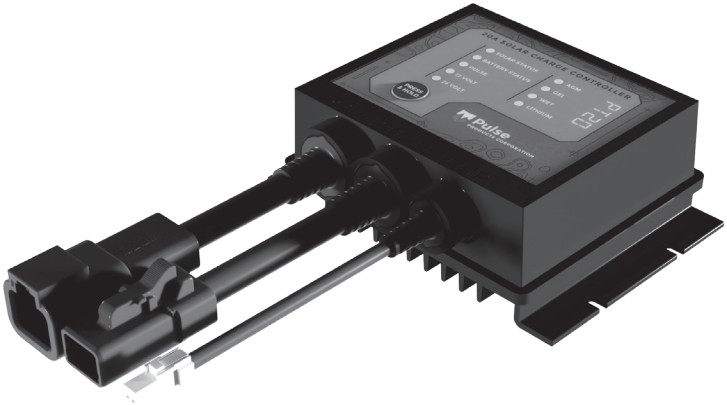
INSTALLATION MANUAL
For Model PT20 Charge Controller



PulseTech®
PRODUCTS CORPORATION

PT20 Charge Controller

Model: PT20
Part #: 746X920

Input: DC12V or DC24V solar panel array (Max 50Voc)
Output: DC 12V 20A
DC 24V 20A

User Manual

What comes in the box:
1 each: PT20 Charge Controller
1 each: User Manual
1 each: Temperature Sensor (2.9m in length)
1 each: Fused Battery Harness (3m in length)
1 each: Solar Input Adapter (allows bare wire connection to solar input)

THIS MANUAL CONTAINS IMPORTANT INSTRUCTIONS FOR INSTALLATION AND MAINTENANCE OF THE PT20 CHARGE CONTROLLER

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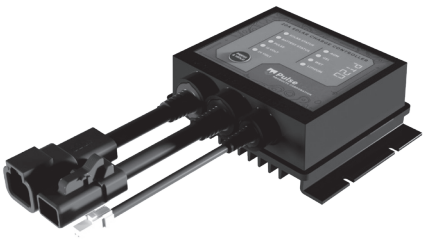


Figure 1: PT20 Side View

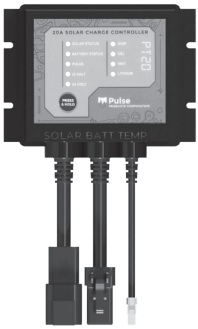


Figure 2: PT20 Top View

1) IMPORTANT SAFETY INSTRUCTIONS - PLEASE READ

⚠WARNING

WARNING: This product can expose you to chemicals including arsenic, which is known to the State of California to cause cancer. For more information, go to www.P65Warnings.ca.gov.

- WARNING: WHEN A GROUND FAULT IS INDICATED, BATTERY TERMINALS AND CONNECTED CIRCUITS MAY BE UNGROUNDED AND HAZARDOUS.
- LEAD-ACID, AGM AND LITHIUM BATTERIES CAN BE DANGEROUS. ENSURE NO SPARKS OR FLAMES ARE PRESENT WHEN WORKING NEAR BATTERIES.
- NEVER SHORT CIRCUIT THE BATTERY.
- SOLAR PANELS WILL GENERATE ENERGY WHEN THEY ARE EXPOSED TO LIGHT EVEN WHEN DISCONNECTED. ANY CONTACT WITH WIRES CAN CAUSE INJURY.
- NEVER USE THIS DEVICE WITH A LITHIUM BATTERY THAT DOES NOT HAVE A BATTERY MANAGEMENT SYSTEM (BMS). A BMS IS CRITICAL FOR LITHIUM BATTERY SAFETY.
- Eye protection should always be used when working near batteries.
- Accidental shorting of the wiring during installation can result in sparks causing personal injury or a fire hazard. PulseTech recommends covering the solar panels to block all light from reaching the surface.
- Use the provided 12-AWG, 105°C wire harnesses for the solar and battery connections.
- Always install a battery fuse (25-amp recommended) between the battery and the solar controller. (See Wiring and Installation section for more details on fusing.)
- Be very careful not to connect the wires to the solar panel or battery in reverse.
- Do not disassemble the controller. Please contact PulseTech Customer Service if you have any problems with your device at 800-580-7554 or ppc@pulsetech.net.
- Device has overcurrent protection up to 22-amps on both the solar and battery terminals.
- PulseTech recommends not exceeding 20-amps of short circuit current (Isc) for your solar input.
- Audible buzzing noise during charging is normal, particularly during absorption and float modes. The noise is due to the PT20 charging functionality of the device and not an indication of a device failure.

2) Overview

Intro

The PulseTech PT20 solar charge controller monitors, regulates and protects the attached solar components. The PT20 automatically controls the solar charging power for optimal battery health. Equipped with advanced, high efficiency, pulse width modulated (PWM) technology and temperature compensation, batteries safely charge to 100% every time.

PulseTech

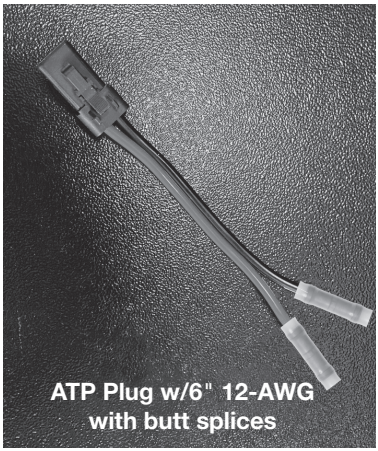
Patented PulseTech pulsing technology increases the life of lead-acid batteries. PulseTech works by desulfating, or removing, and hindering the natural sulfation (corrosion) that occurs in all lead-acid/ AGM batteries that eventually leads to a dead battery. PulseTech patented technology has been proven to increase the life of lead-acid/AGM batteries by three times their normal life. This technology is built into the PT20 and is automatically enabled to be turned on for any lead-acid/AGM battery charging profile and is active during charging only.

3) Features

1. 20-amp Pulse Width Modulation (PWM) Solar Charge Controller
2. Charge 12-volt and 24-volt battery systems using 12-volt or 24-volt solar panels
3. Preprogrammed battery charging profiles selectable using built-in button
    a. AGM, WET and GEL lead-acid type batteries
    b. Lithium battery profile to be used for Lithium Iron Phosphate and Lithium Ion batteries
    c. Press and hold button to change between profiles
4. PulseTech pulsating technology to increase the life of all lead-acid battery types (See PulseTech Functionality Section for more details.)
5. Recharge
    a. 20-amps of pure regulated sunlight will recharge your batteries faster and safer than a generator or alternator
    b. 12 and 24-volt auto-switching
    c. Advanced pre-programed multi-staged charging algorithms for AGM, Gel, Wet, and Lithium battery types
6. Restore
    a. Patented Pulse Technology removes and inhibits growth of battery killing sulfate deposits to extend the performance and life of your hard working batteries
    b. Included temperature sensor for optimal charging and safe temperature compensation

7. Maintain
    a. The PT20 Solar Charge Controller is always working, even when your batteries are not
    b. Protects your batteries from overvoltage, overcurrent, reverse polarity, and reverse current damage
    c. Rugged “all-weather” design will maintain your battery investment in the harshest conditions

Battery harness



Solar Input

4) Wiring and Installation

IMPORTANT INSTALLATION NOTES - PLEASE READ

1. Use the provided 12-AWG, 105°C wire harnesses for the solar and battery connections.
2. Ensure that your solar input has a maximum short circuit current (Isc) of no more than 20-amps.
3. Always use a 25-amp fuse between the battery and the charge controller.
4. The maximum overcurrent protection of the PT20 is 22-amps.
5. It is important to use the external temperature sensor to ensure proper battery charging for all lead-acid/AGM battery types. Please tape the ring terminal end to your battery or connect it to the positive battery post. Do not use the temperature sensor for Lithium batteries.
6. Immediately after connecting the battery to the charge controller, use the button to change the battery profile. Do this before connecting your solar panels to the device.
7. Put the device in a well ventilated area.

Device Connections

The PT20 has three separate connectors that come out of the housing. The solar and battery connectors are both 25A rated ATP connectors. When used with the solar battery harness, the polarity will be indicated with red as positive and black as negative for both the battery and the solar sides. The third, smaller connector is for the temperature sensor. If you remove the ATP connectors, polarity is indicated with Red as positive and Black as negative for both solar and battery connections.

Harness info:

Battery: 3 meter, 12-AWG wire from battery to charge controller - 25A Fuse

Solar: ATP Plug w/6" 12-AWG with butt splices

Ratings:

12V System:	15V-28V
12V Maximum Nominal Panel Wattage:	400W
24V System:	30V-50V
24V Maximum Nominal Panel Wattage:	800W

Array can be safely left floating. No external protection devices required. However, PulseTech recommends using a fuse on the positive output of each solar panel to protect your solar panel. All Zamp Solar Panels have a fuse built into the harness.

Button

Use the button that says “Press & Hold” to change the active battery profile. Press and hold the button for 2 seconds until the battery type LEDs begin cycling. When the LED next to the battery type you would like illuminates/lights, release the button. Ensure that the battery type you want has the LED next to it illuminated.

Installation Guide 12-Volt and 24-Volt

Charge Controller to Battery Wiring

Connect the charge controller to the battery using the supplied 3 meter, 12-AWG, 105ºC copper wire. When connecting the charge controller to the battery, ensure there is a 25-amp fuse on the positive side of the charge controller to the battery connection.

Battery Fusing

Examples of fuses to use are a terminal fuse block, manual resetting breaker or an ANL type fuse. A 25-amp fuse is recommended for all installations.

Automatic resetting breakers are NOT recommended.

Temperature Sensor

The PT20 comes with a 2.9m (9.5 ft.) temperature sensor with a ring terminal on one end and two leads on the other end. If using a lead-acid/AGM battery, connect the temperature sensor to the charge controller by pressing the two connectors together. Once connected, give each lead a light tug to ensure that they are properly fitted. Then tape the ring terminal side of the temperature sensor to the side or the top of your battery. This is recommended over connecting it to one of the battery terminals because it will give a better gauge of the actual temperature of your battery. It is important to use this as described to enable the charge controller to accurately charge your battery bank over all temperature ranges. (See the Charging Profiles section for information on temperature behavior during charging.)

12-Volt Installation Specifics

Table 1: 12-Volt Installation Quick Information

Maximum Nominal Panel Wattage	400W (<= 20A Isc)
Battery to Charge Controller Wire Size	12-AWG
Battery to Charge Controller Fuse Size	25A
Battery to Charge Controller Wire Length (MAX)	9.84 ft. (3m) *included
Solar Panel to Charge Controller Wire Size	12-AWG
Solar Panel to Charge Controller Wire Length (MAX)	15 ft.
Solar Panel Configuration	Parallel (12V)
Temperature Sensor (Use for Lead-Acid/AGM only)	Tape to top or side of the battery

24-Volt Installation Specifics

Table 2: 24-Volt Installation Quick Information

Maximum Nominal Panel Wattage	800W (<= 20A Isc)
Battery to Charge Controller Wire Size	12-AWG
Battery to Charge Controller Fuse Size	25A
Battery to Charge Controller Wire Length (MAX)	9.84 ft. (3m) *included
Solar Panel to Charge Controller Wire Size	12-AWG
Solar Panel to Charge Controller Wire Length (MAX)	15 ft.
Solar Panel Configuration	2 - 12V panels in Series = 24V or 24V panel
Temperature Sensor (Use for Lead-Acid/AGM only)	Tape to top or side of the battery

5) PulseTech Functionality

The PT20 controller contains a proprietary, patented PulseTech Pulsing circuit that has been scientifically proven to extend the life of all types of lead acid batteries. This is achieved using PulseTech's patented pulsing technology that breaks up the lead sulfates that build up on the plates inside the battery whenever the battery is discharging.

Sulfates negatively impact battery performance by:

- Reducing the battery's ability to discharge power
- Reducing the battery's ability to recharge
- Shortening battery life

Pulse Technology is delivered to the battery through a circuit which is independent of the charging circuit. This patented, high-frequency pulse waveform is of a specific amplitude and frequency that is precisely controlled by microprocessors. It rises rapidly in less than one microsecond to its maximum amplitude and gradually returns to zero. There is no abrupt stop and no battery drain. This waveform occurs 25,000 times a second and has been proven to remove sulfation from the battery plates and return the lead sulfate back to the electrolyte solution.

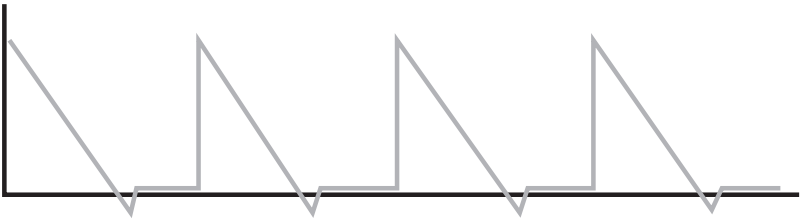


Figure 3: PulseTech Pulse Technology Waveform

For more detailed information, visit the website here:
https://www.pulsetech.net/our-technology/pulse-technology.html

The pulse circuit is applied on top of the charging waveform. Thus, the pulse circuit requires the device to be charging in order to function. The PulseTech Pulsing is automatically enabled on all Lead-Acid/AGM battery profiles and can't be turned off in the settings. For all Lithium battery profiles, the PulseTech Pulsing has been disabled to prevent battery damage.

6) Charging Profiles

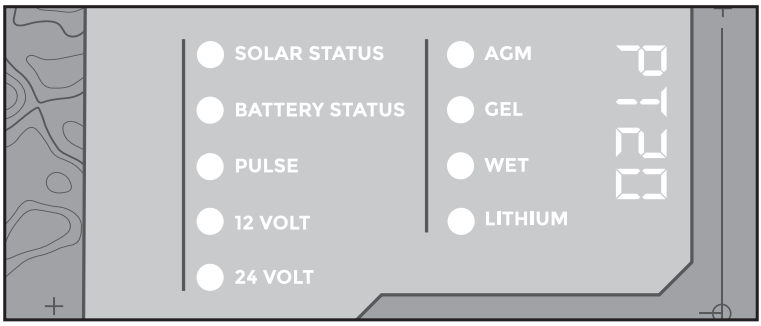
The PT20 contains 4 pre-programmed, multi-stage battery profiles that have been customized to each specific battery type. There are profiles for AGM, Gel, Conventional Lead-Acid (WET) and Lithium (Lithium Ion & LiFePo4) Batteries. See Table 3 below for detailed descriptions of the different charging stages.

Table 3: Default Charging Profile Voltage and Current Descriptions

Default Charging Profile Voltage and Current Descriptions This table shows the 12V system voltage, double the voltage given for a 24V system.				
	AGM (Default)	**Gel**	**Wet/Flooded**	**Lithium (LiFePo4/LiIon**
Soft Charge Voltage	8V - 10V			BMS Lower Cutoff - 10V (1)
Soft Charging Current	4A (2A for 24V)			
Bulk Charge Voltage	10V-Absorption Voltage			
Bulk Charge Current	Max current available up to 20A			
Absorption Charge Voltage	14.6V	14.1V	14.7V	14.4V
Absorption to Float Condition	1. Charging current drops below 1A (or) 2. Charger has been in absorption mode for 4 hours			
Float Charge Voltage	13.6V	13.3V	13.4V	No Float
Default Restart Charge Voltage	13.3V	13.0V	13.1V	13.3V
Pulsing Waveform Applied	Apply pulse in define waveform when solar panel voltage is available battery is charging			Pulsing Circuitry not allowed
Min ~ Max Charging Temperature with Sensor	-4ºF ~ 113ºF -20ºC ~ 45ºC	-4ºF ~ 113ºF -20ºC ~ 45ºC	-4ºF ~ 124.7ºF -20ºC ~ 51.5ºC	The charger relies on the battery's internal BMS to cut off charging due to high or low temperatures.
Max Charging Temperature without Sensor	212ºF (2) 100ºC (2)			
Temperature Compensation	-30mV/ºC for 12V -60mV/ºC for 24V			Lithium batteries: No temperature compensation
Voltage Output Accuracy	+/- 0.1V			

(1) BMS systems should not ever allow the battery to discharge below 10V.
(2) This range is for the board temperature. If no battery temperature sensor is connected, the device can only read the board temperature. Ensure that the device does not operate above the ambient temperature maximum rating given in Table 4.

7) LED Operation



Solar Status LED

This LED gives the current status of the connected solar array.

Green = Solar is present and >15V
Off = Solar is <15V

Battery Status LED

This LED gives the current charging state of the controller.

Solid Green = Float/Fully charged
Fast Blinking Green (six times per second) = Absorption
Solid Orange = Bulk Charging
Solid Red = Soft Charging
Blinking Red = Battery Error
Off = No Battery Connected

Pulse LED

This LED gives the current status of the on-board PulseTech Pulsing Technology.

Blinking Red = PulseTech Pulsing Technology is active and pulsing
Off = Pulsing is off

12 Volt LED

This LED is lit if the device detects a 12V battery.

Solid Green = System voltage is 12V
Off = System voltage is 24V

24 Volt LED

This LED is lit if the device detects a 24V battery.

Solid Green = System voltage is 24V
Off = System voltage is 12V

Battery Type LEDs

These LEDs indicate the active battery type. Only one will be on at a time. Use the button to change between battery types. (See the Button section for more information – see Page 6.)

Solid Green = Battery Type listed is set as the active profile
Off = Another battery type is set as the active profile

8) Troubleshooting

Battery Removal Procedure

If you are going to remove your battery during a period of very low Solar Input (i.e. nighttime, inside a shop with no lighting, etc.), you must also remove the solar panel input. If you remove the battery input and leave a weak solar input, the controller will consider its power source too variable and enter a shutdown state. This can be remedied by removing the solar input and re-attaching the battery input.

If you are removing your battery with plenty of solar input (i.e. any condition where the sun is present), you may disconnect your battery freely without removing the solar input. It is important that you re-connect the battery before the sun goes down to avoid exposing the controller to very weak solar input.

Controller “blinking orange and green”

If you are looking at the front face of your PT20 Charge Controller during dusk or dawn, you may observe that the battery status light is switching quickly between green and orange. This may look like an error, but it is not. The two colors of the LED represent 2 charging states that are being encountered quickly due to the behavior of the charger. Orange occurs when the device enters Bulk mode in an attempt to charge using the available sun. Since the sun is weak during dusk and dawn, there is not sufficient current to cause the device to continue charging and thus it enters an idle state which is represented by a green color on the battery status LED. Since the solar controller always wants to be in a charging mode, the device will then reattempt charging and the LED will turn orange again and begin the cycle all over. This orange-green LED blinking is normal controller behavior and nothing to worry about.

Controller is “buzzing” and making noise

You may notice that the PT20 occasionally makes a buzzing noise during charging. This is normal. This buzzing will only occur during Float/Absorption modes and indicates that the charger is limiting the current to your battery as it proceeds through its normal three stage charging process.

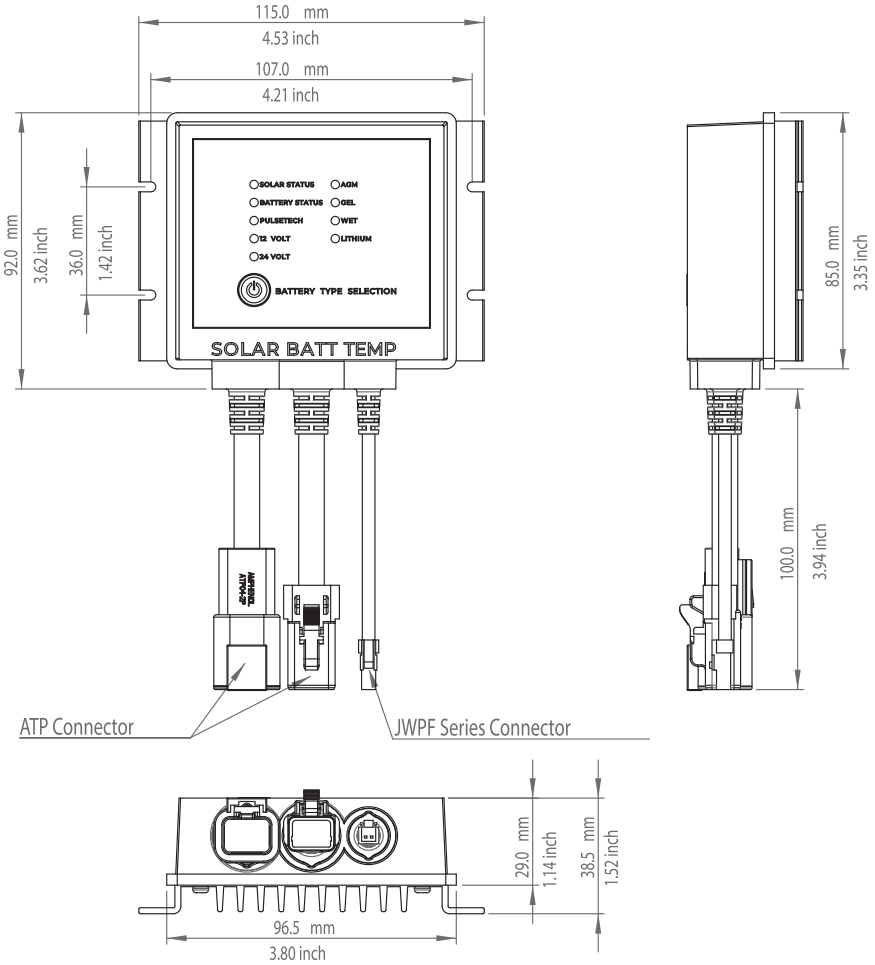
9) Specification

Table 4: Specifications for PT20

Specification	Details
Battery Voltage	12/24V (Automatically Detected) 12V System: 8V ~ 16V 24V System: 16V and up
Maximum Voltage on Battery Terminals	40V
Rated Charge Current	20A
Minimum Solar Input Voltage	12V Battery: 15V 24V Battery: 30V
Maximum Open Circuit Solar Panel Voltage	50V (recommended <28V for 12V)
Maximum PV Short Circuit Current (1)	22A
Maximum Nominal Panel Wattage	12V: 400W 24V: 800W
Self-Discharge	<60mA
Protection	Reverse polarity at solar input Reverse polarity at battery input Protection against reverse current from battery to solar Over temperature protection
Input Terminals	Male 25A Rated ATP connector at the end of 10cm 12AWG wire for solar input Female 25A Rated ATP connector at the end of 10cm 12AWG wire for Battery input Small Female JWPF for External Temperature Sensor Input at the end of a 10cm 26AWG wire
Humidity (non-condensing)	Max 98%
Battery Temperature Sensor (Use for Lead-Acid/AGM batteries only)	Included with device Tape to Battery for accurate temperature compensation For lead-acid/AGM battery types during charging
Min~Max Operating Ambient Temperature Range	-31°F ~ 149°F -35°C to +65°C
Protection Category	Tested to IP66 standards
Weight	1.43 lb / 0.65 kg (includes temperature sensor)
Dimensions (h x w x d)	3.62" x 4.53" x 1.52" (92mm x 115mm x 38.5mm)
Standards	ETL + ETLc: UL 1741; CSA C22.2 No. 107-1 FCC Part 15B (Class A) CE/EMC: EN61000-6-2 and EN61000-6-4 CE/LVD: EN62109-1 CB: IEC 62109-1 Australia (Safety EMC RCM)

(1) Overcurrent protection set at 22-amps for the PT20. PV short circuit current above this value may damage the device.

Figure 4: PT20 Mounting Diagram



10) Contact Us

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