10 TECHNICAL DESCRIPTION OF EQUIPMENT

10.1 Function of Each Semiconductor or Active Device (FCC 2.983 (d)(6))

ANTENNA UNIT

Interface PCB 03P9241

Q1:	Pulse Amplifier
Q2:	Pulse Amplifier

Modulator Control PCB 03P9238

CR11:	Rectifier
CR31-CR32:	Overvoltage Protection
CR33-CR34:	Switching
Q21:	Current Amplifier
Q31-Q32:	Switching
Q41:	Pulse Amplifier
Q43-Q44:	Pulse Amplifier
Q61:	IF Bandwidth Selection
Q71:	DC Amplifier
Q72:	Switching
U11:	Switching Regulator Control
U21:	Reference Voltage Generator
U22:	Photo-coupler
U31	5V Regulator
U32:	Monostable Multivibrator

Modulator PCB 03P9239

CR1:	Transient Suppression
CR2:	Power snubber
CR3-CR4:	Switching
CR5-CR6:	Voltage Shifter
Q1-Q2:	Pulse Amplifier
Q21-Q23:	Pulse Amplifier
Q26-Q28:	Pulse Amplifier
Q31-Q33:	Pulse Amplifier
Q36-Q38:	Pulse Amplifier
Q41-Q43:	Pulse Amplifier
Q46-Q48:	Pulse Amplifier
Q51-Q53:	Pulse Amplifier
Q56-Q58:	Pulse Amplifier

Chassis Mounted Parts

HY801:	3 Ports Circulator
U801:	MIC Frequency Converter with Limiter
V801:	Magnetron
CR810:	Limiter

I.F. Amplifire PCB IF-9099

CR601-CR607:	Switching
CR608:	Over Voltage Protection
CR609:	Switching
CR616:	Reverse Voltage Protection
CR622:	Thermal sensor
CR625:	Over Voltage Protection
CR626:	Switching
CR629-CR630:	Over Voltage Protection
CR633:	Over Voltage Protection
Q601-Q602:	I.F. Amplifier in Cascade Connection
Q603:	Switching
Q609-Q610:	I.F. Amplifier in Cascade Connection
Q614-Q615:	I.F. Amplifier in Cascade Connection
Q616-Q616:	Detector
Q618-Q620:	DC Amplifier
Q625-Q628:	Video Amplifier
Q630:	Emitter-follower Amplifier
Q635-Q636:	Switching
U601-U603:	I.F. Amplifier
U604:	DC Amplifier
U605-U609:	DC Regulator
U610:	Inverter

DISPLAY UNIT

Filter Board FIL-9148

CR1:	Reverse Polarity Protector Diode

Trackball Board TB-9152

U1-U4:	Trackball Pulse Generator

Power Supply Board PTU-9149

CR1:	Current Detector Time delay
CR31-CR34:	Rectifier
CR35-CR37:	Voltage Detector
CR38:	Q33 Driver
CR39:	Fly Wheel Diode
CR40:	Rectifier
CR41:	K2 discharger
CR51:	Q52 Driver
Q1-Q4:	45 kHz PWM Invertor Output FET
Q5:	10V Regulator
Q6:	Overcurrent Protector Swiching
Q31:	Voltage Detector
Q32:	Q33 Driver
Q33:	Stepdown Switching Regulator Output FET
Q41:	K2 Driver
Q51:	Q52 Driver
Q52:	Soft start Output FET
U1:	Power Relay Control
U2:	10V Regulator
U3:	45 kHz PWM Invertor Control
U4:	Current Detector
U5:	Voltage Detector
U6:	Stepdown Switching Regulator Control
U7:	Voltage Detector
U8:	Output Interface
U9:	Isolation
U10:	Voltage Detector

Display Main Board SPU-9211

CR1-CR23:	Over Voltage Protection
Q1-Q2:	NMEA Driver
Q3:	TX Trigger Driver
Q4:	Inverter
Q5-Q6:	Switch
Q7-Q8:	GYRO DATA Driver
Q9:	External Trigger Inverter
Q10:	Sector Blank Switch

Q11:	TX Trigger Driver
Q12:	Video Amplifier
Q13:	Bearing pulse Inverter
Q14:	Voltage Buffer
Q15:	Inverter
Q16:	Switch
Q17:	Slicer
Q18:	Video Amplifier
Q19-Q26:	CRT Video Driver
Q27-Q28:	Voltage Buffer
Q29:	Inverter
Q30:	Switch
Q31-Q32:	CRT Video Driver
Q33:	Switch
Q34:	CRT Contrast Driver
Q35:	CRT Brillance Driver
Q36:	Switch
Q37-Q38:	Bearing pulse Driver
Q39:	Video Amplifier
Q40:	Switch
Q41:	Slave Video Driver
Q42-Q43:	Sampling Trigger Driver
Q44:	MBS Level Signal Driver
Q45:	Video Amplifier
Q46-Q47:	Voltage Buffer
Q48-Q51:	Video Amplifier
Q52:	Signal Level Converter
U1-U4:	Isolator(Photo cupler)
U5:	Auto Tuning Voltage Adder
U6:	-9V Regulator
U7:	Voltage Buffer
U8:	PLL Oscillator
U9:	Schmitt Imput Buffer
U10-U12:	Video Signal Switch
U13:	Synchronous Signal Buffer
U14:	EE Potentiometer (EE=Electrical Erasable)
U15:	STC Voltage Amplifier
U16:	Video Amplifier
U17:	+9V Regulator
U18:	Voltage Buffer
U19:	Voltage Buffer (Transistor Array)
U20:	A/D Converter
U21:	12 CH. D/A Converter
U22-U27:	A/D Converter
U29:	CPU SRAM
U30-U31:	Echo Video RAM
U32:	CPU (Internal 16 Bit, External 8 Bit)
U33:	Graphic Display Controller
U34:	Crystal Oscillter (Sampling)
U35:	Crystal Oscillter (Graphic)
U36:	Flash Memory
U37-U38:	Frequency Divider
U39:	NOR Gate
U40:	Scan Converter Gate Array
U41:	OR Gate
U42:	CPU Peripheral Gate Array

U43-U44:	Graphic Video RAM
U45:	Graphic Gate Array
U46:	Sampling Gate Array
U47:	Inverter
U48:	Bach-up Interface
U50:	Reset IC
U51:	RS-232C Transister
U52:	AND Gate
Y1:	CPU Clock Oscillator

Panel Board PNL-9150

CR1:	Pilot lamp
CR2-CR23:	Illumination
Q1:	LED Driver
Q2:	Buzzer Driver
Q3:	LED Driver

10.2 Description of the circuits employed for suppression of spurious radiation, for limiting or shaping the control pulse, and for limiting or controlling power (FCC 2.983 (d) (11))

Modulator PCB 03P9239

The modulator board 03P9239 which is composed of 8 pieces of MOS FET's (Q23, Q28, Q33, Q38, Q43, Q48, Q53 and Q58) is to drive a pulse transformer RT-9023. The current through the MOS FET's are limited by source resistors 0.47W/1 W (R23, R28, R33, R38, R43, R48, R53 and R58) which control the voltage at their respective gates.
The gate voltage is normally set to approximately 18 V and dropped by 10 V approx. with the source resistor (drain current is 22 A approximately.).
The voltage between the source and the gate of the MOS FET is 8V approx. and limits the drain current.
Two rsistors R8 and R9 (2.0 W, 1/4 W) are provided in the path of magnetron current and voltage at their both ends (magnetron current) are detected. This board also produces the main bang suppression trigger signal (MBS SIG).

Modulator control PCB 03P9238

The board 03P9239 drives the magnetron while its current is controlled by the source voltage of triger circuit on the 03P9239. This source voltage is controled by the modulator control PCB 03P9238.
U11 on this board is to control the switching regulator. The output voltage is controlled by VR11. A series regulator composed of Q21 and U21 provides the magnetron with its heater voltage.
When the magnetron current exceeds 2 A at long range scale, photo-coupler U22 becomes ON and and the heater voltage varies from 8.3 V to 7.0 V (between 7 and 8 of J801). U31 is a tri-pole regulator and to drive U32. When trigger pulse is provided to U32 from the display unit, U32 produces and outputs pulses having widths corresponding to each setting of short range, middle range and long range (P/L A, P/L B). The outputted pulses are amplified by Q41, Q43 and Q44 and then outputted at a terminal 5 of J811.

Duplexer and Frequency Converter (in Scanner unit))

The microwave energy produced by the magnetron enters the circulator from port 2. It is fed to port 3 with a negligible loss of energy; port 1 at this time is isolated. In the same manner, the received signal entering into port 3 is transferred to port 1, isolating port 2. This operation of the circulator protects the receiver during transmission and minimizes the loss of the received signal. Thus, the circulator allows a single antenna radiator to be used for transmission and reception of radar signals.

During transmission cycles the receiver circuits are isolated from high-level RF energy by diode limiter CR810 and second stage limiter built in MIC U801.
It is a passive switching device which allows the low-level RF signal to pass through and prohibits relatively strong microwave energy, such as the leak from the magnetron.
It also protects the sensitive amplifier from pulses received direct from other radars in the proximity.

When a low-level signal is received, the PIN diodes remain in the cutoff state, and the limiter's input impedance matches the characteristic impedance of the receiver allowing the signal to be delivered to the frequency converter of U801. When strong microwave energy is received, the PIN diodes are put in the conductive state (or short-

circuited) causing the input energy to be attenuated. The strong input is further reduced to about 150 mW by the varacter diode.

The MIC converts 9 GHz RF signal into an intermediate frequency of 60 MHz. It is achieved by mixing the received signal with the local oscillator signal in the frequency converter of the MIC. The built-in local oscillator oscillates at a frequency 60 MHz higher than the magnetron frequency of 9410 MHz.

I.F. Amplifier IF9099

The IF signal of 60 MHz coming from the MIC is amplified and converted into a video signal, which is delivered to the display unit.

The IF amplifier is composed of six major circuits; Linear Amplifier (Q601/Q602), Logarithmic Amplifier(U601/U602, Q625/Q626), Video Amplifier (Q627/Q628), Bandpass Selector (U604, CR601 to CR607), Tuning Indicator Circuit (Q609/Q610, Çp614 to Q620, U603) and Main Bang Suppression Circuit (U610, Q630, Çp635/Çp636ÅACR626/ CR633).

The signal applied to the base of Q601 is amplified in cascade by Q601 and Q602, and sent to the bandpass selector.

The IF amplifier operates in narrow or wide bandwidth mode depending on the settings of the RANGE switch and TX touchpad. For short ranges, a wide bandwidth (25 MHz) is selected, since the levels at pin #3 of U604 and pin #6 of U604 go high, thus CR602 to CR605 and CR607 are conductive and CR601/CR606 are cut off, causing the signal to pass through CR603/CR604. On the contrary, CR602 to CR605 and CR607 are cut off and CR601/CR606 are conductive, which causes the signal to pass through T603, selecting a narrow bandwidth (5 MHz) on medium and long ranges.

The signal through the bandpass selector is coupled to the logarithmic amplifier and amplified by U601/U602 and Q625/Q626. Thus, the output signals of Q625/Q626 are fed to Q627/Q628 to be amplified further, and then sent to the display unit.

The IF signal of 60 MHz is amplified by Q609/Q610, U603, Q614/Q615 and detected by Q616/Q617. Then the detected signal (Tuning Indicator Signal) is sent to the display unit via Q618 to Q620.

On the other hand, Q609/Q610 and U603 are additional amplifier circuits to make the dynamic range of the IF signal wider, causing the discrimination of the target echoes to get better. The IF signal from the MIC is fed to Q609/Q610 as well as through resistor R651 which is employed to attenuate the signal level. Therefore, Q609/Q610 amplifies even a strong signal which may be saturated in Q601/Q602 and U601/U602, and then sent to logarithmic amplifier U603. This signal is added to the saturated signal in U601/U602, causing the saturation level of the IF signal to become high.