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 896)
x 2 (Banks I, II)

Steps (per measure)
1 to 16 steps

Tempo
37 to 290

Rear Panel
Master Out (L, R/MONO) [6 V-p-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 (6P-DIN)
(1: Run/Stop, 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 cartridge M-64C
Pedal Switch DP-2

Printed in Japan B-3 1
IC DATA

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

HD14006BP
18-BIT STATIC SHIFT REGISTER

HD14040BP
12-BIT BINARY COUNTER

HD74LS138P
3 TO 8 DEMULTIPLEXER

TC4520BP
DUAL BINARY UP COUNTER

DIODE
15019245 LB4B41 rectifier bridge
15019305 RD6.8JB2 zener
RD5.6JB2 zener SW board
15019125 ISS-133
15019126 ISS-133Y-77
15019661 RD18JB2-T zener

LED
15029412 LB-603VK 7-segment
15029140 SEL102R

CRYSTAL
12389717 12.00MHz

RESISTOR ARRAY
13919143 RGD3R8x102-720 1K x 8
13919133 EM-0621

CONNECTOR
1349133 5046-06A (MOLEX) VOICING board
1349135 5046-09A (MOLEX) VOICING board
1349136 5046-10A (MOLEX) VOICING board
1349130 5046-3A (MOLEX) DIN JACK board

AC CORD SET
13498126P0 DC-357-J01 100V
13498127P0 DC-706-J01 117V
13498139P0 EC-210-J06 220V 2P
13498176P0 EC-702-J05 240V 2P
13498147P0 SC-415-J06 240V 3P

WIRING ASS'Y
2341044001 10P SWITCH board
2341044200 9P SWITCH board
2341044300 30P SWITCH board
2341044100 6P VOICING board
2341043500 3P VOICING board
2341043700 10P VOICING board

OTHERS
12469117 Heat Sink HT-25-BS IC703 PS board
12469116 Heat Sink HT-50-BS IC701,702 PS board
12199414 Battery Holder
2219042000 Battery Box
2219046000 LED Holder
2219041000 Holder MULTI JK Board
2219041100 Holder DIN JK Board
13419206 Battery Snap T-250L
2226034900 Cushion LED segment cover
2224052400 Switch Mask A (375x27 mm)
2224052500 Switch Mask B (27x27 mm)

COMMERCIALY AVAILABLE ACCESSORIES
12569105 Battery UM3G 1.5V
234306700 Connection Cable LP-25
CIRCUIT DESCRIPTIONS

IC604 CPU + PD7811G-033-036 (SWITCH BOARD)
PORT ASSIGNMENT

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

PB 0 1 2 3 4 5 6 7
Scanning Signal Outputs to LED
Latch Signal Output to 7-seg LED Driver
Data Outputs to Tape Interface

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

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

PF 0 7
Address Bus (Higher)

NMI Unused

INT 1
Clock Signal Input from DIN

AN 0 1 2 3 4 7
Analog Voltage Input from TEMPO Control
Unused
Analog Voltage Input from TOTAL Control
Unused

The TR-909 combines Voice Generators and CPU based controller. In basic operation, the CPU scans panel switches, stores 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, 613). Latched ACCENT code is converted to analog equivalent at the output of associated resistor array RM0021. 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 symbols 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 have "0's" on their all outputs. These 0's cause IC72a output to swing to Hihat irrespective of a CLOSED/OPEN being applied to diode OH's (D196-199).

Upon receiving this "run" from IC72a, a combination of two gates (IC72 c 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 (D106 - 199 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:

| 110 0000 0000 0000 ... in OPER mode |
| 010 0000 0000 0000 ... in CLOSER mode |

ADDRESS TABLE

| OPEN HI-HAT | 000 0000 0000 0000 |
| COMMON ADDRESS | 110 0000 0000 0000 |
| CLOSED HI-HAT | 111 1111 1111 1111 |

Voice data clocked out of ROM IC69 are latched into IC68 and then converted to analog voltages while passing through RA9. The sound 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 DECAV control (VR21 or VR23).

CLOSED....A high CLOSED/OPEN on Q2 base removes a positive voltage from its collector which in turn allows Q3 to charge DECAV capacitor C135 through R451 and VR21. Since this charging path is 1/100th 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 Q73 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 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 Q71 (VCA) which is configured as a voltage controlled potentiometer to give the incoming voltage the CRASH decay curve.
**ANALOG VOICE GENERATORS**

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

**SNARE DRUM**

SNARE 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 circuitry except that charging capacitors C69 and C71 have different capacitance so that they can oscillate at different frequencies: VCO-1 runs at lower frequency.

VCO-1 comprises a hyetograph comparator IC37a, inverting buffers configured as voltage-dependent resistor (in IC36) and an integrator consisting of IC37b and Q69 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 D62. When the pulse is applied, IC37a turns its output to low.

b) The base of Q44 which discharges Q69, cancelling VCO-1 output.

The combination of a) and b) 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 Q50, muting unwanted noises in the VCO-1 path.

d) VCO-1 also sees the effects of trigger pulse from Q40 at VDD and VSS terminals of buffer IC86 through the control voltage generator.

The outputs of IC35 gives the buffers output amplitude proportional to ENV-1 as shown in figure; the charging rate of Q69 also continuously changes for about 20ms. The resultant effect is a pitch bend of Snare drum sound for that period.

The amount of drum voice from VCO-1 is determined by VCA Q50 whose gain follows ENV 3 which is in turn controlled by an ACCENT coming through Q44 currently gated by the TRIG.

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**NOISE**

This is a quasi-random noise generator having two shift registers (IC22, 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.

**RESET**

Q70, Q70, Q70, and associated circuits on the Power Supply Board cause RESET inputs to IC64 CPU and IC68 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 provides 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 (IC11–IC10) 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 3903000, replace D701 (zener diode) of Power Supply Board with RD5.6J82. 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) described 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 cassette 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 8-6 and 7. CPU can select one of two codes for one "0", and another one of two for each "1" to make successive 1's and 0's distinguishable from the adjacents when they are chained 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 IC41u, shaped up to a rectangular at IC41a comparator, then entered into the CPU via Port C-3. 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:

Under 300us...."0".

Over 300us....."1".

**TAPE SYNC**

**IN STOP MODE**

The CPU generates continual 1200Hz pulse at Port C-4.

**IN normal PLAY MODE**

The CPU generates 1200Hz and 2400Hz alternately. The CPU changes frequency between 1200 and 2400Hz at every half-period of T which is 1/24 of the time required for most of Roland products to process a quarter note. These 1200 or/and 2400Hz coming to TAPE INTERFACE have their high components filtered out by C69, R228, C94 and R329 before being routed to OUT/SAVE jack for use by the tape recorder as shown below.

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**IN SYNC-TO-TAPE MODE**

IC41, 052 and surrounding circuits work 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.
RELOADING FACTORY-PATTERNS

1. The TR-909 contains factory-rhythm patterns in BANK I, TRACK 1 under as-delivered condition. When the need arises to reload the patterns, follow the procedure below.

Note: Confirm that the resident voice data (especially user’s program) allows replacing.

While holding down TRACK 1 and PATTERN 1, turn the unit ON.

2. RE-LOADING BANKS I, II, TRACK 4

(See “Change Information” No. 1 in the subsequent paragraph to decide whether the following steps are necessary.)

1) While depressing SHIFT, tap TRACK 4.
2) Tap ENTER.
3) Depress TRACK 4.
4) While depressing SHIFT, tap BANK II.
5) While depressing SHIFT, tap TRACK 4.
6) Tap ENTER.

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 TRUCKs is selected for writing, all rhythm patterns may be lost or re-written. 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 falls behind if STOP is pressed, then CONTINUE is pressed (this won’t happen when MIDI clocks are transferred between TR-909’s). Software revision 2 cures this problem and is incorporated in 2764-250NS labeled Ver. 2. To check if existing ROM is Ver. 2, turn the power ON while holding down TRACK 1 key, and MAIN key 2 (BASS DRUM) will blink, if version 2. ROMs of Ver. 2 are available from the factory to upgrade units on the market.

CHANGE INFORMATION

ROM IC609 SWITCH BOARD

GROUP SERIAL NUMBER ROM USED REMARKS
A 300100 2764-250NS
393899 (Revision B) without version number on the label
EPROM
Part Number 15179645
B 429200 2764-250NS
429200 (Revision 1) or
2764-250NS
both contain the same program
MASK ROM
Part Number 15179646

SERIAL NUMBER PART AFFECTED DESCRIPTION
370680 Battery Compartment Lid From rubber made to metal made. For positive engagement. As a replacement, metal one should be used (supplied).
381500 TAPESYNC Filter & Amp VOICING BOARD C37. From 10µF to 100µF.
R306. From 4.7k to 4.7k.
R312. From 470Ω to 4.7MΩ.
For optimizing waveforms coming from tape in LOAD mode.
C378. From 0.33µF to 0.33µF.
For expanding the TUNE range.
243000 BASE DRUM VOICING BOARD D701. From R65.6µΩ to R65.6µΩ.
TR-909 would be forced to stop or its LED would start blinking when high power electrical instrument(s) is powered ON or OFF under poor AC supply condition (about less 10% nominal volt-
age). This simple diodes change will ensure reliable operation even at 20% below the nominal voltage.
415300 RIM SHOT VOICING BOARD Resistor R417. From 12kΩ to 3.3kΩ.
H I HAT VOICING BOARD For giving the vase more realistic sound.
VOICING BOARD Capacitor C134. From 10µF to 0.01µF.
For pulling off unnecessary lower fre-
quencies.
RIM SHOT(TRIG OUT) VOICING BOARD From jumper wire to R490.1kΩ,
( TAPESYNC ) R390. From 10kΩ to 1MΩ.
R932. From 2kΩ to 1MΩ.
Add capacitor C909. 0.01µF between ter-
minal No. 30 and the ground (TRIG OUT jack - Hot-Ground). For preventing RIM SHOT signal from being induced onto TAPER SYNC signal which otherwise may cause glitches.
420700 TOM Notes VOICING BOARD Capacitor C34. From 0.002µF to 0.047µF.
TOM SHOT VOICING BOARD R134. 47kΩ to 10kΩ.
This change will emphasize attack of TOM.

FAULT ISOLATION GUIDE

<table>
<thead>
<tr>
<th>Symptom</th>
<th>CAUSE &amp; ACTION TO BE TAKEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Unit fails to reproduce programmed rhythm sequence. Some memories have been replaced by other data.</td>
<td>PROM IC609 Ver. 1.0 has new program which should solve the problem of unreliability. Refer to &quot;CHANGE INFORMATION.&quot; Check DC rails. Check IC702 on the Power Supply Board. Check RA400 and RA902 on Switch Board.</td>
</tr>
<tr>
<td>The unit stops running upon power ON/OFF or variant of other electrical devices.</td>
<td>RESET circuitry is too sensitive to AC power drop. Check transistor D701 on Power Supply Board. If it is R65.6µΩ, replace with R65.6µΩ. Refer to &quot;CHANGE INFORMATION.&quot;</td>
</tr>
<tr>
<td>Data transfer between Internal Memory and Memory Cart (SAVE/LOAD) fails.</td>
<td>There should be an additional instruction to &quot;3. Memory Cartridge&quot; of the Owner’s Manual (p.33). ENTER KEY must be UN/LIT (Internal Memory Mode) during SAVE or LOAD from Memory Cartridge. That is, &quot;Press ENTER when it is lit, then hold SHIFT.&quot;</td>
</tr>
<tr>
<td>Noise is high in OUTPUT</td>
<td>For the units prior to Serial Number 415100. Add capacitor 0.01µF across jack circuits on Multi Jack Board (MULTI JACK BOARD Diagram denotes these capacitors as CS00-C502).</td>
</tr>
</tbody>
</table>

7
Observed at MULTI OUT jack with all knobs set to center.

**BD**
- 200mV/div
- 5mV/div
- with accent
- w/o accent

**SD**
- 0.5V/div
- 2mV/div
- with accent
- w/o accent

**LT**
- 0.5V/div
- with accent
- w/o accent
- 50mV/div
- LT with accent
- MT, HT with accent
- R417=33K
- R417=12K

**HAND CLAP**
- 500mV/div
- 10mV/div

**CRASH**
- 500mV/div
- 0.1mV/div

**HI-HAT**
- CLOSED
- 500mV/div
- 20mV/div
- w/o accent

**RISE**
- 500mV/div
- 0.1mV/div

**OPEN**
- 500mV/div
- 0.1mV/div

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**SWITCH BOARD**

73133080
(pcb 2291084701 2/2)

View from foil side
MIDI NOTES

The TR-909 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>OMNI ON</td>
<td>Voice messages are received from all Voice Channels and assigned to voices polyphonically.</td>
</tr>
<tr>
<td>POLY</td>
<td></td>
</tr>
<tr>
<td>OMNI ON</td>
<td>Voice messages are received from all Voice Channels, and can only one voice, polyphonically.</td>
</tr>
<tr>
<td>MONO</td>
<td></td>
</tr>
<tr>
<td>OMNI OFF</td>
<td>Voice messages are received in Voice Channel N only, and are assigned to voices polyphonically.</td>
</tr>
<tr>
<td>POLY</td>
<td></td>
</tr>
<tr>
<td>OMNI OFF</td>
<td>Voice messages are received in Voice Channels N thru N+M, 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>MONO</td>
<td></td>
</tr>
</tbody>
</table>

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-909 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-909.
- Do not put TR-909 into MIDI-loop circuit. Feedback may lead to malfunction.

MIDI KEY ASSIGNMENT

<table>
<thead>
<tr>
<th>Number</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>Bass Drum</td>
</tr>
<tr>
<td>37</td>
<td>Rim Shot</td>
</tr>
<tr>
<td>38</td>
<td>Snare Drum</td>
</tr>
<tr>
<td>39</td>
<td>Hand Clap</td>
</tr>
<tr>
<td>41</td>
<td>Low Tom</td>
</tr>
<tr>
<td>42</td>
<td>Closed Hi-Hat</td>
</tr>
<tr>
<td>43</td>
<td>Mid Tom</td>
</tr>
<tr>
<td>44</td>
<td>Open Hi-Hat</td>
</tr>
<tr>
<td>45</td>
<td>Crash Cymbal</td>
</tr>
<tr>
<td>46</td>
<td>Ride Cymbal</td>
</tr>
</tbody>
</table>

MODES AND CHANNELS IN TR-909 MIDI CONNECTIONS

As can be seen from the diagram, TR-909 MIDI OUT does dual duties; it also serves as a kind of MIDI THRU. Using this route, additional data can be sent in different channels, and yet can be mixed with TR-909 output data in one channel at the TR-909 MIDI OUT. Thus, an external voice will be controlled both through TR-909 and by the data that TR-909 cannot provide. MIDI messages common to internal and external voices are coordinated by TR-909.

To prevent the data already applied to TR-909 from being re-fed to the subsequent unit, receiving and transmitting channels are set to different channels at the factory.

MODE 1...OMNI ON, POLY

With this connection, slave unit can recognize voice messages on whichever channel the master unit transmits. There is no difference between MODES 1 and 2 in TR-909 function since it contains only one voice.

MODE 3...OMNI OFF, POLY

In a system as shown, each slave should be in OMNI OFF mode with its basic channel match the channel number assigned by the master respectively. Once set, it will re-respond to voice messages sent over its current basic channel only (see "GENERAL PRECAUTIONS" on page 16). As for TR-909, it must be set to MODE 3. The table below will help set TR-909 to correct mode and channel.

NOTE: Roland products with preliminary MIDI turn to OMNI OFF upon receiving POLY ON.
## 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   | 0kkk   | vvvv  | Note On:  
| mmnn   | kkkk   | vvvv  | kkkkkk = 36 - 51 |
|        |        |       | vvvvvvv = 64 - 96 |
|        |        |       | (accent min-max) |
|        |        |       | Note off:  
|        |        |       | vvvvvvv = 0 |
| 1011   | 0ccc   | vvvv  | Mode Message:  
| mmnn   | cccc   | vvvv  | ccccccc = 124: Omni mode off,  
|        |        |       | 127: Poly mode on;  
|        |        |       | vvvvvvv = 0 |
| 1111   | 0xxx   | yyyy  | Song Position Pointer:  
| 0010   | xxxx   | yyyy  | xxxxxxx: Least significant  
|        | xxxx   | yyyy  | yyyyyyyy: Most significant |
| 1111   | 0ssss  | ssss  | Song Select:  
| 0011   | ssss   | ssss  | ssssss: Track 1  
| 1111   | 1000   | 0     | Timing Clock [5]  
| 1111   | 1010   | 0     | Start  
| 1111   | 1011   | 0     | Continue  
| 1111   | 1100   | 0     | Stop  

### RECOGNIZED RECEIVE DATA

<table>
<thead>
<tr>
<th>Status</th>
<th>Second</th>
<th>Third</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1001   | 0kkk   | vvvv  | Note On:  
| mmnn   | kkkk   | vvvv  | kkkkkk = 35 - 51 [*7]  
|        |        |       | vvvvvvv = 1 - 127 |
| 1011   | 0ccc   | vvvv  | Mode Message:  
| mmnn   | cccc   | vvvv  | ccccccc = 124: Omni mode off,  
|        |        |       | 125: Omni mode on;  
|        |        |       | vvvvvvv = 0 |
| 1111   | 0xxx   | yyyy  | Song Position Pointer:  
| 0010   | xxxx   | yyyy  | xxxxxxx: Least significant  
|        | xxxx   | yyyy  | yyyyyyyy: Most significant |
| 1111   | 0ssss  | ssss  | Song Select:  
| 0011   | ssss   | ssss  | ssssss: Track 1  
| 1111   | 1000   | 0     | Timing Clock [5]  
| 1111   | 1010   | 0     | Start  
| 1111   | 1011   | 0     | Continue  
| 1111   | 1100   | 0     | Stop  
| 1111   | 1111   | 0     | System Reset  

1. On power-up "nnnn" is set to 1010 (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.)
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 sync'd to the positive going edge of DIN clock pulses from DIN jack (MIDI and Internal TEMPO clocks are ignored).
6. The TR-909 always powers-up with channel set to "10"(1001) and 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

<table>
<thead>
<tr>
<th>kkkkkk</th>
<th>mmnn</th>
<th>vvvv</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>37</td>
<td>38</td>
<td>Bass Drum</td>
</tr>
<tr>
<td>36</td>
<td>38</td>
<td>40</td>
<td>Snare Drum</td>
</tr>
<tr>
<td>39</td>
<td>43</td>
<td>44</td>
<td>Hi-Hat</td>
</tr>
<tr>
<td>44</td>
<td>45</td>
<td>47</td>
<td>Mid Tom</td>
</tr>
<tr>
<td>46</td>
<td>48</td>
<td>50</td>
<td>Open Hi-Hat</td>
</tr>
<tr>
<td>48</td>
<td>49</td>
<td>51</td>
<td>Crash Cymbal</td>
</tr>
</tbody>
</table>

**NOTE:** When sounding TR-909'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 "mmmm" through "mmmm+H-1".
9. Recognized only when in TRACK PLAY and STOP modes.
10. Effective only when the TR-909 is in STOP during PLAY, TRACK WRITE PAT., TEMPT, or PATTERN WRITE. Upon receiving, the TR-909 enters TRACK PLAY mode.
11. Recognized only when TEMPO MODE is set to MIDI.

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. 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 by 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>EX0 (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 nnnn</td>
<td>Block # (nnn: 0000 – 1111)</td>
</tr>
<tr>
<td>0000 xxxx</td>
<td>Rhythm data (yyyyyyyy)</td>
</tr>
<tr>
<td>0000 yyyy</td>
<td></td>
</tr>
<tr>
<td>0000 . .</td>
<td></td>
</tr>
<tr>
<td>Gss ssss</td>
<td>Check sum (for the preceding 512 data bytes)</td>
</tr>
<tr>
<td>1111 0111</td>
<td>EX0</td>
</tr>
<tr>
<td>1111 0000</td>
<td>Exclusive status</td>
</tr>
<tr>
<td>0100 0001</td>
<td>Roland ID ≠</td>
</tr>
<tr>
<td>0101 0100</td>
<td>Operation Code (or 0101 0101 = no data follow)</td>
</tr>
<tr>
<td>1111 0111</td>
<td>EX0</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 0011</td>
<td>Operation Code (or 0111 0001 = Error)</td>
</tr>
<tr>
<td>1111 0111</td>
<td>EX0</td>
</tr>
</tbody>
</table>

(4) Repeat (2) and (3) increasing Block # until nnn = 1111. (A bank of rhythm data is divided into 16 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 0001</td>
<td>Operation Code</td>
</tr>
<tr>
<td>1111 0111</td>
<td>EX0 (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 (or 0111 0000 = abort)</td>
</tr>
<tr>
<td>1111 0111</td>
<td>EX0 (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 nnnn</td>
<td>Block # (nnn: 0000 – 1111)</td>
</tr>
<tr>
<td>0000 xxxx</td>
<td>Rhythm data (yyyyyyyy)</td>
</tr>
<tr>
<td>0000 . .</td>
<td></td>
</tr>
<tr>
<td>Gss ssss</td>
<td>Check sum (for the preceding 512 data bytes)</td>
</tr>
<tr>
<td>1111 0111</td>
<td>EX0</td>
</tr>
<tr>
<td>1111 0000</td>
<td>Exclusive status</td>
</tr>
<tr>
<td>0100 0001</td>
<td>Roland ID ≠</td>
</tr>
<tr>
<td>0101 0100</td>
<td>Operation Code (or 0101 0101 = no data follow)</td>
</tr>
<tr>
<td>1111 0111</td>
<td>EX0</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>EX0</td>
</tr>
</tbody>
</table>

(5) Repeat (3) and (4) increasing Block # until nnn = 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 procedures 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 must Roland products complying 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 reset to OMNI OFF mode when it is to accommodate voice messages sent over the channel to which it 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>
<th>SLAVE(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>capable of producing OMNI OFF message for POLY, see NOTES!</td>
<td>incapable of turning to OMNI OFF mode by itself</td>
</tr>
<tr>
<td>1. on panel or other means at desired time</td>
<td></td>
</tr>
<tr>
<td>2. on power up</td>
<td></td>
</tr>
</tbody>
</table>

In the above combination:

1. Slave must be powered ON before the master is turned ON.
2. When the second slave connects to MIDI OUT of the first slave, it is the first to be turned ON.
3. 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.
PROBLEM

TR-909 will rarely miss-read a $F8 (MIDI Clock) just after Start data.

REASON

The interval between Start data and the first Clock of MPU-401 is so short (about 1 msec).

CHANGES

PROM on TR-909
Ver 1.0 \longrightarrow Ver 4.0

NOTE

When you meet above problem, please order us this PROM Ver 4.0 for we have this as Service Parts in our stock.