VG30DE(TT) Crank Trigger and Cam Sync Kit for ATI Race and Street Dampers

Revised 1/7/2025

Always verify you have the most current revision by comparing the date above to the date listed next to the links on our Downloads webpage: https://www.bde-performance.com/downloads.htm

Parts List

(Qty)	Description
(1)	Crank Trigger Wheel 12 Tooth
	or
(1)	Crank Trigger Wheel 36-1 Tooth
(1)	Crank Sensor Bracket A
(1)	Crank Sensor Bracket B
(1)	Crank Sensor Spacer A
(1)	Crank Sensor Spacer B
(1)	Cam Sync Hub
(1)	Cam Sync Sensor Housing
(1)	Cam Sync Sensor Housing Cover
(2)	Hall Effect Sensor with built-in 2.4K pull-up resistor
(5)	M6x1.0x20 SS Allen bolt
(1)	M6x1.0x95 SS Allen bolt
(4)	M7x1.0x30 Allen bolt
(1)	M8x1.25x95 SS Allen bolt
(3)	1/4"-20x0.500 SS button head Allen bolt
(1)	Adel Clamp

Add-On Options

(1)	Power Steering Pulley
(1)	Sensor Adapter Harness, must specify Early or Late CAS

Tools needed for installation

- 5mm Allen socket (M6 bolts)
- 6mm Allen socket (M7 and M8 bolts)
- 5/32” Allen wrench (1/4"-20 Cam Sync Housing Cover bolts)
- 5/16" 12 point socket (ATI PS pulley bolts)
- 10mm wrench and socket
- 11mm socket (stock exhaust pulley bolts)
- 12mm wrench and socket
- 17mm open end wrench (Hall sensor lock nuts)
- 27mm socket with 1/2" drive breaker bar (crankshaft rotation)
- Lubricating oil or assembly grease

Disassembly

1. Remove the engine belly pan.
2. Remove the radiator fan shroud.
3. Remove the radiator fan and clutch assembly.
4. Loosen the belt tension on the alternator, AC, power steering pump pulleys and remove all belts.
5. Remove the ATI power steering pulley bolts and pulley (hint - a putty knife works well to wedge between the damper and pulley to force it off).
6. Remove the CAS.
7. Remove the four OE exhaust cam sprocket bolts and square washer plate.
8. Remove the M8 bolt holding the alternator adjuster bracket to the oil pump (see figure 5)
9. Remove the M6 bolt on the oil pump directly above the M8 bolt removed previously (see figure 5).

If you have a stock crank pulley, you will need to remove it to install an ATI damper. It is best to remove a stock crank pulley with a harmonic balancer puller that uses threaded bolts to attach to the pulley (hint - the stock crank pulley has two M6x1.0 threaded holes in it to allow attaching a harmonic balancer puller to it).

Note, you should never use a claw type puller that grabs the outside of a crank pulley to remove it, especially on a precision part like the ATI damper.

Crank Trigger Wheel and PS Pulley Assembly

1. Manually rotate the crankshaft (do not use the starter) to align the damper's TDC mark with the zero mark on the timing indicator.

2. Depending upon whether you have a Race or Street damper, flip the BDE crank trigger wheel to the appropriately labeled side to face outwards and place the BDE PS pulley onto this side of the trigger wheel (see figure 1 below).

3. Rotate the PS pulley to line up the 6 bolt holes on each (see figure 2 below).

FIGURE 1 - trigger wheel Race damper side out identification


FIGURE 2 - PS pulley and trigger wheel bolt holes aligned

4. Place the trigger wheel and PS pulley assembly onto the ATI damper face and rotate both to align with the appropriate bolt pattern (hint - the Race damper has the larger diameter bolt pattern and Street damper has the smaller diameter bolt pattern).

5. If you are installing a 36-1 trigger wheel, orient the missing tooth to be inline with the TDC mark on the damper.

6. Lubricate the threads of the original ATI PS pulley bolts.

7. Loosely install the original ATI PS pulley bolts and washers to align the trigger wheel PS pulley assembly onto the damper and ensure all bolt holes are lined up.

8. Snug the PS pulley bolts evenly to engage the recessed portion of the trigger wheel PS pulley assembly onto the ATI damper's locating hub.

9. Continue to evenly tighten the PS pulley bolts to pull the trigger wheel PS pulley assembly onto the ATI damper.

10. Torque the PS pulley bolts to 16 to 18 ft-lbs

Crank Sensor Bracket Assembly

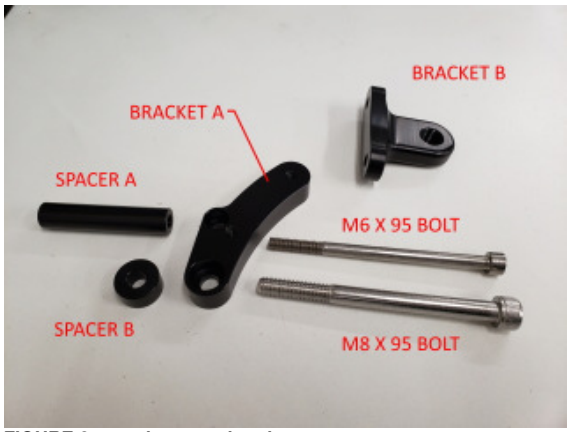

FIGURE 3 - crank sensor bracket parts

FIGURE 4 - bolts and spacers assembled

1. Lubricate the threads on the two M6 x 20 bolts and both M6 and M8 x 95mm long bolts.

2. Slide the M6 and M8 x 95mm long bolts into the counter bored holes of Crank Sensor Bracket A.

3. Slide the long, small diameter, Spacer A onto the shank of the M6 bolt (figures 3 and 4).

4. Slide the short, large diameter, Spacer B onto the shank of the M8 bolt (figures 3 and 4).

5. Align the alternator adjuster bracket with its oil pump mount hole and slip the M8 bolt shank along with the entire Bracket A, spacers A and B, and bolt assembly into position (see figures 5 and 6 below).

6. Align the Bracket A assembly so that the M6 bolt will slide into the upper oil pump bolt hole (see figures 5 and 6 below).

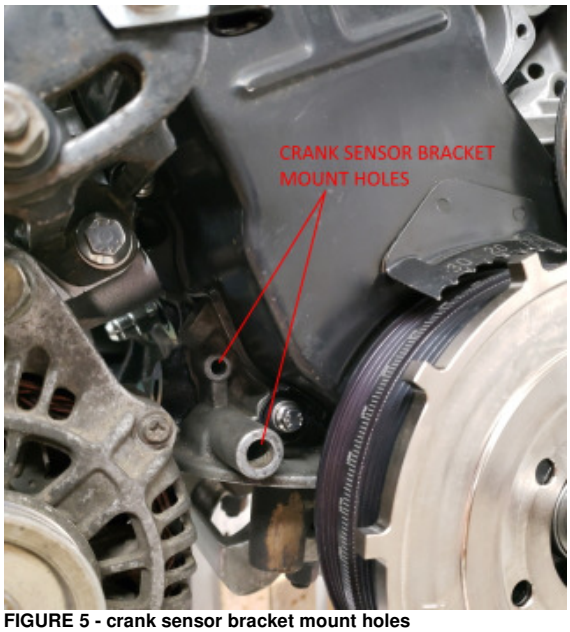

FIGURE 5 - crank sensor bracket mount holes

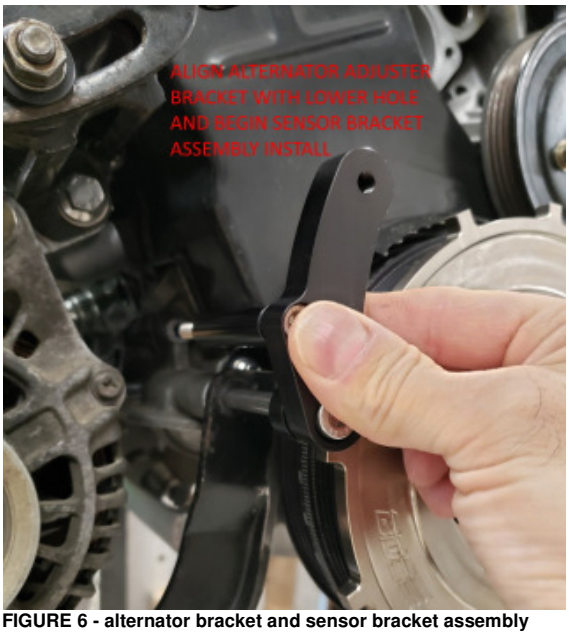

FIGURE 6 - alternator bracket and sensor bracket assembly

7. Snug both M6 and M8 x 95 bolts, but do not tighten yet.

8. Install the Crank Sensor Bracket B onto Crank Sensor Bracket A so that the curved surfaces are in line on both sides, install and lightly snug both M6 x 20 bolts to retain it.

9. Verify that the crank trigger wheel teeth do not hit the Crank Sensor Bracket B (see figure 8 below).

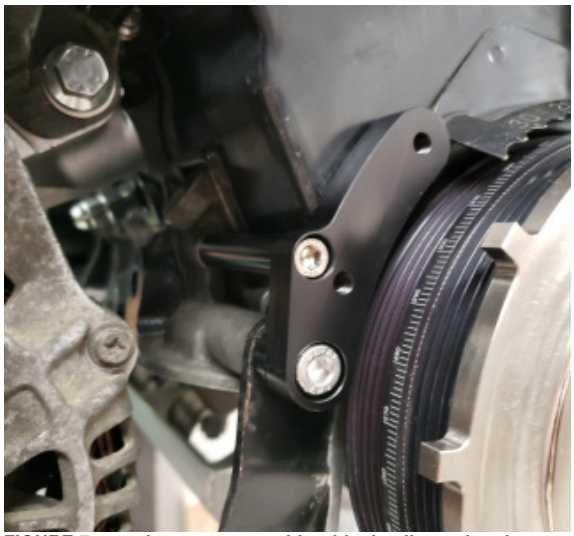

FIGURE 7 - crank sensor assembly with alt adjuster bracket

FIGURE 8 - sensor bracket to trigger tooth clearance

10. When the trigger wheel tooth clearance to the sensor bracket is verified, remove the Crank Sensor Bracket B.

11. With the alternator belt removed, position the alternator so it is at the farthest end of its adjustment slot and tighten its adjuster nut to lock it into position (see figure 9 below).

FIGURE 9 - alternator positioned to end of adjustment slot

FIGURE 10 - sensor installed in bracket B

12. Torque the M8 bolt on Crank Sensor Bracket A to 11 to 13 ft-lbs.
13. Torque the M6 bolt on Crank Sensor Bracket A to 4 to 5 ft-lbs.
14. Lubricate the threads on one Hall Sensor and thread it into Crank Sensor Bracket B's hole until is flush with the other side (see figure 10 above).
15. Install the Crank Sensor Bracket B and torque its two M6 bolts to 4 to 5 ft-lbs.
16. Adjust the Hall sensor to achieve a gap to the trigger tooth of 0.040" to 0.100" (1 to 2.5mm).
17. Thread the first of the sensor's lock nuts down and gently tighten it against the bracket.
18. Thread the second lock nut down and gently tighten it against the first lock nut.
19. Slip the Adel clamp over the crank Hall Sensor's wires under the connector.
20. Install the Adel clamp onto the lower front PS pump adjust bracket bolt.

FIGURE 11 - Adel clamp installed on PS mount

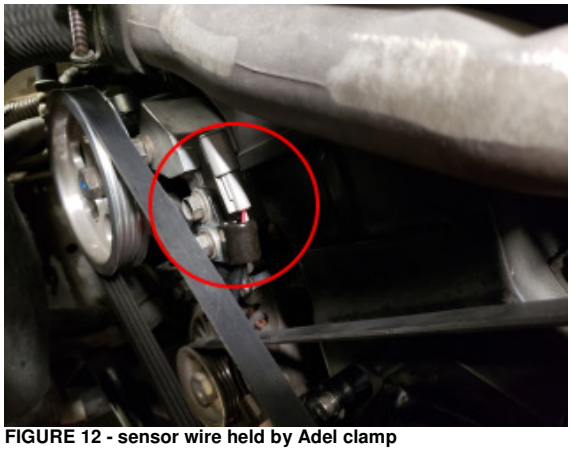

FIGURE 12 - sensor wire held by Adel clamp

Cam Sync Assembly

1. Align the dowel pin on the back of the Cam Sync Hub with the dowel pin hole on the exhaust pulley and install the cam sync hub onto the exhaust pulley (figures 13 and 14).

FIGURE 13 - cam sync hub dowel pin

FIGURE 14 - exhaust sprocket dowel pin hole

2. Lubricate the threads of the four M7 bolts.
3. Install and evenly tighten the M7 bolts to pull the Cam Sync Hub onto the exhaust pulley.
4. Torque the four M7 bolts to 10 to 14 ft-lbs.
5. Manually rotate the crankshaft to bring the Cam Sync Hub's tooth so that it points towards the left side of the engine (see figure 15 below).
6. Lubricate the threads of three M6 x 20 bolts.
7. Lubricate the threads of the Hall sensor.
8. Thread the Hall sensor into the Cam Sync Housing mount hole so that it is flush to the inside of the housing (see figure 15 below).

FIGURE 15 - cam sync hub installed

FIGURE 16 - sensor installed flush to inside of cam sync housing

9. Lightly tighten the Hall sensor's lock nuts to hold the sensor in position.

10. Align the Cam Sync Housing and Hall sensor assembly with the CAS bracket bolt holes so that the sensor's wire end is facing the left side of the car (USDM driver side) and verify there is clearance between the sensor and the Cam Sync Hub tooth.

11. The 12+1 crank trigger uses an adjustable Cam Sync Housing (see figure 17) to accommodate adjustable exhaust pulleys. If the exhaust cam timing is adjusted, this will also move the cam sync hub, which will alter the optimum half-way positioning of the cam sync between two crank teeth. An adjustable Cam Sync Housing allows you to adjust the cam sync back to the optimum position (also see Cam Signal Position Setup on page 10).

12. Install the three M6 x 20 bolts and torque to 3 to 4 ft-lbs.

13. Loosen the Hall sensor lock nuts and adjust to obtain a gap of 0.040" to 0.100" (1mm to 2.5mm) between the Hall sensor and the Cam Sync Hub tooth.

14. Thread one lock nut down and gently tighten it against the bracket.

15. Thread the second lock nut down and gently tighten it against the first lock nut.

16. Form the cam sync sensor's wire pigtail downwards into a "U" shape so that its connector is now pointing towards the center of the engine.

17. Lubricate the threads on the three 1/4"-20 button head bolts.

18. Install the Cam Sync Housing Cover onto the Cam Sync Housing (see figure 18 below).

19. Install the three 1/4"-20 bolts onto the Cam Sync Housing Cover and torque to 3 to 4 ft-lbs.

FIGURE 17 - 12+1 adjustable cam sync housing

FIGURE 18 - cam sync housing cover installed

Wire Harness Adapter

Starting January 2022, the BDE harness adapter will have the CAS wire ends with terminals crimped on but they are not installed into the plastic connector. You will need to verify the 12V power, ground, crank signal, and cam signal wires going to your ECU and install the wires into the supplied CAS connector's locations that work with your setup.

Note: Not all plug-n-play ECUs for the Z32 use the same pins for the crank and cam signal inputs - for example:

- The Haltech Platinum Pro ECU for the Z32 uses pins 41/51 for the crank signal and pins 42/52 for the cam signal.
- The AEM S1 and S2 ECUs for the Z32 are opposite of Haltech and use pins 41/51 for the cam signal and pins 42/52 for the crank signal.

Compounding the issue is if you were using a 24+1 CAS disc, which switches the crank and cam signal outputs on the CAS compared to a stock disc. It is imperative that you verify which pin is used for each signal with your ECU and CAS connector and ensure the BDE sensor signals are routed properly throughout the wire harnesses.

The BDE wire harness adapter wire color identifications are in table 1. Figures 21 and 22 show the factory Z32 Early and Late CAS connector wire colors and location.

TABLE 1 - BDE harness adapter wire color identification

CRANK SIGNAL	WHITE
CAM SIGNAL	GRAY
12V	RED
GROUND	BLACK

TABLE 2 - Z32 CAS connector wire color identification (stock CAS disc)

	Z32 EARLY CAS	Z32 LATE CAS
1° SIGNAL	GREEN/YELLOW	WHITE
120° SIGNAL	GREEN/BLACK	BLACK
12V	BLACK/WHITE	BLACK/WHITE
GROUND	BLACK	BLACK/SILVER

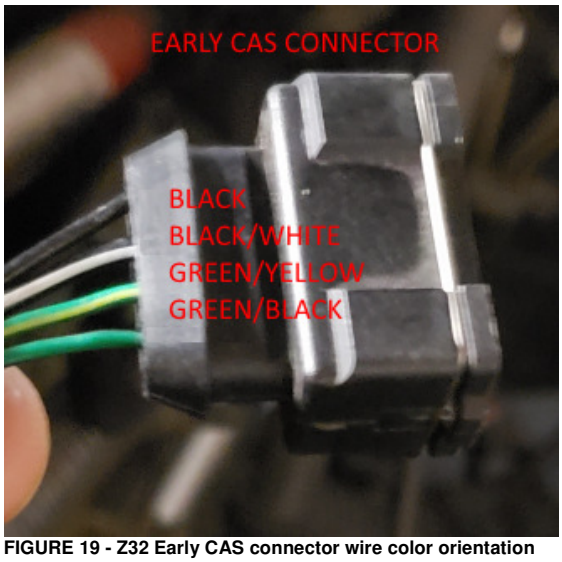

FIGURE 19 - Z32 Early CAS connector wire color orientation

FIGURE 20 - Z32 Late CAS connector wire color orientation

1. After you have identified the wire color orientations, install them into the CAS connector until you hear each terminal "click" as it is locked in place.

   - The Late CAS connector terminals have tabs on one side only and must be properly rotated so the tabs engage the locks in the connector. The Early CAS connector has tabs on both sides and will lock in place regardless of rotation.

   - The Early CAS connector is a bit more difficult to install by pushing the wires and it helps to grab the terminals with a pointed nose pliers from the other end and pull them into place.

2. Slip the single crank sensor end of the harness (see figure 22 below) behind the engine coolant inlet/outlets down to the crank sensor and plug both together.

3. Route the remaining length of the wire harness along with the coolant temperature sensor wires (see figure 22 below).

4. Plug in the cam Hall sensor.

5. Plug in the CAS adapter to the engine wire harness.

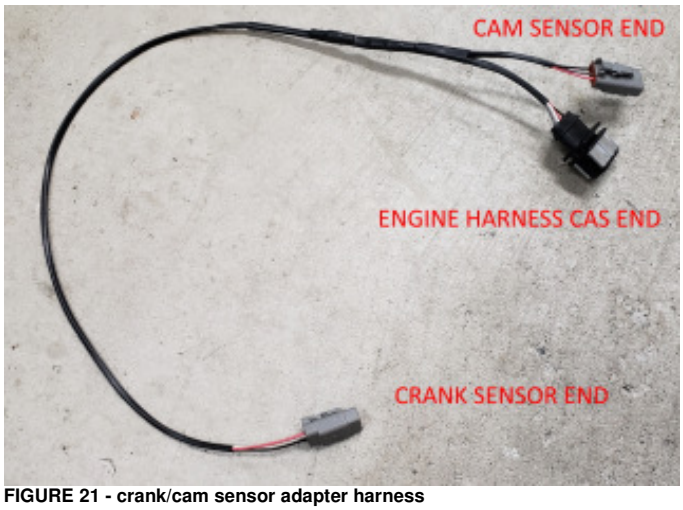

FIGURE 21 - crank/cam sensor adapter harness


FIGURE 22 - sensor adapter harness installed

CAUTION, IF YOU USED A SOCKET AND BREAKER BAR TO MANUALLY ROTATE THE ENGINE DURING INSTALLATION, REMOVE THEM BOTH BEFORE PROCEEDING ANY FURTHER!!!!

Timing Light Hookup

For timing accuracy, BDE advises all inductive timing light hookups to be triggered off of the spark plug side of the coil - **do not use the signal wire of the coil's electrical connector to trigger an inductive timing light. Due to the dwell time it will not be accurate, especially when testing for timing drift at higher RPM.**

ECU Setup / Timing Sync

If you have a higher-capability ECU that may be equipped with internal pull-up resistors, **you will need to disable the internal crank/cam sensor pull-up resistors** (this is typically a user-selectable option in the ECU software's crank/cam trigger setup).

BDE advises you to refer to your ECU manufacturer's setup instructions to sync the physical timing with the ECU.

If no timing sync instructions are available, then at a minimum you should:

- disable the injectors via your ECU's software prior to cranking the engine.
- lock the timing to a set position such as 0° (most ECU software has a tool for locking the timing during the setup process).
- attach your timing light pickup to the spark plug side of the #1 coil.

You will need a second person to crank the engine over with the starter while you operate the timing light. If you have locked the timing at 0° via the ECU's software, then you will need to adjust the **Ignition Sync** (AEM) or **Trigger Angle** (Haltech) until the 0° or TDC mark on the damper lines up with the 0° mark on your engine's timing indicator.

Wasted Spark Timing Sync

The following only applies to wasted spark setups with individual cylinder ignition timing trims, such as was available with the AEM S1. Wasted spark setups will fire each coil twice for every 720° engine cycle (#1 coil fires for #1 cylinder and 360° later for #4 cylinder, of which both coils are paired in the ECU for wasted spark) and the engine will run regardless of if you have the timing synchronized to the TDC compression stroke of cylinder #1 or TDC of it's exhaust stroke. The only problem with this scenario is if the timing isn't synchronized to the #1 TDC compression stroke, the numbered individual cylinder timing trims will never go to the correct cylinder numbers.

To ensure you are syncing to the true TDC compression stroke for #1 cylinder and not the TDC exhaust stroke:

1. Turn off coil #4 (in the AEM software options/coil set "Active" to not checked)
2. Disable all fuel injectors
3. Lock the timing in the ECU setup to 0°
4. Remove the cover on the BDE cam sensor housing
5. Sync the TDC mark on the damper to the 0° mark on the engine timing indicator
6. While cranking the engine, point the timing light at the cam sync hub to see where it's tooth location is when the timing light flashes. #1 cylinder TDC compression will have the cam sync tooth pointing at 10 to 11 o'clock when the timing light flashes - anything different is not #1 TDC compression.

Cam Signal Position Setup

The very reason we are moving the crank trigger signal away from the cam and onto the crankshaft is due to timing belt elasticity and other mechanical harmonics in the cam timing system which allow the camshaft position to move around relative to the crank position. As much as 7° of movement between the cams and crank has been measured on the VG.

With a crank trigger, the cam signal is now physically separated from the crank signal, and the cam signal can still move around relative to the crank under different operating conditions. If the cam signal is set too close to a crank signal, it could possibly occur on the opposite side of the crank signal it has been synced to, causing loss of timing sync.

A 12+1 crank trigger should have the cam signal positioned to occur close to the middle of two crank signals to prevent loss of sync. Setting the cam signal close to the middle will give a safe operating window of roughly ±15° for the cam signal to work within which is more than enough to accommodate what has been measured on the VG.

To set the cam signal to the center of two crank teeth:

1. With the injectors disabled, timing locked in the ECU, and synced to 0°, have someone help you to crank the engine with the starter.

2. Loosen the cam sensor housing bolts so it can rotate and then turn it clockwise while cranking the engine and watching the timing light until you see the timing jump away from 0°.

3. Stop cranking and use some masking tape to mark the sensor housing location to the timing cover where this happens.

4. Crank the engine again while watching the timing light and rotate the sensor housing counter-clockwise until you see the timing jump away from 0° and mark the housing to the timing cover where the timing jump occurs.

5. Rotate the cam sensor housing to be in the middle of the two marks and tighten its bolts.

The cam signal position for a 36-1+1 setup has more leeway and its only requirement is that it must not occur when the missing tooth section is passing the crank sensor. If you find your 36-1+1 setup is losing sync, change the cam sensor trigger edge in the software or rotate the crank trigger wheel 120° on the damper and go through the timing sync process again.

Note - if you have adjustable exhaust cam pulleys and you adjust the cams after positioning the cam signal, this will change the cam signal location at the same time, and you should rotate the cam sensor housing by the same amount of cam adjustment and in the same direction to keep the signal positioned close to as setup above.

Timing Drift Correction

After you have completed the timing synchronization - In the software, keep the timing locked, set the locked timing to 15°, enable the injectors, and start the engine. Check the timing while the engine is idling to verify you have 15° on the damper aligned with the zero mark on the stock timing tab (or the ATI 0° mark is aligned with the 15° mark on the stock timing tab).

Slowly rev the engine while using the timing light to check if the timing remains at 15°. If it changes with increased RPM, you need to adjust the **Pickup Delay Comp** (AEM) or enable the

TDC Offset Angle Table (Haltech) and enter values into it to keep the timing the same at increased RPM as the software locked value of 15°. If you have another brand ECU, you will need to consult with the manufacturer about how to correct for timing drift.

- Timing drift with a crank trigger is **not** caused by timing belt stretch or any other mechanical harmonics in the cam timing system.

- Timing drift is caused by the time it takes for a signal to be generated by the sensor, the signal to be read by the ECU, and then the ECU to initiate a spark event at the coil. This is not unique to the BDE crank trigger, it is present in every ECU controlled ignition system and the time delay can be different for every installation - so, it should be adjusted in your ECU's software to ensure your engine gets the exact timing that is programmed for all RPMs.

- Timing drift at increased RPMs is a linear function. In other words, if the timing changes by ±2° between 2000 and 3000 RPM, then the timing will change an additional ±2° for every 1000 RPM increase and you can extrapolate the numbers to fill into the Haltech **TDC Offset Angle Table** for higher RPMs (the AEM **Pickup Delay Comp** builds a similar table internally based upon the single input). So, you do not necessarily need to free-rev your engine to maximum RPM to verify the timing doesn't change at the outer end of the RPM range. If you get it adjusted to be the same at 1000 and 4000 RPM, due to the linear function, you can be reasonably assured the timing will be the same at higher RPMs as long as you have set the table to correct linearly to your maximum RPM.

If the ECU and physical timing agree at idle and increased RPMs, congratulations you have successfully and completely synchronized your timing with the BDE crank trigger. Unlock the timing in the ECU and go enjoy your hard work.

ECU Compatibility

Stock ECU or Nistune equipped stock ECU - Not compatible

AEM S1 and S2 (PNs: 30-1620 and 30-6620) - 12 or 36-1 tooth crank trigger wheel capable.

AEM Infinity - disable internal pull-up resistors, 12 or 36-1 tooth crank trigger wheel capable.

Haltech Platinum PRO Plug-in (Part Number: HT-055107) - 12 tooth crank trigger only.

Haltech Elite 2000 and 2500 (PNs: HT-151259 and HT-151359) - disable internal pull-up resistors, 12 or 36-1 tooth crank trigger wheel capable.