

## THE SIVERS AUTOMATIC WAVEGUIDE SWITCH

### 1. GENERAL DESCRIPTION

There are a number of types of Sivers Laboratory Automatic Waveguide Switch, but the type most commonly used by the BBC in the 7 Gc/s band is the SL 7020/42.

The switch combines fast switching with a high degree of reliability. It employs a spring which is released for switching and rewound after each operation by a motor driven from a 24 V d.c. supply. The voltage is not critical and may vary plus 30% and minus 10%. The current taken is about 2A. A diode inside the switch prevents the switch rotating in the wrong direction if the 24 V supply is connected in the wrong polarity. The switch may be operated by a relay or by a two position switch.

The operating time is made up of the starting time, from the moment when the remote operating switch is changed over until the waveguide switch begins to move, and the switching time, when the waveguide switch is actually moving. After the switching cycle there follows a period of from half a second to a second during which the spring is rewound ready for the next operation.

The starting time is between 100 and 150 milliseconds, and the switching time is between 15 and 40 milliseconds. It is possible to reduce the starting time to 50 milliseconds by adjustment of the brake on the motor, but this will result in excessive wear on the brake.

The actual waveguide switch consists of a rotor in which two E plane waveguide bonds are formed. The ends of the bonds line up with the four ports of the switch, which are numbered 1, 2, 3, and 4. There are two positions of the switch: in one position ports 1 and 2 and ports 3 and 4 are connected together, and in the other position ports 1 and 4 and ports 2 and 3 are connected. The isolation between the two channels is greater than 80 dB and the V.S.W.R. on each channel less than 1.05.

### 2. OPERATION

In order to make the switching time as short as possible the rotor is turned by a coil spring (item 8 on the exploded view). When the operating switch is changed over the brake (24) is released and the motor (25) begins to rotate. The motor drives the coil spring housing (9) through the gear chain (28, 29, 30, 31, 33, 34, 35). The cam on the coil spring housing lifts the cam follower (16) which in turn lifts the ratchet mounted on the same shaft. The ratchet wheel is attached to the rotor, which is allowed to rotate when the ratchet is lifted. It is driven through 90° by the coil spring, after which it is arrested by the ratchet. The rotor and the shaft bearing the

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ratchet are spring loaded to cushion the shock incurred in stopping the rotor.

The motor continues to rotate in order to rewind the coil spring. Attached to the coil spring housing is a commutator (10) through which the current to the motor and the brake passes. When the coil spring housing has turned through 90° from its rest position the commutator breaks the current to the motor and brake and the motor is stopped. The switch is now reset and ready to operate again.

When the current through the brake is broken a high voltage is developed across the brake coil. This is shunted by a spark quench of the V.D.R. type.

### 3. MAINTENANCE

The switch should function satisfactorily for half a million operations, but it is recommended that the brushes of the motor and the commutator be changed after each two hundred thousand operations. The switch may be dismantled as follows:-

1. Remove the supply socket from the connector (40).
2. Remove the mat on the connector, and the case securing screws, and pull off the case. Do not remove the O rings from the connector and stator.
3. Unwind the coil spring by operating the switch manually. To do this lift the cam follower momentarily off the cam, thus raising the ratchet and allowing the rotor to turn to the next position. Repeat this until the coil is unbound. It is important to count the number of switch operations made, so that the spring, may be set to the correct tension when it is rewound.
4. Unscrew the caps (38) and remove the commutator brushes (37) from the brush holders (36).
5. Remove the four screws (41) and separate the motor mechanics from the main body of the switch.
6. Remove the two screws (42) and withdraw the motor unit from its housing far enough to remove the brushes (27). The motor cannot be completely withdrawn without unsoldering the wiring.

The commutator (10) and collector of the motor may be cleaned with methylated spirit. No oiling is necessary until the switch is dismantled when the brushes are replaced. Recommended lubricants are Tenax 52 or similar in the bearings, and Esso Reason P290 or similar in the coil spring housing, on pinions, the release mechanism (13-23), under the C shaped spring (4) and on the ratchet wheel.

Reassemble the switch as follows:-

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1. Replace the motor in its housing and secure it with the two screws (42).
2. Fit the motor mechanism to the main body of the switch, securing it with the four screws (41).
3. To rewind the coil spring connect up the switch to the 24 V supply, and slide the cam follower along its shaft just far enough to clear the cam. Take care that the ratchet remains engaged in the ratchet wheel and the rotor is not allowed to move. Use the operating switch to drive the motor and wind up the spring. Operate the switch the same number of times as was done during dismantling in order to obtain the correct tension.
4. Check that the position of the waveguide switch is the correct one, corresponding to the numbers on the bottom of the stator and to the position of the operating switch.
5. Check that the waveguide bends in the rotor exactly line up with the ports of the stator. If they do not adjustment may be made by means of the eccentric disc (3).
6. Replace the cover.

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