T2000-A76 AVL Modem

Operation Manual

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Contents

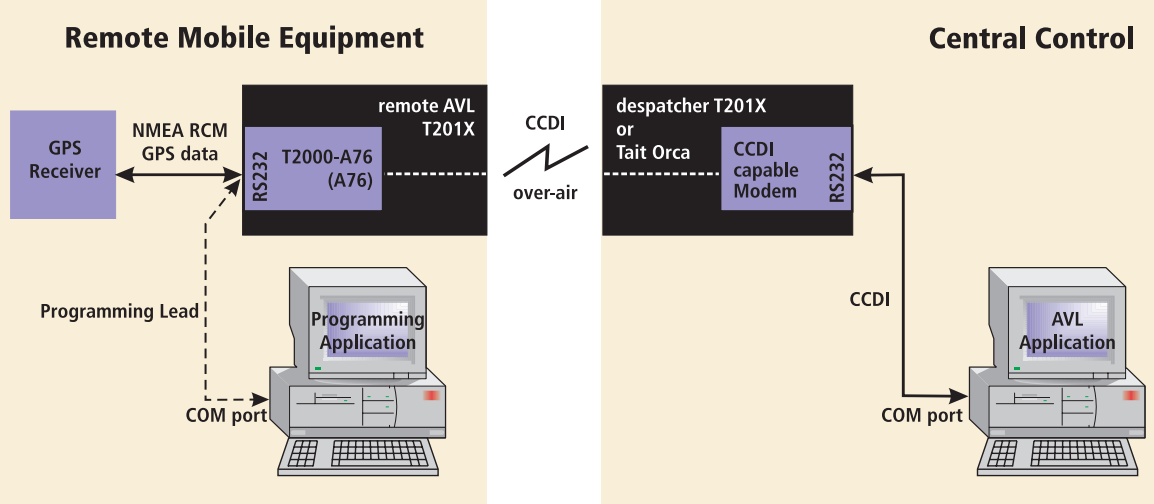
1 Overview

The T2000-A76 AVL Modem is fitted as an options PCB within a T201X mobile radio. The AVL enabled T201X radio collects and stores AVL data from a GPS receiver in its internal memory, which can then be relayed to central control equipment.

A typical AVL system comprises:

- a remote GPS receiver
- a remote AVL T201X radio with a T2000-A76 fitted internally
- a despatcher radio at the central control (CCDI capable T201X, Tait Orca or TRM)
- a central control personal computer (PC) running an AVL application (e.g. SmartTrac)

The AVL application instructs the despatcher radio to poll the remote radio for AVL position and velocity data which, when returned, is stored by the AVL application. The remote radio can also be set to emergency mode where it periodically sends unsolicited AVL data to the despatcher radio.



The despatcher radios uses the Tait CCDI (Computer Controlled Data Interface) over-air command protocol to communicate with the remote radio. CCDI commands containing short data massages (SDMs) are sent to the remote radio by the PC AVL application. Each SDM contains a command which tells the remote radio to one of the following:

- send an AVL report
- send database information
- set the Group Delay Time
- control the AUX line output
- reset the radio

The despatcher radio is CCDI capable and connects to the PC by a serial line using standard RS232 signals.

The GPS receiver sends data to the A76 using the NMEA-0183 data transfer protocol. The A76 interprets the RMC sentance from the GPS receiver.

Programming of the A76 is done using a special programming application from a PC via the serial port. Only the Group Delay Time which enables group polling of radios can be programmed remotely.

Glossary

AVL	Automatic Vehicle Location	NMEA	National Marine Electronics Association
GPS	Global Positioning System	RMC	Recommended Minimum (specific GPS/transit data)
SDM	Short Data Message	UTC	Universal Time Code

2 Operation

Features

The A76 modem in the T201X radio performs the following AVL functions:

- AVL data collection from the GPS receiver
- simple AVL polling by the despatcher radio
- group AVL polling by the despatcher radio
- emergency unsolicited AVL reports to the despatcher radio
- PTT generated AVL reports
- AVL data transfer to another radio using the CCDI over-air protocol
- A76 configuration database modifications using Tait proprietary NMEA style messages
- auxiliary output control using RS232 CTS line
- FFSK tone blanking when data received
- reads the version of A76 firmware over-air
- programs the Group Delay Time over-air so that group polling can be configured
- reads the programmed Group Delay Time setting over-air
- over-air reset of the remote radio with or without initiating database

AVL Data Collection

The A76 modem collects and stores NMEA RMC data at intervals set by the GPS receiver. When a AVL poll is sent from the AVL application to the remote AVL radio or an emergency activation occurs, an AVL report with the stored data is immediately sent to the despatcher radio and saved by the AVL application. Refer to the section , NMEA-0183 RMC Sentence Format, for a description of the NMEA RCM format. All RMC fields are initialised with '0'.

Radio Signalling

The signalling between the despatcher radio and the remote AVL radio uses the Tait CCDI V2.0 terminal and over-air protocol. CCDI Short Data Messages (SDMs) are used to send commands to the remote AVL radio and to pass information back to the central control computer.

Auxiliary Output

The auxiliary output from the A76 uses the RS232 CTS line on the serial port to switch external devices on or off. It can be remotely controlled by the despatcher radio by sending a AUX ON or AUX OFF message. Refer to the Auxiliary Output Control section. This feature can be enabled or disabled by the A76 configuration.

Emergency Mode

Emergency mode is activated by the RTS input on the A76 serial port. If asserted, the A76 enters Emergency mode and sends unsolicited reports at preset intervals. Refer to the Emergency Mode Activation section.

The Emergency mode feature can be enabled or disabled by the A76 configuration.

PTT Activated AVL Reporting

The A76 can be configured to send an unsolicited AVL report each time the PTT is pressed or released. Refer to the PTT Activated AVL Reporting section.

FFSK Tone Blanking

Tone Blanking is used for applications in which voice and data share the same channel. When valid data is received, the FFSK Tone Blanking mutes the radio. If the A76 detect either preamble or synchronisation bytes in the received FFSK data, the speaker is muted using the squelch line. Refer to the Programming the A76 section for database configuration information.

Error Handling

'old'	If the NMEA RMC data from the GPS receiver has the status flag set to 'V' (invalid), the AVL report is marked as 'old'.
'not operational'	If no AVL data is received from the GPS receiver for 20 seconds, an AVL report marked 'not operational' is sent. The will occur if the GPS receiver is disconnected.
'format error'	If a data error occurs, an AVL report is marked 'format error' is sent. This may be due to mismatched baud rates, an incorrect checksum or corrupt NMEA data.

Refer to section 8, Responses from the Remote Radio, for the response message format details.

A76 Configuration

Programming using NMEA

The serial RS232 serial port on the A76 modem is configured to expect NMEA type format. This means that the programming of the A76 database must be done using NMEA sentences rather than sending a standard CCDI Program command as is used with both the T2000-A75 Modem and the Tat Orca/Tait Radio Modem.

For this purpose four new Tait proprietry NMEA messages have been created:

- PTPGM - for programming the database configuration
- PTWDB - response from the A76 ro a PTPGM message
- PTRDB - for reading the database configuration
- PTDAT - response from the A76 ro a PTRDB message

Refer to the Programming the A76 section for details of the PTPGM settings.

Remote programming of Group Delay Time

The Group Delay Time is the only database configuration item that can be programmed remotely.

This is done using the Program Database command with a SEND_SDM CCDI message. Refer tothe Commands to the Remote Radio section for further details.

The Group Delay Time determines the time that a radio waits before responding to a AVL report Poll. This is so that when a Group Poll is sent, all the radios in the group respond at different intervals rather then simultaneously.

3 Compatibility

T201X Radio Firmware

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

Retrofitting an A76 AVL modem into a T201X radio, radios require radio firmware version 2.22 or later. If your radio uses an earlier firmware version, a new microprocessor can be purchased as a separate item. Contact your nearest authorised Tait dealer.

Remote Radio PGM Settings

When the A76 AVL 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 A76 can change the radio channel.
- 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 a CCDI modem fitted, set the default Lead In Delay in the A76 configuration to 200 ms or greater.
  The Lead In Delay can be reprogrammed as low as 40 ms, but the Economy mode **must** be disabled.

Despatcher Radio PGM Settings

The despatcher radio may be a Tait Orca, a Tait Radio Modem or a T2000 with a A75 fitted. Regardless of which radio is used, the modem must have Auto Acknowledge set to **disabled**.

GPS Receiver

The GPS receivers supported must use the National Marine Electronics Association (NMEA) 0183 version 2.01 (or compatible) RMC serial communication standard with suitable transmission rate and data format.

Tait Supports two different types of receivers.

The T2002-A00 GPS Receiver

The T2002-A00 GPS Receiver is a weatherproof receiver suitable for mounting outside a vehicle. It requires 13.8V which needs to be supplied on pin 6 of the RS232 socket at the rear of the T201x. This is generally supplied from S14 pin 1 of the T2000 Logic PCB.

The T2002-A00 has an optional mounting bracket (T2002-A01).

The T2003-A00 GPS Receiver

The T2003-A00 GPS Receiver is suitable for internal mounting. It requires 5V which needs to be supplied on pin 4 of the RS232 socket at the rear of the T201x. This is generally supplied from S14 pin 2 of the T2000 Logic PCB.

4 GPS Interfaces

RS232 Interface

The RS232 interface on the despatcher radio has the following parameters which are fixed in the radio modem 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	T2002-A00 supply
2	TXD	7	RTS *
3	RXD	8	CTS *
4	T2003-A00 supply	9	Not used
5	GND		

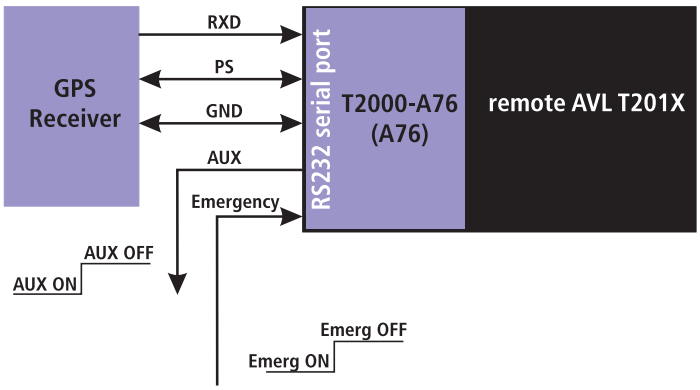
* not available in the standard T201X without a T2000-A76 PCB fitted.

Caution: Note that RS232 pin labelling can be misleading. A straight-trough cable is used to connect the GPS receiver to the T201x radio..

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

RS232 from Remote Radio to GPS Receiver

The NMEA data transfer between the Remote AVL radio and the GPS receiver uses only the RXD data line. CTS and RTS are used to active/deactivate the Aux Control line and Emergency mode respectively.



NMEA-0183 RMC Sentence Format

The NMEA RMC sentence is sent by the GPS receiver to the A76 in the remote AVL radio.

NMEA-0183 is a serial communication standard for encoding and sending GPS and other navigational data between devices. All characters are ASCII (plus carriage return and line feed).

The data is transmitted as sentences, beginning with a $, a two letter sender ID, a three letter sentence ID, followed by data fields separated by commas. The sentence is terminated with a checksum and a carriage return and line feed. A sentence can contain up to 82 characters.

If a data field is empty, a comma is still inserted.

This application of the NMEA standard uses the RMC sentence format which is especially formulated for AVL data.

The RMC sentance structure structure is:

$ - - RMC,hhmmss.ss, A,4925.345,N,yyyyy.yy,a,x.x, x.x,ddmmyy,x.x,a*hh<CR><LF>

sentence part	information type	Definition
- -	GPS receiver ID	
hmmss.ss	time (UTC)	hh = hours : two fixed digits mm = minutes : two fixed digits ss.ss = seconds : two fixed digits plus two optional decimal points
A	status	A navigation receiver warning. A = valid data V = invalid data
4925.345	latitude	49 degrees : two fixed digits 25.345 minutes : two fixed digits plus up to three optional decimal points

sentence part	information type	Definition
N	latitude reference	N = north S = south
12345.123	longitude	123 degrees : three fixed digits 45.123 minutes : two fixed digits plus up to three optional decimal points
W	longitude reference	E = east W = west
xxx	speed over ground (knots)	variable length field with up to three digits
yyy.y	course over ground (degrees true)	variable length field with up to three digits plus one decimal point. **Not sent in the AVL report**
ddmmyy	date	dd = day : two fixed digits mm = month : two fixed digits yy = year : two fixed digits **Only dd (day) sent in AVL report**
020.3	magnetic variation	20.3 degrees magnetic variation **Not sent in the AVL report**
E	magnetic variation reference	E = east : subtracts from the True course W = west : adds to the True course **Not sent in the AVL report**
*hh	checksum	* is a delimiter only cc = checksum calculated as a 8-bit exclusive OR (no start or stop bits) of all characters in the sentence between the '$' and the '*'. All ',' delimiters are counted. **Not sent in the AVL report**
<CR>	carriage return	**Not sent in the AVL report**
<LF>	line feed	**Not sent in the AVL report**

Note: The **shaded rows** define the sentence segments that are not sent by this application of the RMC sentence format.

5 Programming the A76

Before the A76 can operate, the radio must be configured correctly. The PROGRAM command is used to set up the default configuration of the A76. An Tait PC application is available for this.

As the serial port of the A76 is expecting NMEA data, the programming command must be in NMEA type format. For this purpose four new Tait proprietary NMEA messages have been created:

- PTPGM - for programming the database configuration
- PTWDB - response from the A76 to a PTPGM message
- PTRDB - for reading the database configuration
- PTDAT - response from the A76 to a PTRDB message

The NMEA PROGRAM command has the format :
$PTPGM [ITEM1] , [ITEM2] , [ITEM3] , [ITEM4] , [ITEM5] , [ITEM6] , [ITEM7] , [ITEM8] , [ITEM9] , [ITEM10]

[PARAMETER]	Function
[ITEM1]	A76 Configuration flags. Two ASCII hex characters to represent the following 1 byte of A76 configurational information. **Bit 1 and Bit 0 Baud Rate :** default = 10 Selects the baud rate of the A76 serial port. 00 : 1200 bps 01 : 2400 bps 10 : 4800 bps 11 : 9600 bps **Bit 2 PTT ANI Report :** default = 0 If enabled, an ANI report is sent whenever the PTT is pressed. Refer to PTT Activated AVL Reporting. 0 : No ANI report 1 : ANI report Sent **Bit 3 Over-Air Baud Rate :** default = 0 0 : 1200 bps 1 : 2400 bps (Note: the Tait Orca does not support 2400 baud) **Bit 4 FFSK Tone Blanking :** default = 0 If enabled, the speaker is muted if valid FFSK data is detected. Refer to FFSK Tone Blanking. 0 : Tone Blank disabled 1 : Tone Blank enabled **Bit 5 AUX Control :** default = 0 If set to 0, control of the AUX (RS232 CTS) output line is allowed. Refer to Auxiliary Output Control. 0 : AUX Control allowed 1 : AUX Control not allowed **Bit 6 Emergency Mode :** default = 0 If set to 0, the Emergency switch (RS232 RTS) input line will trigger Emergency mode. 0 : Emergency switch detected 1 : Emergency switch not detected **Bit 7 PTT Edge for ANI Report :** default = 0 0 : ANI report sent on PTT **PRESS** 1 : ANI report sent on PTT **RELEASE**

[ITEM2]	**AVL Report Delay Time :** default = 10h (1600ms) Two ASCII hex characters. The time that the A76 delays after receiving an Poll command until it sends back the response SDM. Range : 01 to FFh (25600) in steps of 100 ms. Refer to the section.
[ITEM3]	**SDM Lead In Delay :** default = 10h (320ms Two ASCII hex characters. The Lead In Delay time of data transmission is the time between the T201X radio receiving data and keying-up the transmitter, and the A76 sending the data. Range : 02 to FFh (255) in steps of 20 ms.
[ITEM4]	**Power-up Channel :** default = 01h (channel 1) Two ASCII hex characters to set the channel the selected when the radio powers-up. Range : 01 to 04 (for T2010), or 01 to 24 (for T2015).
[ITEM5]	**Data ID :** default = 00008001h Eight ASCII hex characters to represent the radio ID used when receiving an SDM. Any ASCII char is valid. " * " is the wildcard for any character. e.g. 12**5678.
[ITEM6]	**Emergency AVL Report Count :** default = 03h Two ASCII hex characters to set the number of AVL reports sent once Emergency mode has been activated. Range : 00 to FFh (255), if 00 then the Emergency AVL reports are sent indefinitely.
[ITEM7]	**Emergency AVL Report Period :** default = 05h (5 seconds) Two ASCII hex characters to set the interval between consecutive AVL reports once Emergency mode has been activated. Range : 00 to 3Ch (60), in steps of 1 second.
[ITEM8]	**Group Delay Time** : default = 1000h (4096 ms) Four ASCII hex characters to set the idle period before an AVL report is sent following a Group Poll. Range : 0000 to FEFFh (65279), in steps of 1 ms
[ITEM9]	**Preset AVL Despatcher Address** : default = 00008000 Eight ASCII hex characters to represent the default radio ID used to send AVL reports to. Any ASCII char is valid. " * " is the wildcard for any character. e.g. 12**5678.
[ITEM10]	**Software Version** Eight ASCII hex characters to represent the software version of the A76 firmware. Any ASCII char is valid. Always set to 2303A1xx, where xx is the version number.

6 Operation Sequences

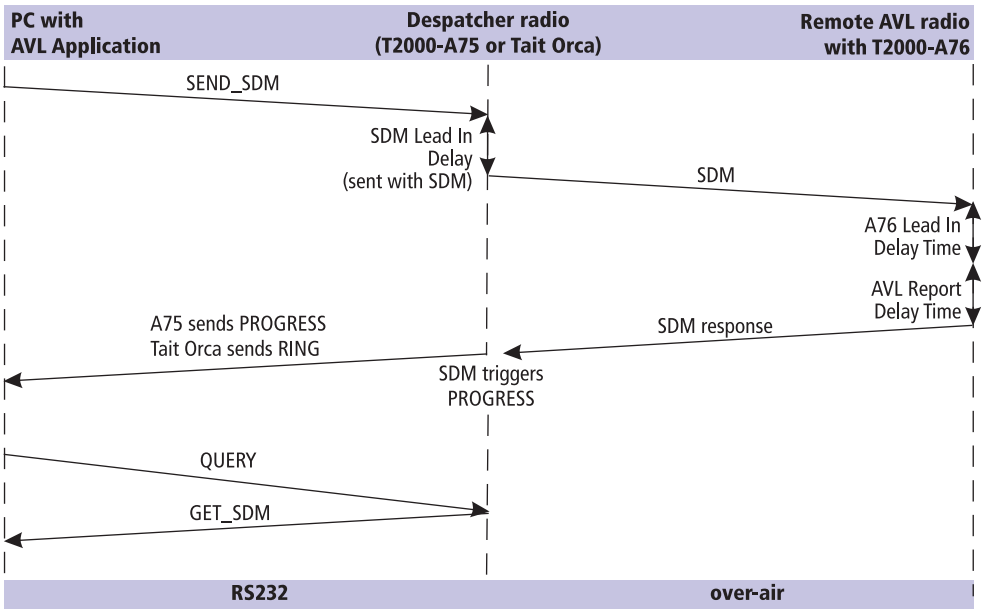
Polling the Remote AVL radio

A simple AVL Poll is sent from the PC AVL application to the remote AVL radio. The remote radio automatically responds with an AVL report.

The AVL Poll command is sent by the despatcher radio using a SEND_SDM command. The SDM contains instructions about sending the AVL report to either the default address (defined in the A76 configuration) or to a specified address sent with the command.

CCDI format : [IDENT] [SIZE] [PARAMETERS] [CHECKSUM] <CR>

SEND_SDM format : s [LEAD_IN_DELAY] [DATA_MESSAGE_ID] [COMMAND] [DATA] [CHECKSUM] <CR>

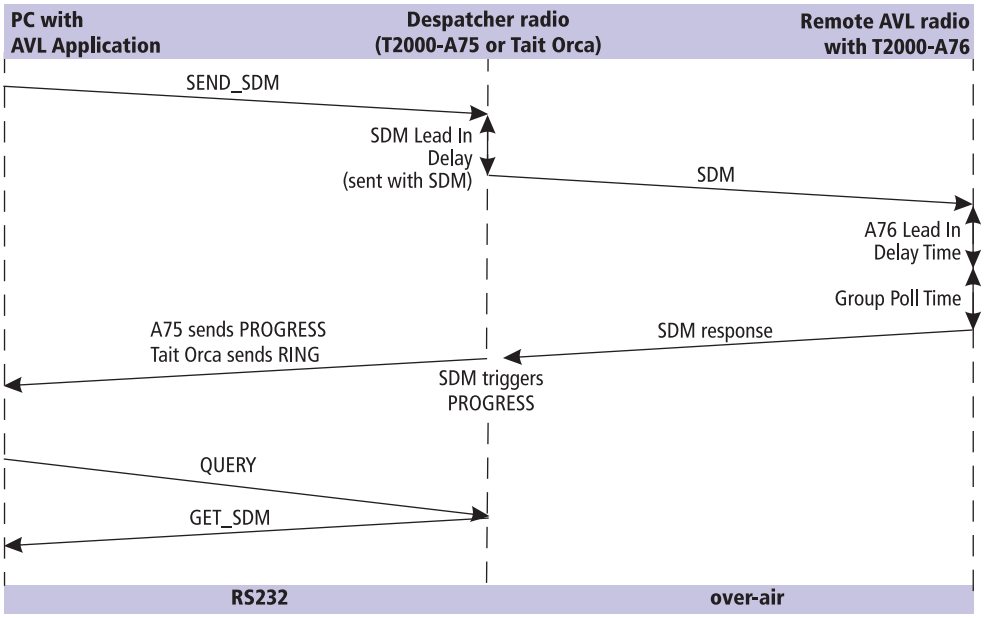


Group Poll

Polling of multiple radios can be done more efficiently by using a Group Poll. A Group Poll is sent by inserting a wildcard into the [DATA_MESSAGE_ID] part of the SEND_SDM command. The [DATA_MESSAGE_ID] is an 8-character string representing the SDM Data ID of the radio to which the SDM is sent. It can contain any alphanumeric characters and * can be inserted as the wildcard for any character. e.g. 12**5678

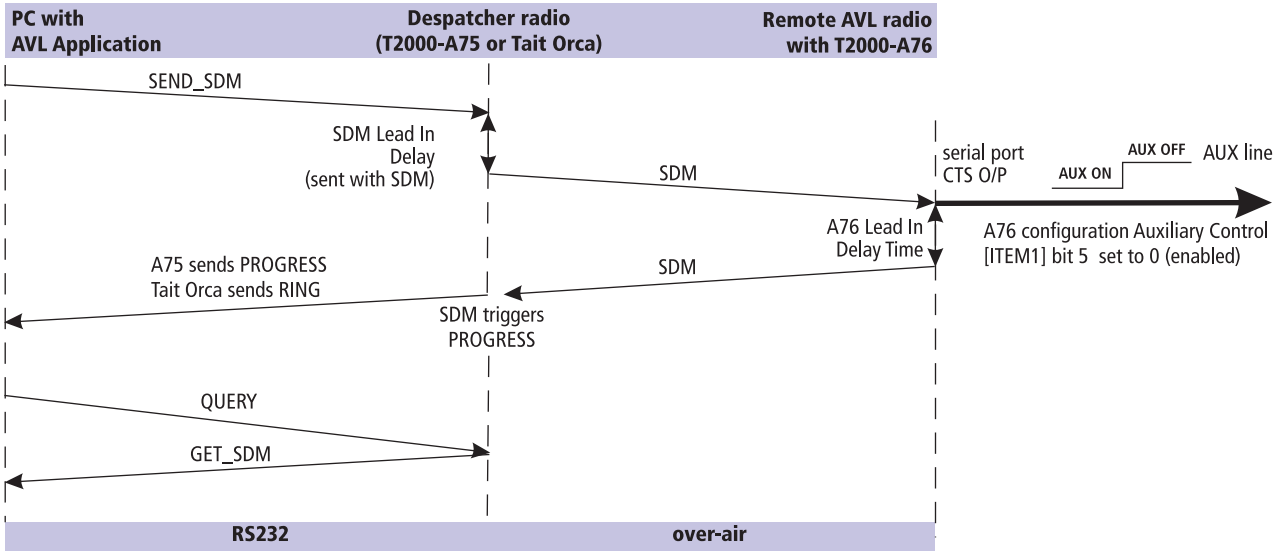
When a radio receives a SDM message, the Data ID is checked against the ID entered in the radio database. If the Data ID matches, the radio returns an AVL report. If the Data ID does not match then the SDM is ignored.

When a Group Poll is sent, all remote radios that are part of the group will respond with an AVL report. The idle time before the AVL report is the Group Delay Time set by the A76 configuration or the Program Database command.



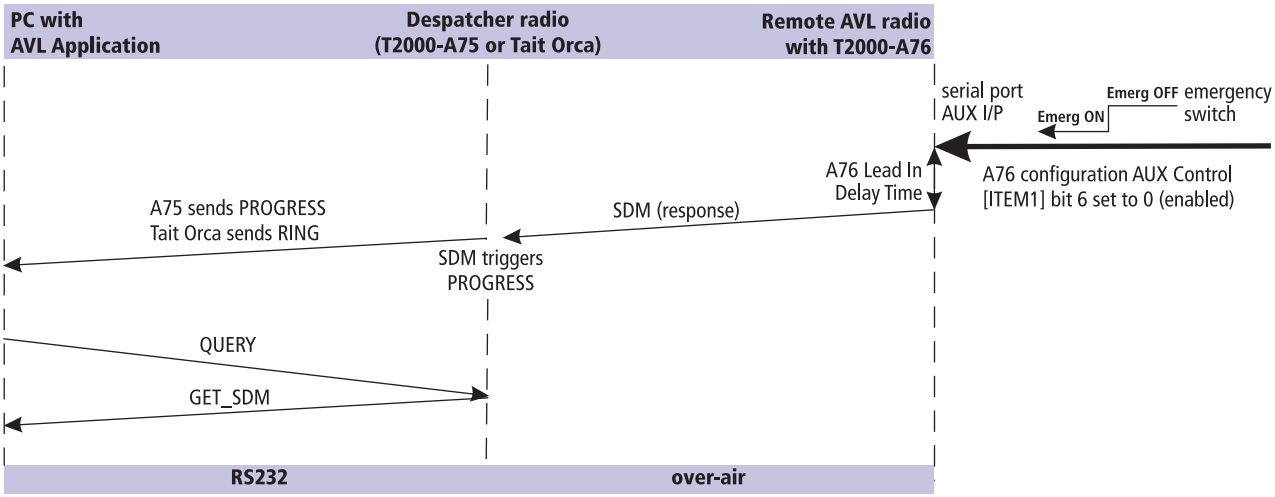
Auxiliary Output Control

The auxiliary output from the A76 uses the RS232 CTS line on the A76 serial port to switch external devices on or off. It can be remotely controlled by the despatcher radio by sending a AUX ON or AUX OFF message. This feature can be enabled or disabled by the A76 configuration.



Emergency Mode Activation

An emergency switch can be connected to the RS232 RTS input on the A76 serial port. When the switch is activated, the AVL radio sends an Emergency AVL report to the despatcher radio.



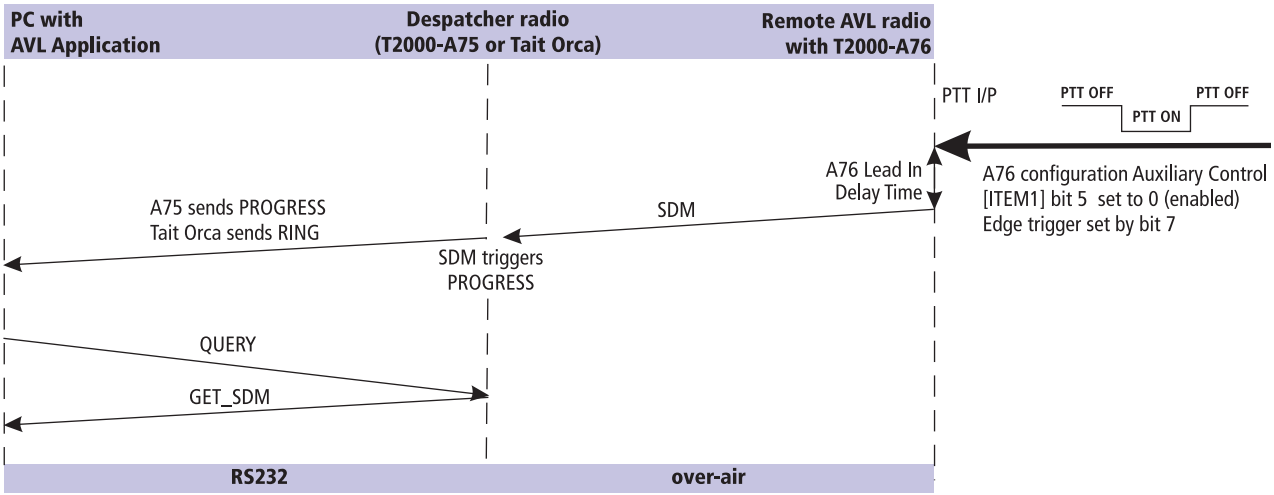
The operation of Emergency mode is controlled by the following configuration items - refer to the A76 Configuration section:

- Emergency AVL report count - the number of AVL reports sent after an emergency switch activation.
- Emergency AVL report period - the idle time between AVL reports sent after an emergency switch activation
- The despatcher address the address that the AVL report is sent to

The Emergency mode feature can be enabled or disabled by the A76 configuration.

PTT Activated AVL Reporting

The A76 can be configured to send an unsolicited AVL report each time the PTT is pressed or released. Refer to the A76 Configuration section. If the radio is already transmitting an AVL report when the PTT is pressed the current transmission is continued and no further AVL report is sent for that particular PTT press.



7 Commands to the Remote Radio

Commands to the remote radio are sent using the SEND_SDM CCDI command. It has the format :

s [LEAD_IN_DELAY] [DATA_MESSAGE_ID] [COMMAND] [DATA]

Notes: The [DATA] field is only sent with some commands.
The [COMMAND] and [DATA] fields are limited to a combined length of 32 hex characters.

The SEND_SDM is sent by the central control AVL application to the despatcher radio, then, after the specified SDM Lead In Delay, over-air to the remote AVL radio.

' s '

' s ' is sent as a single ASCII hex character and represents the SEND_SDM command.

[LEAD_IN_DELAY]

The SDM Lead In Delay is two ASCII hex characters representing the 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 Polling the Remote AVL radio section.

[DATA_MESSAGE_ID]

The [DATA_MESSAGE_ID] is 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

The first four bytes are generally the fleet ID, the second four the radio ID.

When a radio receives a SDM message, the Data ID is checked against the ID entered in the radio configuration database. If the Data ID matches, the radio sends a response to indicate this.
If the Data ID does not match then the SDM data is ignored.

[COMMAND]

The [COMMAND] part of the SEND_SDM contains the SDM text with commands to the remote radio.

The table below shows the structure of the [COMMAND] byte.

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function	0	Command Type			Return Address	Parameter		

[MESSAGE] first byte	Function
Bit 0 - 2	**Parameter** The Parameter is set depending on the Command Type that is sent. Refer to the table below for the Parameter options.
Bit 3	**Return Address** 0 : the AVL report is sent to the default despatcher address 1 : the AVL report is sent to the return address specified.
Bit 4 - 6	**Command Type** 000 : **Poll** - poll for a AVL report from the remote radio 001 : **Read Database** - read a database item from the remote radio 010 : **Program Database** - program database item into the remote radio 011 : **Control AUX** - used for controlling the AUX to the remote radio 100 - 110 : reserved 111 : **Reset** - used for resetting the remote radio
Bit 7	**Always 0**

Command Type Bits 4,5 and 6	C Parameters Bits 0,1 and 2	A76 Action / Response
Poll 000	000 : poll the AVL report. Always set to 000. 001 - 111 : the command will be ignored If a return address is sent, it is sent in the [DATA] bytes.	AVL report is sent
	Examples:	
	[COMMAND] = 00h = 0000 0000	Send AVL report to the default despatcher address
	[COMMAND] = 08,30,30,30,30,30,38,30,30h 08h = 0000 1000 followed by the address where 30h is ASCII for 0 and 38h is ASCII for 8	Send AVL report to the return address 00000800
Read Database 001	000 : read the software version 001 : read the Group Delay Time 010 - 111 : the command will be ignored If a return address is sent, it is sent in the [DATA] bytes.	A 'Read Database ACK' is sent back followed by the value of the database item
	Examples:	
	[COMMAND] = 10h = 0001 0000	Read the software version and send ACK (90h) plus the result to the default despatcher address
	[COMMAND] = 19,30,30,30,30,30,38,30,30h 19h = 0001 1001 followed by the address where 30h is ASCII for 0 and 38h is ASCII for 8	Read the Group Delay Time and send ACK (91h) plus the result to the return address 00000800
Program Database 010	001 : program the Group Delay Time 010 - 111 : the command will be ignored If a return address is sent, it is sent in the [DATA] bytes as is the Group Delay Time data. The address precedes the Group Delay Time.	The Group Delay Time is programmed into the database and a 'Program Database with Group Delay Time ACK' (A1) is sent back
	Examples:	
	[COMMAND] = 21,00,00h 21h = 0010 0001 followed by two bytes of Group Delay Time in ms, where 00 00h = 0ms.	Program the Group Delay Time with the value 0ms and send back a 'Program Database with Group Delay Time ACK' (A1) to the default despatcher address
.	[COMMAND] = 29,30,30,30,30,30,38,30,30,FF,00h 29 = 0010 1001 followed by the address where 30h is ASCII for 0 and 38h is ASCII for 8 and then two bytes of Group Delay Time in ms, where FF 00h = 65,280ms (65.28 seconds).	Program the Group Delay Time with the value 65,280ms and send a 'Program Database Group Delay Time ACK' (A1h) to the return address 00000800

Command Type Bits 4,5 and 6	Parameters Bits 0,1 and 2	A76 Action / Response
Control AUX 011	000 : sets the AUX (CTS) signal to ON 001 : sets the AUX (CTS) signal to OFF 010 - 111 : the command will be ignored If a return address is sent, it is sent in the [DATA] byte.	A 'Control AUX ACK' is sent back
	Examples:	
	[COMMAND] = 30h = 0011 0000	Sets the AUX (CTS) signal at the remote radio to ON and sends a 'Control AUX ON ACK' (B0h) to the default despatcher address
	[COMMAND] = 39,30,30,30,30,30,38,30,30h 39h = 0011 1001 followed by the address where 30h is ASCII for 0 and 38h is ASCII for 8	Sets the AUX (CTS) signal at the remote radio to OFF and sends the message 'Control AUX OFF ACK' (B1h) to the return address 00000800
Reset Radio 111	000 : Reset the remote radio only 001 : Reset the radio and initialise the database with factory settings 010 - 111 : the command will be ignored	no response
	Examples:	
	[COMMAND] = 70h = 0111 0000	Resets the remote radio
	[COMMAND] = 71h = 0111 0001	Resets the remote radio and initialises with values from the firmware

[DATA]

The [DATA] field is only sent if return address information and/or the Group Delay Time data is required to be sent. Refer to the previous table for details.

Note: Addresses
The default despatcher address is set during the configuration programming. Refer to the A76 Configuration section.
Address come in the form of eight ASCII hex characters. Any ASCII character is valid and " * " is the wildcard for any character. e.g. 12**5678.

8 Responses from the Remote Radio

Commands sent to the remote AVL radio generally require a response. The Reset command is the only exception to this. The response from the remote radio is sent as an SDM. It has the format :

[RESPONSE] [DATA]

The SDM is sent by the remote AVL radio over-air to the despatcher radio where it is then retrieved by the AVL application using the GET_SDM CCDI command.

The [RESPONSE] byte is specific to the command that was sent. The [DATA] is either an AVL report or other data determined by the response type.

[RESPONSE]

The [RESPONSE] is a one byte responses to the command from the AVL application.

The table below shows the structure of the [RESPONSE].

[RESPONSE] Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function	1	Response Type			Radio Status / ACK Parameter			

[RESPONSE] parts	Function
Byte 1 : Bits 0 - 3	**Radio Status / ACK Parameters** These bits are set depending on the Response Type being sent. Refer to the table below for the options.
Byte 1 : Bits 4 - 6	**Response Type** 000 : **AVL Report** - send the AVL report in response to the **Poll** command. The AVL report contains up to 17 8-bit bytes of data. 001 : **Read Database ACK** - sent in response to a **Read Database** command 010 : **Program Database ACK** - sent in response to a **Program Database** command. 011 : **Control ACK**- sent in response to the **Control AUX** command 100 - 111 : reserved
Byte 1 : Bit 7	**Always 1**

Response Type Bits 4,5 and 6	Radio Status / ACK Parameters Bits 0,1,2 and 3
AVL Report 000	Bits 0 and 1 are used to send error handling information, where 00 : AVL report sent with new data OK 01 : AVL report sent with old data 10 : GPS receiver down, no data sent, no AVL report to be sent 11 : Data format error, no AVL report to be sent Bit 2 is used it send Emergency mode status, where 0 : Emergency Mode OFF 1 : Emergency Mode ON Bit 3 is used to send the AUX (CTS) signal status, where 0 : AUX (CTS) signal OFF 1 : AUX (CTS) signal ON
	Examples:
	[RESPONSE] = 08 [AVL_REPORT]h 88h = 1000 1000 Interpretation: AVL report will follow with new data, Emergency mode is OFF and the AUX signal is ON. Refer to the AVL Report section for details of the AVL Report.
Read Database ACK 001	0000 : sends the software version 0001 : sends the Group Delay Time The returned data comes immediately after the ACK Parameters.
	Examples:
	If a Read Database command is sent to read the software version, the response is: [RESPONSE] = 90,32,33,30,33,41,35,32,30h 90h = 1001 0000 followed by the software version 2303A520 as 8 bytes of ASCII
	If a Read Database command is sent to read the Group Delay Time, the response is: [RESPONSE] = 91,00,00h 91h = 1001 0001 followed by the Group Delay Time of 00ms
Program Database ACK 010	0001 : the Group Delay Time has been programmed into the database
	Examples:
	[RESPONSE] = A1h = 1010 0001 is sent to acknowledge that the Group Delay Time has been programmed
Control AUX ACK 011	0000 : the AUX (CTS) signal to has been set to ON 0001 : the AUX (CTS) signal has been set to OFF
	Examples:
	[RESPONSE] = B0h = 1011 0000 is sent to acknowledge AUX ON
	[RESPONSE] = B1h = 1011 0001 is sent to acknowledge AUX OFF

[DATA]

The [DATA] field contains either an AVL Report or other data dependent on the type of acknowledgement being sent. Refer to the previous table for acknowledgement details.

AVL Report

Note: If no AVL data is received within 20 seconds or a format error occurs in the RMC data (incorrect check-sum), then the AVL report is not send. Bits 0 and 1 in the [RESPONSE] are set to 10 or 11 and only the response and the radio ID bytes are sent.

[AVL_REPORT]	MSB	LSB	Description
Byte 2	Radio ID '1'	Radio ID '2'	four digit BCD number - last four digits of radio ID from configuration database
Byte 3	Radio ID '3'	Radio ID '4'	
Byte 4	**1** **HH**		HH: Hour - two digit BCD number
Byte 5	**1** **MM**		MM: Minute - two digit BCD number
Byte 6	**1** **SS**		SS: Second - two digit BCD number
Byte 7	**1** **F**	**Ld**	F: Latitude Ref bit 4: 0=N, 1=S bit 5: 0=E, 1=W Ld: Latitude degrees - two digit BCD number
Byte 8	**Ld**	**1** **Lm**	Ld: Latitude degrees cont. Lm: Latitude minutes - two digit BCD number
Byte 9	**Lm**	**Ls**	Lm: Latitude minutes cont. Ls: Latitude decimal points - two digit BCD number
Byte 10	**Ls**		Ls: Latitude decimal points cont.
Byte 11	**1** **0** **1** **Gd**		Gd: Logitude degrees - three digit BCD number
Byte 12	**Gd**	**1** **Gm**	Gd: Longitude degrees cont. Gm: Logitude minutes - two digit BCD number
Byte 13	**Gm**	**Gs**	Gm: Longitude minutes cont. Gs: Logitude decimal - three digit BCD number
Byte 14	**Gs**		Gs: Logitude decimal cont.
Byte 15	**1** **0** **DD**		DD: Day - two digit BCD number
Byte 16	**Vk**		Vk: Speed over ground (knots) - three digit BCD number
Byte 17	**Vk**	**Vp**	Vk: Speed over ground cont. Vp: Speed over ground decimal - one digit BCD number

Note: If a digit is not convertible to BCD, then its value is set to 'F'.

9 CCDI Reference

The CCDI data protocol is used to send and receive commands from a CCDI capable modem in a radio.

The A76 modem in the remote AVL radio communicates with the despatcher radio using CCDI commands. To send and recieve messages using the over-air CCDI protocol, the despatched radio must have a CCDI interface (e.g. Tait Orca, Tait Radio Modem or T201x with an A75 fitted).

The over-air CCDI protocol is not described as the CCDI interface at the despatcher radio described in this manual is the only way to communicate with the A76 radio.

CCDI Message Format

All CCDI 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.

Restrictions

- 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.

Calculating the CCDI [CHECKSUM]

Note: This is not required if an AVL PC application such as is used to send commands.

[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.

Checksum Example

s0D050800TESTHi!DA

1. Take the modulo-2 sum of all message bytes preceding [CHECKSUM].
   - s = 73h, 0 = 30h, D = 44h etc. therefore the modulo-2 sum is:
     73 + 30 + 44 + 30 + 35 + 30 + 38 + 30 + 30 + 54 + 45 + 53 + 54 + 48 + 69 + 21 = 426h
2. Retain bits 0 to 7, discarding any higher order bits resulting from the summation.
   - 26h
3. Form the two's complement of the remainder.
   - 26h = 0010 0110
     two's complement = 1101 1010
4. Convert the binary number into two ASCII-hex digits, MSD first.
   - 1101 1010 = DA

The following CCDI commands are sent between the PC AVL application and the despatcher radio.

GET_SDM (despatcher radio to PC)

Solicited.

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

It has the format :

s [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	A76 Response
[IDENT]	GET_SDM.	s
[SIZE]	Size of parameter field	05
[PARAMETERS]	[SDM_DATA]; the SDM text message from the A76 EEPROM	Hello
[CHECKSUM]	The checksum for the message string, calculated by the A76	34

PROGRESS (despatcher radio to PC)

Unsolicited.

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

It has the format :

p [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 A76 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	A76 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 modem	C7

QUERY (PC to despatcher radio)

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

It has the format :

q [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 A76 configuration	2
[CHECKSUM]	Refer to the Calculating the CCDI [CHECKSUM] section	FC

SEND_SDM (PC to despatcher radio)

The SEND_SDM command requests the modem to send a Short Data Message (SDM). The PC sends the SDM directly to the A76, and the T201X immediately keys up the transmitter. After the specified SDM Lead In Delay the modem sends the SDM.

It has the format :

[LEAD_IN_DELAY] [DATA_MESSAGE_ID] [COMMAND] [DATA]

[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 Polling the Remote AVL radio 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.