Setting up MicroAutoBox 1401/1501 for Power and LIN Communication

Application Note

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I. Abstract

The purpose of this application note is to describe step by step how to set up the MicroAutoBox 1401/1501 so it can have power and be capable of initiating LIN communication on the LIN bus. The introduction covers the hardware and components of the MicroAutoBox. The subsequent sections cover the configuration of the MicroAutoBox. The purpose of this tutorial is to get familiar with the MicroAutoBox for use with the LIN bus.

II. Keywords

dSPACE – Solution for creating a rapid prototyping system with the use of hardware and software

ECU – Electronic control unit

GND - Ground

I/O – Input/output

LED – Light emitting diode

LIN – Local interconnect network

MicroAutoBox – dSPACE prototyping hardware

RCP – Rapid control prototyping

VBAT – Main power supply

ZIF – Zero insertion force

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III. Introduction

The MicroAutoBox features a rapid prototyping (RCP) system and an electronic control unit (ECU) in one package. This makes is a suitable hardware for dSPACE prototyping in a vehicle. The MicroAutoBox used in this application note is the 1401/1501 variant. The package content for this variant includes three boards in a milled aluminum box. One of those is the DS1401 baseboard and the other two are the DS1501 I/O boards. There is a 156-pin Zero Insertion Force (ZIF) connector for matching the corresponding connector on the MicroAutoBox that is already preconfigured. This provides access to the input and output signals provided by the MicroAutoBox. Also included are the I/O connecter pins and dSPACE installation disk. The image in Figure 1 below shows the components necessary for configuring the MicroAutoBox for this tutorial.

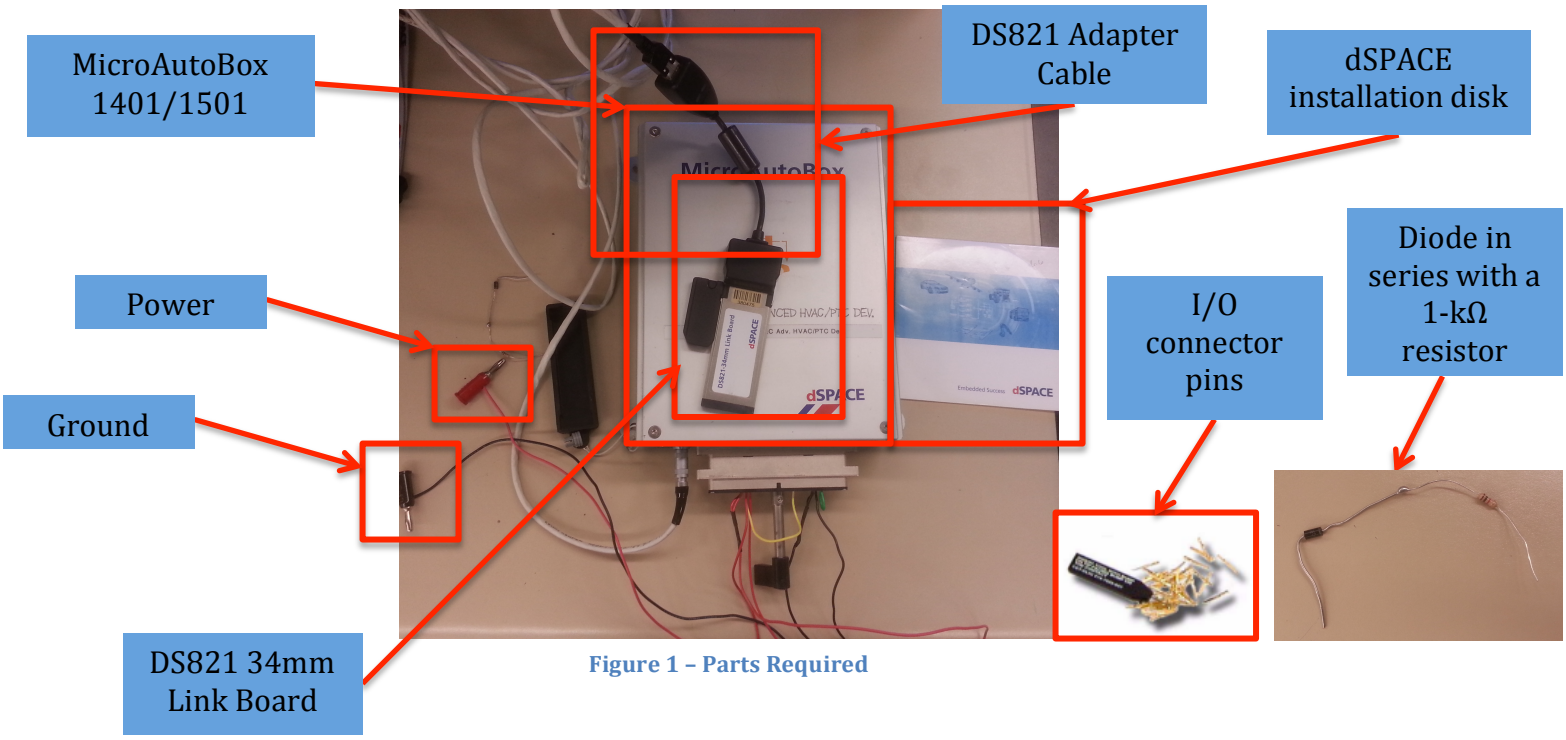


Figure 1 – Parts Required

IV. Power Configuration

Getting Started

Make sure to install the dSPACE software on your host PC before getting started. This came with the MicroAutoBox package and is used for reading data from the MicroAutoBox. The dSPACE software can be seen in Figure 1 above. You will need administrative rights to install the dSPACE software. Contact dSPACE for more information about system requirements or help with installation at http://www.dspace.com/goto?im

Wiring

The wire ends should be stripped for 3 to 4 mm. The sizes of the wire that can be connected to the MicroAutoBox are shown in Figure 2 below. The wire colors should be followed when configuring the power as mentioned in Figure 6.

AWG	Diameter (mm)	Cross section (mm^2)
20	0.812	0.518
21	0.723	0.411
22	0.644	0.326
24	0.511	0.205
25	0.455	0.163
26	0.405	0.129

Figure 2 – Wire Size

Power Supply Requirements

The MicroAutoBox requires a power supply in the range of 6-40 V (30 W with a 5 A peak). The power supply should operate at 12 V and deliver 5 A peak current. It is highly recommended to insert a fuse into the main power supply or to have a power supply with a fuse already installed in it. For the standard MicroAutoBox a fuse within the range of 8 to 10 A is recommended.

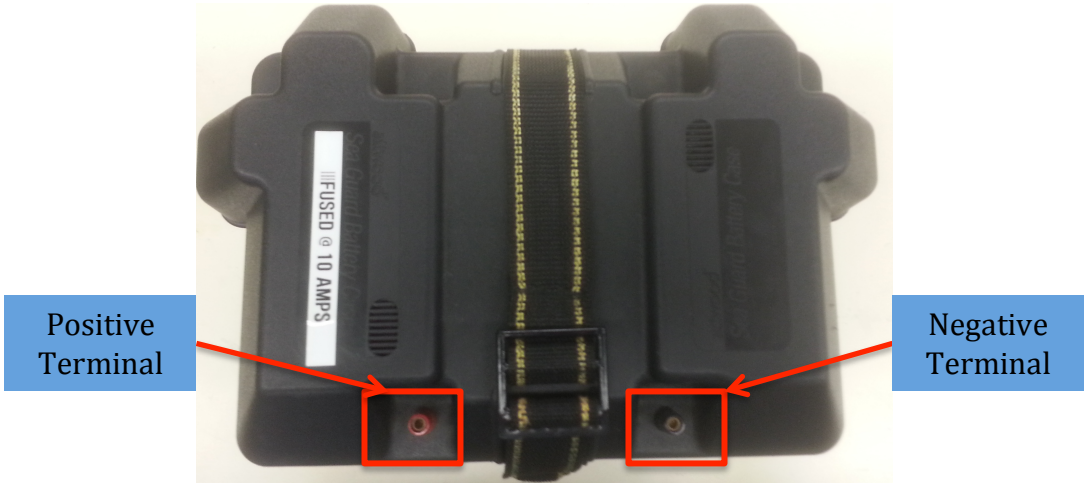


Figure 3 - Battery

Configuring Power and Ground

To configure the power, W3 and W4 must be connected to the battery. To do this attach the I/O connector pins to the end of two wires and then solder the wires together to a single wire. Cover up the connection with shrink-wrap as shown in Figure 4. For ground pin G3 and G4 are used. The same process that is done for power can be done for ground as well. The other end of the wires will then be connected to the proper terminal as shown in Figure 3. Refer to Figure 5 for a detailed description of the pins for power and ground. Refer to Figure 6 to see the pre-configured pins for power and ground fixed by dSPACE.

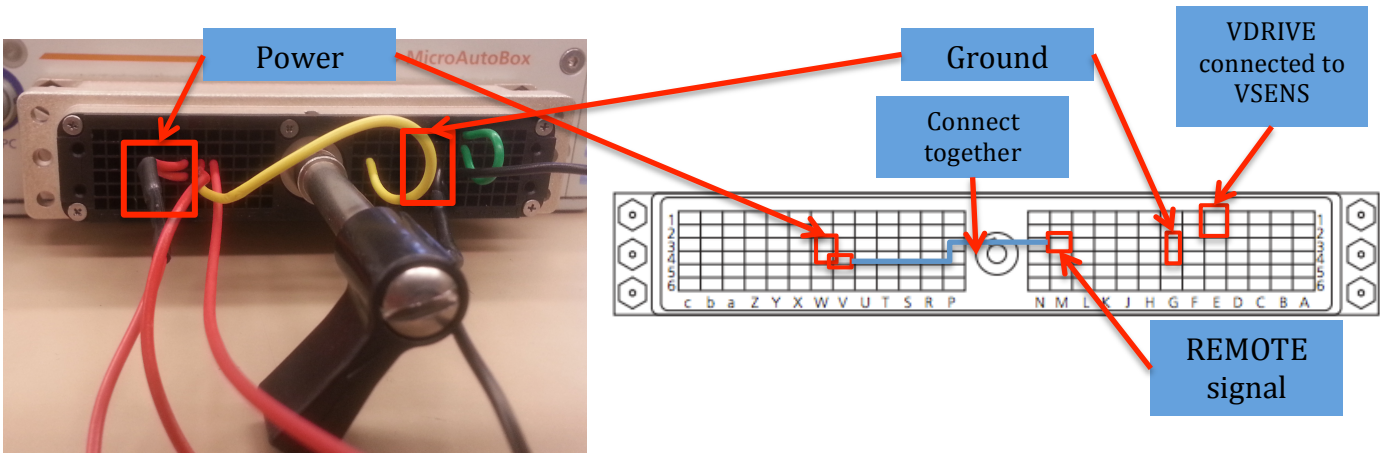


Figure 4 – Configuring Power and Ground

Switching on the MicroAutoBox

To turn on the MicroAutoBox when it is connected to the battery, connect a wire from the REMOTE signal (pin M3) to pin V4. Remember to attach an I/O pin to both ends of the wire. In Figure 4 the yellow wire shows how the connection looks like. When the power and ground is connected to the battery the LED located in the top left corner should light. If the LED is red, then the MicroAutoBox is in reset state, power supply is switched on but no application is downloaded to the real-time processor. If the LED is green then application is running.

Pins	Signal	Description/Function
V3, V4, W3, W4, W5, X3, X4	VBAT	Main power supply input. Connect at least 2 pins to the plus of your car battery.
F3, F4, G3, G4, G5, H3, H4	GND	Main power supply return and reference for all input and output signals. Connect at least 2 pins to the minus of your car battery. Use unused pins to reference your signals. This signal is also connected to the case of MicroAutoBox.
E1	VDRIVE	This input supplies all digital input and output circuits. ▪ Connect this input to VSENS to get TTL-compatible logic levels to your inputs/outputs. ▪ Connect this input to VBATprot to get automotive-compatible logic levels to your inputs/outputs. ▪ Do not connect this pin directly to VBAT, because the input and output circuits are not load dump or reverse voltage protected at this signal. ▪ While MicroAutoBox is being powered down, the output stages have pull-up behavior to VDRIVE. So the outputs may reach the level of VDRIVE. If this behavior is critical in your application, you have to power down your external devices or VDRIVE before MicroAutoBox is powered down. You can also use the REMOTE signal (Kl.15) with the power control software functionality to first switch off VDRIVE via a relay.
E2	VSENS	Sensor Supply output. Use this output to supply your sensors and/or VDRIVE.
c2	VBAT prot	Protected VBAT output. Use this output to supply VDRIVE when automotive logic levels are needed.

1	2	3	4	5	6	
DAC 7 out	DAC 8 out	Group 1 ch 1 out	Group 1 ch 2 out	Group 1 ch 3 out	Group 1 ch 4 out	A
DAC 5 out	DAC 6 out	Group 1 ch 5 out	Group 1 ch 6 out	Group 1 ch 7 out	CTM ch 1 out	B
out	DAC 4 out	CTM ch 2 out	CTM ch 5 out	CTM ch 6 out	CTM ch 7 out	C
out	DAC 2 out	CTM ch 8 out	CTM ch 3 out	CTM ch 4 out	Group 6 ch 1 out	D
in	VSENS out			Group 6 ch 4 out	Group 6 ch 5 out	E
Group 6 ch 6 out	Group 6 ch 7 out	GND in	GND in	Group 6 ch 8 out	TPU ch 1 out	F
TPU ch 2 out	TPU ch 3 out	GND in	GND in	GND in	TPU ch 4 out	G
TPU ch 5 out	TPU ch 6 out	GND in	GND in	TPU ch 7 out	TPU ch 8 out	H
TPU ch 9 out	TPU ch 10 out	TPU ch 11 out	TPU ch 12 out	TPU ch 13 out	TPU ch 14 out	J
TPU ch 15 out	TPU ch 16 out	Group 2 ch 1 out	Group 2 ch 2 out	Group 2 ch 3 out	Group 2 ch 4 out	K
Group 2 ch 5 out	Group 2 ch 6 out	Group 2 ch 7 out	Group 2 ch 8 out	Group 3 ch 1 out	Group 3 ch 2 out	L
Group 3 ch 3 out	CTM ch 1 in	REMOTE in	CTM ch 2 in	CTM ch 3 in	CTM ch 4 in	M
Group 6 ch 1 in	Group 6 ch 2 in	Group 6 ch 3 in	Group 6 ch 4 in	Group 6 ch 5 in	Group 6 ch 6 in	N
Group 6 ch 7 in	Group 6 ch 8 in	TPU ch 1 in	TPU ch 2 in	TPU ch 3 in	TPU ch 4 in	P
TPU ch 5 in	TPU ch 6 in	TPU ch 7 in	TPU ch 8 in	TPU ch 9 in	TPU ch 10 in	R
TPU ch 11 in	TPU ch 12 in	TPU ch 13 in	TPU ch 14 in	TPU ch 15 in	TPU ch 16 in	S
Group 2 ch 1 in	Group 2 ch 2 in	Group 2 ch 3 in	Group 2 ch 4 in	Group 2 ch 5 in	Group 2 ch 6 in	T
Group 2 ch 7 in	ADC Type 1 Con 4 Ch 4	Serial 2 K / LIN i/o	Serial 2 L in	Serial 1 TXD out	Serial 1 RXD in	U
ADC Type 1 Con 2 Ch 4 in	ADC Type 1 Con 3 Ch 4 in	VBAT in	VBAT in	CAN 1 low i/o	CAN 1 high i/o	V
ADC Type 1 Con 1 Ch 4 in	ADC Type 1 Con 4 Ch 3 in	VBAT in	VBAT in	VBAT in	Group 2 ch 8 in	W
ADC Type 1 Con 2 Ch 3 in	ADC Type 1 Con 3 Ch 3 in	VBAT in	VBAT in	CAN 2 low i/o	CAN 2 high i/o	X
ADC Type 1 Con 1 Ch 3 in	ADC Type 1 Con 4 Ch 2 in	Group 4 ch 1 in	Group 4 ch 2 in	ECU / IF RX+ in	Group 4 ch 3 in	Y
ADC Type 1 Con 2 Ch 2 in	ADC Type 1 Con 3 Ch 2 in	Group 4 ch 4 in	Group 4 ch 5 in	ECU / IF RX- in	Group 4 ch 6 in	Z
ADC Type 1 Con 1 Ch 2 in	ADC Type 1 Con 4 Ch 1 in	Group 4 ch 7 in	Group 4 ch 8 in	ECU / IF TX- out	Group 5 ch 1 in	a
ADC Type 1 Con 2 Ch 1 in	ADC Type 1 Con 3 Ch 1 in	Group 5 ch 2 in	Group 5 ch 3 in	ECU / IF TX+ out	Group 5 ch 4 in	b
ADC Type 1 Con 1 Ch 1 in	VBAT prot out	Group 5 ch 5 in	Group 5 ch 6 in	Group 5 ch 7 in	Group 5 ch 8 in	c
1	2	3	4	5	6	

Figure 5 - Pin Description

Pin	Signal	Meaning
W3, W4	VBAT	Main power supply input (red wire)
G3, G4	GND	Main power supply return line (black wire)
M3	REMOTE connected to V4 (VBAT)	MicroAutoBox starts automatically when power is supplied (yellow wire). For the meaning of the REMOTE signal, refer to *Basics on Connecting to Power Supply* on page 74.
E1 connected to E2	VDRIVE connected to VSENS	Selects TTL-compatible logic levels at the input/output signals (green wire).

Figure 6 – Pre Configured pins by dSPACE

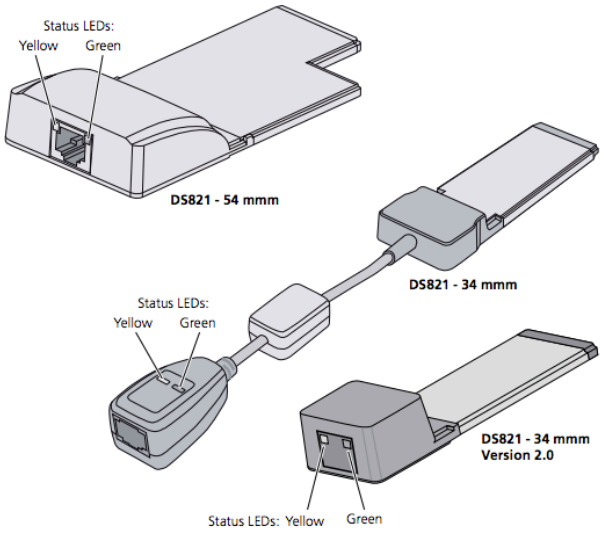
V. Connecting to a LIN Bus

Configure MicroAutoBox as the LIN Master

By default the MicroAutoBox is configured as a LIN slave in a LIN network. To configure it as the LIN master a diode in series with a 1 KΩ resistor must be soldered together as shown in Figure 1. The circuit must then be wired in parallel to the LIN transceiver by wiring one of the empty VBAT (Power) pins shown in Figure 5 to the pin for LIN (U3) also shown in Figure 5. The MicroAutoBox should now be configured as the LIN master.

Connecting MicroAutoBox to PC

With the MicroAutoBox turned of (i.e. not connected to the battery) connect the pin end of the crossed-over patch cable to the MicroAutoBox and the Ethernet end to one of the DS821 adapter cables shown in Figure 7 that came with the dSPACE package. The card should be inserted in the other end of the adapter cable and then connected to the host computer's 32mm PCI card slot. The PCI card slot should look similar to Figure 8. Make sure the pins match correctly when inserting into the PC. See Figure 7 description for information about the indicator LED status for the adapter.



Yellow LED A lit yellow LED indicates that the connection between the host PC and the expansion box is ready for communication.

Green LED A lit green LED indicates that data is being sent or received.

Figure 7 – DS821 Adapter Cable



Figure 8 – PCI Card Slot

VI. Conclusion

The MicroAutoBox should now be configured for using the LIN bus and communicating with a host PC. If the steps were followed correctly, a green LED should light when opening dSPACE software and running an application. This means that data is being sent/received between the host PC and the MicroAutoBox. The next step is to create a model of a system that uses the LIN bus and connect any controllers, actuators, or sensors onto the LIN bus to monitor their interaction with the modeled system.

VII. References

[1] "Hardware Installation and Configuration." dSPACE, n.d. 26 Mar 2014.