TR-909 SERVICE NOTES
First Edition

SPECIFICATIONS

Memory Capacity
48 Rhythm Patterns (16 x 3 Pattern Groups)
x 2 (Bank 1, II)

Tracks
4 Tracks (1 to 4: Continuous Maximum measures 808)
x 2 (Banks 1, II)

Steps (per measure)
1 to 16 steps

Tempo
J = 27 to 290

Rear Panel
Master Out (L, R/MONO) [6 Vp-p, 1kΩ]
Multi Out......See P.9
Bass Drum, Snare, Low Tom, Mid Tom, Hi Tom,
Rim Shot, Cymbals, Hi-Hat, Crash, Ride

Trigger Out
(Rim Shot: +14V, 20 ms pulse)

Sync In (SP-DIN)
(1: Run/Step, 2: GND, 3: Clock, 5: Continue)

Power Consumption: 14W

Dimensions:
486(W) x 105(H) x 300(D) mm/
19-1/8(W) x 4-1/8(H) x 11-13/16(D) in

Weight: 4.5 kg/9 lb 15 oz

Option: Memory cartridde M-64C
Pedal Switch DP-2

Printed in Japan

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**IC DATA**

**HD14511BP**
BCD-TO-7SEGMENT
LATCH/DECODER/DRIVER

**HD14006BP**
18-BIT STATIC SHIFT REGISTER

**HD14040BP**
12-BIT BINARY COUNTER

**HD74LS138P**
3 TO 8 DEMUXPELER

**TC4520BP**
DUAL BINARY UP COUNTER

**DIODE**
- 184861 rectifier bridge
- 1850125
- 18501305 RD8.3J2B zener
- 185019125 R85.6J2B zener SW board
- 185019126 1SS-133
- 185019126 1SS-133T-77
- 185019661 RD18JB2-T zener

**LED**
- 1850298142 1B-603RK 7-segment
- 185029160 SEL102R

**CRYSTAL**
- 18389717 12.0000Hz

**RESISTOR ARRAY**
- 18391943 RCD8x102-720 1k x 8
- 18391913 RCD8x102-720 11k x 8

**CONNECTOR**
- 18349133 5046-06A (Molex) VOICING board
- 18349123 5046-09A (Molex) VOICING board
- 18349116 5046-10A (Molex) VOICING board
- 18349110 5046-3A (Molex) DIN JACK board

**AC CORD SET**
- 18349816F0 DC-357-J01 100V
- 18349812F0 UC-704-J01 117V
- 18349813F0 EC-215-J06 220V 2P
- 18349817F0 EC-702-J05 240V 2P
- 18349814F0 SC-415-J06 240V 3P

**WIRING ASS’Y**
- 1834104001 1PF SWITCH board
- 1834104201 1PF SWITCH board
- 1834104300 1PF SWITCH board
- 1834104400 6PF VOICING board
- 1834104350 3PF VOICING board
- 1834104370 10PF VOICING board

**OTHERS**
- 18269117 Heat Sink MT-25-BS 1C703 PB board
- 18269115 Heat Sink MT-50-BS 1C701,702 PB board
- 18219962 Battery Holder
- 1821904290 Battery Box
- 1821904500 LED Holder MULTI JK Board
- 1821904100 Holder MULT JPB Board
- 1821904100 Holder DIP JK Board
- 18219006 Battery Snap T-250C
- 1822063490 Cushion LED segment cover
- 1822063290 Switch Mask A (375x27 mm)
- 1822405260 Switch Mask B (27x27 mm)

**COMMERCIALy AVAILABLE ACCESSORIES**
- 12569105 Battery UM3G 1.5V
- 2343067500 Connection Cable LF-25
CIRCUIT DESCRIPTIONS

IC604 CPUµP07811G-033-036 (SWITCH BOARD)
PORT ASSIGNMENT

PA 0
1 Scanning Signal Outputs to Switches
2
3
4
5
6
7

PC 0
1 Serial Transmitter to MIDI
2 Serial Receiver from MIDI
3 Input from Foot Switch
4 Data Input from Tape Interface (Rhythm or SYNC data)
5 Tape SYNC Output
6 Start/Stop Signal Input from DIN Socket
7 Unused (Input)

PI 0
1 Scanning Signal Outputs to LED
2
3
4
5
6
7

PD 0
1 Data Bus
2 Multiplexed Address Bus (Lower)
7

PF 0
1 Address Bus (Higher)
7

The TR-909 combines Voice Generators and CPU based controller. In basic operation, the CPU scans panel switches, strobes switch outputs, and generates trigger (TRIG) and volume (ACCENT) data for the voice generators which are categorized into two: Digital and Analog. The CPU provides them with TRIG and ACCENT data in an identical way.

ACCENT & TRIG

Accent data on the CPU bus is latched into one of ACCENT latches (IC2-IC9) selected by Address Decoder (IC612, §13). Latched ACCENT code is converted to analog equivalent at the output of associated resistor array RM0621. The voltage is clamped to the level until it is replaced by the next incoming data.

TRIG

Almost concurrent with ACCENT, TRIG is latched into IC1 or IC10, and appears as 5V positive going pulse on the correct output pin for 2ms. TRIG is used either solely or in combination with ACCENT to reset generator(s) and to create various envelopes for controlling pitch, tone color, contour, loudness, etc. of the particular rhythm sound being sounded.

DIGITAL VOICE GENERATORS

Hi-Hat, Ride and Crash cymbals are reproduced out of digital sound memories which have been sampled from an actual instrument, modified to be useful as data and stored into the ROM by way of PCM.

Circuit configurations and operations of these voices are basically the same. The following description takes Hi-Hat as a representative.

Hi-Hat

Pressing Hi-Hat button(s) develops a positive pulse (TRIG) on pin 7 of IC10, resetting Address Counters (IC70 and IC71) to "0's" on all their outputs. These 0's cause IC72a output to swing to H' or H'2 irrespective of a CLOSED/OPEN being applied to digital outputs (D108-199).

Upon receiving this "run" from IC72a, a combination of two gates (IC72 e and d) starts oscillation and outputs about 60KHz, which is divided by two, and shaped up by IC73 flip-flop (TIMING GEN), clocking the address counters. With the same bits applied from the address counters, a logic (10H - 190 OR gates) places ROM beginning and end at different locations according to H or L of the CLOSED/OPEN as shown in the table. IC72a turns its output to L (stop) when the counter increments to:

110000000000... in OPEN mode
010000000000... in CLOSED mode

ADDRESS TABLE

\[
\begin{array}{ll}
\text{OPEN HI-HAT} & 000000000000 \\
\text{COMMON ADDRESS} & 110000000000 \\
\text{CLOSED HI-HAT} & 111111111111
\end{array}
\]

Voice data clocked out of ROM IC69 are latched into IC68 and then converted to analog voltages while passing through RA9. The output results at RA9 output has an envelope somewhat different from that of actual Hi-Hat sound. This is because the Hi-Hat sounds have been compressed before being digitalized and Pulse Code Modulated (PCM) in order to have greater S/N ratio and higher digital resolution. The envelope of this Hi-Hat sound can be controlled manually with DECAY control (VR21 or VR22).

CLOSED... A high CLOSED/OPEN on QT2 base removes a positive voltage from its collector which in turn allows Q73 to charge DECAY capacitor C135 through R451 and VR21. Since this charging path is 1/ten the total resistance of R452 and VR23, the charging rate of C135 depends on VR21 setting.

OPEN... With low CLOSED/OPEN, CH charging path is disconnected from the DC supply source at QT3 OH path becomes conductive.

CRASH & RIDE

These voices also have unique envelopes that are quite different from actual sounds when the data are directly reproduced. The reason is the same as described in Hi-Hat section. Restoration of the envelopes are made by the use of ROM addresses as the envelope data.

Before being stored into the ROM, the envelope of CRASH is charged with the following compensation measure taken into consideration. When CRASH sound data are read successively from ROM (IC62) with the correct addresses, the same addresses are also converted to analog voltages through RA11, anti-log tapered by IC52b and Q70, and are applied to the base of QT1 (VCA) which is configured as a voltage controlled potentiometer to give the incoming voltage the CRASH decay curve.

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ANALOG VOICE GENERATORS
SNAPE, BASS, TOH TOM operate basically in the same manner and share
the same Noise Generator. For discussion purposes the schematic references
for SNAPE DRUM are used in the description below.

SNARE DRUM
SNAPE DRUM consists of Drum and Snappy, each further separated into
two parts.

DRUM
Drum voice is composed of VCO-1 and VCO-2 with associated Control
Voltage Generator (IC35). VCO-1 and VCO-2 have similar circuits except
that charging capacitors C69 and C71 have different capacitances so that
they can oscillate at different frequencies: VCO-1 runs at lower frequency.
VCO-1 comprises a hysteretic comparator (IC37a), inverting buffer configured
as voltage-dependent resistor (IC35) and an integrator consisting of
IC37b and C69 with Q44 switcher. In this arrangement VCO-1 generates
triangle waveform. When TRIG is applied to the base of Q39 VCO-1 receives
a positive pulse from Q40 collector at the following places:
a) One input of IC37a via Q62. When the pulse is applied, IC37a turns its
output to low.
b) The base of Q44 which discharges C69, canceling VCO-1 output.
The combination of tr and br resets VCO-1 to the starting point at which
VCO-2 also starts oscillation, phasing the initial waveforms of both VCOs.
c) The base of Q46 which cuts off VCA 050, muting unwanted noises in the
VCO-1 path.
d) VCO-1 also sees the effects of trigger pulse from Q40 at VCP and VSS
terminals of buffer IC36 through the control voltage generator.
The outputs of IC35 give the buffered output amplitude proportional to
ENV-1 as shown in figure; the charging rates of C69 also continuously
changes for about 20ms. The resultant effect is a pitch bend of SNAPE drum
sound for that period.
The amount of drum voice from VCO-1 is determined by VCA 050 whose
gain follows ENV 3 which is in turn controlled by an ACCENT coming
through Q4 currently gated by the TRIG.

NOISE
This is a quasi-random noise generator having two filter stages IC32, IC33
connected in cascade making up 32 stages. Chaining of 32 stages provides a
longer interval between the beginning and the end of shift cycles. This means
that the frequency changes occurring at end/start points of shifting cycle are
made less noticeable to the human ear. Two Ex-OR gates of IC31 clock the
shift registers at a higher frequency, allowing them to create noises that
contain favorable higher frequency contents.

On power-up, a trigger is applied into pin 1 of IC32 via D48 for starting run-
ning.

RESET
Q701, Q702, D701 and associated circuits on the Power Supply Board cause
RESET inputs to IC604 CPU and IC608 RAM on Switch Board to be held
low on power-up to allow DC supplies and signals to stabilize before starting
processing. When the voltage on input terminal of IC703 (Power Supply Board)
reaches 7.0V, Q701 conducts and cuts off Q702. The circuit also pro-
vides power down reset when the IC703 input voltage goes sufficiently below
7.0V on power down or power fail. The RESET is also routed to:
Cartridge Board and
TRIG and ACCENT latches (IC1, IC16) on VOICING Board via Switch
Board. When the unit is operated from a poor AC line and is forced to stop or
reset, first check the unit's serial number. If prior to 3930500, replace D701
(zener diode) of Power Supply Board with RD5,68J2. Refer to "CHANGE
INFORMATION" in this manual.

TAPE INTERFACE
TAPE INTERFACE on VG BRD consists of two sections: Output-to-TAPE
and Input-from-TAPE. The Interface will take dual duties; either a) or b) dis-
cribed below depending on TR-909 operation mode.

a) MEMORY SAVE & LOAD
To allow rhythm data stored in TR-909's memory to be preserved on
caustic tape recorder and vice versa.

b) TAPE SYNC
To allow a signal (TEMPO CLOCK) on a tape to control the speed of
operation of TR-909. Also to provide such sync signal for recording on tape.
In normal PLAY mode TAPE INTERFACE sends out TAPE & SYNC signal
from OUT/SAVE jack.
in basic WRITE mode TR-909's CPU does not accept data coming through
the Interface.

SAVE & LOAD/VERIFY
SAVE
During SAVE routine, the CPU (on SW BRD) represents rhythm data, which
is to be recorded on tape, as 2-bit code on Port B, 6 and 7. CPU can select
one of two codes for one “O”, and another one of two for each “1” to make
successive 1s and 0s distinguishable from the adjacent when they are chain-
ed at the output of D-to-A arrangement composed of R318, R322.

LOAD & VERIFY
Rhythm data from tape passing through IN/LOAD jack is first differentiated,
smoothed at IC41b, shaped up to a rectangular at IC41a comparator, then
entered into the CPU via Port C. The CPU measures the length of each
incoming half-period by detecting every edge. Depending on the length the
CPU recognizes a “0” or a “1” as follows:

TAPE SYNC
IN STOP MODE...The CPU develops continual 1200Hz pulse at Port C-4;
IN normal PLAY MODE...The CPU generates 1200Hz and 2400Hz alternate-
ly.
The CPU changes frequency between 1200 and 2400Hz every half-period of
T which is 1/24 of the time required for most of Roland products to pro-
cess a quarter note.
These 1200 or/and 2400Hz coming to TAPE INTERFACE have their high-
components filtered out by C93, R328, Q44 and R329 before being routed to
OUT/SAVE jack for use by the tape recorder as shown below.

IN SYNC-TO-TAPE MODE...IC41, Q52 and surrounding circuits works on
incoming signal in just the same way they do in LOAD or VERIFY mode.
The CPU converts this signal to the actual useful information. That is, the
number of times per second that the signal changes frequency between 1200
and 2400Hz.
# Change Information

## ROM IC609 Switch Board

<table>
<thead>
<tr>
<th>Group</th>
<th>Serial Number</th>
<th>ROM Used</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>300100</td>
<td>2784-250NS, without version number on label EPROM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>203590</td>
<td>2784-250NS, with version number Ver. 1 on the label</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>403590</td>
<td>2784-250NS (Revision 1) or 2364-250NS, mask ROM</td>
<td>Part Number 15179645 or Part Number 15179646</td>
</tr>
</tbody>
</table>

**Description**

ROM in Group A

If measures in TRACK 1, 2 or 3 are incremented or decremented while there is no measure in TRACK 4, and one of subsequent TRACKS is selected for writing, all rhythm patterns may be lost or rewritten. This can be avoided by implementing "RELOADING FACTORY-PATTERNS" paragraph 2 in the preceding section, or by replacing the existing ROM with the one in Group B.

ROMs in Group A and B

When synchronizing to MIDI clocks, there are glitches. TR-909 sometimes fails behind if STOP is pressed, then CONTINUE is pressed (this won't happen when MIDI clocks are transferred between TR-909s). Software revision 2 corrects this problem and is incorporated in 2784-250NS labeled Ver. 2. To check if existing ROM is Ver. 2, turn the power ON while holding down TRACK 1 key, and MAIN key key 2 (BASS DRUM) will blink, if version 2. ROMs of Ver. 2 are available from the factory to upgrade units on the market.

## Fault Isolation Guide

### Symptoms

- **The unit fails to reproduce programmed rhythm sequence.**
- **Some memories have been replaced by other data.**

### Failure Causes & Actions to be Taken

- **From IC609 Ver. 1.0 has new program which should solve the problem of unreliability.**
  - Refer to "Change Information."
  - Check DC rails, Check IC702 on Power Supply Board.
  - Check R4600 and RA600 on Switch Board.

- **The unit stops running upon power ON/OFF transient of other electrical devices.**
  - **RESET circuitry is too sensitive to AC power drops. Check and replace 0701 on Power Supply Board.**
  - If it is R6882, replace with R6882.
  - Refer to "Change Information."

- **Data transfer between Internal Memory and Memory Cartridge (SAVE/LOAD) fails.**
  - **There should be an additional instruction to "3. Memory Cartridge" of the Owner's Manual (p.32): ENTER KEY must be UNLIT (Internal Memory Model) during SAVE or LOAD from Memory Cartridge.**
  - That is, "Press ENTER when it is lit, then hold down."

- **Noise is high in OUTPUT.**
  - For the units prior to Sr of Number 415520, Add capacitor 0.01µF across jack contacts on Multi-Jack Board (MULTI-JACK BOARD Diagram denotes these capacitor as C609—C512).
MIDI NOTES

The TR-090 is designed to accept voice messages sent over MIDI channel(s) in any of four channel modes defined in the MIDI Specification as shown in the table below.

<table>
<thead>
<tr>
<th>MODE</th>
<th>RECEIVER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 OMNI ON POLY</td>
<td>Voice messages are received from all Voice Channels and assigned to voices polyphonically.</td>
</tr>
<tr>
<td>2 OMNI ON MONO</td>
<td>Voice messages are received from all Voice Channels, and control only one voice, monophonically.</td>
</tr>
<tr>
<td>3 OMNI OFF POLY</td>
<td>Voice messages are received in Voice Channel N thru N+M1, and assigned monophonically to voices 1 thru M, respectively. The number of voices M is specified by the third byte of the Mono Mode Message.</td>
</tr>
<tr>
<td>4 OMNI OFF MONO</td>
<td>Voice messages are received in Voice Channel N thru N+M1, and assigned monophonically to voices 1 thru M, respectively. The number of voices M is specified by the third byte of the Mono Mode Message.</td>
</tr>
</tbody>
</table>

N: Basic Channel

This is an inherent channel of an instrument, which cannot be changed by MIDI messages but may be changed by the panel function on the instrument. The TR-090 has channel selections on the front panel.

To fully take advantage of this feature, however, proper Channel Mode must be selected to receive necessary voice messages only, and to reject unnecessary ones.

Before proceeding to this text, please note the following:

* TR-090 is a one voice rhythm machine.
* The rhythm sounds (rhythm voice generators) are assigned to KEY [NOTE] numbers, respectively, as shown below.
* A given MIDI message will take effect only when recognized by TR-090.
* Do not put TR-090 into MIDI-loop circuit. Feedback may lead to malfunction.

MIDI KEY ASSIGNMENT

| Keys not listed are ignored. | Keys listed are assigned to the master unit transmits. No difference between MODES 1 and 2 in TR-090 function since it contains only one voice. |

MODE 1...OMNI ON POLY

With this connection, slave unit can recognize voice messages on whichever channels the master unit transmits. No different between MODES 1 and 2 in TR-090 function since it contains only one voice.

MODE 2...OMNI ON MONO

In a system as shown, each slave should be in OMNI OFF mode with its basic channel match the number channel assigned by the master respectively. Once set, it will response to voice messages sent over its current basic channel only (see "GENERAL PRECAUTIONS" on page 16).

As for TR-090, it must be set to MODE 3. The table below will help set TR-090 to correct mode and channel.

NOTE: Roland products with preliminary MIDI turn to OMNI OFF upon receiving POLY ON.

<table>
<thead>
<tr>
<th>CHANNELS &amp; CHANNEL MODES</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECEPTOR</td>
</tr>
<tr>
<td>ON POWER-UP MODE CHANNEL</td>
</tr>
<tr>
<td>HOW TO CHANGE CHANNELS AND MODES</td>
</tr>
<tr>
<td>1. Press SLIDE 7 and 8.</td>
</tr>
<tr>
<td>2. Holding LAST STEP, select new channel, as desired, by pushing MAIN KEY (1 thru 16).</td>
</tr>
</tbody>
</table>

This function should be adopted when need arises to set its slave behavior is incapable of changing involving channels by itself to OMNI OFF mode.

MASTER 1st slave 2nd slave

When the slave(s) has no capability of channel selection or mode change to OMNI OFF (like some Roland preliminary instruments), this can be cured by using the TR-090 transmitter's feature listed above.

(See "GENERAL PRECAUTIONS" on page 16.)

MODE 4...OMNI OFF, MONO

When the TR-090 receives MONO mode message with OMNI OFF mode, it recognizes the number (M) represented by the 3rd byte of the message. TR-090, then accepts voicing messages on the basic channels and upward according to M.

Example: Basic channel—4, M=3, then 4 + 3 = 1. i.e. channels 4, 5 and 6. Result number exceeding 10 are ignored.
### MIDI IMPLEMENTATION
(Complies with MIDI 1.0)

#### TRANSMITTED DATA

<table>
<thead>
<tr>
<th>Status</th>
<th>Second</th>
<th>Third</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1001 nnm | 0kkk kkkk | 0vvy vyyv | Note On:
  \begin{align*}
  &k\text{k}\text{k}\text{k}\text{k} = \text{36-51} \\
  &v\text{v}\text{v}\text{v}\text{v} = \text{64-96}
  \end{align*} \\
  \text{(accent min-max)}
| Note off: 
  \begin{align*}
  &v\text{v}\text{v}\text{v}\text{v} = 0
  \end{align*} |
| 1011 nnm | 0ccc cccc | 0vvy vyyv | Mode Message:
  \begin{align*}
  &c\text{c}\text{c}\text{c}\text{c} = 124: \text{Omni mode off}
  \end{align*} \\
  \begin{align*}
  &c\text{c}\text{c}\text{c}\text{c} = 127: \text{Poly mode on}
  \end{align*} \\
  \text{v\text{v}\text{v}\text{v}\text{v} = 0}
| Song Position Pointer:
  \begin{align*}
  &x\text{x}\text{x}\text{x}\text{x} = \text{Least significant}
  \end{align*} \\
  \begin{align*}
  &y\text{y}\text{y}\text{y}\text{y} = \text{Most significant}
  \end{align*} |
| 1111 0010 | 0xxx xxxx | 0yy yyy | Song Select:
  \begin{align*}
  &x\text{x}\text{x}\text{x}\text{x} = \text{Track #}
  \end{align*} \\
  \begin{align*}
  &y\text{y}\text{y}\text{y}\text{y} = \text{Track #}
  \end{align*} |
| 1111 1000 | 00s ss | --- | Timing Clock:
  \begin{align*}
  &s\text{s} = \text{Track #}
  \end{align*} |
| 1111 1010 | 1011 | | Start |
| 1111 1011 | | | Continue |
| 1111 1100 | | | Stop |

#### RECOGNIZED RECEIVE DATA

<table>
<thead>
<tr>
<th>Status</th>
<th>Second</th>
<th>Third</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1001 nnm | 0kkk kkkk | 0vvy vyyv | Note On (Trigger):
  \begin{align*}
  &k\text{k}\text{k}\text{k}\text{k} = 35-51 \text{[*7]}
  \end{align*} \\
  \text{v\text{v}\text{v}\text{v}\text{v} = 1-127}
| 1011 nnm | 0ccc cccc | 0vvy vyyv | Mode Message:
  \begin{align*}
  &c\text{c}\text{c}\text{c}\text{c} = 124: \text{Omni mode off}
  \end{align*} \\
  \text{v\text{v}\text{v}\text{v}\text{v} = 0}
| Song Position Pointer:
  \begin{align*}
  &x\text{x}\text{x}\text{x}\text{x} = \text{Least significant}
  \end{align*} \\
  \begin{align*}
  &y\text{y}\text{y}\text{y}\text{y} = \text{Most significant}
  \end{align*} |
| 1111 0010 | 0xxx xxxx | 0yy yyy | Song Select:
  \begin{align*}
  &x\text{x}\text{x}\text{x}\text{x} = \text{Track #}
  \end{align*} \\
  \begin{align*}
  &y\text{y}\text{y}\text{y}\text{y} = \text{Track #}
  \end{align*} |
| 1111 0011 | 0ss ss | --- | Timing Clock:
  \begin{align*}
  &s\text{s} = \text{Track #}
  \end{align*} |
| 1111 1000 | | | Start |
| 1111 1010 | | | Continue |
| 1111 1100 | | | Stop |
| 1111 1111 | | | System Reset |

All valid MIDI IN messages are transferred to MIDI OUT except Timing Clock and System Exclusive.

While the Tape Interface is functioning (SAVE/LOAD/VERIFY), all MIDI routine is frozen.

---

1. On power-up, "mono" is set to 1012 (channel 11). Can be changed to 0000(1) through 1111(16) from the front panel.
2. When a channel number is set, "OMNI OFF" and "POLY ON" are sent in that channel.
3. Sent only when in TRACK PLAY and STOP modes, and after a measure number has been set.
4. Sent when TRACK number or BANK is selected. (The same number is applied to the Memory Cartridge, if selected.)

**ssssss** = 0 Bank-1
1 Track-1
2 Track-2
3 Track-3
4 Bank-2
5 Track-1
6 Track-2
7 Track-3

5. One of the following, according to TEMPO MODE setting.

**INTERNAL mode**
This is synced to the internal TEMPO clock (MIDI clock and DIN SYNC inputs are ignored).

**MIDI mode**
MIDI clock input is selected (Internal TEMPO clock and DIN SYNC input are ignored).

**DIN SYNC mode**
This is synced to the positive going edge of clock pulses from DIN jack (MIDI and Internal TEMPO clocks are ignored).

6. The TR-009 always power-up with channel set to "10"(1001) and with OMNI mode on. The channel can be changed to "11"(0000) through "16"(1111) from the front panel with its mode switched to OMNI OFF.

7. Note On message works as a trigger pulse. Note Off message and Note On with vvvv=0 are ignored.

### MIDI KEY ASSIGNMENT

| kkkkkk = 35, 36 | Bass Drum |
| 37 | Rim Shot |
| 38, 40 | Snare Drum |
| 39 | Hand Clap |
| 41, 43 | Low Tom |
| 42, 44 | Closed Hi-Hat |
| 46, 47 | Mid Tom |
| 46 | Open Hi-Hat |
| 48, 60 | High Tom |
| 49 | Crash Cymbal |
| 51 | Ride Cymbal |

**NOTE:** When sounding TR-009's voices only with MIDI rhythm patterns, select a blank TRACK. Patterns programmed in a selected track will be forced to run whenever START comes from MIDI IN.

8. Voice messages are received in Voice Channels "mmm\text{mm}" through "mmm\text{mm}M-1".

9. Recognized only when in TRACK PLAY and STOP modes.

10. Effective only when the TR-009 is in STOP during PLAY, TRACK WRITE PATTERN PLAY, or PATTERN WRITE. Upon receiving, the TR-009 enters TRACK PLAY mode.

11. Recognized only when TEMPO MODE is set to MIDI.
TR-909 SYSTEM EXCLUSIVE

1. INTRODUCTION

Using system exclusive messages, a bank of rhythm data can be transmitted to or received from the TR-909 (TR-909 has two banks).

To interact with TR-909 using system exclusive a host computer must be linked together.

The host computer must first send REQUEST to the TR-909 which does not take the initiative in transferring system exclusive.

The TR-909 can process the system exclusive only when in TRACK PLAY and STOP modes.

2. DATA SAVE TO THE HOST COMPUTER

(1) REQUEST

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111 0000</td>
<td>Exclusive status</td>
</tr>
<tr>
<td>0100 0001</td>
<td>Roland ID #</td>
</tr>
<tr>
<td>0101 0001</td>
<td>Operation Code</td>
</tr>
<tr>
<td>1111 0111</td>
<td>EOX (End of Exclusive)</td>
</tr>
</tbody>
</table>

(2) DATA

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111 0000</td>
<td>Exclusive status</td>
</tr>
<tr>
<td>0100 0001</td>
<td>Roland ID #</td>
</tr>
<tr>
<td>0101 0010</td>
<td>Operation Code (or 0111 0000 = abort)</td>
</tr>
<tr>
<td>0000 0001</td>
<td>Format type</td>
</tr>
<tr>
<td>0100 mmm</td>
<td>Block # (mmn: 0000 - 1111)</td>
</tr>
<tr>
<td>0000 yyyy</td>
<td>Rhythm data (yyyyyy...)</td>
</tr>
<tr>
<td>0000 . . .</td>
<td>512 bytes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description (for the preceding 512 data bytes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111 0111</td>
<td>EOX</td>
</tr>
</tbody>
</table>

(3) ACKNOWLEDGE

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111 0000</td>
<td>Exclusive status</td>
</tr>
<tr>
<td>0100 0001</td>
<td>Roland ID #</td>
</tr>
<tr>
<td>0101 0010</td>
<td>Operation Code (or 0101 0101 = data follow)</td>
</tr>
<tr>
<td>1111 0111</td>
<td>EOX</td>
</tr>
</tbody>
</table>

(4) ACKNOWLEDGE

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111 0000</td>
<td>Exclusive status</td>
</tr>
<tr>
<td>0100 0001</td>
<td>Roland ID #</td>
</tr>
<tr>
<td>0101 0011</td>
<td>Operation Code (or 0111 0001 = Error)</td>
</tr>
<tr>
<td>1111 0111</td>
<td>EOX</td>
</tr>
</tbody>
</table>

(5) Repeat (3) and (4) increasing Block # until mnn = 1111.

(A bank of rhythm data is divided into 512 blocks.)

3. DATA LOAD FROM THE HOST COMPUTER

(1) REQUEST

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111 0000</td>
<td>Exclusive status</td>
</tr>
<tr>
<td>0100 0001</td>
<td>Roland ID #</td>
</tr>
<tr>
<td>0101 0000</td>
<td>Operation Code</td>
</tr>
<tr>
<td>1111 0111</td>
<td>EOX (End of Exclusive)</td>
</tr>
</tbody>
</table>

(2) ANSWER

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111 0000</td>
<td>Exclusive status</td>
</tr>
<tr>
<td>0100 0001</td>
<td>Roland ID #</td>
</tr>
<tr>
<td>0101 0001</td>
<td>Operation Code</td>
</tr>
<tr>
<td>1111 0111</td>
<td>EOX (End of Exclusive)</td>
</tr>
</tbody>
</table>

(3) DATA

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111 0000</td>
<td>Exclusive status</td>
</tr>
<tr>
<td>0100 0001</td>
<td>Roland ID #</td>
</tr>
<tr>
<td>0101 0010</td>
<td>Operation Code</td>
</tr>
<tr>
<td>0000 0001</td>
<td>Format type</td>
</tr>
<tr>
<td>0100 mmm</td>
<td>Block # (mmn: 0000 - 1111)</td>
</tr>
<tr>
<td>0000 yyyy</td>
<td>Rhythm data (yyyyyy...)</td>
</tr>
<tr>
<td>0000 . . .</td>
<td>512 bytes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111 0111</td>
<td>EOX</td>
</tr>
</tbody>
</table>

(4) ACKNOWLEDGE

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1111 0000</td>
<td>Exclusive status</td>
</tr>
<tr>
<td>0100 0001</td>
<td>Roland ID #</td>
</tr>
<tr>
<td>0101 0011</td>
<td>Operation Code (or 0111 0001 = data follow)</td>
</tr>
<tr>
<td>1111 0111</td>
<td>EOX</td>
</tr>
</tbody>
</table>

(5) Repeat (3) and (4) increasing Block # until mnn = 1111.

(A bank of rhythm data is divided into 16 blocks.)

GENERAL PRECAUTIONS ON MIDI CONNECTION

Although all MIDI instruments function to MIDI specification, some precautions must be taken for satisfactory operation.

This is mainly due to MIDI revision. One of primary precautions to be correctly followed is setting of "Channel Mode" otherwise MIDI function fails from the beginning. Also remember that MIDI information is effective only when receiving device can recognize a given message and has software and hardware that duplicate function defined by the message.

On power up most Roland products comply with MIDI specification 1.0 default to OMNI ON, POLY. On the contrary, they transmit OMNI OFF and POLY mode messages from MIDI OUT jack. The reason is as follows.

Receiving instrument must be set to OMNI OFF mode when it is to accommodate voice messages sent over the channel to it which is currently assigned while other voice messages are present in other channels. (Example: a system consists of one master and more than one slave, each assigned to different channel.) However, some instruments are incapable of changing modes on the front panel and need external OMNI OFF message.

To cure this problem a system including such instruments as slaves should be configured as below.

<table>
<thead>
<tr>
<th>MASTER (1st slave)</th>
</tr>
</thead>
<tbody>
<tr>
<td>capable of producing OMNI OFF message (or POLY, see NOTES)</td>
</tr>
<tr>
<td>1. on panel or other means as desired time</td>
</tr>
<tr>
<td>2. on power up</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SLAVE(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>incapable of turning to OMNI OFF mode by itself</td>
</tr>
</tbody>
</table>

In the above combination:

1. Slave must be powered ON before the master is turned ON.
(When the second slave connects to MIDI OUT of the first slave, it is the first to be turned ON.)

2. Master and Slave(s) must be set in the same channel since mode messages will be recognized by the slave only when set in the channel to which the slave's receiver has been assigned.

NOTES:

1. Roland products with preliminary MIDI turn to OMNI OFF upon receiving POLY mode ON.
2. TR-909 does not send OMNI OFF and POLY messages on power-up but on transmitting channel setting.

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