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* IC3655A118 (LodTrak), DS305MLTA (LodTrak II) and DS3845LT3 (LodTrak III) multifunction modules have all been replaced by DS3820LT4 (LodTrak IV). See page 4-2

**PROTECTIVE RELAYS,
SELSYNS**

Type 3S9890

WHERE TO USE

Selsyns are electro-mechanical devices used for the convenient and accurate transmission of angular data between two or more remote points. This transmission is accomplished electrically without any mechanical connection between the two units. The data may be furnished in terms of precise mechanical position or as an electrical signal.

Selsyns may be used to operate equipment requiring mechanical inputs such as dial indicators, valves, dampers, and literally hundreds of other applications in manufacturing and processing plants, municipal utilities, and steel mills. While most applications are for measurement and position indication, the increased emphasis on automation has resulted in selsyns being specified for control as well as indication.

OPERATION

Most selsyn systems consist only of two selsyns. The master unit, called a transmitter, is operated at the sending point as a generator and is mechanically coupled to the data source transmitting the position change to a remote unit. The second unit, called a receiver, operating as a motor responds to this change. The two units are electrically and physically identical except the receiver has an internal damper which has a braking effect on the oscillation which may develop as a result of overshoot.

When the primary excitation circuit is closed, an alternating-current voltage is impressed on the primary of both the transmitter and the receiver. Since the receiver rotor is free to turn, it assumes a position similar to that of the transmitter rotor. As the transmitter is turned (either manually or mechanically), the receiver rotor follows at the same speed and in the same direction. This self-synchronous action is created because the single-phase current in the primary induces voltages in the three legs of each secondary. The three voltages are not equal in magnitude and vary with the position of the rotor. When the two rotors are in exactly corresponding positions, the voltages induced in the transmitter secondary are equal and opposite to those induced in the receiver secondary, that is, they are balanced; therefore, no current flows in the secondary windings and no torque is developed.

If, however, the transmitter rotor is moved from the original position, the induced voltages are no longer equal and opposite and current flows in the secondary windings. This current flow sets up a torque which tends to return the rotors to the synchronous position. This position corresponds to the new position of the transmitter. Thus if the transmitter rotor is moved either mechanically (by gears for example) or manually by an operator (for a signaling or control operation), the receiver immediately assumes a new corresponding position.

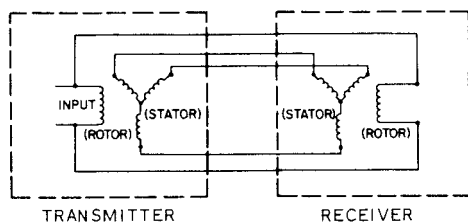


Fig. 13. Schematic of selsyn transmitter-receiver torque transmission system

APPLICATION

Industrial selsyns are supplied in basic accuracy ratings of ± 1 and ± 5 degrees. This is static accuracy and refers to the angle of deviation between a transmitter and receiver required to transmit motion at no load. Accuracy is composed of two elements, electrical and mechanical error. Electrical error is inherent in the windings and construction of the rotors and stators of each machine. Mechanical error is inherent in the bearings and type of lubricant. Selsyns of one degree accuracy have an electrical error of $\frac{1}{2}$ degree and a mechanical error of $\frac{1}{2}$ degree. Selsyns of five-degree accuracy have an electrical error of 1 degree and a mechanical error 2-3 degrees. The above data is for models rated 200 rpm which contain bearings lubricated with a light coating of instrument oil.

Similar units except with grease-packed bearings, rated 1200 rpm, may have a static accuracy of ± 5 or ± 10 degrees. In normal ambient, the grease friction will add approximately 1-2 degree mechanical error. In all "rugged" applications, such as in steel mills, or where selsyn motion is continuous, it is recommended that grease bearing units be supplied regardless of speed in order to achieve long bearing life.

In order to transmit motion from the transmitter to the receiver, some angle of deviation between the two is required to develop whatever torque is required to move the receiver load. Maximum permissible continuous torque occurs at 20-30 degree displacement and should not be confused with static accuracy ratings.

Selsyns are seldom used to transmit information further than several hundred feet. However, greater distances can be accommodated by compensating for the errors introduced by the connecting lines. Resistance in interconnecting lines causes attenuation of torque and, depending on the size of the units involved, should be held to values ranging from 0.2 to 10 ohms per line. Excessive wire sizes can often be eliminated by using 230-volt units.

Selsyn primaries in a given system must always be excited from the same phase of a common power source.

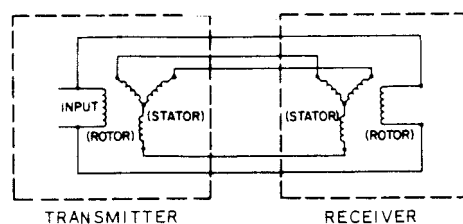


Fig. 14. Schematic of selsyn torque transmission system in which two receivers are operated by a transmitter of the proper frame size

DIFFERENTIALS

The differential transmitter selsyn rotor is mechanically positioned. It modifies electrical angular information received from a transmitter selsyn and retransmits it to a receiver selsyn or a control transformer as electrical information corresponding to the sum or difference of electrical input angle and its rotor position angle. In servo control systems, the stator primary is excited by the stator voltages of a transmitter and the rotor leads are wired to those of another selsyn stator.

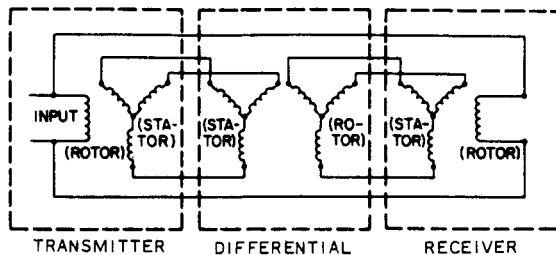


Fig. 15. Schematic of typical selsyn differential system for torque transmission

A torque differential transmitter is constructed primarily for operation with torque receivers, control differential transmitters, or control transformers.

A differential receiver is free to turn in order to assume a position with respect to the stator in accordance with the sum or difference of the electrical angular information received. This unit is primarily constructed for operation with two selsyn torque transmitters.

CONTROL TRANSFORMER

The control transformer consists of a three-phase stator and a single-winding rotor inductively coupled. The electrical output of the rotor is dependent upon both the position of the rotor and the magnitude of electrical input to the stator from another selsyn. There are several important differences between the control transformer unit and other selsyn units. The rotor is never connected to an ac supply; therefore, it never induces a voltage in the stator coils. As a result, the stator current is determined by the impedance of its windings (which is high) and is not affected appreciably by the rotor's position.

Also, there is no appreciable induced current in the rotor, and the rotor does not tend to turn to any particular position when voltages are applied to the stator. The shaft of this unit is mechanically driven.

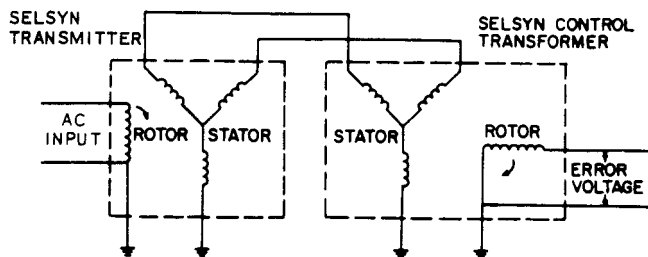


Fig. 16. Schematic of selsyn transmitter and control transformer

SELSYN INDICATORS

When a selsyn system is used to indicate a motion taking place at a remote location, selsyn receivers can be factory assembled in a variety of complete packages. The output shaft is coupled to a pointer for indication on an instrument-type dial or to a digital readout device.

For indication, ten standard indicator dial faces are available utilizing the GE AB-18 and AB-16 shadow-proof galvanometer-type instruments for semi-flush panel mounting.

Permanent dials are moisture resistant with black marks etched on photosensitive aluminum. Blank dials for calibration after installation may also be furnished. These have white paper mounted on an aluminum plate.

DIAL MARKING

Indicators are available with the standard increment calibration markings shown in Figs. 31, page 4-12. Customer may remove portions of dial scale and/or assign desired numbers and description prior to installation.

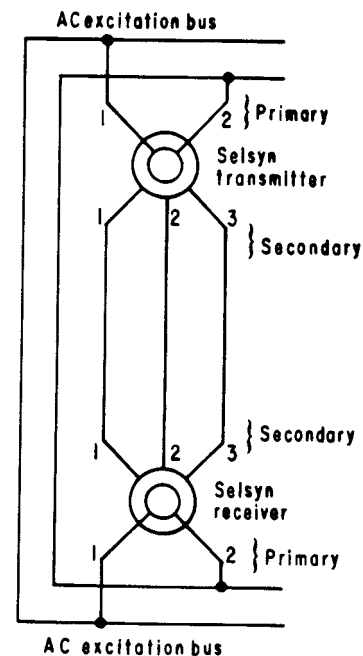


Fig. 17. Connection diagram showing interconnected stator windings and rotor windings connected to source of excitation

TABLE 1. Selsyn Selection

Cat. No.	Function	Max. Safe Continuous Torque in Oz-In	Static Accuracy In Degrees	WK ² (Oz-IN ²)	Volt-amperes Required	Maximum Operating Speed
PRIMARY - 115 VOLTS, 5%; SECONDARY 57.5 VOLTS: 60 HERTZ: SINGLE-PHASE						
2JD123A1†	Transmitter or Receiver	2	5	2.136	55	200
2JD123A10†	Transmitter or Receiver	2	10	2.136	55	1200
2J55VB1†	Transmitter	3.2	1	2.72	40	200
2JD55VB1†	Receiver	3.2	1	2.72	40	200
2J65FB1†	Transmitter	8	1	9.92	55	200
2JD65FB1†-Obsolete	Obsolete	8	1	9.92	55	200
2J65HB1†-Obsolete	Obsolete	8	1	9.92	150	200
2JD57C2†-Obsolete	Obsolete	8	5			
2JDA66PA5†	Transmitter or Receiver	12	5	9.94	100	200
2JDA66PA10†	Transmitter or Receiver	12	10	9.94	100	1200
2JA33BB1†	Transmitter or Receiver	50	5	27.3	165	1200
5MJ35CB1†-Obsolete	Obsolete	50	5			
2JA39BB2†-Obsolete	Obsolete	108	5	59.2	275	1200
2J5KA1†	Control Transformer*	...	1	1200
PRIMARY - 115 VOLTS, 5%; SECONDARY 48 VOLTS: 50 HERTZ: SINGLE-PHASE						
2JD123A7†	Transmitter or Receiver	2	5	2.136	55	200
2JD123A27†-Obsolete	Obsolete	2	10	2.136	55	1200
2J55VB3†	Transmitter	2.6	1	2.72	40	200
2JD55VB3†-Obsolete	Obsolete	2.6	1	2.72	40	200
2J65FB10†-Obsolete	Obsolete	6.5	5	9.92	55	200
2JD65FB10†-Obsolete	Obsolete	6.5	5	9.92	55	200
2JDA66PA30†	Transmitter or Receiver	10	10	9.92	55	1200
2JA33BB27†	Transmitter or Receiver	42	5	27.3	55	1200
5MJ35CB7†	Differential	42	5			
2JA39BB4†	Transmitter or Receiver	90	5	59.2	275	1200

† Suffix does not affect price. Example 2JD123A1A.

* Primary 90 Volts

TABLE 2. Vertical Mounting

When vertical mounting is required, mount pulley end of selsyn up or down as indicated below for minimum noise.

Frame	Mount with Pulley End	Frame	Mount with Pulley End
33	Down	65	Up or Down
35	Down	66	Up
39	Down	123	Up
55	Up or Down	55, 57, 65	Up or Down
57	Up or Down		

TABLE 3. Multiple Operation

Transmitter Frame	No. of Selsyns in Parallel	Transmitter Frame	No. of Selsyns in Parallel
55	1 Frame 55	66	5 Frame 123
65	1 Frame 65	33	1 Frame 33
65	2 Frame 55	33	3 Frame 66
123	1 Frame 123	33	16 Frame 123
66	1 Frame 66	39	2 Frame 33
		39	1 Frame 39

TABLE 4. Selsyn Indicators

Cat. No. 3S9890 *	Dial Type	Approximate Accuracy in Degrees †	Receiver Used	Indicator Parts Used	Use With Transmitter
SINGLE-POINTER NONGEARED INDICATORS					
AB100A1	4-inch dia., 1-pointer (Fig. 28)	1	2JD55VB1	AB18	2J55VB1
AA100A1	4-inch dia., 1-pointer (Fig. 28)	5	2JD123A1	AB18	2JD123A1
BB100A1	8-inch dia., 1-pointer (Fig. 25)	1	2JD55VB1	AB16	2J55VB1
BA100A1	8-inch dia., 1-pointer (Fig. 25)	5	2JD123A1	AB16	2JD123A1
AH100A1	4-inch dia., 1-pointer (Fig. 28)	5	2JDA66PA5	AB18	2JDA66PA5

*Suffix A1 designates a blank dial. Custom numbered dials no longer available.

†Accuracy is the number of degrees the transmitter must rotate before the receiver begins to follow when connected electrically in a system.

‡Standard dial faces available.

ORDERING**Transmitter**

- Based on application requirements, such as accuracy, torque, maximum speed, and size of dial, select the appropriate units from TABLE 1.
- If indicator also being ordered, select per transmitter used column in TABLE 4.
- Order by cat. number. (Example: 2J55VB1)

Indicator

- Order by 3S9890 and select form based on application requirements and dial face. All forms listed have blank dial face (white paper on aluminum) suitable for customer added markings.

Type 3S9890

TORQUE

It will be noted from the curves below that the percentage of normal synchronous torque available at the receiving unit is a

function of the interconnecting secondary leads. These curves are for 115-volt, 60-hertz selsyns.

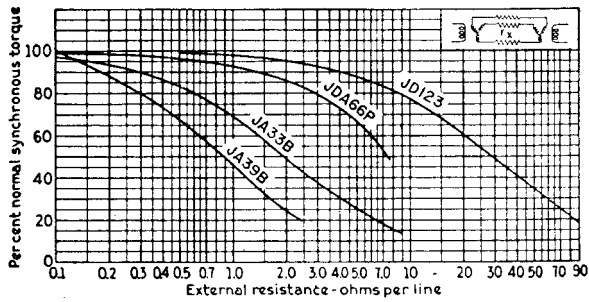


Fig. 18. General-purpose selsyns

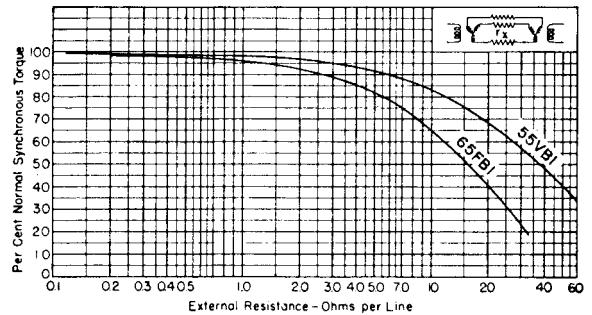


Fig. 19. High-accuracy selsyns

DIMENSIONS

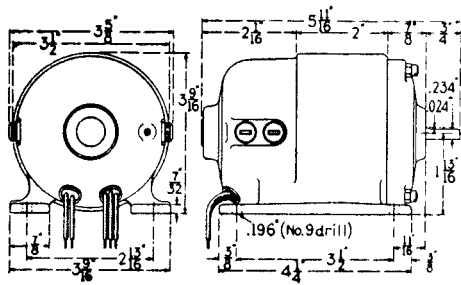


Fig. 20. Type 2JD123A

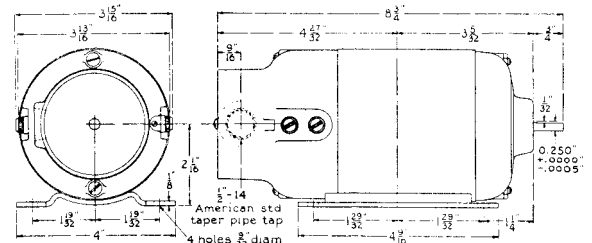


Fig. 21. Type 2JDA66PA

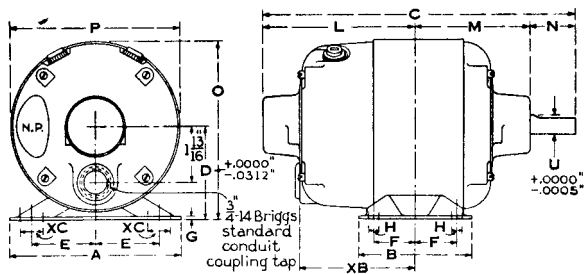


Fig. 22.

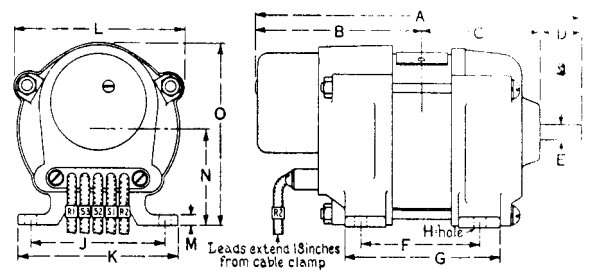


Fig. 23.

PROTECTIVE RELAYS, SELSYNS

Cat. No.	Approximate Dimensions in Inches, Fig. 22									
	Keyway		Length of Key or Flat	A	B	C	D	E	F	G
	Wide	Deep								
2JA33BB1	Flat	3/64	1 1/8	5 5/8	3 5/8	10 3/8	3	2 1/8	1 3/8	3/32
2JA39BB2	Flat	3/64	1 1/8	5 5/8	3 5/8	12 7/8	3	2 1/8	1 3/8	3/32
5MJ35CB1	Flat	3/64	1 1/8	5 5/8	3 5/8	10 23/32	3	2 1/8	1 3/8	3/32

Cat. No.	Approximate Dimensions in Inches, Fig. 22								
	H	L	M	N	O	P	U	XB	XC
2JA33BB1	9/32	5 1/16	3 13/16	1 1/2	5 3/4	5 1/2	0.5	3 13/16	3/4
2JA39BB2	9/32	7 9/16	3 3/16	1 1/2	5 3/4	5 1/2	0.5	6 5/16	3/4
5MJ35CB1	9/32	5 13/32	3 13/16	1 1/2	5 3/4	5 1/2	0.5	4 5/32	3/4

Cat. No.	Approximate Dimensions in Inches, Fig. 23						
	A	B	C	D	E	F	G
2J55VB-2JD55VB-	6 1/16	3 3/32	2 7/32	3/4	0.234	2 7/32	2 27/32
2JD57C-	6 3/4	3 25/64	2 37/64	25/32	0.234	2 21/32	3 21/32
2J65FB-2JD65FB-2J65HB	7 9/32	3 31/32	2 21/32	31/32	0.350	2 7/8	3 7/8

Cat. No.	Approximate Dimensions in Inches, Fig. 23						
	H	J	K	L	M	N	O
2J55VB-2JD55VB-	17/64	2 1/2	3	3 1/8	3/16	1.750	3 5/16
2JD57C-	1/4	2 1/2	3	3 1/8	3/16	1.750	3 3/8
2J65FB-2JD65FB-2J65HB	9/32	3 3/8	4	3 13/16	3/8	2.245	4 5/32

Type 3S9890 Selsyn Indicators

DIMENSIONS

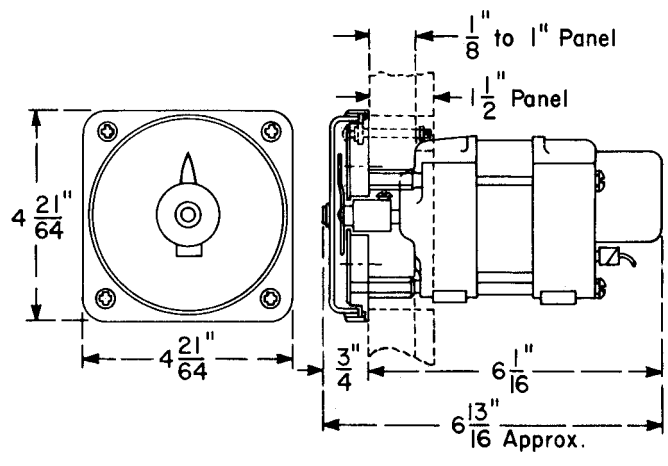


Fig. 24. 3S9890AA100A and 3S9890AB100A indicators

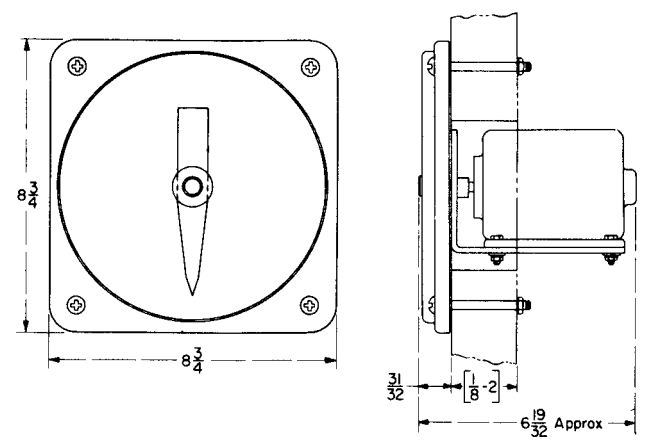


Fig. 25. 3S9890BA100A and 3S9890BB100A indicators

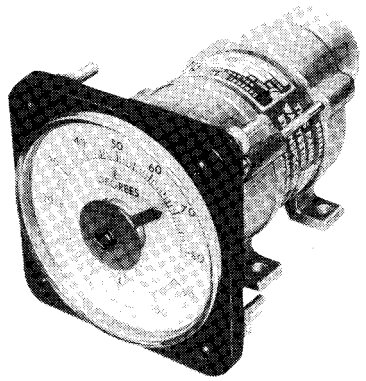


Fig. 26. Selsyn Indicator (3S9890AB100A) with Type AB18 Dial

PROTECTIVE
RELAYS,
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