DIY CHRIS

HYPERCLOCK

Like No Other Timepiece *Ever*



DIY Kit User Guide and Assembly

The HyperClock was originally designed by Leon Schmidt which I discovered in an article published in an edition of Radio Electronics.

This replica of the HyperClock was designed to be as close to the original as possible and while it may look a lot like the original, Leon Schmidt, SkiTronix, or Infinetix is in no way affiliated with this replica design.

Permission has been granted by Leon Schmidt for usage of the license for the code that runs on the included micro controller.

Thank you for your purchase! With every sale of a HyperClock, we will make a \$2.00 donation to Action Against Hunger.

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Illustrations and instruction manual by Donna Fletcher.

Tips

- Take your time!
- This soldering kit is NOT a beginners kit and has a 3 out of 5 star rating for difficulty.
- Practice on scrap before beginning if you have not soldered recently.
- Fill each solder pad completely to ensure a solid connection.
- Clean your tip regularly using brass sponge or a wet sponge.
- Soldering sequence goes from lowest components to highest off board unless otherwise specified in directions.
- Pre-bending your components that require bending is a good way to ensure a clean, tidy board.
- Before moving on to the next component to be soldered, it is recommended you trim any excess component leads.
- Be cautious when soldering, avoid inhaling solder smoke as it may contain flux which is harmful.
- If a component is written in red ink, then that component is polarized and has to be soldered in a specific direction. For example, the diode to the right is polarized. You can see the thick black line on one side of the diode. Match that up to the thick white line on the boards illustration. Other components may have a + sign, like the Tantulum capacitor. Some components show polarity with having one lead shorter than the other, the shorter side is called the Cathode and the longer is the Anode.





Tips

• On each page you will see a grid like the one shown below. This grid gives you the name of each component in that step, its location on the board, it's part number or other defining characteristic, the number of those components located on the board to be soldered, a top down view of what it looks like on the board and the color of the box surrounding it in the illustration. Solder in order from the first component listed.



	Name 		Part Number/ Other 	I11	ustrati 	on
	Ceramic Capacitor	C4, C5, C15, C16	.1 μf	4	104	
_	- Tantulum Capacitor	C13	1 µf	1	+	
	Ceramic Capacitor	C8, C9	.01 µf	2	(103Z)	
	Ceramic Capacitor	C11, C12	560 pf	2	561	
	- Polarized	Location	Q	uanti	ty Bo Col)x or

- Extras have been provided for various components in your kit, but some components like the 7 segment LED's and capacitors only have the quantity required for completion. Be careful and double check before soldering!
- A good tip when soldering components with many pins like the IC sockets is to begin by soldering two corners opposite one another, flipping it over to ensure contact with the board and proper placement (you can never be too sure!) and continuing from there.
- Be careful to not keep heat on any components for longer than absolutely necessary to avoid damage. Transistors are especially sensitive so be cautious!
- When going through each step, put aside what components you will need but focus on one component at a time. For example, pre-bend and place both rectifier diodes, flip the board and solder, trim and move on to the next component.

Tools

In order to complete this project, there are a few tools required that are not included in the HyperClock kit. They are as follows:

- Soldering iron
- Solder
- Brass sponge or wet sponge for cleaning
- Diagonal cutters (precision cutters, wire cutters)
- Allen Key
- A well ventilated room or bench top solder fume extractor
- A workspace free of clutter and flammable materials
- It is also recommended to keep some thin pliers on hand
- AC adapter is not included but can be found on our website, DIYChris.com

Tools that are not required but may be useful are:

- Backup battery (9 Volt) not included
- Flux paste
- Tip tinner
- IC pin straightener
- Component pin bender (For resistors and diodes)
- De-soldering braid
- De-soldering suction tool
- Helping Hands or a board mount

Tools



Parts List

Reference	#	Part Type	Part Number/Specs	Image
D1,D3	x2	Diode - Rectifier	IN914A	
D2	x1	Diode - Switching Diode	IN4001	
BR	x1	Bridge Rectifier	RB151	* RB151 VK42
R9	x1	Resistor	1/4 Watt 2K7 OHM	
R4, R13, R58	x3	Resistor	1/4 Watt 470K OHM	
R1, R6-8, R10-12, R16, R17	x9	Resistor	1/4 Watt 47K OHM	
R2, R3, R5, R14, R15, R18- R32, R41-57	x37	Resistor	1/4 Watt 4K7 OHM	
R33-R40	x8	Resistor	1/2 Watt 330 OHM	
XTAL	x1	Crystal	6MHz	MP060 6M0000 CTS172027
S1-7	x7	Tactile Switch	B3F-1000	
JU1, JU2	x2	Jumper		
JU1, JU2	x2	Pin Header	3 Pin	+++
IC2	x1	IC Socket	8 Pin	••••
IC3	x1	IC Socket	14 Pin	
IC5, IC6, IC7	x3	IC Socket	16 Pin	
IC4	x1	IC Socket	40 Pin	
IC2	x1	IC	LM393	11393
IC3	x1	IC	LM124N	L3/324-0
IC5, IC6	x2	IC	SN74L514SN	307 ALS 1 A 30
IC7	x1	IC	ULN2003AN	JULNIZOOSAN
IC4	x1	IC	Processor	HYPERCLOCK
IC1	x1	Voltage Regulator	LM340T5	

Parts List

LED1-64	x64	LED Display	Red Diffused	
DIS1, DIS3	x2	LED Display	7 Segment Display (Small)	B . B .
DIS2	x1	LED Display	7 Segment Display (Large)	88
C10, C14, C17	x3	Ceramic Capacitor	0.0033 μf	К 5 К
C4, C5, C15, C16	x4	Ceramic Capacitor	.1 μf	104
C8, C9	x2	Ceramic Capacitor	.01 µf	103Z
C1, C2	x2	Ceramic Capacitor	20 pf	20J LOG BKV
C11, C12	x2	Ceramic Capacitor	560 pf	561
C13	x1	Tantalum Capacitor	1 µf	
C6	x1	Electrolytic Capactor	22 μf 16 v Axial	22 uF 16V
C7	x1	Electrolytic Capactor	2.2 µf 150 v Radial	2.2 uF 50 V
C3	x1	Electrolytic Capactor	1000 µf 16 v Radial	
Q1, Q2, Q17, Q18	x4	Transistor	2N2222	2962222
Q3-16, Q18	x15	Transistor	2N2907	29627007
BZ1	x1	Piezo Speaker		$\overline{\bullet}$
13	x1	9V Connector		Ð
MISC	x1	Heat Sink		
MISC	x1	Screw		
MISC	x1	Washer		0
MISC	x1	Nut		\bigcirc
★ MISC	x1	9 Volt		
MISC	x1	Zip Tie		
★★ MISC	x1	AC Power Adapter		

* The 9 volt backup battery is not required but is reccomended (Not included in kit)

** Your kit when purchased may or may not include a power supply, depending on your options at checkout 6

Step 1 : Diodes

Diode - Rectifier	D1, D3	IN914A	2	
Diode - Switching Diode	D2	IN4001	1	

Before beginning, be sure to read through the tips on pages 1 and 2.



Step 2 : Resistors

Resistor	R9	1/4 Watt 2k7 OHM	1	
Resistor	R4, R13, R58	1/4 Watt 470k OHM	3	
Resistor	R1, R6-8, R10-12, R16, R17	1/4 Watt 47k OHM	9	
Resistor	R2, R3, R5, R14, R15, R18, R32, R41-57	1/4 Watt 4k7 OHM	37	
Resistor	R33-R40	1/2 Watt 330 OHM	8	

Tip: have all resistor bands facing the same direction for a consistent, clean finish.



Step 3 : Capacitors

Ceramic Capacitor	C10, C14, C17	0.0033 μf	3	К5К
Ceramic Capacitor	C1, C2	20 pf	2	_20J
Crystal	XTAL	6MHz	1	84P063 64/0000 CTS 1/2027

For the crystal, pre-bend before soldering.





Step 4 : Sockets

IC Socket	IC2	4 Pin	1	• • • •
IC Socket	IC3	14 Pin	1	•••••
IC Socket	IC5, IC6, IC7	16 Pin	3	• • • • • • • •
IC Socket	IC4	40 Pin	1	

Match the notch on the IC socket to the notch on the board.



Step 5 : 7 Segment LEDs & Bridge Rectifier

Bridge Rectifier	BR	RB151	1	
LED Display	DIS1, DS3	7 Segment LED Display (Small)	2	B , B ,

Double check to be sure the 7 segment LED is oriented correctly with decimals towards the bottom of the board.

For the bridge rectifier, match the + on the component with the + on the board. It is the Anode, so it is longer than the other leads.



Step 6 : More Capacitors

Ceramic Capacitor	C4, C5, C15, C16	.1 μf	4	104
Tantulum Capacitor	C13	1 µf	1	+
Ceramic Capacitor	C8, C9	.01 μf	2	103Z
Ceramic Capacitor	C11, C12	560 pf	2	561



Step 7 : Electrolytic Capacitor & Pin Headers

Electrolytic Capacitor	C6	22 μf 16 v Axial	1	
Electrolytic Capacitor	C7	2.2 μf 50 v Radial	1	0
Pin	JU1, JU2	3 Pin	2	
Jumper	JU1, JU2		2	

The + on the board for the radial electrolytic capacitor is quite small. The Anode (Longer, positive lead) goes in the bottom hole.

JU1 determines whether the clock runs at 50 or 60 Hz. A jumper on the top 2 pins sets the clock to run at 50 Hz and the bottom 2 pins to run at 60 Hz. JU2 sets the chime volume, a jumper placeed on the right 2 pins will set a louder chime and the left 2 pins will be less loud.



Step 8 : Transistors

Transistor	Q1, Q2, Q17, Q18	2N2222	4	2N2222
Transistor	Q3-16, Q18	2N2907	15	2N2907

The transistors can be a bit tricky, so here is a guide to help you be sure you have oriented them correctly. The rounded part of the transistor faces the tab on the illustration on the board.



Step 9 : LEDs

LED Display	DIS2	7 Segment LED Display (Large)	1	<u>88</u>
LED	LED1-64	Red Diffused	64	

Tip: Insert a handful of LEDs, then turn over to solder. Do not try to insert them all at once.

Tip: The LEDs have a flat side which is also the side with the shorter lead, the cathode. That shorter side should face the outside of the board.



Step 10 : Power & Battery

Heat Sink	IC1		1	
Voltage Regulator	IC1	LM340T5	1	
9V Connector	J1		1	



Step 11 : Switches

Tactile Switch	S1-7	B3F-1000	7	
Electrolytic Capacitor	C3	1000 µf 16 V Radial	1	
Piezo Speaker			1	•

Tip: for the radial electrolytic capacitor, pre bend then solder.



Step 12 : Logic (ICs)

IC	IC2	LM393	1	LM393
IC	IC3	LM324N	1	LM3344
IC	IC5, IC6	SN74L514SN	2	202741.214.20
IC	IC7	ULN2003AN	1	JULN2003AN
	IC4	Processor	1	HIPERCLOCK

Like we did in step 4, be sure to match up the notch on the IC with the notch on the socket. Be careful when inserting the IC as to not bend and damage the pins.



Step 13 : External Power



★ The AC adapter is an optional addition when purchasing your HyperClock. If you chose to include the power supply, your adapter will come pre stripped and tinned. Be sure to not have the adapter plugged in when soldering.



Finished Product

Plug it in and continue on to the next few pages to see how to use your new HyperClock!



HyperClock User Guide

Not powering on or need help troubleshooting? Head on over to our Discord DIY Chris for support. In the meantime, check to be sure that:

- Each component is completely soldered (check the voltage regulator)
- You have no solder bridges between components
- All components with polarity are soldered in the proper direction
- All ICs are inserted properly, no bent pins and notches line up



Features

1. Eight unique time display modes including fading digits,

"before the hour" minutes indication, and conventional displays give HyperClock that "one of a kind look".

2. The ability to display seconds as the sweeping movement of an illuminated LED in a ring of 60 or...

3. Graphically display the relative level of ocean tides that occur twice in every 24.51 hour period.

- 4. A bell chime and wake up alarm.
- 5. 50/60 Hz operation.
- 6. Complete mode, time, and tide level setting capability.
- 7. Battery backup.
- 8. Month/Date display with date correction for the appropriate month.

Setup

On the back of the clock are 7 switches. Switches 1, 2 and 3 are used together with switches 4 and 5 to set the Display mode, date and alarm. Using the table below you'll start by pressing either switch 1, 2 or 3 and then the corresponding switch 4 or 5 to make the adjustment. Operating switches 4 and 5 independently of other switches will set the current time hour and minute respectively.

Dicplay	Switch 4 (Mode, Hour, Month)	Switch 5 (Minute, Day)		
Display	Set Hour	Set Minute		
Switch 1 (Mode)	Set Mode (0 - 7)	(No Action)		
Switch 2 (Date)	Set Month	Set Day		
Switch 3 (Alarm)	Set Alarm Hour	Set Alarm Minute		

Switch 6 is labeled Snooze / Tide. This switch serves a dual purpose. If you have the alarm setup then pressing this switch will snooze your alarm for 10 minutes. This can go on indefinitely.

If the alarm is off, then this switch will allow you to move the Tide indicator to the desired level.

Finally Switch 7, labeled Alarm Toggle switches the state of the alarm as well as the hour chime. By default the hour chime is on and the alarm is off. When you press this button the alarm is turned on and the hour chime mode is off so that you will not be awakened by the chime during the night. Pressing the button again will turn off both the alarm and the hour chime. Pressing the switch a 3rd time will enable the alarm. You'll know that this has happened because you'll hear a single chime. Continuing to press the button will toggle through these modes.

Display Modes

Each of the display modes can have a combination of Fading Updates, Plain Updates, Before-The-Hour Display, Plain Display, Tide Light Chaser, Seconds Light Chaser. You can reference the table below to quickly decide which mode best suits the operation you'd like to set your clock for.

Feature	Mode							
	0	1	2	3	4	5	6	7
Fading Updates		•		•		•		•
Plain Updates	•		•		•		•	
Before-The-Hour Display			•	•			•	•
Plain Display	•	•			•	•		
Tide Light Chaser					•	•	•	•
Seconds Light Chaser	•	•	•	•				

The default power up mode is Mode 0. Looking at the table then, your clock would operate with the following features; Plain Updates, Plain Display, and Seconds Light Chaser.

A Bit About the Features...

Fading Updates - This feature provides you with subtle fading transitions on display updates for the seconds LED's as well as the 7 segment LED's. So instead of instantly turning off 1 LED and turning on the next, you get a nice fade out of 1 LED while fading in another.

Plain Updates - Basically the opposite of the fading updates. This is a more traditional transition with LED's instantly turning on and off without delay.

Before-The-Hour Display - One of the features that makes this clock so unique is the before-the-hour display. This feature gives you the time in a more human friendly way. So just like you would normally say to someone its 15 minutes until 3 or its 15 minutes after 3, this features allows you to read the clock in exactly this way. The 7-segment LED on the far left would be the minutes before the hour and the 7-segment LED on the far right would be the minutes after the hour. What a fun way to tell time!!

Plain Display - For those of you who prefer a more traditional way to read time, this tells time in the same way many other clocks do. With the 7-segment display on the far left remaining off. The middle LED will display the current hour while the LED on the far right displays the minutes.

Tide Light Chaser - Because the Hyper Clock allows us to observe the tide levels there needs to be an easy way to graphically represent this. So instead of using the 60 LED's to display the seconds on the clock, they are used instead to display the tide levels.

Seconds Light Chaser - If you don't care to see the tide levels then you'd want to use this feature instead to display the seconds on the clock.

A Bit About Tides...

Before setting for high / low tide you'll want to find out when high or low tide occurs for your specific area...

Its easy enough to find this information in the newspaper or your local library... just kidding its 2021, use google and search for "high tide time in my area" or use this website "https://lowtidehightide.com/tides" then type in your zip code. Look for today's date and then check if you've passed high or low tide, whichever hasn't occurred yet you'll want to take a note of that time. Then just wait until that time and then set your tide level to either low or high, 12 or 6 respectively, depending on what you discovered on the site. After that the LED's will advance every 12.5 minutes making one complete revolution every 12 hours and 25.5 minutes.

Prediction of tides in any given locale is not a simple job. Tides are affected by many cyclic astronomical forces of our solar system, the declination of the moon and sun orbits relative to a point on the Earth, and the local geography of the coast line in the area in which you live, to name a few. HyperClock predicts the tidal levels from the most predominate of these forces, the moon. The moon requires 29.53 days to complete an orbit around the Earth (that is if the Earth did not rotate on its axis) and this combined with the 24 hour solar day causes a strong tidal "high and low" influence in every 12 hour and 25.5 minute interval. HyperClock tracks the moons primary affect on the tide.

Battery Backup

The 9 Volt battery is there to keep your clocks settings and keep the time going in the event that the primary power source is disconnected. To conserve battery life, HyperClock turns off all of the LED's while disconnected from primary power. Once primary power is restored HyperClock will turn the LED's back on and will still show the correct time. If you plan to have HyperClock disconnected from primary power for a long period of time then it is best to disconnect the battery to prevent it from being drained.

Accessorize your HyperClock

Want to put your HyperClock on display? Head on over to https://DIYChris.com to check out our red plexiglass cover and sleek, minimalist stand! Forgot to add the AC adapter when purchasing your HyperClock? We've got you covered! AC adapters come pre-stripped and tinned for easy instalation.



Contact

Website: https://DIYChris.com

Need electronic DIY kits, testing equipment and accessories for your HyperClock? DIYChris.com has these and more!





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