Logitech Force Feedback Protocol

V1.5 - December 21, 2015

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6.30.2014

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2 Introduction

This document defines parts of the Logitech Force Feedback protocol. Some commands used for testing/debugging and other purposes have been omitted from this document. However, the given information should be sufficient to implement a fully functional open-source force feedback driver.

2.1 Revision History

RBosa, July 2014: First release; V1.0

Rbosa, July 2014: Second release, incorporated clarifications and feedback from Edwin Velds; added `EXT_CMD 0x0a`, `EXT_CMD 0x10`, `EXT_CMD 0x11` and `EXT_CMD 0x12`; V1.1

Rbosa, July 2014: Added appendix listing all known wheels and their `bcdVersion` in the various modes; added table to list supported commands to switch identity; V1.2

Rbosa, July 2014: Corrected Edwin's name; added G27 to Table 57; fixed some spelling mistakes; clarified spring coefficient swapping rule for older devices; added illustration of force position reporting vs. force location; V1.3

Rbosa, July/August 2015: Converted to PdfTex; added distinction between Classic Force Protocol and the new HID++ Force Protocol; fixed many typos and consistency issues; V1.4

Rbosa, December 2015: Added new HID++ Force effect types; V1.5

2.2 Scope

There are two protocols described in this document.

The first protocol ("Classic") described in this document has been used in almost all force feedback-enabled devices that Logitech has produced. It is used for joysticks and wheels. Each device may slightly deviate from the protocol by not implementing certain commands or using slight variations of a command.

The second protocol ("HID++") is only used for the G920 Driving Force Racing Wheel for Xbox One at the time of this writing.

2.3 Capabilities

2.3.1 Classic Force Feedback

- The protocol provides feedback for a device with one or two force-enabled axes.
- Internally, each force-axis position is encoded in 8 bits, even if that axis is reported in a different size to the host.
- Each axis can be driven with two effects and a default spring for joysticks. For wheels, four effects and two default springs can be combined.
- For joysticks, the two axes are completely independent. In order to play a force at a 45 degree angle, it is up to the host to separate it into an X and Y component.

2.3.2 HID++ Force Feedback

- The protocol allows for multiple force-enabled axes. The axis type is identified with each effect.
- There are many force effect slots, each of which can be assigned to any axis.
- All parameters are given as 16-bit numbers (signed and unsigned, varying on the parameter). Internally, most forces are calculated with `float` precision.

3 Classic Format

Commands are sent to the device via HID Output Reports. These are sent from the host through either an Interrupt Out endpoint (usually EP1) or the default pipe (EP0). HID Output Reports sent over EP0 always use the first byte for the Report ID. This means the available space for the command and its parameters is seven bytes. The seven bytes are defined as vendor-specific data in the HID descriptor. The command payload has the following format:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	FORCE_TYPE or CMD_PARAM							
2	Force/Command parameter 1 (or 0x00 if not used)							
3	Force/Command parameter 2 (or 0x00 if not used)							
4	Force/Command parameter 3 (or 0x00 if not used)							
5	Force/Command parameter 4 (or 0x00 if not used)							
6	Force/Command parameter 5 (or 0x00 if not used)							

Table 1: Output Report

Parameter	Value	Definition
F0...F3	0/1	Each bit indicates to which force slot the command applies to
CMD	see Table 3	One of the commands listed in section 3.1
FORCE_TYPE	see Table 23	One of the force types listed in section 3.2
CMD_PARAM	see Table 52	One of the command parameters listed in section 3.3

Table 2: Output Report Parameters

3.1 Commands

CMD	Command
0x00	Download Force
0x01	Download and Play Force
0x02	Play Force
0x03	Stop Force
0x04	Default Spring On
0x05	Default Spring Off
0x06	[reserved, do not use]
0x07	[reserved, do not use]
0x08	Turn on Normal Mode (see CMD 0x0b)
0x09	Set LED
0x0a	Set Watchdog
0x0b	Turn on Raw Mode (see CMD 0x08)
0x0c	Refresh Force
0x0d	Fixed Time Loop
0x0e	Set Default Spring
0x0f	Set Dead Band
0xf8	Extended Command

Table 3: Commands

3.1.1 CMD 0x00 – Download Force

A force is downloaded from the host into the force slot(s), to be played at a later time. Selecting multiple forces (F0...F3) is allowed.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	0x00			
1	FORCE_TYPE							
2...6	Force parameters (or 0x00 if not used)							

Table 4: Download Force Report

3.1.2 CMD 0x01 – Download and Play Force

A force is downloaded from the host into the force slot(s), and starts playing immediately. Selecting multiple forces (F0...F3) is allowed.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	0x01			
1	FORCE_TYPE							
2...6	Force parameters (or 0x00 if not used)							

Table 5: Download Force and Play Report

3.1.3 CMD 0x02 – Play Force

Starts playing the selected force(s). Selecting multiple forces (F0...F3) is allowed. Assumes that the selected forces have been previously downloaded.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	0x02			
1...6	0x00							

Table 6: Play Force Report

3.1.4 CMD 0x03 – Stop Force

Stops playing the selected force(s). Selecting multiple forces (F0...F3) is allowed.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	0x03			
1...6	0x00							

Table 7: Stop Force Report

3.1.5 CMD 0x04 – Default Spring On

Turns on the default spring(s). Setting F0 and/or F1 selects spring X. Setting F2 and/or F3 selects spring Y. Selecting both springs is allowed.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	0x04			
1...6	0x00							

Table 8: Default Spring On Report

3.1.6 CMD 0x05 – Default Spring Off

Turns off the default spring(s). Setting F0 and/or F1 selects spring X. Setting F2 and/or F3 selects spring Y. Selecting both springs is allowed.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	0x05			
1...6	0x00							

Table 9: Default Spring Off Report

3.1.7 CMD 0x08 – Normal Mode / Extended Command

The F0...F3 bits have a special meaning for CMD 0x08. If all the F0...F3 bits are zero, this command will restore the normal content of the device input report after operating in Raw Mode (see chapter 3.1.10).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	0x08			
1...6	0x00							

Table 10: Restore Normal Mode Report

If all the F0...F3 bits are one, this command is an extended command (see chapter 3.3).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	1	1	1	0x08			
1	EXT_CMD							
2...6	Extended Command Parameters (or 0x00 if not used)							

Table 11: Extended Command Report

3.1.8 CMD 0x09 – Set LED

Turns the device LEDs on (1) or off (0). The LEDs are allocated on a per-device basis.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	0x09			
1	LED7	LED6	LED5	LED4	LED3	LED2	LED1	LED0
2...6	0x00							

Table 12: Set LED Report

3.1.9 CMD 0x0a – Set Watchdog

Turns on the watchdog and sets the watchdog duration (in number of main loop executions).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	0x0a			
1	WATCHDOG							
2...6	0x00							

Table 13: Set Watchdog Report

Parameter	Value	Description
WATCHDOG	0x00 0x01...0xff	Watch dog is turned off. Device will go through a reset, if no Output Report is received during the specified period (number of main loop executions).

Table 14: Set Watchdog Report Parameters

3.1.10 CMD 0x0b – Raw Mode

Turns on Raw Mode for the device. Each device has its own report format definition in Raw Mode. The device will continue to send raw report data until it receives a CMD 0x08, or it gets power-cycled.

Raw Mode is required to get the actual, uncalibrated axis values for exact position tracking for springs and to improve the calibration algorithms implemented in firmware. However, each device defines a unique form of raw data report. These reports will very likely not fit into the fields described by the HID descriptor of the device. Therefore, the data sent from the device needs to be intercepted before it reaches HID and appropriately modified.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	0x0b			
1...6	0x00							

Table 15: Raw Mode Report

3.1.11 CMD 0x0c – Refresh Force

Changes the parameters of a force that is already playing. Multiple forces (F0...F3) may be selected.

After receiving this command, the force continues on from its most recent level. If this command is executed with a different force type than the one that is already playing, the result is undefined (and may cause undesired side-effects).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	0x0c			
1	FORCE_TYPE							
2...6	Force parameters (or 0x00 if not used)							

Table 16: Refresh Force Report

3.1.12 CMD 0x0d – Fixed Time Loop

Makes the main firmware loop run at a constant speed or as fast as possible.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	0x0d			
1	FIXED_LOOP							
2..6	0x00							

Table 17: Fixed Time Loop Report

Parameter	Value	Description
FIXED_LOOP	0x00	Fixed loop mode off (main loop runs as fast as possible).
	0x01	Fixed loop mode on (main loop updates forces every 2ms).

Table 18: Fixed Loop Report Parameters

3.1.13 CMD 0x0e – Set Default Spring

Sets the parameters of the default spring. Setting F0 and/or F1 selects spring X. Setting F2 and/or F3 selects spring Y. Selecting both springs is allowed. The parameters are the same as for the auto-centering force type (see chapter 3.2.4).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	0x0e			
1	0x00							
2	0	0	0	0	0	K1		
3	0	0	0	0	0	K2		
4	CLIP							
5..6	0x00							

Table 19: Set Default Spring Report

3.1.14 CMD 0x0f – Set Dead Band

Controls the exterior dead band. The power-up default is on. If dead band is on, the axis values are clipped at the extremes of their travel and reported as min/max respectively.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	0	0	0x0f			
1	DEAD_BAND							
2..6	0x00							

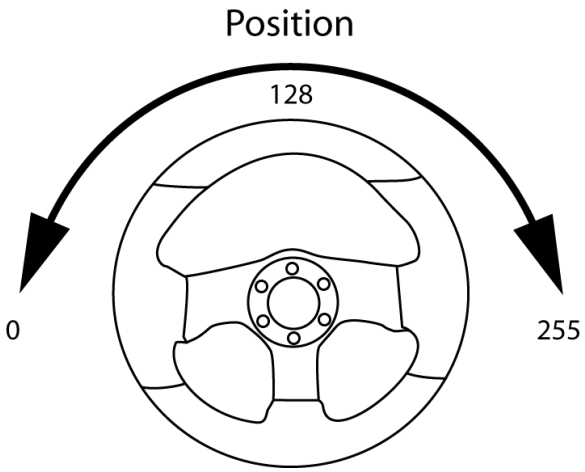
Table 20: Set Dead Band Report

Parameter	Value	Description
DEAD_BAND	0x00	Dead band is off.
	0x01	Dead band is on.

Table 21: Set Dead Band Report Parameters

3.2 Force Types and Parameters

Wheels report the wheel position with 0 on the left side and 255 on the right side:



Force levels are generally indicated with a single byte according to the encoding below:

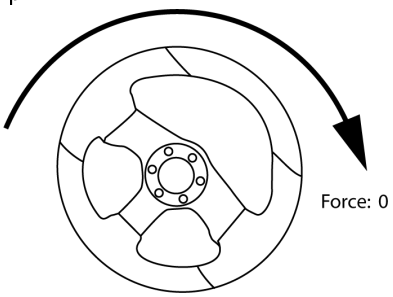
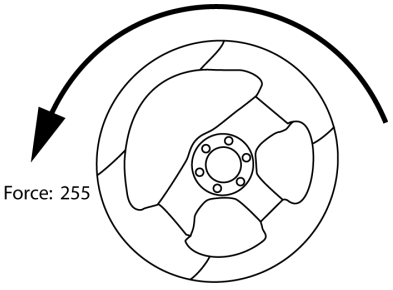
Level	Definition
0	Maximum force 'located' towards the '0' end of the axis. The wheel will spin clock-wise under the influence of such a force: 
127 or 128	No force
255	Maximum force 'located' towards the '255' end of the axis. The wheel will spin counter-clock-wise under the influence of such a force: 

Table 22: Force Levels

Classic Force Feedback implements the following force types:

FORCE_TYPE	Force
0x00	Constant
0x01	Spring
0x02	Damper
0x03	Auto-Centering Spring
0x04	Sawtooth Up

FORCE_TYPE	Force
0x05	Sawtooth Down
0x06	Trapezoid
0x07	Rectangle
0x08	Variable
0x09	Ramp
0x0a	Square Wave (not implemented on all devices)
0x0b	High-Resolution Spring
0x0c	High-Resolution Damper
0x0d	High-Resolution Auto-Centering Spring
0x0e	Friction (not implemented on all devices)

Table 23: Force Types

3.2.1 FORCE_TYPE 0x00 – Constant

A constant force keeps pushing or pulling with the indicated level. It is independent of position or velocity of the axis. The direction is encoded as the sign of the force level (see tabel 22).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	0x00							
2	Force F0 level							
3	Force F1 level							
4	Force F2 level							
5	Force F3 level							
6	0x00							

Table 24: Constant Force Type Report

3.2.2 FORCE_TYPE 0x01 – Spring

A spring force creates an asymmetric force around a central dead-band area. The force is zero within the dead band. It rises linearly just outside the dead band with a slope given by the slope coefficient and saturates at the clip value. Each side of the axis can be inverted individually.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	0x01							
2	D1							
3	D2							
4	0	K2			0	K1		
5	0	0	0	S2	0	0	0	S1
6	CLIP							

Table 25: Spring Force Type Report

Parameter	Value	Definition
D1	0...255	Lower limit of central dead band
D2	0...255	Upper limit of central dead band
K1	see Table 27/28	Low (left or push) side spring constant selector
K2	see Table 27/28	High (right or pull) side spring constant selector

Parameter	Value	Definition
S1	0/1	Low side slope inversion (1 = inverted)
S2	0/1	High side slope inversion (1 = inverted)
CLIP	0...255	Clip level (maximum force), on either side

Table 26: Spring Force Parameters

The spring constants K1 and K2 define the spring coefficient (slope) according to Table 27. The offset is defined as the difference of the current position and the nearest dead band limit.

K Value	Spring Coefficient
0x00	1/4 of offset
0x01	1/2 of offset
0x02	3/4 of offset
0x03	Force = offset
0x04	3/2 of offset
0x05	2 times offset
0x06	3 times offset
0x07	4 times offset

Table 27: Spring Coefficients

Note that for the following devices, the coefficient table entries 5 and 6 are swapped and follow Table 28 instead:

- Logitech Driving Force (PID_C294)
- Logitech Driving Force EX (PID_C294)
- Logitech Racing Force EX (PID_C294)
- Logitech Driving Force RX (PID_C294)
- Logitech Formula Force GP (PID_C293)
- Logitech Force 3D (PID_C283)

K Value	Spring Coefficient
0x00	1/4 of offset
0x01	1/2 of offset
0x02	3/4 of offset
0x03	Force = offset
0x04	3/2 of offset
0x05	3 times offset
0x06	2 times offset
0x07	4 times offset

Table 28: Spring Coefficients

3.2.3 FORCE_TYPE 0x02 – Damper

Direction and speed are provided by an external differentiator circuit, or by subtracting the current position from the position recorded the last time the function ran. The speed is then multiplied by the K1/K2 parameters. The K1 and

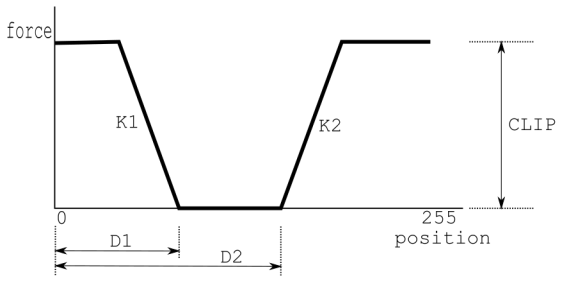


Figure 1: Spring Parameters

K2 force multipliers use the same scale encoding as a spring force (see previous section). K1 is applied when moving to the left/pushing, while K2 is applied when moving right/pulling. If the S1 or S2 parameter is 0, then the force generated opposes the movement (standard damper action). If it is 1, the force generated accentuates the movement (i.e., a negative damper or "ice" effect).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	0x02							
2	0	0	0	0	0	K1		
3	0	0	0	0	0	0	0	S1
4	0	0	0	0	0	K2		
5	0	0	0	0	0	0	0	S2
6	0x00							

Table 29: Damper Force Type Report

Parameter	Value	Definition
K1	0...7	Low (left or push) side damper coefficient
K2	0...7	High (right or pull) side damper coefficient
S1	0/1	Low side inversion (1 = inverted)
S2	0/1	High side inversion (1 = inverted)

Table 30: Damper Force Parameters

3.2.4 FORCE_TYPE 0x03 – Auto-Centering Spring

The center of the Auto-Centering Spring effect is dynamically set as the center of the axis. The dead band area is 2 counts wide from (axis_center-1) to (axis_center+1) This force computes the center of the axis travel using the following formula: axis_center = (Max/2) + (Min/2). When the force is first downloaded, Min is set to 255 and Max to 0. K1, K2 and CLIP are coded the same way as a regular spring (see chapter 3.2.2).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	0x03							
2	0	0	0	0	0	K1		
3	0	0	0	0	0	K2		
4	CLIP							
5...6	0x00							

Table 31: Auto-Centering Spring Force Type Report

3.2.5 FORCE_TYPE 0x04 – Sawtooth Up

Sawtooth Up is the first of a series of periodic effects.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	0x04							
2	L1							
3	L2							
4	L0							
5	0x00							
6	T3				INC			

Table 32: Sawtooth Up Force Type Report

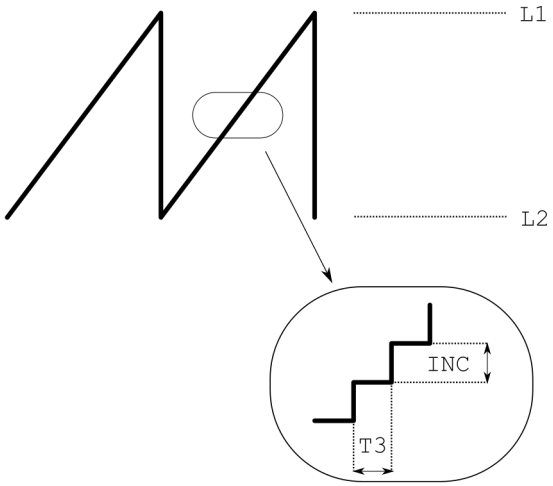


Figure 2: Sawtooth Up Parameters

Parameter	Value	Definition
L1	0...255	Maximum Force Level
L2	0...255	Minimum Force Level
L0	0...255	Initial Force Level (L1 >= L0 >= L2)
T3	0...15	Time (in main loop execution count) per increment
INC	0...15	Increment value

Table 33: Sawtooth Up Force Parameters

3.2.6 FORCE_TYPE 0x05 – Sawtooth Down

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	0x05							
2	L1							
3	L2							

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
4	L0							
5	0x00							
6	T3				INC			

Table 34: Sawtooth Down Force Type Report

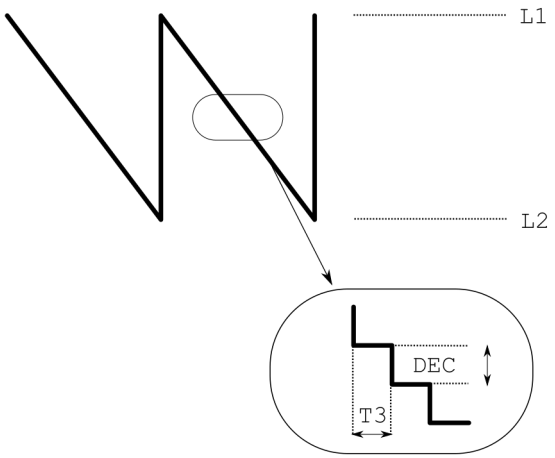


Figure 3: Sawtooth Down Parameters

Parameter	Value	Definition
L1	0...255	Maximum Force Level
L2	0...255	Minimum Force Level
L0	0...255	Initial Force Level (L1 >= L0 >= L2)
T3	0...15	Time (in main loop execution count) per increment
INC	0...15	Increment value

Table 35: Sawtooth Down Force Parameters

3.2.7 FORCE_TYPE 0x06 – Trapezoid

The frequency range of this periodic force depends somewhat on the amplitude because each step cannot be greater than 15 counts. If the amplitude is reduced in half, the maximum frequency is almost doubled. The initial force level is L1. The rising and falling times are the same. If T1 = T2 = 0, then the wave is a triangle.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	0x06							
2	L1							
3	L2							
4	T1							
5	T2							
6	T3				S			

Table 36: Trapezoid Force Type Report

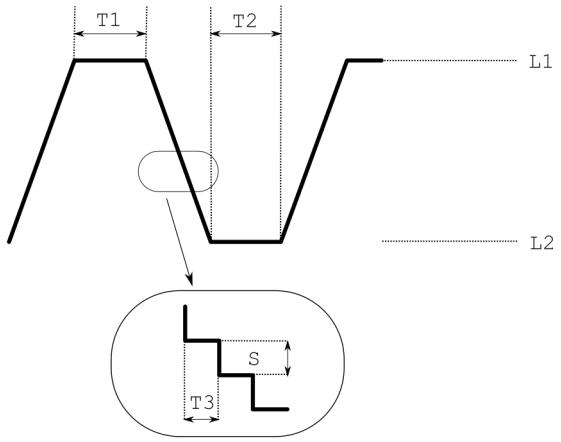


Figure 4: Trapezoid Parameters

Parameter	Value	Definition
L1	0...255	Maximum Force Level
L2	0...255	Minimum Force Level
T1	0...255	Duration (in main loops) of L1 Level
T2	0...255	Duration (in main loops) of L2 Level
T3	0...15	Number of main loops between adding/subtracting S
S	0...15	Amount to add/subtract after each T3 interval

Table 37: Trapezoid Force Parameters

3.2.8 FORCE_TYPE 0x07 – Rectangle

This force can create signals within a frequency range of 61 Hz to 250 Hz (with fixed loop time on).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	0x07							
2	L1							
3	L2							
4	T1							
5	T2							
6	P							

Table 38: Rectangle Force Type Report

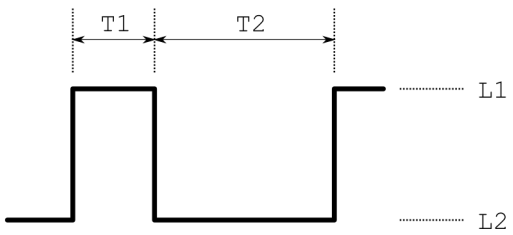


Figure 5: Rectangle Parameters

Parameter	Value	Definition
L1	0...255	Maximum Force Level
L2	0...255	Minimum Force Level
T1	0...255	Duration (in main loops) of L1 level
T2	0...255	Duration (in main loops) of L2 level
P	0...255	Phase. If P*2 < T1, the force starts at L1, otherwise it starts at L2. If P > (T1 + T2), then the phase is 0.

Table 39: Rectangle Force Parameters

3.2.9 FORCE_TYPE 0x08 – Variable

This type defines two independent ramp-like forces for F0 and/or F2 (only). If the force level reaches either minimum or maximum it will be clipped and remain at that level until the force is updated.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	F2	0	F0	CMD			
1	0x08							
2	L1							
3	L2							
4	T1				S1			
5	T2				S2			
6	0	0	0	D2	0	0	0	D1

Table 40: Variable Force Type Report

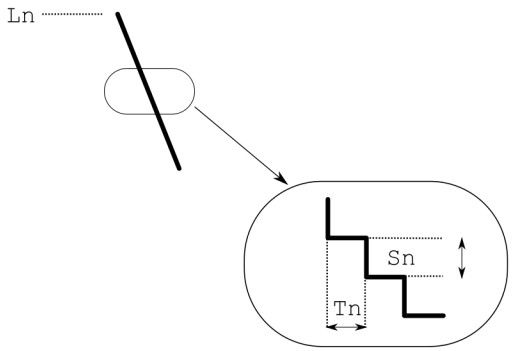


Figure 6: Variable Parameters

Parameter	Value	Definition
L1	0...255	Initial level for Force 0
L2	0...255	Initial level for Force 2
T1	0...15	Force 0 Step duration (in main loops)
S1	0...15	Force 0 Step size
T2	0...15	Force 2 Step duration (in main loops)
S2	0...15	Force 2 Step size
D1	0/1	Force 0 Direction (0 = increasing, 1 = decreasing)
D2	0/1	Force 2 Direction (0 = increasing, 1 = decreasing)

Table 41: Variable Force Parameters

3.2.10 FORCE_TYPE 0x09 – Ramp

Once the target level (L2) is reached, the force stops playing.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	F2	0	F0	CMD			
1	0x09							
2	L1							
3	L2							
4	0	0	0	0	0	0	0	D
5	T				S			
6	0x00							

Table 42: Ramp Force Type Report

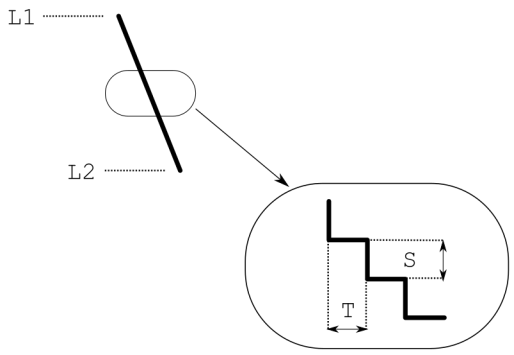


Figure 7: Ramp Parameters

Parameter	Value	Definition
L1	0...255	Maximum Force Level
L2	0...255	Minimum Force Level
D	0/1	Direction (0 = ramp up from L2 to L1; 1 = reverse)
T	0...15	Number of main loops between adding/subtracting S
S	0...15	Amount to add/subtract after each interval T

Table 43: Ramp Force Parameters

3.2.11 FORCE_TYPE 0x0a – Square Wave

This force is not implemented on most devices. It is intended to be used to control vibration feedback.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	0x0a							
2	A							
3	T_{LOW}							
4	T_{HIGH}							
5	N							
6	0x00							

Table 44: Square Force Type Report

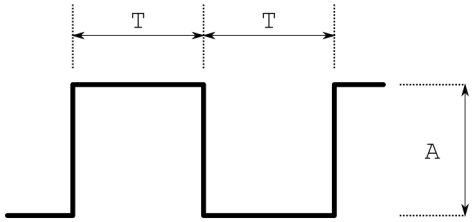


Figure 8: Square Parameters

Parameter	Value	Definition
A	0...255	Amplitude (relative, depends on device)
T	0...65535	Number of mainloops per state (period / 2). 16 bits, low byte sent first.
N	0...255	Number of periods (if N = 0, force plays for 256 periods)

Table 45: Square Force Parameters

3.2.12 FORCE_TYPE 0x0b – High-Resolution Spring

This force type allows more precise control of the spring constant than the FORCE_TYPE 0x01 Spring Effect.
Parameter definitions are identical to FORCE_TYPE 0x01 springs, but with an additional 8 selections for the spring constant (which is represented in 4 bits instead of 3). These coefficients have been tuned for each device to be fairly linear. Hence a coefficient should be scaled linearly from 0 to 15 for K1 and K2 according to the desired spring coefficient.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	0x0b							
2	D1							
3	D2							
4	K2				K1			
5	0	0	0	S2	0	0	0	S1
6	CLIP							

Table 46: High-Resolution Spring Force Type Report

Parameter	Value	Definition
D1, D2	0...255	Deadband on the negative and positive side of the spring.
K1, K2	0...15	Linear slope with 0 being the weakest force and 15 being the strongest. The actual coefficient factor is device dependent.
S1, S2	0/1	Sign of the slope parameter.

Table 47: High-Resolution Spring Force Parameters

Logitech Driving Force Pro (PID_C298) introduced a variation of this force with an additional 3 bits of precision for the deadbands for a total of 11 bit precision. It is backward compatible with older implementations of this force in that the additional low order bits are located in otherwise-ignored bit fields.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	0x0b							
2	$D1_{10...3}$							
3	$D2_{10...3}$							
4	K2				K1			
5	$D2_2$	$D2_1$	$D2_0$	S2	$D1_2$	$D1_1$	$D1_0$	S1
6	CLIP							

Table 48: High-Resolution Spring Force Type Report Variation

3.2.13 FORCE_TYPE 0x0c – High-Resolution Damper

A more precise version of the FORCE_TYPE 0x02 Damper force. Parameter definitions are identical to FORCE_TYPE 0x02 dampers, but with product-specific 4-bit K factor selection as for the FORCE_TYPE 0x0b High-Resolution Spring. (see table 47)

Logitech Driving Force Pro (PID_C298) introduced an additional CLIP parameter to this force. It is backward compatible with older implementations of the force in that the additional parameter is encoded in an otherwise-unused byte field.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	0x0c							
2	0	0	0	0	K1			
3	0	0	0	0	0	0	0	S1
4	0	0	0	0	K2			
5	0	0	0	0	0	0	0	S2
6	CLIP (only for PID_C298)							

Table 49: High-Resolution Damper Force Type Report

3.2.14 FORCE_TYPE 0x0d – High-Resolution Auto-Centering Spring

A more precise version of the FORCE_TYPE 0x03 Auto-Centering Spring effect. Parameter definitions are identical to FORCE_TYPE 0x03 Auto-Centering Spring, but with product-specific 4-bit K factor selection as for the FORCE_TYPE 0x0b High-Resolution Spring force (see table 47).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	0x0d							

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2	0	0	0	0	K1			
3	0	0	0	0	K2			
4	CLIP							
5...6	0x00							

Table 50: High-Resolution Auto-Centering Spring Force Type Report

3.2.15 FORCE_TYPE 0x0e – Friction (only select devices)

This force is used to generate a resistance in movement. It is similar to a damper effect in that it generates a force against velocity. It is distinct from a damper in that it the force effect decreases as the velocity increases.

This force is only supported on the following devices:

- Logitech Driving Force Pro (PID_C298)
- Logitech G25 Racing Wheel (PID_C299)
- Logitech Driving Force GT (PID_C29A)
- Logitech G27 Racing Wheel (PID_C29B)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	F3	F2	F1	F0	CMD			
1	0x0e							
2	K1							
3	K2							
4	CLIP							
5	0	0	0	S2	0	0	0	S1
6	0x00							

Table 51: Friction force type Report

3.3 Extended Commands

Extended Commands provide device-specific functionality. They are used to switch modes of newer devices, which start in a compatibility mode. They are also used to change the amount of wheel rotation of some wheel devices.

EXT_CMD	Command
0x01	Change Mode to Driving Force Pro
0x02	Change Wheel Range to 200 Degrees
0x03	Change Wheel Range to 900 Degrees
0x09	Change Device Mode
0x0a	Revert Identity
0x10	Switch to G25 Identity with USB Detach
0x11	Switch to G25 Identity without USB Detach
0x12	Set RPM LEDs
0x81	Wheel Range Change

Table 52: Extended Commands

3.3.1 EXT_CMD 0x01 – Change Mode to Driving Force Pro

This command will switch a device which starts up in a compatibility mode into "Driving Force Pro" mode.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0xf8							
1	0x01							
2...6	0x00							

Table 53: Change Mode Report

3.3.2 EXT_CMD 0x02 – Change Wheel Range to 200 Degrees

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0xf8							
1	0x02							
2...6	0x00							

Table 54: Change Wheel Range to 200 Degrees Report

3.3.3 EXT_CMD 0x03 – Change Wheel Range to 900 Degrees

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0xf8							
1	0x03							
2...6	0x00							

Table 55: Change Wheel Range to 900 Degrees Report

3.3.4 EXT_CMD 0x09 – Change Device Mode

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0xf8							
1	0x09							
2	DEVICE							
3	DETACH							
4...6	0x00							

Table 56: Change Device Mode Report

Parameter	Value	Description
DEVICE	0...4	Specifies the device (emulation) mode to switch to: 0x00 = Logitech Driving Force EX 0x01 = Logitech Driving Force Pro 0x02 = Logitech G25 Racing Wheel 0x03 = Logitech Driving Force GT 0x04 = Logitech G27 Racing Wheel
DETACH	0/1	0x00 = Switch identity without USB detach 0x01 = Switch identity after detaching from USB

Table 57: Change Device Mode Parameters

3.3.5 EXT_CMD 0x0a – Revert Identity

This command sets a persistent flag in the device to automatically revert the identity of the device to the power-up default upon a USB reset. This is the default behavior for most devices.

In order to instruct a device to NOT revert identity upon reset, the host needs to set the flag to 0.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0xf8							
1	0x0a							
2	REVERT_IDENTITY							
3...6	0x00							

Table 58: Revert Identity Report

Parameter	Value	Description
REVERT_IDENTITY	0/1	0x00 = Do not revert identity. 0x01 = Revert identity (default)

Table 59: Revert Identity Parameters

3.3.6 EXT_CMD 0x10 – Switch to G25 with USB Detach

This command switches a G25 in compatibility mode over to G25 mode. The device will detach from USB and the host will see a new device USB plug-in event.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0xf8							
1	0x10							

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2...6	0x00							

Table 60: Switch to G25 Mode with Detach Report

3.3.7 EXT_CMD 0x11 – Switch to G25 without USB Detach

This command switches a G25 in compatibility mode over to G25 mode. The switch happens immediately, without the device disconnecting from the host.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0xf8							
1	0x11							
2...6	0x00							

Table 61: Switch to G25 Mode without Detach Report

3.3.8 EXT_CMD 0x12 – Set RPM LEDs

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0xf8							
1	0x12							
2	0	0	0	LED_PATTERN				
3...6	0x00							

Table 62: Set RPM LEDs Report

Parameter	Value	Description
LED_PATTERN	0...31	Each bit of the value corresponds to one LED from the right as well as from the left.

Table 63: Set RPM LEDs Parameters

Figure 9: RPM LED patterns

3.3.9 EXT_CMD 0x81 – Wheel Range Change

This command allows setting the range of wheel travel. The range must be within the following limits: 40 <= RANGE <= 900. If it is outside this range, it is clipped to 40 or 900 respectively.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0xf8							
1	0x81							

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2	$RANGE_{7...0}$							
3	$RANGE_{15...8}$							
4...6	0x00							

Table 64: Wheel Range Change Report

Parameter	Value	Description
RANGE	40...900	The new range of wheel travel.

Table 65: Wheel Range Change Parameters

4 HID++ Force Feedback

The Logitech G920 wheel includes a native Xbox One Force Feedback mode and a PC mode. The PC mode is implemented as a HID++ Feature. For further information on the HID++ framework, please see (TODO: Insert link to HID++ documentation)

A HID++ command has a 4-byte header, which includes the HID `REPORT_ID`, the device index (only used for HID++ hub devices; specify `0xff` for the G920), the index of the feature, the index of the method, and a session identifier. After the header are the payload bytes of the specific method. The following description only lists the payload content for the requests and the responses.

4.1 x8123 Force Feedback

The HID++ Feature x8123 implements multi-axis force feedback control. The feature has the following methods and notifications:

Index	Name
0	getInfo
1	resetAll
2	downloadEffect
3	setEffectState
4	destroyEffect
5	getAperture
6	setAperture
7	getGlobalGains
8	setGlobalGains
0	forceHasFinished

Table 66: x8123 Methods and Notifications

4.1.1 `x8123.0` getInfo

The getInfo method returns static data. Data that does not change for the duration of the device being plugged in. The data should be retrieved once during driver load and cached for subsequent queries.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0...N	0x00							

Table 67: getInfo Request Packet

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	SLOT_COUNT							
1	ACTUATOR_MASK							
2...N	0x00							

Table 68: getInfo Response Packet

Parameter	Value	Definition
SLOT_COUNT	0...255	Indicates the number of available force effect slots on the device.
ACTUATOR_MASK	0...255	A bitmask that indicates which axes have force feedback control.

Table 69: getInfo Response Parameters

The axes of a device are assigned according to their prominence for the user and are generally device-specific. For the Logitech G920 wheel in particular, there is just one axis (the main wheel axis), hence the ACTUATOR_MASK value being 0x01.

4.1.2 x8123.1 resetAll

The resetAll method stops and destroys all force effects on the device. This method also enables the default centering spring. There are no parameters for either the request or the response.

4.1.3 x8123.2 downloadEffect

The downloadEffect method is used to create and update force effects on the device. The first byte decides if the effect is to be allocated fresh (EFFECT_ID == 0), or if an existing effect should be modified (0 < EFFECT_ID <= SLOT_COUNT). The first byte of the response contains either 0x00 if there was an error, or the EFFECT_ID.

Each slot controls an effect for a given axis. There are no restrictions on how many slots are assigned to any axis, as long as the total number does not exceed SLOT_COUNT.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	EFFECT_ID							
1	START	AXIS			EFFECT_TYPE			
2...N	Parameters, depending on type of effect							

Table 70: downloadEffect Request Packet Header

Parameter	Value	Definition
EFFECT_ID	0...SLOT_COUNT	0x00: Create new effect and return allocated effect id. 0x01...SLOT_COUNT: indicates id of effect slot to update.
START	0/1	1: immediately start this effect, 0: only create/update the effect, do not start playing.
AXIS	0...7	The index of the axis, for which this force is applicable.
EFFECT_TYPE	see table 72	One of the effect types listed below.

Table 71: downloadEffect Parameters

Depending on the Effect Type, the header is followed by one of three different parameter formats.

Value	Effect Type	Parameter Format
0	CONSTANT	Constant Parameters
1	SINE	Periodic Parameters
2	SQUARE	
3	TRIANGLE	
4	SAWTOOTHUP	
5	SAWTOOTHDOWN	
6	SPRING	Condition Parameters

Value	Effect Type	Parameter Format
7	DAMPER	
8	FRICTION[1]	
9	INERTIA[1]	
10	RAMP[1]	Ramp Parameters

Table 72: Effect Type and Associated Parameter Format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	EFFECT_ID							
1	START	AXIS			0x00			
2	$DURATION_{15...8}$							
3	$DURATION_{7...0}$							
4	$START\_DELAY_{15...8}$							
5	$START\_DELAY_{7...0}$							
6	$LEVEL_{15...8}$							
7	$LEVEL_{7...0}$							
8	ATTACK_LEVEL							
9	$ATTACK\_DELAY_{15...8}$							
10	$ATTACK\_DELAY_{7...0}$							
11	FADE_LEVEL							
12	$FADE\_DELAY_{15...8}$							
13	$FADE\_DELAY_{7...0}$							
14...N	0x00							

Table 73: Constant Effect Force Parameters

Parameter	Value	Definition
DURATION	0...65535	Duration of the effect in milliseconds, does not include START_DELAY. Specify 0x0000 for infinite duration.
START_DELAY	0...65535	Initial delay before the effect starts, measured in milliseconds.
LEVEL	-32767...32767	Signed magnitude of the constant force.
ATTACK_LEVEL	0...255	Initial start level, as a fraction of MAX_FORCE, with the same sign as LEVEL.
ATTACK_DELAY	0...65535	Duration of the envelope attack phase, where the force changes from ATTACK_LEVEL to LEVEL.
FADE_LEVEL	0...255	Final end level, as a fraction of MAX_FORCE, with the same sign as LEVEL.
FADE_DELAY	0...65535	Duration of the envelope decay phase, where the force changes from LEVEL to FADE_LEVEL.

Table 74: Constant Force Parameters

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	EFFECT_ID							
1	START	AXIS			0x01...0x05			
2	$DURATION_{15...8}$							
3	$DURATION_{7...0}$							
4	$START\_DELAY_{15...8}$							
5	$START\_DELAY_{7...0}$							
6	$LEVEL_{15...8}$							

[1] FRICTION, INERTIA and RAMP are only supported on Logitech G920 with firmware V96.2.48 or later.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
7	$LEVEL_{7...0}$							
8	$OFFSET_{15...8}$							
9	$OFFSET_{7...0}$							
10	$WAVELENGTH_{15...8}$							
11	$WAVELENGTH_{7...0}$							
12	$PHASE_{15...8}$							
13	$PHASE_{7...0}$							
14	ATTACK_LEVEL							
15	$ATTACK\_DELAY_{15...8}$							
16	$ATTACK\_DELAY_{7...0}$							
17	FADE_LEVEL							
18	$FADE\_DELAY_{15...8}$							
19	$FADE\_DELAY_{7...0}$							
20...N	0x00							

Table 75: Periodic Effect Force Parameters

Parameter	Value	Definition
DURATION	0...65535	Duration of the effect in milliseconds. Does not include START_DELAY. Specify 0x0000 for infinite duration.
START_DELAY	0...65535	Initial delay, before the effect starts. Unit is in milliseconds.
LEVEL	-32767...32767	Signed magnitude of the periodic force.
OFFSET	-32767...32767	Signed offset for the periodic force.
WAVELENGTH	1...65535	Duration in milliseconds of one full period.
PHASE	-32767...32767	Signed phase of the periodic force.
ATTACK_LEVEL	0...255	Initial start level, as a fraction of MAX_FORCE, with the same sign as LEVEL.
ATTACK_DELAY	0...65535	Duration of the envelope attack phase, where the force changes from ATTACK_LEVEL to LEVEL.
FADE_LEVEL	0...255	Final end level, as a fraction of MAX_FORCE, with the same sign as LEVEL.
FADE_DELAY	0...65535	Duration of the envelope decay phase, where the force changes from LEVEL to FADE_LEVEL.

Table 76: Periodic Force Parameters

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	EFFECT_ID							
1	START	AXIS			0x06/0x07			
2	$DURATION_{15...8}$							
3	$DURATION_{7...0}$							
4	$START\_DELAY_{15...8}$							
5	$START\_DELAY_{7...0}$							
6	$NEG\_SATURATION_{15...8}$							
7	$NEG\_SATURATION_{7...0}$							
8	$NEG\_SLOPE_{15...8}$							
9	$NEG\_SLOPE_{7...0}$							
10	$DEADZONE_{15...8}$							
11	$DEADZONE_{7...0}$							
12	$OFFSET_{15...8}$							
13	$OFFSET_{7...0}$							
14	$POS\_SLOPE_{15...8}$							
15	$POS\_SLOPE_{7...0}$							
16	$POS\_SATURATION_{15...8}$							

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
17	POS_SATURATION$_{7...0}$							
18...N	0x00							

Table 77: Condition Effect Force Parameters

Parameter	Value	Definition
DURATION	0...65535	Duration of the effect in milliseconds. Does not include START_DELAY. Specify 0x0000 for infinite duration.
START_DELAY	0...65535	Initial delay, before the effect starts. Unit is in milliseconds.
NEG_SATURATION	0...65535	Magnitude of the maximum saturation on the negative side of the condition. This is an unsigned value. To achieve negative saturations change the sign of NEG_SLOPE.
NEG_SLOPE	-32767...32767	Signed slope for the negative side of the condition.
DEADZONE	-32767...32767	Signed deadzone for the center area of the condition. A negative value will make the slopes intersect.
OFFSET	-32767...32767	Signed offset of the condition.
POS_SLOPE	0...65535	Signed slope for the positive side of the condition.
POS_SATURATION	0...65535	Magnitude of the maximum saturation on the positive side of the condition. This is an unsigned value. To achieve negative saturations change the sign of POS_SLOPE.

Table 78: Condition Force Parameters

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	EFFECT_ID							
1	START	AXIS			0x00			
2	DURATION$_{15...8}$							
3	DURATION$_{7...0}$							
4	START_DELAY$_{15...8}$							
5	START_DELAY$_{7...0}$							
6	START_LEVEL$_{15...8}$							
7	START_LEVEL$_{7...0}$							
8	END_LEVEL$_{15...8}$							
9	END_LEVEL$_{7...0}$							
10	ATTACK_LEVEL							
11	ATTACK_DELAY$_{15...8}$							
12	ATTACK_DELAY$_{7...0}$							
13	FADE_LEVEL							
14	FADE_DELAY$_{15...8}$							
15	FADE_DELAY$_{7...0}$							
16...N	0x00							

Table 79: Ramp Effect Force Parameters

Parameter	Value	Definition
DURATION	0...65535	Duration of the effect in milliseconds, does not include START_DELAY. Specify 0x0000 for infinite duration.
START_DELAY	0...65535	Initial delay before the effect starts, measured in milliseconds.
START_LEVEL	-32767...32767	Signed magnitude of the start level of the ramp force.
END_LEVEL	-32767...32767	Signed magnitude of the end level of the ramp force.
ATTACK_LEVEL	0...255	Initial start level, as a fraction of MAX_FORCE, with the same sign as LEVEL.

Parameter	Value	Definition
ATTACK_DELAY	0...65535	Duration of the envelope attack phase, where the force changes from ATTACK_LEVEL to LEVEL.
FADE_LEVEL	0...255	Final end level, as a fraction of MAX_FORCE, with the same sign as LEVEL.
FADE_DELAY	0...65535	Duration of the envelope decay phase, where the force changes from LEVEL to FADE_LEVEL.

Table 80: Ramp Force Parameters

4.1.4 x8123.3 setEffectState

The setEffectState is used to start, stop, pause, and resume force effects. The request specifies an EFFECT_ID. If the slot does not contain a force, the response returns 0x00 as EFFECT_ID. Otherwise, the current state is returned in EFFECT_STATE.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	EFFECT_ID							
1	STATE_CMD							
2...N	0x00							

Table 81: setEffectState Request Packet

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	EFFECT_ID							
1	EFFECT_STATE							
2...N	0x00							

Table 82: setEffectState Response Packet

Parameter	Value	Definition
EFFECT_ID	1...SLOT_COUNT	Indicates the force effect slot id
STATE_CMD	0...3	The requested new state of this effect: 0x00 Do not change state, just return current state 0x01 Stop the effect 0x02 Resume (if paused) or Start (if stopped) the effect 0x03 Pause the effect
EFFECT_STATE	0...3	Returns the current state of the effect: 0x01 Effect is stopped 0x02 Effect is playing 0x03 Effect is paused

Table 83: setEffectState Request/Response Parameters

4.1.5 x8123.4 destroyEffect

The destroyEffect frees up the give effect. Once all allocated slots have been freed, the default centering spring will kick back in. To free all effects at once, use the resetAll instead.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	EFFECT_ID							
1...N	0x00							

Table 84: destroyEffect Request Packet

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0...N	0x00							

Table 85: destroyEffect Response Packet

Parameter	Value	Definition
EFFECT_ID	1...SLOT_COUNT	Indicates the slot id of the effect.

Table 86: destroyEffect Request Parameters

4.1.6 x8123.5 getAperture and x8123.6 setAperture

The getAperture and setAperture methods are used to change the operating range of the wheel. Their parameter is a 16-bit value measuring the operating range in degrees. For the Logitech G920, the valid range is 180...900. Any values outside this range will be clipped.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0...N	0x00							

Table 87: getAperture Request Packet

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	$APERTURE_{15...8}$							
1	$APERTURE_{7...0}$							
2...N	0x00							

Table 88: getAperture Response and setAperture Request/Response Packet

Parameter	Value	Definition
APERTURE	180...900	The extent of the wheel reporting range, in degrees.

Table 89: getAperture/setAperture Parameters

4.1.7 x8123.7 getGlobalGains and x8123.8 setGlobalGains

The getGlobalGains and setGlobalGains methods take two 16-bit values. Both values are coefficients that are applied to any force output; however, they vary slightly. The first value (GAIN) is a linear factor. The second value (BOOST) is offset by a factor of 1.0:

```
force = evaluateAllSlots();
force = force * (gain / 65535);
force = force * (1.0 + boost / 65535);
outputForce(force);
```

Typically, the GAIN value is from the application/game. The BOOST value is controlled by the user via some value-add software (for example, on Windows, this is controlled by Logitech Gaming Software).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0...N	0x00							

Table 90: getGlobalGains Request Packet

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	$GAIN_{15...8}$							
1	$GAIN_{7...0}$							
2	$BOOST_{15...8}$							
3	$BOOST_{7...0}$							
4...N	0x00							

Table 91: getGlobalGains Response and setGlobalGains Request/Response Packet

Parameter	Value	Definition
GAIN	0...65535	The force gain.
BOOST	0...65535	The force boost.

Table 92: getGlobalGains/setGlobalGains Parameters

4.1.8 x8123.0 forceHasFinished Notification

The forceHasFinished notification is sent to the host, whenever a force in an slot has finished playing. This notification can be used to destroy these effects in order to recover slots.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	COUNT							
1...COUNT	EFFECT_ID							
COUNT...N	0x00							

Table 93: forceHasFinished Notification Packet

A Appendix

A.1 Classic Compatibility Mode

In order to support older console games, most Logitech Force Feedback steering wheels connect initially in a compatibility mode. Typically, this mode equals a Logitech Driving Force, but in some circumstances it may also look like a G25 or Driving Force Pro.

The table below lists the checks required to identify a particular wheel, when it is in compatibility mode. The checks should be done in the order listed, as they become progressively less specific.

Wheel	Native PID	Identification Criteria when in compatibility mode
Logitech Driving Force GT	0xC29A	((0xC294 == PID) || (0xC298 == PID)) && (0x1300 == (bcdDevice & 0xff00))
Logitech G27 Racing Wheel	0xC29B	((0xC294 == PID) || (0xC298 == PID) || (0xC299 == PID)) && (0x1230 == (bcdDevice & 0xfff0))
Logitech G25 Racing Wheel	0xC299	((0xC294 == PID) || (0xC298 == PID)) && (0x1200 == (bcdDevice & 0xff00))
Logitech Driving Force Pro	0xC298	(0xC294 == PID) && (0x1000 == (bcdDevice & 0xf000))

Table 94: Device Identification Criteria

Once a wheel has been identified, it can be switched to its native mode using the appropriate switch command. The following table lists the supported commands for each wheel. The Logitech Driving Force GT (PID_C29A) and Logitech G27 Racing Wheel (PID_C29B) also support the RevertIdentity command, so that subsequent USB resets will not have to change mode again – the wheel will come up in native mode right-away.

Wheel	Switch command(s)	Byte Sequence
Logitech Driving Force GT	EXT_CMD 0x0a EXT_CMD 0x09	0xf8 0x0a 0x00 - optional 0xf8 0x09 0x03 0x01
Logitech G27 Racing Wheel	EXT_CMD 0x0a EXT_CMD 0x09	0xf8 0x0a 0x00 - optional 0xf8 0x09 0x04 0x01
Logitech G25 Racing Wheel	EXT_CMD 0x10	0xf8 0x10
Logitech Driving Force Pro	EXT_CMD 0x01	0xf8 0x01

Table 95: Mode Switch Command

A.2 Xbox Mode

The Logitech G920 wheel starts out by default in Xbox Force Feedback Mode. To switch to HID++ Mode, issue the following byte sequence as an output report:

Wheel	Byte Sequence
Logitech G920	`0f 00 01 01 42`

Table 96: G920 Mode Switch Command