T2000-A75 Modem

Operation Manual

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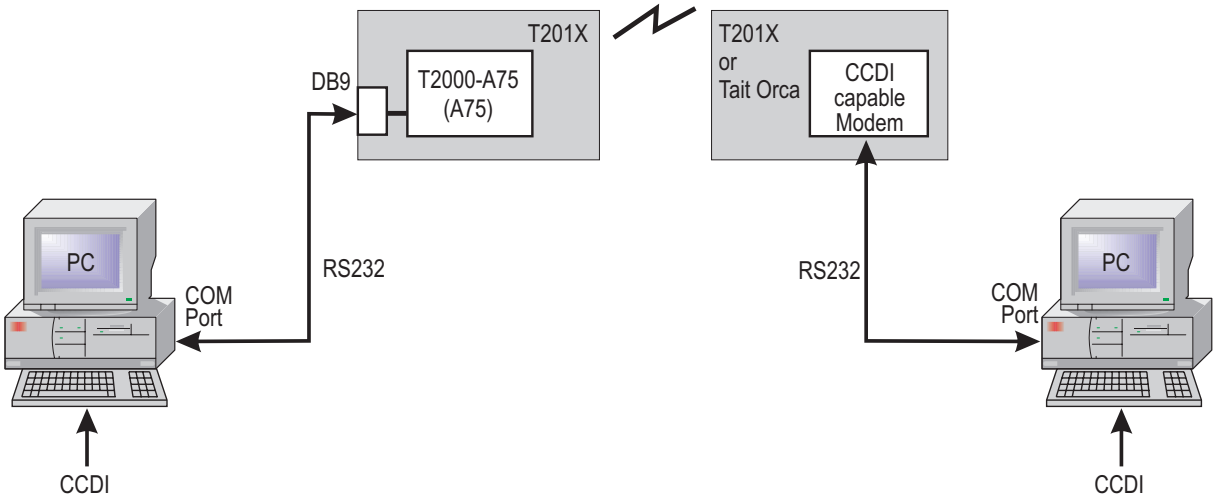
Contents

1 Overview

The CCDI (Computer Controlled Data Interface) is a command protocol embedded in the T2000-A75 (A75) modem firmware to control the T201X radio.



The A75 is fitted to a T201X radio and is connected to a personal computer (PC) by a serial line using five standard RS232 signals (TXD, RXD, CTS, RTS and GND).

The A75 can operate in two modes: Command mode and Transparent mode. In Command mode, the A75 is controlled by the PC sending command sequences and receiving responses.

In Transparent mode there is a direct link between the PC and the FFSK modem on the A75 Modem board and the PC sends and receives data without having to pass messages using CCDI commands. Transparent mode can be set to either 9600, 4800, 2400 or 1200 baud between the PC and the A75. The over-air data rate is either 1200 or 2400 baud.

The T2000-A75 modem described in this manual is CCDI version 2.0 compatible. When an A75 is retrofitted to a T2000 radio, some hardware modifications are needed. Refer to the A75 fitting instructions for details.

RS232 Interface

The RS232 communication between the PC and the A75 has the following parameters which are fixed in the A75 firmware.

For every byte sent, there are 10 bits sent including the start and stop bits:

- Number of data bits = 8
- Parity = none
- Number of start bits = 1 (set to '1')
- Number of stop bit = 1 (set to '0')

The RS232 D-Range socket at the rear of the T201X radio has the following configuration:

Connections	Function	Connections	Function
1	Not used	6	Not used
2	RXD	7	RTS
3	TXD	8	CTS
4	Not used	9	Not used
5	GND		

Note: The start and stop bits are removed by the A75 for the over-air transmission of data. The FFSK data sent is pure binary 8 bit data only.

Compatibility

T201X Radio Firmware

When programming the T201X radio firmware for use with the A75 and CCDI, use version 3.01 or greater.

T2000 PGM

When the A75 modem board is fitted, the T201X PGM program settings have the following constraints:

- 'BCD Channel Selection' should be enabled and polarity set to Normal so that the A75 can change the channel with the GO_TO_CHANNEL command.
- Economy mode reduces the radio's power consumption when it is idle. When economy mode is active and there has been no valid activity on a channel for the duration of the economy mode timer, the radio begins economy cycling. This means that the beginning of a transmission may be lost if it is received after a period of inactivity.
  If 'Economy mode' is enabled in a T201X with an A75 fitted, set the default Transparent mode Lead In Delay to 200 ms.
  If a faster data transfer rate is required, then the Lead In Delay can be reprogrammed as low as 40 ms, but the Economy mode **must** be disabled.

A75 Configuration

The A75 is configured for both Command and Transparent mode communication using the PROGRAM command. It contains 18 ASCII hex characters and sets up the following parameters:

- Transparent mode baud to either 1200, 2400, 4800 or 9600 baud
- Power-up default to Command or Transparent mode
- Command mode baud to either 9600 or the same as Transparent mode
- CTS and RTS signalling attributes
- whether the A75 sends an SDM Auto ACK after receiving an SDM; and waits for an ACK after sending an SDM
- the Delay Time between receiving an SDM and returning an SDM Auto ACK
- the time that the A75 will wait for an SDM Auto ACK before sending a PROGRESS message
- The Transparent mode Lead In Delay time. When the T201X radio receives serial data it keys-up the transmitter but only starts to send the FFSK data after the Lead In Delay.
- The T201X Power-up channel
- The eight character Data ID assigned to the radio for receiving SDM data.

Refer to the PROGRAM command for detailed information.

Command mode

In Command mode, the PC sends command sequences to the A75 and waits for a prompt before beginning the next transaction. The A75 sends a prompt character '.' to the PC to indicate that it is ready to accept a new command. Some commands require the A75 to send a CCDI message in response, before it sends the prompt.

Messages directed to the A75 will always be responded to, either by a return message, or by the presence of the prompt.

Messages from the A75 are either solicited or unsolicited. Solicited messages are sent in response to commands from the PC. Unsolicited messages such as PROGRESS or ERROR messages are sent by the A75 if there is a significant change in the state of the T201X that the PC should be aware of. When errors are detected, an unsolicited ERROR message is sent by the A75 to the PC. The A75 does not send messages that require a reply.

Transparent mode

Transparent mode creates a direct link between the PC and the FFSK modem located on the A75. The transparent link allows the PC to send and receive data without having to pass messages using the CCDI Command mode.

The transparent link is administered by the A75 which reads FFSK data arriving from another FFSK modem and sends it to the serial port. Any form of binary data is acceptable but the escape sequence to switch back to Command mode should be avoided. The escape sequence character is set to '+' by default, or defined within the TRANSPARENT command.

PROGRESS messages are unsolicited status messages sent by the A75 but can be filtered out in Transparent mode by enabling TMODE Filter control with the FUNCTION command. When the TMODE filter is enabled, progress messages are not sent by the A75. When a PROGRESS message is sent in Transparent mode, the escape character is attached to the front of the message, e.g. zzzp0207C7 where 'z' is the escape character.

In Transparent mode, the A75 does not generate or detect CRC checksum data. However if a SDM message is transmitted or received then the CRC checksum data is used.

Transparent mode serial baud can be set to either 9600, 4800, 2400 or 1200 baud using the PROGRAM command.

2 Changing Modes

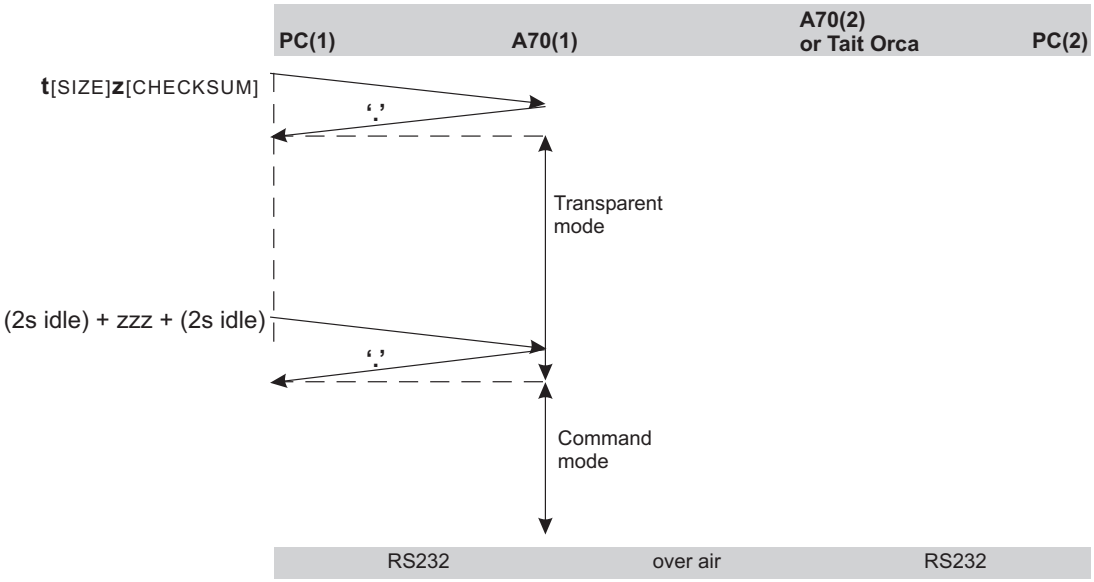
In order to change from Command mode to Transparent mode, the PC must send a TRANSPARENT command to the A75. Once acknowledged, any further communication is linked directly to the A75 modem in Transparent mode.

When the TRANSPARENT command is sent to the A75, the escape sequence character that is used to return to Command mode is also sent.

The escape sequence consists of a 2 second idle time, followed by three escape characters (within 2 seconds), followed by a further 2 second idle time.

If the T201X defaults to Transparent mode at power-up, the escape character is set to the default value of '+'.

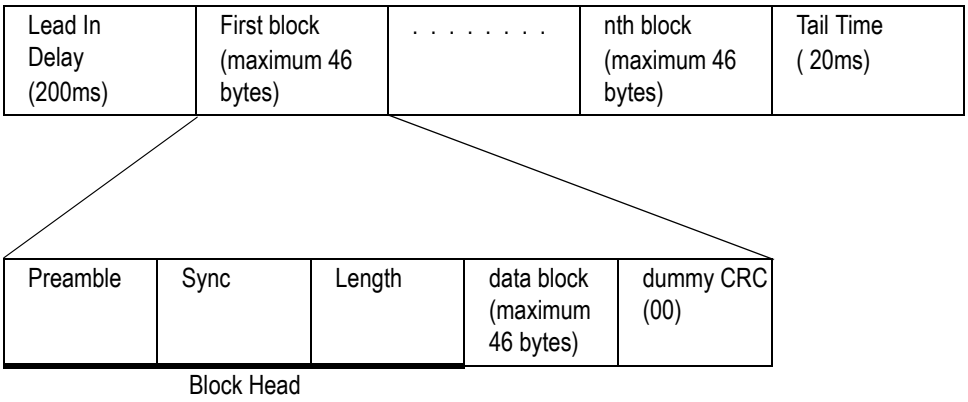
Example



1. t is the message [IDENT] for a TRANSPARENT command telling the A75 to go into Transparent mode
2. The [SIZE] parameter in this example is 01 as there is one character of data to follow in the [PARAMETERS] field.
3. z is the escape character in the [PARAMETERS] field. When 2 second idle + zzz + 2 second idle is detected in Transparent mode, the A75 is forced back to Command mode.
4. The [CHECKSUM] in this example is B1. Refer to the Calculating the [CHECKSUM] section for details.

3 Transparent Mode Operation

The Transparent Mode transmission format is as follows:



The default Transparent mode Lead In Delay is set to 200 ms. If a faster data rate is required the Lead In Delay can be reprogrammed to a minimum of 40 ms using the PROGRAM command. Note that if the Lead In Delay is set this low, Economy mode **must** be disabled.

The Tail Time of 20 ms is fixed in the A75 firmware.

Transparent Mode effective data rate calculation

The Transparent mode effective data rate is dependant on the amount of data sent in one transmission. The more data is sent, the better the data rate.

Example

If we assume that 1K bytes of data is sent with a Lead In Delay of 200 ms:

Time to send data message + block head for each block of data
= (((1000 + (22 x 6)) x 8 /1200) x 1000 = 7546 ms

Where:

1000 = bytes of data (1K bytes)
22 = (1000 bytes/46 bytes per data block) + 1 block to round up to the nearest block = number of block heads
6 = bytes per block head (2 bytes for PREAMBLE + 2 bytes for SYNC + 2 bytes for block LENGTH)
therefore:
(22 x 6) = total bytes in the block heads
8 = bits per byte
1200 = bits per second (bps) over-air standard baud
1000 = to convert bps to ms
Lead In Delay and Tail Time = 200 + 20 = 220 ms

Total time = 7546 + 220 = 7766 ms
Effective data rate = 10000 (bits) / 7766 (ms) = **1287 bps**

If 1M byte of data is sent, the effective data rate goes up to **1500 bps**.

Transparent mode Lead In Delay

The Lead In Delay time ensures that data is not lost from the front of the data block while the transmitter keys-up. To achieve this, CTS inhibit is set to '0' so that radio does not receive any serial data from the PC during the Lead In Delay.

The Lead In Delay time can also be used to activate a series of repeaters in some common applications. When data is detected at the input buffer of the radio, the following chain of events occurs:

1. the transmitter keys-up
2. a carrier is sent from the radio transmitter
3. if the receiving Base Station is set in Repeater Mode, the carrier is detected and Rx Gate becomes active which in turn makes the PTT line active
4. the active PTT line keys-up the transmitter

This sequence is repeated with as many Base Stations as are in the chain.

The optimum length of the Lead In Delay depends on the number of Base Stations that need to be activated before any data is sent.

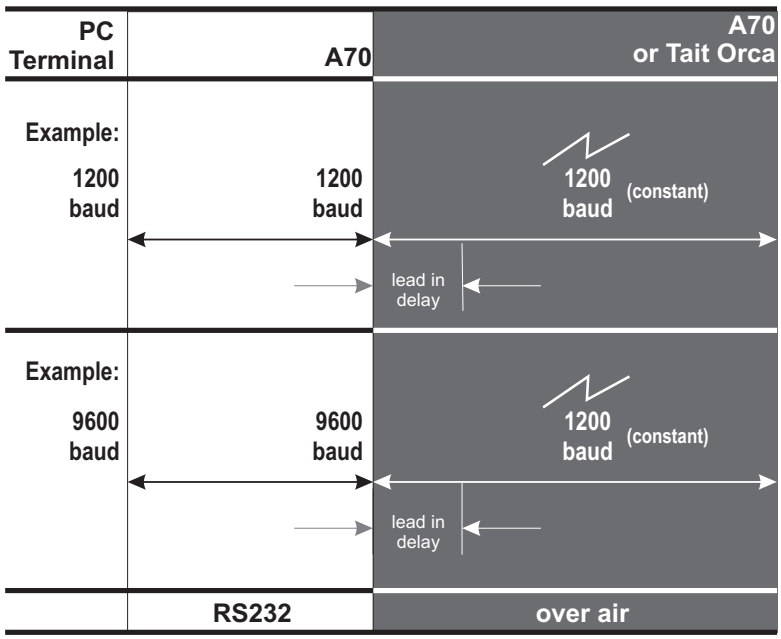
Transparent Mode RTS/CTS Signalling

RTS and CTS signals only operate when the A75 is in Transparent mode. The A75 can be used with or without the RTS and CTS signals as determined by data rate considerations.

Transparent Mode data rate considerations

The A75 has a 50 byte Serial Input buffer and 54 byte Serial Output buffer.

- The PC baud is set up in the terminal program.
- The A75 baud of 9600, 4800, 2400 and 1200 baud is set using the PROGRAM command. It must be set to the same as the PC baud rate.
- The FFSK over-air baud of 1200 or 2400 baud is set using the PROGRAM command.

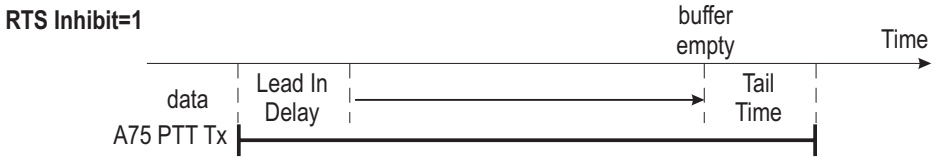


RTS (Request to Send) Signal

RTS is an active high input signal to theA75 from the PC and is used to reduce data transfer delays and improve data throughput.

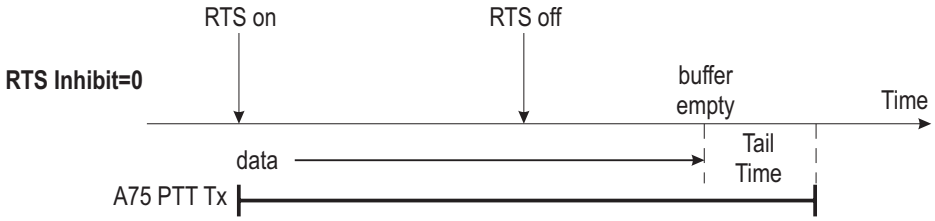
RTS Inhibit is either inhibited or not, using bit 6 of the [ITEM1] parameter in the PROGRAM command which configures the A75.

If 'Inhibit RTS Signal' is set to '1' (RTS inhibited), then an RTS signal is ignored by the A75 (**RTS off**). When RTS is disabled, the A75 starts to transmit when data is received until the input buffer becomes empty. Once empty, the A75 will stop transmitting after the Tail Time set in the A75 firmware. Each time the transmitter keys up, it must wait for the Lead In Delay before data transfer can commence.

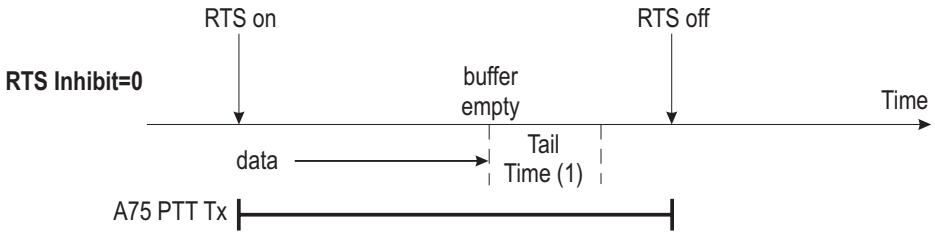


If 'Inhibit RTS Signal' is set to '0' (RTS not inhibited), when an RTS signal is detected (**RTS on**) the following sequences can occur depending on the structure of the data.

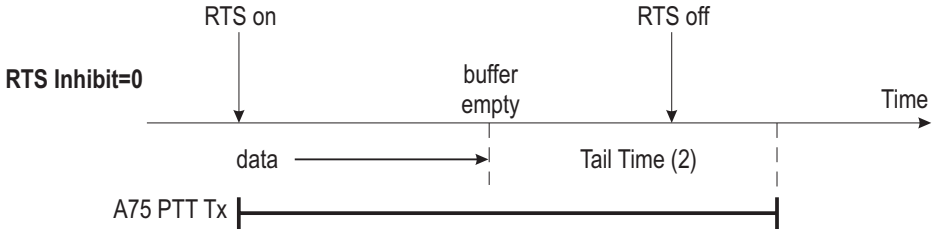
If RTS turns off, the A75 will continue to transmit until the buffer is empty, and stops after the Tail Time.



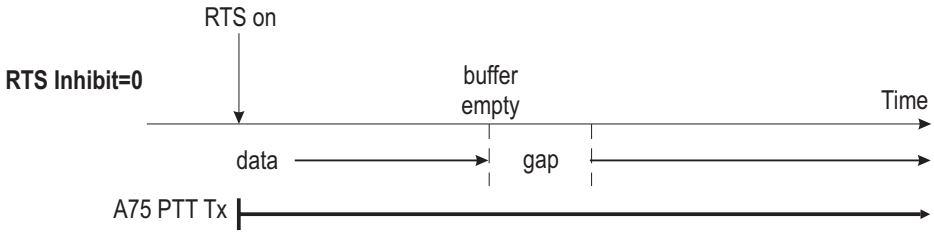
If the buffer becomes empty while RTS is still on, the A75 continues to transmit until either RTS turns off,



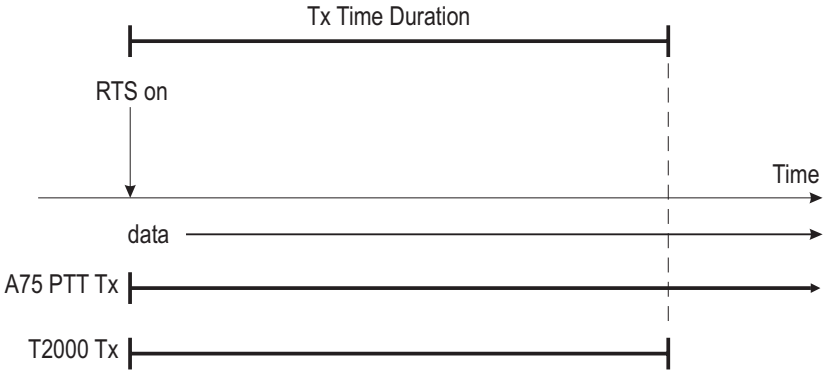
or after the Tail Time if this occurs after RTS has turned off.



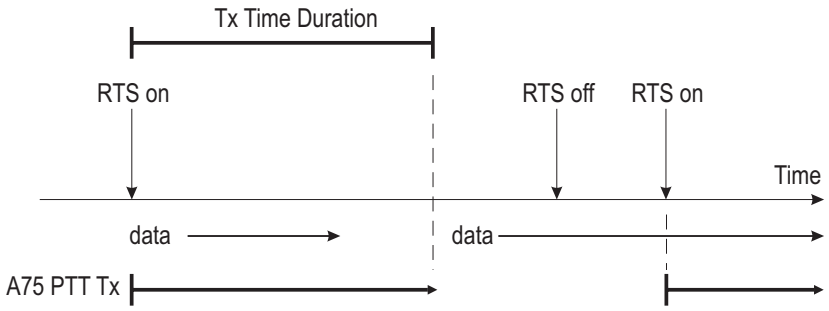
If the data stream has a gap, while RTS remains on, the A75 continues to transmit. This eliminates the data delay caused by the Lead In Delay at the start of each transmission.



If a long data stream is sent, the A75 continues to transmit, but the T201X stops transmitting after the transmitter time-out. The transmitter time-out is set by the Transmit Time Duration which is set to a default of 60 seconds in the T2000 PGM programming software.



If the radio transmitter times-out in this way, it can not transmit data again unless RTS is turned off then on again.



CTS (Clear to Send) Handshaking

CTS is an active high output signal from the A75 to the PC and is used to prevent data overflow under certain conditions such as a full input buffer. CTS should always be used if the PC and A75 baud is higher than the over-air baud.

Data Quantity	A75 and PC Baud	Lead In Delay	CTS Handshaking
<40 bytes / transmission	1200 (2400) - 9600	short	not required
>40 bytes / transmission	1200 (2400) - 9600	short	required

If the data throughput rate is small enough (less than 40 bytes in one transmission), then independent of the baud, CTS handshaking is not necessary. If the data throughput is greater than 40 bytes in one transmission, CTS must be used to avoid data loss. This assumes a short lead in delay otherwise the output data will overflow. At a low baud, 300 ms is a short Lead In Delay but a higher baud may need a Lead In Delay as low as 40 ms.

The CTS state is controlled using bit 6 of the [ITEM1] parameter in the PROGRAM command which sets up the configuration of the A75.

If 'Inhibit CTS Signal' is set to '1', then the CTS signal from the A75 is always on (**CTS handshaking off**).

If 'Inhibit CTS Signal' is set to '0', CTS deactivates under the following conditions

- during the Lead In Delay
- if the PTT is pressed
- if the input buffer exceeds 34 bytes from a total 50 byte input buffer

If the PC terminal application continues to send data while the CTS line is off, the data will continue to be stored in the 50 byte input buffer.

When the buffer is full, further incoming data is lost until there is room in the input buffer again. CTS will turn on again when the buffered data drops below 40 bytes.

At all other times the CTS is ON (high at PC end).

4 Command Mode Operation

Message Format

All Command mode message packets take the general form:

[IDENT] [SIZE] [PARAMETERS] [CHECKSUM] <CR>

Field	Description
[IDENT]	The message identifier. Identifiers are single ASCII characters (lower-case alphabetical) which categorise the message type.
[SIZE]	The number of characters which make up the [PARAMETERS] field. [SIZE] is an 8-bit number expressed in ASCII-hex notation (two characters).
[PARAMETERS]	An optional field, depending upon the command. Parameter values are generally character strings unless explicitly stated otherwise. Parameter type is dependent upon the command - there is no explicit type definition.
[CHECKSUM]	An 8-bit checksum of the [IDENT], [SIZE] and [PARAMETERS] fields. Expressed in two character ASCII-hex notation.
<CR>	The carriage return packet terminator.

- All characters in a message are printable ASCII.
- Where numeric values are represented in ASCII-hex notation (two characters per byte), characters A to F are upper case.
- The minimum length of a command packet is 5 characters. For example q002F is the QUERY command where [SIZE] = 00 as there is no [PARAMETERS] field required.
- The maximum length of the [PARAMETERS] field is 42 characters. The maximum length of the command packet is therefore 47 ([SIZE] = 2F) characters.

Example

#12C401060A010000BASE8F

1. # is the message [IDENT] for a PROGRAM command.
2. 12 is the parameter [SIZE] as there are 18 characters of data to follow in the [PARAMETERS] field.
3. C401060A010000BASE are the data bytes in the [PARAMETERS] field.
4. 8F is the calculated checksum of the message line.
5. The actual data that is sent out the port in hexadecimal form is:
   23 31 32 43 34 30 31 30 36 30 41 30 31 30 30 30 30 42 41 53 45 38 46

Calculating the [CHECKSUM]

[CHECKSUM] is calculated by applying the following algorithm:

1. Take the modulo-2 sum of all message bytes preceding [CHECKSUM].
2. Retain bits 0 to 7, discarding any higher order bits resulting from the summation.
3. Form the two's complement of the remainder.
4. Convert the binary number into two ASCII-hex digits, MSD first.

Example

#12C401060A010000BASE8F

1. Take the modulo-2 sum of all message bytes preceding [CHECKSUM].
   - # = 23h, 1 = 31h, 2 = 32h, C = 43h etc. therefore the modulo-2 sum is:
     23h + 31h + 32h + 43h + 34h + 30h + 31h + 30h + 36h + 30h + 41h + 30h + 31h + 30h
     +30h + 30h + 30h + 42h + 41h + 53h + 45h = 471h
2. Retain bits 0 to 7, discarding any higher order bits resulting from the summation.
   - 71h
3. Form the two's complement of the remainder.
   - 71h = 0111 0001
     two's complement = 1000 1111
4. Convert the binary number into two ASCII-hex digits, MSD first.
   - 1000 1111 = 8F

Sending and Receiving Short Data Messages (SDM)

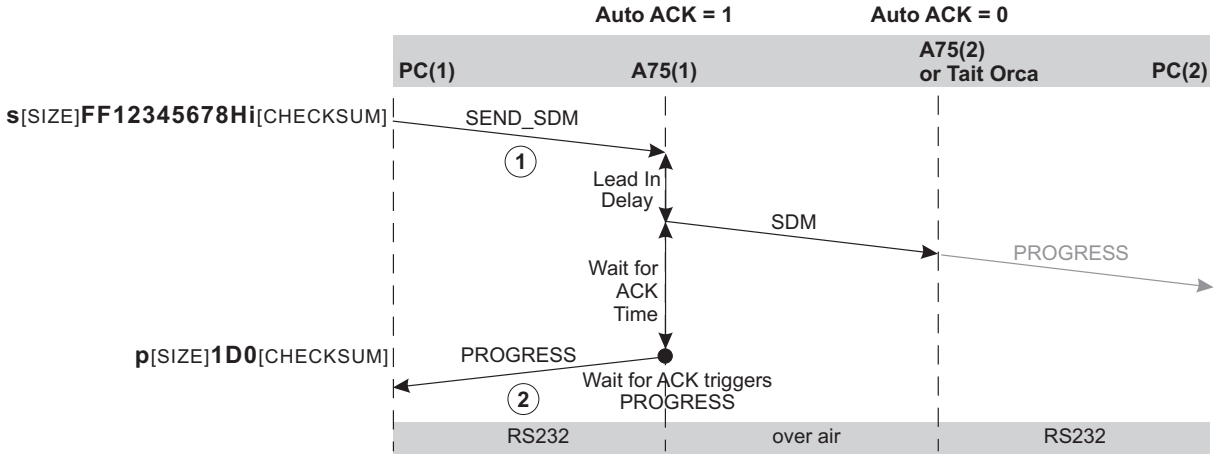
A SDM can only be sent in Command mode from a PC but can be received in both Command and Transparent modes.

Sending SDMs

In the examples shown, the first two bytes of the [PARAMETERS] field are set to FF which translates to an SDM Lead In Delay of 5.1 seconds. The next eight bytes (12345678) are the SDM Data ID of the radio receiving the SDM. The SDM text is 'Hi'.

If the SDM data includes a SDM [MESSSAGE] parameter, the SDM text ('Hi) will update the SDM text buffer in the A75 EEPROM. If there is no SDM [MESSSAGE] parameter attached, the buffer will not be cleared but retains its current contents

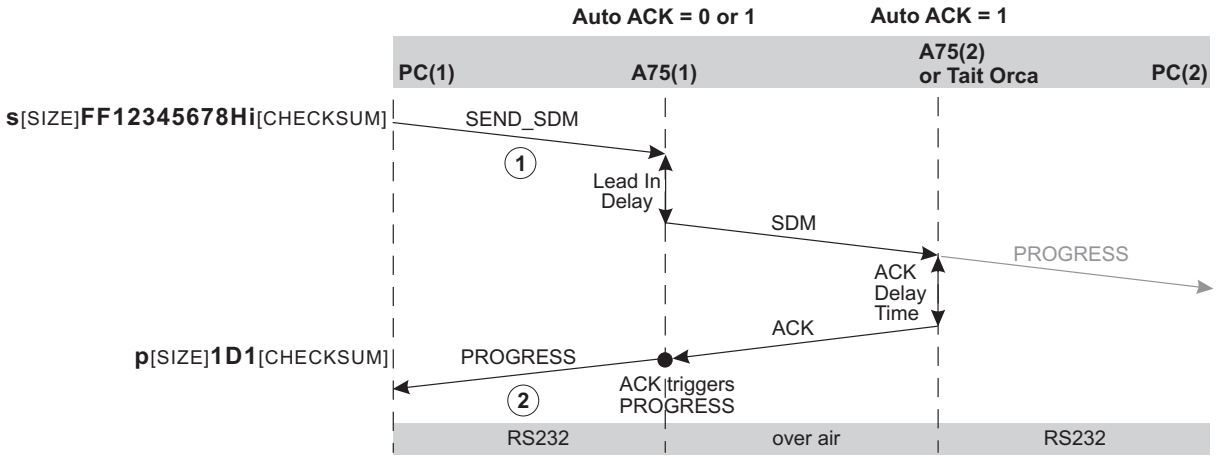
When an SDM is sent (①), the T201X radio keys its transmitter immediately, and the SDM is sent by the A75 after the SDM Lead In Delay.



SDM Auto ACK is either enabled or disabled when the modem is configured. This is done in the A75 with the PROGRAM command or in the PGM programming software for the Tait Orca. If the A75 has SDM Auto ACK is set to '1' (enabled) in bit 7 of the [ITEM1] parameter of the PROGRAM command, then:

- when the A75 receives an SDM, it returns an 'ACK'
- when the A75 sends an SDM, it starts the SDM Wait for ACK timer

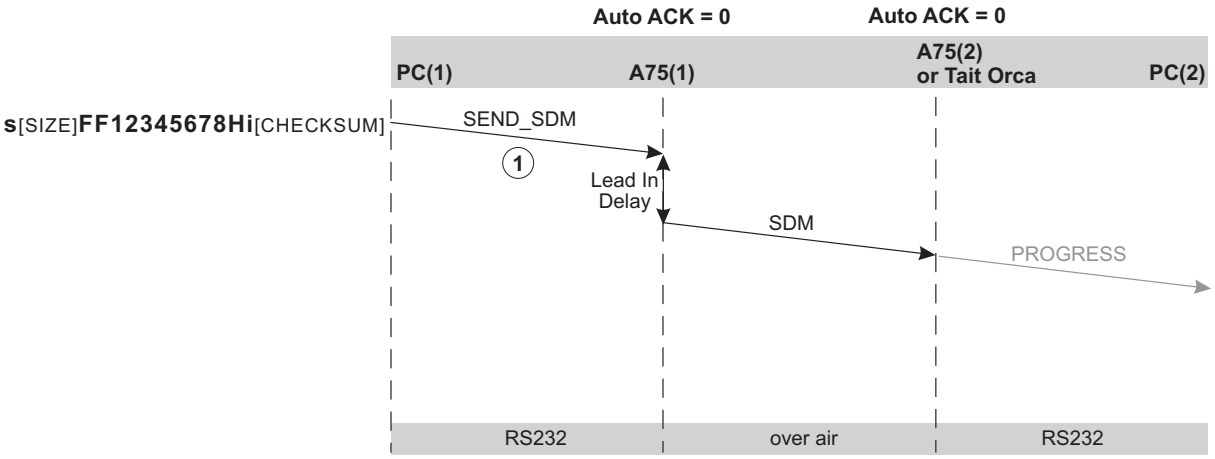
In the above example, the receiving modem A75(2) has the SDM Auto ACK disabled so no 'ACK' is returned. After the SDM Wait for ACK time, the A75(1) generates a PROGRESS message (②) of [PTYPE] SMD ACK (1D) with the flag set to '0' (No ACK Received). Refer to the PROGRESS command details for further information.



In the example above, the receiving modem A75(2) has the SDM Auto ACK enabled so an 'ACK' is returned to the A75(1). When the A75(1) receives the 'ACK', it generates a PROGRESS message (②), of [PTYPE] SMD ACK (1D) with the flag set to '1' (ACK Received). Refer to the PROGRESS command details for further information.

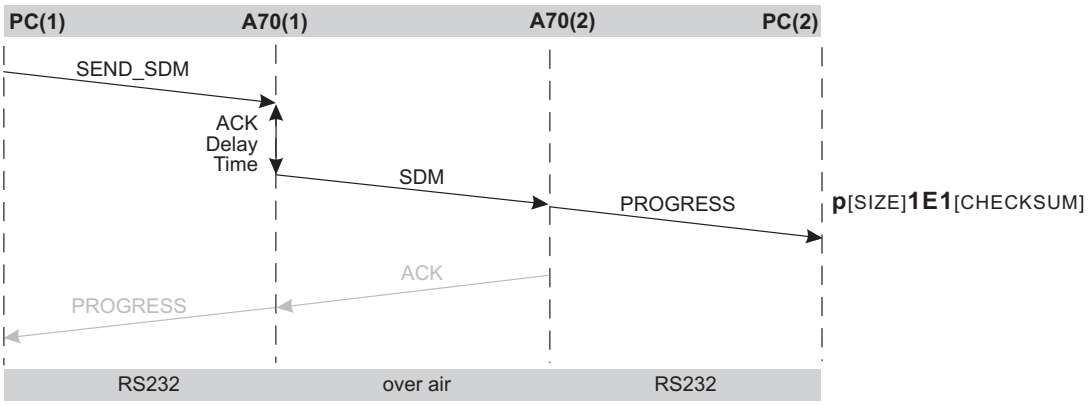
If the A75(1) has SDM Auto ACK enabled and the ACK is not received after the SDM Wait for ACK time, the A75(1) generates a PROGRESS message (②) of [PTYPE] SMD ACK (1D) with the flag set to '0' (No ACK Received). This indicates that there is a communication fault between the modems, or a fault with the second A75(2) modem

The example below shows the case when both modems have the SDM Auto ACK disabled. No ACK is sent or expected.



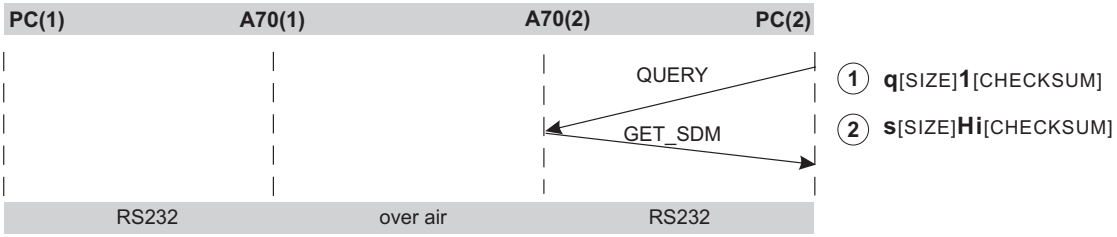
Receiving SDMs

When the A75 receives an SDM, it sends a PROGRESS message of [PTYPE] SMD Data Received (1E) with the flag set to '1' or '0' depending on whether the SDM contained a [MESSAGE] parameter. Refer to the PROGRESS command details for further information.



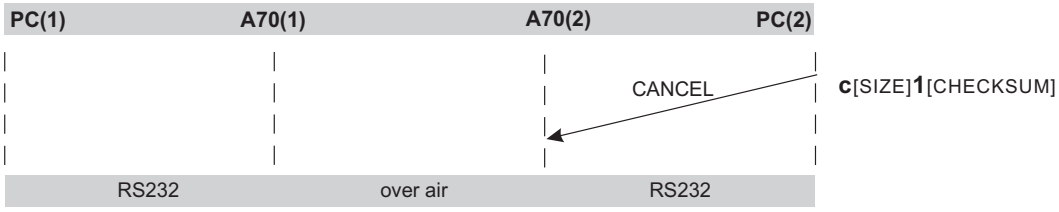
Other SDM Commands

A QUERY command (①) can be sent to the A75 to request the text from the A75 SDM EEPROM.



When it receives the SDM QUERY command, the A75 responds with a GET_SDM message (②). If there is no data in the EEPROM then the GET_SDM is returned with an empty [PARAMETERS] field.

The SDM CANCEL command sent to the A75 clears all SDM text from the A75 SDM EEPROM.



5 Commands

In all cases, if a command is received without error at the A75 and all parameters are valid, the command is executed. The prompt character '.' is then returned to the PC after the A75 completes the current transaction, to signify that another may begin. If an error arises, the PC is notified with an appropriate ERROR response.

Messages from the A75 can be sent to the PC as part of a CCDI transaction or as an unsolicited message indicating a significant change in the T201X radio.

The following CCDI commands and responses are:

Command	IDENT	Function		Command from:
CANCEL	c	Clears the received SDM data or the current call		PC to A75
ERROR	e	A Transaction or System error message	un/solicited	A75 to PC
FUNCTION	f	Forces the radio to Tx or Rx, or sets up Transparent Mode filtering		PC to A75
GET_SDM	s	Gets SDM data from the radio	solicited	A75 to PC
GO_TO_CHANNEL	g	Sets the T201X radio to a specific channel		PC to A75
MODEL	m	Sends T201X radio and CCDI information	solicited	A75 to PC
PROGRAM	#	Programs the A75 configuration into the database		PC to A75.
PROGRESS	p	Sends a progress report	unsolicited	A75 to PC
QUERY	q	Solicits various types of information from the A75		PC to A75
SEND_SDM	s	Sends a Short Data Message (SDM)		PC to A75
S/W_VERSION	v	Sends the A75 firmware version	solicited	A75 to PC
TRANSACTION OK	.	Transaction processed OK	solicited	A75 to PC
TRANSPARENT	t	Switches to Transparent mode		PC to A75

CANCEL (PC to A75)

The CANCEL command allows the PC to clear the currently received SDM data.

[IDENT]	**c**
[PARAMETERS]	[CANCEL_TYPE]

[PARAMETER]	Function
[CANCEL_TYPE]	A single ASCII hex character representing the cancelling type.
[CANCEL_TYPE] = 1	**Delete SDM data**. This will delete last received SDM text data in the A75 EEPROM. If there is no valid SDM data, it will do nothing.

Example

An example of a 'Cancel' message is: c0110B

Message Field	Parameter	Entered at terminal
[IDENT]	CANCEL	c
[SIZE]	Size of parameter field	01
[PARAMETERS]	[CANCEL_TYPE] = 1 to delete SDM text	1
[CHECKSUM]	Refer to the Calculating the [CHECKSUM] section	0B

ERROR (A75 to PC)

Solicited and Unsolicited.

A Transaction ERROR message is solicited and advises the PC that the A75 has detected an error condition and cannot proceed with the current transaction. A System error is unsolicited and occurs where an exceptional condition occurs in the A75 independent of any control transactions.

[IDENT]	**e**
[PARAMETERS]	[ETYPE] [ERRNUM]

[PARAMETER]	Function
[ETYPE]	A single character representing the error category.
[ERRNUM]	A two-digit number representing the error number.
[ETYPE] = 0	**Transaction error**. Indicates some problem with communications over the CCDI RS232 link. All such errors result in the transaction being terminated without the current command being executed. Operation then continues as normal. The [ERRNUM] is defined as the following: [ERRNUM] = 00 : Undefined Error. The A75 cannot decode received serial data. [ERRNUM] = 01 : Unsupported Command Error. The PC attempts to use a command which is not recognised by the A75 e.g. an incorrect command letter was typed or an upper case was used. [ERRNUM] = 02 : CCDI Checksum Error. The checksum is not valid. [ERRNUM] = 03 : CCDI Parameter Error. The [SIZE] and [PARAMETER] field do not match, or the [PARAMETER] entry was not valid. [ERRNUM] = 04 : Not Used [ERRNUM] = 05 : A75 Busy Error.The A75 received serial data while it was processing a current command.
[ETYPE] = 1	**System error** indicates that a critical system error occurred while the A75 was operating. If a System error has happened during initialisation, the A75 generates a System error message and waits to be powered off. If a System error has happened after the initialisation, the A75 generates the System error message and wait for approximately one second, then resets the CPU to restart the firmware. The [ERRNUM] is defined as the following: [ERRNUM] = 00 : INVALID STATE ERROR. While A75 was running one of the operating state was not valid. [ERRNUM] = 01 : ZERO TIMER VALUE ERROR. A timer has attempted to start with 0 time value. [ERRNUM] = 02 : INVLAID INTERRUPT ERROR. An unused interrupt has occurred. [ERRNUM] = 03 : EEPROM WRITE ERROR. EEPROM WRITE operation has an error. [ERRNUM] = 04 : EEPROM WRITE LENGTH ERROR. The data length to be written to the EEPROM is not valid.

Note: During the initialisation, if the database for A75 is invalid, then the database is initialised with '#12C401060A010000BASE8F' as the configuration and the Transaction error 'CCDI Parameter Error' is generated.

Example

An example of an 'Error' message is: e03002A6

Message Field	Parameter	A75 Response
[IDENT]	ERROR.	e
[SIZE]	Size of parameter field	03
[PARAMETERS]	[ETYPE] Transaction error	0
	[ERRNUM] = 02; the checksum was incorrect	02
[CHECKSUM]	The checksum for the message string, calculated by the A75	A6

FUNCTION (PC to A75)

The FUNCTION command provides access to some miscellaneous functions.

[IDENT]	**f**
[PARAMETERS]	[FUNCTION] [QUALIFIER]

[PARAMETER]	Function
[FUNCTION]	A single ASCII hex character representing the required function category.
[QUALIFIER]	A single ASCII hex character representing the action to be taken. The meaning of [QUALIFIER] is dependent upon the value of [FUNCTION].
[FUNCTION] = 6	**TMODE Filter control** enables or disables filtering out all PROGRESS messages when in Transparent mode. [QUALIFIER] = 0 : disable TMODE Filter [QUALIFIER] = 1 : enable TMODE Filter
[FUNCTION] = 9	**Tx/Rx control** forces the T201X radio into a transmitting or receiving state. [QUALIFIER] = 0 : change to Rx state [QUALIFIER] = 1 : change to Tx state

Example

An example of a 'Function' message is: f0291CE

Message Field	Parameter	Entered at terminal
[IDENT]	FUNCTION.	f
[SIZE]	Size of parameter field	02
[PARAMETERS]	[FUNCTION] = 9 to control the Tx/Rx state of the radio	9
	[QUALIFIER] = 1 to start the radio transmitting	1
[CHECKSUM]	Refer to the Calculating the [CHECKSUM] section	CE

GET_SDM (A75 to PC)

Solicited.

The GET_SDM message is sent to the PC in response to a QUERY command. The A75 sends the SDM text message which is saved in the EEPROM.

[IDENT]	**s**
[PARAMETERS]	[SDM_DATA]

[PARAMETER]	Function
[SDM_DATA]	This can be a maximum of 32 characters. If there is any buffered SDM data in the EEPROM, the SDM data is sent to the PC. If there is no data available then the command is sent with no [PARAMETERS] field.

Example

An example of a 'Get SDM' message is: s05Hello34

Message Field	Parameter	A75 Response
[IDENT]	GET_SDM.	s
[SIZE]	Size of parameter field	05
[PARAMETERS]	[SDM_DATA]; the SDM text message from the A75 EEPROM	Hello
[CHECKSUM]	The checksum for the message string, calculated by the A75	34

GO_TO_CHANNEL (PC to A75)

The GO_TO_CHANNEL command forces the A75 to send a new channel number to its BCD output. This will cause a channel change on the T201X radio

[IDENT]	**g**
[PARAMETERS]	[CHANNEL_NO]

[PARAMETER]	Function
[CHANNEL_NO]	**Channel number**. A string of characters representing the new channel number. The range of allowed characters is 0 to.9, and the maximum number of digits is 3. For a T2010 radio the valid range is 1 to 4 and for a T2015 radio the valid range is 1 to 24.

Example

An example of a 'Go to Channel' message is: g0202D5

Message Field	Parameter	Entered at terminal
[IDENT]	GO_TO_CHANNEL.	g
[SIZE]	Size of parameter field	02
[PARAMETERS]	[CHANNEL_NO] = 02 to change the radio to channel 2. The number can be given in a 1, 2 or 3 digit format e.g. 2, 02 or 002.	02
[CHECKSUM]	Refer to the Calculating the [CHECKSUM] section	D5

MODEL (A75 to PC)

Solicited.

The MODEL message is sent to the PC in response to a QUERY command. It identifies the type of T201X radio and the version of CCDI software operating in the T201X radio.

[IDENT]	**m**
[PARAMETERS]	[RU_TYPE] [RU_MODEL] [RU_TIER] [VERSION]

[PARAMETER]	Function
[RU_TYPE]	A single character representing the T201X radio **type**. [RU_TYPE] = 1: Conventional radio.
[RU_MODEL]	A single character representing the T201X radio **model**. [RU_MODEL] = 2: Mobile radio
[RU_TIER]	A single character representing the T201X radio **tier**. [RU_TIER] = 0 for T2010, or 1 for T2015
[VERSION]	**CCDI software version**. A character string, in the format XX.XX. [VERSION] = 02.00

Example

An example of a 'Model' message is: m0812102.00A7

Message Field	Parameter	A75 Response
[IDENT]	MODEL	m
[SIZE]	Size of parameter field	08
[PARAMETERS]	[RU_MODEL] = 1 for a conventional radio	1
	[RU_MODEL] = 2 for a mobile radio	2
	[RU_TIER] = 1 for a T2015 radio	1
	[VERSION] = 02.00 for the CCDI software version	02.00
[CHECKSUM]	The checksum for the message string, calculated by the A75	A7

PROGRAM (PC to A75)

Before the CCDI can operate, the radio must be configured correctly. The PROGRAM command is used to set up the default configuration of the A75.

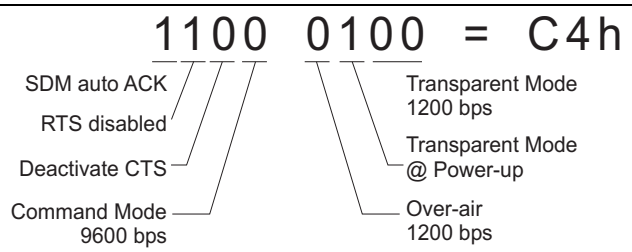
[IDENT]	**#**
[PARAMETERS]	[ITEM1] [ITEM2] [ITEM3] [ITEM4] [ITEM5] [ITEM6]

[PARAMETER]	Function
[ITEM1]	A75 Configuration flags. Two ASCII hex characters to represent the following 1 byte of A75 configurational information. **Bit1 and Bit0 Transparent Mode Baud** 00 : 1200 bps 01 : 2400 bps 10 : 4800 bps 11 : 9600 bps **Bit2 Transparent Mode Power-up Default** 0 : Power-up Default is Command Mode 1 : Power-up Default is Transparent Mode **Bit3 Over-Air Baud** 0 : 1200 bps 1 : 2400 bps (Note: the Tait Orca does not support 2400 baud) **Bit4 Command Mode Baud** 0 : 9600 bps fixed 1 : The same bps as Transparent Mode Baud **Bit5 Inhibit CTS signal** 0 : Deactivate CTS under the conditions referred to in the CTS Handshaking section) 1 : CTS active all the time **Bit6 Inhibit RTS signal** - refer to RTS Signal section 0 : RTS signal input is detected 1 : RTS signal input is ignored **Bit7 SDM Auto ACK** 0 : SDM Auto ACK is disabled 1 : SDM Auto ACK is enabled If SDM Auto ACK is enabled, the A75 sending the SDM **waits** for the SDM ACK for the time set by the Wait for ACK Time. The A75 that receives the SDM **returns** an SDM ACK if SDM Auto ACK is enabled. Refer to the Sending and Receiving Short Data Messages (SDM) section.
[ITEM2]	**SDM ACK Delay Time** Two ASCII hex characters. The time that the A75 delays after receiving an SDM until it sends back the SDM ACK, if the A75 is configured to send back an SDM Auto ACK. See Bit 7 of [ITEM1] above. Range : 01 to 78h (120) in steps of 100 msec. Refer to the Sending and Receiving Short Data Messages (SDM) section.

[ITEM3]	**SDM Wait for ACK Time** Two ASCII hex characters. The maximum time that the A75 will wait for an ACK from after an SDM was sent. After this time, if no 'ACK' is received, the A75 sends a PROGRESS message with the SDM Auto ACK parameter set to '0'. Range : 01 to 14h (20) in steps of 1 second. Refer to the Sending and Receiving Short Data Messages (SDM) section.
[ITEM4]	**Lead In Delay** time in Transparent mode. Two ASCII hex characters. The Lead In Delay time of data transmission in Transparent mode is the time between the T201X radio receiving data and keying-up the transmitter, and the A75 sending the data. Range : 02 to FFh (255) in steps of 20 ms. Refer to the Transparent mode Lead In Delay section.
[ITEM5]	**Power-up Channel** Two ASCII hex characters to represent value of the channel number selected at power-up. Range : 01 to 04 (for T2010), or 01 to 24 (for T2015).
[ITEM6]	**Data ID**. Eight ASCII hex characters to represent the radio ID used when receiving SDM data. Any ASCII char is valid. " * " is the wildcard for any character. e.g. 12**5678. Refer to the Sending and Receiving Short Data Messages (SDM) section.

Example

An example of a typical configuration is: #12C401060A010000BASE8F

Message Field	Parameter	Entered at terminal
[IDENT]	PROGRAM.	#
[SIZE]	Size of parameter field	12
[PARAMETERS]	[ITEM1] = 	C4
	[ITEM2] = 01; SDM ACK delay time is 100ms (for details refer to the SEND_SDM section)	01
	[ITEM3] = 06; Wait for ACK is 6 seconds	06
	[ITEM4] = 0A; Transparent mode Lead in Delay is 200ms	0A
	[ITEM5] = 01; the T201X powers-up into channel 1	01
	[ITEM6] = 0000BASE; the ID assigned to the T201X radio is 0000BASE	0000BASE
[CHECKSUM]	Refer to the Calculating the [CHECKSUM] section	8F

PROGRESS (A75 to PC)

Unsolicited.

The PROGRESS message advises the PC of A75 status when some significant change of state in the radio occurs (typically during call processing).

In Transparent mode, if TMODE Filter control is enabled with the FUNCTION command, the A75 does not generate progress messages.

[IDENT]	**p**
[PARAMETERS]	[PTYPE] [PARA1]

[PARAMETER]	Function
[PTYPE]	A two-digit string representing a decimal number in the range of 00 to 99 which can identify the progress message category.
PARA1]	A single-digit number representing the message status.
[PTYPE] = 05	**Receiver Busy**. This message indicates that the receiver has detected an RF signal on the current channel. This message is sent when the current channel becomes busy.
[PTYPE] = 06	**Receiver Not Busy**. This message indicates that the receiver no longer detects an RF signal on the current channel. This message is sent when the current channel becomes available.
[PTYPE] = 07	**PTT Mic Activated**. This message indicates that the PTT has been pressed. This message is sent whenever the PTT is pressed in an attempt to transmit.
[PTYPE] = 08	**PTT Mic Deactivated**. This message indicates that the PTT has been released. This message is sent whenever the PTT is released after attempting to transmit.
[PTYPE] = 1D	**SDM ACK**. This message indicates that an SDM ACK was received after the last SDM sent. This only occurs if the modem receiving the SDM has SDM Auto ACK enabled. [PARA1] = 0 NO ACK RECEIVED [PARA1] = 1 ACK RECEIVED
[PTYPE] = 1E	**SDM Data Received**. This message indicates that the A75 received valid SDM data with the correct SDM Data ID. [PARA1] = 0 No SDM text message was included in the SDM. The [MESSAGE] parameter was empty [PARA1] = 1 The SDM included an SDM text message.

Example

An example of an ‘Progress’ message is: p0207C7

Message Field	Parameter	A75 Response
[IDENT]	PROGRESS.	p
[SIZE]	Size of parameter field	02
[PARAMETERS]	[PTYPE] = 07; the PTT mic has been activated by the FUNCTION command	07
[CHECKSUM]	The checksum for the message string, calculated by the A75	C7

QUERY (PC to A75)

The QUERY command requests the A75 to respond with data. The data can contain several types of information.

[IDENT]	**q**
[PARAMETERS]	[QUERY_TYPE]

[PARAMETER]	Function
[QUERY_TYPE]	A single ASCII hex character representing the query type.
[QUERY_TYPE] = 0	**Query Model** message. The T201X radio and CCDI information is returned to the PC as a MODEL message.
[QUERY_TYPE] = 1	**Query SDM** message. The SDM message is returned to the PC as a GET_SDM message.
[QUERY_TYPE] = 2	**Query Database** message
[QUERY_TYPE] = 3	**Query S/W Version** message
[QUERY_TYPE] = Blank	Same as [QUERY_TYPE] = 0

Example

An example of a 'Query' message is: q012FC

Message Field	Parameter	Entered at terminal
[IDENT]	QUERY.	q
[SIZE]	Size of parameter field	01
[PARAMETERS]	[QUERY_TYPE] = 2 to interrogate the database for the A75 configuration	2
[CHECKSUM]	Refer to the Calculating the [CHECKSUM] section	FC

SEND_SDM (PC to A75)

The SEND_SDM command requests the A75 to send a Short Data Message (SDM). The PC sends the SDM directly to the A75, and the T201X immediately keys up the transmitter. After the specified SDM Lead In Delay the A75 sends the SDM. The SDM does not need to include a [MESSAGE] parameter.

The SEND_SDM command can only be used in command mode, but an A75 can receive SDMs in both Command mode and Transparent mode.

[IDENT]	**s**
[PARAMETERS]	[LEAD_IN_DELAY] [DATA_MESSAGE_ID] [MESSAGE]

[PARAMETER]	Function
[LEAD_IN_DELAY]	**SDM Lead In Delay**. Two ASCII hex characters representing the SDM Lead In Delay between radio transmitter key-up and the start of data transmission. The range that can be entered is 00 to FF. The Lead In Delay is calculated by multiplying the number by 20 ms. A minimum of at least 100 ms of Lead In Delay is required, so 00 to 04 will always be treated as 05. This corresponds to a Lead In Delay between 100 ms and 5.1 seconds, in steps of 20 ms. Refer to the Sending and Receiving Short Data Messages (SDM) section.
[DATA_MESSAGE_ID]	**SDM Data ID**. An 8-character string representing the SDM Data ID of the radio to which the SDM is sent. It can be any alphanumeric characters. " * " is the wildcard for any character. e.g. 12**5678 When a radio receives a SDM message, the Data ID is checked against the ID entered in the radio database (using the PROGRAM command). If the Data ID matches, the received SDM data is stored and the radio sends a PROGRESS command to indicate this. If the Data ID does not match then the SDM data is ignored.
[MESSAGE]	**SDM text**. Maximum 32 characters of SDM data. [MESSAGE] is optional.

Example

An example of a 'Send SDM' message is: s0DFF0800TESTHi!B3

Message Field	Parameter	Entered at terminal
[IDENT]	TRANSPARENT.	t
[SIZE]	Size of parameter field	01
[PARAMETERS]	[LEAD_IN_DELAY] of FFh = 255 x 20ms = 5.12 seconds	FF
	[DATA_MESSAGE_ID] to address radio unit 0800TEST	0800TEST
	[MESSAGE] string 'Hi!'	Hi!
[CHECKSUM]	Refer to the Calculating the [CHECKSUM] section	B3

S/W_VERSION (A75 to PC)

Solicited.

The S/W_VERSION message is sent to the PC in response to a QUERY command. It sends the version of A75 firmware in the T201X radio.

[IDENT]	**v**
[PARAMETERS]	[SW_VERSION]

[PARAMETER]	Function
[SWVERSION]	**A75 firmware version**. An 8 character string identifying the A75's firmware version operating in the T201X.

Example

An example of an 'S/W Version' message is: v082256A1117F

Message Field	Parameter	A75 Response
[IDENT]	SW_VERSION.	v
[SIZE]	Size of parameter field	08
[PARAMETERS]	[SW_VERSION] = 2256A111; the T201X software version	2256A111
[CHECKSUM]	The checksum for the message string, calculated by the A75	7F

Transaction OK (A75 to PC)

The Transaction OK is a prompt character '.' (full stop, ASCII code = 2Eh) sent in Command mode by the A75 to the PC to indicate that it is ready to accept a new command. The PC must wait for the prompt before beginning the next transaction.

TRANSPARENT (PC to A75)

The TRANSPARENT command puts the A75 into Transparent mode. The parameter sent is the escape character which is used to exit Transparent mode and return to Command mode.

[IDENT]	**t**
[PARAMETERS]	[ESC_CHAR]

[PARAMETER]	Function
[ESC_CHAR]	A single character which is the **escape character**.

Refer to section 2, Changing Modes, for details.

Example

An example of a 'Transparent' message is:t01zB1

Message Field	Parameter	Entered at terminal
[IDENT]	TRANSPARENT.	t
[SIZE]	Size of parameter field	01
[PARAMETERS]	[ESC_CHAR]; used to return the A75 from Transparent mode to Command mode.	z
[CHECKSUM]	Refer to the Calculating the [CHECKSUM] section	B1