Haltech PD-16 CAN Protocol

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Multiplexing

We're sending and receiving a lot of data. We'll multiplex our CAN messages to consume as few CAN IDs as possible. If a message is multiplexed then the first byte will be a multiplex ID used to identify the payload. The Multiplex ID has two sections - the IO type section and the IO index section.

For example, the CAN packet for turning on the 8A output 3 and 25A output 4 will have the same CAN ID and the same payload, but the multiplex ID will indicate which output the packet corresponds to.

Protocol

ECU to PD16

High Priority / High Output Rate

Notes: The ECU and dash can send messages asynchronously whenever there are changes of the I/O. So for example the ECU will send out the message for controlling HBO 1 (CAN ID=base CAN ID, Mux Type=HBO, Mux Index=0) at the base rate of 50ms. So if no changes on the pin occur, that is what can be measured for that particular combination of CAN ID, Mux Type, and Mux Index. If the function that is controlling that pin updates at a faster rate, then you can expect to see a higher rate of CAN messages to control HBO 1. The PD16 will do the same with its inputs, if nothing changes on them they come out at the base rate. If they are changing more often then the frequency is increased.

CAN I.D.	Rate (Hz)	Direction	Message Position	Sign	Channel	Units	Conversion from Raw
PD16 A: 0x6D0 PD16 B: 0x6D8 PD16 C: 0x6E0 PD16 D: 0x6E8	20	RX	0:7 - 0:5	Unsigned	Mux ID (IO Type)		0 = 25A
			0:3 - 0:0	Unsigned	Mux ID (IO Index)		25A: 0 - 3
			1:7 - 2:00	Unsigned	25A <Mux ID> Duty Cycle	%	1000 = 100.0%
			3:7 - 4:00	Unsigned	25A <Mux ID> Frequency	Hz	1000 = 1000Hz

PD16 A: 0x6D0 PD16 B: 0x6D8 PD16 C: 0x6E0 PD16 D: 0x6E8	20	RX	0:7 - 0:5	Unsigned	Mux ID (IO Type)		1 = 8A
			0:3 - 0:0	Unsigned	Mux ID (IO Index)		0 = 8A-HCO1 1 = 8A-HCO2 2 = 8A-HCO3 3 = 8A-HCO4 4 = 8A-HCO5 5 = 8A-HCO6 6 = 8A-HCO7 7 = 8A-HCO8 8 = 8A-HCO9 9 = 8A-HCO10
			1:7 - 2:00	Unsigned	8A <Mux ID> Duty Cycle		1000 = 100.0%
			3:7 - 4:00	Unsigned	8A <Mux ID> Frequency		1000 = 1000Hz
PD16 A: 0x6D0 PD16 B: 0x6D8 PD16 C: 0x6E0 PD16 D: 0x6E8	20	RX	0:7 - 0:5	Unsigned	Mux ID (IO Type)		2 = Half Bridge
			0:3 - 0:0	Unsigned	Mux ID (IO Index)		0 = HBO1 1 = HBO2
			1:7 - 2:00	Unsigned	Half Bridge <Mux ID> Duty Cycle	%	1000 = 100.0%
			3:7 - 4:00	Unsigned	Half Bridge <Mux ID> Frequency	Hz	1000 = 1000Hz

Low Priority / Low Output Rate

CAN I.D.	Rate (Hz)	Direction	Message Position	Sign	Channel	Units	Conversion from Raw

PD16 A: 0x6D1 PD16 B: 0x6D9 PD16 C: 0x6E1 PD16 D: 0x6E9	2	RX	0:7 - 0:5	Unsigned	Mux ID (IO Type)		0 = 25A
			0:3 - 0:0	Unsigned	Mux ID (IO Index)		0 = 25A-HCO1 1 = 25A-HCO2 2 = 25A-HCO3 3 = 25A-HCO4
			1:7 - 1:5	Unsigned	25A <Mux ID> Retries		0 = never 1 = 1 2 = 2 3 = 5 4 = 10 5 = 20 6 = 30 7 = always
			1:4 - 1:3	Unsigned	25A <Mux ID> Drive Type		0 = undefined 1 = high side 2 = both 3 = open circuit
			1:2 - 1:1	Unsigned	25A <Mux ID> Safe State		0 = inactive 1 = active 2 = open circuit
			1:0	Unsigned	25A <Mux ID> Active State		0 = low 1 = high
			2:7 - 2:0	Unsigned	25A <Mux ID> Retry Delay		1 = 1 second range: 0 - 240
			3:7 - 3:0	Unsigned	25A <Mux ID> Fuse Current		1 = 0.2A range = 0 - 250

			4:7 - 4:0	Unsigned	25A <Mux ID> Soft Start Current		1 = 0.2A range = 0 - 250
			5:7 - 5:0	Unsigned	25A <Mux ID> Soft Start Duration		1 = 0.1 seconds range = 0 - 250

PD16 A: 0x6D1 PD16 B: 0x6D9 PD16 C: 0x6E1 PD16 D: 0x6E9	2	RX	0:7 - 0:5	Unsigned	Mux ID (IO Type)		1 = 8A
			0:3 - 0:0	Unsigned	Mux ID (IO Index)		0 = 8A-HCO1 1 = 8A-HCO2 2 = 8A-HCO3 3 = 8A-HCO4 4 = 8A-HCO5 5 = 8A-HCO6 6 = 8A-HCO7 7 = 8A-HCO8 8 = 8A-HCO9 9 =8A-HCO10
			1:7 - 1:5	Unsigned	8A <Mux ID> Retries		0 = never 1 = 1 2 = 2 3 = 5 4 = 10 5 = 20 6 = 30 7 = always
			1:4 - 1:3	Unsigned	8A <Mux ID> Drive Type		0 = undefined 1 = undefined 2 = high side 3 = open circuit
			1:2 - 1:1	Unsigned	8A <Mux ID> Safe State		0 = inactive 1 = active 2 = open circuit
			1:0	Unsigned	8A <Mux ID> Active State		0 = low 1 = high
			2:7 - 2:0	Unsigned	8A <Mux ID> Retry Delay		1 = 1 second range: 0 - 240

			3:7 - 3:0	Unsigned	8A <Mux ID> Fuse Current		1 = 0.2A range = 0 - 250
PD16 A: 0x6D1 PD16 B: 0x6D9 PD16 C: 0x6E1 PD16 D: 0x6E9	2	RX	0:7 - 0:5	Unsigned	Mux ID (IO Type)		2 = Half Bridge
			0:3 - 0:0	Unsigned	Mux ID (IO Index)		0 = HBO1 1 = HBO2
			1:7 - 1:5	Unsigned	Half Bridge <Mux ID> Retries		0 = never 1 = 1 2 = 2 3 = 5 4 = 10 5 = 20 6 = 30 7 = always
			1:4 - 1:3	Unsigned	Half Bridge <Mux ID> Drive Type		0 = low side 1 = high side 2 = both 3 = open circuit
			1:2 - 1:1	Unsigned	Half Bridge <Mux ID> Safe State		0 = inactive 1 = active 2 = open circuit
			1:0	Unsigned	Half Bridge <Mux ID> Active State		0 = low 1 = high
			2:7 - 2:0	Unsigned	Half Bridge <Mux ID> Retry Delay		1 = 1 second range: 0 - 240

PD16 A: 0x6D1 PD16 B: 0x6D9 PD16 C: 0x6E1 PD16 D: 0x6E9	2	RX	0:7 - 0:5	Unsigned	Mux ID (IO Index)		3 = SPI
			0:3 - 0:0	Unsigned	Mux ID (IO Index)		0 = SPI1 1 = SPI2 2 = SPI3 3 = SPI4
			1:1	Unsigned	SPI <Mux ID> Pullup		0 = disable 1 = enable
			1:0	Unsigned	SPI <Mux ID> Edge Select		0 = falling 1 = rising
			4:7 - 5:0	Unsigned	SPI <Mux ID> Upper Threshold	V	5000 = 5.00V
			6:7 - 7:0	Unsigned	SPI <Mux ID> Glitch Filter	us	1 = 1us Range: 0 - 500
			2:7 - 2:0	Unsigned			

PD16 A: 0x6D1 PD16 B: 0x6D9 PD16 C: 0x6E1 PD16 D: 0x6E9	2	RX	0:7 - 0:5	Unsigned	Mux ID (IO Index)		4 = AVI
			0:3 - 0:0	Unsigned	Mux ID (IO Index)		0 = AVI1 1 = AVI2 2 = AVI3 3 = AVI4
			1:2 - 1:0	Unsigned	AVI <Mux ID> Pullup		0 = disable 1 = enable (1k) 2 = enable (240Ω) (AVI 1 only)
			2:7 - 3:0	Unsigned	AVI <Mux ID> Switch On Threshold	V	5000 = 5.00V
			4:7 - 5:0	Unsigned	AVI <Mux ID> Switch Off Threshold	V	5000 = 5.00V

PD16 A: 0x6D2 PD16 B: 0x6DA PD16 C: 0x6E2 PD16 D: 0x6EA	2	RX	0:4	Unsigned	ECR status*		0 = off 1 = on *ECR, when on, will force the PD16 to stay on even if the ignition power switch is removed (until either this bit gets sent with a zero, or CAN comms is lost). Only when in CAN master mode (ie, device was turned on with the ignition switch).
			0:3	Unsigned	CAN Power		0 = disabled 1 = enabled* *Not Implemented / Reserve
			0:2	Unsigned	Reserved		0 = disabled
			0:1	Unsigned	CAN Termination (Bus 1)		0 = disabled 1 = enabled
			0:0	Unsigned	Reserved		0 = disabled

PD16 to ECU

High Priority / High Output Rate

CAN I.D.	Rate (Hz)	Direction	Message Position	Sign	Channel	Units	Conversion from Raw
PD16 A: 0x6D3 PD16 B: 0x6DB PD16 C: 0x6E3 PD16 D: 0x6EB	20	TX	0:7 - 0:5	Unsigned	Mux ID (IO Index)		3 = SPI
			0:3 - 0:0	Unsigned	Mux ID (IO Index)		0 = SPI1 1 = SPI2 2 = SPI3 3 = SPI4
			1:0	Unsigned	SPI <Mux ID> State		0 = OFF 1 = ON
			2:7 - 3:0	Unsigned	SPI <Mux ID> Voltage	V	5000 = 5.000V
			4:7 - 5:0	Unsigned	SPI <Mux ID> Duty Cycle	%	1000 = 100.0%
			6:7 - 7:0	Unsigned	SPI <Mux ID> Frequency	Hz	1000 = 1000Hz

PD16 A: 0x6D3 PD16 B: 0x6DB PD16 C: 0x6E3 PD16 D: 0x6EB	20	TX	0:7 - 0:5	Unsigned	Mux ID (IO Index)		4 = AVI
			0:3 - 0:0	Unsigned	Mux ID (IO Index)		0 = AVI1 1 = AVI2 2 = AVI3 3 = AVI4
			1:0	Unsigned	AVI <Mux ID> State		0 = OFF 1 = ON
			2:7 - 3:0	Unsigned	AVI <Mux ID> Voltage	V	5000 = 5.000V

Low Priority / Low Output Rate

CAN I.D.	Rate (Hz)	Direction	Message Position	Sign	Channel	Units	Conversion from Raw

PD16 A: 0x6D4 PD16 B: 0x6DC PD16 C: 0x6E4 PD16 D: 0x6EC	5	TX	0:7 - 0:5	Unsigned	Mux ID (IO Type)		0 = 25A
			0:3 - 0:0	Unsigned	Mux ID (IO Index)		0 = 25A-HCO1 1 = 25A-HCO2 2 = 25A-HCO3 3 = 25A-HCO4
			1:7 - 1:0	Unsigned	25A <Mux ID> Load	%	100 = 100%
			2:7 - 3:0	Unsigned	25A <Mux ID> Voltage	V	12000 = 12.000V
			4:7 - 5:0	Unsigned	25A <Mux ID> Low Side Current	A	50000 = 50.000A
			6:7 - 6:0	Unsigned	25A <Mux ID> High Side Current	A	50000 = 50.000A
			7:7 - 7:4	Unsigned	25A <Mux ID> Retry Count		0 - 30
			7:3 - 7:0	Unsigned	25A <Mux ID> Pin State		0 = operational 1 = high current 2 = over current 3 = short circuit 4 = open circuit

PD16 A: 0x6D4 PD16 B: 0x6DC PD16 C: 0x6E4 PD16 D: 0x6EC	5	TX	0:7 - 0:5	Unsigned	Mux ID (IO Type)		1 = 8A
			0:3 - 0:0	Unsigned	Mux ID (IO Index)		0 = 8A-HCO1 1 = 8A-HCO2 2 = 8A-HCO3 3 = 8A-HCO4 4 = 8A-HCO5 5 = 8A-HCO6 6 = 8A-HCO7 7 = 8A-HCO8 8 = 8A-HCO9 9 =8A-HCO10
			1:7 - 1:3	Unsigned	8A <Mux ID> Retry Count		0 = never 1 = 1 2 = 2 3 = 5 4 = 10 5 = 20 6 = 30 7 = always
			1:2 - 1:0	Unsigned	8A <Mux ID> Pin State		0 = operational 1 = high current 2 = over current 3 = short circuit 4 = open circuit
			2:7 - 3:0	Unsigned	8A <Mux ID> Voltage	V	12000 = 12.000V
			4:7 - 5:0	Unsigned	8A <Mux ID> Current	A	1000 = 1.000A
			6:7 - 6:0	Unsigned	8A <Mux ID> Load	%	100 = 100%

PD16 A: 0x6D4 PD16 B: 0x6DC PD16 C: 0x6E4 PD16 D: 0x6EC	5	TX	0:7 - 0:5	Unsigned	Mux ID (IO Type)		2 = Half Bridge
			0:3 - 0:0	Unsigned	Mux ID (IO Index)		0 = HBO1 1 = HBO2
			1:7 - 1:3	Unsigned	Half Bridge <Mux ID> Retry Count		0 - 31 31 indicates > 30
			1:2 - 1:0	Unsigned	Half Bridge <Mux ID> Pin State		0 = operational 1 = high current 2 = over current 3 = short circuit 4 = open circuit
			2:7 - 3:0	Unsigned	Half Bridge Voltage	V	12000 = 12.000V
			4:7 - 5:0	Unsigned	Half Bridge LS Current		
			6:7 - 7:0	Unsigned	Half Bridge HS Current		

PD16 A: 0x6D5 PD16 B: 0x6DD PD16 C: 0x6E5 PD16 D: 0x6ED	2	TX	0:7 - 0:4	Unsigned	Status		0=In bootmode 1=In firmware 2=Hardware failure 3=Firmware erased 4=Watchdog timeout 5=Illegal op-code
			0:3	Unsigned	USB Connected		
			0:1	Unsigned	ID Conflict		
			1:7 - 1:3	Unsigned	Boot Version		
			1:1 - 1:0	Unsigned	FW Major Version		
			2:7 - 2:0	Unsigned	FW Minor Version		
			3:7 - 3:0	Unsigned	FW Bugfix Version		
			4:7 - 4:0	Unsigned	FW Release Version		

PD16 A: 0x6D6 PD16 B: 0x6DE PD16 C: 0x6E6 PD16 D: 0x6EE	2	TX	0:7 - 0:0	Unsigned	Mux ID = 0		
			1:0	Unsigned	Ignition input switch status		0 = off 1 = on
			2:7 - 3:0	Unsigned	Main Rail Voltage	V	12000 = 12.000V
			4:7 - 5:0	Unsigned	Protected Rail Voltage	V	12000 = 12.000V
			6:7 - 7:0	Unsigned	ECR Plug Voltage	V	12000 = 12.000V
PD16 A: 0x6D6 PD16 B: 0x6DE PD16 C: 0x6E6 PD16 D: 0x6EE	2	TX	0:7 - 0:0	Unsigned	Mux ID = 1		
			2:7 - 3:0	Unsigned	Boost Voltage	V	12000 = 12.000V The expected value should sit 10V above the Battery Voltage
			4:7 - 5:0	Unsigned	SEPIC Voltage	V	12000 = 12.000V An internal rail. The expected value is 12V
			6:7 - 7:0	Unsigned	ECR Plug Current	mA	1 = 1mA

PD16 A: 0x6D6 PD16 B: 0x6DE PD16 C: 0x6E6 PD16 D: 0x6EE	2	TX	0:7 - 0:0	Unsigned	Mux ID = 2		
			2:7 - 3:0	Unsigned	UVLO Voltage	V	12000 = 12.000V An internal rail. The expected value is 3.3V
			4:7 - 5:0	Unsigned	Sensor Ground Voltage	V	12000 = 12.000V
			6:7 - 7:0	Unsigned	VDD Voltage	V	12000 = 12.000V
PD16 A: 0x6D6 PD16 B: 0x6DE PD16 C: 0x6E6 PD16 D: 0x6EE	2	TX	0:7 - 0:0	Unsigned	Mux ID = 3		
			1:7 - 1:0	Unsigned	Mail Rail Temperature		1 = 1 degree Celsius Temperatures below zero read as zero.
			2:7 - 2:0	Unsigned	Thermistor 1 Temperature		
			3:7 - 3:0	Unsigned	Thermistor 2 Temperature		
			4:7 - 4:0	Unsigned	Thermistor 3 Temperature		
			5:7- 5:0	Unsigned	CPU Temperature		
			6:7 - 7:0	Unsigned	Total Current Draw	A	0.1 A resolution 1000 = 100.0A

PD16 A: 0x6D6 PD16 B: 0x6DE PD16 C: 0x6E6 PD16 D: 0x6EE	2	TX	0:7 - 0:0	Unsigned	Mux ID = 4		
			2:7 - 3:0	Unsigned	Battery Voltage	V	12000 = 12.000V
			4:7 - 5:0	Unsigned	PD-16 On Time		1 = 1 second
			6:7 - 6:6	Unsigned	HCO25 3 & 4 Temperature		0 = OK 1 = Warning (> 115 degrees) 2 = shutdown (> 145 degrees)
			6:5 - 6:4	Unsigned	HCO25 1 & 2 Temperature		
			6:3 - 6:2	Unsigned	TVS Temperature		
			6:1 - 6:0	Unsigned	Main Rail Temperature		

PD16 A: 0x6D6 PD16 B: 0x6DE PD16 C: 0x6E6 PD16 D: 0x6EE	2	TX	0:7 - 0:0	Unsigned	Mux ID = 5		
			2:7 - 2:4	Unsigned	Digit 1 of serial number		0x19
			2:3 - 2:0	Unsigned	Digit 2 of serial number		
			3:7 - 3:4	Unsigned	Digit 3 of serial number		0x80
			3:3 - 3:0	Unsigned	Digit 4 of serial number		
			4:7 - 4:4	Unsigned	Digit 5 of serial number		0x00
			4:3 - 4:0	Unsigned	Digit 6 of serial number		
			5:7 - 5:4	Unsigned	Digit 7 of serial number		0x1c
			5:3 - 5:0	Unsigned	Digit 8 of serial number		
			6:7 - 6:4	Unsigned	Digit 9 of serial number		0x3c
			6:3 - 6:0	Unsigned	Digit 10 of serial number		

			7:7 - 7:4	Unsigned	Digit 11 of serial number		0xd1
			7:3 - 7:0	Unsigned	Digit 12 of serial number		

CAN ID Swaps

Request to swap ID (from ECU):

CAN ID	Byte pos	Value
PD16 A: 0x6F7 PD16 B: 0x6F9 PD16 C: 0x6Fb PD16 D: 0x6Fb	0	0x04
	1	0x2e
	2	0x43
	3	0x2b
	4	Value of the new box ID from 0 - 3
	5	0x55
	6	0x55
	7	0x55

PD16 response / acknowledgement:

CAN ID	Byte pos	Value
PD16 A: 0x6F8 PD16 B: 0x6FA PD16 C: 0x6FC PD16 D: 0x6FE	0	0x01
	1	0x6e
	2	0xaa
	3	0xaa
	4	0xaa
	5	0xaa
	6	0xaa
	7	0xaa

Request soft reset:

CAN ID	Byte pos	Value

PD16 A: 0x6F7 PD16 B: 0x6F9 PD16 C: 0x6FB PD16 D: 0x6FD	0	0x02
	1	0x11
	2	0x03 (soft reset) (could be 01 for hard reset or 02 for key on/off reset)
	3	0x55
	4	0x55
	5	0x55
	6	0x55
	7	0x55

PD16 reset response / acknowledgement:

CAN ID	**Byte pos**	**Value**

PD16 A: 0x6F8 PD16 B: 0x6FA PD16 C: 0x6FC PD16 D: 0x6FE	0	0x03
	1	0x51
	2	0x03
	3	0x00
	4	0xaa
	5	0xaa
	6	0xaa
	7	0xaa

CAN Rates

CAN ID	Payload	# Messages	Desired Output Rate (ms)	Cycle Time (ms)	CAN Packets/s
Base CAN ID	· Output duty cycle · Output frequency	16	50	3	333
Base CAN ID + 1	· Output settings · Input settings	24	500	20	50

Base CAN ID + 2	· System config	1	500	500	2
Base CAN ID + 3	· Input state · Input voltage · Input duty cycle · Input frequency	8	50	6.25	160
Base CAN ID + 4	· Output voltage · Output retry count · Output pin state	16	200	12.5	80
Base CAN ID + 5	· Status info	1	500	500	2
Base CAN ID + 6	· Serial number · Battery voltage · Diagnostics	1	500	500	2
					629

For more information about the Haltech CAN Protocol specification, click on this link.