WayWORD

Mobile Data Terminal and GPS Tracking System Technical and User Manual

Proposal for

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Version A5

Raveon

Mobile Data Terminal

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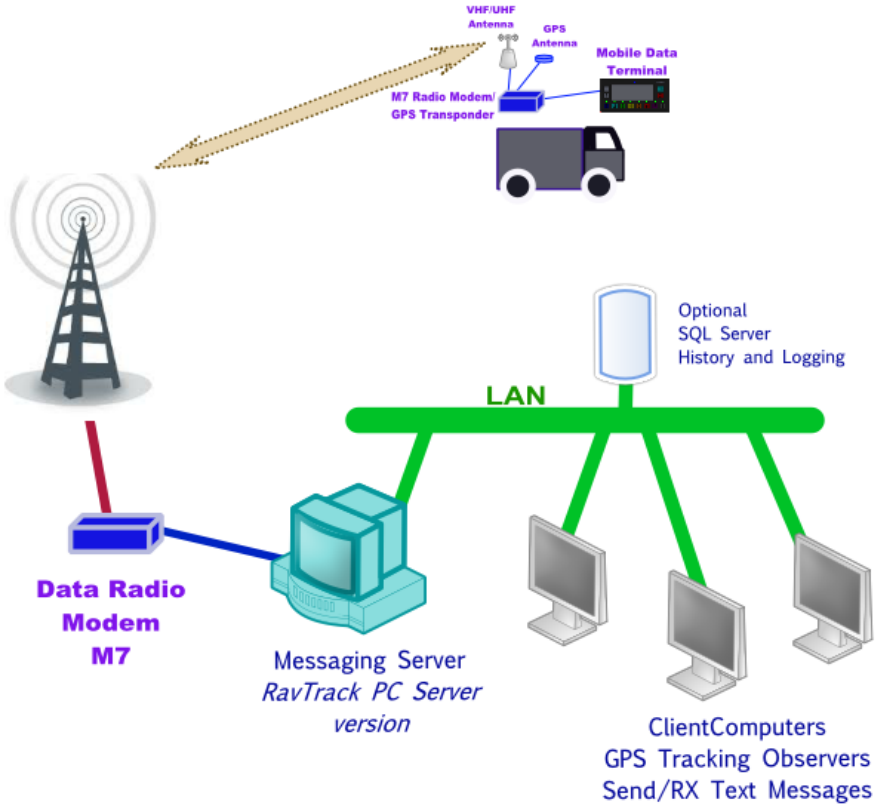
Table of Contents

1 Overview

1.1 General

This manual describes the features and options of the ***WayWORD*** RV-DT-8R Mobile Data Terminal (MDT). It also includes a section describing how the MDT's features are utilized within Raveon's RavTrack PC GPS tracking and messaging application.



2 *WayWORD* Mobile Data Terminal

The *WayWORD* is optimized for GPS tracking and two-way data communications with vehicle operators.

With 8 pre-defined status buttons, operators can quickly relay their status to a control center. Users may add custom captions on the label area on the bracket below the status buttons.

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In summary, the *WayWORD* has these features:

- 192 X 64 pixel graphics LCD capable of 4 lines of 24 characters each.
- 8 buttons to automatically report pre-set statuses.
- 2 more buttons to allow data entry of digits 0-9 for two-digit event codes.
- The LCD will display any text message sent to the radio modem it is connected to.
- A simple code entry mode for the user to enter a two-digit event code. The code is sent over the air, and can be displayed in *RavTrack PC*.
- Mount bracket for connecting a RAM mount with 1” ball.
- RFID reader option. If the RFID reader option is ordered with the MDT, it can read an RFID key fob. If the operator holds an RFID tag near the RFID side of the MDT, it will read the RFID tag number and transmit the number over the air.

3 Operating the *WayWORD*

3.1 Receiving Text Messages

When a new text message is received, the blue “NEW” led above the message window will illuminate. The operator may press the ✓ or **X** button to respond to the message. If one of these two buttons is pressed the NEW led will turn off and the ✓ or X response message is sent back to the radio modem that sent the text message. The *WayWORD* will support displaying messages up to 96 characters.

3.2 Sending One-Button Status Messages

Pressing one of the 8 status buttons will toggle the state of the particular status.

If the state is not active and the button pressed, the state is set to active, and the green led above the status button will illuminate. If the state was active, then pressing the button will deactivate it and the green LED above the button will turn off.

When the radio modem that is connected to the *WayWORD* transits its GPS position and status, the status of the 8 status buttons is transmtited every time.

3.3 Sending Two-Digit Event Codes

Pressing and holding any one of the numeric buttons(0 – 9) for more than one second will put the MDT into the two-digit event entry mode. The LCD will display the message “Event Code: X”, where X is the first digit used for the event code and the corresponding LED will flash, if applicable. The operator can then enter another digit (0-9) multiple times until the intended code is entered, then press the ✓ check button to send it. Once sent, the code is sent out the serial port to the radio modem.

3.4 Entering the UI Menu

By pressing buttons 1 and 2 simultaneously, it is possible to enter the User Interface menu. From here, it is possible to change the LCD contrast, backlight, and flash timer

values in the LCD settings screen, check the current registered RFID tag, vehicle run time and load count in the driver stats screen, and the model number, manufacturer and current software version under the device info screen. Navigating through these menus can be done by scrolling with the 0 and 9 buttons, and moving forward or backward with the ✓ or **X** buttons.

3.5 Backlight Level

Pressing the light bulb button will result in the backlight dimming, then turning off, then turning back on to full brightness.

3.6 ✓Button

This button is responsible for confirming any prompts that come up on screen, and navigating forward through the user interface menu. Inside of the UI menu, it may also be used to choose the selected option.

3.7 X Button

This button is responsible for canceling out of every text prompt the MDT displays. In the UI menu, it also functions to allow the user to move back a screen at a time until they exit the menu.

3.8 Function Button

This button is implemented for future use in the event that additional features are added, or existing features changed. Currently, this button does nothing.

3.9 Operator ID

To identify the operator of the ***WayWORD*** or the vehicle it is in, the ***WayWORD*** has a Radio Frequency ID (RFID) tag reader that can read common RFID tags and key FOBs.

When the operator holds the RFID key fob near the RFID reader, the text display on the MDT will display “YOUR ID: xxxxxxxxx” where xxxxxxxxx is the ID code of the RFID tag read.

Upon reading a valid tag, the ***WayWORD*** will send the RFID code over the air. The ***WayWORD*** will not store the RFID read upon power cycle, but the current operator will be shown correctly in RavTrack.

4 System Setup and Configuration

4.1 GPS Tracking Systems

The reporting interval is programmed into the radio modem. Refer to the technical manual of the radio modem to learn how to configure it for GPS status and position reports.

4.2 Messaging Only Systems without GPS tracking

The ***WayWORD*** can be used in systems that do not utilize GPS tracking. Raveon's data radio modems will work well with this type of system. All MDT features work the same as they do when used with or without GPS tracking.

5 Text Messaging Protocol

Text messages are sent to the ***WayWORD*** over-the-air from base stations or even other ***WayWORD***s. The ***WayWORD*** itself is a serial communication device, compatible with Raveon data radio modems, but the ***WayWORD*** may also be used with other modems or communication systems.

Each Raveon radio has a unique ID in it, so text messages can be sent to specific IDs or to the preset group-ID for multi-cast messaging.

The WayWORD and the RavTrack PC application handle all of the technical aspects of text messaging. Text protocol information is included here for users who want to write their own text messaging application.

5.1 ASCII Codes

5.1.1 Text

Text is sent over the air as ASCII characters:

33	!	34	"	35	#	36	$	37	%	38	&
39	'	40	(	41	)	42	*	43	+	44	,
45	-	46	.	47	/	48	0	49	1	50	2
51	3	52	4	53	5	54	6	55	7	56	8
57	9	58	:	59	;	60	<	61	=	62	>
63	?	64	@	65	A	66	B	67	C	68	D
69	E	70	F	71	G	72	H	73	I	74	J
75	K	76	L	77	M	78	N	79	O	80	P
81	Q	82	R	83	S	84	T	85	U	86	V
87	W	88	X	89	Y	90	Z	91	[	92	\
93	]	94	^	95	_	96	`	97	a	98	b
99	c	100	d	101	e	102	f	103	g	104	h
105	i	106	j	107	k	108	l	109	m	110	n
111	o	112	p	113	q	114	r	115	s	116	t
117	u	118	v	119	w	120	x	121	y	122	z
123	{	124	|	125	}	126	~	161	¡		
162	¢	163	£	164	¤	165	¥	166	¦	167	§
168	¨	169	©	170	ª	171	«	172	¬	173	
174	®	175	¯	176	°	177	±	178	²	179	³

180	´	181	µ	182	¶	183	·	184	¸	185	¹
186	º	187	»	188	¼	189	½	190	¾	191	¿
192	À	193	Á	194	Â	195	Ã	196	Ä	197	Å
198	Æ	199	Ç	200	È	201	É	202	Ê	203	Ë
204	Ì	205	Í	206	Î	207	Ï	208	Ð	209	Ñ
210	Ò	211	Ó	212	Ô	213	Õ	214	Ö	215	×
216	Ø	217	Ù	218	Ú	219	Û	220	Ü	221	Ý
222	Þ	223	ß	224	à	225	á	226	â	227	ã
228	ä	229	å	230	æ	231	ç	232	è	233	é
234	ê	235	ë	236	ì	237	í	238	î	239	ï
240	ð	241	ñ	242	ò	243	ó	244	ô	245	õ
246	ö	247	÷	248	ø	249	ù	250	ú	251	û
252	ü	253	ý	254	þ						

5.1.2 Control Characters

ASCII control characters are:

0	**NULL**		1		
2			3		
4			5		
6			7		
8	**Backspace**		9		
10	**Line Feed**		11		
12			13	**Return**	
14			15		
16			17	**DC1**	
18	**DC2**		19	**DC3**	
20	**DC4**		21		
22			23		
24			25		
26			27	**ESC**	Escape
28			29	**GS**	Group Separator
30	**RS**	Record Separator	31		
32			33		

5.1.3 Parameters

To send information over the serial communications link to/from the ***WayWORD***, Raveon utilizes the Group Separator character to enable binary data and various parameters to be communicated. Parameters start with the Group Separator (ASCII 29 or Hex 0x1D), followed by one ASCII character designating the parameter type, and then the parameter. The end of parameter is the last byte, or a GS indicating another group is coming.

Parameter Codes

Dir	*Code*	*ASCII*	*Meaning*	*Supported (DT8)*
O	A	65	Message response✓.	YES
I	B	66	Beep. Beep the beeper if the MDT supports audible beeping.	NO
O	C	67	Status codes. Following 4 ASCII hex characters are the current 8-bits of the status bits and external IO.	YES
N/A	D	68	NULL – No Use Yet	NO
O	E	69	Two-digit event code. Following two ASCII characters are the event code.	YES
I	F	70	Flash the MDT text display for x seconds. The following ASCII decimal characters specify how many seconds to flash the display.	NO
O	N	78	Message response X.	YES
O	a	65	RFID read one tag; following is the ASCII decimal RFID code.	YES
I/O	R	82	Reset/clear multiple status bits. Following ASCII characters are the ASCII hex representation of the bits to clear (not set).	NO
I/O	S	83	Set specifc status bits. Following ASCII characters are the ASCII hex representation of the bits to set (not clear).	NO
I/O	T	84	Set the state of specific status bits. Following ASCII characters are the ASCII hex representation of the state the output bits should be set to.	NO

After all groups of parameters are sent, the last character in the group of parameters should be a ASCII 30/0x1E RS record separator character.

For example to send the text Hello World followed by flashing the text screen for two seconds, the ASCII sequence of characters would be:

H e l l o <SP> W o r l d <GS> F 2 <RS>

5.1.4 End of Message

The <RS> character is interpreted as the end of the message. If a message is coming into the MDT, and it pauses for more than 20mS, then the ***WayWORD*** will assume the message has ended.

5.2 Status Button Messaging

If using a modem with WMX mode enabled, WMX will use a control byte (0x44) to transmit status to the radio. The command SETBITS will be used to specify the bit pattern of all the status bits in the form of:

SETBITS XXXX[cr]

Where:

XXXX is the bit representation of all status bits.

[cr] is a character return

BITS:

0-3: External Digital Input Bits From MDT

4-7: Digital Output Bits From MDT

8-15: Status Bits 1-8 of MDT Inputs and Outputs

5.3 Text message Format

All text entering the ***WayWORD*** will be displayed as a message on the text display of the MDT. To put the phrase **`Hello World`** onto the display, simply send the phrase **`Hello World`** to the display using a radio modem or its RS232 serial port.

However, the ***WayWORD*** has many additional advance features that you may utilize if you properly format the text to put on the display.

Commented [D1]: Like what?

6 Inputs and Outputs

6.1 DC Power

The MDT operates off a 10-28V DC input. A 3-pin DC input connector must be connected to DC power for the MDT to operate.

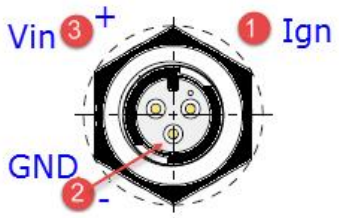


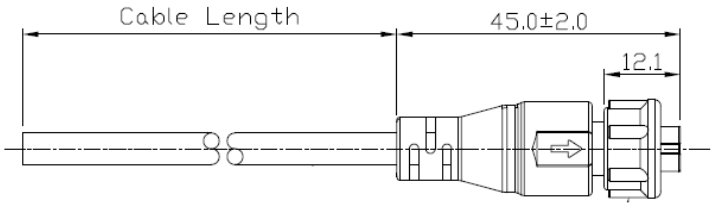
Figure 1 - Front view of the connector on the MDT.

6.2 Pin Out

Pin	Function	Wire Color	
1	Ignition Sense	Yellow	
2	Vin	White	
3	Ground	Black	

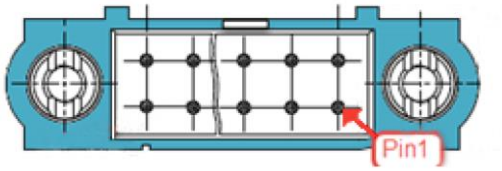
The Vin voltage must be between 10 and 28V DC input. Connect the GND wire to the chassis or battery ground. Battery ground (- wire) is usually best.

The power cable is a three-pin black PVC sealec cable custom made for the MDT. It is Raveon part number 4C001-30.



6.3 Digital Inputs and Outputs

A 12-Pin Harwin M80-5101242 Datamate connector is located on the top to connect various I/O options to the ***WayWORD***.



The mate to the connector is a Harwin J-Tek fema DIL cable connector part number M80-4601242.

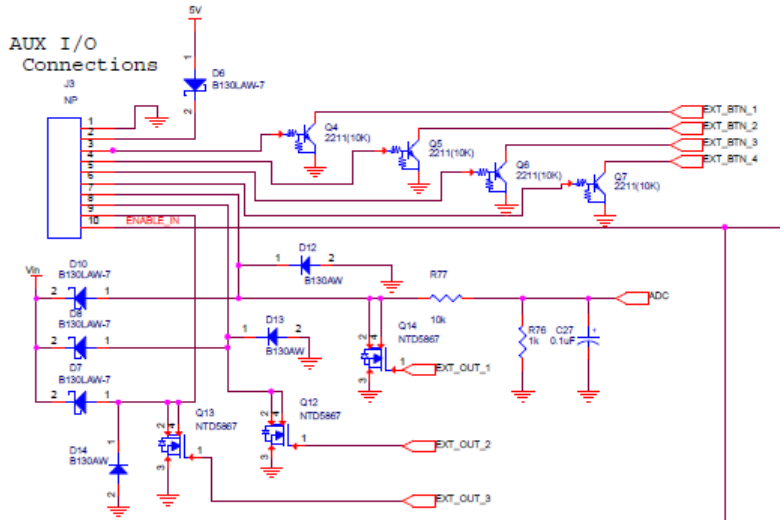
6.3.1 Pin-out:

The following table lists the pin-functions on the I/O connector.

Pin	Function	Connections to Monitoring Camera	Wire Color	
1	Ground	Ground	Black	
2	5V out		Brown	
3	IN 1 (bit 9 in $PRAVE)		Orange	
4	IN 2 (bit 10 in $PRAVE)		Yellow	
5	IN 3 (bit 11 in $PRAVE)	Fatigue Detect	Green	
6	IN 4 (bit 12 in $PRAVE)	Eye Detect Input	Blue	
7	Out 1		Purple	
8	Out 2		Grey	
9	Out 3		White	
10	MDT Enable IN		Pink	
11	Unused		Cream	
12	DC Out	DCV output to camera. Same voltage as DC input.	Red	

6.4 Connector Wiring

For those interested in how the I/O connector is wired inside the ***WayWORD*** to the microcontroller of the ***WayWORD***, below is a schematic diagram of the connections.

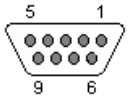


6.5 RS232 Serial Interface

An RS232 serial port on the MDT connects to a radio modem. Typically, that radio modem will communicate with a base station. All ***WayWORD*** units will ship with a 3m(10ft) male-to-female straight cable to ensure quick and easy setup between a radio and the ***WayWORD***.

6.5.1 RS-232/EIA232 Serial I/O Connector

The RS-232 9-pin serial I/O connector is a male 9-pin D-subminiature connector having the following pins configuration. It is pinned out so that it may be plugged directly into a radio modem (such as the M7).



Front-view of DB-9 connector on modem (male)

Pin	*Name*	*Dir*	*Function*	*Level / Specification*
1	CD	in	Carrier detect	Unused
2	RxD	in	Receive data	Data out of the modem to the WayWORD.
3	TxD	out	Transmit data	Data into the modem from the WayWORD.
4	DTR	out	Data terminal ready	Unused
5	GND		Ground connection	Signal and power ground

6	DSR	in	Data Set Ready	Optional input 1
7	RTS	out	Request to send	
8	CTS	in	Clear to send	Optional input 2
9	Power	In	DC power (not Ring signal)	User may supply the DC power to the WayWORD on this pin.

6.6 Command Mode

The WayWord may be put into a "Command Mode", by entering a sequence of three plus characters (+++). To keep the WayWord from unintentionally entering the Command Mode because of the +++ pattern occurring in a stream of data entering the modem, there must be a pause in the data stream before the +++ as well as a pause after the +++ is sent. If either pause is missing, the modem will not enter the command mode.

Using serial communications software such as *HyperTerminal*, send the 3-character command sequence "+++".

When the WayWord first enters the Command Mode, it sends the phrase "*RV-DT-8R*" out its serial port, and then an "OK" sequence. The "OK" sequence is a sequence of 4 characters:

"**O**", "**K**", <**CR**>, and <**LF**> characters (<CR> = ASCII 0D, <LF> = ASCII 0A)

Note that the internal power-management function may turn the product off to save power. When the radio powers on, it will send an "OK".

To ensure the device is on, and able to be put into the Command Mode, you may turn the unit off, and then back on.

6.7 Setting a Parameter

To set a parameter in the WayWord, enter the Command Mode as described above. Then enter the proper command, a space, the parameter, and then a carriage return (enter). For Example, to set the destination address of the WayWord to 1234, enter the following command:

ATDT 1234 <CR>.

Once a Parameter is changed, it will be permanently saved and the modem will begin using the new parameter.

Reading a Parameter

To read the value of a particular setting, issue the command with no parameter. The modem will return the value followed by an "OK".

For example, if the user enters the command to read the WayWord's destination address and its address was 1234, the user would issue the following command:

ATDT<CR>

and the modem will respond with:

1234 <CR> <LF>

OK <CR> <LF>

To get on-line help with a command, enter the command and put a question mark in for the parameter. For example, to see what the ATDT command is used for, type **ATDT ?**. The modem will respond by listing a brief description of the command. To see a list of all commands, type **HELP**.

6.8 Configuration Commands

Command	Command Description	Parameters	Factory Default
ATBD	**Baud Rate** – Sets serial com port baud rate (bps). Over-the-air (throughput) baud rate is set with ATR2 command. If a PC's serial baud rate is set higher than the fixed over-the-air baud rate of the module, hardware handshaking may be required.	Range: 0 – 7 0 = 1200 5= 38400 1 = 2400 6=57600 2 = 4800 7=115200 3 = 9600 4 = 19200	5
ATCH	**Configure Hardware Flow Control** – Enable (1) or disable (0) flow control. When enabled, the modem will monitor the RTS line, and if it is negated, stop sending data out the serial port. If disabled, the modem will ignore the state of RTS, and always send out characters.	1 = Enable 0 = Disable	0
ATDF	**Default Set –** If set, WayWord defaults to no statuses set on power up.	1 = Enable 0 = Disable	0
ATIO	**Set IO Mode –** 0 for normal RS 232 operation. 1 for RSR 232 with IN1 and IN2 mapped to DSR and CTS respectively.	0 = Normal Mode 1 = In1/In2 Mapped	0
ATVB	**Read DC input Voltage**– Returns the DC input voltage reading, in mV (12500 = 12.5VDC input).	None	none
ATVR	**Firmware Version** – Returns firmware version currently loaded on the module.	Read Only, 3 characters	none
ATZ	**Reset**	0 = Disable 1 = Enable	0
CONFIG	**Show Configuration.** Display the settings of every parameter in the unit. If the parameter is 1, then the help text is not displayed, If the parameter is 2, the configuration is output in strictly the format used to program another unit.	None, 1, 2	-
CONTRAST	**Contrast Adjust –** Adjust the value of the contrast.	Range: 0-100	50

EXIT	**Exit –** Exits the command mode	None	None
HELP	**Help Command –** Displays all possible commands	None	None
LANGUAGE	**Language Select –** Choose which language to use.	Range: 0 – 1 Will increase as more are added	1 - English
LCDCYC	**LCD Pixel Cycle –** Turns all the LCD pixels on. Press X to clear the screen.	None	None
LEDCYC	**LED Cycle –** Cycles through all the LEDs. Returns to the LEDs original state once done.	None	None
MMBIT	**New Message Bit Toggle –** Toggle an external IO bit when a message is received, and clear it once a message is responded to. Allows for indirect acknowledgements of messages.	1 = Enable 0 = Disable	0
MODEL	**Model Number –** Displays the model number of the device	None	None
WMX	**WMX Mode –** WMX mode enable/disable	1 = Enable 0 = Disable	1

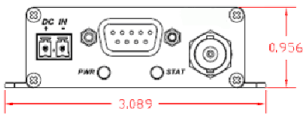
7 Radio Modems

The ***WayWORD*** connects to a radio modem that is used to send and receive its data. Raveon has a number of modems ideal for ***WayWORD*** data communications:

7.1 RV-M7 Series GPS Transponders

This transponder is available in either the UHF frequency band or VHF band. The M7-GX has 4 connectors:

1) GPS antenna connector
2) RF I/O antenna connector
3) DC power in
4) Digital inputs (RS-232).



At a programmable interval, the M7 transmits a short, compressed, and encrypted message with its position (long/lat), as well as other radio and vehicle data.

7.2 RV-M7-VB-WX weatherproof transponders

Raveon's M7 WX series of weatherproof data radio modems are a high-speed FCC compliant data radio designed for telemetry, wireless data, GPS, and remote control applications. Housed in an IP65 rated enclosure, the M7 WX is

a rugged and economical UHF or VHF GPS transponder.

For more information, visit here: http://www.ravtrack.com/rv-m7-weatherproof-gps-transponder

These transponders operate off 10-15VDC.

8 RavTrack PC

RavTrack PC version 6.0 and above support the ***WayWORD*** mobile data terminal, text messaging, status codes, and event codes.

8.1 Client Workstations

Anywhere on a TCP/IP network, workstations running RavTrack PC or other AVL software can access the SQL server; monitor the position of the vehicles, run reports, and set alarms and alerts.

8.2 RavTrack PC MDT Features:

The following is a list of features Raveon has incorporated into *RavTrack PC* for use with the MDT and also enhance its functionality for construction and mining applications.

A. A moving POI to count loads and vehicles entering a geo-referenced location.
B. Sending text messages to the MDT in vehicles.
C. Log operation status codes into a database as activated by driver via buttons on MDT.
D. Assign phrases to each individual status code.
E. Create alert rules based on the above activities.
F. Log the RFID into the SQL database of the person n the vehicle.
G. Validate whether a particular RFID is allowed to be in the vehicle, and output an enable/disable electrical signal that could be used to disable the vehicle.
H. Add a report that lists which drivers are in which vehicles and what activities were activated/logged by driver and vehicle.

8.3 Configuring RavTrack PC for Text Messaging

1. The communication channel used to send data to the mobile data terminal must have WMX enabled. Be sure to enable the WMX protocol on the radio modem used as the base station with RavTrack PC. In the *RavTrack PC* application:

a. Configure the *System Communication* channel that is linked to the base station radio modem to use WMX. The communication device to select in the System Communications is a "WMX Radio Modem".

b. For M7 base stations, select "*WMX Radio Modem, (38.4k baud)*" as the Device. Any Device that uses WMX as the communication protocol should work.

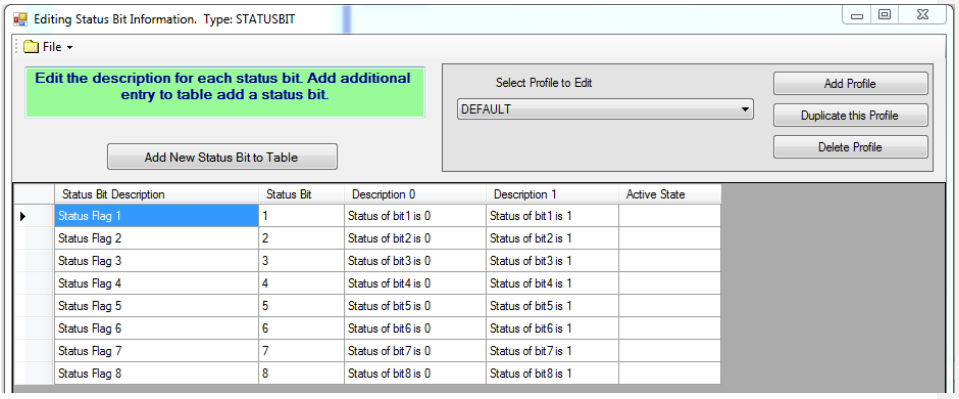
c. On the **Program Properties > Mobile Data** tab, make sure the computer that is connected to the base station has the "This Computer is the Message Server box checked.

d. On the **Program Properties > Mobile Data** tab, choose the channel to use for outbound messages or check the box "Use Last" to send the message on the channel the data terminal or GPS transponder was last received on.

8.4 Configure the IO Profile.

New in RavTrack PC version 6.0 is the concept of a "Profile". A profile describes the configuration and use of the IO bits, status bits, and event codes. Any number of Profiles may be created, and every tracked object must be assigned to some profile. A "Default" profile will be used by all new tracked objects that are added to the system until they are assigned to a different profile. You may create your own profiles or edit the default profile to suit the system needs.

To edit and configure Profiles, go to **Tools > Configure Status and Event Codes** > and then select **Status bits**, **Input Bits** or **Event Codes**. This will bring up the edit window to edit the selected profile information.

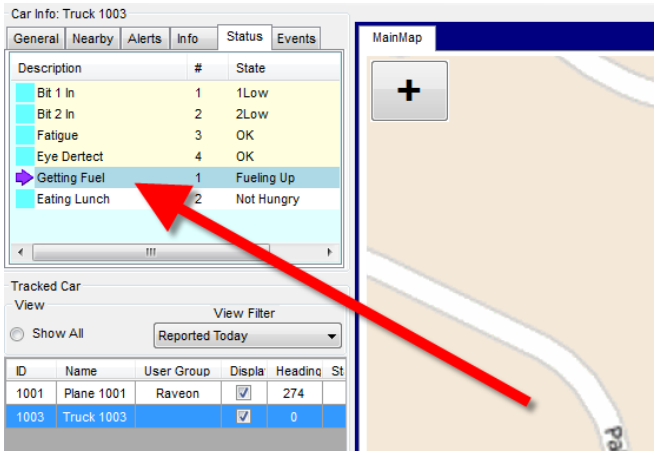


Click **Add Profile** to create a new profile.

In any of the description columns, click on any description to edit it. Hit **<enter>** key when you are done editing the field. When done editing, select **File>Save** to save your edits.

The Profiles are stored in the SQL server's RavTrack database, so all other computers running RavTrack PC will use the same profile settings. If you edit or create a profile, restart RavTrack PC on any other RavTrack PC computers so that they use the new Profile settings.

Set the "**Active State**" to either 0 or 1 depending on which state you want to consider as active. When a particular bit is "Active" it will display with the arrow symbol in the status window, as shown below where the status code 1 was active.



9 Mounting

Holes in the back of the MDT allow the use of RAM brand mounts. RAM makes a large number of mounting devices for most any vehicle and situation.

On the back of the MDT are 4 mounting holes designed to line-up with the RAM model number: RAP-B-202U-225.