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GERTSCH STANDARD RatioTrans*

GENERAL:

Gertsch Standard Ratio Transformers (RatioTrans* also known as Gertsch Boxes* and DecaTrans*) are unique in the field of precision A.C. voltage dividers. Their inherent characteristics of high input impedance, low effective series impedance, and very low phase shift are basic factors which are recognized as being necessary for a good A.C. voltage divider. Performance, in fact, approaches that of the ideal divider.

ACCURACIES:

For the division of A.C. voltages, RatioTrans* are far superior to resistive dividers. This is due to extremely low phase shift characteristics (typical .05 milliradians for normal operation) and the advantages of uniform "shunt switching, multiple winding" techniques, covered by U.S. Patent No. 2,832,036. Accuracies of 0.001%, terminal linearities of 0.001%, and infinite resolution is obtainable with some units.

ACCURACIES UNDER LOAD CONDITIONS:

While the RatioTran* is designed basically for use in an unloaded condition for maximum accuracy, because of design parameters, reasonable loads may be applied. The resulting accuracy is a function of this load. With reference to the equivalent circuit Fig. 1, assuming an ideal transformer, looking into the arm, we see impedance (L_s and R_s) in series with the arm, which is due to leakage inductance, wiring resistance, switch resistance, potentiometer resistance and other stray circuit parameters. From these series impedances, the effect of loading upon the transformer, an overall accuracy can be calculated. Typical values of R_s and L_s are 3 ohms and 75 μ h. In the assumption of the ideal transformer, the indicated unloaded accuracies apply at the arm of the assumed ideal transformer.

CONSTRUCTION:

The unique patented construction of Gertsch RatioTrans* provides "built in" performance factors which are most important when the units are used as an instrument, or incorporated into a system design. Some of these features are:

- (1) Ability to maintain extreme accuracy with time. The units are essentially ageless devices, thus reducing costs for periodic check and recalibration.
- (2) Ability to withstand environmental conditions. All units will operate properly over the temperature range of -15° to $+80^\circ\text{C}$, and are not appreciably affected by extremes of altitude and humidity. All units will withstand normal shock and vibration requirements, consistent with their design usage.
- (3) All units are adequately protected with fuses to prevent damage due to improper hook-up or excessive voltage or load applications.

BASIC TYPES:

RatioTrans* are available, as will be seen by a study of this catalog, in an almost unlimited variety of functional types and form factors. In the various standard "off-the-shelf" designs, ratios may be set by almost any method from the simplest manual in-line decade, to coaxial rotary set, to proportional shaft position, to remote binary selection. Many varieties of form factors, choice of switches, etc. are available within the various general types. Special RatioTrans* can be designed for incorporation into customer systems.

APPLICATIONS:

For use as a standard of ratio, the ratio arm of a bridge, A.C. potentiometer, for checking resolvers, servos, transformers, computers and so forth, the RatioTran* has no equal. **FOR MORE COMPLETE APPLICATIONS, REFER TO GERTSCH ENGINEERING BULLETINS ON RatioTrans* WHICH FORM SECTION NO. XI.**

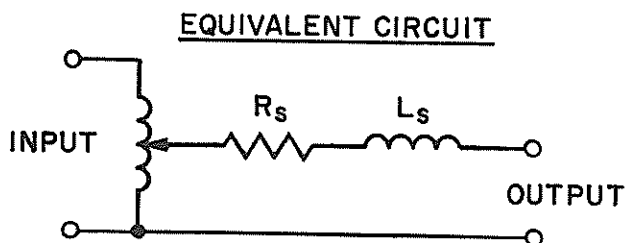


Figure 1

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SUMMARY OF RatioTran* MODELS

The various switch type models of Standard Ratio Transformers have been designed to cover specific applications. Functionally, all models are basically the same. The principal differences are in mechanical construction and such details as the type of switch, number of decades, degree of resolution, maximum input voltage

allowable, form factor and other details sometimes important to the user.

The following table has been prepared, segregating the units into three basic classifications, according to their electrical performance to aid the user in selecting the proper unit for his particular application.

LOW VOLTAGE, HIGH FREQUENCY GROUP

Maximum input voltage $0.35 \times F$ (350 volts max.) F =frequency in cps.

MODEL NO.	SWITCH TYPE	NO. OF DECADES	SIGNIFICANT FIGURES OF RESOLUTION	TYPE OF POTENTIOMETER	REMARKS
RT-1	Push Button	3	6	10 turn	Three decade unit with 10 turn potentiometer. Utilizes push button switches. For low voltage input over wide frequency range. Numbers engraved on push buttons.
RT-2	Push Button	5	5	None	Five decade unit. No potentiometer. For low voltage, wide frequency range use. Numbers engraved on push buttons.
RT-5	Rotary	5	6	1 turn	Five decade unit with one turn potentiometer. Extremely good resolution. Numbers available through window in panel. Most economical and proper instrument where high resolution, high accuracy and wide frequency range is desired.
RT-6	Rotary (Heavy Duty)	5	5	None	Five decade unit. No potentiometer. For low voltage, wide frequency use. Contains heavy duty, rotary switches with numbers on front panel.
RT-7	Rotary (Heavy Duty)	5	6	1 turn	Five decades and one turn potentiometer. Extremely good resolution. For low voltage, wide frequency range use. Numbers on front panel. Heavy duty rotary switches.
RT-10R	Rotary	3	6	10 turn	3½" High Rack Panel. For low voltage, wide frequency range. Low price. Terminals front and rear.
RT-11R	Rotary (Heavy Duty)	5	6	1 turn	3½" High Rack Panel. Terminals front and rear.
RT-12R	Rotary (Heavy Duty)	5	6	1 turn	Militarized version of RT-11R. Glass epon switch insulation. Coils potted in epoxy resin.
RT-13R	Rotary (Heavy Duty)	5	5	None	3½" High Rack Panel. Terminals front and rear.
CRT-1 CRT-4	Coaxial	3	6	10 turn	Three decades with a 10 turn pot. Uses coaxial switches to conserve panel mounting space. For low voltage, high frequency use. Recommended where panel space and weight must be kept to a minimum. Servo mount.
CRT-2-3	Coaxial	3	5	1 turn	Same as CRT-1 except has 1 turn pot.
RRT-1 (302)	Shaft Driven	3	5	Interpolating	A 1000 turn sealed shaft driven unit designed particularly for positioning and calibration applications.
RRT-2 (303)	Shaft Driven	2	4	Interpolating	Same as RRT-1 except 100 turns.
SRT-1 (400)	Remote Sequential Stepping Relays	5	5	None	Uses 24V DC gold contact decade stepping relay switches for remote operation. Readout contacts provided.
BRT-1 (222)	18 bit binary remote relay operated	18 bit 6 octals	$\frac{1}{2^{18}}$	None	18 bit unit arranged in 6 octals. Gold contact relays designed to operate from IBM card or punched tape as a digital to analog converter. 24 V DC.
BRT-2 (309)	Binary to Decimal conversion unit. Remote relay control	3	3	None	Converts binary code to decimal, 3 decade. Contains phase inversion relay and readout contacts. 24 V DC.

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HIGH VOLTAGE, LOW FREQUENCY GROUP

Maximum input voltage $2.5 \times F$ (350 volts max.) F =frequency in cps. Input inductance 500 henries (approx.)

MODEL NO.	SWITCH TYPE	NO. OF DECADES	SIGNIFICANT FIGURES OF RESOLUTION	TYPE OF POTENTIOMETER	REMARKS
RT3	Push Button	5	5	None	Five decade unit. No potentiometer. For high voltage, low frequency use. Numbers engraved on push-buttons.
RT4	Rotary	5	6	1 turn	Same as RT-5 except for high voltage, low frequency use.
RT8	Rotary (Heavy Duty)	5	5	None	Five decades, no potentiometer. For high voltage, low frequency use. Heavy duty rotary switches with numbers on front panel.
RT9	Rotary (Heavy Duty)	5	6	1 turn	Five decade unit, one turn potentiometer. Heavy duty rotary switches. Numbers on front panel. For high voltage, low frequency use.

VERY HIGH VOLTAGE, LOW FREQUENCY GROUP

Maximum input voltage $2.5 \times F$ (1000 V. max. at 400 cps) Input inductance 500 henries (approx.)

MODEL NO.	SWITCH TYPE	NO. OF DECADES	SIGNIFICANT FIGURES OF RESOLUTION	TYPE OF POTENTIOMETER	REMARKS
RT-14 (241)	Rotary (Heavy Duty)	5	5	None	Mechanically same as RT8, 5 decade.
RT-15 (312)	Rotary (Heavy Duty)	5	6	1 turn	Mechanically same as RT9, 5 decade with one turn pot.

The following table classifies the RatioTrans* according to their mechanical characteristics, i.e., type switch, form factors, etc.

PUSH BUTTON	ROTARY SWITCH	SHAFT DRIVEN	COAXIAL	STEPPING DECADE	BINARY	SPECIAL
RT-1, 1R RT-2, 2R RT-3, 3R	<u>Light Duty</u> RT-4, 4R RT-5, 5R RT-10R	RRT-1 (302) RRT-2 (303)	CRT-1 CRT-2 CRT-3 CRT-4	SRT-1 (400)	BRT-1 (222) BRT-2 (309)	NOTE: See Section IX for special units available.
	<u>Heavy Duty</u> RT-6, 6R RT-7, 7R RT-8, 8R RT-9, 9R RT-11R RT-12R RT-13R RT-14, 14R RT-15, 15R					

HEAVY DUTY SWITCHES

It should be noted that a number of RatioTran* models incorporate "HEAVY DUTY" switches. These are the multi-leaf solid silver instrument type switches insuring smooth action, long life, and extremely low contact resistance. Of most importance, how-

ever, extra intermediate position contacts and transient suppression resistors are provided. This feature is of great importance when using the RatioTran* with a sensitive null detector when operating near null.

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