

KC5442: KIT – PROGRAMMABLE IGNITION SYSTEM MK2

Silicon Chip Magazine March 2007 (p16 – p27), April 2007 (p66 – p78), May 2007 (p74 – p83)

Rev 1A

Batch No: 7W9060

PROGRAMMABLE IGNITION SYSTEM FOR CARS KIT

Modify the factory fuel ignition timing of your engine with this project. Many features, incl dual coil and optional knock sensing.

FEATURES:

- PCB with overlay case with screen printed & programmed PIC, wire, terminals and components.
- LED indicator showing lean/rich, clear & parking.
- LED indicator (KC5443) & LCD display (KC5442) for lean/rich & clear.
- Call Driver Project (KC5443). For more: get one.
- Complete knock sensor instruction (KC5444).

Jaycar
No. 1 for Kits

Customers please note:

- The supplied PCB has an overlay showing the various configurations for the different trigger inputs.
- Some case machining is required.
- Additional parts are required for the Points to Hall Effect Sensor conversion.

PLEASE READ BEFORE COMMENCING CONSTRUCTION

The guarantee on this kit is limited to the replacement of faulty parts only, as we cannot guarantee the labour content you provide. Our Service Department does not do general service on simple kits and it is recommended that if a kit builder does not have enough knowledge to diagnose faults, that the project should not be started unless assistance can be obtained. Unfortunately, one small faulty solder joint or wiring mistake can take many hours to locate and at normal service rates the service charge could well be more than the total cost of the kit. If you believe that you may have difficulty in building this kit (which is simply a complete set of separate parts made up to a list provided by the major electronics magazines) and you cannot get assistance from a friend, we suggest you return the kit to us IN ITS ORIGINAL CONDITION for a refund under our satisfaction guarantee. Unfortunately, kits cannot be replaced under our satisfaction guarantee once construction has been commenced.

CONTACTS:

For queries with regards to the design aspects of this kit please contact the Project Designer. It is recommended to check the designers/publishers website for further notes and errata since this document was issued. Silicon Chip Publications, POBox 139, Collaroy Beach, NSW 2097. Tel: +61-2-99795644, Fax: +61-2-99796503 www.siliconchip.com.au, silchip@siliconchip.com.au

For quality issues please contact the Production Manager at Jaycar Electronics and provide the following information:

- Product Number
- Batch No
- Details of Quality Issue

Notes and Errata (at time of print):

It is recommended to check the designers/publishers website for further notes and errata since this document was issued, before starting construction. The project article has been updated with relevant notes and errata. It will therefore differ from the original article published in the magazine.

Possible Substitutions		
Original Part	Original Part Desc	Subst Part Desc.
N/A		

PARTS LIST

Please note that catalogue numbers refer to suitable products from the Jaycar product range. Quantities listed refer to the actual number of items required. When purchasing items separately, take pack quantities into account. ¹ See section about Substitution ² See section about Notes & Errata ³ Processed Panel not part of Case listed Catalogue numbers starting with 'E' or listed as "Special Order" (incl. processed panels) are Kit specific and may not be readily available.

For queries with regards to the design aspects of this project please contact the Project Designer.

COMPONENTS COMMON TO THE VARIOUS PROGRAMMABLE IGNITION CONFIGURATIONS

RESISTOR(S)	Cat.#	Qty*	Description	Component Ident	And/Or Location
	HP1250	10	PIN PCB 0.9MM GLD		
	RR0524	9	RES 0.5W MTL 10R 1%		Brown Black Black Gold Brown
	RR0564	1	RES 0.5W MTL 470R 1%		Yellow Purple Black Black Brown
	RR0572	1	RES 0.5W MTL 1K0 1%		Brown Black Black Brown Brown
	RR0578	1	RES 0.5W MTL 1K8 1%		Brown Grey Black Brown Brown
	RR0580	2	RES 0.5W MTL 2K2 1%		Red Red Black Brown Brown
	RR0596	3	RES 0.5W MTL 10K 1%		Brown Black Black Red Brown
	RR0612	2	RES 0.5W MTL 47K 1%		Yellow Purple Black Red Brown
	RR0620	2	RES 0.5W MTL 100K 1%		Brown Black Black Orange Brown

CAPACITOR(S)

Cat.#	Qty*	Description	Component Ident	And/Or Location
RC5316	2	CAP CER NPO 22P 50V 10% P=5MM		22pF
RC5336	2	CAP CER NPO 1N 50V 10% P=5MM		1n / 1000p / 102
RE6066	1	CAP CER NPO 10N 50V 10% P=5MM		0.01uF / 10n / 103
RE6130	1	CAP ELECT RB 10U 16V 105C P=2MM 5X11MM		10uF / 16V
RE6220	3	CAP ELECT RB 100U 16V 105C P=2.5MM 5X11		100uF / 16V
RM7010	1	CAP ELECT RB 1000U 16V 105C P=5MM 10X21		1000uF / 16V
RM7065	1	CAP MKT 1N 100V P=5MM 7.5X2.5X6.5MM		1.0n / 1n0 / 102
RM7125	3	CAP MKT 10N 100V P=5MM 7.5X2.5X6.5MM		0.01uF / 10n / 103
RM7145	1	CAP MKT 100N 100V P=5MM 7.5X2.5X6.5MM		0.1uF / u1 / 100n / 104
	1	CAP MKT 220N 100V P=5MM 7.5X3.2X8MM		0.22uF / u22 / 220n / 224

SEMICONDUCTOR(S)

Cat.#	Qty*	Description	Component Ident	And/Or Location
EZ9017	1	IC PROG (KC5442) 16F88-E/P* DIP18		
PI6458	1	SKT IC MACHINED 18PIN		
RQ5299	1	CRYSTAL 20MHZ HC49US		20MHZ
ZR1004	1	DIODE 1N4004 400V 1A DO41		1N4004
ZR1162	1	DIODE P4KE 13.6V 16A STANDOFF 400W AC		P16CA
ZT1215	1	TRAN BC337/BC877 NPN 50V 800MA T092		BC337
ZV1560	1	VREG LM2940CT-5 +5V 1A L/DROP T0220		LM2940

HARDWARE / WIRE(S) / MISCELLANEOUS (small)

Cat.#	Qty*	Description	Component Ident And/Or Location
EF1154	1	SCREW M3X6MM SLOT R/HD ZP	
EF1167	4	SCREW M3X20MM POZI CSK SP.	
HM3212	1x2 & 1x3 way	HEADER SGL VRT 40WAY P=2.54MM	
HM3240	2	JUMPER SHUNTS P=2.54MM	
HP0149	1	WASHER NYLON M3 FLAT WHT	
HP0403	1	SCREW M3X10MM PHIL R/HD SP	
HP0414	1	SCREW M3X25MM PHIL R/HD SP	
HP0425	5	NUT M3 SP	
HP0433	8	WASHER MTL M3 S/PRF INT/T SLV	
HP0905	2	SPACER MTL TAPPED HEX M3X15MM	
HP0921	4	SPACER NYLON TAPPED HEX M3X6.3MM	
HP1350	2	LUG SOLDER TIN ID4.3XID2X17.6MM0	
LF1250	3	FERRITE BEADS FX1115	
LO1242	1	RING CORE IRON HY2 15X8X6.5MM	
NS3015	1	SOLDER 60/40 1MM	
PM0852	2sets	NUT SET LOCKING (D CONNECT) L6MM	1set = 1nut, 1 washer, 1screw
PM0854	2	SCREW (D CONNECT) 13MM	
ST0335	1	SWITCH TGL MINI SPDT SLD TAG	
WW4016	70cm	WIRE EN CU 0.5MM 24BS	
WW4032	20cm	WIRE TIN CU 0.71MM 22AWG	
WH5533	10cm	HEATSHRINK 5MM X 1.2M BLK	

HARDWARE / WIRE(S) / MISCELLANEOUS (large)

Cat.#	Qty*	Description	Component Ident And/Or Location
EB2211	2	PNL ALU 80X35X2MM	
EC8250	1	PCB (KC5442) NTN 05104071 102X81MM 03/07	
HB5064	1	ENCL BOX DIECAST 119X93.5X56.5MM	with overlay
HP0725	2	CABLE GLAND IP68 4-8MM	with screen printed lid
HP1203	4	CABLE TIE 100X3MM BLK	
PS0768	1	SKT PCB D25 HI-SPEC SOLDER	
WH3012	2m	CABLE HU RND 13X0.12MM L/D BRN	
WH3014	2m	CABLE HU RND 13X0.12MM L/D YEL	
WH3040	2m	CABLE HU RND 24X0.2MM H/D RED	
WH3041	2m	CABLE HU RND 24X0.2MM H/D BLK	
WH3042	2m	CABLE HU RND 24X0.2MM H/D GRN	

For queries with regards to the design aspects of this project please contact the Project Designer.

COMPONENTS SPECIFIC TO THE VARYING PROGRAMMABLE IGNITION CONFIGURATIONS

Cat.#	Total	(Points Qty)	(Reluctor Qty)	{Hall Effect Qty}	{Crane Qty}	{Pranha Qty}	Description	Component Ident And/Or Location
HP1250	2	1	1	2	2	2	PIN PCB 0.9MM GLD	
RC5332	1		1				CAP CER NPO 470P 50V 10% P=5MM	470p / 471 / n47
RR0548	1		1				RES 0.5W MTL 100K 1%	Brown Black Black Brown
RR0550	1		1				RES 0.5W MTL 120R 1%	Brown Red Black Black Brown
RR0604	1		1				RES 0.5W MTL 22K 1%	Red Red Black Red Brown
RR3274	2	1					RES 5W WW 100R	5W 100R
RT4656	1		1				TRIMPOT 25TURN 100K TOP ADJ SPECTROL	100K / 104
RR0572	1		1	1			RES 0.5W MTL 1K0 1%	Brown Black Black Brown
RR0596	2		2				RES 0.5W MTL 10K 1%	Brown Black Black Red Brown
RR0612	1		1				RES 0.5W MTL 47K 1%	Yellow Purple Black Red Brown
ZT2115	1		1				TRAN BC337/BC877 NPN 50V 800MA TO92	BC337
RM7022	1		1				CAP MKT 2N2 100V P=5MM 7.5X2.5X6.5MM	2.2n / 2n2 / 222

COMPONENT IDENTIFICATION

This section will help you to match some of the symbols used in schematics (electronic circuit diagrams) to the physical component used in the actual product. You will see the symbol on the left and the component on the right.

RESISTORS

Component

Symbol

4 or 5 Bands

1 Watt

5W or 10W Ceramic

VARIABLE RESISTORS

Component

Symbol

Trippot

Potentiometer

CAPACITORS

Component

Symbol

Non-Polarised

Polarised

Ceramic

MKT

GreenCap

Electrolytic

Tantalum

DIODE / ZENER DIODE

Component

Symbol

Diode

Zener Diode

BRIDGE RECTIFIER

Component

Symbol

COMPONENT IDENTIFICATION

LED'S

Component

Symbol

Component

INTEGRATED CIRCUIT (IC)

Component

Symbol (example)

Cutout

Pin 1 (to the left of cutout or mark on IC)

TRANSISTORS

Component

Symbol

(FET)

TO-92 Body has pin assignments depending on the sub type indicated in brackets.

TO-92 (72)

TO-18

TO-18

TO-18

TO-18

COMPONENT IDENTIFICATION

Symbol

Component

LAMP

FUSES

MICROPHONE

CRYSTAL

BATTERY

COMPONENT IDENTIFICATION

VOLTAGE REGULATORS

Symbol

Voltage Regulator

COMPONENT

POSITIVE REGULATOR TO-3 PACKAGE 78XX, LM340, LM7840

NEGATIVE REGULATOR TO-3 PACKAGE 79XX, LM320

POSITIVE ADJUSTABLE REGULATOR TO-20 PACKAGE LM317, LM350

NEGATIVE ADJUSTABLE REGULATOR TO-20 PACKAGE LM337

POSITIVE REGULATOR TO-3 PACKAGE 78XX, LM340

NEGATIVE REGULATOR TO-3 PACKAGE 79XX, LM320

ADJUSTABLE REGULATOR TO-3 PACKAGE LM317, LM350

POSITIVE REGULATOR TO-3 PACKAGE 78XX

COMPONENT

OUTPUT COMMON INPUT

OUTPUT COMMON INPUT

INPUT OUTPUT ADJUST

INPUT OUTPUT ADJUST

COMMON INPUT OUTPUT

INPUT COMMON OUTPUT

OUTPUT ADJUST INPUT

OUTPUT (2) INPUT (1) COMMON (3)

500-30

OHM'S LAW

The most basic law in electronics. The relationship between resistance, voltage and current is determined by Ohm's Law ($V = IR$). If you know two out of the three values you can work out the third.

$$V = IR$$

$$I = V/R$$

$$R = V/I$$

The formulas are:

V is Voltage

I is Current in Amps and

R is resistance in Ohms



No 1 for Kits

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COMPONENT REFERENCE CHART

Ver 1.2 - 01.12.2004

RESISTOR COLOUR CODES

Symbol

Component

3rd Digit

Multiplier

Tolerance

BLACK

BROWN

RED

ORANGE

YELLOW

GREEN

BLUE

PURPLE

GREY

WHITE

4

4

4

10000

100

100

GOLD

0.1

0.01

5%

10%

SILVER

Examples

(5 BAND) yellow-purple-black-brown-gold = 4-7-0-1-1% = 4K7 1%

(4 BAND) orange-purple-yellow-gold = 3-7-4-10% = 370K 10%

CAPACITOR CODES

Microfarads (u)	Nanofarads (n)	Picofarads (p)	EIA code
-	-	100pF	101
0.001uF	0.22pF	220pF	221
0.0047uF	1nF	1000pF	102
0.01uF	4.7nF	4700pF	472
0.047uF	10nF	-	103
0.1uF	47nF	-	473
0.47uF	100nF	-	104
1uF	470nF	-	474
10uF	1000nF	-	105

ZENER DIODES (1 WATT UNLESS SPECIFIED)

Part no.	Voltage	Part no.	Voltage
1N4728	3V3	1N4744	15V
1N4729	3V6	1N4745	16V
1N4730	3V9	1N4746	18V
1N4731	4V3	1N4747	20V
1N4732	4V7	1N4748	22V
1N4733	5V1	1N4749	24V
1N4734	5V6	1N4750	27V
1N4735	6V2	1N4751	30V
1N4736	6V8	1N4752	33V
1N4737	7V5	1N4753	36V
1N4738	8V2	1N4754	39V
1N4739	9V1	1N4761	75V
1N4740	10V	1N5349B	12V 5W
1N4741	11V	1N5352N	15V 5W
1N4742	12V	1N5374	15V 5W
1N4743	13V	-	-



Programmable Ignition System for Cars. Pt1

by John Clarke

Want to program the ignition timing on your car? Now you can, with this completely new design. It can be used in older cars which presently do not have electronic ignition or used as an "interceptor" for cars with engine management systems.

OUR PREVIOUS Programmable Ignition was originally published in March 1996 and proved to be a very popular project with readers. This was subsequently updated as the Programmable Ignition Timing (PIT) Module in the June and July 1999 issues of SILICON CHIP.

The updated PIT module included

a basic 2-step advance curve and a 1-step vacuum advance that changed the timing according to engine load. In operation, it was used to control the High Energy Ignition design from the June 1998 issue.

This latest Programmable Ignition from SILICON CHIP is far more advanced in features and its ability to produce

an accurate advance curve. It is also a complete stand-alone ignition system that is triggered by an engine position sensor and then drives the ignition coil. It can be triggered from one of many sensors in a distributor, including points, reluctor, Hall effect, optical trigger and the 5V signal from the car's Engine Control Unit (ECU).

In order to measure engine load, the Programmable Ignition can use a Sensym absolute pressure sensor. In fact, provision has been made to mount this sensor directly on the PC board, the sensor then being connected to the engine manifold via plastic tubing.

Alternatively, you can connect the ignition circuit to an existing manifold pressure sensor if present. This is commonly called a Manifold Absolute

