I N S T A L L A T I O N I N S T R U C T I O N S

103033 TIMING COMMANDER™ Interface Gauge Ver 7

This product is designed to interface with the airtemp (IAT) sensor in your vehicle AND your tuner software to permit manual ignition timing adjustment to the engine. Using the scaled "Airtemp vs. Timing" table in your software, you can easily add or subtract ignition timing using the 16 position selector switch located on the face of the gauge.

Simply stated, the product tells the ECU to look at inlet air temperature values (resistance that equates to temperature), and the tuner software tells the ECU that, at a desired "air temperature", to either add or subtract ignition spark timing at that particular temperature. In "TIMING" mode, the gauge displays anywhere from a negative (reduction) value to a positive (addition) value and shows the degree designation. In "NUMERIC" mode, the numbers read from 016 to 001, with 016 being the highest timing addition, 001 being the greatest timing reduction. In "DEG C" mode, it displays equivalent air temperature in Centigrade, and in "DEG F" mode, it displays in degrees Fahrenheit. The actual timing added or subtracted is up to you. For example, even though the gauge indicates 6 degrees of added timing, you may choose to only add 4 or 5 degrees at that switch selection. Since it is a "dumb" gauge, it doesn't know what your modified choices are; you make the call by editing the timing table.

The 16 positions of the selector switch essentially feeds a resistance to the ECU Airtemp input which corresponds to theoretical air inlet temperature. The display on the gauge is set from the factory, via jumpers on A+C and B+D, to display -8° to 7° depending upon the position of the selector switch. You can change the jumpers to suit your preference of the display, noted later in this instruction sheet.

IT IS VERY IMPORTANT TO REMEMBER THAT THIS GAUGE IS A "DUMB" GAUGE; IN OTHER WORDS, IT WILL ONLY EXHIBIT POTENTIAL DEGREES OF POSITIVE OR NEGATIVE TIMING, AND ONLY PRODUCE AN OUTPUT LINEAR WITH THE OPERATING RANGE OF THE AIR TEMPERATURE SENSOR. THE TUNER SOFTWARE YOU ARE CURRENTLY USING REQUIRES ADJUSTMENT OF TABLE VALUES IN ORDER FOR THE GAUGE SETTING TO BE EFFECTIVE WITH REGARD TO ACTUAL SCALING OF TIMING VS. ENGINE LOAD. THIS DOCUMENT WILL SHOW EXAMPLES OF "TYPICAL" TIMING TABLE VALUE MODIFICATIONS. IT IS HIGHLY RECOMMENDED THAT THIS MODIFICATION BE DONE BY PERSONNEL WITH COMPLETE UNDERSTANDING OF THE MODIFICATION NECESSARY FOR CONTROL USING THIS PRODUCT. TO CHECK YOUR WORK, YOU MUST USE A SCANTOOL TO CHECK YOUR RESULTS. WE RECOMMEND STARTING WITH SMALL INCREMENTS AND WORKING UPWARDS FROM THERE.

Due to the nature of this product and potential misuse or misunderstanding of its operation, Casper's shall not be liable for consequential or actual damages resulting in the use of this product*. In plain english, do not attempt to install or modify your timing tables unless you FULLY understand what you are doing; if you don't know, ask someone who does.*

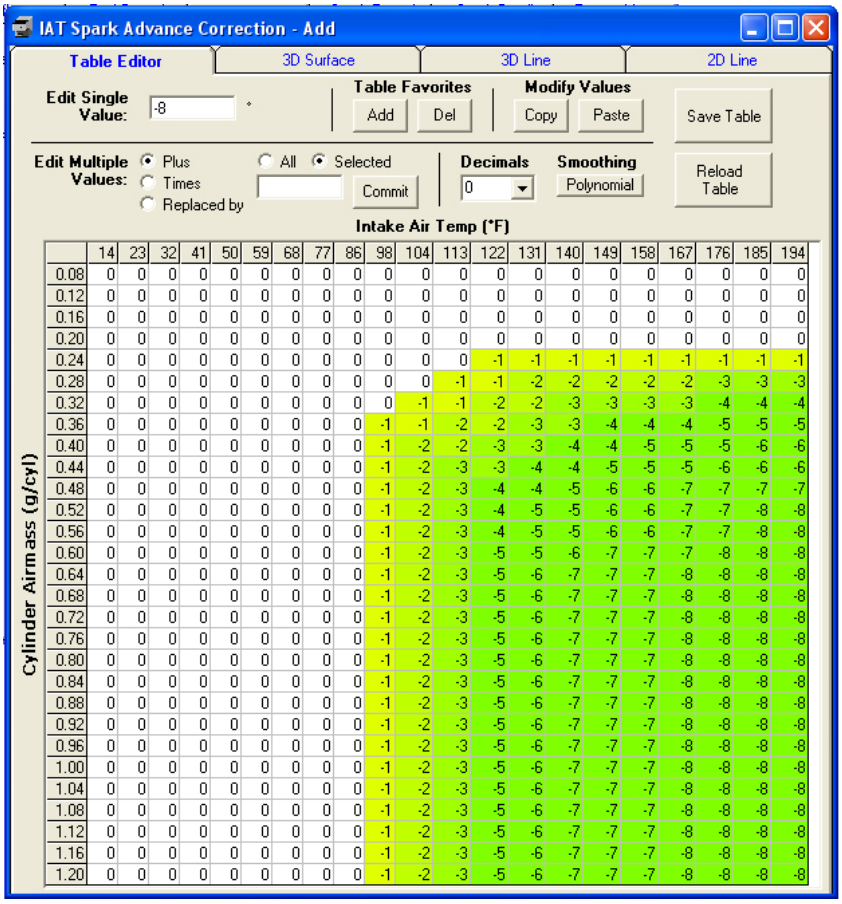
Here is how the gauge works: In your engine, there is an air temp sensor located in the inlet air stream which senses outside air entering the engine plenum. Because air contains more oxygen when it is colder, less when it is warmer, the engine normally needs to know how much oxygen is available for combustion. When there is less oxygen as in a warmer climate, combustion becomes leaner, making the engine more prone to detonation. The scaled table in your ECU takes into account the theoretical lack of oxygen in the air stream, and reduces timing from the equation when the engine senses higher temperature. As the inlet temperature increases, the table reduces the timing by degrees.

That's what happens with a factory stock engine. We are going to scrap that concept in favor of CONTROL. With a combination of hardware and software, we can CONTROL the timing. Since spark timing equates to torque, the more timing advance, the greater the torque; until the engine detonates, where the power is greatly reduced. The idea is to provide as much timing advance at wide-open throttle as feasable without detonating the engine. We control detonation by using higher octane in the fuel, keeping the engine cooler, and reducing exhaust temperature and backpressure by opening up the engine exhaust system with larger diameter tubing and high flow components.

The air temperature sensor as described previously is basically a temperature sensitive resistor. The resistance values of the sensor generally range between 100,000 ohms (cold) to 330 ohms (hot). The Timing Commander™ is a "resistance decade" device that ranges from 100,000 ohms to 330 ohms, and at the same time, provided a digital display to show 7° at 100,000 ohms all the way down to -8° at 330 ohms. This equates to -40 deg. C/-40 deg. F, to +80 deg. C/176 deg. F, or 016 numeric (maximum timing) to 001 numeric (minimum timing) respectively. These user-selectable display values are programmed into the product, and it's up to you, using your tuning software, to determine exactly how much timing you want the product to control. By feeding this data into the ECU, you will use the scalar table of AIR TEMP VS. TIMING to permit manual setting of pertinent ignition timing. This gives you a tremendous advantage of being able to preset spark timing under certain circumstances to provide greater power and torque. Just remember, don't overdo timing; more is better but too much is bad. Typically, you won't need more than 6 or 7 degrees of additional timing, and it works the other way too. Negative timing can be used for road trips when your octane is too low for the engine. Pulling timing with low octane gas can prevent detonation and still allow low octane to be used in the vehicle.
The following tables provide a guideline in "tweaking" the tables using editor software. Note that these are only guidelines; your actual requirements will vary based on a number of factors. This is why we recommend that you have complete knowledge and understanding of ignition timing with respect to engine performance.

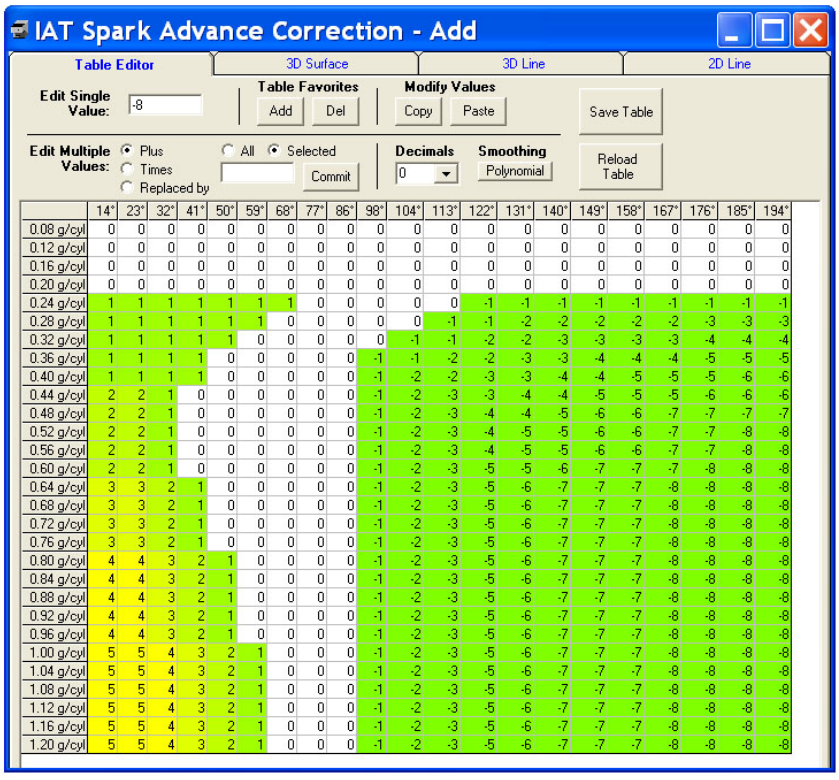
IAT Spark Advance Correction table – screen shot 2005 CTS-V

Stock Cadillac CTS-V with LS 6 engine. Note there are no Positive timing events within the timing tables at any of the temperature ranges…all colder ranges are set to zero regardless of engine load (airmass). Adding positive values in this table results in additional timing to the engine based upon selector switch setting and will provide more engine power. Looking at this factory set table, it's obvious there is a great amount of performance lost to diminished ignition timing.



	14	23	32	41	50	59	68	77	86	98	104	113	122	131	140	149	158	167	176	185	194
0.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.24	0	0	0	0	0	0	0	0	0	0	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
0.28	0	0	0	0	0	0	0	0	0	0	0	-1	-1	-2	-2	-2	-2	-2	-3	-3	-3
0.32	0	0	0	0	0	0	0	0	0	0	-1	-1	-2	-2	-3	-3	-3	-3	-4	-4	-4
0.36	0	0	0	0	0	0	0	0	0	-1	-1	-2	-2	-3	-3	-4	-4	-4	-5	-5	-5
0.40	0	0	0	0	0	0	0	0	0	-1	-2	-2	-3	-3	-4	-4	-5	-5	-5	-6	-6
0.44	0	0	0	0	0	0	0	0	0	-1	-2	-3	-3	-4	-4	-5	-5	-5	-6	-6	-6
0.48	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-4	-5	-6	-6	-7	-7	-7	-7
0.52	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-5	-6	-6	-7	-7	-8	-8
0.56	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-5	-6	-6	-7	-7	-8	-8
0.60	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-5	-6	-7	-7	-7	-8	-8	-8
0.64	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.68	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.72	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.76	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.80	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.84	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.88	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.92	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.96	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
1.00	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
1.04	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
1.08	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
1.12	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
1.16	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
1.20	0	0	0	0	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8

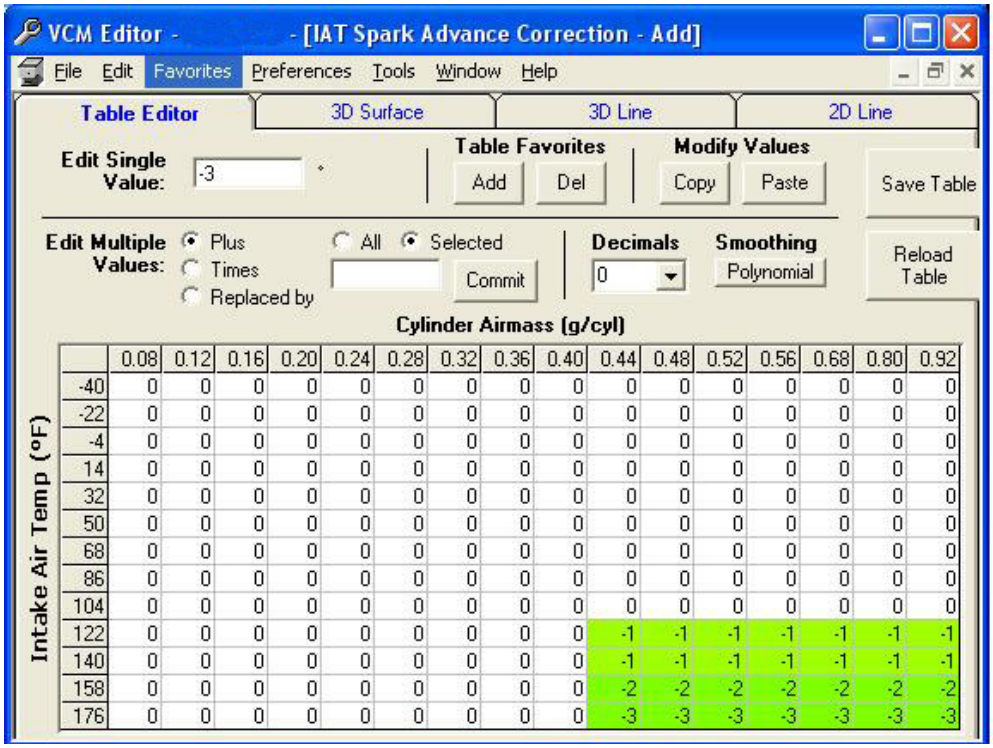
Modified CTS-V With timing advance set up to increase a maximum of 5 degrees at WOT when the gauge is set between +4° to +7° Note that the timing will be as much as -8° when the gauge display reads -7°.These values limit the maximum timing to below the commanded maximum timing for this particular application. Also note that you can't induce more than 5 degrees of timing even though you could set the selector switch to 6 or 7 degrees. This keeps the maximum timing to 5 degrees.



	14°	23°	32°	41°	50°	59°	68°	77°	86°	98°	104°	113°	122°	131°	140°	149°	158°	167°	176°	185°	194°
0.08 g/cyl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.12 g/cyl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.16 g/cyl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.20 g/cyl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.24 g/cyl	1	1	1	1	1	1	1	0	0	0	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
0.28 g/cyl	1	1	1	1	1	1	0	0	0	0	0	-1	-1	-2	-2	-2	-2	-2	-3	-3	-3
0.32 g/cyl	1	1	1	1	1	0	0	0	0	0	-1	-1	-2	-2	-3	-3	-3	-3	-4	-4	-4
0.36 g/cyl	1	1	1	1	0	0	0	0	0	-1	-1	-2	-2	-3	-3	-4	-4	-4	-5	-5	-5
0.40 g/cyl	1	1	1	1	0	0	0	0	0	-1	-2	-2	-3	-3	-4	-4	-5	-5	-5	-6	-6
0.44 g/cyl	2	2	1	0	0	0	0	0	0	-1	-2	-3	-3	-4	-4	-5	-5	-5	-6	-6	-6
0.48 g/cyl	2	2	1	0	0	0	0	0	0	-1	-2	-3	-4	-4	-5	-6	-6	-7	-7	-7	-7
0.52 g/cyl	2	2	1	0	0	0	0	0	0	-1	-2	-3	-4	-5	-5	-6	-6	-7	-7	-8	-8
0.56 g/cyl	2	2	1	0	0	0	0	0	0	-1	-2	-3	-4	-5	-5	-6	-6	-7	-7	-8	-8
0.60 g/cyl	2	2	1	0	0	0	0	0	0	-1	-2	-3	-5	-5	-6	-7	-7	-7	-8	-8	-8
0.64 g/cyl	3	3	2	1	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.68 g/cyl	3	3	2	1	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.72 g/cyl	3	3	2	1	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.76 g/cyl	3	3	2	1	0	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.80 g/cyl	4	4	3	2	1	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.84 g/cyl	4	4	3	2	1	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.88 g/cyl	4	4	3	2	1	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.92 g/cyl	4	4	3	2	1	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
0.96 g/cyl	4	4	3	2	1	0	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
1.00 g/cyl	5	5	4	3	2	1	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
1.04 g/cyl	5	5	4	3	2	1	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
1.08 g/cyl	5	5	4	3	2	1	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
1.12 g/cyl	5	5	4	3	2	1	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
1.16 g/cyl	5	5	4	3	2	1	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8
1.20 g/cyl	5	5	4	3	2	1	0	0	0	-1	-2	-3	-5	-6	-7	-7	-7	-8	-8	-8	-8

IAT Spark Advance Correction table – screen shot 1998 Pontiac GTP

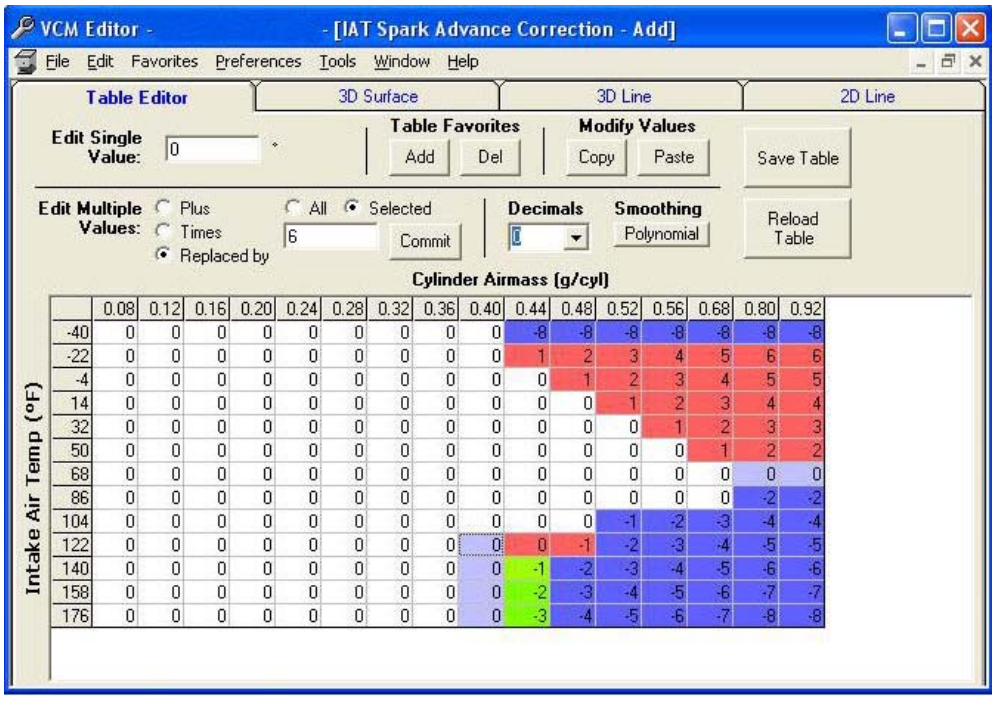
Here is a stock Supercharged 3800 table. Again, there are no positive values in the MAP vs. TEMP at full engine load.



	0.08	0.12	0.16	0.20	0.24	0.28	0.32	0.36	0.40	0.44	0.48	0.52	0.56	0.68	0.80	0.92
-40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
122	0	0	0	0	0	0	0	0	0	-1	-1	-1	-1	-1	-1	-1
140	0	0	0	0	0	0	0	0	0	-1	-1	-1	-1	-1	-1	-1
158	0	0	0	0	0	0	0	0	0	-2	-2	-2	-2	-2	-2	-2
176	0	0	0	0	0	0	0	0	0	-3	-3	-3	-3	-3	-3	-3

IAT Spark Advance Correction table – Modified 1998 Pontiac GTP

Here is an example of a modified table for the supercharged 3800 engine in a Pontiac. Note the slope added to the chart to facilitate control by the gauge.



	0.08	0.12	0.16	0.20	0.24	0.28	0.32	0.36	0.40	0.44	0.48	0.52	0.56	0.68	0.80	0.92
-40	0	0	0	0	0	0	0	0	0	-8	-8	-8	-8	-8	-8	-8
-22	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	6
-4	0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	5
14	0	0	0	0	0	0	0	0	0	0	0	1	2	3	4	4
32	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	3
50	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	-2
104	0	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-4
122	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-5
140	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-6	-6
158	0	0	0	0	0	0	0	0	0	-2	-3	-4	-5	-6	-7	-7
176	0	0	0	0	0	0	0	0	0	-3	-4	-5	-6	-7	-8	-8

***SAFETY NET* Note that the -40 range (7˚) on the gauge will default to an eight degree timing pull – simply a precautionary measure to prevent too much timing if the sensor wiring or controller goes out. The ECU defaults to -40 at this point. Note the maximum timing set to 6 degrees. You can see that if you don't require that much timing, you can set it to 5 or 4; if you require more timing, you can set it to wherever you need it.**

Timing Commander™ Conversion Table

Note that the resistance is essentially linear with respect to the switch setting and the display will increment or decrement from +7 degrees to -8 degrees (in TIMING DEG mode).

Using the display numbers as a reference, you can selectively plan your modification strategy. You don't necessarily need to program your ECU for these timing values, but rather for values you are confortable with. The gauge is programmed to display these numbers but you might choose to only program within a smaller range, i.e. -5 degrees maximum instead of the -8 that's showing on the display, or +5 degrees instead of the +7 degrees showing on the display. When making the changes to the table value, simply keep the maximum and minimum numbers inside the range you choose. The examples show "typical" numbers and even though you selected +7 degrees, the programming will only allow +4 degrees as in the examples above.

Resistance IAT Sensor	**Deg. F** C+D	**Deg. C** A+B	**Numeric** (A+B, C+D)	**Timing Deg.** (A+C, B+D)
100K	-40	-40	016	7°
56K	-22	-30	015	6°
30K	-4	-20	014	5°
16K	14	-10	013	4°
10K	32	0°C	012	3°
5.6K	50	10	011	2°
4.7K	59	15	010	1°
3.5K	68	20	009	0°
2.7K	77	25	008	-1°
2.2K	86	30	007	-2°
1.8K	95	35	006	-3°
1.5K	104	40	005	-4°
1.0K	122	50	004	-5°
680	140	60	003	-6°
470	158	70	002	-7°
330	176	80	001	-8°

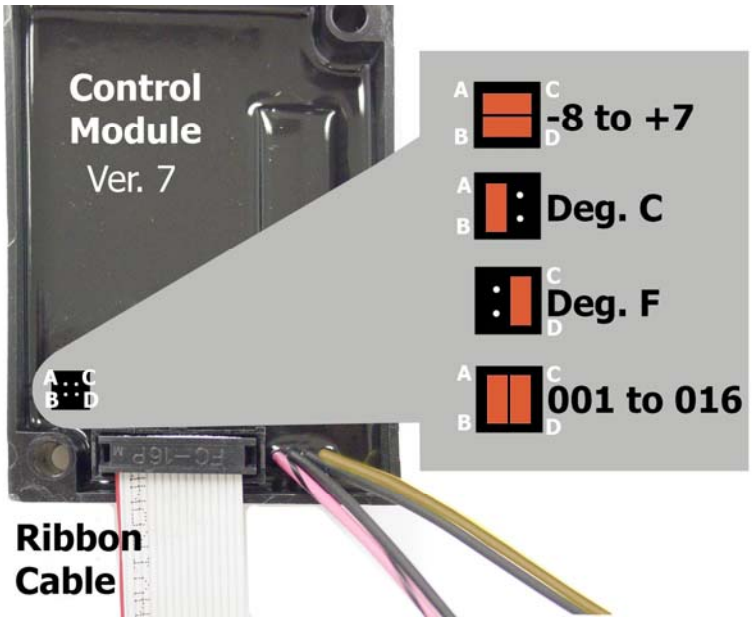
THIS CHART IS THE KEY TO MODIFYING YOUR DATA TABLE. IF YOU FULLY UNDERSTAND THIS TABLE AND WHAT IT MEANS, YOU WILL FIND IT EASY TO MODIFY YOUR SPARK ADVANCE CORRECTION TABLE. IF YOU DON'T UNDERSTAND THIS TABLE, ASK SOMEONE WHO DOES. MISUNDERSTANDING THE DATA IN YOUR PROGRAM CAN RESULT IN DAMAGE TO YOUR ENGINE!

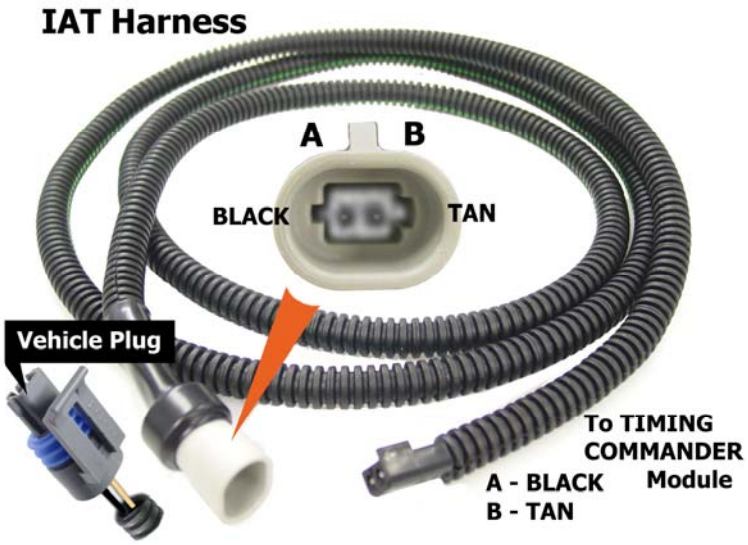
Installing the **Timing Commander™**

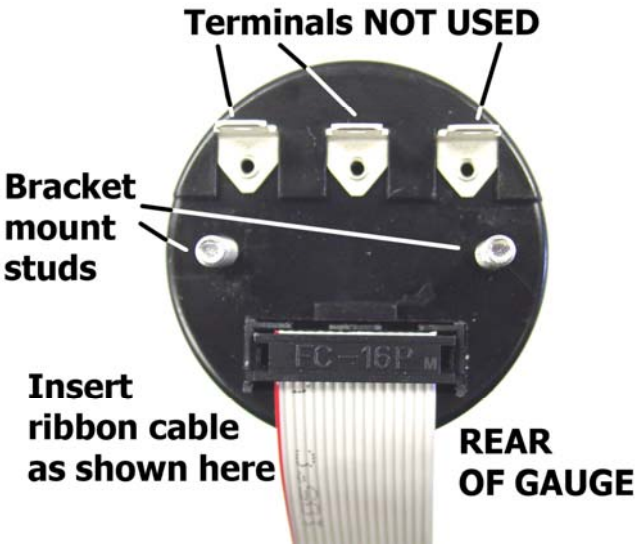
There are a total of four wires that need to be attached to the vehicle; two for 12 volt power and two for the airtemp sensor wires. The flat ribbon cable attaches between the controller module and the gauge and can only be plugged in one way because of the keying on the cable connectors.

Select a location for the gauge; it can be mounted in a standard gauge pod, 2-1/16" (50mm) opening. Select a location where the Control Module can be located within 12-16 inches from the gauge. The ribbon cable attaches between the gauge and the controller module and is limited by the length of the ribbon cable. The ribbon cable can't be installed wrong; the key on the connectors can only be inserted one way (as shown in both gauge and Control Module illustrations). The red stripe on the gray cable can be on either side of the cable; it's not important for installation. The Control Module is protected by epoxy in its own enclosure and doesn't have any specific mounting requirements.

There are four possible combinations to place the two jumpers onto the pins as shown here. This controls the way the display reads and you can choose which display you prefer. Factory setting (jumpers on A+C and B+D) will display **-8**˚to **7**˚.







There are two connectors on the controller module; one red and one black. The red connector attaches to the extension which has two wires; black and pink/black stripe. The striped pink wire (cavity A) must be attached to a switched 12 volt source, typically an accessory feed. Use a voltmeter to determine the switched voltage source, which turns off when the keyswitch is off. The black wire (cavity B) goes to battery negative and must be grounded to the vehicle frame.

The black connector has two wires; one tan and the other black. The extension for the black connector is designed to feed thru the firewall and attach to the connector that is plugged into the standard inlet air temperature (IAT) sensor. This is how the Timing Commander interfaces to the vehicles' ECU. Most vehicles use the stand-alone IAT sensor which can be identified with the use of a gray connector. If your vehicle does not have a stand-alone IAT sensor, you must cut off the gray connector on the harness in this kit, then attach the TAN and BLACK wires to the IAT wiring of the vehicle. *If you don't want to cut the connector off, a splice-in pigtail is available from Casper's.* The black (cavity A) will attach to the black IAT wire on your vehicle, and the tan (cavity B) attaches to the tan or other color wire which is the IAT signal wire. Be sure to remove the factory IAT sensor when installing this system. IT IS ESSENTIAL THAT THE BLACK WIRE FROM THE COMMANDER MATCHES UP WITH THE BLACK WIRE FROM THE VEHICLE'S IAT WIRING.

There are several ways to make the connection between the Timing Commander and the IAT sensor connector; finding the factory rubber grommet that has space in it for the pair of wires is probably the best way. When feeding the extension thru the firewall, find a grommet that the engine wiring is feeding into, and insert the extension through this grommet. If you can't find a grommet, you must make provisions to feed this wire through the firewall, by drilling a ½ in. hole into the firewall. Be sure there is no sharp metal that would cut thru the extension wires; use a rubber grommet (available at auto parts stores) if you need to make a feed-thru hole in the firewall.

Once the gauge is installed ready to test, switch on the ignition. The gauge will show values from -8 to +7 depending on the position of the selector switch. As described previously, there is a small four-pin header on the controller module that can make the display show in one of four modes; numeric (016-001), timing degrees (-8 to +7), degrees Celsius (Centigrade) or degrees Fahrenheit. The output resistance value, however, stays the same as shown in the CONVERSION TABLE regardless of which display mode you choose.