

SD-164

Data Radio

User Instruction Manual

FCC RF Exposure Compliance Requirements -

The Federal Communications Commission (FCC), with its action in General Docket 93-62, November 7, 1997, has adopted a safety standard for human exposure to Radio Frequency (RF) electromagnetic energy emitted by FCC regulated equipment. Topaz3 / Maxon subscribes to the same safety standard for the use of its products. Proper operation of this radio will result in user exposure far below the Occupational Safety and Health Act (OSHA) and Federal Communications Commission limits.

Antennas used for this transmitter must not exceed an antenna gain of 7dBd. The radio must be used in configurations with a maximum operating duty factor not exceeding 50%, in typical push-to-talk configurations. This radio is approved for use by the general population in an uncontrolled environment. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 49cm from all persons, must not be co-located or operating in conjunction with any other antenna or transmitter.

CAUTION - DO NOT transmit for more than 50% of total radio use time (50% duty cycle). Transmitting more than 50% of the time can cause FCC RF exposure compliance requirements to be exceeded. The radio is transmitting when the "TX" icon on the radio display is illuminated. You can cause the radio to transmit by pressing the P-T-T button on the radio's microphone.

Users must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

NOTE: This radio operates in FCC regulated frequency bands. All radios must be licensed by the FCC before use. Because this radio contains a transmitter, Federal law prohibits unauthorized use or adjustments of this radio.

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

Safety

CAUTION - DO NOT operate the transmitter of any radio unless all RF connectors are secure and any open connectors are properly terminated.

CAUTION - DO NOT operate the radio near electrical blasting caps or in an explosive atmosphere.

CAUTION - All equipment must be properly grounded for safe operation.

WARNING - DO NOT allow children to operate transmitter - equipped radio equipment.

WARNING - All equipment should be serviced by a qualified technician.

WARNING - It is mandatory that radio installations in vehicles fueled by liquefied petroleum gas conform to the following standard: National Fire Protection Association Standard NFPA 58 applies to radio installations in vehicles fueled by liquefied petroleum (LP) gas with LP gas container in the trunk or other sealed-off space within the interior of the vehicle. This standard requires that:

1. Any space containing radio equipment shall be isolated by a seal from the space in which the LP gas container and its fittings are located.
2. Remote (outside) filling connections shall be vented to the outside.

About your SD-164 Data Radio

The SD-160 Series (hereinafter called "the radios") of RF Link Modules from Topaz3 utilize the latest technology in their designs and manufacturing. SD-164 models are Phase Lock Loop Synthesizer (PLL) / microprocessor controlled and offer two (2) watts of power with 16-channel capability. Multiple functions including 1200 to 9600 baud rates, AC and/or DC audio coupling, GMSK, FFSK and FSK modulation are standard in these fully programmable wide bandwidth RF Link Module units. Programmable sub-audio squelch system (CTCSS & DCS) and two-tone squelch system are newly added to the signal level detect squelch system (RSSI). GPS Data handling is provided to interface and control internal GPS receiver.

To assure satisfaction from the radio, we urge you to thoroughly read the operation and function information in this manual before operating your SD-164.

Applications of some of the functions described in this manual are determined by the system you use. Your Topaz3 dealer will program your radio so that you have the greatest number of functions possible relative to your needs.

Should you have questions regarding the operation of the radio, please consult your Topaz3 Dealer.

Specifications

GENERAL

Equipment Type	Data radio
Performance Specifications.....	TIA / EIA-603
Band	UHF
Channel Spacings	25 kHz, 12.5 kHz programmable
RF Output Power	2 watt only
Modulation Type	F2D, F3E
Intermediate Frequency	45.1 MHz & 455 kHz
Number of Channels	16
Frequency Source	Synthesizer
Operation Rating	Intermittent 90 : 5 : 5 (Standby: RX: TX)
Power Supply	Ext. Power Supply(12 VDC Nominal) 7.2V - 18.0V DC EXTREME
Temperature Range	
Storage	from - 40°C to + 80°C
Operating	from - 30°C to + 60°C
Current Consumption	
Standby (Muted)	< 65 mA
Transmit 2 Watt RF power	< 1.0 A
Frequency Bands:	
	RX TX
UHF : U2	450.000 - 490.000 MHz 450.000 - 490.000 MHz
Lock Time	< 10 mS
TX to RX attack time	< 20 mS (No Power Saving)
RX to TX attack time	< 20 mS
Dimensions.....	(32 mm)H x (58 mm)W x (125 mm)D
Weight	253 grams

TRANSMITTER Specification

Carrier Power:	Nom. Max. Min. 2W < 2.2W > 1.5W
Sustained Transmission	Nominal conditions Time : 5 10 30 Sec. Power: >90% >85% >80%
Frequency Error	< 0.75 kHz Nominal condition for UHF ±5.0 ppm Extreme condition for UHF
Frequency Deviation:	
25 kHz Channel Spacing.....	Peak ±5.0, Min. ±3.8
12.5 kHz Channel Spacing.....	Peak ±2.5, Min. ±1.9
Audio Frequency Response	Within +1/-3dB of 6dB octave @ 300 Hz to 2.55 kHz for 12.5 kHz C.S. @ 300 Hz to 3.0 kHz for 25 kHz C.S.
Adjacent Channel Power	
25 kHz	< 70 dBc @ Nominal Condition < 65 dBc @ Extreme Condition
12.5 kHz	< 60 dBc @ Nominal Condition < 55 dBc @ Extreme Condition
Conducted Spurious Emission	< -60 dBc
Modulation Sensitivity	100mV RMS @ 60 % Peak Dev.
Hum & Noise:	
25 kHz Channel Spacing	> 40 dB (with no PSOPH)
12.5 kHz Channel Spacing	> 40 dB (with PSOPH)
Modulation Symmetry	< 10 % Peak Dev @ 1 kHz input for nominal dev +20dB
Load Stability	No osc at ≥ 10:1 VSWR all phase angles and suitable antenna No destroy at ≥ 20:1 all phase angle
Peak Deviation Range Adjustment @ 1 kHz, Nom. Dev +20dB:	
25 kHz Channel Spacing	Min. 3.5, Max. 6.0
12.5 kHz Channel Spacing	Min. 1.5, Max. 4.0

RECEIVER Specification

Sensitivity (12dB Sinad)	Standard B.W < -118 dBm, Narrow B.W <-117 dBm @ Nom. Condition
	Standard B.W < -115 dBm, Narrow B.W <-114 dBm @ Extreme Condition
Amplitude Characteristic.	< ±3 dB
Adjacent Channel Selectivity:	
25 kHz Channel Spacing	> 65 dB @ Nom., > 55 dB @ Extreme Condition
12.5 kHz Channel Spacing	> 60 dB @ Nom., > 50 dB @ Extreme Condition
Spurious Response Rejection	> 60 dB (100 kHz - 4 GHz)
Image Response	> 60
IF Response.....	> 60
Others.	> 60
Intermodulation Response Rejection:	
±25 kHz/ 50 kHz	60 dB
±50 kHz/ 100 kHz	60 dB
Conducted Spurious Emission @ Nominal Conditions:	
9 kHz - 1 GHz	< -57 dBm
1 GHz - 4 GHz.	< -47 dBm
RX Spurious Emissions (Radiated) @ Nominal Conditions	
9 kHz - 1 GHz	< -57 dBm
1 GHz - 12.75 GHz	< -47 dBm
AF Distortion.	< 5% @ Nom., < 10 % @ Extreme condition
RX Hum & Noise:	
25.0 kHz CP	< 40 dB No PSOPH
12.5 kHz CP	< 40 dB with PSOPH
Receiver Response Time	< 16 mS
Squelch Opening Range:	RF level for 6 to 14 dB Sinad
Squelch Closing Range (Hysteresis):	0 - 6 dB Sinad @ Nominal Condition
Squelch Attack Time:	
RF Level at Threshold	< 40 mS
RF Level at Threshold + 20 dB	< 30 mS
Squelch Decay Time	5 mS Min., 20 mS Max.
Antenna Socket Input Match	> 10 dB Return Loss
L.O. Frequency Temperature Stability	1st < 5 ppm, 2nd < 15 ppm from -30° to + 60° C
L.O. Frequency Aging Rate	±2 ppm/ year

Unpacking information

Remove and carefully inspect the contents of your package(s) for the following items:

Radio

Fused power cord

User manual

If any items are missing, please contact the Topaz3 dealer from which you purchased the radios, or contact Topaz3.

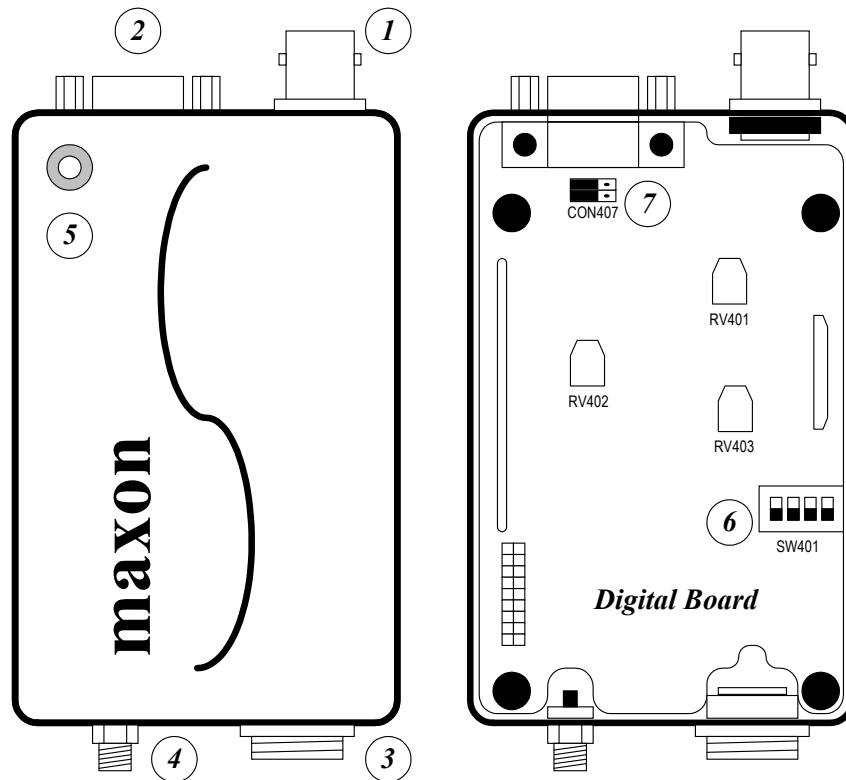
SD-164 Features

- Synthesized Operation with 16 channel capability
- 2 Watt output power
- Programmable 12.5 / 25KHz channel spacing
- Channel scan
- Busy channel lockout
- Tx Time-out timer
- Power Save
- Marked Idle
- Tx Delay
- Data transmission and reception through GMSK modem
- Data transmission and reception through FFSK modem
- Support transmission of global position data

Description of radio components

- ❶ Antenna connector
- ❷ DB-15 connector
- ❸ Power connector
- ❹ GPS Antenna connector (option)
- ❺ LED (Busy / Tx indicator)

Exterior View



Antenna installation

Fasten the antenna to the radio by turning the antenna cable clockwise into the receptacle on left of radio when looking at front of radio.

Powering the data radio

Your data radio accepts many sources of DC power to permit more versatile use. This radio operates from 7.2V to 18V DC and standard voltage for test is 12V DC.

Connecting the data radio to DC power

Connect DC power plug of power cable to radio's DC IN power connector and then fasten power plug to the radio by turning the ring clockwise.

SD-164 Operation

Channel select / SCAN

Your radio's channel can be selected by inner DIP-S/W or serial command inputted from external control system. To change channel by inner DIP-S/W (Ⓔ), you should open the upper cover and then look for DIP-S/W(Ⓔ) on the digital board of bottom cover. After that, change the DIP-S/W to select wanted channel according to channel dip switch chart.

To use serial command for channel selection, it should be inputted by external equipment or device(ex. Personal computer) through Pin 8 of DB-15 connector. See the message format for serial command for full details.

If your radio has been programmed the channel scan, you must enter the scan mode by serial command.

Transmit

The transmission will be made by various inputs as like PTT signal (Pin 3 of DB-15 connector), TX serial command and Serial data input (Pin 10 of DB-15 connector : This input is only available when modem option board is installed). Basically, TTL level is used as PTT signal and it's low active. But, If you installed option modem board, you can use RS-232 level as PTT signal instead of TTL level. To maintain transmission, continuous PTT signal input is required. But, if you use Tx serial command for transmission, normally, it's released by Rx serial command. Before the transmission, check the color of the radio's top-panel LED(Ⓕ). It will glow orange if RF activity is present; it will not be illuminated if the radio indicates a "clear" channel. When the channel is "clear", input the PTT signal or Tx serial command and transmit data or audio. Remove the PTT signal or input Rx serial command when you have finished transmission.

CAUTION : Operation of the transmitter without a proper antenna installed may result in permanent damage to the radio.

Receive

When you have finished transmission, remove the PTT signal or input Rx serial command. You will receive data from another radio or hear another person talking from the connected external speaker.

Scan modes

Scanning is a dealer programmable feature that allows you to monitor a number of channels. Your dealer will help you define a scanning mode and your channel "scan list"

Channel scan

Once the scan list has been established, initiate scan by serial commands. If a conversation is detected on any of the channels in the scan list, the radio will stop on that channel and you will be able to hear the conversation. At that time, busy channel data is sent to external equipment or device through serial command. So, you can identify busy channel data as decoding of received serial command from your radio in the external equipment or device.

Normally, if you try to transmit during scanning, the transmission will be made on the channel that the call was received during the programmable scan delay time. (The scan delay time is the amount of time the radio will stay on that channel once activity has ceased. In case of dealer programmable, 4 ~ 7 seconds is typical). The radio will resume scanning once the scan delay time has expired, and will continue to scan until the serial command for scan stop is inputted by external equipment. After the scan resumes, if a transmission is made, the radio will transmit on the selected priority channel. This feature is similar to priority scan TX except for selection of priority channel. You can assign priority channel by inner dip switch only.

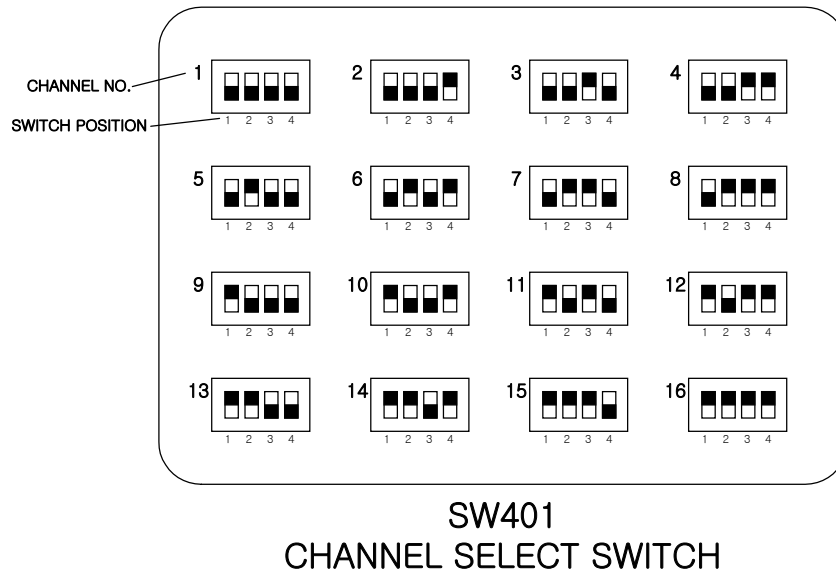
Scan channel delete

To temporarily delete a channel from the scan list, simply input serial command for scan deletion to the radio while scanning and stopped on the channel to be deleted. This will remove that channel from the scan list until the scan is closed or the radio's power is reset. When scan restarts after close one time, all scan list are deleted, start scan after turn off or turn on the power of the radio, the originally programmed scan list will be activated.

CTCSS / DCS Scanning

To help to block out unwanted calls to your radio, the SD-160 series can be programmed by your dealer to scan for tones.

Channel dip switch chart



Serial command

Serial RX/TX Data Format

- (1) Asynchronous Serial Data Transfer
- (2) Baud Rate : 4,800 bit/sec
- (3) Data Bit : 8bit , Non Parity
- (4) Stop Bit : 1bit
- (5) MSB first transmission

Each serial command is consist of 3 bytes.

1st byte is command and 2nd is data required by command and 3rd is check sum to decide validity of total contents.

Byte0

ST	1 st Byte (Command)	SP
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Byte1

ST	2 nd Byte (Data)	SP
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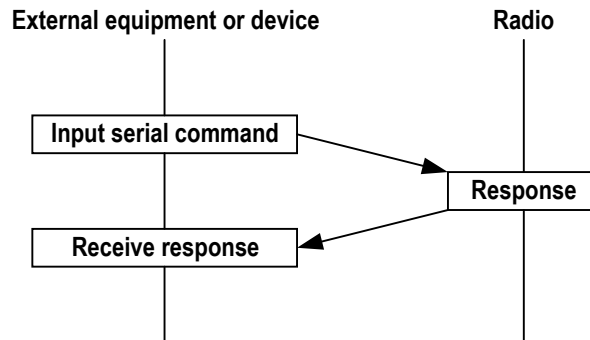
Byte2

ST	3 rd Byte (Check Sum)	SP
----	----------------------------------	----

Data Protocol

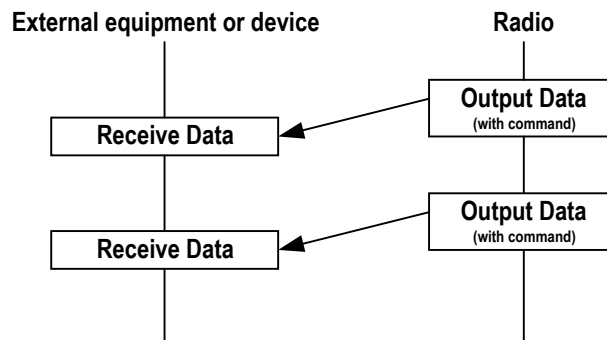
Protocol for input Serial command

Protocol of data transmission from external equipment or device (: PC) to radio :



Protocol for output data

Protocol of data transmission from radio to external equipment or device (: PC) :



Serial Commands

Transmit Command & data

	Mode	Transmit Command (BYTE0)	Transmit data(BYTE1)	Check sum(BYTE2) : Transmit Command + data
1.	Channel Change	0x64	0x?? :Current channel	(0x64 + Channel)
2.	RTX Mode Send.	0x61	R(0x72) : Rx mode T(0x74) : TX mode	(0x61+0x72) (0x61+ 0x74)

3.	Scan Mode	From PC To Radio	0x62	F(0x46) : Scan Stop S(0x73) : Scan Start O(0x4F) : Scan Delete	(0x62+ 0x46) (0x62+ 0x73) (0x62+ 0x4F)
		From Radio To Pc	0x66	0x00 : 1 Channel 0x01 : 2 Channel 0x02 : 3 Channel 0x0f : 16 Channel	0x66 + 0x00 0x66 + 0x01 *Only for Unmute Channel, Correct Call Channel
		Error Message	0x65	<ul style="list-style-type: none"> ● It is occurred when Scan Delete command comes except for Busy/Correct Call ● It is occurred when PTT key is pushed except for Busy/Correct Call. ● It is occurred when channel change command exists during Scanning. 	
4.	GPS Initialize	0x63	0x00 : GPS Disable 0x01 : GPS Enable	(0x63+ 0x00) (0x63+ 0x01)	
5.	Mode Entrance	0x60	0x01	0x60 + 0x01	

Receive Command & data

	Mode	Transmit Command (BYTE0)	Transmit data (BYTE1)	Check sum(BYTE2) : Transmit Command + data
1	Process Complete	0xaa	ACK	
	Commands	0x55	NACK	

Note)

This command is return signal for receiving command.

If Byte2 and sum of Byte0 and Byte1 among received data are same, Radio would send ACK data and execute command. If not, Radio sends Nack data.

User would go into next step if receives ACK data. If user receives Nack data, user should send command again.

example) If user changes from 1st Channel to 2nd Channel,

User should send Channel Change Command (0x64,0x02 , (0x64 + 0x2)) to Radio.

If Byte2 and sum of Byte0 and Byte1 among received data are same, Radio sends ACK data to user and changes to 2nd channel. If not, Radio would send Nack data.

Status indicators and audible alert tones

Your SD-160 series data radio has a sophisticated microprocessor control which provides a range of LED displays. LED displays operation mode, current status of radio, warning, and etc. Moreover, if you connect Speaker filtered OUT (Pin 9 of DB-15 connector) to the external speaker, you can hear audible tones at the following conditions:

- Attempt to transmit on a channel that is already in use when busy channel lockout has been programmed into the radio
- Transmission time has exceeded time-out timer programmed length
- When the other group or people finished transmission using repeater

See the status indicators and audible alert tones chart for full details.

STATUS	DESCRIPTION	LED COLOR	AUDIBLE TONE
NORMAL	POWER ON	-	
	Busy Channel	Yellow	
	Correct Call	Green	
	Transmit	Yellow	
	Transmit Not Allowed		
SCANNING	Normal Scan Mode	Green LED Flash	
	Scan Delete	one times Red LED	
	Scan All Delete	Two times Red LED	
WARNING	Busy Channel lockout	two times Green LED	Single Beep Tone
	Time out Time	one times Green LED	
	Before 5S T-O-T	one times Green LED	Single Beep Tone
	EEPROM Error	one times Yellow LED	
	Unlock	Four times Yellow LED	
	Communication error with Modem MCU	Green LED flash	
	Transmit Hang on time	-	Single Beep Tone
	At transmission, if Audio sound is not heard or Modem is not placed	Two times Green LED	

PROGRAM	Read Mode	Red LED flash	
	Write Mode	Green LED flash	
AUTO TEST		Yellow	
SQUELCH PROGRAM MODE	Open Squelch Mode	three times Green LED	
	Close Squelch Mode	Two times Green LED	
	Save Squelch Mode	One times Green LED	
	Init Data Load	one times Green LED	

DB 15 PIN descriptions with input/output level

D-Type Pin No.	Function	Description	Signal Type	Input/ Output
1	Data modulation IN (Tx Mod)	Signal is directly injected to MOD through data low pass filter without pre-emphasis.	Analog signal 1KHz audio at 60% peak system deviation input level = 100 to 120mVrms	I/P
2	Data unfiltered OUT (RX disc)	Discriminator audio from the SD-160. This is the unprocessed AF signal prior to tone filtering and de-emphasis.	Analog signal 1KHz audio at 60% peak system deviation produces 200 to 300mVrms	O/P
3	PTT In (Tx Key)	Signal from the 'external device' to key the SD-160 transmitter. This line has an internal pull up resistor to +5V. Pulling the line to 0V turns on the transmitter. Note : If you installed option modem board, you can select RS-232 signal level by Jumper (CON407, Ⓢ) on the digital board.	TTL level 0V = Tx o/c = Rx RS-232 level (option) +12V = Tx -12V = Rx	I/P
4	Ground	Ground connection to chassis of the radio.	0V (Chassis)	
5	Serial Data Out (TXD)	Serial data output for radio control or program. It uses asynchronous data format.	TTL level	O/P
6	Busy (CD)	Logic level output from SD-160 to indicate whether a carrier is present or not Note : If you installed option modem board, you can select RS-232 signal level by Jumper (CON407, Ⓢ) on the digital board.	TTL level 0V = carrier 5V = no carrier RS-232 level (option) +12V = carrier -12V = no carrier	O/P
7	Microphone filtered audio IN	This signal is injected to the MOD at the point through audio-amplification, pre-emphasis and high pass filtering where sub-audio tone is mixed with audio.	Audio 1KHz audio at 60% peak system deviation input level = 6 to 8Vrms	I/P

8	Serial data IN (RXD)	Serial command or data input for radio control or program. It uses asynchronous data format.	TTL level	I/P
9	Speaker filtered OUT	Audio output from the audio amplifier. It's filtered by tone-filter, de-emphasis circuit.	Audio 1KHz audio at 60% peak system deviation produces Nominal 1Vrms @ 8Ω	O/P
10	Serial data IN for option modem	The Serial data to be transmitted is input to this pin. It's only available when option modem board is installed. Inputted data are modulated by modem IC and then injected to MOD. It uses asynchronous data format.	RS-232 level	I/P
11	Serial data Out for option modem	The recovered asynchronous serial data output from the receiver. It's only available when option modem board is installed. It uses asynchronous data format.	RS-232 level	O/P
12	Serial data busy for option modem (reserved)	To eliminate data loss according to buffer overrun of slave MCU's memory, it indicates buffer status.	RS-232 level	O/P
13	GPS data input	Data input for initial setting of GPS module. It follows NMEA 0183 format and uses asynchronous data format.	TTL level	I/P
14	DGPS data input	Data input for DGPS Correction of GPS module. It follows NMEA 0183 format and uses asynchronous data format.	TTL level	I/P
15	GPS data output	Position data output from the GPS module. It follows NMEA 0183 format and uses asynchronous data format.	TTL level	O/P

Modem for data communication

Descriptions

A new kinds of internal Option-Modem are applied to SD-160 series. One is FFSK modem and the other is GMSK modem.

The most obvious method of increasing the efficiency is to maximize the data signaling speed in the limited channel bandwidth. But, FSK has very wide transmission bandwidth requirement. To solve this problem, we will supply GMSK (Gaussian Filtered Minimum Shift Keying) internal option-board.

In the case of data, its frequency spectra conflict with sub-audio frequency spectra. So tone squelch system is not adaptable. If there is tone, only FFSK / MSK modem available and no GMSK modem is used.

Our internal Modem Option Boards consist of Slave MCU, Modem IC, and extra circuitry. This Option-Boards directly communicates with DTE (Data Terminal Equipment) to send and receive the meaningful data through the D-sub connector.

Communication between DTE and Option-Board

These modem option boards support only asynchronous communication between DTE and modem option boards to minimize loss of data during the transmission.

Your dealer will help you define a TX On/Off Delay time, RX On Delay time, Baud Rate, Modem Enabled, Modem Baud Rate, RTS Control Mode, and Test Mode.

Chart for modem speed

Data transmission speed for FFSK Modem

UART Baud Rate of DTE (BPS)	Channel Space	Modem Baud Rate (BPS)
1200	Narrow (12.5KHz)	1200
	Standard (25KHz)	1200
2400	Narrow (12.5KHz)	2400
	Standard (25KHz)	2400
4800	Standard (25KHz)	4800

Data transmission speed for GMSK Modem

UART Baud Rate of DTE (BPS)	Channel Space	Modem Baud Rate (BPS)
4800	Narrow (12.5KHz)	4800
	Standard (25KHz)	4800
9600	Standard (25KHz)	9600

Transmission GPS Data through Modem

If GPS option board is installed in SD-160 series data radio, you can obtain your position data through GPS data output of your radio (Pin 15 of DB-15 connector). Besides, you can transmit received GPS data to the other radio or base station through modem if you install modem board with GPS board.

Your dealer will help you install GPS option board and define related parameter set-up.

Option board pin-out chart

FFSK Modem Option board

Connector No.	Pin No.	Function	Description	Input/ Output
Connector 1	1	VCC	6V to 12V Power Input	I/P
	2	GND	Ground	
	3	PTT	Signal from the digital board to transmit data key the SD-160 transmitter	I/P
	4	TXD_EN	It ensures that the radio has stabilized in transmission before the data is processed for modulation.	I/P
	5	TX_END	To finish transmission, it indicates memory buffer of Master MCU of digital board is empty.	O/P
	6	MUTE (Busy)	Logic level input from digital board to indicate whether a carrier is present or not	I/P
	7	CORRECT_CALL	It indicates that received signal has wanted tone or code if you apply tone squelch.	I/P
	8	POWER_SAVE	Power save input for modem board.	I/P
	9	CMD_EN	It indicates that command for Modem programming is effective.	I/P
	10	CMD_IN/OUT	Data Input and Output for Modem programming.	I/P, O/P
	11	CMD_CLK	Clock Input for Modem programming.	I/P
	12	MODEM_SEL	It Indicates modem type to Master MCU for programming.	O/P
	13	RX_IN	The FFSK/MSK signal input for the receiver of modem IC.	I/P
	14	TX_OUT	The FFSK/MSK signal output when the transmitter is enabled.	O/P
Connector 2	1	Serial_IN	The Serial data to be transmitted is input to this pin.	I/P
	2	Serial_OUT	The recovered asynchronous serial data output from the receiver.	O/P
	3	Busy	To eliminate data loss according to buffer overrun of slave MCU's memory, it indicates buffer status.	O/P

	4	Carrier_Detect	Handshake signal for RTS control mode. It indicates whether Slave MCU of modem has decoded data or not.	O/P
	5	PTT_IN	Handshake signal for RTS control mode. It requests data transmission to Slave MCU of modem.	I/P
	6	PROGRAM	It's reserved input for firmware upgrade.	I/P

GMSK Modem Option board

Connector No.	Pin No.	Function	Description	Input/ Output
Connector 1	1	VCC	6V to 12V Power Input	I/P
	2	GND	Ground	
	3	PTT	Signal from the digital board to enable transmitter circuit of modem board.	I/P
	4	TXD_EN	It ensures that the radio has stabilized in transmission before the data is processed for modulation.	I/P
	5	TX_END	To finish transmission, it indicates memory buffer of Master MCU of digital board is empty.	O/P
	6	MUTE (Busy)	Logic level input from digital board to indicate whether a carrier is present or not	I/P
	7	N/C	Not Connected	
	8	POWER_SAVE	Power save input for modem board.	I/P
	9	CMD_EN	It indicates that command for Modem programming is effective.	I/P
	10	CMD_IN/OUT	Data Input and Output for Modem programming.	I/P, O/P
	11	CMD_CLK	Clock Input for Modem programming.	I/P
	12	MODEM_SEL	It Indicates modem type to Master MCU for programming.	O/P
	13	RX_IN	The GMSK signal input for the receiver of modem IC.	I/P
	14	TX_OUT	The GMSK filtered Tx output signal.	O/P
Connector 2	1	Serial_IN	The Serial data to be transmitted is input to this pin.	I/P
	2	Serial_OUT	The recovered asynchronous serial data output from the receiver.	O/P

	3	Busy	To eliminate data loss according to buffer overrun of slave MCU's memory, it indicates buffer status.	O/P
	4	Carrier_Detect	Handshake signal for RTS control mode. It indicates whether Slave MCU of modem has decoded data or not.	O/P
	5	PTT_IN	Handshake signal for RTS control mode. It requests data transmission to Slave MCU of modem.	I/P
	6	PROGRAM	It's reserved input for firmware upgrade.	I/P

GPS Option board

Pin No.	Function	Description	Input/ Output
1	VCC	6V to 12V Power Input	I/P
2	VBAT		
3	ENABLE		I/P
4	PSAVE		I/P
5	GND	Ground	
6	GPS_OUT		I/P
7	DGPS_IN		
8	GPS_IN		I/P
9	+5V		I/P

Compatible accessory list

ACC-513 9600 baud GMSK modem

ACC-514 4800 baud FFSK modem

ACC-515 GPS receiver

ACC-160 GPS antenna

ACC-516 PCB Interface - used to separate digital and RF board for alignment.

ACC-916 Personality programming software.

ACC-2016 Individual programming cable

ACC-2160 Test jig box