



Fixed-coil Radar Displays SD 1000 Series

SPEED AND EFFICIENCY of data presentation, handling and processing in a modern defence radar system become more important as aircraft travel faster and operational systems become more complex. In such applications fixed-coil displays offer the widest scope of advancement, their main advantage being their ability to handle and display large quantities of ancillary information in between timebase sweeps. By this means inter-trace symbols, adjustable in position by range and bearing controls or 'joysticks' can be used to facilitate control procedure. Inter-trace lines are also available, their origins being controlled by a joystick and their orientation and length by range and bearing controls. A further advantage is that the movements of these symbols can be repeated on other display units.

The SD 1000 series is a newly developed and fully comprehensive range of fixed-coil displays. It is based on exhaustive investigation into modern defence operation control techniques, as well as on extensive technical development, made in conjunction with the British Ministry of Supply and the Royal Air Force. Excellent performance and extreme flexibility of arrangement are combined with a maximum saving of data handling time and considerable reduction in 'human element' risks.

The range includes plan position indicators (PPIs) and range-height indicators (RHIs). There is also an 'A'-scope. The RHIs can be used with Marconi Height-finder Type S 244.

Features

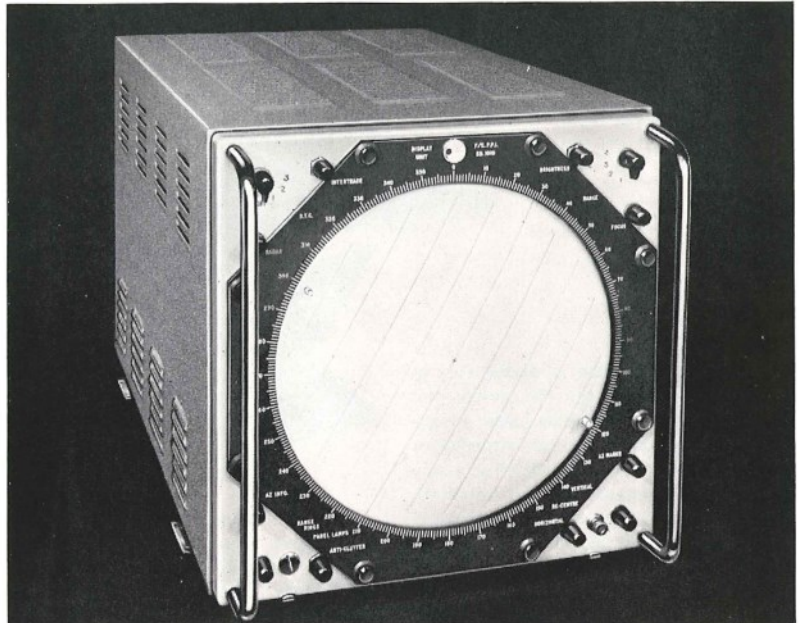
PPI DISPLAYS

Particularly wide range of application covered by a series of six versions.

Positional information can be derived by either the British Selsyn link system or the American mag-slip and servo system.

15 in. or 12 in. diameter display tubes; electrostatically focused, flat faced, magnesium fluoride coated, aluminium backed and with a very long afterglow. (Short afterglow tubes are also available.)

Inter-trace strobe marking symbols, adjustable by joystick control to any part of the display. These can be associated with range and bearing dials and/or can feed



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Type SD 1010.

out cartesian co-ordinate positional information. Facilities are included for repeating the strobe information directly from one display to another.

Off-centring of trace origin, permitting concentration on any sector of the scan.

Facilities for selecting any one of a variety of inputs from different radar heads.

Head combining facilities for 'back-to-back' operation.

Provision for accepting secondary radar.

Ranges variable to suit particular requirements.

Provision for accommodating an externally-generated range strobe.

Heading marker, switchable in or out.

Edge-lit masks and illuminated bearing scales on all versions.

RHI DISPLAYS

Standard range-height indicator display, familiar to operators. Earth curvature correction is incorporated to give straight height lines on display.

Can be used with electronic height marks or using internal height measuring circuit.

A split range strobe is provided, controlled from the PPI display, being linked to the appropriate inter-trace strobe marker. This brackets the echo of which the height is required.

Joystick control of height strobe and automatic transmission of height information.

4 ranges selected by switch - can be expanded if desired to examine part of display.

THE SERIES

Each version of the SD 1000 series consists of the display unit itself and also rack-mounted ancillary equipment which may be located remotely from the operations room. The bulk of the ancillary gear depends on the facilities provided. Characteristics of the various versions may be briefly summarized as follows:

(a) *Type SD 1000*. A horizontal display with a 15 in. tube. Developed for target indication and interception control and is especially suited to ship-borne applications see page 331. Accommodates four seated operators, each one of whom may be equipped with individual strobe control facilities. Elevation scan display can be incorporated.

(b) *Type SD 1010*. A compact table-mounting PPI-type of display with a 12 in. tube. Useful for ship-borne application, airfield control and certain mobile systems. This unit is the simplest and most compact of the range, but nevertheless provides a high-grade display with all normal controls available to the operator. Any joysticks associated with the display are mounted near to it in a convenient position on the table, or on the separate control panel provided. A single framework can be supplied to convert this display to a floor-mounting console.

(c) *Type SD 1011*. A table-mounting PPI-type display with a 15 in. tube. A larger unit than Type SD 1010, it includes the control panel with keys for control of telephone circuits, radar facilities etc, and one or two joysticks for control of strobes. The large tube is an advantage when the display is used by more than one operator.

(d) *Type SD 1015*. A compact plan position indicator suitable for display of marked radar or synthetic pictures. This unit incorporates a dual deflection system,

(i) a linear voltage-current converter for main radar sawtooth sweep, having good sensitivity and economy in current consumption.

(ii) a high-speed writing deflection circuit with wide bandwidth to facilitate the presentation of alpha numeric target markers.

Designed to fit into composite display consoles but having plug and socket connection to permit rapid removal for servicing.

(e) *Type SD 1016*. A unique computer read-out mechanism providing in-line flicker-free display of information.

The display unit employs a dual deflection system, line and frame timebase waveforms being fed to the main amplifier whilst a subsidiary circuit handles the character-writing waveforms. Each character is written in a period of 20 microseconds and the whole picture is flicker-free. The data displayed is called up from the computer by suitable selector switches available on the operator's desk.

The display unit is fed from a character generator which accepts a digital instruction every 20 microseconds, thus producing 50,000 characters per second. It is thus capable of feeding a number of tabular display units with completely different sets of data. The character generator also contains decoding circuits which control the production of timebase and bright-up waveforms for the displays themselves. Characters may be grouped in columns to produce any convenient format (see page 359).

(f) *Type SD 1020*. A floor-mounting console using a 12 in. tube to provide a PPI-type display. This unit has all the control

panels and joystick controls built in and includes the power units which are located in the lower part of the framework. It can be fitted with one or two joysticks or a range and bearing control.

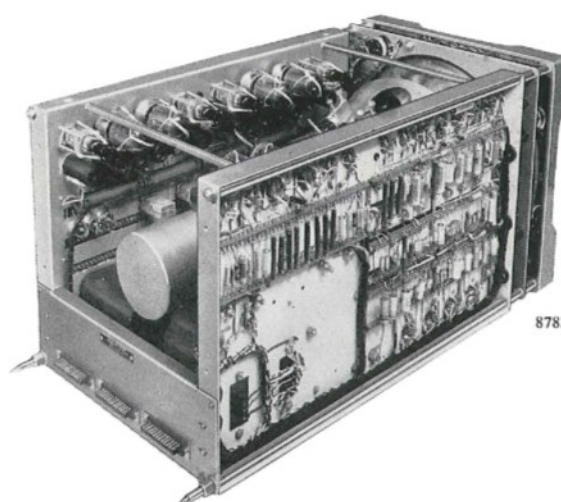
(g) *Type SD 1040*. A compact desk or table-mounting display unit designed for use with high performance search radar equipment, used for raid and jamming analysis operation. It is normally fitted with a 12 in. long persistence CRT having a spot size of 0.5 mm. This is desirable with a narrow beam system in order to retain the 'picture' long enough for study. Confusion does not occur, as only signals appearing over a pre-selected azimuth are displayed. A horizontal range trace is used with signals appearing as vertical deflections which can be emphasized by being simultaneously intensity modulated (see page 359).

(h) *Type SD 1050*. A floor-mounting console, similar to the Type SD 1020 in general design, but with an elevation scan display for height finding purposes.

An RHI console, similar to the Type SD 1020 in general design, is available which provides a standard display, well known to radar operators, but improved by the introduction of earth curvature correction. This straightens the height lines, making height reading easier. Alternative methods of height reading can be provided as follows:

(a) Electronic height marking by means of a height marks generator. This unit provides a series of electronically produced height lines on the display.

(b) Joystick-controlled height strobe consisting of a horizontal line which is laid across the echo. The height so measured is



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Interior view of Type SD 1015 Marked Display.

transmitted automatically to the PPI operator.

A range strobe consisting of two vertical lines is provided, controlled by the joystick at the PPI.

When the PPI operator marks an echo with an inter-trace marker, the range strobe on the RHI will automatically be placed on the same echo, the lines bracketing the echo.

The strobes referred to are all displayed during the inter-trace period.

Data Summary

Ranges: Master timebase range supplied to display units can be between 40 and 320 n.m. (74 and 590 km) depending on the radar used. Expansion in four steps up to 4:1 is effected by control of deflection amplifier gain. More than one master timebase waveform can be supplied to a display unit to provide a greater variation of range.

Timebase off-centring: Up to three-quarters of master timebase range.

Sync. pulse input: Positive, 5 V min. level. Min. pulse width 0.2 μ s. PRF 200-1200 p.p.s. (with inter-trace facilities).

Aerial rotation information input: Either a Selsyn or servo system can be used, driving a magstrip or synchro resolver.

Selsyn: 5-wire Selsyn with 50 V or 100 V stators, running at 30 times aerial speed, with auto align. Max. rotational speed 15 r.p.m.

Servo: (a) Servo system with 1:1 and 36:1 coincidence transformer magstrips and DC servo motor. Max. rotational speed 30 r.p.m. Differential correction for

ship's head variations is available for naval applications, the drive being by compass repeater motor.

(b) Alternative Servo system with 30:1 magflip and auto align, using AC servo motor. Max. rotational speed 24 r.p.m.

PPI DISPLAY INPUTS

(1) **Video signals***: Positive-going, min. mean noise level 0.5 V. Pulse widths down to 0.2 μ s. Video amplifier bandwidth, 4 Mc/s at 6 dB down.

(2) **Range marks***: 1 n.m. markers with every 5th brightened and 10 n.m. markers with every 5th brightened, or other values to suit requirements.

(3) **Azimuth information***: Either azimuth markers or video map signals. Positive-going, 1 V min. level. Two input channels, one fine, one coarse.

(4) **Secondary radar**: Positive-going, 5 V min. level.

(5) **Video range strobe***: Positive or negative, 5 V min. level.

(6) **Deflection waveforms**.

(7) **Radar bright-up**.

(8) **Inter-trace bright-up***.

(9) **DC supplies**.

(10) **Power supplies**: 220, 230 or 240 V ($\pm 6\%$), 45-65 c/s, single-phase AC.

RANGE/HEIGHT DISPLAY INPUTS

(1) **Video signals***: Positive-going, min. mean noise level 0.5 V. Pulse widths down to 0.2 μ s. Video amplifier bandwidth, 4 Mc/s at 6 dB down.

(2) **Elevation-control signal**: 5 kc/s (nominal) sine wave by magflip link from aerial heads.

(3) **Range marks***: Normally 10 n.m. marker with every 5th brightened.

(4) **Electronic height marks***.

(5) **Deflection waveforms**.

(6) **Radar bright-up**.

(7) **Inter-trace bright-up***.

(8) **DC supplies**.

(9) **Power supplies**: As for PPI displays.

Power supplies (general): 220, 230 or 240 V ($\pm 6\%$), 45-65 c/s, single-phase AC.

Bulk power supply system, if used, can be 340-440 V, three-phase AC.

Dimensions:

Height	Width	Depth	Weight
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Type SD 1000

37½ in.	50 in.	50 in.	560 lb
(95.5 cm)	(127 cm)	(127 cm)	(255 kg)

Type SD 1010 and SD 1040

15 in.	14 in.	27 in.	80 lb
(38 cm)	(35 cm)	(68 cm)	(36 kg)

Height	Width	Depth	Weight
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Type SD 1011

23 in.	23½ in.	32¼ in.	170 lb
(58.5 cm)	(60 cm)	(82 cm)	(77 kg)

Type SD 1015

14 in.	14 in.	28 in.	99 lb
(35 cm)	(35 cm)	(71 cm)	(45 kg)

Type SD 1016

9 in.	11 in.	24 in.	42 lb
(23 cm)	(28 cm)	(61 cm)	(19 kg)

Types SD 1020 and SD 1050

43 in.	25 in.	40 in.	500 lb
(109 cm)	(63.5 cm)	(102 cm)	(227 kg)

Ancillary Apparatus Cabinets

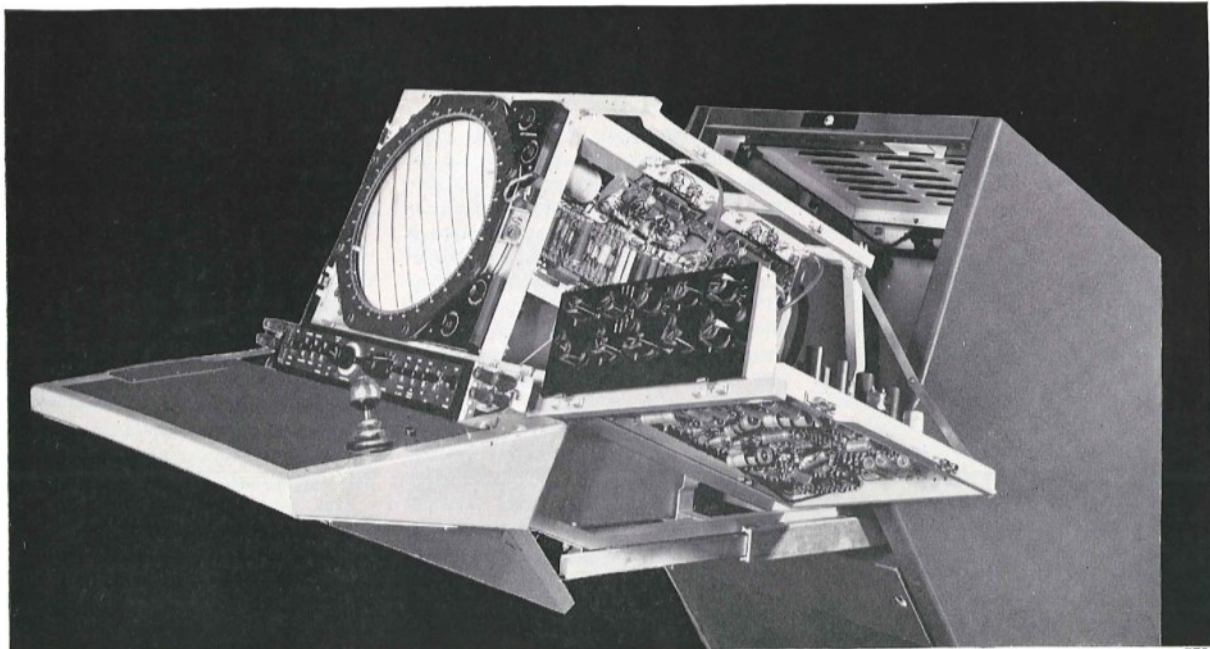
Full depth type

7 ft	23½ in.	25 in.	
(214 cm)	(59 cm)	(63.5 cm)	

Half depth type

5 ft 7 in.	22 in.	14 in.	
(170 cm)	(56 cm)	(35 cm)	

* The amplitude of these signals can be controlled at the console.



Type SD 1020.

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