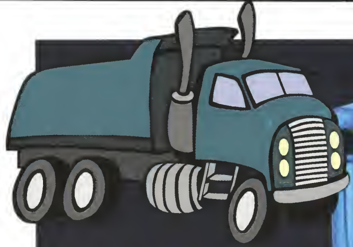


By JOHN CLARKE

Can't remember which bins to put out? Build this . . .

Garbage and Recycling Reminder

Do you occasionally forget to put the garbage out? Or do you have trouble remembering whether it's a recycling week or a green waste week? Build this Garbage And Recycling Reminder and forget your "bin duties" no more.

MOST LOCAL COUNCILS now alternately collect recyclables and green waste on a rotating weekly basis but how do you remember which bin to put out with your regular garbage bin – that's if you remember to put the bins out at all? There can now be up to four bins, each with a different colour-coded lid, to put out at different times – the regular garbage bin plus one for green waste and another one or two for recyclables. So it can all be very confusing.

There have traditionally been a couple of ways to figure out which bins go out each week. The first is to check the special calendar or chart that's (usually) provided by your local council. This chart is commonly attached to the fridge using one of those ubiquitous flexible magnets. However, for many people, that's a big NO; they hate the sight of fridge magnets or anything else plastered over the fridge.

An alternative and somewhat easier approach is to wait until the neighbours have put their bins out and copy them. But what if the first neighbour to put his bins out gets it wrong and other copycat neighbours simply follow suit? In that case, only the regular garbage bin will be emptied and the others left.

Now there's a much better way of figuring it all out – one that doesn't rely on memory or brain power or other neighbours. The answer is our brilliant new "Garbage And Recycling Reminder" and it will allow you to take control of your own "bin destiny". How? – by flashing colour-coded LEDs on the required day to indicate which particular bins should go out.

It doesn't get any easier than that but first, you have to build it.

Presentation

As shown in the photos, the reminder is housed in a small translucent blue plastic case with a row of four LEDs and their associated pushbutton switches protruding through the front panel. These LEDs are red, green, yellow and blue, one for each bin colour. The circuit runs from a small 3V lithium button cell and the unit can be placed on a kitchen cupboard or bench-top so that the flashing reminder LEDs can be easily seen.

Typically, the red bin is for garbage, the yellow for recycling, the green for green waste and the blue for paper and cardboard. However, this scheme may differ somewhat, according to the council. Some councils use a green-lid bin for garbage and many councils do not have the separate paper recycling bin, preferring instead to combine the paper with other recyclables so that there's just one recycling bin (typically yellow).

In some cases too, the green waste bin is collected on a different day of the week to the other bins.

The SILICON CHIP Garbage And Recycling Reminder can cater for all these different situations. It's easily programmed using on-board links and the pushbutton switches and each LED can be individually programmed to flash on a weekly or fortnightly basis on any day of the week.

For example, if you have a garbage collection every week and recycling/green waste collections on alternate weeks, the unit can be programmed to show this. In that case, the red LED will flash on the due day every week, along with either the yellow LED or the green LED. And if the paper is collected separately, then the blue LED can also be programmed to flash on the due day.

Conversely, if you do not have a separate paper recycling bin, then this LED can be disabled to prevent confusion.

Monthly collections?

What about monthly collections? Unfortunately, although it's ideal for weekly and fortnightly collections, the unit is not able to separate out the actual week for a monthly collection cycle. It can, however, indicate the day of collection and flash the appropriate reminder LED each week. This LED is then simply cleared each week (by pressing its switch) after checking the day against the collection calendar supplied by the council.

So at least it reminds you to check the calendar if you have a bin that's collected monthly.

Starting time

The flashing reminder can be set to start on the due day(s) at any time that's convenient to you. For example, you may prefer to put the bins out the night before collection and be reminded at say 5pm. Once activated, the reminder LEDs will then continue flashing for 18 hours, so that if you miss the reminder that evening you will be reminded again in the morning.

Alternatively, you can manually stop the LEDs from flashing after you've put the bins out. You can either stop the LEDs all at the same time by pressing the Clear/Program Switch or stop each one independently by pressing the switch immediately below it. Stopping them independently is useful if you want to delay putting one bin out, or even leave it until next morning.

In any case, it's good practice to clear the LEDs as soon as practicable, as this minimises the power drawn from the 3V lithium cell.

Once programmed, the unit will then repeat its weekly/fortnightly cycle, starting at the same time each week. The 18-hour reminder period should be sufficient to cover the inevitable variations in your routine and any clock changes throughout the year due to daylight saving.

Main Features

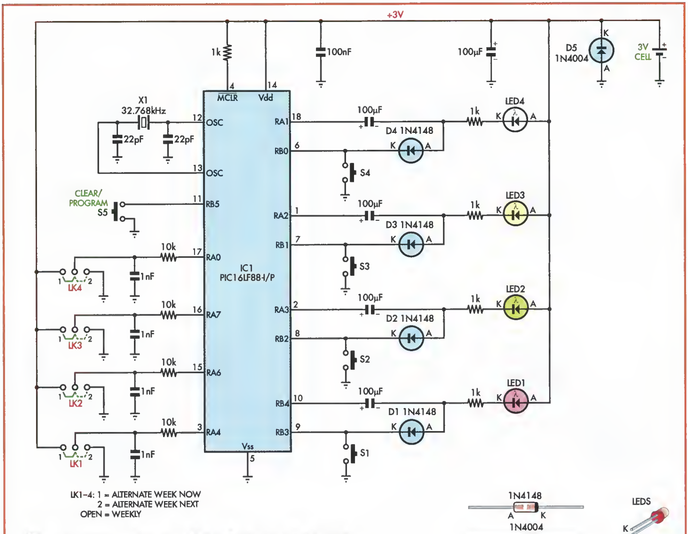
- Eye-catching flashing LED reminder
- Coloured LEDs match bin lid
- Disable function for any LED
- Weekly or fortnightly selection
- Caters for up to four bins
- Easy to program
- Optional individual day programming
- Week advance facility
- 15-minute advance or hold facility
- Powered from a 3V lithium cell
- Low current drain

Reminder adjustments

The Garbage and Recycling Reminder uses a 32.768kHz watch crystal as the timebase for its weekly cycling. This type of crystal is typically accurate to about 20ppm (parts per million) which means that the unit itself should be accurate to within about 10.5 minutes per year. Even allowing for extra frequency drift with temperature for the crystal, the reminder should be sufficiently accurate for its purpose.

However, if necessary, the start time can be shifted forwards or backwards in 15-minute intervals. You might want to do this to correct for drift at the end of a year (for example), or to simply alter the start time.

In addition, if you have mistakenly programmed the unit so that the bins indicated for each alternate week are



RECYCLING & GARBAGE REMINDER

Fig.1: the circuit is based on a PIC16LF88-I/P microcontroller (IC1). This processes the data on its RA4, RA6, RA7 & RA0 ports as set by links LK1-LK4 and drives indicator LEDs1-4 via associated voltage doubler circuits (D1-D4 and their companion 100µF capacitors).

transposed, then it's a simple matter to just swap weeks. This is easier than having to reprogram each LED again for the required day and time. The reminder day for each LED indicator can also easily be changed.

Circuit details

This is a circuit that's just crying out for a PIC microcontroller and guess what . . . yep, we've used a PIC microcontroller

Fig.1 shows the circuit details. Apart from the PIC, it uses a few switches, four LEDs, the 32.768kHz crystal, a 3V lithium cell and a few resistors, capacitors and diodes.

To conserve battery life, a low-power PIC16LF88-I/P microcontroller (IC1) is used. As well as having a low current drain, this micro also allows the circuit to be operated down to 2V to maximise the life of the 3V lithium cell.

In operation, the micro is continuously run at 32.768kHz but is normally in sleep mode with the internal program halted for most of the time. It wakes once per second to update its internal timer, monitor the switches and drive the LEDs when necessary. It then goes back to sleep.

This sleep mode, combined with the low clock frequency, minimises the power drawn from the cell. In addition, the LEDs only flash momentarily when required to further conserve battery power. In fact, the average current drain is just 3µA without the LEDs flashing and 151µA when all four LEDs are flashing. This means that the 3V cell should last for about two years, depending on the number of hours the reminder flashes each week.

The crystal-based oscillator is formed using the Timer1 (T1) ports at pins 12 & 13. This is a low-power oscillator and the timer wakes the micro up from its sleep when its count overflows at 1-second (1s) intervals. The 22pF capacitors at pins 12 & 13 ensure correct loading of the crystal for reliable oscillation.

All five switches (S1-S5) are monitored via the RB3, RB2, RB1, RB0 & RB5 inputs, respectively. These inputs have internal pull-up resistors, so an open switch means that the corresponding input is pulled high to +3V, ie, to the positive supply rail. Conversely, when a switch is pressed (closed), it pulls its corresponding input to 0V.

Link inputs

There are four link options, designated LK1-LK4. In this case, their corresponding inputs at RA4, RA6, RA7 & RA0 do not have internal pull-up resistors. This is because there are actually three possible settings for each link: position 1, position 2 or no link installed. This allows the micro to sense each possible setting, as described below.

In operation, the software running in IC1 goes through a routine to determine which of the three link positions is selected for each port. In the case of RA4, for example, the micro does this by initially setting RA4 as an output and driving it high. The RA4 pin is then set as an input and read.

If the input is read as a low, this means that link LK1 must be in position 2 since it's being pulled to ground via the 10kΩ resistor.

If LK1 is not in position 2, the RA4 pin is again set as an output and this time driven low. It's then set as an input again. If the reading is a high, then LK1 must be in position 1 (ie, RA4 is being pulled high via the 10kΩ resistor).

Finally, if LK1 is open, then when RA4 is driven high, the RA4 input will also be read as a high, since the voltage will remain stored in the 1nF capacitor. Similarly, when RA4 is driven low, the RA4 input will also read as a low.

This process is the same for the RA6, RA7 and RA0 ports.

Note that, for the open link position, current leakage at the pin can cause the input to float at a voltage somewhere between the 3V and 0V supply rails. If that happens, then the micro will draw more current. To prevent this, the RA4, RA6, RA7 & RA0 pins are normally set as outputs, with each output set either high or low. Each second, when IC1 wakes up, these pins are then set as inputs and the input level is read. The input is then set as an output again and driven to the level that was just read when set as an input. This process ensures that the input is always set high or low and is not floating.

Note that if a jumper link is changed from position 1 to position 2 (or vice versa), then there will be a momentary extra 300μA current draw through the associated 10kΩ resistor until the updated reading corrects the driven output level. This occurs within 1s, so the extra power drain is insignificant.

LED drive

As stated, power for the circuit comes from a 3V cell and this can be as low as 2V when the cell is discharged. However, some LEDs require a higher voltage than this in order to operate at

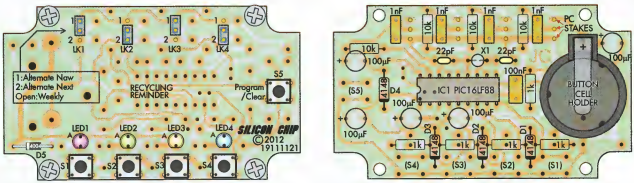
Parts List

1 double-sided PCB, code 19111121, 46 x 79mm
1 front panel label, 75 x 47mm
1 ABS translucent blue enclosure (UB5), 83 x 54 x 31mm
1 PCB-mount 20mm cell holder
1 CR2032 3V lithium cell
1 32.768kHz watch crystal, 20ppm, 12.5pF loading (Jaycar RQ5297, Altronics V1902) (X1)
5 SPST vertical PCB-mount micro tactile switches with 6mm actuator (S1-S5)
1 DIP18 IC socket
4 jumper shunts (2.54mm pitch)
4 M3 x 15mm tapped Nylon spacers
4 M3 x 5mm pan-head screws
4 M3 x 15mm countersunk head screws
8 M3 nuts
12 PC stakes

Semiconductors
1 PIC16LF88-I/P low-power microcontroller (note: the 'L' version) programmed with 1911112A.hex
1 3mm red high-brightness LED (20° viewing, 2000mcd or similar) (LED1)
1 3mm green high-brightness LED (20° viewing, 1500mcd or similar) (LED2)
1 3mm yellow high-brightness LED (20° viewing, 3000mcd or similar) (LED3)
1 3mm blue high-brightness LED (15° viewing, 1500mcd or similar) (LED4)
4 1N4148 diodes (D1-D4)
1 1N4004 1A diode (D5)

Capacitors
5 100μF 16V PC electrolytic
1 100nF MKT polyester
4 1nF MKT polyester
2 22pF NP0 ceramic

Resistors (0.25W, 1%)
4 10kΩ 5 1kΩ



(FRONT OF PCB) (REAR OF PCB)

Fig.2: follow this diagram to install the parts on the front and back of the PCB. Note that you must install the parts on the front of the PCB first, otherwise you will not be able to fit the LEDs. The LEDs must be stood off the PCB by 4mm and this can be done by sliding a 4mm-high cardboard template between their leads when soldering (see text).

a reasonable brightness.

Typically, a red LED that's driven with sufficient current to light will have 1.8V between anode and cathode. Blue LEDs have much more – up to about 3.5V. A 3V supply therefore does not provide sufficient voltage for driving the LEDs, especially as the supply drops with cell discharge.

So, in order to make sure the LEDs are flashed with sufficient brightness, they are each driven via a voltage doubler arrangement comprising a 100µF capacitor and a diode. This operates as follows.

For LED1, RB3 of IC1 is normally set as an input to read the level on switch S1. However, when the LED needs to flash, RB3 is set as a low output. The RB4 pin is then set high and the 100µF capacitor is now connected across the nominal 3V supply via diode D1 and so it charges to about 2.4V (ie, 3V minus the 0.6V drop across the diode).

During this brief capacitor charging period, LED1 glows due to the current flowing through it, its series 1kΩ resistor and diode D1. Note that we say it "glows", because the red LED voltage drop of 1.8V plus the 600mV diode drop leaves only 600mV across the 1kΩ resistor, resulting in a LED current of just 600µA.

The RB4 output is then taken low. When that happens, the positive side of the 100µF capacitor goes to 0V while the negative side is pulled about 2.4V below the 0V supply and diode D1 is reverse biased (ie, no diode current flow). As a result, the LED and its series 1kΩ resistor are now connected between +3V (ie, the positive supply) and -2.4V, or a total voltage of 5.4V.

Subtracting the 1.8V LED forward voltage leaves 3.6V across the 1kΩ resistor, giving a LED current of 3.6mA for a brief period until the 100µF capacitor discharges. The LED is therefore driven with sufficient current to flash brightly.

Note that we do not allow the capacitor to fully discharge while RB4 is low, otherwise the capacitor will be reverse charged via LED1 and the 1kΩ resistor. Consequently, RB4 is taken high some 5ms after the capacitor is allowed to discharge and RB3 is again set as an input.

Blue LED drive

The other LEDs are driven similarly. However, there are some differences, especially for the blue LED (LED4) which has a nominal 3.5V drop when it is lit. That means that the LED current will be low and so it will not generally have much brightness while ever the 100µF capacitor is charging.

The low current also means that towards the end of charging cycle, there is minimal current through diode D4. This low current results in a lower voltage drop across D4 and so this allows the capacitor to charge closer to the +3V supply.

The voltage doubler therefore drives the blue LED at a slightly higher voltage than that applied to the red LED and this compensates to some extent for the greater forward voltage of the blue LED.

Note also that when the 3V cell is discharged to 2V, the LED current is further reduced. However, the LEDs all still flash with adequate brightness due to the voltage doublers.

Supply filtering

As shown on Fig.1, the 3V supply rail from the lithium cell is bypassed using a 100µF and 100nF capacitors. In addition, diode D5 is connected with reverse polarity across the cell. This conducts and protects IC1 if the cell is inserted incorrectly into its holder or if the holder is soldered to the PCB the wrong way round.

Construction

The assembly is a snack with all parts mounted on a double-sided PCB coded 19111121 and measuring 45.7

Table 2: Capacitor Codes

Value	µF Value	IEC Code	EIA Code
100nF	0.1µF	100n	104
1nF	0.001µF	1n	102
22pF	NA	22p	22

Table 1: Resistor Colour Codes

	No.	Value	4-Band Code (1%)	5-Band Code (1%)
❑	4	10kΩ	brown black orange brown	brown black black red brown
❑	5	1kΩ	brown black red brown	brown black black brown brown

Make sure that all polarised parts (LEDs, IC, diodes and electrolytic capacitors) are correctly orientated when fitting them to the PCB. The PC stakes for links LK1-LK4 are soldered at the rear of the PCB (see text)

x 79mm. As shown in the photos, this is housed in a UB5 plastic enclosure measuring 83 x 54 x 31mm. A front panel label measuring 75 x 47mm is affixed under the case lid and is visible through the translucent blue plastic.

Start by checking the PCB for any faults such as shorted tracks, undrilled holes and incorrect hole sizes. The PCBs supplied by Silicon Chip Partshop and from the kit suppliers are double-sided, plated through, solder masked and screen printed. These are of high quality and are unlikely to have any defects.

Having checked the PCB, sit it on the base inside the case and mark out the four corner hole mounting positions. Drill these out to 3mm in diameter. If you are using countersunk screws, these holes should be countersunk on the outside of the box using an oversize drill.

An M3 x 15mm screw is then inserted into the box (ie, from the outside) and secured in place using an M3 nut. That done, a second M3 nut is fitted to each corner mounting screw and then a 15mm tapped Nylon spacer (see photo). That should produce an overall spacer height of 19.5mm above the base of the case.

Fig.2 shows the parts layout on the PCB. The top (front) side accommodates the switches, LEDs and diode D5, while the remaining parts, including the PIC micro, diodes D1-D3, the cell holder and 12 PC stakes (for the LK1-LK4 links) go on the other side.

Begin the assembly by installing the parts on the front side of the PCB (note: you will not be able to install the LEDs if the 1kΩ resistors on the underside are installed first). Make sure that diode D5 is correctly orientated and that it is a 1N4004. Make sure also that switches S1-S5 all sit flush against the PCB before soldering their leads.

Once these parts are in, you can install the LEDs. These must go in with their bodies 4mm above the PCB and that's done by placing a 4mm strip of cardboard between their leads as they are each soldered into position. Be sure to fit the correct colour in each location and check that each LED is installed with its cathode (shorter lead) towards its adjacent switch.

If you are not sure which LED is which (ie, they have clear lenses), most multimeters will drive a LED on the diode test setting. The red, yellow and green LEDs should light on this test (provided they are orientated correctly) but the blue LED may not light due to its higher forward voltage drop.

Once the LEDs are in, you should find that their tops are 9.5mm above the PCB. This ensures that they later protrude through the front panel.

Now that all the parts on this side are in place, flip the PCB over and install the parts on the other side, starting with the resistors and diodes D1-D4 (all 1N4148). Table 1 shows the resistor colour codes but you should also check each one using a digital multimeter as it is installed, as some colour can be hard to read.

Note that the 1kΩ resistors are raised slightly above the PCB, so that they clear the soldered pads of the LEDs.

The remaining parts can now be installed. A socket is used for IC1 and this is orientated with its notched end towards diode D4, as shown. The four 100µF electrolytic capacitors and the cell holder must also be orientated correctly. Check that the cell holder sits flush against the PCB before soldering its leads. Crystal X1 can go in either way around.

The 12 PC stakes go in the LK1-LK4 positions, with the longer end of each stake inserted from the rear of the PCB. These PC stakes are also soldered at the rear of the board. That way, the jumper shunts can be installed on the top of the board and pushed all the way down so that they sit flush against the board's surface.

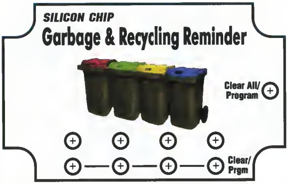
Next, push the programmed microcontroller into its socket, making sure that it is orientated correctly and that all pins go into the socket. The 3V cell can then be fitted. Wipe both faces of the cell with a clean piece of cloth or tissue before pushing it into the holder and avoid touching the cell with your fingers (the oily film left by finger marks on the insulation between positive and negative terminals can cause leakage current, thereby reducing the cell's life).

Final assembly

Once the PCB is completed, it's simply installed in the case with the LEDs and switches facing upwards and secured using four M3 x 6mm screws.

That done, the front panel label can be downloaded from the Silicon Chip website (**www.siliconchip.com.au**). It's available as a PDF file and this should be opened and printed out on photographic paper or plain white paper.

Having done that, trim it to size, then place it in position inside the lid and use it as a drilling template for the LEDs and switches. The LEDs require 3mm holes while the switches require



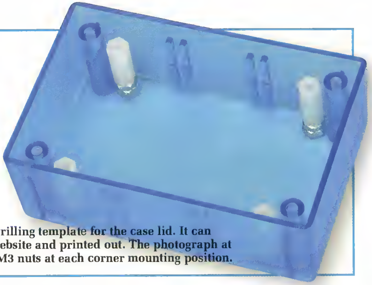


Fig.3 (above): this front-panel artwork can be used as a drilling template for the case lid. It can either be copied or downloaded from the SILICON CHIP website and printed out. The photograph at right shows the M3 x 15mm standoffs and the two extra M3 nuts at each corner mounting position.

3.5mm holes. Drill small pilot holes first (eg, using a 1mm drill) before enlarging them to the correct size.

Alternatively, you can use wad punches to make the holes if you have a set of these.

Finally, the label can be affixed to the inside of the lid using a few spots of neutral-cure silicone.

Programming the schedule

The Garbage and Recycling Reminder is set (or programmed) for the collection days and weeks using links LK1-LK4 and the five switches.

Note that this programming should not be confused with the software file (1911112A.hex) that's programmed into the PIC (IC1). You can either program the PIC yourself (the software is available on the SILICON CHIP website) or you can purchase a programmed PIC from the SILICON CHIP Partshop. Similarly, a programmed PIC will be supplied if you buy a complete kit of parts (if available).

Now let's see how the reminder schedule is programmed. The first step is to install the appropriate jumper link for each reminder LED. LK1 is for LED1, LK2 is for LED2, LK3 is for LED3 and LK4 is for LED4. A jumper in position 1 selects a fortnightly reminder period, with the LED flashing on alternate weeks starting with the current week.

Position 2 also selects a fortnightly reminder cycle but starting on the next week. And finally, leaving the jumper link out selects a weekly reminder cycle (in that case, the jumper can be stored by placing it over only one of the pins).

For example, if you want LED1 to flash weekly, leave out the jumper for LK1. If you want LED2 to flash fortnightly starting with the current week, install a jumper on LK2 in position 1. And if you want LED3 to flash fortnightly starting with the next week, install a jumper on LK3 in position 2.

Note: for monthly collections, select the weekly option and then refer to the collection calendar for the correct week day.

If you don't have four separate bins, then you will want to disable one (or more) of the LEDs to prevent confusion. In that case, the jumper position for that LED is not important since we disable it with the schedule programming.

The next step in the schedule programming is to wait until the exact day and time you want the reminder LEDs to start flashing. If you have collections on different days, then this can be sorted out later on. Just choose the main collection day.

The next programming steps involve using the pushbutton switches. There are two basic types of switch actions. A long press for six seconds or more is for programming the weekly/fortnightly reminder sequence. A shorter press for at least one second is for clearing or disabling the reminder LEDs.

It's just a matter of following this simple step-by-step procedure:

Step 1: at the correct time, press and hold the program button (labelled "Clear All/Program"). After about six seconds, the LEDs selected for the "Weekly" and "Alternate Week Now" fortnightly reminders will flash once, one after the other. Then the LEDs selected for the "Weekly" and the "Alternate Next" fortnightly reminders will flash in sequence and this particular sequence will then be repeated.

The entire cycle will then be repeated while ever the Clear All/Program button is held down. This confirms which LEDs flash on successive weeks.

Step 2: to prevent one LED from flashing, continue pressing the Clear All/ Program button and then press and

The front panel label sits inside the lid of the translucent blue case. The unit is easy to program and has very low current drain, with a battery life of up to three years.

hold the switch associated with the LED to be disabled. The LED will initially glow at a brightness that depends on the cell voltage. Wait until the LED briefly flashes at a greater brightness, then release its switch. The LED will now be disabled and will be prevented from flashing (unless the unit is programmed again with the Clear All/Program button as described above).

Step 3: release the Program button. That will start the Recycling And Garbage Reminder which will now flash the appropriate LEDs to indicate the bins for the current week.

Once the bins are out, the LEDs can all be cleared by pressing the Clear All/Program switch for a 1s period (ie, press and wait until all the LEDs have flashed). Note: do not press this switch for more than about 5s or you may end up reprogramming the unit to start at this time and day.

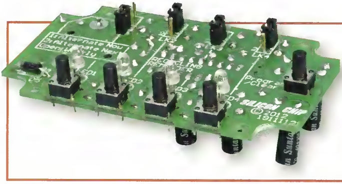
Alternatively, individual LEDs can be cleared by pressing the switch associated with that LED until it flashes. If any LED is not cleared, it will be automatically cleared after 18 hours.

If your bins are all collected on the same day, then that completes the programming procedure. However, if you have a bin that's collected on a different day or want to make other changes, you need to carry out a few additional steps.

As mentioned previously, you can swap the week, change the reminder day for a particular LED and shift the reminder starting time forwards or backwards in 15-minute steps. These alterations must be done outside of the 18-hour reminder period. If you are not sure if you are out of the reminder period (because the LEDs were each cleared individually), simply press the Clear All/Program button for 1s to clear the 18-hour reminder timer.

Here's how the make the changes:

Changing days: to change the day for any LED, press and hold the switch for that LED for six seconds. The LED will then flash. Release the switch after a single flash for a single day advance or keep holding the switch for more days. The LED will flash at a 1s rate and the schedule will advance by as many days as the LED flashes.



Here's another view of the completed PCB from the front. Links LK1-LK4 along the top edge set the flash cycle for each LED (see text).

The advance can be up to 13-days ahead, with the 14th day returning to the original setting.

Changing weeks: if you want to swap the weeks on which the alternate-week LEDs flash, this can be done by simultaneously pressing the two inner switches, S2 & S3. LEDs 2 & 3 will then each flash once to acknowledge the change in week. Essentially, this moves the cycle forwards by one week.

The week is only swapped once for each switch pressing. To change the week again, the switches need to be released for a second or more and then pressed again.

Forward time adjustment: the starting time can be adjusted forwards (ie, so that the flashing reminder starts earlier) by simultaneously pressing switches S3 & S4. This will case LED4 to flash at a 1s rate and the timer will move forwards by 15 minutes with each flash.

Backward time adjustment: pressing S1 & S2 at the same time moves the reminder time backwards. In this case, LED1 flashes at a 1s rate and the timer moves backwards by 15 minutes with each flash.

Note that while the forward time advance can be incremented by as many 15-minute intervals as required, this is not true for the backwards setting. In this case, to delay the reminder, the timing is paused by 15 minutes for each backward timing adjustment. This pause "delay" is limited to a maximum of 4 hours and 15 minutes.

In addition, any timer pausing is cleared each time a forward time adjustment is made.

Alternative reminders

Finally, if you are part of the "i-generation" (or aspire to be), you may prefer to use a smartphone app instead of building this unit. For example, a Garbage Can Reminder App is available from the Apple App Store and is suitable for iPhone, iPad and iTouch products. You enter the collections days into the calendar application and you are then reminded of the day – see **https://itunes.apple.com/au/app/garbage-can-reminder/id542396945?**

Alternatively, your local council may offer a free smartphone application for their garbage and recycling collections. For example, Randwick council in NSW has an app available at **http://www.randwick.nsw.gov.au/Your_Council/Whats_happening/my-RANDWICK_app/index.aspx**

Log onto your local council's website to see if they offer anything similar.

Of course, an app only works if your smartphone is switched on or you haven't left it in the car or upstairs. We think that placing the Recycling and Garbage Reminder on a shelf in the kitchen is more effective. **SC**

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