QUASAR KIT No 1180 - 24HR CLOCK/TIME SWITCH (2 OUTPUTS)

The circuit we are about to introduce will assist you in the correct utilization of your time. Kit 1180 is a digital clock with programmable start and stop capability for two separate devices. The potential applications covered by this unit are many, limited only by your imagination. You may connect to it the coffee machine in order to find sweet and hot coffee constantly, the radio in order to wake you up with music, the TV set which automatically will be closed at your convenience, to access systems to your house or office, etc.

TECHNICAL FEATURES

- Operating voltage: 9 up to 12 VDC / 0,5 A
- Time base: Real Time Clock
- Outputs: Two programmed exit channels with relays
- Backup system: 9V battery

CIRCUIT OPERATION

The circuit is based on micro-controller technology and specifically on Microchip's well known PIC16C57. The construction is simple, considering that the whole procedure of measuring time, the configurations and the control of the devices are totally performed by the micro-controller.

Apart from the PIC16C57, there are 8 transistors and one voltage regulator. For simplicity and practical reasons, the whole construction has been divided in two sections that are being assembled in two independent printed circuits, coded as 1180 and 1180A.
The first includes the control circuit while the second one includes the operation buttons and the displays.

In order to analyze the electronic circuit and familiarize yourself with a clear perception of its functioning, we will split the device in the following sections:

1. The power of 12 Volt, for the relays RL1, RL2.
2. The power of 5 Volt, which is used for the rest of the circuit and it, is consisted of the diodes D1, D2, D3, the resistor R14, the capacitors C1, C2 and the voltage regulator of +5V DC (IC2).

In order to avoid the loss of the current hour and other program data, a backup battery (9V) is activated in case of disconnection of the voltage of +12V.
Let's see how it works.
When the circuit is powered on with 12 V, the backup's battery is inactive. If for any reason the supply of the 12V is cut off, the circuit detects the absence of the voltage after the IC2 and through the diode D3 the voltage of the battery is being directed to it. This voltage is designated only for the circuit operation and not for the relays.
The capacitors C1, C2 absorb the big or the sudden changes of the voltage that may appear after the IC2.

3. The network of C3, C4 and Y1 is the «heart» of the micro-controller (IC1) by supplying it steady frequency of 4 MHz.
4. The switches S1, S2 and the resistors R19 and R20 compose the time adjustment circuit (in hours and minutes) as well as the beginning and the termination of the operation times of the two circuits that are linked to the corresponding relay outlets.
5. The resistors R1 up to R8 limit the display current in order to light sufficiently, without danger.
6. The network of R15, R16, R17, R18 and the transistors Q5, Q6, Q7 and Q8 constitute the special circuit of alternative operation of the display so that the steady illumination is secured.
7. The transistors Q1, Q2, Q3 and Q4 and the resistors R9, R10, R11 and R12 constitute the two - independent from each other – driving output circuits of the two relays (RL1, RL2), while the diodes D5 and D6 protect the transistors Q1 and Q2 from the inductive anti-electromotive power of the relays at the latch time.
8. The basic element of the circuit – as already mentioned – is the micro-controller (IC1) that contains the complex and complicated circuit of the memory and the processing unit of data based on the program that already have registered into it. In its memory every adjustment that you will enter externally when you have completed the assembly of the parts at the two printed circuits. is being registered

QUASAR KIT No 1180 - 24HR CLOCK/TIME SWITCH (2 OUTPUTS)

ASSEMBLY

The assembly is being significantly simplified due to the utilization of the micro-controller PIC 16C57. So, you have to pay the proper attention only regarding the polarity of the transistors, diodes, electrolytic capacitors and integrated circuits.

The placement of the components – topographic – is printed on two PCB's, to facilitate the assembly.

The points that are to be soldered (pad and component's leads) must be heated together for 3-5 seconds. After you approach the solder wire and as soon as it starts melting, you wait until the pad is covered, and an equable and shinny cone is created.

Begin the assembly by soldering firstly the components that are not in danger to be destroyed by excessive heat and they have no polarity (pins, DIL sockets, fuse holders, resistors, crystal, etc). Be attentive to the colors of the resistors, which are mentioned in the component list for every resistor, and are also printed at the back of the package of the kit. Following that, place the diodes and the electrolytic capacitors (paying attention to the polarity), place the transistors (following the topographic) and in the end, place the relays.

In the small printed circuit (1180A), solder now the 16-pin SIP header, in such a way that the big part of pins protrudes out of the printed circuit (so that you solder it later on at the big printed circuit (1180)). Continue by soldering the button switches, and the resistors R19, R20 and **definitely the two wire bridges (J1, J2) behind the second and the third display.** In case you forget them, the circuit will still operate but without the two dots flashing.
If you intend to use the box that we recommend (box No 2180 TK10), you will solder the four displays directly to the printed circuit. In any other case it should be convenient for you to solder a 40 DIL socket and then place them.

ATTENTION: *The first and the third «displays» are placed with the dot or their letter facing upwards, while the second and the fourth «display» with the dot or their letters facing downwards. This happens in order to keep the two dots in the middle of the displays that will flash in the pulse of seconds.*

After you have finished the assembly of the parts in the two printed circuits and have made a test, solder the pin-header to the other printed circuit too, so that the two printed circuits are joined at an angle of 90^0.
Place carefully the micro-controller in its socket with the notch towards the RL2 side.

At the points with the indication 4 (+) and 5 (-), place a 9V battery using the «clip» to secure the operation of the back up. In that case your stored data will remain safe even if your power supply fails. *Pay attention to the polarity of the battery.*
At the points with the indication 6 (+) and 5 (-), supply the circuit with 9 to 12V DC voltage. *Be attentive to the voltage polarity.*

If you have followed correctly the given instructions you must see the four displays light up and displaying the indication «00:00» while the between dots will flash in the "pulse" of seconds. This means that the clock operates normally.

EXTERNAL DEVICES CONNECTION

Now you will have to connect the external devices that are controlled by the clock through the relays (RL1 and RL2).
In order to energize a device in a predetermined time, you must perform – carefully – the following:

1. Connect the phase (L) of the mains at the point 8 for the RL1 (or 2 for the RL2).
2. From the point 7 for the RL1 (or 1 for the RL2) join the phase wire to the device which you wish to control.
3. The neutral (N) will be connected directly to the device.

The relay comprises, in this way, an automatic switch of one position that is controlled by the micro-controller. When the circuit is standby, the points 2 and 3 of the RL2 (and 8 and 9 of RL1) are connected internally (Normal Closed – NC). Once the relay is «armed» the terminals 7 & 8 of RL1 and 1 & 2 of RL2 are connected.

QUASAR KIT No 1180 - 24HR CLOCK/TIME SWITCH (2 OUTPUTS)

ATTENTION: *Be careful when you connect the relays to the mains in order to control external devices. Follow the security rules considering the danger of electrocution due to the voltage of 220V that exists at the specific points.*
Please study carefully the diagrams and the instructions before you attend any kind of connection.

PROGRAMMING

Once the circuit is supplied with power, the displays show the time and the minutes by showing «00:00». The two dots in the center indicate the seconds' flow. By pressing the two buttons simultaneously (S1 & S2), the image of time disappears and the system «goes into» a status of programming by presenting the first mode of A1:00 initiation. This indication states that the micro-controller is ready to accept the adjustment of the operation's starting hour of the 1st external device.

By pushing successively the upper «button» (S1-MODE) you will notice that the indication changes into:

- A2 00 = Operation's beginning minutes of the1st external device.
- b1 00 = Operation's termination hour of the 1st external device.
- b2 00 = Operation's termination minutes of the 1st external device.
- C1 00 = Operation's beginning hour of the 2nd external device.
- C2 00 = Operation's beginning minutes of the 2nd external device.
- d1 00 = Operation's termination hour of the 2nd external device.
- d2 00 = Operation's termination minutes of the 2nd external device.
- e1 00 = Adjustment of the current time.
- e2 00 = Adjustment of the current minutes.

If you press the lower «button» (S2-UP), you can observe that every pressing changes the indication of the two last numbers from 00 up to 23, or from 00 up to 59.
The entry of the parameters in every mode is being stored by pressing the «button» (S1 – SET).
The system comes back in the operation status displaying the present time by pressing the two «buttons» simultaneously.

ADJUSTMENT OF THE TIME (EXAMPLE)

The moment that the indication is e100, press the lower «button» (S2 – UP). You will observe that with every push, the indication of the two last numbers changes from 00 up to 23. Place the time, e.g. «07» if it is seven o' clock in the morning or «19» if it is seven o' clock in the afternoon.
Press the upper «button» (S1) and you will see that the indication becomes e200.
Press the lower «button» (S2) and choose the minutes, e.g. «30» if the time at that moment is seven and thirty by pressing the «button» 30 times.
Press both buttons (S1+S2) simultaneously and you will see the time immediately (e.g. 7:30) and the dots between flashing every second.
Now you are ready to adjust the beginning and the termination time of the operation of the 1st external device.
For example, suppose you wish your radio to be switched on at 8:30 a.m. (20:30) and to be switched off at 10:25 a.m. (22:25).

Make sure that the clock shows the regular time.

- Press both «buttons» simultaneously.
- Press the upper «button» (S1) and choose A1:00.
- Press the lower «button» (S2) for 20 times until you see the indication A1: 20.
- Press the upper «button» (S1) and you will see the indication A2:00.
- Press the lower «button» (S2) for 30 times until you see the indication A2: 30.
- Press the upper «button» (S1) until the indication b1:00 appears.
- Press the lower «button» (S2) until you receive the indication b1:22.
- Press the upper «button» (S1) until the indication b2:00 appears.
- Press the lower «button» (S2) until the indication b2:25 appears.

In that way you have adjusted the following:
Beginning Time: 20 Termination Hour: 22
Beginning Minutes: 30 Termination Minutes: 25

QUASAR KIT No 1180 - 24HR CLOCK/TIME SWITCH (2 OUTPUTS)

All those adjustments mean that the contacts 7 and 8 of the RL1 will switch on at 8:30 p.m. and will remain on until 10:25 p.m., when it's time to switch off again. Well, if you have connected the power supply of your radio in those contacts – that is the phase of the mains or the positive pole of its power supply, if you use continuous voltage – at 08:30 a.m. the radio will start to operate and will stop at 10:25 p.m.
So, the relay terminals 7 and 8 consists an automatic on/off switch witch is controlled by the circuit.

INDICATION	DESCRIPTION	LIMITS
A100	Beginning HOUR of the 1st device	0 – 23
A200	Beginning MINUTES of the 1st device	0 – 59
b100	Termination HOUR of the 1st device	0 – 23
b200	Termination MINUTES of the 1st device	0 – 59
c100	Beginning HOUR of the 2nd device	0 – 23
c200	Beginning MINUTES of the 2nd device	0 – 59
d100	Termination HOUR of the 2nd device	0 – 23
d200	Termination MINUTES of the 2nd device	0 – 59
e100	Clock HOURS	0 – 23
e200	Clock MINUTES	0 – 59

IF IT DOES NOT WORK….

1. Make sure that you have performed every connection as well as the jumpers J1and J2.
2. Check carefully the placement and the position of the components, especially those that they have polarity.
3. Check if you have performed correctly every soldering.
4. Beware of a possible cold gluing. The good soldering is shining and it is spread uniformly around the component's wire.
5. Check if you have placed the battery of backup correctly and if you apply the proper voltage and polarity.
6. Beware if by any chance you have short-circuited close pads of the printed circuit board. In case you use soldering paste, please clear scrupulously the printed circuit from its remains before you power supply again with voltage.

THE COMPONENTS

R1, R2, R3, R4, R5, R6, R7, R8	330 Ω ¼ W	Resistors	Orange, orange, brown
R9, R10, R13, R19, R20	10 KΩ ¼ W	Resistors	Brown, black, orange
R11, R12	1 KΩ ¼ W	Resistors	Brown, black, red
R14	1,2 KΩ ¼ W	Resistor	Brown, red, red
R15, R16, R17, R18	4,7 KΩ ¼ W	Resistors	Yellow, purple, red
C1	33μf / 16V	Electrolytic capacitor	
C2	100nF	Polyester Capacitor	
C3, C4	22pf	Ceramic Capacitors	
D1, D2, D3, D5, D6	1N4001..1N4007	Diodes	
D4	1N4148	Diode	
DS1, DS2, DS3, DS4	TDSO 5150 or MAN 6960 or MAN 5950	Common anode displays	
Q1, Q2	BC327 or BC558	PNP transistors	
Q3, Q4	BC338	NPN transistors	
Q5, Q6, Q7, Q8	BC547 or BC548	NPN transistors	
IC1	PIC216C57	Micro-controller	Pre-Programmed (P1180)
IC2	7805	Voltage regulator	

Y1		4 MHz crystal	
RL1, RL2	FRS3 or FRS10C-03 12V DC	Relays	
S1, S2		MEC «button» switch	

Various: Printed circuit boards Kit No 1180 & 1180A, fuse holder, 1A fuse, 9 pins, 28 DIL socket, 16 pin right angle header, solder wire, battery clip.

PARTS LIST

All components including printed circuit board, assembly instructions including schematics and detailed parts list are supplied when you purchase the kit.

Ordering

For pricing info and online ordering please visit:

http://www.quasarelectronics.com/1180.htm

For further info please contact us by e-mail:

mailto: sales@QuasarElectronics.com