MANUAL

MODEL **1620**

SWITCH MODE BATTERY CHARGER

CE Applicable to 230VAC units only

Before charging, read instructions carefully!

IMPORTANT SAFETY INSTRUCTIONS
SAVE THESE INSTRUCTIONS

Read the Operating Instructions carefully before using the Model 1620 charger.

1. **WARNING** – Failure to install and operate the charger in accordance with these instructions may result in damage to the charger or injury to the operator.
2. **WARNING** – Never place the charger directly above or below the battery being charged. Gases or fluids from the battery will corrode and damage the charger. Locate the charger as far away from the battery as the output cable allows.
3. **WARNING** – Explosive gases may result from charging. Provide adequate ventilation during charging. Prevent flames or sparks.
4. **WARNING** – Do not attempt to open the charger. There is risk of electric shock even if the charger is unplugged. No user serviceable components inside.
5. **WARNING** – If safe operation of the charger can no longer be ensured, stop and secure it against operation.
6. **WARNING** – If the supply cord is damaged, it must be replaced by a qualified person in order to avoid hazard.
7. **WARNING** – Never charge a frozen battery.
8. **WARNING** – To reduce the risk of injury, charge only lead acid or gel cell type batteries. Do not attempt to charge any other type of chargeable or non-rechargeable battery; these batteries may burst, causing personal injury and damage.
9. **WARNING** – To protect the operator from serious injury and the battery from damage, Curtis recommends using a fast blow fuse rated for a minimum of 32V and a maximum of 30A between the battery and the charger.
10. **CAUTION** – It is recommended that you disconnect the AC power cord before connecting or disconnecting the charger to the battery.
11. **CAUTION** – Not intended for outdoor use.
12. **CAUTION** – Charger surface may be hot while plugged in and for a period of time thereafter.
13. **CAUTION** – Units must have at least 30mm of clearance on the vented ends of the charger. Do not restrict ventilation to the charger in any way. Failure to do so may result in degradation of charge performance.
14. **CAUTION** – If charger failure or malfunction may cause personal injury or material damage, use additional safety measures such as limit switches, guards, etc.
15. **CAUTION** – Failure to install and use the charger in accordance with these instructions may impair the protection provided by the charger and may void the manufacturers warranty.
16. **CAUTION** – Never plug a 120VAC only charger into a receptacle not rated for 120VAC nominal.
17. These chargers are suitable for use with all 24V, 12 cell, rechargeable lead acid/gel cell batteries ONLY. It is intended for use with batteries rated up to 200 amp-hours.
18. This charger was manufactured and tested according to the applicable technical standards referenced herein. It complies with safety regulations as shipped from the factory.
19. Be sure to read and understand all of the battery manufacturer's instructions, such as removing or not removing cell caps or recommended rate of charging, prior to using this charger.

Warranty

Two Year Limited Warranty (see terms of sale for specifics).
All specifications subject to change without notice.

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1 MODEL ENCODEMENT

1620uv-www/xx/yy-zzz

1620	**u**	**v**	**-**	**www**	**/**	**xx**	**/**	**yy**	**-**	**zzz**
Model	Cooling	Sealing		Input Voltage		Output Voltage		Output Current		Series Number
	F Fan cooled	**S** Sealed		**120** 120VAC **230** 230VAC		**24** 24VDC		**20** 20 Amps		**001** Consult Factory for additional options

2 TECHNICAL SPECIFICATIONS

2.1 Electrical

	120VAC models	**230VAC models**
Input:		
Voltage:	100-132VAC	180-264VAC
Frequency Range:	57-63Hz	47-63Hz
Input Current:	12Arms max. @ 100VAC/60Hz	4.5Arms max. @ 180VAC/50Hz

Output Voltage:	24VDC, nominal
Output Current:	0-20A
Output Max. Power:	580W

2.2 Mechanical

Case:	Aluminum alloy, black finish
End caps:	Polycarbonate, black
Dimensions (mm):	292L x 165.0W x 73.0H
Weight:	2.8kg

2.3 Connections

AC Power Inlet: IEC 320/C14

Programming Port: Molex 39-01-2040 For use with Curtis Instruments' Model 1311 handheld programmer only.

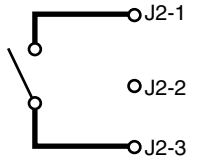
Pin	**Function**
1	Rx
2	SEC_RTN
3	Tx
4	+12V

Motor Controller Inhibit: Molex 39-01-4030 60mA max. current.

Pin	**Function**
1	See wiring diagram 1
2	No connection
3	See wiring diagram 1

DC Power Output: 2 x M5 studs (max torque 2.2Nm).

Pin	**Function**
+	B+ output
–	B– output



Wiring diagram 1.

2.4 Environmental

Operating temperature:	0°C to +50°C
Storage temperature:	-40°C to +85°C
Humidity:	95% non-condensing at 38°C
Shock:	SAEJ1378, 55g pulse at 9-13ms
Vibration:	5g rms, 5-500 Hz, 2 hrs. per axis
Protection:	IP-54, including fan

2.5 Compliance

Radiated Emissions:	FCC Part 15, Class A	EN55011, Class A
Conducted Emissions:	FCC Part 15, Class A	EN55011, Class A
EN50082-1-1997	—	X
ESD:	—	EN61000-4-2:1995
Radiated Immunity:	—	EN61000-4-3:1995 + A1:1998
Electrical fast transient:	—	EN61000-4-4:1995
Surge Immunity:	—	EN61000-4-5:1995
Conducted Immunity:	—	EN61000-4-6:1996
Power Frequency Magnetic Field:	—	EN61000-4-8:1993
Voltage dips and sags:	—	EN61000-4-11:1995
Harmonics:	—	EN61000-3-2:2000
Voltage fluctuations (flicker)	—	EN61000-3-3:1995
Safety	—	EN60335-1:1995 EN60335-2-29:1997

2.6 Battery Types

This charger is suitable for use with all 24V, 12 cell, rechargeable lead acid batteries with capacities of approximately 200Ah.

2.7 Charge Cycle Profile

The Model 1620 charger provides three different charge profiles: IVa (Off Mode, see Figure 1), I_1VI_2a (Equalize Mode, see Figure 2) and IV_1V_2 (Float Mode, see Figure 3).

For definitions of the variables mentioned in this section, refer to Table 1.

2.7.1 – End of Charge Mode

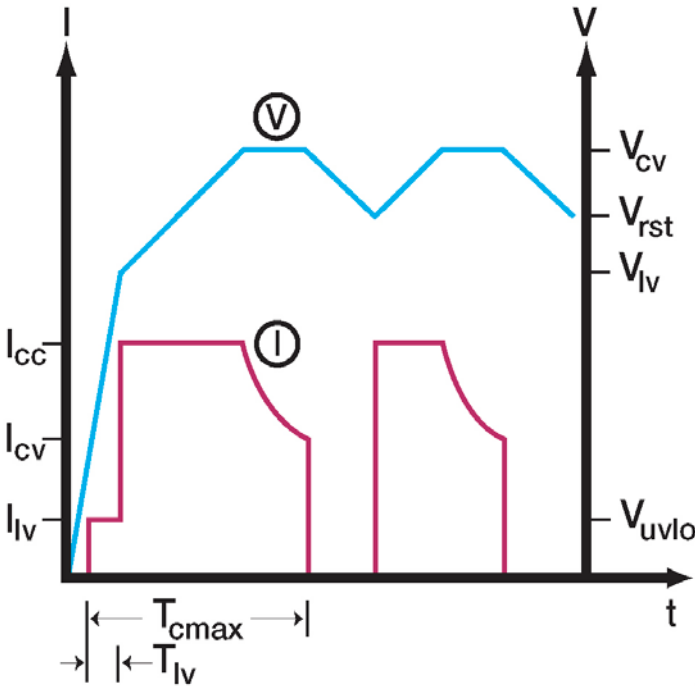


Figure 1. Charge profile for End of Charge Mode

Figure 1 defines the charge profile for the End of Charge Mode. As long as the battery voltage (V) is above Undervoltage Lockout Level (Vuvlo), charging will start after short delay of about 6 seconds. For battery voltage between Vuvlo and Vlv, charge current will be limited to lower value (Ilv) in order to prevent gassing damage to the batteries. Good batteries will quickly increase voltage above Vlv and the 1620 will increase current to Constant Current value (Icc).

This is beginning of a bulk charge, which typically returns 80% of the charge. At the end of bulk charging, battery voltage has reached Constant Voltage level (Vcv) and the charger will maintain the voltage by reducing the current (I) gradually. When the current drops to Icv, charging will stop, at which point the charger has returned 105-110% of the Ampere-hours discharged.

If the battery is not used, its voltage will slowly drop due to self-discharging. When battery voltage reaches Restart Voltage (Vrst), the 1620 will turn back on and fully charge battery again.

2.7.2- Equalize Mode after End of Charge Mode

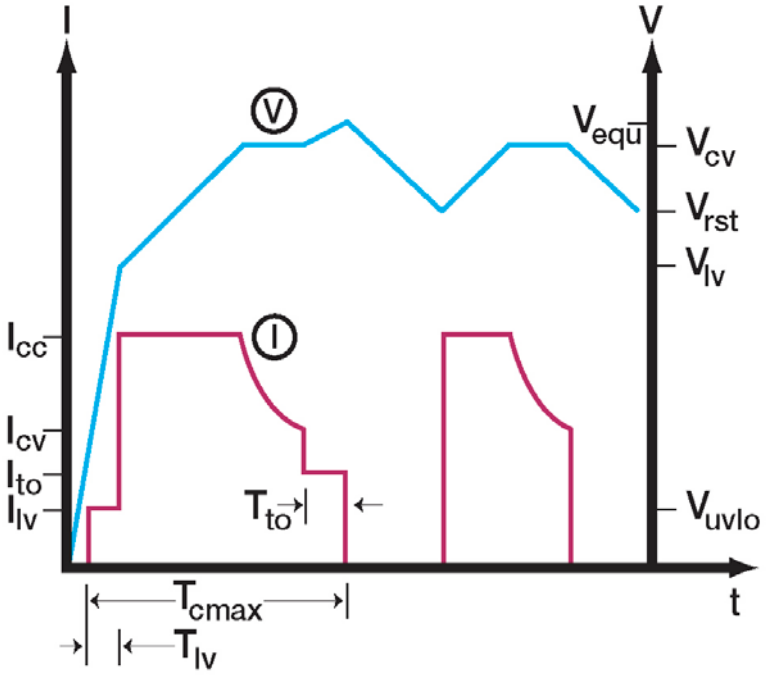


Figure 2. Charge profile for Equalize Mode

Figure 2 defines the charge profile for the Equalize Mode. After going through bulk charge and Constant Voltage modes, the charger will reduce its output current to Top-Off Current (Ito) until one of the two possible outcomes occurs:

(1) Battery voltage rises to Equalize Voltage (Vequ) or
(2) Equalize Time-Out (Tto) is reached.

Once one of these two possibilities occur, charging will stop and the 1620 will set itself to Off Mode; the charger remains in standby until restart voltage (Vrst) is reached.

2.7.3 - Float Mode

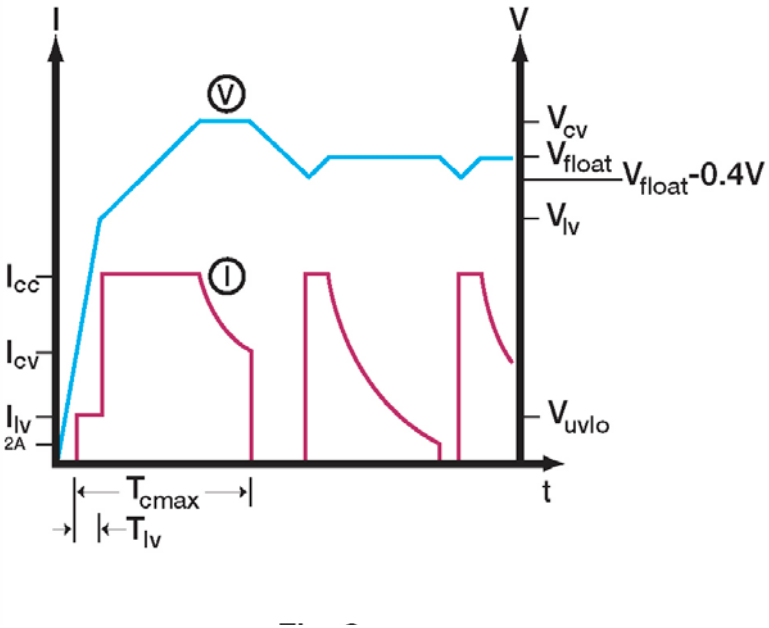


Figure 3. Charge profile for Float Mode

Figure 3 defines the charge profile for the Float Mode. In this mode of operation, batteries are maintained at full charge. In addition to maintaining full charge, the charger can support a load current – as long as the combined load current and battery charging requirements do not exceed the output current defined in the Constant Current setpoint (Icc, default value of 20A in the Basic Mode).

In this mode of operation, the charger will go through bulk charge and Constant Voltage modes as previously described. It then goes into standby until the battery voltage drops 0.4V below the Float Voltage (Vfloat, default value of 26.8VDC in Basic Mode) setpoint. The charger will then reactivate and maintain float voltage as long as the current requirement is above 2A. If current drops to 2A, the charger will again enter standby mode. The charger will continue this cycle of standby/ reactivation until power is removed or until the Model 1311 programmer is connected.

2.8 Indication Lights

The charger features built in diagnostics. Refer to the table below to interpret the flashing of the green and yellow indicator lights.

Flash Pattern	Mode	Charge Status
Yellow on, Green on	Standby Indicator 1	Charge done, ready to use.
Yellow on, Green blinks[1]	Charging	Charging normally.
Yellow and Green blink[1] together	Standby Indicator 2	Charge cycle has not started, refer to troubleshooting section.
Yellow and Green blink alternately	Programming	1311 programmer connected to the unit.
Yellow blinks[1], Green on	Standby Indicator 3	End of Charge (Veoc) voltage reached. Charge done, ready to use.(200s delay)
Yellow blinks[1], Green off	Error	Charge cycle stopped, refer to troubleshooting section.
Yellow blinks[2] once, 2 seconds off, repeats, Green off	Error	Charge cycle stopped, refer to troubleshooting section.
Yellow blinks[2] twice, 2 seconds off, repeats, Green off	Error	Charge cycle stopped, refer to troubleshooting section.
No indicators on	Off/Error	Charger is unplugged, otherwise refer to troubleshooting section.

[1] – 0.5s on, 0.5s off
[2] – 0.5s on

3 INSTALLATION

3.1 Unit should be securely mounted to a flat surface.

3.2 The power cord to the IEC 320/C14 connector should be of the appropriate gauge to carry a 15A current, for the cable's length, to meet the requirements of applicable electrical codes. The power cord must meet IEC requirements with a minimum cross section of 1.5mm.

3.3 The wires between the charger output and the battery should be of the appropriate gauge to carry a 20A current, for the cable's length, to meet the requirements of applicable electrical codes. An inline fuse (32V min. 30A max.) is recommended to protect against accidental battery short circuit.

3.4 A minimum of 30mm clearance should be provided at each vented end of the charger.

3.5 Charger should not be installed in locations which restrict airflow to the unit.

3.6 The circuit supplying power to the charger should be rated at a minimum of 15A for a 120VAC circuit, or for 5A for a 230VAC circuit.

4 OPERATION

4.1 Charging the battery

4.1.1 If using the motor speed controller inhibit, and a Curtis motor controller is present, connect the Motor Controller Inhibit connector to the appropriate connector on the motor speed controller.

4.1.2 Connect the (–) terminal of the charger to the (–) terminal of the battery.

4.1.3 Connect the (+) terminal of the charger to the (+) terminal of the battery.

4.1.4 Plug the charger into an appropriate AC power source.

4.1.5 Charging is complete when a steady green indicator light is seen next to the battery symbol on the charger. Unplug the charger from the wall and disconnect the charger from the battery, removing the connection to the (+) terminal first.

4.2 Programming Options

Curtis chargers do not use the 1311's Monitor, Faults, or Functions Menus. The Information and Programmer Setup Menus operate as described in the 1311's instruction manual with the exception of the Serial Number submenu in the Information Menu – this field is filled with a default value of 12345678.

The 1620 offers two levels of programmability, Basic and Advanced. The program features are accessed by connecting a Curtis Model 1311 handheld programmer to the Programming port. Programming in Basic Mode involves setting battery type (Flooded or Sealed Lead-Acid) and End of Charge Mode (charge profile), while Advanced Mode offers flexibility of changing the most important parameters of the charger for optimum charging of almost any Lead-Acid based battery. Of course, selecting the Factory Default option restores the charger settings to the default values it left the factory with. This option can be invoked at any time.

Variable parameters, limits, default settings, accuracy and descriptions are listed in Table 1.

4.3 Programming the charger

Note 1: Connecting the Model 1311 handheld programmer to the charger will cause the charger to enter standby mode while connected. The charger will reset and resume normal operation upon removal of the 1311.

Note 2: The Model 1311 handheld programmer is available with different connectors. Be sure to use a 1311 with the 4 pin Molex connector. Conact a Curtis sales office for assistance.

4.3.1 Attach the programmer to the 4-pin Molex connector, between the indicators. The yellow and green indicators will blink on and off simultaneously, indicating that the charger is in programming mode.

4.3.2 Configure the programmable parameters defined in Section 4.2.

4.3.3 Once the programmable parameters have been defined, disconnect the 1311 programmer from the charger. The charger will reset and resume normal operation.

5 TROUBLESHOOTING

The following checklist should help you to troubleshoot any problems with the charger. Make sure to observe all safety instructions provided on the unit and in this manual.

Flash Pattern	Indication	Solution
Yellow and Green blink[1] together	No battery or reverse polarity	Battery may be disconnected from charger or connected back wards.
		Battery may be severely discharged. Lower Vulvo in the software setting.
		Battery damaged. Replace battery.
Yellow blinks[1], Green off	Charger overvoltage	Battery may have been disconnected before the end of charge; reconnect the battery and reset the charger[3]. (or wait 200 seconds).
		Battery manufacturer's rated voltage may exceed charger's rating. Verify rated battery voltage.
Yellow blinks[2] once, 2seconds off, repeats, Green off	Not reaching VCV within Tcmax.	Battery manufacturer's rated capacity may exceed charger's rating. Increase Tcmax, increase Icc, or reset the charger[3].
		Battery may be damaged or old. Replace battery.
Yellow blinks[2] twice, 2 seconds off, repeats, Green off	Not reaching Vlv within Tlv	Battery manufacturer's rated capacity may exceed charger's rating. Increase Tlv, decrease Vlv, increase Ilv, or reset the charger[3].
		Battery may be damaged or old. Replace battery.
No indicators on	No power or damaged charger	Charger may be unplugged. Check for AC power. Charger may be damaged.
		Consult manufacturer for repair or return.

1 – 0.5s on, 0.5s off

2 – 0.5s on

3 – Resetting the charger: Remove and restore power to the charger. Charger may be damaged if operation does not resume after AC power is recycled (light should go off approx. 20sec after power is removed and then charger can be restarted). Alternately, connect the Model 1311 handheld programmer to the charger until it has completed its boot up phase, then disconnect the programmer.

6 MAINTENANCE

Excess dirt or grime may be removed from the unit by wiping it with a cloth dampened with water.

Although Curtis chargers are equipped with a fan designed to last the life of the charger, exposure to harsh environments – such as dusty condition, grease, chemicals, etc. – may impair the effectiveness of the fan. If the operation of the fan is noticeably degraded, Curtis recommends an immediate replacement of the fan with Curtis Part Number 17603351, 1620 Fan Assembly.

6.1 Replacing the fan:

6.1.1. Disconnect the charger from power and from the battery.

6.1.2. Remove the fanguard by simultaneously pushing in the retaining clips on either side of the fan and gently pulling the fan guard away.

6.1.3. Unplug the fan assembly, noting the fan orientation, air flow direction, and wire routing.

6.1.4. Remove the fan assembly.

6.1.5. Replace with new fan assembly , being sure to match the orientation and airflow direction of the previous fan, and plug the fan in. Route the fan wires as previously located to avoid pinching the wires.

6.1.6. Replace fan guard and push until a click is heard. Verify both retaining clips have fully engaged.

Table 1. Programming Parameters

Programming mode	Description	Programming Limits	Default Value	Increment
BASIC MODE[2]	**Battery Type**	1 or 2	1	1
	End of Charge	1, 2, or 3	1	1
ADVANCED MODE	Constant Current (**Icc)**	10-20A	20A	0.5A
	Constant Voltage Level (**Vcv)**	26-30V	29V	0.1VDC
	Low Voltage Current (**Ilv)**	2-10A	6A	0.5A
	Top-off current **(Ito)**	2-10A	6A	0.5A
	End of charge ("soft" overvoltage) (**Veoc)**	29-35V	31VDC	0.1V
	EoC Threshold (**Icv)**	2-20A	4A	0.5A
	Restart Voltage (**Vrst)**	22-28v	26VDC	0.1V
	Bulk Charge Threshold (**Vlv)**	0-26VDC	24VDC	0.1VDC
	Low Voltage Lockout (**Vuvlo)**	4-21VDC	5VDC	0.1VDC
	Equalize Voltage (**Vequ)**	29-33V	31VDC	0.1VDC
	Float Voltage (**Vfloat)**	25-30V	26.8V	0.1VDC
	Low Voltage Timeout (**Tlv)**	1-10hrs	1 hour	1 hour
	Equalize Timeout (**Tto)**	0-5hrs	2 hours	1 hour
	Maximum Charge Time (**Tcmax)**	2-36hrs	16 hours	1 hour

1 Accuracy is calculated as percentage of the maximum setting.
2 Items in bold are as they appear in the display of the 1311 handheld programmer.

Accuracy*	Definition
	1-FLA: Float voltage is set to 26.8V, Constant voltage set to 29V. **2**-SLA: Float voltage set to 27.6V, Constant voltage to 29.4V
	1-OFF: Charger goes into standby. Charger will cycle to recharge the battery as determined by **Vrst** and enter standby at the end of the charge cycle. **2**-EQUALIZE: Charger adjusts its output current to **Ito**, and drives the battery to **Vequ**. It has the time allotted by **Tto** to do this or a fault will occur. **3**-FLOAT: Charger goes into standby upon entering EoC Mode, and remains in standby until the battery reaches **Vfloat**. At this point the charger turns on and maintains **Vfloat** until power is recycled.
+/- 3%	Current used to charge the batteries during normal (bulk charge) operation. This current is used when the battery voltage is greater than, or equal to **Vlv**, and less than **Vcv**.
+/- 1%	Battery voltage maintained by charger during bulk charge. This voltage is maintained by continuously dropping the output current, until **Veoc** is reached.
+/- 5%	Current used to recover deeply discharged batteries; this current is used when the battery voltage is greater than or equal to **Vuvlo**, and less than **Vlv**.
+/- 5%	Current used to Equalize the batteries.
+/- 1%	Charger goes into "soft" overvoltage mode, from which it recovers when battery voltage drops below **Vrst**.
+/- 3%	Current at which the charger transitions to EoC mode.
+/- 1%	Used when EoC Mode is EQUALIZE or OFF; the battery voltage at which charger automatically turns on and recharges the battery. Charger must be in stand by mode when this voltage is detected; the charger will charge the battery until it reaches **Vcv** and then enter stand by mode.
+/- 1%	Battery voltage at which the charger switches from **Ilv** to **Icc**.
+/- 1%	Battery voltage below which the charger will not turn on.
+/- 1%	Used when EoC Mode is EQUALIZE. The voltage at which the EQUALIZE mode is ended, unless the mode ends by reaching **Tto**.
+/- 1%	Used when EoC Mode is FLOAT. Once the battery voltage drops to this set point, the charger will turn on and stay on, maintaining this battery voltage.
+/- 5min	If battery does not reach **Vlv** within this timeout period, an error is indicated.
+/- 5min	Used when EoC Mode is EQUALIZE. Number of hours charger is kept at equalization current, unless the mode is ended by reaching **Vequ**.
+/- 1hr	The maximum amount of time the charger has to complete a charge cycle and enter standby mode. Failure to complete charge in the allotted time will result in a fault mode.

CURTIS

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