MARATHON
POWER

TRACK SERIES

Battery Backup System for Traffic Signals

Electrical / Mechanical Drawings Volume 2
For Model:
TRTC-2004-N1

TABLE OF CONTENTS

❖ Before You Start: Safety

If the installation is at an active intersection, have law enforcement begin directing traffic before the power to signals is turned off.

There are many different ways that the Utility AC can be wired into the traffic signal cabinet. The intent of this manual is only to explain proper connection of utility AC at the UPS end of the cable.

How the Utility AC is routed from the service entrance or through the traffic signal cabinet (hereafter referred to as the "power source") to the UPS, should be determined by a licensed electrician in accordance with local electrical codes.

The suggested method of wiring Utility AC to the UPS from the traffic signal cabinet is to connect the UPS at the traffic cabinet after the main cabinet breaker and surge suppressor so that the UPS is also protected by the cabinet surge suppressor.

If this is a new traffic signal installation with Utility AC power going directly to UPS, make sure the upstream circuit breaker feeding the Utility Power is OFF before beginning.

❖ Battery Warnings

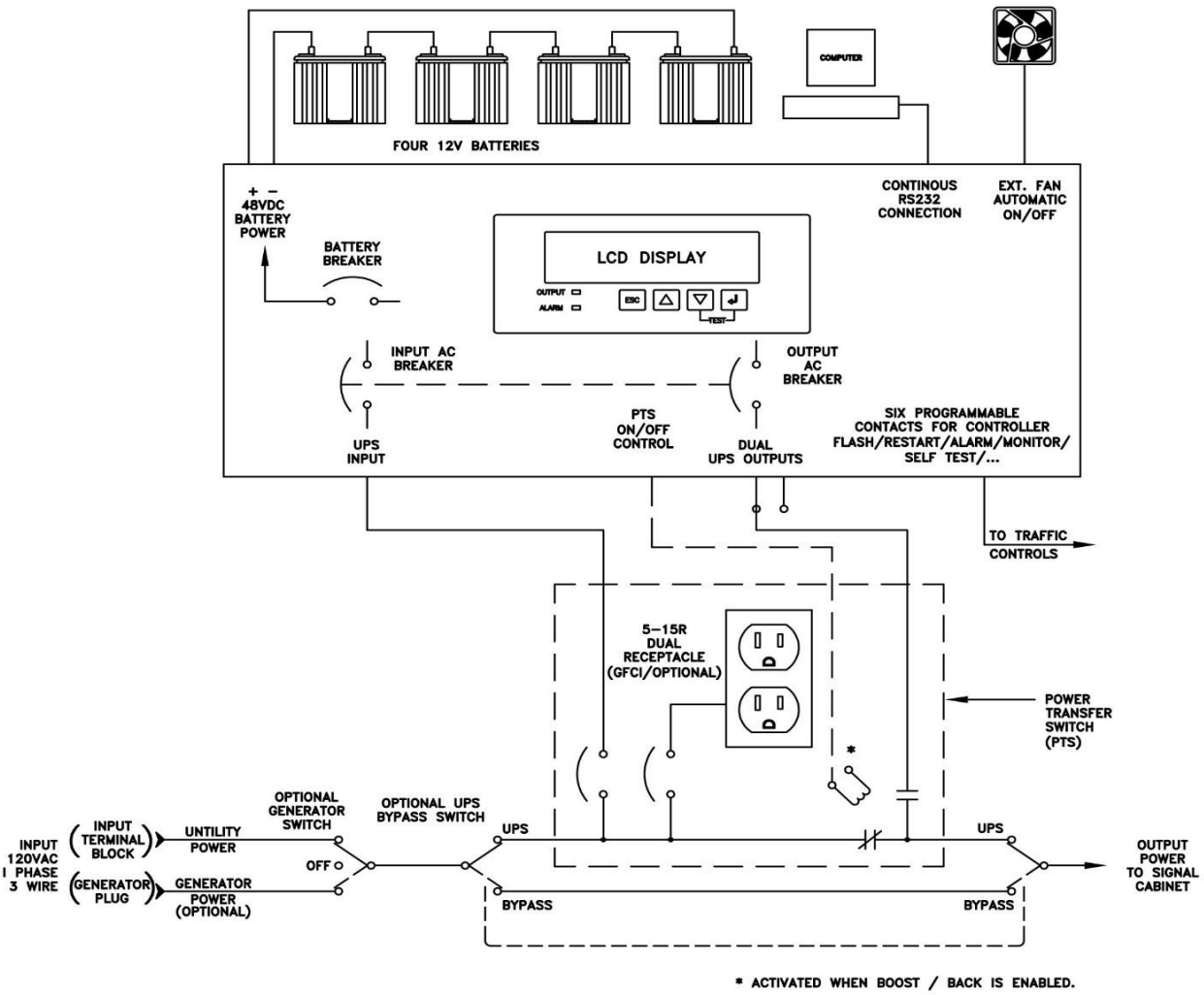
DANGER!

- High & ***dangerous voltages*** are present inside the system. Only qualified personnel should perform installation and maintenance.
- Live battery wires ***must not*** touch the TRTC-2004-N1 chassis or any other metal objects. ***This can cause a fire or explosion.***
- **Inspect** the batteries once a year for signs of cracks, leaks, or swelling. Replace as needed.
- When batteries are in storage, **charge** them at least once every three months for optimum performance and to extend their lifetime.
- **Always** replace batteries with the ones of identical type and rating. **Never** install old or untested batteries. **Never** mix old with new batteries. **Never** mix the different amp hour rated batteries within one system.
- Use **insulated tools** during servicing.
- **Remove** all rings, watches, jewelry, or other conductive items before working inside the enclosure.
- **Follow** local regulations for the disposal of batteries. Recycling is the best method.
- ***Never*** burn batteries to dispose of them. ***They may explode.***
- Do not open the batteries. ***The contents are toxic.***

Section 1: System Description

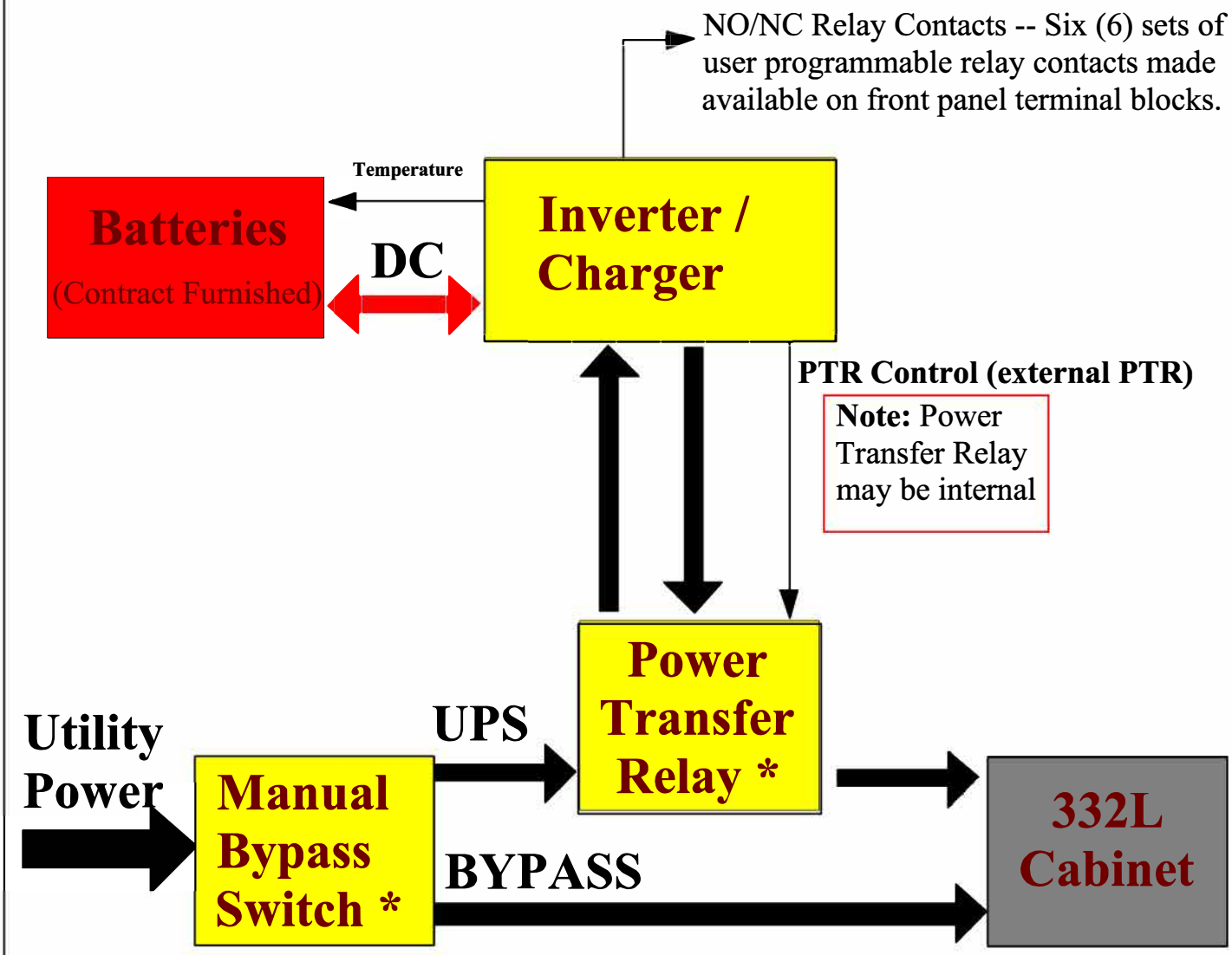
Purpose: *Describes the operation of the TRTC-2004-N1 System.*

The TRTC-2004-N1 System provides backup power to traffic control signal equipment. It consists of the Uninterruptible Power Supply (UPS) System, the Power Transfer Switch (PTS), and batteries that provide back-up power when the line is unqualified. These three components can be mounted inside an enclosure to provide protection from most weather conditions.



Simplified TRTC-2004-N1 System Block Diagram

Battery Back Up System (BBS)
Block Diagram



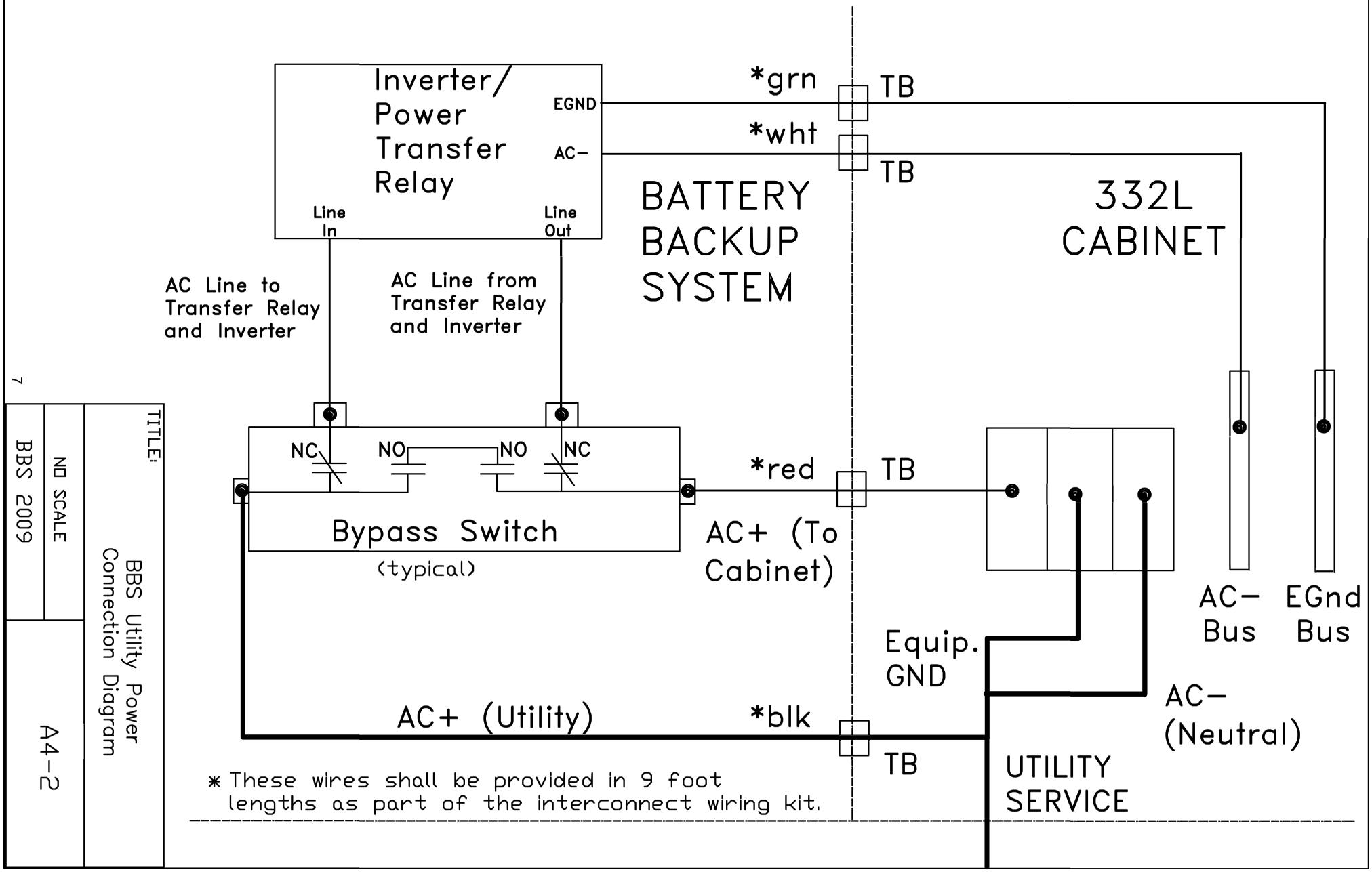
* Manual Bypass Switch (must be external to Inverter), and Power Transfer Relay must be separate functional units, but may share a common enclosure.

AC VOLTAGE

DC VOLTAGE

TITLE: BBS SYSTEM BLOCK DIAGRAM	
NO SCALE	A4-1
BBS 2009	

BBS Utility Power Connection Diagram



7

BBS 2009	NO SCALE	TITLE: BBS Utility Power Connection Diagram
A4-2		

Section 2: Connecting to Utility Power

❖ Recommended Wiring

Consult a licensed electrician in accordance with local electrical codes.

1. AC Input Cords
   a. UL Style 1015 CSA TEW 6 or 10 AWG
   b. 105 stands of 30 AWG tinned copper
   c. Rating 600V, 105°C, PVC Insulation

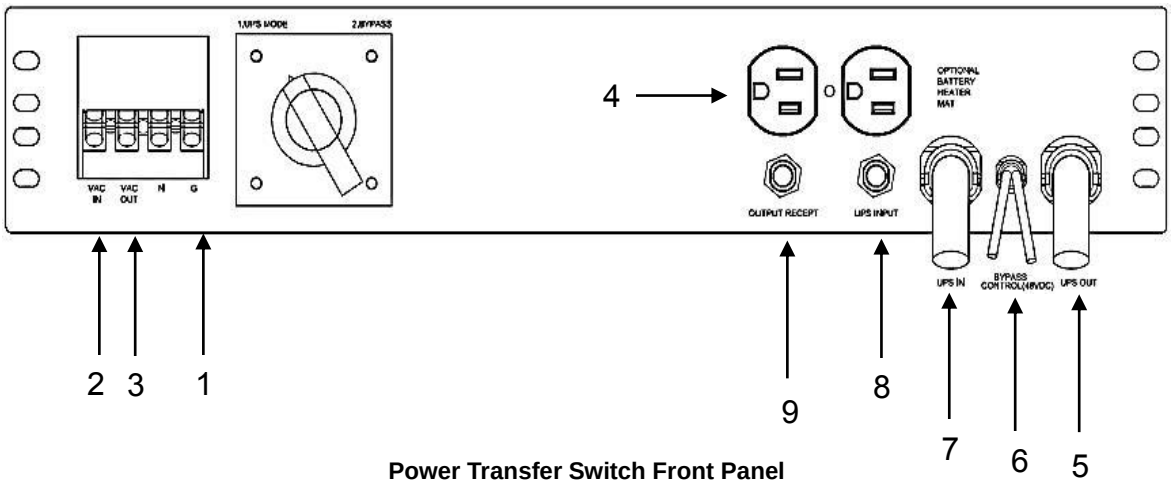
2. Power Interconnects between BBS components and 332A terminal blocks and busses.
   a. UL Style 1015 CSA TEW 10 AWG
   b. 105 stands of 30 AWG tinned copper
   c. Rating 600V, 105°C, PVC Insulation

3. Relay connections
   a. Insulated UL Style CSA TEW 18 AWG
   b. 16 stands of 30 AWG tinned copper
   c. Rating 600V, 105°C, PVC Insulation

4. DC Battery Connectors
   a. Two-Part Modular Harness UL Style 1015 CSA TEW or Welding Style Cable or equivalent, 6 AWG Stranded and 10 AWG Stranded

❖ Power Transfer Switch Connections

The Power Transfer Switch (PTS) shown below allows the UPS to be removed for service, replacement or maintenance without interrupting power to the traffic cabinet.



Power Transfer Switch Front Panel

1. The wires from the neutral and ground bus of the traffic cabinet are connected to this terminal block.
2. The Input line power is connected to the terminal block marked with “AC INPUT”.
3. The Output line power is connected to the terminal block marked with “AC OUTPUT”.
4. An optional surge suppressor, external PC, optional battery heater or a vacuum cleaner for maintenance may be plugged into these receptacles.
5. This “UPS OUT” cord is connected to the OUTPUT AC terminal block on the TRTC-2004-N1.
6. The Black and Red PTS control wires are connected to the PTS connector on the TRTC-2004-N1.
7. This “UPS IN” cord is connected to AC INPUT terminal blocks on the TRTC-2004-N1.
8. This circuit breaker provides input power protection for the TRTC-2004-N1.
9. The dual receptacles are protected by this circuit breaker.

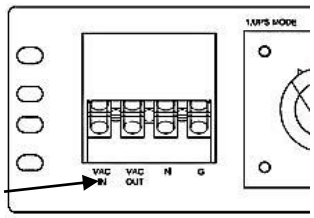
❖ Connecting the Utility Line Input Power

DANGER!

If the installation is at an active intersection, have law enforcement begin directing traffic before the power to signals is turned off.

Make sure the upstream circuit breaker for the power source is OFF before performing this step. Make sure both the BATTERY CIRCUIT BREAKER on the unit is also off.

Make sure the upstream circuit breaker feeding the utility power is OFF before beginning this step. Leave the NEUTRAL and GROUND wires connected from utility to signal cabinet. Extend the NEUTRAL and GROUND wires from their corresponding bus bars in the traffic cabinet to the terminal block on the PTS.

Connect the input HOT black wire from utility to “VAC IN” on PTS. Run wires from neutral and ground bus bars of traffic cabinet to PTS neutral & ground terminal blocks.


❖ Connecting the Output or Signal Cabinet

DANGER!

If the installation is at an active intersection, have law enforcement begin directing traffic before the power to signals is turned off.

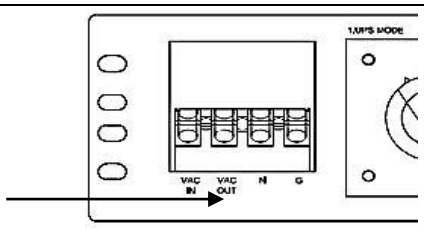
If this is a new traffic signal installation with Utility AC power going directly to UPS, make sure the upstream circuit breaker feeding the Utility Power is OFF before beginning this step. If this is addition of a UPS to an existing traffic signal cabinet, DO NOT terminate the power cable from the signal cabinet to the UPS at the signal cabinet end until the final step after all other connections have been completed. This will minimize the length of time the traffic signals must be off for final power connection.

There are many different ways that the Utility AC can be wired into the traffic signal cabinet. The intent of this manual is only to explain proper connection of utility AC at the UPS end of the cable. How the Utility AC is routed from the service entrance or through the traffic signal cabinet (hereafter referred to as the "power source") to the UPS shall be determined by a licensed electrician in accordance with local electrical codes.

TIP:

The suggested method of wiring Utility AC to the UPS from the traffic signal cabinet is to connect the UPS at the traffic cabinet after the main cabinet breaker and surge suppressor so that the UPS is also protected by the cabinet surge suppressor.

1. Connect a black wire from the VAC Out at the PTS to the Input Hot terminal in the signal cabinet.
2. The wires from Ground and Neutral Bus Bars from the traffic cabinet are extended to PTS Terminal Block.
3. OPEN the upstream breaker feeding utility power to the signal cabinet.
4. Disconnect the HOT wire (Black) connected between utility and traffic cabinet.
5. The cabinet side HOT wire is connected to "AC OUT" on the PTS.
6. The utility side HOT wire is connected to "VAC IN" on the PTS.
7. Torque the PTS terminal block to a maximum of 10.0 lb-in (1.1 Mm).



Section 3: TRTC-2004-N1 Installation

DANGER!

If this is a new traffic signal installation with Utility AC power going directly to UPS, make sure the upstream circuit breaker feeding the Utility Power is OFF before beginning this step. If this is addition of a UPS to an existing traffic signal cabinet, DO NOT terminate the power cable from the signal cabinet to the UPS at the signal cabinet end until the final step after all other connections have been completed. This will minimize the length of time the traffic signals must be off for final power connection.

There are many different ways that the Utility AC can be wired into the traffic signal cabinet. The intent of this manual is only to explain proper connection of utility AC at the UPS end of the cable. How the Utility AC is routed from the service entrance or through the traffic signal cabinet (hereafter referred to as the "power source") to the UPS shall be determined by a licensed electrician in accordance with local electrical codes.

TIP:

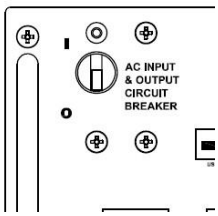
The suggested method of wiring Utility AC to the UPS from the traffic signal cabinet is to connect the UPS at the traffic cabinet after the main cabinet breaker and surge suppressor so that the UPS is also protected by the cabinet surge suppressor.

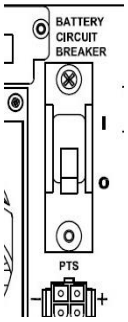
❖ Mounting

Purpose: *Describes how to mount the TRTC-2004-N1 System into an enclosure.*

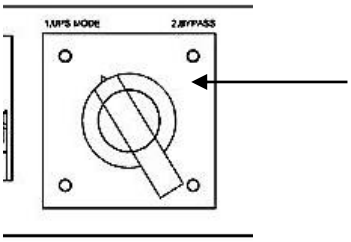
The TRTC-2004-N1 components can be mounted inside an existing NEMA or 332 or various other traffic cabinets. They can be shelf mounted in a NEMA or equivalent cabinet. The TRTC-2004-N1 can be bolted into an industry standard 19" rack using the optional ears or brackets, or it can be shelf mounted in a NEMA type enclosure.

Verify the **UPSTREAM CIRCUIT BREAKER** is off.
Verify the **AC INOUT & OUTPUT CIRCUIT BREAKER** is off.
Verify the **BATTERY CIRCUIT BREAKER** is off.

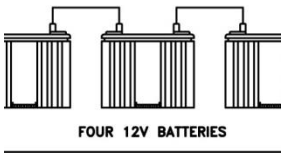




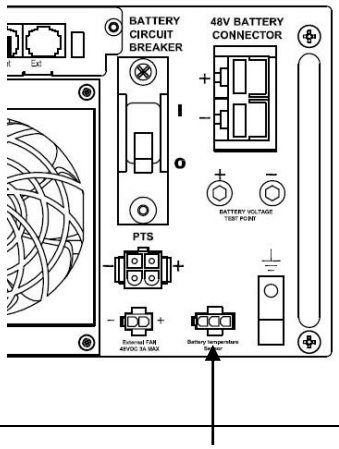
Verify the **UPS MODE / BYPASS** switch is in **BYPASS**.



Attach optional **Battery Temperature Sensor** to the middle battery. Plug the connector on the other end into the TRTC-2004-N1.

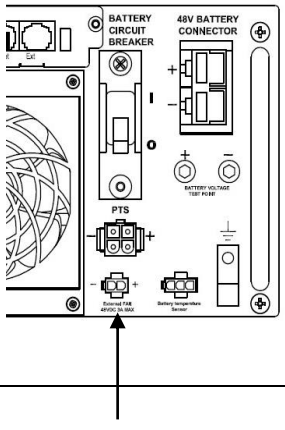


Wrap a tie around the strain relief loop and the battery temperature sensor to prevent the connector from disconnecting during an earthquake or other severe vibrations.

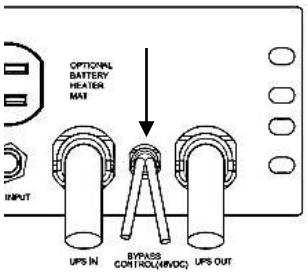


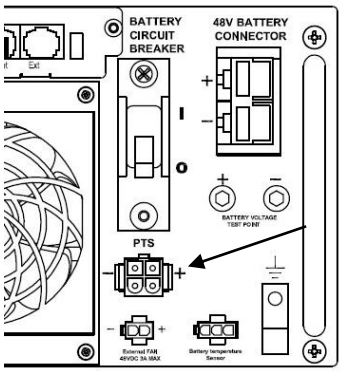
Attach **External Cabinet Fan** into the respective connector on the TRTC-2004-N1.

Wrap a tie around the strain relief loop and the fan to prevent the connector from disconnecting during an earthquake or other severe vibrations.

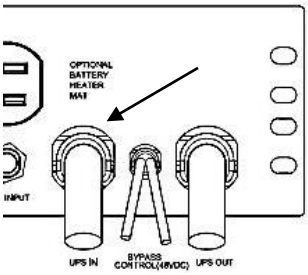


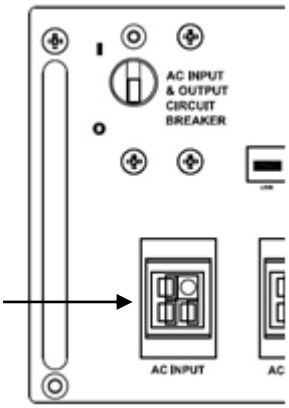
Connect the **BYPASS CONTROL wires** to the **PTS** connector into the TRTC-2004-N1.



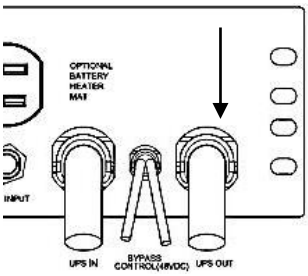


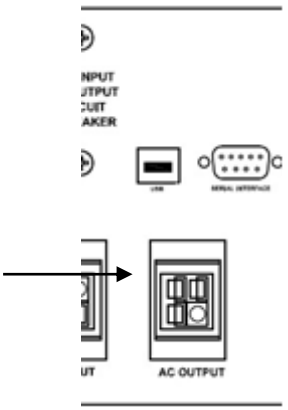
Connect the PTS **UPS IN** to the UPS **AC INPUT**.



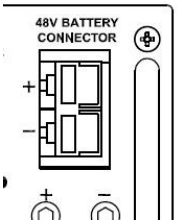


Attach PTS **UPS OUT** to the UPS **AC OUTPUT.**

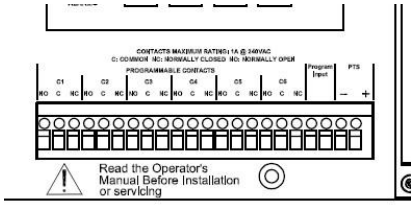




Connect the cable from the batteries to the **48V BATTERY CONNECTOR** into the TRTC-2004-N1.

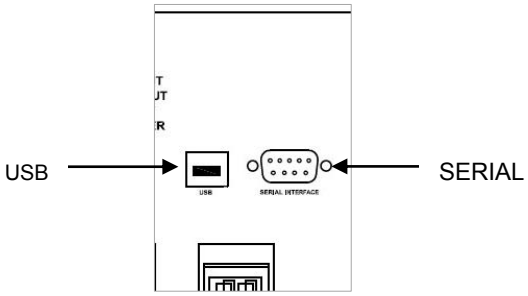


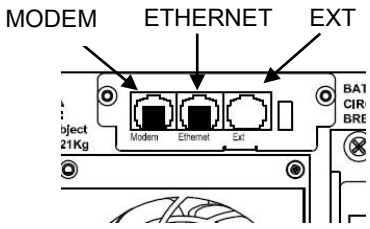
Each of the six contacts are of form C type, meaning Normally Open (NO), common (C) and Normally Closed (NC) dry contact rated for 1A @ 240VAC. Each of these contacts can be individually programmed to energize and stay latched for ON BATTERY, LOW BATTERY, TIMER, ALARM, FAULT and many other conditions as described in subsequent chapters. The ON BATTERY contact(s) are activated as soon as the unit is transferred to Battery mode. LOW BATTERY contact(s) are activated only in the Battery mode, as soon as the discharged battery reaches the lower value battery capacity as set by user and remains latched as long as the system remains in Battery mode.
The TIMER contact(s) are activated only in the Battery mode after the user-programmed time is attained, that can be set in 15 minute intervals from 15 minutes to 8 hours.



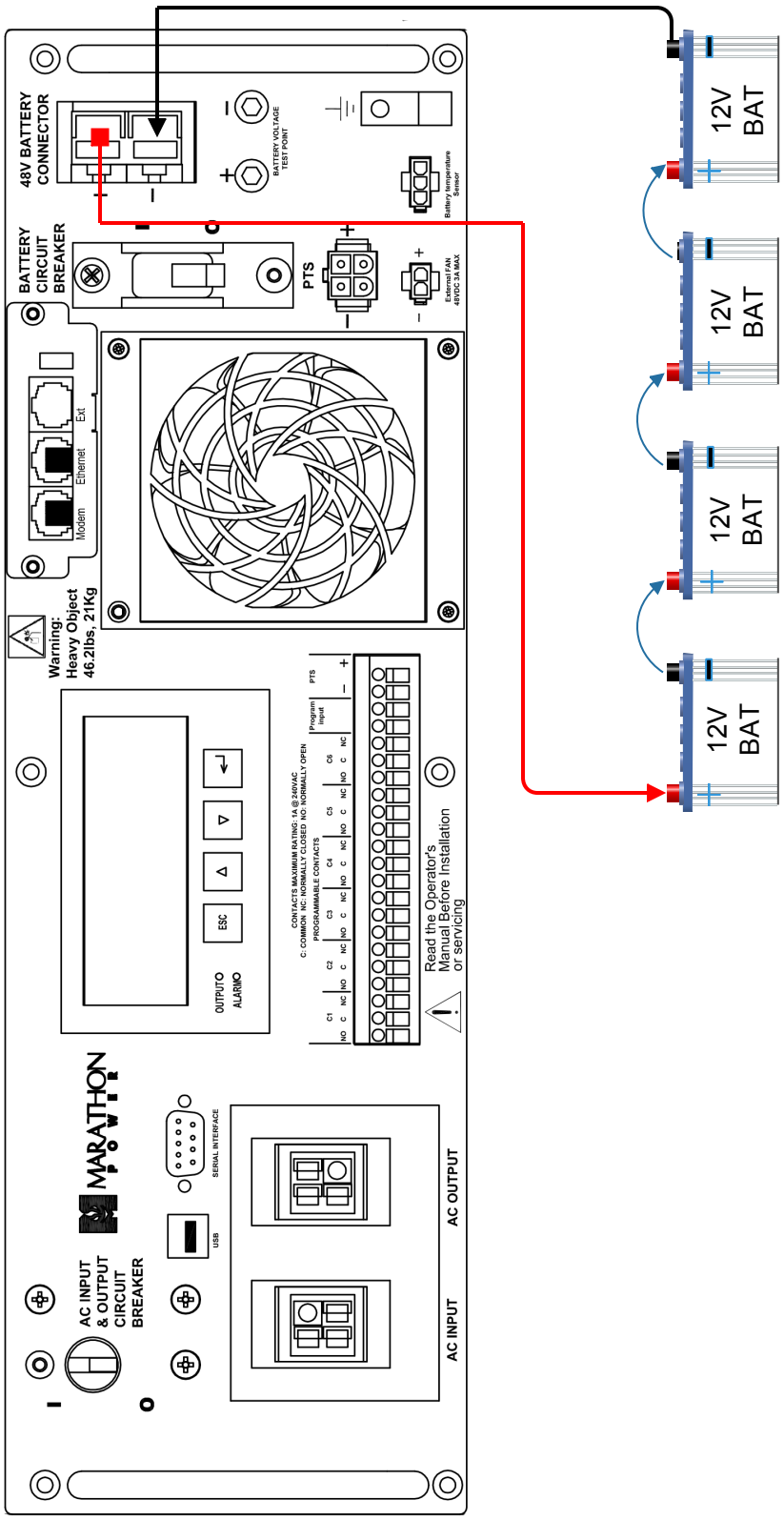
Torque status/self-test terminal block to a maximum of 4.4 lb.-in (0.5Nm).
Maximum wire size 14 AWG.

Connect the **COMMUNICATION CABLES** where appropriate.



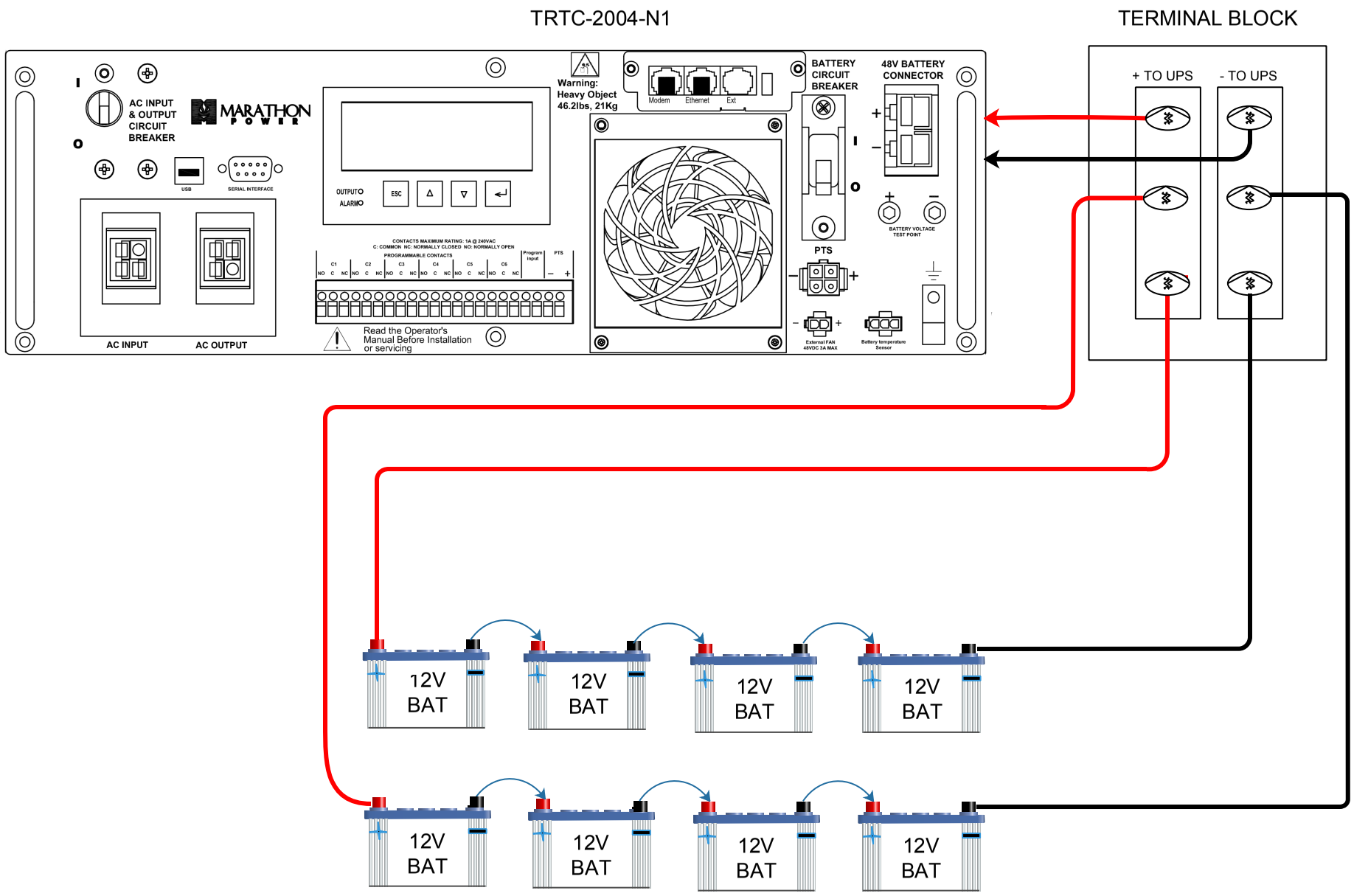


Section 4: Battery Wiring Diagrams



Simplified Battery Wiring Diagram - Batteries in Series

A Battery Harness (P/N: TBHK-0009-48) for connecting the TRTC-2004-N1 to the batteries is available

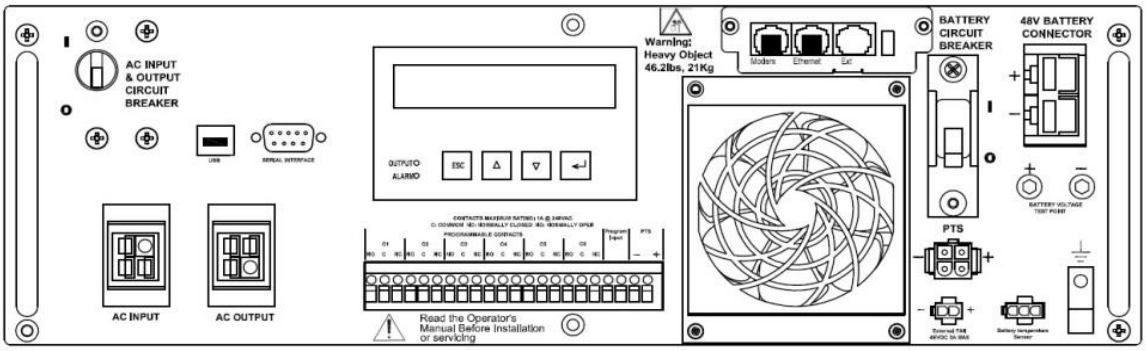


Simplified Battery Wiring Diagram - Batteries in Parallel

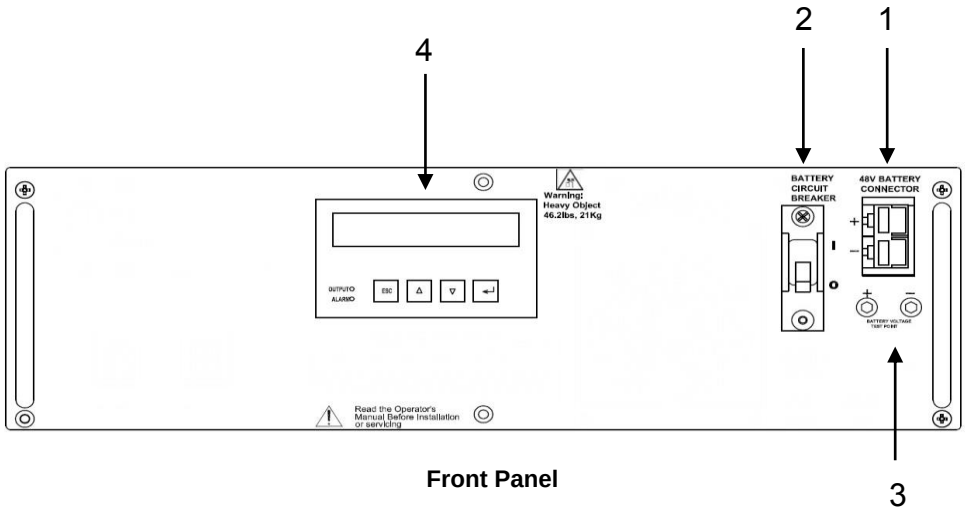
Section 5: TRTC-2004-N1 Details

❖ Front Panel

Purpose: *Describes the display, connections and switches on the TRTC-2004-N1 front panel.*



Front Panel



Front Panel

1. **48VDC Battery Connector**
   Connects the battery to the unit. The battery string voltage is 48VDC.

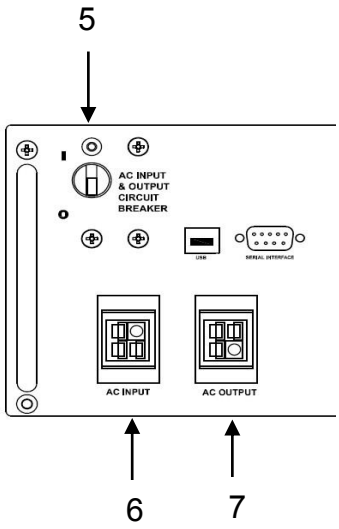
2. **Battery Circuit Breaker**
   Acts as an ON/OFF switch for battery power. Must be in the **ON** position for normal operation.

3. **Battery Voltage Test Points**
   Battery voltage can be measured at these Test Jacks only when the battery circuit breaker is turned **ON**.

NOTE:

TEST JACKS ARE NOT DC POWER OUTLET TERMINALS.

4. **Liquid Crystal Display (LCD) Control Panel**
   The UPS can be controlled and monitored via this LCD panel. See Section 5 for further information.

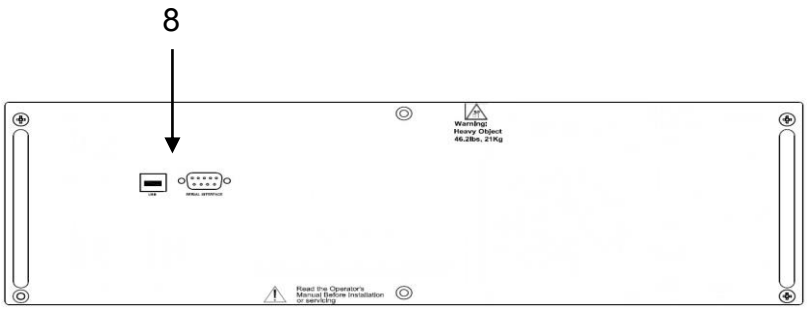


Front Panel

5. **AC Input & Output Circuit Breaker**
   Acts as a line and output power ON/OFF switch to facilitate the unit's maintenance or replacement. Must be in the ***ON*** position for normal operation.

6. **AC Input**
   Inlet Anderson PP45/4P provided for the input of line power.

7. **AC Output**
   Outlet Anderson PP45/4P provides the connection for the output of line power.

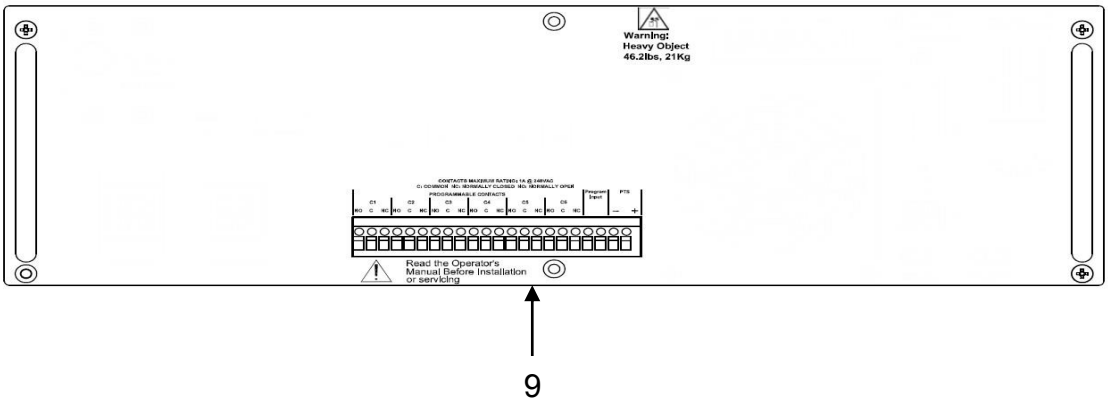


Front Panel

8. **USB / Serial Interface / RS232 Connector**
   The USB and /or DB-9 female connector is used to connect the TRTC-2004-N1 to the host computer for remote control, monitoring and calibration via RS232 commands.

For the USB or DB-9 female RS232 connections use computer industry standard computer cable between the computer's USB or RS232 port and the TRTC-2004-N1 unit's USB or RS232 ports.

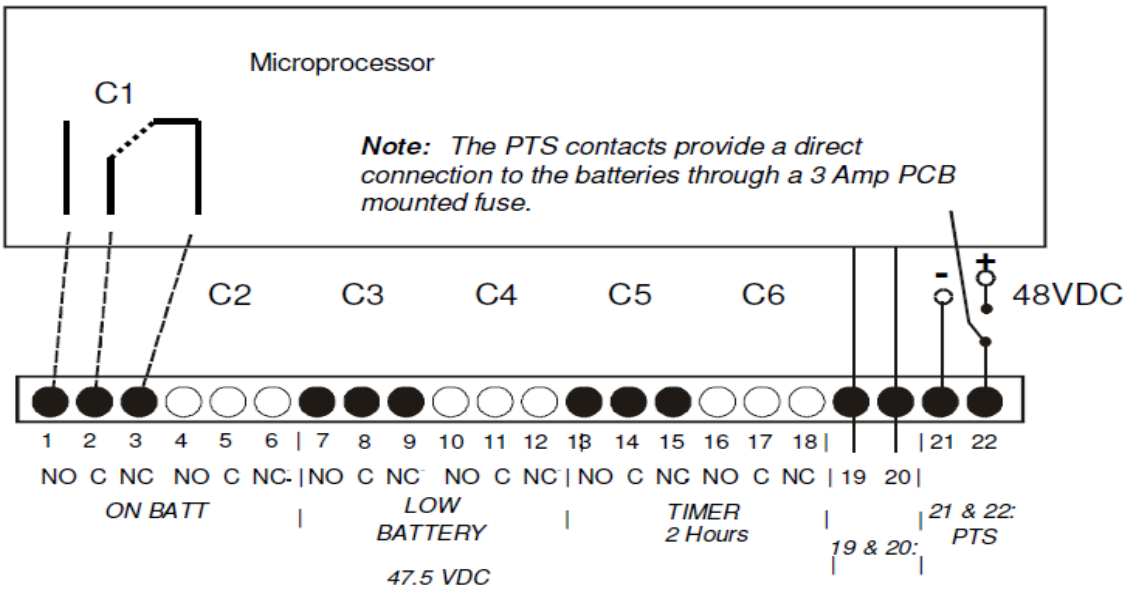
See Section 4 for more details about connection and use.



Front Panel

9. **Green Control Terminal Block**

This 22 position terminal block provides communication with the intersection controller, controls the Power Transfer Switch (PTS) and Programmable Input contact. Figure below shows its layout and operation.



Green Terminal Block

NOTE:

This terminal block is opto-isolated and shares a common ground with the serial interface. Each of the six programmable contacts can be programmed for one or more functions such as: *The Timer*, *Low Battery* and *On Batt.* The relay contacts are Form C type, i.e. each of the six programmable contacts has Common (C);

Normally Closed (NC) and Normally Open (NO) contact position.

- **On Batt**: This relay energizes when Utility Input line power is unqualified.

- **IMPORTANT:** When the AC input and output circuit breaker is turned OFF, an auxiliary switch of the circuit breaker opens which disables the On Batt. contact at the Green Control Terminal Block. This prevents the intersection lights from flashing.

- **Low Battery:** These relays energize when the battery drops below the programmed battery capacity. The default value is 47.5VDC or 40% battery capacity.

TIP:

You can change the preprogrammed value to match the batteries used and the actual operating conditions. See Section 9.7 Battery Maintenance.

- **Timer:** These relays energize after the unit has been in Battery mode for the programmed time period. The factory default value is 2 hours. The time can be programmed to be from 15 min. to 8 hours in 15 minute increments.

- **Program Input**: The programmable input contact can be programmed for one function such as: Self-test, EXT Alarm, EXT Battery Alarm, EXT Fan Failure, Door Interlock. Jumper the TB 19 & 20 on the Green Control Terminal Block and the program alarm will show on LCD display.

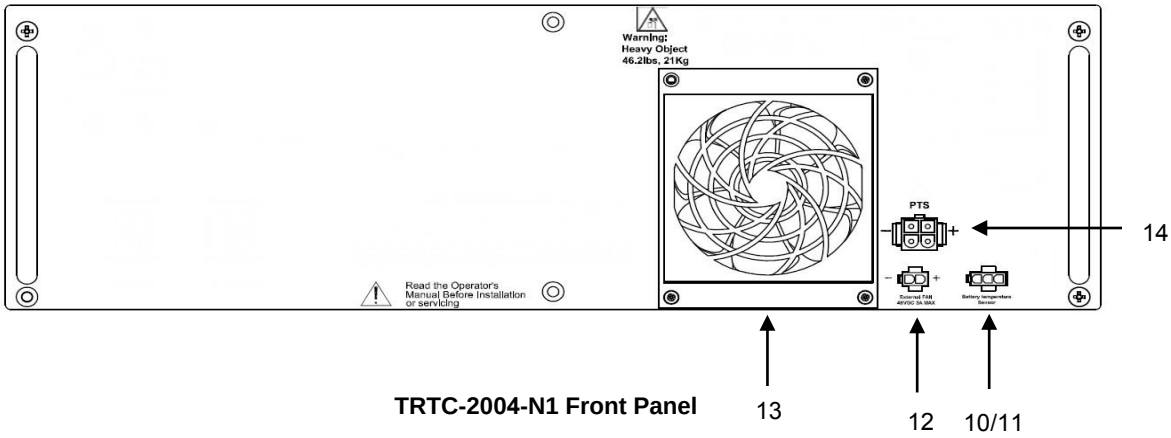
- **PTS:** TRTC-2004-N1 sends a 48VDC signal from the batteries to the PTS, which activates the PTS, resulting in transfer from Input power to BBS power. See Section 1.3, Wiring, of this manual for connection instructions.

NOTE:

These contacts have a maximum rating of 1 Amp at 120V. Only the first On Batt contact is illustrated. The remaining 5 contacts for Low Battery, Timer, etc. are similar.

NOTE:

1) 6 sets of programmable contacts have the following factory default settings:
C1, C2 = "On Batt"
C3, C4 = "Low Batt @ 47.5VDC"
C5, C6 = "Timer @2.00 Hours"
2) User may program each of the six contacts for one or more functions.



TRTC-2004-N1 Front Panel

10. Battery Temperature Sensor Strain Relief

This secures the Battery Temperature Sensor cord to the panel and prevents connector disconnection during an earthquake or other severe vibrations.

First plug the sensor cable into the connector. Then use one of the ties provided in the mounting kit to attach the sensor cord to the strain relief loop. Ensure that the cable is secure.

11. Battery Temp Sensor

It attaches the battery temperature probe to the unit for monitoring battery temperature. The charging voltage is temperature dependent. The microprocessor of the smart charger adjusts the voltage for optimum charging.

The temperature probe connector **must** be plugged in for normal operation. The sensor end should be firmly attached to the terminal of the battery.

NOTE:

If the TRTC-2004-N1 is not charging the batteries check the temperature probe. To test the temperature probe unplug it from the face of the UPS. Check the resistance of the temperature probe by inserting the probes of an ohm meter into the top and bottom pins of the connector. The meter should read approximately 12,000 Ohms at 25°C (77 °F). If resistance is not in this range, replace temperature probe.

12. Ext Fan 48VDC

Provides DC Power (48VDC, 1 Amp (Max)), which could be used to power an optional 48VDC fan, mounted inside the enclosure for regulation of the interior temperature.

13. Internal Fan

This microprocessor-controlled fan regulates the unit's internal temperature. It must not be blocked. The filter in front of the fan is removable for cleaning.

NOTE:

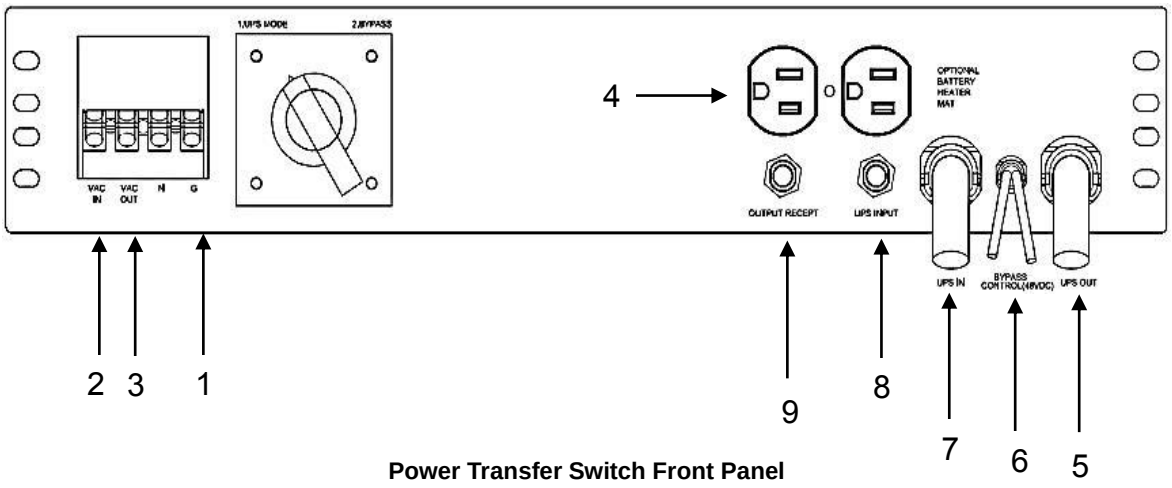
Inspect the filter every 6 months, or as often as required. Clean by removing it, running water through the filter and air-drying before reinstallation.

14. PTS Connector

The PTS Connector connects the TRTC-2004-N1 to the PTS via the Bypass control wires.

Section 6: Power Transfer Switch Details

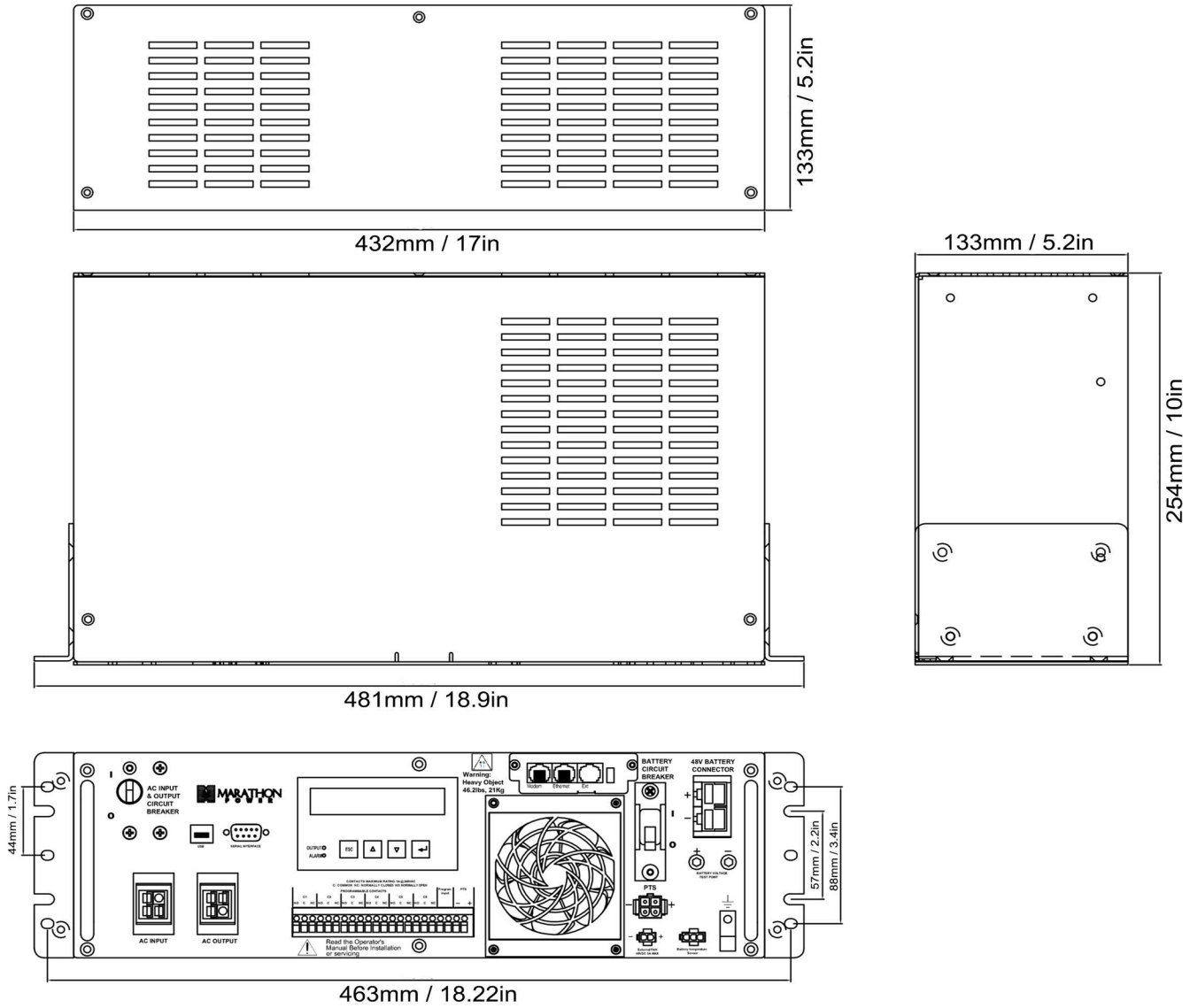
The Power Transfer Switch (PTS) shown below allows the UPS to be removed for service, replacement or maintenance without interrupting power to the traffic cabinet.



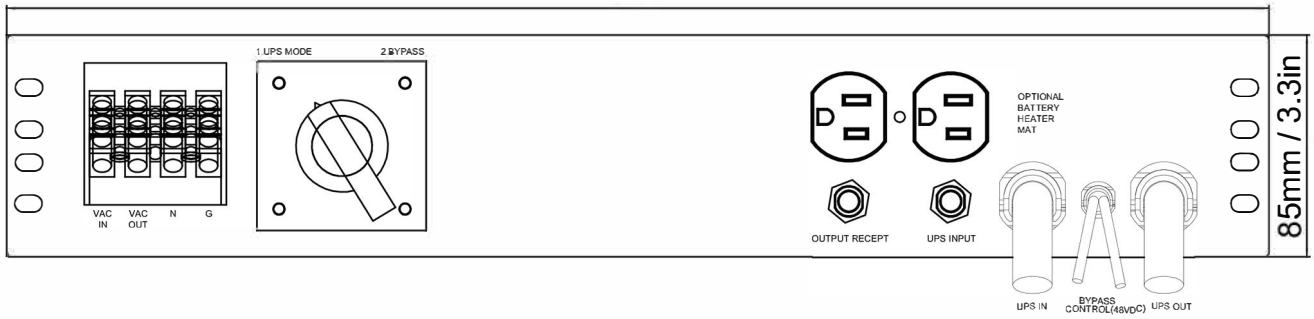
Power Transfer Switch Front Panel

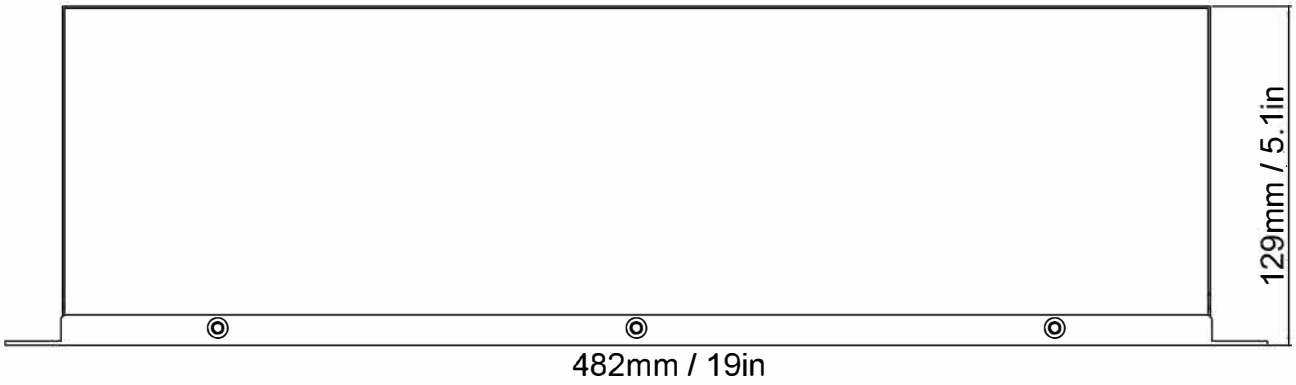
1. The wires from the neutral and ground bus of the traffic cabinet are connected to this terminal block.
2. The Input line power is connected to the terminal block marked with “AC INPUT”.
3. The Output line power is connected to the terminal block marked with “AC OUTPUT”.
4. An optional surge suppressor, external PC, optional battery heater or a vacuum cleaner for maintenance may be plugged into these receptacles.
5. This “UPS OUT” cord is connected to the OUTPUT AC terminal block on the TRTC-2004-N1.
6. The Black and Red PTS control wires are connected to the PTS connector on the TRTC-2004-N1.
7. This “UPS IN” cord is connected to AC INPUT terminal blocks on the TRTC-2004-N1.
8. This circuit breaker provides input power protection for the TRTC-2004-N1.
9. The dual receptacles are protected by this circuit breaker.

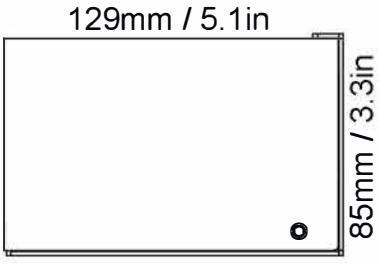
Section 7: TRTC-2004-N1 Dimensional Drawing



Section 8: Power Transfer Switch Dimensional Drawing







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