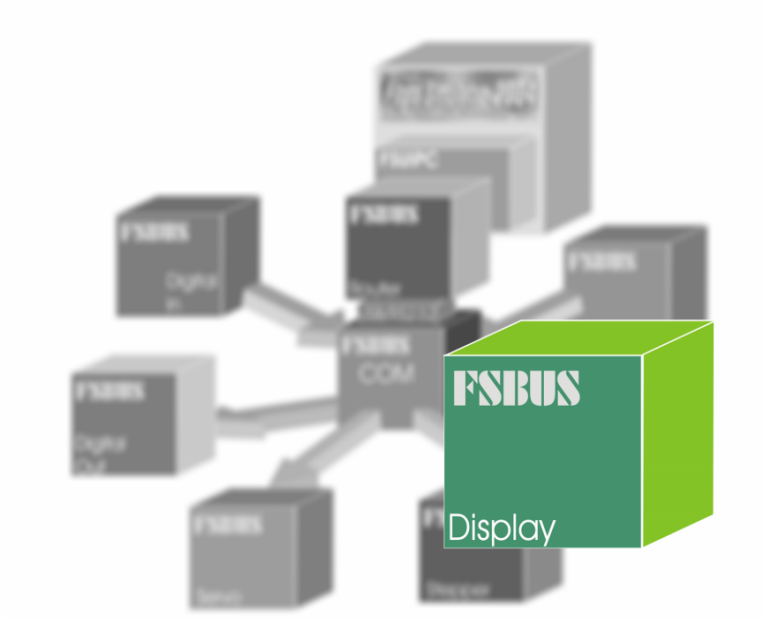
FSBUS



Display

Impressum

Dirk Anderseck
dirk@anderseck.net

History

24.4.2005	First version
3.12.2005	wrong picture on page 10 replaced
19.2.2006	Settings of the ATMEL fusebits for ATTINY 2313 corrected. (Page18)
12.7.2007	Another correction of the fusebits for ATTINY 2313
10.1.2009	Extended CID > 30 for the ATTINY2313 CA and CC displays

Operating conditions

The operation of the assembly is provided for hobby applications in the interior.
All consumers attached directly at the FSBUS cable may not exceed a current consumption of altogether 2 amps.
The permitted environmental temperature may not exceed 0° degrees Celsius and 40° degrees Celsius.
The device is meant for the use in dry and clean rooms.
The assemblies may be taken only under supervision of an informed adult or an expert into operation!

Safety

Tools only may be used if you guarantee that the equipment is separated from the supply tension and electrical charges which are stored in the components situated in the device were unloaded before.

I particularly hereby point out that FSBUS components only should be built by experienced electronics technicians. I dissociate myself from possible damages which can arise.
All operation is carried out at your own risk.

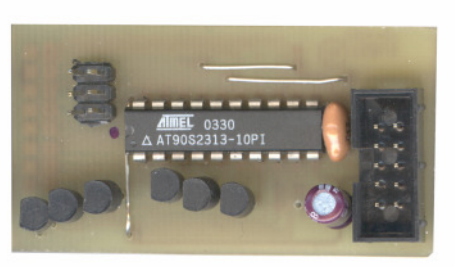
Commercial statement

The FSBUS wirings and software are freely available for the private use. A commercial use of the wirings, software or parts of it, requires a written approval by the owner Dirk Anderseck. Please contact me at dirk@anderseck.net.

7 Segment Display Controller

The 7 segment displays are commonly used in MCP (mode control panel) and the radio stack of an airplane cockpit.

FSBUS supports a single controller board and so called “SixPack” board with 6 individual controllers. Each controller may drive up to 6 7-segment-devices. Both types, common cathode and common anode, are supported.



The display controller consists of a microcontroller (AT90S2313 or ATTINY2313), a resonator (4MHz) and connector block for FSBUS cable or ISP cable.

Each FSBUS device gets its own id from 1-31 and all of them are cabled parallel. You may assign an id of your choice, as long as it is unique.

Features

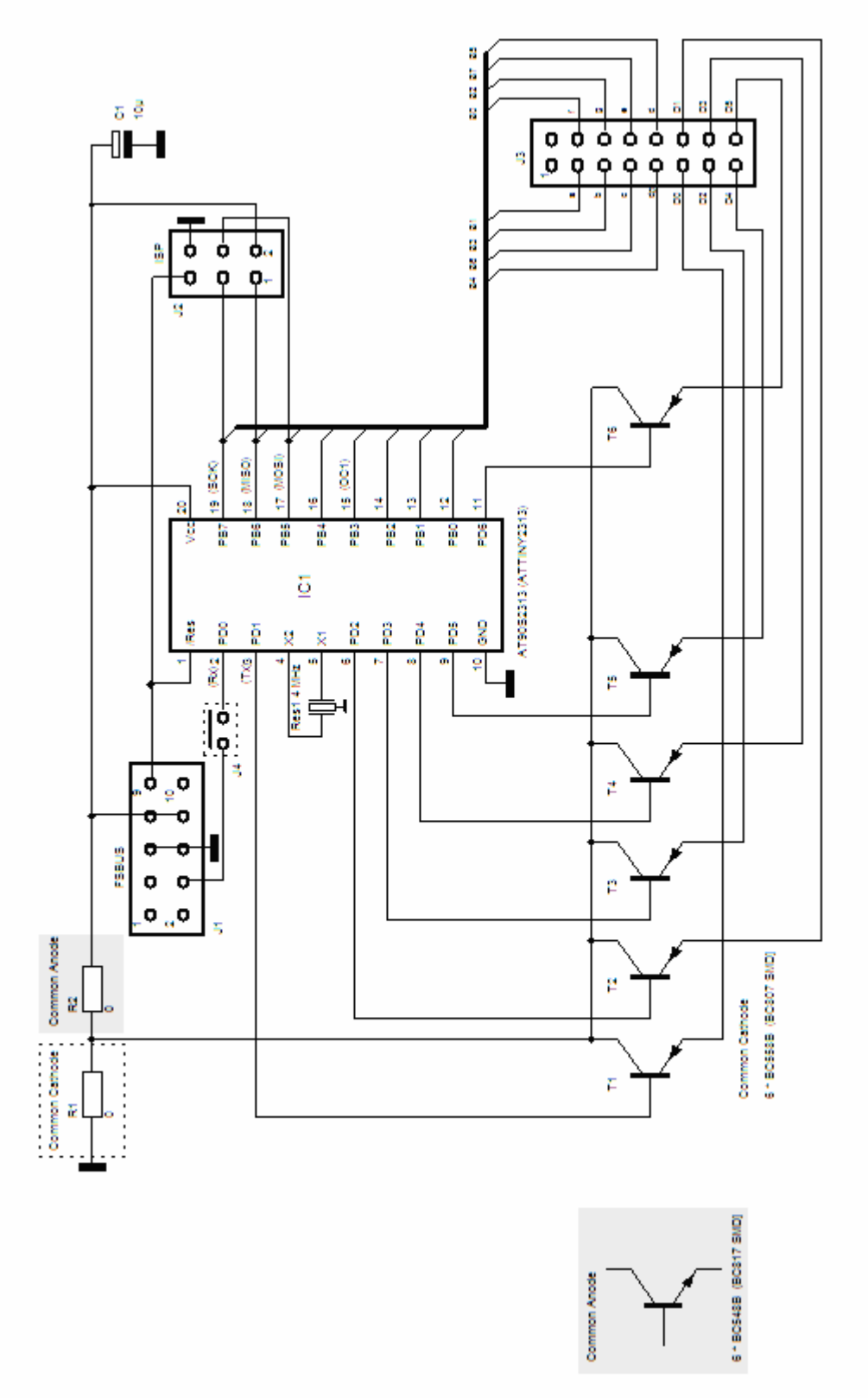
- 7segment displays
- software controlled decimal point
- software controlled brightness
- device specific adjustable brightness
- battery fail simulation (power off)

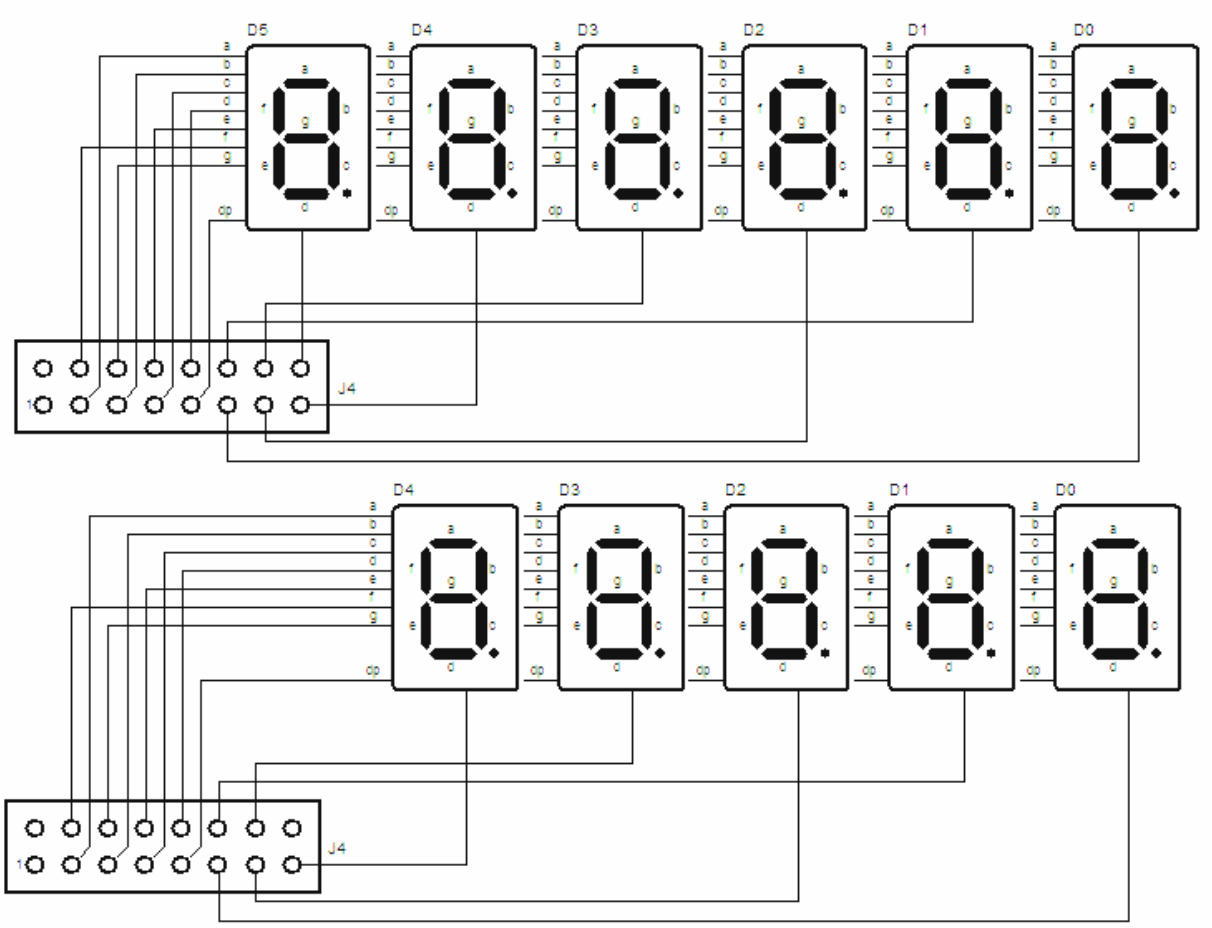
A second layout contains 6 display controllers.

Schematic

The FSBUS display controller receives commands from FSBUS COM interface and generates the necessary signals to drive up to 6 7 segment displays. The main task is done by ATMEL microcontroller AT90S2313. This chip is no longer supported by ATMEL. The successor ATTINY 2313 is pin compatible and can also be used, but it requires a different software.

Res1 is a 4MHz resonator to generate the cpu clock. J4 is usually short cut by a jumper. It can be used to aid the flashing procedure, which is described in detail later in this document. R2 or R1 is a 0-Ohm SMD resistor, which determines the display type (Common anode or cathode). The 6 transistors also differ for both types.


C1
10p
ISP
J2
J3
IC1
ATMEGA8/ATTINY2313
T6
T5
T4
T3
T2
T1
J4
J1
FSBUS
Common Anode
R2
0
Common Cathode
R1
0
Common Cathode
6 - BC558B (BC807 SMD)
Common Anode
6 - BC548B (BC817 SMD)



This schematic shows the wiring of 5 or 6 display version. If you are using less than 5, you simply leave out from left to right.

DIY Production of the printed circuit boards

The layout of PCB was designed with “sprint layout version 4.0”. For the exact reproduction the original layout is provided in download area of www.fsbus.de.

The company ABACOM makes a Viewer available with which an exposure capable foil can be printed for making the circuit board. The Viewer is available for free via Internet: www.abacom-online.de

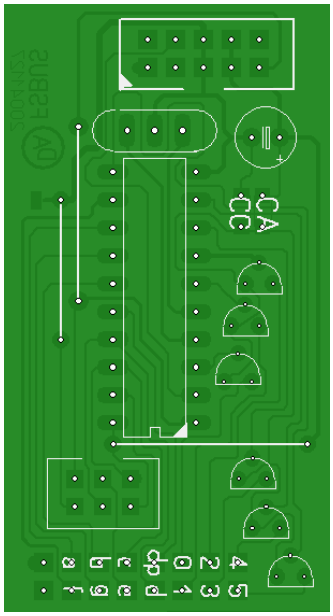
My equipment to produce excellent pcb’s

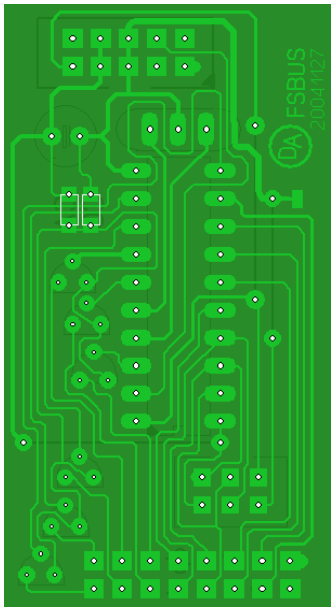
- Canon i865
- transparent foil
- Bungard epoxyd base material

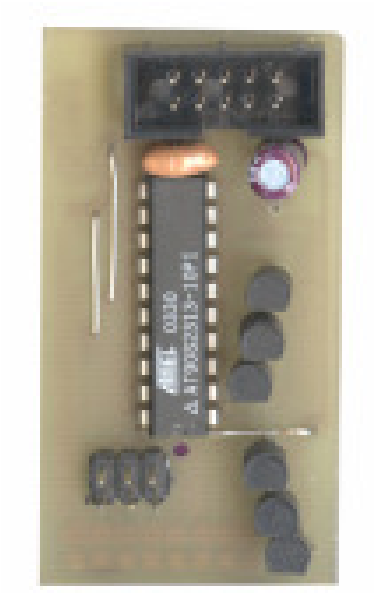
The Canon printer draws a dense black surface, which is very important for fine lines. Other equipment may also work.

PCB

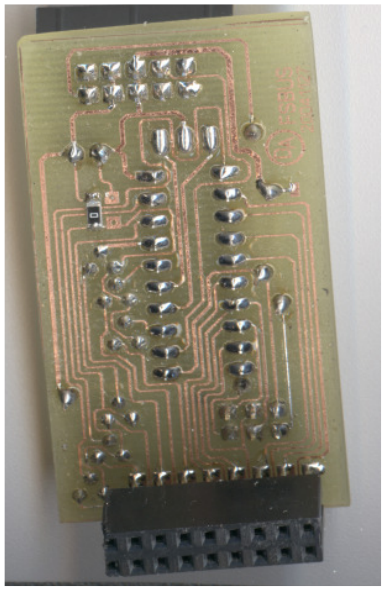
There are 2 display pcb's available. A single controller and a "SixPack".



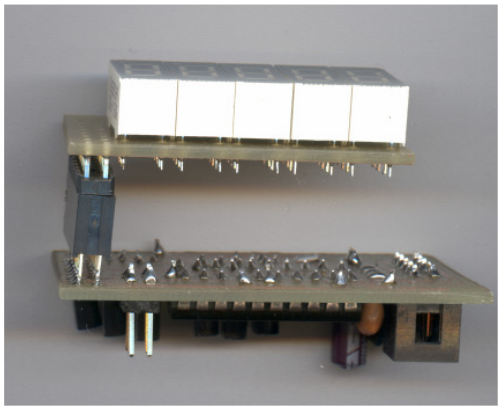




Equipment side single controller



Copper side single controller
I mounted the 16 pin connection block to the display board on the backside to have a direct connection without cable.

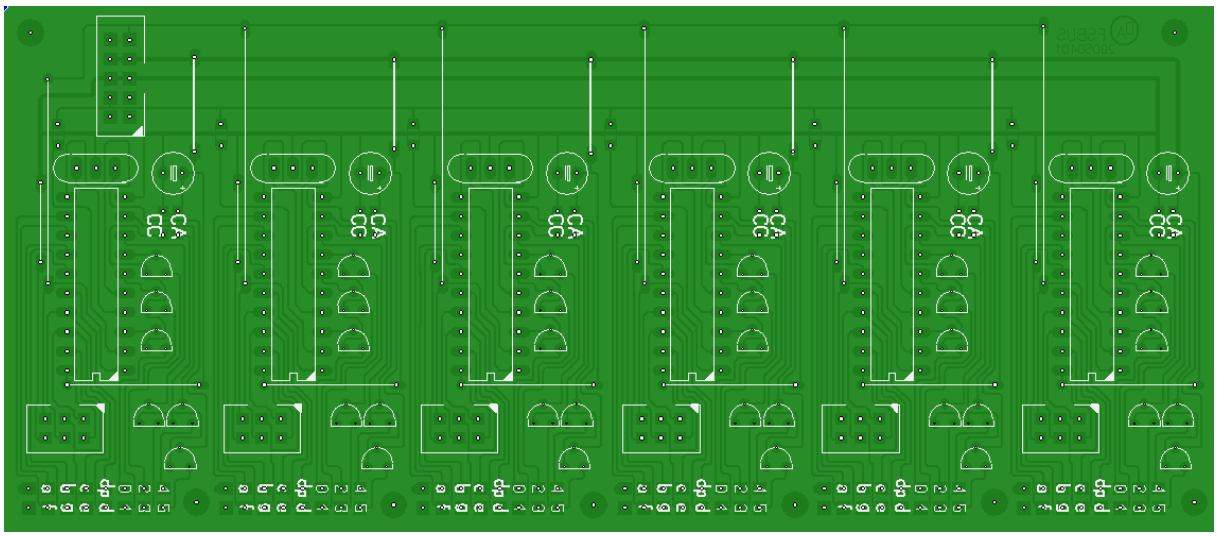


This picture shows a direct coupling of display and controller.

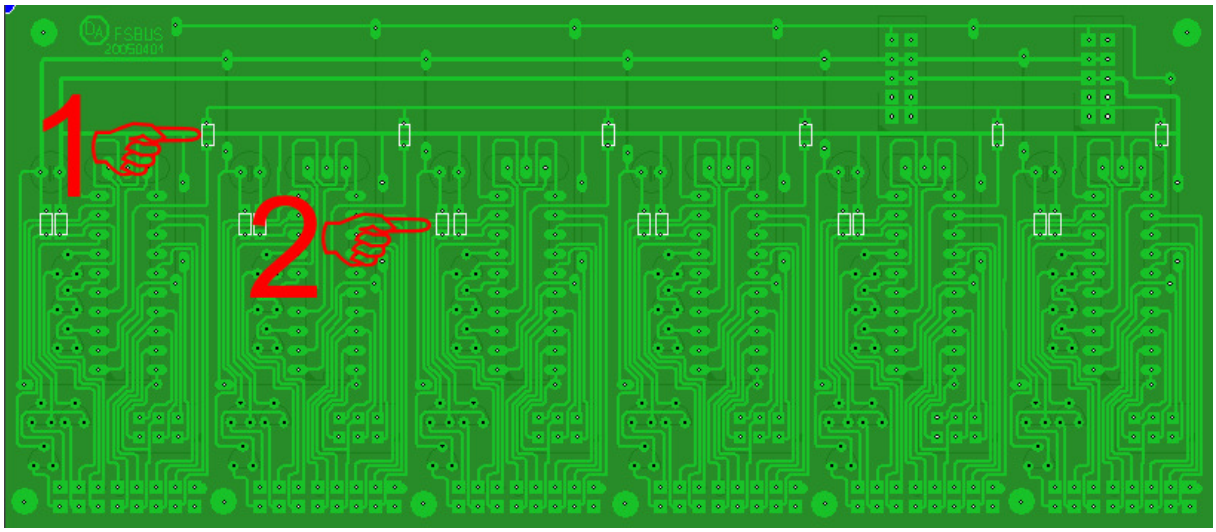
You may also make a connection with ribbon cable. Take care about having pin 1 always at the right place.

Pin 1 is marked by a circle near pin 1 solder point.

SixPack



Component side of the SixPack. The only difference to the single controller is the absence of most of the FSBUS connection blocks.



The solder side.

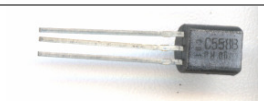
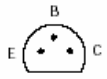
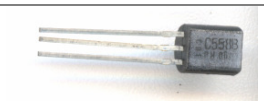
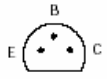
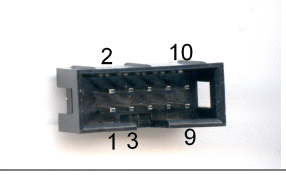
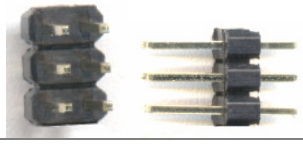
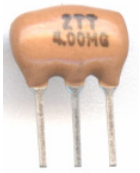
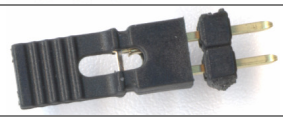
Mark 1 is a 2 pin jumper block.
Mark 2 points to 2 0 Ohm SMD resistors. If you haven't got those, you can use silver plated wire to make the connection.
! only one of both must be used, dependend on the display type.
See the step to step documentation later.

Soldering

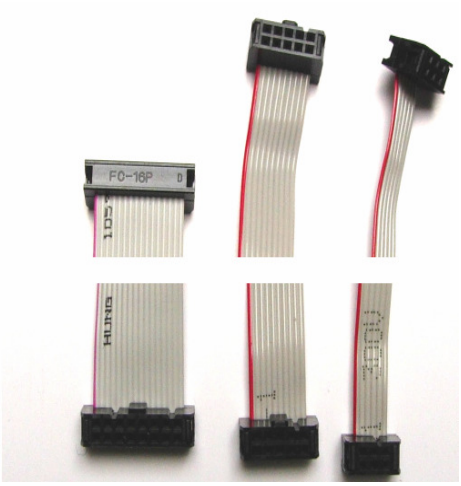
Since soldering is an important process which must be executed cleanly and decides decisively on the functioning of the module, the basic principles are summarized here once again:

- In principle, use soldering water or soldering grease when soldering electronic wirings never. The acid contained in it destroys the components and track conductors.
- Use electronic tin SN 60 Pb (e.g. 60% tin, 40% lead) as soldering fluxes with Kolophonium.
- Use a small soldering iron with not more than 30 watts.
- The soldering process of a soldering point should be speedily but not too briefly carried out. For soldering the well tin-coated soldering tip is held so on the soldering point that component wire and track conductor are touched at the same time. (Not too much) becomes soldering tin supplied at the same time which is on heated. As soon as the soldering tin starts to flow, you take it of the soldering point away. You then still wait for a moment have gone to the retarded plumb line well and soldering irons from the soldering point then take this one.
- Take care that, approx. 5 sec., the just soldered component isn't moved after you have removed the piston. A silver shiny, faultless soldering point then remains back.
- Prerequisite for a faultless soldering point and soldering well is a soldering tip which is clean and not oxidized. You relieve after everybody solder superfluous soldering tin and dirt with an a damp sponge or a silicone Abstreifer.
- After soldering the connection wires are cut off directly over the soldering point with side cutting pliers.

Partlist

IC1	AT90S2313		the old controller type
[IC1]	[ATTINY2313]		this is the new successor of AT90S2313.
T1-T6	BC558 for common cathode display type		 View from downside
[T1-T6]	[BC548] for common anode display type		 View from downside
J1	10 pin		
J2	6 pin terminal block		
Res1	4MHz resonator		
J4	jumper block		
C1	10uF		

Cables



16 pin ribbon cable is used to connect controller pcb to display pcb.

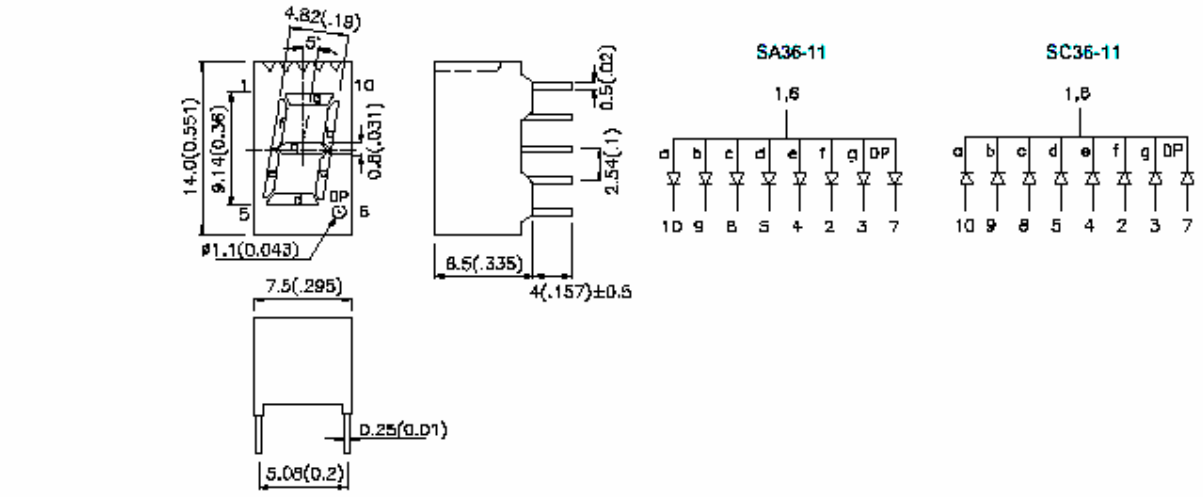
10 pin ribbon cable is used to connect controller pcb to FSBUS COM pcb for ordinary use. This is also called FSBUS cable.

6 pin ribbon cable is used to connect controller pcb to FSBUS COM pcb for ISP flash mode. This is also called ISP cable.

7 Segment Displays

nearly all types of led based 7 segment displays are supported by the hardware. Unfortunatly they differ in size, pin layout and direction of diodes.
The pcb's in this document are made for Kingbright SA36-11.

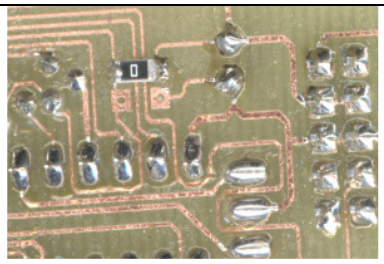
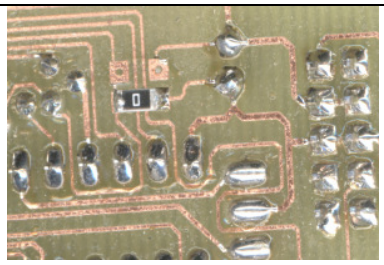
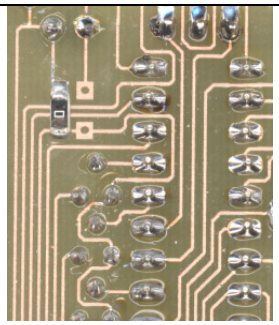
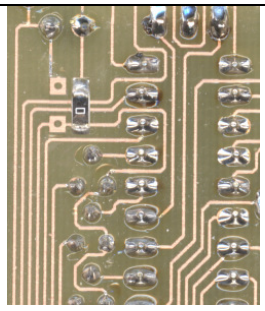
SA/SC36 Series



Above is original drawing of this type. A complete list of Kingbright's display schematic is available at: http://www.kingbright-europe.de/_daten/Displays.pdf.

Display types

dependend on type of display, a 0-Ohm SMD resistor or a simple wire must shortcut different positions. There are 6 driver transistors, which differ in type.

Display Type	Copper View of R	Transistors
Single Display for driving Common Anode displays. The 0-Ohm resistor connects the anode of each display to +5V.		BC548
Single Display for driving Common Cathode displays. The 0-Ohm resistor connects the cathode of each display to ground.		BC558
SixPack Display for driving Common Anode displays.		BC548
SixPack Display for driving Common Cathode displays.		BC558

Flash File

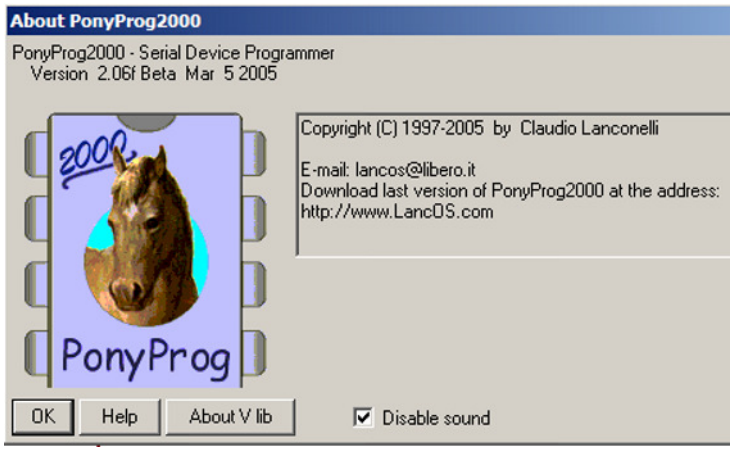
Display type	processor type	binary file
Common Anode	AT90S 2313	dsp_at90_ca.hex
Common Cathode	AT90S 2313	dsp_at90_cc.hex

Flash files for a CID range from 1 – 99. It is compatible to the old 1-30 version.

Display type	processor type	binary file
Common Anode	ATTINY 2313	dsp_t_ca_99.hex
Common Cathode	ATTINY 2313	dsp_t_cc_99.hex

Step by Step

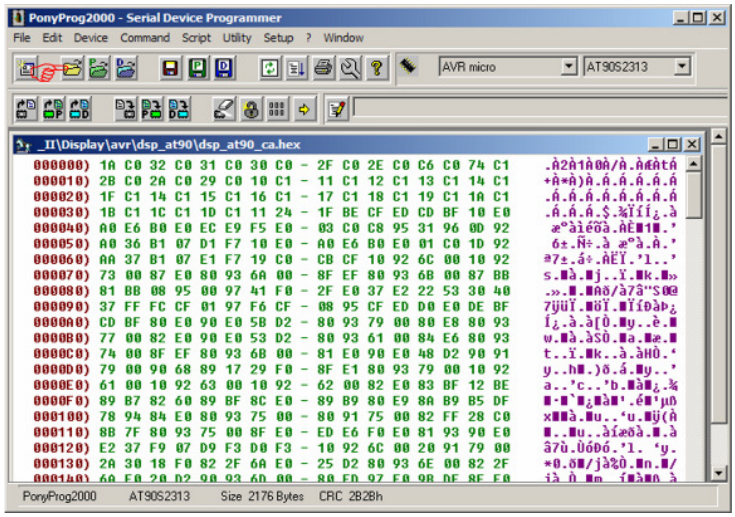
1



The COM interface board contains flash hardware to support PonyProg software.

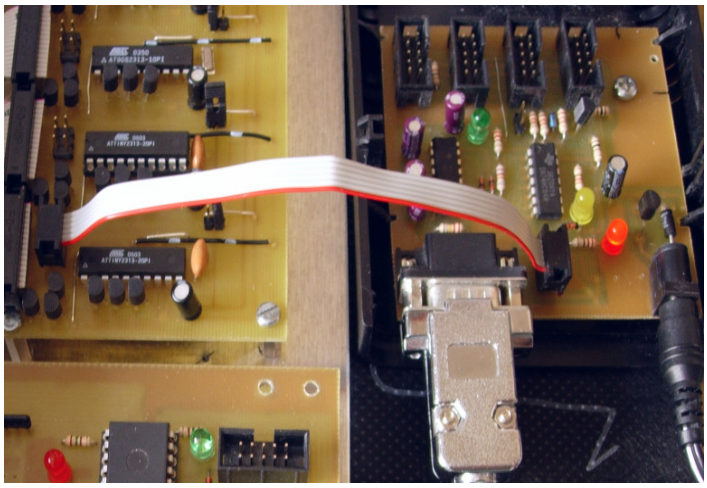
Please download version 2.06 or higher.

2



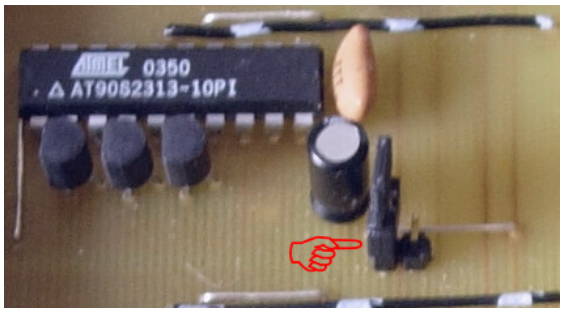
Open Device File “dsp_*.hex”. The correct file depends on processor and display type (see above table).

3



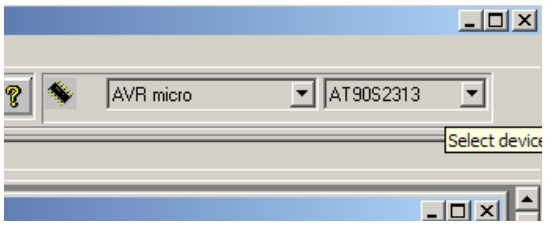
Remove fsbus cable and connect the 6 pin ISP cable from COM board to the display controller.
Take care of correct setting. Pin 1 is marked with the red wire.

4



If you are flashing one of the display controllers on a six pack board, disable all jumpers, except the controllers you are preparing.

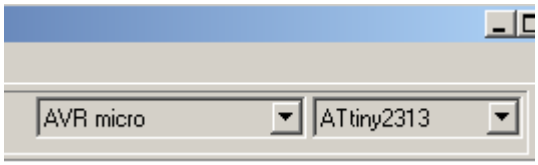
5



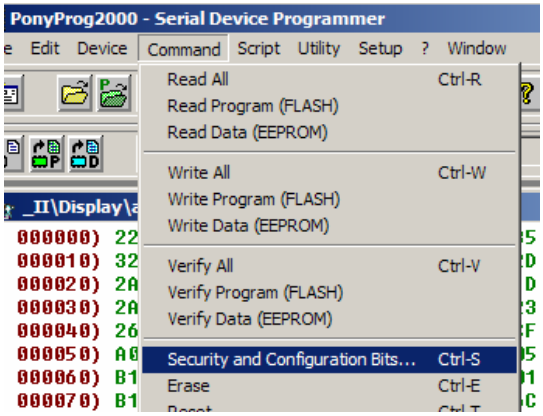
Set the correct device type in PonyProg.

No other software (fsbus admin) should have the serial interface opened!

- or –



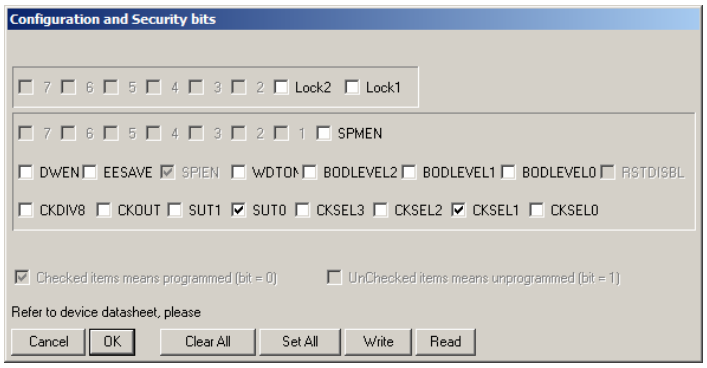
6 The FUSE Bits setup is only for ATTINY2313! Skip to 7 if using AT90S2313.



When flashing a ATTINY2313, you must setup the fuse bits before anything else. This is to be done very carefully.

Wrong settings may make the device unusable.

Set the checkboxes according to the tables below and press “Write”.

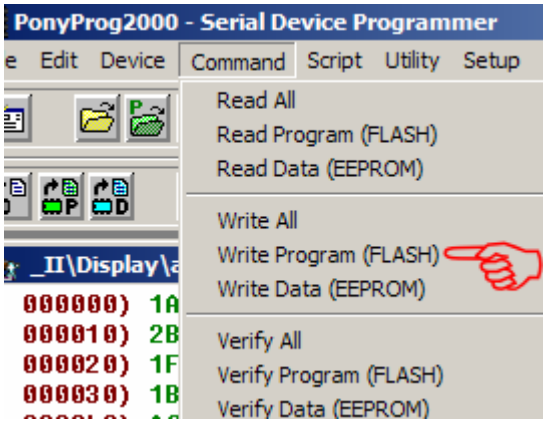


The recommended settings are:

DWEN	
EESAVE	
WDT	
BODLEVEL2	
BODLEVEL1	
BODLEVEL0	
CKDIV8	
CKOUT	
SUT1	
SUT0	☑
CKSEL3	
CKSEL2	
CKSEL1	☑
CKSEL0	

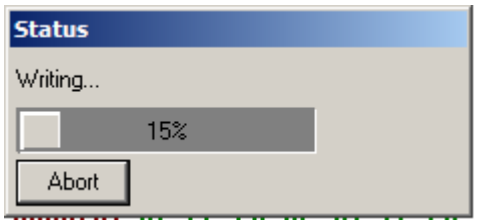
Please refer to the ATMEL specifications page 24.

7



Now it's time to flash the program into the microcontroller.
The Write Program menu point will start it.

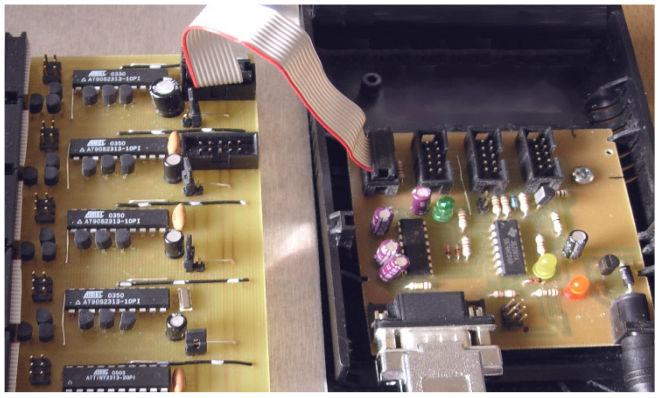
8



You will be proud and happy, if the progress window followed by success message appears.

You can now close PonyProg. The next step is to define the unique controller id and the base brightness level of this display.

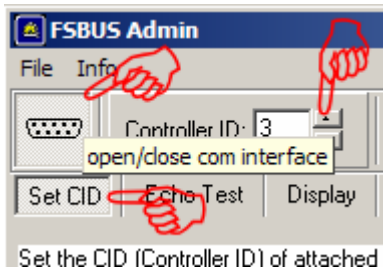
9



Remove the 6 pin ISP cable and connect the 10 pin fsbus cable from COM to the new controller.

On SixPack board, you must remove now all jumpers and set only one jumper to the specific controller.

10



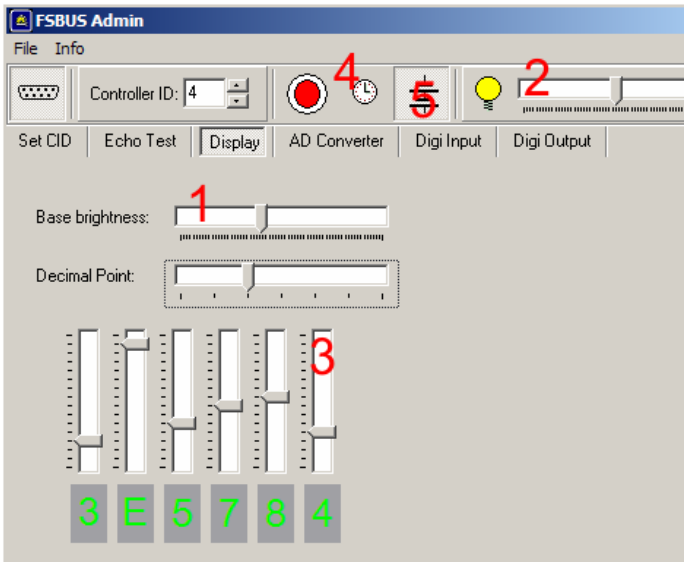
Execute fsadmin.exe which is part of fsbus distribution.
Press the com interface button, to open the serial interface.
Set the desired controller ID.
Select the first panel “Set CID”.

11

Follow the guidelines in textbox.
Press the flash button 3 times.

With each press, the display should show the new CID and in sequence the numbers 3,2,1 and zero.
After this procedure, the new CID is stored in eeprom. Each reboot of the device rereads this CID from eeprom.

12



Now select the Display window.
Set the base brightness (1) of the new controller to a reasonable value. This value is stored in eeprom of the microcontroller. The global brightness can be set with slider (2). This sets the brightness of all controllers.
Individual values can be set with sliders(3). A random value is generated periodically by (4).
Finally button(5) controls global battery power, which will darken the display, if not pressed.

If you are using the avrdude software in combination with AVRISP2 hardware, please use the following commands:

avrdude.exe -p attiny2313 -P usb -c avrisp2 -B 10 -U flash:w:dsp_t_cc_99.hex

avrdude.exe -p attiny2313 -P usb -c avrisp2 -B 10 -U lfuse:w:0xdc:m -U hfuse:w:0xdb:m