SKU 26019 / 26020
December 5th, 2024

CANADUINO® Atomic Clock AM Receiver Kit V4

- Fine tuned ferrite antenna
- Receiver module:
  - 2-15V operating voltage
  - 20mA (+/-) outputs
  - 3.3/5V logic level
  - Status LEDs
  - extra inverted output
- Reception of (examples):
  - US/Canada WWVB
  - British MSF
  - Japanese JJY60
  - German DCF77

INTRODUCTION

The receiver kit consists of an AM receiver module featuring the high-performance MAS6180C IC, along with a precision-tuned ferrite antenna and matching crystal. Status LEDs provide clear indication of input and output signals, with both inverted and non-inverted outputs capable of sinking or sourcing up to 20mA current. This enables placement of the receiver up to 1000m from the decoder circuit using low-impedance termination.

For power efficiency, the status LEDs can be disabled by leaving the "LED" pin floating, or enabled by connecting it to GND. The included 60mm loop stick antenna achieves a Q-factor exceeding 100, delivering superior reception performance. The module requires a stable power supply between 2V and 5.5V, with a battery or gold cap recommended to prevent AM signal interference that could compromise reception quality.

The Auto Gain Control feature is enabled by default with the AON pin high, and can be disabled by connecting this pin to GND. The module begins operation automatically when powered up, though it can be disabled by pulling the EN pin to GND. Recovery from this power-down mode is significantly faster than restarting after a complete power loss.

For implementation details of the encoded time signal, comprehensive information can be found in the Wikipedia articles for WWVB, DCF77, or MSF. Alternatively, numerous example implementations are available on platforms like GitHub.

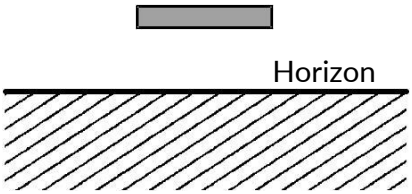
PIN DESCRIPTION

Pin	Function
VCC	Supply voltage 2V-5.5V, must be clean and stable
AON	Auto Gain Control (open = ON), connect to GND to turn AGC off
EN	Enable (open = ON), connecto to GND for power-down-mode
OUT	Decoded output signal, sink/source max. 20mA
/OUT	Inverted decoded output signal, sink/source max. 20mA
LED	Connect to GND to turn status LEDs on (default = OFF)
GND	Supply voltage ground level
ANT	Antenna input pins
Xtal	Spot to assemble the included crystal (60003 or 77503 Hz)

Note: For detailed information about the receiver IC please see MAS6180C AM receiver IC datasheet

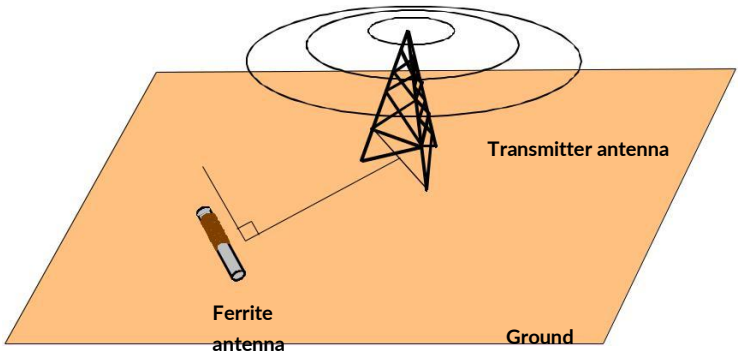
APPLICATION INFORMATION

Antenna orientation



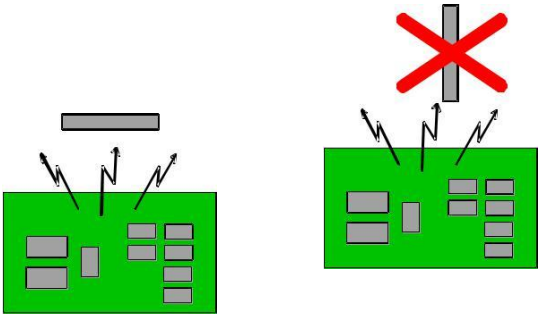
The magnetic field component of the propagating long wave time signal transmission has a horizontal polarization thus the ferrite antenna should be oriented horizontally to maximize the signal (see figure 1).

Figure 1. Antenna orientation relative to ground



The ferrite antenna should also be pointing orthogonally relative to the transmitter.

Figure 2. Antenna orientation relative to transmitter station



The ferrite bar antenna should be located as far as possible from conductive metal walls, PCB ground plane or ferromagnetic objects (speakers). All those objects affect the antenna tuning and can attenuate the received signal. To avoid noise coupling the ferrite antenna should also not be pointing towards noisy electronic circuits (figure 3). It is a good practice to turn off all unnecessary electronic circuits when receiving the weak radio transmission.

Figure 3. Antenna orientation relative to noisy electric circuits

OPERATION

The antenna exhibits sensitivity to both magnetic and electrical disturbances. A notable example occurs in digital radio-controlled clocks, where LCD displays operating on a 32Hz refresh rate produce a 1875th odd harmonic at exactly 60kHz. Even at µVrms levels, this interference can significantly reduce sensitivity. Therefore, antenna and module placement are critical factors, requiring maximized distance from potentially disturbing electronics and metal or ferrous materials that could affect reception.

Best practices include keeping antenna wires at their original length without extensions and positioning both receiver and antenna away from electromagnetic noise sources. To minimize power supply noise, use a battery connected via short wires to the 3-5.5V power supply pin. The receiver can be positioned up to 1000m from the microcontroller or decoder logic when using shielded twisted pair cable (such as network cable) with low-impedance termination (typically 470-1000 Ohms).

For indoor operation, optimal placement typically begins near a window, with the antenna oriented appropriately relative to the transmitter. The fast-start feature can be activated by briefly bringing the module into power-down mode through pulling and releasing the EN pin from GND. In favorable receiving conditions, the AGC will stabilize within seconds.

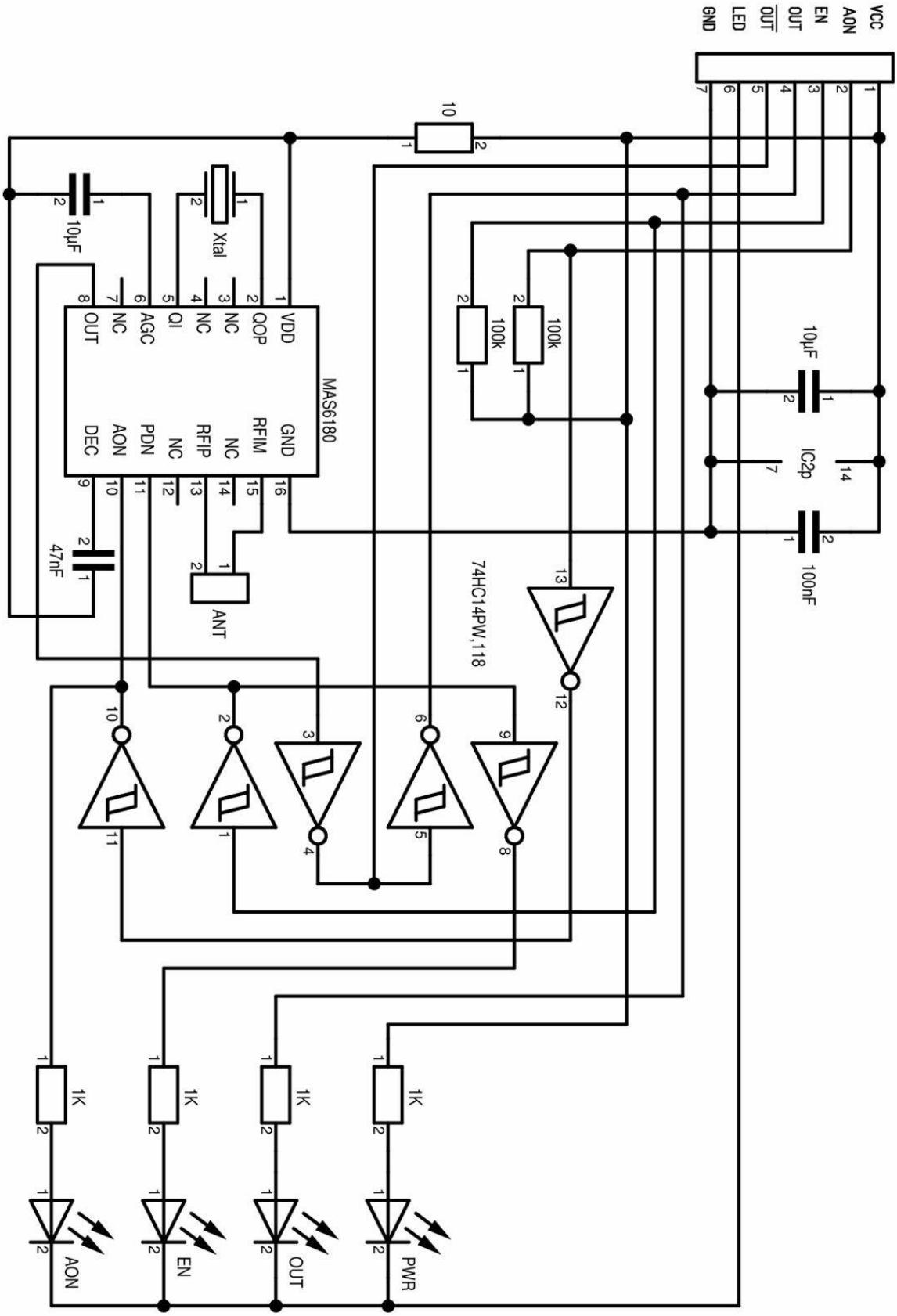
The output signal initializes high but begins switching upon receiving any input, whether it's the desired time signal or interference, depending on local reception conditions. A consistently low output typically indicates the presence of strong interference overwhelming the desired signal. In cases of poor reception, changing location and reinitializing the fast-start procedure may help. Without utilizing the fast-start feature, achieving a decodable signal might require several minutes.

MECHANICAL DIMENSIONS

Antenna:	60mm long, 10mm diameter core, max. 15mm diameter with coil and capacitor
PCB:	25 x 20mm

ORDER INFORMATION

EAN 4260474030200 for 77.5kHz version
EAN 4260474030194 for 60kHz version


VCC
AON
EN
OUT
LED
GND
10µF
Xtal
MAS6180
OUT
NC
AGC
QI
NC
NC
QOP
VDD
DEC
AON
PDN
NC
RFIP
NC
RFIM
GND
47nF
ANT
100k
100k
10µF
IC2p
100nF
74HC14PW,118
1K
1K
1K
1K
AON
EN
OUT
PWR