CHARGETEK

D-Series

Versatile and Rugged Lead-Based Industrial Charger Series

- ***California Energy Compliant***
- ***Rugged and reliable design***
- ***Capable of direct charge or BMS***
- ***Power phase-back with temperature***
- ***Factory Settable voltage/current***
- ***Transient protected input/output***
- ***Active I/O reverse polarity protection***
- ***Informative LED display***
- ***Optional wireless/digital interface***
- ***Relay and discrete I/O signals***
- ***Over temp protection with auto reset***
- ***Overcurrent / overvoltage protected***
- ***Four year warranty***

Description

The D-series is an environmentally robust and sophisticated battery chargers supporting Lead-based batteries. With a wide operating temperature range (-30°C to 65°C), a rugged mechanical design, and AC or DC input power options, this series is well suited for high end industrial applications. The series complies with the California Energy Commission guidelines.

The D-series product line has variable fan speed control algorithm. This provides extremely high power density while minimizing audible noise in low power conditions.

The D-series optional external communications can be programmed with user specific firmware. The product may be ordered with an optional user defined set of discrete I/O signals, a wireless option, an RS-232 or RS-485, CAN or other interfaces.

An informative LED display indicates state of charge, input power present, battery voltage and current, fault conditions and proper battery connection are standard.

The D-series charger precisely controls the charging algorithm to insure a complete recharge while prolonging battery life. The charger can be programmed for direct pack charging or with a BMS (battery management system) equipped pack.

The charger may be left connected indefinitely making the product ideal for remote and standby applications. It is mountable in any orientation. Input and output power connectors can be ordered per customer specification Customized charging algorithms, power sequencing and control/monitoring options are available upon request.

AC series input specifications

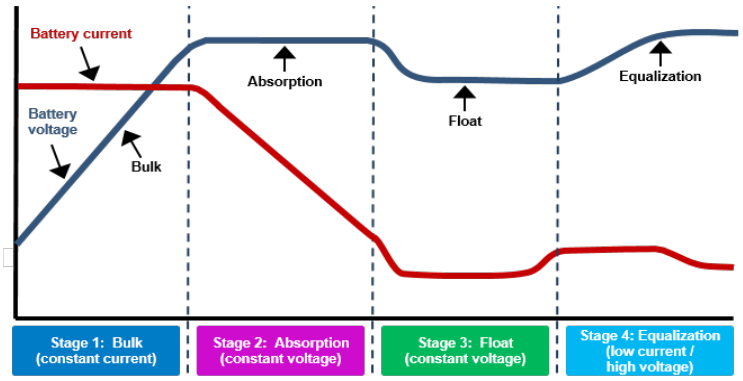
PARAMETER	DESCRIPTION / CONDITIONS
AC input voltage range	3 input ranges covering 85 VAC - 280 VAC
Input AC amps (max)	Measured at 85 VAC / 800 watts output: 13 Arms without PFC
AC input configuration	AC input: line, neutral , chassis ground
Connector	IEC-320

DC input model specifications

PARAMETER	DESCRIPTION / CONDITIONS
DC input voltage range	8 input ranges covering 11 VDC to 500 VDC
Input DC amps (max)	Measured at 40 VDC / 800 watts output: 23A
DC input configuration	DC input: DC Power, DC Return, Chassis ground
Connector	Anderson PP-75 or user defined

D-Series Model Specific Specifications

Four Stage Lead-based battery charging curve



Charging algorithm: Supplies constant current $I_{mx.}$ to battery until absorption voltage is reached (V_{FSTERM}). Transition to absorption mode follows and regulates battery voltage at V_{FSTERM} until current decreases to $I_{ABTERM.}$ Float mode follows and regulates battery voltage at $V_{FLOAT.}$. At the user's discretion, an equalization mode can be initiated. The equalization voltage V_{EQ} is approximately 2.5V/cell and battery current is limited. For more information, please refer to www.chargetek.com/images/pdfs/equal.pdf

Standard LED indicators

PARAMETER	GREEN	RED/GREEN	RED	RED on/off	GREEN on/off
state of charge	Complete	Top Off	Constant Current	-	-
battery voltage (volts)	< 75% of V_{FSTERM}	75% to 85% of V_{FSTERM}	85% to 95% of V_{FSTERM}	> 95% of V_{FSTERM}	-
battery current (amps)	< 10% of I_{max}	10% to 30% of I_{max}	30% to 90% I_{max}	> 90% of I_{max}	-
fault indicator	Polarity OK	Short/Reversed	Battery < 2.7V/cell	Over Voltage	Over Temperature
input power	Power Good	-	-	-	-

D-Series Common Specifications

CHARGING PARAMETERS	DESCRIPTION
Absorption transition time-out	10 hours following 85% of V_{FSTERM} (*factory settable upon request*)
Max charging time	Terminate if > I_{max}/3 > 15 hours (*factory settable upon request*)
Overvoltage protection	Maximum Charging Voltage + 1.0V
Output noise and ripple (PARD)	<150mV, 100MHz BW
Regulation	± 0.5%
Efficiency	Measured at max power, varies from 80% to 92% depending on model

D-Series Charging Specifications

6V battery bank (3S)

PARAMETER	DESCRIPTION / CONDITIONS	VALUE	UNITS
V_{FSTERM}	Fast charge transition voltage	7.3 ±0.1	VDC
V_{FLOAT}	Float voltage, $I_{OUT} < I_{FS}$, 25°C	6.8 ±0.1	VDC
I_{max}	Maximum charging current	80 ±2.0	Amps
I_{ABTERM}	Absorption transition current	3.0 ±0.1	Amps
V_{EQ}	Equalization voltage @ < 1Amp	7.8 ±0.1	volts
I_{SBY}	Max standby current, AC off	1.0	ma

12V battery bank (6S)

PARAMETER	DESCRIPTION / CONDITIONS	VALUE	UNITS
V_{FSTERM}	Fast charge transition voltage	14.6 ±0.1	VDC
V_{FLOAT}	Float voltage, $I_{OUT} < I_{FS}$, 25°C	13.6 ±0.1	VDC
I_{max}	Maximum charging current	50 ±1.0	Amps
I_{ABTERM}	Absorption transition current	2.5 ±0.1	Amps
V_{EQ}	Equalization voltage @ < 1Amp	15.5±0.1	volts
I_{SBY}	Max standby current, AC off	1.0	ma

18V battery bank (9S)

PARAMETER	DESCRIPTION / CONDITIONS	VALUE	UNITS
V_{FSTERM}	Fast charge transition voltage	21.9 ±0.1	VDC
V_{FLOAT}	Float voltage, $I_{OUT} < I_{FS}$, 25°C	20.4 ±0.1	VDC
I_{max}	Maximum charging current	30 ±1.0	Amps
I_{ABTERM}	Absorption transition current	2.5 ±0.1	Amps
V_{EQ}	Equalization voltage @ < 1Amp	23.3 ±0.1	volts
I_{SBY}	Max standby current, AC off	1.3	ma

24V battery bank (12S)

PARAMETER	DESCRIPTION / CONDITIONS	VALUE	UNITS
V_{FSTERM}	Fast charge transition voltage	29.2 ±0.1	VDC
V_{FLOAT}	Float voltage, $I_{OUT} < I_{FS}$, 25°C	27.2 ±0.1	VDC
I_{max}	Maximum charging current	25.0 ±0.1	Amps
I_{ABTERM}	Absorption transition current	2.0 ±0.1	Amps
V_{EQ}	Equalization voltage, <1A	31.0±0.1	volts
I_{SBY}	Max standby current, AC off	1.5	ma

36V battery bank (18S)

PARAMETER	DESCRIPTION / CONDITIONS	VALUE	UNITS
V_{FSTERM}	Fast charge transition voltage	43.8 ±0.2	VDC
V_{FLOAT}	Float voltage, $I_{OUT} < I_{FS}$, 25°C	13.5 ±0.2	VDC
I_{max}	Maximum charging current	15.0 ±1.0	Amps
I_{ABTERM}	Absorption transition current	2.0 ±0.1	Amps
V_{EQ}	Equalization voltage @ < 1Amp	46.5 ±0.2	volts
I_{SBY}	Max standby current, AC off	1.8	ma

48V battery bank (24S)

PARAMETER	DESCRIPTION / CONDITIONS	VALUE	UNITS
V_{FSTERM}	Fast charge transition voltage	58.4 ±0.2	VDC
V_{FLOAT}	Float voltage, $I_{OUT} < I_{FS}$, 25°C	54.4 ±0.2	VDC
I_{max}	Maximum charging current	13.0 ±1.0	Amps
I_{ABTERM}	Absorption transition current	1.5 ±0.1	Amps
V_{EQ}	Equalization voltage @ < 1Amp	62.0 ±0.2	volts
I_{SBY}	Max standby current, AC off	1.	ma

60V battery bank (30S)

PARAMETER	DESCRIPTION / CONDITIONS	VALUE	UNITS
V_{FSTERM}	Fast charge transition voltage	73.0 ±0.2	VDC
V_{FLOAT}	Float voltage, $I_{OUT} < I_{FS}$, 25°C	68.0±0.2	VDC
I_{max}	Maximum charging current	10.0 ±0.1	Amps
I_{ABTERM}	Absorption transition current	1.5 ±0.1	Amps
V_{EQ}	Equalization voltage, <1A	77.5 ±0.2	volts
I_{SBY}	Max standby current, AC off	2.0	ma

72V battery bank (36S)

PARAMETER	DESCRIPTION / CONDITIONS	VALUE	UNITS
V_{FSTERM}	Fast charge transition voltage	87.6 ±0.3	VDC
V_{FLOAT}	Float voltage, $I_{OUT} < I_{FS}$, 25°C	81.6 ±0.3	VDC
I_{max}	Maximum charging current	8.0 ±0.1	Amps
I_{ABTERM}	Absorption transition current	1.0 ±0.1	Amps
V_{EQ}	Equalization voltage, <1A	93.0 ±0.3	volts
I_{SBY}	Max standby current, AC off	2.0	ma

D-Series Ordering Guide, p/n GbD-*xyz-r*

<table>
<tr><th>P/N Field</th><th>Definition</th><th>Options</th><th>Description</th></tr>
<tr><td>b</td><td>Input Power</td><td>A - AC input
E - DC input</td><td>See description of field z in the part number for input voltage range options.</td></tr>
<tr><td>x</td><td>Number of Series Cells

Defines the output voltage.</td><td>For Lead-based chargers the options are:

3S, 6S, 9S, 12S, 18S, 24S, 30S, 36S and 150S</td><td>This option determines the Nominal Charging Voltage for Lead-based batteries. For Lead-based chargers the nominal output voltage is the number of cells multiplied by the nominal cell voltage of 2.0V. For example, option 12S would specify a 24V charger, (12 times 2.0V/cell = 24V)</td></tr>
<tr><td>y</td><td>Maximum Charging Current</td><td>Maximum Charging Current in amps.

For standard model the maximum charging current is determined by the number of Series Cells, see tables to the right. If a lower maximum output current is desired then it is specified in this field as amps.

For example a standard AC input Lead-Based 6S model is ordered as GAD-S650-1. If a charger with a maximum output current of 30 amps is needed the order number would be GAD-S630-1.</td><td>Maximum Charging Current vs. Number of Series Cells
<table><tr><th>Series Cells</th><th>Max. Current</th></tr><tr><td>6V(3S)</td><td>80 Amps</td></tr><tr><td>12V(6S)</td><td>50 Amps</td></tr><tr><td>18V(9S)</td><td>30 Amps</td></tr><tr><td>24V(12S)</td><td>25 Amps</td></tr><tr><td>36V(18S)</td><td>15 Amps</td></tr><tr><td>48V(24S)</td><td>13 Amps</td></tr><tr><td>60V(30S)</td><td>10 Amps</td></tr><tr><td>72V(36S)</td><td>8 Amps</td></tr></table></td></tr>
<tr><td>z</td><td>Input voltage range</td><td>For AC input chargers, three options; 01, 02, and 03 are available

For DC input chargers, eight options; 07, 08, 09, 10, 11, 12, 13, and 14 are available.</td><td>Input Voltage Range Options
<table><tr><th>Option</th><th>Input Voltage Range</th></tr><tr><td>01</td><td>85 - 140 VAC</td></tr><tr><td>02</td><td>180 - 300 VAC</td></tr><tr><td>03</td><td>85 - 300 VAC</td></tr><tr><td>07</td><td>11 - 20 VDC</td></tr><tr><td>08</td><td>18 - 36 VDC</td></tr></table><table><tr><th>Option</th><th>Input Voltage Range</th></tr><tr><td>09</td><td>30 - 50 VDC</td></tr><tr><td>10</td><td>38 - 75 VDC</td></tr><tr><td>11</td><td>72 - 140 VDC</td></tr><tr><td>12</td><td>100 - 200 VDC</td></tr><tr><td>13</td><td>150 - 300 VDC</td></tr><tr><td>14</td><td>250 - 500 VDC</td></tr></table></td></tr>
<tr><td>r</td><td>Options</td><td>List of Available Options, listed separated by ‘-’ characters, some options are mutually exclusive.

An: External Interface
Rxy: Internal Relay</td><td>An: External Interface, choose n as follows:
0 - RS-232, 1 - RS-485, 2 - Wired Ethernet, 3 - CAN,
5 - Wireless Ethernet, 99 - Special
Rxy: Internal Relay, there can be up to 4 internal relays
x = relay configuration; O for NO, C for NC
y = function; 1 - Over voltage, 2 - Charging,
3 - Over temperature, 4 - AC On</td></tr>
<tr><td colspan="4">Example: GAD-S650-01-RA1-RC3-RO4 specifies a Lead based AC input(A) charger with maximum output voltage set to charge 6-series cells, 12V (S6) at a maximum current of 50 amps (50) and the AC input range is 85-140 VAC (01). The chargers has options for an RS-485 interface (RA1) with two relays, NC Over Temperature (RC3) and NO AC On (RO4)</td></tr>
</table>

Certifications and Compliance (model dependant - consult factory)

a	UL CSA
b	CE mark
c	California Energy Compliant
d	RF emissions: US FCC Part 15 Class A, CISPR 22:2009
e	IEC 555, power factor
f	IEC 61000-4-5; Class 4 Severity Level, Surge
g	IEEE C2-2012 National Electrical Safety Code
h	NFPA 70-2014 National Electric Code
i	IEC 60950 Safety of IT Equipment; Pollution Degree 2
j	WEEE and Restriction of Hazardous Substances (ROHS) Directives 2002/95/EC
k	T-Mark

Workmanship specifications

IPC-610	Acceptability of electronic assemblies IPC J-STD-006 Requirements for electronic grade solder alloys and fluxed and non-fluxed solid solders for electronic soldering applications
IPC-2221	FR4, 130C 94V-0
IPC/WHMA-A-620	Requirements and acceptance of wiring and cabling

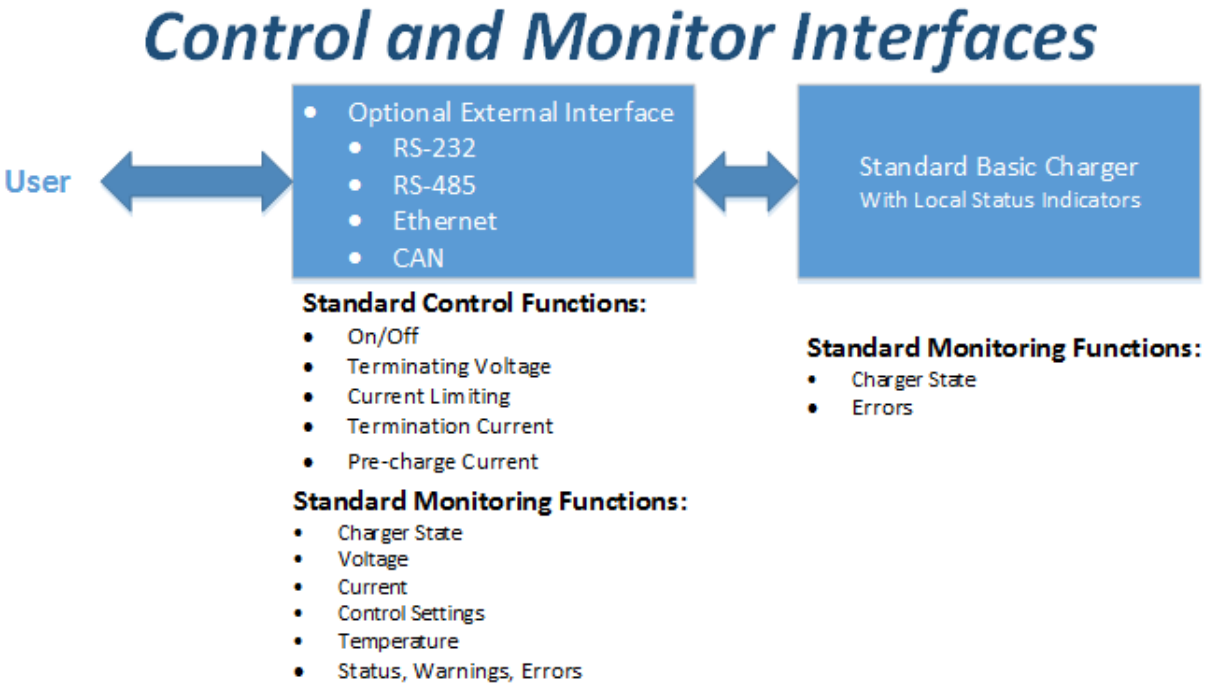
Mechanical specifications

PARAMETER	(units are in inches and pounds)
Dimensions	9.24 (L) x 5.00 (W) x 2.2 (H)
Chassis material	Aluminum
Chassis finish	Black anodized
Clearance	12 inches all sides
Mounting	#6 screws at six locations
Output connector	Model Dependant, consult factory
Fan connector	Not accessible
Weight	Six pounds
Fan noise during full-speed operation	< 45dBA, variable speed

Environmental specifications

PARAMETER	DESCRIPTION / CONDITIONS
Operating environment	Indoor only, fan cooled
Storage temp.	-30°C to +80°C
Operating temp.	-20°C to +60°C at maximum output over entire input voltage range
Humidity	0°C to +95°C relative humidity (non-condensing)
Operational altitude	10,000 feet
Vibration	MIL-STD-810 or IEC60068-2-6 and -2-64 as applicable
Shock	MIL-STD-810 or IEC60068-2-27 as applicable
Isolation	Input - chassis: 2KVDC Input - output: 2KVDC Output - chassis: 500VDC
DC leakage current	Input - chassis: < 200uA at 2KVDC Input - output: < 100uA at 2KVDC
AC leakage current	< 3.5mA at 264VAC, 60Hz

Control and monitoring



Outline and mounting