MITSUBISHI ELECTRIC

Changes for the Better

DIGITAL CIRCUIT MULTIPLICATION EQUIPMENT (DCME) for Maximum 32:1 Compression Gain

Model

DX-7000 (TYPE-A & B)

- **Maximum 32:1 compression gain for voice transmission using cutting edge technology**
- **ITU-T G.729 CS-ACELP for voice transmission is also available**
- **Software-oriented design allows users to upgrade their functions by simply downloading the required software**
- **End-to-End Compression/Decompression**
- **Built-in Echo Canceller**

A New Level of Efficiency for Lin

Mitsubishi Electric's new generation DCME DX-7000 is multi-functional equipment capable of handling a variety of highly compressed voice, voice-band data (VBD), and facsimile signals.

Mitsubishi Electric's EM-CELP & ITU-T G.729-compliant CS-ACELP codec technology provides the Most Advanced, cost-effective solution for voice transmission over telecommunication networks.

What is DCME?

DCME (Digital Circuit Multiplication Equipment) is utilized as a means of augmenting the capacity of digital transmission systems operating between Switching Equipment either by Satellite or Cable Link. Typical configuration is shown in Fig. 1.

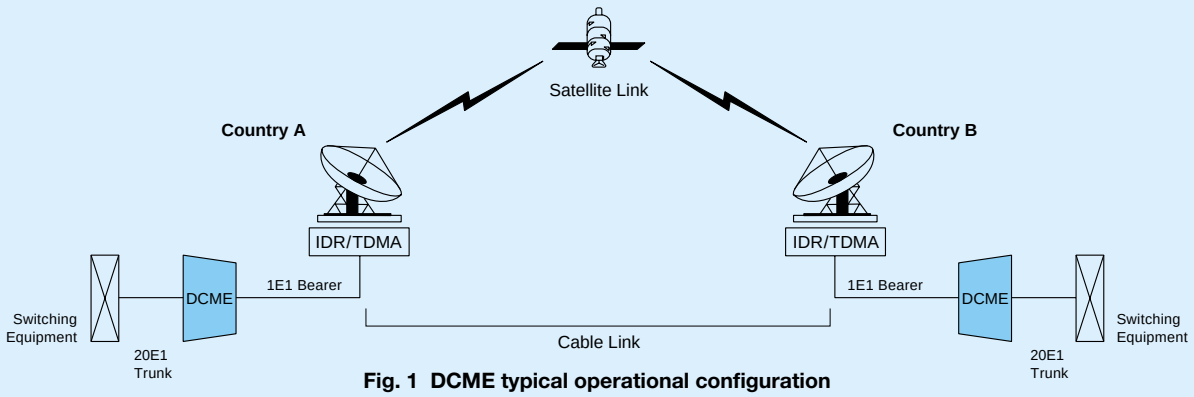

Fig. 1 DCME typical operational configuration

Flexible Mode Change Possible with Minimum Hardware Replacement by DX-7000

DX-7000 Type-A 24:1 Gain by CS-ACELP *1 ⟷ **DX-7000 Type-B 32:1 Gain by EM-CELP *2**

*1: ITU-T G.729 VBR Coding (8 k/6.4 kb/s)

*2: Mitsubishi Electric's Extended Multi mode – Code Excited Linear Prediction (4 k/3.2 kb/s)

DX-7000 Common Features

- High Compression Codecs for Speech
- Digital Speech Interpolation
- Facsimile Demodulation
- Tandem Coding Avoidance
- Multi-Clique/Multi-Destination
- Built-In Echo Canceller
- User Friendly OMC
- 16-to-1 Redundancy

Conclusion

The DX-7000 continually provides the world's highest DCME compression gain for users, with various essential functions.

DX-7000 TYPE-B FEATURES

32:1 High Compression Gain

In the DX-7000 Type-B configuration, a combination of Mitsubishi Electric's EM-CELP and DSI compression delivers the world highest DCME compression gain of 32:1 for voice transmission with excellent quality. EM-CELP normally works at 4 kb/s, and 3.2 kb/s VBR being applied during highly congested periods. Fig. 2 shows the gain curve of the DX-7000 Type-B.

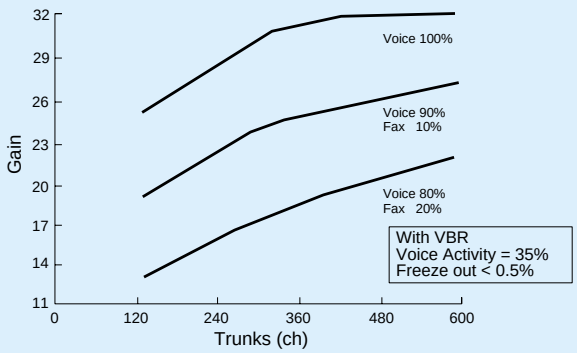

Fig. 2 DX-7000 Type-B DCME compression gain

Easy Upgrade to DX-7000 Type-B

By replacing a card in the DX-7000 Type-A and installing new software, it is easy to upgrade to the DX-7000 Type-B from the DX-7000 Type-A.

Excellent Voice Quality by EM-CELP

Mitsubishi's EM-CELP provides user with almost equivalent voice quality to ITU-T G.729 CS-ACELP.

Variable Rate Coding at 32 kb/s ADPCM for Voice Transmission

During non-congested traffic periods, the DX-7000 Type-B can be operated on 32 kb/s ADPCM mode in order to maintain high voice quality, even with the presence of non-voice type signals (tone, heavy background noise etc). If traffic congestion increases, the DX-7000 Type-B will automatically change the coding mode to EM-CELP.

Support ATM-cell format at Bearer

On the bearer side, the DX-7000 Type-B supports ATM-cell format compliant with ITU-T I.363.1/I.363.2 (AAL1/AAL2).

In-Band Remote Access from OMC

In addition to remote access through modem dial up and Internet connection via LAN, In-Band connection to remote DCME is also available as shown in Fig. 3.

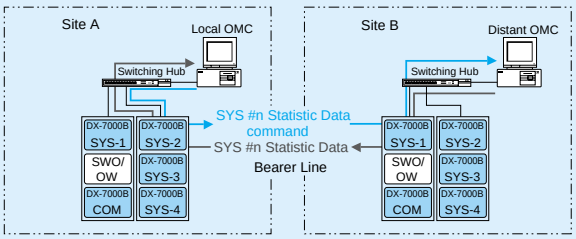

Fig. 3 In-Band Remote Access from OMC

DSP Chip-basis Redundancy

The DX-7000 Type-B is composed of many DSP cards. If either DSP chip or DSP card fails, the redundant DSP chip or card automatically backs it up. Terminal-basis redundancy (up to 16+1) is also available.

Multi-Clique and Multi-Destination Operation

The DX-7000 Type-B supports up to 8 multi-destination (shown in Fig. 4) and 8 multi-clique operations.

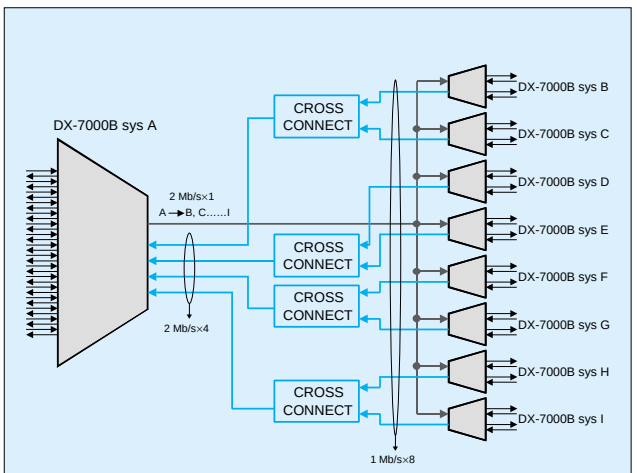

Fig. 4 Example of Network Configuration for 8 Multi-Destinations by DX-7000 Type-B

COMMON DCME FEATURES DETAIL

DCME Operation

The DX-7000 uses three different compression technologies: DSI (silence elimination), Voice coding (EM-CELP, CS-ACELP and ADPCM) and Facsimile demodulation/remodulation. A simplified diagram of the unit's mapping concept is shown in Fig. 5. A maximum of twenty 2 Mb/s E1 streams (for up to 600 ch) or 1.5 Mb/s T1 streams (up to 480 ch) are fed to the trunk interface. DSI-processed voice signals are compressed using high compression speech codecs to create additional bearer channels. Standard G3 facsimile signals are basically compressed by facsimile demodulation/remodulation. DSI-processed voice-band data (VBD) and non-standard facsimile signals are compressed using 40 kb/s ITU-T G.726-compliant ADCPM coding. Non-interpolated channels and on-demand 64 kb/s clear channels can also be provided. All outgoing channels are combined into 2 Mb/s or 1.5 Mb/s bearer stream(s).

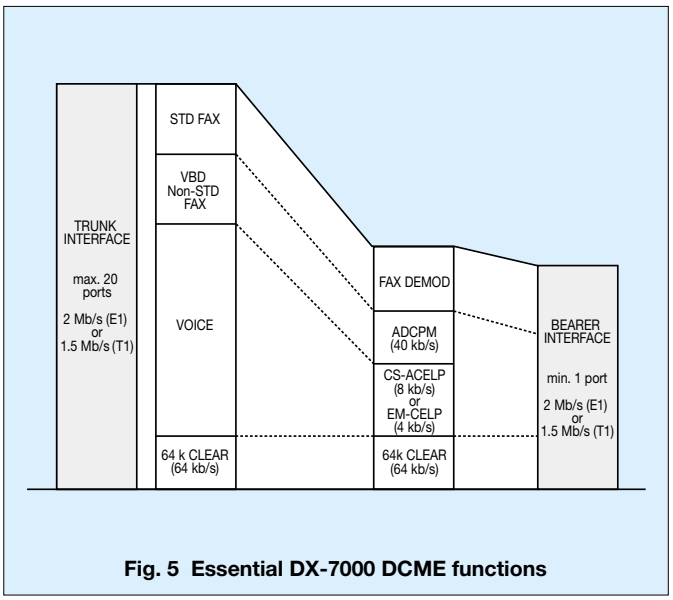

Fig. 5 Essential DX-7000 DCME functions

Built-in Echo Canceller

ITU-T G.164, G.165 and G.168-compliant Built-in Echo Canceller is offered as an option.

Order Wire (OW) and Switch Over (SWO) Control Panel

The OW interface (4-wire) in the SWO/OW control panel of each cluster enables communication with all destinations through any terminal in the cluster.

Software-oriented Design

The software-oriented design concept allows easy upgrade of functions. By simply downloading the updated software from the OMC, users can reconfigure the equipment.

End-to-End Compression/Decompression (Tandem Coding Avoidance)

Usually, when tandem transcoding is introduced in an end-to-end connection, voice quality may fall below the acceptable level. In order to maintain the highest voice quality possible, the adoption of End-to-End Compression/Decompression capability, as shown in Fig. 6, is highly recommended.

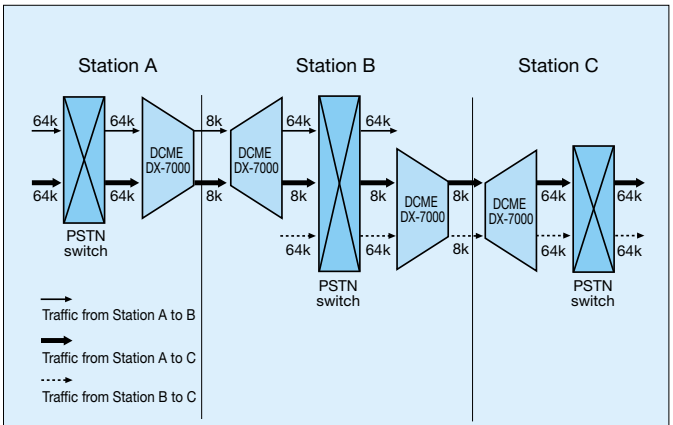

Fig. 6 End-to-End Compression/Decompression

Facsimile Compression

Facsimile demodulation/remodulation recovers the reduced DCME gain when the traffic is mostly facsimile. When all facsimile traffic conforms to G3 standards, a compression gain of 4 to 6 can be expected with Forward Error Correction (FEC) OFF. When non-standard facsimile signals are included, the gain decreases since they are carried through ITU-T G.726 40 kb/s codec.

Operation and Maintenance Console (OMC)

One OMC (PC running Windows NT) can support up to 10 DCME clusters (170 DCME terminals) for controlling the DCME. The OMC also collects alarm, event data, management statistics and other necessary diagnostic data.

Flexible Trunk and Bearer Interface (option)

The trunk and bearer interfaces either for E1 2 Mb/s or T1 1.5 Mb/s can be selected by software without the need of any hardware change.

Various Signaling Modes/Q.50 ISC Interface

The following signaling modes are supported:

- ITU-T No.5, No.6, No.7, R1, R2 and Chinese No.1.

ITU-T Q.50 Annex A and B for DLC or for on-demand clear channels can be established. Functions are set and controlled by the OMC.

DX-7000 TYPE-A FEATURES

More than 20:1 Compression Gain

ITU-T G.729-compliant CS-ACELP provides 8 to 1 compression capability. Combining it with DSI, the DX-7000 Type-A realizes more than 20:1 compression gain even under heavy traffic conditions provided that all the traffic is 100% voice. The 8 kb/s and 6.4 kb/s Variable Bit Rate (VBR) speech coding and facsimile demodulation/remodulation techniques are applied in order to maintain the compression gain, at a constant high level even with the presence of non-voice signals (Fig. 7).

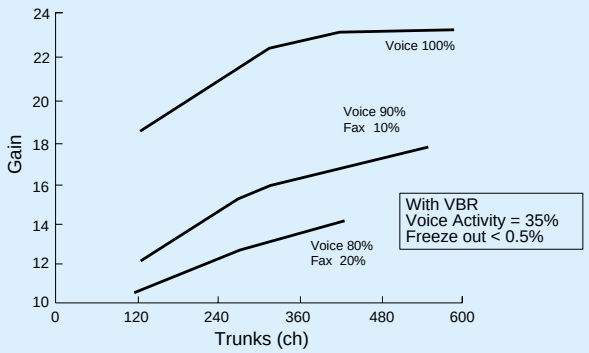

Fig. 7 DX-7000 Type-A DCME compression gain

Multi-Clique and Multi-Destination Operation

The DX-7000 Type-A offers up to 4 multi-clique and 4 multi-destination operations.

Toll Quality

As shown in Fig. 8, ITU-T G.729 CS-ACELP guarantees excellent voice quality.

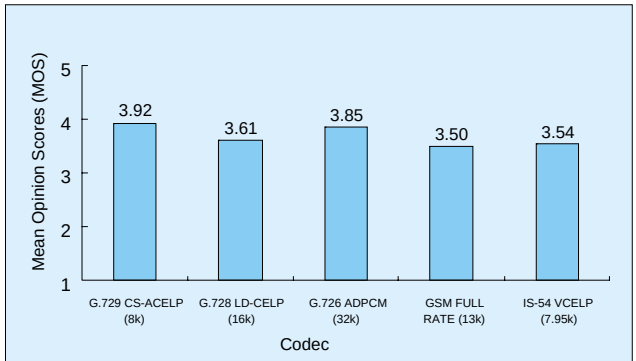

Fig. 8 MOS in various coding algorithms

OMC Remote Access to the DX-7000 Type-A

The OMC allows various types of remote access through LAN interface and internet modem dialup connection to the DX-7000 Type-A.

Compact With High Accessibility

Each DCME terminal is housed on a separate shelf for enhanced expandability and ease of maintenance.

Redundant Control (16+1 Configuration)

Up to 16 DCME terminals can be backed up by one common stand-by DCME terminal which automatically comes into operation within 2.5 seconds in case of operation terminal failure. Fig. 9 shows the maximum cluster configuration of 16+1 systems.

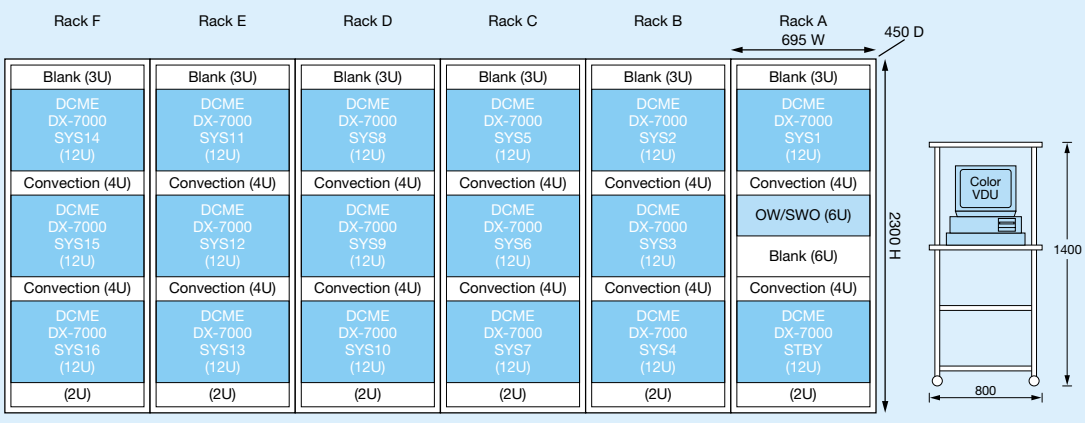

Fig. 9 Cluster configuration of 16:1 DCME

SPECIFICATIONS

Items	DX-7000 (Type-A)	DX-7000 (Type-B)
Compression		
Maximum compression gain (for voice)	20 (without VBR function) 24 (with VBR function)	28 (without VBR function) 32 (with VBR function)
Compression algorithm	DSI, ITU-T G.729 CS-ACELP for voice ITU-T G.726 40 kb/s ADPCM for VBD Facsimile demodulation and re-modulation	DSI, EM-CELP & ITU-T G.726 ADPCM (32 kb/s) for voice, ITU-T G.726 40 kb/s ADPCM for VBD, Facsimile demodulation and re-modulation
Channel capacity		
Number of trunks	20 E1 or T1 PGs	
Number of trunk operation channels	600 (E1), 480 (T1)	
Number of bearer ports	TX: 2 PGs (E1 or T1), RX: 4 PGs (E1 or T1)	TX: 4 PGs (E1 or T1), RX: 4 PGs (E1 or T1)
Operation mode		
Number of Clique/Destinations	Up to 4 Clique / 4 Destinations	Up to 8 Clique / 8 Destinations
Electrical interface		
E1 Bit rate	2.048 Mb/s	
Code	HDB3	
Impedance	75 ohm unbalanced or 120 ohm balanced	
T1 Bit rate	1.544 Mb/s	
Code	B8ZS or AMI with B7	
Impedance	100 ohm balanced	
Signalling	ITU-T No.5, No.6, No.7, R1, R2, Chinese No.1	
ITU-T Q.50	Annex A (Type 1, 2), B (Type 1, 2)	
Main specific functions		
VBR (Variable Bit Rate)	Supported – 8 k/6.4 kb/s (optional)	Supported – 4 k/3.2 kb/s (optional)
Tandem Coding Avoidance	Supported (optional)	
Built-in Echo Canceller	Supported (optional)	
DSP (Digital Speech Processor) Chip Redundancy in SDET/VFP card	Not supported	Supported
OMC In-band connection	Not supported	Supported (optional)
32 kb/s ADPCM Compression at lower bearer occupancy	Not supported	Supported (optional)
Dimensions (W×D×H)		
Terminal	552×370×534 mm	
Rack	695×450×2,300 mm	
Power voltage	–48 VDC +8/–9V	
Power consumption	Less than 350W per terminal	
Environmental conditions		
Operating temperature	+5°C~+40°C	
Humidity	Less than 90%, non-condensing	

CE

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ISO 14001

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MITSUBISHI ELECTRIC CORPORATION

For further details, please contact:
DCME Marketing Manager
2-2-3 Marunouchi, Chiyoda-ku, Tokyo 100-8310, Japan
Tel: +81-3-3218-3397, 9104 Fax: +81-3-3218-3314, 9136
email: asd.DCME@ml.hq.melco.co.jp Website: http://www.mitsubishielectric.com/dcme

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