QS TECHNICAL MANUAL

QS SYSTEM
Quadrasonic

SANSUI ELECTRIC CO., LTD. TOKYO JAPAN

SANSUI QSD1

PROFESSIONAL QS 4-CHANNEL DECODER/ SYNTHESIZER

QS
4 CHANNEL STEREO

Sansui

THE ULTIMATE DECODER/SYNTHES

Three Type-A QS Vario-Matrix Decoders in One

Sansui's new QSD-1 is not for just any 4-channel fan. This extraordinarily advanced QS 4-channel decoder/synthesizer was created specifically for professional and semi-professional applications only. And like any fine audio instrument it deserves to be incorporated within a total system of the highest quality—from source components and preamplifiers right on through to power amplifiers and speaker systems.

The QSD-1 is the culmination of Sansui's original QS 4-channel technology for the discriminating audiophile. Thanks to its three separate QS vario-matrix decoders, each constructed of four custom-designed ICs and each responsible for a particular frequency band, it delivers unparalleled QS 4-channel decoding performance, plus the proven ability to produce musically accurate 4-channel sound signals from ordinary 2-channel sources.

It is the most technically advanced 4-channel matrix decoder and 4-channel synthesizer available to the consumer today. The following technical details will support this claim.

QSD-1 FEATURES AND PERFORMANCE

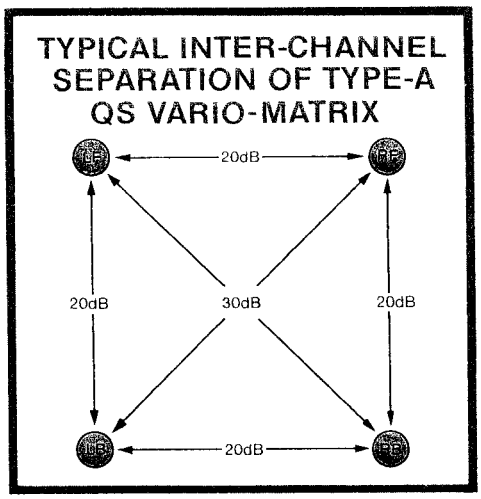
Distortion 0.1% or Less

As numerous independent lab examinations have established beyond doubt, the QSD-1 delivers technical and musical performance equal to and in most cases far surpassing those of 2-channel.
In terms of distortion, for instance, months of Sansui research and development have resulted in reducing the distortion factor to *0.1% or less* at 1kHz (see graph), while at the same time actually extending dynamic range, frequency response and other measurable *and* unmeasurable criteria of tonal quality.

Inter-Channel Separation 20dB to 30dB

Effective separation of the sound signals in each of the four channels is vital to the *believability* of a 4-channel sound field. And today the Sansui QS System delivers this necessary separation—equal even to that produced by discrete 4-channel master tapes.

In theory the QS vario-matrix can be made to provide *infinite* inter-channel separation. In practical terms, the QSD-1, representing as it does the peak of the QS vario-matrix technique, offers a proven 20dB separation between adjacent channels and 30dB separation across the diagonally opposite channels. Prove it to yourself. This means that the QSD-1 never compromises the 4-channel sound field concept. At the same time it ensures optimum tonal quality during the actual appreciation of music.



High-Performance QS Synthesizer

Your ears will tell you that what you have thought to be a myth is actually true. It *is* possible to derive a 4-channel sound field from ordinary 2-channel sources, and there is no more effective way to achieve this miracle than with the QS Synthesizer. The "synthesizer encoder" in the QSD-1 works together with the three separate QS vario-matrix decoders to derive the "hidden" or unexpressed phase relationships in conventional 2-channel records, tapes and FM stereo signals, and convert them into a multi-channel sound field. It differs greatly from other so-called "stereo expanders" in technical aspects as well as in actual performance effectiveness, and it offers two separate modes:

Surround: Sound images are clearly and distinctly located in each of the four channels with the same 20dB separation between adjacent channels as offered from a QS 4-channel source played through the QSD-1.

Hall: The 2-channel signals are reproduced through the front channels as in ordinary stereo, while the QSD-1 sends ambience signals to the back channels to result in the same kind of rich musical sound you would hear in a concert hall.

Professional Monitor Decoder Application

The QSD-1 is being applied at this very time to professional monitor decoder uses in recording studios and FM stations.
It has the same design and standards as the expensive professional QS encoder QSE-4/decoder QSD-4, and is easily mounted in the standard 19-inch (480mm) studio equipment rack.

Function Controls

In addition to the volume, level and balance controls, the QSD-1 has six front-panel pushbutton switches: four are for functions, including 2-channel, QS Synthesizer-Surround, QS Synthesizer-Hall, and QS decoding. The other two select 4-channel inputs and a 2-channel tape monitor.

TYPE-A QS VARIO-MATRIX TECHNOLOGY

Type-A QS Vario-Matrix Technique

The QS vario-matrix technique is a Sansui innovation to decode QS-encoded signals with the same high inter-channel separation as discrete 4-channel tape.
It works this way:

When two sounds of different levels reach the human ears simultaneously from different directions, the ears are known to perceive the directionality of the louder sound very clearly. But their sensitivity to the directionality of the weaker is momentarily lost or weakened, resulting in an apparent broadening of location for that sound. The louder sound is masking the directionality of the weaker sound, and hence this phenomenon is called "directional masking."

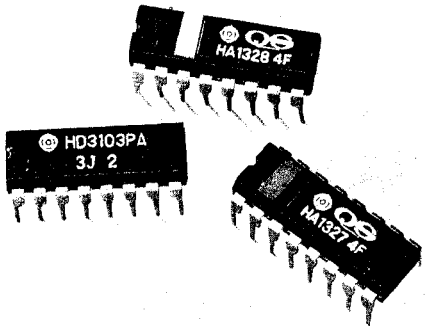
Taking advantage of this, the QS vario-matrix circuit works to emphasize the directionality of the loudest sound at each moment, while broadening those of the weaker sounds. It does this by retrieving from the input encoded signals the information on the directionality of the loudest sound, creating signals that reflect this information. It then uses these signals to control the operating parameters of the decoding matrix in such a way that the latter will increase the separation of the channel containing the loudest sound at each moment, while reducing that of the other channels.

Note that this is a fundamentally different approach than the so-called gain control logic. In the latter, the gain (volume) of the playback amplifier is instantaneously adjusted to cancel the weaker sounds at each moment to achieve spurious separation for the loudest sound. In the QS vario-matrix circuit, however, only the directionality of the weaker sounds is broadened; all the weaker sounds, so very important in the original live sound field and so essential to recreate its full

musicality, are still reproduced in full with QS.

QS Vario-Matrix ICs

The QSD-1 incorporates peripheral discrete components and twelve custom-designed, Sansui-patented integrated circuits. The latter have been developed for mass production to assure the uniform performance of professional and consumer class Type-A QS vario-matrix decoders. The ICs are of three types:



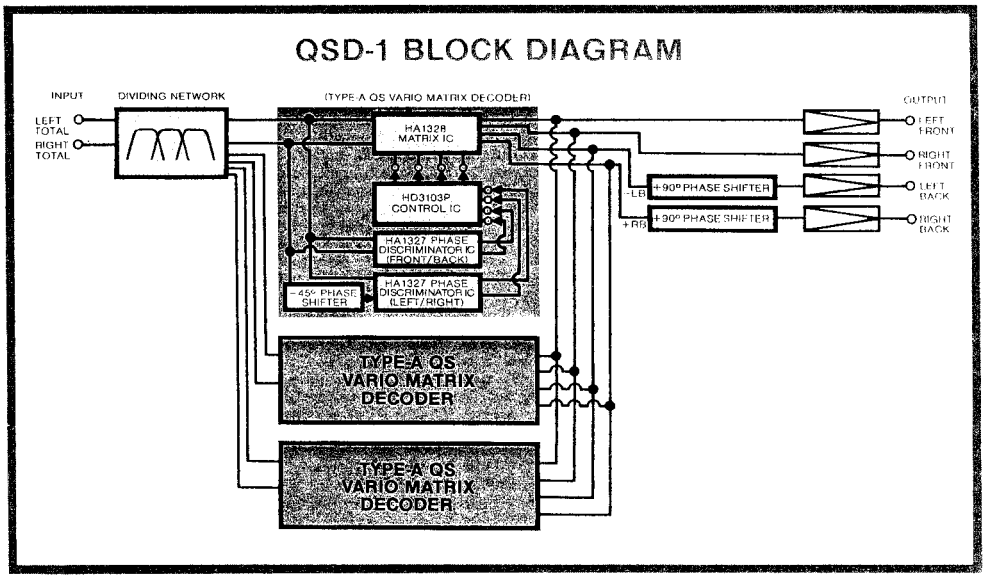
Phase Discriminator IC (HA1327): This IC, the equivalent of 43 transistors and 14 diodes, detects the directionality of the loudest sound via a phase-discrimination process of the input signals LT and RT. The signals it passes on to the control IC in turn control the matrix IC. In the QS vario-matrix circuit, two HA1327 ICs are used, one for the front-back and another for the left-right directions.

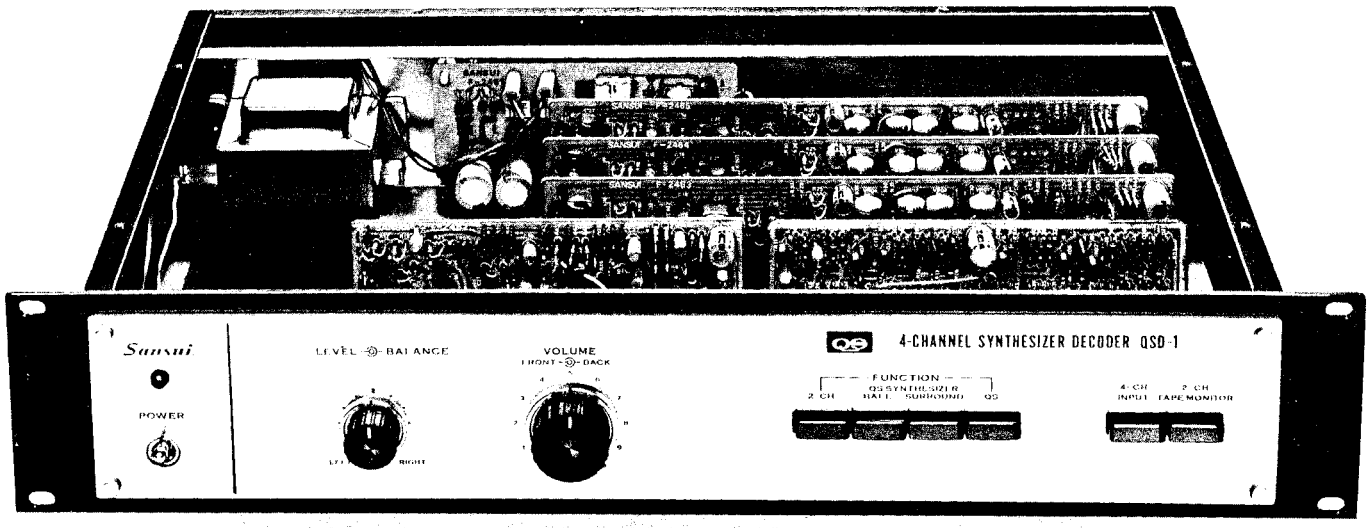
Control IC (HD3103P): This is a MOS FET array with five FETs. The IC's internal resistance changes when it receives the signal from the HA1327, and it subsequently delivers four control signals of different levels to the matrix IC.

Matrix IC (HA1328): This IC is the equivalent of 50 transistors. Its function is to de-matrix the input signals LT and RT (and to handle the signals encoded by the synthesizer encoder section when creating 4-channel sound from 2-channel sources) to deliver four output signals, the matrix configuration being controlled from instant to instant by the HD 3103P.

Three-band Type-A QS Vario-Matrix Circuit

Normally, a QS vario-matrix decoder (Type-A) contains four of these special ICs. In the QSD-1, however, twelve are used, forming three separate QS vario-matrix circuits, each devoted to handling a specific portion of the audio frequency spectrum. One is for the lows, another for the mid-ranges, and a third for the highs to ultra-highs. In this way the results achieved are truly professional in accuracy, since each circuit identifies and processes the loudest sound for maximum separation in its own band. This naturally means richer tonality and clearer sound image location overall.



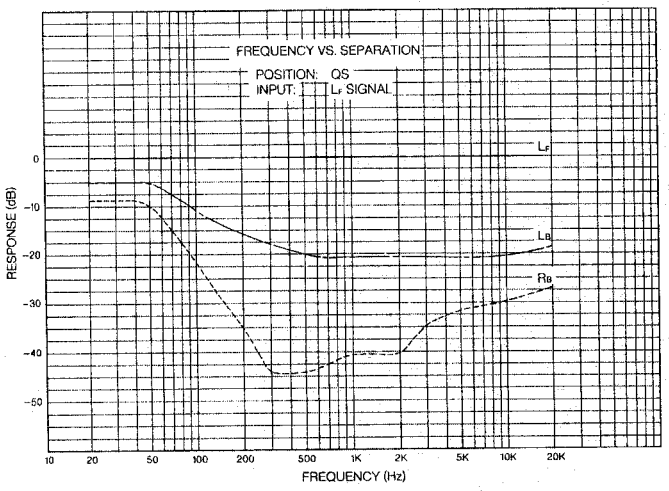


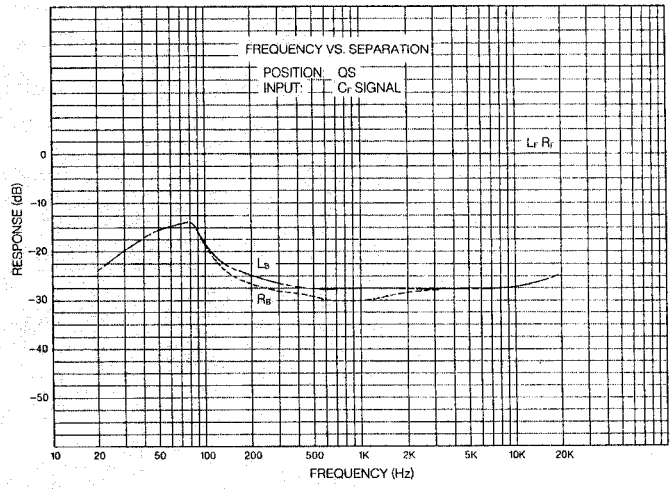
SPECIFICATIONS

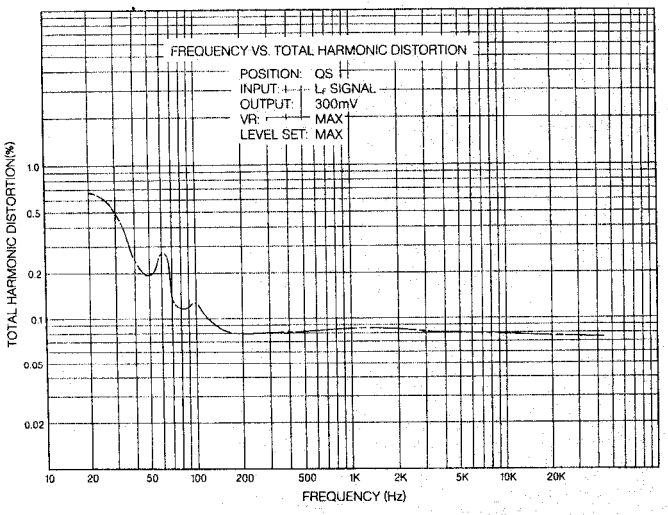
4-CHANNEL DECODER SECTION
(TYPE-A QS VARIO-MATRIX)
FREQUENCY RESPONSE
20 to 30,000Hz
DISTORTION less than 0.1% (at 1,000Hz)
SEPARATION
QS Decoder 20dB (adjacent channels)
30dB (diagonal channels)
QS Synthesizer equivalent to QS Decoder
INPUT SENSITIVITY
2-CHANNEL INPUT 100mV
TAPE MONITOR (2-ch) 100mV
4-CHANNEL INPUT 140mV
MAX. INPUT CAPABILITY
25V (LEVEL SET MINIMUM, THD 0.5%)
OUTPUT LEVEL
4-CHANNEL OUTPUT
300mV
NOISE LEVEL less than 250μV
(LEVEL SET MAXIMUM)
GENERAL
SEMICONDUCTORS
35 Transistors, 16 Diodes,
1 Zener Diode, 12 ICs, 1 LED
POWER REQUIREMENT
VOLTAGE 100, 120, 220, 240V,
50/60Hz
CONSUMPTION 10 watts

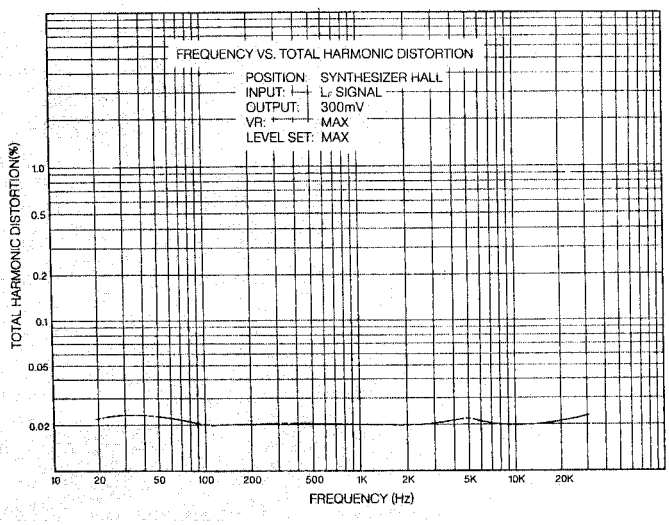
DIMENSIONS 482mm (19") W
88.5mm (3½") H
304mm (12") D
WEIGHT 6.6kg (14.6lbs.)
8.1kg (17.9lbs.) packed

Design and specifications subject to change without notice for improvements.









SANSUI ELECTRIC CO., LTD. 14-1, 2-CHOME, IZUMI, SUGINAMI-KU, TOKYO 168, JAPAN/TELEPHONE: 323-1111/TELEX: 232-2076
SANSUI ELECTRONICS CORPORATION 55-11 QUEENS BLVD. WOODSIDE, NEW YORK 11377, U.S.A./TELEX: NEW YORK 422633 SEC UI
SANSUI AUDIO EUROPE S.A. DIACEM BUILDING, VESTINGSTRAAT 53-55, 2000 ANTWERP, BELGIUM/TELEX: ANTWERP 33538

Sansui

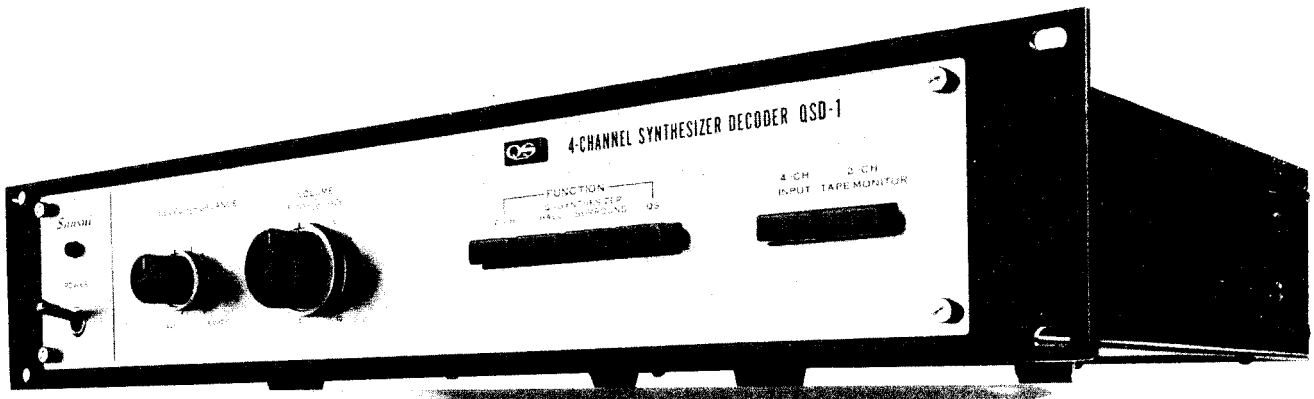
Printed in Japan 63001P2

QS
4-CHANNEL STEREO

SERVICE MANUAL

4-CHANNEL SYNTHESIZER DECODER

SANSUI QSD-1



Sansui

SANSUI ELECTRIC CO., LTD.

1. SPECIFICATIONS

4-CHANNEL DECODER SECTION

TYPE ..... QS Decoder/QS Synthesizer (QS vario-matrix circuit built in)

SEPARATION

ADJACENT CHANNELS 20dB

DIAGONAL CHANNELS ..30dB

TOTAL HARMONIC DISTORTION (1,000Hz) ..... less than 0.1%

FREQUENCY RESPONSE ....20 to 30,000Hz

INPUT SENSITIVITY

2-CHANNEL INPUT 100mV

TAPE MONITOR (2-CH) ..100mV

4-CHANNEL INPUT 140mV

Max. input capability (Level set at MIN THD 0.5%) 25V

OUTPUT VOLTAGE

4-CHANNEL OUTPUT 300mV

NOISE LEVEL (Level Control at MAX.) ..... less than 250μV

GENERAL

POWER REQUIREMENTS 100V, 120V, 220V, 240V 50/60Hz

POWER CONSUMPTION....10W

SEMICONDUCTORS

TRANSISTORS 35

DIODES 16

L.E.D 1

ZENER DIODE 1

ICs 12

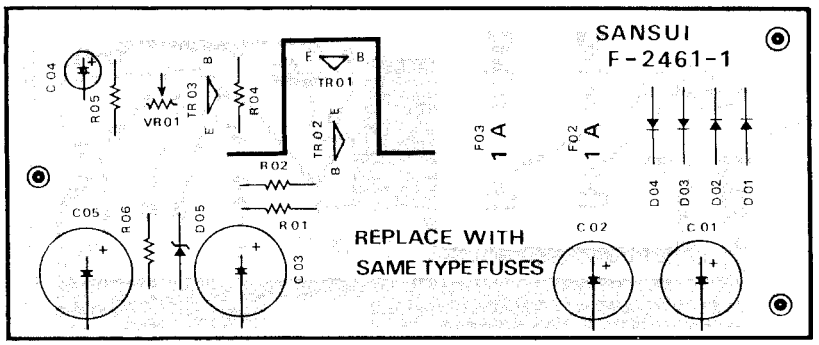
* Design and specifications are subject to change for possible improvements.

Teble of Contents

2. PARTS LOCATIONS AND PARTS LIST

2-1. F-2461 Power Circuit Board (Stock No. 7501020 Complete Circuit Board F-2461)

Conductor Side



Abbreviations:

C.R.	: Carbon Resistor
S.R.	: Solid Resistor
Ce.R.	: Cement Resistor
M.R.	: Metallized Film Resistor
M.C.	: Mylar Capacitor
E.C.	: Electrolytic Capacitor
BP.E.C.	: Bi-Polar Electrolytic Capacitor
C.C.	: Ceramic capacitor
Mi.C.	: Mica Capacitor
O.C.	: Oil Capacitor
P.C.	: Polystyrene Capacitor
T.C.	: Tantalum Capacitor

Parts List

Parts No.	Stock No.	Description
TR01	0308392	2SD313E } Transistor
TR02	0305731	2SC711E } Transistor
TR03	0305731	2SC711E } Transistor
D01	0310340	10D-1 } Diode
D02	0310340	10D-1 } Diode
D03	0310340	10D-1 } Diode
D04	0310340	10D-1 } Diode
D05	0315530	RD-6A(K) Zener Diode

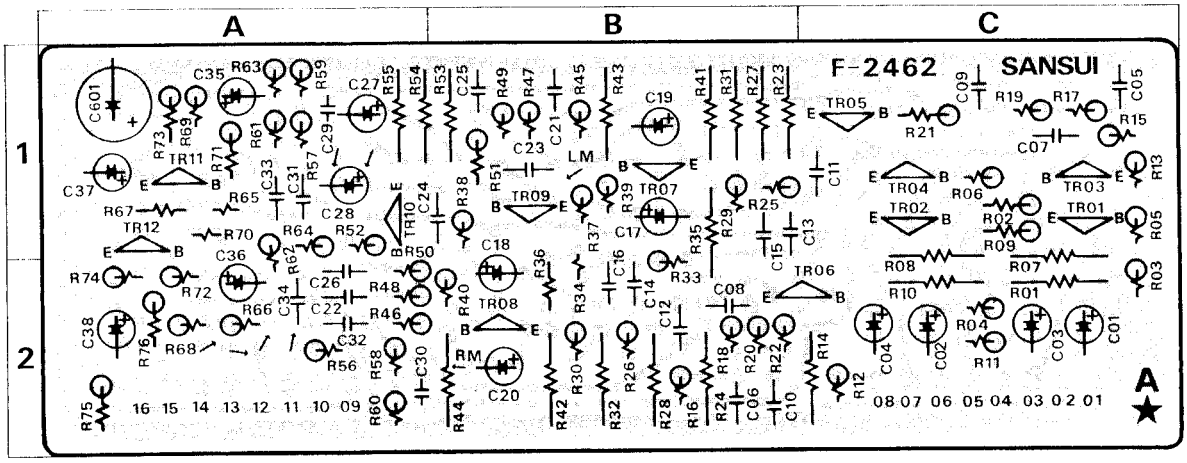
Parts No.	Stock No.	Description
C01	0515471	470μF } 50V E.C.
C02	0515471	470μF } 50V E.C.
C03	0515221	220μF } 50V E.C.
C04	0513100	10μF 25V E.C.
C05	0515101	100μF 50V E.C.
R01	0107103	10kΩ } ½W C.R.
R02	0107472	4.7kΩ } ½W C.R.
R04	0107562	5.6kΩ } ½W C.R.

Parts No.	Stock No.	Description
R05	0107183	18kΩ } ½W C.R.
R06	0107562	5.6kΩ } ½W C.R.
F02,03	0439620	1A 20mm AC Fuse
VR601	1035310	1kΩB Volume
	2310150	P Type Fuse Holder

※ Japanese Model only

2-2. F-2462 Filter Circuit Board (Stock No. 7650320 Complete Circuit Board F-2462)

Conductor Side



Parts List

Parts No.	Stock No.	Description	Position
TR01,02	0306091	2SC1312G } Transistor	1C
TR03,04	0306091	2SC1312G } Transistor	1C
TR05,06	0306091	2SC1312G } Transistor	1C. 2B. C
TR07,08	0306091	2SC1312G } Transistor	1B. 2B
TR09,10	0306091	2SC1312G } Transistor	1B. 1A
TR11,12	0306091	2SC1312G } Transistor	1A
C01,02	0514339	3.3μF } 35V E.C.	2C
C03,04	0514339	3.3μF } 35V E.C.	2C
C05,06	0600396	0.0039μF } 50V M.C.	1C. 2B
C07,08	0600187	0.0018μF } 50V M.C.	1C. 2B
C09,10	0620621	620pF 50V P.C.	1C. 2B
C11,12	0600187	0.018μF } 50V M.C.	1C. 2B
C13,14	0600187	0.018μF } 50V M.C.	1B. 2B
C15,16	0600187	0.018μF } 50V M.C.	1B. 2B
C17,18	0514339	3.3μF 35V E.C.	1B. 2B
C19,20	0515109	1μF 50V E.C.	1B. 2B
C21,22	0600227	0.022μF } 50V M.C.	1B. 2A
C23,24	0600687	0.068μF } 50V M.C.	1B
C25,26	0600336	0.0033μF } 50V M.C.	1B. 2A
C27,28	0515109	1μF 50V E.C.	1A
C29,30	0600336	0.0033μF } 50V M.C.	1A. 2A
C31,32	0600336	0.0033μF } 50V M.C.	1A. 2A
C33,34	0600336	0.0033μF } 50V M.C.	1A. 2A

Parts No.	Stock No.	Description	Position
C35,36	0514339	3.3μF 35V E.C.	1A. 2A
C37,38	0515109	1μF 50V E.C.	1A. 2A
R01	0107224	220kΩ } ¼W C.R.	2C
R02	0106224	220kΩ } ¼W C.R.	1C
R03,04	0106104	100kΩ } ¼W C.R.	2C
R05,06	0106152	1.5kΩ } ¼W C.R.	1C
R07,08	0107682	6.8kΩ } ¼W C.R.	2C
R09	0106682	6.8kΩ } ¼W C.R.	1C
R10	0107682	6.8kΩ } ¼W C.R.	2C
R11,12	0106104	100kΩ } ¼W C.R.	2C
R13	0106682	6.8kΩ } ¼W C.R.	1C
R14	0107682	6.8kΩ } ¼W C.R.	2C
R15,16	0106153	15kΩ } ¼W C.R.	1C. 2B
R17,18	0106153	15kΩ } ¼W C.R.	1C. 2B
R19,20	0106153	15kΩ } ¼W C.R.	1C. 2B
R21,22	0106102	1kΩ } ¼W C.R.	1C. 2B
R23,24	0107682	6.8kΩ } ¼W C.R.	1B. 2B
R25,26	0106102	1kΩ } ¼W C.R.	1B. 2B
R27,28	0107103	10kΩ } ¼W C.R.	1B. 2B
R29,30	0106682	6.8kΩ } ¼W C.R.	1B. 2B
R31,32	0107683	68kΩ } ¼W C.R.	1B. 2B
R33,34	0106391	390Ω } ¼W C.R.	2B
R35,36	0107392	3.9kΩ } ¼W C.R.	1, 2B. 2B

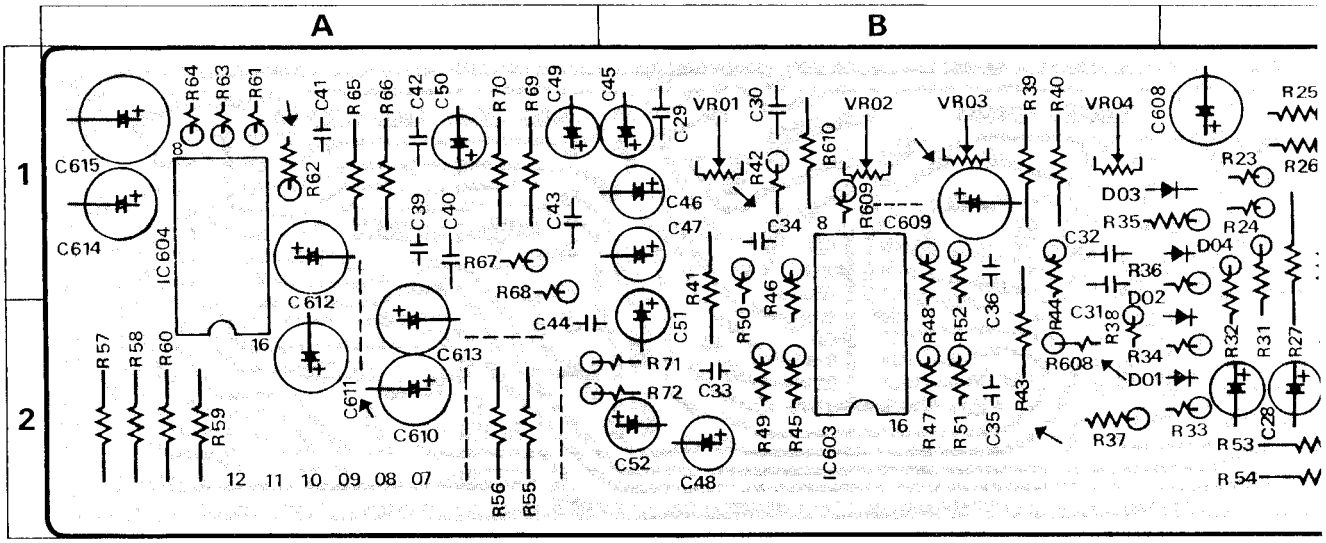
Parts No.	Stock No.	Description	Position
R37,38	0113225	2.2MΩ } ½W S.R.	1B
R39,40	0106102	1kΩ } ¼W C.R.	1B. 2B
R41,42	0107682	6.8kΩ } ¼W C.R.	1B. 2B
R43,44	0107104	100kΩ } ¼W C.R.	1B. 2B
R45,46	0106153	15kΩ } ¼W C.R.	1B. 2A
R47,48	0106153	15kΩ } ¼W C.R.	1B. 2A
R49,50	0106153	15kΩ } ¼W C.R.	1B. 2A
R51,52	0106102	1kΩ } ¼W C.R.	1B. 1A
R53,54	0107682	6.8kΩ } ¼W C.R.	1B. 1A
R55	0107104	100kΩ } ¼W C.R.	1A
R56	0106104	100kΩ } ¼W C.R.	2A
R57,58	0106102	1kΩ } ¼W C.R.	1A. 2A
R59,60	0106103	10kΩ } ¼W C.R.	1A. 2A
R61,62	0106682	6.8kΩ } ¼W C.R.	1A. 1,2A
R63,64	0106683	68kΩ } ¼W C.R.	1A
R65,66	0106391	390Ω } ¼W C.R.	1A. 2A
R67,68	0106392	3.9kΩ } ¼W C.R.	1A. 2A
R69,70	0113225	2.2MΩ } ½W S.R.	1A
R71,72	0106102	1kΩ } ¼W C.R.	1A. 2A
R73,74	0106682	6.8kΩ } ¼W C.R.	1A. 2A
R75,76	0106104	100kΩ } ¼W C.R.	2A
	2420300	Connect Pin Housing	

2-3. F-2463 QS Vario-Matrix Circuit Board (Low Band) (Stock No. 7650330)

2-4. F-2464 QS Vario-Matrix Circuit Board (Middle Band) (Stock No. 7650340)

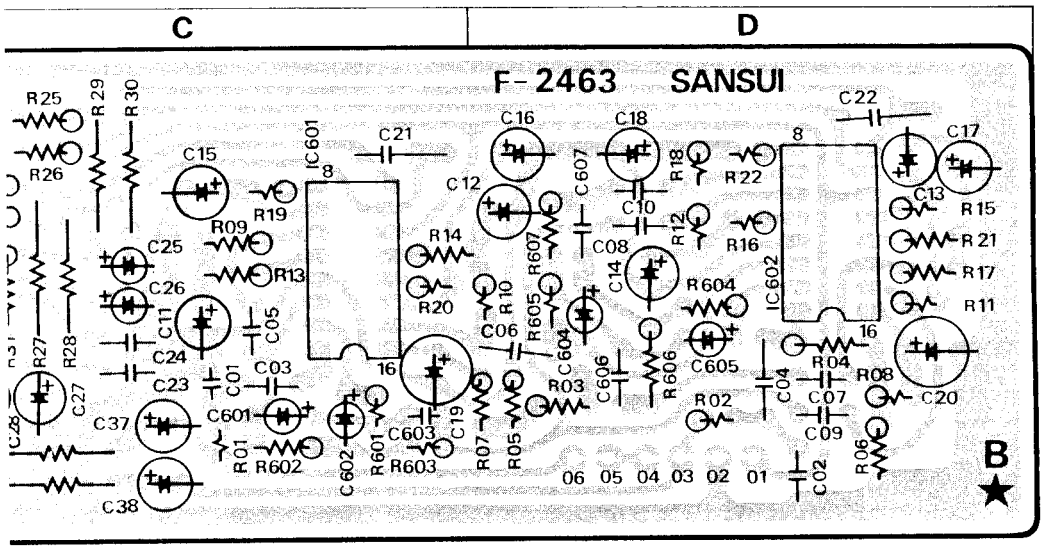
2-5. F-2465 QS Vario-Matrix Circuit Board (High Band) (Stock No. 7650350)

Conductor Side



Common Parts List

Parts No.	Stock No.	Description	Position
IC601	0360090	HA-1327	1, 2C
IC602	0360090	HA-1327	1, 2D
IC603	0360100	HD-3103P	1, 2B
IC604	0360210	HA-3128	1, 2A
D01	0311160	1S2473D	2C
D02	0311160	1S2473D	2C
D03	0311160	1S2473D	1B, C
D04	0311160	1S2473D	1C
C11	0513100	10μF	1, 2C
C12	0513100	10μF	1D
C13	0513100	10μF	1D
C14	0513100	10μF	1, 2D
C15	0513100	10μF	1C
C16	0513100	10μF	1D
C17	0513100	10μF	1D
C18	0513100	10μF	1D
C19	0513330	33μF	2C
C20	0513330	33μF	2D
C33	0601226	0.0022μF	2B
C34	0601226	0.0022μF	1B
C35	0601226	0.0022μF	2B
C36	0601226	0.0022μF	1B
C41	0601336	0.0033μF	1A
C42	0601336	0.0033μF	1A
C43	0601336	0.0033μF	1A
C44	0601336	0.0033μF	2A, B
C608	0513330	33μF	1C
C609	0513330	33μF	1B
C610	0511101	100μF	2A
C611	0511101	100μF	2A
C612	0512470	47μF	1A
C613	0511470	47μF	2A
C614	0511470	47μF	1A
R01	0106333	33kΩ	2C
R02	0106333	33kΩ	2D
R03	0106684	680kΩ	2D
R04	0106684	680kΩ	2D
R05	0106394	390kΩ	2D
R06	0106394	390kΩ	2D
R07	0106684	680kΩ	2D
R08	0106684	680kΩ	2D
R09	0106274	270kΩ	1C
R10	0106274	270kΩ	1, 2D
R11	0106274	270kΩ	1, 2D
R12	0106274	270kΩ	1D
R13	0106124	120kΩ	1C
R14	0106124	120kΩ	1C
R15	0106124	120kΩ	1D
R16	0106124	120kΩ	1D
R17	0106274	270kΩ	1D
R18	0106274	270kΩ	1D
R19	0106394	390kΩ	1C
R20	0106394	390kΩ	1C
R21	0106124	120kΩ	1D
R22	0106124	120kΩ	1D
R23	0106124	120kΩ	1C
R24	0106124	120kΩ	1C
R25	0106124	120kΩ	1C
R26	0106124	120kΩ	1C
R27	0107563	56kΩ	1, 2C
R28	0107563	56kΩ	1, 2C
R29	0107563	56kΩ	1C
R30	0107563	56kΩ	1C
R33	0113225	2.2MΩ	2C
R34	0113225	2.2MΩ	2C
R35	0113155	1.5MΩ	1B, C
R36	0113155	1.5MΩ	1C
R37	0106474	470kΩ	2B
R38	0106474	470kΩ	2B
R39	0107334	330kΩ	1B
R40	0107334	330kΩ	1B
R41	0107105	1MΩ	1, 2B
R42	0106105	1MΩ	1B
R43	0107105	1MΩ	1, 2B
R44	0106105	1MΩ	1, 2B
R49	0106104	100kΩ	2B
R50	0106104	100kΩ	1, 2B
R51	0106104	100kΩ	2B
R52	0106104	100kΩ	1, 2B
R53	0107123	12kΩ	2C
R54	0107123	12kΩ	2C
R55	0107273	27kΩ	2A
R56	0107273	27kΩ	2A
R57	0107153	15kΩ	2A
R58	0107153	15kΩ	2A
R59	0106153	15kΩ	2A
R60	0106153	15kΩ	2A
R61	0106153	15kΩ	1A
R62	0106153	15kΩ	1A
R63	0107153	15kΩ	1A
R64	0107153	15kΩ	1A
R65	0107470	47Ω	1A
R66	0107470	47Ω	1A
R67	0106470	47Ω	1A
R68	0106470	47Ω	1, 2A
R601	0106472	4.7kΩ	2C
R602	0106472	4.7kΩ	2C
R603	0106273	27kΩ	2C
R604	0106472	4.7kΩ	1, 2D
R605	0106472	4.7kΩ	1, 2D
R606	0106473	47kΩ	2D
R607	0106473	47kΩ	1D
R608	0106103	10kΩ	2B
R609	0106272	2.7kΩ	1B
R610	0107472	4.7kΩ	1B
VR01	1035490	1MΩ(B)	1B
VR02	1035490	1MΩ(B)	1B
VR03	1035490	1MΩ(B)	1B
VR04	1035490	1MΩ(B)	1B
	2420290	Connect Pin Housing	



Abbreviations

C.R.	:	Carbon Resistor
S.R.	:	Solid Resistor
Ce.R.	:	Cement Resistor
M.R.	:	Metallized Film Resistor
M.C.	:	Mylar Capacitor
E.C.	:	Electrolytic Capacitor
BP.E.C.	:	Bi-Polar Electrolytic Capacitor
C.C.	:	Ceramic capacitor
Mi.C.	:	Mica Capacitor
O.C.	:	Oil Capacitor
P.C.	:	Polystyrene Capacitor
T.C.	:	Tantalum Capacitor

Other Parts List

F-2463

Parts No.	Stock No.	Description	Position
C01	0600826	0.0082μF } 50V M.C.	2C
C02	0600826	0.0082μF	2D
C03	0600126	0.0012μF	2C
C04	0600126	0.0012μF	2D
C05	0600126	0.0012μF	2C
C06	0600126	0.0012μF	2D
C07	0600126	0.0012μF	2D
C08	0600126	0.0012μF	1D
C09	0600126	0.0012μF	2D
C10	0600126	0.0012μF	1D
C21	0601188	0.18μF } 50V M.C.	1C
C22	0601338	0.33μF	1D
C23	0601227	0.022μF	2C
C24	0601227	0.022μF	2C
C25	0573228	0.22μF } 35V T.C.	1C
C26	0573228	0.22μF	1, 2C
C27	0515109	1μF } 50V E.C.	2C
C28	0515109	1μF	2C
C29	0601826	0.0082μF } 50V M.C.	1B
C30	0601826	0.0082μF	1B
C31	0601477	0.047μF	1B
C32	0601477	0.047μF	1B
C37	0513100	10μF } 25V E.C.	2C
C38	0513100	10μF	2C
C39	0660151	150pF } 50V C.C.	1A
C40	0660151	150pF	1A
C45	0519001	10μF } 25V E.C. (BRN)	1B
C46	0519001	10μF	1B
C47	0519001	10μF	1B
C48	0519001	10μF	2B
C601	0573338	0.33μF } 35V T.C.	2C
C602	0573338	0.33μF	2C
C603	0600686	0.0068μF 50V M.C.	2C
C604	0573688	0.68μF } 35V T.C.	1, 2D
C605	0573688	0.68μF	2D
C606	0600686	0.0068μF } 50V M.C.	2D
C607	0600686	0.0068μF	1D
C615	0515330	33μF 50V E.C.	1A
R31	0106683	68kΩ } ¼W C.R. (E.L.R)	1, 2C
R32	0106683	68kΩ	1, 2C
R45	0106332	3.3kΩ } ¼W C.R. (E.L.R)	2B
R46	0106332	3.3kΩ	1, 2B
R47	0106332	3.3kΩ	2B
R48	0106332	3.3kΩ	1, 2B
R69	0107182	1.8kΩ } ¼W C.R.	1A
R70	0107182	1.8kΩ	1A
R71	0106122	1.2kΩ } ¼W C.R. (E.L.R)	2A, B
R72	0106122	1.2kΩ	2A, B

F-2464

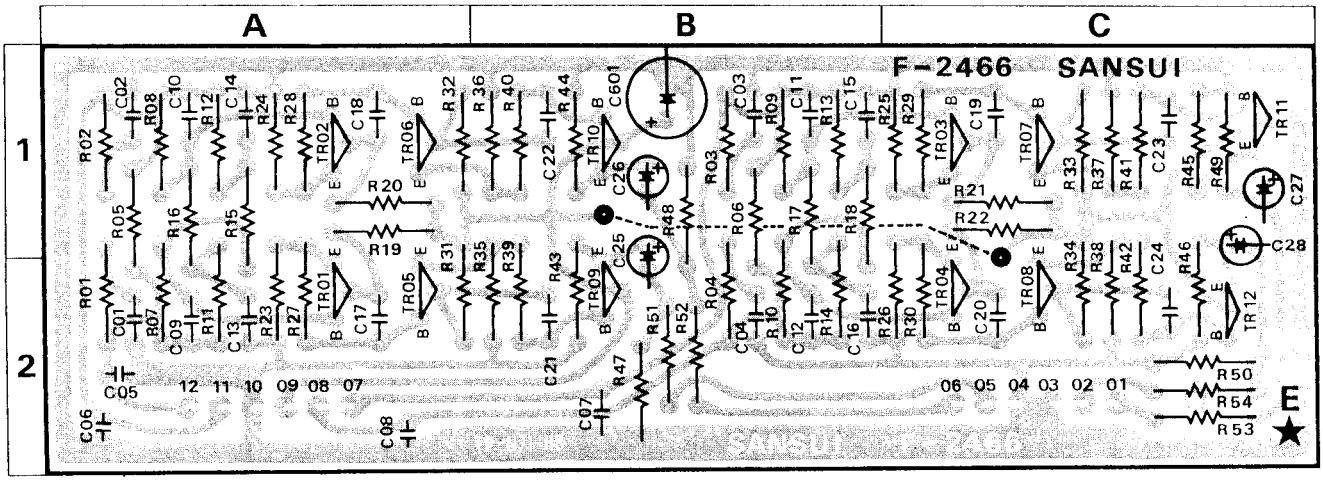
Parts No.	Stock No.	Description	Position
C01	0600156	0.0015μF } 50V M.C.	2C
C02	0600156	0.0015μF	2D
C03	0620561	560pF } 50V P.C.	2C
C04	0620561	560pF	2D
C05	0600186	0.0018μF	2C
C06	0600186	0.0018μF	2D
C07	0600186	0.0018μF	2D
C08	0600186	0.0018μF	1D
C09	0600186	0.0018μF	2D
C10	0600186	0.0018μF	1D
C21	0601827	0.028μF } 50V M.C.	1C
C22	0601128	0.12μF	1D
C23	0601477	0.047μF	2C
C24	0601477	0.047μF	2C
C25	0601827	0.082μF	1C
C26	0601827	0.082μF	1, 2C
C29	0601476	0.0047μF } 50V M.C.	1B
C30	0601476	0.0047μF	1B
C31	0601107	0.01μF	1B
C32	0601107	0.01μF	1B
C37	0515479	4.9μF } 50V E.C.	2C
C38	0515479	4.9μF	2C
C39	0600106	0.001μF } 50V M.C.	1A
C40	0600106	0.001μF	1A
C45	0519106	4.7μF } 50V E.C. (BRN)	1B
C46	0519106	4.7μF	1B
C47	0519106	4.7μF	1B
C48	0519106	4.7μF	2B
C601	0600477	0.047μF	2C
C602	0600477	0.047μF	2C
C603	0600106	0.001μF	2C
C604	0600108	0.1μF } 50V M.C.	1, 2D
C605	0600108	0.1μF	2D
C606	0600106	0.001μF	2D
C607	0600106	0.001μF	1D
R31	0106104	100kΩ } ¼W C.R. (E.L.R)	1, 2C
R32	0106104	100kΩ	1, 2C
R45	0106122	1.2kΩ	2B
R46	0106122	1.2kΩ	1, 2B
R47	0106122	1.2kΩ	2B
R48	0106122	1.2kΩ	1, 2B

F-2465

Parts No.	Stock No.	Description	Position
C01	0600476	0.0047μF } 50V M.C.	2C
C02	0600476	0.0047μF	2D
C03	0620241	240pF	2C
C04	0620241	240pF	2D
C05	0620681	680pF	2C
C06	0620681	680pF } 50V P.C.	2D
C07	0620681	680pF	2D
C08	0620681	680pF	1D
C09	0620681	680pF	2D
C10	0620681	680pF	1D
C21	0601397	0.039μF	1C
C22	0601827	0.082μF	1D
C23	0601277	0.027μF } 50V M.C.	2C
C24	0601277	0.027μF	2C
C25	0601477	0.047μF	1C
C26	0601477	0.047μF	1, 2C
C27	0573338	0.33μF } 35V T.C.	2C
C28	0573338	0.33μF	2C
C29	0601276	0.0027μF } 50V M.C.	1B
C30	0601276	0.0027μF	1B
C31	0601566	0.0056μF	1B
C32	0601566	0.0056μF	1B
C37	0515339	3.3μF } 50V E.C.	2C
C38	0515339	3.3μF	2C
C39	0660101	100pF } 50V C.C.	1A
C40	0660101	100pF	1A
C45	0519102	3.3μF } 50V E.C. (BRN)	1B
C46	0519102	3.3μF	1B
C47	0519102	3.3μF	1B
C48	0519102	3.3μF	2B
C601	0600157	0.015μF } 50V M.C.	2C
C602	0600157	0.015μF	2C
C603	0620221	220pF 50V P.C.	2C
C604	0600277	0.027μF } 50V M.C.	1, 2D
C605	0600277	0.027μF	2D
C606	0620271	270pF } 50V P.C.	2D
C607	0620271	270pF	1D
R31	0106823	82kΩ } ¼W C.R. (E.L.R)	1, 2C
R32	0106823	82kΩ	1, 2C
R45	0106122	1.2kΩ	2B
R46	0106122	1.2kΩ	1, 2B
R47	0106122	1.2kΩ	2B
R48	0106122	1.2kΩ	1, 2B

2-6. F-2466 Phase Shifter (Stock No. 7650360 Complete Board F-2466)

Conductor Side



Parts List

Parts No.	Stock No.	Description	Position
TR01,02	0306091	2SC1312G (Transistor)	2A.1A
TR03,04	0306091	2SC1312G (Transistor)	1C.2C
TR05,06	0306091	2SC1312G (Transistor)	2A.1A
TR07,08	0306091	2SC1312G (Transistor)	1C.2C
TR09,10	0306091	2SC1312G (Transistor)	2B.1B
TR11,12	0306091	2SC1312G (Transistor)	1C.2C
C01,02	0600567	0.056μF 50V M.C.	2A.1A
C03,04	0600567	0.056μF 50V M.C.	1B.2B
C05,06	0620821	820pF 50V P.C.	2A
C07,08	0620821	820pF 50V P.C.	2B.2A
C09,10	0600227	0.022μF 50V M.C.	2A.1A
C11,12	0600227	0.022μF 50V M.C.	1B.2B
C13,14	0600227	0.022μF 50V M.C.	2A.1A
C15,16	0600227	0.022μF 50V M.C.	1B.2B
C17,18	0600567	0.056μF 50V M.C.	2A.1A
C19,20	0600107	0.01μF 50V M.C.	1C.2B

Parts No.	Stock No.	Description	Position
C21,22	0600276	0.0027μF 50V M.C.	2B.1B
C23,24	0620471	470pF 50V P.C.	1C.2C
C25,26	0515109	1μF 50V E.C.	1,2B.1B
C27,28	0515109	1μF 50V E.C.	1C.1,2C
C601	0515330	33μF 50V E.C.	1B
R01,02	0107223	22kΩ	1,2A.1A
R03,04	0107223	22kΩ	1B.1,2B
R05,06	0107393	39kΩ	1,2A.1,2B
R07,08	0107224	220kΩ	1,2A.1A
R09,10	0107224	220kΩ	1B.1,2B
R11,12	0107104	100kΩ ¼W C.R.	1,2A.1A
R13,14	0107104	100kΩ	1B.1,2B
R15,16	0107124	120kΩ	1,2A
R17,18	0107124	120kΩ	1,2B
R19,20	0107472	4.7kΩ	1A
R21,22	0107472	4.7kΩ	1C

Parts No.	Stock No.	Description	Position
R23,24	0107472	4.7kΩ	1,2A.1A
R25,26	0107472	4.7kΩ	1C.1,2C
R27,28	0107333	33kΩ	1,2A.1A
R29,30	0107333	33kΩ	1C.1,2C
R31,32	0107472	4.7kΩ	1,2A.1A
R33,34	0107472	4.7kΩ	1C.1,2C
R35,36	0107472	4.7kΩ	1,2B.1B
R37,38	0107472	4.7kΩ ¼W C.R.	1C.1,2C
R39,40	0107333	33kΩ ¼W C.R.	1,2B.1B
R41,42	0107333	33kΩ	1C.1,2C
R43,44	0107472	4.7kΩ	1,2B.1B
R45,46	0107472	4.7kΩ	1C.1,2C
R47,48	0107124	120kΩ	2B.1,2B
R49,50	0107124	120kΩ	1C.2C
R51,52	0107561	560Ω	2B
R53,54	0107561	560Ω	2C
	2420290	Connect Pin Housing	

2-7. F-2467 Include in all Circuit (Flat Amp.) (Stock No. 7592280 Complete Circuit Board F-2048)

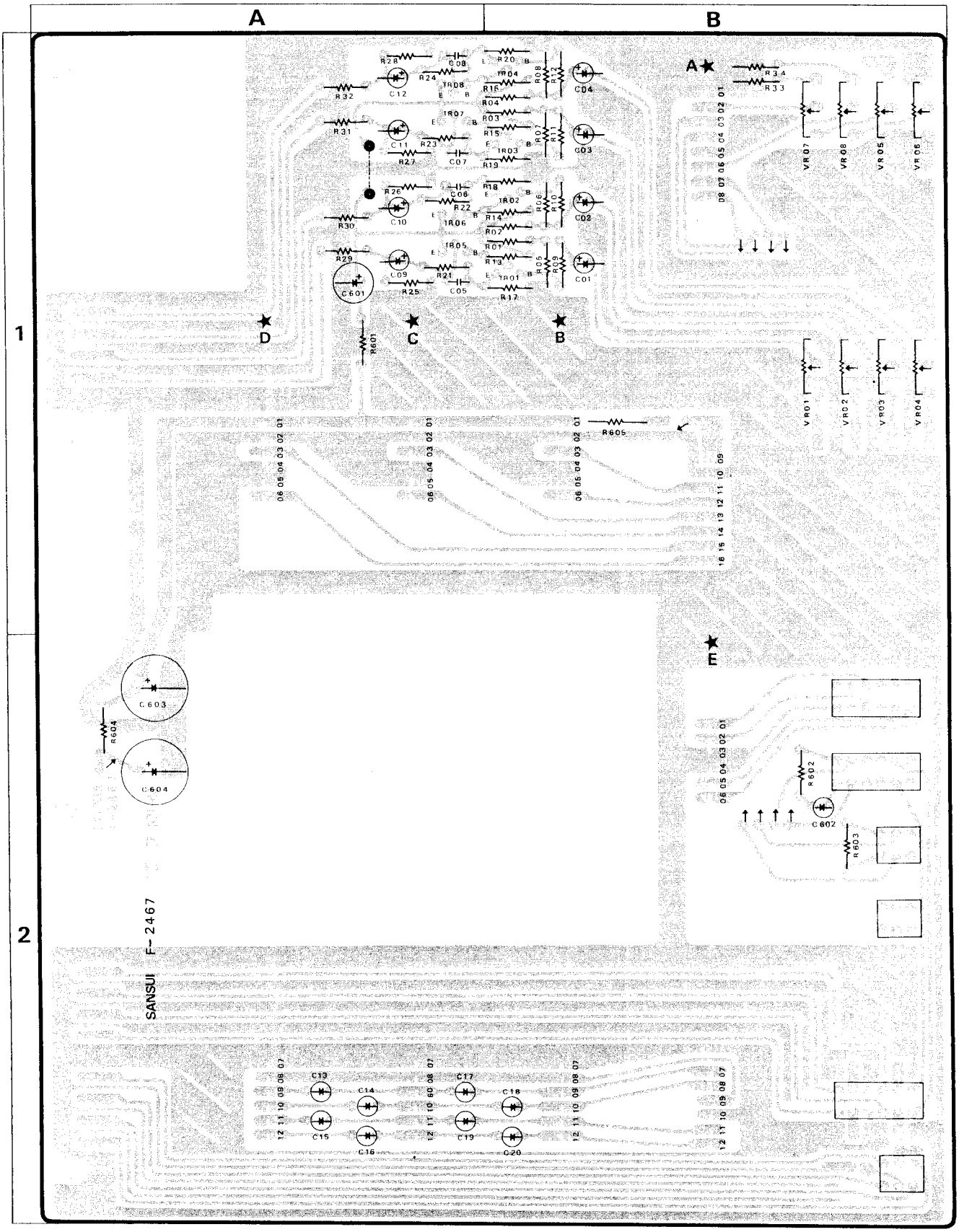
Parts List

Parts No.	Stock No.	Description	Position
TR01,02	0306091	2SC1312G (Transistor)	1B
TR03,04	0306091	2SC1312G (Transistor)	1B
TR05,06	0300410	2SA726F (Transistor)	1A
TR07,08	0300410	2SA726F (Transistor)	1A
C01,02	0515109	1μF 50V E.C.	1B
C03,04	0515109	1μF 50V E.C.	1B
C05,06	0660470	47pF 50V C.C.	1A
C07,08	0660470	47pF 50V C.C.	1A
C09,10	0515109	1μF 50V E.C.	1A
C11,12	0515109	1μF 50V E.C.	1A
C13,14	0530100	10μF 6.3V BP.E.C.	2A
C15,16	0350100	10μF 6.3V BP.E.C.	2A
C17,18	0350100	10μF 6.3V BP.E.C.	2A.2B
C19,20	0350100	10μF 6.3V BP.E.C.	2A.2B
C601	0515330	33μF 50V E.C.	1A

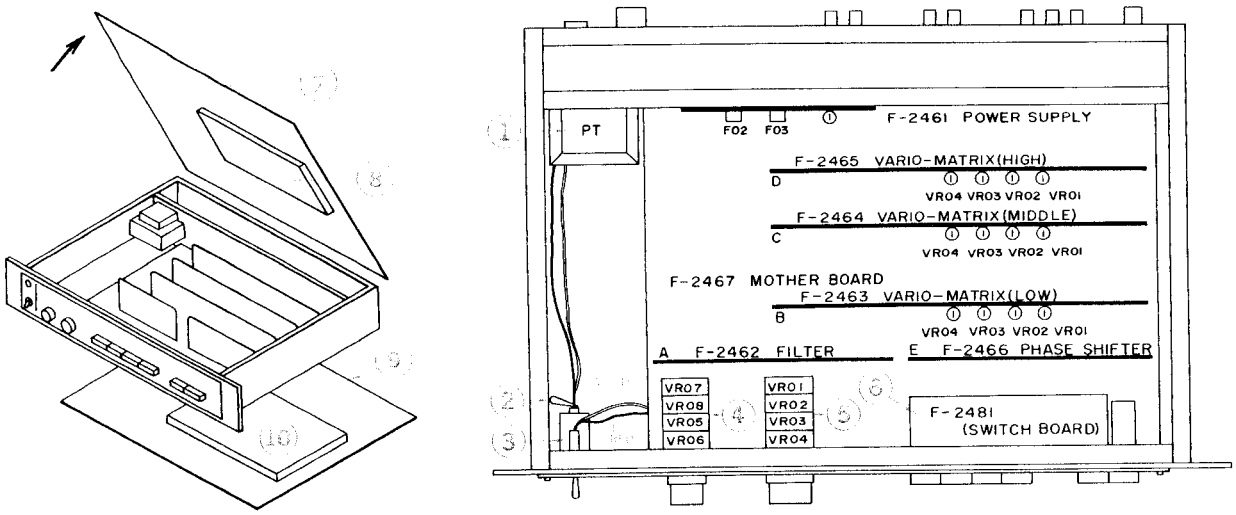
Parts No.	Stock No.	Description	Position
C603	0514102	1000μF 35V E.C.	2A
C604	0514102	1000μF 35V E.C.	2A
R01,02	0107684	680kΩ	1B
R03,04	0107684	680kΩ	1B
R05,06	0107154	150kΩ	1B
R07,08	0107154	150kΩ	1B
R09,10	0107152	1.5kΩ	1B
R11,12	0107152	1.5kΩ	1B
R13,14	0107683	68kΩ ⅛W C.R.	1B
R15,16	0107683	68kΩ	1B
R17,18	0107472	4.7kΩ	1B
R19,20	0107472	4.7kΩ	1B
R21,22	0107103	10kΩ	1A
R23,24	0107103	10kΩ	1A
R25,26	0107154	150kΩ	1A

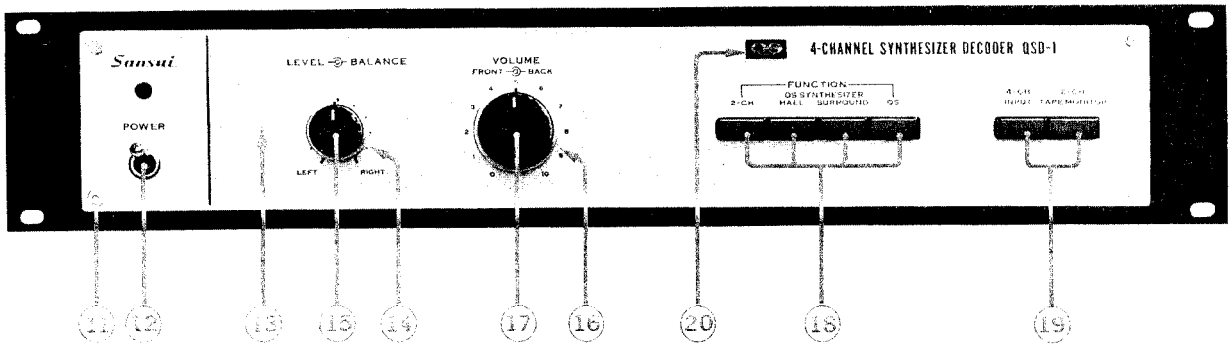
Parts No.	Stock No.	Description	Position
R27,28	0107154	150kΩ	1A
R29,30	0107331	330Ω	1A
R31,32	0107331	330Ω	1A
R33,34	0107103	10kΩ ⅛W C.R.	1B
R601	0107271	270Ω ⅛W C.R.	1A
R602	0107123	12kΩ ⅛W C.R.	2B
R603	0107183	18kΩ ⅛W C.R.	2B
R604	0107820	82Ω ⅛W C.R.	2A
R605	0104152	1.5kΩ 1W C.R.	1B
VR01,02	1060400,1	20kΩ(B)×4 Variable Resistor	1B
VR03,04	1060400,1	250kΩ(B)×4 Variable Resistor	1B
	2410730	Connector Pin Ass'y	
	2410740	Connector Pin Ass'y	

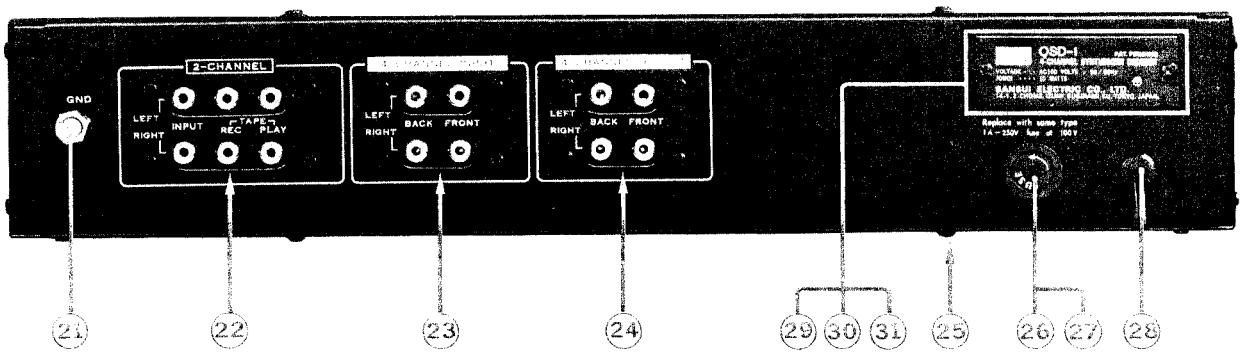
Conductor Side



2-8. Other Parts







Parts List

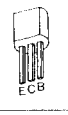
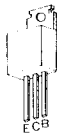
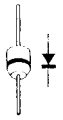
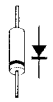
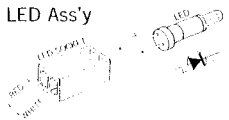
Parts No.	Stock No.	Description
1	4002260	Power Transformer
2	0605227	0.022μF 250V M.C.
3	7726080	LED Ass'y, Power Indicator
4	1060410, 1	Level, Balance Volume
5	1060400, 1	Volume
6	2592230	Switch Board, F-2481
7	5058280	Upper Plate
	5109222	Screw for Upper Plate, 3×8
8	5506790	Packing, Upper Plate
9	5058290	Bottom Plate
	5109222	Screw for Bottom Plate, 3×8
10	5506800	Packing, Bottom Plate
11	5166590	Screw for Panel Plate
12	1140050	Power Switch

Parts No.	Stock No.	Description
13	5309480	Front Panel
14	5318090	Balance Knob, WO-6
15	5318110	Level Knob, V-5
16	5318110	Volume Knob (Back), WO-7
17	5318120	Volume Knob (Front), W-5
18	1131010	Function Switch
19	1131020	4-CH Input Switch
20	5336431	QS Badge
21	2230051	Ground Terminal
22	2200330	6P Input Terminal
23	2200320	4P Input Terminal
24	2200320	4P Input Terminal
25	5516940	Foot
	5166520	Screw for Foot, 3×12

Parts No.	Stock No.	Description
26	2300060	Fuse Holder
27	0433220	1A 100~120V } AC Fuse
	0433210	0.5A 220~240V } AC Fuse
28	3800010	Power Cord
29	5388040	Name Plate
30	2410830	Voltage Selector, Socket
	2410090	Voltage Selector, Plug
※ Japanese Model only		
1	4002191	Power Transformer
12	1140040	Power Switch
27	0431220	1A 250V AC Fuse
28	3800020	Power Cord
29	5387640	Name Plate

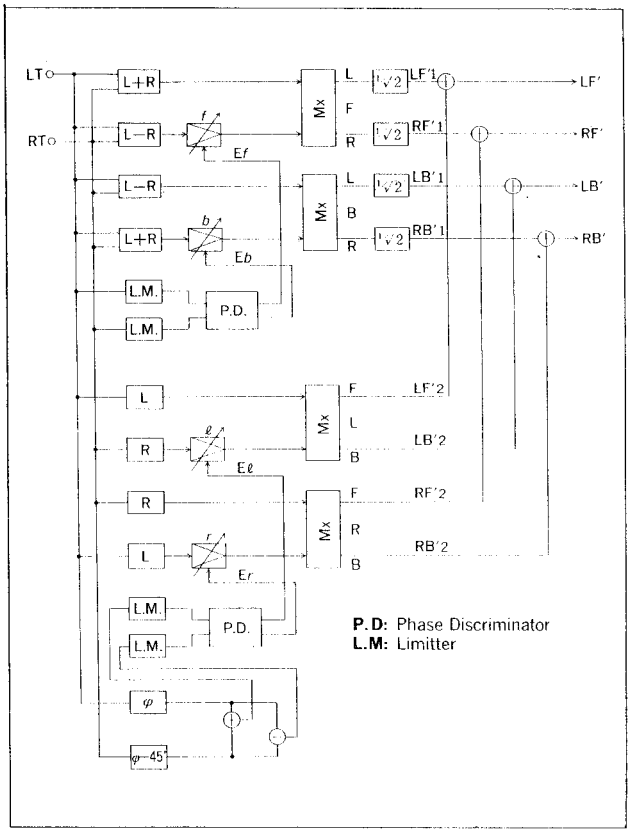
3. BLOCK DIAGRAM (1)

3-1. FIGURES

SEMICONDUCTORS	COMPLETE CIRCUIT BOARD
HA1327 HA1328 HD3103P 	F-2463 F-2464 F-2465
2SA726 2SC711 2SC1312 	F-2461 F-2462 F-2466 F-2467
2SD313 	F-2461
10D1 	F-2461
RD6A 	F-2461
IS2473 	F-2463 F-2464 F-2465
LED Ass'y 	POWER INDICATOR

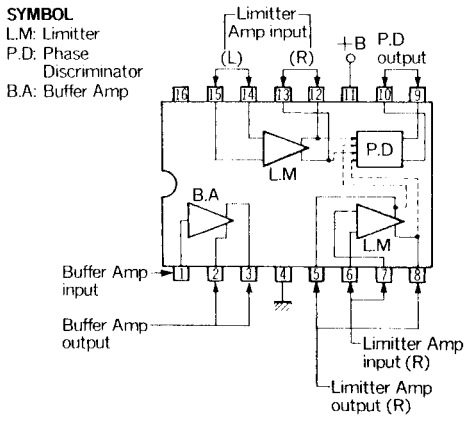
3-2. QS VARIO-MATRIX BLOCK DIAGRAM

F-2463 (LOW RANGE)
F-2464 (MIDLE RANGE)
F-2465 (HIGH RANGE)

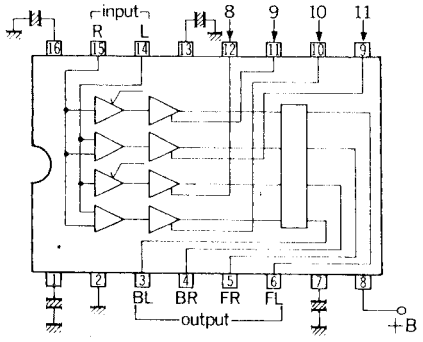


3-3. IC CONFIGURATION

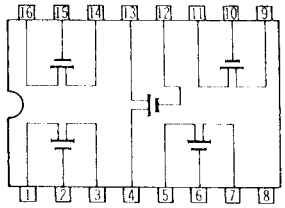
HA1327
(Phase matrix-IC)



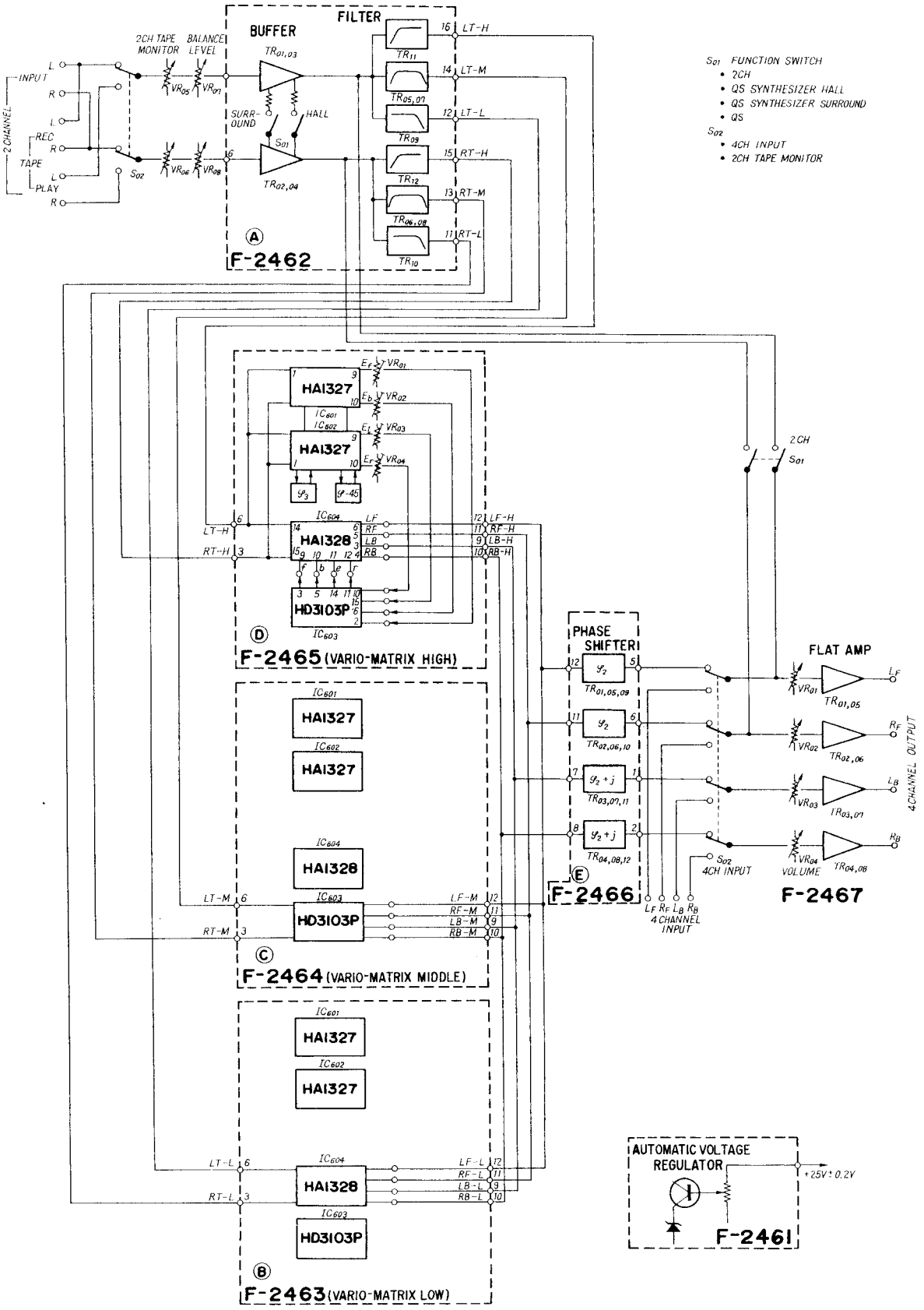
HA1328
(Matrix-IC)



HD3103P
(Control-IC)

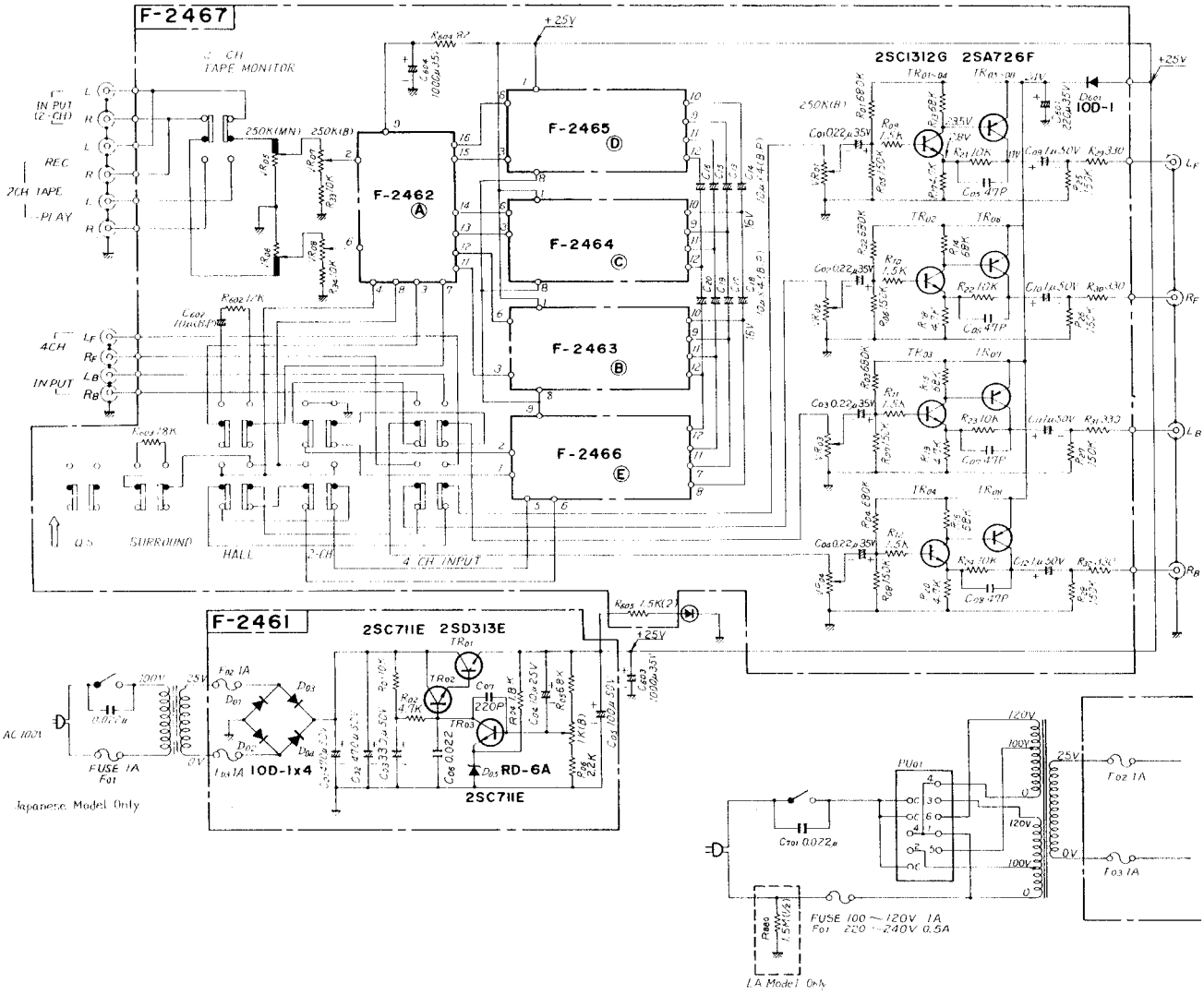


BLOCK DIAGRAM (2)

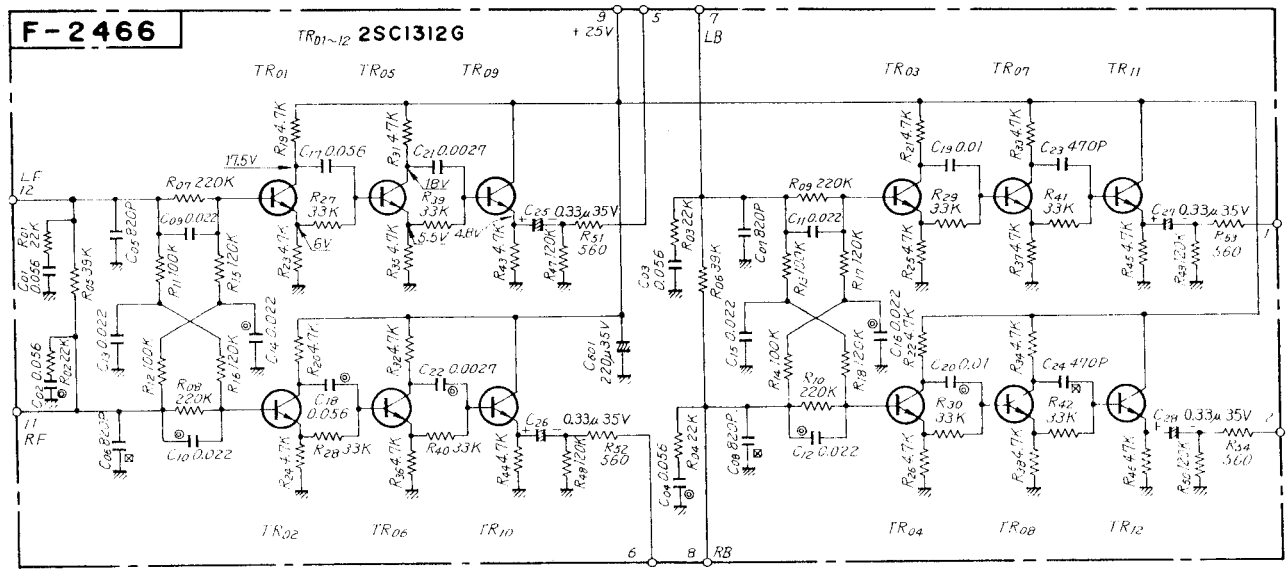


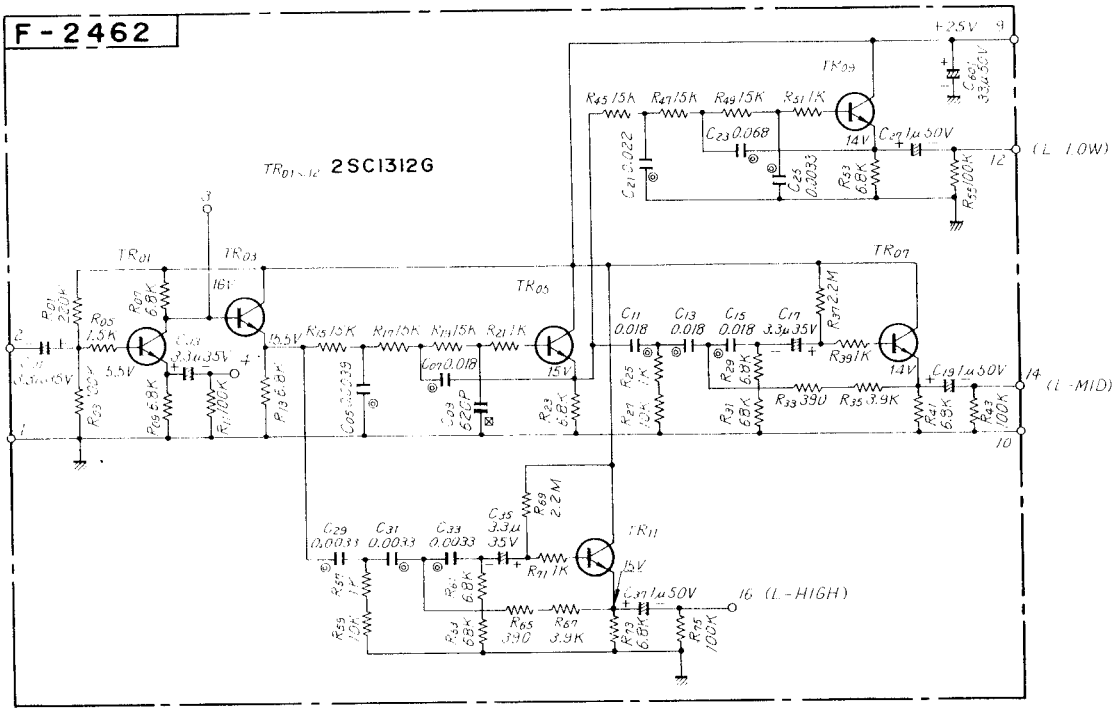
4. SCHEMATIC DIAGRAM

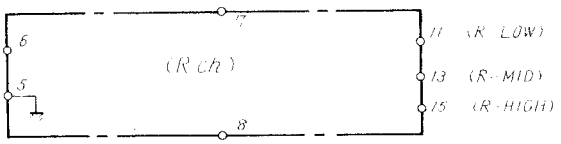
4-1. F-2467 INCLUDE IN ALL CIRCUIT



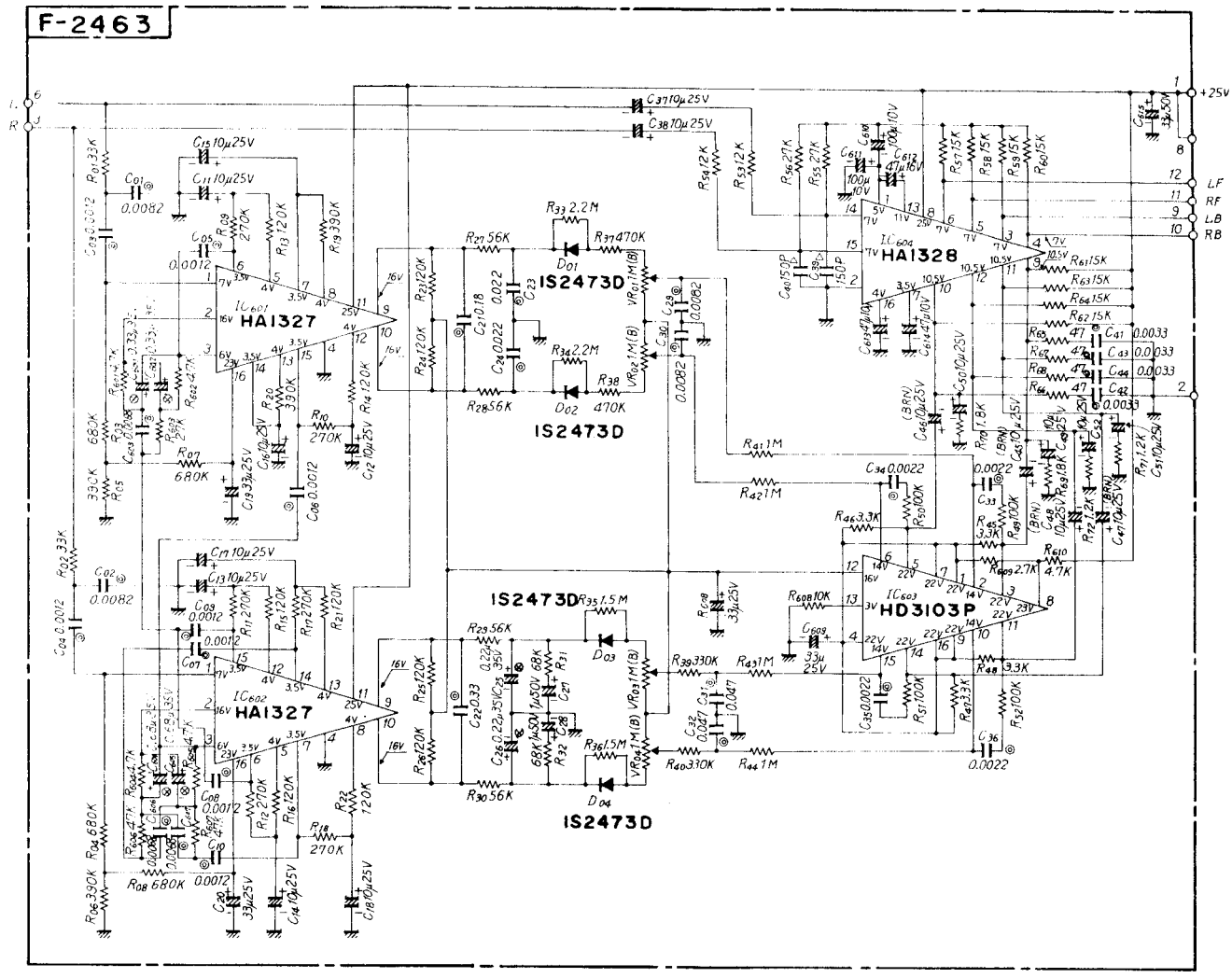
4-2. F-2466 PHASE SHIFTER, F-2462 FILTER



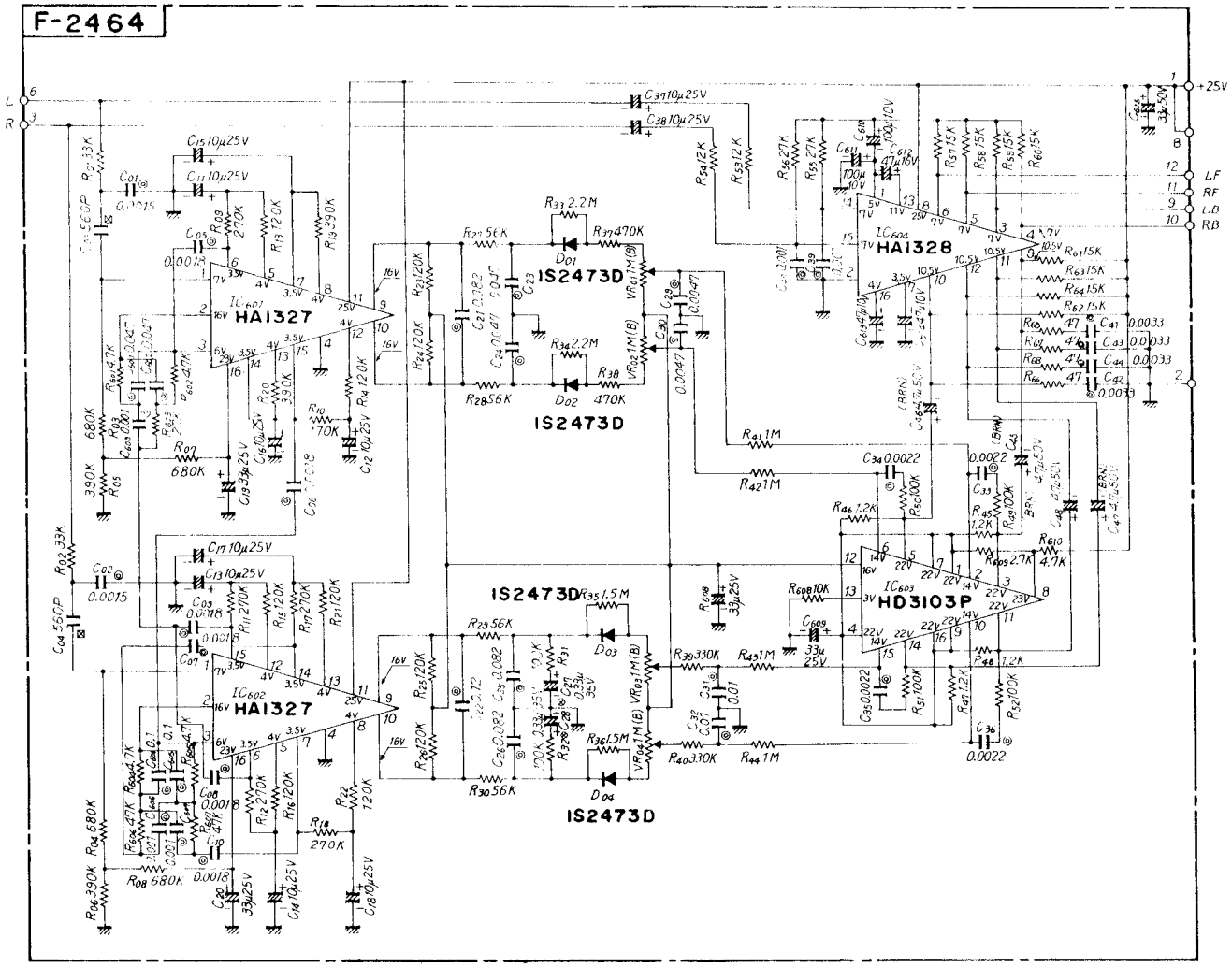




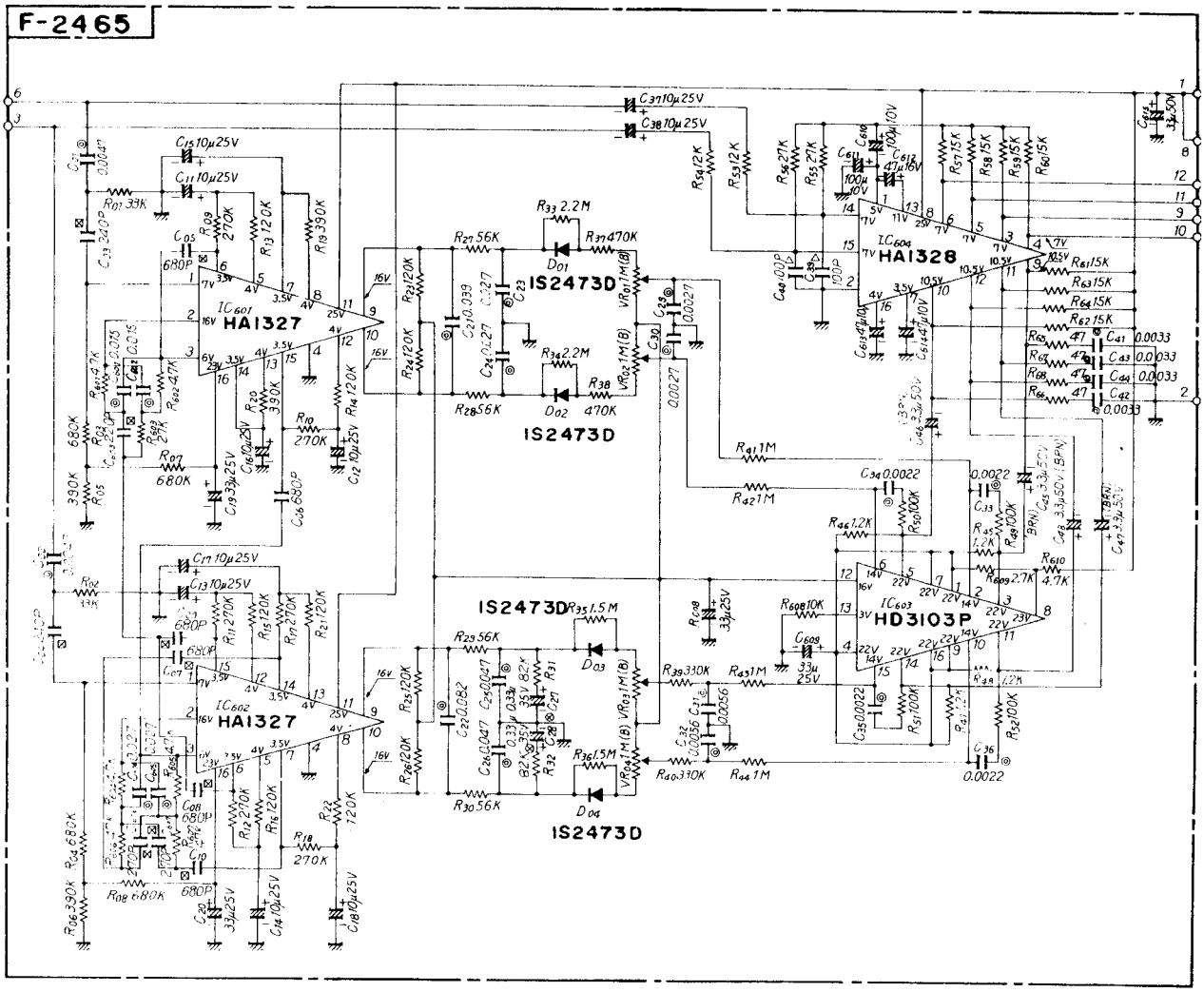
4-3. F-2463 VARIO-MATRIX (LOW RANGE)



4-4. F-2464 VARIO-MATRIX (MIDDLE RANGE)

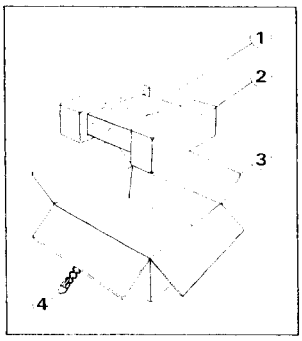


4-5. F-2465 VARIO-MATRIX (HIGH RANGE)



5. PACKING LIST

Parts No.	Stock No.	Description
1	9027850	Stylofoam Packing
2	9116143	Vinyl Cover
3	9008210	Carton Case
4	5996080	Curl stopper



6. ACCESSORY PARTS LIST

Parts No.	Stock No.	Description
1	3810180, 1	Pinplug Cord
2	9208900	Operating Instructions
※ Japanese Model Only		
2	9208610	Operating Instructions

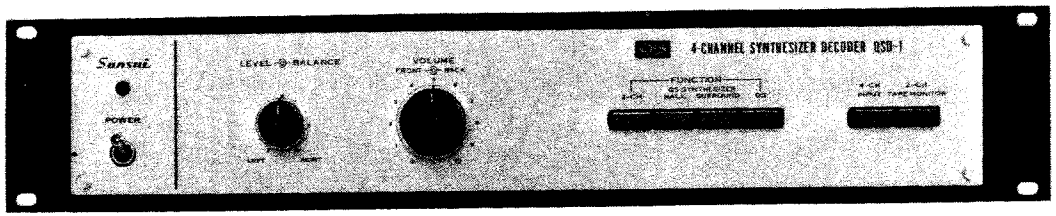
Sansui
SANSUI ELECTRIC CO., LTD.
14-1, 2-chome, Izumi, Suginami-ku, Tokyo 168, Japan
TELEPHONE: (03) 323-1111 /TELEX: 232-2076

Printed in Japan (35210M)

SANSUI

QSD-1

MODE D'EMPLOI
OPERATING INSTRUCTIONS
BETRIEBSANLEITUNG



4 CANAUX DECODEUR SYNTHETISEUR
4-CHANNEL SYNTHESIZER DECODER
4-KANAL-SYNTHESEDEKODERS

Sansui SANSUI ELECTRIC CO., LTD.

Tous nos compliments pour avoir choisi le décodeur synthétiseur Sansui QSD-1 à 4 canaux. Avant de commencer à vous en servir, nous vous invitons expressément à lire attentivement ce livret de mode d'emploi. Vous serez alors en mesure de bien connecter et régler l'appareil afin de profiter de ses performances superbes pendant de longues années.

Le QSD-1 est caractérisé par les plus récents perfectionnements techniques QS, lui permettant de recréer le réalisme d'une salle de concert avec naturel et une musicalité vivante. Le système QS lui-même est un système à matrice régulière à 4 canaux, complété par l'application du savoir-faire et des techniques électriques et audio dans toute la tradition de l'art Sansui.

Le QS a fait l'objet d'un examen sévère par les professionnels, les ingénieurs et membres des commissions audio à l'échelle internationale. Leur conclusion permet de le qualifier de progrès remarquable dans la gamme à 4 canaux, permettant une reproduction musicale excellente dans le domaine sonore à 4 canaux. A présent, de nombreux studios d'enregistrement dans le monde entier utilisent couramment le système QS sous forme d'équipement professionnel décodeur/encodeur QS pour l'encodage de matière à 4 canaux dan sun milieu à 2 canaux (émissions multiplexes FM et disques encodés QS) qui, lors de la reproduction au moyen de décodeurs QS, rendent une excellente sonorité à 4 canaux avec des résultats de haute fidélité authentique.

Rappel: Parmi les caractéristiques professionnelles du QSD-1 on doit noter sa facilité de montage sur tablette: son panneau avant ayant 480 mm de large, il peut ainsi être aisément incorporé dans un système d'enregistrement/reproduction dans n'importe quel studio professionnel à des fins de contrôle sonore parfait.

Remarque: Dans ce livret, le QSD-1 est désigné par "l'appareil".

We are grateful for your choice of the Sansui QSD-1 4-channel synthesizer decoder. Before you begin to operate it, may we suggest that you read this booklet of operating instructions once carefully? You will then be able to connect and operate it correctly, and enjoy its superb performance for years.

The QSD-1 features the latest QS technological advances, making it possible to re-create concert-hall realism with natural and vivid musicality. The QS System itself is a 4-channel regular-matrix system, completed by application of Sansui's state-of-the-art audio and electrical techniques and knowhow.

QS has been reviewed critically by professionals, engineers and audio seminar members around the world. They have judged it to be a remarkable 4-channel advancement, providing excellent 4-channel sound field reproduction of music. At preset, many FM broadcasting and record and tape recording studios around the world are actively using the QS System in the form of professional QS encoder/decoder equipment for encoding 4-channel material into a 2-channel medium (FM multiplex broadcasts and QS-encoded records) which, when played by users through QS decoders, yield excellent 4-channel sound with authentic high fidelity results.

A reminder: among the professional features of the QSD-1 is its readiness for rack-mounting: its front-panel is 480mm (14-3/8") wide and thus can easily be incorporated into a record/playback system in any professional studio for reliable monitoring purposes.

Note: In this booklet, the QSD-1 is referred to as "the unit."

Wir danken Ihnen für Ihre Wahl des Sansui QSD-1 4-Kanal-Synthesedekoders. Bitte lesen Sie vor dem ersten Betrieb diese Betriebsanleitung einmal sorgfältig durch. Sie können dann das Gerät richtig bedienen und anschließen und seine hervorragende Leistung jahrelang genießen.

Dieses Gerät enthält die neuesten Fortschritte auf dem QS-Feld und ermöglicht realistische Konzerthallenwiedergabe mit natürlichem und klarem Klang. Das QS-System selbst ist ein 4-Kanal-Normalmatrix-System, vervollständigt durch die Anwendung des Elektro- und Audio-Knowhow von Sansui.

QS ist von Profis, Ingenieuren und Mitgliedern von Audioseminaren in der ganzen Welt kritisch geprüft worden. Sie haben es als einen bemerkenswerten 4-Kanal-Fortschritt beurteilt, wodurch ausgezeichnete 4-Kanal-Tonfeldwiedergabe von Musik gebracht wird. Gegenwärtig verwenden viele UKW-Sender und Schallplatten- und Tonbandaufnahmestudios in der ganzen Welt das QS-System aktiv in der Form von professioneller QS-Verschlüsselungs-/Entschlüsselungsausrüstung zur Verschlüsselung von 4-Kanal-Material in ein 2-Kanal-Medium (UKW-Multiplexsendungen und QS-verschlüsselte Schallplatten), das bei der Wiedergabe durch QS-Dekoder ausgezeichneten 4-Kanal-Klang mit echten HiFi-Ergebnissen liefert.

Hinweis: Unter den professionellen Eigenschaften dieses Gerätes ist seine Eignung für Gestelleinbau: seine Vorderseite ist 480 mm breit, und es kann deshalb leicht in ein Aufnahme- und Wiedergabesystem für zuverlässiges Mithören in einem professionellen Studio eingegliedert werden.

Hinweis: In dieser Anleitung wird das QSD-1 als "das Gerät" bezeichnet.

Table des matières

Table of contents

Inhaltsverzeichnis

PRECAUTIONS IMPORTANTES
IMPORTANT PRECAUTIONS
WICHTIGE VORSICHTSMASSNAHMEN

Installation:

Pour maintenir l'appareil dans des conditions optimales à tous instants, il convient d'observer les précautions suivantes:

1. Du fait que les transistors et CI sont sensibles à la chaleur, ne pas les soumettre à des températures excessives.
2. En montant l'appareil, éviter une enceinte fermée: essayer d'obtenir toujours une bonne circulation d'air autour de l'appareil.
3. Ne pas démonter le coffret de l'appareil mal à propos. Ce démontage risque d'entraîner des pannes matérielles et électriques.
4. L'appareil fonctionne parfaitement si la tension d'alimentation ne varie pas au-delà de 10% en plus ou en moins de la valeur nominale. Si la tension du cour. alt. du secteur est très inférieure ou supérieure à ces données, il faudra alors employer un régulateur de tension afin d'obtenir la tension nominale voulue.
5. Pour profiter au maximum de la sonorité à 4 canaux, il est recommandé d'installer le système à 4 canaux dans une pièce soignée du point de vue acoustique, autant que possible.
6. Prendre garde à l'emplacement du tourne-disque en vue d'éviter le "hurlement" ou réaction acoustique de se produire.

Connexions:

1. En connectant cet appareil à votre amplificateur, utilisez les cordons de connexion fournis. Si des cordons supplémentaires sont requis; il faudra en choisir armés; Chaque cordon doit avoir une longueur ne dépassant pas 2 m. Des cordons plus longs risquent d'atténuer les hautes fréquences.
   - L'emploi d'un fil à gaine de vinyle pour les connexions risque d'engendrer des parasites et/ou une faible réponse. Par conséquent de tels fils ne doivent servir qu'à la connexion des haut-parleurs.
2. En connectant cet appareil à vos amplificateurs, prendre soin de bien connecter les cordons. Six cordons sont prévus pour cet appareil: un pour chaque HP avant gauche, arrière gauche, arrière droit et avant droit, et deux encore pour l'entrée à 2 canaux.
   - Vous pouvez éviter les erreurs de connexion en fixant les etiquettes d'identification fournies à chacune des extrémités de chaque cordon.

Installation

To keep the unit in top condition at all times, please observe the following precautions:

1. As transistors and ICs are sensitive to heat, do not subject to excessive temperatures.
2. When mounting the unit, avoid a closed box: always try to provide a good circulation of air around the unit.
3. Do not remove the casing of the unit. The removal may subject the unit to electrical and physical insecurity.
4. The unit operates well when driven at a power voltage within 10% over or below the rated voltage. If the AC power voltage of your area is far below or above this figure, use a voltage regulator to obtain the rated voltage.
5. To fully enjoy 4-channel sound, it is recommended that your 4-channel system be installed in an acoustically-processed room, if possible.
6. Be careful about the placement of your record turntable to avoid "howling" or acoustical feedback.

Connections

1. In connecting this unit with your amplifier, use the supplied connection cords. If you require more connection cords, always select shielded ones; each should have a length not exceeding 2m (7 feet). Longer cords may attenuate high frequencies.
   - The use of vinyl-coated wire for connections may result in generated noise and/or poor response. Therefore, such wires should be used for speaker connections only.
2. In connecting the unit with your amplifiers, be careful not to mis-connect connection cords. Six cords are provided with your unit: one each for Front Left, Back Left, Back Right and Front Right, and two more for a 2-channel input.
   - You can avoid mis-connection by attaching the supplied identification labels at both ends of each cord.

Installierung

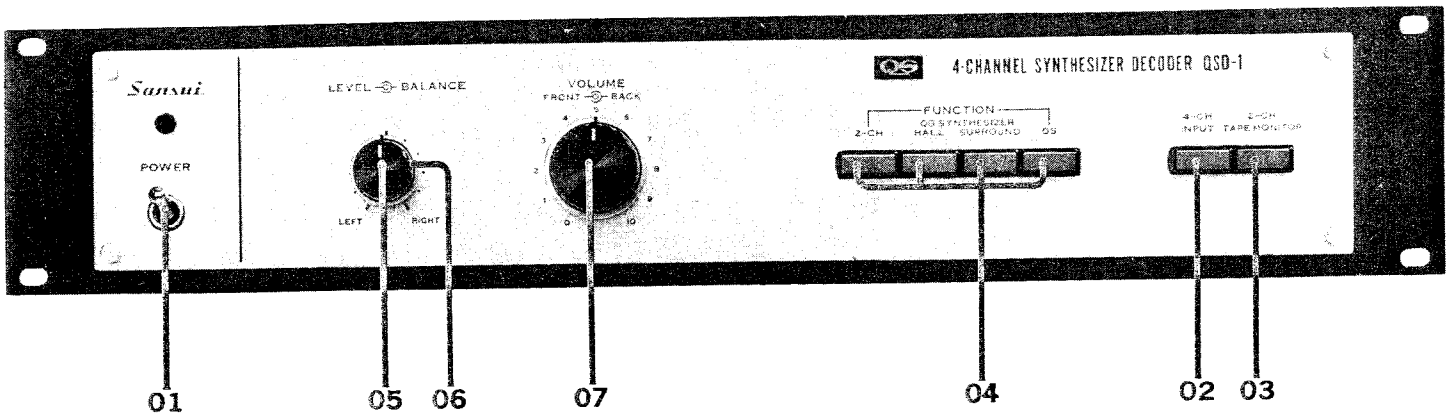
Bitte beachten Sie die folgenden Vorsichtsmaßnahmen, um das Gerät immer in bestem Zustand zu erhalten:

1. Setzen Sie Transistoren und integrierte Stromkreise (IC) nicht übermäßigen Temperaturen aus, da sie sehr wärmeempfindlich sind.
2. Vermeiden Sie bei der Aufstellung der Einheit einen geschlossenen Kasten; versuchen Sie immer für gute Luftzirkulation um das Gerät zu sorgen.
3. Entfernen Sie das Gehäuse des Gerätes nicht, da hierdurch das Gerät elektrisch und physikalisch unsicher wird.
4. Das Gerät kann innerhalb ±10% der Nennspannung gut betrieben werden. Wenn die Wechselspannung Ihres Gebietes weit über oder unter diesem Wert liegt, so verwenden Sie einen Spannungsregler, um die Nennspannung zu erhalten.
5. Für vollen Genuß von 4-Kanal-Ton wird es empfohlen, daß Sie das 4-Kanal-System in einem Raum mit guter Akustik aufstellen.
6. Wählen Sie den Aufstellungsort Ihres Plattenspielers sorgfältig, um "Heulen" oder akustische Rückkopplung zu vermeiden.

Anschlüsse

1. Verwenden Sie zum Anschluß dieses Gerätes an Ihren Verstärker die mitgelieferten Anschlußkabel. Wenn Sie weitere Anschlußkabel brauchen, so wählen Sie immer abgeschirmte Kabel, möglichst nicht länger als 2 m, da längere Kabel die hohen Frequenzen schwächen können.
   - Die Verwendung von Kabeln mit Vinylisolierung für Verbindungen kann zu Störungen und/oder schlechtem Ansprach führen. Solche Kabel sollten deshalb nur für den Anschluß von Lautsprechern verwendet werden.
2. Achten Sie beim Anschluß des Gerätes an Ihre Verstärker darauf, die Verbindungskabel nicht falsch anzuschließen. Ihr Gerät hat sechs Kabel: je eins für vorn links, hinten links, hinten rechts und vorn rechts, und zwei für 2-Kanal-Eingang.
   - Durch Anbringung der mitgelieferten Markierungsschilder an beiden Kabelenden können Sie Fehlverbindungen vermeiden.

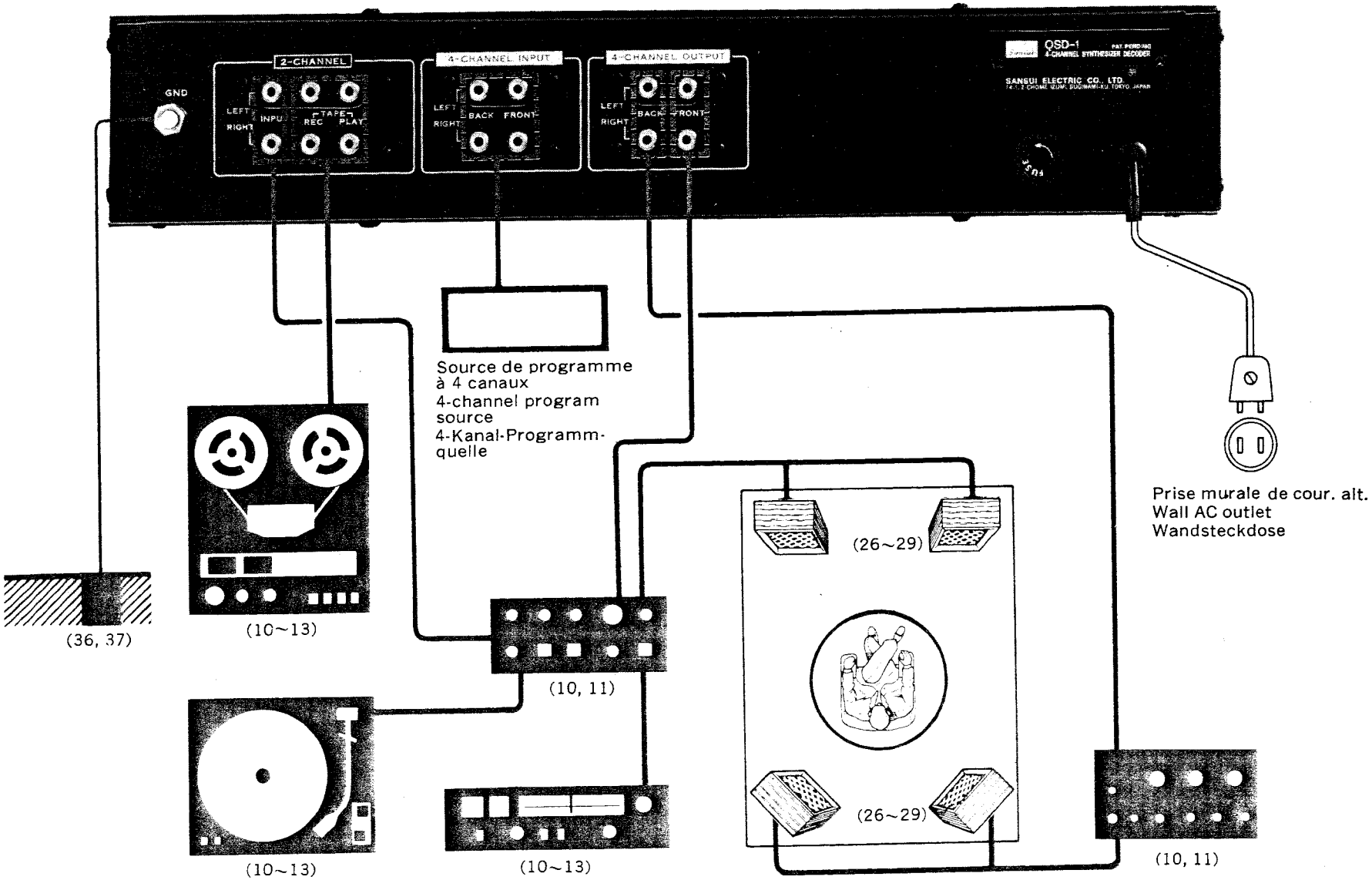
TABLEAU DE RENSEIGNEMENTS
PANEL INFORMATION
SCHALTTAFELINFORMATION



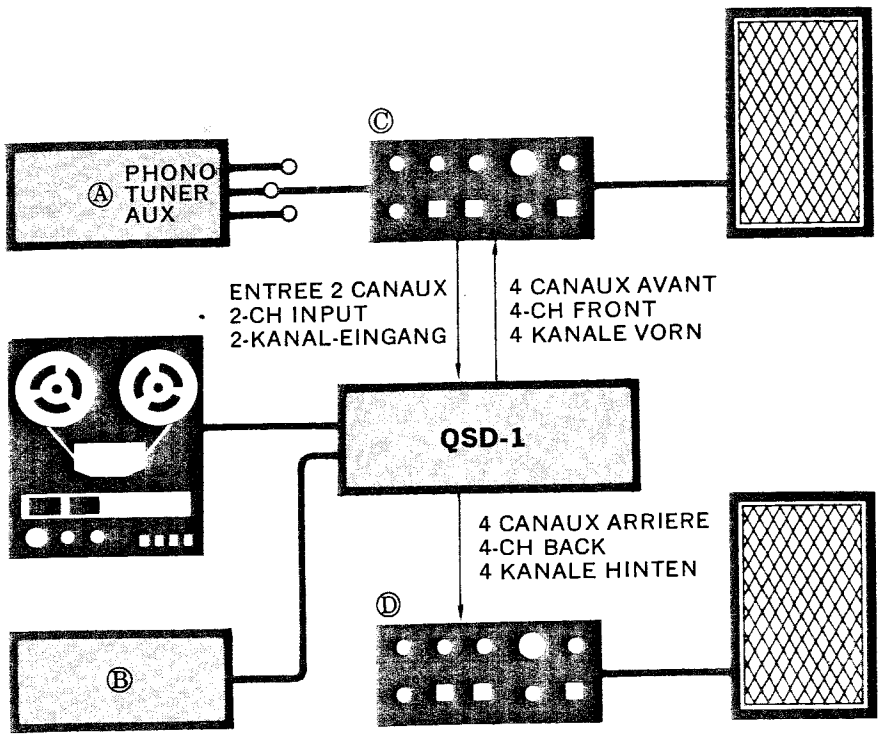
- Tous les renseignements concernant les commutateurs et les commandes de l'appareil sont indiqués aux pages 14 à 25. Le numéro des photos se rapporte à l'ordre d'exécution des opérations.

- All switch and control descriptions are given on pages 14~25. Numbers in photo refer to the description sequence.

- Alle Schalter- und Reglerbeschreibungen sind auf den Seiten 14 bis 25 gegeben. Die Nummern im Photo beziehen sich auf die Reihenfolge der Beschreibung.


GND
2-CHANNEL
LEFT
RIGHT
INPUT
TAPE
REC
PLAY
4-CHANNEL INPUT
LEFT
RIGHT
BACK
FRONT
4-CHANNEL OUTPUT
LEFT
RIGHT
BACK
FRONT
QSD-1
4-CHANNEL SYNTHESIZER DECODER
SANSUI ELECTRIC CO., LTD.
Source de programme à 4 canaux
4-channel program source
4-Kanal-Programm-quelle
Prise murale de cour. alt.
Wall AC outlet
Wandsteckdose
(36, 37)
(10~13)
(10, 11)
(26~29)
(26~29)
(10~13)
(10~13)
(10, 11)

ASSEMBLAGE D'UN SYSTEME A 4 CANAUX
ASSEMBLING A 4-CHANNEL SYSTEM
ZUSAMMENBAU EINES 4-KANAL-SYSTEMS



ⒶSource reproduction 2 canaux ⒷSource reproduction 4 canaux
Ⓐ2-ch. playback source Ⓑ4-ch. playback source
Ⓐ2-Kanal-Wiedergabequelle Ⓑ4-Kanal-Wiedergabequelle

ⒸPreampli/ampli principal pour canaux avant
ⒸPre/main amp. for front channels
ⒸVor-/Hauptverstarker fur vordere Kanale

ⒹPreampli/ampli principal pour canaux arrière
ⒹPre/main amp. for back channels
ⒹVor-/Hauptverstärker fur hintere Kanäle

De façon idéale, les quatre haut-parleurs et amplificateurs dans le système à 4 canaux devraient être de la même marque et de même modèle afin d'obtenir une sonorité de même qualité par les quatre canaux.

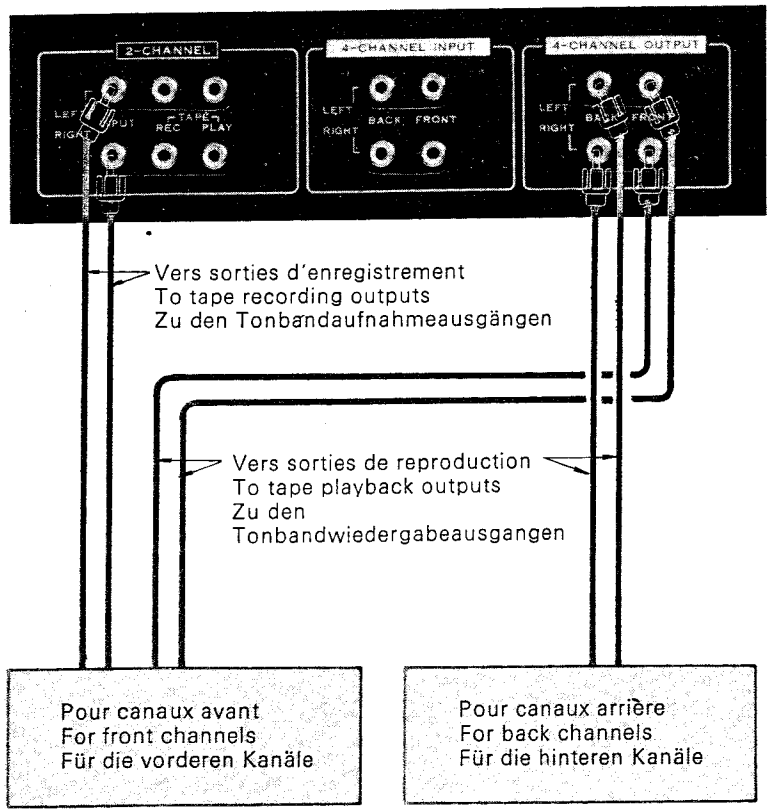
Ainsi, si vous possédez déjà un amplificateur stéréo et deux haut-parleurs, essayez de trouver un autre groupe stéréo composé des mêmes modèles d'amplificateurs et de haut-parleurs. Dans le cas où vous ne pouvez pas vous procurer les mêmes modèles d'amplificateurs et de haut-parleurs pour les deux canaux supplémentaires, vous pouvez utiliser différents modèles, mais ils devront avoir les mêmes caractéristiques de puissance, de dimensions et de qualité tonale. Ou en cas où vous ne disposez que d'un espace au plancher limité pour le système ou si votre budget est restreint, vous pourrez utiliser un amplificateur moins coûteux pour les canaux arrière, mais les haut-parleurs doivent être au moins du même modèle. Dans n'importe quel cas sur les quatre haut-parleurs, les deux à l'avant doivent être de qualité supérieure, car ils jouent le rôle dominant quand il s'agit de rechercher la qualité tonale globale.

Vous pouvez utiliser un amplificateur de puissance stéréo pour les canaux arrière, bien que vous ne puissiez ajuster la qualité tonale des canaux arrière. Etant donné que votre appareil comporte une tension de sortie nominale de 300 mV, la plupart des amplificateurs de puissance disponibles sur le marché avec une tension nominale d'entrée comprise entre 0,8 V et 1,0 V peuvent être connectés et fournir un niveau de sortie suffisant. Il existe des amplificateurs de puissance qui, néanmoins, lorsqu'ils seront connectés à votre appareil, risquent de produire un bruit excessif ou bien ne pas fournir le niveau de sortie suffisant. Ainsi, si vous désirez acquérir un nouvel amplificateur de puissance, il est préférable d'apporter cet appareil au magasin de vente et de savoir si les appareils connectés produisent des résultats satisfaisants.

Ideally, all four speaker systems and amplifiers in a 4-channel system should be of the same makes and models in order to obtain sounds of the same quality from all four channels.
Thus if you already have a stereo amplifier and two speakers, try to use another stereo set consisting of the same amplifiers and speaker models. In case you cannot obtain the same amplifier and speaker models for two additional channels, you may use different models, but they should have the similar size, power characteristics and tone quality. Or in case you have a limited floor space for the system or if your budget is limited, you may use a less expensive amplifier for the back channels, but at least the speakers should be of the same model. In any case, of the four, the front two speakers should be of good quality, for they play the most dominant role in deciding the overall tone quality.
You can use a stereo power amplifier for the back channels, though you cannot adjust tone quality of the back channels. Since your unit has a rated output voltagy of 300mV, most of power amplifiers on the market with a rated input voltage between 0.8V and 1.0V can be connected and provide sufficient output level. There are, however, power amplifiers which, when connected with your unit, may produce excessive noise or may not produce sufficient output level. Thus if you are buying a new power amplifier, you should bring this unit to a dealer and see if the connected units produce satisfactory results.

Idealerweise sollten alle vier Lautsprecheranlagen und Verstärker in einem 4-Kanal-System das gleiche Modell des gleichen Herstellers sein, um Ton gleicher Qualität von allen vier Kanälen zu erhalten.
Wenn Sie deshalb schon einen Stereoverstärker und zwei Lautsprecher haben, sollten Sie versuchen, einen anderen Stereosatz mit den gleichen Verstärker- und Lautsprechermodellen zu verwenden. Wenn Sie für die zwei Zusatzkanäle nicht die gleichen Verstärker- und Lautsprechermodelle erhalten können, so können Sie verschiedene Modelle verwenden, die aber gleiche Größe, Leistungscharakteristiken und Tonqualität haben sollten. Wenn Ihr Aufstellungsplatz für das System oder Ihr Budget begrenzt sind, können Sie einen billigeren Verstärker für die hinteren Kanäle verwenden, aber die Lautsprecher sollten in jedem Fall vom gleichen Modell sein. Von den vier Lautsprechern sollten in jedem Fall die beiden vorderen von guter Qualität sein, da sie die entscheidende Rolle bei der Bestimmung der gesamten Tonqualität spielen.
Sie können einen Stereoleistungsverstärker für die hinteren Kanäle verwenden, obwohl Sie die Tonqualität der hinteren Kanäle nicht regulieren können. Da Ihr Gerät eine Nennausgangsspannung von 300 mV hat, können die meisten Leistungsverstärker auf dem Markt mit einer Nenneingangsspannung zwischen 0,8 und 1,0 V angeschlossen werden und geben einen ausreichenden Ausgangspegel. Es gibt jedoch Leistungsverstärker, die bei Anschluß an Ihr Gerät zu übermäßigen Störungen führen oder keinen ausreichenden Ausgangspegel abgeben. Wenn Sie einen neuen Leistungsverstärker kaufen, sollten Sie deshalb Ihr Gerät zum Händler mitnehmen, um zu überprüfen, ob die beiden Geräte zufriedenstellende Ergebnisse bringen.

CONNEXION AUX AMPLIFICATEURS STEREO
CONNECTION TO STEREO AMPLIFIERS
ANSCHLUSS AN STEREOVERSTÄRKER



AMPLIFICATEUR ou RECEPTEUR
AMPLIFIER or RECEIVER
VERSTARKER ODER EMPFÄNGER

Bornes de connexion

Bormes d'entrée à 2 canaux (2-CHANNEL INPUT): Connecter ces bornes d'entrée (INPUT) aux bornes d'enregistrement (TAPE REC) sur l'amplificateur de canal avant. Si votre tourne-disque, tuner, etc., est connecté à l'amplificateur de canal arrière, connecter les bornes d'entrée (INPUT) de l'appareil aux bornes d'enregistrement (TAPE REC) situées sur l'amplificateur de canal arrière. Si l'amplificateur de canal arrière comporte des bornes d'adapteur à 4 canaux, connecter les bornes d'entrée (INPUT) de l'appareil aux bornes de sortie (OUTPUT) de l'amplificateur de canal arrière.

Bornes de sortie à 4 canaux (avant) (4-CHANNEL OUTPUT (FRONT)): Connecter les bornes de sortie (OUTPUT) de l'appareil avec les bornes de reproduction (TAPE PLAY) sur l'amplificateur de canal avant. Si l'amplificateur de canal avant comporte des bornes d'adapteur à 4 canaux, connecter les bornes de sortie (avant) (OUTPUT) (FRONT) aux bornes d'entrée (INPUT) situées sur l'amplificateur de canal avant.

Bornes de sortie à 4 canaux (arrière) (4-CHANNEL OUTPUT (BACK): Connecter les bornes de sortie (arrière) (OUTPUT (BACK) de l'appareil) avec les bornes de reproduction (TAPE PLAY) sur l'amplificateur de canal arrière. Si l'amplificateur de canal arrière est un simple amplificateur de puissance, connecter les bornes de sortie (arrière) OUTPUT (BACK) de l'appareil à ses bornes d'entrée (INPUT).

NOTA: Il est possible, bien sûr, de connecter et d'utiliser cet appareil avec des récepteurs ou amplificateurs à 4 canaux vendus dans le commerce. De tels appareils offrent habituellement des bornes de sortie à 2 canaux et des bornes d'entrée à 4 canaux destinées à de telles connexions. Cependant, il est recommandé de n'employer de tels appareils que s'ils sont capables de d'ivrer une puissance de sortie raisonnablement élevée, une séparation inter-canaux, une réponse de fréquence, des caractéristiques de distorsion et autres facteurs de rendement maximum pour maintenir les normes de haute fidélité voulues.

Connection terminals

2-CHANNEL INPUT terminals: Connect these INPUT terminals with the TAPE REC terminals on the front-channel amplifier.
If your turntable, tuner, etc., are connected to the back-channel amplifier, connect the unit's INPUT terminals with the TAPE REC terminals on the back-channel amplifier. If the back-channel amplifier has 4-channel adaptor terminals, connect the unit's INPUT terminals to the back-channel amplifier's OUTPUT terminals.
4-CHANNEL OUTPUT (FRONT) terminals: Connect the unit's OUTPUT terminals with the TAPE PLAY terminals on the front-channel amplifier. If the front-channel amplifier has 4-channel adaptor terminals, connect the unit's OUTPUT (FRONT) terminals to the INPUT terminals on the front-channel amplifier.
4-CHANNEL OUTPUT (BACK) terminals: Connect the unit's OUTPUT (BACK) terminals with the TAPE PLAY terminals on the back-channel amplifier. If the back-channel amplifier is a simple power amplifier, connect the unit's OUTPUT (BACK) terminals to its INPUT terminals.

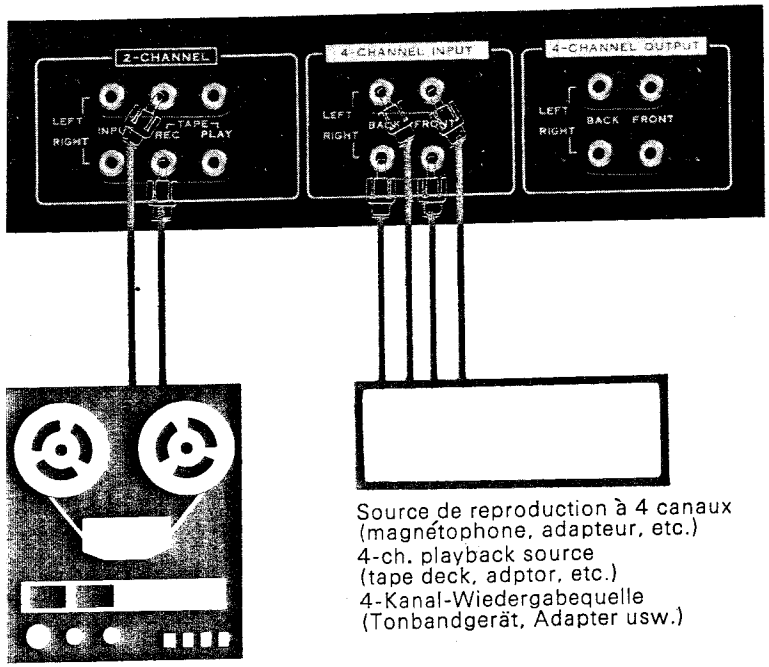
NOTE: It is possible, of course, to connect and use this unit with commercially-available 4-channel receivers or amplifiers. Such equipment usually offers "2-channel out" and "4-channel in" terminals for such connections. However, it is recommended that such equipment be used only if it is capable of delivering reasonably high power output, a maximum of inter-channel separation, and frequency response, distortion characteristics and other performance factors in keeping with high fidelity standards.

Anschlußklemmen

2-Kanal-Eingangsklemmen (INPUT): Verbinden Sie diese Eingangsklemmen (INPUT) mit den Klemmen für Tonbandaufnahme (TAPE REC) am Verstärker für die vorderen Kanäle.
Wenn Ihr Plattenspieler, Tuner usw. am Verstärker für die hinteren Kanäle angeschlossen sind, so verbinden Sie die Eingangsklemmen (INPUT) des Gerätes mit den Klemmen für Tonbandaufnahme (TAPE REC) des Verstärkers für die hinteren Kanäle. Wenn der Verstärker für die hinteren Kanäle Anschlüsse für einen 4-Kanal-Adapter hat, so verbinden Sie die Eingangsklemmem (INPUT) des Gerätes mit den Ausgangsklemmen (OUTPUT) des Verstärkers für die hinteren Kanäle.
4-Kanal- Ausgangsklemmen vorn (OUTPUT FRONT): Verbinden Sie die Ausgangsklemmen (OUTPUT) des Gerätes mit den Klemmen für Tonbandaufnahme (TAPE REC) des Verstärkers für die vorderen Kanäle. Wenn der Verstärker für die vorderen Kanäle Anschlüsse für einen 4-Kanal-Adapter hat, so verbinden Sie die vorderen Ausgangsklemmen (OUTPUT FRONT) des Gerätes mit den Eingangsklemmen (INPUT) des Verstärkers für die vorderen Kanäle.
4-Kanal-Ausgangsklemmen hinten (OUTPUT BACK): Verbinden Sie die hinteren Ausgangsklemmen (OUTPUT BACK) des Gerätes mit den Klemmen für Tonbandaufnahme (TAPE REC) des Verstärkers für die hinteren Kanäle. Wenn der Verstärker für die hinteren Kanäle ein einfacher Leistungsverstärker ist, so verbinden Sie die hinteren Ausgangsklemmen (OUTPUT BACK) des Gerätes mit seinen Eingangsklemmen (INPUT).

Hinweis: Es ist natürlich möglich, dieses Gerät im Anschluß an handelsübliche 4-Kanal-Empfänger oder Verstärker zu verwenden. Solche Ausrüstung hat normalerweise 4-Kanal-Eingangs- und Ausgangsklemmen (4-Kanal-in und out) für solche Verbindungen. Es wird jedoch empfohlen, daß solche Ausrüstung nur verwendet wird, wenn sie in der Lage ist, ausreichend hohe Leistungsabgabe, maximale Kanaltrennung und Frequenzgang, Verzerrungscharakteristiken und andere Betriebsfaktoren entsprechend der HiFi-Norm zu liefern.

CONNEXION D'AUTRES APPAREILS
CONNECTING OTHER EQUIPMENTS
ANSCHLUSS ANDERER AUSRÜSTUNG



Source de reproduction à 4 canaux (magnétophone, adapteur, etc.)
4-ch. playback source (tape deck, adptor, etc.)
4-Kanal-Wiedergabequelle (Tonbandgerät, Adapter usw.)

Lorsqu'on désire connecter un tourne-disque, tuner, etc., le connecter à l'amplificateur de canal avant.
When you wish to connect a turntable, tuner, etc., connect it to the front-channel amplifier.
Wenn Sie einen Plattenspieler, Tuner usw. anschließen wollen, schließen Sie ihn an den Verstärker für die vorderen Kanäle an.

Bornes de connexion:

Bornes d'enregistrement/reproduction (TAPE REC/PLAY): Ces bornes ont exactement les mêmes spécifications et fonctions que celles trouvées dans les emplificateurs conventionnels. Elles sont prévues sur votre appareil, étant donné que la connexion á 4 canaux requiert l'emploi des bornes d'enregistrement/reproduction (TAPE REC/PLAY) sur les amplificateurs pour les canaux supplémentaires. Ainsi, vous pouvez continuer à utilister votre magnétophone (s'il y a lieu) même quand les bornes d'enregistrement/reproduction (TAPE REC/PLAY) de votre amplificateur sont occupées.
De même, vous pouvez connecter à ces bornes de reproduction (TAPE PLAY) sur l'appareil, toute source de programme telle qu'un tuner, un lecteur de cassette et la plupart des autres appareils qui se raccordent normalement aux bornes AUX et qui présentent une tension de sortie de moins de 100 mV.
Bornes d'entrée à 4 canaux (4-CHANNEL INPUT): Connecter les bornes d'entrée (INPUT) de l'appareil à une source de programme à 4 canaux telle qu'un magnétophone à 4 canaux discret, un décodeur SQ ou un démodulateur CD-4.

- Il se peut que vos amplificateurs aient une prise d'enregistrement/reproduction DIN (DIN REC/PLAY) en paralléle avec les prises jacks à plot d'enregistrement/reproduction (TAPE REC/PLAY). Si l'on utilise les prise jacks d'enregistrement/reproduction (REC/PLAY), ne jamais employer la prise DIN.

Connection terminals

TAPE REC/PLAY terminals: These terminals have exactly the same specifications and functions as those found on conventional amplifiers. They are provided with your unit, since 4-channel connection requires use of the TAPE REC/PLAY terminals on the amplifiers for added channels. Thus you can continue to use your tape deck (if any) even when the TAPE REC/PLAY terminals on your amplifiers are occupied. Also, to these TAPE PLAY terminals on the unit can you connect any playback program source such as a tuner, tape player and most of any other equipments that can be connected to usual AUX terminals and which have an output voltage of less than 100mV.

4-CHANNEL INPUT terminals: Connect the unit's INPUT terminals to a 4-channel program source such as a discrete 4-channel tape deck, SQ decoder or CD-4 demodulator.

- Your amplifiers may have a DIN REC/PLAY socket in parallel with the pin-plug TAPE REC/PLAY jacks. When the TAPE REC/PLAY jacks are used, never use the DIN socket.

Anschlußklemmen

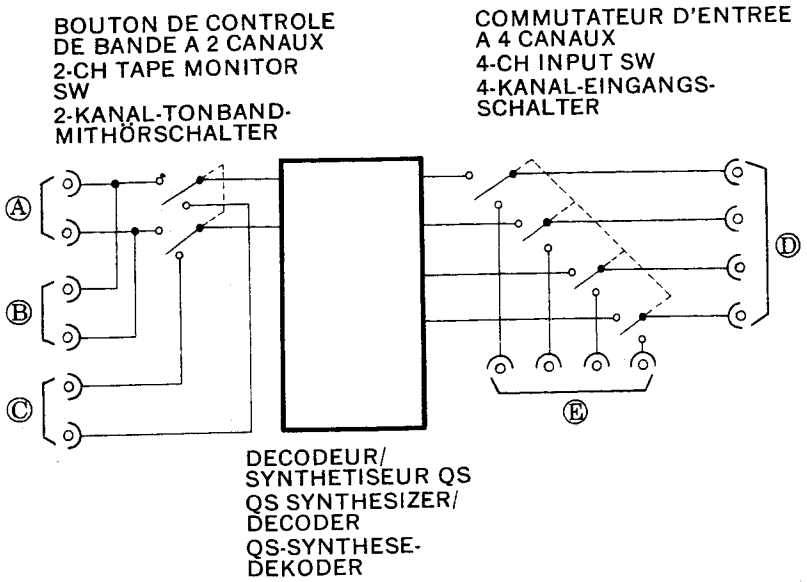
Tonbandaufnahme- und -wiedergabeklemmen (TAPE REC/PLAY): Diese Klemmen haben genau die gleichen Eigenschaften und Funktionen wie an herkömmlichen Verstärkern. Sie sind an Ihrem Gerät vorhanden, da 4-Kanal-Anschluß die Verwendung der Tonbandaufnahme- und -wiedergabeklemmen (TAPE REC/PLAY) für zusätzliche Kanäle erfordert. Sie können deshalb Ihr Tonbandgerät (falls vorhanden) weiterhin verwenden, obwohl die Tonbandaufnahme- und -wiedergabeklemmen Ihrer Verstärker belegt sind. An die Tonbandwiedergabeklemmen (TAPE PLAY) des Gerätes können Sie auch andere Programmquellen, z.B. Tuner, Kassettentonbandgerät usw., anschließen, die normalerweise an die AUX-Klemmen angeschlossen werden und eine Ausgangsspannung unter 100 mV haben.

4-Kanal-Eingangsklemmen (INPUT): Verbinden Sie die Eingangsklemmen (INPUT) des Gerätes mit einer 4-Kanal-Programmquelle wie diskretes 4-Kanal-Tonbandgerät, SQ-Dekoder oder CD-4 Demodulator.

- Ihre Verstärker können DIN-Buchsen (DIN REC/PLAY) parallel zu den Stiftbuchsen TAPE REC/PLAY haben. Verwenden Sie die DIN-Buchse nie zusammen mit den Stiftbuchsen TAPE REC/PLAY.

PROCESSUS DE REGLAGE (1)
OPERATING PROCEDURES (1)
BEDIENUNGSVERFAHREN (1)

Commutateurs et bornes
Switches vs. Terminals
Schalter und Klemmen



Ⓐ ENTREE A CANAUX
2-CHANNEL INPUT
2-KANAL-EINGANG

Ⓑ ENREGISTREMENT
TAPE REC
TONBANDAUFNAHME

Ⓒ REPRODUCTION
TAPE PLAY
TONBANDWIEDERGABE

Ⓓ SORTIE 4 CANAUX
4-CHANNEL OUTPUT
4-KANAL-AUSGANG

Ⓔ ENTREE 4 CANAUX
4-CHANNEL INPUT
4-KANAL-EINGANG

1. Alimentation

01 Bouton interrupteur (POWER)

Relever le levier pour mettre l'appareil sous tension; la lampe témoin au-dessus s'allumera.

2. Sélection de la source de programme

02 Commutateur d'entrée à 4 canaux (4 CH INPUT)

03 Commutateur de contrôle de bande à 2 canaux (2 CH TAPE MONITOR)

Si l'on se sert d'un magnétophone à 4 canaux discret ou d'un adapteur à 4 canaux connecté aux bornes d'entrée à 4 canaux du panneau arrière de l'appareil (4-CHANNEL INPUT), appuyer sur le commutateur commutateur d'entrée 4 canaux (4-CH INPUT).
Si l'on se sert d'un magnétophone à 2 canaux pour la reproduction ou le contrôle de bande et connecté aux bornes d'enregistrement/reproduction à 2 canaux (2-CHANNEL TAPE REC/PLAY) sur le panneau arrière, appuyer sur le commutateur de contrôle de bande à 2 canaux (2-CH TAPE MONITOR). Vous pouvez contrôler les signaux tels qu'ils sont enregistrés si le magnétophone connecté est du type à 3 têtes (effacement/enregistrement/reproduction). Si votre magnétophone est du type à 2 têtes, ne pas appuyer sur ce bouton tandis qu'on enregistre, étant donné que vous pouvez contrôler les signaux juste enregistrés.

- Le circuit est disposé de façon telle que les signaux passant par les bornes d'entrée à 4 canaux (4-CHANNEL INPUT) ne sont pas envoyés au circuit décodeur synthétiseur QS de l'appareil. Par conséquent, si vous avez un magnétophone à 4 canaux et si vous désirez obtenir une sonorité à 4 canaux synthétisée à partir d'une bande à 2 canaux reproduite dessus, connectez les cordons des canaux avant du magnétophone aux bornes de reproduction à 2 canaux (2-CHANNEL TAPE PLAY) de l'appareil ou les bornes AUX ou de reproduction (TAPE PLAY) situées sur l'amplificateur de canal avant.

1. Power

01 POWER Switch

Raise the lever to turn the unit on; the power indicator light above it will be illuminated.

2. Selecting program source

02 4-CH INPUT Switch
03 2-CH TAPE MONITOR Switch

When you play a discrete 4-channel tape deck or a 4-channel adaptor connected to the unit's rear-panel 4-CHANNEL INPUT terminals, push the 4-CH INPUT switch.
When you play or monitor a 2-channel tape deck connected to the rear-panel 2-CHANNEL TAPE REC/PLAY terminals, push the 2-CH TAPE MONITOR switch. You can monitor the signals as they are recorded if the connected tape deck is of the 3-head (erase/record/play) type. When your tape deck is of a 2-head type, do not push this button while recording, since you can not monitor the signals just recorded.

- The circuits is so arranged that the signals through the 4-CHANNEL INPUT terminals are not channeled to the QS Synthesizer Decoder circuit of the unit. Therefore, when you have a 4-channel tape deck and if you want to derive synthesized 4-channel sound from a 2-channel tape played on it, connect the deck's front-channel cords to the 2-CHANNEL TAPE PLAY terminals of the unit or to the TAPE PLAY or AUX terminals on the front-channel amplifier.

1. Stromversorgung

01 Netzschalter (POWER)

Stellen Sie den Hebel zum Einschalten des Gerätes nach oben; die Signallampe darüber leuchtet dann auf.

2. Wahl der Programmquelle

02 4-Kanal-Eingangsschalter (4-CH INPUT)
03 2-Kanal-Tonbandmithörschalter (2-CH TAPE MONITOR)

Wenn Sie ein diskretes 4-Kanal-Tonbandgerät oder einen 4-Kanal-Adapter, angeschlossen an den 4-Kanal-Eingangsklemmen (INPUT) auf der Geräterückseite, wiedergeben wollen, so drücken Sie den 4-Kanal-Eingangsschalter (4-CH INPUT).
Drücken Sie den 2-Kanal-Tonbandmithörschalter (2-CH TAPE MONITOR), wenn Sie ein an die 2-Kanal-Tonbandaufnahme- und -wiedergabeklemmen auf der Geräterückseite angeschlossenes 2-Kanal-Tonbandgerät abspielen oder mithören wollen. Sie können die Aufnahmesignale mithören, wenn das angeschlossene Tonbandgerät 3 Tonköpfe (Löschen, Aufnahme, Wiedergabe) hat. Wenn Ihr Tonbandgerät nur zwei Tonköpfe hat, so drücken Sie diese Taste nicht bei der Aufnahme, da Sie die Aufnahmesignale nicht mithören können.

- Der Stromkreis ist so angeordnet, daß die Signale durch die 4-Kanal-Eingangsklemmen (INPUT) nicht zum QS-Synthese-dekoder-Stromkreis des Gerätes geleitet werden. Wenn Sie ein 4-Kanal-Tonbandgerät haben und von einem darauf abgespielten 2-Kanal-Tonband synthesierten 4-Kanal-Ton erhalten wollen, sollten Sie deshalb die Anschlußkabel für die vorderen Kanäle des Tonbandgerätes an die 2-Kanal-Tonbandwiedergabeklemmen (2-CH TAPE PLAY) des Gerätes oder an die Tonbandwiedergabe- (TAPE PLAY) oder AUX-Klemmen des Verstärkers für die vorderen Kanäle anschließen.

3. Fonctionnement et identification du canal

Avant de metre en marche votre appareil, il convient de procéder à l'identification des 4 canaux, c'est-à-dire, doive s'assurer que les signaux qu'il faut sortent bien des haut-parieurs correspondants. Evidemment, on doit d'abord se familiariser avec les amplificateurs. La méthode préconisée ci-dessous est basée sur la supposition que vous avez connecté les sources de programme (tourne-disque, tuner, etc.) á l'amplificateur du canal avant. Par conséquent, dans le cas où vous les ayez connectées à l'amplificateur de canal arrière, il conviendra de prendre l'indication "avant" pour "arrière" et vice-versa.

Fonctionnement du QSD-1:

1. Appuyer sur la position d'ambiance synthétiseur QS (QS SYNTHESIZER SURROUND) des commutateurs de fonction (FUNCTION) 04.
2. Tourner le réglage de niveau 05 (LEVEL) à fond dans le sens des aiguilles d'une montre.
3. Régler le bouton d'équilibrage 06 (BALANCE) sur la position centrale.
4. Régler le bouton de volume 07 (VOLUME) sur la graduation centrale, indiquée par "5".
5. S'assurer que les commutateur d'entrée 4 canaux 02 (4 CH INPUT) et de contrôle de bande à 2 canaux 03 (2 CH TAPE MONITOR) soient en position saillante. Sinon, les tirer.

Fonctionnement de l'amplificateur de canal avant:

1. Faire fonctionner l'amplificateur de canal avant et choisir les sources de programme (disques, émissions FM, etc.) grâce à son commutateur de fonction (FUNCTION).
2. Régler le bouton de contrôle de bande (TAPE MONITOR) de l'amplificateur sur "ON" (marche). Quand un adapteur á 4 canaux est connecté à cet appareil, placer le bouton correspondant sur IN (en circuit).
3. Ajuster le bouton de volume de l'amplificateur afin d'obtenir le niveau sonore approprié aux haut-parleurs avant.

3. Operation and channel identification

Before operating your unit, you must undertake 4-channel identification, that is, you have to check that the proper signals come from the corresponding speaker systems. Of course, you must first be familiar with your amplifiers. The below-mentioned procedure is based on an assumption that you have connected the program sources (turntable, tuner, etc.) to the front-channel amplifier. Therefore, in case they are connected to the back-channel amplifier, read the word "front" for "back" and vice versa.

Operation of the QSD-1

1. Push the QS SYNTHESIZER SURROUND position of the FUNCTION switches 04.
2. Turn the LEVEL control 05 fully clockwise.
3. Set the BALANCE control 06 at its center position.
4. Set the VOLUME control 07 at its center calibration, indicated "5."
5. Check that the 4-CH INPUT 02 and 2-CH TAPE MONITOR 03 switches are protruding. If they are not, push them to set them OUT.

Operation of the front-channel amplifier

1. Operate the front-channel amplifier and select the program sources (records, FM broadcasts, etc.) by its function switch.
2. Set the amplifier's tape monitor switch ON. When a 4-channel adaptor is connected to this unit, set the corresponding switch IN.
3. Adjust the amplifier's volume control to obtain an appropriate sound level from the front speaker systems.

3. Betrieb und Kanalidentifizierung

Bevor Sie Ihr Gerät betreiben, müssen Sie 4-Kanal-Idenfizierung durchführen, d.h. Sie müssen überprüfen, daß die richtigen Signale aus den entsprechenden Lautsprecheranlagen kommen. Sie müssen natürlich zuerst mit Ihren Verstärkern vertraut sein. Das nachfolgend beschriebene Verfahren basiert auf der Annahme, daß Sie Ihre Programmquellen (Plattenspieler, Tuner usw.) am Verstärker für die vorderen Kanäle angeschlossen haben. Wenn Sie sie am Verstärker für die hinteren Kanäle angeschlossen haben, so vertauschen Sie beim Lesen die Worte "vorderer" und "hinterer".

Betrieb des Gerätes

1. Drücken Sie die Taste QS SYNTHESIZER SURROUND der Funktionstasten (FUNCTION) 04.
2. Drehen Sie den Pegelregler 05 (LEVEL) ganz nach rechts.
3. Stellen Sie den Balanceregler 06 (BALANCE) in seine Mittelstellung.
4. Stellen Sie den Lautstärkeregler 07 (VOLUME) in seine mit "5" markierte Mittelstellung.
5. Überprüfen Sie, daß die Tasten 4-CH INPUT 02 und 2-CH TAPE MONITOR 03 nicht gedrückt sind. Falls dies der Fall ist, bringen Sie sie durch erneuten Druck in die Ausgangsstellung zurück.

Betrieb des Verstärkers für die vorderen Kanäle

1. Betreiben Sie den Verstärker für die vorderen Kanäle und wählen Sie die Programmquelle (Schallplatten, UKW usw.) mit seinem Funktionsschalter.
2. Schalten Sie den Tonbandmithörschalter des Verstärkers ein. Wenn ein 4-Kanal-Adapter an dieses Gerät angeschlossen ist, so schalten Sie den entsprechenden Schalter ein.
3. Stellen Sie den Lautstärkeregler des Verstärkers für angemessene Lautstärke der vorderen Lautsprecheranlagen ein.

PROCESSUS DE REGLAGE (3)
OPERATING PROCEDURES (3)
BEDIENUNGSVERFAHREN (3)

Fonctionnement de l'amplificateur de canal arrière:

1. Mettre le bouton de contrôle de bande (TAPE MONITOR) de l'amplificateur de canal arrière sur ON (marche). Si l'on utilise non pas un préampli ou un ampli principal mais un amplificateur de puissance, il est inutile d'opérer ainsi.
2. Ajuster le bouton de volume de l'amplificateur afin d'obtenir le niveau sonore approprié aux haut-parleurs arrière.

Identification de canal:

1. S'assurer que chacun des quatre haut-parleurs diffuse.
2. Tourner à fond dans le sens contraire des aiguilles d'une montre le bouton d'équilibrage (BALANCE) de l'appareil puis vérifier que seulement les haut-parleurs gauche avant et arrière produisent un son. Ensuite, le remettre à fond dans l'autre sens et vérifier que seulement les haut-parleurs droit avant et arrière produisent un son.
3. Si les haut-parleurs voulus ne diffusent pas en procédant comme ci-dessus, contrôler les cordons de connexion et réparer au besoin pour obtenir les résultats escomptés.
4. Enfin, manoeuvrer le bouton de volume 07 (VOLUME) à friction en s'assurant que le niveau sonore des haut-parleurs avant et arrière varie en fonction de l'angle de rotation du bouton de réglage. Si le niveau des haut-parleurs avant seulement ne varie pas, la cause peut être que l'on n'a pas réglé le bouton de contrôle de bande (TAPE MONITOR) de l'amplificateur de canal avant sur ON (marche).

Operation of the back-channel amplifier

1. Set the back-channel amplifier's tape monitor switch ON. If a power, not a pre/main, amplifier is used, you need not follow this step.
2. Adjust the amplifier's volume control to obtain an appropriate sound level from the back speakers.

Channel idenfitication

1. Check that each of four speaker systems is producing sounds.
2. Turn the BALANCE control on the unit fully counterclockwise and check that only the left front and back speakers are producing sounds. Then turn it fully clockwise and check that the only right front and back speakers are producing sounds.
3. If the sounds do not come from the corresponding speakers as written above, check the connection cords and re-connect for correct results.
4. Then, operate the friction-coupled VOLUME control 07 and check the volume level of the front speakers and back speakers change in proportion to the angle you turn the control. When the level of only the front speakers do not change, the cause may be that you have not set the tape monitor siwtch on the front-channel amplifier ON.

Betrieb des Verstärkers für die hinteren Kanäle

1. Schalten Sie den Tonbandmithörschalter des Verstärkers für die hinteren Kanäle ein. Wenn nicht ein Vor-/Hauptverstärker, sondern ein Leistungsverstärker verwendet wird, brauchen Sie diesen Schritt nicht zu befolgen.
2. Stellen Sie den Lautstärkeregler des Verstärkers für angemessene Lautstärke der hinteren Lautsprecheranlagen ein.

Kanalidentifizierung

1. Überprüfen Sie, daß alle vier Lautsprecheranlagen Töne wiedergeben.
2. Drehen Sie den Balanceregler (BALANCE) des Gerätes ganz nach links und überprüfen Sie, daß nur die linken Lautsprecher vorn und hinten Töne wiedergeben. Drehen Sie ihn dann ganz nach rechts und überprüfen Sie, daß nun nur die rechten Lautsprecher vorn und hinten Töne wiedergeben.
3. Wenn die Töne nicht von den entsprechenden oben angegebenen Lautsprechern kommen, so überprüfen Sie die Anschlußkabel und ändern Sie die Anschlüsse für korrekte Ergebnisse.
4. Betätigen Sie dann den reibungsgekuppelten Lautstärkeregler 07 (VOLUME) und überprüfen Sie, daß der Lautstärkepegel von den vorderen und hinteren Lautsprechern sich proportional zur Drehung des Reglers ändert. Wenn sich nur der Pegel der vorderen Lautsprecher nicht ändert, kann dies daran liegen, daß Sie den Tonbandmithörschalter des Verstärkers für die vorderen Kanäle nicht eingeschaltet haben.

Commutateure de fonction (FUNCTION)
FUNCTION switches
Funktionstasten

Type de programme Type of Program Programmtyp	Mode de reproduction Reproduction Mode Wiedergabeart	Appuyer sur commutateur de fonction (FUNCTION SWITCH) Push FUNCTION Switch: Drücken Sie Funktionstaste (FUNCTION):
Mono Mono Mono	Mono Mono Mono	2 canaux 2-CH 2-CH
	2 canaux 2-channel 2-Kanal	2 canaux 2-CH 2-CH
2 canaux stéréo 2-channel stereo 2-Kanal-Stereo	4 canaux (conversion de 2 canaux à 4 canaux) 4-channel (2-channel to 4-channel conversion) 4-Kanal (Umwandlung von 2-Kanal auf 4-Kanal)	Synthétiseur QS Concert (HALL) ou ambiance (SURROUND) QS SYNTHESIZER (HALL or SURROUND) QS SYNTHESIZER (HALL oder SURROUND)
QS et autre matrice encodée à 4 canaux QS and other matrix encoded 4-channel QS und anderes matrix-verkodetes 4-Kanal-Material	4 canaux 4-channel 4-Kanal	QS QS QS

4. Rapports entre le système à 2 canaux et à 4 canaux

04 Commutateur de fonction (FUNCTION)

Ces boutons sur votre appareil servent à sélectionner le mode de reproduction sonore convenant le mieux pour la source de programme à 2 canaux ou à 4 canaux:

2 canaux: (2-CH): Pour écouter des sources de programme stéréo à 2 canaux en stéréo à 2 canaux, en utilisant vos deux haut-parleurs avant seulement. Employez également ce commutateur pour écouter des émissions mono FM et AM, des disques et bandes magnétiques mono. Le synthétiseur QS incorporé convertit les signaux à 2 canaux en 4 canaux, mais ne fonctionne pas avec les signaux mono.

Synthétiseur QS (QS SYNTHESIZER): Pour convertir (synthétiser) les sources de programme stéréo conventionnelles à 2 canaux en sonorité à 4 canaux. Le synthétiseur QS incorporé fonctionne aux modes concert (HALL) ou d'ambiance (SURROUND).

Concert (HALL): Utiliser ce mode pour les sources de programmes dans lesquelles les instruments musicaux et les chanteurs donnent les meilleurs résultats étant ensemble à l'avant, avec un effet de salle de concert sur les côtés et à l'arrière de la chambre d'écoute. Le synthétiseur QS reconstruira acoustiquement ce genre de sonorité à 4 canaux à effet direct plus ambiance.

Ambiance (SURROUND): Pour les sources de programme qui semblent efficaces quand les instruments musicaux sont disposés autour de soi, donnant l'impression que l'on participe soi-même à la représentation musicale comme chef-d'orchestre ou comme musicien.

QS: Pour décoder et reproduire des sources de programme à 4 canaux (disques, bandes et émissions) encodées dans un format à 2 canaux avec systèmes QS et autres systèmes à matrice régulière. Le circuit QS à vario-matrice sera mis entièrement à profit et permettra d'obtenir une reproduction sonore à 4 canaux authentique à partir de sources convenablement encodées à matrice.

- Les quatre commutateurs de fonction (FUNCTION) à bouton poussoir sont exclusifs les uns des autres. En appuyant bouton préalablement enfoncé. Il ne faut pas appuyer sur deux ou plusieurs boutons à la fois.

4. 2-channel vs. 4-channel

04 FUNCTION Switches

Use these switches on your unit to select the sound reproduction mode most appropriate for your 2-channel or 4-channel program source:

2-CH: To hear 2-channel stereo program sources in 2-channel stereo, using your two front speakers only. Use this switch also to hear AM and FM mono broadcasts, mono records and tapes. The built-in QS Synthesizer covers 2-channel signals to 4-channel, but does not work with mono signals, of course.

QS SYNTHESIZER: To convert (synthesize) conventional 2-channel stereo program sources to 4-channel sound. The built-in QS Synthesizer operates in HALL or SURROUND modes.

HALL: Use this mode for program sources in which the musical instruments and the singers sound best when gathered in the front, with concert-hall-like ambience from the sides and back of your listening room. The QS Synthesizer will acoustically re-construct this type of direct-plus-ambience 4-channel sound field.

SURROUND: For program sources which sound effective when the musical instruments are arranged around you, making you feel as if you were participating in the performance as a conductor or player.

QS: To decode and reproduce 4-channel program sources (records, tapes and broadcasts) encoded into a 2-channel format with the QS and other regular matrix systems. The QS vario-matrix circuit will be put to full use and accomplish authentic 4-channel sound reproduction from properly encoded matrix sources.

- The four push-button FUNCTION switches are exclusive of each other. Pushing any one button will cause any other, previously pushed, button to disengage. Do not push two or more buttons at the same time.

4. 2-Kanal oder 4-Kanal

04 Funktionstasten

Verwenden Sie diese Tasten an Ihrem Gerät zur Wahl der Tonwiedergabeart, die am besten für Ihre 2-Kanal oder 4-Kanal-Programmquelle geeignet ist:

2-CH: Zum Hören von 2-Kanal-Stereoprogrammquellen in 2-Kanal-Stereo nur über die beiden vorderen Lautsprecher. Verwenden Sie diese Taste auch zum Hören von monauralen Radiosendungen, Schallplatten und Tonbändern. Der eingebaute QS-Synthesedekoder wandelt 2-Kanal-Signale in 4-Kanal-Signale um, arbeitet aber nicht mit Monosignalen.

QS-SYNTHESEDEKODER (SYNTHESIZER): Zur Umwandlung konventioneller 2-Kanal-Stereoprogramme in 4-Kanal-Ton. Der eingebaute QS-Synthesedekoder hat zwei Betriebsarten, HALL und SURROUND.

HALL: Verwenden Sie diese Betriebsart für Programmquellen, bei denen die Musikinstrumente und Sänger am besten klingen, wenn sie zusammen vorn sind, mit Klang wie in einer Konzerthalle von den Seitenwänden und der Rückwand Ihres Zimmers. Der QS-Synthesedekoder rekonstruiert diese Art 4-Kanal-Tonfeld von direktem und reflektiertem Ton.

SURROUND: Fur Programmquellen, die am besten klingen, wenn die Musikinstrumente um Sie herum angeordnet zu sein scheinen und Ihnen das Gefühl geben, als Dirigent oder Spieler an der Aufführung teilzunehmen.

QS: Zur Entschlüsselung und Widergabe von 4-Kanal-Programmquellen (Schallplatten, Tonbänder und Radiosendungen), die durch QS oder ein anderes Normalmatrixsystem in ein 2-Kanal-Format verschlüsselt sind. Der QS-Variomatrix-Stromkreis wird vollständing verwendet und sorgt für authentische 4-Kanal-Tonwiedergabe von richtig verschlüsselten Matrixquellen.

- Die vier Funktionsdrucktasten schließen einander aus. Durch Druck auf eine Taste kehren die anderen Tasten in die Normalstellung zurück. Drücken Sie nie zwei oder mehr Tasten gleichzeitig.

5. Réglage du niveau-d'entrée

05 Bouton de niveau (LEVEL)

Normalement, ce bouton doit être tourné à fond dans le sens des aiguilles d'une montre pour profiter au maximum du décodeur synthétiseur QS incorporé. Cependant, si le niveau excessivement élevé des signaux d'entrée depuis, par exemple un magnétophone avec une tension de sortie anormalement élevée, produit la distorsion des sons reproduits, tourner progressivement le bouton dans le sens contraire des aiguilles d'une montre jusqu'à ce que l'on n'entende plus de sons déformés.

6. Réglages de volume/équilibrage (VOLUME/BALANCE)

Ajuster le volume et l'équilibrage entre canaux seulement après avoir réglé le niveau du signal d'entrée comme il a été expliqué ci-dessus. Sinon, le son risque de ne pas être diffusé même si l'on tourne le bouton de volume dans le sens des aiguilles d'une montre, ou bien le son peut être déformé par suite des signaux à niveau excessivement élevé.

06 Bouton d'équilibrage (BALANCE)
07 Bouton de volume (VOLUME)

L'équilibrage gauche-droit se réalise au moyen du bouton d'équilibrage (BALANCE). Le son aux deux haut-parleurs gauche augmentera à mesure que l'on tourne le bouton dans le sens contraire des aiguilles d'une montre à partir de la position centrale, le son aux haut-parleurs droit augmentera à mesure que l'on tourne le bouton dans le sens des aiguiles d'une montre. L'équilibrage gauche-droit soit des canaux avant ou des canaux arrière doit être obtenu en ajustant le bouton d'équilibrage sur l'amplificateur de canal avant ou de canal arrière. Néanmoins, si l'amplificateur du canal arrière ne comporte pas de réglage pour l'équilibrage gauche-droit, it faudra d'abord ajuster l'équilibrage (BALANCE) sur cet appareil et ensuite ajuster l'équilibrage gauche-droit entre les canaux avant avec le bouton d'équilibrage (BALANCE) sur l'amplificateur de canal avant.

5. Input level adjustment

05 LEVEL Control

Normally, this control should be turned fully clockwise to take maximum advantage of the incorporated QS Synthesizer Decoder. If, however, the excessively high level of input signals from, say, a tape deck with an unusually high output voltage, causes distortion in reproduced sounds, turn the control gradually counterclockwise until you hear undistorted sounds.

6. Volume/balance adjustments

Adjust the volume and inter-channel balance only after you have adjusted the input signal level as instructed above. Otherwide, sound may fail to come out even if you turn the volume control clockwise, or the sound may be distorted due to excessively high-level signals.

06 BALANCE Control
07 VOLUME Control

The left-right balance is achieved by adjusting the BALANCE control. The sound from two left speakers grows louder as you turn the control counterclockwise from the center position; the sound from the right speakers grows louder as you turn the control clockwise. The left-right balance of either the front channels or back channels should be achieved by adjusting the balance control on the front-channel or back-channel amplifier. If, on the other hand, the back-channel amplifier has no provisions for adjusting the left-right balance, first adjust the left-right balance between the back channels with the BALANCE control on this unit and then adjust the left-right balance between the front channels with the balance control on the front-channel amplifier.
The overall volume adjustment and the front-back balance is achieved by the VOLUME control. The inner knob part of the control adjusts the front-channel volume, while the outer ring part adjusts the back-channel volume. As you turn the knob, the ring also turns in proportion, thus controlling the overall volume. To adjust the front-channel volume only, turn the knob part with one hand while holding the ring part with the other. Do the opposite to adjust the back-channel

5. Eingangspegeljustierung

05 Pegelregler (LEVEL)

Normalerweise sollte dieser Regler ganz nach rechts gedreht werden, um den eingebauten QS-Synthesedekoder voll auzunutzen. Wenn jedoch der übermäßig hohe Pegel der Eingangssignale z.B. von einem Tonbandgerät mit ungewöhnlich hoher Ausgangsspannung Verzerrung des wiedergegebenen Tons verursacht, so drehen Sie den Regler langsam nach links, bis Sie unverzerrten Ton hören.

6. Einstellung von Lautstärke und Balance

Stellen Sie Lautstärke und Kanalbalance erst ein, nachdem Sie den Eingangssignalpegel wie oben beschrieben justiert haben, da es sonst möglich ist, daß kein Ton zu hören ist, selbst wenn Sie den Lautstärkeregler nach rechts drehen, oder der Ton kann durch übermäßig hohen Pegel der Signale verzerrt werden.

06 Balanceregler (BALANCE)
07 Lautstärkeregler (VOLUME)

Links-rechts-Balance wird durch Einstellen des Balancereglers (BALANCE) erreicht. Durch Drehen des Reglers aus der Mittelstellung nach links wird die Lautstärke der beiden linken Lautsprecher erhöht, durch Drehen nach rechts die der rechten Lautsprecher. Die Balance zwischen links und rechts für die vorderen oder die hinteren Kanäle sollte durch Einstellung des Balancereglers am Verstärker für die vorderen oder die hinteren Kanäle eingestellt werden. Wenn der Verstärker für die hinteren Kanäle jedoch keinen Balanceregler hat, so stellen Sie zuerst die Balance der hinteren Kanäle mit dem Balanceregler (BALANCE) dieses Gerätes ein und dann die Balance der vorderen Kanäle mit dem Balanceregler am Verstärker für die vorderen Kanäle.
Die Einstellung der gesamten Lautstärke und der Balance zwischen vorderen und hinteren Lautsprechern geschieht mit dem Lautstärkeregler (VOLUME). Der innere Knopf des Reglers regelt die Lautstärke der vorderen Kanäle, während der äußere Ring die Lautstärke der hinteren Kanäle regelt. Bei Drehung des Knopfes dreht sich der Ring entsprechend mit, wodurch die Gesamtlautstärke eingestellt wird.

PROCESSUS DE REGLAGE (6)
OPERATING PROCEDURES (6)
BEDIENUNGSVERFAHREN (6)

Le réglage du volume global et l'équilibrage avant-arrière s'obtient par le bouton de VOLUME. La partie interne du bouton de réglage ajuste le volume du canal avant, tandis que la partie externe sert à ajuster le volume du canal arrière. Quand on tourne le bouton, la bague externe tourne également dans les mêmes proportions, contrôlant ainsi le volume global. Pour ajuster seulement le volume de canal avant, tourner la partie interne d'une main tout en immobilisant la partie externe de l'autre main. Procéder à l'inverse pour ajuster seulement le volume du canal arrière. L'équilibrage avant-arrière peut être réalisé facilement en immobilisant la partie externe d'une main et en écoutant le son du canal arrière, on doit alors tourner la partie interne du bouton de l'autre main jusqu'à obtenir l'équilibrage du volume aux haut-parleurs de canal avant.

- La méthode normale pour l'écoute des 4 canaux est de s'asseoir à une position centrale équidistante des quatre haut-parleurs d'ambiance. Ce montage de haut-parleurs est appelé "disposition 2-2". Le réglage du volume global s'obtient simplement en réglant d'abord l'équilibrage gauche-droit entre les canaux avant et ensuite entre les canaux arrière séparément avant d'ajuster l'équilibrage avant-arrière. En principe, le bouton d'équilibrage (BALANCE) et le bouton de volume (VOLUME) (parties internes et externes) doivent être placés à leur position médiane. Cependant, au besoin, on pourra les régler au gré pour convenir à une disposition particulière des haut-parleurs, de la position d'écoute, de la nature des sources de programme reproduites, ou des préférences personnelles.

volume only. The front-back balance can be easily done if, holding the ring part with one hand and listening to the back-channel sounds, you turn the knob part with the other until you have the balanced volume from the front-channel speakers.

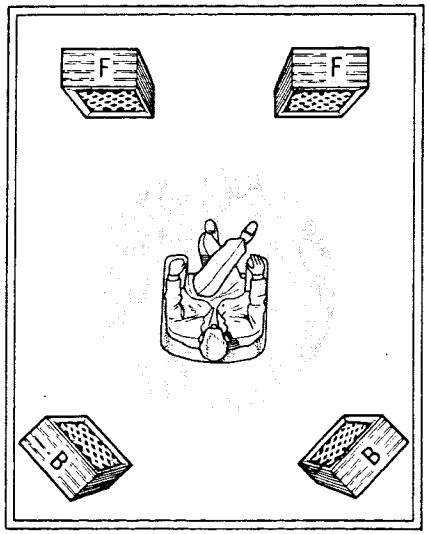
- The standard practice in listening to 4-channel is for you to sit at a center position equidistant from four surrounding speaker systems. This speaker set-up is called "2-2 arrangement." The overall volume adjustment is done simply if you first adjust the left-right balance between the front channels and then between the back channels separately before adjusting the front-back balance.
  Normally, the BALANCE control and the VOLUME control (the knob and ring parts) should be set to their center positions. If necessary, however, they should be adjusted to suit the particular arrangement of your speakers, your listening position, the nature of the program sources in play, or your personal preference.

Drehen Sie zur Einstellung nur der Lautstärke der vorderen Kanäle den Knopf mit einer Hand, während Sie den Ring mit der anderen Hand festhalten. Verfahren Sie für die Einstellung nur der Lautstärke der hinteren Kanäle entgegengesetzt. Die Einstellung der Balance zwischen vorderen und hinteren Kanälen kann leicht durchgeführt werden, wenn Sie den Ring mit einer Hand halten und den Knopf mit der anderen Hand drehen, bis die Balance hergestellt ist.

- Normalerweise sitzt man beim Hören von 4-Kanal-Musik in einer Mittelstellung mit gleichem Abstand von den vier umgebenden Lautsprecheranlagen. Diese Lautsprecheranordnung wird "2-2 Anordnung" genannt. Die Einstellung der Gesamtlautstärke geschieht einfach, wenn Sie zuerst die vorderen Kanäle ausbalancieren, dann die hinteren Kanäle, bevor Sie die Balance zwischen vorderen und hinteren Kanälen einstellen.
  Normalerweise sollten Balanceregler (BALANCE) und Lautstärkeregler (VOLUME) (Knopf und Ring) in der Mittelstellung stehen. Falls erforderlich sollten sie jedoch entsprechend der Anordnung Ihrer Lautsprecher, Ihrer Hörposition, der Art der abgespielten Programmquelle und Ihrem Geschmack eingestellt werden.

DISPOSITION DES HAUT-PARLEURS (1)
PLACEMENT OF SPEAKER SYSTEMS (1)
AUFSTELLUNG DER LAUTSPRECHERANLAGEN (1)

Système 2-2
2-2 System
2-2 System



Abréviations
Abbreviations
Abkürzungen

F : HAUT-PARLEURS AVANT	FRONT SPEAKERS	VORDERE LAUTSPRECHER
B : HAUT-PARLEURS ARRIERE	BACK SPEAKERS	HINTERE LAUTSPRECHER

L'emplacement des quatre haut-parleurs est un facteur très important pour profiter au mieux de la sonorité à 4 canaux. Trois systèmes de base de disposition sont décrits ci-après. Il convient de les essayer tous et de déterminer celui qui donne les meilleurs résultats suivant le genre de musique et l'agencement de la pièce d'écoute.

Système 2-2:

C'est la disposition des haut-parleurs la plus répandue. Deux haut-parleurs sont placés en face de soi et deux autres en arrière. Le système 2-2 comme il est expliqué plus haut vous place au milieu du champ sonore. Des variantes de cette disposition sont possibles et peuvent s'avérer bénéfiques si votre pièce d'écoute est de forme inhabituelle.

The placement of your four speaker systems is a very important consideration to enjoy 4-channel sound at its very best. Three basic placement systems will be described below. Experiment with them to determine the one that best suits the type of music or the layout of your room.

2-2 system

This is the most common speaker system placement. Two speakers are placed in front of you and two others behind. The 2-2 system as explained above puts you in the center of the sound field. Modifications of this arrangement are possible and may be preferred if your listening room is of an unusual shape.

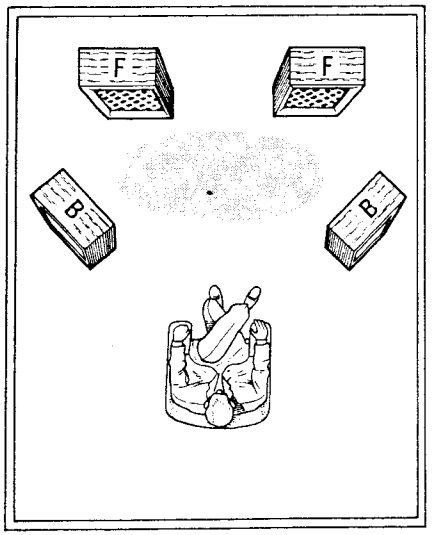
Die Aufstellung Ihrer vier Lautsprecheranlagen ist sehr wichtig für besten Genuß von 4-Kanal-Klang. Nachfolgend werden drei grundlegende Aufstellungssysteme beschrieben. Experimentieren Sie damit, um herauszufinden, welches System am besten zr Art der Musik oder zur Anordnung Ihres Zimmers paßt.

2-2 System

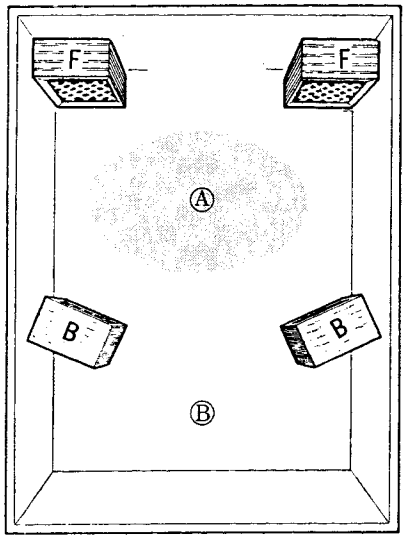
Dies ist die gewöhnlichste Anordnung der Lautsprecheranlagen. Zwei Lautsprecher stehen vor Ihnen und zwei hinter Ihnen. Dieses 2-2 System bringt Sie in das Zentrum des Tonfeldes. Änderungen dieser Anordnung sind möglich und können vorzuziehen sein, wenn Ihr Zimmer eine ungewöhnliche Form hat.

DISPOSITION DES HAUT-PARLEURS (2)
PLACEMENT OF SPEAKER SYSTEMS (2)
AUFSTELLUNG DER LAUTSPRECHERANLAGEN (2)

Système avant 2-2
Front 2-2 System
2-2 Frontsystem



Système compatible 2-2/avant 2-2
2-2/Front 2-2 Compatible System
Kombination von 2-2 System
und 2-2 Frontsystem



Abréviations
Abbreviations
Abkürzungen

F : HAUT-PARLEURS AVANT	FRONT SPEAKERS	VORDERE LAUTSPRECHER
B : HAUT-PARLEURS ARRIERE	BACK SPEAKERS	HINTERE LAUTSPRECHER

Système avant 2-2:

Dans cette disposition, les deux haut-parleurs arrière sont ramenés en avant de soi. Cela s'avère avantageux pour apprécier objectivement la musique.

Système compatible 2-2/avant 2-2:

Si votre pièce est profonde, vous pouvez disposer les haut-parleurs arrière comme illustré et obtenir un bon résultat. Pour former le système 2-2, se déplacer soi-même près du point (A); et pour profiter du système avant 2-2, s'asseoir près du point (B).

Front 2-2 system

In this system, the back two speakers are moved in front of you. This is good for objective appreciation of music.

2-2/front 2-2 compatible system

If your room is deep, you can place the back speaker systems as illustrated and enjoy both systems. To create the 2-2 system, move yourself near point (A); to enjoy the front 2-2 system, sit near point (B).

2-2 Frontsystem

Bei diesem System werden die beiden hinteren Lautsprecher vor Sie gebracht. Dies ist gut für objektive Schätzung von Musik.

Kombination von 2-2 System und 2-2 Frontsystem

Wenn Ihr Zimmer sehr tief ist, können Sie die hinteren Lautsprecher wie gezeigt aufstellen und beide Systeme genießen. Sitzen Sie für das 2-2 System in der Nähe von Punkt (A), für das 2-2 Frontsystem in der Nähe von Punkt (B).

SYSTEME QS A 4 CANAUX (1)
QS SYSTEM 4-CHANNEL (1)
QS 4-KANAL-SYSTEM (1)

Qu'est-ce qu'un système QS à 4 canaux?

Les ondes sonores sont infiniment complexes. Cela provient du fait que le "champ sonore" dans une salle de concert (ou autre place où le son est produit à la source) contiennent une quantité innombrable de "sons directs" et de "sons indirects". Théoriquement, cette infinité de sons peut être enregistrée et reproduite avec précision seulement par un nombre infini de canaux.

Cependant, les recherches dans ce domaine ont révélé qu'un champ sonore en direct peut être bien transmis avec précision et recréé avec seulement quatre canaux sonores, et les ingénieurs Sansui ont mis au point le système QS à 4 canaux basé sur ce principe.

Le système QS Sansui emmagasine ou transmet la musique à 4 canaux au moyen d'un équipement conventionnel à 2 canaux (disques stéréo, bandes magnétiques et émissions FM MPX), et quand on procède à la reproduction à l'aide de ces systèmes, on obtient un champ sonore à 4 canaux totalement dynamique. Si on procède à la reproduction à l'aide d'un équipement conventionnel stéréo à 2 canaux, on obtient une sonorité stéréo à 2 canaux absolument naturelle sans erreur ou perte dans le message musical. Et un autre avantage important s'ajoute c'est qu'il présente une possibilité spéciale de transformer la musique existante à 2 canaux en un champ sonore vibrant et coloré à 4 canaux grâce à l'effet "synthétisé" exploitant l'information cachée dans les rapports de phase à 2 canaux.

What is QS System 4-channel?

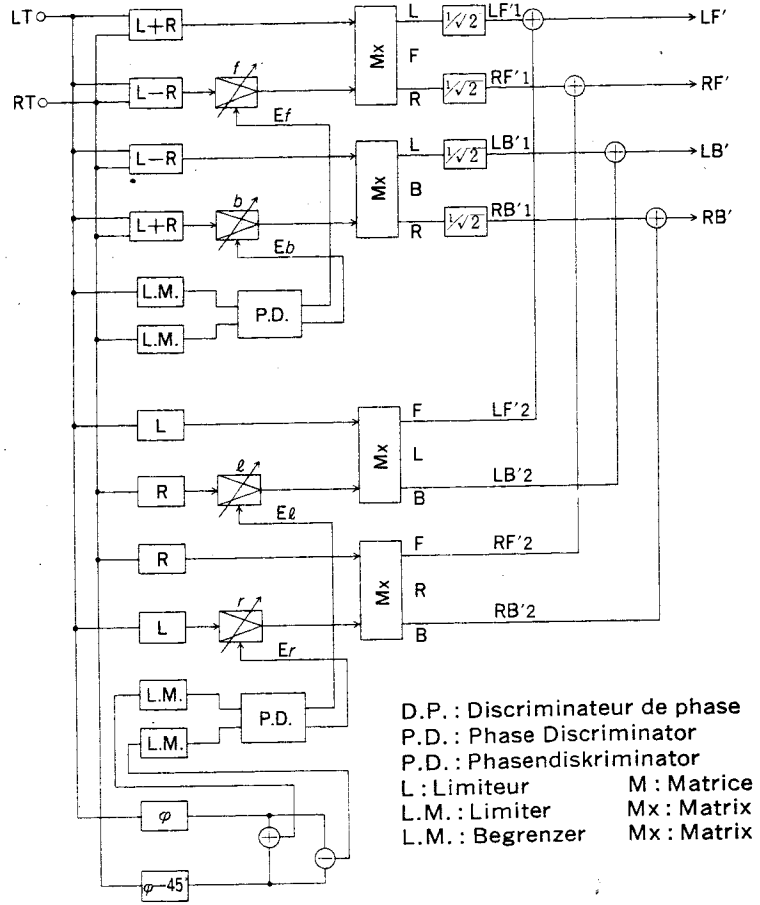
Sound waves are infinitely complex. This is because the "sound field" in a concert hall (or any other place where sound is actually produced) contains an innumerable number of "direct sounds" and "indirect sounds." Theoretically, these infinite sounds can be recorded and reproduced accurately only through an infinite number of channels.
Research on this subject, however, has revealed that a live sound field can be fairly accurately transmitted and recreated with only four channels of sound, and Sansui engineers has developed the QS 4-channel system on the basis of this fact.
The Sansui QS System stores or transmits 4-channel music by means of conventional 2-channel media (stereo records, tapes and FM MPX broadcasts), and when these media are played, reproduces a totally dynamic 4-channel sound field. If these media are played on conventional 2-channel stereo playback equipment, they provide completely natural 2-channel stereo sound without any error or loss of musical information. Still another important advantage is that it has a special capability to transform existing 2-channel music into a lively, vibrant 4-channel sound field with the "synthesized" effect exploiting hidden information in 2-channel phase relationships.

Das QS-4-Kanal-System

Schallwellen sind unendlich komplex. Dies liegt daran, daß das "Schallfeld" in einer Konzerthalle (oder an jedem anderen Platz, an dem Schall tatsächlich erzeugt wird) eine unendliche Anzahl "direkter" und "indirekter" Töne enthält. Theoretisch kann diese unendliche Anzahl von Tönen nur über eine unendliche Anzahl von Kanälen genau aufgenommen und wiedergegeben werden.
Forschung auf diesem Gebiet hat jedoch gezeigt, daß ein lebendiges Tonfeld ziemlich genau mit nur vier Tonkanälen übertragen und wiedergegeben werden kann, und die Ingenieure von Sansui haben auf dieser Basis das QS-4-Kanal-System entwickelt.
Das Sansui QS-System speichert und überträgt 4-Kanal-Musik mit herkömmlichen 2-Kanal-Medien (Stereoschallplatten, -tonbänder und UKW-Stereosendungen), und gibt beim Abspielen dieser Medien ein völlig dynamisches 4-Kanal-Tonfeld wieder. Wenn diese Medien auf herkömmlicher Ausrüstung für 2-Kanal-Stereo abgespielt werden, so geben sie natürlichen 2-Kanal-Stereoklang ohne irgendwelche Irrtümer oder Verlust an musikalischer Information wieder. Ein anderer wichtiger Vorteil liegt darin, daß es die spezielle Fähigkeit hat, vorhandene 2-Kanal-Musik in ein lebhaftes, bewegtes 4-Kanal-Tonfeld umzuwandeln, und zwar durch den Syntheseeffekt, der verborgene Information in der 2-Kanal-Phasenbeziehung ausnutzt.

SYSTEME QS A 4 CANAUX (2)
QS SYSTEM 4-CHANNEL (2)
QS 4-KANAL-SYSTEM (2)

Schéma simplifié du circuit QS vario-matrice
Block Diagram of QS Vario-Matrix Circuit
Blockdiagramm des QS-Variomatrix-Stromkreises



D.P. : Discriminateur de phase
P.D. : Phase Discriminator
P.D. : Phasendiskriminator
L : Limiteur — M : Matrice
L.M. : Limiter — Mx : Matrix
L.M. : Begrenzer — Mx : Matrix

Qu'est-ce que le circuit QS vario-matrice?

Le circuit QS vario-matrice est l'élément le plus important côté reproduction du système QS à 4 canaux. Il met à profit le phénomène psycho-acoustique appelé "masquage directionnel" que l'on trouve dans le mécanisme de l'ouie humaine.

Si l'on se trouve au milieu d'un champ sonore, on est entouré de nombreux sons d'intensité différente, tous provenant de directions variées. On a découvert que si deux sons d'intensité différente atteignent l'oreille humaine simultanément, le son le plus fort masque le son le plus faible de sorte que l'oreille devient temporairement moins sensible à la direction d'où provient le son le plus faible. Cependant, si deux sons sont émis à des instants différents, l'oreille est alors capable de percevoir les directions distinctes des deux sons.

Mettant à profit ce phénomène, le circuit QS vario-matrice localise un son intense avec précision tout en recrutant la place des sons les plus faibles. Et même si un certain son est faible, il sera localisé avec précision s'il est produit avec un certain intervalle de temps par rapport au son le plus fort. Cela recrée un champ sonore tout-à-fait naturel qui est sensiblement pareil à ce qu'on entend dans une vraie salle de concert.

Le circuit QS vario-matrice se charge des opérations mathématiques infiniment complexes et nécessaires dans ce but, de manière électronique et instantanée.

What is the QS vario-matrix circuit?

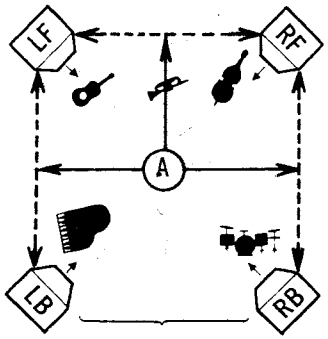
The QS vario-matrix circuit is the most important element at the playback end of the QS 4-channel system. It takes advantage of a psycho-acoustic phenomenon called "directional masking" found in the human hearing mechanism.
When you are in a sound field, you are surrounded with many sounds of different loudness, all coming to you from different directions. It has been discovered that, if two sounds of different loudness reach the human ear simultaneously, the louder sound masks the weaker sound so that the ear momentarily becomes less sensitive to the direction from which the weaker sound arrived. However, if the two sounds are generated at different timings, then the ear is able to perceive the distinct directions of both sounds.
Taking advantage of this phenomenon, the QS vario-matrix circuit locates a loud sound precisely while broadening the location of weaker sounds. And even if a sound is weak, it is accurately positioned if it is produced with a time difference from the loud sound. This creates a totally natural sound field that is quite similar to what an actual concert hall offers.
The QS vario-matrix circuit makes the infinitely complex mathematical calculations necessary for this purpose, electronically and instantaneously.

Der QS-Variomatrix-Stromkreis

Der QS-Variomatrix-Stromkreis ist das wichtigste Element am Wiedergabeende des 4-Kanal-Systems. Er nutzt ein "Richtungsmaskierung" genanntes psychoakustisches Phänomen des menschlichen Gehörs aus. Wenn Sie sich in einem Schallfeld befinden, so sind Sie umgeben von vielen Tönen verschiedener Lautstärke, die Sie aus allen Richtungen erreichen. Es ist festgestellt worden, daß wenn zwei Töne verschiedener Lautstärke gleichzeitig das menschliche Gehör erreichen, der lautere Ton den schwächeren Ton maskiert, so daß das Ohr momentan weniger empfindlich für die Richtung wird, aus der der schwächere Ton kommt. Wenn die zwei Töne jedoch zu verschiedenen Zeiten erzeugt werden, kann das Ohr die genaue Richtung beider Töne feststellen.
Unter Ausnutzung dieser Erscheinung lokalisiert der QS-Variomatrix-Stromkreis einen lauten Ton genau, während der Ort schwächerer Töne erweitert wird. Selbst ein schwacher Ton wird genau positioniert, wenn er mit einem Zeituntêrschied zu dem lauten Ton hervorgebracht wird. Hierdurch wird ein völlig natürliches Schallfeld erzeugt, das dem einer Konzerthalle sehr ähnlich ist.
Der QS-Variomatrix-Stromkreis macht die hierfür erforderlichen unendlich komplexen mathematischen Berechnungen elektronisch und augenblicklich.

SYSTEME QS A 4 CANAUX (3)
QS SYSTEM 4-CHANNEL (3)
QS 4-KANAL-SYSTEM (3)

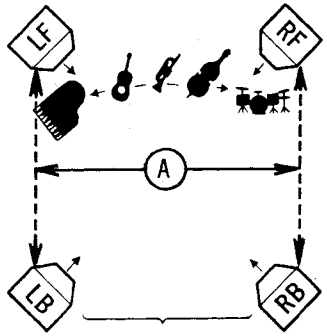
Synthétiseur QS, mode AMBIANCE (SURROUND)
QS Synthesizer, SURROUND mode
QS-Synthesestromkreis, Betriebsart SURROUND



Son d'ambiance primaire
Primarily ambient sound
Hauptsächlich reflektierter Ton

Synthétiseur QS, mode CONCERT (HALL)
QS Synthesizer, HALL mode
QS-Synthesestromkreis, Betriebsart HALL

Memo localisation du son comme pour 2 canaux stéréo
Same sound location as 2-channel stereo
Gleiche Tonlokalisierung wie bei 2-Kanal-Stereo



Son d'ambiance
Ambient sound only
Nur reflektierter Ton

Ⓐ Séparation au-dessus de 20dB
Separation over 20dB
Trennung über 20dB

Abréviations
Abbreviations
Abkürzungen

LF: Gauche Avant	Left Front	links vorn
PF: Droit Avant	Right Front	rechts vorn
LB: Gauche Arrjère	Left Back	links hinten
RB: Droit Arrière	Right Back	rechts hinten

Que sont les circuits de synthétiseur QS?

Le synthétiseur QS, inclus dans cet appareil est en réalité une application du circuit QS vario-matrice expliqué plus haut, et qui transforme la musique conventionnelle à 2 canaux en champ sonore à 4 canaux.
A vrai dire, il peut produire deux types de champs sonores à 4 canaux. Au mode concert (HALL), le synthéthiseur rapproche l'auditeur comme il le serait sur un siège au milieu et à l'avant dans une salle de concert. La plupart des instruments musicaux étant situéss en face de lui et l'élargissement du champ sonore passant par derrière. Au mode ambiance (SURROUND), cela fonctionne à peu près de la même manière que le décodeur QS lui-même, plaçant les instruments musicaux tout autour de l'auditeur! Le choix entre les deux modes dépend du genre de musique que l'on veut reproduire et des sentiments que l'on désire susüter.

What is the QS Synthesizer circuits?

The QS Synthesizer, included in this unit, is actually an application of the QS vario-matrix circuit explained above, and transforms conventional 2-channel music into a 4-channel sound field.
Actually it can produce two types of 4-channel sound field. In the HALL mode, the synthesizer puts the listener in the front-and-center seat in a concert hall, with most of the musical instruments located in front of him and the ambience sound spread in the back of him. In the SURROUND mode, it works much in the same way as the QS decoder itself, placing the musical instruments all around the listener! The choice between the two modes depends on the type of music you play and the feeling you wish to create.

Der QS-Synthesestromkreis

Der in diesem Gerät eingebaute QS-Synthesestromkreis ist in der Tat eine Anwendung des oben erklärten QS-Variomatrix-Stromkreises, und er wandelt herkömmliche 2-Kanal-Musik in ein 4-Kanal-Tonfeld um.
Er kann tatsächlich zwei Arten von 4-Kanal-Tonfeldern erzeugen. In der Betriebsart HALL versetzt der Synthesestromkreis den Zuhörer in einen Sitz in der Mitte der ersten Reihe in einer Konzerthalle, mit den meisten Musikinstrumenten vor ihm und den reflektierten Tönen hinter ihm. In der Betriebsart SURROUND arbeitet er praktisch in der gleichen Weise wie der QS-Dekoder selbst und ordnet die Musikinstrumente rund um den Zuhörer an. Die Wahl zwischen den beiden Betriebsarten hängt von dem Typ der abzuspielenden Musik und dem Gefühl, das Sie erzeugen wollen, ab.

QUELQUES CONSEILS UTILES (1)
SOME USEFUL HINTS (1)
EINIGE NÜTZLICHE HINWEISE(1)

Mise à la terre

La mise à la terre aide grandement à se prémunir contre les parasites d'origine extérieure. Connecter une longueur voulue de cordon CPV standard ou de fil enrobé à la borne marquée GND sur le panneau arrière de l'appareil. Ensuite fixer à l'autre bout du fil une petite plaque de cuivre ou une tige de charbon galvanique et l'enterrer profondément dans le sol. Ou bien, s'il existe un fil de terre ou une borne spéciale dans la pièce, ou encore si les conduits d'eau sont métalliques, le conducteur de terre pourra être connecté à cet endroit.

ATTENTION: Ne jamais connecter de conducteur électrique pour la masse à une canalisation de gaz.

Le bruit, s'il y en a pourra être diminué si l'on connecte la borne de terre (GND) de l'appareil avec la borne de terre sur l'un des amplificateurs du système. La recherche du bruit peut aussi bien conduire à un conducteur de masse déconnecté du tourne-disque; S'assurer de bien vérifier les cordons du signal et leurs connexion si l'on perçoit un ronflement. D'autre part, si l'on entend un son de tonneau, sa cause peut être ce qu'on appelle "effet de hurlement ou de réaction acoustique produite par l'amplification indésirable des signaux captés par la cartouche phono depuis les haut-parleurs. Dans ce cas le tourne-disque doit être éloigné le plus possible des haut-parleurs, ou bien isolés de façon que les vibrations provenant des haut-parleurs ne l'affectent pas.

Grounding

Grounding will help guard your system against external noise. Connect a length of standard PVC cord or enameled wire to the terminal marked GND on the unit's rear panel. To the other end of the wire, then attach a small copper plate or carbon rod, and bury it deep underground. Or if there is a special grounding wire or terminal in your room, or if your water piping is of iron, the grounding lead may be connected to them.
WARNING: Never connect any electrical ground lead to gas piping.
Noise, if any, may diminish when the GND terminal on the unit is connected with a grounding terminal on one of the amplifiers in the system. The noise may also be traced to a disconnected grounding lead of a turntable; be sure to check the signal connection cords if you hear hum. When, on the other hand, you hear loud boom, its cause may be what is called "howling" or acoustic feedback, caused by the undesirable amplification of signals picked up from speaker systems by your phono cartridge. In this case the turntable should be placed as far from the speakers as possible, or insulated so that the vibrations from the speakers do not affect it.

Erdung

Erdung hilft beim Schutz Ihres Systems gegen äußere Störungen. Schließen Sie ein Stück normalen PVC-Kabels oder Lackdrahts an die GND markierte Klemme auf der Rückseite des Gerätes an. Befestigen Sie dann am anderen Ende des Drahtes ein kleines Kupferblech oder einen Kohlestab und graben Sie es tief ein. Wenn sich in Ihrem Zimmer ein Erdungsanschluß oder eine eiserne Wasserleitung befindet, kann die Erdleitung hieran angeschlossen werden.
Warnung: Schließen Sie eine elektrische Erdungsleitung nie an Gasrohre an.
Falls Störungen vorhanden sind, können sie eventuell durch Verbindung der Klemme GND des Gerätes mit der Erdungsklemme an einem der Verstärker des Systems verringert werden. Die Störungen können auch durch gelösten Erdanschluß eines Plattenspielers verursacht werden; überprüfen Sie beim Auftreten von Brummen die Signalverbindungskabel. "Heulen" oder akustische Rückkopplung wird jedoch durch unerwünschte Verstärkung der vom Tonabnehmer aufgenommenen Lautsprechersignale verursacht. In diesem Fall sollte der Plattenspieler so weit wie möglich von den Lautsprechern entfernt aufgestellt oder isoliert werden, so daß er nicht von den Vibrationen der Lautsprecher beeinflußt wird.

Désignation des canaux

Voici une liste des diverses manières de désigner les quatre canaux dans un système à 4 canaux et quelles que soient celles adoptées ne doivent pas être confondues les unes avec les autres.

Gauche Avant	GAV (ou AVG)	CH-1 (Canal 1)
Gauche Arrière	GAR (ou ARG)	CH-2 (Canal 2)
Droit Arrière	DAR (ou ARD)	CH-3 (Canal 3)
Droit Avant	DAV (ou AVD)	CH-4 (Canal 4)
Gauche	G ou GT (Gauche total)	
Droit	D ou DT (Droit total)	

Channel designations

The following is a list of the various ways to nominate the four channels in 1 4-channel system. Whichever terms you use, do not confuse one with another.

Left Front	LF (or FL)	CH-1 (Channel 1)
Left Back or Left Rear	LB (or BL or LR)	CH-2 (Channel 2)
Right Back or Right Rear	RB (or BR or RR)	CH-3 (Channel 3)
Right Front	RF (or FR)	CH-4 (Channel 4)
Left	L or LT (Left Total)	
Right	R or RT (Right Total)	

Kanalbezeichnungen

Nachfolgend ist eine Liste der verschiedenen Arten zur Bezeichung der 4 Kanäle in einem 4-Kanal-System. Verwechseln Sie sie nicht, egal, welches System Sie verwenden.

Links vorn	LF (oder FL)	CH-1 (Kanal 1)
Links hinten	LB (oder BL, LR)	CH-2 (Kanal 2)
Rechts hinten	RB (oder BR, RR)	CH-3 (Kanal 3)
Rechts vorn	RF (oder FR)	CH-4 (Kanal 4)
Links	L oder LT	
Rechts	R oder RT	

SPECIFICATIONS
SPECIFICATIONS
TECHNISCHE EINZELHEITEN

Section décodeur à 4 canaux
- Décodeur QS (Type A QS vario-matrice*)
  - Séparation: . . . . . 20 dB entre canaux adjacents
    30 dB entre canaux en diagonale
  - Distorsion: . . . . . Moins de 0,1% (à 1.000Hz)
  - Réponse de fréquence: . . . . . 20 à 30.000 Hz
- Synthétiseur QS (Type A QS vario-matrice)
  - Séparation: . . . . . Equivalente au décodeur QS
  - Distorsion: . . . . . Equivalente au décodeur QS
  - Réponse de fréquence: . . . . . Equivalente au décodeur QS

Sensibilité d'entrée
- ENTREE 2 CANAUX: . . . . . 100 mV
- REPRODUCTION 2 CANAUX: . . 100 mV
- ENTREE 4 CANAUX: . . . . . 140 mV
- Capacité d'entrée maximale: . . . . . 25 V (niveau fixé au minimum, D.H.T. 0,5%)

Tension de sortie
- SORTIE 4 CANAUX: . . . . . 300 mV

Niveau de bruit: . . . . . Moins de 250 μV
(Niveau fixé au maximum)

Divers:
- Alimentation: 100/120/220/240V 50/60Hz
  120V (Utilisable de 100 á 130V), 60Hz (Uniquement aux Etats Unis et au Canada)
  (Pour les U.S.A. et le Canada seulement)
- Consommation de puissance: . . . . 10 W (nominale)
- Dimensions: . . . . . 482 mm (L)
  88,5 mm (H)
  304 mm (P)
- Poids: . . . . . 6,6 kg net
  8,1 kg emballé

*Breveté aux U.S.A. sous le No 3825684/3836715

Les spécifications et la présentation sont susceptibles d'être modifiées par suite d'améliorations éventuelles.

4-CHANNEL DECODERSECTION

QS DECODER (Type-A QS variomatrix*)

SEPARATION:	20dB between adjacent channels 30dB between diagonal channels
DISTORTION:	less than 0.1% (at 1,000Hz)
FREQUENCY RESPONSE:	20 to 30,000Hz

QS SYNTHESIZER (Type-A QS vario-matrix)

SEPARATION:	equivalent to QS decoder
DISTORTION:	equivalent to QS decoder
FREQUENCY RESPONSE:	equivalent to QS decoder

INPUT SENSITIVITY

2-CHANNEL INPUT:	100mV
2-CHANNEL TAPE PLAY:	100mV
4-CHANNEL INPUT:	140mV
MAX. INPUT CAPABILITY:	25V (level set at min., T.H.D 0.5%)

OUTPUT VOLTAGE

4-CHANNEL OUTPUT:	300mV
NOISE LEVEL:	less than 250μV (level set at max.)

GENERAL

POWER REQUIREMENTS:	100/120/220/240V, 50/60Hz 120V (Usable 110-130V) 60Hz (For U.S.A. & Canada only)
POWER CONSUMPTION:	10W (rated)
DIMENSIONS:	482mm (19")W 88.5mm (3-1/2") H 304mm (12") D
WEIGHT:	6.6kg (14.6 lbs) net 8.1kg (17.9 lbs) packed

*U.S. Patent No. 3825684/3836715

Design and specifications are subject to change for possible improvements.

4-Kanal-Dekoderabschnitt

QS-Dekoder (Typ A QS-Variomatrix*)

Trennung:	20 dB zwischen benachbarten Kanälen 30 dB zwischen diagonalen Kanälen
Verzerrung:	Weniger als 0,1% (bei 1.000 Hz)
Frequenzgang:	20 bis 30.000 Hz

QS-Synthesestromkreis (Typ A QS Variomatrix)

Trennung:	Entsprechend dem QS-Dekoder
Verzerrung:	Entsprechend dem QS-Dekoder
Frequenzgang:	Entsprechend dem QS-Dekoder

Eingangsempfindlichkeit

2-Kanal-Eingang:	100 mV
2-Kanal-Tonbandwiedergabe:	100 mV
4-Kanal-Einang:	140 mV
Max. Eingangskapazität:	25 V (Pegel auf Minimum eingestellt, gesamte harmonische Verzerrung 0,5%)

Ausgangsspannung

4-Kanal-Ausgang:	300 mV
Störungspegel:	Unter 250 μV (Pegel auf Maximum)

Allgemeines

Stromversorgung:	100/120/220/240 V, 50/60 Hz 120 V (Verwendbar von 110 bis 130 V) 60 Hz (Nur für USA und Kanada)
Stromverbrauch:	10 W (Nennverbrauch)
Abmessungen:	482 mm Breite x 88.5 mm Höhe x 304 mm Tiefe
Gewicht:	6,6 kg netto 8,1 kg brutto

*US-Patent Nr. 3825684/3836715

Änderungen, die dem technischen Fortschritt dienen, bleiben vorbehalten.

Sansui
SANSUI ELECTRIC CO., LTD.
14-1, 2-chome, Izumi, Suginami-ku, Tokyo 168, Japan.
TELEPHONE: (03) 323-1111/TELEX: 232-2076

Printed in Japan (35M1) 〈9208900〉

GREETING

As a consequence of the rapid introduction of new techniques and constant technical innovations, the electronics industry in Japan has established itself as a major supporting power of one of the world's fastest growing national economies. Thanks to your patronage and encouragement, we, too, have been able to achieve continuous growth and expand our corporate strength, making our share of contribution to the industry. Our name has come to be recognized around the world as a leading audio specialist.

We have a corporate motto which says "Independent management by independent products." Based on this policy, we have been making all-out efforts to develop and adopt new techniques, to produce truly unique products that bear a mark of the high level of our technology and engineering integrity that we are so proud of.

The QS Coding System, which we have the pleasure of introducing to you hereafter, is a total 4-chnnel stereo system encompassing the complete process of sound reproduction from recording to playback. We have poured every bit of our circuit design technique and audio-acoustic knowhow in developing the system giving our greatest attention to the various properties of music all the time. It is with our fullest confidence that we recommend it to both the software and hardware industries concerned.

This manual contains comprehensive collection of information and data on the QS Coding System, putting everything at your fingertips for quick reference. Please accept it with my compliments. I hope you will make good use of it.

SANSUI ELECTRIC CO., LTD.

K. Kikuchi

Kousaku Kikuchi, President

HEAD OFFICE AND THE SUBSIDIARIES

SANSUI Electric Co., Ltd.	Tokyo	14-1, 2chome, Izumi, Suginami-ku, Tokyo, 168, Japan. Tel.: (03) 323-1111. Cable: SANSUIELEC. Telex: 232-2076.
Sansui Electronics Corp.	New York	32-17, 61st Street, Woodside, N.Y. 11377. Tel.: (212) 721-4408. Cable: SANSUILEC NEW YORK. Telex: 422633 SEC UI.
	Los Angeles	333 West Alondra Blve. Gardena, Calif, 90247. Tel.: (213) 532-7670.
Sansui Audio Europe S.A.	Belgium	Diacem Building, Vestingstraat 53-55. 2000 Antwerp. Tel.: 315663~5. Cable: SANSUIEURO ANTWERP. 33538.

QS TECHNICAL MANUAL

QS SYSTEM
Quadrasonic

Sansui SANSUI ELECTRIC CO., LTD. TOKYO JAPAN

HOW TO USE THIS QS TECHNICAL MANUAL

The QS TECHNICAL MANUAL has been prepared to help you understand the theories behind the Sansui QS Coding System and the various techniques that will be useful in making practical applications of that system. It is also hoped that, through this manual, we will be able to rush to you accurate up-to-date information about the latest developments in 4-channel stereo and keep you informed right.

The contents of the manual are classified as explained below, with each section given a prefix-like capital letter to discriminate it cleary from others. All printed matters we will send you in the future will carry these symbol letters. All you'll have to do is to file them in the proper sections.

I: QS CODING SYSTEM—INTRODUCTORY MANUAL
Titled "Quadrasonic Q & A," this guidebook answers questions about the general theories behind 4-channel stereo, then goes on to introduce the Sansui QS Coding System, ending with more sophisticated discussions of recording and broadcast techniques using that system.

T: QS CODING SYSTEM—TECHNICAL ANALYSES
Analyzes the QS Coding System in detail from different angles, making use of numerous figures, mathematical equations, graphs, etc. A comprehensive technical reference about the system.

D: IMPROVED QS DECODER
Discusses the importance of rotational symmetry in any matrixing 4-channel system, then introduces an improved QS decoder embodying a newly developed Vario-Matrix technique for outstanding inter-channel separation.

N: QS NEWS FLASHES
Keep you infomed on the latest happenings in 4-channel stereo in general and the QS Coding System.

R: QS REFERENCE DATA
A collection of various technical treatises, engineering standards, announcements, etc., concerning or related to the QS Coding System.

P: SANSUI—A PROFILE OF PEOPLE WHO CREATED QS
An outline of the company that invented the QS Coding System, its product lines, and other related information.

QUESTIONS & ANSWERS ON QUADRASONIC

The sudden explosion of quadrasonic or 4-channel stereo on the audio industry scene has generated a great deal of interest and big expectations among a large number of people the world over. Because everything happened so quickly, howerer, there seems to be no comprehensive source of information about it anywhere as yet.

This QUESTIONS & ANSWERS ON QUADRASONIC is an attempt to fill that void. It will discuss, in an easy-to-follow question and answer format, a wide range of subjects about this new sound reproduction technique, including those pertaining to general theories behind it, the Sansui QS Coding System, and recording and broadcast techniques utilizing that system.

The staff engineers of our 4-channel section are meeting people every day somewhere in the world, answering different questions put to them.

This manual is edited on the basis of such experience, and we hope it will be useful to you. We will send additional sheets to you as they are printed in the future.* Just add them to this file, and soon you will have a very complete reference book on quadrasonic.

*So that we can register your name on our mailing list, be sure to clip the enclosed Registration Card and mail it to us.

SECTION 1 GENERAL THEORIES ABOUT QUADRASONIC

QUESTION 1-1: Why do you need quadrasonic anyway?

ANSWER 1-1: The two primary benefits of quadrasonic given below are reason enough to convince us that it is an absolute requirement for further progress of sound reproduction technique.

Benefit 1. It enables us to recreate the complete 360 degrees of sound field around the listener as it naturally exists.

Comment:

In our daily life, sound does not just exist in front of us. We live surrounded by sounds coming from every direction. Conventional stereo playback moves everything to your front—the actual musical performance, the reverberation in the concert hall, the applause by the audience and any other sound produced there. In that sense, it is a simulated reproduction of the original. But it seems this fact was never seriously considered in over a dozen years since the advent of stereo. Strange, isn't it?

Benefit 2. It actually improves the quality of reproduced sound.

Comment:

Man's continued endeavor to improve the quality of sound reproduction has brought us a long way from monophonic playback. Today, quality stereo recording and playback techniques permit us to reproduce 20 to 20,000Hz with a flat response and minimal distortion. Considerable improvement has been achieved in loudspeakers as well.

But true enhancement of the reproduced sound quality cannot be realized unless we introduce the concept of "sound field."

Even actual musical instruments will not sound very rich and pleasant if you play them outdoors or in an acoustically dead anechoic room. The sounds produced by them acquire a sense of depth and other necessary properties for good tone quality in playback, including a wider dynamic range, as a proper amount of reflected sound is mixed with them.

If you treated a loudspeaker merely as a sound source, the best loudspeaker in the world (even if it were capable of producing the same sound as an actual musical instrument) would not create a good sound effect, were it not for the sound field that the sounds from the loudspeaker and their reflections from various surfaces create when they intermingle in the air. It is small wonder, then, that the most expensive stereo in the world is unable to recreate the live sound as it originally was.

Quadrasonic, in contrast, is in itself a means to produce the sound field so essential to the enhancement of reproduced sound quality. It takes us to higher fidelity than was ever before possible.

QUESTION 1-2: What is the difference between a sound source and a sound field?

ANSWER 1-2: A sound source is whatever produces sound, such as music instruments, man's mouth, etc. A sound field is an acoustic space containing the sounds directly emitted by a sound source or sound sources and their reflections from various surfaces.

Comment:

The above answer pertains particularly to "live" sound fields.

Live sound fields exist in a wide variety. Take a church for example. It has a lofty dome to allow the pipe organ to reverberate and create a solumn atmosphere around the faithful. If they were to hear the pipe orgain outdoors, a good part of its grandeur feeling would be lost. In this case, the church dome and pipe organ combine to form one musical instrument.

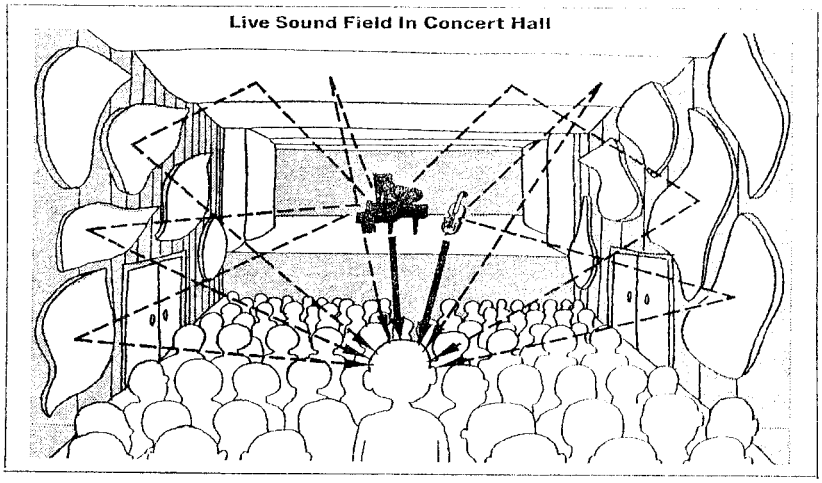
A concert hall has a number of reflector panels to direct as much of the sounds produced by the orchestra as possible toward the audience.

The sound waves generated by a music instrument in different directions possess different tone properties or timbres. For example, a violin radiates a lot of acoustic energy upwards which has a different timbre from that emitted in the lateral directions. So the true timbre of a violin can be fully appreciated only when the sound waves emitted directly toward the listener *and* those radiated in all other directions and reflected by various objects, arrive at the listener's ears.

The effectiveness of such reflection is one reason why the same orchestra seems to sound slightly differently—that is, have different tone qualities—in different concert halls.

In other words, a sound field comprises the combination of a single direct sound emitted by a sound source (or if there are multiple sound sources, the same multiple number of direct sounds as the sound sources) and an infinite number of "indirect" sounds reflected by various surfaces in the surrounding. This is a particularly important consideration to the appreciation of music. A concert hall is generally said to give us a mixture of 30% direct sounds and 70% indirect sounds.

Live Sound Field In Concert Hall



QUESTION 1-3: What are the meanings of sound field reproduction and the synthesis of sound field?

ANSWER 1-3: Sound field reproduction is a term often used by audio equipment manufacturers to mean a sound reproduction technique designed to approximate the live sound field by recreating its multiple-dimensional combination of sound waves as closely as possible. Since it is practically impossible to recreate the original infinite crisscrossing of sound waves as it actually happened in the live sound field, attempts are usually made to "synthesize" or artificially create the insufficient indirect sounds in the playback process. That is what is usually meant by the synthesis of sound field.

Comment:

The majority of domestic sound reprodution systems seem to use two to four loudspeakers at present. The number of sound-radiating objects is thus much smaller than in a live sound field. This would have a grave effect if you were to drive the soudspeakers outdoors or in an acoustically dead anechoic room. Sounds from the loudspeakers would then only provide a meager reproduction of sound sources.

But if you place the loudspeakers in an acoustically live, reflective room, they suddenly emanate very rich sounds. A sound field is thus "synthesized" in the playback process.

If you were to match the number of sound waves in the live sound field with the number of loudspeakers or transmission channels, you would almost need an infinite number. In practice, however, a system requiring more than two to four loudspeakers would be impractical for most poeple. Hence it is important to synthesize a sound field.

Such synthesis can be facilitated by a number of means, including:

1. Make the listening room properly reflective.
2. Position the loudspeakers so as to produce more reflections.
3. Increase the number of loudspeakers.
4. Use a matrix circuit to extract the hitherto dormant indirect sounds and other sound field information electrically from conventional stereo recordings, then reproduce such information from separate loudspeakers.
5. Increase the number of transmission channels.

QUESTION 1-4: How effective is the sound field reproduction by a quadrasonic system?

ANSWER 1-4: Quadrasonic is in no way a reproduction of four monophonic sounds. With just two more loudspeakers added, you obtain the same effect as if you had six stereo sets on hand. Sounds in a full 360 degrees can be reproduced and mixed in the air to approximate the original sound field more closely than ever.

Comment:

(1) Monophonic playback only reproduces a sound source point (Fig. A).

(2) Two-speaker stereo playback gives us either two monophonic sounds, or a "line" of sound field between the two loudspeakers in front of us. The line makes us sense various phantom sound images on it. The sense of acoustic expansion it gives us is a result of complex combinations of phase and time lags among such phantom images (Fig. B).

(3) Quadrasonic gives us an effect equivalent to having six stereo sets by utilizing two loudspeakers in the back. It reproduces all the sound sources and sound field on the horizontal plane around us (Fig. C).

(4) But even quadrasonic cannot give us a three-dimensional reproduction having vertically directional movements.

Mono, Stereo And Quadrasonic Listening Areas

Fig. A Sound Source Point Reproduction
Loudspeaker Listener Mono

Fig. B Line of Sound Reproduction
Loudspeaker Listener Stereo

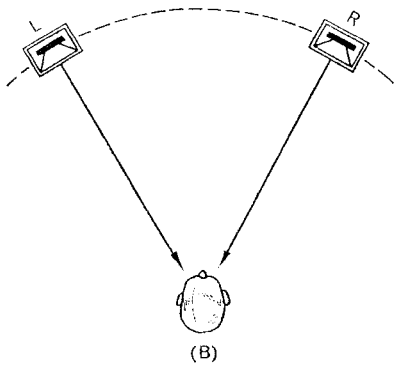
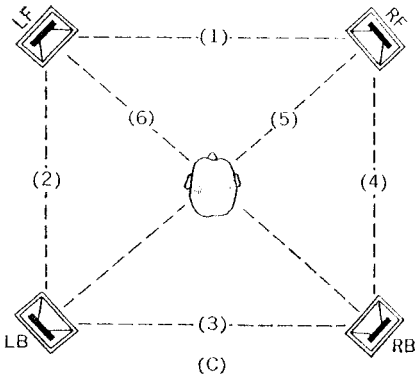


Fig. C Plane of Sound Reproduction
Loudspeaker Listener Quadrasonic



QUESTION 1-5: Is there any artistic value in quadrasonic?

ANSWER 1-5: Yes, very much. When you play music, not only must the melody be played right, but it is very important for the chords to sound beautiful.

Anyone who plays music for himself would be able to sense the difference easily between halls where music sounds beautiful and ones where it somehow does not sound so beautiful. This difference, in most cases, is traceable to the sound of chords, and we attach much more artistic value to the former type of halls.

The sound of chords is a product of reverberation and fine phase differences among sound waves as the sounds from different sound sources and their echoes overlap one another.

Thus there is an inseparable relationship between the sound of music and the effect of sound field. One musician put it best when he said, "Stereo was like listening to a concert outdoors; it was kind of dry. But with quadrasonic, you get the full charm of music—all the delicate atmosphere—reproduced right in your room."

Quadrasonic, indeed, enables us for the first time to reproduce music as it was played by musicians, or to say the least, to reproduce it in a more natural state than ever. That's something musicians themselves have been waiting for for a long time. And listeners are now able to reach out to the musicians and communicate with them as they listen to the music played by them through loudspeakers.

QUESTION 1-6: What artistic possibilities does quadrasonic offer?

ANSWER 1-6: Generally, it gives us two great possibilities. Reproduction of the concert hall sound, and the creation of a "surround" sound effect.

Comment:

(1) Reproduction of the concert hall sound

A large part of classical music, jazz and popular music is played by orchestras and bands in large concert halls. When we listen to recordings of such music through our stereos in our rooms, we should feel as if we were seated right in the concert hall.

With a quadrasonic system, the indirect sounds and reverberation filling the concert hall are picked up by specially located microphones and reproduced out of the back loudspeakers. These microphones collect the sounds of the stirring of the audience and their applause as well. So when they are reproduced in your room, you get a very intense, true feeling of being there at the concert, seatet front and center in the hall.

Recording technique for the front channels much the same as for conventional stereo recordings.

(2) Surround sound effect

Music should not always be something that you appreciate quietly and objectively, gazing at the imaginary stage reproduced by the loudspeakers in front of you.

When we listen to popular music such as jazz and rhythm-and-blues, we often wish we could be with the musicians, playing with them of sharing their emotional feelings.

The surround sound effect as made possible by quadrasonic is a new art of sound reproduction that puts you right on the stage among the performing musicians by arranging them all around you. It has been said many times that once you hear rock music in surround stereo, you can't go back to 2-channel stereo anymore.

Aside from popular music, it gives us infinite possibilities for church music, operas, modern electronic music and so forth. It is something entirely beyond the conventionalism of previous stereo, and is certain to find different applications in various fields of music.

QUESTION 1-7: Do you think the conventional stereo playback system will be completely changed to quadrasonic in the future?

ANSWER 1-7: Yes, we do, for these reasons:

(1) Firstly, as we continue to look for higher fidelity in sound reproduction, we see a definite limit to the improvements we can achieve by just improving the amplifiers and loudspeakers. We see a definite need to introduce the concept of sound field on both the recording and playback ends. This is why we predict the eventual switch to quadrasonic in the design and use of playback equipment.

(2) Many stereo fans are getting tired of the direct sound reproduction of conventional 2-speaker stereo playback. Our studies indicate a large percent of people who are thinnking of buying stereo equipment for the first time or upgrading their present set-ups consider quadrasonic.

(3) Direct and indirect lighting techniques have been used together for a long time in home illumination. We see a similar trend in sound reproduction, too. As the performance of loudspeakers is steadily improved, it is beginning to become common to try to obtain the sound field effect of quadrasonic from even conventinnal stereo recordings.

QUESTION 1-8: How many systems are available for quadrasonic, and where are they headed in the future?

ANSWER1-8: All quadrasonic systems now available can be grouped into three categories.

One is called the regular matrix system, represented by the Sansui QS Coding System. Another is called the phase matrix system, which is represented by CBS-Sony's SQ system. The third one is called the discrete system, and it uses a sub-carrier. No reference is made here to discrete 4-channel playback by tapes, as it only involves utilizing more space on the tape to accommodate the additional two channels.

At one time a number of matrix systems were introduced in Japan and there was great confusion. But as time passed and music lovers and industry engineers made closer investigation, they were gradually narrowed down to the above three systems.

When a new technique of sound reproduction is introduced, it is quite natural and desirable that a number of systems are proposed to accommodate that technique. The consumer, however, should be kept out of the confusion resulting from the technical arguments and political struggles among the manufacturers.

But, as things stand now, the three systems will be evaluated more closely by the consumer and compete with one another for his final vote. We think only the one which is technically superior will withstand the test of time.

QUESTION 1-9: What is the difference between a matrix system and a discrete system? What are their future possibilities?

ANSWER 1-9: (1) Matrix systems permit the use of conventional stereo media, such as discs and tapes, and so give the greatest possibility for consumer use in the future. It should also be noted that they can be adapted to the present FM multiplexing broadcast without requiring a major addition of the broadcasting facilities.
The encoder is an instrument to compress four channels of signal into two, and the decoder expands the two channels of signal back to four. The difference among various matrix systems is in the method of mixing the four channels of signal when compressing them.

(2) The discrete system uses a very high-frequency signal called a sub-carrier to cut the four separate channels of signal in the left and right walls of a record groove. It utilizes frequency modulation to modulate the four signals with the sub-carrier, and is similar to the FM multiplexing system in that sense. But the music recorded by this system cannot be broadcast by the present FM transmitting equipment without major changes. Fig. A). Several proposals have been made for discrete 4-channel broadcasting on FM, but all proposed systems require modifications of the current broadcasting and receiving equipment. It a technique can be found to make the discrete 4-channel disc system and the discrete 4-channel FM broadcasting system equivalent, playback equipment for the consumer need not have separate circuits for the two types of program source.

Comment:
The common deficiency of most matrix systems was the lack of sufficient separation among the four reproduced channels, meaning that a part of the sound in one channel leaks to adjacent channels. As far as regular matrix systems are concerned, however, this has been completely overcome by the development of new, improved decoders by Sansui and a few other Japanese manufacturers which give us outstanding channel separation quite equivalent to that of the discrete system. This has added greatly to the advantages of the regular matrix system, and is expected to accelerate the rate of popularization among consumers. These improved decoders invariably work remarkably well with recordings made by the Sansui QS encoder, but fail to show such marked results with recordings of other matrix systems.
Now that the regular matrix system has the single most important advantage of the discrete system in addition to all its inherent ones, it is beginning to show a distinctive lead over other systems in the consumer interest.

QUESTION 1-10: Are you doing anything about standardizing the various 4-channel systems in Japan?

ANSWER1-10:

(1) The Record Industry Association of Japan (RIA-J) has decided a standard for regular matrix system.
RIA-J decided technical specifications for the regular matrix disc record on March 23, 1972 (see the enclosed QS News Flash of March 24) to encourage the Japanese record companies to start releasing 4-channel records based on the regular matrix system.
In response to EIA-J's move, such major Japanese record companies as Toshiba, Nippon Columbia, King, Nippon Crown, Teichiku and Nippon Polydor and others like Toho, Warner Brothers and Pioneer have all started offering regular matrix records. As of April 15, 300 regular matrix records are on the market, compared to 40 for the SQ system and 50 for the CD-4 discrete system.

(2) The Electronics Industry Association of Japan (EIA-J) has also adopted a standard for the regular matrix system. The decision was made on April 11 (see the QS News Flash of April 12), after long and intensive studies undertaken since last August. EIA-J's standard is practically identical to that of RIA-J in so far as the specifications of the regular matrix system are concerned.
As the above decisions indicate, the regular matrix system as represented by the QS Coding System is now standardized in terms of both software and hardware, and has already entered the mass marketing stage in Japan.

T QS coding system—
Technical analyses

SANSUI QS 4-CHANNEL ENCODER TECHNICAL DATA

This report describes the professional Sansui QS Four-Channel Encoder expressly developed for use in recording studios and FM broadcasting stations. We believe this report, complemented by the Technical Data I, presents comprehensive information about the coding system four-channel stereo based on the Sansui QS Four-Channel Coding System. (Patents Pending)

I How Four-Channel Programs Are Encoded

There are two ways to reproduce multichannel sound by "matrixing". One is a so called 2-2-4 system which "synthesizes" conventional two-channel program sources. The other is a 4-2-4 system which encodes four-channel program sources into a two-channel format and then decodes them back to four.

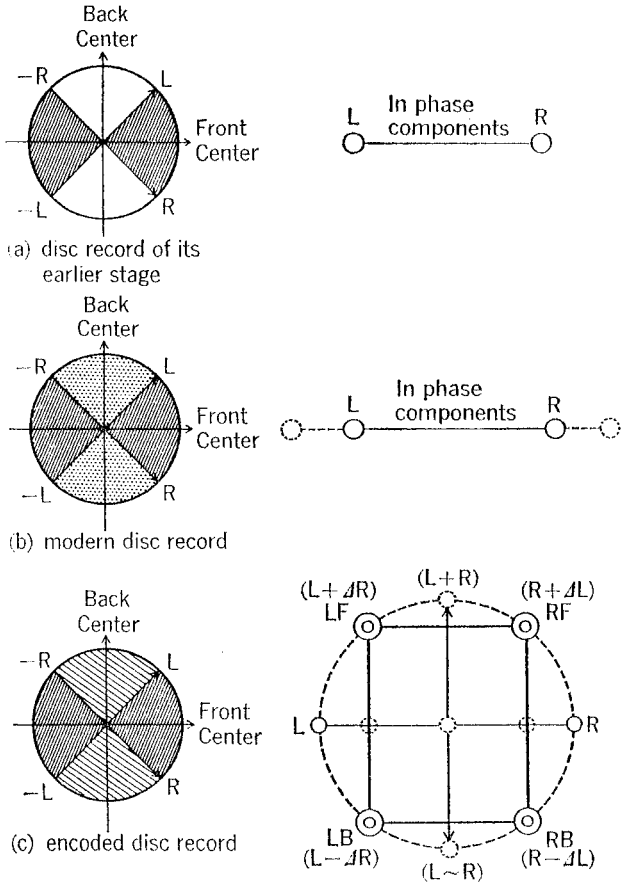
This process is visually explained in terms of disc cutting vectors (or stylus motion) in Fig. 1.

Fig 1-a) illustrates a disc cutting method of an earlier period when only in-phase signals were cut in a disc groove.

Fig 1-b) illustrates a modern disc cutting technique which mixes in- and out-of-phase signals together to obtain better presence. When these disc records are "synthesized," it is possible to better approximate the original sound field.

Fig 1-c) shows encoded four-channel disc cuttings which utilizes the out-of- phase area in the vector diagram to cut back channels information. Thus 360° sounds can be cut in ordinary stereo discs and be reproduced as four-channel stereo.

Fig. 1 Stylus Motion Vectors and The Reproduced Sound Service Area



$$\begin{cases} \mathbf{L}=(\mathbf{LF}+\mathbf{LB})\cos\theta+(\mathbf{RF}+\mathbf{RB})\sin\theta \\ \mathbf{R}=(\mathbf{RF}-\mathbf{RB})\cos\theta+(\mathbf{LF}-\mathbf{LB})\sin\theta \end{cases}$$

when LF=RF=RB=LB (=1);

$$\begin{cases} \mathbf{L}=2\cos\theta+2\sin\theta=2.60 \\ \mathbf{R}=0 \end{cases}$$

$$\begin{cases} \mathbf{L}=(\mathbf{LF}+\mathbf{LB})\cos\theta+(\mathbf{RF}-\mathbf{RB})\sin\theta \\ \mathbf{R}=(\mathbf{RF}+\mathbf{RB})\cos\theta+(\mathbf{LF}-\mathbf{LB})\sin\theta \end{cases}$$

when LF=RF=RB=LB (=1);

$$\begin{cases} \mathbf{L}=2\cos\theta=1.84 \\ \mathbf{R}=2\cos\theta=1.84 \end{cases}$$

* Basic Display of Sansui QS Coding System.

$$\begin{cases} \mathbf{L}=(\mathbf{LF}-\mathbf{LB})\cos\theta+(\mathbf{RF}+\mathbf{RB})\sin\theta \\ \mathbf{R}=(\mathbf{RF}-\mathbf{RB})\cos\theta+(\mathbf{LF}+\mathbf{LB})\sin\theta \end{cases}$$

when LF=RF=RB=LB (=1);

$$\begin{cases} \mathbf{L}=2\sin\theta=0.76 \\ \mathbf{R}=2\sin\theta=0.76 \end{cases}$$

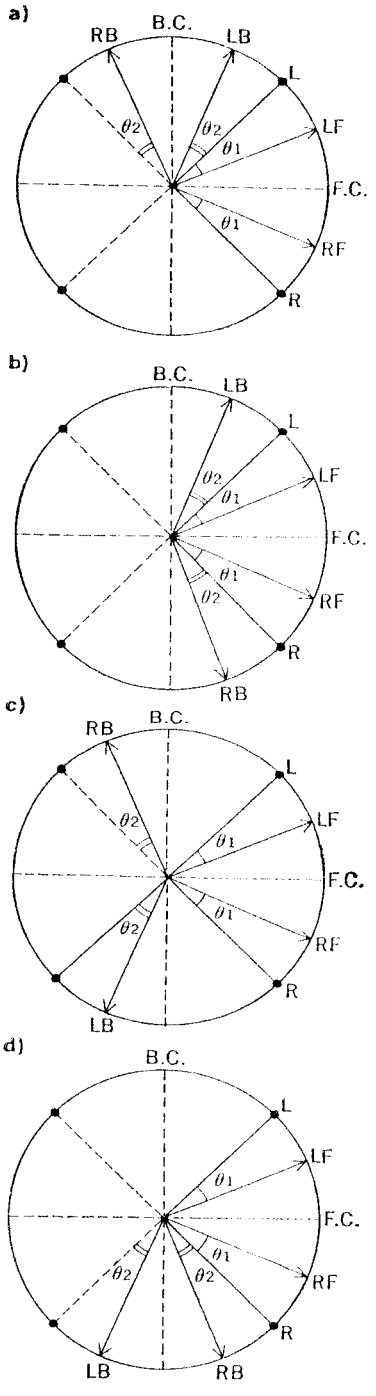
$$\begin{cases} \mathbf{L}=(\mathbf{LF}-\mathbf{LB})\cos\theta+(\mathbf{RF}-\mathbf{RB})\sin\theta \\ \mathbf{R}=(\mathbf{RF}+\mathbf{RB})\cos\theta+(\mathbf{LF}+\mathbf{LB})\sin\theta \end{cases}$$

when LF=RF=RB=LB (=1);

$$\begin{cases} \mathbf{L}=0 \\ \mathbf{R}=2\cos\theta+2\sin\theta=2.60 \end{cases}$$

(at the vector angle $\theta_1=\theta_2=\frac{\pi}{8}$)

Fig. 2 Basic Matrixing Methods and Disc Cuttings

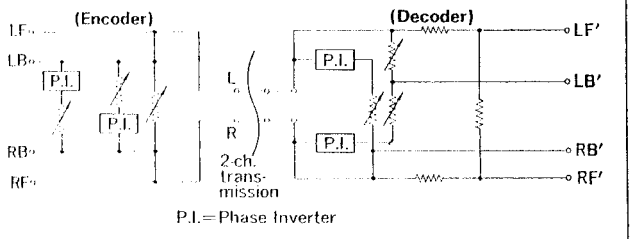


F.C.=Front Center
B.C.=Back Center

1) Four-Channel Matrixing

There are four basic types of coding system four-channel matrixing, as shown in Fig. 2. All four-channel coding systems announced so far by various manufacturers— Scheiber-Audiodata, Feldman-E-V, Hafler-Dynaco, J.O.K.E., Columbia-Sony (this system will be further discussed later because it is slightly different from and is not fully campatible with other matrix systems) and others—are classified into them.

Fig. 3 Typical Encoding/Decoding Diagram



P.I.=Phase Inverter

Whichever system is standardized (which we believe should be done as soon as possible), it must satisfy certain basic requirements. Mr. P. Scheiber lists these requirements in three categories in his AES article* with which we completely agree. They are as follow:

1) Basic four-channel performance:
   a) The ability to record sounds occurring at any point in 360°, and to reproduce each sound from the correct location in playback;
   b) Nondegradation of signal quality, including noise, frequency and nonlinear distortion as consistent with highest standards in the state of the art.

2) Compatibility:
   a) four-channel compatibility: nonobsolescence of playback equipment, using each standard components and construction wherever possible;
   b) stereo compatibility: the ability to reproduce the four-channel program on all standard two-channel "stereo" equipment, with all sounds in the four-channel program heard in their proper left right positions;
   c) mono compatibility: monaural playback possible on all standard equipment, without losing, or altering the relative level of, any sound in the four-channel program.

3) Economy
   a) adaptability to standard practices for software manufacture;
   b) full playing time within a given format, as compared with the equivalent stereo recording;
   c) usable with all major recording media and, preferably, broadcast.

* Journal of the Audio Engineering Society, April 1971 "Four Channels and Compatibility" by Mr. P.Scheiber.

Among the requirements Mr. P. Scheiber enumerates above, the special emphasis must be placed on 1) a), which embodies the importance of correct localization of original surround sounds in the reproduced sound field.

As will be analyzed hereunder, four-channel matrixing causes a loss or miss localization of information in its encoding/decoding process mainly because of the existence of out-of-phase sound components.

To simplify the explanation using the equations in Fig. 2 a)~d), the vector angle θ_1 and θ_2 are set at an identical value. (Of course, both θ_1 and θ_2 could be independent and be of any angular value. The E-V Decoder has different θ_1 and θ_2 angular values.)

Taking Fig. 2-b) equations as an example, the encoder output will be:

$$\left.\begin{aligned} \mathbf{L}&=(\mathbf{LF}+\mathbf{LB})\cos\theta+(\mathbf{RF}-\mathbf{RB})\sin\theta \\ \mathbf{R}&=(\mathbf{RF}+\mathbf{RB})\cos\theta+(\mathbf{LF}-\mathbf{LB})\sin\theta \end{aligned}\right\} \quad \cdots\cdots\cdots\cdots\cdots\cdots ①$$

Then, the relative decoder output will be:

$$\left.\begin{aligned} \mathbf{LF}'&=\mathbf{L}\cos\theta+\mathbf{R}\sin\theta=\mathbf{LF}+2\mathbf{RF}\sin\theta\cos\theta+\mathbf{LB}\cos 2\theta \\ \mathbf{RF}'&=\mathbf{R}\cos\theta+\mathbf{L}\sin\theta=\mathbf{RF}+2\mathbf{LF}\sin\theta\cos\theta+\mathbf{RB}\cos 2\theta \\ \mathbf{RB}'&=\mathbf{R}\cos\theta-\mathbf{L}\sin\theta=\mathbf{RB}-2\mathbf{LB}\sin\theta\cos\theta+\mathbf{RF}\cos 2\theta \\ \mathbf{LB}'&=\mathbf{L}\cos\theta-\mathbf{R}\sin\theta=\mathbf{LB}-2\mathbf{RB}\sin\theta\cos\theta+\mathbf{LF}\cos 2\theta \end{aligned}\right\} \quad ②$$

From the above equations ①, if LB=RB=1, or when there is a sound source at the back center of the original sound field, the following equations are obtained.

$$\left.\begin{aligned} \mathbf{L}&=\mathbf{LF}\cos\theta+\mathbf{RF}\sin\theta+(\cos\theta-\sin\theta) \\ \mathbf{R}&=\mathbf{RF}\cos\theta+\mathbf{LF}\sin\theta+(\cos\theta-\sin\theta) \end{aligned}\right\} \quad \cdots\cdots\cdots\cdots\cdots\cdots ①'$$

The equations ①′ show that there occurs a complete cancellation of out-of-phase components in the left and right back channels, so that all the resultant left and right channels of the encoder output are composed of in-phase sounds only.

In other words, there occurs a loss of information and miss localization of sound sources during the encoding process. This also indicates that it is practically impossible to encode simultanious four-channel signals of an identical level and phase.

Then, equations ② show that the left and right back are in completely reverse phase. This means that any sound sources located in the back in a four-channel program would sound very unnatural and unclear from the lack of directionality and localization of sounds even if the encoding is correctly done.

In the same manner, it is easily proved that the same phenomena occur in other types of matrixing shown in Fig. 2 as well.

Unfortunately, all the four-channel encoders introduced so far have been incapable of converting true four-channel information to two-channels faithfully and reconvert them to four because of the cancellation of certain information in program sources in their encoding processes.

Here, it must be concluded that a simple matrixing system to encode and decode four-channel programs does not seem to overcome this vital defect, and that a new technique must be added to augment it.

From the very beginning of its research and development work in this area, Sansui tackled these difficulties, and has recently completed, for the first time ever in this field, a revolutionary four-channel encoding/decoding system which completely does away with them.

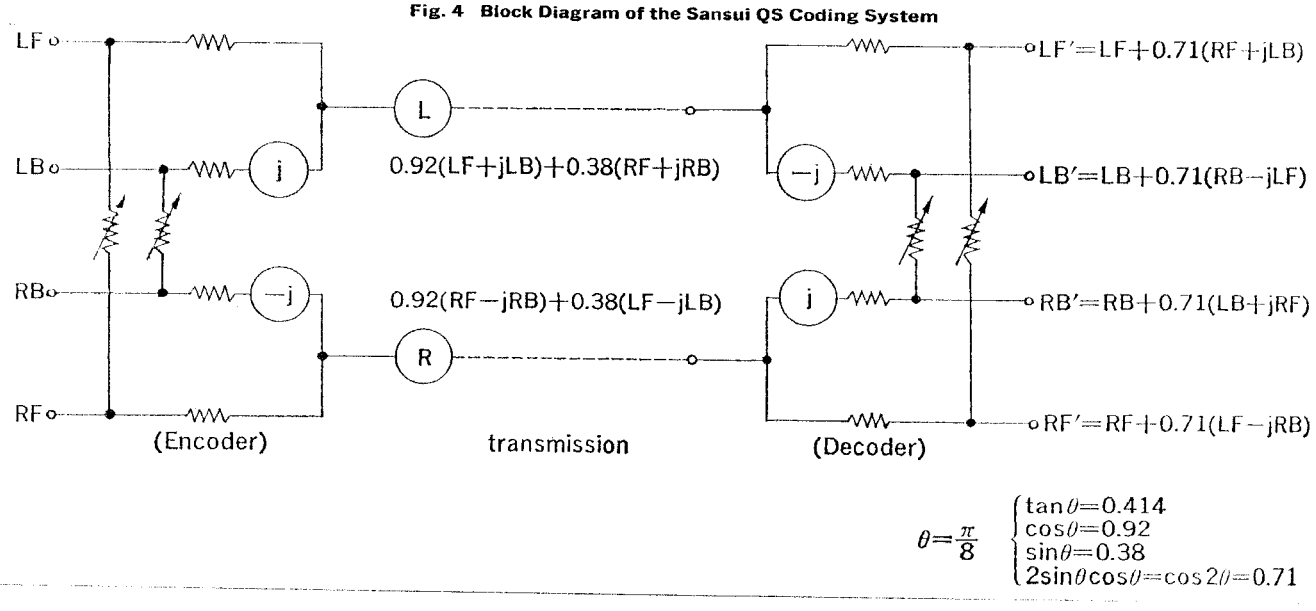
II The Sansui QS Coding System

The Sansui coding system completely satisfies the basic requirements previously mentioned. It offers these exclusive features:

a) An ability to encode original 360° sounds without any loss and miss localization of sound sources, and to decode them faithfully in playback as four-channel stereo.
b) Nondegradation of sound quality by adding two back channels to ordinary stereo. No colouration or artificiality.
c) Compatibility with stereo (in two-way) and monaural (for practical use) and also with other matrix four-channel systems (except CBS system as they claim).
d) Adaptability to present standards of discs, tapes and broadcasts, and thus nonobsolescence of existing hardware and software.
e) Very light extra-expenses for consumers to quadralize their existing equipment and no increase of cost to purchase encoded four-channel program sources.
f) Very light investment for recording and broadcasting industry to quadralize the existing systems.

These have become a reality by the adaptation of ±90° phase shifters (patents pending) and by setting disc cutting vector angles (θ) between four-channels at 22.5° in an ordinary disc groove. Fig. 4 shows a block diagram of the Sansui QS Encoder and Decoder.

Fig. 4 Block Diagram of the Sansui QS Coding System



(1) Loss of information

Unlike conventional four-channel matrixing circuitry, the Sansui QS Encoder phase-shifts left and right back channels by ±90°, instead of using an ordinary 180° phase inverting method to achieve a reverse-phase (180°) relationship between the left and right back channels.

This puts the four encoded channels in an ideal phase relationship as illustrated in Fig. 6-a) Signals are no longer cancelled in the encoder, and any information from any direction in the original sound field can be faithfully encoded.

On the decoder side, back channels are phase-shifted in a manner contrary to the encoder; namely, left back is shifted by −90° and right back by +90°. Thus the reverse-phase relationship between the back channels is reconverted to an in-phase one (see Fig 6-b).

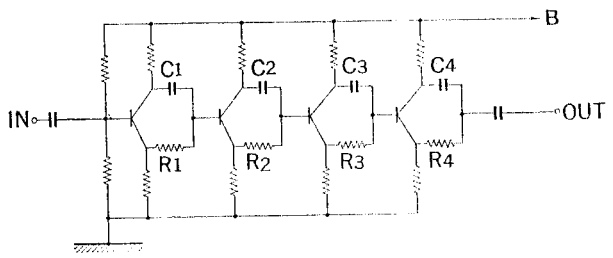
This function is well explained in terms of vector angles in the disc groove (see Fig. 7-b).
Now, the encoder outputs will be:

$$\left.\begin{aligned} \mathbf{L} &= (\mathbf{LF}+\mathbf{jLB})\cos\theta + (\mathbf{RF}+\mathbf{jRB})\sin\theta \\ \mathbf{R} &= (\mathbf{RF}-\mathbf{jRB})\cos\theta + (\mathbf{LF}-\mathbf{jLB})\sin\theta \end{aligned}\right\} \quad \cdots\cdots\cdots\cdots\cdots\cdots ③$$

The above equations ③ prove that there is no loss of information in the encoding process by adapting j-phase (±90° shifters).

Fig. 5 Sansui QS Phase Shifters

a) Basic diagram



b) Characteristics

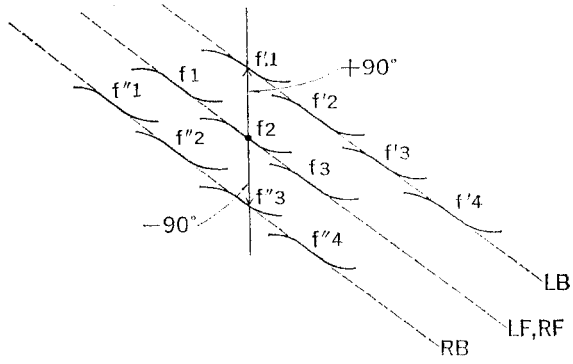
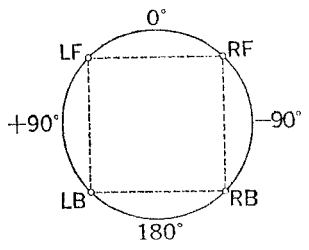
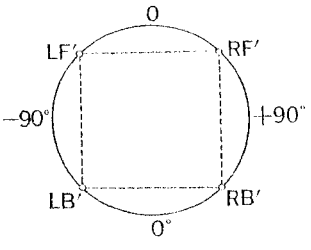


Fig. 6 Phase Relationship between Channels

a) Encoder output



b) Decoder output



While the decoder outputs will be:

$$LB' = L\cos\theta + R\sin\theta = LF(\cos^2\theta + \sin^2\theta) + RF(2\sin\theta\cos\theta) + jLB(\cos^2\theta - \sin^2\theta) = \underline{LF + 2RF\sin\theta\cos\theta + jLB\cos 2\theta}$$

$$LB' = L\cos\theta - R\sin\theta = jLB(\cos^2\theta + \sin^2\theta) + jRB(2\sin\theta\cos\theta) + LF(\cos^2\theta - \sin^2\theta) = jLB + 2jRB\sin\theta\cos\theta + LF\cos 2\theta$$

$$(-j) \rightarrow \underline{LB + 2RB\sin\theta\cos\theta - jLF\cos 2\theta}$$

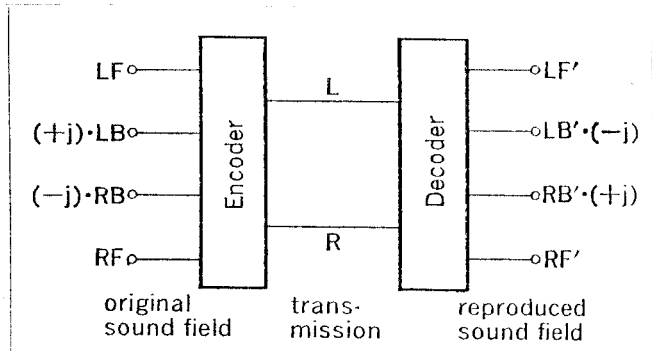
$$RB' = R\cos\theta - L\sin\theta = -jRB(\cos^2\theta + \sin^2\theta) - jLB(2\sin\theta\cos\theta) + RF(\cos^2\theta - \sin^2\theta) = -jRB - 2jLB\sin\theta\cos\theta + RF\cos 2\theta$$

$$(+j) \rightarrow \underline{RB + 2LB\sin\theta\cos\theta + jRF\cos 2\theta}$$

$$RF' = R\cos\theta + L\sin\theta = RF(\cos^2\theta + \sin^2\theta) + LF(2\sin\theta\cos\theta) - jRB(\cos^2\theta - \sin^2\theta) = \underline{RF + 2LF\sin\theta\cos\theta - jRB\cos 2\theta}$$

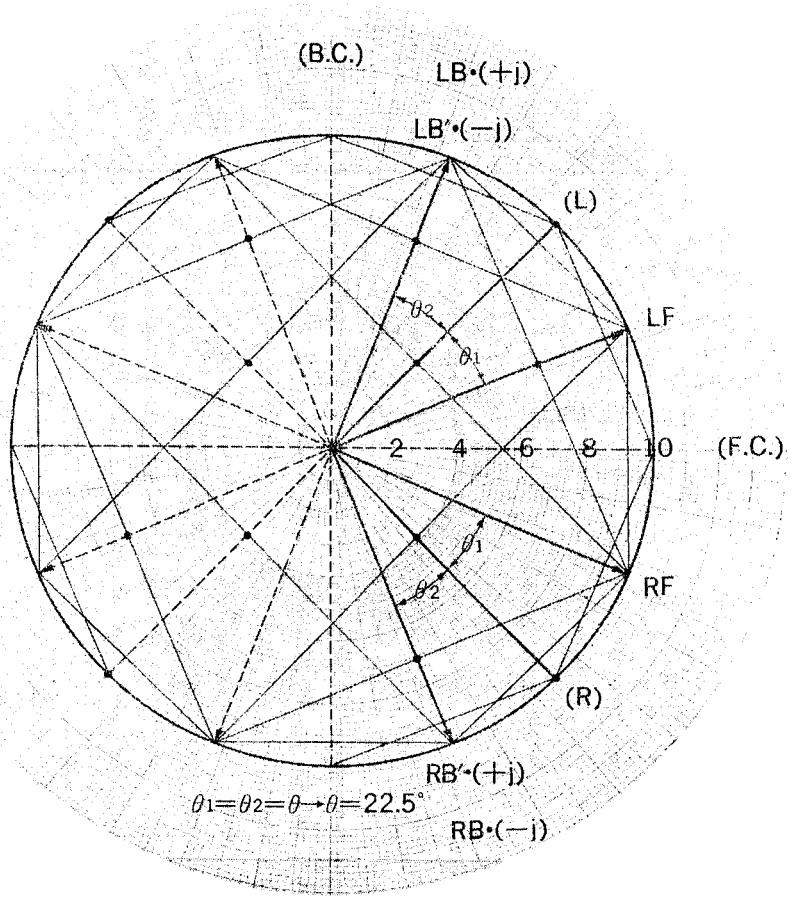
④

As the above equations ④ indicate, the four-channel input signals fed to the QS Encoder are fully brought out in their entirety by the QS Decoder through any two-channel media to the reproduced sound field.



a) Coding System

Fig. 7 Sansui QS Coding System



(2) Blending Coefficient for the Encoder/ Decoder

In determining the value of the inter-channel blending coefficient for a matrix coding system, careful consideration must be given to the types of program sources available.
Even conventional 2-channel stereo sources are available in variety, including:

1) those utilizing only two (left and right) mono channels independently (no intermediate phantoms).
2) those with sound images localized at three mono channels i.e., left, center and right.
3) multiple-track sources with sound images localized at multiple points on a line between left and right channels.
4) sound field recodings without any distinctive sound images such as those of a church organ.

Four-channel program sources can also be classified in a similar manner, and this fact must be carefully weighed in determining the blending coefficient. The blending quantity among four channels of information in the encoding process must in no way restrict the flexibility.

(3) Localization of Sound Images by the Sansui QS Coding System

Fig. 8 (A) illustrates the localization of sound images by the Sansui QS coding system. L_1 and R_1 symbolize the input signals representing sound sources located to the front of the listener, while L_2 and R_2 symbolize those representing sound sources located to the back of the same listener.
Sound images between L_1 and R_1 can be localized in exactly the same manner as when recording a conventional 2-channel stereo program source. It is therefore possible to localize as many sound images as desired. The same is also true of the localization of sound images between L_2 and R_2. For example, suppose, in Fig. 8 (A), a microphone located at point M_1 picked up a sound pressure $E\varphi_1$.

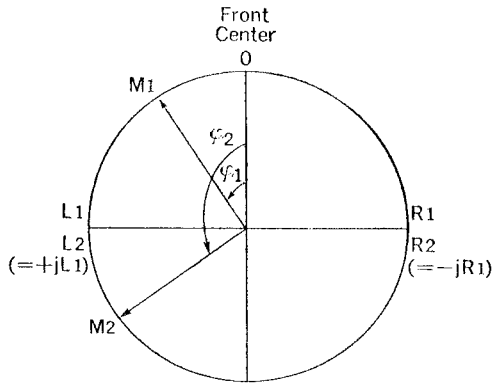
When $-\frac{\pi}{2} \leqq \varphi_1 < -\frac{\pi}{2}$, the left (L) and right (R) channel outputs would then be:

$$\left.\begin{aligned} L &= E\varphi_1 \cos\left(\frac{\pi}{4} - \frac{\varphi_1}{2}\right) \\ R &= E\varphi_1 \sin\left(\frac{\pi}{4} - \frac{\varphi_1}{2}\right) \end{aligned}\right\} \quad \cdots\cdots ⑤$$

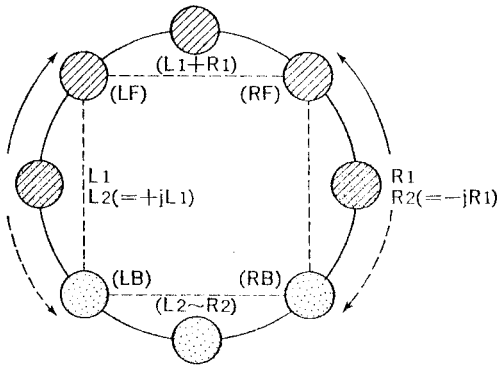
when $\frac{\pi}{2} \leqq \varphi_1 < \frac{3\pi}{2}$,

Fig. 8

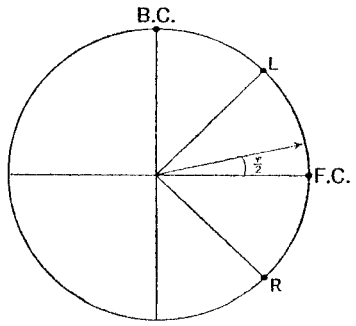
(A) Recording and Localization of Sound Images in 360°



(B) LF', LB', RF' and RB' Represent 'Primary Sound Images'*.



(C) Disc Cutting Vectors of the Sound Images Illustrated in (A).



$$\left.\begin{aligned} L &= jE\varphi_1 \cos\left(\frac{\pi}{4}-\frac{\varphi_1}{2}\right) \\ R &= jE\varphi_1 \sin\left(\frac{\pi}{4}-\frac{\varphi_1}{2}\right) \end{aligned}\right\} \quad \cdots\cdots ⑥$$

These outputs are reproduced through a decoder with any desired blending coefficient with the speaker outputs shown as follow:
when speakers are placed in front of the listener,

$$X_{\varphi_2} = L\cos\left(\frac{\pi}{4}-\frac{\varphi_2}{4}\right)+R\sin\left(\frac{\pi}{4}-\frac{\varphi_2}{2}\right) \quad \cdots\cdots ⑦$$

when speakers are placed at the back of the listener,

$$X_{\varphi_2} = -j\left\{L\cos\left(\frac{\pi}{4}-\frac{\varphi_2}{2}\right)+R\sin\left(\frac{\pi}{4}-\frac{\varphi_2}{2}\right)\right\} \quad \cdots\cdots ⑧$$

The sound pressure response of this "encode-decode" process P is:

$$P = \cos\frac{\varphi_1-\varphi_2}{2} \quad \cdots\cdots ⑨$$

As is formularized above, the most suitable psychoacoustic sound presure is obtained when $\varphi_1=\varphi_2$. Fig. 12 in page T1-11 represents a relative crosstalk characteristics. Localization of surround sound images shown in the equations ⑤ and ⑥ may be thus accomplished either by electrically varying the blending coefficient through the manipulation of the panpots of the mixing console, or by encoding with a pre-determined blending coefficient with respect to the "primary sound images"* which should be consistent throughout the "encode-decode" process. Most important, it should be such a value as produces a "zero" output in the diagonally opposite channel. In the Sansui QS coding system, this value is set at $\frac{\pi}{8}=22.5°$, rendering the "encode-decode" matrix square, for the reasons to be explained later.

*This represents sound images to be localized in the four square corners of the recording and reproducing sound fields. This square array is obtained by selecting φ values in the equations ⑤ ⑥ ⑦ and ⑧ as following:

$$\frac{\pi}{4},\ \frac{3\pi}{4},\ \frac{5\pi}{4},\ \frac{7\pi}{4}$$

(4) Reasons why θ value should be 22.5°

In a four-channel stereo system, the information contained in each channel must be treated equally. As is clear from Fig. 7-a), this can be accomplished only when the vector angles among the four channels are identical, i.e., when they are all $\pi/8$ ($2\theta=\pi/4$).

In this condition;

a) the crosstalks among adjacent channels are equally 3dB. Thus, the four channels are reproduced uniformly to obtain a square sound field (see Fig. 10).

b) equal volume balance is attained among the four channels, so that distinct sound images can be positioned in any direction inside the square sound field (see Fig. 11).

c) the encoder and decoder can be allowed to blend an identical quantity of information into adjacent channels.

d) programs encoded by an encoder in which $\theta=22.5°$, can be decoded by a decoder with a different vector angular value without losing much of their four-channel effect.

e) conversely, a decoder in which $\theta=22.5°$, is able to reproduce programs encoded by an encoder with a different vector angular value without losing much of their four-channel effect.

To clarify the points made above, Figs. 11, 12 and 13 show the sound pressure response in different channels to visualize how the sound images are formulated in reproduction.

Fig. 9 Basic Encoding Diagram to Obtain 360° Directional Sound Images Using Panning Equipment.

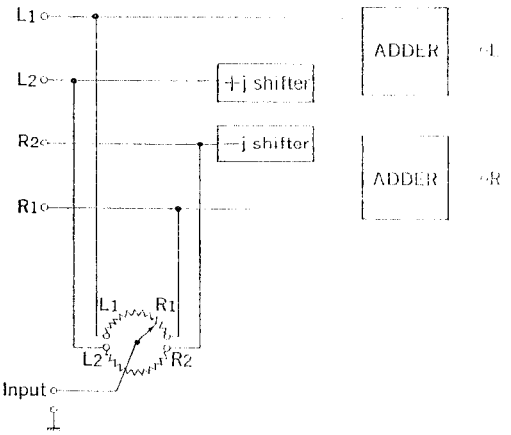


Fig. 10 Ideal Four-Channel Reproduction of Sound Field.

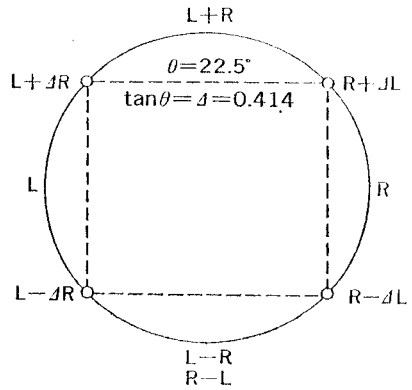


Fig. 11 illustrates eight visual patterns of the phase, crosstalk and directional relationship among the channels. As can be seen in these figures, the QS Decoder allows distinct psycho-acoustic images of direction to be formed in the same directions as those in the original sound field.

Fig. 11 Sansui QS Coding System; Sound Pressure Patterns and Phase Relationship between Channels in the Reproduced Sound Field

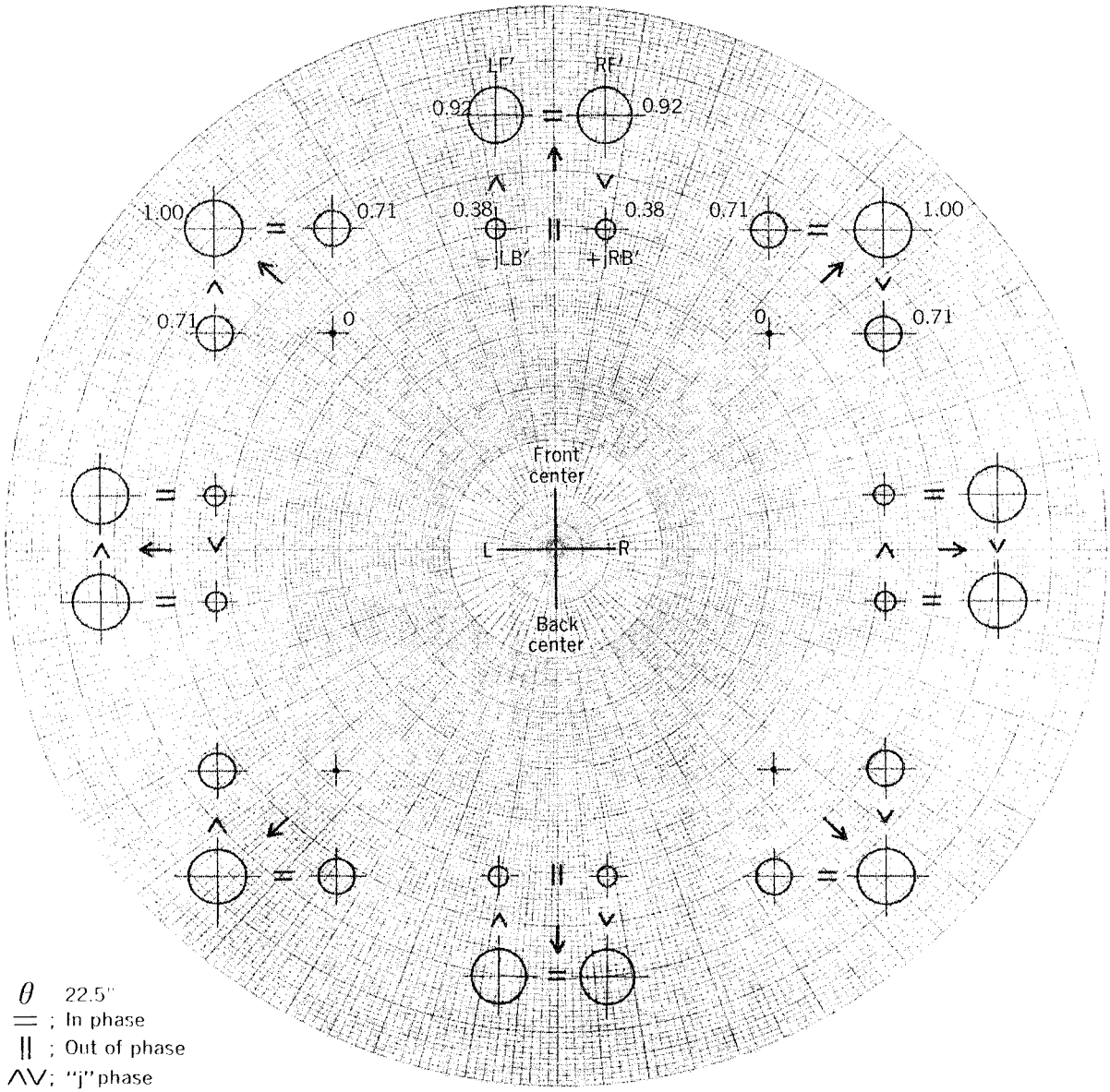


Fig. 12 showing the sound pressure response of a sound source located in the left front channel, clearly indicates the reproduced sound image is shaped as a symmetrical pattern accurately directed from the crossing of polar coordinates toward the point where the sound source is located.

Fig. 12 A Typical Sound Pressure Response

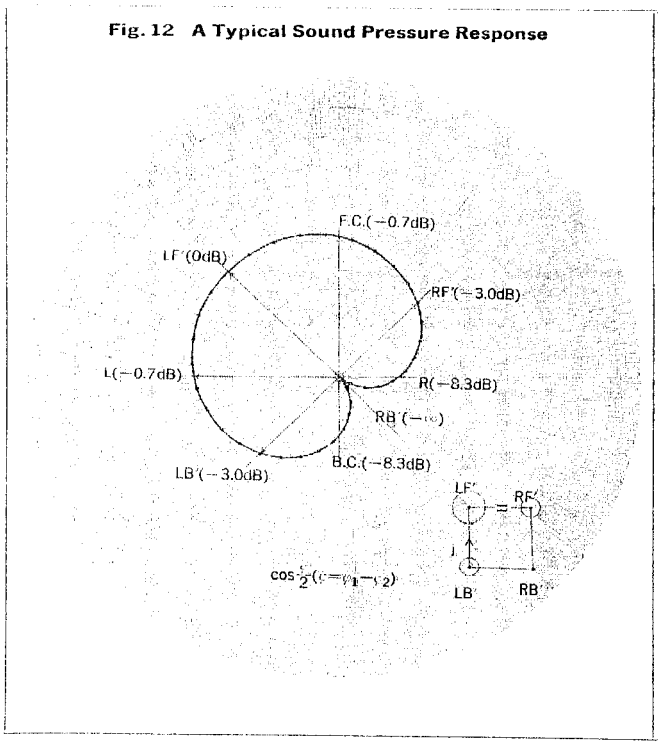
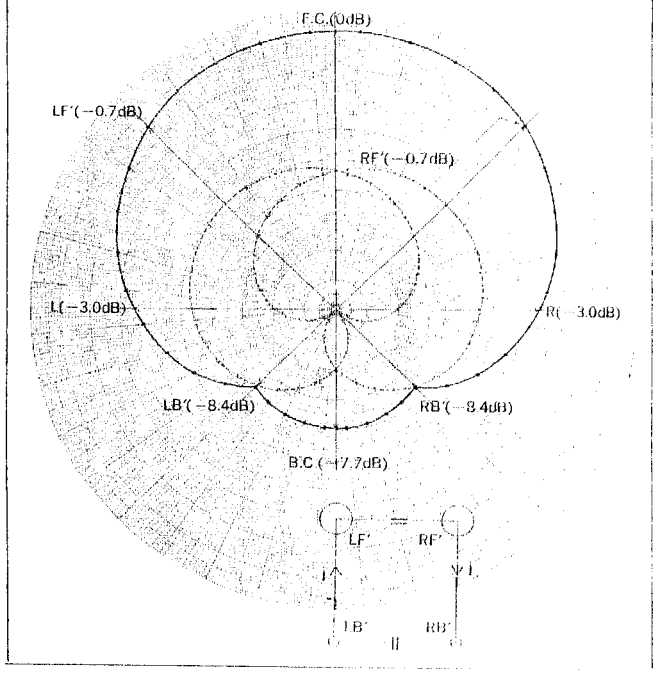


Fig. 13 shows the same situation with respect to a sound source located at the front center. While all four speaker systems emit sound in this case, the crosstalk to the opposite center direction is −7.68dB, enabling a distinctively well-balanced psycho-acoustic field to be created among the four channels with the accurate directionality towards the front center.

Fig. 13 Sound Pressure Response of Front Center Sound Source Point



Let us now consider for a minute what would happen if the vector angle θ were not 22.5°.

First, if it were smaller than 22.5°:
As can be seen in Fig. 14-a), the separation between the left front and back, and that between the right front and back, would be impaired. This would result in a vertically short oblong sound field, making it impossible to obtain equal sepatations among the four channels.

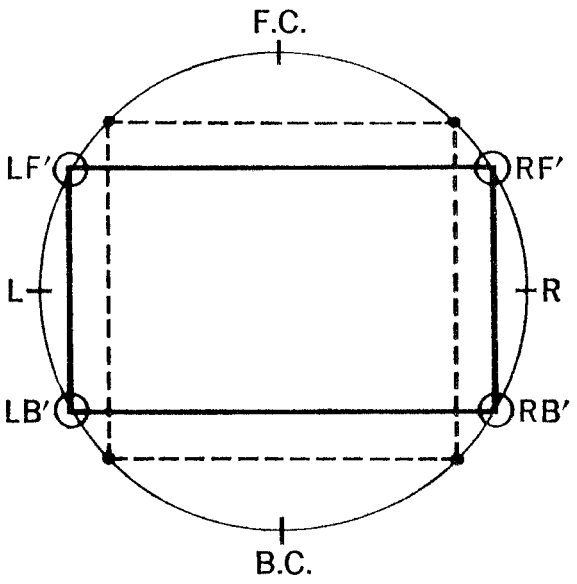
If it were larger than 22.5°:
The separation between the left and right front and that between the left and right back would deteriorate, impairing the volume balance among the channels (see Fig. 14-b).

Thus it is clarified that the value of the vector angle θ has a serious effect on the directional characteristics of the reproduced sound images and the shape of the reproduced sound field. This is relatively inconsequential in a 2-2-4 conversion, but if the vector angle were different in the encoder and decoder, it is obvious that the original sound field pattern would not be faithfully reproduced.

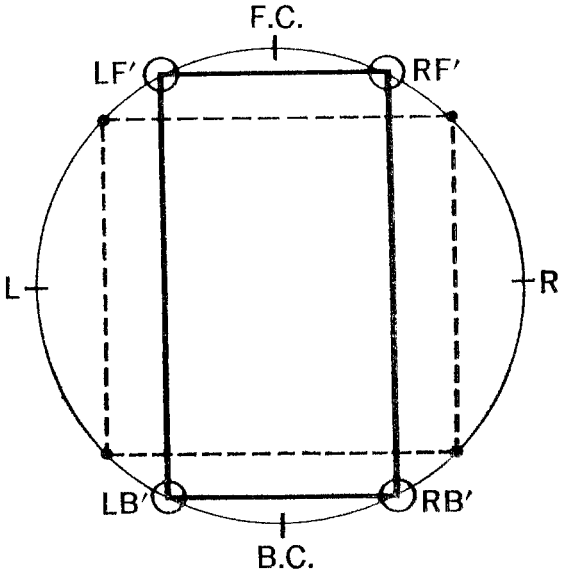
As outlined in the preceding paragraphs, the Sansui QS Coding System thus successfully attains the true aims of four-channel reproduction with its versatile compatibility with two-channel stereo and monaural through an encoding/decoding process. We are convinced that, measured by any standards, it is the most advantageous, most authentic coding system that facilitates the original recording, 4-2 conversion, transmission, 2-4 conversion and reproduction processes. The QS Encoder, an essential part of that coding system, thus makes it possible to take maximum advantage of conventional two-channel audio equipment to reproduce the original sound field in the listener's room.

Fig. 14 An Illustration of Reproduced Sound Field Simulation When "θ" Angle is Not Set to 22.5°

a) $\theta < 22.5°$



b) $\theta > 22.5°$



D Improved QS decoder

THE SANSUI QS CODING SYSTEM AND A NEW TECHNIQUE TO IMPROVE INTER-CHANNEL SEPARATION CHARACTERISTIC

(Patents Pending)

ABSTRACT

Reasons are given why a matrix must be rotationally symmetrical to encode and decode a sound field. Then a new technique is introduced to achieve an exceptional sense of naturalness and greatly enhanced separation between any pair of the four decoded channels. It involves the use of a rotationally symmetrical **variable** decoding matrix (Vario-Matrix) and controlling it with the phases of the two encoded channels.

BASIC DESIGN CONSIDERATIONS OF A MATRIX

A few fundamental requirements of a 4-channel matrix are described below.

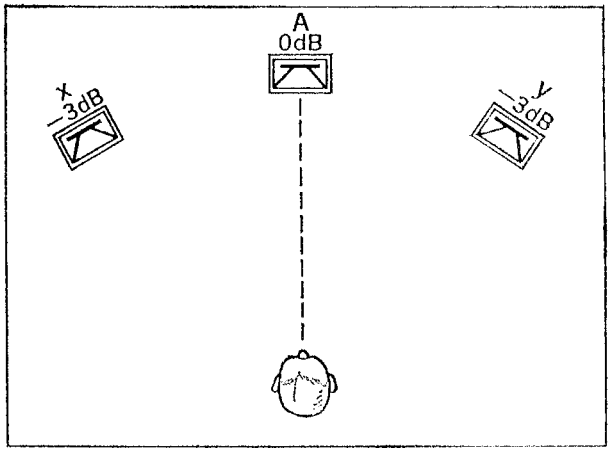
(1) Symmetry

Crosstalk is an unavoidable consequence of any matrixing system of 4-channel stereo whereby four channels of information are matrixed or encoded into two channels, stored in 2-channel media, and then dematrixed or decoded back into four channels. The question then is how to best distribute such crosstalk.

It is mathematically obvious that the maximum separation among the four channels in any 4-2-4 matrix system (such as described above) is 0dB, −3dB, −3dB and $-\infty$dB. The question is thus further narrowed down to how best to exploit this mathematical ultimatum.

To locate a real sound image correctly, the ideal distribution of the crosstalk is as illustrated in Fig. 1. In this arrangement, the −3dB crosstalk is allowed in the two adjacent channels, x and y, of the primary channel A. The phantom sound image formed by the crosstalk components will then be located in the primary channel. All this means that a phantom sound image resulting from crosstalk components coincides with a real sound image only if the speakers reproducing the crosstalk components are placed symmetrically on both sides of the subject speaker. The same symmetry is also required for any phantom sound image located between any pair of speakers.

Fig. 1. Superposition of Real Sound Image and phantom Images Produced by Crosstalk (Symmetry)



(2) Superposition of Input Signals inside the Encoder

This is another important requirement. Namely, if identical signals were fed simultaneously to the two input terminals of the encoder which are directional by ϕ_1 and ϕ_2, respectively, they must be superposed upon each other inside the encoder, without cancelling each other to any extent, and be encoded into an output signal whicn is directional exactly halfway between ϕ_1 and ϕ_2. This is particularly important to locate a phantom sound image correctly.

Since we are encoding into two channels, the matrix must be constructed so that the two encoder output signals will gradually come to represent a full circle as the difference between ϕ_1 and ϕ_2 approaches π.

(3) Circular Continuity

To reconstruct a complete sound field out of four speakers, the above requirements need be fulfilled with respect to signals on a complete circle. It means that a rotationally symmetrical matrix is required for both encoding and decoding.

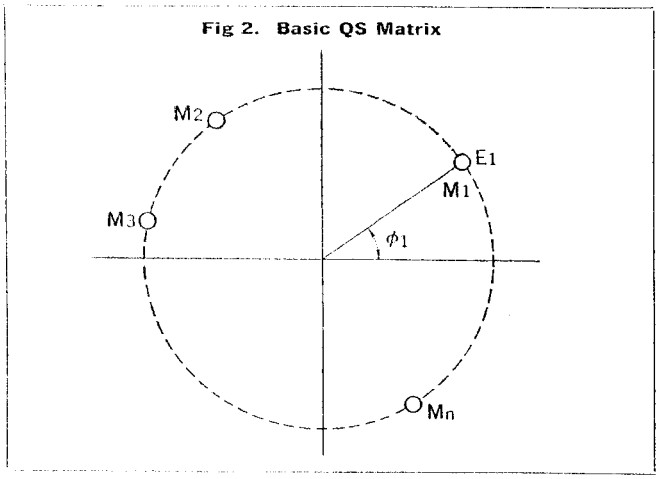
However, this is much easier said than done. Symmetry and superposition of input signals are realized very well in given directions if the encoding matrix always treats them in phase with one another. Doing so, however, would produce points of discontinuity in the reproduced sound field. This is a basic dilemma in trying to embody a full 360° directionality in two channels only.

The rotational symmetry input signal superposition and circular continuity are important characteristics of the QS Coding System, and are also essential foundations for the variable decoding matrix described in the second half of this paper.

QS MATRIX

A matrix as described below achieves the symmetry, superposition and circular continuity discussed previously.

Fig 2. Basic QS Matrix



Vision a sound field where microphones $M_1 \sim M_n$ are placed (Fig. 2). M_i is placed at a counterclockwise angle of ϕ_i from the right, and assume its output voltage to be E_i. Then, assuming all the succeeding microphones up to the M_nth one are placed in corresponding counterclockwise directions, the optimal encoding matrix is expressed as

$$\begin{pmatrix} L \\ R \end{pmatrix} = \begin{pmatrix} e^{j\left(\frac{\phi_1}{2}-\frac{\pi}{4}\right)}\sin\frac{\phi_1}{2} & \cdots & e^{j\left(\frac{\phi_n}{2}-\frac{\pi}{4}\right)}\sin\frac{\phi_n}{2} \\ e^{j\left(\frac{\phi_1}{2}-\frac{\pi}{4}\right)}\cos\frac{\phi_1}{2} & \cdots & e^{j\left(\frac{\phi_n}{2}-\frac{\pi}{4}\right)}\cos\frac{\phi_n}{2} \end{pmatrix} \cdot \begin{pmatrix} E_1 \\ \vdots \\ E_n \end{pmatrix} \quad \cdots\cdots (1)$$

Such a matrix provides for "panning" a complete circle. With two differently directional microphones feeding signals from the same sound source, their cutting vectors will be superposed. As the difference in angles (ϕ) grows and approaches π, the locus of the resultant composite vector will approach a full circle to represent sounds on a full circle. It will be rotationlly symmetrical, and will always be cut in the direction of $\phi/2$ from the R axis.

In practice, the exponential term j of the term e in equation (1) need not be varied continuously, but can be substituted for by several fixed angles. It Is for this reason that we have been proposing a matrix which puts the front two channels in phase while shifting the back two channels by $\pm 90°$ from the front channels.

This matrix, which we term the QS Matrix, is, for encoding purposes, expressed as

$$\begin{pmatrix} L \\ R \end{pmatrix} = \begin{pmatrix} \sin\frac{\phi}{2} & j\sin\frac{\phi}{2} \\ \cos\frac{\phi}{2} & j\cos\frac{\phi}{2} \end{pmatrix} \cdot \begin{pmatrix} F(\phi) \\ B(\phi) \end{pmatrix} \quad \cdots\cdots (2)$$

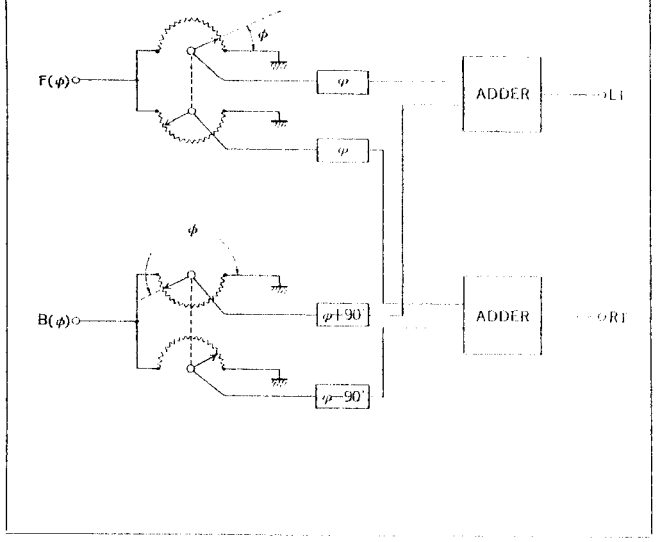
where ϕ is the counterclockwise angle of the sound source from the R axis, F (ϕ) the sound source in the front, and B (ϕ) the sound source in the back. Then, for decoding, the matrix is given by

$$\begin{pmatrix} F'(\theta) \\ B'(\theta) \end{pmatrix} = \begin{pmatrix} \sin\frac{\theta}{2} & \cos\frac{\theta}{2} \\ -j\sin\frac{\theta}{2} & -j\cos\frac{\theta}{2} \end{pmatrix} \cdot \begin{pmatrix} L \\ R \end{pmatrix} \quad \cdots\cdots (3)$$

where θ is the counterclockwise angle of the decoder matrix vector from the R axis, F′ (θ) the decoded output signal to be reproduced in the front, and B′ (θ) the one to be reproduced in the back.

Fig. 3 shows a block diagram of the encoder employing such encoding matrix.

Fig 2. Block Diagram of QS Encoder



ADVANTAGES OF THE QS CODING SYSTEM

The QS Coding System is based on the encoding and decoding matrices previously described. Because of their rotational symmetry, superposition and circular continuity properties, the coding system is able to offer these advantages:

1. There is no directional error. As the matrix gives rotational symmetry and circular continuity, it is possible to reproduce sound source is a full 360° correctly.
2. No loss of the input information occurs. Input signals are superposed inside the encoder and create continuity; no part of the input information is cancelled.
3. As the matrix is rotationally symmetrical and permits superposition of input signals, it is possible to locate a sound image at the dead center of the sound field.
4. Since superposition takes place in a rotationally symmetrical manner, simultaneous multiple input signals are processed normally.
5. It allows rotationally symmetrical coding of input signals, both electrically and acoustically.
6. The front two channels are encoded in phase with each other, lending themselves to 2-channel stereo playback without affecting the sound image positions.
7. The back two channels are encoded out of phase with each other by exactly 180°; in stereo playback they will be located outside of the two speakers or at no definite positions, merely enhancing the stereo effect.
8. For the same reason, even the simplest form of matrix, such as a speaker matrix, will be able to provide sufficient front-back separation.
9. On regular 2-channel stereo discs, reverberation components are often recorded with mutually reverse phases in the left and right channels. This permits the QS decoding matrix to work as a "synthesizer", expanding the two channels to 4-channels.
10. Mixing down to 2-channels by a matrix does not degrade the current standards of hi-fi stereo playback, including those pertaining to frequency response, dynamic range, distortion, etc.
11. It affords excellent compatibility with 2-channel stereo playback. Because of its symmetrical and continuous properties, the left and right speaker positions in 2-channel stereo playback may be merely regarded as two points to the straight left and right of the listener in 4-channel stereo playback. It is possible to locate sounds anywhere between these two points, so there is no problem of compatibility with stereo playback.

NEW TEQUNIQUE TO IMPROVE SEPARATION

(1) Basic Theory

It is a mathematical fact that the maximum possible inter-channel separation of any 4-2-4 matrix system is a combination of two −3dB channels and one −∞dB channel. It is also true that such separation does not permit enjoyment of 4-channel stereo playback with sufficient directional resolution. There are only two courses of action to get around this-giving some psycho-acoustic treatment to the encoded two channels or exploiting the redundancy in the two channels of stereo media.

There is a certain matrix system which places almost undivided emphasis on the left-right separation. It offers excellent separation in the left-right direction by arranging the −∞dB channel in that direction. Such a matrix, however, loses the rotational symmetry, superposing capability and resultant circular continuity that we discussed before. As a result, the front-back separation by such a matrix is practically nil. This is almost analogous to connecting the two left-hand speakers and the two right-hand ones separately in parallel and listening to two separate stereo playback performances. It takes us away from our original aim which is to obtain directional resolution in 4 or more directions from two channels.

The reason why we have brought up this argument here is because the symmetry and resultant continuity are vital prerequisites of the new technique that we have developed to improve the inter-channel separation in 4-channel playback.

A symmetrical matrix provides for controlling its separation characteristic by a special technique which we propose to call a "variable matrix" or "Vario-Matrix", instead of resorting to the usual logic circuit which gives an apparent increase in separation by controlling the decoder gain.

As is already known, when a high-amplitude signal is fed to the LF channel and a low-amplitude signal to the LB channel, such logic circuit boosts the decoder gain in the LF′ channel while lowering that in the LB′ channel at the same time.
The result of this is that greater separation is obtained for the high amplitude signal, but the low-amplitude signal fed to LB is no longer reproduced out of the LB′ channel because the decoder gain in that channel is reduced. Only its crosstalk components are reproduced out of other speakers.
Another serious effect of an asymmetrical matrix is that a real sound image and its phantoms resulting from crosstalk are located at different positions. The extent of this deviation increases as the logic circuit goes to work, producing a series of complicated displacements of sound images in the sound field.
The variable matrix to be discussed in the following paragraphs controls output signals symmetrically by varying the matrix itself. It is an amplitude matrix with an element of phase matrix added, and is possible only because the matrix is rotationally symmetrical in nature.

(2) Variable Matrix

Lets us study the separation characteristic of our QS coding system through the encode-decode process, based on equations (2) and (3).
A sound source in the ϕ direction is encoded by the QS encoding matrix into

$$L = E\phi \sin\frac{\phi}{2}$$

$$R = E\phi \cos\frac{\phi}{2}$$

On the other hand, signal E′θ which is decoded by the QS decoding matrix in the θ direction is given by

$$E'_\theta = L \sin\frac{\theta}{2} + R \cos\frac{\theta}{2}$$

$$= E_\phi \sin\frac{\phi}{2}\sin\frac{\theta}{2} + E_\phi \cos\frac{\phi}{2}\cos\frac{\theta}{2}$$

$$= E_\phi \cos\frac{\phi-\theta}{2}$$

Thus the angular difference between the direction of the encoded signal and a given direction θ in which it is dedoded, is always symmetrical along the encoded direction. For example, Fig. 4 shows the sound pressure response of the decoder outputs when a signal encoded in the LF direction is decoded in a given direction.

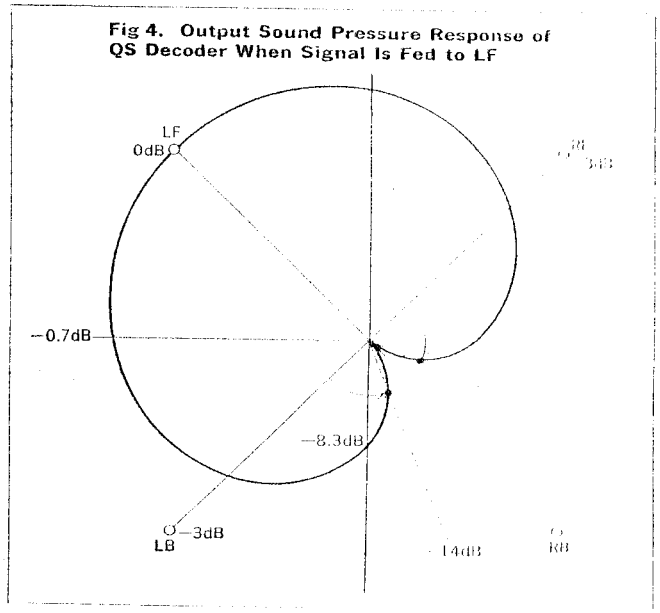
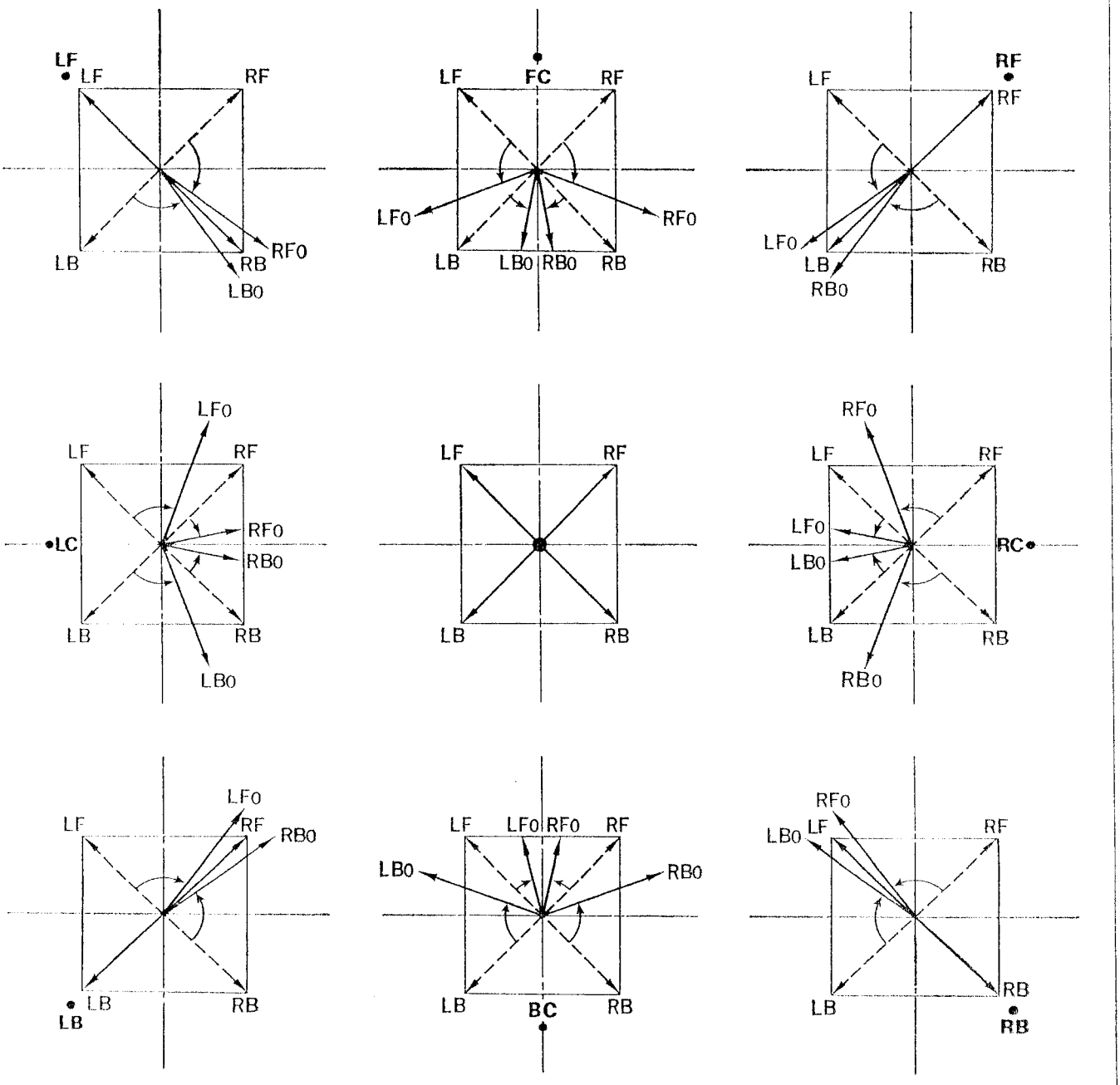


Fig 4. Output Sound Pressure Response of QS Decoder When Signal Is Fed to LF

Under these circumstances, assume a high-amplitude signal is fed to LF. Then, as we alter the LB′ decoder matrix angle as indicated by the arrow, the crosstalk of the LF signal contained in the LB′ decoder output gradually decreases. When the LB′ matrix angle finally coincides with the RB′ matrix angle, the separation between LF′ and LB′ becomes infinitely large (∞dB). Even then, whatever signal exists in LB is only attenuated by −3dB.
Therefore, if we boost the LB′ decoder gain by +3dB simultaneously as we shift the LB′ matrix angle to the RB′ position, the LB signal of the original level, free of any crosstalk of the LF signal, will be delivered at the LB′ output terminal.
The same holds for RF if we shift the RF′ decoder matrix angle toward RB′.
The variation of the matrix as proposed above is performed without losing its symmetrical property. For example, the crosstalk components of the LF signal in the two adjacent channels decrease in equal proportions. Which means that the phantom image produced by the crosstalk components continues to coincide with the real image as it decreases in amplitude. That being the case, the variation of the matrix as previously described does not displace sound images whatsoever. Nine representative variations of the matrix are shown in Fig. 5. It goes without saying that such variations can be made of signals in all 360°.

Thus our new technique to enhance the inter-channel separation characteristic of our QS Coding System is an attempt to increase the directional resolution of a loud sound by raising the inter-channel separation, while merely broadening the direction resolution of a weak sound without altering its directionality. It is fundamentally different from the previously mentioned gain control approach which practically cancels weak sounds.

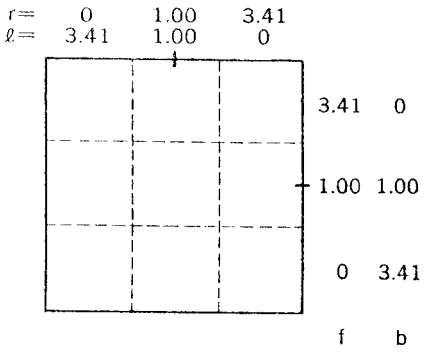
Fig. 5. Nine Representative Variations of Improved QS Decoding Matrix



(3) Control Signals

The signals to control the variable matrix are produced by a phase discriminators by detecting the front-back and left-right distribution of the input signal, as shown in Fig. 6.

Fig. 6. Improved QS Decoder Matrix Control Coefficients



Here, the front coefficient f, the back coefficient b, the left coefficient l and the right coefficient r vary their values between 0 and 3.414. When a signal is uniformly distributed in all four directions, each coefficient assumes the value l.

The reason why the control reference value is not set at the middle of 0 and 3.414 is because the matrix shows an optimal variation for phantom sound images as well when it is 1.

(4) Phase Discriminators

In order to detect each control coefficient, we propose to utilize phase discriminators.

To simplify explanation, suppose now that a single frequency signal is simultaneously fed to the all four input terminals of the encoder. Its outputs would then be given by

$$\mathbf{L}=(\mathbf{LF}+\mathit{j}\mathbf{RF})\sin pt+(\mathbf{LB}+\mathit{j}\mathbf{RB})\cos pt$$
$$\mathbf{R}=(\mathbf{RF}+\mathit{j}\mathbf{LF})\sin pt-(\mathbf{RB}+\mathit{j}\mathbf{LB})\cos pt$$

To put them differently,

$$\mathbf{L}=\sqrt{(\mathbf{LF}+\mathit{j}\mathbf{RF})^2+(\mathbf{LB}+\mathit{j}\mathbf{RB})^2}\sin(pt+\theta_1)$$
$$\mathbf{R}=\sqrt{(\mathbf{RF}+\mathit{j}\mathbf{LF})^2+(\mathbf{RB}+\mathit{j}\mathbf{LB})^2}\sin(pt+\theta_2)$$

$$\theta_1=\tan^{-1}\frac{\mathbf{LB}+\mathit{j}\mathbf{RB}}{\mathbf{LF}+\mathit{j}\mathbf{RF}} \qquad \theta_2=-\tan^{-1}\frac{\mathbf{RB}+\mathit{j}\mathbf{LB}}{\mathbf{RF}+\mathit{j}\mathbf{LF}}$$

Hence, the phase θ between L and R is given by

$$\theta=\theta_1-\theta_2$$
$$=\tan^{-1}\frac{\mathbf{LB}+\mathit{j}\mathbf{RB}}{\mathbf{LF}+\mathit{j}\mathbf{RF}}+\tan^{-1}\frac{\mathbf{RB}+\mathit{j}\mathbf{LB}}{\mathbf{RF}+\mathit{j}\mathbf{LF}} \quad \cdots\cdots(4)$$

Accordingly, the front-back proportion is transmitted by phase θ. The left-right proportion, on the other hand, is detected in the form of two phase relationships, L+R∠45° and L−R∠45°. The phase shift given to R is aimed to allow the phase to change continuously when a sound moves to the left or right.

(5) Variable Matrix in Mathematical Equations

The variable matrix is controlled in the front-back direction by the coefficients previously detected, in accordance with the following equations (5):

$$\left.\begin{aligned}\mathbf{LF}_1'&=1/\sqrt{2}\{(1+\mathbf{f})\mathbf{L}+(1-\mathbf{f})\mathbf{R}\}\\ \mathbf{RF}_1'&=1/\sqrt{2}\{(1+\mathbf{f})\mathbf{R}+(1-\mathbf{f})\mathbf{L}\}\\ \mathbf{LB}_1'&=1/\sqrt{2}\{(1+\mathbf{b})\mathbf{L}-(1-\mathbf{b})\mathbf{R}\}\\ \mathbf{RB}_1'&=1/\sqrt{2}\{(1+\mathbf{b})\mathbf{R}-(1-\mathbf{b})\mathbf{L}\}\end{aligned}\right\} \quad \cdots\cdots(5)$$

Similarly, it is controlled in the left-right directien according to these equations:

$$\left.\begin{aligned}\mathbf{LF}_2'&=\mathbf{L}+\mathit{l}\mathbf{R}\\ \mathbf{LB}_2'&=\mathbf{L}-\mathit{l}\mathbf{R}\\ \mathbf{RF}_2'&=\mathbf{R}+\mathbf{r}\mathbf{L}\\ \mathbf{RB}_2'&=\mathbf{R}-\mathbf{r}\mathbf{L}\end{aligned}\right\} \quad \cdots\cdots(6)$$

From the above two conditions, the matrix varies according to the following equations (7):

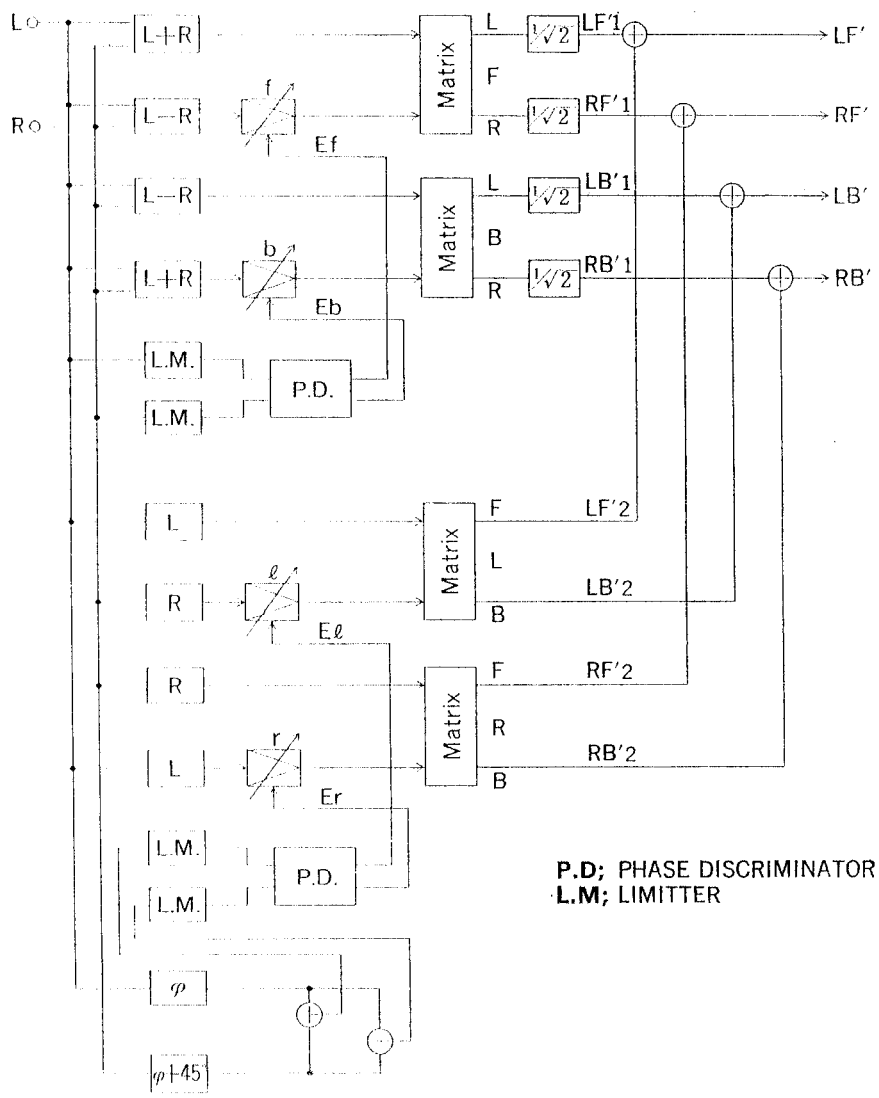
$$\left.\begin{aligned}\mathbf{LF}'&=1/\sqrt{2}\{(1+\mathbf{f}+\sqrt{2})\mathbf{L}+(1-\mathbf{f}+\sqrt{2}\,\mathit{l})\mathbf{R}\}\\ \mathbf{RF}'&=1/\sqrt{2}\{(1+\mathbf{f}+\sqrt{2})\mathbf{R}+(1-\mathbf{f}+\sqrt{2}\,\mathbf{r})\mathbf{L}\}\\ \mathbf{LB}'&=1/\sqrt{2}\{(1+\mathbf{b}+\sqrt{2})\mathbf{L}-(1-\mathbf{b}+\sqrt{2}\,\mathit{l})\mathbf{R}\}\\ \mathbf{RB}'&=1/\sqrt{2}\{(1+\mathbf{b}+\sqrt{2})\mathbf{R}-(1-\mathbf{b}+\sqrt{2}\,\mathbf{r})\mathbf{L}\}\end{aligned}\right\} \quad \cdots\cdots(7)$$

These equations satisfy Fig. 5.

(6) Block Diagram

Fig. 7 shows a block diagram of the variable matrix decorder based on equations (7).

Fig 7. Block Diagram of Improved QS Matrix Decoder



(7) Vector Diagrams

Figs. 8 and 9 are graphic presentations of equations (7). Each demonstrates the directions of the vibration of the playback stylus tip in a disc groove., as well as the vectors of the required decoder matrix.

Fig 8. Decoded Vectors of LF Channel (When Signals Are Fed Simultaneously to LF, LB, RF, RB)

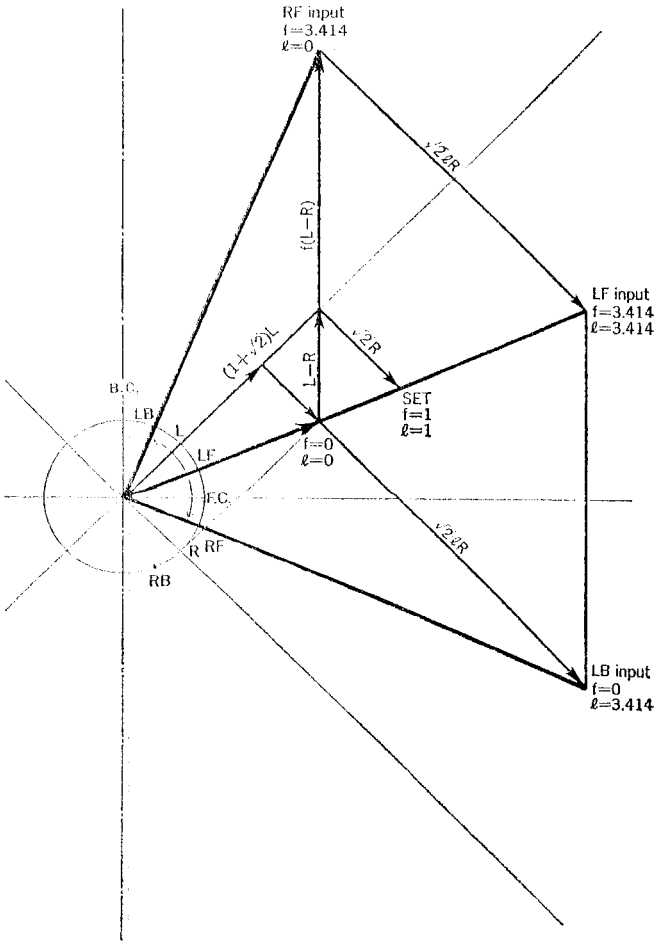
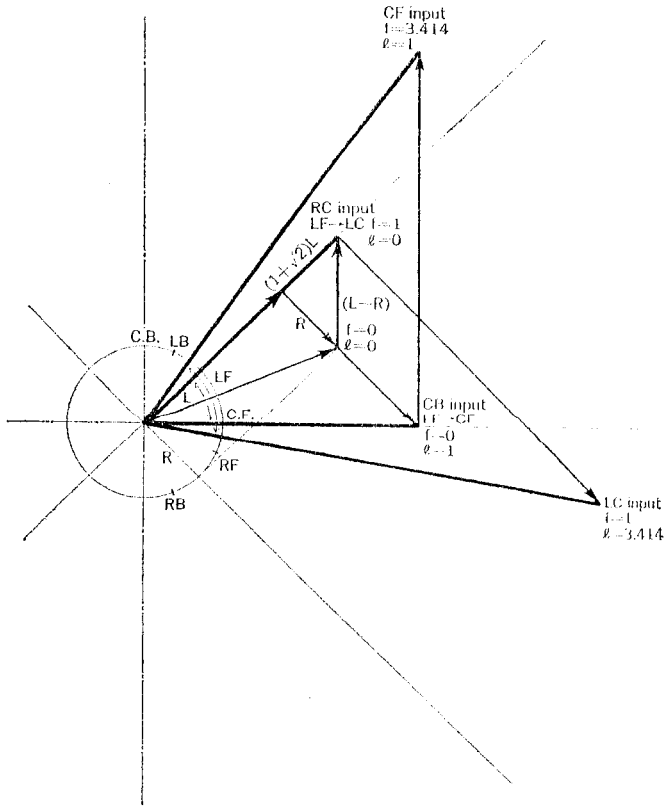


Fig 9. Decoded Vectors of LF Channel (When Signals Are Fed Simultaneously to FC, BC, LC, RC)



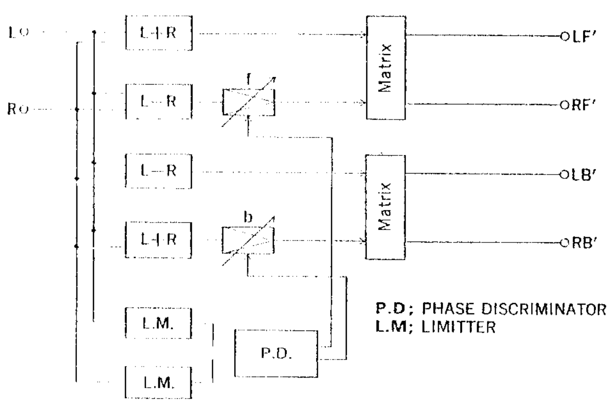
(8) Simplified Version

One possible simplified version of the variable matrix decoder described in the preceding paragraphs may be based on a modification of equations (7). It lends itself to the front-back control only.

$$\left.\begin{aligned} LF' &= (1+f)L+(1-f)R \\ RF' &= (1+f)R+(1-f)L \\ LB' &= (1+b)L-(1-b)R \\ RB' &= (1+b)R-(1-b)L \end{aligned}\right\} \cdots\cdots ⑧$$

The f and b in these equations only fluctuate from 0 to 2.41. Fig. 10 shows a block diagram of the decoder embodying this simplified approach.

Fig. 10. Block Diagram of Simplified Improved QS Decoder (O<f, b<2.41)



CONCLUSION

Matrixing systems of 4-channel stereo offer one outstanding advantage that they require relatively simple hardware, but have invariably had one basic fault, i.e., poor inter-channel separation.
If we empoy a rotationally symmetrical matrix, however, it has been found out that practically sufficient separation is obtainable by controlling the matrix itself.

SANSUI ELECTRIC CO., LTD. / 14-1, 2-CHOME, IZUMI, SUGINAMI-KU, TOKYO, 168, JAPAN / TELEPHONE: 323-1111 / CABLE: SANSUIELEC / TELEX: 232-2076

SOUNDS FROM SANSUI

NEWS FROM THE SANSUI STEREO WORLD

DATE: May 2, 1972

SUBJECT: SANSUI ANNOUNCES A 'REVOLUTIONARY' NEW TECHNIQUE

Its QS 4-Channel System Claimed to Offer Greatly Improved Separation

QS 4-CHANNEL STEREO

Los Angeles, U.S.A.—Sansui Electric Co., Ltd. pioneer of 4-channel stereo concept in Japan, announced today a new technique claimed to achieve a phenomenal improvement in the channel separation characteristic of its QS 4-channel playback decoder.

Over the past few years, 4-channel stereo has attention of audiophiles and related industries, as the next giant step forward in the advancing art of sound reproduction.

Several systems to make it possible have been proposed, Sansui's QS System being considered by many the most practical in all important respects. However, despite its apparent technical superiority to other proposed systems, some of the software industry people expected better inter-channel separation as compared to 4-channel mastertapes.

Sansui's announcement today could answer this silent request, and their system now seems set on its way to being nominated the industry norm.

With all problems cleared out of way, the popularization of Sansui's QS System may well accelerate in the future, or at least, so hopes Mr. Ryosuke Ito, manager of the company's 4-channel project and an inventor of the system.

"Our improved QS decoding circuit gives channel separation far beyond anything obtainable from all previous matrixing 4-channel stereo systems," Ito announced proudly. "We can now claim front-back and left-right separation of at least 15dB each with enough safety margin, and you can't hear any difference in a usual A–B comparison with mastertapes. I think this provides another answer to the long-standing question of whether or not it is necessary at all to create four discrete channels by using a high-frequency sub-carrier," he confided.

"The new decoding circuit makes use of what we call a "Vario-Matrix" and owes its effectiveness to the use of our QS Encoder on the encoding side. This encoder offers excellent properties, especially in terms of information loss, directional error, compatibility and so forth. Most important, it gives us completely symmetrical front-to-back and left-to-right—characteristics, electrically

and acoustically. When I made a proposal for a universal encoding standards at the AES convention in New York last autumn, I already had this new decoder in mind."

According to Ito, the improved decoding circuit can be manufactured at almost the same cost as their present decoder. Unlike most "gain control" or "variable-gain" type decoders, it does away with information loss and sound fluttering.

Sansui plans to start marketing professional QS Decoders incorporating the improved decoding circuit by early autumn this year.

Two-channel recorded material encoded by the Sansui QS Coding System is said to be completely compatible with various regular matrix type 4-channel equipment now being commercially marketed by many makers. Music fans owing such equipment are reported to total several million, concentrated mainly in the U.S.A. and Japan.

SANSUI ELECTRIC CO., LTD. / 14-1, 2-CHOME, IZUMI, SUGINAMI-KU, TOKYO, 168, JAPAN / TELEPHONE: 323-1111 / CABLE: SANSUIELEC / TELEX: 232-2076

SOUNDS FROM SANSUI
NEWS FROM THE SANSUI STEREO WORLD

SUBJECT: # ADVANTAGES OF THE SANSUI QS CODING SYSTEM, AND A NEW TECHNIQUE TO IMPROVE ITS SEPARATION CHARACTERISTIC

QS 4-CHANNEL STEREO

by
Ryosuke Ito and Susumu Takahashi
Sansui Electric Co., Ltd.
Tokyo, Japan

Advantages of the Sansui QS Coding System

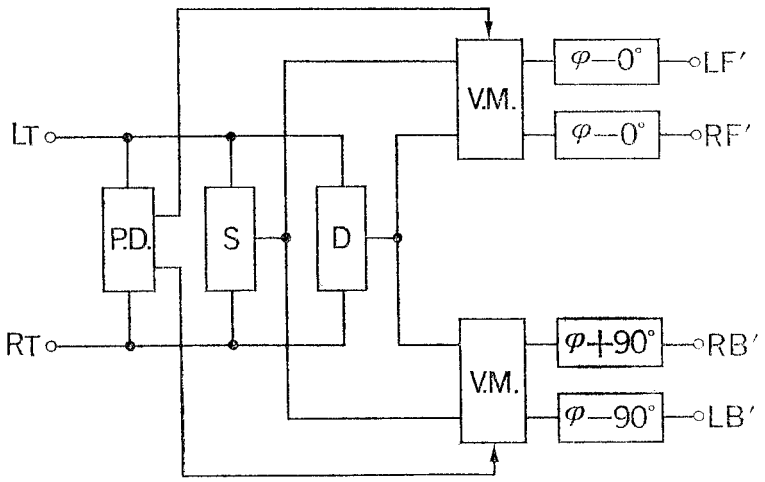
1. Prevents possible directional error and loss of information during encoding. Does not place limitations on the recording and broadcast engineers' technique, and helps to enhance the art of recording.
2. Is the only system that permits, on the decoding end, reproduction of sound both in a full circle and at the dead center of sound field.
3. Does not degrade current standards of high fidelity sound reproduction, including those pertaining to noise, distortion, dynamic range and frequency response.
4. Is based on an amplitude-phase matrix and affords an outstanding "synthesizer" effect (2-2-4 conversion).
5. Avoids the use of a high frequency sub-carrier, and resultant encoded material can be effectively played back even by a speaker matrix. Is therefore economical and easy to popularize.

Advantages of the Improved QS Decoder

1. Offers channel separation of over 15dB between any pair of speakers.
2. Offers symmetrical electrical and acoustic characteristics, both front-to-back and left-to-right, enabling to locate sound either in a full circle or at the dead center of sound field.
3. Adopts a "Vario-Matrix System" to preclude directional error and information loss common to "gain control system" decoders.
4. Does not render obsolete other matrixing systems of 4-channel stereo.

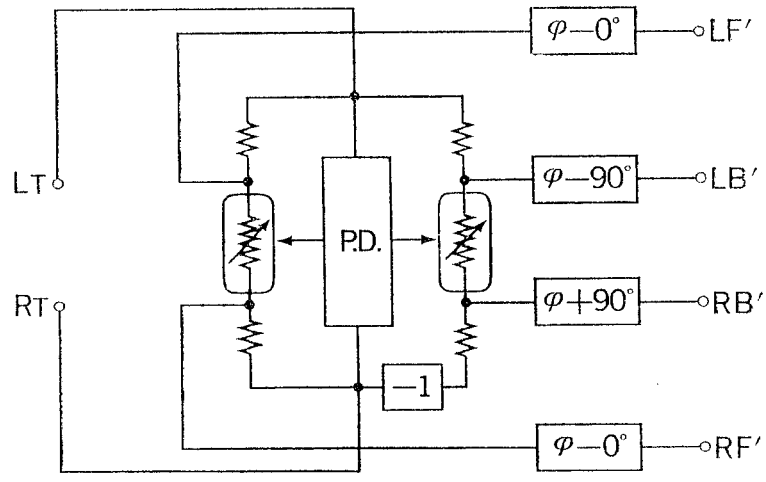
The basic and practical block diagrams of the Improved QS Decoder are presented below:

BASIC DIAGRAM OF IMPROVED QS DECODER



P.D.; PHASE DISCRIMINATOR

PRACTICAL BLOCK DIAGRAM OF IMPROVED QS DECODER



P.D.; PHASE DISCRIMINATOR
S ; SUM CIRCUIT
D ; DIFFERENCE CIRCUIT
V.M.; VARIO-MATRIX CIRCUIT

SANSUI ELECTRIC CO., LTD. / 14-1, 2-CHOME, IZUMI, SUGINAMI-KU, TOKYO, 168, JAPAN / TELEPHONE: 323-1111 / CABLE: SANSUIELEC / TELEX: 232-2076

SOUNDS FROM SANSUI

NEWS FROM THE SANSUI STEREO WORLD

DATE: Tokyo
March, 24 1972

SUBJECT: RIA-J SETS A STANDARD FOR REGULAR MATRIX DISCS

QS 4-CHANNEL STEREO

On March 23, 1972, the Engineering Subcommittee of the Record Industry Association of Japan (RIA-J) made a final decision on the manufacturing standard for what it calls regular matrix disc records.

Officially intended to govern all regular matrix records produced in Japan in the future, the new regulations are applicable to 4-channel cassette tapes as well.

The regulations stipulate that the information of sound source directions be converted into linear modulations of a spiral sound groove, and specify these modulations in terms of the locus of the vibration of the record cutting stylus.

Namely,a signal originated at the front center is to be converted into a left and a right signal which are mutually in phase and of identical quantity. One originated at the back center is to be converted into a left and a right signal which are out of phase with each other by 180 degrees but of identical quantity.

A signal generated on the left-hand (right-hand) side of the front and back centers must be converted so that the left (right) signal is of greater quantity than the right (left) signal.

A signal produced at the dead center of the original sound field is to be converted into a left and a right signal of identical quantity, with the former having a relative phase lead of 90 degrees from the latter.

Such recording system is based on the use of a square matrix and ± 90-degree phase shifters. Which makes it completely equivalent to the Sansui QS Coding System.

SANSUI ELECTRIC CO., LTD. / 14-1, 2-CHOME, IZUMI, SUGINAMI-KU, TOKYO, 168, JAPAN / TELEPHONE: 323-1111 / CABLE: SANSUIELEC / TELEX: 232-2076

SOUNDS FROM SANSUI

NEWS FROM THE SANSUI STEREO WORLD

DATE: Tokyo
March 30, 1972

SUBJECT: EIA-J ADOPTS A STANDARD FOR "REGULAR MATRIX"

QS 4-CHANNEL STEREO

The Electronics Industry Association of Japan (EIA-J) announced yesterday that it officially adopted standard regulations for a "regular matrix 4-channel playback system (RM system)," prepared and proposed by its Four-Channel Stereo Engineering Committee.

The standard defines a consumer decoder for the RM system and also establishes a professional reference decoder to clarify the nature of encoded and decoded signals under the RM system.

The encoding is to be done in exactly the same manner as stipulated by the regular matrix disc record standard announced by the Record Industry Association of Japan a week earlier. Basically, signals generated in the front half of the original sound field are to be matrixed into LT and RT signals which are mutually in phase. Ones produced in the back processed through 90-degree phase shifters and transformed into LT and RT signals with completely reversed phases.

The professional reference decoder, to be used for monitoring recordings and broadcasts and measuring the performance of associated equipment, essentially comprises a square matrix and ± 90-degree phase shifters. The standard consumer decoder is required to be designed in accordance with such stipulations.

Sansui took EIA-J's announcement without much surprise. It only meant official approval of our philosophy about matrixed 4-channel stereo. For the Sansui QS Coding System meets all the requirements of the newly adopted EIA-J standard. And the encoded recordings and decoding equipment based on the Sansui QS Coding System abide by that standard one-hundred percent.

SANSUI ELECTRIC CO., LTD. / 14-1, 2-CHOME, IZUMI, SUGINAMI-KU, TOKYO, 168, JAPAN / TELEPHONE: 323-1111 / CABLE: SANSUIELEC / TELEX: 232-2076

SOUNDS FROM SANSUI

NEWS FROM THE SANSUI STEREO WORLD

DATE: Tokyo
April 18, 1972

SUBJECT: THE THIRD WEST-JAPAN AUDIO FAIR PUSHES 4-CHANNEL STEREO

QS 4-CHANNEL STEREO

The Third West-Japan Audio Fair was held for six days from April 12 to 17, 1972 at the Osaka Senba Center, with 38 manufacturers participating.

As expected before the opening, the fair was heavily slanted toward 4-channel stereo. Indications at the fair convinced toward 4-channel stereo. Indications at the fair convinced the industry leaders that the sales ratio of 2- and 4-channel stereo equipment in Japan would be reversed sometime between this summer and the end of fall.

A few manufacturers did have decoding equipment incorporating the SQ circuit on display at the fair, but the majority demonstrated equipment based on the Sansui QS Coding System or own versions of the regular matrix system stipulated by the RIA-J and EIA-J.

Part of the overwhelming popularity that such equipment received from the fair spectators is cred to the announcements made by Sansui and a few other manufacturers that they have developed new, improved decoders which give them outstanding inter-channel separation quite equivalent to the discrete system.

Prototypes of these decoders were demonstrated, actually proving separation figures of over 15dB between any pair of channels. The appearance of such decoders seemed a big enough event to convince most consumers of the future possibilities of the now-official regular matrix system.

As of this date, no decoder has been announced yet for other matrix systems to offer discrete-like separation.

Hopes are thus mounting quickly among the Japanese industry leaders about the future advance of the QS Coding System and other versions of the regular matrix system.

REGULAR MATRIX SYSTEM DISK RECORD

REGULAR MATRIX SYSTEM DISK RECORD

Standard of The Engineering Sub-Committee, The Record Industry Association of Japan.

Prepared on March 23, 1972 by the Engineering Sub-Committee of the RIAJ

(This is a translation by Sansui of the original Japanese document.)

1. Scope of Applicability

This standard shall apply to the regular matrix system disk record which is commercially marketed.
JIS regulations set forth under S. 8502 (Disk Record) shall apply to all aspects of such record not convered by this standard.

2. Recording System

The sound groove of the regular matrix system disk record shall be modulated by two—left and right—signals in two directions at 90° to each other and at 45° to the record surface. Such two signals shall be converted from multiple original signals in accordance with the regulations given under sub-section 2.1. The left signal shall be recorded in the wall of the groove which is closer to the center axis of the record, and the right signal in the other wall.
If the two signals are in phase with each other and of identical quantity, they shall be recorded in such a manner that they can be reproduced by the movement of a reproducing stylus tip in directions parallel to the record surface and lateral to the sound groove.

2.1 Conversion of Signals

The two signals that modulate the sound groove shall comprise one left signal and one right signal converted from multiple original signals. The conversion of original signals into these two signals shall basically be achieved in the manners described below.

2.1.1 Front and Back Signals

A signal originated at the front center shall be converted into a left and a right signal which are mutually in phase and of identical quantity. A signal originated at the back center shall be converted into a left and a right signal which are out of phase with each other by 180° but of identical quantity.

2.1.2 Left and Right Signals

A signal originated on the left-hand (right-hand) side of the front and back centers shall be converted so that the left (right) signal is of greater quantity than the right (left) signal.

2.1.3 Center Signal

A signal originated at the center of the original sound field shall be converted so that the left and right signals are of identical quantity but the former has a relative phase lead of 90° from the latter.

2.2 Relationship of Direction of Sound Groove Modulation to Sound Source Direction

The relationship of the direction of the modulation of the sound groove to the direction of the corresponding sound source in the original sound field shall, in principle, be such that the angular direction of the fromer is half the angular direction of the latter (See Figures 1 and 2).

Fig. 1. Direction of Sound Source (S)
Front Center Right Back Center Left

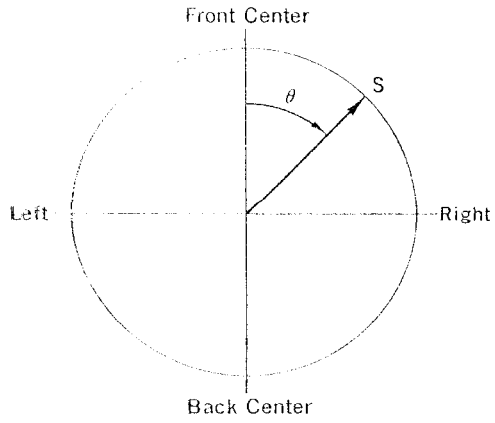
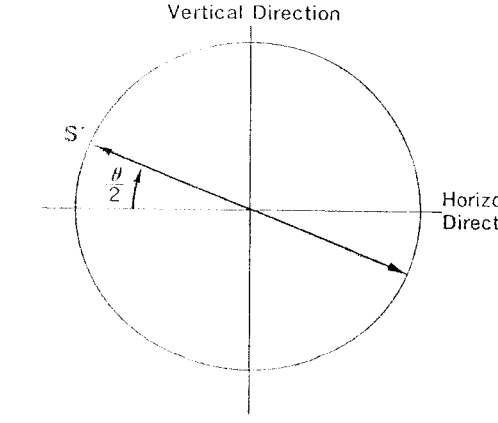


Fig. 2 Direction of Sound Groove Modulation (S')
Vertical Direction Horizontal Direction



EXPOSITION

Foreword

The Engineering Sub-Committee of the Record Industry Association of Japan has compared and examined the various matrix system disc records being marketed by different manufacturers to date. Results of such studies have ascertained that all of them, with the exception of the SQ matrix system, are based fundamentally on one and the same system, that they are encoded similarly, and that they possess sufficient compatibility with one another. Hence the same sub-committee hereby standardizes them as 'regular matrix system disk records.'

1. Scope of Applicability

This standard governs only those aspects which are peculiar to the regular matrix system disc record. All other aspects, such as its physical dimensions and quality, shall be regulated by JIS. S. 8502 (Disc Record).

The regular matrix system disc record which this standard regulates, encompasses all matrix system disc records that are cut by converting the information of sound source directions into linear modulations of a spiral sound groove.

2. Recording System

So as to ensure compatibility with 2-channel stereo playback, this standard is formulated in compliance with the stereophonic recording system stipulated under JIS. S. 8502.

Therefore, the regular matrix system disc record manufactured to this standard, when and if reproduced by regular 2-channel stereo playback equipment, does not impair the relative sound image and sound volume balance between the left and right channels.

3. Relationship of Direction of Sound Groove Modulation to Sound Source Direction

Illustrated below is the relationship of the direction of a sound source in the original sound field to the direction of the modulation of the sound groove on the regular matrix system disc record.

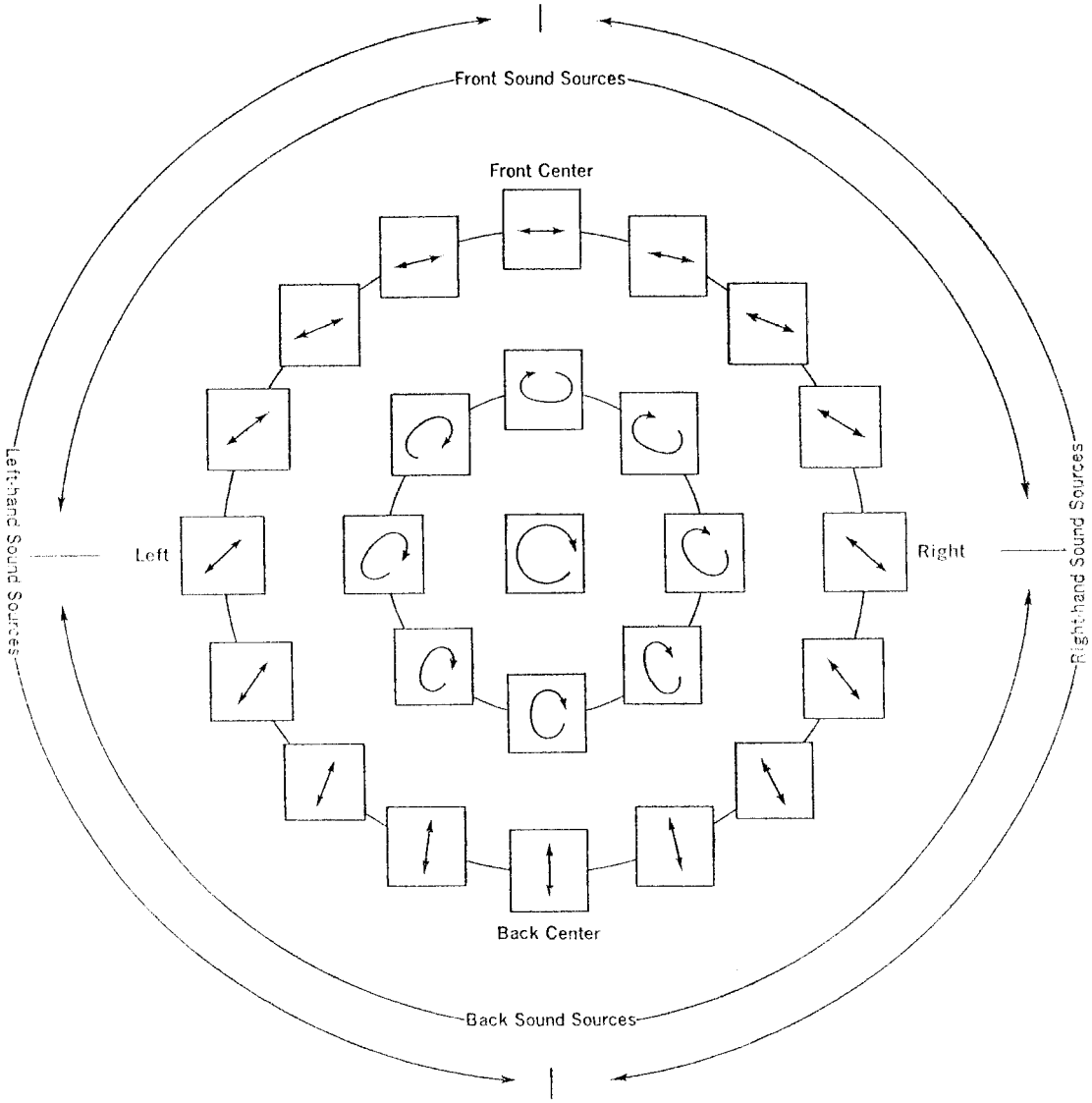
The term "the direction of a sound source in the original sound field" is used to describe the direction of a sound source intended at the time of recording, while the term

"the direction of the modulation of the sound groove" is used to describe the locus of the vibration of a cutting stylus tip.
To reproduce the regular matrix system disc record in more than two channels, it is thus possible to place three or more loudspeakers freely, depending upon the matrixing parameter of the decorder used (including a speaker matrix type).

4. Abbreviation

When there is a need to abbreviate the regular matrix system disc record, it is recommended to utilize 'RM'.

DIRECTION OF SOUND GROOVE NODULATION



Note: As the sound source moves closer to the center of the sound field, the locus approaches an ellipse. When it is at the dead center, the locus assumes a perfect circle.

SANSUI ELECTRIC CO., LTD. / 14-1, 2-CHOME, IZUMI, SUGINAMI-KU, TOKYO, 168, JAPAN / TELEPHONE: 323-1111 / CABLE: SANSUIELEC / TELEX: 232-2076

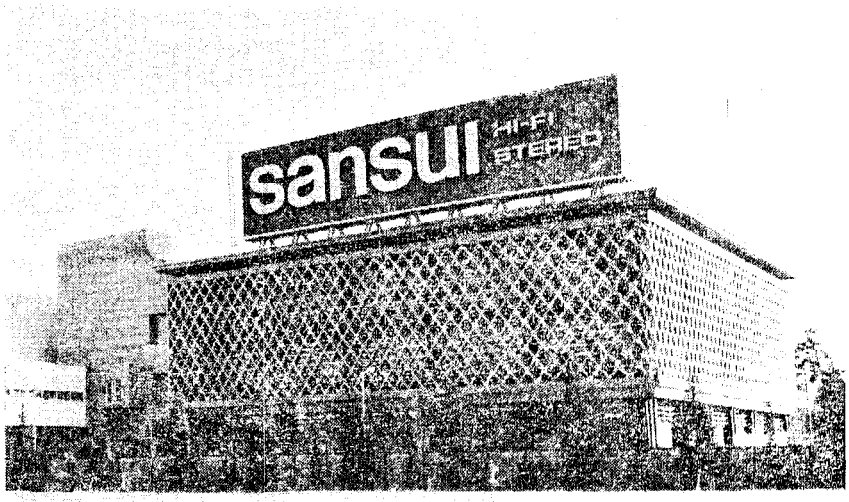
SOUNDS FROM SANSUI

NEWS FROM THE SANSUI STEREO WORLD

SUBJECT: SANSUI ELECTRIC CO., LTD.—
A Profile of The Company That Created The QS Coding System

QS 4-CHANNEL STEREO

Here is a quick picture of Sansui Electric as a comprehensive audio equipment manufacturer as of April, 1972.



Offices Located in	Head; 14-1, 2-CHOME, IZUMI, SUGIMAMI-KU, TOKYO, JAPAN Detached; SUGINAMI, IZUMI and SHINJUKU (all inside Tokyo)
Founded	June, 1947
Capital (Paid-up)	1,200,000,000. Yen (Approx. US$ 3,700,000.) Listed on first and second section markets of Tokyo and Osaka Stock Exchanges
Annual Sales	26,300,000,000. Yen (Approx. US$ 82,000,000.) for fiscal year 1971 ending October, 1971
Number of Employees	Male 1220+Female 1138, Total 2,358
Wholly Owned Subsidiaries	Sansui Electrics Inc., New York, N.Y. and Los Angeles, Calif., U.S.A. Sansui Audio Europe S.A., Antwerp, Belgium
No. of Domestic Sales Offices	24

Domestic Mfg. Plants Located in	Mitaka Shizuoka Saitama Nagano Koriyama Sukagawa
Ratio of Export Sales	Approx. 70% of total sales
No. of Distributors Overseas	140 in over 90 countries
Products	Home stereo sets, modular and compact stereo sets, receivers, tuners, integrated amplifiers and power amplifiers, turntables and changers, speakers and speaker systems, open-real tape decks, cassette decks, headphones, microphones and other accessories
Other Business Lines	Manufactures and sells transformers Holds general distributorship for JBL products in Japan
Production Quantities	Monthly amplifier production of 40,000 sets (Produces more than 25% of all amplifiers annually produced in Japan) Monthly speaker system production of over 40,000 sets (Produces more than 30% of all speaker systems annually produced in Japan) Probably world's largest producer of amplifiers and speaker systems

SANSUI ELECTRIC CO., LTD. / 14-1, 2-CHOME, IZUMI, SUGINAMI-KU, TOKYO, 168, JAPAN / TELEPHONE: 323-1111 / CABLE: SANSUILLEC / TELEX: 232-2076

SOUNDS FROM SANSUI

NEWS FROM THE SANSUI STEREO WORLD

SUBJECT: A Look at the Rich Sounding World of Sansui 4-Channel Stereo

QS 4-CHANNEL STEREO

QR6500

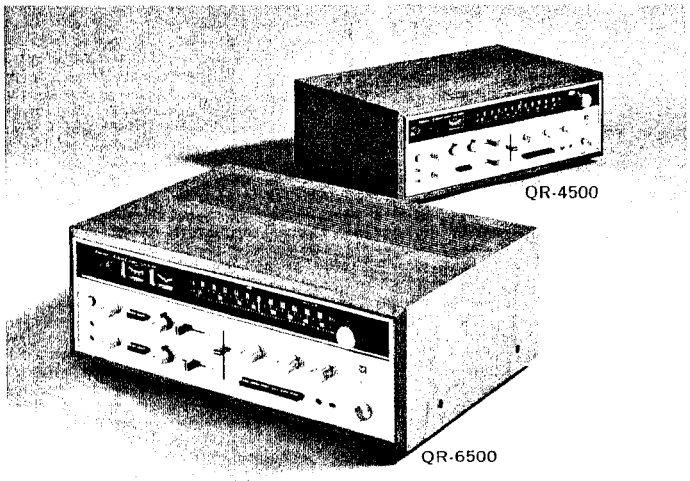
280 Watt 4-Channel Stereo Receiver

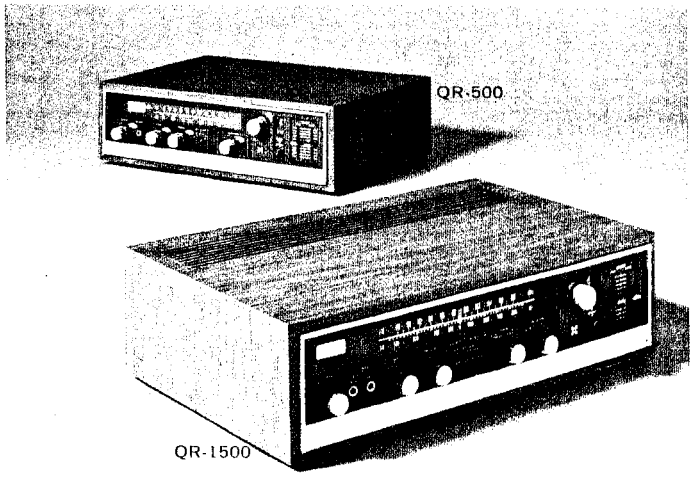
Perhaps the finest 4-Channel receiver made. Teams the famed Sansui 4-Channel Synthesizer Decoder (for converting 2-channel signals to 4-channels), with a mighty 280 watt power amplifier section, a high-performance preamplifier section and an exquisitely engineered tuner section.

QR1500

100 Watt 4-Channel Stereo Receiver

Discrete 4-channel, encoded 4-channel or 4-channel sound reproduction converted from 2-channel sources are yours with the QR-1500. IC and FET equipped, this receiver makes you completely at home in 4-channels with a mode switch that permits you to move sound about the room. Housed in an attractive wooden cabinet.





QR4500

240 Watt 4-Channel Stereo Receiver

The best of its kind in its power and price range. Also offers the Sansui 4-Channel Synthesizer Decoder with exclusive phase modulator circuit, plus a 240 watt power amplifier and superbly engineered preamplifier and tuner sections. For most people, probably a smarter buy than the QR-6500.

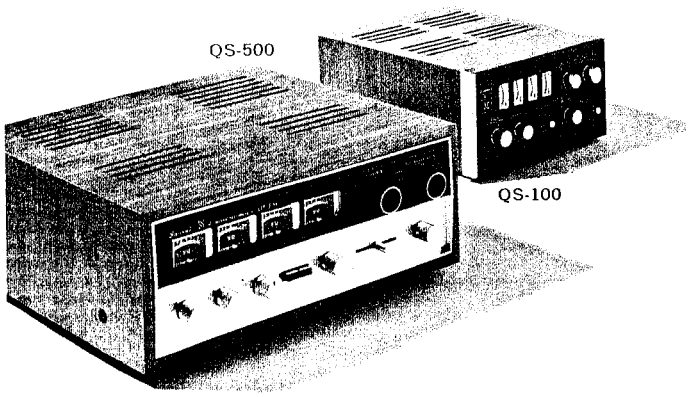
QR500

60 Watt 4-Channel Stereo Receiver

All the richness and excitement of 4-channel stereo for a very modest price. Synthesizer Decoder section converts 2-channel signals into 4-channels, reconverts encoded 2-channel programs back into four channels. Expertly designed and engineered, it offers virtually all the features of the bigger powered models.

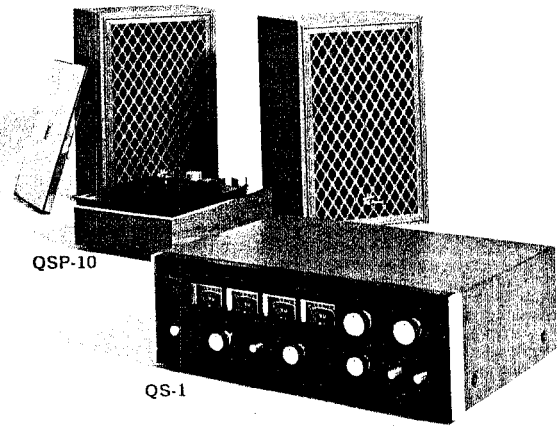
QS500

120 Watt 4-Channel Rear Amplifier
The perfect component for people who already have a 2-channel stereo system and want to convert it into a 4-channel system. Add this economical unit and two more speaker systems, and you're there. Complete with Sansui's authentic Synthesizer/Decoder unit and phase modulating circuit.



QS1

Sansui 4-Channel Synthesizer Decoder
Sansui's contribution to the classics. A revolutionary component that combines a Synthesizer Decoder section to convert 2-channel signals to 4-channels, plus a phase shifter and exclusive phase modulation circuit to create the same sense of presence as in a live performance.



QS100

50 Watt 4-Channel Rear Amplifier
Add this 50 watt amplifier to your present stereo system, plus another pair of speaker systems for the rear channels and you have a 4-channel stereo system. Combines a Synthesizer Decoder section, with a phase shifter/modulator circuit similar to the QS-1 and a power amplifier.

QSP10

20 Watt 4-Channel Rear System
An instant 4-channel conversion kit all in one package. Combines a 20 watt 4-channel rear amplifier with a pair of 15 watt compact speaker systems. Tie this kit in with your present system and enjoy 4-channel sound from 2-channel or discrete 4-channel sources.

TOKYO, 160, JAPAN TELEPHONE 323-1111 CABLE SA ... TELEX 237-2070

SOUNDS FROM SANSUI

NEWS FROM THE SANSUI STEREO WORLD

DATE: February, 1973

SUBJECT: **4-Channel Record Albums Increasing Worldwide**

TOKYO—From the four corners of the globe come reports on the ever-increasing availability of 4-channel sound on 33⅓ rpm record discs. In 1972, no fewer than 43 major record companies in Europe, the U.K., the Americas, Japan and other areas included at least one—and in most cases many more—4-channel discs in their standard catalogues.

The 4-channel software boom shows no signs of abating—in spite of the fact that there are at least three major 4-channel disc systems competing for the edge in this billion-dollar market. The following list, compiled as of January, 1973, is proof positive that the demand for 4-channel records has already grown to profitable proportions and that 4-channel sound in recorded music is a living reality.

-more-

Complete List of 4-Channel Record Albums
(As of January, 1973)

LABEL	QS/RM	CD-4	SQ
ABC	6	—	—
A & M	1	—	—
AMPEX	—	—	1
AUDIO TREASURY	2	—	—
BARCLAY (FRANCE)	1	—	—
BARNABY	—	—	1
BLACK JAZZ	9	—	—
BLUESWAY	4	—	—
CAPITOL	—	—	7
COLUMBIA	—	—	41
CBS (HOLLAND)	—	—	1
CBS (ITALY)	—	—	1
CBS/SONY (JAPAN)	—	—	83
COMMAND	6	—	—
CREATIVE WORLD	—	—	4
CROWN (JAPAN)	24	—	—
DECCA (FRANCE)	15	—	—
EMI (U.K.)	—	—	15
EPIC	—	—	9
GOLDEN CREST	—	—	8
IMPULSE	13	—	—
JVC (JAPAN)	—	156	—
KING (JAPAN)	81	—	—
LONGINES SYMPHONETTE	6	—	—
MASTERWORK	—	—	23
MINORUPHONE (JAPAN)	2	—	—
MONUMENT	—	—	3
NIPPON COLUMBIA	24	—	—
ODE	1	—	—
OVATION	15	—	—
PHILIPS (JAPAN)	—	4	—
POLYDOR (JAPAN)	5	—	—
PROJECT 3	28	—	1
PYE (U.K.)	7	—	—
QUAD SPECTRUM	20	—	—
RCA	—	7	—
RTV	1	—	—
TEICHIKU (JAPAN)	57	3	—
TOHO (JAPAN)	49	—	—
TOSHIBA (JAPAN)	57	—	—
TRIO (JAPAN)	—	—	1
VANGUARD	1	—	19
WARNER/PIONEER	4	—	22
TOTALS: 43	439	170	241

SOUNDS FROM SANSUI

NEWS FROM THE SANSUI STEREO WORLD

DATE: February, 1973

SUBJECT: **QS and Compatible Regular Matrix Leading World Sales**

TOKYO—Recently compiled data indicate that the world of 4-channel stereo is definitely, if slowly, heading toward the compatible regular matrix format at the expense of competing systems.

At present, some 70% of new consumer stereo amplifiers, receivers and consoles bought in Japan incorporate the Sansui QS and compatible regular matrix systems. Some 1.8 million to 2.2 million 4-channel regular matrix decoders (used in these systems) have been sold in Japan alone (EIAJ statistics) and sales are now moving at the average monthly rate of 60,000 units.

A similar sales pattern is found in the United States, with the majority of leading audio manufacturers now giving greater stress to 4-channel than in the past. This is borne out in the fact that roughly 90% of the combined, worldwide saturation of 4-channel home equipment now employes the QS and compatible regular matrix systems.

As of January this year, the 30 Japanese and American manufacturers listed below are marketing 4-channel decoders of the QS and compatible regular matrix and only 4 of the so-called discrete 4-channel disc system. Noted in parentheses beside the manufacturers' names are the numbers of models of the QS and compatible regular matrix systems each is presently marketing.

Japan Market Base	
HITACHI	(6)
JVC	(37)
MITSUBISHI	(13)
NATIONAL	(20)
NIPPON COLUMBIA	(16)
ONKYO	(13)
PIONEER	(16)
SANSUI	(8)
SANYO	(10)
SHARP	(7)
SONY	(9)
TOSHIBA	(8)
TRIO	(17)
YAMAHA	(4)

U.S. Market Base	
ADMIRAL	(1)
AKAI	(1)
CLARRION	(1)
DOKORDER	(1)
DYNACO	(1)
EICO	(1)
ELECTRO-VOICE	(4)
EMERSON	(1)
FISHER	(4)
HARMAN-KARDON	(4)
HEATH	(1)
JVC	(5)
KENWOOD	(3)
LAFAYETTE	(8)
MOTOROLA	(3)
OLSON	(1)
ONKYO	(1)
PACKARD BELL	(3)
PANASONIC	(5)
PIONEER	(5)
PILOT	(3)
RADIO SHACK	(1)
ROBINS	(1)
ROTEL	(1)
SANSUI	(8)
SANYO	(1)
SONY	(2)
SCOTT	(1)
SYLVANIA	(1)
TOSHIBA	(3)

A. Vieutemps:
KONZERTSTUCK
Grand Orchestra Radio Tele Luxembourg,
L. de Froment, Conductor, P. Fontanarosa,
Violin

R. Strauss:
HORN CONCERTOS NO. 1 & NO. 2
Grand Orchestra Radio Tele Luxembourg,
L. de Froment, Conductor, D. Bourgue, Horn

J. Haydn:
CONCERTO NO. 2 IN D FOR HORN
Grand Orchestra Radio Tele Luxembourg,
L. de Froment, Conductor, D. Bourgue, Horn
Gregorian Chants—
Choir of the Monks of The Abbey of
St. Pierre des Solemnes (3LP)

Los Machucambos:
SONGS OF LATIN AMERICA (4LP)
Monastic Choir of Argentina

The company also has under contract the talents of France Clidat, Maxence Larrier, The Jacques Loussier Trio, Jacqueline Francoir and other top European artists.

SANSUI ELECTRIC CO., LTD./14-1, 2-CHOME, IZUMI, SUGINAMI-KU, TOKYO, 168, JAPAN/TELEPHONE: 323-1111/CABLE: SANSUIELEC/TELEX: 232-2076

SOUNDS FROM SANSUI

NEWS FROM THE SANSUI STEREO WORLD

DATE: February, 1973

SUBJECT: **Decca (France) Goes Sansui QS**

After lengthy technical evaluations of the several different 4-channel disc encoding systems on the market, the Paris-based French affiliate of the Decca Record Company has voted "oui" for Sansui.

The company, known as Societe Fransaise du Son, will soon announce the titles of some 30 QS Regular Matrix-encoded LP albums and is, says a company spokesman, "definitely planning to release at least 50 such albums during 1973."

Societe Fransaise du Son is the third European record label to adopt the QS system, following Pye and Barclay. This brings to 24 the number of separate labels now issing QS-encoded 4-channel discs worldwide.

According to the spokesman for Societe Fransais du Son, these fifteen titles have been released in QS 4-channel format so far, with more to come:

F. Mendelssohn-Bartholdy:
CONCERTO FOR VIOLIN AND ORCHESTRA, OP. 64

M. Bruch:
CONCERTO FOR VIOLIN AND ORCHESTRA, OP. 26
Grand Orchestra Radio Tele Luxembourg,
de D. Choratas, Conductor, J.P. Wallez,
Violin

F. Chopin:
CONCERTO FOR PIANO AND ORCHESTRA, NO. 2, OP. 26
ANDANTE SPIANATO & GRAND POLONAISE, OP. 28
Grand Orchestra Radio Tele Luxembourg,
L. de Froment, Conductor, B. Ruguitto, Piano

E. Chausson:
POEM OP. 25

C. Saint-Saens:
PRELUDE OP. 45

H. Berlioz:
REVERE ET CAPRICE, OP. 8

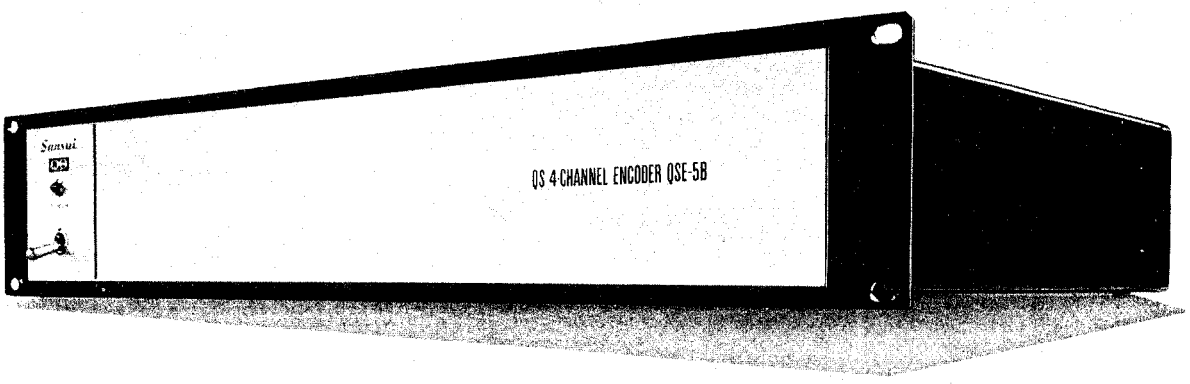
-more-

古.

SANSUI

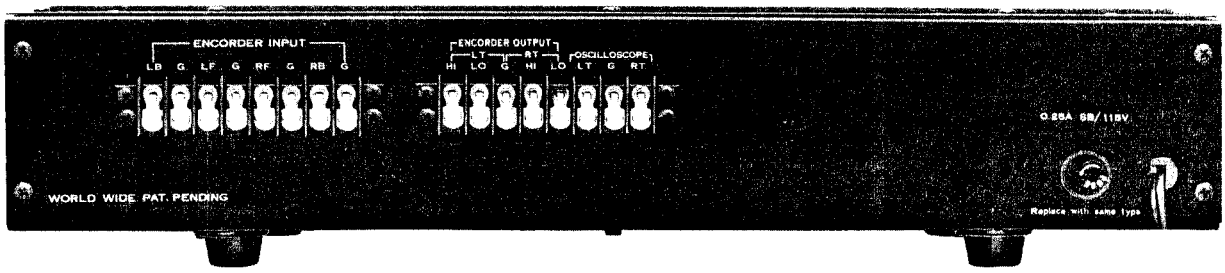
QS 4-CHANNEL PROFESSIONAL ENCODER FOR FM BROADCASTER

QSE-5B



QS CHANNEL STEREO *QS is a trademark of Sunsui Electric Co., Ltd.

Sansui



■ Specification

Input Section	
Input Channels:	Encoder Input, 4 Channels(LF, RF, LB, RB)
Input Impedance:	10k ohms Unbalanced Type
Input Level:	+4dBm (rated), +18dBm (max)
Input Connectors:	Jones Terminal & Fanning Strips
Output Section	
Output Channels:	Encoder Output, 2 Channels (LT, RT)
Output Impedance:	Below 600 ohms Balanced Type
Output Level:	+4dBm (for LF, RF, LB, RB rated) +18dBm (max)
Output Connectors:	Jones Terminal & Fanning Strips HI—Positive, LO—Negative, G—Ground
Scope Section	
Output Impedance:	Below 1k ohm, Unbalanced Type
Output Level:	−2dBm (rated), +18dBm (max) (Output Load: more than 30 k ohms)
Output Connectors:	Jones Terminal & Fanning Strips LT—Left, RT—Right, G—Ground

Total Harmonic Distortion (at rated output)

Output Level (+1dBm) : less than 0.5% (20 to 100Hz)
less than 0.1% (100 to 20,000Hz)
Output Level (+18dBm) : less than 1.0% (20 to 50Hz)
less than 0.5% (50 to 20,000Hz)

Frequency Response (at rated output)

50 to 10,000Hz ±0.3dB
20 to 20,000Hz ±0.5dB

Signal to Noise Ratio (at rated output)

more than 70dB

Gain (at one channel input)

0dB ±0.2dB (LF, RF, LB, RB)

Phase Relationship

	at 1,000Hz	at 20 to 20,000Hz
LF-RF	0° ±1°	0° ±3°
LF-LB	+90° ±2°	+90° ±5°
RF-RB	−90° ±2°	−90° ±5°
LB-RB	180° ±1°	180° ±3°

Power Requirements

Voltage: 115V 60Hz
Consumption: 20W rated

Dimensions

Width: 482mm (19")
Height: 88mm (3-1/2")
Depth: 323mm (12-3/4")

Weight

Net: 6.23kg
Packed: 8.6kg

QS 4-CHANNEL STEREO Sansui

Information on other technical inquiries, please contact one of the following addresses.

SANSUI ELECTRIC CO., LTD., 11-23, 6-chome, Shimorenjaku, Mitaka, Tokyo 181, Japan / Phone: 0422-46-8131 / Telex: 282-2496
SANSUI ELECTRONICS CORPORATION, 55-11 Queens Blvd., Woodside, New York 11377, U.S.A. / Telex: NEW YORK 422633 SEC UI
SANSUI AUDIO EUROPE S.A., Diacem Building, Vestingstraat 53-55, 2000 Antwerp, Belgium / Telex: ANTWERP 33538

Printed in Japan 74053000

A MILESTONE IN THE ART OF SOUND REPRODUCTION

The 4-channel system affords the world of music a number of interesting possibilities that the conventional 2-channel system cannot begin to offer.
Sansui's QS 4-channel system has been developed to fully exploit these possibilities, and its technical and artistic excellence is widely acclaimed. Since its original conception, it has undergone a significant enhancement in the form of the revolutionary QS Vario-Matrix, which enables it to provide inter-channel separation in excess of 20dB.
It has already been subjected to the severe professional scrutiny of hundreds of recording and broadcast engineers around the world, and found to pass the tests of musicality, compatibility and economy.
A multitude of major record companies in the U.S.A., Europe and Japan have released disc records and cassette tapes recorded by the QS system.

All commercial FM stations in Japan are now offering QS 4-channel programs, and so are WFMT in Chicago and other leading stations in the U.S.A.
The RIAA (Record Industry Association of America) have approved the QS encoding system as its standard.
The professional QS 4-channel Encoder introduced here fully benefit from these accomplishments and experiences. Not only are their performances certain to satisfy you, but their versatility, durability and appearances are on a par with the world's highest standards of professional hardware.
Test the instruments for yourself soon, and witness this striking breakthrough in the art of sound reproduction.

4-CHANNEL ON THE AIR (A QUICK GUIDE TO QS FOR FM 4-CHANNEL BROADCASTING)

WHAT CAN YOU EXPECT FROM 4-CHANNEL FM?

1. Fully dimensional music broadcasting — more realistic and totally new. Especially important if you are a music-oriented station.
2. New audience — more listeners tuning in for 4-channel sounds.
3. More revenue — promotional dollars and co-op funds from 4-channel equipment manufacturers, distributors and dealers are available now! Record manufacturers and dealers are also extremely interested in getting more air time for 4-channel sounds.
4. A fresh new image for your station — "The all-quad spot on the dial ....."

CAN YOU BROADCAST IN 4-CHANNEL TODAY?

1. Matrix encoded 4-channel materials — records, tapes made with the Sansui QS or Columbia SQ systems — can be broadcast through your regular 2-channel transmission system. Absolutely nothing else is required. Not some hazy time in the future, but NOW, today.
2. QS Encoder enables you to air:
   *demodulated CD-4 or Quadradiscs,
   *any other discrete 4-channel material such as Q-8 cartridges and "Surround Stereo" discrete 4-channel music tapes,
   *4-channel "live" concerts direct from the concert halls or festival stages,
   *decoded SQ materials, and
   *4-channel commercials or jingles, of cource.

Your audience will receive such 4-channel material as regular stereo (or mono) with rather enhances quality on his stereo equipment. There is *absolutely no loss of 4-channel information.* If a listener owns one of the matrix 4-channel decoders (and there's lots of them around), he hears them in 4-channel at home.

WAITING FOR DISCRETE?

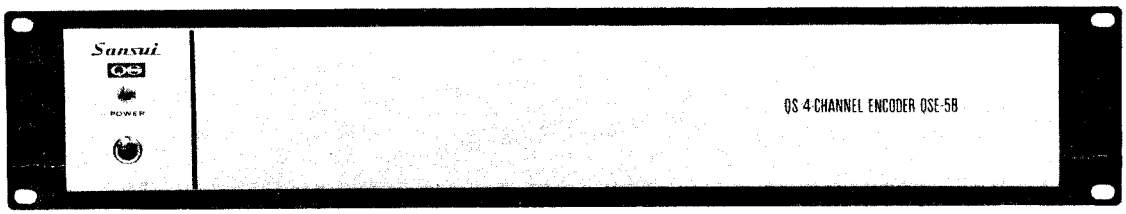
You'll probably wait a long, long time.
Matrix decoders are already widely accepted and in the hands of millions of consumers. *You now have* a matrix 4-channel audience.

With the recent sophisticated matirx decoders such as QS vario-matrix, you are getting over 20dB separation across all four channels. With the discrete system, you will give you the same but no more.

For discrete 4-channel broadcasting, these factors must be considered:
*SCA services must be ceased in all areas.
*The dozen of the proposed discrete broadcast systems must be standardized to one, and that one must wait for approval from the FCC and other official bodies.
*The FCC and others must then change their regulations accordingly.
*Demodulators made specially for this purpose must then be mass produced and introduced to the market.
*Consumers who presumably own matrix and CD-4 demodulators already must purchase yet this additional unit.

You have 4-channel *now* with the matrix. There's no sense waiting for discrete.

4-CHANNEL ON THE AIR (A Quick Guide to QS for FM 4-channel Broadcasting)



WHAT ABOUT 4-CHANNEL SOFTWARE?

More and more QS matrix 4-channel records and tapes are being released by some twenty major and independent labels. CD-4 or Quadradiscs by RCA and WEA group and SQ materials are also widely available. Q-8 cartridges and open reel music tapes have been on the market for quite some time with lots more to come. Complete list is available from Sansui (QS), Columbia (SQ) and JVC (CD-4).

ARE THERE MANY LISTENING?

Yes — Millions. Consumers have taken to 4-channel very rapidly. QS compatible decoders including E-V (Stereo-4) and Dyna (Quadapters) are now being used in America over 2 million listeners, and most of the newest decoders incorporate QS IC's also. These are available from:

AKAI, ADMIRAL, APF, BELL & HOWELL, BENJAMIN, CARTER-CRAFT, CLARION, CONCEPT PLUS, CONCORD, DOKORDER, DY-NACO, EICO, EMERSON, E-V, FISHER, GE, GRUNDIG, HARMAN-KARDON, HEATH, HITACHI, JVC, JULIETTE, KENWOOD, KLH, LAFAYETTE, LLOYD'S, MGA, MARANZ, MASTERWORK, METRO-TEC, MIIDA, MOTOROLA, OLSON, ONKYO, PANASONIC, J.C. PENNY, PILOT, PIONEER, REALISTIC, ROBINS, ROTEL, SANSUI, SANYO, SCOTT, SHERWOOD, SONY, SOUND SYSTEMS INT'L, SUPERSCOPE, SYLVANIA, TELEDYNE PACKARD BELL, TOSHIBA, TOYO, UTAH, V-M, WOOLENSAK, ZENITH and others.

There are approximately three hundred different models of 4-channel matrix decoders for home use offered by these manufacturers.

WHERE CAN YOU GET THE QS ENCODER?

We have designed the QSE-5B professional QS encoder specially for your station to be able to produce any kind of 4-channel programs, live or recorded.

For details, please contact the below:

- Sansui Electronics Corp.
  55-11 Queens Boulevard
  Woodside, N.Y. 11377
  Phone: (212) 779-5300
- Sansui Audio Europe S.A.
  Diacem Building,
  Vestingstraat 53-55,
  2000 Antwerp
  Belgium
  Phone: 315663/4/5

THE QSE-5B ENCODER—ITS ADVANTAGES

Direct encoding from multi-track (8, 16, 32 or more) sources. And of cource it handles 4-track discrete tapes.

Nominal 600 ohms inputs and outputs. Input impedance is 10k ohms unbalanced and output impdeance is below 600 ohms balanced.

Maximum output level of +18dBm to maintain full dynamic range. (Same is true with input level which also is =18dBm)

Linear phase relationship of "within $\pm 2^{\circ}$ at 1,000Hz" or "within $\pm 5^{\circ}$ at all frequencies" is retained.

Combining fanning strips and Jones terminals simplifies quick installation of the QSE-5B in any studio or concert hall.

Simple rack-mounting is possible.

■ QS Synthesizer Encoding Function

1. Description

This function encodes the conventional stereo signals by blending them in reverse-phase, and provides output signals that are almost equivalent to QS-Encoded 4-Channel Signals.

In 4-channel playback, the signals so encoded are reproduced over a 270-degree spread, centered in front of the listener and curving through 135-degree arcs on eather side to reach behined him. The L and R stereo signals, and the many phantom signals between them, are transformed into four specifically-located sound images(LF, RF, LB and RB) and many phantom images scattered around them(see Fig. 1) to create an authentic "SURROUND" effect.

Any ambience content in the stereo program source is reproduced from the rear channels.

Like the QS-Encoded Signals, the signals encoded by this function are compatible with stereo and mono playback.

2. Required Connections

2-1: Connect the L-channel stereo signal to the LB input of the QSE-5B, and the R-channel stereo signal to the RB input of the QSE-5B, so that they are mutually in reverse phase(see Fig. 2).

2-2: Set the "ENCODE" switch on the rear panel of the QSE-5B to "SYNTHESIZER".

2-3: The encoded output signals will then be delivered at the LT and RT output terminals of the QSE-5B.

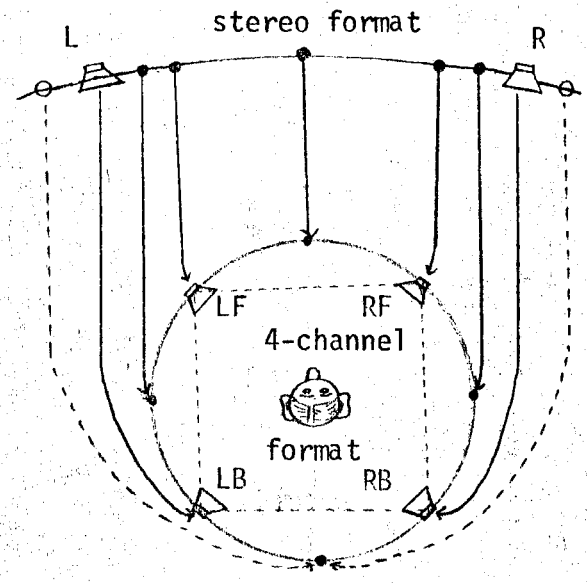


Fig. 1

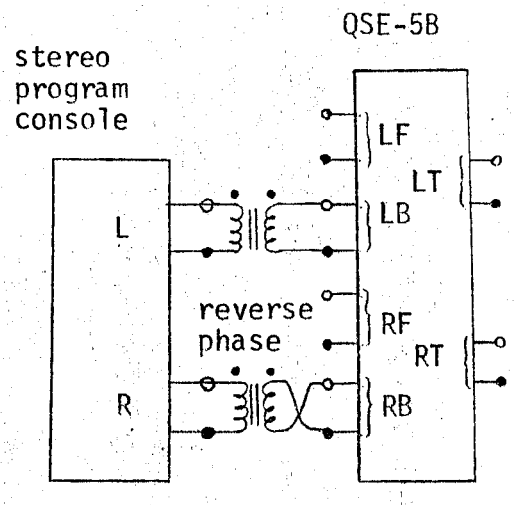
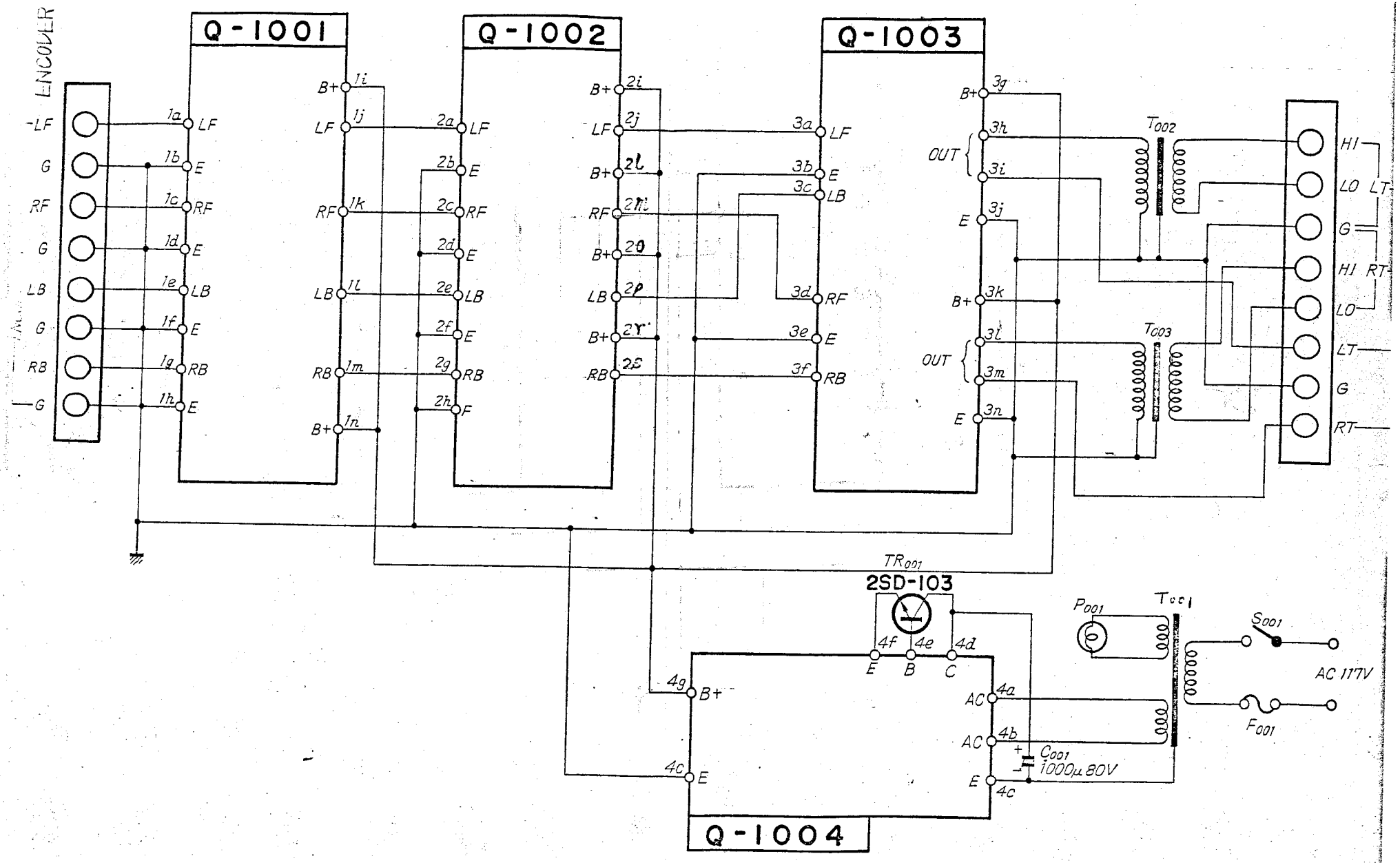
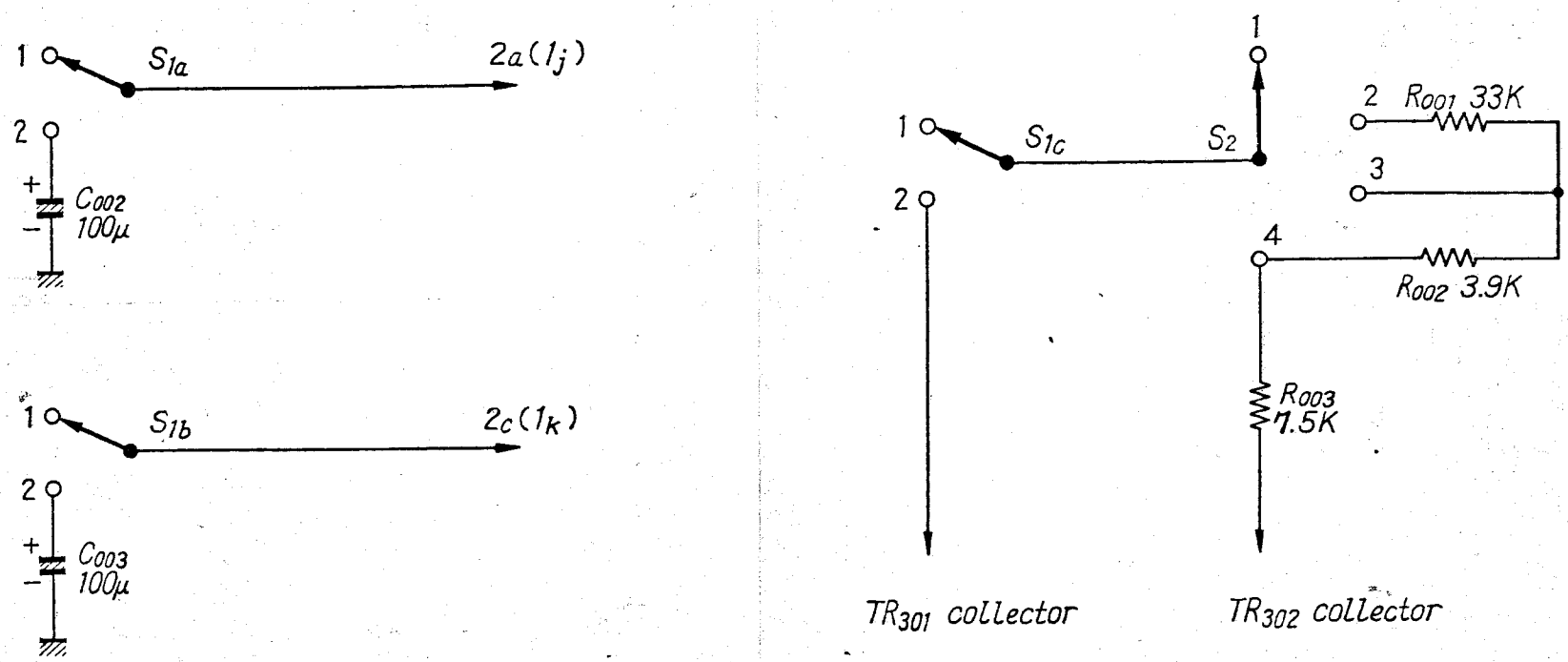


Fig. 2

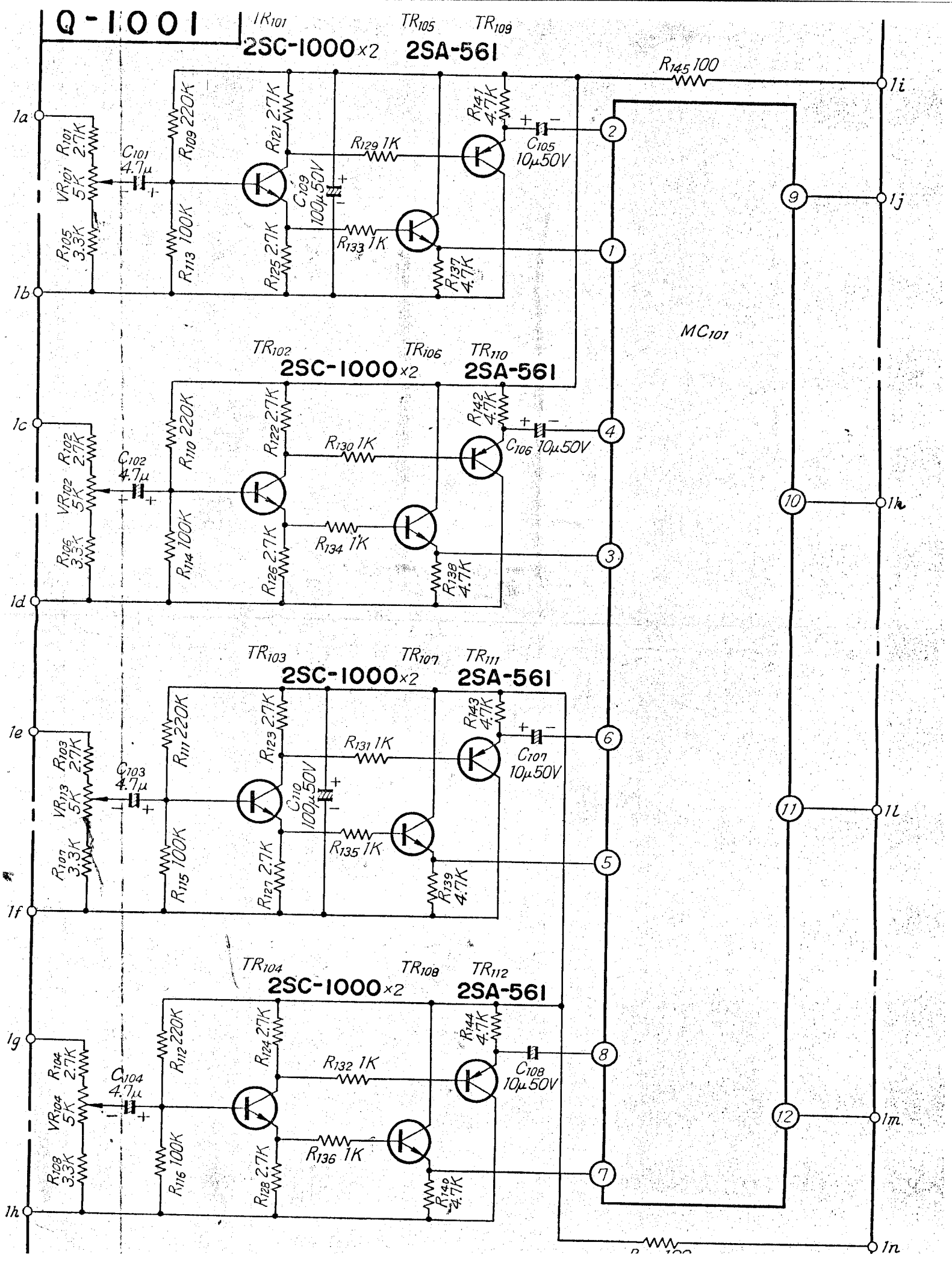

ENCODER
-LF
G
RF
G
LB
G
RB
G
Q-1001
Q-1002
Q-1003
1a LF
1b E
1c RF
1d E
1e LB
1f E
1g RB
1h E
1i B+
1j LF
1k RF
1l LB
1m RB
1n B+
2a LF
2b E
2c RF
2d E
2e LB
2f E
2g RB
2h F
2i B+
2j LF
2k B+
2l RF
2m B+
2n LB
2p B+
2r RB
2s
3a LF
3b E
3c LB
3d RF
3e E
3f RB
3g B+
3h OUT
3i E
3j B+
3k OUT
3l E
3m
3n
T002
T003
HI
LO LT
G
HI RT
LO
LT
G
RT
TR001
2SD-103
4f E
4e B
4d C
4g B+
4c E
AC 4a
AC 4b
E 4c
C001
1000μ 80V
P001
T001
S001
AC 117V
F001
Q-1004

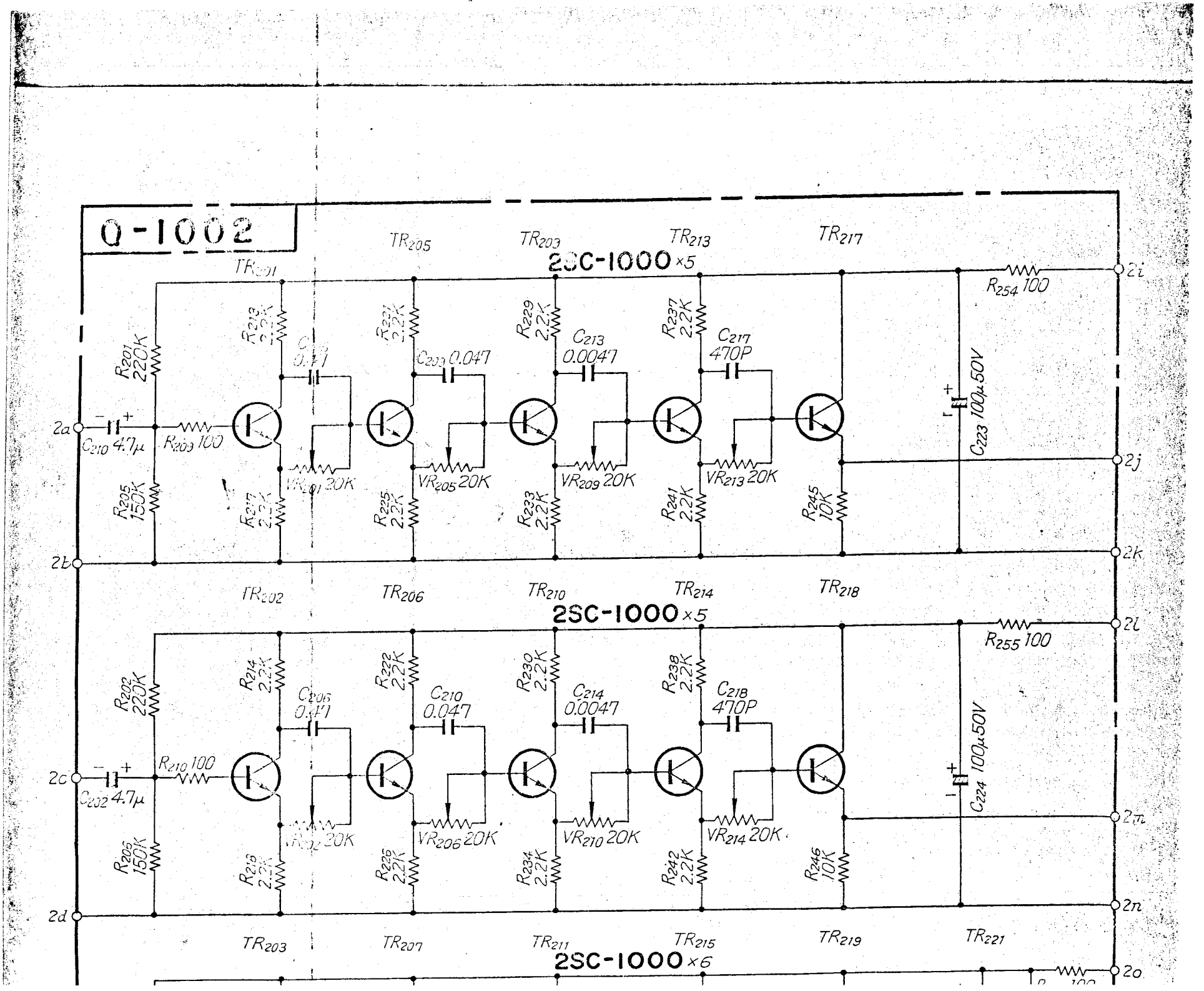
QS - SYNTHESIZER ENCODE SELECTOR

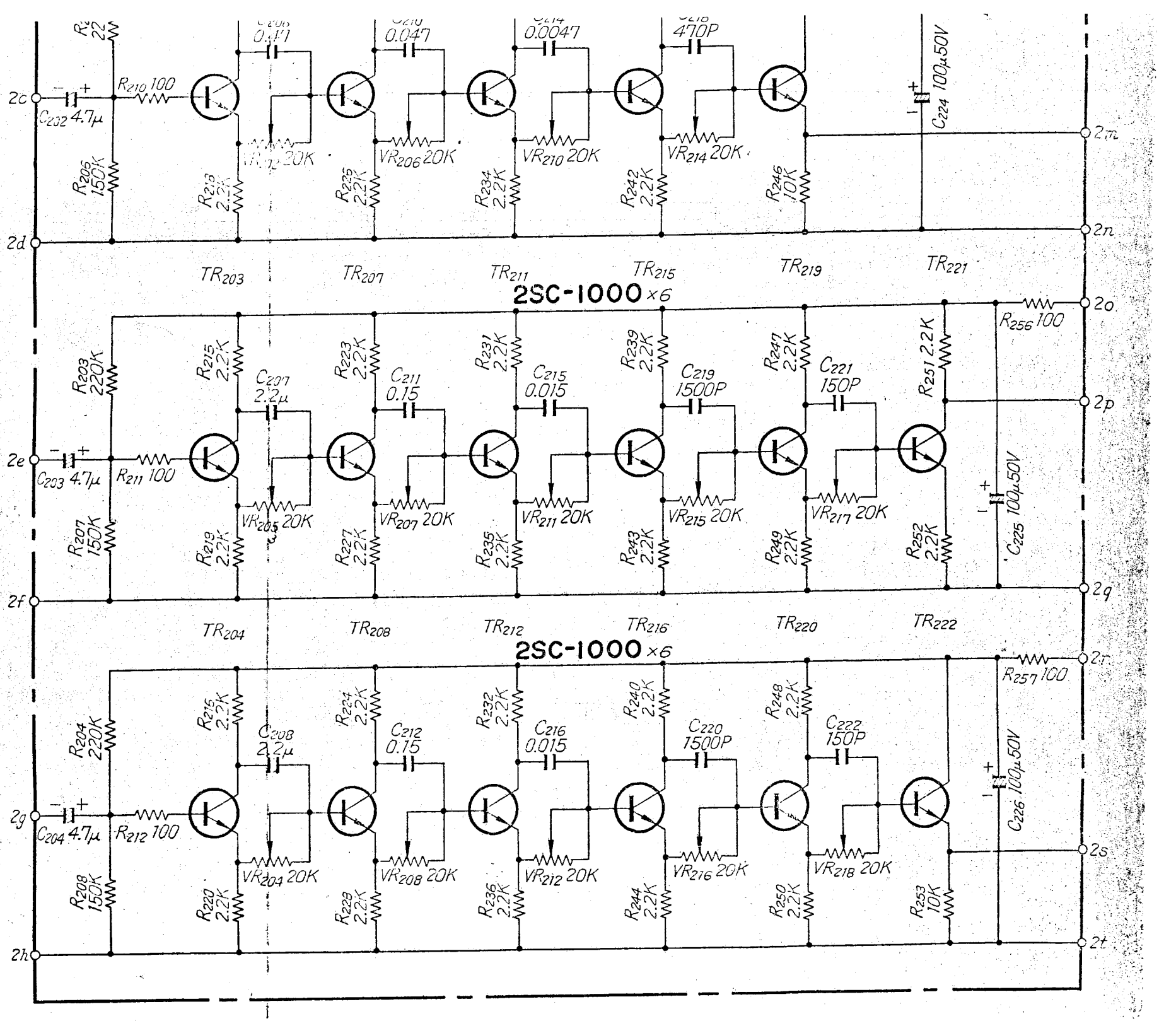


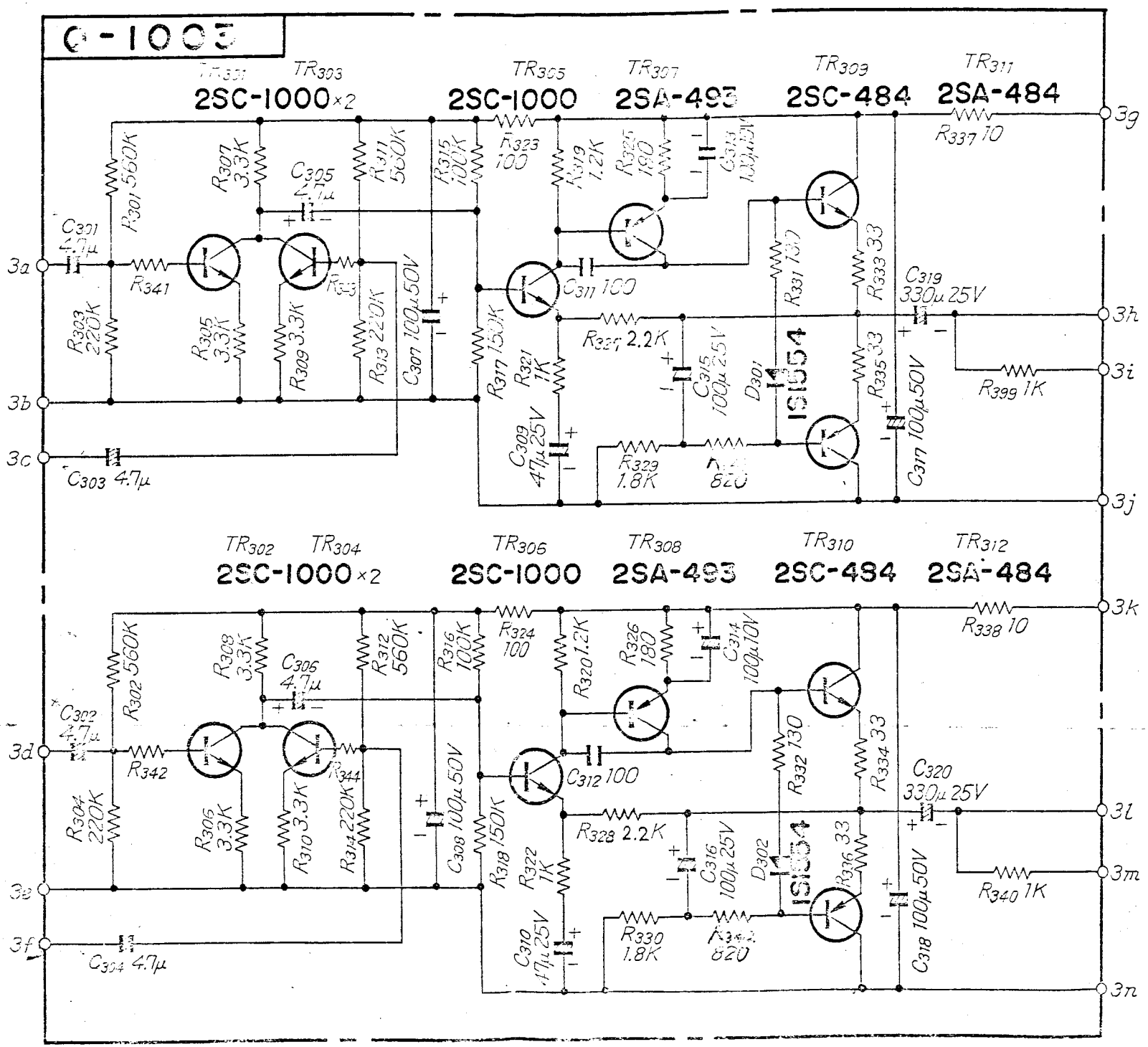
Selector

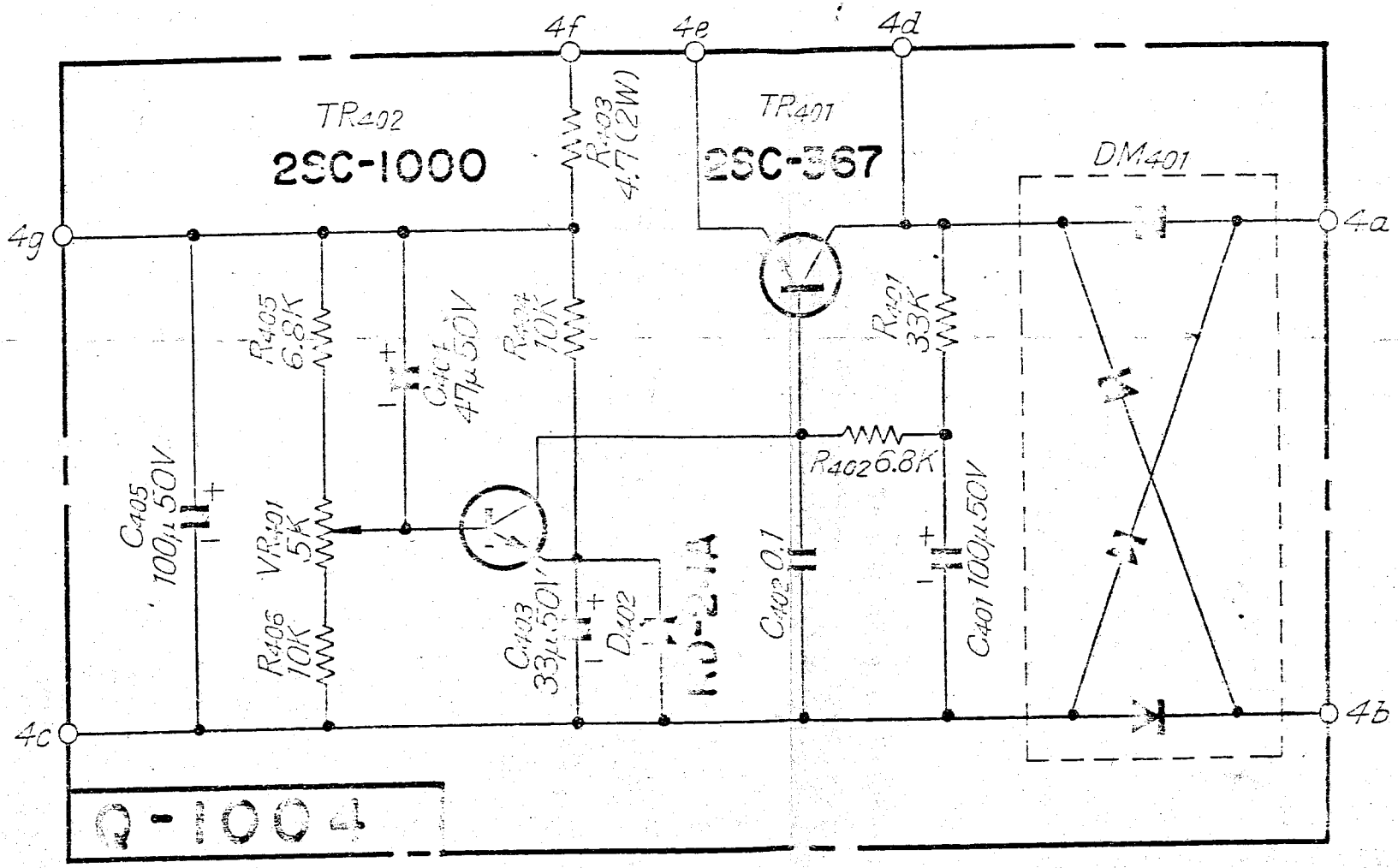
S_1 (a~c)	S_2	
1. QS ENCODE	1. 7.7dB	3. 15dB
2. SYNTHESIZER ENCODE	2. 10dB	4. 20dB


Q-1001
TR101
2SC-1000×2
TR105
TR109
2SA-561
R145 100
1i
1a
1b
R101 27K
VR101 5K
R105 3.3K
C101 4.7μ
R109 220K
R113 100K
R121 27K
R125 27K
R129 1K
C109 100μ50V
R133 1K
R137 4.7K
R141 4.7K
C105 10μ50V
2
1
9
1j
MC101
TR102
2SC-1000×2
TR106
TR110
2SA-561
1c
1d
R102 27K
VR102 5K
R106 3.3K
C102 4.7μ
R110 220K
R114 100K
R122 27K
R126 27K
R130 1K
R134 1K
R138 4.7K
R142 4.7K
C106 10μ50V
4
3
10
1k
TR103
2SC-1000×2
TR107
TR111
2SA-561
1e
1f
R103 27K
VR103 5K
R107 3.3K
C103 4.7μ
R111 220K
R115 100K
R123 27K
R127 27K
R131 1K
C110 100μ50V
R135 1K
R139 4.7K
R143 4.7K
C107 10μ50V
6
5
11
1l
TR104
2SC-1000×2
TR108
TR112
2SA-561
1g
1h
R104 27K
VR104 5K
R108 3.3K
C104 4.7μ
R112 220K
R116 100K
R124 27K
R128 2.7K
R132 1K
R136 1K
R140 4.7K
R144 4.7K
C108 10μ50V
8
7
12
1m
1n


Q-1002
TR201
TR205
TR203
TR213
TR217
2SC-1000 ×5
R201 220K
R213 2.2K
C209 0.047
R221 2.2K
C203 0.047
R229 2.2K
C213 0.0047
R237 2.2K
C217 470P
R254 100
2a
C210 4.7μ
R209 100
VR201 20K
VR205 20K
VR209 20K
VR213 20K
C223 100μ50V
2i
2j
R205 150K
R217 2.2K
R225 2.2K
R233 2.2K
R241 2.2K
R245 10K
2b
2k
TR202
TR206
TR210
TR214
TR218
2SC-1000 ×5
R202 220K
R214 2.2K
C206 0.047
R222 2.2K
C210 0.047
R230 2.2K
C214 0.0047
R238 2.2K
C218 470P
R255 100
2l
2c
C202 4.7μ
R210 100
VR202 20K
VR206 20K
VR210 20K
VR214 20K
C224 100μ50V
2m
R206 150K
R218 2.2K
R226 2.2K
R234 2.2K
R242 2.2K
R246 10K
2d
2n
TR203
TR207
TR211
TR215
TR219
TR221
2SC-1000 ×6
2o


2c
2d
2e
2f
2g
2h
2m
2n
2o
2p
2q
2r
2s
2t
C202 4.7μ
C203 4.7μ
C204 4.7μ
R210 100
R211 100
R212 100
R206 150K
R207 150K
R208 150K
C207 2.2μ
C208 2.2μ
C211 0.15
C212 0.15
C215 0.015
C216 0.015
C219 1500P
C220 1500P
C221 150P
C222 150P
470P
C224 100μ 50V
C225 100μ 50V
C226 100μ 50V
R203 220K
R204 220K
R215 2.2K
R216 2.2K
R223 2.2K
R224 2.2K
R231 2.2K
R232 2.2K
R239 2.2K
R240 2.2K
R247 2.2K
R248 2.2K
R251 2.2K
R252 2.2K
R219 2.2K
R220 2.2K
R227 2.2K
R228 2.2K
R235 2.2K
R236 2.2K
R243 2.2K
R244 2.2K
R249 2.2K
R250 2.2K
R213 2.2K
R225 2.2K
R234 2.2K
R242 2.2K
R246 10K
R253 10K
R256 100
R257 100
VR205 20K
VR206 20K
VR207 20K
VR208 20K
VR210 20K
VR211 20K
VR212 20K
VR214 20K
VR215 20K
VR216 20K
VR217 20K
VR218 20K
VR204 20K
TR203
TR204
TR207
TR208
TR211
TR212
TR215
TR216
TR219
TR220
TR221
TR222
2SC-1000 ×6
2SC-1000 ×6


C-1003
TR301 TR303
2SC-1000×2
TR305
2SC-1000
TR307
2SA-493
TR309
2SC-484
TR311
2SA-484
TR302 TR304
2SC-1000×2
TR306
2SC-1000
TR308
2SA-493
TR310
2SC-484
TR312
2SA-484
IS1554
IS1554
3a
3b
3c
3d
3e
3f
3g
3h
3i
3j
3k
3l
3m
3n


4f
4e
4d
TR402
2SC-1000
R403
4.7 (2W)
TR401
2SC-367
DM401
4g
4a
R405
6.8K
C404
47μ 50V
R404
10K
R401
33K
C405
100μ 50V
VR401
5K
R402 6.8K
R406
10K
C403
33μ 50V
D402
C402 0.1
C401 100μ 50V
4c
4b
0-1004

REGISTERED No. _____

If you are interested in receiving news and technical data on future developments of the QS Coding System, please clip the card below and mail it to us.

tear here

REGISTERED No. _____

Your Name _____

Name of Your Company _____

Address of Your Company _____

_____

Office Tel. No. _____

Your Title _____

Remarks _____

_____

_____

_____

資料タイトル	発送月日	着信月日	備　考	資料タイトル	発送月日	着信月日	備　考

会社名　担当者　国名