SDS CPi-2 IGNITION

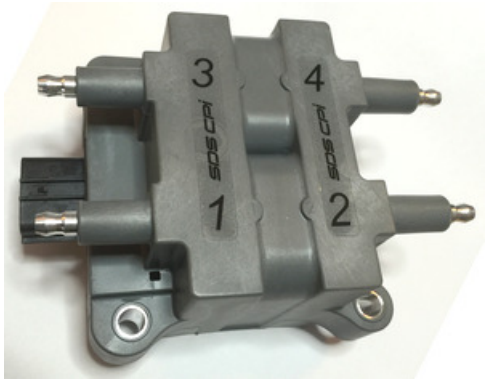
Coil pack ignition for non-certified aircraft engines with automatic battery backup.
Software version 2.8 July 17, 2025

Panel mountable Programmer & Display

Single board CPi-2 ecu

Dual board CPi-2 ecu

4 cylinder Coil pack



6 cylinder Coil pack

For 4,6 and 8 cylinder 4 stroke applications.

Please read the entire manual before beginning installation.
Any text in bold or underlined is especially important and this has been learned from feedback and troubleshooting from over 25 years in this business.

System Variations

The CPi2 is available in multiple configurations:
Single board ecu driving 1 coil pack on a single plug engine.
Single board ecu driving 1 coil pack in conjunction with a magneto or other ignition on a twin plug engine.
Single board ecu driving 2 coil packs on a twin plug engine. (redundant coilpacks, but non-redundant cpu board).

Dual board ecu for twin plug engines, with each board driving its own coil pack.(fully redundant)

System Description

The CPi2 unit is a microprocessor based ignition unit designed to trigger the supplied waste-spark type coil packs either with built in ignition drivers or ignition driver modules mounted nearby the coil pack. The CPi2 cannot drive traditional ignition coils directly without a driver module.

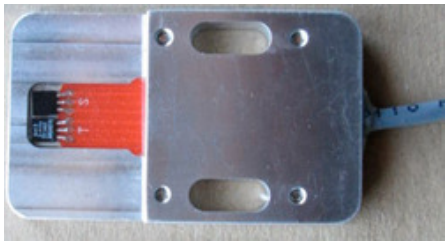
The Cpi2 can automatically switch over to battery backup power if the main 12 volts bus voltage goes above or below set thresholds, or if 12 volt mainbus power is lost.

Dual board CPi2 units have two identical boards double stacked in one box. The boards do simple communication between each board and each knows if the other goes offline and can act accordingly. Throughout the manual the two boards in the Dual board CPi2 are referred to as “A” Primary or “B” Backup. Really they both function the same at all times, and if one board fails or loses power the other board should keep the engine running. The programmer display and keypad unit can access each board in the dual board system by pressing the PROG key on the programmer unit. This is explained in greater detail later in the manual. On Single Board ecu units, the PROG key serves no function. **Dual units require you to program both the “A” Primary and “B” Backup separately and it is easy to change the “A” setting and forget to change the “B” settings, so keep this in mind when programming any changes.**

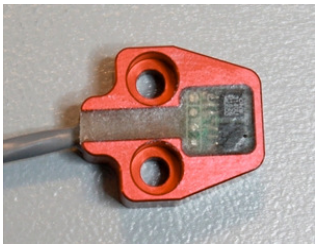
Engine spark timing is fully programmable for both RPM and load (manifold pressure or throttle position). Triggering is accomplished with magnets attached to the crankshaft and a Hall Effect sensor fitted to the engine case. As such, timing variations relating to gear lash or harmonics are eliminated. Two triggering magnets are used on 4 cylinder, three triggering magnets are used on 6 cylinder applications, four triggering magnets on an 8 cylinder. One sync magnet is also used to synchronize the computer with the engine so the computer knows which coil to fire first. As each magnet passes the Hall sensor, a pulse is sent to the CPi2. The CPi2 determines the exact rpm and manifold pressure, sums the programmed spark retard values and calculates the appropriate delay for the specific conditions at that instant, then triggers each coil to fire at the precise time. Each coil fires two cylinders simultaneously, one cylinder on compression, the other on exhaust.

Once the system has been calibrated using a timing light by setting the MAGNET POSITION value, the gauge1 screen will accurately display the actual ignition timing in degrees BTDC in real time. Programming can then be accomplished in the simplest possible terms to understand.

Hall sensor (adjustable type)



Hall sensor (non-adjustable type)



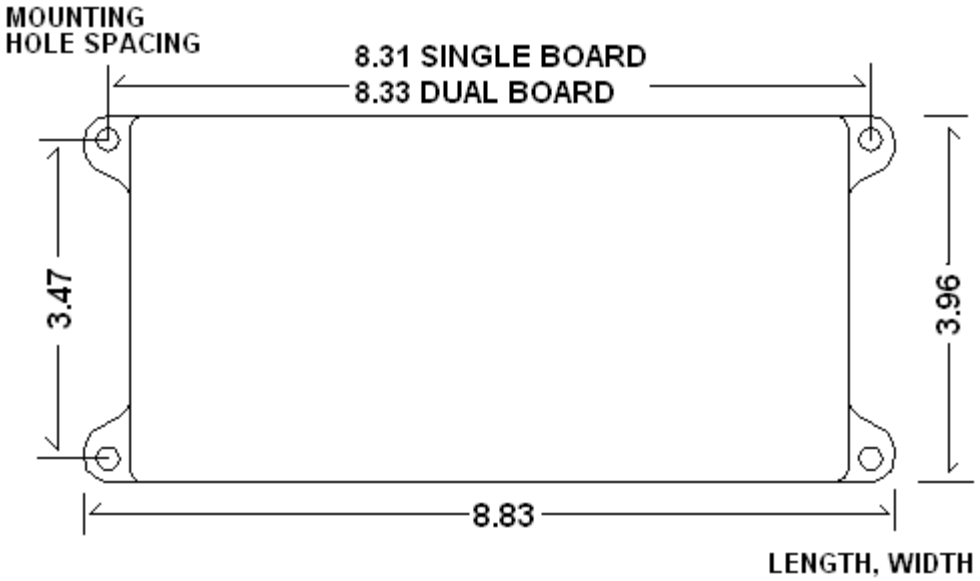
Twin Hall sensor for Dual board CPi2 units

Part 2 Component mounting and wiring

ECU Mounting

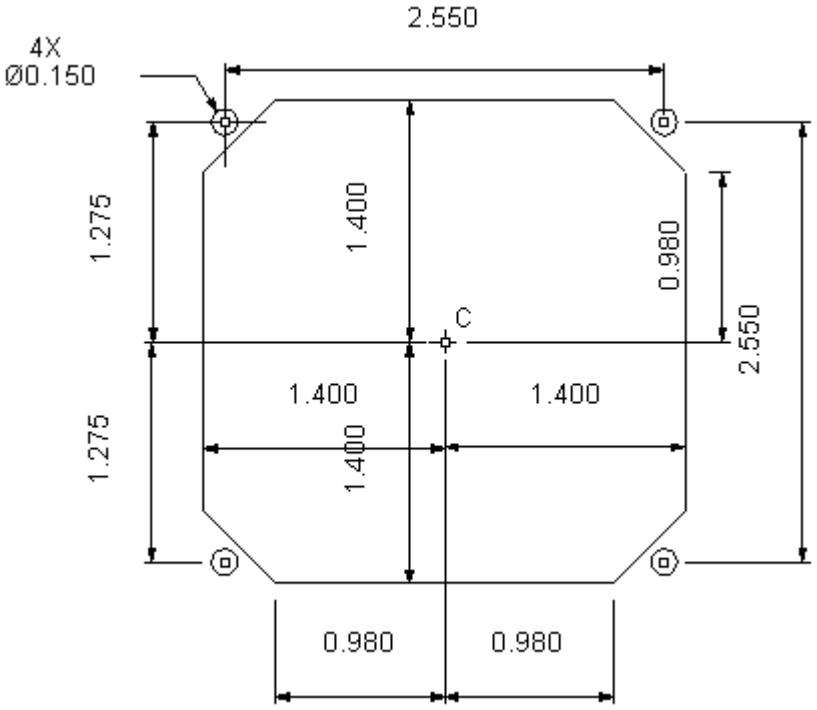
The gold ecu should be mounted in the interior of the aircraft, not in the engine bay. The ecu is not waterproof and should not get water inside. If possible, mount the ecu with the connectors facing downward, so that if water runs through the firewall and down the wiring it will drip off at the lowest point where the wiring turns upward to enter the ecu. Ecu height dimensions, Single board 1.085", Dual board 1.785". Note that the ecu has fuses on one side of it so mounting so the fuses are accessible is wise.

CPi-2 ecu dimensions:



Programmer mounting

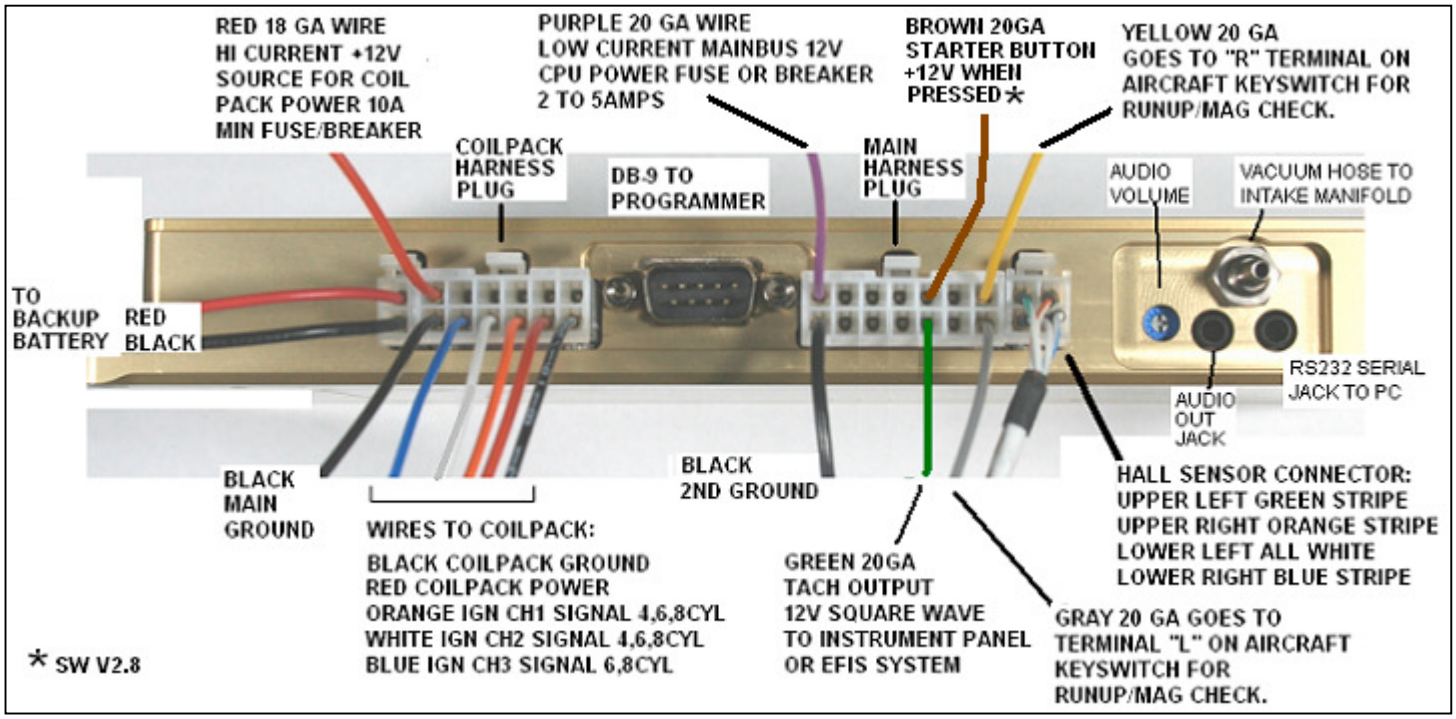
Mount this in a visible area on the panel. Its is important to be able to view the programmer in the event that there is a problem in the system. The LCD display is rated as sunlight readable, but it would still be better to have the screen shaded if possible to aid in viewing. Note the programmer has a chassis ground wire on the rear, please connect this to protect the programmer from static discharge. Damage could result without the programmer body being grounded. Allow 3.75" rear clearance from the back surface of your panel for the cable exiting the rear of the programmer. Cable exits the rear about 3/8" above the rear center of the programmer unit.



Programmer panel cutout dimensions. These are exact dimensions of the programmer so add .010 to.020" around the octagonal cutout for some clearance.

Wiring Installation and connections

Photo showing wiring connections to a Single board CPi2 ecu:

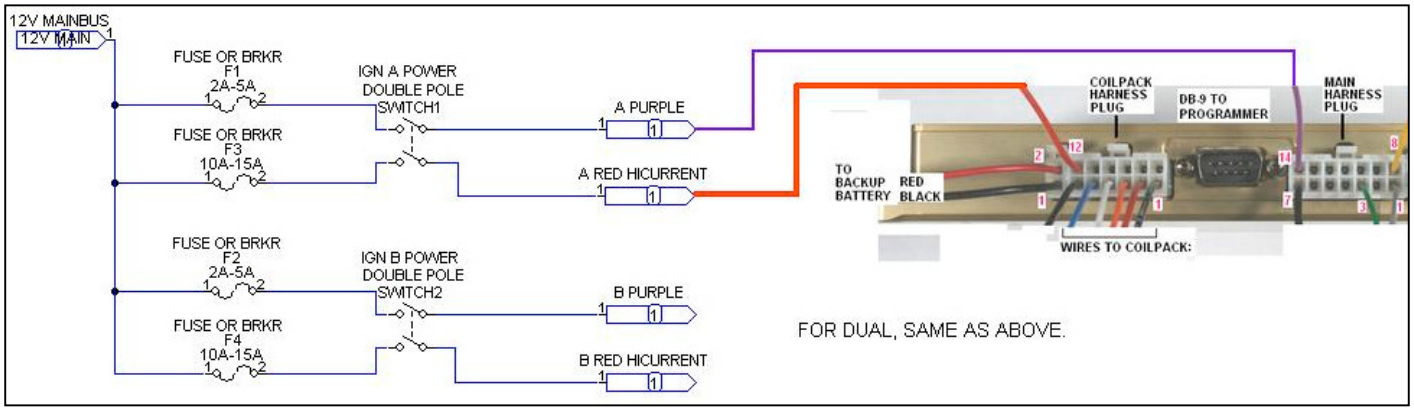


Dual board CPi2:
Like Single board details above, but times two.
New for Software version 2.8 is the brown starter wire.

Power switching +12 volt wires to Cpi2, Purple and Red wires, Breakers and Switches:

Single board CPi2: One Double pole switch and two breakers are required. 2-5A for the purple wire, 10-15A for the Red High current wire.
Dual board CPi2: Two Double pole switches and four breakers are required. 2 x 2-5A for purple wires, 2 x 10-15A for the Red High current wires.

It is important to switch both purple and red wire for proper operation and to also keep the backup battery from slowly draining current when the system if shut off. Also allows proper power-off operation.



The Purple wire on the 14 pin main harness plug is what powers the CPU circuits in the CPi-2. Having this separate power wire, switch and breaker helps provide cleaner power for the CPU. Purple wire current draw is less than 200mA.

The Red 18ga wire on the 12pin coil harness plug.

This red 18 ga wire is the high current source for coil pack power +12volts. With SDS supplied coilpacks, average current draw is less than 6 amps below 5000 rpms. We do need the 10 to 15 amp rating for a safety buffer and also because current spikes between 4 and 8 amps for a few milliseconds with each spark event. Average current draw can be higher depending on coilpack brand and the Coiltime setting, and when engine RPM's get up above 4000RPM.

*****Note***: Due to high pulsing current in the Red 18 Gauge wire it is recommended to keep this wire separate from audio system wiring and other sensor wiring in the aircraft to prevent noise coupling from the red wire into other devices. One customer reported ignition noise and by separating the red wire from audio wiring the noise was significantly reduced.**

VPX Breaker system Not recommended or Use at your own risk. Purple wire should be okay since current is low and constant. The Red Hi current wire is where the risk comes and if connected to a VPX breaker system, set this breaker as high as possible as the VPX may trip due to the current spikes that occur in the coil power circuit. Don't set the VPX for 10amps because it could false trigger. This is really just protecting against a short in the wiring. The CPi2 has coil fuses on its coil power outputs for proper current protection and also traditional fuses won't falsely blow due to current spikes, they see the average current instead.

CPi2 ECU Ground wires:

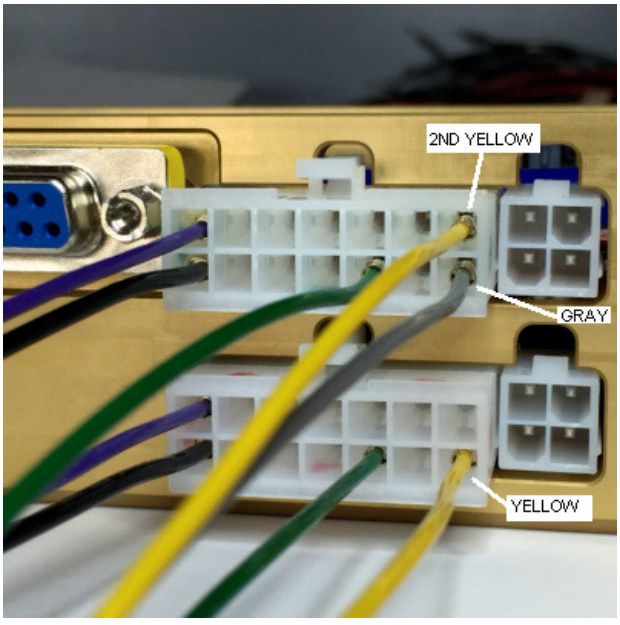
Single board there are two ground wires:
One ground on the Coil Harness 12pin plug.
One ground on the 14 pin main harness connector.
Note on Dual board ecu's there are four ground wires.

Connect these ground wires to separate ground lugs on your grounding bus for better redundancy. No need to run the ground wires direct to the main battery, unless you have no grounding bus installed. Make sure connections are good and surface is clean and free of rust or paint. Poor grounds will cause many problems and problems may only show up at higher engine rpm's, as electrical current demand increases. Do not run ground wires to the engine block.

Runup/magcheck yellow and gray wires

Single board running one coil pack: Connect only the gray wire to your kill switch. Gray wire goes to L terminal on aircraft switches. The yellow wire, don't install. Typically in this case the 2nd spark plugs will be run using magnetos or other ignition. Disconnect the old magneto kill wire off the keyswitch L and connect the CPi2 gray wire to L.

Single board running two coilpacks: Insert the Gray in the lower right corner position of the 14 pin main connector. Insert the Yellow wire in the position just above the gray wire. Connect Gray to L on aircraft key switch, Yellow to R terminal on aircraft key switch.



Dual board running two coilpacks, use this photo below:
Install yellow and gray wires as shown in the photo.

Insert the gray wire terminal into the lower right position of the **upper** main harness connector.
Insert one of the yellow wires terminal into the lower right position of the **lower** main harness connector. Insert the other yellow wire into the upper right position of the **upper** main harness connector. We need the two yellow wires connected together due to system complexity.

Note, the upper is primary closest to enclosure lid, lower is closest to the mounting flange.

Connect the Gray wire to L on the aircraft key switch, or to your toggle kill switch labeled L.
Connect the Yellow to R on the aircraft key switch, or to your toggle kill switch labeled R.
If using toggle switches the other terminal of the toggle switch

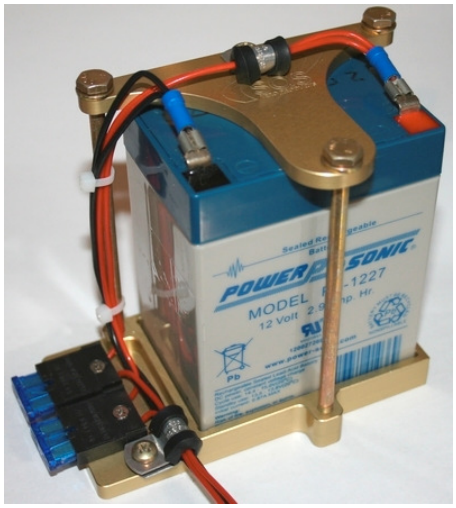
must be connected to ground.

It may be wise to mark the upper and lower main harness plugs so they do not get swapped in position if they are ever unplugged in the future.

Installations without the aircraft type key/mag switch
If you don't have a typical aircraft key/mag type switch, you can wire up yellow and gray to one or two normally open momentary push switches or toggle switches to kill ignition which will then shut down the engine. Remember turning off Mainbus power to the CPi2 just forces it over to backup battery power so your Mainbus or ecu power switch will not shut off the engine.

Engine shut down
If able the best method to shut down the engine is by cutting off fuel because this leaves the engine and spark plugs dry of fuel, versus cutting spark which will leave some wet fuel in the engine which could make restart a problem.

Optional Backup Battery mounting kit, and wiring connections
Mount the backup battery cnc holder to the airframe. The battery kit pictured here, there are 4 countersunk mounting holes in the bottom of the battery bracket using #10 flathead screws. Do not mount the battery close to a hot surface where there would be exhaust heat on the other side of the aluminum. AGM batteries can be mounted in any orientation since they do not leak. There is no need to switch the battery power to the CPi2. When the CPi2 is powered off the current drain on the battery is only 0.0000016A, on a Single board and .0000032A on a Dual board CPi2. Route the wire harness from the battery to where the ecu is located and plug it into the left side of the ecu as shown in the ecu photo below.



Using your own backup battery If you are connecting to your own already installed backup battery then you will need to mount one or two ATC fuse holder(s) close to your backup battery. One fuse holder for single board, two for dual board ecu's. Battery wiring harness-red to fuse, then fuse to battery plus, black to battery minus. For the dual board CPi2 the same applies for the 2nd battery harness. 15 amp ATC fuses should be used for the backup battery.

Battery grounding, important. If your backup battery is powering devices other than the CPi2, then you should connect the battery minus to your grounding bus or chassis ground. If the battery is only being used for the CPi2, there is no need to chassis ground the battery, as it will ground via the CPi2 ecu and harnesses.

Green Tachometer signal output wire
This wire outputs a 12 to16 volt square wave signal to drive instrument panel tachometers. Be sure your instrument can accept a 12 to 16 volt signal before you connect this wire, most should, but consult your manual.

Use the green wire from the primary main harness.
For Garmin G3X, connect to pin 8 J243, no pullup resistor is required, since there is a pullup resistor in the CPi2.
For Advanced Flight Systems 5000, Connect to pin33 electronic ignition input.
For Dynon skyview, connect to pin32 Standard RPM input wire. For Dynon, if you have removed a magneto, there could be a 30K or similar resistor installed in the wiring which they require, but for the CPi-2 you must remove this resistor since the CPi-2 tach output peak voltage is equal to your main bus voltage (less than 15). If the CPi-2 switches to backup power then peak tach signal voltage will equal the backup power source voltage.

On dual board CPi-2's the backup harness green tach wire could be used for a secondary tach or instrument panel or be unconnected. Connect to Dynon pin 33 or G3X pin 6 on J243

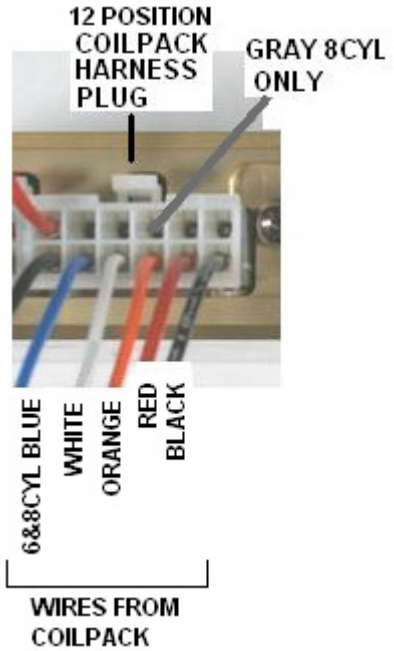
Brown wire Molex Pin10 (If software is V2.8 or newer) Optional but highly recommended.
This wire needs to see +12V when the engine is cranking. Connect to Starter button if it is switching +12V, but if the starter button is a ground switch then you will need to connect the brown wire to the starters main solenoid wire, which will provide +12V while cranking. **Make sure solenoids and contactors have diodes on them to absorb voltage spikes this prevents electrical noise problems.** This option can be retro-fitted to older Cpi-2's if these are sent in for a software upgrade. If you do not connect this wire see programming section for more information.

Programmer DB9 cable

Connects the ecu to the programmer. This is just a generic cable straight through type cable. The Dual Cpi2 unit has only one programmer cable, which is all that is needed. A switching board spans the two main boards inside the dual ecu allow the programmer to access each board separately by pressing the PROG key.

Coilpack wiring harness

Colors/function
Red supplies coilpack 12 volt power, black supplies ground, other wires are the spark signals from the ecu cpu chips. Signal wires are orange, white, blue(6&8cyl), gray(8cyl only).
When you unpack the system, these wires will not yet be installed into the coilpack harness 12 position ecu white connector. These wires will usually be 4 to 10ft in length and they need to be pushed through the firewall from the engine bay side of the aircraft, and routed to the CPi2 ecu. Route these in to verify they are long enough and then you can insert the end terminals into the white 12pin connector as shown here in the photo. Be careful the terminals won't come out without an extractor tool! When inserting terminals, crimp folds must be toward the top of connector and top is where the latch is.



Single board CPi2 driving two coilpacks, the upper row will also get the same wires from the second coil pack. Not applicable to 8cyl, only 4&6 cyl.

Dual Board CPi2 driving two coilpacks will look like the photo on both boards.

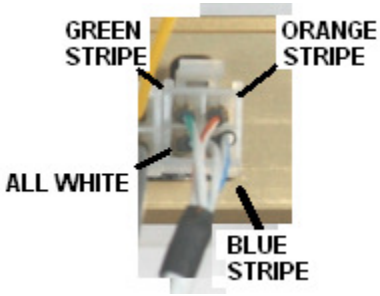
Please don't cut and install a connector at the firewall, this just adds another point of stress/failure.

Coil pack mounting

For common Lycoming and Continental installations refer to supplement manuals to mount coil packs.
Generic mounting: Both types of coilpacks pictured on the front page of the manual are able to be mounted on the engine if needed. Do not mount coil packs within 8 inches of exhaust pipes. Shield coilpacks from infrared exhaust heat also.

Hall sensor cable(s) and ecu connector

From engine bay, route through the firewall to the gold CPi2 ecu. Do not route hall sensor cable alongside spark plug wires. Keep away from spark plug wires by at least 2 inches. Keep away from hot exhaust pipes, and shield with fire sleeve if necessary to reflect infrared from exhaust. Use a grommet at the firewall and please don't cut and install a firewall connector, this just adds another point of stress/failure. Route to the CPi2 ecu and insert the terminals into the white 4-position connector as shown in the photo. Crimp folds up toward latch.



Important:

Dual board ecu's will use a dual hall sensor with 2 cables, marked as follows:
The Green hall cable will connect to the "A" Primary ecu closest to the lid.
The Red hall cable will connect to the "B" Backup ecu closest to the mounting flange.

A note about cutting off crimped on terminals

If you have a small excess of wire its much better to loop the extra length vs cutting and crimping on new pins.
We use a $350 crimp tool and other crimpers don't do the best job. Universal crimper Molex # 0638111000 is okay but you have to trim the insulation tabs of the terminals about halfway before crimping. The conductor part of the terminal will crimp good enough using the smallest opening at the tip of the crimp tool. For the above universal crimper, enter molex part number 0638111000 into Octopart.com to see who has stock and best pricing. Also good idea to use a short piece of 1/16" heatshrink on each wire of the multi conductor tefzel cables. Put heatshrink just before crimping on a molex terminal, this helps protect the wire from breaking. Soldering is actually a good option if crimping is not possible.

Vacuum hose

Route vacuum hose from engine intake manifold through the firewall to the CPi2 ecu. Supplied hose is silicone be sure it fits tight onto the intake fitting. Dual board units will need a “T” fitting near the ecu to split the vacuum signal, as only 1 hose is needed to the engine, and the vacuum signal is not essential to keep flying. If you have no central vacuum port on the intake or throttle body, you could connect the hose to primer port fittings close to the cyl head but use at least two ports to get a smooth enough signal. Use a grommet at the firewall and keep away from exhaust heat. If using an automotive throttle plate, best not to connect to the throttle body unless you are sure the vacuum port channels down below the throttle plate. On some throttle bodies the vacuum port may route to just above the throttle plate when closed and the vacuum reading will be lost at closed throttle.

Audio connection

Connect the supplied 1/8” stereo cable to your audio/mixer intercom aux input. There is a test mode for audio so you can set the volume, this is explained elsewhere in this manual. Audio will only come out 1 side of your headset. It can be made to come out of both sides, L and R, with a jumper installed inside the ecu, email us if you need to do this. For dual board ecu’s, just connect your audio cable to the Primary ecu(closest to the lid). A fault in the backup will be relayed via the Primary. In the event the Primary board is dead there will be no audio warning. You could connect the Backup to your audio system if you still have an extra audio input available.

RS232 connection

This is an optional item upon purchase. You can connect the CPi2 to a windows PC USB port to log data. We have a custom cable manufactured for this application. If you don’t have this cable, you can order it by contacting us via email or phone. 403-671-4015 or racetech1@telus.net. You cannot program the CPi2 via a PC at the present time. Logging can capture up to 4 hours of data, RPM, timing, voltages, manifold pressure etc. Also Logging will download all the settings in the CPi2 so you can view and print them.

On dual board ecu’s you can connect the cable to either Primary or Backup boards, whichever is of interest. On dual board ecu’s currently the PC logging will only download settings from the ecu board that the cable is plugged into, but a future version will download settings from both boards. This will take more development time.

ECU Fuses

In the photo showing the dual board ecu, the left side fuses are for ecu power and rating is 2 amps. The middle and right side fuses are for coil pack power, rating is 10amp. Fuse type is Blade Mini. The single board ecu only has one cpu fuse and 2 coilpack fuses. The 2 amp will blow if the internal crowbar activates when mainbus voltage is above approximately 25 volts. Coilpack fuses are there as extra defense to protect the switching circuits in the CPi2.

Part 3. System Setup and settings less likely to be changed:

It is a good idea to confirm all these settings, many of which will not need to be changed.

Min RPM (Important! new for Software Ver2.8)

Min RPM cuts off ignition sparks when engine rpms are below this setting unless you are cranking the engine. The Cpi-2 uses the brown wire input from Molex pin10 of the main harness connector to sense when +12V is seen from the starter button, then the Cpi2 will allow spark, but if the starter button is released and the engine has not started to run, sparks will be blocked while the engine winds down to a halt. This can prevent further ignition after engine cranking but with no-start result. This helps prevent kickback from a late spark with sudden engine stoppage. Important on engines with lightweight propellers. Ideally this setting should be about 20 to 50 rpm higher than what the engine cranks at. Increments are steps of 10 rpm. If starting is difficult try lowering this setting. If you cannot or do not want to connect the brown wire to your starter button, then set Min Rpm down low to 30 or 40, and you'll have ignition during cranking without the brown wire being used. If you have a Dual Cpi2 don't forget to change the "B" setting!

Molex Pin10 selection

For aircraft use Starter Butn(button) . Aircraft: do not use Knock. Starter Butn works in combination with the Min RPM setting shown above to block sparks below the Min Rpm setting when the starter button is released.

LOP MAX MANIFOLD PRESSURE

LOP, Lean Of Peak ignition advance will not occur when engine manifold pressure is higher than this setting, even if the LOP is activated and the LOP LED is lit up. Typical setting is around 25"Hg Absolute. If you don't want the Lop advanced timing at high manifold pressures then you can lower this setting some more. This effectively blocks the LOP advance at lower altitudes when at full throttle.

Of Coilpacks

New for Ver1.4, this window only appears on Single board CPi-2's. If you have only 1 coilpack then the setting needs to be **1**. If your Single CPi-2 is driving two coilpacks to run all 8 spark plugs on a 4 cylinder engine then this setting must be set to **2**. This window does not appear on Dual CPi-2's because each board only ever drives a single coilpack so there is no need for this selection in this case.

Tach Output

With Normal setting tach pulses will be 2 pulses per rev on 4cyl, 3 pulses/rev on 6cyl and 4 pulses per rev on an 8cyl engine. With 1PPR setting output will be 1 pulse per crankshaft revolution on all number of cylinders. Use the 1 PPR setting if your instrument panel tach is reading extra high RPM's.

Battery Charge

Enables or Disables Trickle charge on the Backup Battery. With our recommended backup battery this option should be set to enabled. With other batteries it could be enabled or disabled depending on requirements. If another charging method is used for your backup battery then you should set this to DISABLED.

On Dual board systems: In the Primary board, this is normally enabled. In the Backup board this will default to Disabled, as the dual board systems cannot allow both primary and backup boards to trickle charge the backup battery.

Main Battery Type

This is to select the type of main battery in the aircraft so the CPi2 knows when to switch power over to the backup battery. In the event of an alternator failure the CPi2 attempts to run on the main battery as long as possible before switching over to the backup battery. Important to have this set correctly. Select either Pb for Lead-acid or Li for Lithium Ion. The number following is Mainbus cutoff voltage when the CPi2 switches over to battery backup. Select using the plus key.

Backup Battery Type

This is the CPi2 backup battery type. Select either Pb for Lead-acid and also Pb for AGM(glass mat).
Select Li for Lithium Ion. Each has a different cutoff for trickle charging.

Mainbus Cali

No photo. If required you can use this to calibrate Mainbus voltage. Incrementing by 1 will increase the reading by 0.1 volts. To get a negative calibration, example –1, you need to enter 255. –2 enter 254 etc.

Bakbatt Cali

No photo. If required you can use this to calibrate Backup Battery voltage.

Map Cali

No photo. Offset value used at the factory to calibrate the MAP sensor. Default setting is 5 for the built in map sensor.

Config1, Config2 (no photo)

Do not change these values. This value may control various functions in software. Change only if instructed to do so from the factory.

Coil Time

Adjusts the charge time or dwell of the coils in milliseconds. Default is 3.6mS for 4cyl and 6 cyl coil pack systems. Increasing may help spark if running high boost on turbo/supercharged engines. Increasing dwell will increase current draw of the coil pack, and could cause the coil pack/ignition fuse to blow at high rpm. If experimenting with larger coiltime settings, rev the engine in neutral and monitor ignition current. One way to monitor current is to pull the coil pack fuse out and substitute your ammeter leads into the fuse socket. Fuse should be at least 50% greater amperage capacity than what you observe on the meter at redline. Too much Coiltime can cause extra heat in the coilpack. If using SDS supplied coil packs its best to just leave this at default setting especially on a normally aspirated engine. Alternate or customer supplied coils/coilpacks should be sent to us for testing to find out what COILTIME(dwell) is required, as this can be a safety issue because too much COILTIME(dwell) can damage coils and too short will produce weak spark causing misfires at high throttle. For Turbo/Supercharged engines running high manifold pressure with SDS supplied coilpacks, higher Coiltime may be needed to fire the spark, try in the 4-4.5mS range.

Coil Test

This screen turns on coil test by pressing +1, turns off with –1. Remove all spark plug wires and place them close to ground so the spark can jump.
When turned ON, 1 coil will spark every 32.7 milliseconds. **Do not turn this ON when the plug wires are connected to the engines spark plugs, because fuel could ignite in the intake manifold**. See troubleshooting section.

Err Mask, Err Mask2

No photos. These can be used to block Faults from showing. Email or phone us for help if you need to block a certain Fault. Default is 255 for both, and this allows all Faults to show and turn on the Fault LED.

RPM Err Cnt

No photo. Currently not used. Nothing to program here.

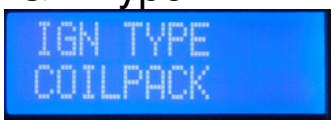
Burn

No photo. Serial number of database of software download into the CPi2. Not user programmable.

CPU Identity

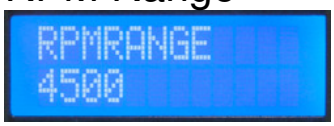
Not programmable or changeable this just displays automatic board ID in the system. Will display Single for single board CPi2, Primary or Backup will display for dual board CPi2 units. If you are not sure which type of CPi-2 you have this window will identify the system for you. If you see either Primary or Backup here then it's a Dual system.

IGN Type



For systems using Coilpack or Coil-on-plug coils this setting must be "Coilpack".
For engines using a single coil and distributor, then this should be set to "1Coil&Dist".
Note, we expect sales for distributor engines to be extremely rare.
SW older than V1.4 this was named # COILS, set to multi for Coilpack.

RPM Range



Allows selection of RPM range resolution. 4500, 9750 or 15,000 rpm can be selected. For most aircraft engines the 4500 setting will be used. For higher revving engines use 9750 or 15,000.

Number of Cyls

Number of cylinders of the engine. 4,6 or 8. Setting is locked during engine running to prevent an accidental change.

Map Type

74" HG AB will be the aircraft setting, good for normally aspirated and turbo/superchaged engines up to 74" Mercury Absolute. For automotive applications, select 22PSI for PSI boost & Inches hg vacuum. There are a variety of other settings for sensors which can be externally connected for higher levels of manifold pressure.

Gauge Diag1

This screen is used mainly for factory testing, but could also be used for troubleshooting purposes. This screen allows viewing of critical voltage levels feeding the coil packs in the system. Low voltage readings can indicate resistance in wiring or poor connections, breakers and fuses. Losing voltage to the coilpack can weaken spark so this screen could be useful in narrowing down a problem in the electrical system.

CPi-2's with serial number 30 and lower, CP should read about 10 to 12 volts higher than the power source voltage, so 24 to 26 volts is normal here. CPi-2's with serial numbers 30 and higher, CP should read about 4.5 to 5.5 volts higher than the voltage power source. This higher voltage is needed for the switching circuitry in the CPi2 unit.
CS is Coil Supply voltage from Mainbus power.
PC is voltage going out to the coil pack positive supply wire of the Primary Coilpack.
BC is the coil pack positive supply wire of the Backup Coilpack.
Only single board units will display both PC and BC readings.
Dual board systems will only show either PC or BC but not both, on the bottom line of the display. Press PROG key and look for this screen in the backup boards settings to view BC voltage.
If CS is reading zero, then there is no power source to the CPi2 units coil power section and there will be no spark. Check wiring to the CPi2, check the CPI2 fuses, and also check airframe fuses and breakers. Without coil power supplied the switching circuits in the CPi2 will switch over to backup battery to power the coilpack(s).

Rev Limiter

No photo. Cuts off spark at the setting shown. Increments are in 100rpm steps.
For Dual board systems, be sure to switch over to the B unit by pressing the PROG key, and set its setting the same as the A unit. Settings need to match if not the engine will rev to the highest setting of the two.

On Batt Coil Time

This can extend backup battery life by shortening coil dwell time when running on the backup battery. Time is adjustable but don't go too low, or the engine can misfire. Also as the main and backup batteries weaken, spark will weaken so care must be taken not to shorten the dwell time too much. Less that 2.8mS could be risky. Misfires can occur at high throttle if dwell time is too short. Also, coils not supplied by SDS may have different dwell time requirements, so if you're running an uncommon coil pack, this setting may be different from the 2.8mS default. Adjust this when doing a Battery Test run and see what the limit is when lowering the setting, but raise the setting back to a higher setting than minimum. Best tested at full throttle.

Ignition Off Setup

This feature has been deleted in SW Version 2.5 Please use Kill switches connected to gray wire on single ECU or gray and yellow wires on Dual ECU units. Window in programmer screen has been labeled "Spare Window press < or >"

Show Hidden Settings

Hides all settings above this point of the manual in the programmer, so in other words the programmer will skip over the other settings, so if you scroll left using the < key, none of the above will appear. If all above settings are not appearing then this setting must be NO so change this setting to YES to make all settings appear in the programmer.

Recommended to just leave this set to YES unless you need to access the RET-ADV/LOAD settings many times. When set to NO this will speed up access to RET-ADV/LOAD.

Values Lock

Extra protection against another person unknowingly pushing buttons on the system. Press the plus key + to turn ON Values Lock, then most values cannot be changed. **Some however, are still able to be changed in event of a system problem or emergency situation.**

5 Unlockables are:

1. ON BACK BATT COIL "B" ON(OFF)-allows you to turn back ON the B coil pack in case of poor engine performance on one coilpack, if it was set to cutoff coilpack B when on Battery power.
2. AUDIO CTRL.
3. BATTERY TEST.
4. RUNUP.
5. IGNITION OFF.

In all other windows, no settings can be changed.

Part 4. Commonly changed settings or settings you might change in flight.

Many of these screens will be used in day to day operation of the aircraft. These are all located within a few presses of the left or right arrow keys from the Gauge1 screen.

On Backup Battery LOP (Lean Of Peak) turn off or keep on

If the CPi2 goes onto backup battery power, Lean of Peak ignition advance will turn off, or stay on depending on this setting. If 12V mainbus power is restored, you would need to press the LOP key on the keypad to turn LOP advance back on again.

LCD Contrast Adjust to help visibility at different viewing angles and at different temperatures.

LCD Brightness 0 through 7, with 7 being the brightest. Settings 0 to 4 are for night time.

On Back Batt Ign Adv

This works in conjunction with another screen, ON BACK BATT COIL “B” OFF(ON). This will advance ignition timing on coilpack “A” (primary coilpack) if power is on the backup battery, and if ON BACK BATT COIL “B” is set to OFF. If ON BACK BATT COIL “B” is set to ON, then this value will display 0 instead of 5 so in other words no ignition advance will be added because COIL”B” will keep running on if the system is switched onto the Backup Battery. Extra advance can help with engine power when on a single spark plug.

On Back Batt Coil “B” OFF(or ON)

Only useful for CPi2 systems with two coil packs. If the engine will run ok with just one set of plugs, then you can set this setting to OFF, then Coil B will turn off if the CPi2 loses Mainbus +12V power. This would extend the backup battery run time by only having to run one of the two coil packs. Works in conjunction with another screen called ON BACK BATT IGN ADV, which will advance timing on primary coil pack to help engine power when running on a single spark plug.

Audio Control

The CPi2 system will output a beep warning sound out of the 3.5mm audio output jack whenever there is a fault. Frequency of the beep sound is approximately every 10 seconds, and the duration of the beep sound is 0.7 seconds. Press + key to change the setting to OFF or to TEST. OFF disables the audio beep, and the TEST setting can be used to setup volume levels and for troubleshooting an audio problem. If you have a fault occur, be sure to check the FAULT LIST window to see what is wrong. This screen is just 4 left arrow key presses away from the GAUGE screen if you need to turn AUDIO OFF in the event it becomes distracting.

Battery Test

With the engine running, this is a good way to test your backup battery performance, without having to shut off Mainbus power to the CPi2. Selecting this screen to ON BATT NOW by pressing the plus(+) key, which then forces the CPi2 power to switch over to backup battery power. When BATTERY TEST is turned on this will light the Fault LED, which is normal and also turn off the MAIN LED and turn on the BATT LED on the programmer. **Be sure to turn this back to OFF by pressing the plus(+) key again, and the Fault and Batt LED's should act as a reminder.**

Dual board CPi2's, the Primary(A) board will send a signal to the Backup(B) board to also switch over to Battery Test, so there is no need to switch over the programmer to B. With both boards doing Battery Test, you are getting a true test on both boards and both coil packs running on backup battery power.

If you see BATT TOO LOW message displayed, then this means the backup battery power is too low or not present. If you restore battery power you will need to refresh the screen by pressing the left arrow then right arrow keys.

It may be good practice to do a battery test before every flight to make sure the battery is functioning. Also you can scroll 4 > key presses to the right to view Gauge2, Mainbus and Battery voltage while its running on the backup battery, again be sure to scroll back and turn the Battery Test OFF. Also a good idea to rev the engine as high as possible when doing this test.

Ignition Off / Engine shut down

This feature has been deleted in SW Version 2.5 Please use Kill switches connected to gray wire on single ECU or gray and yellow wires on Dual ECU units. Window in programmer screen has been labeled "Spare Window press < or >"

Runup, ("Mag Check")

Pressing the plus(+) key or minus(-) keys will cut spark for 5 seconds to either coilpack. Read below for details.

For Single board systems with single coil pack: Press the plus(+) key to cut the spark to the primary coil pack., and the engine should continue to run on its secondary ignition system. There should be some rpm drop. –CUTB appears but the minus key serves no function due to only a single coilpack.

For Dual Board and Single board systems with two coil packs: Press the plus(+) key to cut the spark to the primary coil pack, and the engine should continue to run on the "B" backup board and "B" coilpack. There should be some rpm drop.
Press the minus(-) key to cut spark to the "B" coil pack, and the engine should continue to run on the "A" primary coilpack. There should be some rpm drop.
For Dual Board ecu's: There is no need to use the PROG key to switch to the "B" ecu because the "A" ecu will send a signal to the "B" ecu to cut spark for this test.

Gauge1, Live readings Map, RPM & Timing

This screen is the instrument panel of the system, showing a live reading of engine RPM's, Manifold pressure (MP) (26.6 inches Hg shown) and current amount of ignition timing on lower left line. Aircraft applications are in absolute inches mercury. Proper readings with a typical aircraft engine at idle should be around 8 to 12 inches with a prop installed.

This is the best screen to be in when flying the airplane since you can see the most important information, also other important screens nearby can be accessed with a few presses of the left or right arrow keys.

If you are in another window, pressing the GAUGE key will display this window, then if you press GAUGE again you can return to the prior window you were in before. **If you have a FAULT, press the plus(+) key in this window and see if the FAULT clears.**

V2.8+ If Molex pin10 is set for Starter Butn, the Gauge1 RPM reading will show STRT if you touch the brown wire to +12V, this can be used to check for correct function of the brown wire. Once the engine turns the STRT will change back to 500 or higher.

Gauge2, Live Voltage Readings

Reading of Mainbus 12V supply voltage and backup battery voltage.
The arrow mirrors the LED's MAIN and Batt. This is one press of the > key from Gauge1.

Fault List for CPi-2.

If you have a FAULT, press the plus(+) key in this window and see if the FAULT clears.

This window displays any Faults with the system. A maximum of 4 faults can be displayed. Some faults are latching, Fuse1,Fuse2, Map sensor and Hall sensor are latching meaning that even if the fault is only for a short time, the cpu keeps the fault code in memory so it can be seen. Press +1 key to for the cpu to try to clear Fuse, Hall and Map faults. If the fault was momentary it will clear, but if the fault still exists the fault will remain on display. Other faults like Voltages, Comms, Other will clear if the conditions change and the particular parameter is within limits.

On Dual board units you may need to Press the PROG key and check the Backup unit and view its Fault window to see what is wrong in the B board. There is limited communication between dual boards, the Primary "A" board does not know what the specific fault is with the Backup "B" board, just that there is a problem.

Fault List chart

Fault will display	**Explanation**
VOLTS	Mainbus power weak or no power
BATLO	Backup battery weak or not connected or battery fuse blown.
HALL	Check hall sensor, magnets, connections and wiring.
CHG P	Power switching circuits problem. Water inside ecu box or malfunction on board.
OTHER	Primary is seeing a fault in the backup "B" system board. Vice-versa applies.
COMMS	Dual board only. CPU boards not communicating, one may have no power.
Fuse1 or Fuse2	Problem with 10amp Coil fuses for coilpack power. Check fuses on side of gold ecu.
Map	Map sensor hit high or low voltage limits.
VCOIL	Hi current +12V power source low or not present.

If you have a FAULT, press the plus(+) key in this window and see if the FAULT clears. Fuse1, Fuse2, Hall, Map Need to be cleared by pressing the plus(+) key while in this window or the Gauge1 window

LOP, Lean Of Peak Ignition advance.

Ignition advance for Lean Of Peak is adjusted using this window. When the LOP key is pressed and the LED is lit, then there will be extra ignition advance to help power under leaner fuel running. **Note, that engine manifold pressure must be lower than the LOP MAX MANIFOLD PRESSURE setting, and engine RPM's must be 1100 rpm or higher for the extra ignition advance.**
On Dual board ecu's if you change this setting, make sure you also press the PROG key and change the setting in the "B" backup ecu so the timing matches on both the "A" Primary and "B" backup ecu's.

Knock Retard and Knock Sense

Airplanes, make sure Kock Retard is zero and Knock Sense is 1. Knock retard is the amount of degrees per knock event. Knock Sensitivity adjusts the gain of the knock sensor circuit.

Crank Retard

Extra ignition retard needed for engine cranking. This amount doesn't show up in gauge mode, but it does occur if you watch using a timing light. It helps correct timing as the engine slows under compression during cranking. This retard disappears above 120 RPM's. Keep at 15 minimum for all types of engines.

RPM Ignition

This is where the main ignition timing is programmed. There are 38 Rpm ranges in total just 4 are shown in photos above. The first 3 are always 500,750 and 1000. Above that RPM steps are in 100, 250 or 400 increments, with RPM RANGE settings of 4500, 9750, or 15,000 respectively.

Ignition Programming

Ignition timing requirements differ widely between various types of engines and fuels used so we can only offer general guidelines for ignition values. **SERIOUS ENGINE DAMAGE CAN OCCUR with improper values entered.** Excessively retarded timing can cause high exhaust gas temperatures while advanced timing can lead to pre-ignition and detonation. **Default values may not be correct for your engine!**

Ignition Advance and Retard vs. Load(manifold pressure)

These 64 settings allow programming of ignition retard or advance with reference to load on the engine. Load information is from the MAP sensor. RET refers to retard, and ADV refers to advance.

RETard reduces timing, usually done at higher MAP to prevent detonation (left photo above).
ADVance adds to your timing, usually at lower MAP to help fuel economy (right photo above).
ADVance will be added to RPM IGN, RETard will get subtracted from RPM IGN.
If too much retard is programmed, power output from the engine may be reduced significantly.
Advance may be useful to improve fuel economy. Advance can be programmed by pushing the minus key.

To the right is a generic example timing map to show how RPM Ignition and the RET-ADV/LOAD work together. Some advance is used under low MAP to help fuel economy, and some retard at high MAP to help prevent detonation. The CPi2 will read engine RPM and lookup the RPM timing for that RPM range. Next the CPi2 will read the Manifold pressure via the Map sensor, and lookup the RET-ADV for that Manifold pressure range. Software uses the RPM Ignition amount and adds Advance or subtracts Retard from the manifold chart to get the final timing.
Example: RPM is say, 1600, RPM Igniton=23, and lets say manifold pressure is at 21.9" where we have 3 deg Advance, so total timing will be 23+3Adv=26 degrees. Another example, RPM=1500, RPM Ignition=23, Manifold pressure at 38.1", 4 Ret, so 23 minus Retard of 4 = 19 Degrees total timing.

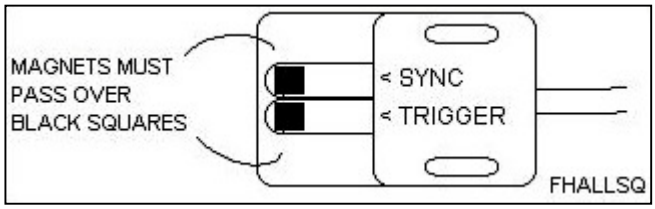
RPM	IGNITION	MANIFOLD PRESSURE	RET-ADV /LOAD
500	10	2.32	0 RET
750	15	3.52	0 RET
1000	20	4.72	0 RET
1100	23	5.92	0 RET
1200	23	7.12	0 RET
1300	23	8.22	0 RET
1400	23	9.42	0 RET
1500	23	10.6	0 RET
1600	23	11.5	0 RET
1700	23	12.7	0 RET
1800	23	13.9	1 ADV
1900	23	15	2 ADV
2000	23	16.2	3 ADV
2100	23	17.4	3 ADV
2200	23	18.6	3 ADV
2300	23	19.8	3 ADV
2400	23	20.7	3 ADV
2500	23	21.9	3 ADV
2600	23	23	2 ADV
2700	23	24.2	1 ADV
2800	23	25.4	0 RET
2900	23	26.6	0 RET
3000	23	27.8	0 RET
3100	23	28.9	0 RET
3200	23	30.1	0 RET
3300	23	30.9	0 RET
3400	23	32.2	1 RET
3500	23	33.4	2 RET
3600	23	34.6	3 RET
3700	23	35.8	4 RET
3800	23	36.8	4 RET
3900	23	38.1	4 RET
4000	23	39.3	4 RET
4100	23	40.5	4 RET
4200	23	41.3	4 RET
4300	23	42.5	4 RET
4400	23	43.8	4 RET
4500	23	45	4 RET
		46	4 RET
		47.2	4 RET
		48.4	4 RET
		49.7	4 RET
		50.5	4 RET
		51.9	4 RET
		53.1	4 RET
		54.1	4 RET
		55.2	4 RET
		56.4	4 RET
		57.6	4 RET
		58.8	4 RET
		60.1	4 RET
		60.9	4 RET
		62.1	4 RET
		63.1	4 RET
		64.3	4 RET
		65.5	4 RET
		66.8	4 RET
		68	4 RET
		69	4 RET
		70	4 RET
		71.2	4 RET
		72.3	4 RET
		73.5	4 RET
		73.9	4 RET

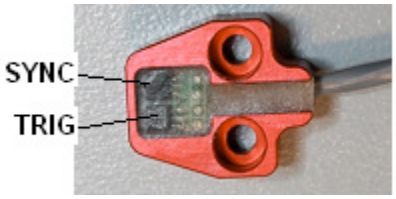
Aligning the Hall sensor and magnets
MAGNET SEEN WINDOW

Safety note, Disable power to coil pack(s) before doing hall alignment or checking.

Rotate the crankshaft very slowly by hand using appropriate tools.

LCD display, top line is used for checking trigger magnets. Bottom line is used for checking the sync magnet.





If CNC supplied brackets are used with the system, alignment is not adjustable but it is still required to verify that all the magnets are being seen by the sensor, so the ignition will operate properly. Watch for magnets installed backward which will then trigger the wrong sensor element in the hall sensor.

If the slotted type sensor is used then you will have to move the sensor inward or outward for best alignment to the magnets.

Alignment Steps for slotted type sensor:
1. Best to rotate the crankshaft so that a trigger magnet is closest to the sensor.
2. Have the mounting bolts loosened slightly and slide the sensor in or out until the window shows TRIG YES. YES means the CPi is seeing the trigger magnet.
3. On adjustable sensors, slide the sensor back and forth and try to find the mid-point where the Trig shows YES.
4. Tighten the hall sensor mounting bolts. Check remaining trigger magnets and also the sync magnet.

Each magnet should be seen for at least 2 to 3 degrees of crank rotation.
Note: This window has no use once the engine is running, since the sampling rate of the programmer is only about twice per second. You will see NO in the display when running with the rare occasional flicker of YES for a magnet being seen while software happens to be updating screen data when the magnet is over the sensor.

PROGRAMMING THE CPi-2

MAGNET POSITION, *THE* MOST IMPORTANT SETTING!

Initial Setup - VERY IMPORTANT

This is how timing is calibrated. This step requires a timing light. The best timing light to use, is one that does not have a delay knob. Delay lights may not work properly with multi-spark ignitions or with multi-coil/waste spark ignitions. If you only have a delay type light set the delay to 0. The crank pulley and timing cover must have timing marks on them. The timing light inductive pickup clamp can also be connected onto the ground wire of the coil pack unit if clipping to the spark plug wires does not work well. Magnet Position is adjustable from 50 to 110. If you find you need to exceed the limits of magnet position, then this means the magnets are mounted in the wrong locations and will need to be redone.

For **Lycoming** engines with dual board CPi-2s, set Magnet Position on the **Primary ECU (green Hall cable) to 97**, set Magnet Position **on backup ECU (red Hall cable) to 88**. On single board CPi-2s, set Magnet position to 92. On other engine types, consult the supplemental manual for specific settings for Magnet position, as this will allow the ignition timing to be fairly accurate on the first startup. On engines other than Lycoming, you still should connect a timing light to verify the timing is correct though to be safe as mistakes could be made during the magnet mounting process.

For custom installations where the installer has fabricated their own Hall mount hardware, then following procedures here are very important because ignition timing could be far from target and engine damage could occur if Magnet Position calibration procedures are not executed.

To be even more careful it may be best to disable fueling to the engine and crank the engine while watching a timing light to see if the timing is approximately correct. Somewhere between 15 degrees BTDC to 0 degrees or even if its after 0 degrees is acceptable. If you see timing more than 15 degrees BTDC then you can increase the Magnet Position number and this will move the timing closer to Top dead center which is safer for the engine.

This step should be performed as soon as the engine is fired up and idling. Ignition timing is meaningless without first setting the MAGNET POSITION parameter properly.

STEP 1. Set RPM Ignition values from 500 thru 1500 RPM's all to 10 degrees. If you have no 10 degree mark on your prop hub and no pointer you may have to make these.

STEP 2. Make sure that all IGN RET-ADV/LOAD values below 30 inches are 0.
STEP 3. Start the engine and keep it running below 1500 rpm.
STEP 4. Connect a timing light.
STEP 5. Change the MAGNET POSITION value until the timing light reads 10 degrees BTDC.

Now some people may have difficulty and say, "But I don't have a 10 degree mark, how do I line up the timing?" One way is instead to program RPM ignition numbers to zero instead of 10. Then adjust Magnet Position until the timing light is flashing at TDC. Some engines may need the throttle opened a bit more with zero degrees of timing.

Once the MAGNET POSITION is set, it does not have to be changed again- it is only to tell the ECU what the "distance" between the #1 MAGNET and Hall sensor is. Once the above 5 steps are completed, you can program any of the ignition values.

For the slotted type sensor, MAGNET POSITION may need to be adjusted if the Hall sensor is removed for engine repairs, so after it is installed again, then the above procedure should be completed, so the ignition timing is the same as before.

Important!
On Dual board CPi2 units you will have to do this for the Backup unit also, and the

Magnet Position value will end up to be different from the primary board due to dual hall sensor used on the dual board unit.

Dual Board CPi2 programming Primary and Backup boards.

Pressing the PROG button toggles back and forth from the “A” Primary, to the “B” Backup ecu.

Note the A and B LED’s in photos, left the programmer is accessing the “A” ecu board, right its accessing the “B” ecu board.

When programming timing on the Dual board CPi2, you need to have all the timing values equal in both the “A” and “B” boards. The same goes for most other settings.

For the most part once the “B” backup ecu has equal timing values to the “A” ecu, you won’t need to switch over to the “B” unit unless you make changes to timing.

On Dual board ecus the Magnet Position values will be different between the “A” and “B” units.

Source MAIN and BATT LED's on the Programmer

The Main and Batt LED's at the top of the programmer unit keypad indicate which power source the CPi2 is getting its power from.

Under normal conditions with 12 volt mainbus power turned on and above 10.2(Pb),11.6(Lithium) volts, the green MAIN LED should be lit and the BATT LED should be off.

If the Mainbus voltage falls below 10.3(Pb), 11.7(Lithium) volts, the green Main LED will turn off and the BATT red LED will turn on, indicating power is being drawn from the backup battery. This indicates there must be a problem with Mainbus power supply, either a broken connection, fuse, breaker or wiring problem or alternator/charging problem if voltage is low. Below are 4 scenarios you may see on the programmer.

Normal condition with good Mainbus voltage, and good backup battery voltage. MAIN LED lit. Batt LED not lit.

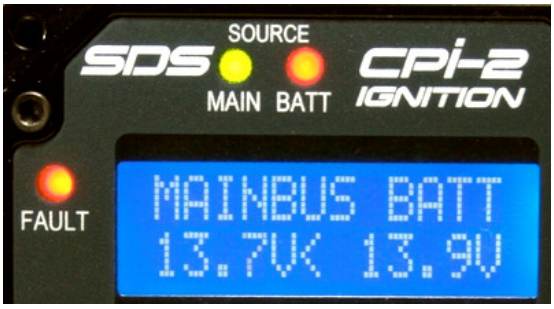
Mainbus voltage is low, but not low enough for the CPi2 to switch over to backup battery power. Fault LED is lit indicating lower than 12.5(Pb) volts on the Mainbus power source.

If Mainbus voltage is below 10.3(Pb) volts, then the CPi2 will switch over its power source to the backup battery, so MAIN led goes off, BATT LED is lit up, and Fault LED will be lit also.

Note right arrow in LCD display is pointing to 13.2 Battery side. Arrow just mirrors the MAIN & BATT LEDs.

MAIN and BATT can be lit at the same time when there Mainbus 12 volts to the cpu purple power wire, but no power to the coil power source wire of the CPi2 unit.

When there is no coil power supplied to the CPi2 then it will switch its coil pack power source over to the backup battery, while the CPU is running on Mainbus power.



If the backup battery is below 7.5 volts the CPi2 will not switch over to the backup battery.

CPi2 Power source switching and reaction to Mainbus voltage

The CPi2 has dedicated circuits to constantly monitor Mainbus voltage and will immediately and quickly switch over its power source to the backup battery if the Mainbus is below 10.3 volts with a Pb main battery, or 11.7 volts with a Lithium main battery. The CPi2 will also switch over the ignition coil +12v power to the backup battery at the same time. Switching does not interrupt the CPi2 and it will continue running without any reset and the ignition system will continue to run without misfire. Coil power is switched using the latest Mosfet technology with only 50 milliohms resistance and result is very little power loss and very little heat in the switching circuits. There is some hysteresis for the voltage switching and Mainbus must return to 11.8V(Pb) or 12.6V(Li) for the CPi2 to switch back to Mainbus power. This hysteresis helps prevents oscillation or continuous switching back and forth from Mainbus to backup battery power. If the battery voltage drops down too far though, the CPi2 will switch back to Mainbus voltage if Mainbus is below 12.5, at this point there will be some oscillation back and forth and you would see the MAIN LED flicker.

Power down of the CPi2.

Due to the ecu having its own backup battery, power down is unique on the CPi2. When you turn off Mainbus 12 volt power to the CPi-2 it automatically switches over to its backup battery. If there is no engine rpms, and no keypad keys are pressed, it will begin a power off countdown within 5 seconds, and after counting down from 10 to 0 it will shut off unless Mainbus power is switched back on. So total power off time is approximately 15 seconds.

Power up of the CPi2

The CPi2 normally powers up when voltage is present on the purple wire going into the 14 pin main harness connector. There is no supplied power on switch with the CPi2 system. The intention is for the installer to wire the purple wire to their own panel mounted power switch. There is no way to power ON the CPi2 from its backup battery.

Battery trickle charge

The CPi2 will send a trickle charge to the backup battery to keep it topped up. Normally this is enabled by default in the CPi2. If you have some other charging system onboard the aircraft for your backup battery then you should disable the charge feature on the CPi-2, this is discussed earlier in the manual in the Batt Charge section. Having two different systems charging the battery could be bad for the battery, and may also confuse the CPi2. Charge current is limited in the CPi2 circuitry so there is no damage to the battery. Charge current will be less than 100mA typically on a partially run down battery. On Dual board ecu's, the "B" backup ecu will not send any charge current to the battery, as this would cause confusion in the system.

Do not connect a dead or really discharged battery to the CPi-2 because the CPi2 will not attempt to charge a battery in a discharged condition. This is not practical with any backup battery because charge time would take a very long time and the CPi2 needs to see a battery voltage of at least 10 volts for charge system to function, below 10V charging turns off. If Mainbus power goes higher than 19 volts then charging also shuts off.

When connecting an external charger to AGM or other batteries, make sure you have the proper charger for your battery. The battery recommended to be used with the CPi2 is AGM, and these batteries require a charger that limits current to avoid damage to the battery. You cannot just bridge 12 volts over from Mainbus especially if the backup battery is in a very low state of charge as the charge current would exceed the batteries rating.

The Backup battery can remain connected to the CPi2 without any switch. Current leakage is only 1.6uA on a Single board CPi-2 and 3.2uA on a Dual Board CPi2.

Choosing your own battery.

Thinking about a lighter weight or smaller size battery? The one concern with a smaller battery is not simply the amp-hour rating but also the ability to deliver surge current required to fire the ignition coils. If two coil packs are running, the peak surge current can be around 14 amps, so running a smaller than recommended battery may be very risky as voltage will dip too low with the current surge. This can cause weak spark and worse, possible reset or shut down of the CPi2 earlier than expected.

Crowbar

The CPi2 has a built in crowbar and if Mainbus voltage goes above approximately 24 volts for several milliseconds, the crowbar will short circuit and blow the 2 amp fuse on the side of the ecu disconnecting the CPi2 from your Mainbus power. Trip time varies for the crowbar depending on how high the mainbus voltage goes. Higher voltage equals quicker trip time. The crowbar has filtering to prevent triggering from short voltage spikes.

Cpi2 Specs

CPi2 Average current draw vs Engine RPM for SINGLE BOARD ECU

Conditions, 3.6mS Coiltime, 14.25 volts supply
Unit of Measure, Amps

RPM	4cyl	6cyl	8cyl
0	0.22	0.22	0.22
1000	0.77	0.84	1.3
2000	1.8	2.1	3.4
2500	1.6	1.75	3.0
3000	1.8	2.1	3.4
4000	2.4	2.7	4.6
5000	2.9	3.3	5.6
6000	3.5	3.7	6.8
7000	4.0	4.7	7.8

If you have a DUAL BOARD CPi2,
then double the above current.
Software execution varies the coiltime
sowewhat in the 1500 to 2500 rpm range.

Data includes the programmer/keypad display unit. Cpu & programmer current draw is .22A with the engine not running. Allow for an extra .15A draw to supply trickle charge current to the Backup Battery. Above test was done with Backup Battery disconnected.

First Run Checklist

Verfiy engine shut down will function correctly.
Must do if you have wired a kill switch to the yellow and gray wires.
Power up the CPi2, but don't start the engine yet.
Find the RUNUP screen then activate your kill switch(es) and in the Runup screen it needs to show CUT COIL A&B like in this photo. If not check wiring and switch type. If you still have one magneto then you will just have one kill switch wire, gray, and this screen only needs to show CUT COIL A.

Verify no black wires are unconnected on the 12 and 14 pin harnesses, these need to be grounded. Its possible to miss a ground wire and the CPi2 still appears to function just fine.

Verify that the Purple wire goes to a low current 12 volt source. Check breaker/fuse rating.

Verify that the Red wire from coil harness goes to a high current 12 volts source. Check breaker/fuse rating.

Verify Spark plug wire resistances are less than 1000 ohms if using MSD red spark plug wire.

Resistor type spark plugs are installed.

Verify plug wires, cylinder numbering, firing order.
Dual Board ecu's verify hall sensor cables are correct to primary and backup. Green closest to lid, red closest to flange.

Start the Engine and connect a timing light, read and follow the Magnet Position information and procedure.
On Lycoming and Continental engines we may provide known Magnet Position values if the CNC hall sensor brackets were shipped with your CPi2 kit. If you did your own hall sensor mount you need to do the Magnet position procedure with a timing light. Important so timing is calibrated. Uncalibrated timing can destroy your engine.

Once timing is verified you can program specific timing values for your engine. Scroll with the left or right arrows until you find RPM IGNITION and use plus and minus keys to change the timing in each RPM Ignition window to whatever is required.

Run engine RPMS as high as possible either tied down or on the brakes.
While running the engine, test other electrical systems in the airplane, things like adjustable prop pitch, and anything drawing high current or any devices using a solenoid or DC motor to see if these interfere with the CPi2. Inductive loads may cause electrical noise, so switch these devices on and off many times during your test.

While running the engine test the radio and make some test audio transmissions to see if there is any effect on engine running, and watch Gauge1 screen and Gauge2(voltage) screens for erroneous readings during radio transmissions.
Do a high speed taxi test to get RPM's to maximum possible, this is to test that you don't blow any breakers or fuses. Best to do the preflight checklist also especially the Battery Test part of it to prove the backup battery will perform.

Preflight checklist

1. Press the GAUGE key after powerup.
2. Check voltages MAINBUS BATT Press > once from Gauge1.
3. Start the engine.
4. Runup, Press < once from Gauge1 screen. Do runup test by pressing plus key, wait 5 seconds press minus key.
5. From Runup screen Press < twice.
6. Battery Test, press + key to make the CPi2 run on battery backup power, then press minus key to change back to mainbus power. Best to rev the engine as high as possible on backup battery to check that your backup battery is delivering required current.
7. If any RED LED's are lit don't fly. See FAULT screen to investigate.
8. Have a printed copy of CPi-2 Fault codes section of this manual. Know how to clear Faults.

RED LED's, Fault or Batt lights up while in flight

Make a plan to land as soon as possible.
Find the Fault screen, which is just two > key presses from Gauge1 screen.
Press +1 in Gauge or Fault screen to attempt to clear the Fault.
Note what the Fault was and if it clears or not. If the Fault clears it may be ok to keep flying but if the Fault occurs again or will not clear it is best to land the airplane as soon as possible to investigate the cause.

Annual maintenance

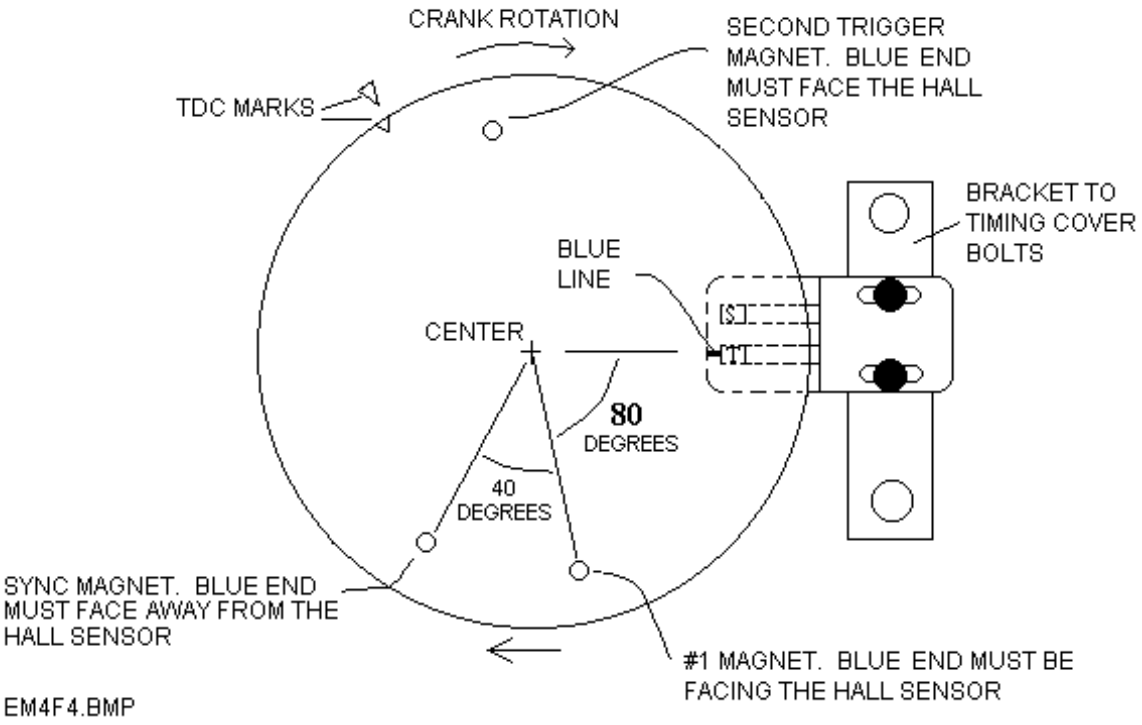
When doing spark plug checks it is a good idea at the same time to check spark plug wire resistance, should be less than 1000 ohms for each plug wire. Reading may vary some due to carbon based coating on the surface of the plug wire copper conductor. Higher than 1000 ohms and the plug wire should be replaced or both crimp terminals re-crimped or replaced. Usually a bad wire will still give a reading but if resistance is too high it would be risky to continue using the plug wire and it could be arcing inside the boot and may cause misfires at high power, but idle just fine, not a good situation.

Do a visual check of all wiring where wires enter the white connectors at gold ecu. Look for broken or frayed wiring. Check ground bus connections for tightness and if any corrosion. Check power wire connections to your power switches for loose screws or loose crimp connections.

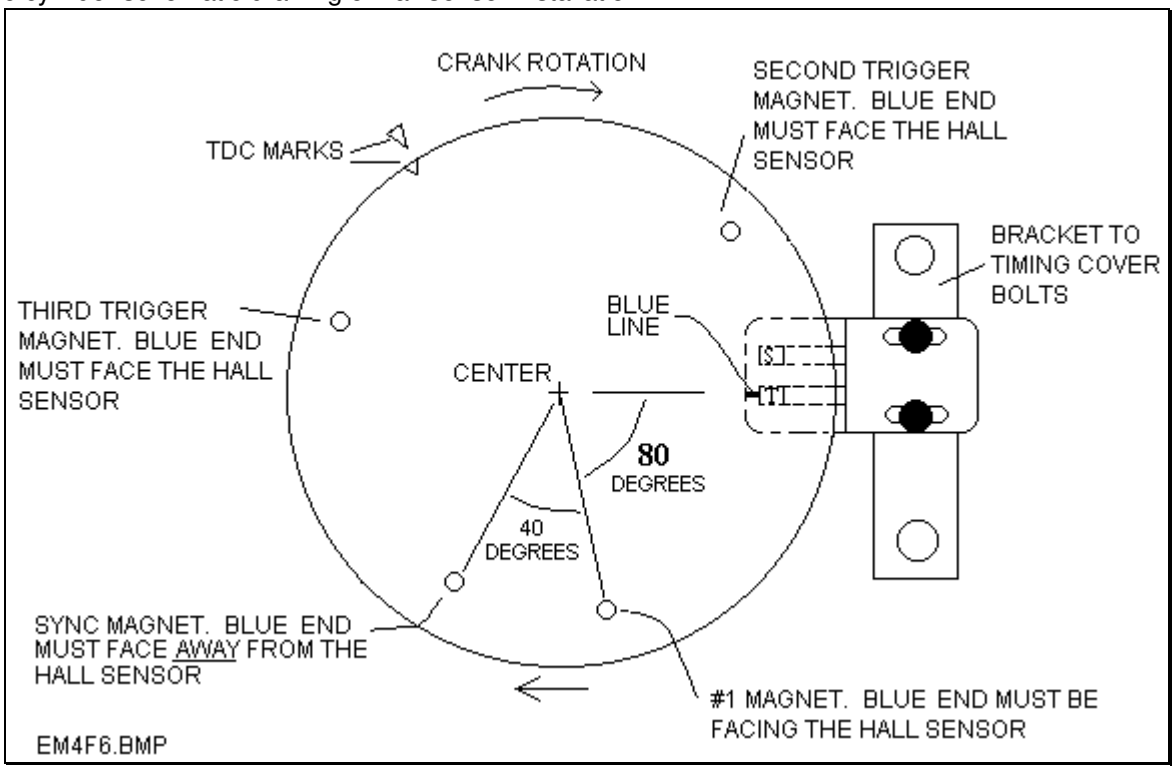
Check hall sensor wiring for physical damage where it passes through bulkheads, baffling or firewall.

Generic Hall sensor and Magnet installation diagrams.
If you have a Lycoming consult our special supplement instead of these diagrams below.

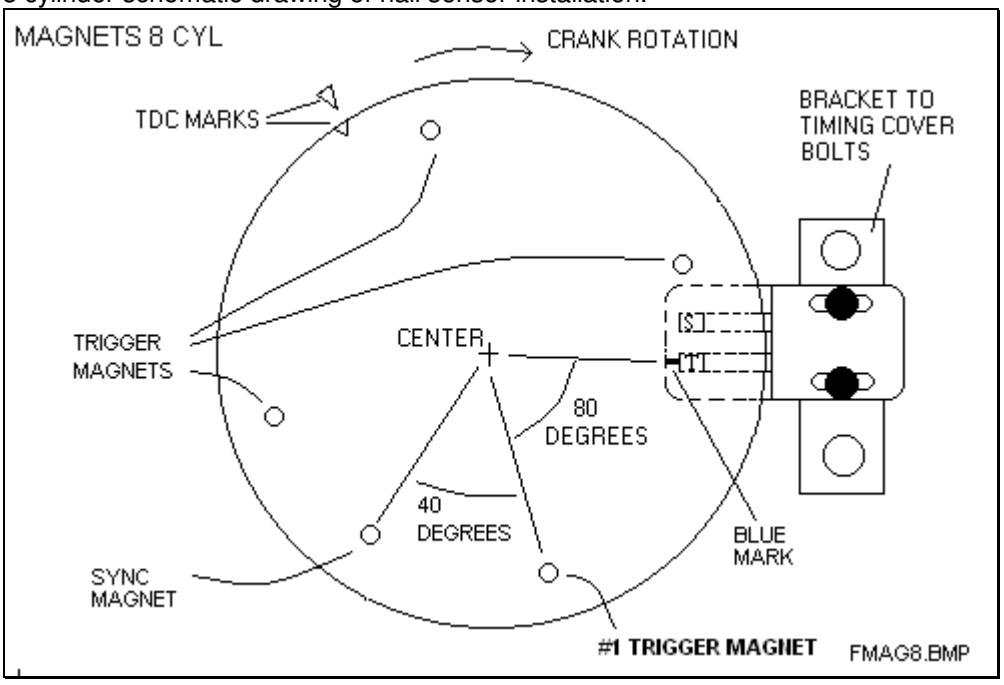
4 cylinder schematic drawing of hall sensor installation.



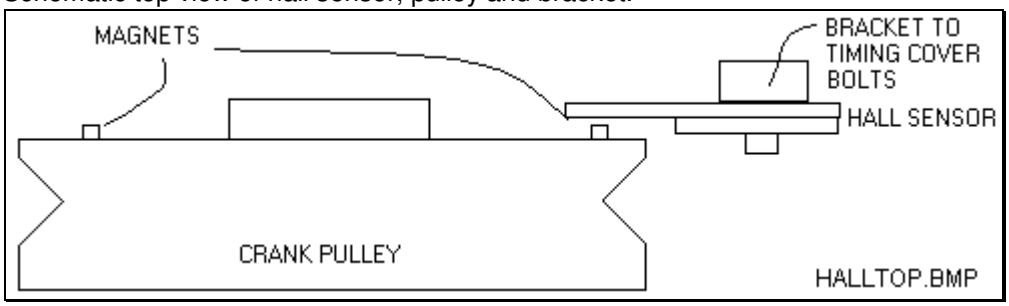
6 cylinder schematic drawing of hall sensor installation.



8 cylinder schematic drawing of hall sensor installation.



Schematic top view of hall sensor, pulley and bracket.



Troubleshooting

Testing the coil pack for spark (4 & 8cylinder) Caution high voltage!

The easiest test if the CPi2 unit is installed is to use the COILTEST function in the Hidden Settings area. This will send test signals out all channels of the CPi2 to the coil pack(s) connected.
Dual board CPi2's, Press the PROG key to switch to the "B" ecu and use that Coiltest function to test the second coilpack for sparks.

Disconnect plug wires from engine spark plugs and place wires ends close to ground with a small gap to see the spark jump. You can also use spare spark plugs as shown in the photo. Note how wire and plugs are connected in this photo to pairs of 2 spark plugs clamped together. Never test for spark by just removing the plug wires.

Spark plugs

We recommend resistor type spark plugs only. Non resistor type may cause electrical interference.

Verify firing order of the engine. Double check plug wire routing and cyl numbering.

Spark plug wires, and Interference Problems

Always use radio suppression type spark plug wires. NEVER use solid core wires.
Recommended wires:
Magnecor, MSD superconductor, NGK, OEM or factory carbon string, Accel 8.8 yellow.

Troubleshooting continued

Excessive RPM drop when doing Runup test, AKA MAG CHECK:

1. Different timing in A and B ecu's.
2. Check timing with a timing light on both coil packs to confirm timing is correct and if timing is equal on both coil packs.
3. Swapped hall sensor cables going to A&B ecu's. Check green and red connector colors where hall sensor connectors plug into the ecu. Green should be closest to the ecu lid, red closest to mounting flange. Did someone unplug wiring and plug it back into the cpi2 with hall sensor plugs swapped?
4. Fouled bottom spark plugs. Check spark plug condition.

Will not power up.

1. Check 2A fuse on side of ecu box.
2. Check for +12V on Purple wire of Main harness 14 pin plug.

Will not start:

1. Software V2.8&up, Note the MIN RPM setting but then lower it to 30 and try cranking again. If the engine starts then check try checking the brown wire connection and also try a Min RPM setting of around 90 and see if the engine still starts or not. Most engines crank at around 90 to 120 rpms. See Min RPM section.
2. Check power and ground connections. Two grounds on a single board CPi2 and four grounds on a Dual board CPi2. Look for unconnected black wires.
3. Check Hall sensor alignment. Double check wires at the 4 pin connector at the CPi2, they may have been inserted wrong.
4. No sync magnet being seen by the CPi2 unit. Check TRIG SYNC window and make sure all magnets are being seen. Without at least 1 sync magnet pulse the CPi2 cannot begin to make sparks occur.
5. Check # OF CYLS setting for 4,6,8 cylinder to make sure it is correct for the engine. If you cannot find this screen using arrow keys, then find the SHOW HIDDEN SETTINGS screen and change this to YES, then scroll using the left arrow key
6. Check for a Trigger magnet that registers as a Sync magnet. This indicates that the Trigger magnet is installed backwards so the wrong polarity is facing the hall sensor. This magnet would need to be removed and a new magnet installed in its place.
7. If aircraft type key/mag check switch is connected, check connections to yellow and gray wire and check the

ground connection to the mag switch. Disconnect yellow and gray and try starting again.

8. Check firing order and spark plug wires. Cylinder numbering on Lycoming and Continental engines is different. See supplement manual for more information.
9. Crank over engine with timing light connected, try to find out if timing is close or far from TDC. It could be far from TDC if magnets are mounted wrong. Place a piece of masking tape on the front of the crank pulley or flywheel to more easily see timing event and where the spark is occurring in rotation while cranking. If timing is really wrong then check the 500 RPM Ignition setting it should be around 5 to 15 degrees and if it has been changed to a really high value, then change it back to 10. Check the Magnet Position setting and normally on most installations this value should be between 75 and 90, if out of range try setting around 90 and cranking engine again. If timing is really wrong a mistake may have been made when installing magnets.

Runs smooth but no power

1. If you don't have a knock sensor installed set KNOCK RETARD to zero and KNOCK SENSE to 1.
2. Keep the knock sensor wire away from spark plug wires.
3. Magnets positioned incorrectly, so timing is retarded too much. Check timing with a timing light (non-knob or non-delay type). See Magnet Position window and read about this in the manual instructions.
4. RPM IGNITION values are too low.

Runs but is missing or rough:

1. Check alignment of Hall sensor over magnets. If using the slotted type hall sensor, loosen sensor mounting bolts and try adjusting Hall sensor. Not necessary to check on CNC hall mounts.
2. Check Hall sensor air gap. Should be close to .060". On supplied CNC hall mounts gap is not adjustable. Only on DIY hall mounts do you need to check air gap.
3. Interference from plug wires. **Make sure that all CPi2 sensor wiring and Hall sensor cable is not close to spark plug wires or any high current/voltage wires.**
4. Check spark plug gap, possibly too large. Reduce to confirm.
5. Check spark plug wire resistance, if MSD Superconductor resistance should be less than 1000 ohms for each plug wire. Reading may vary some due to carbon based coating on the surface of the plug wire copper conductor. Higher than 1000 ohms and the plug wire should be replaced or both crimp terminals re-crimped or replaced. A bad plug wire will have much higher resistance than a good plug wire, and may be arcing internally, and the spark plug wire performance will rapidly degrade over time when this occurs**.**
6. Check spark plug wires and cylinder numbering.
7. Check that magnets are installed to correct depth, and therefore not too distant from the hall sensor.

Coil pack breaker/fuse blows all the time:

1. Hall sensor and magnets not aligned.
2. CPi2 ground wires are not connected. Make sure ground wires are permanent and never switched in any way.
3. Single board CPi2 will have 2 ground wires. A Dual board CPi2 will have 4 ground wires.

Batt LED is lit all the time on the Programmer even while the Green LED is lit.

1. High current +12V wire on 12 pin white connector is not getting power. Remember the CPi2 needs two power source wires to function properly. Check airframe electrical supply breaker/fuse and wiring.

I only received one magnet:

1. The magnets stick together really well. Separate them with your fingers.

Will not power off after countdown or LCD screen flickers or Powers back on again:

1. Purple wire needs dedicated switch and must disconnect from all other devices on your 12V mainbus.
2. Red high current wire may also need a dedicated switch so it gets isolated from other devices on the mainbus.

Document changes:

July 17, 2025, V2.8 updates regarding Min RPM and brown wire addition to the system.
Apr 29, 2020. Add power switch diagram. Add Runup section in troubleshooting. Reorder wiring section.
Ver 1.6 Apr 20, 2020. B-ecu will shut off LOP if A-ecu stops functioning, whereas before LOP stayed on in B-ecu.
Ver 1.5 Mar 14, 2020. Fix no spark condition at very low cranking rpms. <60RPM.
Ver 1.4 Nov 21, 2019. Update info regarding MSD plug wire resistance.
Ver 1.4, Nov 21, 2019. New window in programmer on Single board CPi-2's named "# of Coilpacks".

Ver 1.4, Nov 21,2019. Window in programmer previously labeled “# COILS” has been renamed “IGN TYPE”.
Sept 19 2019. Purple power wire update, needs its own dedicated switch for proper power down.
Sept 19 2019. Add sentence stating that the Yellow kill wires are connected together.
Aug 2, 2019. Gauge Diag CP voltage reading different s/n 30 & higher.