

Black Box Electronic Wastegate Controller



Black Box by Turbosmart is a dedicated Electronic Wastegate Controller which can be used in cooperation with a range of Factory, Aftermarket and Motorsport ECU's. The Black Box protects from the current demands and translation of basic as well as more advanced boost control strategies into a gate position and can be used on single, twin electronic wastegate systems for the ultimate boost control as well as Antilag Valves.

- Dual Channel, High Current Capable H-Bridge Driver
- Capable of multiple strategies
- PWM as used in standard boost control solenoids.
- CAN BUS Position Target
- Auto-Calibration available via the Software
- Over-Temperature Shutdown
- Flow vs. lift calibration for simple setup and accurate boost control.

Power Supply

Operating Voltage	7.0 to 22.0 Volts DC
Operating Current	32mA at 14.0V (Excluding H-Bridge Load)
Polarity Protection	Yes, with Zero Current Draw
Over Current Protection	Yes, as well as Battery Transient
Pin Current Capacity	6 Amps per Pin.

Internal

Processor	64Mhz 16-bit Automotive Processor
Analog Channel Sampling Rate	1000Hz

Inputs

Analog Inputs (AV1-4)	Range	0.0V to 5.0, Resolution 1.22mV 12 Bit
	Input Impedance	100k to Ground
	1 st Order LPF	1600Hz
	Analog Sampling Rate	1000Hz
Frequency Inputs Freq In 2 and 4	Range	0.5Hz up to 6500.0Hz, Resolution. 0.1Hz
	Sensor Compatibility	Magnetic and Hall Effect
	Rising Edge Threshold	1.65V
	Falling Edge Threshold	1.0V
Suitable Gauge Wire	22 AWG	

Included in the Box

- Black Box
- 34 Pin Connector
- 34 Pins
- Sticker
- Instruction card

Tools/Parts Req.

Tools	Super seal Connector Crimping Tool
USB	Micro USB to USB 2.0 A
Allen Key	2.5mm Size

Communications

Baud Rate	250k/500k or 1MBaud Auto Detect
Transmit Rate	50Hz/100Hz/200Hz/500/1000 Hz
USB	Yes

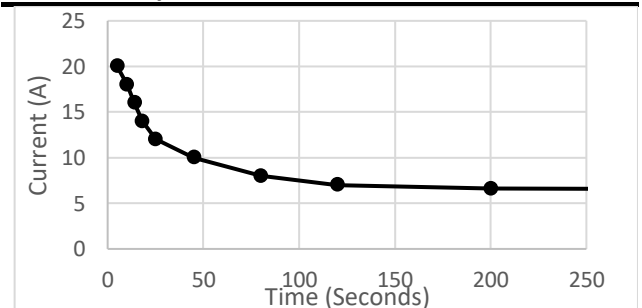
Thermal Data

Operating Temperature Range	-30 to 100°C (-22 to 212°F)
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Outputs

Sensor Supply	Output Voltage	5V
	Output Current	250mA
		Short Circuit to ground protected.
H Bridge	Output Current	6.5A per Channel
	Peak Switched Current	25A Per Channel
	Overtemperature Shutdown	Yes
Suitable Gauge Wire	2x14 AWG	15 Amps
Valve Output Speed	3000%/second	

Current Output vs Time

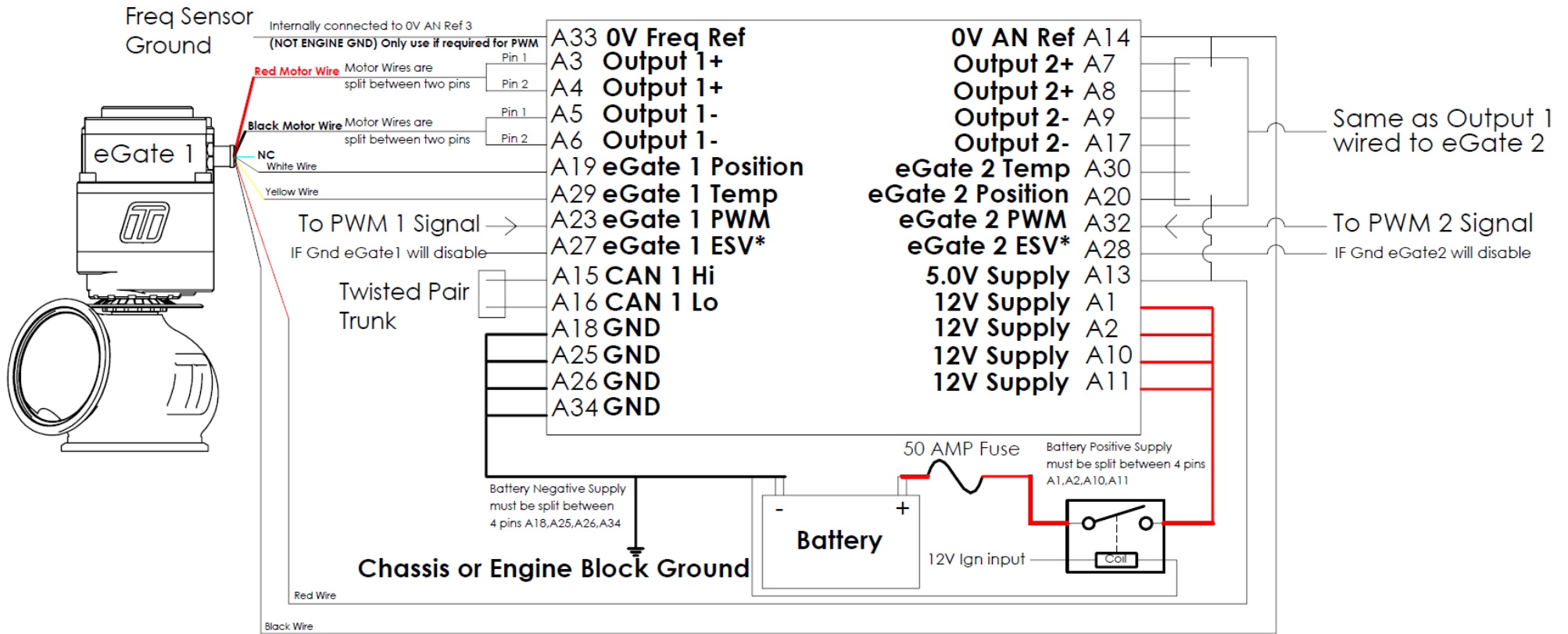


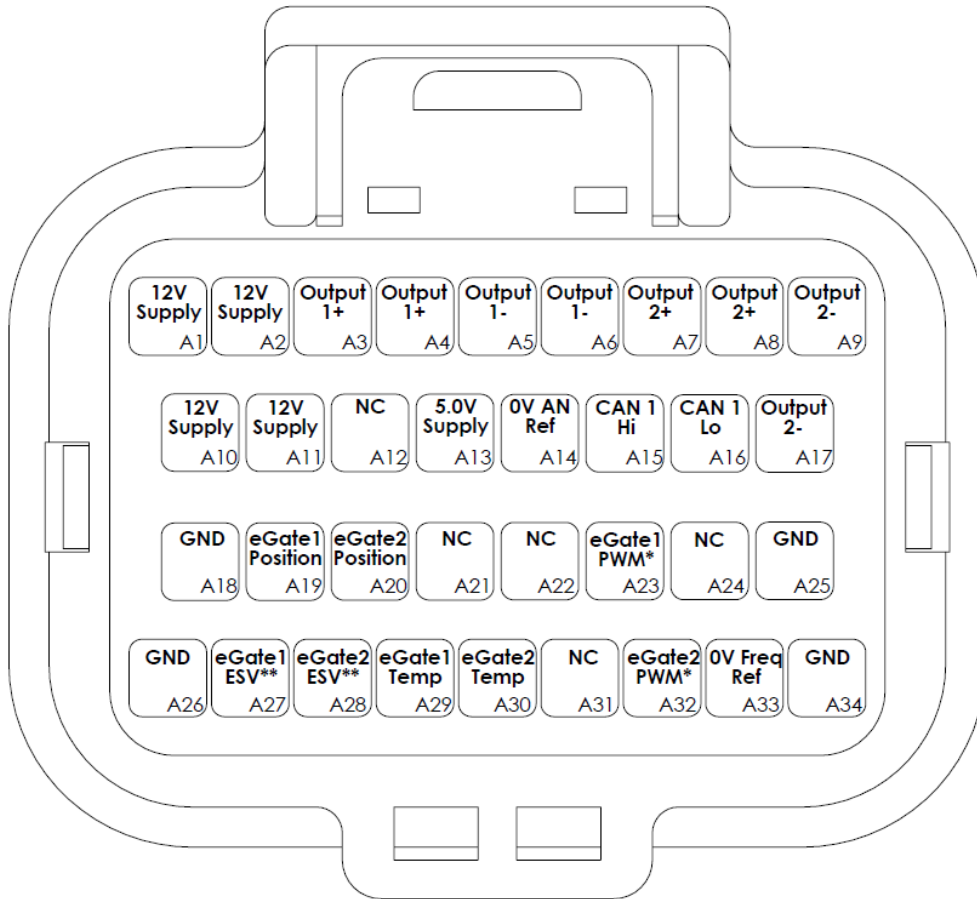
Material Data

Beryllium (Be)	0%
Actuator housing	6061 T6 anodised Al.

Order Data

TS-0305-1001	Black Box Electronic Wastegate Controller
TS-0305-3001	Black Box Spare Pin and Connector

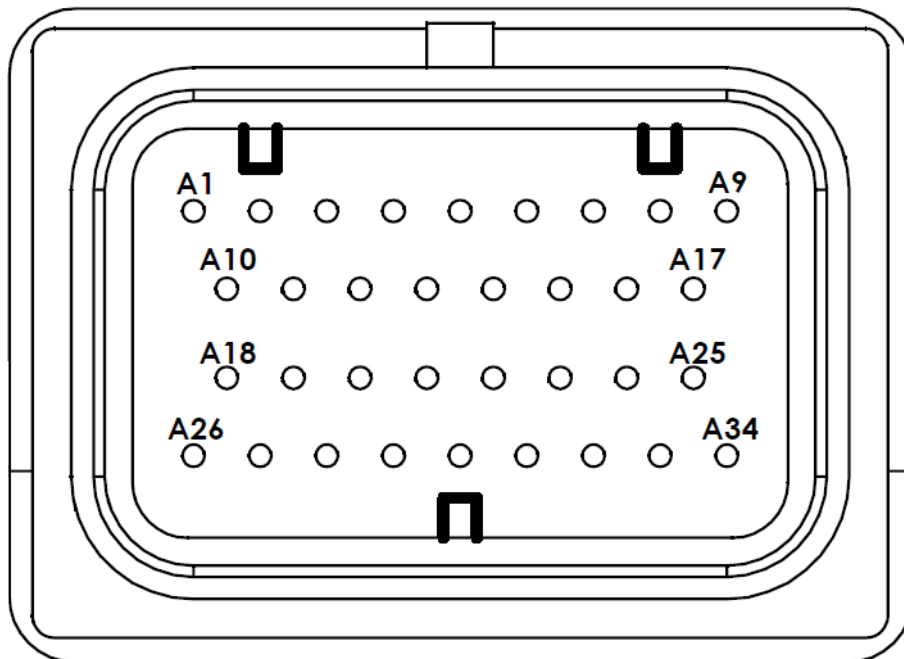




*PWM input optional

**Enable Switch Voltage - If Grounded coressponding eGate will disable

Backside of Connector



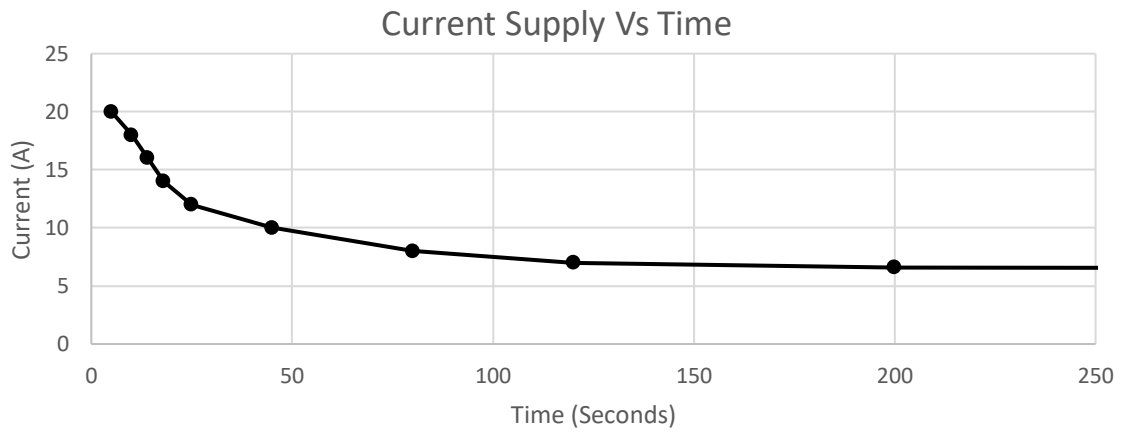
Looking into Black Box Pins

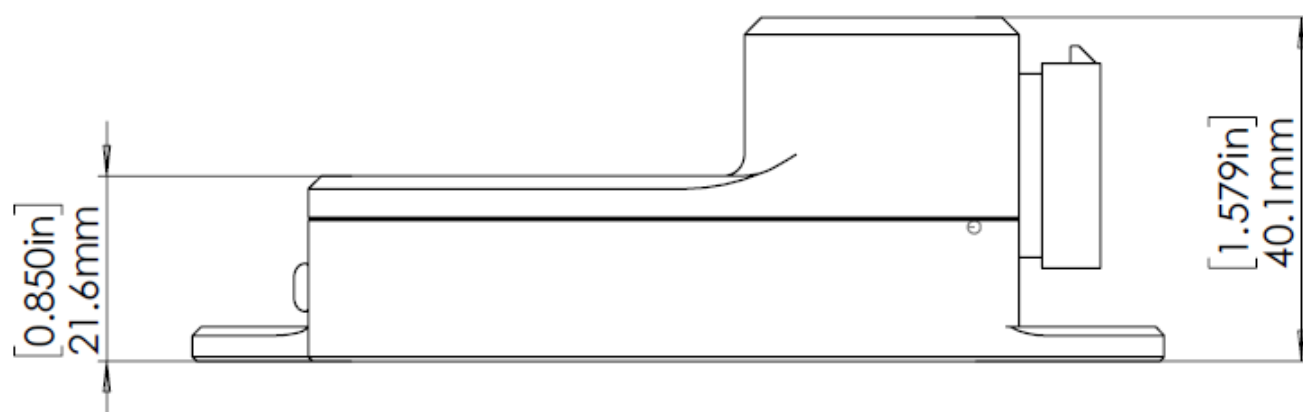
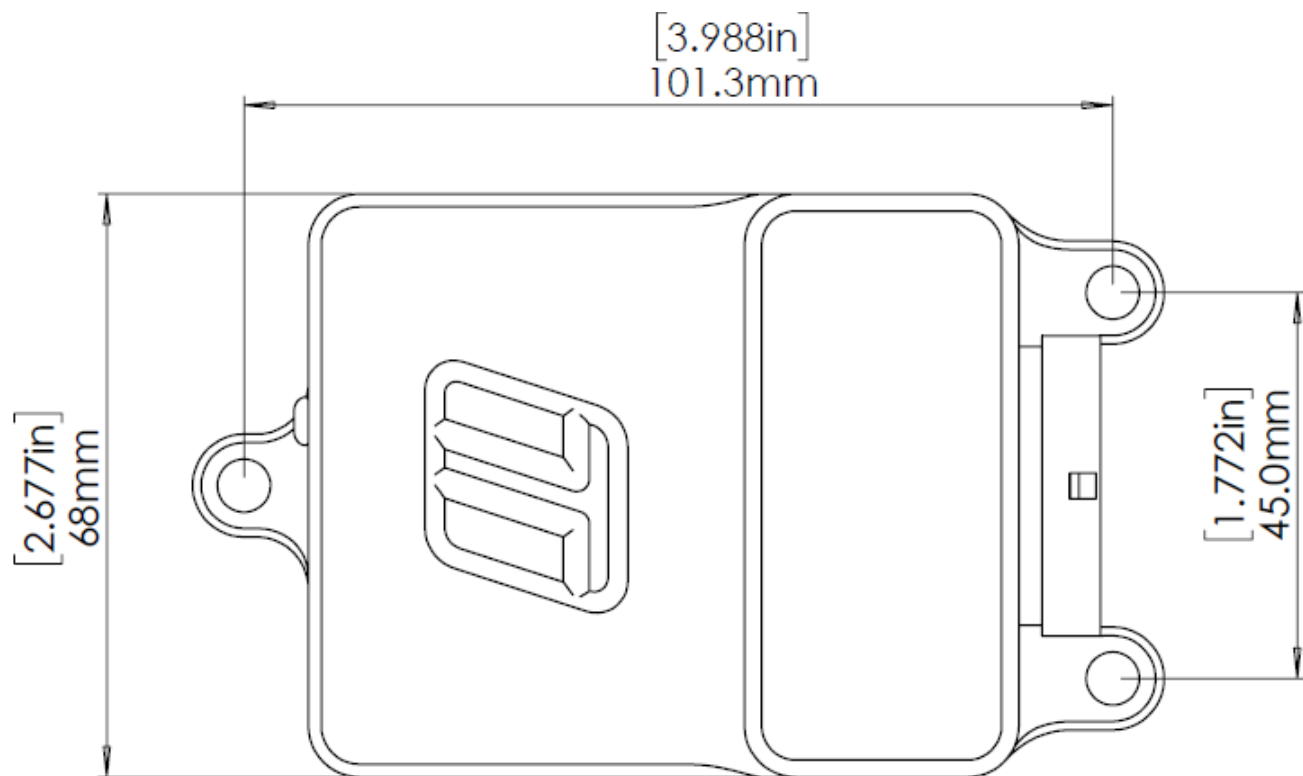
Pin	Channel Name	Description	Wiring from eGates
1	12V Supply	Positive Battery Power Supply 1/4*	
2	12V Supply	Positive Battery Power Supply 2/4*	
3	Output 1+ve	eGate 1 Positive Power Supply 1/2*	eGate 1 Red Larger Gauge Motor Wire
4	Output 1+ve	eGate 1 Positive Power Supply 2/2*	eGate 1 Red Larger Gauge Motor Wire
5	Output 1-ve	eGate 1 Negative Power Supply 1/2*	eGate 1 Black Larger Gauge Motor Wire
6	Output 1-ve	eGate 1 Negative Power Supply 2/2*	eGate 1 Black Larger Gauge Motor Wire
7	Output 2 +ve	eGate 2 Positive Power Supply 1/2*	eGate 2 Red Larger Gauge Motor Wire
8	Output 2+ve	eGate 2 Positive Power Supply 2/2*	eGate 2 Red Larger Gauge Motor Wire
9	Output 2-ve	eGate 2 Negative Power Supply 1/2*	eGate 2 Black Larger Gauge Motor Wire
10	12V Supply	Positive Battery Power Supply 3/4*	
11	12V Supply	Positive Battery Power Supply 4/4*	
12	NC	No Connection	
13	5.0V Supply	5V Sensor Supply	eGate/s Red Wire
14	0V AN Ref**	0V Sensor (Do NOT connect with Chassis GND)	eGate/s Black Wire
15	CAN 1 HI	CAN 1 High	
16	CAN 1 LO	CAN 1 Low	
17	Output 2-ve	eGate 2 Negative Power Supply 2/2*	eGate 2 Black Larger Gauge Motor Wire
18	Power Ground	Negative Battery Power Supply	
19	AV1	Analog Voltage 1	eGate 1 White Position Sensor
20	AV2	Analog Voltage 2	eGate 2 White Position Sensor
21	NC	No Connection	
22	NC	No Connection	
23	FREQ IN 1	ECU eGate 1 PWM Input	
24	NC	No Connection	
25	Power Ground	Negative Battery Power Supply	
26	Power Ground	Negative Battery Power Supply	
27	AV5	eGate 1 Enable Switch Voltage	
28	AV6	eGate 2 Enable Switch Voltage	
29	AV7	Analog Voltage 7	eGate 1 Yellow Temperature Sensor
30	AV8	Analog Voltage 8	eGate 2 Yellow Temperature Sensor
31	NC	No Connection	
32	FREQ IN 4	ECU eGate 2 PWM Input	
33	0V FREQ REF**	0V Frequency (Do NOT connect with Chassis GND)	
34	Power Ground	Negative Battery Power Supply	

NOTE:

*Each eGate requires 4 power wires. Two Positive and two negative to allow the correct amount of current to flow to the eGate for correct operation. Please see Pinout Current Sharing

**The Sensor 0V Reference pin(s) are specialised ground outputs for all analog sensors and frequency inputs. Power Ground should not be connected with 0V Reference Pins. They should remain separate. Grounding these sensor grounds to the battery ground will cause issues with calibration and sensor readings due to noise.





CAN ID Transmitted Information

The black Box Receives and Transmit Certain Data, these addresses are noted below.

Turbosmart Default Transmit Base Address CAN ID 256 (0x100)

	Data 0	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	Data 7																																																																																												
0x100 TX 100Hz	E-Gate1 Feedback Position 0 - 100.0% (Multi 0.1 , Offset -100)		E-Gate1 Area Target (Either received from CAN OR PWM Input) (Multi 0.1 , Offset -100)		E-Gate1 Motor DC (Multi 0.1 , Offset -100)		E-Gate1 Position Target (Translated from Area Target received over CAN or PWM input) (Multi 0.1 , Offset -100)																																																																																													
0x101 TX 100Hz	E-Gate1 P- Gain Result (Multi 0.1 , Offset -100)		E-Gate1 I- Gain Result (Multi 0.1 , Offset -100)		E-Gate1 D- Gain Result (Multi 0.1 , Offset -100)		<table border="1"> <thead> <tr> <th colspan="2">Byte 6 = E-Gate1 PID Status</th> <th colspan="2">Byte 7 = E-Gate1 System Status</th> </tr> </thead> <tbody> <tr><td>0</td><td>OFF</td><td>0</td><td>OFF</td></tr> <tr><td>1</td><td>ON</td><td>1</td><td>Reserved</td></tr> <tr><td>2</td><td>Min DC Clamp</td><td>2</td><td>OFF-IC Reset</td></tr> <tr><td>3</td><td>Max DC Clamp</td><td>3</td><td>OFF-Posn Sensor Err.</td></tr> <tr><td>4</td><td>- Int Clamp</td><td>4</td><td>OFF-Enable Sw</td></tr> <tr><td>5</td><td>+ Int Clamp</td><td>5</td><td>OFF-Over-Temp</td></tr> <tr><td>6</td><td>Deadband</td><td>6</td><td>OFF-Auto Stop</td></tr> <tr><td></td><td></td><td>7</td><td>OFF-Parked</td></tr> <tr><td></td><td></td><td>8</td><td>OFF-Over Current</td></tr> <tr><td></td><td></td><td>9</td><td></td></tr> <tr><td></td><td></td><td>10</td><td>Calibrating 0% Posn ..</td></tr> <tr><td></td><td></td><td>11</td><td>Calibrating 100% Posn ..</td></tr> <tr><td></td><td></td><td>12</td><td>Calibrate Complete !!</td></tr> <tr><td></td><td></td><td>13</td><td>eGate Current Calibrating</td></tr> <tr><td></td><td></td><td>14</td><td>eGate Parked</td></tr> <tr><td></td><td></td><td>15</td><td>eGate Prespool</td></tr> <tr><td></td><td></td><td>16</td><td>ON-Temp Sensor Fault</td></tr> <tr><td></td><td></td><td>17</td><td>ON-Target CAN</td></tr> <tr><td></td><td></td><td>18</td><td>ON-Target PWM</td></tr> <tr><td></td><td></td><td>19</td><td>ON-Target USB Override</td></tr> <tr><td></td><td></td><td>20</td><td>ON-Pass-Through %DC</td></tr> <tr><td></td><td></td><td>21</td><td>ON-PreLoad Active</td></tr> </tbody> </table>		Byte 6 = E-Gate1 PID Status		Byte 7 = E-Gate1 System Status		0	OFF	0	OFF	1	ON	1	Reserved	2	Min DC Clamp	2	OFF-IC Reset	3	Max DC Clamp	3	OFF-Posn Sensor Err.	4	- Int Clamp	4	OFF-Enable Sw	5	+ Int Clamp	5	OFF-Over-Temp	6	Deadband	6	OFF-Auto Stop			7	OFF-Parked			8	OFF-Over Current			9				10	Calibrating 0% Posn ..			11	Calibrating 100% Posn ..			12	Calibrate Complete !!			13	eGate Current Calibrating			14	eGate Parked			15	eGate Prespool			16	ON-Temp Sensor Fault			17	ON-Target CAN			18	ON-Target PWM			19	ON-Target USB Override			20	ON-Pass-Through %DC			21	ON-PreLoad Active
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0x103 TX 100Hz	E-Gate2 Feedback Position 0 - 100.0% (Multi 0.1 , Offset -100)		E-Gate2 Area Target (Either received from CAN OR PWM Input) (Multi 0.1 , Offset -100)		E-Gate2 Motor DC (Multi 0.1 , Offset -100)		E-Gate2 Position Target (Translated from Area Target received over CAN or PWM input) (Multi 0.1 , Offset -100)																																																																																													

0x104 TX 100Hz	E-Gate2 P- Gain Result (Multi 0.1 , Offset -100)	E-Gate2 I- Gain Result (Multi 0.1 , Offset -100)	E-Gate2 D- Gain Result (Multi 0.1 , Offset -100)	Byte 6 = E-Gate2 PID Status <table border="1" data-bbox="1301 161 1532 453"> <tr><td>0</td><td>OFF</td></tr> <tr><td>1</td><td>ON</td></tr> <tr><td>2</td><td>Min DC Clamp</td></tr> <tr><td>3</td><td>Max DC Clamp</td></tr> <tr><td>4</td><td>- Int Clamp</td></tr> <tr><td>5</td><td>+ Int Clamp</td></tr> <tr><td>6</td><td>Deadband</td></tr> </table>	0	OFF	1	ON	2	Min DC Clamp	3	Max DC Clamp	4	- Int Clamp	5	+ Int Clamp	6	Deadband	Byte 7 = E-Gate2System Status <table border="1" data-bbox="1630 161 2022 911"> <tr><td>0</td><td>OFF</td></tr> <tr><td>1</td><td>Reserved</td></tr> <tr><td>2</td><td>OFF-IC Reset</td></tr> <tr><td>3</td><td>OFF-Posn Sensor Err.</td></tr> <tr><td>4</td><td>OFF-Enable Sw</td></tr> <tr><td>5</td><td>OFF-Over-Temp</td></tr> <tr><td>6</td><td>OFF-Auto Stop</td></tr> <tr><td>7</td><td>OFF-Parked</td></tr> <tr><td>8</td><td>OFF-Over Current</td></tr> <tr><td>9</td><td></td></tr> <tr><td>10</td><td>Calibrating 0% Posn ..</td></tr> <tr><td>11</td><td>Calibrating 100% Posn ..</td></tr> <tr><td>12</td><td>Calibrate Complete !!</td></tr> <tr><td>13</td><td>eGate Current Calibrating</td></tr> <tr><td>14</td><td>eGate Parked</td></tr> <tr><td>15</td><td>eGate Prespool</td></tr> <tr><td>16</td><td>ON-Temp Sensor Fault</td></tr> <tr><td>17</td><td>ON-Target CAN</td></tr> <tr><td>18</td><td>ON-Target PWM</td></tr> <tr><td>19</td><td>ON-Target USB Override</td></tr> <tr><td>20</td><td>ON-Pass-Through %DC</td></tr> <tr><td>21</td><td>ON-PreLoad Active</td></tr> </table>	0	OFF	1	Reserved	2	OFF-IC Reset	3	OFF-Posn Sensor Err.	4	OFF-Enable Sw	5	OFF-Over-Temp	6	OFF-Auto Stop	7	OFF-Parked	8	OFF-Over Current	9		10	Calibrating 0% Posn ..	11	Calibrating 100% Posn ..	12	Calibrate Complete !!	13	eGate Current Calibrating	14	eGate Parked	15	eGate Prespool	16	ON-Temp Sensor Fault	17	ON-Target CAN	18	ON-Target PWM	19	ON-Target USB Override	20	ON-Pass-Through %DC	21	ON-PreLoad Active
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0x106 TX 20Hz	Byte 0/1 = E-Gate Main Supply - (Multi 0.001, Offset 0)	Byte 2/3 = E-Gate 5V supply (Multi 0.001, Offset 0)	Byte 4/5 = E-Gate Internal Temperature (Multi 0.1, Offset -50)	Byte 6 = E-Gate 1 Translation Source Bits 0 -3, <table border="1" data-bbox="1301 1062 1594 1433"> <tr><td>0</td><td>Unknown</td></tr> <tr><td>1</td><td>Poppet Default</td></tr> <tr><td>2</td><td>Poppet 1:1 Ratio</td></tr> <tr><td>3</td><td>Poppet WG40</td></tr> <tr><td>4</td><td>Poppet WG45</td></tr> <tr><td>5</td><td>Poppet WG50</td></tr> <tr><td>6</td><td>Poppet WG60</td></tr> <tr><td>7</td><td>Straight 1:1 Ratio</td></tr> <tr><td>8</td><td>Straight</td></tr> <tr><td>9</td><td>Bosch</td></tr> <tr><td>10</td><td>%DC Pass Through Mode</td></tr> </table> Source Bits 4 -7,	0	Unknown	1	Poppet Default	2	Poppet 1:1 Ratio	3	Poppet WG40	4	Poppet WG45	5	Poppet WG50	6	Poppet WG60	7	Straight 1:1 Ratio	8	Straight	9	Bosch	10	%DC Pass Through Mode	Byte 7 = BIT 0-1: eGate 1 Device Target Source; <table border="1" data-bbox="1675 1062 1968 1155"> <tr><td>0</td><td>Unknown</td></tr> <tr><td>1</td><td>CAN</td></tr> <tr><td>2</td><td>PWM</td></tr> </table> BIT 2-3: eGate 2 Device Target Source; <table border="1" data-bbox="1675 1248 1968 1340"> <tr><td>0</td><td>Unknown</td></tr> <tr><td>1</td><td>CAN</td></tr> <tr><td>2</td><td>PWM</td></tr> </table> BIT 4-5: eGate Auto Stop. <table border="1" data-bbox="1675 1401 1968 1460"> <tr><td>0</td><td>Unknown</td></tr> <tr><td>1</td><td>OFF</td></tr> </table>	0	Unknown	1	CAN	2	PWM	0	Unknown	1	CAN	2	PWM	0	Unknown	1	OFF																				
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Turbosmart Default Receive Base Address CAN ID 272 (0x110)

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7																																																																		
0x110 RX 100Hz	Area Target Egate 1: 0 -100.0% (0 – 1000)		Area Target Egate 2: 0 -100.0% (0 – 1000)		Egate 1 Pass Through %DC (when Egate 1 Translation Type = %DC Pass Through. 0 - 100% (0 – 100 CAN)	Egate 2 Pass Through %DC (when Egate 2 Translation Type = %DC Pass Through. 0 -100% (0 – 100 CAN)	EGate Pre Load <table border="1"> <tr> <td rowspan="3">BIT0</td> <td colspan="2">Egate 1 Activate Pre Load*</td> </tr> <tr> <td>0</td> <td>No Change</td> </tr> <tr> <td>1</td> <td>OFF</td> </tr> <tr> <td>2</td> <td>ON</td> <td></td> </tr> <tr> <td rowspan="3">BIT1</td> <td colspan="2">Egate2 Activate Pre Load*</td> </tr> <tr> <td>0</td> <td>No Change</td> </tr> <tr> <td>1</td> <td>OFF</td> </tr> <tr> <td>2</td> <td>ON</td> <td></td> </tr> </table> <p>*(When function has been enabled)</p>	BIT0	Egate 1 Activate Pre Load*		0	No Change	1	OFF	2	ON		BIT1	Egate2 Activate Pre Load*		0	No Change	1	OFF	2	ON		0=(Unused)																																														
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0x111 ONLY send when a setting is changed. DON'T send continuously	Egate 1 Translation Type(Lower nibble Bits 0-3) <table border="1"> <tr><td>0</td><td>Unknown</td></tr> <tr><td>1</td><td>Poppet Default</td></tr> <tr><td>2</td><td>Poppet 1:1 Ratio</td></tr> <tr><td>3</td><td>Poppet WG40</td></tr> <tr><td>4</td><td>Poppet WG45</td></tr> <tr><td>5</td><td>Poppet WG50</td></tr> <tr><td>6</td><td>Poppet WG60</td></tr> <tr><td>7</td><td>Straight 1:1 Ratio</td></tr> <tr><td>8</td><td>Straight</td></tr> <tr><td>9</td><td>Bosch</td></tr> </table>	0	Unknown	1	Poppet Default	2	Poppet 1:1 Ratio	3	Poppet WG40	4	Poppet WG45	5	Poppet WG50	6	Poppet WG60	7	Straight 1:1 Ratio	8	Straight	9	Bosch	BIT0/1= Egate Target Source 1. <table border="1"> <tr><td>0</td><td>No Change</td></tr> <tr><td>1</td><td>CAN</td></tr> <tr><td>2</td><td>PWM</td></tr> </table> BIT2/3 = Egate Target Source 2 <table border="1"> <tr><td>0</td><td>No Change</td></tr> <tr><td>1</td><td>CAN</td></tr> <tr><td>2</td><td>PWM</td></tr> </table> BIT4/5 = Egate Auto Stop Control <table border="1"> <tr><td>0</td><td>No Change</td></tr> <tr><td>1</td><td>CAN</td></tr> <tr><td>2</td><td>PWM</td></tr> </table> BIT4/5 = Unused	0	No Change	1	CAN	2	PWM	0	No Change	1	CAN	2	PWM	0	No Change	1	CAN	2	PWM	OverTemperature Shutdown (1350 = 135.0 DegC Shutdown) 0 = no change	BIT0/1 = Egate 1 Pre-Load Enable <table border="1"> <tr><td>0</td><td>No Change</td></tr> <tr><td>1</td><td>OFF</td></tr> <tr><td>2</td><td>ON</td></tr> </table> BIT2/3 = Egate 2 Pre-Load Enable <table border="1"> <tr><td>0</td><td>No Change</td></tr> <tr><td>1</td><td>OFF</td></tr> <tr><td>2</td><td>ON</td></tr> </table> BIT4/5 = Egate Auto Stop Control	0	No Change	1	OFF	2	ON	0	No Change	1	OFF	2	ON	BIT0/1: Egate 1 Position Calibration <table border="1"> <tr><td>0</td><td>No Change</td></tr> <tr><td>1</td><td>Off</td></tr> <tr><td>2</td><td>ON – Cal Closed Position</td></tr> <tr><td>3</td><td>ON Cal Open Position</td></tr> </table> BIT2/3: Egate 2 Position Calibration <table border="1"> <tr><td>0</td><td>No Change</td></tr> <tr><td>1</td><td>Off</td></tr> <tr><td>2</td><td>ON – Cal Closed Position</td></tr> <tr><td>3</td><td>ON Cal Open Position</td></tr> </table>	0	No Change	1	Off	2	ON – Cal Closed Position	3	ON Cal Open Position	0	No Change	1	Off	2	ON – Cal Closed Position	3	ON Cal Open Position	Pre-Load %DC (0dp) . CAN value 65 = - 65%	Pre-Load Max Time (0dp) . CAN value 36 = 36 secs	Park Enable Target Threshold. CAN Value 12 = Target 1.2%
0	Unknown																																																																									
1	Poppet Default																																																																									
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10	%DC Pass Through*
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BIT6/7 = Unused

Egate 2 Translation Type (upper nibble bits 4-7)

0	Unknown
1	Poppet Default
2	Poppet 1:1 Ratio
3	Poppet WG40
4	Poppet WG45
5	Poppet WG50
6	Poppet WG60
7	Straight 1:1 Ratio
8	Straight
9	Bosch
10	%DC Pass Through*

*Raw PWM so NO Closed Loop. The value from the Bytes 4/5 or 6/7 become the %DC and get directly applied to the motor

0	No Change
1	OFF
2	ON

BIT6/7: Unused