

TS-0305-1001 - BlackBox Electronic Wastegate Controller - Instructions

Product Name: BlackBox Electronic Wastegate Controller

Product Description: BlackBox Electronic Wastegate Controller

Product Number: [TS-0305-1001](#)



Important Information About Your Black Box Wastegate Controller

- The gate will be closed if using Low Side PWM as the control strategy, and the ECU requires 100%(99%).
- The BlackBox Instructions are not a substitute for basic tuning knowledge.
- Turbosmart accepts no responsibility for the incorrect installation of this product which is potentially hazardous and can cause serious engine damage or personal injury.
- Turbosmart recommends that an appropriately qualified technician fits your Black Box.
- Consult your local tuning specialist before setting your boost pressure; setting a boost beyond the capability of your engine can result in severe engine damage or failure!
- Turbosmart recommends checking the engine's Air/Fuel ratio once the desired boost pressure is set. Any increase in boost pressure can cause the engine to
- run lean, resulting in severe engine damage or failure.
- Turbosmart recommends that boost pressure is set using a Dynamometer and not on public roads.
- The Black Box may not be able to completely compensate for a drop in boost pressure at high RPM due to the turbocharger operating beyond its maximum efficiency range, i.e., incorrect turbocharger sizing or excessive exhaust back-pressure.
- The Black Box cannot compensate for increases in boost pressure at high RPM due to inadequate waste gate flow capacity; the turbo system must maintain a steady base boost curve.
- For best results, your turbocharger should be correctly sized for your application.

Kit Contents



Please check that the following items have been provided in your Black Box packaging.

Part	Description	Use
1	Turbosmart Black Box	Main unit
2	Black Box Connector	Black Box Connector 34 Pin Allocation
3	Black Box Pins	34 x Black Box Pins
4	Sticker	Turbosmart Sticker

Tools Required

Part	Tool
1	Super seal Connector Crimping Tool
2	Micro USB to USB 2.0 A
3	2.5mm Allen Key

About Your Black Box

BlackBox by Turbosmart is a dedicated Electronic Wastegate Controller. The BlackBox protects from the current demands and translation of basic and more advanced boost control strategies into a gate position and can be used on single or twin electronic wastegate systems for the ultimate boost control. They cooperate with a range of Factory, Aftermarket and Motorsport ECU.

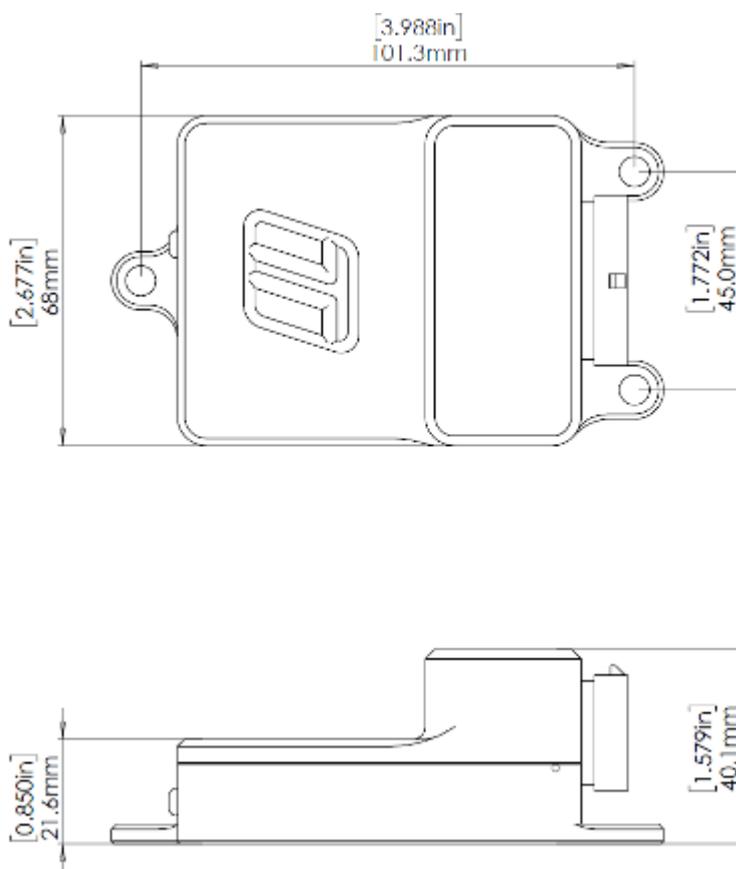
The BlackBox is a Dual Channel, High current Capable H-Bridge Driver for use with the Turbosmart range of Electronic External Wastegates, including the StraightGate50 and our Electronic poppet style gates, including

CompGate40, HyperGate45, ProGate50 and PowerGate60 electronic Wastegates.

Blackbox Capability

The Black Box can use multiple strategies and accept PWM (Pulse Width Modulation) inputs as traditional boost control solenoids, 0-5v position target CAN position target. It CAN bus override for more advanced ECUs where control strategy can be developed natively. The Blackbox auto-calibration of Electronic External Wastegates via a full sweep.

The BlackBox is pre-configured with the flow vs. lift calibration data of all Electronic Actuated Wastegates from Turbosmart for simple setup and accurate boost control. Settings can be adjusted via a simple USB connection and PC-based application. Unlimited control strategies can be implemented with the CAN-based override system, limiting your strategy only to your ECU's capability.



Black Box Connector Pinout

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	OV 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

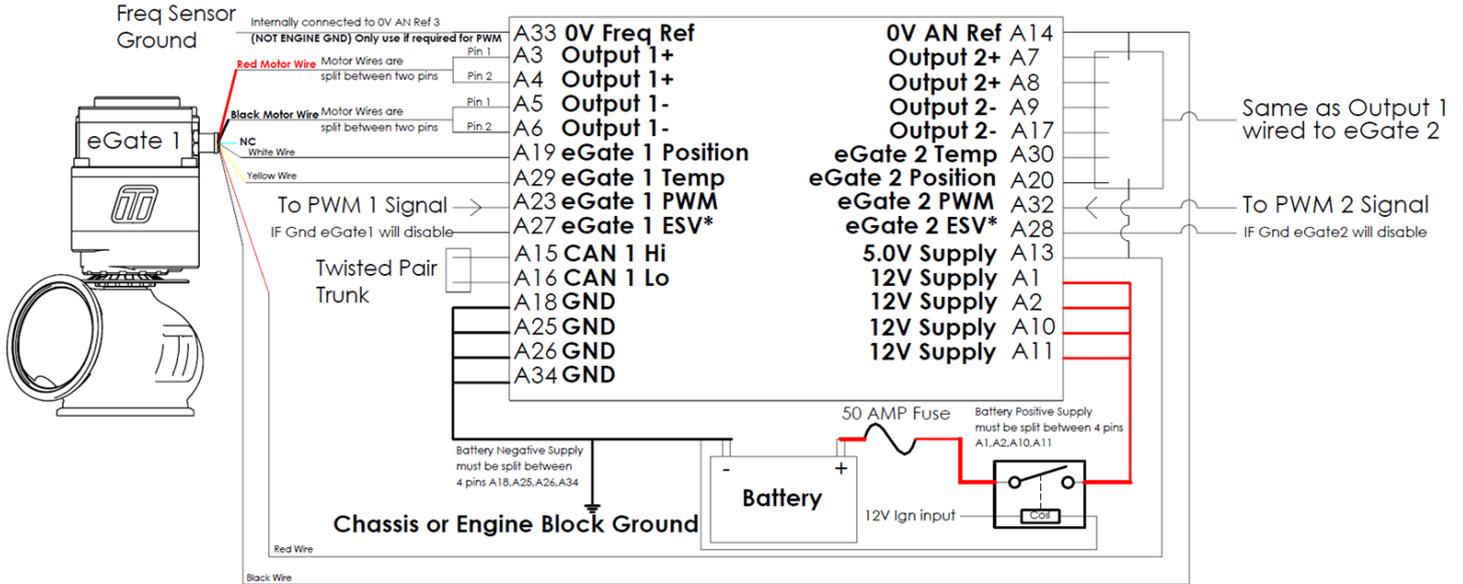
18	Power Ground	Negative Battery Power Supply	
19	AV1	Analog Voltage 1	eGate 1 White Position Sensor
20	AV2	Analog Voltage 2	eGate 2 White Position Sensor
21	NC	No Connection	
22	NC	No Connection	
23	FREQ IN 1	ECU eGate 1 PWM Input ***	
24	NC	No Connection	
25	Power Ground	Negative Battery Power Supply	
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:

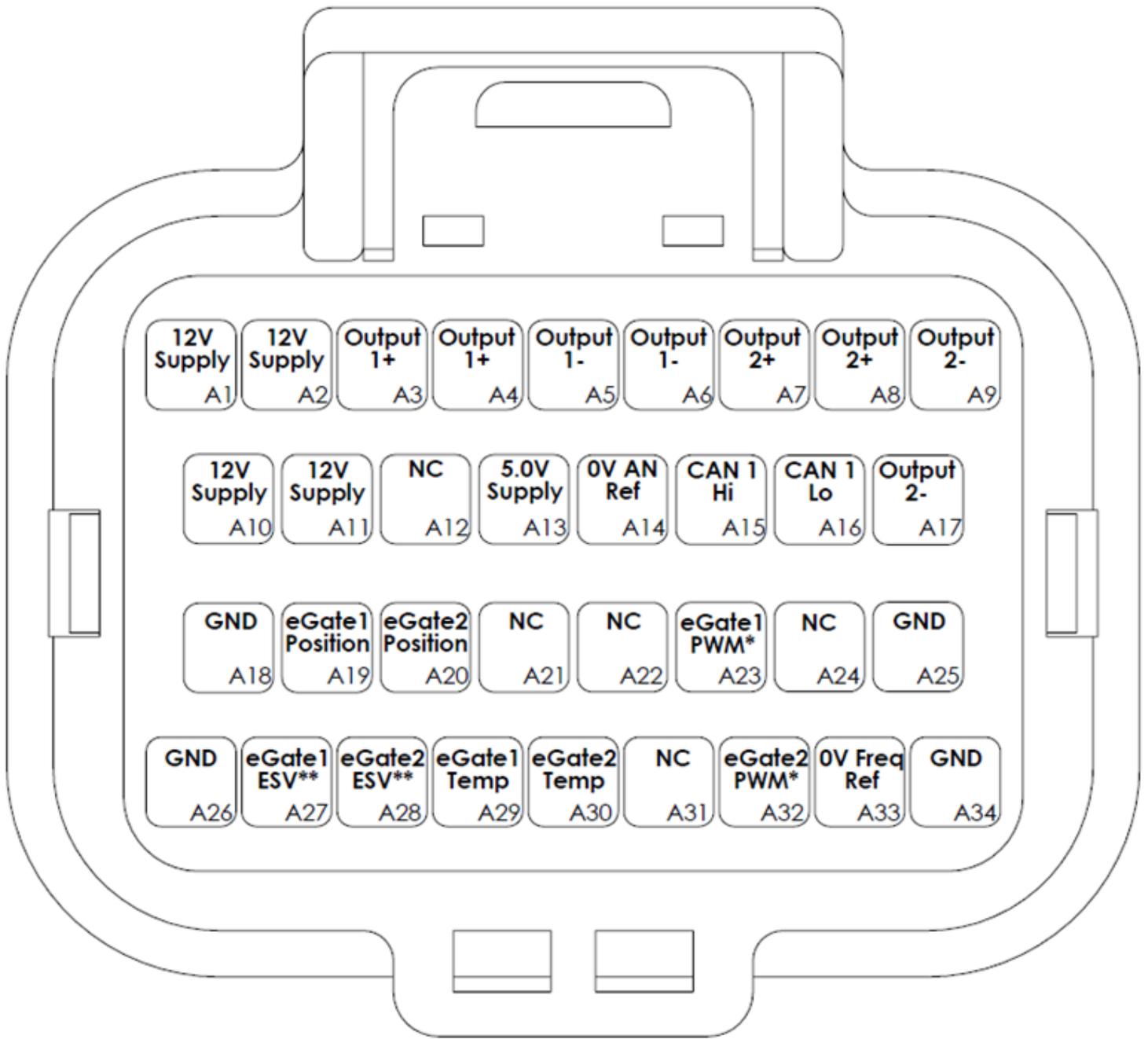
*Each eGate requires 4 power wires. Two Positive and two negative to allow the correct amount of current to flow to the eGate for correct operation. Please see Pinout Current Sharing

**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.

***The PWM input is commonly found on a standard electronic boost controller as a low side switch (or negative trigger). High side maybe used. But must conform to the voltage threshold listed in control options - Pulse Width Modulation (PWM) Input.

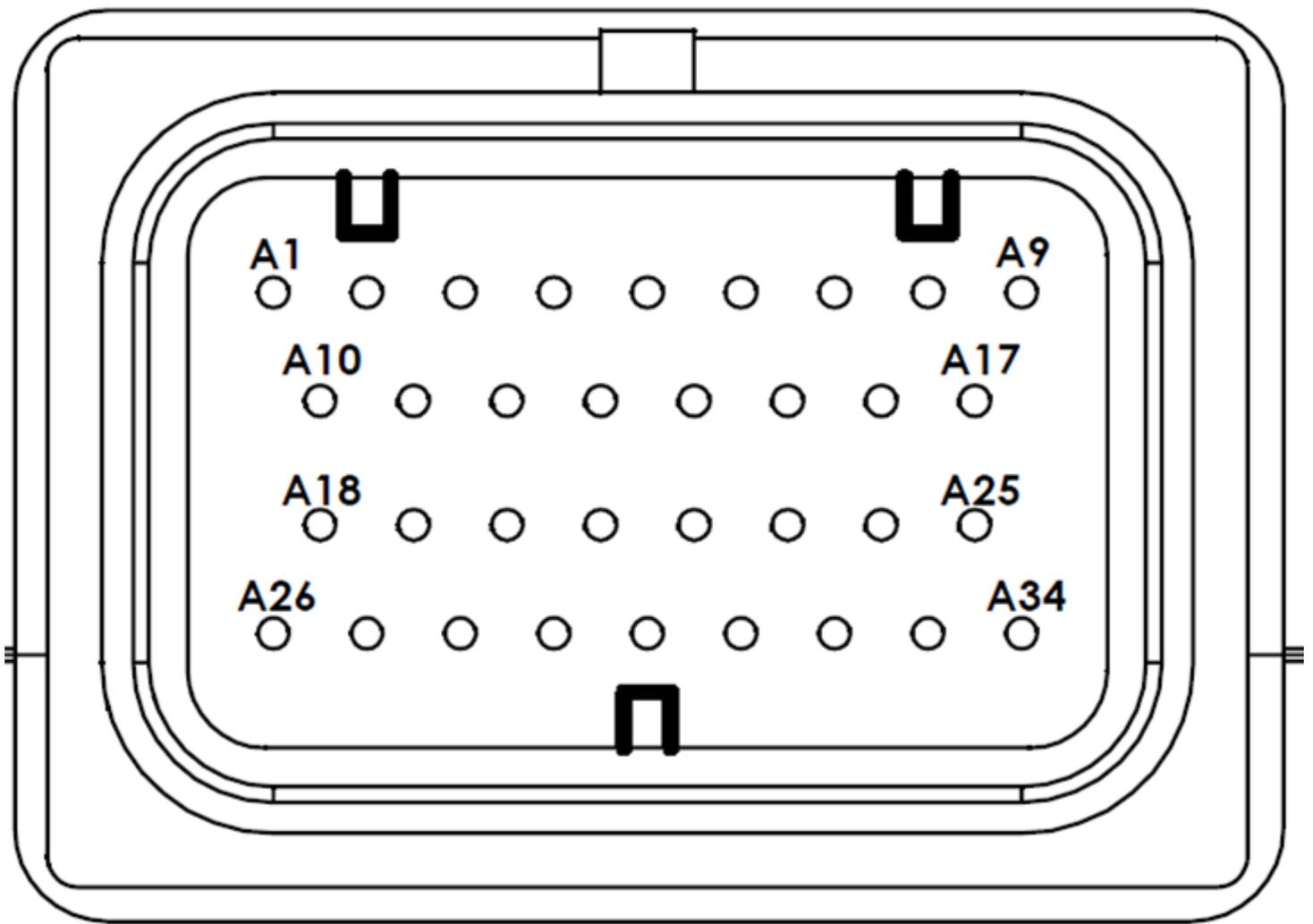


NOTE! 0V Supplies from the ECU are internally connected and should not be connected to battery ground.



*PWM input optional

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

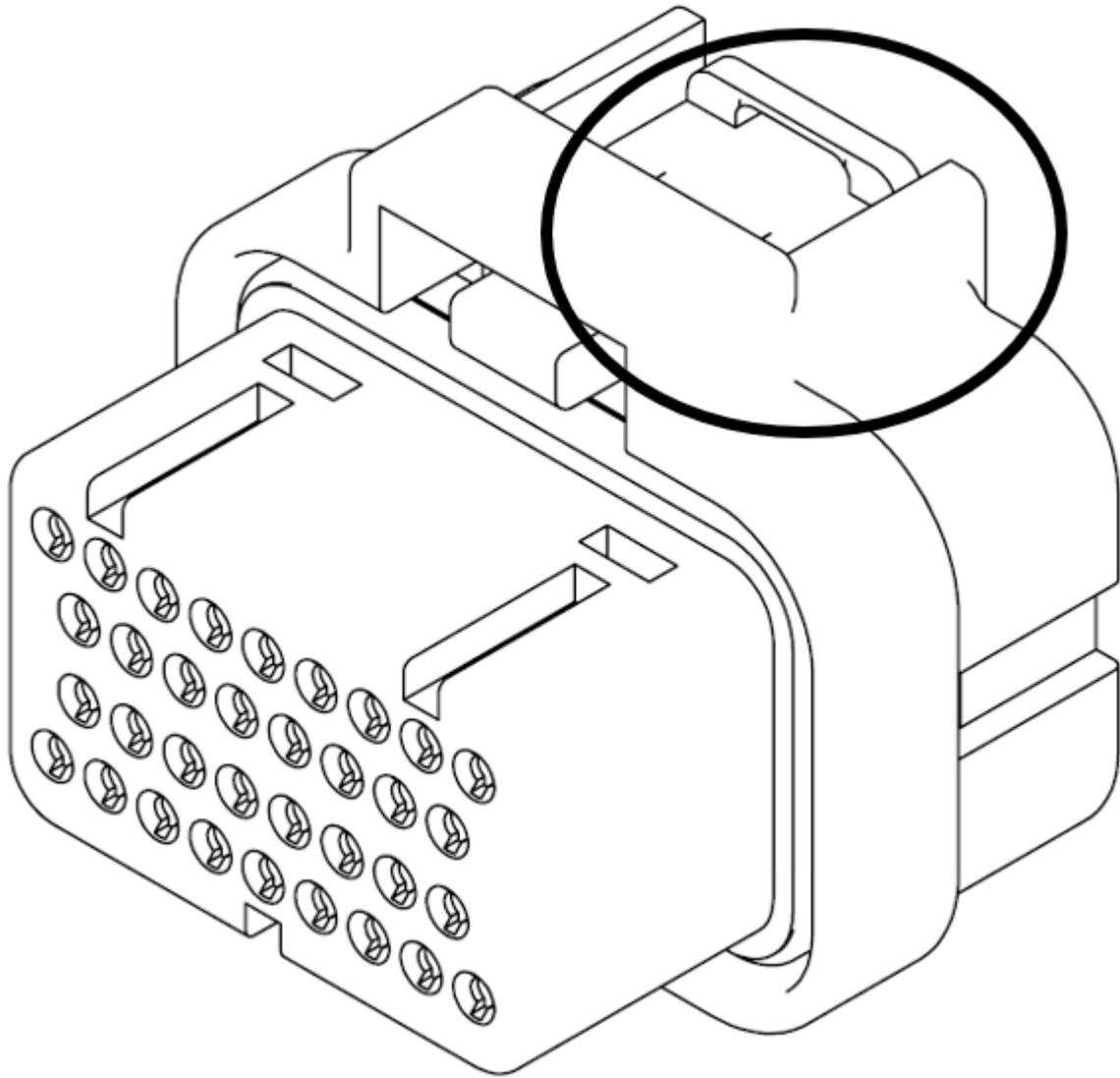


Looking into Black Box Pins

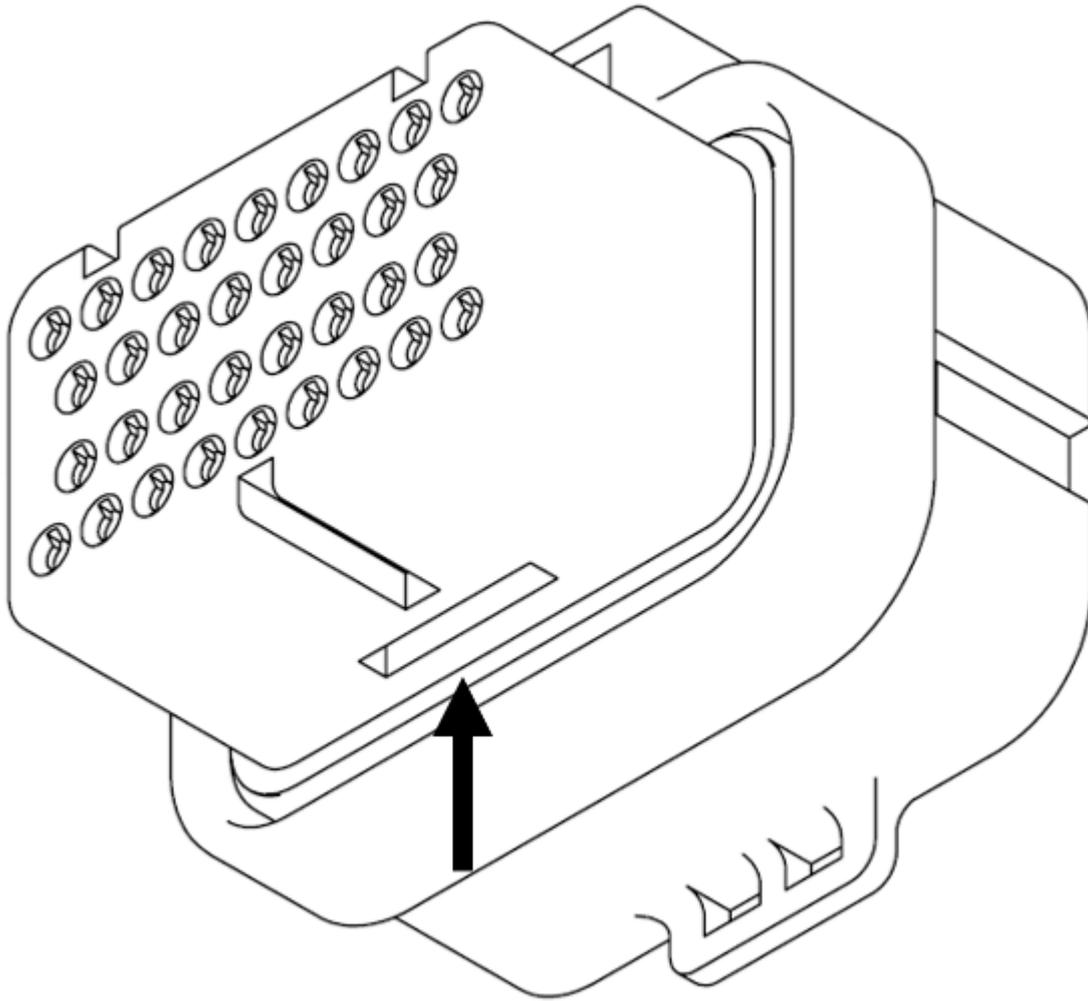
Fitting Your Turbosmart BlackBox

Using the Black Box Connector

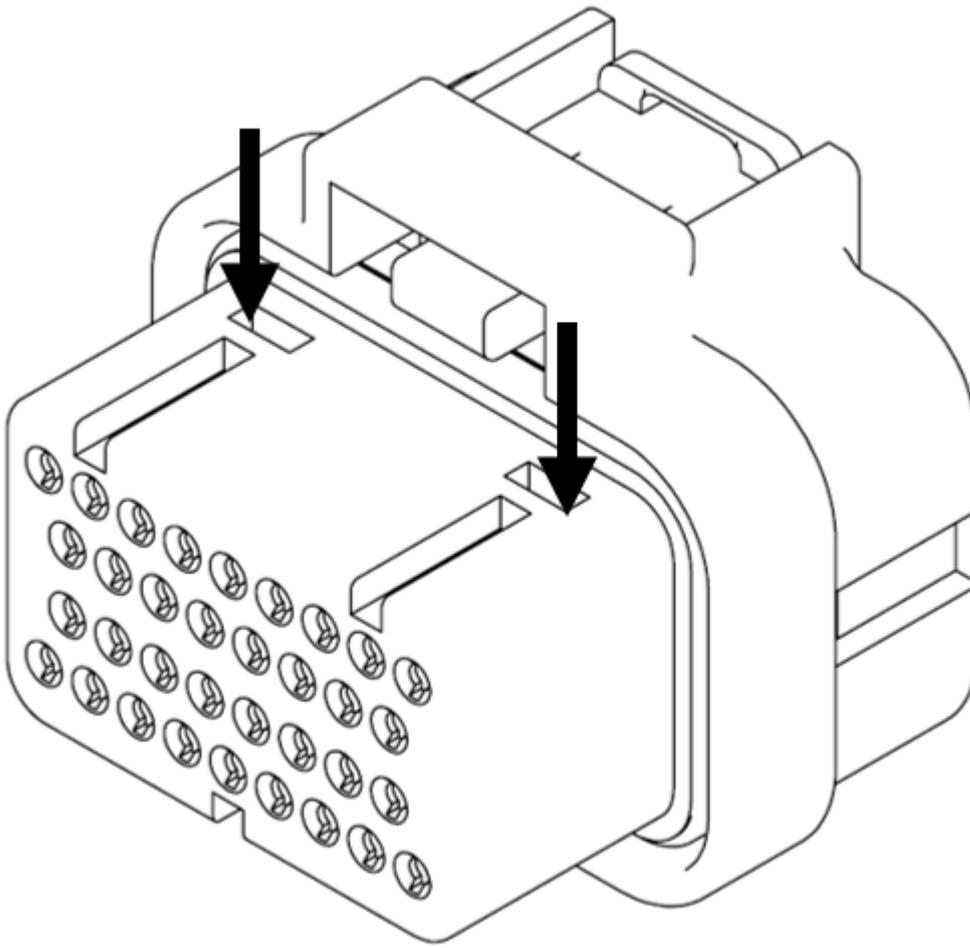
The Black Box connector needs to be populated as defined by the pinout information for each eGate. To remove the connector, The clip needs to be pushed down, removal of the connector from the black box.



To populate the connector with pins we need to disengage the lock tab. To unlock we need to push the tab at the bottom up.



To lock we need to push the tabs at the top up

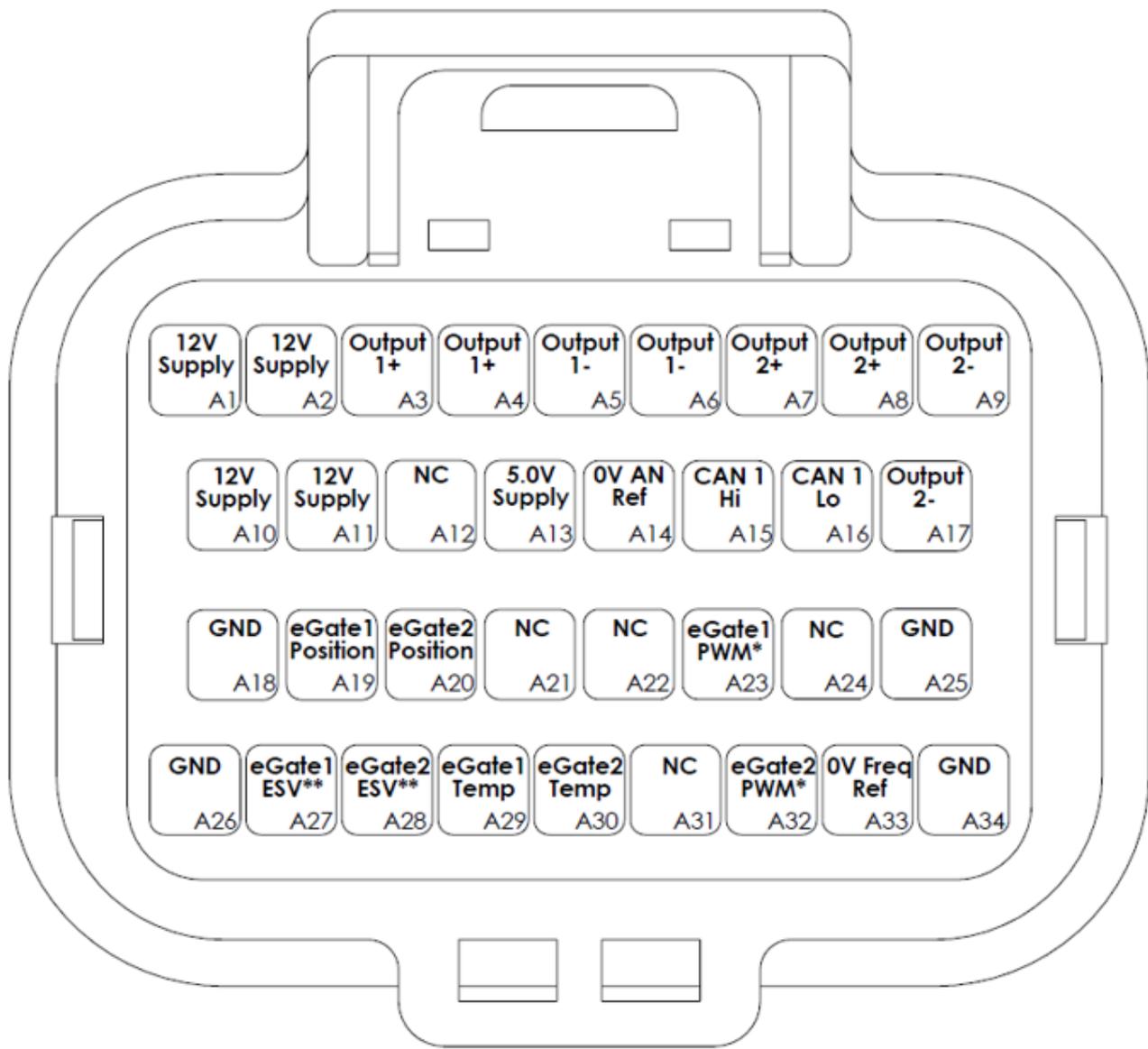


Pinout Designation

Depending on the number of eGates that are running will dictate what wiring is needed.

Focusing on 1 eGate we must use all that are designated eGate 1. If a second eGate is used it must be wired to the corresponding eGate 2 Positions.

Outputs must be wired to two pins with high current wire as pins are limited to 6 Amps. A suitable gauge wire should be used that is capable



*PWM input optional
 **Enable Switch Voltage - If Grounded corresponding eGate will disable

Pinout Current Sharing

Due to the high current nature of Black Box, the connector pins are current limited. To allow for high current to flow a correctly matched power supply wire must be used. This is then Paralleled to allow for the correct current to flow to each eGate. The Power and Ground are to be wired up to each 4 pins to manage the correct current for the Black Box to distribute.

Pin Limit

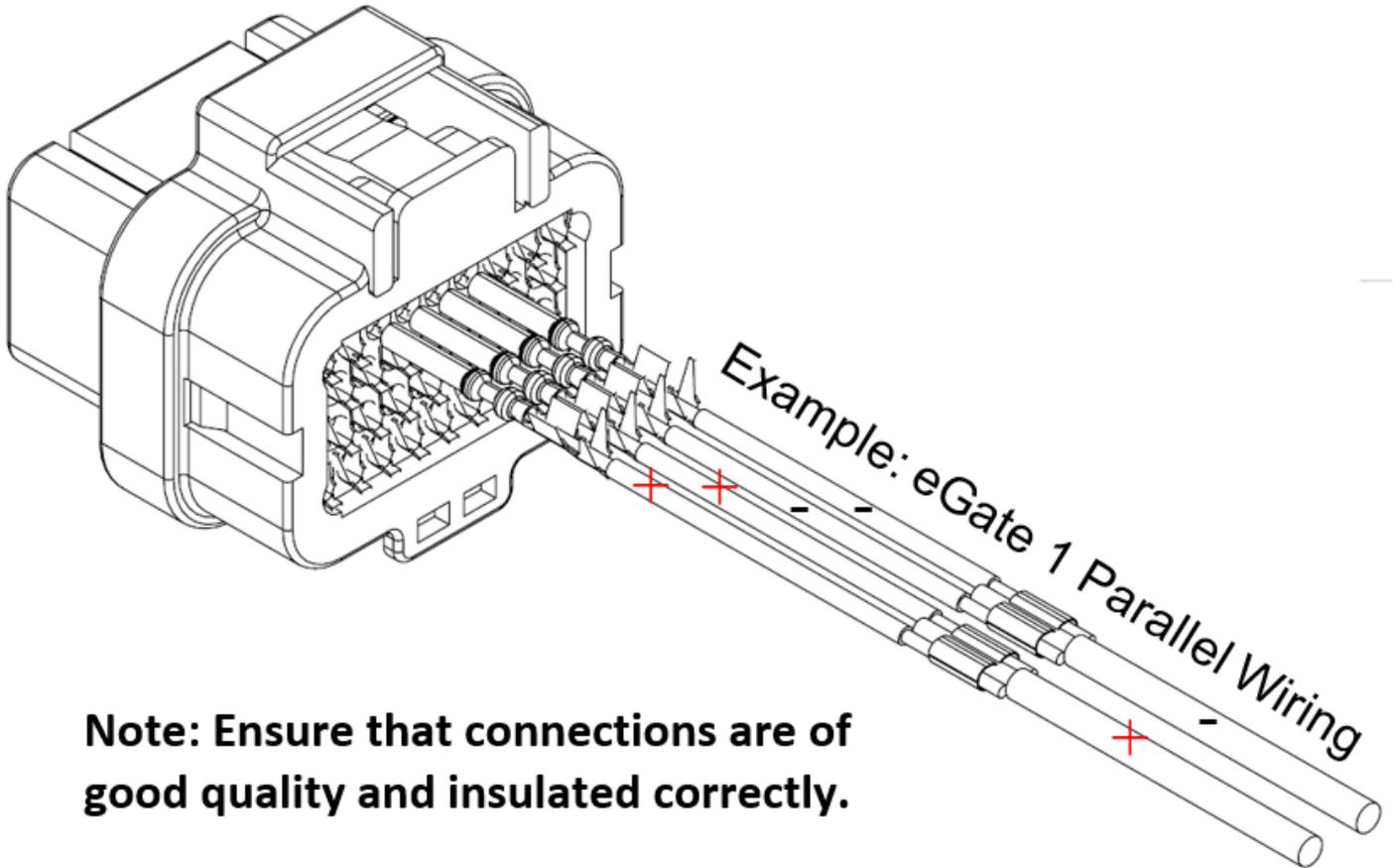
Each Pin is rated for 15A per pin (This is wire gauge dependant) This means we need at least need 30A wire current ability on the spliced option.

In the case below two wires are split and spliced into a larger gauge wire.

Recommended Wire Limit

Motor Wires and Power Wires

14AWG or better.



Note: Ensure that connections are of good quality and insulated correctly.

USB Port

The USB port is accessed at the opposite end of the black box. It is held on via a 2.5mm Allen key bolt once removed a USB micro female connector is visible this is required to be accessed to setup and configure the Black box. **NOTE!**

The USB port must be fitted after tuning is done.

Control Options

Pulse Width Modulation (PWM) Input

PWM is the standard for Boost Control solenoids, the Black Box can use this frequency input as position input for the e-Gates. The PWM inputs must be wired in correctly.

The Black Box accepts both high and low side inputs. The Rising edge threshold is 1.65V and the falling edge threshold is 1.0V. As long as the PWM signal alternatives across these values the signal can be used. The Low side is the digitally pulsed output from a standard boost controller. The low side is the negative trigger. It's more common and easier to use, a standard boost controller commonly uses 12V and a digitally pulsed output. This Digitally pulsed output should be wired in to the A23 for eGate 1.

Some investigation should be placed into reviewing the ecu's PWM output. For example of 100% and 0% Duty cycle. We see no pulsing of a duty cycle and therefore will not cross the voltage thresholds designed to count the duty cycle. In these cases 99% and 1% will be acceptable.

Note In some cases PWM input will be turned off if Over boost is exceeded. This will result in the valve closing as the PWM input is turned off (0%). Ensure that Boost Control is set in such a way that the value is never set to OFF.

Frequency Recommended	100Hz
Frequency Possible Range	25-100Hz
Connections Required	A23 - eGate 1 PWM input A32 - eGate 2 PWM input

	Low Side	High Side
0% Duty Cycle	Gate Open	<i>Gate Closed</i>
100% Duty Cycle	<i>Gate Closed</i>	Gate Open

eBoost PWM Hook-up

It is required to setup the eBoost to use the Auxiliary output to disable the Black Box in the event of a boost level reaching over the required level.

The OBS (Over boost) Feature must be set, but it must be set greater than the Auxiliary output bOn. Failure to do so will see the eBoost default to off and close the valve, resulting in higher boost pressure. The bOn (Boost On Feature) White Wire will be wired to the Enable switch voltage and disable the Valve in the event of an over boosting.

The Auxiliary Output is located on the white wire from the eBoost this must then terminate to the corresponding gate which is to be disabled at the point at which its disabled.

For example, we have selected a random boost pressure in this case of 20psi. bOn(Boost On) must be set to 20psi. Over boost should be set to the maximum possible value to ensure it does not interfere.

eBoost Only Settings	
eBoost PWM Wire	Grey Wire
eBoost Auxiliary Wire	White Wire
0% Duty Cycle	<i>Gate Closed</i>
100% Duty Cycle	Gate Open

CAN Bus Input

Can Bus information must be transmitted from an ECU to the Black Box. This information is addressed in the datasheet for specific address for Transmitted and Received data.

The CAN information required for the eGate to function correctly at a minimum requires the Boost Control Duty Cycle to be transmitted to the Black Box. As An example, here is the CAN Address required for eGate 1 to Function

Connections Required

A15 - Can High

A16 - Can Low

Base Address 0x110 (272)

Byte 0,1 Area Target Egate 1 0-100.0% (0-1000)

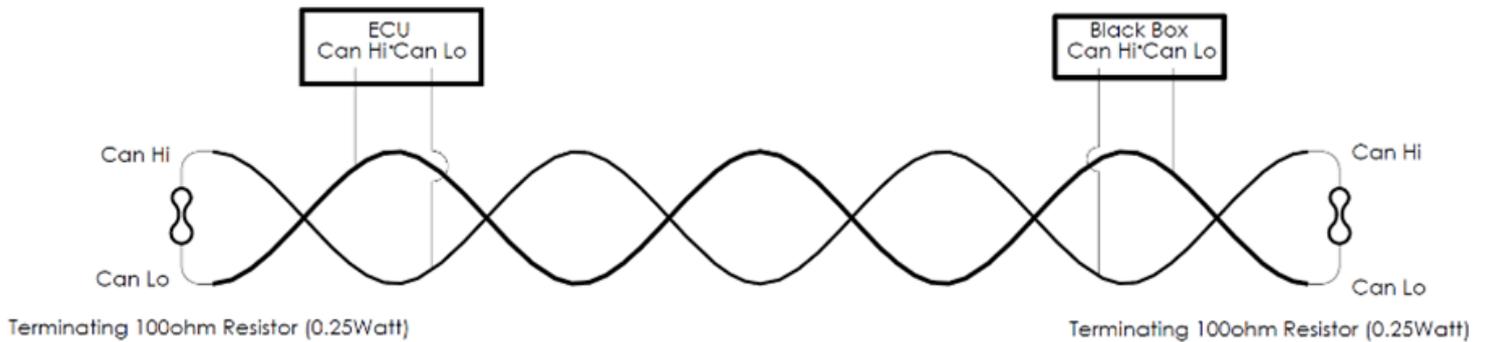
This address allows for the area position to be transmitted to the Black box for the Black Box to target the correct position to effectively use the CAN BUS, as much information as possible should be used.

More info located in [Datasheet](#)

CAN Bus Wiring

The CAN Bus is a network within a vehicle that allows for vast amounts of information to be shared within each part of the vehicle.

- CAN BUS Trunks should be no more than 500mm long from the main trunk
- The twisted wire should have one twist per 50mm
- A terminating resistor must be placed on either end of the Main harness trunk if more than 2m. Less than 2m will only require one. (100Ω 0.25W Resistor)
- Max Length is 16m long.



USING YOUR TURBOSMART BLACK BOX CONFIG TOOL SOFTWARE

Installing Software

The Turbosmart Black Box Config Tool is available to download from the Turbosmart Website at

[Turbosmart Black BoxConfig Tool](#)

Connecting to Black Box

The first step after physically connecting the USB to the Black Box. We see the feedback from the software on the state of the connection in the top right corner.

NOTE!

The Black Box requires the wiring to be completed as power is sourced from the car.

BlackBox

DISCONNECTED

BlackBox

CONNECTED

User Interface

A breakdown of the software layout and the features that are available with the Black Box.

Open File

- o Saved Files configurations can be opened from here.

Save to File

- o Open files can be saved in here

Live Editing – Write to Device

- o The Black box will give you two options depending on what state Black Box is in.
 - § Write to Device sends a configuration
 - § Live Editing allows the Black Box to make live edits to the configurations while being connected to Black Box.

Translation Type

- o **Poppet Default**
 - § A default option to that operates all Poppet style eGates. This is optimised to match flow capacity to valve height but not optimised to the specific Wastegate size.
 - § Example 50% Position is requested may not output 50% Valve Position due to flow matching.
- o **Poppet 1:1 Ratio**

- § An option that matches valve height percentage and position percentage. This could be common if using the eGate as an exhaust cut out.
- § Example 50% Position is requested will output 50% Valve Position due to 1:1.
- § This could be used for an Electric antilag valve.
- o **WG40**
 - § A default option to that operates the Wastegate 40 Poppet style eGates. This is optimised to match flow capacity to valve height
 - § Example 50% Position is requested may not output 50% Valve Position due to flow matching.
 - § Recommended for most applications running this Wastegate.
- o **WG45**
 - § A default option to that operates the Wastegate 45 Poppet style eGates. This is optimised to match flow capacity to valve height
 - § Example 50% Position is requested may not output 50% Valve Position due to flow matching.
 - § Recommended for most applications running this Wastegate.
- o **WG50**
 - § A default option to that operates the Wastegate 50 Poppet style eGates. This is optimised to match flow capacity to valve height
 - § Example 50% Position is requested may not output 50% Valve Position due to flow matching.
 - § Recommended for most applications running this Wastegate.
- o **WG60**
 - § A default option to that operates the Wastegate 60 Poppet style eGates. This is optimised to match flow capacity to valve height
 - § Example 50% Position is requested may not output 50% Valve Position due to flow matching.
 - § Recommended for most applications running this Wastegate.
- o **Straight 1:1 Ratio**

§ An option that matches valve height percentage and position percentage. This could be common if using the eGate as an exhaust cut out.

§ Example 50% Position is requested will output 50% Valve Position due to 1:1.

o **Straight**

§ A default option to that operates the Straight Gate style eGates. This is optimised to match flow capacity to valve height

§ Example 50% Position is requested may not output 50% Valve Position due to flow matching.

§ Recommended for most applications running this Wastegate.

o **Reserved**

§ Selected if Gate is not being used.

Target Source

o **CAN Target**

§ CAN Target selects the CAN Bus network as the source for Wastegate Information. A large amount of information can be transmitted and received over this network.

§ Recommended to allow the full potential of the Black Box.

o **PWM Target**

§ Pulse width modulation is defined as a percentage of a set period. For example, to achieve a 25% Duty cycle we need to have the PWM ON for 25% of the time period and OFF for 75%.

§ This is the most common boost control method used with three port boost controllers.

§ Can be used with most Factory ECU's

§ Easier option but does not allow for the full potential of the Black box.

Overtemp

o A user defined value that the eGates will shut down if the internal temperature is reached.

o The gates are internally calibrated to a maximum value of 150degC (302degF).

- o Value is typically 140degC(284 degF) But must be less than 150degC (302degF).

Egate AutoStop Feature

- o Autostop
 - § The Autostop feature allows for current to be preserved if the gate sees no change in position demand for 5 seconds. This allows the gate to remain at its current position preserving current until a change is registered.
 - § Typically selected

Park Feature

- o Park Enable
 - § The Park Enable feature, the Park Enable allows the Gate to get to a user defined Park Threshold percentage and stop supplying current to the motor. When selected and the target is less than Park Target Threshold for 2 seconds the motor will switch off.
 - § Typically selected
 - § **Note that failure to enable Park Feature may result in the valve continuously moving and resulting in overcurrent due to the integral of current being above the allowable limit.**
- o Park Threshold
 - § Used when Park Enable is selected. This is the Position Percentage that the gate will be considered closed. This value typically should be 2%.
 - § When selected and the target is less than Park Target Threshold for 2 seconds the motor will switch off.

Preload

- o Preload Enable
 - § Enables the Preload enable feature, this feature allows the gate to be driven harder into the seat once the gate measures deviation from its aim path.
 - § Applied to both eGates

- o Preload DC

- § Preload Duty cycle is the amount of duty cycle the gate will preload the valve with. This Value is typical -20% it should be a negative value.

- o Preload MAX time

- § Max time is the amount of allowable time that position demand can be ramped to ensure preload on the valve.

CAN Address

- o The CAN BUS network allows for a large amount of information to be transmitted and received over a simple two wire twisted pair network. This allows vast amounts of information to be shared and adapted to many advanced tuning strategies.

- o CAN Address may need to move as other data may conflict with these base address.

- o This address must correspond to the relevant address on the ECU Can bus.

- o TX - Transmit

- § Typically

- § Decimal = 256

- Converted

- o Hexadecimal (0x100)

- o RX - Receive

- § Typically

- § Decimal = 272

- Converted

- o Hexadecimal (0x110)

Calibration

- o Automatic Calibration is set by selecting which e-Gate and the state that the calibration is required. It is highly advisable to select both open and closed calibration.

- o A Set value is predefined by Turbosmart, these Offsets are stored as calibration offset Voltages at either state.

- o **NOTE: It is also advisable to move the gate with Manual Override when calibrating to the 25% mark and 75% mark depending on which calibration is required.**

Manual Override

- o The option to manually select the position for the valve to move to that overwrites any position data feed from the ECU.

This should be used for diagnostic purposes.

Connected User Interface

Once connected and a file has been loaded e-Gate Positions are populated. As well as Calibration options are now accessible.



Open File Save to File Live Editing

Settings

E-Gate 1 Translation Type	Straight	▼
E-Gate 2 Translation Type	WG60	▼
E-Gate 1 Target Source	CAN Target	▼
E-Gate 2 Target Source	CAN Target	▼
Over Temperature Shutdown	140.0	DegC
E-Gate Auto Stop	<input checked="" type="checkbox"/>	
E-Gate 1 Park Enable	<input checked="" type="checkbox"/>	
E-Gate 2 Park Enable	<input checked="" type="checkbox"/>	
E-Gate Park Threshold	2.0	%
E-Gate 1 Preload Enable	<input checked="" type="checkbox"/>	
E-Gate 2 Preload Enable	<input checked="" type="checkbox"/>	
E-Gate Preload %DC	-20.0	%
E-Gate Preload Max Time	4.0	s
CAN Base Tx Address	256	
CAN Base Rx Address	272	

Calibration

Calibrate E-Gate 1 Open	Calibrate E-Gate 1 Closed
Calibrate E-Gate 2 Open	Calibrate E-Gate 2 Closed

Manual Override

E-Gate 1 Override	<input type="checkbox"/>	●	0.5
E-Gate 2 Override	<input type="checkbox"/>	●	0.5

E-Gate 1



E-Gate 2



User Interface Data Read Out

While connected to the Black Box the selection of Data that is collected via the Black Box is presented to for troubleshooting, verification, and tuning.

Diagnostics

- o E-Gate Position status

- § The Position status can be Ok, Fail Low and Fail High readout on the status of the calibrations that the eGate is reporting to the Black Box.
- § Failing Low indicates a Position lower than the calibration is expecting
- § Failing High indicates a Position higher than the calibration is expecting

- o E-Gate Temperature Status
 - § The Temperature status can be Ok, Fail Low and Fail High readout on the status of the calibrations that the eGate is reporting to the Black Box.
 - § Failing Low indicates a Temperature lower than the calibration is expecting
 - § Failing High indicates a Temperature higher than the calibration is expecting

- o 5V Supply Status
 - § The 5V Supply status can be Ok, Fail Low and Fail High readout on the status of the voltage that the Black Box is reporting.
 - § Failing Low indicates a Voltage lower than the Black Box is expecting
 - § Failing High indicates a Voltage higher than the Black Box is expecting
 - §

- o EEPROM Status
 - § Indicates the Black Box is working correctly with the required software.

E-Gate Type: Dual
 Firmware: v1.0
 Hardware: v1.1
 Serial: 1000

BlackBox

CONNECTED

Diagnostics

E-Gate 1 Position Input Status	Ok
E-Gate 2 Position Input Status	Fail Low
E-Gate 1 Temperature Input Status	Fail High
E-Gate 2 Temperature Input Status	Ok
5V Supply Status	Ok
EEPROM Status	PASS

eGate 1/2 Readout - Refer to Datasheet for Possible outputs.

- o Area Target

- § Area Target uses the position target and converts it using the flow characteristics so 50% flow is 50% Position, but not 50% valve position.

- § 0-100%

- o Position Target

- § Position Targeted from the ECU.

- § 0-100%

- o Position

- § Position of eGate in a percentage for Valve Position

- § 0-100%

- o Motor Duty

- § Motor Duty cycle required to move the eGate to the requested target.

- § +/- 0-100%

- o Target Error

- § Percentage error from requested target.

- § +/- 0-100%

- o Current

- § Current flowing to the eGate to as requested to allow for movement.

- § Amps

- o Position Voltage

- § Raw Voltage from eGate encoder.

- § 0.5-4.5V

- o Control Duty Input

- § PWM Duty cycle required while PWM option is selected.

- § 0-100% (1-99%)

- o Control Frequency Input
 - § Frequency of which the signal is sent to the Black Box
 - § Recommended 100Hz
- o Temperature
 - § Temperature from the eGate encoder.
 - § Displayed in DegC Only
 - § 0-150degC
 - § 32-302degF
- o Enable Switch Voltage
 - § If this Voltage is grounded, the corresponding eGate will be disabled.
- o Translation
 - § Readout of the current selected eGate for the Position selected
 - § Turbosmarts Wastegate Selection
- o Target Source
 - § Shows the current target source selection.
 - § CAN or PWM
- o System Status
 - § Current Status of logic being performed on the eGate
 - § **Note: Over Current Status will require power to be cycled.**

Enumeration	Status	Status Condition
0	OFF	System Standby
1	Reserved	Reserved
2	OFF-IC Reset	Not Relevant in Field
3	OFF-Posn Sensor Err.	The valve is outside the allowable 4.5V to 0.2V window.
4	OFF-Enable Sw	Enable switch is grounded, gates are disabled from moving from position input.
5	OFF-Over-Temp	Valve disregards position until temperature is under (Over temperature shutdown - 10 degC)
6	OFF-Auto Stop	Valve has met conditions to allow for auto stop. Will only move once change is detected.

7	OFF-Parked	Valve is not moving and has parked up. Awaiting change larger than park threshold.
8	OFF-Over Current	Current intergral has exceeded the allowable limit. (Current Supply Vs Time) Black box will attempt 3 times before disabling. (Power Cycle necessary)
9		-
10	Calibrating 0% Posn ..	Calibrating the 0% Position
11	Calibrating 100% Posn ..	Calibrating the 100% Position
12	Calibrate Complete !!	Calibration has cycled and completed
13	eGate Current Calibrating	Reports when egate closed or open calibration is being commanded.
14	eGate Parked	Reserved
15	eGate Prespool	Reserved
16	ON-Temp Sensor Fault	The temperature signal is not being reported to the ECU. Valve is still active with no temperature signal
17	ON-Target CAN	Valve is using the CANBUS Signal
18	ON-Target PWM	Valve is using the PWM signal
19	ON-Target USB Override	USB Black Box software is being used to command position
20	ON-Pass-Through %DC	Valve is being sent raw motor duty cycle
21	ON-PreLoad Active	Only used if preload command is sent over CAN BUS

- o PID Status

- § Current Status of movement logic being applied to the eGate

- o Proportional Output

- § Percentage of Proportional Control being applied to the Motor Driver

- o Integral Output

- § Percentage of Integral Control being applied to the Motor Driver

- o Derivative Output

- § Percentage of Derivative Control being applied to the Motor Driver

- o Feedforward

- § Predetermined Table applied to aid in targeting correct position

E-Gate 1

Area Target	30.0	%
Position Target	33.5	%
Position	33.4	%
Motor Duty	0.0	%
Target Error	0.0	%
Current	0.0	A
Position Voltage	3.150	V
Control Duty Input	0.0	%
Control Frequency Input	0	Hz
Temperature	-25.0	DegC
Enable Switch Voltage	4.983	V
Translation	Straight	
Target Source	CAN	
System Status	OFF-Auto Stop	
PID Status	OFF	
Proportional Output	0.0	%
Integral Output	0.0	%
Derivative Output	0.0	%
Feedforward	0.0	%

General

- o 14V Motor Supply Readout
 - § Battery Voltage being supplied to Black Box

- o 5V Supply
 - § 5V Supply Voltage being supplied to Black Box Sensors

- o Device Temperature
 - § Internal Temperature of the Black Box

- o Calibration Offsets
 - § Open
 - Voltage Deviation from pre-set calibration values.
 - Values over indicate +/-0.2V indicate possible issue with manual calibration

 - § Closed
 - Voltage Deviation from pre-set calibration values.

Values over indicate +/-0.2V indicate possible issue with manual calibration

General

14V Motor Supply	12.341	V
5V Supply	5.001	V
Device Temperature	22.9	DegC
E-Gate 1 Calibration Offset Voltage Open	0.000	V
E-Gate 1 Calibration Offset Voltage Closed	0.028	V
E-Gate 2 Calibration Offset Voltage Open	0.000	V
E-Gate 2 Calibration Offset Voltage Closed	0.000	V

TROUBLE SHOOTING

It is important that any issues are resolved before heavy driving.

Black Box will not turn on

- Ensure Good quality wire is being used that is rated correctly
- Check for Wires Shorting to Ground.
- Good Quality Ground point has been selected

No Communication with Black Box

- Ensure decent quality USB and connector is correctly seated
- Verify Voltage and Ground at Black Box Connector

Failing the above, submit a technical request to tech@turbosmart.com.au with information of your Black Box configuration and photos of installation. As well as any information regarding wiring.