4-Wire fans

Standard for connection fans with 4 wires was developed by Intel. Main purpose of creation of new standard is possibility revolution measuring with low fan speeds and precision control of revolution in all speed range.

Signal description

Connector pinout

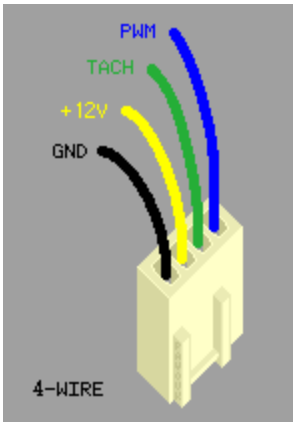
Pin	Function	Wire color
1	GND	Black
2	12V	Yellow
3	Sense (tach.)	Green
4	Control (PWM)	Blue

Signal **GND** is ground and **12V** is voltage supply for fan.

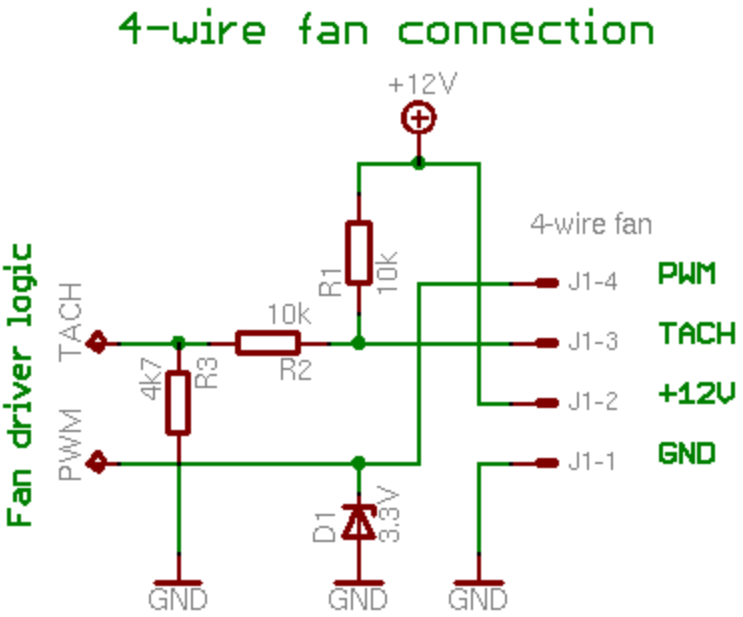
Signal **Sense (tachometer)** provides two pulses per revolution of fan. Output is opened collector and main board must have pull-up resistor to 12V.

Signal **Control (PWM)** is input for PWM pulses. Base frequency is 25kHz and it is acceptable from 21kHz to 28kHz. Input has TTL level and includes pull-up resistor to 5V or to 3.3V in new constructions. Signal is not inverted and 100% PWM means maximal revolutions of fan. Motherboard has open-collector type output. This construction guarantee, that with disconnected PWM signal will runs fan with maximum revolutions.

Connector circuit:



Example of motherboard logic:



Diode D1 protects **PWM** output from motherboard in case, that fan has pull-up to +5V and motherboard logic is on +3.3V.

Input **TACH** includes pull-up to +12V and next voltage ratio box, which guarantee on the I/O board logic around 2.3V (logical 1).

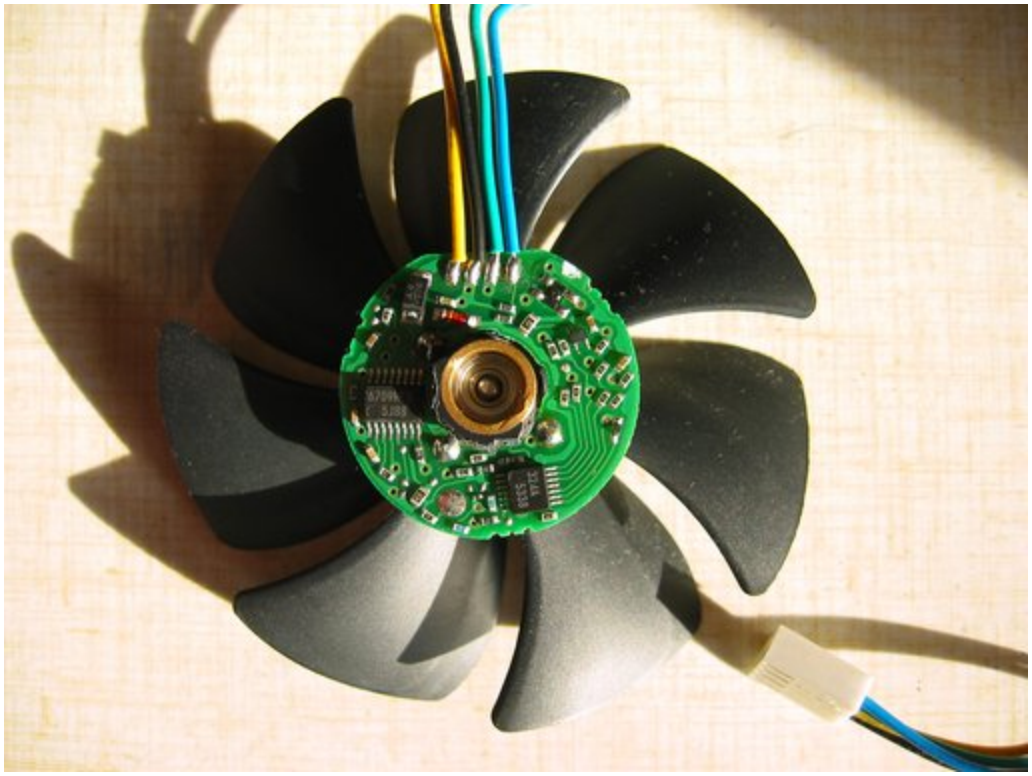
Example of 4-Wire fan

I had in hand fan NIDEC F09A-12B3S1, which is supplied with boxed Intel processors. Fan is high-quality and includes two ball bearings. It is superior made with good balanced airscrew. I tried to nondestructive demounting but I failed, because it is practically not possible. I disassembled it without damage of electronics. I find that fan contains relatively complicated electronics and few integrated circuits which are unknown to me. Copying of circuit will be very time consument and without knowledge of integrated circuits practically for nothing. I decided to not copy for now.

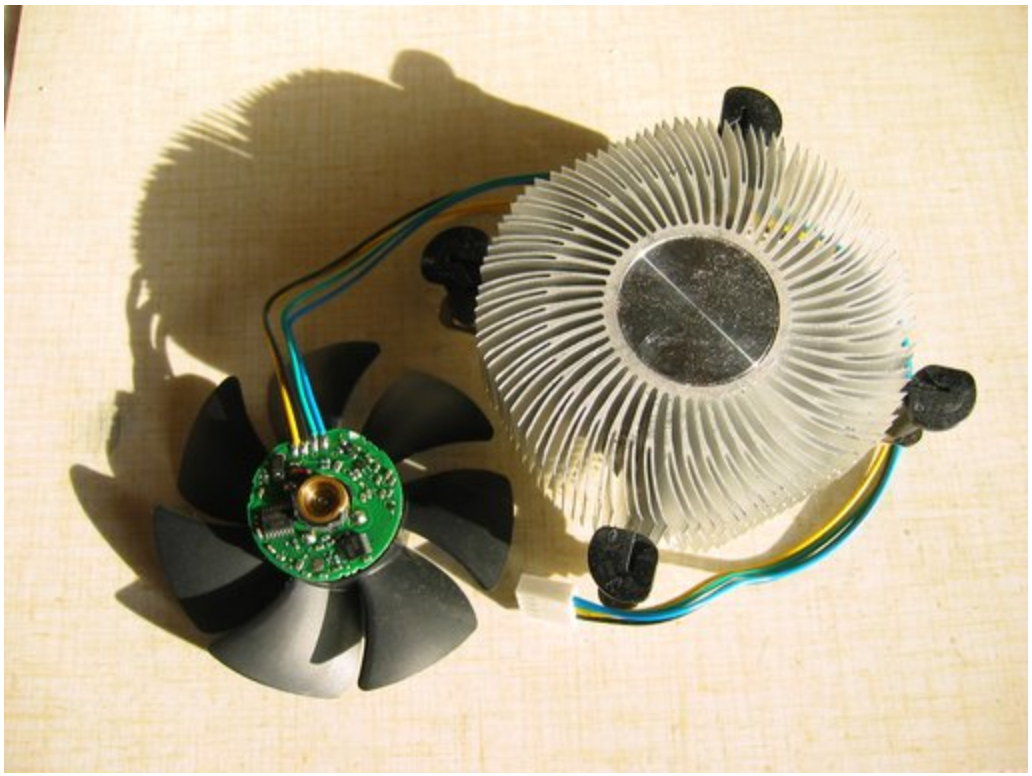
Photographs

Top view

Nidec inside



With heatsink



Links

- **http://www.formfactors.org/developer/specs/4_Wire_PWM_Spec.pdf** 4-Wire connection specification.
- **http://www.nidec.com** Nidec - fan manufacturer.

Conclusion

On the end I write some notes, that standard solve most of 3-wire fan problems. Standard was developed with idea of backward compatibility with 3-wire fans. Teoretically is possible to use 4-wire fan like 3-wire on the board with 3-wire connector. Vice-versa it is possible to use old 3-wire fan on new board with 4-wire header, but with limited possibility of PWM control depending on board logic.

Update October 13 2008

Fan uses control IC BD6709NFS from Rohm company. http://www.rohm.com/products/databook/motor/pdf/bd6709fs-e.pdf Second IC is quad op-amp LM324. Thanks to Franc Zabkar for these informations.