

Servo Sequencer

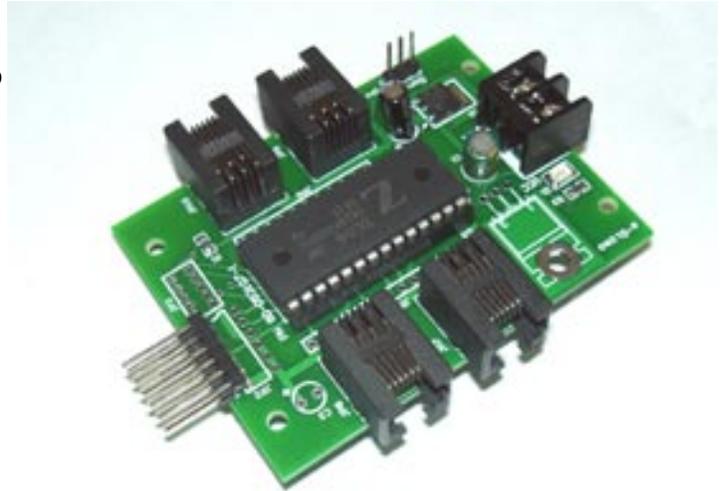
Servo Robot motion controller & General Purpose microcontroller board

The servo sequencer is in reality a general purpose reprogrammable microcontroller board built for ease of use with e-Gizmo Servo Driver-Controller kit. These two kits, when put together, form a powerful servo motor motion control system.

The servo sequencer is built around Zilog Encore! XP microcontroller, z8F082A. This IC is essentially a complete microcontroller system, everything you need, plus more, are already built inside this chip. Even the flash programmer and debugger are on-chip. The On-Chip Debugger OCD, through the ZDS II PC development software, lets you program the IC in-circuit, and allows you to do complex debugging operations (real time program tracking, breakpoints, register access, etc), eliminating the need for expensive development hardware like those required by most other competing microcontroller chips. Even the PC development software ZDS II, a full featured integrated development software with ANSI C compiler and assembler, is free!

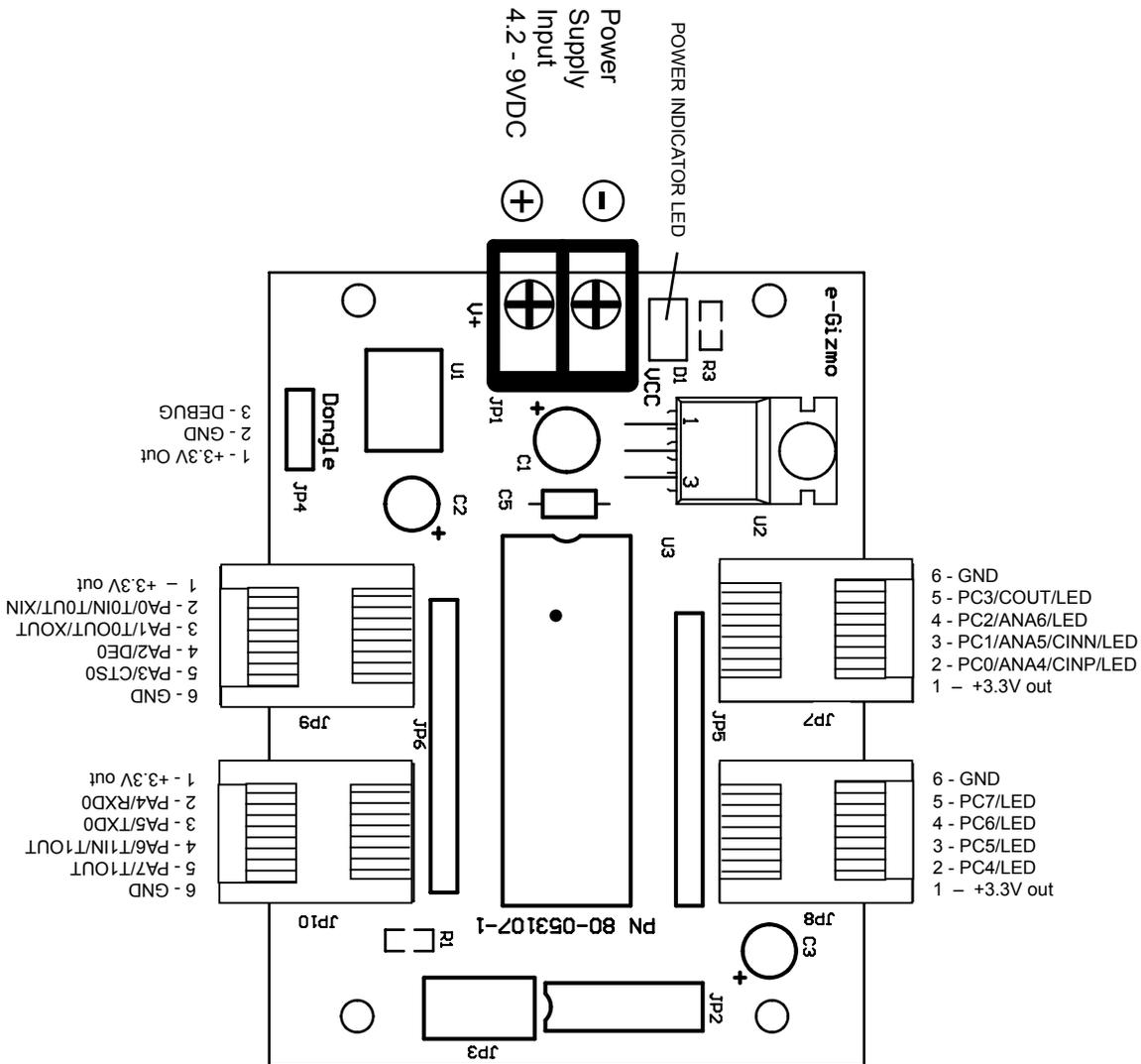
The Servo Sequencer can readily connect with two e-Gizmo Servo Driver-Controller, making it capable of controlling up to 32 servo motors at the same time. Note that this is not the physical limit for sequencer; you can actually add more servo driver-controller board if there is a need to by using a few servo sequencer user I/Os.

Servo Sequencer is just a name we have given to the board. Being a general purpose microcontroller board, you can use it freely for many other applications, even to circuits not at all related to servo control.



General Specifications

Controller:	z8F082A 28 pins Encore! XP
Program Memory:	8Kbytes Flash
RAM Memory:	1024 bytes
Clock Frequency:	5.53 MHz Internal
Servo Controller Interface:	2 Servo Driver-Controller (Up to 32 servo motors)
User I/O:	16 Multi function I/O
Built-in Peripherals:	10 bit ADC Two 16-bit Counter/Timers Comparator OPAMP UART On chip Temperature Sensor
Power Supply:	5V-9V DC
Programming Language:	ANSI C and Assembly
PC Development Software:	Zilog Developer Studio ZDSII



- 6 - GND
- 5 - PC3/COUT/LED
- 4 - PC2/ANA6/LED
- 3 - PC1/ANA5/CINN/LED
- 2 - PC0/ANA4/CINP/LED
- 1 - +3.3V out

- 6 - GND
- 5 - PC7/LED
- 4 - PC6/LED
- 3 - PC5/LED
- 2 - PC4/LED
- 1 - +3.3V out

- 11 - +3.3V OUT
- 9 - +3.3V OUT
- 7 - +3.3V OUT
- 5 - +3.3V OUT
- 3 - PB1/ANA1/AMPINP
- 1 - PB0/ANA0/AMPOUT
- 12 - GND
- 10 - GND
- 8 - GND
- 6 - PD0
- 4 - PB5/REF
- 2 - PB4/ANA7
- 10 - GND
- 8 - GND
- 6 - PD0
- 4 - PB5/REF
- 2 - PB4/ANA7

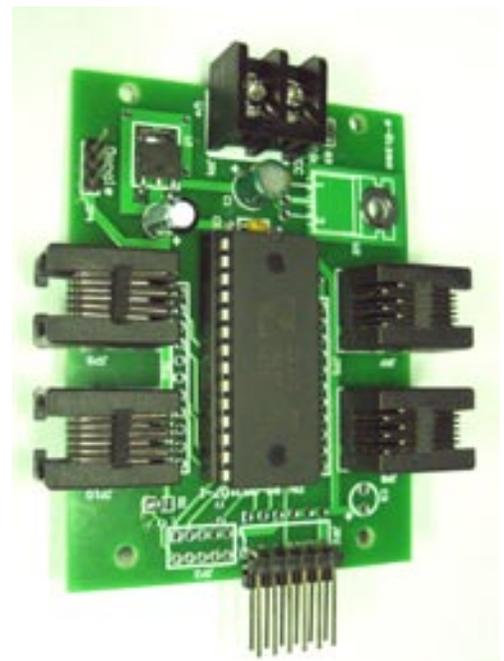


Figure 1. Connectors layout of the Servo Sequencer.

Pin Description

Zilog has thrown literally everything inside the F082A chip. Personally, I find it even tougher to think of applications that will require some peripherals not present inside this chip. Aside from the usual I/O drivers and buffers, there is nothing else you will need (for the microcontroller sub circuit). This fact is revealed with the simplicity of the Sequencer module. It contains only the chip itself, and a 3.3V on board regulator - which is not even necessary if an external 3.3V source is available. The on-board regulator, however, allows the module to operate over a wider range of supply voltage, and to limited extend, protects it from damaging abnormal input supply conditions.

The F082A Encore! XP chip used in this product is a 28 pin variant. To gain access to all internal hardware features with only 28 pins to work on, each I/O pins are shared by two or more peripherals. Hence, as shown in the following pin descriptions, each pins can have two or more software selectable alternate functions. Each pins can be independently configured to function as follows:

JP7 – User I/O

Pin		
1	-	+3.3V out
2	-	PC0/ANA4/CINP/LED
3	-	PC1/ANA5/CINN/LED
4	-	PC2/ANA6/LED
5	-	PC3/COU/LED
6	-	GND

PC0.. PC3 – General purpose logic input/output
 ANA4..ANA6 – 10-bit ADC analog inputs
 CINP – Comparator (+) input
 CINN – Comparator (-) input
 COU – Comparator Output
 LED – Direct LED drive capable outputs

JP8 – User I/O

Pin		
1	-	+3.3V out
2	-	PC4/LED
3	-	PC5/LED
4	-	PC6/LED
5	-	PC7/LED
6	-	GND

PC4.. PC7 –General purpose logic input/output
 LED – Direct LED drive capable outputs

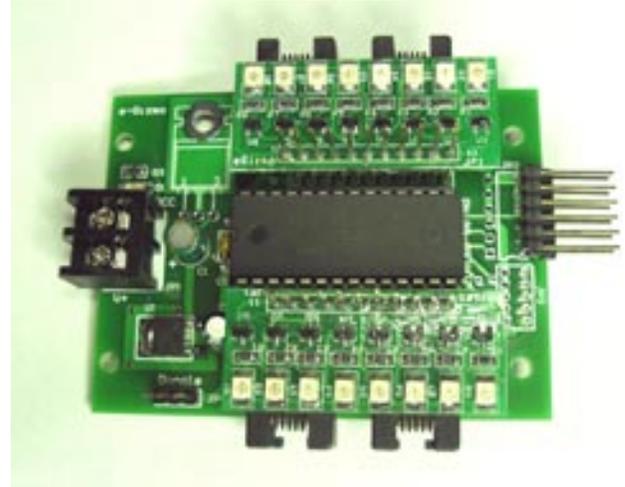


Figure 2. Servo sequencer with LED I/O Monitor board installed.

JP9 – User I/O

Pin		
1	-	+3.3V out
2	-	PA0/T0IN/T0OUT/XIN
3	-	PA1/T0OUT/XOUT
4	-	PA2/DE0
5	-	PA3/CTS0
6	-	GND

PA0..PA3 – General purpose logic input/output
 5V tolerant (note 1)
 T0IN – Timer0 input. This input can be used for gating, counting, and capture functions
 T0OUT – Timer0 output.
 T0OUT – Complement of T0OUT in PWM Mode.
 DE0- Device Enable. This allows automatic control of external RS-485 drivers.
 CTS0 – Clear to Send , flow control input for the UART.
 XIN – External crystal input.
 XOUT – External crystal output.

JP10 – User I/O

Pin		
1	-	+3.3V out
2	-	PA4/RXD0
3	-	PA5/TXD0
4	-	PA6/T1IN/T1OUT
5	-	PA7/T1OUT
6	-	GND

PA4..PA7 – General purpose logic input/output, 5V tolerant (note 1)
 RXD0 – Receive input of UART or IRDA
 TXD0 – Transmit output of UART or IRDA
 T1IN – Timer0 input. This input can be used for

gating, counting, and capture functions
T1OUT – Timer1 output.
T1OUT – Complement of T1OUT in PWM Mode.

JP2 and JP3 are reserved for Servo Controller Functions.

JP2- Servo Driver Controller Interface (M1 to M16)

- 1 - ENABLE1
- 2 - ACKNOWLEDGE
- 3 - ENABLE2
- 4 - CLOCK OUT
- 5,7,9,11- +3.3V Out
- 6 - DATA OUT
- 8,10,12 - GND

JP3- Servo Driver Controller Interface (M17 to M32)

- 1 - ENABLE3
- 2 - ACKNOWLEDGE
- 3 - ENABLE4
- 4 - CLOCK OUT
- 5,7,9 - +3.3V Out
- 6 - DATA OUT
- 8,10 - GND

JP2 and JP3 , when not used for servo functions, assumes their native functions as listed follows:

JP2- User I/O

- 1 - PB0/AN0/AMPOUT
- 2 - PB4/ANA7
- 3 - PB1/ANA1/AMPINN
- 4 - PB5/VREF
- 5,7,9,11- +3.3V Out
- 6 - RESET/PD0
- 8,10,12 - GND

JP3- User I/O

- 1 - PB2/ANA2/AMPINP
- 2 - PB4/ANA7
- 3 - PB3/CLKIN/ANA3
- 4 - PB5/VREF
- 5,7,9 - +3.3V Out
- 6 - RESET/PD0
- 8,10 - GND

JP4 is where you connect the programming/debugging cable.

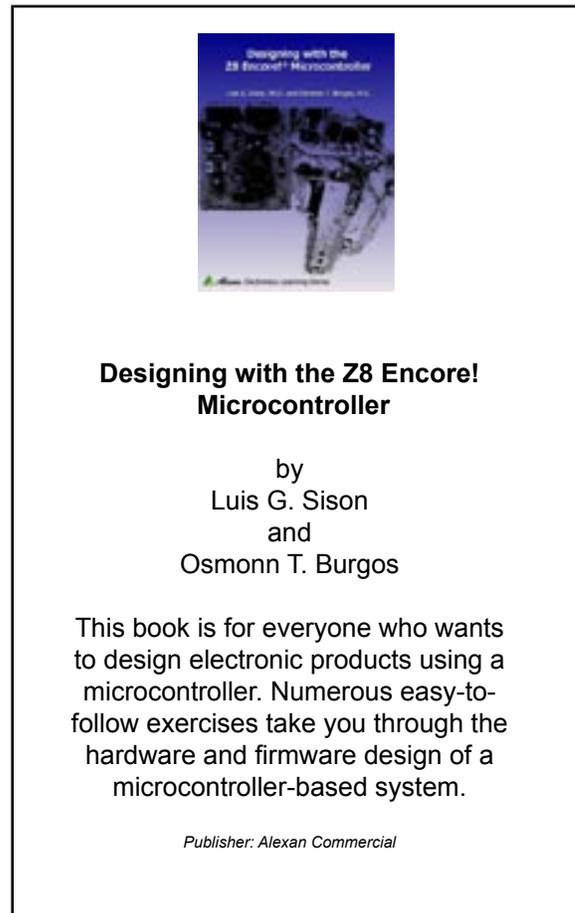
JP4 – Debug

- 1 - +3.3V out
- 2 - GND
- 3 - Debug

JP4 is used for in system flash programming and debugging.

Program Development Setup

This guide assumes that you are already familiar with Z8 Encore! Microcontroller chip. Detailed discussion of the chip’s architecture and programming is beyond the scope of this document. Zilog’s site www.zilog.com contains a wealth of information detailing everything you need to know about this chip, from specifications to application examples.



Equipment Required:

Zilog Developer Studio ZDS II. You can program the sequencer board in C or assembly language, or a combination of the two. The Zilog Developer Studio ZDS II packaged into one integrated software platform everything you need to develop applications. This Zilog free-ware ZDS II has built in program editor, C and assembly language compiler, and debugging functions.

Personal Computer running the ZDS II.

- Pentium II (or higher) PC running Windows 98/ME/XP operating system.
- Serial Port (COM port)

Programming Cable (Dongle). The Sequencer board is connected to the PC running ZDS II during programming and debugging operations with the use of a programming cable (a.k.a dongle). The PC end connects to a COM port, while the Sequencer end connects to the debug JP4.

Power Supply. The sequencer's built-in regulator allows it to work over a wide range of input supply voltage. It will work best with a supply input of 4.2V to 6VDC. Use a power supply or battery source with current rating of at least 200mA. Be careful with the polarity of the supply input. Wrong supply connection may permanently damage the sequencer board.



Figure 3. The programming cable is plugged on to the Sequencer board through JP4, with the programmer board component side facing out.

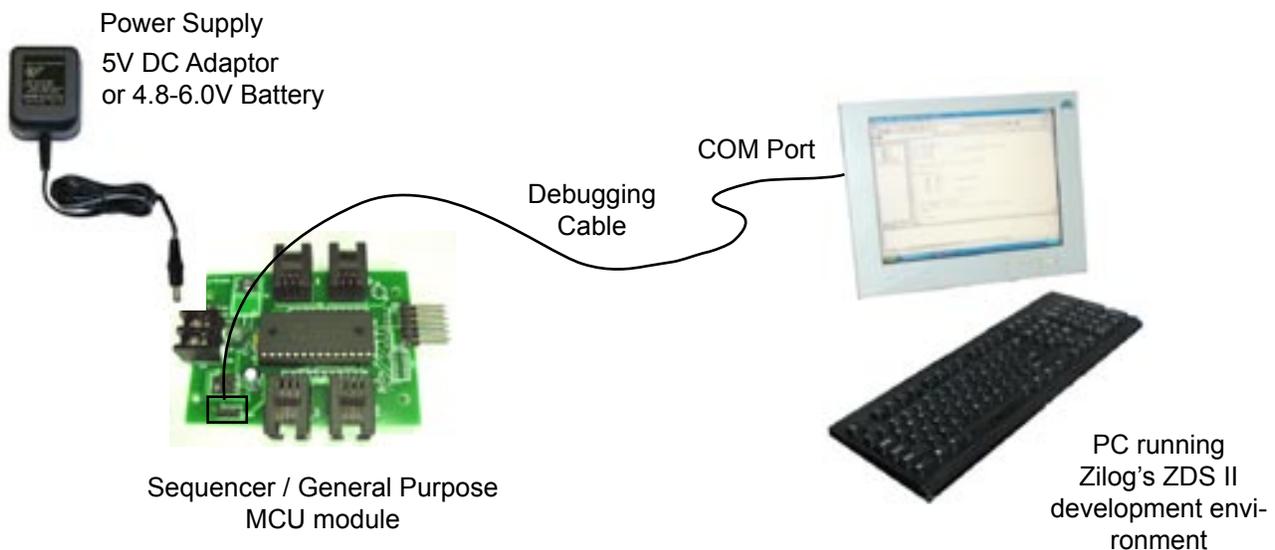


Figure 4. Servo Sequencer programming and debugging setup.

Servo Application Examples



Figure 5. You can install quickly and just as easily a Servo Driver controller module with the Sequencer board. Simply plug to join them together forming a complete Servo motion controller circuit.



Figure 7. A Servo Motion Controller configuration with two Servo Driver Controller installed. The lower Servo Driver module connects through JP2, and the upper module connects through the Sequencer JP3. This will allow independent control of up to 32 servo motors.

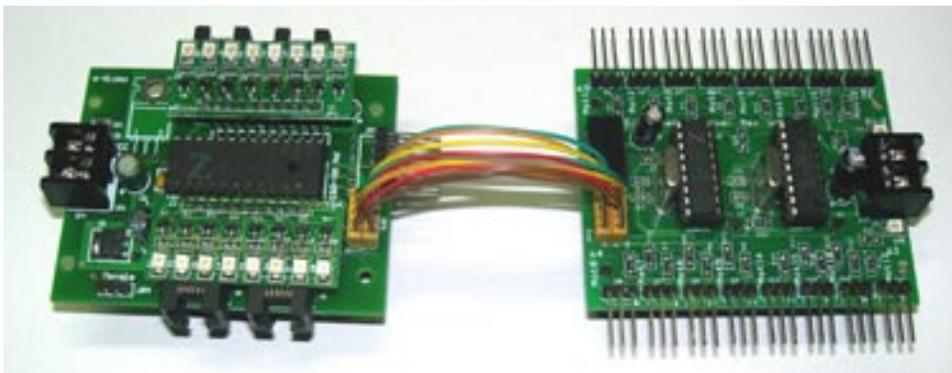


Figure 6. If your installation calls for a flexible link between the two board, you can connect them together using the JP3 interface connectors. Prepared wire connectors are available and are sold separately. Keep in mind that with this connection, motor addressing now starts at Motor 17 instead of Motor 1.

Servo Application Example Program

A C language program prototype containing the low level routines necessary to interface the Servo Controller with the Sequencer is bundled with the Servo Sequencer. You can download a copy of this program from the Servo Sequencer product page at www.e-gizmo.com.

GSM/GPRS Modem Control Application

The Servo Sequencer, as previously mentioned, is actually a general purpose microcontroller board that you can use in numerous applications other than servo functions. In this sample application, you will see how the Servo controller sets up the GSM module for use as simple SMS autoresponding unit - you give it a ring, and it will reply with an SMS message. You can work this sample program to create more GSM functions such as remote output controls, data logging, and monitoring. ■

Bill of Materials

ID	Description	
C1	220 uF / 16V Electrolytic Cap	
C2	220 uF / 6.3V Electrolytic Cap	
C5	150	
D1	smd LED green size 1210	
JP1	2 pin terminal block	
JP10	RJ22 jack	
JP2	6X2 angle connector	
JP3	HEADER 5X2	n/a
JP4	HEADER 3	3 pin con for dongle
JP7	RJ22 jack	
JP8	RJ22 jack	
JP9	RJ22 jack	
R3	220 ohms	
U1	BA033 DPAK 3.3V LDO Voltage Regulator	
U3	z8F082A Flash Microcontroller	

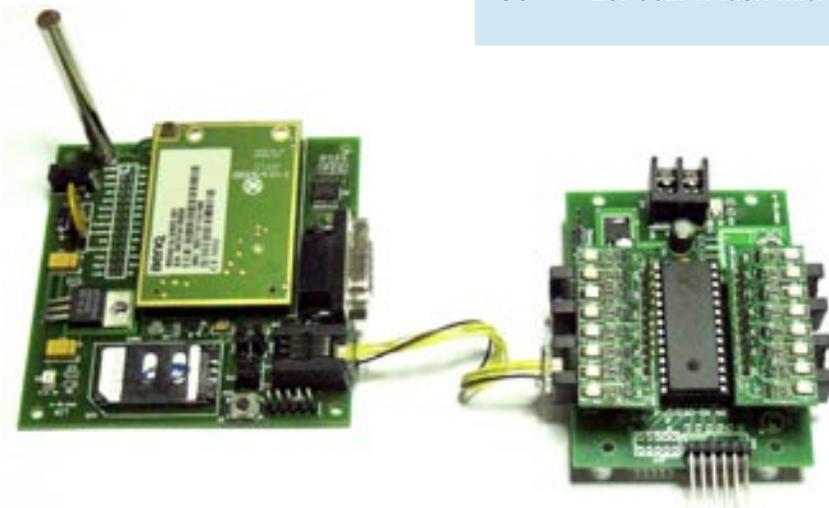


Figure 8. e-Gizmo GSM/GPRS modem kit easily connects with the Servo Sequencer board (JP10). These two makes a powerful GSM/GPRS application platform.

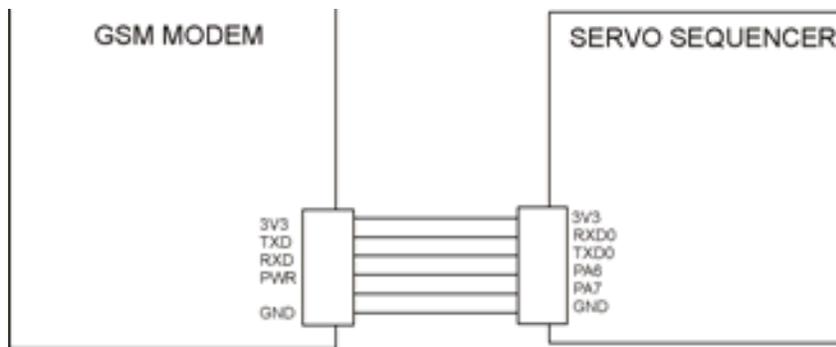
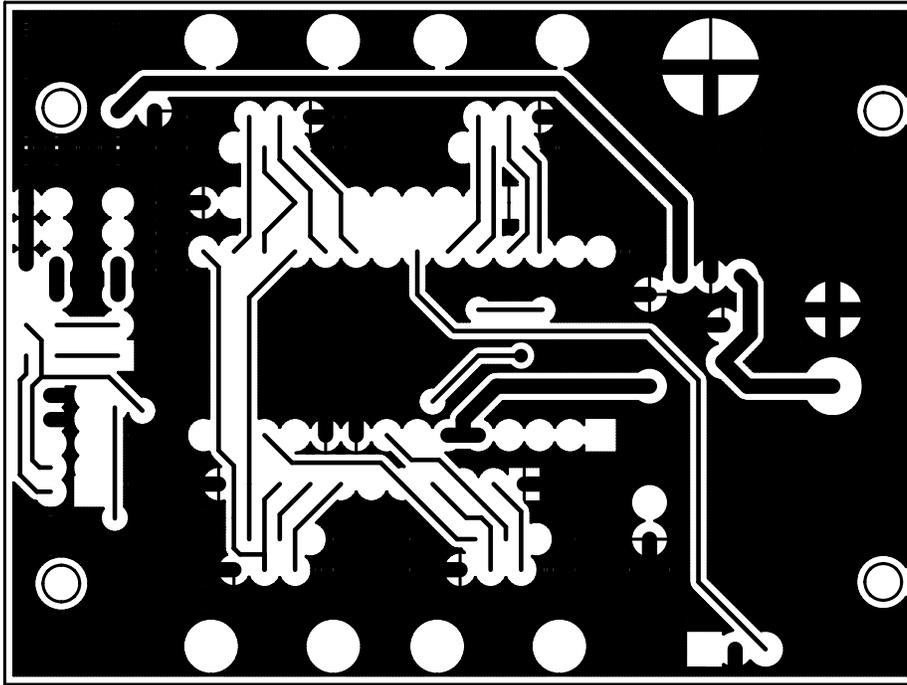
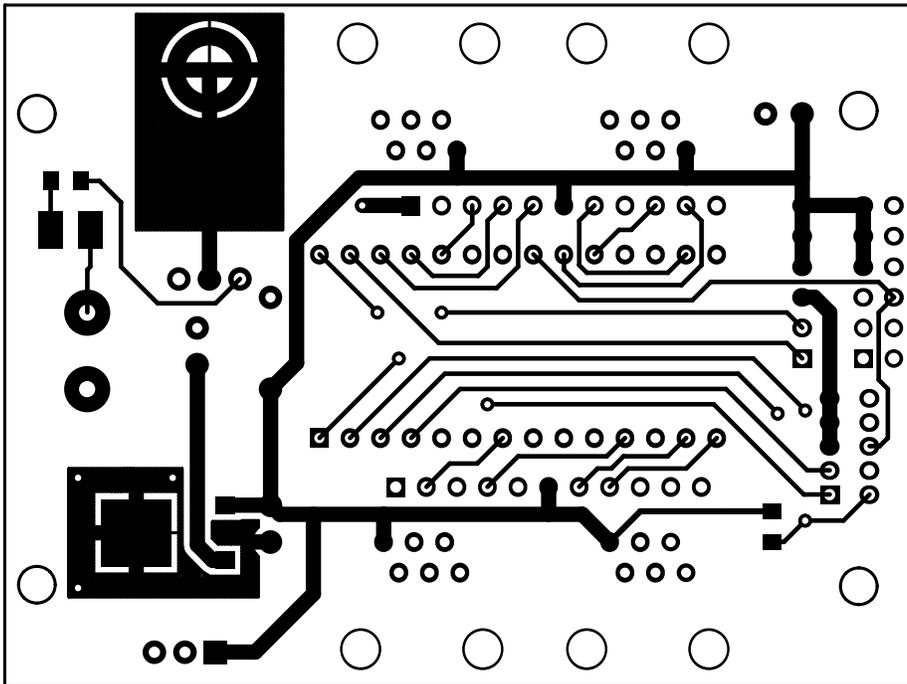


Figure 9. Connection diagram of the Servo Sequencer + GSM/GPRS modem application. (Power supply connections are not shown.)

PCB LAYOUT



TOP COMPONENT SIDE



BOTTOM COPPER SIDE