

# Haltech CAN Dash Protocol PDF

## Version Information

Date Updated: 2022-08-09

Device	Version for Full Support*
Nexus Series ECU	1.20
Elite Series ECU	3.7
IC7 Dash	?

\* Earlier versions support parts of this protocol. The most up-to-date ECU and dash firmware available will support most signals.

## Protocol Specification

CAN I. D.	Rate (Hz)	Direction	Message Position	Sign	Channel	Units	Conversion from Raw
0x360	50	TX	0 - 1	Unsigned	RPM	RPM	$y = x$
			2 - 3	Unsigned	Manifold Pressure	kPa (Abs)	$y = x/10$
			4 - 5	Unsigned	Throttle Position	%	$y = x/10$
			6 - 7	Unsigned	Coolant Pressure	kPa	$y = x/10 - 101.3$
0x361	50	TX	0 - 1	Unsigned	Fuel Pressure	kPa	$y = x/10 - 101.3$
			2 - 3	Unsigned	Oil Pressure	kPa	$y = x/10 - 101.3$
			4 - 5	Unsigned	Engine Demand	%	$y = x/10$
			6 - 7	Unsigned	Wastegate Pressure	kPa	$y = x/10 - 101.3$
0x362	50	TX	0 - 1	Unsigned	Injection Stage 1 Duty Cycle	%	$y = x/10$
			2 - 3	Unsigned	Injection Stage 2 Duty Cycle	%	$y = x/10$
			4 - 5	Signed	Ignition Angle (Leading)	°	$y = x/10$
0x363	20	TX	0 - 1	Signed	Wheel Slip	km/h	$y = x/10$
			2 - 3	Signed	Wheel Diff	km/h	$y = x/10$
0x364	50	TX	0 - 1	Unsigned	Injection Stage 1 Average Injection Time	ms	$y = x/1000$
			2 - 3	Unsigned	Injection Stage 2 Average Injection Time	ms	$y = x/1000$
			4 - 5	Unsigned	Injection Stage 3 Average Injection Time	ms	$y = x/1000$
			6 - 7	Unsigned	Injection Stage 4 Average Injection Time	ms	$y = x/1000$
0x368	20	TX	0 - 1	Unsigned	Wideband Sensor 1		$y = x/1000$
			2 - 3	Unsigned	Wideband Sensor 2		$y = x/1000$
			4 - 5	Unsigned	Wideband Sensor 3		$y = x/1000$
			6 - 7	Unsigned	Wideband Sensor 4		$y = x/1000$
0x369	20	TX	0 - 1	Unsigned	Trigger System Error Count	raw	$y = x$
			2 - 3	Unsigned	Trigger Counter	raw	$y = x$
			6 - 7	Unsigned	Trigger Sync Level	raw	$y = x$
0x36A	20	TX	0 - 1	Unsigned	Knock Level 1	dB	$y = x/100$
			2 - 3	Unsigned	Knock Level 2	dB	$y = x/100$
0x36B	20	TX	0 - 1	Unsigned	Brake Pressure Front	kPa	$y = x - 101.3$
			2 - 3	Unsigned	NOS Pressure Sensor 1	kPa	$y = x*11/50 - 101.3$ . Saturated at 14316.4 kPa, 14417.7 kPa absolute, 2076 psi.
			4 - 5	Unsigned	Turbo Speed Sensor 1	RPM	$y = x*10$
			6 - 7	Signed	Lateral G	m/s <sup>2</sup>	$y = x/10$
0x36C	20	TX	0 - 1	Unsigned	Wheel Speed Front Left	km/h	$y = x/10$

			2 - 3	Unsigned	Wheel Speed Front Right	km/h	y = x/10
			4 - 5	Unsigned	Wheel Speed Rear Left	km/h	y = x/10
			6 - 7	Unsigned	Wheel Speed Rear Right	km/h	y = x/10
0x36D	20	TX	4 - 5	Signed	Exhaust Cam Angle 1	°	y = x/10
			6 - 7	Signed	Exhaust Cam Angle 2	°	y = x/10
0x36E	20	TX	0 - 1	Unsigned	Engine Limiting Active	boolean	0=Off, 1=On
			2 - 3	Signed	Launch Control Ignition Retard	°	y = x/10
			4 - 5	Signed	Launch Control Fuel Enrich	%	y = x/10
			6 - 7	Signed	Longitudinal G	m/s2	y = x/10
0x36F	20	TX	0 - 1	Unsigned	Generic Output 1 Duty Cycle	%	y = x/10
			2 - 3	Unsigned	Boost Control Output	%	y = x/10
0x370	20	TX	0 - 1	Unsigned	Vehicle Speed	km/h	y = x/10
			4 - 5	Signed	Intake Cam Angle 1	°	y = x/10
			6 - 7	Signed	Intake Cam Angle 2	°	y = x/10
0x371	10	TX	0 - 1	Unsigned	Fuel Flow	cc/min	y = x
			2 - 3	Unsigned	Fuel Flow Return	cc/min	y = x
0x372	10	TX	0 - 1	Unsigned	Battery Voltage	Volts	y = x/10
			4 - 5	Unsigned	Target Boost Level	kPa	y = x/10
			6 - 7	Unsigned	Barometric Pressure	kPa (Abs)	y = x/10
0x373	10	TX	0 - 1	Unsigned	EGT Sensor 1	K	y = x/10
			2 - 3	Unsigned	EGT Sensor 2	K	y = x/10
			4 - 5	Unsigned	EGT Sensor 3	K	y = x/10
			6 - 7	Unsigned	EGT Sensor 4	K	y = x/10
0x374	10	TX	0 - 1	Unsigned	EGT Sensor 5	K	y = x/10
			2 - 3	Unsigned	EGT Sensor 6	K	y = x/10
			4 - 5	Unsigned	EGT Sensor 7	K	y = x/10
			6 - 7	Unsigned	EGT Sensor 8	K	y = x/10
0x375	10	TX	0 - 1	Unsigned	EGT Sensor 9	K	y = x/10
			2 - 3	Unsigned	EGT Sensor 10	K	y = x/10
			4 - 5	Unsigned	EGT Sensor 11	K	y = x/10
			6 - 7	Unsigned	EGT Sensor 12	K	y = x/10
0x376	10	TX	0 - 1	Unsigned	Ambient Air Temperature	K	y = x/10
			2 - 3	Signed	Relative Humidity	%	y = x/10
			4 - 5	Unsigned	Specific Humidity	ppm	y = x*100
			6 - 7	Unsigned	Absolute Humidity	g/m3	y = x/10
0x3E0	5	TX	0 - 1	Unsigned	Coolant Temperature	K	y = x/10
			2 - 3	Unsigned	Air Temperature	K	y = x/10
			4 - 5	Unsigned	Fuel Temperature	K	y = x/10
			6 - 7	Unsigned	Oil Temperature	K	y = x/10
0x3E1	5	TX	0 - 1	Unsigned	Gearbox Oil Temperature	K	y = x/10
			2 - 3	Unsigned	Diff Oil Temperature	K	y = x/10
			4 - 5	Unsigned	Fuel Composition	%	y = x/10
0x3E2	5	TX	0 - 1	Unsigned	Fuel Level	L	y = x/10
0x3E3	5	TX	0 - 1	Signed	Fuel Trim Short Term Bank 1	%	y = x/10
			2 - 3	Signed	Fuel Trim Short Term Bank 2	%	y = x/10
			4 - 5	Signed	Fuel Trim Long Term Bank 1	%	y = x/10
			6 - 7	Signed	Fuel Trim Long Term Bank 2	%	y = x/10
0x3E4	5	TX	1:7	Unsigned	Neutral Switch	boolean	0=Off, 1=On
			1:6	Unsigned	Reverse Switch	boolean	0=Off, 1=On

			1:5	Unsigned	Gear Switch	boolean	0=Off, 1=On
			1:4	Unsigned	Decel Cut Active	boolean	0=Off, 1=On
			1:3	Unsigned	Transient Throttle Active	boolean	0=Off, 1=On
			1:2	Unsigned	Brake Pedal Switch	boolean	0=Off, 1=On
			1:1	Unsigned	Clutch Switch	boolean	0=Off, 1=On
			1:0	Unsigned	Oil Pressure Light	boolean	0=Off, 1=On
			2:7	Unsigned	Launch Control Active	boolean	0=Off, 1=On
			2:6	Unsigned	Launch Control Switch	boolean	0=Off, 1=On
			2:5	Unsigned	Aux RPM Limiter Active	boolean	0=Off, 1=On
			2:3	Unsigned	Flat Shift Switch	boolean	0=Off, 1=On
			2:1	Unsigned	Torque Reduction Active	boolean	0=Off, 1=On
			3:7	Unsigned	Traction Control Enabled	boolean	0=Off, 1=On. See Traction Control States section.
			3:6	Unsigned	Traction Control Active	boolean	0=Off, 1=On. See Traction Control States section.
			3:5	Unsigned	Air Con Request	boolean	0=Off, 1=On
			3:4	Unsigned	Air Con Output	boolean	0=Off, 1=On
			3:3	Unsigned	Thermo-fan 4 On	boolean	0=Off, 1=On
			3:2	Unsigned	Thermo-fan 3 On	boolean	0=Off, 1=On
			3:1	Unsigned	Thermo-fan 2 On	boolean	0=Off, 1=On
			3:0	Unsigned	Thermo-fan 1 On	boolean	0=Off, 1=On
			4	Signed	Rotary Trim Pot 1	raw	y = x
			5	Signed	Rotary Trim Pot 2	raw	y = x
			6	Signed	Rotary Trim Pot 3	raw	y = x
			7:7	Unsigned	Check Engine Light	boolean	0=Off, 1=On
			7:6	Unsigned	Battery Light Active	boolean	0=Off, 1=On
			7:0	Unsigned	Traction Control Light	boolean	0=Off, 1=On. See Traction Control States section.
0x3E5	50	TX	0	Unsigned	Ignition Switch	boolean	0=Off, 1=On
			1	Unsigned	Turbo Timer - Time Remaining	s	y = x
			2	Unsigned	Turbo Timer - Engine Time Remaining	s	y = x
			3:7	-	-	-	
			3:6	Unsigned	Pit Lane Speed Limiter Error	enum	0=OK,1=Error
			3:5	Unsigned	Pit Lane Speed Limiter Active	enum	0=Inactive,1=Active
			3:4	Unsigned	Pit Lane Speed Limiter Switch State	boolean	0=Off, 1=On
			3:3	-	-	-	
			3:2	Unsigned	ABS Error	enum	0=OK,1=Error
			3:1	Unsigned	ABS Active	enum	0=Inactive,1=Active
			3:0	Unsigned	ABS Armed	enum	0=Not Armed,1=Armed
			4 - 5	Signed	Steering Wheel Angle	°	y = x/10
			6 - 7	Unsigned	Driveshaft RPM	RPM	y = x
0x3E6	20	TX	0 - 1	Unsigned	NOS Pressure Sensor 2	kPa	y = x*11/50 - 101.3. Saturated at 14316.4 kPa,14417.7 kPa absolute, 2076 psi.
			2 - 3	Unsigned	NOS Pressure Sensor 3	kPa	y = x*11/50 - 101.3. Saturated at 14316.4 kPa,14417.7 kPa absolute, 2076 psi.
			4 - 5	Unsigned	NOS Pressure Sensor 4	kPa	y = x*11/50 - 101.3. Saturated at 14316.4 kPa,14417.7 kPa absolute, 2076 psi.
			6 - 7	Unsigned	Turbo Speed Sensor 2	RPM	y = x*10
0x3E7	20	TX	0 - 1	Unsigned	Generic Sensor 1		See Generic Sensors.
			2 - 3	Unsigned	Generic Sensor 2		See Generic Sensors.
			4 - 5	Unsigned	Generic Sensor 3		See Generic Sensors.
			6 - 7	Unsigned	Generic Sensor 4		See Generic Sensors.
0x3E8	20	TX	0 - 1	Unsigned	Generic Sensor 5		See Generic Sensors.
			2 - 3	Unsigned	Generic Sensor 6		See Generic Sensors.
			4 - 5	Unsigned	Generic Sensor 7		See Generic Sensors.

0x3E9	20	TX	6 - 7	Unsigned	Generic Sensor 8		See Generic Sensors.
			0 - 1	Unsigned	Generic Sensor 9		See Generic Sensors.
			2 - 3	Unsigned	Generic Sensor 10		See Generic Sensors.
			4 - 5	Unsigned	Target Lambda		$y = x/1000$
			6:7	Unsigned	Nitrous Stage 1 Output State	boolean	0=Off, 1=On
			6:6	Unsigned	Nitrous Stage 2 Output State	boolean	0=Off, 1=On
			6:5	Unsigned	Nitrous Stage 3 Output State	boolean	0=Off, 1=On
			6:4	Unsigned	Nitrous Stage 4 Output State	boolean	0=Off, 1=On
			6:3	Unsigned	Nitrous Stage 5 Output State	boolean	0=Off, 1=On
			6:2	Unsigned	Nitrous Stage 6 Output State	boolean	0=Off, 1=On
			6:1	Unsigned	Water Injection Advanced Output State	boolean	0=Off, 1=On
		7	Signed	Torque Management Knob	raw	$y = x$	
0x3EA	50	TX	0 - 1	Unsigned	Gearbox Line Pressure	kPa	$y = x/10 - 101.3$
			2 - 3	Unsigned	Injection Stage 3 Duty Cycle	%	$y = x/10$
			4 - 5	Unsigned	Injection Stage 4 Duty Cycle	%	$y = x/10$
			6 - 7	Unsigned	Crank Case Pressure	kPa	$y = x/10 - 101.3$
0x3EB	50	TX	0 - 3	Unsigned	Race Timer	ms	$y = x$
			4 - 5	Signed	Ignition Angle Bank 1	°	$y = x/10$
			6 - 7	Signed	Ignition Angle Bank 2	°	$y = x/10$
0x3EC	50	TX	0 - 1	Signed	Torque Management Driveshaft RPM Target	RPM	$y = x$
			2 - 3	Signed	Torque Management Driveshaft RPM Target Error	RPM	$y = x$
			4 - 5	Signed	Torque Management Driveshaft RPM Target Error Ignition Correction	°	$y = x/10$
			6 - 7	Signed	Torque Management Driveshaft RPM Timed Ignition Correction	°	$y = x/10$
0x3ED	50	TX	0 - 1	Signed	Torque Management Combined Ignition Correction	°	$y = x/10$
0x3EE	20	TX	0 - 1	Unsigned	Wideband Sensor 5		$y = x/1000$
			2 - 3	Unsigned	Wideband Sensor 6		$y = x/1000$
			4 - 5	Unsigned	Wideband Sensor 7		$y = x/1000$
			6 - 7	Unsigned	Wideband Sensor 8		$y = x/1000$
0x3EF	20	TX	0 - 1	Unsigned	Wideband Sensor 9		$y = x/1000$
			2 - 3	Unsigned	Wideband Sensor 10		$y = x/1000$
			4 - 5	Unsigned	Wideband Sensor 11		$y = x/1000$
			6 - 7	Unsigned	Wideband Sensor 12		$y = x/1000$
0x3F0	50	TX	0 - 1	Unsigned	Shock Travel Sensor Front Left (Uncalibrated)	mm	$y = x / 10$
			2 - 3	Unsigned	Shock Travel Sensor Front Right (Uncalibrated)	mm	$y = x / 10$
			4 - 5	Unsigned	Shock Travel Sensor Rear Left (Uncalibrated)	mm	$y = x / 10$
			6 - 7	Unsigned	Shock Travel Sensor Rear Right (Uncalibrated)	mm	$y = x / 10$
0x3F1	50	TX	0 - 1	Signed	Shock Travel Sensor Front Left	mm	$y = x / 10$
			2 - 3	Signed	Shock Travel Sensor Front Right	mm	$y = x / 10$
			4 - 5	Signed	Shock Travel Sensor Rear Left	mm	$y = x / 10$

			6 - 7	Signed	Shock Travel Sensor Rear Right	mm	$y = x / 10$
0x469	5	TX	0 - 1	Unsigned	ECU Temperature	K	$y = x/10$
0x470	20	TX	0 - 1	Unsigned	Wideband Overall		$y = x/1000$
			2 - 3	Unsigned	Wideband Bank 1		$y = x/1000$
			4 - 5	Unsigned	Wideband Bank 2		$y = x/1000$
			6	Signed	Gear Selector Position	enum	See 'Gears and Selector Positions'
			7	Signed	Gear - Can be combined with selector pos	enum	See 'Gears and Selector Positions'
0x471	50	TX	0 - 1	Signed	Injector Pressure Differential	kPa	$y = x/10$
			2 - 3	Unsigned	Accelerator Pedal Position	%	$y = x/10$
0x472	20	TX	0 - 1	Unsigned	Cruise Control Target Speed	km/h	$y = x/10$
			2 - 3	Unsigned	Cruise Control Last Target Speed	km/h	$y = x/10$
			4 - 5	Signed	Cruise Control Speed Error	km/h	$y = x/10$
			6:7 - 6:4	Unsigned	Cruise Control Controller State	enum	0=Disabled, 1=Inactive, 2=Cruising, 3=Accelerating, 4=Decelerating
			6:3 - 7:0	Unsigned	Cruise Control Input State	bit-field	0=Unused, 1=Disable, 2=Enable, 3=Enable/Disable, 4=Cancel, 8=Set, 12=Set/Cancel, 16=Resume, 20=Resume/Cancel, 32=Accel, 64=Decel, 76=Set/Coast/Cancel, 84=Resume/Coast/Cancel, 128=Increment, 168=Set/Accel/+, 176=Resume/Accel/+, 256=Decrement, 328=Set/Coast/-, 336=Resume/Coast/-, 512=Rest Position
0x473	10	TX	0 - 3	Unsigned	Total Fuel Used	cc	$y = x$
			4:7	Unsigned	Rolling Antilag Switch State	boolean	0=Off, 1=On
			4:6	Unsigned	Antilag Switch State	boolean	0=Off, 1=On
			4:5	Unsigned	Antilag Output State	boolean	0=Off, 1=On
			4:4	Unsigned	Traction Control Switch State	boolean	0=Off, 1=On
			4:3	Unsigned	Primary Fuel Pump Output State	boolean	0=Off, 1=On
			4:2	Unsigned	Aux 1 Fuel Pump Output State	boolean	0=Off, 1=On
			4:1	Unsigned	Aux 2 Fuel Pump Output State	boolean	0=Off, 1=On
			4:0	Unsigned	Aux 3 Fuel Pump Output State	boolean	0=Off, 1=On
			5:7	Unsigned	Nitrous Enable 1 Switch State	boolean	0=Off, 1=On
			5:6	Unsigned	Nitrous Enable 1 Output State	boolean	0=Off, 1=On
			5:5	Unsigned	Nitrous Enable 2 Switch State	boolean	0=Off, 1=On
			5:4	Unsigned	Nitrous Enable 2 Output State	boolean	0=Off, 1=On
			5:3	Unsigned	Nitrous Enable 3 Switch State	boolean	0=Off, 1=On
			5:2	Unsigned	Nitrous Enable 3 Output State	boolean	0=Off, 1=On
			5:1	Unsigned	Nitrous Enable 4 Switch State	boolean	0=Off, 1=On
			5:0	Unsigned	Nitrous Enable 4 Output State	boolean	0=Off, 1=On
			6:7	Unsigned	Nitrous Override 1 Switch State	boolean	0=Off, 1=On
			6:6	Unsigned	Nitrous Override 1 Output State	boolean	0=Off, 1=On
			6:5	Unsigned	Nitrous Override 2 Switch State	boolean	0=Off, 1=On
6:4	Unsigned	Nitrous Override 2 Output State	boolean	0=Off, 1=On			
6:3	Unsigned	Nitrous Override 3 Switch State	boolean	0=Off, 1=On			
6:2	Unsigned	Nitrous Override 3 Output State	boolean	0=Off, 1=On			

			6:1	Unsigned	Nitrous Override 4 Switch State	boolean	0=Off, 1=On
			6:0	Unsigned	Nitrous Override 4 Output State	boolean	0=Off, 1=On
			7:7	Unsigned	Water Injection Advanced Enable Switch State	boolean	0=Off, 1=On
			7:6	Unsigned	Water Injection Advanced Enable Output State	boolean	0=Off, 1=On
			7:5	Unsigned	Water Injection Advanced Override Switch State	boolean	0=Off, 1=On
			7:4	Unsigned	Water Injection Advanced Override Output State	boolean	0=Off, 1=On
			7:3 - 7:0	Unsigned	Cut Percentage Method	enum	0 = No Cut 1 = Fuel 2 = Ignition 3 = Fuel and Ignition
0x474	20	TX	0 - 1	Signed	Vertical G	m/s2	y = x/10
			2 - 3	Signed	Pitch Rate	deg/s	y = x/10
			4 - 5	Signed	Roll Rate	deg/s	y = x/10
			6 - 7	Signed	Yaw Rate	deg/s	y = x/10
0x475	5	TX	0 - 1	Unsigned	Primary Fuel Pump Duty Cycle	%	y = x/10
			2 - 3	Unsigned	Aux 1 Fuel Pump Duty Cycle	%	y = x/10
			4 - 5	Unsigned	Aux 2 Fuel Pump Duty Cycle	%	y = x/10
			6 - 7	Unsigned	Aux 3 Fuel Pump Duty Cycle	%	y = x/10
0x476	20	TX	0 - 1	Unsigned	Brake Pressure Rear	kPa	y = x - 101.3
			2 - 3	Unsigned	Brake Pressure Front Ratio	%	y = x/10
			4 - 5	Unsigned	Brake Pressure Rear Ratio	%	y = x/10
			6 - 7	Signed	Brake Pressure Difference (Front minus Rear)	kPa (Abs)	y = x
0x477	10	TX	0 - 1	Unsigned	Engine Limiter Max RPM	RPM	y = x
			1 - 2	Unsigned	Cut Percentage	%	y = x/10
			4	Unsigned	Engine Limiter Function	enum	Engine Limiting Functions table
			5	Unsigned	RPM Limiter Function	enum	Engine Limiting Functions table
			6	Unsigned	Cut Percentage Function	enum	Engine Limiting Functions table
			7:7 - 7:4	Unsigned	Engine Limiter Method	enum	0 = No Cut 1 = Fuel 2 = Ignition 3 = Fuel and Ignition
			7:3 - 7:0	Unsigned	RPM Limiter Method	enum	0 = No Cut 1 = Fuel 2 = Ignition 3 = Fuel and Ignition
0x6F0	5	TX	0 - 1	Unsigned	Front Left Tyre Pressure	kPa	CAN Error Values table otherwise: y = x/10 - 101.3
			2 - 3	Unsigned	Front Right Tyre Pressure	kPa	0 = error (can be No Signal, Calibrating or Device Timeout) otherwise: y = x/10 - 101.3
			4 - 5	Unsigned	Rear Left Tyre Pressure	kPa	0 = error (can be No Signal, Calibrating or Device Timeout) otherwise: y = x/10 - 101.3
			6 - 7	Unsigned	Rear Right Tyre Pressure	kPa	0 = error (can be No Signal, Calibrating or Device Timeout) otherwise: y = x/10 - 101.3
0x6F1	5	TX	0 - 1	Unsigned	Front Left Tyre Temperature	K	0 = error (can be No Signal, Calibrating or Device Timeout) otherwise: y = x/10
			2 - 3	Unsigned	Front Right Tyre Temperature	K	0 = error (can be No Signal, Calibrating or Device Timeout) otherwise: y = x/10
			4 - 5	Unsigned	Rear Left Tyre Temperature	K	0 = error (can be No Signal, Calibrating or Device Timeout) otherwise: y = x/10
			6 - 7	Unsigned	Rear Right Tyre Temperature	K	0 = error (can be No Signal, Calibrating or Device Timeout) otherwise: y = x/10

0x6F2	5	TX	0 - 1	Unsigned	Front Left Tyre Sensor Battery Voltage	V	0 = error (can be No Signal, Calibrating or Device Timeout) otherwise: $y = x/1000$
			2 - 3	Unsigned	Front Right Tyre Sensor Battery Voltage	V	0 = error (can be No Signal, Calibrating or Device Timeout) otherwise: $y = x/1000$
			4 - 5	Unsigned	Rear Left Tyre Sensor Battery Voltage	V	0 = error (can be No Signal, Calibrating or Device Timeout) otherwise: $y = x/1000$
			6 - 7	Unsigned	Rear Right Tyre Sensor Battery Voltage	V	0 = error (can be No Signal, Calibrating or Device Timeout) otherwise: $y = x/1000$
0x6F3	5	TX	0 - 1	Unsigned	Front Tyre Recommended Pressure	kPa	$y = x/10 - 101.3$
			2 - 3	Unsigned	Rear Tyre Recommended Pressure	kPa	$y = x/10 - 101.3$
			4:3	Unsigned	Rear Right Tyre Air Leak Detected	boolean	0=No Leak,1=Leak Detected
			4:2	Unsigned	Rear Left Tyre Air Leak Detected	boolean	0=No Leak,1=Leak Detected
			4:1	Unsigned	Front Right Tyre Air Leak Detected	boolean	0=No Leak,1=Leak Detected
			4:0	Unsigned	Front Left Tyre Air Leak Detected	boolean	0=No Leak,1=Leak Detected
			5	Unsigned	Engine Protection Severity Level	raw	0 - Idle, 1 - Level 1, 2 - Level 2, 3 - Level 3
			6 - 7	Unsigned	Engine Protection Reason	enum	This value is hexadecimal, and represents the OBDII DTC. The upper 2 bits determine which letter it is (0b00 = P, 0b01 = B, 0b10 = C, 0b11 = U). The remaining 14 bits, when viewed as hexadecimal are the number part of the code. e.g. 0x2A00 = P2A00 = "Wideband 1 Sensor Failure. See Wideband O2 1 channel."
0x6F4	100	TX	0:0	Unsigned	Park Light State	boolean	0=Off, 1=On
			0:1	Unsigned	Head Light State	boolean	0=Off, 1=On
			0:2	Unsigned	High Beam Light State	boolean	0=Off, 1=On
			0:3	Unsigned	Left Indicator State	boolean	0=Off, 1=On
			0:4	Unsigned	Right Indicator State	boolean	0=Off, 1=On
0x6F6	5	TX	0 - 3	Unsigned	Fuel Trip Meter	cc	$y = x$
0x700	50	TX	0-1	Unsigned			Sends out HBO, HCO8, HCO25 information as per the PD16 to ECU protocol for the internal R5 PDM.  See <a href="#">(PD16 CAN Protocol)</a> for more detailed info.
			2-3	Unsigned			
			4-5	Unsigned			
			6-7	Unsigned			

## Notes

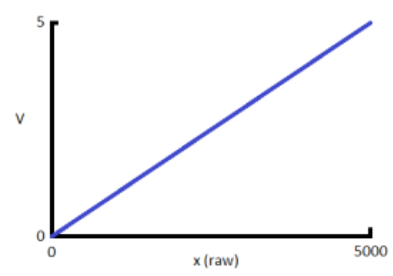
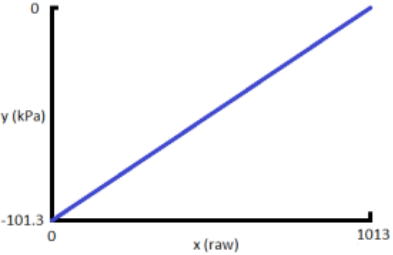
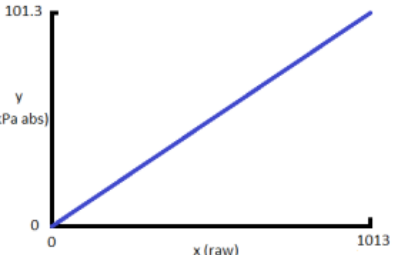
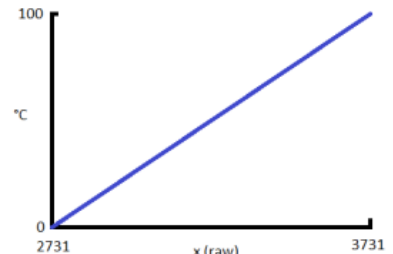
- This protocol will have more things added in future. Non-Haltech products on the same CAN bus may cause CAN bus ID conflicts when that happens.
- This protocol can change at Haltech's discretion (though we generally try to avoid it).
- The rates specified above are not guaranteed.

## Traction Control States

Traction Control State channel	Raw	Enabled Bit	Active Bit	Light Bit	Notes
CAN ID		0x3E4	0x3E4	0x3E4	
Byte:bit		3:7	3:6	7:0	
Function Disabled	-1	✘	✘	✘	Function disabled in the software
Idle	0	✔	✘	✘	Enabled, slip is currently less than target. Or Driven Wheel Speed is below Min setting.
Active	2	✔	✔	✔	Slip is greater than target slip.  Action is being taken. - PID control style has an RPM limiter active - Cut Percentage style the cut percentage table is being obeyed.

Ramp Out	4	✓	✓	✓	After being Active, the PID controller ramps the RPM limiter up while in this state.
Disabled	5	✗	✗	✓	Disabled by the Traction Control Switch and/or Conditional Activation. Light bit is on to warn the driver that the traction control is inactive.

## Generic Sensors

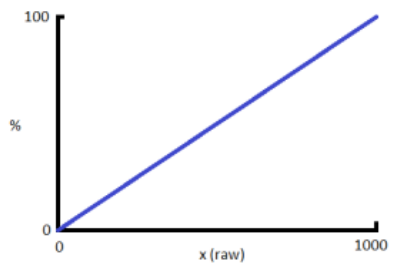
Sensor Type	Unit	Scaling	
Switch		0 = off, 1 = on	
Voltage	V	$y = x/1000$	
Pressure	kPa	$y = x/10 - 101.3$	
	kPa (abs)	$y = x/10$	
Temperature	K	$y = x/10$	
	°C	$y = x/10 - 273.1$	
	°F	$y = x*0.18 - 255.372$	



Percentage

%

$$y = x/10$$



## Key Information

The Haltech CAN bus operates at 1MBit and uses 11-bit IDs. IDs are expressed in Hexadecimal.

The first byte in a packet is considered byte 0, and the 8th byte is byte 7. The most significant bit in a byte is considered bit 7 and the least significant bit is bit 0.

Data is encoded as big endian.

## Addressing Data

Data that is the size of an individual byte (that is byte aligned) are represented with the byte number. E.g. 4 for data at byte 4

Data that crosses multiple bytes (that is byte aligned) are represented with a byte range. The range is inclusive. E.g. 0 - 1 for 2 bytes of data in byte 0 & 1, 4 - 7 for 4 byte of data in bytes 4, 5, 6 & 7.

To address data stored in individual bit within a byte, the following notation is used X:Y. The X is the byte number, and the Y is the bit number. E.g. 4:0 for bit 0 in byte 4.

To address data stored across many bits that may span bytes the above notation is used but express as a range. The range is inclusive. E.g. 6:3 - 7:0 for 12 bits of data starting at bit 3 on the byte 6 to bit 0 on byte 7.

## Example

Byte	0								1								2								3								4							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Data	Manifold Pressure								Switch State	Reserved	Input Voltage								Status Enum																					
Value	1013 (0x03F5)								1	0	3000 (0x0BB8)								200 (0xC8)																					
Addressing	0 - 1								2:7	2:6-2:4	2:3-3:0								4																					
	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	1	1	0	0	0	1	0	1	1	1	0	1	1	1	0	0	0	1	1	0	0	1	0	0	0

## Units

The *Conversion From Raw To Units* column in below table show how to convert the raw value in the message to a value known units as indicated by the *Units* column. The *x* symbol represents the raw value and *y* represents the value converted.

E.g. The *Throttle Position* channel has a raw value of 456. The conversion for it is  $y = x / 10$ . Therefore the converted value of *y* equals:

$$y = 456 / 10 = 45.6\%$$

If other units are required, it is the responsibility of the device reading these values to perform these conversions. All pressures are absolute, and it is necessary to subtract 101.3 kPa from the final result if *gauge pressure* is desired.

# Units

Symbol	Name	Quantity	Notes
RPM	Revolutions Per Minute	Rotational velocity	Typically engine crankshaft rotational speed.
kPa	kiloPascals - gauge	Pressure	0= standard atmospheric pressure. -101.3kPa = pure vacuum.
kPa (abs)	kiloPascals - absolute	Pressure	0 = pure vacuum. 101.3kPa(abs) = standard atmospheric pressure.
%	percent		
°	degree	Angle	360 degrees makes up one revolution. Note that a 4-stroke engine cycle requires 2 crankshaft revolutions, so is 720 degrees.
$\lambda$	lambda		1 lambda = the stoichiometric ratio of the fuel being used.  To convert to typical gasoline/petrol AFR: multiply by 14.7  To convert to ethanol AFR: multiply by 9  To convert to methanol AFR: multiply by 6.47
K	Kelvin	Temperature	A unit of temperature where 0 is absolute zero temperature. It uses the same scaling as degrees Celsius. So an increase of 1K is an increase of 1°C.  To convert from Kelvin to degrees Celsius, simply subtract 273.15. $temp\_C = temp\_K - 273.15$  To convert from Kelvin to degrees Fahrenheit: $temp\_F = (temp\_K - 273.15) \times 9/5 + 32$  Water freezes at 273.15K and boils at 373.15K.
km/h	kilometres per hour	Velocity	A common metric speed measurement.  To convert to metres per second: divide by 3.6.  To convert to miles per hour: divide by 1.609.
m/s <sup>2</sup> m/s <sup>2</sup>	metres per second-squared	Acceleration	A common metric acceleration measurement. To convert to G: divide by 9.8
dB	deciBel		
cc/min	cubic centimetres per minute	Volume Flow Rate	A volume flow-rate measurement commonly used for fuel injectors.  A common approximate conversion to pounds per hour (lbs/hr) is to
cc	cubic centimetre	Volume	0.001 L.  To convert to fluid ounces (fl. oz.): divide by 29.574.
L	litre	Volume	Volume. 1000 cc.  To convert to US gallons: divide by 3.785
V	Volt		
ppm	parts per million	Concentration / Ratio	A mass ratio used for representing concentrations of a substance within another. 1,000,000 ppm is a pure substance. e.g. Seawater has a salinity of roughly 35,000 ppm, equivalent to 35 grams of salt per kilogram of water.
g/m <sup>3</sup> g/m <sup>3</sup>	grams per cubic metre	Density	Water has a density of 1 million g/m <sup>3</sup>
ms	millisecond	Time	1/1000 of a second.
s	second	Time	1/60 of a minute, 1/3600 of an hour.
min	minute	Time	60 seconds. 1/60 of an hour.
h hr	hour	Time	60 minutes. 3600 seconds.

## Bit-Field Interpretation

Bit fields are a useful way of indicating the state of multiple things simultaneously within one value. Typically, each binary digit (bit) represents whether a thing is 0 or 1. 0 typically means false or off. 1 typically means true or on.

e.g. Engine Limiting Method has 1 as Fuel and 2 as Ignition. This is 0b01 for fuel and 0b10 for Ignition. If both Fuel and Ignition are being used, the two values are added together, giving a value of  $1 + 2 = 3$ .

### Windows 10 calculator can decode bit-fields

- Select Programmer mode by clicking on the three lines, then Programmer.
- Click the DEC to put it into decimal mode (normal numbers).
- type in your number.
- The binary version of your number will be shown next to BIN. The right-most digit has value 1. The next has value 2, then 4, then 8, then 16, etc. (doubling each time)

### To manually decode bit-fields

- To decode a bit-field, look for the largest raw value which is less than or equal to the value you're trying to decode. In this example, 2 is the highest when decoding 3.
- So we know that Ignition is one of the values. Now we need to find the other value(s).
- We simply subtract the 2, and repeat the process until we are left with 0.
- So  $3 - 2 = 1$ . 1 is the highest, so Fuel is one of the values.
- When we subtract the 1 for fuel, we get  $1 - 1 = 0$ . Because we get 0, we are finished decoding the value, and know that both Fuel and Ignition are true.