Fault finding an X250 heated windscreen

A guide determining the reason for a failure

The X250 heated windscreen is a dual zone system with each half of the windscreen having a dedicated heating element. This guide is provides information on how to troubleshoot a fault in the system.

There are three types of problem that could occur:
One half of the screen not defrosting/demisting.
The whole screen not defrosting/demisting.
Small vertical areas across the screen not defrosting/demisting.

The last situation is not repairable by the user, as this occurs if small numbers of the heating element have failed and so the only cure is a replacement screen.

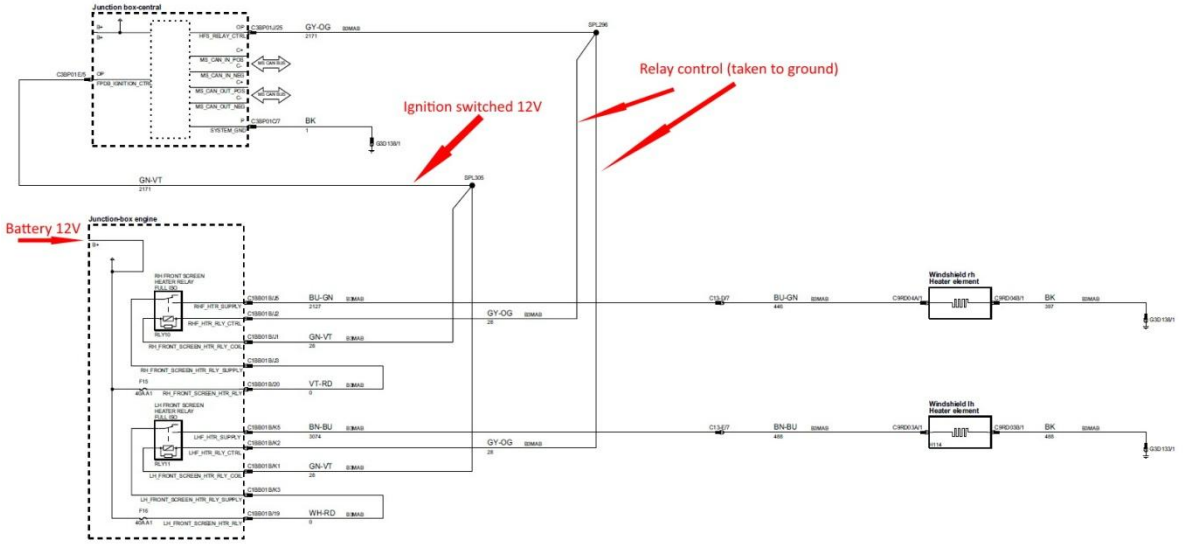
This guide provides troubleshooting steps to take in the case of the first two situations and hopefully ruling out a faulty heating element or elements in the windscreen itself.

The useful thing about the system being dual zone is that if there is a problem with only one side of the screen, there is a useful 'known good' zone to compare against if needs be.

Below is the system description, describing how the heated windscreen works.

Windshield heater operation is only enabled when the engine is running. The ATC module controls operation of the windshield heater using two relays in the EJB (engine junction box). When windshield heater operation is required, the ATC module broadcasts a message to the CJB on the medium speed CAN bus. On receipt of the message, the CJB energizes the relays by providing a ground path for both relay coils. This allows a battery feed to flow across the relays to power the windshield left and right heater elements.
There are two modes of windshield heater operation; manual and automatic.
Manual operation is activated by pressing the windshield heater switch on the integrated control panel. When the switch is pressed, the status LED in the switch illuminates and the windshield heater elements are energized. Manual operation is discontinued when the windshield heater switch is pressed a second time, 5 minutes have elapsed (the heating phase), or the engine stops. If manual operation is discontinued by the engine stopping, the previous heating phase is resumed if the engine is re-started within 30 seconds.
There are two variants of automatic operation; automatic operation at the start of a journey and automatic operation during a journey.
Automatic operation at the start of a journey is initiated if the ambient air temperature is below 5 °C (41 °F). In this instance, the switch LED is illuminated and the heater elements are energized for 6.5 minutes. Automatic operation is discontinued if the windshield heater switch is pressed or the engine stops.
Automatic operation during a journey is initiated when low ambient air temperatures are experienced and the vehicle has been travelling for a set period of time above a threshold speed. In this instance, no feedback is given to the driver to inform him the windshield heater is operational (the switch LED is not illuminated) and the duration of operation is variable depending upon the ambient air temperature, vehicle speed and the amount of time the vehicle has been travelling.

Below is the circuit diagram of the system, which I have annotated to highlight the important power feeds and control function.



Heated Windscreen circuit diagram

12V from the battery enters the engine junction box and provides a permanent supply to fuses 15 and 16, which are both 40A.
An ignition 12V is supplied from the central junction box and applied to the coils in relays 10 and 11.
A control signal is supplied from the central junction, in the form of taking the coils of both relays to ‘ground’, thus energising both relays and switching the battery 12V through to the heating elements in the windscreen.

Screen fault Scenarios

Failure of one side of the screen to operate
This will most likely be the most common scenario.
The good thing here is that because one half of the screen is working, three things can be immediately confirmed and ruled out.
Battery 12V is reaching the fuse.
Ignition 12V from the CJB is present at the relays.
The ‘ground’ control signal is being sent out from the CJB.

The first thing to do is inspect the appropriate fuse and ensure it is intact.
If the fuse is blown insert a new 40A fuse (do not be tempted to use a fuse of a higher rating, unless you want a bonfire on your hands). If the fuse stays intact, then a cure has most likely been effected and normal operation should resume. If the fuse immediately blows, then there is a short circuit present. Remove the appropriate relay and replace the fuse again. If the fuse remains intact, then suspect the relay. Insert a replacement relay. If the fuse remains intact, then a cure has most likely been effected and normal operation should resume.
If the fuse is intact, then check for 12V at the heater element connection. If 12V is present, then this proves that the relay is working correctly. If 0V is measured, then the relay should be suspected. Replacing the relay should restore normal operation.
Top tip: Because the two circuits are identical swapping relays 10 and 11 with each other is a good test. If the fault moves to the other side of the screen, you have proved that the relay is faulty.

If the fault stays on the same side of the screen, then the relay is good.
A continuity check of the heater element should now be carried out (see below).

It could well be that none of the actual components in the chain are faulty. What could (and is most likely) be the problem is a poor connection. Electrical connectors in a car are in a fairly 'hostile' environment and a process called oxidisation can occur. This causes a high impedance connection and thus can prevent things from working correctly.
In this instance both of the electrical connectors on the heater element on the screen should be inspected. 'Cleaning' the spade connector with something like emery cloth or a fine file should provide a sound connection again.
If the ground connector on the heater element has become oxidised and has made a high impedance connection, this results in what is often referred to as a "bad earth"(a common occurrence in older cars where the tin worm has taken hold).
This can cause confusion, especially with lights, as voltage is getting there, the component is known to be good, but still does not work.
The spade type connectors on the relay can also suffer from this. Again 'cleaning' these up should do the job. Usually just unplugging and plugging the relay back in (several times is quite effective) can also provide a cure.

Total failure of the screen to demist/defrost.
In my opinion this is probably an unlikely scenario, but is included for completeness.
In this case it must be determined if the permanent 12V feed is missing, the ignition 12V feed is missing, or the 'ground' control signal is not being sent, as these are common to both sides.
It is extremely unlikely that there would be a total failure of both heating elements in the screen, but not an impossibility. By the same token, it is extremely unlikely that both relays will have failed at the same time.

To fault find this scenario, first check that 12V is present on both sides of the fuses 15 and 16. If this is confirmed, then (with the engine running and the switch operated) check for 12V at each heating element terminal connection. If there is a confirmed 12V present at each heating element, this proves that the fuses and relays are working as they should and that the 'ground' control signal is being sent out. A continuity test should then be carried out on each heating element (see below).
If a continuity test proves that the elements are good, then the only thing left is that both ground connections for the heating elements are faulty (this is extremely unlikely).

Continuity testing of the heating elements
A simple continuity check with a multimeter will confirm if the heating elements have failed.
Each element will have a resistance in the very low Ohms value, typically 20 Ohms or so. If a very high reading is measured, or an open circuit, then this confirms the heating element is at fault.

There now follows a serious of pictures showing access and locations of the components mentioned in the previous text.

Under the bonnet

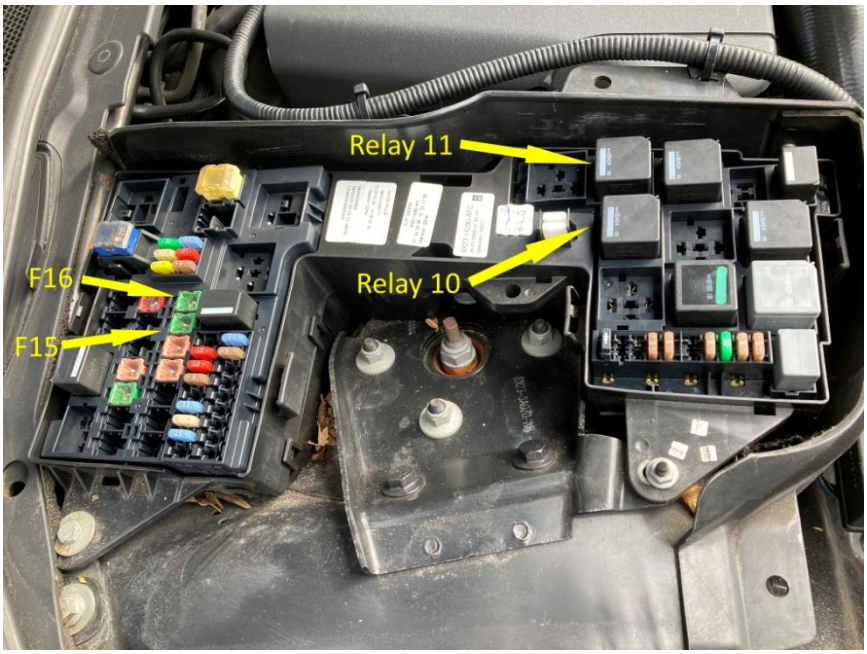
Note: These pictures feature a 3.0L V6 diesel engine bay. Others may differ.

To gain access to the engine junction box, remove the three screws indicated below

Watch out for these. They can easily go ‘ping’ into the bowels of the engine bay as you pull the cover off

This reveals the cover to the EJB.

There are four clips holding this on. These just have to be ‘squeezed’ to get the cover off.
Once off. The fuses and relays are revealed.
I have indicated the items of interest.



The positions of these fuses and relays are actually shown in the lid.

Inside the cabin

To gain access to the heater element connections the A pillar trim will have to be removed. This is achieved by first removing the plastic cover with the Air Bag logo on it.

This will reveal a T30 Torx bolt which will need removing.
The trim can then be removed. Easing the door seal off where it overlaps this trim makes this a bit easier. Pull it outwards from the pillar at the top and then wiggle it upwards to release it from the bottom.

Once off this will reveal the air bag and the two connections to the heater element.

The positive connection is tucked behind the metal bracket you can see. It should be eased out for access. Care should be taken doing this to ensure the ribbon cable is not damaged.

Oxidised Connector

In my case I had 12V present at the heater element connector and the continuity test gave a value of 20 Ohms for the heater element.
Even before I carried out these tests, I already knew what the problem was, due to the heat damage done to the insulation on the connector.
The connection had oxidised and caused a high resistance connection. This in turn had generated a bit of heat (due to the high current flowing in this circuit). The oxidisation and heat damage can be seen in the picture below.

Cleaning the connector proved a 100% cure to my faulty heated screen.