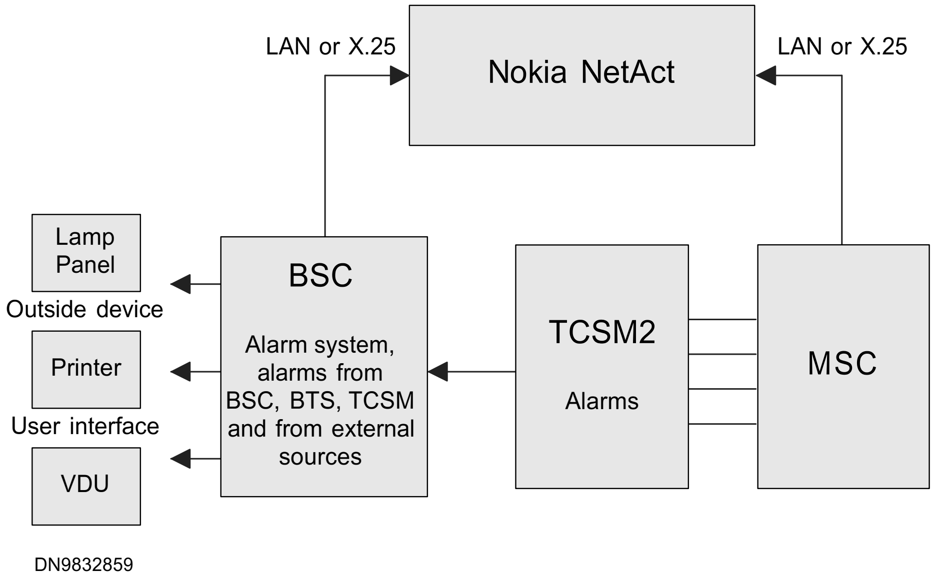


Figure 13. Implementation model of the alarm system

Alarms from TCSM2

Alarms are transferred over the O&M link from TCSM2 to BSC2. Current alarms can, however, be viewed on a local MMI terminal. For immediate understanding at a local MMI terminal, the TRCO software assigns a text string to the alarms.

BSC2 assigns an identity, a time stamp, an alarm class, a text string, and a physical location to each alarm. BSC2 stores information on the physical location of each piece of the TCSM2 equipment. It converts the logical location information of the TCSM2 alarms into a physical address.

Alarms which indicate that traffic channels, trunks, or other portions of the traffic capacity are lost cause blocking of the respective elements by BSC2. TCSM2 is not itself aware of the blocking measures taken by BSC2.

For a general introduction to *Engineering for TCSM2* , see *Overview of Engineering for TCSM2.*

9 Synchronisation

For a general introduction to *Engineering for TCSM2* , see *Overview of Engineering for TCSM2.*

Synchronisation principles on the system level

The primary synchronisation method in the DX 200 network is based on the so-called master-slave principle. In this method, the network elements in a given network are hierarchically organized in such a way that a network element on a higher level in the hierarchy controls the synchronisation of network element(s) one step below it. A DX 200 network element which is synchronized to higher level equipment can, in turn, function as a synchronisation source for lower level equipment. The synchronisation signals are transmitted through the PCM lines.

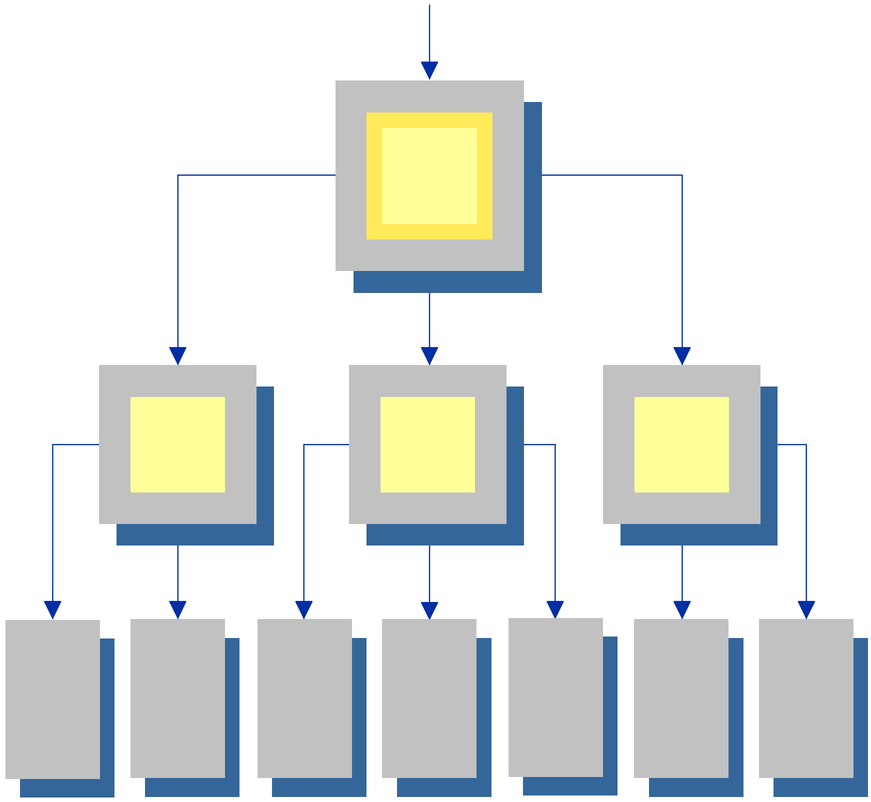


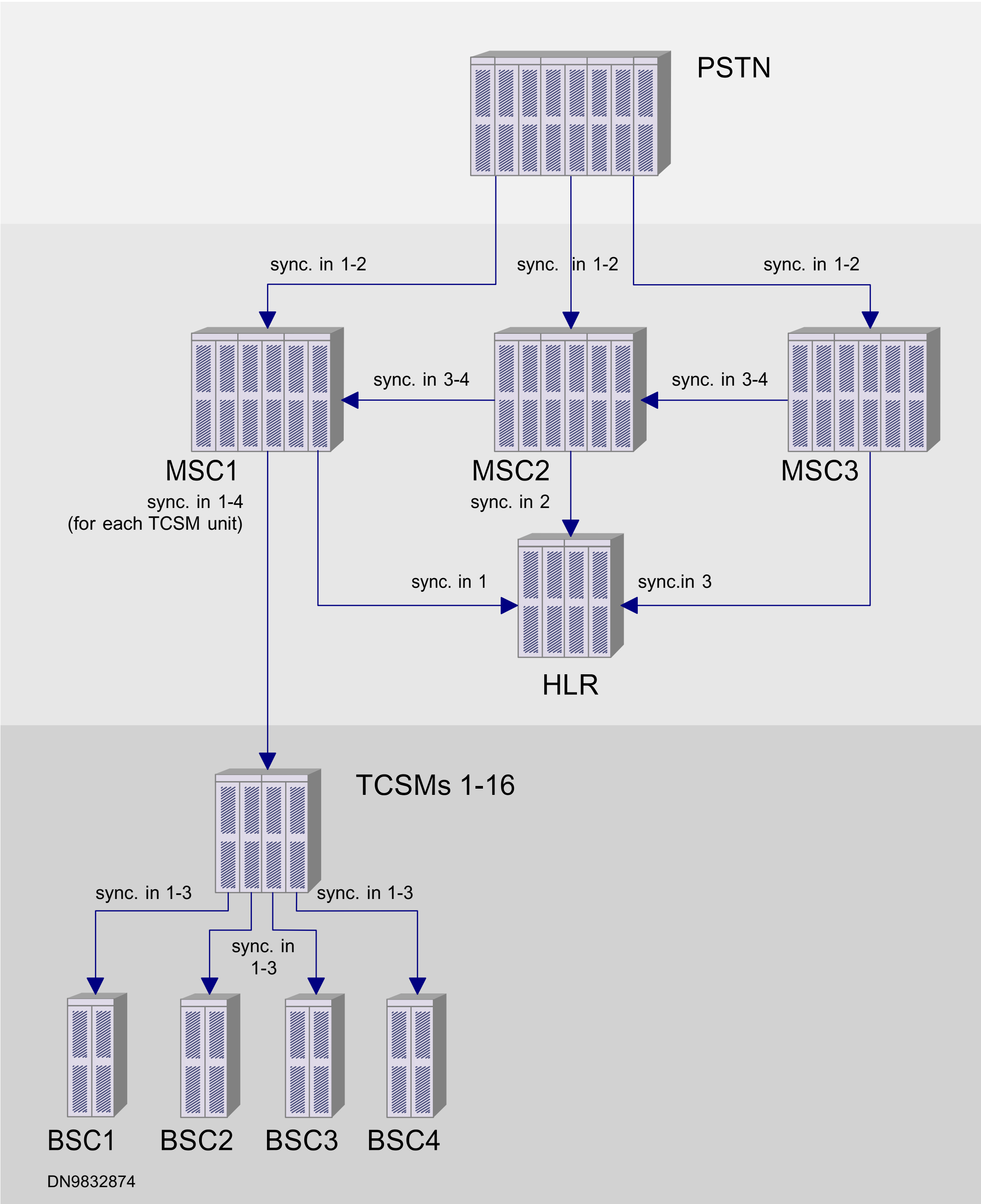
Figure 14. Master-slave principle

If the connection to the master equipment is broken, the DX 200 equipment can continue operation by switching into *plesiochronous mode* ; that is by generating its own basic frequency without an external synchronisation reference. When the connection to the master equipment is restored, the equipment re-synchronizes to the synchronisation signal coming from the higher-level exchange.

Architecture of the DX 200 network synchronisation

The DX 200 cellular network synchronisation plan is usually designed in such a way that one of the exchanges in a PSTN or an ISDN network functions as the master exchange and supplies the synchronisation reference to the MSCs in the cellular network. The synchronisation signal is also fed to each MSC from one or more other MSCs of the same network to ensure the availability of the synchronisation reference in case the connection to the PSTN/ISDN is disrupted.

The MSCs, in turn, supply the synchronisation reference to the HLRs of the network, as well as to the BSCs via the TCSMs. To ensure redundancy, each HLR of the network receives the synchronisation reference from multiple MSCs and each BSC from multiple TCSMs. The redundancy of the synchronisation reference to the TCSMs and BSCs has been arranged by supplying each reference signal through a separate PCM. The architecture of the network synchronisation system is depicted in the following figure.


PSTN
sync. in 1-2
sync. in 1-2
sync. in 1-2
sync. in 3-4
sync. in 3-4
MSC1
MSC2
MSC3
sync. in 1-4
(for each TCSM unit)
sync. in 2
sync. in 1
sync.in 3
HLR
TCSMs 1-16
sync. in 1-3
sync. in 1-3
sync. in
1-3
BSC1
BSC2
BSC3
BSC4
DN9832874

Note

In the configuration depicted in this figure there are 16 separate transcoders in the TCSM racks, each of which receives 4 synchronisation reference signals from MSC1.

Figure 15. Synchronisation in the TCSM network

Internal synchronisation of TCSM2

Each DX 200 network element has an internal clock generator which receives the reference timing from external synchronisation sources (normally, external PCM circuits) and generates pairs of timing signals which are distributed to all other plug-in units in the network element. In TCSM2 each pair normally uses the frequencies 8.192 MHz/8 kHz.

Performance characteristics of the TCSM2 synchronisation block

Each TC1C cartridge of TCSM2 is provided with one TRCO plug-in unit which controls the synchronisation of the other plug-in units.

The performance characteristics of TRCO are the following:

- stability (at temperature +5 °C / 41 °F to 40 °C / 104 °F): < 3×10-7
- stability (because of ageing): $< 5\times10^{-9}$ /day
- accuracy after loss of external synchronisation:
  - initially: +/- 1×10^{-9}
  - after one day: +/- 2×10^{-8}

The number of synchronisation inputs:

- One external ESI/ESO input/output
- TCSM2E and TCSM2A: a maximum of seven for PCM lines (with four normally in use)
- TCSM2A-C: six for PCM lines (with four normally in use)

Line coding/decoding standards supported by the PCM inputs:

- TCSM2E: HDB3
- TCSM2A and TCSM2A-C: AMI and B8ZS

Note

The PCM cables carrying the synchronisation signal connect to ET2E or ET2A plug-in units powered by different power supplies in order to ensure redundancy of the power supply.