U.S. SOLAR MOUNTS

TT-24-A

ADVANCED

24VDC Time & Temp Controller

REV 1

Ultra-Rugged Solar Solutions

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Customer Support

U.S. Solar Mounts products are designed to be simple and easy to install. If, for whatever reason, you need help during installation, please give U.S. Solar Mounts' customer support a call. We are happy to help ensure each installation goes as smooth as possible. Have a comment or suggestion on how we can improve your experience? Let us know. We do appreciate your feedback.

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1. Installer Responsibility

- Complying with all applicable **local and national** codes, including any that may supersede this manual.

- It is the sole responsibility of the installer to determine and ensure the suitability of this product for the intended application. The specifications, performance data, and guidelines provided herein are based on standardized testing under controlled conditions and are intended for general reference only. Installers must assess all factors—including environmental conditions, compatibility with existing systems, and compliance with local regulations and codes—to ensure that the product is appropriate for its specific use. By proceeding with the installation, the installer acknowledges that any decisions regarding the product's application, modifications, or integration into a system are made at their own risk. The manufacturer shall not be held liable for any consequences resulting from the use of the product in an unsuitable or unapproved manner.

- Use only U.S. Solar Mounts parts and installer-supplied parts as specified by U.S. Solar Mounts. Substitution parts may void the warranty.

- **If you are unfamiliar** with NEC **compliant** electric installations or control systems, consult **with the dealer** that supplied your mount. They should have the skill and expertise to supply you with the necessary wiring diagrams and the appropriate connection wire, grounding equipment, junction boxes and fusing.

WARNING: Hazardous Voltage

- This equipment is designed to operate with and/or control high voltages that can cause severe injury or death. Only qualified personnel should perform installation, maintenance, or servicing tasks.

- Ensure that the power supply is turned off and all stored energy is properly discharged before working on this equipment.

- Verify the absence of voltage using a properly rated voltage detector before beginning work.

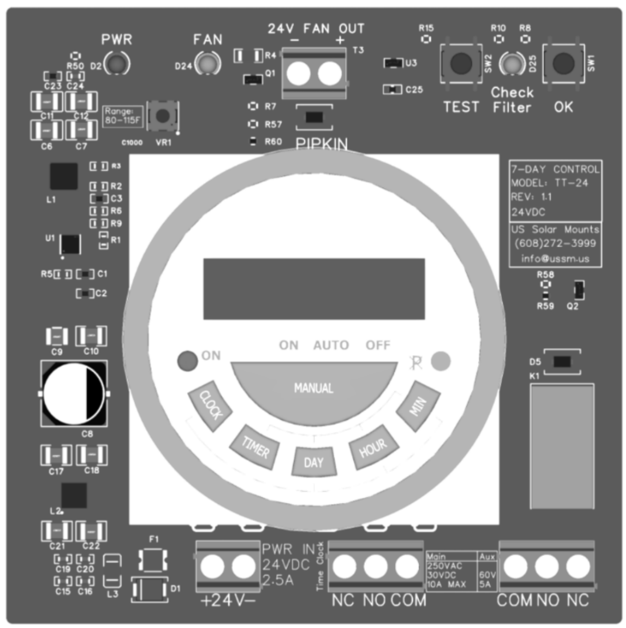
Failure to observe these warnings could result in electrical shock, death, equipment damage, or fire.

2. Description

The TT-24-A is a self-contained time and temperature controller engineered for demanding industrial applications. Compact in design, measuring just 4" (W) x 4.5" (H) x 2.375" (D), this unit is designed for easy DIN rail mounting (standard 35mm) and is ideal for integration into systems that control pumps, compressors, and other critical equipment. Operating on 24VDC, the TT-24-A is the perfect solution where precise time control and automatic environmental control are required.

The built-in digital 7-day timer accommodates 16 programmable on/off functions per day, allowing for flexible scheduling to control external loads up to 120V, 15A. Whether you need to manage compressor cycles, pump operations, or lighting, this controller provides the reliability and versatility required for complex industrial environments.

In addition to its time-based control capabilities, the TT-24-A incorporates an internal digital temperature sensor and microprocessor that continuously monitors the enclosure's ambient conditions, automatically activating a cooling fan when needed. Should the temperature exceed a preset high limit, the controller triggers its onboard relay—capable of switching external loads up to 24V, 5A—to activate optional remote alarm monitoring devices.



The TT-24-A also supports proactive maintenance with a built-in, automatic filter timer. The filter timer keeps track of time(in days) since the last filter inspection and gives a friendly inspection reminder.

For ease of use and rapid diagnostics, the TT-24-A includes multiple LED indicators that clearly display power status, fan operation, service reminders, and alarm conditions. While the unit is designed for industrial use, it must be installed within an appropriate environmental enclosure to ensure reliable long-term operation.

3. Installation Guidelines

3.1 Choose a suitable mounting location

This assembly contains sensitive electronic components and must be installed in a protective enclosure using standard 35mm DIN Rail. Normally, the TT-24-A is located within the compressor/pump enclosure.

Keep in mind that the controller needs to be protected from environmental factors such as:

- Rain and water
- Dust and dirt
- Mist and humidity
- Potential physical impacts and debris

3.2 Mount the DIN Rail

The DIN Rail should be fastened to solid, flat surface using screws, bolts or rivets. The fastener type will depend on the mounting surface and installer preference. Fastener material should be Stainless Steel or Aluminum.

Regardless of fastener type, make sure of the following:

- The fastener head is large enough to span the DIN Rail's fastener slots
- Don't interfere with the DIN mounting brackets on the TT-24-A. See Figure 1.

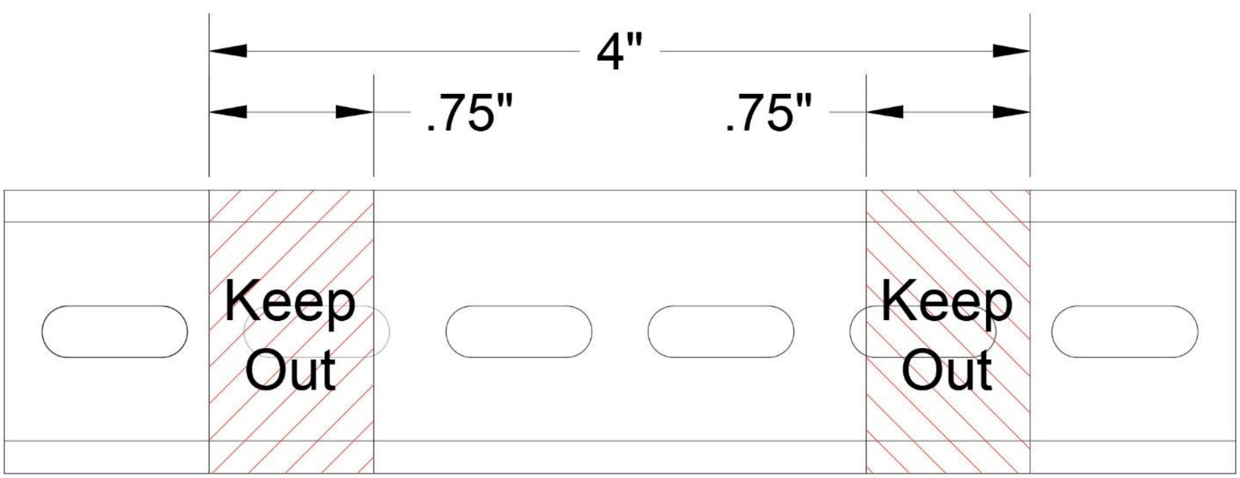


Figure 1

3.3 Mount the controller onto DIN Rail

- Engage the upper slot of the controller mounting base onto the upper rail of the DIN Rail as shown in Figure 2 below.
- Rotate the controller onto the DIN Rail until you feel the lower mounting slot “click” onto the lower rail of the DIN Rail.

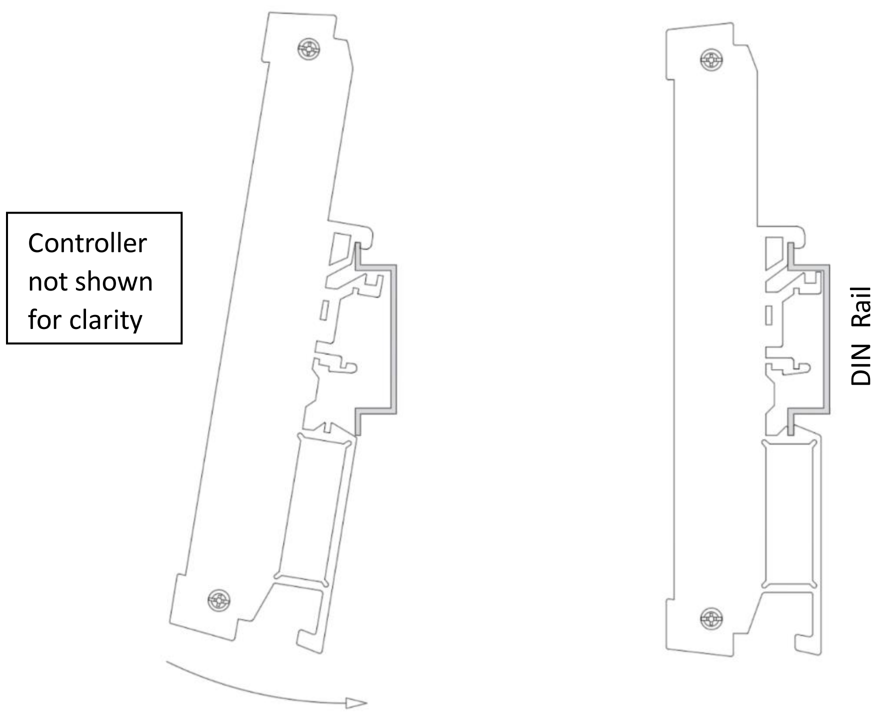


Figure 2

Tip:

When installing the controller onto the DIN Rail, hold onto the plastic outer frame. DO NOT push on the circuit board or any of the components. Damage could result!

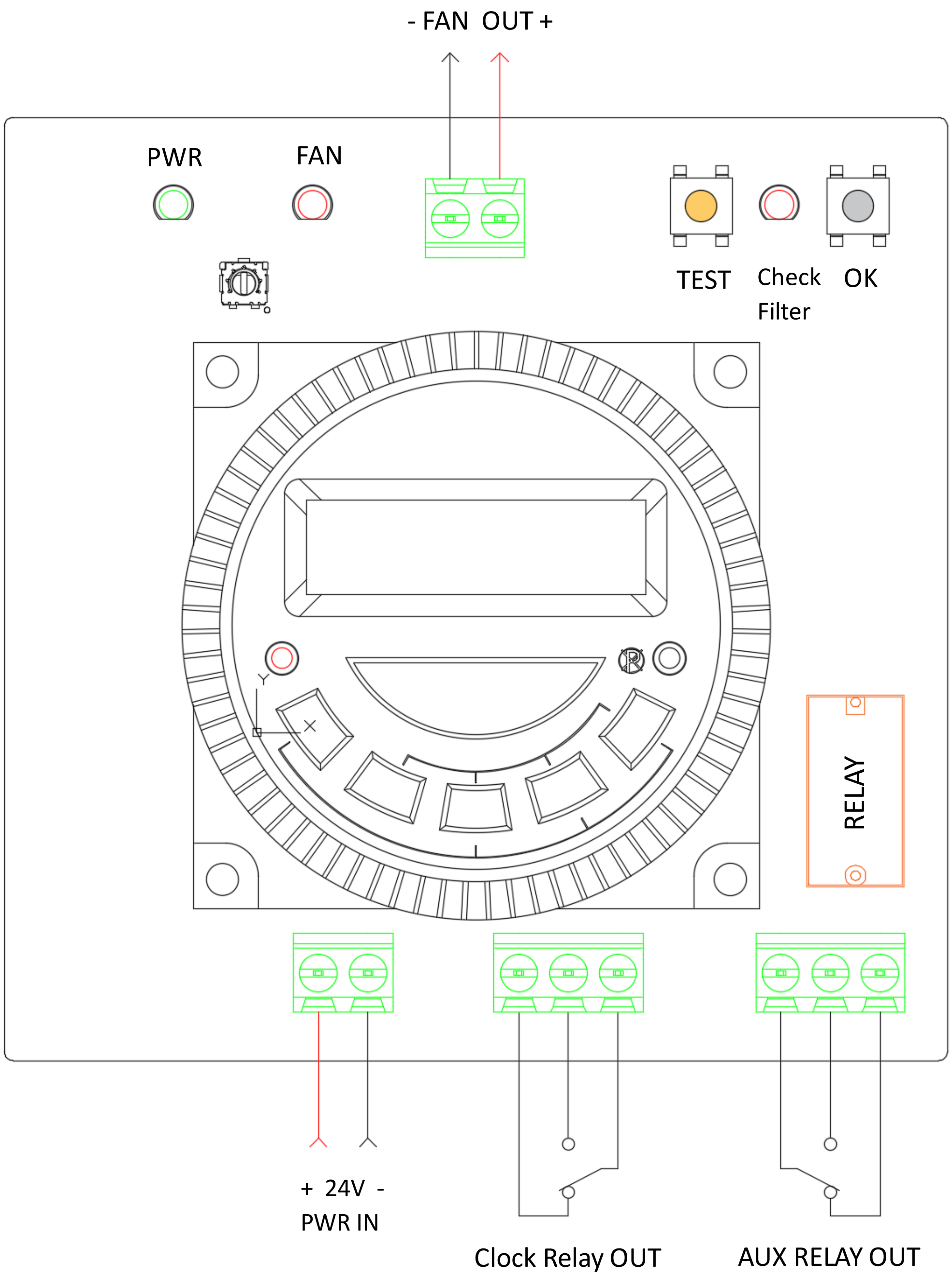
4. Terminal Functions, Buttons & LEDs

Power IN		
-24V	Negative terminal for power input.	
+24V	Positive terminal for power input.	
Time Clock Terminals		
COM	Common terminal for auxiliary relay.	
NO	Normally open contact for AUX Relay. Open when relay is OFF	
NC	Normally closed contact for AUX Relay. Closed to COM when relay is OFF	
AUX OUT (Relay)		
COM	Common terminal for auxiliary relay.	
NO	Normally open contact for AUX Relay. Open when relay is OFF	
NC	Normally closed contact for AUX Relay. Closed to COM when relay is OFF	
Fan Out		
-24V	Negative terminal for fan output.	**NEVER, EVER** APPLY VOLTAGE to these terminals! **24V OUT ONLY!**
+24V	Positive terminal for fan output.	
Buttons and LEDs		
FAN Push Button	Press to manually test fan operation. Momentary Operation.	
OK Push Button	Used to reset Timers and alarms such as the high-temperature alert.	
PWR LED	Indicates that the device is powered on and operational.	
FAN LED	Lights up when the fan is activated.	
Check Filter LED	Illuminates to indicate when it's time to check filters or screens	

Note: *For timer button functions and connections, refer to the 7-Day Timer section.*

- **Power Connections**: Ensure correct polarity when connecting the power supply to avoid damage.
- **Fan Operation**: The FAN Pushbutton can be used to manually engage the fan for testing purposes, and the FAN LED provides visual confirmation of fan operation.
- **Maintenance Indicators**: Pay attention to the Check Filter LED to perform timely maintenance.

5. Connections Overview



6. Wiring the Controller

Once you have become familiar with the terminal connections and their function, determine the best wiring scheme based on the requirements of your project. Several example schematics are shown in Section 12 at the end of this manual.

The wiring examples in this manual are by no means a complete list of all possible connection methods. Rather, it is a short list of common, possible uses of the controller. The diagrams are included as a possible starting point for your project.

If you have questions or need help determining the best wiring method for your project, contact US Solar Mounts for assistance.

Power Input

The TT-24-ADV is designed to operate using 24V DC Control Power Input. Ensure that proper voltage and polarity is observed. Reverse polarity or improper voltage could cause damage to the controller and/or connected devices.
DO NOT apply power to the controller until all connections have been made.

Time Clock Relay Out

The Clock Relay Output is an isolated relay output. It is not internally connected to anything else on the controller and allows the control of external devices based on time of day. The maximum load rating for these contacts is 125VAC / 60VDC 15-Amp MAX.

AUX Relay OUT

The AUX OUT Relay is a signal relay and is configured to activate if the sensed temperature reaches the High Limit SET VAL of 130°F. It can be used to trigger external signal devices or connected to other equipment. This is a FORM C, Dry-Contact Relay and is rated at 5A Max.

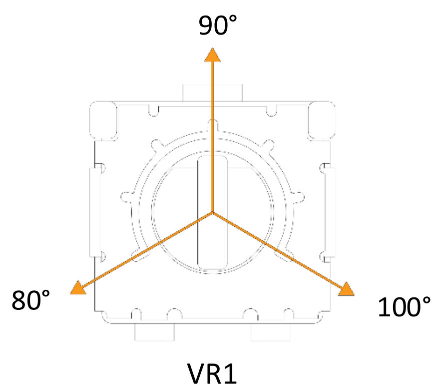
Fan OUT

The Fan Out is a 24VDC Output and is controlled by the Sensed Temp VAL Setpoint. It can also be connected to small control relays. Max Load on these connections is 1A.

7. Temperature Control and Adjustment

Factory Setpoint

- **Setpoint**: The system comes with a factory-set temperature threshold of 90°F and should not require adjustment. In some cases, a lower or higher Setpoint Value may be desired. The factory Setpoint Value can be carefully adjusted -/+ 10°F if needed. Full range is 80-100°F.
- **Adjustment**: Adjusting the Setpoint Value is done by adjusting VR1 in the upper left-hand corner of the board.
  - Disconnect power before adjusting.
  - CCW Rotation **<u>LOWERS</u>** the Setpoint.
  - CW Rotation **<u>RAISES</u>** the Setpoint.



Hysteresis

- **Purpose**: To prevent the fan from frequently cycling on and off, a hysteresis of 5°F is applied.
- **Operation**: Once the fan is activated, it will remain on until the temperature falls below the setpoint minus hysteresis. For example, if set at 90°F, the fan will turn off once the temperature drops to 85°F.
- The hysteresis of 5°F remains unchanged regardless of the Temperature Setpoint Value.

8. Filter Timer and Reset

- **Function**: Gives a visual indication that the intake filter/screen should be inspected. The timer is initiated upon first power-up and will increment the Day Count until Reset.
- Once a Day Count Value has been reached, the Check Filter LED will activate and will continue until the timer is manually RESET.
- **To Reset the Timer**: Press & HOLD OK button for 3 seconds to reset.

LED Patterns	
Timer Interval	**Flash Pattern**
30 Days	1 sec on, 2.5 sec off
45 Days	0.5 sec on, 0.5 sec off
60 Days	0.1 sec on, 0.1 sec off

9. High-Temperature Limit and Reset

- **Threshold**: Alert at temperatures =>130°F. This Value cannot be adjusted.
- **Indicators**: The Check Filter LED flashes rapidly once the High Limit Setpoint has been reached.
- The **AUX OUT Relay** will activate and **STAY ACTIVE** until the alarm is manually RESET.
- **Reset**: Press & HOLD the OK button for 5 seconds after cooling.

10. Auxiliary Relay Connections

The AUX relay can be used with a variety of external integrations:

- **Applications**:
  - External LED Beacon
  - Remote Wi-Fi Switch/Relay
  - Cellular Modem/Switch
  - External Device Control
  - Unit Shutdown

11. 7-Day Timer Configuration and Usage

Overview

The 7-day timer allows precise scheduling and control of your aeration system. While it shares the 24VDC power input with the main board, its relay connections are isolated. The Time Clock relay provides Normally Open (NO), Normally Closed (NC), and Common (COM) terminals for versatile control of external equipment.

Relay Connections

- **NO (Normally Open)**: Use this terminal to connect devices that should only activate when the timer is set to ON.
- **NC (Normally Closed)**: Use this terminal to connect devices that should deactivate when the timer is set to ON.
- **COM (Common)**: The shared terminal that serves as a reference for connecting external devices.

Using the 7-Day Timer

Follow the detailed instructions in this section to configure the timer settings, including time adjustments and event scheduling.

Button Functions

1. **TIMER**: Press to review or set/program events.
2. **MANUAL**: Select mode: AUTO, MANUAL, or OFF.
3. **CLOCK**: Adjust the current day and time.
4. **DAY**: Adjusts the day of the week.
5. **HOUR**: Adjusts the hour value (24-hour format).
6. **MIN**: Adjusts the minutes.
7. **RESET**: Resets all settings to factory defaults.
8. **LED**: Indicates the on/off status.

Setting the Current Time and Day

1. **Press and Hold the CLOCK BUTTON.**
    - **Set Day**: Use the DAY BUTTON.
    - **Set Hour**: Use the HOUR BUTTON.
    - **Set Minutes**: Use the MIN BUTTON.
2. **Release the CLOCK BUTTON.**

Programming On/Off Time Events

1. **Enter Programming Mode with the TIMER BUTTON.**
    - **Select Days**: Use the DAY BUTTON for the desired day combination.
    - **Set On Time**: Use the HOUR and MIN BUTTONS.
    - **Set Off Time**: Advance with the TIMER BUTTON and set days/hours/minutes.
2. **Maximum of 16 On/Off Setpoints Available.**
3. **Save Settings with the CLOCK BUTTON.**

Button Functions

1. TIMER	Press to **REVIEW** or **SET/PROGRAM EVENTS**
2. MANUAL	Press to select **MODE**: AUTO - MANUAL - OFF
3. CLOCK	Press to adjust the current **DAY** and **TIME**
4. DAY	Adjusts the **DAY** of the week value
5. HOUR	Adjusts the **HOURS** value
6. MIN	Adjusts the **MINUTES** value
7. Ⓡ	Resets all **Time Clock** settings to **Factory Default**
8. LED	Indicates the **ON/OFF STATUS** of the Time Clock

To set the CURRENT TIME AND DAY

1. **Press** and **hold** the **CLOCK BUTTON** and then:
2. Press the **DAY BUTTON** to set the current **DAY OF THE WEEK**
3. Press the **HOUR BUTTON** set the current **HOUR OF THE DAY**
4. Press the **MIN BUTTON** to set the current **MINUTES**
5. **Release** the **CLOCK BUTTON**

To PROGRAM ON/OFF TIME EVENTS

1. Press the **TIMER BUTTON** to enter PROGRAMMING MODE
    Mo Tu We Th Fr Sa Su — 1 ON --:--
2. Press the **DAY BUTTON** until the desired **DAYS** are shown at the top of the screen. There are 15 DAY combinations
    Mo Tu We Th Fr Sa Su — 1 ON 00:00
3. Press the **HOUR BUTTON** to set the desired **ON TIME** is shown. Time is displayed in 24-HR time
    Mo Tu We Th Fr Sa Su — 1 ON 14:00
4. Press the **MIN BUTTON** to set the desired **MINUTES** is shown. If operation is to occur on the hour, skip to Step 5.
    Mo Tu We Th Fr Sa Su — 1 ON 14:30
5. Press the **TIMER BUTTON** to advance to the **OFF TIME**
    Mo Tu We Th Fr Sa Su — 1 OFF 19:00
6. Set the **DAYS**, **HOURS** and **MINUTES** as Steps 2-4 above

    Repeat this procedure for all **ON/OFF** setpoints. There are a total of **16 ON/OFF Setpoints** available for programming.
7. Press the **CLOCK BUTTON** accept the settings and execute the programmed setpoints.

The example shown will turn the load **ON** at 2pm and then **OFF** at 7pm, 7 Days per week.

NOTE: If an **ON TIME** is set, a corresponding **OFF TIME must be set**. Time Clocks must be set individually and are not syncronized.

DAY COMBINATIONS

1.	Mo	Tu	We	Th	Fr	Sa	Su
2.	Mo						
3.		Tu					
4.			We				
5.				Th			
6.					Fr		
7.						Sa	
8.							Su
9.	Mo	Tu	We	Th	Fr		
10						Sa	Su
11	Mo	Tu	We	Th	Fr	Sa	
12	Mo	Tu	We				
13				Th	Fr	Sa	
14	Mo		We		Fr		
15		Tu		Th		Sa	

NOTE

These Time Clocks do not automatically adjust for Daylight Savings Time.

***Note**: To ensure proper functionality, synchronize each ON time with a corresponding OFF time. This timer does not adjust for daylight savings time.*

12. Example Wiring

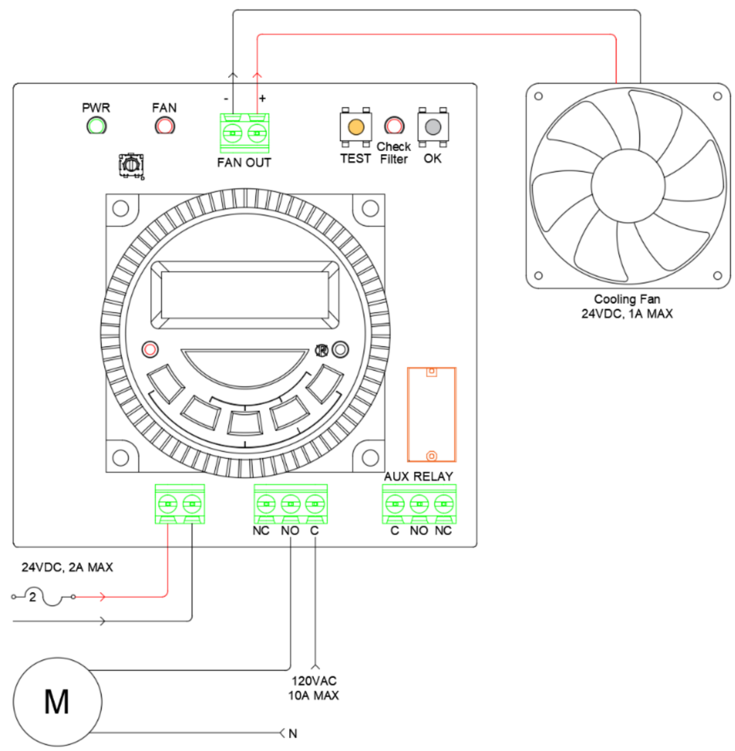
Example 1

- 24VDC Control PWR IN
- 24VDC Cooling Fan OUT
- Time Clock Control of a 120VAC Motor

Operation:

This is the most common use of the controller. The time clock controls the ON/OFF cycles for a motor or compressor. The cooling fan is cycled ON/OFF as needed based on sensed enclosure Temp VAL.

Note: The <u>AUX RELAY</u> can still be used for controlling external devices.

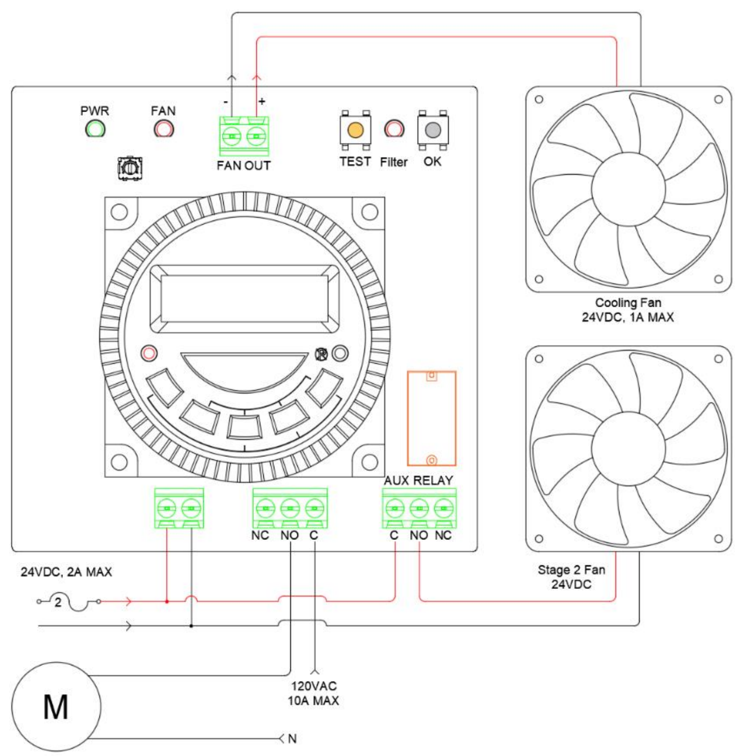


Example 2

- 24VDC Control PWR IN
- Stage 1 Fan – 24VDC Fan
- Stage 2 Fan – 24VDC Fan
- Time Clock Control of a 120VAC Motor

Operation:

The functions are the same as Example 1, with the addition of a Backup cooling fan. The Stage 1 Fan operates normally based on the sensed Temp VAL and the Stage 2 fan will turn on when the sensed Temp VAL reaches the High Limit Value 130°F.

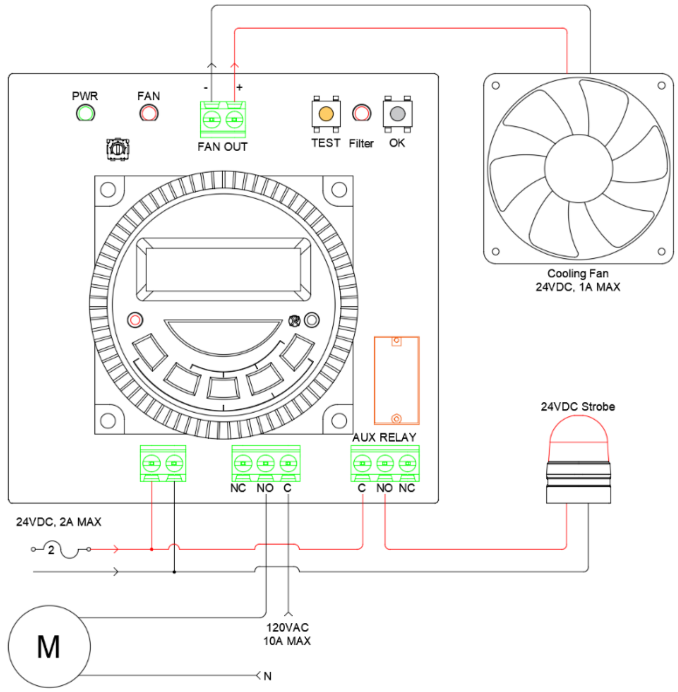


Example 3

- 24VDC Control PWR IN
- 24VDC Cooling Fan OUT
- 24VDC LED Strobe OUT
- Time Clock Control of a 120VAC Motor

Operation:

Same as Example 2, but with an LED Beacon in place of a cooling fan. The Fan operates normally based on the sensed Temp VAL and the LED Beacon will activate when the sensed Temp VAL reaches the High Limit Value 130°F.



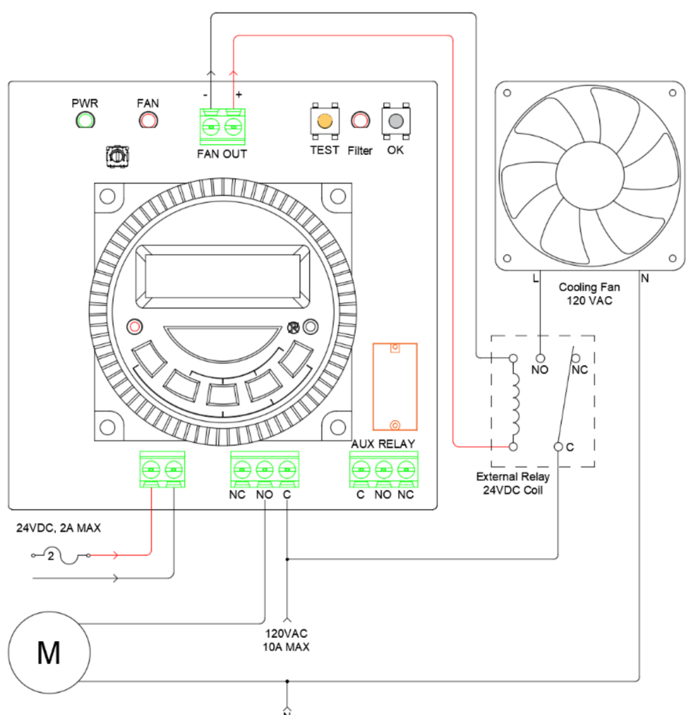
Example 4

- 24VDC Control PWR IN
- 120VAC Cooling Fan
- Time Clock Control of a 120VAC Motor

Operation:

Same primary functions but uses the 24VDC Fan OUT to control a 120VAC cooling fan via an external control relay.

Note: The <u>AUX RELAY</u> can still be used for controlling external devices.



Example 5

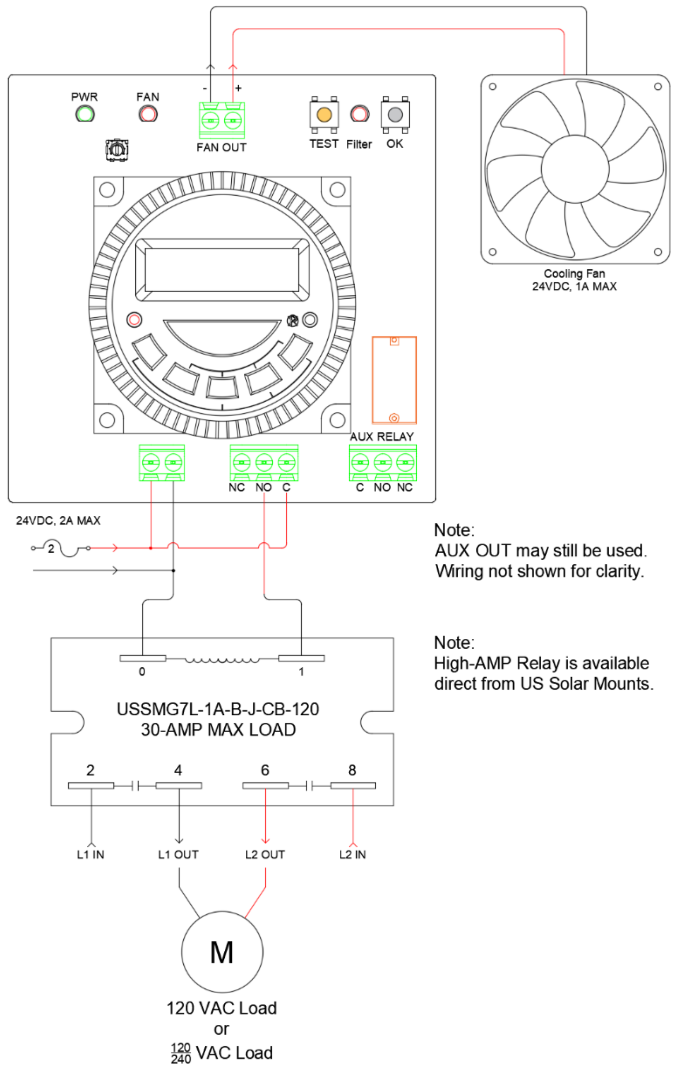
- 24VDC Control PWR IN
- 24VDC Cooling Fan OUT
- Time Clock Control of a 120VAC or 240VAC Motor

Operation:

This arrangement maintains all main functions but allows the Time Clock to control 120V or 240V loads of up to 30 Amps using an external 24-volt control relay. This same wiring arrangement can be used to control a 3-phase Motor Starter (24VDC Coil) for larger systems.

Note: The AUX RELAY can still be used for controlling external devices.

Note: Make sure that the 30-Amp relay is adequate for motor inrush current.



Example 6

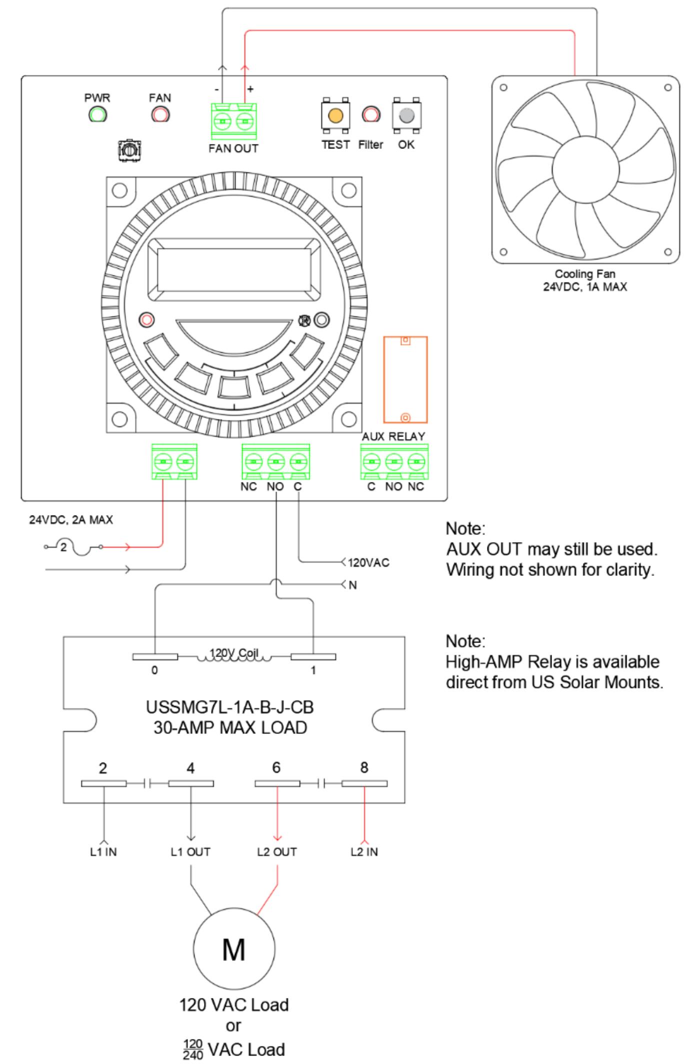
- 24VDC Control PWR IN
- 24VDC Cooling Fan OUT
- Time Clock Control of a 120VAC or 240VAC Motor

Operation:

This arrangement maintains all main functions but allows the Time Clock to control 120V or 240V loads of up to 30 Amps using an external 120-volt control relay. This same wiring arrangement can be used to control a 3-phase Motor Starter (120VAC Coil) for larger systems.

Note: The AUX RELAY can still be used for controlling external devices.

Note: Make sure that the 30-Amp relay is adequate for motor inrush current.



13. Technical Support

For further assistance, troubleshooting, or technical inquiries, please contact US Solar Mounts through the provided support channels.

US Solar Mounts can provide design assistance or full system design as a paid service.