Gmax Race Live Progress Feed Specification

5th October 2022

GX-UG-00020

- The Gmax Race system tracks race horses during real-time. Its minimal infrastructure makes it easy and economical to use. It is the world's most widely installed tracking system for horse racing.

- Various data feeds are available. This document describes the protocol for a 'Live Race Progress' feed, which provides a summarised overview of the live status of the race. It is ideal for producing on screen graphics showing viewers the live running order, timing and progress of a race.

- The system is under active development. Feedback on possible future improvements is welcome.

Live Race Progress| Data Summary

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- The Live Progress Feed provides the following information for each race at 2Hz (every 0.5s)

Description	Name	Type	Example	Notes
Packet Type	K	Number	5	A value of 5 indicates that this is a progress packet
Timestamp	T	String	2016-01-12T13:11:10.9Z	UTC time in ISO 8601 format
Unique Race Identifier	I	String	30201601121310	String containing unique identifier for the race
Gate Name	G	String	1f	The last timing 'Gate' for which a sectional time was recorded
Length	L	Number	100.6	Distance in meters to the finish line of the last 'Gate'
Sectional Time	S	Number	10.61	Sectional time in seconds between the current Gate and the previous Gate for the lead horse(s)
Cumulative Time	C	Number	40.13	Time since start of race to current 'Gate' for the lead horse(s)
Running Time	R	Number	46.72	The elapsed time since the start of the race in seconds
Speed	V	Number	14.8	The speed in meters per second of the lead horse(s)
Progress	P	Number	87.5	'Official' Distance remaining for to the finish line in meters
Order	O	String Array	["3","5","1","2","6"]	List indicating the order of runners, with the leading horse first
Field	F	String Array	["2","1","3","5","6"]	List of horses running in the race
Distance Back	B	Number Array	[0,0.4,0.4,0.9,1.5]	Estimated distance in meters from the leading horse to each horse in the same order as the "O" Order parameter.
Warning Level	W	Number	0	A bit field with warning flags that can be set by the operator

- For each race, the data is provided as a ECMA-404 JSON array.
- This stream will be sent to subscribers using UDP to a static IP address/port to be specified to Gmax in advance by the subscriber. The subscriber must open and listen to this port to receive the data.

- An example progress message is provided below. Additional whitespace has been added here to aid readability:


```
{
      "K":5,
      "T":"2016-01-12T13:11:10.9Z",
      "I":"30201601121310",
      "G":"1f",
      "L":100.6,
      "S":10.61,
      "C":40.13,
      "R":46.72,
      "V":14.8,
      "P":87.5,
      "O":["3","5","1","2","6"],
      "F":["2","1","3","5","6"],
      "B":[0,0.4,0.4,0.9,1.5],
      "W":0
}
```


Warning Level Flags:

The following bits may be set and cleared in the 'W' parameter based on the discretion of the system operator.

Bit	Meaning
0	Reserved
1	Reserved
2	Start Warning
3	Assignment Warning
4	Field Warning
5	Reserved
6	Reserved
7	Reserved

Failure Modes | Errors & Warnings

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- The Gmax Race system will attempt to maintain the feed as reliably as possible. The design of this feed has multiple redundancy mechanisms built in to make it as tolerant as possible to, for example, temporary interference with radio transmissions or physical damage to an individual tracker during the race.
- However, we advise subscribers to consider the following failure modes and ways of recognising them from the data.

Failure Mode	Symptoms/Warnings
System wide failure – for example, due to failure of the racecourse's network.	Data feed may be interrupted
Start detection failure	Running time, progress and cumulative time may remain at zero. Or individual horses may be detected as not starting the race, affecting running order. Operator may set 'Start Warning' flag.
Erroneous Start Detection/False start	Running time may begin in advance of the race starting, it will normally be reset again in preparation for when the race actually starts. Operator may set 'Start Warning' flag.
Assignment Error	Data may appear but be associated with an incorrect horse ID. Operator may set 'Assignment Warning' flag.
Failure of tracking of any horse	The horse will be removed from the running order. The order of horses may be incorrect, and information relating to the leading horse may be incorrect if it is the leading horse suffering the failure.
Data appears for invalid horse	Despite best efforts by operators, there may be a time delay in removing an invalid horse (e.g. fallen rider; late non-runner). Operator may set 'Field Warning' flag.

Discussion | Implementation Notes

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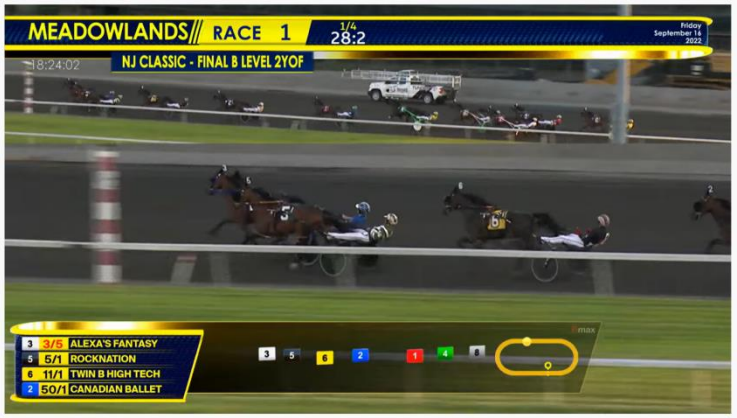
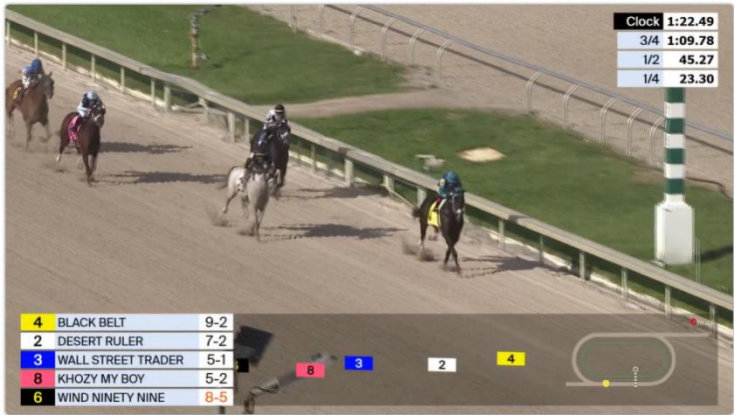
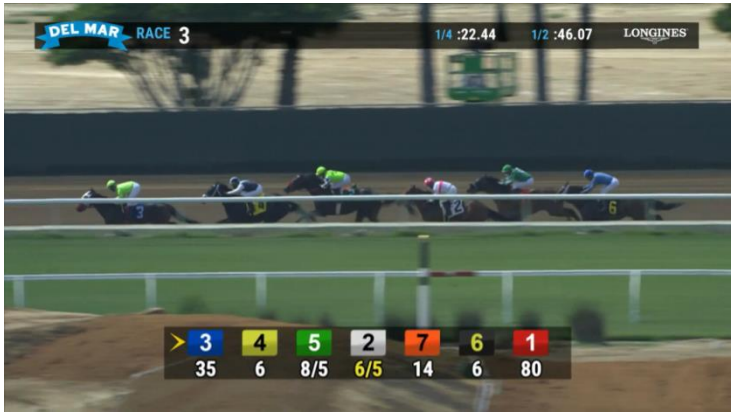
- Protocol
  - JSON has been chosen due to its simplicity and extendibility. Subscribers should ensure that their system is tolerant to additional parameters being added to the feed, change in order of parameters, and ignore any out of band (i.e. invalid JSON, or data of different packet type) messages.
  - UDP is widely used and the most appropriate protocol for live streaming data. However, note that UDP provides for no guarantee of packet delivery, packet order, and duplicate packets may be generated by the network. Subscribers to this feed should be tolerant to such errors. The network quality varies between racecourses.
- Accuracy and Latency
  - Updates will be provided by default at intervals of 0.5s. Latency may vary, but will typically be less than 0.1s. The timestamp is synchronised to UTC time, with an estimated accuracy of ±0.02s. Other update rates are available upon request.
  - Tracking accuracy, expressed as sectional timing accuracy is estimated to be approx. ±0.08s (1 sigma)
- Race identifier
  - This allows unique identification of the race. Additional meta-data (race start time, racecourse etc.) for the race can be requested using the separate Gmax ''Race List' data feed.
- Running Time/Cumulative Time
  - The running time is based on the system determining when the race has started. This varies from track to track dependant on the methods used. This video shows one example of how differences can arise. Note that at some tracks a third party race start signal (as used for official timing), which has been found not to be 100% reliable. When it does not work, other data should remain valid but the running time will be zero. Work is ongoing to find a better alternative.
  - Cumulative time is provided in addition to sectional time, so that subscribers wishing to summarise the sectional times can avoid rounding errors accumulating.
- Official distance
  - The 'Progress' and 'Length' parameters represents the official distance remaining along the official running line. Note that horses may in fact run a greater or smaller distance to reach the finish, depending on how much their actual path deviates from the official line.
  - Prior to the start of the race, the value of the 'Progress' parameter will be the race official distance in meters.
  - Using the 'Progress' value in combination with the running time allows the subscriber to calculate sectional times over any arbitrary section of the race. Interpolation should be used between updates to obtain the most precise time for the period of interest.
- Order and Field
  - The numbers of the horses that are considered to be running in the race are listed in the 'Field' array. Those horses for which a running order has been calculated are listed in the 'Order' array. Comparison of the two arrays makes it possible to determine whether horses missing from the race order are an expected omission (e.g. a non-runner, fallen jockey) vs an error in generating the running order. Note that the determination of the 'field' involves manual input, and so there may be some delay in its update (e.g. when a jockey falls, or late withdrawal).
- Sectional Times
  - Sectional times are provided between pre-defined locations ('gates') on the racecourse. Gates are positioned at intervals back from the start line and spacing may vary to suit standard practice at different racecourses.
  - The sectional time provided in this feed is not for a particular horse, but for the leader(s) of the field – the leader may change between the beginning and end of a section
  - The last sectional time measurement is output in every message until a new sectional time is measured. This ensures that the system is tolerant to dropped packets. Note that the time for a particular section may change (improve in accuracy) after the first time output for that section. Subscribers should continue to update times for the previous section based on data in the feed until the next section appears for best accuracy, or can chose to use an earlier time for lower latency. Recommendations for your use scenario can be provided if required.

- Please discuss with our team how you wish to present the data to so that we can make sure this feed best meets your needs
- Other complementary data feeds are available, including the live co-ordinates of each horse, and historical data to allow live data to be displayed in context (e.g. live speed vs typical/record speed)
- Gmax can also provide a Race Graphics System, capable of overlaying graphics based on the data in this feed (and other feeds) onto live video signals. A gallery of examples can be viewed using the following link: https://vimeo.com/showcase/5541577 (password: GmaxGraphics)







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