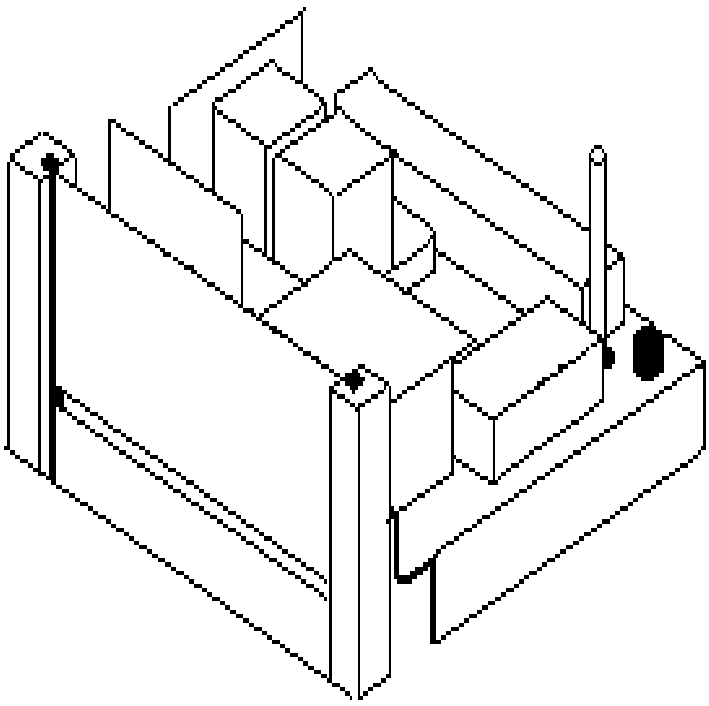
FORDS CAPFLOW CONTROLLER TECHNICAL MANUAL



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Introduction

The FORDS type 3 capflow controller has been with us for over 35 years. Although the technology is undoubtedly dated, the unit is reliable and simple in operation and is still being manufactured in Bedford.

Scope of this manual

This Manual covers the TYPE 3 cap flow controller chassis **01030044** with plug in boards **01031698, 01030043, 01030042** and **01030041**.

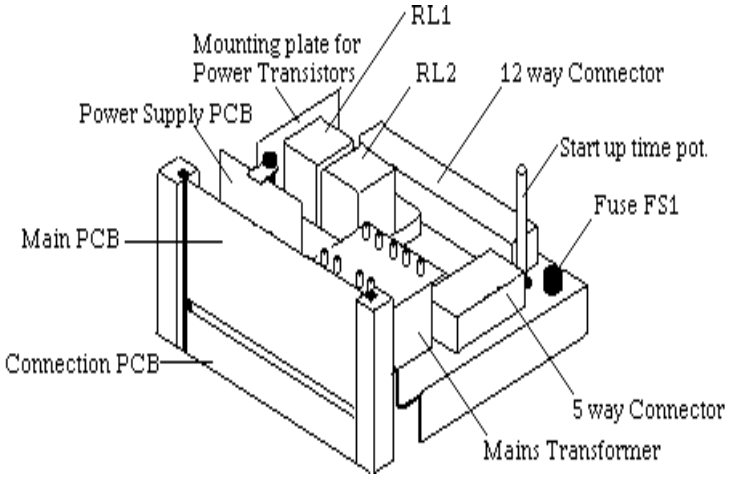
This includes P.O. type relays, Plug in relays and the addition of an Opto-isolator on the **01031698**

The chassis **01030044** is wired in many ways but the two most common (and the ones covered in this manual) are the **01090093** and the **01090005**. The **01090093** (known as the **0093**) is used extensively in the dairy trade in filler driven presses. The **01090005** (known as the **0005**) is used on freestanding presses.

The intention is that this manual will provide the information you need to understand, maintain and repair the cap flow controller, it is assumed that you have access to a multimeter and that you can use it to test diodes, transistors and lamps.

Chassis Layout

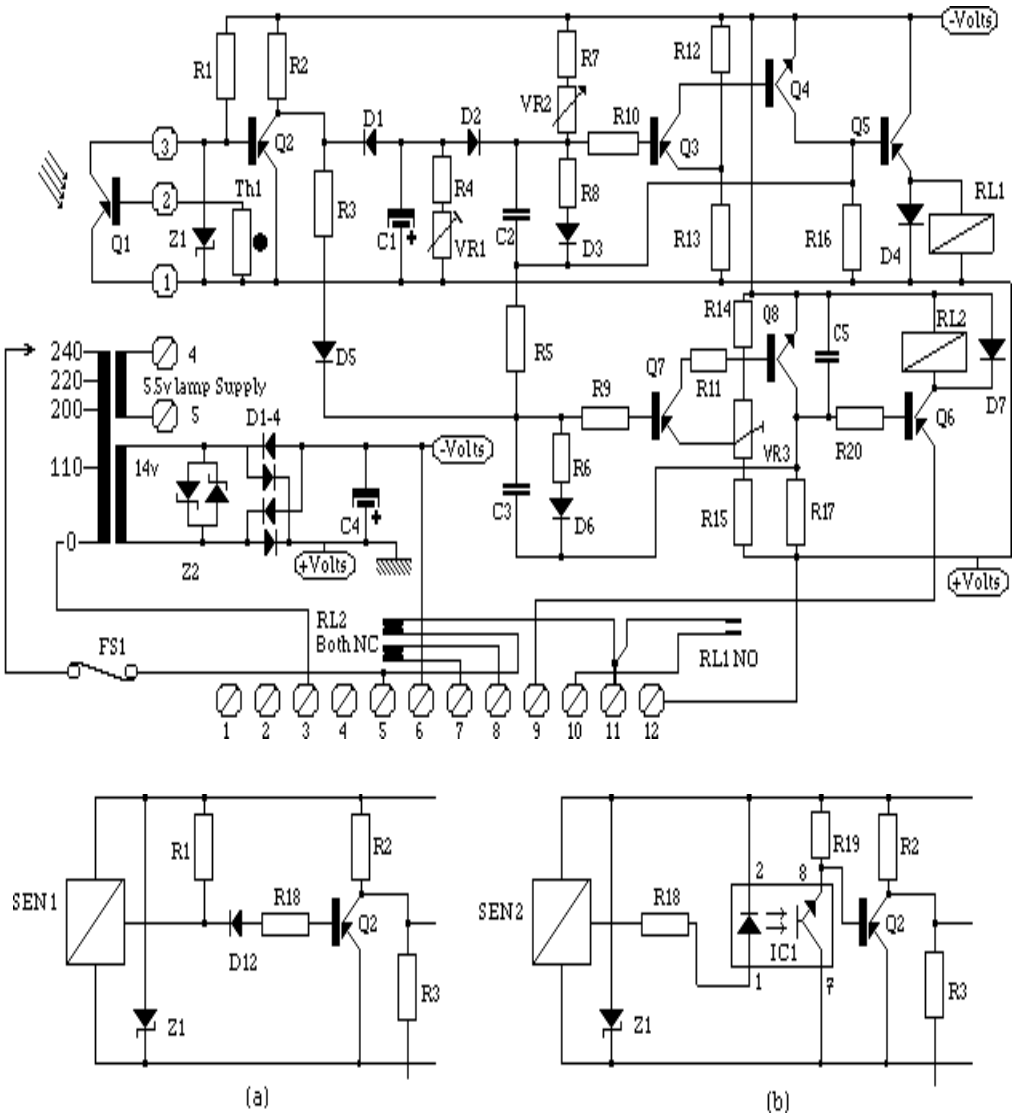
The type 3 cap flow controller chassis consists of a folded metal chassis with three printed circuit boards (PCB's), Two relays, a mains transformer and two connection blocks. The layout is shown below.



The chassis is mounted inside the press 'boat', which is directly beneath the tool unit, accessible from the front via a removable plate. In presses which have gravity fed enclosed chutes then they are mounted with the main PCB upwards and in fact the studs in the press casting are located to mount in this position. Presses with air assisted chutes make access to the chassis and in particular to the main PCB very difficult. A modification to invert the chassis has been introduced in the form of two plates with offset studs.

Circuit Description

This is the circuit diagram of the type 3 capflow controller. The drawing is that of the original type of main PCB used with the lamp and photocell (FORDS part No. 01030041 wired as a filler driven Press). The later versions had modified input circuits shown below, (a) the intermediate type and (b) the latest type with opto-isolation (Both these boards have the FORDS part No. 01031698 although only type (b) is now supplied).



Although 3 different sensors and input circuits are used with the capflow controller they all present the base of Q2 with a low voltage when no cap is present and a high voltage when a cap is present.

The Phototransistor Q1 shows a low resistance between collector and emitter when illuminated by the lamp, pulling the base of Q2 down to chassis. When the phototransistor is covered, the collector to emitter resistance increases allowing the base of Q2 to be pulled up to the negative line by R1. (Th1 is a thermistor and was added to give better high temperature performance)

The proxistor fitted to the intermediate type PCB (**01031698**) is a PNP N/C type, which replaces the phototransistor. The diode D12 and the resistor R18 perform the interface needed. The latest type, with an opto-isolated input, (developed by the author) was designed to allow the connection of a range of sensors by providing a standard input.

Let us assume that the press is switched on with no caps in the chute. Whichever sensor is used the base of Q2 will be low, i.e. Q2 turned off, allowing the collector to be pulled up to the negative line by R2. Capacitor C1 will be charged via D1. When the capacitor is sufficiently charged then the Diode D2 will be biased off. C2 will then be charged via R7, VR2 (the start up time control) and R16. When the voltage from this capacitor makes the base of Q3 more negative than the emitter (set by the potential divider R12 and R13) then the transistor is switched on, turning on Q4, Q5 and energising the relay RL1. The circuit is held on by a current through D3 and R8.

With the clutch now engaged (by applying power to the VARLEY B solenoid or Solenoid valve) caps should be made and travel down the chute past the sensor. Caps moving past the sensor in this way will cause the transistor Q2 to turn on for short periods but not long enough to allow C1 to discharge through R4 and VR1. Should the caps build back to cover the sensor then Q2 would be turned on, biasing D1 off and allowing C2 to discharge through R4 and VR1. The diode D2 will then be biased on returning the timing cycle of the circuit to zero and turn off Q3 and Q4 thus de-energising the clutch. This condition will be maintained until the caps are used, uncovering the sensor.

You will see on the lower half of the diagram that there is another timing circuit similar to the one already described, this is the missing cap timer. The timing capacitor C3 is charged via R5 when the clutch is enabled and discharged via Q2, R3, and D5 when a cap passes or rests in front of the sensor. Therefore if the clutch is enabled and no caps are present then the voltage on the base of Q7 continues to rise until it becomes more negative that the emitter (the voltage on the emitter is set by the potential divider R14, VR3 and R15). When this happens Q7 is turned on energising the relay via Q8, Q6 and RL2. RL2 is usually incorporated into the filler E-Stop circuit so that it can shut down the driving machinery when the missing cap fault occurs.

On the filler driven version (**0093**) is necessary to de-energise the relay RL2 on starting so that the machine may produce its first cap. The emitter circuit of Q6 is brought out to a set of NC contacts on the rear of the start button. When the machine is started, the start button should be held in until the first cap passes the sensor, so resetting the missing cap circuit and allowing the release of the button without bringing in RL2.

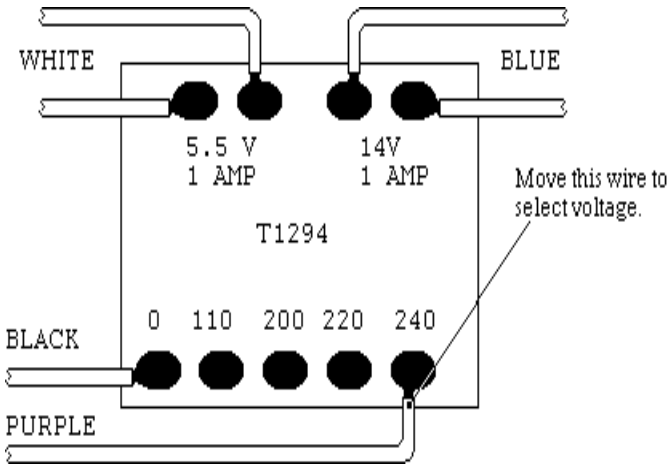
The power supply is a conventional transformer, bridge rectifier and capacitor type. The output is unregulated with a no load value of 22v dropping to 19v under load. The positive side of the supply is taken to the chassis; this should be borne in mind when taking readings.

A recent modification was to add two Trans-Zorbs, one across the 14v connectors on the mains transformer and the other across connectors 1 and 3 of the 5-way connector. These were added to eliminate electrical noise affecting the operation of the controller.

Installation and Adjustment of the Type 3 Capflow Controller

Transformer Voltage

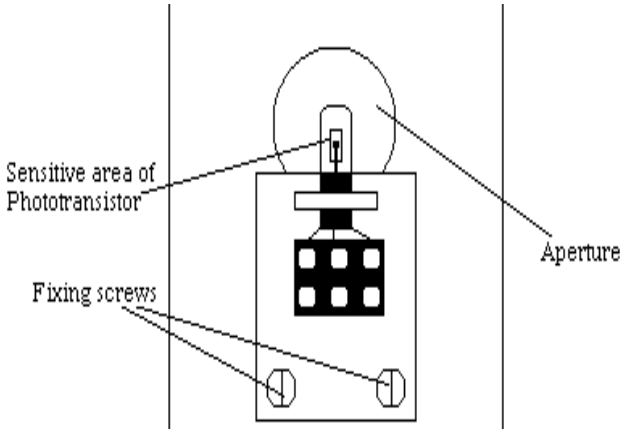
The controller may be powered from 110, 200, 220 or 240 volts AC at 50 or 60 Hz. (WARNING - the clutch solenoid may also need adjustment). Before changing the setting, make sure that the chassis is fully isolated. The required voltage is selected by moving the PURPLE wire to the appropriate tag on the transformer. The picture below shows the correct connection for 240 volts.



The mains fuse should be 1 Amp for 200 - 240v supply and 2 Amp for 110v supply. The fuses are type 'OO' 5/8".
nb : On some older chassis, mainly 110v units the wire colour is red instead of purple.

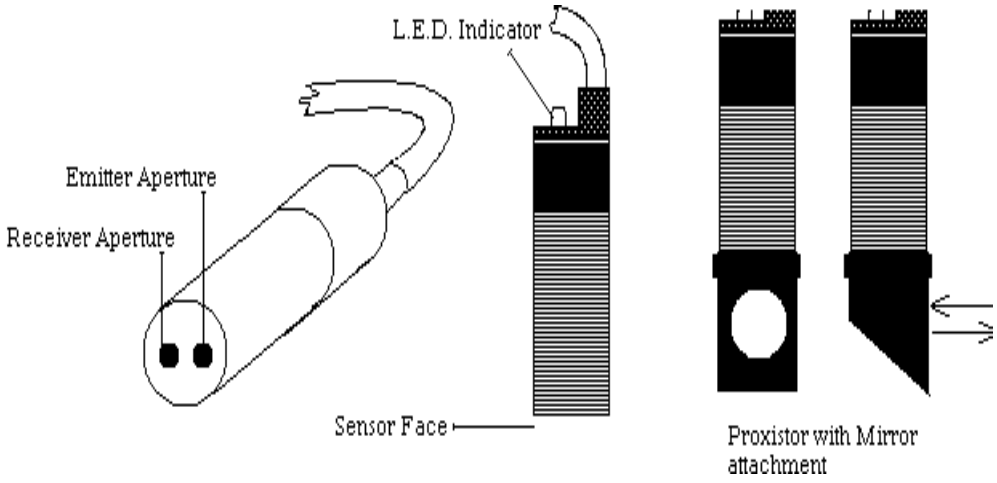
Photocell Sensor

The lamp and photocell sensor should be mounted on the chute so that the photocell is inline with the centre of the passing caps. The unit itself has no adjustments but if it should become mis-aligned then the loosen the sensor assembly and adjust to give maximum light on the sensitive area of the phototransistor. The nominal setting places the phototransistor in the centre of the aperture.



Proxistor

The short HUNTLEIGH Proxistor is fixed range and should be mounted perpendicular to the chute no nearer than 15mm to the caps and with no obstruction (air pipes, filler bowl) nearer than 100mm . The sensor apertures should be aligned so that they are in line with the sides of the chute. The L.E.D. indicator may be used to check that the proxistor is switching cleanly on seeing a cap.



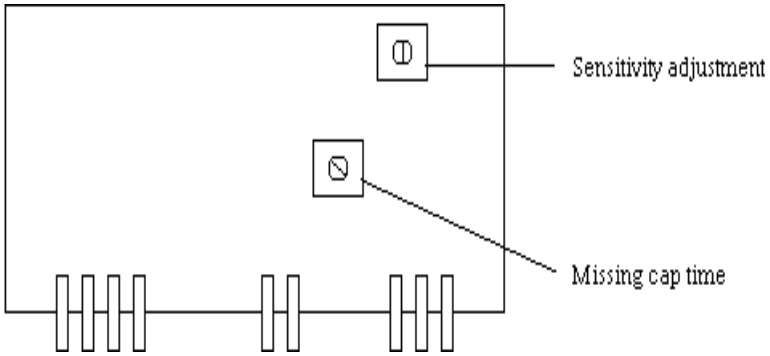
Later Proxistors had variable range and this was accessible via a screw cover next to the L.E.D. This should be adjusted to switch cleanly on seeing a cap but not be affected by the sides of the chute or the filler bowl. On some presses where there is limited space behind the chute, the proxistor is fitted along the chute and fitted with a mirror attachment, which moves the beam through 90 degrees. This arrangement works well providing the mirror is cleaned regularly.

Start up time

Near the fuseholder, mounted on the chassis is the start up time potentiometer. The early chassis had a small black knob, the later chassis had a long white spindle. This potentiometer controls the time from the sensor being uncovered, to the clutch being pulled in, making more caps. The range of this control is 0 to 6 seconds. If the time is to short then the clutch will be working overtime, if the time is too long then there is a danger of the caps running out or getting so low that there is not enough weight to allow good cap application.

Missing Cap time and Sensitivity

There are two adjustments on the main PCB. They are both set during manufacture but may need further adjustment in the field. You will need a fine screwdriver or a trimming tool (I use an RS 543-434) to set the small potentiometers without damage.



The Sensitivity adjustment is on the upper right of the board and alters the level of the light to dark changes of the sensor. The control is set at the factory to half way and is usually only changed for slow machines or large diameter caps. Fully clockwise the press would not stop on build-back, fully anticlockwise the press would not start or the clutch would pull in and out as each cap passed the sensor.

The other adjustment on the board is the missing cap time. This sets the time from the clutch coming in AND the sensor being uncovered, to pulling in the stop relay. normally this time is set to be just longer than the time between caps, It has a range of 1 to 17 seconds and is set at the factory at fully anticlockwise and then back one eighth (about 1.5 seconds) This setting may need adjustment on machines which run slowly or which ramp up and down during operation.

Routine Maintenance

There is very little maintenance to be done on the capflow chassis but I list here some of the checks to make at regular intervals.

1) Check tightness of connectors on the 5 and 12 way connection blocks as well as the mains switch and the solenoid especially the Varley 'B' type.

2) Inspect the main PCB for corrosion looking carefully around the transistor leads close to the board. Check that the protective lacer is intact. If not then re-coat with Electrolube PCB Conformal. (Farnell PAJ200H) Make sure to mask the connection pins and potentiometers first.

3) Inspect the relays and replace if contacts appear damaged. in the case of the P.O. style fixed relays clean up with contact paper if possible.

Replacement of parts

This section deals with replacement of parts on the controller. Before working on the chassis you should isolate it from the mains supply. **REMEMBER** that although you may disconnect the mains supply to the press, the guard circuit may still be LIVE.

Proxistor (FORDS part No. 00630180 or 00630248 or 00630319)

Isolate press from electrical power and remove front access cover of press. Disconnect Blue, Brown and Black proxistor wires from the five-way connection block. If the flexible conduit is long attach a lead wire or string to make the re-threading easier. Loosen the 5mm allen head bolt and remove the old proxistor (You may need to loosen the clamp from the chute if it still nips). Snip the ty-raps and remove the boot. Remove the proxistor and cable and refit the replacement. Adjust and re-assemble.

Main Panel (FORDS part No. 01030041 or 01031698)

Isolate the chassis, remove the two clamps at the top of the support pillars (if fitted). Pull PCB squarely out to avoid damage to the Veroconnectors. Make sure that you are fitting the correct type of PCB as they are not interchangeable. Check the mating connectors on the connector strip PCB are straight before carefully sliding in the replacement.

Power supply PCB (FORDS part No. 01030042)

Isolate the chassis, loosen the clamp above the power supply PCB and remove carefully, pulling squarely out. Inspect the socket for corrosion before pushing in a replacement.

Mains Transformer (FORDS part No. 00900001)

This job is best done with the chassis on the bench. Make note of all the connections to the 12 way and 5 way connectors BEFORE disconnection. Desolder the two white wires from the tags marked 5.5v. Remove the two blue wires from the tags marked 14v. Remove the black wire from the tag marked 0 and the purple wire from its tag.

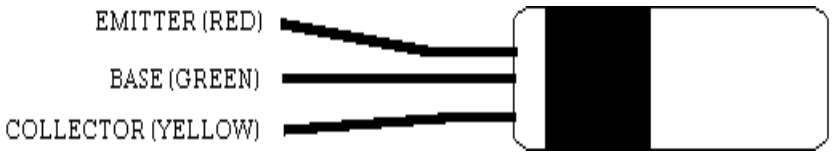
Remove the two fixing screws and washers and remove the old unit. Fit the new transformer and resolder the wires (see page 6). When you are satisfied that all is well (are the diodes D8 -D11 and capacitor C4 on the power supply PCB OK?) return the unit to the press to test.

Varley B Solenoid Coils

The Varley B solenoid coils are available separately as matched pairs. One is marked 'S' and is fitted at the bottom of the Solenoid, the other marked 'O' is fitted at the top (plunger end) of the unit. it is important that they are fitted correctly. They are available from VARLEY LTD. (address is at back of manual) You must know the voltage and frequency to order. The replacement of either or both of the coils is straightforward but can be awkward. I have replaced them in situ but would advise you to remove the whole unit and do the job on the bench. It is important that the coils are rewired correctly, as they were, or according to advice from VARLEY.

Phototransistor (OCP71)

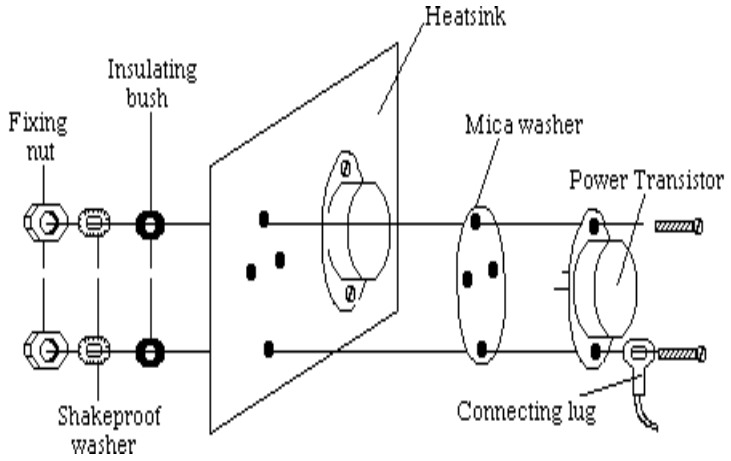
Replacing the OCP 71 is a simple matter of removing the old transistor and replacing the new one, trimming the leads and remembering polarity. The base is the middle lead and you will see that the emitter is closer than the collector is. If you order the assembly from FORDS then it will be ready assembled. See page 6 about adjustment.



Replacing Power Transistors.

This job is best done with the chassis on the bench. Make note of all the connections to the 12 way and 5 way connectors BEFORE disconnection. You will need snipe nose pliers, a fine soldering iron and solder as well as a replacement power transistor, PNP3055 (RS 293-684 or Farnell MJ2955). Both transistors on the chassis are the same types and the procedure for replacement is the same.

Remove RL1 (Clutch Relay) to make access to the transistor pins easier. Note the connection to each pin then carefully pull back the insulating sleeves and de-solder the transistor. (I usually take this opportunity to re-test the transistor whilst it is out of circuit) Remove the fixing screws, you may find that snipe nose pliers help at this point to grasp the fixing nut and washer as well as to fish out the insulating bush. Take care not to lose any of the parts, see diagram below.



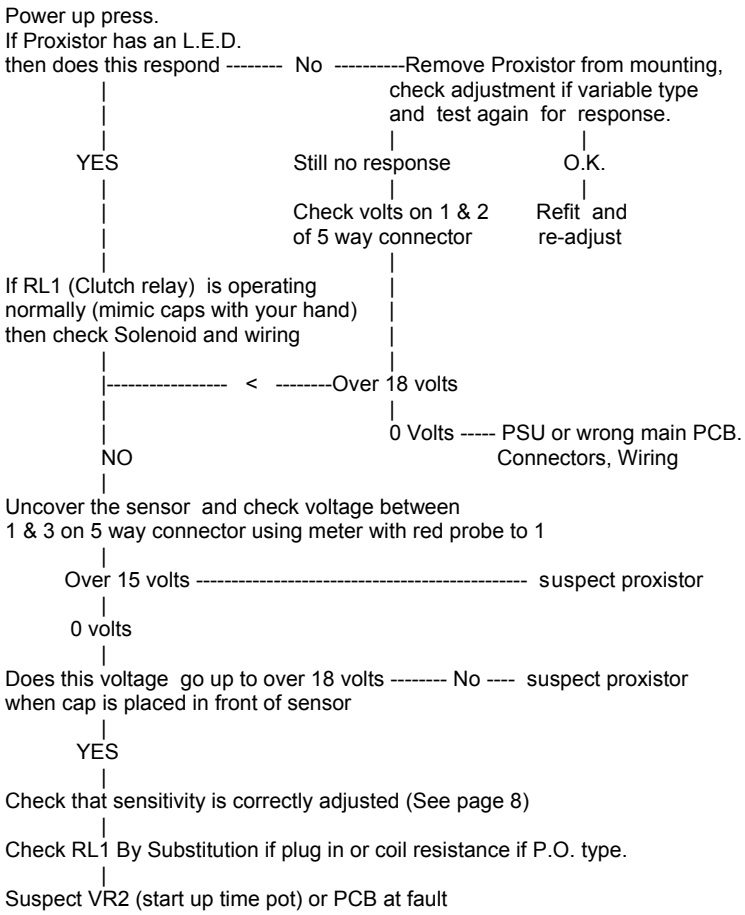
The Mica washer and the insulating bushes separate the transistor and heatsink electrically so inspect them carefully and replace if necessary. Smear a little heatsink compound on either side of the mica washer before re-assembly with a new transistor. When replacing the fixing screws do not forget the lower screw has a connecting lug underneath to provide the collector connection. Carefully resolder the wires to the emitter and base then reposition the insulating sleeves. At this point it would be wise to pull out the other relay and check the relay coil diodes, they are mounted on the coil tags in the case of the older P.O. type or across terminals 7 and 8 in the case of the plug in types.

When you are satisfied that all is well, replace the relays and return the unit to the press to test.

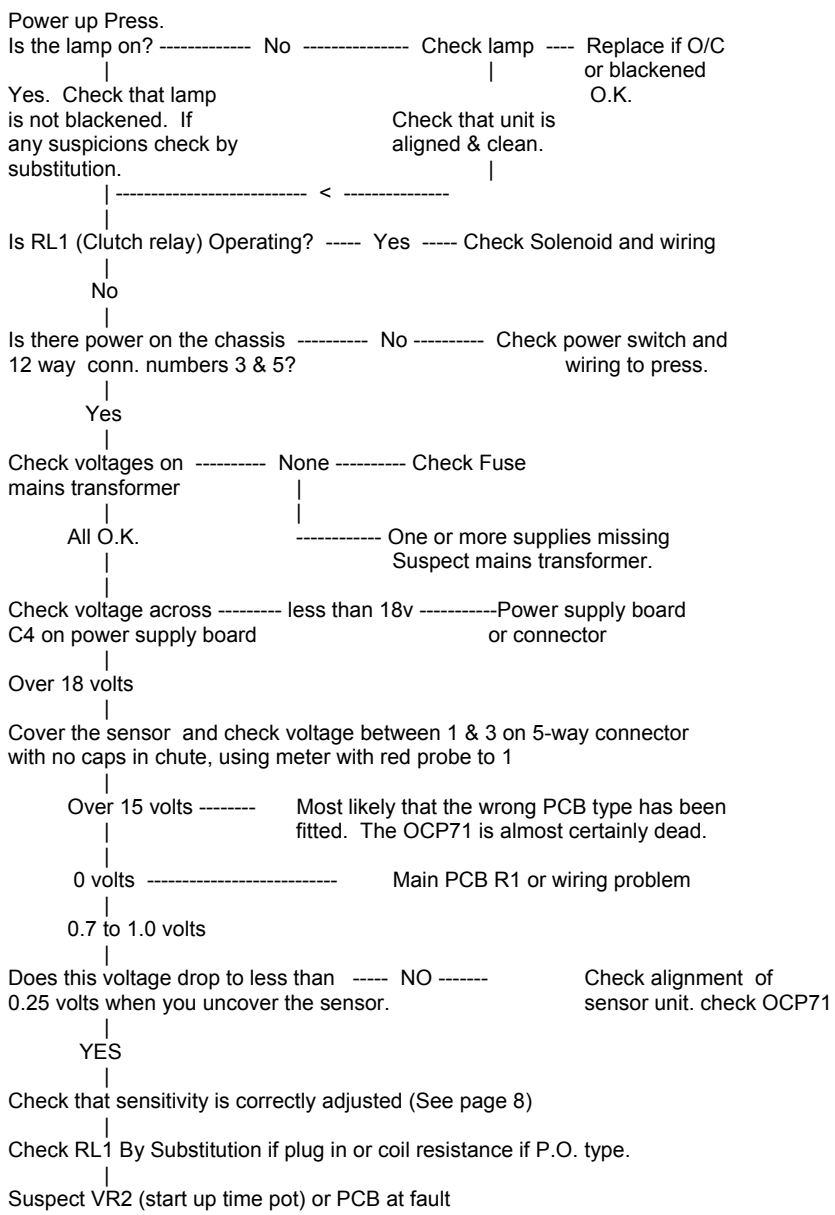
Fault Finding

This section is intended to be used to pinpoint electrical faults on the controller by answering the questions listed after each general fault description. The lists have been constructed to test for the most common faults first but also in a way which carries out the easiest tests early on.

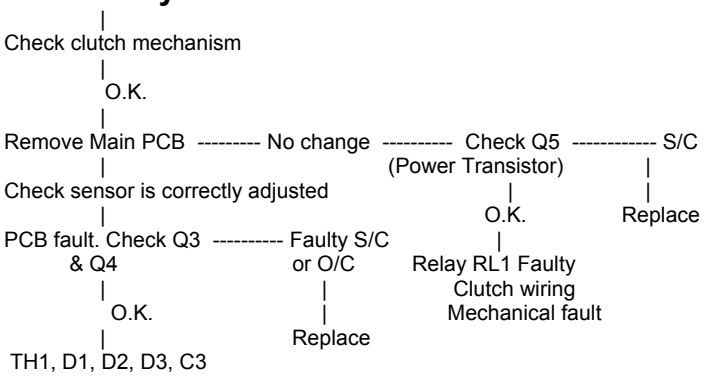
Clutch not coming in, Proxistor type



Clutch not coming in, Lamp and Photocell type

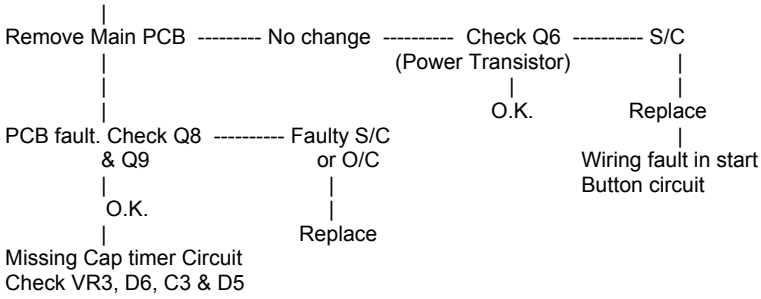


Clutch stays in

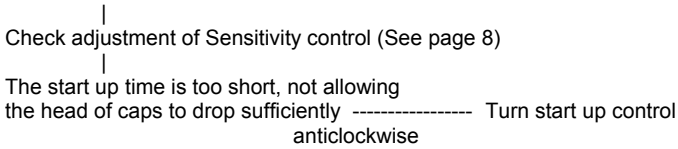


This has been caused more than once by a 'sensitive' sensor OCP71!

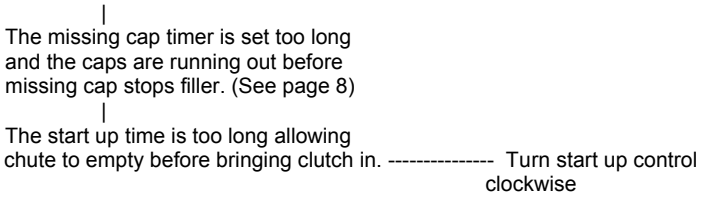
Filler cuts out when press power is on (RL2 on constantly)



Press clutching in and out excessively



Caps are running out



Filler cuts out intermittently.

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Check that caps are not hesitating due to some mechanical fault in chute or cap collector

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Check the proxistor setting. (especially range, if fitted)

|

Loose connections in guard circuit. (or mech. fault on nose cone)

|

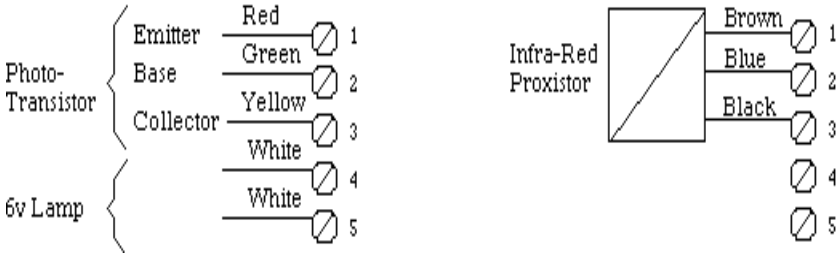
Check main PCB by substitution if possible

|

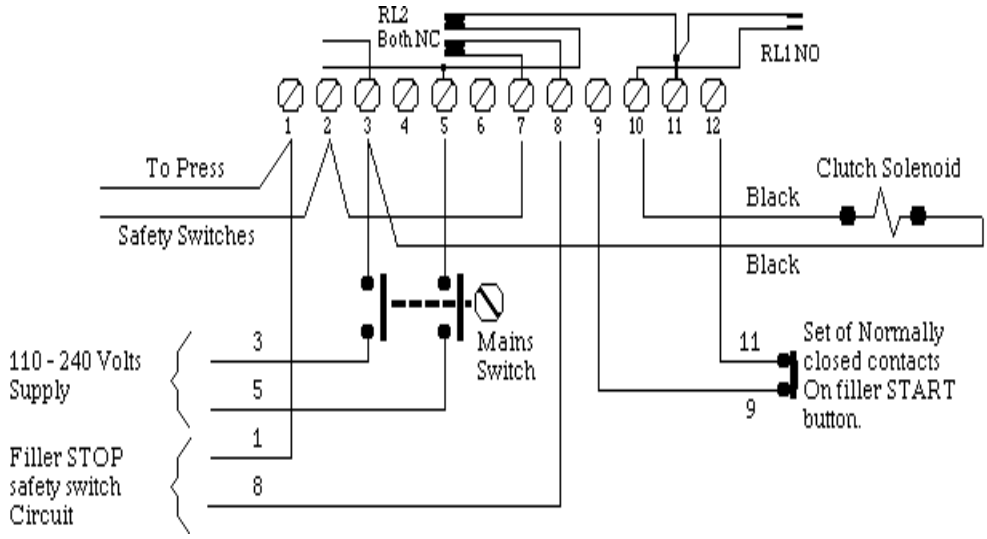
Electrical noise is a likely cause of this problem so check the following :
12 way and 5 way connectors (all screws should be tight)
Wiring to Varley B solenoid
Wiring on mains transformer and connectors to power supply and main PCB
Loose fuse.
External wiring

External Connections

The first diagram in this section shows the 5-way connector and how it connects to the sensor. The left-hand side shows the lamp and photocell type and the other the later proxistor types. The latest type with opto isolated input can accept a wide range of PNP NC sensors with the + connected to 1, - connected to 2 and the signal to 3.



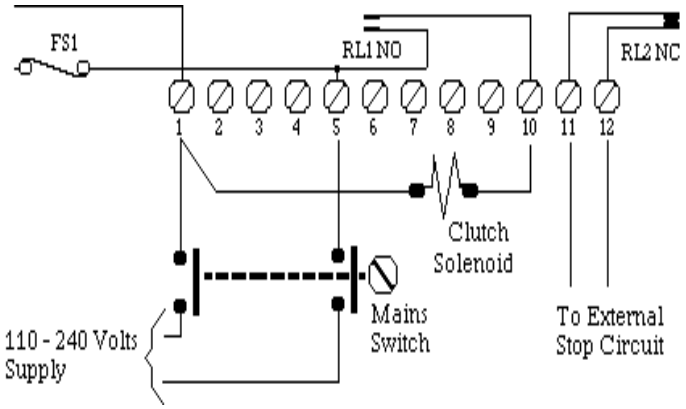
The next diagram shows the external connections to the filler of a type **0093**. Connectors 1 & 8 are connected to the external filler stop circuit. The circuit consists of the relay RL2 and the press nose cone switch, you will see that connectors 1 and 2 are just used as terminations. Power input is connectors 3 & 5 , 3 being the phase input if there is one. Connectors 3 & 10 go to the clutch solenoid, either a Varley 'B' type or air solenoid valve. The voltage for this is derived from the power input at connectors 3 & 5. The clutch power circuit includes a pair of normally closed contacts on RL2 so that the clutch will immediately drop out on 'missing cap'. Connectors 9 & 12 go to a pair of normally closed contacts on the back of the start button. This allows the relay RL2 to be disabled until the press has made the first cap. (n.b. when using numbered cable you will find that connector 12 went out on cable number 11)



External Connections (type 005)

The **005** unit was designed to be used with a wide range of filling equipment and so it is not easy to give a definitive-wiring scheme. Thankfully the wiring is simple and therefore the diagram below gives a 'typical' application. The external circuit may be PLC or other such controller but the idea is that opening the contacts RL2 cuts the power to the press and so re-setting it.

Mains power is applied via connections 1 & 5 (phase if any is connected to connector 5)



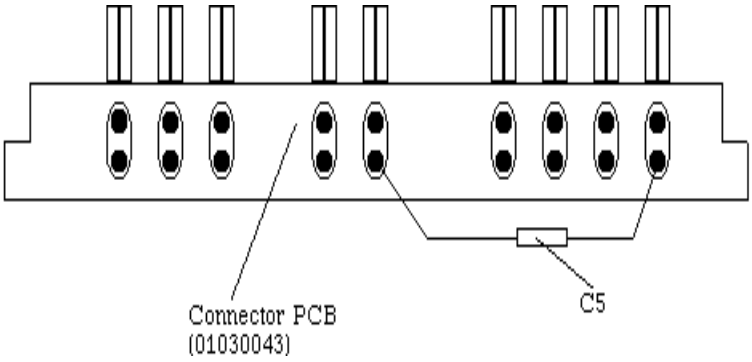
Parts list - use in conjunction with drawings

Ref.	Type	FORDS Part Number	Notes
	Main PCB	01030041	For use with Photocell
	Main PCB	01031698	For use with Proxistor
	Power PCB	01030042	
Q1	OCP71	00780002	
Q2, Q3, Q7	2S303	00910003	
Q4, Q8	BFY50	00910028	Farnell BFY50
Q5, Q6	MJ2955	00910001	STC 062306D
IC1	ILD74		Farnell ILD74
D1	OA91	00600001	Farnell OA9105
D2, D3, D5, D6	1S921	00600005	Farnell 1S921
D4, D7	1N5408	00600018	Farnell 1N5408
D8 - D11	1N4001	00600002	Farnell 1N4001
Z1	1N6282	00610243	Farnell 1N6282
Z2	1N6284	00610244	Farnell 1N6284
SEN1,2	DPC080CSF	00630180	OEM DPC080CSF
			Plastic, fixed range
OR	DPC150VCSF	00630248	OEM DPC150VCSF
			Plastic, variable range
OR	DPC150VCMF 00630319	OEM DPC150VCMF	
			Metal, variable range.
RL1, RL2	LY2 12v	00940041	Farnell
Relay base	PTF08A	00940059	Farnell 178 - 629
T1	110 -240v pri.	00900001	Sec. 5.5v @ 1A Sec. 14 volts @ 1A

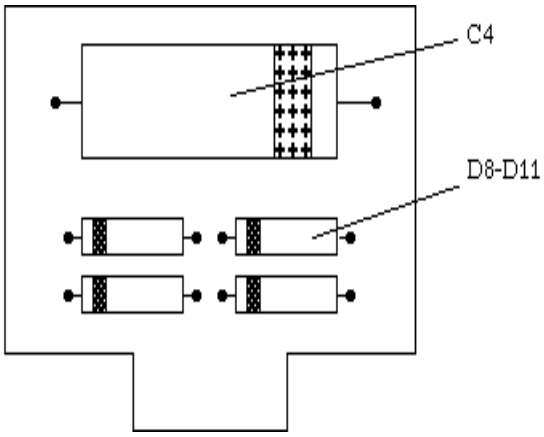
Parts list - use in conjunction with drawings

F1	1A (200 - 240v)	00640010	Farnell 151 - 454
OR	2A (110v)	00640014	STC 124124D
R1	8k2	00810022	Farnell SFR258k2
R2,R9,R10,R18	1k	00810004	Farnell SFR251k
R3, R14	220R	00810002	Farnell SFR25220R
R4	5k6	00810058	Farnell SFR255k6
R5	5M6	00810249	Farnell MRS255M6
R6, R8	3k9	00810006	Farnell SFR253k9
R7	22k	00810008	Farnell SFR2522k
R11,R16,R17	2k2	00810005	Farnell SFR252k2
R19	10k		Farnell SFR2510k
R20	2k2	00810005	Farnell SFR252k2
VR1	10k	00760043	Farnell 780 - 3210k
VR2	500R	00760042	Farnell 780 - 32500R
VR3	2M (Log)	00760001	2M2 on some chassis
C1	22uF @ 25v	00530003	
C2, C3	2.2uF @63v	00530002	Farnell 106 - 451
C4	1000uF @ 63v	00530001	Farnell 021 18102
C5	0.01uF @ 63v	00530005	Farnell 108 - 990
C6	0.1uF @ 63v		Farnell 143 - 680
Th1	Brimister CZ2	00610003	

PCB Layout for Connection PCB and Power Supply PCB

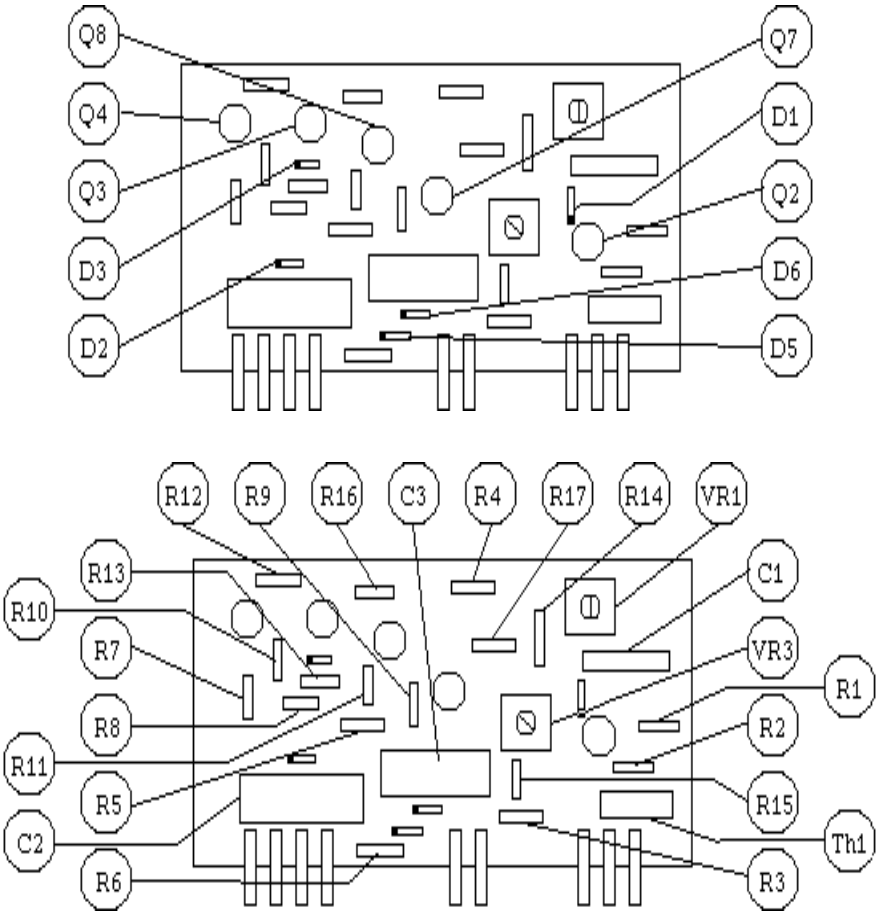


This PCB is used to allow the main PCB to be removable. The capacitor C5 is either mounted as shown or directly to the pins.



The power supply PCB originally had the 'top hat' type of diodes but the 1N4001 plastic type are used now and should be fitted if replacements are required.

PCB Layout for 01030041 (lamp & Photocell)

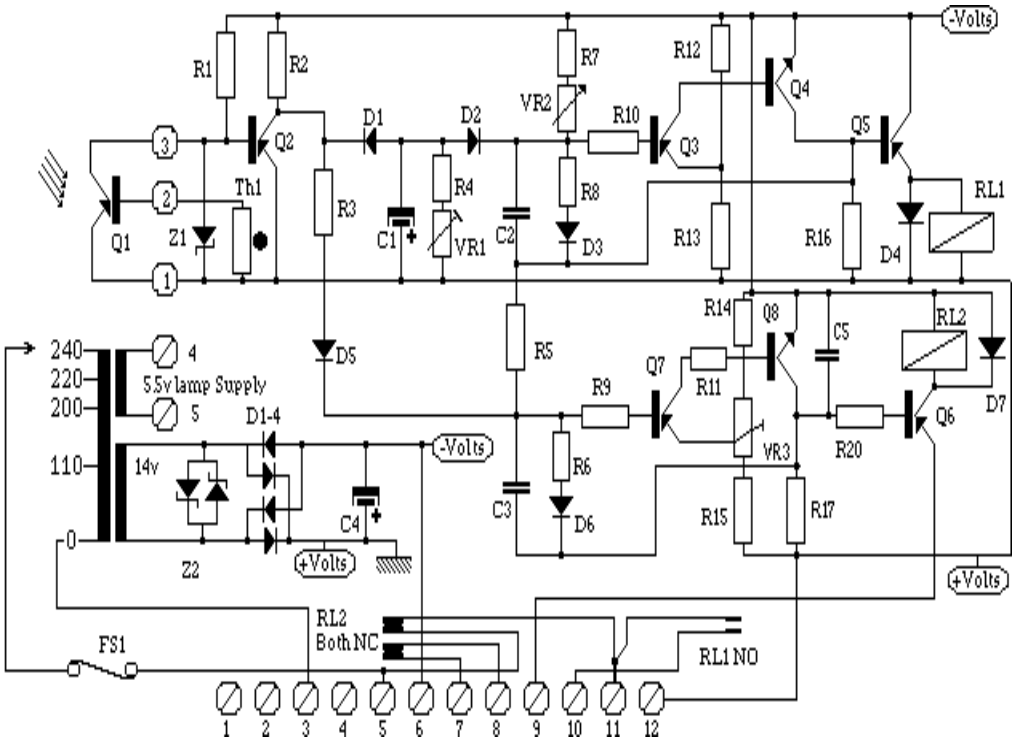


Notes:

This PCB is easily recognised by the large black thermistor (**Th1**) in the lower right corner.

PCB is coated both sides with protective lacer (this can be removed with Electrolube Preclene ECS [Farnell ECS200H]). Solder through and re-coat after repair with Electrolube PCB Conformal. (Farnell PAJ200H) Make sure to mask the connection pins and potentiometers

Circuit Diagram of capflow controller wired as 0093 with 01030041
(Filler driven lamp & photocell type)



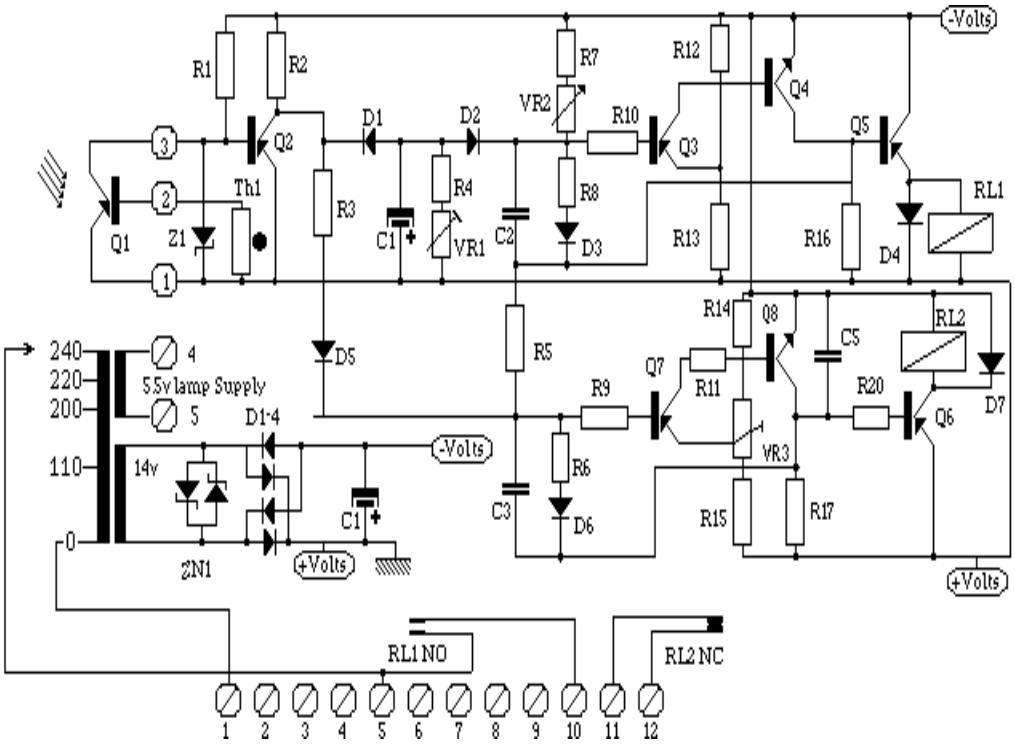
Notes:

Value of FS1 200 - 240v.....1A
110v 2.5A

On some early units resistor R20 is not fitted.

Trans-Zorbs Z1 and Z2 were only fitted as standard from late 1989

Circuit Diagram of capflow controller wired as 0005 with 01030041
(Free Standing lamp & photocell type)



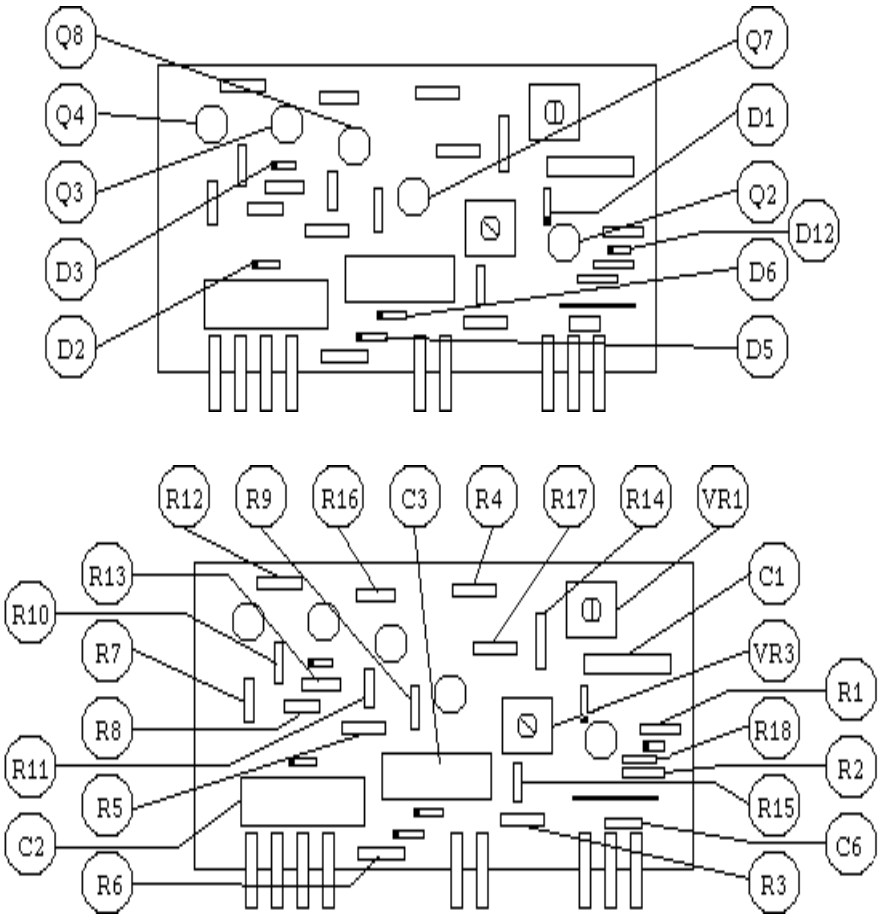
Notes:

Value of FS1 200 - 240v.....1A
110v 2.5A

On some early units resistor R20 is not fitted.

Trans-Zorbs Z1 and Z2 were only fitted as standard from late 1989

PCB Layout for the 01031698 (early Proxistor type)



Notes:

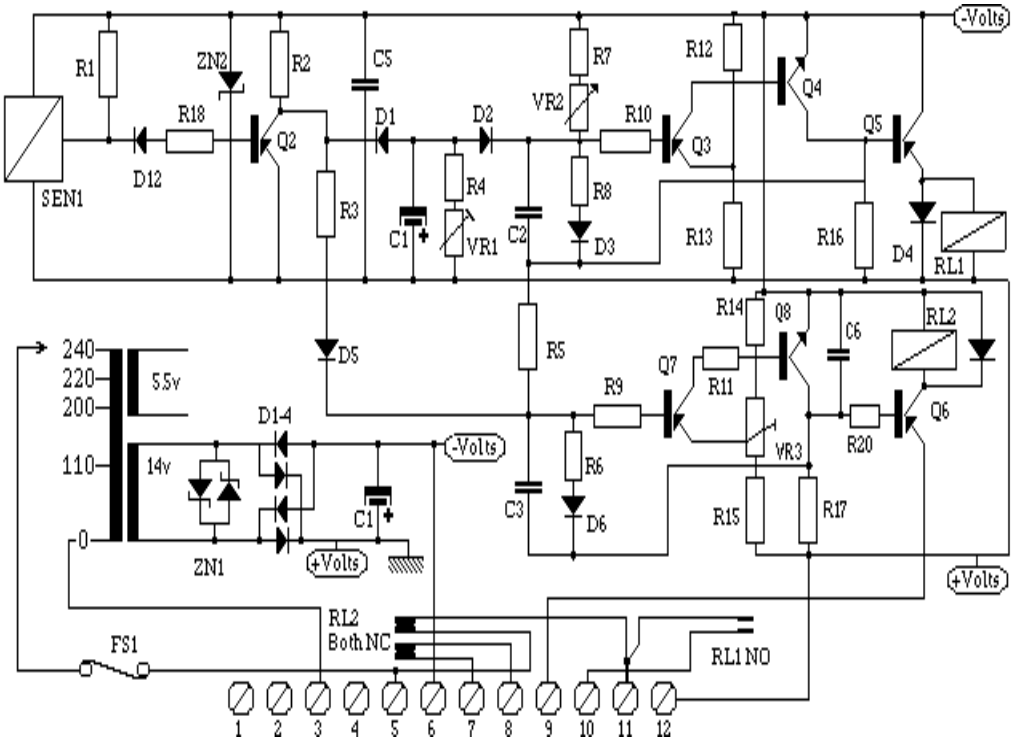
This PCB is recognised by a wire link in the lower right of the board but with no IC (Integrated circuit)

PCB is coated both sides with protective lacer (this can be removed with Electrolube Preclene ECS [Farnell ECS200H]). Solder through and re-coat after repair with Electrolube PCB Conformal. (Farnell PAJ200H) Make sure to mask the connection pins and potentiometers

This type of PCB must not be used with the lamp & photocell sensor. The OCP71 will almost certainly be destroyed.

This PCB has been superseded by the opto-isolated version, which can be fitted as a replacement.

Circuit diagram of capflow controller wired as 0093 with early 01031698
(Filler driven proxistor sensor)



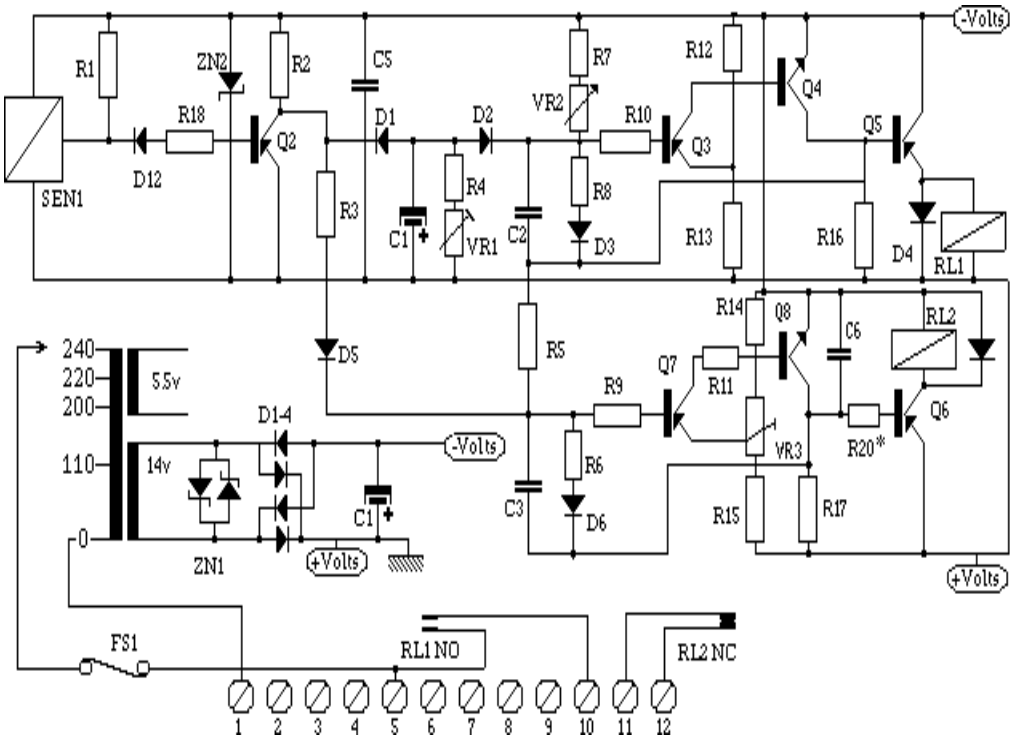
Notes:

Value of FS1 200 - 240v.....1A
110v 2.5A

On some early units resistor R20 is not fitted.

Trans-Zorbs Z1 and Z2 were only fitted as standard from late 1989

Circuit diagram of capflow controller wired as 0005 with early 01031698
(Free standing, proxistor sensor)



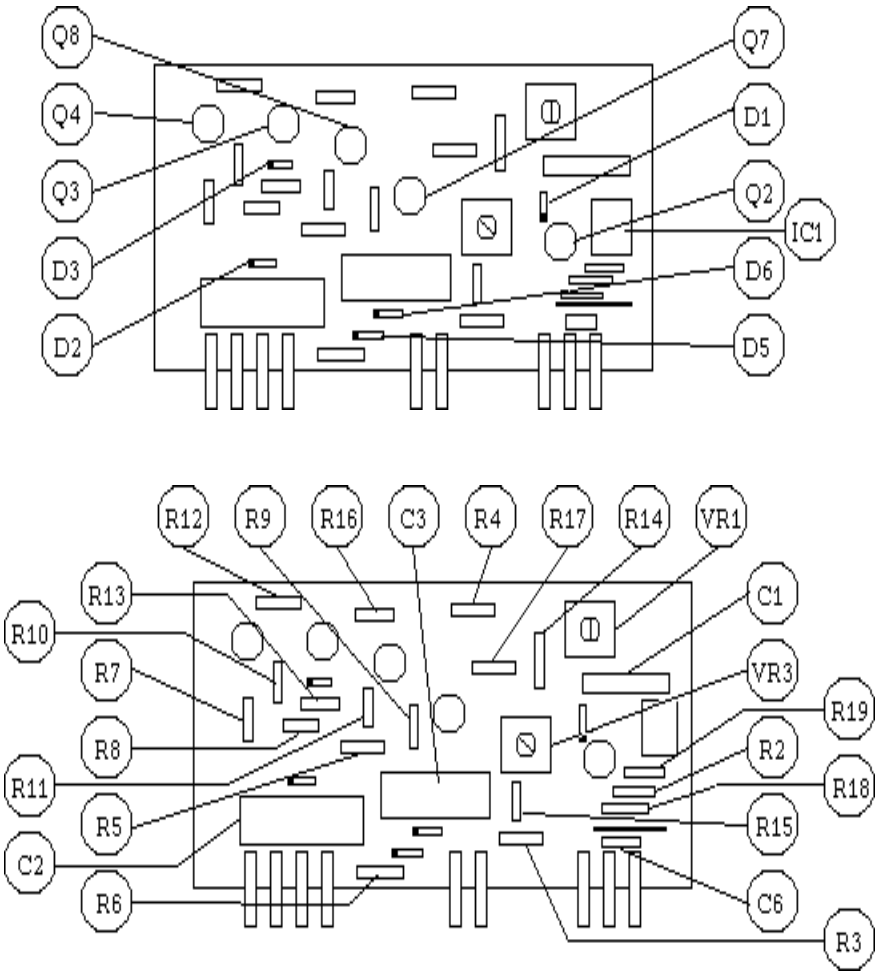
Notes:

Value of FS1 200 - 240v.....1A
110v 2.5A

On some early units resistor R20 is not fitted.

Trans-Zorbs Z1 and Z2 were only fitted as standard from late 1989

PCB Layout for latest 01031698 (Proxistor)

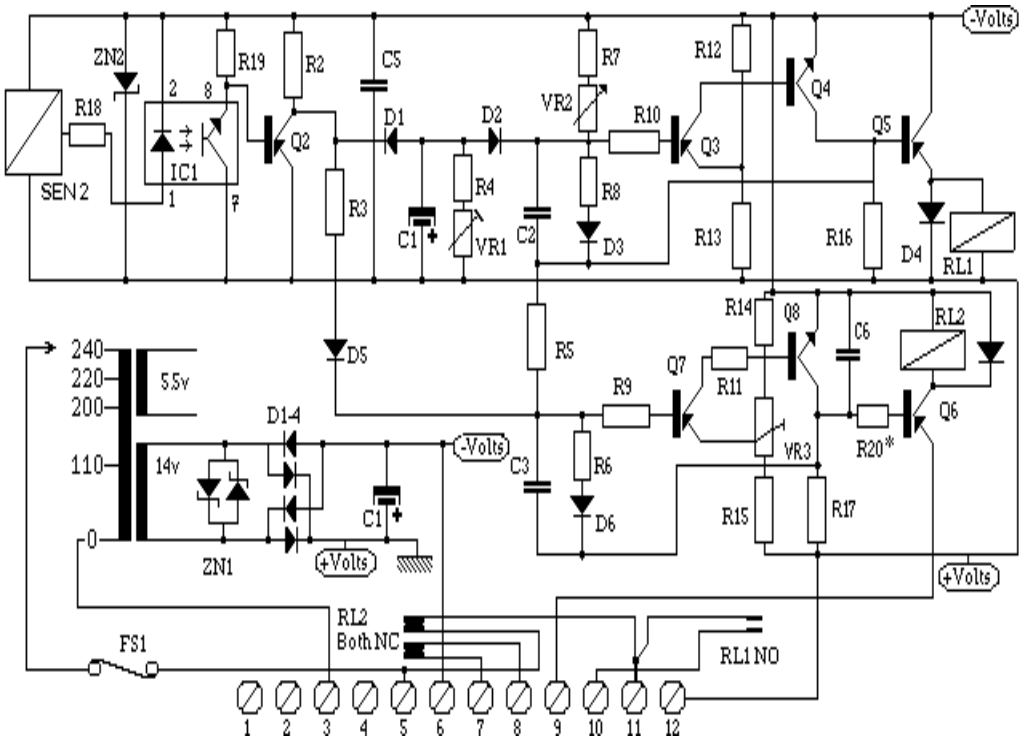


Notes:

PCB is coated both sides with protective lacer (this can be removed with Electrolube Preclene ECS [Farnell ECS200H]). Solder through and re-coat after repair with Electrolube PCB Conformal. (Farnell PAJ200H) Make sure to mask the connection pins and potentiometers

This PCB is the latest type and can be recognised by the 8-pin integrated circuit on the right hand edge. It can be used with all previous proxistor types. This type of PCB must not be used with the lamp & photocell sensor. The OCP71 will almost certainly be destroyed.

Diagram of capflow controller wired as 0093 with latest 01031698
(filler driven with proxistor)



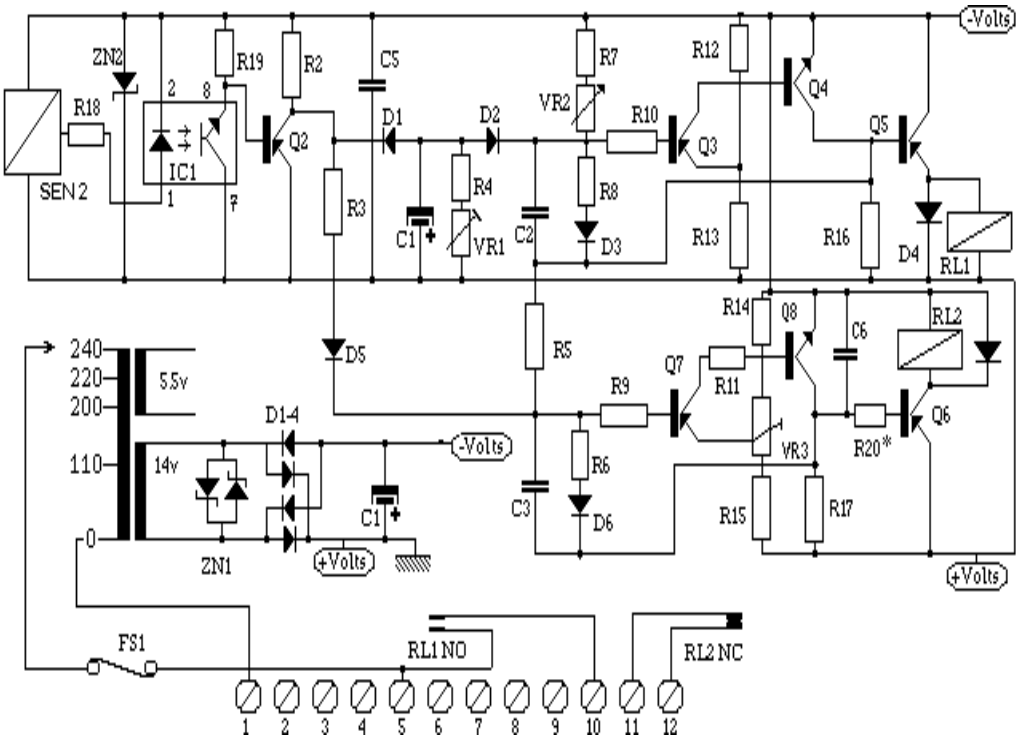
Notes:

Value of FS1 200 - 240v.....1A
110v 2.5A

On some early units resistor R20 is not fitted.

Trans-Zorbs Z1 and Z2 were only fitted as standard from late 1989

Circuit diagram of capflow controller wired as 0005 with latest 01031698
(free standing with proxistor)



Notes:

Value of FS1 200 - 240v.....1A
110v 2.5A

On some early units resistor R20 is not fitted.

Trans-Zorbs Z1 and Z2 were only fitted as standard from late 1989

Useful Addresses

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