ORSUK0917

DAIKIN

Operation Manual
for
Inverter Analyzer RSUK0917

ENGLISH

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Contents

The Inverter Analyzer is applicable to all inverter products. (It can be used with other manufacturer's air conditioners and products other than air conditioner.)

Instruction Manual for Inverter Analyzer (Type: RSUK0917)

1. Characteristics

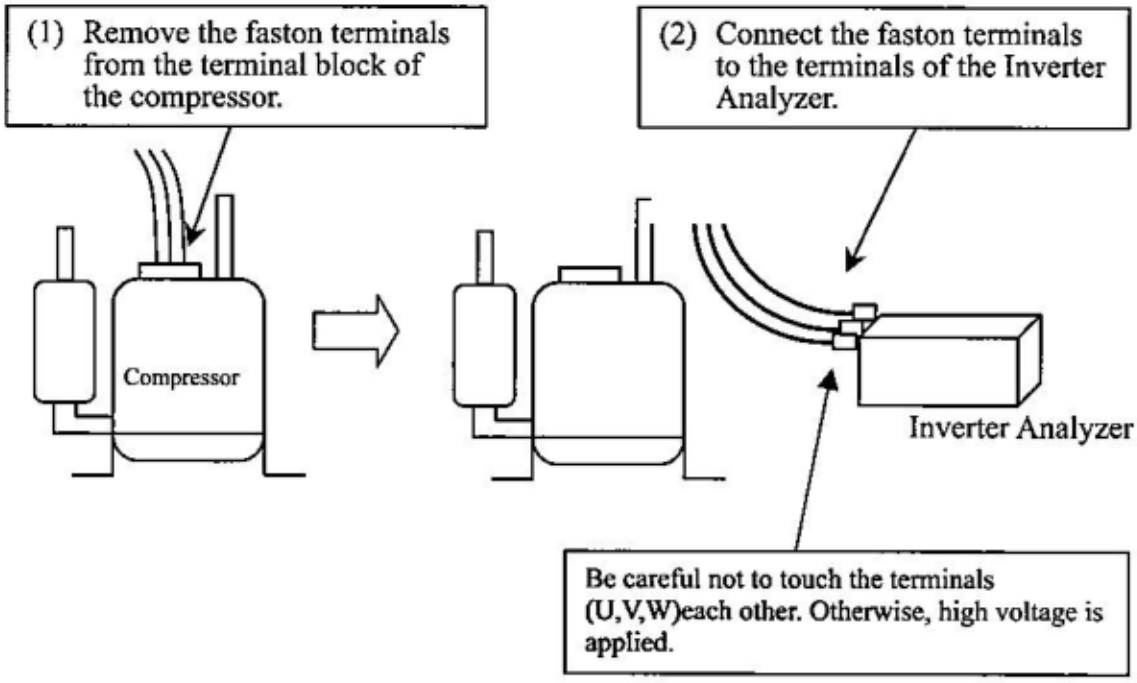
If abnormal stop occurs due to compressor startup failure or overcurrent output when using inverter unit, it is difficult to judge it results from the compressor failure or other failure (control PC board, power transistor, etc.). The inverter analyzer makes it possible to judge the cause of trouble easily and securely. (Connect this analyzer as a quasi compressor instead of compressor and check the output of inverter)

2 .Operation Method

1) Be sure to turn the power off.

2) Install the Inverter Analyzer instead of a compressor.

Note: Make sure the charged voltage of the built-in smoothing electrolytic capacitor drops to 10 VDC or below before carrying out the service work.



Reference

If the connector terminal of compressor is not a faston terminal (difficult to remove the wire on the terminal), it is possible to connect a wire available on site to the unit from output side of PC board. (Do not connect it to the compressor at the same time, otherwise it may result in incorrect detection.)

3) Turn the power on and operate the air conditioner.

3. Diagnose method (Diagnose can be made according to 6 LEDs lighting status as follows:)

(1) When all LEDs are lit uniformly. → Compressor malfunction (to be replaced)

(2) When some of LEDs are not lit (LEDs are not lit or go off, etc.):
Check the individual power transistor. (Refer to the service manual)

※ When the power transistor and control PC board are integrated: → Replace the control PC board.

※ When the power transistor can be checked individually:

↓ Check the resistance value. (Refer to the relevant service manual)

If NG: → The power transistor may have a failure. (Replace the power transistor).

If the power transistor is normal, check if there is any solder cracking on filter PC board.

※ If any solder cracking is found: → Replace the filter PC board (or repair the soldered section).

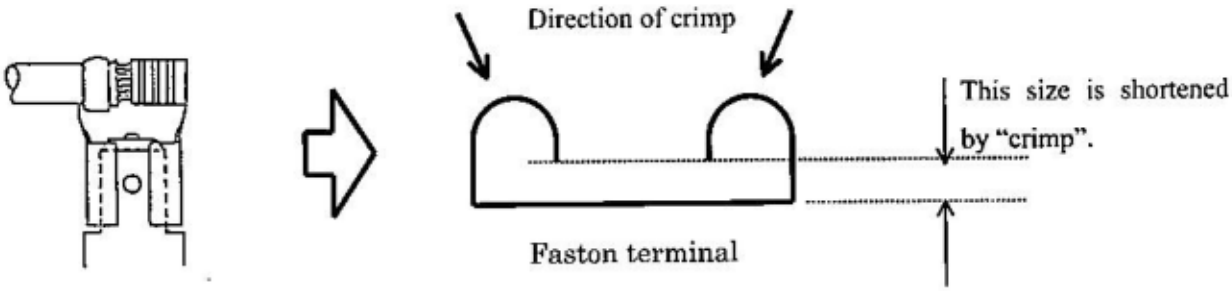
※ If filter PC board is normal: → Replace the control PC board.

Caution

① When the output frequency is low, the LED flashes slowly. As the frequency increases, the LED flashes quickly. (It looks like the LED is lit)

② If the operation is carried out with no load (the condition of the compressor is disconnected), some of units may stop operation with "CT system error" (due to no electric current) or "startup failure" (because the compressor does not turn). In this case, check if the LED is flashing during "operation" to "malfunction stop". (Refer to the service manual of each air conditioner for checking whether the alarm LEDs for CT system, startup failure, etc. are provided or not.)

③ On completion of diagnose by this checker, be sure to re-crimp the faston terminal for resetting the system.
(Otherwise, the terminal may be burned due to loosening.)



Technical Description on Inverter Analyzer (Type: RSUK0917)

1) Outline of Inverter Analyzer

An inverter circuit may result in several types of malfunction typically including overcurrent output (OPC: malfunction code L5). If an excessive current flows for several microseconds (10^{-6} sec) to the N terminal of the transistor module at the final stage of the inverter, the overcurrent function of the inverter will suspend the operation of the inverter to protect the transistor module. An excessive current occurs occasionally, but an excessive current flow itself is not considered as a malfunction. Therefore, the inverter automatically restarts in such cases when the current returns to normal. If an overcurrent malfunction occurs several times successively (or more or less, depending on the model), however, the inverter will display "L5" and stop operation. (Since the frequency of the malfunction to stop unit operation is depending on the model of unit, refer to the service manual for details.)

The inverter will stop within a very short time in the above case. Therefore, the phenomenon cannot be monitored in usual service methods. Moreover, it is almost impossible to single out what parts are bad. In the worst case, you may have to replace the whole compressor, transistor module, and inverter PCB.

In such cases, the Inverter Analyzer makes it possible to detect whether the compressor or the control side (the PCB or the transistor module) is responsible for the malfunction.

The inverter has quasi three-phase output that is produced by switching the DC power supply on and off by using six transistors. If any of the six transistors fails to operate, proper three-phase power output will not be obtained. The Inverter Analyzer makes it possible to check the operation of all the transistors simultaneously.

2) Operation of Inverter

Figure 1 shows the waveform of three-phase power supply and that of the quasi three-phase output of the inverter. The output waveform of the inverter in the figure is simplified for ease of explanation. The inverter in actual operation switches the DC power supply on and off more frequently so that the output waveform will be very close to a sine wave. The transistor module at the final stage of the inverter consists of six transistors and six diodes as shown in figure 2. These transistors on the positive (upper) and negative (lower) sides of the UVW terminals are called U_U, U_L, V_U, V_L, W_U, and W_L. By turning each transistor on and off in a timely manner, the quasi three-phase output of the inverter as shown in the lower part of figure 1 will be generated. A motor will be connected as a load (i.e., an inductive load). The diode connected to each transistor in parallel will discharge the generated counter-electromotive force of the motor to the power supply line.

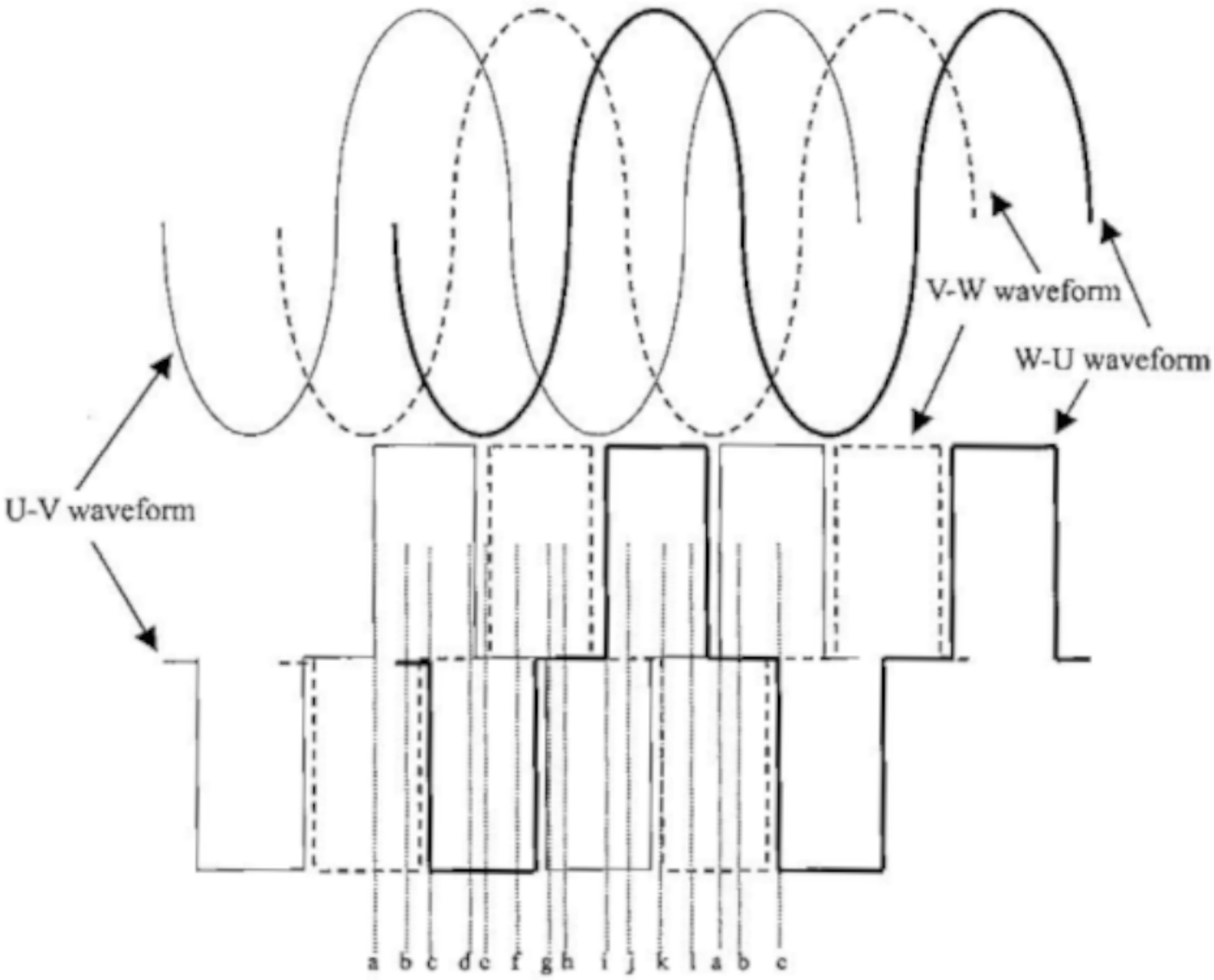


Fig. 1 Waveform of Standard Three-phase Power Supply (Upper Part)
Output Waveform of Inverter (Lower Part)

At the moment of d, the voltage between terminal U and terminal V is positive, that between terminal V and terminal W is zero, and that between terminal W and terminal U is negative. The positive voltage between terminal U and terminal V is generated because transistors U_U and V_L are turned on while the negative voltage between terminal W and terminal U is generated because transistors W_L and U_U are turned on. In other words, transistors U_U, V_L, and W_L are turned on at the moment of d. As you see, the upper and lower side transistors in pairs (e.g., U_U and U_L) are not turned on at the same time because they are the same in phase, or otherwise, the positive and negative terminals of the output of the inverter will short-circuit. Consequently a high current will flow to the transistor module. If that happens, the transistor module will be broken.

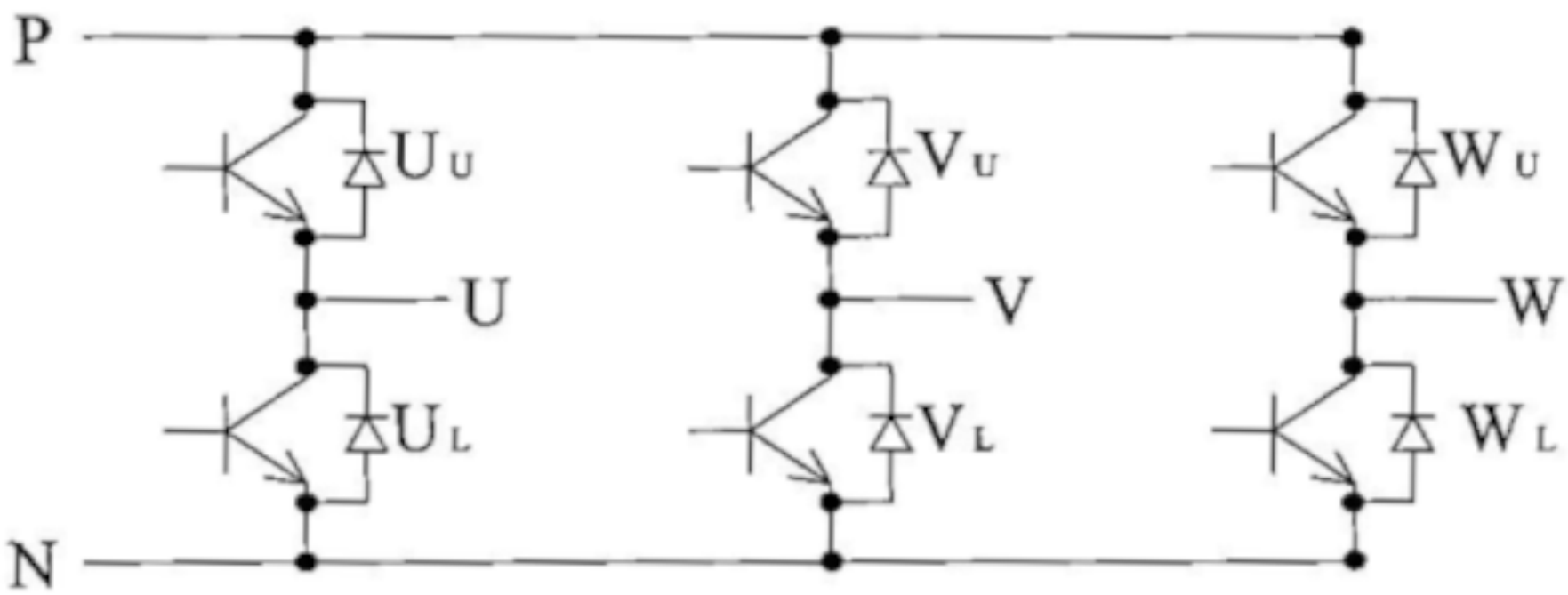


Fig. 2 Internal Circuit of Transistor Module

Table 1 Transistors in Switching Operation

	U_U	U_L	V_U	V_L	W_U	W_L
a				ON	ON	
b	ON			ON	ON	
c	ON			ON		
d	ON			ON		ON
e	ON					ON
f	ON		ON			ON
g			ON			ON
h		ON	ON			ON
i		ON	ON			
j		ON	ON		ON	
k		ON			ON	
l		ON		ON	ON	

3) Breakdown Modes of Transistor Module and Detection Method Inverter Analyzer

There are two major breakdown modes of the built-in transistor module (internal element). They are called short mode and open mode. If a built-in transistor or diode (e.g., transistor U_U or the diode connected to the transistor) is broken in short mode, a high current will flow to the module when transistor U_L is turned on and the inverter outputs power, regardless of whether the load is connected or not. The overcurrent protection (OCP) function will work in such cases. The OCP function detects the current flow to terminal N of the transistor module and shuts off the output of the inverter. Therefore, if the output of the inverter is shut off as a result of overcurrent output while the compressor is not connected, the transistor module is considered to have a short mode failure.

On the other hand, if the transistor module is broken in open mode, there will be no high current flow. The output waveform of the inverter is, however, distorted and no proper three-phase output will be obtained. The Inverter Analyzer will detect such failures. Figure 3 shows the internal circuit of the Inverter Analyzer. The LEDs are lit when there is a voltage between phases. If all the six transistors are operating, all the LEDs will be lit. If any one of them has a failure (i.e., any one of them is broken in open mode), the corresponding LED will not be lit. The Inverter Analyzer judges the condition of the transistor module as explained above.

The situation will be, however, different if diodes are broken in open mode. If the diode connected in parallel to transistor U_U is open, for example, the Inverter Analyzer cannot detect the breakdown because transistor U_U operates normally. In such cases, however, counter-electromotive force that is generated from the compressor will most probably damage transistor U_U. Conclusively, if all the six LEDs are lit, it will be possible to determine that the transistor module is in normal operation. To troubleshoot the cause precisely, you should stop the inverter (i.e., turn the inverter off), measure the resistance between the UVW and PN terminals, and check if the diode is in normal condition. See the table 2 below for the concrete method.

Table 2 Technical Reference Table (Reference of resistance between the UWV and PN terminals)

Negative probe of tester	Power transistor (positive side)	UVW	Power transistor (negative side)	UVW
Positive probe of tester	UVW	Power transistor (positive side)	UVW	Power transistor (negative side)
Normal resistance	Several hundred kΩ to several MΩ			
Failure resistance	0 or infinite			

4) Conclusion

(1) If the inverter is broken in short mode, the inverter will stop operating due to overcurrent output regardless of whether the compressor is connected or not.

(2) Any transistor breakdown in open mode will be detected with the Inverter Analyzer.

(3) Any diode breakdown in open mode will be more reliably detected with a tester.

(4) The Inverter Analyzer is applicable to all inverter models regardless of the power supply specifications of inverters (i.e., the voltage, frequency, single- or three-phase specifications). For a DC compressor, checking can be performed by connecting UVW only.

5) Limitations of Inverter Analyzer

(1) In a rare case, the cause of a transistor breakdown cannot be detected with the Inverter Analyzer because the characteristics of the transistor will vary with ambient temperature rising, thus causing the breakdown.

(2) If the Inverter Analyzer is connected to the compressor, the Inverter Analyzer cannot precisely detect the breakdown of any transistor because the LEDs of the Inverter Analyzer may be lit due to the generated counter-electromotive force of the compressor

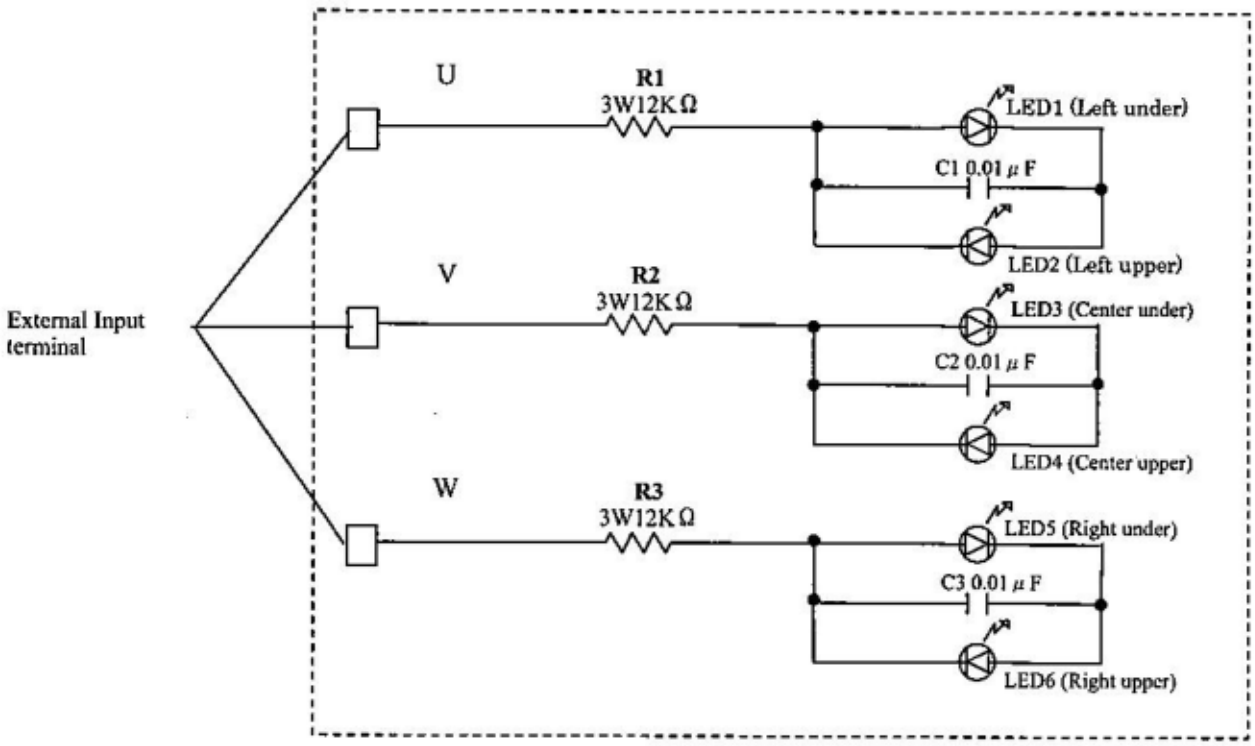


Fig.3 Internal Circuit of the Inverter Analyzer