

Technical Bulletin

Number	073
Subject	Hitachi Utopia & Set Free Inverter Fault Finding (04 Fault)
Date	05 March 2012

Standard tests to carry out when fault conditions occur:

Power Source.

For Condensing Units, measure the incoming mains voltage, checking from the Mains distribution board to the Isolator and then from the Isolator to the A/C Equipment Terminal Board.

Single Phase: Isolator switched to ON position but A/C equipment switched off. Using either a digital or analogue multimeter on AC Volts, check for 240V \pm 10% between Live and Neutral. Check for zero Volts between Neutral and Earth. Check these voltages at the distribution board, both sides of the Isolator and on the Terminal Board of the Condenser.

Three Phase: Isolator switched to ON position but A/C equipment switched off. Using either a digital or analogue multimeter on AC Volts, check for 240V \pm 10% between each Live line and Neutral and for 415V between each of the Live phases. Check for zero Volts between Neutral and Earth. Check these voltages at the distribution board, both sides of the Isolator and on the Terminal Board of the Condenser.

Problems:

1. If the mains voltage varies from its nominal value by more than 10% this can cause unpredictable behaviour from the A/C Equipment and can also result in damage to the A/C Equipment.
2. If the voltage between each of the phases varies by more than 10% this can cause unpredictable behaviour from the A/C Equipment.
3. If the voltage between Neutral and Earth is measurable, then there may be a problem with the Neutral line. If the Voltage is between 0.5V and 5V, then this is only 'suspect' and all connections should be checked and tightened, if it is between 10V and 30V then it is possible that there is a Floating or Poor connection (this could cause damage to the A/C Equipment) and if the voltage is between 30V and 50V then it is most likely that the Neutral is not connected (this can also damage the A/C Equipment).

For both Single and Three Phase systems:

If the Condensing unit can be run, check the Mains voltage at the Terminal Block once the compressor is running. If the voltage measured is significantly less than that measured when the unit is off then there may be a problem with the Isolator. Over time the contacts of the Isolator can become charred and this creates a resistance in the Isolator which results in a drop in Mains voltage to the A/C Equipment when it is running under load.

Also take care to check all the internal fuses in the unit that feed the ISPM, particularly on Three Phase units. Switch off the power at the isolator, remove the fuses from their holders and check them for continuity.

Once the power supply though to the ISPM has been verified, the next stage would be to check the compressor. Power down the system. Please ensure that you wait until the small red LED on the Inverter board fades out completely before working on the condensing unit, as this indicates the state of stored charge within the circuitry. This should only take a few minutes to fade out completely.

Testing the Compressor:

First, disconnect the compressor – this is easiest done by disconnecting the connectors on the body of the compressor. Make these connections safe to prevent them making contact with any earth point.

Test the value of each of the three windings of the compressor (U-V, V-W and U-W on the terminals of the compressor). These should be tested using the multimeter on the ohms range. The value varies for each model, but the key is that all three windings should read roughly the same amount (i.e. within 10% of each other's value). Any variation greater than that would suggest a problem with the compressor.

The next test is to ensure that the compressor is not shorting to earth. To measure this you need to use a Megger test meter. This applies a high voltage to the windings and tests their isolation from the earth. Connect the negative lead to Earth –the body of the compressor should provide a suitable earth point – and connect the positive lead to each of the winding terminals in turn, testing each of them. As a minimum the Megger should indicate a resistance of 1 Megohm, but most healthy compressors will read in excess of 10 Megohms. Anything less than 1 Megohm would indicate a problem with the compressor. This means that the compressor would be likely to draw excessive current, leaving the Inverter Module liable to damage.

Testing the Inverter Module (with an Inverter Checker [recommended]):

With the compressor still disconnected, attach an Inverter Tester to the output leads from the Inverter module (PCB3). On the Hitachi Utopia and Set Free ranges there is a small two-switch dipswitch (marked DSW1). These are set, by default, to be both the same. Change the position of switch 1 on DSW1 before powering up the condensing unit. This prevents the under current alarm from triggering. REMEMBER to switch this back to its original position before returning the system to its normal duty.

Use the DSW1 dipswitch on the Main PCB (PCB1), set the Condensing unit to Test Cooling. Set switch 1 to on before powering up the unit.

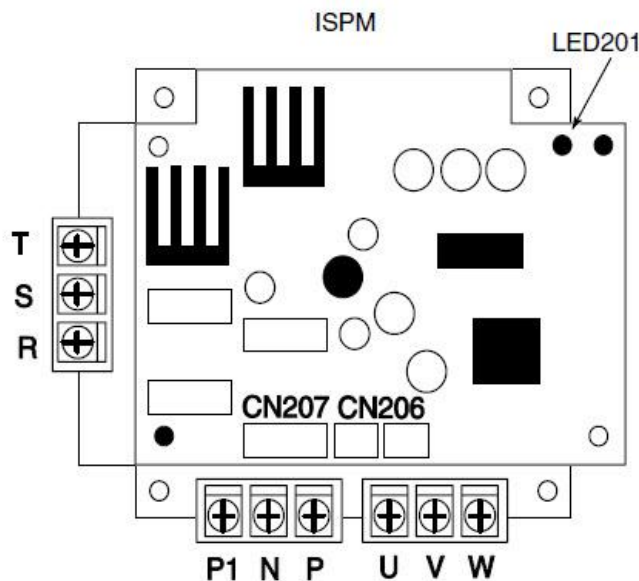
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When the condensing unit fires up the Inverter Checker should illuminate. Initially the LEDs should light in a circular sequence, but that should settle to a steady illumination of all six LEDs within a few seconds. If any of the LEDs fail to light there may be a problem with a section of the Inverter Module but if none of the LEDs illuminate the problem may be with power feed to the Inverter Module.

In the event that the Inverter checker shows no LEDs at all, use a multimeter to check the input voltage to the Inverter Module. Set the Meter to DC Voltage – the range should be set to at least 500V for Single or Three Phase – and measure the input voltage across the P & N terminal on the input of the Inverter module. It should read between 300V and 330V for the Single Phase models and between 460V and 490V for the Three Phase models. If there is no voltage on the input, check the cartridge fuses feeding the Inverter (single 40A fuse or two 20A fuses, depending on model). It is also advisable to check the condition of the Load resistors (R1 & R2) and the smoothing capacitors.

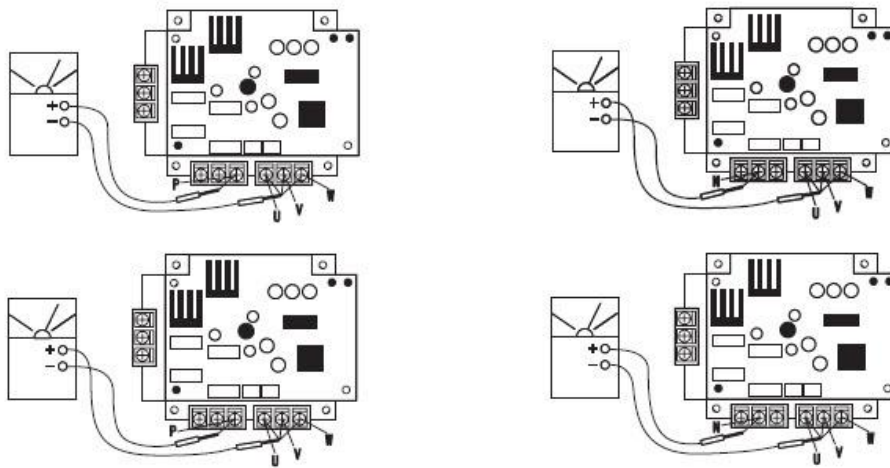
Checking the Inverter Module with the power off:

Using a multimeter, you can check the state of the Inverter Module with the power off.



With an analogue meter, using the Kilohm range, measure the resistance between the Input (P) and each of the outputs (U, V & W), between the Neutral (N) and each of the outputs (U, V & W) and also between each of the outputs (U-V, V-W and U-W). Measure the resistance in both directions, there should be a reading in one direction only. The resistance readings should be balanced, within 10% of each other, in the direction that gives a reading. If any one of the readings is unbalanced or if all readings in both directions show either high or low resistance, then the ISPM is damaged and requires replacement.

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You can also test the ISPM with a digital multimeter, but be aware that the readings may look 'reversed' in comparison with an analogue meter. This is not unusual, and the same rules apply about the balanced readings for each set of measurements. Some digital meters, particularly those that 'auto range', may not give accurate readings. If you can set them to manual ranges, do so, otherwise use an analogue meter as above.