

Summary of Rand Actuators and Variants

by Jay Mendoza (revised January 2017)

This document will describe the different models and versions of actuators made by Rand Take-Off Products, and Rand Manufacturing. Later on (late 1969) Ace R/C also sold these products as they bought out Rand's line of Galloping Ghost actuators and servos.

To simplify things, we will begin by with some basic acronym terminology applicable to Rand actuators:

PPS stands for pulses per second and describes the rate at which these systems pulsed.

L is for low rate, typically 3-14 PPS.

R is for Rate, in PPS.

H is for high rate, typically 12-20 PPS.

RO is rudder only

REM is for rudder, elevator, and motor/throttle.

To apply this to Rand actuators, lets look at the LR-3 and decode it's model number:

LR= low rate

3= 3 function

Thus we have a 3-function low rate actuator. The HR-1 would be a high rate single function actuator.

Rand released the LR-3, HR-1, and HR-2 initially in 1965. The first versions featured brass gears on a phenolic base, and for all intents and purposes they were hand made in low volume. The HR series could also be used at low pulse rates as well as high pulse rates. Rand offered an optional lower tension centering spring for high rate to lower the current draw.

The LR-3 was a 3 function actuator which offered rudder, elevator and motor control, at low pulse rates.

The HR-1 was a single function actuator for high rate systems for elevator, or it could be used as a rudder only (RO) actuator in a low pulse rate system.

The HR-2 was a two-function actuator for rudder and throttle in high, or low rate systems.

The HR-1, and HR-2 could be used together in a high rate system with a pulse rate decoder to give independent interaction free control of rudder, and elevator, along with position-able throttle control.

The second generation of the Rand actuators were produced using injection molded plastic for virtually all the pieces including the gears, base and output arms. All motors used were of the Mitsumi type, and were designed to use a 2.4-volt power supply. The very first batch of these actuators had a white pinion idler gear, which was prone to breaking in a hard landing or crash, so it was changed to a black plastic which was presumably stronger. The bases of these actuators are black plastic with two small pins on the top rim of the base near the throttle arm. Purpose of these pins is to prevent the

ratchet spring ends of the throttle gear from jumping over the frame. Later, the top rim of the base was raised to provide the same function (without the pins).

An early version of the HR-1 had a shorter plastic base with the centering spring looped over to attach to the base. This was quickly replaced by the same base as used in the HR-2, and LR-3, presumably to simplify manufacturing, thus a later HR-1 can be converted to an HR-2, or LR-3 by adding additional parts.

Rand also produced some “OEM” versions of the LR-3, and HR-1 and HR-2 for Min-X Pulsmite systems. The LR-3 that came with the Min-X SH-1R receiver had a 3.6 volt motor to work with the on board switcher built into the receiver, thus the “R” designation of the Min-X SH-1R, which was specifically for the “OEM” version Rand LR-3. Additionally, Min-X had a high rate decoder to drive the HR-1, and HR-2, so these too were made to Min-X’s specifications.

Like Min-X, Hallco also used Rand Actuators exclusively in their 103 and 123 systems and Rand made OEM versions to their specifications, the main differences were spring tension and hash filtering.

The very first Rand servos, and later versions as well, all had some sort of noise filtering in the form of capacitors and chokes soldered to the motor of the actuator to reduce interference with the receiver operation due to the motors electrical noise, which was significant. The very first models with black bases and red dot Mitsumi 2.5 volts motors had only capacitors soldered directly to the motors. Afterwards, chokes were added and the free ends were run through two drilled holes in the oval shaped pocket surrounding the motor providing connection points for the wiring. Later on Rand simplified this filtering by soldering a small printed circuit board to the bottom of the motor with the filtering components soldered to the underside of the board. There were three iterations of this board. The first only used two capacitors while the two later versions had both caps and chokes. For black based models with 2.5 volt motors and no electronics, the wiring connections were made to the PC board instead of to protruding chokes leads.

Rand actuators with black bases and the filter boards came next. The two small motor gear spring retaining pins on the rim of the base were replaced for the higher rim. One other difference is some of these actuators say “Rand” on the bottom of the base, whereas others do no. The ones marked “Rand” were sold retail, the others were OEM as supplied to Hallco, and Min-X, for use with their systems.

By around late 1967 Rand’s engineer Herb Abrahms responded to many modelers building their own transistorized switchers for his actuators by having Ed Fisher design one specifically for the LR/HR series actuators. This then allowed the use of a single 3-cell 3.6-volt Ni-cad battery pack, and eliminated the need for an additional actuator battery and a relay in the receiver as well. This significantly simplified the system wiring, reduced weight, and improved reliable performance. Rand introduced this as the “GG Pak” which had a modified LR-3 complete with wiring harness, on/off switch, 600 MAH Ni-cads, and plugs. The actuator had a red base, which contained a pocket on the

underside to hold the small six-transistor switcher board and wiring. Additionally, it now used a 3.6-volt motor.

The “GG Pak” was a sensation, and so it was offered by all other OEMs for their Galloping Ghost systems; Ace, Controlaire, Bonitron, F&M, Logictrol (Digi-Ghost) all came with the GG-Pak, and later the optional high rate “Dual Pak”. This leads into the next Rand offering, the Dual Pak. The Dual Pak was as stated a dual actuator system complete with wiring harness, switch, plugs, rate decoder, transistorized switcher, and battery pack. It was designed for high rate only, and offered what was touted as “steady” or low dithering of the control surfaces. Put simply, it pulsed so quickly that the control surfaces effectively just quivered. Of course, your transmitter had to be a high pulse rate type, and many had a switch to select high pulse rate. In response to this, Controlaire, Ace and others offered retro fits to convert earlier Galloping Ghost transmitters to high pulse rate. Hallco called their version of this “Steady Ghost”.

The actuators supplied in Dual Packs also had the red bases with pockets for the electronics: the HR-1 had a rate decoder with switcher, and the HR-2 had the same switcher board as in the LR-3 GG-Pak actuator. A cable and connector from the HR-2 switcher board plugged into a mating cable on the HR-1 to supply power and signal to it. Both HR-1, and HR-2 actuators as supplied in the Dual Packs had 3.6 volt Mitsumi motors, and lighter tension centering springs.

After the GG-Pak and Dual Pak were introduced, all Rand actuators utilized the revised red plastic base that contained a pocket for the switcher (LR-3 and HR-2) or the decoder (HR-1). All red based versions came with electronics and had a 3.6 volt Mitsumi motor with a black dot on the bottom. At this point, the original small based HR-1 was discontinued.

Because Rand changed the mold for the new GG-Pak and Dual Pak bases, the individual black base actuators also used the same base configuration but without electronics. The individual actuators also used a 2.5 volt Mitsumi motor with a red dot. These were for use with older relay receivers, or with a separate decoder/driver like a “Lahti”, or with earlier switchers such as the “Dickerson See-Saw” that used a center tapped 4 cell battery to provide plus and minus 2.4 volts. Thus, the later black based Rands had a base pocket for electronics if the user desired to add them.

Last, but not least, Rand also offered their switcher, and decoder/switcher separately as replacements, and as retro fits for earlier actuators. Do-it-yourself kits were offered as well for the switcher, and decoder for the electronics minded hobbyists. A 1.8 ohm dropping resistor was included so they could be used with black base 2.4 volt red dot motors and the now standard 3.6 volt battery. The dropping resistor lowered the voltage to the motor to prevent excessive throw and overheating. These assembled and kit form upgrade packages were primarily designed to update older Rand actuators for use with a single 3.6 volt flight pack battery (one battery for both receiver and actuator). They also eliminated the need for the receiver relay. End result was lighter weight and better reliability.

Rand additionally offered a version of the LR-3 that was similar to the GG-Pak version without the switcher, but the base included the pocket for the switcher, and these can be identified by their black base. These were sold separately as replacements, and also re-packaged by Ace as part of a complete do it your self-kit. You could buy the completely assembled GG-Pak, or Dual Pak, or get them as kits. The black base with pocket distinguished these kit version actuators from ones sold exclusively in factory assembled Rand Paks and Dual Paks; for warranty reasons they were not the same. The decoder kit came with a lighter spring for high rate, and instructions on how to convert an LR-3 to work as a high rate HR-2, or HR-1.

The wiring on the Rand Paks (GG and Dual) was originally green, yellow, and blue. Blue was signal, yellow was Plus battery, and green was minus battery. On the battery, red was plus and white was minus. Later Rand Paks came with red, black, and white wires where red was plus, black was minus, and white was signal. The switchers and decoders, assembled or kit form, also came with red, black, and white wiring. On some of the Ace R/C produced Rand Paks, blue was substituted for white as the signal. This was especially used by the versions set up for sale with a GG system in order to match the colors used by the receivers.

Rand supplied Ace, Citizen-Ship, Controilaire, F&M, Bonitron, Hallco, and several other manufacturers with GG Paks and Dual Paks custom wired with colors to match these different receivers. Also, because some hobbyists liked to customize their wiring for the switcher and decoder kits, you will see quite a variation in the wiring colors.

A popular modification by hobbyists was to replace the Mitsumi motor with a Furuchi motor that was used by Controilaire for their "Ghost" actuators and sequential servos. It was done because the Furuchi was a lower current draw motor with good power. The other part of the mod was to use the lighter spring Rand offered for high pulse rate applications. This was needed because the Furuchi had slightly less torque than the Mitsumi.

Rand made several servo/actuator trays to mount the actuator in, they had two rubber grommets that cushioned and damped them. There was also a dual actuator side-by-side tray that was sold with the Dual Pak, and separately for mounting dual actuators. Along with these, Rand developed and sold their own line of snap links and clevises for making connections to threaded and solid wire pushrods that were specifically tailored to use with their actuators. Rand also made a line of control sticks for Cannon, Larson/RS, and Ace, The Ace RO Pulse Commander transmitter used a special version modified for rudder only.

In late 1969, Herb Abrahms sold the Rand line of Galloping Ghost actuators to Ace R/C, who was at the time the leading distributor of inexpensive single channel and pulse proportional systems and accessories. Afterwards, Ace removed all references to Rand as best they could. However some actuators sold by Ace still had the name Rand molded into the base. The same applies to the literature and packaging. Some of the original Rand

literature was stamped with Ace's address. Later when they needed to print more, Ace eliminated the Rand address and replaced it with their own. The little black cases with clear lids (jewelry cases) that the LR-3, HR-1, and HR-2 came in were sealed with a yellow tape labeled "Ace R/C" to signify they had taken over. The GG-Pak and Dual Pak cardboard inserts had the Rand name removed, but they were otherwise identical.

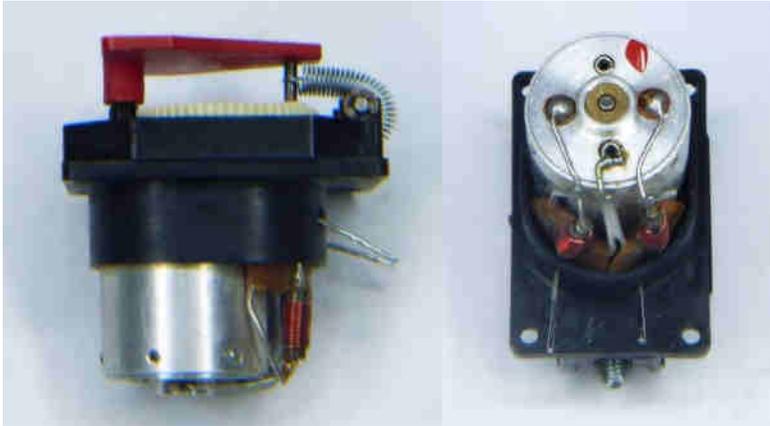
There is also a bit of overlap in Rand and Ace products. Ace acquired a lot of finished inventory from Rand with the purchase, including un-assembled actuator parts. These were used wherever possible to make assemblies and some of the Rand actuators built by Ace have parts from earlier versions. For example: we have seen them with the early filter board that had but two caps, and no chokes. But despite these assembly differences, Ace did not make any design changes and the Rand products remain unchanged.

Along with the Rand actuators, Ace R/C also acquired the production of the Rand Joystick assemblies and used them extensively in their Pulse Commander and GG Pulse Pak transmitters.

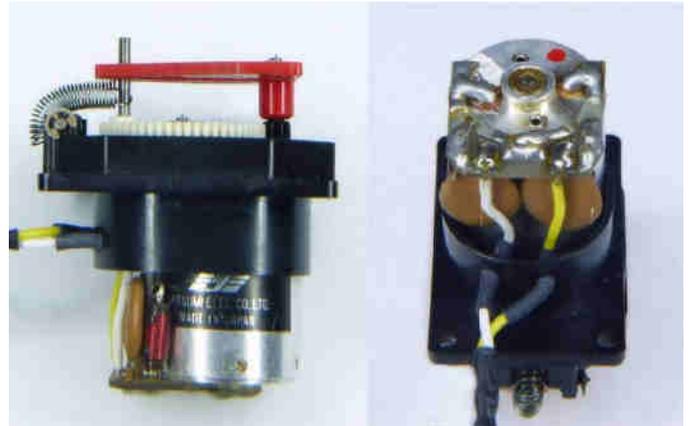
The advent of digital proportional, the introduction of silicon transistors, and the first commercially available integrated circuits changed the landscape of the model radio control so drastically that by the end of 1969 all manufacturers but one discontinued making Galloping Ghost systems. By late 1971 the last holdout, Ace R/C, had discontinued all Rand actuators and the Galloping Ghost versions of their venerable Pulse Commander series. The cost of digital proportional equipment had come down in price to the point where Galloping Ghost systems were no longer competitive in price, or features, thus ending this chapter in pulse proportional R/C. Ace continued to sell out the remainder of their Rand actuator stock for replacements and repair of existing systems, but no longer advertised them in the catalog or price sheet. Only their RO (rudder only) Pulse Commander system which used the Adams type magnetic actuators continued to be offered until they sold out in 1988.

RAND ACTUATOR PHOTOS

HR-1's



early HR-1



later HR-1 with 3rd generation
printed circuit filter

HR-2's



early HR-2 with white gear

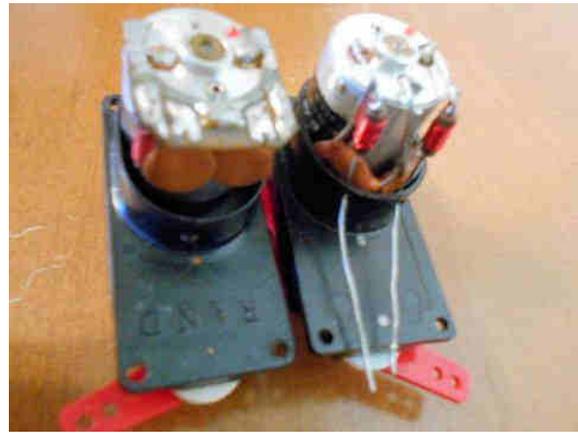


later HR-2 with "RAND" name on base and 3rd
generation printed circuit filter

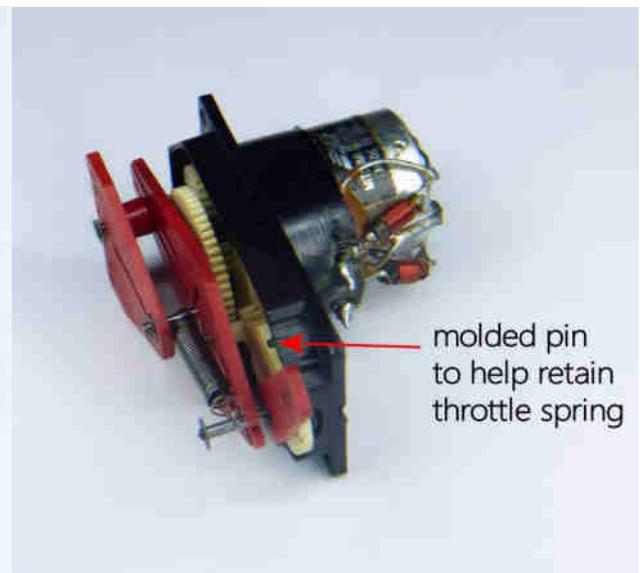
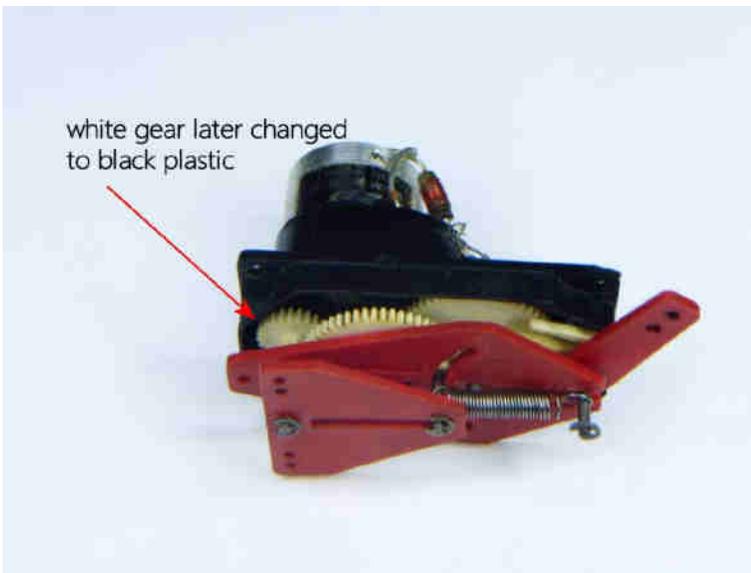
LR-3's



early LR-3



later (left) & early (right) LR-3's

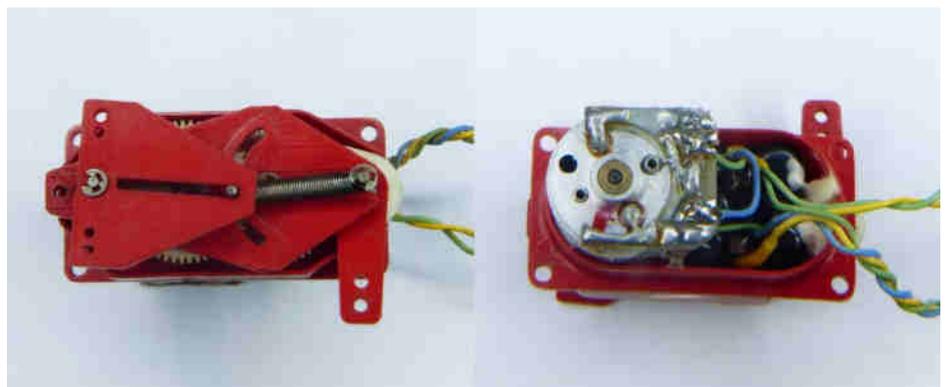


early LR-3 with white gear and retaining pins

GG PAK



GG PAK in the box

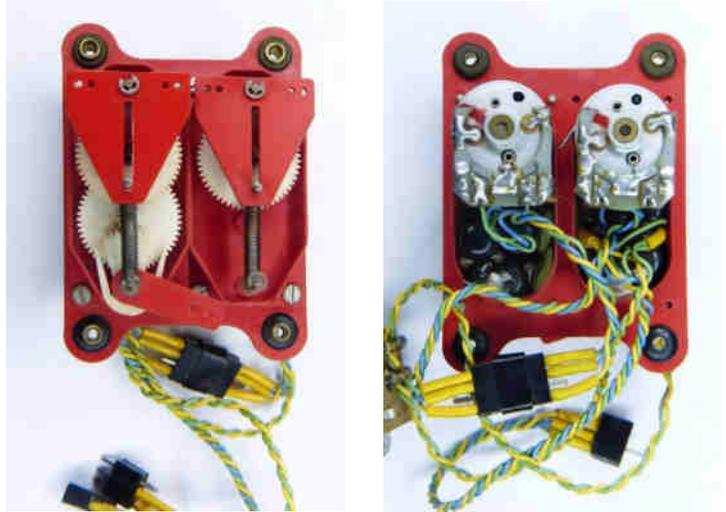


LR-3 as packaged in GG Pak -- black dot indicates 3.6 volt motor

DUAL-PAK



Dual-Pak in the box

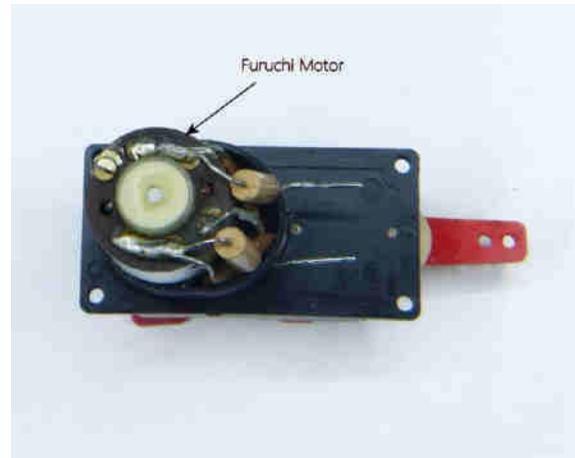


Dual-Pak mounted in Rand accessory tray

CHANGES



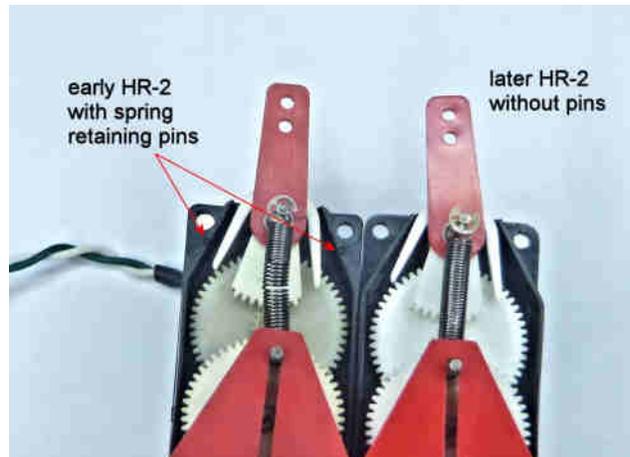
three generations of circuit board motor noise filters



Popular Modification - Mitsumi motor replaced with Furuchi motor



early and later black cases



early and later black cases

LABELS



GG PAK and DUAL PAK front labels



GG PAK and DUAL PAK end labels



early label



later label



LR-3 sticker



HR-2 sticker