

# Build Your Own 1-2-3 Hour Medication Timer

It all started with an Email titled "Write a PIC program" from a retired electronics college professor (with a Ph. D. credential) from a mideastern U.S. University. He had stated that he wasn't able to write an assembly language program for a timer circuit that he needed to remind his wife to take her medication. She had an illness for many years that required her to take pills on a regular basis. The professor had previously used a Radio Shack timer...but the unit stopped operating and Radio Shack no longer manufactured the unit.

He began to outline the features which he needed and then proceeded to ask if it were possible to add some enhancements. After several Email exchanges...we were able to add all the enhancements he had wanted as well as a few I thought of and finalize the design which I am about to describe. The project took less than two weeks from initial contact to developing a working prototype and we were able to do it for much less than \$ 100.00 total cost ! This should help illustrate how inexpensive we can be.

We develop a lot of systems here that are never highlighted on our website because many products are for clients who do not wish to share their designs. It is a privilege to share this with you because this kind gentleman thought that others might benefit from this project as well. We are offering you the programmed chip and ceramic resonator for only \$ 10.00 postpaid in the continental U.S. As you may also know...we'll ship anywhere in the world if you pay the extra postage.

## The Design

Once again...we designed this project around the PIC 16C54. Now I know that there's lots of different PIC chips out there with a number of different enhancements... but we want to offer you the best ratio of price vs. performance and using this chip allows us to give you features at a rock bottom price so you don't have to pay for more than you need. It does require a little 'creative programming'. ..but that's what we enjoy doing !

As you can see in the schematic, we've stuck to Radio Shack components so with the exception of the PIC, ceramic resonator, and 78L05 voltage regulator...everything is available over the counter. You can actually order the voltage regulator from Radio Shack but since We've already been paid for developing the product...I've decided to throw in the 78L05 voltage regulator with the programmed chip and resonator for this product .

When the circuit is powered up...all outputs on 'Port B' (rb.0-rb.7) are energized continuously for 3 seconds to test the circuitry. The 'Acknowledge' PB will reset these outputs as well as resetting the 10 second warning ( 5 minutes before pill time) and the 30 second alert (30 seconds before pill time). All 3 outputs (rb.0-rb.2) are toggled on and off @ 1 Hz. rate during both warning and alert. A DPST switch is provided to allow you to disable the audible and relay output options. This was a desired feature because the client used the relay contacts to energize an alarm system he installed in his house to let them know it was time for medication. The switch allows them to sleep at night since he decided to let the unit run 24 hrs./day.

The timer selection switch is a SPDT Center OFF. That means ON-OFF-ON configuration. If the input rb.2 is energized...then the timing period is 1 hr. If the switch is in the Center (OFF) position...then the timing period is 2 hrs. And, of course, if the input rb.3 is energized...then the timing period is 3 hrs. This position is 'read' during the startup sequence and will be displayed as an output on rb.4-rb.6 . The reasoning for this is simple. You need to know which timing period you are timing. This also gives you the ability to change timing 'on the fly'.

This means that whatever output is indicated on rb.4-rb.6 is what you're timing REGARDLESS of the switch setting . It will, however, 're-read' the position at the completion of each timing cycle. This gives you the advantage to 'pre-select' the next timing period to automatically change at the end of the previous timing period. Or leave the switch alone and let it continue to repeat the timing period indefinitely.

We've also provided a 'heartbeat' pulse output on rb.7. This flashes @ 1 Hz. to let you know the processor is timing. At 5 minutes before the end of each timing period...rb.0-rb.2 will energize and toggle @ 1 Hz. rate. Pressing the 'Acknowledge' PB will disable the outputs. At the end of the 'warning' period rb.3 will energize for 4 minutes/20 seconds to indicate an 'interim' status. This can be very useful if you were away from the timer and you weren't sure whether it was pill time or 5 minute before.

This can be very important because some medications do require that precise an interval between doses...especially on a 1 hour schedule. 5 minutes is an 8 % time variation on 1 hour. Also during the 'interim' time the output status indicators (rb.4-rb.6) are disabled to prevent any confusion on which output was on. For your convenience... and to make this product as versatile as possible (you should know by now...we can't see any reason to waste a perfectly good I/O pin) we've included more features than most people have need for. But then again...it let's you select the features you need and ignore the rest.

As long as you hook up at least 1 device to rb.0-rb.2 (they're all the same so it really doesn't matter what device goes to which pin)...you can ignore the rest of the circuitry on rb.3-rb.7 or use it as you like.

## Timing Accuracy

I know this is an issue for concern. Since there's 60 sec/min...60 min/hr...24 hr/day...this all adds up to 86,400 seconds/day. And since the PIC instructions execute @ 1 usec. intervals...it's very easy to see how important an accurate timebase is, whether it's a ceramic resonator (supplied with the kit) or a crystal. The timing loops have been trimmed with software and the worst case timing error is 0.1 % with the ceramic resonators we supply. That's 3X better than the manufacturers specs (+/- 0.3 %). Some purists out there may need much better accuracy...especially if you run continuously. The best crystals are somewhere around .005 % accurate and these can be trimmed by 'trimmer capacitors'. The PIC oscillator configuration at programming time is XT. The other configurations are LP, RC, & HS. This data will allow you to select a crystal and padding capacitors (from the manufacturers spec sheets) should you need ultimate precision. Remember, a timing error of 11 seconds on a single 3 hour timer interval (10,800 seconds) is going to be 99.99 % accurate.

## A Tribute

I'd like to take a moment here and pay tribute to this gentleman who was kind enough to allow us to offer this product to the general public. This man is 75 years old and has taken care of his wife's illness for nearly 30 years. He outlined how he moved around attaining his education and experience and how he taught all levels of electronics. He also wrote that thru all that she never complained and that she deserves all of his attention.

This not only speaks well of how much this man must love his wife but is typical of the selfless devotion which is very much a requirement of teaching. I have always had the highest respect for my instructors and mentors who had the patience, talent and understanding which is required to instruct people. Think about it. These people have the ability to take something unknown to us and present it in such a way that we not only remember it, but we believe in it and built upon that trust we have the door of understanding opened for us.

Without that extra time and effort to properly understand the basics of electronics, and build upon that foundation, I wouldn't have developed the ability to design the products that we provide. If you're a student...take a moment and thank you teachers for their dedication. And if you have a mentor at work...thank them also because electronics is a very fascinating field but it often takes the help of others who are more experienced to allow us to understand it better.