RC/AV Protocol Version 1

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1 Purpose

This document exists to describe and define Remote Controller (RC)/Autonomous Vehicle (AV) Protocol, a protocol for exchanging telemetry between an RC and an AV. For the purposes of this protocol, we define an RC to be any commander not directly attached to the vehicle. Moreover, we define an AV to be any vehicle receiving telecommands from an RC.

Technically, *telemetry* refers to metric data sent AV→RC, and *telecommand*refers to metric data sent RC→AV. This is an important distinction, because the AV measures and calculates metrics; contrast with the RC, which issues commands to the AV to alter various metrics. Bearing this difference in mind, we hereafter refer to all metric data collectively, regardless of point-of-origin, as telemetry. Hence, commands sent RC→AV are telemetry just as much as measurements sent AV→RC.

2 Telemetric Objects

The loose category of telemetry consists of six total metrics, which we call a telemetric object T_n. Each T_n is exactly one byte of information. We define the current list of telemetric objects as follows:

- T_1: Velocity v;
- T_2: Throttle Δv;
- T_3: Braking force $-\Delta v$;
- T_4: Steering angle θ;
- T_5: Slip angle α;
- T_6: Automatic function A.

Note that T_1 was formerly speed; this change to velocity allows for $v < 0$, commanding reverse motion. Due to the lag between RC→AV telecommands and actuation by the AV, we keep T_2 and T_3 as separate objects, as it may be the case that $-(\Delta v) \neq -\Delta v$. Lastly, note that T_6 communicates procedures performed by the AV automatically, such as an emergency stop. The actual data-value of T_6 is a lowercase English letter; for example, an emergency stop may give $A = e$.

3 The `TELEM` Packet and RC/AVPv1

In addition to the telemetric objects, define the Sender ID S to be the final string of digits of the sending machine's IP address, and define the Receiver ID R to be the final string of digits in the receiving machine's IP address. Thus, we may generalize both the RC→AV and the AV→RC cases by $S \to R$.

RC/AVPv1 consists of exactly one type of packet: the `TELEM` packet. Each `TELEM` packet consists of bytes of data arranged the following precise and immutable order:

S	R	T_1	T_2	T_3	T_4	T_5	T_6	R	S	T_1^*	T_2^*	T_3^*	T_4^*	T_5^*	T_6^*

Note that, when $S \mapsto$RC, then each T_n is a telecommand and each T_n^* is the most recent telemetry received from the AV. Likewise, when $S \mapsto$AV, then each T_n is a telemetric reading and each T_n^* is the most recent telecommand received from the RC. Future versions of the `TELEM` packet may have a timestamp (to qualify disconnection errors) and asymmetrical telemtric objects, depending one which machine is the sender.

The purpose of the second half the `TELEM` packet is to serve as a replacement for the `ACK` packets seen in other protocols. As we intend to for constant broadcast from both the RC and the AV, other types of packet prove unnecessary. Hence, RC/AVP is a simple process of broadcasting telemetry paired with the most recent telemetry received.