

x2111 - SmartShift 3G/EPM wheel with tunable torque

Version 0

SmartShift

[0] `getCapabilities()` → capabilities, autoDisengageDefault, defaultTunableTorque, maxForce

[1] `getRatchetControlMode()` → wheelMode, autoDisengage, currentTunableTorque

[2] `setRatchetControlMode(wheelMode, autoDisengage, currentTunableTorque)` → wheelMode, autoDisengage, currentTunableTorque

This feature exposes and configures the smart shift enhanced functionality on a 3G/EPM wheel (threshold and tunable torque)

Overview

The presence of this feature indicates that the device has an inertia scroll wheel with motor driven / EPM ratchet engagement. This ratchet can be configured to engage or disengage depending on wheel speed, a user button press, or via software control.

There are two different wheel modes, known as freespun and ratchet. In freespun mode the ratchet is never engaged and the wheel is always free to spin. In ratchet mode the ratchet engagement depends on the wheel speed. The wheel speed at which disengagement happens is configured by the "autoDisengage" parameter. Setting autoDisengage to 0xFF causes the ratchet to stay engaged while in ratchet mode.

When the wheel speed exceeds the speed threshold causing the ratchet to disengage it will remain disengaged as the wheel slows down and stops. As soon as the wheel stops, the ratchet will reengage.

The wheel mode can be changed either by the user pressing a ratchet control button or by the software setting the mode in response to a UI action. In either of these cases the firmware should engage or disengage the ratchet immediately. The wheel mode is stored persistently in the device's nonvolatile storage.

A ratchet control button is an undiverted 0x1B04 button with CID 196 (SmartShift) or a button remapped to a CID 196 (SmartShift) button via 0x1B04. Diverting a ratchet control button to SW via 0x1B04 or remapping it to another button effectively disables it from acting as a ratchet control button.

The 0x2121 HiResWheel feature already reports mechanical ratchet engagement state and user activation. Since it is not useful for host software to know transient ratchet states, the 0x2121 HiResWheel feature will instead report the wheel mode of this feature. During the time the ratchet is disengaged due to smartshift the 0x2121 feature will continue to report it as engaged. The 0x2121

feature should generate a ratchet change event when the wheel mode is changed either by a user button press or by software calling `setRatchetControlMode` to change it.

The torque force is configured by the "currentTunableTorque" parameter. The real force will be % of the `maxForce` value.

The default values cannot be changed by software. These values are given to restore OOB parameters.

A HID reset will not change the persistent values (wheel mode, `autoDisengage` and `currentTunableTorque`) On HID reset the ratchet control button will be configured to toggle the wheel mode when pressed.

The EPM parameters (`wheelMode`, `autoDisengage`, `currentTunableTorque`) are changed persistently on a device basis.

Functions and Events

[0] `getCapabilities()` → `capabilities`, `autoDisengageDefault`, `defaultTunableTorque`, `maxForce`

Returns the EPM configuration capabilities.

Parameters

None

Returns

`capabilities`

- Supported capabilities

```
tunableTorque = 0 -> tunable torque is not supported.  
tunableTorque = 1 -> tunable torque is supported.
```

`autoDisengageDefault`

Returns the default value of the `autoDisengage` setting

```
0x01-0xFE = Disengage when wheel rotation exceeds N/4 turns per second  
            (i.e., increment in 0.25 turn/s)  
0xFF = Ratchet always engaged
```

`defaultTunableTorque`

Returns the default tunable torque in % of the `maxForce`

1%-100% = % of the max tunable force

maxForce

Returns maxForce value expressed in gram-Force (gF)

0x01-0xFF = value of the maxForce

Table 1. *getCapabilities()* response packet format

byte \ bit	7	6	5	4	3	2	1	0
0	capabilities							
	—	—	—	—	—	—	—	tunableTorque
1	autoDisengageDefault							
2	defaultTunableTorque							
3	maxForce							
4..15	reserved							

[1] getRatchetControlMode() → wheelMode, autoDisengage, currentTunableTorque

Returns the current smartshift configuration.

Parameters

None

Returns

wheelMode

Returns the current wheel mode

1 = Freespin mode
2 = Ratchet mode (smartshift and fixed ratchet)

NOTE

This value is not the state of the ratchet engagement. While the ratchet is in the autoDisengaged state the wheelMode is still ratchet mode.

autoDisengage

Returns the speed at which the ratchet automatically disengages

0x01-0xFE = Disengage when wheel rotation exceeds N/4 turns per second
(i.e., increment in 0.25 turn/s)
0xFF = Ratchet always engaged

currentTunableTorque

Returns the current tunable torque in % of the maxForce

1%-100% = % of the max tunable force

Table 2. *getRatchetControlMode()* response packet format

byte \ bit	7	6	5	4	3	2	1	0
0	wheelMode							
1	autoDisengage							
2	currentTunableTorque							
3..15	reserved							

[2] setRatchetControlMode(wheelMode, autoDisengage, currentTunableTorque) → wheelMode, autoDisengage, currentTunableTorque

Sets the wheel mode and configures the automatic disengage setting.

Setting the wheel mode by writing a nonzero value will cause the ratchet engagement motor/EPM to activate as needed to immediately put the ratchet in the requested state. Writing zero (0 = do not change) to the wheel mode value will not activate the motor/EPM.

Changing the autoDisengage value will not activate the motor/EPM.

Parameters

wheelMode

Sets the current wheel mode. Note that the wheel mode can also be changed by the user pressing the ratchet control button.

0 = Do not change
1 = Freespin mode
2 = Ratchet mode (used for smartshift and fixed ratchet)

autoDisengage

Sets the speed at which the ratchet automatically disengages. This setting has no effect if the wheel mode is freespin. If the wheel mode is ratchet, setting autoDisengage to 0xFF immediately engages the ratchet.

0x00 = Do not change
 0x01-0xFE = Disengage when wheel rotation exceeds N/4 turns per second
 (i.e., increment in 0.25 turn/s)
 0xFF = Ratchet always engaged

currentTunableTorque

Sets the current tunable torque in % of the maxForce

0 = Do not Change
 1%-100% = % of the max tunable force

Table 3. setRatchetControlMode request packet format

byte \ bit	7	6	5	4	3	2	1	0
0	wheelMode							
1	autoDisengage							
2	currentTunableTorque							
3..15	reserved							

Returns

On success, the parameters are echoed back as the return value.

Table 4. setRatchetControlMode response packet format

byte \ bit	7	6	5	4	3	2	1	0
0	wheelMode							
1	autoDisengage							
2	currentTunableTorque							
3..15	reserved							

ChangeLog

- Version 0: Initial version