cmc electronics

APPLICATION NOTE

WAAS Dynamic Configuration

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1. Purpose

The objective of this application note is to explain how the user may change the dynamic configuration of the WAAS receiver.

2. Predefined Configuration Definition

The characteristic defined here are not limits where the receiver will cease functioning. They are rather limits within which the receiver performance and behaviour are optimal. Exceeding those limits will cause the receiver to display degraded performance.

2.1 MAN

This is a typical configuration for a very slow vehicle. Speed is limited to 10 m/s and maximum lateral acceleration for a radius of ten metres is 3 m/s^2. Maximum manoeuvring error[i] is limited to 0.001 m. Stand still threshold is fixed to 0.20 m/s.

2.2 TRACTOR

This is a typical configuration for a slow vehicle such a tractor. Speed is limited to 20 m/s and maximum lateral acceleration for a radius of ten metres is 7 m/s^2. Maximum manoeuvring error is limited to 0.002 m. Stand still threshold is fixed to 0.20 m/s.

2.3 MARINE

This is a typical configuration for a marine vehicle such as a boat. Speed is limited to 20 m/s and maximum lateral acceleration for a typical radius of ten meters is 7 m/s^2. Maximum manoeuvring error is limited to 0.002 m. Stand still threshold is fixed to 0.10 m/s.

2.4 CAR

This is a typical configuration for an automoble or other land vehicle . Speed is limited to 45 m/s and maximum lateral acceleration for a radius of ten metres is 8 m/s^2. Maximum manoeuvring error is limited to 0.002 m. Stand still threshold is fixed to 0.20 m/s.

This configuration is the default value.

2.5 PLANE

This is a typical configuration for an airplane. Speed is limited to 100 m/s and maximum lateral acceleration for a radius of ten metres is 20 m/s^2. Maximum manoeuvring error is limited to 0.009 m. Stand still threshold is fixed to 0.20 m/s.

2.6 ROCKET

This is a typical configuration for a rocket or other high-speed vehicle. Speed is limited to 510 m/s and maximum lateral acceleration for a radius of ten metres is 39.2 m/s^2. Maximum manoeuvring error is limited to 0.03 m. Stand still threshold is fixed to 0.20 m/s.

The speed limit is the maximum value allowed to a normal user and maximum lateral acceleration is the maximum physical value that our receiver will handle.

2.7 UNLIMITED[ii]

This is typical configuration for an unlimited speed and altitude vehicle. Speed is limited to 4000 m/s and maximum lateral acceleration for a radius of ten metres is 39.2 m/s^2. Maximum manoeuvring error is limited to 0.03 m. Stand still threshold is fixed to 0.20 m/s.

2.8 Summary

	Man	Tractor	Marine	Car	Plane	Rocket	Unlimited
Speed Limit (m/s)	10	20	20	45	100	510	4000
Lateral Acceleration (m/s^2)	3	7	7	8	20	39.2	39.2
Manoeuvring Error (m)	0.001	0.002	0.002	0.002	0.009	0.030	0.030
Stand still (m/s)	0.20	0.20	0.10	0.20	0.20	0.20	0.20
Default Configuration				✓			

3. User configuration

The user may also select his own pre-defined configuration using his own parameters. To do so, select User Configuration (0) in Configuration field (refer to section 4). In section 5, one can find definition of all the parameters used.

4. IO Messages

4.1 BINARY INPUT

MESSAGE	BYTE	DESCRIPTION	UNIT	TYPE
30 Receiver configuration	5	Bits 0..3 : Configuration 0 : User configuration 1 : Man 2 : Tractor 3 : Marine 4 : Car 5 : Plane 6 : Rocket : 7..14 : Reserved 15 : Unlimited Bits 4..7 : Reserved	N/A	N/A
	6	Reserved	N/A	N/A
	7	Bit 0-1 : Antenna type 0 : Passive 1 : Active Bits 2..7 : Motion detector Reserved	N/A	N/A
	8	Reserved		
	9-10	This field is read only when User configuration is set. Maximum velocity	Meter per second	Unsigned short
	11	This field is read only when User configuration is set. Bits 0..5 : Maximum lateral acceleration Range 0..40 When 40 is set, internal value is set to 39.2. Bits 6-7 : Reserved	Meter per second^2	N/A
	12	This field is read only when User configuration is set. Stand still threshold	centimeter per second	Unsigned char
	13	Dead reckoning threshold Range 0..254 255 : use current value	Second	Unsigned char
	14..20	Reserved		

4.2 BINARY OUTPUT

MESSAGE	BYTE	DESCRIPTION	UNIT	TYPE
30 Receiver configuration	5	Bits 0..3 : Predefined configuration 0 : User configuration 1 : Man 2 : Tractor 3 : Marine 4 : Car 5 : Plane 6 : Rocket : 7..14 : Reserved 15 : Unlimited Bits 4..7 : Reserved	N/A	N/A
	6	Bits 0-1 : Transmission rate of navigation message 0 : 1 Hz 1 : 2 Hz 2 : 5 Hz 3 : 10 Hz Bits 2..7 : Reserved		
	7	Bit 0-1 : Antenna type 0 : Passive 1 : Active Bits 2-3 : Use not ready phase measurement 0 : FALSE 1 : TRUE Bits 4..7 : Motion detector 0 : Automatic 1 : Static 2 : Motion		
	8	Reserved		
	9-10	Maximum speed	Metre per second	N/A
	11	Bits 0..5 : Maximum acceleration Range 0..40 When 40 is received, internal value is set to 39.2. Bits 6-7 : Reserved	Metre per second^2	
	12	Stand still threshold	Centimeter per second	Unsigned char
	13	Dead reckoning threshold Range 0..254	Second	Unsigned char
	14..20	Reserved		

5. Definition

5.1 Maximum speed

Maximum velocity that the vehicle is expected to reach. This value is limited to 510 m/s unless the user has the unlimited speed and altitude option.

5.2 Maximum acceleration

Maximum lateral acceleration of the vehicle for a typical radius of ten metres. This value is limited to 39.2 m/s^2.

5.3 Stand still threshold

Maximum velocity threshold to consider position in static mode. This value is limited to 2.55 m/s.

5.4 Dead reckoning threshold

Maximum period of time that dead reckoning is allowed. This value is limited to 254 seconds.

5.5 Antenna type

Antenna type used with the receiver. Two types of antenna could be chosen : Active or Passive.

[i] Maximum manoeuvring error is given by :

$v = (a * r)^{½}$

Where:

v : velocity of the vehicle (meter/second);

a : maximum acceleration of the vehicle (meter/second^2);

r : curve radius (meter);

$d = v / navrate$

$\theta = d / (2 * \pi * R) * 360$

$c = (2 R^2 - 2 R^2 \cos\theta)^{½}$

$M = d - c$

Where :

navrate : navigation rate of the receiver (Hz) (For a Allstar II WAAS use 5 because navigator runs all the time at 5 hertz)

d : real trajectory distance (meter);

θ : angle covert by the curve (degree);

c : trajectory computed by the receiver (meter);

M : maximum manoeuvring error (meter);

[ii] Only available to customer buying the unlimited speed and altitude option.