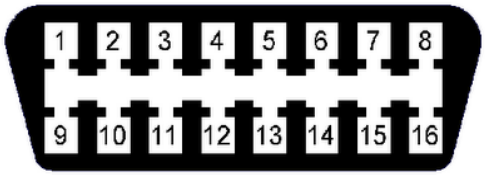
OBD 2
Communications Protocols



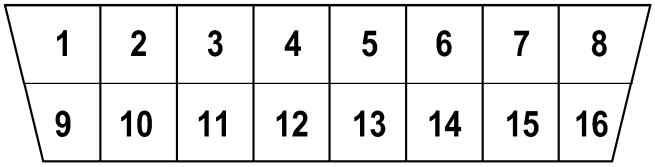
By Steve Caruso

This document is to help technicians with no communications with the scan tool on different OBD 2 vehicles. It is based off the SAE document J1962 and J1850

This article will wxplain the known good labsope patterns from the four (4) protocols. I used a OBD2 connector breakout box as to not spead the pins in the vehicle connector, which could induce other commincations problems. Most any labscope will work,however, I used a PC based scope for this article.

To start out with, you need power at pin 16 of the OBD 2 connector. This is crucial for powering up the scan tool. When the scan tool is using the vehicle's battery power, you can assume that the scan tool is connected to the vehicle. There are two ground pins: pins 4 chassis ground and pin 5 signal ground. Depending on the scan tool, it may use either one or both of the ground pin. If one scan tool does not works and another one does on the same vehicle, suspect a gound problem at pins 4 and 5 . I use pin 4 as my ground for all my labscope connections. If there is a difference between pins 4 and 5 check your grounds on the vehicle to the modules in to which you are communicating.

When looking at the OBD 2 connector, this is what SAE has designated the OBD2 pin configuration should look like:

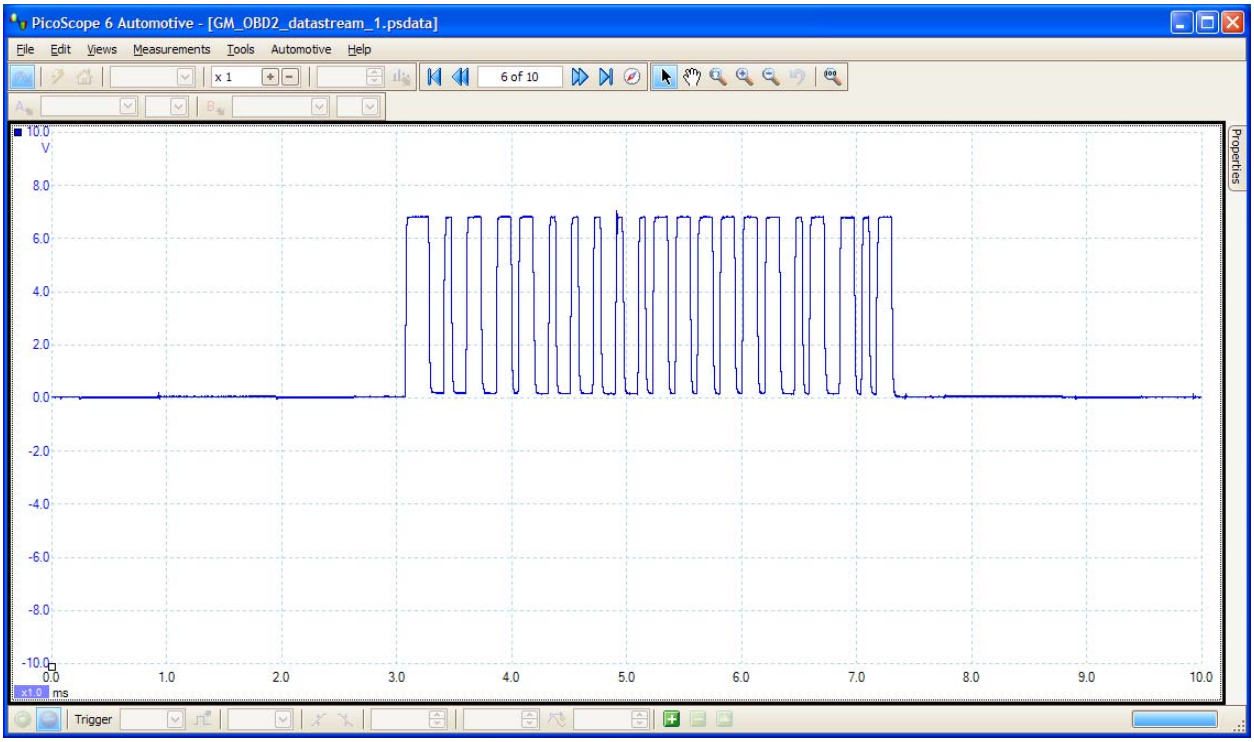


And this is what SAE has dedicated the pin useage to be.

1	Discretionary [1)]
2	Bus positive line of SAE J1850 [2)]
3	Discretionary [1)]
4	Chassis ground
5	Signal ground
6	CAN_H line of ISO 15765-4 [2)]
7	K line of ISO 9141-2 and ISO 14230-4 [2)]
8	Discretionary [1)]
9	Discretionary [1)]
10	Bus negative line of SAE J1850 [2)]
11	Discretionary [1)]
12	Discretionary [1)]
13	Discretionary [1)]
14	CAN_L line of ISO 15765-4 [2)]
15	L line of ISO 9141-2 and ISO 14230-4 [2)]
16	Permanent positive voltage

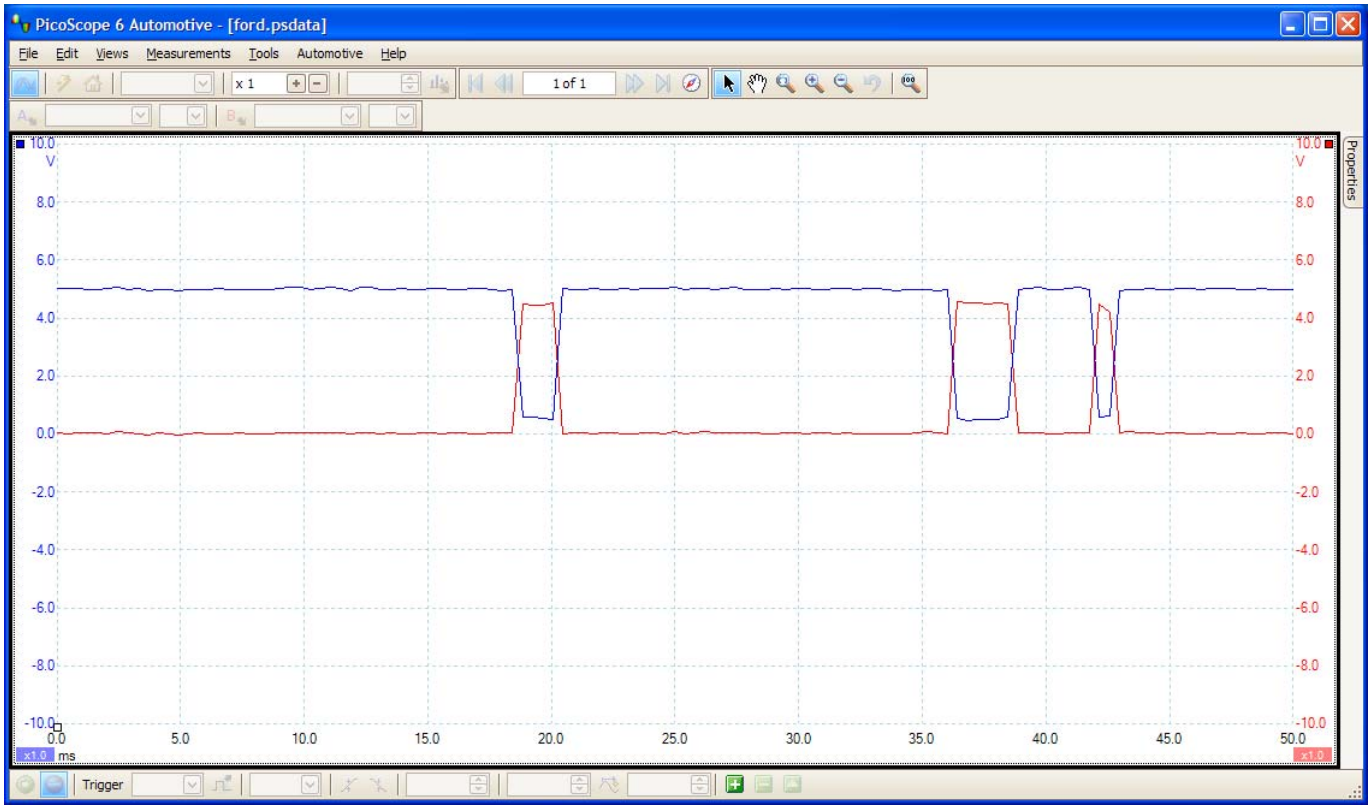
Note 1 These are the discretionary pins to be used by the manufacturers as they need them
Note 2 This is to be used strictly for emission diagnostic related communications only

J1850 10.4k



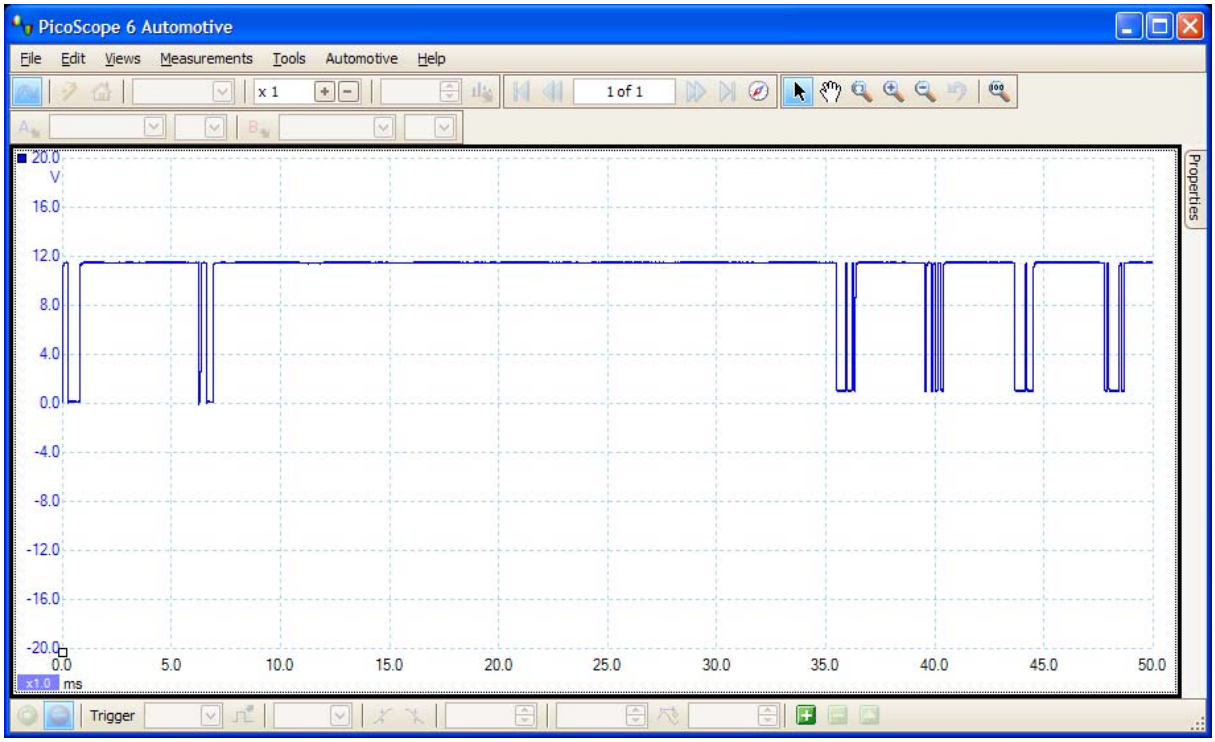
This is a pattern of GM communications on pin 2 of the OBD 2 connector. It is referred to as a J1850 10.4K baud rate protocol that is **V**ariable **P**ulse **W**idth modulated. At rest, the voltage value is 0 volts. When there is communications, the scan tool connected and/or the ECM, will pull the voltage value to 7 volts to talk. If there is only 0 volts, suspect that the line is shorted to ground. If the voltage is a constant 7 volts, and there is no communications suspect a stuck drive in the ECM. If there is any voltage near battery voltage suspect a short to power. Depending on the sampling rate and time based that you have your scope set at, there may be periods that you may not see communications. . You can normaly create communication on the BUS by turning the key on or operating some devices that require support of other modules on the BUS.

J1850 41.6k

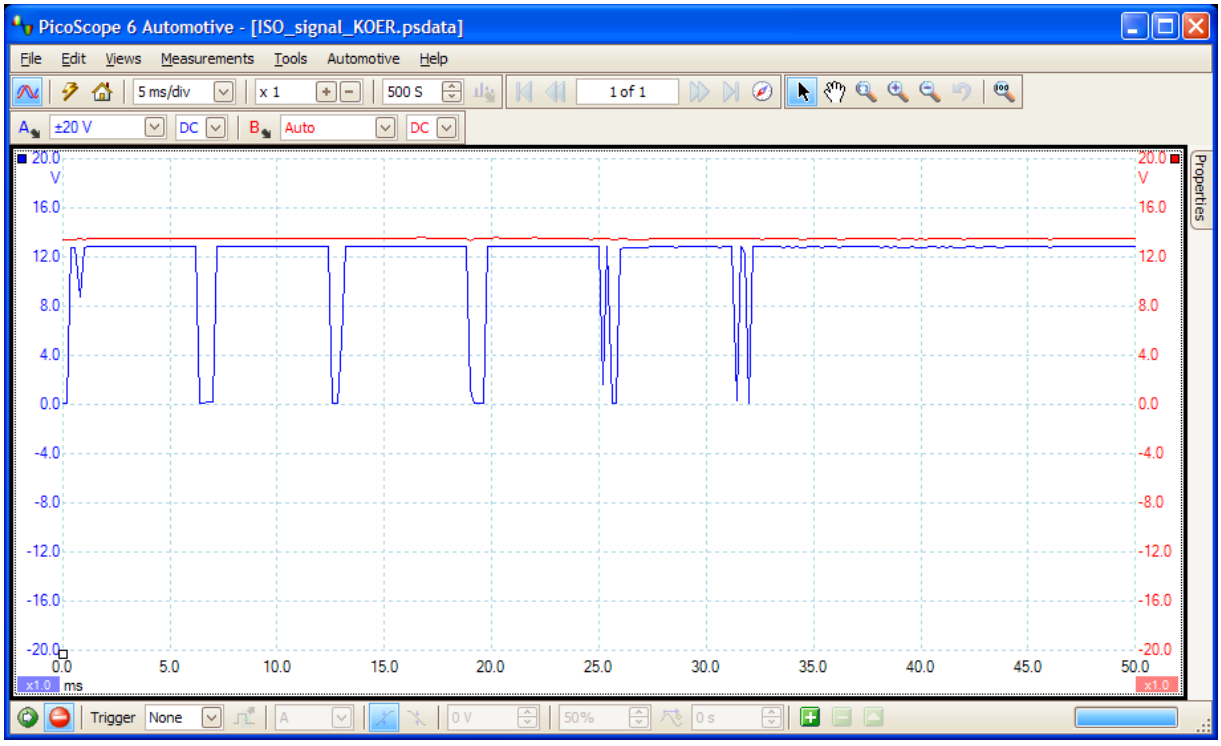


This is a Ford communication protocol that is on pin 2 (blue) and pin 10(red) in the OBD 2 connector. This is referred to as a J1850 41.6K baud rate protocol that is **P**ulse **W**idth **M**odulated. The bus line of this communication is 5 volts differential and should be *mirrored opposite* of each other. The characteristic of this protocol is that there is always chatter going on. If you see that there is one leg of this protocol near 0 volts, suspect a shorted line. Any value above 5 volts, suspect a short to power that, could be internal in a module or external. If the lines are identical in voltage pattern they may be shorted together.

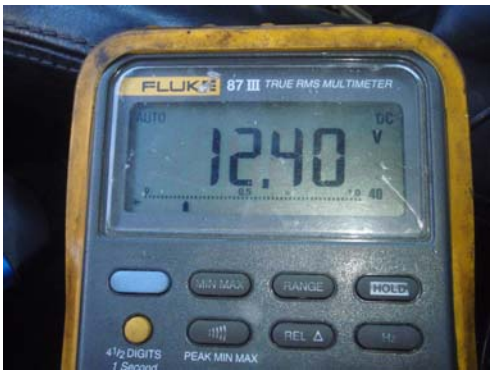
ISO 9141



This is an ISO-9141 communication pattern key-on-engine-off

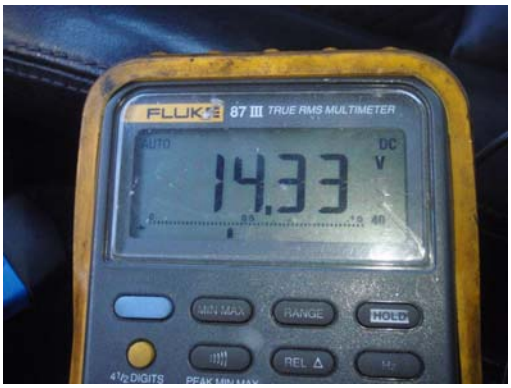


This is an ISO 9141 communication signal with the vehicle running.The red trace line is battery voltage. If you were to use a DVOM, you could easily see the difference between the two voltage value. Notice the K line voltage level rose just slighly between KOEO and KOER.

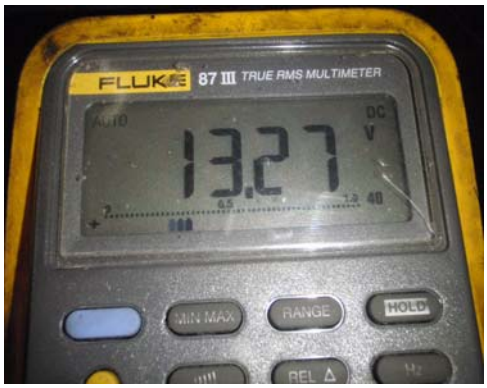


Key –on –engine –off battery voltage

Key-on-engine-off voltage of the K line



Key-on-engine-running battery voltage



Key-on-engine-running voltage of the K Line

The above pictures are to illistrate the importance of knowing what we are trying to find. Notice the difference that the voltage values are compared to the key-on-engine-off and key-on-engine-running . Not paying careful attention to details could have us chasing our tails.

The K line will aways be less that battery voltage.

.

Thie patterns above are ISO 9141-2 protocol, the baud rate is about 10.4k, the signal is on pin 7 of the OBD 2 connector. The signal value is ***near*** 12.0 volts, but not battery voltage which is usually 12.6 volts static. This protocol will only show the signal when spoken to, that means you need a scan tool to initate the conversation. This is a ***BOSCH*** designed ***communication*** protocol which is used on Europeans and Asian vehicles.

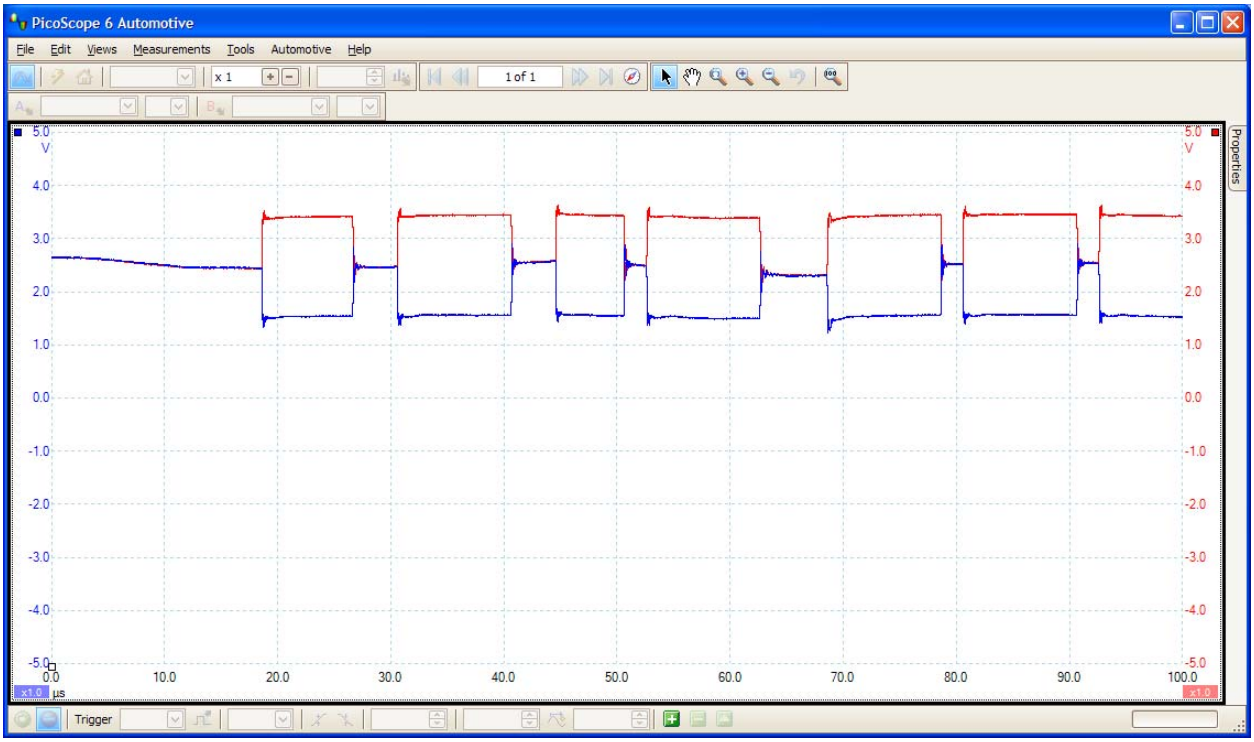
This protocol is referred to as a " K " line. Why K you may ask? Because BOSCH is a German language based company and in the German laguage there is no letter " C" . The word communication in German is spelled Kommunikation. For short, it is referred to as the 'K - line'.

If this line is at battery voltage at any time, suspect a short to battery power. It should be near 12.0 volts. Do not connect your scan tool up and try to initiate communications, it will short the transistor in the scan tool and destroy that level of circuitry in the tool. Your scan tool is not made to pull direct battery voltage to ground. The near 12.0 volts is the bias voltage that is designed to be pulled low, near 0 volt or ground. When the vehicle running and there is charging system voltage, the K – Line is definitely shorted to battery power. I have shown two snap shots of this protocol, one at key on engine off and the at other key on engine running. This is to show how it should stay near 12.0 volts

On some applications, pin 15, can be used to send a command request to start communications on pin 7 to the scan tool. This is known as the L-line.

The Keyword 2000 protocol is based off this ISO 9141- protocol. Advanced scope users will see a different wake-up signal when communication is initialized.

Controller Area Network



This a CAN scope pattern from a known good vehicle. Notice that the rest voltage is about 2.5 volts, the CAN high signal is about 3.5 volts and CAN low signal is about 1.5 volts. When there is communications the voltage value will either be pulled up or down approximinely 1.0 volt. The total voltage spread is 2 volts.

The pattern should mirror them selves in amplitude and time. Here, we are looking for signal intregity. If there is a problem and the pattern does not mirror them selves then communication error codes could be set. The signal is from pins 6 and 14 in the OBD 2 connector with the ground of the scope on pin 4. If there is a difference of pattern with the ground on pin 5 as compared to pin 4 and there are codes from communication errors, you should suspect ground issues. Any voltage value other than 2.5 volts for rest voltage,you should suspect short to power issues.