

## Caravan (12S) Relays

### Smart Combi Relays: TF1170-3

#### **Introduction: Caravan fridges and auxiliary batteries. Protecting the vehicle battery.**

When a vehicle tows a caravan and the caravan is equipped with a 12-volt fridge or an auxiliary battery or both, it is necessary to provide a connection between the caravan and the towing vehicle to provide power to these.

When such a connection is provided it is advisable to protect to vehicle's own battery from being accidentally drained by the caravan fridge and auxiliary battery. In the U.K. the usual way of providing this protection is to install a suitable relay or pair of relays that will turn off the connections when the vehicle's alternator is not running.

#### **Alternator or Ignition-switched? Smart Combination Relay: switches itself**

They can be switched by a connection to the alternator or to some suitable ignition-switched source. The TF1170 series Smart Combination Relays make the installation of these relays much easier and safer. They do away with the need to find a signal/current from the alternator or ignition to switch the relays.

#### **Function**

A **TF1170 series Smart Combination Relay** incorporates a trigger device that switches two built-in relays when certain voltages occur. The normal operating environment is a nominally 12-volt DC circuit within a motor vehicle.

#### **Application**

Typically it is used in an auxiliary towbar electrical circuit, connected to a single feed from the vehicle's battery, to switch the caravan battery charging circuit and the fridge circuit on and off. When the voltage in the line from the battery reaches the appropriate level as the alternator begins to charge the battery, the trigger system switches the relays on. When the alternator ceases to charge and the voltage drops, it switches the relays off, isolating the caravan fridge and battery from the car.

**There are two versions of the Smart Combination Relay, TF1170-3 and TF1170-4** (See separate data sheet for TF1170-4)

The **TF1170-3**, "Super Combi" will handle up to 30 amps. Use when a small size is not important, and in all cases of vehicles likely to tow caravans with large fridges.



#### **Minimise voltage drop: Keep resistance down**

#### **Choose the right cable.**

For a standard fitting to supply a fridge and charge a battery, we recommend twin 35's (2x2.5mm<sup>2</sup>) or single 44's (1x3.0mm<sup>2</sup>) at least. For the largest vehicles and caravans, twin 44's (2x3.0mm<sup>2</sup>) is required if the customer wants his big caravan fridge to work properly. Thinner cable is likely to produce excessive voltage drops under heavy load conditions.

(Finding other, thinner wires, such as the boot lamp wire, to feed the auxiliary circuits is potentially dangerous as these wires may overheat under load. It is unlikely that the trigger unit would operate under such circumstances, which could be just as well!)

#### **Fit the correct fuse**

The correct fuse rating for the TF1170-4 is 20amps and for the TF1170-3, 30 amp.

[We recommend blade or good quality ceramic fuses. Traditional glass fuses have different operating characteristics and are not recommended.]

#### **Make sure that all connections are well made.**

Amongst the most common problems encountered by fitters using these Smart units has been the problem of voltage drop caused by connections that are badly made. Of these, loose battery nuts, and crimp terminals weakly crimped are the worst culprits. In any event, poor connections can get hot or very hot under load conditions and may therefore become dangerous.

### ***Safety***

One of the greatest safety features built into the Smart combination relay is that, under load in unsafe conditions, as described above, they will switch off the current to the caravan.

### ***How the Smart Combi does its job***

#### ***Accommodating different cars and different conditions.***

In order to work effectively, the unit has to accommodate a number of variables. Some variables occur between one car and another and some occur within individual cars depending on circumstances. Therefore the trigger unit has, at the outset, to be preset very precisely to operate within that narrow window of conditions that can be identified as common to all or, at least, the great majority of cars in most circumstances.

#### ***1. Variations between one car and another***

The performance of battery and alternator will vary between one car and another. Factors that affect performance include good or poor battery condition, alternator condition and slipping alternator belts.

#### ***2. Variations within each particular car.***

The performance of the battery and alternator of any individual car will also be affected by circumstances. For instance, not only do winter conditions make batteries and alternators work harder by virtue of the fact that heaters, wipers, lamps etc. are used more but in cold

weather the voltage drop observed in a battery when even a fairly small load is applied to it is much greater than it would be in warm conditions.

Other factors that affect performance and battery condition include night driving, frequent short journeys and additional loads created by in-car accessories.

#### ***3. Voltage drop under load***

One very important variable is the voltage drop that always occurs when a load is put on a battery (and the consequent rise in voltage when the load is removed). There is also some voltage drop across the length of supply cable.

#### ***4. Accommodating normal voltage drops.***

To succeed in doing its job in the context of all these variables the device has to be preset very precisely as described above. The unit is also intelligent enough to deal with a number of other variables that would otherwise prevent it working efficiently. It is also equipped with a time delay that allows it to ignore transitory voltage changes.

#### ***5. Conditions that will not be accommodated***

It is inevitable that some cars will fall outside the defined operating window of the Smart relay. In most cases, the poor condition of the battery or alternator or even the alternator belt will be to blame but it is possible that some cars may be "set up" differently even in prime condition. On such cars the trigger unit will not work properly.

It is also inevitable that, even in cars where the system works well, there will be times when, due to the use of other accessories that subject the battery to heavy loads, the trigger unit will turn off. This should not be regarded as a failure since the device is effectively protecting the battery from further overload but owners should be informed of the possibility and advised to monitor it

### **Fitting the TF1170-3**

#### **General Instruction, 12S installations (Caravan auxiliary circuits)**

Find a suitable entry point or near to the socket mounting point on the towbar. (If you have to drill a hole, take great care to ensure that you drill in a safe place where you will not damage wires, pipes, bodywork, etc.) Treat the edges of the hole with a rust inhibitor and line it with the grommet provided.

Wire the trailer socket, as shown in **Chart C** and mount it on the towbar. Lead the 7-core cable into the boot through the entry point.

Route your power source cable(s) from the boot to a suitable power source. Fit a fuse in line in the cable, close to the power source. Do not connect yet

Follow the instructions in **Chart C** and connect together your 7-core cable and your relay.

Note that post 1998 caravans use pins 4 and 2 differently from the way pre 1998 caravans did. If you wire according to these instructions, all caravans will be properly accommodated.

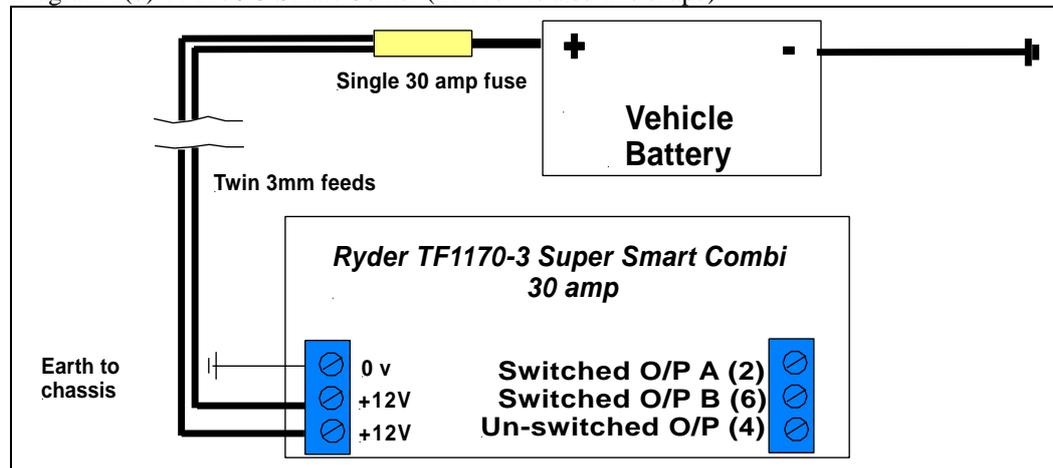
Connect your power cable(s) to the power source and insert the fuse(s) provided. Check that the fuse is of the value shown in **Chart C**.

Use a suitable test board to test the circuits. The loads created by the test board must simulate the load created by a caravan fridge (red, Pin 6) and battery (yellow, pin 2 or green, pin 4). Make sure that the relay stays on under load.

| Chart C: Wiring the 12S Socket & connecting to the vehicle: TF1170 type Self Switching Combi   |  |    |           |                 |  |
|--|--|----|-----------|-----------------|--|
| <b>Relay function:</b> Switches the caravan auxiliary circuits on when the vehicle alternator provides sufficient power. Fuse rating: TF1170-4 20 amp; TF1170-3 30 amp |  |    |           |                 |  |
| 12 Socket pin<br>(13 pin in brackets)  | 7-core cable colour<br>(13 core in brackets) | to | Relay pin | Vehicle circuit |  |
| 1 (8)  | Yellow (Pink)                                | to | N/A       | Reversing light |  |
| 2 (N/A)  | Blue (N/A)                                   | to | 2         | Switched live   |  |
| 3 (13)   | White (White/red)                            | to | N/A       | Chassis earth   |  |
| 4 (9)  | Green (Orange)                               | to | 4         | Permanent live  |  |
| 5 (N/A)  | Brown (N/A)                                  | -  | N/A       | Spare           |  |
| 6 (10)   | Red (Grey)                                   | to | 6         | Switched live   |  |
| 7 (11)   | Black (White/black)                          | to | N/A       | Chassis earth   |  |

The feed cable from the battery must be heavy duty. We recommend TF15430D1, double-insulated 27.5amp. This cable must be fused, as close to the power source as practically possible: TF1170-3 30 amp

Diagram 1(b) TF1170-3 Smart Combi (TF1174 is also this shape)



**Unswitched output** The green 12S wire to socket Pin 4 supplies the interior lights of the caravan; on new caravans this is automatically switched within the caravan when towing, to charge the caravan (auxiliary) battery. The switching is controlled by a relay in the fridge circuit. The fridge circuit is controlled by the Smart combi.

In a 13-pin socket, BOTH the blue cable from relay terminal 2 AND the red cable from relay terminal 6 should be connected to pin 10 in the 13-pin socket.

### Switched outputs

The blue 12S wire to Pin 2 is used to charge the caravan (auxiliary) battery except in new vans: *see above, Pin 4*

The red 12S wire to pin 6 supplies the caravan fridge



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Please note that the two black relays on this device are designed to run at a temperature of around 70 degrees C. This is normal. When fitting the device, do not lodge it in a tight space or wrap it up. Allow some space around it where air can move.

**TF1174 (24 volt) is exactly the same as TF1170-3 but for 12V substitute 24V and reduce the fuse rating by 50%**

### Trouble shooting the TF1170 Series (TF1170-4, TF1170-, TF1174)

| SYMPTOMS   | COMMENT/LOOK FOR   |
|--|--|
| Relay feels warm:  | This is normal. The relay coil warms when it is powered. Mount where there is space for some air circulation.  |
| Relay will not switch on:                                      | Poor battery condition<br>Poor alternator performance  |
| Relay switches on but switches off again when load is applied: | Poor connections. Loose battery nuts and crimp terminals not made with the appropriate ratchet crimping tool are the most common culprits  |
| Relay cycles on and off:                                       | Poor connections as above<br>Feed cable too thin (Use 2.5 mm 2 or 3 mm 2 cable)<br>Overload: Current over 22 amps may cause excessive voltage drop.<br>Check auxiliary battery, short circuits, etc. Check fuse in relay circuit.  |
| Relay takes time to switch off:                                | Poor connections as above.<br>Faulty battery causing abnormal voltage drop under load.<br>Lower value fuse in power line causing voltage drop as it heats up.<br>Caused by battery maintaining high voltage. Try draining battery slightly by applying load (switching on fan, brake lights, etc.) for a few seconds. Relay should switch off within approx 30 seconds of engine being switched off although some batteries can maintain unusually high voltage (above 13.2 volts unloaded) especially in warm weather.<br>Check if there is any load on relay.<br>Try another unit. |
| Caravan fridge does not cool / battery does not charge         | Check thickness of power cables. Check all connections for heating (sign of voltage drop)<br>Check trailer socket pins, caravan plug, etc.<br>Possibly double earth<br><br>Phone for advice on 0161 430 1120.  |

All units are thoroughly tested. If you think a unit is faulty try another unit. It is extremely unlikely that you will find two in a row that are incorrectly calibrated.

IF IN DOUBT PHONE FOR ADVICE ON THE NUMBER BELOW