**Data Output from F1 2021**

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# Overview

The F1 series of games support the output of certain game data across UDP connections. This data can be used supply race information to external applications, or to drive certain hardware (e.g. motion platforms, force feedback steering wheels and LED devices).

The following information summarise these data structures so that developers of supporting hardware or software can configure these to work correctly with the F1 game.

***Note:*** *To ensure that you are using the latest specification for this game, please check our official forum page*[***here***](https://forums.codemasters.com/topic/80231-f1-2021-udp-specification/)*.*

If you cannot find the information that you require then please contact the team via the official Codemasters forum thread listed above, or raise a bug report through the F1 2021 forum, and a member of the team will respond to your query as soon as possible.

# Packet Information

## Packet Types

Each packet can now carry different types of data rather than having one packet which contains everything. A header has been added to each packet as well so that versioning can be tracked and it will be easier for applications to check they are interpreting the incoming data in the correct way. Please note that all values are encoded using Little Endian format. All data is packed.

The following data types are used in the structures:

|  |  |
| --- | --- |
| **Type** | **Description** |
| uint8 | Unsigned 8-bit integer |
| int8 | Signed 8-bit integer |
| uint16 | Unsigned 16-bit integer |
| int16 | Signed 16-bit integer |
| uint32 | Unsigned 32-bit integer |
| float | Floating point (32-bit) |
| uint64 | Unsigned 64-bit integer |

## Packet Header

Each packet has the following header:

struct PacketHeader

{

uint16 m\_packetFormat; // 2021

uint8 m\_gameMajorVersion; // Game major version - "X.00"

uint8 m\_gameMinorVersion; // Game minor version - "1.XX"

uint8 m\_packetVersion; // Version of this packet type, all start from 1

uint8 m\_packetId; // Identifier for the packet type, see below

uint64 m\_sessionUID; // Unique identifier for the session

float m\_sessionTime; // Session timestamp

uint32 m\_frameIdentifier; // Identifier for the frame the data was retrieved on

uint8 m\_playerCarIndex; // Index of player's car in the array

uint8 m\_secondaryPlayerCarIndex; // Index of secondary player's car in the array (splitscreen)

// 255 if no second player

};

## Packet IDs

The packets IDs are as follows:

|  |  |  |
| --- | --- | --- |
| **Packet Name** | **Value** | **Description** |
| Motion | 0 | Contains all motion data for player’s car – only sent while player is in control |
| Session | 1 | Data about the session – track, time left |
| Lap Data | 2 | Data about all the lap times of cars in the session |
| Event | 3 | Various notable events that happen during a session |
| Participants | 4 | List of participants in the session, mostly relevant for multiplayer |
| Car Setups | 5 | Packet detailing car setups for cars in the race |
| Car Telemetry | 6 | Telemetry data for all cars |
| Car Status | 7 | Status data for all cars |
| Final Classification | 8 | Final classification confirmation at the end of a race |
| Lobby Info | 9 | Information about players in a multiplayer lobby |
| Car Damage | 10 | Damage status for all cars |
| Session History | 11 | Lap and tyre data for session |

## Motion Packet

The motion packet gives physics data for all the cars being driven. There is additional data for the car being driven with the goal of being able to drive a motion platform setup.

*N.B. For the normalised vectors below, to convert to float values divide by 32767.0f – 16-bit signed values are used to pack the data and on the assumption that direction values are always between -1.0f and 1.0f.*

Frequency: Rate as specified in menus

Size: 1464 bytes

Version: 1

struct CarMotionData

{

float m\_worldPositionX; // World space X position

float m\_worldPositionY; // World space Y position

float m\_worldPositionZ; // World space Z position

float m\_worldVelocityX; // Velocity in world space X

float m\_worldVelocityY; // Velocity in world space Y

float m\_worldVelocityZ; // Velocity in world space Z

int16 m\_worldForwardDirX; // World space forward X direction (normalised)

int16 m\_worldForwardDirY; // World space forward Y direction (normalised)

int16 m\_worldForwardDirZ; // World space forward Z direction (normalised)

int16 m\_worldRightDirX; // World space right X direction (normalised)

int16 m\_worldRightDirY; // World space right Y direction (normalised)

int16 m\_worldRightDirZ; // World space right Z direction (normalised)

float m\_gForceLateral; // Lateral G-Force component

float m\_gForceLongitudinal; // Longitudinal G-Force component

float m\_gForceVertical; // Vertical G-Force component

float m\_yaw; // Yaw angle in radians

float m\_pitch; // Pitch angle in radians

float m\_roll; // Roll angle in radians

};

struct PacketMotionData

{

PacketHeader m\_header; // Header

CarMotionData m\_carMotionData[22]; // Data for all cars on track

// Extra player car ONLY data

float m\_suspensionPosition[4]; // Note: All wheel arrays have the following order:

float m\_suspensionVelocity[4]; // RL, RR, FL, FR

float m\_suspensionAcceleration[4]; // RL, RR, FL, FR

float m\_wheelSpeed[4]; // Speed of each wheel

float m\_wheelSlip[4]; // Slip ratio for each wheel

float m\_localVelocityX; // Velocity in local space

float m\_localVelocityY; // Velocity in local space

float m\_localVelocityZ; // Velocity in local space

float m\_angularVelocityX; // Angular velocity x-component

float m\_angularVelocityY; // Angular velocity y-component

float m\_angularVelocityZ; // Angular velocity z-component

float m\_angularAccelerationX; // Angular velocity x-component

float m\_angularAccelerationY; // Angular velocity y-component

float m\_angularAccelerationZ; // Angular velocity z-component

float m\_frontWheelsAngle; // Current front wheels angle in radians

};

## Session Packet

The session packet includes details about the current session in progress.

Frequency: 2 per second

Size: 625 bytes

Version: 1

struct MarshalZone

{

float m\_zoneStart; // Fraction (0..1) of way through the lap the marshal zone starts

int8 m\_zoneFlag; // -1 = invalid/unknown, 0 = none, 1 = green, 2 = blue, 3 = yellow, 4 = red

};

struct WeatherForecastSample

{

uint8 m\_sessionType; // 0 = unknown, 1 = P1, 2 = P2, 3 = P3, 4 = Short P, 5 = Q1

// 6 = Q2, 7 = Q3, 8 = Short Q, 9 = OSQ, 10 = R, 11 = R2

// 12 = Time Trial

uint8 m\_timeOffset; // Time in minutes the forecast is for

uint8 m\_weather; // Weather - 0 = clear, 1 = light cloud, 2 = overcast

// 3 = light rain, 4 = heavy rain, 5 = storm

int8 m\_trackTemperature; // Track temp. in degrees Celsius

int8 m\_trackTemperatureChange; // Track temp. change – 0 = up, 1 = down, 2 = no change

int8 m\_airTemperature; // Air temp. in degrees celsius

int8 m\_airTemperatureChange; // Air temp. change – 0 = up, 1 = down, 2 = no change

uint8 m\_rainPercentage; // Rain percentage (0-100)

};

struct PacketSessionData

{

PacketHeader m\_header; // Header

uint8 m\_weather; // Weather - 0 = clear, 1 = light cloud, 2 = overcast

// 3 = light rain, 4 = heavy rain, 5 = storm

int8 m\_trackTemperature; // Track temp. in degrees celsius

int8 m\_airTemperature; // Air temp. in degrees celsius

uint8 m\_totalLaps; // Total number of laps in this race

uint16 m\_trackLength; // Track length in metres

uint8 m\_sessionType; // 0 = unknown, 1 = P1, 2 = P2, 3 = P3, 4 = Short P

// 5 = Q1, 6 = Q2, 7 = Q3, 8 = Short Q, 9 = OSQ

// 10 = R, 11 = R2, 12 = R3, 13 = Time Trial

int8 m\_trackId; // -1 for unknown, 0-21 for tracks, see appendix

uint8 m\_formula; // Formula, 0 = F1 Modern, 1 = F1 Classic, 2 = F2,

// 3 = F1 Generic

uint16 m\_sessionTimeLeft; // Time left in session in seconds

uint16 m\_sessionDuration; // Session duration in seconds

uint8 m\_pitSpeedLimit; // Pit speed limit in kilometres per hour

uint8 m\_gamePaused; // Whether the game is paused

uint8 m\_isSpectating; // Whether the player is spectating

uint8 m\_spectatorCarIndex; // Index of the car being spectated

uint8 m\_sliProNativeSupport; // SLI Pro support, 0 = inactive, 1 = active

uint8 m\_numMarshalZones; // Number of marshal zones to follow

MarshalZone m\_marshalZones[21]; // List of marshal zones – max 21

uint8 m\_safetyCarStatus; // 0 = no safety car, 1 = full

// 2 = virtual, 3 = formation lap

uint8 m\_networkGame; // 0 = offline, 1 = online

uint8 m\_numWeatherForecastSamples; // Number of weather samples to follow

WeatherForecastSample m\_weatherForecastSamples[56]; // Array of weather forecast samples

uint8 m\_forecastAccuracy; // 0 = Perfect, 1 = Approximate

uint8 m\_aiDifficulty; // AI Difficulty rating – 0-110

uint32 m\_seasonLinkIdentifier; // Identifier for season - persists across saves

uint32 m\_weekendLinkIdentifier; // Identifier for weekend - persists across saves

uint32 m\_sessionLinkIdentifier; // Identifier for session - persists across saves

uint8 m\_pitStopWindowIdealLap; // Ideal lap to pit on for current strategy (player)

uint8 m\_pitStopWindowLatestLap; // Latest lap to pit on for current strategy (player)

uint8 m\_pitStopRejoinPosition; // Predicted position to rejoin at (player)

uint8 m\_steeringAssist; // 0 = off, 1 = on

uint8 m\_brakingAssist; // 0 = off, 1 = low, 2 = medium, 3 = high

uint8 m\_gearboxAssist; // 1 = manual, 2 = manual & suggested gear, 3 = auto

uint8 m\_pitAssist; // 0 = off, 1 = on

uint8 m\_pitReleaseAssist; // 0 = off, 1 = on

uint8 m\_ERSAssist; // 0 = off, 1 = on

uint8 m\_DRSAssist; // 0 = off, 1 = on

uint8 m\_dynamicRacingLine; // 0 = off, 1 = corners only, 2 = full

uint8 m\_dynamicRacingLineType; // 0 = 2D, 1 = 3D

};

## Lap Data Packet

The lap data packet gives details of all the cars in the session.

Frequency: Rate as specified in menus

Size: 970 bytes

Version: 1

struct LapData

{

uint32 m\_lastLapTimeInMS; // Last lap time in milliseconds

uint32 m\_currentLapTimeInMS; // Current time around the lap in milliseconds

uint16 m\_sector1TimeInMS; // Sector 1 time in milliseconds

uint16 m\_sector2TimeInMS; // Sector 2 time in milliseconds

float m\_lapDistance; // Distance vehicle is around current lap in metres – could

// be negative if line hasn’t been crossed yet

float m\_totalDistance; // Total distance travelled in session in metres – could

// be negative if line hasn’t been crossed yet

float m\_safetyCarDelta; // Delta in seconds for safety car

uint8 m\_carPosition; // Car race position

uint8 m\_currentLapNum; // Current lap number

uint8 m\_pitStatus; // 0 = none, 1 = pitting, 2 = in pit area

uint8 m\_numPitStops; // Number of pit stops taken in this race

uint8 m\_sector; // 0 = sector1, 1 = sector2, 2 = sector3

uint8 m\_currentLapInvalid; // Current lap invalid - 0 = valid, 1 = invalid

uint8 m\_penalties; // Accumulated time penalties in seconds to be added

uint8 m\_warnings; // Accumulated number of warnings issued

uint8 m\_numUnservedDriveThroughPens; // Num drive through pens left to serve

uint8 m\_numUnservedStopGoPens; // Num stop go pens left to serve

uint8 m\_gridPosition; // Grid position the vehicle started the race in

uint8 m\_driverStatus; // Status of driver - 0 = in garage, 1 = flying lap

// 2 = in lap, 3 = out lap, 4 = on track

uint8 m\_resultStatus; // Result status - 0 = invalid, 1 = inactive, 2 = active

// 3 = finished, 4 = didnotfinish, 5 = disqualified

// 6 = not classified, 7 = retired

uint8 m\_pitLaneTimerActive; // Pit lane timing, 0 = inactive, 1 = active

uint16 m\_pitLaneTimeInLaneInMS; // If active, the current time spent in the pit lane in ms

uint16 m\_pitStopTimerInMS; // Time of the actual pit stop in ms

uint8 m\_pitStopShouldServePen; // Whether the car should serve a penalty at this stop

};

struct PacketLapData

{

PacketHeader m\_header; // Header

LapData m\_lapData[22]; // Lap data for all cars on track

};

## Event Packet

This packet gives details of events that happen during the course of a session.

Frequency: When the event occurs

Size: 36 bytes

Version: 1

// The event details packet is different for each type of event.

// Make sure only the correct type is interpreted.

union EventDataDetails

{

struct

{

uint8 vehicleIdx; // Vehicle index of car achieving fastest lap

float lapTime; // Lap time is in seconds

} FastestLap;

struct

{

uint8 vehicleIdx; // Vehicle index of car retiring

} Retirement;

struct

{

uint8 vehicleIdx; // Vehicle index of team mate

} TeamMateInPits;

struct

{

uint8 vehicleIdx; // Vehicle index of the race winner

} RaceWinner;

struct

{

uint8 penaltyType; // Penalty type – see Appendices

uint8 infringementType; // Infringement type – see Appendices

uint8 vehicleIdx; // Vehicle index of the car the penalty is applied to

uint8 otherVehicleIdx; // Vehicle index of the other car involved

uint8 time; // Time gained, or time spent doing action in seconds

uint8 lapNum; // Lap the penalty occurred on

uint8 placesGained; // Number of places gained by this

} Penalty;

struct

{

uint8 vehicleIdx; // Vehicle index of the vehicle triggering speed trap

float speed; // Top speed achieved in kilometres per hour

uint8 overallFastestInSession; // Overall fastest speed in session = 1, otherwise 0

uint8 driverFastestInSession; // Fastest speed for driver in session = 1, otherwise 0

} SpeedTrap;

struct

{

uint8 numLights; // Number of lights showing

} StartLIghts;

struct

{

uint8 vehicleIdx; // Vehicle index of the vehicle serving drive through

} DriveThroughPenaltyServed;

struct

{

uint8 vehicleIdx; // Vehicle index of the vehicle serving stop go

} StopGoPenaltyServed;

struct

{

uint32 flashbackFrameIdentifier; // Frame identifier flashed back to

float flashbackSessionTime; // Session time flashed back to

} Flashback;

struct

{

uint32 m\_buttonStatus; // Bit flags specifying which buttons are being pressed

// currently - see appendices

} Buttons;

};

struct PacketEventData

{

PacketHeader m\_header; // Header

uint8 m\_eventStringCode[4]; // Event string code, see below

EventDataDetails m\_eventDetails; // Event details - should be interpreted differently

// for each type

};

## Event String Codes

### 

|  |  |  |
| --- | --- | --- |
| **Event** | **Code** | **Description** |
| Session Started | “SSTA” | Sent when the session starts |
| Session Ended | “SEND” | Sent when the session ends |
| Fastest Lap | “FTLP” | When a driver achieves the fastest lap |
| Retirement | “RTMT” | When a driver retires |
| DRS enabled | “DRSE” | Race control have enabled DRS |
| DRS disabled | “DRSD” | Race control have disabled DRS |
| Team mate in pits | “TMPT” | Your team mate has entered the pits |
| Chequered flag | “CHQF” | The chequered flag has been waved |
| Race Winner | “RCWN” | The race winner is announced |
| Penalty Issued | “PENA” | A penalty has been issued – details in event |
| Speed Trap Triggered | “SPTP” | Speed trap has been triggered by fastest speed |
| Start lights | “STLG” | Start lights – number shown |
| Lights out | “LGOT” | Lights out |
| Drive through served | “DTSV” | Drive through penalty served |
| Stop go served | “SGSV” | Stop go penalty served |
| Flashback | “FLBK” | Flashback activated |
| Button status | “BUTN” | Button status changed |

## Participants Packet

This is a list of participants in the race. If the vehicle is controlled by AI, then the name will be the driver name. If this is a multiplayer game, the names will be the Steam Id on PC, or the LAN name if appropriate.

N.B. on Xbox One, the names will always be the driver name, on PS4 the name will be the LAN name if playing a LAN game, otherwise it will be the driver name.

The array should be indexed by vehicle index.

Frequency: Every 5 seconds

Size: 1257 bytes

Version: 1

struct ParticipantData

{

uint8 m\_aiControlled; // Whether the vehicle is AI (1) or Human (0) controlled

uint8 m\_driverId; // Driver id - see appendix, 255 if network human

uint8 m\_networkId; // Network id – unique identifier for network players

uint8 m\_teamId; // Team id - see appendix

uint8 m\_myTeam; // My team flag – 1 = My Team, 0 = otherwise

uint8 m\_raceNumber; // Race number of the car

uint8 m\_nationality; // Nationality of the driver

char m\_name[48]; // Name of participant in UTF-8 format – null terminated

// Will be truncated with … (U+2026) if too long

uint8 m\_yourTelemetry; // The player's UDP setting, 0 = restricted, 1 = public

};

struct PacketParticipantsData

{

PacketHeader m\_header; // Header

uint8 m\_numActiveCars; // Number of active cars in the data – should match number of

// cars on HUD

ParticipantData m\_participants[22];

};

## Car Setups Packet

This packet details the car setups for each vehicle in the session. Note that in multiplayer games, other player cars will appear as blank, you will only be able to see your car setup and AI cars.

Frequency: 2 per second

Size: 1102 bytes

Version: 1

struct CarSetupData

{

uint8 m\_frontWing; // Front wing aero

uint8 m\_rearWing; // Rear wing aero

uint8 m\_onThrottle; // Differential adjustment on throttle (percentage)

uint8 m\_offThrottle; // Differential adjustment off throttle (percentage)

float m\_frontCamber; // Front camber angle (suspension geometry)

float m\_rearCamber; // Rear camber angle (suspension geometry)

float m\_frontToe; // Front toe angle (suspension geometry)

float m\_rearToe; // Rear toe angle (suspension geometry)

uint8 m\_frontSuspension; // Front suspension

uint8 m\_rearSuspension; // Rear suspension

uint8 m\_frontAntiRollBar; // Front anti-roll bar

uint8 m\_rearAntiRollBar; // Front anti-roll bar

uint8 m\_frontSuspensionHeight; // Front ride height

uint8 m\_rearSuspensionHeight; // Rear ride height

uint8 m\_brakePressure; // Brake pressure (percentage)

uint8 m\_brakeBias; // Brake bias (percentage)

float m\_rearLeftTyrePressure; // Rear left tyre pressure (PSI)

float m\_rearRightTyrePressure; // Rear right tyre pressure (PSI)

float m\_frontLeftTyrePressure; // Front left tyre pressure (PSI)

float m\_frontRightTyrePressure; // Front right tyre pressure (PSI)

uint8 m\_ballast; // Ballast

float m\_fuelLoad; // Fuel load

};

struct PacketCarSetupData

{

PacketHeader m\_header; // Header

CarSetupData m\_carSetups[22];

};

## Car Telemetry Packet

This packet details telemetry for all the cars in the race. It details various values that would be recorded on the car such as speed, throttle application, DRS etc. Note that the rev light configurations are presented separately as well and will mimic real life driver preferences.

Frequency: Rate as specified in menus

Size: 1347 bytes

Version: 1

struct CarTelemetryData

{

uint16 m\_speed; // Speed of car in kilometres per hour

float m\_throttle; // Amount of throttle applied (0.0 to 1.0)

float m\_steer; // Steering (-1.0 (full lock left) to 1.0 (full lock right))

float m\_brake; // Amount of brake applied (0.0 to 1.0)

uint8 m\_clutch; // Amount of clutch applied (0 to 100)

int8 m\_gear; // Gear selected (1-8, N=0, R=-1)

uint16 m\_engineRPM; // Engine RPM

uint8 m\_drs; // 0 = off, 1 = on

uint8 m\_revLightsPercent; // Rev lights indicator (percentage)

uint16 m\_revLightsBitValue; // Rev lights (bit 0 = leftmost LED, bit 14 = rightmost LED)

uint16 m\_brakesTemperature[4]; // Brakes temperature (celsius)

uint8 m\_tyresSurfaceTemperature[4]; // Tyres surface temperature (celsius)

uint8 m\_tyresInnerTemperature[4]; // Tyres inner temperature (celsius)

uint16 m\_engineTemperature; // Engine temperature (celsius)

float m\_tyresPressure[4]; // Tyres pressure (PSI)

uint8 m\_surfaceType[4]; // Driving surface, see appendices

};

struct PacketCarTelemetryData

{

PacketHeader m\_header; // Header

CarTelemetryData m\_carTelemetryData[22];

uint8 m\_mfdPanelIndex; // Index of MFD panel open - 255 = MFD closed

// Single player, race – 0 = Car setup, 1 = Pits

// 2 = Damage, 3 = Engine, 4 = Temperatures

// May vary depending on game mode

uint8 m\_mfdPanelIndexSecondaryPlayer; // See above

int8 m\_suggestedGear; // Suggested gear for the player (1-8)

// 0 if no gear suggested

};

## Car Status Packet

This packet details car statuses for all the cars in the race.

Frequency: Rate as specified in menus

Size: 1058 bytes

Version: 1

struct CarStatusData

{

uint8 m\_tractionControl; // Traction control - 0 = off, 1 = medium, 2 = full

uint8 m\_antiLockBrakes; // 0 (off) - 1 (on)

uint8 m\_fuelMix; // Fuel mix - 0 = lean, 1 = standard, 2 = rich, 3 = max

uint8 m\_frontBrakeBias; // Front brake bias (percentage)

uint8 m\_pitLimiterStatus; // Pit limiter status - 0 = off, 1 = on

float m\_fuelInTank; // Current fuel mass

float m\_fuelCapacity; // Fuel capacity

float m\_fuelRemainingLaps; // Fuel remaining in terms of laps (value on MFD)

uint16 m\_maxRPM; // Cars max RPM, point of rev limiter

uint16 m\_idleRPM; // Cars idle RPM

uint8 m\_maxGears; // Maximum number of gears

uint8 m\_drsAllowed; // 0 = not allowed, 1 = allowed

uint16 m\_drsActivationDistance; // 0 = DRS not available, non-zero - DRS will be available

// in [X] metres

uint8 m\_actualTyreCompound; // F1 Modern - 16 = C5, 17 = C4, 18 = C3, 19 = C2, 20 = C1

// 7 = inter, 8 = wet

// F1 Classic - 9 = dry, 10 = wet

// F2 – 11 = super soft, 12 = soft, 13 = medium, 14 = hard

// 15 = wet

uint8 m\_visualTyreCompound; // F1 visual (can be different from actual compound)

// 16 = soft, 17 = medium, 18 = hard, 7 = inter, 8 = wet

// F1 Classic – same as above

// F2 ‘19, 15 = wet, 19 – super soft, 20 = soft

// 21 = medium , 22 = hard

uint8 m\_tyresAgeLaps; // Age in laps of the current set of tyres

int8 m\_vehicleFiaFlags; // -1 = invalid/unknown, 0 = none, 1 = green

// 2 = blue, 3 = yellow, 4 = red

float m\_ersStoreEnergy; // ERS energy store in Joules

uint8 m\_ersDeployMode; // ERS deployment mode, 0 = none, 1 = medium

// 2 = hotlap, 3 = overtake

float m\_ersHarvestedThisLapMGUK; // ERS energy harvested this lap by MGU-K

float m\_ersHarvestedThisLapMGUH; // ERS energy harvested this lap by MGU-H

float m\_ersDeployedThisLap; // ERS energy deployed this lap

uint8 m\_networkPaused; // Whether the car is paused in a network game

};

struct PacketCarStatusData

{

PacketHeader m\_header; // Header

CarStatusData m\_carStatusData[22];

};

## Final Classification Packet

This packet details the final classification at the end of the race, and the data will match with the post race results screen. This is especially useful for multiplayer games where it is not always possible to send lap times on the final frame because of network delay.

Frequency: Once at the end of a race

Size: 839 bytes

Version: 1

struct FinalClassificationData

{

uint8 m\_position; // Finishing position

uint8 m\_numLaps; // Number of laps completed

uint8 m\_gridPosition; // Grid position of the car

uint8 m\_points; // Number of points scored

uint8 m\_numPitStops; // Number of pit stops made

uint8 m\_resultStatus; // Result status - 0 = invalid, 1 = inactive, 2 = active

// 3 = finished, 4 = didnotfinish, 5 = disqualified

// 6 = not classified, 7 = retired

uint32 m\_bestLapTimeInMS; // Best lap time of the session in milliseconds

double m\_totalRaceTime; // Total race time in seconds without penalties

uint8 m\_penaltiesTime; // Total penalties accumulated in seconds

uint8 m\_numPenalties; // Number of penalties applied to this driver

uint8 m\_numTyreStints; // Number of tyres stints up to maximum

uint8 m\_tyreStintsActual[8]; // Actual tyres used by this driver

uint8 m\_tyreStintsVisual[8]; // Visual tyres used by this driver

};

struct PacketFinalClassificationData

{

PacketHeader m\_header; // Header

uint8 m\_numCars; // Number of cars in the final classification

FinalClassificationData m\_classificationData[22];

};

## Lobby Info Packet

This packet details the players currently in a multiplayer lobby. It details each player’s selected car, any AI involved in the game and also the ready status of each of the participants.

Frequency: Two every second when in the lobby

Size: 1191 bytes

Version: 1

struct LobbyInfoData

{

uint8 m\_aiControlled; // Whether the vehicle is AI (1) or Human (0) controlled

uint8 m\_teamId; // Team id - see appendix (255 if no team currently selected)

uint8 m\_nationality; // Nationality of the driver

char m\_name[48]; // Name of participant in UTF-8 format – null terminated

// Will be truncated with ... (U+2026) if too long

uint8 m\_carNumber; // Car number of the player

uint8 m\_readyStatus; // 0 = not ready, 1 = ready, 2 = spectating

};

struct PacketLobbyInfoData

{

PacketHeader m\_header; // Header

// Packet specific data

uint8 m\_numPlayers; // Number of players in the lobby data

LobbyInfoData m\_lobbyPlayers[22];

};

## Car Damage Packet

This packet details car damage parameters for all the cars in the race.

Frequency: 2 per second

Size: 882 bytes

Version: 1

struct CarDamageData

{

float m\_tyresWear[4]; // Tyre wear (percentage)

uint8 m\_tyresDamage[4]; // Tyre damage (percentage)

uint8 m\_brakesDamage[4]; // Brakes damage (percentage)

uint8 m\_frontLeftWingDamage; // Front left wing damage (percentage)

uint8 m\_frontRightWingDamage; // Front right wing damage (percentage)

uint8 m\_rearWingDamage; // Rear wing damage (percentage)

uint8 m\_floorDamage; // Floor damage (percentage)

uint8 m\_diffuserDamage; // Diffuser damage (percentage)

uint8 m\_sidepodDamage; // Sidepod damage (percentage)

uint8 m\_drsFault; // Indicator for DRS fault, 0 = OK, 1 = fault

uint8 m\_gearBoxDamage; // Gear box damage (percentage)

uint8 m\_engineDamage; // Engine damage (percentage)

uint8 m\_engineMGUHWear; // Engine wear MGU-H (percentage)

uint8 m\_engineESWear; // Engine wear ES (percentage)

uint8 m\_engineCEWear; // Engine wear CE (percentage)

uint8 m\_engineICEWear; // Engine wear ICE (percentage)

uint8 m\_engineMGUKWear; // Engine wear MGU-K (percentage)

uint8 m\_engineTCWear; // Engine wear TC (percentage)

}

struct PacketCarDamageData

{

PacketHeader m\_header; // Header

CarDamageData m\_carDamageData[22];

};

## Session History Packet

This packet contains lap times and tyre usage for the session. **This packet works slightly differently to other packets. To reduce CPU and bandwidth, each packet relates to a specific vehicle and is sent every 1/20 s, and the vehicle being sent is cycled through. Therefore in a 20 car race you should receive an update for each vehicle at least once per second.**

Note that at the end of the race, after the final classification packet has been sent, a final bulk update of all the session histories for the vehicles in that session will be sent.

Frequency: 20 per second but cycling through cars

Size: 1155 bytes

Version: 1

struct LapHistoryData

{

uint32 m\_lapTimeInMS; // Lap time in milliseconds

uint16 m\_sector1TimeInMS; // Sector 1 time in milliseconds

uint16 m\_sector2TimeInMS; // Sector 2 time in milliseconds

uint16 m\_sector3TimeInMS; // Sector 3 time in milliseconds

uint8 m\_lapValidBitFlags; // 0x01 bit set-lap valid, 0x02 bit set-sector 1 valid

// 0x04 bit set-sector 2 valid, 0x08 bit set-sector 3 valid

};

struct TyreStintHistoryData

{

uint8 m\_endLap; // Lap the tyre usage ends on (255 of current tyre)

uint8 m\_tyreActualCompound; // Actual tyres used by this driver

uint8 m\_tyreVisualCompound; // Visual tyres used by this driver

};

struct PacketSessionHistoryData

{

PacketHeader m\_header; // Header

uint8 m\_carIdx; // Index of the car this lap data relates to

uint8 m\_numLaps; // Num laps in the data (including current partial lap)

uint8 m\_numTyreStints; // Number of tyre stints in the data

uint8 m\_bestLapTimeLapNum; // Lap the best lap time was achieved on

uint8 m\_bestSector1LapNum; // Lap the best Sector 1 time was achieved on

uint8 m\_bestSector2LapNum; // Lap the best Sector 2 time was achieved on

uint8 m\_bestSector3LapNum; // Lap the best Sector 3 time was achieved on

LapHistoryData m\_lapHistoryData[100]; // 100 laps of data max

TyreStintHistoryData m\_tyreStintsHistoryData[8];

};

## Restricted data (Your Telemetry setting)

There is some data in the UDP that you may not want other players seeing if you are in a multiplayer game. This is controlled by the “Your Telemetry” setting in the Telemetry options. The options are:

* Restricted (Default) – other players viewing the UDP data will not see values for your car
* Public – all other players can see all the data for your car

Note: You can always see the data for the car you are driving regardless of the setting.

The following data items are set to zero if the player driving the car in question has their “Your Telemetry” set to “Restricted”:

### Car status packet

* m\_fuelInTank
* m\_fuelCapacity
* m\_fuelMix
* m\_fuelRemainingLaps
* m\_frontBrakeBias
* m\_ersDeployMode
* m\_ersStoreEnergy
* m\_ersDeployedThisLap
* m\_ersHarvestedThisLapMGUK
* m\_ersHarvestedThisLapMGUH

### Car damage packet

* m\_frontLeftWingDamage
* m\_frontRightWingDamage
* m\_rearWingDamage
* m\_floorDamage
* m\_diffuserDamage
* m\_sidepodDamage
* m\_engineDamage
* m\_gearBoxDamage
* m\_tyresWear (All four wheels)
* m\_tyresDamage (All four wheels)
* m\_brakesDamage (All four wheels)
* m\_drsFault
* m\_engineMGUHWear
* m\_engineESWear
* m\_engineCEWear
* m\_engineICEWear
* m\_engineMGUKWear
* m\_engineTCWear

# FAQS

## How do I enable the UDP Telemetry Output?

In F1 2021, UDP telemetry output is controlled via the in-game menus. To enable this, enter the options menu from the main menu (triangle / Y), then enter the settings menu - the UDP option will be at the bottom of the list. From there you will be able to enable / disable the UDP output, configure the IP address and port for the receiving application, toggle broadcast mode and set the send rate. Broadcast mode transmits the data across the network subnet to allow multiple devices on the same subnet to be able to receive this information. When using broadcast mode it is not necessary to set a target IP address, just a target port for applications to listen on.

*Advanced PC Users*: You can additionally edit the game’s configuration XML file to configure UDP output. The file is located here (after an initial boot of the game):

...\Documents\My Games\<game\_folder>\hardwaresettings\hardware\_settings\_config.xml

You should see the tag:

<motion>

...

<udp enabled="false" broadcast=”false” ip="127.0.0.1" port="20777" sendRate=”20” format=”2021” yourTelemetry=”restricted” />

...

</motion>

Here you can set the values manually. Note that any changes made within the game when it is running will overwrite any changes made manually. Note the enabled flag is now a state.

## What has changed since last year?

F1 2021 sees the following changes to the UDP specification:

* Car Damage packet including new engine wear parameters, brakes damage and more detailed body damage included. Some data sizes changed.
* Damage and wear parameters moved from car status packet to car damage for consistency and to more efficiently use space
* Block rev lights have been added for showing more accurate rev light LED arrays
* Session packet has been updated with more detailed weather forecast together with accuracy setting
* Nationality IDs have been updated
* Session types have been updated
* Adding new track Ids
* Added car number in the lobby info packet
* Network identifier added to participants – previously the network Id was offset by 100, but this could be confused with valid Driver Ids as they go over 100 now
* Updated Result Status values
* Added AI difficulty to the session packet
* Added My Team flag to participants and now set invalid driver, team, nationality & network ids to 255
* Added number of pit stops to the lap data
* New “Start lights” and “Lights out” events
* Added identifiers into the session packet so data sets can be linked
* Pit stop window data for the player has been added to the session packet
* Pit stop timings for all vehicles are now available in the lap data
* New session history packet gives details of lap times and tyre usage across the session
* Removed best lap/sector times/lap numbers from Lap Data packet as all this information is now available in the Session History packet
* Assists for local player are now in the session packet
* Added num penalties unserved into lap data and events for when drive through and stop-go penalties are served
* Added num warnings a driver has been issued in the lap data
* Added network paused flag to the car status (for every car)
* Flashback event added to help figure out discontinuities in the data
* Added dynamic racing line assists
* Lap times are now all in milliseconds (lap data and final classification packets affected)
* Lap valid flags added to the session history
* Added new event for button status so it can be detected throughout the game, not just driving
* Removed the button status from the car telemetry packet as the event packet is now available

## What is the order of the wheel arrays?

All wheel arrays are in the following order:

0 – Rear Left (RL)

1 – Rear Right (RR)

2 – Front Left (FL)

3 – Front Right (FR)

## Do the vehicle indices change?

During a session, each car is assigned a vehicle index. This will not change throughout the session and all the arrays that are sent use this vehicle index to dereference the correct piece of data.

## What encoding format is used?

All values are encoded using Little Endian format.

## Are the data structures packed?

Yes, all data is packed, there is no padding used.

## Will there always be 20 cars in the data structures?

No, for F1 2020, there is a new feature called “My Team” which allows an extra team to be present on the grid. This means that all previous places where 20 cars were used, 22 is now the maximum. If “My Team” is not active however, most games modes will act as before and have a maximum of 20. Note that if your UDP format is 2019, 2018 or legacy and you are in “My Team” career mode, no UDP output will be produced because of this limitation.

There is still the data item called m\_numActiveCars in the participants packet which tells you how many cars are active in the race. However, you should check the individual result status of each car in the lap data to see if that car is actively providing data. If it is not “Invalid” or “Inactive” then the corresponding vehicle index has valid data.

## How often are updated packets sent?

For the packets which get updated at “Rate as specified in the menus” you can be guaranteed that on the frame that these get sent they will all get sent together and will never be separated across frames. This of course relies on the reliability of your network as to whether they are received correctly as everything is sent via UDP. Other packets that get sent at specific rates can arrive on any frame.

If you are connected to the game when it starts transmitting the first frame will contain the following information to help initialise data structures on the receiving application:

**Packets sent on Frame 1: (All packets sent on this frame have “Session timestamp” 0.000)**

* Session
* Participants
* Car Setups
* Lap Data
* Motion Data
* Car Telemetry
* Car Status
* Car Damage

As an example, assuming that you are running at 60Hz with 60Hz update rate selected in the menus then you would expect to see the following packets and timestamps:

**Packets sent on Frame 2: (All packets sent on this frame have “Session timestamp” 0.016)**

* Lap Data
* Motion Data
* Car Telemetry
* Car Status

…

**Packets sent on Frame 31: (All packets sent on this frame have “Session timestamp” 0.5)**

* Session (since 2 updates per second)
* Car Setups (since 2 updates per second)
* Lap Data
* Motion Data
* Car Telemetry
* Car Status
* Car Damage (since 2 updates per second)

## Will my old app still work with F1 2021?

F1 2021 uses a new format for the UDP data. However, earlier formats of the data are still supported so that most older apps implemented using the previous data formats should work with little or no change from the developer. To use the old formats, please enter the UDP options menu and set “UDP Format” to either “F1 2020”, “F1 2019”, “F1 2018” or “Legacy” (for F1 2017 and earlier).

Specifications for the olders formats can be seen here:

* Legacy (2017 and earlier) - <http://forums.codemasters.com/discussion/53139/f1-2017-d-box-and-udp-output-specification/p1>.
* F1 2018 - <https://forums.codemasters.com/topic/30601-f1-2018-udp-specification/>
* F1 2019 - <https://forums.codemasters.com/topic/44592-f1-2019-udp-specification/>
* F1 2020 - <https://forums.codemasters.com/topic/54423-f1%C2%AE-2020-udp-specification/>

## How do I enable D-BOX output?

D-BOX output is currently supported on the PC platform. In F1 2021, the D-BOX activation can be controlled via the menus. Navigate to Game Options->Settings->UDP Telemetry Settings->D-BOX to activate this on your system.

*Advanced PC Users:* It is possible to control D-BOX by editing the games’ configuration XML file. The file is located here (after an initial boot of the game):

...\Documents\My Games\<game\_folder>\hardwaresettings\hardware\_settings\_config.xml

You should see the tag:

<motion>

<dbox enabled="false" />

...

</motion>

Set the “enabled” value to “true” to allow the game to output to your D-BOX motion platform. Note that any changes made within the game when it is running will overwrite any changes made manually.

## How can I disable in-game support for LED device?

The F1 game has native support for some of the basic features supported by some external LED devices, such as the *Leo Bodnar SLI Pro* and the *Fanatec* steering wheels. To avoid conflicts between Codemasters’ implementation and any third-party device managers on the PC platform it may be necessary to disable the native support. This is done using the following led\_display flags in the hardware\_settings\_config.xml. The file is located here (after an initial boot of the game):

...\Documents\My Games\<game\_folder>\hardwaresettings\hardware\_settings\_config.xml

The flags to enabled/disable LED output are:

<led\_display fanatecNativeSupport="true" sliProNativeSupport="true" />

The sliProNativeSupport flag controls the output to SLI Pro devices. The fanatecNativeSupport flag controls the output to Fanatec (and some related) steering wheel LEDs. Set the values for any of these to “false” to disable them and avoid conflicts with your own device manager.

Please note there is an additional flag to manually control the LED brightness on the SLI Pro:

<led\_display sliProForceBrightness="127" />

This option (using value in the range 0-255) will be ignored when setting the sliProNativeSupport flag to “false”.

Also note it is now possible to edit these values on the fly via the Game Options->Settings->UDP Telemetry Settings menu.

## Can I configure the UDP output using an XML File?

PC users can edit the game’s configuration XML file to configure UDP output. The file is located here (after an initial boot of the game):

...\Documents\My Games\<game\_folder>\hardwaresettings\hardware\_settings\_config.xml

You should see the tag:

<motion>

...

<udp enabled="false" broadcast=”false” ip="127.0.0.1" port="20777" sendRate=”20” format=”2021” yourTelemetry="restricted" />

...

</motion>

Here you can set the values manually. Note that any changes made within the game when it is running will overwrite any changes made manually.

# Appendices

Here are the values used for the team ID, driver ID and track ID parameters.

## Team IDs

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ID** | **Team** | **ID** | **Team** | **ID** | **Team** |
| 0 | Mercedes | 76 | MP Motorsport ‘20 |  |  |
| 1 | Ferrari | 77 | Prema ‘20 |  |  |
| 2 | Red Bull Racing | 78 | Trident ‘20 |  |  |
| 3 | Williams | 79 | BWT ‘20 |  |  |
| 4 | Aston Martin | 80 | Hitech ‘20 |  |  |
| 5 | Alpine | 85 | Mercedes 2020 |  |  |
| 6 | Alpha Tauri | 86 | Ferrari 2020 |  |  |
| 7 | Haas | 87 | Red Bull 2020 |  |  |
| 8 | McLaren | 88 | Williams 2020 |  |  |
| 9 | Alfa Romeo | 89 | Racing Point 2020 |  |  |
| 42 | Art GP ’19 | 90 | Renault 2020 |  |  |
| 43 | Campos ’19 | 91 | Alpha Tauri 2020 |  |  |
| 44 | Carlin ’19 | 92 | Haas 2020 |  |  |
| 45 | Sauber Junior Charouz ’19 | 93 | McLaren 2020 |  |  |
| 46 | Dams ’19 | 94 | Alfa Romeo 2020 |  |  |
| 47 | Uni-Virtuosi ‘19 | 106 | Prema ‘21 |  |  |
| 48 | MP Motorsport ‘19 | 107 | Uni-Virtuosi ‘21 |  |  |
| 49 | Prema ’19 | 108 | Carlin ‘21 |  |  |
| 50 | Trident ’19 | 109 | Hitech ‘21 |  |  |
| 51 | Arden ’19 | 110 | Art GP ‘21 |  |  |
| 70 | Art GP ‘20 | 111 | MP Motorsport ‘21 |  |  |
| 71 | Campos ‘20 | 112 | Charouz ‘21 |  |  |
| 72 | Carlin ‘20 | 113 | Dams ‘21 |  |  |
| 73 | Charouz ‘20 | 114 | Campos ‘21 |  |  |
| 74 | Dams ‘20 | 115 | BWT ‘21 |  |  |
| 75 | Uni-Virtuosi ‘20 | 116 | Trident ‘21 |  |  |

## Driver IDs

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ID** | **Driver** | **ID** | **Driver** | **ID** | **Driver** |
| 0 | Carlos Sainz | 45 | Artem Markelov | 88 | Guiliano Alesi |
| 1 | Daniil Kvyat | 46 | Tadasuke Makino | 89 | Ralph Boschung |
| 2 | Daniel Ricciardo | 47 | Sean Gelael | 90 | Michael Schumacher |
| 3 | Fernando Alonso | 48 | Nyck De Vries | 91 | Dan Ticktum |
| 4 | Felipe Massa | 49 | Jack Aitken | 92 | Marcus Armstrong |
| 6 | Kimi Räikkönen | 50 | George Russell | 93 | Christian Lundgaard |
| 7 | Lewis Hamilton | 51 | Maximilian Günther | 94 | Yuki Tsunoda |
| 9 | Max Verstappen | 52 | Nirei Fukuzumi | 95 | Jehan Daruvala |
| 10 | Nico Hulkenburg | 53 | Luca Ghiotto | 96 | Gulherme Samaia |
| 11 | Kevin Magnussen | 54 | Lando Norris | 97 | Pedro Piquet |
| 12 | Romain Grosjean | 55 | Sérgio Sette Câmara | 98 | Felipe Drugovich |
| 13 | Sebastian Vettel | 56 | Louis Delétraz | 99 | Robert Schwartzman |
| 14 | Sergio Perez | 57 | Antonio Fuoco | 100 | Roy Nissany |
| 15 | Valtteri Bottas | 58 | Charles Leclerc | 101 | Marino Sato |
| 17 | Esteban Ocon | 59 | Pierre Gasly | 102 | Aidan Jackson |
| 19 | Lance Stroll | 62 | Alexander Albon | 103 | Casper Akkerman |
| 20 | Arron Barnes | 63 | Nicholas Latifi | 109 | Jenson Button |
| 21 | Martin Giles | 64 | Dorian Boccolacci | 110 | David Coulthard |
| 22 | Alex Murray | 65 | Niko Kari | 111 | Nico Rosberg |
| 23 | Lucas Roth | 66 | Roberto Merhi | 112 | Oscar Piastri |
| 24 | Igor Correia | 67 | Arjun Maini | 113 | Liam Lawson |
| 25 | Sophie Levasseur | 68 | Alessio Lorandi | 114 | Juri Vips |
| 26 | Jonas Schiffer | 69 | Ruben Meijer | 115 | Theo Pourchaire |
| 27 | Alain Forest | 70 | Rashid Nair | 116 | Richard Verschoor |
| 28 | Jay Letourneau | 71 | Jack Tremblay | 117 | Lirim Zendeli |
| 29 | Esto Saari | 72 | Devon Butler | 118 | David Beckmann |
| 30 | Yasar Atiyeh | 73 | Lukas Weber | 119 | Gianluca Petecof |
| 31 | Callisto Calabresi | 74 | Antonio Giovinazzi | 120 | Matteo Nannini |
| 32 | Naota Izum | 75 | Robert Kubica | 121 | Alessio Deledda |
| 33 | Howard Clarke | 76 | Alain Prost | 122 | Bent Viscaal |
| 34 | Wilheim Kaufmann | 77 | Ayrton Senna | 123 | Enzo Fittipaldi |
| 35 | Marie Laursen | 78 | Nobuharu Matsushita |  |  |
| 36 | Flavio Nieves | 79 | Nikita Mazepin |  |  |
| 37 | Peter Belousov | 80 | Guanya Zhou |  |  |
| 38 | Klimek Michalski | 81 | Mick Schumacher |  |  |
| 39 | Santiago Moreno | 82 | Callum Ilott |  |  |
| 40 | Benjamin Coppens | 83 | Juan Manuel Correa |  |  |
| 41 | Noah Visser | 84 | Jordan King |  |  |
| 42 | Gert Waldmuller | 85 | Mahaveer Raghunathan |  |  |
| 43 | Julian Quesada | 86 | Tatiana Calderon |  |  |
| 44 | Daniel Jones | 87 | Anthoine Hubert |  |  |

## Track IDs

|  |  |
| --- | --- |
| **ID** | **Track** |
| 0 | Melbourne |
| 1 | Paul Ricard |
| 2 | Shanghai |
| 3 | Sakhir (Bahrain) |
| 4 | Catalunya |
| 5 | Monaco |
| 6 | Montreal |
| 7 | Silverstone |
| 8 | Hockenheim |
| 9 | Hungaroring |
| 10 | Spa |
| 11 | Monza |
| 12 | Singapore |
| 13 | Suzuka |
| 14 | Abu Dhabi |
| 15 | Texas |
| 16 | Brazil |
| 17 | Austria |
| 18 | Sochi |
| 19 | Mexico |
| 20 | Baku (Azerbaijan) |
| 21 | Sakhir Short |
| 22 | Silverstone Short |
| 23 | Texas Short |
| 24 | Suzuka Short |
| 25 | Hanoi |
| 26 | Zandvoort |
| 27 | Imola |
| 28 | Portimão |
| 29 | Jeddah |

## Nationality IDs

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ID** | **Nationality** | **ID** | **Nationality** | **ID** | **Nationality** |
| 1 | American | 31 | Greek | 61 | Paraguayan |
| 2 | Argentinean | 32 | Guatemalan | 62 | Peruvian |
| 3 | Australian | 33 | Honduran | 63 | Polish |
| 4 | Austrian | 34 | Hong Konger | 64 | Portuguese |
| 5 | Azerbaijani | 35 | Hungarian | 65 | Qatari |
| 6 | Bahraini | 36 | Icelander | 66 | Romanian |
| 7 | Belgian | 37 | Indian | 67 | Russian |
| 8 | Bolivian | 38 | Indonesian | 68 | Salvadoran |
| 9 | Brazilian | 39 | Irish | 69 | Saudi |
| 10 | British | 40 | Israeli | 70 | Scottish |
| 11 | Bulgarian | 41 | Italian | 71 | Serbian |
| 12 | Cameroonian | 42 | Jamaican | 72 | Singaporean |
| 13 | Canadian | 43 | Japanese | 73 | Slovakian |
| 14 | Chilean | 44 | Jordanian | 74 | Slovenian |
| 15 | Chinese | 45 | Kuwaiti | 75 | South Korean |
| 16 | Colombian | 46 | Latvian | 76 | South African |
| 17 | Costa Rican | 47 | Lebanese | 77 | Spanish |
| 18 | Croatian | 48 | Lithuanian | 78 | Swedish |
| 19 | Cypriot | 49 | Luxembourger | 79 | Swiss |
| 20 | Czech | 50 | Malaysian | 80 | Thai |
| 21 | Danish | 51 | Maltese | 81 | Turkish |
| 22 | Dutch | 52 | Mexican | 82 | Uruguayan |
| 23 | Ecuadorian | 53 | Monegasque | 83 | Ukrainian |
| 24 | English | 54 | New Zealander | 84 | Venezuelan |
| 25 | Emirian | 55 | Nicaraguan | 85 | Barbadian |
| 26 | Estonian | 56 | Northern Irish | 86 | Welsh |
| 27 | Finnish | 57 | Norwegian | 87 | Vietnamese |
| 28 | French | 58 | Omani |  |  |
| 29 | German | 59 | Pakistani |  |  |
| 30 | Ghanaian | 60 | Panamanian |  |  |

## Surface types

These types are from physics data and show what type of contact each wheel is experiencing.

|  |  |
| --- | --- |
| **ID** | **Surface** |
| 0 | Tarmac |
| 1 | Rumble strip |
| 2 | Concrete |
| 3 | Rock |
| 4 | Gravel |
| 5 | Mud |
| 6 | Sand |
| 7 | Grass |
| 8 | Water |
| 9 | Cobblestone |
| 10 | Metal |
| 11 | Ridged |

## Button flags

These flags are used in the telemetry packet to determine if any buttons are being held on the controlling device. If the value below logical ANDed with the button status is set then the corresponding button is being held.

|  |  |
| --- | --- |
| **Bit Flag** | **Button** |
| 0x00000001 | Cross or A |
| 0x00000002 | Triangle or Y |
| 0x00000004 | Circle or B |
| 0x00000008 | Square or X |
| 0x00000010 | D-pad Left |
| 0x00000020 | D-pad Right |
| 0x00000040 | D-pad Up |
| 0x00000080 | D-pad Down |
| 0x00000100 | Options or Menu |
| 0x00000200 | L1 or LB |
| 0x00000400 | R1 or RB |
| 0x00000800 | L2 or LT |
| 0x00001000 | R2 or RT |
| 0x00002000 | Left Stick Click |
| 0x00004000 | Right Stick Click |
| 0x00008000 | Right Stick Left |
| 0x00010000 | Right Stick Right |
| 0x00020000 | Right Stick Up |
| 0x00040000 | Right Stick Down |
| 0x00080000 | Special |

# 

## Penalty types

|  |  |
| --- | --- |
| **ID** | **Penalty meaning** |
| 0 | Drive through |
| 1 | Stop Go |
| 2 | Grid penalty |
| 3 | Penalty reminder |
| 4 | Time penalty |
| 5 | Warning |
| 6 | Disqualified |
| 7 | Removed from formation lap |
| 8 | Parked too long timer |
| 9 | Tyre regulations |
| 10 | This lap invalidated |
| 11 | This and next lap invalidated |
| 12 | This lap invalidated without reason |
| 13 | This and next lap invalidated without reason |
| 14 | This and previous lap invalidated |
| 15 | This and previous lap invalidated without reason |
| 16 | Retired |
| 17 | Black flag timer |

## Infringement types

|  |  |
| --- | --- |
| **ID** | **Infringement meaning** |
| 0 | Blocking by slow driving |
| 1 | Blocking by wrong way driving |
| 2 | Reversing off the start line |
| 3 | Big Collision |
| 4 | Small Collision |
| 5 | Collision failed to hand back position single |
| 6 | Collision failed to hand back position multiple |
| 7 | Corner cutting gained time |
| 8 | Corner cutting overtake single |
| 9 | Corner cutting overtake multiple |
| 10 | Crossed pit exit lane |
| 11 | Ignoring blue flags |
| 12 | Ignoring yellow flags |
| 13 | Ignoring drive through |
| 14 | Too many drive throughs |
| 15 | Drive through reminder serve within n laps |
| 16 | Drive through reminder serve this lap |
| 17 | Pit lane speeding |
| 18 | Parked for too long |
| 19 | Ignoring tyre regulations |
| 20 | Too many penalties |
| 21 | Multiple warnings |
| 22 | Approaching disqualification |
| 23 | Tyre regulations select single |
| 24 | Tyre regulations select multiple |
| 25 | Lap invalidated corner cutting |
| 26 | Lap invalidated running wide |
| 27 | Corner cutting ran wide gained time minor |
| 28 | Corner cutting ran wide gained time significant |
| 29 | Corner cutting ran wide gained time extreme |
| 30 | Lap invalidated wall riding |
| 31 | Lap invalidated flashback used |
| 32 | Lap invalidated reset to track |
| 33 | Blocking the pitlane |
| 34 | Jump start |
| 35 | Safety car to car collision |
| 36 | Safety car illegal overtake |
| 37 | Safety car exceeding allowed pace |
| 38 | Virtual safety car exceeding allowed pace |
| 39 | Formation lap below allowed speed |
| 40 | Retired mechanical failure |
| 41 | Retired terminally damaged |
| 42 | Safety car falling too far back |
| 43 | Black flag timer |
| 44 | Unserved stop go penalty |
| 45 | Unserved drive through penalty |
| 46 | Engine component change |
| 47 | Gearbox change |
| 48 | League grid penalty |
| 49 | Retry penalty |
| 50 | Illegal time gain |
| 51 | Mandatory pitstop |

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