ACC-513 / ACC-514

(GMSK / FFSK Modem for SD-160 Series)

Technical Manual

Rev 0.0
Jul./23/2003
Maxon Telecom Co., Ltd

Contents

1. Introduction

The ACC-513 and ACC-514 are internal option-modems, which are applied to the SD-160 series to increase capability for data application. The goal of an internal modem is to improve the efficiency for data transmission and provide maximum flexibility for user application. The most obvious method of increasing the data efficiency is to maximize the data signaling speed in the limited channel bandwidth. But, FSK, called direct FM modulation, has a very wide transmission bandwidth requirement. To solve this problem, a GMSK(Gaussian Filtered Minimum Shift Keying) internal option-board can be used

Generally a data application can not be directly applied in an audio system (Voice) Because of its spectra characteristic. The spectra of data has a wider and bandwidth than audio. So, a direct application of data is not matched with audio system (Voice) and its application. For instance, if a sub-audio(Tone) SQ system is applied to a data application, its data frequency spectra will conflict with that of sub-audio tones. Moreover, the inputted data is filtered by the audio filter resulting in a broken data transmission. To overcome these problems and provide maximum flexibility, an FFSK(Fast Frequency Shift Keying) internal option-board modem can be used.

Our internal modem option boards consist of a Slave MCU, Modem IC, and extra circuitry. These option-boards directly communicate with DTE (Data Terminal Equipment) to send and receive the meaningful data through the DB-15 connector to the digital board of the SD-160. These modems are designed to accept RS232 serial data format and are also capable of high speed wireless data-transmission between two or more devices. To cope with various applications the SD-160 can be controlled by automatically or manually. In automatic control the SD-160 will transmit simply by automatically sending data. The data to be transmitted is automatically stored while the transmitter is turned on. Before the data is transmitted, a preamble sequence is transmitted to synchronize the receiving modem. The data is placed in data blocks (packets) with header and end data information added. In manual control, when the SD-160 receives data from DTE, the data communication process is almost similar to the auto mode except that transmission is controlled by a control signal such as PTT or RTS.

2. Technical Specification

2.1. Specification for ACC-513

Modulation type	: Modified GMSK
Maximum RF Baud rate	: 4800 for 12.5KHz channel spacing and 9600 for 25KHz channel spacing (Programmable, see below table)
Data Sensitivity	: below –113dBm for 1 in 100 error rate
Method for elimination of DC offset	: Data scrambling
Data input/output	: RS232
RS232 Baud input rate	: follow the RF Baud rate (see below table)
Number of Data Bit	: 8 bits
Parity	: None
Number of Stop Bit	: 1 bit
Data flow control	: None, Software(Xon/Xoff), Hardware(RTS/CTS) (Programmable)
Tx forcing mode	: Configures the modem to transmit regardless of squelch state
Data Block (Packet) size	: Programmable from 16bytes to 8192bytes by multiple of 16bytes increments. To provide maximum flexibility, the packet doesn't include additional bits for error detection and correction. We recommend that User adds their own methods for error detection/correction.

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

Table 2.1. Available Baud rate for GMSK modem

2.2. Specification for ACC-514

Modulation type	: FFSK
Maximum RF Baud rate	: 2400 for 12.5KHz channel spacing and 4800 for 25KHz channel spacing (Programmable, see below table)
Data Sensitivity	: below –110dBm for 1 in 100 error rate
Mark /Space tone freq. (for each available RF Baud rate)	: 1200Hz (M) / 1800Hz (S) at 1200bps 1200Hz (M) / 2400Hz (S) at 2400bps 2400Hz (M) / 4800Hz (S) at 4800bps
Data input/output	: RS232
RS232 Baud input rate	: follow the RF Baud rate (see below table)
Number of Data Bit	: 8 bits
Parity	: None
Number of Stop Bit	: 1 bit
Data flow control	: None, Software(Xon/Xoff), Hardware(RTS/CTS) (Programmable)
Tx forcing mode	: Configures the modem to transmit regardless of squelch state
Data Block (Packet) size	: Programmable from 16bytes to 8192bytes by multiple of 16bytes increments. To provide maximum flexibility, packet doesn't include additional bits for error detection and correction. We recommend that the User adds their own methods for error detection/correction.

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

Table 2.2. Available Baud rate for FFSK modem

3. Installation of ACC-513/ACC-514

To install ACC-513/ACC-514 into the SD-160, this section explains step-by-step of how to disassemble the radio, install the ACC-513/ACC-514 and reassemble the radio.

Important

Before disassembling and reassembling the radio, wear a conduction wrist strap to prevent any components on its main board from being damaged by electrostatic discharge.

Opening the Upper Cover :

1. Unfasten the four mounting screws located on the bottom cover of the radio.

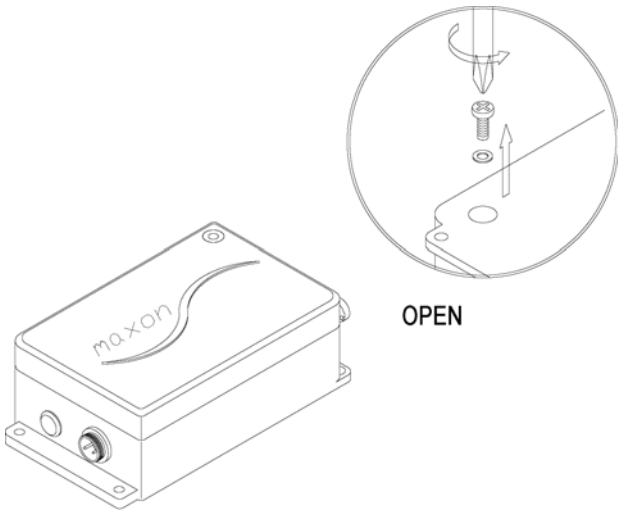


Figure 3.1. Loosing the four mounting screws

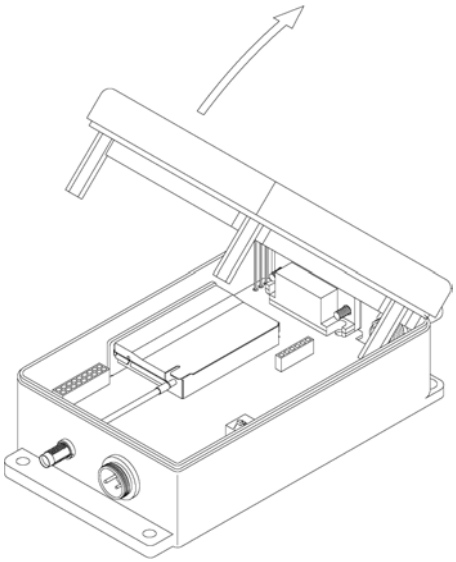


Figure 3.2. Opening the upper cover

2. Open slowly the upper cover from the side of power connector.

Caution : Do not open the upper cover from the side of DB-15 connector

Installation of ACC-513/514 :

1. Align 6-pin Header of ACC-513/514 to 6-pin socket on digital B'D and then push header into socket

2. Align the 14-pin Molex female connector of ACC-513/514 to its male connector on the digital B'D.

3. Attached the ACC-513/514 to the digital B'D by pushing down.

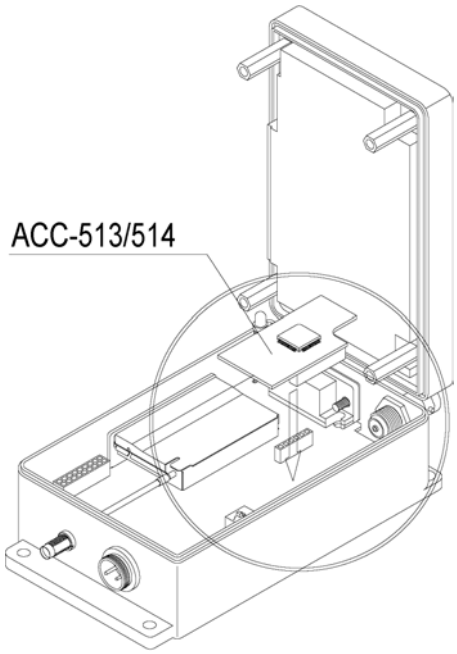


Figure 3.3. Alignment of ACC-513/514

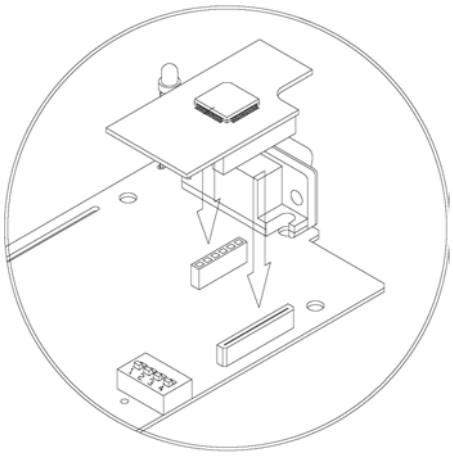


Figure 3.4. Enlarged drawing

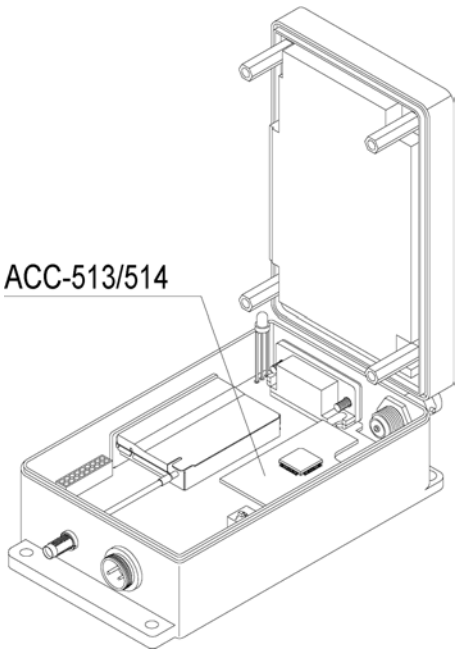
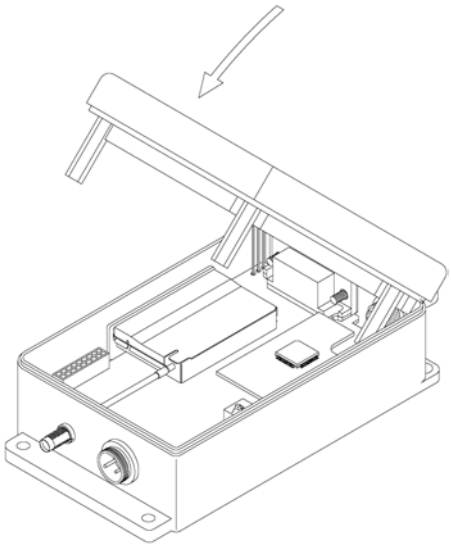


Figure 3.5 Installation of ACC-513/514



Closing the Upper Cover :

1. Align the upper cover with the bottom cover.
2. Close the upper cover.

Figure 3.6. Closing the upper cover

3. Screw down the bottom cover of the radio.

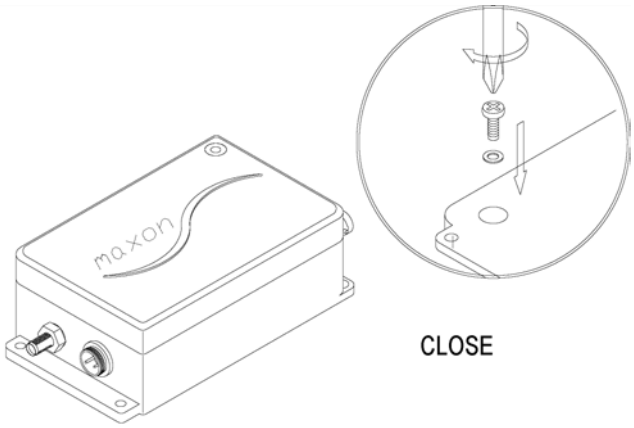


Figure 3.7. Inserting the four mounting screws

4. System Application

The SD-160 is a flexible data radio transceiver intended for a wide variety of applications. The basic radio data applications may be divided into several categories, examples of these are :

- Point to point telemetry (Data logging system)
- Tele-command and tele-control to / from outstations or machinery
- Automatic irrigation system
- Job allocation and status reporting
- Automatic location reporting / polling

Typical function specific systems may include the following :

4.1. Fixed applications

1. Control point to multiple outstation tele-control. Used for control and exception reporting in water pumping stations and other similar situations. (See Figure 4.1.)

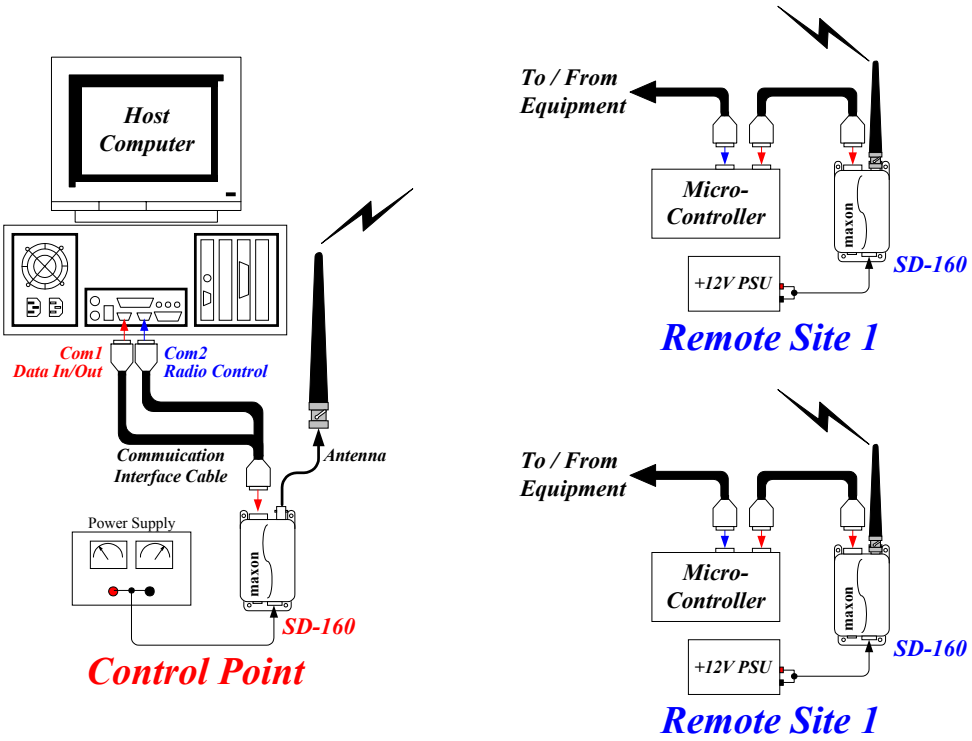


Figure 4.1. Tele-control Application

2. Point to point telemetry using FFSK or GMSK modulation with RS232 control via a micro-controller. User applications for this may include remote control data links such as control of a remote paging transmitter or single direction status reporting or data flow (see Figure 4.2.) from a gas pipeline monitoring station.

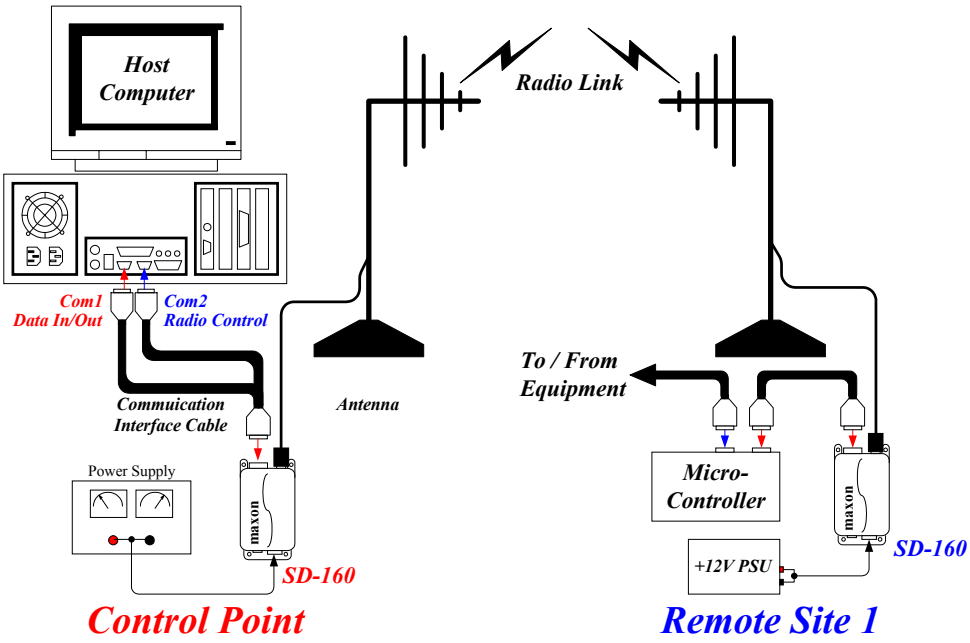


Figure 4.2. Telemetry Application

3. Multiple remote sites to control irrigation system (see Figure 4.3.)

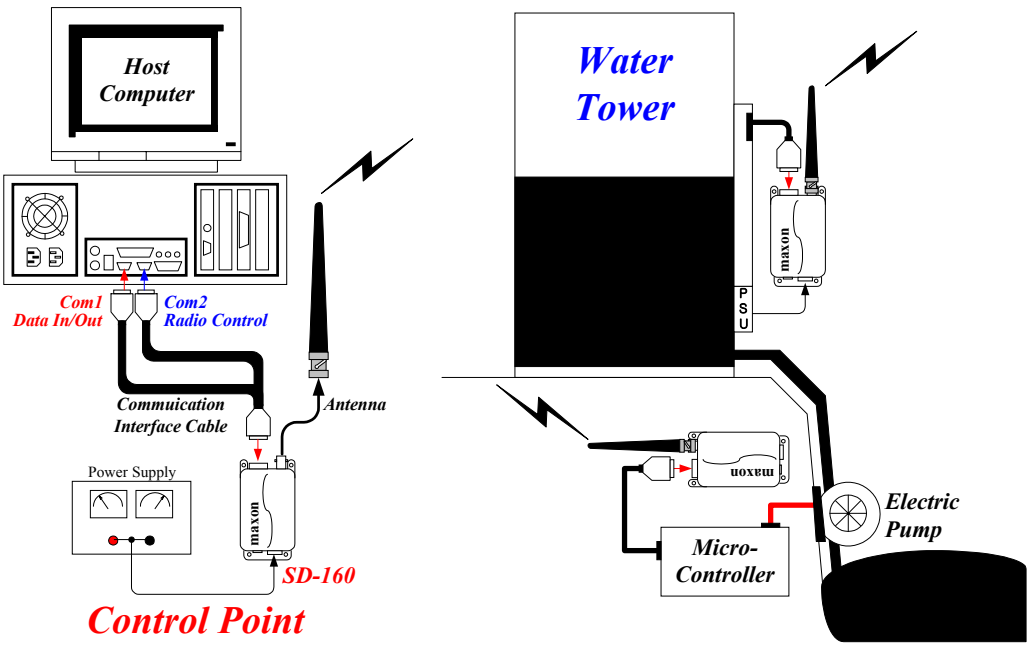


Figure 4.3. Irrigation equipment control Application

4.2. Mobile Applications

4. Local area mobile system for job allocation and status reporting to and from taxis. (see Figure 4.4).

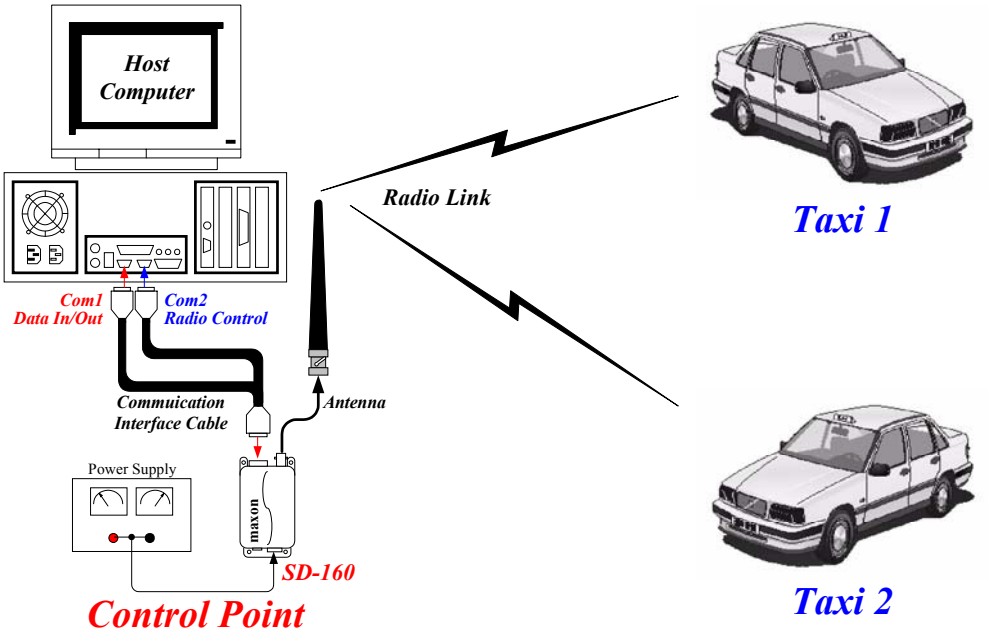


Figure 4.4. Job allocation and status reporting Application

5. Marine data communications for ports / harbors and inland waters allowing GPS navigation information to be relayed from vehicle or vessel to a control point.

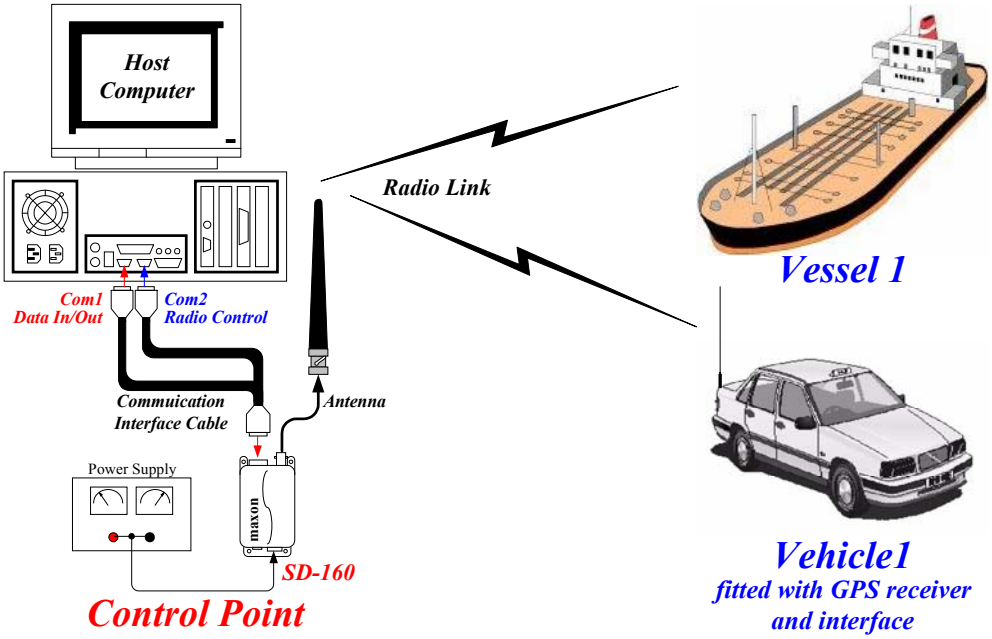


Figure 4.5. Vehicle / Vessel Data Application

5. Operation

By applying an ACC-513 or ACC-514 to the SD-160, which is intended to be used as a radio data-generating device utilizing GMSK or FFSK type modulation. There is also a facility, called Micro-controller Unit, to control your overall application, including the radio, and to handle data to transmit or receive. The radio is controlled through the DB-15 connector and interfaces with a DTE by interface cable.

In operation, the radio is placed into the transmit condition by receiving data from DTE. If the radio receives data, the slave MCU of the ACC-513/514 saves that data in its memory and automatically creates a PTT signal at the same time to get the RF stage to prepare for transmission. To avoid data loss in transition time of the RF stage, it is important that there is a delay between activating the PTT signal and applying the data to the RF stage. In these processes, there are many tunable parameters, which will be explained in the next section, to provide maximum performance for user application.

This section describes the basic connection for data transmission or radio control and then explains important parameters for data transmission.

5.1. Serial interface

In some systems, where data is required to be inputted to a SCADA system or simple PC logger, the most useful receiver output will be the RS-232 serial stream. Any system using serial data output will also require DTE(Data Terminal Equipment) such as a PC, or workstation driver package, or PDA, to display the data and upload it into a host process. So, To interface with these external equipment, the SD-160 contains a 15 pins D-sub female connector. The serial interface is configured as DCE with the pin out shown in the table below.

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	Signal from the 'external device' to key the	TTL level	I/P

	(Tx Key)	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.**	0V = Tx o/c = Rx RS-232 level (option) +12V = Tx -12V = Rx	
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 the SD-160 to indicate whether a carrier is present or not **Note : If you installed an option modem board, you can select RS-232 signal level by Jumper (CON407, ❼) 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

Table 5.1. Pin Description for DB-15 female connector of SD-160

The serial protocol supported by the ACC-513/514 is fixed at 1 start bit, 8 data bits, 1 stop bit and no parity. Flow control can be selected as either hardware (RTS/CTS), software (XON/XOFF) and none. The serial baud rate is also user configurable and supports the following rates: 1200, 2400, 4800, 9600bps.

According to your application, SD-160 can be connected with one or two serial communication port of control the unit an through interface cable. Normally, the DB-15 connector of the radio is connected with one communication port of the control unit to transmit or receive data. But, if you wants additional control such as channel change, one more communication port is needed to control the radio through serial command. Figure 5.1. shows an interface cable for data communication and its inner connection. In the connection, red lines, pins 3, 6 and 12 on the SD-160 are the minimum required connection to transmit and receive RS-232 data, and blue lines, pins 4,10, and 11 on the SD-160 are additional connection for handshaking. In Figure 5.2., additional connection for radio control is added, which needs RS-232 driver to connect the RS-232 serial port because the radio control signal uses a TTL level to provide compatibility with former system. Detailed interface information and its use are given in next section.

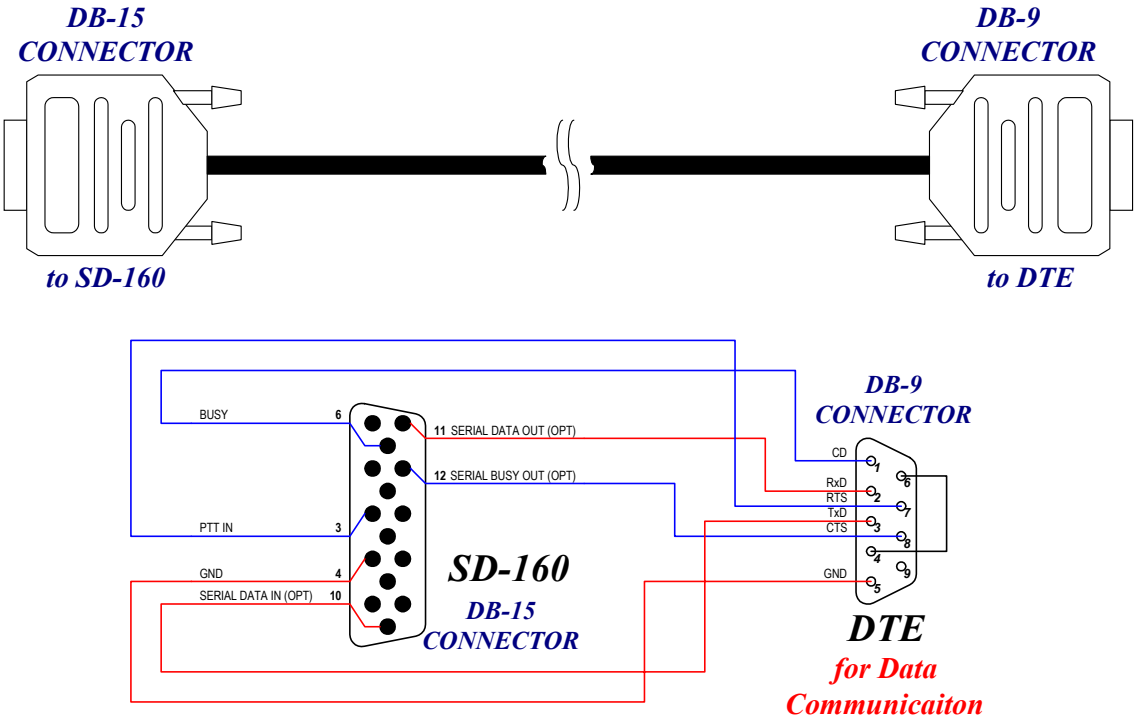


Figure 5.1. Interface cable for data communication and its inner connection

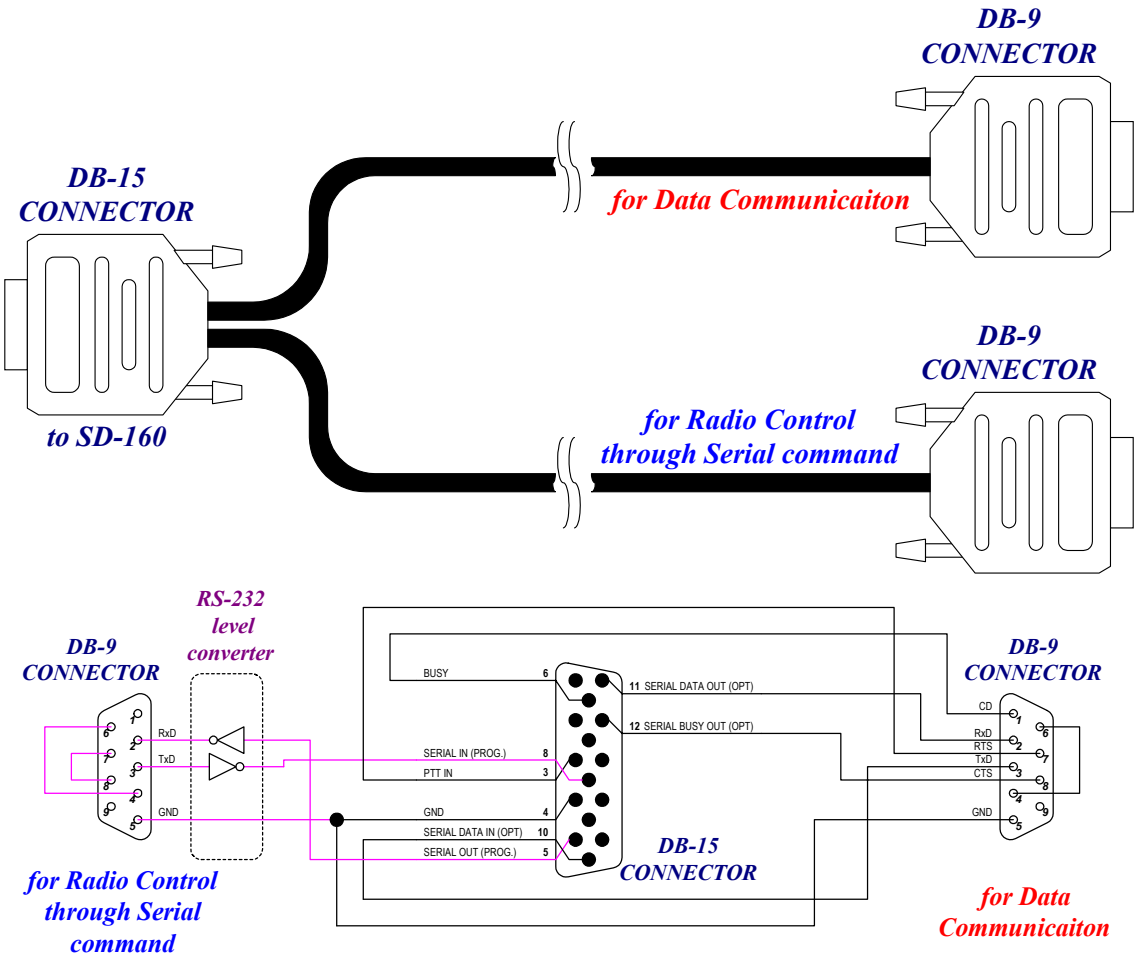


Figure 5.2. Interface cable for data communication and radio control

5.2. Configuring the SD-160

In case of mobitex application, which is an international and open standard for dedicated wireless data for professional users, all timing is decided by recommendation of network system. But, this radio does not use a specific network system. For this reason, timing parameters will be tuned by the user to fit their own system realization.

5.2.1. Data Transmission (Tx)

If the SD-160 receives data from a DTE, the Master MCU of the SD-160 will get RF stage to prepare for a transmission. In this case, proper timing is required to stabilize the RF stage (ex. PLL lock time, Power-up time, and etc.). To prevent data loss, inputted data will be saved in the internal memory, called a buffer, in the slave MCU of

the modem option board by the completion of the RF stabilization. The model contains tunable value for this period of time, which the user can adjust these timings into their system within the limited range. Especially, “Tx On delay” and “Tx Off delay” which are important timing parameters in the transmitter. (see Figure 5.3.)

Tx On delay : The period of time for transmitter’s stabilization before the data is processed for modulation.

Tx OFF delay : The period of time for avoidance for cutting off the tail end of the data bit stream.

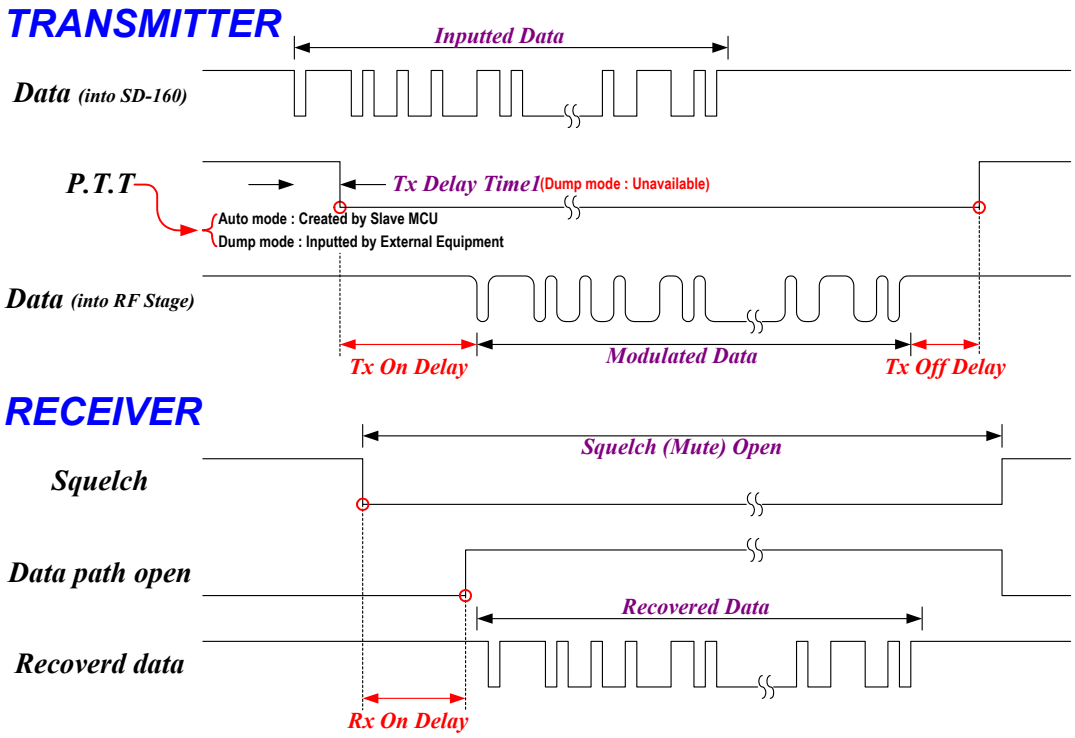


Figure 5.3. Timing parameters in data transmission

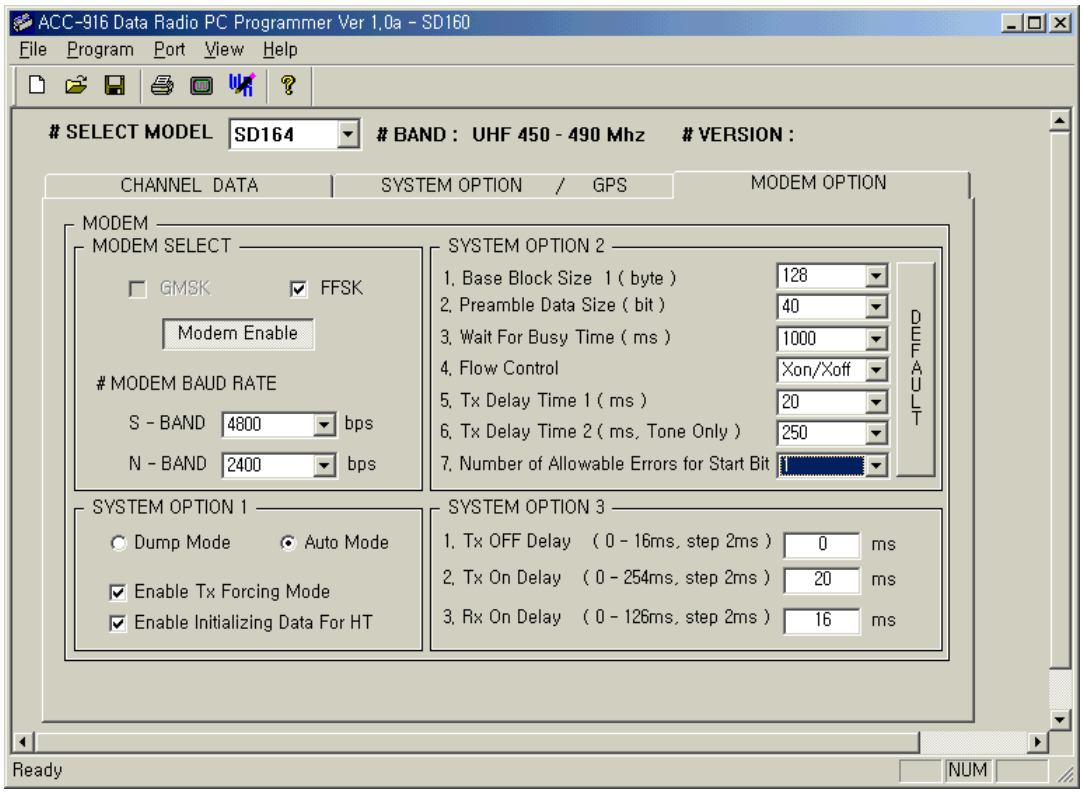
5.2.2. Data Reception (Rx)

If the Slave MCU receives a Rx_ready signal from the Master MCU, the Slave MCU on the modem option board will get the Modem IC to prepare to receive data, at the same time, the Master MCU releases a Busy detecting signal through the DB-15 Connector. Before receiving data, the Modem IC or receiver should be synchronized by a

transmitted preamble sequence. To prevent synchronization by unwanted signal, a time delay, called “Rx On Delay”, is needed between squelch open (the point of busy detection) and data signaling path to Modem (see Figure 5.3.). If insufficient preamble code is released from another radio, data loss will occur by missing synchronization. So, a minimum period of time is required for synchronization, this is given by modem IC specification and you can adjust this value within the limited range. Detailed other parameters for ACC-513/514 will be given in the next section.

6. Understanding Modem Option

In this section, explanation of modem options in ACC 916, PC Programmer is given. The modem option consists of four groups, MODEM SELECT, SYSTEM OPTION 1,2 and 3. In MODEM SELECT, the type of modem and modem speed for channel space are selectable and in SYSTEM OPTION1, transmission mode of radio and functions of forcing TX and initializing Hyper Terminal are chosen. In SYSTEM OPTION 2, options for R/TX data format and its processing is selectable. In SYSTEM OPTION3, On/OFF delay time for R/TX is inputted.



6.1. Modem Select

a. GMSK/FFSK

You can select modem type (GMSK/FFSK). Mark on check box.

b. Modem Enable/Disable

If you want to use modem, click on <Modem Enable> Button.

c. Modem Baud Rate

Modem	Channel Space	Baud rate
GMSK (ACC-513)	Standard (25KHz)	9600 bps
		4800 bps
	Narrow (12.5KHz)	4800 bps
FFSK (ACC-514)	Standard (25KHz)	4800 bps
		2400 bps
		1200 bps
	Narrow (12.5KHz)	2400 bps
		1200 bps

Table 6.1. Available Modem Baud Rate

In above cases, Modem speed is selectable.

6.2. System Option 1

a. Auto Mode

The radio will be automatically controlled by existence of inputted data from a DTE. There is no need for the user to be concerned with operation of the radio. The SD-160 will transmit simply by sending data.

b. Dumb Mode

The Radio should be controlled by user application, manually. For instance, to transmit data, you should input PTT(RTS) signal besides assigned data. Moreover, in control of the radio, exact timing should be defined by you. This mode is only provided to give compatibility with existent radios.

c. TX Forcing Mode

During RX mode, when the Radio receives data from the DTE, if *TX Forcing Mode* Option is enable, the radio will transmit data. If disabled, the radio will not.

d. Initializing Data for HT (Hyper Terminal)

This is a strongly recommended option when using Hyper Terminal. In addition, you can check the version of the modem.

6.3. System Option 2

a. Base Block Size 1

This option is about the data size to be transmitted at one time. If data flow control is selected in Auto mode, radio will try handshaking after a transmission of assigned data. you can select the *Base Block Size1* according to communication conditions. Proper value is maximum data size to complete successful transmission without any error. Usually, under 128 byte (Default) is recommended. Detailed information is given in Section 7.4.

b. Preamble Data Size

This size of bit is for synchronization of the modem. At least 32 bits (Default) is recommended. Detailed information is given in Section 7.4.

c. Wait for Busy Time

After the radio transmits established data, the radio waits for a response signal. If there is no response signal, after this specified time elapses, next data will be transmitted, next data will be transmitted on receiving response signal. Normally, 1000ms (Default) is recommended.

d. Flow Control

There are three methods to control data. Under Auto Mode, you can select Xon/Xoff, RTS/CTS or NONE but in Dumb Mode, this is fixed to NONE. Detailed information is given in Section 7.1.

Software	:	Flow Control is controlled by Xon/Xoff code.
Hardware	:	Flow Control is controlled by RTS/CTS of RS-232
None	:	Radio does not use any Flow Control.

e. Tx Delay Time 1

In Auto Mode, to prevent frequent transmission due to irregular data input, this option allows for the radio to enter transmission mode after an assigned time. For your reference, frequent transmission spends too much time for its preparation such as PLL lock, Power-Up, stabilizing Power, and etc. So, it will degrade overall system performance. Usually, the SD160 series uses at least 20ms (Default).

f. Tx Delay Time 2

This is the required time to detect tone, and is only available for the FFSK Modem and channel with Tone (CTCSS/DCS). In case of SD160 series, 250ms (Default) is recommended.

g. Number of Allowable Errors for Start Bit

This option prevents the radio from receiving invalid data by an external disturbance. Consequently, the more unwanted signal the radio receives, the less selectable value you may select.

6.4. System Option 3

a. Tx Off Delay

If all assigned data is transmitted, after the transmission the Radio keeps the TX status during this period of time, TX stops. Normally, in case of the SD160 series, 0ms (Default) is recommended. Detailed information is given in Section 5.2.

b. Tx On Delay

Radio transmits data after elapsing this period of time since TX starts. In case of the SD160 series, 20ms (Default) is recommended. Detailed information is given in Section 5.2.

c. Rx On Delay

The radio enters RX status after elapsing this period of time since receiving the carrier. In case of the SD160 series, 16ms (Default) is recommended. Detailed information is given in Section 5.2.

7. Modem Operation Explained

This section explains each operating mode and details the modem serial pin connections. There are two types of modes, Auto and Dumb mode. In Auto mode, the radio is automatically controlled by existence of inputted data from a DTE. To avoid data overflow by limitation of the buffer memory due to continuous input, serial port data flow is controlled by the radio in communication with a DTE. In Dumb mode your application should control all these processes such as Tx preparation for the RF stage and handshaking. Basic pin connection types that can be used are a three, RXD, TXD and GND or five, RXD, TXD, GND, RTS and CTS signal line. RS232 is used according to flow control. In addition, the CD signal line can be utilized for your application.

7.1. Auto Mode

This mode is “intelligent” and removes the need for the user to understand how the radio system is used. The data to be transmitted is automatically stored while the transmitter is turned on and transmitted after finishing preparation for transmission. For this reason, there is nothing to do to as a user except inputting data to the radio. Even though there is a timing difference between inputted data from the DTE and transmitted data from the radio, applying flow control for this mode ensures that the transmit buffer does not overflow. This operating mode supports software, hardware and none flow control, and pin connections are changed according to the type of flow control used. The detailed instruction for flow control is the following.

7.1.1. Flow Control

The buffers in the radio modem and its flow control function permit serial communications even if the speed differs between the computer (DTE) and the modem DCE or between the radio modems (modem ports). If there is a speed difference between the serial port and modem port (DTE speed and radio throughput), the buffers in the radio modem may become full periodically. Therefore communications speed is controlled so that data transmission and reception is temporarily halted before the data exceeds the buffer capacity, and that transmission is resumed when the receiving buffers have room. This is the flow control function. The radio has two kinds of flow control:

- ◆ Software flow control
- ◆ Hardware flow control

7.1.2. Software flow control

This flow control function uses three wires, RXD, TXD and GND in RS232. When DCE is receiving data from DTE, to prevent received data from exceeding the buffer1 capacity in DCE, the DCE sends command of transmission halt request which is XOFF code to the DTE. When the buffer1 have room to receive data again, the DCE sends command of transmission request which is XON code to the DTE.

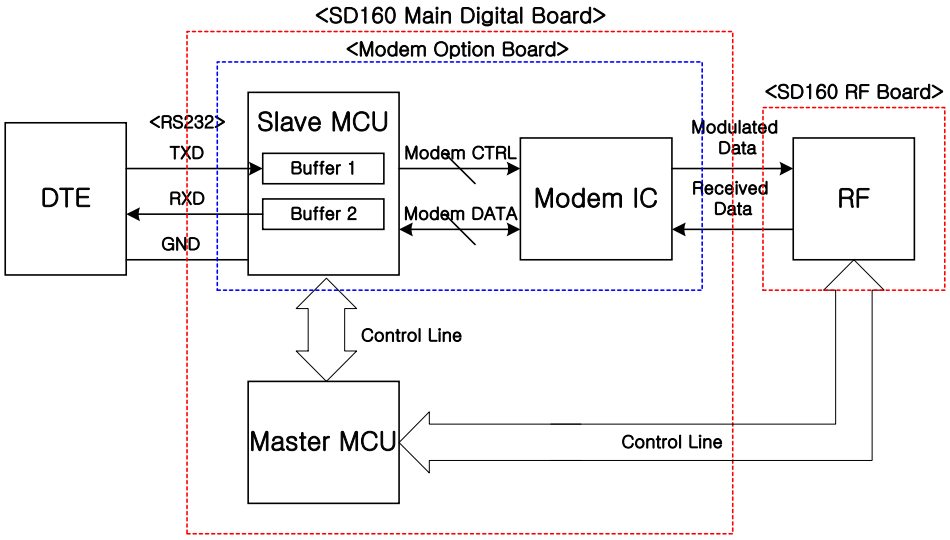


Figure 7.1. Data and Control signal flow in Software flow control

Pin connection

Configuration of pin connecting for software flow control is the following.

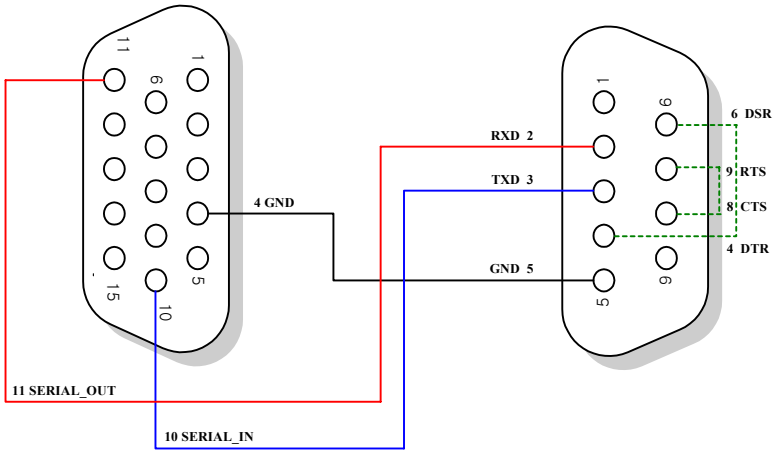


Figure 7.2. Pin connection for Software flow control

7.1.3. Hardware flow control

This flow control function is performed by using the control lines RTS(Request To Send), CTS(Cleat To Send), TXD, RXD and GND in RS232. When the DTE has data to

be transmitted, After the DTE sends RTS signal to the DCE, the DTE waits for a CTS signal from the DCE. If the DTE receives a CTS signal from the DCE, the DTE transmits data. When the DCE is receiving data from the DTE, to prevent received data from exceeding the buffer capacity in the DCE, the DCE sends command of transmission halt request that is the CTS signal to the DTE. When the buffers have room to receive data again, The DCE sends command of transmission request which is the CTS signal to the DTE.

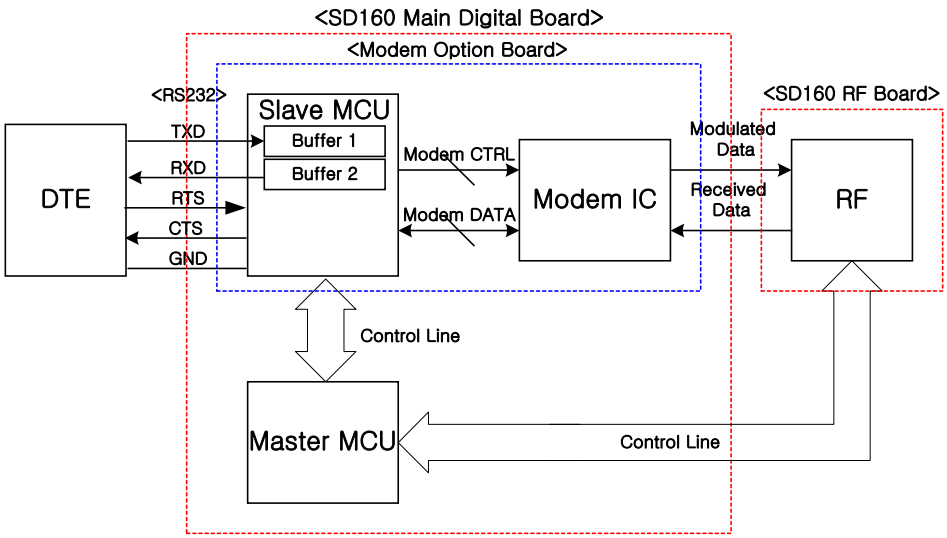


Figure 7.3. Data and Control signal flow in Hardware flow control

Pin Connection

Configuration of pin connecting for software flow control is the following

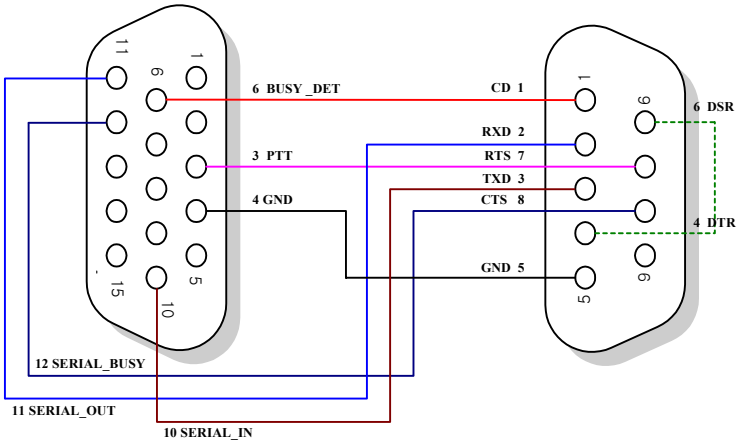


Figure 7.4. Pin connection for Hardware flow control

Hardware preparation

Change the jumper position of con407 as the following.

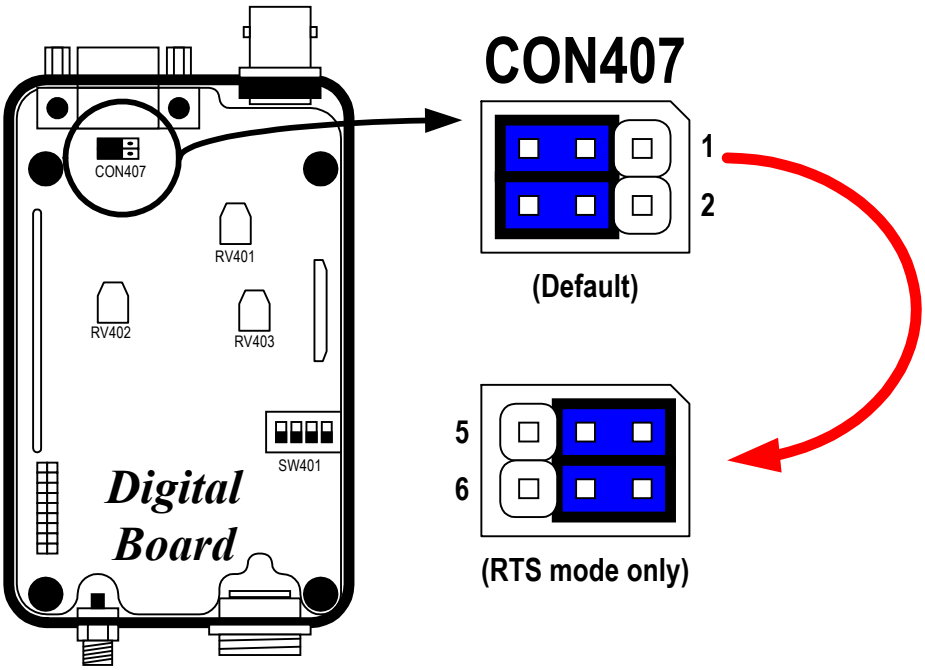


Figure 7.5. Hardware preparation for Hardware flow control

REMARK : RTS mode means the mode which uses RTS signal for radio control. The following modes use the RTS signal.

- ◆ Hardware flow control at Auto mode
- ◆ Dumb mode

7.1.4. None (No flow control)

Flow control between the modem and the DTE can be turned off altogether. With flow control disabled inputted data from the DTE will be continuously transmitted, but there is no protection offered by the modem to prevent its internal buffers from overflowing. If an overflow occurs within the modem, serial data is lost and the data transfer becomes corrupted. Transmission of limited data that has less size than available buffer memory of the Slave MCU of Modem should be used. Pin connection is the same as software flow control, handshaking is not used.

7.2. Dumb Mode

To give compatibility with existent radio, this mode is provided. In this mode, Standard Terminal Emulation programs, such as Procomm, can be used for communication between the SD-160 radios but the PTT/RTS line has to be controlled, manually, from another source.

NOTE : The Dumb mode will not transmit simply by sending it's data.

This operating mode uses 6wire cable like in hardware flow control and jumper position of CON407. If the DTE has data to transmit, the DTE applies a 2.5V high to the PTT/RTS line on pin 4 of the DB-15 connector, which will cause the radio disable the receive circuits and switch the transmitter on, and then release data to radio. This size of data to be released should be limited under size of the buffer memory of the slave MCU. After all assigned data is transmitted, the DTE returns RTS signal below -2.5V to complete the transmission. In other words, the RTS line is used like a conventional PTT line in this mode.

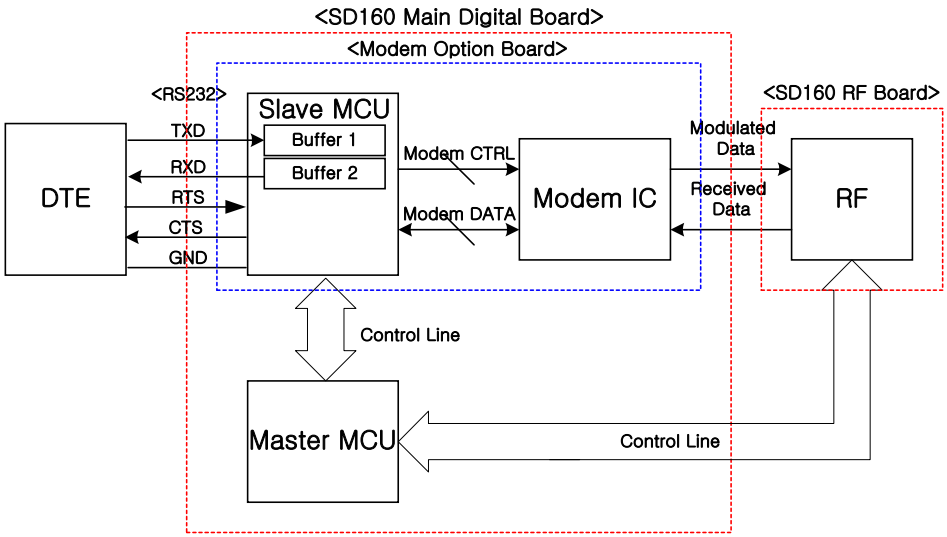


Figure 7.6. Data and Control signal flow in Dumb mode

7.3. Test Mode

This operating mode is simple transmission test. The radio transmits programmed data, "*Testing Maxon Modem ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789*", which exists in the internal memory of the modem. Refer to ACC 916 user manual for detailed instruction.

7.4. Operating Diagram

As show below, If the radio has data to transmit and has assigned data block size, when the radio transmits data as much as assigned data block size, if receiving radio receives this data, the radio transmits an Ack signal as indication of successful receipt, sequentially, next data will be transmitted. But if an incorrect receipt happens, an Ack signal will not be sent. In this case, the transmitting radio sends next data after elapsing a given period of time. Under this process, flow control occurs between the radio and the DTE when the radio receives data as much as the assigned data block size from the DTE.

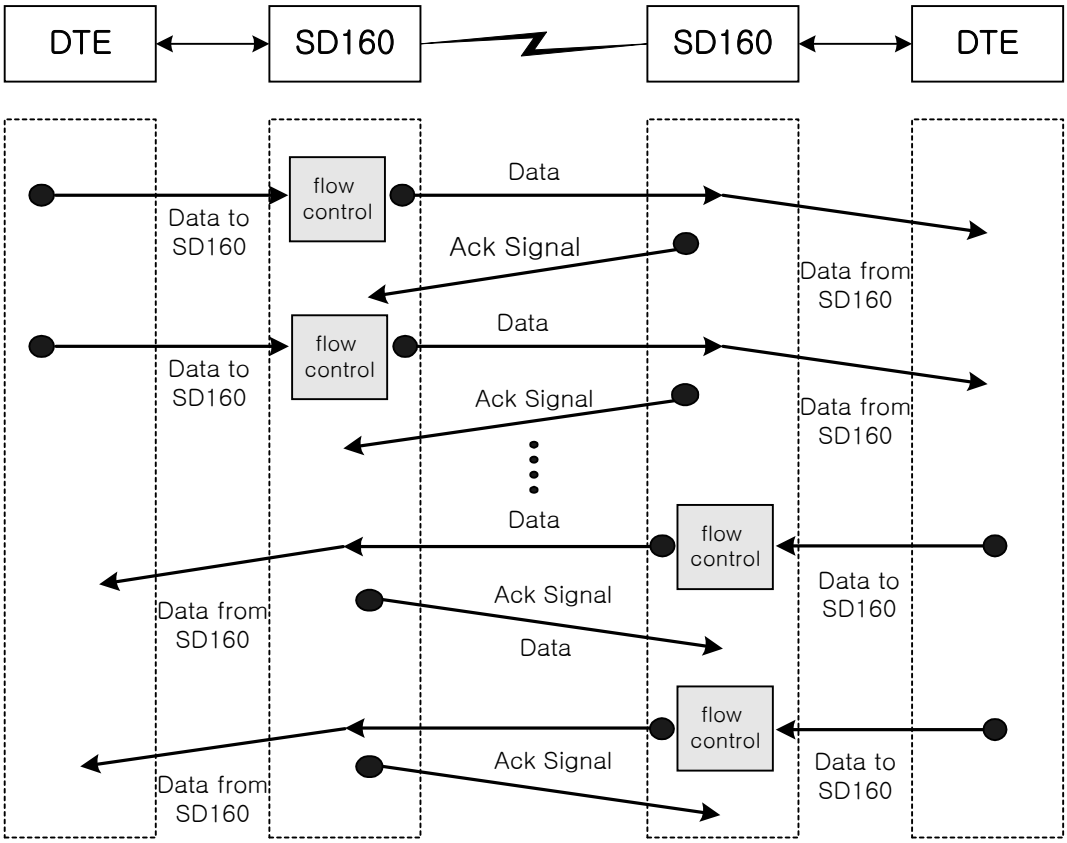


Figure 7.7. Data transmission and handshaking operation

Each data block is assembled with a preamble, ABDS, start data, data and end data. Detailed explanation is the following. The Preamble is data bits, which synchronize the modem IC in the receiving radio and the length of this data bit is selectable for your

application in ACC 916 programming software. 6 bits ABDS (Additional Bits to Detect Start data) is to detect more safely the start data. Start data is the beginning bits of valid data and if only these bits are matched with the assigned data bits, the following data is treated as valid. For your reference, maximum allowable error in this start data is 3 bits and is selectable in the ACC916 programming software. The size of Data is optional in the ACC 916 programming software. End data is the last bits of valid data and if no data is detected during a 16 bits interval, the modem terminates to receive valid data.

ABDS : Addtional Bits to Detect Start data

Figure 7.8. Data block for transmission

8. Example of Operation Test

In this section, to help you understand the operation of the radio, a simple example using an operating test application program such as Hyper Terminal is explained Part 8.1 is an example using Hyper Terminal, GMSK modem, modem speed of 9600bps and software flow control.

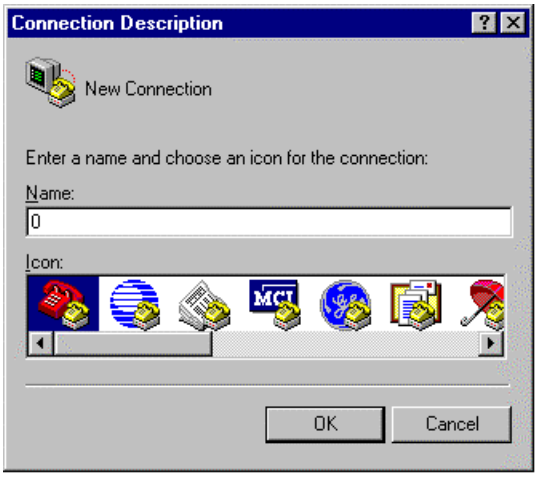
8.1. Example of using Hyper Terminal.

8.1.1. Preparation

Setting up the Hyper Terminal for test examples.

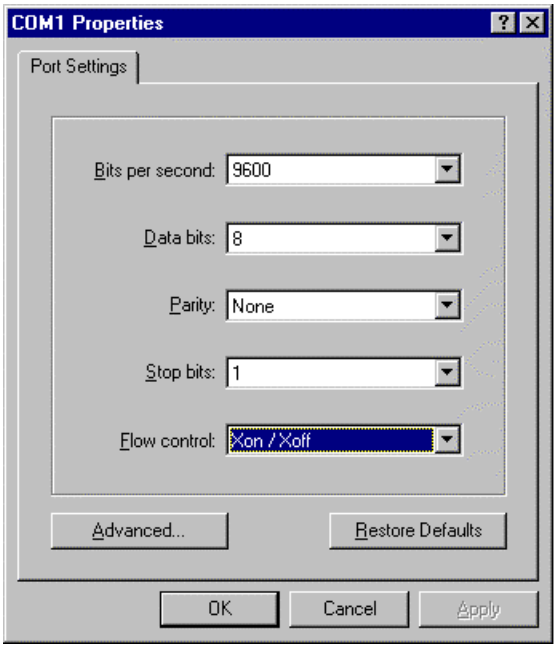
a. Execute Hyper Terminal program. Opening window will appear.

b. After input of name, Click OK.

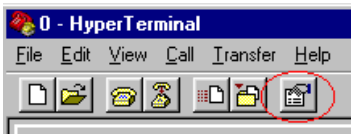


c. Select Com Port1, Click on ‘OK’

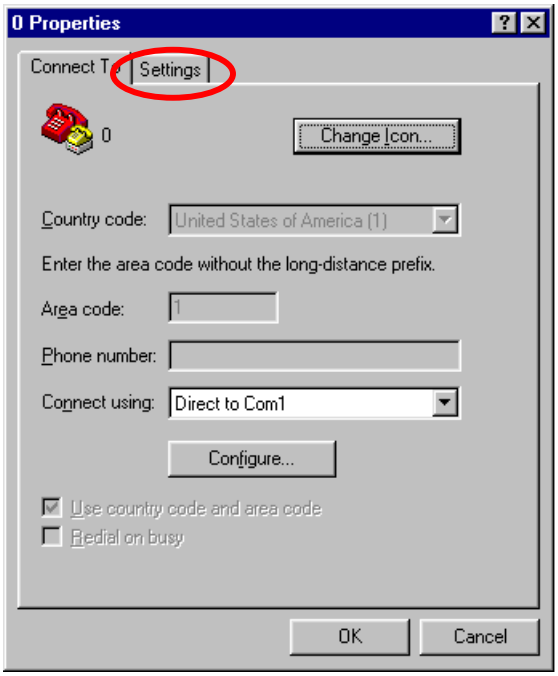
d. Select the detail of Com1 port, 9600bps, 8 bits of Data bits, None of Parity, one bit for Stop bits and Xon/Xoff for Flow control and then click the “OK” button.



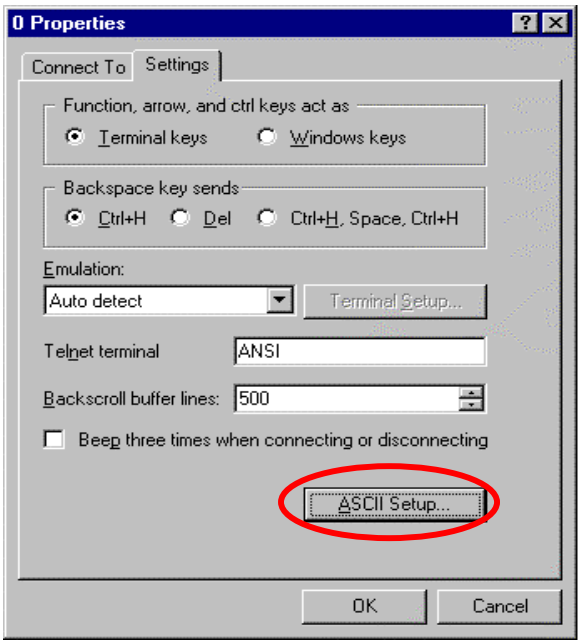
e. Main window appears, click Icon inside red circle.



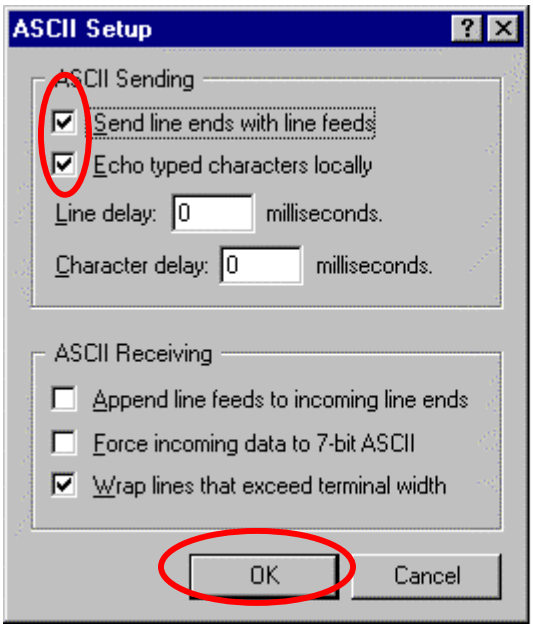
f. Click the “Settings” tab button.



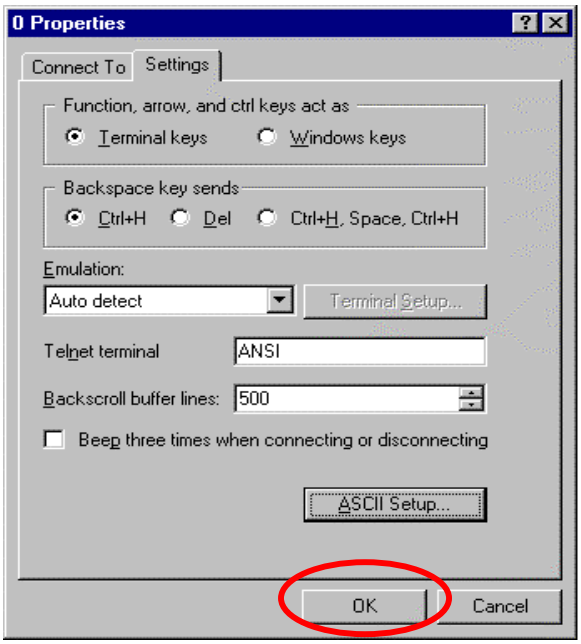
g. Click the “ASCII Setup” button.



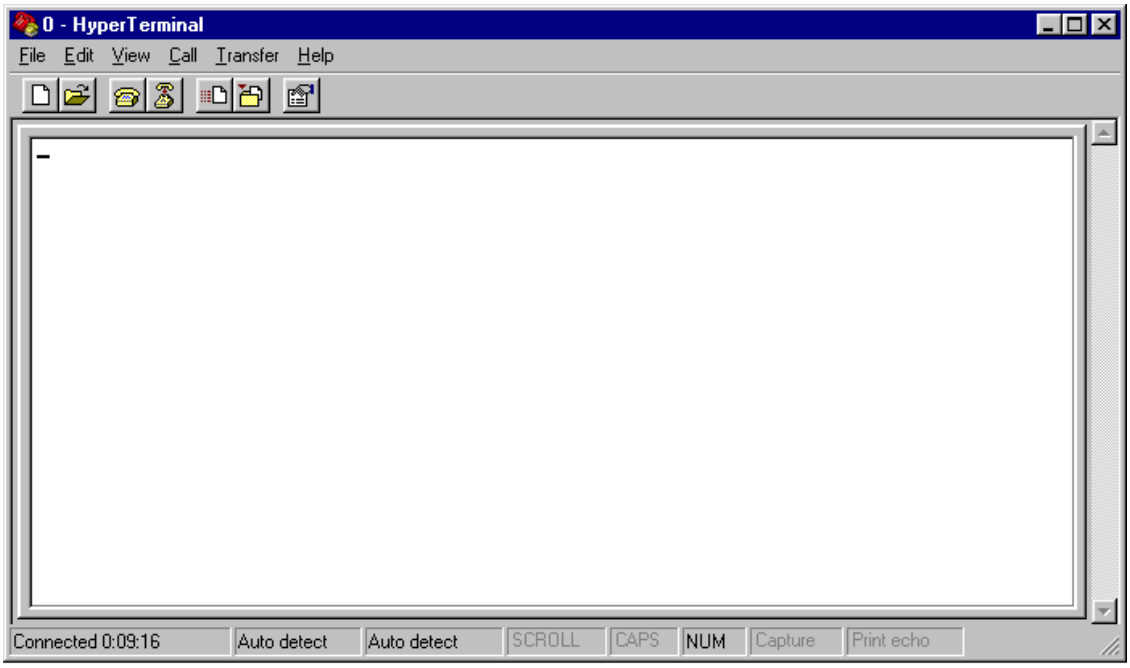
h. Check “Send line ends with line feeds” and “Echo typed characters locally” and click the “OK” button.



i. By clicking the “OK” button, the software escape from the properties window.



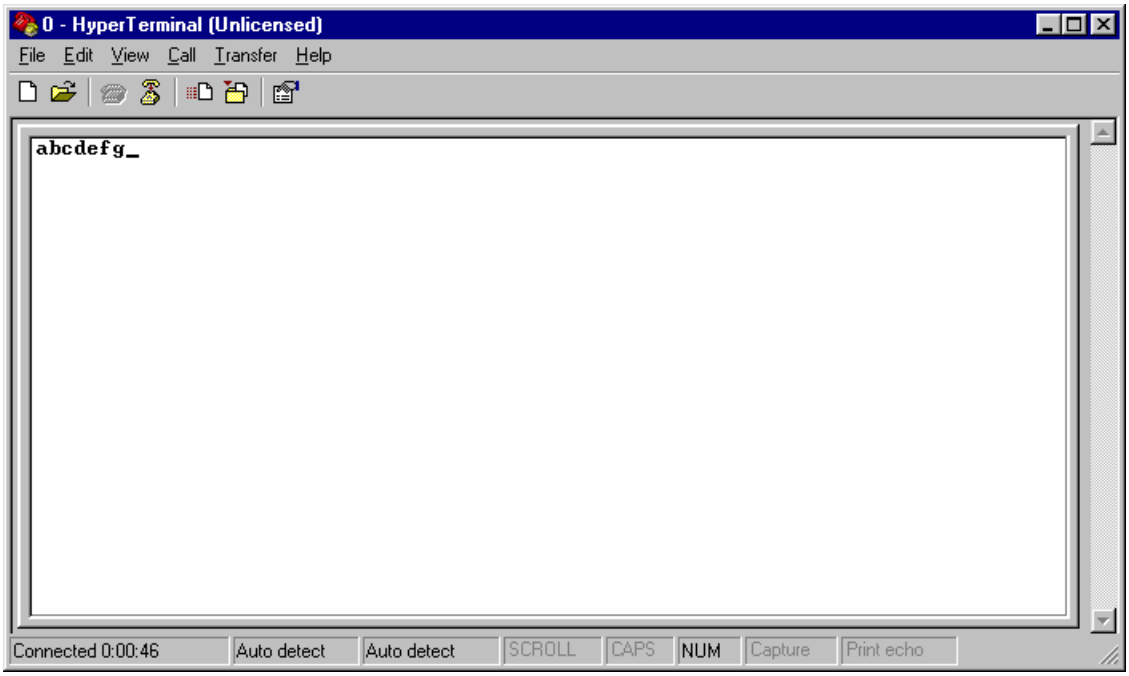
j. If the following main window will be displayed, basic setting-up is completed



8.1.2. Test examples

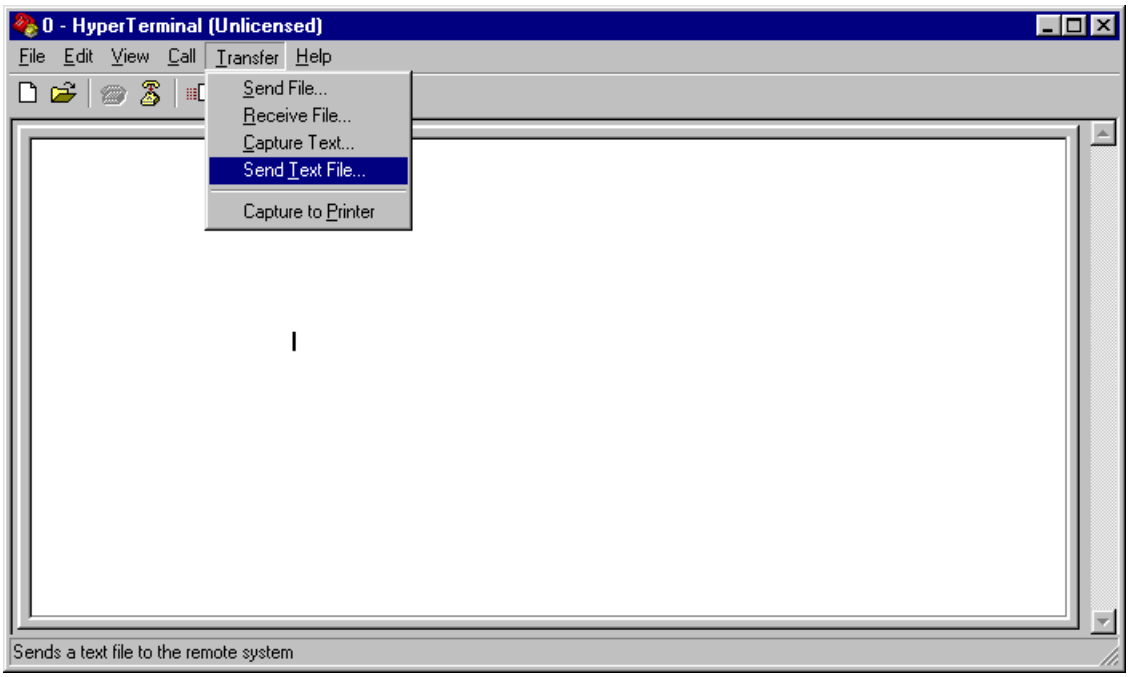
a. Text character communication

Type any types of character with keyboard and transmitted text will be displayed in receiving main window.

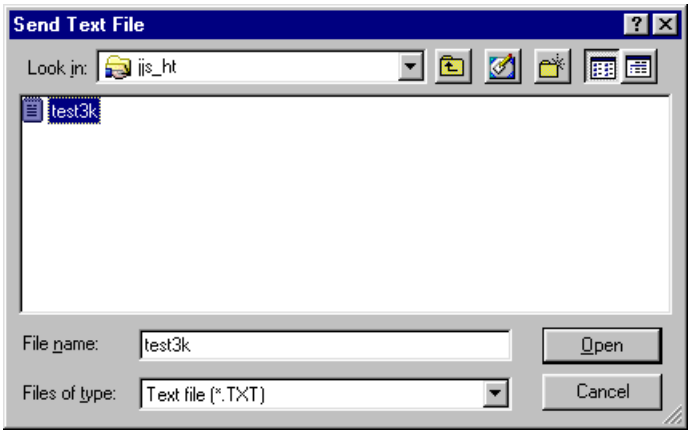


b. Text file communication

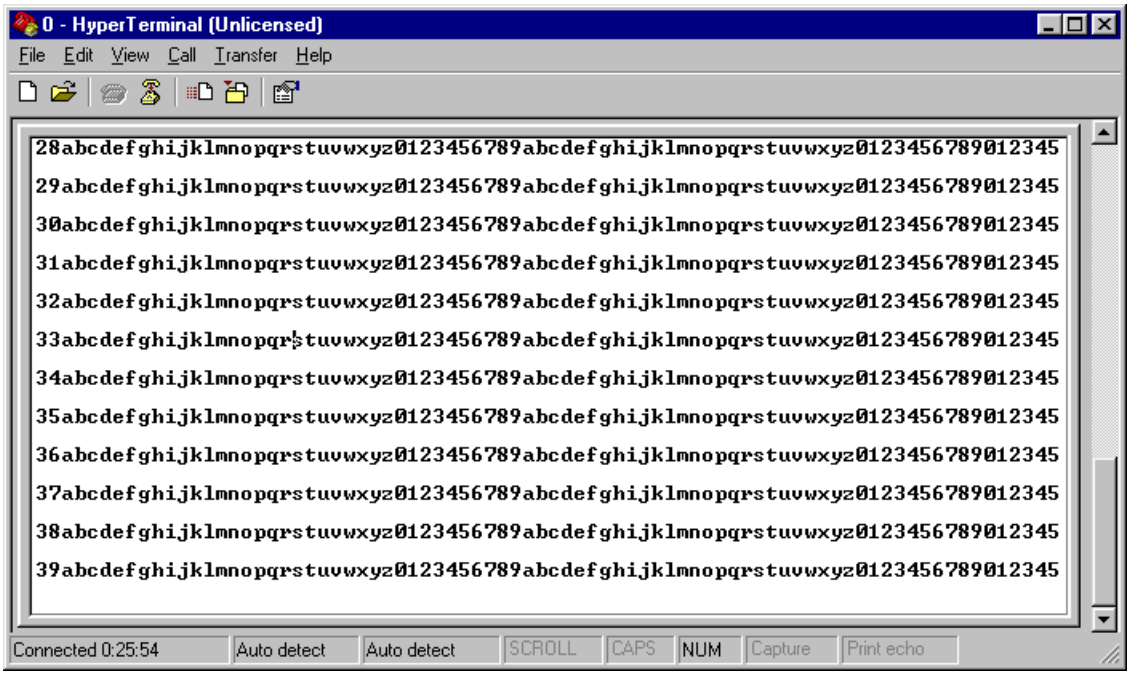
① Select “Transfer → Send Text File”



② Select text file of about 2K bytes. Click the “Open” and the text file will be transmitted. If there is no text file, you can make one. For your reference, you can determine the size of text file because the text file is only for test.

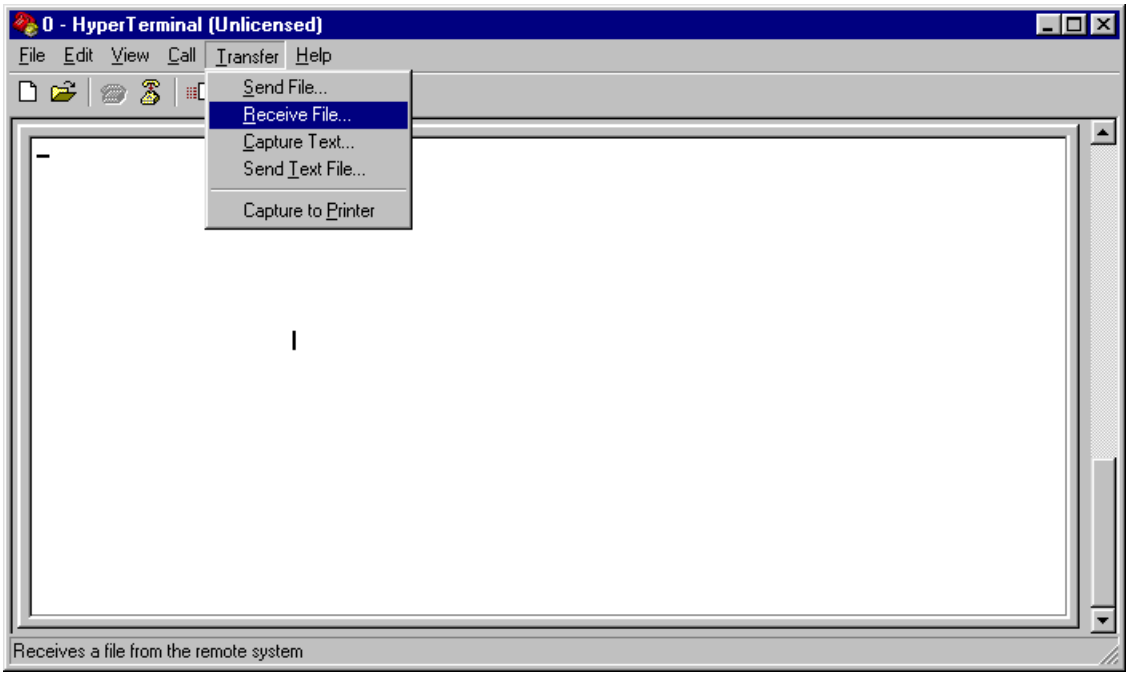


③ The received text file data is displayed in the main window like the following.

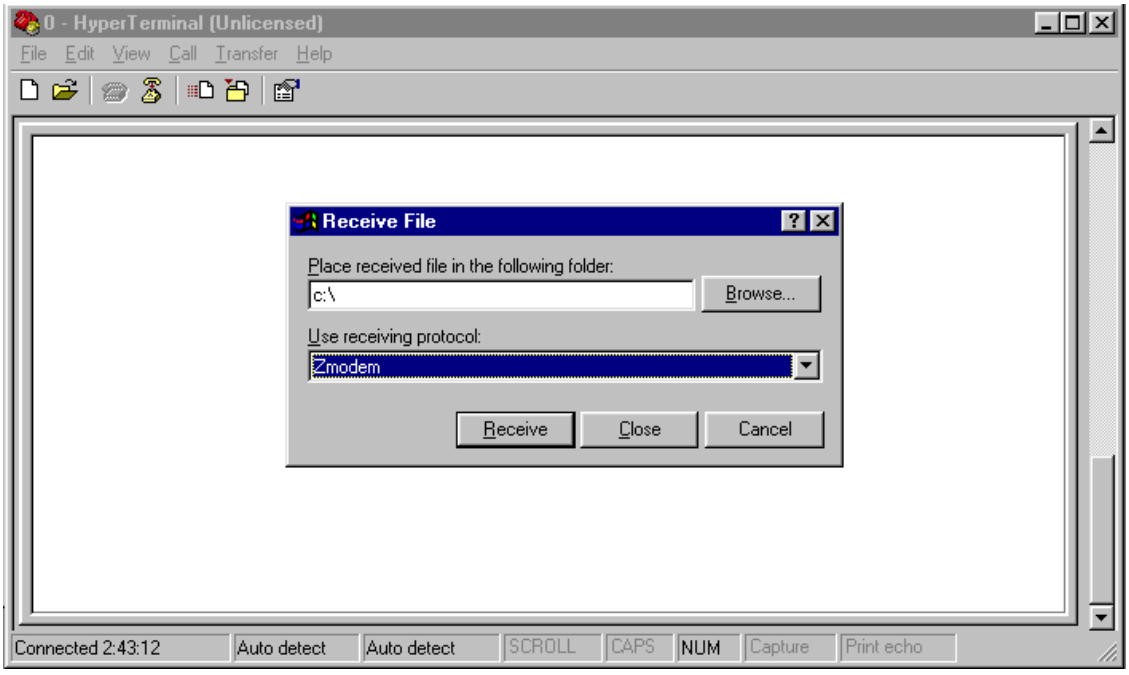


c. Any types of data file except text file communication

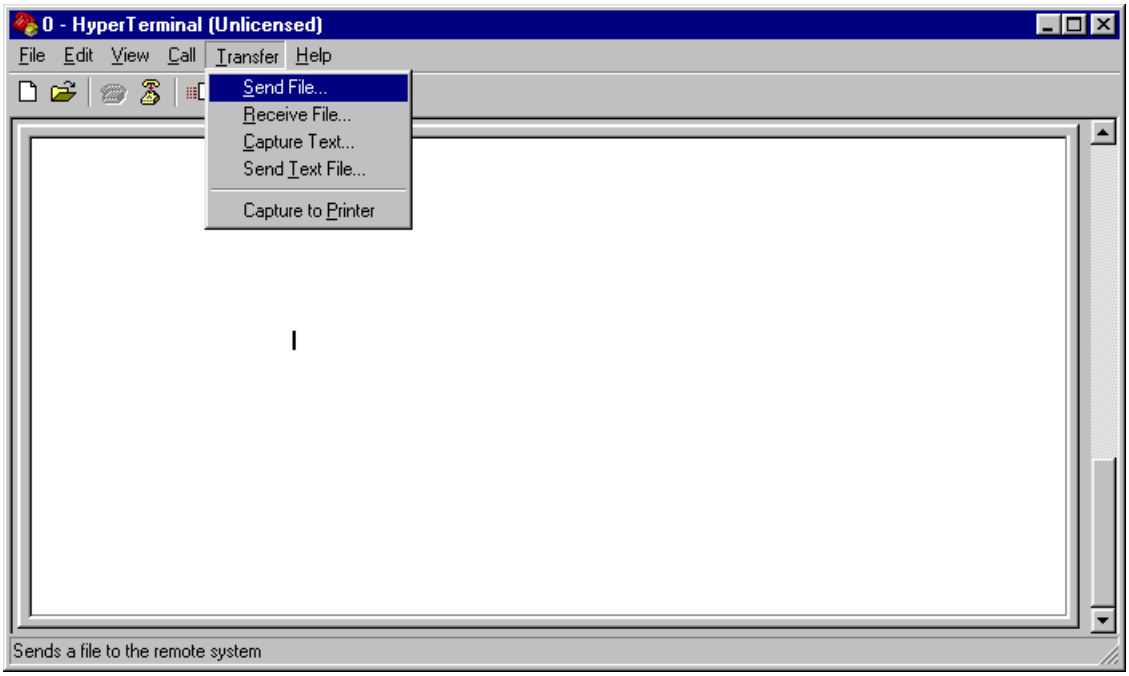
① Select “Transfer → Receive File”



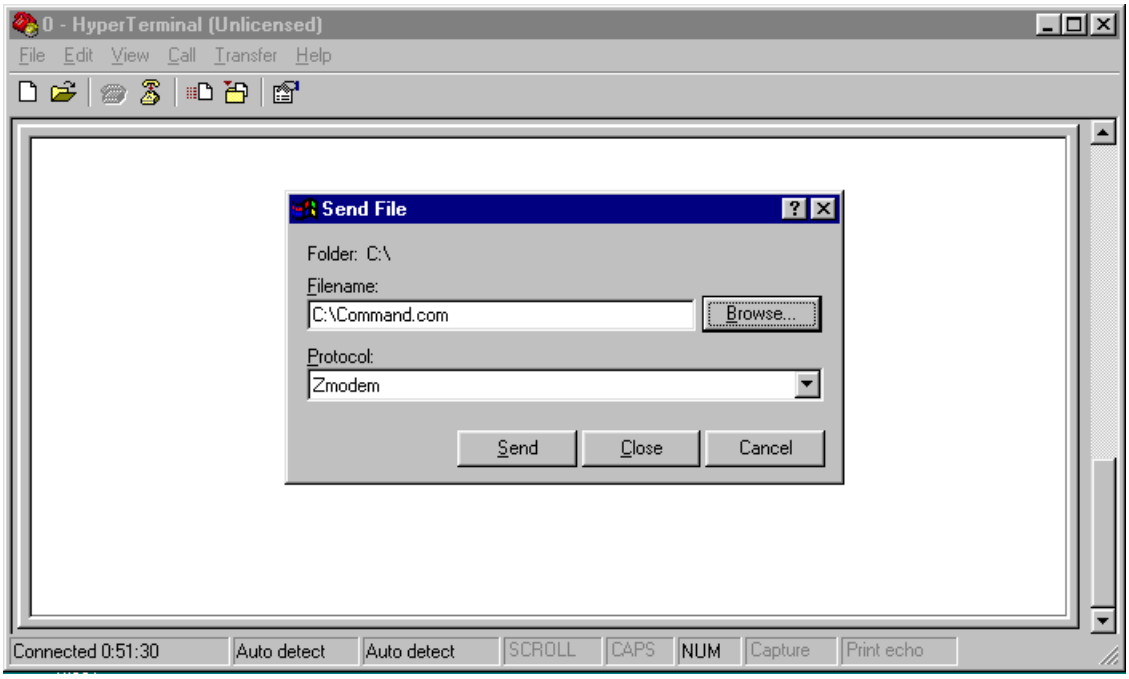
② Determine receiving path and select “Zmodem” of receiving protocol and then click the “Close” button to return to the main window.



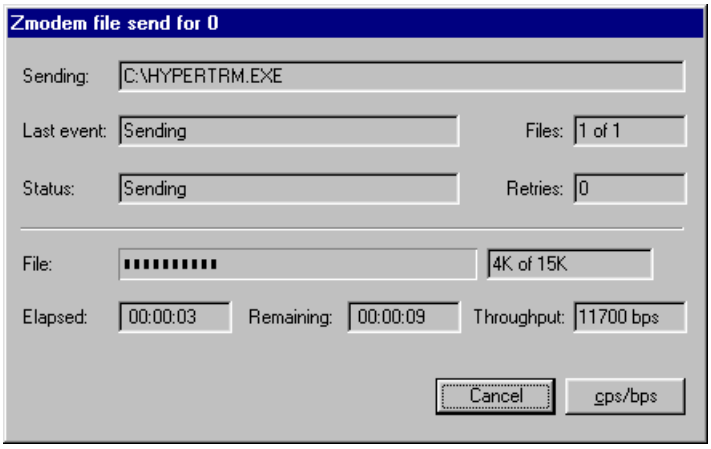
③ Select “Transfer → Send File”



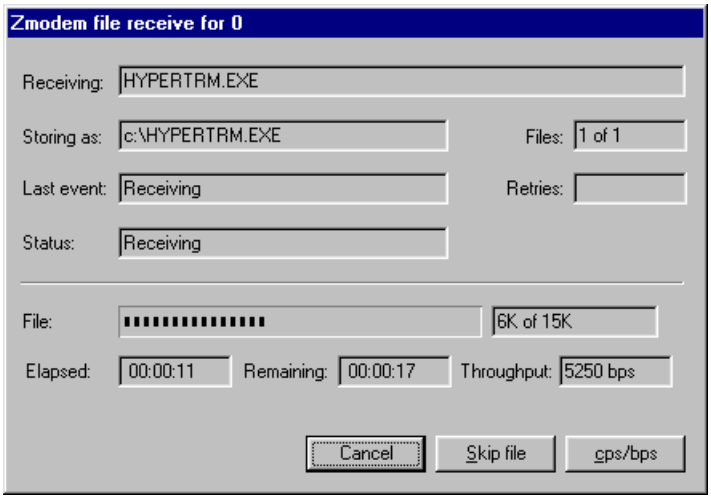
④ Determine transmitting file and select “Zmodem” of protocol and then click the “Send” button.



⑤ The following pop-up box appears and state of the file transmission is displayed.



⑥ In receiving side, the following pop-up box appears and state of file reception is displayed.



⑦ If transmission and reception of file have finished, each pop-up box is automatically closed.

9. Pin-out chart for ACC-513/514

9.1. Pin-out for ACC-513

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	MODEM_EN	Modem Enable input	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 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

9.2. Pin-out for ACC-514

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	MODEM_EN	Modem Enable input	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

10. product version information

10.1. Version information

The modem contains a modem firmware version string, “Copyright 2003-2004 Maxon Telecom CO., LTD Version 1.0d”. After item of “initializing data for HT” of modem option in ACC 916 is enabled, if the radio is turned on, information of the modem version is transmitted through the TXD line.