Wisard Sensor Message Format Reference

File Reference:

Word Doc: /net/isf/isff/doc/Wisard/Wisard_Message_Format.doc
PDF Doc: /net/isf/isff/doc/Wisard/……

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Scope: This document describes the Wisard Sensors message format, the I2C addresses, identification numbers, naming assignments and how those are declared in the XML configuration for a project.

For more complete information about the SensorNode/Server and Repeaters and Sensors themselves including 'Operator Commands' see the individual Wisard Board Reference Documents.

See Also Wisard_Boards_V1.pdf
Wisard_Boards_V2.pdf
Wisard_Boards_PartsList.xls
Xbee9XRadioNotes.docx

Here is Documentation on the I2C Protocol, Addressing, line termination/impedance, etc.
http://www.i2c-bus.org/i2c-primer/

SensorNode Message Format:

Basic Message Format:

IDxxx	':'	Version#	MsgType	Message Contents defined by 'Version#'	CRC	EOM

3 Different Message Types following the same basic pattern that can be sent:

Serial Number *Messages*

NodeID	':'	Version#	0x00	SensorTypeIDs with S/N's for each	CRC	EOM

Data *Messages*

NodeID	':'	Version#	0x01	Sequence#	SensorTypes with data	CRC	EOM

Comment *Messages*

NodeID	':'	Ver#	0x02	Printable Character String	CRC	EOM

NodeID = 'IDx' - Printable Identifier denoting the Box ID Number specific to the SensorNode. Ranging from xxx= 'ID1' to 'ID128' in decimal representation.

> *Numbering issues related to DSM-XML Conventions:*
> In general the xml-id numbering is set to begin with 0x8000 for ID0, and 0x8100 for ID1, etc. so that each node can have 0xff sensor-types as noted below (i2c limit of 0x7f).
> If a configuration has multiple base motes connected to a dsm then we have to be a bit more careful in numbering the node 'IDxx' because we would be inclined to set the base id of the second base mote to 0x9000. Thus, a mote id of 17 (0x11) on the first base mote would then conflict with a mote id of 1 on the second base. They both would have ids starting at 0x9100.
> However there is a work around for that too. One can have multiple base motes and give them all an id of 0x8000.

Separator Character ':' 1-Byte Printable: Indicates the end of the 'NodeName'

Version# - 1-Byte Binary: 1-255. The version number which defines message contents. It is primarily used for keying the SensorTypeIDs and their specific data fields. The Version# maps to different tables of SensorID's with each ID segment having a unique number of data parameters/format as shown in the Version# Tables below…

Message-Type Value - 1-Byte: As noted above

Sequence# - 1-Byte Binary: 0-255.

SensorTypeIDs with S/N's - A sequence of 3-Byte fields each holding a 1-Byte SensorTypeID followed by its 16-bit serial number, up to the total number of sensors being reported.

SensorTypeIDs with Data - A sequence of 1-Byte ID values followed by specific binary data unique to the sensor. Data are big-endian: ie. LSB first, then MSB.

Printable Comment Messages – Unique to the comment. Some examples will be the reply a SensorNode sends in response to a Command issued by the base: Base sends: "xb=pl" Node Responds "IDx xb=pl=1"

CRC CheckSum - 1-Byte Binary: XOR of all characters appearing up to but not including the EOM and the CRC itself. CRC is initialized with the message length as: total-message-length - 'end-of-message-record-length' (i.e. 3) – crc-length (1).

EOM Message Terminator - 3-Bytes Binary: ETX, EOT, CR (0x03, 0x04, 0x0D)

SensorTypeIDs - Version 1

ID=I2C address	Short Name	Long-Name	# Data Values	Data Parameters: 16-bit (LSB,MSB)
0x00-07	Non-Pollable Addresses reserved by I2C specification			
0x01		Time – PIC's idea of it	1-unsigned 16-bit	tenths of seconds of 'current hour'
0x04		Generic Short-Int	1-signed 16-bit	
0x05		Generic Long	1-signed 32-bit (lsb to msb)	Missing = 0x80000000
0x0C		Timer_Count	1-unsigned int	Status: Value being used of TIMER_COUNT
0x0B		TotalTimeTicks-1S	1-unsigned 32-bit (lsb to msb)	Total Time Counter Accumulated: 1Secs
0x0D		TotalTimeTicks-10mS	1-unsigned 32-bit (lsb to msb)	Total Time Counter Accumulated: 10mSecs
0x0E		TotalTimeTicks-100mS	1-unsigned 32-bit (lsb to msb)	Total Time Counter Accumulated: 100mSecs
0x0F		Date//Time	1-unsigned 16-bit 3-unsigned 8-bit	Jday, hour, minute, seconds
0x10-13	T,RH	TRH – NCAR	3-signed 16-bit	Temp .01degC; Humidity .01%; Current mA
0x14–17	P	Baro		
0x18–1B	Spd, Dir	Winds		
0x1C–1F	Rainr, Raina	Rain		
0x20–23	Tsoil	Tsoil – 4-probe pitchfork	4-signed 16-bit	soil temps 1-4, hundredths of degC **Fastest I2C Polling >= 2Seconds per sample**
0x24–27	Gsoil	Gsoil – Rebs HFT	1-signed 16-bit	soil heat flux, tenths of W/M^2
0x28–2B	Qsoil	Qsoil – Echo Probe	1-unsigned 16-bit	soil moisture, hundredths of percent
0x2C–2F	Vheat, Vpile.on, Vpile.off, Tau63, lambdasoil	TP01 – Huskeflux	5-signed, 16-bit	soil thermal properties CHANGED 11-09 #1=Vheat, signed heater voltage in .1mV, expect 0-2v (12001 = 1.2001v) #2= Vpile-SensorOn, in microVolts (ie 925) #3=Vpile-SensorOff, in microVolts (ie 24) #4=Tau63, unsigned time difference, in .01sec (ie 1535 = 15.35secs, expect 0-200 #5=lambda, thermal properties in .001W/milli-degK (ie 259=.259)
0x30-33	Generic 5Ch		5-unsigned 16-bit	
0x34-37	Generic 4Ch		4-unsigned 16-bit	
0x38-3B	Generic1Ch		1-unsigned 16-bit	
0x3C-3F	Tsfc		1-signed 16-bit	IR Temperature Sensor, .01degC
0x40		ModeID	1-unsigned 8-bit	SamplingMode
0x41		Xbee Status	7-unsigned 16-bit	HeartBeat (count from repeater/base) TR (#Tx Errors w.o. Ack) ER (#Rx Errors: length,crc) GD (#Rx good) SM (sleep mode) MS (missed sync messages) SQ (#sleep cycles with missed sync)
0x49-OLD-	Vin, Iin, V3.3, I3.3,	PowerMonitor	6-unsigned 16-bit	Vsupply, I supply, I3.3, V3.3, Ixbee, Isensors in either mVolts or mAmps per reading.

Version1 Note 3	Ixb, Isnsr			
0x49 Version2 **Note 3**	Vin, Iin, I3.3, Isnsr, spare, spare	PowerMonitor	6-unsigned 16-bit	Vsupply (mV), I supply, I3.3, Isensors (mAmps) Spare, Spare.
0x49	Vbatt, Iload, Icharging, Temperature, spare, spare	PowerMonitorBoard for ISFS; Batt status monitor for DSM	6-unsigned 16-bit	Vbattery (mV), I load (mA), Icharging (mA), Temperature (mdegC) Spare, Spare.
0x4C-4F				
0x50–53	Rnet	Rnet – Rebs Q7	1-signed 16-bit	net rad.; tenths of W/m^2
0x54–57	Rsw.in	Rsw – Incoming	1-unsigned 16-bit	shortwave; tenths of W/m^2
0x58–5B	Rsw.out	Rsw – Outgoing	1-unsigned 16-bit	shortwave; tenths of W/m^2
0x5C–5F	Rpile.in, Tcase.in, Tdome.in	Rlw – Incoming, Eppley	5-signed 16-bit	Rpile in .1 W/m^2; Tcase, Tdome1-3, in .01 degC **Fastest I2C Polling Rate >= 2Seconds per sample timing.**
0x60–63	Rpile.out, Tcase.out, Tdome.out	Rlw – Outgoing, Eppley	5-signed 16-bit	Rpile out300 .1 W/m^2; Tcase, Tdome1-3, in .01 degC **Fastest I2C Polling Rate >= 2Seconds per sample timing.**
0x64-67	Rpile.in, Tcase.in	Rlw – Incoming, Kipp&Z	2-signed 16-bit	Rpile in .1 W/m^2; Tcase in .01degC
0x68-6B	Rpile.out, Tcase.out	Rlw – Outgoing, Kipp&Z	2-signed 16-bit	Rpile out .1 W/m^2; Tcase in .01degC
0x6C-6F	Rsw.net Rlw.net	CNR2 - Kipp&Zonnen	2-signed 16-bit	Rsw Difference in .1 W/m^2 (incoming-outgoing) Rlw Difference in .1 W/m^2
0x70-73	Rsw.dfs	Rsw - Diffuse / shadow-band Licor	2-unsigned 16-bit	shortwave; tenths of W/m^2
0x74-77	Rpar		1-unsigned 16-bit	Photosynthetically Active Radiation, .1W/m^2
0x78-7B	Unavailable: Introduces 10-bit addressing using the last 2 bits plus another address byte			
0x7C-7F	Unavailable: Reserved by specification for future purposes			

Update Feb-13: Added types for: Tsfc, Rpar
Update Oct-10: Added types for Generic5Ch,4Ch,1Ch
Update May-10: Added Rsw.dfs for Diffuse Radiation, addresss 0x70-73, Changed names Rsw/Rlw.diff to Rsw/Rlw.sum for the difference. Changed rainr/a to Rainr/a
Update Nov-09: Added Rlw.in/out. for K&Z type long waves
Changed TP01 message from 3 values to 5 per SteveO/SteveS

Note 0: Sensor data will appear in a 'packet' beginning with its 1-byte ID followed by the indicated 16-bit parameters; resulting in a length of 1+nvalues*2 bytes.

Note 1: I2C addresses are 7-bit, although 10-bit is available, wisard does not use it. Addresses 0-7 are reserved slots. **Poll-able addresses can range from 0x08-0x77.**

Note 2: Missing Data Values: 0x8000 (i.e. -32768 for a 16-bit signed int), 0x80 (for byte value)

Note 3: PowerMonitor: Version1 Wisard boards had 6 values for power monitor as shown. Version2 Wisard boards do not include the extra V3.3 and Ixbee readings and the values have been re-ordered. The 'Version2' format retains the 2 last slots for backwards 'crc' compatibility with version1, and will allow specialized test code, if created, to send additional readings.

The **'Short-Name'** fields correspond to the ASTER naming convention and appear in the netcdf variable field names combined with the 'Height' and 'Location', etc.

Actual Sensor I2C Message: The sensor's message is slightly different than above. When polled it responds with 1 extra byte holding its serial-number 0-255.
Example – Tsoil:
Sensor I2C poll address 0x20; reply = sn,t1-lsb/msb,t2-lsb/msb,t3-lsb/msb,t4-lsb/msb
Message Sent through SensorNode 0x20,t1-lsb/msb,t2-lsb/msb,t3-lsb,msb/t4-lsb,msb

XML Declarations / ID Assignments:

Adam XML declarations depends upon setting up the correct SensorClass, Sensor IDs and Sample IDs .
SensorClass: isff.WisardMote
SensorID: Normally beginning 0x8000, but not required. The difference between sensorIDs will be 256 to allow for all possible sensor-types a node may serve. Historically tagged to the serial interface port, height, etc. but not in this case. Instead they are tagged to the box/UnitID: <!-- This is for the 'Normal Wisard V1 Message' -->

```
<serialSensor class="isff.WisardMote"
 baud="9600" parity="none" databits="8" stopbits="1"
 devicename="/dev/ttyS5" id="0x8100">      // sensor id for UnitID=1
<serialSensor class="isff.WisardMote"
 baud="9600" parity="none" databits="8" stopbits="1"
 devicename="/dev/ttyS10" id="0x8200">      // sensor id for UnitID=2
```

To support dynamically added SensorNodes a sample entry is needed in the xml for each and every possible mote that could be added. For an example:

```
<serialSensor class="isff.WisardMote"
        baud="57600" parity="none" databits="8" stopbits="1"
        devicename="/dev/ttyS5" id="0x8000"  >
              <sample id="0x100" suffix=".mote1_ttyS5" >
            </sample>
```

The mote (ID=1), needs an entry sample id="0x100" in the xml. The data output from the mote(id=1) needs to have ID1 as a data message. The same is true for motes 2-x.

Operator Interaction:

Sensor Node Commands: Version 2.4 and beyond

BasicOperations:	‘id’ ‘md’ 'mp' 'pp' 'fsON' 'fsOFF' 'sensorsON' 'sensorsOFF'
Rates/Timing:	‘dr’ ‘sp’ ‘sn’ ‘fsr’ ‘sx’ ‘xr’ ‘cache’ ‘bf’ ‘ba’ ‘st’ ‘jd’
EEPROM:	'eecfg' 'eeinit' 'eeupdate' 'eeload' 'eeflags'
BattVoltageMonitor:	'vm' 'vh' 'vl' ‘vs’
XbeeRadio:	‘XBtalk’ ‘hb’ 'sx' 'xr' 'xg' 'xbdl' 'xbch' 'xbid' 'xbst' 'xbsp' 'xb=' 'xs' 'xv' ‘rxb’
GPS:	'gpsON' 'gpsOFF' 'gr' 'gforce' 'gnl' 'gto' 'gfr' 'gmf'
Misc:	'reset' 'reboot' '?'

Command	***Description***	***Notes***
?	List available Commands	List sent as ‘comment-messages’
Basic Operating Commands		
id id=xx	Report/Set Node ID number	ID Maximum=99 decimal
md md=0 md=1	Report/Set Sampling Mode Normal Self-Timed Xbee Sleep Mode	 Self-Timed initiated Sampling Xbee Sleep mode interrupt Sampling xb=st reports awake time (in mS) xb=sp reports sleep time (in 10mS)
mp mp=0 mp=1 mp=2	Report/Set Output Message Mode Normal Wisard Binary DSM Printable (i.e. for rserial) ASCII Printable (i.e. for dumb terminal)	 Decoded values in ‘Wisard-Wrapper’ Decoded values
pp pp=0 pp=1	Reports Primary Output Port Sets Primary Port to SIO Sets Primary Port to Xbee	
fsON / fsOFF	Turns On or Off Local Message Storage	
sensorsON sensorsOFF	Self explanatory.	
reboot / reset	Self explanatory.	Causes full Software Reboot.
Message Rates / Timing Commands		
dr dr=xx	Set/Report Data Sampling Rate in Seconds	Self-Timed Mode Only
cache cache=x	Reports if Caching is ON … Sets how many to send in 1 cached message in Self-Timed Mode, or Turns on Caching in Xbee-Sleep Mode	NOTE: Xbee Sleep Mode caching works differently. Depends upon the xb=sp (sleep time) and your dr data rate. Data rate samples are cached until the Xbee comes awake.
sp sp=xx	Power Sampling Rate in Skip-Messages-Count * ‘dr’=seconds	0=disabled
sfr sfr=xx	Local Storage File Cycle Rate in Skip-Messages-Count * ‘dr’= seconds	Normally 10-minutes. If a crash occurs, local store data is lost after its most recent file cycle, ie up to 10min
sn sn=xx	Serial Number Report Rate in Skip-Messages-Count * ‘dr’= seconds	0=Disabled

sx sx=xx	Xbee Status Report Rate in Skip-Messages-Count * 'dr'= seconds	0=Disabled
st st=hhmmss	Report/Set	
EEPROM Commands		
eecfg	Reports the default Operating Values	
eeupdate	Reprograms the EE with the current Operating Values	Do this after changing a EE parameter and have it saved.
eeinit	Restores 'factory defaults' to EE	
eeflags	Diag. only	
eeload	Immediately reloads the Operating Values from EE	You may want to do this to confirm your 'eeupdate' settings.
Battery Voltage Monitoring / Shutdown-Startup Commands		
vm	Toggles 'Vbatt-Power-Shutdown-Monitor' mode.	Xbee radio, gps, sensors are turned off if battery is below….and starts again if above….
vl vl=xxxxx	Vbatt_Shutdown_Level in mVolts: vl=11500 would be 11.5VDC	
vh vh=xxxxx	Vbatt_Startup_Level in mVolts: vl=12200 would be 12.2VDC	
vs vs=xxxx	Vbatt Sleep Rate in seconds	Time period in-between checking if vbatt is high enough to restart
Xbee Radio Commands		
xs	Send Xbee Status Report immediately	Lists important Xbee Operating Parameters
xr xr=	Xbee Reset Rate in Seconds	0=Disabled If a 'hb' heart-beat isn't received in this time period a reset is performed.
hb	Xbee Heart-Beat Message Clears the counter for Xbee resetting	Normally this is sent automatically by the base station/repeater. If that is not being used as in PCAPS, then the Xbee will reset at the 'xr' rate.
rxb	Immediately Reset Xbee by pulling reset line low	Normally not needed
xb=xx	Individual Xbee command handling. Reports the current setting of the given Xbee AT command 'xx'.	See Xbee AT command table
xb=xxy	Sets the Xbee AT command parameter 'xx' to 'y'	Examples: xb=pl0 Turns radio power to lowest xb=pl4 Turns radio power to highest xb=wr Saves current Xbee settings
xv	Programs the Xbee Radio with the following 3 values and the correct settings for base communications. i.e. to change xbee settings either use these or else individual xbee commands.	
xbdl xbdl=xxxxxxxx	Reports or Sets the Wisard EE value for what the radio destination s/n is.	Primary Value for 'Base' settings. Doesn't auto program Xbee
xbch	Reports or Sets the Wisard EE value for	

xbch=xx	what the radio channel is.	
xbid xbid=xx	Reports or Sets the Wisard EE value for what the radio ID is.	
xg xg=	Report/Set the Xbee Guard Time. Tune this to match the xbee radio's 'GT' guard time	Normally not needed. Default=120 = .3sec for 2.5mS each Tuned for xb=gtFA
XBtalk	Interactive char-by-char interaction Use for BlueRadios BlueTooth Radio interction	Probably more reliable than 'xb' or 'xb=' commands. Direct i/o however you must know 'at' commands: '+++' enters command more; 'atpl' for power, etc.
GPS Commands		
gr gr=xx	GPS Sync Rate in Seconds	0=Disabled Default usually 12-hours = 43200
gpsON	Turns GPS On	Powers up the GPS, and initiates a regular cycle of trying to obtain lock and setting the RTCC
gpsOFF	Turns GPS Off	Forces it to be powered down
gforce	Forces the RTCC to be set with current GPS time value	Normally not used.
ginit	Initializes the GPS settings	Normally not used. Wisard automatically initializes the GPS when powering it up
gnl	Sets Number of sequential Lock Messages Required to set clock	Default=2
gto	Sets TimeOut Seconds if no lock acquired	Default=180
gfr	Sets Failed Acquisition Retry Seconds	If GPS failed to acquire lock, instead of waiting the full 'gps sync rate' this lets it try again more quickly.
gmf	GPS Messages Flag	1=Sends all GPS messages received 0=Sends only GPRMC 'A' messages when it is locked

All Commands are terminated by a CR. It is sometimes advisable to simply hit 'return' before entering a new command just to clear out the buffer.

In straight serial mode, when a sensor-node is directly connected to a dsm / computer, then the commands can be entered as shown: i.e. 'dr<cr>'

Quick Command Reference: V2.4+

BasicOperations: ‘id’ ‘md’ 'mp' 'pp' 'fsON' 'fsOFF' 'sensorsON' 'sensorsOFF'
Rates/Timing: ‘dr’ ‘sp’ ‘sn’ ‘fsr’ ‘sx’ ‘xr’ ‘cache’ ‘bf’ ‘ba’ ‘st’ ‘jd’
EEPROM: 'eecfg' 'eeinit' 'eeupdate' 'eeload' 'eeflags'
BattVoltageMonitor: 'vm' 'vh' 'vl' ‘vs’
XbeeRadio: ‘hb’ 'sx' 'xr' 'xg' 'xbdl' 'xbch' 'xbid' 'xbst' 'xbsp' 'xb=' 'xs' 'xv' ‘rxb’
GPS: 'gpsON' 'gpsOFF' 'gr' 'gforce' 'gnl' 'gto' 'gfr' 'gmf'
Misc: 'reset' 'reboot' '?'

Command	***Description***	***Notes***
?	List available Commands	List sent as ‘comment-messages’
Basic Operating Commands		
id	Report/Set Node ID number	ID Maximum=99 decimal
md	Report/Set Sampling Mode	md=0 (Self-Timed) md=1(Xbee Sleep) xb=st reports awake time (in mS) xb=sp reports sleep time (in 10mS)
mp	Report/Set Output Message Mode	0=Normal, 1=DSMprint, 2=Ascii
pp	Reports Primary Output Port	0=RS232, 1=Xbee
fsON / fsOFF	Turns On or Off Local Message Storage	
sensorsON sensorsOFF	Self explanatory.	
reboot / reset	Self explanatory.	Causes full Software Reboot.
Message Rates / Timing Commands		
dr dr=xx	Set/Report Data Sampling Rate in Seconds	Self-Timed Mode Only
cache cache=x	Reports if Caching is ON … Sets how many to send in 1 cached message in Self-Timed Mode, or Turns on Caching in Xbee-Sleep Mode	NOTE: Xbee Sleep Mode caching works differently. Depends upon the xb=sp (sleep time) and your dr data rate. Data rate samples are cached until the Xbee comes awake.
sp sp=xx	Power Sampling Rate in Skip-Messages-Count * ‘dr’=seconds	0=disabled
sfr sfr=xx	Local Storage File Cycle Rate in Skip-Messages-Count * ‘dr’= seconds	Normally 10-minutes. If a crash occurs, local store data is lost after its most recent file cycle, ie up to 10min
sn sn=xx	Serial Number Report Rate in Skip-Messages-Count * ‘dr’= seconds	0=Disabled
sx sx=xx	Xbee Status Report Rate in Skip-Messages-Count * ‘dr’= seconds	0=Disabled
st	Report/Set Time in hhmmss	
EEPROM Commands		
eecfg	Reports the default Operating Values	
eeupdate	Reprograms the EE with the current Operating Values	Do this after changing a EE parameter and have it saved.
eeinit	Restores ‘factory defaults’ to EE	
eeflags	Diag. only	
eeload	Immediately reloads the Operating Values from EE	You may want to do this to confirm your ‘eeupdate’ settings.
Battery Voltage Monitoring / Shutdown-Startup Commands		

vm	Toggles 'Vbatt-Power-Shutdown-Monitor' mode.	Xbee radio, gps, sensors are turned off if battery is below….and starts again if above….
vl vl=xxxxx	Vbatt_Shutdown_Level in mVolts: vl=11500 would be 11.5VDC	
vh vh=xxxxx	Vbatt_Startup_Level in mVolts: vl=12200 would be 12.2VDC	
vs vs=xxxx	Vbatt Sleep Rate in seconds	Time period in-between checking if vbatt is high enough to restart
Xbee Radio Commands		
xs	Send Xbee Status Report	Most relevant
xr xr=	Xbee Reset Rate in Seconds	0=Disabled If a 'hb' heart-beat isn't received in this time period a reset is performed.
hb	Xbee Heart-Beat Message Clears the counter for Xbee resetting	For base station/repeater. If none rcvd the Xbee will reset at the 'xr' rate.
rxb	Immediately Reset Xbee	Normally not needed
xb=xx	Individual Xbee command handling.	See Xbee Manual/AT command table
xb=xxy	Sets the Xbee AT command parameter	
xv	Programs the Xbee Radio with the following 3 values and the correct settings for base communications. i.e. to change xbee settings either use these or else individual xbee commands.	
xbdl xbdl=xxxxxxxx	Reports or Sets the Wisard EE value for what the radio destination s/n is.	Primary Value for 'Base' settings. Doesn't auto program Xbee
xbch xbch=xx	Report/Sets EE value for hat the radio channel is.	
xbid xbid=xx	Reports or Sets the Wisard EE value for what the radio ID is.	
xg xg=	Report/Set the Xbee Guard Time.	Default=120 = .3sec for 2.5mS each Tuned for xb=gtFA
GPS Commands		
gr	Report/Set GPS Sync Rate in Seconds	0=Disabled, 12-hours = 43200
gpsON / gpsOFF	Turns GPS On (initiate clock sync)	
gpsOFF	Turns GPS Off	Forces it to be powered down
gforce	Forces Clock to be set with current GPS time value	Normally not used.
ginit	Initializes the GPS settings	Done Automatically
gnl	Report/Set # of Lock Messages Reqd to set clock	Default=2
gto	Sets TimeOut Seconds if no lock acq.	Default=180
gfr	Sets Failed Acquisition Retry Seconds	If GPS failed to acquire lock
gmf	GPS Messages Flag	1=Sends all GPS messages received 0=Sends only GPRMC 'A' messages when it is locked

Xbee Radio Mode: Global versus Specific SensorNode Commands.

There are 2 ways to address a specific SensorNode from the base-receiver:

Best Method = NodeID Specific Addressing versus Global commands:

Prefix any of the commands with '#xx' where xx=SensorNode_ID number:

"#5dr=10" sends the message to all SensorNodes but **only ID5 responds**.

"dr=10" sends the command to all Nodes and **all should respond**.

Hard Addressing Base Radio to specific sensor-node radio. This requires knowing what the xbee radio address is of the sensor-node you with to communicate with. Normally a table is retained for a project which records these.

Shutdown DSM: 'adn'

'minicom ttySx'

'ctrl-a a' add linefeed to cr received from radio.

'+++' Quickly enter these characters to go into the base radio command mode. This will timeout after ~5 seconds of no serial activity.

'atdhxxxxxxxx' Normally this is 13A200

'atdlxxxxxxxx' xxxxxxxx= 8 character address of the xbee radio you want to talk with. example='atdl405240DA'

Note: Normally the base receiver radio is programmed to talk to all nodes on it's channel and 'id'. This means 'atdh0' and 'atdlFFFF'

LED Indicators

Startup: 3-Blinks: either Green=Xbee output, or Red=Serial output. Also have solid yellow and orange. The green blinks can be hard to see because the heartbeat begins during the startup.

7-Blinks Red/Green indicating the mote is configured and sampling begins.

Comment messages are sent to the DSM indicating the operating conditions.

Normal Operation:

Green: HeartBeat - Toggles on-off 1/sec with RTCC (RealTime Clock Calendar) interrupt

Red: Sample Taken and message sent to output: ~ every 5seconds, but depends upon 'dr'

Yellow: GPS has been turned on and a message being received from it.

Orange: Command input being received. This goes out when a 'cr' is received, so it can happen fairly fast.

Watchdog Reboot:

This is bad and usually appears as a *continual 'Startup'* condition

It usually happens during a Sampling Period when the Red comes on and stays on followed by the 'Startup.'

Usually this means one of the I2C sensors is not responding properly. Try unplugging one or more sensors.