



SENS® DC PowerCab™ 120

Installation, Operation, & Maintenance Manual



Stored Energy Systems

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1. IMPORTANT INFORMATION ABOUT THIS MANUAL

SAVE THESE INSTRUCTIONS! This manual contains important information that is needed during the installation and maintenance of the system.

1.1 MANUAL SYMBOLS



Warning / Caution:

Indicates information provided to protect the user against personal injury, safety hazards and/or possible equipment damage.



Important:

Indicates information provided as an installation or operating instruction or tip as well as general important installation and system information.

2. INTRODUCTION

Stored Energy Systems (SENS®) would like to thank you for choosing SENS product for your power and back-up equipment needs. We know there are a lot of choices in the industry, and we appreciate the opportunity to supply our customers with the highest quality power products manufactured in the United States.

All SENS products are built to the highest industry standards and are Hi Pot tested to UL standards prior to shipment. All standard configurations are C-UL listed.

Sales support for existing or future equipment needs are provided by our technical sales staff. For all technical, sales, and service related questions please call our office line at 303-678-7500 and you will be directed to the appropriate individual to answer your questions.

After normal working hours please leave a detailed message, with your phone number, on our voice mail system and a qualified representative will contact you as quickly as possible.

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3. SAFETY PRECAUTIONS



Before installing or maintaining this system, it is extremely important to read this manual and be sure that all system drawings and schematics are reviewed and clearly understood. If there are any questions concerning this manual or any of the installation or maintenance procedures and/or requirements please contact a C&C Power representative before proceeding.



When installing this power system, follow all applicable federal, state and local regulations as well as industry guidelines to insure proper system installation.



Only qualified electricians or DC power technicians should attempt to install or service this equipment.



System installation and maintenance should always be performed with heavily insulated tools. It is also recommended to wear rubber gloves, boots, and use insulating mats to stand on when working on this equipment.



Always wear eye protection when installing or maintaining batteries and/or power equipment.



Do not attempt to unpack or move the battery cabinet without assistance. Use appropriate handling equipment rated to bear the weight and bulk of the battery cabinet, such as freight elevators, pallet jacks and forklifts. (Fully extend forks under load. Spread forks to maximum possible width under load. Lift cabinet from bottom only. Wear safety shoes.)



Do not smoke or present open flames near any battery system.



For the safety of others, never leave an open cabinet or panel unattended.



To reduce the risk of fire, replace fuses with the same type and rating of fuses supplied with the system.



DC Power and Batteries can be very dangerous and have extremely high short circuit current. Electrical shock, severe burns, fire or death can result from a system short.



To avoid personal injury including electrical shock, severe burns and possible death, all jewelry including bracelets, rings and watches must be removed prior to installing or servicing this system.



Do not open or mutilate batteries. Opened or severely damaged batteries can release toxic electrolyte which is harmful to the skin and eyes.



Never lay loose cables, metal parts or tools on top of batteries.



Under certain conditions, batteries can vent potentially explosive gas (hydrogen). Never enclose batteries or battery cabinets in a sealed room.

4. INSPECTION UPON RECEIPT OF GOODS

4.1 GENERAL

Special precautions and care have been taken to ensure the system arrives safe and undamaged. However, upon receipt, you should inspect the entire shipment, including the crate and any boxes for evidence of damage that may have occurred during transit.

4.2 VISIBLE DAMAGE

It is the responsibility of the person receiving the shipment to inventory and fully inspect all materials against the bill of lading or weigh bill IMMEDIATELY while the carrier representative is still present. Insure that all items are accounted for, including number of skids and quantity of boxes. Also note any visible external damage that may have occurred during transit. Make all applicable notations on the delivery receipt before signing and file a damage report with the carrier.

4.3 CONCEALED DAMAGE

Within 3 to 30 days of receipt (depending on courier), unpack the system and check for any concealed damage. Check the materials received against the detailed packing list to verify the quantity and the condition as complete and satisfactory.

Note any damage to the internal packaging, then request an inspection by the carrier and file a concealed damage claim. If there is a material shortage, contact a representative at SENS to file a claim.

**Please contact your shipping company for all shipping damage.
C&C Power is not responsible for any shipping damage.**

4.4 RETURN OF DAMAGED GOODS

Should equipment be damaged and require return, contact SENS Technical Support. A representative will provide instructions along with an RMA number to expedite the return.

A RMA number must be obtained before returning equipment to Sens or C&C Power, Inc.

5. SYSTEM OVERVIEW

The DC PowerCab 120 is a non-stop DC power system designed to deliver uninterruptible DC power to critical loads. PowerCab includes a DC power supply/charger, storage battery string, and DC distribution to load center.

In addition to the charger, battery, distribution panel and cabinet, PowerCab can be optionally equipped with:

- Additional DC distribution
- Low voltage disconnect (to prevent battery from over-discharge)
- Top-Lift Bracket
- Multiple DC to AC inverter options

The DC PowerCab system is fully factory assembled and is ready to install upon delivery.

6. SYSTEM SPECIFICATIONS

6.1 BATTERIES

Type: Valve Regulated Lead Acid (VRLA), sealed, non-spillable

Amp-Hour Options: 100 AH, 150AH, 170AH or 200AH

Voltage: 12 VDC Nominal



Only cabinets with **Flame Retardant Batteries** are suitable for computer room use.

6.2 SYSTEM GROUNDING



All system ground wires should be derived from the main building ground source.

Cabinet Safety Ground: Each cabinet is supplied with a mechanical ground lug that accepts bare wire from #2/0 AWG to #14 AWG.

Torque: 375 in-lbs

Wire Size and Type: Ground wire should be sized per NEC and/or all applicable national and local codes.

6.3 AC INPUT

The AC input to the charger (see Figure 1 for location) can be:

208 VAC 60 Hz, 1 ϕ

230 VAC 50/60 Hz, 1 ϕ

240 VAC 60 Hz, 1 ϕ

115-120/208/230-240 VAC 60 Hz, 1 ϕ

115-120/208/230-240 VAC, 50/60 Hz, 1 ϕ

400 VAC 50/60 Hz, 1 ϕ

480 VAC 60 Hz, 1 ϕ

6.4 DC OUTPUT

DC Output Voltage Options include:

- 24-volt nominal (12 cells lead-acid)
- 48-volt nominal (24 cells lead-acid)
- 120-volt nominal (60 cells lead-acid)
- 240-volt nominal (120 cells lead-acid)

Charger Output Current Options include:

- 6 Amps (15A charger to panelboard breaker)
- 12 Amps (15A charger to panelboard breaker)
- 16 Amps (20A charger to panelboard breaker)
- 25 Amps (35A charger to panelboard breaker)
- 35 Amps (45A charger to panelboard breaker)
- 50 Amps (70A charger to panelboard breaker)

- 75 Amps (100A charger to panelboard breaker)
- 100 Amps (125A charger to accessory breaker)
- 150 Amps (200A charger to accessory breaker)

DC Load Center: Panelboard, 100A, 2-pole battery main breaker, 2-pole charger-feed breaker, plus 12 each 2-pole load breaker positions.

Wire Size and Type: Per NEC and/or all applicable national and local codes.

6.5 OPTIONAL AC OUTPUT

- 600 Watt Inverter, 120VAC, 60Hz
- 600 Watt Inverter, 230VAC, 50Hz
- 1000 Watt Inverter, 120VAC, 60Hz
- 1000 Watt Inverter, 230VAC, 50Hz
- 1100 Watt Inverter, 120VAC, 60Hz
- 1100 Watt Inverter, 230VAC, 50Hz
- 2000 Watt Inverter, 120VAC, 60Hz
- 2000 Watt Inverter, 230VAC, 50Hz
- 3000 Watt Inverter, 120VAC, 60Hz
- 3000 Watt Inverter, 230VAC, 50Hz

AC output option consumes one 2-pole load breaker position.

Wire Size and Type: Per NEC and/or all applicable national and local codes.



Wire should be sized for a maximum voltage drop of 0.5 volt.

6.6 OPTIONAL LVD

When AC power fails, the systems batteries will discharge in order to provide the necessary backup power to the load. If the DC PowerCab 120 is equipped with the Low Voltage Disconnect (LVD) feature, the system load will be automatically disconnected at the customer adjustable LVD disconnect voltage setting. This will prevent the batteries from being discharged to unsafe levels. A Bender VME420 type Digital Voltage Monitor Relay is used to control the contactor in the LVD circuit. The LVD circuit, with the Monitor Relay imbedded, wiring connections to the DC load center and the Charger is shown in Figure 2/Section 9. The activation and factory settings of the LVD Voltage Relay are shown in Figure 3/Section 9 for a 120 VDC system, Figure 4/Section 9 for a 48 VDC system and Figure 5/Section 9 for a 24 VDC system.

6.7 GENERAL SPECIFICATIONS

Cabinet Size: 30.5”W x 31.5”D x 78.7”H

Typical Weights:

Empty Cabinet (approximately): 450 lbs

Complete System Weight can be found on the individual cabinet drawing that is mounted to the inside of the door.

Operating Temperature: 20°C to 25°C (68°F to 77°F) recommended for optimum battery performance.

Ventilation: Ventilation holes located in the front, rear, and top of the cabinet. Clearance around the equipment should be as suggested by NEC and/or all applicable national and local codes. The battery cabinet does not require rear access or rear clearance.



Under certain conditions, batteries can vent potentially explosive gas (hydrogen). Never enclose batteries or battery cabinets in a sealed room.



Batteries should be stored no longer than three months at 25°C (77°F) or lower before recharging. Exceeding the recommended ambient storage temperature may cause damage to the batteries.

7. INSTALLATION

7.1 PREPARATION

7.1.1 EQUIPMENT INSPECTION

Remove the equipment from the packaging material and inspect for any shipping damage that may have been overlooked upon receipt of goods. Verify that the system includes all necessary hardware for installation.

7.1.2 NECESSARY EQUIPMENT AND TOOLS

- Heavily insulated assortment of hand tools
- Digital voltmeter

7.1.3 INSTALLATION SAFETY PRECAUTIONS



Before proceeding with system installation, be sure to review and understand all of the SAFETY PRECAUTIONS in this manual!



DC VOLTAGE WARNING!

Hazardous DC voltages are present in the system. This hazard will always be present in a battery system including when it is offline. Accidental short circuit of the positive and negative terminal will cause tremendous currents to flow resulting in electrical shock, severe burns, fire and possible death! Use extreme caution when installing and maintaining the system!

7.2 INSTALLATION STEPS



Before installing or maintaining this system, it is extremely important to read this manual and be sure that all system drawings and schematics are reviewed and clearly understood. If there are any questions concerning this manual or any of the installation or maintenance procedures and/or requirements please contact a C&C Power representative before proceeding.

7.2.1 EQUIPMENT LOCATION

Prior to installation, verify floor loading requirements (see weights in Section 6.7) and all applicable codes pertaining to the related equipment. Environmental conditions should also be reviewed. Battery systems require an area with proper ventilation and cooling. An ambient temperature between 20°C to 25°C (68°F to 77°F) is recommended for optimum battery life and performance. Clearance around the equipment should be as suggested by NEC and/or all applicable national and local codes. The battery cabinet does not require rear access or rear clearance.



Under certain conditions, batteries can vent potentially explosive gas (hydrogen). Never enclose batteries or battery cabinets in a sealed room. Follow international (IFC 608), state, and local codes for ventilation requirements.

7.2.2 EQUIPMENT MOUNTING

Do not attempt to unpack or move the battery cabinet without assistance. Use appropriate handling equipment rated to bear the weight and bulk of the battery cabinet, such as freight elevators, pallet jacks and forklifts. (Fully extend forks under load. Spread forks to maximum possible width under load. Lift cabinet from bottom only. Wear safety shoes.)

1. The SENS DC PowerCab 120 cabinet is equipped with pallet jack and/or forklift access openings in the front and rear of the cabinet. Move the equipment into the desired location and set into place.
2. With the cabinet in the desired location, mark the location of four mounting holes found at the bottom of the cabinet legs. Two sets of mount holes are provided so that mount hardware can be offset in multi cabinet installations.
3. Move the cabinet out of the way and drill holes for the mounting hardware that will be used.
4. Move the cabinet back into place, align the holes, and tighten the hardware.
5. Should any drilling be performed on this equipment, make sure all exposed batteries and connections are completely covered using insulated type mats.

7.2.3 EQUIPMENT GROUNDING

All system ground wires should be derived from the main building ground source.



For multi cabinet systems, each cabinet needs to have a designated cabinet ground wire derived from the main building ground source.

Terminate a cabinet ground wire from the main building ground source to the supplied #2/0 AWG - #14AWG mechanical lug located on the bottom panel of the cabinet in the front right-hand corner. Wire should be sized per NEC and/or all applicable national and local codes.

7.2.4 AC/DC CONNECTIONS

Review the attached to the cabinet System Drawings and Schematics for model specific information on DC output connections to the panelboard.



Wire should be sized for a maximum voltage drop of 0.5 volt.



Verify that the Battery Main Breaker and the Charger Main Breaker on the panelboard (see System Drawing/Schematic) are in the off/open position before making any DC connections from the panelboard breakers to their respective loads.

Open the front doors on the cabinet and check for any noticeable problems or damage that may have occurred during shipment.

1. Review the attached system drawing/schematic located inside the cabinet doors to find the location of the jumper that has been left off in the middle of the battery string for added safety during installation and shipping. This jumper will be installed later.
2. Check and re-torque all internal battery connections, as shipping may have caused these connections to come loose. Proper torque values are noted on the system schematic/drawing and can also be found on most battery cases.
3. Refer to the Charger Operation Installation and Operation Manual for instructions for making AC power connections to the charger. The AC input cables can ingress the cabinet from either the top panel or the bottom panel by removing the appropriate panel knockout plate. The AC input cables should be run in the wire ducts located on the left-side of the cabinet from the cabinet ingress point to the connection point on the charger.
4. **Without LVD Option:** Verify that the battery string output and the charger DC output are connected to the breakers on the panelboard specified in the system schematic/drawing. Assure that these two breakers are in the off/open position before making any DC connections from the panelboard breakers to their respective loads.

With LVD Option: Referencing Figure 2/ Section 9, verify that the battery string output and the charger DC output are connected as shown to the LVD circuit and the LVD circuit is terminated to the proper breaker in the DC Load Center.

5. Review the supplied cabinet schematic/drawing for information on the size and location of the DC distribution breakers on the panelboard. Route the DC output cables from the breakers through the wire duct located on the right-side of the cabinet to the cabinet egress point on the top of the cabinet (after removing the knockout plate) and connect to their respective loads. All cables should be sized per NEC and any other local codes pertaining to this equipment.
6. Connect the jumper that was left off during shipment and install as shown on the system schematic. Torque connections properly.

7.2.5 SYSTEM OPERATION

Please refer to the Charger Operation Installation and Operation Manual included with the SENS DC PowerCab 120 product for startup and operation information for the charger unit.

8. SYSTEM MAINTENANCE



Before proceeding with system maintenance, be sure to review and understand all of the SAFETY PRECAUTIONS in this manual!



Verify that the Battery Main breaker on the panelboard and Charger AC Main breaker (on the charger unit) are in the off/open position before servicing the system.

8.1 BATTERY REPLACEMENT



When batteries are replaced they must be properly installed paying special attention to terminal polarity orientation! If wired incorrectly it will cause a short in the system and can result in electrical shock, severe burns, fire and possible death! Be sure to review the system schematics before terminating any battery cables.



Caution: Risk of explosion if batteries are replaced by an incorrect type.



Do not dispose of batteries in a fire. The batteries may explode. Contact your local hazardous waste or recycling center for battery disposal requirements.



Do not discard batteries in the trash. This product contains sealed lead acid batteries. Contact your local hazardous waste or recycling center for battery disposal requirements.

1. Prepare the new battery for installation. Verify that the battery is the same type and amp-hour rating as the batteries that are in the system.
2. Using a digital voltmeter, measure the battery voltage to verify that it is 12.4 VDC or above.
3. Use a brass wire brush or abrasive pad to polish the battery terminals.
4. Apply no-ox type terminal grease to the battery terminals to avoid corrosion.
5. Disconnect the loads from the battery string by turning off/opening the Battery Main circuit breaker on the panelboard.
6. Remove the center jumper on the battery string to reduce the voltage. If replacing all batteries, continue reducing the voltage by removing the inter-shelf jumper.
7. Disconnect the cables from the battery to be replaced.
8. Remove the bad battery.

9. Put the new battery into place. Make sure new battery is installed properly regarding polarity orientation. Use the supplied wiring schematic/ drawing found inside the battery cabinet door to verify the cabinet wiring.
10. Reconnect the cables to battery and make sure the connections are properly torqued.
11. Reconnect any removed string jumpers and make sure the connections are properly torqued.
12. Check the battery string voltage at input side of the Battery Main circuit breaker.
13. Start the charger and reconnect the loads to the battery string by turning on/closing the circuit breakers turned off in step 5.

9. REFERENCE MATERIALS

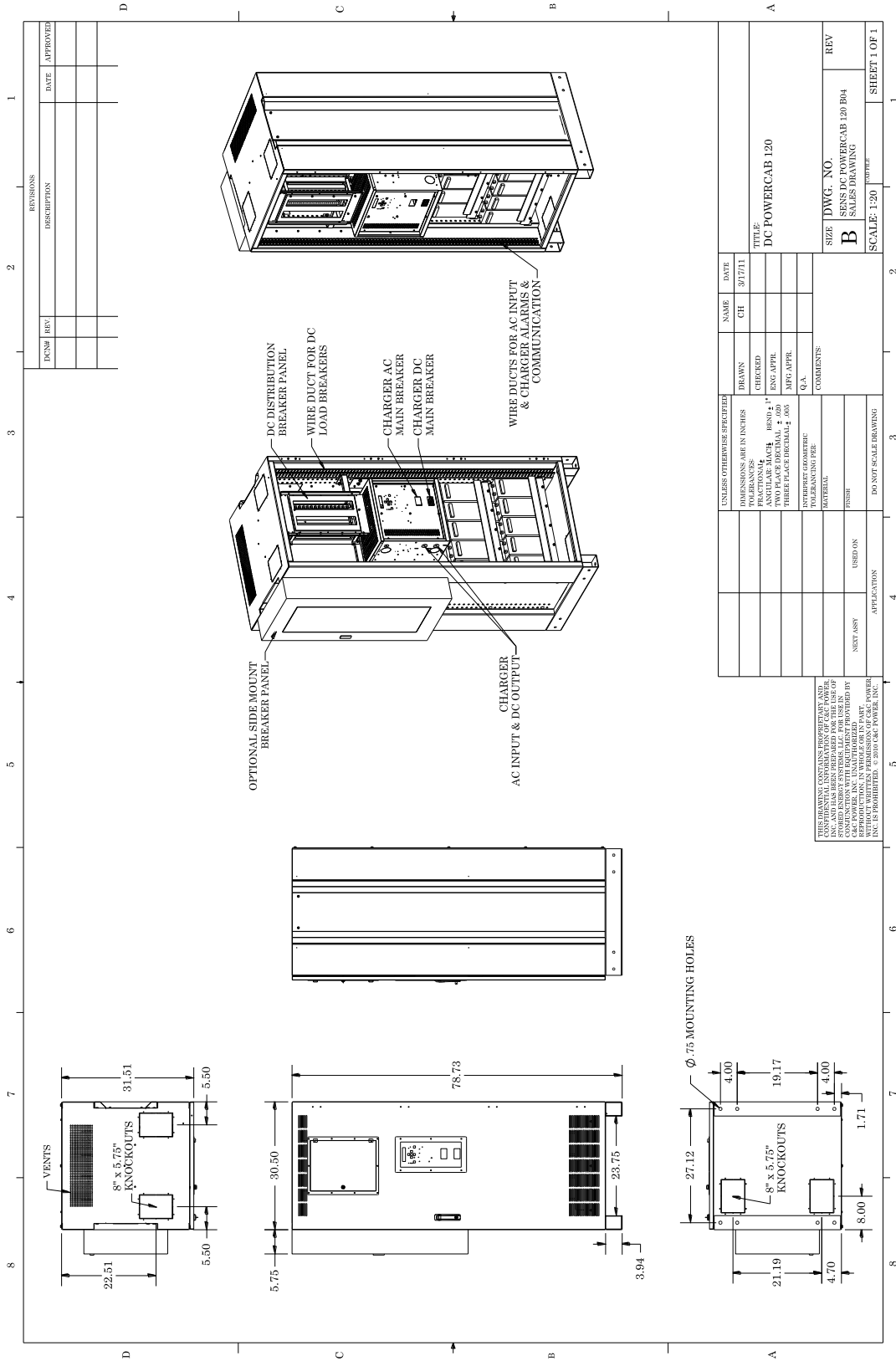


Figure 1

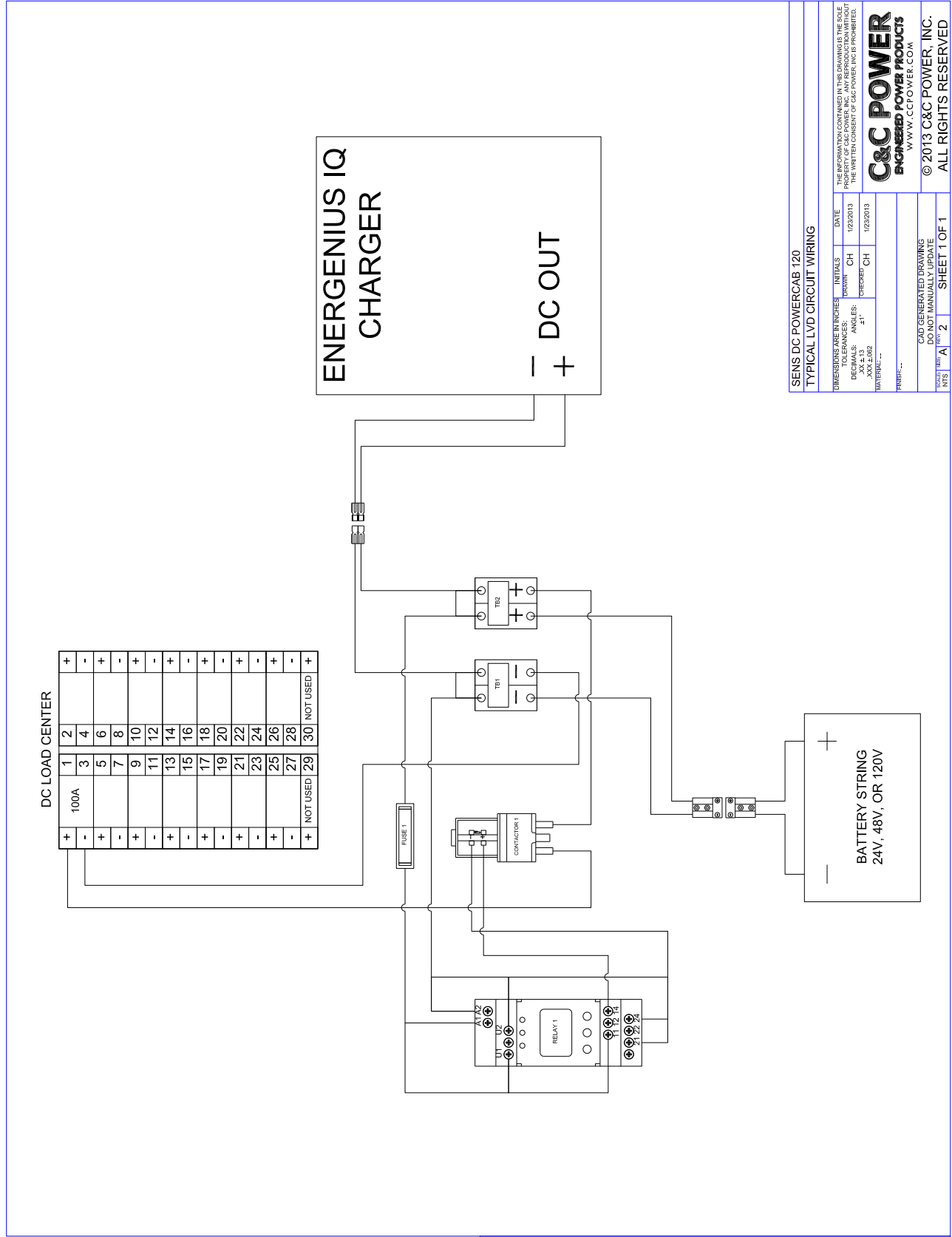


Figure 2

SENS DC POWERCAB 120
TYPICAL LVD CIRCUIT WIRING

DATE	1/2/2013
INITIALS	CH
DESIGNED BY	CH
CHECKED BY	CH
DATE	1/2/2013

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SHEET 1 OF 1

SENS DC PowerCab LVD Voltage Relay Settings - 120 VDC Systems

Bender VME420-D-2 (043-00009)

The settings for the LVD Voltage Relay are listed in the table below:




Menu	Sub Menu	Menu Item	Activation & Setting	Adjustable parameter	
AL (response - values)	----->	<U	ON (105V)	Undervoltage	
		>U	OFF	Overvoltage	
		U Hys	14%	Hysteresis < U / > U	
		< Hz	OFF	Underfrequency	
		> Hz	OFF	Overfrequency	
		Hz Hys	N/A	Hysteresis, frequency	
out (output control)	----->	M	OFF	Fault memory	
		 1	N.C.	Operating mode K1	
		 2	N.C.	Operating mode K2	
		LEd	OFF	LED's Signal relay in alarm state	
	r1 (K1: assignment alarm category)	1 Err	OFF	Device error at K1	
		r1 < U	ON	Undervoltage K1	
		r1 > U	OFF	Overvoltage K1	
		r1 < Hz	OFF	Underfrequency K1	
		r1 > Hz	OFF	Overfrequency K1	
		1 S.AL	OFF	Start with alarm during (t+t) _{on1}	
	r2 (K2: assignment alarm category)	2 Err	OFF	Device error K2	
		r2 < U	ON	Undervoltage K2	
		r2 > U	OFF	Overvoltage K2	
		r2 < Hz	OFF	Underfrequency K2	
		r2 > Hz	OFF	Overfrequency K2	
		2 S.AL	OFF	Start with alarm during (t+t) _{on2}	
	t (timing check)	----->	t on 1	0	Response delay K1
			t on 2	0	Response delay K2
T			0	Starting delay	
t off			0	Delay on release K1/K2	
Set (device control)	----->		OFF	Parameter setting via password	
		FAC	-	Re-establish factory settings	
		PrE	-	Manual preset	
		SYS	-	Function blocked	
InF	----->		-	Display hard/ software version	
HiS	----->	Clr	-	History memory for the first alarm value, erasable	

Figure 3

SENS DC PowerCab LVD Voltage Relay Settings - 48 VDC Systems

Bender VME420-D-1 (043-00011)

The settings for the LVD Voltage Relay are listed in the table below:




Menu	Sub Menu	Menu Item	Activation & Setting	Adjustable parameter
AL (response - values)	----->	<U	ON (42V)	Undervoltage
		>U	OFF	Overvoltage
		U Hys	17%	Hysteresis < U / > U
		< Hz	OFF	Underfrequency
		> Hz	OFF	Overfrequency
		Hz Hys	N/A	Hysteresis, frequency
out (output control)	----->	M	OFF	Fault memory
		 1	N.C.	Operating mode K1
		 2	N.C.	Operating mode K2
		LEd	OFF	LED's Signal relay in alarm state
	r1 (K1: assignment alarm category)	1 Err	OFF	Device error at K1
		r1 < U	ON	Undervoltage K1
		r1 > U	OFF	Overvoltage K1
		r1 < Hz	OFF	Underfrequency K1
		r1 > Hz	OFF	Overfrequency K1
		1 S.AL	OFF	Start with alarm during (t+t) _{on1}
			2 Err	OFF
	r2 < U		ON	Undervoltage K2
	r2 > U		OFF	Overvoltage K2
	r2 < Hz		OFF	Underfrequency K2
	r2 > Hz		OFF	Overfrequency K2
	2 S.AL		OFF	Start with alarm during (t+t) _{on2}
t (timing check)	----->	t on 1	0	Response delay K1
		t on 2	0	Response delay K2
		T	0	Starting delay
		t off	0	Delay on release K1/K2
Set (device control)	----->		OFF	Parameter setting via password
		FAC	-	Re-establish factory settings
		PrE	-	Manual preset
		SYS	-	Function blocked
InF	----->		-	Display hard/ software version
HiS	----->	Clr	-	History memory for the first alarm value, erasable

Figure 4

SENS DC PowerCab LVD Voltage Relay Settings - 24 VDC Systems

Bender VME420-D-1 (043-00011)

The settings for the LVD Voltage Relay are listed in the table below:




Menu	Sub Menu	Menu Item	Activation & Setting	Adjustable parameter
AL (response - values)	----->	<U	ON (21V)	Undervoltage
		>U	OFF	Overvoltage
		U Hys	14%	Hysteresis < U / > U
		< Hz	OFF	Underfrequency
		> Hz	OFF	Overfrequency
		Hz Hys	N/A	Hysteresis, frequency
out (output control)	----->	M	OFF	Fault memory
		 1	N.C.	Operating mode K1
		 2	N.C.	Operating mode K2
		LEd	OFF	LED's Signal relay in alarm state
	r1 (K1: assignment alarm category)	1 Err	OFF	Device error at K1
		r1 < U	ON	Undervoltage K1
		r1 > U	OFF	Overvoltage K1
		r1 < Hz	OFF	Underfrequency K1
		r1 > Hz	OFF	Overfrequency K1
		1 S.AL	OFF	Start with alarm during (t+t) _{on1}
	r2 (K2: assignment alarm category)	2 Err	OFF	Device error K2
		r2 < U	ON	Undervoltage K2
		r2 > U	OFF	Overvoltage K2
		r2 < Hz	OFF	Underfrequency K2
		r2 > Hz	OFF	Overfrequency K2
		2 S.AL	OFF	Start with alarm during (t+t) _{on2}
	t (timing check)	----->	t on 1	0
t on 2			0	Response delay K2
T			0	Starting delay
t off			0	Delay on release K1/K2
Set (device control)	----->		OFF	Parameter setting via password
		FAC	-	Re-establish factory settings
		PrE	-	Manual preset
		SYS	-	Function blocked
InF	----->		-	Display hard/ software version
HiS	----->	Clr	-	History memory for the first alarm value, erasable

Figure 5

10. WARRANTY

For warranty information, please go to www.sens-usa.com/warrantyrepair/

