



Diode Coupling Negative Output Guide

North American Office:
5600 General Washington Drive
Suite B211, Alexandria, VA 22312
USA
Toll Free: (800) 272-4775
T: (703) 933-0024
F: (703) 933-0025



European Office:
Twickenham Avenue
Brandon, Suffolk
IP27 0PD
United Kingdom
T: +44 (0)1842 814814
F: +44 (0)1842 813802

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Introduction

Your Solid State Coupler System is delivered complete and ready for installation. It has several important advantages over earlier electromechanical systems, which will quickly become apparent. It is very much easier and cheaper to install, since it needs fewer wires. Once it has been installed and tested it is very unlikely to go wrong, since it has no moving parts. And, since it works faster and more reliably than other systems, it will do its job better.

Installation

As installation is such a simple operation, only brief instructions need be given. Nevertheless these instructions must be followed carefully, since incorrect installation will almost certainly cause damage. In particular the system must not be used with magnets of resistance less than 50 ohms or more than one magnet per note, unless this was agreed at time of order.

The unit supplied as two connected parts, a box or frame containing the printed circuit boards, and a pin (connector) board with attached overvoltage protection unit. There is about 5ft of cable between the parts, and although the printed circuit boards do not normally require access they should be placed so that it would be possible to reach them should it become necessary. The pinboard should be placed where it is easy to make connections to it.

The Pinboard carries clearly marked sets of pins. Connect one wire only from each soundboard magnet, key and pedal contact, and drawstop, to the appropriately labelled pin. (On console frame installations, key and pedal looms are supplied ready for direct connection to the appropriate contacts.)

Connect the other wire from the soundboard magnets, and the drawstop, key and pedal contacts, to the POSITIVE side of the transformer rectifier.

Connect the RED terminal (marked + T/R) on the protection unit to the positive side of the transformer rectifier and the BLACK terminal (marked - T/R) to the negative side. This negative lead carries the full magnet current and must be sufficiently heavy: we suggest 70/.0076", or equivalent, at least.

Warning

NEVER OPERATE THE UNIT, OR TEST ANY MAGNETS WITH A LEAD (AT THE PINBOARD OR ANYWHERE ELSE), WITHOUT BOTH POSITIVE AND NEGATIVE SUPPLY CONNECTED TO THESE TERMINALS. THIS IS MOST IMPORTANT, TO PREVENT DAMAGE TO THE TRANSISTORS.

Testing

Switch the power on, but DO NOT TOUCH ANY KEYS OR PEDALS YET. First check for errors, which if left uncorrected might damage components.

Using the black test lead supplied, touch each magnet pin in turn and check that the correct note is speaking. If more than one note speaks, suspect a running in your cable to the magnets. Check also for any faulty magnets, which must be replaced.

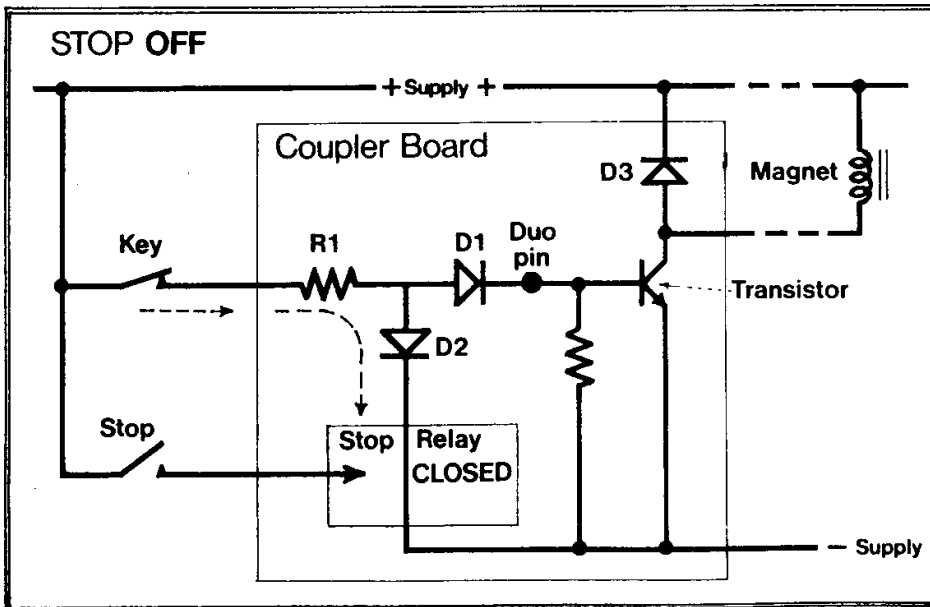
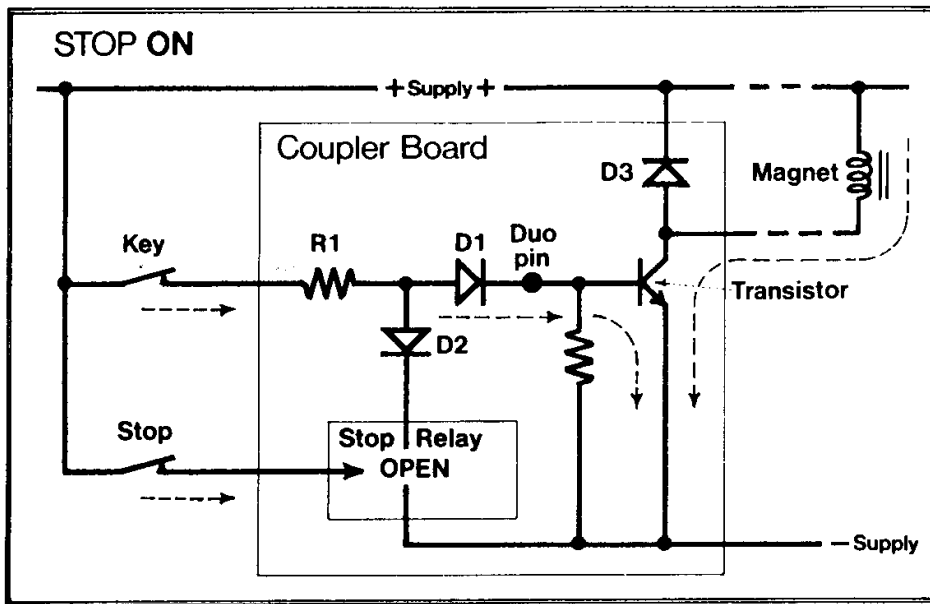
The coupling system can now be tested from the keyboard and should function correctly.

Explanatory

We give below a circuit diagram of a single switchway and transistor relay. It can be seen that it is in fact very simple, and the apparent complexity of the board is due only to the large number of separate circuits on it. The individual circuits are clearly marked, at input and output, and since they are all identical no difficulty should be experienced in tracing them. With each system there is a schematic diagram showing the loom routes.

When the key is depressed, positive current flows through the resistor R1 and if the stop is ON, through the diode D1, thus switching the transistor relay ON, and operating the magnet. If, however, the stop is OFF all the current is leaked away through diode D2 and no current reaches the transistor, so the magnet does not operate. (A transistor relay fitted to each stop line conducts this current away).

Diode D3 suppresses the spark produced when current through the magnet is interrupted. Resistor R2 leaks away any residual current, which might hold the magnet on in the absence of key current.



Protection Unit

The overvoltage Protection Unit is fitted with a fuse to protect the coupler system from misconnection and faulty transformer/rectifiers. In addition the protection unit is fitted with red and black sockets for connection of test leads.

Faults - General

If the setting up procedure has been carefully followed, faults will be extremely uncommon. The coupler system has been fully tested before leaving the factory, and it is always more likely that some other part of the wiring is at fault. A good idea of the nature of the fault can be gained from what is heard (or not). For example, if a given note cannot be made to sound from any key or pedal irrespective of the coupler system, the fault will most likely lie in the magnet/chest/pipe system.

At the other extreme, if a given key fails to sound at any time, the fault is likely to lie in the key contact itself or its wiring. Only if there is partial but incomplete coupling will it be reasonable at once to suspect the coupler system. In any case, any fault in the coupler system will almost certainly have been caused by mechanical shock in transit or by accidental overload in setting up. Once the system is in service it is very unlikely to give trouble. Since there are no moving parts, in contrast with other systems, its reliability in effect increases with age.

In tracing faults, USE ONLY THE TEST LEADS SUPPLIED, which have been designed to be harmless to the circuit. The NEGATIVE (black) test lead is used for tests between the magnets themselves and the output connections on the printed circuit boards. The POSITIVE (red) test lead is used at all stages earlier than the output transistors.

Faults - Specific

NOTE OFF

This fault can be traced by following the circuit back from the magnet until a touch with the BLACK test lead fails to sound the note.

The fault must then lie between this and the last point at which the note worked.

Table 1 provided a full test sequence, which will pinpoint the fault's exact location.

Table 1 . Note Off

TEST	RESULT AND REMEDY	
	Note sounds	Note still off
BLACK Test Lead		
(1) Touch magnet pin with negative test lead	Go to (2)	Magnet misconneted or faulty
(2) Touch magnet pin on pinboard with negative test lead	Go to (3)	Check cable between magnet and board
(3) Touch output pin on printed circuit board	Go to (4)	Check cable between pinboard and circuit board
(4) Touch can of output transistor with negative test lead	Go to (5)	Check printed circuit track from transistor to output pin
RED Test Lead		
(5) Touch track from switch ways to transistor, with positive test lead	Go to (6)	Replace transistor AND DIODE D3
(6) Trace the copper track to the switchways – look for breaks.		

N.B. When replacing a transistor, ensure that the type numbers correspond exactly.

NOTE CYPHERING

This fault is almost certainly the result of a sticking magnet or of a faulty output transistor. The test sequence in Table 2 will determine the cause.

Table 2 Note Cyphering

TEST	RESULT AND REMEDY	
	Note still cyphers	Note goes off
(1) Remove wire from magnet	Check magnet and chest-replace magnet if necessary	Replace wire and go to (2)
(2) Remove wire from pinboard	Check wire in loom for short circuit to	Replace wire and go to (3)
(3) Remove wire from output pin on printed circuit board	Check wire between printed circuit board and pinboard	Replace wire and go to (4)
(4) Remove and replace output transistor AND DIODE D3 Check magnet for rating (not less than 50 ohm)	Go to (5)	
(5) Check copper tracks on printed circuit board for loose connections, solder blobs etc.		

NOTE SOUNDS FROM SOME STOPS ONLY

If the note fails to sound on one or more stops, but sounds normally on the others, a fault has developed in the appropriate coupling channel.

Table 3 gives a test sequence for locating this.

First switch the faulty stop on and locate the switchway (2diodes, 1 resistor – see circuit diagram) corresponding to the faulty note.

Stops are clearly marked on the printed circuit board.

Table 3 . Note Sounds From Some Stops Only.

TEST	RESULT AND REMEDY	
	Note sounds	Note silent
RED Test Lead (1) Touch the positive (red) lead to that end of the diode D1 marked with a band (2) Touch the positive lead to the other end of D1	Go to (2) Check R1 for open circuits and dry joints here or at input pin	Check copper track between D1 and output transistor for breaks

NOTE PLAYS EVEN WHEN ALL STOPS ARE OFF

This can be caused only by dry joints or open circuit in the diode D2 of a particular switchway. Which switchway is at fault can be determined by a process of elimination.

NOTE RUNNING

This will be caused either by the Diode D2 of the appropriated switchway having gone short circuit or by accidental cross-connections between adjacent tracks on the printed circuit which are easily visible. The correct switchway can be located as before.

NOTE WILL NOT PLAY THROUGH COUPLERS (or Extensions)**UNTIL A PARTICULAR COUPLER (or Stop) IS DRAWN**

This will be cause by a short-circuited diode D1 on the switchway corresponding to the stop, which functions correctly.

Buffers

Interdepartmental couplers (e.g. Sw-Gt) sometimes require an alternative form of transistor circuit called a Buffer. When current from a key or pedal has passed through one Solid State switch it is much weaker and cannot supply any further switches direct (e.g. Swell unit stops.) We therefore have to magnify this current before passing it on to further switches.

You may have notice that in a conventional Solid State switch, positive current from the key caused the transistor to conduct positive current through the magnet down to negative. Thus a positive input to the transistor has caused a negative return through the transistor.

When we are magnifying the small positive current for the interdepartmental couplers (e.g. Sw-Gt) we require a positive current from the transistor to supply the ensuing switchways. Thus a buffer magnifies a small positive current to provide a much larger positive current.

There are two types of buffer:

Low level

High level

Both have the same function, but a high level buffer can supply current to more switchways than a low level, and is mainly used on extension organs where for example the Sw-Gt has to feed many extension switches of various pitches.

The only Solid State components used in buffers are transistors. No diodes are employed. High level buffers use two transistors, low-level buffers use only one transistor. In the unlikely event of a fault on a buffer the transistors should be replaced.

Table 4. Buffer Faults

FAULT	REMEDY
(1) Note cyphering on all stops	Check key contacts – if correct Replace buffer transistor(s)
(2) Note off on an interdepartmental coupler, yet plays correctly from its own manual key.	Replace buffer transistor(s)

N.B. Do NOT use the negative test lead to check buffers.

Stop Relay

This circuit is incorporated on the coupler board to control each coupler or extension switch, and permits a normal POSITIVE-make-for-ON drawstop or stopkey contact to be used.

If it fails to operate, check for obvious faults such as dry joints; if none, replace the transistor(s).

Gate

This circuit, situated in one corner of the coupler board, is used in certain systems to control automatic (or "blind") coupling, or, for instance, a bass octave shared between two or more stops.

If a fault develops, check for dry joints etc. if none, replace the transistor and , if the fault persists, the diodes.

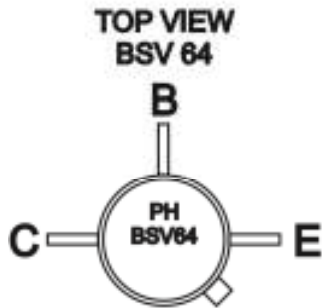
Transistor Usage

22EBCBDE	NPN 2N3709	Used on: 837
Used as the first stage of High Level Buffers		
22ECECCH	NPN BFY51 (0.36A)	Used on: 834,835,836,837,838
No longer available. See 22ECEDEK ZTX851		
22ECEDEK	NPN ZTX851 (1.5A)	Used on: 834,835,836,837,838
Replacement for BFY51, BSV64, BDX35 (no longer available). Used in stop relays, gates, low level buffers and magnet drivers		
22EEFDCH	NPN BSV64 (1.0A)	Used on: 834,835,836,837,838
No longer available. See 22ECEDEK ZTX851		
22EEFDCQ	NPN BDX35 (1.0A)	Used on: 834,835,836,837,838
No longer available. See 22ECEDEK ZTX851		
22FBBCCE	PNP 2N3906	Used on: 834,835,836,837
Used in stop relays		
22FBCCEE	PNP BC212L	Used on: 834,835,836,837
No longer available. See 22FBBCCE 2N3906		
22FCEDDE	PNP BFR80	Used on: 837
Used as the second (output) stage of the High Level Buffers		
22GHFDHP	NPN BD677 (1.5A)	Used on: 834,836,838
Used for magnet drivers in high current applications		

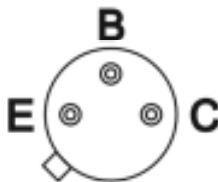
The current ratings given are typical maximums when used for magnet drivers and are given as a guide only

**NPN TRANSISTORS USED FOR NEGATIVE OUTPUT DRIVERS AND
LOW LEVEL BUFFERS (CF835, CF836, CF838)
22EEFDCH (BSV64) 22ECECCH (BFY51) 22EEFDCQ (BDX35)
22ECEDEK (ZTX851)**

NOTE: The BFY51 and BSV64 Transistor used on many SSL designs have been replaced by the BDX35 and ZTX851 Transistors. When replacing a BFY51/BSV64 you should ensure that you connect the BDX35 or ZTX851 as per this drawing. (BDX35 Can also be replaced by BDX36 &BDX37)



**BOTTOM VIEW
BSV 64**



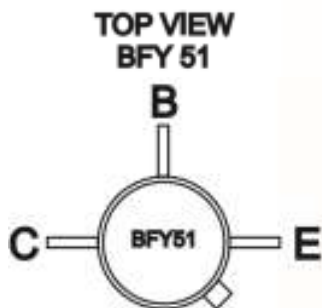
**FRONT VIEW
BDX35/6/7**



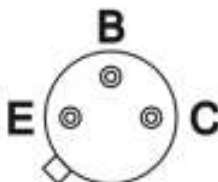
**REAR VIEW
BDX35/6/7**



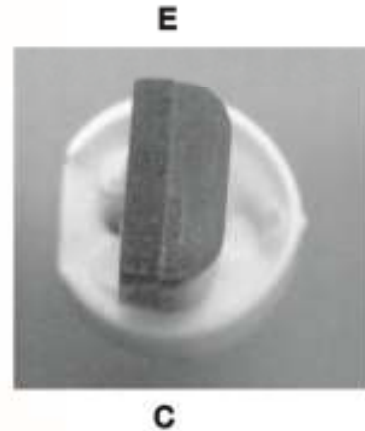
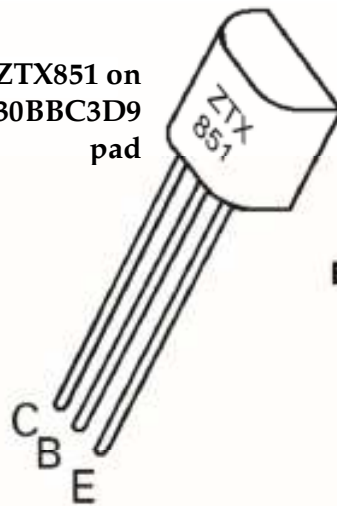
The pin marked E on the new transistor should be soldered into the hole vacated by the pin marked E on the original transistor. C to C and B to B. (If you are unsure call your local SSOS Office for more advice)



**BOTTOM VIEW
BFY 51**



ZTX851 on
30BBC3D9
pad

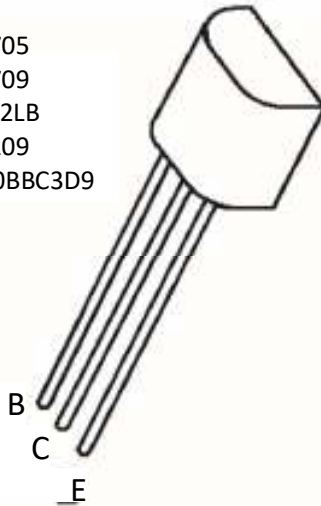


Replacements:

- BFY51 can be replaced with BDX35, BSV64 or ZTX851
- BSV64 can be replaced with BDX35 or ZTX851
- BDX35 can be replaced with BDX35 or ZTX851
- ZTX851 can be replaced with BDX35 or ZTX851

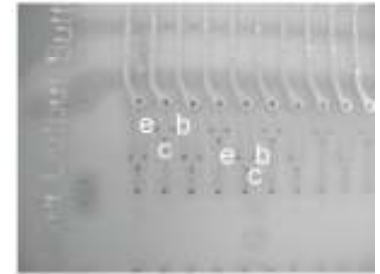
**TRANSISTORS USED FOR
HIGH LEVEL BUFFERS (CF837)
Row 1 22EBCBDE (2N3705 or 2N3709) or
22EBCCEE (BC182LB) or (2N5209)
Row 2 (nearest edge of PCB) 22FCEDDE
(BFR79, BFR80 or BC640)**

2N3705
2N3709
BC182LB
2N5209
on 30BBC3D9

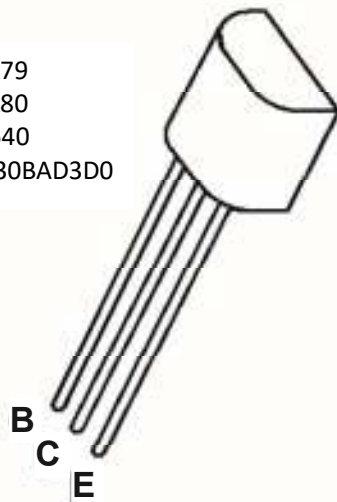


These transistors are all NPN and are interchangeable. They cannot be used to replace PNP transistors.

Row 1

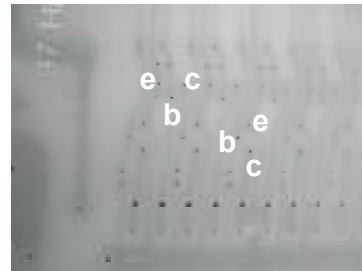


BFR79
BFR80
BC640
on 30BAD3D0



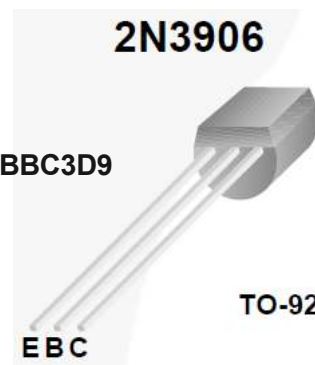
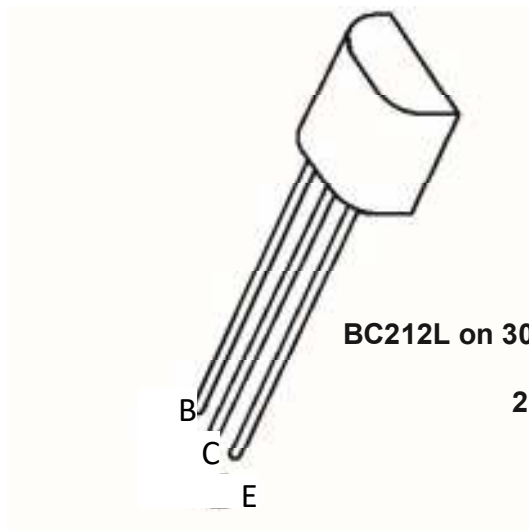
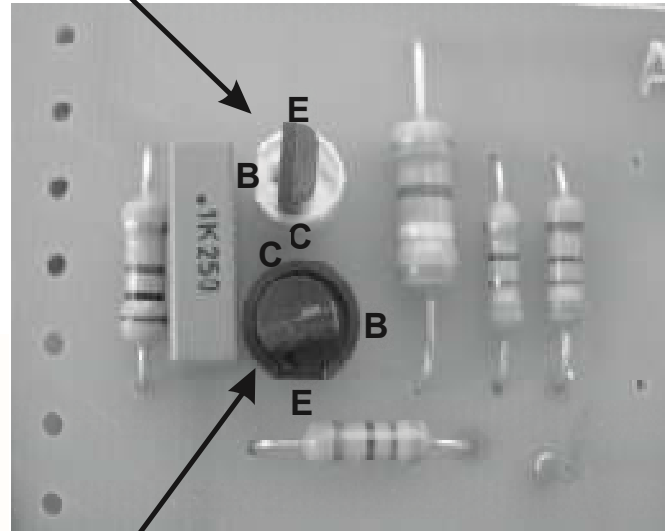
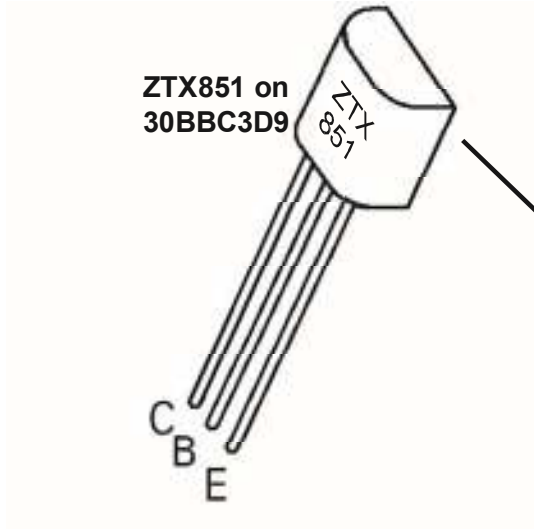
These transistors are all PNP and are interchangeable. They cannot be used to replace NPN transistors.

Row 2



The pin marked E on the new transistor should be soldered into the hole vacated by the pin marked E on the original transistor. C to C and B to B.
(If you are unsure please call a Solid State office for more advice)

TRANSISTORS USED FOR STOP RELAYS
(CF835, CF836 & CF837)
T1 22ECEDEK (ZTX851)
T2 22FBCCEE (BC212L)
22FBBCCE (2N3906)



The pin marked E on the new transistor should be soldered into the hole vacated by the pin marked E on the original transistor. C to C and B to B.
 (If you are unsure call your local SSOS Office for more advice)